
**RETAIL COMMUNICATIONS SERVICES IN
CALIFORNIA**

*REPORT OF THE COMMUNICATIONS DIVISION
PURSUANT TO ORDERING PARAGRAPH 3 OF
DECISION 16-12-025 ANALYZING THE CALIFORNIA
TELECOMMUNICATIONS MARKET*

Staff Report
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**CALIFORNIA
PUBLIC
UTILITIES
COMMISSION
STAFF REPORT**

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Executive Summary

Communications Division (CD) Staff submits this report pursuant to requirements in the Commission's proceeding on Investigating the State of Competition Among Telecommunications Providers in California ("Competition OII").¹ Decision (D).16-12-025, issued in that proceeding on December 8, 2016, described the California telecommunications market, analyzed the state of competition in its various sub-markets. Ordering Paragraph 3 of D.16-12-025 directs CD Staff to deliver a subsequent report to the Commission by December 1, 2018 providing analysis of:

- 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;
- Voice and market shares by various geographic areas in California; and
- A recommendation as to whether (and the extent that) the required reporting remains necessary.²

¹ Order Instituting Investigation (I.) 15-11-007, filed November 5, 2015.

² The reporting referred to here is stated in Ordering Paragraphs 1 and 2 of D.16-012-025, which require all certified and/or registered providers to submit subscriber and deployment data as well as wholesale access, transport and facilities data in shapefile format.

Using provider-submitted subscription and deployment data as of December 31, 2016, CD Staff finds the following with respect to broadband Internet services:³

- **Almost 97 Percent of Californians Have Access to at Least Some Broadband.**⁴ Approximately 96.8 percent of California households live in census blocks with access to at least one wireline broadband connection; if fixed wireless availability is included, this jumps to 98.9 percent of households with broadband access. If mobile broadband is included, nearly 100 percent of California's households have access to a broadband connection.⁵
- **Regional Broadband Markets are Highly Concentrated.** All of the State's largest metropolitan markets for fixed broadband Internet service are highly concentrated, with concentration in some markets increasing over the previous year.⁶

³ Findings in this report are based on analysis of data as of December 31, 2016. The Competition OII analysis was based on data as of December 31, 2015. The data from 2015 and 2016 are different based on their sources and on the collection methodology used. This report endeavors to reconcile data sets and provide comparative analysis for key aspects of market characteristics of the broadband and voice communications markets in California. For a further detailed explanation of the data collection and analysis see Appendix A to this report.

⁴ The federally defined minimum broadband speed is 200kbps in either direction, which is slow by today's standard. The percentages here include households in census blocks with at least available internet service of at least 200 kbps.

⁵ Note that the Commission has previously found that mobile broadband Internet service is not a full substitute for fixed broadband Internet service.

⁶ Fixed broadband includes DSL, Cable Modem, Fiber and fixed wireless, but does not include mobile broadband. No mobile broadband providers in California reliably provide the threshold speed of 25 mbps downstream and 3 mbps upstream.

- **Competitive Choices Decrease at Higher Speeds.**⁷ While 39.9 percent of households live in census blocks with at least three fixed broadband Internet service providers offering speeds of 6 mbps downstream and 1 mbps upstream or greater, 31.9 percent of households live in census blocks with at least three fixed broadband Internet service providers offering speeds of 10 mbps downstream and 1 mbps upstream, and 20.5 percent of California households are located in census blocks served by three or more fixed broadband Internet service providers at speeds of 25 mbps downstream and 3 mbps upstream.⁸ About 87.1 percent of households are in census blocks with 2 or more broadband providers at 6 mbps upstream and 1 mbps downstream, 78.2 percent are in blocks with 2 or more providers at 10 mbps upstream and 1 mbps downstream, and 66.5 percent of households are in census blocks with 2 or more providers at 25 mbps downstream and 3 mbps upstream.
- **Mobile Broadband is Available to Most Californians, But Not Reliably at High Speeds.** At 200 kbps or higher, 97.4 percent of California households are located in census blocks served by three or more mobile broadband providers. Fewer than 1 percent of California households are located in census blocks with either one mobile data provider or no mobile data provider available. The Competition OII found similar results for 2015: 98 percent of households in census blocks with three or more providers and fewer than 1 percent of households in census blocks with either one or zero mobile data providers. However, when factoring in

⁷ Internet speed is measured in megabits per second (mbps) for two-way communication including downstream from the provider to the consumer and upstream from the consumer to the provider.

⁸ Using the FCC benchmark for Residential Advanced Services to mean fixed high-speed broadband service advertised at speeds of at least 25 mbps download and 3 mbps 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).

reliability, no census block in California is served by a mobile carrier that consistently achieves speeds of 25 mbps downstream and 3 mbps upstream.⁹

- **The Digital Divide Between Urban and Rural and Tribal Areas is Significant.** Californians living in urban census blocks have the highest number of advanced services providers available to them. Just 2.4 percent of urban households live in census blocks without advanced services availability (broadband at speeds of at least 25 mbps downstream and 3 mbps upstream), compared with 33.7 percent of tribal households and a full 46.4 percent of rural households.¹⁰

Staff found the following with respect to voice services:

- **Voice Services Are Almost Universally Available to Californians From Multiple Providers.** 99.2 percent of California households are in census blocks with access to at least three voice providers.¹¹ 81.2 percent of all California households are in census blocks with at least six voice providers. The Competition OII found that 96.4 percent of California households were in

⁹ The Commission has found that average measured speeds are not representative of a consumer's actual mobile experience. Rather than using average speeds, we quantify expected speeds at varying probabilities by taking into account the distribution of results around the mean in a single testing session. We use two standard deviations below the mean result to calculate the speeds a consumer will receive approximately 98 percent of the time.

¹⁰ These figures include fixed wireless availability. If fixed wireless availability is not considered, the number of rural households without advanced services availability increases to 62.7 percent.

¹¹ This analysis includes wireline voice, wireless 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. VoIP, or Voice over Internet Protocol, is defined as a technology that allows you to make voice calls using a broadband Internet connection instead of a regular (or analog) phone line. Over-the-Top, or OTT VoIP, is defined as a non-network service or application provided over the network, for example Skype or Vonage.

census blocks with access to at least three voice providers and 87 percent were in blocks with at least six voice providers.¹² 89.4 percent of California's rural households are located in census blocks served by three or more voice providers, up considerably from the Competition OII's finding of 77 percent of rural households.¹³ 91 percent of tribal households are located in census blocks served by three or more voice providers. Only 0.1 percent of all California households live in census blocks with access to no voice provider, including 437 urban households and 6,931 rural households. The Competition OII found 1.5 percent of households in blocks with no voice providers.

