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(54) **COMMUNICATION PROTOCOLS OVER INTERNET PROTOCOL (IP) NETWORKS**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

686,836 A 11/1901 Richard
1,738,540 A 12/1929 Replogle et al.
(Continued)

FOREIGN PATENT DOCUMENTS

AU 2010297957 9/2010
AU 2005223267 B2 12/2010
(Continued)

OTHER PUBLICATIONS

Network Working Group, Request for Comments H.Schulzrinne Apr. 1998.*
(Continued)

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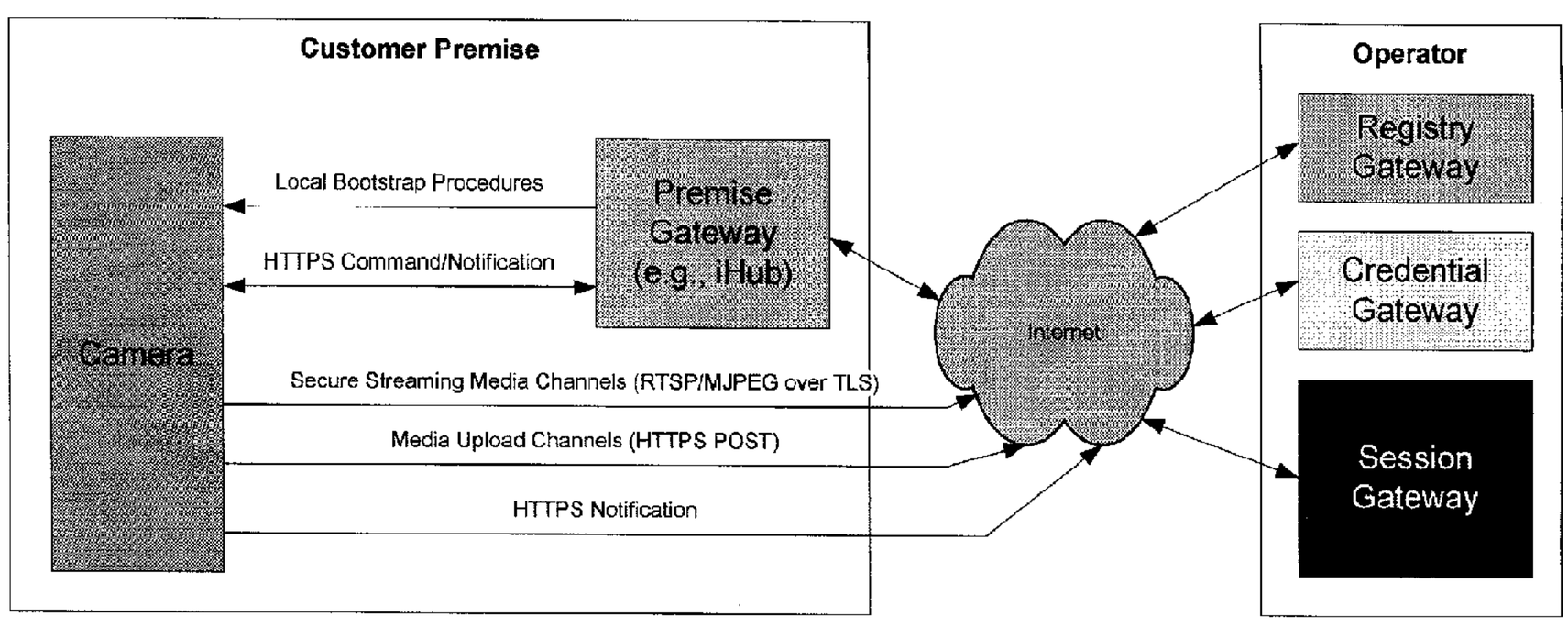
(57) **ABSTRACT**

A system and methods comprise a gateway that includes a processor coupled to a security system at a premises. A touchscreen at the premises is coupled to the gateway and presents user interfaces. The user interfaces include a security interface that provides control of functions of the security system and access to data collected by the security system, and a network interface that provides access to network devices. A camera is located at the premises and coupled to the gateway via a plurality of interfaces. A security server at a remote location is coupled to the gateway. The security server comprises a client interface through which remote client devices exchange data with the gateway and the security system.

49 Claims, 28 Drawing Sheets



Camera with Premise Gateway Deployement Scenario

Related U.S. Application Data

a continuation-in-part of application No. 13/718,851, filed on Dec. 18, 2012, now abandoned, and a continuation-in-part of application No. 13/932,837, filed on Jul. 1, 2013, now Pat. No. 9,621,408, and a continuation-in-part of application No. 11/761,745, filed on Jun. 12, 2007, now Pat. No. 8,635,350, and a continuation-in-part of application No. 12/019,568, filed on Jan. 24, 2008, and a continuation-in-part of application No. 13/925,181, filed on Jun. 24, 2013, now abandoned, and a continuation-in-part of application No. 13/531,757, filed on Jun. 25, 2012, now abandoned, and a continuation-in-part of application No. 13/335,279, filed on Dec. 22, 2011, and a continuation-in-part of application No. 12/539,537, filed on Aug. 11, 2009, and a continuation-in-part of application No. 12/750,470, filed on Mar. 30, 2010, now Pat. No. 9,191,228, and a continuation-in-part of application No. 13/104,932, filed on May 10, 2011.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

3,803,576	A	4/1974	Dobrzanski et al.
3,852,541	A	12/1974	Altenberger
4,006,460	A	2/1977	Hewitt et al.
4,141,006	A	2/1979	Braxton
4,257,038	A	3/1981	Rounds et al.
4,286,331	A	8/1981	Anderson et al.
4,304,970	A	12/1981	Fahey et al.
4,363,031	A	12/1982	Reinowitz
4,520,503	A	5/1985	Kirst et al.
4,559,526	A	12/1985	Tani et al.
4,559,527	A	12/1985	Kirby
4,567,557	A	1/1986	Burns
4,574,305	A	3/1986	Campbell et al.
4,581,606	A	4/1986	Mallory
4,591,834	A	5/1986	Kyle
D284,084	S	6/1986	Ferrara, Jr.
4,641,127	A	2/1987	Hogan et al.
4,652,859	A	3/1987	Van Wienen
4,670,739	A	6/1987	Kelly, Jr.
4,683,460	A	7/1987	Nakatsugawa
4,694,282	A	9/1987	Tamura et al.
4,716,973	A	1/1988	Cobern
4,730,184	A	3/1988	Bach
4,754,261	A	6/1988	Marino
4,779,007	A	10/1988	Schlanger et al.
4,801,924	A	1/1989	Burgmann et al.
4,812,820	A	3/1989	Chatwin
4,818,970	A	4/1989	Natale et al.
4,833,339	A	5/1989	Luchaco et al.
4,833,449	A	5/1989	Gaffigan
4,855,713	A	8/1989	Brunius
4,860,185	A	8/1989	Brewer et al.
4,887,064	A	12/1989	Drori et al.
4,897,630	A	1/1990	Nykerk
4,918,623	A	4/1990	Lockitt et al.
4,918,717	A	4/1990	Bissonnette et al.
4,951,029	A	8/1990	Severson
4,959,713	A	9/1990	Morotomi et al.
4,962,473	A	10/1990	Crain
4,980,666	A	12/1990	Hwang
4,993,059	A	2/1991	Smith et al.
4,994,787	A	2/1991	Kratt et al.
4,996,646	A	2/1991	Farrington
5,023,901	A	6/1991	Sloan et al.
5,083,106	A	1/1992	Kostusiak et al.
5,086,385	A	2/1992	Launey et al.
5,091,780	A	2/1992	Pomerleau
5,109,278	A	4/1992	Erickson et al.
5,132,968	A	7/1992	Cephus
5,134,644	A	7/1992	Garton et al.
5,159,315	A	10/1992	Schultz et al.
5,160,879	A	11/1992	Tortola et al.
5,164,703	A	11/1992	Rickman
5,164,979	A	11/1992	Choi
D337,569	S	7/1993	Kando
5,227,776	A	7/1993	Starefoss
5,237,305	A	8/1993	Ishikuro et al.
5,245,694	A	9/1993	Zwern
5,280,527	A	1/1994	Gullman et al.
5,283,816	A	2/1994	Gomez Diaz
5,299,971	A	4/1994	Hart
5,319,394	A	6/1994	Dukek
5,319,698	A	6/1994	Glidewell et al.
5,334,974	A	8/1994	Simms et al.
5,400,011	A	3/1995	Sutton
5,400,246	A	3/1995	Wilson et al.
5,406,260	A	4/1995	Cummings et al.
5,410,343	A	4/1995	Coddington et al.
5,412,708	A	5/1995	Katz
5,414,409	A	5/1995	Voosen et al.
5,414,833	A	5/1995	Hershey et al.
5,428,293	A	6/1995	Sinclair et al.
5,438,607	A	8/1995	Przygoda, Jr. et al.
5,446,445	A	8/1995	Bloomfield et al.
5,448,290	A	9/1995	Vanzeeland
5,452,344	A	9/1995	Larson
5,465,081	A	11/1995	Todd
5,471,194	A	11/1995	Guscott
5,483,224	A	1/1996	Rankin et al.
5,486,812	A	1/1996	Todd
5,499,014	A	3/1996	Greenwaldt
5,499,196	A	3/1996	Pacheco
5,510,975	A	4/1996	Ziegler, Jr.
5,519,878	A	5/1996	Dolin, Jr.
RE35,268	E	6/1996	Frolov et al.
5,525,966	A	6/1996	Parish
5,526,428	A	6/1996	Arnold
5,534,845	A	7/1996	Issa et al.
5,541,585	A	7/1996	Duhame et al.
5,543,778	A	8/1996	Stouffer
5,546,072	A	8/1996	Creuseremee et al.
5,546,074	A	8/1996	Bernal et al.
5,546,447	A	8/1996	Skarbo et al.
5,548,646	A	8/1996	Aziz et al.
5,550,984	A	8/1996	Gelb
5,557,254	A	9/1996	Johnson et al.
5,570,079	A	10/1996	Dockery
5,572,438	A	11/1996	Ehlers et al.
5,578,989	A	11/1996	Pedtke
5,579,197	A	11/1996	Mengelt et al.
5,579,221	A	11/1996	Mun
D377,034	S	12/1996	Matsushita
5,587,705	A	12/1996	Morris

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,598,086	A	1/1997	Somerville
5,602,918	A	2/1997	Chen et al.
5,604,493	A	2/1997	Behlke
5,606,615	A	2/1997	Lapointe et al.
5,621,662	A	4/1997	Humphries et al.
5,623,601	A	4/1997	Vu
5,625,338	A	4/1997	Pildner et al.
5,625,410	A	4/1997	Washino et al.
5,629,687	A	5/1997	Sutton et al.
5,630,216	A	5/1997	McEwan
5,631,630	A	5/1997	McSweeney
5,638,046	A	6/1997	Malinowski
5,650,773	A	7/1997	Chiarello
5,651,070	A	7/1997	Blunt
5,652,567	A	7/1997	Traxler
5,675,321	A	10/1997	McBride
5,680,131	A	10/1997	Utz
5,682,133	A	10/1997	Johnson et al.
5,686,885	A	11/1997	Bergman
5,686,896	A	11/1997	Bergman
5,689,235	A	11/1997	Sugimoto et al.
5,689,708	A	11/1997	Regnier et al.
5,691,697	A	11/1997	Carvalho et al.
5,694,335	A	12/1997	Hollenberg
5,694,595	A	12/1997	Jacobs et al.
5,696,486	A	12/1997	Poliquin et al.
5,696,898	A	12/1997	Baker et al.
D389,501	S	1/1998	Mascarenas, Sr. et al.
5,706,191	A	1/1998	Bassett et al.
5,712,679	A	1/1998	Coles
5,714,933	A	2/1998	Le Van Suu
5,715,394	A	2/1998	Jabs
5,717,378	A	2/1998	Malvaso et al.
5,717,379	A	2/1998	Peters
5,717,578	A	2/1998	Afzal
5,719,551	A	2/1998	Flick
5,726,912	A	3/1998	Krall et al.
5,731,756	A	3/1998	Roddy
5,736,927	A	4/1998	Stebbins et al.
5,737,391	A	4/1998	Dame et al.
5,748,084	A	5/1998	Isikoff
5,748,089	A	5/1998	Sizemore
5,757,616	A	5/1998	May et al.
5,761,206	A	6/1998	Kackman
5,774,051	A	6/1998	Kostusiak
5,777,551	A	7/1998	Hess
5,777,837	A	7/1998	Eckel et al.
5,784,461	A	7/1998	Shaffer et al.
5,784,463	A	7/1998	Chen et al.
5,793,028	A	8/1998	Wagener et al.
5,793,763	A	8/1998	Mayes et al.
5,794,128	A	8/1998	Brockel et al.
5,796,401	A	8/1998	Winer
5,798,701	A	8/1998	Bernal et al.
5,801,618	A	9/1998	Jenkins
5,805,056	A	9/1998	Mueller et al.
5,805,064	A	9/1998	Yorkey
5,809,013	A	9/1998	Kackman
5,812,054	A	9/1998	Cohen
5,819,124	A	10/1998	Somner et al.
5,821,937	A	10/1998	Tonelli
5,844,599	A	12/1998	Hildin
5,845,070	A	12/1998	Ikudome
5,854,588	A	12/1998	Dockery
5,859,966	A	1/1999	Hayman et al.
5,861,804	A	1/1999	Fansa et al.
5,867,484	A	2/1999	Shaunfield
5,874,952	A	2/1999	Morgan
5,877,696	A	3/1999	Powell
5,880,775	A	3/1999	Ross
5,881,226	A	3/1999	Veneklase
5,886,894	A	3/1999	Rakoff
5,892,442	A	4/1999	Ozery
5,898,831	A	4/1999	Hall et al.
5,905,438	A	5/1999	Weiss et al.
5,907,279	A	5/1999	Bruins et al.
5,909,183	A	6/1999	Borgstahl et al.
5,914,655	A	6/1999	Clifton et al.
5,924,069	A	7/1999	Kowalkowski et al.
5,926,209	A	7/1999	Glatt
5,933,098	A	8/1999	Haxton
5,940,387	A	8/1999	Humpleman
5,943,394	A	8/1999	Ader et al.
5,952,815	A	9/1999	Rouillard et al.
5,955,946	A	9/1999	Beheshti et al.
5,958,053	A	9/1999	Denker
5,959,528	A	9/1999	Right et al.
5,959,529	A	9/1999	Kail, IV
5,963,916	A	10/1999	Kaplan
5,967,975	A	10/1999	Ridgeway
D416,910	S	11/1999	Vasquez
5,982,418	A	11/1999	Ely
5,991,795	A	11/1999	Howard et al.
6,002,430	A	12/1999	McCall et al.
6,009,320	A	12/1999	Dudley
6,011,921	A	1/2000	Takahashi et al.
6,032,036	A	2/2000	Maystre et al.
6,037,991	A	3/2000	Thro et al.
6,038,289	A	3/2000	Sands
6,040,770	A	3/2000	Britton
6,049,272	A	4/2000	Lee et al.
6,049,273	A	4/2000	Hess
6,049,598	A	4/2000	Peters et al.
6,052,052	A	4/2000	Delmonaco
6,060,994	A	5/2000	Chen
6,067,346	A	5/2000	Akhteruzzaman et al.
6,067,440	A	5/2000	Diefes
6,069,655	A	5/2000	Seeley et al.
6,078,253	A	6/2000	Fowler
6,078,257	A	6/2000	Ferraro
6,078,649	A	6/2000	Small et al.
6,085,030	A	7/2000	Whitehead et al.
6,091,771	A	7/2000	Seeley et al.
6,094,134	A	7/2000	Cohen
6,097,429	A	8/2000	Seeley et al.
6,104,785	A	8/2000	Chen
6,107,918	A	8/2000	Klein et al.
6,107,930	A	8/2000	Behlke et al.
6,108,034	A	8/2000	Kim
6,112,237	A	8/2000	Donaldson et al.
6,117,182	A	9/2000	Alpert et al.
6,124,882	A	9/2000	Voois et al.
6,128,653	A	10/2000	Del et al.
6,134,303	A	10/2000	Chen
6,134,591	A	10/2000	Nickles
6,138,249	A	10/2000	Nolet
6,139,177	A	10/2000	Venkatraman et al.
6,140,987	A	10/2000	Stein et al.
6,144,993	A	11/2000	Fukunaga et al.
6,154,133	A	11/2000	Ross et al.
6,157,943	A	12/2000	Meyer
6,161,182	A	12/2000	Nadooshan
6,167,186	A	12/2000	Kawasaki et al.
6,181,341	B1	1/2001	Shinagawa
6,192,418	B1	2/2001	Hale et al.
6,198,475	B1	3/2001	Kunimatsu et al.
6,198,479	B1	3/2001	Humpleman et al.
6,208,247	B1	3/2001	Agre et al.
6,209,011	B1	3/2001	Vong et al.
6,211,783	B1	4/2001	Wang
6,215,404	B1	4/2001	Morales
6,218,938	B1	4/2001	Lin
6,219,677	B1	4/2001	Howard
6,226,031	B1	5/2001	Barraclough et al.
6,229,429	B1	5/2001	Horon
6,230,271	B1	5/2001	Wadlow et al.
6,239,892	B1	5/2001	Davidson
6,243,683	B1	6/2001	Peters
6,246,320	B1	6/2001	Monroe
6,271,752	B1	8/2001	Vaios
6,275,227	B1	8/2001	Destefano
6,281,790	B1	8/2001	Kimmel et al.
6,282,569	B1	8/2001	Wallis et al.
6,286,038	B1	9/2001	Reichmeyer et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,288,716	B1	9/2001	Humpleman et al.
6,289,382	B1	9/2001	Bowman-Amuah
6,292,766	B1	9/2001	Mattos et al.
6,292,827	B1	9/2001	Raz
6,295,346	B1	9/2001	Markowitz et al.
6,314,425	B1	11/2001	Serbinis et al.
6,320,506	B1	11/2001	Ferraro
6,323,897	B1	11/2001	Kogane et al.
D451,529	S	12/2001	Vasquez
6,331,122	B1	12/2001	Wu
6,332,193	B1	12/2001	Glass et al.
6,347,393	B1	2/2002	Alpert et al.
6,351,213	B1	2/2002	Hirsch et al.
6,351,595	B1	2/2002	Kim
6,351,829	B1	2/2002	Dupont et al.
6,353,853	B1	3/2002	Gravlin
6,353,891	B1	3/2002	Borella et al.
6,359,560	B1	3/2002	Budge et al.
6,363,417	B1	3/2002	Howard et al.
6,363,422	B1	3/2002	Hunter et al.
6,369,695	B1	4/2002	Horon
6,369,705	B1	4/2002	Kennedy
6,370,436	B1	4/2002	Howard et al.
6,374,079	B1	4/2002	Hsu
6,377,861	B1	4/2002	York
6,378,109	B1	4/2002	Young et al.
6,385,772	B1	5/2002	Courtney
6,392,538	B1	5/2002	Shere
6,400,265	B1	6/2002	Saylor et al.
6,405,348	B1	6/2002	Fallah-Tehrani et al.
6,411,802	B1	6/2002	Cardina et al.
D460,472	S	7/2002	Wang
6,418,037	B1	7/2002	Zhang
6,421,080	B1	7/2002	Lambert
6,430,629	B1	8/2002	Smyers
6,433,683	B1	8/2002	Robinson
6,434,700	B1	8/2002	Alonso et al.
6,437,692	B1	8/2002	Petite et al.
6,441,723	B1	8/2002	Mansfield et al.
6,442,241	B1	8/2002	Tsumpes
6,446,192	B1	9/2002	Narasimhan et al.
6,452,490	B1	9/2002	Garland et al.
6,452,923	B1	9/2002	Gerszberg et al.
6,453,687	B2	9/2002	Sharood et al.
D464,328	S	10/2002	Vasquez et al.
D464,948	S	10/2002	Vasquez et al.
6,462,507	B2	10/2002	Fisher et al.
6,462,663	B1	10/2002	Wilson et al.
6,467,084	B1	10/2002	Howard et al.
6,476,858	B1	11/2002	Ramirez et al.
6,480,901	B1	11/2002	Weber et al.
6,493,020	B1	12/2002	Stevenson et al.
6,496,927	B1	12/2002	McGrane et al.
6,499,131	B1	12/2002	Savithri et al.
6,504,479	B1	1/2003	Lemons et al.
6,507,589	B1	1/2003	Ramasubramani et al.
6,526,581	B1	2/2003	Edson
6,529,230	B1	3/2003	Chong
6,529,723	B1	3/2003	Bentley
6,542,075	B2	4/2003	Barker et al.
6,542,992	B1	4/2003	Peirce et al.
6,552,647	B1	4/2003	Thiessen et al.
6,553,336	B1	4/2003	Johnson et al.
6,559,769	B2	5/2003	Anthony et al.
6,563,800	B1	5/2003	Salo et al.
6,563,910	B2	5/2003	Menard et al.
6,567,122	B1	5/2003	Anderson et al.
6,567,502	B2	5/2003	Zellner et al.
6,574,234	B1	6/2003	Myer et al.
6,580,950	B1	6/2003	Johnson et al.
6,587,046	B2	7/2003	Joao
6,587,455	B1	7/2003	Ray et al.
6,587,736	B2	7/2003	Howard et al.
6,587,739	B1	7/2003	Abrams et al.
6,591,094	B1	7/2003	Bentley
6,597,703	B1	7/2003	Li et al.
6,601,086	B1	7/2003	Howard et al.
6,603,488	B2	8/2003	Humpleman et al.
6,609,127	B1	8/2003	Lee et al.
6,611,206	B2	8/2003	Eshelman et al.
6,615,088	B1	9/2003	Myer et al.
6,621,827	B1	9/2003	Rezvani et al.
6,624,750	B1	9/2003	Marman
6,631,416	B2	10/2003	Bendinelli et al.
6,636,893	B1	10/2003	Fong
6,643,652	B2	11/2003	Helgeson et al.
6,643,669	B1	11/2003	Novak et al.
6,643,795	B1	11/2003	Sicola et al.
6,648,682	B1	11/2003	Wu
6,658,091	B1	12/2003	Naidoo et al.
6,661,340	B1	12/2003	Saylor et al.
6,662,340	B2	12/2003	Rawat et al.
6,667,688	B1	12/2003	Menard et al.
6,674,767	B1	1/2004	Kadyk et al.
6,675,365	B2	1/2004	Elzinga
6,680,730	B1	1/2004	Shields et al.
6,686,838	B1	2/2004	Rezvani et al.
6,690,411	B2	2/2004	Naidoo et al.
6,693,530	B1	2/2004	Dowens et al.
6,693,545	B2	2/2004	Brown et al.
6,697,103	B1	2/2004	Fernandez et al.
6,704,786	B1	3/2004	Gupta et al.
6,720,990	B1	4/2004	Walker et al.
6,721,689	B2	4/2004	Markle et al.
6,721,740	B1	4/2004	Skinner et al.
6,721,747	B2	4/2004	Lipkin
6,727,811	B1	4/2004	Fendis
6,728,233	B1	4/2004	Park et al.
6,728,688	B1	4/2004	Hirsch et al.
6,738,824	B1	5/2004	Blair
6,741,171	B2	5/2004	Palka et al.
6,754,717	B1	6/2004	Day, III et al.
6,756,896	B2	6/2004	Ford
6,756,998	B1	6/2004	Bilger
6,759,956	B2	7/2004	Menard et al.
6,762,686	B1	7/2004	Tabe
6,771,181	B1	8/2004	Hughen, Jr.
6,778,085	B2	8/2004	Faulkner et al.
6,779,019	B1	8/2004	Mousseau et al.
6,781,509	B1	8/2004	Oppedahl et al.
6,785,542	B1	8/2004	Blight et al.
6,789,147	B1	9/2004	Kessler et al.
6,795,322	B2	9/2004	Aihara et al.
6,795,863	B1	9/2004	Doty, Jr.
6,798,344	B2	9/2004	Faulkner et al.
6,804,638	B2	10/2004	Fiedler
6,810,409	B1	10/2004	Fry et al.
6,826,173	B1	11/2004	Kung et al.
6,826,233	B1	11/2004	Oosawa
6,829,478	B1	12/2004	Layton et al.
6,834,208	B2	12/2004	Gonzales et al.
6,850,252	B1	2/2005	Hoffberg
6,856,236	B2	2/2005	Christensen et al.
6,857,026	B1	2/2005	Cain
6,865,690	B2	3/2005	Kocin
6,871,193	B1	3/2005	Campbell et al.
6,873,256	B2	3/2005	Lemelson et al.
6,885,362	B2	4/2005	Suomela
D504,889	S	5/2005	Andre et al.
6,891,838	B1	5/2005	Petite et al.
6,912,429	B1	6/2005	Bilger
6,914,533	B2	7/2005	Petite
6,918,112	B2	7/2005	Bourke-Dunphy et al.
6,920,502	B2	7/2005	Araujo et al.
6,920,615	B1	7/2005	Campbell et al.
6,928,148	B2	8/2005	Simon et al.
6,930,599	B2	8/2005	Naidoo et al.
6,930,730	B2	8/2005	Maxson et al.
6,931,445	B2	8/2005	Davis
6,941,258	B2	9/2005	Van Heijningen et al.
6,943,681	B2	9/2005	Rezvani et al.
6,956,477	B2	10/2005	Chun
6,957,186	B1	10/2005	Guheen et al.
6,957,275	B1	10/2005	Sekiguchi

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,959,341 B1 10/2005 Leung
6,959,393 B2 10/2005 Hollis et al.
6,963,908 B1 11/2005 Lynch et al.
6,963,981 B1 11/2005 Bailey et al.
6,965,294 B1 11/2005 Elliott et al.
6,965,313 B1 11/2005 Saylor et al.
6,970,183 B1 11/2005 Monroe
6,971,076 B2 11/2005 Chen
6,972,676 B1 12/2005 Kimmel et al.
6,975,220 B1 12/2005 Foodman et al.
6,977,485 B1 12/2005 Wei
6,983,432 B2 1/2006 Hayes
6,990,591 B1 1/2006 Pearson
6,993,658 B1 1/2006 Engberg et al.
6,999,992 B1 2/2006 Deen et al.
7,015,806 B2 3/2006 Naidoo et al.
7,016,970 B2 3/2006 Harumoto et al.
7,019,639 B2 3/2006 Stilp
7,020,697 B1 3/2006 Goodman et al.
7,020,701 B1 3/2006 Gelvin et al.
7,023,913 B1 4/2006 Monroe
7,023,914 B2 4/2006 Furukawa et al.
7,023,975 B2 4/2006 Mansfield et al.
7,024,676 B1 4/2006 Klopfenstein
7,028,328 B2 4/2006 Kogane et al.
7,030,752 B2 4/2006 Tyroler
7,032,002 B1 4/2006 Rezvani et al.
7,034,681 B2 4/2006 Yamamoto et al.
7,035,907 B1 4/2006 Decasper et al.
7,039,391 B2 5/2006 Rezvani et al.
7,043,537 B1 5/2006 Pratt
7,047,088 B2 5/2006 Nakamura et al.
7,047,092 B2 5/2006 Wimsatt
7,050,388 B2 5/2006 Kim et al.
7,053,764 B2 5/2006 Stilp
7,053,765 B1 5/2006 Clark
7,068,164 B1 6/2006 Duncan et al.
7,072,934 B2 7/2006 Helgeson et al.
7,073,140 B1 7/2006 Li et al.
7,075,429 B2 7/2006 Marshall
7,079,020 B2 7/2006 Stilp
7,080,046 B1 7/2006 Rezvani et al.
7,081,813 B2 7/2006 Winick et al.
7,082,460 B2 7/2006 Hansen et al.
7,085,814 B1 8/2006 Gandhi et al.
7,085,937 B1 8/2006 Rezvani et al.
7,086,018 B2 8/2006 Ito
7,099,944 B1 8/2006 Anschutz et al.
7,099,994 B2 8/2006 Thayer et al.
7,103,152 B2 9/2006 Naidoo et al.
7,106,176 B2 9/2006 La et al.
7,107,322 B1 9/2006 Freeny, Jr.
7,110,774 B1 9/2006 Davis et al.
7,113,090 B1 9/2006 Saylor et al.
7,113,099 B2 9/2006 Tyroler et al.
7,114,554 B2 10/2006 Bergman et al.
7,119,609 B2 10/2006 Naidoo et al.
7,119,674 B2 10/2006 Sefton
7,120,139 B1 10/2006 Kung et al.
7,120,232 B2 10/2006 Naidoo et al.
7,120,233 B2 10/2006 Naidoo et al.
7,126,473 B1 10/2006 Powell
7,130,383 B2 10/2006 Naidoo et al.
7,130,585 B1 10/2006 Ollis et al.
7,134,138 B2 11/2006 Scherr
7,136,711 B1 11/2006 Duncan et al.
7,142,503 B1 11/2006 Grant et al.
7,148,810 B2 12/2006 Bhat
7,149,798 B2 12/2006 Rezvani et al.
7,149,814 B2 12/2006 Neufeld et al.
7,158,026 B2 1/2007 Feldkamp et al.
7,158,776 B1 1/2007 Estes et al.
7,158,920 B2 1/2007 Ishikawa
7,164,907 B2 1/2007 Cochran et al.
7,166,987 B2 1/2007 Lee et al.
7,171,466 B2 1/2007 Van Der Meulen
7,171,686 B1 1/2007 Jansen et al.
7,174,018 B1 2/2007 Patil et al.
7,174,564 B1 2/2007 Weatherspoon et al.
7,180,889 B1 2/2007 Kung et al.
7,181,207 B1 2/2007 Chow et al.
7,181,716 B1 2/2007 Dahroug
7,183,907 B2 2/2007 Simon et al.
7,184,848 B2 2/2007 Krzyzanowski et al.
7,187,279 B2 3/2007 Chung
7,187,986 B2 3/2007 Johnson et al.
7,194,003 B2 3/2007 Danner et al.
7,194,446 B1 3/2007 Bromley et al.
7,203,486 B2 4/2007 Patel
7,209,945 B2 4/2007 Hicks et al.
7,212,570 B2 5/2007 Akiyama et al.
7,213,061 B1 5/2007 Hite et al.
7,218,217 B2 5/2007 Adonailo et al.
7,222,359 B2 5/2007 Freund et al.
7,237,267 B2 6/2007 Rayes et al.
7,240,327 B2 7/2007 Singh et al.
7,246,044 B2 7/2007 Imamura et al.
7,248,150 B2 7/2007 Mackjust et al.
7,248,161 B2 7/2007 Spoltore et al.
7,249,177 B1 7/2007 Miller
7,249,317 B1 7/2007 Nakagawa et al.
7,250,854 B2 7/2007 Rezvani et al.
7,250,859 B2 7/2007 Martin et al.
7,254,779 B1 8/2007 Rezvani et al.
7,262,690 B2 8/2007 Heaton et al.
7,277,010 B2 10/2007 Joao
7,292,142 B2 11/2007 Simon et al.
7,298,253 B2 11/2007 Petricoin et al.
7,305,461 B2 12/2007 Ullman
7,310,115 B2 12/2007 Tanimoto
7,313,102 B2 12/2007 Stephenson et al.
D558,460 S 1/2008 Yu et al.
D558,756 S 1/2008 Andre et al.
7,337,217 B2 2/2008 Wang
7,337,473 B2 2/2008 Chang et al.
7,340,314 B1 3/2008 Duncan et al.
7,343,619 B2 3/2008 Ofek et al.
7,346,338 B1 3/2008 Calhoun et al.
7,349,682 B1 3/2008 Bennett, III et al.
7,349,761 B1 3/2008 Cruse
7,349,967 B2 3/2008 Wang
7,356,372 B1 4/2008 Duncan et al.
7,359,843 B1 4/2008 Keller et al.
7,362,221 B2 4/2008 Katz
7,367,045 B2 4/2008 Ofek et al.
7,370,115 B2 5/2008 Bae et al.
7,383,339 B1 6/2008 Meenan et al.
7,383,522 B2 6/2008 Murgai et al.
7,391,298 B1 6/2008 Campbell et al.
7,403,838 B2 7/2008 Deen et al.
7,409,045 B2 8/2008 Naidoo et al.
7,409,451 B1 8/2008 Meenan et al.
7,412,447 B2 8/2008 Hilbert et al.
7,425,101 B2 9/2008 Cheng
7,428,585 B1 9/2008 Owens, II et al.
7,430,614 B2 9/2008 Shen et al.
7,437,753 B2 10/2008 Nahum
7,440,434 B2 10/2008 Chaskar et al.
7,440,767 B2 10/2008 Ballay et al.
7,447,775 B1 11/2008 Zhu et al.
7,454,731 B2 11/2008 Oh et al.
7,457,869 B2 11/2008 Kernan
7,466,223 B2 12/2008 Sefton
7,469,139 B2 12/2008 Van De Groenendaal
7,469,294 B1 12/2008 Luo et al.
7,469,381 B2 12/2008 Ording
7,469,391 B2 12/2008 Carrere et al.
D584,738 S 1/2009 Kim et al.
D585,399 S 1/2009 Hwang
7,477,629 B2 1/2009 Tsirtsis et al.
7,479,949 B2 1/2009 Jobs et al.
7,480,713 B2 1/2009 Ullman
7,480,724 B2 1/2009 Zimler et al.
7,483,958 B1 1/2009 Elabbady et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,493,651	B2	2/2009	Vaenskae et al.
7,498,695	B2	3/2009	Gaudreau et al.
7,502,672	B1	3/2009	Kolls
7,506,052	B2	3/2009	Qian et al.
7,509,687	B2	3/2009	Ofek et al.
7,511,614	B2	3/2009	Stilp et al.
7,512,965	B1	3/2009	Amdur et al.
7,526,539	B1	4/2009	Hsu
7,526,762	B1	4/2009	Astala et al.
7,528,723	B2	5/2009	Fast et al.
7,542,721	B1	6/2009	Bonner et al.
7,549,134	B1	6/2009	Li et al.
7,551,071	B2	6/2009	Bennett, III
7,554,934	B2	6/2009	Abraham et al.
7,558,379	B2	7/2009	Winick
7,558,903	B2	7/2009	Kinstler
7,562,323	B1	7/2009	Bai et al.
7,564,855	B1	7/2009	Georgiou
7,568,018	B1	7/2009	Hove et al.
7,571,459	B2	8/2009	Ganesh et al.
7,577,420	B2	8/2009	Srinivasan et al.
7,583,191	B2	9/2009	Zinser
7,587,464	B2	9/2009	Moorer et al.
7,590,953	B2	9/2009	Chang
7,596,622	B2	9/2009	Owen et al.
D602,014	S	10/2009	Andre et al.
D602,015	S	10/2009	Andre et al.
D602,017	S	10/2009	Andre et al.
D602,486	S	10/2009	Andre et al.
D602,487	S	10/2009	Maskatia
7,606,767	B1	10/2009	Couper et al.
7,610,555	B2	10/2009	Klein et al.
7,619,512	B2	11/2009	Trundle et al.
7,620,427	B2	11/2009	Shanahan
7,627,665	B2	12/2009	Barker et al.
7,633,385	B2	12/2009	Cohn et al.
7,634,519	B2	12/2009	Creamer et al.
7,639,157	B1	12/2009	Whitley et al.
7,651,530	B2	1/2010	Winick
7,653,911	B2	1/2010	Doshi et al.
7,671,729	B2	3/2010	Hershkovitz et al.
7,679,503	B2	3/2010	Mason et al.
7,681,201	B2	3/2010	Dale et al.
7,697,028	B1	4/2010	Johnson
7,701,970	B2	4/2010	Krits et al.
D615,083	S	5/2010	Andre et al.
7,711,796	B2	5/2010	Gutt et al.
7,720,654	B2	5/2010	Hollis
7,734,020	B2	6/2010	Elliot et al.
7,734,286	B2	6/2010	Almeda et al.
7,734,906	B2	6/2010	Orlando et al.
7,739,596	B2	6/2010	Clarke-Martin et al.
7,747,975	B2	6/2010	Dinter et al.
7,751,409	B1	7/2010	Carolan
7,755,472	B2	7/2010	Grossman
7,755,506	B1	7/2010	Clegg et al.
7,761,275	B2	7/2010	Chopra et al.
7,787,863	B2	8/2010	Groenendaal et al.
7,804,760	B2	9/2010	Schmukler et al.
D624,896	S	10/2010	Park et al.
D626,437	S	11/2010	Lee et al.
7,825,793	B1	11/2010	Spillman et al.
7,827,252	B2	11/2010	Hopmann et al.
7,847,675	B1	12/2010	Thyen et al.
7,855,635	B2	12/2010	Cohn et al.
7,859,404	B2	12/2010	Chul et al.
7,882,466	B2	2/2011	Ishikawa
7,882,537	B2	2/2011	Okajo et al.
7,884,855	B2	2/2011	Ortiz
7,890,612	B2	2/2011	Todd et al.
7,890,915	B2	2/2011	Celik et al.
7,899,732	B2	3/2011	Van Beaumont et al.
7,904,074	B2	3/2011	Karaoguz et al.
7,904,187	B2	3/2011	Hoffberg et al.
7,911,341	B2	3/2011	Raji et al.
D636,769	S	4/2011	Wood et al.
7,921,686	B2	4/2011	Bagepalli et al.
D637,596	S	5/2011	Akana et al.
7,949,960	B2	5/2011	Roessler et al.
D639,805	S	6/2011	Song et al.
D640,663	S	6/2011	Arnholt et al.
7,956,736	B2	6/2011	Cohn et al.
7,970,863	B1	6/2011	Fontaine
D641,018	S	7/2011	Lee et al.
7,974,235	B2	7/2011	Ghozati et al.
D642,563	S	8/2011	Akana et al.
8,001,219	B2	8/2011	Moorer et al.
D645,015	S	9/2011	Lee et al.
D645,435	S	9/2011	Kim et al.
D645,833	S	9/2011	Seflic et al.
8,022,833	B2	9/2011	Cho
8,028,041	B2	9/2011	Olliphant et al.
8,032,881	B2	10/2011	Holmberg et al.
8,042,049	B2	10/2011	Killian et al.
8,046,411	B2	10/2011	Hayashi et al.
8,069,194	B1	11/2011	Manber et al.
D650,381	S	12/2011	Park et al.
8,073,931	B2	12/2011	Dawes et al.
8,086,702	B2	12/2011	Baum et al.
8,086,703	B2	12/2011	Baum et al.
D654,460	S	2/2012	Kim et al.
D654,497	S	2/2012	Lee
8,122,131	B2	2/2012	Baum et al.
8,125,184	B2	2/2012	Raji et al.
D656,137	S	3/2012	Chung et al.
8,140,658	B1	3/2012	Gelvin et al.
8,144,836	B2	3/2012	Naidoo et al.
8,149,849	B2	4/2012	Osborn et al.
8,159,519	B2	4/2012	Kurtz et al.
8,159,945	B2	4/2012	Muro et al.
8,160,425	B2	4/2012	Kisliakov
8,196,064	B2	6/2012	Krzyzanowski et al.
8,200,827	B1	6/2012	Hunyady et al.
8,205,181	B1	6/2012	Singla et al.
8,209,400	B2	6/2012	Baum et al.
D663,298	S	7/2012	Song et al.
D664,540	S	7/2012	Kim et al.
8,214,494	B1	7/2012	Slavin
8,214,496	B2	7/2012	Gutt et al.
8,229,812	B2	7/2012	Raleigh
D664,954	S	8/2012	Kim et al.
D666,198	S	8/2012	Van Den Nieuwenhuizen et al.
8,239,477	B2	8/2012	Sharma et al.
D667,395	S	9/2012	Lee
D667,396	S	9/2012	Koh
D667,397	S	9/2012	Koh
D667,398	S	9/2012	Koh
D667,399	S	9/2012	Koh
8,269,376	B1	9/2012	Elberbaum
8,269,623	B2	9/2012	Addy et al.
8,271,629	B1	9/2012	Winters et al.
8,271,881	B2	9/2012	Moorer et al.
8,272,053	B2	9/2012	Markham et al.
8,275,830	B2	9/2012	Raleigh
D668,650	S	10/2012	Han
D668,651	S	10/2012	Kim et al.
D668,652	S	10/2012	Kim et al.
D669,469	S	10/2012	Kang
D670,692	S	11/2012	Akana et al.
D671,514	S	11/2012	Kim et al.
8,311,526	B2	11/2012	Forstall et al.
D671,938	S	12/2012	Hsu et al.
D672,344	S	12/2012	Li
D672,345	S	12/2012	Li
D672,739	S	12/2012	Sin
D672,768	S	12/2012	Huang et al.
8,335,842	B2	12/2012	Raji et al.
8,335,854	B2	12/2012	Eldering
8,336,010	B1	12/2012	Chang et al.
D673,561	S	1/2013	Hyun et al.
D673,948	S	1/2013	Andre et al.
D673,950	S	1/2013	Li et al.
D674,369	S	1/2013	Jaewoong
D675,203	S	1/2013	Yang

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,350,694	B1	1/2013	Slavin
D675,588	S	2/2013	Park
D675,612	S	2/2013	Andre et al.
D676,443	S	2/2013	Canizares et al.
D676,819	S	2/2013	Choi
8,373,313	B2	2/2013	Maurer
D677,255	S	3/2013	Mcmanigal et al.
D677,640	S	3/2013	Kim et al.
D677,659	S	3/2013	Akana et al.
D677,660	S	3/2013	Groene et al.
D678,271	S	3/2013	Chiu
D678,272	S	3/2013	Groene et al.
D678,877	S	3/2013	Groene et al.
8,400,767	B2	3/2013	Yeom et al.
D679,706	S	4/2013	Tang et al.
D680,151	S	4/2013	Katori
D680,524	S	4/2013	Feng et al.
D681,032	S	4/2013	Akana et al.
8,413,204	B2	4/2013	White et al.
D681,583	S	5/2013	Park
D681,591	S	5/2013	Sung
D681,632	S	5/2013	Akana et al.
D682,239	S	5/2013	Yeh et al.
8,451,986	B2	5/2013	Cohn et al.
D684,553	S	6/2013	Kim et al.
D684,968	S	6/2013	Smith et al.
8,456,293	B1	6/2013	Trundle et al.
8,473,619	B2	6/2013	Baum et al.
D685,778	S	7/2013	Fahrendorff et al.
D685,783	S	7/2013	Bryan et al.
8,478,450	B2	7/2013	Lu et al.
8,478,844	B2	7/2013	Baum et al.
8,478,871	B2	7/2013	Gutt et al.
8,483,853	B1	7/2013	Lambourne
8,493,202	B1	7/2013	Trundle et al.
8,499,038	B1	7/2013	Vucurevich
8,520,068	B2	8/2013	Naidoo et al.
8,520,072	B1	8/2013	Slavin et al.
8,525,664	B2	9/2013	Hadizad et al.
8,543,665	B2	9/2013	Ansari et al.
D692,042	S	10/2013	Dawes et al.
8,554,478	B2	10/2013	Hartman
8,560,041	B2	10/2013	Flaherty et al.
8,570,993	B2	10/2013	Austin et al.
8,584,199	B1	11/2013	Chen et al.
D695,735	S	12/2013	Kitchen et al.
8,599,018	B2	12/2013	Kellen
8,612,591	B2	12/2013	Dawes et al.
8,634,533	B2	1/2014	Strasters
8,635,350	B2	1/2014	Gutt et al.
8,635,499	B2	1/2014	Cohn et al.
8,638,211	B2	1/2014	Cohn et al.
8,649,386	B2	2/2014	Ansari et al.
8,666,560	B2	3/2014	Lu et al.
8,675,071	B1	3/2014	Slavin et al.
8,700,769	B2	4/2014	Alexander et al.
8,713,132	B2	4/2014	Baum et al.
8,723,671	B2	5/2014	Foisy et al.
8,730,834	B2	5/2014	Marusca et al.
8,738,765	B2	5/2014	Wyatt et al.
8,812,654	B2	8/2014	Gelvin et al.
8,819,178	B2	8/2014	Baum et al.
8,825,871	B2	9/2014	Baum et al.
8,836,467	B1	9/2014	Cohn et al.
8,885,552	B2	11/2014	Bedingfield, Sr. et al.
8,902,740	B2	12/2014	Hicks, III
8,914,526	B1	12/2014	Lindquist et al.
8,935,236	B2	1/2015	Morita et al.
8,937,658	B2	1/2015	Hicks et al.
8,953,479	B2	2/2015	Hall et al.
8,953,749	B2	2/2015	Naidoo et al.
8,963,713	B2	2/2015	Dawes et al.
8,976,763	B2	3/2015	Shrestha et al.
8,988,217	B2	3/2015	Piccolo, III
8,988,221	B2	3/2015	Raji et al.
8,996,665	B2	3/2015	Baum et al.
9,047,753	B2	6/2015	Dawes et al.
9,059,863	B2	6/2015	Baum et al.
9,094,407	B1	7/2015	Matthieu et al.
9,100,446	B2	8/2015	Cohn et al.
9,141,276	B2	9/2015	Dawes et al.
9,144,143	B2	9/2015	Raji et al.
9,147,337	B2	9/2015	Cohn et al.
9,160,784	B2	10/2015	Jeong et al.
9,170,707	B1	10/2015	Laska et al.
9,172,532	B1	10/2015	Fuller et al.
9,172,553	B2	10/2015	Dawes et al.
9,172,605	B2	10/2015	Hardy et al.
9,189,934	B2	11/2015	Jentoft et al.
9,191,228	B2	11/2015	Fulker et al.
9,202,362	B2	12/2015	Hyland et al.
9,246,921	B1	1/2016	Vlaminck et al.
9,286,772	B2	3/2016	Shapiro et al.
9,287,727	B1	3/2016	Egan
9,300,921	B2	3/2016	Naidoo et al.
9,306,809	B2	4/2016	Dawes et al.
9,310,864	B1	4/2016	Klein et al.
9,412,248	B1	8/2016	Cohn et al.
9,426,720	B2	8/2016	Cohn et al.
9,450,776	B2	9/2016	Baum et al.
9,462,041	B1	10/2016	Hagins et al.
9,510,065	B2	11/2016	Cohn et al.
9,529,344	B1	12/2016	Hagins et al.
9,531,593	B2	12/2016	Baum et al.
9,600,945	B2	3/2017	Naidoo et al.
9,609,003	B1	3/2017	Chmielewski et al.
9,613,524	B1	4/2017	Lamb et al.
9,621,408	B2	4/2017	Gutt et al.
9,729,342	B2	8/2017	Cohn et al.
9,779,595	B2	10/2017	Thibault
9,843,458	B2	12/2017	Cronin
9,876,651	B2	1/2018	Cho et al.
9,882,985	B1	1/2018	Esam et al.
9,978,238	B2	5/2018	Fadell et al.
9,979,625	B2	5/2018	Mclaughlin et al.
10,002,507	B2	6/2018	Wilson et al.
10,025,473	B2	7/2018	Sarao et al.
10,062,273	B2	8/2018	Raji et al.
10,078,958	B2	9/2018	Cohn et al.
10,120,354	B1	11/2018	Rolston et al.
10,127,801	B2	11/2018	Raji et al.
10,140,840	B2	11/2018	Cohn et al.
10,156,831	B2	12/2018	Raji et al.
10,156,959	B2	12/2018	Fulker et al.
10,237,757	B2	3/2019	Raleigh et al.
10,264,138	B2	4/2019	Raleigh et al.
10,380,873	B1	8/2019	Halverson
2001/0016501	A1	8/2001	King
2001/0022836	A1	9/2001	Bremer et al.
2001/0025349	A1	9/2001	Sharood et al.
2001/0029585	A1	10/2001	Simon et al.
2001/0030597	A1	10/2001	Inoue et al.
2001/0034209	A1	10/2001	Tong et al.
2001/0034754	A1	10/2001	Elwahab et al.
2001/0034759	A1	10/2001	Chiles et al.
2001/0036192	A1	11/2001	Chiles et al.
2001/0042137	A1	11/2001	Ota et al.
2001/0046366	A1	11/2001	Susskind
2001/0047474	A1	11/2001	Takagi et al.
2001/0053207	A1	12/2001	Jeon et al.
2001/0054115	A1	12/2001	Ferguson et al.
2002/0000913	A1	1/2002	Hamamoto et al.
2002/0003575	A1	1/2002	Marchese
2002/0004828	A1	1/2002	Davis et al.
2002/0005894	A1	1/2002	Foodman et al.
2002/0016639	A1	2/2002	Smith et al.
2002/0018057	A1	2/2002	Sano
2002/0019751	A1	2/2002	Rothschild et al.
2002/0026476	A1	2/2002	Miyazaki et al.
2002/0026531	A1	2/2002	Keane
2002/0027504	A1	3/2002	Davis et al.
2002/0028696	A1	3/2002	Hirayama et al.
2002/0029276	A1	3/2002	Bendinelli et al.
2002/0031120	A1	3/2002	Rakib

(56) **References Cited**

U.S. PATENT DOCUMENTS

2002/0032853 A1 3/2002 Preston et al.
2002/0037004 A1 3/2002 Bossemeyer et al.
2002/0038380 A1 3/2002 Brawn et al.
2002/0046280 A1 4/2002 Fujita
2002/0052719 A1 5/2002 Alexander et al.
2002/0052913 A1 5/2002 Yamada et al.
2002/0055977 A1 5/2002 Nishi
2002/0059078 A1 5/2002 Valdes et al.
2002/0059148 A1 5/2002 Rosenhaft et al.
2002/0059637 A1 5/2002 Rakib
2002/0068984 A1 6/2002 Alexander et al.
2002/0072868 A1 6/2002 Bartone et al.
2002/0077077 A1 6/2002 Rezvani et al.
2002/0083342 A1 6/2002 Webb et al.
2002/0085488 A1 7/2002 Kobayashi
2002/0091815 A1 7/2002 Anderson et al.
2002/0095490 A1 7/2002 Barker et al.
2002/0099809 A1 7/2002 Lee
2002/0099829 A1 7/2002 Richards et al.
2002/0099854 A1 7/2002 Jorgensen
2002/0103898 A1 8/2002 Moyer et al.
2002/0103927 A1 8/2002 Parent
2002/0107910 A1 8/2002 Zhao
2002/0109580 A1 8/2002 Shreve et al.
2002/0111698 A1 8/2002 Graziano et al.
2002/0112051 A1 8/2002 Ullman
2002/0112182 A1 8/2002 Chang et al.
2002/0114439 A1 8/2002 Dunlap
2002/0116117 A1 8/2002 Martens et al.
2002/0118107 A1 8/2002 Yamamoto et al.
2002/0118796 A1 8/2002 Menard et al.
2002/0120696 A1 8/2002 Mousseau et al.
2002/0120790 A1 8/2002 Schwalb
2002/0126009 A1 9/2002 Oyagi et al.
2002/0128728 A1 9/2002 Murakami et al.
2002/0131404 A1 9/2002 Mehta et al.
2002/0133539 A1 9/2002 Monday
2002/0133578 A1 9/2002 Wu
2002/0143805 A1 10/2002 Hayes et al.
2002/0143923 A1 10/2002 Alexander
2002/0147982 A1 10/2002 Naidoo et al.
2002/0152298 A1 10/2002 Kikta et al.
2002/0156564 A1 10/2002 Preston et al.
2002/0156899 A1 10/2002 Sekiguchi
2002/0163534 A1 11/2002 Choi et al.
2002/0163997 A1 11/2002 Bergman et al.
2002/0164997 A1 11/2002 Parry
2002/0165006 A1 11/2002 Haller et al.
2002/0166125 A1 11/2002 Fulmer
2002/0174367 A1 11/2002 Kimmel et al.
2002/0174434 A1 11/2002 Lee et al.
2002/0177428 A1 11/2002 Menard et al.
2002/0177482 A1 11/2002 Cheong et al.
2002/0178211 A1 11/2002 Singhal et al.
2002/0180579 A1 12/2002 Nagaoka et al.
2002/0184301 A1 12/2002 Parent
2002/0184527 A1 12/2002 Chun et al.
2002/0191636 A1 12/2002 Hallenbeck
2003/0005030 A1 1/2003 Sutton et al.
2003/0009552 A1 1/2003 Benfield et al.
2003/0009553 A1 1/2003 Benfield et al.
2003/0010243 A1 1/2003 Roller
2003/0023839 A1 1/2003 Burkhardt et al.
2003/0025599 A1 2/2003 Monroe
2003/0028294 A1 2/2003 Yanagi
2003/0028398 A1 2/2003 Yamashita et al.
2003/0030548 A1 2/2003 Kovacs et al.
2003/0031165 A1 2/2003 O'Brien
2003/0038730 A1* 2/2003 Imafuku G08C 17/00 340/4.3
2003/0038849 A1 2/2003 Craven et al.
2003/0039242 A1 2/2003 Moore
2003/0041137 A1 2/2003 Horie et al.
2003/0041167 A1 2/2003 French et al.
2003/0050731 A1 3/2003 Rosenblum
2003/0051009 A1 3/2003 Shah et al.
2003/0051026 A1 3/2003 Carter et al.
2003/0052905 A1 3/2003 Gordon et al.
2003/0052923 A1 3/2003 Porter
2003/0056012 A1 3/2003 Modeste et al.
2003/0056014 A1 3/2003 Verberkt et al.
2003/0061344 A1 3/2003 Monroe
2003/0061615 A1 3/2003 Van Der Meulen
2003/0061621 A1 3/2003 Petty et al.
2003/0062997 A1 4/2003 Naidoo et al.
2003/0065407 A1 4/2003 Johnson et al.
2003/0065757 A1 4/2003 Mentze et al.
2003/0065791 A1 4/2003 Garg et al.
2003/0067923 A1 4/2003 Ju et al.
2003/0071724 A1 4/2003 D'Amico
2003/0073406 A1 4/2003 Benjamin et al.
2003/0081768 A1 5/2003 Caminschi
2003/0090473 A1 5/2003 Joshi
2003/0096590 A1 5/2003 Satoh
2003/0101243 A1 5/2003 Donahue et al.
2003/0101459 A1 5/2003 Edson
2003/0103088 A1 6/2003 Dresti et al.
2003/0110302 A1 6/2003 Hodges et al.
2003/0112866 A1 6/2003 Yu et al.
2003/0113100 A1 6/2003 Hecht et al.
2003/0115345 A1 6/2003 Chien et al.
2003/0123634 A1 7/2003 Chee
2003/0128114 A1 7/2003 Quigley
2003/0128115 A1 7/2003 Giacopelli et al.
2003/0132018 A1 7/2003 Okita et al.
2003/0137426 A1 7/2003 Anthony et al.
2003/0137991 A1 7/2003 Doshi et al.
2003/0147534 A1 8/2003 Ablay et al.
2003/0149671 A1 8/2003 Yamamoto et al.
2003/0153325 A1 8/2003 Veerepalli et al.
2003/0155757 A1 8/2003 Larsen et al.
2003/0158609 A1 8/2003 Chiu
2003/0158635 A1 8/2003 Pillar et al.
2003/0159135 A1 8/2003 Hiller et al.
2003/0174154 A1 9/2003 Yukie et al.
2003/0174648 A1 9/2003 Wang et al.
2003/0174717 A1 9/2003 Zabarski et al.
2003/0177236 A1 9/2003 Goto et al.
2003/0182396 A1 9/2003 Reich et al.
2003/0182640 A1 9/2003 Alani et al.
2003/0184436 A1 10/2003 Seales et al.
2003/0187920 A1 10/2003 Redkar
2003/0187938 A1 10/2003 Mousseau et al.
2003/0189509 A1 10/2003 Hayes et al.
2003/0197847 A1 10/2003 Shinoda
2003/0200285 A1 10/2003 Hansen et al.
2003/0200325 A1 10/2003 Krishnaswamy et al.
2003/0201889 A1 10/2003 Zulkowski
2003/0208610 A1 11/2003 Rochetti et al.
2003/0210126 A1 11/2003 Kanazawa
2003/0217110 A1 11/2003 Weiss
2003/0217136 A1 11/2003 Cho et al.
2003/0225883 A1 12/2003 Greaves et al.
2003/0230934 A1 12/2003 Cordelli et al.
2003/0233155 A1 12/2003 Slemmer et al.
2003/0233332 A1 12/2003 Keeler et al.
2003/0234725 A1 12/2003 Lemelson et al.
2003/0236841 A1 12/2003 Epshteyn
2004/0003051 A1 1/2004 Krzyzanowski et al.
2004/0003241 A1 1/2004 Sengodan et al.
2004/0008724 A1 1/2004 Devine et al.
2004/0015572 A1 1/2004 Kang
2004/0024851 A1 2/2004 Naidoo et al.
2004/0034697 A1 2/2004 Fairhurst et al.
2004/0034798 A1 2/2004 Yamada et al.
2004/0036615 A1 2/2004 Candela
2004/0037295 A1 2/2004 Tanaka et al.
2004/0041910 A1 3/2004 Naidoo et al.
2004/0054789 A1 3/2004 Breh et al.
2004/0056665 A1 3/2004 Iwanaga et al.
2004/0068657 A1 4/2004 Alexander et al.
2004/0086088 A1 5/2004 Naidoo et al.
2004/0086090 A1 5/2004 Naidoo et al.
2004/0086093 A1 5/2004 Schranz

