OBAC
Oregon Broadband Advisory Council

www.broadband-oregon.org

October 30, 2020

Joint Legislative Committee on Information Management and Technology
Oregon Legislative Assembly
900 Court Street NE, Room H-178
Salem, Oregon 97301

Attention: The Honorable Nancy Nathanson, Co-Chair
The Honorable Chuck Riley, Co-Chair

Representative Nathanson and Senator Riley:

Please accept the attached report, "Broadband in Oregon," respectfully submitted by the Oregon Broadband Advisory Council in accordance with ORS 285A.160. This is the biennial report of the Council to the Legislative Assembly on the affordability and accessibility of broadband technology in all areas of this state, the extent of broadband technology use in business, healthcare, energy management, education and government and the role of broadband technology in local, state and regional economies and economic development. The report will also be available online on the Council website at www.broadband-oregon.org.

The Council looks forward to briefing the members of the Committee on the information presented in the report and related issues.

Sincerely,

Joseph Franell
Chair
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cc: Governor's Office

Broadband in Oregon

A Report of the

Oregon Broadband Advisory Council

Presented to the

Joint Legislative Committee on Information Management and Technology
for
The Eighty-first Legislative Assembly

November 1, 2020

Broadband in Oregon
2020

Contents

Executive Summary

This is the sixth report of the Oregon Broadband Advisory Council (OBAC) to the Legislative Assembly on the affordability and accessibility of broadband technology in all areas of the state, and on broadband technology use in business, healthcare, energy management, education and government. The 2020 report will also present information on the role of broadband in local, regional and state economies, economic development, public policy issues, and key broadband related challenges and opportunities facing the state.

In its last report to the Legislative Assembly in 2018, OBAC stated that it believes that Oregon's broadband public policy needs to be focused on the future, be more aggressive, be more financially supportive, be more specific, and have a renewed sense of urgency. The Council reaffirms these beliefs in 2020, and is submitting its report during a pandemic that has served to underscore the essential nature of broadband telecommunications infrastructure, the applications it enables, and the value of having the skills and access to use them.

The COVID-19 pandemic has been a hyper-accelerator for broadband public policy, applications, adoption, utilization and infrastructure deployment. It has created a new sense of understanding, urgency and commitment to address the long-standing challenges of the Digital Divide. The stage is set, and it is time to act.

Key Broadband Challenges and Opportunities

OBAC has identified the following key broadband challenges and opportunities facing Oregon.

- Digital Inclusion: Oregon needs funded state-level strategies and programs to ensure that all individuals and communities have access to affordable state of the art broadband communications services, and the skills, knowledge and technical support needed to use them.
- Cyber Security: The security of data and communications systems continues to be a critical risk exposure for government, public organizations, private sector businesses, and for individuals that is widely unrecognized and under managed. Oregon needs to follow-through on its 2017 cyber security legislative initiatives www.cyberoregon.com. Expanded and pro-active cyber risk management is needed.
- Education: Oregon's K-20 educational institutions are positioned to realize significant economic, work force and community development benefits for the state through the utilization of broadband networks and applications. State level support and technical assistance is needed.
- Public Safety: Oregon's first responders are at a transition point for migration to new broadband Internet Protocol (IP) technologies. Support is needed for Oregon's

911 centers and first responders to migrate from legacy systems to Next Generation 911 and to interoperable wireless broadband communications systems.
- Agriculture is emerging as an important application and may become the largest driver for broadband infrastructure deployment in rural areas of the state. State level engagement, support and technical assistance is needed.
- Local Community Broadband Planning: Local community engagement in broadband development, adoption and utilization continues to be a low cost high-return "game-changing" activity that needs to be promoted and supported.
- Federal Funding Programs: Federal broadband programs are a key source of available financing to be leveraged for new infrastructure. State support in the form of technical assistance and matching funds is needed for eligible applicants.
- Network Interconnection: Oregon needs to develop strategies to improve the state's connectivity to national and global networks, improve network resilience and support the growth of network enabled data centers and e-commerce businesses.

To address these challenges, OBAC offers the following recommendations

- Provide and expand state funding for grant, loan and loan guarantee programs for broadband infrastructure in unserved and underserved geographic areas, for technical assistance and for matching funds to leverage federal funding programs.
- Provide support to low adopter underserved populations and community anchor institutions.
- Promote and support scalable broadband infrastructure deployment.
- Reduce barriers to broadband infrastructure deployment.
- Promote and support digital inclusion and cyber security initiatives.
- Require that broadband infrastructure components be included for all state funded infrastructure projects including roads, bridges, water, and wastewater projects.
- Encourage public-private partnerships in broadband infrastructure that leverage limited state resources.
- Remain technology and provider neutral.

Information and communications technologies have been the most disruptive and transformative technologies of the past one hundred years. Oregon's information and communication technology infrastructure and the capacity of Oregon to utilize these technologies for economic growth, community development and public safety is an important public policy issue. It will determine the state's future economic growth and development. The internet has become *the platform* on which the world works, and broadband *connectivity* is becoming a universal common denominator that is important and essential for all sectors of the economy.

"Competitive high-speed access to the internet and telecommunications networks is essential, *statewide,* for Oregon's schools, libraries, businesses, agricultural producers, governments, first responders, healthcare providers and individual residents."

- *Oregon Broadband Office Strategic Plan, January 2020*

Infrastructure Trends and Technologies
Industry Structure

Oregon is served by a mix of franchised telephone companies, cable companies, competitive access providers, fixed and mobile wireless companies, satellite service providers and publicly owned municipal and consortia telecommunications networks. These providers are represented by associations including the Oregon Telecommunications Association www.ota-telecom.org, the Oregon Cable Telecommunications Association www.oregoncable.com, and the Northwest Telecommunications Association http://nwta.biz/. Regional consortia are formed by agreements outlined under ORS 190 such as www.connectingoregon.org.

Trends

Telecommunications continues to be a dynamic industry with changing technologies, markets, structure, and applications. Since the Council's last report,

- Policymakers are recognizing the importance of universal broadband. Once viewed as a luxury, broadband increasingly is seen as a necessity, as essential infrastructure and service.
- Broadband Mapping was recognized as a national problem and that government, policy makers, and funding programs do not have accurate data about where broadband is and is not available.
- Mobile wireless continues to be a major growth segment of the telecommunications industry as it starts deploying 5G while driving the need for fiber backbone networks.
- Continued growth of video as an application, which is increasing network data traffic and user bandwidth needs.
- Changing patterns of use, cord cutting, basic telephone service cutting and the continuing convergence of all user applications onto broadband networks.

Since the Council's last report, the state has seen the significant developments of the T-Mobile / Sprint merger and the sale of the second largest telephone company local exchange business, Frontier Communications, to Northwest Fiber d.b.a. Ziply Fiber. There has also been a consolidation of regional service providers including the sale of ORCA Communications and ComSpan to Douglas FastNet, the sale of SAWNet to Wave, the sale of Gorge Networks to Blue Mountain Networks, the sale of Fatbeam to SDC Capital Partners, the sale of Crestview Cable to TDS BendBroadband, the sale of Rio Networks to InfoStructure, the sale of Hunter Communications to Grain Management, a Washington, D.C. based investment firm, and InstarAGF Asset Management Inc. announced it has entered into a definitive agreement to acquire 100% of LS Networks from a collective of Oregon rural electric cooperatives. Additionally, a growing number of electric cooperatives, counties and municipalities are considering providing broadband services.

New developments include the deployment of 5G mobile/fixed wireless and Low Earth Orbit satellites, along with the growing capacity and performance of other technologies and the proven ability of the industry's networks to stand up under the dramatic changes in traffic loads and usage patterns.

2020 has been an extraordinarily challenging year due to the hugely disruptive COVID-19 pandemic. It has affected every sector of our economy and almost every aspect of our professional and personal lives. The impact on broadband has been profound.

Physical distancing, hand washing, and the use of masks are our primary strategies to fight and control the spread COVID infections. Oregon and the nation have been directed, advised, and asked to avoid contact with others, avoid groups and avoid public places by working from home, attending school from home, seeking health care from home, maintaining friend and family relationships from home, shopping from home, and entertaining ourselves at home.

Our strategic response to the pandemic has been to rely on telework, telehealth, distance learning, social media – all relying on telecommunications. Telecommunication means "communication at a distance." As a result, the demand for and utilization of broadband telecommunications, in the terminology of this time, *has spiked*.

Traffic on carrier networks has dramatically increased. Patterns of use have changed. Networks have performed very well having been engineered for periods of peak demand. Those periods of peak demand are now longer and more sustained, and upstream traffic and the demand for upstream bandwidth has significantly increased.

The pandemic has been a growth-accelerator for all types of broadband technology, public policy, applications, adoption, utilization and infrastructure deployment. These trends are not *new*; however, the emergence of the internet as the global platform for communication, business, government, education, healthcare, energy management, information storage and distribution, public safety and entertainment existed before the pandemic. The pandemic has resulted in years of increased adoption and utilization within a period of months.

Essential Infrastructure

Before the pandemic, a report by Finley Engineering found that broadband is essential infrastructure and is now seen as equally important to electricity and water for a community's long-term viability. Communities, regardless of size, are evaluating their technology future and a robust broadband infrastructure as the key to that future. Finley Engineering's whitepaper, *Beyond Fast Internet and Netflix: The True Value of Broadband*, outlines and discusses why broadband is so much more than high-speed Internet and streaming video, detailing how it's helping lay the technology foundation for any community's long-term future.

Broadband is now the lifeblood of economic development. Companies and industries need it to conduct their business and empower their employees. If robust broadband is *not* available, companies will migrate to where it *is* available. As companies leave, jobs disappear. As jobs disappear, people choose to relocate, the tax base erodes and communities struggle to meet the bare necessities, much less recruit new companies for economic development.

This reality is leading communities all across the globe to demand robust communications networks, and in the face of the pandemic, demand it now. Whether partnering with network operators or building it themselves, communities must work to ensure the availability of broadband internet access so they are not left behind. https://telecompetitor.com/clients/finley/broadband_value/Beyond_Fast_Internet_the_True_Value_of_BB_2019.pdf

The Internet celebrated a milestone in 2019, according to the International Telecommunications Union. The organization, which is part of the United Nations, says that at the end of 2018, 51.2% of people on earth – 3.9 billion people – accessed the internet. https://cdgportal.com/blog/index.php/2018/12/13/itu-more-than-half-the-world-population-online-by-the-end-of-the-year/

The Broadband Forum and Point Topic, a market analyst, predict that there will be 1.2 billion broadband subscribers worldwide by 2025, with fiber-based broadband playing an increasingly important role. The markets and technologies that will drive continued rapid broadband growth over the next decade. The current trends of booming fiber deployment and accelerating broadband penetration in developing markets will be the engine of broadband growth through 2025. It is forecasted that some type of fiber infrastructure – Fiber-To-The-Home (FTTH), Fiber-To-The-Premises (FTTP) or Fiber-To-The-Building (FTTB), Fiber-To-The-Node (FTTN) – will be used by 59% of fixed broadband subscribers globally by 2025. This will also be driven by the deployment of 5G, which requires increased backhaul capacity. Fixed-mobile convergence will mean that the next one billion subscribers may blend wireless and fixed service subscriptions. https://www.telecompetitor.com/report-fiber-based-broadband-will-power-59-of-1-2-billion-connections-by-2025/

The amount of data we produce every day is difficult to comprehend and this trend is driving the need for more bandwidth and fiber. There are 2.5 quintillion bytes of data created each day at our current pace, and that pace is accelerating. Over the last two years alone, 90 percent of the data in the world was generated. Current statistics indicate that

- More than 3.7 billion humans use the internet (that is a growth rate of 7.5 percent over 2016).
- We conduct more than half of our web searches from a mobile phone.
- On average, Google now processes more than 40,000 searches every second (3.5 billion searches per day)!

- While 77% of searches are conducted on Google. Other search engines are also in use. Worldwide there are 5 billion searches a day.

https://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#3f72ad6d60ba

According to Cisco's newest *Visual Networking Index*, video traffic will quadruple by 2022 and at that point, video will account for 82% of all IP traffic, up from 75% today. By 2022, Cisco says that nearly half of all devices and connections will be video capable. In addition to streaming video traffic growth, Cisco's predictions also forecast increases in gaming and virtual reality traffic.

Gaming traffic is expected to grow by 900% from 2017 to 2022, at which point it will account for 4% of all IP network traffic. Virtual and augmented reality traffic will also balloon and by 2022, it will reach 4.02 Exabytes per month, up from 0.33 Exabytes per month in 2017. Cisco says global IP traffic could reach 396 Exabytes per month by 2022, up from 122 Exabytes per month in 2017. It will amount to 4.8 Zettabytes of traffic per year by 2022. [Fierce Video 11-27-18 www.fiercevideo.com]

- One Exabyte equals one billion megabytes
- One Zettabyte equals one trillion megabytes

Broadband homes served by telephone and cable companies without pay-TV grew by 1.2 million in the third quarter of 2018, according to Kagan, a research group within S&P Global Market Intelligence. That is the largest increase in 'broadband-only' homes that the firm has ever measured. Kagan reported that in the third quarter of 2018, 23% of wireline broadband households in the U.S. did not have a subscription to a traditional multichannel service. The percentage of video consumers without a traditional subscription has risen 8.5% during the previous three years.

https://www.telecompetitor.com/kagan-broadband-homes-without-traditional-pay-tv-increase-by-1-2-million/

Gigabit internet is now available from the top 25 wireline ISPs. The ISPs have used a combination of fiber and DOCSIS 3.0 and 3.1 cable technologies to provide the de facto standard that customers are beginning to expect (even if they don't all sign up for this tier of service). As a result, an estimated six in 10 U.S. households now have access to gigabit Internet.

https://cdgportal.com/blog/index.php/2018/12/03/report-finds-gigabit-available-to-60-of-u-s-households/

The U.S. voice-over-internet protocol (VoIP) market is strong and it is growing. VoIP subscriptions have grown 32% since 2013, increasing at a compound annual growth rate of 10%. Interconnected VoIP subscribers now outnumber wireline switched access lines (traditional telephone service) for the first time ever in the FCC's biannual status report. VoIP became the majority of the market at some point in 2016 and it is increasing its size

and share. In addition, there is still growth ahead with tens of millions of customers that can shift from legacy to VoIP solutions. VoIP now represents 57% of the U.S. wireline phone market with legacy "Plain Old Telephone Service" voice service representing 43%. Mobile wireless voice represents more than both combined. https://www.alianza.com/call-to-the-cloud/the-state-of-voip-in-the-u.s

Since the last Council report, consumers began spending more time using their mobile devices than watching TV, a trend that is likely to continue, according to a smartphone usage forecast from research firm eMarketer. The trend of declining TV viewing and increasing smartphone usage for video watching has been continuing since 2014, when the time spent viewing TV was almost double the time spent with mobile devices. The average US adult will spend 3 hours, 43 minutes daily on mobile devices in 2019, just above the time spent on TV, according to the report.
https://cdgportal.com/blog/index.php/2019/06/07/report-smartphone-usage-will-soon-surpass-daily-tv-viewing/

Internet of Things (IoT)
The connection of devices to the network, in homes, offices, and cities is exploding. We may end up with virtually any device that draws electric power, either from a wire, battery, or directly from the sun, becoming a part of the IoT network, which will be hundreds of billions of devices. In the home, consumers are embracing the digital home and that means IoT devices. The upcoming holiday season adds fuel to the consumer IoT fire. For example, the Consumer Electronics Association reported that consumers spent $96 billion during the last holiday season, with much of that spend going towards smart devices. Leading the category were smart speakers, with 22 million units sold just during the last holiday season. That equates to a 44% increase. Similarly, 36% of consumers purchased smart home devices including smart speakers, security cameras, smart lightbulbs and video doorbells. This accelerating adoption of IoT in the home presents both challenges and opportunities. All these devices will fuel more demand for bandwidth and broadband.
https://etisoftware.com/resources/blog/the-iot-explosion/

The early impact of the Internet of Things has been on the industrial markets. Sensors have been added to industrial equipment to collect all sorts of data, and that data has created IoT services. These IoT services provide insights, such as predictive analytics and equipment maintenance management.

IoT systems will have an increasing impact on consumer markets going forward.
The Internet of Things Consortium presented predictions on five key vertical markets and how IoT systems will affect their future.

- Homes: Smart home devices like video doorbells, connected light bulbs, and smart thermostats will lead the charge in 2020. It is estimated the global market for smart home devices grew by 27 percent in 2019, with 833 million devices shipped.

- Retail: In-store robots, automation, and drone deliveries are some of the ways IoT is being introduced into retail stores. IoT systems will increasingly assist and replace human tasks. Walmart and Giant Food Stores are currently using robots for floor cleaning and inventory checking. In the future, robots and automation can be used to restock store shelves and packaging in warehouses, and pick and deliver orders for customers. Another IoT service coming to retail will be smart checkouts. Customers will no longer interact with cashiers but will simply pick their items off the shelf and walk out of the store.
- Smart Cities: Sensors will be used to track energy usage, water facilities, waste production, and carbon emissions to create collaboration management platforms between governments and their citizens.
- Smart Vehicles: Connected vehicles will provide autonomous driving. Over the past five years, automakers and vehicle tech companies have already invested $50 billion to develop autonomous vehicle technology.
- Wearable Technology: Smartwatches, headphones, and earbuds have already been on the rise for the last few years. Further miniaturizations, sensor accuracy, and data analysis will not just connect people to digital networks but will act as medical accessories.

https://www.asme.org/topics-resources/content

Changing patterns of use

AT&T lost approximately 1.16 million premium video subscribers (DirecTV and U-verse) and lost another 195,000 AT&T TV subscribers for about 1.358 million subscriber lines during the third quarter of 2019. The losses were dramatically higher than the 297,000 total net subscribers lost in the third quarter of 2018. Overall, AT&T's domestic video connections are down 14.3% from 25.17 million one year ago to 21.57 million. https://www.fiercevideo.com/cable/at-t-loses-nearly-1-36-million-video-subscribers-q3

New research from the Leichtman Research Group found that pay-tv providers representing about 93% of the market lost approximately 1.74 million net video subscribers during the third quarter of 2019 marking five consecutive quarters of pay-tv losses. Six of the seven pay-tv providers were negative in net subscriber adds: Comcast (down 238,000), Charter (down 75,000), Cox (down 40,000), Altice (down 31,900), Mediacom (down 18,000) and CableONE (down 10,430). https://www.telecompetitor.com/report-att-leads-record-pay-tv-losses-industry-loses-over-1-7-million-subscribers/

Pay TV cord cutting dramatically increases broadband bandwidth usage as subscribers move to streaming video services. Consumers in Europe and the US that have stopped subscribing to pay-tv services use more than twice as much data as average broadband subscribers, passing half a terabyte per month, analytics firm OpenVault says. Consumption is growing across the board, but usage patterns vary between those with unlimited plans and those with usage-based billing.

https://www.telecompetitor.com/openvault-video-cord-cutters-surpass-the-half-terabyte-bandwidth-usage-mark/

Ericsson forecasts that video traffic will increase by about 30% a year from its current 60% share to reach 76% of mobile data by 2025. And that will happen even as the total volume of data explodes from 38 Exabytes a month to 160 Exabytes.
https://www.ericsson.com/en/mobility-report/reports/november-2019

The average amount of internet usage by U.S. broadband homes surged 27.3% in 2019, reaching 344 gigabytes, according to a new report published by telecom industry consultancy OpenVault. The latest surge in broadband usage correlates with an aggregate increase in provisioned internet speed, which jumped from an average of 103.1 Mbps in 2018 to 128.3 Mbps last year. And so-called "power users"—those who consume one terabyte or more of data each month—grew by 60% last year and now account for 12% of all wireline broadband users. OpenVault noted that increased usage is also driven by cord cutting—those consumers that disconnected traditional pay TV cable and satellite services. They averaged 520 Gigabytes of data usage a month.
https://www.nexttv.com/news/average-us-broadband-consumers-monthly-data-use-surged-27-in-2019-to-340-gb

TV White Space
Microsoft continues to advocate for the allocation of TV White Space, the guard bands between licensed broadcast TV frequency bands, for unlicensed broadband and the FCC has officially amended its rules regarding TV white spaces, expanding the use of spectrum for unlicensed wireless services. Microsoft's initial plans called for 12 rural broadband projects in 12 states, with a strong emphasis on fixed wireless technology. The company later extended the timeframe and raised the goal to 25 states. To date, the company has announced eight partners, primarily wireless internet service providers (WISPs), for 16 states.

Microsoft's decision to focus on fixed wireless for the rural Airband project was driven by an economic analysis that found that fixed wireless would be the most economical way to provide broadband to areas with a population density of 2-200 people per square mile. Fiber-to-the-home would be the best option for more densely populated areas, and satellite would be the best option for extremely sparsely populated areas, researchers said. According to the analysis, the vast majority of unserved rural areas in the U.S., eighty percent, fall into the 2-200 per square mile category, making fixed wireless the best choice. Microsoft also would like to see the federal government play a role in promoting the use of TV white spaces for rural fixed wireless and has asked the FCC to reserve three broadcast channels below the 700 MHz band for unlicensed use.
https://www.telecompetitor.com/airband-rural-wireless-program-has-eight-service-provider-partners-230-more-on-microsoft-wireless-isp-program/

Zayo Group has announced that it will provide backbone fiber connectivity to support Microsoft Airband initiative that aims to bring high-speed broadband to three million people in rural areas of the U.S. where service is not available. Microsoft is working primarily with wireless internet service providers (WISPs) on the Airband project, offering technical assistance and in some cases, monetary support. The Zayo deal calls for Zayo to provide fiber connectivity into the communities that Airband partners will serve. Prior to launching Airband in 2017, Microsoft did a study that found that most unserved rural locations could be served most economically through fixed wireless broadband, with a smaller portion best served by fiber to the home. The company has been a strong advocate for TV white spaces technology, which uses vacant TV spectrum on an unlicensed basis. That spectrum band has excellent propagation characteristics and large parts of it are vacant in rural areas. Airband currently has about 10 service provider partners. No Airband projects have been launched in Oregon to date.
https://www.telecompetitor.com/zayo-to-provide-backbone-fiber-for-microsoft-airband-rural-broadband-initiative/

And then came COVID-19

The COVID-19 pandemic has had a profound effect on broadband. In response the Federal Communications Commission (FCC) has asked carriers to take a "Keep Americans Connected" pledge during the pandemic asking that they

- Not terminate service to any residential or small business customers because of their inability to pay their bills due to the disruptions caused by the coronavirus pandemic.
- Waive late fees that any residential or small business customers incur because of their economic circumstances related to the coronavirus pandemic.
- Open Wi-Fi hotspots.

785 ISPs signed the pledge.

The federal government issued special changes to rules, terms and conditions for federal programs in response to the crisis.

- Medicare expanded coverage for clinical services via telemedicine nationwide to help seniors receive help with health problems while staying at home
- Extended application deadlines for multiple broadband funding programs
- Granted spectrum use to expand mobile wireless capacity (UScellular)

Internet service providers responded to the crisis with offers of free service, suspension of data caps and other adjustments to assist end-users. AT&T, Verizon, TDS, Charter Spectrum and Comcast are examples. Other companies like Microsoft, Google and Zoom offered access to remote meeting tools, remote collaboration tools, services and platforms. The crisis produced a surge in network traffic, a change in usage patterns and increased demand for broadband internet access services.

Telecommunications networks in Oregon have supported the surge so far with no reported degradation of service quality though this experience was not the case everywhere. BroadbandNow reported that, as the pandemic broke, internet users in 88 of the 200 most populous US cities experienced some degree of network degradation compared to the 10 weeks prior, and 27 cities suffered speed reductions of at least 20 percent. The cities of Austin, Texas; Winston-Salem, North Carolina; and Oxnard, California experienced speed reductions of more than 40 percent. The internet speed analysis report may be found at https://broadbandnow.com/report/internet-speed-analysis-march-15th-21st/.

- The Northwest Access Exchange (NWAX) in Portland saw network traffic increase by almost 70% in March 2020 over the previous month.
- OpenVault reports that bandwidth traffic during business hours has increased by 41% for the average subscriber.
- Verizon reports a 25% increase in voice traffic and the duration of calls is up 15% and data traffic is 22%
- AT&T reported wireless voice traffic was up 44% and that Wi-Fi VoIP calling also jumped significantly, up 88%
- Virtual Private Network (VPN) usage has increased 65%, according to NordVPN.
- As a group, cellular networks specifically saw traffic rise between 10-20%, service providers across the country reported that traffic on fixed wireless networks increased 20-35%
- 3 to 4 billion text messages per day before the pandemic is now 9 billion text messages per day
- Average number of call increased to 800 million per day (double that of a Mothers' Day)
- Call duration is up 33%
- Carriers have been sharing spectrum to improve network capacity during the crisis

The nation is relying on broadband telecommunications for social distancing through e-commerce, telework, distance education, and telehealth technologies and applications. The average number of people using the Internet at home during the day has more than doubled in the 14 largest metropolitan areas in the country since the pandemic began, according to ADTRAN. The number of mobile phone users using their phones to connect to the Internet has increased 87.5%, and the number of people using the Internet for streaming video and other entertainment has increased 50.2%. Much of the increase in overall Internet traffic has been people working from home and the steep "hockey-stick" curve increase in the number of video conferences.

Now that millions of employees have experienced telework, many do not want to go back to the office once coronavirus-related restrictions ease. Some 60% of U.S. worker respondents told Gallup they would prefer to work from home as much as possible even after the pandemic calms with 40 percent saying they preferred to return to the

workplace. https://www.nytimes.com/2020/05/05/business/pandemic-work-from-home-coronavirus.html?smid=linkedin

Silicon Valley and Seattle tech giants – Facebook, Microsoft, Apple, and Twitter – were the first to send their employees home as the virus spread to the U.S. Now they are among the *last* to return them to the office. Some of their employees might never go back. The companies are studying what their highly paid, highly valued employees want, using their own technology to make remote work easier and looking to hire new workers outside of big city hubs. A Facebook employee survey found that about 20% of workers were "extremely or very interested" in moving to full-time remote work after virus-related restrictions are lifted. Another 20% were "somewhat" interested and the largest group wanted flexibility, with some remote and some in-office work.
https://www.usatoday.com/story/tech/2020/05/22/coronavirus-remote-work-post-pandemic/5242420002/

Videoconferencing is expected to grow by more than three times in the next five years on the heels of the exploding work from home and online learning trends, according to recent research from Global Market Insights. The current market is valued at about $14 billion and is forecast to grow to $50 billion by 2026. That is an annual growth rate of 19%.

Working from home, online distance learning and telehealth will become the norm as companies, schools and health care providers wait for the pandemic to pass.

The government sector has witnessed rapid transformation with the adoption of digitalization. Government agencies and institutions need to have secure, efficient, and reliable communications to collaborate and update information among disparate offices in real-time. This has encouraged government authorities to adopt the video conferencing solution for meetings, public hearings, interviews, training, and press conferences.
https://www.gminsights.com/industry-analysis/video-conferencing-market

Millions of people are working from home who never did before and some in jobs that employers thought could not be done from home. The pandemic has proven that many jobs can be done, and can be done *well* remotely, from home. We are likely to see a sustained increase in telecommuting going forward post pandemic.

Public policy surrounding the compensation of doctors for delivering clinical services through telemedicine has been a major barrier to adoption. The pandemic has knocked it down. During COVID-19, it is vital to keep the healthy separate from the sick, and telemedicine does that.

The use of videoconferencing is growing exponentially as people become familiar with and skilled in using the technology for both professional and for personal communications.

More businesses will adopt cloud computing for core applications. Cloud based systems are reliable, secure, and flexible. Disaster recovery, mobility, and distributed organizations are served well by them. More organizations will adopt cloud-based applications and will need faster internet access to do it.

Public support for broadband expansion has grown swiftly during the pandemic. Increasing numbers of people and policy makers now understand, first hand, the value of broadband network access and the internet as essential infrastructure and as essential service.

Without a doubt, COVID-19 will have a lasting impact on how people live and work, and it will have a positive influence on the fight for better broadband.
https://www.bbcmag.com/broadband-applications/predictions-for-broadband-after-covid-19

The pandemic is also affecting population migration patterns. Far more people moved to Vermont, Idaho, Oregon and South Carolina than have left during the pandemic, according to data provided to Bloomberg News by United Van Lines. On the other hand, the reverse was true for New York and New Jersey, which saw residents moving to Florida, Texas and other Sunbelt states between March and July of this year. Vermont, a state that has been actively recruiting teleworkers, leads all states with seventy-five percent in-bound moves. One in five Americans relocated, or know someone who has during the pandemic according to the Pew Research Center. Rural areas and small cities and towns that have quality broadband are particularly attractive and becoming known as "*Zoom Towns*."

Voice Calls
Another interesting effect of the pandemic has to bring back the use of voice calls, which had dramatically declined in recent years due to the "pandemic of robocalls."

"During COVID-19, people across the globe are reaching out via voice calls from home for both personal and professional reasons," said Brad Russell, Parks Associates research director, connected home. "The combination of shelter-in-place, work-from-home, school-from-home, and other new from-home lifestyles has led many consumers to rediscover the value in voice. This opens new value for fixed-line telephony as many mobile networks have struggled to keep up with the increased usage."
https://cdgportal.com/blog/index.php/2020/09/01/voice-service-rumors-of-my-demise-have-been-greatly-exaggerated/

Industry Structure
The largest cable and telephone providers in the U.S. represent more than 95 percent of the total broadband market; however, market growth is largely being enjoyed by the cable companies, while phone companies as a group are losing subscribers.

The top broadband providers have about 103.3 million subscribers, cable companies: 70.6 million subscribers of and the wireline phone companies: 32.7 million subscribers

- The top cable companies added about 1.4 million subscribers in the second quarter of 2020, compared to a net gain of about 530,000 subscribers in the same period last year
- Cable broadband net additions were the most in any quarter since the first quarter of 2007. Charter's 850,000 net additions in the second quarter of 2020 were more than for any provider in any previous quarter.
- The top wireline phone companies had a net loss of about 155,000 subscribers in the quarter, compared to a net loss of about 160,000 subscribers in the same year ago period.
- The smaller telephone companies were the ones that saw broadband gains. While AT&T, Verizon, CenturyLink and Frontier lost subscribers, Windstream, Consolidated, TDS and Cincinnati Bell had subscriber gains.

"With the continued impact of the coronavirus pandemic, there were more quarterly net broadband additions in 2Q 2020 than in any quarter in eight years," said Bruce Leichtman, president and principal analyst for Leichtman Research Group, Inc., in a prepared statement. "In the first half of 2020, there were over 2.4 million net broadband additions. This is the most net additions in the first half of any year since 2008."
https://finleyusa.com/broadband-growth-due-to-pandemic/

Cable companies collectively serve over 1,090,000 customers across Oregon and provide service to many community anchor institutions. Cable companies are key providers of broadband internet access services. Over 72 million homes and businesses across America subscribe to broadband delivered by cable providers.

Like all telecommunications service providers, cable companies have been significantly impacted by the COVID-19 pandemic. Customers are spending more time on-line generating more demand due to the increase in people working from home, schooling from home and communicating with friends and family via the internet.

Since March 1, national downstream peak demand growth is up 14.3%, the national upstream peak demand growth is up 22.1% and upstream peak hours in many regions have shifted from late evening toward afternoon. There has also been a 36% increase in mobile data use over WiFi on Comcast Xfinity Mobile. The networks have performed well in face of the spike in demand. Provider backbone networks have significant capacity and have not shown signs of congestion.

Cable Companies have responded to the pandemic with special offerings for customers and for communities. All Oregon Cable Telecommunications Association (OCTA) members signed the FCC's pledge to Keep America Connected, which was extended through June

30, 2020. OCTA also signed onto the Keep Americans Connected pledge as a supportive trade association. As part of the pledge, members agreed to stop all service terminations for non-payment resulting from COVID-19 financial hardships. All signatories also stopped charging late fees for residential or small business customers to ensure that Oregonians could stay connected during the public health emergency.

In addition to every OCTA member signing FCC's pledge to Keep Americans Connected, members are also providing free or reduced cost access to services for vulnerable Oregonians. OCTA members will continue to implement policies and establish assistance programs to reduce the burden on Oregon customers throughout the pandemic. Some of the efforts made by OCTA members include:

- Free access to Wi-Fi hotspots throughout the state to all members of the public
- Special offerings for free internet service for low-income households, students, and educators
- Increased service transmission speeds and suspended data caps
- Free access to news, information, and educational content for school age children
- Donated airtime to run more than 1,000 COVID-19 public service announcement spots per week
- Provided nearly 300 laptops and 6 months of pre-paid internet access to low-income job seekers
- Partnered with Portland Community College, Portland Public Schools, Salem-Keizer School District, and other school districts and community partners to assist low-income students during the crisis and make internet more accessible for individuals and families
- Connected the COVID-19 emergency hospital at the Salem Fairgrounds and wired the Governor's Mansion

OCTA members are taking the lead on developing innovative solutions to address the challenges facing Oregon students as they transition back to school. OCTA's members have partnered with schools, businesses, and government entities to help ensure some of the most vulnerable and distressed Oregonians have access to the broadband they need to continue their education online during the pandemic. Some of the efforts from OCTA members include:

Keeping Kids Connected

- Cable providers partnered with Oregon Department of Education and local school districts to help low income students gain access to broadband during the crisis
- OCTA members have pledged to keep public hotspots open to the public to bridge connectivity gaps
- Providers are offering special discounts and payment programs to students and their families

Financial Assistance

- Providers continue to work with customers to tailor service packages and offer repayment plans for those facing financial hardships
- Debt forgiveness options and extended repayment plans have been offered through the end of 2020
- Many providers have expanded their low-income offerings and have provided no cost service for the first 60 days in order to get families connected to broadband

Community Support

- OCTA members have provided laptops, desktops, and pre-paid internet access to low income job seekers
- Donated thousands of essential PPE items to Oregon's healthcare workforce
- Provided grants to organizations providing broadband education, technology and training

In addition to the efforts of OCTA, the National Cable Telecommunications Association (NCTA) recently launched K-12 Bridge to Broadband, a groundbreaking public-private initiative that aims to connect students from low-income families to the internet for remote and hybrid learning. Under the initiative, cable providers partner with school districts and states to identify unconnected student households and offer opportunities to increase access to broadband for low-income families. Under the K-12 Bridge to Broadband initiative, nearly every school in the service area of NCTA members, which offer broadband service to 80% of U.S. homes, will be eligible to participate.

Wireline

CenturyLink

CenturyLink is building out its fiber network that serves its residential and business customers. In 2019, CenturyLink expanded its fiber network to reach an estimated 300,000 additional homes and small businesses with its gigabit service throughout its service territories nationwide. CenturyLink's consumer fiber-to-the-home (FTTH) projects provide symmetrical speeds of up to 940 Mbps. The faster speeds were enabled in parts of Boulder, Colorado, Spokane, Washington, and Tucson, Arizona. This year, CenturyLink will build out its fiber network to an additional 400,000 homes and small businesses including in Denver, Omaha, Phoenix, Portland, Salt Lake City, Spokane, and Springfield, Missouri.

In its first quarter 2020 earnings report, CenturyLink saw a net loss of 11,000 total broadband subscribers but for speeds of 100 Mbps and above, it added 60,000 subscribers. Thanks to its fiber first strategy, and acquisition of Level 3 Communications, CenturyLink is transforming itself from a traditional, legacy telco into a company that is more focused on fiber-based enterprise applications and core network services. Last year, CenturyLink connected an estimated 18,000 additional buildings to its global fiber network. In total, CenturyLink has about 450,000 global route miles of fiber across its network, and it plans

to add more this year. https://www.fiercetelecom.com/telecom/centurylink-continues-its-fiber-builds-for-consumer-and-business-customers

CenturyLink petitioned the FCC to allow them to be late in implementing the Connect America Fund (CAF II) upgrades where the FCC provided subsidies to upgrade rural broadband speeds to 10/1 Mbps. The reason cited for the delay is the COVID-19 pandemic, but the company was already behind and notified the FCC earlier this year that it had not completed its 2019 CAF II installations in 23 out of 33 states.
https://potsandpansbyccg.com/2020/05/18/enough-is-enough/

In September of this year, CenturyLink unveiled a new strategy breaking itself into two brands. The company introduced *Lumen Technologies*, or just *Lumen*, as its new brand for its largest business segment, enterprise and wholesale operations. The CenturyLink brand will remain and will represent the company's legacy residential and small business segments. CenturyLink is also introducing a new brand, Quantum Fiber, for its growing FTTH network. The CenturyLink brand will continue to be used for residential and small business customers over traditional copper-based networks. The company will formally change its corporate name to Lumen Technologies, Inc. There is not any announced structural change in leadership, responsibility, or financial strategy according to the company. It is also changing its stock ticker to LUMN from CTL.
https://www.telecompetitor.com/centurylink-rebrands-as-lumen-sort-of/

Ziply Fiber
On May 1st of this year, Ziply Fiber became Oregon's second largest telephone company. The new company acquired 350,000 residential business customers in Oregon, Washington, Idaho and Montana. In Oregon, Ziply will take over Frontier's advanced, fiber-optic network in Portland's eastern and western suburbs. It will also take over the copper-based phone networks that serve thousands of customers in rural parts of the state. According to the company, 31% of its homes passed are fiber capable and Ziply aims to get that number to 80% over the next few years by investing $100 million towards network upgrades.

Frontier Communications sold its local exchange business in Oregon, Washington, Idaho and Montana for $1.352 billion to Wave Division Capital and Searchlight Capital Partners. The assets in the four states include a fixed network covering around 1.7 million premises, including 500,000 with FTTP. At the end of March, Frontier served around 150,000 fiber broadband, 150,000 copper broadband and 35,000 TV customers in these states, and the activities generated $619 million in revenue for the year to date in March. .
https://www.telecompaper.com/news/ziply-fiber-buys-wholesail-networks-starts-fibre-projects-in-13-areas--1339338

On May 15, 2020, Ziply announced fiber infrastructure deployments in Coos Bay/Empire, Coquille, La Grande and North Bend by the end of the year. It also received a grant offer for

a fiber build in the Santiam Pass – Detroit to Idanha. The next phase of fiber deployment will be in 2021. Clatskanie, Vernonia, Banks, Joseph, and Enterprise are being evaluated as construction project priorities. Ziply is also expanding network capacity to reduce congestion and ensure performance even during peak hours. Its preferred transmission medium is optic fiber.

Ziply is expanding operations and its organization in Oregon and is seeking local partnership opportunities with local communities and local contractors to improve its network infrastructure, its customer experience and its employee experience. Ziply wants to go to where people want them, first. Ziply is dedicated to bringing fiber to more than one million Northwest homes and businesses, many of which have been underserved for decades. Ziply is committed to providing symmetrical Gigabit internet access service to 85% of its customers within five years https://get.ziplyfiber.com/.

Public Switched Telephone Network (PSTN)
The continuing market migration from plain old telephone service (the voice landline) to mobile wireless and broadband VoIP has been noted. AT&T told the Washington Utilities and Transportation Commission that it plans to discontinue residential local service in the state, effective October 1, 2020. The company said it is discontinuing local service in 13 states as a competitive local exchange carrier where AT&T purchases resale local services from CenturyLink, Inc. AT&T said it based the decision on "declining demand," as well as changes CenturyLink is making to its wholesale ordering system that are "incompatible" with AT&T's existing ordering system.

Effective July 1, 2020, Universal service charges on basic telephone services increased from 19.6% to 26.5%, which will likely encourage additional market migration to alternate voice services. Standalone broadband service has reached 42% of homes nationwide, rising from 34% over the past three years, according to a report by Parks Associates.

Cable Companies
Cable companies are key providers of broadband serving 47.8% of urban households and 25.8% of rural households in Oregon.

Comcast
Comcast serves approximately 725,000 Customers in Oregon including the Portland-Metro Region and the I-5 Corridor to Eugene/Springfield. Comcast has more than 1,700 Employees in Oregon and has invested more than $1.1 billion in Oregon since 2011. Comcast has also served more than 52,000 households (208,000 Individuals) through its low-income Internet Essentials program in Oregon since 2011.

Comcast, in particular, has responded to help communities during the COVID-19 pandemic across the country and in Oregon. K-12 schools and students have been under significant stress during this public health emergency and state mandates closing schools. Comcast

is offering Internet Essentials for 60-Days Free through the end of 2020, open Public Hot Spots (Approximately 40,000 of them in Oregon), and established the Xfinity Assistance Program which enables customers to continue to receive internet and voice services for a lower price. Comcast also suspended data caps for 60 days and gave all customers unlimited data at no additional charge.

Comcast is increasing download speeds for some of its most popular Xfinity Internet packages for customers in Oregon/SW Washington. Download speeds for the company's Performance tier will jump from 60 Mbps to 75 Mbps, while the Performance Pro tier will increase from 150 Mbps to 175 Mbps. The Blast! Tier will move from 250 Mbps to 275 Mbps, and the Extreme tier will be upgraded from 400 Mbps to 500 Mbps. The company said about 85 percent of its internet customers in Oregon/SW Washington subscribe to one of these tiers and will have their download speeds upgraded. The speed increases are the latest in a series of moves by Comcast to support growing consumer demand for super-fast, high-capacity internet connections that can not only handle the explosion of connected devices that are powering the smart home, but also offer a single platform to manage and protect them.
https://www.telecompaper.com/news/comcast-increases-internet-speeds-for-most-customers-in-oregonsw-washington--1309290

Comcast says that it has achieved symmetrical 1.25 Gbps transmission on a live production network in Florida and that the test is a milestone in the journey to 10 Gig speeds. In the coming weeks it will expand the project to test performance in different home and network environments. Being able to reach such speeds without extensive physical changes to the existing network offers significant savings and quicker time to market with new services.
https://www.telecompetitor.com/comcast-tests-symmetrical-1-25-gbps-in-move-toward-10g/

Comcast added 323,000 broadband customers in 2Q 2020, and 633,000 customers in 3Q2020. According to David Watson, CEO of Comcast Cable, the company has about 50% penetration for broadband, suggesting they have opportunity for additional growth. The existing DSL base for all large telephone companies, a prime target for Comcast (and all DOCSIS-based cable competitors) to take, is still relatively large. Verizon and AT&T alone have over 10 million DSL customers.

Comcast is also turning its attention to streaming video. This strategy began with the introduction of Xfinity Flex, Comcast's streaming video player. Flex features a variety of streaming services, including the Sling streaming TV platform from Dish. Back in May, Comcast announced Flex had surpassed one million subscribers. Streaming platforms are also available through Comcast's flagship pay-tv interface, X1. The next major installment in the streaming strategy is Peacock; Comcast's streaming TV service to rival Disney+, HBO Max, Netflix and others. It offers both free ad-supported and premium subscription

models, featuring content from NBC Universal's vast content library, but also includes content from Viacom CBS. Comcast announced 10 million sign-ups for Peacock on its 2Q 2020 earnings call. Comcast also owns 1/3 of Hulu.
https://www.telecompetitor.com/with-broadband-domination-almost-complete-comcast-now-turns-attention-to-streaming/

Comcast is also in a partnership with the City of Portland in the *I-Net Institutional Network Comcast Partnership.* Comcast is serving over 300 locations on the Comcast owned network including providing services to Portland Public Schools, Multnomah Education Service District, Multnomah County, several smaller municipality locations and others. This operation was established in the Comcast franchise agreement and the contract expires December of 2021.

Wave Broadband
Wave Broadband serves approximately 50 cities and towns and over 40k residential customers in Oregon, offering download speeds of 100 Mbps, 500 Mbps, and 1 Gig in all locations.
https://www.apnews.com/Business%20Wire/00e5e12a5cec4dc38a270889f6cd5e4a

Wave adopted the FCC's "Keep Americans Connected" pledge in March of 2020 in response to the coronavirus pandemic. The Internet First program was also launched at that time to help families and students have reliable and affordable access to the internet. The company has partnered with Oregon school districts to encourage families to take advantage of the program, as it offers high-speed internet at a significantly discounted rate with the first 60 days at no charge.

Wave has extended this program to accept new enrollments thru December 31, 2020. As part of Wave's commitment to the FCC pledge and to further help families stay connected during the pandemic, Wave Broadband suspended data overage charges thru June 2020 and incorporated COVID Relief programs to help with past due balances for those impacted financially by the pandemic.
https://www.businesswire.com/news/home/20200406005565/en/Wave-Broadband-Offers-Free-Connectivity-Deferred-Payments-Internet-First-Program-and-More-to-Help-Customers-Amid-COVID-19

Wave continues to expand its broadband footprint in Oregon to serve new areas. As an example, Wave recently announced a partnership with the City of Waldport to provide the city and surrounding rural Oregon coastal areas with access to gigabit speed internet for the first time. Under the agreement, Wave's gigabit internet tier and other offerings will be available to both consumers and small businesses, bringing the fastest connectivity speeds to the Waldport area. Wave is currently building out its fiber network to accommodate the services, which will begin to be available locally during the fourth quarter of 2020.

According to Waldport City Manager Dann Cutter, "Our agreement with Wave to deliver gigabit speed internet access will further Waldport's status as a great place to live and to do business. Our residents and business owners have been clear in stating that they want access to true high-speed internet, and we look forward to working with Wave to make this a reality." https://newportnewstimes.com/article/wave-broadband-waldport-partner-to-build-new-offerings-for-residents

Charter Communications

Charter Communications surpassed the mark of 30 million customers nationwide during the first half of this year. With its new record number of subscribers, Charter became the nation's fastest growing internet, voice, TV, and mobile provider. Charter delivers some of the fastest starting speeds in the industry — 200 mbps to 60% of the homes and businesses served — and 100 mbps nearly everywhere else. Spectrum Internet Gig delivers a 1 Gbps connection (940 Mbps maximum download) across virtually the entire Charter footprint. Spectrum Voice® is one of the largest voice providers in the nation, providing unlimited local and long-distance calling.

Charter's national workforce of more than 95,000 highly skilled employees is comprised of 47% people of color and 10% military veterans. Charter offers $15 per hour minimum wage, with a commitment to raise it to $20 per hour in 2022. Charter offers generous benefits, including medical, education and training, relocation, and retirement. A highly regarded, Department of Labor-certified Broadband Field Technician Apprenticeship program demonstrates Charter's commitment to workforce development.

Charter serves approximately 257,000 customers in Oregon, including along the Oregon coastline and the northeastern and southwest regions of the state. Charter has approximately 372 employees in Oregon and invested $51 million in capital in 2019 alone. As schools across the country began to transition to remote learning in March 2020, Charter immediately stepped up for students, educators and families. Charter committed to offering Spectrum Internet up to 100 Mbps (200 Mbps in most areas) for free, including in-home Wi-Fi and a self-installation kit, to households with K-12 and/or college students or educators who did not already have a Spectrum Internet subscription.

By the end of the 2019-2020 school year, Charter helped nearly 450,000 students and teachers continue schooling through remote learning across the country. In addition, Charter kept around 700,000 customers connected when they had a hard time paying bills because of COVID-related economic hardship and forgave approximately $85 million in customers' overdue balances.

As the new school year begins, the Spectrum Enterprise team has been working on an innovative solution to help get more households connected. Through the new Stay Connected K-12 program, Charter is working directly with school districts across their

footprint to assist them in offering high-speed, cable broadband internet access to students, educators and staff in their homes. This partnership will help ensure that learning, teaching, and working are uninterrupted. To make high-speed broadband more accessible for low-income learners and seniors, Charter additionally offers Spectrum Internet Assist, an industry-leading low-cost broadband service for qualified customers.

TDS BendBroadband

TDS, despite the trend toward streaming increased their number of video subscribers. The company reported its video subscriber base increased by 9% in 2Q20 and saw growth in its broadband subscribers. TDS continues to invest in video infrastructure, announcing a pure IPTV replacement for legacy RF video, which provides flexibility to consumers for a variety of commercial set top boxes and smart TVs with cloud DVR and resume anywhere capability. In addition to video, TDS has begun to replace coaxial plant with fiber-based PON services in its Central Oregon markets including La Pine. Middle-mile fiber construction has continued to improve reliability and wildfire resiliency for connected communities and industry in the region.

