

PUBLIC UTILITIES COMMISSION505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

October 18, 2016

Agenda ID #15258
Ratesetting**TO PARTIES OF RECORD IN INVESTIGATION 15-11-007:**

This is the proposed decision of Administrative Law Judge Karl J. Bemesderfer. Until and unless the Commission hears the item and votes to approve it, the proposed decision has no legal effect. This item may be heard, at the earliest, at the Commission's December 1, 2016 Business Meeting. To confirm when the item will be heard, please see the Business Meeting agenda, which is posted on the Commission's website 10 days before each Business Meeting.

Parties of record may file comments on the proposed decision as provided in Rule 14.3 of the Commission's Rules of Practice and Procedure.

The Commission may hold a Ratesetting Deliberative Meeting to consider this item in closed session in advance of the Business Meeting at which the item will be heard. In such event, notice of the Ratesetting Deliberative Meeting will appear in the Daily Calendar, which is posted on the Commission's website. If a Ratesetting Deliberative Meeting is scheduled, ex parte communications are prohibited pursuant to Rule 8.3(c)(4)(B).

/s/ KAREN V. CLOPTONKaren V. Clopton, Chief
Administrative Law Judge

KVC: sbf/avs

Decision PROPOSED DECISION OF ALJ BEMESDERFER (Mailed 10/18/16)

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Investigation into the State of Competition Among Telecommunications Providers in California, and to Consider and Resolve Questions raised in the Limited Rehearing of Decision 08-09-042.

Investigation 15-11-007
(Filed November 5, 2015)

**PROPOSED DECISION ANALYZING THE CALIFORNIA
TELECOMMUNICATIONS MARKET AND
DIRECTING STAFF TO CONTINUE DATA GATHERING,
MONITORING AND REPORTING ON THE MARKET**

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**PROPOSED DECISION ANALYZING THE CALIFORNIA
TELECOMMUNICATIONS MARKET AND
DIRECTING STAFF TO CONTINUE DATA GATHERING,
MONITORING AND REPORTING ON THE MARKET**

Summary

We describe the California telecommunications market, analyze the state of competition in its various sub-markets, and direct staff to continue to monitor and report on developments in the market.

1. Background

Ten years ago the Commission issued a pair of decisions creating a Uniform Regulatory Framework (URF I¹ and URF II²) that largely deregulated traditional landline telephone service in California. The URF decisions concluded that competition among service providers, including wireless companies and cable companies, would produce “just and reasonable” prices and services for traditional landline customers and thereby largely eliminate the need for Commission rate and other regulation. The URF decisions stated that the Commission would remain “vigilant” and monitor the changes in traditional landline prices and services following deregulation.³ This Investigation was initiated to test those conclusions ten years later.⁴

¹ Decision (D.) 06-08-030.

² D.08-09-042.

³ See, e.g., D.06-08-030, Slip Op. at 156 (“we will remain vigilant in monitoring the voice communications marketplace”).

⁴ In the interim, the Commission’s Communications Division (CD) has prepared reports addressing market share, market pricing, and affordability of California retail telecommunications services, in response to the URF decision’s monitoring directive. In addition, staff prepares an annual report pursuant to the Digital Infrastructure and Video Competition Act (DIVCA), various other reports on broadband services including the California Advanced Services Fund (CASF) Report and Mobile Broadband Testing Reports. Many of these reports were listed in Appendix A to the above-referenced Order Instituting Investigation (OII),

(footnote continued on next page)

2. Summary of Findings

In response to data requests we issued concurrently with the initiation of this proceeding, we received widely divergent information and testimony on how competitive the telecommunications market is today. Based on the record in this proceeding, we find the following:

- A. Wireless and cable-based Voice over Internet Protocol (VoIP) services have rapidly displaced traditional land line phones as the primary modes of voice communication in California.
- B. Voice communication itself is a diminishing segment of the broader telecommunications market, which includes data services and text communication, a market segment that is expanding more rapidly than voice.⁵
- C. Competitive bottlenecks and barriers to entry in the telecommunications network limit new network entrants and may raise prices for some telecommunications services above efficiently competitive levels. One particular bottleneck is access to utility poles, where the Commission's safety mandate meets, and must be reconciled with, the Commission's goal of a competitive market.
- D. Despite advancement in technologies and services, the so-called "digital divide" between geographic and economic sub-groups of the State's population has

in the July 1, 2016 Scoping Memo at 17-18, and are published on the Commission's website at <http://www.cpuc.ca.gov/General.aspx?id=5655>.

⁵ See Exhibit 5, AT&T/Aron June 1 Testimony, at fn. 9 and accompanying text, citing "No Time to Talk: Americans Sending/Receiving Five Times as Many Texts Compared to Phone Calls Each Day, According to New Report," PR Newswire, March 25, 2015, at <http://www.prnewswire.com/news-releases/no-time-to-talk-americans-sendingreceiving-five-times-as-many-texts-compared-to-phone-calls-each-day-according-to-new-report-300056023.html>. Another aspect of the diminishing role of voice on the network is the increased use of the network for machine-to-machine (M2M) communications, also known as the Internet of Things. See *In re Business Data Services*, Tariff Investigation Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 4723 (May 2016) (*BDS Order*) at ¶ 41.

- widened. Those Californians who lack reliable and affordable access to that network are unable to participate fully in the economy and society of the 21st century.
- E. With the rapid convergence of voice communications, Internet access, and video streaming into applications that are all accessible from a single device, the economic and social importance of the telecommunications network has multiplied, making the network an “essential infrastructure for [the] 21st century.”⁶
- F. The voice market is tied to the broadband market in a number of ways, including: (1) broadband is the network means of transmitting VoIP, one of the intermodal competitors foreseen by URF I; (2) with the high incidence of service bundling, and the increased importance of broadband Internet access, for many consumers the voice and broadband markets have converged; and (3) traditional phone calls and broadband data services utilize the same physical network.
- G. It is unclear whether the growth of wireless, VoIP, and other alternative means of voice and data communication has kept prices and services for traditional landline service just and reasonable, or even whether that question is relevant to a marketplace in which most consumers obtain voice service in a bundle with broadband and other services.

3. Procedural History

On November 5, 2015, the Commission adopted the Order Instituting Investigation (OII) that commenced this proceeding together with a preliminary

⁶ See, e.g., FCC Chairman Tom Wheeler, *The Facts and Future of Broadband Competition*, 2014 FCC LEXIS 3221 (Sept. 4, 2014) (“essential infrastructure for 21st century economics and democracy”); Exhibit 5, June 1, 2016 Aron/ AT&T Testimony, at 18 (“the wireless industry is one of the most dynamic sectors in the economy and an important contributor to California’s economic growth”); *In re Protecting and Promoting an Open Internet*, Report and Order, 30 FCC Rcd 5601 (March 2015) (*Open Internet Order*), at ¶ 1 (“Internet drives the American economy and serves, every day, as a critical tool for America’s citizens to conduct commerce, communicate, educate, entertain, and engage in the world around them”).

scoping memo. To obtain the information necessary to conduct the “data driven analysis” contemplated in the OII, the Commission issued a set of information requests⁷ to the respondent communications companies (Respondents).⁸ The assigned Administrative Law Judge (ALJ) solicited party requests for clarification of and/or objection to those information requests on December 9, 2015. After receiving party input, the ALJ issued a February 4, 2016 ruling clarifying certain information requests and modifying the response schedule.

To protect the confidentiality of sensitive information contained in the responses to the information requests, on March 4, 2016, the ALJ issued a Protective Order classifying data produced in response to the information requests into varying categories of confidentiality and identifying which parties could have access to each category of data. The ALJ further clarified the March 4, 2016 Protective Order in subsequent rulings issued on April 1 and 18, 2016. On May 3, 2016, the assigned Commissioner (Commissioner) and the ALJ issued a joint ruling denying Respondents’ objections to compliance with the prior discovery rulings and granting a motion by The Utility Reform Network (TURN) to compel responses to certain of its data requests. In response to the May 3, 2016 ruling, Respondents brought an action for injunctive relief in the

⁷ The Information Requests are found at Appendix B to the OII.

⁸ The following telecommunications carriers are named as Respondents in OII: AT&T California (U#1001); Verizon California Inc. (U#1002); Frontier Communications of America, Inc. (U#5429); SureWest Telephone (U#1015); Citizens Telecommunications Co. of California (U#1024); New Cingular Wireless Pcs, LLC (AT&T Wireless, U# 3060); Cellco Partnership (Verizon Wireless U# 3001) and California RSA #3 Ltd Pship (U# 3028); Sprint Telephony PCS, LP (U# 3064/3066); T-Mobile West LLC (U#3056); Comcast Phone of California LLC (U#5698); Time Warner Cable Information Services (California), LLC (U# 6874); Cox California Telecom LLC (U# 5684); and Charter Fiberlink CA-CCO, LLC (U# 6878); and any affiliate of these utilities providing Voice over Internet Protocol (VoIP), wireless, or broadband transmission service in California.

United States District Court for the Northern District of California, which issued a preliminary injunction on May 20, 2016 halting production of highly confidential data “to TURN (or other third parties).”⁹ Cross motions for summary judgment were heard on September 29, 2016.

While the issue of third-party access to highly confidential data (under the Protective Order) was awaiting resolution by the District Court, Respondents continued to produce data responsive to the information requests to Commission staff. Such information provides a basis for the granular analysis of competition set out later in this decision.

In addition to ruling on the multiple motions regarding discovery filed by Respondents and Intervenor,¹⁰ the Commissioner and/or the ALJ also ruled on motions challenging the Commission’s jurisdiction and calling for, among other things, suspension of the proceeding, extension of time to comply with discovery orders, changes to the timetable of the proceeding, and various housekeeping matters.¹¹

⁹ May 20, 2016 Order Granting Motion for a Preliminary Injunction, in *New Cingular et al v. Picker et al*, No. 16-cv-02461-VC (N.D. California). Plaintiffs are Respondents AT&T, AT&T Wireless, Verizon Wireless, Comcast, Cox, and the wireless and cable trade associations (CTIA, and California Cable & Telecommunications Association). Defendants are all five CPUC Commissioners. Respondents Sprint, T-Mobile, Charter, Time Warner, and Frontier have not joined the lawsuit.

¹⁰ Intervenor include The Center for Accessible Technology (CforAT), TURN, the Greenlining Institute (Greenlining), the California Association of Competitive Telephone Companies (CALTEL) and CTIA-The Wireless Association (CTIA). The Commission’s Office of Ratepayer Advocates (ORA) also participated in the proceeding pursuant to its statutory authority.

¹¹ See, e.g., February 4, 2016 ALJ Ruling on Pending Motions and Issues Discussed at January 20, 2016 Prehearing Conference (addressing, *inter alia*, AT&T’s Motion to Suspend Schedule until the Commission Conducts Workshops and an En Banc Hearing (December 9, 2015); Cellco Partnership (Verizon) Motion to Remove Verizon Wireless and Wireless Carriers as Respondents (December 15, 2015); Motion of CTIA for Modification of Procedural Schedule (extension of six months on Information Requests) (December 18, 2015); Motion by Cox California Telecom LLC on Behalf of its [Unnamed] Affiliated Entity to Modify

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Pre-hearing conferences were held on January 20, 2016, and June 22, 2016, and a Scoping Memo issued on July 1, 2016. On July 20, 2016, the Commissioner and the ALJ co-presided over a one-day hearing in which panels of experts provided by the parties discussed issues in the proceeding and responded to questions from the Commissioner and the ALJ. On July 29, 2016, Respondents filed a joint motion to strike most of the expert testimony provided by intervenors on due process grounds or, in the alternative, to strike selected portions of such testimony as irrelevant to or outside the scope of the proceeding. Responses to the strike motions were received from intervenors on August 2, 2016. On August 8, 2016, the ALJ issued a ruling denying the motions to strike based on relevance, scope, and an alleged lack of due process and granting in part and denying in part motions to strike portions of the testimony of the ORA expert Dr. Selwyn in compliance with rulings of the District Court.

In the July 1, 2016 Scoping Memo ruling, we asked the parties to provide any objections they had to official notice of certain documents and reports. We have noted the objections of the parties to our notice of certain documents and reports, but those objections go to the weight we give those documents and reports. Many were prepared by government agencies with telecommunications expertise, including the FCC and Commission staff. We take official notice of the reports, decisions, studies, and other documents of this Commission and other agencies, as set forth in Appendix B of this decision, and they shall be considered part of the record of this proceeding.¹²

List of Named Respondents (December 18, 2015); and Motion by AT&T California and New Cingular to Remove Certain Info Requests and Topics of Investigation (December 22, 2015)).

¹² These documents are also largely found in Appendix A of the OII and in the July 1, 2016 Scoping Memo. Some, like the *19th Wireless Competition Report*, were published after the Scoping Memo; others, like the FCC's *International Broadband Comparison*, had not previously been drawn

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This proceeding is submitted as of September 30, 2016.

4. Discussion

4.1. Data Highlights

The object of this investigation has been to take a snapshot of the telecommunications marketplace in California, with an “as of” date of December 31, 2015. Consistent with that effort, the following data points provide a quick overview of significant facts about the telecommunications market:

- **Total Voice Telephone Lines.** There are approximately fifty-five million voice lines in service in California – over fifteen million landline and under forty million wireless. Of those fifty-five million lines, approximately ninety-two percent provide voice bundled with broadband service.
- **Intermodal Consumer¹³ Voice Market Availability.** Ninety-six percent¹⁴ of California households live in census blocks with access to at least three voice providers.¹⁵

to our attention. California Evidence Code §§ 450-454, on which the Commission relies in these matters, authorizes a tribunal to take notice of “[o]fficial acts of the legislative, executive, and judicial departments of the United States and of any state of the United States,” and “[f]acts and propositions that are not reasonably subject to dispute.” In taking notice of FCC and other agency decisions and reports, we are noticing that the agency reached conclusions based on referenced facts, but not making a determination about the truth of the asserted facts.

¹³ The figures here rely on a finding that, for most but not all consumers, wireline and wireless services are reasonable substitutes. As set forth below, measuring the business market is a more complex undertaking. Availability measurements generally are based on carrier representations, although in some instances staff has been able to verify by comparison with other data.

¹⁴ Percentages in the text are rounded to the nearest whole percent. Tabular data includes fractions of a percent.

¹⁵ Intermodal voice providers for purposes of this analysis includes wireline voice, mobile voice and “fixed” interconnected VoIP but does not include nomadic or OTT VoIP providers such as Vonage or “edge provider” applications such as FaceTime or Skype’s video services. 12,511,322 households, 99 percent of all households in California, live in census blocks with access to one or more service providers of broadband at speeds of at least 200 kbps either downstream or upstream, meaning they may have the option of using these OTT services.

Eighty-seven percent of all California households reside in census blocks with at least six voice providers.

- **Intermodal Voice Market Concentration.** The intermodal voice market is moderately concentrated in California's five largest markets.
- **Urban Voice Market Availability** Ninety-seven percent of urban households in California are located in census blocks served by three or more voice providers of any kind.
- **Rural Voice Market Availability** Seventy-seven percent of California rural households are located in census blocks served by three or more voice providers of any kind.
- **Tribal Voice Market Availability** Seventy-five percent of tribal households are located in census blocks served by three or more voice providers of any kind.
- **Californians Without Voice Availability** One and one-half percent of all California households live in census blocks with access to no voice provider, including 141,531 urban households and 44,246 rural households.
- **Broadband Availability Generally.** Based on carrier reporting and advertised speeds, ninety-six percent of California households have access to a wireline broadband connection at speeds of 200 kilobits per second (kbps)¹⁶ in either direction or higher; Ninety-eight percent of households have access to a broadband connection if fixed wireless availability is added; and one hundred percent of households have access to a broadband connection if mobile broadband is added.
- **Broadband Subscription and Market Concentration Generally.** Based on actual subscription numbers, both the fixed and mobile broadband markets are highly concentrated.

¹⁶ As used herein, kbps means kilobits per second.

- **Residential High-Speed Broadband¹⁷ Market Availability.**¹⁸ Based on carrier reporting (OII responses) of broadband availability at advertised speeds and including fixed wireless (rooftop) connections as well as fixed wireline, seven percent of California households are located in census blocks unserved by any residential high-speed broadband provider; thirty-seven percent of California households are located in census blocks served by only one residential high-speed broadband provider; forty percent of California households are located in census blocks served by two or more residential high-speed broadband providers' and sixteen percent of California households are located in census blocks served by three or more residential high-speed broadband providers.¹⁹

¹⁷ For purposes of this decision, we follow the FCC in setting a benchmark for Residential High-Speed Broadband to mean fixed (i.e., residential) broadband service advertised at speeds of at least 25 megabits per second download and 3 megabits per second upload. See *In re Deployment of Advanced Telecommunications Capability to All Americans Pursuant to Section 706 of the Telecommunications Act of 1996*, (GN Docket No. 14-126), 30 FCC Rcd 1375, released February 4, 2015, at ¶ 3 (2015 *Broadband Progress Report*) (setting 25/3 standard for first time). We note other parts of the world have adopted higher benchmarks. See also *In re International Comparison Pursuant to Broadband Data Improvement Act; International Broadband Data Report*, 31 FCC Rcd 2667 (January 2016) (*International Broadband Comparison*), discussing U.K. (goal of "national minimum broadband speed of 100 Mbps"), Brazil ("goal of increasing broadband access to 95 percent of the population with high-speed broadband of at least 25 Mbps via fiber by 2018 ... remaining 10 percent of connections... via wireless broadband"), Belgium ("target of broadband access above 100 Mbps ... to one gigabit per second for at least 50 percent of Belgian households by 2020"), Iceland (2012 goals included "90 percent of homes and businesses must have access to a 30 Mbps connection by 2014 [and] 70 percent of homes and businesses must have access to a 100 Mbps connection by 2014 (99 percent by 2022)"), Slovak Republic and other countries adopted EU Digital Agenda ("broadband coverage of at least 30 Mbps for downloads by the end of 2020"); available at https://apps.fcc.gov/edocs_public/attachmatch/DA-16-97A1.pdf.

¹⁸ Market concentration in the various sub-markets considered in this decision has been analyzed by first calculating the raw subscriber numbers and market share, and then using those numbers to calculate a Herfindahl-Hirschmann Index (HHI) score, a measure of market concentration employed by the Federal Trade Commission and the Department of Justice in evaluating proposed mergers of competitors, discussed further below.

¹⁹ Staff has noted inconsistencies in the data from AT&T and other providers relating to availability of high speed broadband. Compare FCC's nationwide figures, reporting similarly that approximately 10% of the population is unserved by any provider at 25/3, that 51% have

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- **Residential High-Speed Broadband Market Concentration.** The residential, high-speed broadband market in all of California's geographic markets is highly concentrated.
- **Mobile Broadband (Data) Availability.** At any speed, staff calculates that ninety-eight percent of California households are located in census blocks served by three or more mobile data providers; one and one-half percent of California households are located in census blocks served by two mobile data providers; and fewer than one percent of California households are located in census blocks with either one mobile data provider or no mobile data provider available.
- **Mobile High Speed Broadband Availability.**²⁰ Analysis relying on data using the Commission's CalSPEED mobile broadband testing application estimates shows that twenty-two percent of California households live in census blocks with access to high-speed mobile broadband. When factoring in reliability, no census block in California is served by a mobile carrier that consistently achieves high-speed broadband speeds.²¹

access to only one provider at that speed, and 38% have access to two or more providers. *See In re Deployment of Advanced Telecommunications Capability to All Americans Pursuant to Section 706*, FCC 16-6, 31 FCC Rcd 699 (January 29, 2016) (2016 *Broadband Progress Report*), at Table 6.

²⁰ For purposes of this decision, and for consistent treatment of fixed and mobile broadband services, we likewise set a benchmark for mobile high speed broadband at 25 megabits per second (Mbps) download and 3 Mbps upload. We are aware that: (a) the FCC has not yet set a standard for mobile broadband; and (b), in some sense at least, this is a higher standard than the fixed broadband benchmark in that is based on real-world testing, not carrier-advertised speeds. The problem of actual vs. advertised speeds is addressed below.

²¹ The Commission's Communications Division (CD), with assistance from consultants, created and implemented CalSPEED, a project to measure mobile broadband throughput, quality and reliability data for the large four national carriers. The Commission has found that average measured speeds are not representative of a consumer's actual mobile experience. Rather than use average speeds, Commission staff quantifies expected speeds at varying probabilities by taking into account the distribution of results around the mean in a single testing session. If the mean throughput is 25/3 Mbps, two standard deviations below would suggest that a consumer will receive service at least as fast approximately ninety-eight percent of the time.

- **Mobile High Speed Market Concentration.** The mobile data market is highly concentrated in all of California’s geographic markets.
- **Urban/Rural/Tribal Divide in High Speed Residential (Fixed) Broadband Availability** Californians living in urban census blocks have the highest number of high speed residential broadband services available to them. Just four percent of urban households live in census blocks with no high-speed broadband providers, compared to thirty-six percent of tribal households and fifty-five percent of rural households.²²
- **Urban/Rural/Tribal Divide in High Speed Mobile Broadband.** Using actual mean mobile speeds, seventy-seven percent of urban households live in census blocks with no high-speed mobile provider, compared to eighty-six percent of households in tribal blocks and eighty-three percent of households in rural blocks.

4.2. The Telecommunications Network in California Today

4.2.1. The Physical Network

The telecommunications network serving California is unified and interconnected.²³ It runs on wires²⁴ in the ground, wires on poles, and by radio transmission over licensed and unlicensed spectrum. It carries voice communications, text transmissions, email, financial and business data transfer,

²² These figures include fixed wireless availability. Removing fixed wireless availability, the largest difference in availability is for rural census blocks, where the number of households without high-speed broadband availability increases to sixty-five percent.

²³ There appears to be unanimous consent on this point. *See e.g.*, July 15, 2016 Supp’1 Gillan Testimony on behalf of Cox California Telecom, at 22:10-12 (“given the interconnected nature of networks, it is always possible to create physical linkages between different services, areas and networks”); 47 U.S.C. § 251(a) (“Each telecommunications carrier has the duty ... to interconnect directly or indirectly with the facilities and equipment of other telecommunications carriers”).

²⁴ “Wires” includes twisted copper pairs, fiber-optic cables, and coaxial cables. Where the context requires, we specify which of these is meant.

machine to machine communications,²⁵ music, video, images, radio and television, telemetry (at least some of it) for the State's water and electricity grid, and any other data that can be digitized. Although the network originally carried only voice (and still carries traditional telephone service²⁶ as well as wireless and VoIP calls,²⁷ it also carries data and broadband Internet access services, as well as the many IP applications available from the Internet.

The physical components of the network consist of (i) the poles, wires, conduits, switches, microwave relays, and other physical assets of the legacy telephone system, in most cases owned by one of the state's four incumbent local exchange carriers (ILECs); (ii) the cell towers, fiber-optic cable, antennas, repeaters, switches and other physical assets owned and/or used by the wireless companies operating in California; (iii) the coaxial cable, conduit, switches, and other physical assets owned by the cable companies operating in California; (iv) the modems, routers, fiber-optic cable, antennas, switches and other physical assets owned by the Internet service providers operating in California, including the ILECs, the cable companies, and wireless service providers. The intangible components of the network consist of the legal rights and duties of network

²⁵ Between business data and M2M traffic, "U.S. Business Internet Protocol (IP) traffic grew from 3 exabytes per year in 2005 to 39 exabytes per year in 2015, a multiple of 13 and a compounded annual rate of 29 percent." *BDS Order, supra*, at ¶ 77 (quoting US Telecom study based on Cisco Visual Networking Index).

²⁶ Traditional voice service is sometimes referred to as time division multiplexing (TDM), the acronym for Time Division Multiplex transmission, a protocol associated with telephone service; it is most often contrasted with another protocol, Internet Protocol or IP.

²⁷ VoIP is an acronym that refers to Voice over Internet Protocol. It includes "interconnected VoIP service" as defined in 47 CFR § 9.3 (exchange calls with the public switched telephone network) and "non-interconnected VoIP service" as defined in 47 U.S.C. § 153(36) (does not allow connection with the PSTN), both types of VoIP enable real-time, two-way voice communications, and require a broadband connection and IP-compatible customer premises equipment.

participants related to such things as access to utility poles and conduits, interconnection, call completion, provisioning, and the pricing of unbundled network elements, (UNEs) and special access services.

Competing providers offer a wide array of wholesale and retail communications services on this network, and play different roles in the network “ecosystem.”²⁸ The ILECs and cable companies, which in some instances are licensed as competitive local exchange carriers (CLECs), typically provide a last-mile wired connection to the home or business. Most of the ILECs and many of the CLECs offer both telephone and broadband services; CLECs are further segmented between those that provide service via UNEs purchased from an ILEC, and others, such as cable companies, that typically provide service over their own last-mile connections and network infrastructure. Cellular mobile, satellite and “fixed wireless” companies offer different varieties of an alternative wireless last-mile connection to the network.²⁹ Satellite and fixed wireless are important for customers in rural or otherwise unserved/underserved areas (although their overall market share remains quite small).³⁰ In addition, inter-exchange carriers (IECs) provide long-distance telephone service, although their market share is shrinking as the fixed and mobile carriers increasingly offer “all distance” service plans.

²⁸ See, e.g., *In re Competitive Market Conditions With Respect to Mobile Wireless*, 26 FCC Rcd 9664 (2011) (15th Wireless Competition Report) at ¶ 2 (“mobile wireless ecosystem, including an analysis of the ‘upstream’ and ‘downstream’ market segments, such as spectrum, infrastructure, devices, and applications”); FCC 2016 Broadband Progress Report, *supra*, at ¶ 12 (“the contemporary broadband ecosystem”).

²⁹ While all three use radio transmission to reach the end-user, mass market cell service is mobile, and fixed wireless and satellite are addressed to a particular location, typically an antenna on the roof of the end-user.

³⁰ See generally Exhibit 18, Tully/ORR June 1 Testimony, at II (1-4); 2016 Broadband Progress Report, *supra*, at ¶ 26.

There are also “carriers’ carriers” – such as XO, Global Crossing, and Level 3³¹ -- that provide wholesale transport and transit (including cell-site backhaul) other inputs to the carriers offering retail services (while sometimes providing their own retail services, primarily to business customers).³² Finally, there are providers that specialize in providing other forms of infrastructure. Crown Castle, for instance, offers cell tower access and capacity, and related services.³³

Not included within the scope of this Investigation are the information and service providers at the “edge” of the network. These edge-providers – Facebook, Twitter, Netflix, eBay, Wikipedia and the like – are outside the OII’s focus on telecommunications,³⁴ but they are among the largest drivers of

³¹ See generally *BDS Order* at ¶ 67 (“Separate from the provision of BDS services, many companies provide access to dark fiber, and in some cases, this is the primary focus of their business. Dark fiber providers include Zayo, Integra, Level 3, and Crown Castle”).

³² See, e.g., Exhibit 5, AT&T/Aron June 1 testimony, at Table 1 (“Competitors Offering Wholesale Services in California”); see also *BDS Order*, at ¶ 58 (“Many non-cable competitive LECs have deployed state-of-the-art fiber network facilities and are able to offer customers a variety of innovative business services, including dedicated high-capacity transmission, cloud computing, data storage, IT, managed security, and video conferencing. The largest facilities-based providers of this type ... are: Level 3 Communications, LLC (Level 3), Zayo Group, LLC (Zayo), U.S. TelePacific Corp. (TelePacific), and Birch Communications, Inc. (Birch”).

³³ *In re Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless*, 30 FCC Rcd 14515 (December 2015) (*18th Wireless Competition Report*), at ¶ 65 (“Independent tower operators own, operate and lease shared wireless communications and broadcasting towers, manage other tall structure sites (such as rooftops, and water towers), and to a lesser extent, build and operate DAS networks and small cell facilities for mobile service providers. ... One estimate indicates that the three largest publicly traded neutral host providers (Crown Castle, American Tower, and SBA Communications) own or operate more than 94,540 towers as of August 2015”).

³⁴ 47 U.S.C. § 153(50) defines “telecommunications” as the “the transmission, between or among points specified by the user, of information of the user’s choosing, without change in the form or content of the information as sent and received.” We note that some information providers have crossed the line from information to transmission services. Google, for instance, recently obtained a wireless registration (WIR), and is in the process of acquiring a CLEC,

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network growth, creating the demand for improved access, speed and capacity.³⁵ Indeed, consumer desire to access edge services -- whether via wireline or mobile broadband service -- underscores the importance of analyzing voice services and broadband services as part of the same network. Therefore, consideration of broadband should include study of both mobile and fixed broadband.

Wireline and wireless networks are distinguished by the nature of their last mile connection to the end user. In wired networks, the last mile consists of a copper wire, coaxial cable, or fiber optic cable. Wireless networks are only wireless in the last mile, where transmission occurs over radio waves between a cellular antenna and an end-user handset or other compatible device.³⁶ Mobile wireless transmission over licensed spectrum by the large mobile networks is

WebPass Telecommunications, LLC. See Application (A.) 16-08-009 (Google WebPass Application).

³⁵ Netflix, for example, now reportedly accounts for over a third of all downstream traffic during peak hours, but its streaming service only works when one is connected to the Internet. <https://help.netflix.com/en/node/412>. Real-time entertainment and other audio and video services (like Netflix) drive network growth as part of a “virtuous cycle.” *Open Internet Order, supra*, at ¶ 7, quoting *Verizon v. FCC*, 740 F.3d 623, 659 (D.C. Cir 2015) (“a ‘virtuous cycle’ in which innovations at the edges of the network enhance consumer demand, leading to expanded investments in broadband infrastructure that, in turn, spark new innovations at the edge”).

³⁶ Wireless networks are sometimes referred to as “radio access networks” or RANs, and indeed the use of that term in public safety legislation illuminates the architecture of wireless networks generally. See 47 U.S.C. 1422(b), describing the nationwide public safety broadband network:

The ... network shall be based on a single, national network architecture that evolves with technological advancements and initially consists of:

- 1) a core network that ... provides the connectivity between [a] radio access network; and ... the public Internet or the public switched network; and
- 2) a radio access network that ...consists of all cell site equipment, antennas, and backhaul equipment, based on commercial standards, that are required to enable wireless communications with devices using the public safety broadband spectrum.

distinct from the much shorter-range wireless transmissions over (generally) unlicensed spectrum used by fixed Wi-Fi networks,³⁷ and different again from fixed wireless service using microwave. In all cases, however, the network's antenna connects, directly or indirectly, to the wired network.

Upstream from the cellular or other wireless antenna, the network architecture consists of a wired central network shared by both wireless and wireline network providers. High-capacity backhaul lines (and occasionally further microwave transmission) connect the cellular and other wireless antennas to the Public Switched Network and the Internet.³⁸

The wires and connection media within the network differ widely, with fiber optic cable (fiber) used in the high-capacity transport portion of the network, and some mix of fiber, coaxial cable, copper, and microwave deployed for both last-mile and middle mile transit.³⁹ At the core of the network are

³⁷ In this Decision, we will sometimes refer to the wireless networks as "mobile networks," as they developed largely to serve devices, like cell phones, that customers carry with them. While a Wi-Fi network, too, provides a wireless connection between an antenna and an end-user device, we will not generally include Wi-Fi networks in our discussion of "wireless networks" or "mobile networks" for several reasons: 1) customer-side Wi-Fi networks generally rely on an existing wireline broadband connection to the premises where the Wi-Fi is used (Dr. Roycroft refers to Wi-Fi as "wireline-based broadband" – Exhibit 54, at vi); (2) Wi-Fi networks are not "last mile" but "last couple hundred feet"; (3) Wi-Fi networks are commonly password-protected for the exclusive use of the subscriber to that connection or, in the case of a business, that business's customers and employees; and (4) Wi-Fi networks have only recently begun to be used as a part of a telecommunications carrier's network deployment.

³⁸ See discussion of 47 U.S.C. § 1422, *supra*, concerning the architecture of the radio access network portion of the Public Safety Broadband Network.

³⁹ Copper is still used in these middle mile and/or business data service lines, although the trend is to higher speed media. See *BDS Order* at ¶ 49:

The underlying physical infrastructure plays an important role on the available capacity of the service offering. For example, using copper for the last-mile connection will greatly limit the capacity of the BDS service offering absent the deployment of additional lines to the location. In contrast, a last-mile fiber connection to a building will provide the

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ultra-high-capacity and high-speed fiber lines,⁴⁰ where traffic is exchanged pursuant to “transit” and “peering” agreements.⁴¹

Throughout the network, the physical transmission media (copper, cable, fiber, radio spectrum) can be distinguished from the *technologies and protocols* used to transmit voice and data over them.⁴² While TDM is typically associated with legacy copper connections and IP with fiber or coaxial cable, neither TDM nor IP services are dependent on a specific connection medium. Providers sometimes provide TDM services over fiber and coaxial cable, as well as IP-based

greatest flexibility to increase service capacity without having to deploy additional lines.”

⁴⁰ See *In the Matter of Amendments to Part 4 of the Commission's Rules Concerning Disruptions to Communications*, 30 FCC Rcd 3206 (2015) (2015 *Network Outage* NPRM), at fn. 28 (these higher capacity circuits “are generically referred to as OCn, where the “n” represents a multiplier of the basic OC-1 transmission rate, which is 51.84 Mbps. OC rates are used to measure speeds of high-speed optical networks, from local business-to-business connections, to the highest bandwidth connections used for the Internet backbone. Small and medium sized businesses that require high-speed Internet connectivity may use OC3 or OC12 connections. ISPs that require much larger amounts of bandwidth may use one or more OC48 connections. Generally, OC192 and greater connections are used for the Internet backbone, which connects the largest networks in the world together. For example, OC1 denotes an optical carrier transmission speed of 51.840 Mbps. A DS3 signal operates at 44.736 Mbps.

⁴¹ Because no carrier can provide a complete worldwide, or even State-wide, network, interconnection and service-level agreements between carriers are essential, and the CPUC plays a key role in arbitrating and resolving disputes between connecting networks. Compare July 20, 2016 Hearing Transcript at 24:1 ff (DeYoung) (“The truth is all service providers obtain wholesale inputs from other providers”).

⁴² *BDS Order*, at ¶ 15:

There is the physical network infrastructure layer, which may consist of an assortment of fiber, coaxial cable, copper or even wireless links. ... Then there is the layer of technology protocols employed to move traffic across the network to its intended destination. These protocols can vary across segments ...

services over copper, as they do with digital subscriber lines (DSL).⁴³ A single call may be converted from TDM to IP and back again.⁴⁴

High-speed, dedicated lines, known as special access or business data service (BDS) lines, provide key interstitial connections, to large enterprise customers, backhaul from wireless cell towers and antennas into the network, and connectivity between network offices, meet points, points of presence (PoPs), and long-haul backbone providers. Largely unknown to the general public, special access facilities are in some sense the glue that holds the network together.

A prospective competitor looking to enter the California telecommunications market needs to purchase, lease, build or otherwise gain access to all of these elements and segments of the network, including a last-mile connection (potentially including pole and conduit access), special access connections between offices and to the larger network and its backbone providers. A wireless carrier has similar needs, except spectrum replaces local loops for the last-mile segment.

4.2.2. The Use and Evolution of the Network

The California telecommunications network of 2016 is very different from the network that existed at the time of URF I and URF II. The OII traced some of the changes in the network, most importantly its evolution from a “public

⁴³ *Id.* at ¶ 50.

