BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

In the Matter of the Joint Application of Sprint Communications Company L.P. (U-5112) and T-Mobile USA, Inc., a Delaware Corporation, For Approval of Transfer of Control of Sprint Communications Company L.P. Pursuant to California Public Utilities Code Section 854(a)	Application 18-07-011
In the Matter of the Joint Application of Sprint Spectrum L.P. (U-3062-C), and Virgin Mobile USA, L.P. (U-4327-C) and TMobile USA, Inc., a Delaware Corporation for Review of Wireless Transfer Notification per Commission Decision 95-10-032	Application No. 18-07-012

JOINT APPLICANTS' POST-HEARING OPENING BRIEF ON THE JOINT APPLICATION FOR REVIEW OF WIRELESS TRANSFER NOTIFICATION PER COMMISSION DECISION 95-10-032 (PUBLIC VERSION)

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SUMMARY OF JOINT APPLICANTS' RECOMMENDATIONS

Per Commission Rule of Practice and Procedure 13.11, the Joint Applicants respectfully recommend that the Commission complete its review of the Application for Review of the Wireless Transfer Notification without further delay.

BEFORE THE PUBLIC UTILITIES COMMISSION
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Pursuant to the procedural schedule established in the Amended Scoping Ruling issued on October 4, 2018, as further amended by ALJ Bemesderfer's March 25, 2019 Ruling resetting the briefing schedule, Sprint Spectrum L.P. (U-3062-C) and Virgin Mobile USA, L.P. (U-4327-C) (collectively referred to as the "Sprint Wireless CA Entities"),[1] and T-Mobile USA, Inc. ("T-Mobile USA")[2] (collectively referred to as the "Joint Applicants"), respectfully submit this joint post-hearing brief with respect to the pending Application for Review of the Wireless Transfer Notification (the "Wireless Notification") referenced in the above-captioned proceedings.[3]

[1] Sprint Spectrum L.P. and Virgin Mobile USA, L.P. are wholly owned subsidiaries of Sprint Corporation ("Sprint").

[2] T-Mobile USA, Inc. is a wholly owned subsidiary of T-Mobile US, Inc. ("T-Mobile").

[3] The post-hearing brief in A.18-07-011, the Joint Application for Approval of Transfer of Control of Sprint Communications Company L.P. ("Sprint Wireline") to T-Mobile USA, Inc., pursuant to California Public

I. EXECUTIVE SUMMARY

The record in this proceeding is clear: the proposed merger of T-Mobile and Sprint will allow New T-Mobile to deliver a host of compelling benefits to a broad and diverse group of consumers in California – LifeLine, low-income, rural, urban, ethnically diverse, postpaid, prepaid, and MVNOs – that could not be provided by either T-Mobile or Sprint on their own. The merger will put California at the forefront of the new world of 5G and will deliver a transformative leap forward in wireless speed and capacity that will enable dramatic improvements in existing services and open the door to a new wave of innovations and economic growth. Moreover, the merger will enable New T-Mobile to offer dramatically better service at lower prices, thereby empowering it to more effectively compete with AT&T, Verizon and the large cable companies. It will liberate all California consumers, including the significant number of low-income consumers that currently subscribe to these dominant players, with respect to how, when and where they are able to obtain their wireless and broadband services.

Those who oppose this merger would simply perpetuate the dominance of the two dominant wireless carriers, AT&T and Verizon (and the monopolistic cable companies). Those who favor the status quo are also ignoring the fact that, absent this merger, Sprint and T-Mobile would be increasingly *less* likely to provide meaningful competition to the dominant incumbent wireless providers, to the detriment of all California consumers.

As described in greater detail below, the benefits of this merger are significant and wide-ranging. Among other things, the merger will:

- Drive the investment of billions of dollars in California to build out and support New T-Mobile's 5G network. (*See, e.g.,* Sections IV.B and VII.C, *infra*.)

Utilities Code Section 854(a) (the "Wireline Approval Application"), is being filed concurrently with this post-hearing brief on the Wireless Notification.

- Accelerate the deployment of a robust, world-class 5G network with significantly increased capacity, higher speeds, and increased coverage for all consumers, well beyond that which either company could deliver on its own. For example, by 2024, New T-Mobile's network will provide:

    - Capacity - 3x the capacity of the combined standalone networks;
    - Speed - 99% of Californians with data rates greater than 100 Mbps; and
    - Coverage - 2x the geographic coverage for existing Sprint customers. (*See* Section V*, infra*.)

- Lower prices for consumers based on massive increases to capacity and reduced marginal costs. (*See* Section VI.B, *infra*.)

- Expand coverage and improve service quality for current Sprint LifeLine customers with the broader geographic footprint of New T-Mobile's network. (*See* Section V, *infra*.)

- Broaden the reach of Sprint's existing LifeLine program to low-income communities throughout rural California where it currently is not available. (*See* Section VII.A, *infra*.)

- Enhance service quality for millions of current Sprint California customers – immediately after the close and during the migration period – as they no longer have to rely on roaming and move to the New T-Mobile network for service in California. (*See* Section V.C, *infra*.)

- Increase competitive pressure on Verizon and AT&T, and ultimately drive down prices for all wireless consumers. (*See* Section VI, *infra*.)

- Offer consumers – for the first time – a bona fide alternative to traditional wired in-home broadband service that will help bridge the "digital divide" and save California consumers hundreds of millions of dollars annually by 2024. (*See* Section V.D, *infra*.)

- Create new jobs including approximately one thousand new jobs at a new Customer Experience Center located in California's Central Valley. (*See* Section VII.B, *infra*.)

- Open new stores across a broader geographic footprint to serve small towns and rural areas in California newly accessed by the New T-Mobile network. (*See* Sections VII.B and D, *infra*.)

- Strengthen the companies' already-robust emergency preparedness and network resiliency. (*See* Section VII.C, *infra*.)

- Bring award-winning customer care to all New T-Mobile customers. (*See* Section VII.D, *infra*.)

- Continue the companies' focus on promoting diversity in their workforce, customer base, and supplier base. (*See* Section VII.F, *infra*.)

- Facilitate Internet of Things ("IoT") product innovation with expanded choice and competition for services. (*See* Section V.F, *infra*.)

These benefits are not just the product of wishful thinking. They flow directly from the massive increase in capacity and network capabilities that are created by the combination of T-Mobile's and Sprint's complementary spectrum assets and cell sites and the spectral efficiency of 5G technology. (*See* Section IV.A, *infra*.) This combination will result in a multiplicative effect on New T-Mobile's capacity relative to the sum of the standalone networks and create a robust, broad and deep 5G network that neither company could deploy on its own. Thus, New T-Mobile will be able to deliver a transformative leap forward in wireless and provide Californians with a host of tangible benefits referenced above and described more fully below.

These extraordinary benefits will come without an increase in prices because the combination also generates significant synergies and efficiencies that result in lower marginal costs to produce this increased capacity. With more capacity at lower costs, New T-Mobile will have every incentive to lower prices to attract new customers and to maintain existing customers, validating and supporting New T-Mobile's real-world business plan as backed by the investment community.[4] In brief, the economics of the merger establish that it will promote – not reduce – competition on every level (including increasing pressure on rival service providers) and enhance consumer welfare as quality increases and prices decrease across the industry. (*See* Section VI, *infra*.) Moreover, as discussed below, the economic analysis of the merger confirms that low-income Californians, who often rely

[4] Hearing Tr. at 377:11-14 (Sievert Redirect) ("The last thing I'll say, Mr. Cary, is that this is a plan that's fully funded. That we've taken this plan to Wall Street and funded the financial envelope required to build.").

exclusively on their cell phones for access to the Internet, will benefit most from the merger. (*See* Section VI.D.2, *infra*.).

Consistent with the benefits embodied in the New T-Mobile network and its business plan T-Mobile has made a number of voluntary, enforceable commitments in the context of this proceeding, certain of which are memorialized in memoranda of understanding ("MOUs") it has entered into with intervenors, the California Emerging Technology Fund ("CETF") and the National Diversity Counsel ("NDC").[5] Those voluntary commitments are summarized below:

- *No Price Increase:* New T-Mobile will make available the same or better rate plans as those offered by T-Mobile or Sprint as of February 4, 2019, for three (3) years following the close of the Transaction.[6]

- *Continue LifeLine Program in California:* New T-Mobile will offer LifeLine indefinitely in California. LifeLine services will continue to be offered to eligible customers for free, and at other terms and conditions no less favorable to eligible consumers than those offered under Sprint's Assurance Wireless brand, including free handsets.

- *Increase LifeLine Adoptions:* New T-Mobile will spend at least $5 million ($1 million/year) to promote LifeLine adoption as it strives to add at least 332,500 ***new*** LifeLine / low income households for a total of no less than 675,000 enrolled LifeLine / low-income households at the end of 5 years.[7]

- *5G Network Buildout:* Within 6 years of the Transaction close date, New T-Mobile will spend at least **[Begin Highly Confidential-Attorneys Eyes Only (BHC-AEO)]** [redacted] **[End Highly Confidential -Attorneys Eyes only (EHC-AEO)]**[8] on

[5] *See* Hearing Ex. Jt Appl.-08C (Sylla Dixon Rebuttal Testimony) at Attachment B ("NDC MOU"); see also Joint Applicants and CETF Motion to Modify Positions in Proceeding (filed April 8, 2019) at Exhibit A ("CETF MOU"). Copies of each MOU are attached to this Post-Hearing Brief as Appendices 1 and 2, respectively.

The Joint Applicants note that independent of the MOUs, they are willing to voluntarily make the commitments identified above enforceable by the Commission in the context of this review upon the closure of the Wireless Notification and pending the close of the underlying Transaction. The references to the MOUs in this Post Hearing brief are for reference and clarity only.

[6] Section II, A., *infra* (description of Transaction).

[7] CETF MOU at 5.

[8] Unless specifically identified otherwise, all references to "Highly Confidential" information in the Joint Applicants' Opening Brief is to T-Mobile confidential information.

network capital expenditures to deploy 5G technology in California, with 5G technology deployed at 90% of the cell site locations in its network plan for California. Plus, coverage and speed commitments will be verified by site-specific speed tests and coverage maps.[9]

- *Create New Jobs / New Customer Experience Center in California:* New T-Mobile will create new jobs including approximately one thousand new jobs at a new Customer Experience Center located in California's Central Valley.

- *Maintain Jobs in California*: New T-Mobile will extend job offers with comparable pay and benefits to all California Sprint and T-Mobile retail employees. Moreover, it will commit that the total number of New T-Mobile employees in the State of California at three (3) years after the close of the Transaction will be equal to or greater than the total number of employees of Sprint and T-Mobile in the State of California.

- *Honor Wholesale Partner MVNO Agreements:* New T-Mobile will honor all of T-Mobile's and Sprint's existing MVNO contracts and will extend any MVNO agreement in effect at the close of the Transaction with either company to December 31, 2021. Any existing agreement that is effective beyond December 31, 2021, will continue for the full duration specified in the agreement.

- *Free High Speed Internet and Wireless Devices for Low-Income Children:* New T-Mobile will continue to expand T-Mobile's current EmpowerED Program and Sprint's 1Million Project to provide: (a) free high-speed Internet service and free Internet-enabled devices to an additional 52,000 low-income California families with K-12 school age children within 5 years of the close of the Transaction for a total of 112,000 families; and (b) $12.5 million in funding to assist participating districts and schools to provide digital literacy training for up to 25,000 participating students and their families through CETF's School2Home program.

- *Invest in Digital Literacy and Inclusion:* New T-Mobile will provide $22.5 million to support CETF's digital literacy and inclusion efforts and ongoing operations, including but not limited to funding grants to: (a) community-based organizations (CBOs), schools, and libraries to provide digital literacy training for up to 75,000 new LifeLine and low-income households enrolled by New T-Mobile; and (b) county and city governments to develop, adopt and implement digital inclusion policies and programs.[10]

- *Enhance Network Resiliency and Emergency Preparedness:* New T-Mobile will increase by 50% the number of Sprint's and T-Mobile's Cells on Light Trucks ("COLTs") and Cells on Wheels ("COWs") that are available for emergency

[9] CETF MOU at 9.

[10] CETF MOU at 10-11.

deployment, in addition to maintaining Sprint's existing inventory of COLTs and COWs and portable generators. New T-Mobile also will establish additional microwave and satellite links for emergency backhaul connectivity in California. Moreover, within 5 years, New T-Mobile will deploy robust 5G wireless services to 10 County Fairgrounds in rural counties, giving priority to the fairgrounds most frequently used to stage emergency response and recovery activities for wildfire, flooding, and other emergencies.

- *Increase Diversity and Inclusion Efforts:* The NDC MOU reflects New T-Mobile's commitment to work with NDC on a number of diversity initiatives to further expand and strengthen existing efforts to promote a more diverse and inclusive leadership, workforce, and supplier consortium; to make wireless more accessible to low-to-moderate income, minority, and rural communities via technical measures or via education and support; and to promote a community development and philanthropy program that is sustainable and impactful.

Despite all of these benefits and commitments, various parties – the California Public Advocates Office ("Cal PA"), Communications Workers of America ("CWA"), The Utility Reform Network ("TURN"), and the Greenlining Institute ("Greenlining") (these parties are collectively referred to as the "Intervenors") – continue to oppose the merger. The Intervenors' testimony can effectively be reduced to a few central assertions:

- **Assertion:** T-Mobile and Sprint standalone could build equivalent 5G networks without the merger, and the parties have therefore overstated the merger-specific benefits of the Transaction.
    - **Response:** Wrong. Sprint and T-Mobile lack the necessary type of spectrum, cell sites, and resources to deploy a similarly broad and deep 5G network as New T-Mobile.
- **Assertion:** The combination of the third- and fourth-largest wireless carriers would reduce competition.
    - **Response:** No, competition will increase. The combination will bring new intensity to competition in wireless services, as New T-Mobile will be equipped to go toe-to-toe with entrenched competitors AT&T and Verizon using its superior network. New T-Mobile will have every incentive to lower prices to attract customers and monetize its massive new capacity and reduced costs, rather than letting it sit empty. Indeed, the merger NOT happening would simply serve to further entrench the Big 2 wireless carriers and Big Cable.
- **Assertion:** New T-Mobile could abandon low-income customers by raising prices.

- **Response:** Won't happen. With lower marginal costs and increased network capacity, New T-Mobile will have every incentive to keep prices competitive. To provide even further assurance, New T-Mobile has committed not to raise any prices for any customers for the next three years (regardless of whether they are low-income) and is otherwise committed to providing LifeLine for free in California.

- **Assertion:** The merger will lead to massive job losses in California.

  - **Response:** Not true. Integrating the two networks and servicing the larger customer base will require adding jobs, not reducing them. To provide even further assurance, New T-Mobile has committed to offer all Sprint and T-Mobile retail employees comparable jobs in California, to build a new Customer Experience Center in the Central Valley that alone will create approximately 1,000 new jobs in the state, and to ensure no net job losses.

In sum, the benefits of the merger for California are clear and the Joint Applicants respectfully urge that the Commission has sufficient information to conclude its review of the Wireless Notification and otherwise close this docket without further delay.[11]

II. FACTUAL AND PROCEDURAL BACKGROUND

A. The Transaction

The Transaction will be accomplished pursuant to the Business Combination Agreement between T-Mobile US, Inc. (T-Mobile USA's direct 100 percent parent), and Sprint Corporation, dated April 29, 2018,[12] by which Sprint, and all of Sprint's subsidiaries – including the Sprint Wireless CA Entities – will become wholly owned indirect subsidiaries of T-Mobile (the "Transaction").[13]

In California, the Transaction contemplates a straightforward, parent-level transfer of control of the Sprint Wireless CA Entities. Thus, the Sprint Wireless CA Entities, currently wholly-owned

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[11] See Joint Applicants' Post-hearing Brief in the Wireline Approval Application filed concurrently with this brief.

[12] A copy of the Business Combination Agreement can be found at: https://www.sec.gov/Archives/edgar/data/101830/000110465918028087/a18-12444_1ex2d1.htm.

[13] Hearing Ex. Jt Appl. 2-C ("Sievert Rebuttal Testimony") at 10:3-10.

subsidiaries of Sprint, will become wholly-owned indirect subsidiaries of T-Mobile USA but will otherwise continue to exist as separate, certificated carriers with no change in operational structure. The Wireless Notification, as well as the Public Interest Statement ("PIS") submitted on June 18, 2018, by T-Mobile and Sprint to the Federal Communications Commission ("FCC"),[14] describes the Transaction in greater detail.

1. T-Mobile

T-Mobile USA is a Delaware corporation that is wholly owned by T-Mobile. Through its owned and operated retail stores, third-party distributors, and its websites, T-Mobile provides wireless voice and data services, as well as a wide selection of wireless devices and accessories, to customers in the United States, Puerto Rico, and the U.S. Virgin Islands.

T-Mobile is a publicly traded Delaware corporation headquartered in Bellevue, Washington. Neither T-Mobile nor T-Mobile USA directly offers services in California and neither is certificated by this Commission.[15]

2. Sprint

Sprint is a publicly traded Delaware corporation with headquarters in Overland Park, Kansas.[16]

Sprint's wholly owned subsidiaries that provide wireless services in California are Sprint Spectrum L.P. and Virgin Mobile USA, L.P. Sprint Spectrum L.P. provides a comprehensive range

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[14] *See* Wireless Notification at Section V; *see also* Sievert Rebuttal Testimony, Attachment A (Public Interest Statement ("PIS") and supporting declarations).

[15] T-Mobile does, however, have two indirect subsidiaries that are registered wireless providers in the state, T-Mobile West, LLC (U-3056-C), and MetroPCS California, LLC (U-3079-C), that provide innovative wireless-service options to millions of California consumers. The Transaction, however, does not involve a transfer of control of either entity.

[16] *See* SoftBank Group, *Group Structure*, https://www.softbank.jp/en/corp/irinfo/about/outline/ (last visited June 16, 2018).

of prepaid and postpaid intrastate, interstate, and international wireless telecommunications and information/data services in California pursuant to its wireless registration with the Commission and the authority and licenses granted by the FCC. These services are provided under the commonly recognized trade names of "Sprint" and "Boost Mobile" or "Boost." Sprint and Boost also provide wireless devices and accessories in connection with these services.

Virgin Mobile provides a comprehensive range of prepaid intrastate, interstate, and international wireless telecommunications and information/data services in California pursuant to its wireless registration with the Commission and the authority and licenses granted by the FCC. Virgin Mobile also provides prepaid wireless LifeLine services in California pursuant to its designation as an eligible telecommunications carrier.[17] These LifeLine services are provided under the commonly recognized trade name of "Assurance Wireless Brought to You by Virgin Mobile" ("Assurance Wireless"). Assurance Wireless is the facilities-based carrier with the largest number of wireless LifeLine customers in California.

B. Procedural History

This proceeding was initiated through the Wireless Notification filed on July 13, 2018, by the Sprint Wireless CA Entities and T-Mobile USA.[18] Protests were submitted on August 16, 2018, by Cal PA and jointly by TURN and Greenlining. Joint Applicants provided a reply to the protests on August 27, 2018. On September 11, 2018, the assigned ALJ issued a ruling consolidating the Wireless Notification proceeding with the Wireline Approval Application proceeding.

Subsequent and separate motions for party status filed by Media Alliance, CWA, CETF, and DISH Network Corporation ("DISH") have since been granted.

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[17] *See* Commission Resolution (R.) 17284 (May 5, 2011), authority provided in Decision (D.) 14-01-036, and advice letters submitted in compliance with D.14-01-036 and numerous subsequent Commission decisions.

[18] On July 13, 2018, Sprint Wireline and T-Mobile USA filed the "Wireline Approval Application."

On September 12, 2018, Cal PA and Joint Applicants filed pre-hearing conference ("PHC") statements. A PHC took place in this proceeding on September 13, 2018. Following the PHC, an initial Scoping Memo was issued on September 28, 2018. On October 4, 2018, an Amended Scoping Memo was issued replacing the prior Scoping Memo in its entirety. The Amended Scoping Memo states that the fundamental issue presented by these applications is whether the proposed transaction is in the public interest of the residents of California and notes that the "scope of this proceeding includes all issues that are relevant to evaluating the proposed merger's impacts on California consumers and determining whether any conditions should be placed upon the merged entity."[19] To that end, the Amended Scoping Memo identified various issues and factors to be considered in the course of this proceeding.[20]

On December 10, 2018, the Commission hosted a technical workshop open to the public. The workshop had two panels: (i) a panel of economists which discussed the impact of the merger on competition; and (ii) a second panel which focused on the impact of the merger on low-income consumers.

From January 15, 2019, to January 18, 2019, transcribed public participation hearings ("PPHs") took place at three different locations in or near Joint Applicants' service territory: Fresno, Los Angeles, and San Diego. During the PPHs, various attendees representing a range of interests and constituencies expressed support for the merger including non-profit groups serving diverse communities, local government officials, diverse chambers of commerce, small business owners, high school and community college representatives, home care workers, and both T-Mobile and Metro

[19] Amended Scoping Memo at 2. As discussed in greater detail in Section III, *infra*, the Commission may not impose conditions upon the merged entity.

[20] The Joint Applicants note that the Executive Summary of their rebuttal testimony identifies where each of the issues and factors identified in the Amended Scoping Memo are addressed in their rebuttal testimony. *See* Hearing Ex. Jt Appl. 1.

employees. Most of the opposition came from CWA and other labor organization-affiliated speakers.[21]

Cal PA, CWA, CETF, and Greenlining submitted nine sets of testimony from eight different witnesses on January 7, 2019. Joint Applicants submitted rebuttal testimony from 10 different witnesses on January 29, 2019. Four days of hearings were held in this matter on February 5, 6, 7, and 8.

As noted above, the T-Mobile has entered into two MOUs in the course of this proceeding. The first MOU was with NDC and was executed on January 29, 2019. It was included as Attachment A to the Rebuttal Testimony of Ms. Sylla Dixon submitted on that same date. The second MOU was entered into with CETF on March 22, 2019; some six weeks after the hearing concluded. That MOU was attached as an exhibit to the Joint Applicants and CETF Motion to Revise Position filed with the Commission on April 8, 2019.[22]

The remainder of the procedural schedule, as amended by ALJ Bemesderfer's February 26, 2019 order, and then again by ALJ Bemesderfer's March 25, 2019 ruling, calls for opening briefs to now be filed on April 26, 2019, with reply briefs to follow on May 10, 2019. A proposed decision is still expected to be issued by the 2nd Quarter of 2019.

[21] Joint Applicants estimate that about 100 people attended the first PPH in Fresno, with 28 expressing support, 11 expressing opposition, and 1 stating a neutral position. At the second PPH in Los Angeles, Joint Applicants estimate that more than 220 people attended, with 50 expressing support, 22 expressing opposition, and 2 stating a neutral position. Finally, at the last PPH in San Diego, Joint Applicants estimate that about 130 people attended, with 28 expressing support and 19 expressing opposition.

[22] *See* note 5, *supra*.

To that end, the Joint Applicants note that the 180-day "shot clock" governing the Federal Communications Commission's review of the merger is set to expire on June 1.[23] Moreover, 16 of 19 state regulatory commissions have already concluded their review of transactions associated with the merger.

The Commission's timely completion of review will help ensure that Californians benefit from the broad range of benefits documented in the extensive evidence Joint Applicants have submitted to the Commission. Conversely, any action that could delay consummation of the merger would slow the build-out of New T-Mobile's robust, 5G network in California. This would delay New T-Mobile's ability to provide all consumers in California, including low-income and LifeLine, with increased speeds and expanded coverage, lower prices, and a bona fide wireless alternative to traditional in-home broadband service. Moreover, delay would harm the Joint Applicants' respective businesses – for example, complicating their ability to move forward with long-term planning, either jointly or separately, as long as regulatory review remains pending.

In light of these considerations, the Joint Applicants respectfully urge the Commission to continue to take all appropriate steps to ensure issuance of a final decision and the conclusion of the Commission's review expeditiously, and as early within the second quarter of 2019 as possible so that it coincides with the FCC's anticipated schedule.

[23] *See* Public Notice, FCC (Mar. 7, 2019), https://docs.fcc.gov/public/attachments/DA-19-161A1.pdf (noting that, absent new developments, the "180-day clock will resume on April 4, 2019, at day 122"); T-Mobile and Sprint, WT Docket 18-197, FCC, https://www.fcc.gov/transaction/t-mobile-sprint (visited Mar. 7, 2019).

III. THE WIRELESS NOTIFICATION IS SUBJECT TO COMMISSION REVIEW AND NOT APPROVAL UNDER PUBLIC UTILITIES CODE SECTION 854

The Wireless Notification does not require prior approval from the Commission.[24] Instead, the Wireless Notification was submitted to the Commission so that the Commission could review the proposed transfer of the Sprint Wireless CA Entities. This approach is consistent with both longstanding Commission precedent and the limitations on the Commission's authority over *wireless* carriers under federal law. As the evidence confirms, the Joint Applicants have submitted substantial information in the course of this proceeding and have established that the wireless transfers are consistent with, and otherwise serve, the public interest on all fronts. The Joint Applicants submit that it is now time to conclude this review.

In 1995, the Commission issued Decision 95-10-032 (the "*1995 Decision*"),[25] which interpreted the Commission's authority with respect to wireless transfers in the wake of Congress's enactment of Section 332(c)(3)(A) of the federal Communications Act of 1934.[26] In that *1995 Decision*, the Commission expressly *exempted* wireless carriers from seeking "preapproval" of any transfer of control of a wireless provider or its assets under Public Utilities Code Sections 851-856.[27] The Commission stated that in certain limited circumstances, including the transfer of control of a

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[24] In contrast, the Wireline Approval Application is submitted for the Commission's approval pursuant to California Public Utilities Code § 854(a), which provides that "[n]o person or corporation, whether or not organized under the laws of this state, shall merge, acquire, or control either directly or indirectly any public utility organized and doing business in this state without first securing authorization to do so from the commission." In their Opening Brief in Support of the Wireline Approval Application, the Joint Applicants have explained why the Wireline Approval Application readily satisfies the well-established standard under § 854(a) and should be approved forthwith. *See* Wireline Opening Brief.

[25] *Investigation on the Commission's Own Motion Into Mobile Telephone Service and Wireless Communications*, D. 95-10-032, 1995 Cal. PUC LEXIS 888 (Oct. 18, 1995).

[26] 47 U.S.C. § 332(c)(3)(A).

[27] *1995 Decision* at *45 ("All CMRS providers are *hereby exempted* from compliance with the provisions of Public Utilities (PU) Code §§ 816-830 regarding the issuance of securities and §§ 851-856 relating to transfers of ownership and transfer or encumbrance of CMRS assets…") (Ordering Paragraph 3) (emphasis added)).

wireless provider like the one here, carriers should provide advance notice to the Commission.[28] The Commission reaffirmed this precedent in 2005, noting that "in [the *1995 Decision*], Ordering Paragraph (OP) 3, the Commission held that § 854 should not apply to wireless entities."[29] This is the precedent under which this Transaction is being reviewed. Moreover, the Joint Applicants submit that exempting wireless transactions from the approval requirement under Section 854 is consistent with and otherwise required by federal law, which prohibits the Commission from (among other things) regulating the market entry and rates of wireless providers.[30]

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[28] *Id.* at *30-31. The Commission held that "where transfer of ownership of a CMRS entity is contemplated," *id.* at *30, the wireless provider is required to *provide advance notice* to the Commission. *Id.* at *46 (Ordering Paragraph 3(c)); *see also id.* at *31 ("[T]he CMRS provider shall notify [Commission staff] 30 days in advance of the proposed transaction."). The Wireless Notification here provided such notice to the Commission.

[29] Joint Application of Lynch Telephone Corp. XI, D.05-05-014, 2005 Cal. PUC LEXIS 176, at *6 n.7 ("*2005 Decision*"). While the *1995 Decision* and *2005 Decision* acknowledge that the Commission does not require prior approval for wireless transfers, the *1995 Decision* erroneously suggests that this approach lies within the Commission's discretion and that federal law does not foreclose the Commission from requiring approval. *See 1995 Decision* at *22, 25, 31-32, 41. As discussed below in the following footnote, federal law prohibits the Commission from requiring prior approval for a wireless transfer. Furthermore, fundamental principles of due process and "elementary fairness" would preclude the Commission acting inconsistent with Commission precedent and thereby imposing new regulatory requirements. *See*, *e.g.*, *FCC v. Fox Television Stations, Inc.*, 567 U.S. 239, 253 (2012) ("A fundamental principle in our legal system is that laws which regulate persons or entities must give fair notice of conduct that is forbidden or required.").

[30] For example, the federal Communications Act provision that gave rise to the *1995 Decision* states that "*no State* or local government *shall have any authority to regulate the entry of* or the rates charged by *any commercial mobile service* …." 47 U.S.C. § 332(c)(3)(A) (emphasis added). The Ninth Circuit has confirmed that § 332(c)(3)(A) preempts states from reexamining or second-guessing wireless merger "determination[s] already made by the FCC," including "the public benefit of the merger." *Shroyer v. New Cingular Wireless Servs., Inc*., 622 F.3d 1035, 1041, 1044 (9th Cir. 2010); *see also Telesaurus VPC, LLC v. Power*, 623 F.3d 998, 1008-09 (9th Cir. 2010). Courts have also made clear that § 332(c)(3)(A) preempts state regulation that "obstruct[s] or burden[s] a wireless service provider's ability to provide a network of wireless service coverage." *Johnson v. Am. Towers, LLC*, 781 F.3d 693, 705-06 (4th Cir. 2015) (citations omitted). While § 332(c)(3)(A) does not prohibit states from regulating "other terms and conditions" of wireless service, the Commission may not impinge on "the very areas reserved to the FCC: the modes and conditions" under which a wireless carrier may "offer[] service" in a particular market such as California. *Bastien v. AT&T Wireless Servs., Inc.*, 205 F.3d 983, 989 (7th Cir. 2000); *see also Havens v. Mobex Network Servs., LLC*, 2009 WL 3067046, at *10-14 (Cal. App. 1st Dist. Sept. 25, 2009) (unpublished). Although the *1995 Deci*sion purports to maintain jurisdiction over transfers of control (see discussion at *22), federal precedent makes it clear that state market-entry regulation – such as a state PUC's effort to bar a wireless transfer either directly or indirectly – is prohibited by federal law. Indeed, any form of state regulation that "ha[s] the effect of

While the Commission does not and may not require prior *approval* for a wireless transfer of control – either directly or indirectly (e.g., by mandating conditions) – the Commission may *review* the Wireless Notification here, which is what it has done based on an exhaustive record.[31] As discussed more thoroughly below, and in light of the extensive evidence presented in this proceeding, the Joint Applicants submit that the Commission has sufficient information to determine that its review is complete. No further action or approval is warranted, nor is approval permitted or required.

IV. THE MERGER ENABLES THE NEW T-MOBILE TO CREATE A SUPERIOR 5G NETWORK THAT WILL BRING MASSIVE CAPACITY, BROAD COVERAGE, AND UNPARALELLED DATA SPEEDS TO CALIFORNIA

The future of wireless is 5G.[32] 5G technology will allow consumers to enjoy higher speeds, greater capacity, lower prices, and a plethora of new products and services including smart homes and

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prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service" is prohibited. 47 U.S.C. § 253(a); *see Accelerating Wireless Broadband Deployment By Removing Barriers to Infrastructure Investment*, 2018 WL 4678555, *12, ¶ 35 (FCC Sept. 27, 2018). Finally, principles of conflict preemption also preclude the Commission from second-guessing a merger approved by the FCC. *See, e.g.*, *Farina v. Nokia, Inc.*, 625 F.3d 97, 123-26 (3d Cir. 2010); *Geier v. Am. Honda Motor Co.*, 529 U.S. 861, 875-81 (2000).

[31] This review provided the Commission the opportunity to, for example, share its analyses with the FCC. *Cf.* Comments of the California Public Utilities Commission in Matter of Application of T-Mobile US, Inc., and Sprint Corporation for Consent to Transfer and Control of Licenses and Authorizations, WT Docket No. 18-197 (filed Aug. 27, 2018) at 3 (stating that the Commission "plans to share its data [developed during the present review] with the FCC").

[32] 5G stands for 5th Generation of mobile technologies. Standard bodies including the Third Generation Partnership Project ("3GPP") and the International Telecommunications Union ("ITU") are developing technical requirements for 5G. 5G follows previous generations of mobile technologies including 2G, which predominantly facilitated voice and SMS; 3G, which focused on web browsing; and 4G, which has brought higher speed data and video streaming to consumers. Compared to previous "G's" of mobile technologies, 5G will dramatically improve network efficiencies and address increasing capacity needs. In other words, it will transport a huge amount of data much faster than previous technologies. It will also enable a range of new services and applications. *See* Ericsson, *This is 5G*, https://www.ericsson.com/assets/local/newsroom/media-kits/5g/doc/ericsson_this-is-5g_pdf_v4.pdf (last visited Mar. 22, 2019); ITU, *5G - Fifth generation of mobile technologies*, https://www.youtube.com/watch?v=bR5BLbCL4no (last visited Mar. 22, 2019). *See also* Hearing Ex. Pub Adv-002C ("Selwyn Testimony") at 158 ("5G utilizes spectrum far more efficiently than any of the current transmission protocols."); *Spectrum Considerations for 5G*, CTIA (Apr. 2019), https://api.ctia.org/wp-content/uploads/2019/03/Spectrum-Considerations-for-5G.pdf ("5G is the future of wireless and it will deliver significant benefits to consumers and many sectors of the economy through the deployment of ultra-fast, highly reliable, scalable, and very low latency networks.").

buildings, virtual reality applications, remote medical surgery, industry automation, and smart farming. But whether, and to what degree, those benefits will actually be enjoyed by consumers depends entirely on whether his or her carrier's network can effectively deliver those benefits where the consumer uses his or her wireless device.

As T-Mobile's President and Chief Operating Officer Mike Sievert has testified, neither Sprint nor T-Mobile alone has the full complement of spectrum, sites, and resources that are necessary to build a robust, nationwide 5G network like the one contemplated by the merger.[33] For example, T-Mobile has the spectrum and sites to provide broad 5G geographic coverage with its 600 MHz spectrum, but it does not have the available mid-band spectrum required to deliver deep 5G capacity and ubiquitous high speeds to its customers. Sprint, on the other hand, has the ability to provide deep 5G capacity to its customers with its 2.5 GHz spectrum, but it does not have the low-band spectrum or sites that would allow it to provide broad geographic 5G coverage. In other words, Sprint would be able to offer relatively high 5G speeds and capacity to customers but only in limited geographic areas that are largely urban.

The proposed merger will allow the Joint Applicants to overcome these serious obstacles. Through the combination of T-Mobile's and Sprint's highly complementary spectrum and the deployment of the combined spectrum portfolio across the retained sites, New T-Mobile will have a network that is *broad* and *deep*. That network will allow the company to repurpose, or "refarm," more spectrum to 5G faster and thus deliver the full promise of robust 5G to consumers more quickly. As discussed below (see Section V.A), the merger will create massive capacity relative to what either of the standalones could achieve on their own or to the standalone capacities combined. This, in turn, will allow the New T-Mobile to create a new competitive dynamic in the wireless

[33] Sievert Rebuttal Testimony at 10:23-25.

industry as well as in related industries including in-home broadband. Armed with massive capacity, the New T-Mobile will be incented to drive down prices and increase the quality of service, which will put intense competitive pressure on Verizon and AT&T, to the benefit of all consumers in California.[34]

A. New T-Mobile Will Leverage a Unique Combination of Complementary Assets to Build the First World-Leading Nationwide 5G Network

New T-Mobile will leverage a unique combination of complementary assets to build a world-leading, nationwide 5G network which will massively increase the overall capacity of the new network and deliver dramatically improved speeds and user experiences to consumers relative to what the standalones could achieve. The "capacity" of a wireless network refers to how much data a network can handle in a given period of time. An increase in capacity means that more users can consume more data at the same time.[35] The basic formula for determining wireless network capacity is:[36]

$$Number\ of\ cell\ sites\ \times\ Spectrum\ (MHz) Deployed\ Per\ Site\ \times\ Spectral\ Efficiency = Capacity$$

As the testimony at the hearing[37] made clear, adding to any *one* of these three ingredients – cell sites, spectrum, spectral efficiency – multiplies capacity.[38] In fact, the Transaction will add to *all three*.

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[34] Sievert Rebuttal Testimony, Attachment A (Appx. C: Declaration of G. Michael Sievert ("Sievert PIS Declaration") ¶ 21 (TMUS-CPUC-CD-000212 to 000213).

[35] The "throughput" or the speed of a network (the amount of data moved from one part of the network to another in a given period of time) is largely a function of the network's capacity.

[36] Hearing Ex. Jt Appl. 3-C ("Ray Rebuttal Testimony") at 8:17-23.

[37] *See* Hearing Tr. at 465:28-466:12 (Ray Cross); Hearing Tr. 1102:24-1108:19 (Reed Cross).

[38] *See* Ray Rebuttal Testimony at 8:14-18; *see also* Sievert Rebuttal Testimony, Attachment B ("Joint Opposition") at 41 (TMUS-CPUC-PA-00001346). Cal PA has claimed – without any support or network analysis – that capturing 5G's benefits is largely a matter of using new equipment and a new standard. Deploying new 5G-enabled radios, which will allow improvements in spectral efficiency alone, is only one

The combination of Sprint and T-Mobile will enable New T-Mobile to: (1) utilize the complementary spectrum of both companies across cell sites; (2) access more cell sites relative to each of the standalone companies, thereby increasing network coverage and density; and (3) achieve higher spectral efficiencies even sooner from faster refarming of spectrum from LTE to 5G.

1. Spectrum

The proposed Transaction will uniquely enable New T-Mobile to deploy significant amounts of three complementary types of spectrum: 1) low-band spectrum (below 1 GHz); 2) mid-band spectrum (from 1 to 6 GHz); and 3) high-band spectrum (above 20 GHz, often referred to as millimeter wave band spectrum or mmWave). Low-band spectrum, like T-Mobile's 600 MHz spectrum, allows for better coverage indoors and can easily propagate over relatively large distances to provide broad coverage, which is particularly important in order to serve rural areas.[39] In addition, because broad coverage allows cell sites to be farther apart, these bands can support broad coverage without the need for such large capital expenditures that would make coverage uneconomic.[40] Mid-band spectrum, like Sprint's 2.5 GHz and 1900 MHz spectrum, has greater utility in denser suburban and urban areas because it creates excellent capacity notwithstanding that it does not propagate as far as low-band spectrum.[41] Finally, high-band, mmWave spectrum, which T-Mobile has in certain markets, enables extremely high capacity, but only over very short ranges and is therefore only

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necessary component of 5G deployment. It is not sufficient by itself to create the capacity, speed, and coverage needed for a deep, robust, and broad nation-wide 5G network.

[39] Ray Rebuttal Testimony at 13:8-9.

[40] *Id*. at 9-11. *See* Hearing Ex. Pub Adv-005C ("Reed 5G Testimony") at 17:11-12 ("Covering rural areas with midband spectrum will require significant capital build-outs of more cell sites."); Selwyn Testimony at 161 ("Providing service to rural areas requires capital investment, not spectrum. Capital investment response to profit opportunities, which have tended to be low in rural areas due to the high costs and relatively low potential revenues that the small populations are capable of generating.").

[41] Ray Rebuttal Testimony at 13:12-13.

useable in dense urban markets to address extreme demand, the need for low latency, and high-speed data applications.[42]

As explained in greater detail in previous filings and testimony, it will take a combination of mid-, low-, and high-band spectrum to develop and unlock the greatest benefits of 5G networks.[43]

T-Mobile has available low-band spectrum (*i.e.*, primarily 600 MHz spectrum); a small amount of mid-band spectrum (*i.e.*, AWS and PCS bands) dedicated to LTE usage; and high-band, mmWave spectrum in certain limited geographic areas.[44] Sprint, conversely, has very little low-band spectrum, large amounts of mid-band spectrum (*i.e.*, 2.5 GHz and 1900 MHz PCS bands), and no high-band spectrum.[45] On a standalone basis, neither company has the combination of spectrum to deliver the performance that New T-Mobile will provide.

Through the deployment of both parties' spectrum across the retained cell sites, New T-Mobile will be able to deploy more spectrum on more sites than would otherwise be possible by either Sprint or T-Mobile on a standalone basis.[46] In turn, per the formula described above and in

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[42] *Id.* at 13:16-21.

[43] *See id*. at 13:5-24; *see also* Joint Opposition at 58; *see also* Sievert Rebuttal Testimony, Attachment A, PIS at 48. Cal PA mistakenly subscribes to the view that 5G deployment is largely dependent upon mmWave spectrum. Reed 5G Testimony at 10. While mmWave spectrum can be part of the solution, it is not sufficient to deploy a robust nationwide 5G network, as explained by Mr. Ray in his testimony. Ray Rebuttal Testimony at 13:28-14:15. In particular, a 5G network exclusively built using mmWave spectrum would deprive rural, suburban and small towns from benefits of 5G because mmWave spectrum cannot be economically deployed in those areas given its extremely limited propagation. *See* Ray Rebuttal Testimony at 14:2-6.

[44] Ray Rebuttal Testimony at 14:25-27.

[45] *Id.* at 14:27-29.

[46] New Street Research analyst Jonathan Chaplin recently announced "If it is really important to the administration to be first in 5G and have a more robust set of infrastructure in the U.S. than China, Japan and Korea do, then they should let the deal go through . . . That's the path to the best 5G network we're likely to see in the U.S. and it will drive AT&T and Verizon to invest." That's because Sprint is sitting on a "phenomenal band of spectrum" that can run the technology" and "[i]f the deal with T-Mobile goes through, that's going to put those companies in a phenomenal position. If the deal doesn't go through, that spectrum just sits on the sidelines for the next five years." Michelle Fox, *If US Wants to be Leader in 5G, It Should Approve*

testimony, this leads to a massive increase in capacity since there are now more sites with more spectrum per site. Thus, even without taking into account spectral efficiency (discussed below), the capacity increases are significant due to the deployment of complementary spectrum assets.

2. Sites

The Transaction will also uniquely enable New T-Mobile's network to deploy many more cell sites on a much more economical basis than either company could on a standalone basis.

Because New T-Mobile will have more cell sites and more spectrum than either network standalone, it will be able to deploy more radios to more sites, almost immediately increasing the amount of spectrum deployed per site dramatically even before 5G is deployed.[47] As Mr. Ray testified, New T-Mobile will have **[BHC-AEO]** [redacted] **[EHC-AEO]** than the standalone companies individually or combined in California by 2024.[48] Notably, the approximately **[BHC-AEO** [redacted] **[EHC-AEO]** additional sites retained from the legacy Sprint network will allow New T-Mobile to have access to those additional sites more rapidly, as they have already been permitted and thus likely do not require the expenditure of resources building new sites would entail.[49]

Sprint, T-Mobile Merger: Analyst, CNBC (Apr. 12, 2019), https://www.cnbc.com/2019/04/12/in-race-for-5g-us-should-approve-sprint-t-mobile-merger-analyst.html.

[47] Ray Rebuttal Testimony at 17:10-18:5. Due to the importance of greater site density to overall network performance, when considering the number of 5G-enabled sites that New T-Mobile will have post-transaction, the correct comparison is that New T-Mobile's network will have more towers than *either* standalone, *not* both standalone companies together.

[48] *Id* at 17:10-18:3.

[49] Ray Rebuttal Testimony at 18:6-19:12 (Typically, a carrier seeking a cell split would need to obtain access to a new site, and if none existed in a particular location, new construction would be required, which can be expensive and time consuming. However, New T-Mobile will be able to use existing cell sites from Sprint to multiply the capacity available to the network through not only these new cell sites but also through the additional spectrum resources deployed on them, and will be able to do so nearly immediately.).

3. Spectral Efficiency

Increased spectral efficiency[50] is the third key ingredient of the New T-Mobile's network. 5G is a much more spectrally efficient technology than 4G LTE and the Transaction will uniquely accelerate its rollout.[51] The ability to more rapidly refarm the 4G LTE bands for 5G use and rapidly migrate customers from LTE to 5G will significantly increase network spectral efficiency sooner.

The below chart shows the spectrum repurposing or refarming plan to 5G of standalone T-Mobile, standalone Sprint, and New T-Mobile. The X axis shows each year from 2020 through 2024; the Y axis indicates the various spectrum bands. Every rectangle in the chart indicates a spectrum block of 10 megahertz except in the mmWave row, where each block signifies 100 megahertz of spectrum. In addition, the first, narrower 800 MHz block signifies 4 MHz of spectrum. Thus, Sprint has a full block (10 MHz) and this narrower first block (4 MHz), signifying that it has 14 MHz of total 800 MHz spectrum. As explained in the legend, blue blocks indicate spectrum that is planned to be dedicated to 3G (CDMA and HSPA); pink blocks indicate spectrum that is planned to be dedicated to LTE; violet blocks indicate spectrum that is planned to be split between LTE and 5G; and purple blocks indicate spectrum that is planned to be dedicated exclusively to 5G.

[50] An increase in spectral efficiency translates into a proportional increase in the number of users supported at the same load per user—or, for the same number of users, an increase in throughput available to each user. Public Interest Statement at 35

[51] Ray Rebuttal Testimony, Attachment A ("Ray PIS Declaration") ¶ 24; PIS at 32; Joint Opposition at 41.

[BHC-AEO]

[EHC-AEO]

As signified by the relatively larger amount of purple blocks in the coming years, New T-Mobile will be able to refarm spectrum to 5G far more quickly than either standalone. More spectrum available for 5G (purple blocks) sooner means that New T-Mobile will be able to (1) more easily manage service continuity (*i.e.*, the need to continue to support existing customers with legacy 4G devices) for existing T-Mobile and Sprint customers; and (2) more quickly drive new technology device penetration (*i.e.*, the rate at which users adopt devices using 5G).[52] New T-Mobile's ability to transition Sprint LTE customers to T-Mobile's AWS spectrum, thereby freeing Sprint's 2.5 GHz band, will enable a pure 5G network in the 2.5 GHz band as rapidly as possible. By contrast,

[52] Ray Rebuttal Testimony at 22:14-30. New T-Mobile anticipates that it will be able to increase device penetration levels by **[BHC-AEO** **[EHC-AEO]** because the increased size and scale of its expanded customer base will enable it to offer a better value proposition to equipment manufacturers. *Id.* at 23:1-6.

standalone Sprint would need to split the portion of its 2.5 GHz spectrum between LTE and 5G, resulting in a dramatically slower transition.

The increased 5G capacity enabled by the combination means that a much more robust 5G experience will be available to California consumers much sooner. As shown in the "New T-Mobile" column in the chart, LTE migration from the 2.5 GHz band is projected to be complete by 2022 for the combined entity, while standalone Sprint would likely still be required to reserve at least 43 percent (43%) of its 2.5 GHz spectrum for LTE through 2024. Moreover, as illustrated in the chart, by aggregating T-Mobile's and Sprint's legacy LTE customers on the AWS band, New T-Mobile will be able to deploy a much larger contiguous block of PCS spectrum to 5G use, allowing for even more efficient use of spectrum while allowing for the smoothing out of the distribution of network traffic.[53] As Mr. Ray explained, like a multilane freeway – which can accommodate both more traffic and faster traffic than a single lane highway – bigger blocks and more bands of spectrum provide greater capacity and allow for faster speeds.[54] A further benefit of combining LTE users on the AWS band is to allow more of its 600 MHz spectrum to be used for 5G sooner.[55] This accelerated transition will

[53] Averaging random demand over the combined usage of Sprint and T-Mobile subscribers rather than over each user base individually has the effect of smoothing out the distribution of traffic and thereby increasing the "effective" capacity of the network. Ray PIS Declaration ¶ 56.

[54] Hearing Tr. 430:10-13 (Ray Cross) ("So now you don't have a single-lane freeway. You have a 10-lane multilane freeway with massive capacity and much higher speeds and performance.").

Cal PA does not dispute that the merger will enable New T-Mobile to refarm spectrum and transition to 5G far more quickly than standalone T-Mobile or Sprint. *See* Hearing Tr. at 1128:1-11 (Reed Cross) ("Q: So, the ability to refarm allows you … to take spectrum that currently has a lower spectral efficiency and repurpose it to spectrum that has a higher spectral efficiency, right? A: Yeah. Q: That is what is going to happen when we go to 5G, right? A: The spectral efficiency will or is expected to improve with 5G service, yes."); *id.* at 1129:20-27 ("Q: Okay. So Sprint has fallow spectrum. If you take that fallow spectrum and combine it with T-Mobile, you would agree with me that that will allow the combined company to refarm, to move to 5G more quickly than if they had to do it separately, correct? A: That's the company's plan, yes.").

[55] Ray Rebuttal Testimony at 22:29-23:3.

ease LTE demand for spectrum, ensuring there will be no negative effects on LTE performance during the refarming to 5G process. [56]

B. The Network Model Used to Develop the 5G Network Plan is Well-Tested and Reliable

T-Mobile's projections for the New T-Mobile network are based on extensive technical modeling that the company has long used in the ordinary course of its business.[57] It is based on actual customer data and network experience. Importantly, the model is the same underlying engineering model relied upon by the FCC in approving the merger of T-Mobile and MetroPCS and otherwise used more recently by T-Mobile in the ordinary course of business in planning and executing its expansion of 4G/LTE service on its network.[58] As Mr. Ray has explained, "T-Mobile has based billions of dollars of investment on the output of this model, and [has] total confidence the model provides accurate predictions." [59]

That engineering model takes the assets available to T-Mobile (*e.g.*, spectrum, towers) and a projected amount of traffic, calculates the existing performance of the network, and recommends "solutions" to congestion (sectors that fall below a specific performance threshold).[60] The model projects the incremental capabilities of the combined network by overlaying the combined assets of

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[56] *Id*. at 23:6-14; *see also* Ray Rebuttal Testimony, Attachment B ("Ray Reply Declaration") ¶ 60.

