Santa Cruz *fiber*

Proposal for a City-Wide Fiber Network in Santa Cruz, California

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Summary

The Santa Cruz Fiber Project has a simple goal: to provide affordable, next-generation fiber broadband to homes and businesses throughout the City of Santa Cruz.

This proposal outlines a locally-owned, next-generation broadband network operated openly and independently. Built for Santa Cruz, it is uniquely tailored to fit the diverse needs of the Santa Cruz community.

The project is financially self-sustaining and 100% of the profit generated will stay in the City of Santa Cruz.

In this proposal, fiber-optic infrastructure owned by the City functions as a transport utility separate and distinct from the services provided over it. As new, more demanding technologies are developed, whether voice, video, or any other service, the transport is scalable to carry them.

"Ensuring our citizens have access to robust broadband service is as much a quality-of-life issue as providing clean drinking water, safe neighborhoods, and affordable housing."

-- Mayor Bob Nicholson, Montrose, CO

While the network will generate significant revenue, unlike a wholly-commercial enterprise, a public-private partnership will emphasize universal coverage rather than focusing on commercial profit centers.

Cruzio's design and approach focuses on the efficient buildout of a network where consumers will have full choice over the content and services they want to consume in addition to their primary Internet service.

This paper proposes a shared route to this goal, in which Cruzio Internet will act as Operator and primary Retailer on a Fiber Project financed and ultimately owned by the City of Santa Cruz.

Project Goals

- Universal coverage — use economies of scale to cover every neighborhood in Santa Cruz, including those least likely to be served by commercial providers

- Extremely fast speeds — 1 gigabit per second (Gbps) available to all customers

- Extremely competitive pricing

- Scalable network — ability to offer even faster speeds and expand to other areas in the future

- Efficient and economical to the owners and operators

- Sustainable, economically and environmentally

- Free or subsidized service to selected local institutions, e.g. schools

- Replace City iNet to serve City assets, saving hundreds of thousands of dollars in public expenditure while dramatically increasing service

- Provide for future expansion of our economy; recognize that in Santa Cruz many businesses, especially start-ups, are run from people's homes

- Create new business opportunities and support economic development

- Earn popular support; an opportunity for Santa Cruz to shine on the national stage and a "win" for the whole community

Why Cruzio?

As the largest independent ISP in Santa Cruz, with a 25-year history of great service and support, Cruzio is uniquely positioned to operate this network.

Cruzio's 3,000 existing customers in Santa Cruz would be migrated to this network providing initial financial security unavailable elsewhere. Most communities do not have this option.

Cruzio's existing backhaul fiber connection to Silicon Valley saves many months of effort and tens of thousands of dollars in setup and monthly costs. The backhaul can provide low-cost bandwidth to feed the entire network and is expandable as needed.

Our billing and customer service software is in place, tested, scalable and transferable to the new project. Lease payments for customer connections totaling a million dollars a year, currently going out of our area, could be shifted to pay the City as owner of proposed network.

Cruzio is locally-owned and -operated and 100% locally staffed. This network would provide a boost to a local company and create, we estimate, 15-20 new full-time positions.

Cruzio CEOs Peggy Dolgenos & Chris Neklason during construction of their network headquarters

Why Santa Cruz?

The City of Santa Cruz is also uniquely positioned to participate in the building of a City-wide network.
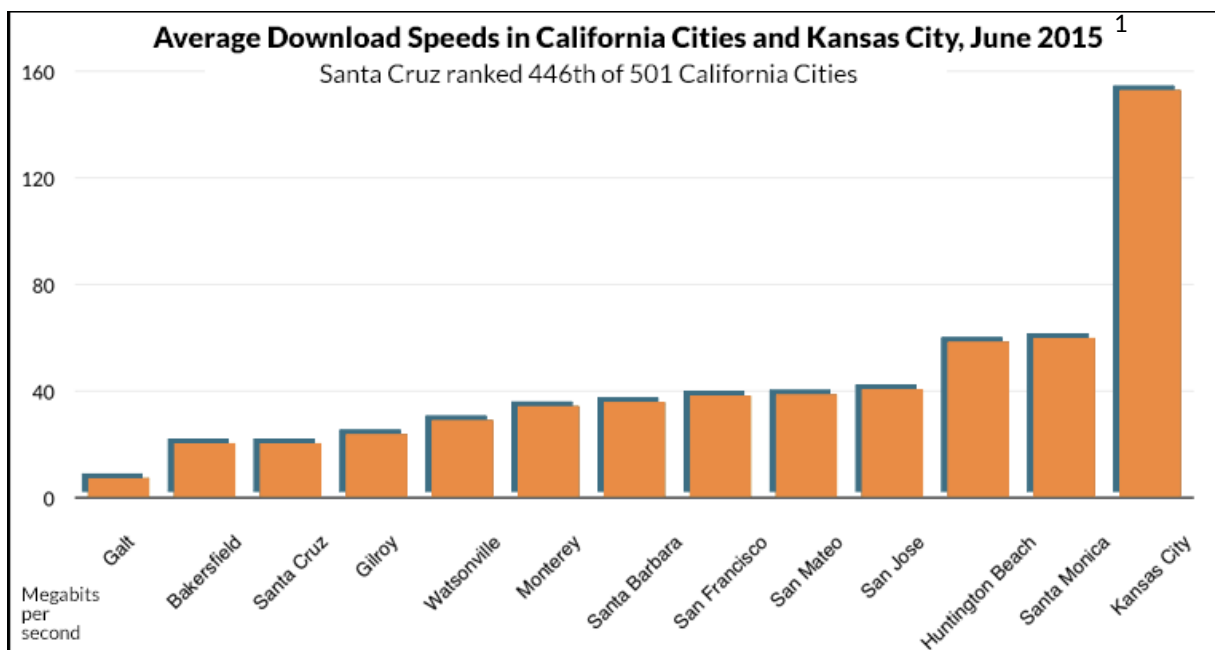
The City has an excellent professional staff overseeing public interest in many relevant areas: Public Works, Finance, Information Technology and Economic Development, to name a few.

