Broadband in Oregon

A Report of the

Oregon Broadband Advisory Council

Presented to the

Joint Legislative Committee on Information Management and Technology

for

The Seventy-ninth Legislative Assembly

November 1, 2016

Broadband in Oregon
2016

Contents

Executive Summary

This is the fourth 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 healthcare, energy management, education and government. The 2016 report will also present key broadband related challenges and opportunities facing the state. The report is best read on-line as it contains many links to references and other reports.

We have now passed the twentieth anniversary of the commercialization of the Internet, and it is inspiring to consider how far the Internet has come in capacity, performance and the utilization in that relatively brief period of time. We have progressed from 9600 bits per second modems to Gigabit broadband, from text and MS-DOS to voice-data-image-video over Internet Protocol (IP) with graphical user and virtual reality interfaces. The Internet has grown from use by less than 1% of the world's population in 1995 to use by over 40% of the world's population, 3.4 billion users, in 2016. Annual worldwide IP traffic is forecast to triple between 2014 and 2019. As the capabilities and applications of the Internet have developed, the bandwidth required by users to access them has steadily increased making *broadband* Internet access essential for organizations and individuals.

Broadband is gaining significant attention *and traction* at the federal, state, and local community levels in public awareness, elected officials' awareness, and with organizations and individuals as end-users. In 2015, President Obama created the Broadband Opportunity Council, which includes twenty-five federal agencies and departments, to engage with industry and other stakeholders to explore ways that the government can better support the needs of communities seeking broadband investment. In 2016, a group of U.S. Senators created the Senate Broadband Caucus to focus on "strengthening broadband infrastructure and deployment across the country." Federal agencies have substantively expanded levels of funding and technical support for an increasing number of broadband programs and initiatives. In 2015, the Oregon Legislative Assembly considered thirty-three broadband related legislative concepts, including proposals for state funding of infrastructure. Local communities are increasingly recognizing broadband as essential infrastructure and are taking action to accelerate the deployment and utilization of competitive broadband technologies.

> *"Access to high-speed broadband is no longer a luxury; it is a necessity for American families, businesses, and consumers. Affordable, reliable access to high-speed broadband is critical to U.S. economic growth and competitiveness. High-speed broadband enables Americans to use the Internet in new ways, expands access to health services and education, increases the productivity of businesses, and drives innovation throughout the digital ecosystem."*
> *– President Barack Obama*

The Rural Telecommunications Congress recently commissioned a study of broadband investment and activity, and in May 2016 issued a report entitled the *Fifty States of Broadband* http://sngroup.com/wp-content/uploads/2016/05/50-States-of-Broadband-Overview-reissued-3may2016.pdf. This report ranked Oregon number three in the nation

for broadband availability and number three in the nation for broadband adoption. Though Oregon continues to be a leader in the adoption and utilization of broadband technologies when compared to other states, the "Digital Divide" continues to exist. In past years, the Digital Divide referred to areas that had access to broadband services vs. those that did not. Today, it refers to differences in the quality of available service and to variances in rates of adoption between regions and demographic groups.

The benchmark for competitive state-of-the-art broadband service continues to be a moving target. On January 29, 2015, the FCC raised the benchmark for broadband from 4 megabits per second (Mbps) down and 1 Mbps up as established in the 2010 National Broadband Plan to 25 Mbps down, and 3 Mbps up. At this new standard, 17 percent of Americans, 53 percent of rural Americans, and 63% of Americans living on Tribal lands now do not have access to high speed broadband as viewed by the FCC. Broadband infrastructure has proven to be a perennial work in progress for Oregon and the nation.

Key Broadband Challenges and Opportunities
OBAC has identified the following key broadband challenges and opportunities facing Oregon in 2016, many of which continue as key issues from its 2014 report.

- Community Broadband Strategic Planning: The Council believes that there are significant benefits to be gained by engaging in broadband strategic planning at the local community level. The process establishes vital communications and relationships between community leaders and establishes a valuable focus on the adoption and utilization of broadband assets for economic and community development.

- Broadband Access and related IT resources in K-12 Schools Statewide: The Council believes that coordinated action to address the challenge of statewide broadband access in its K-12 Schools is needed to meet the state's educational goals as well as to build a foundation for workforce development.

- Public Safety Communications: The Council believes that FirstNet, a national long-term initiative to build a nationwide wireless broadband public safety network, provides Oregon with an opportunity to achieve interoperable public safety communications and enhance wireless broadband systems statewide.

- Disaster Recovery Planning: The Council believes that telecommunications and electric power systems are key to the state's ability to respond to and recover from major disasters. Joint-planning and coordination between federal government, state government, and broadband service providers is needed.

- Federal Funding: Oregon needs to fully utilize and leverage the expanding broadband related federal initiatives and funding programs that are available to help meet the state's broadband needs.

- Cyber Security: The Council believes that cyber security is a "sleeper-issue" that requires urgent attention. The security of data and communications systems is a clear and present risk exposure for government, public organizations, private sector businesses, and for individuals that is widely unrecognized and under managed. An OBAC proposed cyber security Oregon Legislative Assembly Joint Resolution, Legislative Concept 904, is presented in Appendix E of this report.

- Tier 1 Peering: The Internet is a network of networks, and there is a hierarchy of network carriers. Peering is the interconnection of separate Internet Protocol (IP) networks for the exchange of traffic. OBAC believes that Oregon should leverage its growing base of assets to raise its position in this hierarchy and promote establishing Tier 1 Peering in the state.

The Council continues to emphasize that access to competitive high-speed broadband telecommunication networks and the Internet has great value for institutions, businesses and individuals, and that broadband continues to grow in importance as an asset and strategic tool available for economic and community development in Oregon. The deployment of this infrastructure, however, must be followed by the adoption and utilization of the technology and enabled services to realize its benefits. Infrastructure does not produce value unless it is put to use.

Infrastructure Trends and Technologies

Internet Growth
The world's telecommunications infrastructure is challenged to meet the ongoing and rapid growth in user demand. Annual worldwide IP traffic is forecast to triple between 2014 and 2019. In 2019, annual IP traffic is forecast to hit a record of two zettabytes (two billion terabytes or two trillion gigabytes). Global IP traffic has increased over 500% in the past five years http://www.forbes.com/sites/amitchowdhry/2015/06/02/global-fixed-broadband-speeds-to-hit-43-mbps-in-2019-says-report/. Worldwide spending on information technology (IT) will increase from $2.4 trillion in 2016 to more than $2.7 trillion in 2020, according to a forecast from International Data Corporation released this year driven by cloud applications, mobility and big data. http://www.telecompetitor.com/worldwide-it-spending-to-grow-3-3-cagr-exceed-2-7-trillion-by-2020-idc-says/

According to the 2016 Cisco Visual Networking Index (VNI), more than 1 billion additional people and 10 billion new devices will be connected to the Internet over the next five years. Cisco predicts that global IP traffic will expand at a 22 percent compound annual growth rate from 2015-2020. The number of Internet users globally will rise 36.7 percent, from 3 billion in 2015 to 4.1 billion by 2020. The developing and *Internet of Things* (IoT) will mark the next wave of growth as machine-to-machine (M2M) connections including video surveillance, smart meters, digital health monitors, environmental sensors and other new services exceed 12 billion devices representing 46 percent of all of the devices connected to the Internet worldwide by 2020. https://newsroom.cisco.com/press-release-content?type=press-release&articleId=1771211

Akamai State of the Internet
Every quarter, Akamai – a global content delivery service provider, releases an update to its State of the Internet report that shows key trends. For Q1 2016: Average Internet speeds went up about 10% around the world; The US ranks solidly in the top 10% of all nations and in the top 1% of low population density nations; Cyber-attacks are increasing in intensity.
   Akamai findings Q1 2016:
   - United States ranks 16th in the world in Average Connection Speed (web speed) at 15.3 Mbps, up 7.7% from the preceding quarter and 29% from the year-ago quarter.
   - US ranks 22nd in Average Peak Connection Speed (broadband speed) at 67.8 Mbps, up 10% from the preceding quarter and 27% from the year-ago quarter.
   - US ranks first in number of IPv4 addresses seen by Akamai.
   - US ranks 6th in percentage of connections using IPv6, at 17%, up 0.7% from the preceding quarter.
   - US is the 2nd greatest source country for Distributed Denial of Service (DDoS) attacks (after China, the greatest source.)
   - US is the number one source country for web attacks, most aimed at retailers.

- The US is slipping in the global rankings. http://hightechforum.org/akamai-state-internet-q1-2016/

Akamai findings Q2 2016:
- Global average connection speed decreased 2.3% from the first quarter of 2016 to 6.1 Mbps, a 14% increase year over year.
- Global average peak connection speed increased 3.7% to 36.0 Mbps in the second quarter, rising 2.5% year over year.
- Global 10 Mbps broadband adoption rate grew 0.7% quarter over quarter, but 15 Mbps and 25 Mbps broadband adoption rates fell 0.8% and 2.1%, respectively.
- Average mobile connection speeds ranged from a high of 23.1 Mbps in the United Kingdom to a low of 2.2 Mbps in Venezuela. Akamai.com/stateoftheinternet

Public Switched Telephone Network (PSTN)
OBAC noted in its last report that FCC Chair Tom Wheeler has been promoting the migration of users from the legacy Public Switched Telephone Network (PSTN) to new broadband packet switched networks and protocols. It has also been noted that users are steadily migrating their legacy analog voice services to digital wireless and broadband networks. 45.4% of U.S. households do not subscribe to wireline telephone service. There is interest in accelerating this move rather than to continue to invest in maintaining legacy networks that are losing customers. http://www.telecompetitor.com/this-is-big-telcos-mef-launch-ethernet-interconnection-point-eip-project/ / www.mef.net

In July 2016, the FCC established plans for the telecommunications industry's technology transition from the traditional legacy "switched access" phone service to IP based access. The commission ruled that incumbent local exchange carriers are no longer the dominant carriers for local access services, and that Incumbent Local Exchange Carriers (ILECs) wishing to discontinue switched access services may do so, but must show that an adequate replacement exists. Clearly, Telecommunications Protocol / Telecommunications Protocol (TCP/IP), the communications protocol for the Internet, has emerged as the world's de-facto standard for telecommunications networks. http://www.telecompetitor.com/traditional-phone-service-phase-out-rules-adopted-by-fcc-with-demanding-requirements/

Regardless of this milestone transition, the legacy twisted-pair copper network is extensive and in place. Broadband component manufacturer Sckipio Technologies believes that it can help telephone companies extend the life of this legacy infrastructure and enable them to compete with cable companies. G. Fast technology was developed to support high bandwidth transmission over short twisted pair copper loops. Aggregate upstream and downstream speeds of 150 Mbps over 1600 feet of traditional phone wiring, and the aggregate speeds of 300 Mbps over 980 feet of traditional phone wiring are already feasible. So as the PSTN, as a switched voice grade network is retired over the coming years, the physical network will live on carrying new services with new protocols and equipment at competitive speeds. http://www.telecompetitor.com/g-fast-bandwidth-improvement-better-positions-copper-broadband-against-cable-docsis/

CenturyLink has set a goal of bringing broadband service supporting speeds of at least 40 Mbps to 50% of its base by the end of 2018. Although CenturyLink has done some fiber-to-the-home deployments to support speeds as high as 1 Gbps, CenturyLink broadband plans will rely largely on upgrading existing copper loops using bonding, vectoring and G. Fast technologies. Upgrading broadband speeds has become increasingly critical to telephone companies as customers demand higher-speed services to support streaming video and other high-bandwidth applications. By the end of 2019, CenturyLink expects to have 11 million households capable of receiving 100 Mbps within its territory, including three million homes capable of receiving speeds as high as 1 Gbps.

A single copper pair can support speeds of 40 Mbps over a distance of up to 2,500 feet. With two bonded pairs, the distance doubles to about 5,000 feet. And if vectoring is added, the distance is extended to 8,000 feet. Vectoring technology increases broadband speeds on copper cable by using noise cancellation technology.
http://www.telecompetitor.com/centurylink-broadband-roadmap-funding-shifting-from-the-cloud/
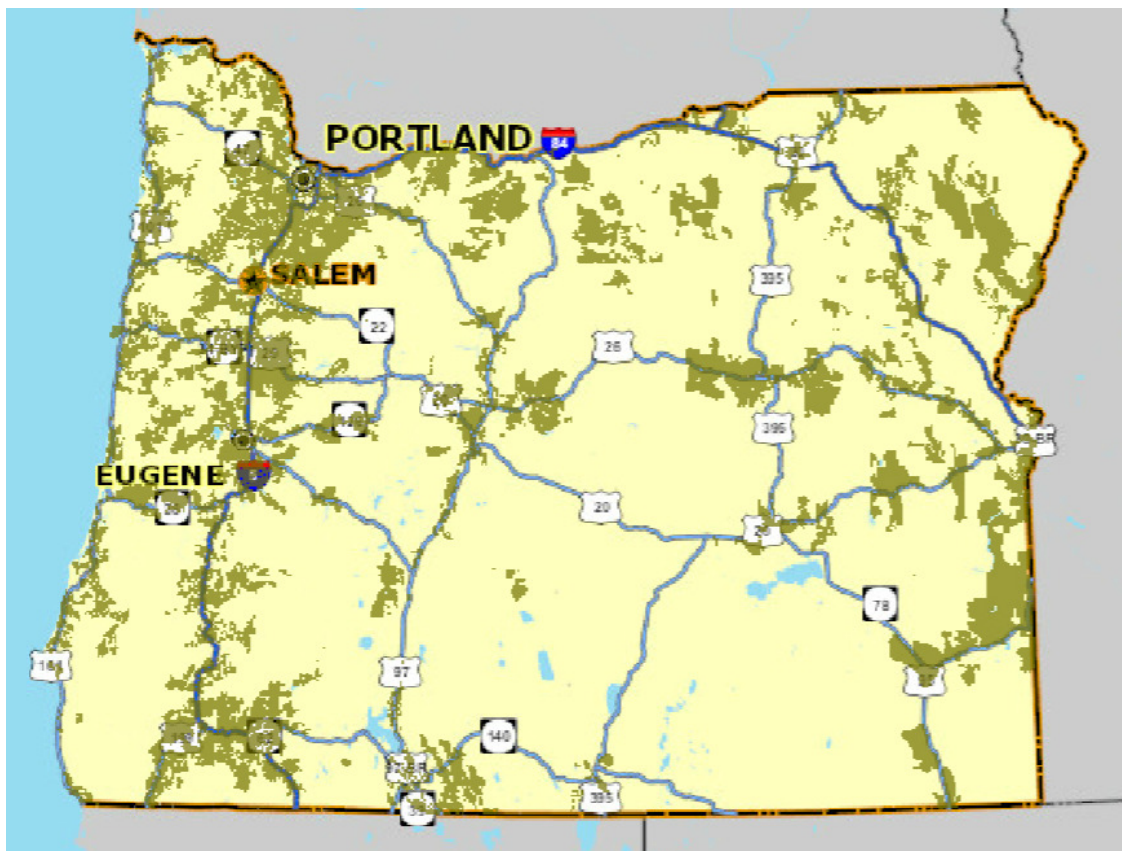
Digital Subscriber Line (DSL) Broadband Coverage
www.broadband.oregon.gov

Cable

Cable service providers currently dominate broadband access in market share, and broadband data services are rapidly expanding as applications on cable provider networks. For the first time, the country's largest cable provider, Comcast, has more Internet subscribers than cable TV programming subscribers. Streaming video over broadband is disruptively changing customer viewing patterns and is reshaping the cable industry. Cable providers are beginning to lose entertainment package subscribers to Internet based content providers like Netflix, Hulu, and YouTube. In the January-March 2015 period, Comcast added 407,000 high-speed Internet access customers, the most since early 2013, while it lost 8,000 video programing customers.
http://www.oregonlive.com/silicon-forest/index.ssf/2015/05/comcasts_internet_subscribers_1.html

Cable broadband subscriber additions were 3.3 million new subscribers in the 12 months from April 2015, and the cable broadband market share is at 62 percent of the total fixed broadband market, according to the latest Strategy Analytics Service Provider Strategies service report. Total fixed broadband household penetration approached 80 percent of the broadband market. http://www.telecompetitor.com/report-cable-broadband-market-share-surging-now-at-62-of-total-fixed-broadband-market/

In December 2015, Comcast announced it had installed the world's first Data Over Cable Service Interface Specifications (DOCSIS) 3.1 modem on a customer-facing network, a key step towards a Comcast DOCSIS 3.1 gigabit broadband future. The trial installations are being tested in preparation for Comcast to install gigabit modems and use DOCSIS 3.1 for its next generation of broadband service. By the end of 2016, Comcast expects to be offering a new gigabit speed service that works over existing connections in customer homes in several additional parts of the country. DOCSIS 3.1 has the advantage of being backwards compatible with existing coaxial cable network infrastructure.
http://www.telecompetitor.com/comcast-docsis-3-1-gigabit-era-begins-with-philadelphia-trial/

Nokia Bell Labs reported it had achieved a world first by downloading and uploading data at a rate of 10 Gbps over coax, specifically the hybrid fiber-coax infrastructure widely used by cable companies today. The achievement was made using XG-CABLE technology. According to Nokia Bell Labs, XG-CABLE can easily integrate into the cable industry's new full-duplex DOCSIS 3.1 equipment. XG-CABLE is a prototype technology that may allow network operators to avoid the need to extend fiber to the premises. Instead operators would be able to use HFC cabling over the last 200 meters, and be able to deliver unprecedented upstream speeds over that infrastructure.
http://finleyusa.com/nokia-bell-labs-demos-xg-cable-10-gbps-over-coax/

Like twisted pair copper telephone lines, legacy cable TV coaxial cable lines will also continue to be a valuable asset and used to deliver competitive broadband services in the future.
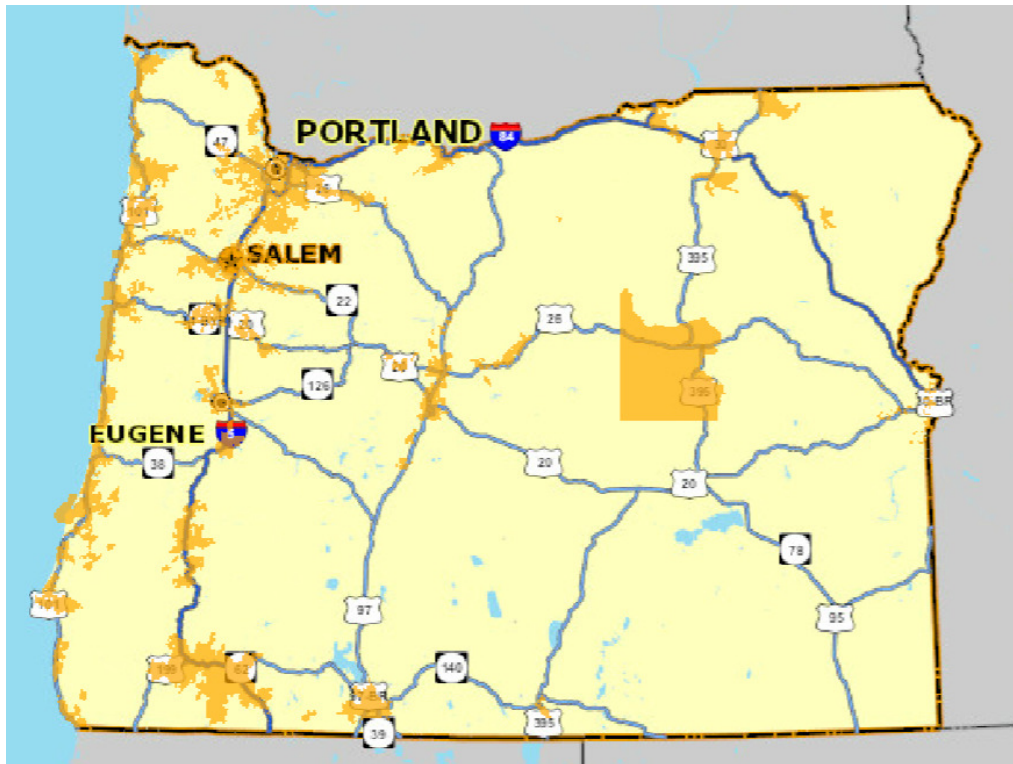
Cable Broadband Coverage
www.broadband.oregon.gov

Mobile Wireless
Mobile wireless services continue to be a rapidly growing segment of the telecommunications industry and its infrastructure. Smart phones and tablets are driving this growth by becoming a primary device for user broadband Internet access. Long Term Evolution (LTE) mobile wireless service subscriptions passed the 1 billion milestone worldwide in the fourth quarter of 2015. LTE subscriptions are expected to double by 2017 and triple by 2019, with continued smartphone, tablet computer, and mobile broadband service adoption. 2G subscribers will become a relative rarity over the period, with 3G and 4G subscribers accounting for 85% of overall global cellular service subscriptions by year-end 2020 and 5G network technology is in development. http://www.telecompetitor.com/ovum-global-lte-subscriptions-exceed-1-billion/

The last two years have seen a significant deployment of optic fiber cable throughout Oregon primarily driven by the construction of back-haul network facilities for 4G mobile wireless services. U.S. wireless carriers invested nearly $32 billion in 2015 due to the rapid growth in network traffic adding nearly 10,000 new cell sites. They have invested more than $177 billion since 2010 in efforts to improve network coverage and capacity http://www.telecompetitor.com/data-consumption-growth-ctia-finds-doubling-between-2014-and-2015/. On May 10, 2016 AT&T announced that it has invested nearly $325 million in its Oregon wireless network during 2013-2015. These investments funded upgrades to reliability, coverage, speed and overall performance for individual, business customers, and also improved services that support public safety and first responders. In 2015, AT&T made 18 wireless network upgrades in Oregon including new

9

cell sites, wireless broadband upgrades, network capacity, and expanded coverage in Oregon of the AT&T 4G LTE network. http://www.prnewswire.com/news-releases/att-invests-nearly-325-million-over-3-year-period-to-enhance-local-network-in-oregon-300265364.html.

This wireless infrastructure expansion trend will continue. Peak-period mobile bandwidth consumption is forecasted to grow by 500 percent over the next three years. It is predicted that typical macro cell capacity requirements will increase from today's 260 Mbps to 1.5 Gbps within five years. Network operators are actively increasing the capacity of their back-haul networks to meet the forecasted increases in bandwidth customer demand http://www.telecompetitor.com/acg-peak-mobile-bandwidth-forecast-surge-five-fold-2018/. Mobile wireless network data traffic has dramatically expanded surpassing voice traffic and carrying more than 100,000 times the traffic they supported as recently as 2008 according to National Science Foundation Media Advisory, July 13, 2016.http://www.nsf.gov/news/news_summ.jsp?cntn_id=139189&WT.mc_id=USNSF_51&WT.mc_ev=click

Reflecting dramatic market penetration, an eMarketer report indicates that 88.3% of teens aged 12–17 will have mobile phones this year, and among that population, 84% will have smartphones. And the trend is moving downward in age group. The report also indicates that about 50% of children aged 0 – 11 will have a smartphone by 2020, up from 41% this year. The age group with the current highest smartphone penetration of 95.2% is adults aged 25–34, followed closely by adults aged 18–24 at 94.9%. By 2020, the 18-24 age group will surpass all other categories, with 99% penetration. Smartphone penetration by adults aged over 65 is at 44%. http://www.telecompetitor.com/report-smartphone-penetration-among-children-surging-not-just-teens-anymore/

Another trend in the mobile wireless industry segment is consolidation. According to an FCC Report on the Mobile Wireless Market, the nation's four largest wireless service providers; AT&T, Sprint, T-Mobile and Verizon have a combined market share of 98.5% with all other providers sharing 1.5% of the market. The largest four providers controlled about 66% of the market in 2003. Today, 99.6% of the U.S. population can get LTE from at least one service provider, 97.8% that can get service from two or more service providers and 91.5% who can get service from three or more providers http://www.telecompetitor.com/fcc-wireless-competition-report-highlights-shrinking-tier-2-and-3-market/. According to data reported by the Center for Disease Control, adults aged 25–29 (69.2%) and aged 30–34 (67.4%) live in wireless voice-only households. The 18–24 demographic is 57.8% wireless only. The 35–44 age group is 53.7% wireless only, the 45–64 age group is 36.8%, and for those 65 and over, 17.1%. http://www.telecompetitor.com/nearly-half-of-u-s-households-are-now-wireless-only-households-but-60-may-be-more-accurate-number/

In yet another trend, mobile wireless service providers continue to develop strategies to off-load their networks of traffic by interfacing with local WiFi networks. By 2019 it is predicted by Juniper Research that WiFi networks will carry almost 60 percent of smartphone and tablet data traffic reaching over 115,000 petabytes (PB) by 2019,

compared to under 30,000 PB in 2015, representing almost 400 percent growth. According to WiFi service provider iPass, there were nearly 40 million community hotspots in 2014 and this is expected to more than double this year to nearly 90 million. http://ipcarrier.blogspot.com/2015/06/wi-fi-to-carry-60-of-mobile-data.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+blogspot%2FCxDEk+%28IP+Carrier%29

This exponential growth will set the foundation for 5G mobile wireless which is in development. Looking forward to 2020 and beyond, the International Telecommunication Union (ITU) is working to develop 5G mobile telecommunications standards that will enable wireless communication to match the speed and reliability achieved by fiber-optic infrastructure providing significant enhancements to voice, data and video performance http://www.telecompetitor.com/itu-5g-standardization-group-launched/.

