IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

TELECOM NETWORK SOLUTIONS, LLC, *Plaintiff*, v. T-MOBILE USA, INC., T-MOBILE US, INC., and SPRINT CORP. *Defendants.*	§ § § § § § § § §	Case No. 2:21-cv-00418 **JURY TRIAL DEMANDED**

COMPLAINT FOR PATENT INFRINGEMENT

Telecom Network Solutions, LLC ("TNS" or "Plaintiff") hereby submits this Complaint for patent infringement against Defendants T-Mobile USA, Inc. ("TUSA"), T-Mobile US, Inc. ("TUS"), and Sprint Corp. ("Sprint") (collectively, "TMO" or "Defendants") and states as follows:

THE PARTIES

1. TNS is a Texas limited liability company with a principal place of business at 3701 Kirby Dr., Suite 1000, Houston, Texas 77098.

2. On information and belief, TUSA is a Delaware corporation with a principal place of business at 12920 Southeast 38th Street, Bellevue, Washington 98006. On information and belief, TUSA may be served through its registered agent, Corporation Service Company, 211 E. 7th Street, Suite 620, Austin, Texas 78701.

3. On information and belief, TUS is a Delaware corporation with its principal place of business at 12920 Southeast 38th Street, Bellevue, Washington 98006. On information and belief, TUS may be served through its registered agent for service, Corporation Service Company, 251 Little Falls Drive, Wilmington, Delaware 19808.

4. On information and belief, Sprint is a Delaware corporation with its principal place of business at 6391 Sprint Parkway, Overland Park, Kansas 66251. On information and belief, Sprint may be served through its registered agent for service, Corporation Service Company, 251 Little Falls Drive, Wilmington, DE 19808.

5. On information and belief, TUSA is a wholly owned subsidiary of TUS.

6. On information and belief, Sprint is a wholly owned subsidiary of TUSA, which is a wholly owned subsidiary of TUS.

NATURE OF THE ACTION

7. This is a civil action for infringement of U.S. Patent No. RE47,813 (the "'813 Patent"), arising under the patent laws of the United States, 35 U.S.C. § 1 *et seq*.

JURISDICTION AND VENUE

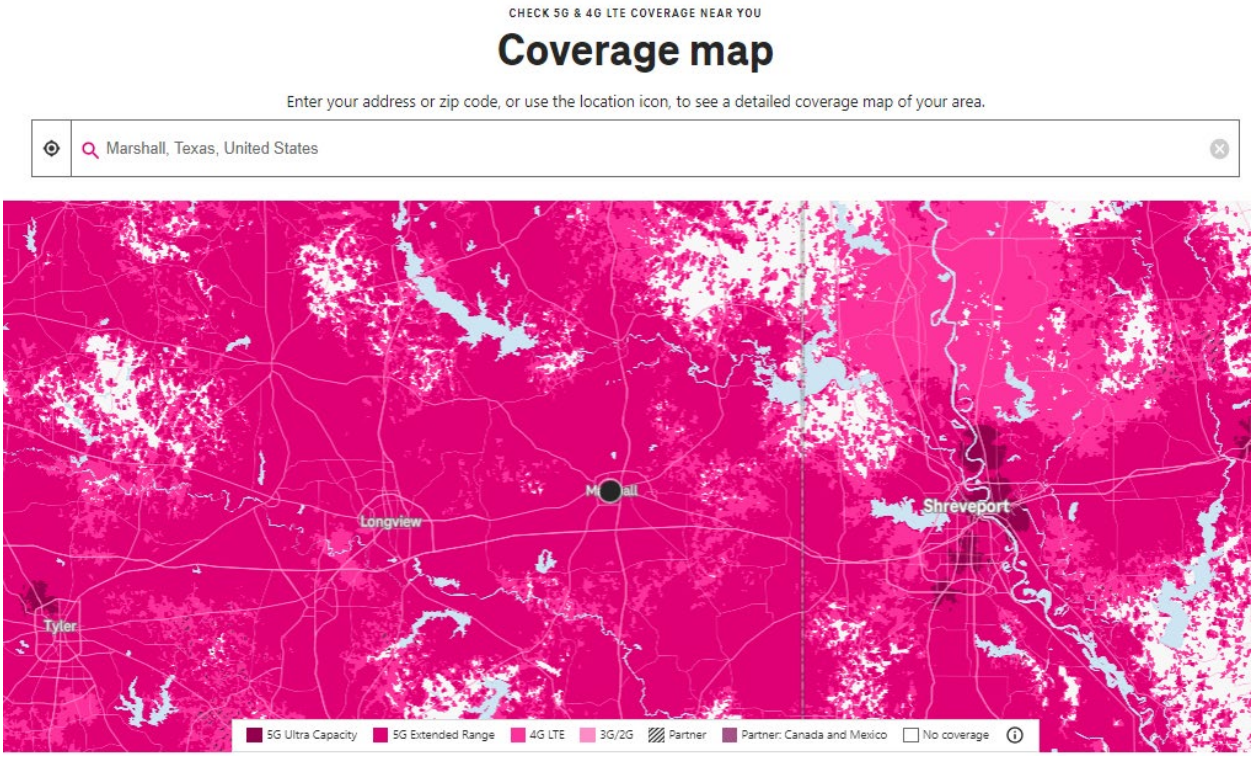
8. This Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a) because this action arises under the patent laws of the United States, 35 U.S.C. §§ 101 *et seq*.

9. On information and belief, TMO's operations in the Eastern District of Texas are substantial and varied.

10. TMO operates one or more wireless telecommunications networks to provide wireless telecommunications services in Texas, including within the Eastern District of Texas.

11. TMO advertises that its 3G/2G, 4G/4G LTE and 5G wireless networks (collectively, "T-Mobile Network") are available in Texas, including within the Eastern District of Texas.[1]

[1] *See, e.g.,* https://www.t-mobile.com/coverage/coverage-map (last visited Nov. 1, 2021).



13. For example, on information and belief, TMO maintains and operates research and development facilities at 7668 Warren Parkway, Frisco, Texas 75034.[2]

[2] *See, e.g.*, https://www.dallasnews.com/business/real-estate/2020/03/18/hundreds-of-t-mobile-workers-moving-to-new-frisco-headquarters/ (last visited Nov. 1, 2021)

The Dallas Morning News

BUSINESS › REAL ESTATE

Hundreds of Metro by T-Mobile workers moving to new Frisco headquarters

Workers from T-Mobile marketing, IT, engineering, human resources and finance will also be relocated from Richardson.

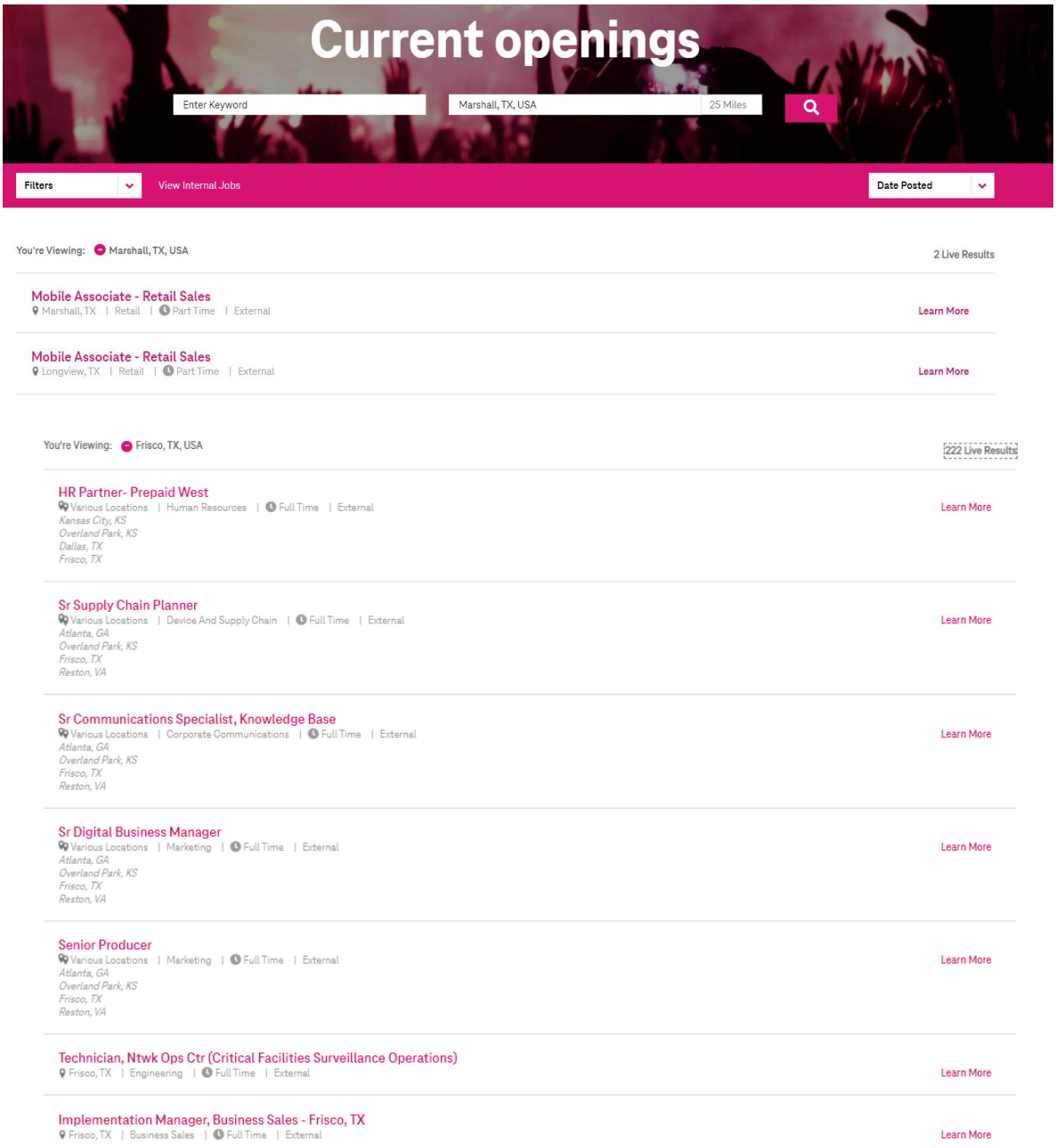
Metro by T-Mobile is moving its headquarters to the Duke Bridges VII building on the Dallas North Tollway at Warren Parkway. (T-Mobile)

[3] On information and belief, any Sprint customers can "visit [their] local T-Mobile retail store for assistance" if they "have any questions or need additional help."[4]

15. On information and belief, TMO has employees who work in the State of Texas.

16. TMO advertises that it is presently seeking to hire for multiple positions within the Eastern District of Texas:[5]

[3] *See, e.g.,* https://www.t-mobile.com/store-locator (last visited Nov. 1, 2021).
[4] *See, e.g.,* https://www.sprint.com/en/support/solutions/device/t-mobile-network-experience.html (last visited Nov. 1, 2021).
[5] https://www.tmobile.careers/job-search/ (last visited Nov. 1, 2021) (excerpts).



18. TMO has manufactured, used, sold, and/or offered for sale the T-Mobile Network in the State of Texas and this judicial district.

19. At the time of filing of this Complaint, the T-Mobile Network is available to consumers in Texas, including within this judicial district.

20. The T-Mobile Network which is available in this judicial district is accused of infringement in this Complaint.

21. TMO derives benefits from its presence in this federal judicial district, including, but not limited to, sales revenue. For example, TMO receives revenue from its corporate stores in this district, by selling network access, products (e.g., phones, tablets, smart watches, etc.), and services and by receiving payment for its network access, products, and services.

22. TMO's commission of acts of infringement, and the presence of TMO retail stores and offices in the Eastern District of Texas, establishes venue over it under 28 U.S.C. § 1400(b). *See, e.g.*, *Intellectual Ventures II LLC v. FedEx Corp.*, No. 16-cv-980-JRG, 2017 WL 5630023, at *6-*7 (E.D. Tex. Nov. 22, 2017) (Gilstrap, J.) (venue proper based on defendants' "physical retail and service locations").

23. In other recent actions, TMO has either admitted or not contested that this federal judicial district is a proper venue for patent infringement actions against it. *See, e.g.,* Answer to First Amended Complaint, at 2-3, ¶¶ 7-10, *Fractus, S.A. v. AT&T Mobility LLC et al.*, No. 2:18-cv-00135-JRG (E.D. Tex. Dec. 13, 2018), ECF No. 116; Answer at 2, ¶¶ 4, 5, *Preferential Networks IP, LLC v. T-Mobile US, Inc. et al.*, No. 2:17-cv-00626 (E.D. Tex. Nov. 01, 2017), ECF No. 17; Answer ¶¶ 4, 5, *Traxcell Techs., LLC v. T-Mobile, USA, Inc.*, No. 2:17-cv-00720 (E.D. Tex. Jan. 23, 2018), ECF No. 8; Answer ¶¶ 5, 6, *Kevique Tech., LLC v. T-Mobile USA, Inc.*, No. 2:17-cv-00095 (E.D. Tex. Apr. 11, 2017), ECF No. 10; Answer to Amended Complaint ¶ 14, *Barkan Wireless IP Holdings, L.P. v. T-Mobile US, Inc. et al.*, No. 2:21-cv-00034 (E.D. Tex. Apr. 12, 2021), ECF No. 36. Defendant TUSA has also admitted or failed to contest that it has transacted

business in this district. *See Preferential Networks* at Answer at 2, ¶ 4; *Traxcell Techs.* at Answer ¶ 2; *Kevique Tech.* at Answer ¶¶ 5, 6. *See also* Answer to First Amended Complaint ¶¶ 19, 20, *Mobile Synergy Sols., LLC v. T-Mobile US, Inc. et al.,* No. 6:16-cv-01223 (E.D. Tex. Feb. 13, 2017), ECF No. 47.

24. Venue as to TMO is proper in this judicial district under 28 U.S.C. §§1391(b)-(c) and 1400(b) at least because TMO has committed acts of infringement in this judicial district and has a regular and established place of business in this judicial district. Each Defendant makes, uses, sells, offers to sell, and/or imports products and/or services accused of infringement in this case into and/or within this judicial district and maintains a permanent and/or continuing presence within this judicial district. On information and belief, each Defendant has transacted and, at the time of the filing of the Complaint, is continuing to transact business within this judicial district.

25. TMO is subject to personal jurisdiction under the provisions of the Texas Long Arm Statute, TX CIV. PRAC. & REM CODE § 17.041 et seq., by virtue of the fact that, upon information and belief, TMO has availed itself of the privilege of conducting and soliciting business within this State, including engaging in at least some of the infringing activities in this State, as well as by others acting as TMO's agents and/or representatives, such that it would be reasonable for this Court to exercise jurisdiction consistent with principles underlying the U.S. Constitution, and the exercise of jurisdiction by this Court would not offend traditional notions of fair play and substantial justice.

26. On information and belief, TMO has also established minimum contacts with this judicial district and regularly transacts and does business within this district, including advertising, promoting and selling products and/or services in its stores, over the internet, through intermediaries, representatives and/or agents located within this judicial district, that infringe the

asserted patents. On further information and belief, TMO has purposefully directed activities at citizens of this State including those located within this judicial district. On information and belief, TMO derives substantial revenue from the goods and services it provides to individuals in the state of Texas and in this judicial district.

27. On information and belief, TMO has purposefully and voluntarily placed its products and/or services into the stream of commerce with the expectation that they will be purchased and used by customers located in the State of Texas and the Eastern District of Texas. On information and belief, TMO's customers in the Eastern District of Texas have purchased and used and continue to purchase and use TMO's products and/or services.

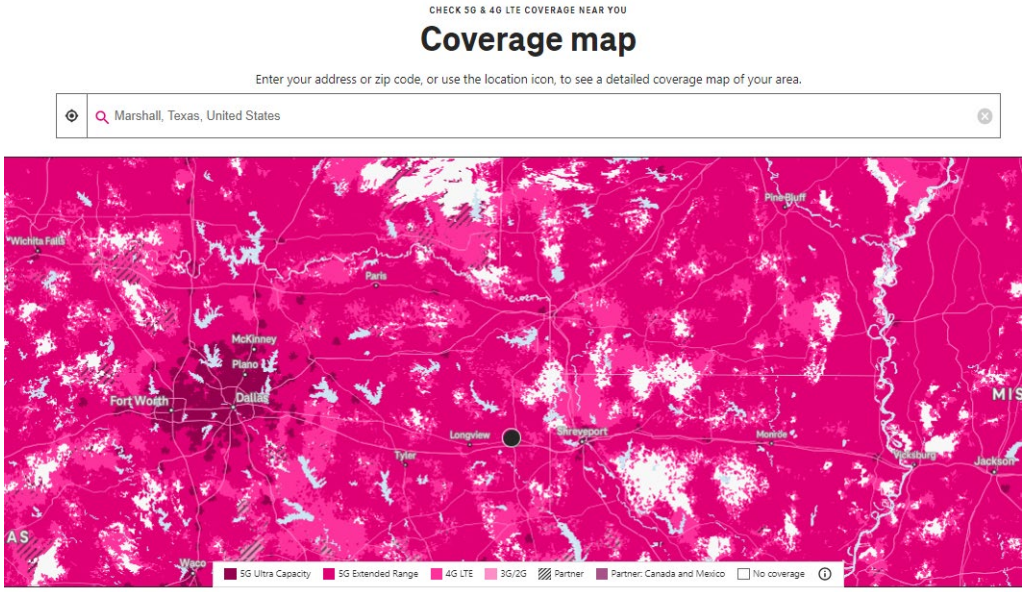
28. Defendants are properly joined under 35 U.S.C. § 299(a)(1) because, as set forth in greater detail below, on information and belief, Defendants commonly and/or jointly make, use, sell, offer to sell, and/or import infringing instrumentalities, such that at least one right to relief is asserted against Defendants jointly, severally, and in the alternative with respect to the same transactions, occurrences, or series of transactions or occurrences relating to the making, using, selling, offering to sell, and/or importing into the United States the same accused instrumentalities, as set forth in greater detail herein.

29. Defendants are properly joined under 35 U.S.C. § 299(a)(2) because, as set forth in greater detail below, on information and belief, Defendants make, use, sell, offer to sell in, and/or import into the United States the same or similar accused instrumentalities, such that questions of fact that are common to all Defendants will arise in this action.

BACKGROUND

30. TMO operates and sells access to a communication network that provides telecommunication, Internet service, and other services to customers via cellular base stations located in this district and throughout the United States.

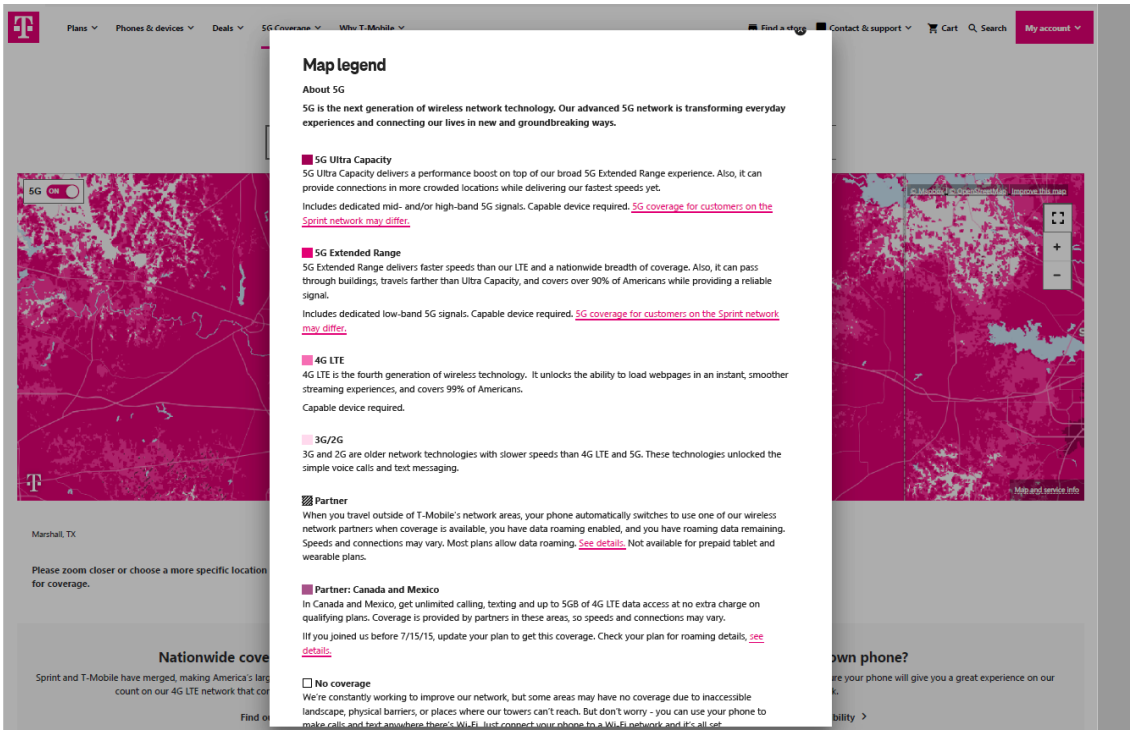
31. The T-Mobile Network, including the cellular base stations, communicates with customers' mobile devices (also referred to as "terminals" or "user equipment"), such as mobile phones, smartphones, tablets, and mobile hotspots, in accordance with third generation ("3G"), fourth generation ("4G")/fourth generation Long Term Evolution ("4G LTE"), and fifth-generation ("5G") mobile network standards.[6]



32. TMO also sells mobile devices, through channels including its website and retail stores, that communicate using the T-Mobile Network in accordance with those 4G/4G LTE, and 5G[7] standards for use on its network.

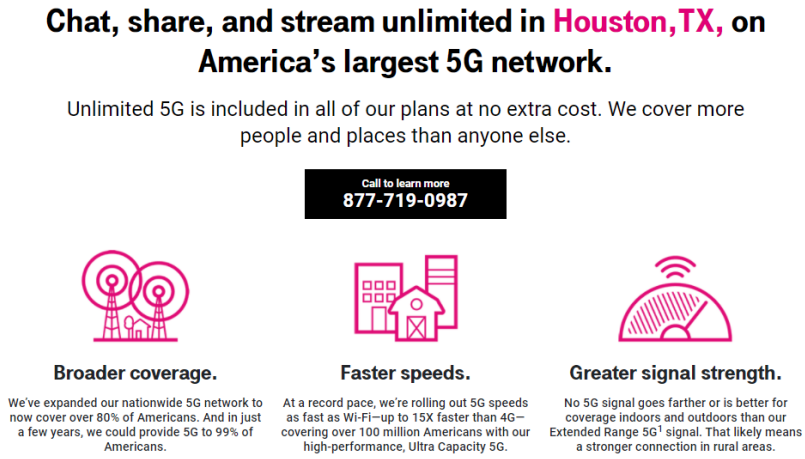
[6] *See, e.g.,* https://www.t-mobile.com/coverage/coverage-map (last visited Nov. 1, 2021); https://www.t-mobile.com/support/coverage/t-mobile-network (last visited Nov. 1, 2021).
[7] *See, e.g.,* https://www.t-mobile.com/cell-phones/network/5g (last visited Nov. 1, 2021).

33. The T-Mobile Network includes a 5G Ultra Capacity and 5G Extended Range (collectively, "5G") as well as 4G/4G LTE and 3G/2G mobile network.[8]

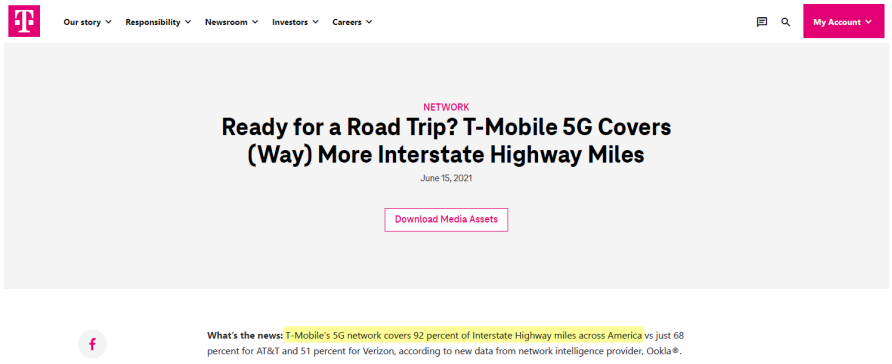


34. The TMO 5G network covers over 80% of Americans and it is expected to cover 99% of Americans in just a few years.[9] TMO covers "over 100 million Americans with [its] high-performance, Ultra Capacity 5G."[10]

[8] *See, e.g.,* https://www.t-mobile.com/coverage/coverage-map (last visited Nov. 1, 2021).
[9] *See* https://www.t-mobile.com/ (last visited Nov. 1, 2021).
[10] *Id.*



35. The T-Mobile 5G network "covers more than 92% of Interstate Highway miles in America."[11]



36. The TMO 5G network covers "nearly 280 million people across 1.6 million square miles."[12]

[11] *See* https://www.t-mobile.com/news/network/ready-for-a-road-trip (last visited Nov. 1, 2021).
[12] https://wholesale.t-mobile.com/docs/default-source/crc-content/customer-connections/1q-2021-5g-customer-webinar-february-2021.pdf (last visited Nov. 1, 2021).