⁴⁴ See *In re AT&T's Phone-to-Phone IP Telephony Services*, 19 FCC Rcd 7457 (2004) (*IP-in-the-Middle decision*), at ¶ 11 (“AT&T routes it through a gateway where it is converted to IP format, then AT&T transports the call over its Internet backbone. This is the only portion of the call that differs in any technical way from a traditional circuit-switched interexchange call, which AT&T would route over its circuit-switched long distance network. To get the call to the called party's LEC, AT&T changes the traffic back from IP format and terminates the call to the LEC's switch”).

switched telephone network ... into a multi-service platform” for the provision of “voice, video, and data services to end users and businesses.”⁴⁵

Data produced in response to the OII Information Requests underscores this point: approximately 92 percent of voice telephone service customers in California buy their voice service bundled with broadband. For wireless competitors, this number is over 95 percent.⁴⁶ Voice telephony is increasingly a subset of *data* transmission service because, in a digital network, voice transmission is just another application. Thus, while lower-price, stand-alone voice service remains available to most Californians, it is increasingly irrelevant to the typical consumer who purchases voice and data bundled in a single service. Customers have also moved from legacy telephone companies to cable VoIP and broadband bundles, and – in large numbers – to wireless voice and data (broadband) bundles.⁴⁷

In both wireline and wireless markets, there was market consolidation before,⁴⁸ and after,⁴⁹ the 2006 URF decision. TURN’s Roycroft reports that in

⁴⁵ OII at 7-9.

⁴⁶ Here, reference is only to consumer wireless services, not business.

⁴⁷ Exhibit 5, Aron June 1 Testimony, at 5-7, 52-53, and Appendix I Tables (showing prevalence of bundled service).

⁴⁸ Staff’s 2011 *Market Share Report* reports on the impact of mergers market concentration. A large increase in reported HHI concentration in wireline was coincident with the AT&T/SBC, Verizon/MCI, AT&T Mobility-Cingular Wireless, and Sprint-Nextel mergers in 2005. See 2011 *Market Share Report*, at 7 (“the largest increase in HHI concentration in wireline is coincident with the AT&T/SBC merger in 2005, and in wireless is nearly coincident with the AT&T Mobility-Cingular Wireless merger and the Sprint-Nextel merger”), available at [http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Communications_-_Telecommunications_and_Broadband/Reports_and_Presentations/Market%20Share%20Analysis%20\(March%202011\).pdf](http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Communications_-_Telecommunications_and_Broadband/Reports_and_Presentations/Market%20Share%20Analysis%20(March%202011).pdf).

⁴⁹ As described below, AT&T bought Leaf/Cricket, T-Mobile purchased Metro PCS, and Verizon bought Alltel. See 18th Wireless Competition Report, at ¶ 40.

“December of 2004 traditional CLECs served nearly 12 percent of residential lines in AT&T California’s (then known as SBC) service area. Today, few traditional (non-cable) CLECs still offer residential service, and they serve only 1-2 percent of the residential market.⁵⁰ In the wireless market, California mirrors the national picture, where about 98.5 percent of wireless connections are provided by four retail carrier families⁵¹ – Verizon, AT&T, Sprint and T-Mobile – with the AT&T family of companies affiliated with a legacy telephone company.⁵² Serious wireless competitors – facilities-based carriers with their own wireless spectrum and other network facilities – have been acquired or otherwise exited the market since 2006 (notably Alltel, Leap, and Metro PCS), leaving California consumers (and consumers nationwide) with the four large national carriers which among them control 98 percent of the market.⁵³

Most recently, the Verizon-Frontier merger again changed the contours of the retail telecommunications markets. Verizon sold most of its California landline business to Frontier, but retained business customers and long-distance operations.⁵⁴

⁵⁰ Roycroft June 1 testimony, at xi, 13-14; *see also* discussion below.

⁵¹ We will sometimes refer to affiliated carriers as members of a carrier “family,” using the commonly used name for the entities: e.g., T-Mobile West LLC dba T-Mobile and MetroPCS California, LLC dba MetroPCS will be collectively referred to as T-Mobile.

⁵² Exhibit 16, ORA/Selwyn June 1 Testimony, at 39. Verizon Wireless was until this year affiliated with the legacy Verizon wireline network (formerly GTE in California), and as such, may have had an advantage in its initial build out of a mobile network.

⁵³ *19th Wireless Competition Report* (Sept. 23, 2016), at p. 15, Tables II.C.1 and 2, available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0923/DA-16-1061A1.pdf; *see also* Exhibit 54 (Roycroft June 1) at 64. .

⁵⁴ Verizon Wireless submitted initial responses to the OII Information Requests as Verizon, California Inc., the former incumbent (ILEC) landline company. *See* Exhibit 32, Verizon California Inc. Objections and Responses to Initial Information Requests. *See also* Exhibit 34, Responses of Verizon affiliate MCI to Initial Information Requests, at 1 (“MCI operating entities

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While our examination of telecommunications competition does not extend to edge services, we note that several of the major telecommunications carriers in California are affiliated with companies that have ownership or license stakes in edge service content – and that customer access to such affiliated content is sometimes part of the bundle of services a customer acquires with telecommunications service.⁵⁵

4.2.3. Past Policies to Promote Competition

The URF decisions are the most recent in a century of regulatory policy promoting competition among telecommunications providers. It is difficult to establish a starting point for this trend, but historians point to the 1913

(referred to herein as Verizon” include: MCI Communications Services d/b/a Verizon Business Services; MCImetro Access Transmission Services LLC d/b/a Verizon Access Transmission Services; and TTI National, Inc.).

⁵⁵ See May 3, 2016 Assigned Commissioner and ALJ Ruling on TURN’s Motion to Compel [and] Comcast’s Objection to Writers Guild of America West’s Acknowledgment [re access to confidential information], at fn 10 (pp. 6-7), describing how Comcast’s content-related affiliates that negotiate directly with WGAW, including National Broadcasting Company, Universal City Studios, and E! Network Productions, LLC. Other carriers involved in this proceeding also have affiliation with content providers. AT&T has merged with DIRECTV, and has rights to or a stake in NFL Sunday Ticket, ROOT SPORTS, The Tennis Channel, MLB Network, NHL Network, and GSN (Game Show Network). See AT&T Completes Acquisition of DirecTV, at http://about.att.com/story/att_completes_acquisition_of_directv.html (visited April 28, 2016) (also noting AT&T’s joint venture with Otter Media and its stake in Fullscreen – both apparent content-related relationships). Verizon acquired AOL last year, and recently acquired a stake in Awesomeness TV. See “Verizon Buys a Stake in Awesomeness TV ...”, at <http://techcrunch.com/2016/04/06/verizon-buys-a-stake-in-awesomenesstv-to-bring-exclusive-videos-to-its-streaming-service-go90/> (visited March 28, 2016). The AOL acquisition also includes stakes in content providers like the Huffington Post, Engadget, and Techcrunch. See “Verizon to buy AOL for \$4.4bn” at <http://www.bbc.com/news/business-32702558> (visited April 29, 2016). As noted in recent press reports, Verizon has also purchased another edge provider, Yahoo. See “Verizon to acquire Yahoo’s operating business,” available at <http://www.verizon.com/about/news/verizon-acquire-yahoos-operating-business> (“Transaction will create a new rival in mobile media technology reaching over 1B users* with an unrivaled roster of the world’s most beloved brands”). Indeed, even the fact that a group like WGAW, fairly unknown to CPUC proceedings at the time of URF, is now a participant in our proceedings indicates the shift that has occurred.

Kingsbury Commitments, in which AT&T agreed to interconnect its long-distance operation with non-affiliated local telephone companies in order to settle a Department of Justice (DOJ) investigation into its burgeoning monopoly.⁵⁶

When competition nevertheless stalled,

[L]egislatures enacted rate schedules to fix the prices a utility could charge. As this job became more complicated, legislatures established specialized administrative agencies, first local or state, then federal, to set and regulate rates. The familiar mandate in the enabling Acts was to see that rates be ‘just and reasonable’ and not discriminatory.⁵⁷

This public utility rate-of-return model strengthened the AT&T monopoly on local and long-distance telephony.

⁵⁶ Former FCC Commissioner William Kennard described the Kingsbury Commitments as follows:

In 1913, the federal government was considering an antitrust suit against AT&T. Faced with the unhappy prospect of a government suit, the company reached an agreement with the federal government. The agreement was called the Kingsbury Commitment. It stipulated, basically, that AT&T had to interconnect with independent carriers, and open the phone network to competition. The agreement made sense in theory, but in practice it was a bust. AT&T and the independents agreed to divvy up their territory, and the companies soon had monopolies in the local and long-distance markets. Eventually AT&T began to buy the independents, and for much of the 20th century, the story of the phone industry was a story of monopoly markets, high prices and no consumer choice.

Remarks by FCC Chairman William E. Kennard to New York City Bar Association; February 14, 2000, reported at 2000 FCC LEXIS 691; *see also In re App'n of GTE to Acquire Telenet*, 72 F.C.C.2d 91, at ¶ 35 (1979) (“In the 1913 Kingsbury Commitment AT&T agreed not to acquire any more independent telephone companies without the prior approval of the Interstate Commerce Commission”).

⁵⁷ *Verizon Communications Inc. v. FCC*, 535 U.S. 467,, 477 (2002) (citations omitted).

In the early 1970s, Microwave Communications Inc., better known as MCI, built a point-to-point private-line service over microwave between St. Louis and Chicago, and began to offer long distance service, challenging AT&T's long-standing local-long distance monopoly.⁵⁸ This challenge ended in victory for MCI in 1982, when Judge Harold Greene accepted a Modified Final Judgment in *United States v. AT&T*, another DOJ prosecution of AT&T for antitrust violations.⁵⁹ The Judgment resulted in the break-up of AT&T into a number of Regional Bell Operating Companies (Regional Bells). The AT&T that remained was limited to long-distance and competitive local exchange service. One of its main competitors in the long-distance market was MCI, which later became part of Verizon.

While the Modified Final Judgment promoted long-distance competition, the Regional Bells maintained a near monopoly on local service. In an attempt to introduce competition in the local or "last mile" segment, the Telecommunications Act of 1996⁶⁰ (1996 Act or Act) subjected the incumbent carriers "to a host of duties intended to facilitate market entry" for competitors,"⁶¹ expanding "the ability of competitors to access the legacy incumbents' networks when providing local service."⁶² It initiated a regime of

⁵⁸ See *U.S. v. AT&T*, 552 F.Supp. 131 (D.D.C. 1982) (Modified Final Judgment); STEVE COLL, *THE DEAL OF THE CENTURY - THE BREAKUP OF AT&T* (Atheneum, 1986).

⁵⁹ *United States v. AT&T*, *supra*.

⁶⁰ Pub. L. 104-104, 110 Stat. 56.

⁶¹ *AT&T v. Iowa Utilities Board*, 525 U.S. 366, 371(1999).

⁶² D.06-08-030, Slip Op. at 79.

“cooperative federalism” between the FCC and state utility agencies to accomplish that goal.⁶³

5. Definition of the Telecommunications Market

Parties offered varying definitions of the telecommunications market in California.⁶⁴ All parties agree the voice market includes traditional landline service, wireless service and VoIP telephony.⁶⁵ But we cannot ignore the fact that consumers want to use peer-to-peer applications, like Skype or FaceTime that offer real-time two-way voice communication but do not require phone numbers. A broadband connection enables customers to use these applications as well as to access the universe of edge services whose content travels over the same physical network. Indeed, telephone calls are a small subset of the packetized information that travels over the network today.⁶⁶

⁶³ See, e.g., *Global NAPs Inc. v. Verizon New England*, 444 F.3d 59, 72 (1st Cir., 2006).

⁶⁴ The Respondent carriers tend to see both the voice and broadband markets as unitary. See, e.g., Exhibit 5 (Aron) at 3 (“the rapid decline in ILEC residential and business lines, the rapid growth of wireless lines, the growth in VoIP service, the growth in wireless-only households, and the growth in broadband speeds and subscriptions, have continued unabated”), and 62-65 (reframing the question and concluding that wireless “impose a competitive constraint on wireline prices”). The Intervenor tend to see the market as segmented into separate markets for fixed and wireless voice, and fixed and wireless broadband. See e.g., Exhibit 16 (Selwyn) at 24 (“no question but that fixed wireline telephone service and mobile wireless voice 2 service are substitutes for many households, but certainly not for all”), *passim*; Exhibit 17 (Clark) at II-3 (“mobile and wireline broadband are not substitutes due to the unique capabilities of each service”).

⁶⁵ Although some parties would treat landlines and mobile service as separate markets.

⁶⁶ See, e.g., *Akamai’s State of the Internet*, Q1 2016 Report at 49 (showing mobile data overshadowing mobile voice by a roughly 10/1 ratio), available at <https://www.akamai.com/us/en/our-thinking/state-of-the-internet-report/global-state-of-the-internet-connectivity-reports.jsp> (*Akamai State of the Internet*).

When we issued URF I in 2006, Netflix streaming had yet to launch, YouTube was just a year old⁶⁷ and the iPhone had not yet made its market debut. In the intervening years, a variety of streaming video and audio applications proliferated and smartphones rapidly replaced landline phones as consumers' phones of choice. Today, voice service is typically bundled with some form of broadband whether as a wired or a wireless service; broadband is the means of transmitting VoIP voice calls that compete with traditional phone calls, as well as social networking platforms which incorporate both voice and text communications.⁶⁸ Traditional phone calls, VoIP, and broadband services all use the same physical network.

In short, the market we envisioned in 2006 is very different from the market that exists in 2016. As we anticipated, the traditional landline phone has given way to newer, mostly mobile, phone technology. What we did not anticipate is the evolution of the mobile phone from primarily a voice communications device to primarily an Internet portal in which voice is just one application among many. The creation of devices such as the iPhone, and the complementary evolution of the network from 2G to 3G to 4G LTE, have played a significant role in driving the demand behind this evolution. For that reason, it is only possible to understand the present-day voice market by understanding the broadband market of which it is a small but still important part.

Accordingly, the market that concerns us here is the telecommunications transport market, whether such transport services are delivered via copper wire,

⁶⁷ WGAW Opening Brief, at 3 ("Since the advent of streaming video, most notably the debut of YouTube in 2005 and Netflix's streaming business in 2007, use of this technology has become a defining feature of broadband utilization").

⁶⁸ Exhibit 5, AT&T/Aron June 1 testimony, at 8.

coaxial cable, fiber, radio waves, or some combination thereof. This market is in fact comprised of multiple submarkets, including voice and broadband, and retail and wholesale markets. We will examine those markets below, focusing on an intermodal retail voice market, and then on separate fixed and mobile retail broadband markets, as well as the various markets for wholesale inputs that support the retail market.

5.1. Retail Consumer Market

The retail portion of this market consists of traditional landline phone, cellular phone, and IP-based voice communication services.⁶⁹ The retail market is linked to a separate but related wholesale market for infrastructure access and transmission services necessary to transmit and complete telephone calls.

This definition, as in URF, is intended to encompass facilities-based communications between devices with phone numbers or IP addresses,⁷⁰ whether such calls involve transmission via TDM, GSM, LTE, VoIP or some combination thereof.

The data collected for this analysis excludes IP-based peer-to-peer applications supplied by edge providers such as FaceTime or other video chat programs; texting applications such as iMessage and WhatsApp; social networking applications such as Twitter, Snapchat and Facebook; applications such as message boards and Internet chat rooms that enable voice communication via IP addresses but without relying on phone numbers; and

⁶⁹ As described below, we exclude over-the-top voice (e.g., Skype), which we consider more of an edge service akin to Facebook or Twitter.

⁷⁰ *Open Internet Order, supra*, at ¶¶ 48, 319.

so-called “over the top” phone service obtained independently of a physical connection.⁷¹

There is almost universal agreement that bundling of services changes the analysis of competition in this market. Because of the convergence fostered by Internet Protocol, voice and broadband are sold as parts of a bundle, which makes it difficult to consider them separately.⁷² AT&T’s Katz explains that customer decisions regarding voice services may follow their decisions about broadband service: “the incremental cost of adding voice service to an AT&T bundle of data and television service is \$9.99 per month, while the stand-alone voice price is \$20 per month.”⁷³

Various indicia, including evidence cited by Dr. Aron and statements of the FCC, demonstrate that both fixed and mobile broadband are essential communications tools:

- The average American now makes or answers six phone calls per day, but also sends and receives 32 texts and spends 14 minutes on chat/VOIP. Social messaging applications such as WhatsApp, iMessage, or Kik, delivered over the “public Internet” and bypassing texting

⁷¹ Over the top voice providers do not own, control or operate their own transmission facilities, and until recently could not obtain telephone numbers. *See, e.g. Global NAPs v. CPUC*, 624 F3d 1225, 1230 (9th Cir. 2010) (“Global ... contracts with VoIP providers to transfer their broadband-Internet-based calls to traditional telephone lines”).

⁷² *See, e.g.*, Exhibit 6, AT&T/Katz June 1 Testimony, at 4 (“when multiple products are sold to consumers as part of a bundle, it may be difficult to assign revenue to each component of the bundle without suffering some degree of arbitrariness”), and at 16 (“The important issue for competition and consumer welfare is whether the presence of bundles exerts competitive pressure on the pricing of stand-alone voice service. The answer generally is ‘yes’”).

⁷³ *Id.* at 16, fn. 23, citing AT&T, “Shop,” available at https://www.att.com/shop/verse/offers.html?product_suite=DTV, site visited May 26, 2016 (for zip code 95120). The sale of voice and broadband in bundles also multiplies cost-attribution questions, as discussed below under “Cost and Just & Reasonable Service.”

fees from the users' wireless carriers, have also become popular;⁷⁴

- Broadband access to the Internet “drives the American economy and serves, every day, as a critical tool for America's citizens to conduct commerce, communicate, educate, entertain, and engage in the world around them”;⁷⁵
- The FCC emphasizes the importance of broadband for education: “Access to broadband has become essential for students in all levels of education. Fixed broadband access, combined with cutting edge educational tools and content, are transforming the educational landscape in America”;⁷⁶
- Even among the later-adopting “baby boomers,” the percentage of 55-64-year-old mobile subscribers with a broadband-enabled smartphone grew from forty percent in January 2013 to sixty-two percent in December 2014;
- Smartphone penetration for mobile subscribers in households with income of less than \$25,000 increased by almost fifty percent, from forty-three percent to sixty-one percent;⁷⁷ and
- Communications once confined to traditional wireline phone can now take place using mobile phone, over VoIP, through texting using mobile devices, email using the Internet and via applications such as Skype. Mobile technology has evolved to 4G LTE and is poised to move to 5G. The data to voice ratio on smartphones has soared to roughly 10:1.⁷⁸

⁷⁴ Exhibit 5 (Aron) at 8.

⁷⁵ *Open Internet Order, supra*, at ¶ 1.

⁷⁶ 2016 *Broadband Progress Report, supra*, at ¶ 71 (adding “Mobile broadband access does not currently provide the speeds or capacity that schools and libraries need.” Elsewhere, the FCC concludes that “fixed and mobile broadband each provide essential components of advanced telecommunications capability.” *Id.* at ¶ 24.

⁷⁷ Exhibit 5, at 28.

⁷⁸ *Akamai State of the Internet, supra*, at 49.

Therefore, in addition to looking at landline and mobile voice telephone service, we also examine availability, subscription, and concentration in the residential and mobile broadband markets.

The question posed in the original URF proceeding can now be restated as follows: (i) Is the voice market sufficiently competitive to ensure that customers receive satisfactory service at just and reasonable rates? (ii) To what extent is the larger telecommunications market (in which voice is embedded) competitive? And (iii) Is the market innovating and delivering services that meet the needs of consumers today and in the future?

After the passage of a decade, it is now clear that there is no “one size fits all” answer to this question for the entire state. To obtain a meaningful answer, we have to refine this question to take account of geographic and demographic differences. The competitive conditions that exist in a densely populated area like the Los Angeles basin differ considerably from those existing in a sparsely populated area like Shasta County. For that reason, we asked respondents for data broken down by geographic region and, within regions, by both the availability of competing services and by the numbers of subscribers to those competing services. We sought this data at the census block level, with the understanding that the more granular the data, the more meaningful the analysis.⁷⁹

The granular data allow us to not only look at statewide data, but also break the state up into regional sub-markets; within those sub-markets, we look

⁷⁹ The problem of granularity is illustrated by this comment, admittedly in a different context (national business data service vs. regional): “national shares greatly exaggerate competitive LEC presence, since there are many geographically diverse, and in some cases very small, competitive LECs, none of which competes across all the incumbent ... LECs’ footprints.” *BDS Order, supra*, at ¶ 216.

at the competitive options available to a typical subscriber. To the extent possible given the data at our disposal, we estimate customer choice, market share, and market concentration in each of these sub-markets.

With the data collected, we also aim to provide a descriptive snapshot of the functioning of the telecommunications market in California and to discuss the role of the Commission in relation to that market.

5.2. Wholesale Markets and Services

The 1996 Act required the owners of essential network infrastructure – in a typical case, the legacy incumbent carrier -- to sell competitors access to these network elements at a price based on the owner's long-term cost.⁸⁰ This model works to some extent, as witnessed by the CLECs presence in the business market, where the legacy incumbent (ILEC) sells or leases to a competitive carrier access to its last-mile loops. But when we look at intermodal competition, the picture is more complicated. Cable providers are not required to unbundle their local loops.⁸¹ Wireless carriers depend on the availability of backhaul from their antennas to the mobile switching and central offices upstream in order to operate their systems.

A wireless carrier that can obtain backhaul from an affiliated company at little or no cost is in a stronger financial position than a wireless carrier without similar backhaul access, which then has to pay the owners of backhaul

⁸⁰ 47 USC §§ 251-252; see also D.06-08-030, citing *Implementation of the Local Competition Provisions in the Telecommunications Act of 1996*, First Report and Order, 11 FCC Rcd 15499, ¶¶ 618-740 (1996) (*Local Competition Order*) (adopting cost-based price for UNEs designated as "Total Element Long-Run Incremental Cost" (TELRIC)); compare Exhibit 54 (TURN/Roycroft) at 86 ("After the regulatory structure that enabled [competitive] entry was dismantled, the residential CLEC industry collapsed").

⁸¹ *Open Internet Order*, *supra*, at ¶ 37 ("our forbearance approach ... includes no unbundling of last-mile facilities").

infrastructure for such access.⁸² To the extent that a wireless-only competitor has to purchase backhaul from an integrated wireless-wireline competitor, the former is at a potential cost disadvantage. If there is inefficiency in the backhaul market, then the degree that wireless competition can constrain landline prices is limited by that inefficiency. In this docket, we have not collected data on the price of backhaul service paid by wireless carriers. But we have collected data sufficient to identify that the provision of backhaul service is highly concentrated at a statewide level, and may be more highly concentrated within some regions.

To address these kinds of issues, we have asked whether wholesale markets are “efficiently competitive.”⁸³ By this we mean that there is

⁸² After selling its landline assets, Verizon announced the purchase of XO, set to close in 2017. See e.g., Gara, “Verizon To Buy XO Communications' Fiber Business For \$1.8B From Billionaire Carl Icahn,” Feb. 22, 2016 *Forbes*, available at <http://www.forbes.com/sites/antoinagara/2016/02/22/verizon-to-buy-xo-communications-fiber-business-for-1-8b-from-billionaire-carl-icahn/#7dce801249f0> (“Verizon’s acquisition may help the telecom giant bolster its cell network density”).

⁸³ OII at 9-11, citing *Local Competition Order*, *supra*. The FCC has used “efficient competition” (alternatively “efficiently competitive,” “efficient markets” or “market efficiency”) in different contexts, but the common element is the pursuit of maximum production at minimum cost. *Id.* at ¶ 363 (unbundling “consistent with Congress's overriding goal of promoting efficient competition for local telephony services, because it will allow, in the long term, new entrants using unbundled elements to compete on the basis of the economic costs underlying the incumbent LECs' networks”), ¶ 232 (“will allow new entrants to enter local markets by leasing the incumbent LECs' facilities at prices that reflect the incumbents' economies of scale and scope”); see also *In re 271 Application of Ameritech Michigan* 12 FCC Rcd 20543 (1997) at ¶¶ 289-290 (“[i]n order for competition to drive retail prices to cost-based levels, as occurs in efficient, competitive markets, new entrants must be able to purchase interconnection services, unbundled network elements, and transport and termination at rates that reflect forward-looking costs”); . *In re Prime Time Access Rule*, 11 FCC Rcd 546 (1995) at ¶ 24 and n. 46 (“By efficient, we mean that the market produces the quantity and quality of goods and services that society desires and prices the goods and services at the costs to society of producing them. Efficiency is lost however when a firm or group of firms “dominate” a market, i.e., exercise market power”). Another characteristic of efficient markets is the distribution of information among market participants and end-user purchasers, as discussed below in regard to “asymmetric information.”

competition at the wholesale level such that sellers of retail telephone service can obtain access to necessary infrastructure at competitive rates.⁸⁴

Wholesale services are the inputs a carrier needs to enter the retail marketplace and provide service. Their availability also affects the price charged by the carrier to its retail customers.⁸⁵ To facilitate market entry and put competitors on an equal footing, the Telecommunications Act of 1996 adopted mechanisms, enforced by the states, to require phone companies that owned necessary infrastructure to sell access to that infrastructure to non-owner competitors at cost.⁸⁶ In a 2002 Report to the Legislature, the Commission noted that the 1996 Act “seeks to open local markets to competition” by (among other things):

- Providing competing carriers with access to discrete parts of the ILEC network (called unbundled network elements (UNEs)), in order to serve customers; and
- Requiring ILECs [incumbent local exchange carriers] to sell to their competitors, at cost-based wholesale rates, any telecommunications services that the ILEC provides to its

⁸⁴ It would be an understatement to say that the concept of unbundling was controversial. As suggested by *URFI*, it led to years of litigation, leading to the rollback of some of the key pricing concepts for network access. See D.06-08-030, pp. 79-84, citing *United States Telecom Ass’n v. FCC*, 359 F.3d 554 (D.C. Cir. 2004) (*USTA II*); NEUCHTERLEIN AND WEISER, *DIGITAL CROSSROADS, TELECOMMUNICATIONS LAW & POLICY IN THE INTERNET AGE*, The MIT Press, 2d Ed (2013) at 52 (“The 1996 Act immediately spawned protracted litigation about the precise scope of [the CLECs’ network] leasing rights – litigation pitting the Bell companies and other incumbent local exchange carriers ... against their new local exchange rivals”).

⁸⁵ See, e.g., Exhibit 55, TURN/Baldwin June 1 Testimony at 5 (“Consumers pay more – not only for retail telecommunications services but also for the vast array of consumer products and services that are more costly for businesses to produce as a result of inflated special access prices”).

⁸⁶ See 47 USC §§ 251-252.

customers at retail rates in order to allow the CLECs to resell that service to customers (resale)”⁸⁷

The OII referenced four specific categories of wholesale inputs: local loops; special access; poles and conduit; and spectrum. While these categories are not exhaustive, they are sufficient to demonstrate the relationship of wholesale to retail competition. This topic is discussed below.

5.3. Are Fixed and Mobile Services Substitutes for One Another?

Finally, we ask a question that will inform our quantitative analysis of carrier data: to what extent are fixed and mobile services economic substitutes? We approach this question first by examining the voice submarket, then by examining the broader data market.

5.3.1. Substitutability of Voice Services

Almost by definition, wireless and wireline phones are functional substitutes for one another in the voice market. Each can do what the other does: make and receive phone calls based on the use of telephone numbers. While wireless phones have limitations such as poor signal availability or signal strength that wireline phones do not have, and wireline phones offer services that wireless phones do not offer, such as residential alarm service, for most customers in locations where signal coverage exists, either type of phone will do equally well for making or receiving a traditional telephone call.

It is agreed by the parties that cord-cutting in the voice market has grown more pronounced since 2008. Almost half of California households are wireless-only for voice service, and – if national data hold true for

⁸⁷ 2002 CPUC Report to the Legislature on the Status of Telecommunications Competition in California, available at <http://docs.cpuc.ca.gov/published//REPORT/16454.htm>, at fn. 15 and accompanying text.

California – another ~14 percent are wireless-mostly.⁸⁸ Still, more than half of California households still have a landline telephone, though this percentage keeps declining even as the population of the state increases. We are persuaded that wireless voice service is, in general, a reasonable economic substitute for landline voice service⁸⁹ – given the rapid and dramatic rise in wireless-only households, undisputed by parties in this proceeding, and the decline of landline voice connections,⁹⁰ yet such substitution has limits, as discussed below.

Sprint's citation to the Centers for Disease Control (CDC) Report on mobile substitutability, showing that 35.1 percent of households with both landlines and mobile phones receive almost all calls on their wireless phones, provides a clear example of substitutability in practice.⁹¹

Some intervenors argue that wireless is not a substitute for wireline service in the voice market because (a) their prices do not move together,⁹² and (b) many households choose to retain both types of service. As to the first argument, because the price of voice service from a wireless carrier is likely bundled together with the price for myriad other functions of the wireless device, it is impossible to determine the relative movement of prices for the voice functions alone. The same is true for landline voice service when it is obtained in a bundle

⁸⁸ As used by the CDC, meaning they receive all or almost all calls on their mobile phone.

⁸⁹ See discussion below of price elasticity.

⁹⁰ Between June of 2014 and June of 2015, wireless subscriptions in California grew from 37 to 40 million connections, while total wireline connections drifted downward from 15.6 to 15.1 million lines. See FCC 2016 report, *Voice Telephone Services: Status as of June 30, 2015* (August 2016), available at https://apps.fcc.gov/edocs_public/attachmatch/DOC-340665A1.pdf and state-specific California subscription numbers, available at <https://www.fcc.gov/wireline-competition/voice-telephone-services-report> (collectively *Voice Telephone Report*).

⁹¹ Exhibit 78 (Burt/Sprint June 1 Testimony) at 6.

⁹² See, e.g., Exhibit 16, ORA/Selwyn, at 36, 76-77 (wireless and wireline prices have not moved in tandem).

with broadband. As to the second point, customers may choose to retain a wireline phone even after acquiring a wireless phone for multiple reasons including emergency backup, ease of use, relationship of the phone number to a fixed geographic location, and other reasons.⁹³

We find several other arguments intervenors make more persuasive. Wireless service is not available throughout California. Where coverage is poor, mobile telephony is not a reasonable substitute for landline service. As CforAT argues, there are also some customers in California with particular communications needs – like medical devices or Teletypewriter (TTY) and relay service – that are best (or even only) served by landlines.

The ultimate question is whether the availability of wireless service alternatives disciplines the prices of wireline service. We believe it does, although the extent of that price discipline is unclear. Dr. Aron, in her June 1, 2016 testimony, cites econometric studies regarding the extent of wireless' price discipline upon landline service.⁹⁴ This effect, referred to as “positive cross-price elasticities of demand” for wireless service with respect to wireline service, also

⁹³ See, e.g., Exhibit 65, CforAT/Belser at 3 (“people with disabilities rely on each of the two forms of service for different purposes”); Exhibit 71, Greenlining/Goodman June 1 Testimony, at 2 (“For communities of color, wireless and wireline services are not substitutes”).

⁹⁴ Exhibit 5, Aron June 1 testimony at 31, fn 53, citing two studies that found “positive cross-price elasticities of demand for wireless service with respect to the price of wireline service, findings which permit us to conclude that wireless services impose a competitive constraint on wireline prices,” citing Michael R. Ward and Glenn A. Woroch, “The effect of prices on fixed and mobile telephone penetration: Using price subsidies as natural experiments,” *Information Economics and Policy* 22 (2010), pp. 18-32; Kevin W. Caves, “Quantifying price-driven wireless substitution in telephony,” *Telecommunications Policy* 35 (2011), pp. 984-998; and Jeffrey Macher et al., “Demand in a Portfolio-Choice Environment: The Evolution of Telecommunications”, Georgetown McDonough School of Business Research Paper No. 2012-19, August 20, 2012, available at SSRN: <http://ssrn.com/abstract=2133424>. Dr. Topper, testifying for Charter, Comcast, and Time Warner, also cites the Caves article, as well as a further article co-written by Glenn A. Woroch.

suggests that wireless service substitutes for landline service.⁹⁵ Dr. Roycroft raises the question whether such price discipline is “one-way” or “asymmetric”-- “wireless users are unlikely to find wireline service to be a reasonable substitute for the mobility associated with wireless voice services.”⁹⁶ We agree with Dr. Roycroft that, in the voice market, substitution is mostly one-way – wireless phones substitutes for landline phones, but not the other way around.

While we agree that there is imperfect (horizontal or adjacent-market) price discipline, and that the wireless alternative operates as a “check on residential local wireline phone prices,”⁹⁷ we are unable to quantify the extent of price discipline that wireless service provides with respect to landline service. We further note that any inefficiency within the wireless market will mute the price discipline that wireless would otherwise exert on landlines.

Dr. Aron, testifying on behalf of AT&T, and Dr. Selwyn testifying on behalf of ORA, both cite the CDC Report on mobile substitutability, but reach opposite conclusions on the issue.⁹⁸ The FCC also cites the CDC Report in its

⁹⁵ Dr. Selwyn responds that the three studies on mobile and landline voice prices cited by Dr. Aron do not amount to a “formal analysis as to the substitutability of wireless for wireline, such as cross-elasticity studies, pricing behavior, or other hard evidence.” Exhibit 21, ORA/Selwyn July 15 Rebuttal Testimony, at 12.

⁹⁶ Exhibit 54, Roycroft June 1 Testimony, at 31.

⁹⁷ Exhibit 28, Cox/Gillan at 18 (“So long as wireless service is a substitute at the margin – i.e., it will be the relevant price to consumers making a decision – then wireline phone providers must consider the prevailing wireless price when pricing their own services”). Gillan is here speaking of residential/consumer phone service; he offers a more nuanced view of the business market, as discussed below.

⁹⁸ CDC Report on “Wireless Substitution” (December 2015). The 2015 CDC Report is available at <http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201512.pdf>. Aron emphasizes “the percentage of California adults living in wireless-only households has increased each year for which data are available, and according to the most recent survey nearly 43 percent of adults in California live in wireless-only households.” Aron, June 1, at 29, citing CDC figures through 2014. Earlier, and more correctly, she had described the “steady increase in adults and children

(footnote continued on next page)

18th Annual *Wireless Competition Report*, agreeing that the CDC Report shows a marked shift towards wireless-only households, while avoiding any final conclusion about substitutability.⁹⁹ The latest CDC Report notes that, while wireless-only rates in the 25-34 year-old demographic are between sixty-seven and seventy-one percent, the rate is lower for people between the ages of 45 and 64, forty-one percent of whom live in wireless-only households.¹⁰⁰ And the wireless-only rate is still lower for people over 65 – nineteen percent of adults in that age group live in wireless-only households. Yet there is a clear trend for every age group towards higher wireless-only rates based on seven successive CDC data samples from 2012 to 2015. The CDC Report also indicates that low-income customers are more likely to cut the cord than more affluent consumers.¹⁰¹ This Report also indicates that thirty-five percent of households with both landline and cellular phones receive all or almost all calls on cell phones.¹⁰² Indeed, sixty-two percent of households in America are wireless-only or wireless-mostly.

living in households with only wireless telephone service, from less than 5 percent in 2003 to 46.7 percent of adults and 55.3% of children in 2015.” March 15, 2016 testimony, at fn 64 (citing more recent CDC studies). Dr. Selwyn notes that the CDC study is based on close to 20,000 “in person interviews,” conducted around the country, but finds the results do not completely square with California data from the FCC, and likely underestimate the number of homes with continued wireline service. Exhibit 16, ORA/Selwyn June 1 Testimony, at 12, and fn. 8.

⁹⁹ FCC 18th *Wireless Competition Report*, at ¶156.

¹⁰⁰ 2015 *CDC Report*, *supra*, at Table 2 (71.3% of adults aged 25-29 and 71.3% of adults aged 30-34 living in wireless-only households, 40.8% of adults age 45-64 living in wireless-only households).

¹⁰¹ Exhibit 54, Roycroft (June 1, at 74); *see also* 2015 *CDC Report*, at Table 2 (59.3% of “poor” households wireless only, vs. 45.7% “not-poor” and 54.4% of the near-poor, persons between 100% and 200% of the federal poverty level; educational attainment: 49% of those who did not graduate high-school vs. 43.5% with a 4-year college degree or higher).

¹⁰² *CDC Report*, at 3.