Verizon announced that it will launch America's first 5G network, five years after it became the first carrier to offer 4G. The nation's largest wireless carrier has announced that it will begin field-testing 5G network technology in 2016, aiming to have some part of its 5G network up and running for commercial use by 2017. Verizon says its 5G technology will have 50 times the capacity of its current 4G network and be able to "handle exponentially more Internet-connected devices." The FCC has indicated that it wants to see 5G wireless service to be commercially available by 2020. http://money.cnn.com/2015/09/08/technology/verizon-5g/index.html
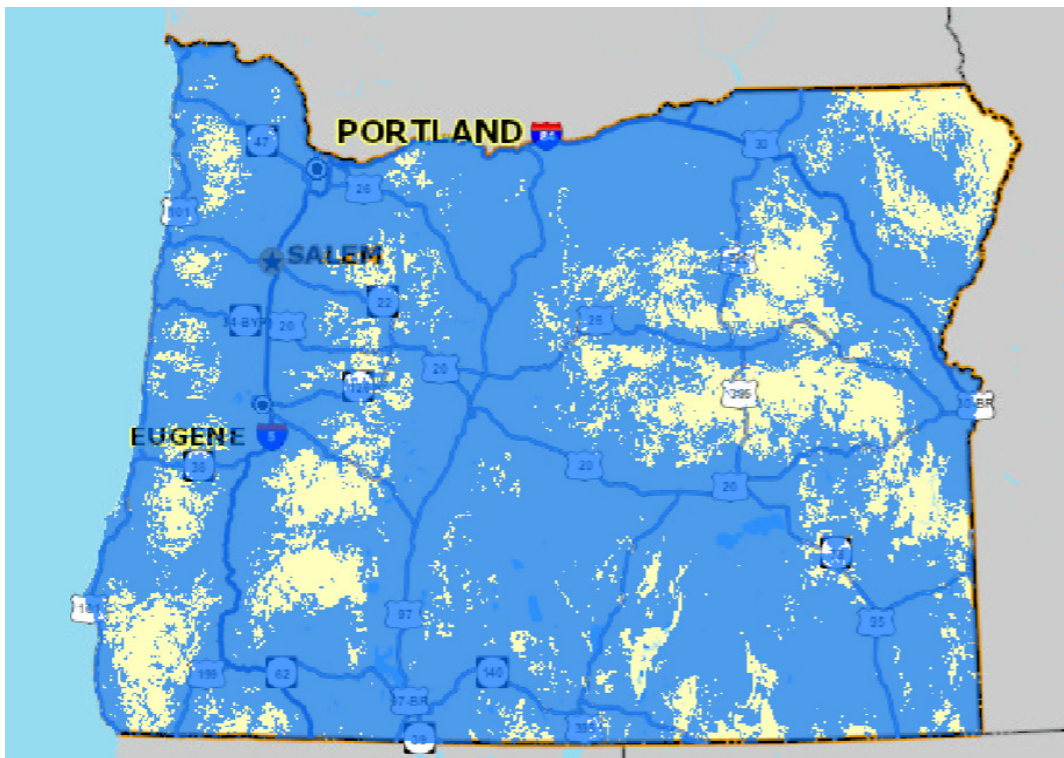
Mobile Wireless Broadband Coverage
www.broadband.oregon.gov

11

Fixed Wireless
Fixed wireless is a cost effective technology for broadband distribution networks, is an important component of Oregon's broadband infrastructure and could play an expanding role in rural broadband infrastructure as an effective solution to distance and terrain barriers for wireline technologies. Though optic fiber is a preferred medium, end users for the most part don't care if Internet access arrives by wireless or by wired connection, as long as it is fast, reliable, secure, and affordable. The cost of building a fixed wireless network can average $200 to $300 per subscriber including the equipment customers need in their homes (the customer premise equipment or CPE). Fiber networks may cost an average of $1,000 – $2,000 and up to $10,000 per household in the sparsely populated rural areas. In addition, the deployment time for fixed broadband is faster with wireless http://www.dailyyonder.com/analysis-new-use-of-wireless-holds-promise-for-rural-broadband/2016/08/17/14829/. Google is currently re-evaluating its gigabit broadband distribution network architecture, and looking at fixed wireless as an alternative to fiber-to-the-home in urban areas.

Oregon based fixed-wireless service providers include Gorge Net, EONI, and Eastern Oregon Telecom (EOT), serving north-central and northeastern Oregon providing fixed wireless Internet service with residential speeds up to 20 Mbps and commercial speeds up to 1 Gbps (1000 Mbps) collectively to more than 5500 customers. In most cases, the only alternative these customers have is satellite-based Internet which has signal latency and data-cap constraints. Counties served include Hood River, Wasco, Sherman, Gilliam, Morrow, Umatilla, Union, and Wallowa. It should be noted that these companies are competitive providers who reach the most rural and remote customers without state or federal subsidies. Freewire Broadband serves business customers in Washington, Multnomah, Washington, Clackamas, Yamhill, Marion, and Lane counties with guaranteed 99.99% uptime.
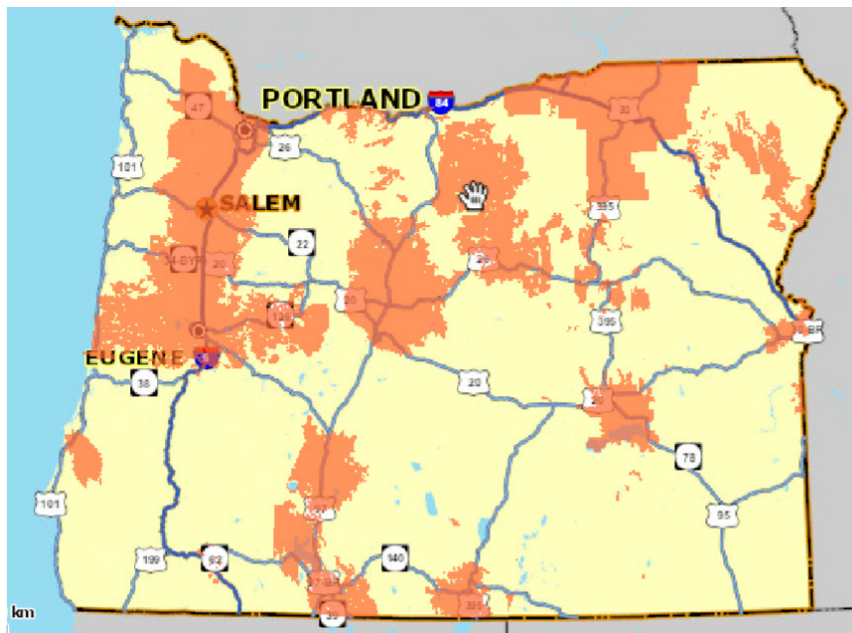
Fixed Wireless Broadband Coverage
www.broadband.oregon.gov

Other fixed wireless service providers include King Street Wireless in Benton, Linn, Lane, Deschutes, Jefferson and Grant Counties; Unwired West in Lane County; Douglas FastNet in Douglas County; FireServe in Klamath and Lake Counties; and High Desert Air in Harney County.

This year, fixed wireless technologies appear to be gaining in popularity with carriers. Windstream announced that it will launch fixed wireless service in 40 markets nationwide. The service is targeted to provide speeds of up to 275 Mbps up and 275 Mbps down with available service level agreements. AT&T recently entered into a CenturyLink market with competitive fixed wireless broadband service using spectrum in the 70-80 GHz band for which the company has a nationwide license. The spectrum that Verizon also has fixed wireless plans using frequencies in the 28-31 GHz and 39 GHz bands. Google has been experimenting with fixed wireless using 3.5 GHz unlicensed band frequencies and has halted fiber-to-the-home projects while it evaluates fixed wireless alternatives. Google has acquired fixed wireless provider Webpass which uses spectrum in the 70-80 GHz band. http://www.telecompetitor.com/windstream-fixed-wireless-expansion-highlights-growing-competitive-realities/

Satellite
Satellite broadband service capabilities continue to improve and provide service options for users located in urban, rural and frontier areas with a clear view of the southern sky. ViaSat Inc. has introduced its new *Exede* Business Internet service plans offering variety of satellite Internet service options for primary connectivity, and a new Internet back-up service. The continuity service offers businesses a diverse access redundant satellite broadband connection to avoid service interruptions during outages with their primary Internet service provider. The new Exede Business Service plans offer up to 15 Mbps download and 4 Mbps upload speeds that support applications such as video, data, voice, remote monitoring, point-of-sale (POS) systems and "cloud connectivity." http://www.telecompetitor.com/viasat-introduces-new-exede-business-internet-service-plans/   News Release: http://www.prnewswire.com/news-releases/viasat-introduces-new-exede-business-internet-service-plans-300209645.html

Satellite broadband provider ViaSat plans to participate in the FCC's Connect America Fund auction, and not just in the portion of the Connect America Fund targeting extremely high-cost areas. ViaSat appears to meet the two slowest of the four CAF auction speed tiers. These include the 10 Mbps downstream / 1 Mbps upstream tier and a 25 Mbps / 3 Mbps tier. Both of those tiers have a minimum usage allowance of 150 gigabytes per month, while the two higher speed tiers (a 100 Mbps / 20 Mbps tier and a 1 Gbps/ 500 Mbps tier) require unlimited monthly usage. http://www.telecompetitor.com/www-viasat-com/

Satellite based broadband services will be increasingly competitive with terrestrial solutions and may be the only services available for some rural and frontier areas.

Optic Fiber

Optic fiber is a preferred transmission medium because it is virtually unlimited in its data carrying capacity, limited by the equipment connected to it. The term "fiber" is often used as being synonymous with broadband though it is but one of many transmission media. Fiber is used in the core and "middle mile" sections of telecommunications networks, and has been increasingly extended to distribution networks or "fiber-to-the-home (FTTH)" networks. It is widely touted as the premier broadband transmission medium particularly in the context of Gigabit Services, though, as was noted earlier, hybrid-fiber network architectures are receiving new interest as alternatives. Hybrid networks utilize fiber to the neighborhood, "curb," or pedestal, but then use twisted pair copper, coax, or fixed wireless technologies for the final connection to the end user.
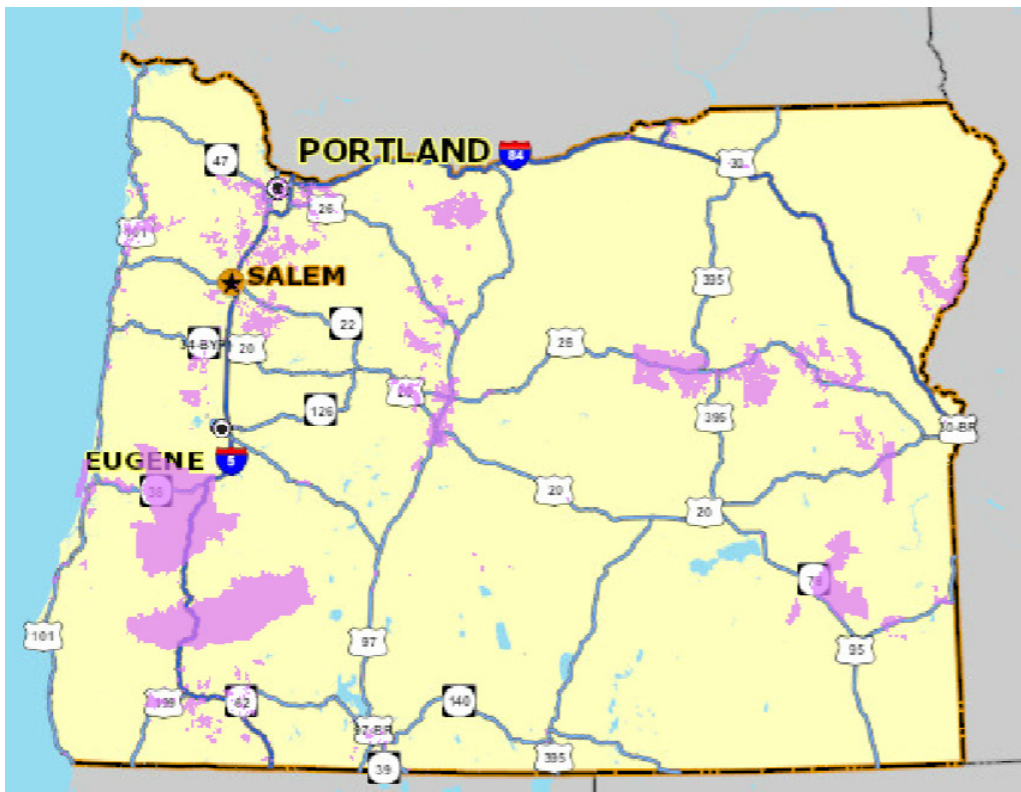
Fiber Broadband Coverage
www.broadband.oregon.gov

Fiber has been deployed in Oregon as a distribution network technology by telephone company, cable company, competitive access, and municipal service providers. Oregon service providers offering fiber-to-the-home for residential services include CenturyLink, Comcast, Wave Broadband, MINET, SandyNet, Douglas FastNet, ComSpan USA, Online NW, and Eastern Oregon Telecom.

An excellent reference for "all things fiber" is the Fiber to the Home (FTTH) Council Americas, a non-profit association consisting of companies and organizations that deliver services over fiber optic connections, companies that manufacture FTTH products, and others involved in planning and building FTTH networks www.ftthcouncil.org.

A key area of "traction" for Oregon has been undersea fiber optic cable landings. There are currently fourteen in-service commercial undersea cables coming ashore in Oregon. Oregon is a preferred location to come ashore on the West Coast of North America because of a well-established working relationship between state government, the fishing fleet, and the undersea cable operators.
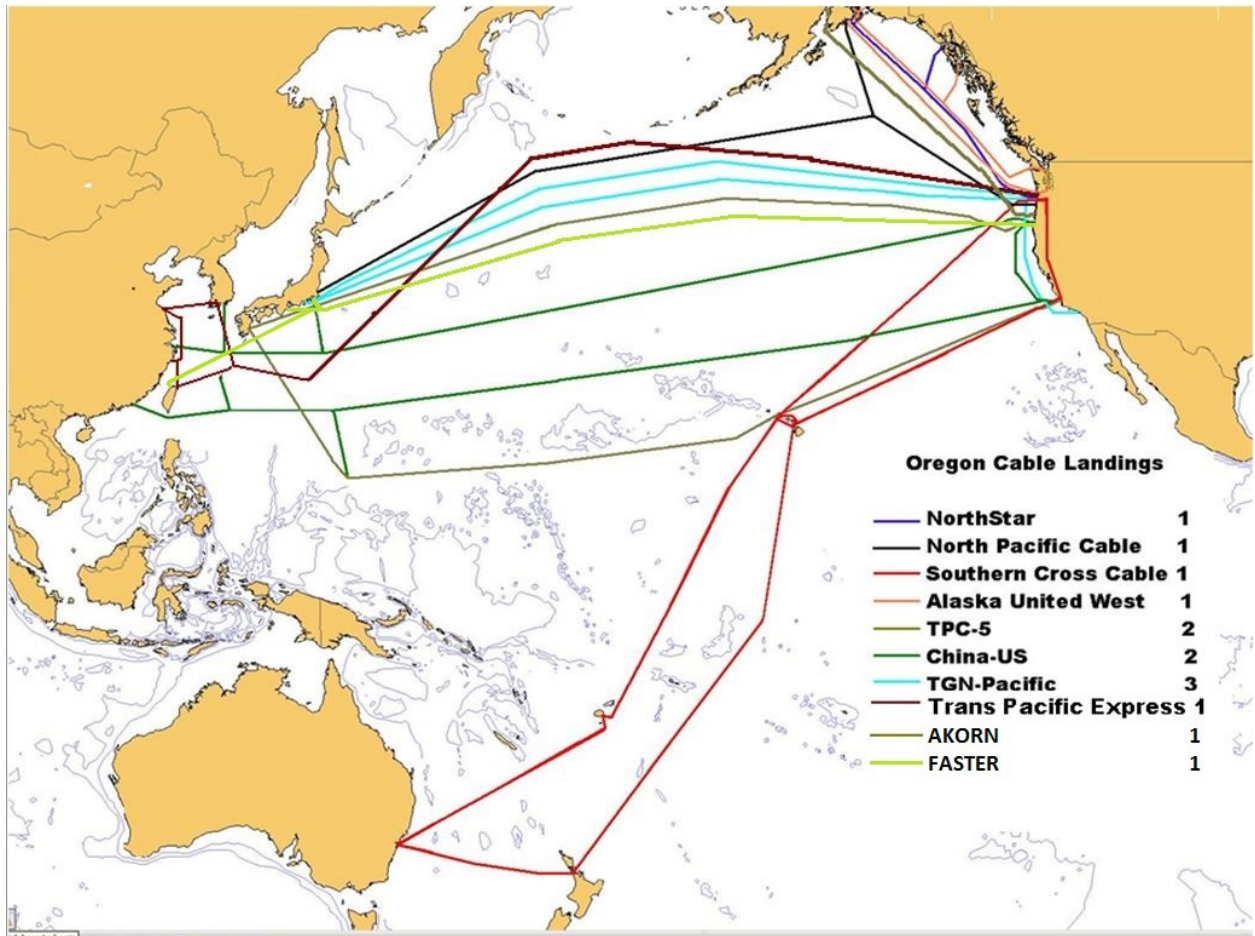
Oregon Cable Landings

On June 30, 2016 a new undersea fiber-optic cable funded by Google and a consortium of Asian telecommunications companies went into service. The cable system called *FASTER* was built by Japan's NEC Corporation, stretches 5,600 miles from Bandon, Oregon to two landing points in Japan and a landing point in Taiwan, and has an estimated cost of $300 million. The project was announced in 2014 and was completed on schedule, a hallmark of Oregon cable landings.

FASTER is the fastest, highest capacity trans-Pacific undersea cable built, to date. It can theoretically deliver as much as 60 terabits per second of bandwidth—more than half the total bandwidth available between the U.S West Coast and Asia at the end of 2015, according to telecommunications consulting firm Telegeography. Google is reserving 10 terabits of that capacity to speed up communications between its own computer data centers. Traditionally, these cables have carried public Internet and carrier traffic. But

now, companies like Google and Facebook are using them to carry data directly between their own data centers, bypassing the Internet and carrier networks altogether in order to speed up content delivery and reduce costs. Private networks now use 60 percent of the capacity of trans-Atlantic cables. Facebook and Google are also buying up "dark fiber" capacity throughout the US—to connect their various data centers in private network configurations. http://www.wired.com/2016/06/google-turns-giant-internet-cable/

There are two additional undersea cables coming ashore in Oregon 2017-2018, the Hawaiki Cable landing in Pacific City and connecting to Hawaii, American Samoa, Australia and New Zealand in Q3 2017 http://hawaikicable.co.nz, and the New Cross Pacific Cable System also landing in Pacific City and connecting to China, Taiwan, Korea and Japan planned for completion in Q1 2018.

Tata Communications, headquartered in India, has brought its network to a Digital Realty data center in Hillsboro, a hub for access to the numerous transpacific submarine cables. Tata operates an extensive submarine cable network, linking countries in Asia Pacific, Middle East, Africa, Europe, North America, and South America.

Digital Realty is one of the world's largest data center providers whose recent focus has been on expanding its business from major cloud providers, expecting them to attract enterprise customers. Global connectivity services like Tata's are especially important to cloud providers, who serve customers around the world.
HTTP://WWW.DATACENTERKNOWLEDGE.COM/ARCHIVES/2016/05/10/GLOBAL-DATA-CENTER-CONNECTIVITY-UPDATE/

Centeris, a new data center provider that recently launched what it describes as a "transpacific connectivity hub" outside of Seattle, has partnered with the US subsidiary of Chunghwa Telecom, Taiwan's largest telecommunications company, for connectivity between the hub and Chunghwa's network end points in Asia. The partnership establishes new connectivity options between the US and Asia via the Trans-pacific Express, New Cross-Pacific, and *FASTER* submarine cable systems all of which come ashore or will come ashore in Oregon.
www.datacenterknowledge.com/archives/2016/05/10/global-data-center-connectivity-update/

This growing cluster of undersea cables is positioning Oregon as a telecommunications gateway to the Pacific Rim. There is an ongoing 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 between North America and 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.

Oregon has worked to build this working relationship and generate awareness in the industry. In January 2016, the Pacific Telecommunications Conference, the Asia-Pacific's premier undersea telecommunications conference, was held in Honolulu.

Governor Kate Brown provided an open letter to the delegates of that conference reaffirming Oregon's interest and competitiveness as the place for fiber optic cables to come ashore on the west coast.

January 6, 2016

KATE BROWN
Governor

Delegates
Pacific Ocean Undersea Cable Projects
Pacific Telecommunications Conference
Honolulu, Hawaii 96826

Ladies and Gentleman:

We invite and encourage you to consider Oregon as your future site to come ashore on the west coast of North America, and as an excellent location for the placement of related on-shore operations. Oregon has a long record of successful submarine cable industry projects, a highly developed telecommunications infrastructure, a workforce of skilled professionals for marine and terrestrial telecommunications cable installation, and unparalleled cooperation between its undersea cable operators, fishing industry, and state government.

As chair of the State Land Board, which approves easements for cable landings on the Oregon coast, I can assure you that we will welcome and give full and timely consideration to all landing requests. Please know that the Department of State Lands and the Oregon Business Development Department along with other involved state agencies will work in partnership with you, as an undersea cable operator, and Oregon's fishing fleet to ensure the success of your project once approved.

Please contact Chris Castelli, Oregon Department of State Lands, 775 Summer St. NE, Salem, OR 97301-1279 USA, phone: 503 508-4312, e-mail: chris.castelli@state.or.us, for more information.

We stand ready to assist you and to provide you with the information you need to come ashore in Oregon.

Sincerely,

Governor Kate Brown
State Land Board Chair

KB:vp/ct

Other Technologies
There is also the potential for the development of new technologies to deliver broadband services. AT&T Inc. announced that it has a way, other than power-line carrier, to deliver high-speed broadband over electrical power lines. The technology, which AT&T calls AirGig, works by placing antennae on power poles and transmitting a wireless signal that "hugs" the outside of the power line. The wireless signal then radiates from the power line and provides web connections at gigabit speeds. AT&T has filed patents for the technology and is looking for a place to conduct field trials next year. The advantage of using existing power lines is that such wires have already been built around the world, including into places where traditional broadband or wireless signals have not. It could also serve as an inexpensive way to deliver high-speed Internet in cities or suburban areas, by using existing power line infrastructure. Though AirGig is still in the early stages of development, AT&T views it as a potentially transformative technology that could deliver low-cost, multi-gigabit wireless internet access services to customers in underserved areas around the world.

AirGig Antenna

http://www.wsj.com/articles/at-t-to-test-broadband-over-power-lines-1474411386

Also see:
http://arstechnica.com/information-technology/2016/09/atts-airgig-uses-power-lines-for-multi-gigabit-wireless-broadband/

http://gigcommunities.net/att-introduces-project-airgig-with-the-hope-of-speeding-gigabit-network-deployment-worldwide/

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 Telecommunications Association of Oregon www.ota-telecom.org, the Oregon Cable Telecommunications Association www.oregoncable.com, and the Northwest Telecommunications Association http://nwta.biz/.

The industry has fundamentally changed over the past ten years with the migration from basic narrowband service to broadband, from wireline to wireless, from analog to digital, and from the migration of telecommunications network traffic from voice to data / text / video / image. We can expect to see continued significant rates of change as new applications and technologies are introduced. The growing Internet of Things (IoT) will dramatically impact data traffic on carrier networks. Bandwidth capabilities and service offerings will continue to grow. The move by the Federal Communications Commission to retire the legacy voice grade Public Switched Telecommunications Network (PSTN) and declaring that incumbent local exchange carriers are no longer dominant carriers for local access services reflects the extent of this "sea change." 100% of Oregon's Incumbent Local Exchange Companies (ILECs) now offer DSL broadband services.

Cable companies continue to dominate the broadband market nationally and in Oregon. Telephone companies AT&T, CenturyLink, Verizon and other telephone companies collectively added just 65,893 broadband subscribers and lost 185,000 subscribers in the fourth quarter of 2015. Cable providers accounted for 111 percent of the three million net broadband additions over the past year http://www.fiercetelecom.com/story/att-centurylink-verizon-lose-more-broadband-subscribers-q1-lrg-says/2016-05-16.

Leichtman Research Group (LRG) reported that the seventeen largest cable and telephone providers in the US representing about 94 percent of the market acquired about 645,000 net additional high-speed Internet subscribers in the third quarter of 2015. These top broadband providers now account for 89.5 million subscribers with the top cable companies having nearly 54.3 million (61%) broadband subscribers, and top telephone companies having over 35.2 million (39%) subscribers.

Other broadband findings include:
- Overall, broadband additions in 3Q 2015 amounted to 92 percent of those in 3Q 2014.
- The top cable companies added about 790,000 broadband subscribers in 3Q 2015, representing 134 percent of the net additions for the top cable companies in 3Q 2014.
- The top telephone companies lost about 140,000 broadband subscribers in 3Q 2015 compared to a gain of about 110,000 in 3Q 2014.
- AT&T and Verizon added 305,000 subscribers via U-verse and FiOS in 3Q 2015, while having a net loss of 432,000 DSL subscribers.

- In the first three quarters of 2015, cable companies added about 2,300,000 broadband subscribers, while telephone companies lost about 130,000 subscribers.

http://bbpmag.com/wordpress2/2015/11/isps-add-over-600000-broadband-subscribers-in-q3-2015/

We will continue to see industry consolidation of service providers, as well as industry vertical integration, as many service providers move to provide content services in addition to transport services. Verizon has been steadily acquiring companies like Yahoo!, Complex, and AOL. AT&T's recently announced agreement to acquire Time Warner reflects its business plan to vertically integrate through information, communications, and entertainment services.

Broadband Industry Regulation
Broadband has been classified as an enhanced service and has not been subject to regulation at the federal or state level. In 2015, the FCC adopted new Open Internet rules after months of deliberation and over 4 million public comments. The FCC ruling states that wired *and* wireless broadband providers may not:
- Block access to legal content, applications, services, or non-harmful devices.
- Impair or degrade lawful Internet traffic on the basis of content, applications, services, or non-harmful devices.
- Favor some lawful Internet traffic over other lawful traffic in exchange for consideration of any kind.

One of the most controversial parts of the ruling is reclassifying retail broadband service as a telecommunications service under Title II of the Telecommunications Act of 1996, and therefore subject to regulation by the FCC as a "common carrier" service. Broadband providers sued the FCC to stop the new net neutrality regulations http://www.politico.com/story/2015/04/net-neutrality-lawsuit-ctia-116957.html.

In 2016, the D.C. Circuit Court of Appeals upheld the Federal Communications Commission's 2015 Net Neutrality rules in their entirety. The court ruled that the FCC had the authority to regulate broadband Internet access service as a "common carrier" service and to issue rules that police the relationship between customers, broadband Internet service providers, and Internet content and application companies. The decision is being appealed by broadband providers to the U.S. Supreme Court and will likely also result in proposed legislation that would restrict the FCC's ability to enforce the new rules. The final resolution of this issue will impact the future develop and deployment of broadband services.
http://www.connectednation.org/sites/default/files/bb_pp/06142016_open_internet_court_ruling.pdf

Universal Service Fund – Connect America Fund

In line with viewing broadband as a telecommunications service under Title II, and subject to regulation, the FCC has made significant changes to use of the Universal Service Fund over the past two years. It has repurposed the fund as the Connect America Fund offering carriers nearly $1.7 billion to expand broadband service in rural areas that are unserved.

> Broadband has gone from being a luxury to a necessity for full participation in our economy and society – for all Americans. For that reason, the FCC has adopted comprehensive reforms of its Universal Service Fund (USF) and Intercarrier Compensation (ICC) systems to accelerate broadband build-out to the approximately 23 million Americans (as of December 31, 2013) who lack access to infrastructure capable of providing 10/1 Mbps fixed broadband. This reform will expand the benefits of high-speed Internet to millions of consumers in every part of the country by transforming the existing USF into a new Connect America Fund focused on broadband.
> https://www.fcc.gov/general/connect-america-fund-caf

The program seeks to expand broadband service availability to over 8.5 million additional rural Americans.
- The Oregon allocation accepted by Frontier Communications is $3,897,357 for 8,542 homes and businesses in Oregon.
- The Oregon allocation accepted by CenturyLink is $17,759,903 to reach 41,785 homes and businesses

UM 1481 - PUC Investigation of the Oregon Universal Service Fund

A little over six years ago, the PUC opened Docket UM 1481 to examine what changes might be needed in the Oregon Universal Service Fund (OUSF) to reflect the technological advances in data transmission rates and broadband services and the explosive growth of cellphone use. The Commission's response was to have a multiphase proceeding addressing the definition of universal service, criteria for funding, sources and levels of funding and eligibility criteria for parties receiving funding.

The journey has been neither short nor linear. As landline subscriber numbers declined due to a customer shift to cellular phones as the primary means of telecommunication, the sources of OUSF funding became fewer and increases in monthly customer surcharges went into effect to compensate for the shortfall in funds due under the support calculations.

The Commission soon began to narrow its focus on to three areas:
1. Accountability for Non-Rural Companies: Identifying methods for accurately estimating how OUSF funds are directed to operating expenses in claimed high-cost areas.