[57] *See* Ray Reply Declaration ¶ 2 ("This model [the model being used to develop the 5G network] is built upon the ordinary course engineering tool that T-Mobile has used since 2011/2012 and has been utilized to dictate capacity expansion and expenditures.").

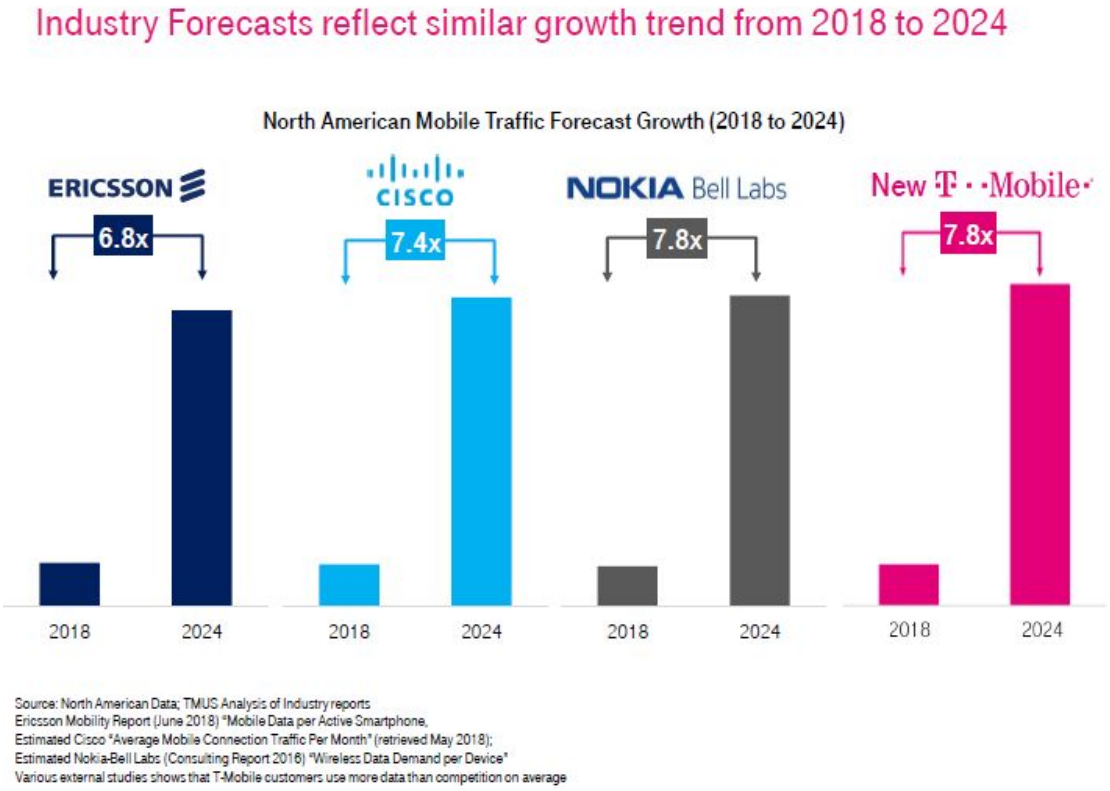
[58] Hearing Tr. 861:10-19 (Israel Redirect) ("Just to make that clear, the same model – I was also an economist in the T-Mobile/MetroPCS merger. It is the same model that was used to predict that merger, as we heard said, those efficiencies that come to be realized, that was in the 3G into 4G world. Same logic though … it is inherent – the FCC has also recognized this – inherent in the efficiencies of the cellular network."); Ray Reply Declaration ¶ 60.

[59] Ray Rebuttal Testimony at 26:9-11.

[60] *Id*. at 26:18-24; *Id*., Attachment C at 9.

the Joint Applicants with their combined traffic and incremental capabilities, and then implementing the integration of Sprint spectrum and towers contemplated by the Joint Applicants' build plans.[61]

T-Mobile validated its 5G demand forecast by comparing the data growth rates to similar projections from industry experts at Cisco, Nokia Bell Labs, and Ericsson:[62]



C. Criticisms of the Network Model Are Unfounded

Cal PA has claimed – without any support or network analysis – that capturing 5G's benefits is largely a matter of using new equi[redacted]and a new standard. Cal PA is mistaken. Rather, it takes the multiplicative impact that comes from enhancing the number of cell sites and combining spectrum

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[61] *See, e.g.,* Ray Reply Declaration ¶ 14, 21-218; Ray Rebuttal Testimony, Attachment C.

[62] *Id.* at 11. As Mr. Ray testified on cross, "[w]e have definitely looked at various industry predictions from, you know, traditional industry sources. We have a wealth of our own experience. We have been very successful as a company, you know, introducing both new phones for new technologies…. We have a lot of experience when we look forward and we project the adoption of new handset technology. And this is my fifth G, so I've been through all of these before." Hearing Tr. at 415:28-416:15 (Ray Cross); *see also* Ray Rebuttal Testimony at 9:1-12:11.

of different types to deliver the full level of performance.[63] Cal PA asserts that there is no need for all of the additional capacity generated from the Transaction because New T-Mobile's demand projections allegedly are "unduly aggressive." But instead of attempting to create an alternate network model, or looking at actual data to support this conclusion, Cal PA relies on online articles and blog posts to speculate about future demand for 5G.[64]

While Cal PA acknowledges that additional capacity flows from the combination of the T-Mobile and Sprint networks,[65] it asserts that the Joint Applicants' model (1) "assume[s] unrealistic customer adoption rates of 5G devices," and (2) "inflated data consumption per mobile user for both 5G and 4G service."[66] Neither critique is correct.

1. New T-Mobile's Projections of its 5G Handset Adoption Rate is Well-Founded.

Cal PA's assertion on handset adoption is apparently based only on a selective and incomplete internet search, yielding one blog post and one article, titled "The Hater's Guide to 5G Hardware – Don't buy a 5G smartphone - at least, not for a while," and ignoring numerous other public sources corroborating more rapid adoption. Cal PA relies on the blog post, which is dated from 2014, to conclude that T-Mobile's projections are "unduly aggressive." As an initial matter, Cal PA mischaracterizes what the blog post reports. While Cal PA claims that the blog post reports that "smartphones have an average life expectancy of 4.7 years,"[67] in fact it merely reports on "consumer *perceptions* of product life cycles."[68] Cal PA made no effort to review the underlying data, let alone

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63 *See* Hearing Tr. at 1104:1-1105:1 (Reed Cross).

65 Hearing Tr. at 1101:27, 1110:19-25 (Reed Cross).

66 Hearing Ex. Pub Adv-006C ("Reed Service Quality Testimony") at 21:7-8.

67 Reed 5G Testimony at 13:7-8.

68 *See* Appendix 1, "CTA - The Life Expectancy of Electronics" (cited in Reed 5G Testimony at 13 n.31).

perform any analysis to determine the reliability of the survey's methodology or conclusions.[69] Cal PA chose this five-year-old internet source to support its claims, while ignoring more recent sources that address the issue of how long consumers actually use their wireless devices before they replace them and in fact report that consumers generally use their handsets less than half the time that Cal PA asserts to be the case.[70] Similarly, Cal PA cites only one source for its claim that 5G adoption will be approximately 50 percent in 2025.[71] This single source provides a projection for the total U.S. 5G handset adoption rate and ignores the fact that adoption rates vary by wireless carrier. Cal PA also ignores the effects the merger itself will have in accelerating 5G handset penetration. As the first broad and deep nationwide 5G network, adoption rates can be expected to be higher on New T-Mobile than the average for all carriers.[72] Indeed, T-Mobile estimates the merger will drive 5G device penetration up **[BHC-AEO]** **[EHC-AEO]** percent year over year,[73] and as the evidence demonstrates, has every incentive to add consumers to fill the capacity created by the new network.[74]

2. New T-Mobile's Projections of Future Data Usage are Sound.

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69 Hearing Tr. at 1149:16-20 (Reed Cross).

70 *See* Reed 5G Testimony at 13:7-8. *See, e.g.*, Kantar Worldpanel, "*An Incredible Decade for the Smartphone: What's Next*" (Feb. 24, 2017) (Kantar Worldpanel report from 2017 finds that the average U.S. consumer kept their smartphone for 23 months before upgrading); Sarah Krouse, Upgrade. No Thanks. Americans Are Sticking With Their Old Phones, WALL ST. J. (Oct. 29, 2018), https://www.wsj.com/articles/upgrade-no-thanks-americans-are-sticking-with-their-old-phones-1540818000 (WSJ reported in October 2018 the average smartphone user keeps phone for 2.83 years.).

71 Reed 5G Testimony at 13:8-10. *See also id.* at n.32, Reed cites "Mobile Economy North America 2018 Report by GSMA."

72 Cal PA's witness testified that **[BHC-AEO]** **[EHC-AEO]**. Hearing Tr. at 1158:1-21 (Reed Cross). In 2017, T-Mobile's end-of-year sub/month network usage was 10.1 GB. Ray Rebuttal Testimony at 11:4-7. New T-Mobile will be able to deploy 5G much faster than the standalone companies. *See* Ray Rebuttal Testimony at 7:17-21. This rapid deployment of 5G, along with the already higher data usage of T-Mobile users, means that adoption rates for 5G handsets will be faster with the Transaction than without. *See also id.*, Attachment C at 20.

73 Ray Rebuttal Testimony at 36:1-7; *see also id.*, Attachment A ¶ 40.

74 Sievert Rebuttal Testimony at 15:18-20.

Cal PA also called T-Mobile's projections of future data usage "unreasonably inflated."[75] Cal PA, however, made an apples-to-oranges comparison to come up with this erroneous conclusion. Cal PA compared T-Mobile's projected data usage *for 5G subscribers* to industry projections of average usage for *all* subscribers, including both those on 4G and on 5G.[76] As demonstrated at the hearing, once this error is corrected by comparing T-Mobile's projections for the weighted average of both 4G and 5G subscriber data usage, the industry projections Cal PA's testimony cites actually predict *higher* data usage than T-Mobile has projected.[77] Thus, Cal PA's testimony actually supports the Joint Applicants' position and confirms that T-Mobile's assessment of future data usage was, if anything, conservative.

Furthermore, the industry benchmark for anticipated data usage relied upon by Cal PA includes data usage in both the U.S. and Canada.[78] In contrast, T-Mobile projections are just for New T-Mobile, which will be a U.S.-only carrier. U.S. consumers use more than one-and-a-half times as

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[75] Reed Service Quality Testimony at 22:2.

[76] Hearing Tr. at 1163:14-23, 1164:3-5 (Reed Cross); *see also* Reed Service Quality Testimony at 21:23-22:1 (emphasis added) ("The [New T-Mobile] network model assumes that each subscriber would use **[BHC-AEO]** [redacted] **[EHC-AEO]**. This varies significantly from industry expectations: Cellular radio manufacturer Ericsson predicts that North American mobile customers will use approximately 48 GB *of data* per month by 2023.").

[77] Specifically, *see* Hearing Tr. at 1168:2-26 for an explanation of the correct averaging of 4G and 5G subscriber data usage. *See* Reed 5G Testimony Exhibit C-34 for supporting numbers. *See also* Hearing Ex. Jt Appl.-014C at Slides 1 and 2 for a visual representation. Cal PA's projected per-subscriber monthly data usage number for 2023, from the Ericsson Mobility Report November 2017, is 48 GB per month. New T-Mobile's projected data usage figures, which can be found at Reed 5G Testimony Exhibit C34, are **[BHC-AEO** [redacted] **[EHC-AEO]** for 5G users and **[BHC-AEO]** [redacted] **[EHC-AEO]** for 4G users. When weighted to reflect New T-Mobile's projection that **[BHC-AEO]** [redacted] **[EHC-AEO]** of users will be 5G subscribers and **[BHC-AEO]** [redacted] **[EHC-AEO]** will be 4G subscribers, this averages to about **[BHC-AEO]** [redacted] **[EHC-AEO]**, more conservative than that Cal PA's 48 GB per month figure.

[78] *See* Appendix 2, Ericsson Mobility Report November 2017 at 5 (shows maps of North America including Canada and the U.S., but not Mexico). Cited in Reed Service Quality Testimony at 22 n.42.

much data as Canadian consumers.[79] In other words, the U.S. industry benchmark would be higher than the 48GB/month cited by Cal PA.

Finally, Cal PA ignores the fact that T-Mobile's customer base uses more data than the average user. If Cal PA had applied the growth rate from its own report[80] to the actual T-Mobile data usage numbers from 2017 (rather than the U.S./Canada average), it would have found a projection that – as admitted in its testimony at the hearing – is comparable to the number it called "overly aggressive."[81] In other words, the T-Mobile projections are reasonable even by Cal PA's methodology. Indeed, when its errors are corrected, Cal PA's analysis again confirms that the network projections made by T-Mobile were, if anything, conservative.

But more fundamentally, even if the New T-Mobile network ended up having more capacity than would be consumed by immediate demand from the combined Sprint and T-Mobile customer base, that would not be a reason to disfavor the Transaction. As Dr. Israel has shown, additional capacity at very low incremental cost puts significant downward pressure on prices. If it turns out that consumer demand does not meet T-Mobile's projections, and New T-Mobile had more unused capacity than expected, this would put even more downward pressure on prices as capacity chases demand. Furthermore, such capacity would also reinforce New T-Mobile's incentives and ability to offer better quality service to existing customers and to pursue growth opportunities by winning new subscribers from other carriers – principally AT&T and Verizon – and offerin[redacted]tly related to network

[79] Hearing Ex. Jt Appl.-17 OECD (Americans used 3.03 GB per month per mobile broadband subscription compared to 1.90 GB per month for Canadians).

[80] Hearing Tr. at 1164:18-22 (Reed Cross).

[81] Hearing Tr. at 1165:24-1166:5 (Reed Cross) ("And then let's apply the 37 percent cumulative average growth rate to that number. What number do you get? A: So the number shown on the right is 66.8. Q: Yeah. And what was the number that you said that T-Mobile's prediction was overly aggressive? A: **[BHC-AEO]** [redacted] **[EHC-AEO]**"); *see also* Hearing Ex. Jt Appl.-014C at Slides 3 through 5 for a visual representation.

utilization, reduced demand allows remaining customers to achieve even faster data speeds than projected.

In addition, T-Mobile's business plan is to fill capacity not needed for mobile wireless services by offering a fixed broadband product at prices significantly below what the cable companies charge. Thus, even assuming it turned out that actual consumer demand unexpectedly does not meet T-Mobile's projections, that will simply mean more capacity available for fixed broadband.[82] In short, the enhanced capabilities of the New T-Mobile network will benefit California consumers under any scenario.

V. CALIFORNIA CONSUMERS WILL BENEFIT FROM ROBUST CAPACITY, FASTER SPEEDS AND EXPANDED COVERAGE

A. New T-Mobile's 5G Network will Create Massive Increases in Capacity

By 2024, New T-Mobile's 5G network will have approximately 8x (eight times) the capacity of T-Mobile today.[83] Moreover, as demonstrated in the charts below, included in Mr. Ray's Rebuttal Testimony, the combined network will more than *double* 5G monthly capacity by 2021 and nearly *triple* 5G monthly capacity by 2024 when compared to the combined 5G capacities of the standalone networks.[84] By 2024, the total capacity of the new network – inclusive of LTE – will be approximately *twice* what the combined capacity of the standalone firms would be.[85]

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82 *See* Sievert Rebuttal Testimony at 29:17-25.

83 *See, e.g.*, Sievert Rebuttal Testimony at 12:5-6.

84 Ray Rebuttal Testimony at 28:1-6; *see also id.* at 27:14-17.

85 *Id*. at 27:16-17.

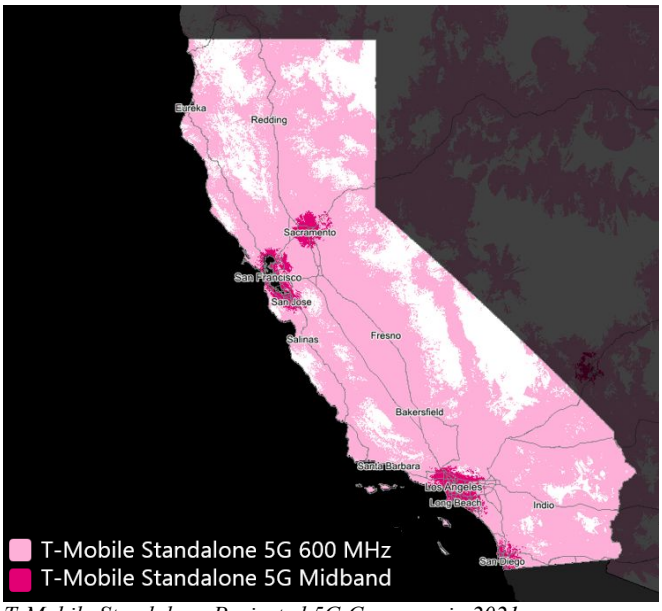
[BHC-AEO]

[EHC-AEO]

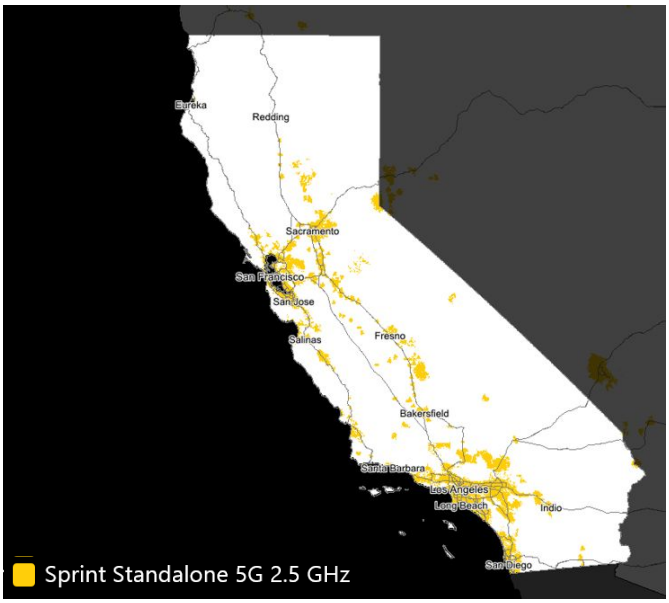
These figures reflect that New T-Mobile will provide high-capacity 5G services for the overwhelming majority of Californians. Specifically, New T-Mobile will deploy a high-capacity 5G network for the overwhelming majority of Southern California, California's Central Valley, the

[86] The charts show the New T-Mobile network's projected offered and carried capacity per month. Offered capacity is the total amount of data that could be delivered by the network. Carried capacity is the amount of traffic actually carried (or, if projected in the future, the amount of traffic consumers will demand to be carried) on the network's capacity. The company plans to build the network so that the amount of offered capacity guarantees 5G users an average of 12 Mbps during the busiest hour of the day. Ray Reply Decl. at ¶ 27. However, because capacity additions are lumpy (they come in large increments) and because there are also cell sites added to the network for non-capacity reasons (e.g., to enhance coverage), the amount of offered capacity across the network will typically significantly exceed the traffic the network actually carries in the busy hour. Further, although the network is dimensioned to support a certain level of speed in the busy hour, the amount of traffic carried during other hours of the day will also typically be lower. Thus, as established in the record, while the offered capacity numbers for the combined network have been developed using a robust set of assumptions and associated calculations, T-Mobile's offered capacity of its network today is materially greater than what is consumed by its customers. See Ray PIS Declaration at ¶ 54 (discussing offered capacity for T-Mobile on today's network).

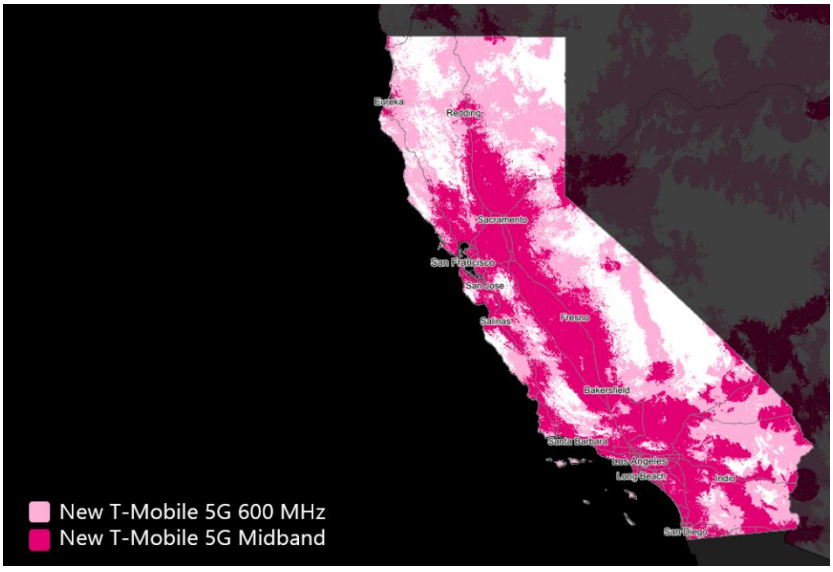
greater Bay Area, and much of rural California.[87] Standalone T-Mobile and Sprint, by contrast, would leave vast parts of the state without high-capacity, mid-band coverage, covering only a few scattered urban centers. The expanded 5G coverage is well-illustrated in the maps provided by Mr. Ray in his Rebuttal Testimony which are duplicated below:[88]



T-Mobile Standalone Projected 5G Coverage in 2021



Sprint Standalone Projected 5G Coverage in 2021



New T-Mobile Projected 5G Coverage in California in 2021

87 Ray Rebuttal Testimony, 9:3-9:25, 31:3-35:2.

88 *See* Ray Rebuttal Testimony at 32:1-33:2.

While these maps show that a large portion of California will gain the additional capacity of 5G made possible by deploying mid-band spectrum, their two-dimensional nature cannot fully capture the *depth* of the mid-band spectrum deployed. It is this depth of coverage that "is critical to actually unleash the full glory of 5G."[89] Ultimately, these maps illustrate that significantly more non-urban and rural communities will get deep 5G coverage relative to the standalone world, helping to bridge the urban-rural digital divide.[90]

Increased capacity will also improve the network experience, because capacity is correlated with the speed a network can deliver.[91] In short, more customers will be able to use the network to download more bits of data, while achieving faster download speeds, experiencing fewer delays and interruptions, greater continuity, and a more satisfying service generally.

B. Significant Improvements in Speed

To begin with, and prior to the deployment of 5G, all **[BHC-AEO** [redacted] **[EHC-AEO]** current California Sprint consumers will experience a material increase in their current average data speeds as they migrate to the New T-Mobile network over the course of the next three years. Both the CalSpeed and the Ookla data cited by Cal PA establish that Sprint's current LTE upload and download speeds are slower than T-Mobile's.[92] Indeed, as Cal PA testified, "Ookla ranked T-Mobile as the fastest carrier in 2017 and 2018 and Sprint was ranked the worst."[93] The Ookla speed tests, which are publicly available, confirm that T-Mobile's urban and rural data speeds are both

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89 *See* Hearing Tr. at 411:28-412:4 (Ray Cross).

90 *See id.* at 411:28-412:4 (Ray Cross); *see also* Ray Rebuttal Testimony, Attachment D (county-specific coverage maps for California).

91 Ray Rebuttal Testimony, 7:25-8:10, 31:3-23.

92 *See* Reed Service Quality Testimony at 17:7-8, Figure 5 (FCC's compilation of CALSPEED data); *id.* at 17:9:11; *see also id.* at 19:1-7 (reporting on Ookla speed test results); *id.* at Ex. C-10 (Ookla's 2018 speed test report).

93 *See* Reed Service Quality Testimony at 19:6-7.

considerably higher than those of Sprint.[94] In addition, the evidence confirms that the latency – *i.e.*, the time (in milliseconds) it takes to send and receive a data packet – associated with T-Mobile's network is significantly lower than that associated with 4G networks.[95] Thus, as Sprint consumers migrate to the New T-Mobile network, they will have the immediate benefit of a faster network with lower latency.[96]

As the New T-Mobile 5G network becomes fully deployed, the increase in speed (and capacity) for consumers is nothing short of transformational. As illustrated in the charts below, by 2024, New T-Mobile will provide:

- 99% of Californians with data rates greater than 100 Mbps,
- 97% of Californians with data rates greater than 150 Mbps,
- 92% of Californians with data rates greater than 300 Mbps, and
- 83% of Californians with data rates greater than 500 Mbps.[97]

A comparison of these speeds to those of the standalone companies' 5G plans for the equivalent time period is striking. For example, New T-Mobile will provide 6 million more Californians with data rates greater than 100 Mbps than either of the standalone companies, and an additional 5 million Californians with data rates greater than 150 Mbps. In addition, the New T-Mobile will provide data rates exceeding 300 Mbps to nearly 37 million POPs, and 500 Mbps to almost 34 million POPs, data speeds which neither the standalone T-Mobile nor Sprint 5G networks would be able to provide at all without the benefit of the combined company's assets. The dramatic

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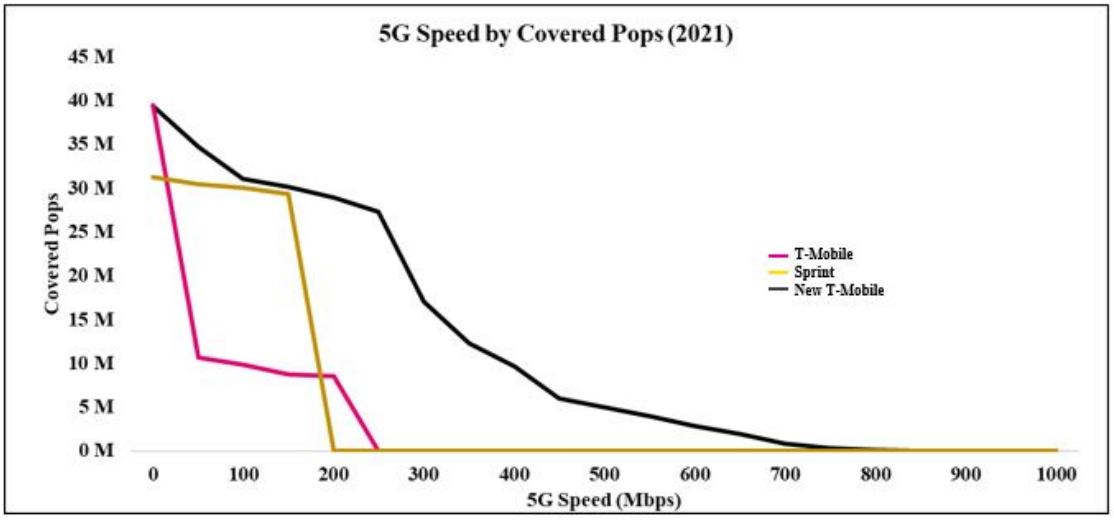
[94] *See* link at https://www.speedtest.net/reports/united-states/2018/mobile/ (T-Mobile's urban and rural data speeds are 29% and 40% faster than Sprint respectively).

[95] Ray Reply Declaration ¶11; Ray Rebuttal Testimony at 41:15.

[96] In addition, 5G technology provides for reduced latency when compared to LTE. *See, e.g.*, Ray Rebuttal Testimony, Attachment A at 6-7 (describing advantages of 5G over LTE). Thus, the latency for all New T-Mobile consumers is expected to decrease markedly upon the deployment of 5G which will only further facilitate the ability of all consumers to utilize their mobile devices for a host of uses from streaming movies to telemedicine and beyond. *Id*. at 41:15.

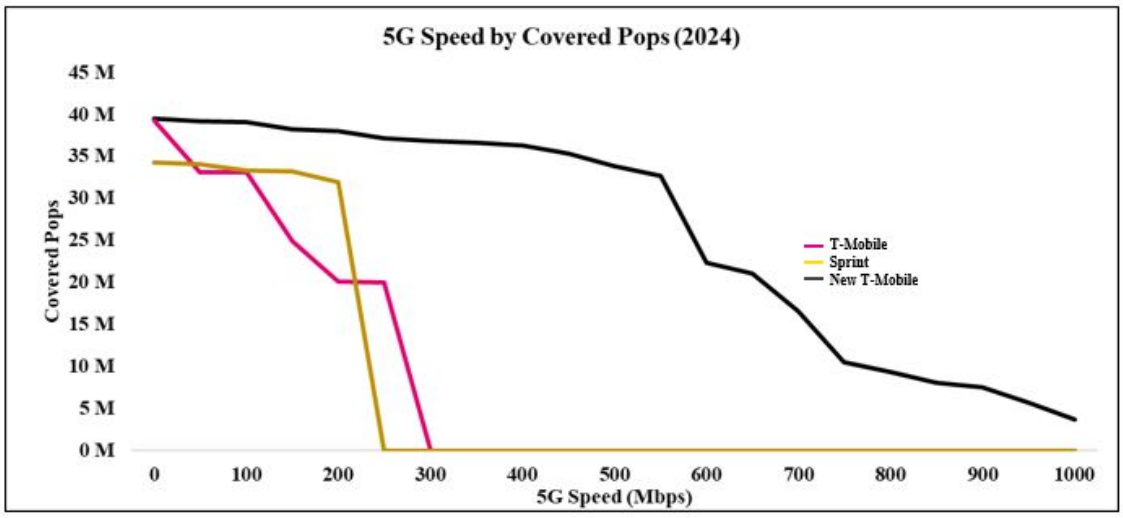
[97] Seivert Rebuttal Testimony at 19:20-21:10; *see also* Ray Rebuttal Testimony at 33:5-35:1.

increases in 5G data speeds are best illustrated by the charts included in the testimony of both Mr. Sievert and Mr. Ray:[98]



	California Covered Pops by Speed			% California Pops		
2021	T-Mobile	Sprint	New T-Mobile	T-Mobile	Sprint	New T-Mobile
Pops with > 100 Mbps	9.8 M	30.1 M	31.0 M	25%	76%	79%
Pops with > 150 Mbps	8.8 M	29.3 M	30.1 M	22%	74%	76%
Pops with > 300 Mbps			17.0 M			43%
Pops with > 500 Mbps			5.0 M			13%

[98] *See* Sievert Rebuttal Testimony at 20:6-21:2; Ray Rebuttal Testimony at 34:1-35:3. The increase in data speed is even more striking when compared to current download speeds. In the FCC's recently released Communications Marketplace report, cited by Mr. Sievert in his testimony, T-Mobile and Sprint reported mean LTE download speeds of 30.48 Mbps and 21.78 Mbps in the second half of 2017, respectively. Sievert Rebuttal Testimony at 18:13-17. However, by 2024, those speeds will seem sluggish when compared to the speeds New T-Mobile's 5G network will provide (e.g., 100 Mbps for 99% of Californians; 500 Mbps for 83% of Californians).



	California Covered Pops by Speed			% California Pops		
2024	T-Mobile	Sprint	New T-Mobile	T-Mobile	Sprint	New T-Mobile
Pops with > 100 Mbps	33.1 M	33.3 M	39.1 M	84%	84%	99%
Pops with > 150 Mbps	24.9 M	33.2 M	38.2 M	63%	84%	97%
Pops with > 300 Mbps			36.8 M			93%
Pops with > 500 Mbps			33.8 M			83%

The increase in data speeds anticipated by the merger is especially beneficial for low-income consumers and for rural Californians. As noted below, low-income consumers will be able to enjoy data speeds that will no longer relegate them to being "underconnected."[99] At the same time, in addition to the increase in 5G *mobile* coverage already discussed, New T-Mobile will provide rural Californians with meaningful access to *fixed* in-home broadband for the first time.[100]

As explained above, T-Mobile's projections for the increases in data speeds are derived from its ordinary course engineering model which in turn relies on both companies' assets including the combined companies spectrum and cell sites. Although the company is confident that the model provides accurate projections,[101] New T-Mobile has made several network buildout related

[99] *See, e.g.*, Hearing Tr. at 298:20-299:19 (Sievert Cross). Indeed, distribution systems to serve those customers – as well as others – are already in place. *See* Section V.D, *infra*.

[100] *See* Section V.B, *infra*.

[101] *See* Section IV.A, *infra*.

commitments in its MOU with CETF to provider further reassurance. First, New T-Mobile commits to at least **[BHC-AEO** [redacted] **[EHC-AEO]** in network capital expenditures to deploy 5G technology in California within 6 years of the close of the Transaction, with the right to defer **[BHC-AEO]** [redacted] **[EHC-AEO]** of those planned capital expenditures for an additional 7th year.[102] New T-Mobile also commits to deploy 5G technology at 90% of the cell site locations included in its engineering model (or geographically comparable locations) for California by 2025.[103] New T-Mobile further commits to achieve the average (mean) speed tier (100 Mbps or 300 Mbps), across all sites at which 5G technology is deployed in a given year and to achieve a minimum of 80% of the specified speed tier category *at each site.*[104] To verify speeds, New T-Mobile has committed to site-specific speed tests conducted by an independent third party and will provide CETF and the Commission with an Annual Compliance Report detailing New T-Mobile capital expenditures, its buildout progress, speed tests results and coverage maps.

C. Coverage Improvements Will Significantly Enhance Access and Bring Choice to More Consumers Throughout the State Immediately Post-Close

It is undisputed that T-Mobile's network currently has a considerably larger geographic footprint than Sprint's network. According to Cal PA, T-Mobile (similarly to AT&T and Verizon)

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[102] CETF MOU at 9. New T-Mobile expected capital expenditures in California are **[BHC]** [redacted] **[EHC]** than T-Mobile standalone. *See* Sievert Rebuttal Testimony at 13:22-14:7.

[103] CETF MOU at 10. As Mr. Ray explained in his testimony New T-Mobile plans to deploy 5G spectrum at approximately **[BHC]** [redacted] **[EHC]** sites across California. Ray Rebuttal Testimony at 18:2.

[104] CETF MOU at 10-11. In order to create a verifiable measurement tool T-Mobile took the list of the California cell sites used in the model and added an expected speed tier(s) for each of the cell sites and the year that the anticipated speed tier would be achieved. Note that many of the sites are designated to reach both speed tiers – 100Mpbs in an earlier year and then 300 Mbps subsequently. For sites that are designated to achieve both speed tiers (100 Mbps and 300 Mbps), there will be two speed tests: (i) one in the year when spectrum and equipment are deployed that allow a site to reach the first speed tier (i.e., 100 Mbps); and (ii) a second in the year when the spectrum is deployed to allow the site to meet its second speed tier (e.g., 300 Mbps).

covers more than twice the geographic area of California compared to Sprint, including rural and sparsely populated areas.[105] Sprint's network meanwhile, is located primarily in urban areas and along highways.[106] Perhaps most notably, Sprint has no plans to provide any type of significant coverage to rural areas absent the merger.[107]

The expanded coverage available post-merger will be especially striking in the LifeLine context as discussed below in Section VII.A. Sprint's current network coverage, however, is not limited just for its LifeLine customers. Sprint struggles today to provide consistent coverage to wireless customers of all sorts in rural areas (as well as in-building coverage even within its network footprint).[108] To the extent Sprint has customers who demand service in rural California, they are forced to rely on roaming agreements for coverage in rural areas where Sprint's own network is absent. Roaming agreements are typically inferior with respect to both the customer experience they offer (e.g., with regard to data speeds and technology) and their cost to Sprint.[109] Once the deal is finalized, we will initiate efforts to integrate and migrate Sprint customers on to the New T-Mobile network immediately – to accomplish this, we must move existing T-Mobile and Sprint subscribers to

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[105] Reed Service Quality Testimony at 11:6-12:11.

[106] *Id.* at 12:6-8; *id.* at Attachment B; *see also* Sylla Dixon Rebuttal Testimony at Attachment A.

[107] Reed Service Quality Testimony at 12:11-12. The Joint Applicants do not dispute that Sprint uses roaming agreements with other carriers, including T-Mobile, to supplement its coverage area. *Id.* at 10:20-21 and 12:6. However, as noted above, Sprint's LifeLine customers are limited to the Sprint Legacy network and do not have the ability to roam on the broader network. See Sylla Dixon Rebuttal at 12:13-26. Even for those non-LifeLine consumers that do have the ability to roam, service quality associated with roaming is limited. *See* Section V.C, *infra.* In any event, even Cal PA concedes that Sprint consumers will benefit from T-Mobile's larger service coverage area. Reed Service Quality Testimony at 10:14-15.

[108] Hearing Ex. Jt Appl.-5C ("Draper Rebuttal Testimony") at 13:13-29 and 14:1-3.

[109] *Id.* ¶ 12:9-12; *see also* Hearing Tr. at 1117:23-1118:15 (Reed Cross) ("Q: Okay. So you are aware though that roaming is an inferior alternative to being on your own network, right? A: 'Inferior' seems a bit harsh. But yeah, it is not quite as good as being a home network. Q: You testified in fact that roaming services often include low data caps, correct? … A: Yes, typically low caps and reduced speeds.").

a common core network.[110] In the near-term, our engineering team will work to bridge the two standalone core networks together.[111] This bridge will be accomplished through use of Multi-Operator Core Network ("MOCN") technology.[112] Sprint customers, with activation of MOCN functionality, will be able to access the New T-Mobile LTE network with greatly improved LTE coverage and data throughputs than under Sprint's current roaming arrangement with T-Mobile.[113]

As Sprint customers migrate onto the New T-Mobile network, however, they will no longer need to rely on roaming and will gain the advantage of improved coverage on a better and more ubiquitous network.[114]

D. New T-Mobile Will Benefit Consumers Through the Creation of a Bona Fide Wireless Alternative to In-Home Broadband and Help Bridge the Digital Divide

Although the data varies by source, all stakeholders agree that too many Californians have limited or no access to broadband services. Recent data from the Commission indicates that 38.1 percent of California households had only one choice of broadband provider and more than 800,000 households had no broadband available from any provider.[115] Similarly, information submitted by CETF during the course of the hearings indicates that while 87 percent of California households have broadband at home, a significant proportion of those households rely exclusively on their wireless

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[110] Ray Reply Declaration ¶ 39; *see also* Draper Rebuttal Testimony at 15:25-26; 16:1-5.

[111] *Id.*

[112] *Id.*

[113] *Id.*

[114] *Id.*

[115] *Id*. at 29:1-3 (citing DIVCA Video, Broadband and Video Employment Report for The Year Ending December 31, 2016, California Public Utilities Commission at 26 (June 8, 2018)).

device for that connectivity and are thus "under connected."[116] These issues are particularly stark in rural areas and among low-income customers.[117] New T-Mobile will enhance the broadband service options for these customers in two ways.

1. New T-Mobile's In-Home Broadband Product

New T-Mobile's business plan is to disrupt the in-home broadband market. New T-Mobile will have a broad and deep wireless network with fiber-like speeds and massive capacity that will benefit consumers of both mobile and in-home broadband services. Because capacity comes online in large units, in some areas, particularly in rural areas, the network will have more capacity than expected cell phone traffic. That unused capacity will be made available for wireless in-home broadband (sometimes referred to as "fixed wireless") service.[118]

Subscribers of the in-home broadband service will use customer premises equipment ("CPE") – which is already being tested – to convert New T-Mobile's wireless network signal into a Wi-Fi signal for the home, much like a wireless router.[119] Customers will be able to install the equipment themselves, relieving them of the need to schedule installation appointments and related charges while providing them with the full functionality of a wired broadband connection.[120] New T-Mobile will also extend the Un-carrier customer care model to its in-home broadband offering, providing consumers with high-quality 24-7 customer support.

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[116] *See* Hearing Ex. CETF-002 (CETF Annual Survey Excerpt).

[117] *Id*.

[118] Sievert Rebuttal Testimony at 29:17-20.

[119] Sievert Rebuttal Testimony at 28:19-21; *see also* Hearing Tr. at 323:27-324:15 and 325:9-26 (Sievert Cross) (discussing availability of CPE as soon as late 2019).

[120] Hearing Tr. at 317:26-318:27 (Sievert Examination by ALJ) (discussing capabilities of in-home wireless product with respect to traditional cable connection).

Speeds of the in-home broadband product will track the speeds of the merged company's mobile wireless service. Thus, by full deployment of the New T-Mobile 5G network in 2024, New T-Mobile's in-home broadband customers will experience average download speeds in excess of 100 Mbps (with a minimum speed of 25/3 Mbps).[121] This essentially *doubles* the number of rural Californians who have access to those types of broadband speeds today.[122]

2. 5G Mobile Service as a Viable Broadband Alternative

The speeds provided by New T-Mobile's 5G network will also enable customers to forego any fixed in-home service at all in favor of subscribing to a 5G mobile plan for all of their broadband needs.[123] For these consumers, subscribing to the New T-Mobile 5G mobile wireless service will enable them to access nearly ubiquitous speeds in excess of 100 Mbps and close the traditional performance gap typically separating in-home and mobile services. This will be of particular value for cost-conscious and low-income consumers, who may not be able to, afford the option of traditional in-home service in the first place.[124] As a result, New T-Mobile's 5G network will help close this digital divide. As Mr. Sievert testified:

> [T]he idea that people are trading off something important in order to be connected only through mobile technology is going to fall away. People who have a mobile connection won't be under connected when this new company is created. This company will have the ability to serve mobile users with eight times the capacity that we have today, with 15 times the speed. So when the median speed in the country

[121] *See* Sievert Rebuttal Testimony at 19:22–21:10 (discussing network speeds in California); *see also id.* at 29:21-23 (discussing California rural broadband coverage); Ray Rebuttal Testimony at 40:8-10 (same); *see also* Hearing Tr. at 304:27-305:8 (Sievert Cross) (discussing antennas on CPE equipment for in-home product); Hearing Tr. at 509:22-510:24 (Ray Cross) (same).

[122] *See* Hearing Ex. CETF-003 (FCC Broadband Deployment Report Excerpts) at page marked 8 of 242 (showing that 46.2% of rural Californians have access to fixed broadband speeds of 25/3 Mbps).

[123] Sievert Rebuttal Testimony at 31:22-32:4.

[124] Hearing Tr. at 295:17-28 (Sievert Cross) (discussing that cost is barrier for low-income consumers to adopt in-home broadband); *see also* Sievert Rebuttal Testimony at 32:6-12.

> served by this network is 450 megabits per second to a mobile device, well, that user is not under connected anymore.
>
> That is a really important benefit for people who, you know, frankly can't afford both. They have to choose to have a mobile broadband connection on their mobile phone or a home broadband connection. And in a world where you have to choose, it's very important that that mobile broadband connection be high speed and high capacity and low cost. And that's what this merger will uniquely enable us to provide.[125]

3. Californians Will Enjoy Significant Cost Savings from Both the Fixed and Mobile Broadband Options

By 2024, New T-Mobile expects to offer its high-speed, in-home broadband service to approximately **[BHC-AEO** [redacted] **[EHC-AEO]** California residences.[126] T-Mobile estimates that 20 to 25 percent of these new subscribers will be in rural areas.[127] The new fixed broadband offering will have monthly prices **[BHC-AEO]** [redacted] **EHC-AEO]** than the products of traditional in-home broadband providers, and in California the estimated cumulative consumer welfare benefits are expected to be **[BHC-AEO** [redacted] **[EHC-AEO]** in annual savings by 2024.[128] Customers who substitute New T-Mobile mobile 5G broadband service for the fixed in-home broadband services of other providers (i.e., "cord cutters") will save up to $50 per month though elimination of fixed in-home broadband service altogether. Even customers who stick with their wired broadband connection will pay less as incumbent wired in-home broadband providers will be forced to lower prices to respond to this new competition.[129]

4. Standalone T-Mobile or Sprint Cannot Offer Equivalent Broadband Alternatives

[125] Hearing Tr. at 298:25-299:24 (Sievert Cross).

[126] Sievert Rebuttal Testimony at 31:19-20.

[127] Sievert Rebuttal Testimony at 31:15-16 and 18:22-20:8.

[128] *Id*. at 30:1-19 (discussing economic study of California consumer savings associated with in-home broadband offerings).

[129] *See* Section V.D; *see also* Sievert Rebuttal Testimony at 32:13-21.

Neither T-Mobile nor Sprint on its own has the spectrum assets, sites, scale, or other resources necessary to deploy networks with the capacity and speed required to widely support quality of streaming HD and 4K video and other key applications that in-home broadband customers will demand.[130] Moreover, as Sprint's Chief Commercial officer, Mr. Draper, has confirmed, Sprint "has no current plans to launch in-home fixed wireless broadband services."[131]

E. The Merger will Provide MVNOs with More Robust Options to Compete for Customers in the Wireless Market

As the evidence makes clear, Mobile Virtual Network Operators and Mobile Virtual Network Aggregators (collectively "MVNOs") provide significant wireless competition through their various prepaid plan offerings.[132] The merger will benefit the MVNOs and their millions of subscribers by creating a new, nationwide 5G mobile network operator ("MNO") network with massive capacity and lower operational costs. In brief, the higher network capacity translates into an improved ability to serve the MVNOs as neither the current standalone networks of T-Mobile and Sprint, nor the 5G networks they plan to deploy, have the necessary combination of coverage and capacity to respond to changing consumer preferences for greater speeds and data in all areas of the country.[133] Naturally, these limitations render T-Mobile and Sprint – neither of whom is a dominant provider of wholesale services - as less attractive standalone MNO partners for MVNOs now or in the future. Moreover,

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[130] *See* Sievert Rebuttal Testimony at 11:4-11; *see also id.*, Attachment A, Appendix F ("Draper PIS Declaration") at 12, ¶ 35 (TMUS-CPUC-CD-000275).

[131] Id. at Attachment A, Draper PIS Declaration at 12, ¶ 35 (TMUS-CPUC-CD-000275).

[132] Sievert Rebuttal Testimony at 42:5-6; Hearing Ex. Jt Appl.-04C ("Keys Rebuttal Testimony") at 8:3-6 and 11:6-10.

[133] Sievert Rebuttal Testimony at 44:8-18.

Sprint's reliance on roaming in certain parts of the country makes it an even less attractive option for MVNOs looking to offer their customers nationwide coverage.[134]

However, with its massively increased network capacity, New T-Mobile will have an increased incentive to work with MVNOs to put subscribers on New T-Mobile's network so that this expanded capacity does not simply sit idle.[135] And, New T-Mobile's decreased capacity costs will result in lower wholesale costs for MVNOs and their subscribers. The increased competition for the provision of wholesale services will spur Verizon and AT&T - *currently the predominant wholesale providers for MVNOs* - to lower prices to maintain MVNO relationships and further invest in their networks to keep pace with New T-Mobile.[136] Ultimately, the result will be that MVNO subscribers across the industry will benefit from improved service quality and lower prices. In this regard it is notable that a number of leading MVNOs have filed in support of the merger at the FCC, including the largest MVNO TracFone.[137]Moreover, MVNOs operate with long-term contracts that will allow them to continue to flourish post-merger, because the contracts are generally at wholesale rates and provide for added capacity that will allow MVNOs to compete and expand their subscriber bases. As noted above, New T-Mobile is committed to honoring the terms of the existing MVNO agreements with both T-Mobile and Sprint and extending those agreements to at least the end of 2021 to any requesting MVNO.[138]

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[134] Sievert Rebuttal Testimony at 44:18-20.

[135] Sievert Rebuttal Testimony at 44:21-26; Keys Rebuttal Testimony at 12:29-13:6.

[136] Sievert Rebuttal Testimony at 44:22-29; Keys Rebuttal Testimony at 13:6-10.

[137] Keys Rebuttal Testimony at 13:17-14:2

[138] Sievert Rebuttal Testimony at 45:1-5; Keys Rebuttal Testimony at 13:12-14.

F. The Merger will Create Revolutionary Opportunities for IoT

New T-Mobile's 5G network will also enable it to turbocharge existing IoT product lines, attract more customers, and facilitate innovative new IoT products.[139] The New T-Mobile 5G network will focus on smart mobility, using its 5G network to provide IoT solutions that will help Americans transport themselves and their goods more efficiently and more cost-effectively.[140] New T-Mobile's ubiquitous 5G network will empower "smart communities" to connect, manage, and optimize community infrastructure in ways that more limited 5G networks including AT&T's, Verizon's, and standalone T-Mobile's and Sprint's planned 5G networks could not.[141] New T-Mobile will also invest in private wireless networks, distributed computing, telehealth, and backup connectivity.[142] Through emerging commercial IoT applications, New T-Mobile's 5G network and associated capabilities will enable it to spark and accelerate new parts of the value chain.[143] New T-Mobile's 5G network will also provide IoT solutions for numerous other new diverse applications for which its unique combination of high speed, high capacity, low latency, and broad coverage will be particularly well-suited.[144]

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[139] *See* Sievert Rebuttal Testimony at 34:26-28.

[140] *See* Sievert Rebuttal Testimony at 34:28-35:.