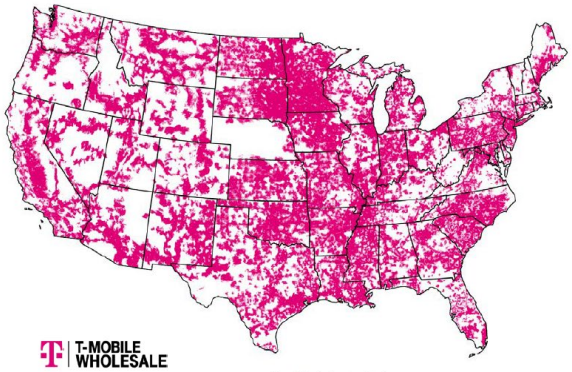
T-MOBILE WHOLESALE

T-Mobile 5G Standalone

What's the news?	Why it matters?	What's the benefit?
T-Mobile is leading the industry in deploying mobile 5G with the first and only nationwide • standalone 5G network • multi-band 5G spectrum holdings. Covering nearly 280 million people across 1.6 million square miles.	Standalone architecture is the future of wireless connectivity, bringing 5G closer to reaching its true potential with: • faster speeds • lower latency • massive connectivity. It will pave the way for new applications and supercharge things like • mobile augmented and virtual reality, • cloud gaming, • real-time translation and so much more.	Standalone architecture: T-Mobile launched Standalone 5G on August 4th, 2020, well ahead of our competition, enabling: • expanded coverage – especially in rural areas • improved latency • faster upload speeds. This is great news for applications such as • AR/VR • cloud gaming • smart factories.

America's Largest 5G Network

T-Mobile Extended Range 5G covers
280 million people across1.6 million square miles

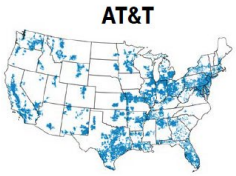


T-MOBILE WHOLESALE

Capable device required.

3.5x Verizon's 5G coverage

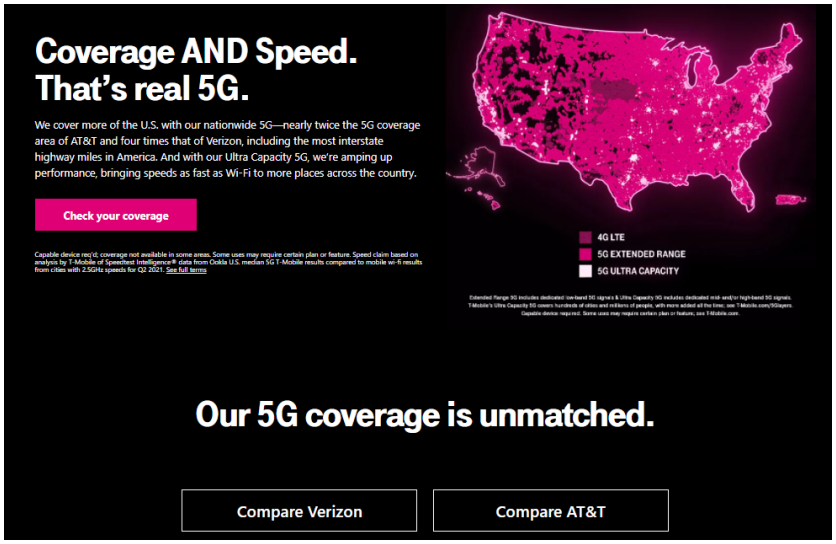
2.5x AT&T's 5G coverage

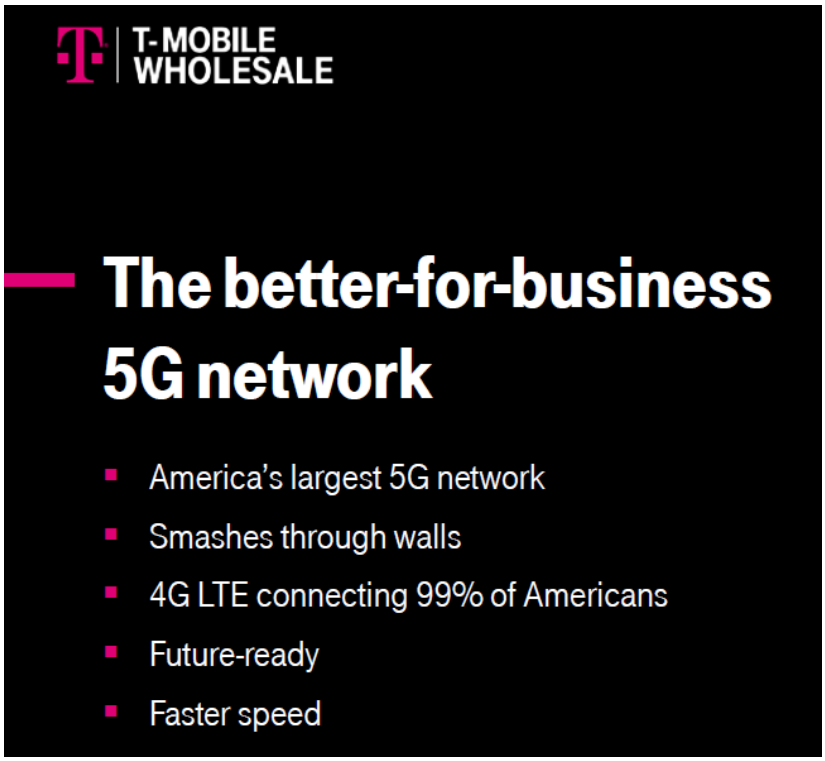


T-Mobile Confidential ■ 6

37. The TMO network including its 4G LTE and 5G network covers almost all of the United States.[13] For instance, a T-Mobile presentation states that its 4G LTE network connects "99% of Americans."[14]

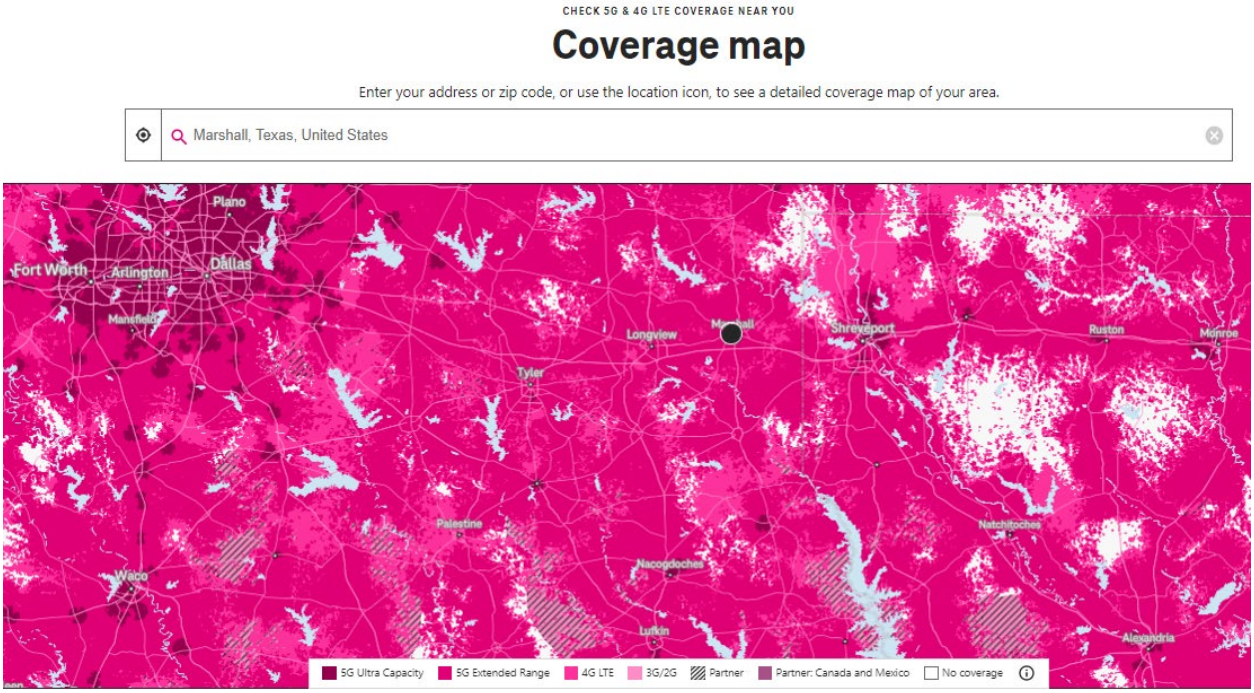
[13] https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited Nov. 1, 2021).
[14] https://wholesale.t-mobile.com/docs/default-source/crc-content/customer-connections/1q-2021-5g-customer-webinar-february-2021.pdf (last visited Nov. 1, 2021).



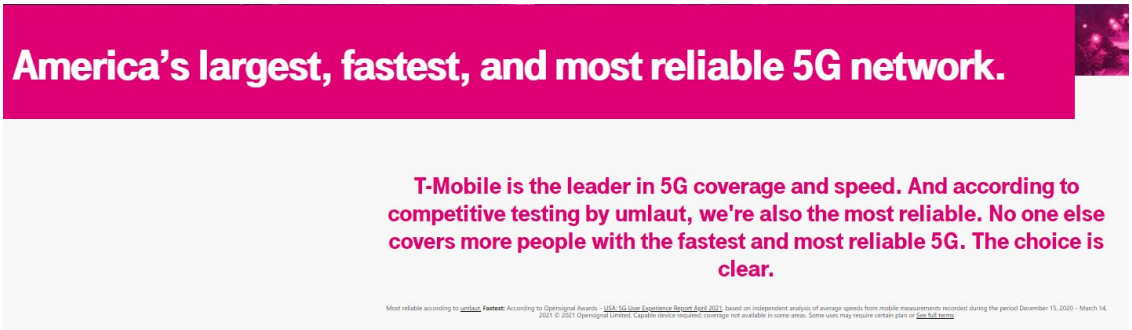


38. According to the interactive map available on the TMO website (reproduced below), a majority of the cities in this district have 4G LTE and/or 5G coverage. Among the cities in this district identified with coverage are Marshall, Lufkin, Plano, Tyler, and Longview.[15]

[15] https://www.t-mobile.com/coverage/coverage-map (last visited Nov. 1, 2021).



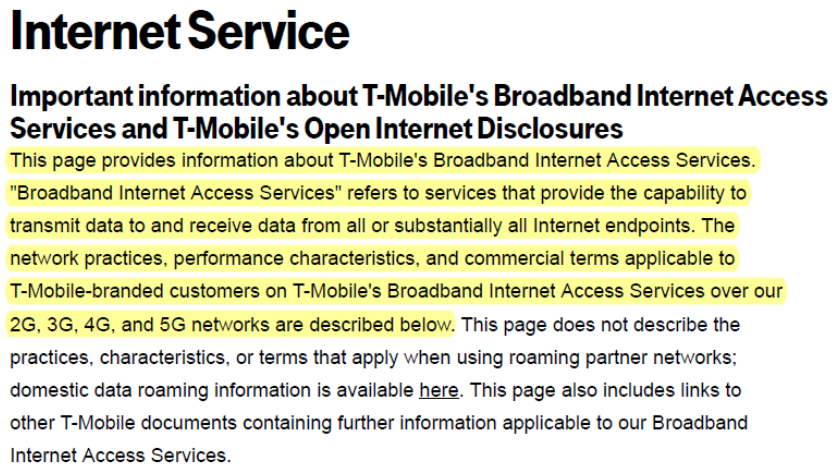
39. TMO encourages prospective customers and visitors to its website to sign up for the T-Mobile Network claiming, for instance, that "[t]he choice is clear" since "[n]o one else covers more people with the fastest and most reliable 5G."[16]



40. The TMO website provides information regarding TMO's "Broadband Internet Access Services" which are services "that provide the capability to transmit data to and receive data from all or substantially all Internet endpoints."[17] The "network practices performance characteristics, and commercial terms applicable to T-Mobile branded customers on T-Mobile's

[16] https://www.t-mobile.com/coverage/4g-lte-5g-networks (last visited Nov. 1, 2021).
[17] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

Broadband Internet Access Services over [its] 2G, 3G, 4G, and 5G networks" are described on the TMO website.[18]

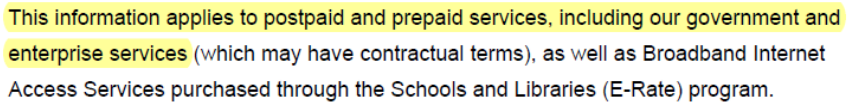


Internet Service

Important information about T-Mobile's Broadband Internet Access Services and T-Mobile's Open Internet Disclosures

This page provides information about T-Mobile's Broadband Internet Access Services. "Broadband Internet Access Services" refers to services that provide the capability to transmit data to and receive data from all or substantially all Internet endpoints. The network practices, performance characteristics, and commercial terms applicable to T-Mobile-branded customers on T-Mobile's Broadband Internet Access Services over our 2G, 3G, 4G, and 5G networks are described below. This page does not describe the practices, characteristics, or terms that apply when using roaming partner networks; domestic data roaming information is available here. This page also includes links to other T-Mobile documents containing further information applicable to our Broadband Internet Access Services.

41. The information provided on the TMO website regarding its Broadband Internet Access Services applies to postpaid and prepaid services including TMO's "government and enterprise services."[19]



This information applies to postpaid and prepaid services, including our government and enterprise services (which may have contractual terms), as well as Broadband Internet Access Services purchased through the Schools and Libraries (E-Rate) program.

42. TMO offers "mobile Broadband Internet Access Services for smartphones, basic phones, tablets, netbooks, USB modems, mobile hotspot devices and other wireless devices over [its] 2G, 3G, 4G, and 5G broadband networks" with respect to which the TMO plan may feature a "designated allotment of high-speed data," after which a user's data speed "may be reduced" or "data access may be suspended" for the remainder of the billing cycle.[20]

[18] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[19] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[20] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

What data plans and pricing does T-Mobile offer?

T-Mobile offers mobile Broadband Internet Access Services for smartphones, basic phones, tablets, netbooks, USB modems, mobile hotspot devices and other wireless devices over our 2G, 3G, 4G, and 5G broadband networks. Your data plan may feature a designated allotment of high-speed data, after which your data speed may be reduced or your data access may be suspended for the remainder of the billing cycle. If your data plan features a designated allotment of high-speed data, certain uses of the network may not count against that allotment.

43. In order to "manage network traffic and deliver a good experience to all customers while offering a range of customer choices," in T-Mobile branded rate plans a "Heavy Data User" is "defined as a customer using more than 50 GB of data (100 GB of data for new Magenta plans activated beginning February 24, 2021) in a billing cycle."[21] TMO's network management practices include "prioritizing data usage of non-Heavy Data Users."[22]

Many factors affect the speed and performance that customers experience, including the programs running on the device, proximity to a cell site, the capacity of the cell site, weather, the surrounding terrain, use inside a building or moving vehicle, radio frequency interference, how many other customers are attempting to use the same spectrum resources, any high-speed data allotment, the rate plans or features you select, and uses that affect your network prioritization, such as whether you are using Smartphone Mobile HotSpot (tethering) or if you are a Heavy Data User. For most T-Mobile-branded rate plans, a "Heavy Data User" is defined as a customer using more than 50GB of data (100GB of data for new Magenta plans activated beginning February 24, 2021) in a billing cycle. The threshold number is periodically evaluated across our rate plans and brands to manage network traffic and deliver a good experience to all customers while offering a range of customer choices. You can always check the threshold amount for a rate plan by speaking with a representative, review our rate cards or T-Mobile.com, or by logging in to my.t-mobile.com, or the T-Mobile app. The term "Heavy Data User" does not apply to customers on Magenta MAX, a new customer choice we are offering as we explore the expanding capacity of our 5G network, or on a small number of T-Mobile-branded business and government-oriented plans, which are not subject to a threshold.

***

[21] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[22] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

How does T-Mobile manage the flow of data on its network?

We engineer our network to provide consistent high-speed data service, but at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds. To provide the best possible experience for the most possible customers on their T-Mobile-branded plans, we implement network management practices on a content-agnostic basis, such as caching less data, prioritizing data usage of non-Heavy Data Users, and video optimization. These practices do not discriminate against offerings that might compete against those offered by T-Mobile or any T-Mobile affiliate on the basis of such competition.

44. TMO prioritizes network usage by plan and brand in order to deliver a range of customer choice points.[23] A TMO customer's "network experience and access may also be impacted if" the customer fails to pay amounts owed to T-Mobile.[24] Accordingly, certain TMO customers "may notice reduced speeds in comparison to customers with a higher priority during network congestion."[25]

Additionally, we prioritize network data by plan and brand to deliver a range of customer choice points at great values. Data for customers on most T-Mobile-branded plans (and for customers on Sprint-branded plans while using the T-Mobile network), is prioritized before the data of customers on Essentials plans and Metro by T-Mobile or Assurance Wireless-branded plans. Mobile internet plans offered after December 12, 2020 with 30GB or more data per month, and Project 10Million and some other education-focused mobile internet plans, are prioritized next. The vast majority of customers on T-Mobile-branded, Sprint-branded, Metro by T-Mobile-branded, and Assurance Wireless-branded plans receive higher priority than the small fraction of customers who are Heavy Data Users on their rate plan, who are prioritized last on the network after exceeding the relevant threshold for the current billing cycle. T-Mobile Home Internet (available in select locations) customers receive the same network prioritization as Heavy Data Users, but should be less likely to experience congestion because the equipment is stationary and available in limited areas.

What is the impact of network prioritization?

As described in more detail below, customers may notice reduced speeds in comparison to customers with a higher priority during network congestion.

Customer devices also have varying speed capabilities and may connect to different networks depending on technology. Even within coverage areas and with broadband-capable devices, network changes, traffic volume, outages, technical limitations, signal strength, obstructions, weather, and other conditions may impact speeds and service availability. Your network experience and access may also be impacted if you fail to pay amounts you owe T-Mobile.

[23] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[24] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[25] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

45. Some TMO plan options feature a "high-speed data allotment with reduced speeds" on the TMO Network "after a user's high-speed allotment is exhausted."[26] Such network management procedures are implemented by TMO "because very heavy data usage at times and places of competing network demands can affect the network performance for other customers."[27]

Network management for extremely high data usage and tethering

Some of our plan options feature a customer-chosen high-speed data allotment with reduced speeds on our network after the high-speed allotment is exhausted, so customers can choose the combination of high-speed data and price that is right for their needs. Unlimited high-speed data customers do not have a specific high-speed data allotment on their device, however, and customers on some limited high-speed plans may have extremely high data usage under certain circumstances, including if their plan enables access to significant amounts of data that does not count against their high-speed data allotment. While T-Mobile continues to expand its network capacity, at this time, some network management for these scenarios is required, because very heavy data usage at times and places of competing network demands can affect the network performance for other customers.

46. In order "[t]o provide the best possible experience for the most possible customers on their T-Mobile-branded plans, and to minimize capacity issues and degradation in network performance," TMO manages "significant high-speed data usage on the vast majority of [its] plans through prioritization."[28]

To provide the best possible experience for the most possible customers on their T-Mobile-branded plans, and to minimize capacity issues and degradation in network performance, we manage significant high-speed data usage on the vast majority of our plans through prioritization. Heavy Data Users (as defined by a customer's rate plan) will have their data usage prioritized below the data usage (including tethering) of other customers at times and at locations where there are competing customer demands for network resources, which may result in slower data speeds. At the start of the next bill cycle, the customer's usage status is reset, and this data traffic is no longer prioritized below other traffic. Customers who use data in violation of their Rate Plan terms or T-Mobile's Terms and Conditions may be excluded from this calculation. Data features that may not count against the high-speed data allotment for some plans, such as certain data associated with Music Freedom, or Binge On, still count towards all customers' usage for this calculation. Smartphone Mobile HotSpot (tethering) data is also included in this calculation. Data used for customer service applications, such as the T-Mobile My Account app does not count towards customers' usage for this calculation. To help avoid application of this practice, and reduce mobile data consumption, customers can set automatic updating of apps, podcasts and file downloads to run off Wi-Fi (making sure to connect to Wi-Fi to update applications and system periodically).

[26] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[27] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[28] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

47. TMO also offers "other services to its customers that use the same network infrastructure and resources as its broadband internet access services and are given priority over other traffic on the network."[29] For instance, the T-Mobile Network supports Wireless Priority Service.[30] Wireless Priority Service (WPS) supports national leadership; federal, state, local, tribal and territorial governments; and other authorized national security and emergency preparedness (NS/EP) users. It is intended to be used in an emergency or crisis situation when the wireless network is congested and the probability of completing a normal call is reduced.[31] Wireless Priority Service may preempt other traffic on the TMO network during times of extreme congestion.[32]

> Additionally, T-Mobile offers other services to its customers that use the same network infrastructure and resources as its broadband internet access services and are given priority over other traffic on the network. These other services currently include calling-related services: Voice over Internet Protocol (VOIP), Voice over LTE (VoLTE), and Video over LTE (ViLTE); more may be added, e.g., to serve public safety needs. These services may affect the availability of network resources for consumer or enterprise broadband internet access services, which may be noticeable in times of congestion. Similarly, Wireless Priority Service traffic may preempt other traffic during times of extreme congestion, which means that in rare cases we may interrupt an active data or voice session to support public safety needs.

48. On the T-Mobile Network, "Heavy Data Users (as defined by a customer's rate plan) will have their data usage prioritized below the data usage (including tethering) of other customers at times and at locations where there are competing customer demands for network resources, which may result in slower data speeds."[33] Accordingly, certain TMO customers "may notice reduced speeds in comparison to customers with a higher priority during network congestion."[34] "At times and at locations where the network is heavily loaded in relation to

[29] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[30] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[31] https://www.cisa.gov/wireless-priority-service-wps (last visited Nov. 1, 2021).
[32] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[33] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[34] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

available capacity, these customers will likely see significant reductions in data speeds, especially if they are engaged in data-intensive activities."[35]

> To provide the best possible experience for the most possible customers on their T-Mobile-branded plans, and to minimize capacity issues and degradation in network performance, we manage significant high-speed data usage on the vast majority of our plans through prioritization. Heavy Data Users (as defined by a customer's rate plan) will have their data usage prioritized below the data usage (including tethering) of other customers at times and at locations where there are competing customer demands for network resources, which may result in slower data speeds. At the start of the next bill cycle, the customer's usage status is reset, and this data traffic is no longer prioritized below other traffic. Customers who use data in violation of their Rate Plan terms or T-Mobile's Terms and Conditions may be excluded from this calculation. Data features that may not count against the high-speed data allotment for some plans, such as certain data associated with Music Freedom, or Binge On, still count towards all customers' usage for this calculation. Smartphone Mobile HotSpot (tethering) data is also included in this calculation. Data used for customer service applications, such as the T-Mobile My Account app does not count towards customers' usage for this calculation. To help avoid application of this practice, and reduce mobile data consumption, customers can set automatic updating of apps, podcasts and file downloads to run off Wi-Fi (making sure to connect to Wi-Fi to update applications and system periodically).
>
> ***
>
> Where the network is lightly loaded in relation to available capacity, a customer whose data is prioritized higher than other traffic will notice little, if any, effect from having higher priority. This will be the case in the vast majority of times and locations. Customers may notice reduced speeds in comparison to customers with a higher priority during network congestion. At times and at locations where the network is heavily loaded in relation to available capacity, these customers will likely see significant reductions in data speeds, especially if they are engaged in data-intensive activities. Customers should be aware that these practices may occasionally result in speeds below those typically experienced on our 5G or LTE networks, including a greater likelihood of reduced speeds in the lower end of the speed ranges. Depending on the extent of network congestion, these customers may notice more frequent impacts to some video streaming, file downloads, and other high-bandwidth activities. T-Mobile constantly works to improve network performance and capacity, but there are physical and technical limits on how much capacity is available, and in constrained locations the frequency of heavy loading in relation to available capacity may be greater than in other locations. When network loading goes down or the customer moves to a location that is less heavily loaded in relation to available capacity, the customer's speeds will likely improve.

49. If a user's "total high-speed data usage exceeds [the] selected high-speed allotment during a billing cycle," TMO will reduce the user's "data speed to 2G speeds (for most plans, 128 kbps) for the remainder of the billing cycle."[36]

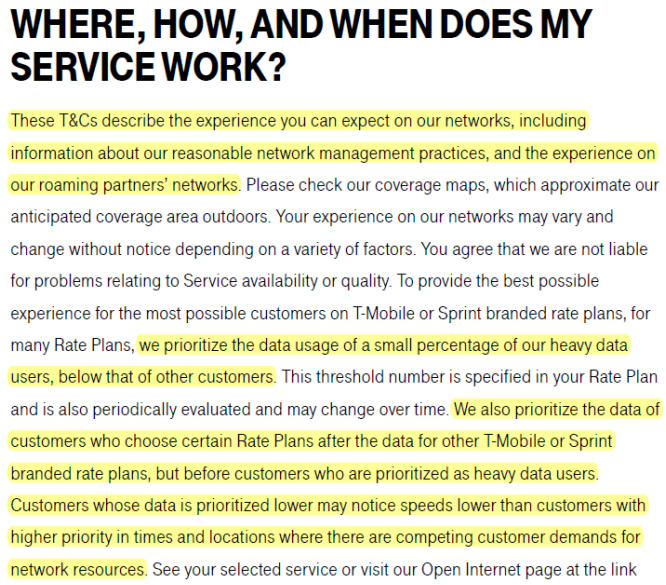
[35] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[36] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

Choice of high-speed data

Customers select how much high-speed data they receive under their service plan. Certain features, such as Music Freedom, some Binge On content, data used by certain T-Mobile customer service applications, such as the T-Mobile App, and the federal telehealth VA Video Connect app, do not count against your high-speed data allotment. If your total high-speed data usage exceeds your selected high-speed allotment during a billing cycle, we reduce your data speed to 2G speeds (for most plans, 128 kbps) for the remainder of that billing cycle.