The City's outstanding credit rating enables it to borrow for public-interest projects at a reasonable rate, something of which private markets are not yet capable.
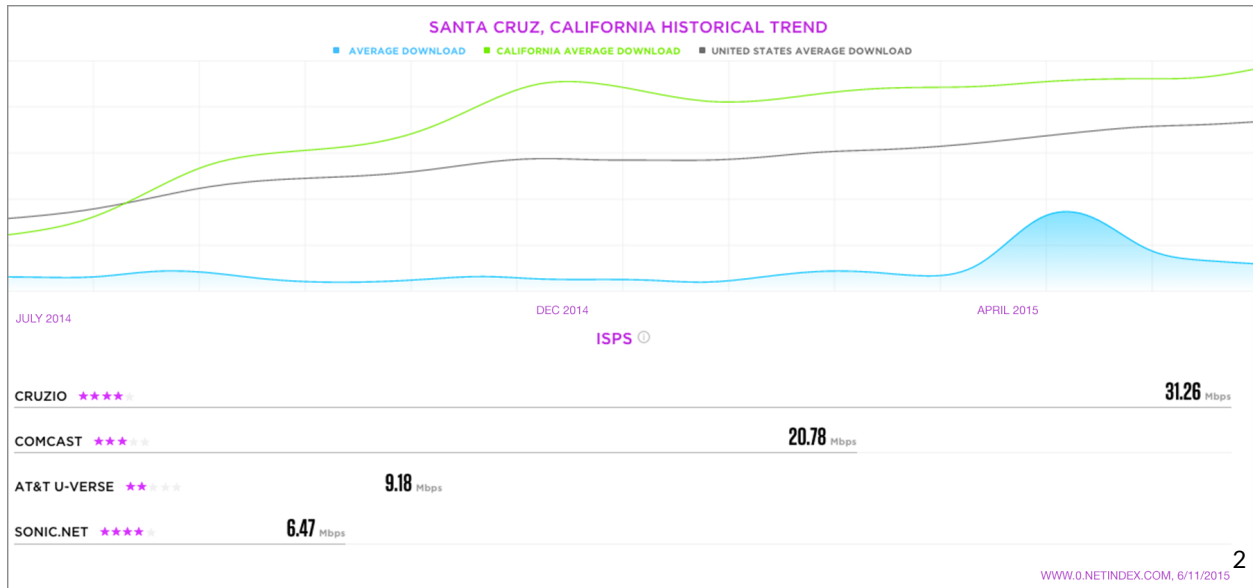
With leased connections among its many facilities up for renewal — or replacement — by 2017, the timing is excellent for a new City INET. And a new network wouldn't simply replace the old one. It would be far better and cheaper, so that Santa Cruz could engage in "smart city" projects that reduce waste and improve service to its citizens.

Another advantage: the City's interest in the public welfare leads to a more inclusive project than private companies, acting alone, would undertake. Lower income and less populated neighborhoods would not be left out. The City has already demonstrated their commitment — and a powerful partnership — by working with Cruzio on projects offering free or subsidized Internet at affordable housing developments.

With the encouragement of City leaders, a high-tech ecosystem has developed with many small startups building businesses locally. These, as well as more traditional businesses, need good infrastructure to prosper.