[141] *Id*. at 35; *see also* PIS at 74-75. For example, some IoT services like fleet management, remote sensing, and Unmanned Aerial Systems do not need high bandwidth or capacity but do require geographic range, which standalone Sprint cannot provide; other IoT services like smart building/campus/city solutions do not need geographic ubiquity but do require capacity beyond the capabilities of standalone T-Mobile; and yet other IoT services like autonomous vehicles require *both* geographic range and capacity, suitable for New T-Mobile's network but not for the networks of standalone T-Mobile and Sprint. Joint Opposition at 106-07 (TMUS-CPUC-PA-00001411-12).

[142] *See* Sievert Rebuttal Testimony at 35:3-4; *see also* PIS at 74-75.

[143] *See* Sievert Rebuttal Testimony at 35:4-6.

[144] *Id*.; *see also* Joint Opposition at 106-07 (TMUS-CPUC-PA-00001411-12).

In short, the 5G services provided by the new network, given its unique breadth and depth relative to the standalone companies and to AT&T and Verizon, will fundamentally transform the way Californians live, work, travel, and play by being able to connect an enormous variety of IoT devices and sensors[145] at lower prices.[146]

As the home of Silicon Valley and a driver of the nation's high-tech industry, California will particularly benefit, just as it did with 4G, sparking many thousands of jobs and substantial new tax revenue. History has shown that a first-mover advantage in a new generation network breeds leadership in the software applications running on the network.[147] As a result of this world-leading 5G network, California's economy will gain a head-start in developing the next generation of world-leading applications and services relative to international competitors in, for example, China and Korea. This head start will fuel the California economy and employment for years to come.

G. Customer Migration to the New T-Mobile Network Will Be Seamless and No Customer Will Be Left Behind

As both Mr. Ray and Mr. Keys have testified, New T-Mobile's migration of Sprint's entire customer base, including *postpaid, prepaid, and LifeLine* consumers, will not tax the capabilities of the New T-Mobile network and will be professional, timely, and efficient.[148] New T-Mobile will rely on the incredibly successful migration plan and the personnel who transitioned over 9 million customers nationwide from the MetroPCS network to T-Mobile's network following the 2013

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[145] Sievert Rebuttal Testimony at 35:19-21; *see also* PIS at 56-57.

[146] Sievert Rebuttal Testimony at 35:23-24; *see also* Joint Opposition at 107; PIS at 56-57.

[147] *See* PIS at 69-70.

[148] *See generally* Ray Rebuttal Testimony at Section X; *see also* Keys Rebuttal Testimony at Section VI.

acquisition.[149] Consistent with that approach, New T-Mobile will ensure that the Sprint migration is smooth, that no customer is left behind, and that service to existing Sprint customers is improved, not degraded, during the transition. The migration is expected to be complete within three years of the closing.[150]

1. Migration Plan

All Sprint customers will be migrated to the New T-Mobile network as quickly and as seamlessly as possible. Indeed, every single market in the New T-Mobile network will see customer migration from Sprint's network within the first year of the merger.[151] The **[BHC-AEO]** [redacted] **[EHC- AEO]** – currently have handsets compatible with T-Mobile's network,[152] and they will gain access to New T-Mobile's nationwide network and its improved coverage quality without any additional effort on their part, and without degrading their network experience or that of T-Mobile's customers. As Mr. Ray testified, those Sprint customers can have their existing devices updated through over-the-air software to allow almost immediate access to the New T-Mobile network.[153] A feature of T-Mobile's LTE network known as Multi-Operator Core Network ("MOCN") allows New T-Mobile to unify the T-Mobile and Sprint radio

[149] Longtime industry analyst Craig Moffett has stated "The PCS deal is now the te[redacted] *Into an Industry Success*, FORTUNE (May 5, 2017), http://fortune.com/2017/05/05/t-mobile-metropcs-merger/.

[150] Ray Rebuttal Testimony at 47:5-6.

[151] Keys Rebuttal Testimony at 15:22-23.

[152] *See* Reed Service Quality Testimony at Ex. C-5 (identifying the number of Sprint California consumers with compatible devices).

[153] Ray Rebuttal Testimony at 48:29-30. As Mr. Ray further testified, the first step of course is to build out build out sufficient capacity to provide the migrating base with the service quality associated with the T-Mobile network. *See* Hearing Tr. at 485:7-11 (Ray Cross).

access networks so that existing customers with compatible devices can access the best of both networks during the migration process.[154]

The remaining Sprint customers will require handset change outs.[155] The majority of these will be accomplished through the natural upgrade cycle, but New T-Mobile will also offer promotions to expedite upgrades to compatible devices, similar to what T-Mobile did during the MetroPCS transition.[156] Promotions could include discounted or even free devices for the last few customers to migrate, which proved to be very successful in the MetroPCS transition.[157]

To be clear, Sprint prepaid customers and Sprint Assurance Wireless LifeLine customers will be migrated in the same way and on the same timeframe as Sprint postpaid customers.[158] All Sprint Assurance Wireless LifeLine customers will be provided with a compatible handset for free.[159]

2. MetroPCS Migration Experience

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[154] Ray Rebuttal Testimony at 47:11-15. This feature was also utilized in the MetroPCS migration discussed below. *Id*. at 48:19-25.

[155] *See* Reed Service Quality Testimony at Ex. C-5 (identifying the number of Sprint California consumers with incompatible devices or devices with limited compatibility). The Joint Applicants note that the total number of Sprint California customers with incompatible devices **[BHC-AEO]** [redacted] **[EHC- AEO]** is actually less than the total number of MetroPCS California customers that were migrated in the T-Mobile/Metro 2013 merger.

[156] *See* Reed Service Quality Testimony at Ex. C-5 (identifying the number of Sprint California consumers with incompatible devices or devices with limited compatibility).

[157] Ray Rebuttal Testimony at 47:2-6 and 48:3-9; *see also* Hearing Tr. at 488:9-17 (Ray Cross).

[158] Ray Rebuttal Testimony at 47:19-21; *see also* Sylla Dixon Rebuttal Testimony at 3:16-28 ("Existing Assurance LifeLine customers with incompatible handsets (*i.e.*, those that do not work on the New T-Mobile Network) will be migrated to the New T-Mobile Network as quickly as practicable."). Hearing Tr. at 942:26-944:3 (Sylla Dixon Cross) (stating that the New T-Mobile will get Sprint Assurance Wireless LifeLine customers on the New T-Mobile network "as quickly as – or as soon as possible").

[159] *See* Hearing Tr. at 313:6-10; 319:14-23 (Sievert Cross); CETF MOU at 3-4.

When T-Mobile acquired MetroPCS in 2013, it had to migrate approximately 9 million MetroPCS subscribers, all of whom (unlike the situation in this merger) were using incompatible technology (CDMA) that required handset changes to access the T-Mobile network.[160] Despite that challenge, MetroPCS customers were migrated to the T-Mobile network even more quickly than anticipated.[161] In addition, merger synergies exceeded expectations, spectrum refarming was expedited, and MetroPCS customers quickly enjoyed expanded coverage and better service as evidenced, in part, by the fact that the churn for their customer base *declined* during this period, and subscribership grew 2 fold.[162]

The scope of the MetroPCS migration demonstrates that New T-Mobile will be able to successfully implement the Sprint migration. For example, in Los Angeles, all 1.43 million Metro subscribers had incompatible phones requiring change outs, yet they were seamlessly migrated onto the T-Mobile network within 26 months, if not earlier, of the close of that merger. In comparison, 1.46 million Sprint subscribers in Los Angeles will need to be migrated, but many already will have compatible handsets.[163]

3. No Service Degradation for Sprint Customers

New T-Mobile will ensure that there will be no service degradation for Sprint consumers who have not yet migrated. As with the MetroPCS migration, Sprint sites will not be decommissioned

[160] Ray Rebuttal Testimony at 48:16-25.

[161] Ray Rebuttal Testimony at 48:18-23 (the vast majority of the MetroPCS migration was completed within 15 months and the process was completed within 26 months of the close without any material customer disruptions).

[162] Keys Rebuttal Testimony at 15:11-12.

[163] Ray Rebuttal Testimony at 49:4-9.

until consumers can be accommodated on the New T-Mobile network.[164] The transition from the Sprint 800 MHz CDMA network will begin no earlier than January 1, 2021, and T-Mobile will not terminate the CDMA network in any market without migrating users first.[165]

In sum, the process of migrating legacy Sprint customers will be built upon a proven methodology that has previously delivered cost savings ahead of schedule, with synergies better than expected, and without any customer disruption.[166]

VI. ECONOMIC ANALYSIS OF THE MERGER CONFIRMS THAT IT WILL BE PRO-COMPETITIVE AND RESULT IN LOWER PRICES AND INCREASED QUALITY OF SERVICE FOR CALIFORNIA CONSUMERS

The massive new capacity made possible by the Transaction is only profitable to New T-Mobile if it can sell it. This gives New T-Mobile compelling incentives to fill that capacity and grow by lowering prices to attract new customers, including new wireless customers from AT&T and Verizon;[167] new wholesale customers by offering a better value proposition to MVNOs;[168] and new enterprise customers for whom AT&T and Verizon have up to now been the only meaningful options.[169]

Current customers of AT&T and Verizon, who have not been attracted to T-Mobile and Sprint as standalone companies, will now have additional options because New T-Mobile would be able to

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[164] Ray Rebuttal Testimony at 49:19-20.

[165] *Id.* at 47:8-10.

[166] *Id.* at 49:20-24.

[167] *See* Sievert Rebuttal Testimony at 22:5-16.

[168] *See* Sievert Rebuttal Testimony at 44:21-30.

[169] Sievert Rebuttal Testimony at 34:9-13.

offer a much higher quality network and value proposition.[170] This new value proposition will create a new level of intensified competition in the wireless industry.

The additional capacity will also give New T-Mobile greater incentives to offer wholesale access to its network and a more attractive coverage footprint than the standalone companies, strengthening competition for wholesale/MVNO customers.[171]

And in the enterprise segment, where both Sprint and T-Mobile have struggled due to their networks with a combined share of less than 10 percent, New T-Mobile will for the first time be a meaningful third option to Verizon and AT&T, which have long dominated this segment.[172]

Economic analyses of these core features of the Transaction, capacity, coverage, and cost profile, confirm that consumers, competition, and the California economy will benefit from the Transaction.

A. Analytical Framework

The Joint Applicants and the Intervenors agree that evaluating the competitive effects of a proposed merger requires a holistic assessment, as described in the Horizontal Merger Guidelines which the parties have agreed are authoritative,[173] that goes well beyond simply counting the number of market participants or calculating concentration ratios. Central to this analysis is an evaluation of whether a merger is likely to reduce output (*i.e.*, is anticompetitive) or to expand output (*i.e.*, is

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[170] *See* Sievert Rebuttal Testimony at 15:9-11.

[171] Sievert Rebuttal Testimony at 44:21-30.

[172] Sievert Rebuttal Testimony at 34:9-22.

[173] Hearing Tr. at 1190:14-22 (Goldman Cross) ("The U.S. Department of Justice and the Federal Trade Commission have adopted the Horizontal Merger Guidelines"); Hearing Tr. at 1174:19-26 (Reed Redirect) ("So as a state employee it is my […] charge to sort of look at a lot of these and ensure that, by the horizontal guidelines, merger guidelines, all of the commitments and all of the benefits and everything that will come out of the merger is merger specific and concrete.").

procompetitive); as part of this evaluation, it is critical to carefully analyze efficiencies.[174] And to understand these incremental benefits to competition, including potential efficiencies, it is necessary to compare the quality and prices of New T-Mobile's combined network against the quality and prices that would be offered by the standalone companies going forward.[175]

The Horizontal Merger Guidelines acknowledge that merger simulation is a proper way to measure whether a merger is procompetitive or anticompetitive with respect to unilateral pricing effects.[176] Merger simulations take into account the efficiencies that will flow from combining complementary assets, the competitive reactions of other firms in the market, and the implications of a reduction in the number of competitors. CWA admits in its testimony that merger simulations are a "particularly relevant" form of analysis.[177]

The merger simulation conducted by the Joint Applicants' economists does exactly that - in fact, it is the *only* economic analysis in the record that does so.[178] That analysis, which "consider[ed]

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[174] Hearing Ex. Jt Appl.-015 Horizontal Merger Guidelines ("Horizontal Merger Guidelines") at 2, 4 ("The Agencies consider any reasonably available and reliable evidence to address the central question of whether a merger may substantially lessen competition … Likewise, the Agencies look for reliable evidence that the merger is likely to result in efficiencies."); Hearing Tr. at 1191:10-20 (Goldman Cross) (Q: "You are also aware that going back many decades now the merger guidelines require consideration of cost savings and efficiencies that come from a transaction, right?" A: "Correct.").

[175] Selwyn Testimony ¶ 100(1) ("[W]hat [Cornerstone] … *should have done* is to compare *future* standalone Sprint and T-Mobile network quality with *future* incremental New T-Mobile network quality at a corresponding future point in time, assuming that, if the merger is denied, both companies would continue to invest in their networks, *as both had stated, before the announced plans to merge, that they intended to do.*").

[176] Horizontal Merger Guidelines at 21 ("Where sufficient data are available, the Agencies may construct economic models designed to quantify the unilateral price effects resulting from the mergers. These models often include independent price responses by non-merging firms. They also can incorporate merger-specific efficiencies.").

[177] Hearing Ex. CWA-1 ("Goldman Testimony") at 28 ("The Guidelines also discuss three types of economic evidence that are particularly relevant to unilateral effects analysis: diversion ratios …, 'gross upward pricing pressure,' and merger simulation models.").

[178] Hearing Ex. Jt App.-07C ("Israel Rebuttal Testimony") at 14:4-7.

both the effect of loss of a competitor and efficiencies in a unified framework," found that the proposed merger would enhance consumer welfare and "benefit California consumers."[179]

B. New T-Mobile's Substantially Lower Marginal Costs and Massive Increase in Capacity Will Drive Lower Prices for Consumers

Basic economic principles dictate that lower marginal costs increase the profitability of attracting additional customers, and therefore incentivize a frim to *lower prices* and *increase product quality* in order to attract more customers and thereby earn higher profits. New T-Mobile will be able to realize significant cost savings – approximately $25.7 billion[180] – from integrating the existing T-Mobile and Sprint networks. More specifically, these projected cost savings will be achieved through (1) decommissioning a selection of Sprint sites that duplicate existing T-Mobile sites and (2) lower operating expenses from spectrum and scale efficiencies. For example, New T-Mobile will be able to materially lower its marginal costs by utilizing existing Sprint cell sites to deploy its 5G network rather than adding capacity through new cell splits, which is typically the most expensive and time consuming way to add capacity. A carrier seeking a cell split would need to obtain access to a new site. If none exists in a particular location, new construction would be required.[181] New T-Mobile will also be able to multiply its capacity quickly and cheaply by adding equipment deploying Sprint spectrum to its existing sites.[182] The combination allows New T-Mobile to rapidly broaden and deepen its network while simultaneously reducing the marginal cost of incremental capacity.[183]

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[179] *Id.* at 36:19-20.

[180] Ray Rebuttal Testimony at 20:21-22.

[181] *Id.* at 18:8-12.

[182] *Id.* at 20:6-13.

[183] *Id.* at 20:10-13.

New T-Mobile will also significantly lower its marginal costs because it will piggyback deployment of 5G on processes already necessary to integrate T-Mobile's and Sprint's networks. In order to integrate the two existing networks, New T-Mobile will have to mount additional radios on each tower and can deploy radios capable of 5G in that process. Because New T-Mobile will already be incurring the cost of visiting the towers as part of the integration process, the incremental costs of adding 5G-capable radios while rolling out the combined spectrum is much lower than the costs that standalone T-Mobile or Sprint would have to incur.[184] And, as explained above, the effect of the increased number of cell sites, the combination of T-Mobile and Sprint spectrum on each cell site, and the more rapid addition of new 5G radios with enhanced spectral efficiency relative to 4G, is multiplicative, making the cost of adding capacity going forward much lower for New T-Mobile than for the standalone firms.

The combination of T-Mobile's and Sprint's subscriber bases will also give New T-Mobile the economies of scale necessary to effectively compete against AT&T and Verizon. Both T-Mobile and Sprint are at a significant competitive disadvantage vis-à-vis AT&T and Verizon because of their much larger scale. AT&T and Verizon each have about twice the revenues of T-Mobile[185] and an even greater multiple of Sprint's.[186] They are able to spread their network costs over a much larger number of subscribers (as compared to T-Mobile and Sprint) and to invest much more in their networks than either T-Mobile or Sprint have been able to do.[187] The proposed merger would allow

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[184] Joint Opposition at 97.

[185] Sievert Rebuttal Testimony at 8:7-21.

[186] *See* Hearing Ex. Jt Appl.-006C ("Bresnahan Rebuttal Testimony"), Attachment A, Ex. 81 (TMUS-CPUC-PA00005084), providing the shares of subscribers for March-May 2018.

[187] Sievert Rebuttal Testimony at 8:7-21 ("As of 2017, both AT&T and Verizon had approximately five times the capital expenditure of Sprint and were approximately twice as large as T-Mobile."); *id.* at 25:3-11

New T-Mobile to close some of that gap and begin to invest greater sums in its network. While New T-Mobile would still remain smaller than both AT&T and Verizon, it would be much better positioned to compete against the two leading wireless carriers.[188] Moreover, New T-Mobile's greater scale would enable it to support more expansive and more robust deployment in rural California than either T-Mobile or Sprint could have ever been able to support separately.[189]

C. Lower Marginal Costs and More Supply Mean Lower Prices

As Mr. Sievert testified, it would be economically irrational for New T-Mobile to raise prices in light of the massive available capacity created by the Transaction at significantly reduced marginal costs, during the transition to 5G and beyond.[190]

Indeed, New T-Mobile's enhanced incentives to lower prices are recognized in its business plan, developed at the outset of the Transaction and which was the basis of billions of dollars in financial commitments by the bankers funding the Transaction; as well as from declarations from T-

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("Providing mobile wireless services requires significant capital investments that do not depend on the number of subscribers using the network. If we have more subscribers, it spreads those large expenses over a larger customer base.… This is the concept of economies of scale and it is what allows larger providers across any number of industries to charge lower prices to consumers while maintaining profitability."); *see also* Hearing Tr. at 1181:8-9 (Reed Cross) ("Yes, there are scale efficiencies.").

[188] Sievert Rebuttal Testimony at 8:17-21.

[189] *See* Ray Rebuttal Testimony at 43:7-13; *see also* Selwyn Testimony 165:16-20 ("Rural areas are currently underserved because of the high cost of building out facilities and recovering those costs over relatively small populations. Simply put, costs are lower and potential profits are higher in more densely populated urban and suburban areas than in sparsely populated rural communities."); Hearing Tr. 1121:6-15 (Reed Cross) (Q: "You would also agree that one of the reasons that Sprint is not covering rural areas is because it is much more expensive to do that with 2.5 than it is with 600?" … A: "I would agree with that, that is generally correct.").

[190] *See* Hearing Tr. at 255:22-27 (Sievert Cross) ("And I can tell you that we'd be crazy while we're building out that capacity to do anything but compete aggressively with lower prices and the best possible network conditions we can create for consumers.").

Mobile executives.[191] For prepaid brands in particular New T-Mobile will **[BHC-AEO]** [redacted] **[EHC-AEO]** the price of Boost to **[BHC-AEO]** [redacted] **EHC-AEO]**. The Company expects this **[BHC-AEO]** [redacted] **[EHC-AEO]** New T-Mobile's total non-Metro prepaid ARPU by **[BHC-AEO]** [redacted] **[EHC-AEO]**, while increasing the quality of service for non-Metro customers on prepaid plans.[192] The Joint Applicants' Public Interest Statement made similar express assurances. Specifically, the Applicants stated that "New T-Mobile will guarantee each [Sprint] customer a rate plan that is equal or better than the plans they currently enjoy with Sprint."[193] The Applicants also noted the T-Mobile Un-contract rate promise to their customers and that it would be extended to Sprint customers post-closing.[194] Joint Applicants have committed to preserving current pricing plans for all consumers – *prepaid, postpaid, urban, rural, low-income* – so that they will be able to keep their current plans over the next three years, if they would prefer not to switch to the even better plans New T-Mobile will offer.[195] As for LifeLine customers, they will continue to receive their service and their handsets for free.[196] This commitment should address any concerns about New T-Mobile raising prices while it builds out its 5G network.[197]

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[191] Sievert PIS Declaration ¶ 21 (TMUS-CPUC-PA-000212 to 213); Sievert Rebuttal Testimony, Attachment A, Appendix D ("Ewens PIS Declaration") ¶ 8.

[192] Keys Rebuttal Testimony at 9:21-26.

[193] Ewens PIS Declaration ¶ 8.

[194] *Id.*

[195] Hearing Tr. at 387:8-388:9 (Sievert Cross) (describing three-year commitment). While the Joint Applicants have committed to low pricing for the next three years, Verizon, on the other hand, has already announced that it will levy a $10 surcharge on customers who wish to use 5G. *See* Ahiza Garcia, *Verizon Will Soon Offer 5G In Select Cities For $10 Extra* (Mar. 13, 2019), https://www.cnn.com/2019/03/13/tech/verizon-5g-wireless-attachment/index.html.

[196] *Id.* at 305:21-23; 313:9-10; 319:14-24.

[197] Hearing Tr. at 269:11-22, 282:8-16 (Sievert Cross).

To eliminate any remaining doubt, the Joint Applicants submitted the following commitment to the FCC on February 4, 2019 and reaffirmed this commitment in their MOU with CETF: "New T-Mobile will make available the same or better rate plans as those offered by T-Mobile or Sprint as of today's date for three years following the merger."[198] These commitments ensures that American consumers, including consumers in California, will pay less and get more as a result of the merger.

D. The Only Quantitative Analyses in the Record Confirm That the Merger is Procompetitive and Consumers Will Benefit From Lower Prices and Higher Quality

The Joint Applicants engaged two teams of world-renowned experts to conduct complementary analyses of the merger's anticipated competitive effects. A team led by Michael Katz, Professor of Economics at the University of California, Berkeley and former Chief Economist at the DOJ and at the FCC, conducted a detailed merger simulation (the study is collectively referred to as the "IKK" model from the authors' initials, Mark Israel, Michael Katz, and Bryan Keating). IKK's merger simulation evaluates efficiencies grounded in the engineering model that T-Mobile used to evaluate the 5G network discussed above and that it otherwise uses in the ordinary course of business to manage its network demand.[199] A second team, led by Timothy Bresnahan, Professor of Economics at Stanford University and former DOJ Chief Economist, and John Asker, Professor of Economics at UCLA and former visiting scholar at the Federal Trade Commission's Bureau of Economics, conducted a complementary study by analyzing granular data revealing how consumers

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[198] Hearing Tr. at 387:4-388:9 (Sievert Recross).

[199] *See* Sievert Rebuttal Testimony, Attachment B at 253-276 (Appx. F: Declaration of Compass Lexecon, Mark Israel, Michael Katz, and Bryan Keating ("IKK Declaration") ¶¶ 52-83 (Sept. 17, 2018)).

choose wireless plans to assess whether consumers would be better or worse off after the merger.[200] Both teams concluded that competition will be intensified following the Transaction and that consumers will benefit as a result.

As Professor Bresnahan explained, when a firm gains market share after a transaction relative to the shares of the two firms combined, this is powerful, if not dispositive, evidence that the merger is pro-competitive because it demonstrates that more consumers prefer the combined entity than the sum of its parts.[201] However, the benefits will not be limited to customers of New T-Mobile: with the increased network quality and lower costs of New T-Mobile, AT&T and Verizon will be forced to compete more vigorously, improving their own networks and/or lowering prices to attract and retain customers, benefiting all wireless consumers.[202] The economic analysis in the record shows that all wireless consumers will benefit from a decrease in price per GB,[203] and that "industry-wide prices to consumers will go down more quickly."[204]

1. The IKK Model Confirms That the Merger Will Create Incentives to Decrease Prices

[200] Bresnahan Rebuttal Testimony, Attachment A ("Economic Analysis of the Proposed T-Mobile/Sprint Merger") 5-6.

[201] Hearing Tr. at 791:2-12 (Bresnahan Cross) ("It is a conclusion of our analysis that with improvements in network quality and lower marginal costs, the New T-Mobile is able to liberate customers from AT&T and Verizon that neither merger partner can today, that it therefore has an incentive to compete harder in price and by offering people a better deal. And that it does increase its market share which is a pro-competitive outcome as a result of the merger.").

[202] Hearing Tr. at 787:6-18 (Bresnahan Cross), 833:3-834:10 (Bresnahan Redirect); see Section VI, *infra*.

[203] Sievert Rebuttal Testimony, Attachment B, Appendix G ("Evans Reply Declaration") ¶ 6 (Bates No. TMUS-CPUC-PA-00001450) ; Sievert Rebuttal Testimony, Attachment A, Appendix G ("Evans PIS Declaration") ¶¶ 220-44.

[204] Evans PIS Declaration ¶ 7.

IKK's simulation considered the net effect of three ways the merger will affect the parties' competitive incentives. On the one hand, New T-Mobile will own both T-Mobile and Sprint, which means that it will internalize the value of customers that otherwise would have switched between the two carriers and been considered a lost sale, potentially creating incentives to reduce output and raise prices. On the other hand, New T-Mobile will have lower marginal costs to serve additional customers compared to the standalone companies, which will give New T-Mobile the incentive to *lower* prices and *increase* output. And due to network integration, the merger will improve service quality, intensifying competition.[205] IKK's merger simulation measures the net effect of these counter-tendencies.

The starting point of IKK's study is the engineering model used by T-Mobile in the ordinary course of business to manage demand on its network.[206] IKK calculated the incremental cost of adding capacity to this network relative to adding capacity to the standalone networks of T-Mobile and Sprint.[207] In addition, IKK assessed reductions in non-network marginal costs based on New T-Mobile's financial plan.[208]

IKK then conducted a merger simulation to assess the worst-case net effect of the downward pricing pressure created by this massive additional capacity at low incremental costs and any potential upward pricing pressure that could result from the reduction of the number of competitors. IKK found that the profit incentives to lower prices and gain customers given the lower costs and

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[205] Sievert Rebuttal Testimony, Attachment B, Appendix F ("IKK Declaration") ¶ 20.

[206] This ordinary-course T-Mobile engineering model is described in greater detail in Section IV, *supra*.

[207] This analysis expressly incorporated how the standalone networks would grow—and adopt 5G—in the absence of the merger, to ensure that all efficiencies that were identified are specific to the merger.

[208] IKK Declaration ¶ 6.

increased capacity of the New T-Mobile network dramatically outweighed any profits that could be achieved by holding or raising prices and foregoing these incremental sales. IKK also found that the merger will generate significant quality improvements in the form of faster data speeds, better coverage, and relaxation of usage restrictions.[209] Indeed, IKK concluded that the merger would generate, even on worst-case assumptions, **[BHC-AEO]** [redacted] **[EHC-AEO]** in incremental consumer surplus for California customers.[210]

Given the undisputed increase in capacity that flows from combining the two networks, this result should not be surprising.[211] Nevertheless, Cal PA asserts that "there is simply no merit to the notion that, even if New T-Mobile were able to achieve a lower marginal cost than the two firms could standing alone, this would be flowed through to consumers."[212] In making this criticism, Cal PA commits a fundamental and basic error. As Dr. Israel explained, as a matter of basic economics, *all* firms have an incentive to lower prices when marginal costs fall. With lower marginal costs, each new sale generates more profit than before. A profit-maximizing firm will therefore seek to attract more customers. To do so, it must lower its prices. This dynamic does not depend on any specific

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[209] *Id.*

[210] Israel Rebuttal Testimony at 36:14-15. Incremental consumer surplus is the value customers will gain from New T-Mobile relative to the value that they would experience absent the merger. The increase in incremental surplus is due to, among other factors, improvements in network quality and lower costs that the merger efficiencies will generate. The incremental surplus calculation also accounts for any potential harm from the loss of an independent competitor. The fact that it is positive indicates that the merger efficiencies will more than offset the loss of an independent competitor and therefore the merger will enhance consumer welfare in California. It indicates that the benefit to consumers is the same as a series of price cuts over time with a present financial value of **[BHC-AEO]** [redacted] **[EHC-AEO]**.

[211] Hearing Tr. at 859:5-860:1 (Israel Redirect) ("Q: When we talk about efficiency, we are really talking about getting more output from the same inputs in your example? A: To economists 'efficiency' means to produce more with the same amount; therefore, it is more cost effective.… Efficiency says now we can get more with the same resources, so we can do it at a much lower cost, becomes more attractive.").

[212] Selwyn Testimony 121:7-10.

assumption about the degree of competition in the market.[213] Otherwise, Cal PA offers no rebuttal to the IKK simulation.

2. The Cornerstone Model Confirms That the Merger Will Benefit All Types of Consumers and Low-Income Consumers in Particular

The complementary Cornerstone Model, using a different methodology, came to the same conclusion.[214] To assess how network coverage and speed drive consumers' choices, Professor Bresnahan and Professor Asker used detailed data from over 50,000 customers' actual experiences as they used their wireless phones.[215] By correlating the choices made by consumers against the relative quality and prices of the various cellular networks, Professor Bresnahan and Professor Asker were able to quantify the value that consumers placed on network quality. The data show that if the Transaction were to improve network quality or reduce marginal costs even a minimal amount – well below the thresholds projected by the network model or found by IKK – the combination will mean lower prices and improved network quality for consumers in California and across the country.[216] The relevant data set also allows Professors Bresnahan and Asker to assess the impact of the Transaction on the lowest-income Californians, as well as Black and Hispanic residents. They conclude that these groups will be among the largest beneficiaries of the merger.[217] In sum, the key competitive effects of this merger for consumers are that speeds will go up, prices will go down,

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[213] Israel Rebuttal Testimony at 18:22-26 (as Dr. Israel notes, even a monopolist – clearly not the case here – will find it profitable to pass through some or all marginal cost reductions, and the degree of pass-on depends on the structure of demand, rather than the degree of competition).

[214] Bresnahan Rebuttal Testimony, Attachment A, ¶ 4.

[215] Bresnahan Rebuttal Testimony at 18:1-19:14.

[216] *See, e.g.*, Bresnahan Rebuttal Testimony at 5:1-20, Attachment A ¶¶ 13-16 (TMUS-CPUC-PA-00004964 – 65); *see also* Hearing Tr. at 730:2-7, 790:21-791:12 (Bresnahan Cross), 836:15-837:14 (Bresnahan Redirect).

[217] Hearing Tr. at 836:15-837:14 (Bresnahan Redirect).

quality will increase, New T-Mobile will *gain* customers, and AT&T and Verizon will *lose* customers.[218]

Even relatively modest merger-related increases in network quality over the standalone entities would allow New T-Mobile to more effectively compete for customers of AT&T and Verizon.[219] Competition for these additional customers will benefit *all* consumers as New T-Mobile lowers prices across the board to win these customers newly in play, and AT&T and Verizon are forced to respond by lowering their own prices to maintain share.[220]

As Professor Bresnahan explained at the hearing, post-merger, if New T-Mobile's speeds were just 10 percent higher due to the network-quality improvements inherent in this Transaction, New T-Mobile would be a more competitive option for millions more Californians. New T-Mobile therefore has powerful incentives to go out and win those customers by dropping prices across the board. As Professor Bresnahan testified "[t]hat's great for these people. It's great for T-Mo[bile]. It's really bad for Verizon."[221]

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[218] Bresnahan Rebuttal Testimony at 5:1-20; Hearing Tr. at 810:23-811:2 (Bresnahan Cross); *id.* at 791:2-12 (Bresnahan Cross).

[219] Bresnahan Rebuttal Testimony at 24:12-28:10, Attachment A ¶¶ 108-09 (TMUS-CPUC-PA-00005010 - 11).

[220] Hearing Tr. at 810:23-811:2 (Bresnahan Cross).

[221] Hearing Tr. at 832:9-11 (Bresnahan Redirect); *see also* Bresnahan Rebuttal Testimony at 14 n.15 ("Similarly, there are 4.4 million Verizon subscribers in California who would lose at least ten percent speed if they were to switch to Sprint. There are 3.3 and 3.5 million AT&T subscribers in California who would lose at least ten percent speed if they were to switch to Sprint or T-Mobile, respectively. These numbers drop by 1.6, 1.3, and 1.5 million consumers if T-Mobile and Sprint were each to increase their standardized delivered speeds by ten percent.").

Even in more conservative scenarios, the merger would be procompetitive.[222] Indeed, the Cornerstone Model calculates this outcome *even without* accounting for the additional improvements anticipated by the enhanced New T-Mobile 5G network.[223] They are also consistent with the parties' stated rationale for this combination, and conservative in light of the more robust network quality improvements the parties expect and are incentivized to pursue.[224]

E. The Merger Will Not Increase the Likelihood of Coordination

The evidence is also clear that this industry is not vulnerable to coordinated conduct and that, in any event, the merger will not increase the likelihood of such conduct.[225]

First, under the Horizontal Merger Guidelines, markets with product offerings that are heterogeneous are less susceptible to coordination than markets of homogenous products.[226] Here, as

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[222] Bresnahan Rebuttal Testimony at 24:21-25:2; *see also* Israel Rebuttal Testimony at 23:4-8 (Table 2) and 23:18-24:6 (Table 3); *see also* Bresnahan Rebuttal Testimony at 26:19-28:5.

[223] Bresnahan Rebuttal Testimony at 18:3-8, 24:21-25:2, Attachment A ¶¶ 89-90 (TMUS-CPUC-PA-00004999 - 5000), Attachment C (TMUS-CPUC-PA-00005348).

[224] *See* Hearing Tr. at 739:13-740:7, 834:11-25 (Bresnahan Cross); Bresnahan Rebuttal Testimony at 24:12-25:2, Attachment A ¶ 80 (TMUS-CPUC-PA-00004996).

[225] During Professor Bresnahan's testimony, ALJ Bemesderfer asked whether this Transaction would create an "incentive to cartelize," citing as an example a 1950's cartel of a number of electrical equipment manufacturers. Hearing Tr. at 793:25-26, 795:8-9 (Bresnahan Cross). However, that case was a criminal price-fixing conspiracy, not a merger case. *See United States v. Westinghouse Elec. Corp.*, 1960 U.S. Dist. LEXIS 4763, at *2-3 (E.D. Pa. Mar. 24, 1960). In contrast to criminal cases, the more typical concern in merger cases is tacit, not express, collusion. There are a number of features of the wireless industry that make it much less susceptible to coordination than would be an express cartel in the industry at issue in that case, including differentiated product quality and a corresponding lack of available information to catch cartel "cheating," *id.* at 796:3-7, and a lack of mechanisms to enforce compliance with the cartel.

[226] Horizontal Merger Guidelines at 25-26; Israel Rebuttal Testimony at 50:22-25 ("Coordination is difficult because, given the nature of competition in this industry, successful coordination would require much more than coordination on price. Rather, competition is multi-dimensional and complex, a circumstance which is known to make coordination more difficult."); *see also* Hearing Tr. at 1206:27-1207:4 (Goldman Cross). Products are considered to be homogenous when they are relatively undifferentiated, meaning that offerings among firms are largely the same. Heterogeneous product offerings, on the other hand, are differentiated and can have different characteristics.

the Cornerstone analysis makes clear, wireless services offered by different carriers to consumers with different usage patterns and geographies are dramatically different with respect to quality, coverage and consistency. Carriers also differ in the variety of plans offered, and the relative revenue by plan. Carriers also differ in the extent to which they offer bundled pricing.[227] For example, AT&T and Verizon offer bundles of services that may include wireless service along with wired telephone, Internet, or video. Comcast and Charter, the country's two largest cable companies, are now offering bundles including wireless services which rely heavily on their own wireless hotspots.[228] These bundled offerings make coordination very difficult as they create fundamentally different business and pricing incentives.[229] AT&T's vertical integration into video content through its acquisitions of Time Warner further affects its pricing incentives to the extent that it views its wireless service as a distribution channel for its owned video content. Its ownership of Direct TV also complicates its incentives in pricing wireless. And Verizon's FIOS wired video service, often bundled with wireless, has fundamentally different economics than AT&T's Direct TV. In contrast,

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[227] Goldman Testimony at 4 ("Wireless phone service is purchased by various types of customers with different needs. It is a differentiated product. Some examples of the relevant points of product and price differentiation include: payment plans; contract lengths; types of handsets; data features and costs of data services; roaming costs; and family plans"); Israel Rebuttal Testimony at 51:1-7 ("For example, networks compete across the multiple dimensions of service plans. There are many different types of wireless plans with many different types of features (*e.g.*, with or without contract, with or without handset subsidy, prepaid or postpaid, number of minutes, number of texts, data allowance, congestion policies, policies when above a data allowance, with and without bundled features like Hulu, with and without any of a wide range of international and domestic roaming options, *etc*.) and within a given type of plan with a given set of features, there is wide variance in the quality of the underlying networks and the services."); *see also* Hearing Tr. at 1206:27-1207:4 (Goldman Cross) (Q: "Would you agree that the wireless industry or wireless marketplace has carriers that offer diverse and heterogeneous services who compete against each other across multiple variables?" A: "Yes."); Hearing Tr. at 795:19-796:13 (Bresnahan Examination).

[228] *See* Israel Rebuttal Testimony at 51:18-23; *see also* Sievert Rebuttal Testimony at 42:12-16.

[229] Israel Rebuttal Testimony at 51:18-23.

unlike AT&T and Verizon, T-Mobile does not have a wireline business that serves residential customers.

While AT&T is the largest nationwide distributor with DirecTV and Verizon is one of the largest with FiOS, T-Mobile does not have a video offering nearly as significant.[230] Even the planned 5G offerings of AT&T, Verizon, and New T-Mobile differ significantly. AT&T and Verizon plan to deploy 5G primarily on mmWave. Due to mmWave's propagation limitations, discussed in further detail in Section IV, 5G deployed on this spectrum would be largely limited to densely populated urban areas. Meanwhile, New T-Mobile will deploy a robust, nationwide 5G network on a combination of low-band, mid-band, and mmWave, resulting in a 5G offering available not only in urban areas but in many suburban and rural areas as well. Sorting these elements out from the outside in order to arrive at a mutually agreeable price is an insurmountable obstacle to coordination.[231]

Second, the Horizontal Merger Guidelines note that coordinated conduct is less likely in markets where monitoring of competitive variables is more difficult.[232] Just as bundles create different pricing incentives, they also serve to hide the prices of individual components. Details on planned network improvements are typically kept close, and a general knowledge of a competitor's budget for improvements provides little insight into how or where those improvements will be made,

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[230] On April 10, 2019, T-Mobile launched TVision Home, a new Internet television service built off of Layer3 TV, in eight cities. *See* Press Release, *Meet T-Mobile TVision Home: BS-Free TV That Learns You* (Apr. 10, 2019), https://www.t-mobile.com/news/tvision-home.

[231] Horizontal Merger Guidelines at 26; *see also* Bresnahan Rebuttal Testimony at 36:4-8 ("Product quality in the wireless industry is strongly individualized and depends on where, when, and how each individual consumer utilizes his or her mobile phone. Because brands compete based on individual network quality, reaching and monitoring agreements to coordinate to compete less aggressively is much harder than it would be in an industry where this was not the case.").

[232] Horizontal Merger Guidelines at 26.

which could dramatically change quality adjusted prices to many consumers.[233] Monitoring is also difficult because the different levels of capacity utilization among competitors means that their timelines for adding capacity, and the resulting changes to network quality, are extremely varied.[234]

Third, the efficiencies that will result from this Transaction will make coordination even less likely.[235] The merger and network integration will significantly increase New T-Mobile's capacity and lower its marginal costs,[236] giving it an increased incentive to lower quality-adjusted prices to win sales from AT&T and Verizon.[237] These new competitive incentives make coordination particularly unlikely, as it would not be profit maximizing for New T-Mobile to limit its growth by coordinating with AT&T and Verizon to keep prices high rather than seizing its first mover advantage

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[233] Israel Rebuttal Testimony at 51:27-30 ("It is difficult in general to monitor rivals' network investment with any degree of precision (*i.e.*, knowledge of an overall capital budget provides little information as to the precise application of those funds to the network and the precise changes in network quality that will result) or timeliness.").

[234] Israel Rebuttal Testimony at 51:9-12 ("Critically, even if firms were able to coordinate on pricing, and thus raise profit margins, that would create incentives to compete on other dimensions to capture those margins. For example, firms could increase the quality offered at a given price point by, among other possibilities, slightly lowering congestion thresholds or slightly softening usage restrictions.").

[235] Bresnahan Rebuttal Testimony at 36:9-12 ("Our analysis shows that the proposed merger will make New T-Mobile a more effective competitor against AT&T and Verizon than the standalone companies. This injection of competition against the two leading firms also makes it unlikely that there will be an increase in coordination.").

[236] Sievert Rebuttal Testimony, Attachment B at 497-98, Appendix H ("Salop and Sarafidis Declaration") ¶ 23 ("Pricing and quality of service are also important dimensions of competition and will remain so after 5G technology becomes established. . . [T]here is no credible basis for concluding that coordination is likely. First, merger efficiencies will lead New T-Mobile to significantly expand its network capacity, increase its network quality, and reduce its network and non-network marginal costs (relative to the standalone firms).")

[237] *Id*. ¶ 23 ("These large efficiency benefits will decrease the likelihood of coordination because they provide a significantly increased incentive to the merged firm to grow its subscriber base, by increasing network quality and lowering quality-adjusted prices. Hence, the merged firm will have an increased incentive to deviate from a hypothetical price or quality coordination outcome, relative to the standalone firms. Second, the industry will be transitioning to 5G at the same time as New T-Mobile will be rolling out a 5G network that it expects to be superior to that of AT&T and Verizon. New T-Mobile also will have lower profitability than AT&T and Verizon.").

to win their customers.[238] This would defy economic logic and is entirely inconsistent with New T-Mobile's business plan.

Fourth, the "lumpy" nature of the large investments necessary to transition to 5G is also inconsistent with coordination. For example, retaliation by competitors is made more difficult due to the long lead times involved in these large investments.[239]

Fifth, the Horizontal Merger Guidelines recognize that coordination is less likely where "competition in the relevant market is marked by leapfrogging technological innovation." Here, the industry will be transitioning to 5G at the same time that New T-Mobile will be integrating the Sprint and T-Mobile networks, accelerating its roll-out of a robust, nationwide 5G network ahead of AT&T and Verizon[240] – precisely the type of "leapfrogging technological innovation" that decreases the likelihood of coordination.[241] Sacrificing its first mover advantage for the benefit of AT&T and Verizon makes no economic sense and, as Mr. Sievert testified, is not the New T-Mobile business plan.[242]

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[238] Hearing Tr. at 796:14-20 (Bresnahan Examination) ("There is just this big change in the industry which is New T-Mo can -- it can take away a lot of customers from AT&T and Verizon, that . . . T-Mo or Sprint can't today and has an incentive to do [so]. That is a new thing in the mix.").

[239] Israel Rebuttal Testimony at 51:30-52:3.

[240] *Id.* at 51:26-52:3 ("The large 'lumpy' investments required to transition to 5G also make coordination difficult.… Moreover, the lumpy nature of such investments creates incentives to compete for customers because marginal costs are typically lower once the investments are made. Finally, investments require long lead times, making any retaliation by competitors difficult.").

[241] Ray Rebuttal Testimony at 20:10-13 ("The ability to create cell splits nearly immediately in this fashion, in many cases without incurring substantial new costs or delays, will allow New T-Mobile to more rapidly deploy a wider and deeper network while simultaneously reducing the cost of adding incremental capacity.").

[242] Cal PA's economic expert also fails to provide any evidence demonstrating that this market has exhibited coordination historically or, as is relevant here, any merger-specific evidence that this Transaction will lead to *enhanced* coordination. If there were price coordination, one would expect to see pricing behavior that was stable and consistent across carriers. However, as Cal PA's economic expert establishes in his own testimony,

F. Intervenors Have Not Properly Analyzed the Merger's Impact on Consumer Welfare

None of the Intervenors' experts conducted a proper merger simulation (or other quantitative economic analysis) to predict the merger's effects on competition. Cal PA's economic expert, for example, admits that "some" claimed benefits of combining Sprint and T-Mobile spectrum "may well be true," yet he did not even attempt to quantify how those benefits would improve the consumer welfare of Californians,[243] or to quantify (or, for that matter, dispute any element of) the massive decreases in marginal costs from the Transaction. Instead of analyzing the merger's efficiencies and their effects on consumers, Cal PA's economic expert devotes over thirty pages of his testimony to the first step of the analysis, detailing calculations of HHI at levels as small as census blocks (which are totally irrelevant given that pricing is national), while never carrying out the fuller analysis that he agrees is necessary.[244]

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precisely the opposite is true: each firm's prices are different and their relative positioning changes over time. *See*, *e.g.*, Selwyn Testimony, Figure 11 at 82.

The sole evidence that Cal PA's economic expert cites as purportedly reflecting existing coordination is that carriers use mandatory arbitration. Selwyn Testimony at 96:5-10. In fact, the arbitration clauses of the four national carriers are very different, which undermines Cal PA's conclusion. *See* Sylla Dixon Rebuttal Testimony at 18:3-20:6. T-Mobile, for example, offers customers the ability to "opt out" of its arbitration provision, meaning that customers are not required to arbitrate their disputes with T-Mobile. *Id.* at 18:3-20:16. In any case, many companies from a broad swath of industries have arbitration provisions; it has nothing to do with coordination. *See* Selwyn Testimony at 98:15-26 ("Over the last few years, it has become increasingly difficult to apply for a credit card, use a cellphone, get cable or Internet service, or shop online without agreeing to private arbitration. The same applies to getting a job, renting a car or placing a relative in a nursing home."); Selwyn Testimony, Att. 2 ("Signs posted in a theater in Los Angeles and a hamburger joint in East Texas informed guests that, simply by walking in, they had agreed to arbitration.").

[243] Selwyn Testimony at 153:25-155:4.

[244] *Id.* at 27:15-58:18. Selwyn calculates HHIs down to the census block and then aggregates these census block HHIs to the county level. If he were correct that these HHIs are relevant to assessing competition, then he should be able to demonstrate that in those cell blocks or counties where HHIs are particularly high – for example, Trinity County – prices are higher than in those with considerably lower HHIs – for example, Humboldt County. In fact, the record evidence is that prices are the same nationwide. *See, e.g.*, Sievert Rebuttal Testimony at 25-26.

Cal PA's economic expert witness admits that HHIs are merely a starting point.[245] The Horizontal Merger Guidelines make clear that HHI thresholds are "not … a rigid screen to separate competitively benign mergers from anticompetitive ones … [r]ather, they provide one way to identify some mergers unlikely to raise competitive concerns and some others for which it is particularly important to examine whether other competitive factors confirm, reinforce, or counteract the potentially harmful effects of increased concentration."[246] Even with "mergers that cause a significant increase in concentration," this presumption of enhanced market power "can be rebutted."[247] And as CWA acknowledges, "[i]ndustries with few players may be intensely competitive."[248]

Cal PA's economic expert presents evidence that vividly illustrates the fact that increased concentration can make a market more efficient to the benefit of consumers. For example, when HHIs provided by Cal PA's economic expert in his testimony are overlaid onto his own price chart, it is clear that prices decreased despite increasing HHIs. Similarly, CWA observed these same price drops following wireless mergers despite increases in HHI.[249]

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[245] Selwyn Testimony 16:22-27 (quoting the Horizontal Merger Guidelines); *see also* Goldman Testimony at 16 ("To be sure, market shares and HHIs do not necessarily tell the whole story. Industries with few players may be intensely competitive.").

[246] Horizontal Merger Guidelines at 19.

[247] *Id.* at 3.

[248] Goldman Testimony at 16.

[249] Hearing Ex. Jt Appl.-018 Figure 2 of Selwyn's Testimony of January 7, 2019, Modified (included above); *see also* Hearing Tr. at 1204:18-24 (Goldman Cross) ("My interpretation of Dr. Selwyn's chart is that it shows that the average price of wireless service – on the chart it's called CMRS – has gone down since the starting year of 2008 and that the Consumer Price Index average price for cable has gone up.").

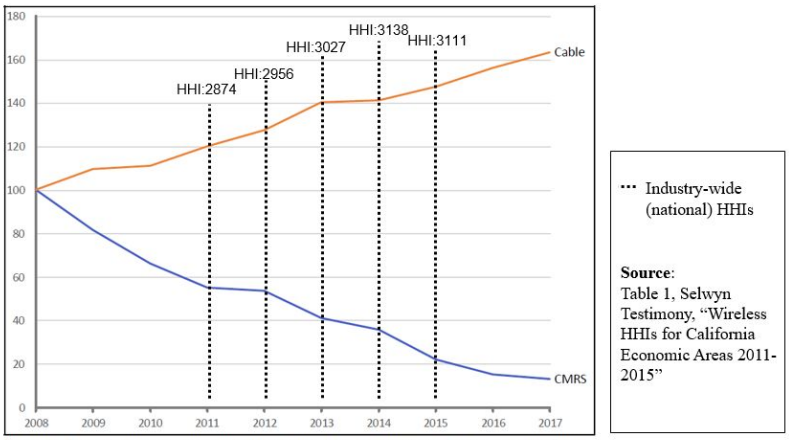

Figure 2. Prices for wireless voice and data services have been steadily decreasing, while Basic Cable prices have steadily risen. Index (2008=100) of Basic Cable average service price and Average Revenue per Mixed Unit for CMRS. Sources: FCC Cable Report; CTIA Semi-Annual Wireless Industry Survey, year end 2013, 2017. Note that prices for Basic Cable for 2016 and 2017 have not been published; those shown here are linearly extrapolated from the previous trend. Wireless usage rates for 2015 were not published; the 2015 index value was constructed using actual 2015 pricing and the average for the 2014 and 2016 usage values.