CALTEL raises the issue of comparing an individual mobile subscription with a household landline subscription. Because a household with one landline may have multiple mobile subscriptions, it makes little quantitative sense to compare household subscriptions directly with individual subscriptions. We address this issue in Section VI, below.

Finally, the parties raise questions about whether the “either/or” dichotomy between fixed and mobile services even remains meaningful. TURN suggests integrated wireline-wireless voice providers may not be as worried about losing landline customers as a wireline-only company.¹⁰³ Verizon Wireless notes the “incorrect premise that ‘wireless and wireline service’ are the *only distinct and relevant categories* within the broader rubric of voice communications or communications generally,” noting *inter alia*, the increased use of hybrid fixed/mobile services that are Wi-Fi-only or Wi-Fi first.¹⁰⁴

Our quantitative analysis of data provided on residential voice deployment and subscription will treat mobile voice and landline voice as functional equivalents, subject to the limitations discussed above, including:

- wireless coverage gaps and weak wireless signals or weak indoor wireless signals; and

¹⁰³ Exhibit 54, Roycroft June 1 at 129 (“When wireline prices are increased, some of the customers who drop wireline will instead use wireless services more intensively, resulting in increased revenues from wireless mobility operations.” The wireline firm “will recapture some of the lost revenues”), comparing AT&T and Verizon to wireline-only companies such as Frontier and Consolidated, who were not, Roycroft states, able to raise their prices as steeply as AT&T.

¹⁰⁴ Exhibit 36, Verizon/Vashington June 1 “Objections & Responses,” at 4-6 (emphasis in original), citing in particular cable operators like Comcast that “are rapidly deploying Wi-Fi access points,” and Google’s Project Fi, a service that looks first to Wi-Fi coverage and then defaults to MVNO cellular coverage provided by Sprint and T-Mobile when Wi-Fi not available).

- special needs of customers with disabilities for the features provided by landline service, such as compatibility with medical devices or with TTY and TTY relay services.¹⁰⁵

We examine first the fixed voice market, then the mobile market, and conclude with an analysis of competition in the intermodal voice market.

5.3.2. Substitutability of Residential and Mobile Broadband/Data Services, Segmentation by Speed

In defining whether residential and mobile broadband are separate and complementary markets, or substitutable for one another and therefore part of the same market, we apply a similar analysis as that described above with regard to the substitutability of voice services. Here, however, we arrive at a different result: while mobile voice service generally substitutes for landline voice service, mobile and residential broadband services are generally complementary, not substitutes.

Residential broadband service is typically delivered over coaxial cable or existing phone lines using DSL technology.¹⁰⁶ Wireless data services access the Internet using a mobile phone (or tablet), and, in wireless' current leading technology, the 4G LTE protocol, which can provide download speeds faster than DSL but is often slow and unreliable compared with Internet provided over cable or fiber.¹⁰⁷

¹⁰⁵ We note that these types of needs will not be captured in our quantitative analysis of carrier data. But we remain mindful that such needs exist and we will continue to support the telecommunications needs of customers with disabilities.

¹⁰⁶ Other products include AT&T's U-Verse and the former Verizon (now Frontier's) FIOS (fiber-to-the-premises). Technologies with few subscribers in California are fixed wireless and satellite technologies, as described further below.

¹⁰⁷ To complicate this picture further, people receiving cable Internet at their homes frequently employ a wireless router (home Wi-Fi) that allows their mobile phones and other Wi-Fi enabled devices to access the Internet without incurring data usage charges on their mobile phone bills.

While residential and mobile broadband data services are in many respects functional substitutes – both services allow users to access email, browse the web, stream audio and video content, etc. – lower data caps and much higher data use charges suggest that they are not reasonable economic substitutes at present. TURN’s expert Dr. Roycroft notes that LTE-based mobile data service may offer speeds faster than DSL service but slower than cable service, though mobile carriers may limit data speeds for a variety of reasons.¹⁰⁸

Dr. Roycroft also notes that low data caps and metered usage substantially limit mobile data’s substitutability for home broadband. He calculates that an average home broadband customer would have to pay between \$750 and \$1,125 per month to satisfy their home broadband usage with mobile data.¹⁰⁹ Using a similar approach, WGAW calculates that a data capped mobile data connection used for 147 hours of HD video in a month would cost over \$700 per month for a tablet and over \$300 per month for a smartphone.¹¹⁰ WGAW notes that available “unlimited” mobile data plans either: 1) reduce the quality of all video, or 2) “throttle” user speeds after a set amount of data is used each month.¹¹¹

Consistent with their view that this proceeding should be confined to voice service, many carriers limit their discussion of broadband (if any) to whether it can support VoIP telephone service. AT&T’s expert Dr. Aron, for example, does not differentiate between wireless and fixed broadband in analyzing Californians’ access to broadband service, finding that nearly one hundred

¹⁰⁸ Ex. 54 at 41 (Roycroft/TURN June 1 Testimony).

¹⁰⁹ Ex. 54 at 42-43 (Roycroft/TURN June 1 Testimony).

¹¹⁰ Exhibit 61 (Blum-Smith/WGAW June 1 Testimony) at 5-7.

¹¹¹ *Id.* at 8.

percent of the census blocks in AT&T's service territory have access to advertised download speeds of at least 10 megabits per second.¹¹² She argues that nearly all mobile data service offers speeds necessary for VoIP, which competes with traditional landlines.¹¹³ Reflecting this view, the Coalition¹¹⁴ urges us to consider the role of broadband in the market only to the extent that it enables VoIP, and as such broadband should be examined at speeds as low as one hundred kilobits per second. At such speeds, the Coalition claims that ninety-nine percent of Californians have access to three or more broadband providers offering speeds adequate for VoIP.¹¹⁵ This argument is, however, irrelevant to the broader question as to whether – generally speaking – fixed and wireless broadband are substitutes or complements.¹¹⁶ Rather, this argument raises a distinct but related question: what is the role of broadband speed in segmenting the data

¹¹² Exhibit 5 (Aron/AT&T) at 35.

¹¹³ *Id.* at 32.

¹¹⁴ For briefing purposes, Respondents formed a Coalition consisting of all Respondents except Sprint Telephony PCS, LP and, SureWest Telephone (aka Consolidated): Citizens Telecommunications Company of California, Frontier California Inc., Frontier Communications of America, Inc., Frontier Communications of the Southwest, Inc., Comcast Phone of California, LLC, T-Mobile West LLC d/b/a T-Mobile, California Cable & Telecommunications Association, Time Warner Cable Information Services (California) LLC, Charter Fiberlink CA-CCO, LLC, Cox California Telcom, LLC, AT&T Services, Inc., AT&T California, Inc. and New Cingular Wireless PCS, LLC. *Compare* OII Ordering Paragraph 3.

¹¹⁵ Coalition Opening Brief at 28.

¹¹⁶ The fact that VoIP requires much lower bandwidth than other “Advanced Services” may be important for our analysis of the voice submarket, as wireless and home broadband services are frequently capable of supporting VoIP, even if they offer only low-speed broadband. But we decline to analyze the broader data market at the lowest-possible speeds adequate for VoIP service for several reasons: 1) very few Californians in 2016 subscribe to data services at such low speeds; 2) Californians are moving toward high-speed broadband for a multitude of non-voice services, and limiting our analysis to the speeds required for voice would ignore the uses to which Californians actually apply their data subscriptions; 3) individuals in a household may use data services concurrently rather than sequentially; and 4) the difficulty in applying the same metrics and criteria to facilities-based and over-the-top (OTT) VoIP, as discussed further below.

transmission market. There is little doubt that Californians voting with their feet, and transitioning to faster broadband services when they are available, with almost no subscription at the low data rates the carriers suggest are adequate for VoIP.¹¹⁷

ORA rejects the Coalition approach, arguing that home broadband at speeds of 25/3¹¹⁸ is the relevant broadband market and agreeing with TURN that carrier-imposed data caps and other problems with mobile data service render it a compliment to home Internet service rather than a substitute.¹¹⁹ In support of that argument, ORA points to speeds, prices, reliability, and availability as limitations on mobile data service that render it an inadequate substitute for home broadband.¹²⁰ Citing the FCC's 2016 *Broadband Progress Report*, ORA also argues that the FCC has found that mobile data service is not a functional equivalent to home broadband.¹²¹

In evaluating these competing arguments, we begin by agreeing with TURN that the 25/3 speed tier, the FCC's current benchmark for "Advanced

¹¹⁷ 2016 *Broadband Progress Report*, at ¶ 53 ("The past year has seen rapid expansion in service offerings far exceeding the 25 Mbps/3 Mbps threshold, including services at speeds greater than 100 Mbps. Moreover, as many commenters observe, consumers have increasingly flocked to these higher-speed services, belying the notion that the 25 Mbps/3 Mbps benchmark is somehow divorced from the needs of today's consumers"). See September 2015 *Annual DIVCA Report for the Year Ending December 31, 2013 (2015 DIVCA Report)* at 37-39, available at http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Communications_-_Telecommunications_and_Broadband/Service_Provider_Information/Video_Franchising/DIVCAReportSept_10_2015.pdf.

¹¹⁸ "25/3" means not less than 25 megabits per second (Mbps) download speed and not less than 3 Mbps upload speed.

¹¹⁹ Exhibit 17 (Clark/ORA June 1 Testimony). at II-3-II-10.

¹²⁰ *Id.* at II-3-II-10.

¹²¹ *Id.* at II-2.

Services,”¹²² represents a useful, reasonable, and forward-looking dividing point to define a “high-speed” broadband tier. We note that higher speeds improve the performance of video streaming services from companies like Netflix and Amazon, and live-video feeds from companies like Facebook¹²³ and Twitter.¹²⁴ While Netflix recommends a five Mbps connection for high definition video streaming, households that include multiple end-users using multiple devices to access multiple services at the same time may find that download speed inadequate.

ORA points out that video streaming and other high data usage applications require more than just bandwidth – data caps and latency also impact the user experience of such services.¹²⁵ We do not have adequate data collected in this proceeding to comprehensively analyze the data caps and latency of different services available to different customers. But we

¹²² The FCC explains the difference between “broadband” and “advanced telecommunications capability” in Footnote 1 of its 2016 *Broadband Progress Report*, although we are unsure if this distinction makes a difference in the instant analysis:

For simplicity in past inquiries, the Commission has sometimes used the term “broadband” to refer to “advanced telecommunications capability.” However, “advanced telecommunications capability” is a statutory term with a definition that differs from the term “broadband” as it is used in other contexts. See 47 U.S.C. § 1302(d)(1) (“The term ‘advanced telecommunications capability’ is defined, without regard to any transmission media or technology, as high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology.”). Thus, in this Inquiry, we do not equate the term “broadband” with the statutory term “advanced telecommunications capability,” but we do necessarily consider the availability of various broadband services that contribute to advanced telecommunications capability in our analysis under the statute.

¹²³ Via its Facebook Live application, see <https://live.fb.com/about/>.

¹²⁴ Via its Periscope application, see <https://www.periscope.tv/>.

¹²⁵ Exhibit 17, ORA/Clark June 1 Testimony, at II5-7, *passim*.

acknowledge that mobile data service typically has lower data caps than home broadband.¹²⁶ A significant justification cited by the FCC in its 2015 *Broadband Progress Report*, in creating the new 25/3 benchmark, was that households may be comprised of multiple individuals using multiple devices.¹²⁷ The FCC has periodically raised the minimum bandwidth for “Advanced Services” over the last decade,¹²⁸ and it is reasonable to anticipate that “Advanced Services” will not be static in the next decade. Fixed providers (especially cable providers) are already routinely offering speeds substantially in excess of the 25/3 benchmark.

We are persuaded that mobile data service, at present, is not a reasonable substitute for home broadband service. Data caps and higher data usage charges for phone-based Internet access limit the ability of Californians to use their mobile data subscription to meet all of their data needs. Likewise, the non-mobile nature of home broadband makes it a poor fit for Californians’ need for mobile data.

¹²⁶ To complicate this picture, people receiving fixed BIAS at their homes frequently employ a wireless router (home Wi-Fi) that allows their mobile phones and other Wi-Fi enabled devices to access the Internet without incurring data usage charges on their mobile phone bills. We recognize that mobile carriers are offering “zero-rated” streaming service that does not count the use of certain streaming media against a user’s data cap. The FCC is currently considering whether “zero-rating” is permissible under the *Open Internet Order*.

¹²⁷ *In re Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, (GN Docket No. 14-126), 30 FCC Rcd 1375, released February 4, 2015, at ¶ 3 (2015 *Broadband Progress Report*). The FCC notes that “[t]he average household has more than 2.5 people, and for family households, the average household size is as high as 4.3.” *Id.*

¹²⁸ Exhibit 16, ORA/Selwyn June 1 Testimony, at 79 (“In 2010, the FCC adopted a benchmark transmission speed for residential broadband of 4 Mbps down and 1 Mbps up, yet just five years later, the FCC increased its minimum standard for consumer broadband to 25/3,” citing *Connecting America: The National Broadband Plan* (March 17, 2010) at 135, available at <https://www.fcc.gov/general/national-broadband-plan> (*National Broadband Plan*), and 2015 *Broadband Progress Report*, *supra*).

Further, the cord cutting trends evident in the voice market are not present in the broadband market (i.e., the abandonment of wireline service for wireless),¹²⁹ as both residential and wireless subscriptions continue to increase (more slowly in the case of wireline). The FCC noted in its 2015 *Broadband Progress Report* that “many households subscribe to both fixed and mobile services because they use fixed and mobile services in fundamentally different ways and, as such, view fixed and mobile services as distinct product offerings”¹³⁰ and that “fixed and mobile broadband might be complementary, rather than substitutes, and might warrant different speed and non-speed benchmarks.”¹³¹ In its 2016 *Broadband Progress Report*, the FCC was more emphatic: “fixed and mobile broadband are not functional substitutes.”¹³²

The growth of residential & mobile broadband subscription is illustrated below:¹³³

¹²⁹ Another sort of “cord-cutting” is observable, however, in the broadband market, as end-users appear to be terminating their video (cable tv) service in favor of broadband and “over-the-top” programming. See 2015 *DIVCA Report*, *supra*, at 18, 28.

¹³⁰ 2015 *Broadband Progress Report*, *supra*, at ¶ 120.

¹³¹ *Id.* at ¶ 11. Note that in its 2016 *Broadband Progress Report*, the FCC declined to set a speed benchmark for mobile “advanced services” due to an insufficient record. See 2016 *Broadband Progress Report*, *supra* at ¶ 58.

¹³² *Id.* at ¶ 1, ¶ 17 (“both critically important services that provide different and complementary capabilities, and are tailored to serve different consumer needs”), *passim*.

¹³³ But note that a much higher percentage of households subscribed to residential broadband in December 2008 than the percentage of individuals in California subscribing to mobile data service. In other words, the residential broadband market is limited by the number of households in California and was closer to saturation than the mobile data market.

Statewide Broadband Subscriber Growth Rates (millions)¹³⁴				
	Residential	% Change	Mobile	% Change
December 2008	9.2		3.5 million	
June 2011	10.2	10.9%	15.8	451.4%
June 2013	10.9	6.9%	23.2	146.8%

Screen size may also be an important factor in differentiating uses to which fixed and mobile broadband are put. There are many activities such as editing documents and viewing video content, for instance, for which the mobile phone is ill-suited.¹³⁵

We recognize that the deployment of linked Wi-Fi networks may increase the mobility of “home” broadband.¹³⁶ But at present, we do not view such networks as sufficiently developed to serve as a functional equivalent to mobile service for most Californians.

Likewise, we recognize that forthcoming mobile technologies, like 5G service, may offer faster speeds and higher data caps that render mobile a closer substitute for home broadband. But the standard for 5G service remains unfinished, and its implementation problems are formidable, as discussed below.

¹³⁴ 2015 *Market Share Report*, at 30.

¹³⁵ See Exhibit 71. Greenlining/Goodman June 1 Testimony, at 3 (“When given a choice, consumers prefer a device with a larger screen that uses a home broadband connection for tasks such as watching video, while they prefer to use their phone for tasks such as getting in touch with family or friends”), Pew *Home Broadband 2015 Study* (December 21, 2015), at 3, available at <http://www.pewinternet.org/2015/12/21/home-broadband-2015/> (last accessed June 1, 2016) (hereafter, Home Broadband Report (Attachment C)). We are cognizant of the fact that the mobile phone can be used as a hot-spot for larger devices, or that air cards can enable larger devices to connect to mobile networks, but such uses remain subject to consumer price constraints we describe below. We also note the increasing use of tablets, which partially ameliorates the screen-size issue.

¹³⁶ See n. [104], *supra*.

Once operational, 5G will undergo testing and require network upgrades before it is deployed on a wide, commercial basis. If the promises of 5G development materialize, then our analysis of mobile/home broadband substitution will need to be revisited.

6. Analysis – What the Data Tell Us

6.1. Methodological Issues

Before discussing the results of this inquiry, we take note of certain methodological issues we encountered and the limitations of the data we collected.

6.1.1. Availability Overstatement

We have collected availability information, for both voice and data services, at the census block level. A carrier will report that it provides service to a certain census block even if it offers service only one household in that census block. Unfortunately, although we recognize that this is a problem, particularly in more remote areas (rural census blocks tend to be much larger than urban census blocks), we lack subscription data sufficiently granular to reliably estimate the size of this effect. Our analysis partially compensates for this effect by only recognizing a service's availability in a census block if that service has at least one actual subscriber in the census block. We recognize that availability will remain overstated in spite of this compensation.

6.1.2. Comparing the Numbers of Landline and Mobile Subscribers

CALTEL raises the issue of how an individual subscription service, like mobile, should be compared to a household subscription service, like landlines. Landline subscriptions are per household; mobile phone subscriptions are per user. To compare the sizes of the user bases for each type of telephone requires adjusting the landline subscriber numbers to reflect the number of landline

telephone users per household. In order to address this difference, multiply the number of landline subscriptions by the average number of people, ages 10 and up, living in a household in each respective region. In the regions examined, the multiplier ranges from 1.95-2.45. We also present an unadjusted “line count” concentration measure using the HHI.¹³⁷

6.1.3. Estimating Landline Telephone Users

We recognize that even with a household size adjustment, we can only approximate the number of actual landline telephone users in any geographic region and this, in turn, renders our estimates of market concentration less precise than we would like them to be. Further, in households with both a landline telephone and one or more cell phones, it may be that the landline telephone is there only for emergency use or that only some of the people in the household use the landline telephone. We lack data sufficient to refine our estimate of landline telephone users to those who live in a household with both types of phones but are entirely or mainly landline telephone users. At best we can say that the number of landline telephone users is substantially greater than the number of landline telephone subscribers.

6.1.4. HHI: Measuring Market Share/Concentration

The parties disagree on the value of HHI measurements. Both Drs. Aron and Selwyn agree that the Commission did not rely on, and was in fact very

¹³⁷ See DoJ/FTC *Horizontal Merger Guidelines*, available at <https://www.justice.gov/atr/horizontal-merger-guidelines-08192010#5c>. HHI is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers, and can range from close to zero to 10,000. FTC/DoJ considers a market with an HHI of less than 1,500 to be an unconcentrated marketplace, an HHI of 1,500 to 2,500 to be a moderately concentrated marketplace, and an HHI of 2,500 or greater to be a highly concentrated marketplace. *Id.* at § 5.3. As a general rule, mergers that increase the HHI by more than 200 points in highly concentrated markets “will be presumed to be likely to enhance market power.” *Id.*

critical of, HHI measurements in the URF decisions. Dr. Aron contends that URF considered other quantitative evidence of competition;¹³⁸ Dr. Selwyn counters that neither HHI nor other quantitative evidence was considered.

In URF I, the Commission found:

The calculation of HHI values provides no information relevant to our assessment of ILEC market power, because rapidly changing technological and market conditions undercut our ability to use HHI as a measure of market power.¹³⁹

The Commission also was skeptical of the use of related market share metrics.

“Market share tests are inherently backward looking and not good predictors of future developments, particularly in a rapidly changing industry like telecommunications.”¹⁴⁰

HHI is, however, one tool to measure market concentration, which (as we will discuss below) has not disappeared in the post-URF world.¹⁴¹ Mindful of warnings from several experts, we will not reflexively resort to HHI as the sole measuring stick for market power; nor will we ignore it.

It should also be noted that because of resource constraints we are only able to present HHI calculations for the largest California markets, also known as

¹³⁸ Exhibit 7, July 15, 2016 Aron Rebuttal Testimony, at 12-13.

¹³⁹ D.06-08-030, Finding of Fact 52.

¹⁴⁰ *Id.*, Slip Op. at 128, Finding of Fact 57.

¹⁴¹ The Department of Justice continues to suggest the use of HHI as one method to measure competition and market concentration. See DoJ January 2010 Comments in FCC Docket 09-51, *In re Economic Issues in Broadband Competition*, at 13 (“The Department recommends that the Commission develop a classification for evaluating the degree of competition in different broadband markets using a method of analysis similar to that set forth in the *Horizontal Merger Guidelines*. In part, this could involve measuring market concentration in various local markets using the HHI metrics. Such measurements might be calculated separately for services with differing capabilities, and such classifications might shift over time as demand migrates to applications requiring faster speeds.”)

Metropolitan Statistical Areas (MSAs).¹⁴² Those markets include 23,276,123 Californians, roughly 60 percent of California's population, and are presumed to contain the least concentrated markets in the State. With some exceptions,¹⁴³ the remaining 40 percent of Californians generally live in less densely populated MSAs and counties that we expect would be more concentrated for every product market we examine.¹⁴⁴ These are counties where there are typically three or fewer providers. The lowest possible HHI in a market with three providers is 3,333 which is a highly concentrated market. Indeed, even a market with four providers with precisely equal market shares will have an HHI of at least 2,500, on the border between moderately and highly concentrated.¹⁴⁵

For purposes of analyzing market concentration using HHI, a market needs at least five providers to be moderately concentrated (between 1500 and 2500), and at least seven providers to be unconcentrated (below 1500). Due to limited overbuilding of legacy telephone and cable networks, geographic sub-markets will usually require at least three mobile voice providers – more than two of them – in order to reach moderate concentration. We have examined the largest markets in California.¹⁴⁶ We expect that more remote regions, where

¹⁴² Staff performed an HHI analysis for Los Angeles, Oakland, Sacramento, San Diego, San Francisco, and San Jose areas, breaking out San Francisco and Oakland areas even though they are in the same MSA.

¹⁴³ The notable exceptions would be the intermodal voice market in counties where most of the population has robust access to wireless voice.

¹⁴⁴ Apart from the Riverside, Oxnard, and Santa Rosa-Petaluma MSAs, remaining MSAs include Santa Barbara-Santa Maria-Goleta, Fresno, Bakersfield, Stockton, Modesto, San Louis Obispo, Salinas, Yuba City, Vallejo-Fairfield, Santa Cruz-Watsonville, Truckee-Grass Valley, Madera, Visalia-Porterville, Merced, Chico Redding, El Centro, Hanford-Corcoran, Eureka-Arcata-Fortuna, Ukiah, Clearlake, Red Bluff, CA Susanville, and Crescent City.

¹⁴⁵ See DOJ/FTC *Horizontal Merger Guidelines*, *supra*, at § 5.3 (Market Concentration).

¹⁴⁶ Consolidated Communications argues that Placer County is a particularly competitive market that we have not specifically analyzed here. We anticipate that other counties, including

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cell service and cable are not as well deployed, will generally be more highly concentrated.

6.1.5. Broadband Speeds – Advertised vs. Actual.

In reporting fixed broadband speeds in this report, we are largely reliant on what the carriers report. Unlike mobile broadband, where the CPUC has a robust testing program, this Commission does not have sufficient data to draw conclusions about non-mobile broadband quality and speeds. The FCC's Office of Engineering and Technology, on the other hand, has placed measuring devices¹⁴⁷ in the homes of over 5,000 "panelists" across the U.S., to measure actual fixed broadband speeds.¹⁴⁸ Based on this *Measuring Broadband America* study, the FCC has "continue[d] to find that consumers' broadband services using cable, fiber or satellite technologies are close to or exceed advertised speeds, while consumers' broadband services from certain DSL-based ISPs experience actual speeds that are on average below the advertised 'up-to' speed."¹⁴⁹ In order to obtain such data, the Commission would either need a program like the FCC's, or a program to encourage the public to use the CalSPEED application for residential broadband.

The Commission has collected nearly five years of mobile broadband data with its CalSPEED program, which measures actual wireless broadband data in the field. The Commission created and pioneered this open source,

but not limited to Napa, Sonoma, Solano, Santa Cruz, Monterey, San Luis Obispo, Ventura, and Santa Barbara counties would be good candidates for further examination.

¹⁴⁷ A "measurement client ... located within the modem or router within a panelist's home."

¹⁴⁸ 2015 *Measuring Broadband America* (5th Report) (Dec. 31, 2015), available at <https://www.fcc.gov/reports-research/reports/measuring-broadband-america/measuring-broadband-america-2015#block-menu-block-4>.

¹⁴⁹ 2016 *Broadband Progress Report*, *supra*, at ¶ 105.

non-proprietary, network performance measurement tool and methodology with the assistance of a grant from the National Telecommunications and Information Administration. CalSPEED has been cited and relied on by the FCC's 17th, 18th, and 19th *Wireless Competition Reports*.¹⁵⁰ The CalSPEED data, collected in a "structured sampling program" at roughly 2000 locations across the state, allows us to conclude (among other things) that advertised wireless speeds regularly exceed the speeds actually measured in the field.¹⁵¹

It is a significant limitation of our analysis, and for our ability to monitor this rapidly changing market, that we do not have a comparable data set for residential broadband.

6.1.6. The Problem with Price Data

It is difficult to obtain objective and comprehensive price data in an unregulated market where prices can change daily and may depend on zip code or other micro-targeting by communications carriers, and when voice (or broadband) services are sold as part of a bundle.¹⁵² Temporary price discounts

¹⁵⁰ 19th *Wireless Competition Report* (Sept. 23, 2016), at ¶ 110, available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0923/DA-16-1061A1.pdf.

¹⁵¹ See *CalSPEED: California Mobile Broadband -An Assessment*, (Sept 2014, based on 2012-13 data) at 2, 34-35, 38, available at <ftp://ftp.cpuc.ca.gov/telco/BB%20Mapping/Field%20Testing/Biba%20Mobile%20Broadband%20Assessment%209%204%2014%20filed.pdf>.

¹⁵² Dr. Aron states she has found "no evidence of any provider whose posted prices for voice service or voice bundles vary by location within its service territory. According to my research, and as reflected in Appendix 1, the prices listed by each service provider for voice service are homogeneous across the territory it serves." Exhibit 5, at 53. Dr. Roycroft counters: "Because Dr. Aron only examines information posted on carrier web sites, she does not address geographically-based offers that carriers make. For example, as discussed in my June 1, 2016 testimony, AT&T geographically targets price reductions where Google Fiber has entered its service area." Exhibit 57, Dr. Roycroft's July 15 Testimony, referencing his earlier testimony, Exhibit 54 at 125-26. Many broadband services are now sold online, and the customer is required to enter a zip code. It is not beyond imagining that the carriers use sophisticated

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(“teaser rates”) used as inducements for new customers complicate the analysis. Reviewing rates offered at any given point in time may not reflect what consumers on average pay. Given the growth in bundling of voice, data and video offerings, separating voice from data and other charges becomes increasingly difficult.

See further discussion below of “disaggregating bundled prices” and – more generally – “asymmetric information.”

6.1.7. How Granular?

A further methodological problem: some carriers ask us to disregard any granular data about market competition, because “markets do not operate at a census block level.”¹⁵³ We question that view. While statewide or even nationwide figures may be useful to measure a carrier’s market share and general economic clout,¹⁵⁴ a customer’s actual choices are best seen at a local level, at the census block if not address-specific level.¹⁵⁵ Considering AT&T and

algorithms, as does the airline industry, to calculate the market clearing price in any given area at any given time.

¹⁵³ Exhibit 13, Frontier/Born June 1 Testimony and Responses, at 3 (URF’s “broad geographic view reflects the fact that markets do not operate on a census block level – the telecommunications market is national in scope”).

¹⁵⁴ See, e.g., Exhibit 15, ORA/Selwyn March 15 testimony, at 80-81 (“any substantial increase in a telecommunications provider’s market dominance, its *monopsony power* – its ability to dictate terms of its purchases from upstream input providers – will in any event be increased”) (emphasis in original).

¹⁵⁵ *Id.* at 32 (“Where fixed infrastructure is involved, the “relevant geographic market” could well be defined at the individual customer level, because from the perspective of any given customer, any provider that does not offer service at the customer’s address is simply not relevant”). Dr. Selwyn specifically compares the residential perspective to what occurred in the AT&T/SBC merger with regard to business data services, then known as special access: “Although the DOJ’s focus in the [merger] proceedings was on services being furnished to commercial buildings, the same principle applies with respect to any fixed wireline service”); compare *BDS Order, supra*, at ¶ 40, noting past FCC use of “customer location as the relevant geographic market stating ‘that a customer is unlikely to move in response to a small, but significant and nontransitory increase in the price of the service’”).

Frontier, or Comcast and Cox, as competitors for the same customers is suspect, as the landline operations of these companies do not for the most part, overlap.¹⁵⁶ We also use granular census block subscription data to validate carrier deployment claims. Accordingly, in the analysis that follows, we analyze competition at the most granular level permitted by the data.

6.1.8. Segmentation of Data Analysis

Consistent with the definition of the telecommunications network as host to many submarkets, we will first discuss the voice submarket, and then the broadband telecommunications market which - to a considerable extent - now drives the telecommunications market.

6.2. Voice Services

Consistent with our discussion of substitutability above, and in accord with the practice of the FCC, we will first analyze the landline voice market,¹⁵⁷ then the mobile voice market,¹⁵⁸ and finally the intermodal market for voice services.

6.2.1. Consumer Landline & Other Fixed Voice Services

Most of the Respondent carriers provided testimony that urged the Commission to focus on whether competition had disciplined prices for “traditional landline services.”¹⁵⁹ Those carriers, however, offered little, if any, analysis of the wireline voice market *per se*, adopting either the view that

¹⁵⁶ We recognize, as discussed above, prices may be set at a statewide level, or at the address or the census block, level. In a de-tariffed age, we no longer have clear information about actual carrier pricing practices.

¹⁵⁷ See 2016 FCC report, *Voice Telephone Report*, *supra*.

¹⁵⁸ See *In re Competitive Market Conditions With Respect to Mobile Wireless*, 18th Report, 30 FCC Rcd 14515 (Dec 2015) (“18th Wireless Competition Report”).

¹⁵⁹ Cox, for example, submitted the July 15, 2016 rebuttal testimony of Joseph times.

traditional landline services were an anachronism in an age of bundled telecommunications services,¹⁶⁰ or that traditional landline service now competes with VoIP and wireless telephony and that only this combined or intermodal market matters.¹⁶¹

“Fixed” is a term of art, meaning tied to a specific geographic location, as opposed to mobile services which travel with the consumer. “Fixed” voice services include traditional voice as offered by the legacy carriers; fixed interconnected VoIP, whether offered by a legacy carrier, a traditional competitive carrier, or a cable carrier; and “fixed wireless” (described below) and satellite offerings, all of which are delivered to a specific address.¹⁶²

6.2.1.1. Availability

Most Californians have two wires into their house: (1) a local loop built by the local telephone system, largely during the era of cost-of-service rate regulation; and (2) a coaxial cable connection built by the cable company for

¹⁶⁰ Frontier, for example, stated that the state of competition in traditional landline service should not guide the Commission:

As the URF decision confirmed, “basic phone service” is not a concept that should guide an evaluation of competition in California. The Commission found that “concepts like “Basic Local Exchange Service,” “long distance service,” “call waiting service,” “call forwarding service,” and “pay phone service,” make little sense in an era dominated by telecommunications sold through bundled services.”

June 1 Information Responses, at 7.

¹⁶¹ See, e.g., Exhibit 8, Katz July 15 Rebuttal Testimony, at 15 (“it is appropriate to combine wireless and wireline services for a competitive calculation”). The word “intermodal,” while used extensively in *URFI*, is not mentioned at all in the opening and supplemental testimony of Dr. Katz (for AT&T), in the opening testimony of Dr. Topper (for Charter/Comcast/Time Warner), and not at all in the opening testimony of Dr. Aron (for AT&T).

¹⁶² We follow the FCC’s template in this regard. See 2016 *Voice Telephone Report*, *supra*, at Table 1 (including traditional “switched access” voice, VoIP – whether delivered over copper, coaxial cable, or fiber, “terrestrial fixed wireless,” and satellite transmission in the “fixed” service category).

cable television transmission, which began to be used in the late 1990s for two-way voice and broadband communication.¹⁶³ In relatively rare instances, a third provider will “overbuild,” i.e., construct a third wireline connection to the home.¹⁶⁴

6.2.1.1.1. Legacy carriers, and competitive carriers using legacy facilities (offering both traditional/TDM and VoIP services over the legacy local loop)

The ILECs have the largest historic service areas in the state. The “traditional” (i.e., non-cable) CLECs have theoretical access to customers in these areas, through the incumbent network using unbundled network elements (UNEs) pursuant to federal law. Although a few CLECs offer residential service, the availability of that service has shrunk since URF I, as has its market share (*see below*).

Moreover, there is a school of thought that sees CLECs as not offering true competition:

¹⁶³ See *In re TCI-AT&T Transfer*, 14 FCC Rcd 3160 (1999) at ¶¶ 1, 7, *passim*; see also Exhibit 28, Cox/Gillan June 1 Testimony at 26 (“most (but not all) residential consumers” have access to an “incumbent, a cable-based provider,” and wireless providers).

¹⁶⁴ As traditionally used, “overbuild” meant a second cable company building over an incumbent cable company’s territory, a fairly rare occurrence. With the entrance of the telecommunications incumbents into the content delivery business, “overbuild” took on a new meaning, as it was telephone companies overbuilding the cable providers. See *Behrend v. Comcast*, 2012 U.S. Dist. LEXIS 51889 (E.D. Pa., Apr. 12, 2012), at *40-41 (“Another Comcast expert, Dr. Stanley Besen, opines that entry into the MVPD market by ILECs, who are essentially in the same shoes as wireline overbuilders, has not been impeded by clustering. He opines that, ‘Verizon is currently an actual competitor [to Comcast]’”); summary judgment for defendant reversed, 655 F.3d 182 (3d Cir, 2011); *rev’d sub nom Comcast v. Behrend*, 133 S. Ct. 1426 (2013). In this Decision, we use “overbuild” to refer to any third, competitive carrier that overbuilds either the incumbent cable provider or the legacy telephone company. Compare Exhibit 15, ORA/Selwyn March 15 Testimony, at 26, referring to both RCN cable and Verizon FIOS as overbuilders.

The [competition] analysis must also be confined to *facilities-based* providers – those not dependent upon an upstream provider for any major network facility input. Firms that rely upon capacity leased from others – particular where the lessor is itself a competitor in the same geographic and product market – offer no additional source of competition beyond that offered by the facilities based upstream provider. ... With the exception of a limited number of large multi-dwelling unit (MDU) buildings, non-cable CLECs rarely own distribution (loop) facilities to residential customer premises. In order to serve such customers, the CLEC must lease the underlying facility from a facilities based carrier, either as a UNE-L (an Unbundled Network Element Loop) or as total local 11 exchange access service for resale.¹⁶⁵

The FCC seems to agree, albeit in the special access/BDS context:

While wholesale access can be a cost effective means for a competitive LEC to expand its reach, such a wholesale purchaser cannot place competitive pressure on supply of the underlying facility that it purchases, but rather can only compete by being more efficient at retailing. Thus, *we do not consider competition over resold lines as a material competitive restraint on any facility-based supplier with market power.*¹⁶⁶

Nevertheless, because URF considered CLECs as a competitive force, and because even Dr. Selwyn views them as such in other contexts,¹⁶⁷ we will continue to consider CLECS in our deployment and market share analysis.

6.2.1.1.2. Competitive cable providers (offering VoIP)

¹⁶⁵ Exhibit 16 (Selwyn) at 42 and 44, ¶¶ 51 and 53.