Cable providers are now setting their sights on 10 Gigabit service. An industry consortium of NCTA, CableLabs, and Cable Europe have established a 10G brand, calling it the next leap for broadband. The cable industry claims to be able to offer gigabit broadband to 80% of the U.S. today, thanks in large part to efforts from Comcast, Cox, and Charter. Smaller cable MSOs have been active in gigabit capability as well, which relies primarily on DOCSIS 3.1 technology. CableLabs, the R&D consortium of the cable industry, is spearheading the technical capability to bring 10G to market. The goal is to deliver 10G over existing coaxial networks.
https://www.telecompetitor.com/cable-industry-aims-to-capture-10-gig-momentum-with-launch-of-cable-10g-program/

Electric Cooperatives

Rural electric cooperatives (RECs) are viewed as an attractive and viable rural broadband solution. RECs are increasingly joining the work being done by traditional telephone cooperatives in bringing broadband service to rural territories. It is a solution that is in line with the history of cooperative utilities, which brought both electricity and telephone service to these same territories many decades ago. RECs possess important skills and assets that make expansion into broadband very feasible. Those skills and assets include:

- Network Assets — a utility network possesses many network assets important to the operation of a broadband network, including fiber backbone, poles, rights-of-way, substations, pedestals, buildings and trucks/vehicles.
- Skills and Expertise — operating an electric network enables skills and know-how that translate well into building and operating a broadband network.
- Customer Relationships — established billing relationships with customers provides a captive and engaged audience for broadband services.

- Government and Community Relationships — building broadband networks often involves partnering with local governments, and RECs can leverage long-standing government and community relationships for that purpose.
- Location — as RECs typically already serve these rural markets, proximity challenges are nonexistent.

There are 190 electric cooperatives, that are eligible bidders for the FCC's Rural Development Opportunity Fund (RDOF) auction.
http://www.govtech.com/network/Rural-Electric-Cooperatives-The-Digital-Divides-Salvation-

This month, Calix announced a formal partnership with full-service broadband consulting firm that is focused on Electric Cooperatives, Conexon. The terms of the relationship provide Conexon customers access to the entire Calix product portfolio—both Revenue EDGE and Intelligent Access EDGE solutions, along with the full set of Calix Services, which means electric cooperatives that work with Conexon can also leverage Calix solutions to build future-proof networks that will help their communities thrive for decades to come. Currently more than a quarter of the 800-plus electric cooperatives serving rural areas are deploying broadband services, and the federal government has made billions of dollars available to fund rural deployment projects. However, the process to secure funding is lengthy and complicated; and the actual deployment requires the technology and expertise to build fiber networks and deliver subscriber experiences that can succeed in rural environments.
https://www.telecompetitor.com/calix-and-conexon-partner-on-electric-cooperatives/
Press Release: https://www.businesswire.com/news/home/20201009005073/en

Coos-Curry Electric Cooperative
Coos-Curry Electric Cooperative (CCEC) has spent the past couple of years exploring the feasibility of a fiber-to-the-premises broadband network project to serve Coos and Curry Counties. They have held town hall meetings in Gold Beach, Port Orford and Coquille.

CCEC's service territory is 2,475 square miles. A full build-out of a fiber-to-the-home system would make service available to nearly 15,000 households and businesses. The fiber optic infrastructure is expected to cost about $40.2 million and the associated equipment and electronics are expected to cost about $4.6 million. The project would be built in phases over about two years if it moves forward.

"Electric cooperatives were founded in the 1930s and '40s on the principle that power was a necessity to sustain the lives and lifestyles of people in rural America," CEO Brent Bischoff said. "CCEC is convinced that the same is true today regarding internet connectivity. Just like nearly 100 years ago – if a local cooperative will not fulfill that need, then it is unlikely someone else will. "We are uniquely qualified to meet this need due to our reputation and relationship with our members, access to low-cost capital, and we are

extremely familiar with building and operating a utility infrastructure in this rugged coastal environment."
https://www.currypilot.com/news_paid/high-speed-internet-may-be-in-south-coast-s-future/article_1d725544-6003-11ea-b2f0-97f351902638.html

Hood River Electric Cooperative

Hood River Electric Cooperative https://hrec.coop/ is currently providing broadband internet access services in its territory. It has deployed an extensive network of wireless sites set at strategic locations; HREC is able to provide fixed-wireless broadband internet service to much of the Hood River Valley. This wireless network provides an alternative to wired Internet access solutions such as DSL and cable modems which often depend on a 3rd party carrier and aging infrastructure. Most wireless sites are directly connected to the Co-op's own fiber-optic network providing excellent speed and reliability.

HREC owns and operates a fiber-optic network running from the Bonneville Power Administration transmission lines in Parkdale to downtown Hood River, with a Points-of-Presence in Parkdale, Odell, and Hood River. Direct fiber-optic connections for internet access and Ethernet transport are available in many locations in the Hood River Valley.

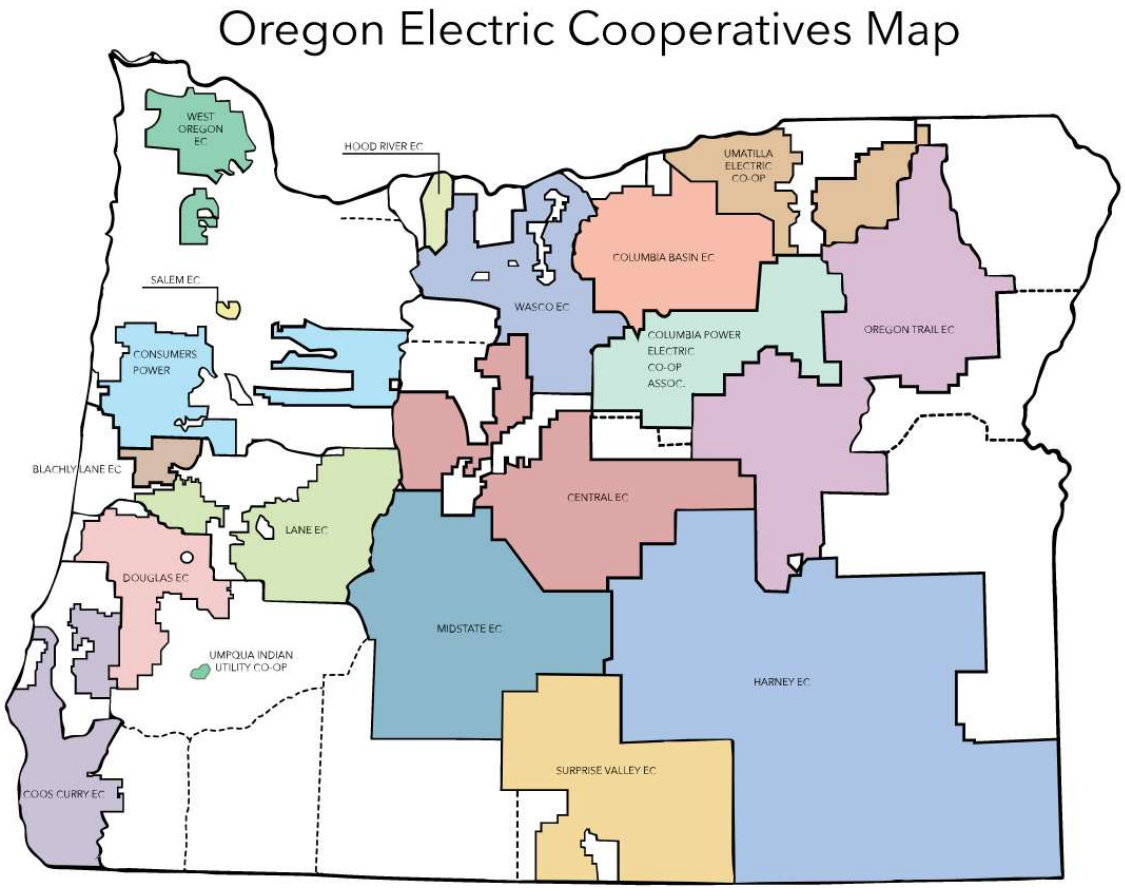
Douglas Electric Cooperative

Douglas FastNet

Douglas Fast Net (DFN), a wholly owned subsidiary of Douglas Electric Cooperative, owns and operates a local fiber communications network in Douglas, Coos, and Lane counties. DFN was created in 2001 to bring advanced telecommunications to Roseburg and the surrounding areas of Douglas County. Since then the company has expanded its network into Lane and Coos counties and has become a leader in fiber-optic voice and data services. DFN provides residential, business, government, and wholesale services throughout its service area. https://dfn.net/

Oregon Electric Cooperative Association

The Oregon Electric Cooperative Association https://www.oreca.org/ represents and promotes the interests of its eighteen Oregon electric cooperatives and their members. Currently more than twenty-five percent of the 800-plus electric cooperatives serving rural areas of the United States are deploying broadband services, and interest is growing across the industry, including Oregon. Broadband, as an essential infrastructure, is important to the long-term economic health and sustainability of the communities that electric coops serve.



Oregon Electric Cooperatives Map

Oregon-Idaho Utilities

This month, the U. S. Department of Agriculture (USDA) announced $43.2 million in grants and loans to provide broadband service in unserved and underserved rural areas in Idaho, Oregon and Nevada. Oregon-Idaho Utilities Inc. will use a $12.8 million ReConnect grant to deploy a fiber-to-the-premises network to connect 612 people, 75 farms and three businesses to high-speed broadband internet in Owyhee County, Idaho; Malheur County, Oregon; and Humboldt and Elko counties in Nevada.

LS Networks

Headquartered in Portland, Oregon, LS Networks operates the largest locally owned and operated fiber-optic network in the Pacific Northwest. For more than 15 years, LS Networks has served rural, urban and underserved communities with high-speed connectivity and market-leading bandwidth that is transforming the regional telecommunications landscape for customers and partners. With a mission to be the most trusted provider of digital infrastructure through a focus on quality and innovation, LS Networks is proud to invest in local communities and create opportunities for businesses and citizens. For more information: www.lsnetworks.net.

Municipalities

Municipal Broadband

A new municipal broadband report was released from non-profit broadband advocacy organization US Ignite and consulting firm Altman Solon. Eight percent of U.S. markets that are "well served" with broadband are "municipally enabled," The other 92% of well-served municipalities get broadband from private service providers. Moving forward, however, public and hybrid networks may be a viable alternative for bringing broadband to communities that are not well served. The researchers estimate that there are 6,500 such communities nationwide.

Nationwide, there are five municipal broadband models:

- Full municipal broadband. This category includes more than two thirds (68%) of current municipally enabled networks in which a city or utility company owns and operates the network and serves end users.
- Publicly owned, privately serviced. With this model, which represents 17% of municipally enabled networks, one or more commercial partners serve end users and may operate infrastructure, but the municipality owns the infrastructure.
- Hybrid ownership. With this model, the city owns middle mile infrastructure, but one or more private service providers own and operate last mile infrastructure, as well as serving end users.
- Private developer open access. This category includes municipalities where a private developer owns and operates broadband infrastructure, but private service providers serve end users.
- Full private broadband. With this model, one or more service providers own and operate the network, as well as providing service to end users. While this might sound like the typical commercial network that comprises 92% of well-served markets, the difference is that the municipality becomes actively involved in attracting service providers by, for example, simplifying access to rights of way.

Municipal networks in Oregon serve about 18% of households. Examples of Oregon municipal networks are presented in the E-Government section of this report.
https://www.telecompetitor.com/municipal-broadband-report-sees-5-public-private-hybrid-models/

Competitive Access Providers

Eastern Oregon Telecom

Regional service provider Eastern Oregon Telecom was profiled in the national publication, Telecompetitor. When Eastern Oregon Telecom (EOT) received a request to provide voice and Wi-Fi connectivity for a new incident response center to serve three counties in the state, it was a request that normally would have required 30 to 45 days to fulfill.

Considering how critical the center would be to coordinating response efforts during the COVID-19 pandemic, however, EOT devoted virtually its entire staff to the project and managed to get the job done in just three days, and did the work at no charge. The concept of the incident response center initially was triggered by lessons learned from 9/11. The goal is to gain closer coordination between police, fire, emergency medical technicians and other emergency personnel, rather than having them operate independently of one another. The emergency response center that Eastern Oregon Telecom helped set up was able to connect to a middle-mile statewide fiber network. Eastern Oregon Telecom's responsibility was to install Wi-Fi and program and install a phone system with 50 telephones.

Since the COVID-19 pandemic started, the company completed fiber-to-the-home deployments in the cities of Weston, Athena, and Adams, in rural Eastern Oregon. EOT has also opened all public WiFi hotspots to include the Umatilla County Fairgrounds for citizen use. EOT is covering 100% of the costs for all installations of new service during the crisis. EOT is not disconnecting customers who have stopped paying us during the crisis, and EOT is waiving late fees during the crisis.

The company President Joe Franell was quoted as saying, "Broadband is the singular greatest tool to help us through this safely and prepare us to recover as rapidly as possible." https://www.telecompetitor.com/broadband-operator-profile-eot-answers-the-call-to-equip-incident-response-center-amid-covid-19/

Eastern Oregon Telecom announced that it has installed a home fiber terminal in Boardman, and will be serving residential customers. Internet fiber has been available to Boardman commercial businesses for years, but providing access to residential customers is a first for the Morrow County city. EOT will also expand home fiber services to Umatilla. https://www.eastoregonian.com/news/local/eot-expands-residential-fiber-services-to-boardman-and-umatilla/article_8d739e7a-6adb-11e9-a8b7-8f9d8b12e790.html

Eastern Oregon Telecom built fiber to the home networks in three other rural communities, the Cities of Weston, Athena, and Adams. Additionally, EOT will be conducting a Digital Transformation Program in these three communities to conduct a full residential and commercial assessment of user needs and wants to design and provide training and education to end users.

Weston Mayor Jennifer Spurgeon made her case for rural broadband to members of Congress and the chair of the Federal Communications Commission, but the solution turned out to be local. Joseph Franell met Mayor Spurgeon at a Hermiston Chamber of Commerce function about a year ago, a meeting that helped convince him that it was worth it to extend fiber internet to some of Oregon's smallest incorporated towns. In addition to Weston, EOT is extending fiber into Athena by the end of the year and then to

Adams. EOT is also planning a digital transformation program to give residents a better idea of what they can do with their strengthened internet connection https://www.eastoregonian.com/news/local/high-speed-internet-comes-to-the-east-county/article_5201eb04-f75c-11e9-ac32-9bc4722b20c0.html.

Eastern Oregon Telecom (EOT) has also formed Blue Mountain Networks, which is now the parent company of EOT, Access Communications, and Gorge Networks. By the end of 2020, Blue Mountain Networks, using the Gorge Networks name, will complete fiber-to-the-home builds in Fossil, Mitchell, and Spray, in remote Wheeler County. Wheeler County is Oregon's least densely populated county.

Hunter Communications

Hunter Communications owns and operates one of the largest private fiber optic networks in Oregon, with over 2,000 route miles of high-quality fiber. The Company provides high bandwidth data and voice services to businesses and homes throughout Southern Oregon and parts of northern California. Earlier this year, Grain Management, a Washington, D.C.-based investment firm, acquired Hunter.

Recognizing the vital role that broadband providers play in ensuring communities remain connected during the coronavirus crisis, Hunter has donated services during the pandemic to support crucial community needs.

The Company has:

- Upgraded services at Asante and Providence Health, two leading health systems in southern Oregon, to increase network capacity
- Connected service in less than 24 hours to set up a new emergency health clinic in Medford
- Set up COVID-19 call centers for the Medford School District, the City of Veneta, and the regional 911 system in Jackson County; and
- Upgraded links for StarTech to ensure continued uninterrupted service to remote areas of Northern California

https://www.prnewswire.com/news-releases/grain-management-completes-acquisition-of-oregon-based-hunter-communications-301041636.html

BroadbandNow, an organization that tracks and analyzes broadband speeds and overall customer satisfaction, annually recognizes excellence among internet service providers. This year, Hunter won four awards

- #1 Fastest Business Internet in Oregon
- #1 Fastest Business Fiber Service in Oregon
- Top 10 Fastest Business Internet Nationwide
- Top 10 Fastest Business Fiber Service Nationwide

Hunter Communications provides fiber optic broadband internet, data and voice services to customers in 2,500 fiber-lit commercial buildings over its 2,000-plus mile fiber network. https://www.businesswire.com/news/home/20200826005470/en/Hunter-Communications-Named-Oregon%E2%80%99s-Fastest-Business-Internet

Wave Business Hillsboro Data Center Ring

Wave Business announced that the construction of a Hillsboro Data Center Ring is to be completed in 2020. Hillsboro is already home to Wave's fiber Ring I, a cross-connect facility for several transpacific submarine cables that currently connects six data centers. Ring I and Ring II will together connect up to 14 existing or planned data centers and will service seven transpacific submarine cable systems. The transpacific destinations involving submarine cable systems include China, Taiwan, Japan, Korea, Guam, Hawaii, New Zealand, Australia, and American Samoa, and additional destinations including the Philippines and Alaska are set to be added in 2020, as well as New Caledonia that will be added in 2021. Wave also operates the Tillamook Lightwave-owned cable landing station in Pacific City, Oregon and provides path-diverse dark fiber routes to Hillsboro for incoming transpacific subsea cables.
https://data-economy.com/wave-business-announces-construction-of-hillsboro-data-centre

Link Oregon

Link Oregon, the service name of the Oregon Fiber Partnership, is the government, research and education network (REN) driving the development and delivery of high-speed, fiber-optic broadband to Oregon's public and non-profit sectors—with a particular focus on supporting community anchor institutions in rural and remote communities facing broadband access challenges that limit pandemic resilience and threaten long-term economic development.

This Oregon non-profit, federally tax-exempt organization operates as a consortium of its five founding members: the State of Oregon (through the Enterprise Information Services division) and the four research universities—Oregon State University (OSU), Oregon Health & Science University (OHSU), Portland State University (PSU), and the University of Oregon (UO). Under its mission, Link Oregon provides network connectivity to K-12 and higher education, research and healthcare organizations, libraries, federally recognized Tribes, and state and local government agencies. Link Oregon is governed by a strategic board of directors, consisting of four representatives from the research universities, four from state government, and up to three at-large members. Initial funding for Link Oregon's network development has been provided by the founding members, and longer-term financing has been provided by OSU. In 2019, Link Oregon absorbed the Network for Education and Research (NERO), supported within UO and responsible for providing Internet connectivity to nearly a third of the state's public school districts – mostly through collaboration with the state's education service districts.

Link Oregon fundamentally is a public-private partnership seeking to support its members' core missions – education, research & innovation, healthcare, and public service – and in parallel to help advance broadband deployment in communities across the state. To this end, Link Oregon has acquired over 2,700 route-miles of dark fiber both statewide and in adjacent states. Almost all of this fiber capacity has been acquired from five long-haul telecommunications providers, requiring very little new fiber construction to date. In addition, Link Oregon is working with over a dozen local providers and public entities to interconnect these long-haul routes and to develop metro fiber rings in larger communities (Portland/Hillsboro metro, Salem, Eugene, and Medford initially). By aggregating the wide area network requirements of the four research universities, state government, and affiliated organizations, Link Oregon can serve as an anchor tenant for broadband investment to support network upgrades in rural communities.

Link Oregon offers two primary classes of network services to its members: advanced Internet transit (including connectivity to the high-speed Internet2 and CENIC networks) and point-to-point, Ethernet-based transport. Additionally, Link Oregon is a strong proponent of local Internet exchange points (IXes) for reasons of resiliency, performance, and cost efficiency. Link Oregon currently connects to two IXes in Oregon (NWAX in Portland and WIX in Eugene) as well as the regional IX in Seattle (SIX).

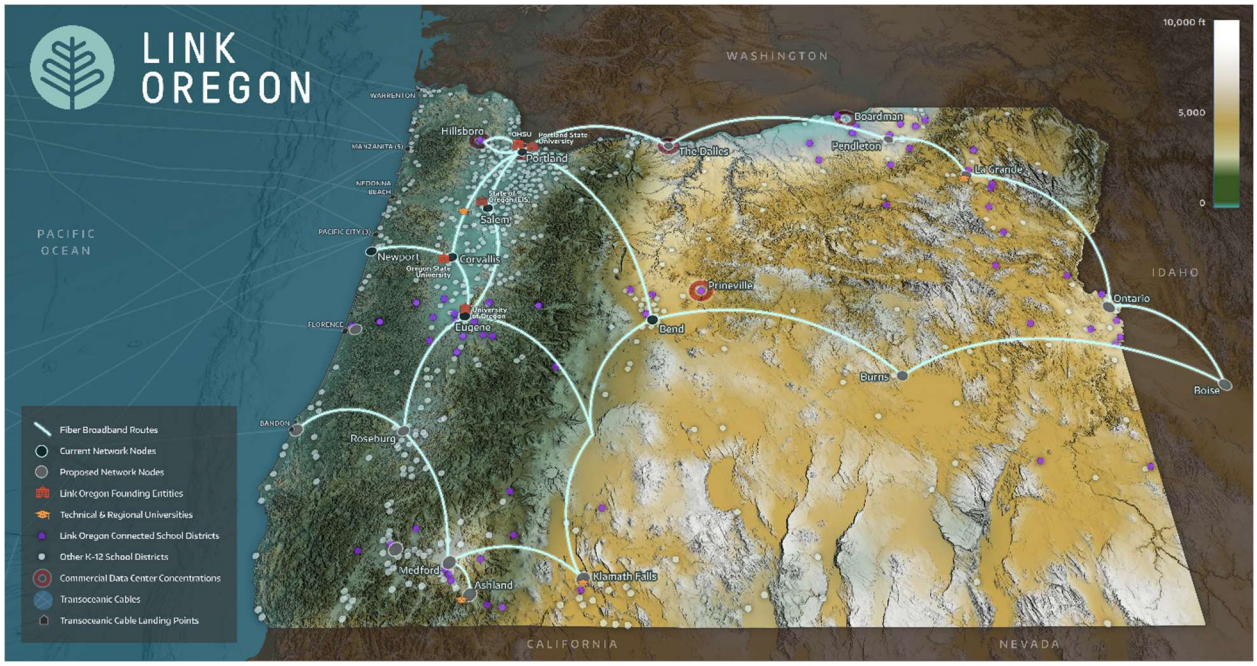
As the pandemic has revealed in many states, Oregon has lagged in making affordable, reliable, and pervasive broadband available consistently to all corners of the state. However, Link Oregon is leveraging its growing ecosystem, which includes national and local telecommunications providers, top-tier equipment vendors, state and local government agencies as well as support from peer RENs in the West and across the U.S., which have led earlier efforts to deploy reliable broadband access for their public and non-profit sectors.

Link Oregon already was planning network enhancements to fulfill the networking needs of K-12 and higher education institutions, public healthcare facilities, public libraries, federally recognized Tribes, and remote state offices. The existing gaps in connectivity, however, were exacerbated by the COVID-19 pandemic, which further intensified the need for online access by and to educational, healthcare, and public services due to the health concerns and safety mandates.

To expedite service delivery, Link Oregon was able to ramp up the design and preparation for deployment of the network—particularly into eastern and southern Oregon, where the historic and current needs are greatest. Action by the Legislative Emergency Board in June 2020 led to Link Oregon receiving a Business Oregon grant of $8.39 million with funding allocated to Oregon from the federal CARES Act Coronavirus Relief Fund. This funding enabled the purchase of required optical and network equipment and the addition of short-term staff to expedite the network extension. Link Oregon was also able to draw

on the statewide dark fiber capacity already acquired for network expansion from national and local telecommunications providers.

The State recognized Link Oregon as the optimal choice to lead this initiative because of its fiber assets and its pre-existing, yet unfunded network expansion plan designed to accomplish exactly this type and breadth of connectivity. The federal funding further expanded Link Oregon's ability to significantly accelerate the network expansion into the State's rural communities in response to the pandemic. The team has coordinated with various components of state government, including the Department of Education, the Higher Education Coordinating Commission, the Oregon Broadband Office, Enterprise Information Services, and the Governor's Office. The expansion ensures that students from pre-kindergarten to college-level can reliably access online learning programs, those unable to receive in-person medical care can connect via telehealth services, and those seeking access to online public services or work-from-home opportunities can reliably access relevant sites and services.



Link Oregon Backbone Network

Link Oregon, a member-based organization, is building the capacity necessary to meet the shared needs of its founding members and those of its growing regular membership. Link Oregon deployed a 70-mile network segment between Oregon State University's main campus in Corvallis and the OSU Hatfield Marine Science Center in Newport to facilitate rapid research data sharing. Additionally, multiple public institutions are now either serving and planning to serve as anchor organizations that can extend public WiFi drive-up access to community members whose homes are not connected with high-speed

broadband to address immediate needs. These efforts focus not only on addressing Oregon's immediate connectivity needs, but also on positioning the state for greater long-term sustainability and resilience.

Additional information on Link Oregon is available at https://www.linkoregon.org.

Althea – An "out of the box" solution

A small Oregon company, Althea https://althea.net/ , has developed and has been deploying innovative broadband solutions for serving rural areas, though the model has and may also be applied in urban areas. Althea creates routing and billing software that enables routers to pay other routers in the system, which enables decentralized networks of networks where participants can be compensated for their contributions. In an Althea network, instead of one ISP at the top collecting monthly payments, many different people can earn money by expanding and strengthening the network. Althea networks are made up of nodes owned by the people who use them.

The solution is a decentralized infrastructure:

- People in the community host hardware and get paid automatically for forwarding bandwidth
- Relays sell their neighbors
- A local group of people help support the network
- Lower build out cost, more efficient network configuration, more equitable governance

Subscribers "load up" their device or WiFi router with blockchain crypto currency to pay for internet access. A network of rooftop transmitters forward packets. They earn money and compete to provide service. Gateways connect the network to the internet, competing with other gateways in the area. The core technology behind Althea is a price-aware routing protocol and blockchain-based payment system that debits and credits cryptocurrency based on a router's bandwidth usage. Bandwidth is metered. The cost of deploying a network is significantly reduced compared to the standard model of an ISP building the network and providing service to subscribers.

The Benefits

- Use of existing homes and businesses
- Price Aware version of Babel to select routes
- the connection will always follow the cheapest and best route
- A discrete "exit node" or VPN for encryption and route verification
- Pay neighbors per GB with Ethereum or Xdai digital crypto currency
- All data traffic is encrypted

Redundancy

- The connection will always follow the cheapest and best route
- Will automatically switch if one route goes down

Althea networks have been deployed in Clatskanie, Tacoma, and Abuja, Nigeria. The initial buildout cost of the network in Clatskanie was about $5,000 using 5GHz unlicensed spectrum line-of-site wireless connections using directional antennae. This solution lends itself to rural areas that have geographic, topographic and economic barriers to providing broadband internet access. End-users can become "relays" by extending the signal to other users and then earn money on the traffic carried.

"AltheaHoods"

- Organizers start an Althea network in their community
- Create a *demand aggregation site*
- Pre-register interested subscribers
- Subscriber thresholds ensure a viable build out
- Local organizers are supported with marketing materials

Digital City Testbed Center - Portland State University

The Digital City Testbed Center (DCTC) at Portland State University established a network of campuses in the Pacific Northwest where smart city innovation can be tested. A primary goal is to balance the promise of new technologies against concerns about security, equity, ethics, and possible monopolization.

Research Universities measure themselves by the funds invested in research. Oregon institutions are competing with larger institutions with larger budgets. The University of Washington invests more in research than all of Oregon's institutions combined. Oregon institutions need to coordinate and combine their efforts to be competitive. This is important because universities drive applications, which drive industry activity, and connections, which drive economic growth.

Battelle out of Ohio was contracted to study this challenge and issued a report on a Data Science Roadmap for Oregon in 2015. Battelle looked at states that are comparable to Oregon for reference and best practices. One of the findings was the Oregon has under-invested in networking. This finding contributed to the development of the Link Oregon initiative of the Oregon Fiber Partnership. Oregon's Universities are working to advance the state's network infrastructure, as is OBAC.

Battelle's study asked:

- How good are Oregon's connectivity and network management?
- What hardware and software tools does the state's network offer?
- How can we advance Data Science research capabilities and technologies?
- How is talent development in Data Science being advanced?

- What applications are supported by statewide research computing?
- How are research computing resources organized and governed?
- What are the economic and research funding benefits and impacts?

Battelle recommended that Oregon's Universities focus on key areas by institution:

- University of Oregon on environmental informatics and education technology.
- Oregon State University on agriculture, fisheries, forestry, water resources and advanced manufacturing.
- Oregon Health and Science University on genomic medicine and health informatics.
- Portland State University on smart cities.

https://www.pdx.edu/research/battellereportoregon

Portland State University is studying and working on smart city projects. There is a lot of potential to bring technology in to cities. "Smart Cities" refers to the use of digital technology (sensors, cloud computing, analytics, visualization) to improve urban operations and residents' quality of life. Smart city applications improve city operations, accessibility, equity, opportunity, health care, and emissions and pollution reduction.

Cities are faced with many technologies, many vendors, and many strategic alternatives making it difficult to decide what to do. It has proven helpful to test these alternatives to decide what to do.

Single owner campuses (academic, government, or corporate) are excellent test-beds. Test before you deploy. PSU is using its own Portland campus, the Oregon Museum of Science and Industry campus, which will be undergoing significant development over the next ten years and University of British Columbia in Vancouver, BC. The Portland International Airport is a fourth campus test bed that will be coming online in the future.

PSU concurrently created Centers of Excellence.

- In 2018, PSU held a competition to create two "Centers of Excellence"
- Two of 28 proposals were selected: Digital City Testbed Center (DCTC) and Homelessness Research and Action Collaborative (HRAC)
- Each received $500K/year for three years
- Goal is to help PSU and Portland become national research leaders
- DCTC relies on PSU's very strong ties to innovative local government
- DCTC is well-connected to the two strongest U.S. smart city networks:
  - MetroLab Network (City-University pairs)
  - NIST's Global City Teams Challenge (Federal-Corporate-Academic)

There are two other groups working in this space that PSU is engaged with, the MetroLab Network https://metrolabnetwork.org/, a network of city-university partnerships and Global Cities Team Challenge https://pages.nist.gov/GCTC/ an initiative to encourage

collaboration and the development of standards. GCTC's long-term goal is to establish and demonstrate replicable, scalable, and sustainable models for incubation and deployment of interoperable, standard-based solutions using advanced technologies such as IoT and CPS, and demonstrate their measurable benefits in communities and cities.

Innovation programs can be implemented at scalable levels; household, block, neighborhood, citywide, metro-area or on a regional (megapolitan level) and include many partners to test new technologies and applications.

Issues for study include seismic preparedness, restricted mobility/physical access, restricted vision, bike-car collisions, air-quality (indoor and outdoor), building occupancy and public smart city education.

The U.S. Census Bureau has identified ten megapolitan regions that represent 70% of the U.S. Population. Cascadia, which incorporates northwest Oregon and western Washington State, is one of those regions. Vancouver BC, Seattle and Portland Metro areas form the Cascadia Innovation Corridor. Cascadia as a region has more commonality that other regions around the country making it attractive as a testbed. The Pacific Northwest is at the leading edge of smart city development. Oregon has not been as engaged in Cascadia initiatives, but it needs to be. https://www.pdx.edu/digital-cities-testbed-center

Other Players

Facebook

Facebook is getting into the fiber transport business. The social media giant requires a tremendous amount of network capacity to deliver all those social posts, ads, and videos all across the globe. As a result, Facebook owns and operates a large and growing number of data centers, and those facilities need robust fiber connectivity. The company is being creative by building its own fiber networks and links. Facebook, according to the blog post, has built a 200-mile fiber route connecting a new data center in New Mexico to one in Texas. It claims that it is one of the highest capacity links in the country.
https://www.telecompetitor.com/facebooks-middle-mile-infrastructure-subsidiary-to-offer-fiber-transport-eyes-underserved-markets/

Microsoft Broadband Initiative

Microsoft Corp. has set a goal to expand Internet access to 40 million unserved or unserved people globally by July 2022 through global growth of its Airband Initiative, which seeks to build out TV white spaces spectrum.

Microsoft said, "Like our work in the U.S., our goal is to empower local partners who know their communities' geographies and needs to solve their community's last mile connectivity challenges. Experience has taught us that diverse challenges require diverse solutions. Bringing broadband access to the world's unserved communities will require

much greater reliance on innovative technologies, regulatory approaches and business models. Our experience has shown us that a multi-stakeholder approach is needed to close the connectivity gap.

Microsoft is promoting rural digital transformation in newly connected areas, with a focus on supporting agriculture, education, rural entrepreneurship and telemedicine, as well as off-grid energy sources where necessary in order to improve rural productivity and livelihood." https://www.microsoft.com/en-us/corporate-responsibility/airband

U.S. Department of Defense Proposes a new 5G network
According to a report published by the Wall Street Journal in October 2020, the DOD is considering the possibility of building and leasing service on a government 5G network to carriers and enterprises. The DOD is considering using a bid process to select a company to build the government 5G network – a process that the government used previously when it selected AT&T to build the FirstNet nationwide mobile broadband network to support public safety users.
https://www.telecompetitor.com/service-provider-groups-ask-trump-to-scrap-u-s-government-5g-network-idea/

Wireless

AT&T
AT&T reports that it will retire its 3G network in 2022 as the company shifts its focus to 5G implementation and compatible 4G networks. Research firm Ovum estimates that the number of devices using 3G exceeds 85 million, while AT&T reports that 3G was still the choice for 11% of the company's postpaid users last year.
https://www.wsj.com/articles/at-t-gives-3g-service-three-years-to-live-11550765221

AT&T believes 5G will be suitable for replacing fixed broadband service in three to five years, CEO Randall Stephenson told analysts, noting the telecom's continued installation of high-band millimeter-wave frequencies. Separately, AT&T has applied for a six-month test of fixed-wireless-based 3.5 GHz in Ohio and Tennessee as part of its evaluation of the technology.
https://www.lightreading.com/mobile/5g/atandt-ceo-mmwave-5g-will-be-fixed-broadband-alternative-in-3-to-5-years-/d/d-id/749142

AT&T's rural fixed wireless service is geared towards fulfilling its Connect America Fund obligations and offers a lower-performing service, averaging 10/1 Mbps service, peaking at 25 Mbps. AT&T's fixed wireless also has a 250 GB monthly data allowance. AT&T announced that it has launched mobile 5G nationwide – and that it will make 5G capability available at no extra charge to customers purchasing unlimited plans. 5G network connectivity is of no use, however, without a 5G device. AT&T 5G device options currently include several Samsung Galaxy phones and several LG phones.

https://www.telecompetitor.com/verizon-rural-broadband-strategy-will-rely-on-lte-home-internet-fixed-wireless/

FirstNet

FirstNet is an independent authority within the U.S. Department of Commerce. Authorized by Congress in 2012, its mission is to develop, build and operate the nationwide, broadband network that equips first responders to save lives and protect U.S. communities. The initiative is enabled by 20 MHz of federally owned spectrum dedicated to public safety nationwide and $6.5 billion in initial funding.

FirstNet was created to be a force-multiplier for first responders – to give public safety 21st century communication tools to help save lives, solve crimes and keep our communities and emergency responders safe. FirstNet consulted with states, territories, tribal governments, and public safety agencies at every level for an understanding of the needs of first responders nationwide. After an RFP bidding process, AT&T was selected as the industry partner and the initiative moved forward to deploy the network to each U.S. state and territory.

Adoption and utilization of FirstNet is making good progress. As of May 2020, there are 1.4 million subscribers from over 12,000 agencies, a 20% increase from December 2019. In Oregon, there are currently over 178 subscriber organizations, an increase of 48.51% since January 2020. Over 1,300 square miles of additional 4G-LTE coverage is being added in Oregon in 2020. Currently twenty-three of the new forty-five FirstNet Oregon tower sites are scheduled to go on-air in 2020. Band 14 (the frequency band dedicated to public safety) connectivity is currently on air covering Portland, Salem, Medford, Bend, and the north coast. Eighteen sites are planned for deployment in 2021. Three more sites are planned for deployment in 2022.

Objectives going forward include engaging and collaborating with public safety and industry, developing and promoting Public Safety Communications, and investing in the network. The First Responder Network Authority will guide the advancement of the Network. Priorities for future investment include the network core, coverage and capacity, enhancing situational awareness, robust voice communications, and positive user experiences during routine, emergency and disaster events.

FirstNet also makes available a response fleet of deployable assets to respond to disasters. The fleet of 76 temporary service solutions includes ground-based assets such as Cell on Wheels (COWs) and heavy-duty Satellite Cell on Light Trucks or SatCOLTs. It also contains groundbreaking use of drones, Flying COWs™ (Cell on Wings), and FirstNet One – an industry-first blimp. These deployables have been utilized in Oregon multiple times including this year's wildfire event.

In response to the COVID-19 pandemic public health emergency, eleven state agencies received FirstNet equipment to help them respond and support for the transition of the State Emergency Coordination Center from Office of Emergency Management to the *Oregon* Department of Public Safety Standards and Training. FirstNet deployed eighty cellular devices and one deployable SATCoLT, provided temporary in-building coverage enhancement while the permanent installation was completed, and participated on Emergency Support Function (ESF-2) Coordination calls and provided network status updates. FirstNet also collaborated with Oregon Health Authority and Enterprise Telecom. Management to support the Oregon Child Abuse Hotline.

The position of Statewide Interoperability Coordinator (SWIC) is established under the Office of the State Chief Information Officer and serves as the central coordination point for statewide interoperable emergency communications efforts, supports the *State Interoperability Executive Council*, assists with the update and implementation of the *State Communications Interoperability Plan*, and serves as a member of the *National Council of SWICs*.

The "emergency communications ecosystem" in Oregon consists of Land Mobile Radio, 911 & Dispatch, and Public Safety Broadband (including FirstNet and other carrier services) and continues to evolve with new technologies, network deployments and applications.

A complete roadmap of the FirstNet plan is available at https://www.firstnet.gov/network/roadmap.

The New T-Mobile

The T-Mobile Sprint merger was completed this year. The merged company, which will use the T-Mobile name and brand, is poised to be a strong player in 5G, as it now has low-band, mid-band and high-band spectrum to support broad 5G coverage, as well as high speeds. The new company will have 14 times more network capacity in six years than T-Mobile alone has today. In addition, the company will become a competitor to cable and telco broadband providers, having promised to deploy fixed wireless service at speeds of at least 100 Mbps.

The FCC and Department of Justice imposed a range of conditions on the merger involving rural, 5G and more in order to give it their approval. Promises made to gain FCC approval include:

- Offering average 5G speeds up to eight times faster than current LTE in just a few years and 15 times faster over the next six years. The FCC also requires an interim milestone to cover 97% of the U.S. population within three years.
- Offering 5G to 99% of the U.S. population and average 5G speeds in excess of 100 Mbps to 90% of the U.S. population within six years. (The FCC requires a minimum speed of at least 50 Mbps to the 99%.)

- Covering 90% of rural Americans with average 5G speeds of 50 Mbps – a requirement the FCC said would also have to be met within six years. The FCC also said two thirds of the rural population would need to have access to 100 Mbps service within that timeframe
- The DOJ conditions require the sale of Sprint's prepaid wireless businesses and its spectrum holdings in the 800 MHz band to DISH Network. DISH has committed to deploying a 5G network covering 70% of the U.S. population by 2023.
- Other commitments made by T-Mobile referenced involve 5G and rural, including:
  - Offering fixed wireless at speeds of at least 100 Mbps to 90% of the population within six years
  - Offering the company's lowest-priced plan ever – a $15 monthly offering known as T-Mobile Connect launched last week
  - Offering a Connecting Heroes Initiative that includes free unlimited talk, text and smartphone data to all first responders, public and nonprofit state and local fire, police and EMS agencies
  - Offering Project 10Million, delivering free internet access and hardware to 10 million households over the next five years

T-Mobile is America's fastest growing wireless company with 86 million customers and $45 billion in annual revenue. T-Mobile has seen 44% business growth since 2018, not including Sprint, and enjoys a record low churn rate of 0.86%. For the third year in a row, T-Mobile received the J.D. Power award for highest overall satisfaction.

T-Mobile is committed to be number one in 5G.

- Over the next 6 years, its capacity will increase 14 times, over what it has today.
- Network speeds will be 8 times faster than current LTE in just a few years, and 15 times faster in the next 6 years with about 450 Mbps nationwide average download speeds, compared to around just 30–40 Mbps today.
- T-Mobile currently has the largest 5G network, and within 6 years, plans to make 5G available to 99% of Americans.

T-Mobile also says is working to close the Digital Divide and will be delivering free internet access and hardware to 10 Million Households over the next five years. Eligible families will receive up to 100 GB of free internet access each year including devices. T-Mobile believes that wireless is a shorter faster path to success to delivering broadband connectivity.

T-Mobile is also offering a new service program for the nation's first responders. *T-Mobile* is making a 10-year commitment to provide every public and non-profit state and local law enforcement, fire and EMS *first responder* agency across the country the ability to get *free* unlimited talk, text and smartphone data.

In response to the COVID-19 Crisis, T-Mobile is providing:

- 1,300,000+ free Hotspots to K12 including Launched Hotspot Programs with over 20 Oregon School Districts
- Unlimited LTE Data Plan – Specific to K12 ($20)
- Direct Assistance to K-12 and Cities and Hospitals in accessing Federal Funding & Relief Program
- Uplifted 2GB Data Plans to 20GB of LTE Data (Education)
- Changed Consumer Data Plans that had limited GB Data Limits to Unlimited
- Added 20GB of LTE Data Tethering/Hotspots to Consumer Plans
- "Borrowed" 600MHz Spectrum from 7 spectrum holders (including DISH) to augment T-Mobile 600Mhz coverage
- The COVID-19 pandemic is driving T-Mobile's $10.7 billion investment in Project 10Million, which targets students who cannot afford to go online and which will be distributed through partnerships with school districts nationwide. School districts can get a free wireless hotspot and 100GB per year of free high-speed data per eligible student, and students will be able to obtain laptops and tablets at cost. The districts will also have the option of applying the value of the free offering toward an unlimited or 100 GB per month plan.

T-Mobile's 5G rollout is differentiated from other carriers by the use of Low Band spectrum (600 MHz and 700 MHz). To provide the best geographic coverage. $30 billion has already been invested in the T-Mobile network and another $40 billion is committed. T-Mobile is the only mobile wireless carrier using low and mid band spectrum for 5G.

T-Mobile has made three and six year commitments for network buildout.

Nationwide Commitment (3 year / 6 year)

- Low-Band 5G Coverage –97%/99% of Population
- Mid-Band 5G Coverage 75%/88% of Population
- 75%/99% of Population @ 50MBps DL
- 63%/90% of Population @ 100MBps DL

Rural Commitment (3 year / 6 year)

- Low-Band 5G Coverage –85%/90% of Population
- Mid-Band 5G Coverage 55%/67% of Population
- 67%/90% of Population @ 50MBps DL
- 55%/67% of Population @ 100MBps DL

T-Mobile plans to exceed these commitments and will also be expanding its HOME Broadband services including fixed wireless broadband services including content.

T-Mobile has just under 700 cell towers in service in Oregon and 150 additional sites are planned. It also provides special services in venues like the MODA Center in Portland and hospitals. 97% of Oregon's population is covered and T-Mobile has a 28% market share. 92% of points of presence are covered by Low Band 5G. T-Mobile is carrying 260 TB of data daily for Oregon customers and Ookla has reported that T-Mobile has demonstrated 35 Mbps transmission speeds.

Verizon

Verizon announced that on November 5, 2020, its 5G Home Internet will expand to parts of Atlanta, Dallas, Denver and San Jose. That brings the number of cities where the fixed wireless service has a presence to 12. The service offers speeds as fast as 1 Gbps downstream and typical download speeds of 300 Mbps. It is available for $50 per month to Verizon wireless subscribers and $70 to non-subscribers. Until the end of 2020, new subscribers will get a free Stream TV device and one month of free YouTube TV. The expansion of 5G Home Internet is related to the growth of Verizon's 5G Ultra Wideband, which recently became available in 19 U.S. cities, 19 stadiums, six airports. https://www.telecompetitor.com/verizon-5g-home-knows-the-way-to-san-joseand-atlanta-dallas-and-denver/

Verizon recently unveiled a new Verizon rural broadband strategy. The carrier announced an initial launch of three markets for LTE Home Internet, with more to come. The carrier is presenting the service as a way to deliver needed internet speeds to rural areas, especially for work-from-home and school-from-home needs in the face of COVID-19. Verizon's LTE Home Internet will offer a fixed wireless service using the company's 4G LTE network. Priced at $60/month (discounted to $40/month for Verizon Mobile Wireless customers), the service will offer average download speeds of 25 Mbps, with peak speeds of up to 50 Mbps. Verizon said, "Verizon's 4G LTE network currently covers over 98% of the population. Verizon is one year into the rollout of 5G, and it is going to be a years-long effort to deploy 5G technology, just as the deployments of 4G LTE and 3G were.

With more and more people working from home and engaging in distance learning, Verizon is working to accelerate deployment. With LTE Home Internet, Verizon's 4G LTE network will provide Internet connectivity for customers in more rural parts of America who may not have access to broadband Internet service. For its 5G Home product, Verizon is using the same network it uses to offer 5G mobility services on mmWave spectrum. The mobile 5G service is available in more than 35 markets and the company expects to offer it in more than 60 markets by the end of the year. The 5G Fixed Wireless service is available in only a handful of markets, and plans call for offering it in 10 markets by year's end.

Fixed wireless via LTE is gaining significant momentum. A key advantage is the ability to offer the service through simple CPE in the home, generally without the need for installing an outdoor antenna. LTE technology with licensed spectrum also generally provides better fixed wireless performance than more widely used unlicensed spectrum that fixed

wireless providers have been using for years. And LTE's current global scale footprint brings good economies of scale for LTE equipment pricing. This momentum is expected to increase with the expansion of CBRS spectrum, with the licensed portion of that band currently being auctioned by the FCC.

Verizon also expects to use in-building 5G small cell sites to support private 5G networks for enterprise customers. According to a company spokesperson, the technology will be commercially available before the end of 2020. "A private 5G network is a smaller, self-contained network whose components all reside in a single facility. The most robust, lowest-latency, highest performing 5G network relies on three basic components: a private core serving exclusively that single system, a radio access network (an indoor cell site) . . . and a MEC [mobile edge compute] platform." https://www.telecompetitor.com/verizon-in-building-5g-cell-sites-will-support-private-5g-networks/

A key benefit of 5G networks is lower latency, but optimizing its usefulness is expected to require mobile edge computing. The idea is that cloud applications must be delivered from a point near the edge of the network close to the end-user in order to match 5G's low latency. Private 5G customers are likely to include hospitals, manufacturing facilities, warehouses, schools, ports, retail stores and more.

Verizon to date has used millimeter wave spectrum for 5G, enabling the company to obtain the fastest 5G speeds but over relatively short distances. A key concern is that transmissions in that spectrum band do not penetrate walls well, so the company is offering in-building 5G cell sites to address that limitation.

Verizon In-Building 5G

Verizon expects to use in-building 5G cell sites from Corning and Samsung to support its private 5G offering. The company said it has completed successful lab testing with Corning equipment and has begun field-testing the equipment in a live network environment. Samsung 5G small cell sites are currently undergoing lab testing. https://www.telecompetitor.com/verizon-in-building-5g-cell-sites-will-support-private-5g-networks/

UScellular

UScellular https://www.uscellular.com is the fourth largest mobile wireless service provider in the United States with 4.9 million connections in 21 states and is prominent in many of Oregon's rural areas. This carrier based in Chicago is also rapidly deploying 5G as part of a network modernization strategy to deliver enhanced network performance. UScellular reported that it has achieved test speeds of 100 Mbps over a distance of three miles using 5G millimeter wave fixed wireless, which demonstrates the potential of 5G wireless technology to be a broadband solution for rural areas.