- **Voice Telephone Lines Are Decreasing Slightly, and Most Voice Service Is Bundled with Broadband.** There are approximately 57.3 million voice lines in service in California. Of these 57.3 million voice lines, 14.6 million were landlines and 42.7 million were wireless lines. 87.6 percent of these voice lines were bundled with broadband service.

D. 16-12-025 also asks Staff for its recommendation on whether to continue collecting voice and broadband deployment and subscriber data on an annual basis. Staff recommends the Commission continue to rely on this data.

¹² The raw data from the Competition OII showed that 87% of households were in blocks with six or more voice providers as of December 31, 2015, while the validated data as of December 31, 2016 shows only 81% of households in census blocks with six or more voice providers. The OII data, which was not validated, likely overstated service availability. Please see Appendix A for further explanation.

¹³ Much of this increase can be attributed to the more thorough data collection required for 2016 data by D.16-12-025. All service providers in California were required to submit their 2016 subscription and availability data, whereas the Competition OII data from 2015 inadvertently omitted many small, rural providers.

Table of Contents

Staff Report: Retail Communications Services in California

1. Background.....	11
2. Broadband Availability by Speed and Geography	12
2.1. Fixed Broadband Availability by Speed	14
2.2. Mobile Broadband Availability	16
2.3. Broadband Availability – All Technologies	17
2.4. Broadband Availability by Urban, Rural and Tribal Areas.....	18
3. Broadband Market Penetration and HHI Concentration	19
3.1. Fixed Broadband Penetration Rates	20
3.2. Residential Fixed Broadband	20
3.3. Mobile Broadband Concentration	21
3.4. Intermodal Broadband Concentration.....	22
4. Availability of Voice Services	23
4.1. Residential Fixed Voice Availability	24
4.2. Mobile Voice Availability	24
4.3. Intermodal Voice Availability	25
4.4. Voice Availability Trend	28
5. Voice Market Concentration	29
5.1. Fixed Voice Concentration.....	29
5.2. Consumer Mobile Voice.....	30
5.3. Intermodal Voice	31
6. Conclusions	33
7. Recommendations	34
APPENDIX A: Methodology and Data Notes	35
1. Notes on the Data Sets	35
1.1. Data Comparison	35
1.2. Data Composition	37
2. Market Definitions.....	37
2.1. Definition of the Telecommunications Market.....	37
2.2. Retail Consumer Voice Market	38
2.3. Fixed Services	39
2.4. Consumer Mobile Voice and Broadband	39
2.5. Service Substitutability.....	40

2.5.1. Substitutability of Voice Services	40
2.5.2. Substitutability of Residential and Mobile Broadband/Data Services, Segmentation by Speed	41
3. Methodology	42
3.1. Availability Overstatement	42
3.2. Comparing the Numbers of Landline and Mobile Subscribers	43
3.3. Measuring Market Share/Concentration	44
3.4. Broadband Speeds – Advertised vs. Actual.....	44
3.5. Territory Adjustment.....	45
APPENDIX B: Fixed Broadband Penetration Rate by County December 2016...	47

1. Background

This report presents a detailed snapshot of the California retail communications services marketplace as of December 31, 2016, comparing it to the market reported in D.16-12-025. Ordering Paragraph 3 of D.16-12-025 directs CD Staff to deliver a subsequent report to the Commission by December 1, 2018 providing analysis of:

- 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;
- Voice and market shares by various geographic areas in California; and
- A recommendation as to whether (and the extent that) the required reporting remains necessary¹⁴

The methodologies used in the analysis underlying this report are detailed in Appendix A. Summary data underlying the analysis is presented in tabular format and is based on deployment and subscriber data submitted by providers at the census block level collected as part of the Commission's broadband and voice data collection, or using data from Federal Communications Commission (FCC)'s Form 477 Report.¹⁵ Tabular data is displayed for the years 2015 and 2016

¹⁴ The reporting referred to here is stated in Ordering Paragraphs 1 and 2 of D.16-012-125, which require all certified and/or registered providers to submit subscriber and deployment data as well as wholesale access, transport and facilities data in shapefile format.

¹⁵ Underlying data from the FCC 477 Report may be not be in exact alignment with data gathered from providers and utilized in the earlier analysis in D.16-12-025. This report provides a much more inclusive and accurate rendering of service availability. Broadband and mobile

to allow for comparisons. Data is further segmented by urban, rural and tribal areas. Broadband speeds are represented by the notation x/x, which represents download and upload speeds in megabits per second; for example, 6/1 denotes six mbps downstream and one mbps upstream. Market concentration was determined using the Herfindahl-Hirschmann Index (HHI) score similar to that employed by the Federal Trade Commission and the Department of Justice in evaluating proposed mergers of competitors.¹⁶

2. Broadband Availability by Speed and Geography

This section examines broadband availability examined by speed tier, availability and technology. Four benchmark speed tiers were considered:

- All speeds – some broadband is available, but slower than 6 mpbs downstream and 1 mbps upstream;

voice data was validated pursuant to <http://www.cpuc.ca.gov/General.aspx?id=1197> and http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Communications_-_Telecommunications_and_Broadband/Consumer_Programs/Broadband_Availability/ValidationofBroadbandAvailability.pdf

¹⁶ 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 100 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. 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.”

- 6 mbps downstream and 1 mbps upstream (6/1) – the current minimum performance criteria for eligibility of the California Advanced Services Fund (CASF) program;¹⁷
- 10 mbps downstream and one mbps upstream (10/1) – the current threshold for the federal Connect America Fund (CAF) and the minimum performance standard for CASF infrastructure grants;
- 25 mbps downstream and 3 mbps upstream (25/3) – the target for advanced service as set by the FCC. Advanced service of more than 25 mbps downstream allows multiple users and/or devices to use basic functions and high-demand applications simultaneously.¹⁸

Broadband availability is also examined by technology category:

- Wireline broadband excluding fixed wireless, which includes cable, fiber, and Digital Subscriber Line (DSL);
- Fixed broadband, which includes all wireline broadband plus fixed wireless;
- Mobile broadband;
- All technologies, which includes any technology of delivery, or all of the above.

¹⁷ Pub. Util. Code § 281 (f)(15). In consortia regions that have met the 98% availability goal at 6/1, the benchmark for served speeds for CASF is 10/1.

¹⁸ The benchmark was set by the FCC in its 2015 *Broadband Progress Report, supra*. According to the FCC's "Household Broadband Guide," advanced services are necessary for high use (i.e., basic functions plus more than one high-demand application running at the same time) for 3 or more users or devices at a time, and for moderate use (i.e., basic functions plus one high-demand application) by 3 or more users or devices at a time. High-demand applications include streaming HD video, multiparty video conferencing, and telecommuting).