2. Consideration of a methodology (other than revenues) to allocate incumbent local exchange carrier (ILEC) network costs between basic telephone and other services, including a review of the cost models used to calculate OUSF support; and

3. Identifying areas of unsubsidized competition and determining if OUSF support should continue to be provided there.

The primary focus of the parties themselves during the proceeding, however, has been on the funds disbursement levels going forward, in the face of a declining subscriber base. In Order No. 16-093 entered March 4 of this year, the PUC took two actions.

First it addressed the fund disbursement levels by adopting the "Revised Phase III Stipulation," which included an 8.5% cap on the contribution surcharge for the five-year term of the stipulation. The result of applying the cap on the surcharge was a 27.5 percent reduction in OUSF support for non-rural companies and a 15.2 percent reduction for rural companies.

Second, the Commission adopted the "Phase IIIa Stipulation" which modified the reporting requirements for CenturyLink and Frontier Northwest for their expenses in areas eligible for OUSF support, thereby addressing the question of financial accountability of non-rural companies.

In that order, the Commission again set aside resolution of the second and third issues of concern to be addressed in subsequent proceedings.

Several months after the Commission issued Order 16-093, on September 9 of this year, the PUC received a petition for rulemaking filed by the Oregon Telecommunications Association. The petition proposes revisions to the PUC rules that would change the definition of basic telephone service to include "access to broadband services." The petition has been placed in a new docket, AR 604, which is currently under consideration.

Oregon Broadband Infrastructure Projects

OBAC believes that access to competitive high-speed broadband telecommunication networks and the Internet has great value for institutions, businesses and individuals, and that broadband continues to grow in importance as an asset and strategic tool available for economic and community development. That belief is shared by others in the state that have undertaken a range of projects in the past two years to improve the state's broadband infrastructure.

Cities

City of Condon
The City of Condon released a broadband RFP stating that it believes that universal access to reliable, affordable high-speed internet access services is essential for the City's economic vitality and quality of life. Broadband has transformed the ability to communicate, participate, create, educate, inform, and drive economic and community development. It is the function of government to provide essential services to the community, and the City believes broadband is an essential service on par with electricity, telephone, sewer and water services.
http://cityofcondon.com/wp-content/uploads/2016/08/RFP-Final-Aug-2016.pdf

City of Eugene
The City of Eugene been actively engaged in broadband policy development, planning, and infrastructure projects for many years.

In 2014, in partnership with private sector service providers, the city began a 3-year pilot program to install fiber in downtown Eugene in existing electric conduit owned by the Eugene Water and Electric Board (EWEB), a municipal utility. The dark fiber is leased out to private sector service providers for the provision of high-speed broadband services to area businesses. In the third year of the pilot, the city council reviewed the project and directed that the pilot be expanded to approximately 125 additional buildings in the downtown area, including residential. The city is working to identify funding sources and the construction timeline.

The city is offering fiber based Internet access with speeds of up to 1 Gbps at prices as low as $100 per month to companies in downtown Eugene. In May 2016, the first connection was made between building tenants and the fiber network. The long-term goal is to identify funding sources to add fiber optic infrastructure across the downtown core and to the riverfront redevelopment area.

Matt Sayre of the Technology Association of Oregon (TAO), a proponent of the urban renewal funded fiber project says that pilot project across four buildings has been a success. He says that the city's vacancy rate is 12 percent, but for the buildings with the high-speed fiber installed, the vacancy rate is at zero, and that as a result of the pilot

project, Internet speeds at the Broadway Commerce Center increased 250 percent while costs dropped by 40 percent.
https://www.eugene-or.gov/CivicAlerts.aspx?AID=1980&ARC=4111
http://www.eugene-or.gov/3254/Proposed-Projects---High-Speed-Fiber
http://www.eugeneweekly.com/20160922/news-features/urban-renewal-and-high-speed-fiber-downtown

The City of Eugene also operates several Wi-Fi sites: 6 sites downtown; 3 sites in west Eugene; 3 sites in south Eugene; 3 sites in north Eugene; and at the regional airport.

City of Maupin
The City is working with Q-Life, a quasi-public broadband service entity created in The Dalles over a decade ago, to bring fiber optic broadband to Maupin. Currently, the Bonneville Power Administration (BPA) has fiber passing through its' Maupin Substation located about 2 ½ miles from the community. LS Networks, a Q-Life partner in The Dalles has leased BPA fiber through this location. The initial plan is to purchase and install equipment at the substation that will download at least 10 Gbps of Broadband from LS Network's fiber. This will be connected to a Q-Life fiber line that will go from the BPA substation to a telecommunications hut (Point of Presence or POP). The presence of fiber in the community will markedly enhance the potential for industrial and commercial job creation.   The fiber will also reach South Wasco County School District, Deschutes Rim Health Clinic and City of Maupin Facilities.

City of Sandy
In June of 2014 the City of Sandy started construction on a municipally owned and operated fiber to the home network. The goal of this project was to provide state of the art gigabit internet connectivity to the residents of Sandy, ensuring the broadband future of the community.

The scope of the network build was city wide, focusing in the initial phase on all residential neighborhoods inside city limits. Contractors worked for just over 12 months, during which over 40 miles of mainline fiber was constructed throughout the City of Sandy passing approximately 3500 residential premises. The entire network consists of underground construction. Over 2000 service drops were constructed to homes as residents signed up for service on the fiber network.

In 2015, the City of Sandy completed a fiber-to-the-home municipally owned network to provide 1 Gbps service at $59.95 per month and 100 Mbps service at $39.95 per month to its citizens, SandyNet. The 2015 National Association of Telecommunications Officers and Advisors (NATOA) Community Broadband Award recipients are Jeremy Pietzold and Joe Knapp of Sandy Oregon who were recognized for the SandyNet project that is now offering high speed broadband services at affordable prices available to all homes in Sandy and is being subscribed to by nearly 60% of the community's residents. Sandy is receiving significant national attention with the roll-out of its network. Councilman Jeremy Pietzold was invited to the White House to discuss broadband strategies.

Since the completion of construction, the demand for service on the network has not diminished with several hundred new orders for service being requested in the 12 months following construction. Additionally, city staff are working on expanding the network offering in the business district of the City and expects to solicit construction bids for a project this fall. Multiple Dwelling Units are also in the future expansion plans. City staff is currently testing brand new equipment to cost effectively extend the fiber service into existing apartment complexes in a project hoped to launch this fall.

Funding for this project was accomplished by the issuance of a $7.5 million revenue bond. The revenues generated by the system cover the operation costs as well as the bond costs http://www.ci.sandy.or.us/SandyNet/ .

Counties

Clackamas County
Clackamas County continues to develop its nearly 200 mile fiber optic network infrastructure, the Clackamas Broadband eXchange http://www.clackamas.us/cbx/ to provide community anchor institutions, such as schools, police and fire stations, libraries, healthcare centers, governments, transportation facilities and utility companies with cost effective service and make Clackamas County competitive. The Clackamas Broadband eXchange now serves the cities of Milwaukie, Oregon City, Gladstone, Damascus, Boring, Sandy, Estacada, Colton, Molalla, Canby, Government Camp and Wilsonville.

Sherman County
While Sherman County Oregon is a rural county with less than 1800 residents, it feeds millions with its wheat production and powers hundreds of thousands of homes with its wind farms. While its value to others is great, its Court felt that it was suffering from a lack of quality Broadband service availability for all its citizens. The county did not want to become an Internet Service Provider (ISP), but it found that it also could not attract an ISP to build a network to serve such a low population base at a profit. The County chose to create a "Best Effort" Wireless Internet Network Development project leveraging its existing 911 tower system to create a low cost solution. The result was a system that covered 900 square miles at an initial cost of $40,000.00. Sherman County invited ISP's to use the network and pay the County $6.00 a month per subscriber in order to over the continuing costs. The county now has an ISP that serves 13% of the county (mostly those who had little or no service before). The county also sells transport to the ISP and pays for the cost of transport that was borne by the 911 system. It has also led to the county discovering a partner to bring fiber through the area and reducing the original fiber construction cost from $4-6 million to $1.4 million. The state of Oregon is pledging $1 million towards the project. This innovative solution has been covered by the National Association of Counties (NACO) News and Resilient Counties publications County Commissioner Mike Smith, who led the effort for this project, has been a featured speaker at both the NACO New Orleans and Legislative Conferences.

Wheeler County Fiber
Oregon State Representative John Huffman's Office issued a news release announcing that the Oregon Legislature has approved $2 million in lottery bond funds for a fiber-optic extension project in Wheeler County. The bonded funds will be used to deliver fiber-optic capabilities to Fossil, bringing new jobs and economic opportunities to the area. The fiber-optic extension is also a priority for Oregon Health and Science University, with the school pledging to create a number of local, full-time positions upon completion of the project. The project funding was included in SB 5507.
http://www.oregonlegislature.gov/Huffman

Tribes

At least four tribes are working on advanced broadband service delivery projects. The Confederated Tribes of Grande Ronde charge a flat fee for their residential customers and are increasing broadband service speeds by changing from asynchronous DSL to very-high-bit-rat DSL lines. The Confederated Tribes of the Umatilla Indian Reservation are planning for broadband fiber connectivity to their Yellow Hawk Tribal Health Center and residential areas. The Cow Creek Band of Umpqua Tribe of Indians is operating a level-3 commercial data center in Roseburg that provides 36 racks and currently hosts HughesNet among other customers. The Confederated Tribes of the Warm Springs continue to build fiber out to customers from its competitive local exchange company (CLEC) including a recent buildout to serve a future Unmanned Ariel System training center at Kah-Nee-Ta. In August 2016, Warm Springs Telecommunications Company, a certified CLEC and Eligible Telecommunications Carrier (ETC) in Oregon, filed a petition with the FCC to be treated as the Incumbent Local Exchange Carrier (ILEC) of record for two areas identified on the Warm Springs Reservation.

Other Projects

BendBroadband
TDS Telecom, the parent company of BendBroadband continues to invest in fiber-to-the-home with more than 1000 fiber-to-the-home or premises addresses served throughout Central Oregon. 257 service addresses were added in the first half of 2016 enabling future broadband speeds in excess of 1 Gbps.

Residential DOCSIS broadband investment in the region remains strong with 16-channel bonding and a top speed tier of 300 Mbps. Plans for a DOCSIS 3.1 trial were unveiled in 2016 with residential 1 Gbps products to be made available market wide in 2017.

BendBroadband reports that fiber to the business in Madras, Prineville, Sunriver and La Pine continues to see strong adoption after federal Broadband Technology Opportunities Program (BTOP) funding aided in the 2011 deployment. High capacity metropolitan Ethernet services at speeds up to 10 Gbps are available throughout the footprint.

Also, TDS Telecom renewed its long-term platinum sponsorship to Oregon State University's Open Source Lab (OSU OSL). The partnership provides high capacity transport and national datacenter resources for the betterment of the open source community www.bendbroadand.com.

CenturyLink
CenturyLink, Inc. has accepted $505,703,762 in support from the Connect America Fund to expand and support broadband for over 2.3 million of its rural customers across the nation. The Oregon allocation is $17,759,903 and infrastructure projects will reach 41,785 homes and businesses. The Connect America Fund support will enable CenturyLink to deliver broadband at speeds of at least 10 Mbps for downloads and 1 Mbps uploads to homes and businesses in selected rural service areas www.centurylink.com.

CoastCom by Wave
CoastCom by Wave's mission is to continue to deliver advanced fiber optic based telecommunication services to its customers. Wave has invested in excess of $100 million in recent years to rebuild and upgrade its distribution network and related transmission equipment. In 2015, CoastCom built over 1,500 miles of new fiber routes, and is on track to exceed that amount in 2016 including a self-healing ring from the Oregon Coast to Hillsboro supporting undersea fiber cable connections. CoastCom by Wave is also the network operator for Tillamook, an intergovernmental agency comprised of Tillamook County, Tillamook PUD and Port of Tillamook Bay organized to provide advance broadband connectivity in Tillamook County www.coastcom.net.

Colton Tel
ColtonTel is a small telecommunications company providing broadband, video, and voice services to about one thousand households in the Colton Oregon community, and is currently completing a four year fiber to the home project in which ColtonTel invested more than eight million dollars ($8,000 per household) to replace its legacy copper network with fiber optics. By the end of 2016 all of ColtonTel's customers will be fiber connected and have access to broadband speeds up to one Gigabit per second. http://www.colton.com/

Comcast
Comcast has announced plans to provide its new residential multi-gigabit broadband service to more than 650,000 customers later this year. Gigabit Pro is a symmetrical, 2 Gigabit-per-second service that will be delivered via a fiber-to-the-home solution and offered to customers throughout Comcast's footprint in Oregon and Southwest Washington…In addition, Comcast will launch Extreme 250, a new 250 Mbps Internet speed tier for local customers.

Comcast has invested heavily over the past decade in its network and infrastructure across the Oregon and SW Washington service area, doubling the capacity of its network every 18 months. Additionally, the company has been delivering multi-gig (up to 10 Gbps) Ethernet service to businesses in this area since 2011.

Comcast is currently testing DOCSIS 3.1, a scalable, national, next-generation 1 Gbps technology solution with plans to begin rolling it out in early 2016. When fully deployed, it will mean almost every customer in Comcast's national footprint will be able to receive gigabit speeds over the existing network (a combination of both fiber and coax). http://www.marketwatch.com/story/comcast-plans-rollout-of-residential-2-gig-service-in-oregon-and-southwest-washington-2015-05-21

Douglas FastNet
Douglas Services (Douglas FastNet) in Roseburg was selected by the FCC for rural broadband experiments funding. Douglas Services is one of twelve bidders selected nationwide to receive $2,375,000 in funding under the program. The funding will support a fiber-to-the-home construction project to about 2,500 homes in a rural area in Douglas County.
http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db0310/DA-15-288A1.pdf

Eastern Oregon Network, Inc. (EONI)
Since the last OBAC report, EONI has deployed 3 miles of fiber and a gigabit passive optical network (GPON) to business and soon to residential customers. EONI has also completed installation of 60 additional miles of licensed microwave backhaul into Wallowa County to increase transport capacity and lower costs. EONI's projects are self-funded without government subsidy http://www.eoni.com/.

Eastern Oregon Telecom Gigabit Services
Huawei announced in March that Eastern Oregon Telecom (EOT) has selected Huawei to bring a gigabit broadband network to rural homes and businesses in Hermiston and the surrounding area, including Umatilla, Irrigon and Boardman. EOT expects to complete initial deployments in the second half of 2015, with underground fiber rollouts set for some time in 2016. The fiber broadband rollout by EOT and Huawei will also provide new services, including Voice over IP (VoIP), high-speed broadband and Internet Protocol television (IPTV) to the community.

Huawei will provide its GPON solutions throughout EOT's network footprint in Eastern Oregon, bringing broadband to over 8,000 homes and businesses in Hermiston and the surrounding area. The fiber broadband rollout by EOT and Huawei will also provide new services, including Voice over IP (VoIP), high-speed broadband and Internet Protocol television (IPTV) to the community. http://www.virtual-strategy.com/2015/03/09/eastern-oregon-telecom-selects-huawei-launch-gigabit-broadband-network-rural-oregon#axzz3TuGFwtQA

Telecompetitor produced a story on the EOT fiber project including several videos featuring its General Manager and CEO Joe Franell. EOT is a competitive provider based in Eastern Oregon, serving primarily small town and rural markets. EOT recently embarked on a gigabit fiber program, EOT Velocity Internet, which is building FTTP to select markets throughout their service territory. EOT's gigabit project will eventually pass about 7,500 homes throughout their service territory. They currently have about 3,000 broadband customers. EOT is the first U.S. based company to deploy Huawei gear for FTTP. They are also a rural market competitive telecom provider and historically have not secured funding through universal service programs to build or expand their network in rural markets. EOT also has not taken any government grants or loans for the project. http://www.telecompetitor.com/eastern-oregon-telecom-a-model-for-rural-gigabit/

Eastern Oregon Telecom Cable Modem
In later 2012 and early 2013, Eastern Oregon Telecom (EOT) acquired abandoned coaxial cable facilities in Boardman, Irrigon, Umatilla, and unincorporated areas of northwest Umatilla County. Since then, they have repaired and refurbished the systems, launching a DOCSIS 3.0 cable modem service to more than 2500 homes and businesses. Internet access at 100 Mbps speeds are now offered in these areas and EOT has plans to beta test a DOCSIS 3.1 platform in 2017 which will offer speeds up to 1 Gbps (1000 Mbps).   Prior to this project, these communities were only able to get Internet speeds up to 7 Mbps from the telephone company.

Electric Lightwave
Electric Lightwave is the largest fiber-based provider in the West supporting Business, Government, Data Centers, and Carriers. Its Oregon network has more than 1000 fiber miles and more than 1100 fiber lit buildings with dense and diverse routes in several Oregon cities and five different fiber routes entering/exiting the State. Electric Lightwave's capital investment in Oregon over the last two years has been more than $33 million. From 2015 through September of this year, the company added 36 fiber miles and 271 new buildings. In 2015, Electric Lightwave acquired opticAccess, LLC leading to a 40% increase in available route miles and providing unique routes to California and Hillsboro as well as access to West Coast submarine cable landing stations.

Frontier Communications
Frontier Communications announced symmetrical broadband speeds are now available to its residential FiOS customers in Oregon and Washington. Frontier began offering speeds up to 100 Mbps to residences throughout its FiOS footprint this past fall. With this latest enhancement, the company will offer symmetrical speed tiers of 30/30, 50/50, 75/75, 100/100 and 150/150 Mbps.
http://www.wirelessdevnet.com/news/2015/apr/01/news4.html

Frontier Communications announced that it will accept $283 million in annual funding from the FCC to cover some of the costs of bringing broadband to parts of its local service area that cannot get broadband today or only have low-speed broadband available. The FCC confirmed that Frontier would accept the entire $283,401,855 in CAF II funding that the commission offered the company in April. According to the FCC, the funding will go toward bringing service to more than 1.3 million households in 28 states. Frontier the first company to announce its plans for CAF II funding. The Frontier funding includes $3,897,357 for 8,542 homes and businesses in Oregon. http://www.telecompetitor.com/frontier-accepts-caf-ii-broadband-funding-worth-283-million-annually/   FCC News Release: http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db0616/DOC-333932A1.pdf

To qualify as a CAF II-served location, the broadband service must support at least 10 Mbps / 1 Mbps, be comparable to the price of service in urban areas (currently standalone broadband priced below ~$65), offer voice, and have a usage allowance no less than 100 gigabytes (GB), and Latency below 100 milliseconds.

Buildout Schedule:
- End of 2015 & 2016 - no milestone reporting required
- End of 2017 - 40% of households
- End of 2018 - 60% of households
- End of 2019 - 80% of households
- End of 2020 -100% of households

Frontier served cities with broadband construction projects funded by CAF

ALOHA	GLENDALE	POWERS
AZALEA	GOLD BEACH	PROVOLT
BANDON	GRESHAM OR	REEDSPORT
BANKS	HOODLAND	RIDDLE
BEAVERTON	IMBLER	SANDY
BROOKINGS	IMNAHA	SELMA
BULL MOUNTAIN	JOSEPH	SHERWOOD
CANYONVILLE	LA GRANDE	SILVERTON
CAVE JUNCTION	LAKESIDE	SOMERSET WEST
CLATSKANIE	LANGLOIS	SUNNYSIDE
COOS BAY	LOSTINE	TIGARD
COQUILLE	MCMINNVILLE	TUALATIN
COVE	MILL CITY	TURNER
DAYS CREEK	MURPHY	UNION
DETROIT	MYRTLE CREEK	VERNONIA
ELGIN	MYRTLE POINT	WALLOWA
EMPIRE	NORTH BEND	WILSONVILLE
ENTERPRISE	OBRIEN	WOLF CREEK
FOREST GROVE	ORIENT	YAMHIL
GASTON	PORT ORFORD	

Gorge Networks
Gorge Networks is a regional telecommunications provider serving the mid-Columbia region of Washington and Oregon with a wide variety of voice and data products over fiber, copper and wireless facilities throughout the region. In the last two years, Gorge Networks has deployed ten miles of fiber in rural communities to serve both business and residential customers. This local independent provider is the first in its area to offer fiber-to-the-home with service levels of 20 Mbps, 100 Mbps and 1 Gbps service. It as also installed several licensed microwave links reaching into underserved rural areas in Hood River and Wasco Counties www.gorge.net.

LS Networks
LS Networks announced this month that it will deploy a high-density, fiber-optic broadband network in 25 rural communities in Oregon and Washington over the next two years. The program will offer simple broadband plans at 100 Mbps or 1 Gbps speeds for affordable prices. The $1.2 million project, "Connected Communities," launched in Maupin, Oregon in July and the first services will turn up in January 2017. This directly supports the company's mission to build in locations where others cannot or will not, with top-tier service for urban and rural communities. http://www.prweb.com/releases/2016/10/prweb13790263.htm

Stayton Cooperative Telephone Company / People's Telephone Company
Approximately 85% of customers living within the service territory of Stayton Cooperative Telephone Company, and approximately 90% of customers living within the service territory of People's Telephone Company now have access to fiber to the home facilities. SCTC and PTC have continued their outside plant construction with additional fiber builds in 2016. Both companies offer asymmetrical services ranging from 6 Mbps to 100 Mbps. New for 2016 are symmetrical broadband services offered in fiber deployed areas at 50 Mbps upload / 50 Mbps download, 200 Mbps upload / 200 Mbps download, 500 Mbps upload / 500 Mbps download, and Gigabit service at 1000 Mbps upload / 1000 Mbps download.

Wave Broadband expands its Fiber network in Oregon
Wave Broadband has expanded its fiber network by an additional 500 miles in Oregon in 2015. In 2016 Wave acquired CoastCom, Inc., a privately held Competitive Local Exchange Carrier (CLEC) based in Newport that provides fiber optic based telecommunication services on the Coast through its own fiber optic distribution networks and diverse fiber routes from the coast to the Portland metropolitan area, and over 250 miles of fiber in Oregon. Wave has also acquired SawNet, a broadband services provider for businesses, schools, and consumers in the Columbia Gorge region with over 100 miles of fiber. Wave plans to continue its build-out of its fast-growing fiber network in Washington, Oregon, and California, along with future acquisitions. Wave Broadband has also expanded its Wave G residential Gigabit service to Portland http://www.oregonlive.com/silicon-forest/index.ssf/2015/05/wave_broadband_joins_oregons_f.html http://www.businesswire.com/news/home/20160914005409/en/Wave-Raises-125-Million-Continue-Accelerated-Fiber .

Other Oregon Broadband Activities

Oregon Google Fiber
Google has suspended plans to bring Google Fiber to the Portland metro-area. Google is suspending plans to lay fiber optic cables in Portland as it changes its overall strategy, switching from cable to wireless technology because cable has proved too expensive and time-consuming. As recently as June 2016, Google's plans to bring super high-speed internet to Portland seemed on track, even though there's never been an official announcement.
http://www.wweek.com/news/2016/08/15/google-fiber-not-coming-to-portland/

Oregon Broadband Map
In 2010, the State of Oregon through the Public Utility Commission received a $5.6 million grant funded by the American Recovery and Reinvestment Act of 2009 for a Broadband Mapping Project. This five year project included the collection and reporting of broadband Internet provider service areas for facilities-based providers in Oregon to the National Telecommunications and Information Administration and the creation of an Oregon interactive map which was launched in 2011 with a website at www.broadband.oregon.gov.

The Oregon Broadband Mapping Project Team included the Public Utility Commission, the Department of Administrative Services, and the Oregon Business Development Department. The map presents multiple data layers and is searchable by geographic area. Users can search by street address, municipality, county, tribal lands, or by positioning a "push-pin" icon at a desired location on the map. Also included on the map are "Community Anchor Institutions" which include schools, libraries, hospitals, colleges and universities, medical/health care facilities, and public safety entities all identified and searchable by name and location, though you need to zoom in on the map for them to appear. At the conclusion of the project and the federal grant funding, the PUC turned down the Mapping Project website taking the Map off-line in December 2014.

In August 2015, OBDD entered into a two year inter-agency agreement with the Oregon Department of Administrative Services and provided funding to re-launch and update the Oregon Broadband Map. Maintaining the Oregon Broadband Map is important given that the FCC recently announced that it will not be updating the National Broadband Map which currently displays 2014 data. Hopefully, the Oregon Broadband Map will continue to be available as an information resource on facilities-based providers in Oregon for use by citizens, businesses, economic development organizations, government officials and policy makers.

Innovate Oregon – An Innovation Strategy for Oregon
Innovate Oregon www.innovateoregon.org is an initiative to create a culture of problem solving to empower the next generation to meeting the challenges facing Oregon. Community partners include cities, school districts, non-profit corporations, universities, and industry associations. Thompson indicated that competitive broadband access is key to community economic development and the Innovate Oregon strategy. The strategy seeks to bring together leaders and grassroots organizations to solve the challenges facing communities promote creative solutions and develop an innovation culture.

Innovate Oregon's is currently engaged in a project with the Dayton School District to establish an Innovation Academy at Dayton High School as part of required class for students. In this class, students participated in a design sprint for a mobile application and also began to build a foundation in computational thinking and coding. The program is testing a new learning model that integrates individual, team and community learning experiences to accelerate and inspire the learning process. This model is being adopted throughout the school.

The project recognized the critical connection between broadband and economic development and the innovation strategy. This was discussed with community participants including a local service provider, Online NW. Online NW www.onlinenw.com became a partner in the project and is building the broadband infrastructure in response to this identified need by the community, and by the community's organized effort to obtain broadband infrastructure and benefit from the adoption and utilization of broadband technologies.

This has enabled yet another project which illustrates the potential of the Internet of Things in agriculture, and provides an example of how technology can motivate students and support new ways of learning. The agricultural IoT project is a collaborative effort involving IBM, wireless ISP OnlineNW, and the Dayton School District. The project goal is to better control mildew that can damage grapevines by using data gathered from a mesh network of wireless sensors located throughout a large vineyard.

Dayton has the distinction of being one of the nation's first communities to offer 10 Gbps service. The service is to be delivered over infrastructure deployed by OnlineNW with the school district as an anchor tenant.
http://www.telecompetitor.com/oregon-vineyard-local-students-benefit-from-agricultural-iot-project/

Making Rural Communities Better with Broadband
A Making Rural Communities Better with Broadband Workshop was hosted by the Oregon Rural Development Council in partnership with the U.S. Department of Agriculture Rural Development's Rural Utilities Service (RUS) in Bend at Central Oregon Community College on February 2 and 3. There were about 150 attendees. The workshop provided information on how to build rural economies using broadband for educational opportunities; improved healthcare; job creation, retention, and economic development. One-on-one consultation was provided by USDA RUS with prospective applicants for USDA broadband funding programs.

*Oregon Connections Telecommunications Conference*
The Oregon Connections Telecommunications Conference draws attendees from all regions of the state to share ideas, experiences and knowledge about telecommunications. In 2015, the conference program explored aspects of Broadband as it came of age twenty years after the commercialization of the Internet. Program topics included cyber-security, smart communities, the challenge of infrastructure, Internet and Broadband Public Policy, and Broadband enabled applications. The conference held its twenty-first annual gathering in Hood River on October 20 and 21, 2016. This year's conference presenters and attendees explored broadband enabled mobile applications, the impact of mobility technologies on how we live and work, and the status of broadband in Oregon www.oregonconnections-info.