Technologies

5G

5G is arriving. All four major U.S. wireless carriers have launched 5G, with expanding coverage areas. Major national mobile carriers are seeing initial 5G speeds of hundreds of megabits per second and in some cases, even gigabit speeds on their millimeter wave spectrum based 5G networks.

- T-Mobile has launched nationwide 5G on lower band 700 MHz spectrum, with slower 5G speeds than that, at about 20% faster speeds than 4G LTE. The much higher speed millimeter wave 5G sacrifices coverage and range for that higher speed, making for sparse coverage.
- Verizon was in 30 markets with 5G at the end of 2019.
- AT&T has launched lower band 5G on 850 MHz spectrum in multiple markets, and utilizes millimeter wave in other markets.

5G's overall impact will be much more than just about faster speed. Benefits include much lower latency and much greater capacity. This means many more devices can be connected to the network and the network can facilitate much quicker response times. 5G will fuel faster adoption of IoT, initially with industry and enterprise sectors. 5G will ultimately bring the concept of the internet of things (IoT) to life, enabling billions of connections across the globe. These new 5G networks also will accelerate automation and, in combination with artificial intelligence, 5G has the potential to make the world look very different five years from now.
https://www.telecompetitor.com/forecast-84-of-u-s-households-to-subscribe-to-broadband-by-year-end/

This month, the Federal Communications Commission adopted rules for creating *the 5G Fund for Rural America*, which will distribute up to $9 billion over the next ten years to bring 5G wireless broadband connectivity to rural America.
https://www.geospatialworld.net/news/fcc-establishes-a-5g-fund-for-rural-america/

Fixed Wireless

Fixed wireless has grown considerably in popularity in recent years with carriers who have not historically used the technology. AT&T and Verizon both offer fixed wireless and some primarily wireline service providers use fixed wireless to provide broadband in some areas.

T-Mobile plans to launch fixed wireless broadband, the service will rely on both 4G and 5G technologies. Company CEO John Legere promised to deliver 100+ Mbps speeds for wireless broadband to 90% of the population and in-home service to over half the country's households by 2024. The company will provide customers with an in-house router that they can self-install with a mobile app.

Counterpoint Research predicts 60 million users for both 4G and 5G fixed wireless access by the end of 2020, with 10 million of those being 5G users. Counterpoint also predicts the number of fixed wireless users to grow from 60 million to 200 million by 2025. https://www.fiercewireless.com/wireless/fwa-projected-to-grow-dramatically-but-it-still-has-problems

Satellite - Geostationary

The Satellite Industry Association https://sia.org/ notes that satellite communications services are capable of providing broadband connectivity to rural and remote areas of the country where it remains uneconomical for terrestrial services to deploy and with improving technologies provide both speeds and prices comparable to terrestrial alternatives with a clear line of sight to the southern sky. These services are available directly to the consumer today, covering all 50 states and delivering broadband offerings up to 100 megabits per second (Mbps) to millions of customers nationwide. Satellite broadband is also used by business and government enterprises, for both fixed and mobile purposes, using a range of spectral bands to deliver assured access to broadband communications. Further, satellites are providing critical backhaul Internet connectivity to local Internet Service Providers and community institutions in remote locations.

Hughes Network Systems and Viasat have qualified as eligible for awards from the $20.4 billion in broadband subsidies from the FCC's Rural Digital Opportunity Fund (RDOF).

Satellite - Low Earth Orbit

The FCC Approved Amazon's $10B Plan for satellite internet service. Amazon will move forward with Project Kuiper, a $10 billion satellite Internet project that will utilize more than 3,000 satellites to bring high-speed Internet to people who live in remote places around the world. Amazon also said that Kuiper will provide not only "high-speed, low-latency broadband service" to individuals but also "backhaul solutions for wireless carriers that will extend LTE and 5G service to new regions. Amazon's project has a high-profile competitor in Starlink, the satellite Internet project from Elon Musk's aerospace company SpaceX. SpaceX claims that roughly 700,000 U.S. citizens have expressed interest in its upcoming broadband service, which, similar to Kuiper, will also cost around $10 billion to put in place. Starlink is in pre-beta test and is showing speeds as high as 60 Mbps downstream and 17.7 Mbps upstream. Latency was as low as 31 milliseconds. Speeds ranged from 36 Mbps to 60 Mbps on the download and 5 Mbps to 17.7 Mbps on the upload.

BroadbandNow notes that HughesNet and Viasat are currently the two most prominent satellite Internet providers in the country with geostationary satellite systems. https://www.govtech.com/network/FCC-Approves-Amazons-10-Billion-Plan-for-Satellite-Internet.html?utm_term=READ%20MORE&utm_campaign=FCC%20Approves%20Amazon%27s%20%2410B%20Plan%20for%20Satellite%20Internet&utm_content=email&utm_source=Act-On+Software&utm_medium=email

Amazon is seeking government permission to launch 3,236 broadband satellites that would cover nearly all of the United States and much of the rest of the world with a first-phase launch of 578 satellites. Amazon's plan for a nearly global broadband system was previously revealed in filings with the International Telecommunication Union (ITU). Amazon's satellite plan is not solely for residential and business Internet—it is also for mobile access. In its filings, Amazon said its network will be available to mobile operators, raising the possibility that small rural carriers could buy bandwidth from Amazon to boost coverage in areas with poor cellular access. Low-Earth satellites should offer much better latency than current satellite systems, potentially making them a viable substitute for wired broadband networks. While fast wired networks aren't available in many rural parts of America, Amazon told the FCC that it "will help close this digital divide by offering fixed broadband communications services to rural and hard-to-reach areas." https://arstechnica.com/information-technology/2019/07/amazon-follows-spacex-into-satellite-broadband-asks-fcc-to-ok-launch-plan/

SpaceX launched 60 low-earth orbit (LEO) satellites last May to support its ambitious plans to use thousands of LEO satellites to provide a global low-latency SpaceX satellite broadband service branded as Starlink. By using LEO satellites, SpaceX Starlink expects to address latency issues associated with broadband service delivered from satellites in higher-altitude geostationary orbits. SpaceX said it plans to deploy 4,425 satellites to support its satellite broadband service. https://www.telecompetitor.com/spacex-satellite-broadband-takes-step-forward-with-launch-60-leo-satellites-put-in-orbit/

SpaceX plans to bring global internet coverage to the world through a network of Starlink internet satellites. Sixty were launched into orbit in November. This second batch (and first operational set) of satellites is part of SpaceX's broadband internet mega constellation, which the company hopes will help provide affordable internet coverage to the world. Traditional satellite internet providers beam internet coverage down from a high orbital perch, with their satellites stationed in what is known as geostationary orbit (which is typically 22,000 miles above the Earth). Because the signal has to travel such a long distance, the time it takes to send and receive data is substantially longer and more akin to the days of dial-up. By operating at a lower altitude — approximately 217 miles (350 km) above the Earth — SpaceX hopes to improve latency and capacity and provide coverage at an affordable price. With six to eight more launches, the company says it could begin offering broadband service in the United States by mid-2020. "We still have a long way to go from tweets to 4K videos, but we are on our way," according to the company. https://www.space.com/spacex-starlink-launch-fourth-rocket-landing-success.html

SpaceX successfully launched 60 satellites into orbit in January 2020, bringing its total to more than 200. The satellites are intended to blanket the globe with Internet connectivity, once there are enough of them in orbit. There is still have a long way to go before that happens — SpaceX is currently licensed to launch up to 12,000 satellites.

https://www.govtech.com/question-of-the-day/Question-of-the-Day-for-01302020.html?utm_source=gt&utm_campaign=home&utm_term=ANSWER&&utm_content=email&&utm_medium=email

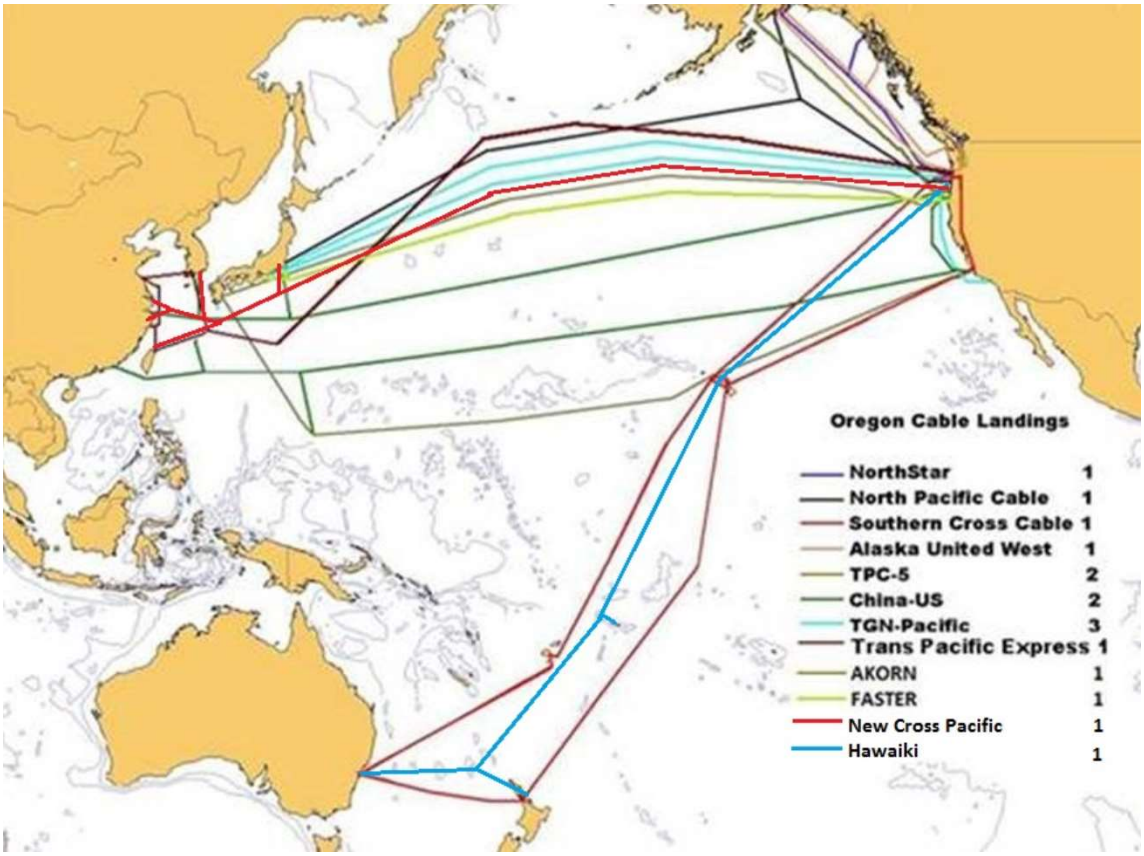
SpaceX has also qualified as being eligible for awards from the $20.4 billion in broadband subsidies from the FCC's Rural Digital Opportunity Fund (RDOF). Depending on the performance and customer experience with these systems, low-earth-orbit satellite systems could prove to be a disruptive innovation for broadband markets.

Wireless vs. Wireline

According to Comcast's CEO, 5G is not cheaper, faster or better than landline broadband. He contrasted 5G with VoIP, which was a truly disruptive technology that dramatically changed the traditional long-distance business. However, while one minute of VoIP was "dramatically cheaper" than a traditional long-distance PSTN minute, that will not be the case with 5G wireless. As for speed, wireless carriers are hoping to use 5G to get to landline speeds available today, but by the time they achieve that, landline speeds will be even faster, plus "There's nothing more reliable than a wire." Another consideration is usage levels. Comcast's heaviest power users consume 100 times more data per month than the average mobile user. Though there will be some level of competition between delivery technologies, it seems that most people want both landline and mobile broadband because each option provides advantages, depending on the situation – unless the cost of having both becomes too steep. Until now, both landline and mobile carriers have been able to increase speeds and performance without increasing a consumer's monthly bill, and as long as that continues many industry observers do not think we will see a lot of mobile broadband substituting for landline broadband service.
https://www.telecompetitor.com/comcast-ceo-5g-isnt-cheaper-faster-or-better-than-landline-broadband-charter-sees-5g-opportunity/

It is generally recognized that there is no "silver bullet" one-best solution for meeting the broadband challenge in all service areas and environments. Trends indicate that we will continue to see fiber pushed out from the core to the edge of the network with multiple technologies used for distribution networks providing connectivity to end-users. It is also a trend that the connection to the end-user is increasingly wireless whether that is 4G LTE, 5G or WiFi. The end-user usually does not know and cannot identify what technologies are being used to serve them to the frustration of many surveys. Ultimately, the end-user does not care as long as it works and meets their needs.

Undersea Cables



Oregon Undersea Cable Landings

This growing cluster of undersea cables has positioned Oregon as a telecommunications gateway to the Pacific Rim. There is a continuing opportunity to promote Oregon for future cable landings, related on-shore operations, and as a preferred location for any business or organization needing high-bandwidth connectivity to the Pacific Rim. Undersea telecommunications cables and their interconnections add valuable infrastructure to the state. Undersea cables bring permitting and easement fees, contract work for the fishing fleet, and the potential of long-term jobs to manage and maintain the cables and the networks.

The unincorporated community of Tierra del Mar has objected to and opposed the JUPITER Cable System landing, the latest undersea cable system currently under construction. The community is concerned about environmental impacts and the impacts on property and property values. The JUPITER Cable System is approximately 9,000 miles in length and consists of five fiber pairs with a design capacity of more than 60 Tbps. The JUPITER Cable System connects from Oregon to Maruyama, Japan; Shima, Japan; Los

Angeles, California, USA; and Daet, Camarines Norte, Philippines. As a new transpacific submarine cable, the JUPITER Cable System will provide additional diversity of connections and enhanced reliability and connectivity to data centers on the West Coast of the United States. The JUPITER Cable Consortium includes Amazon, Facebook, Nippon Telegraph and Telephone, PCCW Global, Philippine Long Distance Telephone Company (PLDT) and SoftBank.

Private Sector Investment

The nation's telecommunications infrastructure continues to be built and maintained by the private sector. USTelecom estimates that broadband providers that comprise 95% of the U.S. market invested $75 billion in 2018. That is a significant increase from 2017 broadband capex, which USTelecom estimated at $72 billion for those providers. Service providers that offer wired and/or wireless services, including cable companies and telecom companies, were included in the USTelecom broadband investment estimate. Since 1996, U.S. broadband providers have invested nearly $2 trillion to connect our communities.

USTelecom, which represents large and small incumbent telecom providers, has estimated annual broadband investment for the last nine years and has noted that capex peaked in 2014, but declined in 2015 and 2016, then began to increase in 2017 after there was a change in the regulatory environment. USTelecom estimates that AT&T, Charter, Comcast, Sprint, T-Mobile and Verizon – spent $66.3 billion in 2018, up from $64 billion in 2017.The six largest broadband providers, the two primarily wireless companies – Sprint and T-Mobile (now merged) – had the highest capex growth between 2017 and 2018, which came in at 48.3% and 5.7%, respectively.
https://www.telecompetitor.com/ustelecom-estimates-u-s-broadband-investment-at-75-billion-for-2018-up-from-72-billion-in-2017/

According to a recently published report from market analyst Dell'Oro Group, the outlook for telecom infrastructure investment remains favorable, even with the increased uncertainty due to the COVID-19 pandemic. Worldwide telecom capex – the sum of wireless and wireline telecom investments – is projected to grow at a one percent CAGR between 2019 and 2022. Additional highlights from the March 2020 3-Year Telecom Capex Forecast: Wireless capex is projected to grow at a faster pace than wireline capex, underpinning projections that 5G capex will accelerate rapidly over the forecast period.

Worldwide capital intensity ratios, wireless plus wireline, are projected to advance at a one percent compound annual growth rate between 2019 and 2022, driven primarily by a healthy increase in wireless capex/revenue.

Wireless investments in China, propelled by the deployment of 5G, are projected to drive the lion share of the global capex upside over the 2019 to 2022 forecast period.

Following three years of elevated investment levels in the U.S. telecom market, wireless investments will be characterized by robust mid-band capex, increasing millimeter wave investments, and some moderation in low-band projects https://www.delloro.com/advanced-research-report/telecom-capex/.

Comcast as a single carrier has invested more than $1.1B in Oregon since 2011.

CTIA, the mobile wireless industry association reports that the industry has invested over $286B in America's wireless networks since the start of 2010. Wireless investment also meant providers were prepared to handle the unprecedented surges in mobile voice and data use due to COVID-19.

In Oregon, CTIA cites impacts of 46,455 wireless related jobs, $2.3 Billion in pay and benefits from the wireless telecommunications industry, and a $5.6 Billion impact on GDP. http://www.telecompetitor.com/wireless-economic-impact-study-industry-contributes-475-billion-annually-to-u-s-gdp/

These investment levels by the private sector underscore the size and scope of deploying and maintaining a broadband network infrastructure and put the level of public sector funding in perspective.

Broadband Public Policy

In Oregon, the impact of the COVID-19 Crisis on local and state government interest in *taking action* to address the continuing Digital Divide and challenges of Broadband connectivity in rural areas and for unserved and underserved populations has been dramatic.

The pandemic has created a new sense of understanding, urgency and commitment to address the long-standing challenges of the Digital Divide.

State of Oregon Response

On June 5, 2020, the Oregon Legislative Assembly Emergency Board approved $20 million in broadband funding from the CARES Act Coronavirus Relief Fund and designated $8.39 million in funding for Link Oregon www.linkoregon.org, $1.61 million in funding for School Districts and $10 million in funding for the Rural Broadband Capacity Program within Business Oregon.

On June 19, 2020, Business Oregon launched the *Rural Broadband Capacity Program* and issued a request for applications.

On June 26, 2020, the Oregon Legislative Assembly passed Senate Bill 1603 in the First Special Session. The bill modifies definitions applicable for purposes of universal service surcharge, subjects sale of retail commercial mobile radio services and retail interconnected voice over internet protocol services to universal service surcharge, reduces rate cap to six percent of sale of services subject to surcharge, directs Public Utility Commission to transfer up to $5 million per year of moneys deposited in universal service fund to Broadband Fund, and establishes Broadband Fund. Further, it continuously appropriates moneys in Broadband Fund to Oregon Business Development Department to provide grants and loans through, and to administer, program related to broadband. Directs department to adopt program for providing grants and loans by rule. Directs department to report annually to interim committee of Legislative Assembly related to telecommunications on status of Broadband Fund. Sunsets Broadband Fund, transfer of moneys from universal service fund to Broadband Fund and grant program on January 2, 2030. Becomes operative on January 1, 2021. Takes effect on 91st day following adjournment sine die. Passed by the Legislative Assembly 5-26-20, and signed by the Governor.
https://olis.oregonlegislature.gov/liz/2020S1/Downloads/MeasureDocument/SB1603/Introduced

On July 2, 2020, Business Oregon received over one hundred applications for grant requests totaling just under $50 million. Business Oregon processed and issued grants for 28 projects across 24 counties to deliver increased broadband-speed internet access for telework, telehealth, and K-12 distance learning applications in unserved and underserved

areas in response to the COVID-19 public health emergency. Recipients include Oregon cities, counties, tribes, cooperatives, school districts, and private sector internet service providers.

On July 29, 2020, the Oregon Department of Education (ODE) announced the *Comprehensive Distance Learning Grant Program* with funding allocations to all Oregon School Districts. Business Oregon coordinated the E-Board Coronavirus Relief Fund allocation to School Districts with ODE. Business Oregon distributed just over $500,000 in grants to school districts. Just under $1.1 million was returned by Business Oregon to the Department of Administrative Services for reallocation to ODE for distribution to school districts through the *Comprehensive Distance Learning Grant Program*.

By September 20, 2020, all Emergency Board CARES Act Coronavirus Relief Fund dollars for broadband have been committed as directed.

2020 Oregon Legislative Session – Broadband related bills signed into law

No bills passed during the regular Legislative Session.

SB 1603

In the First Special Session of 2020, the Legislative Assembly passed SB 1603, which modifies definitions and fees for the Oregon State Universal Service Fund. The bill subjects the sale of retail commercial mobile radio services and retail interconnected voice over internet protocol services to the universal service surcharge and reduces the rate cap to from 8.5 percent to 6 percent of sale of services subject to surcharge. Prior to the passage of SB 1603, wireless companies were specifically exempted from paying the OUSF surcharge. While the statute was silent on VoIP, at least one VoIP provider was voluntarily paying into the fund.

The bill also establishes the Oregon Broadband Fund within Business Oregon and further directs the Public Utility Commission to transfer up to $5 million per year of moneys deposited in the universal service fund to the Oregon Broadband Fund, and continuously appropriates moneys in the Broadband Fund to the Oregon Business Development Department to provide broadband grants and loans, and to administer programs related to broadband. It directs Business Oregon to adopt programs by rule for providing grants and loans. The statute becomes effective January 2021 and sunsets January 2030.

2019 Oregon Legislative Session – Broadband related bills signed into law

HB 2022

Changes name of Oregon Virtual School District to Oregon Online. Expands purposes of Oregon Online to require provision of professional development related to online learning.
Status: Governor signed into law 6-17-19.
https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/HB2022/Enrolled

HB 2173
Creates Oregon Broadband Office within Oregon Business Development Department. Repeals sunset on Oregon Broadband Advisory Council. Adds member to council. Broadens duties of council to include recommending public policy and solutions to address state's broadband needs and goals. Directs council to champion statewide access to broadband services. Presession filed at the request of House Interim Committee on Economic Development and Trade. Status: Speaker signed 7-2-19, President signed 7-3-19, Governor signed 8-9-19.
https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/HB2173/Enrolled

HB 2395
Requires person that manufactures, sells or offers to sell connected device to equip connected device with reasonable security features that protect information that connected device collects, contains, stores or transmits from access, destruction, modification, use or disclosure that consumer does not authorize. Presession filed (at the request of Attorney General Ellen Rosenblum. Status: Governor signed into law 5-30-19.
https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/HB2395/Enrolled

HB 2449
Increases rate of tax for emergency communications. Increases amount of distribution from Emergency Communications Account to counties with population under 40,000. Sponsored by Representatives FINDLEY, LIVELY, MARSH. Status: Speaker signed 7-2-19, President signed 7-3-19, signed by the Governor.
https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/HB2449/Enrolled

HB 2684
Repeals exemption for property of company that builds, maintains and operates project constituting certain communication services infrastructure. Takes effect on 91st day following adjournment sine die. Status: Governor signed into law 5-28-19.
https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/HB2684/Enrolled

HB 3061
Allows political subdivision to convey real property to nonprofit, municipal or private corporation for purpose of providing broadband service. Requires instrument conveying real property to authorize reversion of property to political subdivision if property is not used to provide broadband service. Allows political subdivision to relinquish reversionary interest in real property after less than 20 years to further public interest. Declares emergency, effective on passage. Sponsored by Representative RESCHKE; Representatives BARRETO, BOSHART DAVIS, CLEM, MARSH, NEARMAN, NOBLE, ZIKA, Senators BOQUIST, HANSELL, LINTHICUM, THATCHER. Status: Governor signed into law 5-13-19.
https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/HB3061/Enrolled

HB 3065
Directs Public Utility Commission to establish public process for investigating continuing relevance of telecommunications carrier of last resort obligations. Requires commission to submit report on investigation, which may include recommendations for legislation, to interim committees of Legislative Assembly related to economic development and business and general government no later than September 15, 2020. Sunsets January 2, 2021. Status: Governor signed into law 5-22-19.
https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/HB3065/Enrolled

SB 68
Increases annual fee imposed on public utilities and telecommunications providers for purpose of defraying costs of Public Utility Commission. Declares emergency, effective on passage. Pre-session filed at the request of Governor Kate Brown for Public Utility Commission.
Status: Governor signed into law 5-24-19.
https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/SB68/Enrolled

SB 69
Expands purposes of plan of assistance established by Public Utility Commission under Oregon Telephone Assistance Program to include supporting broadband internet access service. By order of the President of the Senate in conformance with presession filing rules, indicating neither advocacy nor opposition on the part of the President (at the request of Governor Kate Brown for Public Utility Commission). Status: Signed by the Governor 5-7-19. Effective date
1-1-20. https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/SB69/Enrolled

SB 129
Allows licensed optometrist to engage in practice of telemedicine. Defines "telemedicine." Declares emergency, effective on passage. By order of the President of the Senate in conformance with presession filing rules, indicating neither advocacy nor opposition on the part of the President at the request of Senate Interim Committee on Health Care.
Status: Governor signed into law 6-4-19.
https://olis.leg.state.or.us/liz/2019R1/Downloads/MeasureDocument/SB129/Enrolled

Oregon Broadband Office (OBO)
In December 2018, Governor Kate Brown ordered that the Oregon Broadband Office is created within the Oregon Business Development Department. In the 2019 Legislative Assembly, the Oregon Broadband Office was codified in statute providing the Office with specific directives [Executive Order Number 18-31 and HB 2173 Enrolled 2019].

The Broadband Office is directed to:

- Advocate for the adoption of public policies to close the continuing digital divide.
- Develop broadband investment and deployment strategies for unserved and underserved areas.
- Promote private sector, public sector, and cooperative broadband solutions.
- Support and promote local and regional broadband planning.
- Be provider and technology neutral focusing on desired outcomes.
- Pursue and leverage federal sources of broadband funding.
- Manage and award funds allocated to the office for broadband projects.
- Engage with stakeholders to make a business case for broadband investment.
- Promote digital literacy, equity and inclusion.
- Generate public awareness of the value of broadband technologies and applications.
- Promote broadband adoption and utilization of broadband technologies and applications.
- Develop and maintain a broadband map.
- Convene state and federal agencies and advise the Governor, state agencies and the Congressional Delegation on broadband.
- Support and coordinate efforts with the Oregon Broadband Advisory Council.

The Oregon Broadband Office is currently staffed by one full time position, a Telecommunications Strategist.

Broadband Strategic Plan

The strategy of the Oregon Broadband Office is to follow the well-defined directives and goals established in the state's public policy with programs and activities to address each directive and achieve each goal, scaled to the resources available. To carry out these directives, an Oregon Broadband Office website was created with the URL www.broadband.oregon.gov to serve as a portal to the state's broadband activities, initiatives and resources. It is a key tool for promotion and information distribution. A new *Oregon Broadband Map* was also launched and is accessible through the Broadband Office website. The map is a platform for data collected to track the availability of broadband services, measure progress, provide related information and provide public access to the data. The map is searchable by city, county, tribal lands, specific address, or point selection on the map. An expanded Broadband Office with additional staff is planned scaled to available funds.

Business Oregon commissioned a *Statewide Broadband Assessment and Best Practices Study* to evaluate Oregon's current broadband infrastructure and broadband service availability, identify geographic areas of the state that are unserved and underserved, benchmark costs for broadband infrastructure deployment, identify best practice programs, policies, and strategies, identify sources of funding, and improve the database used for the Oregon Broadband Map.
https://www.oregon4biz.com/assets/docs/SNGStudy2020.pdf

A *Rural Broadband Capacity Improvement Program* will be established, scaled to available funds, to support broadband planning, engineering, and/or infrastructure deployment projects targeting unserved and underserved rural areas. The program will provide grants and forgivable loans for planning, engineering, infrastructure deployment, and for matching funds to leverage grants and loans from federal and private funding programs.

A *Digital Literacy, Security and Inclusion Program* will be established, scaled to available funds, to provide grants and forgivable loans to projects to improve digital literacy, cybersecurity, and the digital inclusion of unserved and underserved populations so that the benefits of broadband connectivity may be realized.

A *Broadband Outreach Program* will be established, scaled to available funds, to engage stakeholders; elected officials, government officials, healthcare providers, educators, businesses, agriculture and other community leaders, and broadband service providers to facilitate communications, recruit local champions and aggregate the demand of the different segments of the community to help to make a business case for broadband investment and to match projects with funding sources.

All programs will coordinate with and be guided by the Oregon Broadband Advisory Council. Competitive high-speed access to the internet and telecommunications networks is essential, *statewide,* for Oregon's schools, libraries, businesses, agricultural producers, governments, first responders, healthcare providers and individual residents. This is an aspirational strategic plan. The scope of activities that the Office will ultimately undertake will be enabled, or limited, by the resources available.

Broadband Accessibility in Oregon

Due to the pandemic and changing patterns of use, broadband accessibility has never been a more pressing priority issue for the state. Broadband services are widely available to Oregonians at competitive prices through many national, regional, and local service providers.

Oregon has made significant progress in the deployment of broadband infrastructure throughout the state in recent years; however, we continue to have a digital divide. And what constitutes competitive quality broadband continues to change. *It is a moving target.*

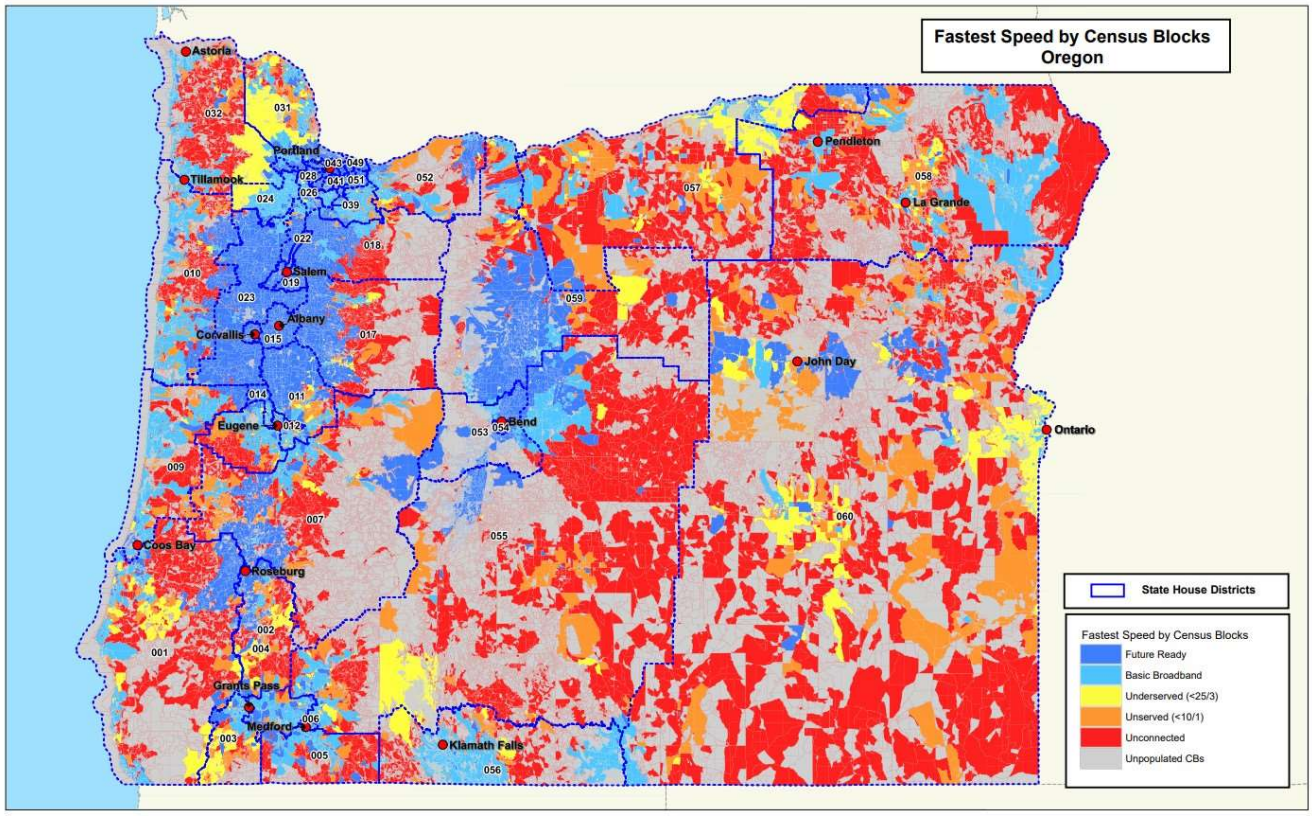
Fifteen years ago, the Digital Divide was considered to be between those geographic areas that had DSL services and those areas that only had "dial-up" Internet access services. Today the divide is between those geographic areas that have access equal to or greater than the latest FCC broadband standard (currently 25 Mbps down and 3 Mbps up) and those areas that do not.

Strategic Network Group's *Oregon Statewide Assessment and Best Practices Study* had several key findings.

- 95 percent of Oregon's population live in areas that have basic broadband access and that population is concentrated in urban areas.
- 54 percent of all census blocks have basic broadband access, reflecting the rural-urban digital divide.
- 41.6 percent of rural households subscribe to basic broadband or faster
- 64.1 percent of urban households subscribe to basic broadband or faster

On the following map, the blue colors represent areas with access to basic broadband or better levels of service, the yellow, orange and red colors represent underserved, unserved, and unconnected areas.

- Underserved (between 10/1 Mbps and 25/3 Mbps)
- Unserved (10/1 Mbps and under)
- Unconnected (No service available)
- Future Ready (100 Mbps or better)
- Basic Broadband (25/3 Mbps as defined by the FCC)



Oregon Broadband "Heat" Map

Speed Blocks (census blocks by speed)	Populated Census Blocks	Unpopulated[1] Census Blocks	Total	% of Census Block	Population	% of Population
Unconnected	17,523	54,330	71,853	36.5%	61,053	1.5%
Unserved (< 10/1)	6,915	3,828	10,743	5.5%	77,607	1.9%
Underserved (< 25/3)	5,026	2,729	7,755	3.9%	70,556	1.7%
Basic Broadband	33,305	9,582	42,887	21.8%	1,141,460	27.6%
Future Ready	53,756	9,627	63,383	32.2%	2,792,017	67.4%
Total Census Blocks	**116,525**	**80,096**	**196,621**	100.0%	**4,142,693**	100.0%
Connected Census Blocks	**99,002**	**25,766**	**124,768**	**63.5%**	**4,081,640**	98.5%

Oregon Broadband Connectivity

[1] Census block with no population according to US Census.

Nationally, 55 percent of people living in rural areas have access to the service transmission speeds that the FCC currently considers to be broadband, compared to 94 percent of people living in urban areas have access.

The divide is not just related to population density, but also to factors of income, age, ethnicity, and education. Less than 50 percent of households with income in the bottom 20% use the Internet at home, compared to 95 percent of households with income in the top 20%. The Digital Divide continues to exist and may well be contributing to the *economic divide* that also exists between urban and rural areas of our state.

Broadband quality, availability, cost, adoption and utilization are important issues for local communities, for the state and for the nation.

In general, Oregon's urban areas are served by multiple broadband internet service providers at speeds of 25 Mbps download and 3 Mbps upload or better. Rural and frontier areas of the state are served by fewer providers and typically at slower speeds of at least 10 Mbps download and 1 Mbps upload, or are unserved. Five percent of Oregon's population live in areas that do not have basic broadband (at least 25/3 Mbps). Though the population of the state may be fairly well served, the geography in total is not.

BroadbandNow reported on wired broadband access on tribal lands and included the following findings for Oregon.

Tribal Wired Broadband Access
Broadband Now (August 2020)

TRIBE	STATE	POPULATION	% ACCESS TO WIRED BROADBAND	% ACCESS TO LOW PRICED WIRED BROADBAND
Burns Paiute Tribe	Oregon	6,471	29%	0%
Celilo*	Oregon	19,838	95%	0%
Confederated Tribes of Siletz Indians of Oregon	Oregon	64,215	95%	3%
Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians*	Oregon	58,274	96%	56%

TRIBE	STATE	POPULATION	% ACCESS TO WIRED BROADBAND	% ACCESS TO LOW PRICED WIRED BROADBAND
Confederated Tribes of the Grand Ronde Community of Oregon	Oregon	5,032	71%	29%
Confederated Tribes of the Umatilla Indian Reservation	Oregon	26,892	86%	63%
Confederated Tribes of the Warm Springs Reservation of Oregon*	Oregon	60,671	82%	19%
Coquille Indian Tribe*	Oregon	53,255	93%	70%
Cow Creek Band of Umpqua Tribe of Indians	Oregon	74,194	94%	81%

*Denotes a Tribe that shares at least one zip code with another Tribe. In these cases, 100% of the zip's population and access is attributed to every Tribe present for their calculation.

(1) POPULATION is the total population of all zip codes in which a Tribe is present

(2) PERCENT ACCESS TO WIRED BROADBAND is the percent of the total population of all zip codes in which a Tribe is present that have access to Cable, DSL, or Fiber internet of at least 25 mbps download and 3 mbps upload

(3) PERCENT ACCESS TO LOW PRICED WIRED BROADBAND is the percent of the total population of all zip codes in which a Tribe is present that have access to a standalone wired broadband plan that is priced at $60 or less per month on the regular monthly rate.

Broadband Providers in Oregon

The following is a list of 110 facility-based Oregon broadband providers. An asterisk before the Provider Name indicates that they are 'business-only' broadband Internet service providers.

Provider Name	*URL*
Adaptive Broadband	https://www.adaptivebroadband.org/
Allstream	https://allstream.com
Alyrica	http://www.alyrica.net
Applegate Broadband LLC	http://www.applegatebroadband.net/

Ashland Fiber Network	http://www.ashlandfiber.net
AT&T Mobility LLC	http://www.att.com
*Axxis Communications	http://www.axxistel.com
Beaver Creek Telephone Company	http://www.bctelco.com
BendBroadband	http://www.bendbroadband.com
BendTel	http://www.bendtel.com
Blue Mountain Cable Co.	http://www.bmtvcable.com
Cableone	http://www.cableone.net
Cal-Ore Communications Inc.	http://www.cot.net
Canby Telcom (DirectLink)	http://www.directlink.coop
Cascade Networks, Inc. (by Wave)	https://cni.net/
Cavenet	http://www.cavenet.com/
CenturyLink	http://www.centurylink.com
Charter Communications Inc. (Spectrum)	http://www.spectrum.com
Clear Creek Mutual Telephone Company	http://www.ccmtc.com
CoastCom, Inc. (by Wave)	http://www.coastcom.net
Cogent Communications Group	http://www.cogentco.com
Coltontel	https://web.colton.com
Comcast	http://www.comcast.com
Communications Access Cooperative Holding	http://hrec.coop/services/internet-service
Community Broadband (Yellow Knife Wireless)	http://www.ykwc.com
Cottage Grove WiFi	http://www.cgwifi.net
Country Vision Cable	https://ccvn.com/
Cricket Communications, Inc.	http://www.mycricket.com
Datavision Communications	https://www.datavision.coop/
DirectLink	https://directlink.coop
Douglas FastNet	http://www.dfn.net
Eagle Telephone Systems, Inc.	http://www.eagletelephone.com
*Earthlink, Inc. (Windstream Enterprise)	http://www.windstreamenterprise.com
Eastern Oregon Net, Inc.	http://www.eoni.com
Eastern Oregon Telecom	https://www.eotnet.com/
*EasyStreet Online (Atmosera)	http://easystreet.com
Elgin TV Association	http://highspeedinternet.com/providers/elgin-tv-
Fibersphere	http://fibersphere.net
FireServe	http://www.fireserve.com
Gervais Telephone Company (DataVision Coop)	http://www.datavision.coop

Gorge Networks	https://www.gorge.net/
Helix Telephone Company	http://www.helixtel.net
HYAK	https://hyak.co/
HughesNet	http://www.hughesnet.com
Hunter Communications, Inc.	http://www.hunterfiber.com
*Infostructure	http://infostructure.net
Ispeed Wireless	http://www.ispeedwireless.com
J & N Cable Systems, Inc.	http://demo.jncable.com/
LS Networks	http://www.lsnetworks.net
Lumen	https://www.lumen.com
M2 MachMedia	http://machmedia.net
MINET	http://www.minetfiber.com
Molalla Communications Company	http://molalla.net
Monitor Cooperative Telephone Company	http://monitorcoop.com
Monroe Telephone	http://www.monroetel.com/
Mount Angel Telephone Company (DirectLink)	http://www.directlink.coop
Nehalem Telecommunications Inc.	http://www.rtci.net/Oregon.aspx
North-State Telephone Co.	https://www.northstate.net/
OnlineNW	http://www.onlinenw.com
Oregon Telephone Corporation	http://www.otcconnections.net/
OregonFast.net	http://www.oregonfast.net
Oregon-Idaho Utilities, Inc.	http://www.oiutelecom.net
Outreach Internet	http://www.outreachinternet.com/
PEAK Internet	http://www.peakinternet.com
Pendleton Fiber Company (Wtechlink)	http://wtechlink.com
Peoples Telephone Company	https://sctcweb.com/ptc/
Pine Telephone Systems, Inc.	http://www.pinetel.com/Internet.html
Pioneer Telephone Cooperative	http://www.pioneer.net
PocketiNet Communications Inc	http://www.pocketinet.com
Prinetime Internet Solutions, LLC	http://www.prinetime.net
QualityLife Intergovernmental Agency	http://qlife.net/
*Quantum Communications	https://www.quantum-networks.net/
Reliance Connects	http://www.relianceconnects.com/
Roome Telecommunications Inc.	https://roome.com
Rural Telecom, Inc.	http://www.rtci.net/services
Rural Technology Group, LLC	http://www.ruraltechnologygroup.com

Safelink Internet Services	http://www.safelink.net
SandyNet	http://www.ci.sandy.or.us/sandynet
Scio Mutual Telephone	https://www.smta.coop/
SCS Communications	http://www.sctcweb.com/SCS/index.php
Silver Star Telecom LLC	http://www.silverstartelecom.com
Skycasters	http://www.skycasters.com
Snake River PCS	https://www.facebook.com/Snake-River-PCS-
Spectrum	https://spectrum.com
SpeedyQuick Networks	http://speedyquick.net
Sprint	http://www.sprint.com
St Paul Telephone	https://www.stpaultel.com/
Stayton Cooperative Telephone Company	https://sctcweb.com/
Stephouse Networks	http://www.stephouse.net/
TDS Telecom	http://www.tdstelecom.com/
Tekfinity	http://www.tekfinity.net
T-Mobile USA, Inc.	http://www.t-mobile.com
Tnet Broadband	http://tnet.biz/index.php
Umpqua Broadband	https://umpquabroadband.com/
U.S. Cellular Corporation	http://www.uscellular.com
UnwiredWest LLC (XS Media)	https://xsmedia.com
Upward Access	http://www.upwardaccess.com/
Verizon Wireless	http://www.verizonwireless.com
ViaSat Communications, Inc.	http://www.viasat.com
Windstream Enterprise	https://www.windstreamenterprise.com
Wallowa Valley Networks	https://wvalley.net/
Warm Springs Telecommunications Co.	https://wstel.com/
Wave Broadband	http://www.wavebroadband.com
Webformix Company	http://www.webformix.com/
Whiz To Coho, Inc.	http://whiz.to/
WiLine	https://www.wiline.com/portland
Wtechlink	http://wtechlink.com/
XS Media	https://xsmedia.com
Yellowknife Wireless	http://www.ykwc.com
Zayo Group LLC	http://www.zayo.com
Ziply Fiber	http://www.ziply.com

Broadband Mapping

Problems and inaccuracies of the National Broadband Map continue to be recognized. The latest initiative aimed at addressing National Broadband Map problems comes from the U.S. Senate in the form of the Broadband Data Improvement Act.

Researchers at BroadbandNow estimate that at least 20.7 million people considered to have broadband available to them actually cannot get service. The total unserved population nationwide is at least 42 million – about twice the FCC's estimate, the researchers said. FCC broadband availability data has received widespread criticism and virtually everyone, including the commission, agrees that it overestimates broadband availability. Based on this research, the report estimates a 19.6% error rate for provider/address combinations nationwide. For addresses where multiple providers were checked, 13% of the time none of the providers offered service. BroadbandNow is not the first organization to estimate FCC broadband availability data inaccuracies. Research conducted by broadband provider association US Telecom last year estimated that as many as 38% of locations reported to be served actually did not have service available to them.

Unfortunately, as with many of the issues surrounding the digital divide, the FCC's over reporting disproportionately impacts rural communities. As an example, in South Carolina, where 50 percent of residents live in an urban area, unserved addresses are 30 percent higher than FCC estimates. In Oregon, the FCC reports that 7.7% of the population is unserved. According to BroadbandNow, that number is 15.5%. The broadband mapping and availability data problem needs to be solved.
https://www.telecompetitor.com/report-flawed-fcc-broadband-availability-data-could-leave-20-7-million-people-unserved/

President Trump signed the Broadband DATA Act on March 24, 2020, which requires the FCC to collect and disseminate granular broadband service availability data from wired, fixed-wireless, satellite and mobile broadband providers. FCC Chair Pai issued a statement on the Broadband DATA Act bill.

National Broadband Availability Map Program (NBAM)

Oregon is among a group of over twenty states that is working with NTIA on its National Broadband Availability Map (NBAM) program. The NBAM is a geographic information system platform, which allows for the visualization and analysis of federal, state, and commercially available data sets. This includes data from the Federal Communications Commission, U.S. Census Bureau, Universal Service Administrative Company, U.S. Department of Agriculture, Ookla, Measurement Lab, and the state governments. The mapping platform provides users, including administrators from the 18 participating states, with access to the NBAM and its data to inform broadband projects and funding decisions in their states. The Oregon Broadband Map is still dependent upon the FCC's Form 477 data for its data.

Broadband Affordability in Oregon

Using FCC and other public data sources, US Telecom assessed recent trends in residential fixed broadband pricing between 2015 and 2020 in the United States. Their analysis revealed that during this period, there have been substantial reductions in price for both the most popular and highest-speed broadband internet services, and also significant improvements in broadband speeds. Their finding is that Americans are paying less today for broadband services that are significantly more capable than they were five years ago.