2.1. Fixed Broadband Availability by Speed

Table 1 below reports the number of households by wireline broadband providers available at each speed tier. The top numbers represent how many households in California have service availability and the bottom number is the percentage of California’s households. When using any of the speed thresholds used in this report, 89.5 percent of California households have access to at least two wireline broadband Internet service providers, though only 23.4 percent have access to a third competitive provider.

As was the case in the Competition OII, the vast majority of households with access to only two wireline providers are able to choose between the incumbent telephone provider and a cable provider, and not an alternate wireline provider like Sonic.net or Wave. In 2016, 66.0 percent of households with two wireline broadband providers had a choice only between the cable provider and the incumbent telephone provider.

Table 1: Wireline Broadband Availability: Households Served by Speed (Excludes Fixed Wireless)

Speed	Served by 3 or More Providers	Served by 2 Providers	Served by 1 Provider	Unserviced
All speeds	3,052,129	8,595,713	954,715	417,857
	23.4 %	66.0 %	7.3 %	3.2 %
6/1	1,549,545	8,689,518	2,256,668	524,682
	11.9 %	66.7 %	17.3 %	4.0 %
10/1	984,626	7,609,724	3,760,279	655,784
	7.6 %	58.4 %	28.9 %	5.1 %
25/3	885,708	6,777,794	4,552,512	804,398
	6.8 %	52.1 %	35.0 %	6.2 %

As shown in Table 2, below, fixed wireless Internet service may provide a third alternative to a significant number of households. The percentage of households served at all speeds by three or more providers increased significantly when including fixed wireless, from 23.4 percent of households with three or more fixed broadband providers (Table 1), to 39.7 percent of households with three or more fixed broadband providers including fixed wireless (Table 2).¹⁹ Even at speeds of 25/3 over 20.5 percent of households have access to three providers when fixed wireless providers are included.

Table 2: Wireline and Fixed Wireless Broadband Availability: Households Served by Speed

Speed	Served by 3 or More Providers	Served by 2 Providers	Served by 1 Provider	Unserviced
All speeds	6,864,048	5,321,500	693,635	141,229
	52.7 %	40.9 %	5.3 %	1.1 %
6/1	5,195,640	6,139,289	1,503,391	182,093
	39.9 %	47.2 %	11.5 %	1.4 %
10/1	4,147,127	6,037,867	2,590,946	244,473
	31.9 %	46.4 %	19.9 %	1.9 %
25/3	2,671,709	5,991,098	3,749,396	608,210
	20.5 %	46.0 %	28.8 %	4.7 %

¹⁹ A key limitation of fixed wireless technology is that the antenna at the consumer's premises and the provider's ground station must have a direct line of sight. CD staff's site visits and analysis indicated in areas with hilly or mountainous terrain and heavy foliage makes full fixed wireless coverage of the area unlikely, making the area, at best, only "partially" served. Wireless propagation in such areas is negatively affected by the scattering effects of randomly distributed leaves, branches and tree trunks, which can cause attenuation, scattering, diffractions and absorption of fixed wireless radio signals. See Resolution T-17495 at 9.

2.2. Mobile Broadband Availability

In order to analyze mobile broadband availability, we relied on mobile field tests using CalSPEED²⁰ and considered reliability.²¹ Mobile broadband is widely available at lower speeds. 97.4 percent of California households are served by at least three mobile broadband providers at any speed. Mobile broadband service appears useful in filling in service gaps in areas with limited fixed service. However, no mobile broadband provider consistently achieves speeds of 25/3. That lack of reliability was one of several reasons, including data caps and different usage patterns, why the Commission found that mobile broadband service was not a full substitute for fixed broadband.²²

²⁰ CalSPEED Reports, 2012-2016, available at <http://www.cpuc.ca.gov/General.aspx?id=1778>. CalSPEED is the CPUC's program to measure mobile broadband speeds and quality using a mobile crowd-sourcing application and by performing semi-annual field testing of mobile broadband service quality in urban, rural and tribal areas throughout the State.

²¹ This is the ninety-eight percent confidence interval CD staff devised to demonstrate actual subscriber experience. At mean-2, the speed results will show the actual performance of mobile broadband by stating the speed the user will achieve 98 percent of the time.

²² See D. 16-12-025 at 49-50.

Table 3: Mobile Broadband Availability: Households Served by Speed

Speed	Served by 3 or More Providers	Served by 2 Providers	Served by 1 Provider	Unserviced at This Speed
All speeds	12,682,595	233,347	69,549	34,922
	97.4 %	1.8 %	0.5 %	0.3 %
6/1	2,624,806	4,956,250	5,037,242	402,115
	20.2 %	38.1 %	38.7 %	3.1 %
10/1	712	77,578	12,204,407	737,717
	0.0 %	0.6 %	93.7 %	5.7 %
25/3	0	0	0	13,020,413
	0.0 %	0.0 %	0.0 %	100.0 %

2.3. Broadband Availability – All Technologies

Table 4 below displays household broadband availability via wireline, fixed wireless and mobile technologies. Including all technologies at all speeds, 99.5 percent of households are in census blocks with availability of three of more providers.

Table 4: Broadband Availability: Households Served by Speed via All Technologies

Speed	Served by 3 or More Providers	Served by 2 Providers	Served by 1 Provider	Unserviced at This Speed
All speeds	12,950,994	51,897	12,120	5,401
	99.5 %	0.4 %	0.1 %	0.0 %
6/1	12,061,171	785,155	151,540	22,547
	92.6 %	6.0 %	1.2 %	0.2 %
10/1	9,877,684	2,706,039	380,099	56,591
	75.9 %	20.8 %	2.9 %	0.4 %
25/3	2,671,709	5,991,098	3,749,396	608,210
	20.5 %	46.0 %	28.8 %	4.7 %

2.4. Broadband Availability by Urban, Rural and Tribal Areas

Table 5, below, shows the continuing digital divide between households in urban and rural areas. This divide is more pronounced in tribal census blocks, which also tend to be in remote areas. 46.4 percent of rural households and 33.7 percent of tribal households have no broadband options at speeds of 25/3.

Table 5: Unserved Households in Urban, Rural and Tribal Census Block (All Technologies)

Speed	Total	Urban	Rural	Tribal
All speeds	5,401	299	5,103	545
	0.0 %	0.0 %	0.7 %	2.1 %
6/1	22,547	2,422	20,125	1,296
	0.2 %	0.0 %	2.9 %	4.9 %
10/1	56,591	8,746	47,845	2,345
	0.4 %	0.1 %	7.0 %	8.9 %
25/3	608,210	290,659	317,550	8,914
	4.7 %	2.4 %	46.4 %	33.7 %

Likewise, when looking at the number of competitive alternatives, the data also shows a similar disparity between rural and urban competitive options. Tribal and rural households have less availability from multiple providers at any served speed and that availability decreases precipitously with increased speed thresholds, as indicated in Table 6.