¹⁶⁶ *BDS Order, supra*, at ¶ 240.

¹⁶⁷ Where there is full functional separation between the physical facilities and the retail operations of the facilities-owner, and where a competitor obtains access to the network on the same terms and conditions as the incumbent's retail affiliate or division, Dr. Selwyn seems to consider the CLEC a viable competitor. *See* discussion of functional separation, below.

Dr. Aron states that the “growth of the competitive marketplace in the last ten years has been driven by facilities investment and technological developments, including by the cable-based CLECs.”¹⁶⁸

Mr. Gillan puts cable VoIP in the CLEC category, but notes that cable providers are not like “traditional CLECs” in that cable companies provide VoIP almost exclusively on their own facilities.

6.2.1.1.3. Overbuilders

As used here, “overbuilder” means any telecommunications wireline provider that constructs new wireline facilities (fiber, cable or copper) to end-users in the traditional service territory of a legacy telephone or cable incumbent, i.e., “where a third wireline connection to the home is constructed.”¹⁶⁹ Dr. Roycroft identifies overbuilders Sonic, Wave, and Giggle Fiber (not to be confused with Google Fiber),¹⁷⁰ and staff is aware of other overbuilders such as Consolidated,¹⁷¹ but these companies altogether account for a small fraction of telephone service, less than 50,000 connections in California, and many of Sonic’s customers are not “overbuilds” per se, but serviced over resold UNE loops.¹⁷² While relatively insignificant in terms of market share, the

¹⁶⁸ Exhibit 7 (Aron Rebuttal) at 14, citing Exhibit 54 Roycroft Testimony at pp. 18-19.

¹⁶⁹ Exhibit 54, TURN/Roycroft June 1 Testimony, at 8); *see also* fn. [155] above.

¹⁷⁰ *Id.* at 47-48.

¹⁷¹ *See* Consolidated Opening Brief, at 24 (“Consolidated has substantially overbuilt Frontier’s Elk Grove exchange, which is the most significant service area of Frontier’s legacy operations. Consolidated has also deployed significant facilities in AT&T’s service territory in Sacramento”). We understand that some or all of this overbuild may be designed to reach specific business customers, rather than residential end-users.

¹⁷² We note that our use of aggregated regional markets for concentration will mute the impact of these carriers. Echoing Dr. Selwyn’s argument that each address is its own market “where fixed infrastructure is involved” (fn. [140], *supra*), a carrier like Webpass may be a significant competitor for subscriptions in a high-rise in San Francisco while offering no competition for

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question of whether new, facilities-based wireline companies can enter the market is a significant one, as it constitutes a test of the pro-competitive theory behind the 1996 Telecommunications Act and the URF decisions.

6.2.1.1.4. Fixed Terrestrial Wireless

Fixed or terrestrial wireless is telecommunication delivered to end-users at their residence, typically via microwave transmission to a fixed rooftop antenna. Although primarily known as a broadband service, some fixed wireless providers also offer voice.

Drs. Katz and Aron include “terrestrial fixed wireless,” as one of the “relevant consumer options” available to California voice consumers,¹⁷³ but neither quantifies its availability or market share in California. CALTEL’s DeYoung mentions fixed wireless as a last mile alternative for some CLECs, but she likewise does not explore its availability or quantify its market share.¹⁷⁴

Much of intervenors’ testimony about fixed wireless addresses its application in the broadband market. As some fixed wireless companies are solely broadband providers,¹⁷⁵ and as their presence in the voice market is by all accounts quite small,¹⁷⁶ the viability of fixed wireless will be discussed primarily

service to a single family building just a mile away. See www.webpass.net (“Webpass is a building specific ISP. You'll find our network in buildings built after 1995 and with 10 units or more”).

¹⁷³ Exhibit 6, AT&T/Katz June 1 Testimony, at 3; Exhibit 1, AT&T/Aron March 15 Testimony, unpaginated, text accompanying footnote 47.

¹⁷⁴ Exhibit 24, CALTEL/DeYoung July 15 Testimony, at 22.

¹⁷⁵ See, e.g., <https://webpass.net/faq/residential/37>. (WebPass appears to connect buildings both by wireline and fixed wireless.)

¹⁷⁶ 2016 *Voice Telephone Report*, at Table 1 (total fixed wireless lines in country less than half of one percent of all fixed telephone service lines, and almost all of those are provided by incumbent rather than competitive carriers, presumably in areas where the incumbents do not

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in the broadband context, below. It is not without impact in the voice markets though, as fixed wireless is often mentioned as an alternative way for incumbents to reach rural customers, and may be argued to fulfill a provider's carrier of last resort (COLR) obligations.

6.2.1.1.5. Satellite

Although the Commission licenses satellite telephone providers in California, their market share also appears quite small.¹⁷⁷ Accordingly, we did not request data from these providers.

6.2.1.1.6. Over-the-Top Voice

Dr. Katz includes "voice delivered as an application over a consumer's broadband Internet access service" as an option for consumers in the market for voice telephony.¹⁷⁸ This option, sometimes called "OTT" does not include connectivity (formerly known as "dialtone"); the customer must purchase that elsewhere. Cox's witness Gillan, for example, views "over the top" VoIP providers as a competitive choice for consumers, but concedes that "a broadband connection is necessary for an OTT VoIP."¹⁷⁹ The fact that Dr. Katz appears to classify OTT as an "application" is telling. As we stated above, this Investigation

have or it is uneconomical to build traditional wireline facilities). The FCC does not even include terrestrial fixed wireless in its California-specific data.

¹⁷⁷ *Id.*, at Table 1 (satellite market share part of and less than fixed wireless market share).

¹⁷⁸ Exhibit 6, Katz June 1 at 3.

¹⁷⁹ Exhibit 28 (Gillan) at 14. Mr. Gillan notes another limitation of over-the-top VoIP: "OTT VoIP is quite different than the VoIP services offered by cable companies and most CLECs. The VoIP offered by these carriers is frequently referred to as "managed VoIP" because it is carried on private IP networks (not the public internet)." *Id.* at fn 14. The "public Internet" is sometimes referred to as a "best efforts" service, as opposed to managed services with service guarantees. See *BDS Order*, at ¶¶ 13-14. In other words, the cable company takes some responsibility (via the "service level agreements" discussed above) for the "managed VoIP" call from end to end, much like a traditional phone company, whereas OTT VoIP providers rely on general transit and peering arrangements.

has focused on telecommunications transport - the transmission of information (be it voice or data) of the user's choosing, without change in the form or content of the information as sent and received.¹⁸⁰ While OTT VoIP provides addressing functions and may provide telephone numbers, it does not provide transport to the end-user's phone.¹⁸¹ The FCC itself characterizes this as "bring your own broadband."¹⁸²

Dr. Aron suggests that Skype and Vonage (and other OTT VoIP providers) are in the same category and market as "free social messaging apps" and edge-providers such as WhatsApp, Facetime, and Facebook,¹⁸³ all of which now also serve as a platform for voice communication.¹⁸⁴ Because a pre-existing broadband connection is a prerequisite for using these new voice applications, there is also a danger of double-counting – a broadband connection (perhaps

¹⁸⁰ This is, in fact, the definition of "telecommunications" in the 1996 Telecommunications Act. See 47 U.S.C. § 153(50).

¹⁸¹ See, e.g., *Baltimore v. Vonage*, 544 F. Supp. 2d 458, 462-63 (D. Balt, 2008) ("The [Vonage] gateway's subsequent connection to the Public Switched Telephone Network (PSTN) does, however, involve the use of telephone wires and lines, although Vonage does not directly connect telephone calls to the PSTN. Instead, Vonage maintains contractual agreements with different third-party carriers, which are responsible for connecting, or "off-loading," the call from Vonage's gateway to the third-party carriers' telephone switches"). Whether Vonage's switch, router, and gateway computers differ from those used by other OTT services, such as Facetime, Facebook, WhatsApp, Viber and Skype, all of which allow voice communications on their platform, is an interesting question, but not pertinent to the distinction we make here. Finally, the FCC – after years of inquiries on this subject – has still not classified VoIP as a telecommunications service, although it subjects it to universal service fees, and the like. CLECs are classified as telecommunications carriers. Cf. *Global NAPs v. CPUC*, 624 F3d 1225 (9th Cir. 2010).

¹⁸² August 2016 *Voice Telephone Report*, at Glossary ("Service delivered to the end-user customer's premises over a high-capacity connection that the customer obtains (that is, buys), or has the use of, from an entity not affiliated with the interconnected VoIP service provider. (Colloquially, 'bring-your- own-broadband.'")

¹⁸³ Exhibit 5 (Aron) at 8-9.

¹⁸⁴ These platforms do not themselves currently provide transport, but purchase it from telecommunications carriers. See fn [179], *supra*.

bundled with telephone service) from the underlying telecommunication (connectivity) provider, and one or more connections from the free or low-cost OTT voice providers – when, in fact, the customer only has one line into the house or one wireless account.

We find it more probative to focus on the facilities-based VoIP and landline voice providers in our analysis below. We also note that OTT VoIP subscribers appear to occupy a relatively small slice of the voice market.¹⁸⁵

6.2.1.1.7. Subscription/Concentration

The parties are largely in agreement that the traditional legacy carriers have lost market share to cable VoIP and wireless providers, “even with [the incumbent’s own] VoIP subscriptions included.”¹⁸⁶

Subscription numbers show that that most wireline consumers obtain voice services from the legacy telephone companies or from cable providers as part of a bundle.

The data provided by the carriers reveals that the legacy telephone companies supply 2.646 million traditional connections to residential consumers and another 1.489 million residential VoIP connections, using the same last-mile

¹⁸⁵ Dr. Selwyn suggests that 7% of the VoIP subscriptions in California are OTT (Exhibit 16, at 44-45), while FCC national figures indicate that consumer OTT VoIP in California accounts for less than 1% of the total voice market. The FCC’s subscription totals for California are presented with the FCC’s *Voice Telephone Report, supra* at <https://www.fcc.gov/wireline-competition/voice-telephone-services-report> (under “State-Level Subscriptions (Excel)”). It is notable that all OTT voice communications services, not just those that report subscriptions to the FCC, have had a disruptive effect on the industry. For example, long-distance toll revenue, once the high-valued revenue source for subsidizing access services is no-longer highly valued and can be avoided entirely with a free OTT application.

¹⁸⁶ Exhibit 13 (Frontier/Born) at 7; Exhibit 28 (Cox/Gillan) at 22: wireless and cable VoIP “have significantly reduced the incumbents’ share of the market (as measured in access lines or subscriptions that are substitutes for traditional landline service”).

facilities in each case, for a total of 4.133 million large legacy carrier residential connections in California.

Cable VoIP providers: the three largest cable VoIP providers – Comcast, New Charter,¹⁸⁷ and Cox¹⁸⁸ – have a combined 2.766 million residential voice connections in California. As suggested above, the number of “traditional” (non-cable) CLEC lines in the residential/consumer market is relatively small, amounting to approximately 120,000 lines over the entire state. The two largest such providers -- Sonic and Wave/Astound -- have fewer than 100,000 lines between them.

The most recent *Market Share Report* confirms that most landline consumers obtain voice services from a legacy telephone company or incumbent cable provider (often bundled with broadband).¹⁸⁹ Based largely on the data submitted by Respondents, we calculated the residential landline voice HHI market concentration ratios for the following urban areas:

¹⁸⁷ At the time the OII issued, Time Warner and Charter were separate companies. They have since merged.

¹⁸⁸ A smaller but significant number of Cox’ subscriber connections provide traditional phone service rather than VoIP. The other large cable companies exclusively provide VoIP service to consumers.

¹⁸⁹ The *Market Share Report* utilized a territory adjustment, also used in the analysis below, because legacy franchise service territories (and therefore their local network facilities) typically do not overlap. Thus, staff combined ILEC broadband data into a single broadband entity and their fixed wireline data into a single wireline entity. Similarly, for cable companies, staff separately combined broadband into a single entity and their VoIP data into an entity. See January 5, 2015 *Market Share Report*, at 9 (“Individual wireline and cable service provider service territories are typically geographically limited; reflecting their embedded geographical segmentation from legacy franchise service territories and do not overlap. Today’s AT&T retail wireline phone services generally do not compete with the Verizon retail wireline phone services. Similarly, the Time Warner cable retail fixed digital phone services generally do not compete in the territories served by the Comcast cable network where it offers digital phone services. When calculating HHI, the number of statewide available services providers must be adjusted”), available at <http://www.cpuc.ca.gov/General.aspx?id=4170>.

Concentration in Largest Landline Voice Markets		
Urban Area	HHI Factor	Concentration Level
Los Angeles	5,152	Highly Concentrated
Oakland	4,783	Highly Concentrated
Sacramento	5,332	Highly Concentrated
San Diego	5,095	Highly Concentrated
San Francisco	4,997	Highly Concentrated
San Jose	4,948	Highly Concentrated

In comparison, when looked at on a statewide basis, the *Market Share Report* showed a higher, but declining level of market concentration measured by HHI over the last 15 years.¹⁹⁰

6.2.2. Consumer Mobile Voice Services

6.2.2.1. Available Services

All four of the large, nationwide, facilities-based wireless or mobile carriers are operating in California:¹⁹¹ AT&T Wireless, Verizon Wireless, Sprint and T-Mobile. Additionally, there are smaller, regional carriers in California, like U.S. Cellular, which play a relatively peripheral role in the competitive picture.

There are also Mobile Virtual Network Operators (MVNOs), companies like TracFone, that are “virtual” because they own none of their own facilities, and instead purchase large amounts of network capacity from the four nationwide carriers, and resell it to particular niche markets. TracFone is by far the biggest of these operators in California.¹⁹² Dr. Aron suggests that the

¹⁹⁰ *Id.*, at 12 and 32 (HHI declines from 9,117 in June 2001 to 7,086 in June 2013).

¹⁹¹ We include their affiliates; Verizon, for example, operates through multiple affiliates in California.

¹⁹² See D.12-02-032, *TracFone Investigation*, Slip Op. at 10-14, describing TracFone MVNO operations. Available at http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/160258.PDF.

MVNOs compete with the major facilities-based carriers.¹⁹³ Dr. Roycroft disagrees, describing the MVNOs as “marketing extension[s] of facilities-based providers,” which “do not compete in the same manner as a facilities-based rival.”¹⁹⁴ The FCC agrees: “MVNOs do not engage in non-price rivalry by creating capacity through network investments, network upgrades, or network coverage,”¹⁹⁵ Finally, the FCC does not require independent reporting by MVNOs; their deployment is wholly dependent on the deployment of the host network, and their subscription numbers are reported as lines provided by the host.¹⁹⁶ Accordingly, we will not consider MVNOs separately in our market share analysis below.

Carrier Respondents report that between 95 percent and 99 percent of their consumer lines are bundled with broadband/data plans.

6.2.2.2.Subscription/Concentration

The currently and formerly ILEC-affiliated wireless companies (AT&T Wireless and Verizon Wireless) have historically had roughly twice as many subscriptions as the largely stand-alone mobile competitors Sprint and T-Mobile,¹⁹⁷ although T-Mobile has partially closed the gap with its acquisition of

¹⁹³ Exhibit 5 (Aron) at 26.

¹⁹⁴ Exhibit 54, (Roycroft) at 65-66.

¹⁹⁵ *18th Wireless Competition Report, supra*, at ¶ 11, and fn. 31, Yankee Group's 2011 Predictions, at 7 (“[I]t's critical the MVNO does not compete to any meaningful degree with the host.”).

¹⁹⁶ Form 477 Instructions, at § 5.12 (requiring the host network to report “subscribers served via unaffiliated mobile voice service resellers”). We recently discovered that some carriers did not provide us with the same numbers section 5.12 would have required them to provide on the Form 477. One large wireless carrier confirmed that, in addition to the numbers reported, it had (roughly) an additional 5% MVNO subscribers on its books. We are continuing to check these numbers, and may amend this Decision to account for any significant discrepancies.

¹⁹⁷ *18th Wireless Competition Report*, at ¶ 15 (“Verizon Wireless and AT&T together accounted for approximately two-thirds of the [total] estimated connections”). Despite T-Mobile’s recent growth, Sprint has almost twice as many “machine-to-machine” connections, an important

(footnote continued on next page)

Metro PCS. Together these four companies control about 98.6 percent of nationwide cellular traffic.¹⁹⁸

With the consolidation in the wireless industry,¹⁹⁹ the national HHI scores have risen steadily since 2005 (2,405, moderately concentrated), to a high of 3,138 at year-end 2014,²⁰⁰ being most concentrated in sparsely populated or rural areas and least (but still highly) concentrated in dense urban areas.²⁰¹

Based on data submitted by Respondents, HHI concentration of the four largest mobile providers in the major California markets is as follows:

Concentration for Largest Mobile Voice Markets²⁰²		
Market	HHI	Concentration Level
Los Angeles	2,217	Moderately Concentrated
Oakland	2,665	Highly Concentrated
Sacramento	2,544	Highly Concentrated
San Diego	3,037	Highly Concentrated
San Francisco	3,074	Highly Concentrated
San Jose	2,782	Highly Concentrated

subset of the “Internet of Things.” *Id.* at ¶ 16 (“Sprint had 8 million, and T-Mobile had 4.5 million” M2M connections).

¹⁹⁸ *Id.* at ¶ 15.

¹⁹⁹ Since 2006, a number of formerly independent wireless companies have been purchased by the “big four.” AT&T has bought Leaf/Cricket, T-Mobile has purchased Metro PCS, and Verizon has bought Alltel. *See 18th Wireless Competition Report*, at ¶ 40 (“recent acquisitions of urban-focused service providers, MetroPCS and Leap Wireless (Cricket) by T-Mobile and AT&T”); *In re Verizon Wireless and Atlantis Holdings (Alltel) Control Transfer*, 23 FCC Rcd 17444 (2008). *See 19th Wireless competition Report*, at Chart II.C.1 (showing big four wireless carriers with 99% of subscriptions nationwide); Exhibit 54, Roycroft June 1 Testimony, at 62 (same).

²⁰⁰ *18th Wireless Competition Report*, at ¶ 24, and Chart II.C.1.

²⁰¹ *Id.* at Chart II.C.2.

²⁰² Due to inconsistencies in Respondents’ voice data, we relied on mobile broadband subscription data as a proxy for mobile voice availability (based on the high percentage of bundled voice and data in wireless service). We generally assume that rural markets are more concentrated.

In comparison, the Market Share Report statewide mobile voice HHI values below show an increasing trend in concentration, due to mergers in 2005/2006, and similar levels of market concentration as shown above.²⁰³

Concentration Trends for Statewide Mobile Voice Market		
Date	HHI	Concentration Level
June 2001	2,318	Moderately Concentrated
June 2006	2,558	Highly Concentrated
June 2013	2,680	Highly Concentrated

6.2.3. Consumer Intermodal Voice Market Availability

Taken together, the combination of fixed and mobile voice markets results in what some refer to as a “six-network” dynamic for consumer voice:

The “six-network” reference recognizes that for most (but not all) residential consumers, the list of active voice suppliers would include the incumbent, a cable-based provider, and the four national wireless networks. The characterization does not claim that every residential consumer has all six choices (and some may have more), or would view them all as equivalent even if they did. Rather ... there is now sufficient overlap between these networks and services to effect price levels.²⁰⁴

Data received from Respondents and a number of other telecommunications carriers in California²⁰⁵ were used to determine how many

²⁰³ 2015 *Market Share Report*, pages 12 and 32.

²⁰⁴ Exhibit 28 (Cox/Gillan) at 26, fn. 27.

²⁰⁵ In addition to Respondents, staff sent data requests to the following competitive carriers, and received complete or partial responses from most of them: US TelePacific Corp dba TelePacific Communications, and its acquired entities Arrival and Mpower Communications); Granite Telecommunications LLC; Windstream/Paetec; Level 3 Communications (and affiliates tw telecom, Global Crossing, and Wiltel); XO Communications (in process of being acquired by Verizon); Birch/Cbeyond; Global TelLink Corporation (prison phones); Sunesys, LLC;

(footnote continued on next page)

retail voice services were deployed as of December 31, 2015 in each populated census block in California. Of 407,879 census blocks with households in California (also called “developed” census blocks), 329,600 blocks, or eighty-one percent have three or more available voice providers. The 329,600 census blocks with three or more providers include 12,118,357 households – ninety-six percent of California households – and 35,710,402 people – ninety-six percent of California’s population. Eighty-seven percent of California households live in census blocks with six or more voice providers.

There are at least two significant limitations of this analysis. First, most voice service today is purchased in bundles with broadband connectivity, so the analysis of a voice-only market as conceived by URF is today something of an artificial construct. Secondly, the largest ILEC (AT&T) is a corporate affiliate of one of the largest wireless carriers (AT&T Wireless) and, until recently, the same relationship existed between Verizon California and Verizon Wireless.

Even on the voice-only numbers, however, there is a great divide between urban blocks and non-urban blocks within this data. Of the 332,194 developed census blocks with three or more voice providers, 301,786 census blocks or ninety-one percent, are urban or “urban clusters,” while 30,408 census blocks, or nine percent are rural.²⁰⁶ Only thirty-nine percent of developed rural blocks and forty percent of developed tribal census blocks have access to three or more providers. Rural census blocks with three or more providers include

CenturyLink Communications/Qwest; Metropolitan Telecom; Zayo Group LLC; Cenic Broadband Initiatives; Sonic Telecom LLC; Sage/Telscape/ Blue Casa LLC; Wave/Astound; Peerless Network of California, LLC; Bandwidth.com-CA; ImpactTNCI/PacWest; and TierZero (collectively the competitive carrier data respondents).

²⁰⁶ See <https://www.census.gov/geo/reference/ua/urban-rural-2010.html>. Where a census block group has a median household income below the identified benchmark, we are treating all census blocks within that tract as having that block group’s median household income.

seventy-eight percent of California’s rural population, while tribal census blocks with three or more providers include just seventy percent of California’s tribal population.

In addition to examining geographic variation, we further evaluated census blocks within census block groups with median household incomes under \$50,000 and with median household incomes under \$25,000.²⁰⁷ We found that eighty-nine percent of households with median household income of less than \$50,000 live in census blocks with at least three voice providers and ninety-six percent of households with median household income of less than \$25,000 live in census blocks with at least three voice providers. This analysis suggests that low-income customers do not typically face an availability barrier to accessing voice service – impediments to access for these customers result from issues of service affordability.²⁰⁸

The following table contains a summary of voice availability data for households in California:

Household Voice Availability (number of households)				
Technology	Served by Three or More Providers	Served by Two Providers	Served by One Provider	Unserved
Fixed	3,382,929 26.9%	7,787,545 61.9%	1,080,543 8.6%	326,481 2.6%
Mobile	11,762,453 93.5%	344,931 2.7%	207,525 1.6%	262,589 2.1%

²⁰⁷ We do not have data on census block median income. Therefore, we use the census block group’s median income for every census block within that tract, noting that this approach will not recognize granular income variations.

²⁰⁸ Indeed, the data suggest that low-income Californians live in urban areas with more voice providers. The data tell us little about how affordable voice service is to low-income Californians.

Intermodal	12,118,537 96.4%	141,320 1.1%	131,864 1.0%	185,777 1.5%
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6.2.3.1.Subscription/Concentration

We analyzed the HHI concentration of the largest markets in California. We elected to aggregate census blocks to the county level to calculate HHI. We do not specifically evaluate more remote markets in this analysis. As noted above, we anticipate that such markets would have higher HHI concentration than the markets analyzed below, with only rare exceptions.²⁰⁹

We have consolidated the subscriptions for Charter, Time Warner, and Brighthouse into one entity to reflect their recent merger and the subscriptions for Frontier and Verizon California to reflect Frontier's purchase of Verizon California's landlines. To get a measure of existing market concentration in the intermodal consumer voice market (i.e., fixed, wireless, and VoIP combined), we calculated the HHI for various regional sub-markets. The first table we present below represents a "persons served" HHI. The number of landlines for each landline carrier is multiplied by the average number of people over the age of 10 per household in the county to determine how many people each landline might serve.

²⁰⁹ See, e.g., Consolidated Opening Brief, at 24 (noting the highly competitive nature of the Sacramento area market).

Concentration in Largest Intermodal Voice Services Markets (By Persons Served)		
Market ²¹⁰	HHI	Concentration Level
Los Angeles	1,555	Moderate Concentration
Oakland	1,712	Moderate Concentration
Sacramento	1,727	Moderate Concentration
San Diego	1,907	Moderate Concentration
San Francisco	1,860	Moderate Concentration
San Jose	1,784	Moderate Concentration

The next table represents an unadjusted “line count” HHI concentration for these markets – the HHI calculated without applying the household size multiplier to landline subscriptions:

Concentration in Largest Intermodal Voice Services Markets (Unadjusted)		
Market	HHI	Concentration Level
Los Angeles	1,867	Moderate Concentration
Oakland	1,890	Moderate Concentration
Sacramento	1,850	Moderate Concentration
San Diego	2,167	Moderate Concentration
San Francisco	2,095	Moderate Concentration
San Jose	2,044	Moderate Concentration

While the retail intermodal voice market appears the least concentrated of any that we examine here, the efficiency of that market is impacted by inefficiencies in wholesale and broadband markets.

CD’s earlier *Market Share Reports*, while using different data sets and different presentation,²¹¹ also illustrate the impact of mobile voice’s growth over time on intermodal voice concentration.

²¹⁰ Staff used the same territory adjustment as the *Market Share Report*, as described above.

Concentration Trends for Statewide Intermodal Voice ²¹²		
Date	HHI	Concentration Level
June 2001	4,003	Highly Concentrated
June 2006	2,403	Moderately Concentrated
June 2013	1,694	Moderately Concentrated

Trends in Statewide Voice Subscriptions (millions) ²¹³		
Date	Wireline Voice (Including VoIP)	Wireless Voice
June 2001	24.8	14.2
June 2006	24.6	27.5
June 2013	16.9	35.8

We note that the FCC's most recent Telephone Voice Services Report and associated data showed California, two years later, with 15.1 million combined "wireline end-user" voice lines (VoIP and traditional "switched access" lines).

TURN's Dr. Roycroft criticizes the *Market Share Report* for combining allegedly different services (wireless and wireline) in the same market. This is the substitutability issue discussed above:

The 2015 CD *Market Share Report* identifies an "intermodal voice" market, which includes both wireless and wireline voice services. In light of the "one-way substitution" discussed above, an intermodal voice market is not appropriately considered in that report. Before a concentration or HHI analysis should be applied, the market must be correctly defined. The CD *Market Share Report* is

²¹¹ For example, the *Market Share Reports, supra*, separate VoIP lines from other landlines.

²¹² 2015 *Market Share Report*, at 33.

²¹³ *Id.* at 30. As tracking of VoIP numbers began in 2008, staff has included the 2.2 million VoIP lines from 2008 in the 2006 figure, and the 5.4 million VoIP lines from 2013 in the 2013 figure.

based on the proposition that there is symmetric substitution between wireless and wireline voice services. This is not a supportable conclusion...

By using the incorrect intermodal interpretation, the 2015 Communication Division report wrongly concludes that concentration has declined in broadband markets. Wireless and wireline broadband services are complementary services, and concentration remains high in both wireless broadband markets and fixed wireline broadband markets.²¹⁴

Although we concluded above that wireless voice service generally substitutes for wireline voice service (but not the reverse), and to that extent reject Dr. Roycroft's analysis, we remain concerned about the level of competition in *intramodal* voice markets (wireline and wireless). Because we believe there are separate fixed and mobile markets for broadband, we will examine those markets separately.

6.2.4. Business Fixed/Landline Voice Market

Our review of the testimony and data submitted by the parties convinces us that the business voice market has different dynamics and presents different issues than the consumer voice market. Cox's Gillan, for instance, points out that incumbent and competing carriers in the business market often serve larger businesses with multiple locations and various needs.²¹⁵

²¹⁴ Exhibit 54 (TURN/Roycroft) at 35-36.

²¹⁵ Exhibit 28 (Cox/Gillan) at 32-33. At p. 20, Gillan explains:

Although business people own and/or use wireless phones, there is no indication that many small (or large) businesses have eliminated wired phone service to rely on wireless. As such, the pricing and availability of wireless services are not particularly relevant in the retail business market.

The carrier Coalition concedes that the business voice market analysis is "distinguishable" from that of consumer voice service market. Coalition Reply Brief at 22.

6.2.4.1. Availability

Non-cable CLECs have had more success in the business voice market than in the residential voice market. Cable companies have also entered the business market, often through their certificated CLEC affiliates. Cox's witness Gillan described some of the problems cable providers face:

Cable-based providers are not nearly as well positioned to compete for retail business services as they are in the retail residential market, as they cannot as immediately reach as many business end-users as the incumbents. Cable-based companies began as fundamentally consumer organizations, and even with their expansion into retail and wholesale business services, have a long-familiarity of marketing and provisioning to the residential market.²¹⁶

6.2.4.2. Subscription/Concentration

Dr. Aron states that there has been a rapid decline in ILEC market share in both ILEC residential and business lines in the past 10 years.²¹⁷ She estimates the number of ILEC business lines at approximately 4.3 million connections, down from approximately 7.6 million connections in 2006.

Data collected from the three largest ILECs in California support Dr. Aron's assertions regarding diminished ILEC market share, but indicate that the largest incumbent carrier continues to have roughly half of the business landline market share. The two largest ILECs provide approximately 4.2 million wireline business connections, more than the largest CLECs and cable companies combined. The largest CLECs - including Telepacific, Paetec/Windstream, Level 3, Century Link (Qwest) and others - provide approximately 1.4 million

²¹⁶ *Id.* at 22.

²¹⁷ Exhibit 5 (AT&TAron) at 3.

business connections, while cable companies provide approximately .6 million more.

The number of the business landlines – whether provided by legacy carriers, cable carriers, or the other large CLECs – has fallen since 2006, from approximately 7.6 million largely ILEC lines in 2006 to roughly 6.2 million fixed business landlines from all providers now. The reason for this decline is not entirely clear. One possibility is that special access lines may have replaced some of the retail business lines reported previously.²¹⁸ Another possibility is that some business customers may have migrated to wireless voice.

6.2.5. Business Mobile Voice Market

Statewide, the Big Four mobile carrier families report 6,394,898 mobile business subscribers. Although the statewide market is highly concentrated, with an HHI factor of 3,116, this number tells us little about market power in localized business mobile voice markets, for which we have no data.

6.2.6. Business Intermodal Voice Market

We have only limited testimony in the record regarding the nature of the business voice market. Mr. Gillan urges us not to consider wireless carriers competitors for retail business services, arguing that wireless is a complement to (and not a substitute for) landline service in the business market.²¹⁹ Our data indicate that there are nearly 6.4 million wireless business lines in California, along with approximately 6.2 million business landlines. Mr. Gillan may be correct that mobile voice is a complement to landline voice in the business

²¹⁸ See Rysman, *Empirics of Business Data Services*, FCC Commissioned study, at 1 (BDS inputs used for “complex services sold to businesses, such as managed voice, private network, and Internet access solution[s].” This white paper was commissioned by the FCC, and is attached to its *BDS Order* as Appendix B.

²¹⁹ Exhibit 28 (Cox/Gillan) at 20-21.

market. Dr. Aron identifies a significant decline in business landlines over the last decade, and we assume that a portion of the lost business landlines have migrated to wireless.²²⁰

Our data are insufficiently granular, however, to draw conclusions about exactly how the business market (or markets) operates in California. It is possible that there are separate enterprise and small business markets, and that the small business market is more likely to see substitution of mobile voice service for landline service. We are unable to make that determination on the record before us.

If one removes mobile telephony from the picture, as Cox's expert Gillan urges us to do, the business wireline market is highly concentrated, with one carrier providing over half the total business landlines (incumbent and competitive carriers combined); three other carriers have, however, made inroads in this market.²²¹

If one looks at the retail business voice market as intermodal, two carriers companies – the current incumbent and its wireless affiliate, and the former incumbent's wireless affiliate -- provide over half of the approximately 13 million combined retail wireless and wireline business connections in California.

Thus, even in an intermodal business market, the incumbent and recently incumbent carriers still have considerable market share and apparent market power.

²²⁰ Exhibit 5 (Aron/AT&T) at 15, and Figure 2. Dr. Aron, and the FCC's latest *Voice Telephone Report* data set, each show approximately .8 million more competitive business landlines than are reflected in the data we have from the carriers.

²²¹ Including a cable company and a traditional competitive carrier (CLEC).

Finally, we note that here, as in the residential voice and consumer broadband markets, the distinctions between wireless and wireline technologies may be fading. Not only are the technologies becoming more interchangeable, bringing hybrid offerings to market (like “Wi-Fi first” phones), but in the large multi-location enterprises that Mr. Gillan describes as typical in the business market there is some indication that customers purchase an integrated wireline-wireless solution. But, here again, our data is inconclusive.

6.3. Broadband

6.3.1. Residential Fixed Broadband Market

6.3.1.1. Availability

The availability of residential broadband roughly mirrors that of landline voice. Residential broadband includes the same categories – incumbent/CLEC service, cable providers, overbuilders, fixed wireless and satellite – but for most Californians residential broadband is available primarily over the last mile facilities of a local telephone company or cable company.

i. Legacy carriers, and competitive carriers using legacy facilities (offering both traditional/TDM and VoIP services over the legacy local loop)

Although the legacy carriers have nearly ubiquitous facilities over which they can offer some form of broadband, they do not have to share their last-mile broadband access facilities with competing carriers.²²² However, incumbent carriers make available unbundled copper loops to competitive providers whereby the provider may offer broadband service utilizing its own electronics enabling the internet connection.²²³ Whatever the reason, the competitive broadband service offering relying on incumbent unbundled loops is a small

²²² *Open Internet Order*, at ¶37 (“no unbundling of last-mile facilities”).

²²³ For example, see AT&T tariff, Cal P.U.C. 175-T.

portion of the market. Broadband supplied over legacy facilities²²⁴ comes almost entirely from legacy carriers or their successors.

ii. Cable providers

The adoption of DOCSIS 3.0 and 3.1²²⁵ have enabled cable providers to offer speeds faster than the legacy telecommunications carriers (except where they have deployed fiber-to-the-premises, as Verizon did in select areas with its FiOS product).²²⁶ Cable providers are under no obligation to unbundle their last-mile loops, which makes them the sole available provider of very high-speed services in many areas.²²⁷

iii. Overbuilders

Overbuilders Consolidated/SureWest, Sonic, Wave/ Astound, Webpass and other fixed microwave providers, and Giggle Fiber are known to have deployed competitive broadband facilities in limited areas.²²⁸

iv. Fixed (Terrestrial) Wireless Broadband

While fixed and satellite broadband together are “adopted by less than three percent of residential fixed broadband subscribers” nationally,²²⁹ the fixed

²²⁴ Whether DSL or a variant of aDSL or xDSL.

²²⁵ DOCSIS is the acronym for Data Over Cable Service Interface Specification. It is the international standard for transmission of data over coaxial cable. Each successive version of this standard has supported higher download and upload speeds. DOCSIS 3.1 is theoretically capable of supporting download speeds of up to 10 gigabytes per second and upload speeds of up to 1 gigabyte per second, though cable users cannot expect to achieve such speeds in practice. See *BDS Order, supra*, at ¶¶ 61-65 for detailed description of DOCSIS 3.0 and 3.1, and the rapidly improving capabilities they provide to cable operators.

²²⁶ Fiber-to-the-node potentially offers speeds comparable to those of cable providers.

²²⁷ Exhibit 54, Roycroft, June 1 Testimony, at 86; Exhibit 16, Selwyn June 1 at 84; *Open Internet Order*, at ¶ 203.