50. TMO provides a number of "Terms and Conditions" ("T&Cs") on its website.[37] TMO's customers have to accept these T&Cs in order to use the T-Mobile Network. These T&Cs "describe the experience [a customer] can expect on [the TMO] networks, including information about [TMO's] reasonable network management practices…."[38] The T&Cs state that TMO "prioritize[s] the data usage of a small percentage of [its] heavy data users, below that of other customers."[39] Additionally, TMO "prioritize[s] the data of customers who choose certain Rate Plans after the data for other T-Mobile or Sprint branded rate plans, but before customers who are prioritized as heavy data users."[40] "Customers whose data is prioritized lower may notice speeds lower than customers with higher priority in times and locations where there are competing customer demand for network resources."[41]

[37] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[38] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[39] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[40] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[41] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).



WHERE, HOW, AND WHEN DOES MY SERVICE WORK?

These T&Cs describe the experience you can expect on our networks, including information about our reasonable network management practices, and the experience on our roaming partners' networks. Please check our coverage maps, which approximate our anticipated coverage area outdoors. Your experience on our networks may vary and change without notice depending on a variety of factors. You agree that we are not liable for problems relating to Service availability or quality. To provide the best possible experience for the most possible customers on T-Mobile or Sprint branded rate plans, for many Rate Plans, we prioritize the data usage of a small percentage of our heavy data users, below that of other customers. This threshold number is specified in your Rate Plan and is also periodically evaluated and may change over time. We also prioritize the data of customers who choose certain Rate Plans after the data for other T-Mobile or Sprint branded rate plans, but before customers who are prioritized as heavy data users. Customers whose data is prioritized lower may notice speeds lower than customers with higher priority in times and locations where there are competing customer demands for network resources. See your selected service or visit our Open Internet page at the link

51. In the T-Mobile Network, "at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds."[42] In such instances, "customers who choose certain rate plans may notice speeds lower than customers on other T-Mobile or Sprint branded rate plans, which are prioritized higher on [the T-Mobile] network."[43] Additionally, in certain instances TMO prioritizes the data usage of "heavy data users (as defined in their Rate Plans), below that of all other customers in times and locations where there are competing customer demands for network resources…."[44]

[42] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[43] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[44] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).

> We engineer our network to provide consistent high-speed data service, but at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds. In those cases, customers who choose certain rate plans may notice speeds lower than customers on other T-Mobile or Sprint branded rate plans, which are prioritized higher on our networks. Further, to provide the best possible on-device experience for the most possible customers on T-Mobile or Sprint branded plans and minimize capacity issues and degradation in network performance, we may, without advance notice, take any actions necessary to manage our network on a content-agnostic basis, including prioritizing all on-device data over Smartphone Mobile HotSpot (tethering) data and, for the vast majority of Rate Plans, further prioritizing the data usage of a small percentage of heavy data users (as defined in their Rate Plans), below that of all other customers in times and locations where there are competing customer demands for network resources, for the remainder of the billing cycle. This threshold number is periodically evaluated and may change over time.

52. On the T-Mobile Network, "[a]t times and locations where the network is heavily loaded in relation to available capacity [a customer whose data is prioritized below other data traffic] will likely see significant reductions in data speed…."[45] Once "network loading goes down or the customer moves to a location that is less heavily loaded in relation to available capacity, the customer's speeds will likely improve."[46]

> Where the network is lightly loaded in relation to available capacity, a customer whose data is prioritized below other data traffic will notice little, if any, effect from having lower priority. This will be the case in the vast majority of times and locations. At times and locations where the network is heavily loaded in relation to available capacity, however, these customers will likely see significant reductions in data speeds, especially if they are engaged in data-intensive activities. Customers should be aware that these practices may occasionally result in speeds below those typically experienced on our 5G or LTE networks. We constantly work to improve network performance and capacity, but there are physical and technical limits on how much capacity is available, and in constrained locations the frequency of heavy loading in relation to available capacity may be greater than in other locations. When network loading goes down or the customer moves to a location that is less heavily loaded in relation to available capacity, the customer's speeds will likely improve. Visit www.T-Mobile.com/OpenInternet for details and for current data amount subject to this practice.

53. On the T-Mobile Network, if a customer's "account is unpaid or otherwise not in good standing, [the customer's] service may be reduced, suspended, or terminated."[47]

[45] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[46] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[47] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).

WHAT IF I DON'T PAY ON TIME?

We may charge a late fee of up to the highest amount allowed by law. We may also charge a returned payment fee at the highest amount permissible by law. We may restrict your payment methods to cashier's check, money order, or other similar secure forms of payment at any time for good reason. If you fail to pay on time and we refer your account to a third party for collection, a collection fee will be assessed by T-Mobile and will be due at the time of the referral to the third party. The fee will be calculated as a percentage of the amount due to the extent permitted, or not otherwise prohibited, by applicable law. If we accept late or partial payments, you still must pay us the full amount you owe, including late fees. We will not honor limiting notations you make on or with your checks. Late payment, non-payment and/or collection fees are intended to be a reasonable advance estimate of our actual costs resulting from late payments and non-payments by our customers; these costs are not readily ascertainable and are difficult to predict or calculate at the time that these fees are set. You and we each agree that if you fail to timely pay amounts due, we may assign your account for collection, and the collection agency may pursue, in small claims court, claims limited strictly to the collection of the past due amounts and any interest or costs of collection permitted by law or this Agreement. If your account is unpaid or otherwise not in good standing, your service may be reduced, suspended, or terminated.

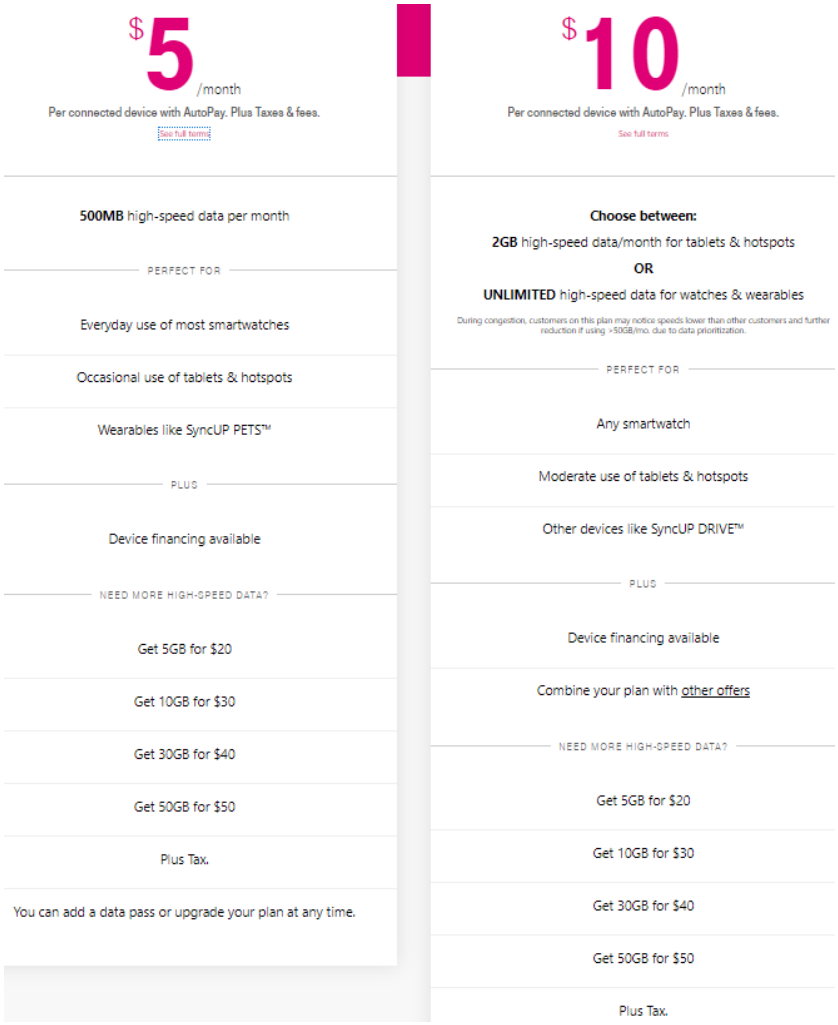
54. For instance, TMO "offers mobile Broadband Internet Access Services for smartphones, basic phones, tablets, netbooks, USB modems, mobile hotspot devices and other wireless devices over [its] 2G, 3G, 4G, and 5G broadband networks."[48]

What data plans and pricing does T-Mobile offer?

T-Mobile offers mobile Broadband Internet Access Services for smartphones, basic phones, tablets, netbooks, USB modems, mobile hotspot devices and other wireless devices over our 2G, 3G, 4G, and 5G broadband networks. Your data plan may feature a designated allotment of high-speed data, after which your data speed may be reduced or your data access may be suspended for the remainder of the billing cycle. If your data plan features a designated allotment of high-speed data, certain uses of the network may not count against that allotment.

55. TMO offers mobile data plans for users to use with a "smartwatch, tablet, hotspot, or other connected device—without the need for Wi-Fi."[49] Specifically, TMO offers a first such data plan for $5 per month per connected device and a second such data plan for $10 per month per connected device.[50]

[48] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[49] https://www.t-mobile.com/cell-phone-plans/affordable-data-plans (last visited Nov. 1, 2021).
[50] https://www.t-mobile.com/cell-phone-plans/affordable-data-plans (last visited Nov. 1, 2021).



$5 /month

Per connected device with AutoPay. Plus Taxes & fees.

See full terms

500MB high-speed data per month

PERFECT FOR

Everyday use of most smartwatches

Occasional use of tablets & hotspots

Wearables like SyncUP PETS™

PLUS

Device financing available

NEED MORE HIGH-SPEED DATA?

Get 5GB for $20

Get 10GB for $30

Get 30GB for $40

Get 50GB for $50

Plus Tax.

You can add a data pass or upgrade your plan at any time.

$10 /month

Per connected device with AutoPay. Plus Taxes & fees.

See full terms

Choose between:

2GB high-speed data/month for tablets & hotspots

OR

UNLIMITED high-speed data for watches & wearables

During congestion, customers on this plan may notice speeds lower than other customers and further reduction if using >50GB/mo. due to data prioritization.

PERFECT FOR

Any smartwatch

Moderate use of tablets & hotspots

Other devices like SyncUP DRIVE™

PLUS

Device financing available

Combine your plan with other offers

NEED MORE HIGH-SPEED DATA?

Get 5GB for $20

Get 10GB for $30

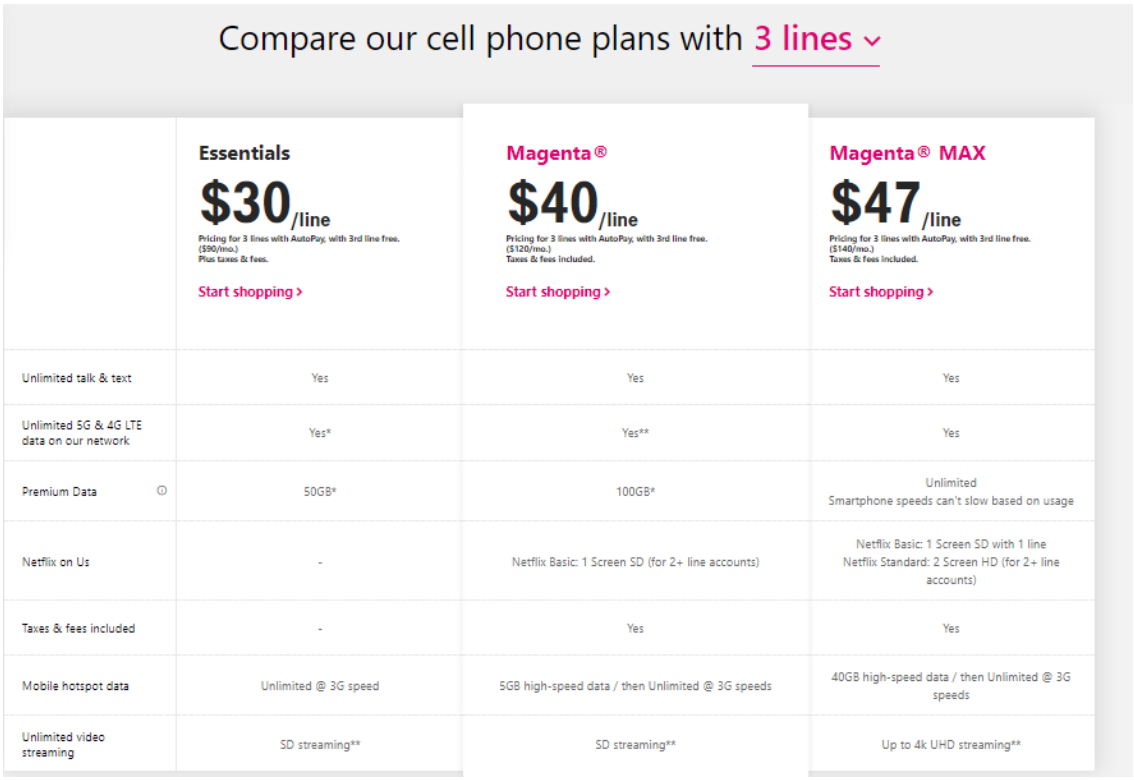
Get 30GB for $40

Get 50GB for $50

Plus Tax.

General Plan Terms: Postpaid only. Credit approval, deposit, $10 SIM card, and, in stores & on customer service calls, $20 assisted or upgrade support charge may be required. Taxes and fees additional (including $0.15/line Monthly Regulatory Programs and $1.01/line Telco Recovery Fee) unless you already have a tax-inclusive voice line. Compatible smartphone/device may be required for certain features. **Discounts:** $5 per line/mo. AutoPay discount (line 1-8 only), and up to $40 per line/mo. discount with qualifying voice line. Discounts may not be reflected on 1st bill. **Data:** High-speed data up to allotment then max 128Kbps speeds. **Roaming:** U.S. roaming and on-network data allotments differ; includes 200 MB roaming. Partial megabytes rounded up. Service may be terminated or restricted for excessive roaming. We notify you of approaching use thresholds via SMS; review device's user manual to ensure receipt; may require third party software. See account for usage. **International Roaming (tablet and mobile internet plans):** Usage may be taxed in some countries. Max 128Kbps speeds in 210+ countries and destinations; see www.t-mobile.com for included destinations (subject to change at our discretion). In Canada/Mexico, high-speed data up to lower of plan allotment or 5GB, then unlimited at max 128Kbps speeds. **Not for extended international use; you must reside in the U.S. and primary usage must occur on our U.S. network**. Device must register on our network before international use. **International Roaming:** Usage may be taxed in some countries. Max 128Kbps speeds in 210+ countries and destinations; see www.t-mobile.com for included destinations (subject to change at our discretion). In Canada/Mexico, high-speed data up to lower of plan allotment or 5GB, then unlimited at max 128Kbps speeds. **Not for extended international use; you must reside in the U.S. and primary usage must occur on our U.S. network**. Device must register on our network before international use. **Coverage** not available in some areas; we are not responsible for our partners' networks. Communications with premium-rate numbers not included. **Video streaming** at up to 1.5Mbps; may affect download speed. For best performance, leave video streaming applications at default automatic resolution setting. **Tethering:** Max 3G speeds (except hotspots). Majority of data usage must be on device. Device usage prioritized over tethering usage, which may result in higher speeds for data used on device. See T-Mobile.com/OpenInternet for data management details. Not available for some devices; may not be combinable with some offers.

56. TMO also offers three different cell phone data plans: (1) Essentials; (2) Magenta; and (3) Magenta Max.[51]



57. TMO prioritizes data transfer rates on the T-Mobile network when the network is congested. For instance, at times when the T-Mobile Network is congested, the data transfer rates for some users may be slowed down compared to data transfer rates for other users.

58. For instance, with respect to its plans offered for use with a "smartwatch, tablet, hotspot, or other connected device—without the need for Wi-Fi," TMO states that the plan offers "high-speed data up to allotment then max 128Kbps speeds."[52]

[51] https://www.t-mobile.com/cell-phone-plans (last visited Nov. 1, 2021).
[52] https://www.t-mobile.com/cell-phone-plans/affordable-data-plans (last visited Nov. 1, 2021).

General Plan Terms: Postpaid only. Credit approval, deposit, $10 SIM card, and, in stores & on customer service calls, $20 assisted or upgrade support charge may be required. Taxes and fees additional (including $0.15/line Monthly Regulatory Programs and $1.01/line Telco Recovery Fee) unless you already have a tax-inclusive voice line. Compatible smartphone/device may be required for certain features. **Discounts:** $5 per line/mo. AutoPay discount (line 1-8 only), and up to $40 per line/mo. discount with qualifying voice line. Discounts may not be reflected on 1st bill. **Data:** High-speed data up to allotment then max 128Kbps speeds. **Roaming:** U.S. roaming and on-network data allotments differ; includes 200 MB roaming. Partial megabytes rounded up. Service may be terminated or restricted for excessive roaming. We notify you of approaching use thresholds via SMS; review device's user manual to ensure receipt; may require third party software. See account for usage. **International Roaming (tablet and mobile internet plans):** Usage may be taxed in some countries. Max 128Kbps speeds in 210+ countries and destinations; see www.t-mobile.com for included destinations (subject to change at our discretion). In Canada/Mexico, high-speed data up to lower of plan allotment or 5GB, then unlimited at max 128Kbps speeds. **Not for extended international use; you must reside in the U.S. and primary usage must occur on our U.S. network**. Device must register on our network before international use. **International Roaming:** Usage may be taxed in some countries. Max 128Kbps speeds in 210+ countries and destinations; see www.t-mobile.com for included destinations (subject to change at our discretion). In Canada/Mexico, high-speed data up to lower of plan allotment or 5GB, then unlimited at max 128Kbps speeds. **Not for extended international use; you must reside in the U.S. and primary usage must occur on our U.S. network**. Device must register on our network before international use. **Coverage** not available in some areas; we are not responsible for our partners' networks. Communications with premium-rate numbers not included. **Video streaming** at up to 1.5Mbps; may affect download speed. For best performance, leave video streaming applications at default automatic resolution setting. **Tethering:** Max 3G speeds (except hotspots). Majority of data usage must be on device. Device usage prioritized over tethering usage, which may result in higher speeds for data used on device. See T-Mobile.com/OpenInternet for data management details. Not available for some devices; may not be combinable with some offers.

59. Similarly, TMO prioritizes network usage with respect to its cell phone data plans. Customers on the TMO Magenta data plan who use more than 100 GB of data per month "may notice reduced speeds until next bill cycle due to data prioritization."[53] Similarly, customers on the TMO Essentials data plan "may notice speeds lower than other customers and further reduction if using" more than 50 GB of data per month.[54]

* During congestion, **Magenta** customers using >100GB/mo. may notice reduced speeds until next bill cycle due to data prioritization; **Essentials** customers may notice speeds lower than other customers and further reduction if using >50GB/mo., due to data prioritization. ** Video typically streams on smartphone/tablet at DVD quality (480p); **Magenta MAX**: activate up to 4K UHD streaming on capable device, or video typically streams at 480p. **Scam Shield**: Capable device required. Turning on Scam Block might block calls you want; disable anytime. See full terms

60. On information and belief, in certain implementations, the T-Mobile network includes a Wide Area Network (WAN) having an Application Server (AS) and an access network having one or more base stations. One or more endpoint user equipment devices (UEs) communicate with each base station. The access network serves as an interface between the WAN and the UEs and may provide access to WAN for UEs. The UEs may be any device with wireless communication functionality (e.g., cellular or mobile wireless network) such as, for example, handheld wireless communication devices like mobile phones, smartphones, or tablets.

61. On information and belief, in TMO's 4G LTE network, the access network includes an LTE network with an evolved Packet Core (EPC) and eNodeB base stations. On information and belief, the EPC may provide wireless packet switched services and wireless packet

[53] *See, e.g.*, https://www.t-mobile.com/cell-phone-plans (last visited Nov. 1, 2021).
[54] *See, e.g.*, https://www.t-mobile.com/cell-phone-plans (last visited Nov. 1, 2021).

connectivity to user devices to provide, for example, data, voice, and/or multimedia services. The EPC may include one or more components that are physical and/or logical entities interconnected via standardized interfaces.

62. For instance, on information and belief, the EPC may further include other components including, for example, a home subscriber server (HSS) and a Policy and Charging Rules Function (PCRF). The PCRF can be linked to a Packet Data Network ("PDN") Gateway of the core network and an Application Function ("AF").

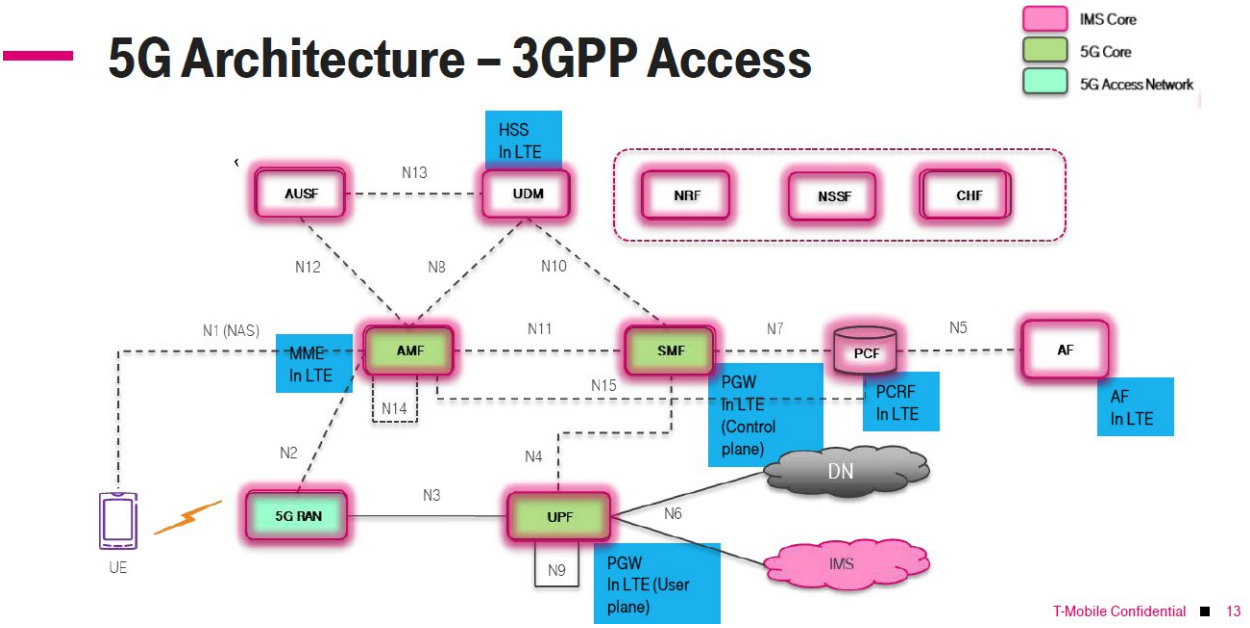
63. On information and belief, the HSS may store information associated with UE and/or information associated with users of UE. For example, HSS may store user profiles that include registration, authentication, and access authorization information. HSS may also store information about whether a UE is a high priority user device.

64. On information and belief, the PCRF may provide and/or enable policy control decisions and flow based charging control functionalities. For instance, the PCRF may provide and/or enable network control such as service data flow detection, gating, quality of service (QoS) and flow based charging. PCRF may also determine and/or provide information for determining how a certain service data flow shall be treated and may ensure and/or provide information for ensuring that user plane traffic mapping and treatment is in accordance with a user's subscription profile based, for example, on a specified QoS class identifier (QCI).

65. On information and belief, the following block diagram depicts an implementation of the TMO 5G system architecture:[55]

[55] https://wholesale.t-mobile.com/docs/default-source/crc-content/customer-connections/1q-2021-5g-customer-webinar-february-2021.pdf (last visited Nov. 1, 2021).

T-MOBILE WHOLESALE



66. On information and belief, in TMO's 5G network, the access network includes a number of components including, for example, one or more base stations, User Plane Function (UPF), Application Function (AF), Unified Data Management (UDM) and a Policy Control Function (PCF).

67. On information and belief, the UDM, UPF and PCF in TMO's 5G network are analogous to the HSS, PGW (user plane) and PCRF in TMO's 4G LTE network.

68. The UPF may perform packet routing and forwarding, perform the user plane part of policy rule enforcement, perform packet inspection, perform traffic usage reporting, enforce QoS policies in the user plane, perform transport level packet marking, and/or perform other types of user plane processes.

69. The AF may provide services associated with a particular application, such as, for example, application influence on traffic routing, interacting with a policy framework for policy control, and/or other types of applications.

70. The UDM may maintain subscription information for UEs, manage subscriptions, generate authentication credentials, handle user identification, perform access authorization based on subscription data, perform network function registration management, maintain service and/or session continuity, support SMS delivery, support lawful intercept functionality, and/or perform other processes associated with managing user data.

71. The PCF may support policies to control network behavior, provide policy rules to control plane functions, access subscription information relevant to policy decisions, execute policy decisions, and/or perform other types of processes associated with policy enforcement. PCF may specify QoS policies based on QoS flow identity (QFI) consistent with 5G network standards.

72. On information and belief, the PCF in TMO's 5G network performs the same or similar functions as the PCRF in TMO's 4G LTE network.