Oregon Broadband Outreach and Strategic Planning Project
The Oregon Broadband Outreach and Strategic Planning Project website remains active at www.oregonbroadbandplanning.org providing reference materials and a template to assist local communities engage in broadband strategic planning. As of September 30, 2016, there have been 9,059 unique visitors (July 1, 2012 - September 30, 2016).

Broadband Accessibility in Oregon

Broadband services are widely available at competitive prices throughout the state.
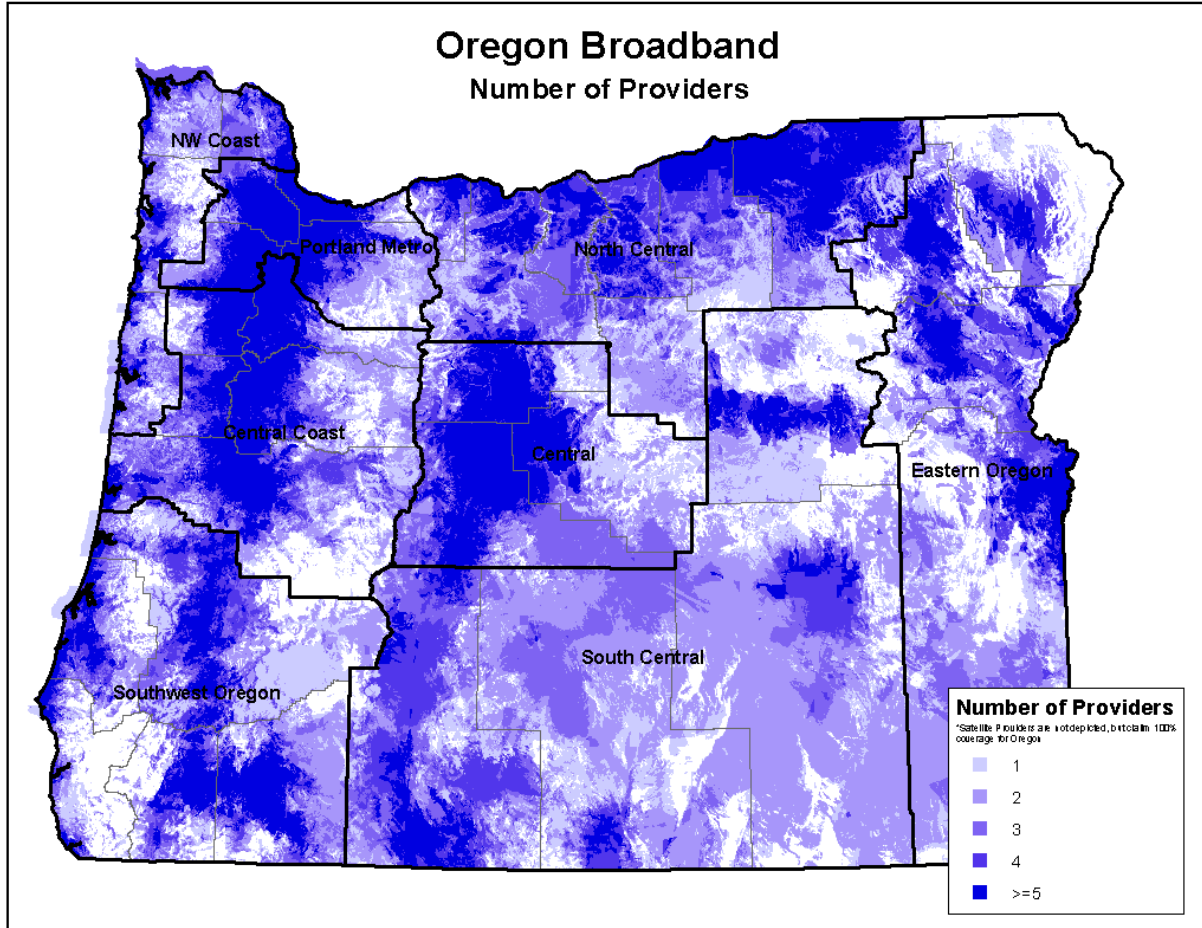
Oregon Broadband Number of Providers

This 2016 map was produced on the Oregon Broadband Mapping Project website www.broadband.oregon.gov. Users of the site may produce maps showing service availability, technology, and providers statewide and by region, county, city, tribal lands and specific addresses.

The Oregon Broadband Survey conducted by the Oregon Business Development Department with the support of OBAC places broadband access in Oregon homes at 82% as compared to 80% nationally.

The Rural Telecommunications Congress recently commissioned a study of broadband investment and activity, and in May 2016 issued a report entitled the *Fifty States of Broadband*

, which ranked Oregon number three in the nation for broadband availability.

FCC's Broadband Progress Reports
This year's *Broadband Progress Report* concludes that while the United States continues to make progress in the deployment of broadband infrastructure, it is not being deployed as rapidly as needed.

Key findings of the report include:
- Approximately 34 million Americans still lack access to fixed broadband at the FCC's new benchmark transmission rate of 25 Mbps downstream and 3 Mbps upstream (the FCC reported Oregon's average download speed at 26.29 Mbps and average tier subscription speed at 26.03 Mbps)
- There is a persistent urban-rural divide; 39 percent of the rural population lacks access as compared with 4% of the urban population
- 41 percent of Tribal Lands population lacks access
- 41 percent of schools have not met the FCC's goal of 100 Mbps per 1,000 students and staff
- The United States continues to lag behind other developed nations ranking 16th out of 34 countries
- Both fixed and mobile access is needed. Mobile devices provide access to the web while on the go, and are useful for real-time two-way interactions, mapping applications, and social media, but consumers who rely solely on mobile broadband are more likely to forego use of the Internet. (The FCC has not set a mobile broadband benchmark).

Additional report finding include:
- Significant growth in advertised broadband speeds available to consumers, though the results are not uniform across technologies.
- Actual speeds experienced by most ISPs' subscribers are close to or exceed advertised speeds.
- Consumers with access to faster services continue to migrate to higher service tiers.
- Latency and packet loss vary by technologies. Consumers generally experienced low latency – the time it takes for a data packet to travel from one point to another in a network – on DSL, cable and fiber systems. Higher latency in satellite services may affect the perceived

Industry has taken issue with the FCC's position noting that private industry has invested over $1.4 trillion to reach most Americans, and that service speeds and performance are steadily increasing year over year.
https://www.fcc.gov/reports-research/reports/measuring-broadband-america/measuring-broadband-america-2015

Broadband Affordability in Oregon

Broadband services are available in Oregon at competitive price points, though prices vary by service area.

Broadband Providers in Oregon

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

Provider Name	URL
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	http://www.canbytel.com
Cascade Networks, Inc.	http://www.cascadenetworks.net
Cavenet	http://www.cavenet.com/
CenturyLink	http://www.centurylink.com
Charter Communications Inc.	http://www.charter-business.com/fiber-internet.aspx
City of Cascade-Locks	http://www.cascade-locks.or.us
Clear Creek Mutual Telephone Company	http://www.ccmtc.com
CoastCom, Inc.	http://www.coastcom.net
Cogent Communications Group	http://www.cogentco.com
Coltontel	http://www.coltontel.com
Comcast	http://www.comcast.com
Communications Access Cooperative Holding Enterprise	http://hrec.coop/internet/index.htm
Community Broadband	http://communitybroadband.com
Comspan Communications Company	http://www.comspancomm.com/en

Cottage Grove WiFi	http://www.cgwifi.net
Country Vision Cable	http://www.countryvisioncable.com/
Crestview Cable	http://www.crestviewcable.net
Cricket Communications, Inc.	http://www.mycricket.com
Datavision Communications	http://www.dvcom.biz/home.html
DC Wireless	http://www.dcwisp.net
Douglas FastNet	http://www.dfn.net
Eagle Telephone Systems, Inc.	http://www.eagletelephone.com
*Earthlink, Inc.	http://www.earthlinkbusiness.com
Eastern Oregon Net, Inc.	http://www.eoni.com
Eastern Oregon Telecom	http://www.eotnet.net
*EasyStreet Online (Atmosera)	http://easystreet.com
Elgin TV Association	http://elgin.elgintv.com
Fibersphere	http://fibersphere.net
FireServe	http://www.fireserve.com
*Freewire Broadband LLC	http://www.gofreewire.com
Frontier Communications of Oregon	http://west.frontier.com
FTX Networks LLC	http://wwwftxnetworks.com
Gervais Telephone Company	http://www.gervaistel.com
Gorge Networks	http://new.gorge.net
Helix Telephone Company	http://www.helixtel.net
HughesNet	http://www.hughesnet.com
Hunter Communications, Inc.	http://www.hunterfiber.com
*Infostructure	http://infostructure.net
*Integra Telecom	http://www.integratelecom.com
Ispeed Wireless	http://www.ispeedwireless.com/index.cfm?
J & N Cable Systems, Inc.	http://www.jncable.net
*Level 3 Communications, LLC	http://www.level3.com
LS Networks	http://www.lsnetworks.net
M2 MachMedia	http://machmedia.net
Megapath Corporation	http://www.megapath.com
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	http://www.mtangel.net

MTE Communications	http://www.ruralnetwork.net
Nehalem Telecommunications Inc.	http://ww2.nehalemtel.net
North-State Telephone Co.	http://www.ortelco.net/nstc/index.html
OneWave Networks	http://www.onewavenetworks.com/boise/index.html
OnlineNW	http://www.onlinenw.com
*ORCA Communications	http://www.orcacomm.com
Oregon Telephone Corporation	http://www.ortelco.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.casco.net/communications/
Pendleton Fiber Company	http://wtechlink.com
Peoples Telephone Company	http://www.sctcweb.com/PTC/index.php
Pine Telephone Systems, Inc.	http://www.pinetel.com
Pioneer Telephone Cooperative	http://www.pioneer.net
PocketiNet Communications Inc	http://www.pocketinet.com
Prinetime Internet Solutions, LLC	http://www.prinetime.com
QualityLife Intergovernmental Agency	http://www.qlife.net/
*Quantum Communications	http://www.quantum-networks.net/
Reliance Connects	http://www.relianceconnects.com/
Roome Telecommunications Inc.	http://www.rtinet.com/
Rural Technology Group, LLC	http://www.ruraltechnologygroup.com
Safelink Internet Services	http://www.safelink.net
SandyNet	http://www.ci.sandy.or.us/
SawNet	http://www.saw.net/
Scio Mutual Telephone	http://www.smt-net.com
SCS Communications	http://www.sctcweb.com/SCS/index.php
Silver Star Telecom LLC	http://www.silverstartelecom.com
Siuslaw Broadband	http://siuslawbroadband.com
Skycasters	http://www.skycasters.com
Snake River PCS	http://www.snakeriverpcs.com/
SpeedyQuick Networks	http://speedyquick.net
Sprint	http://www.sprint.com
St Paul Telephone	http://www.stpaultel.com/
StarBand Communications	http://www.starband.com/
Stayton Cooperative Telephone Company	http://www.sctcweb.com/SCTC/index.php

Stephouse Networks	http://www.stephouse.net/
TDS Telecom	http://www.tdstelecom.com/
T-Mobile USA, Inc.	http://www.t-mobile.com
Tnet Broadband	http://tnet.biz/index.php
*TW Telecom of Oregon LLC	http://www.twtelecom.com/
United States Cellular Corporation	http://www.uscellular.com
UnwiredWest LLC	http://www.unwiredwest.com
Upward Access	http://www.upwardaccess.com/
Verizon Wireless	http://www.verizonwireless.com/b2c/index.html
ViaSat Communications, Inc.	http://www.viasat.com
Wallowa Valley Networks	http://www.wallowavalley.net
Warm Springs Telecommunications Co.	http://www.warmspringstelecom.com
Wave Broadband	http://www.wavebroadband.com
Webformix Company	http://www.webformix.com/
Whiz To Coho, Inc.	http://whiz.to/
Wtechlink	http://wtechlink.com/
Yellowknife Wireless	http://www.ykwc.com
Zayo Group LLC	http://www.zayo.com

* Serves Business customers only.

A survey of facilities-based broadband service providers serving Oregon customers including broadband transmission rates and monthly service costs follows. Information was collected from service provider websites.

DSL Service Provider	Monthly Rate
Canby Telecom [www.canbytel.com]	$39.95
1 Mbps upstream, 5 Mbps downstream (faster speeds available)	
CenturyLink [www.centurylink.com]	
Up to 12 Mbps downstream (faster speeds including 1Gbps available)	$29.95
Douglas FastNet [www.dfn.net]	$39.99
1.5 Mbps upstream, 5 Mbps downstream DSL (speeds up to 40 Mbps available)	
Eagle Telephone System [www.eagletelephone.com]	$54.51
Up to 10 Mbps downstream	
Eastern Oregon Telecom [eotnet.com]	$49.95
1 Mbps upstream, 5 Mbps downstream (speeds up to 1 Gbps available)	

Frontier Communications High Speed Internet [www.frontier.com] $24.99
Up to 30 Mbps downstream (faster speeds available)

Helix Telephone Company [www.helixtel.net] $32.00
1 Mbps upstream, 5 Mbps downstream (faster speeds are available)

Molalla Communications Company [www.mololla.com] $30.00
2 Mbps upstream, 10 Mbps downstream (faster speeds available)

Monroe Telephone Company [www.monroetel.com] $44.95
1.5 Mbps upstream, 1.5 Mbps downstream (faster speeds available)

Mt. Angel Telephone [www.mtangel.net] $39.95
1 Mbps upstream, 5 Mbps downstream (faster speeds available)

Nehalem Telecommunications [www.nehalemtel.com] $29.95
1 Mbps upstream, 5 Mbps downstream (faster speeds available)

Oregon Telephone Corporation [www.ortelco.net] $39.95
765 Kbps upstream, 1.5 Mbps downstream (faster speeds available)

People's Telephone Company [http://ptc-web.com] $39.95
1 Mbps upstream, 6 Mbps downstream

Pine Telephone Company [www.pinetel.com] $39.95
1 Mbps upstream, 14 Mbps downstream (faster speeds available)

Pioneer Telephone Company [www.pioneertelephonecoop.com] $44.95
"Power" speed not specified (speeds up to 100 Mbps available)

Scio Mutual Telephone [www.smt-net.com] $48.95
1 Mbps upstream, 6 Mbps downstream (faster speeds available)

St Paul Cooperative Telephone Association [www.stpaultel.com] $39.99
1 Mbps upstream, 3 Mbps downstream (faster speeds available)

Stayton Cooperative Telephone Company [www.sctcweb.com] $39.95
1 Mbps upstream, 6 Mbps downstream (faster speeds available)

TDS Telecom [www.tdstelecom.com] Prices not posted
512 Kbps upstream, 1. Mbps downstream (faster speeds available)

Cable Modem Service Provider	Monthly Rate
BendBroadband [www.bendbroadband.com] 3 Mbps upstream, 50 Mbps downstream (faster speeds available)	$34.99
Charter Communications [www.charter.com] Starting at 60 Mbps downstream	$39.99
Comcast [www.comcast.com] Up to 25 Mbps (faster speeds available)	$39.99
Crestview Cable Communications [www.crestviewcable.com] Up to 5 Mbps downstream (faster speeds available)	$27.95
Eastern Oregon Telecom [www.eot.net] 1.5 Mbps upstream, 8 Mbps downstream (speeds up to 100 Mbps available)	$39.95
Wave Broadband [www.wavebroadband.com] 5 Mbps upstream, 55 Mbps downstream (faster speeds available)	$59.95

Mobile Wireless Internet Access (3G / 4G)	Monthly Rate
AT&T Wireless [www.ATTwireless.com] Up to 6 Mbps Mobile Internet access	$30.00
Verizon Wireless [www.verizonwireless.com] 4G LTE Up to 2 GB	$35.00
Sprint [www.sprint.com] 4G LTE Up to 1 GB	$20.00
T-Mobile [www.t-mobile.com] 4G LTE Unlimited talk, text, data	$70.00

Fixed Wireless Internet Access	Monthly Rate
Douglas Fastnet [www.dfn.net] 5 Mbps downstream (speeds up to 15 Mbps downstream available)	$39.99
Eastern Oregon Net, Inc. [www.eoni.com] "High Speed" service	$29.95
Eastern Oregon Telecom [www.eotnet.net] 5 Mbps downstream (faster speeds available)	$49.90

FireServe Wireless Broadband [www.fireserve.com]
Up to 10 Mbps downstream   (faster speeds available) $39.95

Freewire Broadband   [www.freewirebroadband.com] (business) Prices not posted.
Symmetrical Ethernet.

Goose Lake Computing [www.gooselake.com]
Up to 10 Mbps downstream   (faster speeds available) $39.95

GorgeNet [www.gorge.net]
5 Mbps upstream, 30 Mbps downstream (Business) (faster speeds available) $54.95

Oregon FAST.net [www.oregonfast.net] speeds not specified $39.99

Rural Technology Group Up to 2 MB
Speeds not specified $29.95

SawNet [www.saw.net] 1 Mbps upstream, 3 Mbps downstream
(faster speeds available) Prices not posted

Municipal / Consortia / Public-Private Partnership Providers	Monthly Rate

Ashland Fiber Network [www.ashlandfiber.net]
3 Mbps upstream, 30 Mbps downstream (faster speeds available) $55.00

Eastern Oregon Telecom [www.eotnet.net]
100 Mbps downstream (Gigabit service available) $69.95

MINET (Monmouth-Independence Network) [www.minetfiber.com]
2 Mbps downstream   (Faster speeds available) $10.00

Q-Life [qlife.net] Q-Life is a middle mile transport provider with independent
ISPs providing end-user services. Prices not posted.

SandyNet FTTH [www.sandynet.org]
300 Mbps upstream, 300 Mbps downstream $39.95
(Symmetrical Gigabit service available)

Facilities based Competitive Access Providers

CoastCom [www.coastcom.net]
Internet / Metro Ethernet Services / Prices not posted

Douglas FastNet [www.dfn.net]
100 Mbps downstream, 10 Mbps upstream (speeds up to 1 Gbps downstream,
20 Mbps upstream available via fiber optics) $39.99

Other Competitive Providers	Monthly Rate
Cogent Communications [www.cogentco.com] DIA, IP Transit, Ethernet, Colocation services	Prices not posted
FTX Networks [ftxnetworks.com] Fiber Optic based services	Prices not posted
Integra Telecom [www.integratelecom.com] / Electric Lightwave [www.electriclightwave.com] Data Networking and Internet, Colocation	Prices not posted
Western Independent Networks [www.win-networks.com] Point-to-Point Special Access / Ethernet Transport / Internet Backbone Access	Prices not posted

Satellite Internet Access	Monthly Rate
HughesNet [www.hughesnet.com] 1 Mbps upstream, 5 Mbps downstream (faster speeds available)	$49.99
ViaSat - WildBlue [www.wildblue.com] 3 Mbps upstream, 10 Mbps downstream (faster speeds available)	$59.99
SkyCasters [www.skycasters.com] 2 Mbps upstream, 16 Mbps downstream	$149.00

The Monthly Rates listed above are mostly for base level services. It should be noted that bundled services and ongoing promotional discounted pricing is also widely available from service providers.

Though prices for broadband services in Oregon are competitive with other states, cost continues to be a barrier to adoption for many Oregonians.

Programs for Digital Inclusion
Families and individuals that do not have access to broadband connectivity are at a competitive disadvantage.
- 90% of college applications are now submitted online.
- 79% of teachers assign homework that requires Internet access.
- Many large employers only accept job applications submitted online.

Online employment resources now rival personal and professional networks as a top source of job information for Americans who are looking for work. According to Pew Research, less than 18% of households with income below $14,000 have Internet Access at home and more than 90% of households with income over $100,000 have Internet Access at home.

Many service providers have participated in offering special pricing programs for "digital inclusion" to address the cost barrier for broadband adoption in disadvantaged segments of the population.

Comcast Internet Essentials Program
Comcast has announced plans to expand its low-cost Internet service to residents of public housing, making inexpensive online connections available to roughly 40,000 more homes in Oregon and Southwest Washington. The Internet Essentials service offers broadband connections of 10 megabits per second for $10 a month, one-fifth the price of the cheapest tier Comcast advertises on its website. Comcast says the discounted service is now available to residents of federally supported housing, including people paying their rent with the assistance of Section 8 vouchers. Previously, Comcast's discounts were limited to families with children who qualified for the federal free and reduced lunch program. More information is available at www.internetessentials.com, and at http://www.oregonlive.com/silicon-forest/index.ssf/2016/07/comcast_expands_low-cost_inter.html

AT&T Broadband Access Program for low income users
AT&T launched "Access from AT&T," an Internet service for low income users costing as little as five dollars a month. The company agreed to offer the service as a condition of its acquisition of DirecTV. Households in AT&T's local service territory that have at least one resident participating in the U.S. Department of Agriculture Supplemental Nutrition Assistance Program (SNAP) will be eligible for the program, which will last through at least through April 2020.

AT&T said it will work with school districts and national and community-based organizations to educate eligible households about Access from AT&T. In its press release, the company also references its AT&T Digital You website, which has a range of resources offering advice on how to get online, use technology safely, use online learning, search for a job and other applications. http://www.telecompetitor.com/access-from-att-launches-offering-5-a-month-internet-for-low-income-users/

More information is available at https://www.att.com/shop/internet/access/#/

BendBroadband
BendBroadband partnered with Boys & Girls Clubs of Bend, Family Access Network and Bend Area Habitat for Humanity to implement a digital literacy outreach program for the 2016-2017 school year modeled on Connect2Compete. Eligible families are able to receive high speed Internet for $9.95 for two years together with a free modem and professional installation. New this year, the available speed of service for program participants has been increased to 15Mbps download speeds and 3 Mbps upload speeds. In 2015, there were about 20 participating families. So far in 2016 there are 59. BendBroadband attributes the increased enrollment to greater awareness of the program thanks to its partnerships with the Boys and Girls Club of Bend, the Family Access Network, and Bend Area Habitat for Humanity.
http://blog.bendbroadband.com/residential/2016/09/08/connect2compete-enrollment-triples-in-2016/

CenturyLink
CenturyLink's Internet Basics Program provides 1.5 Mbps Internet access to qualifying families for $9.95 (plus tax) per month for twelve months. Qualifying families may also purchase an iPad Minicomputer for $150 plus shipping and handling at initial enrollment and receive free Internet training in person or in print. More information is available at
http://www.centurylink.com/home/internetbasics/

Charter Communications / Spectrum
Charter Communications announced a new low-cost broadband service for low-income customers that it pledged to offer within six months of the close of its acquisitions of Time Warner Cable and Bright House Networks. The service, which will be offered across Charter's footprint within three years of close, will deliver speeds of up to 30 Mbps downstream and 4 Mbps upstream for $14.99 per month. Charter Communications has completed the transactions with Time Warner Cable and Bright House Networks, and will being doing business as *Spectrum*. http://www.multichannel.com/news/distribution/charter-pledges-low-cost-broadband-after-twc-bhn-deals/396091

Frontier Communications
Frontier works in cooperation with government and other discount programs that can help qualified individuals, schools, libraries, community based organizations, and health care providers meet their needs. Frontier has been authorized to provide E-Rate, Lifeline, Rural Health Care (RHC), and Low Income Veteran discount programs to approved applicants. The discounts are intended to ensure that qualified entities have access to affordable telecommunications and information services.
https://frontier.com/resources/discount-programs

ConnectHome
ConnectHome is an initiative to extend affordable broadband access to families living in HUD-assisted housing. Through ConnectHome, Internet Service Providers, non-profits, and the private sector are offering broadband access, technical training, digital literacy programs, and devices for residents in assisted housing units in 28 communities across the nation. On July 14, 2016, HUD and Comcast announced a major expansion of Comcast's Internet Essentials program and ConnectHome's efforts to close the digital divide. ConnectHome Nation will extend the Internet Essentials across the country. Two million households will be eligible $9.95 broadband Internet access.

Legal right to fast broadband
In Great Britain, citizens will soon have a legal right to fast broadband under plans to bring rural areas and unconnected households into the 21st century. A law ensuring the right to broadband will mean that up to a million people in rural areas will receive better service. It brings Internet connectivity into line with the right to get electricity, telephone and postal services. In a speech to Parliament, Queen Elizabeth stated, "Measures will be brought forward to create the right for every household to access high-speed broadband" in order to "make the United Kingdom a world leader in the digital economy." Following the Queen's Speech, the government said it would introduce a Digital Economy Bill that would codify in law a universal right to broadband.
http://www.thetimes.co.uk/article/all-households-get-legal-right-to-fast-broadband-86025xf8j

Broadband as a right in Ireland
The new Communications Minister of Ireland has stated that there are plans in place to revise the current 40-year-old universal service obligation (USO) for telephony services across Ireland from basic copper telephony, or voice, to a minimum of 30 Mbps broadband once the National Broadband Plan begins to be rolled out. Unlike the UK, which has stalled at 10Mbps, the Minister has said that when Ireland's National Broadband Plan rolls out in 2017, 30Mbps broadband will be an "enforceable right."
https://www.siliconrepublic.com/comms/national-broadband-plan-right-ireland

Broadband Performance

Oregon benefits from over one-hundred facilities based service providers offering services competitive in performance with service available in other states.

Oregon Broadband
Maximum Advertised Speed

NW Coast

Portland Metro

North Central

Central Coast

Central

Eastern Oregon

Southwest Oregon

South Central

Maximum Advertised Speed
Satellite Providers are not depicted, but claim 100% coverage for Oregon

- Speed 11: >=1 gbps
- Speed 10: >=100 mbps and <1 gbps
- Speed 9: >=50 mbps and <100 mbps
- Speed 8: >=25 mbps and <50 mbps
- Speed 7: >=10 mbps and <25 mbps
- Speed 6: >=6 mbps and <10 mbps
- Speed 5: >=3 mbps and <6 mbps
- Speed 4: >=1.5 mbps and <3 mbps
- Speed 3: >=768 kbps and <1.5 mbps
- Speed 2: >200 kbps and <768 Kbps

Oregon Broadband Maximum Advertised Speed

This 2016 speed map was produced on the Oregon Broadband Mapping Project website www.broadband.oregon.gov. Users may produce maps showing service availability, technology, and providers statewide and by region, county, city, tribal lands, and for specific addresses.

Average Broadband Speeds

Akamai issued its "First Quarter, 2015 State of the Internet Report" and reported that average broadband speeds rose 10 percent quarter-to-quarter globally to reach 5 Mbps for the first time. Average Internet speeds increased in 131 of a total 144 qualifying countries/regions in 1Q'15. At 11.9 Mbps, the U.S. ranked 19th globally in terms of average 1Q Internet connection speeds and 22nd in terms of average peak Internet connection speeds (53.3 Mbps). The top 10 U.S. states

experienced quarter-to-quarter gains in average Internet connection speeds across the board in 1Q. Six states had average Internet connections speeds above 15 Mbps including Oregon which was ranked number eight in the Country at 14.1 Mbps, though none of the top ten reached the FCC's new 25 Mbps broadband threshold.
http://www.telecompetitor.com/akamai-average-broadband-speeds-increase-in-all-u-s-states-but-still-below-new-25-mbps-definition/
See Akamai's full Q1 2015 State of the Internet Report
https://www.stateoftheinternet.com/downloads/pdfs/2015-q1-state-of-the-internet-report.pdf

Akamai Technologies, Inc. released its *Second Quarter, 2015 State of the Internet Report* reporting the following highlights

- The global average connection speed increased to 5.1 Mbps in the second quarter of 2015. Average connection speeds among the top 10 countries/regions all remained well above 10 Mbps and like the previous quarter, six of the 10 had average connection speeds above 15 Mbps. (Oregon has an average connection speed of 14.1 Mbps and is ranked 8th among states in the US.)