²²⁸ As mentioned in the discussion of overbuilders providing voice services, our use of aggregated regional markets for concentration will mute the impact of these carriers. A carrier like Webpass may be a significant competitor for subscriptions in a high-rise in San Francisco while offering no competition for service to a single family building just a mile away.

wireless carriers – when they report at all – often show wide areas of deployment. Dr. Roycroft notes that the granular deployment data submitted to the FCC (and to the Commission under DIVCA) shows near ubiquitous coverage, but might be substantially overstated:

The Form 477 data shows (Santa Cruz based) Cruzio Internet service throughout these areas, including ubiquitous fixed wireless coverage in high density urban areas like San Jose. This is inconsistent with the reporting observed by other fixed wireless providers, which tend to have more narrowly focused and rural service areas. However, further evaluation of Cruzio Internet offerings raised questions about the accuracy of its Form 477 reports. The Cruzio Internet web site identifies a residential DSL-based offering in areas in the Santa Cruz city limits, Live Oak, Capitola, and parts of Aptos and Watsonville. However, no mention of residential fixed wireless service was found on the Cruzio Internet web site – rather, “enterprise” grade fixed wireless is identified, at prices starting at \$499 per month. Similarly, with regard to Sacramento County, another urban area showing ostensibly robust fixed wireless service, one service provider, California Broadband Services, is responsible for the entire urban coverage claim in the Form 477 data. I believe that the claim of ubiquitous coverage in Sacramento County are not likely accurate.²³⁰

Dr. Roycroft concludes that the line-of-sight technical limitation “makes it much less likely that fixed wireless will be a reasonable alternative in high-density urban areas – there are simply too many obstructions that would

²²⁹ 2016 *Broadband Progress Report*, at ¶ 26.

²³⁰ Exhibit 54, Roycroft June 1 Testimony, at 106-107. Dr. Roycroft also notes that some providers inform their customers that a line-of-sight is needed for service:

NOT ALL PLACES in our Service Coverage Area will have a clear line-of-sight from one of our towers, because of trees, buildings, hills, and other objects which may block our signal.

interfere with the deployment of a fixed wireless broadband network.”²³¹ ORA’s Tully echoes concern about limited availability due to line-of-sight and other factors, as well as general lower speeds and higher prices of the service.²³² Tully concludes: “Due to its limited availability, technological and geographical constraints, and substantially higher price, fixed wireless broadband cannot be considered a close substitute for fixed wireline broadband services.”²³³ Fixed-wireless is nevertheless a broadband option for difficult to reach areas of California that would otherwise not receive any service and the Commission has awarded California Advanced Services Fund grants to fixed-wireless providers in such areas.

Although the de facto availability of fixed wireless may be debated, and its market share remains quite small,²³⁴ the Commission is aware of the increasing use of fixed wireless services like those provided by Monkeybrains²³⁵ and Etheric

²³¹ *Id.*

²³² Exhibit 18, ORA/Tully June 1 Testimony, at I-1. Etheric networks charges \$99/month for a guaranteed 3 Mbps download speed, \$139 for 6 Mbps, and \$349/month for 25 Mbps symmetrical service, not including significant installation and equipment charges. See <http://ethericnetworks.com/home-service-plans/>.

²³³ *Id.* at 1. Staff is aware that some companies advertise fixed wireless technologies that are not line-of-sight dependent, but the relative success of these technologies is not yet known.

²³⁴ The last FCC Form 477 data reported to the CPUC, although it did not reflect some known fixed wireless providers, along with isolated and/or anecdotal information collected by CPUC staff, suggest a market share for fixed wireless significantly under 3%. See also *Broadband Progress Report*, at ¶ 26.

²³⁵ www.monkeybrains.net (showing plans at \$35/month); cf <https://www.eff.org/pages/wireless-friendly-isps>.

networks.²³⁶ Not all fixed wireless providers are licensed by this Commission, and we likely do not have complete data on the fixed wireless market segment.²³⁷

6.3.1.2. Availability by Speed

When fixed broadband availability is measured at each of the speed tiers used by the FCC, the resulting picture of the market becomes considerably more nuanced. The higher the reported speed tier, the lower the reported availability, as the discussion below suggests.

For this measurement, we encountered a variety of results, depending on data and methodology used. Most of the data analyzed in this proceeding is dependent on carriers' advertised speeds.²³⁸ At the benchmark 25/3 speed, and using the broadband deployment information found in the June 30, 2015 dataset for the state of California from the FCC,²³⁹ WGAW reports these speeds available, measuring by "served population":²⁴⁰

²³⁶ www.ethericnetworks.com.

²³⁷ While Etheric is a certificated carrier, Monkeybrains is not, and Monkeybrains numbers do not show up in data sets we have reviewed.

²³⁸ The benchmark was set by the FCC in its 2015 *Broadband Progress Report*, *supra*. See discussion above.

²³⁹ The WGAW's witness, Ms. Blum-Smith, further described the data she used:

This dataset contains broadband 7 availability information by U.S. census block, including broadband providers, technology types and download and upload speeds offered, and whether the provider can or does offer consumer/residential service as opposed to business service. The dataset includes only census blocks that are served by a provider and excludes unserved blocks. Included in the dataset but excluded from my analysis were Fixed Wireless and Satellite broadband technologies and rows in which the provider indicated that "Provider cannot or does not offer consumer/mass market/residential service in the block." The analyzed data, in other words, consisted of residential broadband service via DSL, copper, cable modem or fiber by census block.

Exhibit 60, WGAW/Blum-Smith June 1 Testimony, at 10.

²⁴⁰ *Id.* at 12, Table 2.

Number of Broadband Providers at 25 Mbps+/3 Submitted by WGAW					
- By Total Population -					
	Unserved	One Provider	Two Providers	Three or more Providers	TOTAL
Population	1,212,856	25,147,464	9,221,216	643,743	36,225,279
Population Percentage	3.3%	69.4%	25.5%	1.8%	100%

Using data from Respondents, supplemented by the June 15, 2015 FCC data set for non-Respondent carriers,²⁴¹ ORA estimates the number of households served at the 25/3 benchmark speeds as follows:

Number of Broadband Providers at 25 Mbps+/3 Submitted by ORA				
- By Household -				
Total Households	Unserved	One Provider	Two Providers	Three or more Providers
12,830,035	751,555	8,839,686	3,037,259	201,535
Household Percentage	5.9%	68.9%	23.7%	1.6%

Excluding business customers and controlling for carriers that did not market to consumers, among other data adjustments,²⁴² TURN's expert

²⁴¹ Exhibit 16, ORA/Selwyn June 1 Testimony, at 46 and Table 8, noting that the "Total HHs" is "number of households passed ... based upon 2015 Census Bureau Data because individual Respondents did not provide consistent and comparable data for the number of households passed."

²⁴² Exhibit 54, TURN/Roycroft June 1 Testimony at Appendix A004 ("The Form 477 data contains fields to designate whether the service is for either "consumer" or "business." As my study focuses only on the residential market, I did not include any records that were designated as "business." After reviewing the Form 477 data that was designated as "consumer," I next verified that each service provider did in fact actively market service to residential consumers by reviewing provide web sites and by utilizing a third-party broadband-locator service called

(footnote continued on next page)

Dr. Roycroft reports slightly more customers with access to two providers at 25/3:

Number of Broadband Providers at 25 Mbps+/3 Submitted by TURN - By Household -				
Total Households	Unserved	One Provider	Two Providers	Three or more Providers
12,830,035	491,390	8,188,128	3,770,747	381,052
Household Percentage	3.83%	63.82%	29.39%	2.97%

CD staff calculated availability at the following speed tiers:²⁴³

Number of Broadband Providers (Wireline Technologies Excluding Fixed Wireless) - By Household -				
Speed	Unserved	Served by One Provider	Served by Two Providers	Served by Three or More Providers
All Speeds	495,667 3.9%	1,180,168 9.4%	8,003,771 63.6%	2,897,892 23.0%
All Speeds	498,213 4.0%	1,188,216 9.4%	8,009,270 63.7%	2,881,799 22.9%
6/1.5	788,988 6.3%	4,314,132 34.4%	6,251,734 49.7%	1,222,644 9.7%

BroadbandNow.⁴ I found that Form 477 data for two service providers, XO Communications and Global Capacity/MegaPath, ⁵ indicated that they had consumer offerings. However, based on a review of the service provider web sites and BroadbandNow, I concluded that these companies do not actively market to residential customers"). Dr. Roycroft included screen shots from these two providers' websites, to demonstrate the nature of their marketing.

²⁴³ See Appendix C for a list of carriers included in this analysis. We noticed a significant anomaly in residential broadband availability data provided by AT&T in this proceeding. The number of census blocks served at 25/3 in this proceeding dramatically exceeds the same number provided to the Commission's Broadband Mapping team. The difference is several orders of magnitude, and staff is awaiting an explanation for this discrepancy.

10/1	676,247 5.4%	3,015,325 24.0%	7,404,999 58.9%	1,480,927 11.8%
25/3	971,335 7.7%	5,187,495 41.2%	5,450,603 43.3%	968,065 7.7%

Number of Broadband Providers (Wireline and Fixed Wireless Technologies) - By Household -				
Speed	Unserved	One Provider	Two Providers	Three or More Providers
All Speeds	271,831 2.2%	753,469 6.0%	6,684,377 53.1%	4,867,821 38.7%
6/1.5	461,108 3.7%	3,552,974 28.2%	5,241,313 41.7%	3,322,103 26.4%
10/1	382,344 3.0%	2,437,475 19.4%	6,127,222 48.7%	3,630,457 28.9%
25/3	837,977 6.7%	4,668,905 37.1%	5,033,935 40.0%	2,036,681 16.2%

Finally, the FCC calculated the number nationwide, and concluded that “38 percent of Americans” have access to more than one provider, and the rest have access to one or no provider.²⁴⁴

FCC’s Estimated Percentage of Americans with Multiple Options for Fixed Advanced Telecommunications Capability			
	No Provider	One Provider	More Than One Provider
United States	10%	51%	38%
Rural Areas	39%	48%	13%
Urban Areas	4%	52%	44%

²⁴⁴ 2016 *Wireless Progress Report*, at p 38 and Table 6.

6.3.1.3.Subscription/Concentration

The market for residential broadband is highly concentrated, both in terms of market share and HHI. Our analysis of the data gathered in this case shows that, even in In Los Angeles, the least concentrated market in the State, the two largest telecom incumbents AT&T and Frontier together have approximately 1.6 million broadband connections; the cable companies, Cox and Charter/Time Warner, have approximately 2.2 million connections. In others of California's largest counties, staff calculates that cable supplies most of the broadband landlines in service (up to 200 percent more that legacy telephone carriers in some areas).

Concentration in Largest Fixed Broadband Markets		
Market	HHI	Concentration Level
Los Angeles	5,096	Highly Concentrated
Oakland	4,881	Highly Concentrated
Sacramento	5,048	Highly Concentrated
San Diego	5,115	Highly Concentrated
San Francisco	5,190	Highly Concentrated
San Jose	5,469	Highly Concentrated

We have, again, used the *Market Share Report's* territory adjustment, as described above.

In comparison, the *Market Share Report* statewide fixed broadband HHI values show the following levels of market concentration over time.²⁴⁵

Statewide Fixed Broadband Market

²⁴⁵ 2015 *Market Share Report*, *supra*, at 32.

Time Period	HHI	Concentration Level
June 2001	4,587	Highly Concentrated
June 2006	4,666	Highly Concentrated
June 2013	4,687	Highly Concentrated

As was the case for voice, broadband “overbuilders” Sonic, Wave/ Astound, Consolidated/SureWest, and Giggle Fiber (not to be confused with Google Fiber) are active in these markets.²⁴⁶ In the Oakland and San Francisco markets, all non-cable competitive carriers together provide less than 8% of total fixed broadband lines. In Sonic’s case, most of those connections are provided over ILEC facilities with only limited facilities deployed by Sonic, primarily in San Francisco’s Sunset District.

Fixed wireless broadband market share appears to significantly smaller than the overbuilders’ small market share, based on FCC data,²⁴⁷ although there may be some undercounting to the extent that fixed wireless broadband providers do not file Form 477s with the FCC.

The residential broadband market is the most concentrated retail market analyzed in this proceeding. While our jurisdiction to address this subject is limited,²⁴⁸ we will examine policies clearly within our jurisdiction to increase efficiency in this market.²⁴⁹

²⁴⁶ Exhibit 54, Roycroft June 1 Testimony at 47-48.

²⁴⁷ 2016 *Broadband Progress Report*, at ¶ 26 (less than 3% market share for fixed wireless and satellite broadband).

²⁴⁸ See Pub. Util. Code § 710.

²⁴⁹ See “Next Steps,” section VII(D)(7)(b), *infra*.

6.3.2. Mobile Broadband

6.3.2.1. Availability

In order to analyze mobile broadband availability, we used CalSPEED data collected by this Commission to look at the actual mobile speeds available throughout the state, not just the advertised speeds.²⁵⁰ As we explained in comments to the FCC, actual mobile speeds have high variability.²⁵¹

While we rely primarily on the carriers to report fixed broadband speeds, the CalSPEED tool, described above, allows us to measure actual mobile broadband speeds.²⁵²

Using mean mobile speed, the following table displays mobile availability results:

Number Households Served by Mobile Broadband Providers				
Speed	Unserved	One Provider	Two Providers	Three or more Providers
All speeds	15,786 0.1%	40,514 0.3%	186,042 1.5%	12,335,156 98.1%
6/1.5	76,564 0.6%	346,489 2.8%	1,347,036 10.7%	10,807,409 85.9%
10/1	443,008 3.5%	1,690,480 13.4%	3,685,189 29.3%	6,758,821 53.7%
25/3	9,756,647	2,497,970	293,569	29,312

²⁵⁰ CalSPEED Reports, 2012-2016, available at <http://www.cpuc.ca.gov/General.aspx?id=1778>.

²⁵¹ CPUC Comments *In re Deployment of Advanced Telecommunications Capability*, FCC Docket GN 15-191, at 8-9 (“mobile broadband is subject to extreme variability”) (Sept 15, 2015).

²⁵² Since 2012, CD has performed semi-annual field testing of mobile broadband service quality in urban, rural and tribal areas throughout California, collecting approximately 1,400,000 test results at the same 1,986 locations (test locations increased from 1,200 to 1,986 as of autumn, 2013). The data shown here are from Spring 2016. Enhancements were made in our testing protocol prior to the most recent field test to capture backhaul and middle mile information in order to compare its urban, rural and tribal service characteristics and impacts. Analysis of the latest data collection is currently under way. In addition, CPUC Staff have developed an on-line tool, available at www.calspeed.org, to collect fixed broadband service speed, quality and reliability information using the same testing protocol as the mobile application.

	0.2%	2.3%	19.9%	77.6%
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As previously noted, we have found that average measured speeds are not representative of a consumer's actual mobile experience. As shown in the table below, using the ninety-eight percent confidence interval CD staff devised to demonstrate actual subscriber experience results in the following mobile broadband availability trends:

Number Households Served by Mobile Broadband Providers - Consistent Speeds -				
Speed	Unserved	One Provider	Two Providers	Three or more Providers
All speeds	268,130 2.1%	225,200 1.8%	450,188 3.6%	11,633,980 92.5%
6/1.5	11,572,315 92.0%	899,938 7.2%	102,268 0.8%	2,977 0.0%
10/1	12,503,131 99.4%	70,864 0.6%	3,503 0.0%	0 0.0%
25/3	12,577,498 100.0%	0 0.0%	0 0.0%	0 0.0%

As reported to the FCC, the CalSPEED median and mean speeds, measured over thousands of tests in California, ranged from 7.87 and 15.49 Mbps.²⁵³ In none of the four separate speed tests cited by the FCC did mean or median speeds approach 25/3. The FCC noted the CalSPEED results by carrier, at mean and median speeds:

²⁵³ FCC 19th *Wireless Competition Report*, at ¶ 110 Table VI.B.6.

CalSPEED--Estimated LTE Download Speeds by Service Provider, California Only, Fall 2015²⁵⁴			
Service Provider	Mean LTE Download Speed (Mbps)	Median LTE Download Speed (Mbps)	Number of Tests
AT&T	12.26	11.18	3,044
Sprint	9.78	7.87	1,970
T-Mobile	11.84	11.93	2,220
Verizon Wireless	14.36	15.49	3,124

6.3.2.2.Subscription/Concentration

We calculate the HHI concentration for mobile data service, at any speed, within each major market in California.

Concentration in Largest Mobile Broadband Markets		
Market	HHI	Concentration Level
Los Angeles	2,217	Moderately Concentrated
Oakland	2,665	Highly Concentrated
Sacramento	2,544	Highly Concentrated
San Diego	3,037	Highly Concentrated
San Francisco	3,074	Highly Concentrated
San Jose	2,782	Highly Concentrated

The Market Share Report statewide mobile broadband values below show the following levels of statewide market concentration measured by HHI.²⁵⁵

²⁵⁴ *Id.* (dropping top one percent of speed values; data collected December 3, 2015 to January 22, 2016).

²⁵⁵ *See, e.g., Market Share Reports, supra.*

Statewide Mobile Broadband Concentration		
Date	HHI	Concentration Level
December 2008	3,528	Highly Concentrated
June 2011	2,723	Highly Concentrated
June 2013	2,706	Highly Concentrated

6.4. Wholesale Markets

The URF decisions' finding of an "intermodal" marketplace was premised in part on competitive carriers' access to UNEs provided by the legacy incumbent telephone companies.²⁵⁶ Because none of the competitive carriers can build a network from the ground up, they depend on the legacy companies for wholesale inputs, including (variously) last-mile or "local loop" access, middle mile or other dedicated special access transport, pole attachments and/or conduit access, and (for the wireless carriers) spectrum. URF considered last mile access, but not the other three types of wholesale access.

The legacy phone companies generally claim there is a surfeit of wholesale competition;²⁵⁷ intervenors argue that the legacy companies are able to use their market power to extract supra-competitive rates from, and impose

²⁵⁶ URF conceived of a competition between these competitive carriers, VoIP provided by cable companies and others, and wireless or mobile telephone service. *See, e.g.*, D.06-08-030, Finding of Fact 77: "We can rely upon market forces, rather than regulatory proceedings concerning tariffing and contracting practices due to the realistic threat of entry by carriers using UNE-L and widespread competition offered by wireless, cable, and VoIP providers."

²⁵⁷ Dr. Aron offers a table with a full array of assertedly wholesale offerings, all by competitive carriers, but she does not delineate what the products are or how they compete. Exhibit 5, AT&T/Aron June 1 Testimony, at Table 1 (page 54). She does not address the incumbents' provision of wholesale inputs to competitors, except to say that AT&T supplies more local loops to competitors today than it did in 2006. *Id.* at 38.

disadvantageous terms on, competitive carriers, and ultimately on the large and small businesses, and consumers.²⁵⁸ A middle ground is occupied by cable providers like Cox that have no legal obligation to provide unbundled elements to non-cable CLECs, but need wholesale inputs in order to enter the business market. Cox's witness Gillan explains:

[C]able-based entrants have had to overcome many of the same barriers as other [CLEC] entrants – deploying new networks, creating new sales and customer support organizations, and developing new provisioning systems, including systems to order and connect facilities leased from other suppliers, including Unbundled Network Elements (“UNEs”) or special access.²⁵⁹

Of the wholesale inputs discussed here, only spectrum is not controlled to some extent by the incumbent telephone companies.²⁶⁰ Intervenors' testimony and FCC decisions suggest that the higher prices for wholesale inputs, the higher the price that the consumer or business will pay for retail services.²⁶¹

²⁵⁸ See, e.g. Exhibit 55, TURN/Baldwin June 1 Testimony, at 7-8:

The lack of competition for special access services allows the ILECs to charge supracompetitive prices. These overcharges are initially borne by special access 2 customers, such as large businesses, CLECs, and wireless companies, which, in turn, will seek to pass these excess costs on to the consumer. Thus, an efficiently functioning special access market is important to all consumers – not only large sophisticated business users, but also residential and small business customers.

²⁵⁹ Exhibit 28, Cox/Gillan June 1, at 23.

²⁶⁰ Last mile loops and special access/BDS services are largely, but not completely, in the hands of the incumbent carriers, as reflected in both the 2014 *Local Competition Report* (Tables 14-15), available at https://apps.fcc.gov/edocs_public/attachmatch/DOC-329975A1.pdf, and the *BDS Order* (¶ 52). Poles, as discussed below, are often owned jointly, and the incumbent carriers are not infrequently members of the joint pole authorities. Interconnection, as framed in the 1996 Telecommunications Act, inherently involves access to incumbents' facilities.

²⁶¹ Exhibit 55 (Baldwin) at 9-10.

CALTEL agrees on this point. It suggests that there are two different dimensions of telecom competition: 1) intramodal (often resale-based) competition, and 2) intermodal (facilities-based) competition.²⁶² CALTEL further argues that the distinction between “resale” and “facilities-based” service is not always clear,²⁶³ and that the price of wholesale inputs impacts the price of downstream services – and in the case of middle-mile and last-mile facilities, there are bottlenecks that inhibit adequate competition.²⁶⁴ We observe that cable companies and wireless companies who own or control independent last-mile facilities may avoid last-mile bottlenecks by incurring construction (and spectrum access) costs.²⁶⁵

6.4.1. Last-Mile Loops: Access to Unbundled Elements or Wholesale Residential Voice Service

Both the OII and URF I acknowledged the vital role that unbundled network elements play in creating competition:

URF I acknowledged how competitive access to incumbent networks, particularly in the form of UNEs, enables competitors to reach consumers through a “last mile” connection, thus stimulating efficient competition.²⁶⁶

²⁶² CALTEL Reply Brief at 12.

²⁶³ CALTEL Opening Brief at 9-12.

²⁶⁴ *Id.* at 3.

²⁶⁵ Bottlenecks for pole & conduit access present a different problem.

²⁶⁶ OII at 3-4, citing D.06-08-030, pp. 80-81 (footnotes omitted, unless otherwise noted):

[A]ccess at cost to these bottleneck network elements [UNEs] would enable competitors to offer telecommunications services and would limit the market power of the ILECs. Two specific UNEs, UNE-L and UNE-P, deserve special mention because of their market impact and importance to this proceeding. UNE-L, also known as “UNE Loop,” consists of the

(footnote continued on next page)

URF described the last-mile loop as a “bottleneck.”²⁶⁷

The Coalition rejects intervenors’ claims that that “[l]ast mile wireline facilities continue to present barriers to entry.”²⁶⁸ Dr. Aron claims that

AT&T continues to supply lines to competitors as UNEs and on a resale basis, as mandated by the FCC. These include unbundled network element loops, which CLECs combine with their own switching services to provide local service. AT&T California supplies more UNE loops today than it did in 2006.²⁶⁹

Aron also argues, essentially, that UNEs are becoming irrelevant because of a shift to “facilities-based” competition:

Competition by wireline providers today is primarily facilities-based, as can be seen in Figure 12. Lines provided by non-ILEC wireline providers over their own facilities have increased by 75 percent since 2008 (when the FCC began systematically to report VoIP lines), and most of the facilities-based competition is based on VoIP technology. These trends confirm the expectations of the Commission in 2006 that VoIP

loop from the central office to the customer’s premise. [URF I adds in a footnote “Historically, the major bottleneck to local telephone competition was seen as the ILEC’s control of ‘the last mile’ between the central office to the customer’s home.”] The purchase of a UNE-L by a competitive carrier enables the competitive carrier to reach a customer and serve the customer on its network. UNE-P, also known as “UNE-Platform,” consists of a combination of the loop, port, and switching services of the ILEC. The purchase of the UNE-P enabled the competitive carrier to serve the customer with minimal network investment.

See also id. at fn. 124, and discussion of the “larger context” in section 5 below.

²⁶⁷ URF I referred to unbundled network elements almost definitionally as “bottleneck” facilities, and cited local-loops as the historical example. *Id.* at 80, and fn. 306.

²⁶⁸ Coalition Opening Brief, at 39 (and fn. 49), citing Ex. 16 at 28:17-29:2 (Exhibit 16, Selwyn/ORR); Ex. 21 at 11:5-9 (Exhibit 21, Selwyn/ORR July 15 Testimony); Exhibit 54 at 59:15 (Roycroft/TURN).

²⁶⁹ Exhibit 5 (Aron) at 38, citing Figure 11.

technology would be a major competitive threat to traditional wireline providers.

It appears that Dr. Aron is here referring to facilities-based competition from cable companies.

Intervenors respond that, although cable companies deploying DOCSIS 3.1 can provide much faster speed and greater bandwidth, they are not subject to the same unbundling requirements as the legacy telephone companies, and thus would-be competitors have no access to those facilities.²⁷⁰

As for the legacy telephone companies, TURN's Roycroft describes how anemic resale and UNE-unbundling have become in the residential market:

Legacy Frontier and Consolidated do not provision any residential wholesale lines. Frontier indicates that it does not have historical data regarding Verizon wholesale activities. AT&T describes a level of residential wholesale sales that can only be described as de minimis.

In the confidential continuation of this testimony, Roycroft provides the details of AT&T's resale offerings, amounting to a very small portion of the company's own lines.

Roycroft finds that Sonic is the one bright spot among would-be CLEC competitors, both in its utilization of UNE loops, and in its (still limited)

²⁷⁰ Exhibit 54 (Roycroft) at 39:

It is important to keep in mind that the impact of resale and UNE-based competition is diminished further by the fact that only one of the wireline technology platforms has these requirements. Cable technology is now important for the provision of both voice and broadband services; the CLEC sector does not have any access to that platform. Thus, remaining CLECs face similar limitations as ILECs with regard to their technological capabilities – a copper-based platform with limited broadband and video capabilities.

deployment of fiber.²⁷¹ By and large, however, last mile facilities still appear to be concentrated in the legacy phone companies and in the cable companies.

6.4.2. Special Access/BDS, and Cell Site Backhaul in Particular

6.4.2.1. Generally

Last-mile access (unbundled loops) are not the only form of wholesale input that a competitive carrier would need for market entry. The competitive carrier needs dedicated, high-speed special access or business data service (BDS) lines to connect its facilities with the rest of the network. Although BDS lines are also used as a last-mile solution for large enterprise customers, competitive carriers use them for many middle-mile purposes as well:

[A]nother wholesale component of an efficiently-competitive network [is] special access lines used in many middle-mile connections between carriers, such as backhaul from wireless cell sites into the network, as well as last-mile connections to large network users. ... *URF I* acknowledged that “[s]pecial access lines are commonly used by wireless and VoIP competitors in their networks,” and recognized “the importance of this network interconnection service,” it deferred the “pricing of special access services” until “the next phase of this proceeding.”²⁷²

Special access lines (recently re-christened BDS) are *dedicated*, generally high-speed connections provided by carriers to businesses, including other carriers. They are critical for CLECs that “depend on special access in order to

²⁷¹ Exhibit 54 (TURN/Roycroft) at 95 (“Sonic.net provides a bright spot for residential customers, but has limited availability, and does not offer a triple-play option”).

²⁷² OII at 4, citing D.06-08-032 at 244 & 274, Conclusion of Law 12.

fulfill the requirements of multi-location customers,²⁷³ as well as wireless network providers that need to transport their calls from the cell tower back into the network.²⁷⁴ When BDS lines are used as a last-mile solution for large enterprise customers, they are sometimes referred to as “building access”; when it is used by wireless carriers they are referred to as “backhaul.” Competitive carriers may also use them as middle-mile facilities. Special access services are offered as a tariffed product by the incumbent carriers, and may be offered on a de-tariffed basis by competitive carriers.²⁷⁵

The FCC has found that the legacy carriers still exercise considerable market power in the special access market, with ILECs and their affiliates accounting for \$37 billion of the \$ 45 billion in national BDS revenue,²⁷⁶ that 77.2 percent of buildings have only one fiber provider (usually the ILEC) and 57.1 percent have only one fiber or UNE (copper) provider,²⁷⁷ and that significant

²⁷³ Exhibit 55 (Baldwin) at 3-4 (“While CLECs have built fiber connections to some commercial buildings and cell sites, it is uneconomic for them to serve most locations because of costs and/or available revenues”).

²⁷⁴ *Id.* at 4, 31 (“If the prices paid by wireless carriers, particularly those unaffiliated with ILECs, to purchase backhaul special access services are not cost-based, it could threaten the viability of competition within the wireless market”).

²⁷⁵ Decision 09-04-005, April 16, 2009, states that CLECs and IECs “may offer special access services on a detariffed basis.” Whereas, ILECs “shall offer special access services on a tariffed basis.” Tariffed special access is tiered by speed, 1.544 Mbps, 3.154 Mbps, 6.132 Mbps, 44.736 Mbps, and 274.176 Mbps. Schedule CAL P.U.C. 175-T, Special Access Services.

²⁷⁶ *BDS Order* at ¶ 218.

²⁷⁷ *Id.* at ¶¶ 220-223 and Table 3. When hybrid fiber and cable (HFC) is added to the mix, 57% of buildings have two competitors, and 12% have only one. For wireless system backhaul, however, Sprint describes cable’s Ethernet over HFC as a poor substitute for fiber-based services. *Id.* at 202 (reasons redacted). The FCC has not yet measured BDS market concentration in the cellular backhaul market.

barriers remain for competitors wishing to build new BDS facilities, particularly in urban areas.²⁷⁸

TURN's Baldwin explains the connection between this essential wholesale input and retail prices and conditions:

The lack of competition for special access services allows the ILECs to charge supracompetitive prices. These overcharges are initially borne by special access customers, such as large businesses, CLECs, and wireless companies, which, in turn, will seek to pass these excess costs on to the consumer. Thus, an efficiently functioning special access market is important to all consumers – not only large sophisticated business users, but also residential and small business customers. Distorted pricing signals for wholesale inputs thwart the efficient supply of telecommunications services at the retail level. For example, the high cost of purchasing special access from the ILEC may create an insurmountable disadvantage for a CLEC attempting to compete with that ILEC for a multi-location business customer. Thus, the lack of wholesale competition makes retail competition less viable.²⁷⁹

To the extent that the provision of dark fiber is provided as a wholesale input to a carrier's operations, a "carrier's carrier" service, it is similar to "lit" special access. In this regard, energy companies like Southern California Edison Company (Edison) and Pacific Gas and Electric Company (PG&E) are increasingly appearing as the owner/lessor of such fiber facilities.²⁸⁰

²⁷⁸ *Id.* at ¶¶ 224-236.

²⁷⁹ Exhibit 55, TURN/Baldwin June 1 Testimony, at 8.

²⁸⁰ Although none of the parties cite to this phenomenon, the Commission has over the last decade processed (and largely approved) applications by Edison, San Diego Gas & Electric Company (SDG&E), and PG&E to lease fiber to Level 3 and other carriers. A.15-07-012, *Application of Pacific Gas and Electric Company (U 39 E) for Commission Approval Under Public Utilities Code Section 851 of an Irrevocable License for use of Utility Support Structures and Equipment Sites to ExteNet Systems (California) LLC*; *Application of Pacific Gas and Electric Company (U39E) for Commission Approval under Public Utilities Code Section 851 of a Restated*

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6.4.2.2.BDS Used for Cell Site Backhaul in Particular

Perhaps most important, wireless carriers use special access/BDS as backhaul from wireless cell sites to upstream points in the network. Sprint, in particular, complains about market power which incumbent BDS providers apply in this backhaul market:

Sprint contends that ILECs have market power in their provision of special access (both backhaul and building access) and interconnection. The ILECs' obligation to serve all within their serving area gives them the unique capability of serving all building locations. Likewise, the ILECs have the greatest capability of providing cell site backhaul. This issue is currently under investigation by the FCC. In the interest of supporting robust retail competition in CA, Sprint would urge the Commission to engage in the debate taking place at the FCC to ensure that an outcome is achieved consistent with California residential and business customers' best interests.²⁸¹

The incumbent providers' testimony did not address Sprint's claims.²⁸²

Without responding to Sprint's complaint, Comcast's Dr. Topper notes that cable and fiber providers are entering the backhaul market, and thus the backhaul market is not as constrained as it was.²⁸³

License Agreement with IP Networks, Inc. and Level 3 Communications, LLC; Decision 13-09-015, granting Application of Southern California Edison Company (U338E) for Authority to Lease Certain Optical Fibers to Sprint Communications Company; D.96-09-061, granting Application of San Diego Gas & Electric Company (U 902-G) for Authority to Lease Fiber Optics to MCIM. Edison, in addition to being a certificated energy utility, is also a certificated telecommunications carriers. In this capacity, Edison provides backhaul capacity to mobile telecommunications carriers.

²⁸¹ Exhibit 76, Sprint/Burt March 15 Testimony, at 5. TURN's Susan Baldwin cites further Sprint testimony in this regard.

²⁸² See, generally, June 1, 2016 testimony of AT&T/Katz, AT&T/Aron, and Charter/Comcast/Topper.

²⁸³ Exhibit 41, Charter/Topper Testimony at 43 ("Wireless providers do, however, require high-capacity transport to backhaul traffic from cell towers to the backbone telecommunications network... Demand for backhaul from cell towers has been growing rapidly as consumers and business increase their use of mobile broadband. The increase in demand for mobile broadband

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Wireless backhaul conditions at the statewide level have improved since the 2011 AT&T/T-Mobile merger, where it was generally shown that the legacy carriers provided the overwhelming majority, of backhaul from cell sites, thus potentially advantaging then-ILEC affiliates AT&T Wireless and Verizon Wireless over Sprint and T-Mobile.²⁸⁴ Five years later, however, cable and other providers of backhaul supply about 15-20 percent of that market, still leaving one legacy carrier supplying backhaul to a majority of cell towers statewide.²⁸⁵

At a statewide level, the backhaul market is highly concentrated in three firms – with one legacy carrier, far outweighing the other two combined.²⁸⁶ This lead firm accounts for significantly over half of cell site backhaul for the big four wireless carriers.²⁸⁷ The second largest firm accounts for a little less than 15 percent of cell site backhaul, and the third largest firm accounts for a slightly less than 10 percent of cell site backhaul.²⁸⁸

TURN's Ms. Baldwin outlines some of the persistent inefficiencies that the legacy carriers' market power creates:

services has made the economics of providing backhaul services more attractive to a range of competing suppliers").

²⁸⁴ See, e.g., July 8, 2011 public hearing in California Public Utilities Commission proceeding I.11-06-009 *Investigation of Planned Purchase by AT&T of T-Mobile*, transcript at pp. 87 (Sprint assertion that "90-plus percent of our special access [backhaul] is with the ILECs").

²⁸⁵ Respondents' responses to OII Information Requests 17 and 18, as compiled by staff.

²⁸⁶ Because, at the carriers' request, this data was deemed "Highly Confidential," we decline to name the firms involved in a public document. We provide only the nearest round number for our public market share analysis for the same reason. This analysis is based on the data supplied by the Respondents to this proceeding, data which covers all four major wireless carriers in California.

²⁸⁷ AT&T, Verizon Wireless, Sprint, T-Mobile.

²⁸⁸ For these calculations, the number of cell sites with backhaul service by a particular corporate entity is divided by the total number of cell sites reported by the four large wireless carriers.

The Consumer Federation of America's lead economist, Dr. Mark Cooper, has recently calculated what he believes to be the direct overcharges for special access in the neighborhood of \$20 billion per year, while "indirect economic losses that result from the drag on the economy add another \$20 billion to the harm." In recognition that the cost of overpriced special access purchased at wholesale is ultimately borne by the individual consumer, Dr. Cooper points out that \$40 billion in annual expenditures on special access, expressed on a per-household basis, works out to \$300 per year.

Special access overpricing also harms consumers to the extent that it undermines the financial stability of wireless providers that are not ILEC affiliates (e.g., Sprint and T-Mobile). As Sprint described in its comments submitted earlier this year to the FCC: "these dedicated broadband services are the connections that make the mobile Internet possible, by linking both the macro and micro base stations (i.e., cell phone towers) that mobile carriers must deploy to keep up with surging consumer demand for data." Sprint further explained that "these wholesale services are the essential links that connect wireless towers and access points to the Internet," and that "[s]pecial access, roaming, and spectrum are the three critical inputs necessary to ensure that the wireless markets of the future are competitive."²⁸⁹

This issue is likely to become even more important as the wireless carriers move to 5G technologies.²⁹⁰

We do not have pricing data for cell site backhaul, but the issue of special access competition, generally, remains under the consideration of the FCC. The market share data we have on cell site backhaul, in conjunction with testimony

²⁸⁹ Exhibit 55 (Baldwin) at 9-10.