Cal PA's economic expert relies solely on generalizations about market concentration, yet his own testimony regarding the effect of concentration in the wireless market belies his own conclusions. He states this Transaction will result in a "marked increase in concentration" which cannot be offset by benefits of the merger.[250] Yet he also testifies that "[t]he mobile wireless market in the US has been undergoing massive consolidation for more than a decade,"[251] and, crucially, even as concentration has increased, "[p]rices for wireless voice and data services have been steadily *decreasing*."[252] And he acknowledges that disruptive competitors like T-Mobile and technological innovations drove this decrease in prices.[253] With this testimony, Cal PA's economic expert

[250] Selwyn Testimony ¶ 161.

[251] *Id.* ¶ 13.

[252] Selwyn Testimony Figure 2, at 21 (emphasis added). *See also* Hearing Ex. Jt Appl.-018 Figure 2 of Selwyn's Testimony of January 7, 2019, Modified (for Dr. Selwyn's visual with industry-wide HHIs as calculated by Dr. Selwyn overlaid).

[253] Selwyn Testimony at 13:6-9 ("Over the next decade-plus, disruptive competitors such as T-Mobile and Metro PCS introduced a variety of new pricing arrangements that, together with technological innovations that worked to reduce marginal cost, resulted in a precipitous drop in wireless prices overall, as well as the introduction of new services.").

underscores the necessity of going beyond the threshold issue of market concentration to examine and quantify effects on consumers. His failure to consider any benefits to consumers renders his conclusions meaningless.

Similarly, other witnesses' testimony regarding the competitive impact of the merger do not call into question the conclusions of IKK's or Professors Bresnahan's and Asker's analyses. Cal PA's engineering witness testified, in a conclusory manner, that "[t]he harms caused by the loss of a facilities-based provider that is a viable carrier and competitor does [sic] not outweigh the benefits of the merger."[254] Nevertheless, he admitted on the stand that he has no independent basis for this economic conclusion and has no expertise or training in economics.[255] Instead, he completely relies on Cal PA's economic expert for his assertion of consumer harms and offers no explanation of how he compares the harms and benefits, neither of which he quantifies.[256] CWA's witness similarly stated that she did not do a merger simulation or test the simulation submitted by the Joint Applicants.[257]

Indeed, no Intervenor witness conducted a quantitative assessment of the merger's effects on competition or California consumers. Rather, they offered at most personal opinions backed by no expert methodology, none of which is entitled to any evidentiary weight.

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[254] Reed Service Quality Testimony at 7:5-6.

[255] Hearing Tr. at 1101:7-10, 1101:27-1102:9 (Reed Cross); *see also id.* at 1075:12 – 1076:27 (Odell Cross) (no independent competitive analysis; relied exclusively on Dr. Selwyn).

[256] Hearing Tr. at 1102:8-9 (Reed Cross).

[257] Hearing Tr. at 1186:22-27 (Goldman Cross).

G. Cal PA's Testimony on the Purported Impacts of the Transaction on Prepaid Services and Low-Income Consumers Has No Foundation

Cal PA also attacks the Transaction by suggesting, contrary to all of the evidence, that low-income Californians depend primarily on prepaid wireless services provided by T-Mobile and Sprint, that prepaid plans constitute a separate market, that New T-Mobile may be inclined to raise the rates for those customers, and that MVNOs do not provide competition for prepaid consumers. These arguments are wrong on all counts.

As an initial matter, the Joint Applicants note that low-income consumers are important customers to both Sprint and T-Mobile – as they are to all wireless service providers – and that New T-Mobile will take their needs and interests to heart in designing and pricing its services. T-Mobile and Sprint have been industry leaders in offering affordable plans, and Sprint is currently the only facilities-based carrier that offers LifeLine.[258] In addition, New T-Mobile will continue and indeed improve the LifeLine offerings,[259] and is planning to make significant enhancements to the Boost and Metro prepaid offerings as well.

Moreover, Cal PA is mistaken in its conclusions about the impact of the Transaction on low-income Californians. First, Cal PA's testimony proceeds on the flawed premise that there is a separate market for "prepaid wireless services." This assertion is contrary to FCC and DOJ precedent and it flies in the face of market realities, as explained in the unrefuted testimony of Mr. Keys, the President of Metro by T-Mobile, and Mr. Draper, Chief Commercial Officer of Sprint, postpaid and prepaid plans are converging in today's market.[260] As Mr. Keys testified, the main difference

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[258] Hearing Ex. Pub Adv-004C ("Odell Testimony") at 22:4-5.

[259] *See supra* at VII.A.

[260] Keys Rebuttal Testimony at 6:1-7:15; Hearing Ex. Jt Apl.-002C ("Draper Rebuttal Testimony") at 27:2-28:2.

between postpaid and prepaid is whether you pay for the service on the last day of the month or the first day of the following month. The lack of differentiation is further reflected by the fact that there is robust switching between prepaid and postpaid plans with customers "freely moving between plan types depending on where they see opportunities to obtain better values."[261]

Second, contrary to Cal PA's assertions, low-income Californians are not dependent only on prepaid offerings, much less the prepaid offerings of Sprint and T-Mobile. As Professor Bresnahan's and Professor Asker's analysis and Cal PA's cross examination confirmed, a majority of low-income Californians choose wireless services today from AT&T and Verizon (both postpaid and prepaid),[262] as well as from other robust prepaid providers across the entire wireless industry, especially TracFone. The fact that low-income consumers utilize the services of all the major wireless providers is highlighted by the analysis in the Cornerstone Model:[263]

[BHC-AEO]

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[261] Keys Rebuttal Testimony at 6:21-24; *see also id.* at 6:18-19 ("Similarly, postpaid service plans have adopted characteristics of prepaid plans – most notably, the elimination of long-term service contracts."); 7:6-8 ("For example, T-Mobile's introduction of 'Contract Freedom' eliminated long-term service contracts for postpaid plans and replaced them with a transparent pricing model, spurring other providers to do the same.").

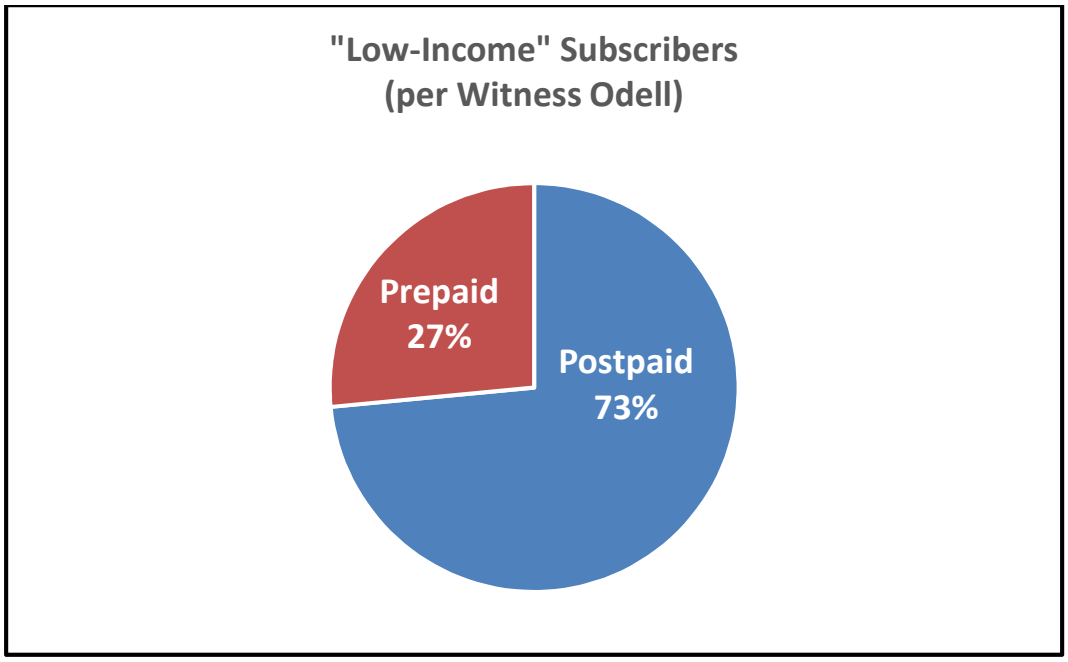
[262] *See* Hearing Tr. at 1088:21-1089:7 (Odell Cross); Bresnahan Rebuttal Testimony, Attachment A, Ex. 9.

[263] *See* Bresnahan Rebuttal Testimony, Attachment A at ¶¶ 68-71, Ex. 9.

[EHC-AEO]

In addition, the calculations acknowledged by Cal PA's witness – using data from her own testimony – show that more than two-thirds of low-income consumers choose *postpaid* wireless service, as reflected in the figure below.[264]

[264] Hearing Tr. at 1083:11-1089:7 (Odell Cross).



Cal PA's effort to dismiss TracFone – the largest seller of prepaid wireless services in the United States – as a viable competitor also has no foundation.[265] Among other things, this assertion fails to credit TracFone's statements to the FCC in support of this Transaction, in which TracFone states that the Transaction would *strengthen* its ability to compete in the retail wireless marketplace because of the stronger network that New T-Mobile will be able to offer TracFone.[266]

Third, as Professor Bresnahan's and Professor Asker's analysis concluded, low-income consumers, who are heavy users of wireless data services (and, as Cal PA's witness acknowledged, care a great deal about the quality of those service[267]) and are particularly dependent on their wireless

[265] *See* Hearing Tr. at 1074:27-1075:3 (Odell Cross).

[266] *See* Hearing Tr. at 1081:10-24 (Odell Cross).

[267] *See* Hearing Tr. at 1072:9-13 (Odell Cross).

devices for voice and broadband services, will benefit in particular from the quality improvements from the merger.[268]

Finally, competition is fierce among all providers, including AT&T, Verizon, MVNOs like TracFone, and now cable companies, and it will be intensified by the merger. This competition will ensure that all Californians – including low-income Californians – reap the benefits with service that was unimaginable just a few years ago. Indeed, the notion that New T-Mobile would increase prices for prepaid consumers and other low-income consumers (or for MVNOs who serve those consumers) is squarely contradicted by the economic analyses prepared by IKK and Cornerstone, as well as by New T-Mobile's business plan.[269]

H. Both Standalone Firms Face Challenges That Limit Their Competitiveness Compared to New T-Mobile

As described in Section VI, *supra*, the relevant analysis of the Transaction's impact on competition demands a comparison of the competitive landscape with and without the Transaction. Ultimately, the evidence establishes that the standalone companies cannot build the type of robust 5G network that New T-Mobile will offer, and that without the merger, all consumers will be deprived of the extensive benefits discussed in the preceding sections.

Both standalone T-Mobile and Sprint face substantial challenges individually that would be overcome by the merger, enabling a much stronger competitor against AT&T and Verizon. For example, as noted in Section IV, *supra*, while T-Mobile has some low-band 600 MHz spectrum, its holdings of mid-band and mmWave spectrum are limited. As a result, it will face capacity constraints that will impede its ability to serve customer data demands, much less add significant

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[268] Bresnahan Rebuttal Testimony at 37:6-9.

[269] Bresnahan Rebuttal Testimony, Attachment B at 212-214; Israel Rebuttal Testimony, 49: 1-15, Table 5; *see also* Section VI, *supra*.

quantities of new customers.[270] Conversely, while Sprint's 2.5 GHz spectrum provides deep capacity, Sprint has only a limited portfolio of low-band spectrum, which constrains its ability to provide wide geographic coverage or consistent coverage even within its footprint.[271]

Sprint also faces a number of other challenges that will limit its ability to compete effectively against AT&T and Verizon. For example, Sprint has experienced difficulty attracting and retaining customers as reflected in both a decline in postpaid handset gross adds and increased churn (which in part results from the lack of coverage and a lack of consistent, high-speed service noted above).[272] Without a growing customer base, Sprint's future revenues will be pressured, and its ability to invest in its business will be challenged.[273] Moreover, while Cal PA has selectively cited to certain of Sprint's financial metrics as evidence of Sprint's supposedly improving financial condition, these "improvements" do not signal that Sprint can overcome these challenges to be an effective competitor going forward. Instead, as Mr. Draper explained, these are in large part a result of accounting or one-

[270] Hearing Tr. at 278:24-279:3 (Sievert Cross) ("T-Mobile has been a leader in bringing lower prices and more innovation into the category for the last five years, partly because we have had more capacity available per subscriber than AT&T and Verizon. And that's decreasingly the case as we go along in standalone T-Mobile, but it's been the case."); *id*. at 379:6-380:13 (Sievert Redirect) (noting that T-Mobile's recent growth "uses up [its] capacity" and that T-Mobile has found that "[its] access to spectrum is becoming more limited as AT&T and Verizon use their financial power to seize it all," which means that "in [T-Mobile's] standalone business, [it has] limited avenues to make step changes in the available capacity for each customer," and that Mr. Sievert "can't predict how much improvement there will be in the available speeds and capacity versus what customers experience today.").

[271] Hearing Tr. at 636:8-14 (Draper Cross) ("The structural disadvantage is the fact that [Sprint has] not had low-band spectrum, only mid-band spectrum, which has challenges propagating, going through buildings, providing coverage, which is critical for customers.").

[272] Draper Rebuttal Testimony at 20:6-9, 20:15-17.

[273] *See, e.g.*, Draper Rebuttal Testimony at 21:4-6 ("[T]he lost revenues from decreased numbers of subscribers could overcome any short-term gains in revenues . . . ."); *id.* at 8:23-9:2 ("The company must constantly manage its cash flow and assess how to balance capex spend, debt financing, and spending on promotions to drive near-term growth.").

time tax treatments that have not actually increased the money available for Sprint to invest in its business.[274]

In addition, while Sprint's has recently increased its network capex in order to avoid losing further ground to its competitors, that increase is not sufficient to *close* the gap but merely to keep it from widening further.[275] Moreover, these investments, as well as Sprint's recent efforts to attract customers through heavy promotional spending, have resulted in significantly more cash flowing out of the company and, when combined with declining revenues noted above, have led to a sharp decline in Sprint's free cash flow – which is a material challenge to Sprint's ability to compete in the wireless market.[276]

Despite these realities, Cal PA argues that the merger will reduce competition because Sprint will continue to exist even without the merger and, remarkably, is purportedly on a comparable financial footing as AT&T, Verizon, and T-Mobile.[277] The Cal PA analysis, however, is superficial and, on its face, deeply flawed.

First, the Cal PA witness completely ignores metrics such as postpaid handset churn, free cash flow, stock price, and dividends paid by the carriers to their shareholders,[278] even though the record evidence shows that wireless executives rely upon these types of metrics on a day-to-day basis in

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[274] Draper Rebuttal Testimony at 5:2-7:12.

[275] *Id.* at 9:8-9:21 and Attachment F.

[276] *Id.* at 8:12-9:2; *id.* at 17:2-24; *id.* at Att. E; Hearing Tr. at 702:24-703:3 (Draper Recross).

[277] Hearing Ex. Pub Adv-003C ("Clark Testimony") at 7:5-6.

[278] Hearing Tr. at 1021:10-12 (Clark Cross) (Cal PA did not analyze churn); *id.* at 1049:16-20 (free cash flow); *id.* at 1057:17-19 (stock prices); *id.* at 1054:12-18 (Verizon's dividends).

gauging the performance and prospects of their business.[279] And even for the metrics that the Cal PA witness did examine, like EBITDA, operating cash flow, and net income, he admitted that he failed to adjust these metrics to account for differences in accounting treatment reflecting the carriers' business models.[280] Indeed, he acknowledged that he had not analyzed how taking these differences into account would, as a result of standard accounting practices, change the results of these metrics.[281]

Moreover, the Cal PA witness concedes that the "scoring" methodology he applied to compare Sprint against other wireless carriers was not based on any generally accepted financial analysis, but was instead his own creation.[282] Not surprisingly, his methodology led to illogical and inexplicable results. For example, he concludes that Verizon was *simultaneously* the most profitable

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[279] Draper Rebuttal Testimony at 10:23-25 (Postpaid handset gross adds and churn "directly relate to the number of customers Sprint has and can expect to have going forward—which is critical to any assessment of Sprint's future prospects."); *id.* at 6:8-9 (Sprint's free cash flow "more accurately depicts Sprint's true cash flow position.").

[280] With respect to EBITDA, Cal PA's witness acknowledged using EBITDA without adjusting for handset depreciation, which would impact EBITDA ratios. Hearing Tr. at 1042:4-1043:13 (Clark Cross). With respect to net income, Cal PA also did not adjust net income for one-time benefits of tax reform, which would affect any ratios including net income. *Id.* at 1036:1-11. Nor did Cal PA adjust operating cash flow metrics to account for changes in receivables. *Id.* at 1048:14-20.

[281] For example, the Cal PA witness acknowledges that while Sprint's change from financing handsets to leasing handsets increased Sprint's operating cash flow from 2016 to 2017 by over $9 billion as a matter of accounting, it did not result in any actual increase in cash available to the business. Hearing Tr. at 1048:5-13 (Clark Cross); *see also* Draper Rebuttal Testimony at 6:11-14. Despite the fact that this accounting change did not result in an increase in actual cash, Cal PA's "cash flow score" – which showed Sprint as the highest "scoring" wireless company in the industry – did not normalize the results for this accounting change, thereby making the cash flow score grossly misleading. Clark Testimony at 25, Figure 11. Further, Cal PA's witness admits he did not assess whether the other wireless carriers he analyzes offer handset financing, the type of handset financing they offer, or when those practices began, despite the acknowledged impact on operating cash flow. Hearing Tr. at 1045:28-1046:9 (Clark Cross) (A: "I'm not aware how [AT&T, Verizon and T-Mobile] handle their furnishing of phones, lease or sale, to customers. Q: You don't know where those companies put the costs of those devices on their balance sheet, correct? A: That is correct.").

[282] Hearing Tr. at 1031:14-16 (Clark Cross) ("Q: [Your methodology is] something that you came up with on your own? A: That is correct."); *see also id*. at 1031:2-13 (Clark Cross) ("Q: [D]o you cite a textbook? A: No, I do not. Q: Did you cite any articles demonstrating it's a commonly accepted method in financial analysis? A: No, I did not.").

and least solvent carrier from 2014 to 2017, even as it paid dividends of almost $10 billion annually to its shareholders in recent years.[283] In essence, Cal PA's assertions regarding Sprint's financial ability to compete effectively are entirely without foundation.

Ultimately, the key question for merger analysis is not simply whether Sprint or T-Mobile would continue to exist in the absence of the merger, but how effective a standalone competitor each is likely to be going forward. As to Sprint, the Cal PA financial analysis, with its inapt and unsupported "scoring system" and its failure to normalize results comparing Sprint to T-Mobile, AT&T, and Verizon, provides distorted information to the Commission about Sprint's prospects as a standalone competitor. The reality is very different, as reflected in its subscriber results, performance in the financial markets, and as otherwise made clear by the testimony of Mr. Draper.

VII. THE TRANSACTION WILL BRING A NUMBER OF ADDITIONAL BENEFITS TO CALIFORNIA

In addition to the numerous benefits flowing directly from New T-Mobile's enhanced network and the resulting increase in competition for wireless, in-home broadband, and other services, the Transaction will provide the following benefits.

A. LifeLine

New T-Mobile's LifeLine offering will provide better and more expansive service to more Californians, plain and simple.

1. New T-Mobile is Committed to Continuing and Expanding the LifeLine Program in California

[283] Clark Testimony at 17:1 (Figure 6), 20:11 (Figure 8). Despite his review of the 10-Ks of these companies, the Cal PA witness admitted he would be "surprised" to learn that Verizon is paying such large dividends. Hearing Tr. at 1054:15-18 (Clark Cross). As just one other example, the Cal PA witness also concluded that Sprint turned the corner to financial success due to a "breakout" year in 2017. Yet, during this supposed "breakout" year, Sprint's stock price plunged over 30 percent—a seemingly inexplicable contradiction. Hearing Tr. 696:10-12 (Draper Recross) ("What I know is overall our stock price was—we had such a breakout year our stock price was down 30 percent in 2017.").

As Mr. Sievert testified, with the increased capacity unlocked by the Transaction, retaining and growing LifeLine program customers is a sound business strategy for New T-Mobile.[284] To that end, New T-Mobile will offer LifeLine *indefinitely* in California.[285]

With respect to *rates, terms, and conditions*, New T-Mobile will continue to offer LifeLine services (pursuant to both federal FCC Lifeline and state CPUC LifeLine programs) indefinitely in California to both current and new LifeLine eligible customers *for free*, and at other terms and conditions no less favorable to eligible consumers than those offered under the Assurance Wireless brand as of the date of the close of the Transaction.[286] With respect to *data offerings*, New T-Mobile will provide all new LifeLine customers a minimum of 3GB per month and will upgrade all existing Assurance Wireless LifeLine customers to a minimum of 3GB without the need to request the upgrade.[287]

In addition, New T-Mobile strive to increase Lifeline adoption in California over five (5) years by achieving at least 332,500 new (additional) low-income households through (i) new Assurance LifeLine customers (gross additions) approved by the LifeLine administrator and (ii) Low-Income customers in California for a total of no less than 675,000 enrolled LifeLine / low-income households at the end of five (5) years.[288] To achieve these adoptions New T-Mobile will prepare a

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[284] *See* Hearing Tr. at 269:16-269:22, 281:6-281:10 (Sievert Cross).

[285] Hearing Tr. at 269:16-269:22, 281:6-281:10 (Sievert Cross). To provide assurance of its commitment, New T-Mobile guarantees the provision of LifeLine in California *through the end of 2024 at a minimum.* CETF MOU at 4. However, should there be material changes to the LifeLine program at either the state or federal level with respect to eligibility criteria, mandatory service standards, or subsidy amounts, New T-Mobile reserves the right to seek appropriate relief from the CPUC after consultation with CPUC staff, consumer groups, and stakeholders.

[286] Sylla Dixon Rebuttal Testimony at 3:8-3:11.

[287] CETF MOU at 4-5.

[288] CETF MOU at 5.

strategic plan, which will be submitted to the Commission within 180 days following the close of the Transaction.[289] The strategic plan will generally describe the activities New T-Mobile will undertake to promote the LifeLine offers and enroll eligible California LifeLine and Low-Income customers, including but not limited to community based direct marketing and use of media.[290] New T-Mobile shall place an appropriate share of the promotion investment with community media to ensure sufficient information in-language and in-culture, which shall be monitored to measure results and to analyze cost-effectiveness in comparison to other promotion investments. Furthermore, the strategic plan will include a promotion investment schedule providing for a minimum of $1 million per year for 5 years for a total of at least $5 million dedicated to outreach and promotion of the LifeLine service and enrollment of new LifeLine and Low-Income customers.[291]

Through these financial and other LifeLine commitments, New T-Mobile will make LifeLine a priority in California in the near term and beyond. Relatedly, T-Mobile commends the Commission on its recent decision authorizing the Boost Pilot program,[292] and New T-Mobile is committed to continuing Boost's participation in the pilot after the merger.

2. Existing and New California Lifeline Customers will Reap the Benefits of the Expanded New T-Mobile Network From the Outset

As discussed above, it is undisputed that T-Mobile covers more than twice the geographic area of California compared to Sprint, including rural and sparsely populated areas. The expanded coverage available to Sprint customers post-merger will be especially striking in the LifeLine context.

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[289] CETF MOU at 6.

[290] CETF MOU at 6.

[291] CETF MOU at 6.

[292] *See* D.19-04-XXX, authorizing Pilot Programs of Boost Mobile, Inc. and iFoster, Inc. in the California LifeLine Program, R.11-03-013 (April 25, 2019).

Currently, Sprint's approximately half-million LifeLine customers (all of whom receive service through Assurance Wireless) are limited to the geographic scope of the Sprint legacy network, *i.e.*, they have no wireless coverage throughout huge swaths of California, primarily rural, which are otherwise covered by T-Mobile and the other two major carriers.[293] However, within six months of closing, *eligible consumers across the entire state*, including those in rural and more sparsely populated areas, will be able to enroll in the Assurance LifeLine program.[294] That would simply not be possible without the merger, as Sprint's legacy network does not provide sufficient coverage to reach eligible LifeLine consumers in those areas. Given the particularly limited options currently available to rural consumers who are otherwise eligible for LifeLine, this benefit could have an immediate impact on some the most underserved consumers in the state.[295] And as existing LifeLine

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[293] *See* Section V, *supra*; *see also* Sylla Dixon Rebuttal Testimony at 3:13-26.

[294] Pursuant to the CETF MOU, New T-Mobile has made the following specific committments regarding LifeLine customer's access to the broad New T-Mobile Network:

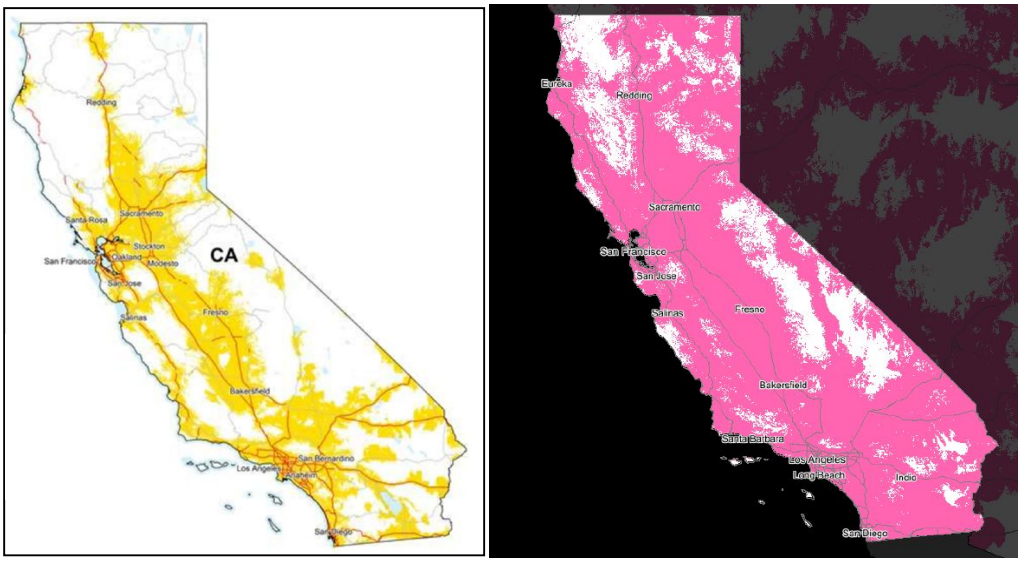
- On the first day after the close of the Transaction, new California Assurance LifeLine customers will be provided a free handset at the time of enrollment that is compatible on both the New T-Mobile and the Sprint network, but their service will continue to be activated on the Sprint network.
- No later than 6 months after the close, new California Assurance LifeLine customers will be activated on the New T-Mobile Network.
- All Assurance LifeLine customers with incompatible handsets (that do not work on the New T-Mobile network) will be migrated in the same timeframe as the non-LifeLine legacy Sprint customers to the New T-Mobile network and will be given a free compatible handset at the time of migration.

CETF MOU at 3-4.

[295] Cal PA also included a comparison of current T-Mobile and Sprint metrics for call drop rates and call connection rates. In each of those categories, T-Mobile consistently outpaced Sprint. *See* Reed Service Quality Testimony at 14:14-16:2. Indeed, Cal PA's conclusion with respect to service quality was that "T-Mobile generally has better voice service quality, coverage, customer perception, and data speeds than Sprint." *Id*. at 6:16-17.

customers receive their free compatible handsets under the migration program,[296] they too will be able to enjoy the broader geographic scope of the New T-Mobile network.[297]

The maps provided below, which were included with Ms. Sylla Dixon's Rebuttal Testimony, illustrate the current LifeLine coverage of standalone Sprint and New T-Mobile respectively, and demonstrate the huge coverage benefit created by the merger even prior to the build out of the 5G network.[298]



Moreover, as amply demonstrated by the evidence, beyond expanding the availability and coverage of LifeLine for more Californians, the quality of the network experience for New T-Mobile's LifeLine customers will be dramatically better than what the Sprint standalone can provide.[299]

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296 *See* Section VII.A.

297 Sylla Dixon Rebuttal Testimony, Attachment A.

298 *Id.*

299 *See* Section VI.D, *supra*.

3. LifeLine Customers Will Benefit from the New T-Mobile Network Directly and Through MVNOs

As the Commission is aware, Sprint is the only facilities-based provider of wireless LifeLine in the state. The remainder of wireless LifeLine service is offered by MVNOs such as TracFone, SafetyNet Wireless, and Blue Jay Wireless.[300] As is explained above in Section V.E, with its massively increased network capacity, New T-Mobile will have an increased incentive to work with MVNOs to put subscribers on New T-Mobile's network, and New T-Mobile's decreased capacity costs will result in lower wholesale costs for MVNOs and their subscribers. This includes MVNOs who provide LifeLine service. Thus, after the merger, eligible LifeLine consumers will have the option of obtaining their service through the more robust and expansive New T-Mobile network either directly from New T-Mobile or the MVNO of their choice (to the extent the MVNO uses the New T-Mobile network). Moreover, as discussed above in Section V.E, New T-Mobile will be able to better compete with AT&T and Verizon, the dominant providers of wholesale services, which should inure to the benefit of consumers and MVNOs alike as costs decrease and network service quality increases dramatically.

B. The Merger Will Create New Jobs in California

Jobs in California are projected to increase as a result of the merger.[301] Sprint and T-Mobile presently employ an internal workforce of just under **[BHC-AEO]** [redacted] **[EHC-AEO]** in California.[302] New T-Mobile, however, expects to add new jobs associated with rural stores, network build, customer care, and new or expanded services. Included among these new jobs will be over a

[300] *See* Hearing Tr. at 25:1-2 (Odell Testimony) (partial list of California Wireless LifeLine providers).

[301] *See, e.g.,* Sievert Rebuttal Testimony at 36:1 – 37:24 (discussing national job gains).

[302] Sievert Rebuttal Testimony at 37:29-38:1.

thousand new employees at a Customer Experience Center to be built in California's Central Valley as a result of the merger.[303]

These new jobs will offer robust opportunities and benefits. For example, employees at Customer Experience Centers can expect to have careers that offer a meaningful path for advancement, and will benefit from significant management preparation experience, as well as qualify for college tuition reimbursement.[304]

New T-Mobile has also committed to offering each and every T-Mobile and Sprint retail employee in the state an opportunity to join New T-Mobile on comparable employment terms.[305] On the stand, Mr. Sievert further confirmed that this offer would be extended to part-time as well as full time employees, that they would be offered comparable jobs, receive the same or better wages and benefits than they do before the merger, and if not offered a nearby job (which Mr. Sievert said was unlikely), would be offered relocation packages.[306] In addition, and although T-Mobile cannot control these employees, New T-Mobile's business plan anticipates that the number of indirect employees; i.e. the dealer employees, will increase as well.[307]

However, for avoidance of all doubt, New T-Mobile has formally committed to no net job losses in California, which means that the total number of New T-Mobile direct employees in the

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[303] *See* https://www.t-mobile.com/news/customer-experience-center-kingsburg-california#(press release on Kingsburg Customer Experience Center).

[304] Sievert Rebuttal Testimony at 37:3-5.

[305] *Id.* at 38:2-4.

[306] Hearing Tr. at 355:17-356:9 (Sievert Cross).

[307] *Id.* at 367:5-15 ("We have a model on what to expect of dealer behavior. Our model suggests and very specifically calls for more activations in the new company than in the sum of the standalones and a bigger customer base doing more upgrades in the new company than in the sum of the standalones. And the result will be a need for more labor in retail stores in the new company including direct external than in the sum of the standalones. That's what I am trying to say.").

State of California at three years after the close of the Transaction will be equal to or greater than the total number of employees of Sprint and T-Mobile in the State of California.[308]

Despite the substantial evidence that the merger will have overall positive effects on jobs for current Sprint and T-Mobile employees in California, CWA has persisted in advancing the same baseless and mathematically impossible criticisms of the merger that it has presented to the FCC and in numerous other state proceedings. Nationally, CWA predicts job losses of nearly 30,000 – a number that exceeds Sprint's entire workforce.[309] In California, CWA predicts a job loss of 3,432 retail store jobs which they calculate will stem from the closure of postpaid stores and prepaid stores.[310] CWA's analysis arrives at such incredible numbers by ignoring key facts: (i) that the projected synergies of the deal do not come from labor cost savings;[311] (ii) that closing of stores results in larger remaining stores with increased staffing to handle the additional traffic associated

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[308] Sievert Rebuttal Testimony at 38:12-15.

[309] CWA simply ignores the repeated representations and evidence that from day one, the merger will be jobs positive, and it will create thousands of jobs going forward. *See* Section VII.B, *supra*; *see also* Sievert Rebuttal Testimony at 36:1-37:7 (For example, New T-Mobile is expected to add approximately 3,600 more employees in its first year and over 11,000 more employees by 2024 than T-Mobile and Sprint would have created absent the merger, combined.).

Moreover, nationwide, T-Mobile is allocating $1.4 billion in increased labor costs for the merger; i.e., the merger anticipated increased – not reduced - labor costs. *See* Sievert Rebuttal Testimony at 36:9-11; *see also* Hearing Tr. at 286:15-21 (Sievert Cross) ("In fact the overall company's labor model has 1.4 billion additional costs for employees than the sum of the two standalone companies. So, overall, this new company's business plan is burdened with more labor costs and that's for a simple reason. We expect to have more employees.").

[310] Goldman Testimony at 48, 52.

[311] Sievert Rebuttal Testimony at 37:15-16 ("Our synergies that fund this effort are not based on cutting employment costs."); Hearing Tr. 286:12-18 (Sievert Cross) ("Q: Isn't one of the big synergies that you have redundant employees and you can get rid of them? A: No. In fact the overall company's labor model has 1.4 billion additional costs for employees than the sum of the two standalone companies.").

with serving a larger customer base;[312] and (iii) that New T-Mobile has no plan to close any prepaid wireless stores."[313] And CWA ignores New T-Mobile's commitment to offer employment to all retail employees of T-Mobile and Sprint.[314] As a result, CWA's conclusions are simply not credible.

Similarly, CWA's claims regarding retail employee wage reduction from consolidation in the wireless industry likewise employ assumptions that do not match up with reality. Its analysis inexplicably assumes that employees at AT&T, Sprint, T-Mobile, and Verizon retail stores are only employable at wireless retail stores of one of those four companies. In fact, most T-Mobile retail hires come from employers other than another wireless carrier. CWA's analysis thus understates the elasticity of the retail employee labor supply, resulting in an artificially depressed wage estimate.[315]

The Joint Applicants note that CWA's prognostications have proven to be dubious at best. For example, CWA claimed that the merger of T-Mobile and AT&T (the largest national carrier at the time) would lead to a massive *increase* in jobs. A few years later, CWA asserted that the T-Mobile merger with MetroPCS would result in the loss of thousands of jobs. However, as CWA's witness admitted on the stand, Metro's merger with T-Mobile resulted in job creation.[316] In fact,

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[312] Hearing Tr. at 365:16-25 (Sievert Cross) (explaining that "jobs required for retail are a direct function of the activations that we expect to have in the company, which are higher in the new company than in the standalones summed up. And a function of the customer base and the amount of upgrades and other transactions by customers that are in the new company, which, again, are higher for the new company than the standalones summed up"). *See also id.* at 285:26-286:2.

[313] Hearing Tr. at 371:8-11 (Sievert Cross) ("Q: Okay. So it's your testimony that New T-Mobile will not combine nearby MetroPCS and Boost stores as a result of the merger? A: That is correct.").

[314] *See* Section I, *supra*.

[315] Sievert Rebuttal Testimony at 39:3-15.

[316] Hearing Tr. at 1219:11-21 (Goldman Cross) ("Q: As a result of the transaction between T-Mobile and MetroPCS employment at MetroPCS increased. It did not decrease, correct? A: As MetroPCS expanded from 15 markets to a nationwide company, yes, employment increased. Q: That's another example of a merger that is creating growth and expanding output, correct? A: It certainly created jobs.").

since its merger with T-Mobile in 2013, MetroPCS has 50 percent more employees, and there are more than three times the number of employees and contractors dedicated to support its operations.[317] Now, again, CWA claims that the merger of T-Mobile and Sprint will result in the loss of thousands of jobs. These claims are unsupported by any credible evidence and should be treated accordingly.

C. The Merger Will Enhance Network Resiliency and Disaster Preparedness

New T-Mobile is fully committed to safeguarding the interests of its customers, employees, the public, and first responders during emergencies and other significant business disruptions.[318] The proposed merger of the two companies, along with New T-Mobile's commitment to maintain Sprint's existing fleet of portable generators, COLTs, and COWs and to expand COLTs and COWs available in California to provide emergency back-up, will only enhance the resiliency of the integrated network and the combined companies' ability to respond to emergency situations.

As explained by T-Mobile witness Neville Ray in his testimony, T-Mobile maintains an enterprise-wide Business Continuity program that promotes active involvement by all lines of business and is regularly refined to maintain its effectiveness and ensure the flexibility needed to effectively address emergency situation around the country.[319] In shaping its Business Continuity Program T-Mobile draws from governmental guidance and industry best practices and participates in

[317] Sievert Rebuttal Testimony at 36:11-16; 38:20; *see also* Keys Rebuttal Testimony at 5:1-3.

[318] Ray Rebuttal Testimony at 50:7-9.

[319] *Id*. at 50:9-19.

the annual certification from CTIA.[320] In its testimony Cal PA recognizes the fact that both Sprint and T-Mobile have "robust emergency plans."[321]

As a standalone company, T-Mobile's network has countless built-in resiliency measures, including backup and alternate power sources at mission critical cell sites and switch locations as well as fiber backhaul to almost every cell site. T-Mobile also retains a variety of tools to expedite restoration of service when outages occur including COLTs, COWs, portable generators, and alternate backhaul options via microwave or satellite. New T-Mobile will continue to utilize those same tools; it formally commits to maintaining Sprint's existing portable generator fleet as well as Sprint's COLTs and COWs and to further expand those capabilities, as explained below.

Permanent Network Backup and Redundancy: T-Mobile and Sprint have both deployed robust permanent backup power throughout their standalone networks.[322] For example, in California, essentially all of T-Mobile's approximately [**BHC-AEO**] [redacted] **EHC-AEO**] macro cell sites have built-in battery backup.[323] In general, the only places that T-Mobile does not have battery backup on its macro cell sites is where local authorities restrict the provision of battery backup or there are physical limitations at the site that prevent the backup power source.[324] In addition, T-Mobile has

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[320] *Id.*

[321] Reed Service Quality Testimony at 36:21-23. In its testimony, Cal PA identifies three elements that are critical to emergency preparedness: (i) a robust emergency plan; (ii) access to portable generators, battery backup and deployables; and (iii) access to telecommunications services for emergency responders. *Id.* at 36-39. As a standalone company, T-Mobile has been fully committed to safeguarding the interests of its customers, employees, the public, and first responders during emergencies and other significant business disruptions and already *incorporates* each of the three elements identified by Cal PA as part of its emergency preparedness. *See* Ray Rebuttal Testimony at 50:7-17.

[322] Ray Rebuttal Testimony at 53:9-21; Reed Service Quality Testimony at 37:9-10.

[323] *Id.* at 53:10-12.

[324] *Id.* at 53:15-18.

permanent generator backup power at all of its California mobile switching centers and data centers.[325] As Mr. Ray testified, New T-Mobile intends to continue its ongoing efforts to enhance battery back-up capabilities on all of its sites.[326]

Backhaul: T-Mobile is well aware that a critical component to maintaining resiliency during emergencies and other network disruption is having robust backhaul to its cell sites. Regardless of the robustness of the backup power infrastructure deployed throughout the network, if a cell site has no backhaul, the network will experience an outage. To that end, T-Mobile has installed fiber backhaul into almost every T-Mobile cell site in California, and as New T-Mobile builds out its 5G network into rural and underserved areas, the fiber backhaul network in these remote and hard-to-reach areas will only grow and become more redundant, thus increasing network resiliency.[327] Moreover, in emergency situations when backhaul does go down, T-Mobile already uses microwave and satellite links to provide backup backhaul to cell sites where appropriate and feasible, and New T-Mobile commits to add microwave and satellite links to further enhance its emergency response capabilities.

Portable Emergency Back-Up Power and COLTs and COWs: To facilitate network resiliency throughout California during emergencies and other disruptions, T-Mobile retains a vari[redacted]ded throughout the state. For example, T-Mobile retains [**BHC-AEO**][redacted][**EHC-AEO**] portable generators in California and approximately [**BHC-AEO**][redacted][**EHC-AEO**] additional portable

[325] *Id.* at 53:25-54:11; Hearing Tr. at 554:3-28 (Ray Cross).

[326] *See* Hearing Tr. at 522:23-525:13, 550:25-551:19 (Ray Cross).

[327] Hearing Tr. at 512:28-515:10 (Ray Cross).

generators that can be delivered to California within 24-48 hours.[328] New T-Mobile also recognizes the significant value in maintaining a robust fleet of portable generators and commits to retaining Sprint's fleet of [**SPRINT BHC-AEO**] [redacted] [**SPRINT EHC-AEO**] portable generators located in California.[329] Furthermore, T-Mobile retains a robust fleet of COLTs and COWs, which provide connectivity to areas impacted by disasters.[330] To further enhance its emergency response capabilities, New T-Mobile commits to increase by fifty percent (50%) the number of COLTs and COWs that New T-Mobile will keep in California to respond to emergencies.[331]

Emergency Response Assistance: As a company with a long history of operation in California, T-Mobile is well aware of the increasing devastation caused by natural disasters in the State. According to the California Governor's Office of Emergency Services, the State of California "faces numerous risks and threats to our people, property, economy, environment and is prone to earthquakes, floods, significant wildfires, prolonged drought impacts, public health emergencies, cybersecurity attacks, agricultural and animal disasters, as well threats to homeland security."[332] Particularly in wake of the recent wildfires, rural fairgrounds have been used in emergency response and recovery activities after emergencies. In recognition of these unique threats to California, New T-Mobile has committed to deploy 5G wireless service that supports continuous service at 10 County Fairgrounds in rural counties that currently lack broadband access, at least 3 of which shall be

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[328] Ray Rebuttal Testimony at 51:23-26.

[329] *Id.* at 52:10-13; Reed Service Quality Testimony at 37:10-15.

[330] *Id.* at 52:13-15.

[331] CETF MOU at 13. T-Mobile maintains approximately [**BHC-AEO**] [redacted] [**EHC-AEO**] total COLTs and COWs in California at all times. Reed Service Quality Testimony at 37:21-22. Sprint maintains [**SPRINT BHC-AEO**] [redacted] [**SPRINT EHC-AEO**] total COLTs and COWs in California at all times. *See* Reed Service Quality Testimony at 37:17-18

[332] *About Cal OES*, CAL OES Governor's Office of Emergency Services, https://www.caloes.ca.gov/cal-oes-divisions/about-cal-oes (last visited Apr. 1, 2019).

installed in the first 3 years after close of the Transaction.[333] In addition, these wireless networks will provide robust connectivity for Fairground users and administrators when not in use by first responders.[334]

Decommissioning Sprint Sites Will Not Impact Network Resiliency: The decommissioning of certain Sprint cell sites will not affect the resiliency of the New T-Mobile network or the reliability of service provided to consumers and first responders; in fact, the Transaction creates an additional network just as dense as AT&T or Verizon, providing another reliable, safe network for these purposes.[335] Decommissioned sites will generally be sites that are either collocated with existing T-Mobile sites (*i.e.*, on the same tower or rooftop) or located very close to an existing T-Mobile site with extensively overlapping coverage.[336] As such, they are unnecessary to provide or maintain service and would not be constructed or maintained by an operator in the ordinary course.[337] Moreover, eliminating these unnecessary sites is critical to realizing the projected network synergies from the Transaction, which are essential to making possible the nearly $40 billion investment in New T-Mobile's network and business.[338]

D. New T-Mobile Customers in California Will Benefit from T-Mobile's Award-Winning Customer Care Model

One of the benefits of the merger customers will experience is access to T-Mobile's unique pioneering Team of Experts ("TEX") customer care model. T-Mobile's customer service has been

[333] CETF MOU at 12.

[334] *Id.*

[335] Ray Rebuttal Testimony at 52:19-53:2.

[336] *Id.* at 52:21-25.

[337] *Id.* at 52:25-26.

[338] *Id.* at 52:28-53:2.

recognized as the premier customer service organization in the wireless industry having received the highest score ever awarded by JD Power in its rankings of wireless-provider customer service quality, and has been ranked the number one wireless company for customer service over the past twenty-four (24) months by Nielsen.[339] As the record evidence demonstrates, New T-Mobile will adopt T-Mobile's TEX customer service model, extending the award winning customer service practices to the broader base of Sprint and New T-Mobile customers.[340]

The TEX Model provides a team of customer support experts focused on a specific geographic locality or specific business segment that are intimately familiar with and loyal to the markets they serve.[341] Under the TEX model, cross-functional groups of 47 people serve a named set of customer accounts in a specific market that can handle an array of customer issues from billing to complex hardware and software problems.[342] T-Mobile's existing customers have responded very positively to TEX since it was implemented, and as acknowledged by Cal PA, T-Mobile's customer complaints have significantly declined in recent years.[343] The extension of T-Mobile customer care model will be especially beneficial to Sprint customers who as Cal PA recognizes are less satisfied with their service than T-Mobile's customers and who "complained twice as often about company policies than T-Mobile's customers."[344]

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339 Sylla Dixon Rebuttal Testimony at 14:8-11.

340 *Id.* at 14:6-8.

341 *Id.* at 14:14-16, 20-22.

342 *Id.* at 14:16-20.

343 *Id.* at 31:7-18.

344 Reed Service Quality Testimony at 32:1-33:5 and 29:4-5.

To ensure that New T-Mobile maintains T-Mobile's industry-leading standard of customer care once the Sprint and T-Mobile customer bases are integrated, New T-Mobile will substantially increase its domestic customer care workforce.[345] Towards this end, New T-Mobile will expand the innovative and pioneering TEX model by opening five new technologically advanced Customer Experience Centers throughout the United States, resulting in 5,600 new jobs by 2021.[346] In fact, New T-Mobile commits to building one of the Customer Experience Centers in Kingsburg, in the Central Valley, which will provide focused TEX support to all of New T-Mobile's California customers creating a standard of customer service excellence that will simply not be matched by any other wireless service provider in California.

Intervenors have done nothing to undermine T-Mobile's strong track record of customer service. In fact the only two criticisms Cal PA leveled at T-Mobile's customer service – the company's alleged lack of a central repository of complaint data compared to Sprint[347] and an alleged [**BHC-AEO**] [redacted] [**EHC-AEO**] in complaints from 2015-2018[348] – were both demonstrated to be factually inaccurate.[349] And notably no Intervenor, including Cal PA, chose to cross examine Ms. Sylla Dixon as to her rebuttal testimony on customer service issues.[350] Thus the record evidence

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345 Sievert Rebuttal Testimony at 36:25-26.

346 *Id.* at 36:26-37:3.

347 Reed Service Quality Testimony at 31:7-8.

348 *Id.* at 31:22-23.

349 Sylla Dixon Rebuttal Testimony at 15:6-12 (explaining that within T-Mobile's Customer Care organization, the Executive Response Team maintains a database containing a full record of the consumer inquiries and complaints that it handles) and *id.* at 16:8-17:11 (describing the **[BHC-AEO]** [redacted] **[EHC-AEO]** of customer care complaints from 2013-2018).

350 Hearing Tr. at 877:5-955:7 (Sylla Dixon Examination and Cross).

conclusively demonstrates that under the New T-Mobile, all customers will benefit from T-Mobile's industry-leading standard of customer care.

E. New T-Mobile is Committed to Closing the Digital Divide

New T-Mobile understands that digital inclusion is critical to ensure California consumers can become meaningful participants in today's technology-dependent society. To ensure that California's students reap the benefits of the New T-Mobile network, New T-Mobile will continue to expand T-Mobile's current EmpowerED Program and Sprint's 1Million Project (which may be rebranded) (together the "New T-Mobile School-Based Programs"). The New T-Mobile School-Based Programs will provide free high-speed Internet service and free Internet-enabled devices to an additional 52,000 low-income California families with K-12 school age children within 5 years of the close of the Transaction for a total of 112,000 families.[351] These students (and their families) can use these devices to access the internet at home --- thereby helping to close the homework gap.

T-Mobile is also committed to fostering the growth of additional digital literacy programs throughout California. Towards that end, New T-Mobile will provide $12.5 million in funding to assist districts and schools participating in New T-Mobile's School–Based Programs to support digital literacy training for up to 25,000 students and their families through CETF's School2Home program. CETFs School2Home Initiative is an innovative cost-effective program that is tackling two of California's most critical and related challenges: closing both the Achievement Gap and the Digital Divide by integrating computing and broadband technologies into teaching and learning in low-performing middle schools and providing a unique focus on parent engagement.[352] Furthermore,

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[351] CETF MOU at 7.

