Broadband Infrastructure in the Monterey Bay Region

Larry Samuels, PhD, and Bud Colligan, Founder & CEO, South Swell Ventures August 2, 2013

Current State of Affairs

The majority of broadband customers in the Monterey Bay region are served by Comcast, AT&T, Cruzio, Verizon and Charter Communications. According to the California Public Utilities Commission's most recent census, the average broadband speeds in the three counties are as follows:

	<u>Santa Cruz</u>	<u>San Benito</u>	<u>Monterey</u>
<u>User type</u>			
Home	4.7Mbps	2.5Mbps	2.5Mbps
Schools/Libraries	50+Mbps	6Mbps	50+Mbps
Small Business	3.8Mbps	2.8Mbps	2.5Mbps

These averages may be misleading, as certain Internet Service Providers (ISPs) have recently added new wireless and hardwire services within the Tri-County area, or are planning to do so in the near future. The large numbers of users in mountainous or rural areas also skew these numbers lower, since service choices in such areas are very limited. But as a general metric for most of the Monterey Bay region, the numbers are largely accurate. As a general guideline, the California Public Utilities Commission has designated communities with broadband speeds of less than 6Mbps as "underserved."

Types of Connectivity

Hardwire – The true state of fiber deployment in the Monterey Bay region is unknown, as AT&T, Comcast, Charter, and Verizon all refuse to publish fiber backbone or coverage maps. The Central Coast Broadband Consortium (CCBC) has been awarded a three-year CPUC grant to assess the state of coverage within the Tri-County region of Monterey, Santa Cruz, and San Benito counties.¹ There are pockets of fiber backbone in all three counties; however, most "broadband" connection offerings from large ISPs are comprised of a blend of fiber and copper or coaxial cabling. As a result of decisions made by the major ISPs, "fiber to the home" (FTTH) is currently not a reality in the Monterey Bay region. The map at the end of this document is based upon information from the California Broadband Mapping Program, which shows the areas in which fiber broadband may exist, but has not been lit.

The general speed limitation of 100Mbps, primarily based upon a business-focused coaxial/ fiber connection from cable television companies using DOCSIS 3 technology and AT&T's Erate program for public libraries and schools, is in place for a limited geographical area of the Monterey Bay region, but indications from public customers of AT&T (schools and libraries)

¹ http://www.cpuc.ca.gov/NR/rdonlyres/5E69C592-DC5C-4BCB-A68C-46F427BEE6E5/0/ CASF2011AnnualReportMarch152012Final.pdf

are that speeds of 1Gbps may be in place by late 2013.² Within limited geographical areas of the major cities in each county, Comcast, AT&T and Cruzio offer 1Gbps data rates, albeit at a substantial cost.

Residential hardwire service from all regional ISPs originates with either Sunesys, Comcast, AT&T, or Charter fiber, and pricing/available bandwidth is controlled by these larger ISPs. With the current blend of fiber/copper and fiber/coaxial deployment throughout the region, residential hardwire is limited to 26-40 Mbps (e.g. AT&T's U-Verse service), with the exception of certain areas where DOCSIS 3 service from Charter and Comcast can extend this speed to 100 Mbps.

Wireless – Broadband wireless technology has two distinct variations, *mobile* and *fixed-point*. Because of costs, monthly data limits, and network congestion, mobile wireless--used in mobile telephony (3G or 4G smart phones)--has not been widely adopted for fixed device residential usage, although a new generation of smart tablets with 4G (LTE) technology is increasing its usage.

Because mobile wireless provides a very large coverage area under optimal conditions, coverage maps commonly show large areas of the Tri-County region as "broadband served" areas. While such a definition involves limitations on both the reliability of connection and available bandwidth, as well as far higher pricing, many government agencies have based regional and municipal financial assistance upon such definitions. CSU Monterey Bay is currently mapping both wireless bandwidth and connectivity in the Tri-County region, which should aid greatly in determining the extent of real broadband coverage.