(56) **References Cited**

U.S. PATENT DOCUMENTS

2004/0093492 A1 5/2004 Daude et al.
2004/0095943 A1 5/2004 Korotin
2004/0103308 A1 5/2004 Paller
2004/0107027 A1 6/2004 Boudrieau
2004/0107299 A1 6/2004 Lee et al.
2004/0113770 A1 6/2004 Falk et al.
2004/0113778 A1 6/2004 Script et al.
2004/0113937 A1 6/2004 Sawdey et al.
2004/0117068 A1 6/2004 Lee
2004/0117330 A1 6/2004 Ehlers et al.
2004/0117462 A1 6/2004 Bodin et al.
2004/0117465 A1 6/2004 Bodin et al.
2004/0123149 A1 6/2004 Tyroler
2004/0125146 A1 7/2004 Gerlach et al.
2004/0125782 A1 7/2004 Chang
2004/0133689 A1 7/2004 Vasisht
2004/0137915 A1 7/2004 Diener et al.
2004/0139227 A1 7/2004 Takeda
2004/0143749 A1 7/2004 Tajalli et al.
2004/0153171 A1 8/2004 Brandt et al.
2004/0155757 A1 8/2004 Litwin et al.
2004/0160309 A1 8/2004 Stilp
2004/0162902 A1 8/2004 Davis
2004/0163073 A1 8/2004 Krzyzanowski et al.
2004/0163118 A1 8/2004 Mottur
2004/0169288 A1 9/2004 Hsieh et al.
2004/0170120 A1 9/2004 Reunamaki et al.
2004/0170155 A1 9/2004 Omar et al.
2004/0172396 A1 9/2004 Vanska et al.
2004/0177163 A1 9/2004 Casey et al.
2004/0181693 A1 9/2004 Milliot et al.
2004/0183756 A1 9/2004 Freitas et al.
2004/0189460 A1 9/2004 Heaton et al.
2004/0189471 A1 9/2004 Ciarcia et al.
2004/0189871 A1 9/2004 Kurosawa et al.
2004/0196844 A1 10/2004 Hagino
2004/0198386 A1 10/2004 Dupray
2004/0199645 A1 10/2004 Rouhi
2004/0201472 A1 10/2004 McGunn et al.
2004/0202351 A1 10/2004 Park et al.
2004/0212494 A1 10/2004 Stilp
2004/0212497 A1 10/2004 Stilp
2004/0212500 A1 10/2004 Stilp
2004/0212503 A1 10/2004 Stilp
2004/0213150 A1 10/2004 Krause et al.
2004/0215694 A1 10/2004 Podolsky
2004/0215700 A1 10/2004 Shenfield et al.
2004/0215750 A1 10/2004 Stilp
2004/0215955 A1 10/2004 Tamai et al.
2004/0223605 A1 11/2004 Donnelly
2004/0225516 A1 11/2004 Bruskotter et al.
2004/0225719 A1 11/2004 Kisley et al.
2004/0229569 A1 11/2004 Franz
2004/0243714 A1 12/2004 Wynn et al.
2004/0243835 A1 12/2004 Terzis et al.
2004/0243996 A1 12/2004 Sheehy et al.
2004/0246339 A1 12/2004 Ooshima et al.
2004/0249613 A1 12/2004 Sprogis et al.
2004/0249922 A1 12/2004 Hackman et al.
2004/0257433 A1 12/2004 Lia et al.
2004/0260407 A1 12/2004 Wimsatt
2004/0260427 A1* 12/2004 Wimsatt G05B 15/02 700/275
2004/0260527 A1 12/2004 Stanculescu
2004/0263314 A1 12/2004 Dorai et al.
2004/0266493 A1 12/2004 Bahl et al.
2004/0267385 A1 12/2004 Lingemann
2004/0267937 A1 12/2004 Klemets
2005/0002417 A1 1/2005 Kelly et al.
2005/0010866 A1 1/2005 Humpleman et al.
2005/0015805 A1 1/2005 Iwamura
2005/0021309 A1 1/2005 Alexander et al.
2005/0022210 A1 1/2005 Zintel et al.
2005/0023858 A1 2/2005 Bingle et al.
2005/0024203 A1 2/2005 Wolfe
2005/0030928 A1 2/2005 Virtanen et al.
2005/0033513 A1 2/2005 Gasbarro
2005/0038325 A1 2/2005 Moll
2005/0038326 A1 2/2005 Mathur
2005/0044061 A1 2/2005 Klemow
2005/0049746 A1 3/2005 Rosenblum
2005/0052831 A1 3/2005 Chen
2005/0055575 A1 3/2005 Evans et al.
2005/0055716 A1 3/2005 Louie et al.
2005/0057361 A1 3/2005 Giraldo et al.
2005/0060163 A1 3/2005 Barsness et al.
2005/0060411 A1 3/2005 Coulombe et al.
2005/0066045 A1 3/2005 Johnson et al.
2005/0066912 A1 3/2005 Korbitz et al.
2005/0069098 A1 3/2005 Kalervo et al.
2005/0071483 A1 3/2005 Motoyama
2005/0075764 A1 4/2005 Horst et al.
2005/0079855 A1 4/2005 Jethi et al.
2005/0081161 A1 4/2005 MacInnes et al.
2005/0086126 A1 4/2005 Patterson
2005/0086211 A1 4/2005 Mayer
2005/0086366 A1 4/2005 Luebke et al.
2005/0088983 A1 4/2005 Wesslen et al.
2005/0089023 A1 4/2005 Barkley et al.
2005/0090915 A1 4/2005 Geiwitz
2005/0091435 A1 4/2005 Han et al.
2005/0091696 A1 4/2005 Wolfe et al.
2005/0096753 A1 5/2005 Arling et al.
2005/0097478 A1 5/2005 Killian et al.
2005/0101314 A1 5/2005 Levi
2005/0102152 A1 5/2005 Hodges
2005/0102497 A1 5/2005 Buer
2005/0105530 A1 5/2005 Kono
2005/0108091 A1 5/2005 Sotak et al.
2005/0108369 A1 5/2005 Sather et al.
2005/0114900 A1 5/2005 Ladd et al.
2005/0119913 A1 6/2005 Hornreich et al.
2005/0120082 A1 6/2005 Hesselink et al.
2005/0125083 A1 6/2005 Kiko
2005/0128068 A1 6/2005 Winick et al.
2005/0128083 A1 6/2005 Puzio et al.
2005/0128093 A1 6/2005 Genova et al.
2005/0144312 A1 6/2005 Kadyk et al.
2005/0148356 A1 7/2005 Ferguson et al.
2005/0149639 A1 7/2005 Vrielink et al.
2005/0149746 A1 7/2005 Lu et al.
2005/0154494 A1 7/2005 Ahmed
2005/0154774 A1 7/2005 Giaffreda et al.
2005/0155757 A1 7/2005 Paton
2005/0156568 A1 7/2005 Yueh
2005/0156737 A1 7/2005 Al-Khateeb
2005/0159823 A1 7/2005 Hayes et al.
2005/0159911 A1 7/2005 Funk et al.
2005/0169288 A1 8/2005 Kamiwada et al.
2005/0174229 A1 8/2005 Feldkamp et al.
2005/0179531 A1 8/2005 Tabe
2005/0182681 A1 8/2005 Bruskotter et al.
2005/0184865 A1 8/2005 Han et al.
2005/0188315 A1 8/2005 Campbell et al.
2005/0197847 A1 9/2005 Smith
2005/0200474 A1 9/2005 Behnke
2005/0204076 A1 9/2005 Cumpson et al.
2005/0207429 A1 9/2005 Akita et al.
2005/0210532 A1 9/2005 Winick
2005/0216302 A1 9/2005 Raji et al.
2005/0216580 A1 9/2005 Raji et al.
2005/0220123 A1 10/2005 Wybenga et al.
2005/0222820 A1 10/2005 Chung et al.
2005/0222933 A1 10/2005 Wesby
2005/0229016 A1 10/2005 Addy
2005/0231349 A1 10/2005 Bhat
2005/0232284 A1 10/2005 Karaoguz et al.
2005/0234568 A1 10/2005 Chung et al.
2005/0237182 A1 10/2005 Wang
2005/0249199 A1 11/2005 Albert et al.
2005/0253706 A1 11/2005 Spoltore et al.
2005/0256608 A1 11/2005 King et al.
2005/0257013 A1 11/2005 Ma
2005/0257260 A1 11/2005 Lenoir et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2005/0259673 A1 11/2005 Lu et al.
2005/0260973 A1 11/2005 Van De Groenendaal
2005/0262241 A1 11/2005 Gubbi et al.
2005/0267605 A1 12/2005 Lee et al.
2005/0270151 A1 12/2005 Winick
2005/0273831 A1 12/2005 Slomovich et al.
2005/0276389 A1 12/2005 Hinkson et al.
2005/0280964 A1 12/2005 Richmond et al.
2005/0282557 A1 12/2005 Mikko et al.
2005/0283823 A1 12/2005 Okajo et al.
2005/0285934 A1 12/2005 Carter
2005/0285941 A1 12/2005 Haigh et al.
2006/0009863 A1 1/2006 Lingemann
2006/0010078 A1 1/2006 Rezvani et al.
2006/0018328 A1 1/2006 Mody et al.
2006/0018479 A1 1/2006 Chen
2006/0022816 A1 2/2006 Yukawa
2006/0023847 A1 2/2006 Tyroler et al.
2006/0025132 A1 2/2006 Karaoguz et al.
2006/0026301 A1 2/2006 Maeda et al.
2006/0031852 A1 2/2006 Chu et al.
2006/0041655 A1 2/2006 Holloway et al.
2006/0045074 A1 3/2006 Lee
2006/0050692 A1 3/2006 Petrescu et al.
2006/0050862 A1 3/2006 Shen et al.
2006/0051122 A1 3/2006 Kawazu et al.
2006/0052884 A1 3/2006 Staples et al.
2006/0053447 A1 3/2006 Krzyzanowski et al.
2006/0053491 A1 3/2006 Khuti et al.
2006/0063534 A1 3/2006 Kokkonen et al.
2006/0064305 A1 3/2006 Alonso
2006/0064478 A1 3/2006 Sirkin
2006/0067344 A1 3/2006 Sakurai
2006/0067356 A1 3/2006 Kim et al.
2006/0067484 A1 3/2006 Elliot et al.
2006/0075235 A1 4/2006 Renkis
2006/0077254 A1 4/2006 Shu et al.
2006/0078344 A1 4/2006 Kawazu et al.
2006/0080465 A1 4/2006 Conzola et al.
2006/0088092 A1 4/2006 Chen et al.
2006/0092011 A1 5/2006 Simon et al.
2006/0093365 A1 5/2006 Dybsetter et al.
2006/0101062 A1 5/2006 Godman et al.
2006/0103510 A1 5/2006 Chen et al.
2006/0103520 A1 5/2006 Clark
2006/0104312 A1 5/2006 Friar
2006/0105713 A1 5/2006 Zheng et al.
2006/0106933 A1 5/2006 Huang et al.
2006/0109113 A1 5/2006 Reyes et al.
2006/0109860 A1 5/2006 Matsunaga et al.
2006/0111095 A1 5/2006 Weigand
2006/0121924 A1 6/2006 Rengaraju et al.
2006/0123212 A1 6/2006 Yagawa
2006/0129837 A1 6/2006 Im et al.
2006/0132302 A1 6/2006 Stilp
2006/0136558 A1 6/2006 Sheehan et al.
2006/0142880 A1 6/2006 Deen et al.
2006/0142968 A1 6/2006 Han et al.
2006/0143268 A1 6/2006 Chatani
2006/0145842 A1 7/2006 Stilp
2006/0154642 A1 7/2006 Scannell, Jr.
2006/0155851 A1 7/2006 Ma et al.
2006/0159032 A1 7/2006 Ukrainetz et al.
2006/0161270 A1 7/2006 Luskin et al.
2006/0161662 A1 7/2006 Ng et al.
2006/0161960 A1 7/2006 Benoit
2006/0167784 A1 7/2006 Hoffberg
2006/0167919 A1 7/2006 Hsieh
2006/0168178 A1 7/2006 Hwang et al.
2006/0176146 A1 8/2006 Krishan et al.
2006/0176167 A1 8/2006 Dohrmann
2006/0181406 A1 8/2006 Petite et al.
2006/0182100 A1 8/2006 Li et al.
2006/0183460 A1 8/2006 Srinivasan et al.
2006/0187900 A1 8/2006 Akbar
2006/0190458 A1 8/2006 Mishina et al.
2006/0190529 A1 8/2006 Morozumi et al.
2006/0197660 A1 9/2006 Luebke et al.
2006/0200845 A1 9/2006 Foster et al.
2006/0206220 A1 9/2006 Amundson
2006/0208872 A1 9/2006 Yu et al.
2006/0208880 A1 9/2006 Funk et al.
2006/0209857 A1* 9/2006 Hicks, III G08B 25/08 370/401
2006/0215650 A1 9/2006 Wollmershauser et al.
2006/0218593 A1 9/2006 Afshary et al.
2006/0220830 A1 10/2006 Bennett, III
2006/0221184 A1 10/2006 Vallone et al.
2006/0222153 A1 10/2006 Tarkoff et al.
2006/0229746 A1 10/2006 Ollis et al.
2006/0230270 A1 10/2006 Goffin
2006/0233372 A1 10/2006 Shaheen et al.
2006/0235963 A1 10/2006 Wetherly et al.
2006/0238372 A1 10/2006 Jung et al.
2006/0242395 A1 10/2006 Fausak
2006/0245369 A1 11/2006 Schimmelpfeng et al.
2006/0246886 A1 11/2006 Benco et al.
2006/0246919 A1 11/2006 Park et al.
2006/0250235 A1 11/2006 Astrin
2006/0258342 A1 11/2006 Fok et al.
2006/0265489 A1 11/2006 Moore
2006/0271695 A1 11/2006 Lavian
2006/0274764 A1 12/2006 Mah et al.
2006/0281435 A1 12/2006 Shearer et al.
2006/0282886 A1 12/2006 Gaug
2006/0288288 A1 12/2006 Girgensohn et al.
2006/0291507 A1 12/2006 Sarosi et al.
2006/0294565 A1 12/2006 Walter
2007/0001818 A1 1/2007 Small et al.
2007/0002833 A1 1/2007 Bajic
2007/0005736 A1 1/2007 Hansen et al.
2007/0005957 A1 1/2007 Sahita et al.
2007/0006177 A1 1/2007 Aiber et al.
2007/0008099 A1 1/2007 Kimmel et al.
2007/0043478 A1 2/2007 Ehlers et al.
2007/0043954 A1 2/2007 Fox
2007/0047585 A1 3/2007 Gillespie et al.
2007/0052675 A1 3/2007 Chang
2007/0055770 A1 3/2007 Karmakar et al.
2007/0058627 A1 3/2007 Smith et al.
2007/0061018 A1 3/2007 Callaghan et al.
2007/0061020 A1 3/2007 Bovee et al.
2007/0061266 A1 3/2007 Moore et al.
2007/0061430 A1 3/2007 Kim
2007/0061878 A1 3/2007 Hagiu et al.
2007/0063836 A1 3/2007 Hayden et al.
2007/0063866 A1 3/2007 Webb
2007/0064714 A1 3/2007 Bi et al.
2007/0079151 A1 4/2007 Connor et al.
2007/0079385 A1 4/2007 Williams et al.
2007/0083668 A1 4/2007 Kelsey et al.
2007/0090944 A1 4/2007 Du Breuil
2007/0094716 A1 4/2007 Farino et al.
2007/0096981 A1 5/2007 Abraham
2007/0101345 A1 5/2007 Takagi
2007/0103433 A1 5/2007 Katz
2007/0105072 A1 5/2007 Koljonen
2007/0106124 A1 5/2007 Kuriyama et al.
2007/0116020 A1 5/2007 Cheever et al.
2007/0117464 A1 5/2007 Freeman
2007/0118609 A1 5/2007 Mullan et al.
2007/0127510 A1 6/2007 Bossemeyer et al.
2007/0130286 A1 6/2007 Hopmann et al.
2007/0140267 A1 6/2007 Yang
2007/0142022 A1 6/2007 Madonna et al.
2007/0142044 A1 6/2007 Fitzgerald et al.
2007/0143440 A1 6/2007 Reckamp et al.
2007/0146484 A1 6/2007 Horton et al.
2007/0147419 A1 6/2007 Tsujimoto et al.
2007/0150616 A1 6/2007 Baek et al.
2007/0154010 A1 7/2007 Wong
2007/0155325 A1 7/2007 Bambic et al.
2007/0160017 A1 7/2007 Meier et al.
2007/0161372 A1 7/2007 Rogalski et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2007/0162228 A1 7/2007 Mitchell
2007/0162680 A1 7/2007 Mitchell et al.
2007/0164779 A1 7/2007 Weston et al.
2007/0168860 A1 7/2007 Takayama et al.
2007/0182543 A1 8/2007 Luo
2007/0183345 A1 8/2007 Fahim et al.
2007/0185989 A1 8/2007 Corbett et al.
2007/0192486 A1 8/2007 Wilson et al.
2007/0198698 A1 8/2007 Boyd et al.
2007/0208521 A1 9/2007 Petite et al.
2007/0214262 A1 9/2007 Buchbinder et al.
2007/0214264 A1 9/2007 Koister
2007/0216764 A1 9/2007 Kwak
2007/0216783 A1 9/2007 Ortiz et al.
2007/0218895 A1 9/2007 Saito et al.
2007/0223465 A1 9/2007 Wang et al.
2007/0223500 A1 9/2007 Lee et al.
2007/0226182 A1 9/2007 Sobotka et al.
2007/0230415 A1 10/2007 Malik
2007/0245223 A1 10/2007 Siedzik et al.
2007/0255856 A1 11/2007 Reckamp et al.
2007/0256105 A1 11/2007 Tabe
2007/0257986 A1 11/2007 Ivanov et al.
2007/0260713 A1 11/2007 Moorer et al.
2007/0262857 A1 11/2007 Jackson
2007/0263782 A1 11/2007 Stock et al.
2007/0265866 A1 11/2007 Fehling et al.
2007/0271398 A1 11/2007 Manchester et al.
2007/0275703 A1 11/2007 Lim et al.
2007/0282665 A1 12/2007 Buehler et al.
2007/0283001 A1 12/2007 Spiess et al.
2007/0286210 A1 12/2007 Gutt et al.
2007/0286369 A1 12/2007 Gutt et al.
2007/0287405 A1 12/2007 Radtke
2007/0288849 A1 12/2007 Moorer et al.
2007/0288858 A1 12/2007 Pereira et al.
2007/0290830 A1 12/2007 Gurley
2007/0296814 A1 12/2007 Cooper et al.
2007/0298772 A1 12/2007 Owens et al.
2008/0001734 A1 1/2008 Stilp et al.
2008/0013957 A1 1/2008 Akers et al.
2008/0027587 A1 1/2008 Nickerson et al.
2008/0042826 A1 2/2008 Hevia et al.
2008/0043107 A1 2/2008 Coogan et al.
2008/0048861 A1 2/2008 Naidoo et al.
2008/0048975 A1 2/2008 Leibow
2008/0052348 A1 2/2008 Adler et al.
2008/0056261 A1 3/2008 Osborn et al.
2008/0059533 A1 3/2008 Krikorian
2008/0059622 A1 3/2008 Hite et al.
2008/0065681 A1 3/2008 Fontijn et al.
2008/0065685 A1 3/2008 Frank
2008/0072244 A1 3/2008 Eker et al.
2008/0074258 A1 3/2008 Bennett et al.
2008/0074993 A1 3/2008 Vainola
2008/0082186 A1 4/2008 Hood et al.
2008/0084294 A1 4/2008 Zhiying et al.
2008/0084296 A1 4/2008 Kutzik et al.
2008/0086564 A1 4/2008 Putman et al.
2008/0091793 A1 4/2008 Diroo et al.
2008/0102845 A1 5/2008 Zhao
2008/0103608 A1 5/2008 Gough
2008/0104215 A1 5/2008 Excoffier et al.
2008/0104516 A1 5/2008 Lee
2008/0109302 A1 5/2008 Salokannel et al.
2008/0109650 A1 5/2008 Shim et al.
2008/0112340 A1 5/2008 Luebke
2008/0112405 A1 5/2008 Cholas et al.
2008/0117029 A1 5/2008 Dohrmann et al.
2008/0117201 A1 5/2008 Martinez et al.
2008/0117922 A1 5/2008 Cockrell et al.
2008/0120405 A1 5/2008 Son et al.
2008/0122575 A1 5/2008 Lavian et al.
2008/0126535 A1 5/2008 Zhu et al.
2008/0128444 A1 6/2008 Schininger et al.
2008/0129484 A1 6/2008 Dahl et al.
2008/0129821 A1 6/2008 Howarter et al.
2008/0130949 A1 6/2008 Ivanov et al.
2008/0133725 A1 6/2008 Shaouy
2008/0134343 A1 6/2008 Pennington et al.
2008/0137572 A1 6/2008 Park et al.
2008/0140868 A1 6/2008 Kalayjian et al.
2008/0141303 A1 6/2008 Walker et al.
2008/0141341 A1 6/2008 Vinogradov et al.
2008/0144884 A1 6/2008 Habibi
2008/0147834 A1 6/2008 Quinn et al.
2008/0155080 A1 6/2008 Marlow et al.
2008/0155470 A1 6/2008 Khedouri et al.
2008/0163355 A1 7/2008 Chu
2008/0168404 A1 7/2008 Ording
2008/0170511 A1 7/2008 Shorty et al.
2008/0180240 A1 7/2008 Raji et al.
2008/0181239 A1 7/2008 Wood et al.
2008/0183483 A1 7/2008 Hart
2008/0183842 A1 7/2008 Raji et al.
2008/0189609 A1 8/2008 Larson et al.
2008/0201468 A1 8/2008 Titus
2008/0204190 A1 8/2008 Cohn et al.
2008/0204219 A1 8/2008 Cohn et al.
2008/0208399 A1 8/2008 Pham
2008/0209505 A1 8/2008 Ghai et al.
2008/0209506 A1 8/2008 Ghai et al.
2008/0215450 A1 9/2008 Gates et al.
2008/0215613 A1 9/2008 Grasso
2008/0219239 A1 9/2008 Bell et al.
2008/0221715 A1 9/2008 Krzyzanowski et al.
2008/0235326 A1 9/2008 Parsi et al.
2008/0235600 A1 9/2008 Harper et al.
2008/0239075 A1 10/2008 Mehrotra et al.
2008/0240372 A1 10/2008 Frenette
2008/0240696 A1* 10/2008 Kucharyson H04N 7/181
396/56
2008/0253391 A1 10/2008 Krits et al.
2008/0261540 A1 10/2008 Rohani et al.
2008/0266080 A1 10/2008 Leung et al.
2008/0266257 A1 10/2008 Chiang
2008/0271150 A1 10/2008 Boerger et al.
2008/0284587 A1 11/2008 Saigh et al.
2008/0284592 A1 11/2008 Collins et al.
2008/0288639 A1 11/2008 Ruppert et al.
2008/0294588 A1 11/2008 Morris et al.
2008/0297599 A1 12/2008 Donovan et al.
2008/0303903 A1 12/2008 Bentley et al.
2008/0313316 A1 12/2008 Hite et al.
2008/0316024 A1 12/2008 Chantelou et al.
2009/0003820 A1 1/2009 Law et al.
2009/0007596 A1 1/2009 Goldstein et al.
2009/0013210 A1 1/2009 McIntosh et al.
2009/0019141 A1 1/2009 Bush et al.
2009/0036142 A1 2/2009 Yan
2009/0041467 A1 2/2009 Carleton et al.
2009/0042649 A1 2/2009 Hsieh et al.
2009/0046664 A1 2/2009 Aso
2009/0049488 A1 2/2009 Stransky
2009/0055760 A1 2/2009 Whatcott et al.
2009/0063582 A1 3/2009 Anna et al.
2009/0066534 A1 3/2009 Sivakkolundhu
2009/0066788 A1 3/2009 Baum et al.
2009/0066789 A1 3/2009 Baum et al.
2009/0067395 A1 3/2009 Curtis et al.
2009/0067441 A1 3/2009 Ansari et al.
2009/0070436 A1 3/2009 Dawes et al.
2009/0070473 A1 3/2009 Baum et al.
2009/0070477 A1 3/2009 Baum et al.
2009/0070681 A1 3/2009 Dawes et al.
2009/0070682 A1 3/2009 Dawes et al.
2009/0070692 A1 3/2009 Dawes et al.
2009/0072988 A1 3/2009 Haywood
2009/0074184 A1 3/2009 Baum et al.
2009/0076211 A1 3/2009 Yang et al.
2009/0076879 A1 3/2009 Sparks et al.
2009/0077167 A1 3/2009 Baum et al.
2009/0077622 A1 3/2009 Baum et al.
2009/0077623 A1 3/2009 Baum et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2009/0077624 A1 3/2009 Baum et al.
2009/0079547 A1 3/2009 Oksanen et al.
2009/0086660 A1 4/2009 Sood et al.
2009/0100329 A1 4/2009 Espinoza
2009/0100492 A1 4/2009 Hicks, III et al.
2009/0113344 A1 4/2009 Nesse
2009/0119397 A1 5/2009 Neerdaels
2009/0125708 A1 5/2009 Woodring
2009/0128365 A1 5/2009 Laskin
2009/0134998 A1 5/2009 Baum et al.
2009/0138600 A1 5/2009 Baum et al.
2009/0138958 A1 5/2009 Baum et al.
2009/0146846 A1 6/2009 Grossman
2009/0158189 A1 6/2009 Itani
2009/0158292 A1 6/2009 Rattner et al.
2009/0161609 A1 6/2009 Bergstrom
2009/0165114 A1 6/2009 Baum et al.
2009/0172443 A1 7/2009 Rothman et al.
2009/0177298 A1 7/2009 McFarland et al.
2009/0177906 A1 7/2009 Paniagua, Jr. et al.
2009/0187297 A1 7/2009 Kish et al.
2009/0193373 A1 7/2009 Abbaspour et al.
2009/0202250 A1 8/2009 Dizechi et al.
2009/0204693 A1 8/2009 Andreev et al.
2009/0221368 A1 9/2009 Yen et al.
2009/0224875 A1 9/2009 Rabinowitz et al.
2009/0228445 A1 9/2009 Gangal
2009/0240353 A1 9/2009 Songkakul et al.
2009/0240730 A1 9/2009 Wood
2009/0240787 A1 9/2009 Denny
2009/0240814 A1 9/2009 Brubacher et al.
2009/0240946 A1 9/2009 Yeap
2009/0256708 A1 10/2009 Hsiao et al.
2009/0259515 A1 10/2009 Belimpasakis et al.
2009/0260052 A1 10/2009 Bathula et al.
2009/0260430 A1 10/2009 Zamfes
2009/0265042 A1 10/2009 Mollenkopf et al.
2009/0265193 A1 10/2009 Collins et al.
2009/0289787 A1 11/2009 Dawson et al.
2009/0303100 A1 12/2009 Zemany
2009/0307255 A1 12/2009 Park
2009/0313693 A1 12/2009 Rogers
2009/0322510 A1 12/2009 Berger et al.
2009/0324010 A1 12/2009 Hou
2010/0000791 A1 1/2010 Alberty
2010/0001812 A1 1/2010 Kausch
2010/0004949 A1 1/2010 O'Brien
2010/0008274 A1 1/2010 Kneckt et al.
2010/0013917 A1 1/2010 Hanna et al.
2010/0023865 A1 1/2010 Fulker et al.
2010/0026487 A1 2/2010 Hershkovitz
2010/0030578 A1 2/2010 Siddique et al.
2010/0030810 A1 2/2010 Marr
2010/0039958 A1 2/2010 Ge et al.
2010/0041380 A1 2/2010 Hewes et al.
2010/0052612 A1 3/2010 Raji et al.
2010/0066530 A1 3/2010 Cohn et al.
2010/0067371 A1 3/2010 Gogic et al.
2010/0074112 A1 3/2010 Derr et al.
2010/0077111 A1 3/2010 Holmes et al.
2010/0082744 A1 4/2010 Raji et al.
2010/0095111 A1 4/2010 Gutt et al.
2010/0095369 A1 4/2010 Gutt et al.
2010/0100269 A1 4/2010 Ekhaguere et al.
2010/0102951 A1 4/2010 Rutledge
2010/0121521 A1 5/2010 Kiribayashi
2010/0122091 A1 5/2010 Huang et al.
2010/0138758 A1 6/2010 Mizumori et al.
2010/0138764 A1 6/2010 Hatambeiki et al.
2010/0145485 A1 6/2010 Duchene et al.
2010/0150170 A1 6/2010 Lee et al.
2010/0153853 A1 6/2010 Dawes et al.
2010/0159898 A1 6/2010 Krzyzanowski et al.
2010/0159967 A1 6/2010 Pounds et al.
2010/0164736 A1 7/2010 Byers et al.
2010/0165897 A1 7/2010 Sood
2010/0177749 A1 7/2010 Essinger et al.
2010/0177750 A1 7/2010 Essinger et al.
2010/0185857 A1 7/2010 Neitzel et al.
2010/0197219 A1 8/2010 Issa et al.
2010/0204839 A1 8/2010 Behm et al.
2010/0210240 A1 8/2010 Mahaffey et al.
2010/0212012 A1 8/2010 Touboul et al.
2010/0218104 A1 8/2010 Lewis
2010/0238286 A1 9/2010 Boghossian et al.
2010/0241711 A1 9/2010 Ansari et al.
2010/0245107 A1 9/2010 Fulker et al.
2010/0248681 A1 9/2010 Phills
2010/0267390 A1 10/2010 Lin et al.
2010/0274366 A1 10/2010 Fata et al.
2010/0277300 A1 11/2010 Cohn et al.
2010/0277302 A1 11/2010 Cohn et al.
2010/0277315 A1 11/2010 Cohn et al.
2010/0280635 A1 11/2010 Cohn et al.
2010/0280637 A1 11/2010 Cohn et al.
2010/0281135 A1 11/2010 Cohn et al.
2010/0281161 A1 11/2010 Cohn et al.
2010/0281312 A1 11/2010 Cohn et al.
2010/0298024 A1 11/2010 Choi
2010/0321151 A1 12/2010 Matsuura et al.
2010/0325107 A1 12/2010 Kenton et al.
2010/0332164 A1 12/2010 Aisa et al.
2011/0000521 A1 1/2011 Tachibana
2011/0029875 A1 2/2011 Milch
2011/0030056 A1 2/2011 Tokunaga
2011/0037593 A1 2/2011 Foisy et al.
2011/0040415 A1 2/2011 Nickerson et al.
2011/0040877 A1 2/2011 Foisy
2011/0051638 A1 3/2011 Jeon et al.
2011/0068921 A1 3/2011 Shafer
2011/0080267 A1 4/2011 Clare et al.
2011/0093799 A1 4/2011 Hatambeiki et al.
2011/0096678 A1 4/2011 Ketonen
2011/0102588 A1 5/2011 Trundle et al.
2011/0125333 A1 5/2011 Gray
2011/0125846 A1 5/2011 Ham et al.
2011/0128378 A1 6/2011 Raji
2011/0156914 A1 6/2011 Sheharri et al.
2011/0169637 A1 7/2011 Siegler et al.
2011/0197327 A1 8/2011 McElroy et al.
2011/0200052 A1 8/2011 Mungo et al.
2011/0208359 A1 8/2011 Duchene et al.
2011/0212706 A1 9/2011 Uusilehto
2011/0218777 A1 9/2011 Chen et al.
2011/0230160 A1 9/2011 Felgate
2011/0234392 A1 9/2011 Cohn et al.
2011/0257953 A1 10/2011 Li et al.
2011/0283006 A1 11/2011 Ramamurthy
2011/0286437 A1 11/2011 Austin et al.
2011/0302497 A1 12/2011 Garrett et al.
2011/0309929 A1 12/2011 Myers
2012/0016607 A1 1/2012 Zolkiewski
2012/0020060 A1 1/2012 Myer et al.
2012/0023151 A1 1/2012 Bennett, III et al.
2012/0030130 A1 2/2012 Smith et al.
2012/0062026 A1 3/2012 Dawes
2012/0062370 A1 3/2012 Feldstein et al.
2012/0066608 A1 3/2012 Fulker
2012/0066632 A1 3/2012 Fulker
2012/0081842 A1 4/2012 Ewing et al.
2012/0143383 A1 6/2012 Cooperrider et al.
2012/0154126 A1 6/2012 Kitchen
2012/0154138 A1 6/2012 Cohn et al.
2012/0172027 A1 7/2012 Partheesh et al.
2012/0182245 A1 7/2012 Hutton
2012/0209951 A1 8/2012 Enns et al.
2012/0214502 A1 8/2012 Qiang
2012/0232788 A1 9/2012 Diao
2012/0242788 A1 9/2012 Chuang et al.
2012/0257061 A1 10/2012 Edwards et al.
2012/0260184 A1 10/2012 Dawes et al.
2012/0265892 A1 10/2012 Ma et al.
2012/0278877 A1 11/2012 Wood
2012/0296486 A1 11/2012 Marriam et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2012/0307646 A1 12/2012 Xia et al.
2012/0309354 A1 12/2012 Du
2012/0315848 A1 12/2012 Smith et al.
2012/0324566 A1 12/2012 Wood
2012/0327242 A1 12/2012 Barley et al.
2012/0331109 A1 12/2012 Wood
2013/0007871 A1 1/2013 Meenan et al.
2013/0038730 A1 2/2013 Peterson et al.
2013/0038800 A1 2/2013 Yoo
2013/0062951 A1 3/2013 Dawes
2013/0073746 A1 3/2013 Singh et al.
2013/0082835 A1 4/2013 Shapiro et al.
2013/0085620 A1 4/2013 Lu et al.
2013/0103207 A1 4/2013 Ruff et al.
2013/0115972 A1 5/2013 Ziskind et al.
2013/0120134 A1 5/2013 Hicks, III
2013/0136102 A1 5/2013 Macwan et al.
2013/0154822 A1 6/2013 Kumar et al.
2013/0155229 A1 6/2013 Thornton et al.
2013/0163491 A1 6/2013 Singh et al.
2013/0174239 A1 7/2013 Kim et al.
2013/0183924 A1 7/2013 Saigh
2013/0184874 A1 7/2013 Frader-Thompson et al.
2013/0191755 A1 7/2013 Balog et al.
2013/0218959 A1 8/2013 Kodama
2013/0222133 A1 8/2013 Schultz et al.
2013/0223279 A1 8/2013 Tinnakornsrisuphap et al.
2013/0261821 A1 10/2013 Lu et al.
2013/0266193 A1 10/2013 Tiwari et al.
2013/0314542 A1 11/2013 Jackson
2013/0318231 A1 11/2013 Gutt
2013/0318443 A1 11/2013 Bachman et al.
2013/0331109 A1 12/2013 Dhillon et al.
2013/0344875 A1 12/2013 Chowdhury
2014/0032034 A1 1/2014 Raptopoulos et al.
2014/0035726 A1 2/2014 Schoner et al.
2014/0053246 A1 2/2014 Huang et al.
2014/0068486 A1 3/2014 Sellers et al.
2014/0075464 A1 3/2014 McCrea
2014/0098247 A1 4/2014 Rao et al.
2014/0112405 A1 4/2014 Jafarian et al.
2014/0126425 A1 5/2014 Dawes
2014/0136936 A1 5/2014 Patel et al.
2014/0140575 A1 5/2014 Wolf
2014/0143695 A1 5/2014 Fulker
2014/0143851 A1 5/2014 Dawes
2014/0143854 A1 5/2014 Lopez et al.
2014/0146171 A1 5/2014 Brady et al.
2014/0153695 A1 6/2014 Yanagisawa et al.
2014/0167928 A1 6/2014 Burd
2014/0172957 A1 6/2014 Dawes
2014/0176797 A1 6/2014 Silva et al.
2014/0180968 A1 6/2014 Song et al.
2014/0201291 A1 7/2014 Russell
2014/0218517 A1 8/2014 Kim et al.
2014/0233951 A1 8/2014 Cook
2014/0236325 A1 8/2014 Sasaki et al.
2014/0266678 A1 9/2014 Shapiro et al.
2014/0278281 A1 9/2014 Vaynriber et al.
2014/0282934 A1 9/2014 Miasnik et al.
2014/0289384 A1 9/2014 Kao et al.
2014/0293046 A1 10/2014 Ni
2014/0316616 A1 10/2014 Kugelmass
2014/0340216 A1 11/2014 Puskarich
2014/0355588 A1 12/2014 Cho et al.
2014/0359101 A1 12/2014 Wales
2014/0359524 A1 12/2014 Sasaki et al.
2014/0368331 A1 12/2014 Quain
2014/0369584 A1 12/2014 Fan et al.
2014/0372599 A1 12/2014 Gutt
2014/0372811 A1 12/2014 Cohn et al.
2015/0009325 A1 1/2015 Kardashov
2015/0019714 A1 1/2015 Shaashua et al.
2015/0054947 A1 2/2015 Dawes
2015/0074206 A1 3/2015 Baldwin
2015/0077553 A1 3/2015 Dawes
2015/0082414 A1 3/2015 Dawes
2015/0088982 A1 3/2015 Johnson et al.
2015/0097949 A1 4/2015 Ure et al.
2015/0097961 A1 4/2015 Ure et al.
2015/0106721 A1 4/2015 Cha et al.
2015/0116108 A1 4/2015 Fadell et al.
2015/0142991 A1 5/2015 Zaloom
2015/0161875 A1 6/2015 Cohn et al.
2015/0205465 A1 7/2015 Robison et al.
2015/0222517 A1 8/2015 McLaughlin et al.
2015/0261427 A1 9/2015 Sasaki
2015/0325106 A1 11/2015 Dawes et al.
2015/0331662 A1 11/2015 Lambourne
2015/0334087 A1 11/2015 Dawes
2015/0348554 A1 12/2015 Orr et al.
2015/0350031 A1 12/2015 Burks et al.
2015/0365217 A1 12/2015 Scholten et al.
2015/0373149 A1 12/2015 Lyons
2016/0012715 A1 1/2016 Hazbun
2016/0019763 A1 1/2016 Hazbun
2016/0019778 A1 1/2016 Raji et al.
2016/0023475 A1 1/2016 Bevier et al.
2016/0027295 A1 1/2016 Raji et al.
2016/0036944 A1 2/2016 Kitchen
2016/0042637 A1 2/2016 Cahill
2016/0062624 A1 3/2016 Sundermeyer et al.
2016/0065413 A1 3/2016 Sundermeyer et al.
2016/0065414 A1 3/2016 Sundermeyer et al.
2016/0077935 A1 3/2016 Zheng et al.
2016/0100348 A1 4/2016 Cohn et al.
2016/0107749 A1 4/2016 Mucci
2016/0116914 A1 4/2016 Mucci
2016/0127641 A1 5/2016 Gove
2016/0161277 A1 6/2016 Park et al.
2016/0163185 A1 6/2016 Ramasubbu et al.
2016/0164923 A1 6/2016 Dawes
2016/0171853 A1 6/2016 Naidoo et al.
2016/0180719 A1 6/2016 Wouhaybi et al.
2016/0183073 A1 6/2016 Saito et al.
2016/0189509 A1 6/2016 Malhotra et al.
2016/0189527 A1 6/2016 Peterson et al.
2016/0189549 A1 6/2016 Marcus
2016/0191265 A1 6/2016 Cohn et al.
2016/0191621 A1 6/2016 Oh et al.
2016/0225240 A1 8/2016 Voddhi et al.
2016/0226732 A1 8/2016 Kim et al.
2016/0231916 A1 8/2016 Dawes
2016/0232780 A1 8/2016 Cohn et al.
2016/0234075 A1 8/2016 Sirpal et al.
2016/0260135 A1 9/2016 Zomet et al.
2016/0261932 A1 9/2016 Fadell et al.
2016/0266579 A1 9/2016 Chen et al.
2016/0267751 A1 9/2016 Fulker et al.
2016/0269191 A1 9/2016 Cronin
2016/0274759 A1 9/2016 Dawes
2016/0364089 A1 12/2016 Blackman et al.
2016/0371961 A1 12/2016 Narang et al.
2016/0373453 A1 12/2016 Ruffner et al.
2017/0004714 A1 1/2017 Rhee
2017/0005818 A1 1/2017 Gould
2017/0006107 A1 1/2017 Dawes et al.
2017/0019644 A1 1/2017 K et al.
2017/0039413 A1 2/2017 Nadler
2017/0052513 A1 2/2017 Raji
2017/0054571 A1 2/2017 Kitchen et al.
2017/0054594 A1 2/2017 Dawes
2017/0063967 A1 3/2017 Kitchen et al.
2017/0063968 A1 3/2017 Kitchen et al.
2017/0068419 A1 3/2017 Sundermeyer et al.
2017/0070361 A1 3/2017 Sundermeyer et al.
2017/0070563 A1 3/2017 Sundermeyer et al.
2017/0078298 A1 3/2017 Vlaminck et al.
2017/0103646 A1 4/2017 Naidoo et al.
2017/0109999 A1 4/2017 Cohn et al.
2017/0118037 A1 4/2017 Kitchen et al.
2017/0154507 A1 6/2017 Dawes et al.
2017/0155545 A1 6/2017 Baum et al.
2017/0180198 A1 6/2017 Dawes

(56) **References Cited**

U.S. PATENT DOCUMENTS

2017/0180306	A1	6/2017	Gutt
2017/0185277	A1	6/2017	Sundermeyer et al.
2017/0185278	A1	6/2017	Sundermeyer et al.
2017/0192402	A1	7/2017	Karp et al.
2017/0227965	A1	8/2017	Decenzo et al.
2017/0244573	A1	8/2017	Baum et al.
2017/0255452	A1	9/2017	Barnes et al.
2017/0257257	A1	9/2017	Dawes
2017/0279629	A1	9/2017	Raji
2017/0289360	A1	10/2017	Baum et al.
2017/0301216	A1	10/2017	Cohn et al.
2017/0302469	A1	10/2017	Cohn et al.
2017/0310500	A1	10/2017	Dawes
2017/0331781	A1	11/2017	Gutt
2017/0337806	A1	11/2017	Cohn et al.
2017/0353324	A1	12/2017	Baum et al.
2018/0004377	A1	1/2018	Kitchen et al.
2018/0019890	A1	1/2018	Dawes
2018/0054774	A1	2/2018	Cohn et al.
2018/0063248	A1	3/2018	Dawes et al.
2018/0083831	A1	3/2018	Baum et al.
2018/0092046	A1	3/2018	Egan et al.
2018/0096568	A1	4/2018	Cohn et al.
2018/0191720	A1	7/2018	Dawes
2018/0191740	A1	7/2018	Decenzo et al.
2018/0191741	A1	7/2018	Dawes et al.
2018/0191742	A1	7/2018	Dawes
2018/0191807	A1	7/2018	Dawes
2018/0197387	A1	7/2018	Dawes
2018/0198688	A1	7/2018	Dawes
2018/0198755	A1	7/2018	Domangue et al.
2018/0198756	A1	7/2018	Dawes
2018/0198788	A1	7/2018	Helen et al.
2018/0198802	A1	7/2018	Dawes
2018/0198841	A1	7/2018	Chmielewski et al.
2018/0278701	A1	9/2018	Diem

FOREIGN PATENT DOCUMENTS

AU	2005223267	B2	12/2010
AU	2011250886		5/2011
AU	2011305163		9/2011
AU	2010297957	A1	5/2012
AU	2011250886	A1	1/2013
AU	2011250886	A1	1/2013
AU	2011305163	A1	5/2013
AU	2013284428	A1	2/2015
AU	2010297957	B2	10/2016
AU	2011305163	B2	12/2016
AU	2017201365	A1	3/2017
AU	2017201585	A1	3/2017
BE	1008939	A6	10/1996
CA	2203813	A1	6/1996
CA	2174482	A1	10/1997
CA	2346638	A1	4/2000
CA	2389958	A1	3/2003
CA	2559842		9/2005
CA	2878117	A1	1/2014
CA	2559842	C	5/2014
CA	2559842	C	5/2014
CA	2992429	A1	12/2016
CA	2976682	A1	2/2018
CA	2976802	A1	2/2018
CN	102834818	A	12/2012
CN	201080053845.7		12/2012
CN	102985915	A	3/2013
CN	201180034090.0		3/2013
EP	0295146	A2	12/1988
EP	0308046	A2	3/1989
EP	0591585	A1	4/1994
EP	1117214	A2	7/2001
EP	1119837	A1	8/2001
EP	0978111		11/2001
EP	0978111	B1	11/2001
EP	1881716	A1	1/2008
EP	2112784	A1	10/2009
EP	2868039	A2	5/2015
EP	3031206	A2	6/2016
EP	1738540	B1	10/2017
EP	3285238	A2	2/2018
EP	3308222	A1	4/2018
FR	2584217	A1	1/1987
FR	2661023	A1	10/1991
FR	2793334	A1	11/2000
GB	2222288	A	2/1990
GB	2273593	A	6/1994
GB	2286423	A	8/1995
GB	2291554	A	1/1996
GB	2319373	A	5/1998
GB	2320644	A	6/1998
GB	2324630	A	10/1998
GB	2325548	A	11/1998
GB	2335523	A	9/1999
GB	2349293	A	10/2000
GB	2370400	A	6/2002
GB	2442628	A	4/2008
GB	2442633	A	4/2008
GB	2442640		4/2008
GB	2442640	A	4/2008
GB	2428821		6/2008
GB	2428821	B	6/2008
GB	2442628		9/2008
GB	2442633		9/2008
IN	45/2015		11/2015
IN	04/2016		1/2016
JP	63-033088	A	2/1988
JP	05-167712	A	7/1993
JP	06-339183	A	12/1993
JP	8227491	A	9/1996
JP	10-004451	A	1/1998
JP	2000-006343	A	1/2000
JP	2000-023146	A	1/2000
JP	2000-278671	A	10/2000
JP	2001-006088	A	1/2001
JP	2001-006343	A	1/2001
JP	2001-069209	A	3/2001
JP	2002055895	A	2/2002
JP	2002-185629		6/2002
JP	2003085258	A	3/2003
JP	2003141659	A	5/2003
JP	2004192659	A	7/2004
JP	2007-529826	A	10/2007
KR	20060021605	A	3/2006
TW	340934	B	9/1998
TW	I239176	B	9/2005
TW	99113848		1/2011
TW	99113853		1/2011
TW	99113856		1/2011
TW	99113855		5/2011
TW	I480839	B	4/2015
TW	I480840	B	4/2015
TW	I509579	B	11/2015
TW	I517106	B	1/2016
WO	WO-8907855	A1	8/1989
WO	89/11187	A1	11/1989
WO	WO-9403881	A1	2/1994
WO	95/13944	A1	5/1995
WO	WO-9636301	A1	11/1996
WO	97/13230	A2	4/1997
WO	98/25243	A1	6/1998
WO	98/52343	A1	11/1998
WO	WO-9849663	A1	11/1998
WO	98/59256	A2	12/1998
WO	WO-9934339	A2	7/1999
WO	00/21053	A1	4/2000
WO	00/36812		6/2000
WO	00/72598	A1	11/2000
WO	01/11586	A1	2/2001
WO	WO-0152478	A2	7/2001
WO	01/71489	A1	9/2001
WO	WO-0199078	A2	12/2001
WO	02/11444	A1	2/2002
WO	WO-0221300	A1	3/2002
WO	2002/100083		12/2002

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

WO	WO-02097584	A2	12/2002
WO	2003/026305	A1	3/2003
WO	WO-03040839	A1	5/2003
WO	WO-2004004222	A1	1/2004
WO	WO-2004098127	A1	11/2004
WO	WO-2004107710	A1	12/2004
WO	WO-2005091218	A2	9/2005
WO	WO-2005091218	A3	7/2006
WO	WO-2007038872	A1	4/2007
WO	WO-2007124453	A2	11/2007
WO	2008/056320	A1	5/2008
WO	WO-2009006670	A1	1/2009
WO	2009/023647	A1	2/2009
WO	2009/029590	A1	3/2009
WO	2009/029597	A1	3/2009
WO	2009/064795	A1	5/2009
WO	WO-2009145747	A1	12/2009
WO	2010/019624	A1	2/2010
WO	2010/025468	A1	3/2010
WO	2010/127009	A1	11/2010
WO	2010/127194	A2	11/2010
WO	2010/127200	A1	11/2010
WO	2010/127203	A1	11/2010
WO	2011/038409	A1	3/2011
WO	2011/063354	A1	5/2011
WO	2011/143273	A1	11/2011
WO	2012/040653	A1	3/2012
WO	2014/004911	A2	1/2014
WO	PCT/US2013/048324		1/2014
WO	2015/021469	A2	2/2015
WO	2015/134520	A1	9/2015
WO	2016/201033	A1	12/2016
ZA	2013/02668		6/2014
ZA	201302668		6/2014

OTHER PUBLICATIONS

Alarm.com—Interactive Security Systems, Elders [retrieved on Nov. 4, 2003], 1 page.
Co-pending U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Co-pending U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.
Co-pending U.S. Appl. No. 12/189,765, filed Aug. 11, 2008.
Co-pending U.S. Appl. No. 12/197,931, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/197,946, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/197,958, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/198,039, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/198,051, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/198,060, filed May 28, 2008.
Co-pending U.S. Appl. No. 12/198,066, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/269,735, filed Nov. 12, 2008.
Co-pending U.S. Appl. No. 12/539,537, filed Aug. 11, 2009.
Co-pending U.S. Appl. No. 12/568,718, filed Sep. 29, 2009.
Co-pending U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Co-pending U.S. Appl. No. 12/691,992, filed Jan. 22, 2010.
Co-pending U.S. Appl. No. 12/718,385, filed Mar. 5, 2010.
Co-pending U.S. Appl. No. 12/732,879, filed Mar. 26, 2010.
Co-pending U.S. Appl. No. 12/750,470, filed Mar. 30, 2010.
Co-pending U.S. Appl. No. 12/770,253, filed Apr. 29, 2010.
Co-pending U.S. Appl. No. 12/770,365, filed Apr. 29, 2010.
Co-pending U.S. Appl. No. 12/771,071, filed Apr. 30, 2010.
Co-pending U.S. Appl. No. 12/771,372, filed Apr. 30, 2010.
Co-pending U.S. Appl. No. 12/771,471, filed Apr. 30, 2010.
Co-pending U.S. Appl. No. 12/771,624, filed Apr. 30, 2010.
Co-pending U.S. Appl. No. 12/892,303, filed Sep. 28, 2010.
Co-pending U.S. Appl. No. 12/892,801, filed Sep. 28, 2010.
Co-pending U.S. Appl. No. 12/952,080, filed Nov. 22, 2010.
Co-pending U.S. Appl. No. 12/970,313, filed Dec. 16, 2010.
Co-pending U.S. Appl. No. 12/971,282, filed Dec. 17, 2010.
Co-pending U.S. Appl. No. 12/972,740, filed Dec. 20, 2010.
Co-pending U.S. Appl. No. 13/099,293, filed May 2, 2011.
Co-pending U.S. Appl. No. 13/104,932, filed May 10, 2011.
Co-pending U.S. Appl. No. 13/104,936, filed May 10, 2011.
Co-pending U.S. Appl. No. 13/153,807, filed Jun. 6, 2011.
Co-pending U.S. Appl. No. 13/244,008, filed Sep. 23, 2011.
Co-pending U.S. Appl. No. 13/311,365, filed Dec. 5, 2011.
Co-pending U.S. Appl. No. 13/334,998, filed Dec. 22, 2011.
Co-pending U.S. Appl. No. 13/335,279, filed Dec. 22, 2011.
Co-pending U.S. Appl. No. 13/400,477, filed Dec. 22, 2011.
Co-pending U.S. Appl. No. 13/406,264, filed Feb. 27, 2012.
Co-pending U.S. Appl. No. 13/486,276, filed Jun. 1, 2012.
Co-pending U.S. Appl. No. 13/531,757, filed Jun. 25, 2012.
Co-pending U.S. Appl. No. 13/718,851, filed Dec. 18, 2012.
Co-pending U.S. Appl. No. 13/725,607, filed Dec. 21, 2012.
Co-pending U.S. Appl. No. 13/925,181, filed Jun. 24, 2013.
Co-pending U.S. Appl. No. 13/929,568, filed Jun. 27, 2013.
Co-pending U.S. Appl. No. 13/932,816, filed Jul. 1, 2013.
Co-pending U.S. Appl. No. 13/932,837, filed Jul. 1, 2013.
Examination Report under Section 18(3) re for UK Patent Application No. GB0724248.0, dated Jan. 30, 2008.
Examination Report under Section 18(3) re for UK Patent Application. No. GB0724760.4, dated Jan. 30, 2008.
Examination Report under Section 18(3) re for UK Patent Application No. GB0800040.8, dated Jan. 30, 2008.
Faultline, "AT&T Targets Video Home Security as Next Broadband Market," The Register, Nov. 2, 2006. 2 pages.
Final Office Action dated Aug. 1, 2011 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Final Office Action dated Jun. 1, 2009 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Final Office Action dated Jun. 5, 2012 for U.S. Appl. No. 12/771,071, filed Apr. 30, 2010.
Final Office Action dated May 9, 2013 for U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.
Final Office Action dated May 9, 2013 for U.S. Appl. No. 12/952,080, filed Nov. 22, 2010.
Final Office Action dated Jan. 10, 2011 for U.S. Appl. No. 12/189,785, filed Aug. 11, 2008.
Final Office Action dated Jun. 10, 2011 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Final Office Action dated Jul. 12, 2010 for U.S. Appl. No. 12/019,554, filed Jan. 24, 2008.
Final Office Action dated Jan. 13, 2011 for U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.
Final Office Action dated Sep. 14, 2011 for U.S. Appl. No. 12/197,931, filed Aug. 25, 2008.
Final Office Action dated Feb. 16, 2011 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Final Office Action dated Oct. 17, 2012 for U.S. Appl. No. 12/637,671, filed Dec. 14, 2009.
Final Office Action dated Sep. 17, 2012 for U.S. Appl. No. 12/197,958, filed Aug. 25, 2008.
Final Office Action dated Mar. 21, 2013 for U.S. Appl. No. 12/691,992, filed Jan. 22, 2010.
Final Office Action dated Jul. 23, 2013 for U.S. Appl. No. 13/531,757, filed Jun. 25, 2012.
Final Office Action dated Feb. 26, 2013 for U.S. Appl. No. 12/771,471, filed Apr. 30, 2010.
Final Office Action dated Jun. 29, 2012 for U.S. Appl. No. 12/539,537, filed Aug. 11, 2009.
Final Office Action dated Dec. 31, 2012 for U.S. Appl. No. 12/770,365, filed Apr. 29, 2010.
Final Office Action dated Oct. 31, 2012 for U.S. Appl. No. 12/771,624, filed Apr. 30, 2010.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US05/08766," dated May 23, 2006, 2 pages.
Form PCT/ISA/210, "PCT international Search Report for the Application No. PCT/US08/72831," dated Nov. 4, 2008, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US08/74246," dated Nov. 14, 2008, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US08/74260," dated Nov. 13, 2008, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US09/53485.," dated Oct. 22, 2009, 2 pages.

(56) **References Cited**

OTHER PUBLICATIONS

Form PCT/ISA/210, "PCT international Search Report for the Application No. PCT/US09/55559," dated Nov. 12, 2009, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US10/50585," dated Dec. 30, 2010, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US10/57674," dated Mar. 2, 2011, 2 pages.
Form PCT/ISA/210, "PCT international Search Report for the Application No. PCT/US11/34858," dated Oct. 3, 2011, 2 pages.
Form PCT/ISA/210, "PCT international Search Report for the Application No. PCT/US11/35994," dated Sep. 28, 2011, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US11/53136," dated Jan. 5, 2012, 2 pages.
Form PCT/ISA/210, "PCT International Search Report of the Application No. PCT/US08/83254," dated Jan. 14, 2009, 2 pages.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration," 1 pg.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the lnternational Searching Authority, or the Declaration," 1 pg.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US05/08766," dated May 23, 2006, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US08/72831," dated Nov. 4, 2008, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US08/74246" dated Nov. 14, 2008, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US08/74260," dated Nov. 13, 2008, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US09/53485," dated Oct. 22, 2009, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US09/55559," dated Nov. 12, 2009, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US10/50585," dated Dec. 30, 2010, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US10/57674," dated Mar. 2, 2011, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US11/35994," dated Sep. 28, 2011, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration of the Application No. PCT/US08/83254," dated Jan. 14, 2009, 1 page.
Form PCT/ISA/237, "PCT Written Opinion ofthe International Searching Authority for the Application No. PCT/US05/08766," dated May 23, 2006, 5 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority," 6 pgs.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US08/72831," dated Nov. 4, 2008, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US08/74246," dated Nov. 14, 2008, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US08/74260," dated Nov. 13, 2008, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US09/53485," dated Oct. 22, 2009, 8 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US09/55559," dated Nov. 12, 2009, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US10/50585," dated Dec. 30, 2010, 7 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US10/57674," dated Mar. 2, 2011, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US11/34858," dated Oct. 3, 2011, 8 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US11/35994," dated Sep. 28, 2011, 11 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US11/53136," dated Jan. 5, 2012.
Form PCT/ISA/237, "PCT Written Opinion ofthe International Searching Authority of the Application No. PCT/US08/83254," dated Jan. 14, 2009, 7 pages.
Gutierrez J.A., "On the Use of IEEE 802.15.4 to Enable Wireless Sensor Networks in Building Automation," Personal, Indoor and Mobile Radio Communications (PIMRC), 15th IEEE International Symposium, 2004, vol. 3, pp. 1865-1869.
Non-Final Office Action dated May 5, 2010 for U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.
Non-Final Office Action dated May 5, 2010 for U.S. Appl. No. 12/189,785, filed Aug. 11, 2008.
Non-Final Office Action dated Feb. 7, 2012 for U.S. Appl. No. 12/637,671, filed Dec. 14, 2009.
Non-Final Office Action dated Feb. 7, 2013 for U.S. Appl. No. 12/970,313, filed Dec. 16, 2010.
Non-Final Office Action dated Feb. 8, 2012 for U.S. Appl. No. 12/630,002, filed Dec. 3, 2009.
Non-Final Office Action dated Apr. 9, 2012 for U.S. Appl. No. 12/771,624, filed Apr. 30, 2010.
Non-Final Office Action dated Dec. 9, 2008 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Non-Final Office Action dated Aug. 10, 2012 for U.S. Appl. No. 12/771,471, filed Apr. 30, 2010.
Non-Final Office Action dated Oct. 11, 2012 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Non-Final Office Action dated Apr. 12, 2012 for U.S. Appl. No. 12/770,365, filed Apr. 29, 2010.
Non-Final Office Action dated Jul. 12, 2012 for U.S. Appl. No. 12/691,992, filed Jan. 22, 2010.
Non-Final Office Action dated Oct. 12, 2012 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Non-Final Office Action dated Sep. 12, 2012 for U.S. Appl. No. 12/952,080, filed Nov. 22, 2010.
Non-Final Office Action dated Apr. 13, 2010 for U.S. Appl. No. 11/761,745, filed Jun. 12, 2007.
Non-Final Office Action dated Jul. 13, 2010 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Non-Final Office Action dated Nov. 14, 2012 for U.S. Appl. No. 13/531,757, filed Jun. 25, 2012.
Non-Final Office Action dated Sep. 14, 2010 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Non-Final Office Action dated Sep. 16, 2011 for U.S. Appl. No. 12/539,537, filed Aug. 11, 2009.
Non-Final Office Action dated Sep. 17, 2012 for U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.

(56) **References Cited**

OTHER PUBLICATIONS

Non-Final Office Action dated Aug. 18, 2011 for U.S. Appl. No. 12/197,958, filed Aug. 25, 2008.
Non-Final Office Action dated Feb. 18, 2011 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Non-Final Office Action dated Jan. 18, 2012 for U.S. Appl. No. 12/771,071, filed Apr. 30, 2010.
Non-Final Office Action dated Feb. 21, 2013 for U.S. Appl. No. 12/771,372, filed Apr. 30, 2010.
Non-Final Office Action dated Jul. 21, 2010 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Non-Final Office Action dated Dec. 22, 2010 for U.S. Appl. No. 12/197,931, filed Aug. 25, 2008.
Non-Final Office Action dated Jul. 22, 2013 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Non-Final Office Action dated May 23, 2013 for U.S. Appl. No. 13/104,932, filed May 10, 2011.
Non-Final Office Action dated May 23, 2013 for U.S. Appl. No. 13/104,936, filed May 10, 2011.
Non-Final Office Action dated Jan. 26, 2012 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Non-Final Office Action dated Nov. 26, 2010 for U.S. Appl. No. 12/197,958, filed Aug. 25, 2008.
Non-Final Office Action dated Jun. 27, 2013 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Non-Final Office Action dated Dec. 30, 2009 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Non-Final Office Action dated May 30, 2008 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Notice of Allowance dated May 14, 2013 for U.S. Appl. No. 12/637,671, filed Dec. 14, 2009.
Notice of Allowance dated Oct. 25, 2012 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Requirement for Restriction/Election dated Jan. 22, 2013 for U.S. Appl. No. 13/104,932, filed May 10, 2011.
Requirement for Restriction/Election dated Jan. 22, 2013 for U.S. Appl. No. 13/104,936, filed May 10, 2011.
Requirement for Restriction/Election dated Oct. 24, 2012 for U.S. Appl. No. 12/750,470, filed Mar. 30, 2010.
Security for the Future, Introducing 58046D—Advanced two-way wireless remote technology, Advertisement, ADEMCO Group, Syosset, NY, circa 1997.
Wilkinson, S: "Logitech Harmony One Universal Remote" Ultimate AV magazine May 2008 (May 2008), XP002597782 Retrieved from the Internet : Original URL: http://www.ultimateavmag.com/remotecontrols/508logi) [retrieved on Aug. 23, 2010] the whole document; Updated URL: https://www.soundandvision.com/content/logitech-harmony-one-universal-remote, Retrieved from internet on Jan. 11, 2018.
Visitalk, Communication with Vision, http://www.visitalk.jimbo.com; website accessed Jan. 10, 2018.
Genex Technologies, Genex OmniEye, www.av-iq.com/avcat/images/documents/pdfs/omnieye%20nightwatch_brochure.pdf; webpage accessed Jan. 10, 2018.
Foreign communication from a related counterpart application—International Search Report, App No. PCT/US02/14450, Dec. 17, 2002, 6 pgs.
Foreign communication from a related counterpart application—International Preliminary Examination Report, App No. PCT/US02/14450, Mar. 2, 2004, 4 pgs.
Condry M et al., Open Service Gateway architecture overview, Industrial Electronics Society, 1999, IECON '99 Proceedings, The 25th Annual Conference of the IEEE, San Jose, CA, USA, Nov. 29-Dec. 3, 1999, Piscataway, NJ, USA, IEEE, US, vol. 2, Nov. 29, 1999 (Nov. 29, 1999), pp. 735-742, XP010366642.
Valtchev, D., and I. Frankov. "Service gateway architecture for a smart home." Communications Magazine, IEEE 40.4 (2002): 126-132.
J. David Eisenberg, SVG Essentials: Producing Scalable Vector Graphics with XML. O'Reilly & Associates, Inc., Sebastopol, CA 2002.
Gong, Li, A Software architecture for open service gateways, Internet Computing, IEEE 5.1, Jan.-Feb. 2001, 64-70.
Gateway Registry Methods and Systems, U.S. Appl. No. 13/486,276.
EP examination report issued in EP08797646.0, dated May 17, 2017, 11 pages.
Diaz, Redondo R P et al., Enhancing Residential Gateways: OSGI Service Composition, IEEE Transactions on Consumer Electronics, IEEE Service Center, New York, NY, US, vol. 53, No. 1, Feb. 1, 2007 (Feb. 1, 2007), pp. 87-95, XP011381790.
CorAccess Systems, Companion 6 User Guide, Jun. 17, 2002.
6270 Touch Screen Keypad Notes, Honeywell, Sep. 2006.
US Patent Application filed Jan. 28, 2019, entitled "Automation System User Interface With Three-Dimensional Display", U.S. Appl. No. 16/258,858.
US Patent Application filed Dec. 27, 2018, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 16/233,913.
US Patent Application filed Dec. 14, 2018, entitled "Communication Protocols Over Internet Protocol (IP) Networks", U.S. Appl. No. 16/221,299.
US Patent Application filed Nov. 29, 2018, entitled "Premise Management Systems and Methods", U.S. Appl. No. 16/204,442.
US Patent Application filed Oct. 18, 2018, entitled "Generating Risk Profile Using Data of Home Monitoring and Security System", U.S. Appl. No. 16/164,114.
US Patent Application filed Oct. 10, 2018, entitled "Method and System for Providing Alternate Network Access", U.S. Appl. No. 16/156,448.
US Patent Application filed Oct. 3, 2018, entitled "Activation of a Home Automation Controller", U.S. Appl. No. 16/150,973.
US Patent Application filed Oct. 1, 2018, entitled "User Interface in a Premises Network", U.S. Appl. No. 16/148,572.
US Patent Application filed Oct. 1, 2018, entitled "Integrated Security System with Parallel Processing Architecture", U.S. Appl. No. 16/148,411.
US Patent Application filed Oct. 1, 2018, entitled "Integrated Security System With Parallel Processing Architecture", U.S. Appl. No. 16/148,387.
US Patent Application filed Sep. 11, 2018, entitled "Premises Management Networking", U.S. Appl. No. 16/128,089.
US Patent Application filed Sep. 28, 2018, entitled "Forming a Security Network Including Integrated Security System Components and Network Devices", U.S. Appl. No. 16/147,044.
US Patent Application filed Sep. 28, 2018, entitled "Control System User Interface", U.S. Appl. No. 16/146,715.
US Patent Application filed Sep. 17, 2018, entitled "Integrated Security System With Parallel Processing Architecture", U.S. Appl. No. 16/133,135.
US Patent Application filed Sep. 6, 2018, entitled "Takeover of Security Network", U.S. Appl. No. 16/123,695.
US Patent Application filed Aug. 21, 2018, entitled "Premises System Management Using Status Signal", U.S. Appl. No. 16/107,568.
US Patent Application filed Aug. 9, 2018, entitled "Method and System for Processing Security Event Data", U.S. Appl. No. 16/059,833.
US Patent Application filed Jul. 20, 2018, entitled "Cross-Client Sensor User Interface in an Integrated Security Network", U.S. Appl. No. 16/041,291.
US Patent Application filed Jul. 12, 2018, entitled "Integrated Security System with Parallel Processing Architecture", U.S. Appl. No. 16/034,132.
US Patent Application filed Jul. 3, 2018, entitled "WiFi-to-Serial Encapsulation in Systems", U.S. Appl. No. 16/026,703.
US Patent Application filed Jun. 27, 2018, entitled "Activation of Gateway Device", U.S. Appl. No. 16/020,499.
US Patent Application filed Jan. 3, 2019, entitled "Methods and Systems for Data Communication", U.S. Appl. No. 16/239,114.
"Windows". Newton's Telecom Dictionary, 21st ed., Mar. 2005.
Yanni Zhai et al., Design of Smart Home Remote Monitoring System Based on Embedded System, 2011 IEEE 2nd International Conference on Computing, Control and Industrial Engineering, vol. 2, pp. 41-44.

(56) **References Cited**

OTHER PUBLICATIONS

visitalk.com—communication with vision, http://www.visitalk.com.
US Patent Application filed Aug. 9, 2016, entitled "Controller and Interface for Home Security, Monitoring and Automation Having Customizable Audio Alerts for SMA Events", U.S. Appl. No. 15/232,135.
US Patent Application filed Aug. 8, 2016, entitled "Security, Monitoring and Automation Controller Access and Use of Legacy Security Control Panel Information", U.S. Appl. No. 15/231,273.
US Patent Application filed Jul. 28, 2016, entitled "Method and System for Automatically Providing Alternate Network Access for Telecommunications", U.S. Appl. No. 15/222,416.
US Patent Application filed May 23, 2018, entitled "Networked Touchscreen With Integrated Interfaces", U.S. Appl. No. 15/987,638.
US patent application filed May 2, 2018, entitled "Automation System With Mobile Interface", U.S. Appl. No. 15/969,514.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols Over Internet Protocol (IP) Networks", U.S. Appl. No. 14/202,579.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/203,219.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/203,141.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/203,128.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/203,084.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/203,077.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/202,685.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/202,627.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/202,592.
US Patent Application filed Mar. 10, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/202,573.
US Patent Application filed Mar. 7, 2014, entitled "Security System Integrated With Social Media Platform", U.S. Appl. No. 14/201,133.
US Patent Application filed Mar. 7, 2014, entitled "Integrated Security and Control System With Geofencing", U.S. Appl. No. 14/201,189.
US Patent Application filed Mar. 7, 2014, entitled "Device Integration Framework", U.S. Appl. No. 14/201,227.
US Patent Application filed Mar. 7, 2014, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 14/200,921.
US Patent Application filed Mar. 7, 2014, entitled "Activation of Gateway Device", U.S. Appl. No. 14/201,162.
US Patent Application filed Mar. 2, 2017, entitled "Generating Risk Profile Using Data of Home Monitoring and Security System", U.S. Appl. No. 15/447,982.
Shang, Wei-lai, Study on Application of Embedded Intelligent Area System, Journal of Anyang Institute of Technology, vol. 9, No. 6, pp. 56-57 and 65.
PCT Application filed on Nov. 17, 2016, entitled "Mobile Premises Automation Platform", PCT/US2016/062519.
PCT Application filed on Oct. 13, 2016, entitled "Coordinated Control of Connected Devices in a Premise", PCT/US2016/056842.
PCT Application filed on Aug. 17, 2016, entitled "Automation System User Interface", PCT/US2016/047262.
PCT Application filed on Aug. 16, 2016, entitled "Automation System User Interface", PCT/US2016/047172.
PCT Application filed on Jul. 7, 2016, entitled "Automation System User Interface with Three-Dimensional Display", PCT/US2016/041353.
PCT Application filed on Jun. 30, 2016, entitled "Integrated Cloud System with Lightweight Gateway for Premises Automation", PCT/US2016/040451.
PCT Application filed on Jun. 29, 2016, entitled "Integrated Cloud System for Premises Automation", PCT/US2016/040046.
PCT Application filed on Jun. 9, 2016, entitled "Virtual Device Systems and Methods", PCT/US2016/036674.
GTI Genex Technologies, Inc. OmniEye.(Trademark). Product Brochure, Sep. 14, 1999 (5 pages).
GrayElectronics, http://www.grayelectronics.com; webpage accessed on Jan. 10, 2018.
GrayElectronics, "Digitizing TV cameras on TCP/IP Computer Networks," http://www.grayelectronics.com/default.htm, printed on Oct. 12, 1999 (2 pages).
Genex OmniEye, http://www.genextech.com/prod01.htm.
Elwahab et al.; Device, System and . . . Customer Premises Gateways; Sep. 27, 2001; WO 01/71489.
US Patent Application filed Jan. 25, 2019, entitled Communication Protocols in Integrated Systems, U.S. Appl. No. 16/257,706.
US Patent Application filed Jan. 22, 2019, entitled "Premises System Automation", U.S. Appl. No. 16/254,480.
US Patent Application filed Jan. 22, 2019, entitled "Data Model for Home Automation", U.S. Appl. No. 16/254,535.
"Dragging" The Authoritative Dictionary of IEEE Standard Terms. 7th ed. 2000, p. 337.
US Patent Application filed Mar. 18, 2019, entitled "Server-Based Notification of Alarm Event Subsequent to Communication Failure With Armed Security System", U.S. Appl. No. 16/356,742.
US Patent Application filed Apr. 23, 2019, entitled "Control System User Interface", U.S. Appl. No. 16/391,625.
US Patent Application filed Apr. 26, 2019, entitled "Custom Content for Premises Management", U.S. Appl. No. 16/396,368.
US Patent Application filed Jul. 2, 2019, entitled "Communication Protocols in Integrated Systems", U.S. Appl. No. 16/460,712.
Alarm.com—Interactive Security Systems, Frequently Asked Questions [retrieved on Nov. 4, 2003], 3 pages.
Alarm.com—Interactive Security Systems, Overview [retrieved on Nov. 4, 2003], 2 pages.
Alarm.com—Interactive Security Systems, Product Advantages [retrieved on Nov. 4, 2003], 3 pages.
Control Panel Standard—Features for False Alarm Reduction, The Security Industry Association, SIA 2009, pp. 1-48.
Co-pending U.S. Appl. No. 11/761,745, filed Jun. 12, 2007.
Supplemental European Search Report for Application No. EP05725743.8 dated Sep. 14, 2010, 2 pages.
Supplementary European Search Report for Application No. EP10819658, dated Mar. 10, 2015, 2 pages.
Supplementary European Search Report for Application No. EP11827671, dated Mar. 10, 2015, 2 pages.
Supplementary European Search Report for Application No. EP2191351, dated Jun. 23, 2014, 2 pages.
Supplementary Non-Final Office Action dated Oct. 28, 2010 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Supplementary Partial European Search Report for Application No. EP09807196, dated Nov. 17, 2014, 5 pages.
Co-pending U.S. Appl. No. 29/419,628, filed Apr. 30, 2012.
Co-pending U.S. Appl. No. 29/420,377, filed May 8, 2012.
Examination Report under Section 18(3) re for UK Patent Application No. GB0620362.4, dated Aug. 13, 2007.
Examination Report under Section 18(3) re for UK Patent Application No. GB0724248.0, dated Jun. 4, 2008.
Topalis E., et al., "A Generic Network Management Architecture Targeted to Support Home Automation Networks and Home Internet Connectivity, Consumer Electronics, IEEE Transactions," 2000, vol. 46 (1), pp. 44-51.
Wireless, Battery-Powered Smoke Detectors, Brochure, SafeNight Technology, Inc. Roanoke, VA, 1995.
WLS906 Photoelectric Smoke Alarm, Data Sheet, DSC Security Products, Ontario, Canada, Jan. 1998.
X10—ActiveHome, Home Automation Made Easy [retrieved on Nov. 4, 2003], 3 pages.
International Search Report for Application No. PCT/US2014/050548, dated Mar. 18, 2015, 4 pages.
Lagotek Wireless Home Automation System, May 2006 [retrieved on Aug. 22, 2012].

(56) **References Cited**

OTHER PUBLICATIONS

Non-Final Office Action dated Apr. 4, 2013 for U.S. Appl. No. 12/197,931, filed Aug. 25, 2008.
Non-Final Office Action dated Mar. 4, 2013 for U.S. Appl. No. 13/400,477, filed Feb. 20, 2012.
Non-Final Office Action dated Jan. 5, 2010 for U.S. Appl. No. 12/019,554, filed Jan. 24, 2008.

* cited by examiner

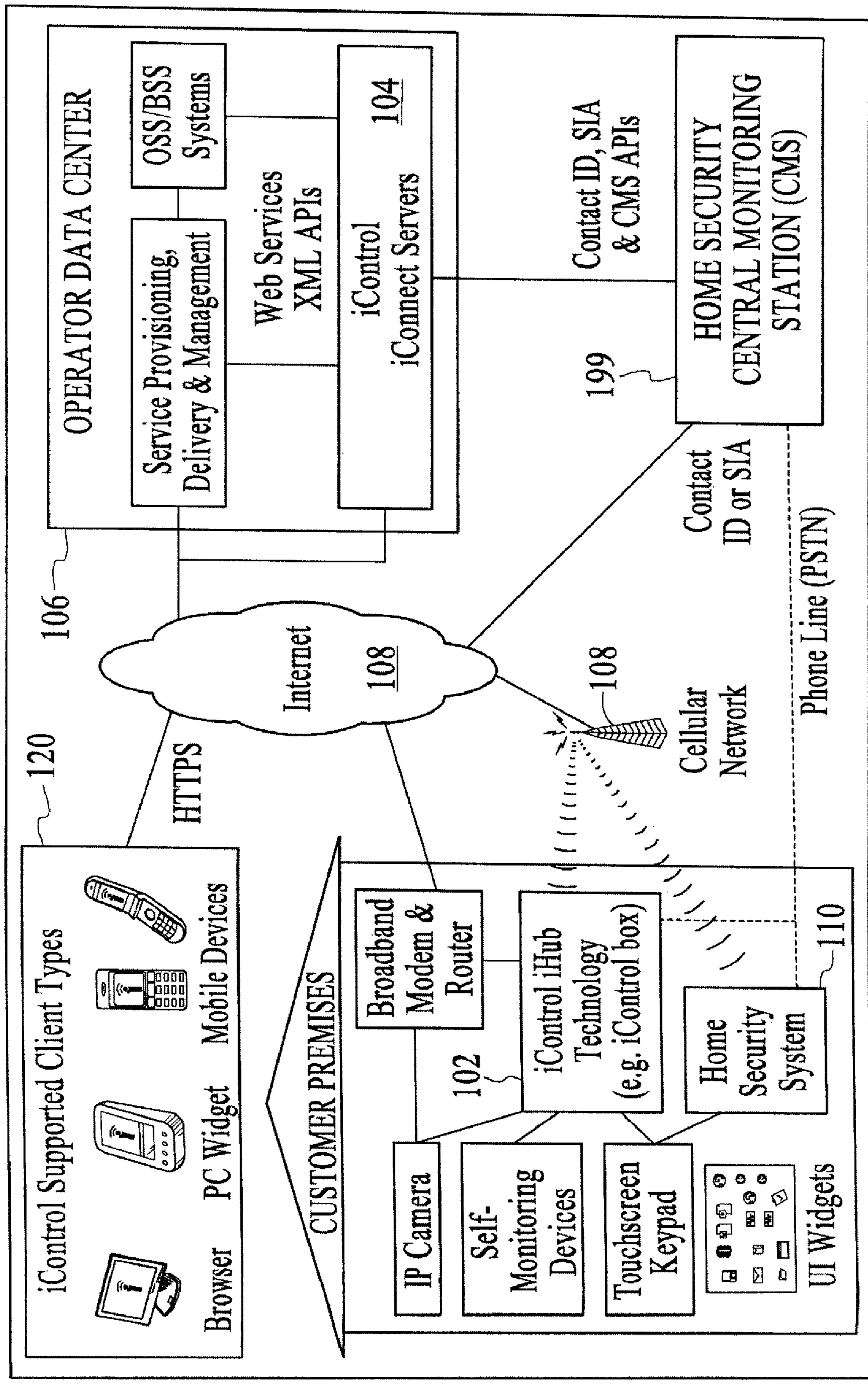

OPERATOR DATA CENTER
OSS/BSS Systems
Service Provisioning, Delivery & Management
Web Services XML APIs
iControl iConnect Servers
104
106
Contact ID, SIA & CMS APIs
HOME SECURITY CENTRAL MONITORING STATION (CMS)
199
Contact ID or SIA
Phone Line (PSTN)
Internet
108
HTTPS
120
iControl Supported Client Types
Browser
PC Widget
Mobile Devices
CUSTOMER PREMISES
Broadband Modem & Router
102
iControl iHub Technology (e.g. iControl box)
Home Security System
110
IP Camera
Self-Monitoring Devices
Touchscreen Keypad
UI Widgets
Cellular Network
100

FIG.1

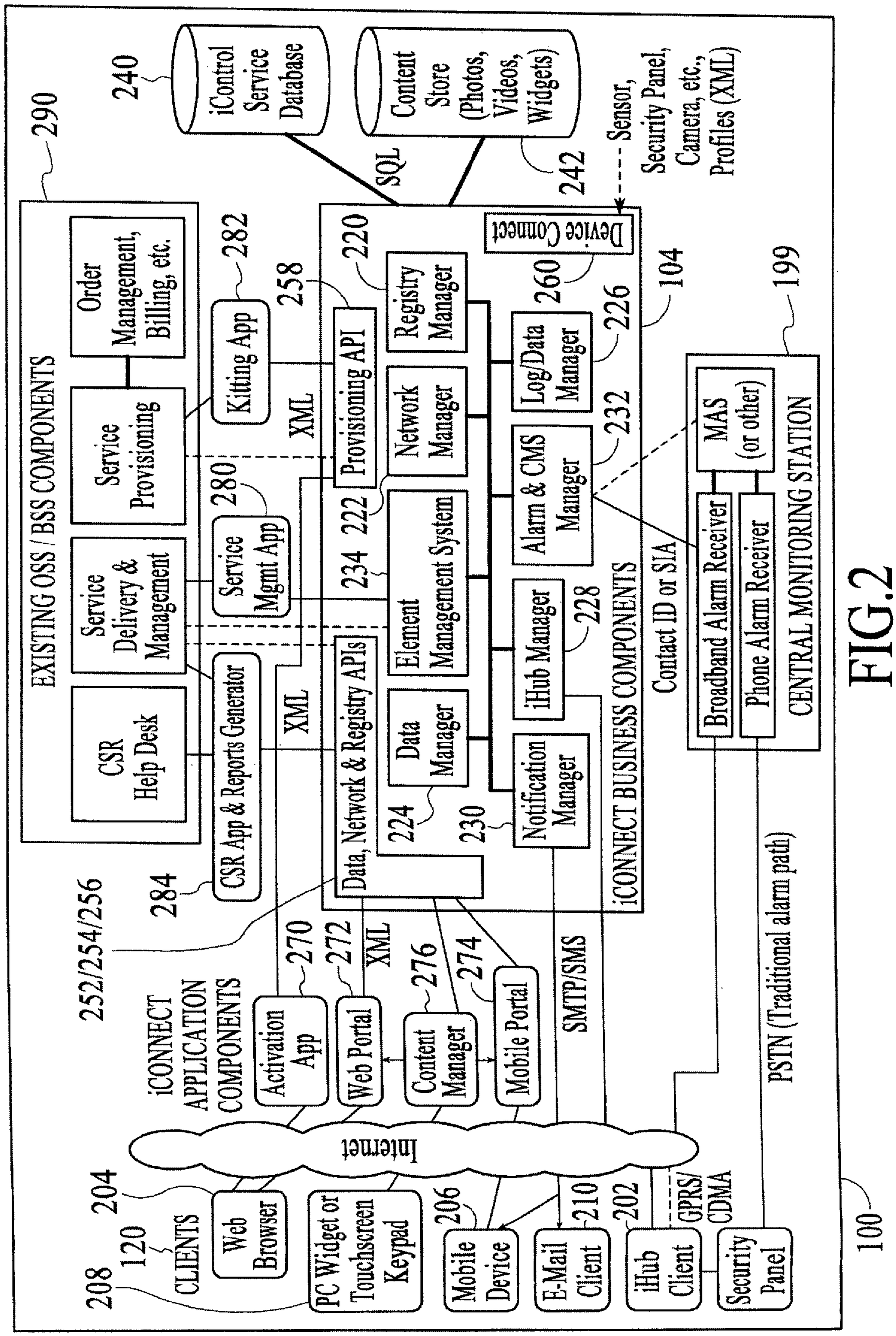

EXISTING OSS / BSS COMPONENTS
290
Order Management, Billing, etc.
Service Provisioning
Service Delivery & Management
CSR Help Desk
240
iControl Service Database
Content Store (Photos, Videos, Widgets)
242
SQL
Sensor, Security Panel, Camera, etc., Profiles (XML)
282
Kitting App
280
Service Mgmt App
284
CSR App & Reports Generator
258
XML
220
Provisioning API
222
Registry Manager
Network Manager
234
Element Management System
Data, Network & Registry APIs
224
Data Manager
230
Notification Manager
Device Connect
260
Log/Data Manager
226
Alarm & CMS Manager
232
iHub Manager
228
104
iCONNECT BUSINESS COMPONENTS
Contact ID or SIA
199
MAS (or other)
Broadband Alarm Receiver
Phone Alarm Receiver
CENTRAL MONITORING STATION
252/254/256
iCONNECT APPLICATION COMPONENTS
Activation App
270
Web Portal
272
XML
Content Manager
276
Mobile Portal
274
SMTP/SMS
PSTN (Traditional alarm path)
Internet
204
CLIENTS
120
208
Web Browser
PC Widget or Touchscreen Keypad
206
Mobile Device
E-Mail Client
210
202
iHub Client
GPRS/ CDMA
Security Panel
100

FIG.2

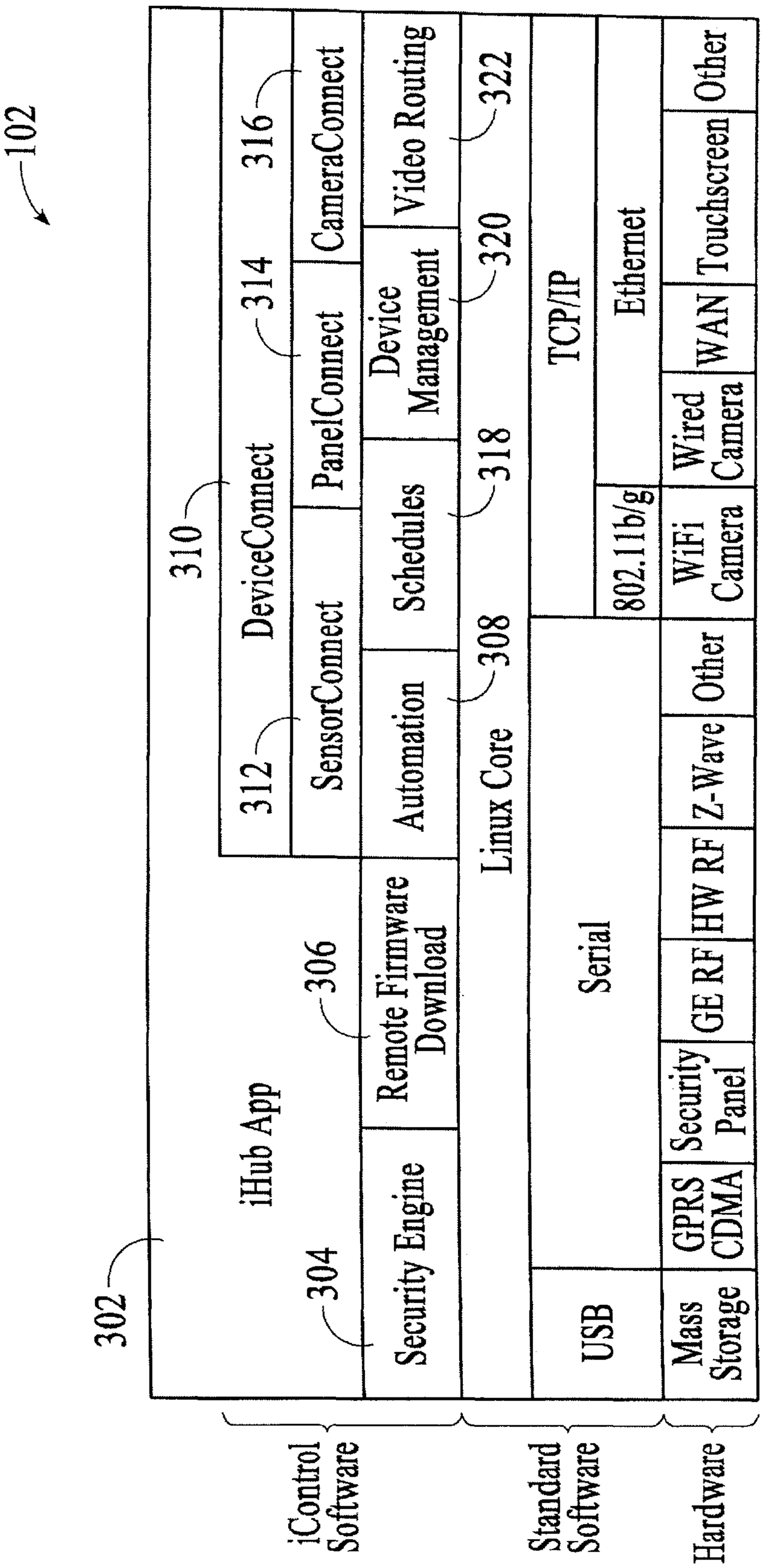

102
302
iHub App
304
306
Security Engine
Remote Firmware Download
310
DeviceConnect
312
SensorConnect
314
PanelConnect
316
CameraConnect
Automation
Schedules
Device Management
Video Routing
308
318
320
322
Linux Core
Serial
USB
TCP/IP
802.11b/g
Ethernet
Mass Storage
GPRS CDMA
Security Panel
GE RF
HW RF
Z-Wave
Other
WiFi Camera
Wired Camera
WAN
Touchscreen
Other
iControl Software
Standard Software
Hardware

FIG.3

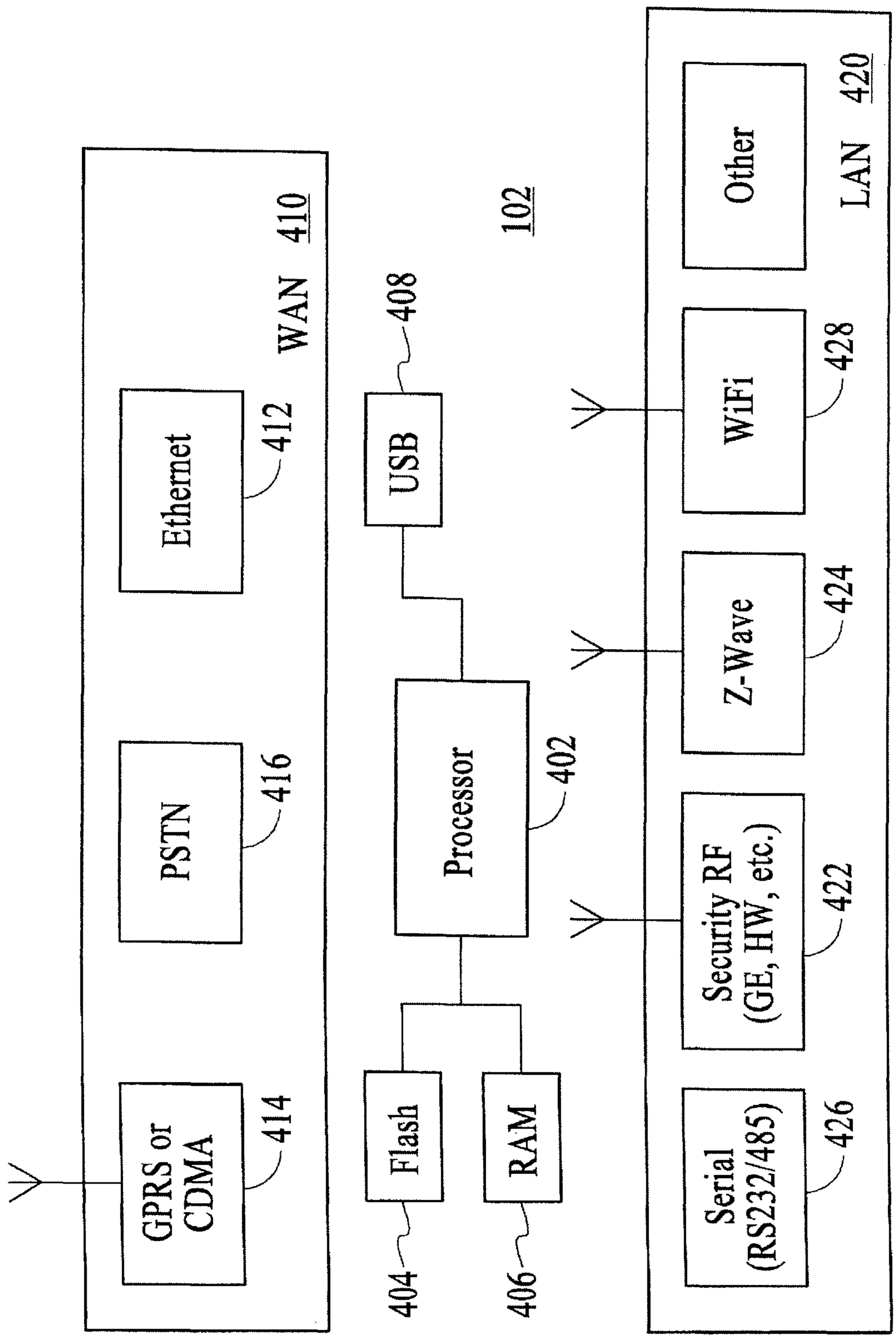

WAN 410
Ethernet 412
PSTN 416
GPRS or CDMA 414
USB 408
Processor 402
Flash 404
RAM 406
102
Other
LAN 420
WiFi 428
Z-Wave 424
Security RF (GE, HW, etc.) 422
Serial (RS232/485) 426

FIG.4

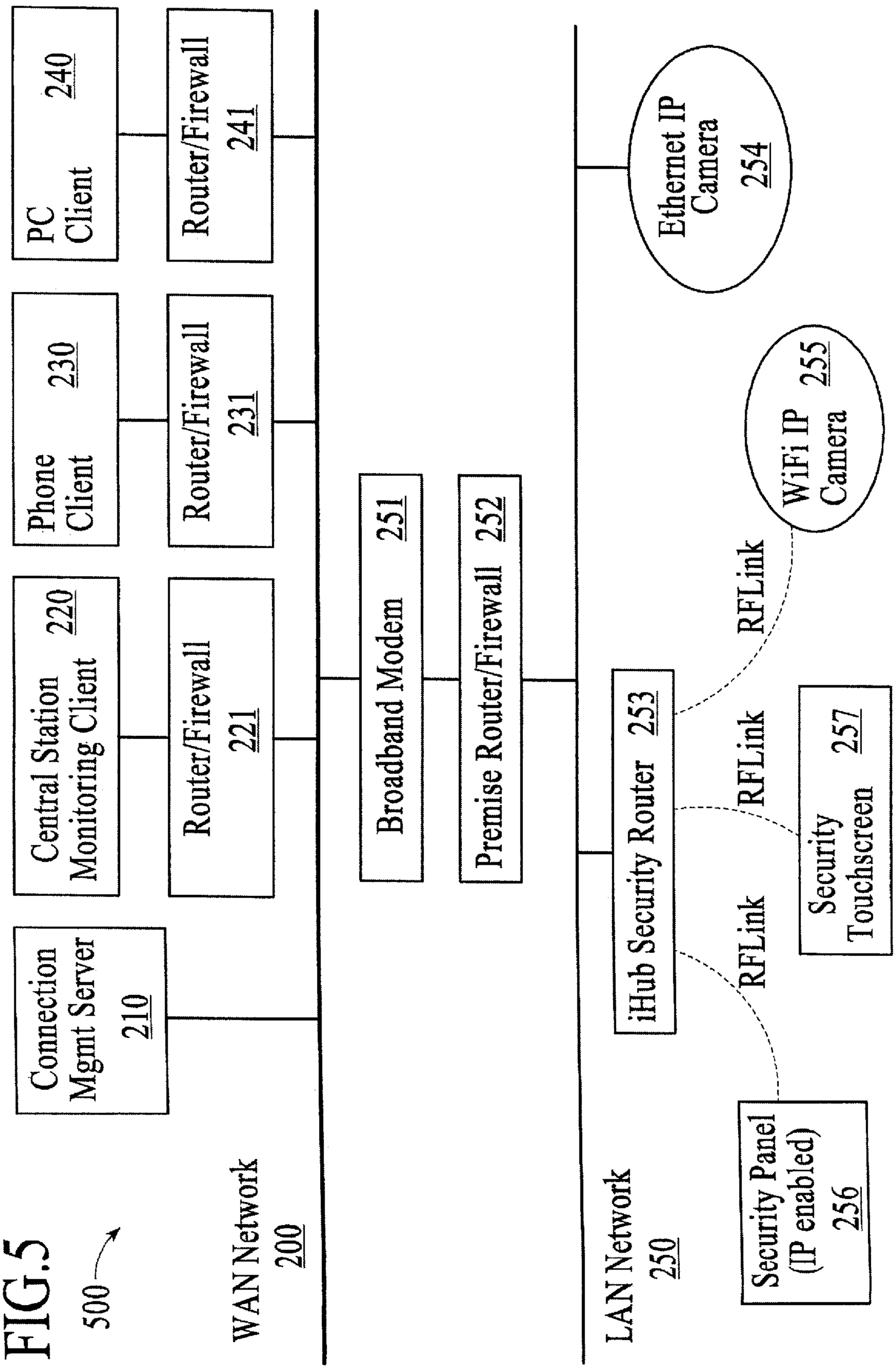


FIG.5
500
WAN Network
200
Connection Mgmt Server
210
Central Station Monitoring Client
220
Phone Client
230
PC Client
240
Router/Firewall
221
Router/Firewall
231
Router/Firewall
241
Broadband Modem
251
Premise Router/Firewall
252
LAN Network
250
iHub Security Router
253
Ethernet IP Camera
254
WiFi IP Camera
255
Security Panel (IP enabled)
256
Security Touchscreen
257
RFLink
RFLink
RFLink