- Reversing the trend seen in the first quarter, the number of unique IPv4 addresses worldwide connecting to Akamai dropped by about 8.6 million in the second quarter as IPv6 addresses are increasingly used. Growth in IPv6 adoption has been led primarily by cable and wireless companies in each geography. US-based Verizon Wireless reached 50 percent IPv6 adoption in 2014.

- The number of mobile data subscriptions is increasing rapidly, driving growth in data traffic along with a continuous increase in the average data volume per subscription. The volume of mobile data traffic grew by 15% between the first and second quarters of 2015, and increased 55% year-over-year.

https://www.stateoftheinternet.com/resources-cloud-security-2015-q2-web-security-report.html

Akamai reports continued improvement in 2016
Average Internet speeds go up about 10% around the world; The US ranks solidly in the top 10% of all nations and in the top 1% of low population density nations.

Akamai findings Q1 2016:
- United States ranks 16th in the world in Average Connection Speed (web speed) at 15.3 Mbps, up 7.7% from the preceding quarter and 29% from the year-ago quarter.
- US ranks 22nd in Average Peak Connection Speed (broadband speed) at 67.8 Mbps, up 10% from the preceding quarter and 27% from the year-ago quarter.
- The US is slipping in the global rankings since the good old days of Title I.
http://hightechforum.org/akamai-state-internet-q1-2016/

Akamai findings Q2 2016:

- Global average connection speed decreased 2.3% from the first quarter of 2016 to 6.1 Mbps, but still reflects a 14% increase year over year.
- Global average peak connection speed increased 3.7% to 36.0 Mbps in the second quarter, rising 2.5% year over year.
- Average mobile connection speeds ranged from a high of 23.1 Mbps in the United Kingdom to a low of 2.2 Mbps in Venezuela.

Akamai.com/stateoftheinternet

Broadband Technology Adoption and Utilization

Broadband Adoption

The Rural Telecommunications Congress commissioned a study of broadband investment and activity, and in May 2016 issued a report entitled the *Fifty States of Broadband*, which ranked Oregon number three in the nation for broadband adoption. Though Oregon continues to be a leader in the adoption and utilization of broadband technologies compared to other states, there are significant variances in the rates of adoption between regions and demographic groups. Notably adoption rates are notably lower in Eastern Oregon and in rural areas as compared to the I5 corridor and urban areas of the state. The "Digital Divide" continues to exist and will continue to exist for the foreseeable future. As service quality improves in rural areas of the state, it also continues to improve in urban areas. What constitutes high-quality broadband service is a moving target.

Pew Research reports Internet penetration in the U.S. may have reached saturation levels according to an analysis of 15 years of data collected by a Pew Research Center. The Internet saturation point has been reached for Americans with high levels of education and those who live in more affluent households. Seventy percent of young U.S. adults used the Internet in 2000. Today 96 percent of young adults use the Internet. Internet penetration continues to lag among older adults, those with lower levels of education and those living in lower-income households.

Key Trends over the 15-year study period:
- Age differences: Older adults have lagged behind younger adults in their adoption, but now a clear majority (58%) of senior citizens uses the Internet.

- Class differences: Those with college educations are more likely than those who do not have high school diplomas to use the internet. Similarly, those who live in households earning more than $75,000 are more likely to be Internet users than those living in households earning less than $30,000. Still, the class-related gaps have shrunk dramatically in 15 years as the most pronounced growth has come among those in lower-income households and those with lower levels of educational attainment.

- Racial and ethnic differences: African-Americans and Hispanics have been somewhat less likely than whites or English-speaking Asian-Americans to be Internet users, but the gaps have narrowed. Today, 78% of blacks and 81% of Hispanics use the Internet, compared with 85% of whites and 97% of English-speaking Asian Americans.

- Community differences: Those who live in rural areas are less likely than those in the suburbs and urban areas to use the Internet. Still, 78% of rural residents are online. http://www.telecompetitor.com/pew-internet-penetration-reaches-saturation-levels-for-some/
See the Pew Research Report at:
http://www.pewinternet.org/2015/06/26/americans-internet-access-2000-2015/

Of particular concern to the Council are the variances in rates of adoption in rural areas as compared to urban areas of Oregon.

Broadband Status	Total	NW Coast	Portland	Central Coast	SW Oregon	North Central	Central Oregon	South Central	Eastern
Broadband at home	82%	78%	85%	83%	79%	76%	83%	69%	67%
Not-at-home Internet User	4%	6%	4%	2%	4%	3%	5%	6%	4%
Dial-up	1%	3%	1%	1%	2%	1%	2%	1%	4%
Internet Non-user	13%	14%	10%	13%	15%	20%	10%	24%	25%

Oregon Broadband Adoption by Region
Oregon Broadband Survey Report

Farm Internet use
The USDA issued a report indicating that the Internet is becoming increasingly important to U.S. farmers. Nearly 70% of farms currently have Internet access, up from 67% in 2013 and from about 57% in 2007. Oregon is a national leader with 85% of farms having Internet access through a mix of technologies: Dial-up 7%, DSL 23%, Cable Modem 7%, Satellite 23%, Wireless 37%, and Unknown 3%. The number of farmers that own or lease computers has tracked quite closely with Internet access since 2007, with 71% of farmers now falling into that category, as reported by the USDA report, "Farm Computer Usage and Ownership" (August 2015).
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1062

Telehealth

Telemedicine, the interactive delivery of health care over distance using advances in telecommunication technology (i.e. video-conferencing equipment), is an evolving model for care delivery that increases access, improve outcomes, and reduces costs. By improving access, both geographically and temporally, telemedicine is a transformative use of technology, allowing earlier involvement of specialists in acute, life-threatening situations, as well as for many other in-person health interactions that while not urgent, are not efficiently occurring, impeded by the current delivery system. Access to medically underserved areas, both rural and urban, is improved, with resultant improved outcomes and cost savings from reduced patient transports. The term Telehealth is used to more broadly include all use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration, in other words not restricted to clinical care alone.

Oregon is viewed as a leader in Telehealth due to progressive programs employed by many of its healthcare service providers and a supportive state-level public policy. Telemedicine activities in the state have been detailed in previous versions of this report in 2010, 2012, and 2014. Current clinical activity continues to grow among all the major health systems. In this report, we will report on significant policy issues affecting Telehealth and statewide efforts in the field.

Oregon Health Authority and Telehealth Alliance of Oregon project
Telehealth in Oregon is evolving rapidly. In order to better understand the Telehealth landscape within Oregon, the Oregon Health Authority (OHA) asked the Telehealth Alliance of Oregon (TAO) to undertake three tasks, detailed below. This project is funded through the Oregon Health Authority's federal State Innovation Model (SIM) grant, which supports projects that advance Oregon's health system transformation efforts.

- Create a comprehensive, easy to understand Law and Policy Review with on-going quarterly updates;
- Develop a portal where Telehealth providers can share information regarding the types of services being offered and to whom; and
- Conduct a Telehealth gaps and opportunities assessment and follow it up in a year with another assessment that will help determine how those gaps and opportunities are being addressed.

Law and Policy Review
Law and policy issues have provided some the biggest barriers to the deployment and growth of Telehealth. TAO has created an online resource with information for providers and others interested about the laws and policies at both the state and federal levels that apply to the practice of Telehealth in Oregon. This review will be updated on a quarterly basis.
http://www.ortelehealth.org/content/law-and-policy

Telehealth Services Inventory Portal
This on-line portal allows providers of Telehealth services in Oregon to enter information about the services they offer. The data entered is available to anyone, is searchable by provider, services type, geographic region, and reimbursement method, and allows the user to refine the search to meet specific needs. The portal has a data and a geographic display.
The portal can assist both those providing Telehealth services as well as those seeking services. Telehealth providers can use the portal to determine where their services might be needed and market to that area. Those seeking a specific service can determine which providers are offering that service and the parameters around that service.
http://www.ortelehealth.org/content/oregon-telehealth-services-inventory-portal

Telehealth Gaps and Opportunities Assessment (TGOA)
This assessment was conducted by TAO throughout the state in August 2015. There were five focus groups covering five separate regions, and additional individual discussions with several key informants. In addition, TAO conducted a quick, informal scan of Telehealth services currently being provided in Oregon. Through the focus groups and the scan, TAO found that a wide variety of specialty services are being delivered by large urban providers to acute care settings such as rural and regional hospitals. Ambulatory care is being delivered by both urban and regional hospitals to clinics and directly to patients in their homes, schools and workplaces. Home monitoring services are just beginning to be offered. Distance education and knowledge sharing, between providers at separate sites, between providers and community groups, groups of patients, or individual patients occurs], but not is always acknowledged as Telehealth.

While focus group participants and key informants could envision the opportunities offered by Telehealth, they believed that significant barriers would need to be removed in order to facilitate expansion. Barriers were classified into four categories:

- Cultural (including education and knowledge sharing)
- Operational (including funding)
- Technical
- Regulatory / Policy

Cultural barriers appear to present the biggest challenge to implementing or expanding Telehealth in the different regions. Participants from all focus groups believed that increased information about Telehealth was necessary, ranging from very basic information about what Telehealth is to very sophisticated information regarding security, scope of practice issues, and billing. Another common theme was that current provider and patient cultures surrounding Telehealth are the biggest barriers to Telehealth development. In the current culture, originating site providers (providers at the patient location) worry that Telehealth providers at distant sites (locations where the Telehealth provider is located) will take away their patients, or that Telehealth is a way for other providers to oversee and attempt to manage their practice. For Telehealth providers, they are uncertain about receiving reimbursements and there are difficulties with getting licensed and credentialed to provide services. Patients have concerns that they will be getting sub-standard care not tailored to them as individual patients. With so much of the healthcare culture changing, participants expressed that it seems overwhelming to take on

changing Telehealth culture as well, though all agreed that providing more educational opportunities would be the key to changing the culture for both providers and patients.

The Telehealth Alliance of Oregon (TAO) conducted a follow up assessment in August 2016 to determine how barriers have been addressed for the participants, and if some of the requested supports were provided and proved helpful. The 2015 assessment is available online and the follow up will be soon: http://www.ortelehealth.org/sites/default/files/fileattachments/general/page/521/gaps_and_opportunities_assessment_oha_final.pdf

Policy Developments
Stakeholders and the state of Oregon have been developing policy that will allow Telehealth to grow with demand. Policy in Oregon has been developed in two ways. The first has been through collaboration between providers and state agencies to change or develop policies that allowed providers to move forward with their Telehealth program (examples include Grande Ronde Hospital working with the Oregon Medical Board to change their cross-state licensure protocol so that Grande Ronde could more easily use out of state consultants to provide needed services. Another example is the work done between TAO and the state Medicaid office to develop the state's first protocols regarding Medicaid payment for Telehealth services.)

Telehealth policy in Oregon has also been developed through legislation. In 1999, Senate Bill (SB) 622 was passed. It allowed US West to build six interconnected broadband rings throughout the state with funds that would have been used to pay a significant fine from the Public Utility Commission. These rings were to be used by education and healthcare. In 2003, House Joint Resolution (HJR) 4 was passed. The bill expressed legislative support and encouragement for telemedicine and for reimbursement for services delivered telemedically. In 2009, SB 24 was passed mandating that health benefit plans cover telemedicine services between health care organizations without consideration for urban and rural designations. In 2013, SB 569 was passed requiring the OHA to develop uniform documentation requirements for credentialing providers of telemedicine services. New legislation related to Telehealth is detailed below.

SB 144 (2015)
SB 144, a Bill which modifies requirements for health benefit plan coverage of "telemedical" health service was passed unanimously by both houses in the 2015 legislative session. SB 144 updated Oregon's statute on the reimbursement of clinical services provided through telemedicine and applies to plans beginning in 2017. The bill modified health benefit plan coverage to include coverage of direct provider to patient services via telemedicine regardless of where the patient was located. It also required the Oregon Educators Benefit Board (OEBB) and the Public Employees Benefit Board (PEBB) to cover telemedicine services. https://olis.leg.state.or.us/liz/2015R1/Downloads/MeasureDocument/SB144/Enrolled

SB 5701 (2016)
SB 5701, passed in the 2016 session, appropriates moneys from General Fund to Emergency Board for allocations during biennium. The Bill includes $1.1 million for telemedicine services

to rural areas through a virtual clinic, increasing opportunities for rural residents to receive care through online video conferencing.
https://olis.leg.state.or.us/liz/2016R1/Downloads/MeasureDocument/SB5701/Enrolled

OHSU Office of Rural Health / Oregon Health Authority Telehealth Projects
The Oregon Health Authority (OHA) and the Oregon Office of Rural Health (ORH) are partnering to implement five Telehealth pilot projects. The projects are supported by the federal State Innovation Model (SIM) grant, which Oregon received to fund innovative projects that support the State's health care system transformation efforts. In October 2014, OHA, in partnership with ORH, requested letters of intent from organizations interested in conducting Telehealth pilot projects that improve care coordination; increase individuals' access to their own health data and engagement in their care; expand system capacity; and achieve efficiencies in health care delivery. Proposed projects were required to be innovative, scalable, and align with SIM grant purposes:
- Support Oregon's coordinated care model and health care transformation;
- Identify and spread health care innovation and/or;
- Promote the triple aim of better health, better care, and lower costs.

Five projects were selected. The Telehealth pilots will run through June of 2016. OHA and ORH will share the results of these projects in early fall of 2016.

Adventist Health Tillamook Medical Group
Adventist Health Tillamook Medical Group paramedics cover 1,100 square miles and respond to nearly 4,000 calls for service each year from four ambulance stations strategically located throughout Tillamook County. This project's focus is to reduce hospital readmissions related to gaps in a care between the hospital and primary care or specialty management. Adventist Tillamook Medical Health Group will put high-speed data connectivity in each ambulance to support direct, real-time communication with the Rural Health Clinics (RHC). Hospital-based Community Paramedics (CP) will visit patients identified as at-risk for hospital readmission due to lack of post-discharge follow up with a primary or specialty care provider. The CP will have the capability to communicate directly with the RHC's Care Coordinator, or provider to help individuals adequately manage their health care follow up from home.

Capitol Dental Care
Studies in other states have shown that a remotely located dentist, working with an Expanded Practice Dentist Hygienist (EPDH), who is seeing a patient at a different location, can collaboratively deliver quality dental care. Capitol Dental Care's pilot project will target approximately 1,500 children in the Central School District of Polk County, which includes three elementary schools, a middle school and a high school. Led by an EPDH, Capitol Dental Care will implement Telehealth-connected oral health teams to reach children who have not been receiving dental care on a regular basis and to provide community-based dental diagnostic, prevention and early intervention services.

HIV Alliance
People living with HIV/AIDS who are newly diagnosed or those that have unsuppressed viral loads, co-morbidities, and/or other medication adherence issues have greater issues with drug interactions, side effects, and other medication adherences, resulting in poorer health outcomes. HIV Alliance's project aims to increase access to care for these persons in rural eastern and southern Oregon with collaborative practice agreements and Telehealth technology. The pilot will proactively engage Pharmacists to be more directly involved with HIV specialists or primary care providers through collaborative practice agreements. These agreements will enable Pharmacists to: view and order labs for patients; assess a patient's current medication regimen; identify problems in the regimen; make changes to the regimen as needed and in consultation with the HIV specialist; and provide regular education, consultations and follow-up monitoring with patients.

Oregon Health & Science University: Layton Aging and Alzheimer's Disease Center
Currently, 80,000 Oregonians have dementia. One of the main goals of the State Plan for Alzheimer's Disease and Related Dementias in Oregon (SPADO) is to increase access to dementia care. To meet this need, SPADO experts recommend expansion of telemedicine services across the state. The Layton Center's project will create a direct-to-home telemedicine program to: establish the reliability of standard measures of patient and caregiver well-being when used with telemedicine, and establish the feasibility and usability of direct-to-home video dementia care using telemedicine technology.

Trillium Family Services
Children in Secure Children's Inpatient (SCIP) and Secure Adolescent Inpatient (SAIP) programs can spend up to six months on a waitlist to see a Psychiatrist in their community, which is a requirement for discharge. For low-income children in rural areas, access to outpatient mental health services is a significant challenge. Trillium Family Services' project will improve access to mental health services for vulnerable children in rural Oregon by providing psychiatric assessments, follow-up and medication management via Telehealth for approximately 80 children each year discharged from SCIP and SAIP programs and approximately 300 children in rural school settings who cannot effectively access outpatient psychiatry services.

Office of Health Information Technology (OHIT)
The Office of Health Information Technology (OHIT) was established in 2011 as is part of the Oregon Health Authority. OHIT's work focuses on supporting the adoption of electronic health records, the secure exchange of health information, and achievement of meaningful use in the state. Through collaboration and partnerships, OHIT seeks to increase the use of health information technology (HIT) across Oregon's health care community. Stakeholder engagement has led to a vision for Oregon of a transformed health system where health information technology and exchange efforts are foundational. The Health Information Technology Oversight Council (HITOC) is a statutory body of Governor appointed, Senate confirmed citizens, tasked with setting goals and developing a strategic health information technology plan for the state, as well as monitoring progress in achieving those goals and providing oversight for the implementation of the plan. The Council, in collaboration with the Oregon Health Authority:

- Monitors and evaluates the shifting health information technology environment;
- Makes policy and strategy recommendations;
- Convenes committees as needed to collect and share information.

Council members are appointed by the Oregon Health Policy Board. They represent consumer and business perspectives, public and private sectors, and the geographic and demographic differences of Oregon's health care providers and the patients they serve. HITOC builds on the past work of the Health Information Infrastructure Advisory Committee and the Health Information Security & Privacy Collaborative. HITOC is supported by the Office of Health Information Technology at the Oregon Health Authority (OHA).

Initiatives include:
- Common Credentialing Program - solution will streamline the process for applying for and maintaining credentialing information for Oregon practitioners. Today, health care practitioners are credentialed independently by different organizations, resulting in a duplication of efforts. Health care practitioners must repeatedly complete credentialing applications and provide supporting documentation for each credentialing organization. Oregon's Common Credentialing tool will provide credentialing organizations access to information necessary to credential and re-credential health care practitioners. The common credentialing solution will not only capture and store credentialing information and documents; it will include a verification process for select credentialing information according to state and national requirements.

- Provider Directory Services - Today, Oregon does not have an authoritative statewide directory of health care providers. Instead, health care organizations use a multitude of isolated provider directories, spread across state and non-state systems. Those directories are often limited in scope and data accuracy, and are costly and burdensome to maintain. They also may or may not meet current and emerging nationwide provider directory standards. OHA is developing a state-level provider directory or "provider directory services" to fill this gap. The directory will contain the information providers need to securely communicate and exchange patient information. It will also provide a rich single source of authoritative provider information, such as contact information, clinic affiliations, licensing data, etc. that can support the operations and analytics needs of health care organizations. OHA seeks to leverage data in current provider databases and add critical new information and functions. A stakeholder advisory group is working to help inform the development process, scope and requirements.

- Clinical Quality Metrics Registry - The Oregon Health Authority is developing a clinical quality metrics registry with the ability to receive and display clinical quality data for the Medicaid program and inform benchmarks and other quality improvement reporting. The registry will be utilized to calculate eligibility for paying quality incentives to coordinated care organizations and Medicaid EHR incentives to providers. The State will use the registry data and other state data sources to produce information on utilization, cost, and performance on clinical quality metrics. Once implemented, the registry will likely have value for non-Medicaid pay-for-performance programs and reduce administrative burden

on providers by collecting Meaningful Use clinical quality measures for multiple programs.

More information about HITOC's plan can be found at:
https://www.oregon.gov/oha/OHIT/resourceDocuments/Business Plan Framework.pdf

OCHIN – Medical Grade Network
OCHIN, based in Portland, is the nation's largest provider of EPIC electronic medical records systems to Federally Qualified Health Centers across nineteen states. OCHIN also provides data aggregation, disaster recovery, billing, and consulting services. OCHIN acquired the Oregon Health Network (OHN) in 2013, and OHN now does business as the OCHIN Broadband Network Services (OBNS).

The Federal Communication Commission's Rural Health Care Pilot Program (RHCPP) that provided subsidies to the Oregon Health Network ended in May 2014. At that time, the Oregon Health Network had 231 sites and $20.182 million in subsidies expended. It was an OCHIN fiber build project in Southwest Oregon that enabled a ring architecture and redundancy for the Southern Oregon coast, and another OHN project that brought fiber to Christmas Valley. The permanent replacement for RHCPP is the Healthcare Connect Fund, and under OCHIN's stewardship, participants have migrated to the new FCC program. The new FCC program provides up to a 65% subsidy for the installation and monthly cost of network services as well as broadband equipment costs for eligible healthcare providers. 97% of OCHIN members, mostly Federally Qualified Health Centers (FQHCs), are eligible for the program. OCHIN has recently added over 40 additional sites and is expanding the managed network outside of Oregon into Washington, Montana and Alaska.

OCHIN's goal is to provide a robust, scalable, monitored network to clinics and hospitals that leverages the FCC's Healthcare Connect Fund funding to help support EMR, telemedicine, video conferencing, and image transport. 221 hospitals and clinics were transitioned from the original 231 Rural Healthcare Pilot Program to the Healthcare Connect Fund in 2015. Since then, 76 additional clinics and hospitals have been added. Additional sites are continuously being added to the network.

OCHIN members are collectively receiving a total of $3.1M in annual FCC funding, and anticipate that their membership base will be receiving a collective annual subsidy of $4.5M in FCC funding in the next year. This funding is expected to increase as new members are brought on to the OCHIN network in other states.

Healthcare is effectively serving as an anchor tenant in rural communities driving the deployment of new broadband infrastructure which then becomes available for other users in the community. Thirteen different carriers provide telecommunications services to OCHIN in Oregon. More information about OCHIN may be found at www.ochin.org.

Mapping Broadband Health in America
The Federal Communications Commission has continued its support of broadband in healthcare with the launch of its *Mapping Broadband Health in America*, a web-based mapping platform created by the Connect2Health FCC Task Force to drive more efficient, data-driven decision making at the intersection of broadband and health. Users can generate customized, county-level maps displaying broadband access, adoption and speed data alongside various health outcomes, access, and quality measures in urban and rural areas. The mapping platform can be used by both public and private sectors and local communities to identify gaps and opportunities in connected health https://www.fcc.gov/health/maps.

OHSU Project ECHO
Project ECHO® enhances the ability of primary care physicians (PCP) to treat chronic and complex illnesses in their hometown clinic and increases patient access to care. It is modeled after the University of New Mexico's Project ECHO® (Extension for Community Healthcare Outcomes). OHSU ECHO connects primary care providers with OHSU specialists for live, weekly video teleconferences. These one-hour virtual clinics give PCPs real-time reviews of complex cases. OHSU specialists provide written treatment recommendations. Each session also includes a 15- to 20-minute didactic presentation. Continuing Medical Education credit is provided. PCPs are expected to present cases up to six times a year and share patient outcome data.

OHSU's first Project ECHO® initiative, a Psychiatric Medication Management pilot program, was launched in September 2014 in conjunction with and support from Health Share. This pilot focused on PCPs in counties surrounding the Portland metropolitan area, enabling them to work more effectively with individuals seeking treatment for mood disorders, anxiety disorders, psychotic disorders, ADHD and other mental health challenges. Medications are one of many important tools for treating a variety of psychiatric disorders, including those related to sleep and substance use. Because individuals can respond differently to the same medications, appropriate prescription of psychotropic medications remains challenging. Managing these medications can be enhanced with the assistance of OHSU psychiatric specialists.

Based on the success of this first pilot, OHSU has continued the Psychiatric Medication Management program with funding from Health Share and Columbia Pacific CCO. With funding from OHA, a Child Psychiatry ECHO Clinic was launched in 2016, to help PCPs throughout the state diagnose and treat child patients with ADHD, anxiety, depression, learning disabilities, trauma, PTSD and other issues.
http://www.ohsu.edu/xd/health/for-healthcare-professionals/telemedicine-network/for-healthcare-providers/ohsu-echo/

Telehealth Review
Individuals looking for more information regarding the current status of Telehealth nationwide are directed to the following excellent review published in *The New England Journal of Medicine* in 2016. The authors identified three trends currently shaping Telehealth, specifically:

- The transformation of the application of Telehealth from increasing access to health care to providing convenience and eventually reducing cost
- The expansion of Telehealth from addressing acute conditions to also addressing episodic and chronic conditions
- The migration of Telehealth from hospitals and satellite clinics to the home and mobile devices

http://www.nejm.org/doi/pdf/10.1056/NEJMra1601705

Energy Management

Broadband is helping Oregon utilities move to a smarter electrical grid where power outages are identified, responded to, and repaired more quickly. Additionally, customers are empowered with information to help them understand and manage their energy use, stay connected to their utility in case of emergencies, and use less energy. Saving energy is easier and in some cases automatic as timing of energy use is being managed to match supply.

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. In 2012, 55 percent of the electric meters in Oregon were smart meters, but this penetration is expected to increase with PacifiCorp's recently announced three-year project to install AMI.

Smart meters can be thought of as one step to 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 encompassed by broadband. The Federal Communications Commission (FCC) has recognized this and holds that broadband is an advantageous component of smart 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).

Smart grids are therefore a noteworthy element of broadband usage in energy management. The three Oregon investor-owned utilities (IOUs) have or will have implemented smart grid infrastructure to achieve higher efficiency in energy management. Most Customer Owned Utilities (COUs) have or will have similar smart grid infrastructures to achieve higher efficiency in energy management as well.

Idaho Power Company

Idaho Power Company (IPC) is headquartered in Boise, and while IPC's service territory 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 estimations reveal IPC's broadband network reaches about 350 miles. 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 155.52 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 their Oregon substations have used leased communication facilities.

Broadband technology has also been used in IPC's Irrigation Peak Rewards Program, for backhaul communication between IPC's substation data collectors and the utility enterprise network, but this did not include communication with individual meters or devices. 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. Broadband technology is, however, used to retrieve meter reads and load profiles.

PacifiCorp

PacifiCorp (PAC), headquartered in Portland, serves approximately 567,000 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, as well as Southern and Eastern Oregon.

Given PAC's Oregon customer base, and its diverse service area, it has a rather extensive data network of which the vast majority is owned by PAC. It also contracts with third-party providers for networking into and out of their Portland control center. In the past, PAC has had approximately 600 miles of broadband capability in Oregon related to sustaining power flows in Oregon. PAC uses this system for two-way radio communication, generation and/or transmission energy management, implementing and monitoring responses to power disturbances, inter-connections with other utilities, and security operations. Speeds have ranged from a low of 1.2 kb/s to 1,500 kb/s on the high end.

In addition to this capability, PAC recently filed an update to its Smart Grid Report with the Oregon Public Utility Commission expressing its intent to develop and install AMI in Oregon. In its filing, PAC states that it intends to develop AMI technology in an effort to reduce operating costs and improve customer service. PAC plans to place these smart meters into service within the next three years. While details about how PAC will be using broadband to deploy its AMI technology is limited, PAC is currently planning on using a "Wi-SUN" certified

wireless mesh network to facilitate communication between geographically distributed access points and retail meters.