Fixed-point wireless, a line-of-sight technology, has seen considerable advances in recent years, with new frequency spectrums and miniaturization of transmitter and receiver components. ISPs such as Cruzio are viewing fixed wireless as a better near term solution for residential and business broadband purposes because of bandwidth, cost, speeds up to 1 Gbps, and a range of up to 30 miles. The speed and relatively low price of fixed wireless infrastructure allows for a rapid build-out of a network, with equipment that is mobile and re-usable. While gaining considerable ISP support as a "last mile" solution in both urban and rural areas, fixed wireless can also serve as broadband backbone over shorter distances and redundant connectivity in emergency situations. And technology advances have increased the reliability and security of fixed wireless systems, with "Quality of Service" (QoS) guarantees up to 99.99%, suitable for enterprise use.³ The limitations to wireless include the need for line-of-sight, which can be difficult in mountainous and tree-covered areas, and an overall lower carrying capacity. However, in areas where these limitations are less of a factor, fixed wireless is booming.

Wireless broadband is being rapidly deployed in Monterey and Santa Cruz counties, driven by two primary factors. The first factor is geographical, in that the region's topography and the low population density of rural areas have made building out hardwire broadband

² Author's conversations with Director of Technology, Pajaro Valley Unified School District and with CIO of Santa Cruz County, June 2013.

³ Correspondence with Peggy Dolgenos, July 24, 2013

infrastructure economically less desirable for large ISPs. The second factor is that regional ISPs such as Red Shift and Cruzio have aggressively sought to fill the void created by the larger ISPs' hesitation to expand their offerings. The result has been an expansion of wireless broadband offerings from a variety of regional ISPs. In the less mountainous regions of the Tri-County region, Cruzio is currently offering fixed wireless broadband with data rates approaching those of fiber (500Mbps-1Gbps) and Red Shift has announced plans to offer similar services. In the more mountainous areas where line-of-sight installations are less practical and "last mile" distances are longer, a much larger set of ISPs offer both mobile and fixed wireless, with speeds ranging from 3-50 Mbps.

The proliferation of wireless broadband is not limited to these regional ISPs, as Sprint, T-Mobile, AT&T and Verizon have all announced plans to expand their wireless offerings to include residential services. At the present time, such services are limited to traditional mobile wireless plans in the Tri-County region, although this may change in the near future. As Cruzio and Red Shift have demonstrated, the use of fixed wireless for "last mile" broadband deployment is a viable solution for most current business and residential customers. Although future applications and increasing demand for bandwidth may require fiber to the curb for enterprise and business customers and FTTH for residential customers, fixed wireless is proving to be a viable alternative in the near term.

Satellite – A third option, satellite broadband from companies such as Hughes and ViaSat, has three drawbacks: speeds for this type of service lag wireless and hardwire broadband significantly, most residential plans have monthly data limits, and all existing plans are far more expensive (and far slower) than hardwire plans. A longstanding issue with satellite has also been latency, in that the time for the signal to be transmitted and received makes such connections inherently non-synchronous. Compensating software for the inherent latency works only to a certain extent. For real time gaming or applications requiring a secure synchronous connection (many financial trading sites have such requirements), the inability to maintain a completely synchronous connection can cause security-based disconnects.

While recent technology advances in satellite broadband show promise for delivering improved service to geographically isolated communities, in the Tri-County region, fixed point wireless is likely to be more competitive in terms of data rates and pricing for all but the most isolated installations.

Santa Cruz County

In 2010, Sunesys established a fiber link connecting Level 3's Sunnyvale hub with UCSC in the city of Santa Cruz. Cruzio has leased two strands of the Sunesys fiber and has built 96 strands directly into their commercial data center, in downtown Santa Cruz. Cruzio uses this fiber for Cruzioworks, a tech oriented co-working building, and for ADSL and ADSL2+ service, as well as wireless residential & business service in Santa Cruz County.⁴

According to various maps submitted to the CPUC, an AT&T fiber link connects Salinas with Watsonville. AT&T has not publicly acknowledged fiber between Watsonville and Santa Cruz, although all indications are that AT&T and Comcast may have fiber connecting these towns.