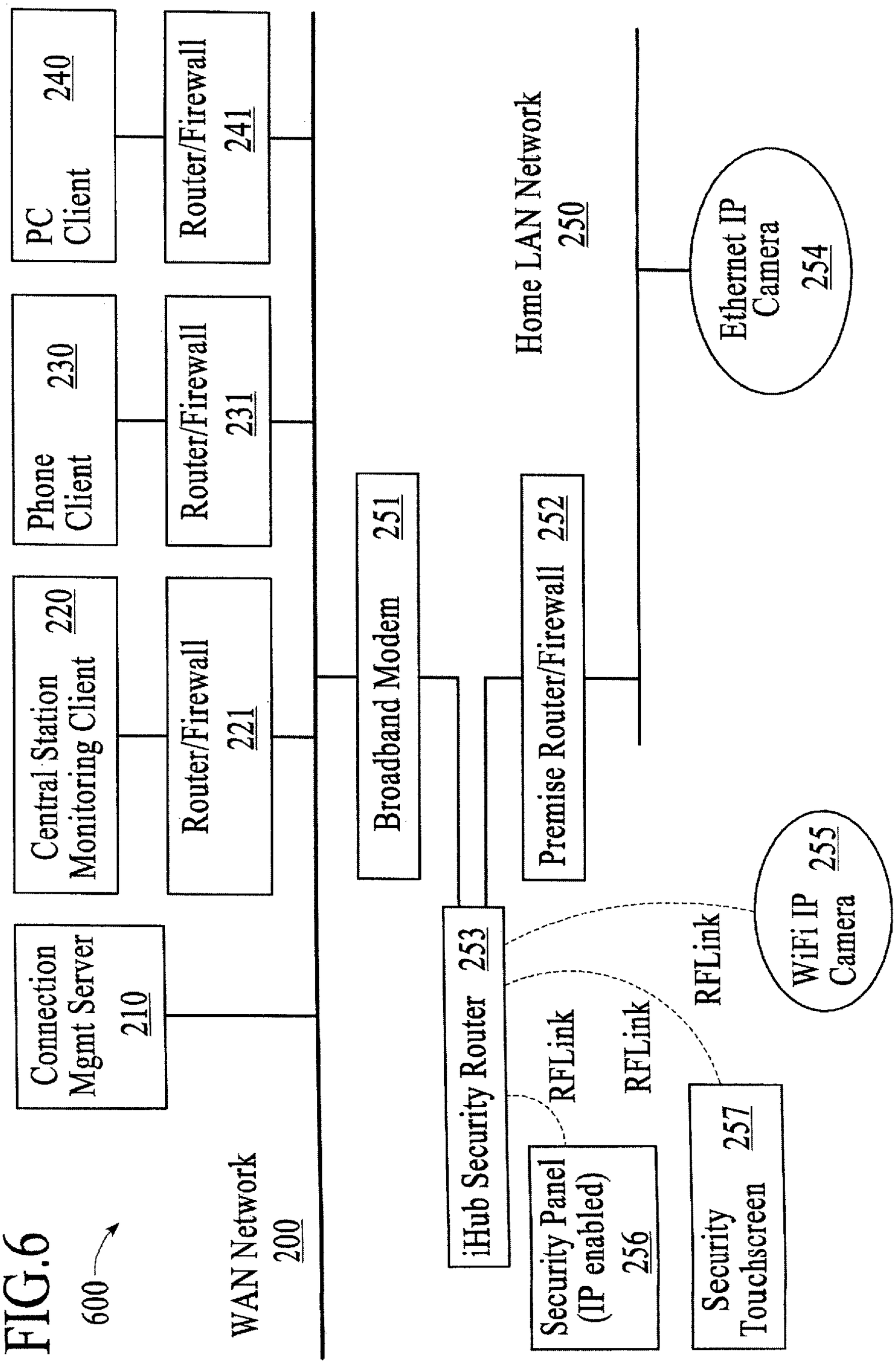

PC Client 240
Router/Firewall 241
Phone Client 230
Router/Firewall 231
Central Station Monitoring Client 220
Router/Firewall 221
Connection Mgmt Server 210
WAN Network 200
Broadband Modem 251
Home LAN Network 250
Premise Router/Firewall 252
Ethernet IP Camera 254
WiFi IP Camera 255
RFLink
iHub Security Router 253
RFLink
RFLink
Security Panel (IP enabled) 256
Security Touchscreen 257
600

FIG.6

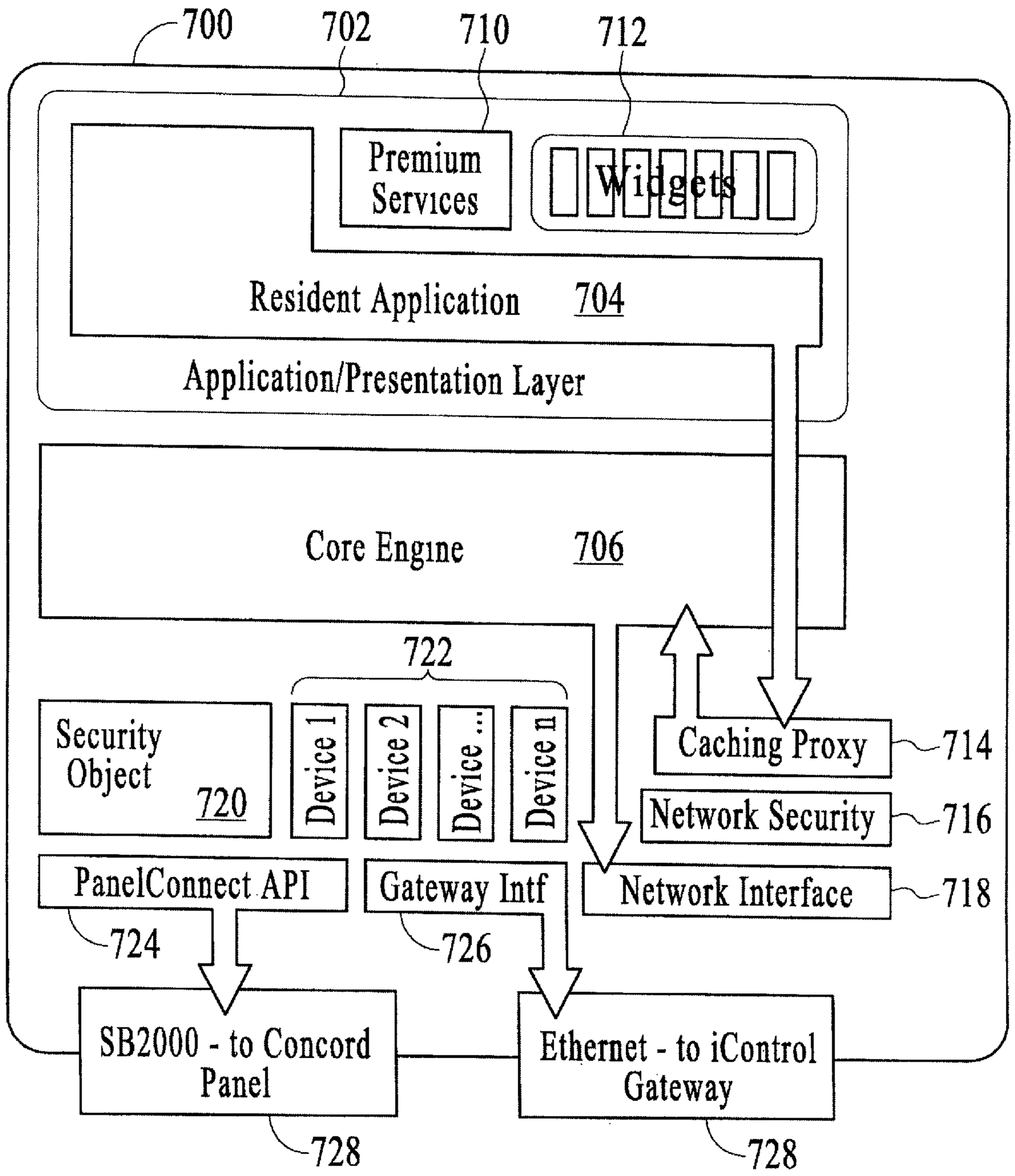

700
702
710
712
Premium Services
Widgets
Resident Application 704
Application/Presentation Layer
Core Engine 706
722
Security Object 720
Device 1
Device 2
Device ...
Device n
Caching Proxy
714
Network Security
716
Network Interface
718
PanelConnect API
724
Gateway Intf
726
SB2000 - to Concord Panel
728
Ethernet - to iControl Gateway
728

FIG.7

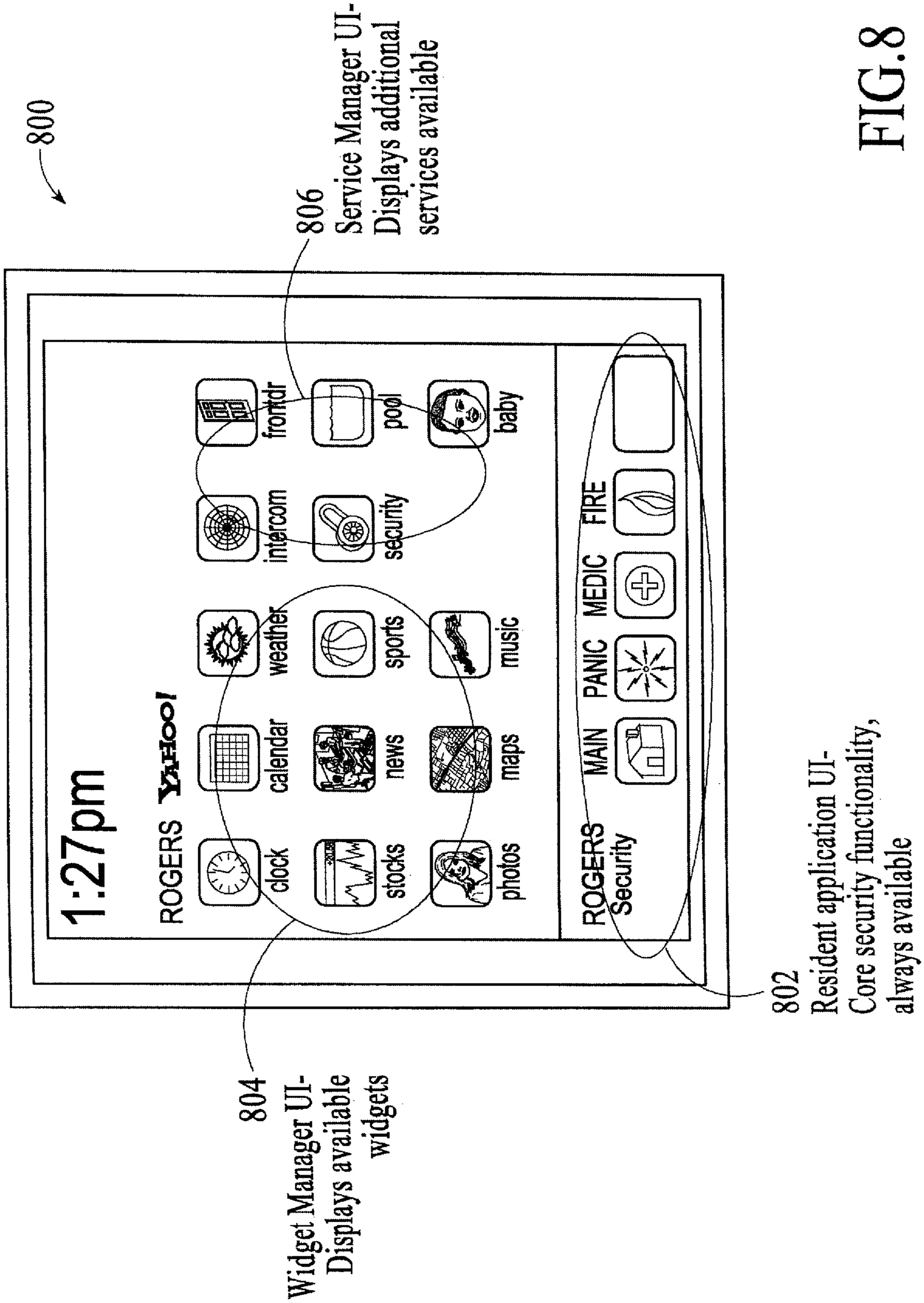

800
806
Service Manager UI-
Displays additional
services available
1:27pm
ROGERS
YAHOO!
clock
calendar
weather
intercom
frontdr
stocks
news
sports
security
pool
photos
maps
music
baby
ROGERS
Security
MAIN
PANIC
MEDIC
FIRE
804
Widget Manager UI-
Displays available
widgets
802
Resident application UI-
Core security functionality,
always available

FIG.8

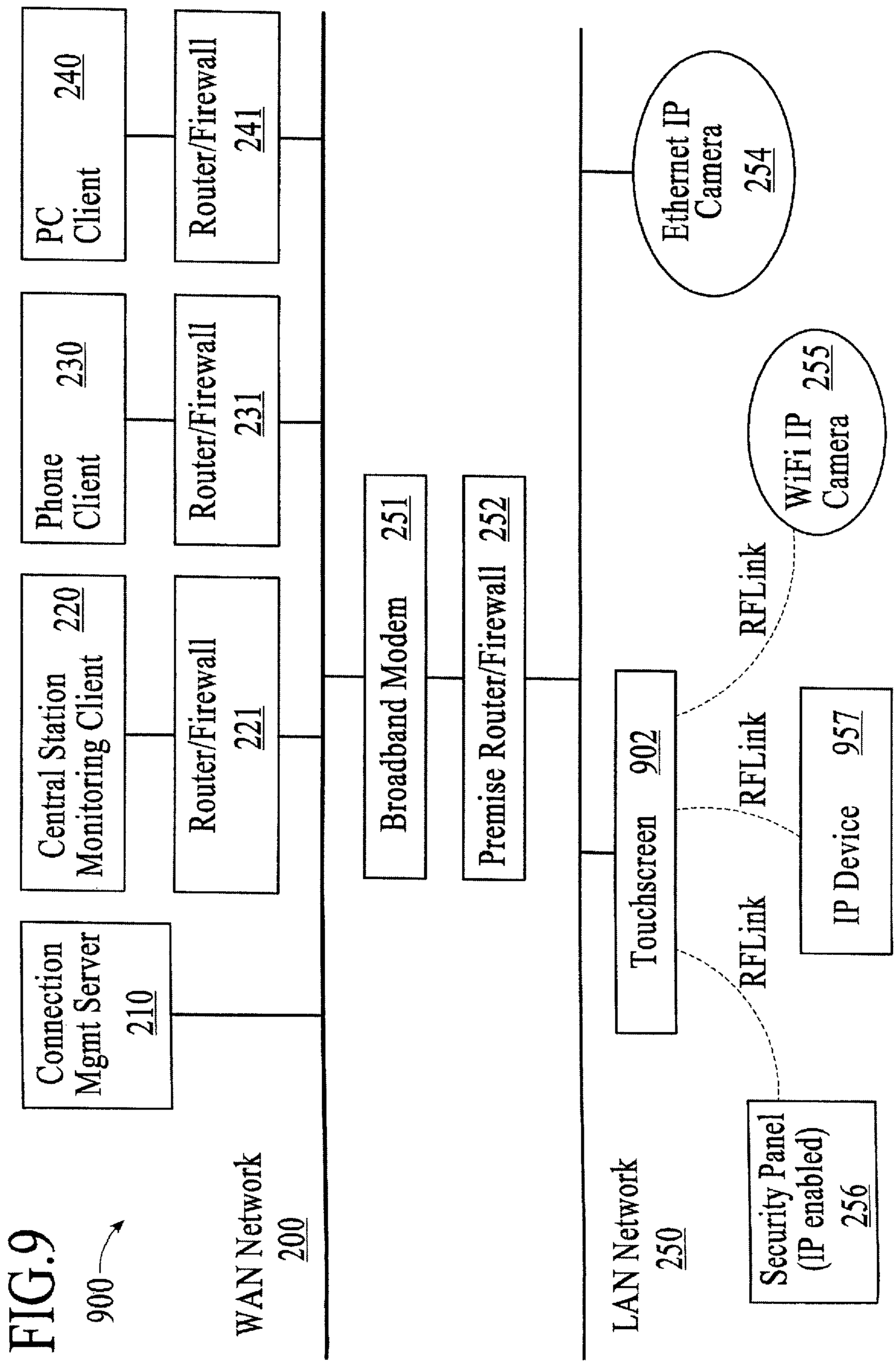

900
PC Client 240
Router/Firewall 241
Phone Client 230
Router/Firewall 231
Central Station Monitoring Client 220
Router/Firewall 221
Connection Mgmt Server 210
WAN Network 200
Broadband Modem 251
Premise Router/Firewall 252
Ethernet IP Camera 254
WiFi IP Camera 255
RFLink
Touchscreen 902
RFLink
IP Device 957
RFLink
Security Panel (IP enabled) 256
LAN Network 250

FIG.9

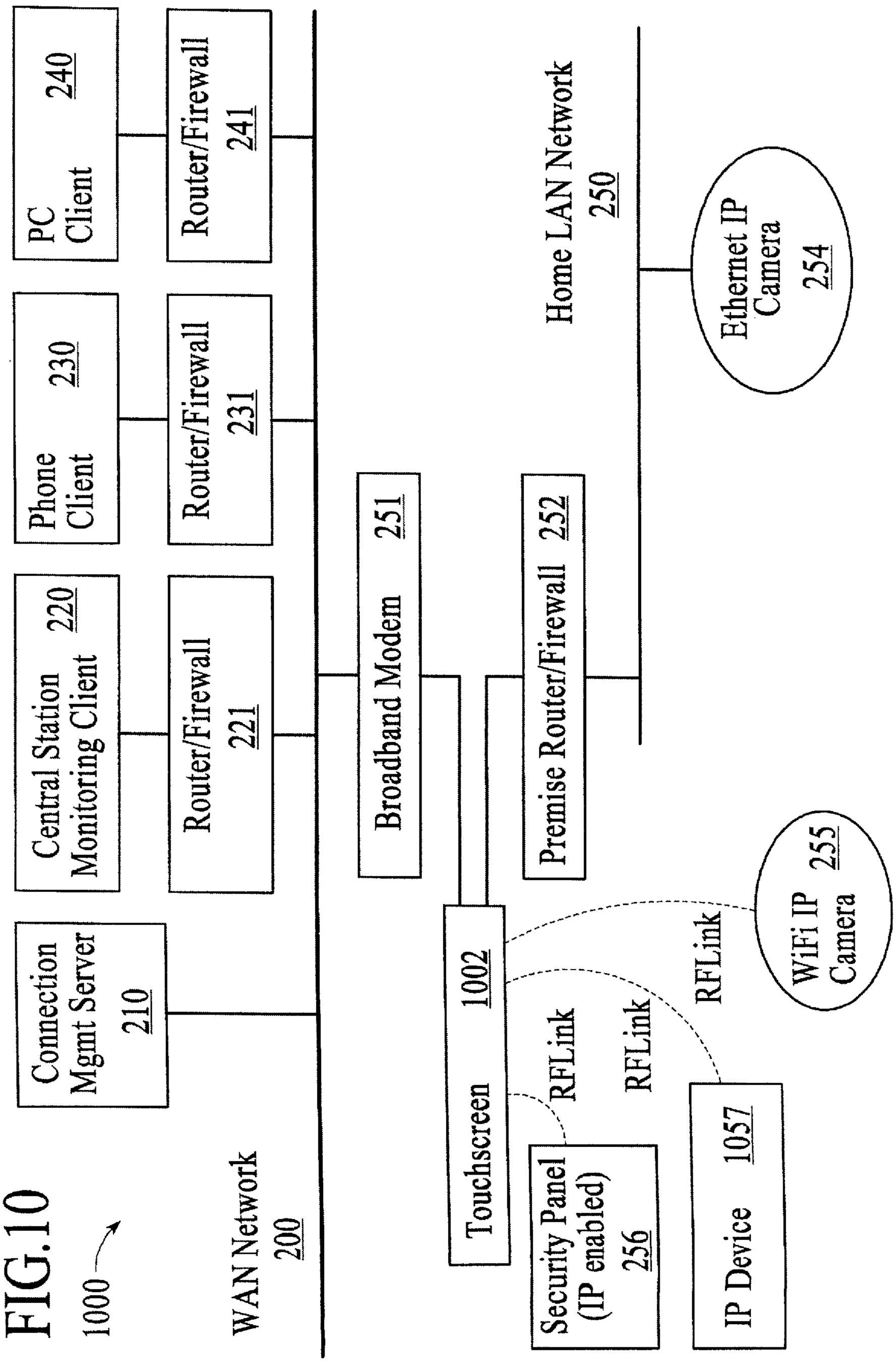

1000
WAN Network
200
Connection Mgmt Server
210
Central Station Monitoring Client
220
Phone Client
230
PC Client
240
Router/Firewall
221
Router/Firewall
231
Router/Firewall
241
Broadband Modem
251
Premise Router/Firewall
252
Home LAN Network
250
Ethernet IP Camera
254
WiFi IP Camera
255
Touchscreen
1002
RFLink
RFLink
RFLink
Security Panel (IP enabled)
256
IP Device
1057

FIG.10

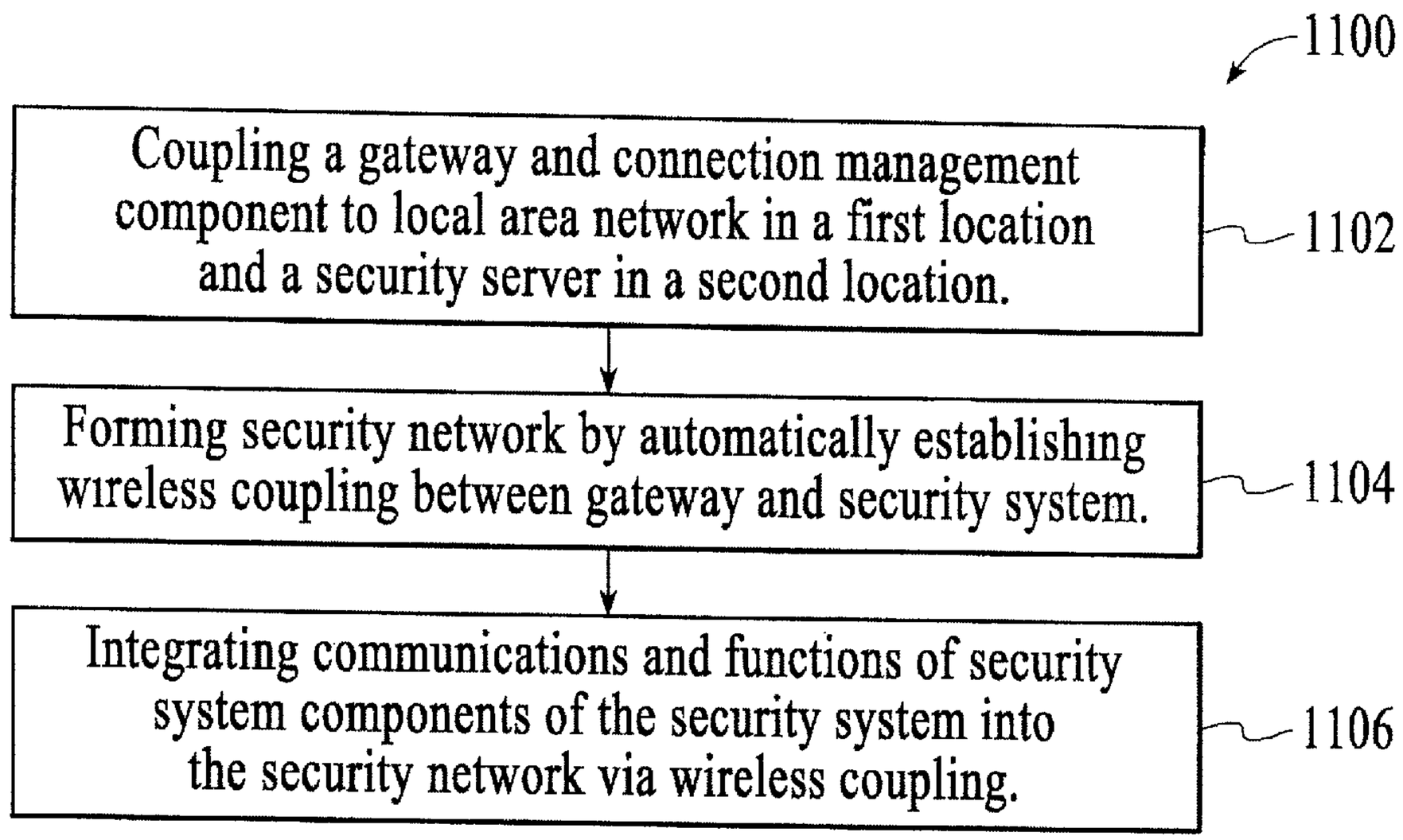

1100
Coupling a gateway and connection management component to local area network in a first location and a security server in a second location.
1102
Forming security network by automatically establishing wireless coupling between gateway and security system.
1104
Integrating communications and functions of security system components of the security system into the security network via wireless coupling.
1106

FIG.11

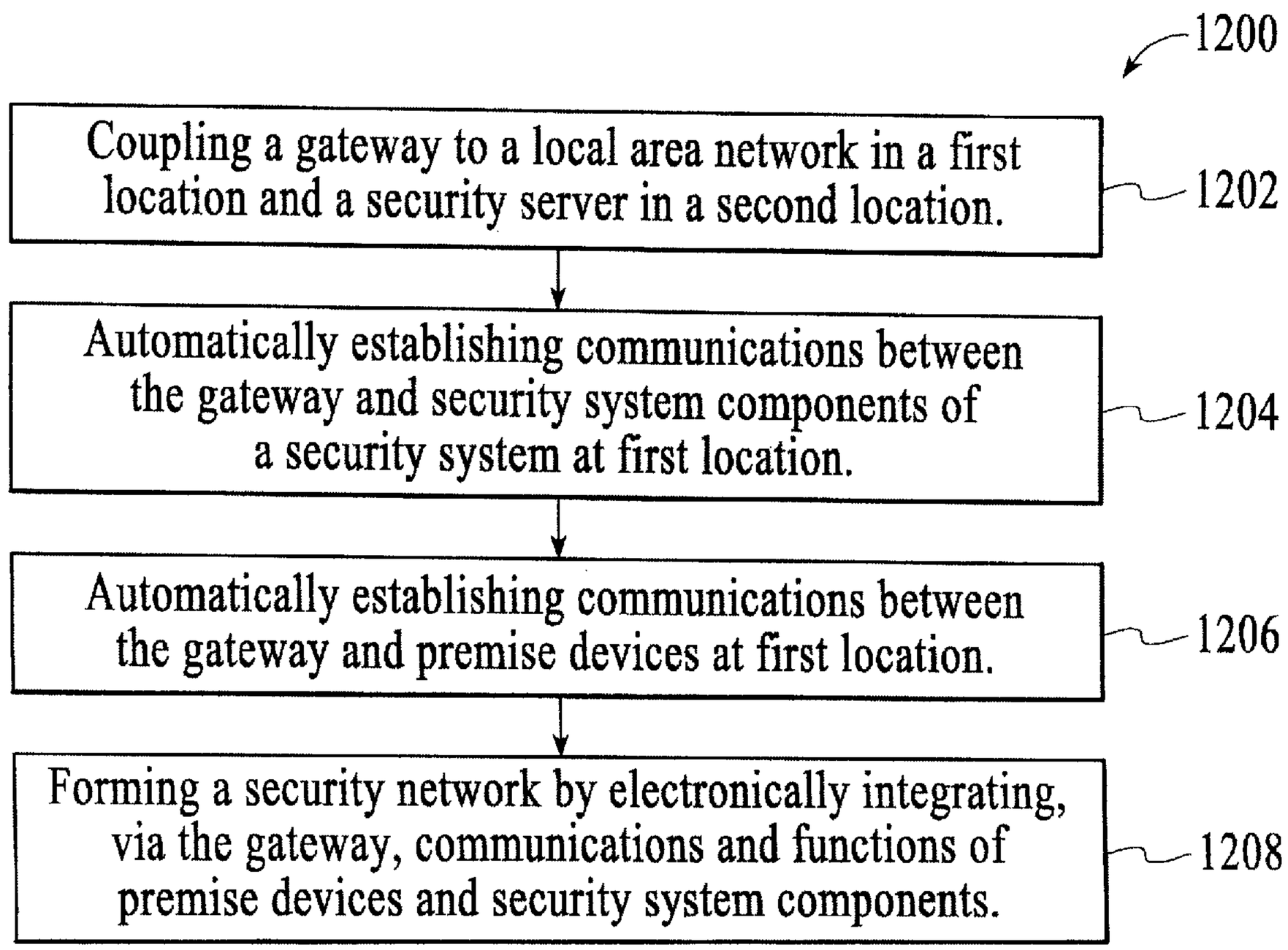

1200
Coupling a gateway to a local area network in a first location and a security server in a second location.
1202
Automatically establishing communications between the gateway and security system components of a security system at first location.
1204
Automatically establishing communications between the gateway and premise devices at first location.
1206
Forming a security network by electronically integrating, via the gateway, communications and functions of premise devices and security system components.
1208

FIG.12

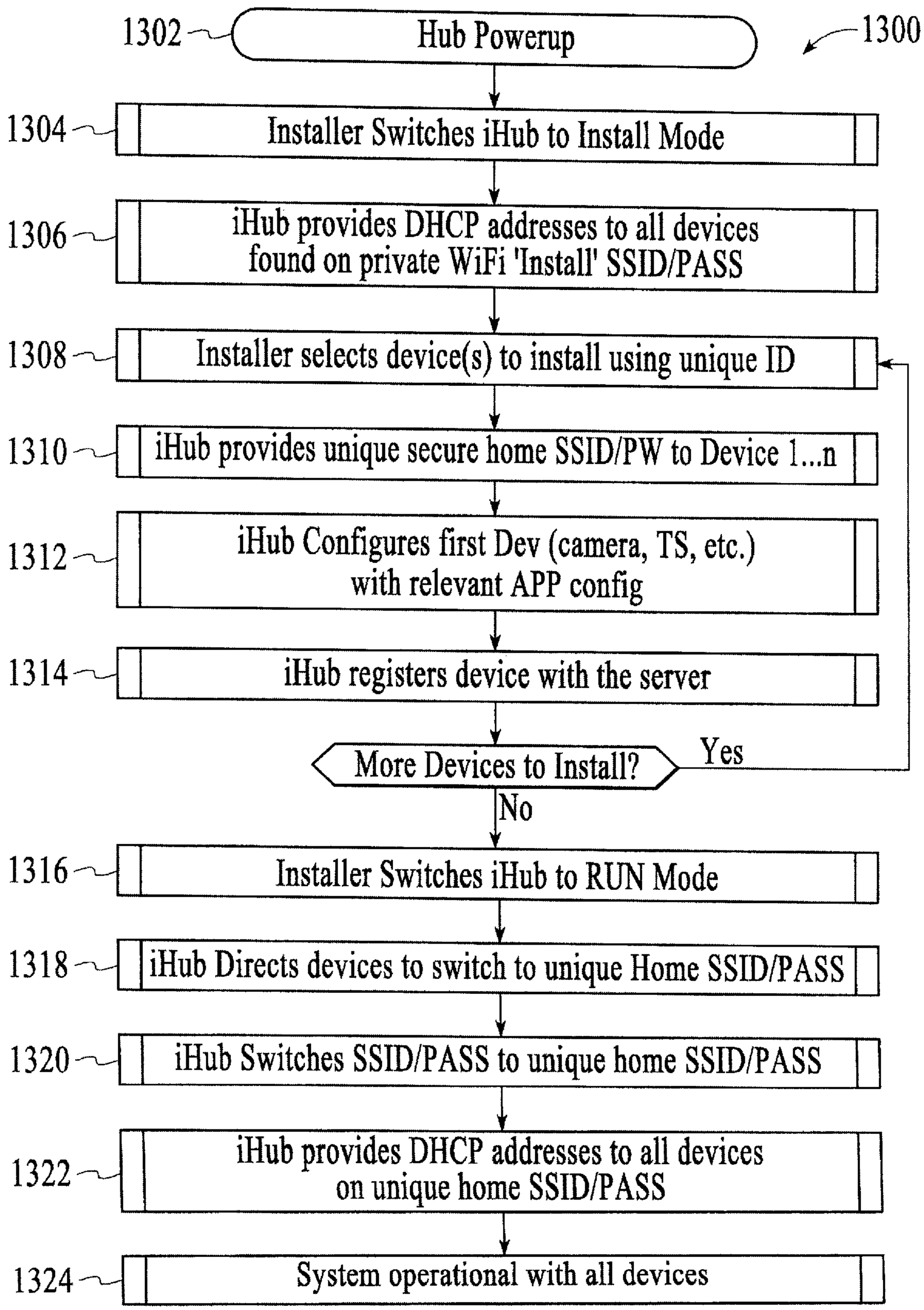

1300
1302
Hub Powerup
1304
Installer Switches iHub to Install Mode
1306
iHub provides DHCP addresses to all devices found on private WiFi 'Install' SSID/PASS
1308
Installer selects device(s) to install using unique ID
1310
iHub provides unique secure home SSID/PW to Device 1...n
1312
iHub Configures first Dev (camera, TS, etc.) with relevant APP config
1314
iHub registers device with the server
More Devices to Install?
Yes
No
1316
Installer Switches iHub to RUN Mode
1318
iHub Directs devices to switch to unique Home SSID/PASS
1320
iHub Switches SSID/PASS to unique home SSID/PASS
1322
iHub provides DHCP addresses to all devices on unique home SSID/PASS
1324
System operational with all devices

FIG.13

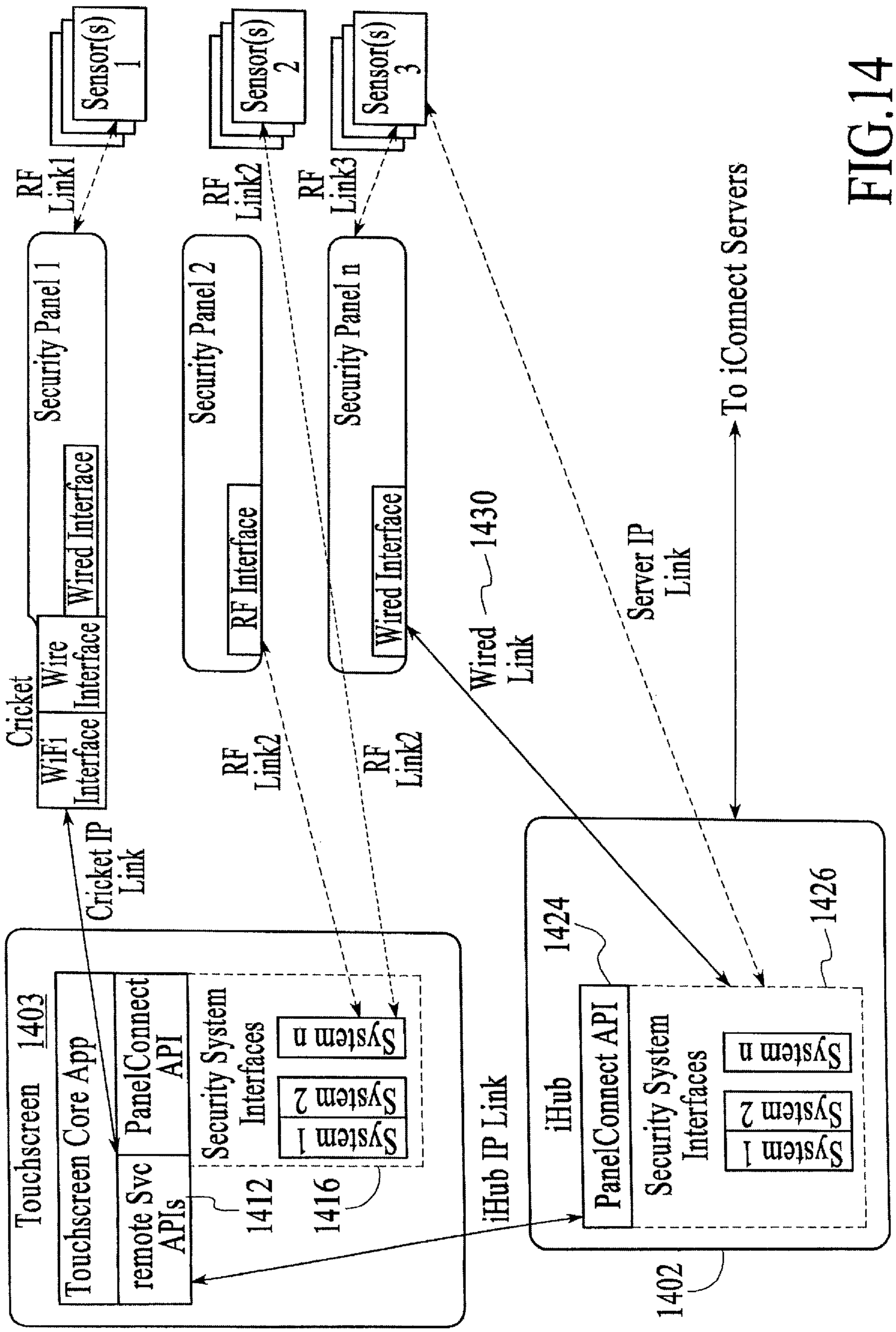

Sensor(s) 1
Sensor(s) 2
Sensor(s) 3
RF Link1
RF Link2
RF Link3
Security Panel 1
Security Panel 2
Security Panel n
Wired Interface
RF Interface
Wired Interface
Cricket
WiFi Interface
Wire Interface
Cricket IP Link
RF Link2
RF Link2
Wired Link
1430
Server IP Link
To iConnect Servers
Touchscreen 1403
Touchscreen Core App
remote Svc APIs
PanelConnect API
Security System Interfaces
System 1
System 2
System n
1412
1416
iHub IP Link
iHub
1424
PanelConnect API
Security System Interfaces
System 1
System 2
System n
1426
1402

FIG.14

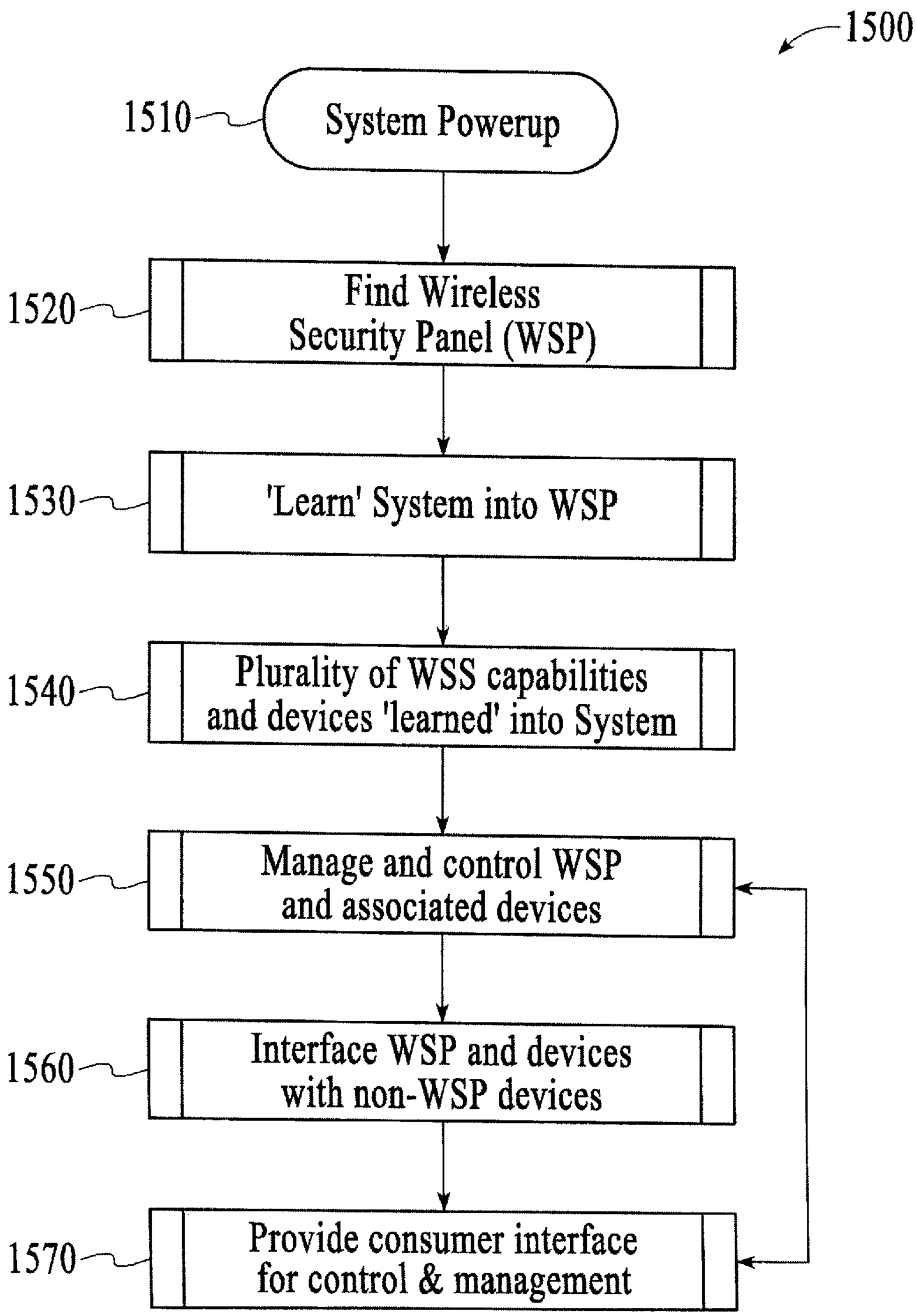

1500
1510
System Powerup
1520
Find Wireless Security Panel (WSP)
1530
'Learn' System into WSP
1540
Plurality of WSS capabilities and devices 'learned' into System
1550
Manage and control WSP and associated devices
1560
Interface WSP and devices with non-WSP devices
1570
Provide consumer interface for control & management

FIG.15

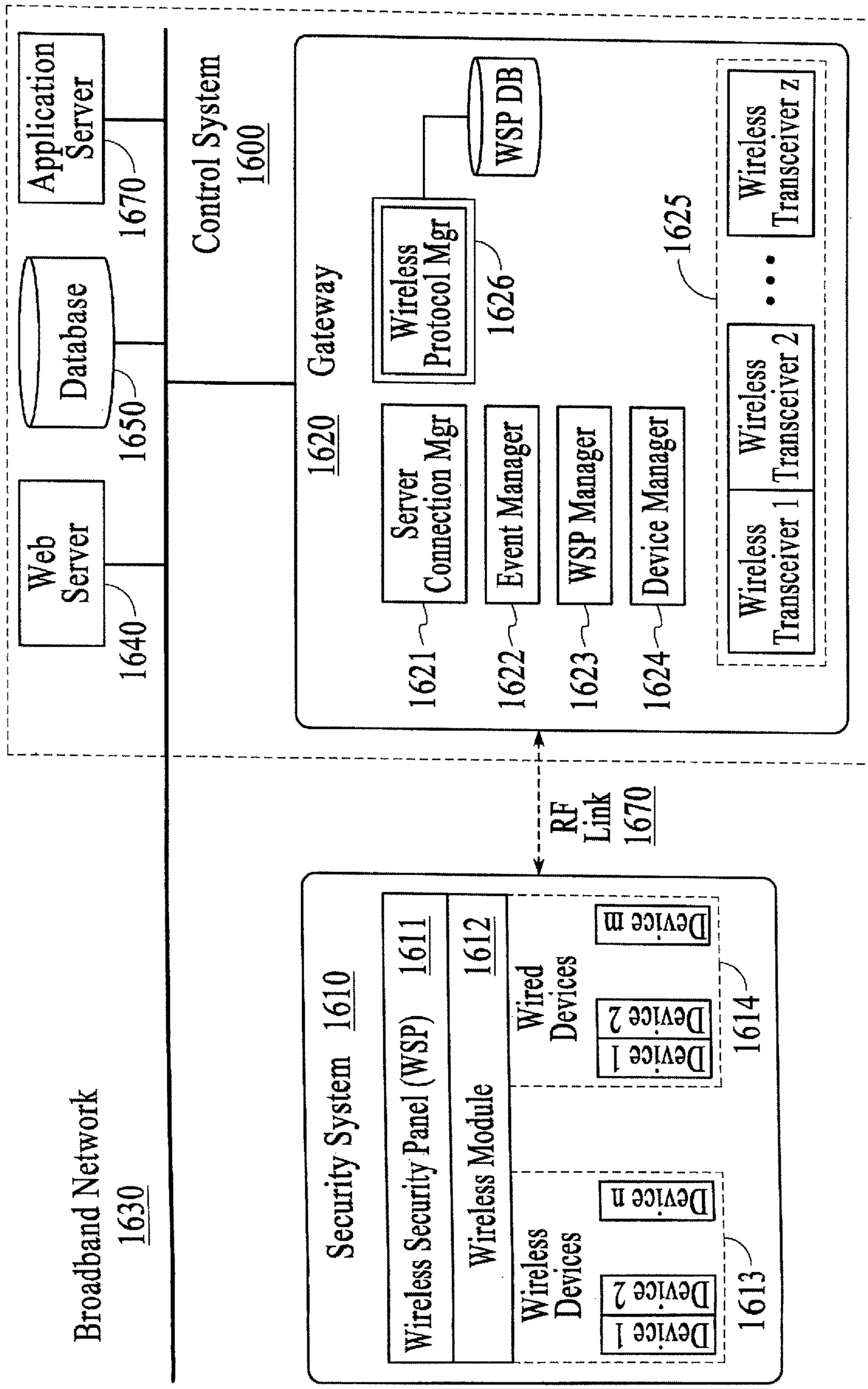

Application Server
1670
Database
1650
Web Server
1640
Control System
1600
Gateway
1620
Wireless Protocol Mgr
1626
WSP DB
Server Connection Mgr
1621
Event Manager
1622
WSP Manager
1623
Device Manager
1624
1625
Wireless Transceiver 1
Wireless Transceiver 2
Wireless Transceiver z
RF Link
1670
Broadband Network
1630
Security System 1610
Wireless Security Panel (WSP) 1611
Wireless Module 1612
Wireless Devices
Device 1
Device 2
Device n
1613
Wired Devices
Device 1
Device 2
Device m
1614

FIG.16

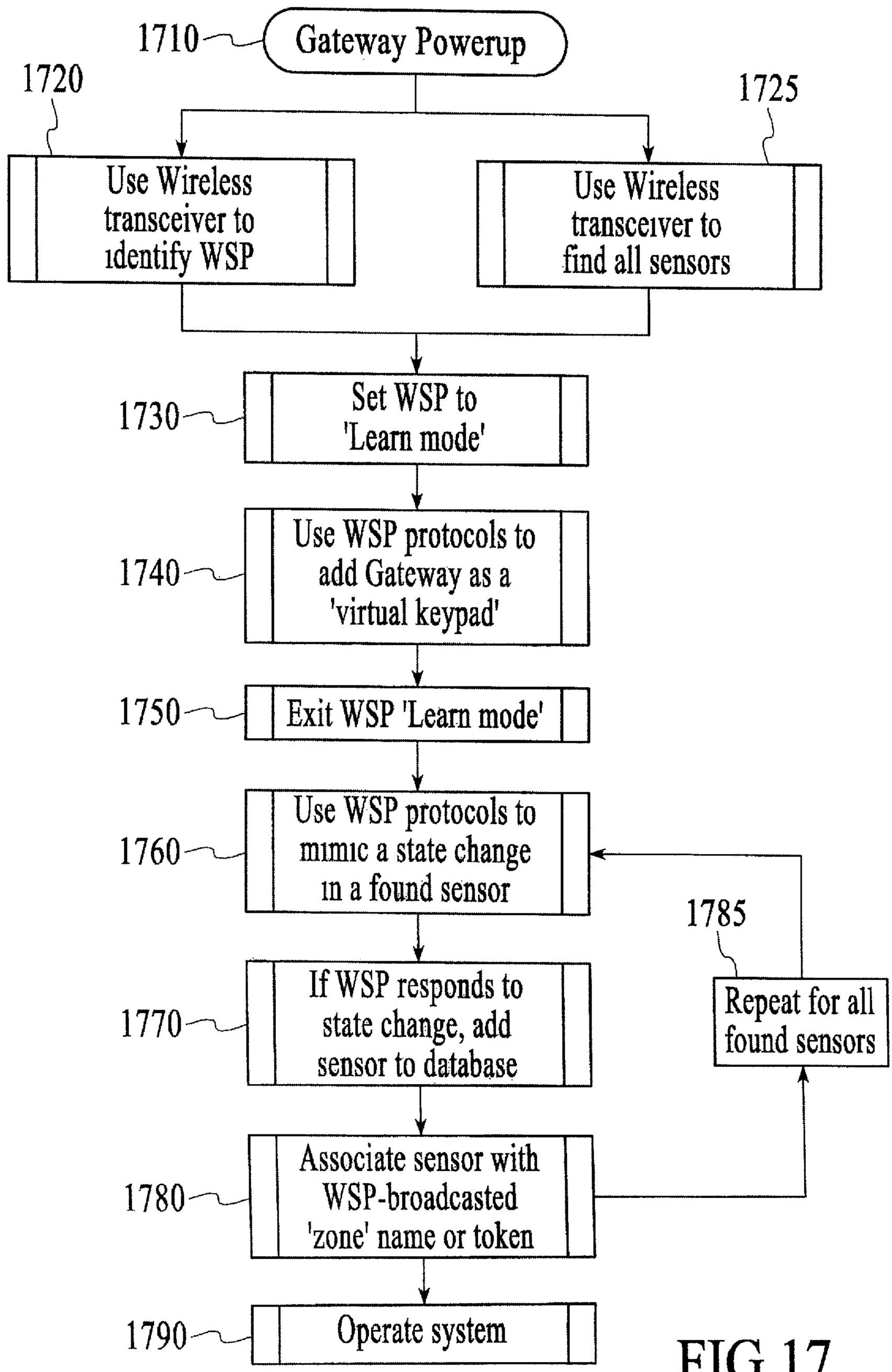

1710
Gateway Powerup
1720
Use Wireless transceiver to identify WSP
1725
Use Wireless transceiver to find all sensors
1730
Set WSP to 'Learn mode'
1740
Use WSP protocols to add Gateway as a 'virtual keypad'
1750
Exit WSP 'Learn mode'
1760
Use WSP protocols to mimic a state change in a found sensor
1770
If WSP responds to state change, add sensor to database
1780
Associate sensor with WSP-broadcasted 'zone' name or token
1785
Repeat for all found sensors
1790
Operate system

FIG.17

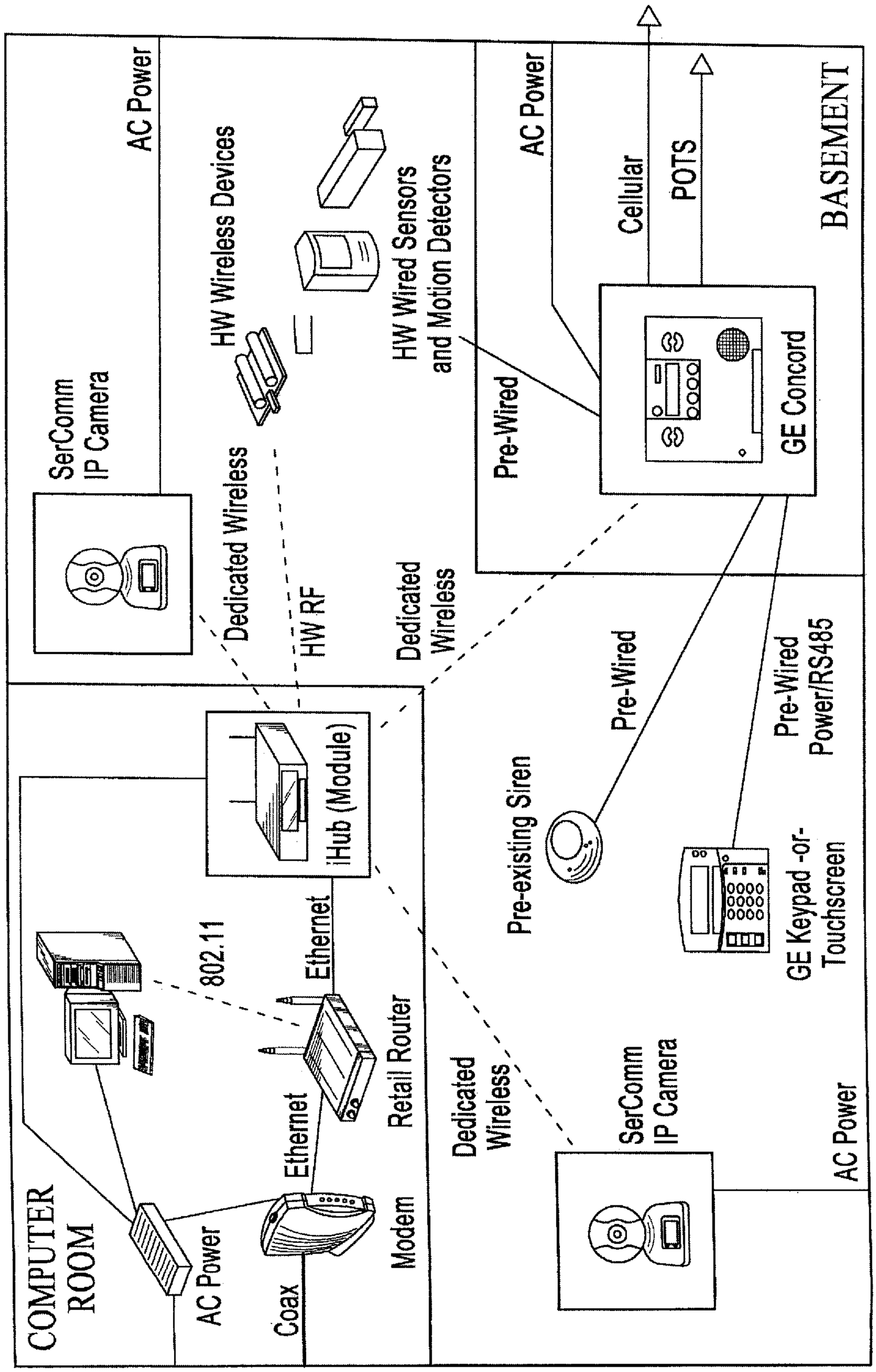

AC Power
HW Wireless Devices
SerComm
IP Camera
Dedicated Wireless
HW RF
HW Wired Sensors
and Motion Detectors
AC Power
Cellular
POTS
BASEMENT
Pre-Wired
GE Concord
Dedicated
Wireless
Pre-Wired
Pre-Wired
Power/RS485
iHub (Module)
Pre-existing Siren
GE Keypad -or-
Touchscreen
COMPUTER
ROOM
802.11
Ethernet
Retail Router
Ethernet
Modem
AC Power
Coax
Dedicated
Wireless
SerComm
IP Camera
AC Power

FIG.18

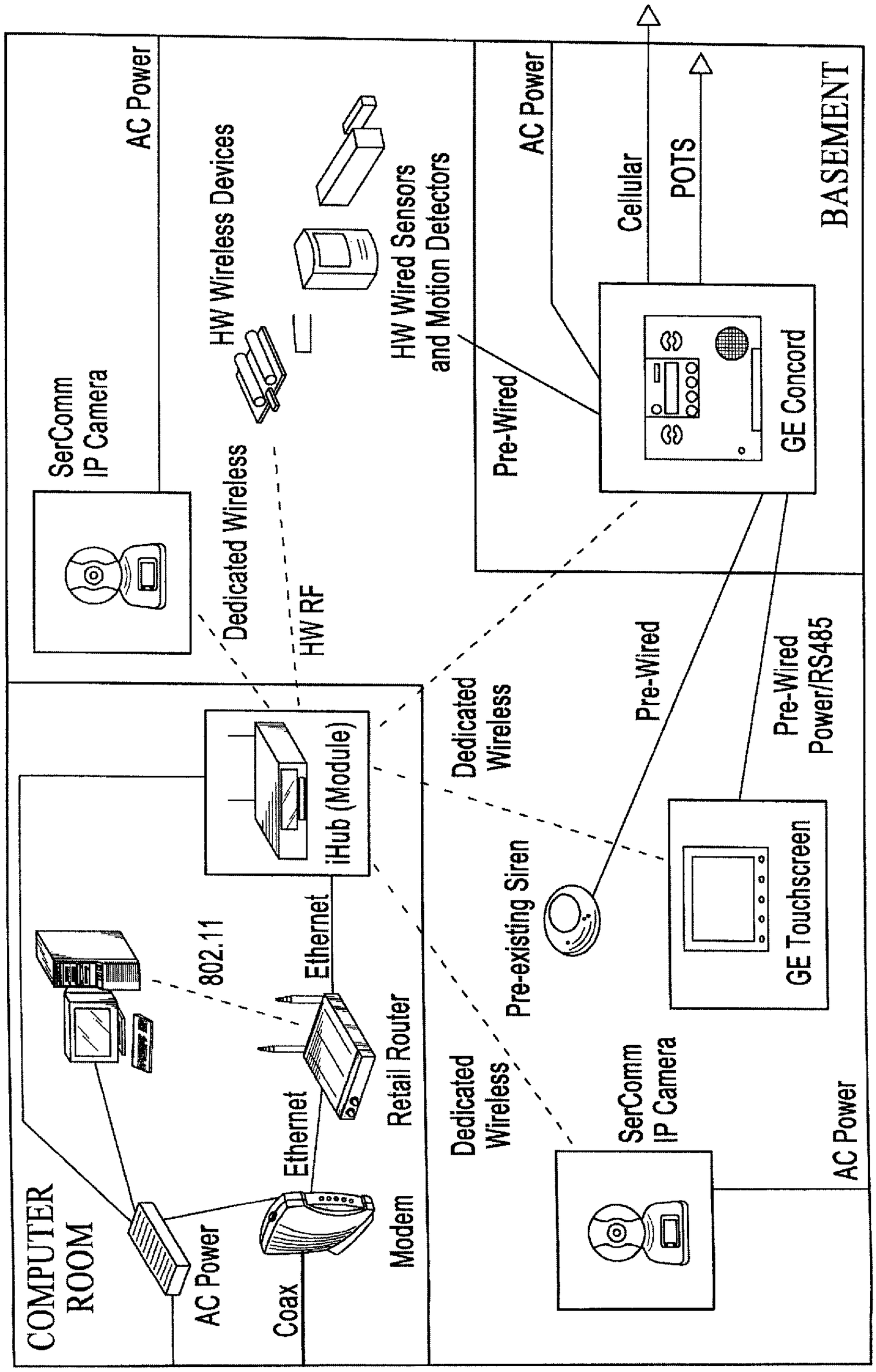

BASEMENT
AC Power
HW Wireless Devices
HW Wired Sensors
and Motion Detectors
AC Power
Cellular
POTS
SerComm
IP Camera
Pre-Wired
GE Concord
Dedicated Wireless
HW RF
Dedicated
Wireless
Pre-Wired
Pre-Wired
Power/RS485
iHub (Module)
Pre-existing Siren
GE Touchscreen
802.11
Ethernet
Retail Router
Ethernet
Dedicated
Wireless
SerComm
IP Camera
AC Power
COMPUTER
ROOM
AC Power
Coax
Modem

FIG.19

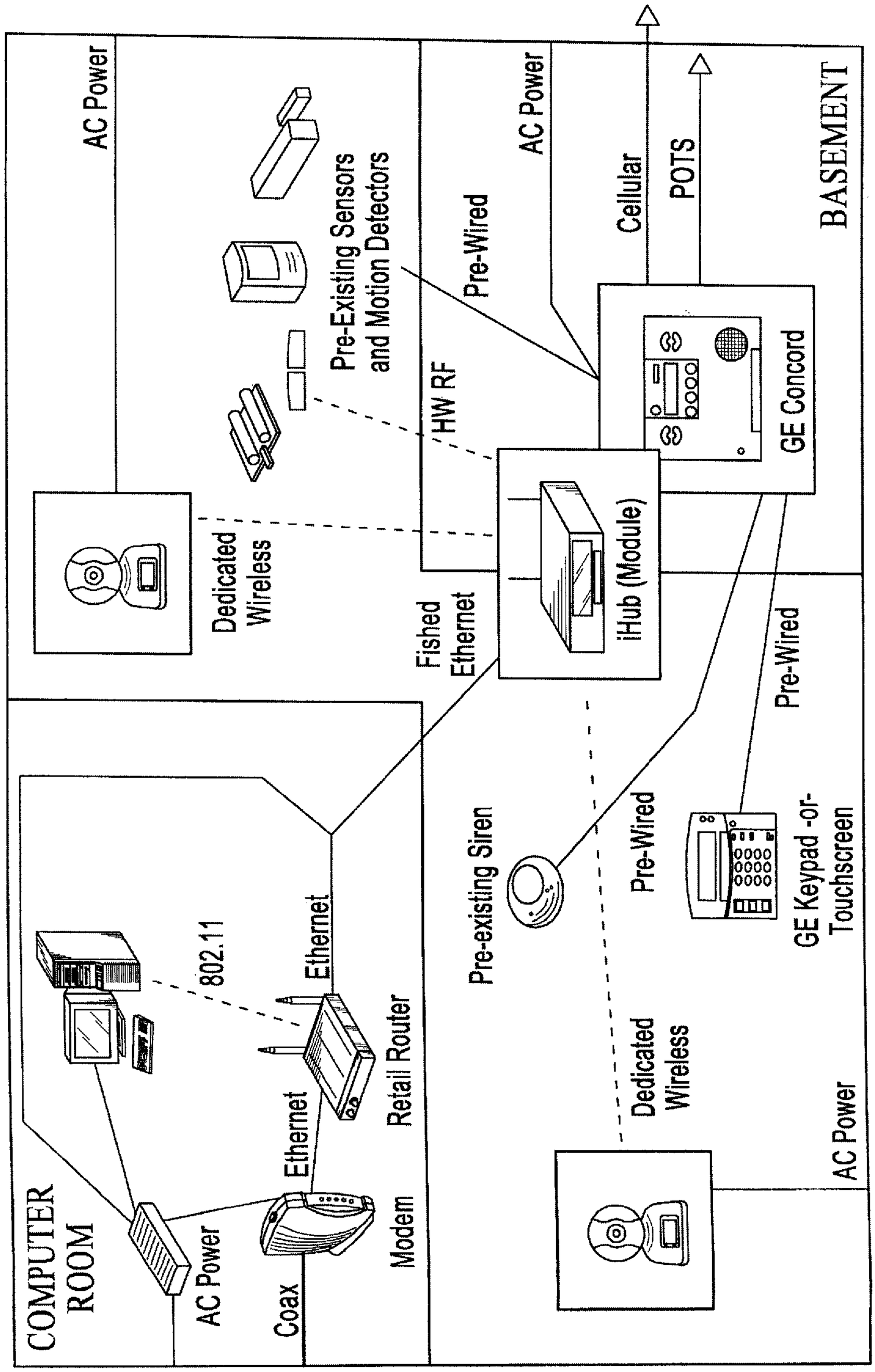

AC Power
Pre-Existing Sensors
and Motion Detectors
Pre-Wired
AC Power
Cellular
POTS
BASEMENT
HW RF
GE Concord
Dedicated
Wireless
Fished
Ethernet
iHub (Module)
Pre-Wired
Pre-existing Siren
Pre-Wired
GE Keypad -or-
Touchscreen
COMPUTER
ROOM
802.11
Ethernet
Retail Router
Ethernet
Dedicated
Wireless
AC Power
AC Power
Coax
Modem

FIG.20

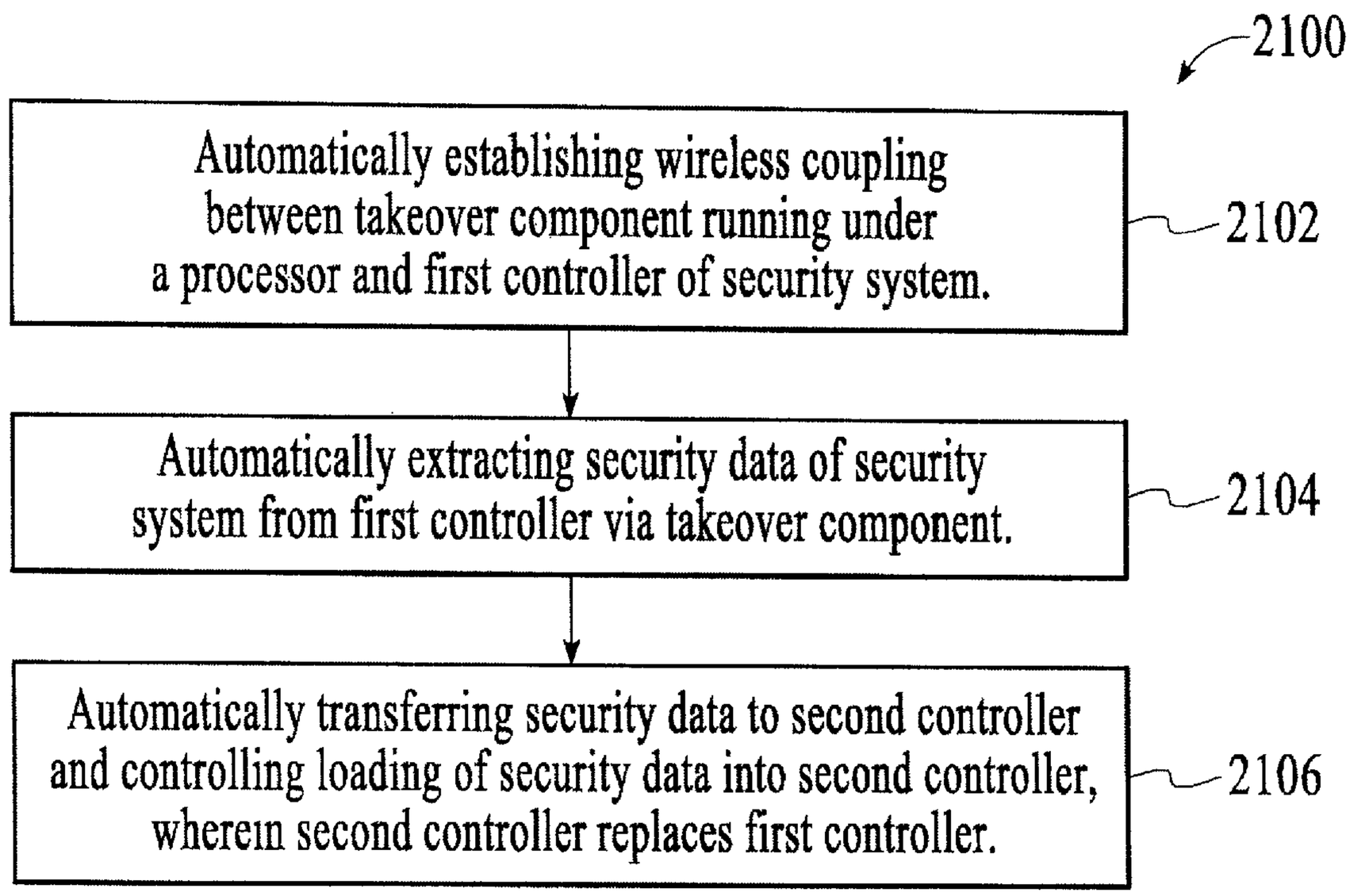

2100
Automatically establishing wireless coupling between takeover component running under a processor and first controller of security system.
2102
Automatically extracting security data of security system from first controller via takeover component.
2104
Automatically transferring security data to second controller and controlling loading of security data into second controller, wherein second controller replaces first controller.
2106

FIG.21

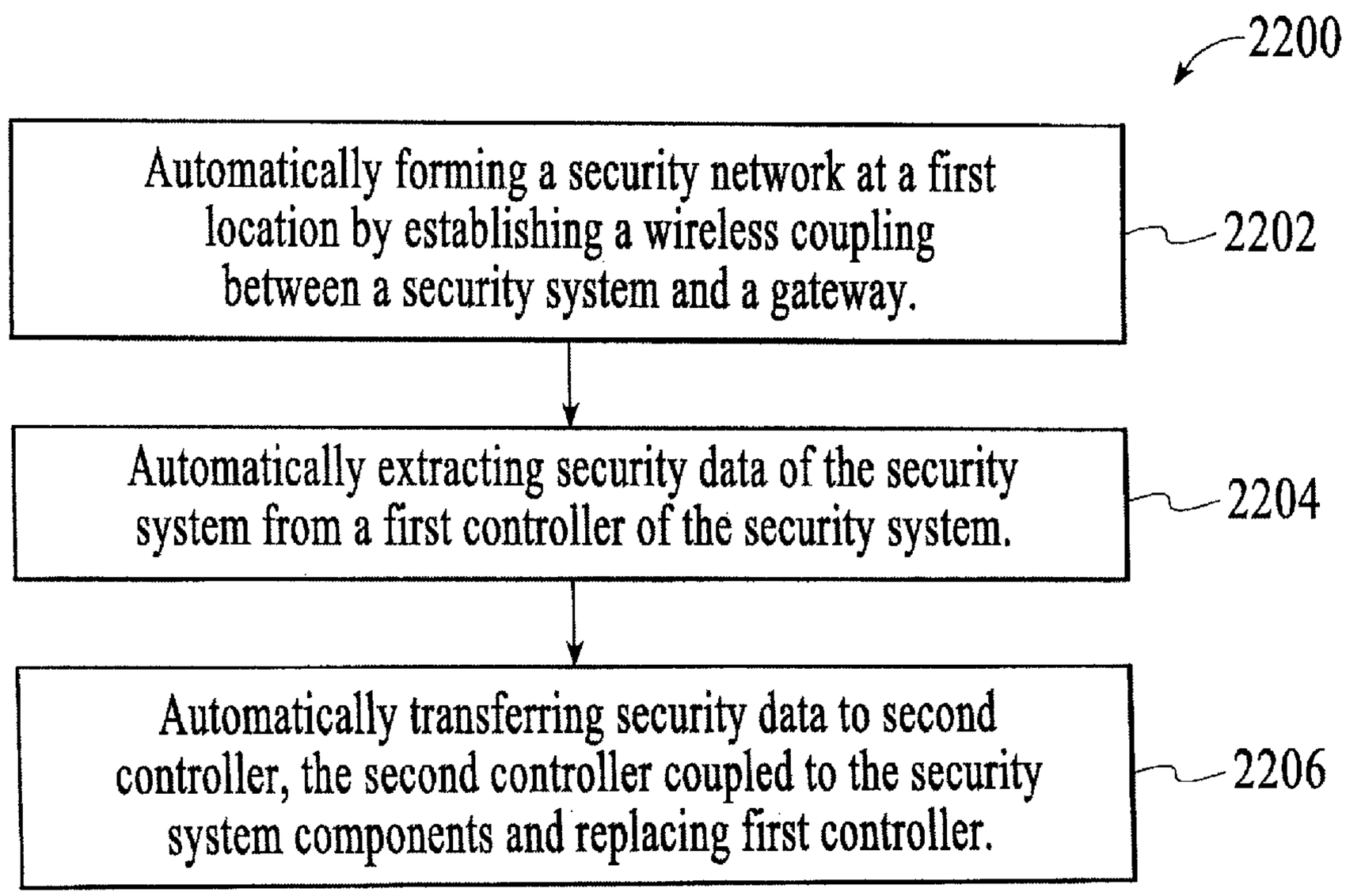

2200
Automatically forming a security network at a first location by establishing a wireless coupling between a security system and a gateway.
2202
Automatically extracting security data of the security system from a first controller of the security system.
2204
Automatically transferring security data to second controller, the second controller coupled to the security system components and replacing first controller.
2206

FIG.22

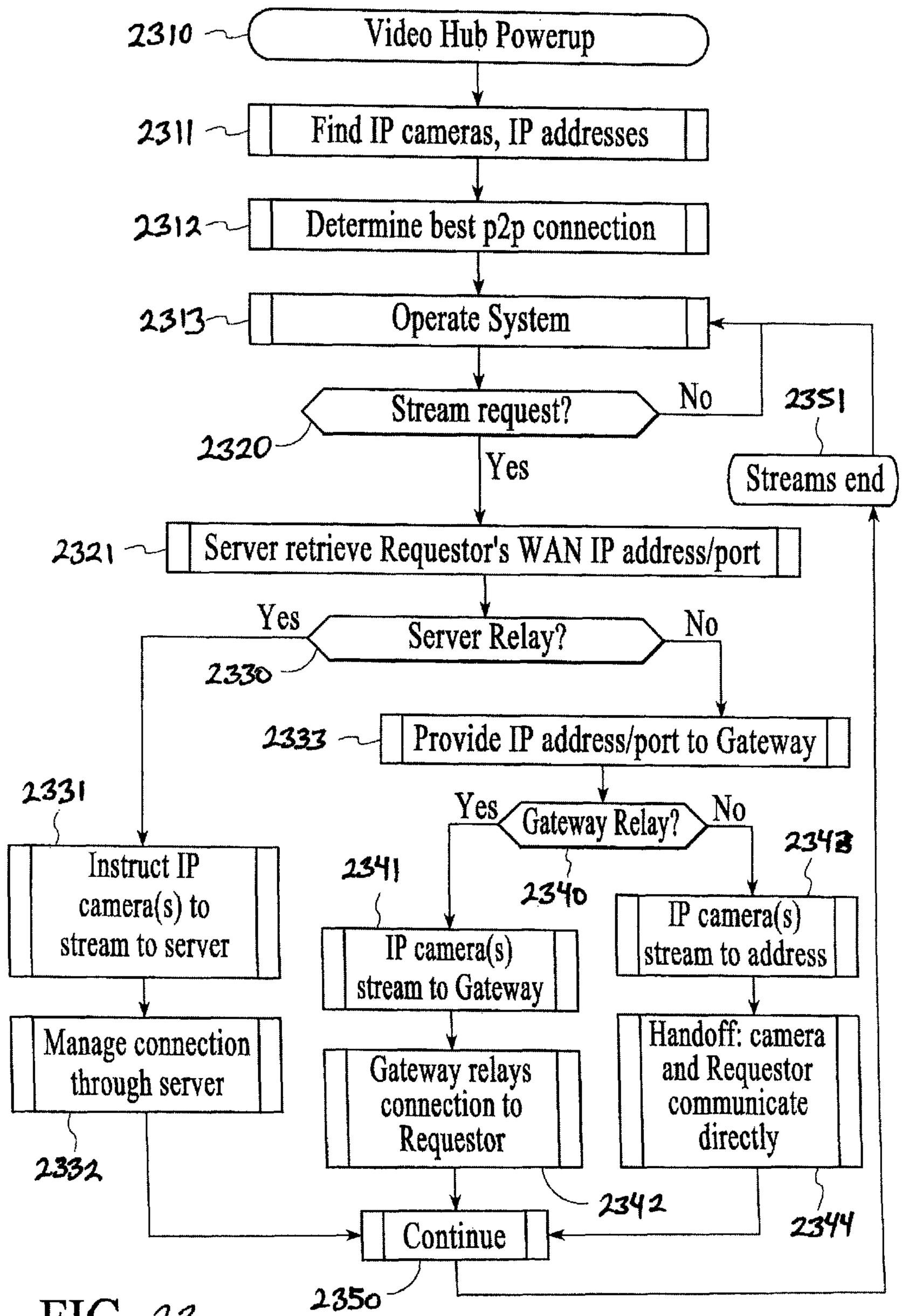

2310
Video Hub Powerup
2311
Find IP cameras, IP addresses
2312
Determine best p2p connection
2313
Operate System
Stream request?
No
2320
Yes
2351
Streams end
2321
Server retrieve Requestor's WAN IP address/port
Yes
Server Relay?
No
2330
2333
Provide IP address/port to Gateway
2331
Yes
Gateway Relay?
No
2343
2341
2340
Instruct IP camera(s) to stream to server
IP camera(s) stream to Gateway
IP camera(s) stream to address
Manage connection through server
Gateway relays connection to Requestor
Handoff: camera and Requestor communicate directly
2332
2342
2344
Continue
2350