[352] *School2Home Initiative*, CETF, http://www.cetfund.org/investments/school2home (last visited Mar. 27, 2019)

New T-Mobile will provide up to $1 million for School Leadership Teams from the districts and schools participating in the New T-Mobile School-Based Programs to attend the annual School2Home Leadership Academy.[353]

T-Mobile shares CETF's concerns that low-income and other disadvantaged communities have low connection rates to the internet.[354] To help address this issue, New T-Mobile has committed to provide: (i) $4.5 million for grants to CBOs, schools, and libraries to provide digital literacy training for up to 75,000 new LifeLine and low-income households enrolled by New T-Mobile; (ii) $5 million for CETF grants to county and city governments to develop, adopt and implement digital inclusion policies and programs and (iii) $13 million to fund CETF's ongoing mission to bridge the digital divide.[355] These additional funds will help CBOs and CETF design and tailor digital literacy programs to the specific needs of individuals across California so that no one is left behind in today's technology-dependent society. Moreover, the provision of funding to CETF for its ongoing operations is consistent with Commission precedent conditioning approval of the AT&T-SBC and Verizon-MCI mergers on the acquiring entities' financial commitments to fund CETF's work.[356]

F. New T-Mobile Will Promote Diversity and Inclusion

T-Mobile has a strong track record in promoting diversity and inclusion in its workforce, customer base, and supplier base. The company is committed to continuing these initiatives as New

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[353] CETF MOU at 8.

[354] Hearing Ex. CETF-001 ("McPeak Testimony") at 7:12-17.

[355] *See* CETF MOU at 8.

[356] CETF was established as a non-profit corporation pursuant to orders from the Commission in approving the mergers of SBC-AT&T and Verizon-MCI in 2005. As a condition of approval of the mergers, AT&T and Verizon are required to contribute to CETF a total of $60 million over 5 years for the purpose of achieving ubiquitous access to broadband and advanced services in California, particularly in underserved communities. See D.05-11-028 (SBC/AT&T) and D.05-11-029 (Verizon/MCI).

T-Mobile. Towards that end, as discussed above, T-Mobile has entered into an MOU with the National Diversity Council which memorializes New T-Mobile's commitments in a number of these areas.

1. New T-Mobile Will Promote the Diversity of Its Workforce at All Levels

T-Mobile already has a diverse employee base with approximately 62 percent of employees being ethnically diverse and approximately 42 percent being women (which is significantly above the technology industry average).[357] New T-Mobile is committed to further promoting a diverse employee base, which it believes helps it break down barriers and rewrite the rules in the wireless industry as it draws from its employees' experiences, creativity and ideas to help support its success.[358]

Towards that end, under the NDC MOU discussed *supra*,[359] New T-Mobile commits to strive to increase the diversity of its workforce in California at all levels to reflect the diversity of the communities in which it operates.[360] In order to accomplish this goal, New T-Mobile further commits to create an External Diversity and Inclusion Council ("Council")[361] and to work with that Council on mentoring, outreach, recruiting, development, and training programs that provide meaningful opportunities for advancement. Plans for this outreach and programs will be included in the "Diversity Strategic Plan" that will be developed per the NDC MOU.[362]

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[357] Sylla Dixon Rebuttal Testimony at 7:3-12; Hearing Tr. at 902:19-23 (Sylla Dixon Cross).

[358] Sylla Dixon Rebuttal Testimony at 7:7-12.

[359] *See* Section I, *supra*, discussing Sylla Dixon Rebuttal Testimony Attachment B "Memorandum of Understanding between T-Mobile US, Inc. and National Diversity Coalition," January 29, 2019.

[360] NDC MOU at 4-5.

[361] *See* NDC MOU at 2-3.

[362] *See id*. at 3.

T-Mobile has a Diversity and Inclusion Office that leads the company's diversity and inclusion initiatives.[363] New T-Mobile plans to retain this Diversity and Inclusion Office which is spearheaded by the Vice President of Diversity and Inclusion; the person in that position will continue to lead the New T-Mobile's diversity and inclusion initiatives and will have primary responsibility for implementing the Diversity Strategic Plan.

Under the NDC MOU, New T-Mobile also commits to diversity at the top of its organization, agreeing to encourage its stockholders to consider a diverse pool of Board candidates for the vacancies.[364]

The NDC MOU specifically addresses Greenlining's testimony in this area, which calls for telecommunication providers to "work on a wide range of efforts intended to attract diverse candidates at all levels throughout their service territories," including "targeted outreach to recruit a workforce that 'top to bottom' reflects California's diversity," "internships and other opportunities for diverse candidates entering the workforce," and "work to increase board and executive diversity."[365]

2. New T-Mobile Will Support and Serve Its Low-Income and Diverse Customer Base

T-Mobile's corporate philosophy is that a culture of diversity and inclusion helps it serve its customers, the majority of which are from diverse communities.[366] T-Mobile also has a proven track record and is fully committed to serving low-income and underserved customers both through its own brand and through the Metro brand, which has a well-established history of serving low-income

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[363] *Id*.

[364] *Id*. at 2.

[365] Hearing Ex. GLI-001 ("Goodman Testimony") at 4:7-12.

[366] Sylla Dixon Rebuttal Testimony at 8:11-13.

consumers in California by putting its stores and people in the communities where those consumers live, work, and play.

As part of the NDC MOU, New T-Mobile commits to work with NDC and its members to launch a "Community Wireless Initiative" which will seek to expand and improve wireless capabilities within New T-Mobile's coverage area throughout low-income communities, to low-income Californians, to underserved minority populations, and to organizations serving these underserved communities, including via technical measures (e.g., the installation of a signal boosters or Wi-Fi hot spots) or via education and support. Further, pursuant to the Community Wireless Initiative, New T-Mobile will work with NDC to expand programs of New T-Mobile has to make wireless devices available at low or no cost to school children eligible for free or reduced lunches (see discussion of Sprint's One Million Program and New T-Mobile EmpowerEd above) and to explore other measures with NDC to promote digital adoption and education.

3. New T-Mobile Will Improve on T-Mobile's Diversity in Its Procurement of Goods and Services

As part of the NDC MOU, New T-Mobile commits to partner with NDC and the Council on diversity procurement in California.[367] New T-Mobile will achieve these increased goals by adopting Sprint's best practices[368] and partnering with NDC and the Council on a number of supplier diversity initiatives, including: (i) identifying and investing in programs that mentor and coach diverse business owners who desire to compete for contracting opportunities in the wireless industry; (ii) expanding its utilization of minority-owned law firms and accounting firms; (iii) engaging at least one minority-owned advertising agency; (iv) increasing its spending on advertising with minority-

[367] *See* Section I, *supra*; NDC MOU at 2-3.

[368] Sylla Dixon Rebuttal Testimony at 9:17-18.

owned media; and (v) growing the diversity of its banking, accounting, and other financial services partners.[369]

4. New T-Mobile Will Promote Philanthropy and Community Investment

Under the NDC MOU, New T-Mobile will develop a "Community Investment Plan" that will outline its Philanthropy and Community Investment in California for the three years following the close of the Transaction. This plan will reflect New T-Mobile's commitment to organizations in California that are mission-driven to improve the socio-economic conditions facing people of color, women, disabled persons, and veterans. The Plan will be developed in the 120 days following the close of the Transaction in consultation with NDC.

The NDC MOU specifically addresses Greenlining's testimony in this area, which calls for telecommunication providers to promote economic equity for communities of color and serve the public interest by "continually seek[ing] out opportunities that benefit the community and customers and focus on providing quality products and services that reflect equity for communities of color," requiring their executive leadership to regularly emphasize the importance of diversity in philanthropy and community engagement to its managers," and collecting and sharing "(1) information regarding their philanthropic contributions (including the identity of the recipient, amount, percentage of pre-tax California *revenue*, and hours of volunteer work) and (2) information regarding its philanthropic *activities* (including volunteer efforts)."[370]

G. The Retail Store Strategy of the Combined Company Will Result in Direct Benefits to New T-Mobile Consumers in CaliforniaCustomers will benefit from the retail store strategy of the combined company.[371] Specifically customers will benefit from (i) the addition of postpaid retail stores to service rural areas and small towns, communities that need them most, and (ii) the retention of the

[369] Sylla Dixon Rebuttal Testimony at 9:28-10:6; NDC MOU at 5-6.

[370] Goodman Testimony at 2:1-8.

stores that support the company's prepaid brands – stores which are integral parts of the low-income communities in which many are located.

New T-Mobile will have a far better retail store network that provides enhanced service to rural areas.[372] In California, New T-Mobile plans to open **[BHC-AEO]** [redacted] **[EHC-AEO]** new stores located to serve rural and small towns in the state.

Additionally, consistent with its plans to retain its prepaid brands, New T-Mobile has stated that its intention is to not close any Metro or Boost stores anywhere in California.[373] This decision will inure to the benefit of the low-income communities served by many of these stores. For example, over half of Metro stores in California are located in high and extreme poverty census tracts (*i.e.*, tracts with poverty rates above 20 percent), providing valuable service to low-income consumers.[374]

VIII. CONCLUSION

The Joint Applicants respectfully submit that the Commission has sufficient information to conclude its review of the Wireless Notification and that this proceeding should be closed without further delay.

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[371] Selwyn Testimony at 92:18-20.

[372] Hearing Tr. at 308:8-22 (Sievert Cross).

[373] Hearing Tr. at 621:13-20 (Keys Cross).

[374] Keys Rebuttal Testimony at 17:15-17.

Respectfully submitted this 26th day of April, 2019.

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APPENDIX 1

(PUBLIC VERSION)

Memorandum of Understanding
between California Emerging Technology Fund and T-Mobile USA, Inc.
Outline of Contents

Memorandum of Understanding
between California Emerging Technology Fund and T-Mobile USA, Inc.

By their authorized representatives, and intending to be legally bound, this Memorandum of Understanding (MOU or Agreement) is entered into between T-Mobile USA, Inc. (T-Mobile) and the California Emerging Technology Fund (CETF) as of March 22, 2019.

On April 29, 2018, T-Mobile and Sprint Corporation (Sprint) entered into a Business Combination Agreement by which all of Sprint subsidiaries will become wholly indirect subsidiaries of T-Mobile (the Transaction). The combined companies will be operated as the New T-Mobile.

On July 13, 2018, T-Mobile and Sprint filed two applications with the California Public Utilities Commission (CPUC): (i) Application (A.) No. 18-07-011, *In the Matter of the Joint Application of Sprint Communications Company L.P. (U5112) and T-Mobile USA, Inc., a Delaware Corporation, For Approval of Transfer of Control of Sprint Communications Company L.P. Pursuant to California Public Utilities Code Section 854(a)* (the Wireline Application) and (ii) A.18-07-012, *In the Matter of the Joint Application of Sprint Spectrum L.P. (U3062C), and Virgin Mobile USA L.P. (U4327C) and T-Mobile USA, Inc., a Delaware Corporation, for Review of Wireless Transfer Notification per Commission Decision 95-10-032*) (the Wireless Notification). The Wireline Application and Wireless Notification were consolidated and are referred to jointly as the CPUC Proceedings.

CETF is a party to the CPUC Proceedings, and it has actively participated in the application proceeding on behalf of broadband consumers.

All the terms of this MOU are expressly contingent upon the CPUC's approval of the Wireline Application, the CPUC's completion of its review of the Wireless Notification, and the consummation of the Transaction.

T-Mobile is entering into this MOU to settle and resolve the issues raised by CETF about the Transaction in the CPUC Proceedings. The MOU reflects CETF's agreement that based on the commitments set forth herein, the concerns expressed in CETF's pleadings, testimony, and appearances regarding the Transaction have been resolved. To the extent that T-Mobile's or CETF's previous positions are inconsistent with this MOU, those positions are hereby modified in accordance with the terms set forth herein.

Declarations

- The California State Legislature established in Pub. Util. Code § 709(d) that a key state policy objective for telecommunications in California is "To assist in bridging the 'digital divide' by encouraging expanded access to state-of-the-art technologies for rural, inner-city, low-income, and disabled Californians." Indeed, the desire of the California State Legislative to bridge the Digital Divide is infused throughout the Public Utilities Code, including Pub. Util. Code §§ 871.7(c)(4), 883(b)(4)(D), 884.5(d), and 5810(a)(2)(E). Moreover, according to the U.S. Census Bureau, in 2017 (the most current data year), California had the highest rate of poverty among all states in the nation – 19.0 percent – which rate is more than 5 percentage points above the national average of 13.9 percent.

- Based on the 2019 Statewide Survey on Broadband Adoption which CETF conducted in partnership with the University of California, Berkeley, Berkeley Institute of Governmental Studies, it was found that in California that 88% of households have high-speed Internet access at home through either a computing device or a smartphone, but 12% or one in eight homes still do not have access. Further, the following California demographic groups fall below the 88% overall adoption rate:
    - Households earning less than $20,000/year (70%)
    - Adults 65 years or older (76%)
    - Not a high school graduate (74%)
    - Spanish-speaking Latinos (80%)
    - Adults with disabilities (79%)

- The mission of CETF is to close the Digital Divide in California by accelerating broadband deployment and adoption. CETF provides leadership to promote public policy to close the Digital Divide and to facilitate consensus among stakeholders to achieve results. CETF collaborates with Regional Consortia, local governments, and civic organizations to identify opportunities to support broadband infrastructure construction. CETF partners with community-based organizations (CBOs) throughout California that are experienced in reaching disadvantaged populations in-culture and in-language to increase broadband adoption among low-income and other unconnected households. CETF is focused on results and has a track record of performance with transparency and accountability. Particular concern has been focused by CETF and the California Department of Education on low-income students who do not have a computing device or are not allowed to take a device home to perform Internet-enabled homework, and thus fall behind in their studies.

- CETF actively supports the promulgation of public-private partnerships as a public policy foundation for closing the Digital Divide and promoting Digital Inclusion by harnessing the discipline and innovation of the private sector with the expertise and cultural competency of those working on behalf of the public sector as "trusted messengers" to reach disadvantaged populations. A public-private partnership is characterized by partners reaching agreement on goals, jointly developing an action plan to achieve explicit outcomes, and working together continuously in good faith to implement the plan with mutual accountability for results. CETF also engages with local municipalities and agencies on digital inclusion, Smart Cities and other technology enabled initiatives.

- CETF and T-Mobile (and New T-Mobile) are joining forces to work together in collaboration with other stakeholders and CBOs in the true spirit of a public-private partnership with the intent to make a significant contribution to closing the Digital Divide in California and to pursuing innovative approaches to increasing broadband adoption throughout the state.

- CETF recognizes that the proposed New T-Mobile (combining the existing networks and spectrum of Sprint and T-Mobile) has significant potential to provide numerous consumer advantages which will serve the public interest if coupled with a strong commitment to public benefits and performance-based measures by New T-Mobile.

- CETF and T-Mobile agree that Californians without broadband access or the ability to afford high-speed Internet service at home are being left behind at an accelerating pace. Therefore, these commitments shall be implemented with all deliberate speed consistent with appropriate planning and prudent business practices to ensure success.

- This agreement is responsive to the CETF objective to advance a policy and identify a framework to ensure an "appropriate, fair, and comparable" public benefit contribution by all applicants seeking corporate consolidations before the CPUC and is consistent with settlement agreements entered into in other such consolidation proceedings in California.

In order to make public benefit investments that are "appropriate, fair and comparable" to prior corporate consolidations in the telecommunications industry in California, CETF and New T-Mobile make the following public benefit commitments subject to the terms in this MOU:

Public Benefits for Broadband Adoption

I. Pricing Commitment

A. Rate Plans

T-Mobile has made a nationwide pricing commitment to the FCC that provides that New T-Mobile shall make available the Same Rate Plans or Better Rate Plans offered by T-Mobile and/or Sprint as of the Reference Date of February 4, 2019 for 3 years following the close of the Transaction. A copy of the FCC pricing commitment is attached hereto as Attachment A. It is hereby incorporated by reference.

Within 60 days of close, New T-Mobile shall provide to CETF and the CPUC a list of Rate Plans offered to new customers as of the Reference Date, and will include this information in the Annual Compliance Report discussed in Section X *infra* beginning with the first full year following the close date of the Transaction and for 2 years thereafter.

II. LifeLine Commitment

A. California LifeLine Services Offer

New T-Mobile shall offer LifeLine services (pursuant to both federal FCC Lifeline and state CPUC LifeLine programs) indefinitely in California. To provide assurance of its commitment, New T-Mobile guarantees the provision of LifeLine in California through the end of 2024 at a minimum. New T-Mobile agrees to continue to offer LifeLine services in California to both current and new eligible customers under rates (i.e. free), terms, and conditions no less favorable to eligible consumers than those offered under the Virgin/Assurance brand as of the date of close of the Transaction. New T-Mobile shall provide all new LifeLine customers a minimum of 3 gigabytes (GB) per month of data and will upgrade all existing Assurance LifeLine customers to a minimum of 3 GB per month of data without the need for a customer to request the upgrade. New T-Mobile shall re-assess every 2 years the data allotment to determine its adequacy consistent with FCC guidelines and shall make adjustments to align with FCC guidelines.

B. Handsets and Network Assignment

After a transition period, Customers will be able to avail themselves of New T-Mobile's larger geographical coverage footprint in California. CETF recognizes that there needs to be a brief transition period of no more than 6 months to implement the necessary operational changes to activate Assurance LifeLine customers on the New T-Mobile Network/platform. Therefore, New T-Mobile commits to the following:

- On the first day after the close of the Transaction, new California Assurance LifeLine customers will be provided a free handset at the time of enrollment that is compatible on both the New T-Mobile and the Sprint network, but their service will continue to be activated on the Sprint network.

- No later than 6 months after the close, new California Assurance LifeLine customers will be activated on the New T-Mobile Network. All Assurance LifeLine customers with incompatible handsets (that do not work on the New T-Mobile network) will be migrated in the same timeframe as the non-LifeLine legacy Sprint customers to the New T-Mobile network and will be given a free compatible handset at the time of migration.

III. New LifeLine and Low-Income Adoptions

A. Goal for New Adoptions

New T-Mobile and CETF share a general goal in increasing LifeLine adoption in California. To that end, within 5 years of the close of the Transaction, New T-Mobile shall use good faith efforts to achieve a combined goal of 332,500 new (additional) low-income households through (i) new Assurance LifeLine customers (gross additions) approved by the LifeLine administrator and (ii) Low-Income customers in California for a total of no less than 675,000 enrolled LifeLine / low-income households. Low-Income customers may include customers added through other non-LifeLine offers (e.g. Boost pilot program, if adopted) that are priced at $20.00 per month or less (total cost to the customer) and that provide the minimum data allowance required under FCC LifeLine rules.

B. Strategic Plan

New T-Mobile shall prepare a detailed Strategic Plan for achieving 332,500 new LifeLine and Low-Income customers in California and submit to CETF a Draft Plan no later than 90 days following close of the Transaction. New T-Mobile and CETF shall confer and reach agreement on a Strategic Plan and submit to the CPUC the Strategic Plan no later than 180 days following the close of the Transaction. The Strategic Plan shall delineate planned activities for distribution of information about the availability of LifeLine and any other lower-cost offers, including a Promotion Investment Schedule (described in Section IV *infra*) and a timetable for implementation. The Strategic Plan will be subject to a non-disclosure agreement (NDA) between New T-Mobile and CETF and will be treated confidentially by the CPUC. New T-Mobile and CETF shall meet annually to review the progress in achieving new low-income household adoptions and shall revise and refine the Strategic Plan as necessary to achieve the goals.

IV. Promotion of LifeLine and Low-Income Offers

A. Promotion Investment Schedule

New T-Mobile shall prepare a Promotion Investment Schedule as part of the Strategic Plan, which is to be agreed upon by CETF and submitted to the CPUC within 180 days of the close of the Transaction. The Promotion Investment Schedule shall generally describe the activities New T-Mobile will undertake to promote the LifeLine offers and enroll eligible California LifeLine and Low-Income customers, including but not limited to community based direct marketing and use of media. New T-Mobile commits that to the extent the Promotion Investment Schedule proposes the use of television or radio ads, those ads will be run between 6 a.m. and 11 p.m. New T-Mobile shall place an appropriate share of the promotion investment with community media to ensure sufficient information in-language and in-culture, which shall be monitored to measure results and to analyze cost-effectiveness in comparison to other promotion investments. CETF shall facilitate meetings between T-Mobile and community media to explore opportunities for collaboration and business relationships.

B. Pledged Promotion Investment

The Promotion Investment Schedule for California shall include a minimum of $1 million per year for 5 years for a total of at least $5 million. At least $2.5 million shall be dedicated to outreach and promotion of the LifeLine service and enrollment of new LifeLine and Low-Income customers. However, should New T-Mobile achieve 332,500 new LifeLine and Low-Income customers in California before the conclusion of 5 years and expenditure of $5 million, then New T-Mobile shall have the right to reduce expenditures in the Promotion Investment Schedule, except those planned and committed to community media.

V. Material Changes in LifeLine Program

Should there be material changes in the LifeLine programs at either the state or federal level, including with respect to eligibility criteria, mandatory service standards, or subsidy amounts, New T-Mobile reserves the right to seek appropriate relief from the LifeLine provisions in this agreement from CETF, the CPUC, and/or FCC after consultation with CETF and the CPUC and/or FCC staff.

VI. Investments in Digital Inclusion

A. School-Based Programs

New T-Mobile shall continue to expand T-Mobile's current EmpowerED Program and Sprint's 1Million Project (which may be rebranded) (together the New T-Mobile School-Based Programs) to reach an additional 52,000 low-income California families with K-12 school age children within 5 years of the close of the Transaction for a total of 112,000 families. For the additional 52,000 families, the New T-Mobile School-Based Programs will provide at least 3 GB of free high-speed Internet service and unlimited (non-high speed) Internet service thereafter and free Internet-enabled devices, such as Chromebooks or other Internet-enabled tablets or other wireless devices that may be used as hot spots if the school also provides a companion notebook or tablet to work with the hotspot. New T-Mobile may set or modify the eligibility for the New T-Mobile School-Based Programs in consultation with CETF, but they must serve primarily low-income students and engage the participating districts and schools in providing data regarding impact on academic performance. New T-Mobile shall provide a description of services and impact information about the New T-Mobile School-Based Programs, including the number of families assisted by the programs and benefits to schools, students and families, in the Annual Compliance Report submitted to CETF and CPUC Staff described in Section X *infra*.

New T-Mobile shall provide up to $1 million over 5 years for School Leadership Teams from the districts and schools in the New T-Mobile School-Based Programs selected to participate in the School2Home Partnership to attend the annual School2Home Leadership Academy. The funding shall be used to pay for the Leadership Academy venue and travel, lodging and meals for approximately 3 members of each School Leadership Team. CETF and New T-Mobile shall develop a process for coordinating the planning and payment of expenses for the School Leadership Teams.

New T-Mobile and CETF shall agree upon an evaluation process and methodology to compare student academic performance and other relevant metrics for districts and schools also participating in the School2Home Partnership vs. those only participating in New T-Mobile School-Based Programs.

B. Digital Inclusion Policy and Programs

New T-Mobile shall provide $7 million each year commencing 60 days from the close of the Transaction and continuing for 5 years for a total of $35 million to CETF to sustain its core mission to close the Digital Divide in California and to promote digital inclusion policy and programs as set forth below as explicit public benefits of the Transaction. CETF shall continue to work with T-Mobile and other Internet Service Providers to collaborate with community, local, regional and statewide stakeholders to get online all unconnected and underconnected households in the state. In addition to pursuing its core mission, CETF shall dedicate a portion of the $35 million to the following digital inclusion programs:

- $12.5 million to assist districts and schools participating in the New T-Mobile School-Based Programs (and representing up to 25,000 students) to implement School2Home to incorporate technology into teaching and learning with significant parent engagement. CETF and New T-Mobile shall develop a process for inviting and selecting applications from the districts and schools participating in the school-based programs to join in the School2Home Partnership. This investment will augment the commitment by T-Mobile to support the School Leadership Teams from the selected districts and schools to attend the annual School2Home Leadership Academy.

- $4.5 million for grants to community-based organizations (CBOs), schools, and libraries to provide digital literacy training for up to 75,000 new LifeLine and low-income households enrolled by New T-Mobile. Within 6 months after the close of the Transaction, CETF and New T-Mobile shall develop a process for T-Mobile to inform and refer interested new low-income households to appropriate CBOs.

- $5 million for CETF grants to county and city governments to develop, adopt and implement digital inclusion policies and programs. Priority consideration for grants shall be given to local governments working in collaboration with their CASF-funded Regional Consortium.

- CETF shall provide an annual report to New T-Mobile regarding the Digital Inclusion Policy and Programs.

VII. Investments in Infrastructure

A. Background

To create the 5G coverage maps included in Attachment D "California 2021 and 2024 5G County Level Coverage" (dated 12-06-2018) to the Joint Applicants' Rebuttal Testimony of Neville Ray (5G County Coverage Maps), and to predict the average speeds (throughput), T-Mobile used its network model. T-Mobile's network model relies on a number of inputs for the 5G deployment including: (i) the number and general location of cell sites in California at which New T-Mobile expects to deploy 5G; (ii) the type of spectrum to be deployed at each of those sites (i.e. mid band, low band, high band); and (iii) the year in which it is deployed.

B. Network Improvement Plan Tracking Tool

In order to develop a Network Improvement Plan Tracking Tool for this settlement, T-Mobile took the list of cell sites used for the model and added the expected speed tier for each of the cell sites and the year that the anticipated speed tier would be achieved. (See HIGHLY CONFIDENTIAL – ATTORNEYS EYES ONLY Attachment B.)

C. Network Improvement Commitments

Capital Expenditures: New T-Mobile will commit to at least **[Begin Highly Confidential-Attorneys' Eyes Only (BHC-AEO)]** [redacted] **[End Highly Confidential -Attorneys Eyes only (EHC-AEO)]** in network capital expenditures to deploy 5G technology in California within 6 years of the close of the Transaction, with the right to defer **[BHC-AEO]** [redacted] **[EHC-AEO]** of those planned capital expenditures for an additional 7th year.

5G Buildout: New T-Mobile will commit to deploy 5G technology at 90% of the cell site locations specified in the Network Improvement Plan Tracking Tool (or geographically comparable sites) by 2025.

The commitment is for 2025 to align with the capital expenditure commitment that allows a portion of the capital expenditure to be deferred to a seventh year. If the close of the Transaction is delayed until late 2019, CETF will meet and confer with New T-Mobile about extending the 5G deployment commitment until 2026.

The commitment is for 90% vs. 100% of sites given the variability in siting, permitting, spectrum clearing timeframes, backhaul acquisition and other factors beyond New T-Mobile's control. CETF and New T-Mobile agree to work in good faith to adjust the 90% commitment as reasonably appropriate should other events occur that are beyond the reasonable control of T-Mobile, including but not limited to:

- A regulatory or other imposed divestiture of assets:
- A force majeure event (e.g. natural disaster, etc.);
- Inability to acquire necessary equipment or backhaul before the conclusion the six-year commitment; and
- A siting moratorium or other extraordinary permitting delay or limitation.

Although Highly Confidential – Attorneys Eyes Only Attachment B lists the years in which speed tiers are anticipated to be achieved at each site, the year in which 5G technology may be deployed at any individual site may vary depending on a variety of factors. New T-Mobile will use industry best practices to deploy 5G spectrum at 90% of the total number of sites by year as reflected in the table below: **[BHC-AEO]**

[EHC-AEO]

If New T-Mobile does not meet the yearly cell site construction target, it will offer a detailed explanation at a regional level for the variance in the annual Network Report (see Section X, subsection (c) *infra*).

Speed Tests: New T-Mobile will commit to achieve the average (mean) speed tier (per the measurement protocol discussed *infra*) across all sites a specified speed category in the applicable year as specified in the Network Improvement Plan Tracking Tool . For sites that are designated to achieve both speed tiers (100 Mbps and 300 Mbps), there will be two speed tests: (i) one in the year when spectrum and equipment are deployed that allow a site to reach the first speed tier (i.e. 100 Mbps); and (ii) a second in the year when the spectrum is deployed to allow the site to meet its second speed tier (e.g. 300 Mbps). In addition, New T-Mobile will commit to achieve a minimum of 80% of the specified speed tier category *at each site* (per the measurement protocol discussed *infra*). To the extent that a site does not achieve 80% of the established speed tier at a particular site, New T-Mobile will promptly use good faith efforts to achieve the designated speed tier at that site.

Speed test results will be provided as part of the Network Report beginning in 2022. To the extent that the independent speed testing demonstrates New T-Mobile consistently achieves the specified speed tier at sites at which 5G technology is deployed in 2021, CETF will meet and confer with New T-Mobile to consider reducing the number of sites subject to speed tests in future years to a reasonable sample size.

Unserved/Underserved Areas: New T-Mobile shall prioritize its planned 5G network improvements in 10 unserved and underserved California areas. The 10 unserved/underserved areas for prioritization shall be selected by New T-Mobile after consultation with CETF and the Rural Regional Consortia. See Section IX *infra* regarding consultation with the Rural Regional Consortia.

D. Coverage Maps

The Network Report shall include high resolution pdf maps depicting buildout progress in the form of the 5G County Coverage Maps. New T-Mobile will also provide CETF with high resolution pdf version of the New T-Mobile 5G County Coverage Maps that were provided in the Joint Applicants' Rebuttal Testimony of Neville Ray so that these may be compared to the coverage maps later presented to CETF as part of the Network Report.

Note: The 5G County Coverage Maps are projections of 5G coverage as of the date of the maps, and they are provided for illustrative purposes. As is the case of any projection of wireless coverage, actual coverage may differ due to regulatory or governmental delays or denials, site unavailability or limitations, antenna location or height, or other factors. T-Mobile is confident that actual overall coverage will be substantially similar to the coverage depicted in the 5G County Coverage Maps.

In addition to the 5G County Coverage Maps, New T-Mobile will include as part of the Network Report a link to its current public coverage map which allows consumers to zoom in to assess levels of coverage on a more granular basis.

E. Test Protocol for Coverage and Speed

In order to verify the data speed achieved for a given site, New T-Mobile will provide a speed test for each site conducted after necessary work is completed. The speed tests shall be conducted by an independent third party selected by CETF from a list of experts which is attached hereto as Attachment C (and which may supplemented by New T-Mobile until a satisfactory firm is agreed upon), paid for by New T-Mobile, using a mutually agreed upon recognized third-party data speed test. The testing location shall be selected by the independent third party testing firm consistent with customary professional standards reflecting a reasonable outdoor use case for the individual cell site being tested, without unusual blockage and an appropriate distance between cell tower and cell site edge. The speed test data will be provided to CETF in the annual Network Report.

VIII. Emergency Preparedness and Response

According to the California Governor's Office of Emergency Services, the State of California "faces numerous risks and threats to our people, property, economy, environment and is prone to earthquakes, floods, significant wildfires, prolonged drought impacts, public health emergencies, cybersecurity attacks, agricultural and animal disasters, as well threats to homeland security." In recent years, wildfires have become increasingly frequent, destructive, and deadly. In recognition of these unique threats to California, New T-Mobile has agreed to the following provisions to support disaster recovery and response efforts.

A. Installations at County Fairgrounds

Within 5 years of the date of the close of the Transaction, New T-Mobile shall deploy 5G wireless service that supports continuous service at 10 County Fairgrounds in rural counties, at least 3 of which shall be installed in the first 3 years. The wireless networks shall provide robust connectivity for Fairground users and administrators, provided that New T-Mobile shall not be required to add cell sites in addition to those specified in the Investments in Infrastructure section above. The fairgrounds will be selected from the ones that currently have coverage below 25 Mbps (see Attachment D for a list of 24 such Fairgrounds). Priority consideration shall be given to the rural Fairgrounds most frequently used in the last decade to stage wildfire, flooding, and other emergency responses, and support recovery activities. Priority consideration also shall be given to rural Fairgrounds for which the County Fair Board (in consultation with the County Board of Supervisors and other local stakeholders) has developed a plan for digital inclusion and other economic development activities when the site is not being used for emergency response and recovery. The 10 Fairgrounds shall be selected by New T-Mobile after consultation with CETF, and the Rural Regional Consortia.

B. Support for First Responders

Sprint and T-Mobile maintain Cells on Wheels (COWs) and Cells on Light Trucks (COLTs) in California to assist the State with efforts to restore wireless service after major disasters, as well as to support connectivity for first responders, emergency workers, and displaced residents. New T-Mobile shall retain the number of Sprint and T-Mobile COWs and COLTs that each company has in California as of the close of the Transaction and, by 2021, shall expand by 50% the number of COWs and COLTS available to assist in emergencies. New T-Mobile shall continue the practice of offering community support to those impacted during an emergency, with concessions such as free wireless service, charging stations for devices, and other support which is determined by the severity of the event.

IX. Consultation with Regional Consortia

A. Initial Consultation

New T-Mobile shall meet with the Regional Consortia in a joint meeting within 180 days of the close of the Transaction to: (i) provide an overview to the Regional Consortia of planned 5G network improvements and capital expenditures in California; (ii) obtain input from and consult with the Rural Regional Consortia to identify the selection of the 10 unserved/underserved areas that New T-Mobile will prioritize as specified above; and (iii) obtain recommendations from and consult with the Rural Regional Consortia regarding which of the listed County Fairgrounds shall be selected. However, the final decision regarding which unserved/underserved areas to prioritize and which Fairgrounds to select is New T-Mobile's. CETF shall assist New T-Mobile with planning the meeting, identifying an appropriate location, and inviting the Regional Consortia. New T-Mobile will pay for any venue costs of the meeting, if any.

B. Annual Consultations

After the initial meeting, New T-Mobile shall meet annually in 2021 through 2024 with the Regional Consortia in a joint meeting following submission of the Annual Compliance Report described in Section X infra to describe the capital investments in the previous year and discuss plans for the next year. This annual meeting shall provide an opportunity for New T-Mobile to obtain feedback and input from the Regional Consortia for future planning for capital investments, and to identify ways in which the consortia can help with implementation of the plan. CETF shall assist New T-Mobile with planning and convening the annual consultation of the Regional Consortia, and T-Mobile shall pay for any venue costs of the meeting.

Overall Partnership Commitments

X. Annual Compliance Report

Beginning in 2020 for 5 consecutive years, and no later than February 28 of each year, New T-Mobile will provide to CETF and CPUC Staff an Annual Compliance Report detailing New T-Mobile's compliance with this MOU and progress on meeting the specified commitments stated herein for the prior calendar year. Parties acknowledge that certain portions of the Annual Compliance Report may be confidential and subject to an NDA between CETF and New T-Mobile and treated confidentially by the CPUC. The Annual Compliance Report shall include at least the following information:

(A) Rate Plan: A status report on Rate Plans that were offered in the past calendar year.

(B) Lifeline/Low Income Report: Beginning with the first full year following the close of the Transaction and for 4 years thereafter, New T-Mobile shall provide to CETF and the CPUC a LifeLine/Low Income Report no later than February 28 each year specifically describing its progress in achieving 332,500 new LifeLine and Low Income household adoptions and a total of no less than 675,000 Low-Income customers for the prior calendar year. The number of new and total LifeLine and Low -Income household customers shall be available to the public. However, the LifeLine/Low Income Report also shall include agreed-upon analytical information about the effectiveness and results of the Strategic Plan in generating new low-income adoptions and will be subject to an NDA between New T-Mobile and CETF and will be treated confidentially by the CPUC.

(C) Network Report: Beginning with the first full year following the close of the Transaction and for 5 years thereafter, New T-Mobile shall submit a Network Report to CETF and the CPUC no later than February 28. The Network Report shall include the following: (i) a report on capital expenditures made during the previous calendar year; (ii) a list of cell sites on which 5G technology was deployed during the previous calendar year; (iii) results of the individual speed tests conducted for the prior calendar year, along with the average (mean) of speed tests for all sites constructed the prior calendar year; (iv) 5G County Coverage Maps; (v) a report on the prioritization of the 10 unserved/underserved areas; and (vi) a report on the installation of service to the fairgrounds. The Network Report will be subject to an NDA between CETF and New T-Mobile and will be treated confidentially by the CPUC to protect proprietary information.

XI. Binding Agreement

This Memorandum of Understanding (MOU) shall be binding upon, and shall inure to the benefit of the parties hereto and their respective successors in interest and assigns.

XII. CETF Support for Transaction with Public Benefit Commitments

CETF shall support the Transaction publicly and to government officials, including filing a motion in the CPUC Proceedings containing a copy of this MOU, expressing full support of the Transaction because of the public benefit commitments, and requesting: (i) the MOU be reflected in the decision(s) in the CPUC Proceedings; (ii) its commitments be included in the Ordering Paragraphs; and (iii) the decision(s) reflect that both parties consent that any disputes over the MOU be brought back to the CPUC. The fact that T-Mobile agrees that the CPUC may enforce these voluntary settlement conditions does not constitute an admission by T-Mobile that the CPUC has independent subject matter jurisdiction over the conditions agreed to this MOU. CETF further agrees that it will cooperate and work closely with T-Mobile to engage in outreach and advocacy efforts to demonstrate the various ways in which the Transaction serves the public interest. Should the Transaction not be consummated, this MOU shall not take effect.

XIII. Commitments Made to Other Intervenors or Regulatory Bodies

To the extent that certain commitments contained in this MOU repeat commitments made to other intervenors in the CPUC Proceedings or any other regulatory body reviewing the Transaction, CETF acknowledges that the reiteration of those commitments here are not intended to create separate or additional commitments on New T-Mobile but are included for illustrative purposes only.

XIV. Persons Responsible for MOU Compliance

The following persons shall be responsible for compliance of this MOU:

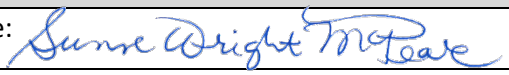
For New T-Mobile: [*New T-Mobile will designate a senior executive in the compliance organization within 60 days of close of the Transaction*]

For CETF: Sunne Wright McPeak

XV. Notice and Opportunity to Cure

New T-Mobile shall be given notice of any alleged non-compliance with this MOU, and an opportunity to meet and confer to discuss any such allegation, and pursue in good faith any required remedy. Should the issue remain unresolved, New T-Mobile will be provided a reasonable opportunity to cure any alleged non-compliance, which in the case of Network Improvements shall be no less than 180 days, and in the case of any other alleged non-compliance, shall be no less than 90 days. This section does not restrict either party from seeking relief from the CPUC after this process.

IN WITNESS WHEREOF, the Parties have caused this Memorandum of Understanding to be executed as of the date of the last signature below.

T-Mobile USA, Inc.	**California Emerging Technology Fund**
Signature: 	Signature: 
Name: G. Michael Sievert	Name: Sunne Wright McPeak
Title: President and COO	Title: President and CEO
Date of Execution: March 23, 2019	Date of Execution: March 22, 2019

Schedule of Attachments

Attachment A – Pricing Commitment Letter to FCC Secretary Marlene H. Dortch; WT Docket No. 18-19 (February 4, 2019)

Attachment B (HIGHLY CONFIDENTIAL – ATTORNEYS EYES ONLY) – Network Improvement Plan Tracking Tool

Attachment C – List of Third-Party Speed Test and Coverage Experts

Attachment D – List of Eligible California County Fairgrounds

Attachment A

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February 4, 2019

VIA ECFS

Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, DC 20554

Re: Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations; WT Docket No. 18-197

Dear Ms. Dortch:

Pursuant to Section 1.1206(b) of the Commission's Rules, 47 C.F.R. § 1.1206(b), notice is hereby provided of a written *ex parte* presentation in the above-referenced docket. T-Mobile US, Inc. ("T-Mobile") and Sprint Corporation ("Sprint", and collectively with T-Mobile, "Applicants") have stated in the Public Interest Statement, and reiterated repeatedly since, that the merger will ensure that "American consumers will pay less and get more".[1] Our merger will enable the deployment of a world-class nationwide 5G network with massive capacity and lower marginal costs per customer, with the result that customers get better service and more data at the same or lower prices.[2] The Applicants' representation that consumers will pay less as a result of the merger is supported by the New T-Mobile business plan,[3] declarations from T-Mobile

[1] *See, e.g., Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of the Licenses and Authorizations*, WT Docket No. 18-197, Description of Transaction, Public Interest Statement, and Related Demonstrations at i (June 18, 2018) ("Public Interest Statement"); *Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, Joint Opposition of T-Mobile US, Inc. and Sprint Corporation at i (Sept. 17, 2018) ("Joint Opposition").

[2] Public Interest Statement at 51.

[3] *Id.*

executives,[4] merger simulations focused on New T-Mobile prices,[5] and economic work showing all wireless consumers will benefit from a decrease in price per GB due to competitive responses from AT&T and Verizon.[6]

The Public Interest Statement also provided further assurances to existing customers of T-Mobile and Sprint that prices will not go up following the close of the merger. Specifically, the Applicants stated that "New T-Mobile will guarantee each [Sprint] customer a rate plan that is equal or better than the plans they currently enjoy with Sprint."[7] The Applicants also noted the T-Mobile Un-contract rate promise to their customers and that it would be extended to Sprint customers post-closing.[8] These assurances were intended to address any concerns about post-closing price increases and they are fully consistent with the New T-Mobile business plan.

Despite all this, merger opponents tried to raise questions about New T-Mobile's pricing incentives during the three-year period from merger closing until completion of the network combination and customer migration. The Applicants believe that the myriad showings on the record fully answer those questions. However, to remove all doubt and simplify the Commission's review of the merger, the Applicants are providing the following statement to remove any doubts, concerns or ambiguity:

> *New T-Mobile will make available the same or better rate plans as those offered by T-Mobile or Sprint as of today's date for three years following the merger.*

T-Mobile and Sprint legacy rate plans will continue as New T-Mobile plans for three years after the merger or until better plans that offer a lower price or more data are made available,

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[4] Public Interest Statement, Appx C, Declaration of G. Michael Sievert, President and Chief Operating Officer, T-Mobile US, Inc. at ¶21; Public Interest Statement, Appx. D, Declaration of Peter Ewens, Executive Vice President, Corporate Strategy, T-Mobile US, Inc. at ¶8 ("Ewens Decl.").

[5] Joint Opposition, Appx. F, Declaration of Compass Lexecon, Mark Israel, Michael Katz, and Bryan Keating at ¶6; John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos, *Economic Analysis of the Proposed T-Mobile/Sprint Merger*, Cornerstone Research at 1-6 (Nov. 6, 2018).

[6] Public Interest Statement, Appx. G, Declaration of David S. Evans, Market Platform Dynamics, "Economic Analysis of the Impact of the Proposed Merger of T-Mobile and Sprint on the Deployment of 5G Cellular Technologies, the 5G App Ecosystem, and Consumers, Enterprises, and the Economy," at ¶¶220-44.

[7] Ewens Decl. at ¶8.

[8] *Id.*

whichever occurs first.[9] The retained legacy rate plans may be adjusted to pass through cost increases in taxes, fees and surcharges as well as services from third party partners that are included in the rate plans, as these increased costs are not within the control of New T-Mobile. The legacy plans may also be adjusted to modify or discontinue third party partner benefits based on changes in the terms of the offering initiated by the third party partner, as this is also not within the control of New T-Mobile.[10]

As New T-Mobile CEO John Legere has said, we would be pleased to discuss the details of this commitment with the Chairman, Commissioners and Transaction Team. As noted, this representation is fully consistent with the New T-Mobile business plan and responsive to merger-specific questions that have been raised. For those reasons, the Applicants have no objection to this representation being included as a formal merger condition in the order approving the transaction.

Please direct any questions regarding the foregoing to the undersigned counsel for Deutsche Telekom and T-Mobile.

Respectfully submitted,

DLA Piper LLP (US)

/s/ Nancy Victory

Nancy Victory
Partner

cc: Chairman Ajit Pai
Commissioner Michael O'Rielly
Commissioner Brendan Carr
Commissioner Jessica Rosenworcel
Commissioner Geoffrey Starks
David Lawrence
Kathy Harris
Linda Ray
Kate Matraves

[9] When a better post-merger plan is offered, New T-Mobile may discontinue a less appealing legacy plan.

[10] Device/handset offerings are not included in this pricing commitment.

Jim Bird
David Krech

Attachment B

(HIGHLY CONFIDENTIAL – ATTORNEYS EYES ONLY)

PUBLIC VERSION

Attachment C

List of Third Party Speed Experts

MobileComm Professionals

TTS Wireless

FES – Further Enterprise Solutions

Verveba Telecom

Pramira

Quadgen Wireless

Attachment D

Consortium	County	Fairground Name
Northeast California Connect Consortium	Modoc County	Modoc County Fairgrounds
Upstate California Connect Consortium	Colusa County	Colusa County Fairgrounds
Broadband Consortium of the Pacific Coast	Santa Barbara County	Earl Warren Showgrounds
~~Northeast California Connect Consortium~~	~~Lassen County~~	~~Lassen County Fairgrounds~~
Central Sierra Connect Consortium	Mariposa County	Mariposa County Fairgrounds
Central Coast Broadband Consortium	Monterey County	Salinas Valley Fairgrounds
San Joaquin Valley Regional Broadband Consortium	Merced County	Merced County Fairgrounds - Los Banos
Northeast California Connect Consortium	Shasta County	Inter-Mountain Fairgrounds
East Bay Broadband Consortium	Solano County	Solano County Fairgrounds
Northeast California Connect Consortium	Siskiyou County	Tulelake-Butte Valley Fairgrounds
San Joaquin Valley Regional Broadband Consortium	Kern County	Kern County Fair and Event Center
Gold Country Broadband Consortium	Nevada County	Nevada County Fairgrounds
Los Angeles County Regional Broadband Consortium	Los Angeles County	Antelope Valley Fairgrounds
San Joaquin Valley Regional Broadband Consortium	Merced County	Merced County Fairgrounds - Merced
Inland Empire Regional Broadband Consortium	Riverside County	So Cal Lake Perris Fairgrounds
Central Coast Broadband Consortium	San Benito County	San Benito County Fairgrounds - Bolado Park Event Center
Redwood Coast Connect Consortium	Trinity County	Trinity County Fairgrounds & Event Center
Connected Capital Area Broadband Consortium	Sacramento County	Cal Expo
~~Central Sierra Connect Consortium~~	~~Calaveras County~~	~~Calaveras County Fairgrounds~~
Central Coast Broadband Consortium	Monterey County	Monterey County Fairgrounds & Event Center
Northeast California Connect Consortium	Siskiyou County	Siskiyou Golden Fairgrounds
Inland Empire Regional Broadband Consortium	Riverside County	Colorado River Fairgrounds
~~North Bay / North Coast Consortium~~	~~Mendocino County~~	~~Mendocino County Fairgrounds~~
Redwood Coast Connect Consortium	Humboldt County	Redwood Acres
Redwood Coast Connect Consortium	Humboldt County	Humboldt County Fairgrounds
~~Northeast California Connect Consortium~~	~~Plumas County~~	~~Plumas-Sierra County Fairgrounds~~
San Joaquin Valley Regional Broadband Consortium	San Joaquin County	San Joaquin County Fairgrounds
North Bay / North Coast Consortium	Mendocino County	Redwood Empire Fair

Note: Removed fairgrounds with strike-through because they lacked sufficent speeds.

APPENDIX 2

MEMORANDUM OF UNDERSTANDING
between
T-MOBILE US, INC.
and
NATIONAL DIVERSITY COALITION

THIS MEMORANDUM OF UNDERSTANDING ("**MOU**") is entered into on this _____ day of _____ 2019 by and among T-Mobile US, Inc. ("**T-Mobile**") and the National Diversity Coalition ("**NDC**") to set forth their mutual goals and commitments in promoting a more diverse and inclusive leadership, workforce, and supplier consortium; a superior advanced 5G wireless network that is more accessible for low-to-moderate income, minority, and rural communities; and a community development and philanthropy program that is sustainable and impactful. T-Mobile and NDC shall collectively be known herein as "**The Parties**".

WHEREAS, T-Mobile and Sprint Corporation are in the process of merging (the **"Transaction"),** with the combined corporation (hereinafter, the "**New T-Mobile**") expected to be the third largest wireless carrier with over 126 million subscribers;

WHEREAS, NDC is a 501(c)(3) nonprofit public benefit corporation comprised of *community*, *faith-based*, and *corporate leaders* spanning our nation's Asian, Latino, and African American communities united under a new definition of diversity and inclusion that reinforces greater opportunity, empowerment, and financial equality for underserved communities;

WHEREAS, NDC's leadership and membership is supportive of the Transaction into the creation of New T-Mobile and will work with New T-Mobile in advising on its promises of more jobs, lower prices, and a superior advanced 5G wireless network, among others;

NOW, THEREFORE, the foregoing premises considered, the parties enter into this MOU and agree to be bound as follows:

1. Purpose

T-Mobile and NDC enter into this MOU to establish an action plan, inclusive of strategic goals and timelines, to guide their collaborative efforts following the Transaction between T-Mobile and Sprint on the initiatives enumerated herein on five "**Focus Areas**": (a) **Corporate Governance**; (b) **Workforce Recruitment and Retention**; (c) **Procurement**; (d) **Wireless Services (including 5G Wireless Services) for Low Income Consumers**; and (e) **Philanthropy and Community Investment**.

2. Scope

This MOU is intended to apply to New T-Mobile, following the Transaction, and will include each of New T-Mobile's operating subsidiaries. References herein to "T-Mobile" or "New T-Mobile" are intended to include T-Mobile US, Inc. and its existing and future operating subsidiaries.

3. Corporate Governance

a. Board of Directors and Management.