⁴ CENIC http://www.cenic.org/pressroom/releases/2010/FibertotheFuture.pdf

The schools and libraries in Santa Cruz County are fiber wired (100Mbps-1Gbps) by AT&T, indicating that fiber may be widespread. According to an AT&T representative, fiber is installed in limited portions of Scotts Valley, Capitola, and western Santa Cruz, but residential and business speeds are limited to 24Mbps.⁵ With central offices in Santa Cruz, Capitola, Aptos, Scotts Valley, and Watsonville, AT&T offers service throughout Santa Cruz County. The majority of AT&T customers in the county are still limited to ADSL and ADSL2+ service, with the higher speeds of ADSL (up to 6Mbps) and ADSL2+ (up to 24 Mbps) available only to certain areas of the county.

Comcast may have fiber in the county, but at a minimum, the majority of municipalities in the county are equipped with DOCSIS 3 level architecture, allowing speeds up to 100Mbps. For reasons associated with the company's contract with Santa Cruz County, Comcast had delayed implementing DOCSIS 3 level service within most municipalities of the county until summer of 2013,⁶ but that upgrade has now been completed. In more remote areas of the county, DOCSIS 2 level (with residential speeds to 16Mps) is the norm.

Charter may have fiber connections to their Watsonville service area, but they have no fiberbased offerings to either business or residential customers. Charter does offer DOCSIS 3 level service in Watsonville and Capitola (up to 100Mbps),⁷ but the coverage is sporadic, with no broadband being offered at many Charter cable television served households within the city limits of Watsonville.⁸

Cruzio has partnered with the City of Watsonville to construct a high-speed, fixed wireless broadband connection that links the Watsonville Civic Center to Cruzio and its leased Sunesys fiber in Santa Cruz. Cruzio offers ADSL and ADSL2+ service with up to 40Mbps (bonded ADSL2+) in limited areas of Santa Cruz County. The company offers high speed fixed wireless (up to 1Gbps) to business customers in limited areas of Santa Cruz County, as well as residential fixed wireless. Via their 2009 acquisition of Gatespeed, Cruzio has wireless transmission towers on Loma Prieta, Mount Umunhum, and Mount Allison, giving them lower speed (up to 10Mbps) wireless coverage for much of Santa Cruz County and possibly portions of northern Monterey and northwestern San Benito counties.⁹

Most rural and mountainous areas of Santa Cruz County are served only by AT&T ADSL or wireless service. Verizon, Cruzio and Surfnet are the primary wireless providers, with Verizon's offerings limited to LTE service. As discussed earlier, where adequate line of sight and distance parameters are met, fixed wireless can allow speeds of up to 100Mbps, although Cruzio's residential offerings are usually in the range of 10 to 20 Mbps (synchronous). In general, the terrain of the county's more mountainous areas limits most residential wireless service to mobile wireless (LTE). Speeds for this service can range as

⁵ Conversation with AT&T representative 11/13/13

⁶ San Jose Mercury News, 3/19/13 http://www.mercurynews.com/ci_22823939/comcast-boosts-internet-speeds-bay-area

⁷ Santa Cruz County CIO, 6/12/13

⁸ Conversation with Charter representative 6/6/13

⁹ Santa Cruz Sentinel, Nov. 19, 2009. http://www.santacruzsentinel.com/news/ci_13821303

high as 10 Mbps, although the cost for that speed is significantly higher than hardwire connections.

Monterey County

Comcast has provided a 100Mbps DOCSIS 3 level backbone, which may be fiber based, to the public buildings in Monterey County as part of their contract with the county. Residential service to 100 Mbps is available in most central and coastal county municipalities. Outside the core of these communities, Comcast service is sporadic.

AT&T does not have residential or business fiber offerings in Monterey County, but over 80% of the schools in Monterey County are linked to AT&T fiber with data rates ranging from 100Mbps to 1Gbps.¹⁰ AT&T may have a fiber trunk in the Laguna Seca office park that provides broadband access to CSUMB, MBARI and other Monterey public entities (schools, county offices) as a result of a past settlement involving the SBC/PacBell merger, based on anecdotal evidence. AT&T also seemingly has fiber as far south as King City, according to Monterey County planning records.¹¹ The company offers its U-verse service (up to 24Mbps) in the city of Salinas, in select communities in the southern Salinas Valley and in the municipalities of the Monterey Peninsula, but in the balance of the county (including the remaining 20% of schools) it offers ADSL (up to 6 Mbps, but primarily 1.5Mbps).