Key findings:

- The most popular tier of broadband service in 2015 (BPI-Consumer Choice) is now priced 20.2% lower and offers 15.7% faster speeds in 2020 on an average subscriber-weighted basis.
- The highest speed offerings in 2015 (BPI-Speed) are now priced 37.7% lower and offer 27.7% faster speeds in 2020 on an averaged subscriber-weighted basis.
- Further, these price reductions run counter to inflation, which has increased consumer costs for overall goods and services by 9.3% over the same five-year period analyzed in this report. When inflation is considered, the real price of the most popular tier of broadband service has dropped by 28.1% since 2015; and the real price of the highest speed broadband service has dropped by 43.9%.
- This combination of declining prices and rising speeds delivers even greater value to consumers—as shown by a declining cost per megabit of connection speed (Mbps) of 37.9% for the most popular service and 56.1% for the highest speed service.

https://prodnet.www.neca.org/publicationsdocs/wwpdf/92820ustelecom.pdf

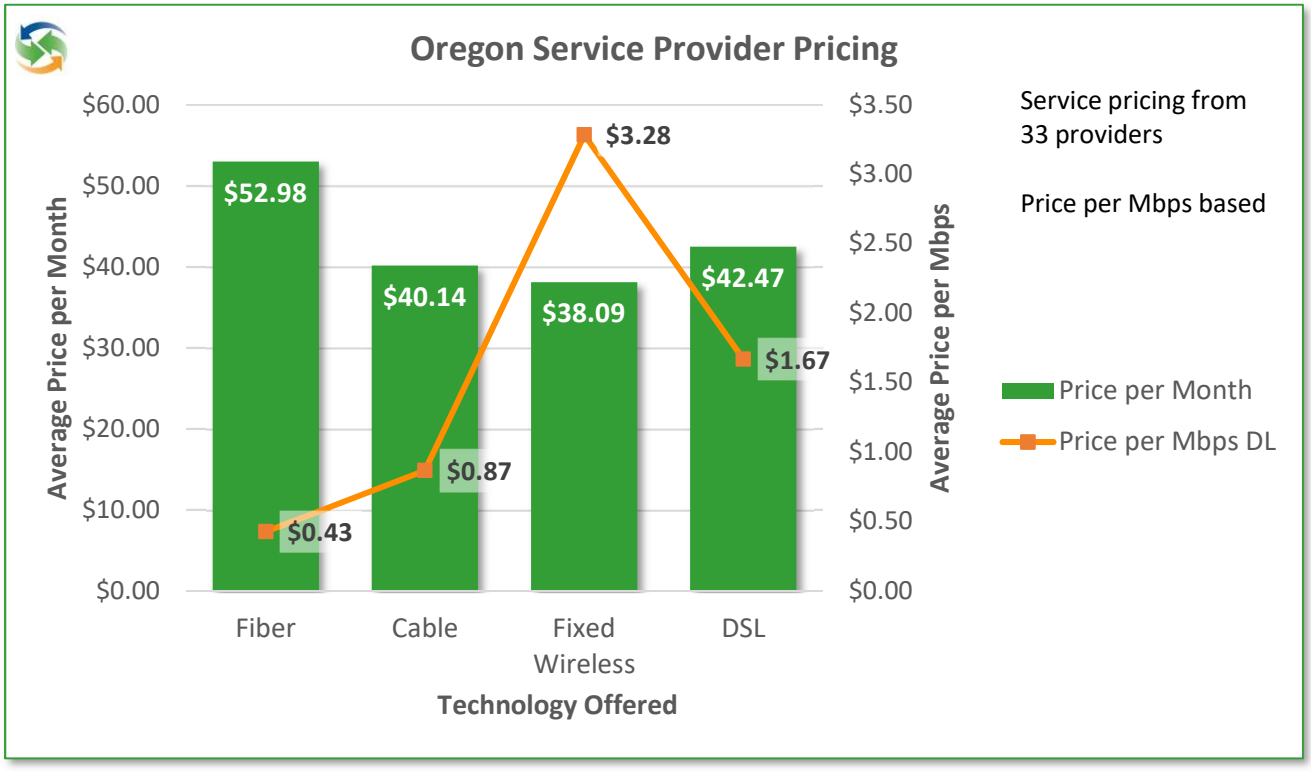
The Phoenix Center for Advanced Legal and Economic Public Policy Studies released an analysis on October 26, 2020, entitled "Are Broadband Prices Declining? A Look at the FCC's Price Survey Data." Phoenix Center chief economist George S. Ford found large price declines across a wide range of broadband speeds, and average broadband prices in the United States declined 36% between 2015 and 2020.
https://prodnet.www.neca.org/publicationsdocs/wwpdf/102620phoenix.pdf

Though the price-value proposition for broadband is improving, nearly half of the U.S. population (45%) lacks access to a low-price wired broadband offering, according to a new broadband affordability report from BroadbandNow, the organization that maintains a detailed database of broadband offerings throughout the U.S. The research also showed that people in rural areas pay higher prices and that, ironically, people in areas with higher average income pay less for service. Researchers defined broadband as service supporting speeds of at least 25 Mbps downstream and 3 Mbps upstream. Low-priced plans were defined as those with prices less than or equal to the 20th percentile of all qualifying broadband plan prices within a given technology such as fiber-to-the-home (FTTH), DSL or cable broadband.

Broadband services are available in Oregon at competitive price points, though prices vary by service area. Though prices for broadband services in Oregon are competitive with other states, cost continues to be a barrier to adoption for many Oregonians.

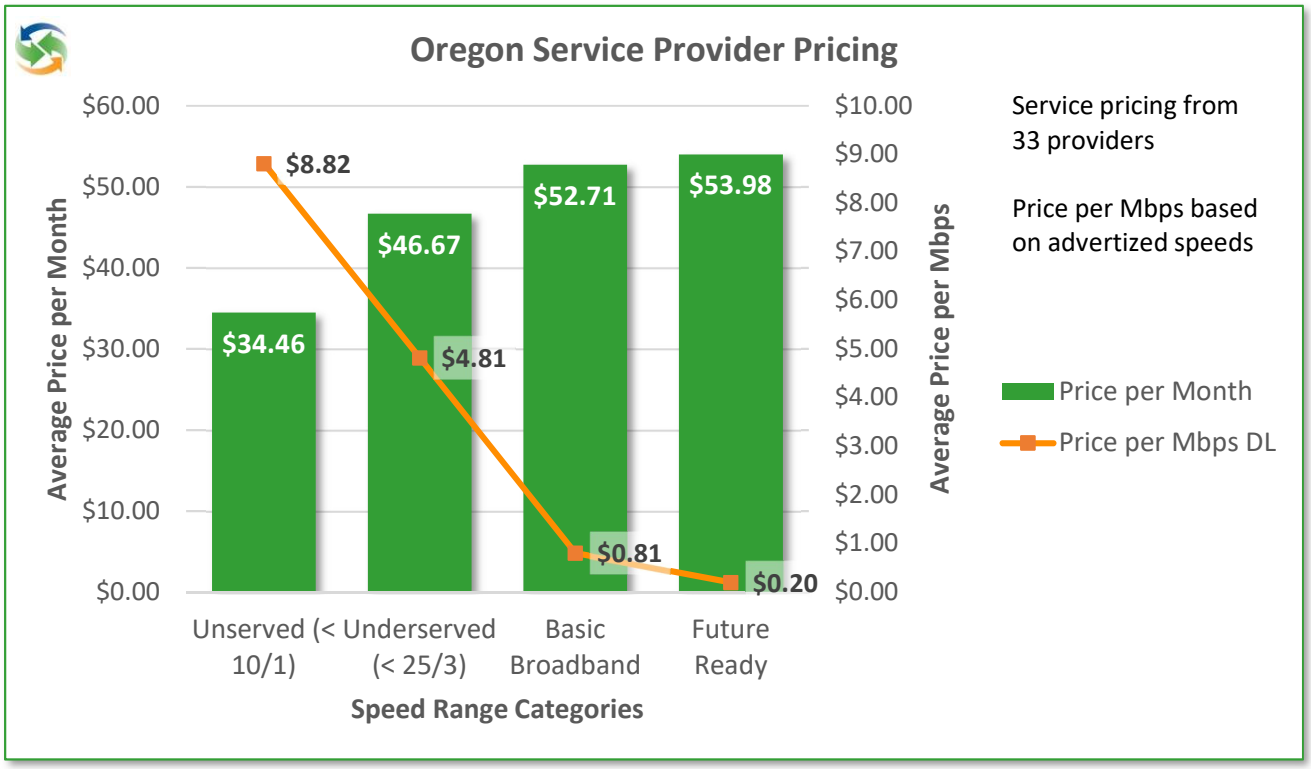
Rural communities have less access to wired broadband internet, and seen when multiple service providers are available, prices tend to be higher. According to a study by BroadbandNow, Zip codes in the bottom 10 percent of population density pay up to 37 percent more on average for residential wired broadband than those in the top 10 percent. Across the 50 states, fiber has the lowest average price per Megabits per second (Mbps) ($0.48), followed by cable ($0.65) and DSL ($1.53). States with median household income of at least $60K have 78 percent low-priced plan coverage on average, compared to only 37 percent for states with less than $60K income.

Broadband service pricing across Oregon averages between $38.00 and $53.00 per month, depending on the technology. The following chart shows the average pricing by technology along with the average cost per Mbps based on the advertised download (DL) speeds. Fiber is the highest cost, while cable, fixed wireless, and DSL are all within five (5) percent of each other. However, all technologies are competitive with each other, and fiber has the lowest cost per Mbps.



Oregon Service Provider Pricing by Technology

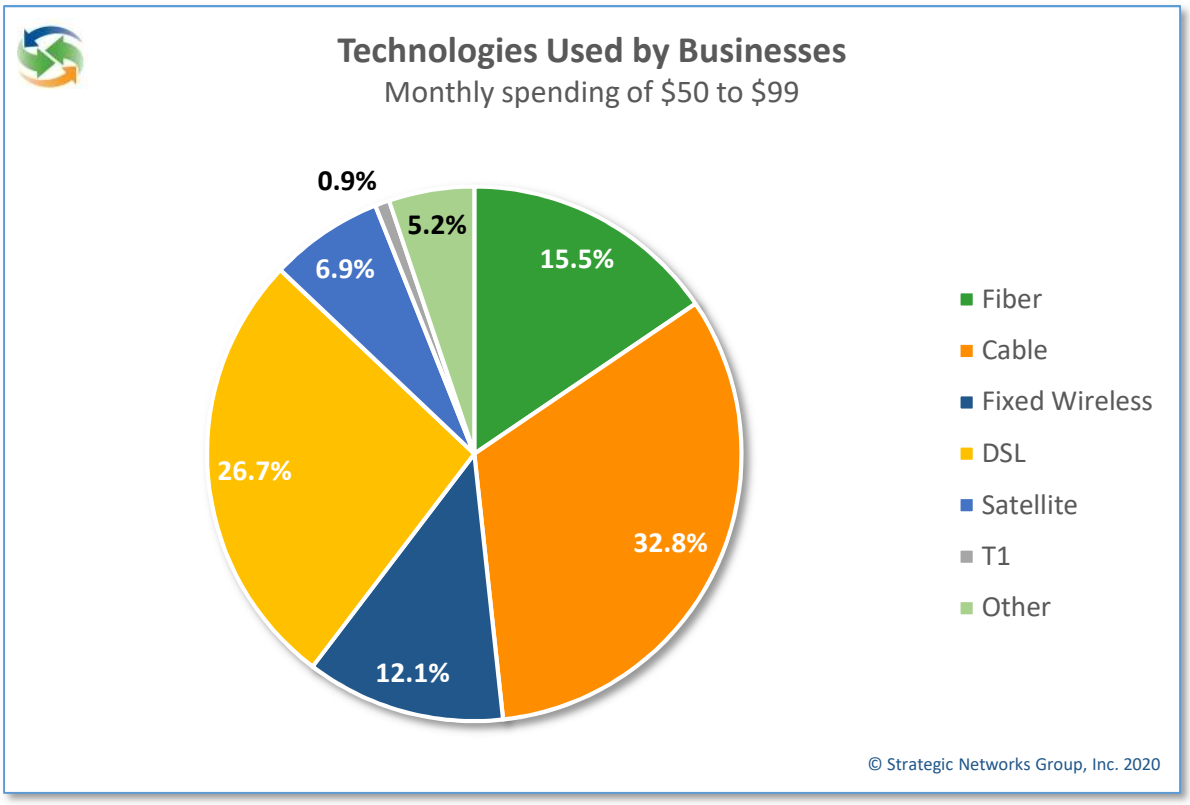
The following chart shows the average price per month for service offered in the different speed block categories. While the unserved (< 10/1) category has the lowest average cost, the average costs for Basic Broadband and Future Ready broadband are very close to each other at $52.71 and $53.98 respectively.



Oregon Service Provider Pricing by Speed

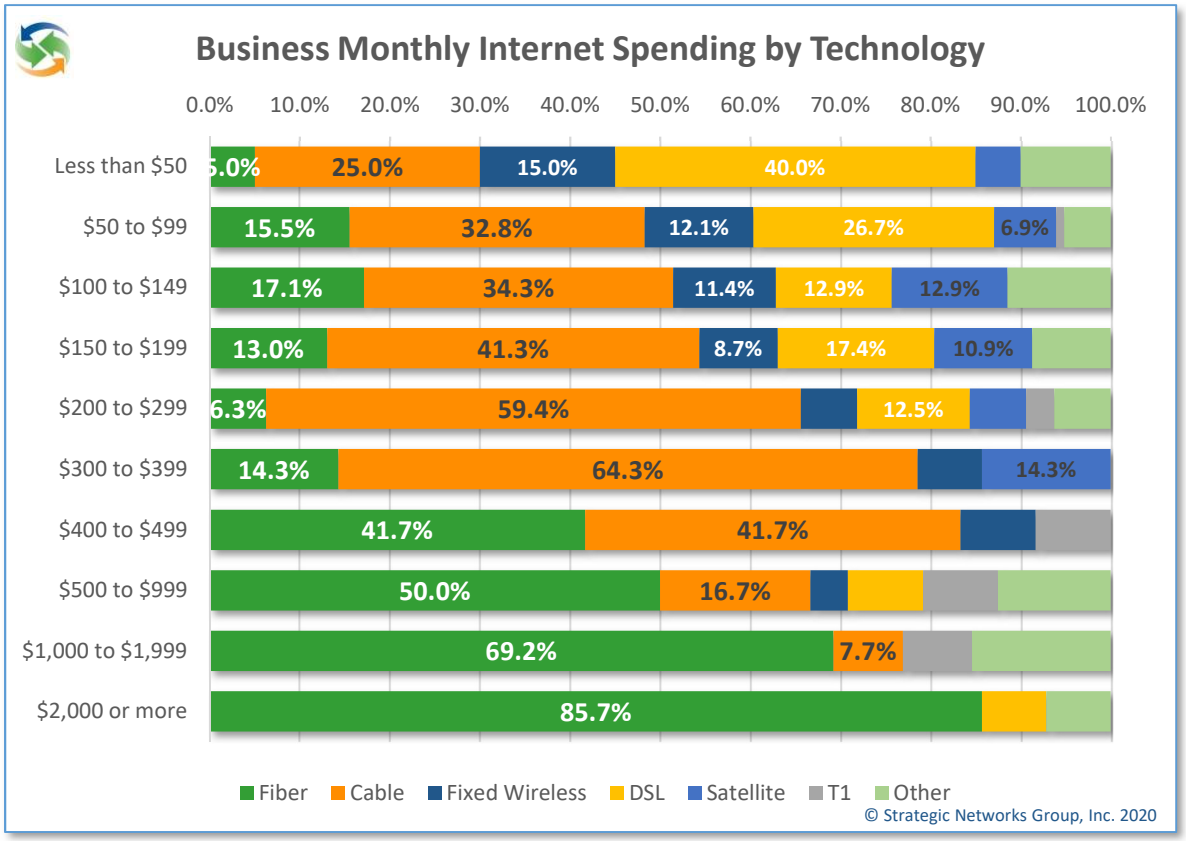
While monthly spending on internet ranges widely from less than $10 to more than $200 per month the majority (55.1%) of households fall in a mid-range of $40-$80. The average household spending on internet service averages at $76.90 per months based on SNG research of Oregon households. Comparison of rural versus urban household monthly spending on internet reveals roughly comparable averages of $73 rural and $79 urban. In part, the lower spending by rural households reflects the fact that fiber that is more expensive is not an available option.
https://www.oregon4biz.com/assets/docs/SNGStudy2020.pdf

The majority of businesses in Oregon (53.1%) spend between $50 -$99 each month for internet access. Within this price range almost 60% of businesses access the internet through either cable (32.8%) or DSL (26.7%) technologies.



Broadband Technologies Used by Businesses

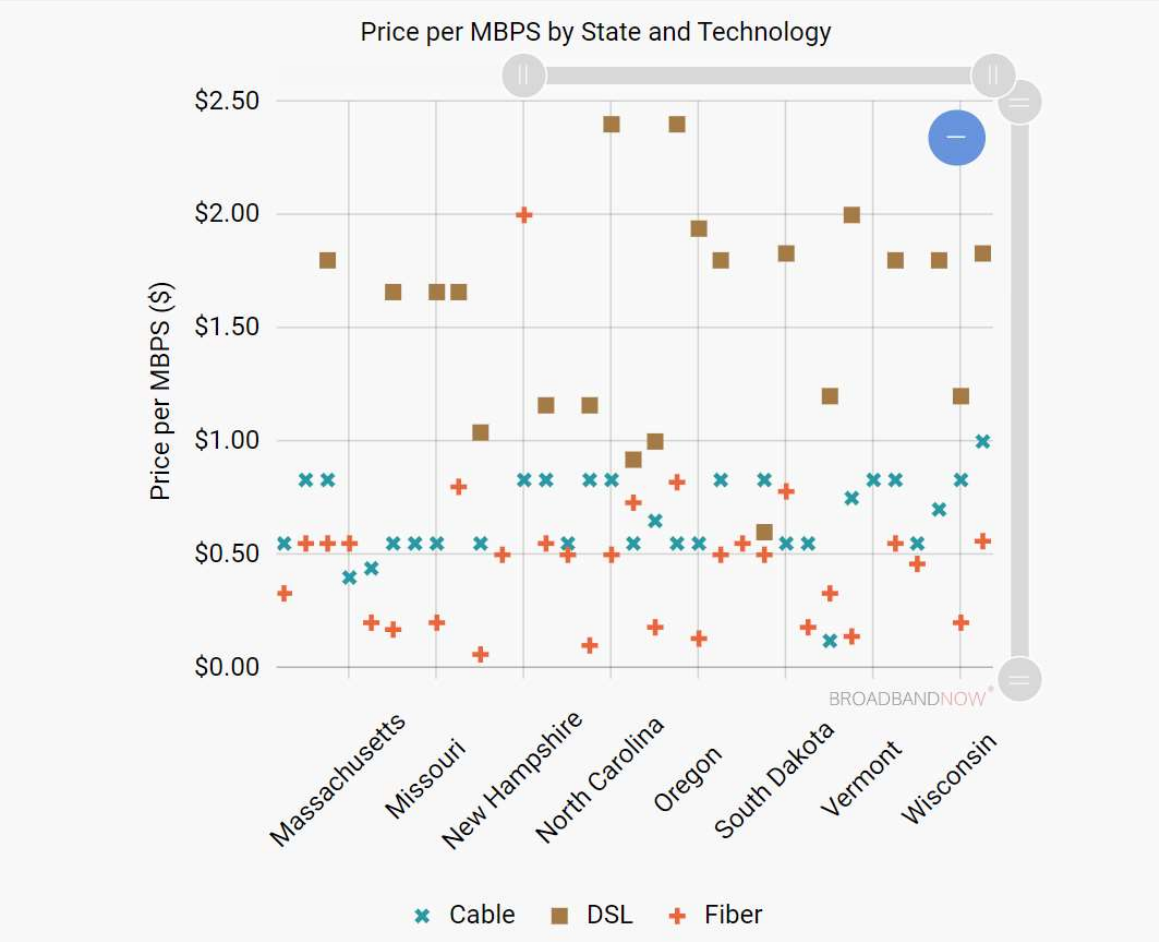
Businesses in the lower monthly cost categories are using a broader variety of technology to access the internet while the higher end of spending range fiber becomes the dominant technology type.



Business Internet Spending by Technology

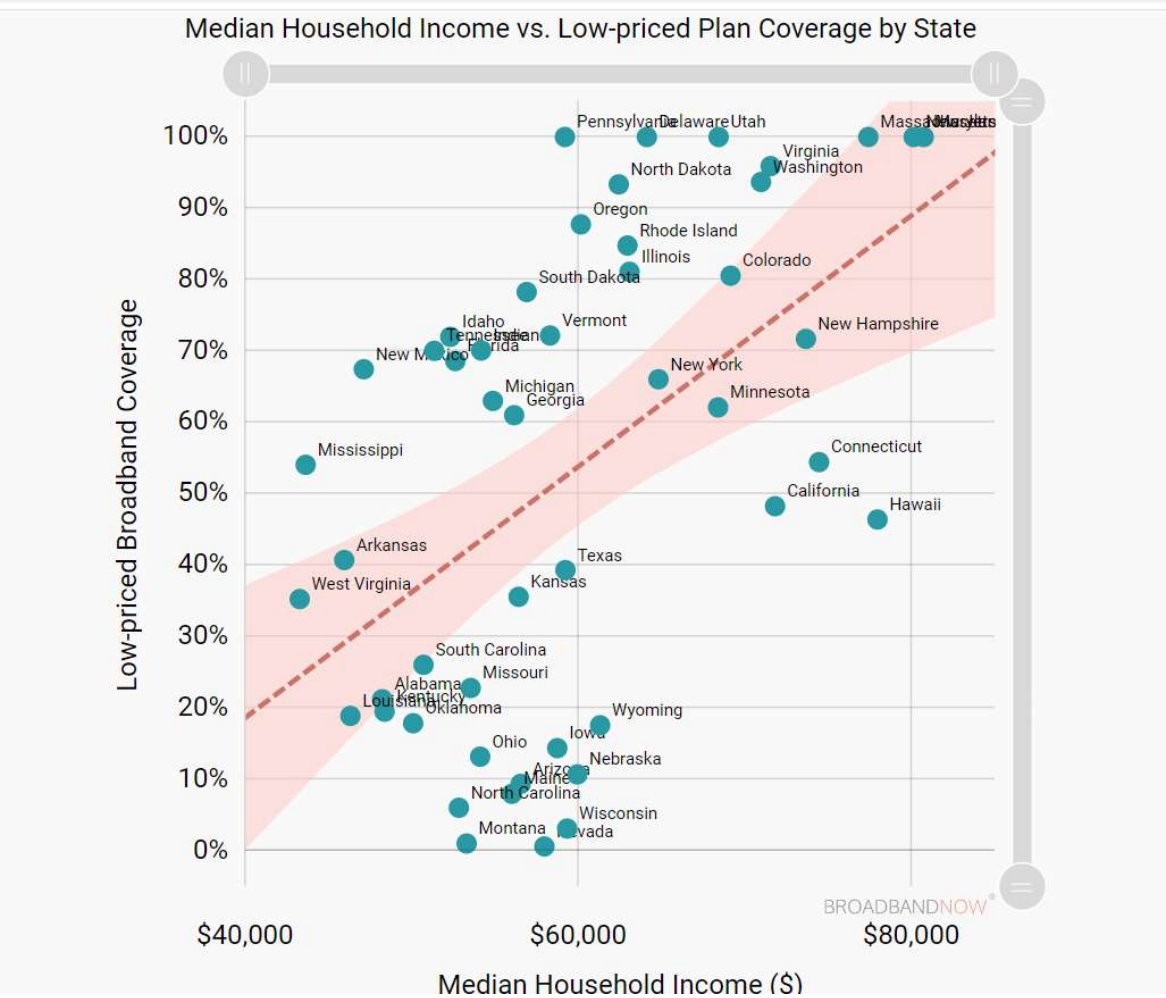
Business spending on internet services is influenced by a number of factors over and above the service subscription rates. Businesses may subscribe to other services in addition to connectivity, such as secure connections and managed services. Larger businesses may have multiple connections for redundancy and/or for network capacity. As indicated in the chart above, businesses spending under $200 per month tend to be smaller business that may use a variety of technologies, depending on what is available. The majority of businesses spend between $50 and $150 per month.

Those businesses that spend more per month on internet services they tend to purchase fiber services where available, both for its capacity and reliability. It is not an accident that larger businesses are often near urban areas and demand high service levels, and providers are also attracted to these localities to serve such customers.



Price per Mbps by State
BroadbandNow

The BroadbandNow broadband affordability report shows a direct relationship between population density and the mean and median lowest price available for 25/3 Mbps broadband service. Overall, that price was about $50 in the most densely populated areas, but in the range of $65 to $68 for the least densely populated areas. That is as much as 37% more for the least densely populated areas, the researchers noted.
https://www.telecompetitor.com/broadband-affordability-report-nearly-half-of-u-s-population-lacks-access-to-a-low-price-offering/



Low-priced Plan Coverage by State

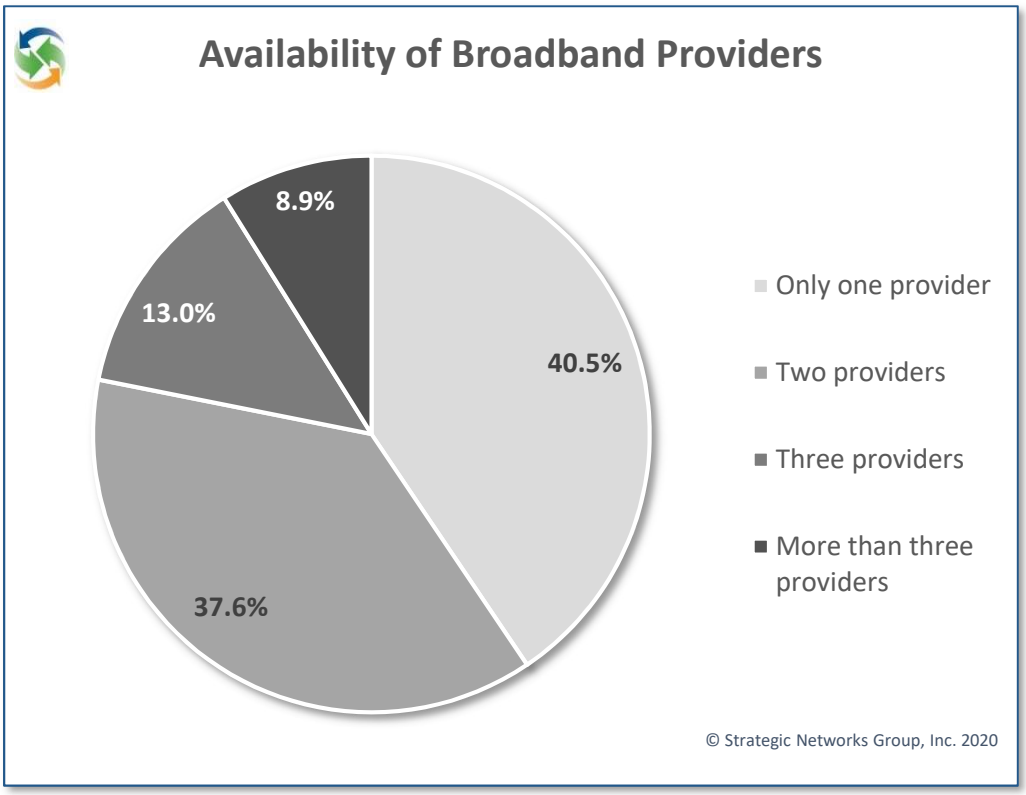
Low-priced plan Coverage in Oregon is 87.8%

[BroadbandNow]

Cost continues to be a barrier to broadband adoption. Approximately 60% of the U.S. population had low-priced wired broadband available to them in the fourth quarter of 2019, according to new broadband affordability research from BroadbandNow. Researchers defined low-priced service to include offerings priced at $60 or less. BroadbandNow maintains a geographic database of broadband services available nationwide. In addition to tracking service costs, the organization tracks broadband availability by speed. Speeds available showed relatively few changes between third quarter and fourth quarter, particularly for higher-speed services. The percentage of Americans that can get gigabit service increased from slightly below 23% to slightly more than 23% and the percentage that can get service at speeds of at least 500 Mbps was unchanged at 67.1%.

The minimum internet service speed that BroadbandNow considers broadband is 25 Mbps downstream and 3 Mbps upstream. The percentage of Americans that had non-satellite fixed service at speeds at or above 25/3 Mbps increased slightly between the third and

fourth quarter of 2019 – from 94.5% to 94.8%. Nationwide, BroadbandNow says that 61% of consumers have access to wired broadband service at 500 Mbps. Oregon is reported as 73% of Consumers having access. There were 12 states where 80% or more of the population could get broadband at speeds of at least 500 Mbps, including four with the availability of 90% or higher.
https://www.telecompetitor.com/broadband-affordability-research-61-of-u-s-can-get-low-cost-service-but-will-this-last/



Availability of Broadband Providers

If having competitive markets for internet services requires at least three internet service providers, then 78 percent of businesses find themselves in uncompetitive markets – with 41 percent having only one provider. Limited choice in service providers is not surprising in areas of low population density, difficult terrain, low take rates, etc. where the high-cost of building and operating networks makes it difficult for providers to develop a strong business case for network expansions – or for justifying an overbuild where infrastructure and service offerings are already available from other provider(s).

Cost of Transport

A key cost of service issue for rural Internet Service Providers is the cost of transport for the communication links that connect rural Oregon to the internet and the rest of the world. The reasons for the higher cost of internet access in rural and remote areas go beyond population density. Since the internet consists of thousands of networks all around the world that are all interconnected at regional internet exchanges, rural providers have to get connections to the nearest exchange in order to allow the flow of traffic from the customer to the worldwide web. The more remote the customer is, the more costly it is to get data to and from the nearest exchange. The cost of transport for the communication links that connect rural Oregon to the internet and the rest of the world is a key cost of service issue and a significant contributor to the cost delta between urban and rural markets for Internet Service Providers. .

Cost of transport and internet connection in Portland is easily acquired at less than $0.10 per megabit, per month; while the current cost per megabit in Pendleton is more than $2.50 per month. To put that in perspective, one Gigabit of internet in Portland costs about $100 per month. In Pendleton, it costs about $2,500. In more remote areas of Oregon, prices for that same Gigabit have been reported at costs up to $10,000 per month.

Finding ways to ensure equity of transport and internet access costs for providers regardless of location is central to ensuring digital equity for all Oregonians. This would have a similar impact as standardizing postage for a letter in the U.S. regardless of where in the country it originated or was sent. That standardization meant that all residents were able to communicate with others at the exact same cost regardless of where they lived within the country."

Broadband Performance

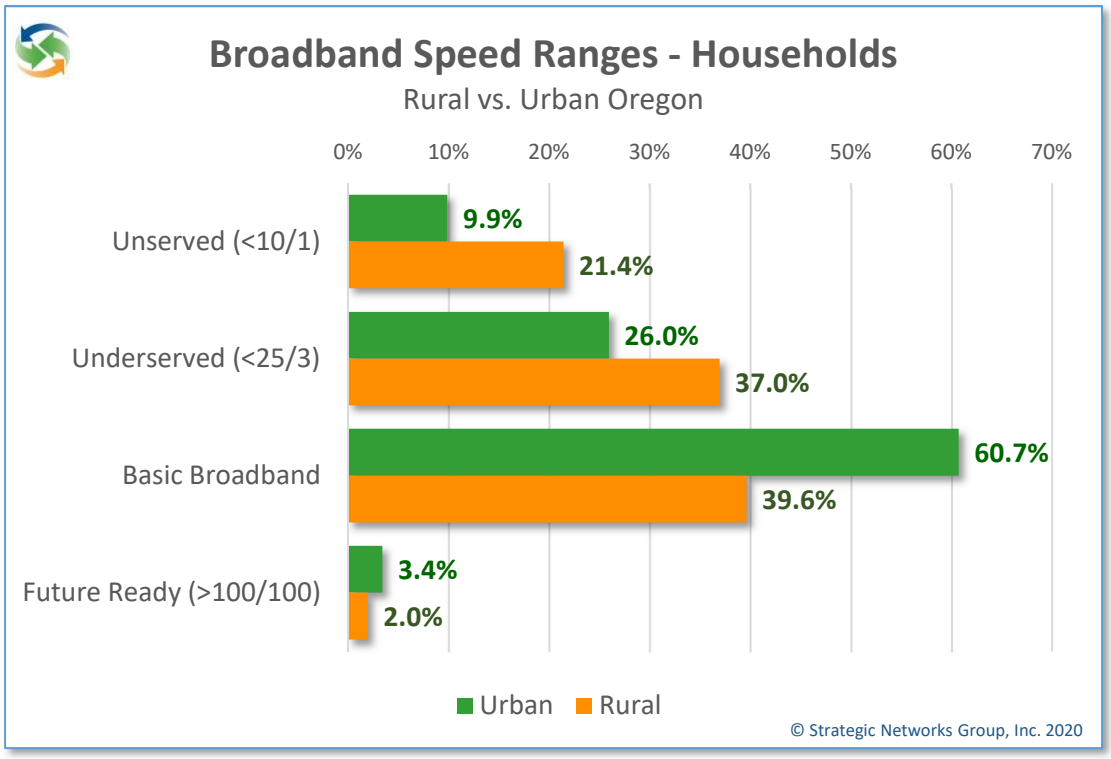
Oregon benefits from over one-hundred facilities based service providers offering services competitive in performance with services available in other states. The events of 2020 have provided a stress test for Oregon's network infrastructure and service resilience. The impact of the pandemic began to hit in March 2020. Telecommunications networks in Oregon have supported the surge so far with no significant reported network degradation of service quality.

Then, in addition to the pandemic, Oregon was hit by over forty-five wildfires that burned telecommunications infrastructure including buildings, equipment, poles and cable. Infrastructure sites were destroyed and other sites suffered power outages and remained in service on back-up generator power. Carrier "deployables, such as Cells on Wheels (COWS) and Cells on Light Trucks (COLTS) were placed into service to restore services in affected areas. Private sector providers coordinated with local government, with state and federal agencies, and supported one another in responding to the disaster repairing facilities and restoring service. Not only was the resilience of the infrastructure demonstrated, so was the resilience of the state's service providers.

Oregon's telecommunications networks are also resilient during time of normal operations, though they reflect the continuing digital divide. Rural household respondents have on average half the download speed of households in urban Oregon. Similarly, rural households in Oregon have upload speeds that are half as fast as that of urban households.

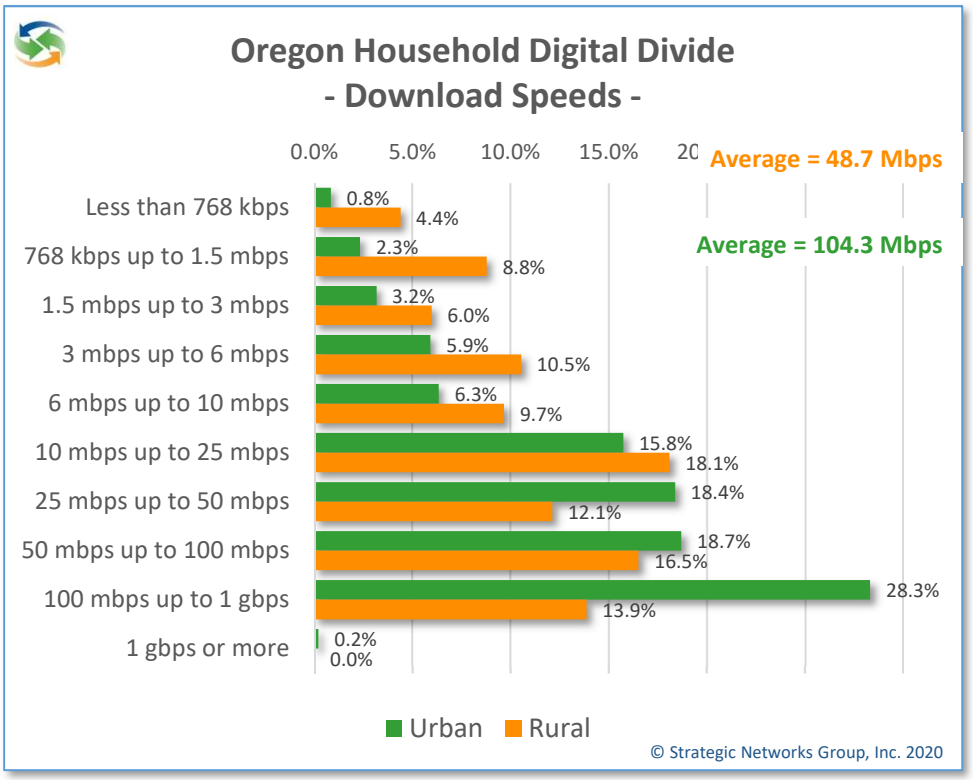
The difference in average upload speeds can be explained by the differing mix in availability of technologies, as well as the vintage of technologies, between urban and rural areas. Urban areas with higher populations and population densities attract more investment by broadband service providers and tend to have better coverage of fiber and cable services than rural areas, as seen in the speed block maps above. These technologies, and competition within these areas, drives the availability of higher speed service offerings.

Rural areas are often left behind in private broadband investment since urban markets generate greater returns on investment for providers. Hence, even Basic Broadband areas often rely on cable, fixed wireless, and DSL services. Cable can provide high download speeds, but is often provisioned where there is sufficient housing density. Fixed wireless can achieve very high speeds with current technology and can serve less densely populated areas where terrain allows.



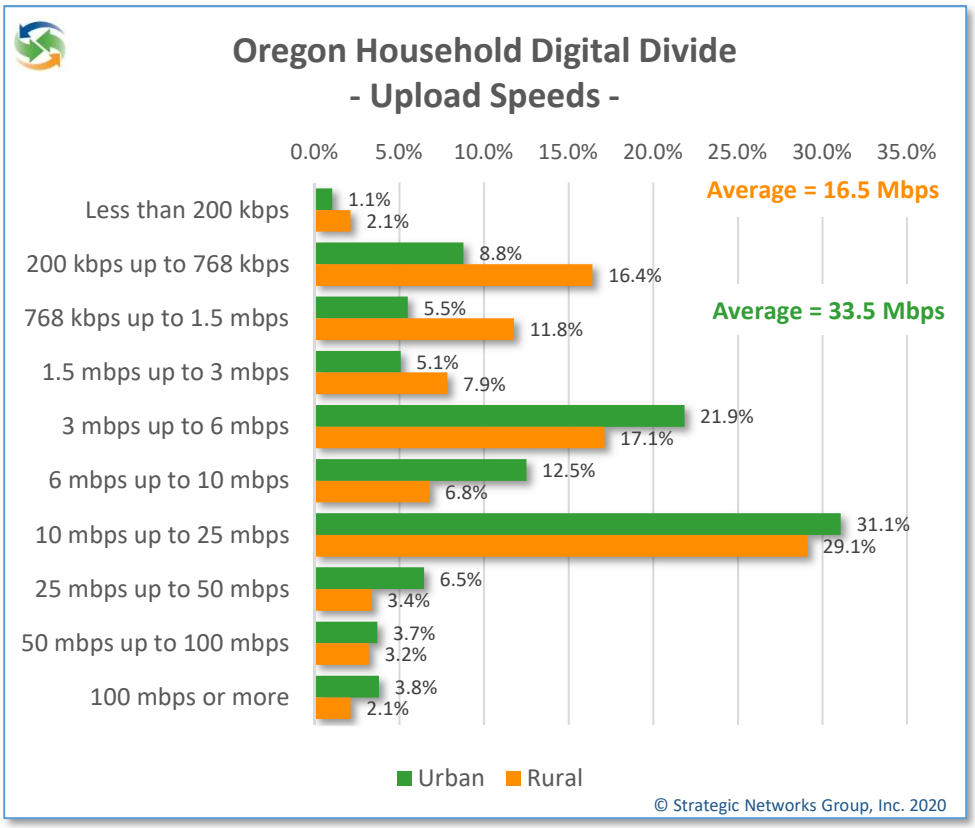
Broadband Speed Ranges - Households

Households in urban areas have significantly higher speeds than rural households.



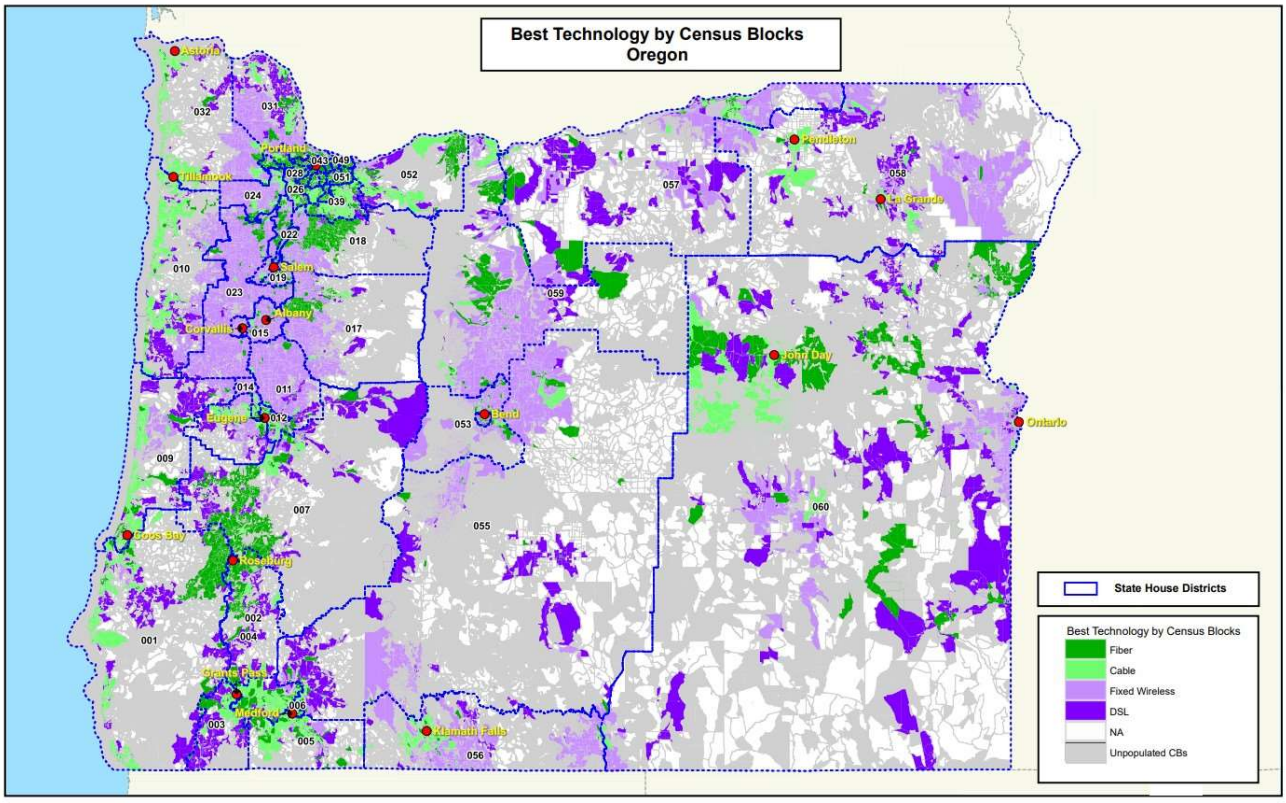
Oregon Household Download Speeds

Upload speeds, illustrated below, are not symmetric with download speeds, but have less of a rural-urban difference.



Oregon Household Upload Speeds

Similar to the fastest speed heat maps, the fiber services census blocks tend to be prominent in the more densely populated areas, as shown in the detailed heat maps below. One significant exception is the areas extending north and south from Bend, which shows extensive use of fixed wireless broadband that is also advertised as Future Ready.



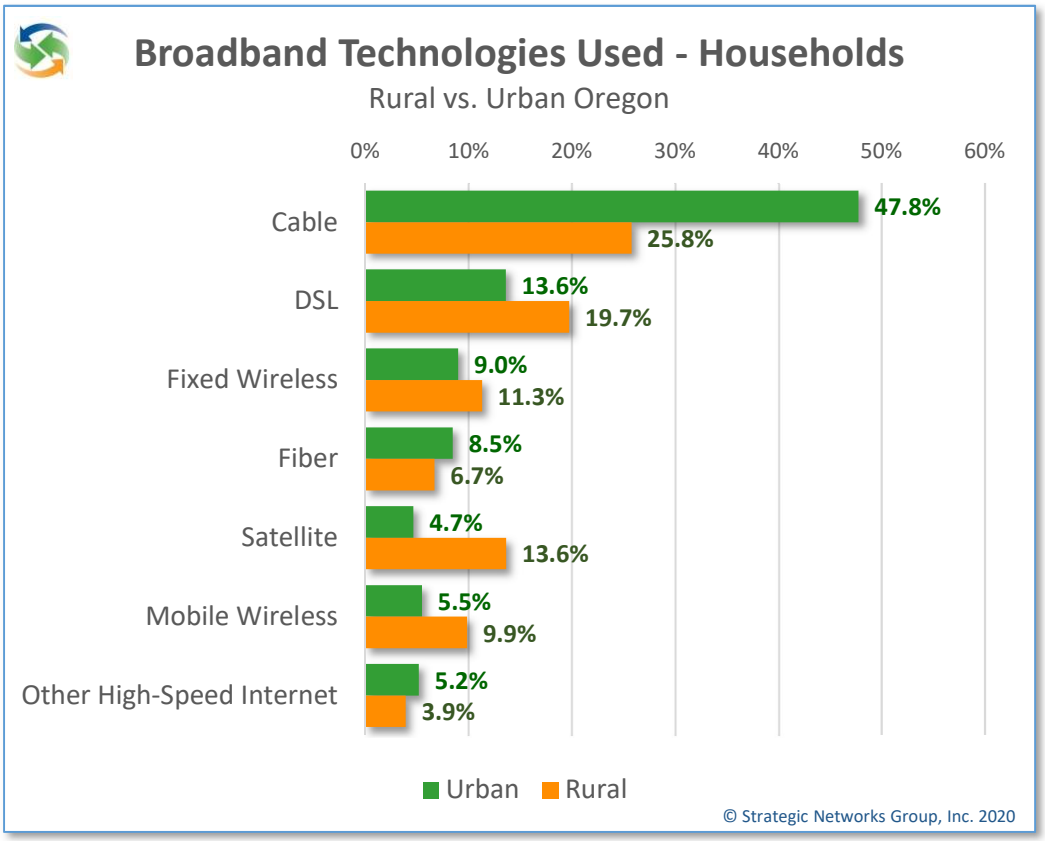
Best Technologies by Census Block Heat Map - Oregon

Internet Service Provider (ISP) Performance

A study by PC Magazine once again highlights how community-run internet service providers (ISPs) offer better, faster broadband than their private sector counterparts. Using data from 356,925 broadband speed tests conducted over a year, PC Magazine recently compiled a list of the fastest ISPs in America. ISPs were then affixed a PC Magazine Speed Index score based on a combination of line performance, upload, and download speeds. When all regional ISPs were compared side by side, the fastest ISP in America was independent California ISP Sonic, with a score of 610.6. Sonic has been working with select California communities to leverage their publicly owned fiber networks. In all, six of the ten fastest ISPs in the States were either directly run by a local community, or involved some form of partnership between the public and private sectors. Community-run networks may not be the answer for every community, but in areas where they are deployed, private ISPs like Comcast often are forced to actually compete and upgrade their networks, improving service across the entire region. "You can rapidly see that nonprofit business models have an important role to play in improving Internet access." https://www.vice.com/en_us/article/7xgne9/locally-run-isps-offer-the-fastest-broadband-in-america

Broadband Technology Adoption and Utilization

In Oregon, 41.6 percent of rural households subscribe to basic broadband or faster and 64.1 percent of urban households subscribe to basic broadband or faster.



Broadband Technologies Used - Households

Broadband Technologies Used by Households

The statewide data collection conducted by Strategic Networks Group for its Oregon study reveals information about what technologies are being used by households. This data is based on a sample of over 3,600 households across all counties in Oregon.

While there are more unserved and underserved households in rural area than urban areas, there continue to be unserved households and underserved households in urban areas. Almost 10 percent of urban households reported using less than 10/1 Mbps services, and another 26 percent of urban households use underserved service levels. However, the majority (60 percent) of urban households use Basic Broadband, compared to less than 40 percent of rural households.