73. 3GPP TS 23.203 titled "Technical Specification Group Services and System Aspects; Policy and charging control architecture" is a standard adopted by the 3rd Generation Partnership Project.[56]

74. The scope of TS 23.203 is defined as follows:[57]

[56] *See, e.g.,* 3GPP TS 23.203 V 15.5.0 (2019-06) (Release 15) (hereinafter, "TS 23.203"), available at https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=810

[57] TS 23.203 at 14.

1 Scope

The present document specifies the overall stage 2 level functionality for Policy and Charging Control that encompasses the following high level functions for IP-CANs (e.g. GPRS, Fixed Broadband, EPC, etc.):

- Flow Based Charging for network usage, including charging control and online credit control, for service data flows and application traffic;
- Policy control (e.g. gating control, QoS control, QoS signalling, etc.).

The present document specifies the Policy and Charging Control functionality for Evolved 3GPP Packet Switched domain, including both 3GPP accesses GERAN/UTRAN/E-UTRAN and Non-3GPP accesses, according to TS 23.401 [17] and TS 23.402 [18].

The present document specifies functionality for unicast bearers. Broadcast and multicast bearers, such as MBMS contexts for GPRS, are out of scope of the present document.

NOTE: For E-UTRAN access, the usage of functionalities covered in this specification for features such as MBMS, CIoT and V2X is described in TS 23.246 [6], TS 23.682 [42] and TS 23.285 [48], respectively.

75. On information and belief, the T-Mobile Network complies with TS 23.203 standard.

76. For instance, on information and belief, with respect to the Nationwide Public Safety Broadband Network (NPSBN), the Federal Communications Commission requires compliance with TS 23.203.[58]

[31] The NPSBN SHALL support all 9 QCI classes specified in table 6.1.7 of 3GPP 23.203 v9.11 or future equivalents.
[32] QoS mechanisms in the NPSBN SHALL comply with 3GPP TS 23.203.
[33] The NPSBN SHALL support the usage of all 15 ARP values defined in 3GPP 23.203.

[34] The NPSBN SHALL support the ARP pre-emption capability and vulnerability functions as defined in 3GPP 23.203.

[58] *See, e.g.,* Recommended Minimum Technical Requirements to Ensure Nationwide Interoperability for the Nationwide Public Safety Broadband Network, prepared by Technical Advisory Board for First Responder Interoperability Final Report (May 22, 2012) available at https://docs.fcc.gov/public/attachments/FCC-12-68A3.txt (last visited Aug. 19, 2021).

> These mechanisms are used by the LTE network, for example, to determine how packets should be scheduled for transmission and how other network resources should be assigned to users to ensure the delay, loss and throughput requirements of the IP flows are met.
> 3GPP TS 23.203 defines a standardized set of QoS Class Identifiers (QCIs) (shown in the table below). This set of QCIs describes the QoS characteristics of all applications that are currently envisioned to be carried over an LTE network. Use of a common set of QCI definitions across the NPSBN facilitates interoperability by ensuring there is a common way to describe the QoS requirements of all applications which use the NPSBN. Use of the standardized set of QCIs defined in the table below also facilitates roaming onto commercial networks – as these networks also use the same standard definitions of QCI defined in TS 23.203.

77. The National Public Safety Telecommunications Council ("NPSTC") is "a federation of organizations whose mission is to improve public safety communications and interoperability through collaborative leadership."[59] On information and belief, TMO complies with the requirements of the NPSTC. A Technical Working Group at NPSTC issued a document setting forth "the minimum requirements necessary to enable roaming between LTE networks built by multiple, independent public safety organizations and commercial service providers."[60] In that document, NPSTC states that "Quality of Service (QoS), priority and pre-emptive access are all important features to public safety networks" and that Public Safety Networks "should utilize QoS as defined in [TS 23.401 and in TS 23.203]."[61]

78. 3GPP TS 23.401 titled "LTE; General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access" is a standard adopted by the 3rd Generation Partnership Project.[62]

79. On information and belief, the T-Mobile Network complies with TS 23.401 standard.

---

[59] https://www.npstc.org/index.jsp (last visited Nov. 1, 2021).
[60] https://www.npstc.org/documents/LTE_System_Interoperability.pdf (last visited Nov. 1, 2021).
[61] https://www.npstc.org/documents/LTE_System_Interoperability.pdf (last visited Nov. 1, 2021).
[62] *See, e.g.,* 3GPP TS 23.401 V 16.1.0 (2021-04) (Release 15) (hereinafter, "TS 23.401"), available at https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=849 (last visited Aug. 19, 2021).

COUNT I: INFRINGEMENT OF U.S. PATENT NO. RE47,813

80. On January 14, 2020, the United States Patent and Trademark Office ("USPTO") duly and legally issued United States Patent No. RE47,813 ("the '813 Patent"), entitled "Feedback Loop for Dynamic Network Resource Allocation."

81. The inventions disclosed in the '813 Patent provide "[a] system, apparatus and method for dynamic resource allocation" within a computer network. '813 Patent, Abstract. These inventions provide technological solutions to the network-centric problem of managing the allocation of network resources (*e.g.*, bandwidth) for use by a plurality of user devices, each having a corresponding service profile and billing profile. *See id.* Network congestion is unpredictable and it can compromise the quality of service provided to (or guaranteed to) user terminals or devices (*e.g.*, cellular phones). *See id.* at 1:28-31. The improvements of the claimed inventions allow network operators to manage network congestion by prioritizing one or more user terminals or devices (e.g., cellular phones) sharing the network. The '813 Patent claims patent-eligible subject matter and is valid and enforceable.

82. TNS holds all rights, title, and interest in and to the '813 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '813 Patent. TMO is not licensed to the '813 Patent, either expressly or implicitly, nor does it enjoy or benefit from any other rights in or to the '813 Patent whatsoever. As such, TMO's infringement described below has injured, and continues to injure, TNS.

83. On information and belief, TMO has infringed directly and continues to infringe directly the '813 Patent. The infringing acts include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from TMO which prioritize data transfer rates with respect to one or more users (or devices) on the TMO network as part of the

network management functionality in the TMO Network (collectively, "Accused Instrumentalities").

84. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 1 of '813 Patent. The following paragraphs provide details regarding only one example of TMO's infringement, and only as to a single patent claim. Plaintiff reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under this Court's scheduling order.

85. Claim 1 of the '813 Patent states:

> 1. A method for dynamic allocation of network resources comprising:
> receiving a service profile for each of a plurality of devices sharing a network resource;
> receiving a billing profile for each of said plurality of devices;
> generating a prioritization list defining an order of said plurality of devices, based on said billing profiles and on a billing history for each of said plurality of devices;
> repeating:
> receiving traffic profiles over said network resource for said plurality of devices;
> managing said network resource according to said service profile and said billing profile if said network resource is fully utilized by said traffic profiles; and,
> selecting at least one of said devices based on said prioritization list and
> dynamically modifying at least one of said service profile and said billing profile for said selected devices, if said network resource is under-utilized by said traffic profile or if said network resource would be over-utilized by said traffic profiles;
> until said plurality of devices no longer continue to share said network resource; and
> when said plurality of devices are no longer sharing said network resource, clearing said prioritization list.

'813 Patent at 14:30-55.

86. The network management functionality of the Accused Instrumentalities implements the recited method for dynamic allocation of network resources. The Accused Instrumentalities dynamically allocate network resources (e.g., cell towers). With respect to certain

data plans, the TMO network has a "designated allotment of high-speed data" after which a user's data speed may be reduced or data access may be suspended for the remainder of the billing cycle.

What data plans and pricing does T-Mobile offer?

T-Mobile offers mobile Broadband Internet Access Services for smartphones, basic phones, tablets, netbooks, USB modems, mobile hotspot devices and other wireless devices over our 2G, 3G, 4G, and 5G broadband networks. Your data plan may feature a designated allotment of high-speed data, after which your data speed may be reduced or your data access may be suspended for the remainder of the billing cycle. If your data plan features a designated allotment of high-speed data, certain uses of the network may not count against that allotment. [63]

Moreover, with respect to certain data plans, TMO designates certain users as "Heavy Data Users" and these users "will have their data usage prioritized below the data usage [] of other customers at times and at locations where there are competing customer demands for network resources, which may result in slower speeds."

Many factors affect the speed and performance that customers experience, including the programs running on the device, proximity to a cell site, the capacity of the cell site, weather, the surrounding terrain, use inside a building or moving vehicle, radio frequency interference, how many other customers are attempting to use the same spectrum resources, any high-speed data allotment, the rate plans or features you select, and uses that affect your network prioritization, such as whether you are using Smartphone Mobile HotSpot (tethering) or if you are a Heavy Data User. For most T-Mobile-branded rate plans, a "Heavy Data User" is defined as a customer using more than 50GB of data (100GB of data for new Magenta plans activated beginning February 24, 2021) in a billing cycle. The threshold number is periodically evaluated across our rate plans and brands to manage network traffic and deliver a good experience to all customers while offering a range of customer choices. You can always check the threshold amount for a rate plan by speaking with a representative, review our rate cards or T-Mobile.com, or by logging in to my.t-mobile.com, or the T-Mobile app. The term "Heavy Data User" does not apply to customers on Magenta MAX, a new customer choice we are offering as we explore the expanding capacity of our 5G network, or on a small number of T-Mobile-branded business and government-oriented plans, which are not subject to a threshold. [64]

[63] *See, e.g.,* https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[64] *See, e.g.,* https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

To provide the best possible experience for the most possible customers on their T-Mobile-branded plans, and to minimize capacity issues and degradation in network performance, we manage significant high-speed data usage on the vast majority of our plans through prioritization. Heavy Data Users (as defined by a customer's rate plan) will have their data usage prioritized below the data usage (including tethering) of other customers at times and at locations where there are competing customer demands for network resources, which may result in slower data speeds. At the start of the next bill cycle, the customer's usage status is reset, and this data traffic is no longer prioritized below other traffic. Customers who use data in violation of their Rate Plan terms or T-Mobile's Terms and Conditions may be excluded from this calculation. Data features that may not count against the high-speed data allotment for some plans, such as certain data associated with Music Freedom, or Binge On, still count towards all customers' usage for this calculation. Smartphone Mobile HotSpot (tethering) data is also included in this calculation. Data used for customer service applications, such as the T-Mobile My Account app does not count towards customers' usage for this calculation. To help avoid application of this practice, and reduce mobile data consumption, customers can set automatic updating of apps, podcasts and file downloads to run off Wi-Fi (making sure to connect to Wi-Fi to update applications and system periodically). [65]

Additionally, TMO "prioritize[s] network data by plan and brand to deliver a range of customer choice points." Accordingly, certain customers on the TMO network "may notice reduced speeds in comparison to customers with a higher priority during network congestion."

Additionally, we prioritize network data by plan and brand to deliver a range of customer choice points at great values. Data for customers on most T-Mobile-branded plans (and for customers on Sprint-branded plans while using the T-Mobile network), is prioritized before the data of customers on Essentials plans and Metro by T-Mobile or Assurance Wireless-branded plans. Mobile internet plans offered after December 12, 2020 with 30GB or more data per month, and Project 10Million and some other education-focused mobile internet plans, are prioritized next. The vast majority of customers on T-Mobile-branded, Sprint-branded, Metro by T-Mobile-branded, and Assurance Wireless-branded plans receive higher priority than the small fraction of customers who are Heavy Data Users on their rate plan, who are prioritized last on the network after exceeding the relevant threshold for the current billing cycle. T-Mobile Home Internet (available in select locations) customers receive the same network prioritization as Heavy Data Users, but should be less likely to experience congestion because the equipment is stationary and available in limited areas.

What is the impact of network prioritization?

As described in more detail below, customers may notice reduced speeds in comparison to customers with a higher priority during network congestion.

Customer devices also have varying speed capabilities and may connect to different networks depending on technology. Even within coverage areas and with broadband-capable devices, network changes, traffic volume, outages, technical limitations, signal strength, obstructions, weather, and other conditions may impact speeds and service availability. Your network experience and access may also be impacted if you fail to pay amounts you owe T-Mobile. [66]

[65] *See, e.g.,* https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[66] *See, e.g.,* https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

Some of the plans offered by TMO "feature a customer-chosen high-speed data allotment with reduced speeds on [the T-Mobile Network] after the high-speed allotment is exhausted."

Network management for extremely high data usage and tethering

Some of our plan options feature a customer-chosen high-speed data allotment with reduced speeds on our network after the high-speed allotment is exhausted, so customers can choose the combination of high-speed data and price that is right for their needs. Unlimited high-speed data customers do not have a specific high-speed data allotment on their device, however, and customers on some limited high-speed plans may have extremely high data usage under certain circumstances, including if their plan enables access to significant amounts of data that does not count against their high-speed data allotment. While T-Mobile continues to expand its network capacity, at this time, some network management for these scenarios is required, because very heavy data usage at times and places of competing network demands can affect the network performance for other customers. [67]

According to the "Terms and Conditions" set forth by TMO, TMO "prioritize[s] the data usage of a small percentage of [its] heavy data users, below that of other customers." TMO also "prioritizes the data of customers who choose certain rate plans after the data for other T-Mobile or Sprint branded rate plans, but before customers who are prioritized as heavy data users." On the T-Mobile Network, "[c]ustomers whose data is prioritized lower may notice speeds lower than customers with high priority in times and locations where there are competing customer demands for network resources."

[67] *See, e.g.,* https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

WHERE, HOW, AND WHEN DOES MY SERVICE WORK?

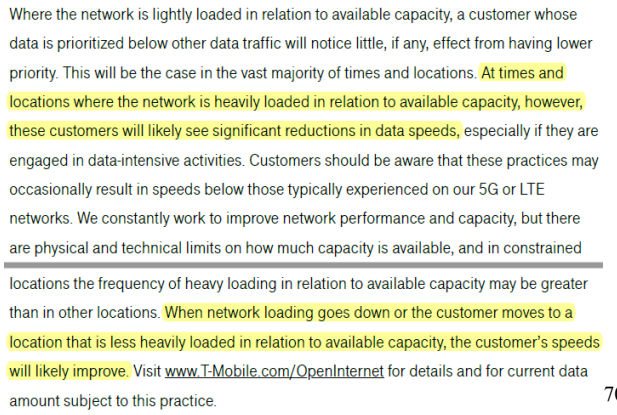
These T&Cs describe the experience you can expect on our networks, including information about our reasonable network management practices, and the experience on our roaming partners' networks. Please check our coverage maps, which approximate our anticipated coverage area outdoors. Your experience on our networks may vary and change without notice depending on a variety of factors. You agree that we are not liable for problems relating to Service availability or quality. To provide the best possible experience for the most possible customers on T-Mobile or Sprint branded rate plans, for many Rate Plans, we prioritize the data usage of a small percentage of our heavy data users, below that of other customers. This threshold number is specified in your Rate Plan and is also periodically evaluated and may change over time. We also prioritize the data of customers who choose certain Rate Plans after the data for other T-Mobile or Sprint branded rate plans, but before customers who are prioritized as heavy data users. Customers whose data is prioritized lower may notice speeds lower than customers with higher priority in times and locations where there are competing customer demands for network resources. See your selected service or visit our Open Internet page at the link [68]

On the T-Mobile Network, "at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds" and "customers who choose certain rate plans may notice speeds lower than customers on other T-Mobile or Sprint branded rate plans, which are prioritized higher."

We engineer our network to provide consistent high-speed data service, but at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds. In those cases, customers who choose certain rate plans may notice speeds lower than customers on other T-Mobile or Sprint branded rate plans, which are prioritized higher on our networks. Further, to provide the best possible on-device experience for the most possible customers on T-Mobile or Sprint branded plans and minimize capacity issues and degradation in network performance, we may, without advance notice, take any actions necessary to manage our network on a content-agnostic basis, including prioritizing all on-device data over Smartphone Mobile HotSpot (tethering) data and, for the vast majority of Rate Plans, further prioritizing the data usage of a small percentage of heavy data users (as defined in their Rate Plans), below that of all other customers in times and locations where there are competing customer demands for network resources, for the remainder of the billing cycle. This threshold number is periodically evaluated and may change over time. [69]

[68] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[69] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Sep. 23, 2021).

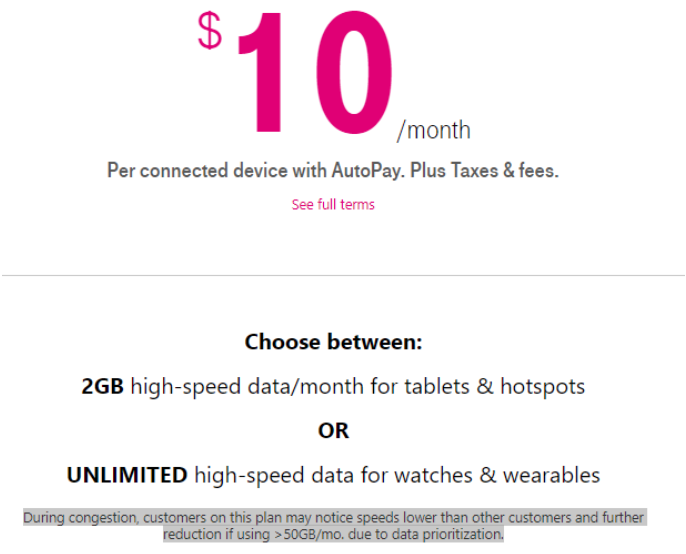
On the T-Mobile Network, "[a]t times and locations where the network is heavily loaded in relation to available capacity," certain customers "will likely see significant reductions in data speeds." Once "network loading goes down or the customer moves to a location that is less heavily loaded in relation to available capacity, the customer's speeds will likely improve."



Where the network is lightly loaded in relation to available capacity, a customer whose data is prioritized below other data traffic will notice little, if any, effect from having lower priority. This will be the case in the vast majority of times and locations. At times and locations where the network is heavily loaded in relation to available capacity, however, these customers will likely see significant reductions in data speeds, especially if they are engaged in data-intensive activities. Customers should be aware that these practices may occasionally result in speeds below those typically experienced on our 5G or LTE networks. We constantly work to improve network performance and capacity, but there are physical and technical limits on how much capacity is available, and in constrained locations the frequency of heavy loading in relation to available capacity may be greater than in other locations. When network loading goes down or the customer moves to a location that is less heavily loaded in relation to available capacity, the customer's speeds will likely improve. Visit www.T-Mobile.com/OpenInternet for details and for current data amount subject to this practice.

[70]

On certain TMO data plans customers may notice lower speeds compared to other customers once they reach a certain data usage threshold.



$10/month

Per connected device with AutoPay. Plus Taxes & fees.

See full terms

Choose between:

2GB high-speed data/month for tablets & hotspots

OR

UNLIMITED high-speed data for watches & wearables

During congestion, customers on this plan may notice speeds lower than other customers and further reduction if using >50GB/mo. due to data prioritization.

[71]

[70] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[71] *See* https://www.t-mobile.com/cell-phone-plans/affordable-data-plans (last visited Nov. 1, 2021).

* During congestion, **Magenta** customers using >100GB/mo. may notice reduced speeds until next bill cycle due to data prioritization; **Essentials** customers may notice speeds lower than other customers and further reduction if using >50GB/mo., due to data prioritization. ** Video typically streams on smartphone/tablet at DVD quality (480p); **Magenta MAX**: activate up to 4K UHD streaming on capable device, or video typically streams at 480p. **Scam Shield**: Capable device required. Turning on Scam Block might block calls you want; disable anytime. See full terms

72

Why did I receive an SMS about using 50GB of data?

I just got a text from you about reaching a 50GB data limit. What does it mean?

It looks like you've used 48GB or more of data overall in this bill cycle. After 50GB, you still get unlimited LTE data but may at times notice reduced speeds in areas with network congestion.

What happens if I do access a congested tower after I've used 50GB of data?

In the vast majority of times and places, you will notice little if any difference. In the small number of times or locations where there's network congestion, you may notice reduced data speeds. This experience is due to our data prioritization practice, which prioritizes customers who use more than 50GB of data in a single bill cycle after other customers. This practice helps to optimize overall network performance and maintain a quality service experience for as many customers as possible. Your data usage resets at the beginning of your next billing cycle, so this practice will only apply until that time.

Why does T-Mobile do this?

Our goal is to provide the best possible experience for as many customers as possible. Data prioritization is one way we accomplish this, especially at times and locations with network congestion. It's described in more detail in T-Mobile's Open Internet Disclosures here. Our policy is also in line with common industry standards for network management, which are designed optimize network performance and service. Every wireless provider maintains policies that govern network traffic management because there is a fixed amount of network capacity available at each cell tower.

73

87. For instance, this functionality may be implemented in the access network of the T-Mobile Network, in part by the PCF/PCRF.[74]

IP-CAN session: The association between a UE and an IP network. The association is identified by one IPv4 and/or an IPv6 prefix together with UE identity information, if available, and a PDN represented by a PDN ID (e.g. an APN). An IP-CAN session incorporates one or more IP-CAN bearers. Support for multiple IP-CAN bearers per IP-CAN session is IP-CAN specific. An IP-CAN session exists as long as UE IP addresses/prefix are established and announced to the IP network.

4.4 Usage Monitoring Control

It shall be possible to apply usage monitoring for the accumulated usage of network resources on a per IP-CAN session and user basis. This capability is required for enforcing dynamic policy decisions based on the total network usage in real-time.

The PCRF that uses usage monitoring for making dynamic policy decisions shall set and send the applicable thresholds to the PCEF or TDF for monitoring. The usage monitoring thresholds shall be based either on time, or on volume. The PCRF may send both thresholds to the PCEF or TDF. The PCEF or TDF shall notify the PCRF when a threshold is reached and report the accumulated usage since the last report for usage monitoring. If both time and volume thresholds were provided to the PCEF or TDF, the accumulated usage since last report shall be reported when either the time or the volume thresholds are reached.

NOTE: There are reasons other than reaching a threshold that may cause the PCEF/TDF to report accumulated usage to the PCRF as defined in clauses 6.2.2.3 and 6.6.2.

[72] *See, e.g.,* https://www.t-mobile.com/cell-phone-plans (last visited Nov. 1, 2021).
[73] *See* https://www.t-mobile.com/offers/mydatausage (last visited Nov. 1, 2021).
[74] *See, e.g.,* TS 23.203 at pp. 17, 25, 28, 31, and 69.

5.1 Reference architecture

The PCC functionality is comprised by the functions of the Policy and Charging Enforcement Function (PCEF), the Bearer Binding and Event Reporting Function (BBERF), the Policy and Charging Rules Function (PCRF), the Application Function (AF), the Traffic Detection Function (TDF), the Traffic Steering Support Function (TSSF), the Online Charging System (OCS), the Offline Charging System (OFCS) and the Subscription Profile Repository (SPR) or the User Data Repository (UDR). UDR replaces SPR when the UDC architecture as defined in TS 23.335 [25] is applied to store PCC related subscription data. In this deployment scenario Ud interface between PCRF and UDR is used to access subscription data in the UDR.

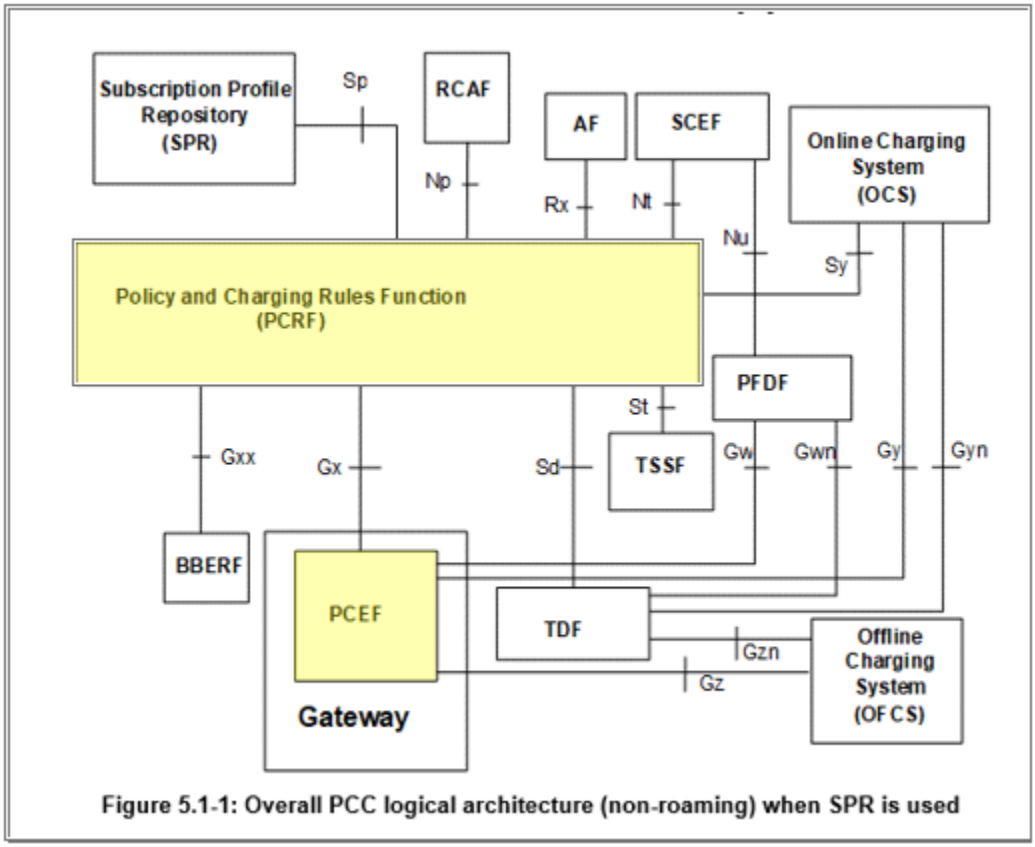


Figure 5.1-1: Overall PCC logical architecture (non-roaming) when SPR is used

5.2.2 Gx reference point

The Gx reference point resides between the PCEF and the PCRF.