There is a California Research and Education (CalREN) hub in Soledad, and the Corporation for Education Networking in California's (CENIC) fiber backbone runs the length of 101 within the county.¹² It is believed that the AT&T fiber connections to County libraries and schools may be linked to this hub; however AT&T may have adequate fiber coverage to not require such a connection. Municipal Internet Services (I-Net) in Monterey and Marina, managed by CSU Monterey Bay's information technology resources, are connected to the university's Otternet broadband network, which in turn is connected to the CENIC backbone.

Most rural and mountainous areas of Monterey County are served only by ADSL or wireless service. Verizon, Red Shift, and Razzolink are the primary wireless providers, although Verizon's offerings are limited to mobile wireless (LTE) plans. Red Shift has residential and business offerings of up to 10 Mbps via a series of transmitters located in rural Monterey County that allow a high level of coverage for most residences and businesses on the Salinas Valley floor and in the immediate foothills. In the near future, Red Shift plans to offer 500+ Mbps fixed wireless service to enterprise customers.

The map at the end of this document shows that the majority of Monterey County is unserved or underserved by wired broadband, for both geographic and demographic reasons. While wireless service may need to be the interim step for many of the more mountainous areas, the lack of broadband service to the larger communities in southern Monterey County has been a largely economic decision on the part of the larger ISPs, reflecting the generally lower socioeconomic status (SES) of many of these communities.

¹² http://www.cenic.org

¹⁰ California Department of Education http://www.k12hsn.org

¹¹ http://www.co.monterey.ca.us/planning/projects/planning/annual/2000_Approved.PDF

San Benito County

San Benito County has established a fiber link between the Hollister airport and downtown Hollister as a county initiative to stimulate economic growth. The majority of this fiber is dark, awaiting future expansion. In general, the broadband linkage between the two largest towns in San Benito County is excellent, reflecting a more forward looking stance on the part of county planners and the outcome of litigation between the county and Charter Communications.

Charter Communications has been the county's primary partner. The existing Institutional Network (I-Net) was installed by Charter to meet requirements established in the previous franchise agreement with the cities of Gilroy, Hollister, and San Juan Bautista. The I-Net was designed to support the transport of high-speed digital services and analog video communications for the following entities:

- Community Media Access Partnership
- City of Gilroy
- Gilroy Unified School District
- City of Hollister
- San Benito County
- San Benito County Office of Education
- City of San Juan Bautista.

The I-Net is configured around two backbone hubs at the Gilroy City Hall and Hollister City Hall, which are connected by 16 strands of fiber.¹³ Due to a settlement agreement with Charter, this configuration is being reworked, improving the video communications aspect of the I-net. Charter does not offer fiber broadband to residential or business customers, but does offer up to 100 Mbps to business customers in Gilroy, Hollister, and San Juan Bautista. Most residential customers in the part of the greater Gilroy area located within San Benito County are limited to a maximum of 10Mbps (see map at end of paper).

AT&T has U-verse availability within the municipalities of Hollister, Gilroy and San Juan Bautista. Outside these communities, the only AT&T service offered is ADSL.

The bulk of San Benito County has only wireless broadband available. It is expensive and has speed limitations of 50Mbps for business customers and 6-10Mbps for residential customers. The primary wireless providers are Etheric and Pinnacles Telephone Co.

Monterey Bay Region Synopsis

With the exception of those areas within reach of Cruzio's leased fiber, in the core municipalities of the Monterey Bay region, wired broadband services are generally available from two providers. In most of the region these two providers are Comcast and AT&T. In a region comprising northern Monterey County, southeastern Santa Cruz County, and most of

¹³ Community Media Access Partnership, April 2011 https://docs.google.com/document/d/

¹b_FcgKL4nditUotstPYSglMo20bv2S0b0b4pV5W4ND4/edit?hl=en&pli=1

San Benito County, these two providers are AT&T and Charter. None of these three companies has attempted to aggressively build out their infrastructure in the Monterey Bay region, leaving several communities severely underserved.¹⁴ Instead, providers have delayed deployment of available services,¹⁵ delivered substandard signals and quality,¹⁶ and reneged on commitments to build out their network within the region.¹⁷ Smaller ISPs that have leased bandwidth on a wholesale basis from these providers have found themselves undercut by the retail offerings made by these same companies.¹⁸