Broadband Utilization

Ten or more connected devices populate the average US broadband home, finds a Parks Associates survey, which defined such devices as consumer electronics, smart home and connected health equipment. Analysts say interoperability with other devices is top of mind for 75% of consumers looking to purchase a smart home device.
https://www.telecompetitor.com/connected-home-research-parks-finds-more-than-10-connected-devices-in-broadband-homes/

According to new research from US Telecom — the percentage of U.S. households that subscribe to broadband continues to climb. They forecast that by the end of the 2020, 84% of U.S. households –will subscribe to fixed broadband, 79% of voice connections will be wireless, and only 6% of U.S. households will use traditional telephone lines. Traditional switched telephone subscriptions are plummeting: They will have fallen from a peak of 186 million in 2000 to 24 million at the end of this year.
https://www.telecompetitor.com/forecast-84-of-u-s-households-to-subscribe-to-broadband-by-year-end/

Current FCC Report on Adoption

FCC Universal Service Monitoring Report

The Federal Communications Commission released its twenty-second Universal Service Monitoring Report on February 4, 2020, prepared by federal and state members of the Federal-State Joint Board on USF and is generally based on information available to us as of September 2019. Oregon was reported as having high-speed Internet Penetration for Households of 87.9% compared to national penetration of 85.1%
https://docs.fcc.gov/public/attachments/DOC-362272A1.pdf

Fixed Internet Access Connections by County - FCC

County Name	Consumer (000's)	Non-Consumer (000's)	All (000's)	Households HHS (000's)	Ratio
Baker County	5	1	5	6.927	0.67
Benton County	32	2	34	35.056	0.90
Clackamas County	135	11	146	155.456	0.87
Clatsop County	16	2	18	15.910	1.01
Columbia County	16	1	17	19.296	0.82
Coos County	22	2	24	26.640	0.81
Crook County	7	1	7	9.339	0.74
Curry County	9	1	10	10.440	0.86
Deschutes County	74	7	81	72.471	1.01
Douglas County	35	3	38	45.026	0.77
Gilliam County	1	0	1	0.848	0.62
Grant County	2	0	3	3.294	0.69
Harney County	2	0	2	3.157	0.65
Hood River County	8	1	9	8.539	0.94
Jackson County	69	7	76	87.417	0.79
Jefferson County	7	1	7	7.892	0.84
Josephine County	26	2	28	35.978	0.72
Klamath County	21	2	23	27.402	0.77
Lake County	2	0	2	3.494	0.59
Lane County	124	11	135	150.780	0.82
Lincoln County	22	2	24	21.110	1.02
Linn County	39	3	42	47.030	0.84
Malheur County	6	1	7	10.138	0.64
Marion County	97	8	105	116.861	0.83
Morrow County	3	0	3	3.959	0.70
Multnomah County	281	30	311	321.968	0.87
Polk County	25	1	27	29.692	0.85
Sherman County	0	0	1	0.736	0.66
Tillamook County	13	1	14	10.816	1.18
Umatilla County	17	2	19	26.886	0.64
Union County	7	1	8	10.481	0.69
Wallowa County	2	0	3	3.165	0.72
Wasco County	8	1	9	10.266	0.77
Washington County	187	16	203	216.507	0.86
Wheeler County	0	-9999	-9999	0.661	0.47
Yamhill County	31	3	33	36.197	0.84

Fixed Internet Access Connections by County - FCC
[Posted October 2, 2020]

https://www.fcc.gov/general/form-477-county-data-internet-access-services

Growing Broadband Adoption

Nearly 500,000 new broadband Internet subscribers joined the rolls of the largest U.S. cable and telephone providers in the second quarter of 2018, according to new research from Leichtman Research Group, Inc. (LRG).

In the same period last year, there was a net gain of 235,000 subscribers. According to the LRG report, the top broadband providers now represent 95% of the market, with the top cable companies having 62.9 million broadband subscribers, and top telephone companies growing to 34.2 million subscribers.

- The top cable companies added about 585,000 subscribers in the second quarter of the year – compared to about 465,000 net new subscribers in the second quarter of 2017.
- Cable company gains were telephone company losses. The telcos had a net loss of 130,000 broadband subscribers in the second quarter. However, that figure was far better than the 230,000 subscribers lost in the second quarter a year ago. Telcos have had net broadband losses in each of the past nine quarters
- Over the past year, broadband providers added nearly 2.2 million net new subscribers, less than the 2.5 million added during the same period a year ago.

https://www.telecompetitor.com/report-nearly-500k-added-broadband-in-2q18-almost-double-from-the-same-period-last-year/

Business

Electronic commerce or E-commerce is the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the internet. These business transactions occur as either business-to-business, business-to-consumer, consumer-to-consumer or consumer-to-business. It has become the key business model for the global information age economy.

While e-commerce retail sales represent just 10% of the total retail sales made in Oregon in 2018, the level of on-line sales jumped 50% from just three years earlier.
https://www.portlandoregon.gov/transportation/article/751002

The global e-commerce market for all goods surpassed $2 trillion in 2017 and it is expected to hit $4.135 trillion in 2020 and more than $6.5 trillion by 2023. It is expected that by 2040, 95% of all purchases will be via ecommerce. The United States has the highest ecommerce penetration rates, with around 80% of all internet users making at least one purchase, yet it is estimated that nearly half of American small businesses do not have a website.
https://www.oberlo.com/ecommerce-wiki/ecommerce

According to new data from IBM's U.S. Retail Index, the pandemic has accelerated the shift away from physical stores to digital shopping by roughly five years. Department stores, as a result, are seeing significant declines. In the first quarter of 2020, department store sales

and those from other “non-essential” retailers declined by 25%. This grew to a 75% decline in the second quarter.

The report indicates that department stores are expected to decline by over 60% for the full year. Meanwhile, e-commerce is projected to grow by nearly 20% in 2020. The report suggests that department store retailers will need to pivot to omni-channel fulfillment capabilities in order to remain competitive in the new environment. Specifically, they will need to drive traffic to their stores through services like buy online and pickup in store (BOPIS), and will need to offer an expanded set of ship-from-store services.

Large retailers like Walmart and Target have embraced Omni-channel fulfillment to their advantage. Both reported stellar earnings thanks to their earlier investments in e-commerce. In Walmart’s case, the pandemic helped drive e-commerce sales up 97% in its last quarter. Target set a sales record as its same-day fulfillment services grew 273% in the quarter. Both retailers have also invested in online grocery, with Walmart now offering grocery pickup and delivery services, the latter through partners. Target has also just now rolled out grocery pickup and runs delivery through Shipt, a delivery application.

Amazon, naturally, has also benefited from the shift to digital with its recent record quarterly profit and 40% sales growth.

The shift away from physical stores was already underway, but it has now jumped ahead in time as to where it would be if a health crisis had not occurred. This is a similar trend to what other industries have seen as well, including things like streaming/cord cutting, gaming and social video apps and more as the internet continues to change how we live and work.
https://techcrunch.com/2020/08/24/covid-19-pandemic-accelerated-shift-to-e-commerce-by-5-years-new-report-says/

Several of Oregon's more than 70 enterprise zones have received special status to further encourage electronic commerce (or "e-commerce") investments.

Electronic Commerce-Designated Enterprise Zones and Other Areas

Beaverton	Effective July 3, 2014
Bend	Effective July 1, 2010
East Portland	Effective October 11, 2012
Dallas/Independence/Monmouth	Effective July 3, 2014

Greater Redmond Area	Effective April 1, 2008
Gresham	Effective October 6, 2015
Hermiston	Effective July 3, 2014
Jackson County	Effective July 5, 2018
Portland	Effective April 23, 2009
Roberts Creek	Effective July 11, 2016
Salem	Effective August 8, 2006
Sandy	Effective July 3, 2017
Springfield Community	Effective July 3, 2014
West Eugene	Effective July 18, 2017
West Valley	Effective July 15, 2019
City of North Plains* (electronic commerce city)	Effective March 4, 2002

*A total of 15 Enterprise Zones may be designated. In addition, there is one "electronic commerce city," where being engaged in electronic commerce is the only way that a business's new investment is eligible for the property tax abatement.

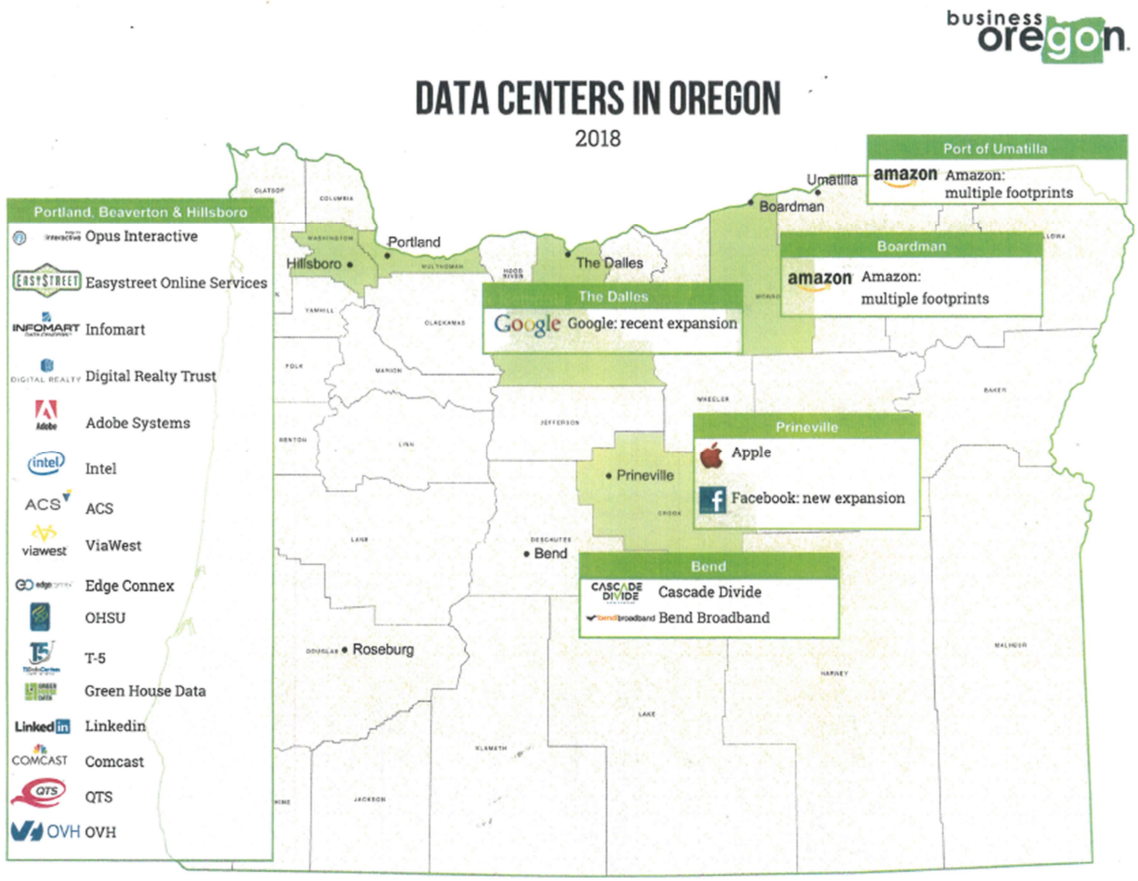
Local Property Tax Abatement

In an e-commerce enterprise zone, "being engaged in electronic commerce" is an eligible activity for the standard property tax abatement. Many such operations would be eligible anyways in any enterprise zone, for example, by satisfying criteria for an eligible administrative or call center. In a designated e-commerce area, local retail is less restricted, and third-party vendors who facilitate the use of the internet by others for business transactions are also eligible.

Additional newly installed personal property—i.e., readily movable machinery and equipment—can also qualify. Usually, such property that costs between $1,000 and $50,000 per item qualifies only if used in the production of tangible goods, but in an e-commerce enterprise zone or city, using it for electronic commerce similarly allows for the exemption.

Qualified new investments also can comprise operations connected to the e-commerce activity, which include not only otherwise eligible activities such as shipping or storage facilities to fulfil orders arising from e-commerce, but it would also extend to administrative, technical, or other functions that are integral to the retail or commercial transactions that are conducted or supported through electronic commerce inside the designated area.
https://www.oregon4biz.com/Oregon-Business/Tax-Incentives/Enterprise-Zones/Electronic-Commerce/

Aside from e-commerce, competitive quality access to broadband networks is now essential for businesses of any size if they want to be able to effectively interact with customers, suppliers, and sources of information.



Data Centers in Oregon

Data Centers

Data centers have emerged as a prominent industry sector in the state. Oregon is viewed by the industry as a prime location for data centers due to its robust telecommunications infrastructure, tax structure, climate, cost of electric power, and availability of water. There

are currently 25 data centers in Oregon. There are 20 colocation facilities, 24 cloud nodes, 1 Internet exchange (IX), and six disaster recovery and business continuity (DRBC) sites. Marquis companies such as Google, Amazon, Facebook, and Apple serve as anchor tenants giving Oregon the reputation of being a "digital state."
https://www.datacenters.com/united-states/oregon

E-commerce and using broadband internet access to communicate with customers and suppliers and as the platform on which to conduct business transactions are trends that are transforming the global economy and underscore the importance of broadband telecommunications as essential infrastructure for our state, particularly for rural and frontier areas of the state.

Health Care

The impact of the COVID-19 pandemic on healthcare delivery has been dramatic. The promise of telehealth was immediately realized, initially as an emergency response to limit exposures, reduce disease transmission, and to preserve limited supplies of Personal Protective Equipment (PPE). And now, a wide acceptance and desire for telehealth services will be part of the "new normal". Per Centers for Medicare and Medicaid Services Administrator Seema Verma:

> *"I think the genie's out of the bottle on this one. I think it's fair to say that the advent of telehealth has been just completely accelerated, that it's taken this crisis to push us to a new frontier, but there's absolutely no going back."*
> The Doctor Will Zoom You Now - The pandemic lockdown is proof of concept for mass telemedicine. *Wall Street Journal, April 26, 2020*

Telehealth/telemedicine is the provision of healthcare services and the delivery of clinical care to evaluate, diagnose and treat patients remotely at a distance using telecommunications technology.

OBAC member Dr. Miles Ellenby reported that as a result of the pandemic, we have seen a transition from the early-adopter, champion phase for telehealth to virtually universal adoption. Years of telehealth program development, public policy reform, and change management took place in a period of weeks. Prior to the crisis, Oregon Health and Science University Hospital (OHSU) was conducting about one percent of its outpatient clinical visits using telemedicine, that level jumped to approximately 70 percent within 3 weeks. The fact that OHSU had an existing telehealth program and infrastructure enabled it to ramp up quickly in response to the crisis. Prior to COVID, about 2% of PacificSource Health Plan's primary care visits were held via telehealth, but within a 35-day period that jumped to 71%. As stay at home orders are relaxed and more is learned about how to decrease disease transmission, more clinical encounters are taking place in person. However, telehealth encounters are now holding at between 30% and 45% of total volume (varies by health system, medical specialty, etc). Most importantly, the relaxation of

restricting federal regulations and improvements in reimbursement policy allowed health care providers to respond to the crisis. It is expected that some of the regulatory easing will be rolled back when the public health crisis ends, however there is every expectation of wider usage going forward. In addition to the rapid growth of ambulatory telehealth, digital tools have been deployed on the inpatient side, again to decrease exposures and transmission, as well as to preserve PPE. Another trend of note is the growth of virtual ICU programs to support community hospitals who have inadequate staffing for 24/7 coverage. Moving ahead, a significant amount of work will be needed to explore patient and staff experiences, efficiency of the modalities, quality assurance, and defining best use cases when we emerge from the Public Health Emergency.

The number of in-office visits to primary care physicians in the United States were 50% lower in the spring compared with the same periods in 2018 and 2019, a study published by the Journal of the American Medical Association, JAMA Network Open, found. At the same time, more than 35 million telemedicine consultations -- in which patients communicate with their doctors by phone or online -- were held in April, May and June 2020, a 3,000 percent increase over previous years, the data showed. In the second quarter of this year -- April, May and June -- telemedicine consultations, which accounted for approximately 1% -- or about 1.4 million per quarter -- of all primary care appointments in 2018 and 2019, increased to just over 4 million visits.
https://www.upi.com/Health_News/2020/10/02/Rates-of-key-tests-drop-with-fewer-doctor-visits-more-telemedicine-amid-COVID-19/9521601645019/

FCC COVID-19 Telehealth Program

The Federal Communications Commission voted to adopt a $200 million telehealth program to support healthcare providers responding to the ongoing coronavirus pandemic. Congress appropriated the funds as part of the CARES Act. Through the COVID-19 Telehealth Program, the FCC helped healthcare providers purchase telecommunications, broadband network connectivity, and devices necessary for providing telehealth services. Funding applications from healthcare providers were processed on a rolling basis. The FCC also adopted final rules to stand up a Connected Care Pilot Program. This separate three-year Pilot Program will provide up to $100 million of support from the Universal Service Fund (USF) to help defray health care providers' costs of providing connected care services and to help assess how the USF can be used in the long-term to support telehealth.
https://docs.fcc.gov/public/attachments/DOC-363498A1.pdf

Telehealth Reimbursement

Medicare benefits for telehealth have been increased due to the COVID-19 crisis. The Centers for Medicare and Medicaid Services expanded its Medicare telehealth coverage during the Public Health Emergency to enable more patients to get virtual care services from their doctors without having to travel to a healthcare facility. Physicians, nurse practitioners, clinical psychologists and licensed clinical social workers can now deliver

telehealth to Medicare beneficiaries in any healthcare facility, including a physician's office, hospital, nursing home or rural health clinic, as well as to their homes.

Medicare beneficiaries will be able to receive care, including common office visits, mental health counseling and preventive health screenings via remote technology. This helps ensure they do not travel to clinics and hospitals where they could put themselves or others at risk of COVID-19.

Clinicians can bill immediately for dates of service starting March 6, 2020 per CMS officials, with telehealth services paid under the Physician Fee Schedule at the same amount as in-person services. Medicare coinsurance and deductibles still apply.

The Health and Human Services Office of Inspector General is also adding flexibility for healthcare providers to reduce or waive cost-sharing for telehealth visits paid by federal healthcare programs. Before that, Medicare was only allowed to pay clinicians for telehealth services in certain circumstances, such as for patients in remote locations, and generally did not cover home-based virtual consults.

Telehealth Alliance of Oregon (TAO)

The Telehealth Alliance of Oregon (TAO) has been working to distribute telehealth information and resources as health care providers try to adapt. TAO is a non-profit membership organization. TAO began in 2001 as a formal committee of the Oregon Telecommunications Coordinating Council. The Council was created by the legislature and served as advisors to the Governor and the legislature regarding telecommunications in Oregon. At the time, there was intense interest in telemedicine and healthcare workforce education in the state. The committee soon realized that there were enormous challenges to be dealt with if telehealth was to grow beyond the handful of grant-funded programs scattered throughout the state. The committee believed that they would be better able to accomplish the tasks before them if they formed a separate organization. TAO was incorporated in 2005 and was recognized as a 501(c)(3) by the IRS in 2007. TAO is governed by a 15 member volunteer board and currently has no paid staff.

TAO's Vision: *Access to affordable quality healthcare for all Oregonians*

TAO's Mission: *To advance telehealth knowledge, practice and policy in Oregon*

TAO's Goals:

- Improve access to high quality health care and healthcare workforce education through the use of broadband telecommunications;
- Promote collaborations that advance the use of telehealth to deliver affordable high quality health care;
- Disseminate information about telehealth best practices, policies, training, and funding opportunities;

- Provide access to technical assistance for existing telehealth programs or healthcare providers seeking to establish telehealth programs in Oregon.

TAO was instrumental in the passage of:

- Oregon SB 622 in 1999 that created six large interconnected fiber rings throughout the state;
- Oregon SB 24 in 2009 that required private payers to reimburse for telemedicine; and
- Oregon SB 144 in 2015 that required service parity for private providers and eliminated the originating site requirement.
- In 2009, TAO coordinated a successful application to the FCC and received over $20 million for the development of the Oregon Health Network.
- TAO offered an annual conference from 2005 to 2019.
- TAO partnered with Northwest Regional Telehealth Resource Center (NRTRC) for a conference in Portland in 2020, but due to COVID-19 ended up offering the conference virtually. In 2021, TAO will again partner with the NRTRC to present a virtual conference. TAO will continue to develop and expand its partnership with NRTRC.
- TAO also partners with the Oregon Office of Rural Health to help advance telehealth in rural areas.
- TAO continues to provide telehealth information to all that request it both by providing information directly, or by sharing resources that can provide the needed information.

More information about TAO may be found at www.ortelehealth.org.

OCHIN

Another key Oregon telehealth non-profit is OCHIN, which announced earlier this year that it will receive three years of federal funding totaling $8.1 million to support nearly 100 health centers across the country. The award is part of the Health Center Controlled Network (HCCN) grant program through the Health Resources and Services Administration. The award will help OCHIN to leverage technology to improve patient care coordination, reduce provider burden and increase connectivity to state immunizations registries, prescription drug monitoring programs, and Health Information Exchanges. This three-year award makes OCHIN the largest HCCN in the nation, reaching primary care sites for more than two million patients. OCHIN will provide critical training and technical assistance across 14 states

OCHIN is one of the largest and most successful health information and innovation networks with solutions that improve the integration and delivery of health care services. OCHIN is now celebrating its 20th year as a Portland-based non-profit community-based health information technology organization. OCHIN is one of the largest and most successful innovation networks and a national leader in promoting high-quality health

care in historically underserved areas across the country, also operating the California Telehealth Network. Serving more than 500 organizations and 20,000 providers across the nation with solutions that improve health care delivery and integration, OCHIN started with a commitment to provide a growing community the innovative tools, research, knowledge, and voice needed to participate in the rapidly changing national health care landscape. OCHIN supports Federally Qualified Health Centers, correctional facilities, Ryan White Centers, and public health agencies.

OCHIN helps hundreds of clinics and hospitals connect to high-speed medical grade broadband networks with subsidy funding from the FCC Healthcare Connect Fund (HCF). This Federal Communications Commission (FCC) program dedicates almost $600 million annually to the expansion of access by health care providers to robust broadband networks. Specific to Oregon, OCHIN currently manages the Healthcare Connect Fund Program for over 319-member site locations (50 hospitals, 182 clinics, 87 FQHCs) throughout the state of Oregon and United States. Current funding for Oregon members exceeds $5.5 million annually, which assists in subsidizing the recurring monthly support necessary for broadband connectivity. The total amount of funding applied for OCHIN members is up 9.2% in Funding Year 2020. The number of participating OCHIN member locations is up 9.6% in Funding Year 2020.

OCHIN also supports the broadband infrastructure needs of the most rural and remote health care provider facilities throughout the state. In response to COVID-19, OCHIN ramped up its telehealth support to assist providers roll out new programs to serve their patients virtually. Despite reaching 50% of all visits delivered fully virtually, this put a great strain on OCHIN and its member providers to rapidly upgrade and acquire costly technology. To help, OCHIN applied for and was awarded $2 million through the FCC's COVID-19 Telehealth Program, supporting the distribution of virtual clinic-at-home packages, remote patient monitoring packages, and other supplies to help providers better serve their patients during the pandemic of 2020.

Coronavirus exacerbated pre-existing disparities in broadband connectivity and technology, and their impact on access to care. Using its practice-based research network, OCHIN is consistently pulling together lessons from COVID-19 to share widely and bring more attention to the gaps in broadband, and the need to increase funding to bridge these gaps and consolidate efforts to expand connectivity nationally.

Analyzing Electronic Health Record data from more than 500 community health center clinics across multiple states, OCHIN seeks to improve care for the underserved nationally. Priority areas include:

- National frameworks and National Standards—focuses on the way patient records are transmitted, and its impact on coordination and safety of care, privacy and security of patient data, and lack of standardization of data and how it impacts metrics and research.

- Reimbursement—understanding the effects of reimbursement on telehealth utilization and sustainability, with COVID-19 providing a deeper insight into how payment parity affects telehealth deployment and participation.
- Social Determinants of Health—evaluates how to capture social determinants—factors in everyday life that impact our health—to improve care for disadvantaged patients and expand networks to provide patients with the resources they need. Access to broadband for patients is now considered a social determinant of health.
- Health Care Transformation—dedicated to improving health care delivery and outcomes through the development, application, and modification of health care tools to support evidence-based care and allow providers to deliver care at the top of their practice.
- Health Policy—examines the effects of federal and state policies on health care access, delivery, and outcomes in order to inform future policy and improve health in our communities.

More information about OCHIN may be found at www.ochin.org.

Telehealth Physician Adoption

Prior to the pandemic, telehealth was demonstrating positive trends of adoption by physicians. Previously about 22% of physicians have used telehealth to see patients, and a new telehealth forecast suggests that 61% of doctors will use it by 2022 according to a 2019 research study from telehealth platform provider American Well. Physicians are looking at telehealth to improve patient access to care, improve patient outcomes, and attract and retain patients.

This shift in expectations for telehealth, coupled with a more promising reimbursement landscape and health systems' vision to expand telehealth use, is expected to drive continued growth.

In a survey of 800 physicians conducted by American Well https://amwell.com, a company that connects patients with board-certified doctors, discovered:

- Physician adoption of telehealth has increased significantly and is up 340 percent from 2015 when only 5 percent of physicians reported having ever used telehealth.
- More physicians are willing to try telehealth. A total of 69 percent of physicians said they would be willing to use telehealth, up 12 percentage points, from 57 percent in 2015.

These rates of adoption will certainly be accelerated due to the pandemic.
https://www.telecompetitor.com/telehealth-forecast-61-of-doctors-expect-to-use-it-by-2022/

When the pandemic ultimately passes, there will be another health care crisis to follow in the United States. If trends continue, the United States may be facing a shortage of 95,000 physicians by 2025, according to a recent report from the Association of American Medical Colleges. This is further being contributed to by the Baby Boomer retirement crisis, which will crest in 2030 and will affect many sectors of the economy.

Additionally there will be a physician distribution challenge with doctors clustering in urban areas and not enough doctors locating in rural areas. The Medicare Payment Advisory Commission (MedPAC) recently reported that 47 hospitals closed in 2019. There were 23 closures in 2018, 16 closures in 2017, 21 closures in 2016 and 28 closures in 2015. The totals included short-term acute care hospitals and critical access hospitals, which are having trouble staffing doctors and nurses in rural areas.
https://www.hfma.org/topics/news/2019/12/47-hospitals-have-closed-in-2019--medpac-reports.html

These are contributing reasons why telehealth / telemedicine enabled by broadband will be essential to health care going forward and why we will never return to health care as it existed in January of 2020.
https://www.govtech.com/network/Broadband-Can-Alleviate-the-Health-Care-Crisis-Contributed.html?utm_medium=email&utm_campaign=Newsletters&utm_source=sendgrid

Energy Management

Oregon utilities rely on broadband in a number of ways, as they undertake efforts to move toward a "smarter" electrical grid. These efforts enable utilities to more quickly identify and respond to power outages and system issues, and empower customers with new information about their energy usage. This information helps customers better understand their consumption, and participate more fully in managing it. It also allows them to stay better connected to their utility in case of emergencies. Broadband-enabled utility services make it easier for customers to save energy, and to use it in ways that better match energy supply, sometimes automatically, in ways that help benefit the energy delivery system.

Advanced Metering Infrastructure (AMI) is an integrated system of smart utility meters, communication networks, and data management systems that enables two-way communication between utilities and customers. Smart meters are electronic devices that record consumption of electric energy in intervals of an hour or less and communicate that information back to the utility for monitoring and billing purposes. Smart meters enable two-way communication between the meter and the central system. Presently, the vast majority of Oregon investor-owned utility (IOUs) meters are now smart meters. Most recently, PacifiCorp has deployed AMI throughout Oregon, so all three Oregon electric IOUs are utilizing AMI. Most Customer Owned Utilities (COUs) have or will have similar smart grid infrastructures to achieve higher efficiency in energy management as well.

Smart meters are an important element of modernizing all aspects of the electric grid, from the generation of electricity to the consumption of electricity. The requirements for the speed of such communications are enabled by broadband. The Federal

Communications Commission (FCC) has recognized this and holds that broadband is an advantageous component of modern grids, as it allows more content to be carried through information networks. (FCC's National Broadband Plan is available at https://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf).

Idaho Power Company

Idaho Power Company (IPC) is headquartered in Boise, and while IPC's service area is primarily in Idaho, it also extends into parts of Eastern Oregon, including Ontario and outlying areas extending west, near Baker City, John Day, and Prairie City. Past estimates are that IPC's broadband network reaches about 135 route miles in Oregon. IPC uses this system for two-way radio communication, generation and/or transmission energy management, along with implementing and monitoring responses to power disturbances, inter-connections with other utilities, and security operations.

Within Oregon, IPC owns and operates communications facilities including microwave terminals, microwave repeaters, and transmission switching stations. In the past, IPC's broadband capabilities have ranged in data rates as low as 12.35 Mb/s and as high as 360 Mb/s. IPC has also utilized commercially owned telecommunications facilities and leased approximately 240 miles of broadband facilities for carrying AMI service and distribution substation energy management EMS. At least some of its Oregon substations have used leased communication facilities.

IPC's Irrigation Peak Rewards Program and AC Cool Credit program, both of which provide important energy and capacity management tools for the company, utilize Idaho Power's AMI system, which as mentioned above, uses broadband technology between IPC's substation data collectors and the utility enterprise network. Idaho Power also has a web portal that customers can access for energy monitoring purposes, but it does not broadcast this information to customers using broadband technology.

PacifiCorp

PacifiCorp (PAC), headquartered in Portland, serves approximately 615,000 customers in Oregon. PacifiCorp also serves retail customers in the states of California, Idaho, Utah, Washington, and Wyoming. PAC's Oregon service territory includes sections of Portland, the Coast, Willamette Valley, and Southern and Eastern Oregon.

Given PAC's Oregon customer base, and its diverse service area, it has a rather extensive privately owned data network. PAC also leases broadband circuits to supplement its private network where it is cost prohibitive to internally expand. PAC has in excess of 1,000 route miles of broadband capability in Oregon related to electrical grid operations. PAC uses this network for two-way radio communication, remote site access, supervisory control and data acquisition (SCADA) of substations and generation sources, implementing and monitoring responses to power disturbances, interconnections with other utilities, and security operations. Speeds on the private network range from 1,200

baud serial for polling radios to 10 GigE for fiber optic communications (with planned 100 GigE links in the future).

In addition to this capability, PAC recently deployed AMI in its Oregon and California service areas. The PAC AMI business case was based on reducing operating costs and improving customer service. PAC began placing smart meters into service in January 2018 and completed installations in December 2019. PAC deployed its AMI system by leveraging broadband networks provided by commercial wireless providers for network backhaul. The meter-to-collector network consists of an IPv6 mesh network built around the IEEE 802.15.4g standard, commonly referred to as WiSUN (Wireless Smart Utility Network).

PacifiCorp subsidiary Pacific Power is making a $117 million investment with the deployment of 590,000 smart meters across Oregon that will track power usage by the hour. The smart meters have a communications module that uploads power usage data via a secure wireless mesh network to Pacific Power's servers. About six weeks after installation, customers will be able to look at their hourly power usage on a secure website. Some customers do not want the smart meters, and provisions to enable them to opt-out are being developed.
https://www.govtech.com/fs/infrastructure/Oregon-Utility-Makes-117-M-Move-to-Smart-Meters.html

Portland General Electric

Portland General Electric (PGE), also headquartered in Portland, currently serves around 840,000 customers within a 4,000 square mile service territory, which focuses on the Portland Metropolitan area and the Willamette Valley. PGE uses a combination of owned and leased fiber at all of its generation plants and transmission and distribution substations for broadband services. Given the need for minimal delay, high reliability and redundancy, fiber is used for both operations monitoring and control. PGE utilizes a range of speeds on its system, from 56 Kbps to 100 Gbps. Data to and from retail meters is transmitted over a wireless network at very low speeds.

PGE also has about 90 substations with low speed connections and about 50 that use cellular connections. PGE has begun the process to move those connections to a leased broadband MPLS system.

In 2015, PGE completed its Outage Management System (OMS), which uses input from AMI, SCADA and customer calls. The intent of the OMS upgrade was to pinpoint, collect information about, and respond to outages more quickly. However, PGE currently has no plans for expanding its broadband to include connection to customer meters.

PGE has also launched smart thermostat and water heater demand response pilot programs (with plans to launch an EV charging station offering) that uses customers' own

Wi-Fi networks (enabled through existing broadband-based internet service providers) to communicate with PGE, in combination with a simple FM radio network that broadcasts control signals. In this program, customers allow PGE to connect to their home water heaters and ramp them up or down, with these control events occurring on a daily basis. This allows a matching of supply and demand through adjustments to the appliances of residential customers. In this way, PGE gets the benefit of existing broadband networks without the expense of installing its own dedicated fiber.

Customer Owned Utilities (COUs)

There are 41 COUs in Oregon: 20 electric cooperatives, 12 municipal electric utilities, and 6 people's utility districts (PUDs). While COUs serve more than two-thirds of Oregon geographically, they only serve about 26% of Oregon's population. Smart grid related deployments in this group vary from very aggressive deployments to no deployments at all. A lack of broadband infrastructure is a significant barrier to smart grid deployments in some rural areas. Several COUs have built their own fiber optic communications infrastructure while many rely upon the infrastructure of local communication providers. Some have a combination of their own fiber optic infrastructure and service from a local communication provider. Twenty Gbps was cited as the fastest speed utilized. Nearly 2,500 miles of fiber optic cable was cited as the largest deployment of fiber optics under one COU's control. Aggressive deployments include AMI and SCADA at substations with some planning to deploy Distribution Automation (DA) on their local electric distribution systems in the future. Smart Grid applications are designed to save costs, reduce outage time, and improve both internal and customer communications.

Current applications of Smart Meters include:

- reading meters remotely
- energy use monitoring by the customer via smart phone or PC
- in-home energy use displays of customer electric usage
- outage management systems (OMS)
- outage detection by the utility
- outage notification via smart phone or PC to customers
- outage progress updates via smart phone or PC to customers
- outage map viewing by customers via the web
- social media outage notification and progress updates
- automated pre-pay programs that eliminate the need for sending electric bills
- remote connect/disconnects
- load control

Current applications of SCADA include:

- substation monitoring of internal equipment
- substation video monitoring
- remote switch operations
- remote fault detection
- load control management

Other applications:

- conservation voltage reduction (CVR).

About Smart Meters

Current and pending Smart Meter deployments increased from 94.5% in 2018's "Broadband in Oregon Report" to 95% in this report with the addition of two small electric cooperatives deploying AMI. The increased percentage refers to all electric meters in Oregon. As reported by the Institute of Electric Innovation in December 2019, nearly 70% of electric customers in the nation have smart meters. Oregon far exceeds the national average. Most smart meter deployments utilize Power Line Carrier (PLC) with the remainder being Wireless Mess (RF).

About COUs providing broadband to others

Seventeen COUs either directly or indirectly provide broadband to their local communities. Some provide wholesale broadband services while others provide retail and wholesale broadband services. Services generally are provided via a subsidiary or by intergovernmental agreement (IGA) with others. Some are wholly owned by the COU or are in partnerships corporations, LLCs or IGAs. A few provide wholesale broadband services directly from the COU. Some COUs that do not currently provide broadband are in the process of seriously considering providing broadband services in the future.

Education

"Every student in Oregon deserves the opportunity to learn and thrive. We are committed to expanding access to a world of knowledge and skills by improving the reach of high-speed Internet and digital learning in classrooms in every Oregon community."
- Governor Kate Brown

<u>K-12</u>

On March 17, 2020, all public schools, including those operated by school districts, education service districts (ESDs), and public charter schools were closed through April 28, 2020, under Governor Brown's "Stay Home, Save Lives" Executive Order 20-08. On April 8, 2020, Governor Brown extended the physical closures for Oregon's K-12 schools through the end of the 2019-2020 school year in response to the pandemic public health crisis. This resulted in the adoption and deployment of distance learning for all of Oregon's schools.

K-12 student broadband internet access in their homes is one of the most glaring illustrations of the impact of the continuing Digital Divide. The Oregon Department of Education, the state's Education Service Districts and the state's 197 school districts have mobilized to address this challenge in support of the move to distance learning.

The Oregon Department of Education conducted a survey earlier this year to assess the level of broadband access available for K-12 students. 95% of school districts responded (187 of 196), which collectively serve 99% (575,973) of students in the state. The survey found that the greatest areas of need are access to broadband network infrastructure, services, and end-user devices. Connection to reliable high-speed broadband, access to affordable service, and access to both devices for learning and mobile hotspots for connectivity are the greatest challenges faced by Oregon students and families. According to this survey, 136 of 197 Oregon districts reported that about 32,000 households needing internet access. 118 districts reported needing additional Chromebooks, and 110 districts reported needing additional hotspots.

Prior to implementing *Distance Learning for All*, many Oregon school districts were implementing digital learning and blended learning within classrooms. Since 2001, educators, IT managers, school district administrators and technology coaches have participated in the Oregon Ed Tech Professional Development Cadre hosted by ODE.

Many of the skills used in digital teaching and learning and blended learning translate into use for online learning; however, the practice of presenting, communicating and engaging students in a fully online environment is different than teaching and learning in a face-to-face environment for teachers, students and their families. [ODE-Developing the Online Learning Playbook]

Oregon Department of Education – Comprehensive Distance Learning Grant Program
In March 2020, Governor Brown declared a state of emergency due to the public health threat posed by the novel coronavirus ("COVID-19"). Governor Brown followed the declaration with the suspension of in-person instructional activities in all of Oregon public and private schools starting March 16, 2020 until the remainder of the 2019-2020 school year.

Despite the suspension of in-person activities, every Oregon school needs to provide equitable access to learning for its students. As a result of ongoing needs to resume the 2020-21 school year with Distance Learning, ODE created the $28.1 million Comprehensive Distance Learning Grant Program utilizing federal funding from the Governor's Emergency Education Relief Fund (GEER Fund), the Elementary and Secondary School Emergency Relief Fund (ESSER Fund), and the CARES Act Coronavirus Relief Fund.

The Comprehensive Distance Learning Grant Program supports:
(1) Access and Connectivity: Adequate infrastructure and/or services that enable internet access and connectivity for student learning. Examples include Purchasing hotspots or routers for buses or external locations.

(2) Student and Teacher Devices: Appropriate and user-friendly devices for students and educators to navigate through distance learning curriculums and programs of study.

Examples include the purchase and distribution of laptops, iPads, and Chromebooks for use by students.

(3) Digital Content and Curriculum: High quality, adaptable, culturally responsive, and effective digital learning curriculums and content that fosters student learning and engagement. Examples include the purchase of digital content that will form less than half of the content for a course and that is aligned to grade level content standards in terms of depth and breadth.

(4) Learning Management Systems: Online technology that allows educators to successfully deliver their teaching content and lessons. Examples include the purchase of a Learning Management System or add-ons to a Learning Management System that support online instruction.

(5) Professional Learning for Educators: Various supports and training that ensure effective use of all digital learning tools. Examples include registration fees, substitute reimbursement, and special time or extra-duty pay for professional learning specific to standards based online or distance learning professional development Additional examples for each category listed

State Education Technology Directors Association (SETDA)
State Education Technology Director's Association (SETDA) continues to be the de facto body that establishes broadband service standards for K-12 schools and provides a wide range of tools, reports and resources in addition to being a key advocacy organization.

(SETDA issued a new report, *The Broadband Imperative III: Driving Connectivity, Access and Student Success*. This report advocates for equitable, reliable, robust broadband access both on and off campus to prepare all students for life and work. New technologies and increased access to robust connectivity is reshaping the K-12 landscape for teaching and learning. School districts nationwide are leveraging digital instructional materials and resources to deliver transformative and impactful personalized learning opportunities for students and to enhance the administrative coordination of school business www.setda.org.

COVID-19 impacts on K-12 education
The mandated distance learning model for K-12 schools is a major challenge for students, parents, teachers and staff, as many need to quickly learn new skills and use new tools to function in this new environment. An additional barrier is that many students do not have access because it is not available or because they cannot afford it. Intermountain ESD reports 25% of students do not have access to broadband while Tillamook County reports 60% do not have access. Many differences exist between traditional in-person education, a blended program of in-person and distance learning methods, and a full distance learning program.

Oregon is a #GoOpen State. In 2015, Oregon was one of the first states to join the U.S. Department of Education #GoOpen initiative that supports States, districts and educators using openly licensed educational materials to transform teaching and learning. Oregon launched the Oregon Open Learning Hub in May 2020 as the place to find and share open educational resources (OER) that are curated and created for and by Oregon educators and vetted by ODE.

For the most current updates and guidance from ODE, visit ODE's COVID-19 Resource page.

Resources are also available through SETDA, including the *Coalition for eLearning* to ensure students can continue learning away from brick and mortar schools and provide a forum for collaboration and sharing. The SETDA Coalition for eLearning focuses state leaders, affiliates, and partners in collective action around teaching and learning in the digital age. This portal, the edWeb community, and series of webinars are an ever-evolving compilation of rapidly developing resources around eLearning for state education agencies and school districts.

Oregon needs to focus short term on what can be done to provide broadband connectivity to the state's students. In the face of the pandemic, the Homework Gap is now effectively an Education Gap.

It requires extraordinary effort to transition from in-school to virtual distance education for all students within a period of weeks, and that in many ways the technology challenges are the easiest to address. The challenge of managing the impacts on teachers, staff, students, and parents is tremendous.

We need virtual education skill development, we need end-user devices, and we need available and affordable broadband internet access for this to be successful. 163 out of 164 Oregon school districts surveyed in April described the need for professional development related to digital and online instruction.

Oregon needs to make investments in:

- Online learning tools & professional development for how to use these tools
- Devices to achieve a 1:1 student/device ratio
- High quality, adaptable, culturally responsive, and effective online curriculum
- Family Support

> "Over the last four years, it has become clear that state action can meaningfully accelerate broadband upgrades. States have catalyzed fiber construction by making matching funds available and increased Wi-Fi upgrades by educating school districts on the availability of Category 2 E-rate funding. Perhaps the most widespread impact of state action, however, has been on Internet access upgrades.

> From 2015-2019, states that undertook governor-led K-12 broadband initiatives increased Internet access in their schools by three times more than states without such initiatives. As states embrace the 1 Mbps per student standard, it is clear that states that take action to support their districts will be among the first to achieve the objective of enabling digital learning in every classroom, every day."
>
> – Education SuperHighway 2019

Libraries

Libraries play a key role in making broadband accessible to those who do not have broadband in their home. The FCC established broadband goals of 100 Mbps for smaller libraries and 1 Gbps for larger libraries though about 35 percent of public libraries have subscribed speeds of 10 Mbps or less. Price and availability are a problem for public libraries, particularly in rural areas. More than 33 percent of public libraries and 41 percent of rural libraries cannot offer better broadband because they subscribe to the maximum speed available in their area.

- 8.2 percent of public libraries have download speeds of 1.5 Mbps or less
- 34.2 percent of public libraries have download speeds between 1.5 and 10 Mbps
- 29.3 percent of public libraries have download speeds between 10 and 50 Mbps
- 28.3 percent of public libraries have download speeds greater than 50 Mbps

The majority of public libraries are in rural areas serving small communities. Sixty of the seventy public libraries serving communities of 10,000 or less in Oregon report that their download speeds average download speed was 55 Mbps. This is a challenge because there are multiple users sharing that bandwidth.

Service costs vary widely. To illustrate, one Idaho library pays about $1,300 monthly for wireless internet access at five Mbps. The only other option for internet at this library is dial-up. In contrast, a suburban library near Boise pays $750 per month for 40 Mbps broadband, once again reflecting the rural urban digital divide.

There have been a number of national initiatives regarding library broadband access.

- Toward Gigabit Libraries includes a Toolkit and Improvement Plan funded by the Institute for Museum and Library Services (IMLS), has created a "Broadband Toolkit" and customized "Broadband Improvement Plan" designed to help public and tribal librarians learn about their current broadband infrastructure and internal information technology (IT) environment. Through the use of the "Broadband Toolkit" and "Broadband Improvement Plan", librarians will be better equipped to improve their broadband services and become stronger advocates for their libraries' broadband infrastructure needs.
- E-rate makes fiber buildout or connections possible through Category One funding
- General advocacy by the American Libraries Association and the Public Library Association representing libraries to the FCC and policy makers and promoting opportunities to libraries.

The role of broadband in libraries is significant and growing. 65% of local government leaders say libraries play an important or highly important role in advancing digital literacy in their communities, as being connected to the internet is increasingly necessary to function in the modern world. This is a challenge for many Americans due to lack of access and due to lack of the skills to use and benefit from digital technologies.

Wi-Fi exponentially increases the library's capacity to serve the public beyond its wired desktops—powering patron's handheld devices and laptops inside the library and on the road with mobile training labs and pop-up library programs, connected through Wi-Fi. Some libraries only provide Wi-Fi access during open hours, others provide it 7 days a week, 24 hours a day. Additionally, some libraries offer mobile technical training for the community and hotspot devices that may be checked out for access away from the library.

Libraries are leaders in providing digital literacy resources. Google is offering a program called *Grow with Google* https://grow.google/ offering free training, tools, and resources to help grow digital skills. Since 2017, more than four million Americans1 have grown their businesses and careers with help from Grow with Google's training and in-person workshops. And through a network of more than 7,000 partner organizations including local libraries, schools, and nonprofits. Libraries are partnering with Google in a *Libraries Lead with Digital Skills* initiative to help with local workforce development. Oregon is on the list to joint this initiative, but it has not yet started.

There is a program called Edge for public libraries http://www.libraryedge.org/. It is a technology management program with an on-line tool to help libraries assess how they are using technology to serve their community, how well they are managing it within the organization and developing a strategic plan. Edge helps public libraries establish a baseline for continuous improvement and greater community impact. Edge achieves this mission by providing libraries with standards in technology services and programming, and tools to help libraries measure and implement change.

Crook County recently received grants from Facebook. The grant program addresses local needs by making grants available to non-profit organizations and schools for projects that address critical community needs by putting the power of technology to use for community benefit, connect people online or off, and improve local Science, Technology, Engineering, and Mathematics ("STEM") education.

Public libraries have evolved and adapted during a period of dynamic change in information technologies, and remain essential resources for the community.
Libraries serve as a broadband access point of last resort for people in the community that do not have access at home or end-user devices.

Oregon's public libraries have not been big users or recipients of E-Rate Program funds. The reason is that the smallest libraries with the greatest need do not have the resources or capacity to navigate the application process. Some libraries also take issue with restrictions on use by the E-Rate Program and the Children's Internet Protection Act that require filters and implement other control measures on information / content access as a condition for the receipt of certain federal funding. "Public Library" is an official designation granted by the Oregon State Library.

The Council discussed focusing on the needs of and opportunities for public libraries to address the continuing digital divide and digital inclusion in its 2020 *Broadband in Oregon* report with the help of the state's library professionals.

E-Government

State of Oregon

Oregon relies on a robust web presence, Oregon.gov, to provide information and services to Oregonians. Oregon.gov provides websites for most state agencies, boards, and commissions at no cost to them. All Oregon.gov websites are now deployed using an updated templates and a new content management system. These updates provide increased responsiveness, security, accessibility, and an enhanced experience to visitors. During the pandemic, e-government platforms are enabling the continued delivery of information and services despite the closure of state government buildings.

In the 2019 E-Government Survey of Oregon residents, 97% of respondents think that it is important for state of Oregon websites to be optimized for smart phones and tablets. Over one in every three visitors came to Oregon.gov from a mobile device. Since the 2018 *Broadband in Oregon Report*, Oregon.gov received 19.5 million additional mobile device visits. In 2019, 30 new mobile-enabled services were made available, raising the total to 176 mobile services.

Visitors have access to over 1,800 Oregon online services. Through these services, user needs can be met over the internet anytime and anywhere.

2019 brought new services and enhancements to Oregon agencies

- Website Visits: Over 46.5 million visits
- Web Pages Loaded: Over 120 million pages viewed
- Payments Collected: Over $1.75 billion dollars
- Payment Transactions: Over 3.7 million transactions

The survey of Oregon residents pointed out that online services are faster (67%), more convenient (78%), and more useful (67%) than traditional services. In Oregon, almost all residents surveyed (92%) reported having internet access at home or have internet access from somewhere else. Access to E-Government services via mobile devices continues to be very important to Oregonians, 79% of Oregon residents responded that it was important for the State of Oregon websites to be optimized for smart phones and tablets.

In response to an unprecedented volume of traffic to Oregon.gov webpages during the COVID-19 pandemic, a new service called GovStatus was launched. GovStatus provides high availability and bandwidth to handle large volume of web traffic and is hosted on Amazon Web Services. This service provides a new way for any agency to create webpages quickly, supports heavy traffic, and prevents outages. Since the launch of this new service in March 2020, there have been no major outages of Oregon.gov websites.

In 2019, E-Government e-commerce services collected more than $4.8 billion in over 3.3 million transactions. This is in addition to other online payment services provided by the Oregon State Treasury.

Nearly every agency, board, commission and branch of state government participates in using E-Government service offerings. These service offerings include websites, online applications, online payments, open data access, and enterprise collaboration.