The Gx reference point enables the PCRF to have dynamic control over the PCC behaviour at a PCEF.

The Gx reference point enables the signalling of PCC decision, which governs the PCC behaviour, and it supports the following functions:

- Establishment of Gx session (corresponding to an IP-CAN session) by the PCEF;
- Request for PCC decision from the PCEF to the PCRF;
- Provision of IP flow mobility routing information from PCEF to PCRF; this applies only when IP flow mobility as defined in TS 23.261 [23] is supported;
- Provision of PCC decision from the PCRF to the PCEF;
- Reporting of the start and the stop of detected applications and transfer of service data flow descriptions and application instance identifiers for detected applications from the PCEF to the PCRF;
- Reporting of the accumulated usage of network resources on a per IP-CAN session basis from the PCEF to the PCRF;
- Delivery of IP-CAN session specific parameters from the PCEF to the PCRF or, if Gxx is deployed, from the PCRF to the PCEF per corresponding request;
- Negotiation of IP-CAN bearer establishment mode (UE-only or UE/NW);
- Termination of Gx session (corresponding to an IP-CAN session) by the PCEF or the PCRF.

6.2.1 Policy Control and Charging Rules Function (PCRF)

6.2.1.0 General

The PCRF encompasses policy control decision and flow based charging control functionalities.

The PCRF provides network control regarding the service data flow detection, gating, QoS and flow based charging (except credit management) towards the PCEF and/or TDF.

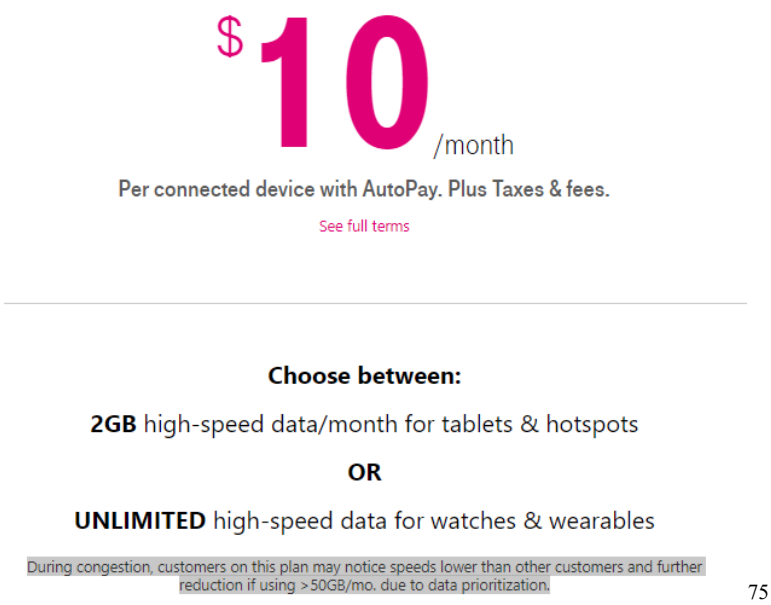
The PCRF provides network control regarding the application detection, gating, QoS and application based charging (except credit management) towards the TDF and the PCEF enhanced with ADC.

The PCRF shall apply the security procedures, as required by the operator, before accepting service information from the AF.

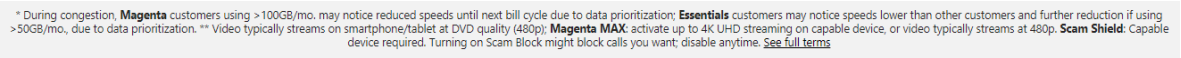
The PCRF shall decide whether application traffic detection is applicable, as per operator policies, based on user profile configuration, received within subscription information.

The PCRF shall decide how certain service/application traffic shall be treated in the PCEF and in the TDF, if applicable, and ensure that the PCEF user plane traffic mapping and treatment is in accordance with the user's subscription profile.

88. The Accused Instrumentalities receive a service profile for each of a plurality of devices sharing a network resource. For instance, the T-Mobile plans include an overall bit-rate cap or data volume cap.

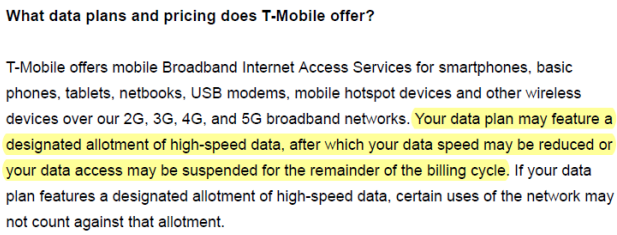


75



76

Based on the "allotment of high-speed data" for a given plan, TMO may reduce or suspend a user's data access in a billing cycle.



77

TMO then prioritizes "network data by plan and brand" with customers on certain plans given priority over customers on other plans during network congestion.

[75] *See, e.g.*, https://www.t-mobile.com/cell-phone-plans/affordable-data-plans (last visited Nov. 1, 2021).
[76] *See, e.g.*, https://www.t-mobile.com/cell-phone-plans (last visited Nov. 1, 2021).
[77] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

Additionally, we prioritize network data by plan and brand to deliver a range of customer choice points at great values. Data for customers on most T-Mobile-branded plans (and for customers on Sprint-branded plans while using the T-Mobile network), is prioritized before the data of customers on Essentials plans and Metro by T-Mobile or Assurance Wireless-branded plans. Mobile internet plans offered after December 12, 2020 with 30GB or more data per month, and Project 10Million and some other education-focused mobile internet plans, are prioritized next. The vast majority of customers on T-Mobile-branded, Sprint-branded, Metro by T-Mobile-branded, and Assurance Wireless-branded plans receive higher priority than the small fraction of customers who are Heavy Data Users on their rate plan, who are prioritized last on the network after exceeding the relevant threshold for the current billing cycle. T-Mobile Home Internet (available in select locations) customers receive the same network prioritization as Heavy Data Users, but should be less likely to experience congestion because the equipment is stationary and available in limited areas.

What is the impact of network prioritization?

As described in more detail below, customers may notice reduced speeds in comparison to customers with a higher priority during network congestion.

Customer devices also have varying speed capabilities and may connect to different networks depending on technology. Even within coverage areas and with broadband-capable devices, network changes, traffic volume, outages, technical limitations, signal strength, obstructions, weather, and other conditions may impact speeds and service availability. Your network experience and access may also be impacted if you fail to pay amounts you owe T-Mobile. [78]

What speeds and performance can T-Mobile-branded Broadband Internet Access Services customers expect? Where are these speeds available?

Many factors affect the speed and performance that customers experience, including the programs running on the device, proximity to a cell site, the capacity of the cell site, weather, the surrounding terrain, use inside a building or moving vehicle, radio frequency interference, how many other customers are attempting to use the same spectrum resources, any high-speed data allotment, the rate plans or features you select, and uses that affect your network prioritization, such as whether you are using Smartphone Mobile HotSpot (tethering) or if you are a Heavy Data User. For most T-Mobile-branded rate plans, a "Heavy Data User" is defined as a customer using more than 50GB of data (100GB of data for new Magenta plans activated beginning February 24, 2021) in a billing cycle. The threshold number is periodically evaluated across our rate plans and brands to manage network traffic and deliver a good experience to all customers while offering a range of customer choices. You can always check the threshold amount for a rate plan by speaking with a representative, review our rate cards or T-Mobile.com, or by logging in to my.t-mobile.com, or the T-Mobile app. The term "Heavy Data User" does not apply to customers on Magenta MAX, a new customer choice we are offering as we explore the expanding capacity of our 5G network, or on a small number of T-Mobile-branded business and government-oriented plans, which are not subject to a threshold. [79]

Choice of high-speed data

Customers select how much high-speed data they receive under their service plan. Certain features, such as Music Freedom, some Binge On content, data used by certain T-Mobile customer service applications, such as the T-Mobile App, and the federal telehealth VA Video Connect app, do not count against your high-speed data allotment. If your total high-speed data usage exceeds your selected high-speed allotment during a billing cycle, we reduce your data speed to 2G speeds (for most plans, 128 kbps) for the remainder of that billing cycle. [80]

[78] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[79] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[80] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

WHERE, HOW, AND WHEN DOES MY SERVICE WORK?

These T&Cs describe the experience you can expect on our networks, including information about our reasonable network management practices, and the experience on our roaming partners' networks. Please check our coverage maps, which approximate our anticipated coverage area outdoors. Your experience on our networks may vary and change without notice depending on a variety of factors. You agree that we are not liable for problems relating to Service availability or quality. To provide the best possible experience for the most possible customers on T-Mobile or Sprint branded rate plans, for many Rate Plans, we prioritize the data usage of a small percentage of our heavy data users, below that of other customers. This threshold number is specified in your Rate Plan and is also periodically evaluated and may change over time. We also prioritize the data of customers who choose certain Rate Plans after the data for other T-Mobile or Sprint branded rate plans, but before customers who are prioritized as heavy data users. Customers whose data is prioritized lower may notice speeds lower than customers with higher priority in times and locations where there are competing customer demands for network resources. See your selected service or visit our Open Internet page at the link [81]

We engineer our network to provide consistent high-speed data service, but at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds. In those cases, customers who choose certain rate plans may notice speeds lower than customers on other T-Mobile or Sprint branded rate plans, which are prioritized higher on our networks. Further, to provide the best possible on-device experience for the most possible customers on T-Mobile or Sprint branded plans and minimize capacity issues and degradation in network performance, we may, without advance notice, take any actions necessary to manage our network on a content-agnostic basis, including prioritizing all on-device data over Smartphone Mobile HotSpot (tethering) data and, for the vast majority of Rate Plans, further prioritizing the data usage of a small percentage of heavy data users (as defined in their Rate Plans), below that of all other customers in times and locations where there are competing customer demands for network resources, for the remainder of the billing cycle. This threshold number is periodically evaluated and may change over time. [82]

Typical data speeds

Data speeds vary depending on many factors, including:

- Your device model and its network support
- Device software and running applications
- Distance from the cell site
- How many other customers are using the same cell site
- Surrounding terrain, buildings, and trees
- Being inside a building or a moving vehicle
- Interference on the radio band or frequency
- Features of your plan or data plan, especially **older plans**.
- Tethering usage vs. using data on the device (On-device usage has a priority on our network.)
- International roamers may purchase a data pass for faster data speeds. [83]

[81] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[82] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[83] https://www.t-mobile.com/support/plans-features/data-speeds (last visited Nov. 1, 2021).

89. For instance, this functionality is implemented in the access network of the T-Mobile Network, in part in conjunction with the PCF/PCRF.[84]

4.3.3 QoS control

4.3.3.1 QoS control at service data flow level

It shall be possible to apply QoS control on a per service data flow basis in the PCEF.

QoS control per service data flow allows the PCC architecture to provide the PCEF with the authorized QoS to be enforced for each specific service data flow. Criteria such as the QoS subscription information may be used together with policy rules such as, service-based, subscription-based, or predefined PCRF internal policies to derive the authorized QoS to be enforced for a service data flow.

It shall be possible to apply multiple PCC rules, without application provided information, using different authorised QoS within a single IP-CAN session and within the limits of the Subscribed QoS profile.

4.3.3.2 QoS control at IP-CAN bearer level

It shall be possible for the PCC architecture to support control of QoS reservation procedures (UE-initiated or network-initiated) for IP-CANs that support such procedures for its IP-CAN bearers in the PCEF or the BBERF, if applicable. It shall be possible to determine the QoS to be applied in QoS reservation procedures (QoS control) based on the authorised QoS of the service data flows that are applicable to the IP-CAN bearer and on criteria such as the QoS subscription information, service based policies, and/or predefined PCRF internal policies. Details of QoS reservation procedures are IP-CAN specific and therefore, the control of these procedures is described in Annex A and Annex D.

It shall be possible for the PCC architecture to support control of QoS for the packet traffic of IP-CANs.

The PCC architecture shall be able to provide policy control in the presence of NAT devices. This may be accomplished by providing appropriate address and port information to the PCRF.

The enforcement of the control for QoS reservation procedures for an IP-CAN bearer shall allow for a downgrading or an upgrading of the requested QoS as part of a UE-initiated IP-CAN bearer establishment and modification. The PCC architecture shall be able to provide a mechanism to initiate IP-CAN bearer establishment and modification (for IP-CANs that support such procedures for its bearers) as part of the QoS control.

The IP-CAN shall prevent cyclic QoS upgrade attempts due to failed QoS upgrades.

NOTE: These measures are IP-CAN specific.

The PCC architecture shall be able to handle IP-CAN bearers that require a guaranteed bitrate (GBR bearers) and IP-CAN bearers for which there is no guaranteed bitrate (non-GBR bearers).

5.2.3 Reference points to subscriber databases

5.2.3.1 Sp reference point

The Sp reference point lies between the SPR and the PCRF.

The Sp reference point allows the PCRF to request subscription information related to the IP-CAN transport level policies from the SPR based on a subscriber ID, a PDN identifier and possible further IP-CAN session attributes, see Annex A and Annex D. For example, the subscriber ID can be IMSI. The reference point allows the SPR to notify the PCRF when the subscription information has been changed if the PCRF has requested such notifications. The SPR shall stop sending the updated subscription information when a cancellation notification request has been received from the PCRF.

NOTE: The details associated with the Sp reference point are not specified in this Release.

5.2.3.2 Ud reference point

The Ud reference point resides between the UDR and the PCRF, acting as an Application Frontend as defined in TS 23.335 [25]. It is used by the PCRF to access PCC related subscription data when stored in the UDR.

The details for this reference point are described in TS 23.335 [25] and TS 29.335 [26].

[84] *See, e.g.,* TS 23.203 at pp. 24, 32, 69-70, 76, 91-93.

6.2.1.2 Subscription information management in the PCRF

The PCRF may request subscription information from the SPR for an IP-CAN session at establishment or a gateway control session at establishment. The subscription information may include user profile configuration indicating whether application detection and control should be enabled. The PCRF should specify the subscriber ID and, if available, the PDN identifier in the request. The PCRF should retain the subscription information that is relevant for PCC decisions until the IP-CAN session termination and the gateway control session termination.

The PCRF may request notifications from the SPR on changes in the subscription information. Upon reception of a notification, the PCRF shall make the PCC decisions necessary to accommodate the change in the subscription and updates the PCEF and/or the BBERF and/or the TDF by providing the new PCC and/or QoS and/or ADC decisions if needed. The PCRF shall send a cancellation notification request to the SPR when the related subscription information has been deleted.

The PCRF provides network control regarding the service data flow detection, gating, QoS and flow based charging (except credit management) towards the PCEF and/or TDF.

The PCRF provides network control regarding the application detection, gating, QoS and application based charging (except credit management) towards the TDF and the PCEF enhanced with ADC.

The PCRF shall apply the security procedures, as required by the operator, before accepting service information from the AF.

The PCRF shall decide whether application traffic detection is applicable, as per operator policies, based on user profile configuration, received within subscription information.

The PCRF shall decide how certain service/application traffic shall be treated in the PCEF and in the TDF, if applicable, and ensure that the PCEF user plane traffic mapping and treatment is in accordance with the user's subscription profile.

If Gxx applies, the PCRF shall provide QoS rules with identical service data flow templates as provided to the PCEF in the PCC rules. If the service data flow is tunnelled at the BBERF, the PCRF shall provide the BBERF with information received from the PCEF to enable the service data flow detection in the mobility tunnel at the BBERF. In case 2a, defined in clause 7.1, the PCRF may also provide to the BBERF the charging ID information received from the PCEF. If IP flow mobility as specified in TS 23.261 [23] applies, the PCRF shall, based on IP flow mobility routing rules received from the PCEF, provide the authorized QoS rules to the applicable BBERF as specified in clause 6.1.1.3.

The PCRF should for an IP-CAN session derive, from IP-CAN specific restrictions, operator policy and SPR data, the list of permitted QoS class identifiers and associated GBR and MBR limits for the IP-CAN session.

The PCRF may check that the service information provided by the AF is consistent with both the operator defined policy rules and the related subscription information as received from the SPR during IP-CAN session establishment before storing the service information. The service information shall be used to derive the QoS for the service. The PCRF may reject the request received from the AF when the service information is not consistent with either the related subscription information or the operator defined policy rules and as a result the PCRF shall indicate that this service information is not covered by the subscription information or by operator defined policy rules and may indicate, in the response to the AF, the service information that can be accepted by the PCRF (e.g. the acceptable bandwidth). In the absence of other policy control mechanisms outside the scope of PCC, it is recommended that the PCRF include this information in the response.

When receiving service information from the AF, the PCRF may temporarily reject the AF request (e.g. if the service information is not consistent with the operator defined policy rules for the congestion status of the user). To temporarily reject the AF request the PCRF shall indicate a re-try interval to the AF. When receiving a re-try interval from the PCRF the AF shall not send the same service information to the PCRF again (for the same IP-CAN session) until the re-try interval has elapsed.

NOTE 1: How the PCRF derives the re-try interval is up to implementation.

In this Release, the PCRF supports only a single Rx reference point, i.e. there is one AF for each AF session.

The PCRF authorizes QoS resources. The PCRF uses the service information received from the AF (e.g. SDP information or other available application information) and/or the subscription information received from the SPR to calculate the proper QoS authorization (QoS class identifier, bitrates). The PCRF may also take into account the requested QoS received from the PCEF via Gx interface.

NOTE 2: The PCRF provides always the maximum values for the authorized QoS even if the requested QoS is lower than what can be authorized.

The Authorization of QoS resources shall be based on complete service information unless the PCRF is required to perform the authorization of QoS resources based on incomplete service information. The PCRF shall after receiving the complete service information, update the affected PCC rules accordingly.

The PCRF may use the subscription information as basis for the policy and charging control decisions. The subscription information may apply for both session based and non-session based services.

6.2.4 Subscription Profile Repository (SPR)

The SPR logical entity contains all subscriber/subscription related information needed for subscription-based policies and IP-CAN bearer level PCC rules by the PCRF. The SPR may be combined with or distributed across other databases in the operator's network, but those functional elements and their requirements for the SPR are out of scope of this document.

NOTE 1: The SPR's relation to existing subscriber databases is not specified in this Release.

The SPR may provide the following subscription profile information (per PDN, which is identified by the PDN identifier):

- Subscriber's allowed services;
- For each allowed service, a pre-emption priority;
- Information on subscriber's allowed QoS, including the Subscribed Guaranteed Bandwidth QoS;
- Subscriber's charging related information (e.g. location information relevant for charging);
- Subscriber's User CSG Information reporting rules.
- List of Presence Reporting Area identifiers and optionally the elements for one or more of the Presence Reporting Areas;
- Subscriber category;
- Subscriber's usage monitoring related information;
- MPS EPS Priority and MPS Priority Level;
- IMS Signalling Priority;
- Subscriber's profile configuration indicating whether application detection and control can be enabled.
- Spending limits profile containing an indication that policy decisions are based on policy counters available at OCS that has a spending limit associated with it and optionally the list of policy counters.

The SPR may provide the following sponsored data connectivity profile information:

- A list of Application Service Providers and their applications per sponsor identity.

NOTE 2: The sponsored data connectivity profile may be locally configured at the PCRF.

If the IMS Signalling Priority is set, it indicates that the IMS Signalling Bearer and the Default Bearer are assigned ARP appropriate for MPS at the time of the establishment of the PDN connection for IMS, i.e. EPS Attach or PDN Connectivity Request.

The SPR may provide the following policy information related to an ASP (see clause 6.1.16):

- The ASP identifier;
- A transfer policy together with a reference ID, the volume of data to be transferred per UE, the expected amount of UEs and the network area information.

6.2.8 User Data Repository (UDR)

The UDR is a functional entity that acts as a single logical repository storing user data. As such it may contain all subscriber/subscription related information needed by the PCRF. In deployment scenarios where the UDR is used it replaces the SPR. The UDR provides a unique reference point to fetch these subscriber/subscription data. This reference point is named Ud. More information on the UDR can be found in TS 23.335 [25].

The SPR data listed in clause 6.2.4 are stored in the UDR, the information model remains unspecified.

90. The Accused Instrumentalities receive a billing profile for each of said plurality of devices.

What speeds and performance can T-Mobile-branded Broadband Internet Access Services customers expect? Where are these speeds available?

Many factors affect the speed and performance that customers experience, including the programs running on the device, proximity to a cell site, the capacity of the cell site, weather, the surrounding terrain, use inside a building or moving vehicle, radio frequency interference, how many other customers are attempting to use the same spectrum resources, any high-speed data allotment, the rate plans or features you select, and uses that affect your network prioritization, such as whether you are using Smartphone Mobile HotSpot (tethering) or if you are a Heavy Data User. For most T-Mobile-branded rate plans, a "Heavy Data User" is defined as a customer using more than 50GB of data (100GB of data for new Magenta plans activated beginning February 24, 2021) in a billing cycle. The threshold number is periodically evaluated across our rate plans and brands to manage network traffic and deliver a good experience to all customers while offering a range of customer choices. You can always check the threshold amount for a rate plan by speaking with a representative, review our rate cards or T-Mobile.com, or by logging in to my.t-mobile.com, or the T-Mobile app. The term "Heavy Data User" does not apply to customers on Magenta MAX, a new customer choice we are offering as we explore the expanding capacity of our 5G network, or on a small number of T-Mobile-branded business and government-oriented plans, which are not subject to a threshold. [85]

Additionally, we prioritize network data by plan and brand to deliver a range of customer choice points at great values. Data for customers on most T-Mobile-branded plans (and for customers on Sprint-branded plans while using the T-Mobile network), is prioritized before the data of customers on Essentials plans and Metro by T-Mobile or Assurance Wireless-branded plans. Mobile internet plans offered after December 12, 2020 with 30GB or more data per month, and Project 10Million and some other education-focused mobile internet plans, are prioritized next. The vast majority of customers on T-Mobile-branded, Sprint-branded, Metro by T-Mobile-branded, and Assurance Wireless-branded plans receive higher priority than the small fraction of customers who are Heavy Data Users on their rate plan, who are prioritized last on the network after exceeding the relevant threshold for the current billing cycle. T-Mobile Home Internet (available in select locations) customers receive the same network prioritization as Heavy Data Users, but should be less likely to experience congestion because the equipment is stationary and available in limited areas.

What is the impact of network prioritization?

As described in more detail below, customers may notice reduced speeds in comparison to customers with a higher priority during network congestion.

Customer devices also have varying speed capabilities and may connect to different networks depending on technology. Even within coverage areas and with broadband-capable devices, network changes, traffic volume, outages, technical limitations, signal strength, obstructions, weather, and other conditions may impact speeds and service availability. Your network experience and access may also be impacted if you fail to pay amounts you owe T-Mobile. [86]

[85] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[86] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

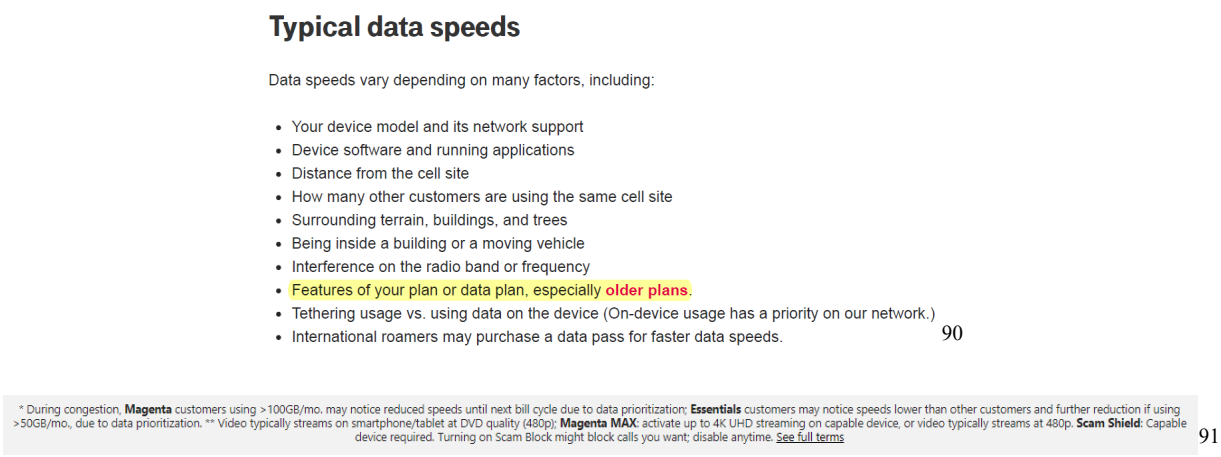
Network management for extremely high data usage and tethering

Some of our plan options feature a customer-chosen high-speed data allotment with reduced speeds on our network after the high-speed allotment is exhausted, so customers can choose the combination of high-speed data and price that is right for their needs. Unlimited high-speed data customers do not have a specific high-speed data allotment on their device, however, and customers on some limited high-speed plans may have extremely high data usage under certain circumstances, including if their plan enables access to significant amounts of data that does not count against their high-speed data allotment. While T-Mobile continues to expand its network capacity, at this time, some network management for these scenarios is required, because very heavy data usage at times and places of competing network demands can affect the network performance for other customers. [87]

To provide the best possible experience for the most possible customers on their T-Mobile-branded plans, and to minimize capacity issues and degradation in network performance, we manage significant high-speed data usage on the vast majority of our plans through prioritization. Heavy Data Users (as defined by a customer's rate plan) will have their data usage prioritized below the data usage (including tethering) of other customers at times and at locations where there are competing customer demands for network resources, which may result in slower data speeds. At the start of the next bill cycle, the customer's usage status is reset, and this data traffic is no longer prioritized below other traffic. Customers who use data in violation of their Rate Plan terms or T-Mobile's Terms and Conditions may be excluded from this calculation. Data features that may not count against the high-speed data allotment for some plans, such as certain data associated with Music Freedom, or Binge On, still count towards all customers' usage for this calculation. Smartphone Mobile HotSpot (tethering) data is also included in this calculation. Data used for customer service applications, such as the T-Mobile My Account app does not count towards customers' usage for this calculation. To help avoid application of this practice, and reduce mobile data consumption, customers can set automatic updating of apps, podcasts and file downloads to run off Wi-Fi (making sure to connect to Wi-Fi to update applications and system periodically). [88]

We engineer our network to provide consistent high-speed data service, but at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds. In those cases, customers who choose certain rate plans may notice speeds lower than customers on other T-Mobile or Sprint branded rate plans, which are prioritized higher on our networks. Further, to provide the best possible on-device experience for the most possible customers on T-Mobile or Sprint branded plans and minimize capacity issues and degradation in network performance, we may, without advance notice, take any actions necessary to manage our network on a content-agnostic basis, including prioritizing all on-device data over Smartphone Mobile HotSpot (tethering) data and, for the vast majority of Rate Plans, further prioritizing the data usage of a small percentage of heavy data users (as defined in their Rate Plans), below that of all other customers in times and locations where there are competing customer demands for network resources, for the remainder of the billing cycle. This threshold number is periodically evaluated and may change over time. [89]

[87] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[88] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[89] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).