²⁹⁰ *BDS Order*, at ¶ 5 ("backhaul ... is critical to the ability of wireless carriers to expand and operate their networks today and will be even more critical as the advent of 5G wireless drives the creation of the dense thicket of cell sites that will be needed to deliver high bandwidth wireless services").

offered on the subject, raises concern about inefficiency in this marketplace. The FCC is the primary regulatory authority for this subject, but we note the state of this market for its potential to impact wireless rates, which are a primary driver of retail intermodal competition.

6.4.3. Access to Poles & Conduit

Parties generally recognize that access to poles and conduits is essential for the provision of both wireline and wireless service to retail end-users.²⁹¹ Conversely, lack of access to poles and conduit is a critical obstacle to making the telecommunications market fully competitive. The Commission recently gave wireless providers the right to attach cellular antennas on utility poles, at which point the cable companies (eyeing the wireless market) and CLECs (wishing to mount distributed antenna systems, or DAS, antennas) filed for similar access to the poles.²⁹² A recent CLEC Application for Arbitration raises the issue of access to incumbent underground conduit.²⁹³ And at least one prominent would-be broadband Internet access provider has requested clarification of its rights to attach fiber to the poles. Meanwhile, the Commission's Safety and Enforcement

²⁹¹ See, e.g., July 15, 2016 CalTel/DeYoung rebuttal testimony, at 20 (letter to Assemblyman Gatto: "The CPUC provides a critical venue for adjudication and resolution of intercarrier disputes that involve critical issues such as local interconnection, the unbundling of network elements, colocation, number portability, and access to rights-of-way, poles and conduits").

²⁹² See, e.g.: D.16-01-046, Decision Regarding the Applicability of the Commission's Right of Way Rules to Commercial Mobile Radio Service Carriers; A.16-05-015, WebPass Application for Arbitration of Dispute with AT&T/Pacific Bell regarding access to underground conduit; P.16-08-016, Petition of the Wireless Infrastructure Association for a rulemaking to Extend the Rights of Way Rules for CMRS Facilities to Wireless Facilities Installed by CLECs; P.16-07-009 Petition of the California Cable and Telecommunications Association (CCTA) for a Rulemaking to Extend the Right of Way Rules to CMRS Facilities to wireless facilities Installed by Cable Corporations; R 06 10 005 - Petition of Google Fiber Inc. for Modification to Clarify D.07-03-014 (re access to poles).

²⁹³ A.15-05-015.

Division has filed a petition to strengthen the safety aspects of pole attachment rules. It is becoming increasingly clear that utility poles and corresponding rights of way are areas where safety and competition goals, and asserted property rights, meet and potentially clash.

Several of the parties also mention the pending introduction of 5G wireless, or ‘mobile fiber’ as FCC Chairman Tom Wheeler calls it, as an “event horizon of critical importance.”²⁹⁴ The fact that 5G will require perhaps ten times as many wireless antennas as currently deployed (“densification,” discussed below) can only mean that there will be increasing pressure put on a finite stock of poles and conduit in California.

Poles and conduit are a major part of the expense of deploying telecommunications infrastructure. For example, total network construction costs to deploy Google Fiber in San Jose were estimated at \$500 million, assuming a cost of \$25 a foot to hang fiber on poles, including making existing poles ready and replacing ones that are inadequate to support additional infrastructure, and \$50 a foot to install conduit.²⁹⁵ The San Francisco Board of Supervisors Budget and Legislative Analyst’s Office estimated in March 2016 that it would cost between \$285 million and \$867 million to construct a municipal broadband network in San Francisco, depending on the model used.²⁹⁶ The FCC

²⁹⁴ Exhibit 28 (Gillan) at 15-16 (“deployment of 5G technology – with speeds of up to 1 Gbps – will position wireless networks in the broadband market ... 5G speeds will fundamentally change the mobile broadband experience to be more like the speeds and experience achieved by wired broadband services”).

²⁹⁵ Steve Blum, Tellus Venture Associates, “[Gigabit for San Jose could cost Google a gigabuck](http://www.tellusventure.com/blog/gigabit-for-san-jose-could-cost-google-a-gigabuck/),” October 23, 2015, with links to San Jose environmental review of planned network, available at <http://www.tellusventure.com/blog/gigabit-for-san-jose-could-cost-google-a-gigabuck/>.

²⁹⁶ Memo of Budget and Legislative Analyst’s Office to Supervisor Farrell, “Financial Analysis of Option for a Municipal Fiber Optic Network for Citywide Internet Access,” March 15, 2016,

(footnote continued on next page)

has found that the expense of leasing pole attachments and rights-of-way can amount to 20 percent of the cost of fiber optic deployment.²⁹⁷

Fixed wireless technology, which avoids last mile pole and conduit issues, faces significantly lower deployment costs, as Dr. Topper's asserted on behalf of Comcast, Charter and Time Warner, "[f]ixed wireless technology allows carriers to extend their network in a fraction of a time and at much lower cost than with wireline technologies."²⁹⁸ In an example of this lower cost for fixed wireless, Cal.NET's El Dorado North Project, a California Advanced Services Fund (CASF) Infrastructure Account grant approved by the Commission in January 2016, had a per-household subsidy of \$742.²⁹⁹ For comparison, the following recently approved CASF Infrastructure Account grants for fiber builds have much higher per household subsidies:

- Race Gigafy Mono -- \$13,893 per household;³⁰⁰

at 10, 30, 44-48, 52 (excess to poles and conduit major cost driver) available at <http://sfbos.org/sites/default/files/FileCenter/Documents/55324-BLA.MuniGigabitFiberFinance031516.pdf>.

²⁹⁷ FCC, *Connecting America: The National Broadband Plan*, p. 109. The FCC derived this estimate from several sources. See Letter from Thomas Jones, Counsel to FiberNet, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 09-51, WC Docket No. 07-245 (Sept. 16, 2009) (FiberNet Sept. 16, 2009 Ex Parte) at 20 (noting average cost for access to physical infrastructure of \$4,611-\$6,487 per mile); Comment Sought on Cost Estimates for Connecting Anchor Institutions to Fiber – NBP Public Notice #12, GN Docket Nos. 09-47, 09-51, 09-137, Public Notice, 24 FCC Rcd 12510 (2009) (NBP PN #12) App. A (Gates Foundation estimate of \$10,500-\$21,120 per mile for fiber optic deployment); see also Letter from Charles B. Stockdale, Fibertech, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 09-47, 09-51, 09-137 (Oct. 28, 2009) at 1-2 (estimating costs ranging from \$3,000-\$42,000 per mile).

²⁹⁸ Exhibit 41, Topper June 1 Testimony, p. 46.

²⁹⁹ Resolution T-17497, approved January 14, 2016. The CPUC approved a \$1,139,755 grant to Cal.net, representing 60 percent of the applicant's estimated total project cost of \$1,899,591. The per-household cost is based only on the subsidy amount, not the full project cost.

³⁰⁰ Resolution T-17477, approved January 28, 2016. The CPUC approved a \$6,580,007 grant, representing 60% of the project costs on \$9,238,987, plus \$1,036,614 for Contribution In Aid of

(footnote continued on next page)

- Race Five Mining -- \$10,087 per household,³⁰¹ and
- Bright Fiber -- \$8,324 per household.³⁰²

Fixed wireless may not, however, be the panacea that this discussion suggest. Spectrum costs (and issues with unlicensed spectrum), line-of-sight technological limitations, and the persistent need for backhaul, are all potential problems with fixed wireless.

The Commission is also aware of informal complaints that certain incumbents and public utilities are erecting artificial obstacles to effectively deny pole and conduit access to potential new market entrants. For example, a February 5, 2016 letter from Google Fiber to Executive Director Tim Sullivan asserted that PG&E and the Northern California Joint Pole Association were “resisting their duty of providing nondiscriminatory access” afforded under D.15-05-002.³⁰³

In a separate example, AT&T in May, 2015 announced that it was discontinuing its practice in Northern California of buying space on a pole for

Construction (CIAC). The per-household cost is based only on the subsidy amount, not the full project cost.

³⁰¹ Resolution T-17488, approved January 14, 2016. The CPUC approved a \$2,037,721 grant, representing 60% of the total underserved project cost of \$3,396,201. The per-household cost is based only on the subsidy amount, not the full project cost.

³⁰² Resolution T-17495, approved December 3, 2015. The CPUC approved a \$16,156,323 grant and a \$500,000 loan. The grant amount represents 59.3 percent of the applicant’s estimated total project cost of \$27,232,418, while the loan amount represents about two percent. The per-household cost is based only on the subsidy amount, not the full project cost.

³⁰³ February 5, 2016 letter of Austin Schlick Director of Communications Law, Google, Inc. to CPUC Executive Director Tim Sullivan. HYPERLINK http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utili.

third-party attachers when AT&T itself did not own sufficient surplus space on that pole to accommodate the attacher.³⁰⁴

In addition to informal complaints regarding access denials, the Commission on occasion receives formal complaints. For example, on May 25, 2016, Webpass filed an application for arbitration of its dispute with AT&T over access to utility support structures. In its application, which Webpass has since moved to dismiss, Webpass asserted that:

AT&T California has denied Webpass the ability to install splice cases and similar equipment in AT&T California's conduit systems and has also stated that it will deny Webpass the right to install fiber optic cable in a conduit that is partially occupied by an existing AT&T California cable except in entrance facilities owned by other parties or unless AT&T California's cable is enclosed in an inner duct.³⁰⁵

We cite these complaints as examples of the increasing topicality and salience of pole, conduit, and right-of-way issues. We will continue to study them; where we have authority to intervene we will consider acting to address them.

6.4.4. Access to Spectrum

As we stated in the OII:

“A ...component, on which wireless competitors in particular rely, is electromagnetic spectrum. While we are aware that spectrum issues are the province of the FCC, a comprehensive examination of the wholesale marketplace necessarily includes a review of spectrum in California. To determine the availability and sufficiency of spectrum, this proceeding will

³⁰⁴ AT&T Notice Regarding Requests To Attach To Poles Managed By The Northern California Joint Pole Association, provided to staff on or about May 5, 2016.

³⁰⁵ [Application by Webpass Telecommunications, LLC \(U7278C\) pursuant to D.98-10-058 for Arbitration of Dispute over Denial by Pacific Bell Telephone Company \(U I 00 I C\) of Nondiscriminatory Access to Utility Support Structures \(A.16-05-015\)](#), May 25, 2016, p. 1-2.

seek data on who controls what spectrum in California, and how wireless spectrum shortages and acquisitions affect competition in the telecommunications marketplace.”

TURN’s Dr. Roycroft asserts that there is a shortage of spectrum; the incumbent-affiliated wireless carriers deny this is the case. Scarcity of electromagnetic spectrum limits the data speeds that are available in wireless networks and raises the question of whether wireless is and will remain an effective substitute for fixed services, particularly broadband. “While voice services do not place a substantial burden on available spectrum, data services do, and this scarcity results in mobility data services that are costlier than wireline broadband services.” Dr. Roycroft further observes some of the specific consequences of spectrum limitations:

Because of spectrum limitations, wireless carriers limit the data speeds that are available in their wireless networks. Given the scarcity of spectrum in each cell site, consumers may face much lower broadband speeds than is the case on some wireline broadband networks. When wireless networks become congested, network performance will degrade. Furthermore, if a household were to consider replacing their wireline broadband with an LTE-based wireless hotspot in their home, the limited bandwidth would be potentially shared among multiple household users, further degrading application performance.³⁰⁶

We note that the spectrum market situation is unclear at the moment, due to the ongoing FCC spectrum auctions, designed to repurpose TV spectrum for wireless telecommunications. The FCC has undertaken an historic double-auction to obtain spectrum from television broadcasters and reassign it to

³⁰⁶ Exhibit 54, Roycroft June 1 at 41. *See also* 17th *Wireless Competition Report* at ¶ 92.

mobile telecommunications companies. In the recently initiated mobile half of the auction, wireless carriers were unwilling to bid sufficiently high prices to make the auction work.

An additional complication is that some of the proposed new technologies in development would provide at least some communications over unlicensed spectrum.

6.4.5. Interconnection

Although not mentioned as a species of wholesale input in the OII, Cox's Mr. Gillan makes a compelling case why this should be considered an important input for competitive carriers looking to enter or remain in the business market:

Although the Commission did not separately ask about the interconnection side of the wholesale market, reasonable interconnection and traffic exchange terms are a threshold condition for competition to exist for all retail voice services, residential and business alike. ... [T]o prevent discrimination and unreasonable terms, incumbent local exchange carriers must file these [interconnection] agreements with state commissions and make them available to other carriers to prevent discrimination and unreasonable terms, incumbent local exchange carriers must file these agreements with state commissions and make them available to other carriers.³⁰⁷

Sprint agrees, albeit for somewhat different reasons:

With regard to interconnection, Sprint's position is that today's time division multiplexing (TDM) interconnection scheme is highly inefficient and costly. Sprint contends that all voice interconnection should be via Internet Protocol (IP) at a few regional locations across the U.S and pursuant to sections 251 and 252. The ILECs, however, generally do not agree with this position and argue they have no obligation to

³⁰⁷ Exhibit 28, Cox/Gillan June 1 Testimony, at 8-9. Mr. Gillan cites the condition of approval of the Verizon-Frontier transaction relating to publication of IP interconnection agreements.

interconnect in this manner and refuse to do so. Sprint contends that this is an abuse of the ILECs' market power. The ILECs take this position while at the same time they are converting their networks from TDM to IP. Sprint is concerned that the ILECs are presently attempting to use the IP transition as a means of evading their [interconnection] obligations under sections 251 and 252.³⁰⁸

CALTEL's DeYoung also testifies about the critical importance of interconnection agreements, and the availability of negotiated interconnection agreements to other carriers on a non-discriminatory and efficient basis.³⁰⁹

Competitors' interconnection access strikes us as fundamental to an efficiently competitive marketplace. Ms. DeYoung points out the critical and varied roles that an interconnection agreement can play, and the CPUC's obligation to facilitate such agreements.³¹⁰

It appears to us that complaints about access to interconnection and special access facilities are common among competitive carriers.³¹¹

³⁰⁸ Exhibit 77, April, 15 Sprint/Burt Testimony at 6-7 (referring to interconnection obligations under 47 U.S.C. §§ 251-252).

³⁰⁹ Exhibit 24, CALTEL/DeYoung July 15, 2016 Testimony, at 7 ("[A]ccess to non-discriminatory and efficient interconnection arrangements is of vital importance to CLECs, as I and Joseph Gillan testified last year in the Commission's review of Frontier's acquisition of the Verizon California ILEC which resulted in a decision finding that IP interconnection agreements must be negotiated and filed subject to the requirements of Section 252").

³¹⁰ *Id.* at 20, ("[T]he CPUC has the duty and authority to arbitrate and enforce interconnection agreements pursuant to Sections 251 and 252 of the Act. The CPUC provides a critical venue for adjudication and resolution of intercarrier disputes that involve critical issues such as local interconnection, the unbundling of network elements, colocation, number portability, and access to rights-of-way, poles and conduits.").

³¹¹ *See, generally*, Exhibit 24, CalTel/DeYoung July 15 Rebuttal Testimony, at 13 *ff*; January 27, 2016 Comments of Winstream Services, LLC, in FCC's *Special Access/BDS* proceeding, WC Docket 05-25, available at <https://ecfsapi.fcc.gov/file/60001416062.pdf>.

7. Further Analysis

7.1. What Is Not Part of Our Analysis

Although Intervenors invite us to consider inadequate service quality as part of our competition analysis, we decline to do so. Even a robustly competitive market might not deliver adequate service quality, as witnessed (for example) by the safety oversight still accorded to the concededly more competitive automobile market.³¹²

Similarly, although we discuss digital divide issues below, that discussion may more properly occur in the context of an affordability analysis, as affordability is a key driver in broadband adoption. While competition – at least theoretically – will drive prices closer to cost, it is a separate analysis whether such competitive prices will be affordable to low-income segments of society. As stated in the OII, the Commission will address the issue of affordability in a separate proceeding. We also note that residential broadband affordability is under consideration by the FCC.

7.2. What the Data Do Not Tell Us

7.2.1. The Problem of Asymmetric Information

The OII stated our intent to conduct a “data-driven” analysis of the market, and we have endeavored to do that. The OII asked the Respondent carriers (and any other interested party) to provide responses to 23 Information Requests found in OII Appendix B. In addition, staff sent a data request to 13 identified competitive carriers. While the carriers have produced to the Commission most of the data sought, some data remain outstanding, and staff is still waiting for carriers to adequately explain certain data anomalies. Generally

³¹² See, e.g., 49 USC §§ 30101 *et seq.*, motor vehicle safety statutes, administered by the National Highway Traffic Safety Administration (NHTSA); see generally <http://www.nhtsa.gov/Laws+&+Regulations/NHTSA+Statutory+Authorities>.

speaking, large parts of the carriers' California operations that continue to not be visible to this Commission.

In pursuing this Investigation, it has become clear to us that the problem of regulation can be expressed as a problem of information, or lack thereof. Full information about, and visibility into, the telecommunications network and its associated markets would allow the regulator's choices to be data driven, and regulation to be as efficient as we would like the market to be. There is, however, a fundamental asymmetry at work here, as carriers possess detailed information about the operations of the network and market, while regulators can only try to piece together a picture of the network and market from incomplete information.

Obtaining reliable data has been problematic at every level. The multiple estimates of availability at the 25/3 benchmark, as set forth above, indicate how data can be viewed through multiple prisms or filters. And there is a substantial gap between carriers services' reported availability and actual subscriptions to those services, a gap between theoretical availability, and actual market behavior, that drives our resolve to improve our measurement tools.

The problems are also reflected in other ways -- the testimony of Dr. Roycroft, for example, shows how his testimony was hobbled by carrier withholding of information on claims of confidentiality, and reflects how he was required to redact key pieces of his testimony that provide specific detail supporting his claims.³¹³ Data asymmetry was further accentuated by the refusal

³¹³ Exhibit 54, TURN/Roycroft June 1 Testimony, at 6-7. The carriers objected to production of granular subscription information, as well as information about their wholesale services. By Ruling of May 3, 2016, the Assigned Commissioner and ALJ required the carriers to provide granular subscription data to TURN under the terms of a strict Protective Order. The carriers objected and filed suit in federal court to prevent TURN from having this information. We

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of Respondents in the carrier “Coalition” to enter into non-disclosure agreements with each other, or otherwise examine each other’s data as they have done in other proceedings at the FCC and the CPUC.

The location and ownership of telecommunications facilities, even those located in public easements and under public streets, is largely unknown to this agency.³¹⁴ Similarly, the dark fiber owned by energy utilities only becomes visible when the energy utility files an application to lease such lines to a third party, usually a telecommunications carrier, and even then the salient information is often filed under seal.³¹⁵ As discussed above, the market share of fixed wireless providers may also not be fully visible to us. Information

have, however, recognized the importance of participation by public representatives like TURN, and their need for full and accurate information, even if it is competitively sensitive. In Commission Decision 06-06-066, involving equally sensitive energy market pricing information, the Commission stated:

Part of what gives our processes legitimacy is participation from outside groups in our decision making process. With their participation, we consider diverse viewpoints, examine concerns, and develop a fuller record in support of our decisions.

Slip Op. at 58-59.

³¹⁴ In the ongoing FCC proceedings regarding special access (business data services), the FCC collected a wealth of previously unreleased data relating to the location of fiber and other transmission facilities, *inter alia*, but the FCC required all those with access to this information per protective order to agree to use the information only for the current proceeding. . See, e.g., *In re Special Access for Price Cap Local Exchange Carriers*, Order and Data Collection Protective Order, DA14-1424, 29 FCC Rcd 11657 (October 1, 2014) (*FCC Special Access Protective Order*), at Appendix A, Data Collection Protective Order, ¶ 8. *Use of Confidential and Highly Confidential Information* (“solely for the preparation and conduct of this proceeding before the Commission”).

³¹⁵ See, e.g., D.02-07-027, in *Application of Pacific Gas and Electric Company for Commission Approval of Two Irrevocable License Agreements to Permit Use of Utility Support Structures, Optical Fiber and Equipment Sites to IP Networks*.

submitted by the parties is at times at odds with what is observed in the field,³¹⁶ or is internally inconsistent, or simply incorrect.³¹⁷

Access to data is also a problem for the carriers, particularly the competitive carriers. Competitive carriers have requested that incumbents make a broader range of interconnection terms and conditions public.³¹⁸ Even a carrier's generally applicable contract terms are not always available. The FCC recently reiterated its intent to require carriers to "publicly disclose their generally available rates, terms and conditions" for business data services.³¹⁹

This problem is not limited to California. While the FCC had been collecting voice and broadband information on its Form 477 since 2000, there remain gaps in the data. In 2009, the U.S. Congress passed the Broadband Data Improvement Act, with the goal of improving Federal data on the deployment and adoption of broadband service will assist in the development of broadband technology across all regions of the Nation and recognizing and encouraging "complementary State efforts to improve the quality and usefulness of broadband data."³²⁰

Economists and the FCC both assert that competition, and well-functioning markets, rely on the distribution of information among market

³¹⁶ See, e.g., Exhibit 54 (Roycroft) at 106 ("further evaluation of Cruzio Internet offerings raised questions about the accuracy of its Form 477 reports").

³¹⁷ One carrier provided staff reformatted census block data, without clearly informing staff that the formatting had dropped over 2 million customers from the data set. At least one carrier failed to include Mobile Virtual Network Operator (MVNO) numbers in its customer totals, contrary to directions for the preparation of those numbers. A third carrier provided deployment data to the OII team that differed starkly from data submitted for the same period under the DIVCA statute. Other examples abound.

³¹⁸ See discussion above of interconnection agreements.

³¹⁹ *BDS Order*, at ¶ 436.

³²⁰ 47 U.S.C. §§ 1301, 1303-04.

participants.³²¹ At present, however, it appears to us that marketplace information is asymmetric, and that the marketplace is less than transparent. Asymmetric information hinders our understanding of current market conditions, impedes the efficient administration of CASF and other universal service programs, and may also hamper the efficiency of market competition.

7.2.2. The Marginal Customer

We are unable to precisely determine the cross-price elasticity of demand for the telecommunications services we analyze in this OII. We cannot describe how many landline customers, for example, would terminate their landline service if it cost \$50 per month. Several economists in this proceeding have asserted that competition occurs at the margins, or that appropriate product market definitions depend on sensitive evaluation of product equivalency – including equivalency of pricing.

A further refinement of this market study might explore methods to approximate customer demands as they respond to the pricing of different

³²¹ The principle that distributed information is crucial for efficient competition applies in both the retail and wholesale markets. See, e.g., *In re Consumer Information and Disclosure, Truth-in-Billing and Billing Format*, 24 FCC Rcd 11380 (2009) at ¶ 5 (“access to accurate information plays a central role in maintaining a well-functioning marketplace that encourages competition, innovation, low prices, and high-quality services”); *In re Modernizing the Form 477 Data Program* 28 FCC Rcd 9887 (2013) at ¶ 82 (“We find that dissemination of deployment data promotes a more informed, efficient market”); *In re Rate of Return for Interstate Services of Local Exchange Carriers*, 5 FCC Rcd 7507 (1990) at n. 160 (“The efficient market hypothesis holds that all available and relevant information about a company [and its services] is incorporated into the market price of that company”); see generally essays of Friedrich Hayek, “Economics and Knowledge” (1937), “The Use of Knowledge in Society” (1945) at § 21 (“in a system in which the knowledge of the relevant facts is dispersed among many people, prices can act to coordinate the separate actions of different people”), available at <http://www.econlib.org/library/Essays/hykKnw1.html>, and the “Meaning of Competition” (1946), available at <https://mises.org/library/meaning-competition> (“Competition is essentially a process of the formation of opinion: by spreading information, it creates that unity and coherence of the economic system which we presuppose when we think of it as one market”).

telecommunications services. A customer who retains both a landline and a mobile subscription when both cost \$30 per month may choose to drop one if they both cost \$40 per month. An additional refinement of this analysis would improve modeling of customer behavior: how are different customer segments making different purchasing choices in response to service offerings and pricing?

7.2.3. The Marginal Supplier

Likewise, this proceeding offers us little insight into the elasticity of the supply of telecommunications services. Carriers have asserted, for example, that competition in one geographic area disciplines prices in other geographic areas, as carrier pricing is insufficiently granular to price discriminate in a way that targets potential market power in a census block (or even a city). And carriers have further asserted that the threat of market entry, even in a market with one telecommunications supplier, disciplines prices. A further refinement of this study might explore methods to approximate carrier supply decisions. If, for example, a cable company prices its services on a zip code-by-zip code basis, then a zip code where the company does not offer service to all households may still see price competition from that carrier's less granular carrier pricing policies. Similarly, at the edges of a cable company's territory, the threat of the cable company's footprint expansion may limit the ability of an adjacent legacy phone company to sustain supra-competitive prices.³²² Although it is difficult to measure the existence or extent of such horizontal price pressure from the mere potential of competitive market entry, when a new entrant (like Google) does in

³²² Such limitation depends, in part, on the marginal cost of expansion into new territory. If the cost is prohibitive, then the threat of entry is muted. We are unable to perform robust analysis of this effect without data on pricing and cost.

fact put specific plans in action to build new facilities, the incumbent carriers have reacted by increases in speed and/or decreases in cost.³²³

7.2.4. Pricing (Other than Basic Service) - Disaggregating Bundled Prices

The data submitted by Respondents makes abundantly clear that – in the majority of cases – California consumers purchase voice telephone service bundled together with either Internet access or cable television programming or both. Since the bundle aggregates the prices of the bundled services, it is impossible to know how any individual consumer values the individual parts of the bundle. As AT&T witness Dr. Katz states,

When multiple products are sold to consumers as part of a bundle, it may be difficult to assign revenue to each component of the bundle without suffering some degree of arbitrariness.³²⁴

Furthermore, bundle prices vary with the speed of the Internet access or the scope of the programming package included in the bundle. Additionally, bundles are frequently modified so that comparing the value of the telephone component in a bundle purchased last year with its value in one purchased this year is impossible as a practical matter. While the companies offering bundles may also offer stand-alone phone service, the majority of consumers opt to purchase bundles. Intervenors allege that stand-alone phone prices are kept artificially high in order to induce consumers to purchase the bundles,³²⁵ but the evidence in the record is inconclusive on this point.

³²³ Exhibit 54, TURN/Roycroft June 1 Testimony, at 125 (“Where AT&T directly competes with Google, or believes that Google 10 will soon be entering, AT&T has dropped the price of its GigaPower service by \$40 per 11 month – from \$110 to \$70”) (multiple citations omitted).

³²⁴ Exhibit 6, Katz June 1st Testimony at 4.

³²⁵ Exhibit 54 (Roycroft) at 14-36; Exhibit 16 (Selwyn) at 25-26.

7.3. Market Performance Analysis

7.3.1. Innovation and Technology Deployment

Whether as a result of competition, “Moore’s Law,”³²⁶ or a combination of both, Californians have reaped the benefit of enormous technological innovation in the telecommunications industry, beginning in the 1980s, and continuing at an accelerating pace through the implementation of the 1996 Telecommunications Act and the adoption of the URF framework in California, to the present day. Mobile and interconnected VoIP telephone services have replaced the wireline telephone for many, though not all, subscribers. As parties point out, communications once confined to traditional wireline phone can now take place using mobile phone, over VoIP, through texting using mobile devices, email using the Internet, and via Internet applications such as Skype. Subscribership has shifted significantly since June 2001, as mobile voice subscribers now considerably outnumber wireline voice subscribers, with most of the mobile subscribers also purchasing mobile broadband data plans. Households now subscribe to multiple services, placing considerable value on mobile services. Innovations like the iPhone and streaming video have combined to accelerate broadband adoption and spurred demand for higher network capacity and speed.

Year over year, broadband providers offer improved speed, latency, and other service metrics. Advertised broadband Internet at speeds between 100 Mbps to 1 Gbps was made available to an additional 4.5 million California

³²⁶ “Moore’s Law” refers to the observation made in 1965 by Gordon Moore, co-founder of Intel, that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future. Moore, “Cramming More Components onto Integrated Circuits,” *Electronics* (April, 1965). More generally, the expression has come to stand for an exponential change without apparent limit.

households in 2014. At the end of 2013, only 54 percent of California households had such availability, while at the end of 2014, 89 percent of households did. This increase is largely due to cable providers' deployment of DOCSIS 3.0 technology.³²⁷ Cable providers also are in the early stages of deploying DOCSIS 3.1.³²⁸ Smaller broadband Internet access service (BIAS) providers such as Sonic.net and Race Telecom hope to soon offer Gigabit per second speeds.

Actual speeds also are increasing across technologies. Akamai's Fourth Quarter 2015 State of the Internet report shows the average Internet connection from Californian users to its content distribution network servers at 15.3 megabits per second, a 22 percent increase over the previous year and a 107 percent increase from three years before.³²⁹ National trends also indicate Internet speeds are increasing. In its latest Measuring Broadband American Report, the FCC found that the average annual increase in actual download speeds by technology has been 28.2 percent for DSL, 61.2 percent for cable, and 19.2 percent for fiber.³³⁰ Akamai, however, also shows California lagging behind other states, and the U.S. lagging behind other countries, in measurements of mean/average speed, and adoption across different speed tiers.³³¹

During the two year period between 2012 and 2014, the number of broadband subscribers in the download speed category "Under 3 Mbps" fell by 85.3 percent, while the number of broadband subscribers in the download speed

³²⁷ See, generally, *BDS Order*, *supra* at ¶¶ 61-65 (describing development of DOCSIS).

³²⁸ Joyce Wang, "[Arris Talks DOCSIS 3.1, Active Video JV](#)," May 10, 2016.

³²⁹ Steve Blum, "[California broadband improves but still falls short of excellence](#)," March 26, 2016.

³³⁰ FCC [2015 Measuring Broadband America Fixed Broadband Report](#): A Report on Consumer Fixed Broadband Performance in the United States, December 30, 2015, p. 13.

³³¹ See generally 2016 *Akamai State of the Internet Report*, discussed below.

category “25 Mbps or faster,” increased by 360 percent. At the end of 2014, 75.4 percent (7.7 million) of the households in CA subscribed to broadband at download speeds of 10 Mbps or faster.³³²

The wireless communications market also has evolved significantly. The FCC found in its 2016 Broadband Progress Report that:

Americans increasingly rely on mobile devices as indispensable tools of daily life as personal and business interactions have rapidly become interwoven with smartphone- and tablet-based texting, email, social media, and entertainment applications that rely on mobile broadband services. In emergency situations, Americans often use mobile devices to contact first-responders when a fixed connection is not readily available... As smartphone and tablet use increases, mobile broadband will play an increasingly central role... The smartphone share of mobile phones in the U.S. increased to 77 percent in November 2015 from 50 percent two years earlier. Monthly data usage per subscriber with data capable units also increased to 849 MB from 122 MB over the 2010 to 2013 period. Ericsson predicts that by 2021, the mobile data traffic per active smartphone in the U.S. and Canada will be almost 25 GB per month. In addition to the increasing demand from smartphones and tablets, other connected devices such as health monitors could significantly increase the number of wireless connections... Pew Research reports that over half of American smartphone users in the year before October 2014 used their phone to look up health information and do online banking, and significant percentages use their smartphones for job searches and for education.³³³

³³² Source: currently unpublished 2014 DIVCA report. Note this data only covers video providers. However, because both AT&T California and Verizon California are video providers, a substantial majority of the California market is included.

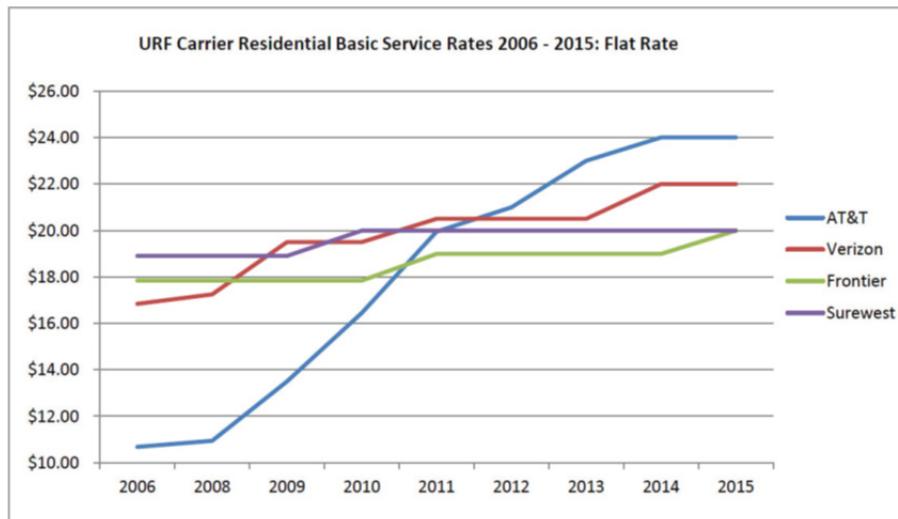
³³³ FCC [2016 Broadband Progress Report](#), FCC 16-6, Released January 29, 2016, ¶20.

While both mobile and landline speeds are improving globally, the United States generally, and California in particular, are in the middle of the pack when it comes to speed, availability, and adoption.³³⁴

7.3.2. Pricing

Dr. Roycroft summarized the increases in basic telephone service rates since URF:

Chart 1. Increases in the Basic Service Flat Rate 2006-2015



³³⁴ *In re International Broadband Comparisons Pursuant to Broadband Data Improvement Act*, 31 FCC Rcd 2667 (Jan. 2016), at ¶ 24 (“Based on the Ookla data, the United States ranked 26th of 40 countries in 2014 in terms of actual download speeds (26.68 Mbps) when weighted by sample size”); see also Akamai [State of the Internet], *supra*, at 13-15 (U.S. not in top 10 for average connection speed, average peak connection speed, and 4, 10, 15 and 25 Mbps adoption), and at 18-21 (California not in the United States top 10 in any of those categories), available at <https://content.akamai.com/PG6575-q1-2016-soti-connectivity-report.html>; see also The Berkman Center at Harvard, “Next Generation Connectivity, a review of broadband Internet transitions and policy from around the world” (2010), at 12 (“The United States is a middle-of-the-pack performer on most first generation broadband measures, but a weak performer on prices for high and next-generation speeds,” 18/19th of 30 OECD countries in price for medium to high-speed speed broadband), available at <https://cyber.law.harvard.edu/pubrelease/broadband/> (Berkman Study); see also FCC’s *International Broadband Data Report*, at 165-66, Table 3d (Average Weighted Download Speed) (California 20th of the United States, 46th in world); Exhibit 54 (Roycroft) at 57 (showing U.S. 24th in world advertised download speeds).

Dr. Roycroft adds:

While I suspect the rate increases... up to 2009 were more likely to be in line with the Commission's expectations at the time of the URF decision, I am not sure the Commission expected AT&T to ... increase basic service rates another 78 percent during the following five years, for a total 124.5 percent basic service rate hike.³³⁵

Dr. Selwyn testifies similarly.

Dr. Aron rejects these arguments as fundamentally flawed because they ignore that (regulated) rates for basic local services had been kept artificially low for many years before the regulatory restrictions were relaxed as a result of the URF I and II decisions in 2006 and 2008 respectively.³³⁶

³³⁵ Exhibit 57, Final Rebuttal/Supplemental Testimony of Trevor R. Roycroft, Ph.D. On Behalf of TURN, July 15, 2016, p. 27-28.