NDC advocates that boards be comprised of one-third minority members (and not less than at least three (3) minority members) to ensure appropriate voice is given to the diverse viewpoints represented by minorities. New T-Mobile is committed to the diversity of its Board of Directors. Although many of the members of New T-Mobile's Board of Directors have yet to be announced, it is currently contemplated that at least two (2) of the initial appointees to New T-Mobile's Board will come from minority communities. New T-Mobile will continue to evaluate the makeup of its Board on an ongoing basis and encourage its stockholders to consider a diverse pool of Board candidates to fill vacancies as they occur.

b. Vice President of Diversity and Inclusion

T-Mobile has a Diversity and Inclusion Office which is spearheaded by the Vice President of Diversity and Inclusion ("VP D&I") who leads the company's diversity and inclusion initiatives.

New T-Mobile plans to retain the VP D&I position and the person in that position will continue to lead the company's diversity and inclusion initiatives and be empowered with budgetary and decision-making authority to ensure that diversity is integrated into all aspects of the organization and is among the organization's core values. The VP D&I will have primary responsibility for implementing the Diversity Strategic Plan, described below.

c. Vice-President of Government and External Affairs

T-Mobile has a Vice-President of Government and External Affairs who will work with community organizations on policy matters, technology needs, as well as investment. The Government Affairs department will be the primary point of contact with community organizations.

d. External Diversity and Inclusion Council

i. Composition. Within ninety (90) days after the close of the Transaction, New T-Mobile will establish a national diversity and inclusion council (the "**Council**") (sponsored by New T-Mobile's Government Affairs and Diversity and Inclusion teams) and a California focused diversity and inclusion SubCouncil (the "SubCouncil"). The Council and SubCouncil will be comprised of non-employees who are highly esteemed, regarded as pillars in their respective communities, and represent a diverse constituency. New T-Mobile shall appoint a person to serve as Chair of the Council and appoint the other individuals who will sit on the Council.

New T-Mobile shall endeavor to achieve ethnic and geographic diversity in the Council and SubCouncil, each of which shall be comprised of no fewer than twelve (12) individuals from diverse groups, including African Americans, Latinos, Asian Americans, Native Americans, women, the LGBTQ community, and persons with disabilities.

New T-Mobile will consider timely nominations from NDC to widen and improve the quality of the pool of potential candidates to the Council.

New T-Mobile agrees that a focus of the national Council will be diversity issues in California and will work with NDC to best determine how to achieve that focus through the SubCouncil or other agreeable form.

ii. Role. The Council shall be the main external advisory group to New T-Mobile, regarding the development and implementation of a "Diversity Strategic Plan." The Diversity Strategic Plan shall be presented by the VP D&I to New T-Mobile Management Team within one-hundred and eighty (180) days following the close of the Transaction for review and approval. The Council shall also be a venue for open communication regarding New T-Mobile's diversity and inclusion initiatives.

iii. Term. Members of the Council shall serve a term of three years from the time the Council is constituted and the members are appointed. Removal for cause will be permitted where a member has violated the terms of this agreement or otherwise engaged in conduct which New T-Mobile deems inconsistent with their duties as council member.

iv. Meetings. The Council shall meet at least two (2) times per year at the headquarters of New T-Mobile, unless another convenient location is selected by New T-Mobile. New T-Mobile's VP D&I along with the VP of Government and External Affairs shall attend each meeting of the Council. New T-Mobile understands NDC's goals that the Council have the attention of senior executive leadership of New T-Mobile and will use reasonable efforts to ensure that relevant members of its Senior Leadership Team attend meetings as appropriate and interact with the Council to receive their advice and counsel.

The Council meetings shall be to provide input on the continuing development of the Diversity Strategic Plan; brief the Council as to relevant, non-confidential business and operations plans within the scope of this MOU; review progress on diversity initiatives; and recommend ways in which New T-Mobile can improve its efforts in the Focus Areas.

New T-Mobile shall assist the Council in scheduling the meetings and other associated administrative tasks and shall reimburse members of the Council for reasonable meeting-related expenses such as travel, lodging, programming by experts in the Focus Areas of the Council, and meals, plus a per diem for members consistent with comparable boards and Councils.

Every year for the three (3) years following the close of the Transaction, and upon the advanced and reasonable request of NDC, New T-Mobile's VP D&I and VP of Government and External Affairs, along with other relevant members of the Senior Leadership Team as determined by New T-Mobile, shall meet at least once a year with NDC leaders and members to provide updates on the Focus Areas discussed in this MOU as well as other areas of mutual interest. The first meeting shall be held within the first twelve (12) months following the close of the Transaction.

4. Workforce Recruitment and Retention

New T-Mobile shall strive to increase the diversity of its workforce in California at all levels to reflect the diversity of the communities in which it operates. New T-Mobile will work with the Council to establish plans in this area, which will be included in the Diversity Strategic Plan, to create and enhance existing mentoring, outreach, recruiting, development, and training programs that provide meaningful opportunities for advancement. New T-Mobile shall consider recommendations submitted by NDC to expand and improve the quality of potential candidates.

At a minimum, New T-Mobile will establish the following initiatives:

a. New T-Mobile will establish or improve upon existing workplace diversity and inclusion awareness program with the following components: (1) a comprehensive policy describing New T-Mobile's commitment to a diverse employee population and creation of an inclusive culture; (2) dissemination and communication of New T-Mobile's diversity policy via its Intranet and Internet sites, New Employee Orientation Program, and Careers web page; (3) encouraging and supporting the expansion of employee affinity groups; and (4) training all leaders concerning their role in creating and maintaining an inclusive work environment and diverse workplace.

b. New T-Mobile will set up an annual award during the term of this agreement that recognizes the New T-Mobile Executive or Senior Management Employee(s) in each region or division who best implements or furthers the goals of the diversity and inclusion initiatives set forth in this MOU. The VP D&I shall report the recipients to the Council and recognize the recipients internally.

c. To increase the pool of skilled and qualified diverse candidates for employment, New T-Mobile shall support and partner with local trade schools and other community and civic organizations in California to train and/or certify individuals for employment in the wireless, telecommunications, technology or other industries. In addition, New T-Mobile will invest in local community programs designed to prepare people of color and other diverse individuals to succeed in the workplace, including mentoring programs to enhance opportunities for upward mobility from entry-level to mid-level and senior management. NDC shall propose to New T-Mobile organizations that are able to provide such training.

d. Internships for students who attend minority-serving educational institutions located in New T-Mobile's footprint in California, such as local colleges, universities, and trade and vocational institutions.

e. New T-Mobile shall partner with NDC and other community and civic groups as well as local workforce development organizations to assist in the selection of executive leadership development programs and the development of internship programs aimed at exposing college and university students to employment opportunities with the company in California, including recommendations for search firms with expertise in identifying diverse candidates to fill executive positions and to identify, train, and recruit qualified people of color and other diverse candidates to fill the additional California jobs anticipated to be created after the Transaction.

f. With input from NDC and other community groups, New T-Mobile will consider fostering community reintegration reentry into the California workforce of formerly incarcerated individuals by providing opportunities for training and employment, especially those who served time for non-violent crimes.

g. New T-Mobile will provide NDC information subject to non-disclosure and only for internal discussions and progress reports related to the company's diversity initiatives and efforts in California. NDC, and the members of the Council, will keep confidential all communications with New T-Mobile and all information provided by New T-Mobile, unless the VP D&I agrees in writing that such information can be communicated externally.

5. Procurement

New T-Mobile will partner with NDC and the Council to improve diversity in its procurement of goods and services by substantially increasing over the next three (3) years its diverse supplier spending in California. New T-Mobile will work with the Council to establish specific goals in this area which shall be included in the Diversity Strategic Plan. The following minimum actions will be taken to achieve this goal:

a. New T-Mobile will create opportunities for building and growing relationships between minority-owned suppliers in the communities in which it operates in California and its leadership, partner with organizations that serve the minority business communities, and participate in procurement-related events that showcase diverse suppliers. NDC will provide guidance and advice to New T-Mobile to identify opportunities for spending with diverse suppliers who are able to meet the company's needs in areas such as banking, investments, IT, engineering, construction, customer precise equipment, legal services, advertising and media services, janitorial services, building maintenance, office supplies and furniture, and staffing services.

b. New T-Mobile in collaboration with the Council and NDC will identify and invest in programs that mentor and coach diverse business owners in California who desire to compete for contracting opportunities in the wireless network industry, particularly with New T-Mobile.

c. New T-Mobile will partner with minority-led organizations in California, including engaging with African American, Hispanic, and Asian American chambers of commerce and trade organizations, being an active participating member in the National Minority Supplier Development Council, and consulting the Council to model best practices in supplier diversity and procurement successfully adopted by other companies.

d. New T-Mobile shall provide guidance on its website on how diverse vendors can become New T-Mobile suppliers. New T-Mobile shall utilize a supplier diversity tracking system for California that meets the following criteria:

   i. Identifies New T-Mobile's diverse suppliers;

   ii. Tracks, monitors, and reports on a companywide basis New T-Mobile's spend with each diverse supplier;

iii. Shows New T-Mobile's amount and percentage spent from total procurement among each diverse group (i.e., African American, Latino, Asian, women, veterans);

iv. Categorizes specific supplies and/or services provided by New T-Mobile's diverse suppliers; and

v. Tracks and analyzes New T-Mobile's spend with its diverse suppliers.

e. New T-Mobile commits to strive to expand its utilization of minority-owned law firms and accounting firms.

f. New T-Mobile commits to strive to engage at least one minority-owned advertising agency to develop national and/or local advertising and marketing materials, as well as committing to increase its spending on advertising with minority-owned media.

g. New T-Mobile will strive to grow the diversity of its banking, accounting, and other financial services partners by developing and expanding relationships with minority-owned banks, investment firms, and asset managers. To the extent New T-Mobile is unable to develop a relationship with a minority-owned company, it will consider minority-managed companies and relationships with such minority partners at non-minority and/or public companies.

h. New T-Mobile will provide annual reports and data related to California supplier diversity in an agreed upon format to the Council and NDC, subject to non-disclosure and for internal discussions only.

i. Within five (5) years following the close of the Transaction, New T-Mobile's aspirational goal for all annual diverse spend in California will be the CPUC's General Order 156 goal of 21.5%. Within three (3) years of the close of the Transaction, New T-Mobile's aspirational goal for annual diverse spend in California excluding spend with handset and network OEMs will be 40%. This split goal recognizes (but is not contingent on) the fact that there are currently no diverse certified suppliers of handsets and network equipment.

6. Access to Wireless Services (including 5G Wireless Services) for Low Income Consumers

Among the key benefits of the Transaction are **more jobs, lower prices, and a superior advanced 5G wireless network**. T-Mobile has a proven track record of seeking out and serving under-served consumers, including low income and diverse consumers. New T-Mobile plans to continue that track record by offering products and services designed to serve those communities.

New T-Mobile recognizes that NDC and its members play a vital role in serving the needs of low income, minority, and faith-based communities and offering general social service assistance, community development and economic opportunities for communities of color in California and has an interest in promoting digital adoption and education in these communities. NDC members have reported that certain of their community centers and churches in California lack access to wireless services they need to serve their communities. New T-Mobile commits to work with NDC and its members to launch a Community Wireless Initiative that will be part of New T-Mobile's Community Investment Plan (see below in

Philanthropy and Community Investment). The Community Wireless Initiative will seek to expand and improve wireless capabilities within New T-Mobile's coverage area throughout low income communities, to low income Californians, to underserved minority populations, and to organizations serving these underserved communities. The Community Wireless Initiative will, amongst other things, (i) work with NDC members to create a plan within one-hundred and eighty (180) days of the close of the Transaction to enhance the wireless experience offered at target locations within New T-Mobile's coverage area whether that be via technical measures (e.g. the installation of a signal booster or Wi-Fi hot spot) or via education and support. Further, the Community Wireless Initiative will work with NDC to expand programs that New T-Mobile has to make wireless devices available at low or no cost to school children eligible for free or reduced lunches or districts eligible for free or reduced lunches (e.g. Sprint 1 Million Project and T-Mobile's EmpowerED programs) and to community organizations (including non-profits, churches, and community centers) serving low income populations with limited wireless access and to explore other measures with NDC to promote digital adoption and education.

7. Philanthropy and Community Investment

New T-Mobile recognizes the importance of investing in minority-led organizations, including African American, Latino, and Asian American organizations, as well as the programs and services provided by organizations that serve communities of color. NDC and its members play a vital role in serving the needs of low income, minority, and faith-based communities and offer general social service assistance, community development, and economic opportunities for communities of color in California. Moreover, New T-Mobile understands that financial support and capacity building provided to these organizations is important to the communities in which they operate.

Recognizing these, New T-Mobile commits to continuing and improving its involvement in and commitment to organizations in California that are mission-driven to improve the socio-economic conditions facing people of color, women, disabled persons, and veterans, realizing that investing in these peoples ultimately improves New T-Mobile's bottom line.

New T-Mobile will develop a "Community Investment Plan" that will outline its Philanthropy and Community Investment for the three year years following the close of the Transaction for California. This plan will be developed in the one-hundred and twenty (120) days following the close of the Transaction in consultation with NDC. T-Mobile will consult with NDC annually on the Community Investment Plan at the same meeting or meetings NDC holds with New T-Mobile relating to the Diversity Strategic Plan. The Community Investment Plan will consider the following:

a. Community Investment. New T-Mobile commits to increase its philanthropic efforts to support minority-led and minority-serving organizations and institutions in California.

   New T-Mobile and NDC both recognize the value of collaboration, and NDC shall make recommendations about future community investment opportunities for New T-Mobile's government affairs and community outreach teams and there will be mutual collaboration to further shared goals.

b. Internships, Scholarships, and Workforce Development and Training. New T-Mobile will support minority-led and minority-serving organizations and

educational institutions that provide internships and scholarships to minority students and promote workforce development and training in California.

c. Community Marketing, Education, and Outreach. New T-Mobile shall partner with minority-led and minority-serving organizations to support its marketing, education, and outreach about its products and services, especially to hard-to-reach areas and populations.

d. Community Investment Data. New T-Mobile shall provide annual community investment-related data in an agreed upon format to the Council, subject to non-disclosure and for internal discussion purposes only. This data shall be disaggregated to reflect support given to each community of color.

8. Monitoring and Evaluation

New T-Mobile will work with NDC to create a mechanism which will ensure adequate monitoring and oversight of this MOU.

9. Effective Date

This MOU shall take effect upon the closing of the Transaction. NDC commits to perform diligently and in good faith all actions required to conclude the California Public Utilities Commission ("CPUC") proceedings in a manner satisfactory to T-Mobile and publicly support the Transaction. Additionally, NDC agrees that it will cooperate and work closely with T-Mobile to engage in outreach and advocacy efforts to demonstrate the various ways in which the Transaction serves the public interest.

This MOU shall remain in effect three (3) years from the effective date. Thereafter, the parties will jointly discuss the desirability of extending the agreement for an additional three-year term.

10. Miscellaneous

a. New T-Mobile and NDC agree that this MOU is intended to create a binding commitment in the Focus Areas specified, and that New T-Mobile shall make commercially reasonable efforts to satisfy each of these commitments. This MOU shall be binding upon NDC and New T-Mobile only and shall not confer rights upon any third-party that may benefit from this agreement or the right to bring any legal or equitable action against the parties hereto. Nor is it intended that either party to this agreement should act in contravention to applicable law.

b. This MOU does not create a legal partnership among or between the parties. No party shall have the authority to bind the other to any agreement, contract, or understanding with any third party or to act as an agent or representative of the other.

c. The parties to this MOU intend that the planning, development, implementation, and oversight of this MOU is to be a cooperative, mutual, long-term endeavor in which the parties actively participate, in good faith and with due diligence. To that end, at NDC's request, New T-Mobile will consider appropriate budget requests relating to ongoing monitoring and oversight of

this MOU which shall be part of the Community Investment Plan. Nothing in this MOU is intended to imply or otherwise suggest that NDC has any authority or discretion over the Focus Areas enumerated herein, which shall remain within the full discretion of T-Mobile.

d. The Parties agree in good faith to review and revise any terms to reflect any significant changes in circumstances.

T-Mobile US, Inc.

John Legere
Chief Executive Officer

Date: 1/29/2019

National Diversity Coalition

Faith Bautista
President and Chief Executive Officer

Date: 1-29-19

APPENDIX 3

NEWS > BLOG

The Life Expectancy of Electronics

September 16, 2014

Chris Ely, Consumer Technology Association

The pace of new product releases is a testament to the dynamism and innovativeness inherent in the consumer electronics industry. One indication of a dynamic and fast-paced industry, complete with a steady stream of new products, is the answer to the question: how long do products last before replacement? And what happens to products once they have reached their life expectancy?

CEA's recent *CE Product Life Cycle* study explores consumer perceptions of product life cycles for several key categories, including flat panel televisions, digital cameras, DVD and Blu-ray players, tablets, laptops, desktop computers, smartphones, cell phones and video game consoles. Here's some of what we learned:

- On average, consumers expect most CE products to last approximately five years. However there are differences between products.
- Flat panel TVs have the longest expected life cycle of any CE product surveyed in the study at 7.4 years.
- Conversely, smartphones and feature phones have the shortest life expectancy at 4.7 years.

Furthermore, the industry's efforts to promote recycling are clearly working, as most consumers anticipate recycling or finding a second home for the CE devices they stop using.

Check out the recent *CE Product Life Cycle* study to learn more about consumer perceptions on how long key CE products should last.

RELATED

BLOG

HYPERVSN's CES Success Story

APPENDIX 4

ERICSSON

ERICSSON MOBILITY REPORT

NOVEMBER 2017

with Central and Eastern Europe appendix

ERICSSON MOBILITY REPORT

Welcome to this edition of the Ericsson Mobility Report, where we, among other things, forecast 1 billion 5G subscriptions for enhanced mobile broadband by 2023. The evolution to 5G will enable a range of new use cases. One example we describe is the use of augmented reality-assisted maintenance and repair in the manufacturing industry.

Between Q3 2016 and Q3 2017, the total data traffic in mobile networks increased by 65 percent. The number of LTE subscriptions is growing rapidly, and LTE is anticipated to become the dominant mobile access technology by the end of this year. Operators are increasingly deploying networks that are capable of Gigabit speeds.

In addition to the forecast figures, we have included three feature articles in this report. One article looks into the subject of mobile data plans, exploring operators' need for a variety of offerings. The other two articles cover different aspects of 5G, the first focusing on enhancing the event experience through digitalized services and the second on consumer expectations.

I hope you find this report valuable and engaging. You can find all our content, including regional versions of the report, at **www.ericsson.com/mobility-report**

PUBLISHER

Niklas Heuveldop,
Chief Strategy Officer
and Senior Vice President
Technology and Emerging Business

CENTRAL AND EASTERN EUROPE KEY FIGURES

	2017	2023	CAGR 2017–2023
Mobile subscriptions (million)	610	640	1%
Smartphone subscriptions (million)	270	490	10%
Mobile broadband subscriptions (million)	420	630	7%
LTE subscriptions (million)	160	540	23%
Data traffic per active smartphone (GB/month)	3.8	19	31%
Total mobile data traffic (EB/month)	1.2	9.3	41%

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Articles

Central and Eastern Europe appendix

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Regional Appendices:	Veronica Gully, Steven Davis

MOBILE SUBSCRIPTIONS Q3 2017

In Q3, 95 million new mobile subscriptions were added, resulting in a total of 7.8 billion

The number of mobile subscriptions is growing at almost 6 percent year-on-year, reaching 7.8 billion in Q3. China had the most net additions during the quarter (+30 million), followed by Indonesia (+7 million), the US (+4 million), Angola (+4 million) and Pakistan (+3 million).

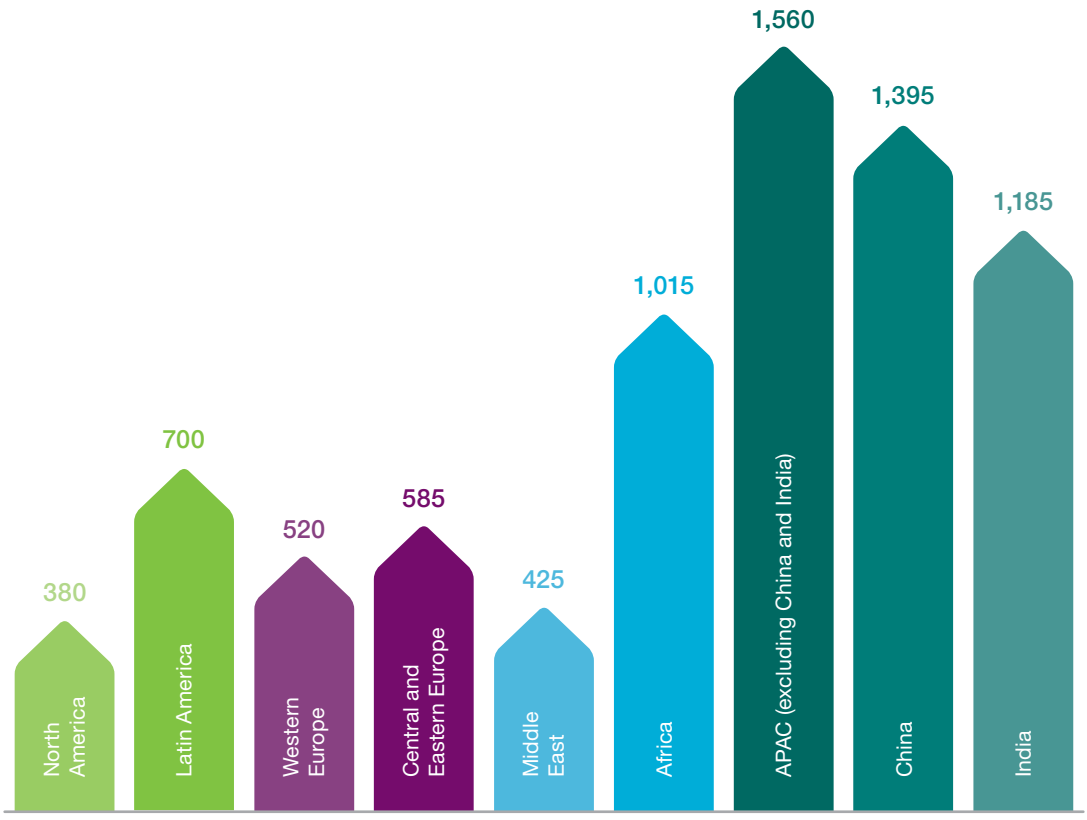
The number of mobile broadband subscriptions[1] is growing at around 20 percent year-on-year, increasing by 210 million in Q3 2017 alone. The total number is now 5 billion.

During Q3 2017, 170 million LTE subscriptions were added to reach a total of 2.5 billion. The net additions for WCDMA/HSPA were around 60 million subscriptions during the quarter. The majority of 3G/4G subscriptions can use GSM/EDGE as a fallback.

There are now 5 billion mobile broadband subscriptions

Over the same period, GSM/EDGE-only subscriptions declined by 130 million. Other technologies declined by around 5 million.

Subscriptions associated with smartphones now account for 57 percent of all mobile phone subscriptions. Around 400 million smartphones were sold in Q3, which equates to 83 percent of all mobile phones sold in the quarter.

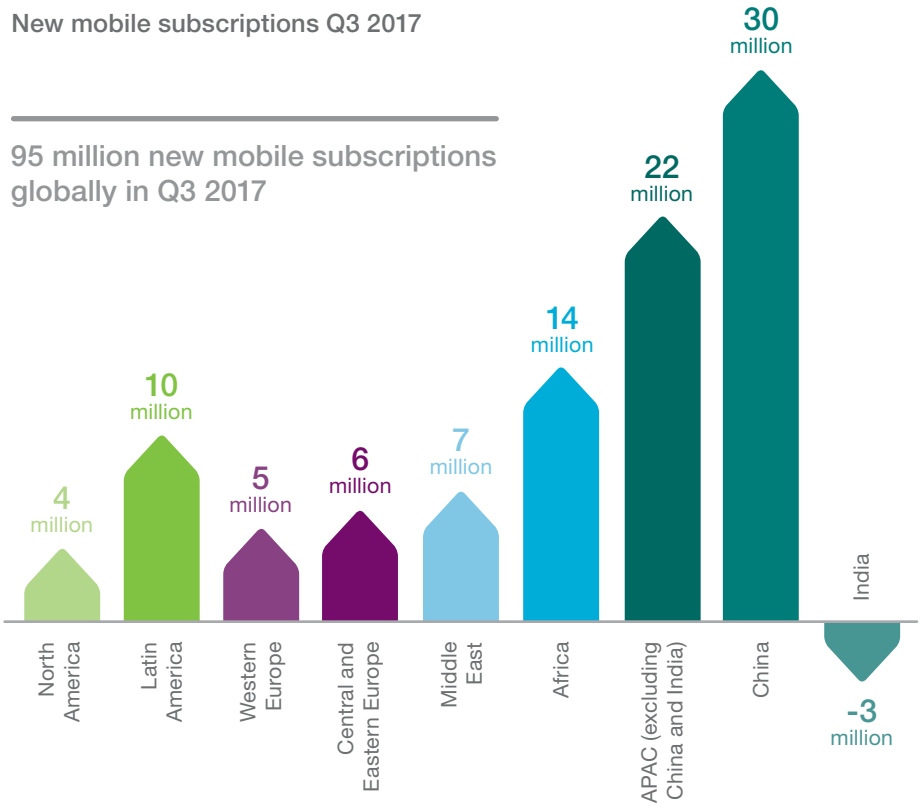


Mobile subscriptions Q3 2017 (million)

[1] Mobile broadband includes radio access technologies HSPA (3G), LTE (4G), 5G, CDMA2000 EV-DO, TD-SCDMA and Mobile WiMAX
Note: WCDMA without HSPA and GPRS/EDGE (2G) are not included

New mobile subscriptions Q3 2017

95 million new mobile subscriptions globally in Q3 2017



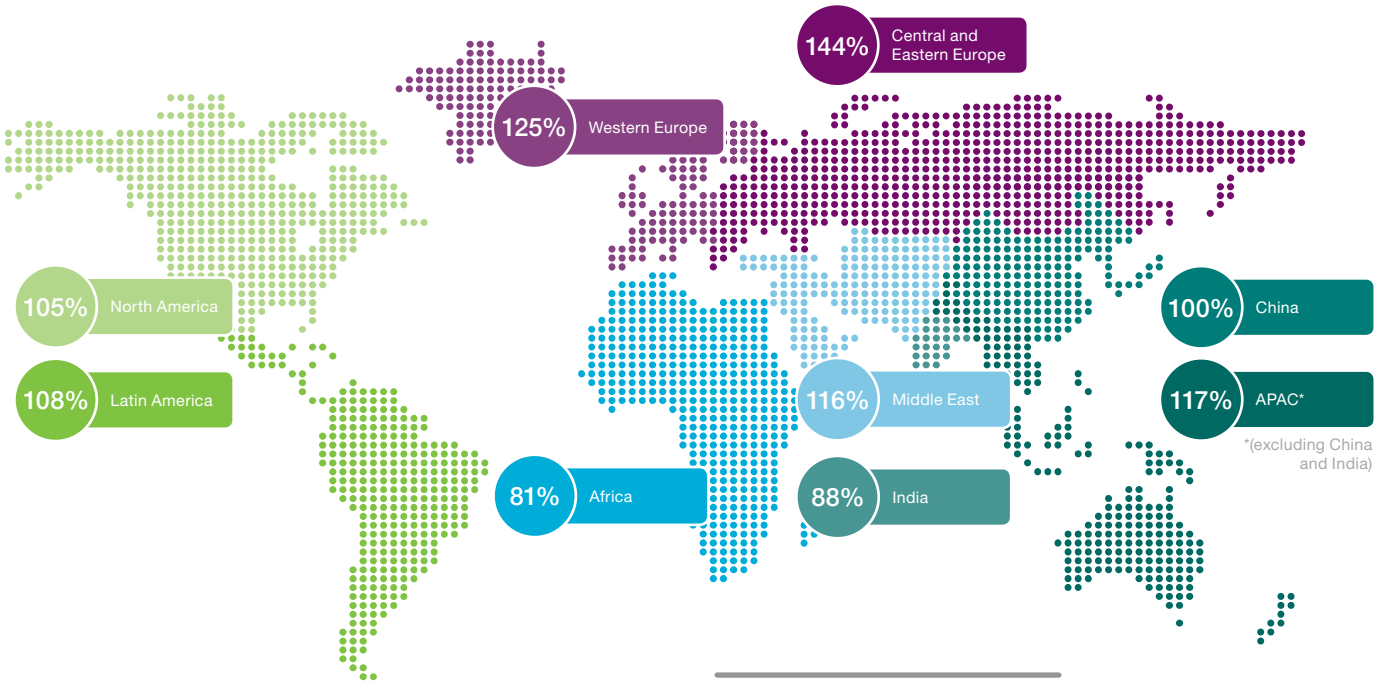
Top 5 countries by net additions Q3 2017

1	China	+30 million
2	Indonesia	+7 million
3	US	+4 million
4	Angola	+4 million
5	Pakistan	+3 million

The number of mobile subscriptions exceeds the population in many countries, which is largely due to inactive subscriptions, multiple device ownership or optimization of subscriptions for different types of calls.

As a result, the number of subscribers is lower than the number of subscriptions. Today, there are around 5.3 billion subscribers globally compared to 7.8 billion subscriptions.

5.3 BILLION
subscribers



103% global subscription penetration in Q3 2017

Subscription penetration Q3 2017 (percent of population)

MOBILE SUBSCRIPTIONS OUTLOOK

Preparations for 5G are gaining momentum and operators are gearing up for commercial launches. The number of 5G subscriptions is forecast to reach 1 billion by the end of 2023

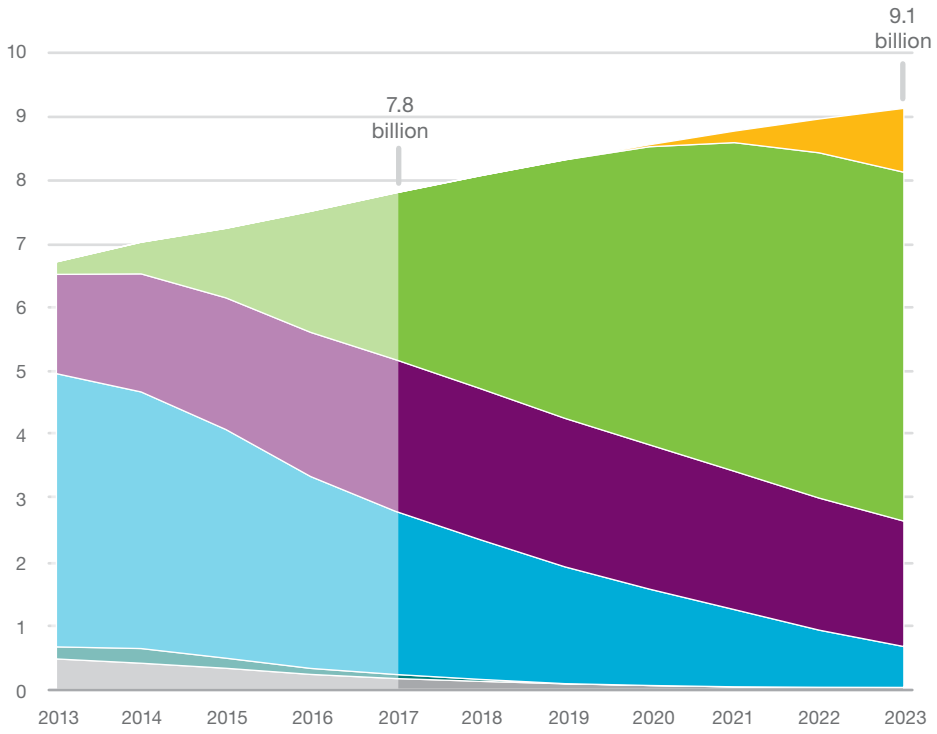
The standardization work plan for 5G has been accelerated. The standard as specified in 3GPP Release 15 is planned to be finalized by the end of 2017 for Non-Standalone 5G New Radio (NR)[1], and by mid-2018 for Standalone 5G NR. Early 5G deployments are anticipated in several markets, including the US, South Korea, Japan and China. The first commercial networks based on Standalone 5G NR are expected to go live in 2019, with major network deployments from 2020. By the end of 2023, over 1 billion 5G subscriptions are forecast for enhanced mobile broadband.

LTE is anticipated to become the dominant mobile access technology by the end of 2017, and is estimated to reach 5.5 billion subscriptions by the end of 2023. At that point, LTE subscriptions will account for more than 60 percent of all mobile subscriptions. In developing markets, GSM/EDGE-only will still account for a significant share of subscriptions.

Smartphone penetration will continue to rise, driven by the increasing affordability of devices. At the end of 2023, 7.3 billion subscriptions associated with smartphones are anticipated.

A 5G subscription is here counted as such when associated with a device that supports NR as specified in 3GPP Release 15, connected to a 5G-enabled network.

Mobile subscriptions by technology (billion)

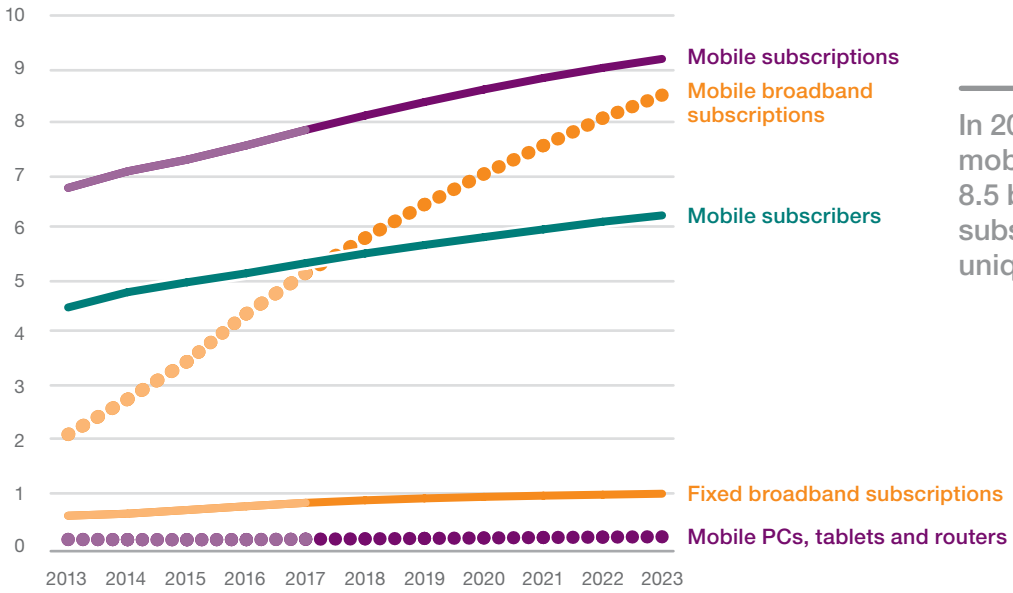


5G subscriptions will reach 1 billion by the end of 2023

- 5G
- LTE
- WCDMA/HSPA
- GSM/EDGE-only
- TD-SCDMA
- CDMA-only

[1] Non-Standalone 5G NR will utilize the existing LTE radio and Evolved Packet Core network as an anchor for mobility management and coverage, while adding a new 5G radio access carrier to enable certain 5G use cases
Figure note: IoT connections and Fixed Wireless Access (FWA) subscriptions are not included in the above graph

Subscriptions/lines, subscribers (billion)



In 2023, there will be 9.1 billion mobile subscriptions, 8.5 billion mobile broadband subscriptions and 6.2 billion unique mobile subscribers

Subscriptions for mobile broadband are expected to approach 95 percent of all subscriptions by the end of 2023

It is forecast that there will be 9.1 billion mobile subscriptions by the end of 2023. Mobile broadband subscriptions will reach 8.5 billion, accounting for close to 95 percent of all mobile subscriptions. The number of unique mobile subscribers is estimated to reach 6.2 billion by the end of the forecast period.

Mobile broadband will complement fixed broadband in some segments, and will be the dominant mode of access in others.[2] Subscriptions for PCs and tablets with mobile capabilities are expected to show moderate growth, reaching 330 million in 2023.

5G will be introduced in higher spectrum bands to meet new traffic demands

Mobile broadband traffic is expected to increase by eight times over the coming six years, while commercial 5G systems will be introduced from 2019. However, below 3GHz, most of the mobile cellular spectrum bands currently used by service providers are becoming congested during busy hours in highly loaded cells.

In response to increasing demands, the mobile industry is focusing on optimizing the spectral efficiency of LTE in existing frequency bands using new advanced functionalities, such as Multiple Input Multiple Output (MIMO) and carrier aggregation. To solve capacity needs long term, most countries are expected to make additional spectrum available under new national 5G regulatory regimes. This will be achieved by extending the use of spectrum to higher bands, where a large amount of bandwidth could help accommodate the expected mobile data consumption from around 1 billion new 5G subscriptions in 2023.

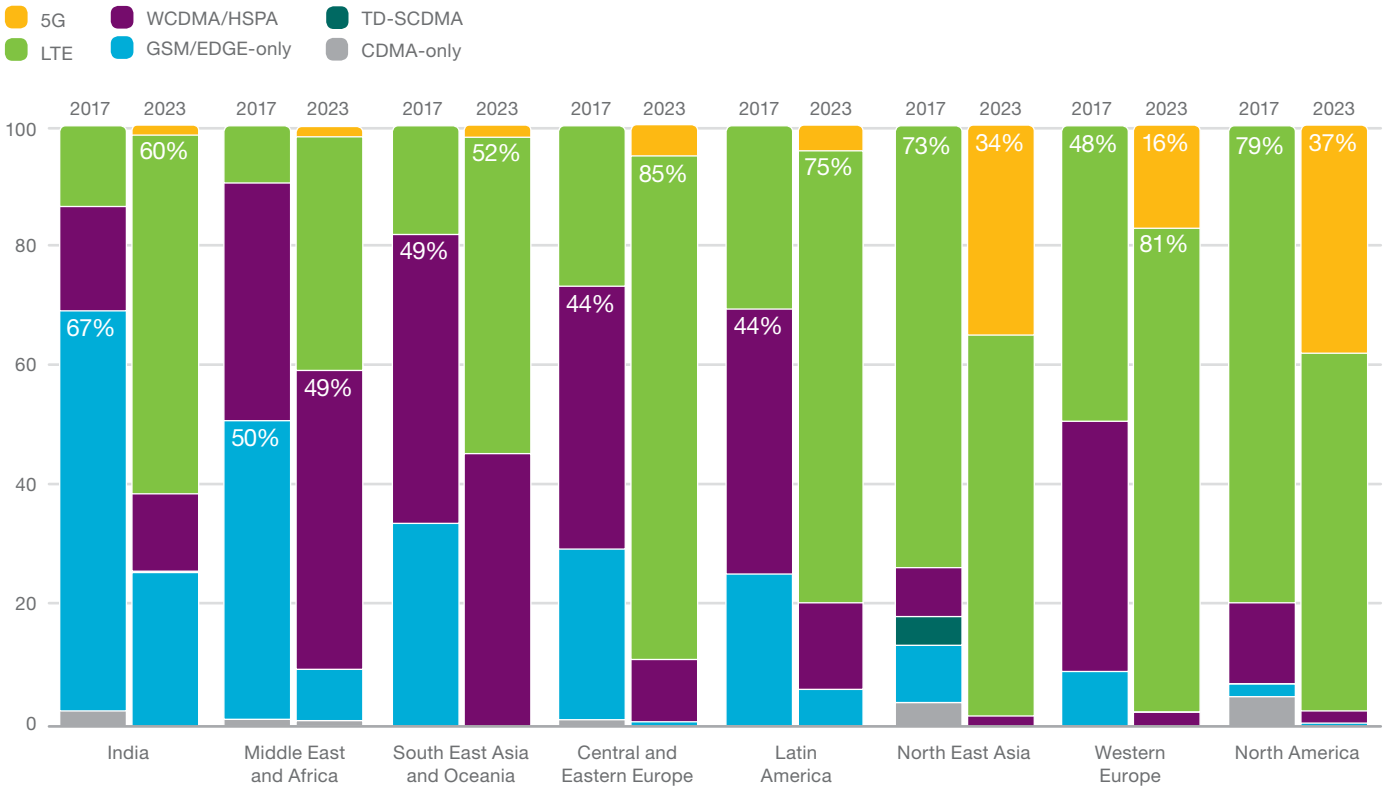
Several suitable bands are currently being considered to support 5G subscription growth, and to deliver the data rates needed to meet the future demand for broadband services and applications. Currently bandwidth in the 28GHz band (26.5–29.5GHz) is being allocated in some countries, but bandwidth in the 26GHz band (24.25–27.5GHz) is also being considered. The latter band is part of the International Telecommunication Union's (ITU) World Radiocommunication Conference 2019 (WRC-19) agenda, while the former band is being assigned under an already existing mobile allocation in the ITU Radio Regulations.

The mobile industry considers these two bands to be the most important for terrestrial mobile applications on higher frequencies (above 6GHz). The 38GHz and 42GHz bands are also being considered as complementary resources to support 5G requirements.

[2] The number of fixed broadband users is at least three times the number of fixed broadband connections, due to shared subscriptions in households, enterprises and public access spots. This is the opposite of the situation for mobile phones, where subscription numbers exceed user numbers

REGIONAL SUBSCRIPTIONS OUTLOOK

Mobile subscriptions by region and technology (percent)



Mobile broadband drives subscription growth across all regions

The number of mobile subscriptions continues to grow across the regions, fueled by a strong uptake in mobile broadband.[1] There are still large variations between regions. However, with the exception of India, subscriptions for mobile broadband now make up 50 percent or more of total subscriptions in all regions. Globally, the most common way to access the internet is over a mobile network.

By the end of 2023, the Middle East and Africa region will transform from a situation where half of all mobile subscriptions are GSM/EDGE-only, to one where 90 percent of subscriptions are for mobile broadband. Driving factors for this growth include a young and growing population with increasing digital skills, as well as more affordable smartphones.

37% of subscriptions in North America are expected to be for 5G in 2023

In North East Asia, 5G is expected to be deployed early in South Korea, Japan and China. For the region as a whole, 5G subscription penetration is expected to reach 34 percent by the end of the forecast period.

North America currently has the highest penetration of LTE subscriptions at close to 80 percent. The region will also lead 5G uptake, with major operators stating their intentions to deploy 5G early. 5G subscriptions are expected to account for 37 percent of all mobile subscriptions in the region by the end of 2023.

Western Europe is expected to evolve more slowly, with 5G making up 16 percent of mobile subscriptions at the end of the period.

[1] Mobile broadband includes radio access technologies HSPA (3G), LTE (4G), 5G, CDMA2000 EV-DO, TD-SCDMA and Mobile WiMAX
Note: WCDMA without HSPA and GPRS/EDGE (2G) are not included

VOICE OVER LTE OUTLOOK

VoLTE subscriptions[1] are expected to exceed 650 million by the end of 2017, creating a foundation for interoperable consumer and enterprise communication services on different devices

VoLTE has now been launched in more than 125 networks in over 60 countries across all regions. The number of VoLTE subscriptions is projected to reach 5.5 billion by the end of 2023, accounting for more than 80 percent of the combined LTE and 5G subscriptions.

Enabling new consumer and enterprise use cases with VoLTE

VoLTE is delivered via the IP Multimedia Subsystem (IMS) and enables operators to offer high-quality, simultaneous communication and data services on smartphones and other devices. Functionality includes HD voice, HD voice+ and music within calls with the new Enhanced Voice Services (EVS) codec, content sharing within calls, video communication, IP messaging and evolution to chat bots, and allowing several devices to share the same phone number.

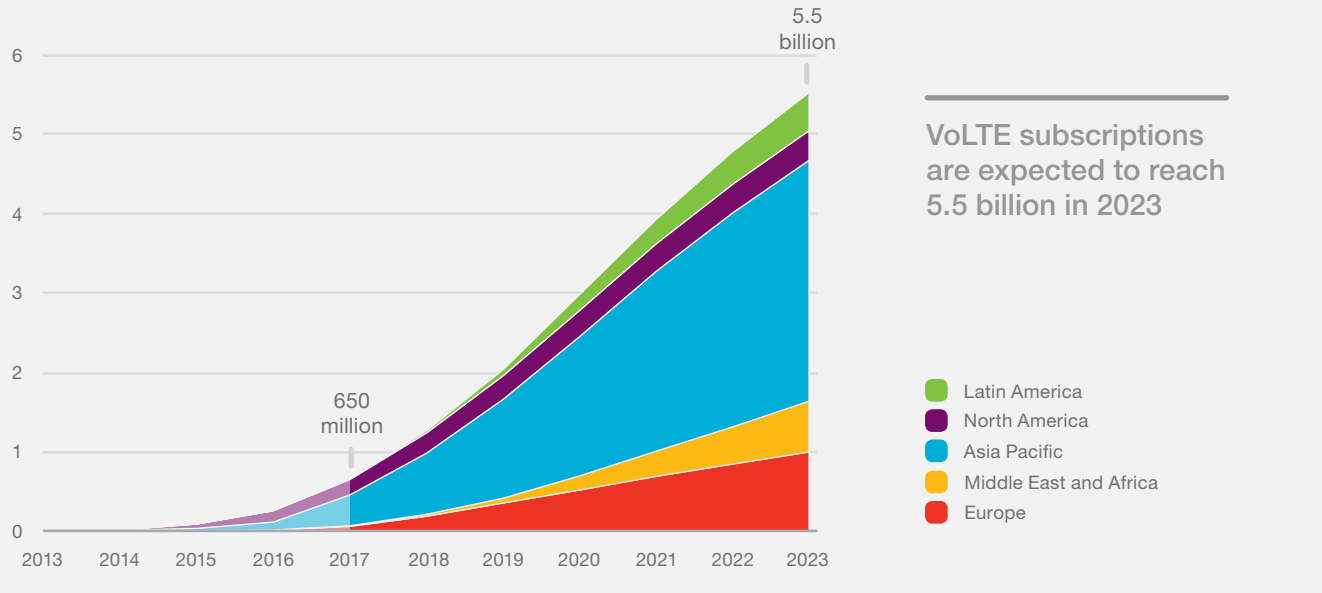
Wi-Fi calling is built on the same core network systems as VoLTE, and enables operators to extend their voice service to places with limited cellular coverage. To date, Wi-Fi calling has been implemented on over 55 networks in more than 30 countries.[2]

There are more than 1,300 VoLTE-enabled device models.[3] Cellular smartwatches are one of the latest devices to utilize VoLTE. Users are able to make voice calls directly on their smartwatch, without having a smartphone nearby. Calls can also be transferred between a user's smartphone and watch.

VoLTE support in Cat-M1-capable Internet of Things (IoT) devices and network infrastructure is now being enabled, and new use cases are being explored. Many IoT use cases could benefit by incorporating basic voice calling functionality. One example is in assistance situations, such as using an alarm panel in an elevator, or calling the owner of a lost dog via its IoT-connected collar. The technology could also be used to improve business performance, for example, enabling faster repair of vending machines by providing a button to call a service center easily.

VoLTE technology will be the foundation for enabling voice calls over 5G access. New communication service use cases in a 5G context are being explored, such as combining them with augmented reality and virtual reality.