FIG. 23

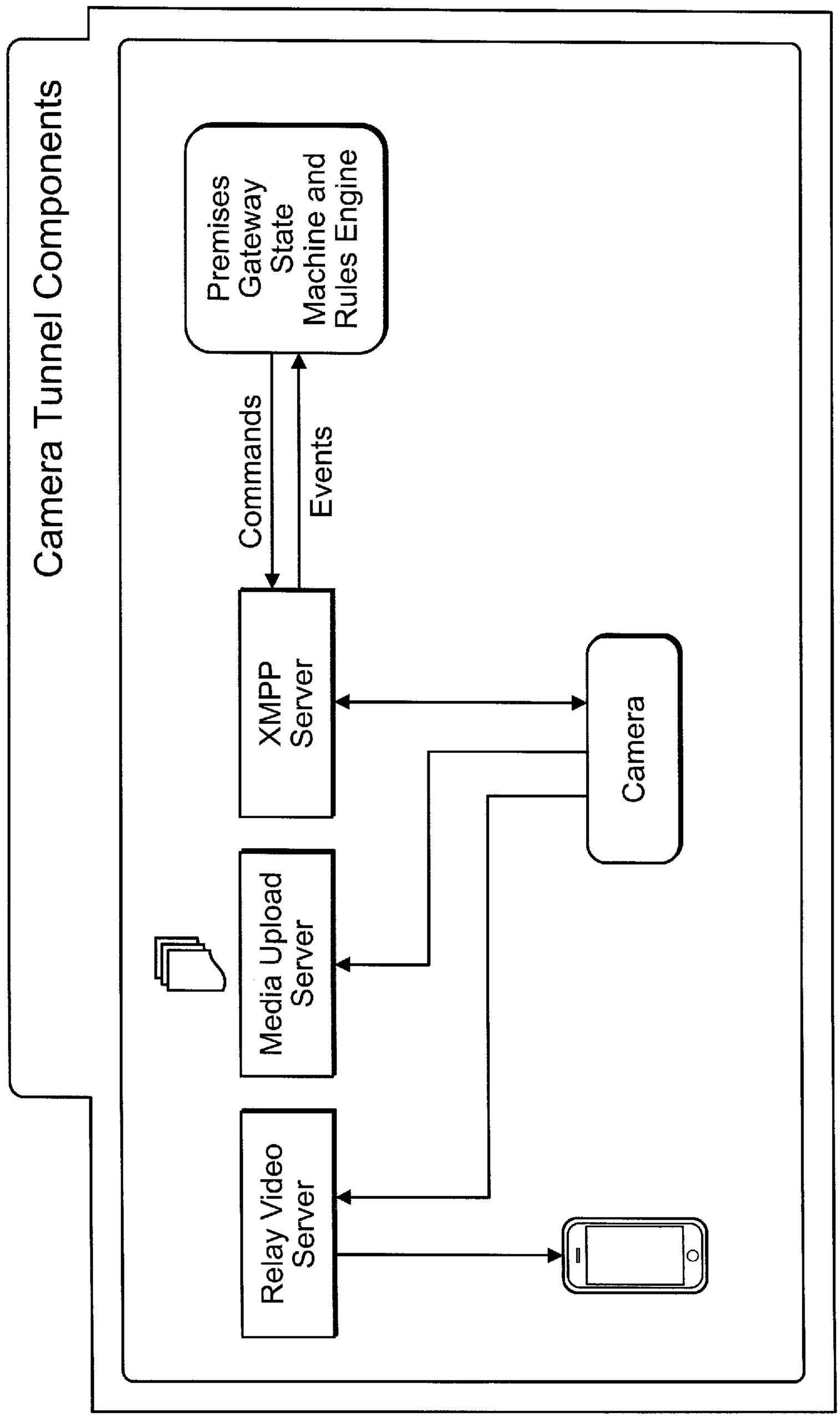
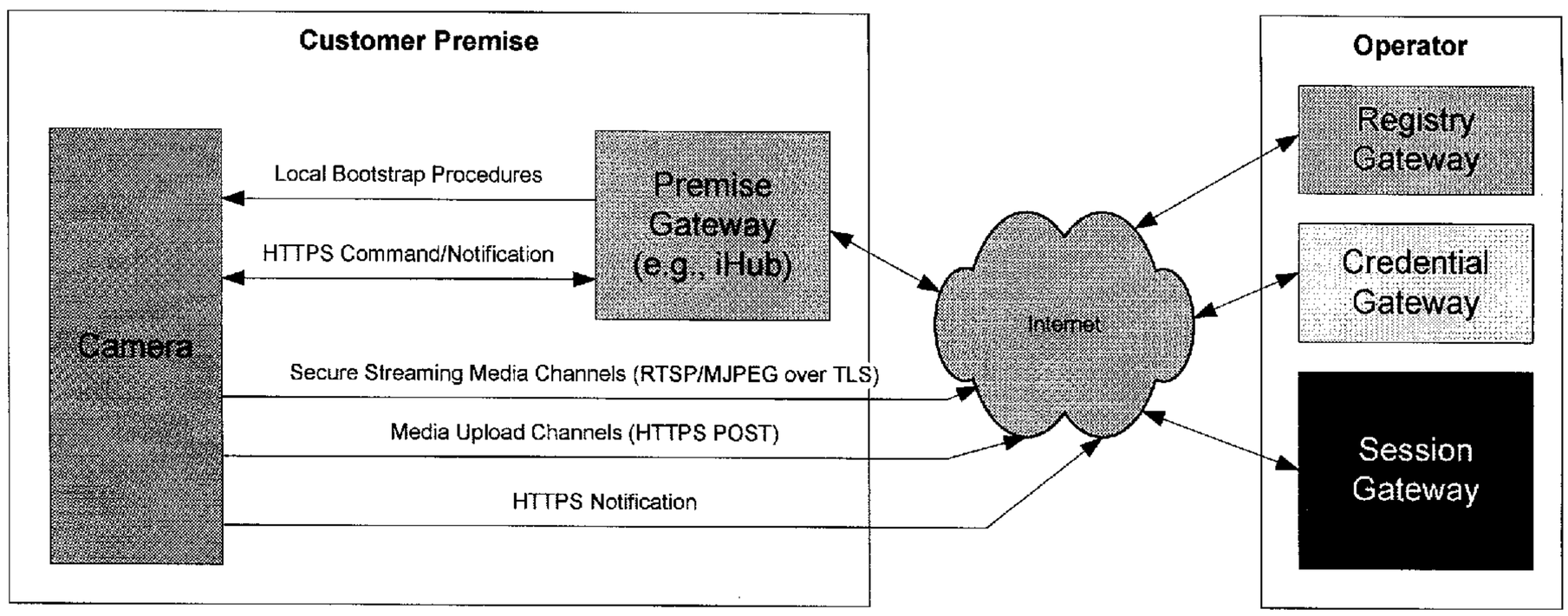
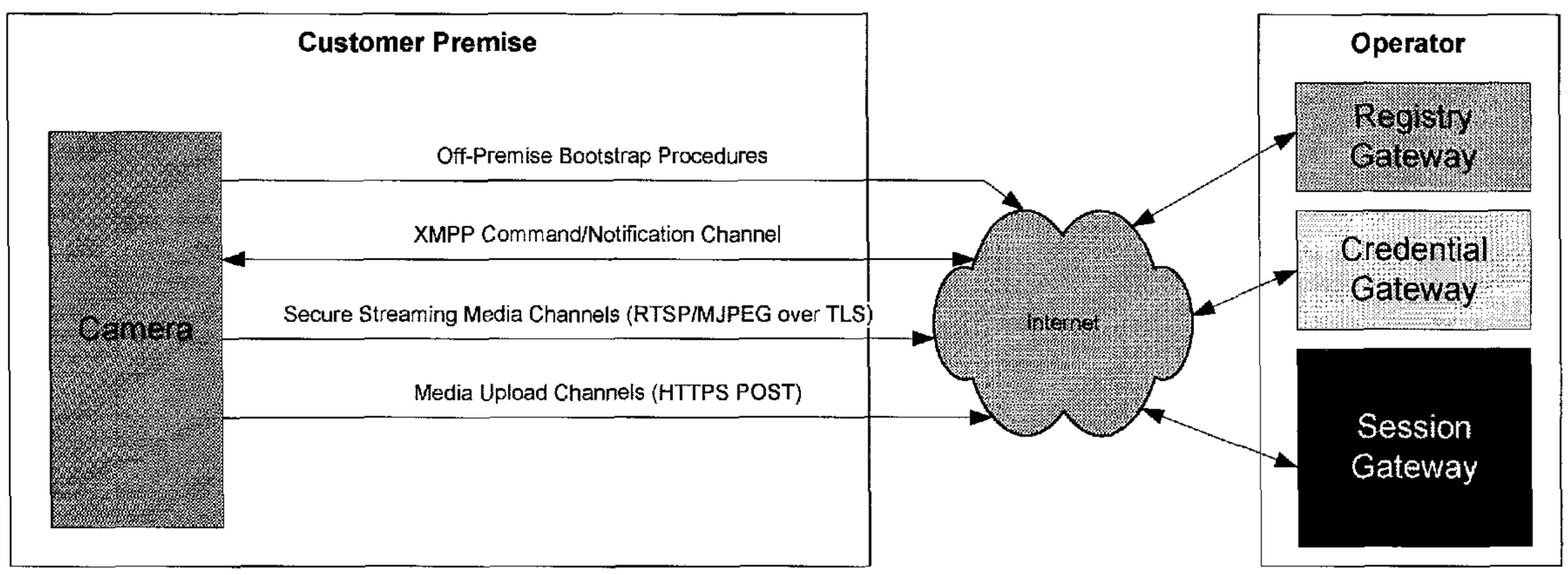

Camera Tunnel Components
Premises Gateway State Machine and Rules Engine
Commands
Events
XMPP Server
Camera
Media Upload Server
Relay Video Server

FIG. 24



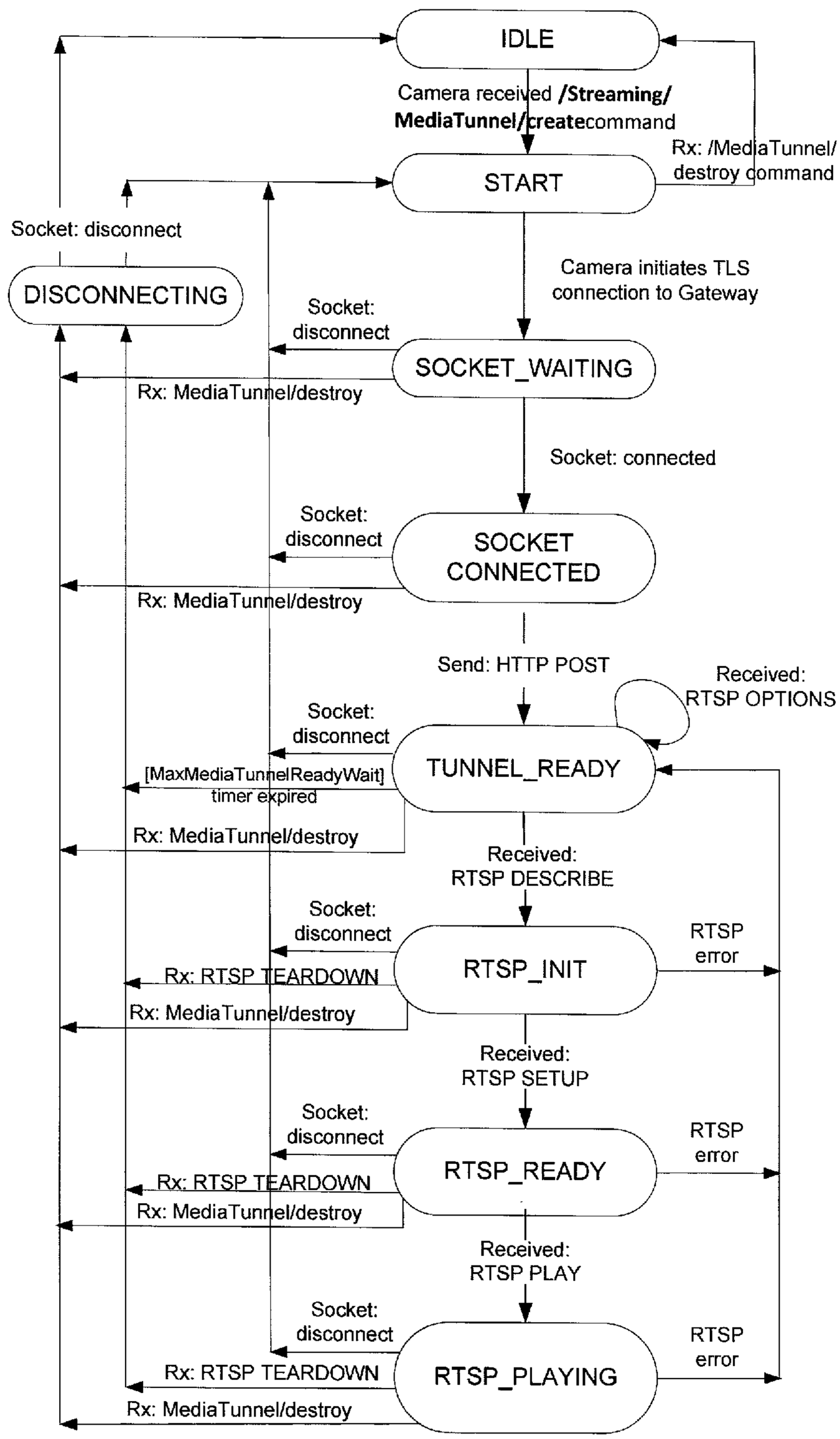
Camera with Premise Gateway Deployement Scenario

Fig. 25



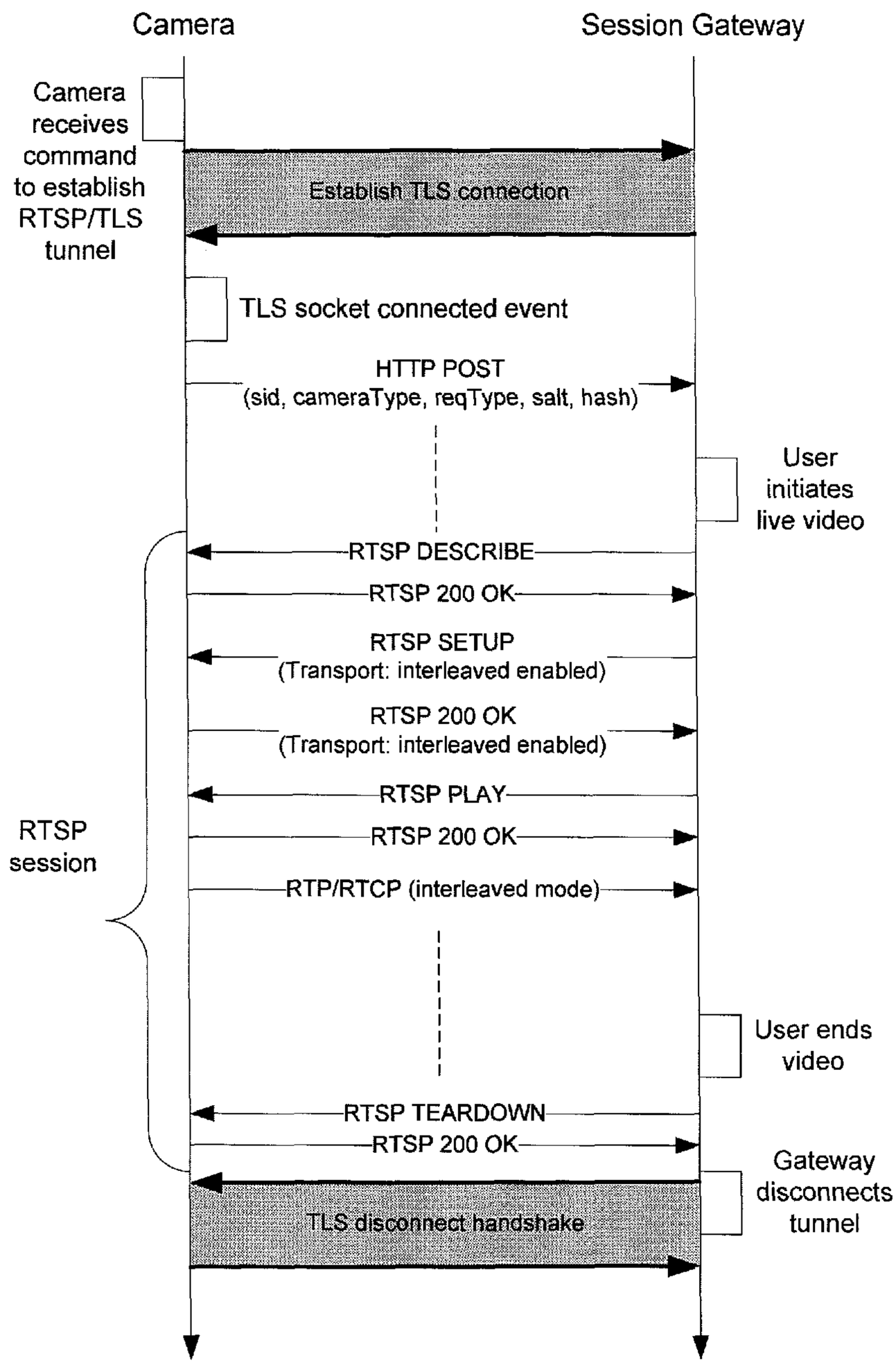
Camera Deployment without requiring Premise Gateway

Fig. 26



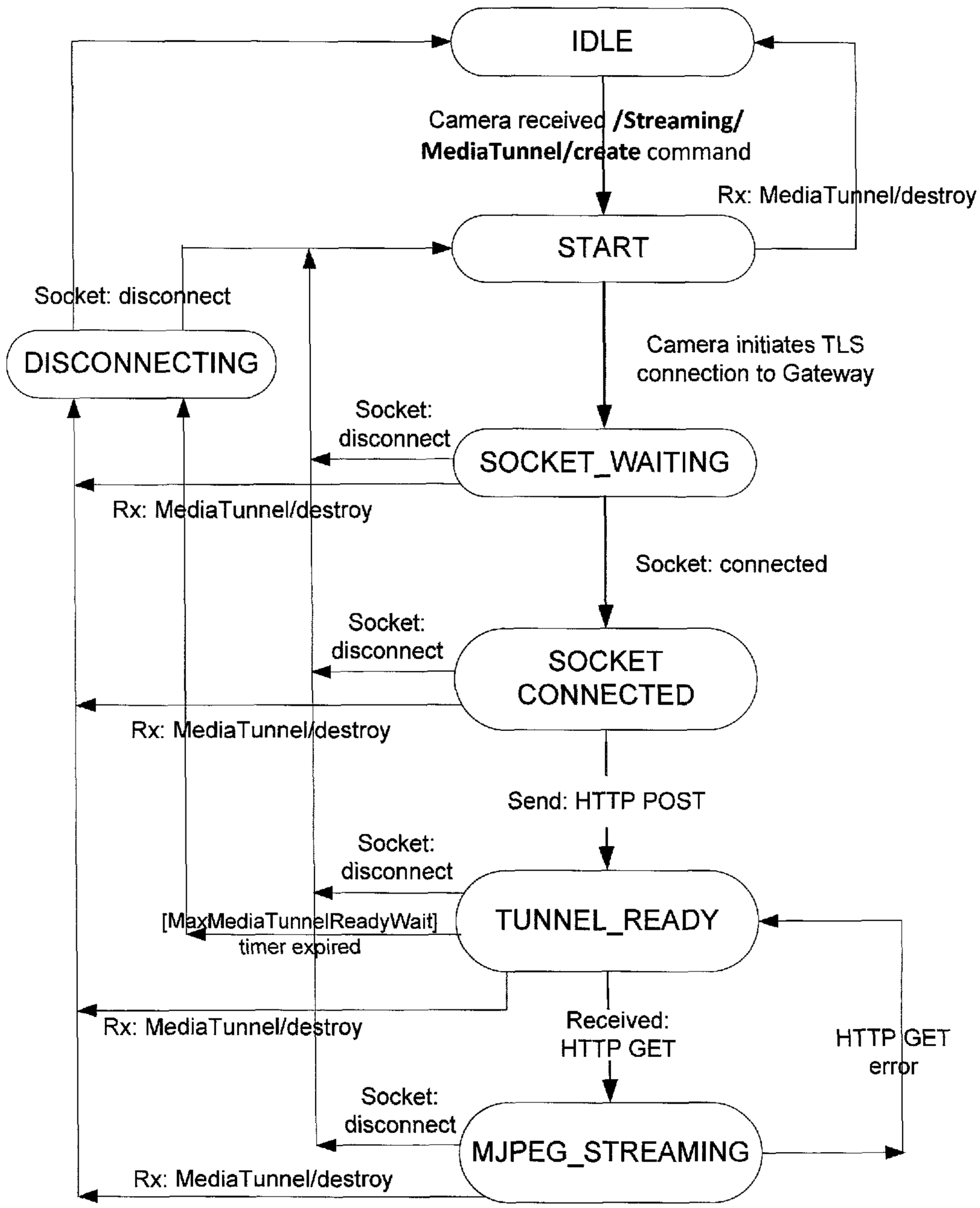
RTSP Tunnel State Transition Diagram

Fig. 27



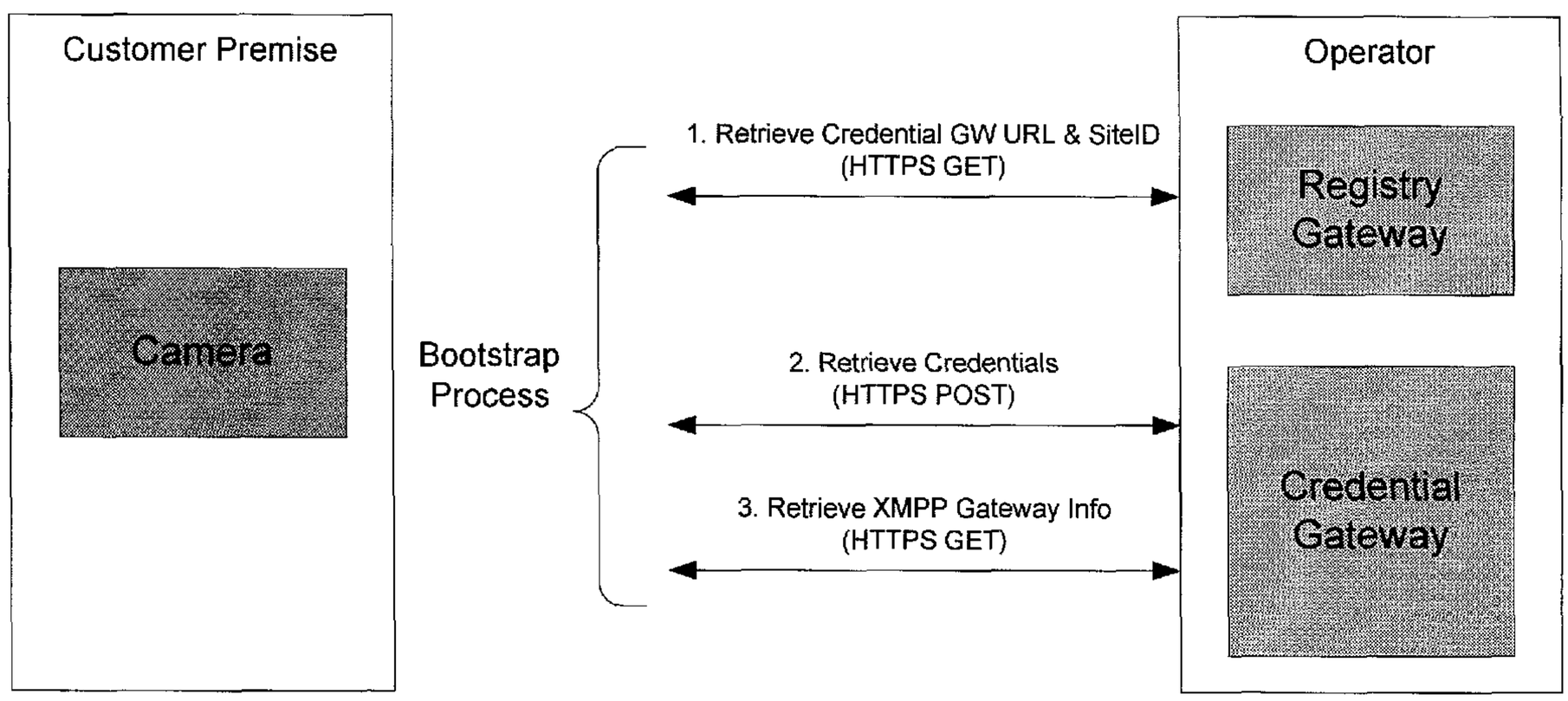
Media Channel Sample Call Flow

Fig. 28



MJPEG Media Channel State Transition Diagram

Fig. 29



Off-Premise Bootstrap Process

Fig. 30

COMMUNICATION PROTOCOLS OVER INTERNET PROTOCOL (IP) NETWORKS

RELATED APPLICATIONS

This application claims the benefit of U.S. Patent Application No. 61/782,345, filed Mar. 14, 2013.

This application claims the benefit of U.S. Patent Application No. 61/802,077, filed Mar. 15, 2013.

This application claims the benefit of U.S. Patent Application No. 61/777,061, filed Mar. 12, 2013.

This application claims the benefit of U.S. Patent Application No. 61/778,853, filed Mar. 13, 2013.

This application claims the benefit of U.S. Patent Application No. 61/779,028, filed Mar. 13, 2013.

This application claims the benefit of U.S. Patent Application No. 61/779,753, filed Mar. 13, 2013.

This application claims the benefit of U.S. Patent Application No. 61/780,092, filed Mar. 13, 2013.

This application claims the benefit of U.S. Patent Application No. 61/780,290, filed Mar. 13, 2013.

This application claims the benefit of U.S. Patent Application No. 61/780,435, filed Mar. 13, 2013.

This application claims the benefit of U.S. Patent Application No. 61/780,538, filed Mar. 13, 2013.

This application claims the benefit of U.S. Patent Application No. 61/780,637, filed Mar. 13, 2013.

This application claims the benefit of U.S. Patent Application No. 61/781,401, filed Mar. 14, 2013.

This application claims the benefit of U.S. Patent Application No. 61/781,713, filed Mar. 14, 2013.

This application is a continuation in part application of U.S. patent application Ser. No. 12/197,946, filed Aug. 25, 2008.

This application is a continuation in part application of U.S. patent application Ser. No. 13/718,851, filed Dec. 18, 2012.

This application is a continuation in part application of U.S. patent application Ser. No. 13/932,837, filed Jul. 1, 2013.

This application is a continuation in part application of U.S. patent application Ser. No. 11/761,745, filed Jun. 12, 2007.

This application is a continuation in part application of U.S. patent application Ser. No. 12/019,568, filed Jan. 24, 2008.

This application is a continuation in part application of U.S. patent application Ser. No. 13/925,181, filed Jun. 24, 2013.

This application is a continuation in part application of U.S. patent application Ser. No. 13/531,757, filed Jun. 25, 2012.

This application is a continuation in part application of U.S. patent application Ser. No. 13/335,279, filed Dec. 22, 2011.

This application is a continuation in part application of U.S. patent application Ser. No. 12/539,537, filed Aug. 11, 2009.

This application is a continuation in part application of U.S. patent application Ser. No. 12/750,470, filed Mar. 30, 2010.

This application is a continuation in part application of U.S. patent application Ser. No. 13/104,932, filed May 10, 2011.

TECHNICAL FIELD

The embodiments described herein relate generally to a method and apparatus for improving the capabilities of

security systems in home and business applications. More particularly, the embodiments described herein relate to a touchscreen device that integrates security system control and functionality with network content interactivity, management and presentation.

BACKGROUND

The field of home and small business security is dominated by technology suppliers who build comprehensive 'closed' security systems, where the individual components (sensors, security panels, keypads) operate solely within the confines of a single vendor solution. For example, a wireless motion sensor from vendor A cannot be used with a security panel from vendor B. Each vendor typically has developed sophisticated proprietary wireless technologies to enable the installation and management of wireless sensors, with little or no ability for the wireless devices to operate separate from the vendor's homogeneous system. Furthermore, these traditional systems are extremely limited in their ability to interface either to a local or wide area standards-based network (such as an IP network); most installed systems support only a low-bandwidth, intermittent connection utilizing phone lines or cellular (RF) backup systems. Wireless security technology from providers such as GE Security, Honeywell, and DSC/Tyco are well known in the art, and are examples of this proprietary approach to security systems for home and business.

Furthermore, with the proliferation of the internet, ethernet and WiFi local area networks (LANs) and advanced wide area networks (WANs) that offer high bandwidth, low latency connections (broadband), as well as more advanced wireless WAN data networks (e.g. GPRS or CDMA 1×RTT) there increasingly exists the networking capability to extend these traditional security systems to offer enhanced functionality. In addition, the proliferation of broadband access has driven a corresponding increase in home and small business networking technologies and devices. It is desirable to extend traditional security systems to encompass enhanced functionality such as the ability to control and manage security systems from the world wide web, cellular telephones, or advanced function internet-based devices. Other desired functionality includes an open systems approach to interface home security systems to home and small business networks.

Due to the proprietary approach described above, the traditional vendors are the only ones capable of taking advantage of these new network functions. To date, even though the vast majority of home and business customers have broadband network access in their premises, most security systems do not offer the advanced capabilities associated with high speed, low-latency LANs and WANs. This is primarily because the proprietary vendors have not been able to deliver such technology efficiently or effectively. Solution providers attempting to address this need are becoming known in the art, including three categories of vendors: traditional proprietary hardware providers such as Honeywell and GE Security; third party hard-wired module providers such as Alarm.com, NextAlarm, and uControl; and new proprietary systems providers such as InGrid.

A disadvantage of the prior art technologies of the traditional proprietary hardware providers arises due to the continued proprietary approach of these vendors. As they develop technology in this area it once again operates only with the hardware from that specific vendor, ignoring the need for a heterogeneous, cross-vendor solution. Yet another disadvantage of the prior art technologies of the traditional

proprietary hardware providers arises due to the lack of experience and capability of these companies in creating open internet and web based solutions, and consumer friendly interfaces.

A disadvantage of the prior art technologies of the third party hard-wired module providers arises due to the installation and operational complexities and functional limitations associated with hardwiring a new component into existing security systems. Moreover, a disadvantage of the prior art technologies of the new proprietary systems providers arises due to the need to discard all prior technologies, and implement an entirely new form of security system to access the new functionalities associated with broadband and wireless data networks. There remains, therefore, a need for systems, devices, and methods that easily interface to and control the existing proprietary security technologies utilizing a variety of wireless technologies.

INCORPORATION BY REFERENCE

Each patent, patent application, and/or publication mentioned in this specification is herein incorporated by reference in its entirety to the same extent as if each individual patent, patent application, and/or publication was specifically and individually indicated to be incorporated by reference.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of the integrated security system, under an embodiment.

FIG. **2** is a block diagram of components of the integrated security system, under an embodiment.

FIG. **3** is a block diagram of the gateway software or applications, under an embodiment.

FIG. **4** is a block diagram of the gateway components, under an embodiment.

FIG. **5** is a block diagram of IP device integration with a premise network, under an embodiment.

FIG. **6** is a block diagram of IP device integration with a premise network, under an alternative embodiment.

FIG. **7** is a block diagram of a touchscreen, under an embodiment.

FIG. **8** is an example screenshot of a networked security touchscreen, under an embodiment.

FIG. **9** is a block diagram of network or premise device integration with a premise network, under an embodiment.

FIG. **10** is a block diagram of network or premise device integration with a premise network, under an alternative embodiment.

FIG. **11** is a flow diagram for a method of forming a security network including integrated security system components, under an embodiment.

FIG. **12** is a flow diagram for a method of forming a security network including integrated security system components and network devices, under an embodiment.

FIG. **13** is a flow diagram for installation of an IP device into a private network environment, under an embodiment.

FIG. **14** is a block diagram showing communications among IP devices of the private network environment, under an embodiment.

FIG. **15** is a flow diagram of a method of integrating an external control and management application system with an existing security system, under an embodiment.

FIG. **16** is a block diagram of an integrated security system wirelessly interfacing to proprietary security systems, under an embodiment.

FIG. **17** is a flow diagram for wirelessly 'learning' the gateway into an existing security system and discovering extant sensors, under an embodiment.

FIG. **18** is a block diagram of a security system in which the legacy panel is replaced with a wireless security panel wirelessly coupled to a gateway, under an embodiment.

FIG. **19** is a block diagram of a security system in which the legacy panel is replaced with a wireless security panel wirelessly coupled to a gateway, and a touchscreen, under an alternative embodiment.

FIG. **20** is a block diagram of a security system in which the legacy panel is replaced with a wireless security panel connected to a gateway via an Ethernet coupling, under another alternative embodiment.

FIG. **21** is a flow diagram for automatic takeover of a security system, under an embodiment.

FIG. **22** is a flow diagram for automatic takeover of a security system, under an alternative embodiment.

FIG. **23** is a general flow diagram for IP video control, under an embodiment.

FIG. **24** is a block diagram showing camera tunneling, under an embodiment.

FIG. **25** is a flow diagram illustrating a deployment scenario where the Camera is deployed in conjunction with a Premise Gateway at the customer premise, under an embodiment.

FIG. **26** is a flow diagram illustrating a deployment scenario where the Camera is deployed without requiring a Premise Gateway at the customer premise, under an embodiment.

FIG. **27** is a flow diagram of the state transition for a sequence, under an embodiment.

FIG. **28** is a flow diagram of sample call flows, under an embodiment.

FIG. **29** is a flow diagram of the state transition for a sequence, under an embodiment.

FIG. **30** is a flow diagram illustrating steps involved in off-premise bootstrap procedures, under an embodiment.

DETAILED DESCRIPTION

An integrated security system is described that integrates broadband and mobile access and control with conventional security systems and premise devices to provide a tri-mode security network (broadband, cellular/GSM, POTS access) that enables users to remotely stay connected to their premises. The integrated security system, while delivering remote premise monitoring and control functionality to conventional monitored premise protection, complements existing premise protection equipment. The integrated security system integrates into the premise network and couples wirelessly with the conventional security panel, enabling broadband access to premise security systems. Automation devices (cameras, lamp modules, thermostats, etc.) can be added, enabling users to remotely see live video and/or pictures and control home devices via their personal web portal or webpage, mobile phone, and/or other remote client device. Users can also receive notifications via email or text message when happenings occur, or do not occur, in their home.

Although the detailed description herein contains many specifics for the purposes of illustration, anyone of ordinary skill in the art will appreciate that many variations and alterations to the following details are within the scope of the embodiments described herein. Thus, the following illustra-

tive embodiments are set forth without any loss of generality to, and without imposing limitations upon, the claimed invention.

As described herein, computer networks suitable for use with the embodiments described herein include local area networks (LAN), wide area networks (WAN), Internet, or other connection services and network variations such as the world wide web, the public internet, a private internet, a private computer network, a public network, a mobile network, a cellular network, a value-added network, and the like. Computing devices coupled or connected to the network may be any microprocessor controlled device that permits access to the network, including terminal devices, such as personal computers, workstations, servers, mini computers, main-frame computers, laptop computers, mobile computers, palm top computers, hand held computers, mobile phones, TV set-top boxes, or combinations thereof. The computer network may include one of more LANs, WANs, Internets, and computers. The computers may serve as servers, clients, or a combination thereof.

The integrated security system can be a component of a single system, multiple systems, and/or geographically separate systems. The integrated security system can also be a subcomponent or subsystem of a single system, multiple systems, and/or geographically separate systems. The integrated security system can be coupled to one or more other components (not shown) of a host system or a system coupled to the host system.

One or more components of the integrated security system and/or a corresponding system or application to which the integrated security system is coupled or connected includes and/or runs under and/or in association with a processing system. The processing system includes any collection of processor-based devices or computing devices operating together, or components of processing systems or devices, as is known in the art. For example, the processing system can include one or more of a portable computer, portable communication device operating in a communication network, and/or a network server. The portable computer can be any of a number and/or combination of devices selected from among personal computers, personal digital assistants, portable computing devices, and portable communication devices, but is not so limited. The processing system can include components within a larger computer system.

The processing system of an embodiment includes at least one processor and at least one memory device or subsystem. The processing system can also include or be coupled to at least one database. The term "processor" as generally used herein refers to any logic processing unit, such as one or more central processing units (CPUs), digital signal processors (DSPs), application-specific integrated circuits (ASIC), etc. The processor and memory can be monolithically integrated onto a single chip, distributed among a number of chips or components, and/or provided by some combination of algorithms. The methods described herein can be implemented in one or more of software algorithm(s), programs, firmware, hardware, components, circuitry, in any combination.

The components of any system that includes the integrated security system can be located together or in separate locations. Communication paths couple the components and include any medium for communicating or transferring files among the components. The communication paths include wireless connections, wired connections, and hybrid wireless/wired connections. The communication paths also include couplings or connections to networks including local area networks (LANs), metropolitan area networks (MANS), wide area networks (WANs), proprietary networks, interoffice or backend networks, and the Internet. Furthermore, the communication paths include removable fixed mediums like floppy disks, hard disk drives, and CD-ROM disks, as well as flash RAM, Universal Serial Bus (USB) connections, RS-232 connections, telephone lines, buses, and electronic mail messages.

Aspects of the integrated security system and corresponding systems and methods described herein may be implemented as functionality programmed into any of a variety of circuitry, including programmable logic devices (PLDs), such as field programmable gate arrays (FPGAs), programmable array logic (PAL) devices, electrically programmable logic and memory devices and standard cell-based devices, as well as application specific integrated circuits (ASICs). Some other possibilities for implementing aspects of the integrated security system and corresponding systems and methods include: microcontrollers with memory (such as electronically erasable programmable read only memory (EEPROM)), embedded microprocessors, firmware, software, etc. Furthermore, aspects of the integrated security system and corresponding systems and methods may be embodied in microprocessors having software-based circuit emulation, discrete logic (sequential and combinatorial), custom devices, fuzzy (neural) logic, quantum devices, and hybrids of any of the above device types. Of course the underlying device technologies may be provided in a variety of component types, e.g., metal-oxide semiconductor field-effect transistor (MOSFET) technologies like complementary metal-oxide semiconductor (CMOS), bipolar technologies like emitter-coupled logic (ECL), polymer technologies (e.g., silicon-conjugated polymer and metal-conjugated polymer-metal structures), mixed analog and digital, etc.

It should be noted that any system, method, and/or other components disclosed herein may be described using computer aided design tools and expressed (or represented), as data and/or instructions embodied in various computer-readable media, in terms of their behavioral, register transfer, logic component, transistor, layout geometries, and/or other characteristics. Computer-readable media in which such formatted data and/or instructions may be embodied include, but are not limited to, non-volatile storage media in various forms (e.g., optical, magnetic or semiconductor storage media) and carrier waves that may be used to transfer such formatted data and/or instructions through wireless, optical, or wired signaling media or any combination thereof. Examples of transfers of such formatted data and/or instructions by carrier waves include, but are not limited to, transfers (uploads, downloads, e-mail, etc.) over the Internet and/or other computer networks via one or more data transfer protocols (e.g., HTTP, FTP, SMTP, etc.). When received within a computer system via one or more computer-readable media, such data and/or instruction-based expressions of the above described components may be processed by a processing entity (e.g., one or more processors) within the computer system in conjunction with execution of one or more other computer programs.

Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in a sense of "including, but not limited to." Words using the singular or plural number also include the plural or singular number respectively. Additionally, the words "herein," "hereunder," "above," "below," and words of similar import, when used in this application, refer to this application as a whole and not to any particular portions of

this application. When the word "or" is used in reference to a list of two or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list and any combination of the items in the list.

The above description of embodiments of the integrated security system and corresponding systems and methods is not intended to be exhaustive or to limit the systems and methods to the precise forms disclosed. While specific embodiments of, and examples for, the integrated security system and corresponding systems and methods are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the systems and methods, as those skilled in the relevant art will recognize. The teachings of the integrated security system and corresponding systems and methods provided herein can be applied to other systems and methods, not only for the systems and methods described above.

The elements and acts of the various embodiments described above can be combined to provide further embodiments. These and other changes can be made to the integrated security system and corresponding systems and methods in light of the above detailed description.

In accordance with the embodiments described herein, a wireless system (e.g., radio frequency (RF)) is provided that enables a security provider or consumer to extend the capabilities of an existing RF-capable security system or a non-RF-capable security system that has been upgraded to support RF capabilities. The system includes an RF-capable Gateway device (physically located within RF range of the RF-capable security system) and associated software operating on the Gateway device. The system also includes a web server, application server, and remote database providing a persistent store for information related to the system.

The security systems of an embodiment, referred to herein as the iControl security system or integrated security system, extend the value of traditional home security by adding broadband access and the advantages of remote home monitoring and home control through the formation of a security network including components of the integrated security system integrated with a conventional premise security system and a premise local area network (LAN). With the integrated security system, conventional home security sensors, cameras, touchscreen keypads, lighting controls, and/or Internet Protocol (IP) devices in the home (or business) become connected devices that are accessible anywhere in the world from a web browser, mobile phone or through content-enabled touchscreens. The integrated security system experience allows security operators to both extend the value proposition of their monitored security systems and reach new consumers that include broadband users interested in staying connected to their family, home and property when they are away from home.

The integrated security system of an embodiment includes security servers (also referred to herein as iConnect servers or security network servers) and an iHub gateway (also referred to herein as the gateway, the iHub, or the iHub client) that couples or integrates into a home network (e.g., LAN) and communicates directly with the home security panel, in both wired and wireless installations. The security system of an embodiment automatically discovers the security system components (e.g., sensors, etc.) belonging to the security system and connected to a control panel of the security system and provides consumers with full two-way access via web and mobile portals. The gateway supports various wireless protocols and can interconnect with a wide range of control panels offered by security system providers. Service providers and users can then extend the system's capabilities with the additional IP cameras, lighting modules or security devices such as interactive touchscreen keypads. The integrated security system adds an enhanced value to these security systems by enabling consumers to stay connected through email and SMS alerts, photo push, event-based video capture and rule-based monitoring and notifications. This solution extends the reach of home security to households with broadband access.

The integrated security system builds upon the foundation afforded by traditional security systems by layering broadband and mobile access, IP cameras, interactive touchscreens, and an open approach to home automation on top of traditional security system configurations. The integrated security system is easily installed and managed by the security operator, and simplifies the traditional security installation process, as described below.

The integrated security system provides an open systems solution to the home security market. As such, the foundation of the integrated security system customer premises equipment (CPE) approach has been to abstract devices, and allows applications to manipulate and manage multiple devices from any vendor. The integrated security system DeviceConnect technology that enables this capability supports protocols, devices, and panels from GE Security and Honeywell, as well as consumer devices using Z-Wave, IP cameras (e.g., Ethernet, wife, and Homeplug), and IP touchscreens. The DeviceConnect is a device abstraction layer that enables any device or protocol layer to interoperate with integrated security system components. This architecture enables the addition of new devices supporting any of these interfaces, as well as add entirely new protocols.

The benefit of DeviceConnect is that it provides supplier flexibility. The same consistent touchscreen, web, and mobile user experience operate unchanged on whatever security equipment selected by a security system provider, with the system provider's choice of IP cameras, backend data center and central station software.

The integrated security system provides a complete system that integrates or layers on top of a conventional host security system available from a security system provider. The security system provider therefore can select different components or configurations to offer (e.g., CDMA, GPRS, no cellular, etc.) as well as have iControl modify the integrated security system configuration for the system provider's specific needs (e.g., change the functionality of the web or mobile portal, add a GE or Honeywell-compatible TouchScreen, etc.).

The integrated security system integrates with the security system provider infrastructure for central station reporting directly via Broadband and GPRS alarm transmissions. Traditional dial-up reporting is supported via the standard panel connectivity. Additionally, the integrated security system provides interfaces for advanced functionality to the CMS, including enhanced alarm events, system installation optimizations, system test verification, video verification, 2-way voice over IP and GSM.

The integrated security system is an IP centric system that includes broadband connectivity so that the gateway augments the existing security system with broadband and GPRS connectivity. If broadband is down or unavailable GPRS may be used, for example. The integrated security system supports GPRS connectivity using an optional wireless package that includes a GPRS modem in the gateway. The integrated security system treats the GPRS connection as a higher cost though flexible option for data transfers. In an embodiment the GPRS connection is only used to route

alarm events (e.g., for cost), however the gateway can be configured (e.g., through the iConnect server interface) to act as a primary channel and pass any or all events over GPRS. Consequently, the integrated security system does not interfere with the current plain old telephone service (POTS) security panel interface. Alarm events can still be routed through POTS; however the gateway also allows such events to be routed through a broadband or GPRS connection as well. The integrated security system provides a web application interface to the CSR tool suite as well as XML web services interfaces for programmatic integration between the security system provider's existing call center products. The integrated security system includes, for example, APIs that allow the security system provider to integrate components of the integrated security system into a custom call center interface. The APIs include XML web service APIs for integration of existing security system provider call center applications with the integrated security system service. All functionality available in the CSR Web application is provided with these API sets. The Java and XML-based APIs of the integrated security system support provisioning, billing, system administration, CSR, central station, portal user interfaces, and content management functions, to name a few. The integrated security system can provide a customized interface to the security system provider's billing system, or alternatively can provide security system developers with APIs and support in the integration effort.

The integrated security system provides or includes business component interfaces for provisioning, administration, and customer care to name a few. Standard templates and examples are provided with a defined customer professional services engagement to help integrate OSS/BSS systems of a Service Provider with the integrated security system.

The integrated security system components support and allow for the integration of customer account creation and deletion with a security system. The iConnect APIs provides access to the provisioning and account management system in iConnect and provide full support for account creation, provisioning, and deletion. Depending on the requirements of the security system provider, the iConnect APIs can be used to completely customize any aspect of the integrated security system backend operational system.

The integrated security system includes a gateway that supports the following standards-based interfaces, to name a few: Ethernet IP communications via Ethernet ports on the gateway, and standard XML/TCP/IP protocols and ports are employed over secured SSL sessions; USB 2.0 via ports on the gateway; 802.11b/g/n IP communications; GSM/GPRS RF WAN communications; CDMA 1×RTT RF WAN communications (optional, can also support EVDO and 3G technologies).

The gateway supports the following proprietary interfaces, to name a few: interfaces including Dialog RF network (319.5 MHz) and RS485 Superbus 2000 wired interface; RF mesh network (908 MHz); and interfaces including RF network (345 MHz) and RS485/RS232bus wired interfaces.

Regarding security for the IP communications (e.g., authentication, authorization, encryption, anti-spoofing, etc), the integrated security system uses SSL to encrypt all IP traffic, using server and client-certificates for authentication, as well as authentication in the data sent over the SSL-encrypted channel. For encryption, integrated security system issues public/private key pairs at the time/place of manufacture, and certificates are not stored in any online storage in an embodiment.

The integrated security system does not need any special rules at the customer premise and/or at the security system provider central station because the integrated security system makes outgoing connections using TCP over the standard HTTP and HTTPS ports. Provided outbound TCP connections are allowed then no special requirements on the firewalls are necessary.

FIG. **1** is a block diagram of the integrated security system **100**, under an embodiment. The integrated security system **100** of an embodiment includes the gateway **102** and the security servers **104** coupled to the conventional home security system **110**. At a customer's home or business, the gateway **102** connects and manages the diverse variety of home security and self-monitoring devices. The gateway **102** communicates with the iConnect Servers **104** located in the service provider's data center **106** (or hosted in integrated security system data center), with the communication taking place via a communication network **108** or other network (e.g., cellular network, internet, etc.). These servers **104** manage the system integrations necessary to deliver the integrated system service described herein. The combination of the gateway **102** and the iConnect servers **104** enable a wide variety of remote client devices **120** (e.g., PCs, mobile phones and PDAs) allowing users to remotely stay in touch with their home, business and family. In addition, the technology allows home security and self-monitoring information, as well as relevant third party content such as traffic and weather, to be presented in intuitive ways within the home, such as on advanced touchscreen keypads.

The integrated security system service (also referred to as iControl service) can be managed by a service provider via browser-based Maintenance and Service Management applications that are provided with the iConnect Servers. Or, if desired, the service can be more tightly integrated with existing OSS/BSS and service delivery systems via the iConnect web services-based XML APIs.

The integrated security system service can also coordinate the sending of alarms to the home security Central Monitoring Station (CMS) **199**. Alarms are passed to the CMS **199** using standard protocols such as Contact ID or SIA and can be generated from the home security panel location as well as by iConnect server **104** conditions (such as lack of communications with the integrated security system). In addition, the link between the security servers **104** and CMS **199** provides tighter integration between home security and self-monitoring devices and the gateway **102**. Such integration enables advanced security capabilities such as the ability for CMS personnel to view photos taken at the time a burglary alarm was triggered. For maximum security, the gateway **102** and iConnect servers **104** support the use of a mobile network (both GPRS and CDMA options are available) as a backup to the primary broadband connection.

The integrated security system service is delivered by hosted servers running software components that communicate with a variety of client types while interacting with other systems. FIG. **2** is a block diagram of components of the integrated security system **100**, under an embodiment. Following is a more detailed description of the components.

The iConnect servers **104** support a diverse collection of clients **120** ranging from mobile devices, to PCs, to in-home security devices, to a service provider's internal systems. Most clients **120** are used by end-users, but there are also a number of clients **120** that are used to operate the service.

Clients **120** used by end-users of the integrated security system **100** include, but are not limited to, the following:

Clients based on gateway client applications **202** (e.g., a processor-based device running the gateway technology that manages home security and automation devices).

A web browser **204** accessing a Web Portal application, performing end-user configuration and customization of the integrated security system service as well as monitoring of in-home device status, viewing photos and video, etc. Device and user management can also be performed by this portal application.

A mobile device **206** (e.g., PDA, mobile phone, etc.) accessing the integrated security system Mobile Portal. This type of client **206** is used by end-users to view system status and perform operations on devices (e.g., turning on a lamp, arming a security panel, etc.) rather than for system configuration tasks such as adding a new device or user.

PC or browser-based "widget" containers **208** that present integrated security system service content, as well as other third-party content, in simple, targeted ways (e.g. a widget that resides on a PC desktop and shows live video from a single in-home camera). "Widget" as used herein means applications or programs in the system.

Touchscreen home security keypads **208** and advanced in-home devices that present a variety of content widgets via an intuitive touchscreen user interface.

Notification recipients **210** (e.g., cell phones that receive SMS-based notifications when certain events occur (or don't occur), email clients that receive an email message with similar information, etc.).

Custom-built clients (not shown) that access the iConnect web services XML API to interact with users' home security and self-monitoring information in new and unique ways. Such clients could include new types of mobile devices, or complex applications where integrated security system content is integrated into a broader set of application features.

In addition to the end-user clients, the iConnect servers **104** support PC browser-based Service Management clients that manage the ongoing operation of the overall service. These clients run applications that handle tasks such as provisioning, service monitoring, customer support and reporting.

There are numerous types of server components of the iConnect servers **104** of an embodiment including, but not limited to, the following: Business Components which manage information about all of the home security and self-monitoring devices; End-User Application Components which display that information for users and access the Business Components via published XML APIs; and Service Management Application Components which enable operators to administer the service (these components also access the Business Components via the XML APIs, and also via published SNMP MIBs).

The server components provide access to, and management of, the objects associated with an integrated security system installation. The top-level object is the "network." It is a location where a gateway **102** is located, and is also commonly referred to as a site or premises; the premises can include any type of structure (e.g., home, office, warehouse, etc.) at which a gateway **102** is located. Users can only access the networks to which they have been granted permission. Within a network, every object monitored by the gateway **102** is called a device. Devices include the sensors, cameras, home security panels and automation devices, as well as the controller or processor-based device running the gateway applications.

Various types of interactions are possible between the objects in a system. Automations define actions that occur as a result of a change in state of a device. For example, take a picture with the front entry camera when the front door sensor changes to "open". Notifications are messages sent to users to indicate that something has occurred, such as the front door going to "open" state, or has not occurred (referred to as an iWatch notification). Schedules define changes in device states that are to take place at predefined days and times. For example, set the security panel to "Armed" mode every weeknight at 11:00 pm.

The iConnect Business Components are responsible for orchestrating all of the low-level service management activities for the integrated security system service. They define all of the users and devices associated with a network (site), analyze how the devices interact, and trigger associated actions (such as sending notifications to users). All changes in device states are monitored and logged. The Business Components also manage all interactions with external systems as required, including sending alarms and other related self-monitoring data to the home security Central Monitoring System (CMS) **199**. The Business Components are implemented as portable Java J2EE Servlets, but are not so limited.

The following iConnect Business Components manage the main elements of the integrated security system service, but the embodiment is not so limited:

A Registry Manager **220** defines and manages users and networks. This component is responsible for the creation, modification and termination of users and networks. It is also where a user's access to networks is defined.

A Network Manager **222** defines and manages security and self-monitoring devices that are deployed on a network (site). This component handles the creation, modification, deletion and configuration of the devices, as well as the creation of automations, schedules and notification rules associated with those devices.

A Data Manager **224** manages access to current and logged state data for an existing network and its devices. This component specifically does not provide any access to network management capabilities, such as adding new devices to a network, which are handled exclusively by the Network Manager **222**.

To achieve optimal performance for all types of queries, data for current device states is stored separately from historical state data (a.k.a. "logs") in the database. A Log Data Manager **226** performs ongoing transfers of current device state data to the historical data log tables.

Additional iConnect Business Components handle direct communications with certain clients and other systems, for example:

An iHub Manager **228** directly manages all communications with gateway clients, including receiving information about device state changes, changing the configuration of devices, and pushing new versions of the gateway client to the hardware it is running on.

A Notification Manager **230** is responsible for sending all notifications to clients via SMS (mobile phone messages), email (via a relay server like an SMTP email server), etc.

An Alarm and CMS Manager **232** sends critical server-generated alarm events to the home security Central Monitoring Station (CMS) and manages all other communications of integrated security system service data to and from the CMS.

The Element Management System (EMS) **234** is an iControl Business Component that manages all activities associated with service installation, scaling and monitoring, and filters and packages service operations data for use by service management applications. The SNMP MIBs published by the EMS can also be incorporated into any third party monitoring system if desired.

The iConnect Business Components store information about the objects that they manage in the iControl Service Database **240** and in the iControl Content Store **242**. The iControl Content Store is used to store media objects like video, photos and widget content, while the Service Database stores information about users, networks, and devices. Database interaction is performed via a JDBC interface. For security purposes, the Business Components manage all data storage and retrieval.

The iControl Business Components provide web services-based APIs that application components use to access the Business Components' capabilities. Functions of application components include presenting integrated security system service data to end-users, performing administrative duties, and integrating with external systems and back-office applications.

The primary published APIs for the iConnect Business Components include, but are not limited to, the following:

- A Registry Manager API **252** provides access to the Registry Manager Business Component's functionality, allowing management of networks and users.
- A Network Manager API **254** provides access to the Network Manager Business Component's functionality, allowing management of devices on a network.
- A Data Manager API **256** provides access to the Data Manager Business Component's functionality, such as setting and retrieving (current and historical) data about device states.
- A Provisioning API **258** provides a simple way to create new networks and configure initial default properties.

Each API of an embodiment includes two modes of access: Java API or XML API. The XML APIs are published as web services so that they can be easily accessed by applications or servers over a network. The Java APIs are a programmer-friendly wrapper for the XML APIs. Application components and integrations written in Java should generally use the Java APIs rather than the XML APIs directly.

The iConnect Business Components also have an XML-based interface **260** for quickly adding support for new devices to the integrated security system. This interface **260**, referred to as DeviceConnect **260**, is a flexible, standards-based mechanism for defining the properties of new devices and how they can be managed. Although the format is flexible enough to allow the addition of any type of future device, pre-defined XML profiles are currently available for adding common types of devices such as sensors (SensorConnect), home security panels (PanelConnect) and IP cameras (CameraConnect).

The iConnect End-User Application Components deliver the user interfaces that run on the different types of clients supported by the integrated security system service. The components are written in portable Java J2EE technology (e.g., as Java Servlets, as JavaServer Pages (JSPs), etc.) and they all interact with the iControl Business Components via the published APIs.

The following End-User Application Components generate CS S-based HTML/JavaScript that is displayed on the target client. These applications can be dynamically branded with partner-specific logos and URL links (such as Customer Support, etc.). The End-User Application Components of an embodiment include, but are not limited to, the following:

- An iControl Activation Application **270** that delivers the first application that a user sees when they set up the integrated security system service. This wizard-based web browser application securely associates a new user with a purchased gateway and the other devices included with it as a kit (if any). It primarily uses functionality published by the Provisioning API.
- An iControl Web Portal Application **272** runs on PC browsers and delivers the web-based interface to the integrated security system service. This application allows users to manage their networks (e.g. add devices and create automations) as well as to view/change device states, and manage pictures and videos. Because of the wide scope of capabilities of this application, it uses three different Business Component APIs that include the Registry Manager API, Network Manager API, and Data Manager API, but the embodiment is not so limited.
- An iControl Mobile Portal **274** is a small-footprint web-based interface that runs on mobile phones and PDAs. This interface is optimized for remote viewing of device states and pictures/videos rather than network management. As such, its interaction with the Business Components is primarily via the Data Manager API.
- Custom portals and targeted client applications can be provided that leverage the same Business Component APIs used by the above applications.
- A Content Manager Application Component **276** delivers content to a variety of clients. It sends multimedia-rich user interface components to widget container clients (both PC and browser-based), as well as to advanced touchscreen keypad clients. In addition to providing content directly to end-user devices, the Content Manager **276** provides widget-based user interface components to satisfy requests from other Application Components such as the iControl Web **272** and Mobile **274** portals.

A number of Application Components are responsible for overall management of the service. These pre-defined applications, referred to as Service Management Application Components, are configured to offer off-the-shelf solutions for production management of the integrated security system service including provisioning, overall service monitoring, customer support, and reporting, for example. The Service Management Application Components of an embodiment include, but are not limited to, the following:

- A Service Management Application **280** allows service administrators to perform activities associated with service installation, scaling and monitoring/alerting. This application interacts heavily with the Element Management System (EMS) Business Component to execute its functionality, and also retrieves its monitoring data from that component via protocols such as SNMP MIBs.
- A Kitting Application **282** is used by employees performing service provisioning tasks. This application allows home security and self-monitoring devices to be associated with gateways during the warehouse kitting process.
- A CSR Application and Report Generator **284** is used by personnel supporting the integrated security system service, such as CSRs resolving end-user issues and employees enquiring about overall service usage. The

push of new gateway firmware to deployed gateways is also managed by this application.

The iConnect servers **104** also support custom-built integrations with a service provider's existing OSS/BSS, CSR and service delivery systems **290**. Such systems can access the iConnect web services XML API to transfer data to and from the iConnect servers **104**. These types of integrations can compliment or replace the PC browser-based Service Management applications, depending on service provider needs.

As described above, the integrated security system of an embodiment includes a gateway, or iHub. The gateway of an embodiment includes a device that is deployed in the home or business and couples or connects the various third-party cameras, home security panels, sensors and devices to the iConnect server over a WAN connection as described in detail herein. The gateway couples to the home network and communicates directly with the home security panel in both wired and wireless sensor installations. The gateway is configured to be low-cost, reliable and thin so that it complements the integrated security system network-based architecture.

The gateway supports various wireless protocols and can interconnect with a wide range of home security control panels. Service providers and users can then extend the system's capabilities by adding IP cameras, lighting modules and additional security devices. The gateway is configurable to be integrated into many consumer appliances, including set-top boxes, routers and security panels. The small and efficient footprint of the gateway enables this portability and versatility, thereby simplifying and reducing the overall cost of the deployment.

FIG. **3** is a block diagram of the gateway **102** including gateway software or applications, under an embodiment. The gateway software architecture is relatively thin and efficient, thereby simplifying its integration into other consumer appliances such as set-top boxes, routers, touch screens and security panels. The software architecture also provides a high degree of security against unauthorized access. This section describes the various key components of the gateway software architecture.

The gateway application layer **302** is the main program that orchestrates the operations performed by the gateway. The Security Engine **304** provides robust protection against intentional and unintentional intrusion into the integrated security system network from the outside world (both from inside the premises as well as from the WAN). The Security Engine **304** of an embodiment comprises one or more sub-modules or components that perform functions including, but not limited to, the following:

- Encryption including 128-bit SSL encryption for gateway and iConnect server communication to protect user data privacy and provide secure communication.
- Bi-directional authentication between the gateway and iConnect server in order to prevent unauthorized spoofing and attacks. Data sent from the iConnect server to the gateway application (or vice versa) is digitally signed as an additional layer of security. Digital signing provides both authentication and validation that the data has not been altered in transit.
- Camera SSL encapsulation because picture and video traffic offered by off-the-shelf networked IP cameras is not secure when traveling over the Internet. The gateway provides for 128-bit SSL encapsulation of the user picture and video data sent over the Internet for complete user security and privacy.
- 802.11b/g/n with WPA-2 security to ensure that wireless camera communications always takes place using the strongest available protection.
- A gateway-enabled device is assigned a unique activation key for activation with an iConnect server. This ensures that only valid gateway-enabled devices can be activated for use with the specific instance of iConnect server in use. Attempts to activate gateway-enabled devices by brute force are detected by the Security Engine. Partners deploying gateway-enabled devices have the knowledge that only a gateway with the correct serial number and activation key can be activated for use with an iConnect server. Stolen devices, devices attempting to masquerade as gateway-enabled devices, and malicious outsiders (or insiders as knowledgeable but nefarious customers) cannot effect other customers' gateway-enabled devices.

As standards evolve, and new encryption and authentication methods are proven to be useful, and older mechanisms proven to be breakable, the security manager can be upgraded "over the air" to provide new and better security for communications between the iConnect server and the gateway application, and locally at the premises to remove any risk of eavesdropping on camera communications.

A Remote Firmware Download module **306** allows for seamless and secure updates to the gateway firmware through the iControl Maintenance Application on the server **104**, providing a transparent, hassle-free mechanism for the service provider to deploy new features and bug fixes to the installed user base. The firmware download mechanism is tolerant of connection loss, power interruption and user interventions (both intentional and unintentional). Such robustness reduces down time and customer support issues. Gateway firmware can be remotely download either for one gateway at a time, a group of gateways, or in batches.

The Automations engine **308** manages the user-defined rules of interaction between the different devices (e.g. when door opens turn on the light). Though the automation rules are programmed and reside at the portal/server level, they are cached at the gateway level in order to provide short latency between device triggers and actions.

DeviceConnect **310** includes definitions of all supported devices (e.g., cameras, security panels, sensors, etc.) using a standardized plug-in architecture. The DeviceConnect module **310** offers an interface that can be used to quickly add support for any new device as well as enabling interoperability between devices that use different technologies/protocols. For common device types, pre-defined sub-modules have been defined, making supporting new devices of these types even easier. SensorConnect **312** is provided for adding new sensors, CameraConnect **316** for adding IP cameras, and PanelConnect **314** for adding home security panels.

The Schedules engine **318** is responsible for executing the user defined schedules (e.g., take a picture every five minutes; every day at 8 am set temperature to 65 degrees Fahrenheit, etc.). Though the schedules are programmed and reside at the iConnect server level they are sent to the scheduler within the gateway application. The Schedules Engine **318** then interfaces with SensorConnect **312** to ensure that scheduled events occur at precisely the desired time.

The Device Management module **320** is in charge of all discovery, installation and configuration of both wired and wireless IP devices (e.g., cameras, etc.) coupled or connected to the system. Networked IP devices, such as those used in the integrated security system, require user configu-

ration of many IP and security parameters—to simplify the user experience and reduce the customer support burden, the device management module of an embodiment handles the details of this configuration. The device management module also manages the video routing module described below.

The video routing engine **322** is responsible for delivering seamless video streams to the user with zero-configuration. Through a multi-step, staged approach the video routing engine uses a combination of UPnP port-forwarding, relay server routing and STUN/TURN peer-to-peer routing.

FIG. **4** is a block diagram of components of the gateway **102**, under an embodiment. Depending on the specific set of functionality desired by the service provider deploying the integrated security system service, the gateway **102** can use any of a number of processors **402**, due to the small footprint of the gateway application firmware. In an embodiment, the gateway could include the Broadcom BCM5354 as the processor for example. In addition, the gateway **102** includes memory (e.g., FLASH **404**, RAM **406**, etc.) and any number of input/output (I/O) ports **408**.

Referring to the WAN portion **410** of the gateway **102**, the gateway **102** of an embodiment can communicate with the iConnect server using a number of communication types and/or protocols, for example Broadband **412**, GPRS **414** and/or Public Switched Telephone Network (PTSN) **416** to name a few. In general, broadband communication **412** is the primary means of connection between the gateway **102** and the iConnect server **104** and the GPRS/CDMA **414** and/or PSTN **416** interfaces acts as back-up for fault tolerance in case the user's broadband connection fails for whatever reason, but the embodiment is not so limited.

Referring to the LAN portion **420** of the gateway **102**, various protocols and physical transceivers can be used to communicate to off-the-shelf sensors and cameras. The gateway **102** is protocol-agnostic and technology-agnostic and as such can easily support almost any device networking protocol. The gateway **102** can, for example, support GE and Honeywell security RF protocols **422**, Z-Wave **424**, serial (RS232 and RS485) **426** for direct connection to security panels as well as WiFi **428** (802.11b/g) for communication to WiFi cameras.

The integrated security system includes couplings or connections among a variety of IP devices or components, and the device management module is in charge of the discovery, installation and configuration of the IP devices coupled or connected to the system, as described above. The integrated security system of an embodiment uses a "sandbox" network to discover and manage all IP devices coupled or connected as components of the system. The IP devices of an embodiment include wired devices, wireless devices, cameras, interactive touchscreens, and security panels to name a few. These devices can be wired via ethernet cable or Wifi devices, all of which are secured within the sandbox network, as described below. The "sandbox" network is described in detail below.

FIG. **5** is a block diagram **500** of network or premise device integration with a premise network **250**, under an embodiment. In an embodiment, network devices **255-257** are coupled to the gateway **102** using a secure network coupling or connection such as SSL over an encrypted 802.11 link (utilizing for example WPA-2 security for the wireless encryption). The network coupling or connection between the gateway **102** and the network devices **255-257** is a private coupling or connection in that it is segregated from any other network couplings or connections. The gateway **102** is coupled to the premise router/firewall **252** via a coupling with a premise LAN **250**. The premise router/firewall **252** is coupled to a broadband modem **251**, and the broadband modem **251** is coupled to a WAN **200** or other network outside the premise. The gateway **102** thus enables or forms a separate wireless network, or sub-network, that includes some number of devices and is coupled or connected to the LAN **250** of the host premises. The gateway sub-network can include, but is not limited to, any number of other devices like WiFi IP cameras, security panels (e.g., IP-enabled), and security touchscreens, to name a few. The gateway **102** manages or controls the sub-network separately from the LAN **250** and transfers data and information between components of the sub-network and the LAN **250**/WAN **200**, but is not so limited. Additionally, other network devices **254** can be coupled to the LAN **250** without being coupled to the gateway **102**.

FIG. **6** is a block diagram **600** of network or premise device integration with a premise network **250**, under an alternative embodiment. The network or premise devices **255-257** are coupled to the gateway **102**. The network coupling or connection between the gateway **102** and the network devices **255-257** is a private coupling or connection in that it is segregated from any other network couplings or connections. The gateway **102** is coupled or connected between the premise router/firewall **252** and the broadband modem **251**. The broadband modem **251** is coupled to a WAN **200** or other network outside the premise, while the premise router/firewall **252** is coupled to a premise LAN **250**. As a result of its location between the broadband modem **251** and the premise router/firewall **252**, the gateway **102** can be configured or function as the premise router routing specified data between the outside network (e.g., WAN **200**) and the premise router/firewall **252** of the LAN **250**. As described above, the gateway **102** in this configuration enables or forms a separate wireless network, or sub-network, that includes the network or premise devices **255-257** and is coupled or connected between the LAN **250** of the host premises and the WAN **200**. The gateway sub-network can include, but is not limited to, any number of network or premise devices **255-257** like WiFi IP cameras, security panels (e.g., IP-enabled), and security touchscreens, to name a few. The gateway **102** manages or controls the sub-network separately from the LAN **250** and transfers data and information between components of the sub-network and the LAN **250**/WAN **200**, but is not so limited. Additionally, other network devices **254** can be coupled to the LAN **250** without being coupled to the gateway **102**.

The examples described above with reference to FIGS. **5** and **6** are presented only as examples of IP device integration. The integrated security system is not limited to the type, number and/or combination of IP devices shown and described in these examples, and any type, number and/or combination of IP devices is contemplated within the scope of this disclosure as capable of being integrated with the premise network.

The integrated security system of an embodiment includes a touchscreen (also referred to as the iControl touchscreen or integrated security system touchscreen), as described above, which provides core security keypad functionality, content management and presentation, and embedded systems design. The networked security touchscreen system of an embodiment enables a consumer or security provider to easily and automatically install, configure and manage the security system and touchscreen located at a customer premise. Using this system the customer may access and control the local security system, local IP devices such as cameras, local sensors and control devices (such as lighting

controls or pipe freeze sensors), as well as the local security system panel and associated security sensors (such as door/window, motion, and smoke detectors). The customer premise may be a home, business, and/or other location equipped with a wired or wireless broadband IP connection.

The system of an embodiment includes a touchscreen with a configurable software user interface and/or a gateway device (e.g., iHub) that couples or connects to a premise security panel through a wired or wireless connection, and a remote server that provides access to content and information from the premises devices to a user when they are remote from the home. The touchscreen supports broadband and/or WAN wireless connectivity. In this embodiment, the touchscreen incorporates an IP broadband connection (e.g., Wifi radio, Ethernet port, etc.), and/or a cellular radio (e.g., GPRS/GSM, CDMA, WiMax, etc.). The touchscreen described herein can be used as one or more of a security system interface panel and a network user interface (UI) that provides an interface to interact with a network (e.g., LAN, WAN, internet, etc.).

The touchscreen of an embodiment provides an integrated touchscreen and security panel as an all-in-one device. Once integrated using the touchscreen, the touchscreen and a security panel of a premise security system become physically co-located in one device, and the functionality of both may even be co-resident on the same CPU and memory (though this is not required).

The touchscreen of an embodiment also provides an integrated IP video and touchscreen UI. As such, the touchscreen supports one or more standard video CODECs/players (e.g., H.264, Flash Video, MOV, MPEG4, M-JPEG, etc.). The touchscreen UI then provides a mechanism (such as a camera or video widget) to play video. In an embodiment the video is streamed live from an IP video camera. In other embodiments the video comprises video clips or photos sent from an IP camera or from a remote location.

The touchscreen of an embodiment provides a configurable user interface system that includes a configuration supporting use as a security touchscreen. In this embodiment, the touchscreen utilizes a modular user interface that allows components to be modified easily by a service provider, an installer, or even the end user. Examples of such a modular approach include using Flash widgets, HTML-based widgets, or other downloadable code modules such that the user interface of the touchscreen can be updated and modified while the application is running. In an embodiment the touchscreen user interface modules can be downloaded over the internet. For example, a new security configuration widget can be downloaded from a standard web server, and the touchscreen then loads such configuration app into memory, and inserts it in place of the old security configuration widget. The touchscreen of an embodiment is configured to provide a self-install user interface.

Embodiments of the networked security touchscreen system described herein include a touchscreen device with a user interface that includes a security toolbar providing one or more functions including arm, disarm, panic, medic, and alert. The touchscreen therefore includes at least one screen having a separate region of the screen dedicated to a security toolbar. The security toolbar of an embodiment is present in the dedicated region at all times that the screen is active.

The touchscreen of an embodiment includes a home screen having a separate region of the screen allocated to managing home-based functions. The home-based functions of an embodiment include managing, viewing, and/or controlling IP video cameras. In this embodiment, regions of the home screen are allocated in the form of widget icons; these widget icons (e.g. for cameras, thermostats, lighting, etc) provide functionality for managing home systems. So, for example, a displayed camera icon, when selected, launches a Camera Widget, and the Camera widget in turn provides access to video from one or more cameras, as well as providing the user with relevant camera controls (take a picture, focus the camera, etc.)

The touchscreen of an embodiment includes a home screen having a separate region of the screen allocated to managing, viewing, and/or controlling internet-based content or applications. For example, the Widget Manager UI presents a region of the home screen (up to and including the entire home screen) where internet widgets icons such as weather, sports, etc. may be accessed). Each of these icons may be selected to launch their respective content services.

The touchscreen of an embodiment is integrated into a premise network using the gateway, as described above. The gateway as described herein functions to enable a separate wireless network, or sub-network, that is coupled, connected, or integrated with another network (e.g., WAN, LAN of the host premises, etc.). The sub-network enabled by the gateway optimizes the installation process for IP devices, like the touchscreen, that couple or connect to the sub-network by segregating these IP devices from other such devices on the network. This segregation of the IP devices of the sub-network further enables separate security and privacy policies to be implemented for these IP devices so that, where the IP devices are dedicated to specific functions (e.g., security), the security and privacy policies can be tailored specifically for the specific functions. Furthermore, the gateway and the sub-network it forms enables the segregation of data traffic, resulting in faster and more efficient data flow between components of the host network, components of the sub-network, and between components of the sub-network and components of the network.

The touchscreen of an embodiment includes a core functional embedded system that includes an embedded operating system, required hardware drivers, and an open system interface to name a few. The core functional embedded system can be provided by or as a component of a conventional security system (e.g., security system available from GE Security). These core functional units are used with components of the integrated security system as described herein. Note that portions of the touchscreen description below may include reference to a host premise security system (e.g., GE security system), but these references are included only as an example and do not limit the touchscreen to integration with any particular security system.

As an example, regarding the core functional embedded system, a reduced memory footprint version of embedded Linux forms the core operating system in an embodiment, and provides basic TCP/IP stack and memory management functions, along with a basic set of low-level graphics primitives. A set of device drivers is also provided or included that offer low-level hardware and network interfaces. In addition to the standard drivers, an interface to the RS 485 bus is included that couples or connects to the security system panel (e.g., GE Concord panel). The interface may, for example, implement the Superbus 2000 protocol, which can then be utilized by the more comprehensive transaction-level security functions implemented in Panel-Connect technology (e.g SetAlarmLevel (int level, int partition, char *accessCode)). Power control drivers are also provided.

FIG. **7** is a block diagram of a touchscreen **700** of the integrated security system, under an embodiment. The touchscreen **700** generally includes an application/presenta-

tion layer **702** with a resident application **704**, and a core engine **706**. The touchscreen **700** also includes one or more of the following, but is not so limited: applications of premium services **710**, widgets **712**, a caching proxy **714**, network security **716**, network interface **718**, security object **720**, applications supporting devices **722**, PanelConnect API **724**, a gateway interface **726**, and one or more ports **728**.

More specifically, the touchscreen, when configured as a home security device, includes but is not limited to the following application or software modules: RS 485 and/or RS-232 bus security protocols to conventional home security system panel (e.g., GE Concord panel); functional home security classes and interfaces (e.g. Panel ARM state, Sensor status, etc.); Application/Presentation layer or engine; Resident Application; Consumer Home Security Application; installer home security application; core engine; and System bootloader/Software Updater. The core Application engine and system bootloader can also be used to support other advanced content and applications. This provides a seamless interaction between the premise security application and other optional services such as weather widgets or IP cameras.

An alternative configuration of the touchscreen includes a first Application engine for premise security and a second Application engine for all other applications. The integrated security system application engine supports content standards such as HTML, XML, Flash, etc. and enables a rich consumer experience for all 'widgets', whether security-based or not. The touchscreen thus provides service providers the ability to use web content creation and management tools to build and download any 'widgets' regardless of their functionality.

As discussed above, although the Security Applications have specific low-level functional requirements in order to interface with the premise security system, these applications make use of the same fundamental application facilities as any other 'widget', application facilities that include graphical layout, interactivity, application handoff, screen management, and network interfaces, to name a few.

Content management in the touchscreen provides the ability to leverage conventional web development tools, performance optimized for an embedded system, service provider control of accessible content, content reliability in a consumer device, and consistency between 'widgets' and seamless widget operational environment. In an embodiment of the integrated security system, widgets are created by web developers and hosted on the integrated security system Content Manager (and stored in the Content Store database). In this embodiment the server component caches the widgets and offers them to consumers through the web-based integrated security system provisioning system. The servers interact with the advanced touchscreen using HTTPS interfaces controlled by the core engine and dynamically download widgets and updates as needed to be cached on the touchscreen. In other embodiments widgets can be accessed directly over a network such as the Internet without needing to go through the iControl Content Manager

Referring to FIG. **7**, the touchscreen system is built on a tiered architecture, with defined interfaces between the Application/Presentation Layer (the Application Engine) on the top, the Core Engine in the middle, and the security panel and gateway APIs at the lower level. The architecture is configured to provide maximum flexibility and ease of maintenance.

The application engine of the touchscreen provides the presentation and interactivity capabilities for all applications (widgets) that run on the touchscreen, including both core security function widgets and third party content widgets. FIG. **8** is an example screenshot **800** of a networked security touchscreen, under an embodiment. This example screenshot **800** includes three interfaces or user interface (UI) components **802-806**, but is not so limited. A first UI **802** of the touchscreen includes icons by which a user controls or accesses functions and/or components of the security system (e.g., "Main", "Panic", "Medic", "Fire", state of the premise alarm system (e.g., disarmed, armed, etc.), etc.); the first UI **802**, which is also referred to herein as a security interface, is always presented on the touchscreen. A second UI **804** of the touchscreen includes icons by which a user selects or interacts with services and other network content (e.g., clock, calendar, weather, stocks, news, sports, photos, maps, music, etc.) that is accessible via the touchscreen. The second UI **804** is also referred to herein as a network interface or content interface. A third UI **806** of the touchscreen includes icons by which a user selects or interacts with additional services or components (e.g., intercom control, security, cameras coupled to the system in particular regions (e.g., front door, baby, etc.) available via the touchscreen.

A component of the application engine is the Presentation Engine, which includes a set of libraries that implement the standards-based widget content (e.g., XML, HTML, JavaScript, Flash) layout and interactivity. This engine provides the widget with interfaces to dynamically load both graphics and application logic from third parties, support high level data description language as well as standard graphic formats. The set of web content-based functionality available to a widget developer is extended by specific touchscreen functions implemented as local web services by the Core Engine.

The resident application of the touchscreen is the master service that controls the interaction of all widgets in the system, and enforces the business and security rules required by the service provider. For example, the resident application determines the priority of widgets, thereby enabling a home security widget to override resource requests from a less critical widget (e.g. a weather widget). The resident application also monitors widget behavior, and responds to client or server requests for cache updates.

The core engine of the touchscreen manages interaction with other components of the integrated security system, and provides an interface through which the resident application and authorized widgets can get information about the home security system, set alarms, install sensors, etc. At the lower level, the Core Engine's main interactions are through the PanelConnect API, which handles all communication with the security panel, and the gateway Interface, which handles communication with the gateway. In an embodiment, both the iHub Interface and PanelConnect API are resident and operating on the touchscreen. In another embodiment, the PanelConnect API runs on the gateway or other device that provides security system interaction and is accessed by the touchscreen through a web services interface.