Average Download Speeds in California Cities and Kansas City, June 2015 [1]
Santa Cruz ranked 446th of 501 California Cities

Yet despite this recognition, a highly educated population and proximity to Silicon Valley, Internet in Santa Cruz lags most California cities. This makes it a good target for an infrastructure upgrade.

SANTA CRUZ, CALIFORNIA HISTORICAL TREND

■ AVERAGE DOWNLOAD   ■ CALIFORNIA AVERAGE DOWNLOAD   ■ UNITED STATES AVERAGE DOWNLOAD

JULY 2014   DEC 2014   APRIL 2015

ISPS ⓘ

CRUZIO ★★★★		31.26 Mbps
COMCAST ★★★	20.78 Mbps	
AT&T U-VERSE ★★	9.18 Mbps	
SONIC.NET ★★★★	6.47 Mbps	

2

WWW.0.NETINDEX.COM, 6/11/2015

Scope & Timeline

Cruzio's proposal involves a 6-12 month engineering and planning phase, followed by a 24-month construction phase.

There are 16,149 total parcels and 22,097 total addresses within the City of Santa Cruz. Cruzio's goal is to pass 100% off those parcels and connect 6,000 households and businesses by the end of the third year.

After year three, we project that the revenue generated by the network will be sufficient to pay Operator costs, cover ongoing bond payments and fund the additional expansion of the network.

Project Phases

The project will be carried out on 4 phases: feasibility, planning, construction and operation.

1. Feasibility (3-6 months)
Market analysis
Financial & Business modeling
Definition of roles
Pre-engineering
Identifying current assets
Initial Network design

2. Planning (6-12 months)
Additional detailed financial & business modeling
Full route Engineering — final scope determined
Detailed Network Architecture design
Hardware specifications
Service definition, pricing & schedule
Marketing planning
Identification of and negotiation with Suitable Contractors and Consultants

3. Construction (24 months)
Construction management
Infrastructure construction
Hardware deployment
Operational systems development
Legal work, contracts, leases, etc
Marketing campaigns

4. Operations (ongoing)
Order provisioning and installation
Billing
Customer service operations
Ongoing marketing
Further construction where required
Network Operations Center (NOC) management
Outside plant maintenance
System monitoring
Reporting

Roles

The City of Santa Cruz Fiber Project comprises three roles combining to serve the **End User**: **Owner, Operator and Retailer** [see figure 1 below]

1.Owner

The Owner funds construction, and is ultimately responsible for maintaining the network by selecting an appropriate Operator. The Owner will own the physical asset when the obligation has been paid off. The Owner contracts with the Operator to oversee all aspects of building and running the network, including fees for maintaining the physical network, and receives the wholesale payments which the Operator collects from one or more Retailers. Once network revenue exceeds initial construction costs and financing payments, excess revenue can be used to fuel expansion, prepay loan/bond costs or both.

As Owner, the City of Santa Cruz will finance initial and ongoing construction of the network which will become an extremely valuable asset. Specifically:

- Engineering and planning costs

- Permitting

- Network construction

- Cost of network architecture hardware and software

- Cost of customer premise drops and customer premise equipment

- Additional network expansion expenses

- Oversight

2. Operator

The Operator is hired by the Owner to build and maintain the network, and manage technological and business operations. On behalf of the Owner, the Operator sells and supports wholesale network service to one or more Retailers who in turn use the physical network to deliver services to end users. The Operator does not sell to end user. The Operator sets wholesale prices and collects revenue from Retailers, just as a landlord might collect rent from a shopkeeper. All revenues collected by the Operator are turned over to the Owner. The Operator receives compensation from the Owner in the form of a pre-determined fee. Costs related to daily maintenance and customer service to the Retailers are borne by the Operator. Costs related to building and maintaining the physical network are borne by the Owner.

As the Owner-contracted Operator Cruzio would be responsible for:

- Robust network design

- Pricing and packaging to Retailers

- Order management

- Order provisioning for Retailers

- Management of field operations

- Installation of premise fiber drops and building entrances

- Network Operations Center (NOC) management

- Network equipment maintenance

- Security

- Outside plant maintenance

- Routing through the path and provider diverse gateways

- Network monitoring, reporting and uptime maintenance

- Location Services & Underground Service Alert (USA) Administration

- Billing of Retailers

- Support/helpdesk/ticketing for Retailers

- Collecting and processing revenue

- Financial reporting

- Change management

3. Retailer

The Retailer purchases raw transit on the network and serves the end users — individual customers (residential or businesses) who use services which the Retailer provides over the network. The Retailer can provide Internet service, or telephone service, or video service — any content that an end user would wish to consume. The Retailer collects money from end users for services rendered — which could also include services that don't use the network or are peripheral to the network — but doesn't pass their revenue along to the Operator. Instead they pay wholesale fees set by the Operator for use of the network.