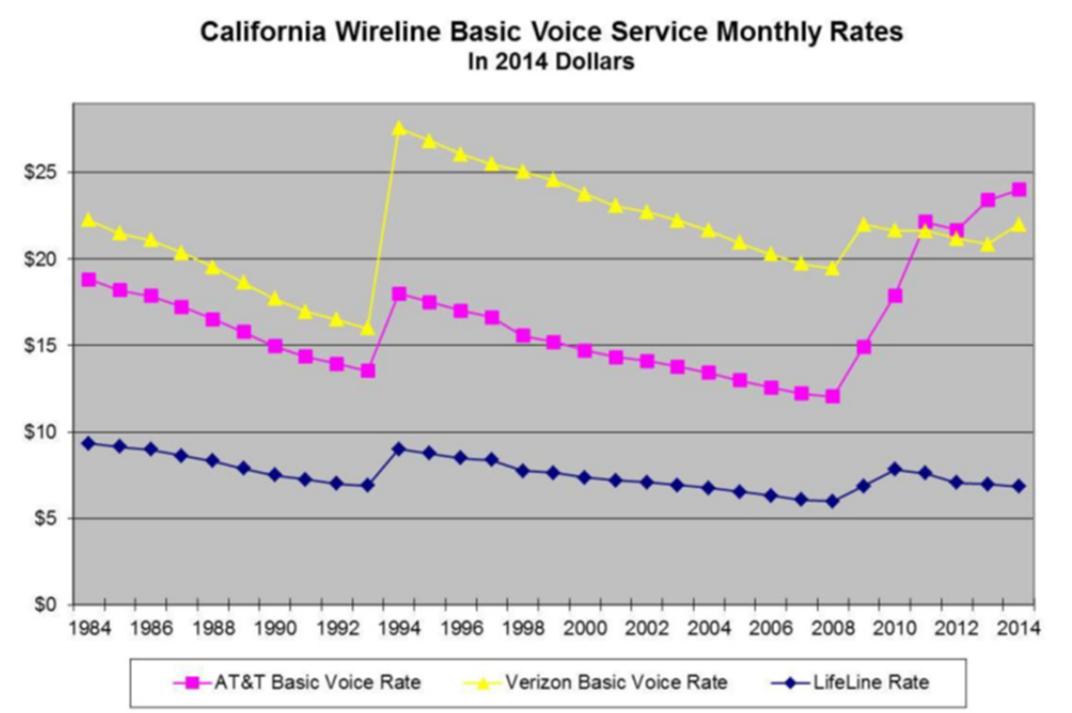
³³⁶ Exhibit 5 (Aron) at 59. Dr. Aron explains:

When prices in a market are suppressed below competitive rates, economic theory would predict that they will rise when the regulatory limits are loosened. When prices are frozen below competitive rates for over a decade, without even adjustment for inflation, one would expect that they may rise precipitously when the regulatory constraints are removed. As part of the 2008 URF II transition plan, the Commission evaluated and approved increases in basic service rates of up to \$3.25 in 2009 and up to an additional \$3.25 in 2010 for AT&T, Verizon, SureWest, and Frontier. The actual increases in basic rates for these service providers in these years – the very increases that DRA objects to – were within these bounds set by the Commission. AT&T's 2009 basic rate was \$13.50, below the \$14.19 rate allowed by the Commission. AT&T's 2010 basic rate was \$16.45, below the \$17.44 rate allowed by the Commission.

Dr. Selwyn counters that AT&T had been raising its rates even within the regulated marketplace. Exhibit 21, ORA/Selwyn July 15 Reply Testimony, at 20 ("In late 2004, AT&T

(footnote continued on next page)

Our Market Pricing Report shows changes in basic service rates for the two largest legacy carriers over time, measured in 2014 dollars.³³⁷



In the era of regulated rates, customer cross-subsidies impacted the rates paid for telephone service, but the resulting rates were nevertheless deemed just and reasonable through the ratemaking process. Basic service rates, indeed the price of voice service alone, is increasingly irrelevant to a marketplace driven by broadband, mobile service, and service bundles.

Indeed, an effort to regulate rates for telephone service, given the market transitions described in this decision, might create unintended consequence that would harm consumers. We are not certain that rate-regulating telephone services would result in just and reasonable rates.

raised by \$1 to \$3 per month the retail rates for various local service packages with prices that range from \$12 to \$30 per month"). But we need not pursue this debate.

³³⁷ Market Pricing Survey of Retail Communications Services in California, Report.

We need not, and effectively cannot, pursue this debate further. Reliable price and cost data are both particularly difficult to obtain in a market where bundles predominate. Because most consumers in fact purchase communications services in a bundle, we find that the price of stand-alone voice – while central to the URF decisions – is not centrally relevant to a market in which voice is most often bundled with broadband. Because we lack the data to make a reasoned judgment on whether bundled prices *per se* are just and reasonable, we look to other indicia of whether the market is functioning efficiently, such as market share, service availability, switching costs, carrier access to wholesale inputs, and market performance.

7.4. Has Intermodal Competition Developed as the URF decisions predicted?

7.4.1. Generally

There is intermodal competition in the market today, but not quite in the way or to the extent that the URF decisions anticipated that it would happen. Although there are a few exceptions at the margin,³³⁸ and there is the promise (as there was in 2006) that new competitors will enter the market using their own facilities or leasing facilities from wholesale carriers or municipal wholesale networks,³³⁹ there has been no new facilities-based market entrant with wide deployment in the last ten years.³⁴⁰ We know that existing carriers have

³³⁸ See discussion of Sonic and Wave/Astound, above.

³³⁹ Lang, “High-speed Google Fiber is coming to San Francisco,” February 24, 2016 *SF Chronicle*, available at <http://www.sfgate.com/business/article/High-speed-Google-Fiber-is-coming-to-San-Francisco-6850338.php>; Google Blog, “Serving San Francisco apartments and condos, using existing fiber,” at <http://googlefiberblog.blogspot.com/2016/02/san-francisco-google-fiber.html> (describing plans to lease fiber an “existing carrier” in San Francisco, and from Huntsville Alabama’s municipal network).

³⁴⁰ Exhibit 16 (ORA/Selwyn) at 18 (competition “still largely confined to the incumbent LEC and the incumbent MSO” cable provider), and 30 (“any prospective facilities-based entrant in

(footnote continued on next page)

continued to invest in facilities-upgrades, but the full extent of those upgrades is unclear.³⁴¹ Though there has been a substantial shift of customers from the legacy carriers to the cable companies, the telephone line and the coaxial cable line remain the two wired, facilities-based routes into most homes and small businesses. Since 2006, no non-cable CLEC has maintained a considerable market share among residential customers, and CLECs today supply less than 2 percent of residential lines.³⁴² Instead of obtaining telephone service from a traditional CLEC, many legacy telephone customers have moved to cable VoIP and (especially) wireless competitors, although the legacy incumbents still provide telephone service to more fixed telephone lines (both residential and business) in California than do the cable companies.

Most customers today purchase voice services bundled with broadband. While URF cleared away some of the regulatory impediments to bundled

the wireless market will require electromagnetic spectrum, an expensive commodity that remains in very limited supply”).

³⁴¹ URF was premised in significant part on the notion that deregulation would lead to facilities-based market entry. *See, e.g.*, D.06-08-030, Slip Op. at 22 (noting Dr. Hazlett’s comment that “for deregulated activity to be successful, facilities-based investment was necessary for long-term consumer welfare and meaningful competition”), at 34 and Conclusion of Law 5 (citing Pub. Utils. Code California Legislature’s “intent that our policies encourage development of a wide variety of advanced telecommunication facilities and services,” and noting similar intent in Section 706 of the 1996 Telecommunications Act); and at 77 (quoting Dr. Aron: “Once the ILEC loses the customer relationship to the reseller, the reseller can easily migrate the customer to its own facilities or to [Unbundled Network Element]-based provision when the facilities are ready”). It is unclear whether and to what extent wireline competitors have climbed the ladder of competition by adding facilities to what was initially a resale operation. On the other hand, the FCC has reported that the mobile carriers have made serious and significant investments in wireless facilities. *See, e.g.*, *19th Wireless Competition Report*, at ¶¶ 23 ff_ (in part to transition from 3G to 4G).

³⁴² As noted above, while ILEC Respondents supply approximately 4.1 million residential wireline connections, and the cable VoIP Respondents provide another 3.7 million residential connections, the largest traditional CLECs provide only about 120,000 residential lines; *see also* Baldwin, June 1 Testimony at 14.

service,³⁴³ URF did not anticipate that roughly ninety-two percent of consumers would be purchasing voice service bundled with broadband within ten years. Nor did URF anticipate broadband's status as the dominant telecommunications service. All of the major wireline carriers offer voice bundled with broadband, as do the four major wireless carriers.

Several intervenors assert that the market is less efficient than it could be because of high "switching costs" – both monetary and structural. Evidence of this alleged inefficiency is seen in incompatible handsets and other equipment,³⁴⁴ early termination fees that discourage switching,³⁴⁵ the general "stickiness" of bundles, and the relatively high price of stand-alone, unbundled services, all of which leaves the customer with a choice between bundles.

The big question, and one that URF did not answer, is how much competition is enough? Both the Department of Justice (with regard to broadband)³⁴⁶ and FCC staff (with regard to wireless)³⁴⁷ have suggested that four competitors is the minimum desirable number. As Dr. Selwyn recounts:

³⁴³ D.06-08-032, Findings of Fact 86-89, 92, Conclusions of Law 41-46, and OP 14-15.

³⁴⁴ See, e.g., Exhibit 15 (ORA/Selwyn) at 75 ("customer would need to replace a DSL modem with a cable modem" or a wireless handset, incompatibility between CDMA and GSM wireless protocols).

³⁴⁵ Exhibit 54 (TURN/Roycroft) at 112-13 ("consumers who are locked into a bundle are less likely to switch providers, thus firms can take advantage of the locked-in consumers' reluctance to switch"), 115-116 (long-term contracts and early termination fees); Exhibit 15, at 75-77 (noting that even when a carrier offers to pay the customer's early termination fee, the "competitor's customer acquisition costs are increased, perhaps substantially," and arguing that such "switching costs – particularly those that are artificially created – are far more easily imposed and enforced in highly concentrated markets than in robustly competitive markets").

³⁴⁶ DOJ January 4, 2010 *Ex Parte* Submission in FCC docket GN 09-51, *In re National Broadband Plan (Economic Issues of Broadband Competition)*, at 4:

Based in large part on its extensive experience in evaluating horizontal mergers, the Department starts from the presumption that in highly concentrated markets consumers can be significantly harmed when the

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[O]nce the number of [facilities-based mobile] incumbents grew to four or more, price competition developed, and carriers sought out resellers and began aggressively to encourage retail-level competition through so-called “Mobile Virtual Network Operator” (MVNO) arrangements. The mid-2000s saw some consolidation of CMRS providers, but with four national carriers and more regional competitors, price competition persisted. Over the next decade-plus,

number of strong competitors declines from four to three, or three to two. This same experience teaches us that consumers can enjoy substantial benefits when the number of strong competitors rises from two to three, or three to four, especially if the additional competitor offers products based on a new and distinct technology. Developments in both the MVPD and the wireless markets over the past 15 years underscore this point

Available at <https://www.justice.gov/atr/ex-parte-submission-United-States-Department-Justice-matter-economic-issues-broadband>

³⁴⁷ *Applications of AT&T Inc. and Deutsche Telekom AG for Consent to Assign or Transfer Control of Licenses and Authorizations*, FCC WT Docket No. 11-65, FCC Staff Analysis and Findings, November 30, 2011, at paras. 75-77:

75. Coordinated effects are of particular concern here because the retail mobile wireless services market, being relatively concentrated and hard to enter, appears conducive to coordination. In addition, T-Mobile plays a disruptive role in this market to the benefit of buyers, and, thus, likely constrains coordination. An acquisition eliminating a disruptive firm in markets vulnerable to coordinated conduct is likely to cause adverse coordinated effects.

76. The retail mobile wireless services market would be more vulnerable to coordination post-transaction. Features of this market make it likely that the remaining three nationwide providers would be able to reach a consensus on the terms of coordination (by identifying a mutually agreeable coordinated price), deter cheating on that consensus (by undercutting the coordinated price to steal high-margin business from its rivals), and prevent new competition in this market. Because these providers offer the same plans and charge the same prices nationwide, increased coordination would most likely take the form of raising the level of prices.

77. Reaching a consensus would be facilitated by the small number of firms and the use of national prices and service plan offerings by most providers across most geographic markets.

disruptive competitors such as T-Mobile and Metro PCS introduced a variety of new pricing arrangements and forced a precipitous drop in wireless prices overall, as well as the introduction of new services – an evolution that is still underway.³⁴⁸

Dr. Selwyn states that such competition and resale activity have not occurred in the fixed landline market.³⁴⁹ As noted above, fixed and mobile voice services are much closer to being functional substitutes than are fixed and mobile broadband services. In the residential fixed broadband market, the FCC's *National Broadband Plan* essentially concedes that there is a lack of robust competition, but then asks how problematic that is:

The lack of a large number of wireline, facilities-based providers does not necessarily mean competition among broadband providers is inadequate. While older economic models of competition emphasized the danger of tacit collusion with a small number of rivals, economists today recognize that coordination is possible but not inevitable under such circumstances. Moreover, modern analyses find that markets with a small number of participants can perform competitively; however, those analyses do not tell us what

³⁴⁸ Exhibit 15 (ORA/Selwyn) at 59-60.

³⁴⁹ *Id.* at 69-70:

There are now four major national facilities-based wireless providers in the US, and all four regularly offer their services at wholesale to resellers who rebrand them and use them to compete at the retail level. Yet ILECs and, more recently, cable television MSOs, have steadfastly resisted such efforts, and have engaged in protracted litigation and in regulatory/legislative efforts to forestall any requirement that they do so. 67 “Refusal to deal” tactics of this sort could not be sustained in an effectively competitive facilities-based market; its persistence in the case of most last-mile wireline service providers (ILECs and cablecos) is compelling evidence that even where two “last mile” wireline providers are present, effective competition between them remains elusive.

degree of competition to expect in a market with a small number of wireline broadband providers combined with imperfect competition from wireless providers. In addition, as the Department of Justice (DOJ) describes the issue, the critical question is not “some abstract notion of whether or not broadband markets are ‘competitive’” but rather “whether there are policy levers [around competition policy] that can be used to produce superior outcomes.”³⁵⁰

The *National Broadband Plan* was, however, less sanguine when looking at *de facto* market conditions in 2011:

Given that approximately 96% of the population has at most two wireline providers, there are reasons to be concerned about wireline broadband competition in the United States. Whether sufficient competition exists is unclear and, even if such competition presently exists, it is surely fragile. To ensure that the right policies are put in place so that the broadband ecosystem benefits from meaningful competition as it evolves, it is important to have an ongoing, data-driven evaluation of the state of competition.³⁵¹

The carriers’ experts, Drs. Aron, Topper, and Katz, all assert that the sufficiency of current competitive conditions is reflected in the abundance of different products and choices available to the consumer.³⁵² Indeed, when one looks at the plethora of services available “over the top,” as well as the proliferation of MVNO resold wireless services, one could construct a scale of competition, which is most robust at the edge, and less so the more that facility inputs are required. Thus, there is more competition in OTT voice and MVNO wireless, the provision of which involves no facilities-based transmission on the

³⁵⁰ *National Broadband Plan*, *supra*, at 37.

³⁵¹ *Id.*

³⁵² *See e.g.* Exhibit 41(Comcast-Charter-TW/Topper) at 4-5.

part of the provider, than there is in at least partly facilities-based services provided by the traditional competitive carriers like the CLECs (who even then most likely lease, rather than own the last mile loop to their customers).³⁵³

From the perspective of the average California end-user, the threshold choice is between three different types of last-mile channels to connect to the larger network: the legacy telephone carrier's wire (copper or fiber); coaxial cable from a cable provider; and a wireless transmission path (or paths) to a cellular antenna (radio frequency or spectrum). For roughly half or more of California customers, the choice for residential high-speed broadband at 25/3 Mbps benchmark narrows to one provider or none at all.³⁵⁴ The carriers argue that fixed wireless is an alternative for the residential customer, and when its asserted availability is added to the mix, choices appear more varied. Its market share, however, is quite small, as indicated above.

Indeed, there is some reason to question whether the traditional telephone utilities are leaving the high-speed, residential broadband market to the cable companies. Verizon first halted the development of its fiber (FiOS) plant, and then sold its entire California local wireline network to Frontier.³⁵⁵ We also observe the increasing market share of the cable carriers.

³⁵³ CLECs like Sonic typically collocate servers in the ILECs' central office.

³⁵⁴ The exact number of households limited to one or no choice at 25/3 depends on the data source and methodology used in the calculation, as described above.

³⁵⁵ See D.15-12-005, approving Application 15-03-005. Dr. Selwyn notes that this is consistent with Verizon's nationwide strategy: Verizon discontinued its FiOS investment initiative after 2010 and has been actively seeking to exit the residential broadband market ever since.

7.4.2. Intermodal Competition in Light of Current Market Developments

This complex marketplace continues to evolve. Comcast is partitioning its Wi-Fi routers to offer a distributed Wi-Fi network for Comcast customers, with reported plans to launch a wireless network in 2017.

Google has announced plans to lease fiber in San Francisco to provide residential service in limited areas, and has acquired Webpass, two actions that may enable it to deploy some combination of wired or wireless networks. When Google's market entry becomes fact, or likely fact, incumbent carriers have increased speed or reduced prices, as noted above. On the other hand, the problems that even a well-financed potential market entrant like Google has had in actually trying to enter the market underscore how difficult facilities-based market entry is. Google has delayed plans for a larger fiber roll-out in Santa Clara, reportedly at least in part because of problems obtaining pole attachment rights.³⁵⁶ Google's approach to market entry is unclear. The company had initial efforts to build fiber networks, sought to lease wholesale muni fiber owned by Huntsville, Alabama, and pursued strategic partnerships and acquisitions like the project with Webpass.

The four major mobile carriers have also recently rolled out a Wi-Fi calling feature (for compatible phones) for their mobile services – a feature that makes existing Wi-Fi networks available to mobile customers who can make calls and send texts while avoiding use of the carriers mobile network and attendant

³⁵⁶ Baron, Giwargis, "San Jose's Google Fiber rollout is delayed while tech giant explores alternatives," August 8, 2016 (reporting that "Google competitors including AT&T and Comcast have been blocking the company from accessing privately owned utility poles"), available at <http://www.mercurynews.com/2016/08/08/san-joses-google-fiber-rollout-is-delayed-while-tech-giant-explores-alternatives/>.

limitations, like traffic congestion or poor reception.³⁵⁷ Comcast and Google are similarly experimenting with “Wi-Fi first” networks, which would allow their customers to access Wi-Fi hotspots when accessible (potentially every Comcast router in the State), with an MVNO as a backup network. In a larger sense, this may signal what some have described as a further convergence between wired and wireless networks.

In perhaps the most significant development, 5G wireless looms as a technology that could merge the residential and wireless networks. FCC Chairman Tom Wheeler has announced that the transition to 5G wireless (called “mobile fiber” by some) is of the highest importance.³⁵⁸ Verizon’s Chairman, President, and CEO recently discussed, in an earnings call, the company’s 5G trials and the technology’s potential.³⁵⁹ Such 5G networks however, will require

³⁵⁷ See AT&T: “Wi-Fi Calling,” available at <https://www.att.com/shop/wireless/features/wifi-calling.html> (last visited Sept. 2, 2016); Verizon: “Wi-Fi Calling FAQs,” available at <https://www.verizonwireless.com/support/wifi-calling-faqs/#learn> (last visited Sept. 2, 2016); T-Mobile: “Wi-Fi Calling Wi-Fi Extenders,” available at <http://www.t-mobile.com/offer/wifi-calling-wifi-extenders.html> (last visited Sept. 2, 2016); Sprint: “Sprint Wi-Fi Calling,” available at http://shop.sprint.com/mysprint/services_solutions/details.jsp?detId=sprint_wi-fi_calling&atId=service_communication&catName=Communication&detName=Sprint+Wi-Fi+Calling&specialCat (last visited Sept. 2, 2016).

³⁵⁸ Prepared Remarks of FCC Chairman Tom Wheeler, ‘The Future of Wireless: A Vision for U.S. Leadership in a 5G World,’ National Press Club, Washington, D.C. June 20, 2016 (“like mobile fiber”), available at https://apps.fcc.gov/edocs_public/attachmatch/DOC-339920A1.pdf.

³⁵⁹ See Verizon Q2 2016 Earnings Call Transcript, available at <http://seekingalpha.com/article/3991660-verizon-communications-vz-lowell-c-mcadam-q2-2016-results-earnings-call-transcript?part=single> (“[W]e’ve got a big [5G] deployment down in Dallas working with Ericsson and Nokia. We’ve got several in New Jersey and some down in Virginia. . . . We’ve typically seen speeds above 1 gigabit over, let’s just say, 500 yards or less, because of the confined space that we’ve got available to us. . . . And how we stay ahead is by densifying the 4G LTE network, but then driving very hard to 5G. Because we’ve seen this time and time again throughout the history of Verizon – and I’d argue throughout the history of [w]ireless – is if you build it, they’ll come. And the more we build, the more speeds that we

(footnote continued on next page)

up to a ten-fold “densification” of the network, i.e., a sharp increase in antenna numbers.³⁶⁰

All of these developments, in turn, make utility pole and conduit access, and related fiber backhaul (business data services) into substantially more important network components. Access to this “physical layer,” at a level more basic and in a sense closer to the ground than even the transmission media themselves, is becoming an increasingly critical component for market entry. It is an area where safety and competition meet.³⁶¹

Google’s trouble getting access to utility poles and conduit, referenced above, provides an example of how difficult it is for a new facilities-based competitor to enter the market. Google has still faced difficulties in attempting to break into the market, most recently in the form of incumbent lawsuits seeking to prevent, or at least slow down, Google’s access to poles in Louisville, Kentucky, and Nashville Tennessee.³⁶²

The successful implementation of 5G services, for example, and the resulting densification of the network, will demand all of the following:

(i) increased access to utility poles and support structure; (ii) increased access to Ethernet backhaul (likely over fiber), which in turn requires (iii) increased access

deliver, the more ubiquitous the network is, the customers just soak up that broadband capacity.”).

³⁶⁰ Anders, Gatherer, “Will Densification Be the Death of 5G?” IEEE/ComSoc Technology News (May 2015) available at <http://www.comsoc.org/ctn/will-densification-be-death-5g>

³⁶¹ Currently pending before the Commission is SED’s Petition for changes to GO 95. P.

³⁶² *BellSouth Telecommunications v. Louisville/Jefferson County Metro Govt*, US Dist. Ct. for Western Dist of Kentucky, Civil 3:16-cv-124 TBR (February, 2016); *BellSouth Telecommunications v. Nashville, Tenn.*, US Dist. Ct for the Middle Dist. Of Tennessee, Civil 3:16-cv-02509 (September, 2016). Both are Complaints for Declaratory and Injunctive Relief, and both seek to declare illegal and enjoin enforcement of a recently passed ordinances allowing expedited “one touch” access to poles.

to underground conduit. In addition, success will also depend on access to public streets and utility easements, and consequently on municipal permitting, and ability to overcome potential neighborhood opposition.³⁶³

As much promise as 5G and other cutting edge technologies offer, the Commission must be careful to distinguish between actual deployed facilities and merely theoretical or potential facilities in evaluating the market today.

7.4.3. The Customers Left Behind

7.4.3.1. Urban/rural, and other digital divides

Not all customer segments appear to benefit on the same scale from the technological advances described above. Rural customers in particular stand out as not receiving the same service. The Commission's 2010 Universal Telephone Service Report, the latest one available, found that California continued to meet and exceed the 95 percent telephone penetration goal adopted by the Commission in 1994. As of March 2010, 97 percent of all California households had some form of voice service.³⁶⁴ Despite the significant presence of service, the Commission became aware that "Rural California telephone customers are experiencing call completion problems" and opened an investigation into the matter in May 2014.³⁶⁵ Mobile broadband faces similar concerns. An analysis by the Commission's Communications Division has found that rural and tribal areas

³⁶³ See, e.g., *T-Mobile West LLC v. San Francisco*, Cal First Appellate Dist. A144252 (September 15, 2016) (upholding City discretion to consider aesthetic factors in cell siting approvals).

³⁶⁴ [Universal Residential Telephone Service](#), Report to the California Legislature, December 2010, Executive Summary p. ii.

³⁶⁵ See [I.14-05-012](#).

currently receive half the throughput³⁶⁶ of urban areas and the TCP (transmission control protocol) failure rate is twice as high in rural and tribal areas.³⁶⁷

Wireline broadband deployment is slower in rural communities, except areas benefiting from significant subsidies such as the CASF or the FCC Connect America Fund. Additionally, certain population segments (e.g. low-income) may not realize the benefits of innovation at the same pace as other consumers. CforAT and Greenlining note that “customer segments with more limited telecommunications options are low-income customers, customers in rural areas of the state, customers with disabilities, and customers with limited English proficiency.”³⁶⁸ These organizations assert that these customer segments must be given separate consideration as part of this proceeding.³⁶⁹ In other proceedings CforAT has argued that people with disabilities have one of the lowest levels of access to broadband service both in California and nationally, with affordability

³⁶⁶ Newton’s Telecom Dictionary (27th Edition, 2013) defines “throughput” as “The actual amount of useful and non-redundant information which is transmitted or proceeds. The relationship of what went in one end and what came out the other is a measure of the efficiency of that communications network. Throughput is a function of bandwidth, error performance, congestion and other factors.”

³⁶⁷ Note TCP failure happens when a user is unable to access a web site from a mobile browser. Often, the browser progress bar stops, and the user needs to retry connecting to a particular site. Based on the data gathered to date, Commission consultant Ken Biba, with the technical, logistic, and geostatistical assistance of Commission staff, California State University at Monterey Bay and California State University at Chico, published a report titled CalSPEED: California Mobile Broadband - An Assessment Fall 2014, which provides an analysis of the availability and quality of mobile broadband service deployed in California. This report appears as Attachment C in the June 1, 2016 testimony submitted by ORA’s Adam Clark.

³⁶⁸ Prehearing Conference Statement of the Greenlining Institute and the Center for Accessible Technology, June 15, 2016, p. 3-4.

³⁶⁹ *Id.*

being the main obstacle: “People with disabilities are disproportionately low-income.”³⁷⁰

Our analysis of broadband data shows that 94.9 percent of California households (12,180,931) have access to wireline broadband Internet service from at least one provider at speeds higher than 6 Mbps download and 1.5 Mbps upload, while 649,104 households do not meet those speeds.³⁷¹ Sixty percent of the households failing to meet such speeds are in rural locations. Table 1 below compares residential and mobile Internet availability in rural versus urban areas at the 6/1.5 speed tier. At that speed, fewer than 43 percent of households in rural areas are served by residential broadband.

Rural and Urban Household Availability to Wireline and Mobile Broadband³⁷²

³⁷⁰ [Brief of the Center for Accessible Technology](#) in Joint Application of Comcast Corporation, Time Warner Cable Inc., Time Warner Cable Information Services (California), LLC, and Bright House Networks Information Services (California), LLC for Expedited Approval of the Transfer of Control of Time Warner Cable Information Services (California) LLC, (U-6874-C); and the Pro Forma Transfer of Control of Bright House Networks Information Services (California), LLC (U-6955-C), to Comcast Corporation Pursuant to California Public Utilities Code Section 854(a) A.14-04-013; and Joint Application of Comcast Corporation, Time Warner Cable Information Services (California), LLC (U6874C) and Charter Fiberlink CA-CCO, LLC (U6878C) for Expedited Approval to Transfer Certain Assets and Customers of Charter Fiberlink CA-CCO, LLC to Time Warner Cable Information Services (California), LLC, Pursuant to Public Utilities Code Section 851 A. 14-06-012 December 10, 2014 p. 15. See National Broadband Plan at p. 39, which found a 42% adoption rate for people with disabilities. See also a 2014 [Field Poll conducted for CETF](#) that found a 59% adoption rate of people with disabilities in California.

³⁷¹ California Advanced Services Fund Annual Report for January 2015-December 2015, p. 30.

³⁷² *Id* at p. 3.

Rural households*	% Total rural households served	% Total rural households underserved & unserved	Urban households	% Total urban households served	% Total urban households underserved & unserved
Wireline Broadband Access**					
684,213	42.9%	57.1%	12,145,822	97.9%	2.1%
Mobile Broadband Access***					
684,213	15.3%	84.7%	12,145,822	16.0%	84.0%

* CA Department of Finance, January 2015.

** Estimate based on December 2014 Broadband Availability Data.

*** Estimates based on Spring 2015 mobile field testing using interpolated mean minus 2 standard deviation results.

The CASF program provides subsidies to eligible areas of California that lack sufficient broadband access. Among the fifty-two projects thus far awarded CASF grants, one notable region well on its way to defying the general trend of slower innovation in rural California is the Eastern Sierras, where the program helped finance several broadband infrastructure deployment projects.³⁷³ The program's subsidies assist in overcoming financial and environmental hurdles, but do not address the ongoing variable costs to maintain the network.

7.4.3.2. Low-income, tribal, & non-English speaking customers

TURN's Roycroft cites a recent Pew Institute study showing that 59 percent of both non-broadband users and smartphone-only broadband users indicat[e] that the high cost of home

³⁷³ Heavy subsidization of some middle-mile and last-mile infrastructure has or will soon lead to residents in several communities having access to Internet service at Gigabit speeds. The Digital 395 Project that links Reno to Barstow was financed with \$80 million from federal ARRA funds and \$29 million from CASF. It provides communities in the rural Eastern Sierras with potential capacity similar to urban areas (albeit with less providers). The 500-mile backbone project allows last-mile providers the opportunity to dramatically increase service offerings. For example, in the Fall of 2013, Suddenlink announced that customers in Mammoth Lakes with service plans delivering speeds of 1.5 to 3 Mbps would receive speeds of 15 Mbps at no extra cost, with the option to upgrade to a 30 Mbps tier. See Steve Blum, "[Suddenlink makes aggressive move with Digital 395 bandwidth](#)," September 19, 2013. In December 2015 Suddenlink announced it would provide residential and business customers in Mammoth Lakes with 1Gbps Internet speeds by the end of 2017 "[Suddenlink Expands 1Gbps to Three More Markets](#)" CED Magazine, December 18, 2015.

broadband prevents them from subscribing. Many low income consumers would like to have a home broadband connection, but the high cost of the service keeps them from adopting.³⁷⁴

Dr. Roycroft sees the resulting digital divide as a “major market failure,” and we agree. It may be, however, that this is an inherent failing of *all* markets, or at least all telecommunications markets. No matter how competitive, some customers will not be served at, or be able to afford, market rates. Indeed, as discussed below, the issue of universal service was present at the outset of modern telecommunications (see discussion of Kingsbury Commitments, below). That is why the Commission’s Order instituting this Investigation determined that affordability issues would be addressed in a separate proceeding.

Greenlining’s testimony frames this subject as an issue of information equity, noting “[t]he fact that many consumers from communities of color have only a smartphone for online access at home has consequences for how they get information.”³⁷⁵

We conclude that there are different gaps in the market for rural/tribal customers than there are for low income customers. While rural and tribal customers face an availability gap – the lack of services deployed to their residence – low-income customers face an affordability gap – while services are available, low income customers cannot afford high speed services and are often unable to choose both a mobile subscription and a high-speed residential subscription. We will continue to address the gaps impacting these populations through our administration of Public Purpose Programs. Even if the

³⁷⁴ Exhibit 54 (TURN/Roycroft) at 75.

³⁷⁵ Exhibit 71 (Greenlining/Goodman) at 3.

telecommunications markets do not produce just and reasonable rates for the customers left behind, our Public Purpose Programs should address the service needs of those customers.

7.4.4. The Impact of Vertical Integration/Affiliation

In examining the complex telecommunications ecosystem, it has become apparent that some companies enjoy the benefits and advantages of vertical integration. For instance, AT&T's landline affiliates are able to supply inputs to AT&T's wireless affiliates. AT&T, for instance, self-supplies a large portion of its cell tower backhaul lines. AT&T's landline affiliates also supply special access backhaul lines to its wireless competitors, including Sprint and T-Mobile, but such lines are presumably supplied at market rates (other carriers also self-supply some backhaul). We again note the Sprint testimony suggesting that the vertical integration of wireless backhaul poses the risk of anti-competitive conduct, especially where a fully competitive backhaul market may not exist.³⁷⁶

Assuming that a dominant provider of backhaul prices its backhaul service to maximize profits, there is a risk that it is able to charge anti-competitive prices for cell tower backhaul to non-affiliated companies. Such backhaul pricing would presumably be reflected in retail mobile service pricing.

Telecommunications' carriers increasing acquisitions of content affiliates present another type of vertical integration problem. In ruling on Comcast's objections to WGAW's access to granular subscription data, we had to address the question of whether WGAW is (or represents) an interested commercial party involved in negotiations with the telecommunications carrier Respondents. On

³⁷⁶ Sprint has represented that "special access services used for [cell site] backhaul represent approximately one-third of its total monthly cell site operating costs," a good portion of which is paid over to its ILEC competitor(s). See, e.g., Sprint/Nextel November 9, 2009 Comments in FCC Docket 09-51, *In re National Broadband Plan, inter alia*, at 2, *passim*.

the basis of the information and argument before us, we concluded that it is such an interested commercial party, noting the significant content acquisitions of both the legacy telephone companies and the cable broadband affiliates.³⁷⁷

Dr. Selwyn argues that an incumbent firm with effective monopoly control or market dominance with respect to underlying infrastructure is in a position to extend that control into downstream (vertical) markets as well as into adjacent (horizontal) markets unless it is prevented from doing so through either functional/structural separation or requirements that it provide rivals with nondiscriminatory access to underlying network elements.³⁷⁸ The *Open Internet Order*'s non-discrimination and no-blocking provisions represent a form of separation between content and conduit, and a reaffirmation of traditional common carriage obligations in the broadband world.³⁷⁹ Cable operators, in

³⁷⁷ See content-related acquisitions and affiliates of Comcast, AT&T, and Verizon listed in footnote [55], *supra*.

³⁷⁸ Exhibit 15 (ORA/Selwyn March 15) at 70 and ¶¶ 82-83. Dr. Selwyn continues:

Vertically-integrated firms that compete in downstream markets but which maintain market power in upstream markets may limit downstream competition through their control of wholesale inputs used by downstream rivals. If wholesale input markets of this sort are no longer subject to price regulation of any sort, the result will be reduced competition in the downstream retail market. For example, prior to the 2004 *USTA II* ruling and the FCC's Broadband Wireline Internet Access ("BWIA") decision.

³⁷⁹ See *Open Internet Order*, at ¶ 71, *passim* (noting that non-discrimination regulations are the essence of common carrier status). Dr. Selwyn adds (at ¶ 83):

The traditional concept of a "common carrier" is a transport entity that takes on freight, passengers or traffic (more generally, "content") at one location and safely delivers it to another location without modification. If the common carrier is not in itself engaged in the production and/or sale of the freight, passengers or traffic that it carries, it should be largely indifferent (except with respect to matters involving safety and legality) as to what and which suppliers' items are transported over its facilities. However, as soon as the common carrier is also engaged in the "content" business in some manner, that indifference disappears, and the carrier

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their provision of cable programming, were expressly declared *not* to be common carriers,³⁸⁰ but the FCC has now distinguished between one-way entertainment services like cable programming and the two-way communications capabilities of broadband.³⁸¹

7.4.5. Provider Costs, and “Just & Reasonable” Service

URF was predicated on the economic theory that increased competition would drive rates close to cost, and would thus stand in for the historic system of rate regulation.³⁸² Thus, Greenlining’s Mr. Goodman submits that it is “critical” to assess the reasonableness of rates by comparing them to “providers’ actual costs of providing telephone services.”³⁸³ Subject to the condition that effective competition is absent, Ms. Baldwin agrees that “the best way to gauge whether rates are just and reasonable is to compare the rates to the underlying costs.”³⁸⁴

But determining costs for bundled service is substantially more difficult than the cost of service determinations in traditional telecommunications

now has an incentive to favor its own “content” over that provided by rival producers.