Table 6: All Broadband Technologies Households with Three or More Service Providers

Speed	Total	Urban	Rural	Tribal
All speeds	12,950,994	12,312,034	638,960	24,609
	99.5 %	99.8 %	93.3 %	92.9 %
6/1	12,061,171	11,668,732	392,440	16,652
	92.6 %	94.6 %	57.3 %	62.9 %
10/1	9,877,684	9,693,925	183,759	8,906
	75.9 %	78.6 %	26.8 %	33.6 %
25/3	2,671,709	2,661,202	10,508	688
	20.5 %	21.6 %	1.5 %	2.6 %

3. Broadband Market Penetration and HHI Concentration

We define market penetration for broadband as the amount of adoption of a service compared to the total market for that service, so in this case the number of households actually subscribing to broadband service at home as a measure of the total number of households in California. As noted earlier, the Herfindahl-Hirschman index (HHI) is a commonly accepted measure of market concentration. HHI is calculated by squaring the market share of each firm competing in a market and then summing the resulting numbers (For example, if four suppliers in a market with 100 customers each have 25 customers, the HHI would be $25^2 + 25^2 + 25^2 + 25^2$ for a market concentration level of 2500). 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. 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.”²³

3.1. Fixed Broadband Penetration Rates

Statewide, 77.8 percent of California’s housing units receive fixed broadband services in their homes at any speed. On a county-by-county basis, the penetration rates of fixed broadband are higher in urban areas, which have more competitors, and more high-speed options. Appendix B contains a table of fixed broadband penetration rates by county.

3.2. Residential Fixed Broadband

As shown in Table 7, the largest residential broadband Internet service markets are all highly concentrated, reflecting the dominance of the cable providers and Incumbent Local Exchange Carriers (ILECs) in providing fixed broadband Internet service. HHI levels increased in four of the six largest markets, except San Francisco, where Competitive Local Exchange Carriers (CLECs) Sonic and WaveDivision are beginning to deploy competitive service. The Sacramento market remained static, owing in part to the presence of fixed wireless and satellite.

²³ See DOJ/FTC *Horizontal Merger Guidelines*, available at <https://www.justice.gov/atr/horizontal-merger-guidelines-08192010#5c>.

Table 7: Fixed Broadband Concentration in Largest Markets

Market	2015 HHI	2016 HHI	2016 Concentration Level
Los Angeles	5,096	5,453	High
Oakland	4,881	5,042	High
Sacramento	5,048	5,048	High
San Diego	5,115	5,407	High
San Francisco	5,190	5,088	High
San Jose	5,469	5,723	High

3.3. Mobile Broadband Concentration

Because mobile providers generally do not separately report voice versus broadband (data subscriptions), mobile providers have reported the same subscription numbers for both voice and broadband. Therefore, mobile broadband market concentration will appear to be identical to mobile voice concentration. As noted in Table 8, below, all of the six largest mobile broadband markets in the State are concentrated, with concentration increasing from 2015 to 2016.

Table 8: Mobile Broadband Concentration in Largest Markets

Market	2015 HHI	2016 HHI	2016 Concentration Level
Los Angeles	2,217	2,682	High
Oakland	2,665	2,906	High
Sacramento	2,544	3,272	High
San Diego	3,037	3,173	High
San Francisco	3,074	3,284	High
San Jose	2,782	3,047	High

3.4. Intermodal Broadband Concentration

As indicated in Tables 9 and 10, below, the six largest markets in California are moderately concentrated if one views those market as intermodal, meaning mobile broadband subscribers are counted with fixed. As with the intermodal voice market, this report presents one set of measures with an adjustment to account for multiple users in a household,²⁴ as well as an unadjusted line count analysis. The moderate concentration in each market reflects the dominant number of mobile subscriptions (including business customers).

Although the Commission recognized that mobile broadband and fixed broadband are not direct substitutes, it is still worth considering this intermodal market; as wireless technology advances, these services may become closer to substitutability.

Table 9: Intermodal Broadband Concentration in Largest Markets (By Persons Served)

Market	2016 HHI	2016 Concentration Level
Los Angeles	1,804	Moderate
Oakland	2,253	Moderate
Sacramento	2,220	Moderate
San Diego	2,168	Moderate
San Francisco	1,997	Moderate
San Jose	2,040	Moderate

²⁴ The multiple users per households adjustment is explained in Appendix A, and is used to account for the fact that landline broadband services are generally used by all members of the household, whereas mobile broadband services are used generally only by the user of each particular handset. Therefore, we use a multiplier based on the number of persons over 10 years old in a household to compare subscriptions to fixed services to subscriptions to mobile services.

Table 10: Intermodal Broadband Concentration in Largest Markets (Unadjusted Connection Count)

Market	2016 HHI	2016 Concentration Level
Los Angeles	1,967	Moderate
Oakland	1,844	Moderate
Sacramento	1,985	Moderate
San Diego	2,001	Moderate
San Francisco	2,157	Moderate
San Jose	2,103	Moderate

4. Availability of Voice Services

In the Competition Decision the Commission found that competition in the intermodal voice market appeared to be “strong,”²⁵ with 96 percent of California households living in census blocks with access to at least three voice providers and 84 percent of households with access to at least six voice providers.²⁶ Below are the 2016 voice availability results. Data is reported by households in urban, rural and tribal²⁷ areas against the number of available providers and by technology. The top numbers in the report tables represent how many households in California have service availability and the bottom numbers are the percentage of California’s households.

²⁵ D. 16-12-025, Finding of Fact 7e.

²⁶ Id at 9-10.

²⁷ Census block urban/rural designations last updated after 2010 US Census. Tribal designation is determined by the US Census Bureau and distinguishes census blocks within tribal lands.

4.1. Residential Fixed Voice Availability

Table 12, below, displays voice service availability for residential fixed voice services, which include traditional landline telephone, VoIP, and voice service provisioned over fixed wireless.

Most California households can only choose between two providers, namely the legacy ILEC and the legacy cable company, as only 24.4 percent of California households have voice service available from an entity other than the legacy ILEC or cable provider.