The E-Government Program works closely with the Electronic Government Portal Advisory Board (EPAB). EPAB publishes a list of projects under consideration as a handout at each quarterly board meeting. For additional information, see:
https://www.oregon.gov/epab/Pages/Meeting-Documents.aspx

The E-Government Program publishes an annual report. To review the full report, see:
https://www.oregon.gov/epab/Documents/2020-EPAB-Annual-Report.pdf

Oregon Cities

The League of Oregon Cities conducted a survey to measure the use of the Internet and e-government.

Key findings include:

- 95% of the respondents maintain an internet website.
- 31% provided streaming video of city council meetings before the COVID-19 pandemic compared to 53% who streamed video of city council meetings during the COVID-19 pandemic.
- 49% of respondents said their city staff and elected officials have adequate broadband access to work from home or participate in city business from home. 47% of respondents said that they did not have adequate broadband access for all city staff or elected officials and faced some challenges with working from home or participating in city business from home. The challenges faced seemed to be with inadequate bandwidth for video conferencing, spotty or inconsistent service, and complete lack of broadband service for staff or elected officials who lived in more rural parts of an area.
- Public policies regarding broadband are focused primarily on permitting the location of infrastructure, and not on the use of broadband for economic development or problem solving.

- Broadband infrastructure is viewed as being important for economic development.

Many cities during the COVID-19 crisis have found ways to partner or pivot to ensure community members had access to an internet connection. For example, the City of Happy Valley added Wi-Fi service to a park located adjacent to the library since the library is closed. The City of Eugene's COVID 19 Community Response Team developed Wi-Fi siting solutions for the YMCA childcare centers, which had to expand locations, due to social distancing needs, into area churches, which did not have Wi FI. The City of Sandy worked closely with the local school district to help extend broadband to students that lived in underserved clustered areas. The Sandy area is large outside of its city limits, so complexes, mobile home parks, etc. that had poor internet service (DSL or less) were targeted to get adequate wireless internet for distance learning. Other cities applied for Rural Broadband Capacity Program Grant dollars that were allocated by the Joint Legislative Emergency Board.

Many Oregon cities have taken direct action to address the broadband needs of their residents.

City of Eugene

The City of Eugene along with the Lane Council of Governments, and the Eugene Water and Electric Board (EWEB) with support from Technology Association of Oregon embarked on yet another innovative broadband project – EUGNET http://eugnet.org, a fiber network initiative in Eugene. This technology community was not satisfied with the available broadband services available and began working with others back in 2015 to find solutions to make Eugene one of the best-served cities for broadband access and viability for technology companies. "What you can measure, you can improve." The City of Eugene, Lane Council of Governments, and the Eugene Water and Electric Board (EWEB) with support from Technology Association of Oregon installed additional fiber optic connectivity for businesses in downtown buildings in which the City already had already made sizeable financial investment. The fiber runs in existing EWEB electrical conduit, avoiding the expense of trenching or directional boring, down Willamette Street to LCOG's Willamette Internet Exchange (WIX). As a result, at last count, twenty-three new technology companies moved to downtown Eugene, and the city of Eugene received a Gigabit City designation from Mozilla along with grant funding to utilize the fiber infrastructure. It resulted in EUGNET, the largest open access network in Oregon.

In the last two years, the City of Eugene's population of technology companies has grown by over 12%, and is expected to grow another 23% in the next ten years. There are currently more than 200 tech job openings needing to be filled. Eugene received a second designation through a national non-profit, US Ignite, who is focused on partnering with communities to develop technologies that provide transformative public benefit. Eugene has been through three grant rounds with US Ignite with significant success. Hundreds of

thousands of dollars are going to local innovators to develop new technologies and in several cases, start new companies.

Work is underway to expand robust broadband access to the neighboring city of Springfield. The Ambleside neighborhood in Springfield will be connecting 161 homes to word-class internet services delivered by the first fiber-to-the-home project in Springfield. The Springfield Utility Board and community partners are currently deploying the network. To view a video on Mozilla Gigabit City - Eugene, Oregon, go to https://www.youtube.com/watch?v=1v5OlqET4D0.

City of Hillsboro

Hillsboro is currently building Oregon's largest municipal fiber network, wiring up schools and homes in hopes of creating an affordable alternative for residents. It plans to launch service in some areas next month. The city has committed $28 million its HiLight service https://www.hillsboro-oregon.gov/services/hilight. It has already wired local schools and plans to begin serving homes in the Shute Park neighborhood and the new South Hillsboro development in November. The city says there are 1,700 residential and commercial addresses within the initial service area, which will come online more than two years behind Hillsboro's initial schedule. The city has a 10-year buildout plan to serve every home in its jurisdiction. The City of Hillsboro partnered with the Hillsboro School District to connect all District schools and classrooms to a shared fiber network. https://www.governing.com/finance/Oregon-County-Estimates-Public-Internet-Would-Cost-1-Billion.html

City of Portland

The City of Portland is undertaking a fiber expansion project. The city has a significant optic fiber network that was established back in the 1980s and its own telephone switches to support the city government. In recent years, the city has been working to expand that valuable fiber asset.

The city of Portland has two networks:

Integrated Regional Network Enterprise (IRNE) On-Net

IRNE consists of city owned or managed assets. It has some shared assets with ODOT, PBOT, and TriMet as well as with some other smaller municipalities. There are multiple dedicated city locations served. The city of Portland is also a competitive local exchange company (CLEC). IRNE, as a service provider, has a franchise with the City of Portland and pays all the fees needs to obtain permits and follows all the rules, as do other service providers.

There are several construction projects underway to expand IRNE.

- The Division Transit Project is a partnership build between TriMet and PBOT. It runs from 12th and Division to Eastman Parkway with 432 strands of fiber along the entire route. An IRNE fiber will run the length of the build. Twenty-nine prospective

service locations have been identified and planning with stakeholders began this year early. The network should be available in 2023.

- IRNE On-Net Builds are planned for additional service locations that are within three blocks of existing IRNE fiber. Twelve expansion builds are planned for current user/stakeholders, six builds for City of Portland public safety locations, two new backbone builds for a total of twenty builds in the project pipeline with seventy-nine "Near Net" locations
- Prescott Backbone Build is approximately three miles in length from 122nd Avenue and I–84 to Prescott to Sandy, and from Sandy to 82nd Avenue. The build will be a combination of underground and aerial construction and add three service locations.
- Russell Backbone Build is approximately two and one-half miles in length with 432 fiber strands from near the Fremont Bridge to Russell to Rodney to Prescott. The build will be underground and required a bore under the Willamette River, which was just completed. It will serve three additional locations and connect northwest with northeast Portland.
- Organic growth additional builds include a build across the Gideon Pedestrian Bridge which is underway, a build across the Flanders Pedestrian Bridge over I-405 which is in the planning stage, a build across the Willamette River Fremont Bridge which is complete, a build that will complete a NE 122nd fiber ring with PBOT which is almost complete, and a build across the Earl Blumenauer Bike/Pedestrian Bridge over I-84 which is in the planning stages.

The builds will improve the size, capacity, resilience and cost-effectiveness of the city's fiber network.

City of Ashland

The Ashland Fiber Network (AFN) was created in the late 1990s when a small group of local innovators decided to take control of the city's destiny by building a telecommunications network. The Ashland Fiber Network is a community-owned infrastructure designed to provide a platform for showcasing local compassionate people, supporting local innovators and sharing our community's unique independent way of living and thinking with the world.

AFN's unique open access model means that the city owns, manages and maintains the telecommunications infrastructure, then leases it to preferred locally owned Internet Service Providers (ISP's) so customers can choose between going with AFN directly, or the partner ISP that best fits their needs. https://www.ashlandfiber.net/

City of Maupin

Q-Life, GorgeNet, LS Networks and the city of Maupin coordinated efforts to offer a fiber to home and fiber to business network. The fiber network servicing Maupin businesses and

residents is owned by the city of Maupin and was partially financed through funding provided by the State of Oregon. www.gorge.net/maupin/

City of Cottage Grove
The city of Cottage Grove manages the fiber-optic network and partners with an ISP to provide free and subscription Wi-Fi services, CGWiFi. The fiber optic and wireless system was developed to create infrastructure capacity, provide connectivity and enhance technology available for South Lane School District and Lane Community College and to improve broadband service for public safety and government operations. http://cgwifi.net/

City of Sandy
The City of Sandy has been widely recognized for, and has a national reputation for its deployment of a fiber-to-the-premises network. SandyNet is a local Internet Service Provider, owned and operated by the people of Sandy as a public utility. SandyNet passes 100 percent of homes within Sandy city limits, and 74 percent of households subscribe to the service. SandyNet provides up to one Gigabit symmetrical broadband service https://www.ci.sandy.or.us/sandynet .

Cities of Independence, Monmouth and Dallas
In 2004, the Cities of Monmouth and Independence formed an Intergovernmental Agreement MINET under ORS190 and created the Monmouth/Independence network (MINET) to build a fiber-to-the-premises network serving both cities. MINET's ultimate success attracted the interest of a private investment group, American Fiber Optics, and a partnership was formed to expand operations and coverage areas. A fiber-to-the-premises network was funded and deployed in the City of Dallas doing business as Willamette Valley Fiber, managed by MINET.

In addition to the expansion to Dallas, MINET has also completed upgrades to all of its equipment in Monmouth and Independence ahead of schedule and under budget. On its current strong foundation, MINET wants to continue its mission to bring broadband to neighboring unserved communities. MINET is poised for continued growth and expansion of coverage.

MINET has also decided to become a champion for the cause of telehealth / digital health in an effort to improve the physical and mental health of the residents and diverse populations of Polk County including children, seniors, and veterans through telehealth enabled by the broadband network.

Cities of Dayton and Willamina
The city of Dayton was touted as the first 10 Gig city on the west coast upon turn up of its 10 Gig fiber network, a project of Innovate Oregon, the city of Dayton, and Online NW in a public private partnership to develop and market a Gigabit network and turn Dayton into a Gigabit city. The community is using a strategy to build an innovation ecosystem across

schools, nonprofit 37 organizations, local businesses and government. The network architecture includes an optic-fiber cable backbone with fiber to key locations and a fixed wireless distribution network throughout the community.

A second 10 Gig fiber network project is underway in Willamina, with completion scheduled for the end of the year, using the same integrated framework that was pioneered in Dayton. Dayton's school has become a model for school districts around the state for preparing students to be makers and creators in the innovation economy.

City of Sherwood
The city of Sherwood owns and operates Sherwood broadband as a utility. The fiber network was created in 2005 and services Sherwood and neighboring cities.
http://www.sherwoodbroadband.com/

City of Veneta
The City of Veneta recently leased middle-mile fiber from Eugene to Veneta to bring more ISP competition into the city and to create capacity for more jobs at a local call center. The city plans to acquire or build 1.75 miles of fiber to encourage and enable fiber-to-the premises (FTTP) deployment.

Oregon Counties
Counties in Oregon continue to utilize technology to reach out and make government accessible to citizens.

100% of Oregon counties maintain an official county Internet website.

- Websites provide and distribute general civic information to residents.
- Websites provide information about county government and its activities.
- Websites broadcast county commission meetings and/or other public meetings via streaming video.
- Websites provide transactional services such as paying invoices and obtaining permits.

Counties also have been active developing broadband internet access for their residents.

Clackamas County
Clackamas County has been engaged in improving its broadband infrastructure for years with its Clackamas Broadband Exchange fiber network. It is continuing that effort with additional enhancements to the network.

The Clackamas Broadband eXchange (CBX) is a 325-mile fiber backbone ring, owned and operated by Clackamas County that extends throughout the County. This fiber network connects anchor institutions, such as healthcare facilities, schools, libraries, and government buildings, and also makes fiber available by lease to internet service

providers to use to provide broadband services to customers. Currently, CBX supports a customer base of approximately 350 premises.

CBX Business Broadband Enhancement seeks to provide world-class fiber broadband services directly to key business clusters in Clackamas County that still do not have access to internet service that can meet their needs. The planned project will provide businesses with the high capacity, affordable broadband service and will help to create a fiber-rich environment for further business development and economic diversification. Additionally, 10 Gigabit service would be made available, unlocking new potential for highly technical businesses that require such capacity.

Clackamas County is partnering with the City of Sandy in developing this project. Clackamas County (through the Clackamas Broadband eXchange) will own, manage, and maintain any new physical fiber plant infrastructure constructed as a part of the proposed project. SandyNet will own, manage, and maintain the equipment needed to provide the internet connection to individual business premises. Additionally, SandyNet will serve as the internet service provider and will handle customer service and billing operations.

Clatsop County

Broadband is part of Clatsop County's strategic planning process. Over the next 18 months, the County will be developing and implementing a geographic specific strategy to improve internet connectivity to the most underserved communities in the short/medium term with the intention to develop a process that can be replicated in other communities in future phases. The County is also participating in the Columbia-Pacific Economic Development District's *Broadband Action Team (BAT)*. The BAT is supporting short and medium term needs in Clatsop County and the region, but the BAT is ultimately focused on creating a strategy for Future Ready broadband infrastructure implementation.

Columbia County

Columbia County developed a Broadband Strategic Plan. The County maintains a website providing information about county government, transactional services, and streaming video on-line public access to commission meetings. The County is looking at a countywide middle mile network, the City of St. Helens is looking at a municipal fiber to the home network, and there is a project in the planning feasibility assessment phase to provide broadband to Vernonia.

Marion County

Marion County was able to improve forty-seven rural residents and business' access to the internet by 1,000 percent from 1.5 Mbps to Gigabit speeds by extending the fiber network. Secondly, Marion County has had a Broadband Economic Development Strategic Plan for about a year and a half, and is now working with the city of Jefferson Technology Committee on broadband solutions for that city. The county is studying the problem of obtaining permits to bore under railroad tracks, a permitting process that can significantly

delay broadband deployment projects. Danielle also noted the tremendous returns that can be realized by deploying precision agriculture, particularly irrigation and pesticide application, and precision resource management practices. The County was actively engaged in driving a project to deploy fiber in Santiam Canyon and serving the cities of Idanha and Detroit.

Grant and Wheeler Counties

The Grant County Digital Network Coalition teamed with OTC Connections to build over 80-miles of fiber optic infrastructure to service rural communities in Grant and Wheeler counties. The network is a public private partnership that will extend broadband from Seneca to John Day in southern Grant County, and from Mt. Vernon to Long Creek, Monument, Kimberly, and Spray in northwest Grant County and Wheeler County. The new broadband infrastructure will provide network speeds ranging from 30 megabits per second (Mbps) to 1 gigabit per second (Gbps). The network will allow Voice-Over Internet Protocol (VoIP) and video services to be delivered to each customer. Overall, this expanded fiber optic network will extend broadband across a 242-square-mile area that includes 418 households, 22 businesses, 22 farms, 3 schools and 2 fire stations. The Coalition was successful in obtaining $6 million in grant funding from the USDA Re-Connect Program in addition to the $1.836M that the City of John Day received from the state legislature to finance the project. The network will be owned and operated by the Grant County Digital Network Coalition, a consortium of local governments. https://ktvz.com/news/oregon-northwest/2019/12/03/6-million-usda-grant-to-speed-internet-for-wheeler-grant-counties/

Lane County

Lane County is a partner in establishing Speed Up America https://speedupamerica.com/, a project, not a company, focused on providing accurate information about Internet access in a map showing real Internet speeds received, actual prices paid, and level of service experienced via a new speed test tool. The first step toward finding a broadband internet access solution is having accurate data and has resulted from the critical nature of broadband infrastructure and the frustration of having broadband service inaccurately represented in Lane County on broadband maps. This inaccurate data and mapping has made Lane County ineligible for federal funding programs, when in fact it should be eligible.

Speed Up America uses open source software and the M-Lab test platform to collect Internet speed data and create a dynamic map of broadband access. Users can compare their speeds to service levels in other regions, and industry and government groups can pinpoint where further network investment is needed. Currently the tool provides comparative data on Internet speeds in Oregon. Data will be added from the state of Washington next, with other states soon to follow. The tool combines crowdsourced internet speed test results with a map of the entire United States that is filterable by state,

zip code, census tract, census block and other statistical boundaries. Speed Up America is asking people to participate in Speed Up America and test their broadband connectivity.

A video on the project may be viewed at https://www.youtube.com/watch?v=RICE4_8dSro.

To participate, visit https://speedupamerica.com/ and click the "Take the Test" button. The test does not collect personally identifiable data, but asks the user's general location so that test data can be compared across ZIP codes, census tracts and other relational data.

Speed Up America also has a Facebook Page at
https://www.facebook.com/pages/category/Community-Service/Speed-Up-America-416927695803950/

Lincoln, Linn, Benton and Lane Counties
Lincoln County has established a Broadband Action Team (BAT) made up of the four Counties that encompass the Cascades West Economic Development District (Linn, Benton, Lincoln, and Lane), local internet service providers, school districts, the Cascades West Council of Governments, local non-profits, utility providers and more. The BAT identified the need to complete feasibility studies that would allow the region to move forward with rural broadband projects. The BAT applied for funding for these studies and is currently waiting on responses. The BAT is also helping members to identify funding opportunities and common projects that support rural broadband expansion, such as a regional broadband equity mapping project.

Jefferson County
The Bean Foundation of Madras has convened stakeholders to exploring a formal initiative to increase access to and improve the quality of high-speed broadband in Jefferson County.

Multnomah County
Multnomah County collaborated with the Cities of Fairview, Gresham, Portland, Troutdale and Wood Village on a feasibility study for a pubic broadband fiber network to serve the Portland metropolitan area. A public fiber network spanning Multnomah County would cost $1 billion according to the study by consultant CTC Technology & Energy.

The recent study found Internet service is nearly universal throughout Multnomah County. Ninety-six percent of homes have some form of home Internet access, though the study also noted that low-income households are much less likely to have connections, and the costs represent a disproportionate burden on those families. Another option noted by the consultant is for the county to deploy free public Wi-Fi connections in 600 public locations for about $3 million.
https://www.governing.com/finance/Oregon-County-Estimates-Public-Internet-Would-Cost-1-Billion.html

Polk County

In the summer of 2019, Polk County sent out over 5000 broadband surveys to rural property owners outside the city limits of Dallas, West Salem, Monmouth, and Independence. Approximately 32% of the property owners responded, and of those almost 87% responded that they wanted better service. For more details, download the Polk County "Rural Broadband Survey Summary".

Polk County has also developed a broadband map and is seeking to help local ISP's develop more infrastructure for unserved and underserved citizens. The County does not want to compete with the private sector providers but seeks to help any way it can to expand broadband capacity.

Tillamook County

Twenty years ago, Tillamook County formed an Intergovernmental Agency composed of Tillamook County, Tillamook People's Utility District and Port of Tillamook Bay to provide a fiber backbone within the county to provide high speed internet service to schools, medical facilities, libraries, county/port/public utility district facilities, county-wide radio communications system, 911 center, and local businesses. Today, Tillamook County arguably has the most robust fiber backbone of any Oregon coastal county.

Soon after the pandemic hit Oregon in March 2020, Governor Brown imposed distance learning for K – 12 students that exposed a long-standing issue for much of rural Oregon, a lack of adequate high-speed internet necessary to participate in distance learning. Tillamook County is fortunate to have been awarded a grant from Business Oregon along with additional grants from several local businesses and Tillamook County. In close cooperation with its three (3) school districts and the Northwest Regional ESD, the County is working to connect as many student families as quickly as possible utilizing existing service providers such as cable and wireless phone providers as well as developing a fixed wireless system for more remote areas of the county.

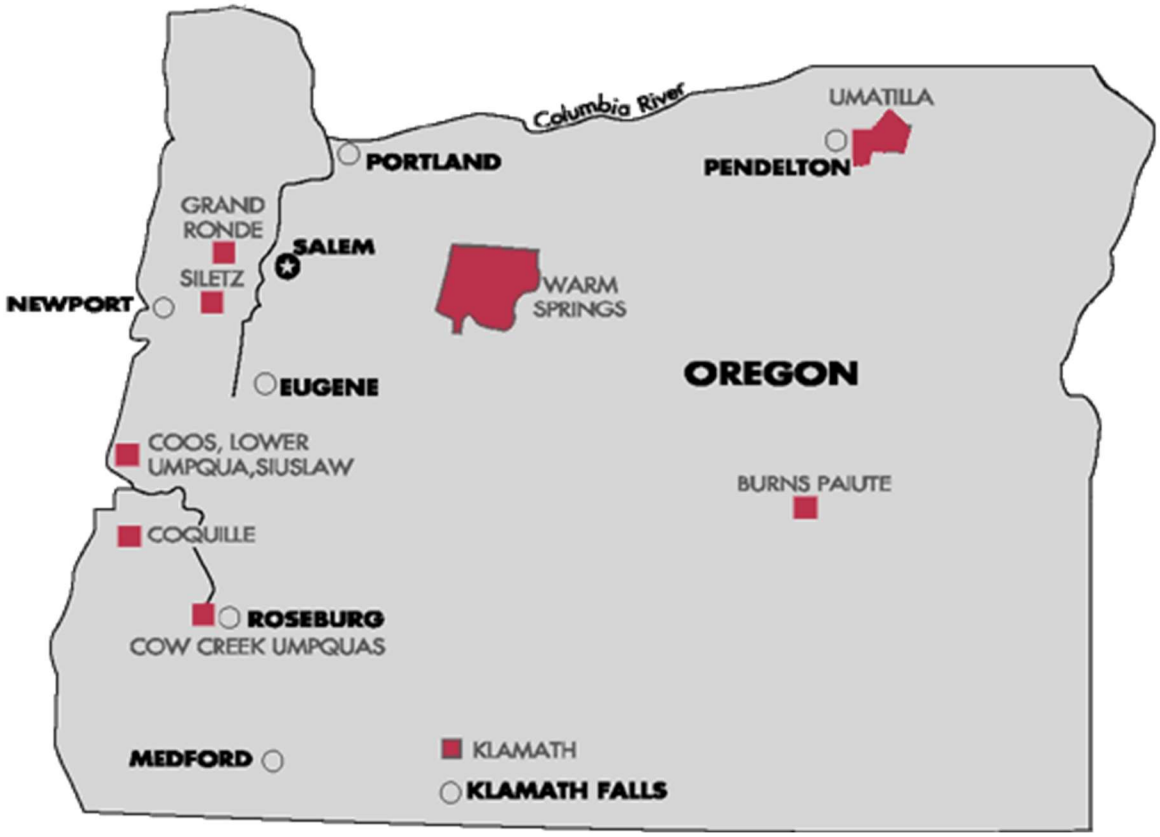
Just prior to the pandemic in February 2020, the County explored the possibility of a pilot project to deploy fiber to the home. County communities are prime candidates for FTTH due to the existing fiber backbone. When the pandemic hit, however, FTTH had to pause in place, but the County is now looking at early 2021 to start a pilot project.
Tillamook County is actively involved in a Broadband Action Team (BAT) with Clatsop and Columbia Counties in planning an interconnected fiber backbone with multiple connections to the Willamette Valley. In addition, the County is participating in a BAT, which includes Lincoln, Lane, Benton and Linn Counties. These partnerships with interconnected grids are essential to helping rural counties bridge the urban/rural divide when it comes to high-speed internet and digital inclusion.

Harney County

Harney County is are located on Eastern Oregon's frontier high desert and is home to less than 8,000 people. The county has engaged in broadband planning efforts to expand the availability and adoption of broadband.

Tribes

There are nine federally recognized Tribes within the boundaries of the State of Oregon.



Oregon federally recognized Tribes

All of the recognized Tribes have websites that provide information about governmental services that include information on tribal law and code, plans, forms, permits, public meeting notices, agendas, meeting minutes, job announcements, maps, e-mail contacts for staff and elected officials, social networking . A few have exclusive portals for information sharing within the tribal organization.

Only one Tribe offers extensive streaming video of public meetings.

Online bill or fee pay and online forms submission is still very limited. A couple tribes offer online purchasing of recreational fishing permits.

As is true for communities and governments across the nation, tribes are increasingly engaging in solving the broadband digital divide, which is significantly greater in Indian lands that rural America. The 2020 National Tribal Broadband Summit was an opportunity for Tribal Leaders, representatives of Tribal organizations, representatives of schools and school districts serving under-connected Native students, tribal libraries and cultural programs, federal program managers, and policy-makers at multiple levels of government to come together and share their innovations and ideas for expanding broadband access and adoption for tribal communities. On September 21 - 25, 2020, the Department of the Interior (DOI), in collaboration with the U.S. Department of Agriculture and the Institute of Museum and Library Services, displayed creative solutions to some of the biggest barriers to tribal broadband development https://www.doi.gov/tribalbroadband.

The Klamath Tribes, Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians, Cow Creek Band of Umpqua Tribe of Indians, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Grand Ronde Community of Oregon, Burns Paiute Tribe, Warm Springs Telecommunications Company, and the Coquille Indian Tribe have submitted applications to the FCC for the Educational Broadband Service spectrum 2.5 GHz license. https://www.fcc.gov/25-ghz-rural-tribal-window-submitted-applications

To date, five licenses have been granted that will help the Confederated Tribes of the Grand Ronde Community, Confederated Tribes of the Umatilla Indian Reservation, Coquille Indian Tribe, Cow Creek Band of Umpqua Tribe of Indians, and Confederated Tribes of the Warm Springs Reservation provide connectivity to their rural communities.

The Confederated Tribes of the Umatilla Indian Reservation are planning to build a broadband network in three phases. The planned network would establish a fiber loop between the CTUIR's government facilities and tribal enterprises, connect the reservation to Pendleton's fiber infrastructure, and provide internet service for reservation residential customers.

The Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of Warm Springs through the Warm Springs Telecommunications Company received CARES Act Coronavirus Relief Fund grants for infrastructure improvements on their respective Reservations.

Blue Earth Services and Technology, LLC (BES&T) was founded in 2015, and is a wholly owned subsidiary of the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians. BES&T is doing business as a full service Surveillance Camera, Voice and Data Network interconnect company providing service to other businesses and institutions for education, government and health care. They have extensive knowledge and training in structured cabling, including Cat5, Cat5e, Cat6 and fiber optics, and are certified resellers for Iwatsu APS and ECS, NEC, Windstream and Panasonic telephone systems.

Tribe	URL	Resources Offered
Burns Paiute Tribe	http://www.burnspaiute-nsn.gov/	Tribe organizational contacts Tribe employment opportunities Social Services Police and Court Services *The Tribe website will be updating throughout the months of October and November.
Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians	http://ctclusi.org/	History of the tribe Human Resources & Employment Housing Department Veteran Resources
Confederated Tribes of the Grand Ronde	http://www.grandronde.org/	History & Culture Housing Tribal Events Employment
Confederated Tribes of the Umatilla Indian Reservation	http://ctuir.org/	History & Culture Tribal Services (education, housing, planning, etc.) Employment Tribal Government
Confederated Tribes of the Warm Springs	http://www.warmsprings.com/ https://warmsprings-nsn.gov/ (Tribe government website)	Culture Events Employment
Confederated Tribes of Siletz Indians	http://www.ctsi.nsn.us/	History & Heritage News & Events Tribal employment Tribal government
Coquille Indian Tribe	http://www.coquilletribe.org/	Heritage Health care Employment Tribal news
Cow Creek Band of Umpqua Tribe of Indians	http://www.cowcreek.com	History Tribal government Employment
Klamath Tribes	http://klamathtribes.org/	History Tribal permits Employment Department (Human resources, education, social services) Tribal news

Oregon Tribe Websites

Transportation

Not only has the COVID-19 pandemic heightened awareness of the importance of broadband for supporting Oregonians access to services during the pandemic, but it has also revealed the potential for broadband as a transportation demand management tool. Transportation Demand Management refers to a broad set of strategies designed to reduce travel demand or to shift trips to alternative times to maximize use of existing transportation infrastructure. Demand management is a cost effective alternative to increasing transportation system capacity.

Some experts are now referring to broadband as another transportation mode due to the potential for broadband solutions related to telework, telehealth, education, and other applications to replace vehicle trips. During the early phases of the pandemic, Oregon traffic volumes were down significantly. As Oregon has progressed through re-opening stages, traffic volumes have begun to increase back toward pre-pandemic levels. While virtual services will not eliminate the need for in person services, the pandemic has improved awareness of the viability of virtual services, and it seems likely that that broadband-driven, virtual solutions will continue to play an important role in everyday life post pandemic. As a result, there will be benefits to Oregon's transportation system from the reduction in trips.

Technology has become increasingly important as a tool for actively managing the operation of the transportation system. One of policy goals in the Oregon Transportation Plan relates to management of the system. Included in the goal statement is the concept of improving the efficiency of the transportation system through optimization of management and operations of the system. In other words, getting better performance out of existing investment in transportation infrastructure by implementing strategies and technologies that help optimize the operation of the system. One of the tools for meeting this goal is called Intelligent Transportation Systems (ITS).

ITS solutions leverage communications and IT technologies to monitor the transportation system status and respond in real time. For example, applications include adaptive traffic signal control where traffic signals adapt to changes in traffic flow in real time and traffic incident management to restore the system to normal operation.

A new area of development is cooperative automated transportation. As more technology is included in vehicles, it is becoming possible for a new level of communication to occur among vehicles utilizing the system and between vehicles and infrastructure. It is also expected that this connected vehicle technology will play an important supplemental role in safe operation of automated vehicles. These technologies offer new ways to gather information about the transportation system status as well as implement more effective operations strategies. A key enabler of both existing ITS applications and future cooperative automated transportation applications is access to broadband communications along the highway system.

Role of Broadband in Local, Regional and State Economies and Economic Development

Broadband as an essential infrastructure and service is critically important to the sustainability of local, state and regional economies and to future prospects for economic growth and community development. Key applications are enabled by broadband that contribute directly to economic and community development.

E-commerce is emerging as a powerful strategy for businesses of all sizes *wherever* they may be located. It enables small businesses in small towns to effectively compete in and serve national and international markets, and provides important opportunities for economic development.

E- Government applications have proven to be an extremely effective way to deliver up to date information as well as transactional services and access to government proceedings to residents and is widely used by Federal, State and local governments.

Telework or Telecommuting enables people to work from physical locations other than their employer's with network access equal to or in some cases better than they get in the office. This application offers tremendous opportunities for increased productivity, improved energy management, and reduced traffic congestion, as workers are able to stop driving for forty minutes to get from one computer screen to another.

A Business Oregon employee survey of employees directed to work from home in response to the COVID-19 pandemic.

- 93 Submissions for a 73% participation rate
- Over 50% of responses indicated they would like to work from home 3 days or less
- Close to 25% indicated they would like to work from home 5 days a week
- Nearly 75% indicated that they feel more productive working from home and it is easier working from home
- Most indicated they felt their job could be done from home

Telemedicine delivering clinical services and patient consultations remotely using telecommunications offers one of the few viable strategies for improving and maintaining access to healthcare in small town and rural America. Virtual Care is an increasing popular new term for telemedicine enabling a full range of clinical services provided to patients where they live.

Distance Learning or On-line Education for instructional delivery that does not constrain the student to be physically present in the same location as the instructor. It is

increasingly being used for K-12 up through post-graduate education and workforce development with excellent results.

Libraries to provide local community access to the information resources of the world and to provide broadband Internet access to members of the local community that do not have access in their homes.

Smart agriculture through use of precision agriculture technologies and applications.

Energy management enabled by the deployment of smart grids. According to a study by the National Rural Electric Cooperative Association (NRECA), the lack of broadband access for 6.3 million electric co-op households results in more than $68 billion in lost economic value. The report noted that households in parts of America with broadband access receive, on average, a benefit of $1,950 annually. Applying this value to 6.3 million electric co-op households without broadband, the study finds a total lost value of $68.2 billion to cooperative members nationwide. In response, about 100 electric cooperatives are bridging the digital divide and bringing broadband to their communities.
https://www.electric.coop/rural-communities-losing-68-billion-economic-value-due-digital-divide-new-nreca-study-finds/

Broadband is essential infrastructure for economic and community development. This is an important issue for rural counties in Oregon, especially those that are losing population.

County	2020 Population	Growth Since 2010
Multnomah County	811,880	10.12%
Washington County	597,695	12.42%
Clackamas County	416,075	10.43%
Lane County	379,611	7.87%
Marion County	346,868	9.79%
Jackson County	219,564	7.98%
Deschutes County	191,996	21.71%
Linn County	127,335	8.94%
Douglas County	110,283	2.46%
Yamhill County	107,002	7.76%
Benton County	92,101	7.63%
Josephine County	87,393	5.45%
Polk County	85,234	12.83%
Umatilla County	77,516	1.87%
Klamath County	67,653	2.01%
Coos County	64,389	2.19%
Columbia County	52,377	6.12%

Lincoln County	49,388	7.37%
Clatsop County	39,764	7.22%
Malheur County	30,725	-1.99%
Tillamook County	26,787	6.07%
Wasco County	26,505	4.82%
Union County	26,461	2.83%
Jefferson County	24,192	11.69%
Crook County	23,867	14.28%
Hood River County	23,428	4.38%
Curry County	22,813	1.94%
Baker County	16,006	-0.63%
Morrow County	11,372	1.44%
Lake County	7,879	0.06%
Harney County	7,329	-0.96%
Grant County	7,176	-3.86%
Wallowa County	7,081	0.98%
Gilliam County	1,894	0.64%
Sherman County	1,708	-3.99%
Wheeler County	1,366	-5.60%

Oregon Population Trends by County

Public Safety
Broadband has tremendous potential for public safety communications giving first responders in the field the ability to send and receive voice, text, images and video.

Economic impact of telecommunications in rural areas
The Foundation for Rural Service (FRS) has reported that rural telecom companies supported $10 billion in economic activity in 2017. The rural telecom economic impact report also found that rural telecom companies contributed over 77,000 jobs that year. Broadband provided by rural telecom companies has a positive impact on 29 different industries, according to the report. For every job created in telecom, two additional jobs are created in other industries, according to the researchers.
https://www.telecompetitor.com/rural-telecom-economic-impact-report-10-billion-impact-in-2017/

BroadbandNow issued a report on the State of Broadband in America noting that access to affordable, reliable broadband internet is critical to America's economic competitiveness, and impacts education, opportunity and economic growth at the local level. The landscape and geography of access to high-speed internet continues to change rapidly due to economic and regulatory changes, private investments into new technology and policy

proposals leading up to the 2020 presidential election.
https://broadbandnow.com/research/q3-broadband-report-2019.

Strategic Network Group's *Oregon Statewide Assessment and Best Practices Study* had several key findings that underscore the importance of broadband for local, regional and state economic development.

- Without at least Basic Broadband, communities risk losing businesses and population, as well as finding it more and more difficult to attract new residents and businesses. Broadband is an essential factor in deciding to *remain* in a location for almost half of businesses.
- Broadband enables Oregonians to supplement their income by earning additional income from online activities. In Oregon, there are local economic growth opportunities from 38 percent of households currently with a home business or planning to launch a home business.
- Before the pandemic, one in five (20.3 percent) Oregon households have one or more teleworkers working from home on a formal, regular basis in an arrangement with their employer.
- 87 percent of Oregon parents responded that the internet was extremely important or very important for school success. Broadband enables distance learning and continuing education for K-20 school and for online training and certification professional development.
- 68 percent of Oregon households are currently using, planning to use, or willing to use telehealth services.
- Broadband enables workforce development and access to employment opportunities.
- Broadband enables civic / smart community services – crime prevention, micro-grids and distributed power generation, public transportation and traffic management.
- Broadband enables Local economic development – teleworking and home-based business start-ups, economic diversification and sustainability.
- Broadband enables Enhanced public safety and first responder capacity.

https://www.oregon4biz.com/assets/docs/SNGStudy2020.pdf

CTIA, the mobile wireless industry association, has estimated the economic impact of the deployment of 5G in the following Oregon cities over the next five years.

City	Estimated GDP Growth from 5G	Estimated 5G Jobs Created	Estimated Network Network Investment
Portland	$994 million	6,096	$537 million
Salem	$264 million	1,619	$143 million
Eugene	$261 million	1,598	$141 million
Gresham	$168 million	1,028	$91 million
Hillsboro	$165 million	1,012	$89 million
Beaverton	$151 million	924	$81 million
Bend	$149 million	911	$80 million
Medford	$125 million	769	$68 million
Springfield	$96 million	588	$52 million
Corvallis	$89 million	547	$48 million
Total	*$2.462 billion*	*15,092*	*$1.330 billion*

5G Economic Impact
https://www.ctia.org/5g/print?state=OR

Cost of the Rural Broadband Divide
Populations in rural America without broadband internet access are losing out on billions of dollars in quality-of-life benefits ranging from better employment and education to commerce and health care according to the National Rural Electric Cooperative Association (NRECA) Chief Economist Russell Tucker, lead author of the NRECA report "Unlocking the Value of Broadband for Electric Cooperative Consumer-Members. He noted in his presentation at the USDA's 95th Annual Agricultural Outlook Forum in February 2019 that, "Access to broadband is essential for the economic health of rural communities." To the extent that broadband access provides an opportunity to maintain or grow the rural workforce combined with productivity-enhancing applications—such as precision agriculture—then this bodes well for local economic growth."
https://www.electric.coop/usda-forum-nreca-chief-economist-details-local-impact-rural-broadband/

Broadband Related Challenges and Opportunities

OBAC has identified the following key broadband challenges and opportunities facing Oregon in 2020.

Digital Inclusion

Oregon needs funded state-level strategies and programs to ensure that all individuals and communities have access to affordable state of the art broadband communications services, and the skills, knowledge and technical support needed to use them.

Digital Inclusion is improving the capability of individuals or groups in unserved and underserved populations to obtain the benefits of broadband connectivity, and to be able to use telecommunications technology and enabled applications confidently, safely and securely to improve their lives. The Digital Divide is not just related to population density, but also to factors of income, age, ethnicity, and education. In the face of the pandemic, digital inclusion is tantamount to social and economic inclusion.

Digital equity is defined by the National Digital Inclusion Alliance (NDIA), as a condition in which all individuals and communities have the information technology capacity needed for full participation in society, democracy, and the economy. Digital inclusion is the effort made to provide the information technology capacity needed for full participation in society, democracy, and the economy. This includes access to affordable, robust broadband internet service; internet-enabled devices that meet the needs of the user; digital literacy resources; quality technical support; and applications and online content designed to enable and encourage self-sufficiency, participation, and collaboration. https://www.digitalinclusion.org/

NDIA with Public Knowledge and support from Mobile Beacon and Mobile Citizen has published a Discount Internet Guidebook. It is a guide for digital inclusion practitioners -- local community-based organizations, libraries, housing authorities, government agencies and others working directly with community members in need of affordable home broadband service. It describes affordable broadband plans for disadvantaged American households offered by commercial Internet providers (or in two cases, nonprofit resellers of a commercial service). This guidebook also contains recommendations for policy makers and Internet service providers to improve current offers and establish new offers. https://www.discounts.digitalinclusion.org/

Many Oregon broadband service providers have programs aimed at improving digital inclusion by offering special terms and assistance to unserved or underserved populations.

Comcast Internet Essentials Program

Comcast announced the biggest expansion to date of its Internet Essentials program. All qualified low-income families in the cable company's service area now will have access to the service, which offers low cost discounted broadband and other services and benefits targeting low-income users. Now, approximately 3 million households –which include residents with disabilities in addition to low-income households — will be able to apply. The expansion will bring households eligible for the program to almost 7 million. Internet Essentials appears to be having its intended effect. Last year, Comcast reported that 62% of low-income broadband customers say that the service has helped them or someone in their family find a job. And 93% of those surveyed said that the program has positively affected their child's grades. Almost all respondents – 98% — said that they use the service for schoolwork and 90% say they use it almost every day. In Oregon, Comcast has connected 52,000 households in the region serving an estimated 208,000 individuals. Comcast predicts that another 100,000 households in the Oregon/SW Washington region will be eligible under the program expansion.
https://www.telecompetitor.com/comcast-internet-essentials-broadband-now-offered-to-almost-7m-low-income-households/

The Comcast Internet Essentials program achieved a number of milestones in 2019:

- 8 million low-income people have been connected to home Internet services, 90% of which did not have connections previously.
- More than $650 million in digital skills training, benefiting nearly 9.5 million people,
- 100,000 discounted and subsidized laptop or desktop computers have been provided since the program started.
- In August, the company lowered the threshold for people to qualify for the program.

https://www.telecompetitor.com/comcast-internet-essentials

AT&T Broadband Access Program for low-income users

AT&T has launched *Believe Portland* as a program to promote Digital Inclusion efforts in Portland. AT&T is committed to addressing the struggles around digital inequity in Portland and are doing that through this employee initiative designed to raise awareness and generate support around digital inclusion initiatives that improve the lives of underserved communities in Portland. [George Granger – AT&T Oregon President]

Charter Spectrum

Charter Communications' Spectrum Internet Assist program provides reliable, high-speed internet access at an affordable price for eligible low-income households, which can receive discounted 30 Mbps high-speed internet service along with Security Suite and an internet modem, at no additional charge. Spectrum Internet Assist requires no contracts, and there are no data caps.

To qualify for this program, one or more members of a household must currently receive assistance under the National School Lunch Program (NSLP), Community Eligibility Provision of the NSLP, or Supplemental Security Income for applicants 65 years of age and older. https://www.spectrum.net/support/internet/spectrum-internet-assist/

Additionally, Charter Communications established the *2020 Spectrum Digital Education Grant Program* to support nonprofit organizations that educate community members on the benefits of broadband and how to use it in their lives. Charter launched the Spectrum Digital Education program in 2017 and has since committed to awarding $6 million in cash grants and in-kind donations to support broadband education. Prior awards have allowed local beneficiaries to set up technology labs, provide online education to senior centers, and distribute laptops, impacting 28,845 individuals across 17 states and Washington, D.C., through 2019. https://corporate.charter.com/newsroom/charter-launches-2020-digital-education-grant-program

Wave Broadband
Wave Broadband's Internet First program provides affordable Internet designed to help families and students in low-income households have reliable access to the internet. Fast internet for home schooling, homework, accessing educational resources, and more for $9.95 per month for up to 25 Mbps. https://residential.wavebroadband.com/internet-first/

TDS BendBroadband
BendBroadband's Connect2Compete Program partners with local nonprofits to provide eligible low-income families with high-speed Internet for just $9.95 per month, including a wireless modem. BendBroadband waives deposit and installation fees, and the $9.95 per month price is good for 2 years, at which point eligible customers may recertify. Connect2Compete provides speeds up to 25Mbps downloads, and up to 3Mbps upload, and a 250GB monthly data usage allotment.

CenturyLink
CenturyLink offers discounted High-Speed Internet service starting at $9.95 a month, plus applicable taxes and fees, to eligible consumers in states where it has local operations.

Ziply Fiber
Ziply Fiber is committed to helping qualified low-income individuals pay for telephone or qualified internet services through participation in government programs:
Federal Lifeline, Enhanced Tribal Lifeline (Federal), Tribal Link-Up Assistance (Federal) and Telephone Assistance Programs (State).
https://ziplyfiber.com/resources/discount-program-types/low-income-assistance-programs

Federal Lifeline

Federal Lifeline is one of four Federal Communications Commission (FCC) Federal Universal Service Fund programs funded through a monthly, per line surcharge to help make communications services more affordable for low-income consumers. The FCC reviews this rate quarterly. Assistance received through these programs are non-transferable (from one person to another) that provides one discount per household on the cost of either: • $7.25* on monthly telephone service • $9.25 on qualified internet access service with or without telephone service. *Please note, effective December 1, 2020 the monthly discount for telephone service only will be reduced to $5.25.
Qualified internet access service is defined as at least 20/3mbps** service unless 20/3mpbs is not available. In the event that 20/3mpbs service is not available, the following two conditions must be met: • A minimum of 4/1mpbs must be available. • The customer must purchase the highest performing generally available residential offering ranked by (i) download bandwidth; (ii) upload bandwidth; and (iii) usage allowance. **Please note, effective December 1, 2020 the qualified internet access service definition is changing to 25/3mbps.

Federal Enhanced Tribal Lifeline & Tribal Link-Up Assistance

An eligible resident living on federally recognized Tribal Lands who participates in one of above programs or one of the following federal assistance programs shall also qualify for an additional monthly credit of up to $25.00 with Enhanced Tribal Lifeline and up to $100.00 toward installation fees with Tribal Link-Up Assistance: • Bureau of Indian Affairs General Assistance • Tribally Administered Temporary Assistance for Needy Families (Tribal TANF) • Head Start (Income-Based) • Food Distribution Program on Indian Reservations (FDPIR)

Digital Literacy

The American Library Association's digital-literacy task force offers this definition: "Digital literacy is the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills." Digital literacy means being able to understand and use digital technology. It relates to the ability to find, use and create information online in a beneficial and useful way. Digital literacy also means knowing the limitations of technology and understanding the dangers and precautions that the use of technology requires.

The lack of digital literacy is a barrier to adoption and utilization for many and is a key contributor to the digital divide.

Google is offering a program called Grow with Google https://grow.google/ offering free training, tools, and resources to help grow digital skills. Since 2017, more than four million Americans1 have grown their businesses and careers with help from Grow with Google's training and in-person workshops. And through a network of more than 7,000 partner organizations including local libraries, schools, and nonprofits.

On April 11, 2019, U.S. Senator Patty Murray (D-W.A.) and a group of democratic senators introduced the Digital Equity Act of 2019, aimed at closing the digital divide in communities across the country. The legislation would create two grant programs to promote digital equity and support digital inclusion programs for students, families, and workers. More specifically, it authorizes $125 million in funding per year over five years for each of the two programs.
https://www.murray.senate.gov/public/index.cfm/newsreleases?ContentRecord_id=016FCF9F-F00F-42D7-BD98-EFDA3D9784EF

Cyber Security
The security of data and communications systems continues to be a critical risk exposure for government, public organizations, private sector businesses, and for individuals that is widely unrecognized and under managed. Oregon needs to follow-through on its 2017 cyber security legislative initiatives www.cyberoregon.com. Expanded and pro-active cyber risk management is needed.

To respond to this challenge, Oregon Senate Bill 90 (ORS 276A.326-9), was signed into law and effective as of July 1, 2017, required establishing the Oregon Cybersecurity Center of Excellence (CCoE) and the Oregon Cybersecurity Advisory Council within the office of the State Chief Information Officer. The council consists of nine voting members. A majority must be representatives of cyber-related industries in Oregon.

The voting members of the council must include at least one representative of post-secondary institutions of education and one representative of public law enforcement agencies in Oregon.

- Serve as Statewide Advisory body to State CIO on Cybersecurity
- Coordinate cybersecurity information sharing and promote shared and real-time awareness between public and private sectors
- Provide Statewide Forum for discussing and resolving cybersecurity issues.
- Encourage the development of the cybersecurity workforce
- Provide information and recommend best practices to public and private entities

Council Vision: Cybersecurity is a shared responsibility and must be accessible to all.
Council Mission: Build tangible solutions to protect the digital lives of all Oregonians.
OCAC is not just a policy body, but will be launching and managing programs to address the cybersecurity needs of the state. Rural areas face similar challenges in cybersecurity, as they face in broadband. They are lagging behind urban areas. Tangible solutions are needed. OCAC is using a "public health" model to develop programs. Most people do not know what to do or who to contact if they suffer a data breach or ransomware attack. Additionally, law enforcement does not know what to do. Everyone needs help.

OCAC has developed several outreach programs to assist Oregonians.

Oregon Cybersecurity Awareness Program

- Create an Oregon's website/portal for all things Oregon cybersecurity - www.CyberOregon.com
- Build awareness across the state and beyond about Oregon's cybersecurity business and educational programs, talent and companies
- Promote workforce development and create awareness of career opportunities
- Raise visibility of the Cybersecurity Center of Excellence (CCoE) and support legislative initiatives
- Provide critical information and tools to help Oregon businesses and organizations improve cybersecurity
- Industry and education summits (four in 2018)

Oregon Cyber Pathways Project

The Oregon Cyber Pathways Project (OCPP) will seek out, identify, and guide future security professionals along their development path from youth-focused programs through internships and apprenticeships that establish them in the workforce. The OCPP will work with school districts, youth organizations, academia, and businesses throughout Oregon to build and leverage a network of contacts to connect youth and young adults to organizations that provide cyber security education, competitions, mentoring, work experience, and long-term careers in the field.