Cruzio would be one Retailer and the network will be designed in such a way as multiple Retailers can be brought onto the network at a pre-determined stage after construction is complete.

Retailer is responsible for:

- Creating services for end users

- Marketing and outreach to end users

- Acquisition of customer connections

- Ordering customer services from Operator

- End user customer care

- Quality assurance for all end users

- Direct customer technical support

- Customer billing

- Payments to Operator

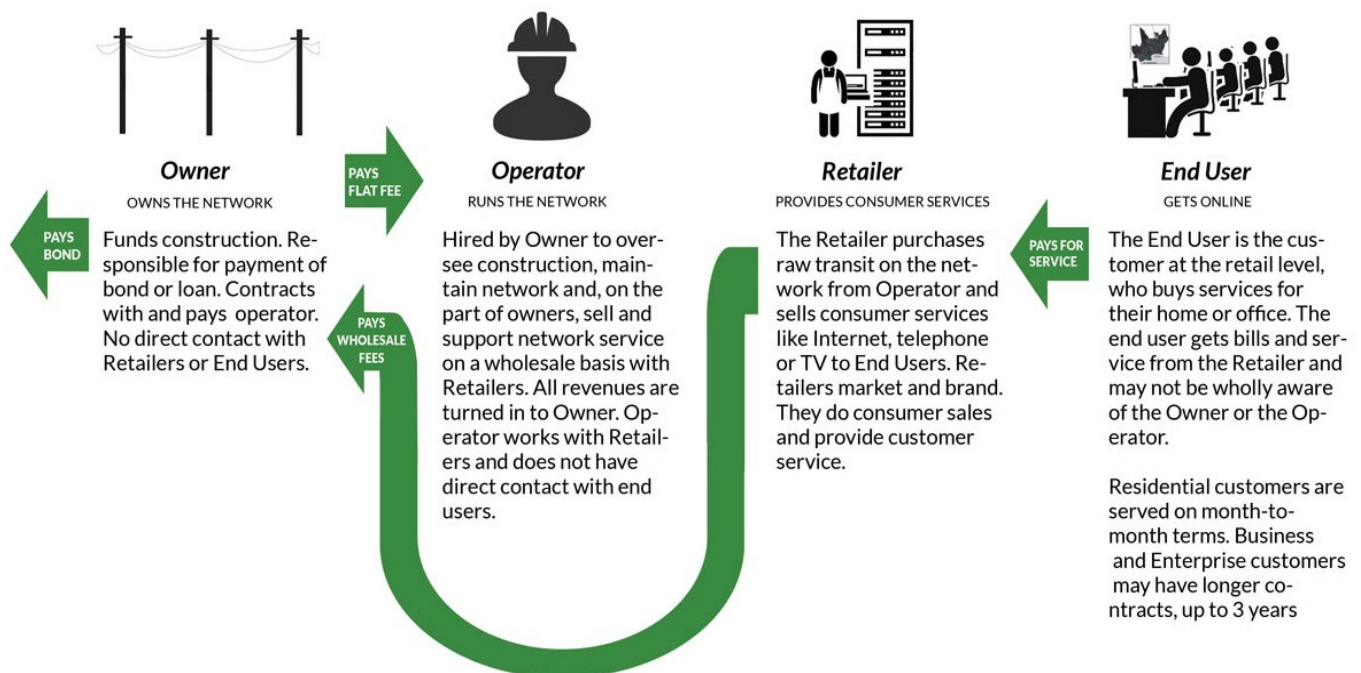- Providing primary and redundant backhaul Internet connection for network

4. End User

The end user is the customer at the retail level who buys services for their home or office. The end user is billed by the Retailer and may not be wholly aware of the Owner or Operator. Ultimately, the end users pay for the network by paying the Retailer, who is then able to afford the fixed monthly fees to the Owner. A large number of end users is beneficial both as a community good and also as a financial resource which pays for the network.

End users can be individuals in their homes, small- to medium-sized businesses who need a higher level of service, or large enterprises such as hospitals, government facilities or corporations requiring extraordinary reliability and bandwidth. The City network would amply serve all types. Residential customers are served primarily on month-to-month terms. Business and enterprise customers may have longer contracts, up to 3 years.

Figure 1: Project structure

Owner
OWNS THE NETWORK

PAYS BOND

Funds construction. Responsible for payment of bond or loan. Contracts with and pays operator. No direct contact with Retailers or End Users.

PAYS FLAT FEE

Operator
RUNS THE NETWORK

PAYS WHOLESALE FEES

Hired by Owner to oversee construction, maintain network and, on the part of owners, sell and support network service on a wholesale basis with Retailers. All revenues are turned in to Owner. Operator works with Retailers and does not have direct contact with end users.