VoLTE subscriptions by region (billion)



[1] A subscriber is counted as having a VoLTE subscription if making at least one VoLTE call per month
[2] GSMA (November 2017)
[3] GSA (July 2017), supporting different regions and frequencies

MOBILE TRAFFIC Q3 2017

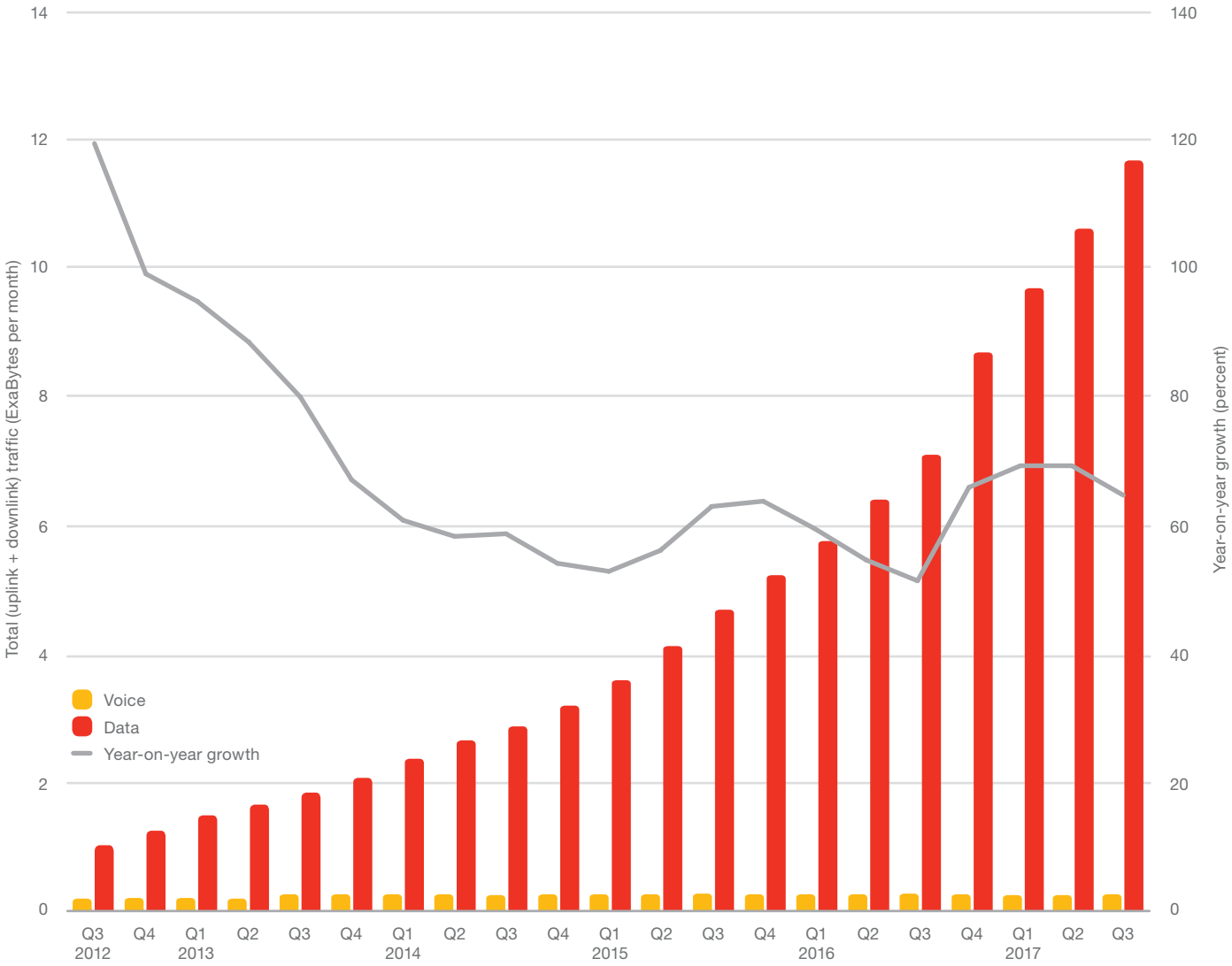
Mobile data traffic[1] continues to grow. This is driven by increasing smartphone subscriptions and increasing average data volume per subscription, fueled primarily by more viewing of video content.

The graph below shows total global monthly data and voice traffic from Q3 2012 to Q3 2017, along with the year-on-year percentage change for mobile data traffic.

This curve illustrates a typical moderating growth rate as the market has evolved over time, which has been disrupted on a couple of occasions. In 2015, the growth rate was influenced by zero-rated video offers in North America. In 2016, introductory free data traffic offers in India pushed up the global traffic noticeably.

In Q3 2017, data traffic grew around 10 percent quarter-on-quarter and around 65 percent year-on-year. However, there are large differences in traffic levels between markets, regions and operators.

Data traffic grew 65% between Q3 2016 and Q3 2017



Source: Ericsson traffic measurements (Q3 2017)

[1] Traffic does not include DVB-H, Wi-Fi, or Mobile WiMAX. VoIP is included in data traffic

MOBILE TRAFFIC BY APPLICATION CATEGORY

Increased viewing of video on mobile devices, embedded video and emerging video formats will drive data consumption

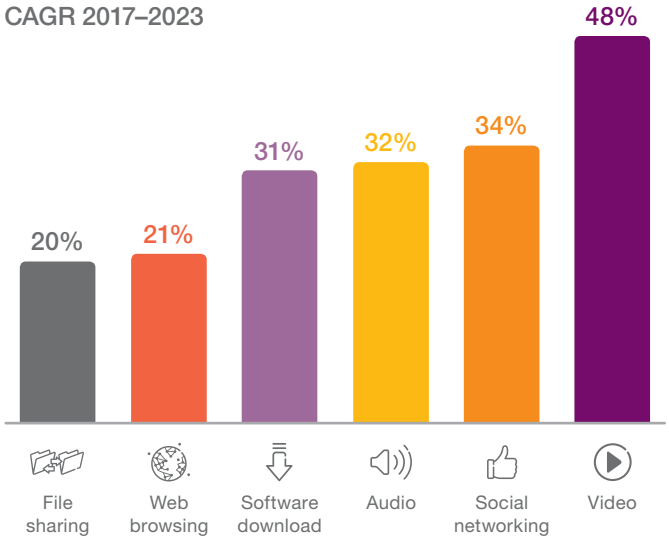
Mobile video traffic is forecast to grow by around 50 percent annually through 2023 to account for 75 percent of all mobile data traffic. Social networking is also expected to grow – increasing by 34 percent annually over the next 6 years. However, its relative share of traffic will decline from 12 percent in 2017 to around 8 percent in 2023, as a result of the stronger growth of video.

Other application categories have annual growth rates ranging from 20 to 32 percent, and so are shrinking as a proportion of overall traffic. The use of embedded video in social media and webpages (here counted as video traffic) is also growing, fueled by larger device screens, higher resolution and new platforms supporting live streaming.

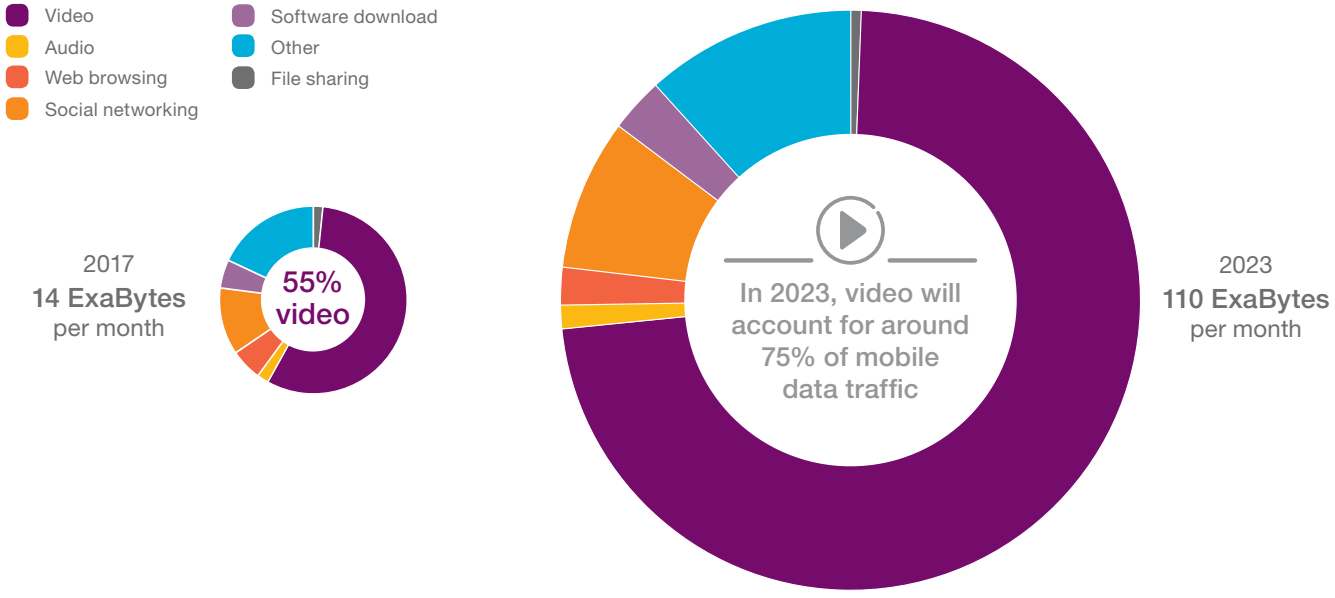
The emergence of new applications and changes in consumer behavior can shift the forecast relative traffic volumes. Streaming videos in different resolutions can impact data traffic consumption to a high degree. Watching HD video (1080p) rather than video at a standard resolution (480p) typically increases the data traffic volume by around 4 times. An emerging trend with increased streaming of immersive video formats, such as 360-degree video, would also impact data traffic consumption. For example, a YouTube 360-degree video consumes 4 to 5 times as much bandwidth as a normal YouTube video at the same resolution.

Another driver is an increasing preference among consumers for on-demand and catch-up TV over scheduled linear TV viewing. Consumer research indicates that as early as 2020, half of all TV and video viewing will be done on a mobile screen.[1]

Mobile traffic by application category
CAGR 2017–2023



Mobile data traffic by application category per month (ExaBytes)



[1] Ericsson ConsumerLab, TV and Media (2017)
Base: Population aged 16–69 watching TV/video at least weekly and having broadband at home in Brazil, Canada, China, Germany, Italy, Mexico, Russia, South Korea, Spain, Sweden, Taiwan, the UK and the US

MOBILE DATA TRAFFIC OUTLOOK

In 2023, monthly global mobile data traffic will surpass 100 ExaBytes (EB)

Monthly mobile data traffic per smartphone continues to increase in all regions. North America has the highest usage, and traffic is expected to reach 7.1 GigaBytes (GB) per month per smartphone by the end of the year and increase to 48GB by the end of 2023. Western Europe has the second highest usage, with traffic set to reach 4.1GB by the end of 2017 and 28GB by the end of 2023. Western Europe will be the region with the highest growth rate in monthly mobile data traffic per smartphone during the forecast period.

The high average usage in India – estimated to reach 3.9GB per month per smartphone at the end of 2017 – is mainly due to an introductory LTE offer by an operator during the latter half of 2016, which included free voice and data traffic. Data traffic is expected to continue to grow, reaching 18GB per month per smartphone in 2023.

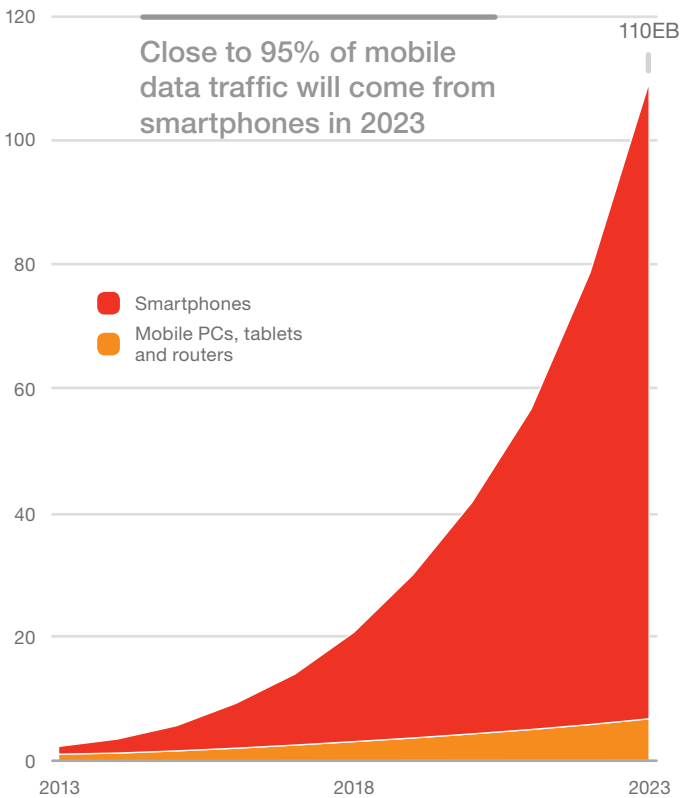
Factors that will drive higher usage in general include an increase in the number of LTE subscriptions, improved device capabilities and more affordable data plans, as well as an increase in data-intensive content. As virtual reality and augmented reality technologies are more widely adopted, content will become even more data intensive.

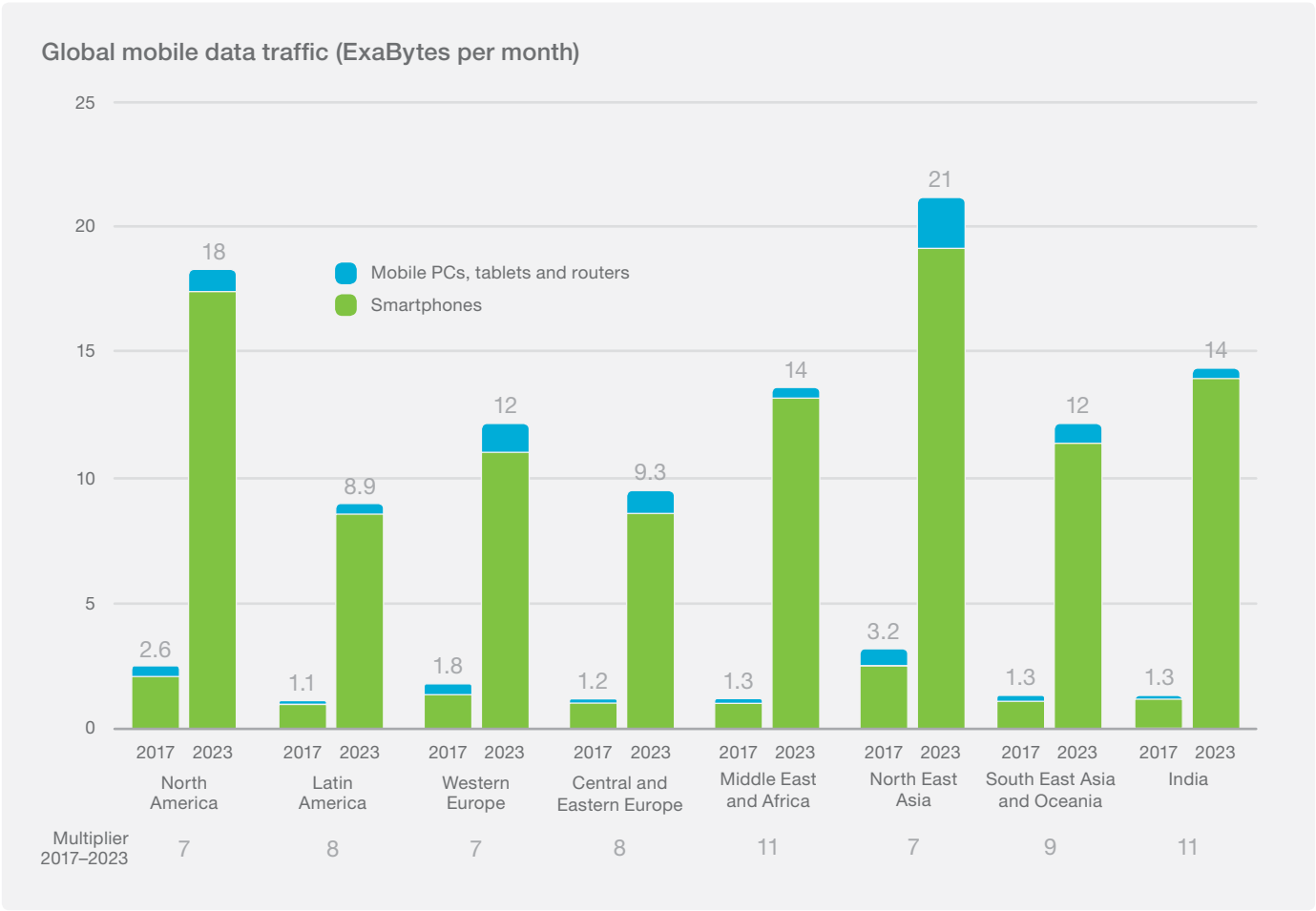
Total mobile data traffic is expected to rise at a compound annual growth rate (CAGR) of 42 percent

Total mobile data traffic for all devices is anticipated to increase by 8 times during the forecast period, reaching around 110EB per month by the end of 2023. At close to 85 percent, data traffic generated by smartphones is already accounting for the largest proportion of mobile data traffic. Going forward, smartphone data traffic will become even more dominant, and is expected to increase by 9 times during the forecast period to account for close to 95 percent of total mobile data traffic by the end of 2023.

Data traffic per active smartphone (GigaBytes per month)

Global mobile data traffic (ExaBytes per month)





North East Asia is set to keep the largest share of global mobile data traffic

North East Asia is the most populous region and as such has the largest share of global mobile data traffic – 23 percent by the end of 2017. This will continue into 2023, when total mobile data traffic in the region is forecast to reach 21EB per month. South Korea and Japan engaged in early deployment of LTE with fast uptake, and markets like Singapore and Hong Kong are also highly advanced. The rapid growth in mobile broadband subscriptions is expected to continue. China is set to add 420 million mobile broadband subscriptions by the end of 2023, driving data traffic to 15EB per month.

In India, total mobile data traffic per month is expected to increase by 11 times during the forecast period to exceed 14EB in 2023. The strong growth in LTE subscriptions and increasing smartphone penetration, as well as the demand for data-intensive applications like video, will drive usage. In South East Asia and Oceania, total mobile data traffic will also show strong growth, increasing by 9 times to reach 12EB per month in 2023.

The regions of the Middle East and Africa and Central and Eastern Europe will experience an 11 times and 8 times increase in mobile data traffic, respectively, up to the end of the forecast period. In 2023, total monthly mobile data traffic will reach 14EB in the Middle East and Africa and 9.3EB in Central and Eastern Europe.

There will be 11 times more mobile data traffic in India in 2023

North America and Western Europe have a larger share of the total traffic volume than subscription numbers imply. This is due to well built-out WCDMA and LTE networks and high penetration of high-end user devices, complemented with affordable packages offering large volumes of data. This combination leads to high data usage per subscription. Total mobile data traffic is expected to exceed 18EB per month in North America in 2023 and reach 12EB per month in Western Europe.

In Latin America, the rising number of smartphone subscriptions, as well as the increasing use of mobile broadband to access a range of online services, has led to strong growth in mobile data traffic. This growth is expected to continue over the forecast period to reach close to 9EB per month by the end of 2023.

IOT CONNECTIONS OUTLOOK

The number of connected IoT devices is expected to increase at a CAGR of 19 percent up to 2023. More than 20 massive IoT cellular networks have been commercially deployed across several regions

20 billion connected IoT devices by 2023

By 2023, over 30 billion connected devices[1] are forecast, of which around 20 billion will be related to the IoT. Connected IoT devices include connected cars, machines, meters, sensors, point-of-sale terminals, consumer electronics[2] and wearables. Between 2017 and 2023, connected IoT devices are expected to increase at a CAGR of 19 percent, driven by new use cases and affordability.

Short-range and wide-area segments

In the figure below, IoT is divided into short-range and wide-area segments. The short-range segment largely consists of devices connected by unlicensed radio technologies, with a typical range of up to 100 meters, such as Wi-Fi, Bluetooth and Zigbee. This category also includes devices connected over fixed-line local area networks and powerline technologies.

The wide-area segment consists of devices using cellular connections, as well as unlicensed low-power technologies, such as Sigfox and LoRa.

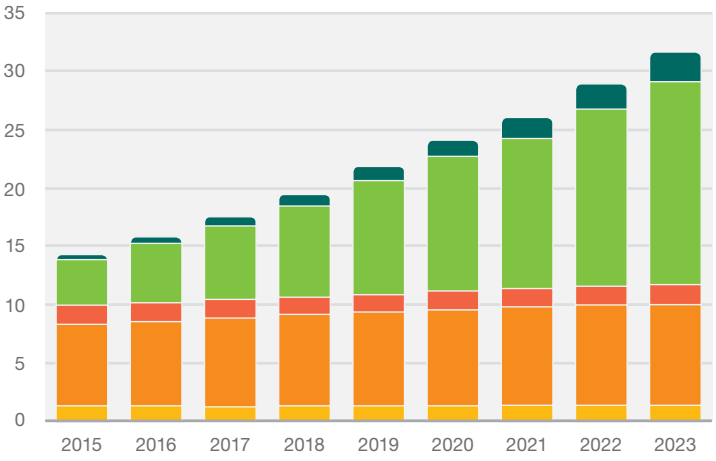
1.8 billion IoT devices with cellular connections by 2023

At the end of 2017, there will be around 0.5 billion IoT devices with cellular connections. This number is projected to reach 1.8 billion in 2023, or around 75 percent of the wide-area category.

Presently, the dominant technology in the wide-area segment is GSM/GPRS. However, by 2023, IoT cellular connectivity will mainly be provided by LTE and 5G. The majority of these connections will be over LTE networks, while 5G technology will continue to support an increase in IoT applications, especially those requiring critical communications. 5G will also provide mechanisms for rapid and cost-effective introduction and provisioning of new IoT services.

Based on technologies like Cat-M1 and NB-IoT,[3] a growing number of cellular IoT networks are being deployed, with more than 20 networks now commercially launched across several regions.[4]

Connected devices (billion)



	2017	2023	CAGR
Wide-area IoT	0.6	2.4	26%
Short-range IoT	6.4	17.4	18%
PC/laptop/tablet	1.6	1.7	0%
Mobile phones	7.5	8.8	3%
Fixed phones	1.4	1.3	0%
	17.5 billion	31.6 billion	

[1] In our forecast, a connected device is a physical object that has a processor, enabling communication over a network interface
Note: Traditional landline phones are included for legacy reasons
[2] Including: Smart TVs, digital media boxes, Blu-Ray players, gaming consoles, audio/video (AV) receivers, etc.
[3] Cat-M1 supports a wide range of IoT applications, including content-rich ones, and NB-IoT is streamlined for ultra-low throughput applications. Both of these technologies are deployed on LTE networks
[4] GSA (October 2017)

NETWORK COVERAGE

In 2023, more than 20 percent of the world's population will be covered by 5G

Demand for population and geographical coverage

Historically, mobile services have been centered on providing sufficient radio signal for the world's inhabitants where they live, which is defined as population coverage. Today, mobile networks cover around 95 percent of the world's population and this figure continues to grow.

Mobile service usage has evolved from predominantly voice to messaging and internet access, as well as to a variety of apps on a range of smart devices, placing greater demands on network performance.

For mobile broadband (WCDMA/HSPA or a later technology), population coverage is currently at around 80 percent and forecast to grow to over 95 percent in 2023.

With the expected growth of IoT services, there is a higher demand on geographical coverage – be it wide-area or dedicated coverage – as networks of sensors are installed in places with low population density such as agricultural areas or forestland.

LTE deployment continues to gain momentum

In terms of build-out and subscription uptake, LTE is the fastest-deployed mobile communication technology to date. It took just 5 years for LTE to cover 2.5 billion people, compared to 8 years for WCDMA/HSPA.

LTE is driven by demand for improved user experience and faster networks. Several drivers are further increasing the speed of LTE deployment. In India, a rise in low-cost offerings and low cost per MegaByte is making the technology attractive. Similar drivers are also prevalent in other high-growth markets.

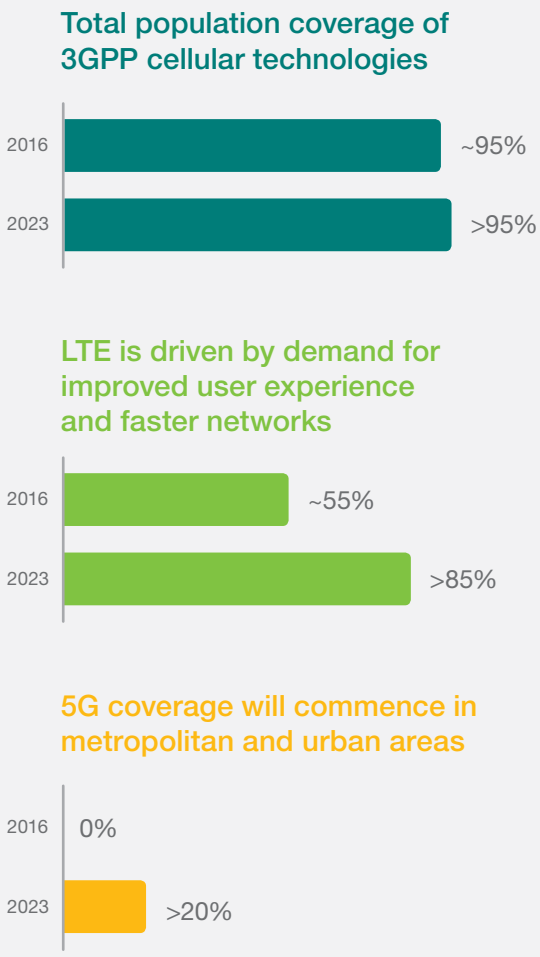
LTE population coverage is currently around 55 percent and is forecast to grow to more than 85 percent in 2023.

Providing coverage for 5G use cases

In the past, mobile networks have first been deployed in urban areas, and then gradually expanded to areas such as suburban and major interconnecting highways.

In a similar fashion, 5G is expected to be deployed first in dense urban areas to support enhanced mobile broadband services, and by 2023, more than 20 percent of the world's population is expected to be covered by the technology.

World population coverage by technology[1]



To a large extent, 5G is driven by use cases with a wide range of requirements. One of the first commercial uses for 5G is expected to be for Fixed Wireless Access (FWA), implying a coverage build-out in urban areas. Other use cases will come from industries such as automotive, manufacturing, energy and utilities, and healthcare, and will drive demand for dedicated coverage.

[1] The figures refer to population coverage of each technology. The ability to utilize the technology is subject to factors such as access to devices and subscriptions

NETWORK EVOLUTION

Mobile networks with Gigabit speed capabilities are currently being launched and trialed in several regions worldwide. Beyond enhanced mobile broadband use cases, a range of new industrial and enterprise use cases are enabled by evolving networks. In the manufacturing industry, augmented reality-assisted maintenance and repair could improve productivity and efficiency throughout the manufacturing process

Mobile networks are evolving to deliver enhanced mobile broadband and communication services with high data throughput, quality of service and low latency requirements, as well as new IoT services with strong requirements on scalability, reliability, availability and latency. Significant radio performance enhancements, together with a more flexible and agile core network, will enable operators to serve a much broader range of use cases in the future.

Gigabit LTE network deployments gaining momentum

Operators have deployed multi-standard access networks with GSM, HSPA and LTE, and are evolving their existing LTE networks to LTE-Advanced (LTE-A), enabling Gigabit network speeds. Device ecosystems are well aligned, as most new smartphones support the latest 3GPP Category[1] (Cat 16).

By using higher order carrier aggregation, operators can combine more spectrum assets. As carrier aggregation is coupled with 4x4 MIMO and 256 QAM, operators can achieve network speeds with peak rates of Gigabit per second. This will lead to increased network capacity, a wider coverage area, and faster average end-user data speeds.

There are currently 14 Gigabit LTE networks that have been commercially launched, and the deployment rate is expected to increase during 2018. Even so, in ongoing trials (based on commercially available network infrastructure and chipsets) speeds above Gigabit per second have been achieved. Commercial launches of such networks are also expected during 2018.

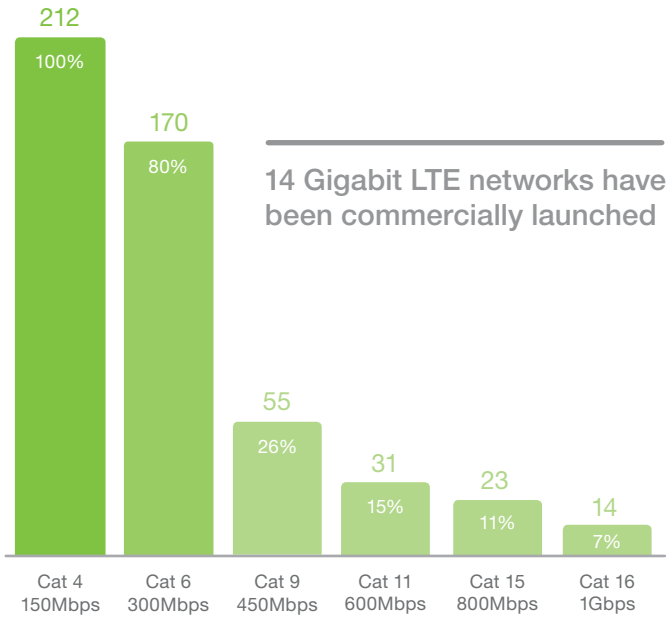
There are currently 644 commercial LTE networks deployed in 200 countries. Of these, 212 have been upgraded to LTE-A networks.

Further technology advances on the road to 5G

In the quest to offer increased capacity and faster data speeds, one of the limiting factors is the availability of a sufficient amount of licensed spectrum. Licensed Assisted Access (LAA) is a new technology that allows operators to use unlicensed spectrum in combination with their licensed spectrum to improve network capacity and speed. Commercial deployments are expected in 2018.

Another technology that improves end-user experience, as well as increasing network capacity and coverage while reducing interference, is Massive MIMO. Massive MIMO will play an important role in current generations of mobile communication and will become even more important with 5G technology. Several trials are ongoing and commercial deployments are expected during 2018.

Percentage and number of LTE-Advanced networks supporting Cat 4, Cat 6, Cat 9, Cat 11, Cat 15 and Cat 16 devices



Source: Ericsson and GSA (November 2017)

[1] Category (Cat) labels the theoretical maximum downlink speed a mobile device supports. The higher the Cat number, the faster the speeds

Examples of use case evolution and supporting network technologies

	Current	On the road to 5G	5G experiences
Enhanced mobile broadband	Browsing, social media, music, video	Fixed Wireless Access, interactive live concerts and sports events	4K/8K videos, mobile AR/VR gaming, immersive media
Automotive	Wi-Fi hotspots, on-demand GPS map data, over-the-air software updates	Predictive vehicle maintenance; capturing of sensor data for real-time traffic, weather, parking and mapping services	Autonomous vehicle control, cooperative collision avoidance, vulnerable road user discovery
Manufacturing	Connected goods, intra/inter enterprise communication	Collaborative robots, distributed control system, remote quality inspection	Remote control of robots; AR in training, maintenance, construction and repair
Energy and utilities	Smart metering, dynamic and bidirectional grids	Distributed energy resource management, distribution automation	Control of edge-of-grid generation, virtual power plants, real-time load balancing
Healthcare	Remote patient monitoring, connected ambulances, electronic health records	Tele surgery, AR aiding medical treatment	Precision medicine, remote robotic surgery, ambulance drones
Technologies	> Multi-standard network > Cat-M1/NB-IoT > Cloud-optimized network functions > VNF orchestration	> Gigabit LTE (TDD, FDD, LAA) > Massive MIMO > Network slicing > Dynamic service orchestration > Predictive analytics	> 5G New Radio > Virtualized RAN > Federated network slicing > Distributed cloud > Real-time machine learning/AI

Evolution of use cases

Beyond enhanced mobile broadband, networks are evolving to handle use cases with different demands on mobility, data rates, latency, scalability, security, integrity, reliability, availability and device density. As indicated in the table above, networks will serve an increasing number of use cases over time. These will come from a range of industries, such as automotive, manufacturing, energy and utilities, and healthcare.

As an example, digitalization in the manufacturing industry will enable a range of new use cases with the potential to improve productivity and efficiency throughout the whole manufacturing process.

Use case: Augmented reality-assisted maintenance and repair

The manufacturing industry has short business cycles and caters to increasingly varied customer demands. Now, digitalization and globalization are making the industry more competitive, requiring supply chains to be managed more efficiently as they become interconnected worldwide.

Unplanned interruptions in the manufacturing process drive increased costs, leading to lower utilization of machinery and product throughput, and extended lead times. Current operational processes create several related challenges. For example, maintenance planning is typically based on inadequate data and much time is spent on information collection and documentation, or on training repair crews to use complex and diverse machinery.

Augmented reality (AR)[2] will help to address these challenges. One example is the use of AR alongside applications supporting data analysis and diagnostics, which will enable preventive and remote maintenance. These measures optimize the cost of operations, while also increasing uptime in the manufacturing process. Depending on the specifics of the use case, AR support will be provided through a range of devices, such as smartphones, tablets, smart helmets, smart gloves and smart glasses.

Repair crews could also be supported by augmented information. For example, operational guidance and automated processes could enable them to more easily carry out preventive and corrective maintenance, with less time spent on fault identification and a reduction in human error.

The role of 5G

Many use cases can be addressed by evolved 4G (LTE) networks. As networks evolve further there will be even more opportunities to enhance existing use cases, as well as to meet the demands of new ones when 5G is implemented.

5G will be highly beneficial for industrial use cases where AR-based applications will require high data rates and low latency. Bandwidth requirements are expected to be significant to ensure consistent and secure streaming of high-resolution images, as well as large volumes of data, in a sensor-rich environment with high-connection density.

[2] Live direct or indirect view of a physical, real-world environment with elements augmented by computer-generated sensory input such as sound, video and graphics

SHIFTING MOBILE DATA PLANS

The most popular mobile broadband data plans are those with limits ranging from 2 to 5 GigaBytes (GB) per month. As mobile data consumption continues to increase globally, there is a consistent shift towards ever larger plans. However, there are steady customer segments at both ends of the scale, suggesting a demand for a broad mix of plans. Smartphone user data, collected through on-device measurements, reveals the latest mobile plan, usage and traffic trends[1]

An evolving mix of data plans

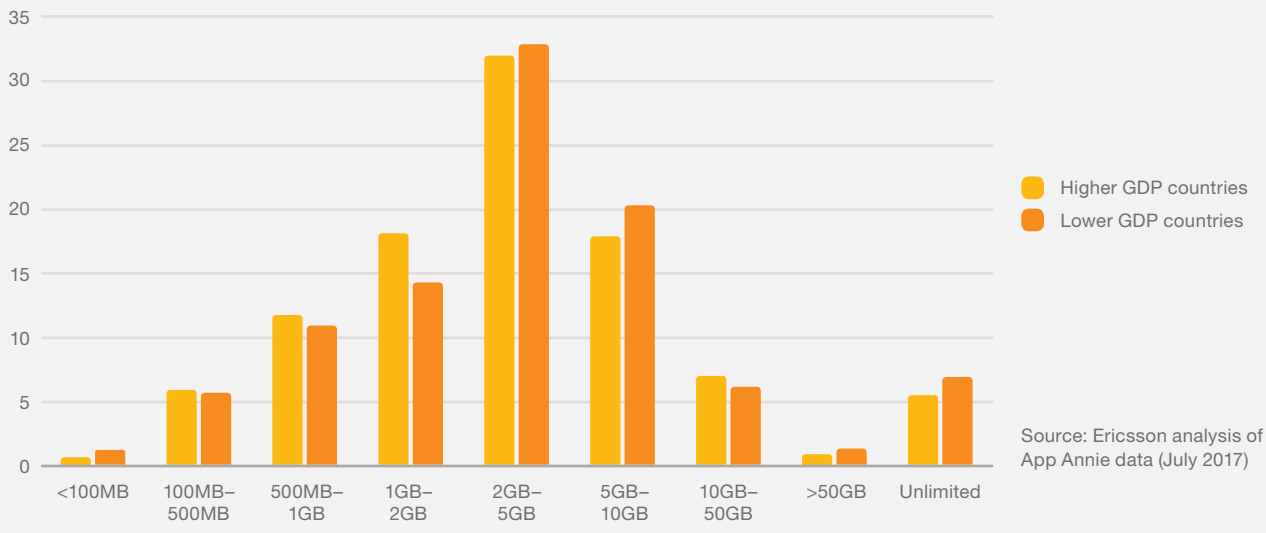
Analysis of the available data indicates a general and long-term pattern of larger data plans attracting an increasing proportion of the customer base. Over the last year, 6 to 7 percent of users have moved from a smaller plan to a plan with a data bucket larger than 5GB. Driving this shift is customers' growing demand for more data, in combination with competition among operators to offer the most attractive packages. The trend also follows the incessant growth in smartphone capabilities and the continuous increase in network performance.

On the other hand, the 2 ends of the scale – plans with an allowance lower than 100 MegaBytes (MB) per month and plans with an allowance greater than 50GB per month (including unlimited plans) – have stable proportions of the user base, representing 1 and 7 percent of users, respectively. These are likely customer segments with specific requirements: one price-sensitive group preferring small data buckets, and the other group paying a premium for an all-you-can-use price model. This highlights the need to provide subscriptions with a range of data plans to meet customer demands.

Over a 12-month period, 6 to 7% of users moved to a data plan larger than 5GB

As a further basis for comparison, the study split the world into two market groups based on income – countries with gross domestic product (GDP) per capita higher than the world average ("higher GDP countries"), and those countries with below average GDP per capita ("lower GDP countries"). Analysis shows that there is little difference in preference patterns between the two market groups.

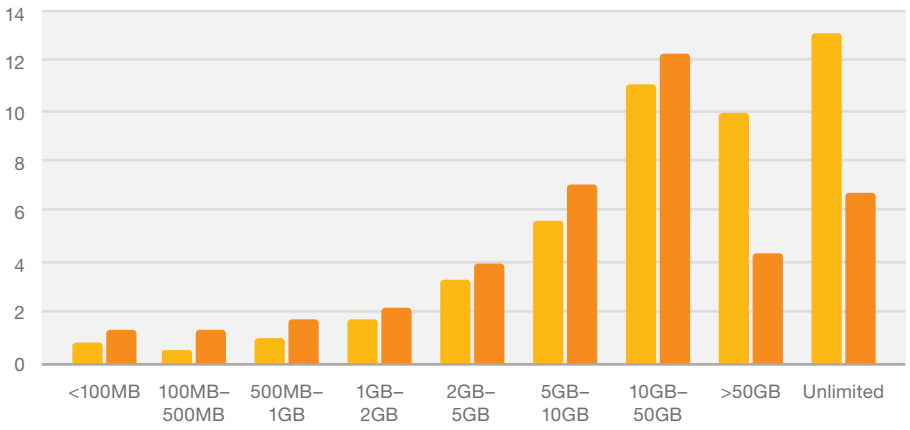
Distribution of mobile data plans in July 2017 – share of users (percent)



Source: Ericsson analysis of App Annie data (July 2017)

[1] Data for the study includes consumption, traffic and plan size data from App Annie, and GDP per capita data from the World Bank

Monthly mobile data consumption per plan in July 2017 (GB)



Source: Ericsson analysis of App Annie data (July 2017)

Usage patterns within data plans

The choice of mobile plan usually reflects customers' estimated needs for mobile data over the month. However, this does not always match their actual usage, as can be seen in the graph above.

On average, users on the smallest plans (lower than 100MB) go well beyond their limits. More than 60 percent of users in this group exceed their data allowance by over 200 percent, consuming data almost in parity with users of medium-sized plans (up to 1GB). Users of small plans do not seem to feel bound by their small data bucket, but rather consume data on a "pay-as-you-go" basis.

At the other end of the scale, unlimited users cannot consume an infinite amount of data, and here the two economic groups differ in their behavior.

In higher GDP countries, unlimited users consume around 20 percent more data than the users of very large but limited plans (10 to 50GB). However, those from lower GDP countries demonstrate an interesting behavior – consuming 40 to 45 percent less data on average per month than customers on very large but limited plans.

Despite these differences, people in both groups buy unlimited plans for peace of mind. Consumers appear to pay a premium for the assurance of not running out of data at the end of the month. Maximizing usage is not their main priority.

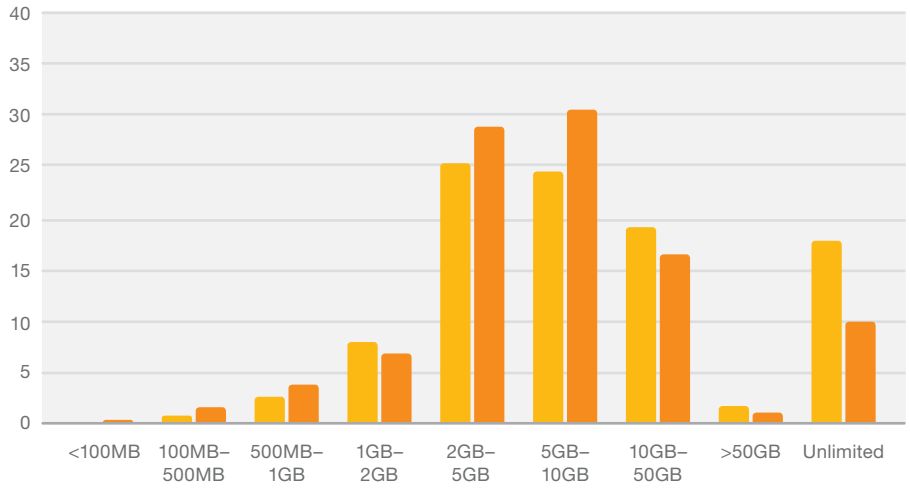
Total traffic generated from different plans

Plans with low-to-moderate allowances (lower than 2GB per month) represent around 35 percent of users and 12 percent of traffic in the networks. From a capacity point of view, these customers could be viewed as easy to serve. The relatively low consumption does, however, not say anything about the requirements these customers have on quality differentiators, such as network performance.

Consumers with medium-sized to very large data plan buckets (from 2 to 50GB per month) represent 60 percent of the user base and a significant 75 percent of traffic consumed.

Of all the traffic generated by the users of limited plans, around 30 percent is consumed above data bucket limits. This allows operators to continuously upsell data through top-ups. In addition, this demand for more data plays a key role in the shift to larger plans.

Distribution of mobile data plans in July 2017 – share of traffic (percent)



Source: Ericsson analysis of App Annie data (July 2017)

Unlimited plans come with restrictions

In higher GDP countries, users of very large plans (beyond 50GB) generate around 20 percent of total traffic. Considering that this segment represents only 6 percent of users, it is over-represented in the traffic domain. However, unlimited plans usually come with restrictions in the form of fair usage policies and prioritization mechanisms. This prevents usage patterns that could negatively impact other users' experience. With such mechanisms, combined with a pricing model that captures the premium value of unlimited, the very large packages can be both controlled and monetized.

Mobile vs Wi-Fi traffic

The graph below shows that the larger the mobile plan consumers have, the less prone they are to switch to Wi-Fi. For small plans (below 100MB), only around 5 percent of traffic passes through mobile networks. For unlimited plans, this figure can be as high as 35 percent. Perceiving no boundaries, unlimited users both consume more data in total, and allow a higher share of their traffic through mobile networks.

When comparing the behavior of users on smaller data plans, those in lower GDP countries are more likely to stay on the mobile network than users in higher GDP countries. This is explained by the lower availability of fixed broadband and Wi-Fi in the former group.

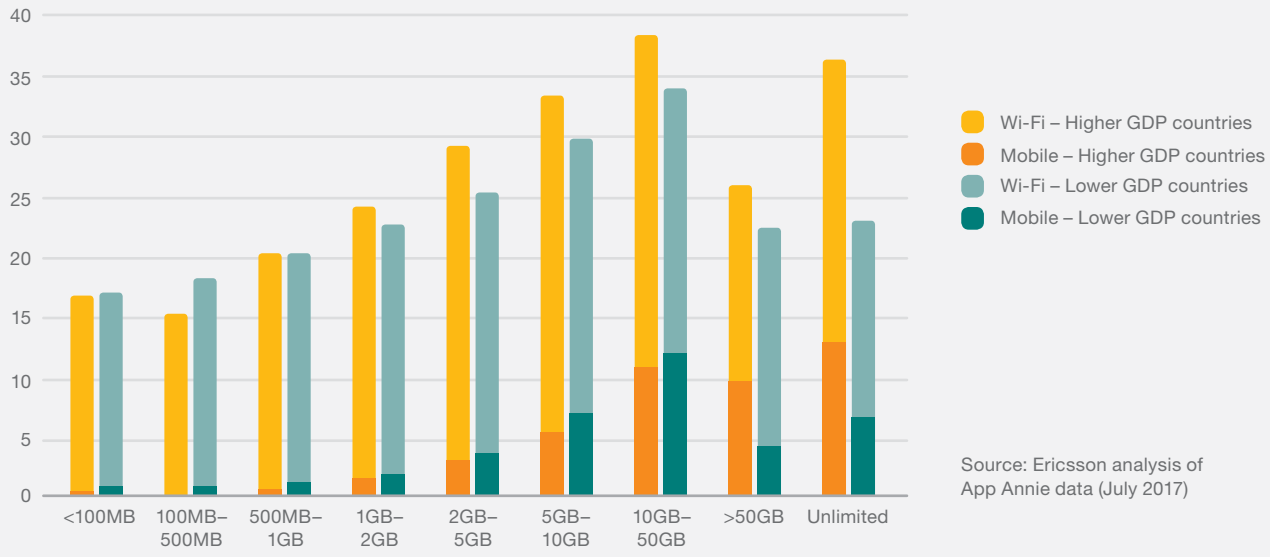
For the users in lower GDP countries, however, the relation between mobile and Wi-Fi traffic changes for large and unlimited plans, with a greater share of traffic offloaded to Wi-Fi.[2] It is likely that households that can afford unlimited plans can also afford a fixed broadband connection and Wi-Fi.

Even without restrictions on mobile usage, unlimited users consume a larger share of traffic via Wi-Fi, which is consistent with people spending a significant part of their active time indoors, where the connection often automatically switches. This indicates that the share of traffic ending up in the Wi-Fi domain will continue to be significant, even when consumers shift to larger data plans.

The total consumption of data (mobile and Wi-Fi) does not differ significantly across the customer base, with only a 2.5 times difference between users of the highest and the lowest plans. However, in terms of mobile data consumption, the 2 groups differ by as much as 24 times. This suggests that, while the basic data demand is universal, users have different ways to fulfill this demand.

Total data consumption (mobile and Wi-Fi) differs by only 2.5 times between the highest and the lowest plans

Monthly data consumption per plan in July 2017 – mobile and Wi-Fi (GB)



Source: Ericsson analysis of App Annie data (July 2017)

[2] Relative to both the users of smaller data plans in lower GDP countries and the unlimited data plan users in higher GDP countries

Meeting a range of requirements

There is no one-size-fits-all plan. The 2 to 5GB per month segment represents a sizeable proportion of the total customer base. However, the presence of stable, niche customer segments means that a good mix of plans will be important to address the variety of data requirements on the market.

There is no major difference in preference patterns across the world. While the most popular plans have data limits between 1 and 10GB per month, there is a stable proportion of customers at each end of the scale and higher growth is in the larger plans. Not only does this further highlight the need for a range of plans, but it also demonstrates that the shift towards larger plans is global.

Plans with limited allowances represent 94 percent of the customer base and 84 percent of total traffic. Thirty percent of traffic from these users is consumed above the data bucket limits. As limited users pay by usage, this represents an additional revenue stream for operators.

Unlimited data plans address a small customer segment. While there has been some concern about the increase in data traffic generated by users of unlimited plans, this traffic can be controlled through fair usage policies. In addition, 60 to 65 percent of unlimited users' traffic goes through Wi-Fi networks.

There is no one-size-fits-all plan – a good mix will be important to address the variety of user demands on the market

Methodology

Using data from the World Bank, the countries in this study were segmented into two categories: higher GDP countries and lower GDP countries. The first group includes 43 countries with a GDP per capita greater than the world average (USD 10,150), while the second group includes 33 countries with a GDP per capita lower than the world average.

The statistics on mobile consumption and bucket sizes were sourced from App Annie. App Annie Intelligence data for iPhone and Android phones was derived from mobile usage data collected from a large sample of real-world users, combined with additional proprietary data sets.

ENHANCING THE EVENT EXPERIENCE

Data from recent international sporting events illustrates spectators' growing use of mobile services during competitions. Operators now plan to use 5G technologies to showcase enhanced spectator experience at upcoming events, such as at the 2018 sports event in Pyeongchang, South Korea, and the 2020 sports event in Tokyo. Large events present an opportunity for operators and organizers to provide visitors with additional digital services throughout the entire experience

Event organizers and operators can further extend and enhance the spectator experience through ever more engaging content. Examples include video integrated with real-time data, historic event data, sports performance data, live event replays, event highlights, interactive statistics, event-related social media and exclusive behind-the-scenes content, such as press conferences and interviews.

Rising mobile data traffic at large events

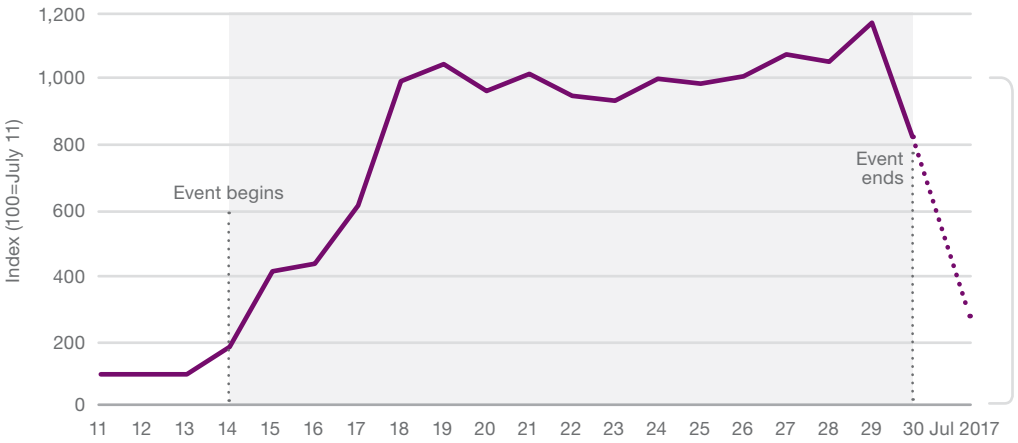
At the 2016 sports event in Rio, four times more mobile data traffic was carried by networks in and around the event arenas than at the 2012 event in London. Data from another recent major event, the world championships for aquatic sports in Hungary in 2017, shows that daily mobile data traffic in areas associated with the event was as high as 10 times normal volumes. At the Rio event, the increase in traffic can be explained by a combination of better network capabilities and a general rise in consumers' use of digital services.

Increased usage of digital services, such as social media and video content, in and around an event, as well as the demands posed by new types of services, will create challenges for operators. To meet raised user expectations, operators will need to effectively prepare networks before the event and then manage network performance in real time during the event.