Managed Security Service Provider

Developed by the Technical Services Working Group of OCAC, this concept addresses the need for cyber security protections in place by large numbers of organizations (such as K-12 districts, small businesses, and non-profits) throughout the state that are unattractive for commercial cyber security companies due to their lack of funding, remote locations, or lack of capacity.

Oregon Veteran Cybersecurity Initiative

Engage veterans to work directly with other veterans to identify where they can apply their interests and service experience with the goal of connecting them with institutions in Oregon that are hiring cybersecurity professionals. Would require funding for programming, staff, and website development.

Cyber Oregon Public Outreach/Awareness

Build awareness across the state and beyond about Oregon's cybersecurity business and education programs, talent, and companies; promote workforce development and create awareness of career opportunities; raise visibility of cybersecurity and support legislative initiatives; and provide critical information and tools to help Oregon businesses and organizations improve cybersecurity. Funding for maintaining a website and supporting staff in managing content, advertising, etc. would be required.

Oregon State University's Oregon Research & Teaching Security

Partner with Oregon State University to build the ORTSOC into a world-class teaching and research Security Operations Center that offers learning opportunities for undergraduate students, offers cybersecurity training and education opportunities for IT staff of small businesses, creates opportunities for researchers at OSU and partners to develop new approaches in cybersecurity protection, help address operational security needs at Oregon institutions of higher education, and provide cybersecurity information sharing and potentially threat assessment and monitoring services as well for the Oregon Cybersecurity Center of Excellence. This proposal would be supported by funding to expand existing services, staff and student positions, as well as a small amount for equipment.

Broadening Security Education in Oregon

This concept would be to expand current cybersecurity education efforts for technical and non-technical audiences. The non-technical trainings would expand existing CyberPDX programs, security awareness, and phishing curriculum. The concept would also increase training for technical audiences, including Saturday Academy ASE internships, Oregon CTF, and among other things, technical training that targets an emerging, underserved area in cloud and block-chain security. Funding would be required for curriculum development, mentorship, and event organization.

Business Education Concept Cyber Internship Model

This concept proposes a unique internship model that focuses on short-term, project-based, and high-need experiences that are facilitated by the Business Education Compact (BEC) and classroom instructors. The concept involves placing interns in organizations to work on cybersecurity related projects. Businesses would contribute funding to intern salary. Additional core funding would allow more businesses, students, and instructors to benefit from this experience.

Professional Certification Fund

This proposal outlines the creation of a "certification scholarship fund" that allows students pursuing cyber education programs to apply for access to free or substantially reduced exam vouchers for industry certification exams offered through organizations like CompTIA, CISCO, and others. The program concept incorporates standards for eligibility and processes for allocating funding. This program would increase the Appendix A, p. 3 cybersecurity professionals and reduce barriers for entry into the workforce. This program is expandable based on the number of students and institutions involved in the effort.

BSIDES Portland

BSIDES Portland is a 501(c)(3) organization that hosts the only annual information security-focused conference in Oregon. This concept proposal would allow BSIDES

Portland to grow from the established volunteer-run information security / cybersecurity event it has been for the last 8 years into the professional information security/cybersecurity event that Oregon deserves. This proposal would support the Oregon information security community, allowing the community in turn to support the security needs of all citizens of Oregon. Funding for BSIDES would help support presenters' costs, allow for a greater number of highly impactful talks and workshops, support capture the flag competitions to more venues in Oregon, and will enable the documentation and publication of the event for the benefit of all Oregonians.
OCAC was charged with developing the plan for a Cybersecurity Center of Excellence to be delivered in January 2019. The plan was developed and may be viewed at https://bit.ly/2ICfXvU.

This CCoE Establishment Plan addresses the required four types of primary activities and tasks specified in ORS 276A.326-29. The CCoE programmatic initiatives are envisioned as the following:

- Workforce development
- Education
- Extensive public outreach and awareness campaigns
- Public-facing incident response and recovery capabilities, in two key areas:
- Creation of a threat information sharing and analysis (ISAO) node to participate in cybersecurity initiatives at the state and national levels– and serve as a liaison with the National Cybersecurity and Communications Integration Center within the United States Department of Homeland Security.
- Completion and implementation of the Oregon Cybersecurity Strategy and Cyber Disruption Response Plans

There were a record-high 10.52 billion malware attacks in 2018 and IoT attacks increased by 217% from 2017, and 74,290 never-seen-before attacks in 2019 according to malware attack data from cybersecurity technology company SonicWall. The data was compiled from threat intelligence obtained from the company's more than 1 million sensors from around the world.
http://finleyusa.com/cybersecurity-alert-malware-attack-data-finds-record-high-10-52-billion-attacks/

Cybersecurity Workforce
Oregon needs to build its cybersecurity workforce. The state does not have enough cybersecurity professionals to meet the needs of Oregon's institutions s and business organizations. This is not only a statewide shortage. It is national and global.

Between September 2017 and August 2018, U.S. employers posted nearly 314,000 jobs for cybersecurity pros. If they could be filled, that would boost the country's current cyber workforce of 714,000 by more than 40 percent, according to the National Initiative for Cybersecurity Education. In a recent study, (ISC)2 — the world's largest nonprofit

association of certified cybersecurity pros — said there is now a gap of almost 3 million cybersecurity jobs globally
https://techcrunch.com/2019/01/27/too-few-cybersecurity-professionals-is-a-gigantic-problem-for-2019/

In order to create CCoE that meets the real needs of Oregonians, OCAC with the support from State commissioned Portland University's Center for Public Service (CPS) to conduct a study on the cybersecurity needs and existing resources for the state of Oregon. CPS conducted both survey research (174 respondents), as a way to better understand the need for cybersecurity tools and programs, and conducted focus groups (8 groups).

Survey Findings
CPS found that 90% of their study respondents recognized and acknowledged growing cyber security needs. 75% of them said that cyber expertise is either critical or very important to their typical operations. Despite this, approximately 59% of organizations reported that staffing has been difficult or very difficult over the past five years. In addition, 84% thought there would be a significant or moderate shortage of qualified workers for important positions. In terms of cyber security resources or programs, 78% indicated they would use a statewide cyber event warning system; 65% would use a fully online continuing education and certification program; 63% would attend cybersecurity information sharing events; and 63% would use low-cost reviews of cybersecurity systems.

Based on the research findings from CPS at PSU, contributions from Oregon Cybersecurity Advisory Council working groups, and guiding documents from the Oregon State Chief Information Officer [OSCIO and Senate Bill 90 (2017)], OCAC created a plan for CCOE that is informed and framed by 18 months of intensive academic research, robust public engagement of many individuals and businesses, and an assessment of stakeholder and beneficiary needs.

The original CCoE budget to fund the required statewide planning efforts and launch programs of CCoE was estimated at $832,500 per year for 2 years. OCAC put out a call for concept program proposals from Oregon organizations, to advance the state of cybersecurity in Oregon. To fully fund, all of the concepts CCoE received would require an additional $3,110,544 per year for 3 years. It was understood these programs could be prioritized to be responsive to the State's needs and to scale (both up and down) depending on the availability of funds. Further, the programs were designed to gain self-sufficiency over time. OCAC proposes a number of programs that can begin to address the State's needs for improved cybersecurity.

NW Cyber Camp
Nationwide, there are about half a million open cybersecurity jobs and more than 5,000 in Oregon alone. The cybersecurity industry, the public sector, and any company that uses computers, needs trained cybersecurity professionals, but there is a shortage of supply. For the last 5 years, NW Cyber Camp (www.nwcyber.camp) has provided a weeklong day camp for high school students to attract talented students to cybersecurity field. Because of great interest from students and industry alike, the camp has grown from one camp in 2016, to four camps in 2019.

NW Cyber Camp introduces students to defending computer systems and networks from cyberattacks, breaches, and malware. The camp includes an evening networking reception where students and parents can talk one-to-one with local professionals and businesses to discuss career opportunities and potential internships. NW Cyber Camp includes a girls-only camp featuring female guest speakers and instructors, to provide an inclusive and tailored program for young women interested in STEM careers.
NW Cyber Camp is taught by leading industry professionals and educators (on a volunteer basis), and includes expert guest speakers from companies such as PacStar, McAfee, Intel, Facebook, PKI Solutions, Galois, HP, Cylance, Oregon Health Science University, Salesforce.com, and Splunk.

The current management and financial structure currently in place – which has relied on volunteer efforts for nearly the entirety of the program – along with strong corporate support covering direct expenses and student scholarships, cannot grow further to meet growing demand. Currently the camp is serving only Portland metro and parts of Willamette Valley – but has repeatedly received requests by representatives in communities such as Pendleton, Klamath Falls, Central Oregon, and Medford to expand to those locations.

NW Cyber Camp seeks financial assistance to a) hire (on a part time basis) a program manager to manage the camp – enabling the camp to continue, to ensure quality programming, and enable growth b) additional funds to support direct expenses and expenses related to student recruiting, and c) create a small scholarship fund of stipends for a select number of low-income students. NW Cyber Camp is looking for $362,632 over two years to serve 400+ students across 10 campsites spanning the state over the two years.

Security and Privacy Education for the General Public through Libraries
This project proposes a training program for librarians across Oregon, modeled after the Library Freedom Institute (https://libraryfreedomproject.org/lfi/), to build skills and capacity for general education in computer security and privacy. Libraries support information-seekers at all levels and are trained to know when they need to get referrals, making them well-positioned both as a conduit to disperse information to the public, as well as to pass questions back up to experts. We believe that the libraries of Oregon are an

ideal place to provide education to the public to help people of all ages and abilities protect their personal information online. There are over 200 public libraries across Oregon, in addition to libraries in K-12 schools, community colleges, and universities. Libraries provide vital access to technology, particularly for low-income, low-digital literacy, and rural community members, as well as technology education.

This training program will consist of 3-6 month of weekly distance-learning activities including lectures, readings and hands-on activities, along with two days of intensive in-person training. Librarians who complete the program will be expected to integrate privacy and cybersecurity curriculum into technology programming at their libraries and advocate for privacy and cybersecurity in their public computing services as well as in the broader community. The program will provide ongoing support for libraries' outreach and education activities. This will help establish and foster a network of privacy and cybersecurity advocates centered at libraries across the state, who can share emerging concerns and questions from their communities to shape future training in inform potential solutions, as well as a network of cybersecurity and privacy experts who can respond to more advanced concerns. Training curriculum will be developed at and administered through Oregon State University.

The program will initially train three cohorts of 20-30 librarians. Given the budgetary constraints of many libraries, librarians are unlikely to be able to take the time to pursue such an in-depth training-for-trainers program. Funding will help libraries release key staff to participate in the program and initiate the integration of the privacy and cybersecurity curriculum into technology programming at their libraries. It will also cover the costs of the in-person part of the training.

The program's 2-year goal is to have at least one trained privacy and cybersecurity advocate in every county in the state and per 100,000 residents; training 60 librarians in 2 years could accomplish this goal. Priority for participation would focus on geographic and demographic diversity, and ensuring that each cohort includes public, K-12, and academic librarians. Our goal is to train three cohorts of librarians in the first 2 years, each with 20-30 participants. This project is seeking seed funding of $220,420 to $696,190 over 2 years depending on the target number of trained librarians.

Oregon Research and Teaching Security Operations Center
According to a recent report by the U.S. Departments of Commerce and of Homeland Security, existing education efforts may be failing to meet demands for trained cybersecurity professionals. "Employers increasingly are concerned about the relevance of cybersecurity-related education programs in meeting the needs of their organizations" was one of the key findings of the report. Further research has pointed to the importance of experiential learning to make graduating students appealing to employers.

Oregon State University's newly formed Oregon Research & Teaching Security Operations Center (ORTSOC), a collaborative effort between OSU's Information Security Team and the College of Engineering's Cybersecurity Program, is uniquely situated to not only educate and train the next generation of cybersecurity workforce but to also provide the core operational security and information sharing and analysis programs for the Cybersecurity Center of Excellence.

ORTSOC's intends to integrate with the Oregon Fiber Partnership's (Link Oregon) network, to provide continuous monitoring services that could strengthen the security posture of the organizations connected to that network. Information sharing concerning security threats, protection and response through engagement in a private, vetted community of information security and other technical professionals across the state will promote and improve cybersecurity, enabling practitioners of all levels to respond to threats and incidents. Hands-on training and real-world experience for OSU cybersecurity track students, interns from Oregon institutions, and for IT staff through seminars will significantly improve the skills of cybersecurity workforce and provide ready-to-go workforce to Oregon businesses.

Currently, ORTSOC is able to offer the training opportunity to 2 – 3 students at a time and is growing slowly. However, we do not currently have the capacity to provide experiential learning to all our cybersecurity track students (~75 students) in the program. Expanding the capacity requires hiring more security professional - we will need one security professional for every 6 – 8 students. This scaled up operation will be used as a foundation to offer security monitoring services for underserved public and non-profit entities. ORTSOC is seeking seed funding of $1.25 million over 2 years to scale this program into a self-sufficient engine of innovation, education and workforce development for the State. ORTSOC plans to attain budgetary self-sufficiency through a membership model for its threat information sharing and analysis (ISAC) service and through security monitoring services for underserved public entities such as school districts.

Oregon Cybersecurity Advisory Council (OCAC) Recommendations
The three highlighted program concepts described above addressing key needs of OBAC stakeholders, most notably, rural communities. The original budget estimate for these three program concepts combined is estimated between $594,347 and $752,937 per year over 2-3 years, not including the CCoE management costs. The budget for these programs is highly variable, and may be adjusted to a great degree, depending on availability of funds.

Because of state budget constraints, CCoE has not yet been funded and established. Today, representatives of OCAC, the State of Oregon CIO office, OSU, PSU, Mount Hood Community College, and the private sector, continue to pursue sources of funding and alternative means to fund all or parts of the CCoE plan and related programs.

OCAC recommends that these CCoE programs be funded. The first step would be an allocation of resources necessary to staff a CCoE director/manager, with a small allocation of operating funds, to ensure appropriate management and oversight. This should be followed by establishment of three or more CCoE programs that align with OBAC needs, with revised budgets scoped as funds allow, and modified to accommodate constraints that may be imposed by COVID-19.

The concept programs above are designed to complement existing upper educational institution programs in Oregon, while seemingly numerous, currently graduate a very small number of students compared to the established need. Further, the university and college programs do not offer the programs outlined above, which are aimed to fill significant gaps in recruiting, experiential learning, and public education.
Other Upper Educational Resources.

The following is a list of Oregon higher education programs related to cybersecurity.

Institution	Program	URL
George Fox University	BS Computer Science with Cyber security Concentration	https://www.georgefox.edu/college-admissions/academics/major/cyber-security-concentration.html
Lewis and Clark College	2 National Science Foundation grants related to cybersecurity	https://college.lclark.edu/live/news/30529-cybersecurity-education-tools
Linfield University	Cyber Security and Digital Forensics Certificate program	https://www.linfield.edu/dce/certificates/cyber-security-and-digital-forensics-certificate.html
Linn-Benton Community College	Dual Partnership Program offers dual enrollment with OSU for computer science students; no further details on cybersecurity specific programming available	https://www.linnbenton.edu/degree-partnership https://www.linnbenton.edu/current students/student-support/instructional departments/computer-systems/computer-science
Mt. Hood Community College	Home of Oregon Center for Cyber Security. Provides cybersecurity services to small businesses around Oregon through network of	https://www.mhcc.edu/OCCS/ https://bizcenter.org/cybersecurity/

	Small Business Development Centers (SBDC)	
Oregon Institute of Technology	Operates Cyber Defense Center (staffed by students in Information Technology degree program)	http://www.oit.edu/cyber-defense-center
Oregon State University	Oregon State University offers a Bachelor of Science in Computer Science with an applied track in cybersecurity.	https://eecs.oregonstate.edu/cybersecurity
Portland Community College	Offers a certificate in Cybersecurity Fundamentals	https://www.pcc.edu/about/events/cyber-security/ https://www.pcc.edu/programs/computer info/cyber-security.html
Portland State University	Portland State University offers a Masters Security Certificate and Master of Science Computer Science degree with a security track.	https://www.pdx.edu/computer-science/cybersecurity
Source U	Warner Pacific University's sourceU school will offer a Bachelor of Science in Information Technology with an emphasis on cybersecurity and web development.	https://sourceu.warnerpacific.edu/
Umpqua Community College	CYBERSECURITY ASSOCIATE OF APPLIED SCIENCE DEGREE	https://www.umpqua.edu/cybersecurity?utm_source=News-job-security&utm_medium=website&utm_campaign=Cybersecurity-1
University of Oregon	University of Oregon's Center for Cyber Security and Privacy (CCSP). Conducts a variety of research projects and educational efforts focusing on the security and privacy of computer networks and systems.	https://ccsp.uoregon.edu/

Cyber Attacks

Annual global cyber losses are expected to hit $6 trillion by 2021, with cybersecurity spending projected to exceed a total of $1 trillion for the five years leading up to 2021, according to a new report from Aon quoting statistics from Cybersecurity Ventures. While the immediate costs of a cyberattack can be significant, Aon's report suggested that damage to a business's reputation could cost just as much or even more in the long term. "The reputational crisis resulting from an attack can erode a company's market value, destroy brand loyalty, limit companies' digital transformation efforts and even lead to a credit-rating downgrade," Aon said. "An effective cyber resilience strategy can help mitigate both immediate and long-term financial losses." Business leaders need to make defending against cyber risks a priority.
https://www.insurancebusinessmag.com/us/news/cyber/global-cyber-losses-expected-to-hit-6-trillion-by-2021--report-177552.aspx

School districts are under pressure from cyber-attacks. Ransomware, network interruptions and phishing scams are increasingly targeting schools, which are often prime targets because of outdated hardware and software systems, says Doug Levin of EdTech Strategies. The company has tracked 533 cyberattacks on schools since the start of 2016.
https://thehill.com/policy/cybersecurity/456780-cyberattacks-find-easy-target-in-nations-schools

The National League of Cities reports that every hour, 26% of local governments report a cyberattack. However, according to a new National League of Cities analysis, done in partnership with the Public Technology Institute, nearly a quarter do not have a cybersecurity plan that is designed to protect government information systems from attack.
https://www.nlc.org/resource/new-report-what-cities-should-know-about-cybersecurity

Providence Health Plan Data Breach

A security breach may have exposed the personal information of up to 122,000 Providence Health Plan dental patients in Oregon, including their social security numbers and other sensitive data. Providence customers were notified late last month by Dominion National, the Virginia-based administrator of Providence's dental program. Dominion says the unauthorized party may have accessed information like patient names, addresses, dates of birth and social security numbers, as well as Providence enrollee information like member identification, group and subscriber numbers. In a subsequent statement, Dominion said it began mailing notices to potentially affected customers in June. Dominion will provide affected members with two years of free access to credit monitoring and fraud protection services. [Source: The Lund Report]

A data breach at a contractor for Health Share of Oregon, the Portland area's Medicaid insurer, has potentially compromised the personal information of about 650,000 people.

Health Share urged clients to take advantage of the free credit monitoring and take other steps to protect their information, including monitoring financial statements, credit reports and Social Security reports for suspicious activity; contacting banks about any suspected fraud; putting a freeze on credit reports; and reporting fraud to the Federal Trade Commission, Oregon's attorney general or law enforcement.
https://www.thelundreport.org/content/data-breach-affects-650000-medicaid-members-portland-area?mc_cid=ff9a318866&mc_eid=38b2987c1b

Tillamook County Ransomware Attack
On January 22, 2020, Tillamook County became aware of a data security incident when it began to experience computer difficulties. The Information Services department director immediately launched an investigation and determined that the county was a victim of a cyber-attack.

The county retained a legal counsel expert in responding to data security incidents and a leading independent computer forensics provider to assist with restoring the county's operations, determine the scope of the incident and what information may have been impacted, and to negotiate the ransom payment, if necessary. The county activated its Incident Command Team and coordinated with county law enforcement, as well as the FBI.

Tillamook County was attacked by an international cybercriminal organization known to law enforcement both nationally and internationally. The cyber attacker demanded a ransom of $600,000. At stake was our data including public records. Had we chosen not to pay the ransom, our encrypted data would have been irretrievable. The county made every effort to avoid the payment of a ransom to the cyber attacker, including recovery through two independent backup solutions and hundreds of hours of retained and county resources; however, data critical to County operations could not be restored without paying the cyber attacker for decryption keys.

Tillamook End-Results
- The county determined its only viable option was to authorize the negotiated ransom amount of $300,000 in order to obtain the decryption key(s) for its data.
- The County with the aid of retained forensic services was able determine there was no evidence indicating the personal information of its employees or residents was accessed or taken by the attacker
- County technology services were down completely for two weeks
- Full County technology services were not restored for four weeks
- Total estimated costs of the cyber/ransomware attack including Insurance, retained legal counsel, retained forensic and technology support, Information Services hours, and loss of County staff services and functional productivity are estimated between $750,000 to $850,000 dollars.
- Reputational loss costs are difficult to estimate.

Tillamook Lessons Learned

- Technology must be maintained; infrastructure and solutions must have a lifecycle and that lifecycle needs to be support through with appropriate funding and budget awareness.
- You can never place too much emphasis on risk assessment and security controls around remote access and external parties who have access to your network environments legally or illegally.
- Skilled workforce is a must. Technology staff must not only be able to provide solutions but also secure them in order to help lines of business/partner departments manage risk, skilled workforce is a challenge for any organization let alone smaller governmental entities like Tillamook County
- All organizations should have at least two forms of data/system backup environments, with one being off site and more importantly offline. Testing your backup and restore environments regularly or at a minimum annually is a must
- Pre-emptive risk management strategies or business continuity plans are imperative. At least some form of annual organizational plan/plans testing is necessary. Ultimately, prevention is desired, but you must be prepared for the eventuality of a need to respond and recover.
- Understanding the options available to your organization for cyber insurance (a solid risk transference strategy) are very important. Discussions with your Insurance Broker, Carrier, and their retained legal/forensic partners should take place at least annually. This gives you the opportunity to understand their capabilities prior to an event occurring

Risk Assessment

A global ransomware attack could cost the U.S. economy up to $89 billion, according to a new report from the Cyber Risk Management project. "A cyberattack is the second-greatest threat to the U.S. economy — in large part due to the increasing impact of attacks as the U.S. and global economies become more dependent on and driven by technology," Hank Watkins, president of Lloyd's America, said. Lloyd's of London is one of the founding members of the CyRiM project, which conducted the study. "While awareness of the threat posed by cyberattack and the global insurance industry's response have been growing in the U.S. … it's more important than ever for companies, individuals and organizations to anticipate and prepare for breaches," he added.
https://www.beckershospitalreview.com/cybersecurity/a-ransomware-attack-could-cost-us-economy-89b-researchers-warn.html

Senator Ron Wyden recently introduced a bill that would give the Federal Trade Commission the authority to establish privacy and cybersecurity standards. The bill would impose levy steep fines – even jail time – for companies and executives who misrepresent their compliance. The 38-page bill's provisions would:

- Establish a "do not track" option for people using online services. In lieu of allowing their search history, social media favorites and online activity to be sold to advertisers, people could opt to pay an unspecified fee to preserve their privacy.
- Authorize the FTC to establish privacy and cybersecurity standards and require big companies to report annually on their privacy practices.
- Penalize large companies that submit false information in their annual privacy report. Penalties could amount to 4 percent of annual revenue – a number that could run in the billions of dollars for the biggest social media companies. Executives could face jail time up to 20 years.
- Require companies to assess their algorithms for accuracy, fairness, bias and discrimination.

https://www.oregonlive.com/silicon-forest/2019/02/wyden-pitches-jail-time-billions-in-fines-for-online-privacy-violators-with-do-not-track-bill.html

Cyber security will always be a work in progress. Oregon needs to follow through on its initiatives and support their implementation.

Education

Oregon's K-20 educational institutions are positioned to realize significant economic, work force and community development benefits for the state through the utilization of broadband networks and applications. State level support and technical assistance is needed.

Oregon needs to focus short term on providing broadband connectivity to the state's students. In the face of the pandemic, the Homework Gap is now effectively an Education Gap.

It requires extraordinary effort to transition from in-school to virtual distance education for all students within a period of weeks, and that in many ways the technology challenges are the easiest to address. The challenge of managing the impacts on teachers, staff, students, and parents is tremendous, and the summer months provided an opportunity to catch-up. We are building an airplane while it is in flight.

We need virtual education skill development, we need end-user devices, and we need available and affordable broadband internet access for this to be successful. 163 out of 164 Oregon school districts surveyed in April described the need for professional development related to digital and online instruction.

Oregon needs to make investments in

- Online learning tools & professional development for how to use these tools
- Devices to achieve a 1:1 student/device ratio
- High quality, adaptable, culturally responsive, and effective online curriculum
- Family Support

Our education will not return to January 2020. Its systems and methods of operation have changed. Going forward, our education system will have greater utilization and reliance on distance education and digital systems for student learning in the classroom *and at home.*

Public Safety

Oregon's first responders are at a transition point for migration to new broadband Internet Protocol (IP) technologies. Support is needed for Oregon's 911 centers and first responders to migrate from legacy systems to Next Generation 911 and to interoperable wireless broadband communications systems.

FirstNet

Nationally, FirstNet is now has well over 425,000 subscribers with over 5,250 agencies. Band 14 implementation milestones are being met for the build-out. Cellular based push-to-talk feature applications have been introduced. FirstNet "on-boarding" support is provided to establish service, provide training and ensure positive user experiences.

In Oregon, new tower construction is in process and Band 14 milestones are met with over 30% of AT&T's Oregon network covered. AT&T was on plan for deployment at the end of 2018. The 2019 build-out will cover both rural and urban areas with dozens of Band 14 sites added. FirstNet subscribers continue to have priority preemption on all frequency bands on the AT&T network. FirstNet user devices look for Band 14 first when establishing connection. All subscribers are approved and credentialed to use FirstNet as a protected private network. Because of the FirstNet project, mobile wireless capacity is increasing for all Oregon customers.

In addition to AT&T's deployment of FirstNet, other mobile wireless carriers have also developed and are offering services designed for first responders.

OSCIO holds quarterly meetings with AT&T and the FirstNet Responder Authority to track progress. There are construction plans for forty-five new towers around the state over a period of five years.

The five-year build-out in Oregon is a contractual obligation. The FirstNet Responder Authority has a twenty-five year contract with AT&T. In 2019, there was a state of emergency declaration in Oregon due to a severe winter storm. In response, AT&T sent in "deployables" to expedite the restoration of service in affected areas along Highway 58 using Band 14 in addition to commercial frequencies.

9-1-1 Centers / Public Safety Answering Points (PSAPs)

The State 9-1-1 Program was established by the 1981 Oregon Legislature and its primary mission is to ensure the seamless operation of the statewide 9-1-1 communications

system ensuring uniform, prompt, and efficient access to public and private safety services for the citizens of, and visitors to, the State of Oregon. Oregon is home to 43 9-1-1 centers known as Public Safety Answering Points (PSAP) that cover all 36 Counties within the State. A directory of PSAPs may be found at https://www.oregon.gov/oem/911/Documents/psap_directory.pdf

911 centers fall under the Oregon Office of Emergency Management. Public Safety Answering Points (PSAPs) are organized through the Association of Public-Safety Communications Officials (APCO) https://www.apcointl.org/

Oregon PSAPs continue to face budget challenges in the face of needing to upgrade their systems to respond to changing technologies and user patterns within the telecommunications service market. PSAPs still rely on legacy telephone technologies, adopted decades ago to receive voice calls from landline phones and caller ID delivering address associated with the phone number. With 80% of 911 calls now coming from mobile devices, 911 systems have less information on emergency calls today.

Much of what was reported by OBAC in 2018 remains true in 2020. Oregon has not applied for grant funding related to Next Generation 911 (NG-911) in part due to the lack of matching funds and resources. The 2020 SCIP that was approved in August 2020 by the State Interoperability Executive Council calls for an NG-911 planning group to be created under the SIEC's Strategic Planning Committee. This group is envisioned as a multi-disciplinary, multi-agency, cross-sector task force that will be (is) made up of members that can move Oregon forward and develop a plan to implement Next Gen within the state and secure the needed funding to do so. This is time sensitive as legislation has been introduced in Congress to reauthorize the NG-911 Grant Program. Should it pass, Oregon needs to be application-ready to take advantage.

In 2019, Oregon APCO/NENA was able to secure a $0.25 increase of the Emergency Communications Tax (911 Tax) that became effective in January 2020. This increase has provided much needed funding for Oregon's 911 system, but still only accounts for approximately 24% of the total cost of operating all of the 911 centers. The rest is funded by local monies in the form of property taxes. There is no state money used to fund 9-1-1 in the State of Oregon and the increase was not enough to fund an investment in NG-911. The irony is that a Next Gen system would be significantly cheaper to operate and would likely pay for itself quickly. The costs of operating the current legacy system will continue to increase and our reliance on dated infrastructure inhibits our emergency response capacity and represents a very real danger to Oregonians.

Agriculture

Agriculture continues to emerge as an important driver and application for broadband infrastructure in rural areas of the state and is an area of particular focus for OBAC. The Council believes that agriculture will become the largest driver for broadband

infrastructure deployment in rural areas of the state. From expansion of precision agriculture applications to the deployment of agricultural research stations, the sector is underscoring the need for broadband deployment in rural places and will require reliable connectivity for producers on agricultural lands in all areas of the state to remain competitive. To meet this need, it will require recognition and a strategic response that includes dedicated and increased broadband investment in rural Oregon.

Precision agriculture (PA) is an approach to farm management that uses information technology (IT) to ensure that the crops and soil receive exactly what they need for optimum health and productivity. The goal of PA is to ensure profitability, sustainability and protection of the environment. PA depends on reliable high-speed network connections to function, and relies on cloud-based systems to perform computation and sourcing of data to feed into locally based decision support systems. Shortened and real-time analysis improves decision making, efficiency, production and profitability.

Precision agriculture applications reduce inputs such as labor, chemicals, fertilizers; increase outputs such as quality and quantity of food/products; and reduce environmental impacts of agricultural practices.

Farm Survey Data

Building broadband internet and cellular networks in rural America is critical to making the promise of data-driven farming a reality. Progress has been painfully slow. A United Soybean Board study confirmed U.S. farmers find the lack of broadband internet access an obstacle to their businesses. According to USB, 60% of farmers say they do not have adequate internet connectivity to perform necessary business tasks. Part of the reason that revolution has been slow to materialize is because high-speed data transfer is so hard to do in rural America. USB's survey validated what many who live or work in rural America know: Connectivity is awful, despite those promising "coverage" maps the telecommunications companies provide. The reality of those maps is connectivity often only occurs in the top floor of the house or by driving to the high spot down the road. https://www.dtnpf.com/agriculture/web/ag/blogs/editors-notebook/blog-post/2019/11/11/working-without-net

A survey was conducted across a wide cross-section of 2,000 farmers and ranchers from across the country. In addition to the conclusions on inadequate connectivity, other key findings of the survey include:

- 60% of farmers said the primary problem with their broadband is slow speed. Other issues identified include the cost and reliability of broadband connections.
- 78% of farmers said they have only one option for choosing an ISP.
- The survey showed that 59% of farmers want to incorporate the use of more data in their business and another 28% are considering it.

- The survey looked at two aspects of broadband – in the office and in the fields. Only 32% of farmers found broadband in their office to be reliable. Over 77% do not think they have a good broadband solution in their fields. Only 26% say that cellular coverage is reliable in their fields.
- 67% of farmers want the ability to transfer data wirelessly from their fields.
- 90% of farmers are using a cellphone for Internet access in their fields. A few farmers surveyed constructed their own wireless networks to reach their fields.
- Most farmers now use 2 or 3 different wireless devices (laptops, tablets, smartphones, desktops, and smart farm machinery).
- 33% of farmers say lack of broadband has affected their equipment purchases – they are not yet buying smart machinery.

Farmers in the survey could also tell their story about how they use or would like to use broadband. Some of the technologies reported include:

- Precision agriculture where field data provides the ability of farm equipment to apply different amounts of nutrients and insecticide only where it is needed.
- Soil monitoring to better understand the condition of the soil – with a goal to improve the soil year after year.
- Precision irrigation that provides water only where it is needed.
- Drones to survey the fields to gather data.

https://potsandpansbyccg.com/2019/11/20/another-farming-broadband-survey/

The USDA released a report entitled "A Case for Rural Broadband: Insights on Rural Broadband Infrastructure and Next Generation Precision Agriculture Technologies" on April 30, 2019. The report finds that deployment of both broadband e-connectivity and next generation precision agriculture technology on farms and ranches throughout the U.S. could result in at least $47 billion in national economic benefits every year. The USDA also said the report finds if broadband infrastructure and digital technologies at scale were available at a level that meets estimated producer demand, the U.S. economy could realize benefits equivalent to nearly 18 percent of total agriculture production. The USDA noted of that 18 percent, more than one third is dependent on broadband e-connectivity, equivalent to at least $18 billion in annual economic benefits that only high-speed, reliable internet can provide. Press release

The report looks at the intersection of broadband Internet infrastructure and the digital Next Generation Precision Agriculture technologies that will be dependent on and enabled by broadband network connectivity. USDA's analysis estimates that connected technologies are poised to *transform* agricultural production, and can create a potential $47 to $65 billion in annual gross benefits for the United States. If broadband Internet infrastructure, digital technologies, and on-farm capabilities become available at a level that meets estimated producer demand, the U.S. agriculture industry would realize benefits of nearly 18 percent of total production, based on 2017 levels.

Also, under the USDA's new ReConnect Program for broadband, grant and loan award selection criteria now include providing services to agricultural producers.

FCC Task Force on Agriculture

In 2019, the FCC announced that it is creating a Task Force for Reviewing Connectivity and Technology Needs of Precision Agriculture in the United States. Membership will include public and private stakeholders in the agricultural and technology fields and will act in consultation with the Secretary of Agriculture for a period of two years.

The Task Force has six mandates

- Identify and measure current gaps in the availability of broadband Internet access service on agricultural land;
- Develop policy recommendations to promote the rapid, expanded deployment of broadband Internet access service on unserved agricultural land, with a goal of achieving reliable capabilities on 95 percent of agricultural land in the United States by 2025;
- Promote effective policy and regulatory solutions that encourage the adoption of broadband Internet access service on farms and ranches and promote precision agriculture;
- Recommend specific new rules or amendments to existing FCC rules that the Commission should issue to achieve the goals and purposes of the policy recommendations;
- Recommend specific steps that the Commission should take to obtain reliable and standardized data measurements of the availability of broadband Internet access service as may be necessary to target funding support, from future programs of the Commission dedicated to the deployment of broadband Internet access service, to unserved agricultural land in need of broadband Internet access service; and
- Recommend specific steps that the FCC should consider to ensure that the expertise of the Secretary and available farm data are reflected in future programs of the Commission dedicated to the infrastructure deployment of broadband Internet access service and to direct available funding to unserved agricultural land where needed.

https://www.telecompetitor.com/fcc-to-create-precision-ag-connectivity-task-force/

The first meeting of the FCC's advisory Task Force on precision agriculture was on December 9, 2019. Working groups are (1) Mapping and Analyzing Connectivity on Agricultural Lands; (2) Examining Current and Future Connectivity Demand for Precision Agriculture; (3) Encouraging Adoption of Precision Agriculture and Availability of High-Quality Jobs on Connected Farms; and (4) Accelerating Broadband Deployment on Unserved Agricultural Lands. Interim findings from this taskforce will be released soon. Early indicators point to a need for symmetrical high-speed connectivity to the farmhouse or operation centers, while asymmetrical connectivity coverage over larger agricultural lands to start will go a long way toward enabling ubiquitous adoption of PA.

A new U.S. Department of Agriculture initiative dubbed Agriculture Innovation Agenda, aims to "align resources, programs and research to position American agriculture to better meet future global demands," according to the USDA. The initiative sets an ambitious goal of increasing U.S. agricultural production by 40% while cutting the environmental footprint of U.S. agriculture in half by 2050.
https://www.telecompetitor.com/usda-agriculture-innovation-agenda-could-spur-broadband-usage-deployment/

Data is the key

The ability to collect data is rapidly increasing with new technologies including satellites, drones, and sensors placed on farm equipment, in the soil and on crops. The ability to collect, access, analyze and act on the data enables farmers to manage their crops with precision. Technology is already being extensively deployed in farm equipment, but connectivity is necessary to utilize the data and information from that smart equipment. Current generations of farm equipment use artificial intelligence and automation and *require* network connectivity to support real time applications. See John Deere's video, *John Deere Farm Forward 2.0 – Revolutionizing agriculture, one plant at a time* https://www.deere.com/en/our-company/technology-and-innovation/. Also see *Azure Farm Beats* for an example of Microsoft's effort to support farming with IoT, AI and machine learning that can be achieve today, https://azure.microsoft.com/en-us/resources/videos/azurefarmbeats/?cdn=disable

The supply chain also benefits from investments into smart technologies. *Twenty-five to forty percent* of agricultural production is lost to spoilage through the distribution chain. Reducing food spoilage and loss is the equivalent of increasing production. Another challenge is food safety, which can be addressed by the ability to identify and track production from the field to the table. Consumers are also increasingly demanding this information.

Broadband for farmers, ranchers and growers is not just an information distribution system, it is a *two-way connection* that enables the agricultural community to contribute, provide information, engage and participate in the economy and society.

Oregon Agriculture

Oregon's 2019 GDP was $42.87 Billion. Agriculture, forestry, fishing, and hunting represented 4.75 percent of the GDP. Oregon agriculture directly and indirectly contributes 686,518 jobs, $29.71 billion in wages, $12.12 billion in taxes, and $2.85 billion in exports to the state. There are 37,200 farms in the state and the economic impact and contribution of agriculture has the greatest impact in the rural counties and rural communities. These contributions can and will be further enhanced with broadband deployment.

It is critical that we improve the efficiency and productivity of agriculture in Oregon. Producers need to be able to have access to information, make decisions and respond to the many natural, political and economic factors that affect them. To do that, they need communications and they need information in real time. They need broadband access to the internet and global networks.

If you look at broadband access and precision agriculture from an equity lens, we have seen a decrease in small to medium sized farms over time. Large farm operations have additional resources to bring in broadband to support the adoption of precision agricultural practices. This makes them more profitable and makes it harder for smaller operations to compete on the market.

Ubiquitous broadband can begin to level the playing field, enabling agricultural producers of all sizes to adopt PA tools and practices. If small to medium sized agricultural producers have broadband access, they can implement the same technologies to improve their practices and we should see a strengthening of the market and our rural communities. They are implementing these technologies, where connectivity exists.

The potential is illustrated by a study commissioned by the city of Hermiston which showed that if every acre in Northern Umatilla and Morrow County, 1000 vertical feet from the Columbia River, that never had water, had water at one time (well but turned off), or doesn't have full season water, received water from the Columbia River through a managed system, the annual economic benefit would be $1.5 billion.

One of the primary innovation mechanisms for Oregon involves the Agricultural Research Service (ARS) and Statewide Public Service Programs through Oregon State University: OSU Extension Service, Oregon Agricultural Experiment Stations, and the Oregon Forest Research Laboratory. With facilities in communities all around the state, ARS and OSU have struggled to upgrade offices with high-speed bandwidth to complete the research that informs and enhance precision agricultural practices and provides information and expertise to help meet local challenges.

Investments by agriculture producers in research has been a long-term effort of many producer groups. For instance, the Oregon Wheat Commission invests nearly $1 million annually of producer dollars directly to wheat research on topics ranging from plant breeding innovation, to variety trials to plant pathology and weed research.

In 2019, Senator Merkley, in partnership with Senator Wyden and congressional leaders, secured Senate Ag Appropriations funding to further accelerate and leverage producer investments into research for the 'Resilient Dryland Farming Initiative' (RDFI). The $2 million RDFI annually provides needed new investments in research that provides ARS and OSU scientists opportunities to pursue solutions to improve agriculture resilience and competitiveness in dryland areas. Further expansion of this work would leverage the

resource at the Pendleton Ag Research Station for a soil carbon research center to evaluate effects of dryland crop production in the Columbia Plateau on carbon dioxide emissions and provide information on effective cropping systems that benefit carbon, nitrogen, and water dynamics, crop productivity, and economic outcomes. Of particular importance is the advanced advance knowledge of soil carbon in dryland systems at this station and the unique data set created by the long-term cropping system studies established as far back as 1931. It is an extremely data intensive research project, yet the station is challenged by having only limited wireless service. This station and others like it in rural communities through the state represent an opportunity to be an anchor institution and hub in the rural connectivity equation.

The OSU Extension Service, Oregon Agricultural Experiment Station, and the Oregon Forest Research Laboratory, face the same challenges as rural agricultural producers. They have offices in communities all around the state. They are struggling to upgrade offices with high-speed bandwidth so they can do the research that will inform and enhance precision agricultural practices and so that they can provide information and expertise to help meet local challenges. OSU Extension Service is partnering with Link Oregon who is establishing a high-speed statewide backbone that will initially serve education and state offices.

To date, broadband connectivity to Oregon's agricultural lands has been random and not due to any strategic or organized effort. The effort needs to be strategic or organized. Agriculture is no different from any other business regarding its need for high-speed broadband connectivity. The search for solutions should be technology neutral. Fiber is not the only answer. We need to be open to hybrid technology solutions. Investments to connect the research institutions/ agriculture research stations will further accelerate rural innovation. The OSU Extension Service is also partnering with Link Oregon who is establishing a high-speed statewide backbone that will initially serve education and state offices.

Oregon should seek to aggregate demand to help build business cases for investment and to aggregate solutions through the development of partnerships. Oregon should:

- Combine broadband infrastructure projects with other types of infrastructure projects such as water, wastewater and roads. We need to adapt and modify funding program rules to enable and promote the "stacking" of projects.
- Engage economic development organizations in broadband strategic efforts.
- Develop strategic goals for the state, develop public-private partnerships, and adapt procurement rules to enable multiple provider proposals.
- Address the continuing divide between urban areas with knowledge-based economies that are thriving and rural areas with natural resource based economies that are distressed.
- Bring together technology, knowledge and capital.
- Engage the vendor community in solution and business case development.

- Include cybersecurity in the development of all solutions in agricultural information technology systems to maintain system security and food security.
- Accelerate the pace and increase the scale of projects. Varying terrains of agricultural lands create different challenges for delivering service. Oregon is a diverse state with different topologies and service challenges and there is no "silver bullet" solution.

There does not appear to be good communication between producers across the state regarding precision agriculture applications and solutions. What do 60,000 acre farms in Eastern Oregon have in common with much smaller farms in the Willamette Valley? The crops, scale of operations, and challenges are different. Sometimes the small producer needs to be more flexible and creative and ends up being the innovator. We need to improve communications within Oregon's agriculture community of interest regarding precision agriculture. Technology development is ahead of practical deployment.

Key resources to draw on include the Oregon Department of Agricultural Sciences, Oregon Farm Bureau, Oregon State University College of Agriculture and Extension Service, the state's community colleges, high schools, 4H, producer associations, and individual producers.

The City of Independence is working with Oregon State University to organize a "reverse pitch" meeting this year in which producers can identify their greatest operational problems to technologists to look for how technology may be used to provide solutions and determine what it is going to cost and what it is going to save.

Technology deployment is driven by resource limitations. When all the needed resources are abundant, there is a lower need for technological solutions to be efficient. As resources become limited, producers look for solutions to be more efficient. Water is a good illustration of that today. Water has been a limited resource in Eastern Oregon generating technological solutions to improve irrigation method. Historically, water has not been a limited resource in the Willamette Valley but that is changing. The current level of adoption of precision agriculture technologies varies with the resource levels of agricultural lands.

Precision agriculture may also have an impact on succession planning and the future of the family farm. The ongoing flight of population from rural areas to urban areas threatens the future of the family farm and rural communities. According to the U.S. Labor Department, the average age of farmers and ranchers is 58 years, and the next generation of farm families is pursuing a wide range of vocations and life styles that are increasingly technology based. Precision agriculture may have a side effect of retaining the next generation in farmers.

Increasing investments in broadband for agricultural business purposes will enhance other aspects of rural life. From rural healthcare options, to first response communications, to telework opportunities, to education. Of particular note, is the issue of first response. Rural agriculture producer are also typically the first responders as they compose the bulk of rural fire protection districts and are the knowledgeable landowners. Communications networks are critical for emergency response and public safety.

Public Policy Priority

The U.S. Department of Agriculture views broadband as essential to improve agricultural production, and has stated that broadband deployment into rural America will only happen with government support, just like rural electrification. If we can bridge the connectivity gap, we will see the adoption of technology by farmers, ranchers and agricultural producers skyrocket, and with it likely the beginning of the agriculture technology renaissance with further development of sensors and most importantly, the integration of data into cohesive systems that will benefit us all. Deploying rural broadband is the way to start.

According to Dave Dillon, Executive Vice President of the Oregon Farm Bureau (OFB), rural and agricultural are not always the same. The distribution of farmers and ranchers in Oregon mirrors that of the general population. Seventy percent of the producers are in the Willamette Valley. In the early Twentieth Century, nearly 30% of Oregonians lived on farms and ranches, today that is 1% or less, and almost universally, agricultural producers business locations are also their homes which means that not just smart agriculture, but communication, education, healthcare, public safety and all the other applications also apply.

- Agriculture challenges are not a separate thing from rural challenges, they are intertwined,
- Broadband for farmers, ranchers and growers is not just an information distribution system, it is a two way connection that enables the agricultural community to contribute, provide information, engage and participate in the economy and society,
- Broadband affords the agricultural community and opportunity for innovation and collaboration,
- Government reporting and regulation issues are extensive for agriculture and it all is progressively moving on-line and into the cloud,
- the challenges of time and distance faced by growers living in remote areas that can be overcome through telecommunications, and
- the ongoing flight of population from rural areas to urban areas that threatens the future of the family farm and rural communities.

These are all important issues and broadband is a valuable tool that can be used to address them.

The agriculture water factor opportunity
Agriculture represents 80% of the nation's water consumption – 480 billion gallons of water, and it is also responsible for 80% of water quality issues. Most of the irrigation infrastructure in the western United States was built over one-hundred years ago. Irrigated agriculture is a western U.S. phenomenon. There are about 6500 farms in the state of Oregon and they use about 480 billion gallons of water a year.

In 2015, the Farm Credit Administration launched an irrigation system modernization program to work with large-scale irrigation systems and farmers to address systems the modernization of systems that were starting to fail. The primary method of modernization is to pipe water, which is now being carried through open, often unlined, irrigation canals, which lose between 50% and 80% to evaporation and seepage.

There are irrigation modernization projects planned and needed in the Hood River irrigation district, all seven irrigation districts in the Deschutes basin, in the Medford and Klamath basins and Eastern Oregon in Baker and Union Counties in the Powder River-Burnt River basins. Modernization involves a watershed assessment and developing a system plan. Modernized systems also enable the alternative methods of generation of renewable energy.

The impacts of Oregon modernization projects already scheduled:

- 602 cubic feet per second - Water Saved
- 346 miles - Stream Miles Improved – water quality and improved habitat
- 68,565 MWh - Energy Conserved
- 40 MW - Renewable Energy Generation Potential - Pressurized systems do not need farms to pump the water to their crops resulting in massive electric energy savings for farmers
- 23,926 jobs - Jobs Supported

Senator Jeff Merkley serves on the Senate Appropriations Subcommittee on Agriculture and Rural Development, and has been instrumental in these efforts. A major source of funds for irrigation system modernization is federal through the Natural Resources Conservation Service (NRCS) within the U.S. Department of Agriculture. Over $100 million for modernization has been provided for the Deschutes basin alone.
https://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

Matching funds are coming in part from the Oregon Clean Water State Revolving Fund.