PAC also currently uses broadband to manage and facilitate the use of: Supervisory Control and Data Acquisition (SCADA); to control/monitor spinning reserves, non-spinning reserves, regulation service; and demand bidding and buyback.

PGE
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 as well as 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 dark fiber (unused fiber) to 2.488 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 stated that it is planning to switch these connections to leased broadband over the next few years in PGE service territory.

In 2015, PGE completed its Outage Management System (OMS), which uses input from AMI, SCADA and customer calls. The intent of the OMS upgrade is 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 a smart water heater demand response pilot program 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. To date, fourteen residential customers are participating in the pilot.

Customer Owned Utilities
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 being a significant barrier to smart grid deployments in some rural areas was cited by most that had no deployments. Several 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. One Gbps was cited as the fastest speed utilized.

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
- energy use in-home monitors by customer
- outage management systems (OMS)
- outage detection by the utility
- outage notification via smart phone or PC by 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

Current applications of SCADA include:
- substation monitoring of internal equipment
- substation video monitoring
- remote switch operations
- remote fault detection
- load control management

Other Applications include:
- Conservation voltage reduction (CVR)

A NOTE ABOUT SMART METERS: Smart Meter current and pending deployments increased from 55% in 2012's "Broadband in Oregon Report" to 85% in this report of all electric meters in Oregon. As reported in the Third Annual Grid Modernization Index, January, 2016, only three states and Washington DC had a higher percentage than 85% of smart meter penetration.

A NOTE 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.

Education

There have been significant developments regarding broadband in K-12 schools since OBAC's last report. The Federal Communications Commission (FCC) has continued to support its 2014 adoption of the high speed broadband connectivity targets established by the State Educational Technology Directors Association (SETDA). In September 2016, SETDA released *The Broadband Imperative II: Equitable Access for Learning* (www.setda.org) in which SETDA continues to advocate for increasing robust access both in and out of school to best prepare all students for college and careers. The Broadband Imperative II focuses on four key areas:

- Increasing Infrastructure to support Student-Centered Learning
- Designing Infrastructure to Meet Capacity Targets
- Ensuring Equity of Access for All Students Outside of School
- Leveraging State Resources providing direct state funding to Increase Broadband Access

This 2016 report expands on earlier recommendations from SETDA's groundbreaking report, *The Broadband Imperative: Recommendations to Address K-12 Education Infrastructure Needs*. The 2016 report includes the following updated recommendations for high-speed broadband connectivity based on school district size.

INTERNET SERVICE PROVIDER RECOMMENDATIONS		
School Year	**2017-18 Targets**	**2020-21 Targets**
Small School District (fewer than 1,000 students)	At least 1.5 Mbps per user (Minimum 100 Mbps for district)	At least 4.3 Mbps per user (Minimum 300 Mbps for district)
Medium School District Size (3,000 students)	At least 1.0 Gbps per 1,000 users^	At least 3.0 Gbps per 1,000 users
Large School District (more than 10,000 students)	At least 0.7 Gbps per 1,000 users	At least 2.0 Gbps per 1,000 users
^Published by SETDA 2012; Adopted by the FCC in 2014 https://www.fcc.gov/general/summary-e-rate-modernization-order *User: students, teachers, administrators, staff, and guests Methodology Appendix A		

http://www.setda.org/wp-content/uploads/2016/09/SETDA-Broadband-ImperativeII-Full-Document-Sept-8-2016.pdf

Oregon Department of Education (ODE) staff members have been integrally involved in the development of the SETDA Broadband Imperative II Report. Amy McLaughlin - Director of Information Technology Operations and Carla Wade - Digital Innovations Lead, both served on the Broadband Steering Committee for the development of the 2016 SETDA report. Carla Wade of the ODE was the Chair of the SETDA Board of Directors for 2015-16 and continues on the Board as the Past Chair for 2016-17.

The ODE is working with a variety of partners to improve K-12 connectivity statewide. During the summer of 2015, the Oregon Department of Education worked with EducationSuperHighway (ESH) www.educationsuperhighway.org, a non-partisan non-profit focused on improving school connectivity nationwide, on a K-12 broadband connectivity study to assess the current status of schools and support planning to meet broadband needs. Applications to the federal FCC E-Rate Program provided most districts' data for the survey. Schools that did not apply for E-Rate subsidies were contacted to collect the needed data. Data was collected on 144 of Oregon's 197 K-12 school districts representing 1,224 of Oregon's 1260 K-12 public schools (97%).

The results of this study were published in an Oregon Broadband Connectivity Report, issued in 2016. This report provides a point in time snapshot of K-12 connectivity at Oregon's school districts and highlights opportunities to make digital learning a possibility for more students. The report also provided a baseline analysis of some of the challenges facing Oregon school districts but did not go to the individual school building level. Some key observations based on the district level data include:
- 74% of districts meet 2014 goals for Internet access, but 82% need to upgrade to meet 2018 goals.
- 18% of districts currently meet 2018 goals for Internet access
- Internet costs vary significantly across the state and price transparency can make the cost more equitable
- School districts in I-5 corridor are mostly all on fiber; Eastern and Southern Oregon needs the most help procuring fiber
- Internet services procured and aggregated by Education Service Districts (ESDs) is cheaper than districts that procure on their own
- Internet connectivity is more expensive in Eastern and Southern Oregon.
- Neighboring districts frequently pay different costs for the same service

Additionally, ODE has collaborated with ESDs across the state to conduct a follow up survey that will provide connectivity data down to the individual school building level. This data collection will be completed in October 2016 and utilized for planning strategies to further improve high speed broadband connectivity to all schools and improve school internal networks so that connectivity can be leveraged in the classroom.

E-Rate Program
The FCC's "modernization" of the E-Rate program has been a positive development in the challenge to equip Oregon schools with broadband network access and in-school distribution network infrastructure. There are currently $44 million of E-rate funds can be leveraged for a statewide broadband access and in-school Wi-Fi implementation and education. In another enhancement to the program, the FCC will add another 10% subsidy if the state provides 10% funding. These contributions added to the E-Rate subsidy of up to 80% means that some schools may qualify for no out of pocket cost.

The FCC adopted two major orders re-orienting the E-rate program to provide support for high-capacity broadband services to and within schools and libraries; improving the administration of the program; and raising the annual E-rate funding cap.

The first FCC E-Rate order
- Re-oriented the E-rate program to focus it on broadband
- Adopted goals and measures for the program
- Significantly expanded Wi-Fi funding for all libraries and schools
- Improved E-rate program cost-effectiveness through pricing transparency, encouraging consortia and bulk purchasing
- Simplified the E-rate application process and program administration
- Seeks comment on how to best meet the needs of the program going forward

Internet access targets:
- 100 Mbps per 1,000 students (short term); 1 Gbps per 1,000 students (long term)
- 100 Mbps for libraries serving fewer than 50,000 people and at least 1 Gbps for libraries serving more than 50,000 people

In-school / On-campus Distribution Network target:
- Connection scalable to 10 Gbps per 1,000 students (long term)

The second FCC E-Rate order
- Raised the annual E-rate funding cap to $3.9 billion
- Focused on addressing the connectivity gap facing many schools and libraries, particularly in rural areas, by maximizing the options available for purchasing affordable high-speed connectivity
- Directed the Universal Service Administrative Company (USAC) to establish a performance management system to assess the effectiveness of policy changes and program administration
- Expanded the definition of rural to include schools and libraries located in urban clusters with fewer than 25,000 residents

The Oregon Department of Education promoted the enhanced E-Rate Program to and encouraged applications to the program to address broadband needs and is leveraging an E-Rate trial enhancement. The Department of Education approached the Emergency Board in May 2016 with a request for a pilot project for state funding of qualified e-rate projects for category 1 access. The Emergency Board funded $273,000 Education to conduct a pilot program of providing state matching funds for seven school districts that are funding optic-fiber infrastructure projects through the FCC's E-Rate Program. The participating school districts are in Paisley, Arlington, Sherman County, Dufur, South Wasco, Santiam Canyon, and Glendale. The FCC's additional 10% funding offer will continue for three years.

OBAC is excited by the progress made by the Oregon Department of Education. This spring, the Oregon Department of Education, in conjunction with the National Governors Association with support from EducationSuperHighway, developed a plan to continue to assess and address the broadband needs of the state's K-12 Schools. In their national State of the States report ESH reports that 38 Governors have committed to upgrade their schools, including Oregon's Governor Brown.

Oregon is making significant progress, however, the Digital Divide continues to exist. Students in low-population frontier and low-income areas have less access to the educational resources than their peers do. Adequate access to broadband can narrow that gap.

Digital Learning in Oregon

Quality broadband access supports digital learning and access for students to a broader range of opportunities and equitable educational opportunities. Since the last report, ODE has made significant forward progress in supporting digital learning options.

Students in Oregon's small and rural districts do not always have access to the courses needed for personalized learning and preparation for career and college. Beginning in the fall of 2015, ODE offered Online Course Access to 138 rural districts through the Oregon Virtual School District (ORVSD) program. Online Course Access offers students more flexibility, increased curricular options, and alternatives to meet their unique learning interests.

Additional resources provided by this program include district licenses for professional level tools including ARC GIS mapping tools and SketchUp Pro for engineering and architectural design. ODE's ORVSD is also providing access to online content from the National Repository of Online Content including HippoCampus educational resources, EdReady which allows students to assess their readiness for higher level math, provides study options and a personalized study path to fill in knowledge gaps.

ODE is also providing resources for school district implementation of digital learning. The Oregon Ed Tech Professional Development Cadre is celebrating its 15th year of providing professional development in effective integration of technology, emerging technologies and effective professional development strategies to build the capacity of districts and Education Service Districts across the state. Many of the participants are extending this professional development by providing Regional Ed Tech Cadres to expand the learning to the local districts and regions.

The Oregon Department of Education has convened the Oregon Digital Learning Advisory group to guide development of a new State Digital Learning Plan and guide to Digital Learning Standards and Computer Science Standards. In order to assist school districts in implementing this plan, ODE will be using resources such as the SETDA *Guide to Implementing Digital Learning* which addresses a number of factors districts must consider to implement digital learning including planning, professional learning, content & software, broadband connectivity, devices and tech support. ODE will also have some schools participating in *Future Ready,* which provides a roadmap to achieve success with high quality teaching, dynamic use of technology and personalized learning.

The Future Ready Framework addresses:
- Curriculum, Instruction, and Assessment
- Use of Space and Time
- Robust Infrastructure
- Data and Privacy
- Community Partnerships
- Personalized Professional Learning
- Budget and Resources

Oregon is also engaged in the National #GoOpen Exchange where states are "working alongside with innovators from education technology companies and nonprofit organizations to share effective strategies and ideas, create new tools and provide professional learning opportunities that help educators find, adapt, create, and share resources." http://tech.ed.gov/open-education/states/

As a part of the state commitment to #GoOpen, supported by Governor Brown, the ODE is:
- Implementing a statewide strategy that includes the use of open educational resources (OER)
- Developing a statewide repository for openly licensed resources
- Developing the technical capability to publish OER to the National Learning Registry
- Participating in a community of practice with other #GoOpen states and supporting local #GoOpen districts
- Posting its #GoOpen commitment, resources and progress on the Oregon Educator Network

ODE is also providing the Oregon Educator Network (OEN) for schools, districts and educator groups. The OEN is a dynamic tool for sharing and discovery of practices, resources, model programs and professional development. Engineering of enhancements is underway to increase the functionality of the site and migrate a previously developed professional development strategies database into the OEN.

The Homework Gap
The Homework Gap refers to the problem of students that do not have broadband access at home while course content, learning tools and resources, and school communications are moving on-line. In 2012, the Joint Interim Task Force on STEM Access and Success (HB4056) Report recommended that Oregon make investments to "ensure that the appropriate IT infrastructure is in place to provide reliable broadband internet access, online delivery systems, and computers and technology in schools and the home for all P-20 students. In 2014, OBAC referenced the lack of home access to high-speed broadband and recommended that Oregon provide equitable access for students and educators to reliable and robust broadband connectivity both in the school and at home. In order to make a case for our students without home access to high-speed broadband connectivity, the Oregon Department of Education continues to share data and information with the FCC and the USED about access to high-speed broadband in our rural and frontier school districts and the communities they serve.

The Homework Gap is becoming an issue of national concern. The FCC's Wireline Competition Bureau is seeking comment on two petitions, one filed by Microsoft Corporation and others in Virginia, and the other filed by the Samuelson-Glushko Technology Law & Policy Clinic on behalf of the Boulder Valley School District in Colorado requesting that the Commission allow E-rate subsidized broadband networks to be accessed by students at home for educational purposes, without an obligation on the E-rate applicant to cost allocate the portion of the traffic attributable to off-campus use.

Oregon Districts and Education Service Districts are looking at multiple strategies to address the Homework Gap.

EBS Spectrum and LTE
Educational Broadband Service (EBS) Spectrum and LTE technology has the potential of being an effective strategy to meet the broadband service needs of unserved students through schools and Community Anchor Institutions. Currently, High Desert Education Service District and Deschutes County Administrative School District, Community Anchor Institutions, are testing the use of EBS spectrum to provide Internet connectivity to their schools.

EBS Spectrum makes up one of the largest spectrum bands allocated by the FCC for advanced wireless services. The band in the 2495-2690 MHz (2.5 GHz) frequency range is licensed by the FCC on a geographic service area (GSA) basis only to accredited educational institutions and nonprofit entities whose missions are educational. Currently, EBS is an underused resource and commonly resold by license holders. It has the potential of being an effective strategy to meet the broadband service needs of unserved students through schools as Community Anchor Institutions.

Call Sign	Organization	Frequencies	Lease ID(s)	Lease Holder Names	Lease Commencement	Lease Expiration
Educational Broadband Service (BRS & EBS - 2496-2690 MHz)						
http://wireless.fcc.gov/services/index.htm?job=service_home&id=ebs_brs						
WNC471	Oregon State University	B1, B2, B3, B4	L000018291	Clearwire Spectrum Holdings III, LLC (Sprint)	2/13/2016	11/3/2024
WNC527	Oregon State University	A1, A2, A3, A4	L000018358	Clearwire Spectrum Holdings III, LLC (Sprint)	3/3/2016	1/17/2025
WNC574	Oregon State University	C1, C2, C3, C4	L000018359	Clearwire Spectrum Holdings III, LLC (Sprint)	3/3/2016	3/20/2025
WNC718	Oregon State University	C1, C2, C3, C4	L000018292	Clearwire Spectrum Holdings III, LLC (Sprint)	2/13/2016	10/16/2025
WNC771	Oregon State University	D1, D2, D3, D4	L000003933	ATI Sub, LLC	10/16/2008	3/3/2018
WNC470	Portland State University	D1, D2, D3, D4	L000018290	Clearwire Spectrum Holdings III, LLC (Sprint)	2/13/2016	11/3/2024
WNC487	Lane Community College	D1, D2, D3, D4	L000018356	Clearwire Spectrum Holdings III, LLC (Sprint)	3/3/2016	11/8/2024
WLX237	Portland Community College	B3, B4	N/A	-	-	-
WHR746	Portland Community College	B1, B2	N/A	-	-	-
WHR771	Chemeketa Community College District	A1, A2, A3, A4	N/A	-	-	-
WHR543	Oregon Public Broadcasting	A1, A2, A3, A4	L000010314	Clearwire Spectrum Holdings III, LLC (Sprint)	2/9/2013	10/19/2022
WNC526	University of Oregon	B1, B2, B3, B4	L000018357	Clearwire Spectrum Holdings III, LLC (Sprint)	3/3/2016	1/17/2025
WNC987	High Deser Educational Service District	B1, B2, B3, B4	L000008031	Webformix Company	1/25/2011	9/15/2017
WNC540	Linn-Benton Community College	G1, G2, G3, G4	L000018360	Clearwire Spectrum Holdings III, LLC (Sprint)	3/3/2016	2/13/2025
WNC717	Western Oregon University	G1, G2, G3, G4	L000018293	Clearwire Spectrum Holdings III, LLC (Sprint)	2/13/2016	10/16/2025
WNC759	Southern Oregon University	G1, G2, G3, G4	L000003928	ATI Sub, LLC	10/16/2008	3/3/2018
WNC815	Central Oregon Community College	D1, D2, D3, D4	L000008033	Webformix Company	1/25/2011	10/7/2016
WNC816	Deschutes County Admin School District No. 1	A1, A2, A3, A4	L000008032	Webformix Company	1/25/2011	10/7/2016

Current State of Oregon EBS License Holders

WiFi on Buses
Another development has been equipping school buses with WiFi Internet access for extended learning time. Additionally, some buses have been positioned in residential neighborhoods as WiFi hotspots for student use.

The Oregon Broadband Advisory Council will continue to work with ODE to analyze the State of high-speed broadband access for Oregon school districts and promote the development of solutions to deliver equitable access to connectivity and digital learning resources for all students.

E-Government

Oregon.gov
In 2015, the State of Oregon launched an upgraded version of the state portal that is a finalist, for the second year in a row, in the Center for Digital Government's Best of the Web awards.

One in every three visitors come to Oregon.gov from a mobile device such as a smart phone or tablet. Over the year, mobile devices have visited Oregon.gov websites over 42 million times. 58, 71% of Oregonians told Oregon.gov that optimizing our services to work with mobile devices was important.

Visitors have access to over 1,900 Oregon services where they can complete their entire interaction over the internet.

The survey of Oregon residents has pointed out for the first time that contacting the state over the internet is considered just as convenient as using the telephone. In Oregon, 9 of 10 residents (91%) report having internet access at home. Another 5% have internet access from somewhere else (page 38 & 39). Only 4% of Oregonians did not have access to the internet.

Last year, Oregon residents visited Oregon.gov webpages over 42 million times viewing over 139 million web pages.

The Electronic Portal Advisory Board (EPAB) publishes three key measures: 1) Survey of Oregonians 2) Number of Online Services 3) Agency Defined measures. These three cover 80 different measures published once a year in the EPAB Annual Report.

One of the 80 measures is how does Oregon compares against national criteria used to rank all 50 states for Best of the Web by the Center of Digital government. Within that measure is 59 different criteria. Oregon was selected as a finalist for Best of the Web in 2015.

In 2015, the E-Government ecommerce service collected more than 2.54 billion dollars in over 3 million transactions. This is in addition to the other online payment services provided by the Treasurer's office.

Nearly every agency, board and commission participates in the centralized Oregon E-Government service offering, including websites, online applications, online payments, open data and enterprise collaboration.

The Electronic Government Portal Advisory Board publishes the future projects under consideration as a handout at each quarterly board meeting:
http://www.oregon.gov/epab/pages/agenda_minutes_handouts.aspx

To review the full 70 page annual Oregon.gov report go to:
http://www.oregon.gov/epab/docs/2016_EPAB_Annual_Report.pdf

Cities
The use of the broadband Internet by city governments in Oregon continues to expand and the inventory of Internet and broadband services throughout the state is becoming more robust. This is particularly important as cities seek to use technology to communicate with and provide services and information to the citizens and businesses residing and operating within their jurisdiction.

The League of Oregon Cities approached several of its members with a questionnaire provided by staff of the Oregon Broadband Advisory Council. So while not a comprehensive view of the use of Internet and broadband services in terms of e-government, it does provide some interesting insights.

Internet Websites
While not representative of every city in Oregon, every responding city indicate that they maintain an Internet website. Some sites are more robust than others depending upon city size. Typically, these websites are used to provide general civic information to citizens as well as more specific information on the city government itself and its activities. Many cities provide streaming video of council meetings as well. And of value to both the citizenry and the local government, business transactions are increasingly being conducted over the Internet - such as paying invoices and obtaining permits. A few cities go as far as to have available to the public information about their broadband infrastructure. This is particularly so in cities that operate their own facilities.

Broadband Services
Several cities in Oregon act as a provider of broadband services to the community. Affirmative respondents to this portion of the survey included Portland, Eugene, and Sandy (SandyNet), although there are others who do so as well. Portland's offering includes services to government, schools and public libraries utilizing optic fiber and copper cable. Eugene's is a partnership with private sector providers and serves businesses, government, schools, hospitals and other users with optic fiber and wireless. The City of Sandy extends its broadband services

(Internet and phone) to citizens in their homes, businesses, government, and schools, mostly with optic fiber and some copper cable and wireless.

Public Broadband Policy
The City of Portland has been actively engaged in establishing broadband policy can be viewed at https://www.portlandoregon.gov/revenue/57451 . The National Association of Telecommunications Officers and Advisors (NATOA) 2016 Community Broadband Awards recipients included two from the City of Portland. The Community Broadband Awards recognize exceptional leaders and innovative programs that champion community interests in broadband deployment and adoption in local communities nationwide. Recipients were selected based on their extraordinary efforts, achievements and innovation in community-based approaches to broadband technology. Portland was recognized for its Digital Equity Action Plan, and Mary Beth Henry, its recently retired director of the Office for Community Technology was recognized as a Community Broadband Visionary.

The City of Eugene adopted a telecommunication vision and policy in 1997 and in 2013 approved a Eugene Community Broadband Plan.
http://www.oregonbroadbandplanning.org/Engaged-Communities/Community-Plans/G1plans/EugenePlan.pdf

The City of Sandy has modified its development code to require infrastructure improvements for SandyNet fiber facilities in all new developments and has also established a Broadband Adoption and Utilization Strategic Plan. http://www.oregonbroadbandplanning.org/Engaged-Communities/Community-Plans/G1plans/SandyPlan.pdf

Counties
In 2016, the Association of Oregon Counties conducted a survey of the counties regarding their use and focus on broadband. Of the thirty-one counties that responded, 100 percent maintain a website, and most use the website to provide and distribute general civic information to citizens, and provide information about county government and its activities. Some of the counties broadcast county commission meetings and/or other public meetings via streaming video, and provide transactional services such as paying invoices and obtaining permits. Only a few counties display information about their broadband infrastructure or provide broadband services to the community.

County	Does your county maintain an internet website?	Is your website used to provide and distribute general civic information to citizens?	Is your website used to provide information about county government and its activities?	Do you broadcast county commission meetings and/or other public meetings via streaming video?	Is your website used to provide transactional services such as paying invoices and obtaining permits?	Does your website include information about the county's broadband infra-structure?	Is your county a provider of broadband services?
Grant	Yes	Yes	Yes	No	No	No	No
Union	Yes	Yes	Yes	No	No	No	No
Clackamas	Yes	Yes	Yes	Yes	Yes	Yes	No
Crook	Yes	Yes	Yes	No	Yes	No	No
Marion	Yes	Yes	Yes	Yes	Yes	No	No
Lane	Yes	Yes	Yes	Yes	Yes	No	No
Deschutes	Yes	Yes	Yes	Yes	Yes	No	No
Linn	Yes	n/a	n/a	No	No	No	No
Sherman	Yes	Yes	Yes	No	Yes	No	Yes
Jackson	Yes	Yes	Yes	Yes	Yes	No	No
Wheeler	Yes	Yes	Yes	Yes	Yes	No	No
Washington	Yes	Yes	Yes	Yes	Yes	No	No
Coos	Yes	Yes	Yes	Yes	Yes	No	No
Clatsop	Yes	Yes	Yes	Yes	Yes	No	No
Benton	Yes	Yes	Yes	No	Yes	No	No
Wasco	Yes	Yes	Yes	No	Yes	No	Yes
Klamath	Yes	Yes	Yes	Yes	No	No	No
Douglas	Yes	Yes	Yes	Yes	Yes	No	No
Wallowa	Yes	No	Yes	No	No	No	No
Columbia	Yes	Yes	Yes	Yes	No	No	No
Clatsop	Yes	Yes	Yes	No	No	No	No
Malheur	Yes	Yes	Yes	No	Yes	No	No
Umatilla	Yes	Yes	Yes	Yes	Yes	No	No
Lincoln	Yes	Yes	Yes	Yes	Yes	No	No
Josephine	Yes	Yes	Yes	Yes	Yes	No	No
Baker	Yes	Yes	Yes	No	Yes	No	No
Tillamook	Yes	Yes	Yes	Yes	Yes	No	No
Lincoln	Yes	Yes	Yes	Yes	Yes	No	No
Coos	Yes	Yes	Yes	No	No	No	No
Jefferson	Yes	Yes	Yes	No	No	No	No
Gilliam	Yes	Yes	Yes	No	Yes	No	Yes

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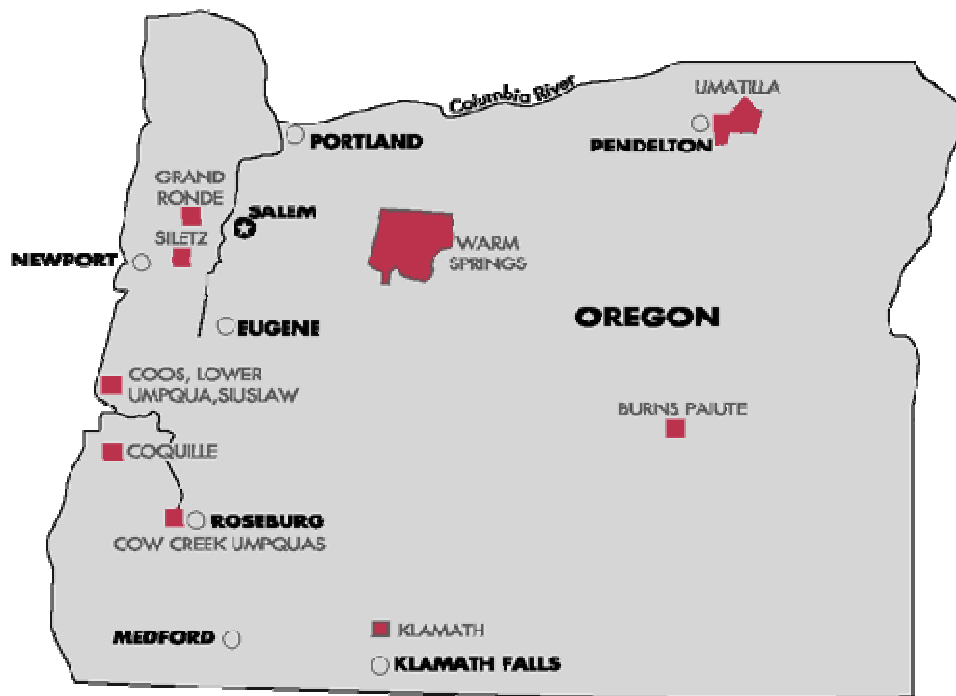
Oregon federally recognized Tribes

All Oregon Tribes have websites that provide information about governmental services (Table below). Typical information includes tribal law and code, plans, forms, permits, public meeting notices, agendas, meeting minutes, and job announcements. Most of the websites provide maps with information like land boundaries, roads and service locations, directions, etc. One website offers extensive streaming video of public meetings.

Few of the websites provide opportunities for interaction with the exception of providing e-mail contacts for elected officials and administrative departments. A few tribes offer informal discussion forums on social networking sites like Facebook, Twitter and Google+.

Listserv or E-mail notification services, online bill or fee pay, and online forms submission is very limited. Most Tribes have exclusive portals for information sharing within the tribal organization. These provide information and opportunities for interactivity that do not exist at the public website.