Shift in spectators' usage of mobile data services

Growth in mobile traffic at events can be attributed to changes in user behavior, especially among younger people. When the mobile data usage trend began, spectators were mainly using mobile devices to post selfies, make phone calls and use text services. Now spectators mainly share or stream live videos and engage with social networks. In addition, as spectators increasingly create their own content, a rise in uplink data traffic volume has occurred. For example, during the 2016 Rio event, the uplink data traffic share was as high as 33 percent of total traffic in and around the event arenas. This is significantly higher than normal.

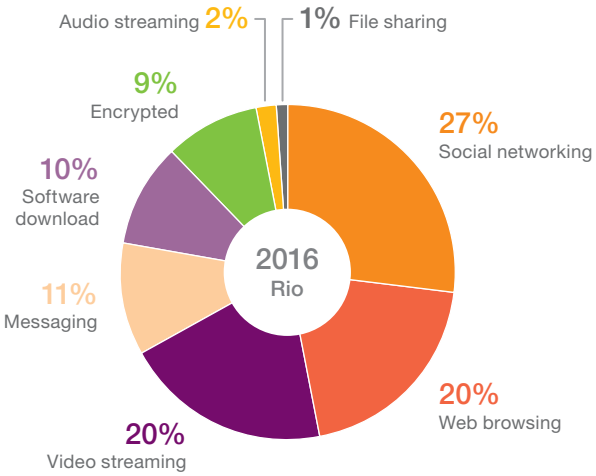
Daily mobile data traffic level at the world championships for aquatic sports in Hungary in 2017



10X higher mobile data traffic levels compared to normal daily volumes

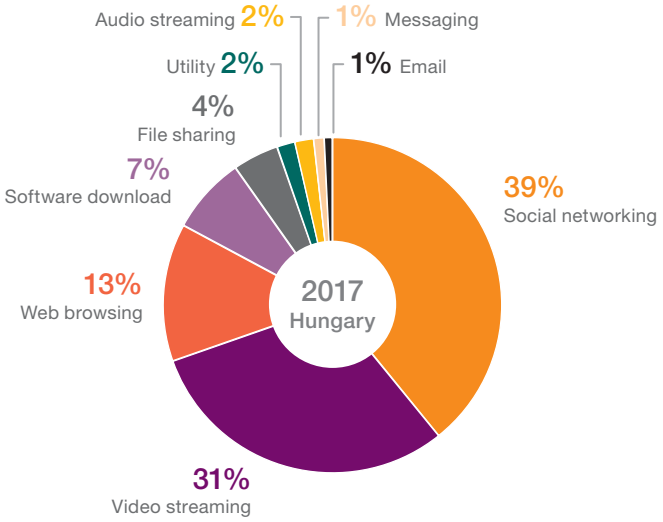
Source: Ericsson (July 14–30, 2017)
Base: Network measurements from more than 400 radio cells associated with the event in Hungary, including cells deployed in the area only for the event

App category share of traffic for the top 15 apps at the 2016 Rio sports event



Source: Brazilian operator network measurements (August 5–21, 2016)
Note: Top 15 apps by share of total traffic, used in and around the event

App category share of traffic for the top 15 apps at the Hungary world championships for aquatic sports in 2017



Source: Ericsson network measurements (July 14–30, 2017)
Base: Android OS device network measurements from more than 400 radio cells associated with the event, including cells deployed in the area only for the event
Note: Top 15 apps by share of total traffic, used in and around the event

Social networking, video streaming and web browsing dominate

At the 2016 sports event in Rio, network measurements of different app categories' share of traffic for the top 15 apps used show that social networking, video streaming and web browsing dominated. Messaging was also prominent – presumably due to posting of pictures and videos.

At the world championships for aquatic sports in Hungary in 2017, there was a similar distribution. However, the social networking and video streaming categories were even more dominant.

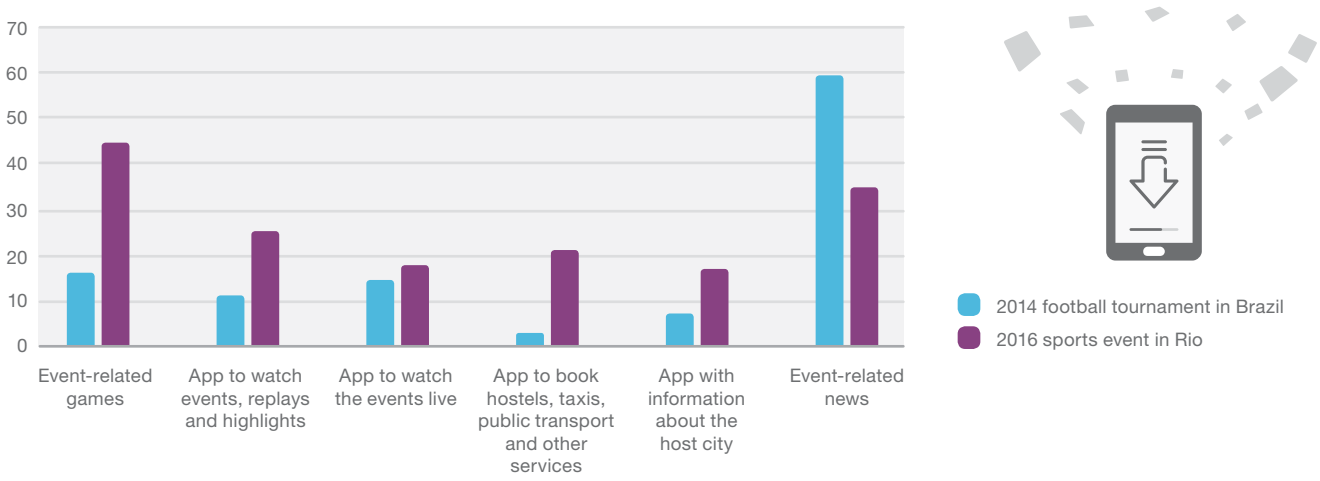
The different app categories' share of traffic at both events can be seen in the graphs above.

Connected venues and the role of event-related apps

In terms of data traffic volume, the usage of event-related apps in and around the arenas at the 2014 international football tournament and the 2016 sports event in Rio was insignificant. However, the interest in downloading and using an app related to the event (with the exception of event news) increased in 2016. This rise in interest can likely be attributed to the wider range of apps available at the sports event in Rio, as well as a general increase in the use of digital services among event visitors.

Despite this increased interest, only around 25 percent of the interviewees at both the 2014 international football tournament and the 2016 sports event in Rio downloaded event-related apps. One reason for this could be limited investments in apps. However, those who did download event-related apps downloaded more of them in Rio, in comparison to those who downloaded event-related apps at the 2014 football tournament.

Comparison of event-related apps downloaded (percent)



Source: Ericsson ConsumerLab (2016)
Base: Smartphone internet users aged 15–60, watching the events in and around the main arenas. Of the interviewees, 25 percent downloaded event-related apps

Extending the event experience with digitalized services

Recent consumer research shows that the event experience starts long before the actual event and continues after it.[1] There is the opportunity for event organizers and operators to extend and enhance the visitor experience by addressing more of visitors' needs with innovative, digitalized services. Most of the identified event-related needs for visitors, displayed to the right, are still at a low level of digitalization. The most digitalized areas are information and ticketing, as well as socializing.

The most important need for spectators is the overall live event experience, including factors such as event atmosphere and feelings of excitement, relaxation and closeness to the event activities. Augmented reality (AR), virtual reality (VR) and mixed reality (MR) technologies have the potential to enhance visitors' and remote spectators' experience of events, making them available in new ways, for example, as an on-demand service. The related development of 3D and 360-degree content is driving an emerging trend to "interact with the event", immersing people in the action, wherever they are in the world.

Connected venues and arenas – supported by 4G and 5G technology – will cater for visitors' needs for more digitalized services and immersive experiences at any event. The opportunity to transform event experiences with new digitalized services will also be relevant to large one-off arrangements such as those major events described in this article.

5G will transform the event experience

Initially, 4G systems are expected to continue to play an important role in supporting event visitors with mobile connectivity and services, both outdoors and indoors. Enabled by functionality such as carrier aggregation and 4x4 Multiple Input Multiple Output (MIMO), as well as higher modulation techniques, these 4G systems are capable of providing Gigabit per second download speeds.

In the near future, 5G technology will have the capability to transform the experience for spectators and will enable many of the services discussed in this article on a large scale. Functionality such as Massive MIMO introduces new technology that significantly increases the efficiency in which data is provided to end users over the available spectrum, thereby significantly increasing system capacity. This allows for very high capacity networks to serve the data traffic demands at event arenas and surrounding areas. A first version[2] of 5G specifications (3GPP Release 15) is to be completed by 3GPP by the end of 2017 to enable large-scale trials and deployments starting in 2019. Even so, early 5G trials have already progressed far enough to provide Gigabit speeds in real-world environments.

The most important event-related needs for visitors

1. **Event experience:** There is a great atmosphere at the event, and it is both exciting and relaxing, priceworthy and welcoming. The experience should be immersive.
2. **Environment and safety:** There is confidence and a feeling of safety and security in the arena. The arena should also be clean.
3. **Information and ticketing:** There is a smooth ticketing process and it is easy to get information about the event.
4. **Belonging:** The event creates a sense of community and of being part of the crowd – for example, through traditions related to the specific event.
5. **Food and drink:** There is a satisfactory selection of places to get food and drinks, as well as reasonable prices and a range of options.
6. **Accessibility:** It is easy to get to the arena and queues for toilets and restaurants, for example, are of an acceptable length.
7. **Socializing:** It is easy to find, mingle and socialize with friends and family at the arena.
8. **Individual needs:** The event is adapted to individual needs, and provides the possibility for visitors to efficiently do different things, depending on personal preference.

Source: Ericsson ConsumerLab, Connected Venues (2017)
Base: Large arena visitors in the UK

[1] Ericsson ConsumerLab, interviews with large venue visitors in the UK (May 2017)
[2] The first version of 3GPP Release 15 will be a non-standalone version of New Radio (NR), which relies on LTE for some of its basic functionality, followed by a finalized version in June 2018 that will include standalone support

5G showcases expected at major upcoming sports events

It is anticipated that 5G technology and services will be showcased at upcoming major sports events, such as the 2018 sports event in Pyeongchang, South Korea, the 2018 international football tournament in Russia and the 2020 sports event in Tokyo. In South Korea, a pre-commercial 5G system will be used to provide 5G-like experiences, and the event organizers and operators are making investments in a range of different event-related apps.

Operators are at various stages in terms of planning the types of 5G services they will deploy at the upcoming major sports events. Among other things, the availability of 5G devices in sufficient volumes and their form factors are expected to have a significant impact on the types of applications and services that will be launched, as well as whether usage will go beyond a select number of VIP visitors and event organizers. Based on current industry initiatives and ongoing 5G trials, it is highly likely that some of the anticipated services will include AR and VR-based applications.

Enhancing the digital experience with new types of applications and immersive content

AR and VR are expected to constitute a significant proportion of the 5G showcases at upcoming major sports events. Use cases range from ultra-high definition (UHD)[3] live video streaming to a fully virtualized experience. As well as enhancing the experience at the event itself, the technology could extend the digital experience to remote fans by providing immersive content – allowing them to hear and see the real-time action, almost as if they were there themselves.

Ensuring good network quality during events

The digitalization trend creates the potential for operators and event organizers to provide ever better content at events. However, as spectators continue to consume more data and demand more digital services, preparatory actions are required to ensure a good network experience, and to meet the expectations for connectivity and performance throughout the whole event period. To achieve this, network flexibility and scalability are important factors, as dynamic event traffic will vary greatly over time depending on service type, usage scenario and event schedules.

To optimize network performance in real time, following adaption to traffic forecasts, network parameters should be actively changed during the event to increase the quality and capacity of the system. Proactive network monitoring and optimization, feature activation and software upgrades are required prior to the event, and then in real time during the event. With the right network design, optimization and real-time support, operators will be able to handle expected traffic demand.

At future events and connected venues, with high traffic density and increasing use of demanding services such as AR and VR, proactive management and automation will be essential to meet committed service levels. This will be supported through centralized intelligence and analytics, with support from expert systems and machine-learning technologies for network monitoring and dynamic optimization.

A range of services may be included in 5G showcases, allowing venue visitors to turn from spectators into participants and enabling them to:

- Watch events from different viewpoints with interactive control
- Access multiple cameras filming an object to achieve a 3D view
- Experience sports activity from the perspective of the athlete via mini-cameras
- Enjoy an in-stadium experience outside the venue through haptic or tactile feedback
- View live holographic projections of athletes
- Integrate supplementary content into their live streams
- See athlete, event or venue statistics superimposed on their device display
- Analyze and display performance data through sensors embedded in sports equipment
- Receive real-time information on factors such as the speed and location of a ball
- View overlay and substitution content, for example, explaining rules, giving more details and personalizing the experience

[3] 4K/8K video

MILLENNIALS' EXPECTATIONS FOR 5G

Born between the early 1980s and the early 2000s, millennials have grown up in the age of the internet and mobile communications. This age group is not only leading the way in terms of the adoption of digital devices but also will most likely set the demands on future digital networks and services due to its technical knowledge and skills, as well as its high expectation level

As 5G wireless technology is rolled out, millennials will be the largest generation and in their prime years of consumer spending. They will play a pivotal role in shaping the future of the telecommunications industry and, more specifically, 5G services.

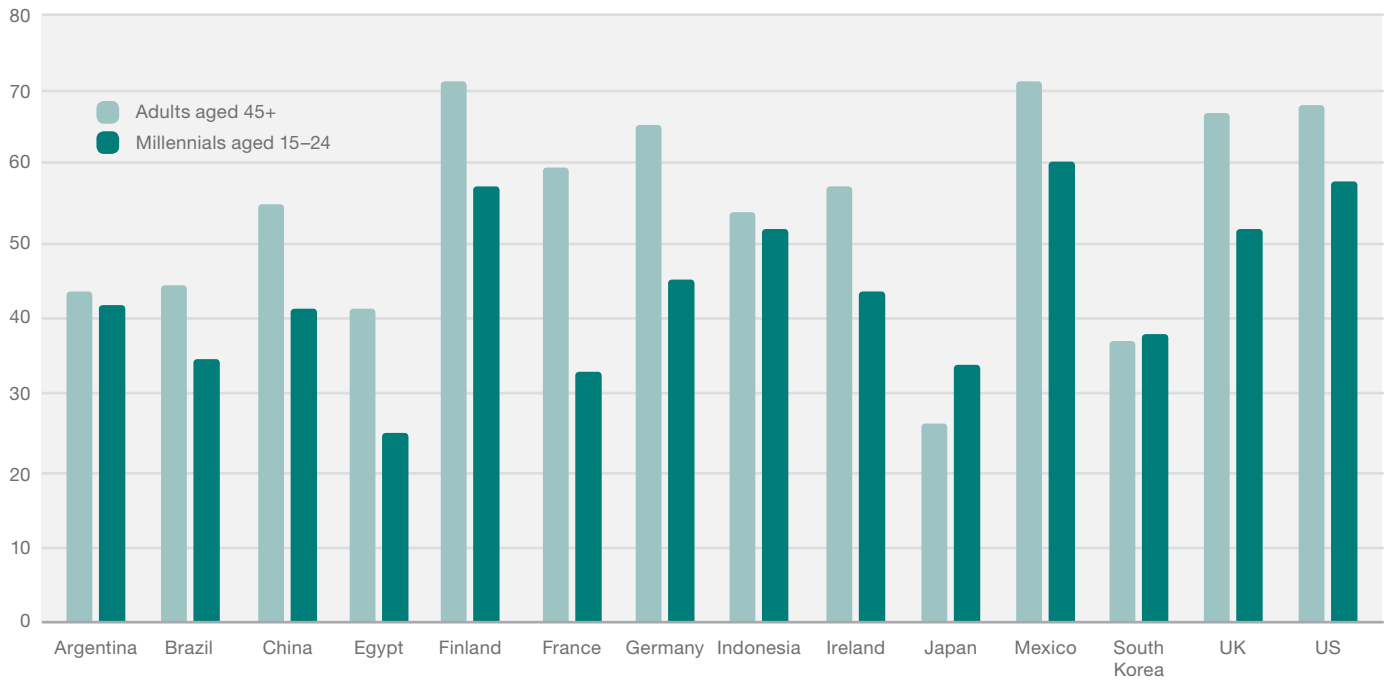
Millennials demand more from network performance

Relative to other consumer segments, millennials have high expectations for network performance and demand a lot from their mobile service providers. Younger millennials have led a clear shift in video consumption trends, and how they engage with video today offers an insight into the way mainstream viewing patterns could develop over the next 5 to 10 years. A recent survey of 14,000 smartphone users in 14 countries revealed that 28 percent of millennials aged 15 to 24 stream on-demand videos for 1 to 3 hours a day, and 17 percent stream for 3 to 6 hours – nearly 6 times more than those aged 45 or over.[1]

The group's high video consumption pattern leads to higher expectations on network performance. In 12 of the 14 countries surveyed, millennials were more critical of network performance than those aged over 45. Less than half of millennial smartphone users said their mobile broadband quality expectations have been met. As millennials' spending power and expectations rise, these findings suggest that operators will need to focus on how to meet the expectations of this consumer segment.

Less than half of millennial smartphone users say their expectations have been met on mobile broadband performance

Millennials and adults aged over 45 who say their expectations on network performance have been met (percent)

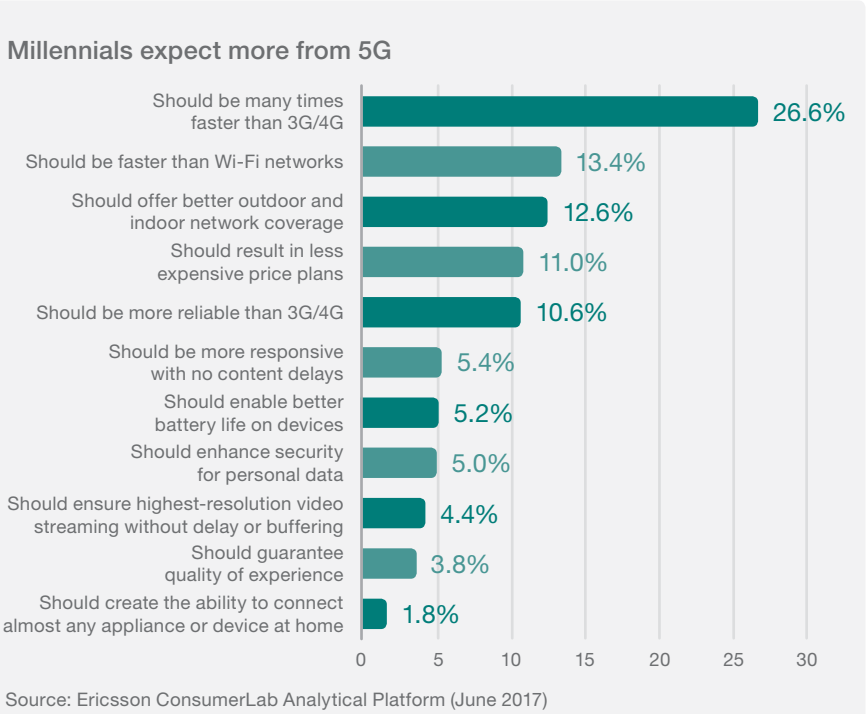


[1] Ericsson ConsumerLab Analytical Platform (June 2017)

High expectations for 5G

The potential benefits of 5G networks are already creating big expectations in the market. The recent survey among smartphone users previously referenced suggests that young millennials expect better speeds and coverage from 5G. In addition, when asked to choose their most important expectation, over 30 percent named a factor beyond speed and coverage, such as better battery life, high network reliability and guaranteed quality. While some of these expectations will be difficult for operators to deliver soon, many tie in well with the promise of 5G.

Over 30% of millennial smartphone users say a factor beyond better speed and coverage is their most important expectation from 5G



Source: Ericsson ConsumerLab Analytical Platform (June 2017)

Evolving video experience

Making the expectations for 5G a reality will have significant implications for mobile networks. Up until this point, increasing video usage has been the main driver behind the growth in mobile data traffic. As video continues to merge with other types of content, beyond streaming apps and video on-demand services, this trend is expected to continue. Video now accounts for over 50 percent of all mobile traffic – a figure that is expected to increase to over 75 percent by the end of 2023.

There is much discussion within the mobile industry community about the rapid development of online video to ever more immersive formats. For example, the rise of virtual reality (VR) and augmented reality (AR) will place new demands on networks in the future. A recent survey[2] of consumers aware of VR in 8 countries suggested that 7 out of 10 early adopters expect VR/AR to fundamentally change everyday life. These early adopters expect 5G to play a significant role in enriching the shared VR experience by providing lower latencies, haptic feedback and higher resolutions.

Given that network performance is sufficient, AR and VR look set to make the transition from media and entertainment novelties to enabling a wide range of consumer and industrial use cases. This transition should accelerate as 5G network capabilities, including significantly reduced latency in the radio access, are combined with network slicing and Mobile Edge Computing (MEC).

In its current forms, AR may be much more suited than VR to mobile applications. However, the line between the two is already dissolving, with merged reality (MR), stereoscopic six degrees of freedom (6DoF) and holographic video on the horizon.

Meeting expectations

As existing mobile broadband networks improve, and consumers become more aware and exposed to the services that can be further enriched by 5G, expectations will continue to evolve. Operators preparing for 5G have an opportunity to win the trust of these millennials by keeping up with their demands – reaping the benefits of increased customer loyalty.

[2] Ericsson ConsumerLab, Merged Reality (June 2017)
Base: 9,200 consumers aged 15–69 in France, Germany, Italy, Japan, South Korea, Spain, the UK and the US

CENTRAL AND EASTERN EUROPE IN FOCUS

The Central and Eastern Europe[1] telecommunications market continues to advance, with the transition from WCDMA/HSPA to LTE gathering further momentum in the region. By the end of 2017, LTE is forecast to increase by over 60 million subscriptions and will account for around 25 percent of all mobile subscriptions

Key figures: Central and Eastern Europe	2017	2023	CAGR 2017–2023
Mobile subscriptions (million)	610	640	1%
Smartphone subscriptions (million)	270	490	10%
Mobile broadband subscriptions (million)	420	630	7%
LTE subscriptions (million)	160	540	23%
Cellular IoT subscriptions (million)	30	90	20%
Data traffic per active smartphone (GB/month)	3.8	19	31%
Total mobile data traffic (EB/month)	1.2	9.3	41%

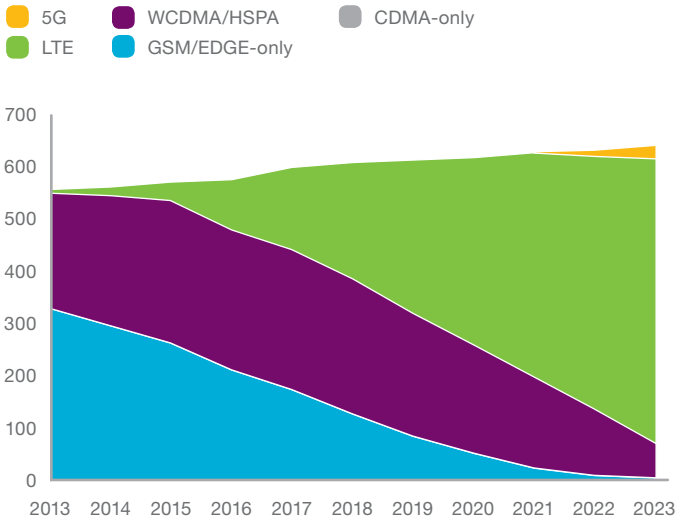
LTE is forecast to become the dominant technology in the region in 2019, and will account for around 85 percent of subscriptions by 2023.

Market overview

The Central and Eastern Europe region is diverse, with levels of gross domestic product (GDP) per capita and forecasts for growth varying from country to country. Countries such as the Czech Republic, Estonia, Hungary, Latvia, Poland and Slovenia have shown growth rates significantly higher than the Eurozone average of 1.75 percent.[2] Other countries have forecast a growth rate of 2 percent or more, such as the Slovak Republic, where GDP is expected to increase 3.6 and 4.2 percent in 2017 and 2018, respectively.

This continued economic growth is helping to drive the adoption of LTE subscriptions across the region – a trend which is further strengthened by the increasing availability of low cost LTE-capable smartphones and the growing demand for online broadband-intensive content. The first 5G subscriptions are expected in the period 2020 to 2021, and by 2023 will equate to nearly 5 percent of total subscriptions.

Mobile subscriptions by technology for Central and Eastern Europe (million)



In 2023, LTE will be the dominant technology, accounting for 85% of all subscriptions

[1] Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kirghizstan, Kosovo, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Mongolia, Montenegro, Poland, Romania, Russia, Serbia, Slovak Republic, Slovakia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan

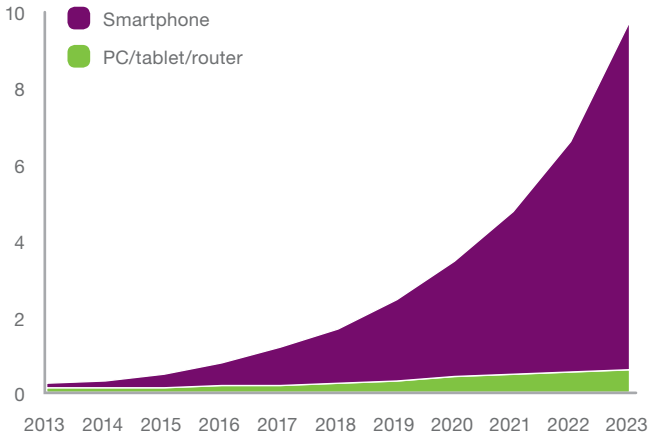
[2] OECD Global Economic Outlook (2017)

MOBILE TRAFFIC

An increase in the use of broadband-intensive services means that mobile data traffic is forecast to grow by eight times between 2017 and 2023. This represents a compound annual growth rate (CAGR) of 41 percent, reaching almost 10EB per month by the end of 2023 – equivalent to 4.5 billion hours of movie watching[1]

This growth is fueled by the transition towards LTE and increasing smartphone penetration. By the end of 2017, there will be around 270 million smartphone subscriptions, equating to around 45 percent of all mobile subscriptions in the region. Smartphone subscriptions are expected to reach around 500 million by the end of the period, accounting for around 75 percent of all subscriptions. Average data traffic per active smartphone will increase from 3.8GB per month in 2017 to almost 20GB by 2023: a CAGR of 31 percent.

Mobile data traffic forecast for Central and Eastern Europe (EB/month)



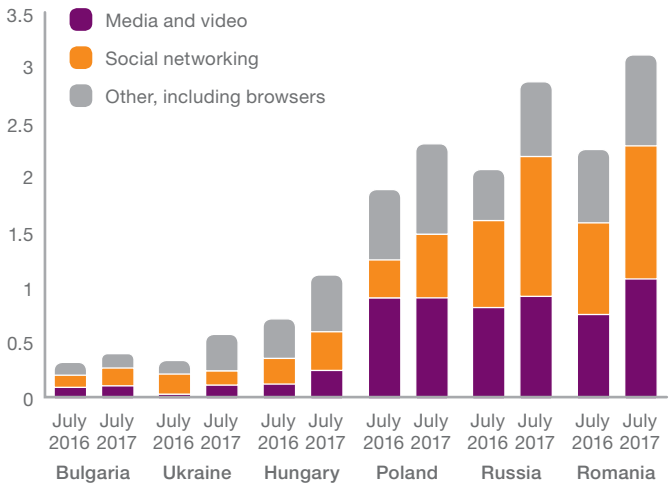
Video and social apps drive mobile broadband usage

Video, photo sharing and social networking are the categories that dominate the top 10 applications per country.[2] Video is a significant driver of traffic, accounting globally for 55 percent of mobile data traffic. YouTube is the number one driver of data consumption for users in the region.[3] For example, in Poland, YouTube generates nearly six times the amount of traffic that Facebook does. However, in Russia, VK[4] is the most popular social platform – it is also very popular for video content, generating more than half the amount of the traffic of YouTube.

The figure below shows significant mobile broadband traffic growth for the top 10 Android smartphone applications in 6 countries between July 2016 and July 2017. In all 6 markets, the categories media and video, and social networking have together been the largest traffic drivers, representing 50 to 75 percent of traffic from the top 10 apps. The highest growth comes from social media apps in Bulgaria, Poland, Romania and Russia; in the latter, the higher growth rate can be attributed to VK's usage as described earlier.

As shown in the figure below, media and video consumption is relatively low when compared to social media consumption. This is due to the fact that the figure only shows traffic over mobile broadband (and not Wi-Fi), and today only 14 percent of video and media traffic is consumed in this way, compared to 27 percent of social. Nevertheless, traffic from media and video and social networking over mobile broadband has also gone up in the period. Video has risen 4 percentage points, representing a 30 percent increase in the proportion being consumed over mobile.

Analysis of total mobile traffic from the top 10 applications on Android OS smartphones (TeraByte)



Source: Ericsson analysis of App Annie data per application category for Android OS smartphones (July 2016–July 2017)

[1] Calculated with an average streaming video media rate of 5Mbps
[2] Ericsson analysis of App Annie data per application category for Android OS smartphones in Russia, Poland, Bulgaria, Romania, Ukraine and Hungary (July 2016–July 2017). "Top 10 apps" refers to the most-used apps on Android OS smartphones in each country, according to App Annie
[3] The statistics for mobile consumption in the region were sourced from App Annie. App Annie Intelligence data for Android phones was derived from mobile usage data collected from a large sample of real-world users
[4] VK is a Russian-based, online social media and social networking service. It allows users to message each other publicly or privately; create groups, public pages and events; share and tag images, audio and video; and play browser-based games

KEEPING SMARTPHONE USERS LOYAL

In the Central and Eastern Europe region, consumers' expectations, their loyalty to an operator and their reliance on network performance are influenced by a number of factors. These include increasing smartphone penetration, changing data usage patterns and the growing momentum of the transition to LTE

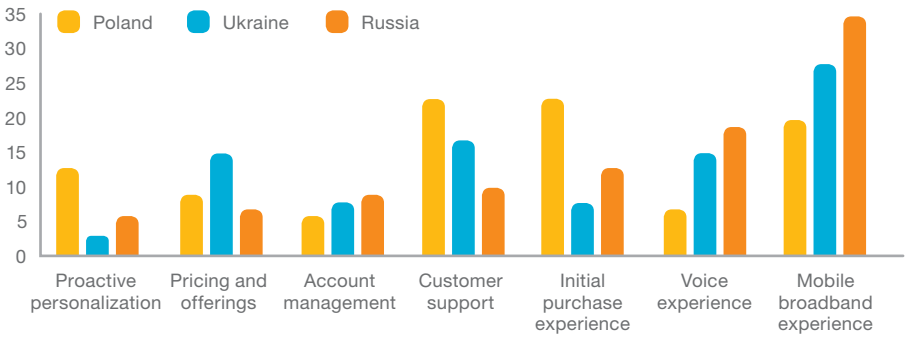
The graph to the right shows the key areas that impact smartphone user loyalty.[1] Generally, it is a combination of performance, experience and customer service elements that drive loyalty towards an operator. However, in Russia and Ukraine, network performance is the main determinant. In Poland, on the other hand, customer support and the initial purchase experience are equally as important as network performance.

Broadband experience is important

The mobile broadband experience is significantly more important than voice experience for smartphone users when looking at network performance.

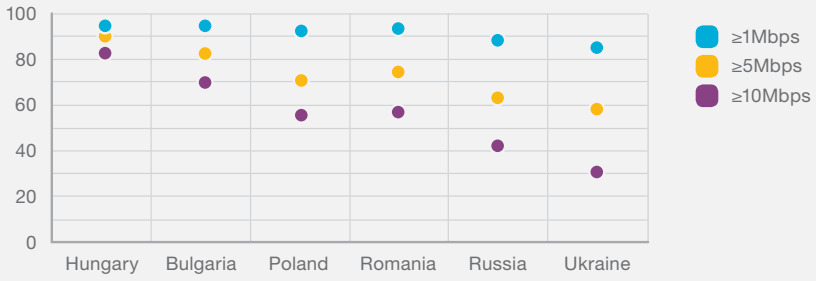
Deeper analysis shows that what drives the mobile broadband experience varies across markets for users. A common trend, however, is that application performance and the time taken for webpages to load are more important factors than having coverage everywhere in the three countries studied. This is because, although frustrating, consumers can work around the lack of coverage in certain places by adjusting where they go or downloading a video or preloading a navigation route. But it is more difficult to work around inconsistent experiences at crucial times, such as when completing a transaction.

Relative impact in driving smartphone user loyalty (percent)



Source: Ericsson ConsumerLab, Experience Shapes Mobile Consumer Loyalty (June 2016)
Base: All 3G/4G users, aged 18–69, using apps on mobile broadband at least weekly in Poland, Ukraine and Russia

Probability of a user achieving the minimum required network speed to ensure a three second time-to-content (percent)



Source: Ericsson analysis of Speedtest Intelligence data from Ookla (August 2017)

As new apps continue to emerge and usage behavior evolves, network performance and time-to-content will play an even more important role in determining smartphone users' loyalty towards their operators in the future.[2] For operators, on the other hand, meeting smartphone users' expectations may not only drive recommendations but also encourage active preference.

The graph above shows the probability of achieving minimum network speeds to ensure a three second time-to-content in six countries in Central and Eastern Europe. The throughput requirements of web browsing, standard video streaming and HD video streaming are used as an example, with downlink speeds set at 1, 5 and 10Mbps, respectively.

As can be seen, subscribers in Hungary have the highest likelihood of achieving these downlink speeds, while subscribers in Ukraine have the lowest probability.

[1] "Loyalty" refers to the recommendation, preference and intention to stay with operators
[2] App coverage can be measured in terms of time-to-content, defined as the time from when a user requests online content until it is rendered on a smart device's display

IOT IN RETAIL: A 5G FUTURE TODAY

5G will be a major driver of digitalization, enabling and enhancing use cases such as immersive experiences with augmented and virtual reality (AR/VR)

Internet of Things (IoT) communications, high-performance mobile connectivity and cloud services are expected to become key driving forces behind business innovation. A recent report[1] highlights that the 5G digitalization revenue potential for operators is USD 619 billion worldwide by 2026 – depending on the role they take in the value chain. Of this, USD 29 billion could be generated in Central and Eastern Europe.

The in-store experience

Retail is one sector that can be enhanced with 5G. It is estimated to be worth USD 1.3 billion by 2026 in the region. In Hungary, a major retail company has trialed the implementation of IoT as part of the shopping experience.

The goal was to explore ways to enrich the physical shopping experience for consumers in the store and provide the retail company with tools to measure shoppers' behavior. Two main use cases were tested: controlling the in-store experience and monitoring consumer movements and interactions.

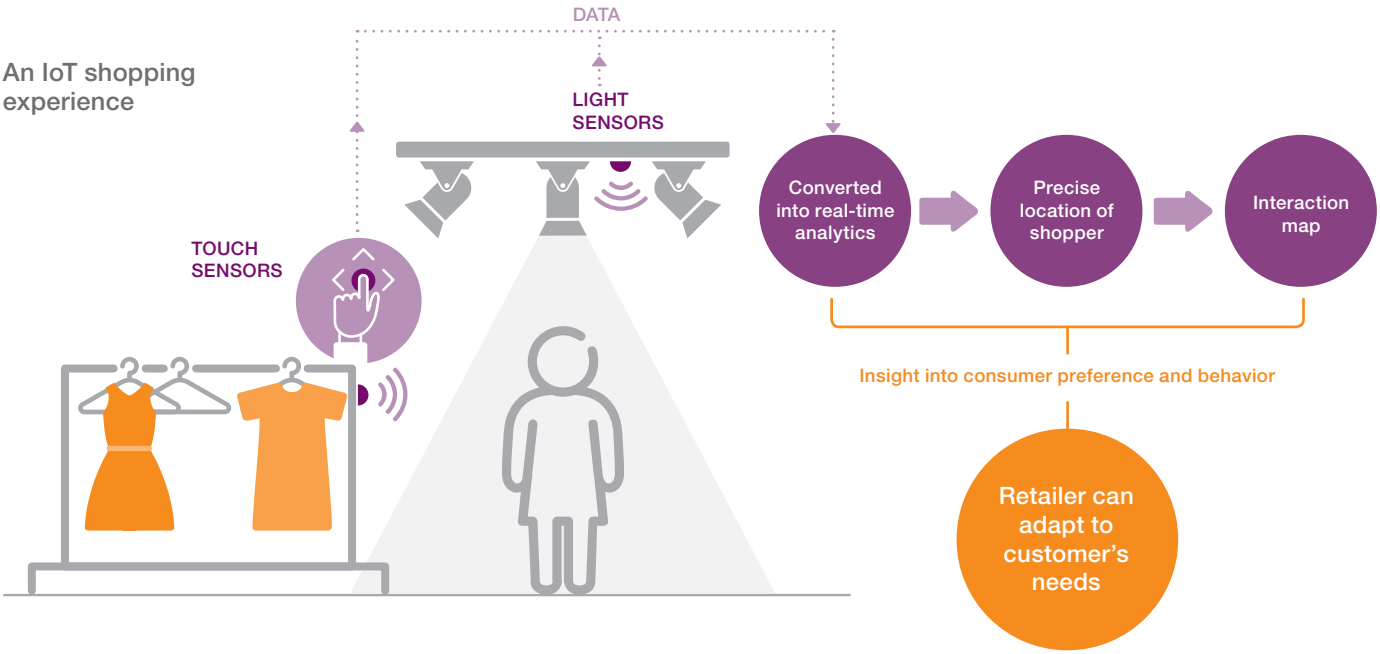
USD 29 billion industrial digitalization revenues are forecast by 2026 for Central and Eastern Europe

This required an interconnection between devices, from touch and light sensors to media and light controls throughout the store, all integrated into a real-time analytics and control engine. The tools enabled the store to gain precise location data of shoppers, and this data could be linked with an interaction map to provide insight into the particular products shoppers were interacting with.

This innovation enabled the retail company to understand consumer preferences and behavior, by illustrating which display rooms were of most interest and which products were most interacted with. The data facilitated the retailer in building enhanced displays with appropriately positioned products, giving shoppers a better experience.

This type of use case is achievable today. It can also be further enhanced with 5G by building in greater consumer interactivity, utilizing tools such as AR/VR. An AR/VR application could enhance the shopping experience by allowing consumers to test products in a virtual world, access product information and visualize products in their homes. To support this there will be a need for high-speed connectivity in the stores and low latency so the applications do not cause nausea.[2] Device positioning and orientation will also need to be accurate in order to support real-time AR overlays.

An IoT shopping experience



[1] Ericsson, The 5G Business Potential, second edition (October 2017)
[2] Ericsson ConsumerLab, Merged Reality (June 2017)

METHODOLOGY

Forecast methodology

Ericsson makes forecasts on a regular basis to support internal decisions and planning, as well as market communication. The subscription and traffic forecast baseline in this report uses historical data from various sources, validated with Ericsson internal data, including extensive measurements in customer networks. Future development is estimated based on macroeconomic trends, user trends (researched by Ericsson ConsumerLab), market maturity, technology development expectations and documents – such as industry analyst reports – on national and regional levels, together with internal assumptions and analyses.

Historical data may be revised if the underlying data changes – for example, if operators report updated subscription figures.

Mobile subscriptions include all mobile technologies. Subscriptions are defined by the most advanced technology that the mobile phone and network are capable of. Figures are rounded and therefore summing up rounded data may result in slight differences from the actual totals. In the key figures tables, subscriptions have been rounded to the nearest 10th million. However, when used in highlights in the articles, subscriptions are usually expressed in full billions or to one decimal. Compound annual growth rate (CAGR) is rounded to the nearest full percentage figure, and traffic volumes are expressed in two digits, for example, 69GB/month or 8.5GB/month.

Traffic refers to aggregated traffic in mobile access networks and does not include DVB-H, Wi-Fi or Mobile WiMAX traffic. VoIP is included in data traffic.

Traffic measurements

New devices and applications affect mobile networks. Having a deep and up-to-date knowledge of the traffic characteristics of different devices and applications is important when designing, testing and managing mobile networks. Ericsson regularly performs traffic measurements in over 100 live networks covering all major regions of the world. Detailed measurements are made in a selected number of commercial WCDMA/HSPA and LTE networks with the purpose of discovering different traffic patterns. All subscriber data is made anonymous before it reaches Ericsson's analysts.

Population coverage methodology

Population coverage is estimated using a database of regional population and territory distribution based on population density. This is then combined with proprietary data on the installed base of Radio Base Stations (RBS) combined with estimated coverage per RBS for each of six population density categories (from metro to wilderness). Based on this, the portion of each area that is covered by a certain technology can be estimated, as well as the percentage of the population it represents. By aggregating these areas on a regional and global level, world population coverage per technology can be calculated.

GLOSSARY

2G: 2nd generation mobile networks (GSM, CDMA 1x)

3G: 3rd generation mobile networks (WCDMA/HSPA, TD-SCDMA, CDMA EV-DO, Mobile WiMAX)

3GPP: 3rd Generation Partnership Project

4G: 4th generation mobile networks (LTE, LTE-A)

5G: 5th generation mobile networks (not yet standardized)

App: A software application that can be downloaded and run on a smartphone or tablet

CAGR: Compound annual growth rate

Cat-M1: A 3GPP standardized low-power wide-area (LPWA) cellular technology for IoT connectivity. Cat-M1 is a solution that can be deployed on LTE, targeting a wide range of IoT applications from simple to rich content

CDMA: Code Division Multiple Access

dB: In radio transmission, a decibel is a logarithmic unit that can be used to sum up total signal gains or losses from a transmitter to a receiver through the media a signal passes

DL: Downlink

EB: ExaByte, 10^{18} bytes

EDGE: Enhanced Data Rates for Global Evolution

EPC: Evolved Packet Core

GB: GigaByte, 10^{9} bytes

GHz: Gigahertz, 10^{9} hertz (unit of frequency)

Gbps: Gigabits per second

GSA: Global mobile Suppliers Association

GSM: Global System for Mobile Communications

GSMA: GSM Association

HSPA: High Speed Packet Access

ICT: Information and Communications Technology

IMS: IP Multimedia Subsystem

ITU: International Telecommunication Union

IoT: Internet of Things

Kbps: Kilobits per second

LTE: Long-Term Evolution

MB: MegaByte, 10^{6} bytes

MBB: Mobile Broadband (defined as CDMA2000 EV-DO, HSPA, LTE, Mobile WiMAX and TD-SCDMA)

Mbps: Megabits per second

MHz: Megahertz, 10^{6} hertz (unit of frequency)

MIMO: Multiple Input Multiple Output is the use of multiple transmitters and receivers (multiple antennas) on wireless devices for improved performance

Mobile PC: Defined as laptop or desktop PC devices with built-in cellular modem or external USB dongle

Mobile router: A device with a cellular network connection to the internet and Wi-Fi or Ethernet connection to one or several clients (such as PCs or tablets)

NB-IoT: A 3GPP standardized low-power wide-area (LPWA) cellular technology for IoT connectivity. NB-IoT is a narrowband solution that can be deployed on LTE, or as a standalone solution, targeting ultra-low-throughput IoT applications

NFV: Network Functions Virtualization

NR: New Radio as defined by 3GPP Release 15

OS: Operating System

PB: PetaByte, 10^{15} bytes

QAM: Quadrature Amplitude Modulation

SDN: Software-Defined Networking

Smartphone: Mobile phone with OS capable of downloading and running “apps” e.g. iPhones, Android OS phones, Windows phones and also Symbian and Blackberry OS

TD-SCDMA: Time Division-Synchronous Code Division Multiple Access

TDD: Time Division Duplex

VoIP: Voice over IP (Internet Protocol)

VoLTE: Voice over LTE as defined by GSMA IR.92 specification. An end-to-end mobile system including IP Multimedia Subsystem (IMS), Evolved Packet Core (EPC), LTE RAN, Subscriber Data Management and OSS/BSS

UL: Uplink

WCDMA: Wideband Code Division Multiple Access

GLOBAL AND REGIONAL KEY FIGURES

In this edition of the Ericsson Mobility Report, we have included the regional key figures in addition to the global figures

To find out more, scan the QR code, or visit
www.ericsson.com/mobility-report

Traffic Exploration Tool:

Create your own graphs, tables and data using the Ericsson Traffic Exploration Tool. The information available here can be filtered by region, subscription, technology, traffic and device type. You may use charts generated from this tool in your own publications as long as Ericsson is stated as the source.

Regional versions:

This time we have provided five versions of the report: a standalone global version as well as four variations of this, each containing a section for a different region of the world.

GLOBAL KEY FIGURES

	2016	2017	2023 forecast	CAGR** 2017–2023	Unit
Mobile subscriptions					
Worldwide mobile subscriptions	7,510	7,790	9,120	3%	million
> Smartphone subscriptions	3,840	4,410	7,270	9%	million
> Mobile PC, tablet and mobile router* subscriptions	240	260	330	4%	million
> Mobile broadband subscriptions	4,410	5,160	8,450	9%	million
> Mobile subscriptions, GSM/EDGE-only	3,010	2,560	640	-21%	million
> Mobile subscriptions, WCDMA/HSPA	2,260	2,380	1,970	-3%	million
> Mobile subscriptions, LTE	1,900	2,620	5,470	13%	million
> Mobile subscriptions, 5G			1,000		million
Mobile data traffic*					
> Data traffic per smartphone	2.1	2.9	17	34%	GB/month
> Data traffic per mobile PC	7.7	9.8	27	18%	GB/month
> Data traffic per tablet	3.6	4.6	12	18%	GB/month
Total data traffic***					
Total mobile data traffic	8.8	14	110	42%	EB/month
> Smartphones	7.2	11	100	44%	EB/month
> Mobile PCs and routers	1.3	1.6	4.5	19%	EB/month
> Tablets	0.32	0.47	1.8	25%	EB/month
Total fixed data traffic	70	80	250	20%	EB/month

* Active devices
** CAGR is calculated on unrounded figures
*** Figures are rounded (see methodology) and therefore summing up of rounded data may result in slight differences from the actual total

[1] These figures are also included in the figures for North East Asia
[2] These figures exclude Pakistan
[3] These figures are also included in the figures for Middle East and Africa

REGIONAL KEY FIGURES

	2016	2017	2023 forecast	CAGR** 2017–2023	Unit
Mobile subscriptions					
North America	380	390	460	3%	million
Latin America	690	700	780	2%	million
Western Europe	520	520	560	1%	million
Central and Eastern Europe	580	610	640	1%	million
North East Asia	1,720	1,780	2,090	3%	million
China[1]	1,320	1,380	1,600	3%	million
South East Asia and Oceania	1,070	1,110	1,290	3%	million
India, Nepal and Bhutan	1,160	1,240	1,500	3%	million
Middle East and Africa[2]	1,390	1,440	1,800	4%	million
Sub-Saharan Africa[3]	660	700	990	6%	million
Smartphone subscriptions					
North America	290	310	390	4%	million
Latin America	410	460	610	5%	million
Western Europe	380	400	480	3%	million
Central and Eastern Europe	240	270	490	10%	million
North East Asia	1,310	1,430	1,940	5%	million
China[1]	1,050	1,150	1,560	5%	million
South East Asia and Oceania	470	560	1,050	11%	million
India, Nepal and Bhutan	270	380	970	17%	million
Middle East and Africa[2]	470	600	1,340	14%	million
Sub-Saharan Africa[3]	260	340	850	17%	million
Data traffic per smartphone*					
North America	5.2	7.1	48	37%	GB/month
Latin America	1.7	2.4	16	36%	GB/month
Western Europe	2.8	4.1	28	38%	GB/month
Central and Eastern Europe	2.7	3.8	19	31%	GB/month
North East Asia	1.2	1.9	12	35%	GB/month
China[1]	0.84	1.5	9.5	36%	GB/month
South East Asia and Oceania	1.8	2.7	15	34%	GB/month
India, Nepal and Bhutan	4.1	3.9	18	30%	GB/month
Middle East and Africa	1.3	2.0	11	34%	GB/month
Sub-Saharan Africa[3]	1.0	1.4	7.0	31%	GB/month
Total mobile data traffic					
North America	1.8	2.6	18	39%	EB/month
Latin America	0.7	1.1	8.9	42%	EB/month
Western Europe	1.2	1.8	12	37%	EB/month
Central and Eastern Europe	0.76	1.2	9.3	41%	EB/month
North East Asia	1.9	3.2	21	37%	EB/month
China[1]	1.0	1.8	15	41%	EB/month
South East Asia and Oceania	0.79	1.3	12	45%	EB/month
India, Nepal and Bhutan	1.0	1.3	14	48%	EB/month
Middle East and Africa	0.71	1.3	14	48%	EB/month
Sub-Saharan Africa[3]	0.25	0.41	4.6	50%	EB/month

Ericsson is a world leader in communications technology and services with headquarters in Stockholm, Sweden. Our organization consists of more than 111,000 experts who provide customers in 180 countries with innovative solutions and services. Together we are building a more connected future where anyone and any industry is empowered to reach their full potential. Net sales in 2016 were SEK 222.6 billion (USD 24.5 billion). The Ericsson stock is listed on Nasdaq Stockholm and on NASDAQ in New York. Read more on www.ericsson.com

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