Table 11: Residential Fixed Voice Availability: Households by Number of Service Providers

	Total	Urban	Rural	Tribal
All Households	13,020,413	12,358,923	684,541	26,478
Unserviced	393,743	185,094	208,649	6,187
	3.0 %	1.5 %	30.5 %	23.4 %
1 Provider	888,634	622,736	265,899	5,566
	6.8 %	5.0 %	38.8 %	21.0 %
2 Providers	8,554,612	8,388,788	165,824	13,778
	65.7 %	68.0 %	24.2 %	52.0 %
3 or More Providers	3,183,424	3,139,274	44,150	948
	24.4 %	25.4 %	6.4 %	3.6 %

The availability picture changes dramatically when one takes mobile voice service into account.

4.2. Mobile Voice Availability

Mobile voice availability is widespread throughout California. Four large carriers provide the majority of service. As indicated in Table 13, below, 97.4

percent of households live in census blocks with access to at least three mobile voice providers and less than 35,000 households are unserved by mobile voice service.

Table 12: Mobile Voice Availability: Households by Number of Service Providers

	Total	Urban	Rural	Tribal
All Households	13,020,413	12,358,923	684,541	26,478
Unserved	34,922	23,189	11,733	703
	0.3 %	0.2 %	1.7 %	2.7 %
1 Provider	69,549	33,786	35,763	664
	0.5 %	0.3 %	5.2 %	2.5 %
2 Providers	233,347	147,516	85,831	3,766
	1.8 %	1.2 %	12.5 %	14.2 %
3 or More Providers	12,682,595	12,131,401	551,194	21,345
	97.4 %	98.3 %	80.5 %	80.6 %

4.3. Intermodal Voice Availability

In the URF Decision the Commission found that VoIP technologies compete with historic wireline telecommunications services.²⁸ In the Competition Decision the Commission found that mobile voice service is a substitute for fixed landline voice service for most Californians, subject to limitations.²⁹ Thus combining traditional landline voice, VoIP and wireless voice

²⁸ D. 06-08-030 at Finding of Fact 63.

²⁹ D. 16-12-025 at Finding of Fact 7c. Limitations include 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

(intermodal voice) represents the most accurate indication of services available to consumers.³⁰

As indicated in Table 14, below, voice service is almost universally available in California. Almost 100 percent of California households are in census blocks with access to at least three voice providers (note: 81.2 percent of all California households are in census blocks with at least six voice providers). 89.4 percent of California's rural households are located in census blocks served by three or more voice providers, up considerably from the Competition Decision's finding of 77 percent of rural households. 91.1 percent of tribal households are located in census blocks served by three or more voice providers. Only 0.1 percent of all California households live in census blocks with access to no voice provider, including 437 urban households and 6,931 rural households. The Competition Decision found 1.5 percent of households in blocks with no voice providers.

³⁰ See Appendix A for more on substitutability. This analysis of data provided on residential voice deployment and subscription will treat mobile voice and landline voice as functional equivalents in an intermodal analysis.

Table 13: Intermodal Voice Availability (All Technologies): Households by Number of Providers

	Total	Urban	Rural	Tribal
All Households	13,020,413	12,335,892	684,541	26,478
Unserviced	7,368	437	6,931	482
	0.1 %	0.0 %	1.0 %	1.8 %
1 Provider	21,100	2,464	18,635	518
	0.2 %	0.0 %	2.7 %	2.0 %
2 Providers	73,209	26,482	46,727	1,355
	0.6 %	0.2 %	6.8 %	5.1 %
3 or More Providers	12,918,737	12,306,510	612,227	24,123
	99.2 %	99.8 %	89.4 %	91.1 %

As shown in Table 15, below, Staff also looked at household with income below \$50,000 and \$25,000,³¹ finding only slight variability in the percentages of low-income households with one or two providers, or three or more voice providers.³² 98.6 percent of households in census block groups with median income under \$50,000 in 2014 had access to three or more voice providers in 2016.

³¹ Median Income is measured at the census block group level. A census block group is comprised of one or more census blocks. Here we use the census block group’s median income for every census block within that blockgroup, noting that this approach will not recognize granular income variations.

³² This figure represents low income households in an area with providers, but does not address whether available services are affordable to these households.

Table 14: Intermodal Voice (All Technologies) Availability: Households in Low Income Census Blockgroups by Number of Providers

	Total	Blockgroups with MHI 2014 < \$50k	Blockgroups with MHI 2014 < \$25k
All Households	13,020,413	4,377,576	555,084
Unserviced	7,368	5,293	678
	0.1 %	0.1 %	0.1 %
1 Provider	21,100	14,212	1,734
	0.2 %	0.3 %	0.3 %
2 Providers	73,209	40,125	4,426
	0.6 %	0.9 %	0.8 %
3 or More Providers	12,918,737	4,317,946	548,246
	99.2 %	98.6 %	98.8 %

4.4. Voice Availability Trend

Table 16, below, compares voice availability in California between 2015 and 2016. Access has increased, as the number of households without available voice service has decreased from 1.5 percent of households to 0.1 percent. The number of households with access to three mobile voice providers increased from 93.5 percent to 97.4 percent, with intermodal voice access in turn increasing from 96.4 percent of households to 99.2 percent. The lone decrease Staff found was in the number of households in census blocks with at least six voice providers. The Competition Decision found that 87 percent of California households were in blocks with at least six voice providers. However, in 2016, 81.4 percent of households have access to at least six voice providers. The drop in the number of households with six or more providers may be due to the validation of 2016 data, as opposed to 2015 data used in the OII.

Table 15: Voice Availability by Household for 2015 and 2016

Technology		Served by Three or More Providers	Served by Two Providers	Served by One Provider	Unserviced
Fixed	2015	3,382,929	7,787,545	1,080,543	326,481
		26.9 %	61.9 %	8.6 %	2.6 %
	2016	3,183,424	8,554,612	888,634	393,743
		24.4 %	65.7 %	6.8 %	3.0 %
Mobile	2015	11,762,453	344,931	207,525	262,589
		93.5 %	2.7 %	1.6 %	2.1 %
	2016	12,682,595	233,347	69,549	34,922
		97.4 %	1.8 %	0.5 %	0.3 %
Intermodal	2015	12,118,537	141,320	131,864	185,777
		96.4 %	1.1 %	1.0 %	1.5 %
	2016	12,918,737	73,209	21,100	7,368
		99.2 %	0.6 %	0.2 %	0.1 %

5. Voice Market Concentration

The Competition Decision reviewed market concentration for fixed and mobile voice services and found that the combined intermodal voice market is moderately concentrated in California’s six largest markets. In this Chapter Staff updates that analysis.

5.1. Fixed Voice Concentration

Subscription data shows that most landline consumers obtain voice services from a legacy telephone company or an incumbent cable provider (often bundled with broadband). Between traditional connections (plain old telephone service or POTS) and VoIP the ILECs supply 3.8 million residential connections

in California. This number has decreased from the 2015 number of 4.1 million connections. Cable providers are the other legacy facilities-based providers offering VoIP over coaxial cable have a combined 2.79 million residential voice connections in California, an increase from the 2.77 million connections in 2015. CLECs providing voice service have a much less significant market share, amounting to approximately 600,000 total residential VoIP lines in California.