Typical data speeds

Data speeds vary depending on many factors, including:

- Your device model and its network support
- Device software and running applications
- Distance from the cell site
- How many other customers are using the same cell site
- Surrounding terrain, buildings, and trees
- Being inside a building or a moving vehicle
- Interference on the radio band or frequency
- Features of your plan or data plan, especially **older plans**.
- Tethering usage vs. using data on the device (On-device usage has a priority on our network.)
- International roamers may purchase a data pass for faster data speeds.

90

* During congestion, **Magenta** customers using >100GB/mo. may notice reduced speeds until next bill cycle due to data prioritization; **Essentials** customers may notice speeds lower than other customers and further reduction if using >50GB/mo., due to data prioritization. ** Video typically streams on smartphone/tablet at DVD quality (480p); **Magenta MAX**: activate up to 4K UHD streaming on capable device, or video typically streams at 480p. **Scam Shield**: Capable device required. Turning on Scam Block might block calls you want; disable anytime. See full terms

91

91. As discussed in paragraphs 88 and 89, *supra,* receiving a billing profile for each of said plurality of devices is implemented in the access network of the T-Mobile Network, in part in conjunction with the PCF/PCRF. [92]

92. The Accused Instrumentalities generate a prioritization list defining an order of said plurality of devices, based on said billing profiles and on a billing history for each of said plurality of devices. For instance, on information and belief, TMO generates a prioritization list to determine which, if any, device will see a decrease in data speed based on, in part, the plan associated with the device (which is part of the "billing profile") and the amount and/or type of data transmitted under that plan or whether a user has failed to pay amounts owed TMO (which is part of the "billing history"). On information and belief, whether a user's device will experience decreased data speeds depends on, in part, the billing profile (e.g., specific plan).

[90] https://www.t-mobile.com/support/plans-features/data-speeds (last visited Nov. 1, 2021).
[91] *See, e.g.,* https://www.t-mobile.com/cell-phone-plans (last visited Nov. 1, 2021).
[92] TS 23.203 at pp. 24, 32, 69-70, 76, 91-93.

What speeds and performance can T-Mobile-branded Broadband Internet Access Services customers expect? Where are these speeds available?

Many factors affect the speed and performance that customers experience, including the programs running on the device, proximity to a cell site, the capacity of the cell site, weather, the surrounding terrain, use inside a building or moving vehicle, radio frequency interference, how many other customers are attempting to use the same spectrum resources, any high-speed data allotment, the rate plans or features you select, and uses that affect your network prioritization, such as whether you are using Smartphone Mobile HotSpot (tethering) or if you are a Heavy Data User. For most T-Mobile-branded rate plans, a "Heavy Data User" is defined as a customer using more than 50GB of data (100GB of data for new Magenta plans activated beginning February 24, 2021) in a billing cycle. The threshold number is periodically evaluated across our rate plans and brands to manage network traffic and deliver a good experience to all customers while offering a range of customer choices. You can always check the threshold amount for a rate plan by speaking with a representative, review our rate cards or T-Mobile.com, or by logging in to my.t-mobile.com, or the T-Mobile app. The term "Heavy Data User" does not apply to customers on Magenta MAX, a new customer choice we are offering as we explore the expanding capacity of our 5G network, or on a small number of T-Mobile-branded business and government-oriented plans, which are not subject to a threshold. [93]

Additionally, we prioritize network data by plan and brand to deliver a range of customer choice points at great values. Data for customers on most T-Mobile-branded plans (and for customers on Sprint-branded plans while using the T-Mobile network), is prioritized before the data of customers on Essentials plans and Metro by T-Mobile or Assurance Wireless-branded plans. Mobile internet plans offered after December 12, 2020 with 30GB or more data per month, and Project 10Million and some other education-focused mobile internet plans, are prioritized next. The vast majority of customers on T-Mobile-branded, Sprint-branded, Metro by T-Mobile-branded, and Assurance Wireless-branded plans receive higher priority than the small fraction of customers who are Heavy Data Users on their rate plan, who are prioritized last on the network after exceeding the relevant threshold for the current billing cycle. T-Mobile Home Internet (available in select locations) customers receive the same network prioritization as Heavy Data Users, but should be less likely to experience congestion because the equipment is stationary and available in limited areas.

What is the impact of network prioritization?

As described in more detail below, customers may notice reduced speeds in comparison to customers with a higher priority during network congestion.

Customer devices also have varying speed capabilities and may connect to different networks depending on technology. Even within coverage areas and with broadband-capable devices, network changes, traffic volume, outages, technical limitations, signal strength, obstructions, weather, and other conditions may impact speeds and service availability. Your network experience and access may also be impacted if you fail to pay amounts you owe T-Mobile. [94]

[93] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[94] *See, e.g.,* NM at 2; *see also* BSI at 3-4.

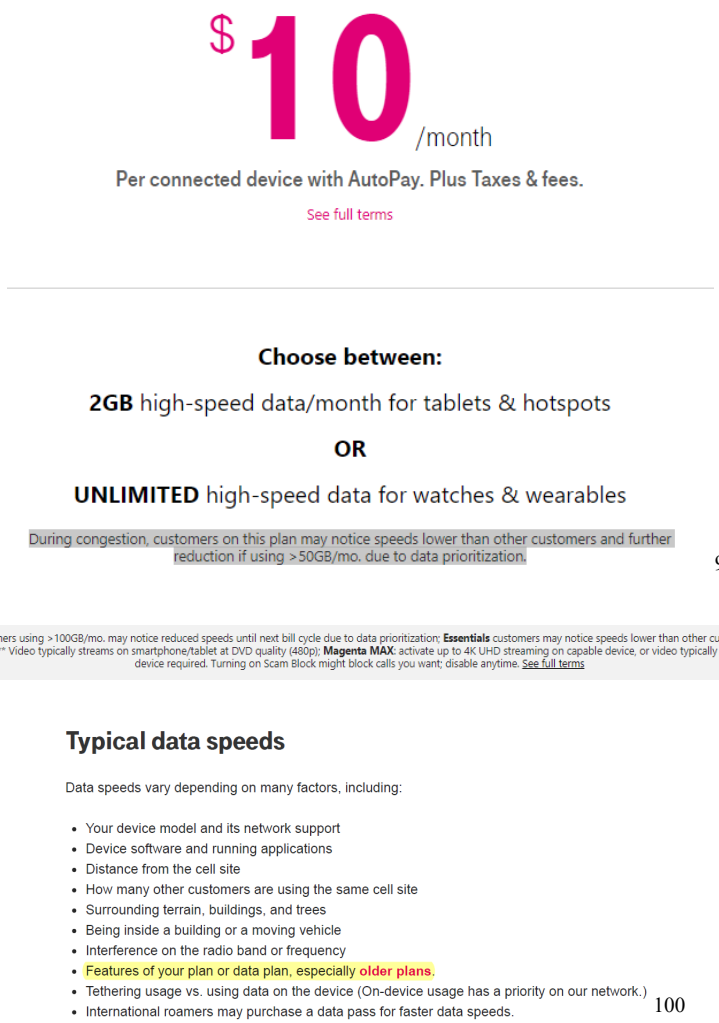
Network management for extremely high data usage and tethering

Some of our plan options feature a customer-chosen high-speed data allotment with reduced speeds on our network after the high-speed allotment is exhausted, so customers can choose the combination of high-speed data and price that is right for their needs. Unlimited high-speed data customers do not have a specific high-speed data allotment on their device, however, and customers on some limited high-speed plans may have extremely high data usage under certain circumstances, including if their plan enables access to significant amounts of data that does not count against their high-speed data allotment. While T-Mobile continues to expand its network capacity, at this time, some network management for these scenarios is required, because very heavy data usage at times and places of competing network demands can affect the network performance for other customers. [95]

To provide the best possible experience for the most possible customers on their T-Mobile-branded plans, and to minimize capacity issues and degradation in network performance, we manage significant high-speed data usage on the vast majority of our plans through prioritization. Heavy Data Users (as defined by a customer's rate plan) will have their data usage prioritized below the data usage (including tethering) of other customers at times and at locations where there are competing customer demands for network resources, which may result in slower data speeds. At the start of the next bill cycle, the customer's usage status is reset, and this data traffic is no longer prioritized below other traffic. Customers who use data in violation of their Rate Plan terms or T-Mobile's Terms and Conditions may be excluded from this calculation. Data features that may not count against the high-speed data allotment for some plans, such as certain data associated with Music Freedom, or Binge On, still count towards all customers' usage for this calculation. Smartphone Mobile HotSpot (tethering) data is also included in this calculation. Data used for customer service applications, such as the T-Mobile My Account app does not count towards customers' usage for this calculation. To help avoid application of this practice, and reduce mobile data consumption, customers can set automatic updating of apps, podcasts and file downloads to run off Wi-Fi (making sure to connect to Wi-Fi to update applications and system periodically). [96]

We engineer our network to provide consistent high-speed data service, but at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds. In those cases, customers who choose certain rate plans may notice speeds lower than customers on other T-Mobile or Sprint branded rate plans, which are prioritized higher on our networks. Further, to provide the best possible on-device experience for the most possible customers on T-Mobile or Sprint branded plans and minimize capacity issues and degradation in network performance, we may, without advance notice, take any actions necessary to manage our network on a content-agnostic basis, including prioritizing all on-device data over Smartphone Mobile HotSpot (tethering) data and, for the vast majority of Rate Plans, further prioritizing the data usage of a small percentage of heavy data users (as defined in their Rate Plans), below that of all other customers in times and locations where there are competing customer demands for network resources, for the remainder of the billing cycle. This threshold number is periodically evaluated and may change over time. [97]

[95] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[96] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[97] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).



93. For instance, generating a prioritization list defining an order of said plurality of devices, based on said billing profiles and on a billing history for each of said plurality of devices is implemented in the access network of the T-Mobile Network.[101]

[98] *See* https://www.t-mobile.com/cell-phone-plans/affordable-data-plans (last visited Nov. 1, 2021).
[99] *See, e.g.,* https://www.t-mobile.com/cell-phone-plans (last visited Nov. 1, 2021).
[100] https://www.t-mobile.com/support/plans-features/data-speeds (last visited Nov. 1, 2021).
[101] *See, e.g.,* TS 23.203 at pp. 47, 74-76, 88-89.

6.1.6 Service (data flow) Prioritization and Conflict Handling

Service pre-emption priority enables the PCRF to resolve conflicts where the activation of all requested active PCC rules for services would result in a cumulative authorized QoS which exceeds the Subscribed Guaranteed bandwidth QoS.

For example, when supporting network controlled QoS, the PCRF may use the pre-emption priority of a service, the activation of which would cause the subscriber's authorized QoS to be exceeded. If this pre-emption priority is greater than that of any one or more active PCC rules, the PCRF can determine whether the deactivation of any one or more such rules would allow the higher pre-emption priority PCC rule to be activated whilst ensuring the resulting cumulative QoS does not exceed a subscriber's Subscribed Guaranteed Bandwidth QoS.

If such a determination can be made, the PCRF may resolve the conflict by deactivating those selected PCC rules with lower pre-emption priorities and accepting the higher priority service information from the AF. If such a determination cannot be made, the PCRF may reject the service information from the AF.

6.2.1.1 Input for PCC decisions

The PCRF shall accept input for PCC decision-making from the PCEF, the BBERF if present, the TDF if present, the SPR and if the AF is involved, from the AF, as well as the PCRF may use its own predefined information. These different nodes should provide as much information as possible to the PCRF. At the same time, the information below describes examples of the information provided. Depending on the particular scenario all the information may not be available or is already provided to the PCRF.

The PCEF and/or BBERF may provide the following information:

- Subscriber Identifier;
- The IMEI(SV) of the UE;
- IPv4 address of the UE;
- IPv6 network prefix assigned to the UE;
- NBIFOM Routing Rules (when NBIFOM as specified in TS 23.161 [43] applies);
- IP flow routing information (when IP flow mobility as specified in TS 23.261 [23] applies);

NOTE 1: IP flow routing information and NBIFOM Routing Rules are provided only by the PCEF.

- Change of usability of an Access (when NBIFOM as specified in TS 23.161 [43] applies);
- IP-CAN bearer attributes;

NOTE 2: If IP flow mobility as specified in TS 23.161 [43] or in TS 23.261 [23] applies, an IP-CAN session may be active over multiple accesses and thus some IP-CAN bearer attributes may have a different value depending on the access type;

- Request type (initial, modification, etc.);
- Type of IP-CAN (e.g. GPRS, etc.);

NOTE 3: The Type of IP-CAN parameter should allow extension to include new types of accesses.

- Location of the subscriber;

NOTE 4: See clause 6.1.4 for the description of this location information.

NOTE 5: Depending on the type of IP-CAN, the limited update rate for the location information at the PCEF may lead to a UE moving outside the area indicated in the detailed location information without notifying the PCEF.

***

The SPR may provide the following information for a subscriber, connecting to a specific PDN:

- Subscriber's allowed services, i.e. list of Service IDs;
- For each allowed service, a pre-emption priority;

- Information on subscriber's allowed QoS, including:
  - the Subscribed Guaranteed Bandwidth QoS;
  - a list of QoS class identifiers together with the MBR limit and, for real-time QoS class identifiers, GBR limit.
- Subscriber's charging related information;
- Spending limits profile containing an indication that policy decisions depend on policy counters available at the OCS that has a spending limit associated with it and optionally the list of relevant policy counters.
- Subscriber category;
- Subscriber's usage monitoring related information;
- Subscriber's profile configuration;
- Sponsored data connectivity profiles;
- MPS EPS Priority, MPS Priority Level (See TS 23.401 [17] for more detail on MPS Subscription);
- IMS Signalling Priority.

***

The RCAF, if involved, may provide the following information for a subscriber:

- Subscriber Identifier.
- Identifier of the eNB, E-UTRAN cell or Service Area serving the subscriber.

NOTE 10: Whether in case of E-UTRAN the eNB identifier or the ECGI are included in the RUCI is up to operator configuration in the RCAF.

NOTE 11: Depending on the RUCI reporting interval configured in the RCAF, a UE may move outside the area indicated without the RCAF immediately notifying the PCRF. The PCRF can avoid receiving information about the cell currently serving a UE from multiple sources (i.e. via the Np and the Gx interface) by deactivating reporting of the congested cell's identifier over Np. In case PCRF receives information about the cell currently serving a UE via Np and Gx, then the information received via Gx is expected to take precedence.

- APNs.
- Congestion level or an indication of the "no congestion" state.

In addition, the predefined information in the PCRF may contain additional rules based on charging policies in the network, whether the subscriber is in its home network or roaming, depending on the IP-CAN bearer attributes.

The QoS Class Identifier (see clause 6.3.1) in the PCC rule is derived by the PCRF from AF or SPR interaction if available. The input can be SDP information or other available application information, in line with operator policy.

The Allocation/Retention Priority in the PCC Rule is derived by the PCRF from AF or SPR interaction if available, in line with operator policy.

6.2.2.4 QoS control

The PCEF enforces the authorized QoS for an IP-CAN bearer according to the information received via the Gx interface and depending on the bearer establishment mode.

3GPP

Release 15 89 3GPP TS 23.203 V15.5.0 (2019-06)

Only the GBR per bearer is used for resource reservation (e.g. admission control in the RAN). The MBR (per PCC rule / per bearer) is used for rate policing.

For a UE-initiated IP-CAN bearer establishment or modification the PCEF receives the authorized QoS (QCI, ARP, GBR, MBR) for a bearer that the PCEF has identified for the PCRF. The PCEF shall enforce it which may lead to a downgrading or upgrading of the requested bearer QoS.

NOTE 1: The MBR is an average value, which is measured over some time period. Services may generate media with variable bitrate. For example, TS 26.114 [45] describes the bitrate variations that may be generated for real-time conversational media in the MTSI service. The policing function in the PCEF should take such bitrate variations into account.

For a network initiated IP-CAN bearer establishment or modification the PCEF receives the authorized QoS per PCC rule (QCI, ARP, GBR, MBR). For GBR bearers the PCEF should set the bearer's GBR to the sum of the GBRs of all PCC rules that are active and bound to that GBR bearer. If a set of PCC Rules is subject to resource sharing as specified in clause 6.1.14 the PCEF should use, for each applicable direction, the highest GBR from the set of PCC Rules sharing resources as input for calculating the bearer´s GBR. For GBR bearers the PCEF should set the bearer's MBR to the sum of the MBRs of all PCC rules that are active and bound to that GBR bearer. If a set of PCC Rules is subject to resource sharing as specified in clause 6.1.14 the PCEF may, for each applicable direction, use the highest MBR from the set of PCC Rules as input for calculating the bearer´s MBR.

94. The Accused Instrumentalities repeat the following limitations recited in claim 1 of the ’813 Patent.

95. The Accused Instrumentalities receive traffic profiles over said network resource for said plurality of devices. For instance, on information and belief, TMO receives traffic profiles over its network which may be used to determine if the network is “congested”.

Additionally, we prioritize network data by plan and brand to deliver a range of customer choice points at great values. Data for customers on most T-Mobile-branded plans (and for customers on Sprint-branded plans while using the T-Mobile network), is prioritized before the data of customers on Essentials plans and Metro by T-Mobile or Assurance Wireless-branded plans. Mobile internet plans offered after December 12, 2020 with 30GB or more data per month, and Project 10Million and some other education-focused mobile internet plans, are prioritized next. The vast majority of customers on T-Mobile-branded, Sprint-branded, Metro by T-Mobile-branded, and Assurance Wireless-branded plans receive higher priority than the small fraction of customers who are Heavy Data Users on their rate plan, who are prioritized last on the network after exceeding the relevant threshold for the current billing cycle. T-Mobile Home Internet (available in select locations) customers receive the same network prioritization as Heavy Data Users, but should be less likely to experience congestion because the equipment is stationary and available in limited areas.

What is the impact of network prioritization?

As described in more detail below, customers may notice reduced speeds in comparison to customers with a higher priority during network congestion.

Customer devices also have varying speed capabilities and may connect to different networks depending on technology. Even within coverage areas and with broadband-capable devices, network changes, traffic volume, outages, technical limitations, signal strength, obstructions, weather, and other conditions may impact speeds and service availability. Your network experience and access may also be impacted if you fail to pay amounts you owe T-Mobile. [102]

TMO identifies "times and locations where there are competing customer demands for network resources."

WHERE, HOW, AND WHEN DOES MY SERVICE WORK?

These T&Cs describe the experience you can expect on our networks, including information about our reasonable network management practices, and the experience on our roaming partners' networks. Please check our coverage maps, which approximate our anticipated coverage area outdoors. Your experience on our networks may vary and change without notice depending on a variety of factors. You agree that we are not liable for problems relating to Service availability or quality. To provide the best possible experience for the most possible customers on T-Mobile or Sprint branded rate plans, for many Rate Plans, we prioritize the data usage of a small percentage of our heavy data users, below that of other customers. This threshold number is specified in your Rate Plan and is also periodically evaluated and may change over time. We also prioritize the data of customers who choose certain Rate Plans after the data for other T-Mobile or Sprint branded rate plans, but before customers who are prioritized as heavy data users. Customers whose data is prioritized lower may notice speeds lower than customers with higher priority in times and locations where there are competing customer demands for network resources. See your selected service or visit our Open Internet page at the link [103]

[102] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[103] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).

We engineer our network to provide consistent high-speed data service, but at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds. In those cases, customers who choose certain rate plans may notice speeds lower than customers on other T-Mobile or Sprint branded rate plans, which are prioritized higher on our networks. Further, to provide the best possible on-device experience for the most possible customers on T-Mobile or Sprint branded plans and minimize capacity issues and degradation in network performance, we may, without advance notice, take any actions necessary to manage our network on a content-agnostic basis, including prioritizing all on-device data over Smartphone Mobile HotSpot (tethering) data and, for the vast majority of Rate Plans, further prioritizing the data usage of a small percentage of heavy data users (as defined in their Rate Plans), below that of all other customers in times and locations where there are competing customer demands for network resources, for the remainder of the billing cycle. This threshold number is periodically evaluated and may change over time. [104]

On information and belief, the received traffic profiles are used to determine if a cell site is experiencing high demand and/or to determine how many other customers are attempting to use the same spectrum resources.

What speeds and performance can T-Mobile-branded Broadband Internet Access Services customers expect? Where are these speeds available?

Many factors affect the speed and performance that customers experience, including the programs running on the device, proximity to a cell site, the capacity of the cell site, weather, the surrounding terrain, use inside a building or moving vehicle, radio frequency interference, how many other customers are attempting to use the same spectrum resources, any high-speed data allotment, the rate plans or features you select, and uses that affect your network prioritization, such as whether you are using Smartphone Mobile HotSpot (tethering) or if you are a Heavy Data User. For most T-Mobile-branded rate plans, a "Heavy Data User" is defined as a customer using more than 50GB of data (100GB of data for new Magenta plans activated beginning February 24, 2021) in a billing cycle. The threshold number is periodically evaluated across our rate plans and brands to manage network traffic and deliver a good experience to all customers while offering a range of customer choices. You can always check the threshold amount for a rate plan by speaking with a representative, review our rate cards or T-Mobile.com, or by logging in to my.t-mobile.com, or the T-Mobile app. The term "Heavy Data User" does not apply to customers on Magenta MAX, a new customer choice we are offering as we explore the expanding capacity of our 5G network, or on a small number of T-Mobile-branded business and government-oriented plans, which are not subject to a threshold. [105]

96. For instance, receiving traffic profiles over said network resource for said plurality of devices is implemented in the access network of the T-Mobile Network.[106]

[104] *Id.*
[105] *Id.*
[106] *See, e.g.,* TS 23.203 at 21, 31, 46, 75.

It shall be possible with the PCC architecture, in real-time, to monitor the overall amount of resources that are consumed by a user and to control usage independently from charging mechanisms, the so-called usage monitoring control.

It shall be possible for the PCC architecture to provide application awareness even when there is no explicit service level signalling.

The PCC architecture shall support making policy decisions based on subscriber spending limits.

The PCC architecture shall support making policy decisions based on RAN user plane congestion status.

The PCC architecture shall support making policy decisions for multi-access IP flow mobility solution described in TS 23.161 [43].

The PCC architecture shall support making policy decisions for (S)Gi-LAN traffic steering.

5.2.1 Rx reference point

The Rx reference point resides between the AF and the PCRF.

NOTE 1: The AF may be a third party application server.

This reference point enables transport of application level session information from AF to PCRF. Such information includes, but is not limited to:

- IP filter information to identify the service data flow for policy control and/or differentiated charging;
- Media/application bandwidth requirements for QoS control.
- In addition, for sponsored data connectivity:
  - the sponsor's identification,
  - optionally, a usage threshold and whether the PCRF reports these events to the AF,
  - information identifying the application service provider and application (e.g. SDFs, application identifier, etc.).

The Rx reference point enables the AF subscription to notifications on IP-CAN bearer level events (e.g. signalling path status of AF session) in the IP-CAN.

In order to mitigate RAN user plane congestion, the Rx reference point enables transport of the following information from the PCRF to the AF:

- Re-try interval, which indicates when service delivery may be retried on Rx.

NOTE 2: Additionally, existing bandwidth limitation parameters on Rx interface during the Rx session establishment are available in order to mitigate RAN user plane congestion.

The SPR may provide the following policy information related to an ASP (see clause 6.1.16):

- The ASP identifier;
- A transfer policy together with a reference ID, the volume of data to be transferred per UE, the expected amount of UEs and the network area information.

The AF, if involved, may provide the following application session related information, e.g. based on SIP and SDP:

- Subscriber Identifier;
- IP address of the UE;
- Media Type;
- Media Format, e.g. media format sub-field of the media announcement and all other parameter information (a= lines) associated with the media format;
- Bandwidth;
- Sponsored data connectivity information (see clause 5.2.1);
- Flow description, e.g. source and destination IP address and port numbers and the protocol;
- AF application identifier;
- AF Communication Service Identifier (e.g. IMS Communication Service Identifier), UE provided via AF;
- AF Application Event Identifier;
- AF Record Information;
- Flow status (for gating decision);
- Priority indicator, which may be used by the PCRF to guarantee service for an application session of a higher relative priority;

NOTE 8: The AF Priority information represents session/application priority and is separate from the MPS EPS Priority indicator.