The Core Engine also handles application and service level persistent and cached memory functions, as well as the dynamic provisioning of content and widgets, including but not limited to: flash memory management, local widget and content caching, widget version management (download, cache flush new/old content versions), as well as the caching and synchronization of user preferences. As a portion of these services the Core engine incorporates the bootloader functionality that is responsible for maintaining a consistent software image on the touchscreen, and acts as the client agent for all software updates. The bootloader is configured

to ensure full update redundancy so that unsuccessful downloads cannot corrupt the integrated security system.

Video management is provided as a set of web services by the Core Engine. Video management includes the retrieval and playback of local video feeds as well as remote control and management of cameras (all through iControl Camera-Connect technology).

Both the high level application layer and the mid-level core engine of the touchscreen can make calls to the network. Any call to the network made by the application layer is automatically handed off to a local caching proxy, which determines whether the request should be handled locally. Many of the requests from the application layer are web services API requests, although such requests could be satisfied by the iControl servers, they are handled directly by the touchscreen and the gateway. Requests that get through the caching proxy are checked against a white list of acceptable sites, and, if they match, are sent off through the network interface to the gateway. Included in the Network Subsystem is a set of network services including HTTP, HTTPS, and server-level authentication functions to manage the secure client-server interface. Storage and management of certificates is incorporated as a part of the network services layer.

Server components of the integrated security system servers support interactive content services on the touchscreen. These server components include, but are not limited to the content manager, registry manager, network manager, and global registry, each of which is described herein.

The Content Manager oversees aspects of handling widget data and raw content on the touchscreen. Once created and validated by the service provider, widgets are 'ingested' to the Content Manager, and then become available as downloadable services through the integrated security system Content Management APIs. The Content manager maintains versions and timestamp information, and connects to the raw data contained in the backend Content Store database. When a widget is updated (or new content becomes available) all clients registering interest in a widget are systematically updated as needed (a process that can be configured at an account, locale, or system-wide level).

The Registry Manager handles user data, and provisioning accounts, including information about widgets the user has decided to install, and the user preferences for these widgets.

The Network Manager handles getting and setting state for all devices on the integrated security system network (e.g., sensors, panels, cameras, etc.). The Network manager synchronizes with the gateway, the advanced touchscreen, and the subscriber database.

The Global Registry is a primary starting point server for all client services, and is a logical referral service that abstracts specific server locations/addresses from clients (touchscreen, gateway **102**, desktop widgets, etc.). This approach enables easy scaling/migration of server farms.

The touchscreen of an embodiment operates wirelessly with a premise security system. The touchscreen of an embodiment incorporates an RF transceiver component that either communicates directly with the sensors and/or security panel over the panel's proprietary RF frequency, or the touchscreen communicates wirelessly to the gateway over 802.11, Ethernet, or other IP-based communications channel, as described in detail herein. In the latter case the gateway implements the PanelConnect interface and communicates directly to the security panel and/or sensors over wireless or wired networks as described in detail above.

The touchscreen of an embodiment is configured to operate with multiple security systems through the use of an abstracted security system interface. In this embodiment, the PanelConnect API can be configured to support a plurality of proprietary security system interfaces, either simultaneously or individually as described herein. In one embodiment of this approach, the touchscreen incorporates multiple physical interfaces to security panels (e.g. GE Security RS-485, Honeywell RF, etc.) in addition to the PanelConnect API implemented to support multiple security interfaces. The change needed to support this in PanelConnect is a configuration parameter specifying the panel type connection that is being utilized.

So for example, the setARMState( ) function is called with an additional parameter (e.g., Armstate=setARMState (type="ARM STAY|ARM AWAY|DISARM", Parameters="ExitDelay=30|Lights=OFF", panelType="GE Concord4 RS485")). The 'panelType' parameter is used by the setARMState function (and in practice by all of the PanelConnect functions) to select an algorithm appropriate to the specific panel out of a plurality of alogorithms.

The touchscreen of an embodiment is self-installable. Consequently, the touchscreen provides a 'wizard' approach similar to that used in traditional computer installations (e.g. InstallShield). The wizard can be resident on the touchscreen, accessible through a web interface, or both. In one embodiment of a touchscreen self-installation process, the service provider can associate devices (sensors, touchscreens, security panels, lighting controls, etc.) remotely using a web-based administrator interface.

The touchscreen of an embodiment includes a battery backup system for a security touchscreen. The touchscreen incorporates a standard Li-ion or other battery and charging circuitry to allow continued operation in the event of a power outage. In an embodiment the battery is physically located and connected within the touchscreen enclosure. In another embodiment the battery is located as a part of the power transformer, or in between the power transformer and the touchscreen.

The example configurations of the integrated security system described above with reference to FIGS. **5** and **6** include a gateway that is a separate device, and the touchscreen couples to the gateway. However, in an alternative embodiment, the gateway device and its functionality can be incorporated into the touchscreen so that the device management module, which is now a component of or included in the touchscreen, is in charge of the discovery, installation and configuration of the IP devices coupled or connected to the system, as described above. The integrated security system with the integrated touchscreen/gateway uses the same "sandbox" network to discover and manage all IP devices coupled or connected as components of the system.

The touchscreen of this alternative embodiment integrates the components of the gateway with the components of the touchscreen as described herein. More specifically, the touchscreen of this alternative embodiment includes software or applications described above with reference to FIG. **3**. In this alternative embodiment, the touchscreen includes the gateway application layer **302** as the main program that orchestrates the operations performed by the gateway. A Security Engine **304** of the touchscreen provides robust protection against intentional and unintentional intrusion into the integrated security system network from the outside world (both from inside the premises as well as from the WAN). The Security Engine **304** of an embodiment comprises one or more sub-modules or components that perform functions including, but not limited to, the following:

Encryption including 128-bit SSL encryption for gateway and iConnect server communication to protect user data privacy and provide secure communication.

Bi-directional authentication between the touchscreen and iConnect server in order to prevent unauthorized spoofing and attacks. Data sent from the iConnect server to the gateway application (or vice versa) is digitally signed as an additional layer of security. Digital signing provides both authentication and validation that the data has not been altered in transit.

Camera SSL encapsulation because picture and video traffic offered by off-the-shelf networked IP cameras is not secure when traveling over the Internet. The touchscreen provides for 128-bit SSL encapsulation of the user picture and video data sent over the internet for complete user security and privacy.

802.11b/g/n with WPA-2 security to ensure that wireless camera communications always takes place using the strongest available protection.

A touchscreen-enabled device is assigned a unique activation key for activation with an iConnect server. This ensures that only valid gateway-enabled devices can be activated for use with the specific instance of iConnect server in use. Attempts to activate gateway-enabled devices by brute force are detected by the Security Engine. Partners deploying touchscreen-enabled devices have the knowledge that only a gateway with the correct serial number and activation key can be activated for use with an iConnect server. Stolen devices, devices attempting to masquerade as gateway-enabled devices, and malicious outsiders (or insiders as knowledgeable but nefarious customers) cannot effect other customers' gateway-enabled devices.

As standards evolve, and new encryption and authentication methods are proven to be useful, and older mechanisms proven to be breakable, the security manager can be upgraded "over the air" to provide new and better security for communications between the iConnect server and the gateway application, and locally at the premises to remove any risk of eavesdropping on camera communications.

A Remote Firmware Download module **306** of the touchscreen allows for seamless and secure updates to the gateway firmware through the iControl Maintenance Application on the server **104**, providing a transparent, hassle-free mechanism for the service provider to deploy new features and bug fixes to the installed user base. The firmware download mechanism is tolerant of connection loss, power interruption and user interventions (both intentional and unintentional). Such robustness reduces down time and customer support issues. Touchscreen firmware can be remotely download either for one touchscreen at a time, a group of touchscreen, or in batches.

The Automations engine **308** of the touchscreen manages the user-defined rules of interaction between the different devices (e.g. when door opens turn on the light). Though the automation rules are programmed and reside at the portal/server level, they are cached at the gateway level in order to provide short latency between device triggers and actions.

DeviceConnect **310** of the touchscreen touchscreen includes definitions of all supported devices (e.g., cameras, security panels, sensors, etc.) using a standardized plug-in architecture. The DeviceConnect module **310** offers an interface that can be used to quickly add support for any new device as well as enabling interoperability between devices that use different technologies/protocols. For common device types, pre-defined sub-modules have been defined, making supporting new devices of these types even easier. SensorConnect **312** is provided for adding new sensors, CameraConnect **316** for adding IP cameras, and PanelConnect **314** for adding home security panels.

The Schedules engine **318** of the touchscreen is responsible for executing the user defined schedules (e.g., take a picture every five minutes; every day at 8 am set temperature to 65 degrees Fahrenheit, etc.). Though the schedules are programmed and reside at the iConnect server level they are sent to the scheduler within the gateway application of the touchscreen. The Schedules Engine **318** then interfaces with SensorConnect **312** to ensure that scheduled events occur at precisely the desired time.

The Device Management module **320** of the touchscreen is in charge of all discovery, installation and configuration of both wired and wireless IP devices (e.g., cameras, etc.) coupled or connected to the system. Networked IP devices, such as those used in the integrated security system, require user configuration of many IP and security parameters, and the device management module of an embodiment handles the details of this configuration. The device management module also manages the video routing module described below.

The video routing engine **322** of the touchscreen is responsible for delivering seamless video streams to the user with zero-configuration. Through a multi-step, staged approach the video routing engine uses a combination of UPnP port-forwarding, relay server routing and STUN/TURN peer-to-peer routing. The video routing engine is described in detail in the Related Applications.

FIG. **9** is a block diagram **900** of network or premise device integration with a premise network **250**, under an embodiment. In an embodiment, network devices **255**, **256**, **957** are coupled to the touchscreen **902** using a secure network connection such as SSL over an encrypted 802.11 link (utilizing for example WPA-2 security for the wireless encryption), and the touchscreen **902** coupled to the premise router/firewall **252** via a coupling with a premise LAN **250**. The premise router/firewall **252** is coupled to a broadband modem **251**, and the broadband modem **251** is coupled to a WAN **200** or other network outside the premise. The touchscreen **902** thus enables or forms a separate wireless network, or sub-network, that includes some number of devices and is coupled or connected to the LAN **250** of the host premises. The touchscreen sub-network can include, but is not limited to, any number of other devices like WiFi IP cameras, security panels (e.g., IP-enabled), and IP devices, to name a few. The touchscreen **902** manages or controls the sub-network separately from the LAN **250** and transfers data and information between components of the sub-network and the LAN **250**/WAN **200**, but is not so limited. Additionally, other network devices **254** can be coupled to the LAN **250** without being coupled to the touchscreen **902**.

FIG. **10** is a block diagram **1000** of network or premise device integration with a premise network **250**, under an alternative embodiment. The network or premise devices **255**, **256**, **1057** are coupled to the touchscreen **1002**, and the touchscreen **1002** is coupled or connected between the premise router/firewall **252** and the broadband modem **251**. The broadband modem **251** is coupled to a WAN **200** or other network outside the premise, while the premise router/firewall **252** is coupled to a premise LAN **250**. As a result of its location between the broadband modem **251** and the premise router/firewall **252**, the touchscreen **1002** can be configured or function as the premise router routing specified data between the outside network (e.g., WAN **200**) and the premise router/firewall **252** of the LAN **250**. As described above, the touchscreen **1002** in this configuration

enables or forms a separate wireless network, or sub-network, that includes the network or premise devices **255**, **156**, **1057** and is coupled or connected between the LAN **250** of the host premises and the WAN **200**. The touchscreen sub-network can include, but is not limited to, any number of network or premise devices **255**, **256**, **1057** like WiFi IP cameras, security panels (e.g., IP-enabled), and security touchscreens, to name a few. The touchscreen **1002** manages or controls the sub-network separately from the LAN **250** and transfers data and information between components of the sub-network and the LAN **250**/WAN **200**, but is not so limited. Additionally, other network devices **254** can be coupled to the LAN **250** without being coupled to the touchscreen **1002**.

The gateway of an embodiment, whether a stand-along component or integrated with a touchscreen, enables couplings or connections and thus the flow or integration of information between various components of the host premises and various types and/or combinations of IP devices, where the components of the host premises include a network (e.g., LAN) and/or a security system or subsystem to name a few. Consequently, the gateway controls the association between and the flow of information or data between the components of the host premises. For example, the gateway of an embodiment forms a sub-network coupled to another network (e.g., WAN, LAN, etc.), with the sub-network including IP devices. The gateway further enables the association of the IP devices of the sub-network with appropriate systems on the premises (e.g., security system, etc.). Therefore, for example, the gateway can form a sub-network of IP devices configured for security functions, and associate the sub-network only with the premises security system, thereby segregating the IP devices dedicated to security from other IP devices that may be coupled to another network on the premises.

The gateway of an embodiment, as described herein, enables couplings or connections and thus the flow of information between various components of the host premises and various types and/or combinations of IP devices, where the components of the host premises include a network, a security system or subsystem to name a few. Consequently, the gateway controls the association between and the flow of information or data between the components of the host premises. For example, the gateway of an embodiment forms a sub-network coupled to another network (e.g., WAN, LAN, etc.), with the sub-network including IP devices. The gateway further enables the association of the IP devices of the sub-network with appropriate systems on the premises (e.g., security system, etc.). Therefore, for example, the gateway can form a sub-network of IP devices configured for security functions, and associate the sub-network only with the premises security system, thereby segregating the IP devices dedicated to security from other IP devices that may be coupled to another network on the premises.

FIG. **11** is a flow diagram for a method **1100** of forming a security network including integrated security system components, under an embodiment. Generally, the method comprises coupling **1102** a gateway comprising a connection management component to a local area network in a first location and a security server in a second location. The method comprises forming **1104** a security network by automatically establishing a wireless coupling between the gateway and a security system using the connection management component. The security system of an embodiment comprises security system components located at the first location. The method comprises integrating **1106** communications and functions of the security system components into the security network via the wireless coupling.

FIG. **12** is a flow diagram for a method **1200** of forming a security network including integrated security system components and network devices, under an embodiment. Generally, the method comprises coupling **1202** a gateway to a local area network located in a first location and a security server in a second location. The method comprises automatically establishing **1204** communications between the gateway and security system components at the first location, the security system including the security system components. The method comprises automatically establishing **1206** communications between the gateway and premise devices at the first location. The method comprises forming **1208** a security network by electronically integrating, via the gateway, communications and functions of the premise devices and the security system components.

In an example embodiment, FIG. **13** is a flow diagram **1300** for integration or installation of an IP device into a private network environment, under an embodiment. The IP device includes any IP-capable device that, for example, includes the touchscreen of an embodiment. The variables of an embodiment set at time of installation include, but are not limited to, one or more of a private SSID/Password, a gateway identifier, a security panel identifier, a user account TS, and a Central Monitoring Station account identification.

An embodiment of the IP device discovery and management begins with a user or installer activating **1302** the gateway and initiating **1304** the install mode of the system. This places the gateway in an install mode. Once in install mode, the gateway shifts to a default (Install) Wifi configuration. This setting will match the default setting for other integrated security system-enabled devices that have been pre-configured to work with the integrated security system. The gateway will then begin to provide **1306** DHCP addresses for these IP devices. Once the devices have acquired a new DHCP address from the gateway, those devices are available for configuration into a new secured Wifi network setting.

The user or installer of the system selects **1308** all devices that have been identified as available for inclusion into the integrated security system. The user may select these devices by their unique IDs via a web page, Touchscreen, or other client interface. The gateway provides **1310** data as appropriate to the devices. Once selected, the devices are configured **1312** with appropriate secured Wifi settings, including SSID and WPA/WPA-2 keys that are used once the gateway switches back to the secured sandbox configuration from the "Install" settings. Other settings are also configured as appropriate for that type of device. Once all devices have been configured, the user is notified and the user can exit install mode. At this point all devices will have been registered **1314** with the integrated security system servers.

The installer switches **1316** the gateway to an operational mode, and the gateway instructs or directs **1318** all newly configured devices to switch to the "secured" Wifi sandbox settings. The gateway then switches **1320** to the "secured" Wifi settings. Once the devices identify that the gateway is active on the "secured" network, they request new DHCP addresses from the gateway which, in response, provides **1322** the new addresses. The devices with the new addresses are then operational **1324** on the secured network.

In order to ensure the highest level of security on the secured network, the gateway can create or generate a dynamic network security configuration based on the unique ID and private key in the gateway, coupled with a random-

izing factor that can be based on online time or other inputs. This guarantees the uniqueness of the gateway secured network configuration.

To enable the highest level of performance, the gateway analyzes the RF spectrum of the 802.11x network and determines which frequency band/channel it should select to run.

An alternative embodiment of the camera/IP device management process leverages the local ethernet connection of the sandbox network on the gateway. This alternative process is similar to the Wifi discovery embodiment described above, except the user connects the targeted device to the ethernet port of the sandbox network to begin the process. This alternative embodiment accommodates devices that have not been pre-configured with the default "Install" configuration for the integrated security system.

This alternative embodiment of the IP device discovery and management begins with the user/installer placing the system into install mode. The user is instructed to attach an IP device to be installed to the sandbox Ethernet port of the gateway. The IP device requests a DHCP address from the gateway which, in response to the request, provides the address. The user is presented the device and is asked if he/she wants to install the device. If yes, the system configures the device with the secured Wifi settings and other device-specific settings (e.g., camera settings for video length, image quality etc.). The user is next instructed to disconnect the device from the ethernet port. The device is now available for use on the secured sandbox network.

FIG. **14** is a block diagram showing communications among integrated IP devices of the private network environment, under an embodiment. The IP devices of this example include a security touchscreen **1403**, gateway **1402** (e.g., "iHub"), and security panel (e.g., "Security Panel **1**", "Security Panel **2**", "Security Panel n"), but the embodiment is not so limited. In alternative embodiments any number and/or combination of these three primary component types may be combined with other components including IP devices and/or security system components. For example, a single device that comprises an integrated gateway, touchscreen, and security panel is merely another embodiment of the integrated security system described herein. The description that follows includes an example configuration that includes a touchscreen hosting particular applications. However, the embodiment is not limited to the touchscreen hosting these applications, and the touchscreen should be thought of as representing any IP device.

Referring to FIG. **14**, the touchscreen **1403** incorporates an application **1410** that is implemented as computer code resident on the touchscreen operating system, or as a web-based application running in a browser, or as another type of scripted application (e.g., Flash, Java, Visual Basic, etc.). The touchscreen core application **1410** represents this application, providing user interface and logic for the end user to manage their security system or to gain access to networked information or content (Widgets). The touchscreen core application **1410** in turn accesses a library or libraries of functions to control the local hardware (e.g. screen display, sound, LEDs, memory, etc.) as well as specialized librarie(s) to couple or connect to the security system.

In an embodiment of this security system connection, the touchscreen **1403** communicates to the gateway **1402**, and has no direct communication with the security panel. In this embodiment, the touchscreen core application **1410** accesses the remote service APIs **1412** which provide security system functionality (e.g. ARM/DISARM panel, sensor state, get/set panel configuration parameters, initiate or get alarm events, etc.). In an embodiment, the remote service APIs **1412** implement one or more of the following functions, but the embodiment is not so limited: Armstate=setARMState (type="ARM STAY| ARM AWAY| DISARM", Parameters="ExitDelay=30|Lights=OFF"); sensorState=getSensors(type="ALL|SensorName|SensorNameList"); result=setSensorState(SensorName, parameters="Option1, Options2, . . . Option n"); interruptHandler=SensorEvent( ); and, interruptHandler=alarmEvent( ).

Functions of the remote service APIs **1412** of an embodiment use a remote PanelConnect API **1424** which which resides in memory on the gateway **1402**. The touchscreen **1403** communicates with the gateway **1402** through a suitable network interface such as an Ethernet or 802.11 RF connection, for example. The remote PanelConnect API **1424** provides the underlying Security System Interfaces **1426** used to communicate with and control one or more types of security panel via wired link **1430** and/or RF link **3**. The PanelConnect API **1224** provides responses and input to the remote services APIs **1426**, and in turn translates function calls and data to and from the specific protocols and functions supported by a specific implementation of a Security Panel (e.g. a GE Security Simon XT or Honeywell Vista 20P). In an embodiment, the PanelConnect API **1224** uses a 345 MHz RF transceiver or receiver hardware/firmware module to communicate wirelessly to the security panel and directly to a set of 345 MHz RF-enabled sensors and devices, but the embodiment is not so limited.

The gateway of an alternative embodiment communicates over a wired physical coupling or connection to the security panel using the panel's specific wired hardware (bus) interface and the panel's bus-level protocol.

In an alternative embodiment, the Touchscreen **1403** implements the same PanelConnect API **1414** locally on the Touchscreen **1403**, communicating directly with the Security Panel **2** and/or Sensors **2** over the proprietary RF link or over a wired link for that system. In this embodiment the Touchscreen **1403**, instead of the gateway **1402**, incorporates the 345 MHz RF transceiver to communicate directly with Security Panel **2** or Sensors **2** over the RF link **2**. In the case of a wired link the Touchscreen **1403** incorporates the real-time hardware (e.g. a PIC chip and RS232-variant serial link) to physically connect to and satisfy the specific bus-level timing requirements of the SecurityPanel**2**.

In yet another alternative embodiment, either the gateway **1402** or the Touchscreen **1403** implements the remote service APIs. This embodiment includes a Cricket device ("Cricket") which comprises but is not limited to the following components: a processor (suitable for handling 802.11 protocols and processing, as well as the bus timing requirements of SecurityPanel**1**); an 802.11 (WiFi) client IP interface chip; and, a serial bus interface chip that implements variants of RS232 or RS485, depending on the specific Security Panel.

The Cricket also implements the full PanelConnect APIs such that it can perform the same functions as the case where the gateway implements the PanelConnect APIs. In this embodiment, the touchscreen core application **1410** calls functions in the remote service APIs **1412** (such as setArmState( )). These functions in turn couple or connect to the remote Cricket through a standard IP connection ("Cricket IP Link") (e.g., Ethernet, Homeplug, the gateway's proprietary Wifi network, etc.). The Cricket in turn implements the PanelConnect API, which responds to the request from the touchscreen core application, and performs the appropriate function using the proprietary panel interface. This interface

uses either the wireless or wired proprietary protocol for the specific security panel and/or sensors.

FIG. **15** is a flow diagram of a method of integrating an external control and management application system with an existing security system, under an embodiment. Operations begin when the system is powered on **1510**, involving at a minimum the power-on of the gateway device, and optionally the power-on of the connection between the gateway device and the remote servers. The gateway device initiates **1520** a software and RF sequence to locate the extant security system. The gateway and installer initiate and complete **1530** a sequence to 'learn' the gateway into the security system as a valid and authorized control device. The gateway initiates **1540** another software and RF sequence of instructions to discover and learn the existence and capabilities of existing RF devices within the extant security system, and store this information in the system. These operations under the system of an embodiment are described in further detail below.

Unlike conventional systems that extend an existing security system, the system of an embodiment operates utilizing the proprietary wireless protocols of the security system manufacturer. In one illustrative embodiment, the gateway is an embedded computer with an IP LAN and WAN connection and a plurality of RF transceivers and software protocol modules capable of communicating with a plurality of security systems each with a potentially different RF and software protocol interface. After the gateway has completed the discovery and learning **1540** of sensors and has been integrated **1550** as a virtual control device in the extant security system, the system becomes operational. Thus, the security system and associated sensors are presented **1550** as accessible devices to a potential plurality of user interface subsystems.

The system of an embodiment integrates **1560** the functionality of the extant security system with other non-security devices including but not limited to IP cameras, touchscreens, lighting controls, door locking mechanisms, which may be controlled via RF, wired, or powerline-based networking mechanisms supported by the gateway or servers.

The system of an embodiment provides a user interface subsystem **1570** enabling a user to monitor, manage, and control the system and associated sensors and security systems. In an embodiment of the system, a user interface subsystem is an HTML/XML/Javascript/Java/AJAX/Flash presentation of a monitoring and control application, enabling users to view the state of all sensors and controllers in the extant security system from a web browser or equivalent operating on a computer, PDA, mobile phone, or other consumer device.

In another illustrative embodiment of the system described herein, a user interface subsystem is an HTML/XML/Javascript/Java/AJAX presentation of a monitoring and control application, enabling users to combine the monitoring and control of the extant security system and sensors with the monitoring and control of non-security devices including but not limited to IP cameras, touchscreens, lighting controls, door locking mechanisms.

In another illustrative embodiment of the system described herein, a user interface subsystem is a mobile phone application enabling users to monitor and control the extant security system as well as other non-security devices.

In another illustrative embodiment of the system described herein, a user interface subsystem is an application running on a keypad or touchscreen device enabling users to monitor and control the extant security system as well as other non-security devices.

In another illustrative embodiment of the system described herein, a user interface subsystem is an application operating on a TV or set-top box connected to a TV enabling users to monitor and control the extant security system as well as other non-security devices.

FIG. **16** is a block diagram of an integrated security system **1600** wirelessly interfacing to proprietary security systems, under an embodiment. A security system **1610** is coupled or connected to a Gateway **1620**, and from Gateway **1620** coupled or connected to a plurality of information and content sources across a network **1630** including one or more web servers **1640**, system databases **1650**, and applications servers **1660**. While in one embodiment network **1630** is the Internet, including the World Wide Web, those of skill in the art will appreciate that network **1630** may be any type of network, such as an intranet, an extranet, a virtual private network (VPN), a mobile network, or a non-TCP/IP based network.

Moreover, other elements of the system of an embodiment may be conventional, well-known elements that need not be explained in detail herein. For example, security system **1610** could be any type home or business security system, such devices including but not limited to a standalone RF home security system or a non-RF-capable wired home security system with an add-on RF interface module. In the integrated security system **1600** of this example, security system **1610** includes an RF-capable wireless security panel (WSP) **1611** that acts as the master controller for security system **1610**. Well-known examples of such a WSP include the GE Security Concord, Networx, and Simon panels, the Honeywell Vista and Lynx panels, and similar panels from DSC and Napco, to name a few. A wireless module **1614** includes the RF hardware and protocol software necessary to enable communication with and control of a plurality of wireless devices **1613**. WSP **1611** may also manage wired devices **1614** physically connected to WSP **1611** with an RS232 or RS485 or Ethernet connection or similar such wired interface.

In an implementation consistent with the systems and methods described herein, Gateway **1620** provides the interface between security system **1610** and LAN and/or WAN for purposes of remote control, monitoring, and management. Gateway **1620** communicates with an external web server **1640**, database **1650**, and application server **1660** over network **1630** (which may comprise WAN, LAN, or a combination thereof). In this example system, application logic, remote user interface functionality, as well as user state and account are managed by the combination of these remote servers. Gateway **1620** includes server connection manager **1621**, a software interface module responsible for all server communication over network **1630**. Event manager **1622** implements the main event loop for Gateway **1620**, processing events received from device manager **1624** (communicating with non-security system devices including but not limited to IP cameras, wireless thermostats, or remote door locks). Event manager **1622** further processes events and control messages from and to security system **1610** by utilizing WSP manager **1623**.

WSP manager **1623** and device manager **1624** both rely upon wireless protocol manager **1626** which receives and stores the proprietary or standards-based protocols required to support security system **1610** as well as any other devices interfacing with gateway **1620**. WSP manager **1623** further utilizes the comprehensive protocols and interface algo-

rithms for a plurality of security systems **1610** stored in the WSP DB client database associated with wireless protocol manager **1626**. These various components implement the software logic and protocols necessary to communicate with and manager devices and security systems **1610**. Wireless Transceiver hardware modules **1625** are then used to implement the physical RF communications link to such devices and security systems **1610**. An illustrative wireless transceiver **1625** is the GE Security Dialog circuit board, implementing a 319.5 MHz two-way RF transceiver module. In this example, RF Link **1670** represents the 319.5 MHz RF communication link, enabling gateway **1620** to monitor and control WSP **1611** and associated wireless and wired devices **1613** and **1614**, respectively.

In one embodiment, server connection manager **1621** requests and receives a set of wireless protocols for a specific security system **1610** (an illustrative example being that of the GE Security Concord panel and sensors) and stores them in the WSP DB portion of the wireless protocol manager **1626**. WSP manager **1623** then utilizes such protocols from wireless protocol manager **1626** to initiate the sequence of processes detailed in FIG. **15** and FIG. **16** for learning gateway **1620** into security system **1610** as an authorized control device. Once learned in, as described with reference to FIG. **16** (and above), event manager **1622** processes all events and messages detected by the combination of WSP manager **1623** and the GE Security wireless transceiver module **1625**.

In another embodiment, gateway **1620** incorporates a plurality of wireless transceivers **1625** and associated protocols managed by wireless protocol manager **1626**. In this embodiment events and control of multiple heterogeneous devices may be coordinated with WSP **1611**, wireless devices **1613**, and wired devices **1614**. For example a wireless sensor from one manufacturer may be utilized to control a device using a different protocol from a different manufacturer.

In another embodiment, gateway **1620** incorporates a wired interface to security system **1610**, and incorporates a plurality of wireless transceivers **1625** and associated protocols managed by wireless protocol manager **1626**. In this embodiment events and control of multiple heterogeneous devices may be coordinated with WSP **1611**, wireless devices **1613**, and wired devices **1614**.

Of course, while an illustrative embodiment of an architecture of the system of an embodiment is described in detail herein with respect to FIG. **16**, one of skill in the art will understand that modifications to this architecture may be made without departing from the scope of the description presented herein. For example, the functionality described herein may be allocated differently between client and server, or amongst different server or processor-based components. Likewise, the entire functionality of the gateway **1620** described herein could be integrated completely within an existing security system **1610**. In such an embodiment, the architecture could be directly integrated with a security system **1610** in a manner consistent with the currently described embodiments.

FIG. **17** is a flow diagram for wirelessly 'learning' the Gateway into an existing security system and discovering extant sensors, under an embodiment. The learning interfaces gateway **1620** with security system **1610**. Gateway **1620** powers up **1710** and initiates software sequences **1720** and **1725** to identify accessible WSPs **1611** and wireless devices **1613**, respectively (e.g., one or more WSPs and/or devices within range of gateway **1620**). Once identified, WSP **1611** is manually or automatically set into 'learn mode' **1730**, and gateway **1620** utilizes available protocols to add **1740** itself as an authorized control device in security system **1610**. Upon successful completion of this task, WSP **1611** is manually or automatically removed from 'learn mode' **1750**.

Gateway **1620** utilizes the appropriate protocols to mimic **1760** the first identified device **1614**. In this operation gateway **1620** identifies itself using the unique or pseudo-unique identifier of the first found device **1614**, and sends an appropriate change of state message over RF Link **1670**. In the event that WSP **1611** responds to this change of state message, the device **1614** is then added **1770** to the system in database **1650**. Gateway **1620** associates **1780** any other information (such as zone name or token-based identifier) with this device **1614** in database **1650**, enabling gateway **1620**, user interface modules, or any application to retrieve this associated information.

In the event that WSP **1611** does not respond to the change of state message, the device **1614** is not added **1770** to the system in database **1650**, and this device **1614** is identified as not being a part of security system **1610** with a flag, and is either ignored or added as an independent device, at the discretion of the system provisioning rules. Operations hereunder repeat **1785** operations **1760**, **1770**, **1780** for all devices **1614** if applicable. Once all devices **1614** have been tested in this way, the system begins operation **1790**.

In another embodiment, gateway **1620** utilizes a wired connection to WSP **1611**, but also incorporates a wireless transceiver **1625** to communicate directly with devices **1614**. In this embodiment, operations under **1720** above are removed, and operations under **1740** above are modified so the system of this embodiment utilizes wireline protocols to add itself as an authorized control device in security system **1610**.

A description of an example embodiment follows in which the Gateway (FIG. **16**, element **1620**) is the iHub available from iControl Networks, Palo Alto, Calif., and described in detail herein. In this example the gateway is "automatically" installed with a security system.

The automatic security system installation begins with the assignment of an authorization key to components of the security system (e.g., gateway, kit including the gateway, etc.). The assignment of an authorization key is done in lieu of creating a user account. An installer later places the gateway in a user's premises along with the premises security system. The installer uses a computer to navigate to a web portal (e.g., integrated security system web interface), logs in to the portal, and enters the authorization key of the installed gateway into the web portal for authentication. Once authenticated, the gateway automatically discovers devices at the premises (e.g., sensors, cameras, light controls, etc.) and adds the discovered devices to the system or "network". The installer assigns names to the devices, and tests operation of the devices back to the server (e.g., did the door open, did the camera take a picture, etc.). The security device information is optionally pushed or otherwise propagated to a security panel and/or to the server network database. The installer finishes the installation, and instructs the end user on how to create an account, username, and password. At this time the user enters the authorization key which validates the account creation (uses a valid authorization key to associate the network with the user's account). New devices may subsequently be added to the security network in a variety of ways (e.g., user first enters a unique ID for each device/sensor and names it in the server, after which the gateway can automatically discover and configure the device).

A description of another example embodiment follows in which the security system (FIG. **16**, element **1610**) is a Dialog system and the WSP (FIG. **16**, element **1611**) is a SimonXT available from General Electric Security, and the Gateway (FIG. **16**, element **1620**) is the iHub available from iControl Networks, Palo Alto, Calif., and described in detail herein. Descriptions of the install process for the SimonXT and iHub are also provided below.

GE Security's Dialog network is one of the most widely deployed and tested wireless security systems in the world. The physical RF network is based on a 319.5 MHz unlicensed spectrum, with a bandwidth supporting up to 19 Kbps communications. Typical use of this bandwidth—even in conjunction with the integrated security system—is far less than that. Devices on this network can support either one-way communication (either a transmitter or a receiver) or two-way communication (a transceiver). Certain GE Simon, Simon XT, and Concord security control panels incorporate a two-way transceiver as a standard component. The gateway also incorporates the same two-way transceiver card. The physical link layer of the network is managed by the transceiver module hardware and firmware, while the coded payload bitstreams are made available to the application layer for processing.

Sensors in the Dialog network typically use a 60-bit protocol for communicating with the security panel transceiver, while security system keypads and the gateway use the encrypted 80-bit protocol. The Dialog network is configured for reliability, as well as low-power usage. Many devices are supervised, i.e. they are regularly monitored by the system 'master' (typically a GE security panel), while still maintaining excellent power usage characteristics. A typical door window sensor has a battery life in excess of 5-7 years.

The gateway has two modes of operation in the Dialog network: a first mode of operation is when the gateway is configured or operates as a 'slave' to the GE security panel; a second mode of operation is when the gateway is configured or operates as a 'master' to the system in the event a security panel is not present. In both configurations, the gateway has the ability to 'listen' to network traffic, enabling the gateway to continually keep track of the status of all devices in the system. Similarly, in both situations the gateway can address and control devices that support setting adjustments (such as the GE wireless thermostat).

In the configuration in which the gateway acts as a 'slave' to the security panel, the gateway is 'learned into' the system as a GE wireless keypad. In this mode of operation, the gateway emulates a security system keypad when managing the security panel, and can query the security panel for status and 'listen' to security panel events (such as alarm events).

The gateway incorporates an RF Transceiver manufactured by GE Security, but is not so limited. This transceiver implements the Dialog protocols and handles all network message transmissions, receptions, and timing. As such, the physical, link, and protocol layers of the communications between the gateway and any GE device in the Dialog network are totally compliant with GE Security specifications.

At the application level, the gateway emulates the behavior of a GE wireless keypad utilizing the GE Security 80-bit encrypted protocol, and only supported protocols and network traffic are generated by the gateway. Extensions to the Dialog RF protocol of an embodiment enable full control and configuration of the panel, and iControl can both automate installation and sensor enrollment as well as direct configuration downloads for the panel under these protocol extensions.

As described above, the gateway participates in the GE Security network at the customer premises. Because the gateway has intelligence and a two-way transceiver, it can 'hear' all of the traffic on that network. The gateway makes use of the periodic sensor updates, state changes, and supervisory signals of the network to maintain a current state of the premises. This data is relayed to the integrated security system server (e.g., FIG. **2**, element **260**) and stored in the event repository for use by other server components. This usage of the GE Security RF network is completely non-invasive; there is no new data traffic created to support this activity.

The gateway can directly (or indirectly through the Simon XT panel) control two-way devices on the network. For example, the gateway can direct a GE Security Thermostat to change its setting to 'Cool' from 'Off', as well as request an update on the current temperature of the room. The gateway performs these functions using the existing GE Dialog protocols, with little to no impact on the network; a gateway device control or data request takes only a few dozen bytes of data in a network that can support 19 Kbps.

By enrolling with the Simon XT as a wireless keypad, as described herein, the gateway includes data or information of all alarm events, as well as state changes relevant to the security panel. This information is transferred to the gateway as encrypted packets in the same way that the information is transferred to all other wireless keypads on the network.

Because of its status as an authorized keypad, the gateway can also initiate the same panel commands that a keypad can initiate. For example, the gateway can arm or disarm the panel using the standard Dialog protocol for this activity. Other than the monitoring of standard alarm events like other network keypads, the only incremental data traffic on the network as a result of the gateway is the infrequent remote arm/disarm events that the gateway initiates, or infrequent queries on the state of the panel.

The gateway is enrolled into the Simon XT panel as a 'slave' device which, in an embodiment, is a wireless keypad. This enables the gateway for all necessary functionality for operating the Simon XT system remotely, as well as combining the actions and information of non-security devices such as lighting or door locks with GE Security devices. The only resource taken up by the gateway in this scenario is one wireless zone (sensor ID).

The gateway of an embodiment supports three forms of sensor and panel enrollment/installation into the integrated security system, but is not limited to this number of enrollment/installation options. The enrollment/installation options of an embodiment include installer installation, kitting, and panel, each of which is described below.

Under the installer option, the installer enters the sensor IDs at time of installation into the integrated security system web portal or iScreen. This technique is supported in all configurations and installations.

Kits can be pre-provisioned using integrated security system provisioning applications when using the kitting option. At kitting time, multiple sensors are automatically associated with an account, and at install time there is no additional work required.

In the case where a panel is installed with sensors already enrolled (i.e. using the GE Simon XT enrollment process), the gateway has the capability to automatically extract the sensor information from the system and incorporate it into the user account on the integrated security system server.

The gateway and integrated security system of an embodiment uses an auto-learn process for sensor and panel enrollment in an embodiment. The deployment approach of an embodiment can use additional interfaces that GE Security is adding to the Simon XT panel. With these interfaces, the gateway has the capability to remotely enroll sensors in the panel automatically. The interfaces include, but are not limited to, the following: EnrolIDevice(ID, type, name, zone, group); SetDeviceParameters(ID, type, Name, zone, group), GetDeviceParameters(zone); and RemoveDevice (zone).

The integrated security system incorporates these new interfaces into the system, providing the following install process. The install process can include integrated security system logistics to handle kitting and pre-provisioning. Pre-kitting and logistics can include a pre-provisioning kitting tool provided by integrated security system that enables a security system vendor or provider ("provider") to offer pre-packaged initial 'kits'. This is not required but is recommended for simplifying the install process. This example assumes a 'Basic' kit is preassembled and includes one (1) Simon XT, three (3) Door/window sensors, one (1) motion sensor, one (1) gateway, one (1) keyfob, two (2) cameras, and ethernet cables. The kit also includes a sticker page with all Zones (1-24) and Names (full name list).

The provider uses the integrated security system kitting tool to assemble 'Basic' kit packages. The contents of different types of starter kits may be defined by the provider. At the distribution warehouse, a worker uses a bar code scanner to scan each sensor and the gateway as it is packed into the box. An ID label is created that is attached to the box. The scanning process automatically associates all the devices with one kit, and the new ID label is the unique identifier of the kit. These boxes are then sent to the provider for distribution to installer warehouses. Individual sensors, cameras, etc. are also sent to the provider installer warehouse. Each is labeled with its own barcode/ID.

An installation and enrollment procedure of a security system including a gateway is described below as one example of the installation process.

1. Order and Physical Install Process
   a. Once an order is generated in the iControl system, an account is created and an install ticket is created and sent electronically to the provider for assignment to an installer.
   b. The assigned installer picks up his/her ticket(s) and fills his/her truck with Basic and/or Advanced starter kits. He/she also keeps a stock of individual sensors, cameras, iHubs, Simon XTs, etc. Optionally, the installer can also stock homeplug adapters for problematic installations.
   c. The installer arrives at the address on the ticket, and pulls out the Basic kit. The installer determines sensor locations from a tour of the premises and discussion with the homeowner. At this point assume the homeowner requests additional equipment including an extra camera, two (2) additional door/window sensors, one (1) glass break detector, and one (1) smoke detector.
   d. Installer mounts SimonXT in the kitchen or other location in the home as directed by the homeowner, and routes the phone line to Simon XT if available. GPRS and Phone numbers pre-programmed in SimonXT to point to the provider Central Monitoring Station (CMS).
   e. Installer places gateway in the home in the vicinity of a router and cable modem. Installer installs an ethernet line from gateway to router and plugs gateway into an electrical outlet.
2. Associate and Enroll gateway into SimonXT
   a. Installer uses either his/her own laptop plugged into router, or homeowners computer to go to the integrated security system web interface and log in with installer ID/pass.
   b. Installer enters ticket number into admin interface, and clicks 'New Install' button. Screen prompts installer for kit ID (on box's barcode label).
   c. Installer clicks 'Add SimonXT'. Instructions prompt installer to put Simon XT into install mode, and add gateway as a wireless keypad. It is noted that this step is for security only and can be automated in an embodiment.
   d. Installer enters the installer code into the Simon XT. Installer Learns 'gateway' into the panel as a wireless keypad as a group 1 device.
   e. Installer goes back to Web portal, and clicks the 'Finished Adding SimonXT' button.
3. Enroll Sensors into SimonXT via iControl
   a. All devices in the Basic kit are already associated with the user's account.
   b. For additional devices, Installer clicks 'Add Device' and adds the additional camera to the user's account (by typing in the camera ID/Serial #).
   c. Installer clicks 'Add Device' and adds other sensors (two (2) door/window sensors, one (1) glass break sensor, and one (1) smoke sensor) to the account (e.g., by typing in IDs).
   d. As part of Add Device, Installer assigns zone, name, and group to the sensor. Installer puts appropriate Zone and Name sticker on the sensor temporarily.
   e. All sensor information for the account is pushed or otherwise propagated to the iConnect server, and is available to propagate to CMS automation software through the CMS application programming interface (API).
   f. Web interface displays 'Installing Sensors in System . . . ' and automatically adds all of the sensors to the Simon XT panel through the GE RF link.
   g. Web interface displays 'Done Installing'→all sensors show green.
4. Place and Tests Sensors in Home
   a. Installer physically mounts each sensor in its desired location, and removes the stickers.
   b. Installer physically mounts WiFi cameras in their location and plugs into AC power. Optional fishing of low voltage wire through wall to remove dangling wires. Camera transformer is still plugged into outlet but wire is now inside the wall.
   c. Installer goes to Web interface and is prompted for automatic camera install. Each camera is provisioned as a private, encrypted Wifi device on the gateway secured sandbox network, and firewall NAT traversal is initiated. Upon completion the customer is prompted to test the security system.
   d. Installer selects the 'Test System' button on the web portal—the SimonXT is put into Test mode by the gateway over GE RF.
   e. Installer manually tests the operation of each sensor, receiving an audible confirmation from SimonXT.
   f. gateway sends test data directly to CMS over broadband link, as well as storing the test data in the user's account for subsequent report generation.
   g. Installer exits test mode from the Web portal.

5. Installer instructs customer on use of the Simon XT, and shows customer how to log into the iControl web and mobile portals. Customer creates a username/password at this time.
6. Installer instructs customer how to change Simon XT user code from the Web interface. Customer changes user code which is pushed to SimonXT automatically over GE RF.

An installation and enrollment procedure of a security system including a gateway is described below as an alternative example of the installation process. This installation process is for use for enrolling sensors into the SimonXT and integrated security system and is compatible with all existing GE Simon panels.

The integrated security system supports all pre-kitting functionality described in the installation process above. However, for the purpose of the following example, no kitting is used.

1. Order and Physical Install Process
   a. Once an order is generated in the iControl system, an account is created and an install ticket is created and sent electronically to the security system provider for assignment to an installer.
   b. The assigned installer picks up his/her ticket(s) and fills his/her truck with individual sensors, cameras, illubs, Simon XTs, etc. Optionally, the installer can also stock homeplug adapters for problematic installations.
   c. The installer arrives at the address on the ticket, and analyzes the house and talks with the homeowner to determine sensor locations. At this point assume the homeowner requests three (3) cameras, five (5) door/window sensors, one (1) glass break detector, one (1) smoke detector, and one (1) keyfob.
   d. Installer mounts SimonXT in the kitchen or other location in the home. The installer routes a phone line to Simon XT if available. GPRS and Phone numbers are pre-programmed in SimonXT to point to the provider CMS.
   e. Installer places gateway in home in the vicinity of a router and cable modem, and installs an ethernet line from gateway to the router, and plugs gateway into an electrical outlet.
2. Associate and Enroll gateway into SimonXT
   a. Installer uses either his/her own laptop plugged into router, or homeowners computer to go to the integrated security system web interface and log in with an installer ID/pass.
   b. Installer enters ticket number into admin interface, and clicks 'New Install' button. Screen prompts installer to add devices.
   c. Installer types in ID of gateway, and it is associated with the user's account.
   d. Installer clicks 'Add Device' and adds the cameras to the user's account (by typing in the camera ID/Serial #).
   e. Installer clicks 'Add SimonXT'. Instructions prompt installer to put Simon XT into install mode, and add gateway as a wireless keypad.
   f. Installer goes to Simon XT and enters the installer code into the Simon XT. Learns 'gateway' into the panel as a wireless keypad as group 1 type sensor.
   g. Installer returns to Web portal, and clicks the 'Finished Adding SimonXT' button.
   h. Gateway now is alerted to all subsequent installs over the security system RF.
3. Enroll Sensors into SimonXT via iControl
   a. Installer clicks 'Add Simon XT Sensors'—Displays instructions for adding sensors to Simon XT.
   b. Installer goes to Simon XT and uses Simon XT install process to add each sensor, assigning zone, name, group. These assignments are recorded for later use.
   c. The gateway automatically detects each sensor addition and adds the new sensor to the integrated security system.
   d. Installer exits install mode on the Simon XT, and returns to the Web portal.
   e. Installer clicks 'Done Adding Devices'.
   f. Installer enters zone/sensor naming from recorded notes into integrated security system to associate sensors to friendly names
   g. All sensor information for the account is pushed to the iConnect server, and is available to propagate to CMS automation software through the CMS API.
4. Place and Tests Sensors in Home
   a. Installer physically mounts each sensor in its desired location.
   b. Installer physically mounts Wifi cameras in their location and plugs into AC power. Optional fishing of low voltage wire through wall to remove dangling wires. Camera transformer is still plugged into outlet but wire is now inside the wall.
   c. Installer puts SimonXT into Test mode from the keypad.
   d. Installer manually tests the operation of each sensor, receiving an audible confirmation from SimonXT.
   e. Installer exits test mode from the Simon XT keypad.
   f. Installer returns to web interface and is prompted to automatically set up cameras. After waiting for completion cameras are now provisioned and operational.
5. Installer instructs customer on use of the Simon XT, and shows customer how to log into the integrated security system web and mobile portals. Customer creates a username/password at this time.
6. Customer and Installer observe that all sensors/cameras are green.
7. Installer instructs customer how to change Simon XT user code from the keypad. Customer changes user code and stores in SimonXT.
8. The first time the customer uses the web portal to Arm/Disarm system the web interface prompts the customer for the user code, which is then stored securely on the server. In the event the user code is changed on the panel the web interface once again prompts the customer.

The panel of an embodiment can be programmed remotely. The CMS pushes new programming to SimonXT over a telephone or GPRS link. Optionally, iControl and GE provide a broadband link or coupling to the gateway and then a link from the gateway to the Simon XT over GE RF.

In addition to the configurations described above, the gateway of an embodiment supports takeover configurations in which it is introduced or added into a legacy security system. A description of example takeover configurations follow in which the security system (FIG. **2**, element **210**) is a Dialog system and the WSP (FIG. **2**, element **211**) is a GE Concord panel (e.g., equipped with POTS, GE RF, and Superbus 2000 RS485 interface (in the case of a Lynx takeover the Simon XT is used) available from General Electric Security. The gateway (FIG. **2**, element **220**) in the takeover configurations is an iHub (e.g., equipped with built-in 802.11b/g router, Ethernet Hub, GSM/GPRS card, RS485 interface, and iControl Honeywell-compatible RF card) available from iControl Networks, Palo Alto, Calif. While components of particular manufacturers are used in

this example, the embodiments are not limited to these components or to components from these vendors.

The security system can optionally include RF wireless sensors (e.g., GE wireless sensors utilizing the GE Dialog RF technology), IP cameras, a GE-iControl Touchscreen (the touchscreen is assumed to be an optional component in the configurations described herein, and is thus treated separately from the iHub; in systems in which the touchscreen is a component of the base security package, the integrated iScreen (available from iControl Networks, Palo Alto, Calif.) can be used to combine iHub technology with the touchscreen in a single unit), and Z-Wave devices to name a few.

The takeover configurations described below assume takeover by a "new" system of an embodiment of a security system provided by another third party vendor, referred to herein as an "original" or "legacy" system. Generally, the takeover begins with removal of the control panel and keypad of the legacy system. A GE Concord panel is installed to replace the control panel of the legacy system along with an iHub with GPRS Modem. The legacy system sensors are then connected or wired to the Concord panel, and a GE keypad or touchscreen is installed to replace the control panel of the legacy system. The iHub includes the iControl RF card, which is compatible with the legacy system. The iHub finds and manages the wireless sensors of the legacy system, and learns the sensors into the Concord by emulating the corresponding GE sensors. The iHub effectively acts as a relay for legacy wireless sensors.

Once takeover is complete, the new security system provides a homogeneous system that removes the compromises inherent in taking over or replacing a legacy system. For example, the new system provides a modern touchscreen that may include additional functionality, new services, and supports integration of sensors from various manufacturers. Furthermore, lower support costs can be realized because call centers, installers, etc. are only required to support one architecture. Additionally, there is minimal install cost because only the panel is required to be replaced as a result of the configuration flexibility offered by the iHub.

The system takeover configurations described below include but are not limited to a dedicated wireless configuration, a dedicated wireless configuration that includes a touchscreen, and a fished Ethernet configuration. Each of these configurations is described in detail below.

FIG. **18** is a block diagram of a security system in which the legacy panel is replaced with a GE Concord panel wirelessly coupled to an iHub, under an embodiment. All existing wired and RF sensors remain in place. The iHub is located near the Concord panel, and communicates with the panel via the 802.11 link, but is not so limited. The iHub manages cameras through a built-in 802.11 router. The iHub listens to the existing RF HW sensors, and relays sensor information to the Concord panel (emulating the equivalent GE sensor). The wired sensors of the legacy system are connected to the wired zones on the control panel.

FIG. **19** is a block diagram of a security system in which the legacy panel is replaced with a GE Concord panel wirelessly coupled to an iHub, and a GE-iControl Touchscreen, under an embodiment. All existing wired and RF sensors remain in place. The iHub is located near the Concord panel, and communicates with the panel via the 802.11 link, but is not so limited. The iHub manages cameras through a built-in 802.11 router. The iHub listens to the existing RF HW sensors, and relays sensor information to the Concord panel (emulating the equivalent GE sensor). The wired sensors of the legacy system are connected to the wired zones on the control panel.

The GE-iControl Touchscreen can be used with either of an 802.11 connection or Ethernet connection with the iHub. Because the takeover involves a GE Concord panel (or Simon XT), the touchscreen is always an option. No extra wiring is required for the touchscreen as it can use the 4-wire set from the replaced keypad of the legacy system. This provides power, battery backup (through Concord), and data link (RS485 Superbus 2000) between Concord and touchscreen. The touchscreen receives its broadband connectivity through the dedicated 802.11 link to the iHub.

FIG. **20** is a block diagram of a security system in which the legacy panel is replaced with a GE Concord panel connected to an iHub via an Ethernet coupling, under an embodiment. All existing wired and RF sensors remain in place. The iHub is located near the Concord panel, and wired to the panel using a 4-wire SUperbus 2000 (RS485) interface, but is not so limited. The iHub manages cameras through a built-in 802.11 router. The iHub listens to the existing RF HW sensors, and relays sensor information to the Concord panel (emulating the equivalent GE sensor). The wired sensors of the legacy system are connected to the wired zones on the control panel.

The takeover installation process is similar to the installation process described above, except the control panel of the legacy system is replaced; therefore, only the differences with the installation described above are provided here. The takeover approach of an embodiment uses the existing RS485 control interfaces that GE Security and iControl support with the iHub, touchscreen, and Concord panel. With these interfaces, the iHub is capable of automatically enrolling sensors in the panel. The exception is the leverage of an iControl RF card compatible with legacy systems to 'takeover' existing RF sensors. A description of the takeover installation process follows.

During the installation process, the iHub uses an RF Takeover Card to automatically extract all sensor IDs, zones, and names from the legacy panel. The installer removes connections at the legacy panel from hardwired wired sensors and labels each with the zone. The installer pulls the legacy panel and replaces it with the GE Concord panel. The installer also pulls the existing legacy keypad and replaces it with either a GE keypad or a GE-iControl touchscreen. The installer connects legacy hardwired sensors to appropriate wired zone (from labels) on the Concord. The installer connects the iHub to the local network and connects the iHub RS485 interface to the Concord panel. The iHub automatically 'enrolls' legacy RF sensors into the Concord panel as GE sensors (maps IDs), and pushes or otherwise propagates other information gathered from HW panel (zone, name, group). The installer performs a test of all sensors back to CMS. In operation, the iHub relays legacy sensor data to the Concord panel, emulating equivalent GE sensor behavior and protocols.

The areas of the installation process particular to the legacy takeover include how the iHub extracts sensor info from the legacy panel and how the iHub automatically enrolls legacy RF sensors and populates Concord with wired zone information. Each of these areas is described below.

In having the iHub extract sensor information from the legacy panel, the installer 'enrolls' iHub into the legacy panel as a wireless keypad (use install code and house ID—available from panel). The iHub legacy RF Takeover Card is a compatible legacy RF transceiver. The installer uses the web portal to place iHub into 'Takeover Mode', and the web portal the automatically instructs the iHub to begin

extraction. The iHub queries the panel over the RF link (to get all zone information for all sensors, wired and RF). The iHub then stores the legacy sensor information received during the queries on the iConnect server.

The iHub also automatically enrolls legacy RF sensors and populates Concord with wired zone information. In so doing, the installer selects 'Enroll legacy Sensors into Concord' (next step in 'Takeover' process on web portal). The iHub automatically queries the iConnect server, and downloads legacy sensor information previously extracted. The downloaded information includes an ID mapping from legacy ID to 'spoofed' GE ID. This mapping is stored on the server as part of the sensor information (e.g., the iConnect server knows that the sensor is a legacy sensor acting in GE mode). The iHub instructs Concord to go into install mode, and sends appropriate Superbus 2000 commands for sensor learning to the panel. For each sensor, the 'spoofed' GE ID is loaded, and zone, name, and group are set based on information extracted from legacy panel. Upon completion, the iHub notifies the server, and the web portal is updated to reflect next phase of Takeover (e.g., 'Test Sensors').

Sensors are tested in the same manner as described above. When a HW sensor is triggered, the signal is captured by the iHub legacy RF Takeover Card, translated to the equivalent GE RF sensor signal, and pushed to the panel as a sensor event on the SuperBus 2000 wires.

In support of remote programming of the panel, CMS pushes new programming to Concord over a phone line, or to the iConnect CMS/Alarm Server API, which in turn pushes the programming to the iflub. The iHub uses the Concord Superbus 2000 RS485 link to push the programming to the Concord panel.

FIG. **21** is a flow diagram for automatic takeover **2100** of a security system, under an embodiment. Automatic takeover includes establishing **2102** a wireless coupling between a takeover component running under a processor and a first controller of a security system installed at a first location. The security system includes some number of security system components coupled to the first controller. The automatic takeover includes automatically extracting **2104** security data of the security system from the first controller via the takeover component. The automatic takeover includes automatically transferring **2106** the security data to a second controller and controlling loading of the security data into the second controller. The second controller is coupled to the security system components and replaces the first controller.

FIG. **22** is a flow diagram for automatic takeover **2200** of a security system, under an alternative embodiment. Automatic takeover includes automatically forming **2202** a security network at a first location by establishing a wireless coupling between a security system and a gateway. The gateway of an embodiment includes a takeover component. The security system of an embodiment includes security system components. The automatic takeover includes automatically extracting **2204** security data of the security system from a first controller of the security system. The automatic takeover includes automatically transferring **2206** the security data to a second controller. The second controller of an embodiment is coupled to the security system components and replaces the first controller.

Components of the gateway of the integrated security system described herein control discovery, installation and configuration of both wired and wireless IP devices (e.g., cameras, etc.) coupled or connected to the system, as described herein with reference to FIGS. **1-4**, as well as management of video routing using a video routing module or engine. The video routing engine initiates communication paths for the transfer of video from a streaming source device to a requesting client device, and delivers seamless video streams to the user via the communication paths using one or more of UPnP port-forwarding, relay server routing and STUN/TURN peer-to-peer routing, each of which is described below.

By way of reference, conventional video cameras have the ability to stream digital video in a variety of formats and over a variety of networks. Internet protocol (IP) video cameras, which include video cameras using an IP transport network (e.g., Ethernet, WiFi (IEEE 802.11 standards), etc.) are prevalent and increasingly being utilized in home monitoring and security system applications. With the proliferation of the internet, Ethernet and WiFi local area networks (LANs) and advanced wide area networks (WANs) that offer high bandwidth, low latency connections (broadband), as well as more advanced wireless WAN data networks (e.g. GPRS or CDMA 1×RTT), there increasingly exists the networking capability to extend traditional security systems to offer IP-based video. However, a fundamental reason for such IP video in a security system is to enable a user or security provider to monitor live or otherwise streamed video from outside the host premises (and the associated LAN).

The conventional solution to this problem has involved a technique known as 'port forwarding', whereby a 'port' on the LAN's router/firewall is assigned to the specific LAN IP address for an IP camera, or a proxy to that camera. Once a port has been 'forwarded' in this manner, a computer external to the LAN can address the LAN's router directly, and request access to that port. This access request is then forwarded by the router directly to the IP address specified, the IP camera or proxy. In this way an external device can directly access an IP camera within the LAN and view or control the streamed video.

The issues with this conventional approach include the following: port forwarding is highly technical and most users do not know how/why to do it; automatic port forwarding is difficult and problematic using emerging standards like UPnP; the camera IP address is often reset in response to a power outage/router reboot event; there are many different routers with different ways/capabilities for port forwarding. In short, although port forwarding can work, it is frequently less than adequate to support a broadly deployed security solution utilizing IP cameras.

Another approach to accessing streaming video externally to a LAN utilizes peer-to-peer networking technology. So-called peer-to-peer networks, which includes networks in which a device or client is connected directly to another device or client, typically over a Wide Area Network (WAN) and without a persistent server connection, are increasingly common. In addition to being used for the sharing of files between computers (e.g., Napster and KaZaa), peer-to-peer networks have also been more recently utilized to facilitate direct audio and media streaming in applications such as Skype. In these cases, the peer-to-peer communications have been utilized to enable telephony-style voice communications and video conferencing between two computers, each enabled with an IP-based microphone, speaker, and video camera. A fundamental reason for adopting such peer-to-peer technology is the ability to transparently 'punch through' LAN firewalls to enable external access to the streaming voice and video content, and to do so in a way that scales to tens of millions of users without creating an untenable server load.

A limitation of the conventional peer-to-peer video transport lies in the personal computer (PC)-centric nature of the solution. Each of the conventional solutions uses a highly capable PC connected to the video camera, with the PC providing the advanced software functionality required to initiate and manage the peer-to-peer connection with the remote client. A typical security or remote home monitoring system requires multiple cameras, each with its own unique IP address, and only a limited amount of processing capability in each camera such that the conventional PC-centric approach cannot easily solve the need. Instead of a typical PC-centric architecture with three components (a "3-way IP Video System") that include a computer device with video camera, a mediating server, and a PC client with video display capability, the conventional security system adds a plurality of fourth components that are standalone IP video cameras (requiring a "4-way IP Video System"), another less-than-ideal solution.

In accordance with the embodiments described herein, IP camera management systems and methods are provided that enable a consumer or security provider to easily and automatically configure and manage IP cameras located at a customer premise. Using this system IP camera management may be extended to remote control and monitoring from outside the firewall and router of the customer premise.

With reference to FIGS. **5** and **6**, the system includes a gateway **253** having a video routing component so that the gateway **253** can manage and control, or assist in management and control, or video routing. The system also includes one or more cameras (e.g., WiFi IP camera **254**, Ethernet IP camera **255**, etc.) that communicate over the LAN **250** using an IP format, as well as a connection management server **210** located outside the premise firewall **252** and connected to the gateway **253** by a Wide Area Network (WAN) **200**. The system further includes one or more devices **220**, **230**, **240** located outside the premise and behind other firewalls **221**, **231**, **241** and connected to the WAN **200**. The other devices **220**, **230**, **240** are configured to access video or audio content from the IP cameras within the premise, as described above.

Alternatively, with reference to FIGS. **9** and **10**, the system includes a touchscreen **902** or **1002** having a video routing component so that the touchscreen **902** or **1002** can manage and control, or assist in management and control, or video routing. The system also includes one or more cameras (e.g., WiFi IP camera **254**, Ethernet IP camera **255**, etc.) that communicate over the LAN **250** using an IP format, as well as a connection management server **210** located outside the premise firewall **252** and connected to the gateway **253** by a Wide Area Network (WAN) **200**. The system further includes one or more devices **220**, **230**, **240** located outside the premise and behind other firewalls **221**, **231**, **241** and connected to the WAN **200**. The other devices **220**, **230**, **240** are configured to access video or audio content from the IP cameras within the premise, as described above.

FIG. **23** is a general flow diagram for IP video control, under an embodiment. The IP video control interfaces, manages, and provides WAN-based remote access to a plurality of IP cameras in conjunction with a home security or remote home monitoring system. The IP video control allows for monitoring and controlling of IP video cameras from a location remote to the customer premise, outside the customer premise firewall, and protected by another firewall. Operations begin when the system is powered on **2310**, involving at a minimum the power-on of the gateway, as well as the power-on of at least one IP camera coupled or connected to the premise LAN. The gateway searches **2311** for available IP cameras and associated IP addresses. The gateway selects **2312** from one or more possible approaches to create connections between the IP camera and a device external to the firewall. Once an appropriate connection path is selected, the gateway begins operation **2313**, and awaits **2320** a request for a stream from one of the plurality of IP video cameras available on the LAN. When a stream request is present the server retrieves **2321** the requestor's WAN IP address/port.

When a server relay is present **2330**, the IP camera is instructed **2331** to stream to the server, and the connection is managed **2332** through the server. In response to the stream terminating **2351**, operations return to gateway operation **2313**, and waits to receive another request **2320** for a stream from one of the plurality of IP video cameras available on the LAN.

When a server relay is not present **2330**, the requestor's WAN IP address/port is provided **2333** to the gateway or gateway relay. When a gateway relay is present **2340**, the IP camera is instructed **2341** to stream to the gateway, and the gateway relays **2342** the connection to the requestor. In response to the stream terminating **2351**, operations return to gateway operation **2313**, and waits to receive another request **2320** for a stream from one of the plurality of IP video cameras available on the LAN. When a gateway relay is not present **2340**, the IP camera is instructed **2343** to stream to an address, and a handoff **2344** is made resulting in direct communication between the camera and the requestor. In response to the stream terminating **2351**, operations return to gateway operation **2313**, and waits to receive another request **2320** from one of the plurality of IP video cameras available on the LAN.

The integrated security system of an embodiment supports numerous video stream formats or types of video streams. Supported video streams include, but are not limited to, Motion Picture Experts Group (MPEG)-4 (MPEG-4)/Real-Time Streaming Protocol (RTSP), MPEG-4 over Hypertext Transfer Protocol (HTTP), and Motion Joint Photographic Experts Group (JPEG) (MJPEG).

The integrated security system of an embodiment supports the MPEG-4/RTSP video streaming method (supported by video servers and clients) which uses RTSP for the control channel and Real-time Transport Protocol (RTP) for the data channel. Here the RTSP channel is over Transmission Control Protocol (TCP) while the data channel uses User Datagram Protocol (UDP). This method is widely supported by both streaming sources (e.g., cameras) and stream clients (e.g., remote client devices, Apple Quicktime, VideoLAN, IPTV mobile phones, etc).

Encryption can be added to the two channels under MPEG-4/RTSP. For example, the RTSP control channel can be encrypted using SSL/TLS. The data channel can also be encrypted.

If the camera or video stream source inside the home does not support encryption for either RTSP or RTP channels, the gateway located on the LAN can facilitate the encrypted RTSP method by maintaining separate TCP sessions with the video stream source device and with the encrypted RTSP client outside the LAN, and relay all communication between the two sessions. In this situation, any communication between the gateway and the video stream source that is not encrypted could be encrypted by the gateway before being relayed to the RTSP client outside the LAN. In many cases the gateway is an access point for the encrypted and private Wifi network on which the video stream source device is located. This means that communication between the gateway and the video stream source device is encrypted

at the network level, and communication between the gateway and the RTSP client is encrypted at the transport level. In this fashion the gateway can compensate for a device that does not support encrypted RTSP.

The integrated security system of an embodiment also supports reverse RTSP. Reverse RTSP includes taking a TCP-based protocol like RTSP, and reversing the roles of client and server (references to "server" include the iControl server, also referred to as the iConnect server) when it comes to TCP session establishment. For example, in standard RTSP the RTSP client is the one that establishes the TCP connection with the stream source server (the server listens on a port for incoming connections). In Reverse RTSP, the RTSP client listens on a port for incoming connections from the stream source server. Once the TCP connection is established, the RTSP client begins sending commands to the server over the TCP connection just as it would in standard RTSP.

When using Reverse RTSP, the video stream source is generally on a LAN, protected by a firewall. Having a device on the LAN initiate the connection to the RTSP client outside the firewall enables easy network traversal.

If the camera or video stream source inside the LAN does not support Reverse RTSP, then the gateway facilitates the Reverse RTSP method by initiating separate TCP sessions with the video stream source device and with the Reverse RTSP client outside the LAN, and then relays all communication between the two sessions. In this fashion the gateway compensates for a stream source device that does not support Reverse RTSP.

As described in the encryption description above, the gateway can further compensate for missing functionalities on the device such as encryption. If the device does not support encryption for either RTSP or RTP channels, the gateway can communicate with the device using these un-encrypted streams, and then encrypt the streams before relaying them out of the LAN to the RTSP Reverse client.

Servers of the integrated security system can compensate for RTSP clients that do not support Reverse RTSP. In this situation, the server accepts TCP connections from both the RTSP client and the Reverse RTSP video stream source (which could be a gateway acting on behalf of a stream source device that does not support Reverse RTSP). The server then relays the control and video streams from the Reverse RTSP video stream source to the RTSP client. The server can further compensate for the encryption capabilities of the RTSP client; if the RTSP client does not support encryption then the server can provide an unencrypted stream to the RTSP client even though an encrypted stream was received from the Reverse RTSP streaming video source.

The integrated security system of an embodiment also supports Simple Traversal of User Datagram Protocol (UDP) through Network Address Translators (NAT) (STUN)/Traversal Using Relay NAT (TURN) peer-to-peer routing. STUN and Turn are techniques for using a server to help establish a peer-to-peer UDP data stream (it does not apply to TCP streams). The bandwidth consumed by the data channel of a video stream is usually many thousands of times larger than that used by the control channel. Consequently, when a peer-to-peer connection for both the RTSP and RTP channels is not possible, there is still a great incentive to use STUN/TURN techniques in order to achieve a peer-to-peer connection for the RTP data channel.

Here, a method referred to herein as RTSP with STUN/TURN is used by the integrated security system. The RTSP with STUN/TURN is a method in which the video streaming device is instructed over the control channel to stream its UDP data channel to a different network address than that of the other end of the control TCP connection (usually the UDP data is simply streamed to the IP address of the RTSP client). The result is that the RTSP or Reverse RTSP TCP channel can be relayed using the gateway and/or the server, while the RTP UDP data channel can flow directly from the video stream source device to the video stream client.

If a video stream source device does not support RTSP with STUN/TURN, the gateway can compensate for the device by relaying the RTSP control channel via the server to the RTSP client, and receiving the RTP data channel and then forwarding it directly to the RTSP with STUN/TURN enabled client. Encryption can also be added here by the gateway.

The integrated security system of an embodiment supports MPEG-4 over HTTP. MPEG-4 over HTTP is similar to MPEG-4 over RTSP except that both the RTSP control channel and the RTP data channel are passed over an HTTP TCP session. Here a single TCP session can be used, splitting it into multiple channels using common HTTP techniques like chunked transfer encoding.

The MPEG-4 over HTTP is generally supported by many video stream clients and server devices, and encryption can easily be added to it using SSL/TLS. Because it uses TCP for both channels, STUN/TURN techniques may not apply in the event that a direct peer-to-peer TCP session between client and server cannot be established.

As described above, encryption can be provided using SSL/TLS taking the form of HTTPS. And as with MPEG-4 over RTSP, a gateway can compensate for a stream source device that does not support encryption by relaying the TCP streams and encrypting the TCP stream between the gateway and the stream client. In many cases the gateway is an access point for the encrypted and private Wifi network on which the video stream source device is located. This means that communication between the gateway and the video stream source device is encrypted at the network level, and communication between the gateway and the video stream client is encrypted at the transport level. In this fashion the gateway can compensate for a device that does not support HTTPS.

As with Reverse RTSP, the integrated security system of an embodiment supports Reverse HTTP. Reverse HTTP includes taking a TCP-based protocol like HTTP, and reversing the roles of client and server when it comes to TCP session establishment. For example, in conventional HTTP the HTTP client is the one that establishes the TCP connection with the server (the server listens on a port for incoming connections). In Reverse HTTP, the HTTP client listens on a port for incoming connections from the server. Once the TCP connection is established, the HTTP client begins sending commands to the server over the TCP connection just as it would in standard HTTP.

When using Reverse HTTP, the video stream source is generally on a LAN, protected by a firewall. Having a device on the LAN initiate the connection to the HTTP client outside the firewall enables easy network traversal.

If the camera or video stream source inside the LAN does not support Reverse HTTP, then the gateway can facilitate the Reverse HTTP method by initiating separate TCP sessions with the video stream source device and with the Reverse HTTP client outside the LAN, and then relay all communication between the two sessions. In this fashion the gateway can compensate for a stream source device that does not support Reverse HTTP.

As described in the encryption description above, the gateway can further compensate for missing functionalities on the device such as encryption. If the device does not support encrypted HTTP (e.g., HTTPS), then the gateway can communicate with the device using HTTP, and then encrypt the TCP stream(s) before relaying out of the LAN to the Reverse HTTP client.

The servers of an embodiment can compensate for HTTP clients that do not support Reverse HTTP. In this situation, the server accepts TCP connections from both the HTTP client and the Reverse HTTP video stream source (which could be a gateway acting on behalf of a stream source device that does not support Reverse HTTP). The server then relays the TCP streams from the Reverse HTTP video stream source to the HTTP client. The server can further compensate for the encryption capabilities of the HTTP client; if the HTTP client does not support encryption then the server can provide an unencrypted stream to the HTTP client even though an encrypted stream was received from the Reverse HTTP streaming video source.

The integrated security system of an embodiment supports MJPEG as described above. MJPEG is a streaming technique in which a series of JPG images are sent as the result of an HTTP request. Because MJPEG streams are transmitted over HTTP, HTTPS can be employed for encryption and most MJPEG clients support the resulting encrypted stream. And as with MPEG-4 over HTTP, a gateway can compensate for a stream source device that does not support encryption by relaying the TCP streams and encrypting the TCP stream between the gateway and the stream client. In many cases the gateway is an access point for the encrypted and private Wifi network on which the video stream source device is located. This means that communication between the gateway and the video stream source device is encrypted at the network level, and communication between the gateway and the video stream client is encrypted at the transport level. In this fashion the gateway can compensate for a device that does not support HTTPS.

The integrated system of an embodiment supports Reverse HTTP. Reverse HTTP includes taking a TCP-based protocol like HTTP, and reversal of the roles of client and server when it comes to TCP session establishment can be employed for MJPEG streams. For example, in standard HTTP the HTTP client is the one who establishes the TCP connection with the server (the server listens on a port for incoming connections). In Reverse HTTP, the HTTP client listens on a port for incoming connections from the server. Once the TCP connection is established, the HTTP client begins sending commands to the server over the TCP connection just as it would in standard HTTP.

When using Reverse HTTP, the video stream source is generally on a LAN, protected by a firewall. Having a device on the LAN initiate the connection to the HTTP client outside the firewall enables network traversal.

If the camera or video stream source inside the LAN does not support Reverse HTTP, then the gateway can facilitate the Reverse HTTP method by initiating separate TCP sessions with the video stream source device and with the Reverse HTTP client outside the LAN, and then relay all communication between the two sessions. In this fashion the gateway can compensate for a stream source device that does not support Reverse HTTP.

As described in the encryption description above, the gateway can further compensate for missing functionalities on the device such as encryption. If the device does not support encrypted HTTP (e.g., HTTPS), then the gateway can communicate with the device using HTTP, and then encrypt the TCP stream(s) before relaying out of the LAN to the Reverse HTTP client.

The servers can compensate for HTTP clients that do not support Reverse HTTP. In this situation, the server accepts TCP connections from both the HTTP client and the Reverse HTTP video stream source (which could be a gateway acting on behalf of a stream source device that does not support Reverse HTTP). The server then relays the TCP streams from the Reverse HTTP video stream source to the HTTP client. The server can further compensate for the encryption capabilities of the HTTP client; if the HTTP client does not support encryption then the server can provide an unencrypted stream to the HTTP client even though an encrypted stream was received from the Reverse HTTP streaming video source.

The integrated security system of an embodiment considers numerous parameters in determining or selecting one of the streaming formats described above for use in transferring video streams. The parameters considered in selecting a streaming format include, but are not limited to, security requirements, client capabilities, device capabilities, and network/system capabilities.

The security requirements for a video stream are considered in determining an applicable streaming format in an embodiment. Security requirements fall into two categories, authentication and privacy, each of which is described below.

Authentication as a security requirement means that stream clients must present credentials in order to obtain a stream. Furthermore, this presentation of credentials should be done in a way that is secure from network snooping and replays. An example of secure authentication is Basic Authentication over HTTPS. Here a username and password are presented over an encrypted HTTPS channel so snooping and replays are prevented. Basic Authentication alone, however, is generally not sufficient for secure authentication.

Because not all streaming clients support SSL/TLS, authentication methods that do not require it are desirable. Such methods include Digest Authentication and one-time requests. A one-time request is a request that can only be made by a client one time, and the server prevents a reuse of the same request. One-time requests are used to control access to a stream source device by stream clients that do not support SSL/TLS. An example here is providing video access to a mobile phone. Typical mobile phone MPEG-4 viewers do not support encryption. In this case, one of the MPEG-4 over RTSP methods described above can be employed to get the video stream relayed to an server. The server can then provide the mobile phone with a one-time request Universal Resource Locator (URL) for the relayed video stream source (via a Wireless Application Protocol (WAP) page). Once the stream ends, the mobile phone would need to obtain another one-time request URL from the server (via WAP, for example) in order to view the stream again.

Privacy as a security requirement means that the contents of the video stream must be encrypted. This is a requirement that may be impossible to satisfy on clients that do not support video stream encryption, for example many mobile phones. If a client supports encryption for some video stream format(s), then the "best" of those formats should be selected. Here "best" is determined by the stream type priority algorithm.

The client capabilities are considered in determining an applicable streaming format in an embodiment. In considering client capabilities, the selection depends upon the

supported video stream formats that include encryption, and the supported video stream formats that do not support encryption.

The device capabilities are considered in determining an applicable streaming format in an embodiment. In considering device capabilities, the selection depends upon the supported video stream formats that include encryption, the supported video stream formats that do not support encryption, and whether the device is on an encrypted private Wifi network managed by the gateway (in which case encryption at the network level is not required).

The network/system capabilities are considered in determining an applicable streaming format in an embodiment. In considering network/system capabilities, the selection depends upon characteristics of the network or system across which the stream must travel. The characteristics considered include, for example, the following: whether there is a gateway and/or server on the network to facilitate some of the fancier video streaming types or security requirements; whether the client is on the same LAN as the gateway, meaning that network firewall traversal is not needed.

Streaming methods with the highest priority are peer-to-peer because they scale best with server resources. Universal Plug and Play (UPnP) can be used by the gateway to open ports on the video stream device's LAN router and direct traffic through those ports to the video stream device. This allows a video stream client to talk directly with the video stream device or talk directly with the gateway which can in turn facilitate communication with the video stream device.

Another factor in determining the best video stream format to use is the success of STUN and TURN methods for establishing direct peer-to-peer UDP communication between the stream source device and the stream client. Again, the gateway and the server can help with the setup of this communication.

Client bandwidth availability and processing power are other factors in determining the best streaming methods. For example, due to its bandwidth overhead an encrypted MJPEG stream should not be considered for most mobile phone data networks.

Device bandwidth availability can also be considered in choosing the best video stream format. For example, consideration can be given to whether the upstream bandwidth capabilities of the typical residential DSL support two or more simultaneous MJPEG streams.

Components of the integrated security system of an embodiment, while considering various parameters in selecting a video streaming format to transfer video streams from streaming source devices and requesting client devices, prioritize streaming formats according to these parameters. The parameters considered in selecting a streaming format include, as described above, security requirements, client capabilities, device capabilities, and network/system capabilities. Components of the integrated security system of an embodiment select a video streaming format according to the following priority, but alternative embodiments can use other priorities.