Table 17, below, shows market concentration for the six largest residential landline voice HHI markets in California. With the exception of the San Diego metropolitan area, landline voice concentration decreased. This indicates an increasing market share of cable VoIP providers, and also a growing market share for non-traditional CLECs.

Table 16: Wireline Voice Concentration in Largest Markets

Market	HHI 2015	HHI 2016	2016 Concentration Level
Los Angeles	5,152	4,966	High
Oakland	4,783	4,413	High
Sacramento	5,332	4,710	High
San Diego	5,095	5,224	High
San Francisco	4,997	4,234	High
San Jose	4,948	4,782	High

5.2. Consumer Mobile Voice

The mobile voice market in California is dominated by the top four nationwide service providers: AT&T, Verizon, T-Mobile and Sprint. In our largest metropolitan areas, the mobile voice market is becoming more concentrated as the dominant carriers, as a group, continue to increase their

market share. Table 18 indicates the change in market concentration from 2015 to 2016 for the six largest mobile voice markets in California. All had high concentration levels in 2015 and are higher in 2016.

Table 17: Mobile Voice Concentration in Largest Markets

Market	2015 HHI	2016 HHI	2016 Concentration Level
Los Angeles	2,217	2,682	High
Oakland	2,665	2,906	High
Sacramento	2,544	3,272	High
San Diego	3,037	3,173	High
San Francisco	3,074	3,284	High
San Jose	2,782	3,047	High

5.3. Intermodal Voice

When viewing the voice market as intermodal, market concentration declines and the market appears more competitive. Tables 19 and 20 show market concentration in the six largest intermodal voice markets in the State. Table 19 includes a per-person-served adjustment to account for multiple users of fixed services in one household and Table 20 uses a raw subscription count.³³ While each market remains moderately concentrated, those markets are more concentrated than in 2015 due to the continued consumer shift to mobile voice services at the expense of landline voice services.

³³ An adjustment was made to account for multiple users of landline services per households, where it is assumed that all members of the household above a certain age all have access to the same household fixed service. This is explained in Appendix A.

Table 18: Intermodal Voice Concentration in Largest Markets (By Persons Served)

Market	2015 HHI	2016 HHI	2016 Concentration Level
Los Angeles	1,555	1,800	Moderate
Oakland	1,712	1,814	Moderate
Sacramento	1,727	2,109	Moderate
San Diego	1,907	2,064	Moderate
San Francisco	1,860	1,988	Moderate
San Jose	1,784	1,943	Moderate

The Oakland metropolitan area had the smallest increase in per-person-served HHI. The reason for this may be that T-Mobile and Sprint have made substantial gains in market share in this region. In 2015, the combined per line Oakland area market share for Sprint and T-Mobile was 21.4 percent.³⁴ This increased to 23.0 percent in 2016. Additionally, the share of landline voice provisioned by cable in the Oakland metropolitan area increased over ILEC subscriptions.

³⁴ Including MetroPCS, which is now part of T-Mobile.

Table 19: Intermodal Voice Concentration in Largest Markets (By Unadjusted Line Count)

Market	2015 HHI	2016 HHI	2016 Concentration Level
Los Angeles	1,867	2,094	Moderate
Oakland	1,890	1,863	Moderate
Sacramento	1,850	2,492	Moderate
San Diego	2,167	2,404	Moderate
San Francisco	2,095	2,320	Moderate
San Jose	2,044	2,322	Moderate

6. Conclusions

Using 2016 data, this report provides a snapshot of the competitive landscape of retail communications industry in California. The report highlights the continuation of trends that were reported in the Competition OII and in prior staff Market Share reports.

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, leading to what is essentially an intermodal voice market from the perspective of consumers.
2. Voice communication itself is a diminishing segment of the broader telecommunications market. Most California households obtain their voice service in a bundle with broadband, inextricably linking the voice and broadband markets into one competitive marketplace.
3. The market for wireline services, both voice and broadband, is highly concentrated statewide and in the state's largest markets. However, when analyzed from an intermodal perspective, these markets are generally moderately concentrated.

4. Intermodal market concentration is generally increasing, or becoming less competitive, as mobile services gain more and more market share.
5. Most residential customers with wireline voice service obtain that service from either the legacy incumbent telephone provider or a cable VoIP provider.
6. There are segments of the California populace that have not fully benefitted from competition and advances in technology. This “digital divide” runs largely along rural/urban lines and stems largely from the lack of sufficient deployment of telecommunications facilities and services in rural areas.
7. No mobile carriers in California consistently deliver high-speed broadband services of 25 mbps downstream and 3 mbps upstream at least 98 percent of the time.
8. The high level of concentration in the residential broadband market poses risks of an insufficiently competitive marketplace. Concentration levels are currently increasing in almost all markets.

7. Recommendations

Ordering Paragraphs 1 and 2 of D.16-12-025 required service providers to submit 1) voice and broadband subscriber and deployment data annually at a census block level; and 2) transport, special access and other wholesale service data on a one-time basis. Ordering Paragraph 3 orders the Communications Division to make a recommendation in this report about whether, and the extent that, continued reporting required in Paragraphs 1 and 2 remains necessary.

Regarding the submission of subscriber and deployment data at a census block level, CD recommends the Commission continue to rely on this data. Accurate and granular data will help the Commission assess accurately the

competitiveness of both markets and allow more knowledgeable decisions on market issues such as pending mergers. Since both voice and broadband markets are becoming more concentrated, this data will be vital to ensuring a competitive marketplace that will benefit California consumers.

APPENDIX A: Methodology and Data Notes

1. Notes on the Data Sets

1.1. Data Comparison

Although this report compares the results of data analyses in two consecutive years (2015 and 2016), it is important to note that the data collection method for these two cycles is different. The 2015 data used in the Competition OII was based almost entirely on the submission of subscribership and deployment data from the service providers themselves. This data was provided in response to data requests that were sent from the CPUC to the state's largest providers. This data was ordered by a separate data request to the participants in the OII proceeding, and other larger providers. Not all of California's service providers received and responded to this data request so additional data was used from the FCC's Form 477 to supplement the data set and approximate the state of competition in California. As records in the investigative proceeding, the data request responses were not thoroughly validated by staff.