97. The Accused Instrumentalities manage said network resource according to said service profile and said billing profile if said network resource is fully utilized by said traffic profiles. For example, on information and belief, the shared network resource (e.g., a cell tower) will deliver data according to the service profile and billing profile—which depends on, in part, the customer's priority and whether the resource is congested.

Additionally, we prioritize network data by plan and brand to deliver a range of customer choice points at great values. Data for customers on most T-Mobile-branded plans (and for customers on Sprint-branded plans while using the T-Mobile network), is prioritized before the data of customers on Essentials plans and Metro by T-Mobile or Assurance Wireless-branded plans. Mobile internet plans offered after December 12, 2020 with 30GB or more data per month, and Project 10Million and some other education-focused mobile internet plans, are prioritized next. The vast majority of customers on T-Mobile-branded, Sprint-branded, Metro by T-Mobile-branded, and Assurance Wireless-branded plans receive higher priority than the small fraction of customers who are Heavy Data Users on their rate plan, who are prioritized last on the network after exceeding the relevant threshold for the current billing cycle. T-Mobile Home Internet (available in select locations) customers receive the same network prioritization as Heavy Data Users, but should be less likely to experience congestion because the equipment is stationary and available in limited areas.

What is the impact of network prioritization?

As described in more detail below, customers may notice reduced speeds in comparison to customers with a higher priority during network congestion.

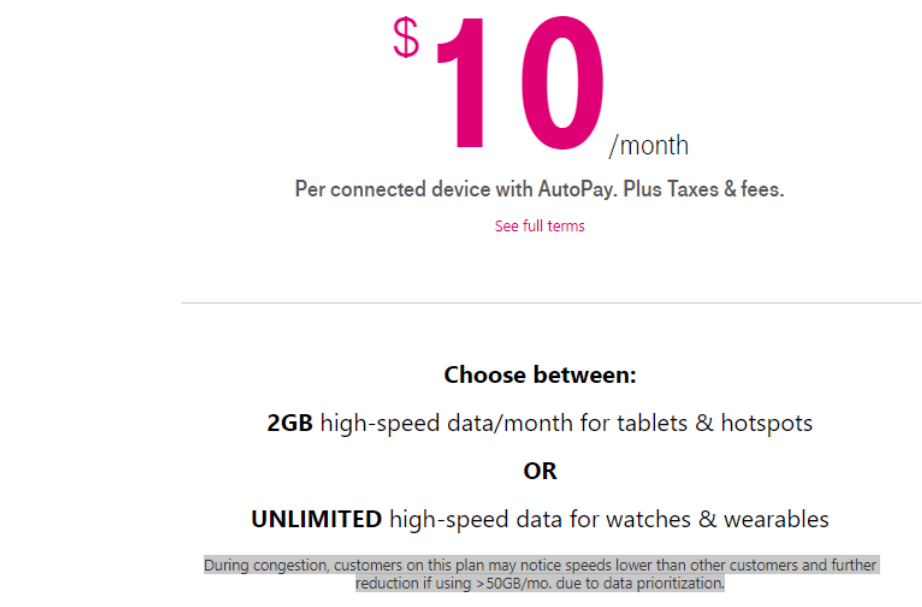
Customer devices also have varying speed capabilities and may connect to different networks depending on technology. Even within coverage areas and with broadband-capable devices, network changes, traffic volume, outages, technical limitations, signal strength, obstructions, weather, and other conditions may impact speeds and service availability. Your network experience and access may also be impacted if you fail to pay amounts you owe T-Mobile. 107

[107] *See, e.g.,* NM at 2; *see also* BSI at 3-4.

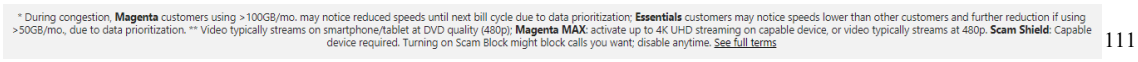
To provide the best possible experience for the most possible customers on their T-Mobile-branded plans, and to minimize capacity issues and degradation in network performance, we manage significant high-speed data usage on the vast majority of our plans through prioritization. Heavy Data Users (as defined by a customer's rate plan) will have their data usage prioritized below the data usage (including tethering) of other customers at times and at locations where there are competing customer demands for network resources, which may result in slower data speeds. At the start of the next bill cycle, the customer's usage status is reset, and this data traffic is no longer prioritized below other traffic. Customers who use data in violation of their Rate Plan terms or T-Mobile's Terms and Conditions may be excluded from this calculation. Data features that may not count against the high-speed data allotment for some plans, such as certain data associated with Music Freedom, or Binge On, still count towards all customers' usage for this calculation. Smartphone Mobile HotSpot (tethering) data is also included in this calculation. Data used for customer service applications, such as the T-Mobile My Account app does not count towards customers' usage for this calculation. To help avoid application of this practice, and reduce mobile data consumption, customers can set automatic updating of apps, podcasts and file downloads to run off Wi-Fi (making sure to connect to Wi-Fi to update applications and system periodically). [108]

We engineer our network to provide consistent high-speed data service, but at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds. In those cases, customers who choose certain rate plans may notice speeds lower than customers on other T-Mobile or Sprint branded rate plans, which are prioritized higher on our networks. Further, to provide the best possible on-device experience for the most possible customers on T-Mobile or Sprint branded plans and minimize capacity issues and degradation in network performance, we may, without advance notice, take any actions necessary to manage our network on a content-agnostic basis, including prioritizing all on-device data over Smartphone Mobile HotSpot (tethering) data and, for the vast majority of Rate Plans, further prioritizing the data usage of a small percentage of heavy data users (as defined in their Rate Plans), below that of all other customers in times and locations where there are competing customer demands for network resources, for the remainder of the billing cycle. This threshold number is periodically evaluated and may change over time. [109]

[108] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[109] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).



110



111

98. For instance, managing said network resource according to said service profile and said billing profile if said network resource is fully utilized by said traffic profiles is implemented in the access network of the T-Mobile Network.[112]

It shall be possible with the PCC architecture, in real-time, to monitor the overall amount of resources that are consumed by a user and to control usage independently from charging mechanisms, the so-called usage monitoring control.

It shall be possible for the PCC architecture to provide application awareness even when there is no explicit service level signalling.

The PCC architecture shall support making policy decisions based on subscriber spending limits.

The PCC architecture shall support making policy decisions based on RAN user plane congestion status.

The PCC architecture shall support making policy decisions for multi-access IP flow mobility solution described in TS 23.161 [43].

The PCC architecture shall support making policy decisions for (S)Gi-LAN traffic steering.

RAN user plane congestion: RAN user plane congestion occurs when the demand for RAN resources exceeds the available RAN capacity to deliver the user data for a prolonged period of time.

NOTE 1: Short-duration traffic bursts is a normal condition at any traffic load level, and is not considered to be RAN user plane congestion. Likewise, a high-level of utilization of RAN resources (based on operator configuration) is considered a normal mode of operation and might not be RAN user plane congestion.

[110] *See* https://www.t-mobile.com/cell-phone-plans/affordable-data-plans (last visited Nov. 1, 2021).
[111] *See, e.g.,* https://www.t-mobile.com/cell-phone-plans (last visited Nov. 1, 2021).
[112] *See, e.g.,* TS 23.203 at 18, 21, 27, 28, 60; *see also* 3GPP TS 23.401 at 82-83, 96-97.

4.6 RAN user plane congestion detection, reporting and mitigation

It shall be possible to transfer RAN user plane congestion information from the RAN to the Core Network in order to mitigate the congestion by measures selected by the PCRF and applied by the PCEF/TDF/AF. The detailed description of this functionality can be found in TS 23.401 [17] and TS 23.060 [12].

The PCRF can receive RAN User Plane Congestion Information from the RAN Congestion Awareness Function (RCAF).

The PCC architecture extends the architecture of an IP-CAN, where the Policy and Charging Enforcement Function is a functional entity in the Gateway node implementing the IP access to the PDN. The allocation of the Bearer Binding and Event Reporting Function is specific to each IP-CAN type and specified in the corresponding Annex.

The non-3GPP network relation to the PLMN is the same as defined in TS 23.402 [18].

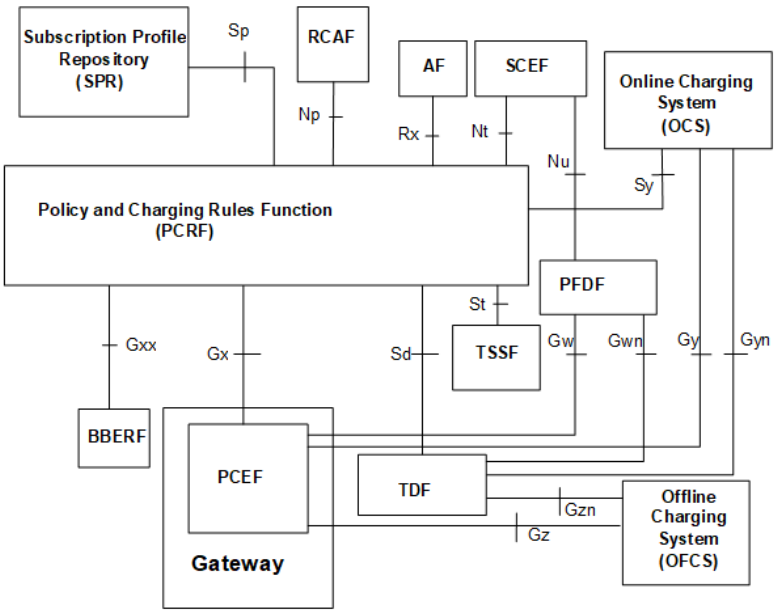


Figure 5.1-1: Overall PCC logical architecture (non-roaming) when SPR is used

6.1.15 Reporting of RAN user plane congestion information

6.1.15.1 General

RAN User Plane Congestion Information (RUCI) is reported to the PCRF to enable the PCRF to take the RAN user plane congestion status into account for policy decisions.

The RUCI includes the following information:

- The IMSI identifying the UE impacted by congestion;
- eNB identifier, ECGI or SAI identifying the eNB, E-UTRAN cell or Service Area, respectively, serving the UE.

NOTE: Whether in case of E-UTRAN the eNB identifier or the ECGI is included in the RUCI is up to operator configuration in the RCAF.

- APN for which congestion information is reported;
- Congestion level or an indication of the "no congestion" state.

6.1.15.2 Reporting restrictions

Depending on the operator's congestion mitigation policy, it may not be necessary to have RUCI reporting for all users. An operator shall be able to specify restrictions for RUCI reporting on a per UE per APN basis. Reporting restrictions can be used to activate or deactivate the RUCI reporting. Reporting restrictions can also be used to limit RUCI reporting. This is achieved by defining one or more sets of congestion levels, such that the RCAF indicates only that the UE experiences a congestion level within the given set but does not indicate the congestion level itself within that set. The sets must be non-overlapping such that a congestion level belongs to a single set only. Reporting restrictions can also be used to deactivate reporting of the congested cell's identifier as part of the RUCI.

NOTE: The support for the reporting restrictions is optional, and used only if both the PCRF and the RCAF support this feature.

6.1.15.3 UE mobility between RCAFs

A RCAF is assumed to serve a geographical area. A UE may move from the area handled by one RCAF to an area handled by a different RCAF. RCAF nodes cannot detect mobility by themselves: an RCAF node cannot differentiate whether a UE that is no longer affected by congestion has moved to another RCAF or not. When a given RCAF indicates no congestion to the PCRF for a given UE on the Np interface, this should be interpreted as no congestion experienced at the given RCAF which does not exclude that another RCAF may report that the same UE experiences congestion.

Consistent operation for UE mobility is ensured by applying the following rules at the PCRF.

- The PCRF maintains the RCAF which has last indicated that the UE is affected by congestion.
- When a new RCAF indicates that the UE is affected by congestion, the PCRF sends a message to the old RCAF to explicitly release context at the old RCAF.

4.3.24 RAN user plane congestion management function

4.3.24.1 General

The user plane congestion management function addresses how the system can effectively mitigate RAN user plane congestion in order to reduce the negative impact on the perceived service quality. The congestion mitigation measures include traffic prioritization, traffic reduction and limitation of traffic, and shall be able to manage user plane traffic across a range of variables including the user's subscription, the type of application, and the type of content. Congestion mitigation can be performed in the RAN or in the CN, or in a combined way both in the RAN and in the CN.

4.3.24.3 RAN user plane congestion mitigation in the CN

RAN user plane congestion mitigation in the CN uses RAN OAM information, collected by the RAN Congestion Awareness Function (RCAF), to detect congestion. The RAN Congestion Awareness Function is further described in clause 4.4.12. This functionality is applicable only in the case of UTRAN/E-UTRAN accesses.

NOTE 1: The criteria used for detection of RAN user plane congestion (including detection of congestion abatement) are outside the scope of 3GPP specifications.

NOTE 2: The interface to the RAN's OAM system is not standardized.

The RCAF can transfer RAN user plane congestion information (RUCI) to the PCRF over the Np reference point in order to mitigate the congestion by measures selected by the PCRF, as specified in TS 23.203 [6]. Decisions to apply congestion mitigation measures may take into account operator policies and subscriber information and all additional available IP-CAN session information.

4.4.12 RAN Congestion Awareness Function

The RAN Congestion Awareness Function (RCAF) is an element that provides RAN User Plane Congestion Information (RUCI) to the PCRF to enable the PCRF to take the RAN user plane congestion status into account for policy decisions.

The RCAF collects information related to user plane congestion from the RAN's OAM system based on which the RCAF determines the congestion level (and the identifier) of an eNodeB or E-UTRAN cell.

ETSI

3GPP TS 23.401 version 16.10.0 Release 16 97 ETSI TS 123 401 V16.10.0 (2021-04)

Via the Nq interface the RCAF determines the UEs served by a congested eNodeB or congested E-UTRAN cell and retrieves the APNs of the active PDN connections of those UEs. The decision whether the RCAF operates on eNodeB or E-UTRAN cell level is up to operator configuration.

Via the Np reference point, the RCAF sends the RUCI to the PCRFs serving the UEs' PDN connections.

99. On information and belief, the Accused Instrumentalities select at least one of said devices based on said prioritization list. In certain instances, the data rate for the selected device may be reduced. For example, the user(s) experiencing temporary lower data speeds are selected based on, in part, their data plan and how much data they used. Each data plan offered by TMO has a different data usage threshold that affects prioritization.

What data plans and pricing does T-Mobile offer?

T-Mobile offers mobile Broadband Internet Access Services for smartphones, basic phones, tablets, netbooks, USB modems, mobile hotspot devices and other wireless devices over our 2G, 3G, 4G, and 5G broadband networks. Your data plan may feature a designated allotment of high-speed data, after which your data speed may be reduced or your data access may be suspended for the remainder of the billing cycle. If your data plan features a designated allotment of high-speed data, certain uses of the network may not count against that allotment. [113]

[113] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

Many factors affect the speed and performance that customers experience, including the programs running on the device, proximity to a cell site, the capacity of the cell site, weather, the surrounding terrain, use inside a building or moving vehicle, radio frequency interference, how many other customers are attempting to use the same spectrum resources, any high-speed data allotment, the rate plans or features you select, and uses that affect your network prioritization, such as whether you are using Smartphone Mobile HotSpot (tethering) or if you are a Heavy Data User. For most T-Mobile-branded rate plans, a "Heavy Data User" is defined as a customer using more than 50GB of data (100GB of data for new Magenta plans activated beginning February 24, 2021) in a billing cycle. The threshold number is periodically evaluated across our rate plans and brands to manage network traffic and deliver a good experience to all customers while offering a range of customer choices. You can always check the threshold amount for a rate plan by speaking with a representative, review our rate cards or T-Mobile.com, or by logging in to my.t-mobile.com, or the T-Mobile app. The term "Heavy Data User" does not apply to customers on Magenta MAX, a new customer choice we are offering as we explore the expanding capacity of our 5G network, or on a small number of T-Mobile-branded business and government-oriented plans, which are not subject to a threshold.

How does T-Mobile manage the flow of data on its network?

We engineer our network to provide consistent high-speed data service, but at times and at locations where the number of customers using the network exceeds available network resources, customers will experience reduced data speeds. To provide the best possible experience for the most possible customers on their T-Mobile-branded plans, we implement network management practices on a content-agnostic basis, such as caching less data, prioritizing data usage of non-Heavy Data Users, and video optimization. These practices do not discriminate against offerings that might compete against those offered by T-Mobile or any T-Mobile affiliate on the basis of such competition. [114]

[114] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

Additionally, we prioritize network data by plan and brand to deliver a range of customer choice points at great values. Data for customers on most T-Mobile-branded plans (and for customers on Sprint-branded plans while using the T-Mobile network), is prioritized before the data of customers on Essentials plans and Metro by T-Mobile or Assurance Wireless-branded plans. Mobile internet plans offered after December 12, 2020 with 30GB or more data per month, and Project 10Million and some other education-focused mobile internet plans, are prioritized next. The vast majority of customers on T-Mobile-branded, Sprint-branded, Metro by T-Mobile-branded, and Assurance Wireless-branded plans receive higher priority than the small fraction of customers who are Heavy Data Users on their rate plan, who are prioritized last on the network after exceeding the relevant threshold for the current billing cycle. T-Mobile Home Internet (available in select locations) customers receive the same network prioritization as Heavy Data Users, but should be less likely to experience congestion because the equipment is stationary and available in limited areas.

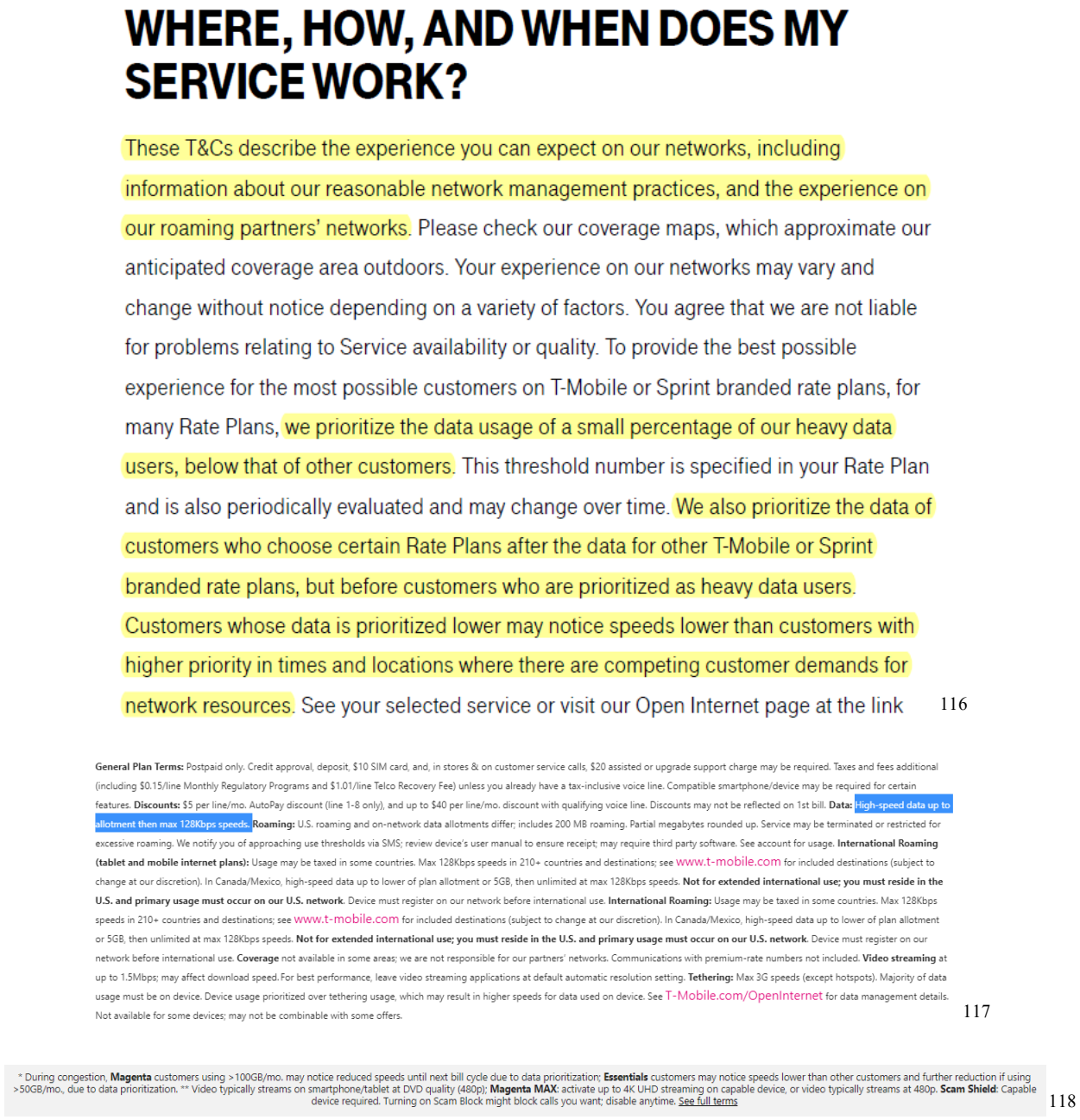
What is the impact of network prioritization?

As described in more detail below, customers may notice reduced speeds in comparison to customers with a higher priority during network congestion.

Customer devices also have varying speed capabilities and may connect to different networks depending on technology. Even within coverage areas and with broadband-capable devices, network changes, traffic volume, outages, technical limitations, signal strength, obstructions, weather, and other conditions may impact speeds and service availability. Your network experience and access may also be impacted if you fail to pay amounts you owe T-Mobile.

115

[115] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).



WHERE, HOW, AND WHEN DOES MY SERVICE WORK?

These T&Cs describe the experience you can expect on our networks, including information about our reasonable network management practices, and the experience on our roaming partners' networks. Please check our coverage maps, which approximate our anticipated coverage area outdoors. Your experience on our networks may vary and change without notice depending on a variety of factors. You agree that we are not liable for problems relating to Service availability or quality. To provide the best possible experience for the most possible customers on T-Mobile or Sprint branded rate plans, for many Rate Plans, we prioritize the data usage of a small percentage of our heavy data users, below that of other customers. This threshold number is specified in your Rate Plan and is also periodically evaluated and may change over time. We also prioritize the data of customers who choose certain Rate Plans after the data for other T-Mobile or Sprint branded rate plans, but before customers who are prioritized as heavy data users. Customers whose data is prioritized lower may notice speeds lower than customers with higher priority in times and locations where there are competing customer demands for network resources. See your selected service or visit our Open Internet page at the link 116

General Plan Terms: Postpaid only. Credit approval, deposit, $10 SIM card, and, in stores & on customer service calls, $20 assisted or upgrade support charge may be required. Taxes and fees additional (including $0.15/line Monthly Regulatory Programs and $1.01/line Telco Recovery Fee) unless you already have a tax-inclusive voice line. Compatible smartphone/device may be required for certain features. **Discounts:** $5 per line/mo. AutoPay discount (line 1-8 only), and up to $40 per line/mo. discount with qualifying voice line. Discounts may not be reflected on 1st bill. **Data:** High-speed data up to allotment then max 128Kbps speeds. **Roaming:** U.S. roaming and on-network data allotments differ; includes 200 MB roaming. Partial megabytes rounded up. Service may be terminated or restricted for excessive roaming. We notify you of approaching use thresholds via SMS; review device's user manual to ensure receipt; may require third party software. See account for usage. **International Roaming (tablet and mobile internet plans):** Usage may be taxed in some countries. Max 128Kbps speeds in 210+ countries and destinations; see www.t-mobile.com for included destinations (subject to change at our discretion). In Canada/Mexico, high-speed data up to lower of plan allotment or 5GB, then unlimited at max 128Kbps speeds. **Not for extended international use; you must reside in the U.S. and primary usage must occur on our U.S. network**. Device must register on our network before international use. **International Roaming:** Usage may be taxed in some countries. Max 128Kbps speeds in 210+ countries and destinations; see www.t-mobile.com for included destinations (subject to change at our discretion). In Canada/Mexico, high-speed data up to lower of plan allotment or 5GB, then unlimited at max 128Kbps speeds. **Not for extended international use; you must reside in the U.S. and primary usage must occur on our U.S. network**. Device must register on our network before international use. **Coverage** not available in some areas; we are not responsible for our partners' networks. Communications with premium-rate numbers not included. **Video streaming** at up to 1.5Mbps; may affect download speed. For best performance, leave video streaming applications at default automatic resolution setting. **Tethering:** Max 3G speeds (except hotspots). Majority of data usage must be on device. Device usage prioritized over tethering usage, which may result in higher speeds for data used on device. See T-Mobile.com/OpenInternet for data management details. Not available for some devices; may not be combinable with some offers. 117

* During congestion, **Magenta** customers using >100GB/mo. may notice reduced speeds until next bill cycle due to data prioritization; **Essentials** customers may notice speeds lower than other customers and further reduction if using >50GB/mo., due to data prioritization. ** Video typically streams on smartphone/tablet at DVD quality (480p); **Magenta MAX**: activate up to 4K UHD streaming on capable device, or video typically streams at 480p. **Scam Shield**: Capable device required. Turning on Scam Block might block calls you want; disable anytime. See full terms 118

100. On information and belief, the Accused Instrumentalities dynamically modify at least one of said service profile and said billing profile for said selected devices, if said network resource is under-utilized by said traffic profile or if said network resource would be over-utilized

116 https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
117 https://www.t-mobile.com/cell-phone-plans/affordable-data-plans (last visited Nov. 1, 2021).
118 *See, e.g.,* https://www.t-mobile.com/cell-phone-plans (last visited Nov. 1, 2021).

by said traffic profiles. For example, T-Mobile adjusts the data speeds when the resource is over utilized (e.g., during "network congestion"; "where there are competing customer demands for network resources"; or when "the network is heavily loaded in relation to available capacity") by the customer's data requests. [119]

> Additionally, we prioritize network data by plan and brand to deliver a range of customer choice points at great values. Data for customers on most T-Mobile-branded plans (and for customers on Sprint-branded plans while using the T-Mobile network), is prioritized before the data of customers on Essentials plans and Metro by T-Mobile or Assurance Wireless-branded plans. Mobile internet plans offered after December 12, 2020 with 30GB or more data per month, and Project 10Million and some other education-focused mobile internet plans, are prioritized next. The vast majority of customers on T-Mobile-branded, Sprint-branded, Metro by T-Mobile-branded, and Assurance Wireless-branded plans receive higher priority than the small fraction of customers who are Heavy Data Users on their rate plan, who are prioritized last on the network after exceeding the relevant threshold for the current billing cycle. T-Mobile Home Internet (available in select locations) customers receive the same network prioritization as Heavy Data Users, but should be less likely to experience congestion because the equipment is stationary and available in limited areas.
>
> **What is the impact of network prioritization?**
>
> As described in more detail below, customers may notice reduced speeds in comparison to customers with a higher priority during network congestion.
>
> Customer devices also have varying speed capabilities and may connect to different networks depending on technology. Even within coverage areas and with broadband-capable devices, network changes, traffic volume, outages, technical limitations, signal strength, obstructions, weather, and other conditions may impact speeds and service availability. Your network experience and access may also be impacted if you fail to pay amounts you owe T-Mobile. [120]

[119] *See, e.g.,* NM at 2; *see also* BSI at 3-4.
[120] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).