At least four tribes are working on advanced broadband service delivery projects. The Confederated Tribes of Grande Ronde charge a flat fee for their residential customers and are increasing broadband service speeds by changing from ADSL to VDSL lines. The Confederated Tribes of the Umatilla Indian Reservation are planning for broadband fiber connectivity to their Yellow Hawk Tribal Health Center and residential areas. The Cow Creek Band of Umpqua Tribe

of Indians is operating a level-3 commercial data center out of Roseburg that provides 36 racks and currently hosts HughesNet among other customers. The Confederated Tribes of the Warm Springs continue to build fiber out customers from their CLEC including a recent buildout to serve a future Unmanned Ariel System training center at Kah-Ne-Ta. In August 2016, Warm Springs Telecommunications Company, a certified Competitive Local Exchange Carrier (CLEC) and Eligible Telecommunications Carrier (ETC) in Oregon, filed a petition with the FCC to be treated as the Incumbent Local Exchange Carrier (ILEC) of record for the two areas identified on the Warm Springs Reservation.

Tribe	URL
Burns Paiute Tribe	http://www.burnspaiute-nsn.gov/
Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians	http://ctclusi.org/
Confederated Tribes of the Grand Ronde	http://www.grandronde.org/
Confederated Tribes of the Umatilla Indian Reservation	http://ctuir.org/
Confederated Tribes of the Warm Springs	http://www.warmsprings.com/
Confederated Tribes of Siletz Indians	http://www.ctsi.nsn.us/
Coquille Indian Tribe	http://www.coquilletribe.org/
Cow Creek Band of Umpqua Tribe of Indians	http://www.cowcreek.com
Klamath Tribes	http://klamathtribes.org/

Broadband Related Challenges and Opportunities

OBAC has identified the following key broadband challenges and opportunities facing Oregon and on its agenda for 2016.

Cyber Security

The Council believes that cyber security is a "sleeper-issue" that requires urgent attention. The security of data and communications systems is a clear and present risk exposure for public organizations, private sector businesses, and for individuals that is under recognized and under managed.

Recently in the news, it was reported that last year's data breach at JPMorgan Chase Bank affected more than 76 million households and seven million small businesses.

JPMorgan Chase reported that hackers may have stolen customer names, addresses, phone numbers and email addresses. That ranks among the biggest consumer data breaches in recent years.

Other big reported breaches include:

- Software-maker Adobe Systems suffered a breach in 2013 that reportedly involved 150 million customer email addresses and encrypted passwords.

- Online retailer eBay had a 2014 breach involving an estimated 145 million customer names, addresses and encrypted passwords.

- Home Depot suffered a 2014 breach that reportedly exposed about 56 million customer payment card accounts, plus email addresses for 53 million more customers.

- Retail chain Target stores had a breach in 2013 that reportedly affected 40 million payment cards and phone numbers or addresses for another 70 million customers.

- Insurance company, Anthem, reported a breach last year that included social security numbers, employment and income information for up to 80 million people.

- Sony Pictures Entertainment suffered a hack last year in which personal information for nearly 50,000 current and former employees, including salaries and social security numbers, was posted online.

- U.S. Office of Personnel Management suffered a hack involving sensitive information including social security numbers and even fingerprint records for over 21 million current and former federal workers. http://abcnews.go.com/Technology/wireStory/jp-morgan-chase-breach-biggest-recent-years-35109338

A recent survey of nearly 4,000 young adults worldwide, commissioned by Raytheon and the National Cyber Security Alliance (NCSA), revealed that the perception of young "millennials" as a tech-savvy generation may not be accurate. There is a surprising ignorance among the 18 to 26 year-old respondents when it comes to their online security.
- 65 percent of respondents said they believe they can stay safe online.
- 58 percent of respondents said they were not taught how to stay safe online
- 67 percent of respondents said they hadn't heard about any cyber-attacks in the past year. https://fcw.com/articles/2015/10/26/millennials-cybersecurity.aspx

Current and Trending Cyber Risks
- The Internet of Things (IoT)
- Data Protection during Transfer and Storage
- Data Privacy – Big Data
- Ransomware
- Cyber Espionage/Terrorism
- Power Grid – SCADA
- Consumer Fraud/Identity Theft
- Weak and Stupid "Human Firewall" (There is no patch for stupidity)
- *Cyber Security Risks*

David Trepp of *Info@Risk, Inc.* provided the Council with a briefing on cyber-security risks. Cyber Security risk management entails more than software, hardware, and communications technologies, it also involves physical facilities such as buildings and offices, people, and administrative systems.

Risk = Likelihood * Impact

Risk may be viewed as the *measure* of the extent to which an organization is threatened by a potential circumstance or event (threat); a function of impact and likelihood. The sources of security threats may be external and internal.

- Cyber risk exposure is increasing over time. Cyber-crime is a growth industry as is becoming "professionalized" with supply chains for tools and professional services. External threats include "Hacktivists" seeking to impart digital vigilante justice on perceived enemies, nation states, and cyber criminals. Internal threats include employees, visitors, vendor and service staff.

- One of the most prevalent paths or "vectors" for cyber-attacks is through people via "social engineering" in person, by phone, and through email. Consequently, people are an important line of defense and need to be trained in cyber threats, risks, and defenses. If an organization has more than 50 employees, then social engineering is likely to be the greatest threat to information security.

- The increasing use of mobile technologies and applications is providing additional channels for hacker access to systems. Other systems such as operating systems, application software, workstations, servers, and other attached devices provide access channels as they get out of sync or out of date through loose administration.

- Effective Information Security requires organizational understanding of business needs, compliance, threats and the vulnerabilities of information assets.

- Not enough professionals with Cyber Security skills

Cyber security is a repeat challenge from 2014 in this report for 2016, and progress is being made. In the 2015 legislative session, the Oregon Department of Justice sponsored SB 601 to update Oregon's statutes regarding data breaches, and the bill passed. The statute requires that entities that collect personal information must keep that information secure, and that if a data breach occurs, the entity must report this to the Oregon Attorney General if it affects more than 250 Oregonians. Since the beginning of 2016, six data breaches have been reported to the Attorney General.

Oregon Department of Justice
The Oregon Department of Justice is focused on the threats associated with cyber-security and has dedicated resources to Cyber Crime within its Criminal Justice Division. The DOJ works with county, state and federal prosecutors to investigate and prosecute cyber-crimes.

Oregon Cyber Task Force
The Oregon Cyber Task Force is a statewide resource that includes the Federal Bureau of Investigation, Department of Homeland Security, Oregon DOJ Criminal Justice Division, Oregon State Police, Portland Police Bureau, and the Beaverton Police Department. The Task Force investigates digital crimes such as the theft / sale of PII, destruction of data by malicious exploits, computer intrusions by organized crime, and network sabotage. The most widely seen areas of activity are ransomware, the compromise of business e-mail, and cyber-scams.

Oregon Cyber Task Force
9109 NE Cascades Parkway
Portland, Oregon 97220
(503) 460-8000
octf.pd@ic.fbi.gov

Legislative Concepts
Other cyber security bills introduced in the 2015 Legislative session included:

SB 187
Establishes Oregon Student Information Protection Act. Prescribes prohibited, required and allowed activities of operator of Internet website, online service, online application or mobile application in relation to certain personal information related to students in any grade from kindergarten through grade 12. Makes violations of Act unlawful practice. Act. Status: Governor signed into law 6/22.
https://olis.leg.state.or.us/liz/2015R1/Downloads/MeasureDocument/SB187/Enrolled

HB 2377
Prohibits person from soliciting, requesting or otherwise inducing another person to provide personal information by representing or implying that person is third person, without third person's knowledge, authorization and consent. Governor signed into law 5/21.
https://olis.leg.state.or.us/liz/2015R1/Downloads/MeasureDocument/HB2377/Enrolled

SB 188
Creates crime of unlawful dissemination of intimate image. Punishes by maximum of one year's imprisonment, $6,250 fine, or both for first offense, and five years' imprisonment, $125,000 fine, or both for subsequent offense. Status: Governor signed into law 6/11.
https://olis.leg.state.or.us/liz/2015R1/Downloads/MeasureDocument/SB188/Enrolled
SB 377
Modifies crime of invasion of personal privacy. Creates manner of committing crime in which nudity of person viewed or recorded is not required. Expands certain definitions related to crime. Elevates crime to Class C felony, punishable by maximum of five years' imprisonment, $125,000 fine, or both, if victim is under 12 years of age. Status: Governor signed into law 6/10.
https://olis.leg.state.or.us/liz/2015R1/Downloads/MeasureDocument/SB377/Enrolled

HB 2704
Provides that recording of peace officer or parole and probation officer does not constitute crime of interfering with peace officer or parole and probation officer unless recording actually prevents officer from performing lawful duties. Creates exemption to prohibition on recording conversations for person recording law enforcement officer while officer is performing official duties. Status: Governor signed into law 6/25.
https://olis.leg.state.or.us/liz/2015R1/Downloads/MeasureDocument/HB2704/Enrolled

SB 641
Prohibits public body from obtaining information from portable electronic device without warrant except when imminent threat to public safety exists. Provides that information obtained in violation of prohibition is not admissible in adjudicatory proceeding. Status: Governor signed into law 6/30.
https://olis.leg.state.or.us/liz/2015R1/Downloads/MeasureDocument/SB641/Enrolled

In September 2016, Governor Kate Brown ordered state agencies to update their cybersecurity systems, and have been directed to work with the state's chief information officer on the task.

Oregon Center of Cyber Excellence
The University of Oregon, Oregon State University, Portland State University, and the Oregon Institute of Technology have established an Oregon Cybersecurity Consortium are prepared to engage as a group with Oregon Industry through the Oregon Center of Cyber Excellence.

The resulting consortium is prepared to develop course offerings, professional development opportunities and other capabilities to create and maintain a pipeline of graduates and professionals with deep cybersecurity expertise to enable Oregon industry to deliver cyber security solutions.

There has been a request to build a Supervisory Control and Data Acquisition (SCADA) laboratory in one of the Community Colleges do study threats and risks faced by SCADA systems in energy, telecommunications, and transportation.

Oregon is one of five states that does not have a cyber-center.

Mt. Hood Community College Cyber Defense Program
The US National Security Agency and US Department of Homeland Security have recognized Mt. Hood Community College as a National Center of Academic Excellence in Cyber Defense Education Two-Year (CAE2Y) beginning June of 2015 through 2019, making MHCC the only institution of higher education in the state of Oregon to hold such a designation. More information about Mt. Hood Community College's Cyber Defense program may be found at mhcc.edu/cis or email Dr. Wayne Machuca at wayne.machuca@mhcc.edu   /
http://www.mhcc.edu/news.aspx?id=3852

New Cyber-Security Commission
The White House has announced a new cybersecurity commission tasked with helping the country better defend itself against and withstand cyber-attacks. The Commission on Enhancing National Cybersecurity will be led by former White House national security adviser Tom Donilon along with former IBM chief executive Sam Palmisano. The commission will include 12 members, including technologists, business people, and others appointed by the president. And, will reside within the Department of Commerce.
http://fortune.com/2016/02/18/former-ibm-chief-obama-cybersecurity-team/

In August 2016, the U.S. Department of Homeland Security (DHS) has announced $40 million in federal funding for a new DHS Center of Excellence (COE) for Homeland Security Quantitative Analysis. The proposed Center will conduct research to enhance the application of analytic tools that support real-time decision making and address homeland security-related

cyber security threats and hazards. The overarching goal of the Center will be to develop the next generation of mathematical, computational and statistical theories to advance quantitative analysis capabilities of the homeland security enterprise. DHS is open to receive proposals from accredited U.S. colleges and universities.
https://www.dhs.gov/science-and-technology/news/2016/08/08/news-release-dhs-announces-40m-funding-opportunity-homeland

OBAC proposed Joint Resolution 2017

Joint Resolution

Whereas the Legislative Assembly has declared that it is the policy of the State of Oregon to promote, facilitate, and encourage activities, projects, and businesses that improve Oregon's Internet Protocol (IP) network infrastructure, performance, and connectivity to the Internet backbone network and "World Wide Web" for the benefit of Oregon's commercial, educational, governmental, and individual users; and

Whereas the Internet and Internet Protocol (IP) networks and technologies are emerging as an infrastructure necessary for the conduct of commerce and communication and necessary to establish and maintain Oregon's global competitiveness; and

Whereas, there is a growing threat and risk of the theft of data and personal identity through cyber-attack, now, therefore,

Be It Resolved by the Legislative Assembly of the State of Oregon:

That it is the policy of the State of Oregon to promote, facilitate, and encourage activities, initiatives, projects, and businesses that improve the security of data and electronic communications and increase the awareness of cyber-security risks and the need for proactive risk management for the benefit of Oregon's commercial, educational, governmental, and individual users.

Governor Kate Brown's cybersecurity order
Governor Kate Brown has ordered state agencies to update their cybersecurity systems and to work with the state's Chief Information officer, Alex Pettit, to unify cybersecurity protocols. At least eight state agencies have been hacked in the past two years. The order comes ahead of an IT security audit conducted by the Secretary of State's Office scheduled to be released on December 1st.
http://registerguard.com/rg/news/local/34800571-75/oregon-orders-cybersecurity-improvements.html.csp

In summary, the good news is that cyber security issues are being engaged at the federal and state levels, the bad news is that risk exposures are increasing and a lack of public awareness remains.

K-12 Schools Broadband Access / Broadband Standards

The Council believes that coordinated action to address the challenge of statewide broadband access in its K-12 Schools is needed to meet the state's educational goals as well as to build a foundation for workforce development. Standards recommended by the State Educational Technology Directors Association (SETDA) www.setda.org have become the defacto standards nationwide and would be excellent standards for Oregon to use for planning and to meet.

Public Safety

FirstNet
The Council believes that FirstNet, a national long-term initiative to build a nationwide broadband public safety network, provides Oregon with an opportunity to achieve interoperable public safety communications and enhance wireless broadband systems statewide.

The First Responder Network Authority (FirstNet) was created by the Middle Class Tax Relief and Job Creation Act of 2012 (Act). The law gives FirstNet the mission to ensure the building, deployment, and operation of the first high-speed, nationwide wireless broadband network with spectrum dedicated to public safety. FirstNet will provide a single, interoperable platform for emergency and daily public safety communications. This broadband network will fulfill a fundamental need of the public safety community as well as the last remaining recommendation of the 9/11 Commission.

FirstNet held its initial consultation meeting with Oregon in October 2014. With more than 90 state and local public safety representatives in attendance. Oregon has continued to work closely with FirstNet and has been engaged in state outreach education efforts, and has developed a tactical reference guide on FirstNet.

As a result of FirstNet's data collection effort in 2015, information and data has been gathered to establish each state's coverage objectives. This was a collaborative exercise for states and territories to identify public safety's needs for coverage.

In January 2016, FirstNet issued an objectives-based request for proposal (RFP) to solicit innovative, private sector solutions to build and deploy the network. Proposals are due on May 31, 2016, and FirstNet's goal is to award a contract by the end of 2016 and begin to offer services in 2018. Following the award of the FirstNet contract for the network, FirstNet and its partner(s) must deliver individual State Plans detailing the proposed network deployment. Each Governor will have 90 days to make the following decision:

> **Opt-In:** If the State opts-in or takes no action, FirstNet will issue a task order to its partner(s) to begin deployment of the Radio Access Network (RAN) portion of the FirstNet network in the State at no cost to the State.
>
> **Opt-Out:** If the State affirmatively opts-out, it must develop and complete an RFP and submit an alternative plan to the FCC within 180 days for the construction, maintenance, operation, and improvement of the RAN in the State. Before deployment can begin, the FCC must approve the alternative plan, and the State must apply to the NTIA to enter into a spectrum capacity lease with FirstNet. The state/territory will also be responsible for related maintenance and future upgrades.

FirstNet's objective through consultation is to work together to deliver a wireless broadband public safety communications plan for Oregon.

911 Centers
Oregon's 911 Centers face significant challenges regarding broadband networks. 911 Centers are currently in a transition period. The Centers are largely operating with legacy systems, technology that has been in place for many years, and do not interface well or at all with the Internet. Data, voice, radio, and computer-aided-dispatch communications are changing from analog to digital.

Many County dispatchers currently sit in front of multiple monitors for the Internet access, for computer-aided-dispatch, for information sharing, and for phone system information. Each monitor is for access to separate systems that are not interconnected except for the human interface – the dispatcher.

Centers are attempting to move to Next Generation 911 under mandates from the FCC that require the capability to receive not only voice 911 calls, but also receive text, video and images. As the public has moved to new technologies, to mobile wireless and broadband, the nature of incoming requests for help have changed. To illustrate, about 70% of incoming 911 calls received by Clackamas County are now from cell phones without actionable location information. A related issue in this environment is "butt-dials" or unintentional calls from cell

phones with no caller on the line. These butt-dials can represent up to 35% of incoming calls, and the 911 Centers are obligated to clear the calls and confirm that there is not an emergency.

Another ongoing change is the different security requirements for police and fire. Two factor authentications for police, and one for fire emergencies driving separated and "siloed" treatment for police and fire. When 911 calls are transferred to the Oregon State Police, often any data that has previously been collected may be lost and the State Police dispatcher has to begin again with the caller. Current issues include the need to provide for text 911 contacts.

As incoming 911 calls increasingly come in from cell phones and via text, 911 Centers are actually losing the ability to automatically obtain location information as was previously provided by landline calls with Caller ID information. Additionally, laws and regulation requiring the registration of locations behind PBXs or for VoIP systems have poor compliance. VoIP calls often have no reliable location information provided, and several VoIP service providers are not located in the United States, which sends 911 calls to other countries. This requires callers to communicate their location to the center, which takes added time, and may not be accurate or effectively communicated.

A key issue of concern is funding and the ability of 911 centers, particularly in rural areas to be able to make the technology upgrades needed in this new communications environment. 911 centers need integrated systems to improve information management, sharing and communication and to replace legacy stand-alone systems that are not interconnected. Systems also need to be robust with very little to no down time.

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/.

Eight agencies in northwest Oregon and southwest Washington began text-to-911 message service at the end of August 2016, though voice calls remain the preferred way for communications for emergency services. Text-to-911 service is now operational in Clackamas County, Lake Oswego, Portland Bureau of Emergency Communications for Multnomah County, Astoria 911 for much of Clatsop County, Columbia County, Washington County, and Marion Emergency Telecommunications, which covers northern Marion County around Woodburn. The service is not yet available state wide, according to Oregon Emergency Management. More information on these websites: www.nwtext911.info / www.wccca.com

Local Community Broadband Planning
The Council believes that there are significant benefits to be gained by engaging in broadband strategic planning at the local community level. The process establishes vital communications and relationships between community leaders and establishes a valuable focus on the assessment and utilization of broadband assets.

One lesson from the last year is that in a few years, the **<u>gigabit divide</u>**
will **NOT** be about *wealth* or *density*; it will between those *communities*
that had a *plan* and those who didn't.
- Blair Levin

Disaster Recovery Planning

The Council believes that telecommunications and electric power systems are key to the state's ability to respond to and recover from major disasters. Joint-planning and coordination between federal government, state government, and service providers needs to be a priority.

Oregon needs to engage in an ongoing process of hazard identification, risk assessment, stakeholder engagement, risk prioritization, and risk mitigation. Oregon needs "resilience" in its infrastructure to minimize damage and enable a more rapid recovery from disasters. Electric power and telecommunications will be key to the success of emergency response and recovery efforts.

Oregon needs the discipline to actively engage in sustained and ongoing disaster recovery planning. The top three hazards facing Oregon are flood, earthquake, and tsunami. These hazards are low frequency, but can have a high impact. The probability of a major Pacific Northwest event is 100%. The last major quake was in January 1700 and there is evidence of many others over the past 10,000 years.

Following the Japanese Subduction Zone earthquake and associated tsunami in March of 2011, scientists were able to apply the data collected from that event and model probable impacts from a Cascadia Subduction Zone event in the Pacific Northwest.

In June of this year, the Oregon Office of Emergency Management (OEM) in coordination with FEMA, hosted Cascadia Rising, an exercise to help prepare for a Cascadia Subduction Zone event and tsunami. First on the published list of exercise objectives for the event was "Operational Communications - Ensure restored communications with local operations centers and coordinate effective public messaging during a major disaster."

OEM specifically was focused on backup modes of communications when primary modes were unavailable. Although there was some discussion on restoration of primary services, it focused more on time frames when services may be restored in different areas of the state, and not on the process of restoring services.

Preliminary lessons learned from the event cause the Council continued concern that the majority of communications infrastructure on the coast may be severely damaged and inaccessible for repair. Facilities along the immediate coastline will likely be destroyed by the force of the tsunami wave. Communications in these areas may be limited to radio frequency and satellite phones.

As detailed in the following chart, the Oregon Coast and Willamette Valley will likely be the hardest hit and Eastern Oregon will need to serve as the staging area for recovery efforts.

Area of Operation	Damage State			
	None	Low	Medium	High
Coastal	0%	0%	18%	82%
I-5 corridor	8%	15%	58%	19%
East	98%	0%	0%	2%
Summary of damage description	No damage to facility building or equipment. Antennae misalignment may temporarily disrupt service.	Slight damage to the communication facility building, or loss of the center's ability to provide services for up to a few days due to loss of electric power and backup power. The facility may be functional with minor repairs.	Moderate to severe damage to communication facility buildings, many digital switching boards dislodged, resulting in malfunction. The central office may be without service for a few days due to loss of electric power or loss of backup power, typically due to overload.	Severe to complete damage to the communication facility building, with most switching boards dislodged, resulting in malfunction. The damage to digital switching boards may beyond repair.

Damage State Projections

There are over a thousand telecommunications facilities in the impacted area of Washington and Oregon. Roughly two-thirds of these facilities may suffer medium to high damage from the initial earthquake. The shaking may rattle equipment off of cell towers, dislodge central control boards and damage central communications offices. Communication facilities that suffer no or low damage may also be un-operational due to antennae being thrown out of alignment or the breaking of cables connecting these facilities.

While most of the communication facilities in eastern Oregon may suffer less physical damage from the earthquake. However, the reduced availability of power may limit the capability of these facilities to provide service. Additionally, the vast majority of U.S. connectivity to the Internet for Oregon flows through communications hubs such as the Pittock Block in Portland and long haul transport runs North and South along the Interstate 5 corridor. There is limited connectivity coming from the Eastern U.S. (Denver and Salt Lake City) meaning that even if infrastructure in Eastern Oregon survives, there may not be adequate connectivity to the Internet initially for recovery operations.

Underground landslides and the shifting of the ocean floor may sever undersea cables that traverse the offshore regions of the Cascadia Subduction Zone. These cables connect the Western U.S. to Asian and other Pacific Rim markets. The remaining cable systems on the northern transpacific routes landing in Puget Sound and the Oregon coast may see some disruptions, but the southern routes through California may remain functional.

With the loss of undersea cable capacity, communications systems may face abnormally high congestion. While alternative routes using satellite microwave communications may exist, the bandwidth is limited. The restoration of these cables may take months.

Additionally, the restoral of telecommunication systems are dependent on other infrastructure resources including electric power, transportation, as well as the availability of skilled technicians. These resources are all likely to be limited following a major disaster event as described in the 2013 report to the Legislative Assembly in the Oregon Resilience Plan http://www.oregon.gov/OMD/OEMlosspac/docs/Oregon Resilience Plan Final.pdf submitted by the Oregon Seismic Safety Policy Advisory Commission.

While completion of the Cascadia Playbook and Cascadia Rising are significant steps toward preparedness, The Oregon Office of Emergency Management and the Federal Emergency Management Administration (FEMA) need to continue to plan for and establish post-event channels of communication to the Oregon's telecommunications service providers so that these agencies will be in a position to know the status of the telecommunications networks statewide to effectively support recovery efforts. See Appendix D for an assessment of broadband communications following a Cascadia Subduction Zone event.

Effective disaster preparedness requires planning, personnel training, and plan implementation exercises. Cascadia is not the only disaster that Oregon should plan for. Disaster events may be natural, technological or human (accidental or intentional).

Training individuals and companies that might be involved in recovery operations should get in advance of a disaster includes FEMA training on the National Incident Management System (NIMS) and the Incident Command System (ICS) (which is a part of NIMS). NIMS is a systematic, proactive approach to guide departments and agencies at all levels of government, nongovernmental organizations, and the private sector to work together seamlessly and manage incidents involving all threats and hazards—regardless of cause, size, location, or complexity—in order to reduce loss of life, property and harm to the environment.

Training on NIMS and ICS prepares individuals and organizations to effectively participate in recovery efforts. An introductory course can be accessed at: https://training.fema.gov/is/courseoverview.aspx?code=IS-100.b

Having a plan in place, personnel trained in the plan, and practiced in putting the plan into action serves to reduce confusion in an emergency, support the efficient use of resources, and improve safety, coordination, and communication.

It should also be noted that for employees of organizations to be prepared to respond effectively to an emergency at work, they must be prepared at home. It is valuable to create a culture of emergency preparedness and awareness organizationally and individually.

<u>Federal Funding Programs</u>
Oregon needs to fully utilize and leverage the expanding broadband related federal initiatives and funding programs available to help meet its broadband needs.

In January 2015, President Obama announced steps to help more Americans get access to fast and affordable broadband, stating that high-speed, low-cost broadband is needed to support economic revitalization.

The Obama Administration is:

- Calling to End Laws that Harm Broadband Service Competition: Laws in 19 states — some specifically written by special interests trying to stifle new competitors — have held back broadband access and, with it, economic opportunity. As a first step, the Administration is filing a letter with the Federal Communications Commission (FCC) urging it to address barriers inhibiting local communities from responding to the broadband needs of their citizens. Aimed at municipal networks.

- Expanding the National Movement of Local Leaders for Better Broadband: As of today, 50 cities representing over 20 million Americans have joined the Next Century Cities coalition, a nonpartisan network pledging to bring fast, community-supported broadband to their towns and cities. They join 37 research universities around the country that formed the Gig.U partnership to bring fast broadband to communities around their campuses. To recognize these remarkable individuals and the partnerships they have built, in June 2015 the White House will host a Community Broadband Summit of mayors and county commissioners from around the nation who are joining this movement for broadband solutions and economic revitalization.

- Announcing a New Initiative to Support Community Broadband Projects: To advance this important work, the Department of Commerce is launching a new initiative, BroadbandUSA, to promote broadband deployment and adoption. BroadbandUSA will offer online and in-person technical assistance to communities; host a series of regional workshops around the country; and publish guides and tools that provide communities with proven solutions to address problems in broadband infrastructure planning, financing, construction, and operations across many types of business models.

- Unveiling New Grant and Loan Opportunities for Rural Providers: The Department of Agriculture is accepting applications to its Community Connect broadband grant program and will reopen a revamped broadband loan program, which offers financing to eligible rural carriers that invest in bringing high-speed broadband to unserved and underserved rural areas.

- Removing Regulatory Barriers and Improving Investment Incentives: The President is calling for the Federal Government to remove all unnecessary regulatory and policy barriers to broadband build-out and competition, and is establishing a new Broadband Opportunity Council of over a dozen government agencies with the singular goal of speeding up broadband deployment and promoting adoption for our citizens. The Council

will also solicit public comment on unnecessary regulatory barriers and opportunities to promote greater coordination with the aim of addressing those within its scope. http://www.whitehouse.gov/the-press-office/2015/01/13/fact-sheet-broadband-works-promoting-competition-local-choice-next-gener

FCC seeks to expand rural broadband access
The FCC has established rules for allocating over $2 Billion in Connect America Fund Phase II Support through competitive bidding. It plans to use an auction that will harness market forces to expand broadband in targeted rural areas. The auction seeks to expand service to census blocks unserved by broadband delivering speeds of 10 Mbps downloads/1 Mbps uploads in 20 states where the price cap carriers declined last year's Connect America Fund offer. Also included in the auction are locations across the country with extremely high deployment costs. Office of Media Relations: (202) 418-0500 www.fcc.gov/office-media-relations

Broadband Opportunity Council
On March 23, 2015 a Presidential Memo on *Expanding Broadband Deployment and Adoption by Addressing Regulatory Barriers and Encouraging Investment and Training* was issued. The memo established the Broadband Opportunity Council (BOC) to be chaired by the Rural Utilities Service (RUS) and the National Telecommunications and Information Administration (NTIA). All Executive Branch Departments and Agencies are members of the Council. The Council was given the charge to consider steps that Federal Departments and Agencies can take to help promote broadband deployment, adoption and competition.