The 2016 data used in this report was submitted by all service providers operating in the state. It has also been validated by Staff. Additionally, the collection methods for 2016 data were more streamlined according to the

ordering paragraphs of D.16-12-025,³⁵ which stipulated that data be collected from all licensed carriers (whereas the Competition OII data collection was mostly from participants in the proceeding and other large carriers). Because the Competition OII collected data from the state's largest providers, some smaller rural providers were not included. These carriers, however, have been included in this current analysis of 2016 data.

These differences lead to two primary ways in which the Competition OII data was likely skewed: 1) For statewide data and data that includes urban areas, it is likely that availability was overstated by the carriers. This is common in deployment reporting, which is why Staff will generally verify this data, removing areas where service may be reported but is not actually provided; and 2) For many rural and tribal areas, the Competition OII underestimates availability because many of these areas are served by small providers who were not included in the Competition OII data request process. This report provides a much more inclusive and accurate rendering of service availability.

³⁵ Data for the Competition OII was produced by service providers because of data requests from the CPUC, whereas the 2016 data was produced by service providers in accordance with the ordering paragraphs of D.15-12-025. Ordering Paragraph 1 states that "all communications providers certificated and/or registered with the California Public Utilities Commission that also file Forms 477 with the Federal Communications Commission shall submit annually to the Communications Division by April 1st, voice and broadband subscriber and deployment data at a census block level as of the prior calendar year's end in a form designated by Communications Division Staff. Mobile providers may submit subscriber data at the census tract level."

1.2. Data Composition

D.16-12-025 required that providers availability and subscription data broken down by geographic region. Here we look at that data within regions by both the availability of competing services and by the numbers of subscribers to those competing services. Wireline and fixed wireless carriers provided data at the census block level, while mobile service providers submitted this data at the census tract level.

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 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.

2. Market Definitions

2.1. Definition of the Telecommunications Market

We define the retail telecommunications market as the retail market for voice and broadband communications. The voice market includes traditional landline service, wireless service and VoIP telephony.³⁶ Noting that voice communications is just one application among many for wireless users, and also that landline voice service is so often purchased as part of a broadband bundle, it

³⁶ Peer-to-peer applications, like Skype or FaceTime that offer real-time two-way voice communication but do not require phone numbers are not included in this analysis.

is critical when studying the voice market to also study the broadband market of which it is a small important part.

2.2. Retail Consumer Voice Market

The retail portion of the market consists of traditional landline phone, cellular phone, and IP-based voice communication services. This definition is intended to encompass facilities-based communications between devices with phone numbers or IP addresses, regardless of technology.

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 so-called “over the top” phone service obtained independently of a physical connection.³⁷ It also excludes a separate but related wholesale market for infrastructure access and transmission services necessary to transmit and complete telephone calls.

The voice market is inextricably linked to the broadband market for two main reasons:

³⁷ 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”).

- The majority of voice communications now take place on a mobile device with many broadband-based applications, voice being only a small portion of the utility of these subscriptions;
- The majority of residential voice-only services, i.e. traditional landline phone and VoIP, are purchased from the carrier as part of a bundle with broadband services. This is also true of mobile voice services, which are nearly always bundled with mobile data service options.

2.3. Fixed Services

“Fixed Service” is used to denote service 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 and satellite offerings, all of which are delivered to a specific address.³⁸

Likewise, fixed broadband services are those that are not mobile. This includes DSL, cable modem, copper, fiber, and fixed wireless technologies.

2.4. Consumer Mobile Voice and Broadband

All four of the large, nationwide, facilities-based wireless or mobile carriers are operating in California:³⁹ AT&T Wireless, Verizon Wireless, Sprint

³⁸ See FCC’s 2016 *Voice Telephone Report*, *supra*, at Table 1 (on 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).

³⁹ We include their affiliates; Verizon, for example, operates through multiple affiliates in California.

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. Nearly all mobile voice subscriptions are bundled with some sort of broadband data service, and the large mobile carriers do not report separately report voice and broadband subscriptions, but rather assume they are equal. Some mobile carriers also do not distinguish between residential and business subscribers, so all subscriptions are included herein.

2.5. Service Substitutability

Substitutability in this context is the extent to which fixed and mobile services are economic substitutes for each other. The closer two services are to being substitutes, the closer those services are to being parts of one market. We approach this question first by examining the voice submarket, then by examining the broader data market.

2.5.1. Substitutability of Voice Services

Almost by definition, wireless and wireline phones are functional substitutes for one another in the voice market, albeit with limitations where either service may not be accessible. Where service is available, each (a wireless or a wireline phone) 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 coverage discrepancies that wireline phones do not have, and wireline phones offer services that wireless phones do not offer, for most customers in locations where signal coverage exists, in most instances a

consumer can use either type of phone to make or receive a traditional telephone call.⁴⁰

Our quantitative analysis of data provided on residential voice deployment and subscription will treat mobile voice and landline voice as functional equivalents in an intermodal analysis.⁴¹

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

We contend that, while mobile and fixed broadband are not direct functional substitutes in the way that voice services are, there is certainly a fair degree of overlap in these markets, as evidenced by the growing number of households utilizing only mobile broadband connections, especially in low income areas.⁴² Therefore, we will analyze retail broadband markets separately, and then as one intermodal market, with the understanding that these services are often functionally equivalent, but not enough to declare them substitutable.

Fixed broadband delivers a direct wired connection to the home via copper (DSL), fiber, or coaxial cable. Mobile broadband services access the Internet using a mobile phone (or tablet) which can provide download speeds faster than DSL but slower than cable or fiber. While fixed broadband service is consistent, mobile broadband service is often unreliable compared with Internet

⁴⁰ 911 location services, however, do differ for the two types of service.

⁴¹ "Intermodal" denotes a single market albeit composed of somewhat different segments. In this context, fixed voice plus mobile voice equals the intermodal voice market.

⁴² "Evolving Technologies Change the Nature of Internet Use". National Telecommunications and Information Administration. April 19, 2016.

provided over DSL, cable or fiber because signal strength and coverage are variable.

Network management further distinguishes mobile broadband from fixed broadband service. Some mobile carriers may limit data speeds for a variety of reasons and may also have low data caps and metered usage which limit mobile data's substitutability for home broadband. Some "unlimited" mobile data plans may have reduced video quality or "throttle" user speeds after a set amount of data is used each month. Screen size may also be an important factor in differentiating fixed and mobile broadband.

3. Methodology

3.1. Availability Overstatement

Availability is assessed for both voice and data services at the census block level. As with the Competition OII data, the 2016 data stipulated that a carrier should report availability in a certain census block if it offers service to any household in that census block, even though it is possible that not all households in that block have service availability. This is generally only relevant in more remote areas (rural census blocks tend to be much larger than urban census blocks). However, our verification process 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 may remain overstated despite this compensation.