Retailer
PROVIDES CONSUMER SERVICES

The Retailer purchases raw transit on the network from Operator and sells consumer services like Internet, telephone or TV to End Users. Retailers market and brand. They do consumer sales and provide customer service.

PAYS FOR SERVICE

End User
GETS ONLINE

The End User is the customer at the retail level, who buys services for their home or office. The end user gets bills and service from the Retailer and may not be wholly aware of the Owner or the Operator.

Residential customers are served on month-to-month terms. Business and Enterprise customers may have longer contracts, up to 3 years

Why fiber?

Fuel Economic Growth

Broadband infrastructure growth is essential to economic vitality, and the Silicon Valley-level Internet available at Cruzio headquarters can be extended to businesses—including the growing sector of home-based businesses—in the City. Large-scale fiber deployment will encourage the growth of existing business, attract new companies to the area and raise property values throughout the City.

Support the burgeoning tech community

The tech community in Santa Cruz is evolving rapidly, and laying the tracks of a world-class broadband infrastructure is essential to its continued growth. In the past, most startups emerging in Santa Cruz have moved over the hill as soon as they are funded. This pattern is changing but to support a robust technology sector we need robust, scalable fiberoptic Internet services.

Fill empty commercial real estate

Talent is leaving the area every day and there are many thousands of square feet of empty real estate that a fiber broadband network would help to fill. Cruzio's fiber-connected office space downtown has been at 90%+ capacity since opening. In a modern economy, bandwidth is a utility as important as electricity or water, and modern business needs state-of-the-art Internet to thrive.

"What the Gig did was change the idea of what our city could be. Mid-sized cities are not generally seen as being ahead of the technological curve, the Gig changed that. We now have people coming in looking to us as a leader."
—Chattanooga mayor Andy Berke

Take cars off the roads

With unlimited broadband, more work can be done from home or from a local technology hub/coworking space. With more broadband, many of the 30,000 folks who drive the hill everyday can stay in Santa Cruz -- either tele-commuting to jobs elsewhere, or working for new companies that spring up supported by the fiber.

Enhance Public Safety

Fiber broadband opens myriad possibilities for feeding video security systems and other appropriate cloud-based solutions for improving public safety and police efficiency.

Events Coverage

The Santa Cruz Warriors live-stream every game they play in Santa Cruz over Cruzio's fiber/wireless network. Other events, such as races or concerts, can do the same when fiber is more widely available.

Financial savings and stability

Instead of paying for relatively low bandwidth from an out-of-state provider, by constructing local fiber households, businesses and local government facilities will have access to hundreds of times the Internet capacity, at a lower cost, with the security of working with a local provider, with local employees paying taxes and being active in the community.

"We calculate $8 million in direct benefits coming from the lower prices we give customers compared with other communities. We have new businesses start up, and high tech companies expand. Several industries list fiber as a strong draw for them."

— Michael Johnson, VP of IT and Broadband – Jackson (TN) Energy Authority.

Medical and scientific uses

A fully-deployed fiber network would make the transfer of research and medical data much easier, improving overall public health and opening up many possibilities for information sharing and collaboration with colleagues both local and worldwide. The availability of world-class Internet infrastructure will also attract research teams to the area.

Libraries, community services and the arts

Modern libraries and community centers are increasingly becoming digitally-connected gathering places. Large data pipes bring with them possibilities for live streaming of events, exchange of graphic files and digital art and even collaboration in real time.

Education

To a modern educational institution, the Internet is an essential tool. Cruzio's plan would make 1 Gbps+ connectivity available to every school in the city at a fraction of the cost currently paid for inferior services.

Hospitality, Hotels and Conference centers

The hospitality industry is amongst the fastest-growing bandwidth consumers in the country. Guests bring smartphones, tablets, and laptops, communicate via video conferences, webinars and VoIP phone calls and watch streaming media via multiple devices. Any modern conference can expect to host hundreds of guests using three or more devices to connect to the Internet at all times. Without exceptional connectivity, none of these things can happen.

Raise property values

A study by RVA LLC Market Research and Consulting found that fiber optic internet adds roughly $5,250 to the value of a $300,000 home. Deb Socia, director of Next Century Cities, a coalition of cities trying to provide gigabit internet speeds to their citizens, said. "You're going to lose people and you're going to lose revenue without it."

Bridge the digital divide

There are still many households without adequate access to broadband, hampering our citizens' ability to do work, research, schoolwork or simple communication from their homes. Cruzio aims to cover 100% of homes in the City and makes cutting-edge broadband available at an affordable price for everyone.