The Monterey Bay region is not alone in experiencing this situation. Customer costs for broadband across the U.S. continue to climb,¹⁹ due to a lack of a competition.^{20 21} As an example of the exorbitant costs for broadband, a recent international study found that while U.S. Comcast users pay an average of \$153/month for "triple play" services (broadband Internet, phone and television), these same services cost \$34.47/month in Paris, \$43.03/ month in London, and \$32.74/month in Seoul.²²

In the face of such industry behaviors, municipalities across the US have started to build their own broadband networks, creating public networks or jointly owned public/private networks.²³ These efforts are driven not only by a desire to create a higher performance/lower cost network and service for their constituents, but also to spur economic development. For more than a decade, Internet bandwidth has attracted new employers to regions,^{24 25} a critical issue to consider for communities that have experienced economic stagnancy or decline.

In the Monterey Bay region, the existing high levels of unemployment, the large ISPs controlling broadband pricing and deployment, and the proximity to a host of Silicon Valley companies and talent that would be attracted by lower cost labor and reasonably priced

²⁵ http://siteselection.com/issues/2001/jan/p43/

¹⁴ California Broadband Authority

¹⁵ http://www.mercurynews.com/business/ci_22823939/comcast-boosts-internet-speeds-bay-area

¹⁶ Community Media Access Partnership, April 2011 https://docs.google.com/document/d/ 1b_FcgKL4nditUotstPYSglMo20bv2S0b0b4pV5W4ND4/edit?hl=en&pli=1

¹⁷ http://www.montereycountyweekly.com/news/local_news/article_e2db4f27-c918-5192-890f-0a81813e3077.html

¹⁸ Authors' conversations with multiple Santa Cruz County & Monterey County ISPs

¹⁹ http://www.dslreports.com/shownews/Boston-Mayor-Trying-to-Fight-Relentless-Comcast-Rate-Hikes-117968

²⁰ http://www.nytimes.com/2013/05/20/business/media/telecoms-big-players-hold-back-the-future.html? pagewanted=1&_r=1&src=dayp

²¹ http://www.huffingtonpost.com/josh-levy/broadband-rankings-worldwide_b_1400630.html

²² http://newamerica.net/publications/policy/the_cost_of_connectivity

²³ http://www.theatlanticcities.com/technology/2013/03/why-are-there-no-big-cities-municipal-broadband-networks/4857/

²⁴ http://www.timesfreepress.com/news/2010/sep/14/fastest-web/

gigabit fiber all contribute to a compelling case for efforts to develop a publicly-owned fiber backbone serving the three counties.

Recognizing these conditions, over the past decade various efforts have arisen to create a multi-county broadband link within the Monterey Bay region, several of which have been private/public partnerships seeking funding from state or federal agencies. Most of these efforts have failed due to changing funding climates, overly ambitious deployment plans, competing plans, and funding priorities that resulted in other regions receiving the available funds. In terms of state funding targeted at unserved and underserved areas, such as the CPUC's CASF program, extensive lobbying by the larger ISPs has also undermined the issue at the state legislative level and undermined local projects spearheaded by smaller ISPs.

The authors believe the Monterey Bay region should take control of its own broadband Internet development and thereby steer the region's economic future, while maintaining the area's longstanding commitment to environmental integrity and quality of life. The means to this civic autonomy is via the creation of a publicly controlled fiber optic network that creates a "middle mile" solution for low cost/high speed broadband access for all communities in the region. For the past decade, countless Monterey Bay organizations and individuals, in both public and private spheres, have attempted to pull together consortia and secure funding for some manifestation of what we are proposing herein. While these efforts have been professional and well organized, they have yet to secure the necessary funding and support to make a connected Central Coast a reality. In order to finally succeed, we strongly believe that more focused leadership at a senior level within the Tri-County region is needed, along with a commitment to substantial local financing. Because a publicly controlled fiber backbone can help change the economic course of all Monterey Bay communities, we have authored Fiber for the Coast – A Tri-County Broadband Plan, which we hope will serve as a blueprint for making this transformation possible.



pan, METI, Esri

Sources) Esri, DeLorme, NAVTEQ, USGS, Intermap, PC, Ohina (Hong Kong), Esri, Thailand), TomTom, 2013s