The selected format is UPnP or peer-to-peer MPEG-4 over RTSP with encryption when both requesting client device and streaming source device support this format.

The selected format is UPnP or peer-to-peer MPEG-4 over RTSP with authentication when the requesting client device does not support encryption or UPnP or peer-to-peer MPEG-4 over RTSP with encryption.

The selected format is UPnP (peer-to-peer) MPEG-4 over HTTPS when both requesting client device and streaming source device support this format.

The selected format is UPnP (peer-to-peer) MPEG-4 over HTTP when the requesting client device does not support encryption or UPnP (peer-to-peer) MPEG-4 over HTTPS.

The selected format is UPnP (peer-to-peer) MPEG-4 over RTSP facilitated by gateway or touchscreen (including or incorporating gateway components) (to provide encryption), when the requesting client device supports encrypted RTSP and the streaming source device supports MPEG-4 over RTSP.

The selected format is UPnP (peer-to-peer) MPEG-4 over HTTPS facilitated by gateway or touchscreen (including or incorporating gateway components) (to provide encryption) when the requesting client device supports MPEG-4 over HTTPS and the streaming source device supports MPEG-4 over HTTP.

The selected format is UPnP (peer-to-peer) MJPEG over HTTPS when the networks and devices can handle the bandwidth and both requesting client device and streaming source device support MJPEG over HTTPS.

The selected format is Reverse RTSP with STUN/TURN facilitated by the server when the streaming source device initiates SSL/TLS TCP to server, the streaming source device supports Reverse RTSP over SSL/TLS with STUN/TURN, and the requesting client device supports RTSP with STUN/TURN.

The selected format is Reverse RTSP with STUN/TURN facilitated by server and gateway or touchscreen (including or incorporating gateway components) when the gateway initiates SSL/TLS TCP to the server and to the streaming source device, the streaming source device supports RTSP, and the requesting client device supports RTSP with STUN/TURN.

The selected format is Reverse MPEG over RTSP/HTTP facilitated by the server when the streaming source device initiates SSL/TLS TCP to server, the streaming source device supports Reverse RTSP or HTTP over SSL/TLS, and the requesting client device supports MPEG over RTSP/HTTP.

The selected format is Reverse MPEG over RTSP/HTTP facilitated by server and gateway or touchscreen (including or incorporating gateway components) when the gateway initiates SSL/TLS TCP to server and to streaming source device, the streaming source device supports MPEG over RTSP or HTTP, and the requesting client device supports MPEG over RTSP/HTTP.

The selected format is UPnP (peer-to-peer) MJPEG over HTTP when the networks and devices can handle the bandwidth and when the requesting client device does not support encryption and does not support MPEG-4.

The selected format is Reverse MJPEG over HTTPS facilitated by the server when the streaming source device initiates SSL/TLS TCP to server, the streaming source device supports Reverse MJPEG over SSL/TLS, and the requesting client device supports MJPEG.

The selected format is Reverse MJPEG over HTTPS facilitated by server and gateway or touchscreen (including or incorporating gateway components) when the gateway initiates SSL/TLS TCP to the server and to the streaming source device, the streaming source device supports MJPEG, and the requesting client device supports MJPEG.

FIG. **24** is a block diagram showing camera tunneling, under an embodiment.

Additional detailed description of camera tunnel implementation details follow.

An embodiment uses XMPP for communication with a remote video camera as a lightweight (bandwidth) method for maintaining real-time communication with the remote camera. More specifically, the remote camera is located on another NAT (e.g., NAT traversal).

An embodiment comprises a method for including a remotely located camera in a home automation system. For example, using XMPP via cloud XMPP server to couple or connect camera to home automation system. This can be used with in-car cameras, cell phone cameras, and relocatable cameras (e.g., dropped in the office, the hotel room, the neighbor's house, etc.).

Components of an embodiment are distributed so that any one can be offline while system continues to function (e.g., panel can be down while camera still up, motion detection from camera, video clip upload etc. continue to work.

Embodiments extend the PSIA in one or more of the following areas: wifi roaming configuration; video relay commands; wifi connectivity test; media tunnel for live video streaming in the context of a security system; motion notification mechanism and configuration (motion heartbeat) (e.g., helps with scalable server); XMPP for lightweight communication (helps with scalable server, reduced bandwidth, for maintaining persistent connection with a gateway); ping request sent over XMPP as health check mechanism; shared secret authentication bootstrapping process; asynchronous error status delivery by the camera for commands invoked by the gateway if the camera is responsible for delivering errors to the gateway in an asynchronous fashion (e.g., gateway requests a firmware update or a video clip upload).

Embodiments extend the home automation system to devices located on separate networks, and make them useable as general-purpose communication devices. These cameras can be placed in the office, vacation home, neighbor house, software can be put onto a cell phone, into a car, navigation system, etc.

Embodiments use a global device registry for enabling a device/camera to locate the server and home to which it is assigned.

Embodiments include methods for bootstrapping and rebootstrapping of authentication credentials. The methods include activation key entry by installer into the cloud web interface. Activation key generation is based upon mac address and a shared secret between manufacturer and the service provider. Embodiments of the system allow activation of a camera with valid activation key that is not already provisioned in the global registry server.

Embodiments include a web-based interface for use in activating, configuring, remote firmware update, and reconfiguring of a camera.

Embodiments process or locate local wifi access points and provide these as options during camera configuring and re-configuring. Embodiments generate and provide recommendations around choosing a best wifi access point based upon characteristics of the network (e.g., signal strength, error rates, interference, etc.). Embodiments include methods for testing and diagnosing issues with wifi and network access.

Embodiments include cameras able to perform this wifi test using only one physical network interface, an approach that enables the camera to dynamically change this physical interface from wired to wifi. Embodiments are able to change the network settings (wifi etc) remotely using the same process.

Cameras of an embodiment can be configured with multiple network preferences with priority order so that the camera can move between different locations and the camera can automatically find the best network to join (e.g., can have multiple ssid+bssid+password sets configured and prioritized).

Regarding firmware download, embodiments include a mechanism to monitor the status of the firmware update, provide feedback to the end user and improve overall quality of the system.

Embodiments use RTSP over SSL to a cloud media relay server to allow live video NAT traversal to a remote client (e.g., PC, cell phone, etc.) in a secure manner where the camera provides media session authentication credentials to the server. The camera initiates the SSL connection to the cloud and then acts as a RTSP server over this connection.

Embodiments include methods for using NAT traversal for connecting to the cloud for remote management and live video access allows the integrated security components to avoid port forwarding on the local router(s) and as a result maintain a more secure local network and a more secure camera since no ports are required to be open.

Embodiments enable camera sensors (e.g., motion, audio, heat, etc.) to serve as triggers to other actions in the automation system. The capture of video clips or snapshots from the camera is one such action, but the embodiments are not so limited.

A camera of an embodiment can be used by multiple systems.

A detailed description of flows follows relating to the camera tunnel of an embodiment.

A detailed description of camera startup and installation follows as it pertains to the camera tunnel of an embodiment.

Activation Key

a. camera to follow same algorithm as ihub where activation key is generated from serial based upon a one-way hash on serial and a per-vendor shared secret.
b. Used com.icontrol.util.ops.activation.ActivationKeyUtil class to validate serialNo <-> activationKey.

Registry Request

[partner]/registry/[device type]/[serial]

a. new column in existing registry table for id type; nullable but the application treats null as "gateway".
b. rest endpoints allow adding with the new optional argument.
c. current serial and siteId uniqueness enforcement by application depends upon device type (for any device type, there should be uniqueness on serial; for gateway device type, there should be uniqueness on siteId; for other device types, there need not be uniqueness on siteId).
d. if no activation yet (e.g., no entry) then send dummy response (random but repeatable reply; may include predictable "dummy" so that steps below can infer.
e. add/update registry server endpoints for adding/updating entries.

If Camera has No Password

Camera retrieves "Pending Key" via POST to /<CredentialGatewayURL>/GatewayService/<siteID>/PendingDeviceKey.

a. pending key request (to get password) with serial and activation key.
b. server checks for dummy reply; if dummy then responds with retry backoff response.
c. server invokes pass-through API on gateway to get new pending key.
d. if device is found, then gateway performs validation of serial+activation key, returns error if mismatch.

e. if activation key checks out, then gateway checks pending key status.

f. if device currently has a pending key status, then a new pending password is generated.

g. gateway maintains this authorization information in a new set of variables on the camera device.

h. device-authorization/session-key comprises the current connected password.

i. device-authorization/pending-expiry comprises a UTC timestamp representing the time the current pending password period ends; any value less than the current time or blank means the device is not in a pending password state.

j. device-authorization/pending-session-key comprises the last password returned to the camera in a pending request; this is optional (device may choose to maintain this value in memory).

k. session-key and pending-session-key variables tagged with "encryption" in the device def which causes rest and admin to hide their value from client.

ConnectInfo Request

a. returns xmpp host and port to connect to (comes from config as it does for gateway connect info).

b. returns connectInfo with additional <xmpp> parameter.

Start Portal Add Camera Wizard

a. user enters camera serial, activation key.

b. addDevice rest endpoint on gateway called

c. gateway verifies activation key is correct.

d. gateway calls addDevice method on gapp server to add LWG_SerComm_iCamera_1000 with given serial to site.

e. Server detects the camera type and populates registry.

f. gateway puts device into pending password state (e.g., updates device-auth/pending-expiry point).

g. rest endpoints on gateway device for managing device pending password state.

h. start pending password state: POST future UTC value to device-auth/pending-expiry; device-auth/pending-expiry set to 30 minutes from time device was added.

i. stop pending password state: POST −1 to device-auth/pending-expiry.

j. check pending password state: GET device-auth/pending-expiry.

k. message returned with "Location" header pointing to relative URI.

l. user told to power on camera (or reboot if already powered on).

m. once camera connects, gateway updates device-auth/pending-expiry to −1 and device-auth/session-key with password and device/connection-status to connected

n. portal polls for device/connection-status to change to connected; if does not connect after X seconds, bring up error page (camera has not connected—continue waiting or start over).

o. user asked if wifi should be configured for this camera.

p. entry fields for wifi ssid and password.

q. portal can pre-populate ssid and password fields with picklist of any from other cameras on the site.

r. get XML of available SSIDs.

s. non-wifi option is allowed.

t. portal submits options to configure camera (use null values to specify non-wifi); upon success, message is returned with "Location" header pointing to relative URI.

u. checks configuration progress and extracting "status" and "subState" fields.

v. puts device state into "configuring"; upon error, puts device state into "configuration failure".

w. performs firmware upgrade if needed, placing device state into "upgrading"; upon error, puts device state into "upgrade failure".

x. upon configuration success, puts device state of "ok" and applies appropriate configuration for camera (e.g., resolutions, users, etc.).

y. if non-blank wifi parameters, automatically perform "wifi test" method to test wifi without disconnecting Ethernet.

z. portal wizard polls device status until changes to "ok" or "upgrade failure/"configuration failure" in "status" field, along with applicable, if any, with error code reason, in "subState" field; upon error, show details to user, provide options (start over, configure again, reboot, factory reset, etc)

aa. notify user they can move camera to desired location.

Camera Reboots

a. gets siteId and server URL from registry.

b. makes pending paid key request to server specifying correct siteId, serial and activation key; gets back pending password.

c. makes connectInfo request to get xmpp server.

d. connects over xmpp with pending password.

If Camera Reboots Again

a. get siteId and server URL from registry.

b. already has password (may or may not be pending) so no need to perform pending paid key request.

c. make connectInfo request to get xmpp server.

d. connect over xmpp with password.

xmpp Connect with Password

a. xmpp user is of the form [serial]@[server]/[siteId]

b. session server performs authentication by making passthrough API request to gateway for given SiteId.

c. Session xmpp server authenticates new session using DeviceKey received in GET request against received xmpp client credential.

d. If authentication fails or GET receives non-response, server returns to camera XMPP connect retry backoff with long backoff.

e. gateway device performs password management.

f. compares password with current key and pending key (if not expired); if matches pending, then update device-auth/session-key to be pending value, and clear out the device-auth/pending-expiry.

g. gateway device updates the device/connection-status point to reflect that camera is connected.

h. gateway device tracks the xmpp session server this camera is connected to via new point device/proxy-host and updates this info if changed.

i. if deviceConnected returns message, then session server posts connected event containing xmpp user to queue monitored by all session servers.

j. session servers monitor these events and disconnect/cleanup sessions they have for same user.

k. may use new API endpoint on session server for broadcast messages.

xmpp Connect with Bad Password

a. Upon receiving a new connection request, session server performs authentication by making passthrough API request to gateway for given SiteId.

b. Session xmpp server authenticates new session using DeviceKey received in above GET request against received xmpp client credential.

c. If authentication fails or GET receives non-response from virtual gateway.

d. Session server rejects incoming connection (is there a backoff/retry XMPP response that can be sent here).
e. Session server logs event.
f. Gateway logs event.

xmpp Disconnect

a. session server posts disconnected event to gateway (with session server name).
b. gateway updates the device/connected variable/point to reflect that camera is disconnected.
c. gateway updates the device/connection-status variable/point to reflect that camera is disconnected.
d. gateway clears the device/proxy-host point that contains the session host to this camera is connected.

LWGW Shutdown

a. During LWGW shutdown, gateway can broadcast messages to all XMPP servers to ensure all active XMPP sessions are gracefully shutdown.
b. gateways use REST client to call URI, which will broadcast to all XMPP servers.

To Configure Camera During Installation

a. applies all appropriate configuration for camera (e.g., resolutions, users, etc).
b. returns message for configuration applied, wifi test passed, all settings taken. returns other response code with error code description upon any failure.

To Reconfigure Wifi SSID and Key

a. returns message for wifi credentials set.
b. returns other response code with error code description upon any failure.

API Pass-Through Handling for Gateway Fail-Over Case

a. When performing passthrough for LWGW, the API endpoint handles the LWGW failover case (e.g., when gateway is not currently running on any session server).
b. passthrough functions in the following way: current session server IP is maintained on the gateway object; server looks up gateway object to get session IP and then sends passthrough request to that session server; if that request returns gateway not found message, server error message, or a network level error (e.g., cannot route to host, etc.), if the gateway is a LWGW then server should lookup the primary/secondary LW Gateway group for this site; server should then send resume message to primary, followed by rest request; if that fails, then server send resume message to secondary followed by rest request
c. alternatively, passthrough functions in the following way: rather than lookup session server IP on gateway object, passthrough requests should be posted to a passthrough queue that is monitored by all session servers; the session server with the Gateway on it should consume the message (and pass it to the appropriate gateway); the server should monitor for expiry of these messages, and if the gateway is a LWGW then server should lookup the primary/secondary LW Gateway group for this site; server should then send resume message to primary, followed by rest request; if that fails, then server send resume message to secondary followed by rest request.

A detailed description follows for additional flows relating to the camera tunnel of an embodiment.

Motion Detection

a. camera sends openhome motion event to session server via xmpp.
b. session server posts motion event to gateway via passthrough API.
c. gateway updates the camera motion variable/point to reflect the event gateway updates the camera motion variable/point to reflect the event

Capture Snapshot

a. gateway posts openhome snapshot command to session server with camera connected.
b. gateway sends command including xmpp user id to xmpp command Queue monitored by all session servers.
c. session server with given xmpp user id consumes command and sends command to camera (command contains upload URL on gw webapp).
d. gateway starts internal timer to check if a response is received from camera (e.g., 5 sec wait window).
e. if broadcast RabbitMQ not ready, then gateway will use device/proxy-host value to know which session server to post command to.
f. session server sends command to camera (comprises upload URL on gw webapp)
g. Example XML body:

```
<MediaUpload>
<id>1321896772660</id>
<snapShotImageType>JPEG</snapShotImageType>
<gateway_url>[gatewaysyncUrl]/gw/GatewayService/SPutJpg/s/[siteId]/
[deviceIndex]/[varValue]/[varIndex]/[who]/[ts]/[HMM]/[passCheck]/</
<failure_url>[gatewaysyncUrl]/gw/GatewayService/SPutJpgError/s/
[siteId]/[deviceIndex]/[varValue]/[varIndex]/[who]/[ts]/[HMM]/
[passCheck]/</
</MediaUpload>
```

h. session server receives response to sendRequestEvent from camera and posts response to gateway.
i. camera uploads to upload URL on gw webapp.
j. passCheck can be verified on server (based upon gateway secret); alternatively, the OpenHome spec calls for Digest Auth here.
k. endpoint responds with message digest password if the URI is expected, otherwise returns non-response.
l. gw webapp stores snapshot, logs history event.
m. event is posted to gateway for deltas.

Capture Clip

a. gateway posts openhome video clip capture command to session server with camera connected.
b. gateway sends command including xmpp user id to xmpp command Queue monitored by all session servers.
c. session server with given xmpp user id consumes command and sends command to camera (command comprises upload URL on gw webapp).
d. gateway starts internal timer to check if a response is received from camera (e.g., 5 sec wait window).
e. session server sends command to camera (comprises upload URL on gw webapp).
f. Example URI from session server to camera: /openhome/streaming/channels/1/video/upload
g. Example XML body:

```
<MediaUpload>
<id>1321898092270</id>
<videoClipFormatType>MP4</videoClipFormatType>
<gateway_url>[gatewaysyncUrl]/gw/GatewayService/SPutMpeg/s/
[siteId]/[deviceIndex]/[varValue]/[varIndex]/[who]/[ts]/[HMM]/
[passCheck]/</<failure_url>[gatewaysyncUrl]/gw/GatewayService/
SPutMpegFailed/s/[siteId]/[deviceIndex]/[varValue]/[varIndex]/[who]/
[ts]/[HMM]/[passCheck]/</
</MediaUpload>
```

h. session server receives response to sendRequestEvent from camera and posts response to gateway.
i. camera uploads to upload URL on gw webapp.
j. passCheck can be verified on server (based upon gateway secret).
k. alternatively, spec calls for Digest Auth here.
l. endpoint responds with message digest password if the URI is expected, otherwise returns non-response.
m. gw webapp stores video clip, logs history event.
n. event is posted to gateway for deltas.

Live Video (Relay)

a. Upon user login to portal, portal creates a media relay tunnel by calling relayAPImanager create.
b. RelayAPImanager creates relays and sends ip-config-relay variable (which instructs gateway to create media tunnel) to gateway.
c. Upon receiving media tunnel create ip-config-relay command, gateway posts openhome media channel create command to session server with camera connected.
d. session server sends create media tunnel command to camera (comprises camera relay URL on relay server).
e. Example URI from session server to camera: /openhome/streaming/mediatunnel/create
f. Example XML body:

```
<CreateMediaTunnel>
<sessionID>1</sessionID>
<gatewayURL>TBD</gatewayURL>
<failureURL>TBD</failureURL>
</CreateMediaTunnel>
```

g. GatewayURL is created from relay server, port, and sessionId info included within ip-config-relay variable.
h. camera creates a TLS tunnel to relay server via POST to <gatewayURL>.
i. When user initiates live video, portal determines user is remote and retrieves URL of Relay server from relay-APImanager.
j. Upon receiving a user pole connection on the relay server (along with valid rtsp request), relay sends streaming command to camera: example: rtsp:://openhome/streaming/channels/1/rtsp
k. Upon user portal logout, portals calls relayAPImanager to terminate media tunnel.
l. RelayAPImanager send ip-config-relay variable to terminate media tunnel.
m. Gateway sends destroy media tunnel command to camera via XMPP.

Camera Firmware Update

a. Gateway checks camera firmware version; if below minimum version, gateway sends command to camera (via session server) to upgrade firmware (command: /openhome/system/updatefirmware).
b. Gateway checks firmware update status by polling: /openhome/system/updatefirmware/status.
c. Gateway informs portal of upgrade status.
d. Camera auto-reboots after firmware update and reconnects to Session server.

Camera First-Contact Configuration

a. After a camera is added successfully and is connected to the session server for the first time, gateway performs first contact configuration as follows.
b. Check firmware version.
c. Configure settings by: download config file using /openhome/system/configurationData/configFile; or configure each category individually (configure video input channel settings—/openhome/system/video/inputs/channels; onfigure audio input channel settings (if any)—/openhome/system/audio/inputs/channels; configure video streaming channel settings—/openhome/streaming/channels; configure motion detection settings—example: PUT /openhome/custom/motiondetection/pir/( ); configure event trigger settings—example: PUT /openhome/custom/event).
d. Reboot camera (/openhome/system/factoryreset) if camera responds with reboot required.

More particularly, details follow of a camera interface specification (LWG CAMERA INTERFACE SPECIFICATION) in an example embodiment of the integrated security system described herein.

1 Introduction

This document describes the communication protocol used between an iControl OpenHome-compatible Camera (OpenHome Camera) and the iControl Gateway. The OpenHome camera is an IP camera that supports the iControl OpenHome Camera Interface Specification and its associated requirements. The iControl Gateway is composed of several logical components—Registry Gateway, Credential Gateway, Premise Gateway (optional), and the Session Gateway. The OpenHome camera communicates with the iControl Gateway over IP networks (could be LAN or Internet) using standard network protocols such as HTTP/HTTPS, and XMPP (RFC 6120). In one deployment scenario, one or more OpenHome cameras are deployed at the customer premise in conjunction with a Premise Gateway, communicating with iControl Registry, Credential, and Session Gateways over the Internet (see FIG. **25**). In another deployment scenario, OpenHome cameras are deployed at the customer premise without the Premise Gateway (see FIG. **26**). Both deployment scenarios are supported by this interface specification.

Henceforth in this document, the OpenHome-compatible camera is referred to as Camera. The iControl Session Gateway, is simply referred to as the Session Gateway, the iControl Registry Gateway, is referred to as the Registry Gateway, the iControl Premise Gateway is referred to as the Premise Gateway, and the iControl Credential Gateway is referred to as the Credential Gateway. Finally, the collective name for all three gateway logical components is referred to as the iControl Gateway.

2 Communication Interface Overview

2.1 Camera Deployment with Premise Gateway

FIG. **25** illustrates a deployment scenario where the Camera is deployed in conjunction with a Premise Gateway at the customer premise.

Under this deployment scenario, the Camera and the Premise Gateway are deployed within the customer premise. The Local Bootstrap Procedures interface is used to discover and configure the Camera for subsequent accesses. The HTTPS Command/Notification interface is a bi-directional interface used by the Gateway to send Commands to the Camera or for the Camera to send Notifications to the Gateway. The Secure Streaming Media Channels interface is used to tunnel live RTSP or MJPEG streams from Camera to Gateway. The Media Upload Channels interface is used to

upload video and image from Camera to Gateway. The HTTPS Notification interface is just a subset of the Command/Notification interface and is used by the Camera to post Notifications to the Gateway. An OpenHome camera when deployed in the Premise Gateway deployment scenario must support all four interface types described above.

2.2 Camera Deployment with Off-Premise Gateway

FIG. **26** illustrates a deployment scenario where the Camera is deployed without requiring a Premise Gateway at the customer premise.

Under this deployment scenario, the use of Premise Gateway within the customer premise is not required (but could optionally be deployed). The Off-Premise Bootstrap Procedures interface is used to discover and configure the Camera with siteID, shared secret, Session Gateway address, and other run-time parameters. The XMPP Command/Notification interface is a persistent bi-directional interface used by the Gateway to send Commands to the Camera or for the Camera to send Notifications to the Gateway. The Secure Streaming Media Channels interface is used to tunnel live RTSP or MJPEG streams from Camera to Gateway. The Media Upload Channels interface is used to upload video and image from Camera to Gateway. An OpenHome camera when deployed without an associated Premise Gateway must support all four interfaces described above.

2.3 Deployment Mode and Interface Requirements

	Premise Gateway Deployment Mode		Off-Premise Gateway Deployment Mode	
Interfaces	Mandatory	Optional	Mandatory	Optional
Local Bootstrap Procedures	✓			✓
Off-Premise Bootstrap Procedures		✓	✓	
HTTPS Command/ Notification	✓		✓	
XMPP Command/ Notification		✓	✓	
Secure Media Streaming Channels	✓		✓	
Media Upload Channels	✓		✓	

3 Camera and Gateway Prerequisites

3.1 Camera Prerequisites

Camera should support all mandatory features described in the iControl OpenHome Camera Requirements Matrix document. Furthermore, depending on the deployment mode supported, this document assumes the following parameters are pre-configured for each Camera:

Camera Prerequisites for On-Premise Gateway Deployment Mode

1. Serial Number—each camera is pre-configured with a unique 12+ digit alpha/numeric number. Serial number is determined by the camera manufacturer.
2. iControl root Certificate Authority (CA) certificates—each camera is pre-configured with a list of root CA certificates provided by iControl
3. Camera supports TLS v1.0 outbound connection per RFC 2246 (TLS Protocol Version 1.0)
   a. Camera supports TLS host name verification—certificate received over TLS must match hostname Camera is sending. Wildcard certificate must be supported.
   b. Camera supports TLS with AES 128 or AES 256 encryption.
4. Administrator account username and password—each camera is pre-configured with a pre-defined administrator username/password (e.g., Administrator/password).
5. UPnP USN—each camera is pre-configured with a pre-defined Universal Plug and Play (UPnP) Unique Service Number (USN) specified by iControl to be used as part of Simple Service Discovery Protocol (SSDP) discovery procedures.
6. HTTP server mode is enabled to listen on port 80

Camera Prerequisites for Off-Premise Gateway Deployment Mode

1. Serial Number—each camera is pre-configured with a unique alpha/numeric number. Serial number is determined by the camera manufacturer and is recommended to be at least 12 digits in length.
2. iControl root Certificate Authority (CA) certificates—each camera is pre-configured with a list of root CA certificates provided by iControl
3. Camera supports TLS v1.0 outbound connection per RFC 2246 (TLS Protocol Version 1.0)
   a. Camera supports TLS host name verification—certificate received over TLS must match hostname Camera is sending. Wildcard certificate must be supported.
   b. Camera supports TLS with AES 128 or AES 256 encryption.
4. Activation Key—each camera is pre-configured with a unique 20-digit alpha/numeric activation key. Activation Key can be stored within the camera's static storage or can be generated on demand at the Camera by using a camera's Serial Number and a manufacturer defined master key. See Appendix C—Activation key Derivation Procedures for a description of the algorithm for calculating activation key from a Camera's serial number.
5. Registry Gateway URL—each camera is pre-configured with an URL provided by iControl

3.2 Camera Optimal WiFi AP/Repeater Selection

For deployment scenarios where WiFi repeaters are utilized or multiple WiFI APs shared the same SSID, a Camera shall periodically compare received signal strengths of all candidate AP/repeaters, and under the right conditions, re-establish connection to the WiFi AP/repeater with the best signal quality. General guidelines for this feature include:

- Camera shall periodcally compare RSSI signal strengths from all possible BSSIDs serving the same SSID in use by the Camera. Time interval between checks is governed by check interval.
- If Camera detects alternate AP(s)/repeater(s) with received RSSI that is higher than existing connection by the switch threshold, the Camera shall disconnect from the current BSSID and re-establish connection with the AP/repeater with the higher signal strength. Re-establishment may be postponed until end of media streaming or upload session.
- Switching hysterisys—Once switched from one BSSI to another, Camera shall not switch sooner than min switch time.
- Check interval, switch threshold, and min switch time are all configurable parameters that can be managed via /OpenHome/System/Network/interfaces/<ID>/ wireless resource.

3.3 Gateway Prerequisites

The iControl Gateway (including Premise Gateway, Session Gateway, Credential Gateway, Registry Gateway, etc.)

should support all mandatory resources/services required by the Camera in order process Commands or Notifications. For example, if a Gateway sends a Command to a Camera that includes mandatory URL for upload, notification, etc., the Gateway must support the specified services when accessed via the URL. At the same time, if a Gateway did not configure a Camera with an upload resource URL, the Camera cannot assume the upload service is available at the Gateway. For example, if no event trigger notifications are enabled at the Camera, the Camera cannot assume the upload Gateway resource will be available.

4 Communication Interface Detail Specifications

Each of the interface types above is described in more detail in the following subsections. The Local Bootstrap Procedures and the Off-Premise Bootstrap Procedures are described in Appendices A and B, respectively.

4.1 Interface Type 1—HTTPS or XMPP Command/Notification Channel

The Command/Notification channel is a bi-directional, asynchronous communication interface that allows for Gateway to send commands to the Camera or for Camera to send Notification Events to the Gateway. There are 2 sub-types of Interface Type 1—XMPP or HTTPS based Command/Notification Channel. The XMPP type, type 1A, uses XMPP as the underlying transport protocol, whereas the HTTPS type, type 1B, relies on HTTPS as the transport protocol. For most applications, only one of the two interface sub-types is required. Each of the two sub-types is described in more detail below. Henceforth in this document, Commands refer to Gateway originated commands from Gateway to Camera, and Notifications refer to Camera originated notifications from Camera to Gateway. Interface Type 1B can only be used if the Premise Gateway is deployed at the same premise as the Camera, whereas Interface Type 1A can be utilized independent of where the Premise Gateway is deployed.

4.1.1 Interface Type 1A—XMPP Command/Notification Channel

The XMPP Command/Notification channel is a bi-directional, asynchronous communication interface that allows for Gateway to send commands to the Camera or for Camera to send Notification Events to the Gateway. This persistent channel is implemented using the XMPP protocol as described in RFC 6120 (Extensible Messaging and Presence Protocol: Core) as the underlying transport, and utilizing messages compliant with iControl's XML stanzas syntax to convey commands and notifications. The iControl XML stanza is a XML wrapper around HTTP-like request/response messages. Detailed definitions of Command and Notifications messages along with their parameters are described in later sections.

A typical channel establishment/disconnect process is described below:

1. Camera receives Session Gateway hostname and port from Credential Gateway per Appendix B—Off-Premise Bootstrap Procedures.
2. Camera opens a TCP connection to Session Gateway (may need to resolve IP address using DNS)
3. Negotiate TLS encryption between Camera and Gateway using Gateway SSL certificates pre-configured in the Camera. Note, no client certificate is required (includes opening 2 XML streams to start TLS negotiation).
4. Open XML streams (one from Camera to Gateway, the other the reverse direction) by sending XMPP XML stream headers.
5. Authenticate using XMPP's SASL (Simple Authentication and Security Layer) using <Serial Number>, <siteID>, and <SharedSecret>. <Serial Number>_<siteID> is used as the Simple Username format.
6. Exchange iControl compliant XML stanzas between Camera and Gateway
   a. Upon receiving a Command stanza, the Camera executes task(s) specified in the received Commands and reply with status message. If a Command requires asynchronous execution, the Camera should execute tasks after initial response and sends Notifications to Gateway (if required).
   b. For Notification stanzas, the Gateway akes appropriate actions and sends acknowledgements.
7. Close XML streams
8. Close TCP connection

4.1.1.1 iControl XMPP Usage Clarifications

The iControl Command/Notification Channel conforms to the XMPP standard with the following further clarifications:

1. Client address—<Serial Number>_<siteID>@<XMPP host>/<siteID> will be used as the client address (e.g., Jabber ID). Where <Serial Number> is embedded in the Camera, <siteID> is derived via Bootstrap Procedures, and <XMPP host> is defined in /OpenHome/System/XMPP/Gateway.
2. Password used in SASL—<SharedSecret> derived via Bootstrap Procedures and will be used as the SASL client password.
3. TLS encryption—Camera must support XMPP TLS encryption mode
4. SASL authentication—Camera must support SASL authentication using client address and credential supplied by the Gateway.
5. XML Streams—2 unidirectional XMPP XML streams will be used over the same TCP connection. One stream from Camera to Gateway and the other from Gateway to Camera.
6. XML Stanzas—Only the <iq> stanza type will be used
7. Reconnection (section 3.3)—Camera backoff wait should exponentially increase per XMPP standard section 3.3, but maximum delay should not be greater than <maxMediaUploadWaitDuration>
8. Others clarifications will be provided in a future version of this document

4.1.1.2 iControl XMPP XML Stanzas Definition

Command and Notification request and response messages are sent using the following XML stanza schema:

TABLE 1

iControl XMPP XML Stanza Schema

```
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
    targetNamespace="http://icontrol.com/http-tunnel/v1"
xmlns:smap="http://icontrol.com/http-tunnel/v1"
    elementFormDefault="qualified"
    attributeFormDefault="unqualified">
    <xs:annotation>
        <xs:documentation>
    This schema defines data types in the HTTP Tunnel request/response
    (used for XMPP, Gateway passthru, etc).
    The primary purpose is to facilitate complex type binding between the
    XML data and native objects such as JavaBeans.
        </xs:documentation>
    </xs:annotation>
    <xs:complexType name="arg">
        <xs:simpleContent>
            <xs:extension base="xs:string">
                <xs:attribute name="name" type="xs:string"
```

TABLE 1-continued

iControl XMPP XML Stanza Schema

```
                use="required"/>
            </xs:extension>
        </xs:simpleContent>
    </xs:complexType>
    <xs:complexType name="body" mixed="true">
        <xs:sequence>
            <xs:any namespace="##any" processContents="lax"
            minOccurs="0"/>
        </xs:sequence>
        <xs:attribute name="encoded" type="xs:string"
        use="optional"/>
    </xs:complexType>
    <xs:complexType name="http-tunnel">
        <xs:sequence>
            <xs:choice>
                <xs:element name="request" type="request"
minOccurs="0" maxOccurs="1" />
                <xs:element name="request" type="response"
minOccurs="0" maxOccurs="1" />
            </xs:choice>
        </xs:sequence>
    </xs:complexType>
    <xs:complexType name="request">
        <xs:sequence>
            <xs:element name="header" type="arg" minOccurs="0"
maxOccurs="unbounded"/>
            <xs:element name="param" type="arg" minOccurs="0"
maxOccurs="unbounded"/>
            <xs:element name="body" type="body" minOccurs="0"
            maxOccurs="1"/>
        </xs:sequence>
        <xs:attribute name="action" type="xs:<CommandURL> |
```

TABLE 1-continued

iControl XMPP XML Stanza Schema

```
<NotificationURL>" use="required"/>
        <xs:attribute name="method" type="xs:string"
        use="required"/>
    </xs:complexType>
    <xs:complexType name="response">
        <xs:sequence>
            <xs:element name="header" type="arg" minOccurs="0"
maxOccurs="unbounded"/>
            <xs:element name="body" type="body"/>
        </xs:sequence>
        <xs:attribute name="code" type="xs:int" use="required"/>
    </xs:complexType>
</xs:schema>
```

This XML stanza schema allows HTTP-type requests and responses to be tunneled across a XMPP channel. <CommandURL> and <NotificationURL> are defined in the Command/Notification Data Types Section. The "method" attribute reflects HTTP methods such as GET, POST, PUT, DELETE, etc. and are defined by the specific <CommandURI> or <NotificationURI> types. HTTP request headers can vary among different Commands and Notifications; these headers can be enumerated using one or more "header" elements in the stanza.

4.1.1.3 Example XML Stanzas

The example below illustrates a Command from Gateway to set wireless configurations for the Camera's network interface **1**. See Section 5.4.4 for URI and XML definitions.

```
Gateway –> Camera
<iq type="set" id="1234567"
from="00d022111234_006035123456@gsess.icontrol.com/006035123456">
    <http-tunnel xmlns="http://icontrol.com/http-tunnel/v1">
        <request method="GET"
                action="/System/Network/interfaces/1/wireless">
                <header name="Host">192.168.2.52</header>
                <header name="Authorization">Basic
tWNgOGdla0Y6bG5IMXdQQ2g=</header>
                <headername="Pragma">no-cache</header>
                <headername="Cache-Control">no-cache</header>
                <header name="Date">Sat, 11 Jun 2011 18:23:51 GMT</header>
                <body name="body"></body >
        </request>
    </http-tunnel>
</iq>
Camera –> Gateway
<iq type="result" id="1234567"
to="00d022111234_006035123456@gsess.icontrol.com/006035123456">
    <http-tunnel xmlns="http://icontrol.com/http-tunnel/v1">
        <response code="200">
            <header name="Content-Type">application/xml; charset="UTF-8"</header>
            <header name="Content-length"><size of the xml body below in bytes></header>
                <body name="body">
                    <Wireless version="1.0" xmlns="urn:icontrol.com/openhome/v1">
                        <enabled>true</enabled>
                        <wirelessNetworkMode>infrastructure</wirelessNetworkMode>
                        <ssid>iHub_00622011211</ssid>
                        <WirelessSecurity>
                            <securityMode>WPA2-personal</securityMode>
                            <WPA>
                                <algorithmType>AES</algorithmType>
                                <sharedKey>mySecretKey</sharedKey>
                            </WPA>
                        </WirelessSecurity>
                    </Wireless>
                </body>
        </response>
    </http-tunnel>
</iq>
```

4.1.2 Interface Type 1B—HTTP/HTTPS Command/Notification Channel

The HTTP/HTTPS Command/Notification channel is a bi-directional, asynchronous communication interface that allows for Premise Gateway to send commands to the Camera or for Camera to send Notification Events to the Premise Gateway. The purpose of this interface is similar to the XMPP Command/Notification Channel sub-type, except the underlying transport protocol is HTTP/HTTPS instead of XMPP. Multiple messages can be sent over each connection due to the use of HTTP 1.1 persistent connection (RFC 2616). However, Unlike XMPP, HTTP/HTTPS (even with the use of HTTP 1.1 persistent option) may terminate a connection after an extended idle period. It is the responsibility of the initiating entity (either Camera or Premise Gateway) to re-establish a new connection when a new message is to be delivered. Detailed definitions of Command and Notifications messages along with their parameters are described in Section 5. This section describes the HTTPS transport used to send/receive these messages.

Commands are always send from Gateway to Camera via inbound HTTP/HTTPS connections to the Camera.

Notifications can be delivered from Camera to Gateway via either 1) Camera outbound HTTPS connection or 2) Camera inbound polling via the "/OpenHome/System/Poll/notifications" retrieval Command.

A typical Command/response process is described below:

Pre-Requisites:

Camera was updated with a valid server SSL certificate per Section 5.7.1.

Gateway Originated Command Channel Setup Process:

1. Gateway opens a TCP connection to Camera
2. Negotiate TLS encryption between Camera and Gateway using Camera's server SSL certificates configured per Section 5.7.1.
3. Gateway sends HTTPS requests to Camera using HTTPS method and URI specific to each Command
4. Camera authenticates request using digest authentication
5. Camera processes received Command via the following sub-steps
   a. Camera executes task(s) specified in the received Command(s). For Commands that require asynchronous execution, Camera should execute tasks after step b.
   b. Camera sends a response message to Gateway using HTTP response procedures
6. The TCP/TLS connection is kept open for a pre-set duration due to the use of HTTP 1.1 persistent connection option.
7. If connection is idle for a pre-set duration, Close TCP connection

Camera Originated Outbound Notification Channel Setup Process:

1. Camera opens a TCP connection to Gateway
2. Negotiate TLS encryption between Camera and Gateway using Gateway's server SSL certificates. Camera must utilize TLS host name verification while establishing connection.
3. Camera sends HTTPS requests to Gateway using HTTPS method and URI specific to each Notification
4. Gateway authenticates request using digest authentication
5. Gateway processes received Notification via the following sub-steps
   a. Gateway executes task(s) specified in the received Notification(s).
   b. Gateway sends a response message to Gateway using HTTP response procedures
6. The TCP/TLS connection is kept open for a pre-set duration due to the use of HTTP 1.1 persistent connection option.
7. If connection is idle for a pre-set duration, Close TCP connection

Camera Notification Via Inbound Polling Process:

In lieu of using Outbound Notification Channel, Notifications can be delivered to Gateway via Inbound Polling. The following is a typical delivery process:

1. Gateway opens a TCP connection to Camera
2. Negotiate TLS encryption between Camera and Gateway using Camera's server SSL certificates configured per Section 5.7.1.
3. Gateway sends /OpenHome/System/Poll/notifications request to Camera
4. Camera waits for new Notification(s) to arrive
5. If a Notification does not arrive before <linger> time expiration, Camera responds with 200 OK with XML body that does NOT contain any Notification
6. If one or more Notification arrive before <linger> time expiration, Camera responds with 200 OK including XML body containing one more more Notifications
7. Upon receiving 200 OK, Gateway repeats loop starting with Step 3

4.1.2.1 Gateway Originated Commands

To issue a Gateway originated command, Gateway initiates HTTP/HTTPS connection to Camera via method and URI <CommandURI> specified by the Command (see Section 5 Command/Notification Data Types). HTTP 1.1 persistent connection mode should be utilized in order to optimize connection usage. Only accounts with administration rights can issue Commands the Camera, with the only exception being that User accounts can access video streaming and picture snapshot.

TABLE 2

HTTPS Command/Notification Channel Setup Message Format

Purpose	Sends Command to Camera
Message Format	HTTPS <CommandURI> HTTP/1.1
Authentication	Digest authentication using a valid Camera user or admin credential (see /OpenHome/Security/AAA/accounts for Camera user/admin accounts)
Mandatory Request Headers	Authorization
Mandatory Response Headers	Content-Type, Connection, Content-Length
Request Body	Varies depending on command, see Section 5.
Camera response	Varies depending on command, see Section 5.

TABLE 2-continued

HTTPS Command/Notification Channel Setup Message Format	
Response body	Varies depending on command, see Section 5.
Variables	
CommandURI	Method and URI Varies depending on command, see Section 5.
accountCredential	Base64 encoding of (<adminUser>:<password>), where <adminUser> and <password> are defined in /OpenHome/Security/AAA/accounts.

4.1.2.2 Camera Originated Notifications

For Interface Type 1B (HTTPS Command/Notification Channel), Notifications can be delivered from Camera to Gateway via either 1) Camera outbound HTTPS connection or 2) Camera inbound polling via the "/OpenHome/System/Poll/notifications" retrieval Command (Note, the third delivery method, using XMPP Camera-to-Gateway channel, is utilized only in the XMPP Command/Notification Channel). Depending on the configuration of the notification URL parameter, the Camera delivers Notifications using one of the three methods above. For example, the following Notification URL specifies using the Camera outbound HTTPS Notification method:

https://gateway.icontrol.com/<eventAlertURL>

whereas, the following Notification URL specifies using Camera inbound polling for Notification delivery.

poll://<eventAlertURL>

Each of the two Notification delivery types is described in more detail below.

4.1.2.2.1 Camera Originated Outbound Notifications

To initiate a Camera originated outbound Notification, Camera starts HTTP/HTTPS connection to Gateway via method and URI <NotificationURI> specified by the Notification (see Section 5). HTTP 1.1 persistent connections should be utilized in order to optimize connection usage. The following request format is used:

TABLE 3

Camera Originated Outbound Notification Message Format	
Purpose	Sends Notification to Gateway
Message Formats	HTTPS <NotificationURI> HTTP/1.1 or HTTP <NotificationURI> HTTP/1.1 Note: only one Command utilizes the non-secure HTTP mode (see Section 5.)
Authentication	Digest authentication using <SerialNumber> and <SharedSecret>
Mandatory Request Headers	Host, Authorization Pragma: no-cache, Cache-Control: no-cache, Date
Mandatory Response Headers	Content-Type, Connection, Content-Length
Request Body	Varies depending on command, see Section 5.
Camera response Variables	Varies depending on command, see Section 5.
NotificationURI	Method and URI Varies depending on command, see Section 5.
basicCredential	Base64 encoding of (<SerialNumber>:<SharedSecret>), where <SerialNumber> and <SharedSecret> are defined in Section 5.

4.1.2.2.2 Notifications Via Inbound Polling

If specified in the Notification URL (e.g., poll://<url>), Camera will queue Notifications for retrieval by the Gateway instead of sending Notifications via outbound HTTP/HTTPS connections. The "/OpenHome/System/Poll/notifications" Command is used to establish a connection from Gateway to Camera for polling Notifications. In this mode, Gateway will establish a semi-persistent HTTP/HTTPS connection to the Camera and wait (or linger) for Notification events. Upon receiving the /OpenHome/System/Poll/notifications Command from the Gateway, if the Camera has Notification events available, it will respond with 200 OK containing Notifications right away. However, if no Notification is pending, the Camera will wait for a Notification or until the <linger> duration has expired before responding with 200 OK. Upon receiving a 200 OK response, the Gateway will issue another /OpenHome/Sytem/Poll/notifications Command to poll for new Notifications. Due to the use of HTTP 1.1 persistent connection, more than one request-response sequences may be sent over a single underlying TCP connection.

4.1.2.3 Examples

Gateway Originated Command

The example below illustrates a Command from Gateway to retrieve wireless configurations for the Camera's network interface **1**. See Section 5.4.4 for URI and XML definitions.

```
Gateway->Camera
GET /System/Network/interfaces/1/wireless HTTP/1.1
Host: 192.168.2.52
Date: Sat, 11 Jun 2011 18:23:51 GMT
Camera->Gateway
HTTP/1.1 401 Unauthorized
Host: 192.168.1.50
Date: Sat, 11 Jun 2011 18:23:60 GMT
WWW-Authenticate: Digest realm="Administrator@192.168.1.50",
        qop="auth,auth-int",
        nonce="dcd98b7102dd2f0e8b11d0f600bfb0c093",
        opaque="5ccc069c403ebaf9f0171e9517f40e41"
Gateway->Camera
GET /System/Network/interfaces/1/wireless HTTP/1.1
Host: 192.168.2.52
Date: Sat, 11 Jun 2011 18:23:51 GMT
Authorization: Digest username="<SerialNumber>",
        realm=" mediagw@
        server.icontrol.com",nonce="dcd98b7102dd2f0e8b11d0f600bfb0c093",
        uri="/vidupload/icamera/1308677301445/43/f/889229dcd864691ffcd4bff342153a
        00/",
    qop=auth,
    nc=00000001,
    cnonce="0a4f113b",
    response="6629fae49393a05397450978507c4ef1",
    opaque="5ccc069c403ebaf9f0171e9517f40e41"
Camera->Gateway
HTTP/1.1 200 OK
Content-Type: application/xml; charset="UTF-8"
Connection: Keep-Alive
Content-Length: <size of the xml body below in bytes>
<Wireless version="1.0">
        <enabled>true</enabled>
        <wirelessNetworkMode>infrastructure</wirelessNetworkMode>
        <ssid>iHub_00622011211</ssid>
        <WirelessSecurity>
                <securityMode>WPA2-personal</securityMode>
                <WPA>
                    <algorithmType>AES</algorithmType>
                    <sharedKey>mySecretKey</sharedKey>
                </WPA>
        </WirelessSecurity>
</Wireless>
```

Camera Originated Outbound Notification

The following example illustrates a Notification from Camera indicating a motion event.

```
Camera->Gateway
POST
/gateway.icontrol.com/GWServices/EventAlert/1308677301445/43/f/889229dcd864691ff
cd4bff342153a00/ HTTP/1.1
Host: gateway.icontrol.com
Date: Sat, 11 Jun 2011 18:23:51 GMT
...
Gateway ->Camera
HTTP/1.1 401 Unauthorized
Host: server.icontrol.com
Date: Sat, 11 Jun 2011 18:23:60 GMT
WWW-Authenticate: Digest realm="mediagw@gateway.icontrol.com",
        qop="auth,auth-int",
        nonce="dcd98b7102dd2f0e8b11d0f600bfb0c093",
        opaque="5ccc069c403ebaf9f0171e9517f40e41"
Camera->Gateway
POST
/gateway.icontrol.com/GWServices/EventAlert/1308677301445/43/f/889229dcd864691ff
cd4bff342153a00/ HTTP/1.1
Host: gateway.icontrol.com
Date: Sat, 11 Jun 2011 18:23:51 GMT
Content-Type: application/xml; charset="UTF-8"
Authorization: Digest username="<SerialNumber>",
    realm=" mediagw@
    server.icontrol.com",nonce="dcd98b7102dd2f0e8b11d0f600bfb0c093",
    uri="/gateway.icontrol.com/GWServices/EventAlert/1308677301445/43/f/88922
    9dcd864691ffcd4bff342153a00/",
    qop=auth,
    nc=00000001,
```

-continued

```
    cnonce="0a4f113b",
    response="6629fae49393a05397450978507c4ef1",
    opaque="5ccc069c403ebaf9f0171e9517f40e41"
Content-Length: <size of the xml body below in bytes>
<EventAlert version="1.0">
    <id>23XZ0933</id>
    <dateTime>2009-03-11T15.5:27Z</dateTime >
    <activePostCount>301</activePostCount>
    <eventType>PirMD</eventType>
    <eventState>active</eventState>
    <eventDescription>PIR motion detected</eventDescription>
</EventAlert>
Gateway->Camera
HTTP/1.1 200 OK
Connection: Keep-Alive
```

Camera Notification Via Inbound Polling

The following example illustrates a motion event Notification from Camera that is delivered to the Gateway via inbound polling.

```
Gateway->Camera
GET /OpenHome/System/poll/notifications/poll?linger=120 HTTP/1.1
Host: 192.168.2.52
Gateway ->Camera
HTTP/1.1 401 Unauthorized
Host: server.icontrol.com
Date: Sat, 11 Jun 2011 18:23:60 GMT
WWW-Authenticate: Digest realm="mediagw@gateway.icontrol.com ",
        qop="auth,auth-int",
        nonce="dcd98b7102dd2f0e8b11d0f600bfb0c093",
        opaque="5ccc069c403ebaf9f0171e9517f40e41"
Gateway->Camera
GET /OpenHome/System/poll/notifications/poll?linger=120 HTTP/1.1
Host: 192.168.2.52
Authorization: Digest username="<SerialNumber>",
    realm=" mediagw@
    server.icontrol.com",nonce="dcd98b7102dd2f0e8b11d0f600bfb0c093",
    uri/OpenHome/System/poll/notifications/poll",
    qop=auth,
    nc=00000001,
    cnonce="0a4f113b",
    response="6629fae49393a05397450978507c4ef1",
    opaque="5ccc069c403ebaf9f0171e9517f40e41"
```

After 120 Seconds Without Notification

```
Camera->Gateway
HTTP/1.1 200 OK
Content-Type: application/xml; charset="UTF-8"
Connection: Keep-Alive
Content-Length: <size of the xml body below in bytes>
```

As Soon as Gateway Received and Processed the 200 OK Message

```
Gateway->Camera
GET /OpenHome/System/poll/notifications/poll?linger=120 HTTP/1.1
Host: 192.168.2.52
Gateway ->Camera
HTTP/1.1 401 Unauthorized
Host: server.icontrol.com
Date: Sat, 11 Jun 2011 18:24:60 GMT
WWW-Authenticate: Digest <digest challenge>
Gateway->Camera
GET /OpenHome/System/poll/notifications/poll?linger=120 HTTP/1.1
Host: 192.168.2.52
Authorization: Digest <challenge response>
Camera->Gateway
HTTP/1.1 200 OK
```

-continued

```
Content-Type: application/xml; charset="UTF-8"
Connection: Keep-Alive
Content-Length: <size of the xml body below in bytes>
<NotificationWrapper>
    <notificationURI>/gateway.icontrol.com/GWServices/EventAlert/130867730144
5/43/f/889229dcd864691ffcd4bff342153a00
    </notificationURI>
    <notifyTime>2009-03-11T15:27.5Z</notifyTime>
    <notifyBody>
        < EventAlert version="1.0">
            <id>23XZ0933</id>
            <dateTime>2009-03-11T15:27.4Z</dateTime >
            <activePostCount>301</activePostCount>
            <eventType>PirMD</eventType>
            <eventState>active</eventState>
            <eventDescription>PIR motion detected</eventDescription>
        </EventAlert>
    </notifyBody>
</NotificationWrapper>
```

4.2 Interface Type 2—Secure Streaming Media Channels

Three types of Streaming Media Channels are utilized for secured upload or live streaming of media contents from the Camera to the Gateway.

1. RTSP Streaming Media Channel—used to transport RTSP video from Camera to Gateway
2. MJPEG Streaming Media Channel—used to transport MJPEG video
3. HTTP Live Streaming Media Channel—used to transport HLS video from Camera to Gateway

Each of these three types is described in more detail in subsequent sections. In addition to the three tunneled Media Channel modes, a Camera must also support direct, non-tunneled RTSP, HLS, or MJPEG connections initiated from RTSP/MJPEG/HLS clients. This mode may be used for direct client to camera access over a LAN without the use of an intervening Gateway.

4.2.1 RTSP Media Channel

The RTSP Media Channel is used to tunnel RTSP video over a TLS connection between the Camera and the Gateway. Upon receiving a Gateway originated Command (which is sent over the Command-Notification Channel), the Camera establishes a RTSP Media Channel connection to the Gateway via the following procedures:

1. Camera receives /Streaming/MediaTunnel/create command from Gateway (could be On-Premise or Off-Premise Gateway) with the following parameters: <relayGatewayAddress>, <sessionID>, <requestType>, <cameraType>, <sessionPassword>
2. Camera initiates a TLS connection to Session Gateway at <sessionGatewayAddress>. This step may require a DNS lookup for IP address based on the hostname.
3. Camera and Session Gateway complete TLS negotiation per RFC 2246 (TLS Protocol Version 1.0). Camera must utilize TLS host name verification while establishing connection.
4. Camera sends a HTTP POST request to Session Gateway in accordance with Table 4 and Table 5 herein.
5. Camera waits for RTSP messages from Session Gateway. If no RTSP message is received after <MaxMediaTunnelReadyWait> timeout, Camera tears down existing TLS connection and restart a new connection per Step 1. An example of <MaxMediaTunnelReadyWait> is 120 seconds.
6. Upon arrival of RTSP message(s) to Camera (usually after an end-user starts a live video session), normal RTSP request-response negation is initiated per RFC 2326 (Real Time Streaming Protocol)
7. RTP/RTCP media streams from Camera to Session Gateway over the existing TLS connection, using RTSP interleaved transport mode per RFC 2326.
8. Camera receives RTSP TEARDOWN from Session Gateway, replies with 200 OK, and then starts to disconnect TLS session with Session Gateway

4.2.1.1 State Transition Diagram

The state transition diagram for the above sequence is illustrated in FIG. **27**, and described in more detail below:

IDLE state	represents idle state where no media tunnel needs to be built.
START state	represents start initiating Media Channel state where the Camera initiates TLS connection with Gateway. Upon entering this state, Camera should increment its number of retries counter and check if it has reached maximum <retries> without successful connection. If maximum <retries> is reached, Camera should return to IDLE state. Before retrying connection, Camera should wait for a delay (e.g., delay equals number of retries*<stepsizeWait>) before starting TLS connection.
SOCKET_WAITING state	represents waiting for network layer to complete establishing a TLS connection between the Camera and the Gateway.
SOCKET_CONNECTED state	represents where TLS negoation was successfully completed between the Camera and the Gateway.
TUNNEL_READY state	represents where the media tunnel is established and the Camera is waiting for a RTSP request from the

-continued

	Gateway. If Camera stays in TUNNEL_READY state for greater than <maxMediaTunnelReadyWait> time, Camera should transition to START state.
RTSP_INIT state	represents state where the Camera received at least one RTSP DESCRIBE request from the Gateway.
RTSP_READY state	represents state where the Camera is waiting for RTSP PLAY or additional RTSP SETUP requests.
RTSP_PLAYING state	represents state where the Camera is streaming media to the Gateway. Camera should resets its number of retry counter to zero.
DISCONNECTING state	represents state where the Camera is tearing down TLS connection with the Gateway.

4.2.1.2 Sample Call Flows

See FIG. **28**.

4.2.1.3 HTTPS POST Format for Tunnel Creation

Format of HTTPS POST URI from Camera to Gateway is described in more detail below. This request is sent from Camera to Gateway while transitioning from the SOCKET_CONNECTED state to the TUNNEL_READY state.

TABLE 4

Media Channel HTTP POST Format	
Purpose	Establish Media tunnel within a TLS connection
Message Format	POST /<GatewayAddress>/<MediaTunnelURI> HTTP/1.1
Authentication	None in HTTP header (authentication required in RTSP header)
Mandatory Request Headers	None
POST Body	One or more tunneled RTSP response messages
Response from Gateway	One or more tunneled RTSP request messages and RTP/RTCP media packets
Error responses	Standard HTTP response codes (e.g., 404)
Example POST URI	POST /1607349153877243391/icamera/sslrelay/1308677301445/889229dcd864691ffcd4bff342153ad7/ HTTP/1.0

TABLE 5

Media Channel HTTP POST Variables Description		
Variable Name	Format	Description/Notes
GatewayAddress	hostname:port	Gateway hostname and port or could be IP address and port. See /OpenHome/Streaming/MediaTunnel/create
MediaTunnelURI	URI	URI used in the Create Tunnel POST. Derived from /OpenHome/Streaming/MediaTunnel/create Command parameter.

4.2.1.4 Example Messages

Precondition: successful TLS negotiation
Camera–>Gateway
POST
/1607349153877243391/icamera/sslrelay/1308677301445/889229dcd864691ffcd4bff342153ad7/ HTTP/1.1
Gateway–>Camera
DESCRIBE rtsp://192.168.2.52:4302/OpenHome/Streaming/channels/2/rtsp RTSP/1.0
CSeq: 1
Accept: application/sdp
Accept-Language: en
User-Agent: iControl Applet 1.0

-continued

```
Authorization: Basic aWN4OGdla0Y6bG5IMXdQQ2g=
Content-Length: 0
Camera->Gateway
RTSP/1.0 200 OK
Cseq: 1
Content-Base: rtsp://192.168.2.52:4302/OpenHome/Streaming/channels/2/rtsp
Content-Type: application/sdp
Content-Length: 405
v=0
o=- 15034 15034 IN IP4 192.168.107.226
s=RTSP Server(MPEG4) - iCamera7FF4BF
c=IN IP4 0.0.0.0
t=0 0
a=charset:Shift_JIS
a=range:npt=0-
a=control:*
a=etag:1234567890
m=video 0 RTP/AVP 96
b=AS:512
a=rtpmap:96 MP4V-ES/30000
a=control:trackID=1
a=fmtp:96 profile-level-id=1;
config=000001B001000001B5090000010000000120000845D4C28A021E0A21F;decode
_buf=76800
a=x-framerate:15
a=framerate:15.0
Gateway->Camera
SETUP rtsp://192.168.2.52:4302/ Streaming/channels/2/rtsp/trackID=1 RTSP/1.0
CSeq: 2
Transport: RTP/AVP/TCP;unicast;interleaved=0-1
User-Agent: iControl Applet 1.0
Content-Length: 0
Camera->Gateway
RTSP/1.0 200 OK
Cseq: 2
Session: 26;timeout=60
Transport: RTP/AVP/TCP;unicast;interleaved=0-1;ssrc=65d471b5;mode="PLAY"
Gateway->Camera
PLAY rtsp://192.168.2.52:4302/OpenHome/Streaming/channels/2/rtsp RTSP/1.0
Accept-Language: en
CSeq: 3
User-Agent: iControl Applet 1.0
Session: 26
Range: npt=0.000000-
Content-Length: 0
Camera->Gateway
RTSP/1.0 200 OK
Cseq: 3
Session: 26;timeout=60
RTP-Info: url=trackID=1;seq=0;rtptime=0
Range: npt=0-
RTCP-Interval: 6000
```

4.2.1.5 RTSP/RTP/RTCP Usage Clarifications

Camera should support RTSP per RFC 2326 (Real-Time Streaming Protocol) and RTP/RTCP per RFC 3550 (A Transport Protocol for Real-Time Applications). Furthermore, the following usage clarifications are to be followed:

1. Camera should support RTSP interleaved transport mode per RFC 2326
2. Camera should support at the minimum, Basic Authorization per RFC 2326
3. Camera should not require the Gateway to transmit RTCP packets, since RTCP is optional per RFC 3550

4.2.2 MJPEG Media Channel

The MJPEG Media Channel is used to tunnel MJPEG streams over a TLS connection between the Camera and the Gateway. The MJPEG Media Channel is very similar to the RTSP Media Channel, with the exception that MJPEG streams are transported over the tunnel and RTSP protocol is not used to negotiate a session. Upon receiving the /Streaming/MediaTunnel/create Command (which was sent over the Command-Notification Channel), the Camera establishes a MJPEG Media Channel connection to the Gateway via the following sequence:

1. Camera receives /Streaming/MediaTunnel/create command from Gateway with the following parameters: <relayGatewayAddress>, <sessionID>, <requestType>, <cameraType>, <sessionPassword>
2. Camera initiates a TLS connection to Gateway at <sessionGatewayAddress>, including DNS lookup.
3. Camera and Gateway complete TLS negotiation per RFC 2246 (TLS Protocol Version 1.0). Camera must utilize TLS host name verification while establishing connection.
4. Camera sends a HTTP POST request to Session Gateway in accordance with Table 4 and Table 5 herein.
5. Camera waits for a HTTP GET request from Gateway. If no HTTP GET request is received after <MaxMediaTunnelReadyWait> timeout, Camera tears down existing TLS connection and restart a new connection per Step 1. An example of <MaxMediaTunnelReadyWait> is 120 seconds.
6. Camera sends a stream of MJPEG data to Gateway over the previously established TLS tunnel as part of its 200

OK response. A MJPEG stream consists of one or more JPEG frames separated by a delineating boundary string defined by the Camera.

4.2.2.1 State Transition Diagram

The state transition diagram for the above sequence is illustrated in FIG. **29** and described in detail below:

IDLE state	represents idle state where no media tunnel needs to be built.
START state	represents start initiating Media Channel state where the Camera initiates TLS connection with Gateway. Upon entering this state, Camera should increment its number of retries counter and check if it has reached maximum <retries> without successful connection. If maximum <retries> is reached, Camera should return to IDLE state. Before retrying connection, Camera should wait for a delay (e.g., delay equals number of retries*<stepsizeWait>) before starting TLS connection.
SOCKET_WAITING state	represents waiting for network layer to complete establishing a TLS connection between the Camera and the Gateway.
SOCKET_CONNECTED state	represents state where TLS connectivity is established between the Camera and the Gateway.
TUNNEL_READY state	represents state where the media tunnel is established and the Camera is waiting for a HTTP GET request from the Gateway. If Camera stays in TUNNEL_READY state for greater than <maxMediaTunnelReadyWait> time, Camera should transition to START state.
STREAMING state	represents state where the Camera has received a valid HTTP GET request and is streaming media to the Gateway. Camera should resets its number of retry counter to zero.
DISCONNECTING state	represents state where the Camera is tearing down TLS connection with the Gateway.

MJPEG HTTP POST Tunnel Creation Format

Format of HTTPS POST URI from Camera to Gateway is the same the HTTPS POST request format in Section 4.2.1.3.

4.2.2.2 HTTP GET Start MJPEG Streaming Format

Format of HTTP GET URI from Gateway to Camera is described below:

TABLE 6

MJPEG HTTP GET Format	
Purpose	Request by Gateway to start MJPEG streaming. This request is sent when the Gateway wants the Camera to start MJPEG streaming.
Message Format	HTTP GET/<MJPEG_Path> HTTP/1.0 Authorization: Basic <BasicCredential>
Authentication	HTTP authorization: Basic
Mandatory Request Headers	Authorization
Response from Gateway	HTTP/1.0 200 OK Content-Type: multipart/x-mixed-replace;boundary=<randomString> follow by one or more JPEG frames delineated by: --<randomString> Content-type: image/jpeg\r\n Content-Length: <jpeg image length in bytes>\r\n \r\n <binary JPEG data>
Error responses	Standard HTTP response codes (e.g., 404)
Example GET	GE/OpenHome/Streaming/channels/2/http HTTP/1.0 Authorization: Basic aWN4OGdla0Y6bG5IMXdQQ2g=

TABLE 7

MJPEG HTTP GET Variables		
Variable Name	Format	Description/Notes
MJPEG_Path	URI path	Path to signaling start MJPEG streaming. This value is read from the Camera,
BasicCredential	Alpha numeric string	Base64 encoding of <username:password> for accessing the camera
randomString	String	Delineator string generated by the Camera used to mark boundaries between JPEG frames within a MJPEG stream

4.2.2.3 Example Messages

```
Precondition: successful TLS negotiation
Carrier a–> Gateway
POST
/1607349153877243391/icamera/sslrelay/1308677301445/889229dcd864691ffcd4bff342
153ad7/ HTTP/1.0
Gateway–>Camera
GET /OpenHome/Streaming/channel/1/http HTTP/1.1
Authorization: Basic tdNnOGdla0Y6bG5IMXdQQ2g=
Camera–>Gateway
HTTP/1.0 200 OK
Content-Type: multipart/x-mixed-replace;boundary=MyRandomStr
--MyRandomStr
Content-Type: image/jpeg
Content-Length: 22444
<jpeg binary data>
```

4.2.3 HTTP Live Streaming Media Channel

The HTTP Live Streaming (HLS) Media Channel is used to tunnel HLS streams over a TLS connection between the Camera and the Gateway. The HLS Media Channel is very similar to the RTSP Media Channel, with the exception that HLS streams are transported over the tunnel and HLS request/response protocols are used to transfer media segments. Upon receiving the /Streaming/MediaTunnel/create Command (which was sent over the Command-Notification Channel), the Camera establishes a HLS Media Channel connection to the Gateway via the following sequence:

7. Camera receives /Streaming/MediaTunnel/create command from Premise Gateway with the following parameters: <relayGatewayAddress>, <sessionID>, <requestType>, <cameraType>, <sessionPassword>
8. Camera initiates a TLS connection to Session Gateway at <sessionGatewayAddress>, including DNS lookup.
9. Camera and Session Gateway complete TLS negotiation per RFC 2246 (TLS Protocol Version 1.0). Camera must utilize TLS host name verification while establishing connection.
10. Camera sends a HTTP POST request to Session Gateway in accordance with Table 4 and Table 5 herein.
11. Camera waits for a HTTP GET request from Session Gateway for retrieving the initial HLS Playlist file. If no HTTP GET request is received after <MaxMediaTunnelReadyWait> timeout, Camera tears down existing TLS connection and restart a new connection per Step 1. An example of <MaxMediaTunnelReadyWait> is 120 seconds.
12. Camera sends a HLS Playlist File to Session Gateway over the previously established TLS tunnel as part of its 200 OK response.
13. Camera waits for one or more HTTP GET request(s) from Gateway for retrieving HLS media segments or updated HLS Playlist.
14. Camera responds to HTTP GET with HLS media segment or Playlist.

4.3 Interface Type 3—Media Upload Channels

The Media Upload Channel is used to transport video clips, still frame images, or event notifications from the Camera to the Session Gateway. The Camera utilizes standard HTTPS POST procedures to transfer media content. All media upload channels must utilize secure TLS and digest authentication to encrypt and secure its content. Furthermore, Camera must utilize TLS host name verification while establishing secure connections. Media Upload Channels can be triggered by either a Gateway originated Command (e.g., CaptureVideoClip) or a Camera Originated event (e.g., motion detected, capture video and upload). Three types of Media Upload Channels are defined—1) Video Clip Upload, 2) Image Upload, and 3) event notification. The following subsections describe their specific formats.

4.3.1 Video Clip Upload

Format of Video Clip HTTPS POST from Camera to Gateway is described below:

TABLE 8

Video Clip Upload Request URI format	
Purpose	Upload video clip from Camera to Gateway
Server Address	<UploadGatewayAddress>
Message Format	HTTPS POST /<postVideoClipURI> HTTP/1.1
Authentication	HTTP Digest Authentication (with <SerialNumber> and <SharedSecret>)
Mandatory Standard Request Headers	Host, Content-Length, Content-Type, Date, Authorization
Mandatory iControl Request Header	X-Capture-Time: <capturedTimestamp>
POST Body	Video clip data
Response from Gateway	Standard HTTP response codes (e.g., 200 OK)
Error responses	Standard HTTP response codes (e.g., 404)

TABLE 9

Video Clip Upload variables

Variable Name	Format	Description/Notes
UploadGatewayAddress	hostname and port	Hostname and port of Gateway handling media upload.
postVideoClipURI	URI	Supplied by Gateway in the media upload command
capturedTimestamp	UTC timestamp	Timestamp at the Camera when media's 1st frame was captured

Example Messages

Camera–>Gateway
POST /vidupload/icamera/1308677301445/43/f/889229dcd864691ffcd4bff342153a00/
HTTP/1.1
Host: server.icontrol.com
Content-Type: video/mp4
Date: Sat, 11 Jim 2011 18:23:51 GMT
X-Capture-Time: 1308677301225
...
Gateway –>Camera
HTTP/1.1 401 Unauthorized
Host: server.icontrol.com
Date: Sat, 11 Jun 2011 18:23:60 GMT
WWW-Authenticate: Digest realm="mediagw@ server.icontrol.com",
qop="auth,auth-int",
nonce="dcd98b7102dd2f0e8b11d0f600bft0c093",
opaque="5ccc069c403ebaf9f0171e9517f40e41"
Camera–>Gateway
POST /vidupload/icamera/1308677301445/43/f/889229dcd864691ffcd4bff342153a00/
HTTP/1.1
Host: server.icontrol.com
Content-Type: video/mp4
Date: Sat, 11 Jun 2011 18:23:51 GMT
X-Capture-Time: 1308677301225
Authorization: Digest username="<SerialNumber>",
realm=" mediagw@
server.icontrol.com",nonce="dcd98b7102dd2f0e8b11d0f600bfb0c093",
uri="/vidupload/icamera/1308677301445/43/f/889229dcd864691ffcd4bff342153a
00/",
qop=auth,
nc=00000001,
cnonce="0a4f113b",
response="6629fae49393a05397450978507c4ef1",
opaque="5ccc069c403ebaf9f0171e9517f40e41"

-continued

Content-Length: 144555
<mp4 binary content>
Gateway –>Camera
HTTP/1.1 200 OK

4.3.2 Image Upload

Format of Image HTTPS POST is described below:

TABLE 10

Image Upload Request URI format	
Purpose	Upload still image from Camera to Gateway
Server Address	<UploadGatewayAddress>
Message Format	HTTPS POST /<postImageURI> HTTP/1.1
Authentication	HTTP Digest (with <SerialNumber> and <SharedSecret>)
Mandatory Standard Request Headers	Host, Content-Length, Content-Type (image/jpeg), Date, Authorization
Mandatory Custom Request Header	X-Capture-Time: <capturedTimestamp>
POST Body	Image data
Response from Gateway	Standard HTTP response codes (e.g., 200 OK)
Error responses	Standard HTTP response codes (e.g., 404)

TABLE 11

Image Upload variables		
Variable Name	Format	Description/Notes
UploadGatewayAddress	hostname and port	Hostname and port of Gateway handling media upload.
postImageURI	URI	Supplied by Gateway in the media upload command
capturedTimestamp	UTC timestamp	Timestamp at the Camera when image was captured

4.3.3 Event Notification Upload

Format of Event Notification HTTPS POST is described below:

TABLE 12

Event Notification Request URI format	
Purpose	Upload event notifications from Camera to Gateway
Server Address	<UploadGatewayAddress>
Message Format	HTTPS POST /<eventNotifyURI> HTTP/1.1 Authroziation: Basic <basicCredential>
Authentication	HTTP Digest Authentication (with <SerialNumber> and <SharedSecret>)
Mandatory Standard Request Headers	Host, Content-Length, Content-Type (application/xml), Date, Authorization
Mandatory Custom Request Header	X-Capture-Time: <capturedTimestamp>
POST Body	XML Body
Response from Gateway	Standard HTTP response codes (e.g., 200 OK)
Error responses	Standard HTTP response codes (e.g., 404)

TABLE 13

Event Notification variables		
Variable Name	Format	Description/Notes
UploadGatewayAddress	hostname and port	Hostname and port of Gateway handling event notification.
eventNotifyURI	URI	Supplied by Gateway
capturedTimestamp	UTC timestamp	Timestamp at the Camera when event occured

4.3.4 Media Upload Under Error Conditions

If error is encountered during a Video or Image Upload procedure, the Camera is responsible for re-initiating the upload procedure up to <retries> times. Upon initial failure, the Camera should wait for a random delay between <minWait> and <stepsizeWait>. Each subsequent retry attempt should backup increasingly (preferably exponentially) using industry standard practices such as "truncated binary exponential backoff", or using a multiple of <stepsizeWait>), up to maximum delay of <maxWait>. If Camera is still unable to upload media after <maxMediaUploadRetries>, Camera should send a MediaUploadFailure Notification event to the Gateway via HTTPS or XMPP Command/Notification Channel.

Example Simple Backoff Timer Calculations

First connection retry wait time=random(0–<stepsizeWait>)

Subsequent retry wait time=max(<maxWait>, #reRetryCount*<stepsizeWait>)

5 Command/Notification Data Types

The following tables list Commands and Notifications request and responses that can be transmitted over either the XMPP Command/Notification Channel or the HTTPS Command/Notification Channel. All Commands and Notifications requests should be responded to as soon as possible and the receiving device should not block the channel from receiving additional requests.

XML Data Blocks described in this document contains annotations that describe the properties of the field. For a complete definition, see the XML schema definitions. The following information is inserted into the comments to describe the data carried in the field:

Annotation	Description
req	Required field.
opt	Optional field. For data uploaded to the device, if the field is present but the device does not support it, it should be ignored.
dep	This field is required depending on the value of another field.
ro	Read-only. For XML data that is both read and written to the device, this field is only present in XML returned from the device. If this field is present in XML uploaded to the device, it should be ignored.
wo	Write-only. This field is only present in XML that can be uploaded to the device. This field should never be present in data returned from the device. [This is used for uploading passwords].
xs:<type>	A type defined in XML Schema Part 2: Datatypes Second Edition, see http://www.w3.org/TR/xmlschema-2

Note that XML structures that are optional may have required fields. This means that the entire XML block is optional, however if it is present the required fields are mandatory.

5.1 Data Type Overview

Many data types defined in this chapter may be similar or have the same characteristics as defined by the Physical Security Interoperability Alliance (PSIA, http://www.psialliance.org). In particular, the PSIA Service Model (Pysical Security Interoperability Alliance Service Model version 1.0, revision 1.2) and the PSIA IPMD (Pysical Security Interoperability Alliance IP Media Device API Specification version 1.1, revision 1) documents define common terminologies and data structures used in this Section. However, new service commands and modifications were necessary to PSIA's model in order to support iControl's interface. The following tables summarize similarities and differences between the PSIA and the iControl data models. Columns marked as "Same as PSIA" are Commands that have same XML elements as PSIA, except for XML namespace. Columns marked as "Modified PSIA" are Commands that have similar XML elements as PSIA, but with iControl specific modifications. Columns marked as "New" are Command or Notifications specific to iControl.