³⁸⁰ 1984 Cable Act, 47 USC 522(6)(C), as amended.

³⁸¹ See, e.g., *Open Internet Order*, *supra*, at ¶ 548 (“CenturyLink and others compare their provision of broadband service to the operation of a cable television system, and point out that the Supreme Court has determined that cable programmers and cable operators engage in editorial discretion protected by the First Amendment. As a factual matter, broadband Internet access services are nothing like the cable service at issue in *Turner I*”).

³⁸² D.06-08-030, Finding of Fact 15 (Economic theory indicates that a reasonably competitive market will, over the long term, yield a system of rates that approximates the costs of providing goods or services ...”).

³⁸³ Exhibit 70, Greenlining Responses/Goodman Testimony, at pp. 8-9.

³⁸⁴ Exhibit 53, TURN/Baldwin March 15 Testimony, at 4.

ratemaking, which were difficult enough.³⁸⁵ Bundled services might use common facilities, and it would be impossible to allocate those costs among services on the basis of causation.³⁸⁶

While we acknowledge the difficulty of calculating a utility's cost for a given service, particularly in a bundled age, we note that testimony in this proceeding never the less considers costs and digital efficiencies.

Dr. Roycroft, for instance, submits data showing that the cost of providing broadband data transit has declined six-fold since URF II: "While transit markets have technical characteristics that are not identical to last-mile networks, these prices suggest that where competition is present, bandwidth prices decline."³⁸⁷ His testimony also presents evidence that electronic technology products do not track general inflation trends, with software, computer hardware, and televisions showing pronounced declines during that same period.³⁸⁸

We note, however, that broadband relies not just on electronic technology products, but also on physical and intangible infrastructure we have already discussed: poles, conduit, wires, wireless spectrum, interconnection or peering agreements, and other carrier equipment, and Moore's law does little to affect the costs of those inputs. While the incumbents may be able to avail themselves of already existing conduit, we are cognizant that expensive, time-consuming, and

³⁸⁵ Exhibit 6 (AT&T/Katz) at 16-17 points out "Cost-of-service regulation is widely recognized by the Commission and other regulatory bodies as being difficult and costly to apply to telecommunications markets."

³⁸⁶ *Id* at 4.

³⁸⁷ Dr. Roycroft submits data on Internet transit prices from various sources showing year-over-year declines between 2008 and 2015. *See* Exhibit 54 (TURN/Roycroft) at 119-20.

³⁸⁸ *Id.*, at Figure 21.

uncertain construction of new last-mile and middle-mile facilities in dense urban and rugged rural areas pose major obstacle to next generation networks.

Once a connection to the customer is established, however the incremental cost of data transmission appears minimal. Sonic CEO Dane Jasper argues that consumers believe that tiered pricing is a fair proposition, because they are used to a pay-more-to-get-more model. For example, consumers are typically willing to pay more for a porterhouse steak than for a petite filet. But he counters:

The difference is that in the steak [example], there's more cow. It's not artificial. There's a higher materials cost," Jasper said. "But when it comes to broadband performance and speed, the limits are artificial. They sound fair, but they're entirely contrived. There isn't a cost around speed. We believe that tiered pricing doesn't make sense."³⁸⁹

Dr. Roycroft submits similar evidence suggesting that usage-based pricing is an artificial construct.³⁹⁰ This perception is reinforced by the large range of price/gigabit ratios reported by the FCC, with U.S. end-users paying more for a gigabit of transmission capacity than their cohorts elsewhere in the world.³⁹¹

We lack cost data sufficient to determine that telephone rates approach cost. We find that improving the efficiency of the market should drive rates closer to cost. Where market inefficiencies are identified – and we possess regulatory jurisdiction – we will consider taking action to improve market efficiency. Regulating retail rates in the current telecommunications market might have unintended consequences that harm consumers. Thus, at this time we will carry out our obligation to ensure just and reasonable rates by

³⁸⁹ *Id.* at 126-27.

³⁹⁰ *Id.* at 125.

³⁹¹ *International Broadband Report, supra*, Tables 7a-7c, U.S. price per mobile Gigabit ranked 23rd in world, almost twice as much as U.K.

monitoring the markets and taking action where inefficiencies are observed and we have authority.

7.4.6. Parties' Suggestions for Increasing Competition

OII Information Request 23 invited the parties, to the extent they had “identified any market failures, inefficiencies or bottleneck,” to “suggest rules, regulations or policies that would ameliorate those market problems.” Of the carrier Respondents, only Sprint responded substantively to this invitation.³⁹² Sprint suggests that the Commission require incumbent carriers to interconnect on an IP basis whenever possible.³⁹³ Sprint also suggests that the Commission use its “influential voice” in arguing for pro-competition policies at the FCC, even when the Commission might lack its own remedial jurisdiction.³⁹⁴ Similarly, Sprint also asks the Commission to be “a voice of reason” in municipal cell-siting and related infrastructure decisions.³⁹⁵

The intervenors had additional suggestions. TURN’s Roycroft urges the Commission to take these specific actions to increase competition:

- The Commission should conduct a statewide review of state and local policies that are in place that may make it more difficult for competing wireline broadband networks to be constructed. To the extent that a statewide set of best practices can be established, market entry conditions may be improved.

³⁹² Cox offered an implicit critique of current market conditions, but declined to offer any specific solutions. *See, e.g.*, Exhibit 28 (Cox/Gillan) at 32 (“The fixed high costs associated with wireline networks generally mean that the multiple networks commonly needed to foster competition for wholesale inputs like loops is rare”).

³⁹³ Exhibit 78, Sprint/Burt June 1 Testimony, at 16-17.

³⁹⁴ *Id.*

³⁹⁵ *Id.*

- The Commission should carefully monitor AT&T's plans for meeting the broadband deployment conditions imposed by the FCC as part of its acquisition of DirecTV.
- The Commission should carefully monitor Charter's plans to fulfill its out-of-territory overbuild merger commitments.
- The Commission should carefully monitor Frontier's plans for fulfilling the broadband deployment commitments associated with its acquisition of Verizon California customers.
- The Commission should pursue measures to ensure that broadband is affordable, including the introduction of a low-income program to support the purchase of fixed broadband services; [and]
- The Commission should impose a cap on stand-alone broadband prices.

Dr. Selwyn suggests that the Commission think more structurally about competition, and promote or adopt a separation of wholesale and retail services, such as has been implemented in England:

British Telecom [after it was largely privatized] was split into two separate (although still affiliated) entities, the wholesale entity, known as *Openreach*, and the BT retail entity. The establishment of this structural approach achieved and far more quickly – what Secs. 251/252 [the unbundling provisions of the 96 Telecommunications Act] was attempting to accomplish – the ability for competing *retail* providers to compete for end-user business without having to overbuild the incumbent's network.³⁹⁶

³⁹⁶ Exhibit 16 (ORA/Selwyn) at 122. "Functional separation" is simplified and explained in this powerpoint by Ofcom's Tom Kiedrowski: <http://www.eett.gr/conference2008/pdf/Kiedrowski.pdf>, explaining how BT to put its last-mile and middle-mile plant into a separate division, and to make these available to competitors at the same rates, terms and conditions as they are available to BT's retail division ("equivalence of inputs"). Ofcom reports that this separation has resulted in lower prices and greater penetration. *Id.* Dr. Selwyn does not say, however, how he distinguishes this sort of

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ORA also recommends:

- Monitoring, measurement and calculation of market share and HHI scores on an annual ongoing basis;
- Monitoring the revenue and earnings of dominant communications providers, and/or requiring “results of operations” type financial reporting;
- Price trend reporting requirements; and
- Imposing and enforcing specific performance targets and service availability targets; and
- Construction of public, wholesale broadband networks such as in Australia.³⁹⁷

CALTEL makes recommendations, but only in its briefing, not in its testimony:

- Take meaningful action in the Commission’s Service Quality proceeding (R.11-12-001). This would include conducting the infrastructure examination previously ordered in that proceeding, as well as adopting a decision that addresses the ILECs’ chronic failures to meet G.O. 133-C maintenance measures;
- Revisit state copper retirement rules, processes and policies adopted in D.08-01-005 (R. 08-01-005) to address changes in federal rules and to reassess impacts on competition and CLEC end user customers;

unbundling from the section 251 unbundling used by U.S. CLECs, which he had earlier labelled as [inauthentic]. The separate division was named openreach, which now provides wholesale services to over 500 retail service providers. *See* <https://www.openreach.co.uk/orpg/home/home.do>, and <http://www.openreach.co.uk> generally; *see also* Exhibit 16 at 122-23. Ofcom has recently called for increased separation between BT’s wholesale and retail operations. *See* 2015 *Review of Digital Communications*, at <https://www.ofcom.org.uk/consultations-and-statements/category-1/dcr-discussion>; and 2016 proposal *Strengthening Openreach’s Independence*, at https://www.ofcom.org.uk/_data/assets/pdf_file/0015/20337/bt-proposal.pdf.

³⁹⁷ Exhibit 16 (Selwyn) at 119-24.

- Ensure that the Commission's delegated role in federal law with regards to the wholesale market, specifically its duty and authority to arbitrate and enforce interconnection agreements pursuant to Sections 251 and 252 of the Act, are retained in light of the agreed-to reassessment of telecommunications governance;
- Ensure that the Commission's duty and authority to issue, and not to revoke, Certificates of Public Necessity and Convenience (CPCNs) is not based on the switching protocol utilized in voice services offered to customers;
- Take additional industry-wide action to reiterate the determination in D.15-12-005 (A.15-03-005) that agreements which apply to the exchange of IP interconnection arrangements for voice traffic are subject to the filing and opt-in requirements of Section 252 of the Act;
- Reverse the determination in D.14-12-084 (R.11-11-007), or reach a new determination, that the service territories of the small independent ILECs should be opened to competition by wireline providers.

While we find many of these ideas thought-provoking, and potentially useful to promote competition, we will focus our immediate efforts on those matters set forth in the next two sections.

7.4.7. Telecommunications Regulation

7.4.7.1. The Role of the Commission at Present

As stated in the OII, URF I was based, in part, on the assumption that the 1996 Act's local competition provisions would be successful, and that "intermodal competition" between traditional landline, VoIP, and wireless telephony would flourish, eliminating the need for rate regulation and large portions of regulatory oversight. URF I removed many of the rules that had governed the prices and operations of the largest incumbent telecommunications carriers (ILECs, incumbents, or traditional landline carriers), and adopted a new Uniform Regulatory Framework for California's four largest traditional landline

carriers.³⁹⁸ URF I included a finding that these carriers lacked significant market power in the voice services market because of the effect of intermodal competition from VoIP, wireless, and cable telephone providers.³⁹⁹ Two years later, URF II followed suit.⁴⁰⁰

In 2012, the legislature added Section 710 to the Public Utilities Code which, for a period of seven years beginning January 1, 2013, largely removes the Commission's regulatory authority over VoIP and IP-enabled telecommunication services, subject to an exception in favor of express delegations of federal authority to the Commission.⁴⁰¹ In 2014, the Court of Appeals for the District of Columbia in *Verizon v. FCC*, 740 F.3d 623, held that Section 706 of the federal Communications Act, which authorizes "the [Federal Communications] Commission and each State commission with regulatory jurisdiction over telecommunications services" to "promote competition" and "remove barriers" to facilities' investment,⁴⁰² constituted an express delegation of regulatory

³⁹⁸ The URF ILECs are: Pacific Bell Telephone Company dba AT&T California (AT&T), Verizon California Inc. (Verizon), SureWest Telephone (SureWest, dba Consolidated Communications), and Citizens Telecommunications Company of California Inc., dba Frontier Communications Company of California (Frontier). Any subsequent reference to ILECs, as used in this decision is intended to apply exclusively to the URF ILECs. Unless expressly indicated otherwise, references to ILECs are not intended to refer to any small independent local exchange carriers.

³⁹⁹ D.06-08-030, pp. 263-264, Findings of Fact 26-40, *passim*.

⁴⁰⁰ D.08-09-042. Concurrently with this OIL, the Commission issued D.15-11-023, Order Granting Limited Rehearing of Decision (D.) 08-09-042, with the issues of market competition raised by the Application for Rehearing to be decided in this Investigation.

⁴⁰¹ Subsection (f) of section 710 authorizes the Commission to monitor VoIP services, i.e., voice data transmitted using IP. The same protocol is used for non-voice data transport.

⁴⁰² Section 706 is codified at 47 USC 1302(a), and provides:

The Commission and each State commission with regulatory jurisdiction over telecommunications services shall encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans (including, in

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authority to promote broadband competition, including the authority to promulgate so-called “net neutrality” rules.⁴⁰³ Following this decision, the Federal Communications Commission adopted its *Open Internet Order*, which reclassified broadband service as a telecommunications service, subject to common carrier regulation under Title II of the Communications Act; the FCC forbore from applying all such regulations, and required any resulting state action to be “consistent” with its ruling,⁴⁰⁴ In June 2016, in *United States Telecom Association, et al., v. FCC*, Case. No. 15-1063, decided June 14, 2016, the DC Circuit applied the *Verizon v. FCC* precedent to uphold the FCC’s *Open Internet Order*.

There are also limits on the Commission’s ability to affect the special access and spectrum markets, as the former is largely federalized,⁴⁰⁵ and the latter completely so.⁴⁰⁶

particular, elementary and secondary schools and classrooms) by utilizing, in a manner consistent with the public interest, convenience, and necessity, price cap regulation, regulatory forbearance, measures that promote competition in the local telecommunications market, or other regulating methods that remove barriers to infrastructure investment.

⁴⁰³ *Verizon v. FCC*, 740 F.3d at 635-38. To Verizon’s objection that “Congress would not be expected to grant both the FCC and state commissions the regulatory authority to encourage the deployment of advanced telecommunications,” the Court responded that “Congress has granted regulatory authority to state telecommunications commissions on other occasions, and we see no reason to think that it could not have done the same here.” *Id.* at 638.

⁴⁰⁴ The FCC retained a leadership role in broadband policy by declaring broadband Internet access service (BIAS) to be “jurisdictionally interstate.” *Open Internet Order, supra*, at ¶¶ 47, 431, and notes 708, 1477 (the “jurisdictionally interstate” designation “does not preclude all state commission action in this area, just that which is inconsistent with the federal regulatory regime we adopt today”).

⁴⁰⁵ If a special access line has over 10% interstate traffic, it is considered an interstate facility, and therefore falls under federal jurisdiction. At present, most special access lines in California are so classified.

⁴⁰⁶ *See OII*, at 12-13.

Although California law also declares that it is State policy to “promote competition” and “reduce barriers” to entry, the legal developments of the past four years have left the Commission’s jurisdiction over telecommunications services in limbo.⁴⁰⁷ As a consequence, the steps we propose to take going forward are limited to those for which we presently have clear and unambiguous legal authority.

7.4.7.2. Next Steps

The pace of technological advancement in the telecommunications marketplace is accelerating. We understand that a high degree of regulatory humility is required in such circumstances, even if an oversight agency were to have plenary regulatory and enforcement authority. By the same token, it is clear that the telecommunications network has assumed central importance in the California economy – and for the health, welfare, and safety of Californians generally.

California has the sixth or seventh largest economy in the world.⁴⁰⁸ It was the birthplace of the Internet revolution,⁴⁰⁹ and continues to play an outsize role

⁴⁰⁷ Here, as throughout, we use “telecommunications” to refer to the transmission of both voice and data, over both traditional copper lines, as well as coaxial cable, fiber, and various radio frequency technologies. See Pub. Utils. Code § 233; 47 U.S.C. § 153(50).

⁴⁰⁸ See “California Surpasses France as World’s Sixth Largest Economy,” Reuters, June 17, 2016, available at <http://www.reuters.com/article/us-california-economy-idUSKCN0Z32K2>. The California Legislative Analyst’s Office last year placed California’s economy between 7th and 8th largest in the world – see <http://www.lao.ca.gov/LAOEconTax/Article/Detail/90>; Bloomberg puts California 7th in the world economy – Marois & Pei, “Brown’s California Overtakes Brazil With Companies Leading World,” January 15, 2015 Bloomberg Pursuits, available at <http://www.bloomberg.com/news/articles/2015-01-16/brown-s-california-overtakes-brazil-with-companies-leading-world>.

⁴⁰⁹ In September 1969, the Stanford Research Institute sent what can be seen as the first Internet message, to UCLA, as part of the newly formed ARPANET. See Barry Leiner, Vint Cerf, David Clark, Robert Kahn, Leonard Kleinrock, Jon Postel, et al., *A Brief History of the Internet*, available

(footnote continued on next page)

in all things digital. By some accounts, however, California lags behind other states, and other countries, in the speed, adoption, and value delivered by the State's telecommunications network.⁴¹⁰ We believe efficient and robust telecommunications competition can deliver a communications network commensurate with California's social and economic importance.

To that end, we propose the following list of initiatives designed to promote competition and reduce barriers to entry. These initiatives are consistent with our mandate to secure "just and reasonable" telephone service, while acknowledging the ongoing technological transformation of the communications market. The more efficiently the telecommunications markets operate, the more just and reasonable the resulting telephone rates should be.

- **Administration of Public Purpose Programs**

This decision recognizes several gaps in the market, particularly deployment of telecommunications services to rural and tribal communities, affordability of telecommunications services to low-income communities, and the particular communications needs of customers with disabilities. This Commission administers several public purpose programs that target those gaps.

Lifeline helps low-income families afford voice service, either mobile or landline. The high cost funds⁴¹¹ subsidize voice service in areas where the cost of

at <http://www.isoc.org/internet/history/brief.shtml#darpa>, at 6-7; see also WALTER ISAACSON, *THE INNOVATORS* (2014) at 154-55, 184-95, 209-215, 258-59, 263-304, *passim*.

⁴¹⁰ See, e.g., Akamai 2016 *state of the internet* report, *supra*, at 18-21, 30; *FCC International Broadband Data Report*, at 165-66, Table 3d, discussed *supra*.

⁴¹¹ See, e.g., Pub. Utils. Code § 270, authorizing California High Cost Fund A and California High Cost Fund B.

voice service would otherwise be unaffordable.⁴¹² The CASF pays part of the cost of deploying broadband to unserved and underserved communities in California. The California Teleconnect Fund provides telecommunications discounts to schools, libraries, hospitals, and other non-profit organizations. Finally, the Deaf and Disabled Telecommunications Program helps Californians with disabilities access telecommunications services through the California Relay Service, the California Telephone Access Program, and through Speech Generating Devices.

The analysis in this decision may help inform future reforms of these programs.

- **Guarantee Non-Discriminatory Access To The Physical Infrastructure Of The Telecommunications Network**

The utility poles, wires, and conduits necessary for operation of the telecommunications network are owned either by a legacy telephone carrier, a cable company, a competitive carrier, the local electric utility company, or a Joint Pole Authority. Many of the more than four million utility poles in California are jointly owned.⁴¹³

As we move rapidly into a largely wireless world, access to that infrastructure is essential to effective competition. In Public Utilities Code Section 767.7, the Legislature has expressed its intent that owners of utility poles

⁴¹² California High Cost Fund B targets a subscriber cost of \$36 per month for a basic service line. Recent California High Cost Fund A carrier rate cases resulted in subscriber costs of \$24 per month for basic service. See D.16-09-047, D. 16-09-049.

⁴¹³ 2014 CPUC Policy and Planning Division, "A Brief Introduction to Utility Poles" ("Many utility poles in California are subject to joint ownership arrangements; for example, the NCJPA has 40 members,¹⁹ and SCE states that 70% of its poles are jointly owned"), available at http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPDUtilityPole.pdf.

make space available on their poles for the stringing of fiber optic cable, a necessary part of the network for the provision of high-speed broadband and wireless backhaul. We will continue to fulfill our mandate to promote competition by acting to guarantee non-discriminatory access to these essential parts of the network.

The Commission has an especially important role to play in this regard because we have elected to administer the federal pole attachment statute.⁴¹⁴ As we have discussed throughout this decision, all forms of telecommunication require access to poles, wires, conduit and spectrum. We have noted that the efficiency of the market with respect to access to these physical inputs is critical to market entry. Just as this Commission and others at the state and local level have acted over the years to guarantee non-discriminatory pricing and equal access to the services of public utility monopolies, so today the Commission finds itself uniquely positioned to act as an impartial arbiter of conflicting claims on the public utility infrastructure that makes modern communications possible. As the Commission examines pole safety issues, it should also consider the importance of pole access in facilitating telecommunications competition with the goal of improving the efficiency of pole access.

- **Make Interconnection Dispute Resolution as Efficient as Possible Including IP to IP Interconnection**

As noted by parties to this proceeding, the Commission is the delegated dispute resolution agency for telecommunications carrier interconnection disputes under federal law, and has an independent duty under state law to resolve such disputes.⁴¹⁵ Making this process as transparent and efficient as

⁴¹⁴ D.98-10-058, implementing right-of-way and pole attachment rules per 47 USC § 224.

⁴¹⁵ See 47 USC §§ 251-252; Cal. Pub. Utils. Code §§ 558, 701, 702, 766, 1702, *inter alia*.

possible would reduce barriers to competitive market entry and operation and increase competition. This will be an increasingly important function as the industry completes its transition to a fully digital architecture, replacing connection via the TDM protocol with interconnection via an IP protocol. The ALJ Division and Communications Division should jointly host a workshop to solicit feedback on the interconnection resolution process, with the goal of improving the efficiency of interconnection.

- **Continue to Monitor Wholesale Markets as Required by Section 716**

Public Utilities Code Section 716 requires the Commission to collect data on competition in any California metropolitan statistical area “includ[ing] but not limited to, separate data on competitive options for residential, business, and wholesale services.” The Commission is required to do this in order to be able to timely file its views on any forbearance petition filed by incumbent carriers at the FCC asking for forbearance from their “duty to provide ... nondiscriminatory access to network elements on an unbundled basis.”⁴¹⁶ Staff should issue a request for relevant data. In addition to carrying out our statutory mandate, improving our knowledge about the operation of the marketplace will improve our regulatory decision-making.

- **Obtain Actual Speed Data for Residential Broadband.**

We direct Communications Division to put in motion plans to improve the CalSPEED program’s dataset for residential broadband.

⁴¹⁶ See FCC decision *In the Matter of Petition of Qwest Corporation for Forbearance in the Phoenix MSA*, 25 FCCR 8622 (2010), at, e.g., ¶ 49 (“the record in this proceeding reveals a lack of significant wholesale competitors to Qwest in the Phoenix MSA”)

- **Continue to Monitor Markets for Telecommunications Services.**

Developing further knowledge about the markets for telecommunications services will inform this Commission about important developments. Timely information will be crucial to carrying out our monitoring role. We will direct carriers certificated or registered by the Commission to regularly submit voice and broadband subscription and availability data, in addition to data about wholesale services and middle-mile facilities.⁴¹⁷ In addition to preparing other reports that are relevant to market developments, Communications Division staff shall update the analysis present in this proceeding in 2019 with the most current data available.

8. Conclusion

“Technological transitions demand regulatory transitions,” the FCC has told us.⁴¹⁸ There is clearly a need for public oversight of the quickly evolving California communications network when it comes to safety, service quality, and universal service, all of which – as we suggested above – are outside the purview of this Investigation into competition. Within the scope of this proceeding, however, are observations about concrete steps that the Commission can take to promote competition in the marketplace, and that are within our authority. Notwithstanding limitations on our regulatory authority, this agency remains tasked with ensuring delivery of essential telecommunications services to California businesses and consumers, which necessarily includes monitoring the

⁴¹⁷ CTIA claims that any new reporting requirement “is a form of regulation,” and thus outside the scope of this proceeding. CTIA Reply Brief, at 4. The new reporting that we direct Communications Division to implement does not, however, constitute a new regulation, but rather it is based on existing statutory authority.

⁴¹⁸ *In re Technology Transitions*, FCC 16-90, 2016 FCC LEXIS 2471 (July 15, 2016), at ¶ 1.

evolving telecommunications marketplace, and preparing to act in the public interest where the Commission has the authority to do so.

9. Categorization and Need for Hearing

This proceeding was preliminarily categorized as ratesetting, and it was preliminarily determined that, although hearings were not required, a hearing to air the widely differing views of the parties would be helpful. We affirm the preliminarily determinations.

10. Comments on Proposed Decision

The proposed decision of the Assigned Commissioner and Assigned ALJ in this proceeding was mailed to the parties in accordance with Public Utilities Code § 311(g)(1) and Rule 77.7 of the Commission's Rules of Practice and Procedure. Comments were filed on _____ by _____. Reply comments were filed on _____, by_____.

11. Assignment of Proceeding

Carla J. Peterman is the Assigned Commissioner and Administrative Law Judge Karl J. Bemesderfer is the Presiding Officer.

12. Outstanding Motions

The following motions, objections, and other procedural matters are outstanding:

- Objections to the Commission taking official notice of the documents set out in OII Appendix A, and in the July 1, 2016 Scoping Memo at 16-17, including Coalition's Motion to Strike and Objections to Proposed Official Notice;
- Motion Requesting Clarification of the Administrative Law Judge's Ruling Granting in Part and Denying in Part Motion to Strike; and
- Motion to Strike Portions of ORA Reply Brief

These motions, and any other outstanding motions, are denied, and objections overruled.

Findings of Fact

1. Wireless and cable-based Voice over Internet Protocol (VoIP) services have rapidly displaced traditional landline phones as the primary modes of voice communication in California.

2. Voice communication itself is a diminishing segment of the broader telecommunications market.

3. Approximately 92 percent of Californians obtain their voice service in a bundle with broadband.

4. The Commission's Communications Division has prepared Market Share Analyses that show concentration throughout various communications markets in California, but that none of these markets is a monopoly. Further, it finds that competition in intermodal voice services (traditional voice, wireless and VoIP telephony taken together) has increased since 2001, predominantly due to competition of mobile and cable VoIP.

5. The additional data submitted by Respondents in this proceeding provides information, including in particular additional census block data, which allows a more granular assessment of individual markets defined by technology and/or geography and other demographic factors.

6. In addition, the Federal Communications Commission (FCC) has posted data online, which we have attempted to integrate with data from Respondents and from the Communications Division.

7. Taken together, this data tells us:

- a. Most residential wireline customers with voice service obtain that service from either the legacy incumbent telephone provider or cable VoIP providers;
- b. Concentration in the wireless market has increased since 2001;
- c. For most consumers, wireline and wireless voice services are substitutes. Stated differently, mobile voice service is a

- substitute for fixed landline voice service for most Californians, subject to limitations including coverage gaps, the special needs of customers with disabilities or medical devices that are not necessarily served by mobile service, and weak indoor wireless signals;
- d. Evidence suggests that this is one-way substitutability. Landline voice service is typically not a substitute for mobile voice service due to its lack of mobility;
 - e. Competition in this retail intermodal voice market, as measured above, appears strong;
 - f. Whether landline and mobile services are substitutes for business customers is less clear;
 - g. For most consumers, residential and mobile broadband services are not substitutes for each other. Mobile data service, at present, is typically not a substitute for residential broadband service because of higher data usage prices for mobile and lower data caps for mobile compared with residential broadband; and
 - h. Our analysis of the substitutability of broadband services could change if either 5G wireless becomes a closer substitute for residential broadband, or if residential broadband services improve their mobility through new functionality or other innovation.
8. With the rapid convergence of voice communications, Internet access, and video streaming into applications that are all accessible from a single device, the economic and social importance of the telecommunications network has multiplied, making the network an “essential infrastructure for [the] 21st century.”
9. To examine telecommunications competition in California, we must also examine the services available in different parts of the State, and the service subscriptions in different parts of the State.
10. The so-called “digital divide” between geographic and economic subgroups of the State’s population has widened. Those Californians who lack

reliable and affordable access to that network are unable to participate fully in the economy and society of the 21st century. For rural and tribal Californians, the “digital divide” stems largely from the lack of sufficient deployment of telecommunications services. For low-income Californians, the “digital divide” stems largely from the unaffordability of telecommunications services.

11. In addition to the Market Share Analyses, the Commission’s Communication Division also prepares reports in conjunction with the Digital Infrastructure and Video Competition Act (DIVCA) (Pub. Utils. Code §§ 914.3, 5800-5970), and with the Communication Division’s administration of the California Advanced Services Fund (CASF). In particular the most recent DIVCA Report shows that competition in video and broadband availability has increased, but not in all areas of the state, and CASF Reports results show differences in service availability and quality between urban and rural areas.

12. It is unclear whether the growth of wireless, VoIP, and other alternative means of voice communication has kept prices and services for traditional landline service just and reasonable, or even whether that is the right question to ask when most consumers obtain voice service in a bundle with broadband and other services.

13. Reliable price and cost data both are difficult to obtain in a market where bundles predominate, and where the lowest available prices of various communications services vary over time, sometimes daily, and often depend on zip code or other micro-targeting by communications carriers.

14. The voice market is tied to the broadband market in a number of ways, including: (1) broadband is the network means of transmitting VoIP, one of the intermodal competitors foreseen by URF I; (2) with the high incidence of service bundling, and the increased importance of broadband Internet access, consumer choices in the voice market may be affected by their choices in the broadband

market; and (3) traditional phone calls and broadband data services utilize the same physical network.

15. This decision focuses on describing the telecommunications market as it exists today and on what this Commission can do or recommend to promote competition and facilitate entry in the voice and broadband markets.

16. The September 10, 2015 DIVCA Report, based on 2013 year-end data, confirms other testimony and information in the record of this proceeding that:

- a. In the fixed broadband market, cable companies generally provide the fastest broadband speed;
- b. Cable companies have a larger share of the fixed broadband market;
- c. In general, customers are gravitating toward faster speed broadband; and
- d. DIVCA franchise holders (most of the large broadband and video providers in the state) now provide more broadband service than they do video service.

17. The residential, high-speed broadband market in all of California's geographic markets is highly concentrated.

18. No census block in California is served by a mobile carrier that consistently achieves high-speed broadband speeds.

19. Although there are varying estimates, roughly half (or more) of California households have access to only one (or no) wireline broadband provider at speeds of 25 Mbps down and 3 Mbps up.

20. Broadband speeds are increasing for both fixed wireline and mobile broadband, both in California and around the world.

21. Competitors' access to the built network infrastructure is a critical aspect of the competitive landscape for telecommunications services.

22. Telephone Incumbents provide legally required access to competitors through "unbundled network elements" at cost-based prices, and to other

necessary inputs at market rates. Thus, there are distinct markets for wholesale inputs that affect retail telecommunications markets and retail prices.

23. The price of stand-alone voice service – while central at the time of the URF decisions – is not centrally relevant to today’s market. An attempt to rate regulate telephone service would likely have unintended consequences that would render rates less just and reasonable than they are in the absence of rate regulation.

24. Competitive bottlenecks and barriers to entry in the telecommunications network limit new entrants and may raise prices for some telecommunications services above efficiently competitive levels.

25. One particular bottleneck is access to utility poles, where the Commission’s safety mandate meets, and must be reconciled with, its goal of a competitive market.

26. Efficient interconnection promotes competition.

27. There is a considerable risk of inefficiency in the market for cell site backhaul, which may impact the rates for retail mobile service.

28. The increasing and high level of concentration in the residential broadband market poses risks of an insufficiently competitive marketplace.

29. In measuring this rapidly evolving market, actual broadband speeds supply more useful information than advertised broadband speeds.

30. The business telecommunications market, both as to voice and broadband, differs from the residential market, but remains critically important to the California economy.

Conclusions of Law

1. Public Utilities Code §§ 216, 233-34, and 451 vest the Commission with the duty to ensure “just and reasonable” charges, terms and conditions for the conduits, ducts, poles, wires, cables, instruments, appliances and other property

used in connection with or to facilitate communication by telephone, whether such communications is had with or without the use of transmission wires.

2. Public Utilities Code § 709 contains “policies for telecommunications in California,” which include encouraging “the development and deployment of new technologies,” “promot[ing] lower prices, broader consumer choice, and avoidance of anticompetitive conduct,” and “remov[ing] the barriers to open and competitive markets and promote fair product and price competition in a way that encourages greater efficiency, lower prices, and more consumer choice.”

3. Public Utilities Code § 709.5 endorses a reliance on competitive markets to achieve California’s goals for telecommunications policy.

4. Public Utilities Code § 710 limits for a time the Commission’s authority over Voice over Internet Protocol and Internet Protocol enabled services, with some exceptions.

5. Data collected for forbearance petitions under Public Utilities Code § 716 can provide useful guidance to the Commission in its oversight of the California communications marketplace. The period after a forbearance petition is filed may not be sufficient time to gather and analyze that information, and thus we direct Communications Division to collect that data on an ongoing basis.

6. Public Utilities Code § 882 establishes that regulatory policies should encourage access to a wide choice of advanced telecommunication services.

7. In Public Utilities Code § 871, the Legislature reiterates its intent that our policies encourage development of a wide variety of advanced telecommunication facilities and services.

8. In reclassifying broadband as a telecommunications service, the FCC determined that it is jurisdictionally interstate. This determination does not foreclose or preempt Commission action related to broadband, but does require

that such Commission action be consistent with the forbearance determinations and related rulings of the FCC.

9. While legacy telephone companies are required to provide access to certain parts of their infrastructure at cost-based rates under current law, they are not required to provide access to their entire infrastructure at cost-based rates.

10. Under current law, cable companies are not required to provide competitive carriers with access to their infrastructure at cost-based rates.

11. The telecommunications markets in California extend to all types of telecommunications transport services, including both retail and wholesale, middle mile and last mile connections, whether those services are delivered via copper wire, coaxial cable, fiber or radio waves or some combination of those media.

12. The FCC's speed benchmark for "Advanced Services," currently set at 25 Mbps download and 3 Mbps upload, is a useful, reasonable, and forward-looking division to separate the broadband market into "low-speed" and "high-speed" tiers.

13. Telecommunications affordability will be addressed in the Lifeline proceeding, as well as by our other public purpose programs.

14. Clearly confidential carrier information, such as granular, census block level data, and the identity of certain wholesale providers are not, being publicly disclosed in this Decision.

15. Statewide subscriber totals or market shares are not likely to cause competitive harm to the providers and are not confidential.

16. The data disclosed in this decision is authorized for disclosure under Public Utilities Code § 583.

17. While it is unclear whether the growth of wireless, VoIP, and other alternative means of voice communication has kept prices and services for

traditional landline service just and reasonable, improving the efficiency of the telecommunications markets should result in rates for traditional landline service that are more just and reasonable.

18. The Commission should consider the role of pole access in facilitating telecommunications competition in any proceeding regarding proposed attachments to existing utility poles.

O R D E R

IT IS ORDERED that:

1. Pursuant to P. U. Code §§ 311, 314, and 716, all communications providers certificated and/or registered with the California Public Utilities Commission shall submit annually to the Communication's Division by April 1st, voice and broadband subscriber and availability block level data reflective of the prior calendar year's end in a form designated by Communications Division Staff.

2. Pursuant to P. U. Code §§ 311, 314, and 716, all communications providers certificated and/or registered with the California Public Utilities Commission shall submit annually to the Communication's Division by January 31st:
(1) location of middle-mile facilities by technology type and capacities and whether such facilities are available to unaffiliated providers of Broadband Internet access service in shapefile form designated by Communications Division staff;
and (2) other information as requested by Communications Division staff in order to monitor competition in California telecommunications markets.

3. The Communications Division staff shall prepare and deliver by December 1, 2019 a report to the Commission analyzing voice and broadband in the following manner: broadband availability by speed and geography; the number of broadband service providers by geographic area; broadband penetration rates by geographic area; areas of the state having a single and no

broadband provider, and voice and broadband market share by various geographic areas in California.

4. The Communications Division staff shall budget and seek state funding for a third party survey of consumer broadband speed experience measured by the CalSPEED fixed location test. Staff shall report to the Commission its findings and recommendations.

5. Investigation 15-11-007 is closed.

This order is effective today.

Dated _____, at San Francisco, California.