3.2. Comparing the Numbers of Landline and Mobile Subscribers

In an intermodal analysis, we recognize that landline subscriptions are per household while mobile phone subscriptions are per user. That is, each landline subscription is usable by every member of the household, whereas mobile subscriptions are largely individual, and one household may have several different mobile subscriptions. To compare the sizes of the user bases for each type of telephone requires adjusting the landline subscriber numbers to reflect the a more accurate number of landline telephone users per household. In order to address this difference, we multiply the number of landline subscriptions by the average number of people, ages 10 and up, living in a household. California's average household size is 2.94 persons, and roughly 13.8 percent of California's population is less than 10 years old. Because household size is less in the major metropolitan counties studied, we use a multiplier of 2.2 to adjust the residential subscriber count to reflect the fact that multiple users have access to home voice service, while mobile voice services generally have only one user. We also present an unadjusted "line count" concentration measure using the HHI.⁴³

⁴³ 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.*)

3.3. Measuring Market Share/Concentration

HHI is one tool to measure market concentration, which is used as the standard by the Department of Justice. 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 Metropolitan Statistical Areas (MSAs), which are comprised of counties.⁴⁴ Those markets include 24,700,463 Californians, roughly 63 percent of California's population, and are presumed to contain the least concentrated markets in the State because they have the largest number of providers competing. The remaining 37 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.⁴⁵

3.4. Broadband Speeds – Advertised vs. Actual

In reporting fixed broadband speeds in this report, we are largely reliant on what the carriers report. While the CPUC has a testing program for mobile broadband to confirm actual speeds, this Commission does not have sufficient data to assess fixed broadband speeds. D.16-12-025 requires carriers to provide

⁴⁴ 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.

⁴⁵ 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.

the same data as required by the FCC's Form 477, which stipulated that carriers report the advertised speed of their broadband services. The FCC has found 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."⁴⁶

For mobile broadband speeds, we use data collected with the Commission's CalSPEED program, which measures actual wireless broadband data in the field. The Commission created and pioneered this open source, non-proprietary, network performance measurement tool and methodology with the assistance of a grant from the National Telecommunications and Information Administration. In order to measure only reliable speeds, we use the CalSPEED data aggregated to -2 standard deviations, meaning that the speeds used in this analysis are obtainable by the use over 98 percent of the time.

3.5. Territory Adjustment

For the purpose of analyzing the consumer market, we have used a territorial adjustment to account for the fact that ILECs, even in the same jurisdiction, are not direct competitors because their legacy franchise territories did not overlap.⁴⁷

⁴⁶ 2016 *Broadband Progress Report*, *supra*, at ¶ 105.

⁴⁷ 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.

Cable companies also largely built their networks in non-competing franchise territories. This means that Charter and Comcast, for example, are never competing for subscribership from the same household. Therefore, in HHI calculations, all ILECs are counted as a single entity and all franchise-territory cable providers are counted as a separate single entity.

APPENDIX B: Fixed Broadband Penetration Rate by County December 2016

County	Housing Units	Housing Units Offered Broadband Internet Access Service	Consumer Connections	Broadband Adoption Rate
California	14,072,272	13,949,680	10,853,739	77.8 %
Alameda	596,936	595,340	489,178	82.2 %
Alpine	1,780	1,423	818	57.5 %
Amador	18,189	18,154	11,794	65.0 %
Butte	98,871	97,634	69,206	70.9 %
Calaveras	27,908	27,219	16,652	61.2 %
Colusa	8,112	8,112	4,649	57.3 %
Contra Costa	412,198	409,911	356,131	86.9 %
Del Norte	11,306	11,054	Withheld	60%-80%
El Dorado	90,353	89,851	60,318	67.1 %
Fresno	329,736	329,012	224,108	68.1 %
Glenn	11,130	11,130	5,516	49.6 %
Humboldt	62,672	62,294	41,090	66.0 %
Imperial	57,401	55,944	32,746	58.5 %
Inyo	9,515	7,960	5,594	70.3 %
Kern	296,596	289,999	196,477	67.8 %
Kings	45,866	45,485	29,695	65.3 %
Lake	34,473	32,464	17,722	54.6 %
Lassen	12,748	12,155	7,546	62.1 %
Los Angeles	3,527,368	3,518,656	2,702,628	76.8 %
Madera	50,125	50,021	31,360	62.7 %
Marin	111,999	110,375	94,840	85.9 %
Mariposa	10,492	9,731	5,416	55.7 %
Mendocino	40,894	37,748	20,139	53.4 %
Merced	85,168	85,137	55,707	65.4 %
Modoc	5,262	4,946	2,045	41.3 %
Mono	14,048	10,044	Withheld	60%-80%
Monterey	139,821	138,710	101,157	72.9 %
Napa	55,567	53,641	42,153	78.6 %

County	Housing Units	Housing Units Offered Broadband Internet Access Service	Consumer Connections	Broadband Adoption Rate
Nevada	53,557	49,976	34,307	68.6 %
Orange	1,084,437	1,071,316	922,993	86.2 %
Placer	162,489	160,511	126,847	79.0 %
Plumas	15,814	14,601	6,430	44.0 %
Riverside	834,652	826,711	629,934	76.2 %
Sacramento	567,281	563,283	452,447	80.3 %
San Benito	18,510	18,405	13,358	72.6 %
San Bernardino	715,634	705,119	524,408	74.4 %
San Diego	1,201,517	1,183,391	992,562	83.9 %
San Francisco	392,619	392,377	307,553	78.4 %
San Joaquin	241,021	240,999	177,961	73.8 %
San Luis Obispo	121,049	119,360	91,205	76.4 %
San Mateo	277,189	276,387	238,246	86.2 %
Santa Barbara	157,578	155,624	122,332	78.6 %
Santa Clara	661,875	661,860	558,016	84.3 %
Santa Cruz	105,501	105,473	82,111	77.9 %
Shasta	78,537	77,915	52,011	66.8 %
Sierra	2,344	1,530	837	54.7 %
Siskiyou	24,088	23,522	11,076	47.1 %
Solano	157,555	154,747	129,065	83.4 %
Sonoma	208,053	205,182	161,194	78.6 %
Stanislaus	181,374	181,275	133,216	73.5 %
Sutter	34,339	34,333	24,556	71.5 %
Tehama	27,536	27,450	14,183	51.7 %
Trinity	8,795	7,271	1,766	24.3 %
Tulare	148,089	147,424	88,044	59.7 %
Tuolumne	31,477	29,716	15,396	51.8 %
Ventura	288,074	285,201	239,359	83.9 %
Yolo	76,449	76,337	59,640	78.1 %
Yuba	28,305	28,231	18,001	63.8 %