REQ	System	Same as PSIA	Modified PSIA	New
✓	/OpenHome/api		✓	
✓	/OpenHome/System/reboot	✓		
✓	/OpenHome/System/updateFirmware		✓	
✓	/OpenHome/System/updateFirmware/status			✓
✓	/OpenHome/System/ConfigurationData/configFile			✓
✓	/OpenHome/System/ConfigurationData/Timers			✓
✓	/OpenHome/System/factoryReset		✓	
✓	/OpenHome/System/deviceInfo		✓	
✓	/OpenHome/System/time	✓		
✓	/OpenHome/System/time/localTime	✓		
✓	/OpenHome/System/time/ntpServers	✓		
✓	/OpenHome/System/time/ntpServers/<ID>	✓		
✓	/OpenHome/System/logging		✓	
✓	/OpenHome/System/logging/logData		✓	
✓	Notification: Logging Event			✓
✓	/OpenHome/System/inputs/privacy			✓
✓	/OpenHome/System/XMPP/Gateway			✓
✓	/OpenHome/System/HTTP/Server			✓
✓	/OpenHome/System/history			✓
✓	/OpenHome/System/history/configuration			✓
✓	/OpenHome/System/Poll/notifications			✓
✓	/OpenHome/System/Ping			✓

REQ	System/Network	Same as PSIA	Modified PSIA	New
✓	/OpenHome/System/Network/interfaces	✓		
✓	/OpenHome/System/Network/interfaces/<ID>	✓		
✓	/OpenHome/System/Network/interfaces/<ID>/ipAddress	✓		
✓	/OpenHome/System/Network/interfaces/<ID>/wireless		✓	
✓	/OpenHome/System/Network/interfaces/<ID>/wireless/status			✓
	/OpenHome/System/Network/interfaces/<ID>/ieee802.1x	✓		
✓	/OpenHome/System/Network/interfaces/<ID>/discovery	✓		

REQ	System/Audio or System/Video Input Settings	Same as PSIA	Modified PSIA	New
✓	/OpenHome/System/Audio/channels	✓		
✓	/OpenHome/System/Audio/channels/<ID>	✓		
✓	/OpenHome/System/Video/inputs	✓		
✓	/OpenHome/System/Video/inputs/channels	✓		
✓	/OpenHome/System/Video/inputs/channels/<ID>	✓		

REQ	Security	Same as PSIA	Modified PSIA	New
✓	/OpenHome/Security/updateSSLCertificate/client			✓
✓	/OpenHome/Security/updateSSLCertificate/server			✓
✓	Request for updateSSLCertificate			✓
✓	/OpenHome/Security/AAA/accounts	✓		
✓	/OpenHome/Security/AAA/accounts/<ID>		✓	
✓	/OpenHome/Security/Authorization/			✓

REQ	Streaming	Same as PSIA	Modified PSIA	New
✓	/OpenHome/Streaming/channels	✓		
✓	/OpenHome/Streaming/channels/<ID>	✓		
✓	/OpenHome/Streaming/channels/<ID>/capabilities		✓	
✓	/OpenHome/Streaming/status	✓		
✓	/OpenHome/Streaming/channels/<ID>/status		✓	
✓	/OpenHome/Streaming/channels/<ID>/rtsp		✓	
✓	/OpenHome/Streaming/channels/<ID>/video/upload			✓
✓	/OpenHome/Streaming/channels/<ID>/requestKeyFrame	✓		
✓	/OpenHome/Streaming/channels/<ID>/http	✓		
✓	/OpenHome/Streaming/channels/<ID>/picture	✓		
✓	/OpenHome/Streaming/channels/<ID>/picture/upload			✓
✓	/OpenHome/Streaming/channels/<ID>/hls/playlist			✓
	/OpenHome/Streaming/channels/<ID>/hls/<MediaSegment>			✓
✓	Notification: MediaUploadFailure			✓

REQ	MediaTunnel	Same as PSIA	Modified PSIA	New
✓	/OpenHome/Streaming/MediaTunnel			✓
✓	/OpenHome/Streaming/MediaTunnel/<ID>/status			✓

-continued

✓	/OpenHome/Streaming/MediaTunnel/create			✓
✓	/OpenHome/Streaming/MediaTunnel/<ID>/destroy			✓
✓	Notification: CreateMediaTunnelFailure			✓

REQ	PTZ	Same as PSIA	Modified PSIA	New
	/PTZ/channels	✓		
	/OpenHome/PTZ/channels/<ID>	✓		
	/OpenHome/PTZ/channels/<ID>/homePosition	✓		
	/OpenHome/PTZ/chamiels/<ID>/relative	✓		
	/OpenHome/PTZ/channels/<ID>/absolute	✓		
	/OpenHome/PTZ/channels/<ID>/status	✓		

REQ	Detection	Same as PSIA	Modified PSIA	New
	/OpenHome/Custom/MotionDetection/PIR		✓	
	/OpenHome/Custom/MotionDetection/PIR/<ID>		✓	
	/OpenHome/Custom/MotionDetection/video		✓	
	/OpenHome/Custom/MotionDetection/video/<ID>		✓	
	/OpenHome/Custom/MotionDetection/video/<ID>/capabilities		✓	
	/OpenHome/Custom/SoundDetection			✓
	/OpenHome/Custom/SoundDetection/<ID>			✓
	/OpenHome/Custom/TemperatureDetection			✓
	/OpenHome/Custom/TemperatureDetection/<ID>			✓
	/OpenHome/Custom/TemperatureDetection/<ID>/Current			✓

REQ	Events	Same as PSIA	Modified PSIA	New
✓	/OpenHome/Custom/Event	✓		
✓	/OpenHome/Custom/Event/triggers	✓		
✓	/OpenHome/Custom/Event/triggers/<ID>		✓	
✓	/OpenHome/Custom/Event/triggers/<ID>/notifications	✓		
✓	/OpenHome/Custom/Event/triggers/<ID>/notifications/<NOTIFYID>	✓		
✓	/OpenHome/Custom/Event/notification		✓	
✓	/OpenHome/Custom/Event/notification/Host	✓		
✓	/OpenHome/Custom/Event/notification/Host/<ID>	✓		
✓	Notification: Event Alert		✓	

5.2 Service Discovery of Camera Resources

Syntax for data type URIs defined in this Section is intended only as a recommendation. A Camera can override specific URIs for resources or add new URIs, if needed. Service discovery of OpenHome Data Type resources and their URLs can be achieved by retrieving (GET) from the following URI:

/OpenHome/api

In response, Camera should return the following XML data structure containing all URI resources supported by the device:

```
<api>
    <resource href="/OpenHome/System/reboot" methods="PUT"
name="System/reboot" version="1.0"/>
    <resource href="/OpenHome/System/deviceInfo" methods="GET,PUT"
name="System/deviceInfo" version="1.0"/>
    ...
    <resource href="/OpenHome/Streaming/channels/0/picture" methods="GET"
name=" Streaming/channels/0/picture" version="1.0"/>
    <resource href="/OpenHome/Streaming/channels/1/picture" methods="GET"
name=" Streaming/channels/1/picture" version="1.0"/>
    ...
</api>
```

where

<resource> delinates a resource available on the Camera

'href' attribute defines URI for the particular resource

'methods' attribute defines methods supported by the resource in capital letters, separated by comma.

'name' attribute provides the resource's name.

'version' attribute provides the resource's version number of the service for the resource.

<api>, <resource>, and 'href', 'methods', 'name' attributes are all mandatory parameters.

This version of the interface specification does not yet standardize on the resources' names. Future version of this document may define standard resource names in order to facilitate auto-discovery.

5.3 /OpenHome/System Data Type Details

A list of Commands/Notifications and corresponding URIs are is described in the following subsections. The Type field in the table describes whether the URI is a Command or Notification, where a Command is a Gateway originated request and a Notification is a Camera originated request.

5.3.1 ResponseStatus XML Block

The ResponseStatus XML block is used throughout this Section. It is defined as:

ResponseStatus XML Block

```
<ResponseStatus version="1.0">
    <requestURL> <!-- opt, xs: string -->        </requestURL>
    <statusCode>
        <!—req, O=1-OK, 2-Device Busy, 3-Device Error, 4-Invalid
    Operation, 5-Invalid XML Format, 6- Invalid   XML Content;
    7-Reboot Required-->
    </statusCode>
    <statusString> <!-- req, xs:string -->        </statusString>
    <ID> <!-- opt, xs:integer --> </ID>
</ResponseStatus >
```

For Commands that return with an error response, Camera should include <statusString> indicating reason for the failure. This response is particularly important when only a sub-portion of a configuration block encounters error; in such situations, Camera should respond with <statusString> indicating the elements and reason for the error.

Camera should respond with 4-Invalid Operation and set <statusString> to indicate the error, if any portion of the Command is not supported. For example, for a configuration Command, if a Camera supports most of the configuration but not all, Camera should return 4-Invalid Operation with <statusString> indicating which portion of the configuration parameters the Camera deems as not supported.

5.3.2 Camera Configuration Changes

Camera configurations can be read or modified via HTTP/HTTPS access to URIs described in this Section. Unless explicitly specified, all configuration changes (if successful) should take effect immediately within the device before sending <ResponseStatus>. Only the following list of URIs can postpone effective status until after a device reboot:

/OpenHome/System/updateFirmware

/OpenHome/System/ConfigurationData/configFile

/OpenHome/Security/updateSSLCertificate/client

/OpenHome/Security/updateSSLCertificate/server

For reach URI request above, the Camera should respond with "Reboot Required" in the <ResponseStatus> "statusCode" element.

5.3.3 /OpenHome/System/Reboot

URI	/OpenHome/System/reboot		Type	Command
Function	Reboot device			
Methods	Query String(s)	Inbound Data	Return Result	
PUT			<ResponseStatus>	

Notes
The <ResponseStatus> XML data is returned before the device proceeds to reboot.

5.3.4 /OpenHome/System/updateFirmware

URI	/OpenHome/System/updateFirmware		Type	Command
Function	Update device firmware			
Methods	Query String(s)	Inbound Data	Return Result	
POST		<FirmwareDownLoad>	<ResponseStatus>	

Notes
Checksum is the MD5 checksum of the firmware image. Camera should verify MD5 checksum after download before proceeding with firmware upgrade. If successful, device should auto-reboot after upgrade.

FirmwareDownLoad XML Block

```
<FirmwareDownLoad version="1.0">
    <url>              <!-- req, xs:string -->    </url>
    <fwVersion>        <!-- opt, xs:string -->    </fwVersion>
    <md5checksum>      <!-- opt, xs:string -->    </md5checksum>
</FirmwareDownLoad>
```

5.3.5 /OpenHome/System/updateFirmware/Status

URI	/OpenHome/System/updateFirmware		Type	Command
Function	Update device firmware			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<UpdateFirmwareStatus>	

Notes
After successful completion of this API, the <ResponseStatus> XML data is returned, and the device proceeds to reboot.
Checksum is the MD5 checksum of the firmware image. Camera should verify MD5 checksum after download before proceeding with firmware upgrade.
<updateTime> is in UTC ISO 8601 format.

UpdateFirmwareStatus XML Block

```
<UpdateFirmwareStatus version="1.0">
    <updateSuccess> <!-- req, xs:string, "true", "false" -->
    </updateSuccess>
    <updateTime>
        <!-- req, xs:dateTime of last successful firmware upgrade -->
    </updatedTime >
    <errorReason>        <!-- opt, xs:string , display string for failure-->
    </errorReason >
    <url>                <!-- opt, xs:string -->     </url>
    <fwVersion>          <!-- opt, xs:string -->     </fwVersion>
    <downloadPercentage> <!-- req, xs:integer, 0-100 -->        </
    downloadPercentage>
    <checksumCheckSuccess>   <!-- opt, xs:string, "true", "false" -->
    </checksumCheckSuccess>
</UpdateFirmwareStatus >
```

5.3.6 /OpenHome/ System/Configuration-Data/configFile

URI	/OpenHome/System/ConfigurationData/configFile	Type	Command
Function	The function is used to get or set a configuration file for the device. This function is used to configure the device with all parameters at once rather than one resource at a time.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<ConfigData>
PUT		<ConfigData>	< ResponseStatus>

Notes

For PUT operation, device should update its configuration file with the updated info and response with "Boot Required" in <ResponseStatus>. New configuration will take effect upon reboot.

ConfigXML contains one or more configurable XML elements defined in this specification. Examples include ConfigTimers, DeviceInfo, Time, etc.

ConfigFile XML Block

```
<ConfigFile version="1.0">
    <!-- opt, XML elements, one or more configurable XML elements
defined in this specification -->
</ConfigFile>
```

5.3.7 /OpenHome/System/ConfigurationData/Timers

URI	/OpenHome/System/ConfigurationData/Timers	Type	Command
Function	The function is used to get or set the timer specific configuration data for the device.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<ConfigData>
PUT		<ConfigData>	< ResponseStatus>

Notes

See MediaTunnel and MediaUpload sections for <maxWait> timer descriptions.

<XmppTimers> are similar to MediaUpload timers such that

<minWait> is the minimum time to wait in milliseconds before the next retry

<maxWait> is the maximum time to wait in milliseconds before the next retry

<stepsizeWait> is the stepsize used in exponential backoff.

<retries> is the maximum number of retries. If <retries> equals −1, the number of retries is infinite.

If error is encountered during an upload or connection procedure, the Camera is responsible for re-initiating the procedure up to <retries> times.

Upon initial failure, the Camera should wait for a random delay between <minWait> and <stepsizeWait>. Each subsequent retry attempt should backup increasingly (preferably exponentially) using industry standard practices such as "truncated binary exponential backoff", or using a multiple of <stepsizeWait>), up to maximum delay of <maxWait>.

ConfigTimers XML Block

```
<ConfigTimers version="1.0">
    <MediaTunnelReadyTimers>   <!-- opt -->
        <maxMediaTunnelReadyWait>   <!-- opt, xs:Integer, in ms -->
</maxMediaTunnelReadyWait>
        <minWait><!-- opt, xs:Integer, in ms -->              </minWait>
        <maxWait>              <!- opt, xs:Integer, in ms -->      </maxWait>
        <stepsizeWait>         <!-- opt, xs:Integer, in ms -->      </stepsizeWait>
        <retries>   <!-- opt, xs:Integer -->      </ retries >
    </MediaTunnelReadyTimers> <!-- opt -->
    <MediaUploadTimers>   <!-- opt -->
        <minWait><!-- opt, xs:Integer, in ms -->              </minWait>
        <maxWait>              <!-- opt, xs:Integer, in ms -->      </maxWait>
        <stepsizeWait>         <!-- opt, xs:Integer, in ms -->      </stepsizeWait>
        <retries>   <!-- opt, xs:Integer -->      </ retries >
    </MediaUploadTimers> <!-- opt -->
    <XmppTimers>               <!-- opt -->
        <minWait><!-- opt, xs:Integer, in ms -->              </minWait>
        <maxWait>              <!-- opt, xs:Integer, in ms -->      </maxWait>
        <stepsizeWait>         <!-- opt, xs:Integer, in ms -->      </stepsizeWait>
        <retries>   <!-- opt, xs:Integer -->      </ retries >
    </ XmppTimers >            <!-- opt -->
</ConfigTimers>
```

5.3.8 /OpenHome/System/factoryReset

URI	/OpenHome/System/factoryReset	Type	Command
Function	This function is used to reset the configuration for the device to the factory default.		

Methods	Query String(s)	Inbound Data	Return Result
PUT	Mode		<ResponseStatus>

Notes

Two factory reset modes are supported:

"full" resets all device parameters and settings to their factory values.

"basic" resets all device parameters and settings except the values in /OpenHome/System/Network, /OpenHome/System/XMPP/gateway, /OpenHome/System/HTTP/server and /OpenHome/Security.

The default mode is "full". The device may be rebooted after it is reset.

5.3.9 /OpenHome/System/deviceInfo

URI	/OpenHome/System/deviceInfo		Type	Command
Function	This function is used to get or set device information.			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<DeviceInfo>	
PUT		<DeviceInfo>	<ResponseStatus>	

Notes

Some fields are read-only and may not be set. If these fields are present in the inbound XML block, they are ignored.

For the <DeviceInfo> uploaded to the device during a PUT operation, all fields are considered optional and any fields that are not present in the inbound XML are not changed on the device. This allows setting of the fields individually without having to load the entire XML block to the device.

<deviceDescription> is a description of the device as defined in RFC1213.

<deviceLocation> is the location of the device as defined in RFC1213

<systemContact> is the contact information for the device as defined in RFC1213.

<systemObjectID> is the System Object Identifier defined in RFC1213.

<apiVersion> is the version of the OpenHome Camera Interface Specification supported

DeviceInfo XML Block

```
<DeviceInfo version="1.0">
    <deviceName>            <!-- req, xs:string -->              </deviceName>
    <deviceDescription>         <!-- opt, xs:string -->
        </deviceDescription>
    <deviceLocation>            <!-- opt. xs:string -->              </deviceLocation>
    <systemContact>             <!-- opt, xs:string -->              </systemContact>
            <!-- Note: The following are read-only parameters -->
    <deviceID>                  <!-- ro, req, xs:string;uuid -->     </deviceID>
    <model>                     <!-- ro, req, xs:string -->          </model>
    <serialNumber>              <!-- ro, req, xs:string -->          </serialNumber>
    <macAddress>                <!-- ro, req, xs:string;-->          </macAddress>
    <firmwareVersion>           <!-- ro, req, xs:string -->
      </firmwareVersion>
    <firmwareReleasedDate>      <!-- ro,, opt, xs:string-->
      </firmwareReleasedDate>
    <logicVersion>              <!-- ro, opt, xs:string -->          </logicVersion>
    <logicReleasedDate>         <!-- ro, opt, xs:string -->          </logicReleasedDate>
    <bootVersion>               <!-- ro, opt, xs:string -->          </bootVersion>
    <bootReleasedDate>          <!-- ro, opt, xs:string -->          </bootReleasedDate>
    <rescueVersion>             <!-- ro, opt, xs:string -->
      </rescueVersion>
    <rescueReleasedDate>        <!-- ro, opt, xs:string -->
      </rescueReleasedDate>
    <hardwareVersion>               <!-- ro, opt, xs:string -->
    </hardwareVersion>
    <systemObjectID>                <!-- ro, opt, xs:string -->
      </systemObjectID>
    <apiVersion>                <!-- ro, opt, xs:string -->          </apiVersion>
    <battery>                       <!-- ro, opt, xs:string -->
        <level> <!-- req, xs:integer, percentage, 0..100 --> </level>
        <timeRemain> <!-- opt, xs:integer, seconds --> </timeRemain >
    </battery>
</DeviceInfo>
```

5.3.10 /OpenHome/System/Time

URI	/OpenHome/System/time		Type	Command
Function	Access the device time information.			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<Time>	
PUT	timeMode localTime timeZone	<Time>	<ResponseStatus>	

Notes

If the "localTime" query string with a value is specified, the <Time> XML block is not required as inbound data.

If <timeMode> is set to "manual" the <localTime> and <timeZone> fields are required. The <LocalTime> block sets the device time.

If <timeMode> is set to "NTP", only the <timeZone> field is required. The device time is set by synchronizing with NTP.

Time XML Block

```
<Time version="1.0">
    <timeMode>      <!-- req, xs:string, "NTP,manual" -->
        </timeMode>
    <localTime>     <!-- req, xs:dateime -->
        </localTime>
    <timeZone>      <!-- req, xs:string, POSIX time zone string;
                    see below -->
        </timeZone>
</Time>
```

5.3.11 /OpenHome/System/Time/localTime

URI	/OpenHome/System/time/localTime	Type	Command
Function	Access the device local time information.		

Methods	Query String(s)	Inbound Data	Return Result
GET			ISO 8601 Date-Time String
PUT		ISO 8601 Date-Time String	<ResponseStatus>

Notes

An ISO 8601 Date/Time string is accepted and returned. If the date/time value has a time zone, the time is converted into the device"s local time zone.

If the device time mode is set to "NTP", setting this value has no effect.

5.3.12 /OpenHome/System/Time/timeZone

URI	/OpenHome/System/time/timeZone	Type	Command
Function	Access the device time zone.		

Methods	Query String(s)	Inbound Data	Return Result
GET			Time zone string
PUT		Time zone string	<ResponseStatus>

Notes

Time zones are defined by POSIX 1003.1 section 8.3 time zone notations.

Note that the value following the +/− is the amount of time that must be added to the local time to result in UTC.

Example:

EST+5EDT01:00:00,M3.2.0/02:00:00,M11.1.0/02:00:00

Defines eastern standard time as "EST" with a GMT − 5 offset. Daylight savings time is called "EDT", is one hour later and begins on the second Sunday of March at 2am and ends on the first Sunday of November at 2am.

CET−1CEST01:00:00,M3.5.0/02:00:00,M10.5.0/03:00:00

Defines central European time as GMT + 1 with a one-hour daylight savings time ("CEST") that starts on the last Sunday in March at 2am and ends on the last Sunday in October at 3am.

5.3.13 /OpenHome/System/Time/ntpServers

URI	/OpenHome/System/time/ntpServers	Type	Command
Function	Access the NTP servers configured for the device.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<NTPServerList>
PUT		<NTPServerList>	<ResponseStatus>
POST		<NTPServer>	<ResponseStatus>

Notes

When the <timeMode> is set to "NTP", the servers in this list are used to synchronize the device's system time.

dateTime is in ISO 8601 Date/Time string format.

NTPServerList XML Block

```
<NTPServerList version="1.0">
    <NTPServer>        <!-- opt -->
        </NTPServer>
</NTPServerList >
```

5.3.14 /OpenHome/System/Time/ntpServers/<ID>

URI	/OpenHome/System/time/ntpServers/ID	Type	Command
Function	Access an NTP server configured for the device.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<NTPServer>
PUT		<NTPServer>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

Depending on the value of <addressingFormatType>, either the <hostName> or the IP address fields will be used to locate the NTP server.

Use of IPv4 or IPv6 addresses depends on the value of the <ipVersion> field in /OpenHome/System/Network/interfaces/ID/ipAddress.

NTPServer XML Block

```
<NTPServer version="1.0">
    <id>                <!-- req, xs:string; id -->          </id>
    <addressingFormatType>   <!-- req, xs:string,
    "ipaddress,hostname" -->
        </addressingFormatType>
    <hostName>          <!-- dep, xs:string -->        </hostName>
    <ipAddress>         <!-- dep, xs:string -->        </ipAddress>
    <ipv6Address>       <!-- dep, xs:string -->        </ipv6Address>
    <portNo>                <!-- opt, xs:integer -->
      </portNo>
</NTPServer >
```

5.3.15 /OpenHome/System/Logging

URI	/OpenHome/System/logging	Type	Command
Function	This function is used to set or read the logging parameters.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<LoggingConfig>
PUT		< LoggingConfig >	<ResponseStatus>

Notes

The device maintains a rolling log of <maxEntries> that can be configured and queried.

Remote logging may be enabled to send each new log entry to a XMPP or a HTTPS server using /OpenHome/System/logging/messages/event

LoggingConfig XML Block

```
<LoggingConfig version="1.0">
    <LogTrigger>            <!--opt-->
        <severity>          <!-- req, xs:string, Severities are
                            defined in RFC3164 -->
      </severity>
    </LogTrigger>
    <LocalLog>                          <!-- opt -->
        <maxEntries> <!-- req, xs:integer --> </maxEntries>
    </LocalLog>
    <remoteLog>                         <!-- opt -->
        <xmpp>                      <!-- opt -->
            <enabled><!-- req, xs:string, if "true" send each new
    log entry to XMPP server --></enabled>
            <url><!-- req, xs:string, destination url --> </url>
        </xmpp>
        <https>             <!-- opt -->
            <enabled><!-- req, xs:string, if "true" send each
    new log entry to HTTPS server --></enabled>
            <url><!-- req, xs:string, destination url --> </url>
        </https>
        <poll>
```

-continued

```
            <enabled><!-- req, xs:string, if "true" send each new
    log entry to XMPP server --></enabled>
        </poll>
    </remoteLog >
</Logging >
```

5.3.16 /OpenHome/System/Logging/logData

URI	/OpenHome/System/logging/logData	Type	Command
Function	This function is used to access the message log.		

Methods	Query String(s)	Inbound Data	Return Result
GET	since (optional)		<LogData>

Notes

Returns a list of messages with timestamp equals to or greater than <since>, where <since> is a UTC string for time in seconds since midnight, Jan. 1, 1970 UTC. If <since> is not specified, return all events contained in the local log file.

<logData> is a text object containing 0 or more lines of logging text data. Each logging line should at least contain 1) Date/time of event, 2) severity of event, and 3) event text string.

5.3.17 Notification: Logging Event

URI	http or https://<ipAddress>:<portNo>/<loggingEventURL> or xmpp://<ipAddress>:<portNo>/<loggingEventURL> or poll://<loggingEventURL>	Type	Notification
Function	This function is used by Camera to send logging events to Gateway.		

Methods	Query String(s)	Inbound Data	Return Result
POST		<LogEventList>	

Notes

This Notification is sent only if enabled in LoggingConfig.

<loggingEventURL>, <ipAdress>, and <portNo> are derived from /OpenHome/System/logging's <remoteLog/xmpp/url> or via <remoteLog/https/url> element and defines protocol used for Notification. <loggingEventURL>

Examples:

https://192.168.2.200:5000/Notification/logging/messages/event/006222000122 or

xmpp://192.168.2.200:5000/Notification/logging/messages/event/006222000122. or

poll://Notification/logging/messages/event/006222000122 dateTime is in ISO 8601 Date/Time string format, including fractions of a second.

LogEventList XML Block

```
<LogEventList version="1.0">
    <LogEvent>        <!-- opt -->
        <logNo>       <!-- req, xs:integer -->        </logNo>
        <dateTime>      <!-- req, xs:datetime -->        </dateTime>
        <severity>    <!-- req, xs:integer,              </severity>
                      defined in RFC3164 -->
        <eventID>     <!-- opt, xs:string;id -->        </eventID>
        <message>     <!-- req, xs: string -->          </message>
    </LogEvent>
</LogEventList >
```

5.3.18 /OpenHome/System/Inputs/Privacy

URI	/OpenHome/System/inputs/privacy	Type	Command
Function	Control device privacy setting across all input channels		

Methods	Query String(s)	Inbound Data	Return Result
GET			<InputPrivacy>
PUT		<InputPrivacy>	< ResponseStatus>

Notes

InputPrivacy XML Block

```
<InputPrivacy version="1.0">
    <videoInputPrivacy>   <!-- req, xs:string, "on", "off" ->
        </videoInputPrivacy >
    <audioInputPrivacy>   <!-- opt, xs:string, "on", "off" ->
        </audioInputPrivacy >
</InputPrivacy >
```

5.3.19 /OpenHome/System/XMPP/Gateway

URI	/OpenHome/System/XMPP/server	Type	Command
Function	Control XMPP server info		

Methods	Query String(s)	Inbound Data	Return Result
GET			<XMPPGateway>
PUT		< XMPPGateway >	< ResponseStatus>

Notes

If enabled, device should communicate with Gateway via XMPP Command/Notification Channel.

If ipAddress and ipv6Address elements are not specified, use DNS to resolve hostname IP address.

XMPPGateway XML Block

```
<XMPPGateway version="1.0">
    <Enabled> <!-- req, xs:string, "on", "off" ->          </Enabled >
    <hostname> <!-- req, xs:string, xmpp hostname used in
    XMPP messages -->
    <ipAddress>   <!-- dep, xs:string -->            </ipAddress>
    <ipv6Address> <!-- dep, xs:string -->            </ipv6Address>
    <port> <!-- dep, xs:Integer -->   </port>
</XMPPGateway >
```

5.3.20 /OpenHome/System/HTTP/Server

URI	/OpenHome/System/HTTP/server	Type	Command
Function	Configure Camera's local HTTP server Listing ports		

Methods	Query String(s)	Inbound Data	Return Result
GET			<HTTPServer>
PUT		< HTTPServer>	< ResponseStatus>

Notes

If enabled, device should communicate with Gateway via Interface Type 1B-HTTP/HTTPS Command/Notification Channel.

<defaultLinger> is the default linger in seconds (see /OpenHome/System/Poll/notifications).

HTTPServer XML Block

```
<HTTPServer version="1.0">
    <https> <!—opt -->
        <enabled> <!-- req, xs:string, "true", "false" ->    </enabled >
        <port> <!-- opt, xs:Integer -->  </port>
    <https> <!—opt -->
    <http> <!—opt -->
        <enabled> <!-- req, xs:string, "true", "false" ->    </enabled >
        <port> <!-- opt, xs:Integer -->  </port>
    <https> <!—opt -->
    <poll>
        <enabled> <!-- req, xs:string, "true", "false" ->    </enabled >
        <defaultLinger> <!-- req, xs:Integer --> </defaultLinger>
    </poll>
</ HTTPServer>
```

5.3.21 /OpenHome/System/History

URI	/OpenHome/System/history	Type	Command
Function	Get history of Commands and response status		

Methods	Query String(s)	Inbound Data	Return Result
GET	sinceCommand (optional) sinceNotification (optional)		<HistoryList>

Notes

sinceCommand and sinceNotification are in <UTC in milliseconds>, where <UTC in milliseconds> is the time in milliseconds since midnight, Jan. 1, 1970 UTC. If sinceCommand and/or sinceNotification query is used, device should return history entries for Commands or Notification since <UTC in milliseconds>, respectively.
If sinceCommand is 0 or missing, all Commands in the device history buffer should be returned.
If sinceNotification is 0 or missing, all Notifications in the device history buffer should be returned.
<notifyTime> is time when Notification was sent by the device in ISO 8601 Date/Time string format, including fractions of a second.
<receivedResponseTime> is time when a response was received by the device in ISO 8601 Date/Time string format, including fractions of a second.
<responseCode> is the Gateway response code
<xmlBody> is the XML body of the Notification

HistoryList XML Block

```
<HistoryList version="1.0">
    <CommandHistory> <!—opt -->
    <NotificationHistory> <!—opt -->
</HistoryList>
```

CommandHistory XML Block

```
<CommandHistory version="1.0">
    <commandURI>        <!-- req, xs:string, request URI -->
    </commandURI >
    <commandRxTime> <!-- req, xs:dateTime --></commandRxTime >
    <commandExecTime> <!-- opt, xs:dateTime -->
    </commandExecTime >
    <responseCode> <!-- req, xs:integer --> </responseCode >
</CommandHistory >
```

NotificationHistory XML Block

```
<NotificationHistory version="1.0">
    <notificationURI>   <!-- req, xs:string, URI -->          </notificationURI >
    <notifyTime> <!-- req, xs:dateTime --> </notifyTime >
    <receivedResponseTime> <!-- opt, xs:dateTime -->      </receivedResponseTime >
    <responseCode>      <!-- req, xs:integer --> </responseCode >
    <xmlBody>           <!—req, XML block of notification body -->
</NotificationHistory >
```

5.3.22 /OpenHome/System/History/Configuration

URI	/OpenHome/System/history/configuration	Type	Command
Function	Configure history events queue size		

Methods	Query String(s)	Inbound Data	Return Result
GET			<HistoryConfiguration>
PUT		<HistoryConfiguration>	<ResponseStatus>

Notes

HistoryConfiguration XML Block

```
<HistoryConfiguration version="1.0">
    <commandHistorySize> <!-- opt, xs:integer, max num of history
    entries -->
        </commandHistorySize >
    <notificationHistorySize> <!-- opt, xs:integer, max num of
    history entries -->
        </notificationHistorySize >
</HistoryConfiguration >
```

5.3.23 /OpenHome/System/Poll/Notifications

URI	/OpenHome/System/Poll/notifications	Type	Command
Function	Poll for one or more pending Notifications		

Methods	Query String(s)	Inbound Data	Return Result
GET	linger		<NotificationWrapper>

Notes

linger is time to wait in seconds before responding to a request (if no notification is available). If a notification is available or becomes available during waiting, a response is sent as soon as possible without waiting for the linger expiration.
This resource should be used to retrieve pending Notifications if the Notification event's URL is configured to use 'poll' as the prefix protocol (vs. http, https, or xmpp).
Only Notifications configured for the poll channel should be returned in the response. For a list of all notifications (including polled notifications), use /OpenHome/System/history.

NotificationWrapper XML Block

```
<NotificationWrapper version="1.0">
    <notificationURI>   <!-- req, xs:string, URI --> </notificationURI >
    <notifyTime> <!-- req, xs:dateTime --> </notifyTime >
    <notifyBody>   <!—req, XML block of notification body -->
</NotificationWrapper >
```

5.3.24 /OpenHome/System/Ping

URI	/OpenHome/System/Ping	Type	Command
Function	Poll for one or more pending Notifications		

Methods	Query String(s)	Inbound Data	Return Result
GET			<ResponseStatus>

Notes

Used by Gateway to verify connection with Camera. Camera responds with <ResponseStatus> upon receiving GET to this resource.

5.4 /OpenHome/System/Network Data Type Details

5.4.1 /OpenHome/System/Network/Interfaces

URI	/OpenHome/System/Network/interfaces	Type	Command
Function	Access the device network interfaces.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<NetworkInterfaceList>

Notes

As hardwired system resources, network interfaces cannot be created or destroyed.

NetworkInterfaceList XML Block

```
<NetworkInterfaceList version="1.0">
    < NetworkInterface/> <!-- req -->
</NetworkInterfaceList >
```

5.4.2 /OpenHome/System/Network/Interfaces/<ID>

URI	/OpenHome/System/Network/interfaces/ID	Type	Command
Function	Access a particular network interface.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<NetworkInterface>
PUT		<NetworkInterface>	<ResponseStatus>

Notes

A <NetworkInterface> represents a virtual network interface, where each interface can be configured separately with IP address configuration (e.g., static for one interface and dynamic for the other). For example, if a camera supports only 1 physical interface but can be used in wireless or wireline mode, two interfaces should be listed to represent each virtual interface.

NetworkInterface XML Block

```
<NetworkInterface version="1.0">
    <id> <!-- ro, req, xs:string;id --> </id>
    <enabled> <!-- ro, req, xs:string; "true" or "false" --></enabled >
    <IPAddress/>                    <!-- req -->
    <Wireless/>                     <!-- opt -->
```

-continued

```
    <IEEE802_1x/>                   <!-- opt -->
    <Discovery/>                    <!-- opt -->
</NetworkInterface >
```

5.4.3 /OpenHome/System/Network/Interfaces/<ID>/ipAddress

URI	/OpenHome/System/Network/interfaces/ID/ipAddress	Type	Command
Function	Access the device network interfaces.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<IPAddress>
PUT		< IPAddress >	<ResponseStatus>

Notes

If <addressingType> is dynamic, fields below it need not be provided. If <addressingType> is dynamic, a DHCP client is used for the device.

If <addressingType> is static the device IP address is configured manually and the gateway and DNS fields are optional.

If <addressingType> refers to APIPA, the device IP address is automatically configured without DHCP. In this case the gateway and DNS fields are optional.

Use of <ipAddress> or <ipv6Address> in fields is dictated by the <ipVersion> field. If <ipVersion> is "v4" the <ipAddress> fields are used;

if <ipVersion> is "v6" the <ipv6Address> fields are used.

If <ipVersion> is "dual", both <ipAddress> and <ipv6Address> fields may be used.

<subnetMask> notation is "xxx.xxx.xxx.xxx".

<IPV6Address> is "xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx" using CIDR notation.

IPAddress XML Block

```
<IPAddress version="1.0">
    <ipVersion>     <!-- req, xs:string, "v4,v6,dual" --> </ipVersion>
    <addressingType>    <!-- req, xs:string, "static,dynamic,apipa" -->
    </addressingType>
    <ipAddress>     <!-- dep, xs:string --> </ipAddress>
    <subnetMask>    <!-- dep, xs:string, subnet mask for IPv4 address -->
        </subnetMask>
    <ipv6Address>   <!-- dep, xs:string --> </ipv6Address>
    <bitMask> <!-- dep, xs:integer, bitmask IPv6 address --> </bitMask>
    <DefaultGateway>    <!-- dep -->
        <ipAddress>     <!-- dep, xs:string -->   </ipAddress>
        <ipv6Address> <!-- dep, xs:string -->    </ipv6Address>
    </DefaultGateway>
    <PrimaryDNS>  <!-- dep -->
        <ipAddress>     <!-- dep, xs:string -->   </ipAddress>
        <ipv6Address> <!-- dep, xs:string -->    </ipv6Address>
    </PrimaryDNS>
    <SecondaryDNS>    <!-- dep -->
        <ipAddress>     <!-- dep, xs:string -->   </ipAddress>
        <ipv6Address> <!-- dep, xs:string -->    </ipv6Address>
    </SecondaryDNS>
</IPAddress >
```

5.4.4 /OpenHome/System/Network/Interfaces/<ID>/Wireless

URI	/OpenHome/System/Network/interfaces/ID/wireless	Type	Command
Function	Access wireless network settings.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<Wireless>
PUT		<Wireless>	<ResponseStatus>

Notes

If the <securityMode> field is "WEP", the <WEP> block must be provided.

If the <securityMode> field is "WPA" or "WPA2-personal", the <WPA> block must be provided.

If the "WPA" or "WPA2-enterprise" security mode is used, the <WPA> block must be used and settings related to 802.
1x must be set using the /OpenHome/System/Network/interfaces/ID/ieee802.1x resource.

<channel> corresponds to an 802.11g wireless channel number or "auto" for autoconfiguration.

<wmmEnabled> enables 802.11e, QoS for IEEE 802.11 networks (Wi-Fi Multimedia)

<defaultTransmitKeyIndex> indicates which encryption key is used for WEP security.

<encryptionKey> is the WEP encryption key in hexadecimal format.

<sharedKey> is the pre-shared key used in WPA

<OptimalWiFiAPSelection> is used to enable/disable optimal Wifi selection mode

<testConnectivity>, for PUT method and if enabled, Camera should verify Wifi connectivity with the configured AP (Camera must validate connectivity and not just association, e.g., Camera can obtain IP address via DHCP).
Upon receiving a valid <testConnectivity> Command, Camera should respond with <ResponseStatus>, and then send a yyy notification to the Gateway after connectivity test.
For Camera that only supports one physical network interface, Camera may disconnect after responding with <ResponseStatus>, run Wifi connectivity test, reconnect to the original interface and send notification to Gateway.

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Wireless XML Block

```
<Wireless version="1.0">
    <enabled>        <!-- req, xs:boolean -->   </enabled>
    <wirelessNetworkMode><!-- opt, xs:string, "infrastructure,adhoc" -->
    </wirelessNetworkMode>
    <channel>        <!-- opt, xs:string, "1-14,auto" --> </channel>
    <ssid>           <!-- opt, xs:string -->          </ssid>
    <wmmEnabled> <!-- opt, xs:boolean --> </wmmEnabled>
    <WirelessSecurity>        <!-- opt -->
      <securityMode> <!-- opt, xs:string, "disable,WEP,WPA-personal,WPA2-
      personal,WPA-RADIUS,WPA-enterprise,WPA2-enterprise" --></securityMode>
      <WEP>        <!-- dep, depends on <securityMode> -->
        <authenticationType> <!-- req, xs:string, "open,sharedkey,auto" --
        ></authenticationType>
        <defaultTransmitKeyIndex>                <!-- req, xs:integer -->
        </defaultTransmitKeyIndex>
        <wepKeyLength>                <!-- opt, xs:integer "64,128" --> </wepKeyLength>
        <EncryptionKeyList>
          <encryptionKey> <!-- req, xs:hexBinary, WEP encryption key in
          hexadecimal format --></encryptionKey>
        </EncryptionKeyList>
      </WEP>
      <WPA>        <!-- dep, depends on <securityMode> -->
        <algorithmType>                <!-- req, xs:string, "TKIP,AES,TKIP/AES"-->
        </algorithmType>
        <sharedKey>          <!-- req, xs:string, pre-shared key used in WPA -->
        </sharedKey>
      </WPA>
    </WirelessSecurity>
    < statusRefreshInterval>              <!-- req, xs:integer, max internval between wireless
    status refresh in sec -->             </statusRefreshInterval >
    <OptimalWiFiAPSelection>                      <!-- opt -->
        <enabled> <!-- req, xs:boolean -->   </enabled>
        <checkInterval> <!-- req, xs:integer in seconds -->       </checkInterval >
        <switchThreshold> <!-- req, xs:percentage --> </switchThreshold >
        <minSwitchTime> <!-- req, xs: integer in seconds -->   </minSwitchTime
    >
    </OptimalWiFiAPSelection>
    <testConnectivity> <!-- opt, valid only with PUT method -->
      <enable><!-- req, xs:boolean --></enable>
      <timeout>
            <!--dep, valid value is 10~1200, unit is second -->
      </timeout>
      <ResultNotifyURL>
            <!-- dep, notification URL for sending WiFi connectivity test result, see
```

-continued

```
<WifiConnectivityTestResult> Notificaiton -->
        </ResultNotifyURL>
        </testConnectivity>
</Wireless >
```

5.4.4.1 Notification: WifiConnectivityTestResult

URI	http or https://<ipAddess>:<portNo>/<notificationURL> or poll:// <notificationURL>	Type	Notification
Function	This function is used by the Camera to send Wifi connectivity test result to the Gateway.		

Methods	Query String(s)	Inbound Data	Return Result
POST		WifiConnectivityTestResult	

Notes

<notificationURL> is derived from <Wireless> XML Block's <testConnectivity> parameters dateTime is in ISO 8601 Date-Time format.

WifiConnectivityTestResult XML Block

```
<WifiConnectivityTestResult version="1.0">
    <id> <!-- req, xs:string;id -->                                    </id>
    <associated><!-- req, xs:boolean --> </ associated >
    <errorReason> <!-- dep, xs:string (req if association is false) -->                    </ errorReason
    >
    <dateTime>                    <!-- opt, xs:datetime, when test was performed -->   </dateTime>
    <!-- the following paramerters are required if associated is true →
    <channelNo>                   <!-- req, xs:string, "1-14" current channel No-->     </channelNo>
    <ssid>   <!-- req, xs:string -->                                  </ssid>
    <bssid> <!-- req, xs:string -->                                  </bssid>
    <rssidB><!-- req, xs:integer, received signal strength indicator in dB -->
        </rssidB >
</ WifiConnectivityTestResult >
```

5.4.5 /OpenHome/System/Network/Interfaces/<ID>/Wireless/Status

URI	/OpenHome/System/Network/interfaces/ID/wireless/status	Type	Command
Function	Access interface status.		

Methods	Query String(s)	Inbound Data	Return Result
GET	forceRefresh (optional)		<WirelessNetworkStatus>

Notes

This resource is read-only.

If 'forceRefresh' query parameter is 'true', device should collect a new set of <WirelessNetworkStatus> data before returning result. If 'forceRefresh' parameter is false or missing, device should return <WirelessNetwork-Status> without collecting new data.

Data underlying <WirelessNetworkStatus> should be periodically refreshed by the device at maximum interval of <statusRefreshInterval> seconds defined in the <Wireless> XML block.

WirelessNetworkStatus XML Block

```
<WirelessNetworkStatus version="1.0">
    <enabled>     <!-- ro,req, xs:boolean -->          </enabled>
    <channelNo>   <!-- ro,req, xs:string, "1-14" current channel No--> </channelNo>
    <ssid>        <!-- ro,req, xs:string -->   </ssid>
    <bssid> <!-- ro,req, xs:string -->     </bssid>
    <rssidB><!-- ro,req, xs:integer, received signal strength indicator in dB -->
        </rssidB >
    <signalStrength><!-- ro,req, xs:integer, 0-100 %- -></signalStrength>
    <noiseIndB> ><!-- ro,req, xs:integer, noise level in dB -->   </noiseIndB >
    <numOfAPs> <!-- ro,req, xs:string --> </numOfAPs>
    <AvailableAPList> <!-- ro,opt -->
        <AvailableAccessPoint>        <!-- ro,opt -->
                <ssid> <!-- ro,req, xs:string -->      </ssid>
                <bssid> <!-- ro,req, xs:string -->     </bssid>
```

-continued

```
                <rssidB><!-- ro,req, xs:integer, received signal strength indicator in dB
    --> </ rssidB >
                <securityMode> <!-- ro,req, xs:string, "disable,WEP,WPA-
      personal,WPA2-personal,WPA-                RADIUS,WPA-enterprise,WPA2-
      enterprise" --></securityMode>
        </AvailableAccessPoint >
    </AvailableAPList>
</WirelessNetworkStatus >
```

5.4.6 /OpenHome/System/Network/Interfaces/<ID>/ieee802.1x

URI	/OpenHome/System/Network/interfaces/ID/ieee802.1x	Type	Command
Function	Access IEEE 802.1x settings.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<IEEE802_1x>
PUT		<IEEE802_1x>	<ResponseStatus>

Notes

If the <authenticatonProtocolType> tag corresponds to "EAP-TTLS", then the <innerTTLSAuthentication-Method> tag must be provided.

If the <authenticationProtocolType> corresponds to "EAP-PEAP" or "EAP-FAST", then the <innerEAP-ProtocolType> tag must be provided.

The <anonymousID> tag is optional.

If the <authenticationProtocolType> corresponds to "EAP-FAST", then the <autoPACProvisioningEnabled> tag must be provided.

<anonymousID> is the optional anonymous ID to be used in place of the <userName>.

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IEEE802_1x XML Block

```
<IEEE802__1x version="1.0">
    <enabled> <!-- req, xs:boolean --> </enabled>
    <authenticationProtocolType>
        <!-- req, xs:string, "EAP-TLS,EAP-TTLS,EAP-PEAP,EAP-LEAP,EAP-FAST"
    --> </authenticationProtocolType> <innerTTLSAuthenticationMethod>
        <!-- dep, xs:string, "MS-CHAP,MS-CHAPv2,PAP,EAP-MD5" -->
    </innerTTLSAuthenticationMethod> <innerEAPProtocolType><!-- dep, xs:string,
    "EAP-POTP,MS-CHAPv2" --> </innerEAPProtocolType>
    <validateServerEnabled> <!-- dep, xs:boolean --> </validateServerEnabled>
    <userName>      <!-- dep, xs:string --> </userName>
    <password>      <!-- dep, xs:string --> </password>
    <anonymousID>   <!-- opt, xs:string --> </anonymousID>
    <autoPACProvisioningEnabled> <!-- dep, xs:boolean -->
    </autoPACProvisioningEnabled>
</IEEE802__1x >
```

5.4.7 /OpenHome/System/Network/Interfaces/<ID>/Discovery

URI	/OpenHome/System/Network/interfaces/ID/discovery	Type	Command
Function	Device discovery settings.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<Discovery>
PUT		<Discovery>	<ResponseStatus>

Notes

Use of IPv4 or IPv6 addresses depends on the value of the <ipVersion> field in /OpenHome/System/Network/interfaces/ID/ipAddress.

<portNo> is the port number for the multicast discovery address.

<ttl> is the time to live for multicast discovery packets.

Discovery XML Block

```
<Discovery version="1.0">
    <UPnP>        <!-- req -->
        <enabled>  <!-- req, xs:boolean --> </enabled>
    </UPnP>
    <Zeroconf>       <!-- opt -->
        <enabled>  <!-- req, xs:boolean --> </enabled>
    </Zeroconf>
    <MulticastDiscovery>   <!-- opt -->
        <enabled>  <!-- req, xs:boolean --> </enabled>
        <ipAddress>         <!-- dep, xs:string -->   </ipAddress>
        <ipv6Address> <!-- dep, xs:string -->        </ipv6Address>
        <portNo>   <!-- req, xs:integer --> </portNo>
        <ttl>      <!-- req, xs:integer --> </ttl>
    </MulticastDiscovery>
</ Discovery>
```

5.5 /OpenHome/System/Audio Data Type Details

5.5.1 /OpenHome/System/Audio/Channels

URI	/OpenHome/System/Audio/channels		Type	Command
Function	Access audio channels.			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<AudioChannelList>	

Notes
Since inputs are resources that are defined by the hardware configuration of the device, audio channels cannot be created or deleted.
ID numbering or values should be considered arbitrary and device-dependent.

AudioChannelList XML Block

```
<AudioChannelList version="1.0">
    <AudioChannel/>   <!-- opt -->
</AudioChannelList >
```

5.5.2 /OpenHome/System/Audio/Channels/<ID>

URI	/OpenHome/System/Audio/channels/ID		Type	Command
Function	Access audio channels.			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<AudioChannel>	
PUT		<AudioChannel>	<ResponseStatus>	

Notes
<audioMode> is the duplex mode for audio transmission between the client and media device.
<microphoneSource> indicates whether the device microphone is internal or external.
<microphoneVolume> Volume control percentage for device microphone. 0 is mute.
<speakerVolume> Volume control percentage for device speaker. 0 is mute.

AudioChannel XML Block

```
<AudioChannel version="1.0">
    <id> <!-- req, xs:string;id -->   </id>
    <enabled> <!-- req, xs:boolean -->   </enabled>
    <audioMode><!-- req, xs:string, "listenonly,talkonly,talkorlisten,talkandlisten" -->
    </audioMode>
    <microphoneEnabled>  <!-- opt, xs:boolean -->   </microphoneEnabled>
    <microphoneSource>    <!-- opt, xs:string, "internal,external" -->
        </microphoneSource>
    <microphoneVolume>  <!-- opt, xs:integer, 0..100 -->   </microphoneVolume>
    <speakerEnabled>       <!-- opt, xs:boolean -->   </speakerEnabled>
    <speakerVolume>        <!-- opt, xs:integer, 0..100 -->   </speakerVolume>
</AudioChannel>
```

5.6 /OpenHome/System/Video Data Type Details

5.6.1 /OpenHome/System/Video/Inputs

URI	/OpenHome/System/Video/inputs		Type	Command
Function	Access the video inputs on an IP media device.			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<VideoInput>	

Notes

An IP media device may contain a set of video inputs. These inputs are hardwired by the device, meaning that the IDs can be discovered but not created or deleted. ID numbering or values should be considered arbitrary and device-dependent.

VideoInput XML Block

```
<VideoInput version="1.0">
    <VideoInputChannelList/> <!-- opt -->
</VideoInput >
```

5.6.2 /OpenHome/System/Video/Inputs/Channels

URI	/OpenHome/System/Video/inputs/channels		Type	Command
Function	Access the video inputs on an IP media device.			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<VideoInputChannelList>	

Notes

Since video input channels are resources that are defined by the hardware configuration of the device, they cannot be created or deleted.

VideoInputChannel XML Block

```
<VideoInputChannelList version="1.0">
    <VideoInputChannel/><!-- opt -->
</VideoInputChannelList >
```

5.6.3 /OpenHome/System/Video/Inputs/Channels/<ID>

URI	/OpenHome/System/Video/inputs/channels/ID		Type	Command
Function	Access video input channel properties.			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<VideoInputChannel>	
PUT		<VideoInputChannel>	<ResponseStatus>	

Notes

<powerLineFrequencyMode> is used to adjust/correct video image based on different power frequencies.

<whiteBalanceMode> indicates the white balance operational mode.

<whiteBalanceLevel> indicates the white balance percentage value when whiteBalanceMode refers to manual. 0 is 'cool', 100 is 'hot'.

<exposureMode> indicates the exposure operational mode.

<exposureTarget> the target exposure for manual or auto-exposure.

<exposureAutoMin> minimum exposure when <exposureMode> is set to auto.

<exposureAutoMax> maximum exposure when <exposureMode> is set to auto.

<GainWindow> defines the coordinates of the window used to determine the auto-gain statistics, if smaller than the entire window.

<gainLevel> indicates the gain level percentage value when

<exposureMode> refers to Manual. 0 is low gain, 100 is high gain.

<irisMode> indicates the iris operational mode. Only applicable for auto-iris lens modules. Override will put lens module into manual mode until the scene changes, at which point operation is switched to the auto mode.

<focusMode> indicates the focus operational mode. Only applicable for auto-focus lens modules. Override will put lens module into manual mode until the scene changes, at which point operation is switched to the auto mode.

In <DayNightFilter>, <beginTime> and <endTime> are only used if <switchScheduleEnabled> is true.

VideoInputChannel XML Block

```
<VideoInputChannel version="1.0">
    <id> <!-- req, xs:string;id --> </id>
    <inputPort> <!-- opt, xs:string --> </inputPort>
    <powerLineFrequencyMode> <!-- opt, xs:string "50hz, 60hz" -->
    </powerLineFrequencyMode> <whiteBalanceMode>
        <!-- opt, xs:string, "manual,auto,indoor/incandescent,fluorescent/white,
        fluorescent/yellow,outdoor,black&white"-->
    </whiteBalanceMode>
    <whiteBalanceLevel> <!-- dep, xs:integer, 0..100 --> </whiteBalanceLevel>
    <exposureMode> <!-- opt, xs:string, "manual, auto" --> </exposureMode>
    <Exposure> <!-- opt -->
        <exposureTarget> <!-- req, xs:integer, microseconds -->
            </exposureTarget>
        <exposureAutoMin> <!-- req, xs:integer, microseconds -->
            </exposureAutoMin>
        <exposureAutoMax> <!-- req, xs:integer, microseconds -->
            </exposureAutoMax>
    </Exposure>
    <GainWindow> <!-- opt -->
        <RegionCoordinatesList> <!-- opt -->
            <RegionCoordinates> <!-- opt -->
                <positionX> <!-- req, xs:integer;coordinate --> </positionX>
                <positionY> <!-- req, xs:integer;coordinate --> </positionY>
            </RegionCoordinates>
        </RegionCoordinatesList>
    </GainWindow>
    <gainLevel> <!-- dep, xs:integer, 0..100 --> </gainLevel>
    <brightnessLevel> <!-- opt, xs:integer, 0..100 --> </brightnessLevel>
    <contrastLevel> <!-- opt, xs:integer, 0..100 --> </contrastLevel>
    <sharpnessLevel> <!-- opt, xs:integer, 0..100 --> </sharpnessLevel>
    <saturationLevel> <!-- opt, xs:integer, 0..100 --> </saturationLevel>
    <hueLevel> <!-- opt, xs:integer, 0..100 --> </hueLevel>
    <gammaCorrectionEnabled> <!-- opt, xs:boolean -->
        </gammaCorrectionEnabled>
    <gammaCorrectionLevel> <!-- opt, xs:integer, 0..100 -->
        </gammaCorrectionLevel>
    <WDREnabled> <!-- opt, xs:boolean --> </WDREnabled>
    <WDRLevel> <!-- opt, xs:integer, 0..100 --> </WDRLevel>
    <LensList><!-- opt -->
        <Lens> <!-- opt --> <lensModuleName> <!-- opt, xs:string -->
            </lensModuleName>
        <irisMode><!-- opt, xs:string, "manual,auto,override" --> </irisMode>
        <focusMode> <!-- opt, xs:string, "manual,auto,autobackfocus,override" --
        ></focusMode> </Lens>
    </LensList>
    <DayNightFilter> <!-- opt -->
        <dayNightFilterType> <!-- req, xs:string, "day,night,auto" --
        ></dayNightFilterType>
        <switchScheduleEnabled><!-- opt, xs:boolean -->
            </switchScheduleEnabled>
        <beginTime> <!-- dep, xs:time --> </beginTime>
        <endTime> <!-- dep, xs:time --> </endTime>
        <illuminationSwitchOver> <!-- opt -->
            <enabled> > <!-- req, xs:boolean --> </enabled>
            <threshold> <!-- req, xs:integer, 0..100 --> </threshold>
        </illuminationSwitchOver>
    </DayNightFilter>
    <shutterspeed> <!-- req, xs:integer --> </shtterspeed>
    <rotationDegree> <!-- opt, xs:integer, degrees, 0..360 --></rotationDegree>
    <mirrorEnabled> <!-- opt, xs:boolean --> </mirrorEnabled>
</VideoInputChannel >
```

5.7 /OpenHome/Security Data Type Details

5.7.1 /OpenHome/Security/updateSSLCertificate/

Camera should support both client SSL certificates (used for validating Gateway identity) as well as server SSL certificates (used for Gateway to validate a camera's identity). One or more client SSL certificates are pre-configured in the Camera, but can be updated via the /OpenHome/Security/updateSSLCertificate/client Command. Server SSL certificate is used only if Interface Type 1B—HTTP/HTTPS Command/Notification Channel is activated, and it is usually not pre-configured at the device. Procedures for updating Camera's client SSL certificate is as follows:

1. Gateway invokes /OpenHome/Security/updateSSLCertificate/server Command to start Certificate Signing Request (CSR) process, Command parameters includes the common name (CN) field to be used as part of the CSR request. CN utilizes the "<serial>-<siteid>-<timestamp>" format.
2. Camera generates its own public/private key pair (if it doesn't have one already)
3. Camera invokes /OpenHome/Security/certificateSigningRequest/server Notification to Gateway, submits this CSR to the server for signing. This is an HTTPS POST request using basic Authorization with the device serial number and key as username and password (see Section 4.1.2.2 Camera Originated Notifications).

4. Gateway authenticates the CSR request (verifies username and password), invokes a check command on the gateway (passing the CN) in order to obtain approval to process the CSR, and if approved, then signs and returns the result to the camera

5.7.1.1 /OpenHome/Security/updateSSLCertificate/Client

URI	/OpenHome/Security/updateSSLCertificate/client	Type	Command
Function	This function is used to trigger the device to retrieve an updated client SSL certificate		

Methods	Query String(s)	Inbound Data	Return Result
POST GET		<UpdateSSLCertCommand>	<ResponseStatus> Exisitng client certificates in PEM format

Notes

For client SSL certificate retrieval, the <clientCert> element is required. Must use either HTTPS or XMPP to request this Command. Caemra returns <ResponseStatus> with reboot-required parameter. Camera should verify certificate validity and ignore certificate if not validate. This Command updates client certificates beyond the pre-configured client certificates on the device. It does NOT replace or remove the pre-configured client certificates.

UpdateSSLCertCommand XML Block

```
<UpdateSSLCertCommand version="1.0">
    <serverCert>   <!-- dep -->
        <url><!-- req, xs:string, url where to retrieve the updated certificate-->
        </url>
        <csr> <!-- req -->
            <CN>   <!-- req, xs:string, common name to be used in Certificate
    Signing Request--> </CN>
        </csr>
    </serverCert>
    <clientCert>   <!-- dep -->
        <url><!-- req, xs:string, url where to retrieve the updated certificate-->
        </url>
    </clientCert>
</UpdateSSLCertCommand >
```

5.7.1.2 /OpenHome/Security/updateSSLCertificate/Server

URI	/OpenHome/Security/updateSSLCertificate/server	Type	Command
Function	This function is used to trigger the device to request a new SSL server certificate for the device (used for HTTPS transaction requests to the device)		

Methods	Query String(s)	Inbound Data	Return Result
POST GET		<UpdateSSLCertCommand>	<ResponseStatus> Exisitng client certificates in PEM format

Notes

For server SSL certificate retrieval, the <serverCert> element is required.

If HTTPS Command/Notification Channel is used to request this Command, HTTP (not HTTPS) will be the underlying transport.

Caemra returns <ResponseStatus> with reboot-required parameter. Camera should verify certificate validity and ignore certificate if not validate.

5.7.1.3 Request for updateSSLCertificate

URI	https://<hostName>:<portNo>/<updateSSLCertGatewayURL> or xmpp://<hostName>:<portNo>/<updateSSLCertGatewayURL>	Type	HTTPS Request from Camera to Gateway

-continued

Function	This function is used to request signing of the device's server certificate from Camera to Gateway		
Methods	Query String(s)	Inbound Data	Return Result
POST		<CertificationRequestInfo>	<CertificationRequest>

Notes

<updateSSLCertGatewayURL>, <hostname>, are derived from the /OpenHome/Security/updateSSLCertificate/server's <ServerCert> element.

Examples:

https://192.168.2.200:5000/Notification/updateSSLCertRequest/006222000122 or xmpp://192.168.2.200:5000/Notification/updateSSLCertRequest/006222000122 <CertificateSigningRequest> and <CertificationRequest> are defined in RFC 2986 (PKCS #10: Certification Request Syntax Specification).

5.7.2 /OpenHome/Security/AAA/Accounts

User and administration accounts on the Camera can be retrieved and configured via the following data types.

5.7.2.1 /OpenHome/Security/AAA/Accounts

URI	/OpenHome/Security/AAA/Accounts		Type	Command
Function	Access the device's user list			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<AccountList>	
PUT		<AccountList>	<ResponseStatus>	
POST		<Account>	<ResponseStatus>	
DELETE			<ResponseStatus>	

Notes

For server SSL certificate retrieval, the <serverCert> element is required.

It is possible to add, remove and update users entries in the list.

Passwords can only be uploaded - they are never revealed during GET operations.

UserList XML Block

```
<UserList version="1.0">
    <Account/>   <!-- opt -->
</UserList >
```

5.7.2.2 /OpenHome/Security/AAA/Accounts/<ID>

URI	/OpenHome/Security/AAA/accounts/ID		Type	Command
Function	Authentication account settings			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<Account>	
PUT		<Account>	<ResponseStatus>	
DELETE			<ResponseStatus>	

Notes

Each <protocolID> tag, if <ProtocolList> is provided, must match a corresponding <id> tag in /OpenHome/Security/adminAccesses.

Note:

<password> is a write-only field.

Account XML Block

```
<Account version="1.0">
    <id> <!-- req, xs:string;id -->   </id>
    <userName>        <!-- req, xs:string --> </userName>
    <password>        <!-- wo, req, xs:string -->   </password>
    <accessRights>    <!-- req, xs:string, "admin", "user" -->
                      </accessRights>
</Account>
```

5.7.3 Authorization

5.7.3.1 /OpenHome/Security/Authorization/

URI	/OpenHome/Security/Authorization	Type	Command
Function	This function is used to get authorization credential from Camera to Gateway		

Methods	Query String(s)	Inbound Data	Return Result
GET			<AuthorizationInfo>
PUT		<AuthorizationInfo>	<ResponseStatus>

Notes

siteID is defined in Appendix B Step 1 - Retrieve Gateway URL and SiteID.

SharedSecreit is defined in in Appendix B Step 2 - Retrieve Credential.

<credentialGWURL> is defined in in Appendix B Step 2 - Retrieve Credential.

pendignKey is defined in in Appendix B Step 2 - Retrieve Credential.

AuthorizationInfo XML Block

```
<AuthorizationInfo version="1.0">
    <siteID>            <!-- req, xs:string -->     </siteID >
    <sharedSecret>      <!-- req, xs:string -->     </sharedSecret >
    <pendingKey>        <!-- req, xs:string -->     </pendigKey >
    <credentialGWURL>     <!-- req, xs:string -->     </
    credentialGWURL>
</Authorization>
```

5.8 /OpenHome/Streaming Data Type Details

5.8.1 Configuring Audio/Video/Image Channels

5.8.1.1 /OpenHome/Streaming/Channels

URI	/OpenHome/Streaming/channels	Type	Command
Function	This function is used to configure or get streaming channels		

Methods	Query String(s)	Inbound Data	Return Result
GET			<StreamingChannelList>
PUT		<StreamingChannelList>	<ResponseStatus>
POST		<StreamingChannel>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

Streaming channels may be hardwired, or it may be possible to create multiple streaming channels per input if the device supports it.

StreamingChannelList XML Block

```
<StreamingChannelList version="1.0">
    <StreamingChannel/> <!-- opt -->
</StreamingChannelList >
```

5.8.1.2 /OpenHome/Streaming/Channels/<ID>

URI	/OpenHome/Streaming/channels/ID	Type	Command
Function	This function is used to configure or get streaming channels		

Methods	Query String(s)	Inbound Data	Return Result
GET			<StreamingChannel>
PUT		<StreamingChannel>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

<ControlProtocolList> identifies the control protocols that are valid for this type of streaming.

<Unicast> is for direct unicast streaming.

<Multicast> is for direct multicast streaming.

<videoSourcePortNo> and <audioSourcePortNo> are the source port numbers for the outbound video or audio streams.

<videoInputChannelID> refers to /OpenHome/System/Video/inputs/channel/ID.

<audioInputChannelID> refers to /OpenHome/System/Audio/channels/ID. It must beconfigured as an input channel.

Use of IPv4 or IPv6 addresses depends on the value of the <ipVersion> field in /OpenHome/System/Network/interfaces/ID/ipAddress.

<Security> determines whether SRTP is used for stream encryption.

<audioResolution> is the resolution for the outbound audio stream in bits.

<mediaCapture> is only required if the device requires pre-configuration of pre/post capture buffer duration.

StreamingChannel XML Block

```
<StreamingChannel version="1.0">
    <id> <!-- req, xs:string;id -->                    </id>
    <channelName>          <!-- opt, xs:string -->            </channelName>
    <enabled>     <!-- req, xs:boolean -->                    </enabled>
    <Transport>              <!-- req -->
        <rtspPortNo>             <!-- opt, xs:integer -->             </rtspPortNo>
        <maxPacketSize>                <!-- opt, xs:integer -->           </maxPacketSize>
        <audioPacketLength>            <!-- opt, xs:integer -->           </audioPacketLength>
        <audioInboundPacketLength><!-- opt, xs:integer -->
                </audioInboundPacketLength>
        <audioInboundPortNo>                    <!-- opt, xs:integer -->  </audioInboundPortNo>
        <videoSourcePortNo>            <!-- opt, xs:integer -->           </videoSourcePortNo>
        <audioSourcePortNo>            <!-- opt, xs:integer -->           </audioSourcePortNo>
        <ControlProtocolList>          <!-- req -->
                <ControlProtocol>              <!-- req -->
                  <streamingTransport><!-- req, xs:string, "HTTP,RTSP" -->
                  </streamingTransport>
                </ControlProtocol>
        </ControlProtocolList>
        <Unicast>            <!-- opt -->
                <enabled>     <!-- req, xs:boolean -->                  </enabled>
                <interfaceID>          <!-- opt, xs:string -->            </interfaceID>
                <rtpTransportType><!-- opt, xs:string, "RTP/UDP,RTP/TCP" -->
                </rtpTransportType>
        </Unicast>
        <Multicast>                <!-- opt -->
                  <enabled> <!-- req, xs:boolean -->                  </enabled>
          <userTriggerThreshold>                  <!--opt,xs:integer--></userTriggerThreshold>
          <destIPAddress>                  <!-- dep, xs:string --> </destIPAddress>
                <videoDestPortNo><!-- opt, xs:integer --></videoDestPortNo>
                <audioDestPortNo>              <!-- opt, xs:integer -->  </audioDestPortNo>
                <destIPv6Address>              <!-- dep, xs:string -->   </destIPv6Address>
                <ttl>      <!-- opt, xs:integer -->            </ttl>
        </Multicast>
        <Security>           <!-- opt -->
                <enabled>     <!-- req, xs:boolean -->                  </enabled>
        </Security>
    </Transport>
    <Video>       <!-- opt -->
        <enabled>            <!-- req, xs:boolean -->                  </enabled>
        <videoInputChannelID>                   <!-- req, xs:string;id -->
                </videoInputChannelID>
        <videoCodecType><!-- req, xs:string, "MPEG4,MJPEG,3GP,H.264,MPNG"
        --> </videoCodecType>
        <videoScanType><!-- opt, xs:string, "progressive,interlaced" -->
        </videoScanType>
        <videoResolutionWidth>                  <!-- req, xs:integer -->
                </videoResolutionWidth>
        <videoResolutionHeight>                 <!-- req, xs:integer -->
                </videoResolutionHeight>
        <videoPositionX>               <!-- opt, xs:integer -->           </videoPositionX>
        <videoPositionY>               <!-- opt, xs:integer -->           </videoPositionY>
```

-continued

```
        <videoQualityControlType><!-- opt, xs:string, "cbr,vbr" -->
        </videoQualityControlType>
        <constantBitRate> <!-- dep, xs:integer, in kbps -->                </constantBitRate>
        <fixedQuality>          <!-- opt, xs:integer, percentage, 0..100 -->
                </fixedQuality>
        <vbrUpperCap>           <!-- dep, xs:integer, in kbps -->            </vbrUpperCap>
        <vbrLowerCap>           <!-- dep, xs:integer, in kbps -->            </vbrLowerCap>
        <maxFrameRate>                  <!-- req, xs:integer, maximum frame rate x100 -->
                </maxFrameRate>
        <keyFrameInterval> <!-- opt, xs:integer, milliseconds -->
                </keyFrameInterval>
        <govLength> <!-- opt, xs:integer, number of frames -->
                </govLength>
        <rotationDegree>                <!-- opt, xs:integer, degrees, 0..360 --
        ></rotationDegree>
        <mirrorEnabled>         <!-- opt, xs:boolean -->                  </mirrorEnabled>
        <snapShotImageType><!-- opt, xs:string, "JPEG,GIF,PNG" -->
        </snapShotImageType>
    </Video>
    <Audio>     <!-- opt -->
        <enabled>           <!-- req, xs:boolean -->                  </enabled>
        <audioInputChannelID>                   <!-- req, xs:string;id -->
                </audioInputChannelID>
        <audioCompressionType>
        <!-- req, xs:string,
        "G.711alaw,G.711ulaw,G.726,G.729,G.729a,G.729b,PCM,MP3,AC3,AAC,A
        DPCM"-->            </audioCompressionType>
        <audioInboundCompressionType>
        <!-- opt, xs:string,
        "G.711alaw,G.711ulaw,G.726,G.729,G.729a,G.729b,PCM,MP3,AC3,AAC,A
        DPCM"-->
        </audioInboundCompressionType>
        <audioBitRate>          <!-- opt, xs:integer, in kbps -->            </audioBitRate>
        <audioSamplingRate>             <!-- opt, xs:float, in kHz -->       </audioSamplingRate>
        <audioResolution>               <!-- opt, xs:integer, in bits -->            </audioResolution>
    </Audio>
    <MediaCapture>  <!-- opt -->
        <preCaptureLength>  <!-- req, xs:integer, milliseconds -->
                </preCaptureLength >
        <postCaptureLength>  <!-- req, xs:integer, milliseconds -->
                </postCaptureLength >
    </MediaCapture>
</StreamingChannel >
```

5.8.1.3 /OpenHome/Streaming/Channels/<ID>/Capabilities

URI	/OpenHome/Streaming/channels/<ID>/capabilities	Type	Command
Function	This function is used to get capability of a specific channel and streaming protocol		
Methods	Query String(s)	Inbound Data	Return Result
GET			<StreamingCapabilities>

Notes

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StreamingCapabilities XML Block

```
<StreamingCapabilities version="1.0">
  <id opt="<!--req xs:integer, list of channel ID-->">      <!--req xs:integer, default
  channel ID-->   </id>
  <channelName min="0" max="64"> <!-- opt xs:string, default descriptive name -->
  </channelName >
  <enabled opt="true,false">   <!-- req xs:string -->        </enabled>
<ControlProtocolList>                       <!-- req -->
    <ControlProtocol>                       <!-- req -->
      <streamingTransport opt="RTSP/RTP,HTTP">      <!-- req xs:string-->
        </streamingTransport>
    </ControlProtocol>
</ControlProtocolList>
<Video>                         <!-- req -->
    <enabled opt="true,false">  <!-- req xs:string -->   </enabled>
    <videoInputChannelID opt="="><!--req xs:integer, list of video input channel ID--
    >">
```

-continued

```
        <!-- req xs:integer -->
    </videoInputChannelID>
    <videoCodecType opt="MJPEG,MPEG4,H264,3GPP"> <!-- req xs:string -->
    </videoCodecType>
    <videoResolutionWidth min="0" max="<!-- req xs:integer, max width-->"> req
    xs:integer </videoResolutionWidth>
      <videoResolutionHeight min="0" max="<!-- req xs:integer, max height-->"> req
    xs:integer </videoResolutionHeight>
    <videoQualityControlType opt="CBR,VBR"> <!-- req xs:string -->
    </videoQualityControlType>
    <constantBitRate min="<!-- req xs:integer, min Kbps-->" max="<!-- req xs:integer,
    max Kbps-->"> <!-- req xs:integer, Kbps -->   </constantBitRate>
    <maxFrameRate min="<!-- req xs:integer, min fps-->" max="<!-- req xs:integer,
    max fps-->" dynamic="<true \ false>" > <!-- req xs:integer, fps -->
    </maxFrameRate>
    <snapShotImageType opt="JPEG" def="JPEG">   <!-- req xs:string -->
    </snapShotImageType>
</Video>
<Audio>                          <!-- req -->
      <enabled opt="true,false" def="false"> <!-- req xs:string -->   </enabled>
      <audioInputChannelID opt="<!--req xs:integer, list of audio input ID-->"><!-- req
    xs:integer -->   </audioInputChannelID>
    <audioCompressionType opt="G.726,G.711ulaw,711alaw,AMR,AAC"
    def="711ulaw"> req xs:string </audioCompressionType>
    <audioBitRate opt="<!-- req xs:integer, list of rates -->" def="32"
    dynamic="true">24</audioBitRate>
</Audio>
  <MediaCapture>   <!-- opt -->
    <preCaptureLength opt="<!-- req xs:integer -->">   <!-- req, xs:integer,
milliseconds -->                  </preCaptureLength >
    <postCaptureLength opt="<!-- req xs:integer -->"> <!-- req, xs:integer,
milliseconds -->                  </postCaptureLength >
    </MediaCapture>
</ StreamingCapabilities>
```

5.8.1.4 Encoder Channel Query Capability and Set Configuration Example

The following example illustrates a Gateway querying Camera's encoder channel **1**'s capabilities and base on capability received, set channel **1** with desired configurations. Note, Authorization flow examples not shown.

```
Gateway->Camera (get capability for encoder channel 1)
GET /OpenHome/Streaming/channels/1/capabilities HTTP/1.1
Host: 192.168.2.52
Pragma: no-cache
Cache-Control: no-cache
Date: Sat, 11 Jun 2011 18:23:51 GMT
Camera->Gateway (response)
HTTP/1.1 200 OK
Content-Type: application/xml; charset="UTF-8"
Connection: Keep-Alive
Content-Length: <size of the xml body below in bytes>
<StreamingCapabilities version="1.0">
    <id opt="1,2">1</id>
    <channelName min="0" max="64"></channelName>
    <ControlProtocolList>
        <ControlProtocol>
            <streamingTransport
    opt="RTSP/RTP">RTSP/RTP</streamingTransport>
        </ControlProtocol>
    </controlProtocolList>
    <Video>
        <enabled opt="true,false">true</enabled>
        <VideoInputChannelID opt="0,1">1</VideoInputChannelID>
        <videoCodecType
opt="MPEG4,H264,3GPP">MPEG4</videoCodecType>
        <videoResolutionWidth min="0" max="640">0</videoResolutionWidth>
        <videoResolutionHeight min="0"
max="480">0</videoResolutionHeight>
        <videoQualityControlType
opt="CBR,VBR">CBR</videoQualityControlType>
        <constantBitRate min="0" max="2000"
```

-continued

```
dynamic="true">500</constantBitRate>
        <maxFrameRate min="0" max="30"
dynamic="true">15</maxFrameRate>
        <snapShotImageTpe opt="JPEG">JPEG</snapShotImageTpe>
    </Video>
    <Audio>
        <enabled opt="true,false">true</enabled>
        <audioInputChannelID opt="1">1</audioInputChannelID>
        <aduioCompressionType
opt=G.726,G.711ulaw,G.711alaw,AMR,AAC">G.726
        </aduioCompressionType>
        <audioBitRate opt="32">32</audioBitRate>
    </Audio>
</StreamingCapabilities>
Gateway->Camera (set encoder channel 1's configuration)
PUT /OpenHome/Streaming/channels/1 HTTP/1.1
Host: 192.168.2.52
Pragma: no-cache
Cache-Control: no-cache
Date: Sat, 11 Jun 2011 18:23:51 GMT
Content-Type: application/xml; charset="UTF-8"
Content-Length: <size of the xml body below in bytes>
<StreamingChannel version="1.0">
    <id>1</id>
    <channelName>rtsp channel 1</channelName>
    <enabled>true</enabled>
    <Transport>
        <ControlProtocol>
                <streamingTransport>RTSP/RTP</streamingTransport>
    </Transport>
    <Video>
        <enabled>true</enabled>
        <VideoInputChannelID>0</VideoInputChannelID>
        <videoCodecType>H264</videoCodecType>
        <videoResolutionWidth>640</videoResolutionWidth>
        <videoResolutionHeight>480</videoResolutionHeight>
        <videoQualityControlType>CBR</videoQualityControlType>
        <constantBitRate>750</constantBitRate>
        <fixedQuality>70</fixedQuality>
        <maxFrameRate>30</maxFrameRate>
        <snapShotImageTpe>JPEG</snapShotImageTpe>
    </Video>
    <Audio>
        <enabled>false</enabled>
    </Audio>
</StreamingChannel>
Camera->Gateway (response)
HTTP/1.1 200 OK
Content-Type: application/xml; charset="UTF-8"
Connection: Keep-Alive
Content-Length: <size of the xml body below in bytes>
<ResponseStatus version="1.0">
    <statusCode>1</statusCode>
    <statusString>OK</statusString>
</ResponseStatus>
```

5.8.2 Accessing Live Video and Channel Status

5.8.2.1 /OpenHome/Streaming/Status

URI	/OpenHome/Streaming/status		Type	Command
Function	This function is used to get			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<StreamingStatus>	

Notes

This command accesses the status of all device-streaming sessions.

StreamingStatus XML Block

```
<StreamingStatus version="1.0">
  <totalStreamingSessions>  <!-- req, xs:integer -->
  </totalStreamingSessions>
  <StreamingSessionStatusList/>  <!-- dep, only if there are sessions -->
</StreamingStatus >
```

5.8.2.2 /OpenHome/Streaming/Channels/<ID>/Status

URI	/OpenHome/Streaming/status		Type	Command
Function	Get the list of streaming sessions associated with a particular channel.			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<StreamingSessionStatusList>	

Notes

Use of IPv4 or IPv6 addresses depends on the value of the <ipVersion> field in /OpenHome/System/Network/interfaces/ID/ipAddress.
dateTime is in ISO 8601 Date/Time string format.

StreamingSessionStatus XML Block

```
<StreamingSessionStatusList version="1.0">
    <StreamingSessionStatus version="1.0">
      <clientAddress>    <!-- req -->
        <ipAddress>     <!-- dep, xs:string -->   </ipAddress>
        <ipv6Address>     <!-- dep, xs:string -->   </ipv6Address>
      </clientAddress>
      <clientUserName>       <!-- opt, xs:string -->          </clientUserName>
      <startDateTime>       <!-- opt, xs:datetime -->          </startDateTime>
      <elapsedTime>         <!-- req, xs:integer, seconds -->       </elapsedTime>
      <bandwidth>           <!-- opt, xs:integer, in kbps -->       </bandwidth>
      <txPackets>           <!-- opt, xs:integer, # of packets transmitted-->   </
      txPackets >
      <rxPackets>           <!-- opt, xs:integer, # of packets received--> </ rxPackets >
    </StreamingSessionStatus >
</StreamingSessionStatusList>
```

5.8.2.3 /OpenHome/Streaming/Channels/<ID>/Rtsp

URI	/OpenHome/Streaming/channels/ID/rtsp		Type	Command
Function	This function is used to request streaming of video from Camera via RTSP			
Methods	Query String(s)	Inbound Data	Return Result	
RTSP	videoCodecType		Stream over RTSP	
	videoResolutionWidth			
	videoResolutionHeight			
	videoQualityControlType			
	constantBitRate			
	fixedQuality			
	vbrUpperCap			
	vbrLowerCap			
	maxFrameRate			
	keyFrameInterval			

Notes

Each channel <ID> is pre-configured with encoding capabilities specific that channel; capabilities include codec type, bitrate, resolution, etc.A channel must be configured to enable RTSP for this Command to succeed. See /OpenHome/Streaming/channels/<ID>.

All query parameters are optional and can be used to override existing profile configuration for a specific channel <ID>; however, if a device does NOT support dynamic reconfiguration of any of the requested parameters, the device may return HTTP error instead of a valid stream.

Device should support RTSP over UDP, TCP, HTTP, and HTTPS transports.

5.8.2.4 /OpenHome/Streaming/Channels/<ID>/Video/Upload

URI	/OpenHome/Streaming/channels/ID/video/upload	Type	Command
Function	This function is used to trigger a video clip capture and upload from Camera to Gateway		

Methods	Query String(s)	Inbound Data	Return Result
POST		<MediaUpload>	<Response Status>

Notes

Camera uploads a video clip via procedures describe in Section 4.3.2. If upload failed, Camera should send the MediaUploadFailure Notification. snapShotImageType should not be set for video upload

Some devices may not support dynamic request for <preCaptureLength> and <postCapatureLength>; for these devices, use <MediaCapture> configuration in /OpenHome/Streaming/channels/<ID> instead.