Irrigation project components

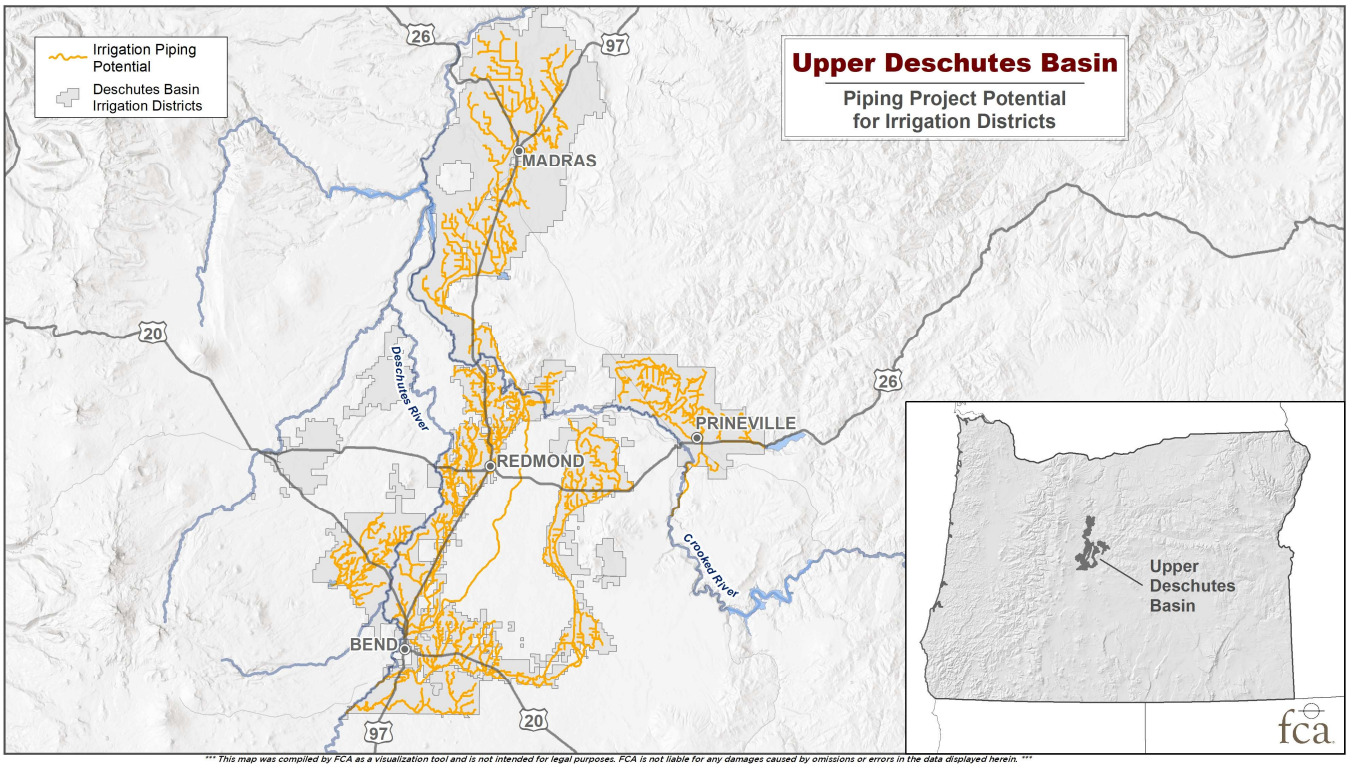
- Converting Canals to Pipes
- Gates
- Telemetry and Sensors
- Fish-friendly In-conduit Hydropower
- Solar
- Batteries
- Fiber Optic and Transmission lines
- EV Charging Stations

Other Project Benefits include:

- Meet multiple stakeholder goals
- Increased development & value for renewables
- Improved water reliability for agriculture
- Improved water quality & quantity in streams
- Reduced modernization costs
- Reduced fire risk
- Reduced transportation costs
- Additionally, there is the ability to place conduit for and with fiber to bring broadband access to rural unserved and underserved areas (Irrigation systems have large geographic
- coverage areas)

The cost benefits of collocating multiple types of infrastructure, e.g., irrigation, water, wastewater, electric, *and* telecommunications are dramatic. Any time you are digging a ditch, you should be placing conduit, even if it is empty.

There will be about $25 million a year in irrigation system pipeline projects starting in 2020 with the Deschutes River basin. Projects will follow in the Hood River and Rogue River basins in the future. There is strong bi-partisan support for these pipeline projects across the western states, but fiber placement is not covered by the federal funding. The placement of fiber as part of these projects would position the deployment of broadband in support of precision agriculture and 5G mobile wireless network deployment for pennies on the dollar as compared to stand-alone fiber infrastructure projects.



Upper Deschutes Basin Irrigation Project Map

This represents a huge opportunity on many different levels including water conservation, rural broadband infrastructure, precision agriculture, existing federal programs already covering the cost of excavation/trenching, and large geographic area coverage. This opportunity needs to be prominent in the 2020 *Broadband in Oregon* report and is another illustration of the need for state funding for broadband projects that can yield significant returns. Timing is tight, however, in that construction projects will be underway in the fall of 2020.

It is ironic that telecommunications systems have always been analogous to water systems with links being referred to as "pipes" and live circuits described as "wet circuits" and unconnected lines described as "dry circuits" and the description of transmissions as "data flow." Now, water irrigation system projects may offer a solution for expanding rural broadband.

Local Community Broadband Planning

Local community engagement in broadband development, adoption and utilization continues to be a low cost high-return "game-changing" activity that needs to be promoted and supported. Perhaps the most effective strategy to make broadband progress at the local community level is to foster local champions and engage local stakeholders. Those communities across Oregon and the nation that have competitive broadband services in

place today despite being rural and not presenting a clear business case for infrastructure investment often owe that welcomed status to a local champion that saw the need and took action. Local champions and planning at the local and regional levels have been instrumental in organizing local communities of interest in broadband services and applications and in aggregating the demand of the different segments of the community such as business, education, libraries, healthcare, and government to help make a business case for broadband investment by the private sector, public sector, and through public-private partnerships.

Federal Funding Programs

Broadband funding has received increased attention from the administration and the U.S. Congress as the country has moved to working and learning remotely due to the COVID-19 pandemic. An inventory of federal broadband funding programs compiled by the National Telecommunications and Information Administration (NTIA) may be found at https://broadbandusa.ntia.doc.gov/sites/default/files/bbusa_federalfunding_all_200511.pdf

Rural Digital Opportunity Fund (RDOF)

Notably this year, The FCC established rules for the Rural Digital Opportunity Fund (RDOF). In January, the FCC adopted rules for the Rural Digital Opportunity Fund (RDOF), which will use a reverse auction to award $20.4 billion in rural broadband funding distributed over 10 years. The RDOF targets areas where the incumbent service provider is a price cap carrier and where broadband service at speeds of at least 25/3 Mbps is not available. Plans call for funds to be awarded in two rounds, with the $16 billion first round targeting areas completely lacking broadband according to FCC data. A second $4.4 billion round targeting additional areas will follow, after the FCC collects more granular broadband availability data through a revised Form 477 process. The auction will be open to a wide range of service provider types and will use a weighting system to favor bids to deploy service at higher speeds up to one Gbps downstream and with lower latency. In RDOF, the FCC is describing 25x3 Mbps as minimum performance and 50x5 Mbps as "Baseline." The target is about to move again.
https://www.telecompetitor.com/20-4-billion-rural-digital-opportunity-fund-adopted-with-a-few-more-tweaks/

The Rural Digital Opportunity Fund (RDOF) auction could have as many as 505 bidders, according to the FCC. Companies that applied to bid include:

- Large and mid-size publicly-held telcos including Consolidated Communications, CenturyLink, Cincinnati Bell, Frontier, Verizon and Windstream
- Rural electric companies, including Rural Electric Cooperative Consortium
- Mobile providers that also offer fixed wireless service including U.S. Cellular
- Cable companies including Altice USA, Cox Communications, and Midcontinent Communications (Midco)
- Satellite broadband providers Hughes Network Systems, Space Exploration Technologies (Space X) and Viasat

- Numerous smaller providers, including rural telcos, wireless internet service providers (WISPs) and others

The Rural Electric Cooperative Consortium, which included Oregon's Douglas FastNet, was one of the largest winners in the Connect America Fund II auction, a previous rural broadband funding auction. Like the CAF II auction, the RDOF auction will award funding to the entity that commits to deploying service at the lowest level of support, with a weighting system favoring bids to deploy higher-speed or lower-latency service.

Viasat also was a large CAF II winner in Oregon, but may find it more difficult to win bids in the RDOF auction because the weighting system has changed a bit to be more favorable to lower-latency services. Viasat and Hughes both operate geostationary satellites, which means that their services are relatively high-latency. A new group of satellite broadband providers plans to use non-geostationary low-earth-orbit satellites to minimize latency and, of these, SpaceX successfully lobbied the FCC to allow the company to bid to provide low-latency service.
https://www.telecompetitor.com/rdof-auction-bidders-could-number-over-500-including-verizon-viasat-many-more/

The rules call for $20.4 billion in rural broadband funding to be made available through reverse auction in two phases. The majority of the funding ($16 billion) would be awarded in the first phase, which would target areas where broadband at speeds of least 25/3 Mbps is not available to any location based on FCC data gathered through Form 477. The remainder of the funding will be awarded later based on new data that the FCC will be collecting from service providers. Service providers winning funding through the reverse auction process will be required to deploy service at speeds of at least 25/3 Mbps and will receive their funding over a 10-year period. A reverse auction is designed to award funding to the provider that offers to deploy service for the lowest level of government support. Proposed auction plans call for a weighting system to be used to prioritize bids to provide service at *higher speeds* and with *lower latency*. This weighting system proposed is different from what was originally outlined in a notice of proposed rulemaking adopted in August. The commission proposed four speed tiers – a baseline tier of 25/3 Mbps, "above baseline" tiers of 50/5 Mbps, 100/20 Mbps, and a gigabit tier of one Gbps/500 Mbps. The FCC identified the number of homes in each state in areas where RDOF will subsidize the deployment of broadband. Oregon has 91,000 locations, Idaho has 76,000 and Washington State has 115,000.
https://www.telecompetitor.com/fcc-poised-to-adopt-rdof-rules-16-billion-for-totally-unserved-areas-in-phase-1/

Another federal broadband funding program of particular interest is the ReConnect Program. The Broadband ReConnect Program furnishes loans and grants to provide funds for the costs of construction, improvement, or acquisition of facilities and equipment needed to provide broadband service in eligible rural areas.

The U.S. Department of Agriculture's ReConnect Program is providing a $6 million grant to construct 89 miles of fiber optic line, connecting the cities of Long Creek, Monument, Seneca and Spray to Oregon Telephone Corporation's high-speed broadband network that already connects the other cities in the county. This will expand broadband across a 242-square-mile area, with nearly 650 potential new customers — 418 households, 22 businesses, 22 farms, three schools and two fire stations — that can receive broadband access and high-speed internet services, according to information from the USDA.

In a public-private partnership with the intergovernmental Grant County Digital Network Coalition, Ortelco has committed to providing the fastest internet access to as many residents at the lowest price possible. Expansion of the broadband network will start in early 2020 and will be a progressive project that is expected to last for five years. The grant funding requires a local match of $1.9 million that will be covered by Ortelco and the Grant County Digital Network Coalition, which includes representatives from John Day, Seneca and Grant County.

The coalition has access to funding, thanks to lobbying by the city of John Day to improve broadband connectivity in the county. In July 2017, before the coalition was created, John Day received a $1.8 million appropriation from the state legislature to modernize Grant County's digital infrastructure.
https://www.bluemountaineagle.com/news/m-grant-will-fund-major-broadband-rollout/article

This month, the U. S. Department of Agriculture (USDA) announced $43.2 million in grants and loans to provide broadband service in unserved and underserved rural areas in Idaho, Oregon and Nevada. Oregon-Idaho Utilities Inc. will use a $12.8 million ReConnect grant to deploy a fiber-to-the-premises network to connect 612 people, 75 farms and three businesses to high-speed broadband internet in Owyhee County, Idaho; Malheur County, Oregon; and Humboldt and Elko counties in Nevada.

A second round of $550 million in United States Department of Agriculture (USDA) Reconnect Pilot Program funding appropriated by Congress. USDA will make available up to $200 million for grants, up to $200 million for 50/50 grant/loan combinations, and up to $200 million for low-interest loans. The application window for this round of funding is January 31 to March 16, 2020 www.usda.gov/reconnect.

Conclusions regarding Agriculture
Precision agriculture can encompass a broad scope of activities from irrigation and crop monitoring, to managing equipment and systems, to the distribution of crops to food processors, distributors, retailers and consumers, "farm to fork."

- Smart agriculture is important for Oregon.
- The status of smart agriculture adoption and utilization is mixed across the state.

- Oregon's current broadband telecommunications infrastructure is a barrier to smart precision agriculture due to limited coverage and availability. Broadband connectivity to Oregon's agricultural lands has been random and not due to any strategic or organized effort.
- We need to raise the level of awareness of the importance of precision agriculture to the IT and telecommunications service providers and agricultural producers, to both the demand side and supply side of the equation.
- The most critical areas of need should be identified and made a priority.
- Smart agriculture is a public policy issue that should be addressed at the state level.
- Rural broadband should be considered as an economic development issue and be addressed by economic development organizations.
- Rural communities in Oregon present an opportunity to show what is possible.
- Agriculture can be a driver for rural broadband infrastructure and for rural economic and community development.

Network Interconnection

Oregon needs to develop strategies to improve the state's connectivity to national and global networks, improve network resilience and support the growth of network enabled datacenters and e-commerce businesses.

Oregon should pursue the following interconnection goals.

- Encourage all the major CDNs to locate physical facilities (Points-of-Presence) in Oregon for interconnection
- Focus on direct interconnection for cloud computing applications
- Get Tier 1 networks to peer in and place Points-of-Presence in Oregon (Google, Facebook, and Apple do not interconnect with Tier 1 networks in Oregon today).
- Strategically leverage the growing number of undersea cables coming ashore and the resulting data traffic that is passing through Oregon.
- Get large data centers in Oregon to join the Oregon ecosystem
- Maximize all levels of interconnection that take place in Oregon.
- Make it easy to interconnect in Oregon.
    - Document available assets
    - Promote Oregon to targeted carrier networks, undersea cable operators, CDNs, cloud computing providers
    - Develop incentives
    - Leverage NWAX (Grow to 100 peers) (14th largest Exchange in the nation located in the 23rd largest Metropolitan Statistical Area)

The continuing challenge is that Oregon has limited number of locations with critical density, like Portland and Hillsboro, to drive interconnection. Despite that challenge, long-term plans should consider locations in the eastern part of the state for interconnection, physical diversity and resilience. The growing number undersea fiber cables landing in Oregon with logarithmically growing data traffic should be leveraged.

Reduce barriers to broadband infrastructure deployment

- Encourage, facilitate and incent private sector investment in broadband infrastructure.
- Encourage competition.
- Aggregate demand and reduce regulatory barriers to improve the private sector business case.
- Adopt Dig Once policies that mitigate a high cost component of buried cable infrastructure by requiring ample time interval notification of open trench construction projects and in some cases requiring placement of conduit within the public right of way for future use in deploying optic fiber network systems.
- Incorporate broadband into all new construction projects including buildings and housing developments. The city of Sandy as a municipality already requires that new housing developments and other new construction projects include the placement of telecommunications conduit.
- Evaluate policies governing access and remove barriers to public rights-of-way, pole attachments, permits, easements, duct access, facilities siting, and public vertical assets such as towers and buildings can impact broadband network deployment. In 2013, the Federal Highway Administration estimated that 90 percent of the cost of burying broadband infrastructure along a roadway consists of the expense of digging up and replacing disturbed land and the road. The National Broadband Plan found that an effective rights-of-way policy of facilitating joint placement of facilities through "dig once" policies can reduce broadband deployment costs by more than 20 percent. https://www.fhwa.dot.gov/policy/otps/policy_brief_dig_once.pdf
- Require that broadband infrastructure components such as conduit be included for all state funded infrastructure programs including roads, bridges, water, and wastewater projects. Governments are the largest owners of property in the nation.
- In 2015, the Broadband Opportunity Council recommended that the Federal Government create an "open data inventory of infrastructure assets" for broadband to enable the private sector to more easily identify and access public assets for broadband infrastructure placement. Create this inventory for Oregon.
- Require public entities to notify broadband providers when planning to do underground work to allow them to access locations for broadband infrastructure.
- Explore developing a statewide policy for railway crossings and paralleling telecommunications infrastructure deployment. The current railroad company permitting process regularly delays and impedes new infrastructure projects.

The value proposition for Oregon and the Oregon economy is the network. Increasingly, the economy is dependent on the internet and people in the internet economy. Fortunately, excellent network infrastructure and companies in this economy like Google, Amazon, and Facebook have already invested in Oregon and are helping to drive that for the state.

Recommendations

The Oregon Broadband Advisory Council, once again, reaffirms that Oregon's broadband public policy needs to be focused on the future, be more aggressive, be more financially supportive, be more specific, and have a renewed sense of urgency. The Council recommends that Oregon should:

- Provide and expand state funding for grant, loan and loan guarantee programs for broadband infrastructure in unserved and underserved areas, for technical assistance and for matching funds to leverage federal funding programs.
- Provide support to low adopter underserved populations and community anchor institutions.
- Promote and support scalable broadband infrastructure deployment.
- Reduce barriers to broadband infrastructure deployment
- Promote and support digital inclusion and cyber security.
- Require that broadband infrastructure components be included for all state funded infrastructure projects including roads, bridges, water, and wastewater projects.
- Encourage public-private partnerships in broadband infrastructure that leverage limited state resources.
- Remain technology and provider neutral.

Concluding Remarks

Oregon has a long history of recognizing the importance of telecommunications and reflecting that importance in public policy. 2019 and 2020 have been pivotal years for Oregon's broadband public policy and for state government engagement. Oregon needs to keep up this momentum. Though the disruptions of the pandemic will eventually pass, the social, economic, and equity issues that have been illuminated by the pandemic will remain. We must not lose our focus on them. We must respond to them today in ways that are not temporary, but in ways that will provide for long-term continuous support, development and improvement of broadband deployment, adoption and utilization for all Oregonians.

Appendix A
What is Broadband?

Broadband is a general term used to represent a wide range of telecommunications technologies and services, which utilize a faster data transmission rate than that available over the standard voice grade telephone line, which is 56 Kbps and usually less. Broadband is also widely referred to as "high-speed" Internet access service.

Until 2008, the FCC's official definition of broadband was a transport service offering a minimum data transmission rate of 200 Kbps in one direction. That year, the FCC established a set of Broadband Tiers:

Tier	*Rate*
1	200 Kbps up to 768 Kbps
2	768 Kbps to 1.5 Mbps
3	1.5 Mbps to < 3.0 Mbps
4	3.0 Mbps to < 6.0 Mbps
5	6.0 Mbps to < 10.0 Mbps
6	10.0 Mbps to < 25.0 Mbps
7	25.0 Mbps but < 100.0 Mbps
8	100.0 Mbps and beyond

FCC Broadband Service Speed Tiers

Tier 1 is characterized as "First Generation Data." 768 Kbps is now the minimum data transmission rate for "Basic Broadband." Tiers 3 through 8 reflect the range of service speeds available and expected to become available from providers.

In its National Broadband Plan, the FCC proposed a goal that every household and business location in America should have access to affordable broadband service with actual download speeds of at least 4 million bits per second (Mbps) and actual upload speeds of at least 1 Mbps with the further recommendation that the FCC review and reset this target every four years. On January 29, 2015, the FCC raised the benchmark for broadband from 4 megabits per second (Mbps) down and 1 Mbps up to 25 Mbps down and 3 Mbps up, and it will be raised again. What constitutes "standard broadband" will continue to be a moving target. The next increase in the standard will likely be to 100 Mbps down and 12 or 25 Mbps up.

Many different technologies are employed to deliver broadband services in Oregon including Digital Subscriber Line (DSL), Cable-Modem, wireless (mobile 3G / 4G, 5G, fixed, geostationary and low-earth-orbit satellite), and optic fiber-to-the-premises (FTTP). These service technologies range in transmission performance from 200 thousand bits per second (Kbps) up to 1 billion bits per second (Gigabits per second Gbps) and beyond.

Broadband services in Oregon are available from a wide mix of service providers including telephone companies, cable companies, competitive access providers, fixed and mobile wireless providers, municipal and consortia providers, and satellite service providers.

Appendix B
Oregon Broadband Advisory Council
COVID-19 Pandemic Recommendations To Governor Kate Brown
April 23, 2020

The Oregon Broadband Advisory Council (OBAC) contributed the following recommendations for consideration in responding to the crisis in the areas of broadband internet access and the continuing digital divide. The Council's recommendations are short term and long term.

Short Term Recommendations

Any immediate relief for the increased demand for broadband services and capability for the most part must rely on infrastructure that is currently in place and in service. New broadband infrastructure deployment is a long-term solution due to constraints on capital, labor and constraints on equipment availability due to a stressed supply-chain.

- Provide clear messaging to broadband service providers and the customers they serve that broadband is essential service for the COVID-19 response.

- Recognize and encourage the voluntary support that service providers are giving, and manage the expectations of customers, reinforcing the responsibilities of customers to preclude a cash-flow crisis for providers and customers in sixty to ninety days.

- Establish a "Broadband COVID-19 Task Force" under the Emergency Coordination Center COVID-19 Infrastructure Branch to monitor developments and be available to help mitigate any broadband network related problem issues.

- Ask service providers to share information on network performance and advise the Emergency Coordination Center COVID-19 Infrastructure Branch if there is service affecting congestion on their networks.

- Plan for demand-side load management actions working through carriers, content providers and end users to manage traffic loads *in the event* that service affecting traffic congestion develops on broadband networks.

- Recommend that on-line classes and meetings stagger their start times so as not to schedule everything to start at the top of the hour (this is a form of demand-side load management).

- Encourage Internet Service Providers (ISPs) to consider establishing mutual-support agreements with other ISPs to have in place in the event that network performance problems develop.

- Encourage the connection of more of the state's healthcare systems to the Northwest Access Exchange (NWAX).

- Encourage the connection of more of the state's largest employers such as Intel and Nike to NWAX.

- Coordinate the supply of refurbished end-user devices that can be distributed to communities in need for free or at low-cost.

- Promote the addition of new public WiFi internet access hotspots.

- Repurpose WiFi networks in schools, libraries, fairgrounds and other public locations as public hotspots by allowing public access, increasing hours, and reconfiguring networks to serve areas like parking lots outside of public buildings.

- Include broadband state-level funding on the agenda for a COVID-19 Response Special Session of the Oregon Legislative Assembly.

- Regarding the next federal stimulus Bill, request that the Oregon Congressional Delegation provide that some broadband funding be directed to the states in the form of block grants for distribution. The challenge with the federal government funding programs is that they are not easily or quickly accessed. For the federal broadband programs that have recently been funded, we are likely to see a repeat of the American Recovery and Reinvestment Act of 2009 experience where stimulus dollars took years to be distributed.

<u>Long Term Recommendations</u>
In its last report to the Legislative Assembly in 2018, OBAC stated that it believes that Oregon's broadband public policy needs to be focused on the future, be more aggressive, be more financially supportive, be more specific, and have a renewed sense of urgency. The COVID-19 crisis has created that state of urgency.

Though the COVID-19 crisis has brought urgent attention to the state's needs relative to the digital divide, the situation and trends that make it an important public policy issue are not new. OBAC's long-term recommendations have been presented before and are well documented.

OBAC has identified the following key broadband challenges and opportunities facing Oregon.

- Digital Inclusion: Oregon needs state-level strategies and programs to ensure that all individuals and communities have access to affordable state of the art

broadband communications services, and the skills, knowledge and technical support needed to use them.

- Cyber Security: The security of data and communications systems continues to be a critical risk exposure for government, public organizations, private sector businesses, and for individuals that is widely unrecognized and under managed. Oregon needs to follow-through on its 2017 cyber security initiatives www.cyberoregon.com. Ongoing, expanded and pro-active cyber risk management is needed.

- Education: Oregon's K-20 educational institutions are positioned to realize significant economic, work force and community development benefits for the state through the utilization of broadband networks and applications. State level support and coordination is needed.

- Public Safety: Oregon's first responders are at a transition point for migration to new broadband Internet Protocol (IP) technologies. Support is needed for Oregon's 911 centers and first responders to migrate from legacy systems to Next Generation 911 and to interoperable wireless broadband communications systems.

- Agriculture, which contributes more than $8.25 billion to Oregon's economy each year, is emerging as an important application and will become the largest driver for broadband infrastructure deployment in rural areas of the state.

- Local Community Broadband Planning: Local community engagement in broadband development, adoption and utilization continues to be a high-return "game-changing" activity to be promoted and supported.

- Federal Funding Programs: Federal broadband programs are currently in flux but remain a key source of available financing to be leveraged for new infrastructure.

- Network Interconnection: Oregon needs to develop near-term strategies to improve the state's connectivity to national and global networks and support the growth of network enabled datacenters and e-commerce businesses.

To address these challenges, OBAC offers the following recommendations

- Provide state funding for new grant, loan and loan guarantee programs for broadband infrastructure in unserved and underserved areas, and for matching funds to leverage federal funding programs.

- Repurpose and redesign the Oregon Universal Service Fund to be sustainable and to improve and subsidize *broadband* infrastructure in unserved and underserved areas.

- Provide support to low adoption populations and community anchor institutions in accessing the FCC's E-rate Program, Healthcare Connect Fund and Lifeline programs.

- Promote and support broadband infrastructure deployment.

- Require that broadband infrastructure components such as conduit and fiber be included for all state funded infrastructure programs including roads, bridges, water, and wastewater projects.

- Remain technology and provider neutral.

- *Broadband in Oregon – A Report by the Oregon Broadband Advisory Council, November 2018* https://www.oregon4biz.com/Broadband-Office/OBAC/Reports/BroadbandRpt2018.pdf

It is further recommended that Oregon:

- Establish a *Rural Broadband Capacity Improvement Program* to support broadband planning, engineering, and/or infrastructure deployment projects targeting unserved and underserved rural areas. The program will provide grants and forgivable loans for planning, engineering, infrastructure deployment, and for matching funds to leverage grants and loans from federal and private funding programs.

- Establish a *Digital Literacy, Security and Inclusion Program* to provide grants and forgivable loans to projects to improve digital literacy, cybersecurity, and the digital inclusion of unserved and underserved populations so that the benefits of broadband connectivity may be realized.

- Establish a *Broadband Outreach Program* to engage stakeholders; elected officials, government officials, healthcare providers, educators, businesses, agriculture and other community leaders, and broadband service providers to facilitate communications, recruit local champions and aggregate the demand of the different segments of the community to help to make a business case for broadband investment and to match projects with funding sources.

Competitive high-speed access to the internet and telecommunications networks is essential, *statewide,* for Oregon's schools, libraries, businesses, agricultural producers, governments, first responders, healthcare providers and individual residents.

- *Oregon Broadband Office Strategic Plan, January 2020* https://www.oregon4biz.com/dev/www/BOR/Broadband-Office/OBAC/Reports/BroadbandStratPlan2020.pdf

Appendix C
Oregon Broadband Advisory Council Members
2020

The mission of the council is to encourage coordination and collaboration between organizations and economic sectors to leverage the development and utilization of broadband for education, workforce development, government and healthcare, and to promote broadband adoption by residents and communities. The council members represent Oregon's cities, counties, telecommunications service providers, tribes, educators, economic development organizations, public safety agencies, healthcare providers, E-Government, the Public Utility Commission, the State House of Representatives and the State Senate. Members of the Council were appointed by the Governor, the Speaker of the House and the President of the Senate.

Council Members
Katie Latimer Cox

Kurtis Danka
Chief Technology Officer
Office of the State Chief Information Officer

Miles Ellenby
Associate Professor of Pediatric Critical Care Medicine
Medical Director, Telemedicine Program
Doernbecher Children's Hospital / Oregon Health and Science University

Joseph Franell (Council Chair)
General Manager and CEO
Blue Mountain Networks

Michael Heffner
Assistant Chief Deputy
Oregon Office of State Fire Marshall

Wade Holmes
Vice President of Technology
TDS Telecommunications (BendBroadband)

Lonny Macy
Planner
Akana

Pam Marsh
Representative
Oregon House of Representatives

Galen McGill
System Operations & Intelligent Transportation Systems Manager
Oregon Department of Transportation

Rick Petersen
President and Chief Executive Officer
PEAK Internet

Jeremy Pietzold (Council Vice-Chair)
City Council President
City of Sandy

Cheri Rhinhart
Information Technology Director
Intermountain Education Service District

Dave Sabala
Economic Development

Arnie Roblan
Senator
Oregon State Senate

Mark Thompson
Commissioner
Oregon Public Utility Commissioner

David Yamamoto
Commissioner
Tillamook County

Staff:
Christopher Tamarin
Telecommunications Strategist
Oregon Business Development Department
121 SW Salmon Street, Suite 205
Portland, Oregon 97204
503 508-0178 Phone / Cell, 503 581-5115 Fax
christopher.tamarin@oregon.gov, Council Website URL: www.broadband-oregon.org

Appendix D
Oregon Broadband Advisory Council Activity Summary
2010-2020

The Oregon Broadband Advisory Council (OBAC) was created in the 2009 Legislative session to help ensure the implementation of statewide broadband strategies. The mission of the council is to encourage coordination and collaboration between organizations and economic sectors to leverage the development and utilization of broadband for education, workforce development and telehealth, and to promote broadband utilization by residents and communities. The council members represent Oregon's cities, counties, telecommunications service providers, Tribes, educators, economic development organizations, public safety agencies, healthcare providers, e-government experts, the Public Utility Commission, the State House of Representatives and the State Senate.

OBAC began meeting in January 2010. In 2015, the Oregon Legislative Assembly passed, and Governor Kate Brown signed a bill to extend the Council's sunset date to January 1, 2020. The Council meets monthly to discuss, deliberate, and report on broadband issues, economics, technologies, and public policy as they relate to the interests of Oregonians. OBAC presenters (in chronological order) are listed below, and OBAC meeting attendees have represented the organizations listed below.

The Council prepared and submitted *Broadband in Oregon* reports to the Legislative Assembly and the Governor in November of 2010, 2012, 2014, 2016, 2018 and 2020. It also produced the *Gas & Electric Utilities Broadband Deployment Report* in 2012, *Broadband Outreach Survey Report* in 2014, *Strategies for Broadband Infrastructure Deployment, Adoption and Utilization in Rural Cities and Counties* in 2016, and the *Local Broadband Champions Report* in 2018.

OBAC participated several State Broadband Data and Development Program grant projects administered by the National Telecommunications and Information Administration and the Oregon Public Utility Commission.

- OBAC participated in the Oregon Broadband Mapping Project and the 2010 Oregon Broadband Adoption Survey
- OBAC was a grant sub-recipient and directly supervised the Oregon Broadband Outreach and Strategic Planning Project and the 2014 Oregon Broadband Adoption Survey.

OBAC reports and projects are posted on the Council website at www.broadband-oregon.org.

OBAC presenters (in chronological order) have included:

2010

Rep. Jefferson Smith
Ray Baum, Oregon Public Utility Commission
Roger White, Oregon Public Utility Commission
Dawn Bonder, Oregon Health Information Technology Oversight Council
Milo Mecham, Lane Council of Governments
Barbara Young, CenturyTel
Frank Miller, BendBroadband
Michael Weidman, LS Networks
Brant Wolf, Oregon Telecommunications Association
Fred Ziari, EZ Wireless / IRZ Consulting / OnSmart Technologies
Doug Cooley, Comcast
Phil Garrett, MINET
Mike Dewey, Oregon Cable Telecommunications Association
Judy Peppler, Qwest
Vicki Walker, U.S. Department of Agriculture Rural Development
Joe Bradley, U.S. Department of Agriculture Rural Development
Scott Lazenby, City of Sandy
Dudley Slater, Integra Telecom
Cobi Jackson, One-Economy Corporation
Eddie Choi, One-Economy Corporation
Rebecca Yalch, Opinion Research Corporation
Bryan Conway, Oregon Public Utility Commission
Adam Grzybicki, AT&T Wireless
Mary Beth Henry, City of Portland

2011

Renee Willer, Frontier Communications
Rich Bader, Easystreet Online Services
Eric Schmidt, Association of Oregon Counties
Michael Lainoff, Lane Community College / Small Business Development Center Network
Mark Gregory, Lane Community College / Small Business Development Center Network
Doug Cooley, Comcast
Steve Noel, Oregon Department of Transportation / Oregon Wireless Interoperability Network
Andrea Crosby, Citizens Utility Board
Rebecca Yalch, Opinion Research Corporation
Cobi Jackson, One-Economy Corporation
Brant Wolf, Oregon Telecommunications Association
Sean McSpaden, Oregon Department of Administrative Services
Wally Rogers, Oregon Department of Administrative Services
Bill Casale, iLinc

Heather Burks, Oregon Department of Administrative Services
Roger White, Oregon Public Utility Commission
Carla Wade, Oregon Department of Education
Mary Beth Henry, City of Portland
Kristi Wilde, Oregon State Interoperability Executive Council (SIEC)
Kim Lamb, Oregon Health Network
Rebekah Dohrman, League of Oregon Cities
Carol Robinson, Oregon Health Information Oversight Council
Doug Cooley, Comcast
Jeff Nicol, Gorge Technology Alliance
Tom Potiowsky, Portland State University
Marilyn Harbur, Oregon Department of Justice
Linda Blacklock, Oregon Department of Justice
Rebecca Yalch, ORC International

2012
Shelley Jones, Oregon Public Utility Commission
John Horvick, Davis Hibbitts and Midghall, Inc.
Tom Lauer, Oregon Department of Transportation
Paul Baldwin, Fortune Data Centers
Brant Wolf, Oregon Telecommunications Association
Barbara Young, CenturyTel
Michael Lainoff, Lane Community College / Small Business Development Center Network
Mark Gregory, Lane Community College / Small Business Development Center Network
Carla Wade, Oregon Department of Education
Steve Noel, Oregon Department of Transportation / FirstNet
Albert Gauthier, Oregon State Police
Steve Viotolo, Oregon Department of Transportation
Renee Willer, Frontier Communications
Peter Trnavskis, Oregon Health Network
Dr. Miles Ellenby, Oregon Health & Science University/ Doernbecher Children's Hospital
Michael Seelig, Oregon Education Investment Board
Will Saunders, Washington State Department of Commerce
Ed Arabas, Oregon Department of Administrative Services
Philip Woods, Oregon Department of Administrative Services

2013
Zach Holander, NetCity Inc.
Michael Lainoff, Lane Community College / Small Business Development Center Network
Laura Cleland, Association of Oregon Counties
Carla Wade, Oregon Department of Education
Amy McLaughlin, Oregon Department of Education
Michael Seelig, Oregon Education Investment Board

MaryKay Dahlgreen, Oregon State Library
Steve Noel, Oregon Department of Transportation / FirstNet
Brant Wolf, Oregon Telecommunications Association
David Bell, Fibersphere
Rock Rakosi, Myrtle Point Police Department / SIEC
Nancy Jesuale, NetCity Inc.
Yumei Wang, Oregon Department of Geology and Mineral Industries
Michael Curri, Strategic Networks Group
Craig Settles, Gigabit Nation
Vicki Walker, U.S. Department of Agriculture Rural Development

2014
Steve Noel, Oregon Department of Transportation / FirstNet
Neil Grubb, Freewire Broadband
Shawn Irvine, City of Independence
Don Patten, MINET
Ben Tate, Oregon Department of Education
Gillien Duvall, Oregon Office of Emergency Management
Bob Duehmig, Telehealth Alliance of Oregon
Cathy Britain, Telehealth Alliance of Oregon
Rick Williams, Leidos
Steve Boespflug, Pivot Group
Dave Nieuwstraten, Pivot Group
Laura McKinney, Oregon University System
David Childers, Compli
Ann Steeves, Portland General Electric
Dave Sabala, Douglas Electric Cooperative

2015
Laura McKinney, Oregon University System
David Childers, Oregon Engineering Technology Industry Council (ETIC)
Carla Wade, Oregon Department of Education
Sidra Metzger-Hines, Oregon Office of Emergency Management
Terry Knight, Federal Emergency Management Agency (FEMA)
Dan Runcie, Education Super Highway
Cheryl Bledsoe, Clackamas County 911 Center
Amy McLaughlin, Oregon Department of Education
Rob Kaye, Providence Health & Services
Steve Noel, FirstNet
Cheryl Hiemstra, Oregon Department of Justice
Bob Duehmig, Telehealth Alliance of Oregon
Monica Koiv, OCHIN
Courtney Stennick, OCHIN

John Windhausen, Schools, Health and Libraries Broadband Coalition (SHLB)
Galen McGill, Oregon Department of Transportation
David Soloos, Office of the Oregon CIO
Thompson Morrison, Innovate Oregon
Dana Shaffer, Federal Communications Commission (FCC)
Craig Settles, Gigabit Nation
Bruce Roton, Level(3) Communications
Theresa Masse, Port of Portland
Matt Modarelli, State of Washington
Program Coordinator (name withheld by request), Federal Bureau of Investigation (FBI)

2016
Mark Tennyson, Oregon Office of Emergency Management
Steve Noel, FirstNet
Brant Wolf, Oregon Telecommunications Association
Amy McLaughlin, Oregon Department of Education
Shawn Irvine, City of Independence
Cheryl Hiemstra, Oregon Department of Justice
Barb Young, CenturyLink
Karen Stewart, CenturyLink
David Trepp, Info@Risk Inc.
Wade Holmes, BendBroadband
Carla Wade, State Educational Technology Directors Association
Meredith Guardino, Oregon Office of Rural Health
Don Bonker and Kristin Harrison, Portland Metro STEM Partnership
Mary Beth Henry, City of Portland
Thompson Morrison, Innovate Oregon
Kathy Tate, OnlineNW
Debbie Moller, Oregon Office of Emergency Management
Vanessa McLaughlin, Welcome Home Health
Eric Rosenberry, Northwest Access Exchange (NWAX)
Kirk Lee, Frontier Communications
Susie Strangfield, Oregon Department of Education
John Webber, Allion USA
Craig Settles, Gigabit Nation
Mike Wells, Oregon Department of Justice
Michael Curri, Strategic Networks Group

2017
Michael Curri, Strategic Networks Group
Mike Wells, Oregon Department of Justice
Tom Gurr, Pacific Technology Alliance
Susie Strangfield, Oregon Department of Education

Carla Wade, Oregon Department of Education
David Soloos, Office of the State Chief Information Officer
Matt Sayre, Technology Association of Oregon
Steve Noel, First Responder Network Authority
Wade Holmes, BendBroadband
Nick Green, City of John Day
Jordan McDonald, Wtechlink
Jeff Crews, Eastern Oregon Net, Inc. (EONI)
Jeff Christiansen, Entry Point Networks
Amy McLaughlin, Oregon State University
Tim Downs, SmallCellSite.com
Eric Rosenberry, Northwest Access Exchange (NWAX)
Jill Miles, Business Oregon
Stuart Taubman, Zayo Group
Craig Fidler, Wave Broadband
Julie Omelchuck, City of Portland
Rebecca Gibbons, City of Portland
Jeff Gavlinski, Ex^2 Technology, LLC
Steve Hill, Satellite Broadcasting & Communications Association
Andrew Plato, Oregon Cybersecurity Advisory Council

2018
Steve Noel, First Responder Network Authority
Melissa Sassi, Microsoft
Richard Roche, AT&T
Ken Lyons, AT&T
Michael Curri, Strategic Networks Group
Angela Siefer, National Digital Inclusion Alliance
Michael Elford, CenturyLink
John Huffman, U.S. Department of Agriculture
Jon Dolan, Oregon State University
Melody Riley-Ralphs, State of Oregon, Office of the State Chief Information Officer
Carl Erhart, Frontier Communications
Carla Montrose, Sprint
Brian Mancuso, Sprint
Thomas Tran, Sprint
Rick Woidyla, Verizon Wireless
Robert Fletcher, Verizon Wireless
Stuart Taubman, Zayo Group
John Talbot, Oregon State University Extension Service
Brant Wolf, Oregon Telecommunications Association
Jonathan Chambers, Conexon
Jim Teece and Todd Way, Northwest Telecommunications Association (NWTA)

Marty Glapa of Bell Labs Consulting
Steve Huter of the Network Startup Resource Center at the University of Oregon
Scott McMullen of the Oregon Fishermen's Cable Committee

2019
Dave Dillon of Oregon Farm Bureau
Shawn Irvine of City of Independence
Charlie Kawasaki, Oregon Cybersecurity Advisory Council
Carla Wade, Oregon Department of Education
Paul Braunstein FirstNet / AT&T
Ben Gherezgiher, Office of the State CIO
Michael Held, RDI
Matt Sayre, Technology Association of Oregon
Wade Holmes, TDS BendBroadband
Greg Mont, City of Hillsboro
Brad Nosler, City of Hillsboro
Karen Perry, National Telecommunications and Information Administration
Lucas Turpin, Oregon State University Extension Service
Philip Hamm, Oregon State University College of Agricultural Sciences
Jean Rice, National Telecommunications and Information Administration
Austin Ramiez, Lane County
Heather Burch, Lane County
Jessica Epley, Frontier Communications
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OBAC meeting attendees represented:

ADP Resources
Aldrich CPAs
Allion USA
Ashland Home Net
Association of Oregon Counties
AT&T
AT&T Mobility
Azimuth Communications
Bean Foundation
Beaverton Schools
BendBroadband
Black Mountain Consulting
BroadMap
California Telehealth Network
Central Lane 911
CenturyLink
CenturyTel
Charter Communications
Citizens' Utility Board
City of Corvallis
City of Eugene
City of Gladstone
City of Hillsboro
City of Independence
City of John Day
City of Milwaukie
City of Oregon City
City of Portland
City of Sandy
City of Springfield
CJSpeaks / Gigabit Nation
Clackamas Community College
Clackamas County
Clackamas County 911 Center
Clackamas ESD
Clatsop County
Comcast
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ComSpan USA
Comstructure Consulting
Connexon
Consumers Power
Converge Communications
Corning
Dale Hines Consulting
DAS-CIO-Economic Recovery Exec. Team
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Day Wireless
Development and Investment, LLC
Douglas Electric Cooperative
Douglas FastNet
Eastern Oregon Net, Inc. (EONI)
EasyStreet Online Services
Education Super Highway
Electric Lightwave
EnerTribe

Entry Point Networks
Ex2 Technology
EZ Wireless
Farmers Conservation Alliance
Federal Bureau of Investigation (FBI)
Federal Communications Commission
Federal Emergency Management Agency (FEMA)
Fibersphere
FirstNet
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Fortune Data Centers
Freewire Broadband
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Gardner & Gardner
Gigabit Nation
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Gorge Technology Alliance
Government Camp Communications
Graybar
Greater Eastern Oregon Development Corporation
Greenwire Broadband
Hermiston School District
High Desert ESD
Hood River County School District
Hood River Electric Cooperative
Hunter Communications
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Innovate Oregon
Integra Telecom
Intel
Intermountain ESD
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Jefferson County
J. Irwin Consulting
Kaiser Permanente
Keenwire
Lake County
Lane Community College / Oregon Small Business Development Center Network
Lane Council of Governments
Lane County
League of Oregon Cities
Level(3) Communications
Link Oregon
LS Networks
Marion County
Microsoft
Mid-Columbia Economic Development District (MCEDD)
MiddleGate
MINET
Motorola
Mt. Hood Cable Regulatory Commission & Office for Community Technology
Multnomah ESD
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National Telecommunications and Information Administration (NTIA)
Northwest Access Exchange (NWAX)
Northwest Senior and Disability Services
Northwest Telecommunications Association
NOKIA
NWAX
Occam Advisors
OCHIN
Office of the Oregon Attorney General
Office of Governor Kate Brown
Opinion Research Corporation
ORC International
Oregon Association of Realtors
Oregon Business Council
Oregon Business Development Department
Oregon Cable Telecommunications Association
Oregon Connections Academy
Oregon Council of Presidents

Oregon Cybersecurity Advisory Council
Oregon Department of Administrative Services
Oregon Department of Education
Oregon Department of Geology and Mineral Industries
Oregon Department of Revenue
Oregon Department of Transportation
Oregon Economic Recovery Executive Team
Oregon Engineering Technology Industry Council (ETIC)
Oregon Education Investment Board
Oregon Employment Department
Oregon Farm Bureau
Oregon Governor's Office
Oregon Health Information Technology Oversight Council
Oregon Health and Science University
Oregon Health Network
Oregon House Republican Office
Oregon Legislative Assembly
Oregon Legislative Fiscal Office
Oregon Legislative Policy and Research Office
Oregon Municipal Electric Utilities Association
Oregon Office of Emergency Management
Oregon Office of Rural Health
Oregon Office of the State CIO
Oregon Public Utility Commission
Oregon Department of Administrative Services
Oregon Department of Agriculture
Oregon Department of Justice
Office of the Oregon CIO
Oregon Department of Justice
Oregon Department of Transportation
Oregon State Interoperability Exec. Council
Oregon Office of Emergency Management
Oregon Office of the State CIO
Oregon State Library
Oregon State Police
Oregon State University
Oregon Trail Electric Cooperative
Oregon Telecommunications Association
Oregon University System
Oregon Wheat Commission
One-Economy Corporation
OnlineNW
OnSmart Technologies
Opinion Research Corporation
Pacific Technology Alliance
PACE Engineers
Parker Telecommunications
PEAK Internet
Pioneer Consulting
Pivot Group, LLC
Port of Portland
Portland General Electric
Portland Metro STEM Partnership
Portland Public Schools
Portland State University
Project A
Providence Health & Services
Q-Life
Qwest
Rare Comet
Rural Development Initiatives, Inc.
Rural 3.0
SAIC / Leidos
Salem Creative Network
Salem-Keizer Public Schools
SandyNet
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Schools, Health and Libraries Broadband Coalition (SHLB)
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Senator Ron Wyden's Office
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Sprint
State Educational Technology Directors Association
State of Washington
Strategic Networks Group
Sunriver Owners Association
T-Mobile
Technology Association of Oregon
Telehealth Alliance of Oregon
The GEO
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TRACER
U.S. Department of Agriculture Rural Development
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Verizon
Verizon Wireless
Willamette Internet Exchange
Willamette Valley Fiber
Windwave
Washington Department of Commerce-Broadband Office
Washington State University
Watts Capital
Wave Broadband
Wave Business
WEBVISIONS
Welcome Home Health, Inc.
Western Independent Networks (WIN)
WiFi Now Networks
Willamette ESD
Wtechlink
Ziply Fiber
Zayo Group

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Acknowledgements

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In Special Acknowledgement

Ray Baum—the first Chair of the Oregon Broadband Advisory Council
In February 2020, the Inaugural Ray Baum Memorial Leadership Award was presented to the Pennsylvania Public Utility Commission's Joseph Witmer at the National Association of Regulatory Utility Commissioners Winter Policy Summit in Washington, D.C. This annual award was created to honor the memory of Ray Baum and will be presented to members of the NARUC Staff Subcommittee on Telecommunications that best reflect initiative and drive toward public service. Ray was a long-time member of the National Association of Regulatory Commissioners, the go-to Staffer on the House Energy and Commerce Committee, a nationally recognized expert on utility law, *and* former Chair of the Oregon Broadband Advisory Council.

"A good man's life is never quite ended; Something of
it always remains to touch and illuminate other lives"
–
Edward Higgins White

More information about the Ray Baum Memorial Leadership Award and Ray's contributions may be viewed at https://pubs.naruc.org/pub/3CB939F3-C32E-4A0A-3D17-64D401F6F6AE