Smart management of City infrastructure and assets

The "smart city" of the 21st Century in which assets and infrastructure are remotely managed and administrated requires an underlying communications network. Street lights, traffic signals, remote cameras, infrastructure sensors and telemetry allow the city to better adapt to situational factors as well as run smarter, faster and cheaper.

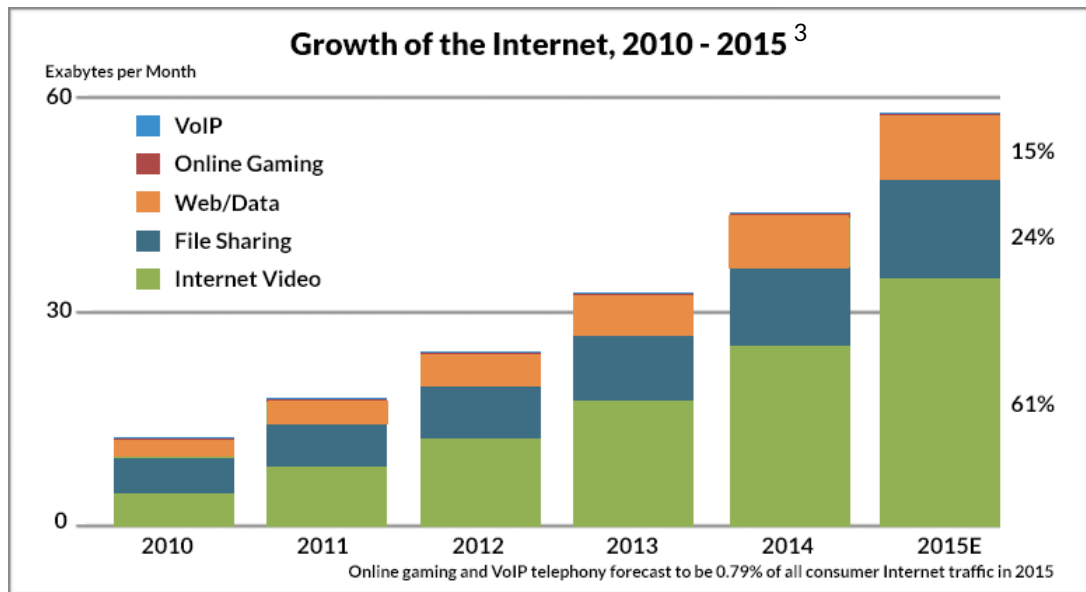### Promote Santa Cruz on the national stage

Nationwide, only 50 communities in 14 states offer gigabit service to homes. Google Fiber has received a lot of attention and inspired bidding wars from cities desperate for more bandwidth. Santa Cruz has the opportunity to do the same thing, on a local level, with an independent locally-owned company and no need for investment from out of the area, or the involvement of large national ISPs.
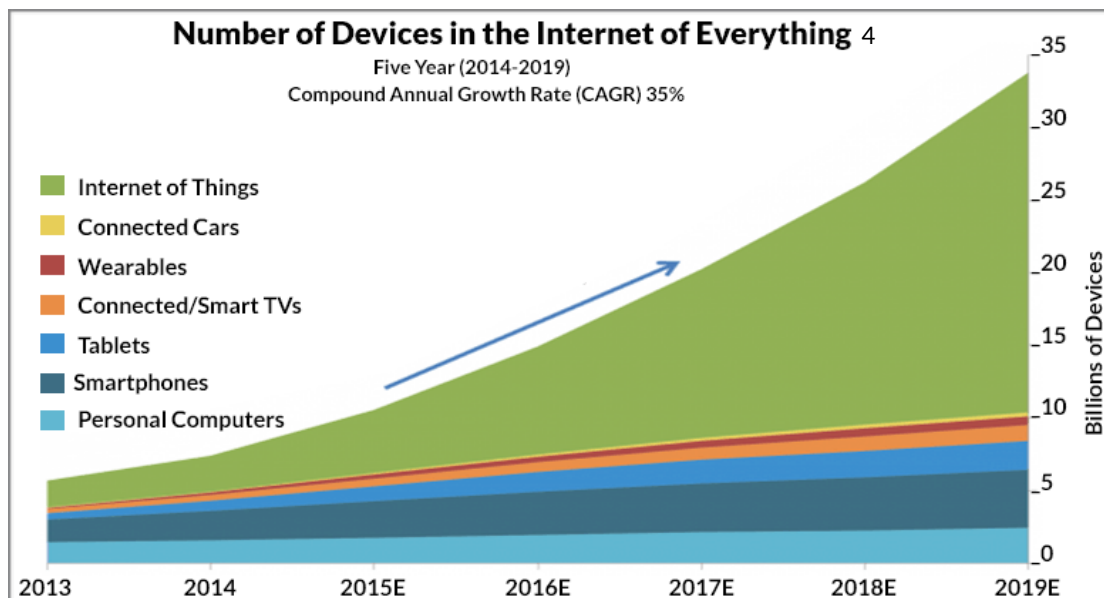
Statistics Show the Need for Internet is Growing
Fiber is Needed to Stay Competitive

Studies from research organizations have confirmed what most of us have experienced personally: the number of uses for the Internet is growing, the amount of data on the Internet is growing, and our dependence on the Internet as a society for business and entertainment is growing. Indeed, all are increasing exponentially. And the newest technologies use the most bandwidth.