MediaUpload XML Block

```
<MediaUpload version="1.0">
    <id> <!-- req, xs:string;id -->      </id>
    <snapShotImageType>   <!-- opt, xs:string, "JPEG" -->
    </snapShotImageType>
    <videoClipFormatType> <!-- opt, xs:string, "ASF,MP4,3GP,264" --
    ></videoClipFormatType> <preCaptureLength>   <!-- opt, xs:integer,
    milliseconds -->     </preCaptureLength>
    <postCaptureLength> <!-- opt, xs:integer, milliseconds -->
        </postCaptureLength>
    <videoResolutionWidth>            <!-- opt, xs:integer -->
    </videoResolutionWidth>
    <videoResolutionHeight>           <!-- opt, xs:integer -->
    </videoResolutionHeight>
    <gateway _url>     <!-- dep, xs:string -->   </gateway _url>
    <failure_url>       <!-- dep, xs:string, url to post if upload fails -->   </failure_url>
</MediaUpload >
```

5.8.2.5 /OpenHome/Streaming/Channels/<ID>/requestKeyFrame

URI	/OpenHome/Streaming/channels/ID/requestKeyFrame	Type	Command
Function	Request that the device issue a key frame on a particular profile.		

Methods	Query String(s)	Inbound Data	Return Result
PUT			Stream over RTSP

Notes

The key frame that is issued should include everything necessary to initialize a video decoder, i.e. parameter sets for H.264 or VOS for MPEG-4.

5.8.2.6 /OpenHome/Streaming/Channels/<ID>/Http

URI	/OpenHome/Streaming/channels/ID/http	Type	Command
Function	This function is used to request streaming of MJPEG video from Camera via HTTP		

Methods	Query String(s)	Inbound Data	Return Result
GET	videoCodecType		Stream over HTTP
	videoResolution Width		
	videoResolutionHeight		
	videoQualityControlType		
	constantBitRate		
	fixedQuality		
	vbrUpperCap		
	vbrLowerCap		

-continued

	maxFrameRate keyFrameInterval

Notes

This URI is intended for streaming MJPEG video.

For RTSP and HLS video streaming, please refer to /OpenHome/Streaming/channels/<ID>/rtsp & /OpenHome/Streaming/channels/<ID>/hls/playlist.

Each channel <ID> is pre-configured with encoding capabilities specific that channel; capabilities include codec type, bitrate, resolution, etc. A channel must be configured to enable RTSP for this Command to succeed.

See /OpenHome/Streaming/channels/<ID>.

All query parameters are optional and can be used to override existing profile configuration for a specific channel <ID>; however, if a device does NOT support dynamic change of any of the requested parameters, the device may return HTTP error instead of a valid stream.

5.8.2.7 /OpenHome/Streaming/Channels/<ID>/Picture

URI	/OpenHome/Streaming/channels/ID/pictures	Type	Command
Function	This function is used to request a picture snapshot		

Methods	Query String(s)	Inbound Data	Return Result
GET	videoResolutionWidth (optional) videoResolutionHeight (optional) fixedQuality (optional)		Picture over HTTPS

Notes

videoResolutionWidth and videoResolutionHeight are capture image width and height respectively.

fixedQuality is the image compression quality, ranges from 1 to 100, with 100 as the highest quality.

To determine the format of the picture returned, either the parameters in <Video> or the query string values are used, or, if the Accept: header field is present in the request and the server supports it, the picture is returned in that format.

5.8.2.8 /OpenHome/Streaming/Channels/<ID>/Picture/Upload

URI	/OpenHome/Streaming/channels/ID/picture/upload	Type	Command
Function	This function is used to trigger a picture capture and upload from Camera to Gateway		

Methods	Query String(s)	Inbound Data	Return Result
POST		<MediaUpload>	<ResponseStatus>

Notes

Camera uploads image via procedures describe in Section 4.3.2.

If upload failed, Camera should send the MediaUploadFailure Notification.

The videoClipFormatType element in <MediaUpload> should not be used for picture upload.

5.8.2.9 /OpenHome/Streaming/Channels/<ID>/Hls/Playlist

URI	/OpenHome/Streaming/channels/ID/hls/playlist	Type	Command
Function	Retrieve HTTP Live Streaming Playlist file		

Methods	Query String(s)	Inbound Data	Return Result
GET			HTTP Live Streaming Playlist file

Notes

This function can be used to retrieve HTTP Live Streaming (HLS) Playlist file in accordance with HLS draft-pantos-http-live-streaming-07. The returned playlist file shall conform to the following requirements:

Playlist shall be refreshed periodically at a frequency for supporting real-time streaming

Each media segment shall be no longer than 10 sec in duration

It is recommended (but not required) that each media segment's URI (in the Playlist) follows the /OpenHome/Streaming/channels/<ID>/hls/<MediaSegmentID> naming convention

For Camera that supports multiple streaming channels from the same input source, the Playlist shall list all media segments from the same source. For example, if input source 1 is used by streaming channels 1 and 2 (where channel 1 encodes at VGA 1 Mbps and channel 2

encodes at QVGA 500 Kbps), both streaming channel 1 and 2's media segments should be presented to the player via the Playlist.

The use of "EXT-X-KEY" for media encryption is optional. However, off-premise access must be protected via SSL using the HLS Media Tunnel procedures described in previous section. For on-premise viewing, HTTP Basic Authorization is utilized to authenticate access.

5.8.2.10 /OpenHome/Streaming/Channels/<ID>/Hls/<MediaSegment>

URI	/OpenHome/Streaming/channels/ID/hls/playlist/MediaSegment	Type	Command
Function	Retrieve HTTP Live Streaming media segment		

Methods	Query String(s)	Inbound Data	Return Result
GET			HTTP Live Streaming media segment

Notes

This is the recommended (but not mandatory) HTTP Live Streaming media segment URI format. The actual URI is specified in the HLS Playlist file (see /OpenHome/Streaming/channels/<ID>/hls/playlist).

HTTP Basic Authentication is used to authenticate access.

For on-premise viewing, HTTP or HTTPS can be used.

For off-premise viewing, media must be protected via SSL using the HLS Media Tunnel procedures.

5.8.2.11 Notification: MediaUploadFailure

The UploadFailure Notification is sent when a media upload Command fails.

URI	http or https://<ipAddess>:<portNo>/<failure_url> or xmpp://<ipAddess>:<portNo>/<failure_url> or poll:// <failure_url>	Type	Notification
Function	This function is used by the Camera to send event alerts to the Gateway.		

Methods	Query String(s)	Inbound Data	Return Result
POST		MediaUploadFailure	

Notes

<failure_url> is derived from <MediaUpload> XML Block.

dateTime is in ISO 8601 Date-Time format.

MediaUploadFailure XML Block

```
<MediaUploadFailure version="1.0">
    <id> <!-- req, xs:string;id, ID from MediaUpload request -->   </id>
    <dateTime>   <!-- req, xs:datetime, when Command was first received -->
        </dateTime>
    <uploadType><!-- req, xs:string, "PICTURE,VIDEOCLIP"--> </uploadType>
    <eventDescription> <!-- req, xs:string -->   </eventDescription>
</MediaUploadFailure >
```

5.8.2.12 Media Streaming Examples

MJPEG Streaming

The following example illustrates how to start a MJPEG video stream from channel **1**.

```
Gateway->Camera (start streaming on channel 1)
GET /OpenHome/Streaming/channels/1/http HTTP/1.1
Host: 192.168.2.52
...
Camera->Gateway
HTTP/1.1 401 Unauthorized
Host: 192.168.2.52
Date: Sat, 11 Jun 2011 18:23:40 GMT
WWW-Authenticate: Digest <digest challenge>
Gateway->Camera (start streaming on channel 1)
GET /OpenHome/Streaming/channels/1/http HTTP/1.1
Host: 192.168.2.52
Authorization: Digest <challenge response>
```

-continued

```
Pragma: no-cache
Cache-Control: no-cache
Date: Sat, 11 Jun 2011 18:23:51 GMT
Camera->Gateway
HTTP/1.1 200 OK
Content-Type: multipart/x-mixed-replace;boundary=MyRandomStr
--MyRandomStr
Content-Type: image/jpeg
Content-Length: 22444
<jpeg binary data>
```

Picture Snapshot

The following example illustrates how to capture a JPEG snapshot from channel **1** using a different image resolution than the pre-configured channel image size.

```
Gateway->Camera (capture picture)
GET
/OpenHome/Streaming/channels/1/picture?videoResolutionWidth=320&videoResolution
Height=240 HTTP/1.1
Host: 192.168.2.52
...
Camera->Gateway
HTTP/1.1 401 Unauthorized
Host: 192.168.2.52
Date: Sat, 11 Jun 2011 18:23:40 GMT
WWW-Authenticate: Digest <digest challenge>
Gateway->Camera (capture picture)
GET
/OpenHome/Streaming/channels/1/picture?videoResolutionWidth=320&videoResolution
Height=240 HTTP/1.1
Host: 192.168.2.52
Authorization: Digest <challenge response>
Pragma: no-cache
Cache-Control: no-cache
Date: Sat, 11 Jun 2011 18:23:51 GMT
Camera->Gateway
HTTP/1.1 200 OK
Content-Type: image/jpeg
Content-Length: 5002
<jpeg binary data>
```

Trigger a Video Clip Upload

The following example illustrates how to trigger a video clip upload.

```
Gateway->Camera (trigger video capture and upload)
POST /OpenHome/Streaming/channels/1/video/upload HTTP/1.1
Host: 192.168.2.52
...
Camera->Gateway (response)
HTTP/1.1 401 Unauthorized
Host: 192.168.2.52
Date: Sat, 11 Jun 2011 18:23:40 GMT
WWW-Authenticate: Digest <digest challenge>
Gateway->Camera (trigger video capture and upload)
POST /OpenHome/Streaming/channels/1/video/upload HTTP/1.1
Host: 192.168.2.52
Pragma: no-cache
Authorization: Digest <challenge response>
Cache-Control: no-cache
Date: Sat, 11 Jun 2011 18:23:51 GMT
Content-Type: application/xml; charset="UTF-8"
Content-Length: <size of the xml body below in bytes>
<MediaUpload version="1.0">
    <id>998d2002</id>
    <videoClipFormatType>MP4</videoClipFormatType>
    <preCaptureLength>10000</preCaptureLength>
    <postCaptureLength>20000</postCaptureLength>
    <target_url>
        https://gw.icontrol.com/vidupload/43/f/889229dcd864691ffcd4bff342153a00/
    </target_url>
    <failure_url>
        https:// gw.icontrol.com/vidulfailed/43/f/889229dcd864691ffcd4bff342153a00/
  </failure_url>
</MediaUpload>
Camera->Gateway (response)
HTTP/1.1 200 OK
Content-Type: application/xml; charset="UTF-8"
Connection: Keep-Alive
Content-Length: <size of the xml body below in bytes>
<Response Status version="1.0">
    <statusCode>1</statusCode>
    <statusString>OK</statusString>
</ResponseStatus>
```

Camera Starts Media Upload

```
Camera->Gateway (upload video clip)
POST /vidupload/43/f/889229dcd864691ffcd4bff342153a00/ HTTP/1.1
Host: gw.icontrol.com
...
Gateway ->Camera (response)
HTTP/1.1 401 Unauthorized
Host: gw.icontrol.com
Date: Sat, 11 Jun 2011 18:23:60 GMT
WWW-Authenticate: Digest <digest challenge>
Camera->Gateway (upload video clip)
POST /vidupload/43/f/889229dcd864691ffcd4bff342153a00/ HTTP/1.1
Host: gw.icontrol.com
Content-Type: video/mp4
Date: Sat, 11 Jun 2011 18:23:51 GMT
X-Capture-Time: 1308677301225
Authorization: Digest <challenge response>
Content-Length: 144555
<mp4 binary content>
Gateway ->Camera (response)
HTTP/1.1 200 OK
```

5.8.3 Media Tunnel Creation and Teardown

5.8.3.1 /OpenHome/Streaming/MediaTunnel

URI	/OpenHome/Streaming/MediaTunnel	Type	Command
Function	This function is used to get a list of active media tunnels		
Methods	Query String(s)	Inbound Data	Return Result
GET			<MediaTunnelList>

Notes

MediaTunnel XML Block

```
<MediaTunnelList version="1.0">
    <MediaTunnel/>   <!-- opt -->
</MediaTunnelList >
```

5.8.3.2 /Open Home/Streaming/MediaTunnel/<ID>/Status

URI	/OpenHome/Streaming/MediaTunnel/ID/status	Type	Command
Function	This function is used to get status of a specific media tunnel		
Methods	Query String(s)	Inbound Data	Return Result
GET			<MediaTunnel>

Notes

state varialbes are defined in Sections 4.2.1.1 and 4.2.2.1

MediaTunnel XML Block

```
<MediaTunnel version="1.0">
    <sessionID>          <!-- req, xsistring --> </sessionID>
    <transportSecurity> <!-- req, xs:string, "TLS,NONE" --> </transportSecurity >
    <startTime>          <!-- opt, xs:datetime -->   </startTime>
    <elapsedTime>        <!-- req, xs:integer, seconds -->      </elapsedTime>
    <state> <!-- opt, xs:string,
    "IDLE,START,SOCKET_WAITING,SOCKET_CONNECTED,TUNNEL_REA
    DY, RTSP_INIT,RTSP_READY,RTSP_PLAYING,MJPEG_STREAMING" -->
    </state>
</MediaTunnel >
```

5.8.3.3 /OpenHome/Streaming/MediaTunnel/Create

URI	/OpenHome/Streaming/MediaTunnel/create	Type	Command
Function	This function is used to create a media tunnel from Camera to Gateway		
Methods	Query String(s)	Inbound Data	Return Result
POST		<CreateMediaTunnel>	<ResponseStatus>

Notes

transportSecurity must be set to TLS

<sessionUD> is returned as the media tunnel <ID> within <ResponseStatus>

CreateMediaTunnel XML Block

```
<CreateMediaTunnel version="1.0">
        <sessionID>   <!-- req, xs:string --> </sessionID >
    <gatewayURL>      <!-- req, xs:string --> </gatewayURL>
    <failureURL>      <!-- req, xs:string, url to post if create fails -->
                      </failureURL>
</CreateMediaTunnel >
```

5.8.3.4 /OpenHome/ Streaming/Media-Tunnel/<ID>/destroy

URI	/OpenHome/Streaming/MediaTunnel/<ID>/destroy	Type	Command
Function	This function is used to create a media tunnel from Camera to Gateway		

Methods	Query String(s)	Inbound Data	Return Result
POST			<ResponseStatus>

Notes

5.8.3.5 Notification: CreateMediaTunnelFailure

The CreateMediaTunnelFailure Notification is sent when a media tunnel creation Command fails.

URI	http or https://<ipAddess>:<portNo>/<failure_url> or xmpp://<ipAddess>:<portNo>/<failure_url> or poll:// <failure_url>	Type	Notification
Function	This function is used by the Camera to send event alerts to the Gateway.		

Methods	Query String(s)	Inbound Data	Return Result
POST		CreateMediaTunnelFailure	

Notes
<failure_url> is derived from <MediaUpload> XML Block.
dateTime is in ISO 8601 Date-Time format.

CreateMediaTunnelFailure XML Block

```
<CreateMediaTunnelFailure version="1.0">
    <id> <!-- req, xs:string;id, ID from MediaUpload request -->        </id>
    <dateTime>        <!-- req, xs:datetime, when Command was first received -->
        </dateTime>
    <eventDescription> <!-- req, xs:string -->        </eventDescription>
</CreateMediaTunnelFailure >
```

5.9 /OpenHome/PTZ Data Type Details

5.9.1 /OpenHome/PTZ/Channels

URI	/OpenHome/PTZ/channels	Type	Command
Function	Access the list of PTZ channels		

Methods	Query String(s)	Inbound Data	Return Result
GET			<PTZChannelList>
PUT		<PTZChannelList>	<ResponseStatus>
POST		<PTZChannel>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes
PTZ channels may be hardwired, or it may be possible to create channels if the device supports it. To determine whether it is possible to dynamically PTZ channels, check the defined HTTP methods in /OpenHome/PTZ/channels/description.

PTZChannelList XML Block

```
<PTZChannelList version="1.0">
    <PTZChannel/>        <!-- opt -->
</PTZChannelList >
```

5.9.2 /OpenHome/PTZ/Channels/<ID>

URI	/OpenHome/PTZ/channels/ID	Type	Command
Function	Access or control a PTZ channel		

Methods	Query String(s)	Inbound Data	Return Result
GET			<PTZChannel>
PUT		<PTZChannel>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes
<videoInputID> links the PTZ channel to a video channel.
<panMaxSpeed> defines or limits the maximum pan speed.
<tiltMaxSpeed> defines or limits the maximum tilt speed.
<autoPatrolSpeed> defines or limits the maximum patrol speed.
<controlProtocol> indicates the control protocol to be used for PTZ.
Supported protocols are device-dependent.
<defaultPreset> identifies the default preset ID to be used with some interfaces.

PTZChannel XML Block

```
<PTZChannel version="1.0">
    <id>   <!-- req, xs:string;id-->        </id>
    <enabled>        <!-- req, xs:boolean -->    </enabled>
    <videoInputID>        <!-- req, xs:string;id -->          </videoInputID>
    <panMaxSpeed>        <!--     opt,     xs: integer,        degrees/sec     -->
    </panMaxSpeed>
    <tiltMaxSpeed>        <!--     opt,     xs:integer,        degrees/sec     -->
    </tiltMaxSpeed>
    <autoPatrolSpeed> <!-- opt, xs:integer, 0..100 -->      </autoPatrolSpeed>
    <controlProtocol> <!-- opt, xs:string, "pelco-d,..." -->   </controlProtocol>
    <defaultPresetID> <!-- opt, xs:string;id -->   </defaultPresetID>
</PTZChannel >
```

5.9.3 /OpenHome/ PTZ/Channels/<ID>/homePosition

URI	/OpenHome/PTZ/channels/ID	Type	Command
Function	Set the home position of the PTZ camera to the current position		

Methods	Query String(s)	Inbound Data	Return Result
GET			<PTZChannel>
PUT		<PTZChannel>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

This function is used to set the current position as the absolute home position for a PTZ enabled device. After calling this API, the current position will act as the reference point for all absolute PTZ commands sent to the device.

5.9.4 /OpenHome/PTZ/Channels/<ID>/Relative

URI	/OpenHome/PTZ/channels/ID/relative	Type	Command
Function	Pans, tilts, and/or zooms the device relative to the current position.		

Methods	Query String(s)	Inbound Data	Return Result
PUT	positionX positionY relativeZoom	<PTZData>	<ResponseStatus>

Notes

The device shall not respond with a <ResponseStatus> until the PTZ command has been issued. The total round-trip time for this API should be less than 70 ms.
Either the inbound data or query string values are used.

The <positionX> and <positionY> tags must be provided in relation to the currently set video resolution. The device will center on the provided coordinates.
The <relativeZoom> tag roughly indicates what percentage to zoom in respect to the current image.
The auto patrol feature is stopped if it is running.

Relative PTZ Data XML Block

```
<PTZData version="1.0">
    <Relative>
        <positionX>        <!-- opt, xs:integer --> </positionX>
        <positionY>        <!-- opt, xs:integer --> </positionY>
        <relativeZoom> <!-- opt, xs:integer, -100..100 -->
        </relativeZoom>
    </Relative>
</PTZData >
```

5.9.5 /OpenHome/PTZ/Channels/<ID>/Absolute

URI	/OpenHome/PTZ/channels/ID/absolute	Type	Command
Function	Pans, tilts, and/or zooms the device relative to the absolute home position.		

Methods	Query String(s)	Inbound Data	Return Result
PUT	elevation azimuth absoluteZoom	<PTZData>	<ResponseStatus>

Notes

The device shall not respond with a <ResponseStatus> until the PTZ command has been issued. The total round-trip time for this API should be less than 70 ms.

Either the inbound data or query string values are used.

All parameters in the <Absolute> block must be provided. The device will pan/tilt to the provided elevation and azimuth degrees in respect to the device"s "home" position. The device will also zoom to the position specified by <absoluteZoom>.

The "homePosition" URI should be called first to configure the device"s "home" or "zero" position.

The auto patrol feature is stopped if it is running.

Absolute PTZ Data XML Block

```
<PTZData version="1.0">
    <Absolute>
        <elevation>    <!-- opt, xs:integer, -90..90 -->          </elevation>
        <azimuth> <!-- opt, xs:integer, 0..360 -->   </azimuth>
        <absoluteZoom> <!-- opt, xs:integer, 0..100 -->        </absoluteZoom>
    </Absolute>
</PTZData >
```

5.9.6 /OpenHome/PTZ/Channels/<ID>/Status

URI	/OpenHome/PTZ/channels/ID/status	Type	Command
Function	Get current PTZ camera position information.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<PTZStatus>

Notes

Currently only querying the absolute coordinates, elevation, azimuth and zoom, is supported.

PTZStatus XML Block

```
<PTZStatus version="1.0">
    <Absolute>
        <elevation>    <!-- opt, xs:integer, -90..90 -->          </elevation>
        <azimuth> <!-- opt, xs:integer, 0..360 -->   </azimuth>
        <absoluteZoom> <!-- opt, xs:integer, 0..100 -->        </absoluteZoom>
    </Absolute>
</PTZStatus >
```

5.10 /OpenHome/Custom/Detection Data Type Details

5.10.1 MotionDetection

/OpenHome/Custom/MotionDetection can be used for both Video Motion detection and Passive Infrared Motion detection methods.

5.10.1.1 /OpenHome/Custom/MotionDetection/PIR or /OpenHome/CustomMotionDetection/Video

URI	/OpenHome/Custom/MotionDetection/PIR or /OpenHome/Custom/MotionDetection/video	Type	Command
Function	Motion detection configuration for all video input channels.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<MotionDetectionList>

Notes

Either PIR or video analystics based motion detection methods are supported via this data model. If the device supports video motion detection, a motion detection ID will be allocated for each video input channel ID. The motion detection ID must correspond to the video input channel ID.

If the device supports PIR motion detection, one or more PIR detection channels can be supported.

If no motion detection capability is supported for a requested path (e.g., /video or /PIR), device returns a MotionDetectionList with no elemen.

MotionDetectionList XML Block

```
<MotionDetectionList version="1.0">
    <MotionDetection/>   <!-- opt-->
</MotionDetectionList >
```

5.10.1.2 /OpenHome/ Custom/MotionDetection/PIR/<ID> or /Open Home/CustonilMotion-Detection/Video/<ID>

URI	/OpenHome/Custom/MotionDetection/PIR/ID or /OpenHome/Custom/MotionDetection/video/ID	Type	Command
Function	Motion detection configuration for all video input channels.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<MotionDetection>
PUT		<MotionDetection>	<ResponseStatus>

Notes

Note that the ID used here MUST correspond to the video input ID or to a non-videochannel-overallping ID that corresponds to a PIR sensor. For video moton based detection, this interface supports both grid-based and region-based motion detection. The actual types supported can be determined by looking at the result of a GET of /OpenHome/Custom/MotionDetection/video/ID/capabilities and looking at the options available for the <regionType> field. Grid-based motion detect divides the image into a set of fixed "bins" that delimit the motion detection area boundaries. ROI-based motion detection allows motion areas or regions of interest to be defined based on pixel coordinates.

For PIR-based detection, the regionType and RegionCoordinateList elements are optional.

MotionDetection XML Block

```
<MotionDetection version="1.0">
    <id> <!-- req, xs:string;id -->   </id>
    <enabled> <!-- req, xs:boolean -->                          </enabled>
    <samplingInterval>   <!-- opt, xs:integer, number of frames -->
        </samplingInterval>
    <startTriggerTime>   <!-- opt, xs:integer, milliseconds -->
        </startTriggerTime>
    <endTriggerTime>    <!-- opt, xs:integer, milliseconds -->   </endTriggerTime>
    <pirValidTime>      <!-- opt, xs:integer, milliseconds -->   </pirValidTime>
    <pirMotionTime>     <!-- opt, xs:integer, milliseconds -->   </pirMotionTime>
```

-continued

```
    <directionSensitivity>
        <!-- opt, xs:string, "left-right,right-left,up-down,down-up" -->
    </directionSensitivity>
    <regionType>        <!-- opt, xs:string, "grid,roi" -->  </regionType>
    <minObjectSize><!-- opt, xs:integer, min number of pixels per object -->
    </minObjectSize>
    <maxObjectSize><!-- opt, xs:integer, max number of pixels per object -->
    </maxObjectSize>
    <Grid>   <!-- dep, required if <motionType> is "grid" --> <rowGranularity>
    <!-- req, xs:integer -->                                  </rowGranularity> <columnGranularity>
    <!-- req, xs:integer --> </columnGranularity>
    </Grid>
    <ROI>   <!-- dep, required if <motionType> is "roi" -->
        <minHorizontalResolution> <!-- req, xs:integer -->
</minHorizontalResolution>
        <minVerticalResolution> <!-- req, xs:integer --> </minVerticalResolution>
    </ROI>
</MotionDetection>
```

5.10.1.3 /OpenHome/Custom/MotionDetection/Video<ID>/Capabilities

URI	/OpenHome/Custom/MotionDetection/video/ID/capabilities		Type	Command
Function	Motion detection configuration for all video input channels.			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<MotionDetectionCapabilities>	

Notes

MotionDetectionCapabilities XML Block

```
<MotionDetectionCapabilities version="1.0">
    <samplingInterval min="0" max=30"><!-- opt, xs:integer, number of frames --
    ></samplingInterval>
    <directionSensitivity opt="left-right,right-left,up-down,down-up"–>
        <!-- opt, xs:string-->
    </directionSensitivity>
    <regionType opt="grid,roi"><!-- opt, xs:string --></regionType>
</MotionDetectionCapabilities >
```

5.10.2 SoundDetection

5.10.2.1 /OpenHome/Custom/SoundDetection

URI	/OpenHome/Custom/SoundDetection		Type	Command
Function	Detection configuration for sound detection channels			
Methods	Query String(s)	Inbound Data	Return Result	
GET			<SoundDetectionList>	

Notes

If the device supports sound detection, a sound detection ID will be allocated for each audio input channel ID. The sound detection ID must correspond to the audio input channel ID.

SoundDetectionList XML Block

```
<SoundDetectionList version="1.0">
    <SoundDetection/>        <!-- opt -->
</SoundDetectionList >
```

5.10.2.2 /OpenHome/Custom/SoundDetection/<ID>

URI	/OpenHome/Custom/SouondDetection/ID	Type	Command
Function	Sound detection configuration for all audio input channels.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<SoundDetection>
PUT		<SoundDetection>	<ResponseStatus>

Notes

Note

that the ID used here MUST correspond to the audio input channel ID.

<triggeringType> indicates the signal conditions to trigger the input port.

Rising/Fallin refer to a rising/falling edge of a signal.

High/Low will continuously trigger for the duration of the high/low input signal.

SoundDetection XML Block

```
<SoundDetection version="1.0">
    <id> <!-- req, xs:string;id -->        </id>
    <enabled> <!-- req, xs:boolean -->        </enabled>
    <triggeringType> <!-- req, xs:string, "high,low,rising,falling" -->
    </triggeringType>
    <detectionThreshold> <!-- req, xs:integer, 0..100, percentage-->
    </detectionThreshold>
</SoundDetection>
```

5.10.3 TemperatureDetection

5.10.3.1 /OpenHome/Custom/TemperatureDetection

URI	/OpenHome/Custom/TemperatureDetection	Type	Command
Function	Detection configuration for temperature change detection channels		

Methods	Query String(s)	Inbound Data	Return Result
GET			<TemperatureDetectionList>

Notes

If the device supports PIR detection, a temperature detection ID will be allocated for each temperature input channel ID. The temperature detection ID must correspond to the temperature input channel ID.

TemperatureDetectionList XML Block

```
<TemperatureDetectionList version="1.0">
    <TemperatureDetection/>        <!-- opt -->
</TemperatureDetectionList >
```

5.10.3.2 /OpenHome/Custom/TemperatureDetection/<ID>

URI	/OpenHome/Custom/TemperatureDetection/ID	Type	Command
Function	Temperature detection configuration for temperature input channels.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<TemperatureDetection>
PUT		<TemperatureDetection>	<ResponseStatus>

Notes

Note that the ID used here MUST correspond to the temperature input channel ID.

<triggeringType> indicates the signal conditions to trigger the input port.

Rising/Fallin refer to a rising/falling edge of a signal.

High/Low will continuously trigger for the duration of the high/low input signal.

TemperatureDetection XML Block

```
<TemperatureDetection version="1.0">
    <id> <!-- req, xs:string;id -->        </id>
    <enabled> <!-- req, xs:boolean -->        </enabled>
    <triggeringType> <!-- req, xs:string, "high,low,rising,falling" -->
    </triggeringType>
    <detectionThreshold> <!-- req, xs:integer, 0..100, percentage-->
    </detectionThreshold>
</TemperatureDetection>
```

5.10.3.3 /OpenHome/Custom/TemperatureDetection/<ID>/Current

URI	/OpenHome/Custom/TemperatureDetection/ID/Current	Type	Command
Function	Get Current Temperature		

Methods	Query String(s)	Inbound Data	Return Result
GET			<CurrentTemperature>

Notes
Note
that the ID used here MUST correspond to the temperature input ID.
Rea-only

CurrentTemperature XML Block

```
<CurrentTemperature version="1.0">
    <datetime><!-- req, xs:datetime -->        </ datetime >
    <scale> <!-- req, xs:string, "C,F" --> </scale>
    <degree> <!-- req, xs:integer, in degree--> </degree>
</CurrentTemperature>
```

5.11 /OpenHome/Custom/Event Data Type Details

5.11.1 /OpenHome/Custom/Event

URI	/OpenHome/Custom/Event	Type	Command
Function	Access and configure the device event behavior and notifications.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<EventNotification>
PUT		<EventNotification>	<ResponseStatus>

Notes
The event trigger list defines the set of device behaviors that trigger events.
The event schedule defines when event notifications are active.
The event notification methods define what types of notification (HTTP, XMPP, FTP, e-mail) are supported.

EventNotification XML Block

```
<EventNotification version="1.0">
    <EventTriggerList/> <!-- opt -->
    <EventNotificationMethod/> <!-- opt -->
</EventNotification >
```

5.11.2 /OpenHome/Custom/Event/Triggers

URI	/OpenHome/Custom/Event/triggers	Type	Command
Function	Access and configure the device event behavior and notifications.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<EventTriggerList>
PUT		<EventTriggerList>	<ResponseStatus>

-continued

POST	<EventTrigger>	<ResponseStatus>
DELETE		<ResponseStatus>

Notes

Event triggering defines how the device reacts to particular events, such as video loss or motion detection.

EventTriggerList XML Block

```
<EventTriggerList version="1.0">
    <EventTrigger/>        <!-- opt -->
</EventTriggerList >
```

5.11.3 /OpenHome/Custom/Event/Triggers/<ID>

URI	/OpenHome/Custom/Event/triggers/ID	Type	Command
Function	Access a particular event trigger.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<EventTrigger>
PUT		<EventTrigger>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

An event trigger determines how the device reacts when a particular event is detected. The following types are supported:

PirMD: trigger on PIR motion detection

VMD: trigger on video motion detection.

SndD: trigger on sound detection

TempD: trigger on temperature detection

eventTypeInputID: ID of eventTypeInput. For example, if VMD supports multiple input channels, this Id is used to differentiate between them. For intervalBetweenEvents: minimum interval in seconds between 2 detection triggers

EventTrigger XML Block

```
<EventTrigger version="1.0">
    <id> <!-- req, xs:string;id --> </id>
    <eventType>        <!-- req -->
     <!-- req, xs:string, "PirMD, VMD,SndD,TempD"-->
    </eventType>
    <eventTypeInputID> <!-- opt, xs:string;id --> </eventTypeInputID >
    <eventDescription>        <!-- opt, xs: string --> </eventDescription>
    <intervalBetweenEvents>        <!-- req, xs:integer, seconds -->
        </intervalBetweenEvents>
    <EventTriggerNotificationList/>        <!-- opt -->
</EventTrigger >
```

5.11.4 /OpenHome/Custom/Event/Triggers/<ID>/Notifications

URI	/OpenHome/Custom/Event/triggers/ID/notifications	Type	Command
Function	List of notification methods and behaviors.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<EventTriggerNotificationList>
PUT		<EventTriggerNotificationList>	<ResponseStatus>
POST		<EventTriggerNotification>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

This section determines the kinds of notifications that are supported for a particular event trigger and their recurrences and behaviors.

EventTriggerNotificationList XML Block

```
<EventTriggerNotificationList version="1.0">
    <EventTriggerNotification/> <!-- opt -->
</EventTriggerNotificationList >
```

5.11.5 /OpenHome/Custom/Event/Triggers/<ID>/Notifications/<NOTIFYID>

URI	/OpenHome/Custom/Event/triggers/ID/notifications/ID	Type	Command
Function	Access and configure a particular notification trigger.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<EventTriggerNotification>
PUT		<EventTriggerNotification>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes
notificationRecurrence:
beginning - send EventAlert at beginning of trigger event
beginningandend - send EventAlert at beginning of event detection and at the end
recurring - send EventAlert at beginning, continue sending
<notificationInterval> while trigger is active until end of detection (e.g. motion stopped).
At end of detection, send EventAlert.
notificationInterval: interval between EventAlert message is sent while detected event is active

EventTriggerNotification XML Block

```
<EventTriggerNotification version="1.0">
    <notificationID> <!-- req, xs:string;id -->          </notificationID>
    <notificationMethod><!-- req, xs:string, "HTTP,XMPP" --> </notificationMethod>
    <notificationRecurrence>
        <!-- req, xs:string, "beginning.beginningandend,recurring" -->
    </notificationRecurrence>
    <notificationInterval> <!-- dep, xs:integer, seconds -->   </notificationInterval>
</EventTriggerNotification >
```

5.11.6 /OpenHome/Custom/Event/notificationMethods

URI	/OpenHome/Custom/Event/notificationMethods	Type	Command
Function	Configure notifications. This data type defines how notification should be sent to the Gateway when an event is triggered.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<EventNotificationMethods>
PUT		<EventNotificationMethods>	<ResponseStatus>

Notes
The following notification types are supported:
HTTPS: the device connects to a given address and port and issues an HTTPS POST with the given parameters.
<MediaFormat> determines the type of snapshot, video clip and the video clip pre and post recording times.
<NonMediaEvent> instructs Camera to post <EventAlert> upon trigger without media upload.
For most applications, either <NonMediaEvent> or <MediaFormat> is used, but not both at the same time.

EventNotificationMethods XML Block

```
<EventNotificationMethods version="1.0">
    <NotificatonList/>          <!-- opt -->
    <MediaFormat> <!-- opt -->
        <snapShotImageType>         <!-- opt, xs:string, "JPEG" -->
        </snapShotImageType> <videoClipFormatType> <!-- opt, xs:string,
        "ASF,MP4,3GP,264" --></videoClipFormatType> <preCaptureLength>
            <!-- opt, xs:integer, milliseconds -->          </preCaptureLength>
        <postCaptureLength> <!-- opt, xs:integer, milliseconds -->
            </postCaptureLength>
    </MediaFormat>
    <NonMediaEvent>   <!-- opt -->
```

-continued

```
        <enabled> <!-- req, xs:string, "yes, no" --> </enabled>
    <NonMediaEvent>
</EventNotificationMethods >
```

5.11.7 /OpenHome/Custom/Event/Notification/Host

URI	/OpenHome/Custom/Event/notification/Host	Type	Command
Function	Access the list of HTTP notification hosts.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<HostNotificationList>
PUT		<HostNotificationList>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

Host notification involves the device connecting to a particular URL and delivering an HTTP/XMPP message whenever the event triggers.

HostNotificationList XML Block

```
    <HostNotificationList version="1.0">
        <HostNotification>        <!-- opt --></HostNotification >
    </HostNotificationList >
```

5.11.8 /OpenHome/Custom/Event/Notification/Host/<ID>

URI	/OpenHome/Custom/Event/notification/Host/<ID>	Type	Command
Function	Access a particular notification host.		

Methods	Query String(s)	Inbound Data	Return Result
GET			<HostNotification>
PUT		<HostNotification>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

Procedures for how to upload media to Gateway are defined in Section 4.3. This data model only defines the host info for where to upload media. No <username> and <password> elements will be configured since authorization format is defined in Section 4.3.

HostNotification XML Block

```
<HostNotification version="1.0">
    <id> <!-- req, xs:string;id -->        </id>
    <url><!-- req, xs:string -->   </url>
    <httpAuthenticationMethod><!-- opt, xs:string, "MD5digest,BASIC,none" -->
</HostNotification >
```

5.11.9 Notification: EventAlert

The EventAlert Notification is sent when an Event trigger occurs and the Event is configured to send EventAlert (see Section 5.11.6). This data type supports non-media upload alerts, for media upload format, see Section 4.3 Interface Type 3—Media Upload Channels.

URI	http or https://<ipAddess>:<portNo>/<eventAlertURL> or	Type	Notification

-continued

	xmpp://<ip Addess>:<portNo>/<eventAlertURL> or poll://<eventAlertURL>
Function	This function is used by the Camera to send event alerts to the Gateway.

Methods	Query String(s)	Inbound Data	Return Result
POST		EventAlert	

Notes

<eventAlertURL> is derived from <HostNotification> element of /OpenHome/Custom/Event/notification.
Response to POST consists of standard HTTP responses (e.g., 200, 404, etc.)

EventAlert XML Block

```
<EventAlert version="1.0">
    <id> <!-- req, xs:string;id -->        </id>
    <dateTime>        <!-- req, xs:datetime -->      </dateTime>
    <activePostCount> <!-- req, xs:integer -->        </activePostCount>
    <eventType>
        <!-- req, xs:string,        "PirMD,VMD,SndD,TempD"--> </eventType>
    <eventState>        <!-- req, xs:string, "active,inactive" --> </eventState>
    <eventDescription> <!-- opt, xs:string -->        </eventDescription>
    <DetectionRegionList>          <!-- dep, if <eventType> is "vmd" -->
        <DetectionRegionEntry>        <!-- req -->
          <regionID>   <!-- req, xs:string;id -->       </regionID>
          <sensitivityLevel> <!-- req, xs:integer, 0..100 --> </sensitivityLevel>
          <detectionThreshold> <!-- req, xs:integer, 0..100 -->
          </detectionThreshold>
        </DetectionRegionEntry>
     </DetectionRegionList>
</EventAlert >
```

5.11.10 Examples

Configuration for Motion Detection Alert

The example below illustrates a Command from Gateway to configure the camera to send PIR motion event Notifications to Gateway.

```
Gateway->Camera
PUT /Custom/Event HTTP/1.1
Host: 192.168.2.52
Date: Sat, 11 Jun 2011 18:23:51 GMT
Camera->Gateway
HTTP/1.1 401 Unauthorized
Host: 192.168.1.50
Date: Sat, 11 Jun 2011 18:23:60 GMT
WWW-Authenticate: <challenge>
Gateway->Camera
 PUT /Custom/Event HTTP/1.1
 Host: 192.168.2.52
 Pragma: no-cache
 Authorization: Digest <challenge response>
 Cache-Control: no-cache
 Date: Sat, 11 Jun 2011 18:23:51 GMT
 Content-Type: application/xml; charset="UTF-8"
 Content-Length: <size of the xml body below in bytes>
<EventNotification>
    <EventTriggerList>
     <EventTrigger>
        <id>0</id>
        <eventType>PirMD</eventType>
        <eventTypeInputID>0</eventTypeInputID>
        <intervalBetweenEvents>300</intervalBetweenEvents>
        <EventTriggerNotificationList>
            <EventTriggerNotification>
              <notificationID>0</notificationID>
              <notificationMethod>HTTP</notificationMethod>
              <notificationRecurrence>beginningandend</notificationRecurrence>
            </EventTriggerNotification>
        </EventTriggerNotificationList>
     </EventTrigger>
    </EventTriggerList>
```

-continued

```
    <EventNotificationMethods>
      <HostNotificationList>
            <HostNotification>
              <id>0</id>
              <url>https://192.168.2.89/service/eventalert/</url>
              <httpAuthenticationMethod>MD5digest</httpAuthenticationMethod>
          </HostNotification>
        </HostNotificationList>
        <NonMediaEvent>
          <enabled>true</enabled>
        </NonMediaEvent>
    </EventNotificationMethods>
</EventNotification>
```

Motion EventAlert Example

The example below illustrates a Notification from Camera to Gateway when a motion event is detected.

```
Camera->Gateway
POST /service/eventalert HTTP/1.1
Host: 192.168.2.52
Date: Sat, 11 Jun 2011 18:23:51 GMT
Gateway->Camera
HTTP/1.1 401 Unauthorized
Host: 192.168.1.50
Date: Sat, 11 Jun 2011 18:23:60 GMT
WWW-Authenticate: <challenge>
 Camera->Gateway
 POST /service/eventalert HTTP/1.1
 Host: 192.168.2.52
 Pragma: no-cache
 Authorization: Digest <challenge response>
 Cache-Control: no-cache
 Date: Sat, 11 Jun 2011 18:23:51 GMT
 Content-Type: application/xml; charset="UTF-8"
 Content-Length: <size of the xml body below in bytes>
 <EventAlert>
     <id>100</id>
     <dateTime>2012-01-09T09:01:29.970-08:00</dateTime>
     <activePostCount>0</activePostCount>
```

-continued

```
     <eventType>PirMD</eventType>
     <eventState>active</eventState>
 </EventAlert>
 Gateway ->Camera (response)
 HTTP/1.1 200 OK
```

6 Digital Video Recorder Features

OpenHome Content Management can be used to control a Camera's DVR (Digital Vidoe Recorder) features. Functionalities such as local recording (scheduled or manual), searching, and playback of stored video "tracks" from the Camera can be accomplished via data types described here. Data types in this Section follow closely the PSIA Recording and Content Management Device Specification Version 1.1a, or RaCM Specification Version 1.1a. This document enumerates and clarifies the subset of the RaCM Specification used in OpenHome.

6.1 Service Discovery of Camera Content Management Resources

6.1.1 /OpenHome/ContentMgmt/Api

URI	/OpenHome/ContentMgmt/api	Type	Command
Function	Retrieve URIs for accessing resources on this device		
Methods	Query String(s)	Inbound Data	Return Result
GET			See Service Discovery of Camera Resources section

Notes

Service discovery of /OpenHome/ContentMgmt Data Type resources and their URLs can be achieved by accessing this URI.
See Service Discovery of Camera Resources for detailed response syntax.

6.1.2 /OpenHome/ContentMgmt/Profile

URI	/OpenHome/ContentMgmt/profile	Type	Command
Function	Access a Camera's RaCM profile and level of service		
Methods	Query String(s)	Inbound Data	Return Result
GET			<CMProfile>

Notes

See RaCM Specification v1.1a for detailed description of <CMProfile>.

6.2 Storage Configuration Control

Local storage on the Camera can be managed in accordance to resources below:

6.2.1 /OpenHome/ContentMgmt/Record/storageMounts

URI	/OpenHome/ContentMgmt/record/storageMounts	Type	Command
Function	Configure the total local storage available for archiving data		

Methods	Query String(s)	Inbound Data	Return Result
GET			<MountList>
PUT		<MountList>	<ResponseStatus>
POST		<Mount>	<ResponseStatus>
DELETE			<ResponseStatus>

Note

This resource is used to manage the total storage allocation and logical mounts of the Recorder. It is allowable to DELETE the entire list.

See RaCM Specification v1.1a for detailed description of <Mount>, <MountList>

6.2.2 /OpenHome/ContentMgmt/Record/storageMounts/<Id>

URI	/OpenHome/ContentMgmt/record/storageMounts/id	Type	Command
Function	Configure local storage for a single <Mount> entry		

Methods	Query String(s)	Inbound Data	Return Result
GET			<Mount>
PUT		<Mount>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

POST (i.e. Create) is not allowed for individual <Mount> entry, with given explicit <id>.

See RaCM Specification v1.1a for detailed description of <Mount>

6.3 Recording Session Configuration

A Camera may record/store one or more recording sessions, or "tracks", in its local storage. "Tracks" are virtual containers. They may, or may not, correspond to a file, or set of files, etc. Basically, a "track" is a handle to specific type of multimedia information (e.g. video or audio) from a specific source. A "track" may contain parameters such as track id, recording method, track size, recording source description, codec type/bitrate/resolution, content type, custom extensions, etc. Furthermore, a track may contain a "schedule" that instructs a Camera to record at predetermined intervals. "Tracks" are managed via resources below:

6.3.1 /OpenHome/ContentMgmt/Record/Profile

URI	/OpenHome/ContentMgmt/record/profile	Type	Command
Function	Retrieve track types supported by the Camera		

Methods	Query String(s)	Inbound Data	Return Result
GET			<CMRecordProfile>

Notes

For this version of the Specification, only the "standard" track profile is supported. "Polymorphic" and "polytemporal" track profiles may be supported in future versions of this Specification.

See RaCM Specification v1.1a for detailed description of <CMRecordProfile>

6.3.2 /OpenHome/ContentMgmt/Record/Tracks

URI	/OpenHome/ContentMgmt/record/tracks	Type	Command
Function	Create/update/delete one or more recording tracks		

Methods	Query String(s)	Inbound Data	Return Result
GET			<TrackList>
PUT		<TrackList>	<ResponseStatus>
POST		<Track>	<ResponseStatus>

Notes

This resource is used to manage one or more recording "tracks".

DELETE is not permitted.

See RaCM Specification v1.1a for detailed description of <TrackList>, <Track>

6.3.3 /OpenHome/ContentMgmt/Record/Tracks/<Id>

URI	/OpenHome/ContentMgmt/record/tracks/id	Type	Command
Function	Manage a particular recording track		

Methods	Query String(s)	Inbound Data	Return Result
GET			<Track>
PUT		<Track>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

This resource is used to manage a particular recording "track".

See RaCM Specification v1.1a for detailed description of <Track>.

See RaCM Specification v1.1a for example track creation message exchange, including an example to create a track using scheduled recording.

6.4 Recording Session Control

Instead of using scheduled recording, a "track" (recording session) can also be controlled explicitly via external stimulus via the following resources:

6.4.1 /OpenHome/ContentMgmt/Record/Control/Manual/Start/Tracks/<Id>

URI	/OpenHome/ContentMgmt/record/control/manual/start/tracks/<id>	Type	Command
Function	Explicitly start a recording track		

Methods	Query String(s)	Inbound Data	Return Result
GET			<ResourceDescription>
PUT		NONE	<ResponseStatus>

Notes

This resource is used to explicitly (or manually) start a recording track, regardless of recording mode.

See RaCM Specification v1.1a for detailed description of <ResourceDescription>

6.4.2 /OpenHome/ContentMgmt/Record/Control/Manual/Stop/Tracks/<Id>

URI	/OpenHome/ContentMgmt/record/control/manual/stop/tracks/<id>	Type	Command
Function	Explicitly stop a recording track		

Methods	Query String(s)	Inbound Data	Return Result
GET			<ResourceDescription>
PUT		NONE	<ResponseStatus>

Notes

This resource is used to explicitly (or manually) stop a recording track, regardless of recording mode.

See RaCM Specification v1.1a for detailed description of <ResourceDescription>

6.4.3 /OpenHome/ContentMgmt/Record/Control/Locks

URI	/OpenHome/ContentMgmt/record/control/locks	Type	Command
Function	Manage recording locks		

Methods	Query String(s)	Inbound Data	Return Result
GET			<RecordingLockList>
PUT		<RecordingLockList>	<ResponseStatus>
POST		<RecordingLock>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

This resource is used to manage the list of recording locks

See RaCM Specification v1.1a for detailed description of <RecordingLockList> and <RecordingLock>

6.4.4 /OpenHome/ContentMgmt/Record/Control/Locks/<Id>

URI	/OpenHome/ContentMgmt/record/control/locks/<id>	Type	Command
Function	Manage a specific recording lock		

Methods	Query String(s)	Inbound Data	Return Result
GET			<RecordingLock>
PUT		<RecordingLock>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

This resource is used to manage the list of recording locks

See RaCM Specification v1.1a for detailed description of <RecordingLockList> and <RecordingLock>

6.5 Recording Schedules

Recording schedules can either be embedded within each track's configuration or can be configured for a Camera device. Recording schedules for a Camera can be managed using resources below:

6.5.1 /OpenHome/ContentMgmt/Schedules

URI	/OpenHome/ContentMgmt/schedules	Type	Command
Function	Configure a Camera's recording schedule list		

Methods	Query String(s)	Inbound Data	Return Result
GET		None	<ScheduleBlockList>
PUT		<ScheduleBlockList>	<ResponseStatus>
POST		<ScheduleBlock>	<ResponseStatus>

Notes

Unlike Target assigned <id>'s (e.g. <Track> id's), the ScheduleBlockGUID's are assigned by the external Client. However, it is expected that, for an individual <ScheduleBlock> POSTed during Creation, a successful operation will cause the returned <ResponseStatus> to contain a matching copy of the POSTed <ScheduleBlockGUID> value within the <ID> tag.

See RaCM Specification v1.1a for detailed descriptions of <ScheduleBlock>, <ScheduleBlockList>

6.5.2 /OpenHome/ContentMgmt/Schedules/<ScheduleBlockGUID>

URI	/OpenHome/ContentMgmt/schedules/<ScheduleBlockGUID>	Type	Command
Function	Configure a particular recording schedule from a Camera's recording schedule list		

Methods	Query String(s)	Inbound Data	Return Result
GET		None	<ScheduleBlock>
PUT		<ScheduleBlock>	<ResponseStatus>
DELETE			<ResponseStatus>

Notes

See RaCM Specification v1.1a for detailed description of <ScheduleBlock>

6.6 Search for Recorded Tracks

Recorded tracks can be "searched" using resources described below:

6.6.1 /OpenHome/ContentMgmt/Search/Description

URI	/OpenHome/ContentMgmt/serach/descripton	Type	Command
Function	Retrieve description of REST method parameters and formats available for "search"		

Methods	Query String(s)	Inbound Data	Return Result
GET		None	<ResourceDescription>

Notes

See RaCM Specification v1.1a and PSIA Service Model specification Section 7.6 for detailed description of <ResourceDescription>

6.6.2 /OpenHome/ContentMgmt/Search/Profile

URI	/OpenHome/ContentMgmt/serach/profile	Type	Command
Function	Retrieve profile/level of the Camera as applied to the "search" functionality		

Methods	Query String(s)	Inbound Data	Return Result
GET		None	<CMSearchProfile>

Notes

See RaCM Specification v1.1a for detailed description of <CMSearchProfile>

6.6.3 /OpenHome/ContentMgmt/Search

URI	/OpenHome/ContentMgmt/schedules	Type	Command
Function	Search recorded "tracks" using supplied search criteria		

Methods	Query String(s)	Inbound Data	Return Result
GET		<CMSearchDescription>	<CMSearchResult or ResponseStatus w/error code>
POST		<CMSearchDescription>	<CMSearchResult or ResponseStatus w/error code>

Notes

The 'GET' or 'POST' messages require a "CMSearchDescription" XML document to engage a search.

See RaCM Specification v1.1a for detailed descriptions and examples of <CMSearchDescription> and <CMSearchResult>

6.7 Status

6.7.1 /OpenHome/ContentMgmt/Status/Volume

URI	/OpenHome/ContentMgmt/status/volumes or/OpenHome/ContentMgmt/status/volumes/<n>	Type	Command
Function	Retrieve status of one or more mounted "volumes" within a Camera		

Methods	Query String(s)	Inbound Data	Return Result
GET		None	<CMStatusVolume>

Notes

For each Camera, there is at least one mounted "volume" that provides logical storage for recorded tracks.

GET to . . . /volumes will return status for ALL volumes.

GET to . . . /volumes/<n> will return status for a particular volume.

See RaCM Specification v1.1a for detailed description of <CMStatusVolume>.

6.7.2 /OpenHome/ContentMgmt/Status/Sources

URI	/OpenHome/ContentMgmt/status/sources or /OpenHome/ContentMgmt/status/sources/<GUID>	Type	Command
Function	Retrieve status of one or more input "source"		

Methods	Query String(s)	Inbound Data	Return Result
GET		None	<CMSourceStatus>

Notes

Each channel and track within a RaCM device's content base is correlated to a 'source.' A source is the input device that originated the multimedia content managed by the RaCM device. For each source, the RaCM content manager maintains a set of status attributes. These status attributes relate to the source itself, the channels that source is inputting, and the track(s) that correspond to that source. For the current Specification, each Camera only needs to support ONE source with a unique GUID. See RaCM Specification v1.1a for detailed description of <CMSourceStatus>.

6.7.3 /OpenHome/ContentMgmt/Status/Channels

URI	/OpenHome/ContentMgmt/status/channels or /OpenHome/ContentMgmt/status/channels/<ID>	Type	Command
Function	Retrieve status of one or more input "channels"		

Methods	Query String(s)	Inbound Data	Return Result
GET		None	<CMChannelStatus>

Notes

A "channel" is a specific instance of an input data stream (e.g., video input source).

The available channel <ID> must match channel <ID> used in /OpenHome/Streaming/Channels.

See RaCM Specification v1.1a for detailed description of <CMChannelStatus>.

6.7.4 /OpenHome/ContentMgmt/Status/Tracks

URI	/OpenHome/ContentMgmt/status/tracks or /OpenHome/ContentMgmt/status/tracks/<id>	Type	Command

-continued

Function	Retrieve status of one or more input "tracks"		
Methods	Query String(s)	Inbound Data	Return Result
GET		None	<CMTrackStatus>

Notes

See RaCM Specification v1.1a for detailed description of <CMTrackStatus>.

6.8 Streaming Playback and Archived Media Upload

Archived recordings are organized into "tracks", each with unique IDs. One or more "tracks" can be streamed to Gateway/end-user or be uploaded to the Gateway via accessing resources below. Please note these resources are not intended for live video viewing; for live video, refer to /OpenHome/Streaming/Channels/ . . . .

6.8.1.1 /OpenHome/Streaming/Tracks/<ID>/Http

URI	/OpenHome/Streaming/tracks/ID/http	Type	Command
Function	Request streaming of MJPEG video from one or more tracks		
Methods	Query String(s)	Inbound Data	Return Result
RTSP	track=<trackID> starttime=<start time> endtime=<end time>		Stream over RTSP

Notes

One or more optional "track" query parameters can be added to the URI. The additional "tracks" are to be streamed sequentially, one after another.
Example:

rtsp://<ip:port>/OpenHome/Streaming/tracks/10/http?track=12&track=22&track =100

The above example will stream MJPEG video for tracks 10, 12, 22, and 100 sequentially.

Starttime and endtime are in ISO 8601 timestamp (RFC 2326). When multiple tracks are identified in a single URI, they can only share one time range.
This resource may be accessed from within a Media Tunnel (see RTSP Media Tunneling).

6.8.1.2 /OpenHome/Streaming/Tracks/<ID>/Rtsp

URI	/OpenHome/Streaming/tracks/ID/rtsp	Type	Command
Function	Request streaming of video from one or more tracks		
Methods	Query String(s)	Inbound Data	Return Result
RTSP	track=<trackID> starttime=<start time> endtime=<end time>		Stream over RTSP

Notes

One or more optional "track" query parameters can be added to the URI. The additional "tracks" are to be streamed sequentially, one after another.
Example:

rtsp://<ip:port>/OpenHome/Streaming/tracks/10/rtsp?track=12&track=22&track =100

The above example will stream via RTSP tracks 10, 12, 22, and 100 sequentially.

Starttime and endtime are in ISO 8601 timestamp (RFC 2326). When multiple tracks are identified in a single URI, they can only share one time range.
This resource may be accessed from within a Media Tunnel (see RTSP Media Tunneling).

6.8.1.3 /OpenHome/Streaming/Tracks/<ID>/Hls/Playlist

URI	/OpenHome/Streaming/tracks/ID/hls/playlist	Type	Command
Function	Retrieve HLS Playlist file for one or more archived tracks		
Methods	Query String(s)	Inbound Data	Return Result
GET	track=<trackID> starttime=<start time> endtime=<end time>		HTTP Live Streaming Playlist file

Notes

One or more optional "track" query parameters can be added to the URI. The additional "tracks" are to be streamed sequentially, one after another.
Starttime and endtime are in ISO 8601 timestamp (RFC 2326). When multiple tracks are identified in a single URI, they can only share one time range.
This resource may be accessed from within a Media Tunnel (see HLS Media Tunneling).
See /OpenHome/Streaming/channels/<ID>/hls/playlist for recommendations/restrictions on HLS playlist.

6.8.1.4 /OpenHome/Streaming/Tracks/<ID>/Hls/<MediaSegment>

URI	/OpenHome/Streaming/channels/ID/hls/playlist/MediaSegment	Type	Command
Function	Retrieve HTTP Live Streaming media segment		
Methods	Query String(s)	Inbound Data	Return Result
GET			HTTP Live Streaming media segment

Notes

This is the recommended (but not mandatory) HTTP Live Streaming media segment URI format. The actual URI is specified in the HLS Playlist file (see /OpenHome/Streaming/tracks/<ID>/hls/playlist). HTTP Basic Authentication is used to authenticate access. For on-premise viewing, HTTP or HTTPS can be used. For off-premise viewing, media must be protected via SSL using the HLS Media Tunnel procedures.

6.8.1.5 /OpenHome/Streaming/Tracks/<ID>/Video/Upload

URI	/OpenHome/Streaming/tracks/ID/video/upload	Type	Command
Function	This function is used to trigger an upload of one or more tracks to the Gateway		
Methods	Query String(s)	Inbound Data	Return Result
POST	track=<trackID> starttime=<start time> endtime=<end time>	<MediaUpload>	<ResponseStatus>

Notes

Only the <id>, <gatewayURL>, and <failureURL> parameters within <MediaUpload> are valid for this use case. See /OpenHome/Streaming/channels/<ID>/video/upload for definition of <MediaUpload> and Media Upload Channels for media upload procedures.

Appendix A—Local Bootstrap Procedures

Local Bootstrap Procedures consist of 1) Camera discovery and 2) Camera configuration. Each step is described in more detail below:

Step 1—Camera Discovery

Camera discovery is achieved using UPnP's SSDP (Simple Service Discovery Protocol) process, where the Premise Gateway searches for one or more Cameras using the Camera's pre-configured USN (Unique Service Name). Camera must be pre-configured with a USN specified by

iControl. Please refer to the UPnP specification (www.upnp.org) for a definition of the UPnP discovery procedure.

Step 2—Camera Configuration

If a Camera is discoverable via Step 1, and end-user/installer confirms intention to activate a specific Camera, the Premise Gateway will issue the following Commands via the HTTP/HTTPS Command Channel (see Section 4.1.2.1) to configure the Camera:

1. GET /<ipAddress>/index/—and walk index tree to discover API resource availability and URI
2. GET /<ipAddress>/System/deviceInfo (or the equivalent URI)—to determine device model, version, etc.
3. If firmware upgrade is required:
   a. POST /<ipAddress>/System/updateFirmware
   b. Wait for upgrade to finish (including wait for reboot)
   c. GET /<ipAddress>/System/deviceInfo—retrieve deviceInfo again
4. PUT /<ipAddress>/System/ConfigurationData/configFile—upload a complete configuration file to Camera based on <deviceInfo> data.
5. If reboot required, /PUT/<ipAddress>:<port>/System/reboot
6. (Optional) POST /<ipAddress>:<port>/Security/updateSSLCertificate/server—this additional Command may be issued if server certificate is to be used.

<ipAddress> is the Camera IP address discovered in Step 1. All Commands above require administrative account priviledges, therefore, the pre-configured administration account should be used to issue the above Commands.

Appendix B—Off-Premise Bootstrap Procedures

The Off-Premise Bootstrap procedures are used by the Camera to retrieve its siteID, shared secret, and remote Gateway addresses. FIG. **30** illustrates steps involved.

Using Step 1, Camera connects to the Registry Gateway (via the pre-configured Registry Gateway URL) and retrieves its assigned siteID and the Credential Gateway URL. Next, via Step 2, Camera retrieves its shared secret from the Credential Gateway using its siteID and Activation Key. Lastly, via Step 3, Camera retrieves Session Gateway Information from the Credential Gateway. At the end of the Bootstrap phase, the Camera will have obtained its secret credentials and its Session Gateway address from the iControl Gateway. Each of the Steps is describe in more detail below.

Bootstrap Procedure Frequency

Camera should perform bootsrap procedures upon EVERY device reboot. Upon statup, If SharedSecret is not set (e.g., brand new Camera, post factory reset), Camera should perform bootstrap Steps 1-3. Upon startup, if SharedSecret is already established (see Step 2), Camera should perform bootstrap Steps 1 and 3 only, and skip Step 2.

Step 1—Retrieve Gateway URL and SiteID

This procedure step is used by the Camera to retrieve its SiteID and Credential Gateway URL.

TABLE 14

Retrieve Gateway URI and SiteID format

Purpose	Retrieve Credential Gateway URL and camera siteID using camera Serial Number as input
Message Format	HTTPS GET /<Registry Gateway URL>/<Serial Number> HTTP/1.1
Authentication	None
Mandatory Request Headers	Host
200 OK response	<registryEntry serial="<Serial Number>" href="/<Registry Gateway URL>/<Serial Number>"> <functions>...</functions > <siteId><siteID></siteId> <gatewayUrl><Credential Gateway URL></gatewayUrl> </registryEntry>
Error responses	Standard HTTP response codes (e.g., 404)
Example Request	https://adminsirius3.icontrol.com/rest/icontrol/registry/serial/00603504026c
Example 200 OK Response	<registryEntry serial="00:60:35:04:02:6c" href="/rest/icontrol/registry/serial/00603504026c"> <functions count="1"> <function name="delete" action="/rest/icontrol/registry/serial/00603504026c" method="DELETE"/> </functions> <siteId>00603504026c</siteId> <gatewayUrl>http://gsess-sirius3.icontrol.com/gw</gatewayUrl> </registryEntry>

TABLE 15

Retrieve Gateway URI and SiteID Variables

Variable Name	Format	Description/Notes
Registry Gateway URL	URL	Pre-configured in camera
Serial Number	12 byte hex string	Pre-configured in camera
siteID	12-20 digit alpha numeric string	
gatewayUrl otherwise known as CredentialGatewayURL	URL prefix protocol:host[:port]/path	Prefix to use for Pending Secret and Connect Info requests.

Step 2—Retrieve Credential

This procedure step is used by the Camera to retrieve its Pending Key. If SharedSecret is already established from previous successful Retreieve Credital procedure, this step should be skipped.

TABLE 16

Retrieve Credential Message Format	
Purpose	Retrieve camera specific shared secret using camera siteID, camera serial and Activation Key as inputs
Message Format	HTTPS POST/<CredentialGatewayURL>/GatewayService/<siteID>/PendingDeviceKey HTTP/1.1
Authentication	None
Mandatory Request Headers	Host, Content-Length, Content-Type (application/x-www-form-urlencoded)
POST body	serial=<Serial Number>&activationkey=<ActivationKey>
200 OK response with pending key	<pendingPaidKey method="server" expires="<pending key expiration epoch millisecs>" ts="<current epoch millisecs>" key="<SharedSecret>" partner="icontrol"/>
200 OK response with retry	Gateway responds with a method="retry" when the camera is not yet activated within the system. Response includes timeout for retry. <PendingPaidKey method="retry" expires="<retry epoch millisecs>" ts="<current epoch millisecs>" partner="icontrol"/>
Other HTTP responses	Standard HTTP error response codes for example 5xx indicate a temporary server issue and cameras should perform an automatic retry in randomized 10 minute backoff.
Example POST body	serial-555500000010&activationkey=AABB12345678
Example 200 OK with pending key Response	<pendingPaidKey method="server" expires="1308892493528" ts="1308849293540" key="398341159498190458" partner="icontrol"/>
Example 200 OK response with retry	<pendingPaidKey method="retry" expires="1308849242148" ts="1308849122148" partner="icontrol"/>

TABLE 17

Retrieve Credential Variables		
Variable Name	Format	Description/Notes
CredentialGatewayURL	Hostname[:port]	Retrieved via Step 1 - Retrieve Gateway URL and SiteID
PendingSecretPath	URL path	Retrieved via Step 1 - Retrieve Gateway URL and SiteID
siteID	12 byte hexadecimal string	Retrieved via Step 1 - Retrieve Gateway URL and SiteID
ActivationKey	10+ digit alpha numeric string	Pre-configured in camera
'method' (in 200 OK body)	String	"server" or "retry"
'key' (in 200 OK body)	Alphanumeric string	Pending key returned by Gateway in 200 OK body
'ts' (in 200 OK body)	Numeric string	Gateway's timestamp in UTC time
'expires' (in 200 OK body)	Numeric string	UTC time when the current pending key expires
Pending Key	Alphanumeric string	Initial key retrieved from Gateway that is not yet confirmed with the Gateway.
SharedSecret or active key	Alphanumeric string	Pending key becomes <SharedSecret> after successful connection to Gateway (see below)

Pending Key→SharedSecret Retrieval Process

While Camera activation is underway, the Gateway will respond to a Camera's request for Credential with 200 OK containing the PendingPaidKey XML body (with method="server") with a pending key field. The pending key field will become active once the Camera connects to the Gateway over the XMPP channel and is authenticated using the pending key as its password. Once authenticated (via a successful XMPP session with the Gateway), the key is no longer pending and instead becomes active, or otherwise known as the Camera's <SharedSecret>. The active key (a.k.a, <SharedSecret>) will not automatically expire; however, the Gateway may update a Camera's <SharedSecret> using the SetKey command over the XMPP interface. Once a pending key becomes active, subsequent requests for the PendingDeviceKey will receive method="retry" responses

unless a new activation process is initiated (this can be done by administrators and installers via the iControl admin and portal applications).

If the Camera does not connect to the server over the XMPP channel and be authenticated using the key by the "expires" time specified in the PendingPaidKey XML body, then the pending key will expire and no longer be valid.

While Camera activation is underway, each request for the PendingPaidKey will receive a different key in the response, causing the previous pending key to be replaced with the new one.

It is expected that upon a factory reset, the device will forget its key and return to the bootstrap process of polling for a PendingDeviceKey.

Step 3—Retrieve Session Gateway Info

This procedure step is used by the Camera to retrieve Session Gateway Info, which includes XMPP Gateway address.

TABLE 18

Retrieve XMPP Gateway Info Message Format

Purpose	Retrieve XMPP Gateway hostname and port from Credential Gateway
Message Format	HTTPS GET /<gatewayUrl>/GatewayService/<siteID>/connectInfo HTTP/1.1
Authentication	None
Mandatory Request Headers	Host
200 OK response	<connectInfo> <session host=<Session Gateway host> port=[port] /> <xmpp host=<XMPP Gateway host> port=[port] /> </connectInfo>
Error responses	Standard HTTP response codes (e.g., 404)
Example 200 OK Response	< connectInfo> <session host="server1.icontrol.com" port="443" /> <xmpp host="server1.icontrol.com" port="5222" /> </ connectInfo>

TABLE 19

Retrieve XMPP Gateway Info Variables

Variable Name	Format	Description/Notes
gatewayUrl	https://hostname[:port]/path	Retrieved Via Step 1 - Retrieve Gateway URL and SiteID
siteID	12-20 char alpha numeric string	Retrieved Via Step 1 - Retrieve Gateway URL and SiteID
XMPP Gateway host:port	Hostname and port IPAddress and port	Host and port to use for XMPP communication with the Gateway.
Session Gateway host:port	Hostname and port IPAddress and port	This variable should be ignored by the Camera

Appendix C—Activation Key Derivation Procedures

A Camera's activation key is derived from its serial number and a master secret. An activation key is 20 hex characters (0-f) long.

The first 10 characters of the activation key will be the last 10 characters of the serial number. The first 2 characters of the serial number will be derived from server configuration and will default to "00".

A manufacturer-specific global code is now introduced which can be customer-specific and must be configured on the server. An example value for this will is "lw2jd3Dq". This portion will be referred to as "globalCode" below.

The next 8 characters will be the first 8 characters of the MD5 hash of the following concatenation: globalCode+serialNumber.

The last 2 characters will be a CRC checksum of the first 18 in hex. The CRC8 checksum algorithm used should be "CRC-8-Dallas/Maxim x8+x5+x4+1 (1-Wire bus)".

Examples

Activation key for 006035010057 will be 6035 0100 57ef 8c2a a6ba

MD5(lw2jd3Dq006035010057)
=ef8c2aa65441ebddd5b7d5351a7e1058

CRC(6035010057ef8c2aa6)=0xBA

Activation key for 006035000000 will be 6035 0000 0014 B08F C388

Glossory and Terminologies

AAA	Authentication, Authorization, and Accounting
AP	Access Point
BSSID	Basic Service Set Identifier
CA	Certificate Authority
DNS	Domain Name System
GUUID	Globally Universally Unique Identifier
HLS	HTTP Live Streaming (Internet draft-pantos-http-live-streaming-07)
HTTP/HTTPS	Hypertext Transfer Protocol (Secured)
PIR	Passive Infra Red
PSIA	Physical Security Interoperability Alliance (www.psialliance.org)
PTZ	Pan, Tilt, Zoom
RaCM	PSIA Recording and Content Management (Specification)
RFC	Request for Proposal
RSSI	Received Signal Strength Indication
RTP	Real Time Transport Protocol
RTSP	Real Time Streaming Protocol
SASL	Simple Authorization and Security Layer (part of XMPP)
SSDP	Simple Service Discovery Protocol (used by UPnP)
SSID	Service Set Identifier
SSL	Secure Sockets Layer (predecessor to TLS)
TCP	Transmission Control Protocol
TLS	Transport Layer Security
URI/URL	Universal Resource Identifier/Universal Resource Locator
UPnP	Universal Plug and Play
USN	Unique Service Number (UPnP device specific ID)
UTC	Coordinated Universal Time
XML	Extensible Markup Language
XMPP	Extensible Messaging and Presence Protocol (RFC 6120)

What is claimed is:

1. A system comprising:

a gateway device, located at a premises, configured to communicate with a plurality of premises devices located at the premises;

a touchscreen device, located at the premises, configured to communicate with the gateway device, wherein the touchscreen device is configured to present a plurality of user interfaces comprising a security user interface and a network user interface,

wherein the security user interface is configured to enable control of functions of the plurality of premises devices and access to data collected by the plurality of premises devices, and

wherein the network user interface is configured to enable access to one or more network devices located at the premises; and

a camera device located at the premises and configured to:

receive, via a first camera interface and from the gateway device, a command, and

send, to at least one computing device located external to the premises and based on receiving the command, content via a second camera interface.

2. The system of claim **1**, wherein at least one of the first camera interface or the second camera interface is configured to establish a communication channel.

3. The system of claim **2**, wherein the communication channel comprises a persistent bi-directional communication channel.

4. The system of claim **1**, wherein the camera device is configured to, based on receiving the command, perform at least one task associated with the command.

5. The system of claim **1**, wherein the camera device is configured to send, via the second camera interface and to the at least one computing device, the content by streaming the content to the at least one computing device.

6. The system of claim **1**, wherein at least one of the first camera interface or the second camera interface is configured to establish a secure protocol session.

7. The system of claim **1**, wherein the camera device is further configured to send, based on the command and to the gateway device, an indication that at least a portion of the command comprises a parameter not supported by the camera device.

8. The system of claim **1**, wherein the camera device is further configured to generate the content.

9. A method comprising:

receiving, via a first camera interface and from a gateway device, a command, wherein the gateway device is located at a premises and is configured to communicate with a plurality of premises devices located at the premises; and

sending, to a computing device located external to the premises and based on the command, content via a second camera interface;

wherein a touchscreen device, located at the premises, is configured to cause output of a security user interface configured to enable control of functions of the plurality of premises devices and a network user interface configured to enable access to one or more network devices located at the premises.

10. The method of claim **9**, wherein the method comprises establishing, via at least one of the first camera interface or the second camera interface, a communication channel with at least one of the gateway device or the computing device.

11. The method of claim **10**, wherein the communication channel comprises a persistent bi-directional communication channel.

12. The method of claim **9**, wherein the method comprises performing at least one task associated with the received command.

13. The method of claim **9**, wherein the sending, to the computing device, the content comprises streaming the content to the computing device.

14. The method of claim **9**, wherein the method comprises establishing, via at least one of the first camera interface or the second camera interface, a secure protocol session with at least one of the gateway device or the computing device.

15. The method of claim **9**, further comprising sending, based on the command and to the gateway device, an indication of an error associated with the command.

16. The method of claim **9**, wherein the content is generated by a camera device.

17. A computing device comprising:

one or more processors; and

memory storing instructions that, when executed by the one or more processors, cause the computing device to:

receive, via a first camera interface and from a gateway device, a command, wherein the gateway device is located at a premises and is configured to communicate with a plurality of premises devices located at the premises; and

send, to a device located external to the premises and based on receiving the command, content via a second camera interface.

18. The computing device of claim **17**, wherein the instructions, when executed, cause the computing device to send, to the device, the content by streaming the content to the device located external to the premises.

19. The computing device of claim **17**, wherein the computing device is located at the premises.

20. The computing device of claim **17**, wherein the instructions, when executed, cause the computing device to establish, via at least one of the first camera interface or the second camera interface, a secure protocol session with at least one of the gateway device or the device.

21. The computing device of claim **17**, wherein the instructions, when executed, cause the computing device to perform at least one task associated with the received command.

22. The computing device of claim **17**, wherein the instructions, when executed, cause the computing device to send, based on the command and to the gateway device, an indication of an error associated with the command.

23. The computing device of claim **17**, wherein the instructions, when executed, cause the computing device to generate the content.

24. A method comprising:

receiving, by a camera device located at a premises and from a gateway device, a command via a first camera interface, wherein the gateway device is located at the premises and is configured to communicate with a plurality of premises devices located at the premises;

sending, to at least one computing device and based on the command, content via a second camera interface; and

outputting, via at least one of a security user interface or a network user interface, the content, wherein the security user interface is configured to enable control of functions of the plurality of premises devices, and wherein the network user interface is configured to enable access to one or more network devices located at the premises.

25. The method of claim **24**, wherein the outputting the content comprises streaming the content.

26. The method of claim **24**, wherein the method comprises establishing, via the first camera interface, a secure protocol session with the camera device.

27. The method of claim **24**, wherein the computing device is located external to the premises.

28. The method of claim **24**, further comprising, performing at least one task associated with the received command.

29. The method of claim **24**, wherein the content comprises streamed content.

30. The method of claim **24**, wherein the method comprises establishing, via the first camera interface, a communication channel with the camera device.

31. The method of claim **30**, wherein the communication channel comprises a persistent bi-directional communication channel.

32. The method of claim **24**, wherein the content is generated by the camera device.

33. A device comprising:

one or more processors; and

memory storing instructions that, when executed by the one or more processors, cause the device to:

receive, via a first camera interface a command from a gateway device, wherein the device and the gateway device are located at a premises, and wherein the gateway device is configured to communicate with a plurality of premises devices located at the premises;

send, to at least one computing device and based on the command, content via a second camera interface; and

output, via at least one of a security user interface or a network user interface, the content, wherein the security user interface is configured to enable control of functions of the plurality of premises devices, and wherein the network user interface is configured to enable access to one or more network devices located at the premises.

34. The device of claim **33**, wherein the instructions, when executed, cause the device to output the content by streaming the content.

35. The device of claim **33**, wherein the instructions, when executed, cause the device to establish, via the first camera interface, a secure protocol session with the gateway device.

36. The device of claim **33**, wherein the computing device is located external to the premises.

37. The device of claim **33**, wherein the instructions, when executed, cause the device to perform at least one task associated with the received command.

38. The device of claim **33**, wherein the content comprises streamed content.

39. The device of claim **33**, wherein the instructions, when executed, cause the device to establish, via the first camera interface, a communication channel with the gateway device.

40. The device of claim **39**, wherein the communication channel comprises a persistent bi-directional communication channel.

41. The device of claim **33**, wherein the content is generated by the device.

42. A system comprising:

a camera device located at a premises, wherein the camera device is configured to:

receive, via a first camera interface and from a gateway device located at the premises, a command; and

send, to at least one computing device and based on receiving the command, content via a second camera interface, wherein the at least one computing device is located external to the premises; and

a touchscreen device located at the premises,

wherein the touchscreen device is configured to:

receive, from the camera device, the content; and

output, via at least one of a security user interface or a network user interface, the content, wherein the security user interface is configured to enable control of functions of a plurality of premises devices located at the premises, and wherein the network user interface is configured to enable access to one or more network devices located at the premises.

43. The system of claim **42**, wherein at least one of the first camera interface or the second camera interface is configured to establish a communication channel.

44. The system of claim **43**, wherein the communication channel comprises a persistent bi-directional communication channel.

45. The system of claim **42**, wherein the camera device is configured to perform at least one task associated with the received command.

46. The system of claim **42**, wherein the camera device is configured to send, via the second camera interface and to the at least one computing device, the content by streaming the content to the at least one computing device.

47. The system of claim **42**, wherein at least one of the first camera interface or the second camera interface is configured to establish a secure protocol session.

48. The system of claim **42**, wherein the camera device is further configured to send, based on the command and to the gateway device, an indication that at least a portion of the command comprises a parameter not supported by the camera device.

49. The system of claim **42**, wherein the camera device is further configured to generate the content.

* * * * *