Where the network is lightly loaded in relation to available capacity, a customer whose data is prioritized higher than other traffic will notice little, if any, effect from having higher priority. This will be the case in the vast majority of times and locations. Customers may notice reduced speeds in comparison to customers with a higher priority during network congestion. At times and at locations where the network is heavily loaded in relation to available capacity, these customers will likely see significant reductions in data speeds, especially if they are engaged in data-intensive activities. Customers should be aware that these practices may occasionally result in speeds below those typically experienced on our 5G or LTE networks, including a greater likelihood of reduced speeds in the lower end of the speed ranges. Depending on the extent of network congestion, these customers may notice more frequent impacts to some video streaming, file downloads, and other high-bandwidth activities. T-Mobile constantly works to improve network performance and capacity, but there are physical and technical limits on how much capacity is available, and in constrained locations the frequency of heavy loading in relation to available capacity may be greater than in other locations. When network loading goes down or the customer moves to a location that is less heavily loaded in relation to available capacity, the customer's speeds will likely improve. [121]

WHERE, HOW, AND WHEN DOES MY SERVICE WORK?

These T&Cs describe the experience you can expect on our networks, including information about our reasonable network management practices, and the experience on our roaming partners' networks. Please check our coverage maps, which approximate our anticipated coverage area outdoors. Your experience on our networks may vary and change without notice depending on a variety of factors. You agree that we are not liable for problems relating to Service availability or quality. To provide the best possible experience for the most possible customers on T-Mobile or Sprint branded rate plans, for many Rate Plans, we prioritize the data usage of a small percentage of our heavy data users, below that of other customers. This threshold number is specified in your Rate Plan and is also periodically evaluated and may change over time. We also prioritize the data of customers who choose certain Rate Plans after the data for other T-Mobile or Sprint branded rate plans, but before customers who are prioritized as heavy data users. Customers whose data is prioritized lower may notice speeds lower than customers with higher priority in times and locations where there are competing customer demands for network resources. See your selected service or visit our Open Internet page at the link [122]

[121] https://www.t-mobile.com/responsibility/consumer-info/policies/internet-service (last visited Nov. 1, 2021).
[122] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).

Where the network is lightly loaded in relation to available capacity, a customer whose data is prioritized below other data traffic will notice little, if any, effect from having lower priority. This will be the case in the vast majority of times and locations. At times and locations where the network is heavily loaded in relation to available capacity, however, these customers will likely see significant reductions in data speeds, especially if they are engaged in data-intensive activities. Customers should be aware that these practices may occasionally result in speeds below those typically experienced on our 5G or LTE networks. We constantly work to improve network performance and capacity, but there are physical and technical limits on how much capacity is available, and in constrained locations the frequency of heavy loading in relation to available capacity may be greater than in other locations. When network loading goes down or the customer moves to a location that is less heavily loaded in relation to available capacity, the customer's speeds will likely improve. Visit www.T-Mobile.com/OpenInternet for details and for current data amount subject to this practice. [123]

101. For instance, dynamically modifying at least one of said service profile and said billing profile for said selected devices, if said network resource is under-utilized by said traffic profile or if said network resource would be over-utilized by said traffic profiles is implemented in the access network of the T-Mobile Network.[124]

dynamic PCC Rule: a PCC rule, for which the definition is provided to the PCEF via the Gx reference point.

policy control: The process whereby the PCRF indicates to the PCEF how to control the IP-CAN bearer. Policy control includes QoS control and/or gating control.

QoS class identifier (QCI): A scalar that is used as a reference to a specific packet forwarding behaviour (e.g. packet loss rate, packet delay budget) to be provided to a SDF. This may be implemented in the access network by the QCI referencing node specific parameters that control packet forwarding treatment (e.g. scheduling weights, admission thresholds, queue management thresholds, link layer protocol configuration, etc.), that have been pre-configured by the operator at a specific node(s) (e.g. eNodeB).

spending limit: A spending limit is the usage limit of a policy counter (e.g. monetary, volume, duration) that a subscriber is allowed to consume.

spending limit report: a notification, containing the current policy counter status generated from the OCS to the PCRF via the Sy reference point.

subscribed guaranteed bandwidth QoS: The per subscriber, authorized cumulative guaranteed bandwidth QoS which is provided by the SPR/UDR to the PCRF.

[123] https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[124] *See, e.g.,* TS 23.203 at 17-18, 20-21, 25, 31-32, 42-43, 45, 47, 69.

4 High level requirements

4.1 General requirements

It shall be possible for the PCC architecture to base decisions upon subscription information.

It shall be possible to apply policy and charging control to any kind of 3GPP IP-CAN and any non-3GPP accesses connected via EPC complying with TS 23.402 [18]. Applicability of PCC to other IP-CANs is not restricted. However, it shall be possible for the PCC architecture to base decisions upon the type of IP-CAN used (e.g. GPRS, etc.).

The policy and charging control shall be possible in the roaming and local breakout scenarios defined in TS 23.401 [17] and TS 23.402 [18].

The PCC architecture shall discard packets that don't match any service data flow of the active PCC rules. It shall also be possible for the operator to define PCC rules, with wild-carded service data flow filters, to allow for the passage and charging for packets that do not match any service data flow template of any other active PCC rules.

The PCC architecture shall allow the charging control to be applied on a per service data flow and on a per application basis, independent of the policy control.

The PCC architecture shall have a binding method that allows the unique association between service data flows and their IP-CAN bearer.

A single service data flow detection shall suffice for the purpose of both policy control and flow based charging.

A PCC rule may be predefined or dynamically provisioned at establishment and during the lifetime of an IP-CAN session. The latter is referred to as a dynamic PCC rule.

The number of real-time PCC interactions shall be minimized although not significantly increasing the overall system reaction time. This requires optimized interfaces between the PCC nodes.

It shall be possible to take a PCC rule into service, and out of service, at a specific time of day, without any PCC interaction at that point in time.

It shall be possible to take APN-related policy information into service, and out of service, once validity conditions specified as part of the APN-related policy information are fulfilled or not fulfilled anymore, respectively, without any PCC interaction at that point in time.

PCC shall be enabled on a per PDN basis (represented by an access point and the configured range of IP addresses) at the PCEF. It shall be possible for the operator to configure the PCC architecture to perform charging control, policy control or both for a PDN access.

PCC shall support roaming users.

The PCC architecture shall allow the resolution of conflicts which would otherwise cause a subscriber's Subscribed Guaranteed Bandwidth QoS to be exceeded.

The PCC architecture shall support topology hiding.

It should be possible to use PCC architecture for handling IMS-based emergency service.

It shall be possible with the PCC architecture, in real-time, to monitor the overall amount of resources that are consumed by a user and to control usage independently from charging mechanisms, the so-called usage monitoring control.

It shall be possible for the PCC architecture to provide application awareness even when there is no explicit service level signalling.

The PCC architecture shall support making policy decisions based on subscriber spending limits.

The PCC architecture shall support making policy decisions based on RAN user plane congestion status.

The PCC architecture shall support making policy decisions for multi-access IP flow mobility solution described in TS 23.161 [43].

The PCC architecture shall support making policy decisions for (S)Gi-LAN traffic steering.

4.4 Usage Monitoring Control

It shall be possible to apply usage monitoring for the accumulated usage of network resources on a per IP-CAN session and user basis. This capability is required for enforcing dynamic policy decisions based on the total network usage in real-time.

The PCRF that uses usage monitoring for making dynamic policy decisions shall set and send the applicable thresholds to the PCEF or TDF for monitoring. The usage monitoring thresholds shall be based either on time, or on volume. The PCRF may send both thresholds to the PCEF or TDF. The PCEF or TDF shall notify the PCRF when a threshold is reached and report the accumulated usage since the last report for usage monitoring. If both time and volume thresholds were provided to the PCEF or TDF, the accumulated usage since last report shall be reported when either the time or the volume thresholds are reached.

NOTE: There are reasons other than reaching a threshold that may cause the PCEF/TDF to report accumulated usage to the PCRF as defined in clauses 6.2.2.3 and 6.6.2.

The usage monitoring capability shall be possible for an individual or a group of service data flow(s), or for all traffic of an IP-CAN session in the PCEF. When usage monitoring for all traffic of an IP-CAN session is enabled, it shall be possible to exclude an individual SDF or a group of service data flow(s) from the usage monitoring for all traffic of this IP-CAN session. It shall be possible to activate usage monitoring both to service data flows associated with predefined PCC rules and dynamic PCC rules, including rules with deferred activation and/or deactivation times while those rules are active.

5.2.2 Gx reference point

The Gx reference point resides between the PCEF and the PCRF.

The Gx reference point enables the PCRF to have dynamic control over the PCC behaviour at a PCEF.

The Gx reference point enables the signalling of PCC decision, which governs the PCC behaviour, and it supports the following functions:

- Establishment of Gx session (corresponding to an IP-CAN session) by the PCEF;
- Request for PCC decision from the PCEF to the PCRF;
- Provision of IP flow mobility routing information from PCEF to PCRF; this applies only when IP flow mobility as defined in TS 23.261 [23] is supported;
- Provision of PCC decision from the PCRF to the PCEF;
- Reporting of the start and the stop of detected applications and transfer of service data flow descriptions and application instance identifiers for detected applications from the PCEF to the PCRF;
- Reporting of the accumulated usage of network resources on a per IP-CAN session basis from the PCEF to the PCRF;
- Delivery of IP-CAN session specific parameters from the PCEF to the PCRF or, if Gxx is deployed, from the PCRF to the PCEF per corresponding request;
- Negotiation of IP-CAN bearer establishment mode (UE-only or UE/NW);
- Termination of Gx session (corresponding to an IP-CAN session) by the PCEF or the PCRF.

NOTE: The PCRF decision to terminate a Gx session is based on operator policies. It should only occur in rare situations (e.g. the removal of a UE subscription) to avoid service interruption due to the termination of the IP-CAN session.

The information contained in a PCC rule is defined in clause 6.3.

6.1.4 Event Triggers

The Event Reporting Function (ERF) performs event trigger detection. When an event matching the event trigger occurs, the ERF shall report the occurred event to the PCRF. The Event Reporting Function is located either at the PCEF or, at the BBERF (if applicable) or, at the TDF for solicited application reporting (if applicable).

The event triggers define the conditions when the ERF shall interact again with PCRF after an IP-CAN session establishment. The event triggers that are required in procedures shall be unconditionally reported from the ERF, while the PCRF may subscribe to the remaining events. Whether an event trigger requires a subscription by the PCRF is indicated in column 4 in table 6.2 below.

The PCRF subscribes to new event triggers or remove armed event triggers unsolicited at any time or upon receiving a request from the AF, an event report or rule request from the ERF (PCEF or BBERF or TDF) using the Provision of PCC Rules procedure or the Provision of QoS Rules procedure (if applicable) or the Provision of ADC Rules procedure (if applicable). If the provided event triggers are associated with certain parameter values then the ERF shall include those values in the response back to the PCRF. Event triggers are associated with all rules at the ERF of an IP-CAN session (ERF is located at PCEF) or Gateway Control session (ERF is located at BBERF) or with Traffic Detection session (ERF is located in TDF). Event triggers determine when the ERF shall signal to the PCRF that an IP-CAN bearer has been modified. It shall be possible for the ERF to react on the event triggers listed in table 6.2.

Table 6.2: Event triggers

Event trigger	Description	Reported from	Condition for reporting
PLMN change	The UE has moved to another operators' domain.	PCEF	PCRF
QoS change	The QoS of the IP-CAN bearer has changed (note 3).	PCEF, BBERF	PCRF
QoS change exceeding authorization	The QoS of the IP-CAN bearer has changed and exceeds the authorized QoS (note 3).	PCEF	PCRF
Traffic mapping information change	The traffic mapping information of the IP-CAN bearer has changed (note 3).	PCEF	Always set
Resource modification request	A request for resource modification has been received by the BBERF/PCEF (note 6).	PCEF, BBERF	Always set
Routing information change	The IP flow mobility routing information has changed (when IP flow mobility as specified in TS 23.261 [23] applies) or the PCEF has received Routing Rules from the UE (when NBIFOM as specified in TS 23.161 [43] applies) (note 11) (note 16).	PCEF	Always set (note 15)
Change in type of IP-CAN (see note 1)	The access type of the IP-CAN bearer has changed.	PCEF	PCRF
Loss/recovery of transmission resources	The IP-CAN transmission resources are no longer usable/again usable.	PCEF, BBERF	PCRF
Location change (serving cell) (see note 10)	The serving cell of the UE has changed.	PCEF, BBERF	PCRF
Location change (serving area) (see notes 4 and 10)	The serving area of the UE has changed.	PCEF, BBERF	PCRF
Location change (serving CN node) (see notes 5 and 10)	The serving core network node of the UE has changed.	PCEF, BBERF	PCRF
Change of UE presence in Presence Reporting Area (see note 17)	The UE is entering/leaving a Presence Reporting Area	PCEF, BBERF	PCRF
Out of credit	Credit is no longer available.	PCEF, TDF	PCRF
Enforced PCC rule request	PCEF is performing a PCC rules request as instructed by the PCRF.	PCEF	PCRF
Enforced ADC rule request	TDF is performing an ADC rules request as instructed by the PCRF.	TDF	PCRF
UE IP address change (see note 9)	A UE IP address has been allocated/released	PCEF	Always set
Access Network Charging Correlation Information	Access Network Charging Correlation Information has been assigned.	PCEF	PCRF
Usage report (see note 7)	The IP-CAN session or the Monitoring key specific resources consumed by a UE either reached the threshold or needs to be reported for other reasons.	PCEF, TDF	PCRF

To activate usage monitoring, the PCRF shall set the Usage report event trigger and provide applicable usage thresholds for the Monitoring key(s) that are subject to usage monitoring in the requested node (PCEF or TDF, solicited application reporting). The PCRF shall not remove the Usage report event trigger while usage monitoring is still active in the PCEF/TDF.

If the Usage report event trigger is set and the volume or the time thresholds, earlier provided by the PCRF, are reached, the PCEF or TDF (whichever received the event trigger) shall report this event to the PCRF. If both volume and time thresholds were provided and the thresholds, for one of the measurements, are reached, the PCEF or TDF shall report this event to the PCRF and the accumulated usage since last report shall be reported for both measurements.

The enforcement of the authorized QoS of the IP-CAN bearer may lead to a downgrading or upgrading of the requested bearer QoS by the GW (PCEF) as part of a UE-initiated IP-CAN bearer establishment or modification. Alternatively, the enforcement of the authorised QoS may, depending on operator policy and network capabilities, lead to network initiated IP-CAN bearer establishment or modification. If the PCRF provides authorized QoS for both, the IP-CAN bearer and PCC rule(s), the enforcement of authorized QoS of the individual PCC rules shall take place first.

QoS authorization information may be dynamically provisioned by the PCRF or, if the conditions mentioned in clause 6.3.1 apply, it can be a predefined PCC rule in the PCEF. In case the PCRF provides PCC rules dynamically, authorised QoS information for the IP-CAN bearer (combined QoS) may be provided. For a predefined PCC rules within the PCEF the authorized QoS information shall take affect when the PCC rule is activated. The PCEF shall combine the different sets of authorized QoS information, i.e. the information received from the PCRF and the information corresponding to the predefined PCC rules. The PCRF shall know the authorized QoS information of the predefined PCC rules and shall take this information into account when activating them. This ensures that the combined authorized QoS of a set of PCC rules that are activated by the PCRF is within the limitations given by the subscription and operator policies regardless of whether these PCC rules are dynamically provided, predefined or both.

The PCRF shall decide how certain service/application traffic shall be treated in the PCEF and in the TDF, if applicable, and ensure that the PCEF user plane traffic mapping and treatment is in accordance with the user's subscription profile.

If Gxx applies, the PCRF shall provide QoS rules with identical service data flow templates as provided to the PCEF in the PCC rules. If the service data flow is tunnelled at the BBERF, the PCRF shall provide the BBERF with information received from the PCEF to enable the service data flow detection in the mobility tunnel at the BBERF. In case 2a, defined in clause 7.1, the PCRF may also provide to the BBERF the charging ID information received from the PCEF. If IP flow mobility as specified in TS 23.261 [23] applies, the PCRF shall, based on IP flow mobility routing rules received from the PCEF, provide the authorized QoS rules to the applicable BBERF as specified in clause 6.1.1.3.

The PCRF should for an IP-CAN session derive, from IP-CAN specific restrictions, operator policy and SPR data, the list of permitted QoS class identifiers and associated GBR and MBR limits for the IP-CAN session.

The PCRF may check that the service information provided by the AF is consistent with both the operator defined policy rules and the related subscription information as received from the SPR during IP-CAN session establishment before storing the service information. The service information shall be used to derive the QoS for the service. The PCRF may reject the request received from the AF when the service information is not consistent with either the related subscription information or the operator defined policy rules and as a result the PCRF shall indicate that this service information is not covered by the subscription information or by operator defined policy rules and may indicate, in the response to the AF, the service information that can be accepted by the PCRF (e.g. the acceptable bandwidth). In the absence of other policy control mechanisms outside the scope of PCC, it is recommended that the PCRF include this information in the response.

102. The Accused Instrumentalities repeat the recited claim limitations until said plurality of devices no longer continue to share said network resource.

Where the network is lightly loaded in relation to available capacity, a customer whose data is prioritized below other data traffic will notice little, if any, effect from having lower priority. This will be the case in the vast majority of times and locations. At times and locations where the network is heavily loaded in relation to available capacity, however, these customers will likely see significant reductions in data speeds, especially if they are engaged in data-intensive activities. Customers should be aware that these practices may occasionally result in speeds below those typically experienced on our 5G or LTE networks. We constantly work to improve network performance and capacity, but there are physical and technical limits on how much capacity is available, and in constrained locations the frequency of heavy loading in relation to available capacity may be greater than in other locations. When network loading goes down or the customer moves to a location that is less heavily loaded in relation to available capacity, the customer's speeds will likely improve. Visit www.T-Mobile.com/OpenInternet for details and for current data amount subject to this practice. [125]

103. For instance, repeating the recited the recited claim limitations until said plurality of devices no longer continue to share said network resource is implemented in the access network of the T-Mobile Network.[126]

6.2.1.2 Subscription information management in the PCRF

The PCRF may request subscription information from the SPR for an IP-CAN session at establishment or a gateway control session at establishment. The subscription information may include user profile configuration indicating whether application detection and control should be enabled. The PCRF should specify the subscriber ID and, if available, the PDN identifier in the request. The PCRF should retain the subscription information that is relevant for PCC decisions until the IP-CAN session termination and the gateway control session termination.

The PCRF may request notifications from the SPR on changes in the subscription information. Upon reception of a notification, the PCRF shall make the PCC decisions necessary to accommodate the change in the subscription and updates the PCEF and/or the BBERF and/or the TDF by providing the new PCC and/or QoS and/or ADC decisions if needed. The PCRF shall send a cancellation notification request to the SPR when the related subscription information has been deleted.

104. On information and belief, the Accused Instrumentalities clear said prioritization list when said plurality of devices are no longer sharing said network resource. [127]

[125] *See, e.g.,* https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).
[126] *See, e.g.,* TS 23.203 at 76.
[127] *See, e.g.,* https://www.t-mobile.com/responsibility/legal/terms-and-conditions (last visited Nov. 1, 2021).

Where the network is lightly loaded in relation to available capacity, a customer whose data is prioritized below other data traffic will notice little, if any, effect from having lower priority. This will be the case in the vast majority of times and locations. At times and locations where the network is heavily loaded in relation to available capacity, however, these customers will likely see significant reductions in data speeds, especially if they are engaged in data-intensive activities. Customers should be aware that these practices may occasionally result in speeds below those typically experienced on our 5G or LTE networks. We constantly work to improve network performance and capacity, but there are physical and technical limits on how much capacity is available, and in constrained locations the frequency of heavy loading in relation to available capacity may be greater than in other locations. When network loading goes down or the customer moves to a location that is less heavily loaded in relation to available capacity, the customer's speeds will likely improve. Visit www.T-Mobile.com/OpenInternet for details and for current data amount subject to this practice.

105. For instance, clearing said prioritization list when said plurality of devices are no longer sharing said network resource is implemented in the access network of the T-Mobile Network.[128]

6.2.1.2 Subscription information management in the PCRF

The PCRF may request subscription information from the SPR for an IP-CAN session at establishment or a gateway control session at establishment. The subscription information may include user profile configuration indicating whether application detection and control should be enabled. The PCRF should specify the subscriber ID and, if available, the PDN identifier in the request. The PCRF should retain the subscription information that is relevant for PCC decisions until the IP-CAN session termination and the gateway control session termination.

The PCRF may request notifications from the SPR on changes in the subscription information. Upon reception of a notification, the PCRF shall make the PCC decisions necessary to accommodate the change in the subscription and updates the PCEF and/or the BBERF and/or the TDF by providing the new PCC and/or QoS and/or ADC decisions if needed. The PCRF shall send a cancellation notification request to the SPR when the related subscription information has been deleted.

106. The acts of infringement by TMO have caused damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' wrongful acts in an amount subject to proof at trial. The infringement of the '813 Patent by TMO has damaged and will continue to damage Plaintiff.

JURY DEMAND

107. Plaintiff hereby demands a trial by jury on all issues.

[128] *See, e.g.,* TS 23.203 at 76.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff requests entry of judgment in their favor and against TMO as follows:

a. A declaration that TMO has infringed and is infringing one or more claims of the ’813 Patent, either literally or under the doctrine of equivalents;

b. An award of damages pursuant to 35 U.S.C. § 284 adequate to compensate TNS for TMO’s infringement of the ’813 Patent in an amount according to proof at trial (together with prejudgment and post-judgment interest), but no less than a reasonable royalty;

c. An award of costs and expenses pursuant to 35 U.S.C. § 284 or as otherwise permitted by law; and

d. Such other and further relief, whether legal, equitable, or otherwise, to which Plaintiff may be entitled or which this Court may order.

Dated: November 9, 2021

Respectfully submitted,

/s/ *Amir Alavi*

Amir Alavi (*Lead Attorney*)
Texas Bar No. 00793239
aalavi@azalaw.com
Masood Anjom
Texas Bar No. 24055107
manjom@ azalaw.com
Justin Chen
Texas Bar No. 24074024
jchen@azalaw.com
Jason McManis
Texas Bar No. 24088032
jmcmanis@azalaw.com
Weining Bai
Texas Bar No. 24101477
wbai@azalaw.com
AHMAD, ZAVITSANOS, ANAIPAKOS, ALAVI & MENSING P.C.
1221 McKinney Street, Suite 2500
Houston, TX 77010
Telephone: 713-655-1101
Facsimile: 713-655-0062

Michael Heim
Texas Bar No. 09380923
mheim@hpcllp.com
R. Allan Bullwinkel
Texas Bar No. 24064327
abullwinkel@hpcllp.com
J. Boone Baxter
Texas Bar No. 24087150
bbaxter@hpcllp.com
Christopher L. Limbacher
Texas Bar No. 24102097
climbacher@hpcllp.com
HEIM PAYNE & CHORUSH LLP
1111 Bagby St., Suite 2100
Houston, Texas 77002
Telephone: 713-221-2000
Facsimile: 713-221-2021

T. John Ward, Jr.
Texas Bar No. 00794818
jw@wsfirm.com

Andrea L. Fair
Texas Bar No. 24078488
andrea@wsfirm.com
WARD, SMITH & HILL, PLLC
P.O. Box 1231
Longview, Texas 75606-1231
Telephone: 903-757-6400
Facsimile: 903-757-2323

ATTORNEYS FOR PLAINTIFF TELECOM NETWORK SOLUTIONS, LLC