Growth of the Internet, 2010 - 2015 [3]

Exabytes per Month

Legend: VoIP, Online Gaming, Web/Data, File Sharing, Internet Video

15%, 24%, 61%

Online gaming and VoIP telephony forecast to be 0.79% of all consumer Internet traffic in 2015

It's not just computers or high-tech workers pushing the envelope. "The Internet of Everything" includes connected appliances, vehicles, even jewelry (e.g. the Apple Watch).

Number of Devices in the Internet of Everything [4]
Five Year (2014-2019)
Compound Annual Growth Rate (CAGR) 35%

Legend: Internet of Things, Connected Cars, Wearables, Connected/Smart TVs, Tablets, Smartphones, Personal Computers

Billions of Devices

In a world where Internet access is increasingly important, access for all is a concern. In the United States, gigabit Internet is sometimes available, but only in certain areas and at a cost unaffordable to low- or fixed-income residents and non-profit organizations among others[5].
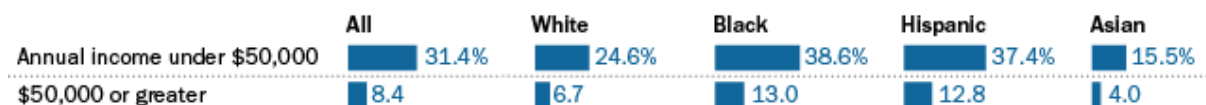
Policies of the 20th century ensured that copper telephone lines were ubiquitous, and using these lines has minimized inequality of access in the first few decades of the Internet, but the copper is becoming outdated and it is expensive to replace with the new standard, fiber. Unless action is taken as a community, some areas will be left behind by purely commercial deployment[6].

This chart from the Pew research center shows that even at a lower (2013) definition of high-speed access, income disparities are evident in Internet access.

Households With School-Age Children That Do Not Have Broadband Access [7]

Among households with school-age children ...

% LACKING A HIGH-SPEED CONNECTION AT HOME

	All	White	Black	Hispanic	Asian
Annual income under $50,000	31.4%	24.6%	38.6%	37.4%	15.5%
$50,000 or greater	8.4	6.7	13.0	12.8	4.0

% WITH A HIGH-SPEED CONNECTION AT HOME

	All	White	Black	Hispanic	Asian
All households with school-age children	82.5%	88.0%	71.5%	72.2%	92.3%
Annual income under $25,000	60.3	67.9	53.6	54.8	79.0
$25,000-$49,999	75.7	80.6	71.2	69.2	88.6
$50,000-$99,999	88.2	90.5	84.1	82.1	94.0
$100,000-$149,999	94.3	95.1	91.7	90.6	96.5
$150,000+	96.7	97.0	93.5	93.9	97.9

Source: Pew Research Center analysis of 2013 American Community Survey (IPUMS).

PEW RESEARCH CENTER

What do experts feel Santa Cruz County businesses will need in the years to come? This chart comes from the Design Nine study for Santa Cruz County in 2014[8]:

	Current	Next Decade	In Twenty Years
Small business needs (1-9 employees)	10–25 megabits of symmetric bandwidth and 5–10 megabits of Internet access	100 megabits of symmetric bandwidth and 20–40 megabits of Internet access	Gigabit+ symmetric bandwidth and 50 to 100 megabits of Internet access
Medium-sized business needs (10–100 employees)	50–100 megabits of symmetric bandwidth and 10–20 megabits of Internet access	Gigabit symmetric bandwidth and 50 to 100 megabits of Internet access	Multiple gigabit symmetric circuits and flightpaths and 100 megabits of Internet access
Large business needs (100–1,000 employees)	Gigabit+ symmetric bandwidth and 100+ megabits of Internet access	Multiple gigabit symmetric connections and 250 to 500 megabits of Internet access	Multiple gigabit symmetric circuits and ightpaths and 1 gigabit+ of Internet access
Residential needs	25–50 megabits of symmetric bandwidth and 4–8 megabits of Internet access	100 megabits of symmetric bandwidth and 20–30 megabits of Internet access	A gigabit symmetric circuit and/or flightpaths, with 50 to 100 megabits of Internet access

1. "Santa Cruz California, California Rankings," Ookla Net Index Explorer, http://explorer.netindex.com/maps, June 11th, 2015.

2. "Average Download, California Average Download, United States Average Download," Ookla Net Index Explorer, http://www.netindex.com/download/4,1758/Santa-Cruz/. June 11th, 2015.

3. "Growth of the Internet, 2010–2015," Cisco VN1, 2011, http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/VNI_Hyperconnectivity_WP.html

4. "Number of Devices in the Internet of Everything," Business Insider Intelligence Estimates, "BI Intelligence : A Research Service By Business Insider," https://mukeshbalani.wordpress.com/2015/03/05/the-internet-of-everything-2015-slide-deck-8/

5. "The Cost of Connectivity 2014," Open Technology Institute, policy paper, October 30 2014, http://www.newamerica.org/oti/the-cost-of-connectivity-2014/

6. "Here's AT&T's $14B Plan to Kill Its Copper Network and Leave Rural America Behind," Stacey Higginbotham, GigaOm research November 7, 2012 https://gigaom.com/2012/11/07/heres-atts-14b-plan-to-kill-its-copper-network-and-leave-rural-america-behind/

7. "Households with School-Age Children That Do Not Have Broadband Access," Pew Research Center analysis of 2013 American Community Survey, http://www.pewresearch.org/fact-tank/2015/04/20/the-numbers-behind-the-broadband-homework-gap/

8. "Broadband Network Rapid Assessment," prepared for Santa Cruz County by Design Nine Inc., March 16, 2015.

About Cruzio

A registered Competitive Local Exchange Carrier (CLEC), Cruzio Internet is one of the largest independent Internet Service Providers in California, and recently introduced heretofore unavailable enterprise-level Internet services to Santa Cruz County, representing a huge investment in the community.

Cruzio provides cutting-edge technology services for more than 8,000 households and businesses in Santa Cruz County including notable organizations like:

- Granite Construction

- Santa Cruz Public Libraries

- Chaminade Resort

- Zero Motorcycles

- Ecology Action

- Santa Cruz Nutritionals

- Fox Racing

- Pacific Collegiate School

- Santa Cruz Seaside Company

- The Cities of Santa Cruz, Watsonville and Capitola

- The Santa Cruz Warriors

"From the beginning, we wanted to make streaming video of the home games available to our fans to build up local support and to show our commitment to the community. Cruzio delivered a reliable, high-performance connection that enables anyone to watch games on any Internet-enabled device. It's been an extremely successful offering to our fans."

--Jim Weyermann, President of the Santa Cruz Warriors.

100% locally owned and staffed, Cruzio has on-site technical support, local IT, and a welcoming storefront in downtown Santa Cruz where members can drop by any time to pay a bill or get advice from our technical staff. Cruzio is known for its friendly, hands-on customer service that caters to its diverse client population, from residents and local nonprofits to small and large businesses throughout Santa Cruz County.

Cruzio's Network

Cruzio has lit up 10 gigabits of fiber transport between our LEED-certified facility at 877 Cedar Street and the Level 3 Internet gateway in Sunnyvale. Connectivity to the Internet is provided by Level 3 and Layer 42.

Cruzio added two more gigabit fiber hubs, on the Westside of Santa Cruz and in Scotts Valley, in early 2015.

A high-speed/high-bandwidth wireless link connects the Cruzio 877 Cedar facility with the Equinix San Jose facility via Mount Umunhum to provide a completely separate path in event of a fiber outage.

Cruzio maintains a backbone of wireless points of presence (POP) on various mountain tops overlooking the Monterey Bay, South San Francisco Bay, and Silicon Valley Regions.

Our mountaintop locations are protected by on-site industrial grade UPS battery backups and generator backup power. Our data center is protected by an 80 kilowatt UPS system and a 150 kilowatt generator.

Cruzio has begun the development of our fiber network, connecting facilities, both directly and indirectly, and building fiber and laying conduit in downtown and Westside Santa Cruz.

References

Below are a few representatives of local business and government who are happy to answer any questions you may have about their experience with Cruzio's services.

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"I have worked with Cruzio to develop alternative Broadband facilities other than those provided by AT&T, Comcast and Charter. Contracts for T1 and above that were initiated only three years ago are now obsolete in the world of cable and fiber optics and (wireless) options coming on line in Santa County.

I strongly recommend looking at Cruzio when planning your next Broadband installation, they have several alternatives that will cost less and provide more broadband service at a lower cost."

-- Ben Post, Post-Tech

Contact Cruzio

We understand that you may have additional questions about or beyond this packet. Please feel free to reach out to us to talk about any questions that emerge or to discuss your specific needs.

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