The President's Broadband Opportunity Council issued a report on September 21st with its recommendations to increase broadband deployment, competition and adoption through executive actions within the scope of existing Agency programs, missions and budgets.

The Broadband Opportunity Council presented four overarching recommendations:
- Modernize Federal programs to expand program support for broadband investments.

- Empower communities with tools and resources to attract broadband investment and promote meaningful use (adoption and utilization for economic and community development)

- Promote increased broadband deployment and competition through expanded access to Federal assets (Lands and structures)

- Improve data collection, analysis and research on broadband.

The full report may be viewed at:
https://www.whitehouse.gov/sites/default/files/broadband_opportunity_council_report_final.pdf

Broadband USA Program
NTIA has launched its BroadbandUSA initiative to assist communities in securing the broadband capacity they need to advance economic development, education, health care, and public safety. http://www2.ntia.doc.gov/new_BroadbandUSA

HUD ConnectHome Program
ConnectHome is an initiative to extend affordable broadband access to families living in HUD-assisted housing. Through ConnectHome, Internet Service Providers, non-profits and the private sector will offer broadband access, technical training, digital literacy programs, and devices for residents in assisted housing units in 28 communities across the nation. HUD's ConnectHome initiative strives to ensure that students can access the same level of high-speed Internet at home that they possess in their classrooms. The President and HUD Secretary Julián Castro announced that HUD has selected the twenty-seven cities and one tribal nation to participate in ConnectHome program launch. None are in Oregon. For more information and a complete listing of private sector commitments for ConnectHome visit:
http://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2015/chomefactsheet

HUD focuses on broadband
On May 18, 2016, the U.S. Department of Housing and Urban Development (HUD) proposed two sets of rules that are targeted at closing the digital divide for low- and medium-income families. HUD proposed to require state and local governments to analyze and assess broadband access, adoption, and competition as part of their comprehensive consolidated public housing plans, which serve as the basis for funding many HUD programs, including the Community Development Block Grant program.

HUD has also proposed to require that all new public housing construction and substantial rehabilitation funded by HUD include the installation of high-speed broadband facilities (such as cabling and conduit).

These proposals could help bridge the digital divide faced by many households that benefit from HUD housing programs. This initiative could also benefit low- and middle-income neighborhoods generally, as the proposed change to the HUD planning process will include direct community engagement and an assessment of general community needs for digital inclusion. Public comment on these proposed rules is due July 18, 2016.
http://www.connectednation.org/sites/default/files/bb_pp/05242016_hud_broadband_rules.pdf

FCC Rural Broadband Experiments Program - Douglas FastNet is an awardee
Douglas Services (Douglas FastNet) in Roseburg has been provisionally selected by the FCC for rural broadband experiments funding. Douglas Services is one of twelve bidders selected nationwide and may receive $2,375,000 in funding under the program.
http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db0310/DA-15-288A1.pdf

FCC Connect America II funding
The Federal Communications Commission (FCC) announced that it is launching Phase II of the Connect America Fund by offering "carriers nearly $1.7 billion to expand and support broadband service in rural areas where market forces alone cannot support deployment." The program aims to expand broadband to over 8.5 million rural Americans. The carriers have four months to decide whether to accept the funding on a state-by-state basis. CenturyLink has a subsidy offer of $514.3 million and Frontier Communications has a subsidy offer of $283.4 million.
http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db0429/DA-15-509A1.pdf

OBAC maintains an inventory of broadband related federal funding programs and contacts which is posted on the Council website at www.broadband-oregon.org.

Smart Cities / Internet of Things national campaign
The White House also announced a national campaign to boost the research, development and deployment of systems to support smart cities and the Internet of Things. The National Science Foundation and National Institute of Standards and Technology are contributing $45 million; a group of five federal departments and agencies are adding another $115 million; 20 cities are partnering with local higher education institutions; and a cornucopia of organizations are issuing challenges and conducting their own, smaller projects to support the larger campaign.
http://www.govtech.com/fs/Obama-Places-160-Million-Bet-on-Smart-Cities-Internet-of-Things.html / https://www.whitehouse.gov/the-press-office/2015/09/14/fact-sheet-administration-announces-new-smart-cities-initiative-help

Lifeline Universal Service Program
In March 2016, the FCC voted to expand its Lifeline program which currently subsidizes voice telephone service for low-income households, to also subsidize the cost of broadband service for low-income households. The Lifeline program is available to eligible low-income consumers in every state, territory, commonwealth, and on Tribal lands. The expansion to broadband will make the Lifeline program the largest federal broadband adoption program in history. The FCC established an annual budget for the Lifeline program at $2.25 billion per year. Today, over 10% of American households (12.9 million) participate in the program for discounted dial tone or mobile voice service. https://www.fcc.gov/general/lifeline-program-low-income-consumers

Tier 1 Peering
The Internet is not one single network but instead thousands of separate networks that must interconnect. These interconnections happen primarily in these key buildings in the United States:

- The Westin Building   2001 6th Ave, Seattle
- Equinix SV1   11 Great Oaks Boulevard, San Jose
- One Wilshire   624 S Grand Ave, Los Angeles
- The InfoMart   1950 N Stemmons Fwy, Dallas
- Equinix Chicago   350 East Cermak, Chicago

- Telx Atlanta   56 Marietta St, Atlanta
- NAP of the Americas   50 NE 9th St, Miami
- Equinix Ashburn   21715 Filigree Ct, Ashburn
- 111 Eighth Avenue   111 8th Ave, New York

Peering is the interconnection of separate IP networks for the purpose of exchanging traffic between the networks. According to Wikipedia, "a network that can reach every other network on the Internet without purchasing IP transit or paying settlements" is a Tier 1 provider, so a Tier 1 network is a "transit-free" network that peers with every other Tier-1 network. They do not pay a third party for a network connection to any other network. Examples include AT&T, Cogent Communications, CenturyLink, Deutsche Telekom, NTT, Tata, Sprint, Zayo, Verizon, Level 3, Telefonica, and Telia.

Currently, there is no Tier 1 peering in Oregon. There is, however, a growing peering exchange that provides public peering exchange services to about 80 member networks. The Northwest Access Exchange (NWAX) is a 501(c)(6) non-profit corporation www.nwax.net. NWAX was created in 2001 and operated by Oregon Health and Science University, Portland State University, and the Oregon Graduate Center. It transitioned to an independent non-profit January 1, 2014 and was modeled after the very successful Seattle Internet Exchange (SIX). Its operations are supported by a volunteer board, officers, engineers and technicians. NWAX is growing (36 members in 2013 to 80 members today). Its service capacity is also growing and now delivers 60 Gbps peak traffic nightly up from four in July 2013 with 7x sites up from one in July 2013. NWAX is currently the 14th largest Internet exchange in the U.S.

If Oregon can raise its position on this hierarchy, there are potential economic development benefits. The next two years will be critical in determining Oregon's future position in the Internet hierarchy, and Oregon has some valuable assets that may be leveraged to improve its position and pursue Tier 1 peering within the state including:
- "Long Haul" Fiber routes
  - Portland North to Seattle
  - Portland South to San Jose and Los Angeles
  - Portland to points East is more limited, but routes are available
- Undersea fiber cables
  - This is a key differentiator (especially with focus on the Pacific Rim)
  - Cable landing stations
  - Hillsboro Datacenter Fiber Ring to undersea cables
- Established Carrier Hotels
- Major Datacenters
  - Amazon, Google, Facebook, Apple
- Wholesale Datacenters
  - InfoMart, ViaWest, Telx/Digital Realty Trust, EdgeConneX, T5 Datacenters, Adobe
- NWAX
  - Seven locations linking Portland and Hillsboro
  - Carrier neutral

Netflix Servers are now located in Oregon

Netflix is now serving content over NWAX from servers in the Portland metro area. Previously, their connection to NWAX was via backhaul to their Seattle POP. According to NWAX president Eric Rosenberry, this is significant in a number of ways:

- Serving content locally reduces the dependency of the region on Seattle
- Many regional NWAX member networks are dual homed to both Portland and Seattle. With Netflix having independent content POP's in both cities, dual homed networks are more reliable
- This investment on Netflix's part exemplifies the growing network ecosystem in Oregon

In other NWAX news, Yahoo has joined as a member.

What Oregon can do to improve its position

- Evangelism with existing ecosystem players and prospects
- Include network requirements when giving economic development incentives
- Add the requirement to exchange traffic locally

The Council will continue to explore strategies regarding this opportunity with the telecommunications carrier and data center community.

Concluding Remarks

OBAC believes that access to competitive high-speed IP telecommunication networks and the Internet is becoming essential for Oregon's institutions, businesses and individual citizens. And that action is required to ensure that our state's and our nation's broadband needs are met and that broadband benefits are realized.

OBAC submitted a set of national public policy recommendations to the Federal Broadband Opportunity Council, and believes that those recommendations may also, and should be, applied to state and local public policy.

- Mandate that state government agencies incorporate broadband into their planning efforts.

- Create a "fast-track" approval process for rights-of-way access and co-use of existing facilities on state lands for broadband infrastructure.

- Encourage state, local and tribal governments to incorporate broadband into local planning efforts for community and economic development.

- Encourage state, local and tribal governments to proactively plan for the migration to the next generation of public safety broadband communications.

- Utilize the Oregon Universal Service Fund to help bring high-speed broadband infrastructure to all areas of the state.

- Promote the development of local and statewide strategies to increase and accelerate the adoption and utilization of broadband.

- Support efforts at the state level to standardize the process for physician credentialing to provide telehealth services and provide reimbursement for appropriate health care services delivered via telecommunications.

- Promote access for educators and students and to reliable and robust broadband connectivity in both the school *and at home*.

- Promote ongoing professional development for educators to ensure effective quality implementation and utilization of broadband technology and practice in the classroom

- Support Oregon applicants in the application process for broadband related federal funding programs so that eligible applicants may fully utilize and leverage those programs to help meet Oregon's broadband needs

- Promote cyber-security of broadband communications systems to mitigate the growing challenge and significant risk exposure facing institutions, businesses and individuals

- Establish performance metrics for the deployment and utilization of broadband

Oregon has recognized and has been working on telecommunications as essential infrastructure as a matter of public policy for over twenty-five years through a series of task forces, committees, commissions, and councils. The state has benefitted from its long standing deliberations and has codified broadband public policy in statute and resolution. This discussion, these efforts, and the continuing formulation of proactive broadband public policy are more important today than ever before.

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 proposes 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.

Many different technologies are employed to deliver broadband services in Oregon including Digital Subscriber Line (DSL), Cable-Modem, wireless (mobile 3G / 4G, fixed, satellite), and optic fiber to the premises (FTTP). These service technologies range in transmission performance from 200 Kbps up to 1 billion bits 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 Members – 2016

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 citizens 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.

<u>Council Members</u>
Stephen Bloom
Commissioner
Public Utility Commission of Oregon

Anne Carloss
Director of Special Education
Hood River County School District

Brian Clem
Representative
Oregon House of Representatives

Miles Ellenby
Associate Professor of Pediatric Critical Care Medicine
Medical Director, Telemedicine Program
Doernbecher Children's Hospital / Oregon Health and Science University

Ted Ferrioli
Senator
Oregon State Senate

Joseph Franell **(Council Chair)**
General Manager and CEO
Eastern Oregon Telecom

Mary Beth Henry **(Council Vice-Chair)** through June 30, 2016
Deputy Director, Office for Community Technology
City of Portland / Mt. Hood Cable Regulatory Commission

Wade Holmes
Vice President of Technology
BendBroadband

Lonny Macy
Community and Economic Development Planner
Confederated Tribes of Warm Springs

Julie Pearson (retired 2016)
IT Governance Lead
Oregon Department of Administrative Services

Dave Sabala
Douglas Electric Cooperative, Economic Development

Michael Smith
Commissioner
Sherman County

Michael Weidman
President and CEO
LS Networks, Inc.

Tom Worthy
Major
Oregon State Police

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 C
Oregon Broadband Advisory Council Activity Summary 2010-2016

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 citizens and communities. The council members represent Oregon's cities, counties, telecommunication 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. As of November 1, 2016, the Council has convened sixty-eight times 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 and 2016. It also produced the *Gas & Electric Utilities Broadband Deployment Report* in 2012 and *Broadband Outreach Survey Report* in 2014.

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 (through October 19)
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

OBAC meeting attendees have represented:

Allion USA
Ashland Home Net
Association of Oregon Counties
AT&T
AT&T Wireless
Azimuth Communications
BendBroadband
BroadMap
Central Lane 911
CenturyLink
CenturyTel
Charter Communications
Citizens' Utility Board
City of Eugene
City of Independence
City of Portland
City of Sandy
City of Springfield
CJSpeaks / Gigabit Nation
Clackamas Community College
Clackamas County 911 Center
Comcast
Compli
ComSpan USA
Comstructure Consulting
Converge Communications
Dale Hines Consulting
DAS-CIO-Economic Recovery Exec. Team
Davis, Hibbits & Midghall, Inc.
Day Wireless
Douglas Electric Cooperative
Douglas FastNet
EasyStreet Online Services
Education Super Highway
Electric Lightwave
EZ Wireless
Fibersphere
FirstNet
Fortune Data Centers
Freewire Broadband
Frontier Communications
Gigabit Nation
Gorge Technology Alliance

Greenwire Broadband
Hermiston School District
High Desert ESD
Hood River County School District
Hunter Fiber
iLinc
Individual citizens representing themselves
Info@Risk, Inc.
Integra Telecom
Intel
Intermountain ESD
IRZ Consulting
J. Irwin Consulting
Keenwire
Lake County
Lane Community College / Oregon Small
    Business Development Center Network
Lane Council of Governments
League of Oregon Cities
LS Networks
MiddleGate
MINET
Motorola
Northwest Access Exchange (NWAX)
OCHIN
Level(3) Communications
Mt. Hood Cable Regulatory Commission &
Office for Community Technology
Multnomah ESD
Education Super Highway
Federal Bureau of Investigation (FBI)
Federal Communications Commission
Federal Emergency Management Agency
    (FEMA)
Frontier Communications
Gigabit Nation
Innovate Oregon
NetCity, Inc.,
NWAX
Office of the Oregon Attorney General
Opinion Research Corporation
ORC International

Oregon Cable Telecommunications Association
Oregon Connections Academy
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 Governor's Office
Oregon Health Information Technology Oversight Council
Oregon Health and Science University
Oregon Health Network
Oregon Legislative Assembly
Oregon Legislative Fiscal Office
Oregon Office of Emergency Management
Oregon Office of Rural Health
Oregon Public Utility Commission
Oregon Department of Administrative Services
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 State Library
Oregon State Police
Oregon Telecommunications Association
Oregon University System
One-Economy Corporation

OnlineNW
OnSmart Technologies
Opinion Research Corporation
PACE Engineers
Pivot Group, LLC
Port of Portland
Portland General Electric
Portland Metro STEM Partnership
Portland Public Schools
Portland State University
Project A
Providence Health & Services
Qwest
SAIC / Leidos
Salem-Keizer Public Schools
Schools, Health and Libraries Broadband Coalition (SHLB)
Sherman County
SNGroup.com
State Educational Technology Directors Association
State of Washington
Strategic Networks Group
Telehealth Alliance of Oregon
TRACER
U.S. Department of Agriculture Rural Development
Verizon
Verizon Wireless
Washington Department of Commerce Broadband Office
Wave Broadband
Welcome Home Health, Inc.
Western Independent Networks (WIN)
WiFi Now Networks
Willamette ESD

Broadband Communications Following a Cascadia Subduction Zone Event

Cascadia Rising
The focus on communications during Cascadia Rising was on backup modes of communications when primary modes were unavailable. Although there was some discussion on restoration of primary services, it focused more on time frames when services may be restored in different areas of the state, and not on the process of restoring services.

Cascadia Rising Scenario
The Cascadia Rising scenario document was created by Western Washington University and contains estimates of earthquake impacts using loss estimation modeling software based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique, so damages from an actual event may differ from those represented in the scenario document.

Communications Systems
Definition: Communication systems consist of central offices and broadcasting stations, transmission lines connecting central offices, and cabling. A communication facility consists of a building, unanchored or anchored central switching equipment, and backup fuel or battery generators.

In the immediate aftermath of the earthquake, all forms of communication may be disrupted – at a time when they are needed most. Survivors and responders may have limited access to internet, cell phone, landline phone, and television services due to the combination of communication and power disruptions.

Intergovernmental communication capabilities may be significantly degraded, which may limit their ability to coordinate. Responders may be unable to collect information and provide situational awareness, which may delay the delivery of lifesaving and life-sustaining assistance. Survivors may have limited access to news, social media, and other informational outlets that could help them determine what to do and where to go. Rumors may fill the void created by the absence of traditional information channels.

There are over a thousand telecommunications facilities in the impacted area of Washington and Oregon. Roughly two-thirds of these facilities may suffer medium to high damage from the initial earthquake. The shaking may rattle equipment off of cell towers, dislodge central control boards and damage central communications offices. Communication facilities that suffer no or low damage may also be un-operational due to antennae being thrown out of alignment or the breaking of cables connecting these facilities.

In areas experiencing power outages, communications facilities may be forced to operate on backup generators. However, these backup power systems typically last for only eight to twelve hours. Refueling these systems may be a challenge; damaged roadways may make it difficult for

crews to reach communications towers. Personnel shortages may also limit the number of teams sent out to repair facilities. As facilities running on backup power begin to go offline, communications may further deteriorate. The accumulation of numerous points of failure may result in widespread failure far beyond the impacted area.

Long-haul Fibers and Cables
Underground landslides and the shifting of the ocean floor may sever undersea cables that traverse the offshore regions of the Cascadia Subduction Zone. The remaining cable systems on the northern transpacific routes landing in Puget Sound and the Oregon coast may see some disruptions, but the southern routes through California may remain functional.
With the loss of undersea cable capacity, communications systems may face abnormally high congestion. While alternative routes using satellite microwave communications may exist, the bandwidth is limited. The restoration of these cables may take several months.
On land, regional long-haul fiber optic cables may be severed by landslides or the collapse of the bridges they span, which may cause regional and nationwide delays in internet and long-distance services as the network attempts to reroute around the impacted area.

Oregon Communications Systems
The majority of communications infrastructure on the coast may be severely damaged and inaccessible for repair. Facilities along the immediate coastline will likely be destroyed by the force of the tsunami wave. Communications in these areas may be limited to radio frequency and satellite phones.

Most of the communication facilities in eastern Oregon may suffer less physical damage from the earthquake. However, the lower availability of power may limit the capability of these facilities to provide service.

Area of Operation	Damage State			
	None	Low	Medium	High
Coastal	0%	0%	18%	82%
I-5 corridor	8%	15%	58%	19%
East	98%	0%	0%	2%
Summary of damage description	No damage to facility building or equipment. Antennae misalignment may temporarily disrupt service.	Slight damage to the communication facility building, or loss of the center's ability to provide services for up to a few days due to loss of electric power and backup power. The facility may be functional with minor repairs.	Moderate to severe damage to communication facility buildings, many digital switching boards dislodged, resulting in malfunction. The central office may be without service for a few days due to loss of electric power or loss of backup power, typically due to overload.	Severe to complete damage to the communication facility building, with most switching boards dislodged, resulting in malfunction. The damage to digital switching boards may beyond repair.

Backup Communications

When primary communication modes, (phone, internet, primary radio systems) are down, emergency services rely heavily on backup modes, such as Amateur Radio voice & data modes, Satellite phones, and portable repeaters, all of which have limitations. Amateur Radio lacks the bandwidth (throughput) required for the large amount of traffic that is expected after a catastrophic event, due to current FCC restrictions, and may also not have the needed volunteers following an event. Handheld satellite phones require the user to be outdoors and still offer spotty coverage. Other satellite voice and data systems that offer better service can be cost prohibitive to most agencies. Portable repeaters used to connect first responders need to be transported to areas they are needed and require fuel to run their generators. All of which require a viable transportation network to get them to where they are needed. Many agencies will utilize the GETS/WPS (Government Emergency Telecommunications Service/Wireless Priority Service) capability when basic initial services are restored. And state responders may request restoration or temporary assistance through the TSP (Telecommunications Service Priority) program to receive priority treatment for vital voice and data circuits or other telecommunications services.

Conclusion

All modes of communications in the coastal regions will be severely damaged. Telephone and broadband may be non-operational for months or even years due to lack of access to repair systems. Some radio systems may still be usable but will lack long range connectivity due to broken landline services and misaligned microwave systems. Lack of local personnel to repair systems may be extremely limited due to the effects of the event. Access to mountaintop repeaters may not be possible for some time due to changes in topography and possible weather events, depending on what time of year the Cascadia event takes place. Repair and alignment of services will require a large personnel force from outside the affected area and viable transportation routes to get into affected areas.

Although our backup communications capabilities should survive the event, there will still be personnel shortages for operating the equipment as well as a shortage of equipment needed to respond to a region-wide event. Bandwidth limitations of our backup modes will also extremely hamper the amount of information needed to be transmitted during a large scale event.

Appendix E

Legislative Concept 904
DRAFT
2017 Regular Session

Summary

Declares policy of State of Oregon concerning cybersecurity risks and need for proactive cybersecurity risk management.

CONCURRENT RESOLUTION

Whereas the Legislative Assembly has declared that it is the goal of the State of Oregon to promote access to broadband services for all Oregonians in order to improve the economy in Oregon; and

Whereas the Legislative Assembly has declared that it is the policy of the State of Oregon to promote, facilitate, and encourage activities, projects, and businesses that improve Oregon's Internet Protocol (IP) network infrastructure, performance, and connectivity to the Internet backbone network and World Wide Web for the benefit of Oregon's commercial, educational, governmental, and individual users; and

Whereas the Legislative Assembly has declared that the Internet and Internet Protocol (IP) networks serve as infrastructure necessary for the conduct of commerce and communication, and also necessary to establish and maintain Oregon's global competitiveness; and

Whereas, there is a growing threat and risk of the theft of data and personal identity through cyber attack, now, therefore,

Be It Resolved by the Legislative Assembly of the State of Oregon:

That we, the members of the Seventy-ninth Legislative Assembly, declare that it is the policy of the State of Oregon to promote, facilitate, and encourage activities, initiatives, projects, and businesses that improve the security of data and electronic communications, and to increase the awareness of cyber-security risks and the need for proactive cybersecurity risk management for the benefit of Oregon's commercial, educational, governmental, and individual users.

References

BroadbandUSA: National Telecommunications and Information Administration (NTIA) broadband portal. http://www2.ntia.doc.gov

Oregon Broadband Advisory Council website. www.broadband-oregon.org

Oregon Broadband Mapping Project website. www.broadband.oregon.org

Oregon Broadband Outreach and Strategic Planning Project website. www.oregonbroadbandplanning.org

The Digital Divide is Closing, Even as New Fissures Surface, by Giulia McHenry, Edward Carlson, Maureen Lewis, Rafi M. Goldberg of the National Telecommunications and Information Administration and Justin Goss and Celeste Chen of Georgetown University, An NTIA Working Paper Last Revised: September 27, 2016. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2757328

Trust in Internet Privacy and Security and Online Activity, by Rafi M. Goldberg, Giulia McHenry and Luise. Zambrano Ramos of the National Telecommunications and Information Administration, and Celeste Chen of Georgetown University, September 27, 2016. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2757369

The Broadband Imperative II: Equitable Access for Learning, by principal authors Christine Fox and Rachel Jones of SETDA, September 8, 2016. http://www.setda.org/wp-content/uploads/2016/09/SETDA-Broadband-ImperativeII-Full-Document-Sept-8-2016.pdf

The Broadband Imperative II: Equitable Access for Learning by Christine Fox and Rachel Jones, State Educational Technology Directors Association, September 2016. http://www.setda.org/wp-content/uploads/2016/09/SETDA-Broadband-ImperativeII-Full-Document-Sept-8-2016.pdf

The State of Broadband: Broadband catalyzing sustainable development, by Broadband Commission for Sustainable Development, International Telecommunications Union, September 2016. http://broadbandcommission.org/Documents/reports/bb-annualreport2016.pdf

Survey on Fifty States Broadband Programs, by National Association of Regulatory Utility Commissioners, Submitted to the Federal Communications Commission September 16, 2016.

Akamai's [state of the internet] Q1 and Q2 Reports, by Akamai Technologies, Inc., 2016 www.akamai.com/stateoftheinternet
Full Report: https://www.akamai.com/us/en/multimedia/documents/state-of-the-internet/akamai-state-of-the-internet-connectivity-report-q2-2016.pdf?mkt_tok=eyJpIjoiWVddObE9XTXdPVFJoWVRrMCIsInQiOiJyNitYbW9rQ1BxVWJF

OUxVYzY0ZngzQTFFSElZSzMxdVBpTnJRM2FGVzBWZUhwaEprN0lSbjBRQWF4WS9QM
2IyanNRU013cUtSRFdXSmdiN1F5TG9ZQ3hjR0NwU0U0NFVKeTdseUw4L0lsVT0ifQ%3D
%3D

The Fifty States of Broadband: A State-by-State Study on the State of Broadband Investment and Activity in Each American State by the Rural Telecommunications Congress and Strategic Networks Group, April 2016. http://sngroup.com/50states/

The Economic Impact of Rural Broadband, by Hanns Kuttner, Hudson Institute, April 2016. http://hudson.org/research/12428-the-economic-impact-of-rural-broadband

The Digital Divide and Economic Benefits of Broadband Access, Council of Economic Advisors Issue Brief, March 2016. https://www.whitehouse.gov/sites/default/files/page/files/20160308_broadband_cea_issue_brief. pdf

2016 Cascadia Rising Earthquake Exercise Plan, by Eric Holdeman, January 22, 2016. http://www.emergencymgmt.com/emergency-blogs/disaster-zone/2016-cascadia-rising-earthquake-exercise-plan.html

2016 Broadband Progress Report, by the Federal Communications Commission, January 28, 2016. https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-6A1.pdf

Community-Based Broadband Solutions: *the benefits of competition and choice for community development and high speed Internet access*, by the Executive Office of the President, January 2015. http://www.whitehouse.gov/sites/default/files/docs/community-based_broadband_report_by_executive_office_of_the_president.pdf

BroadbandUSA: An introduction to effective public-private partnerships for broadband investments, by the National Telecommunications and Information Administration, January 2015. http://www2.ntia.doc.gov/files/ntia_ppp_010515.pdf

Internet Use in 2015 - NTIA Report
https://www.ntia.doc.gov/blog/2016/first-look-internet-use-2015

Cyber Security Threats: vulnerabilities of the "physical" Internet.
http://www.nytimes.com/2015/11/08/sunday-review/the-cyberthreat-under-the-street.html?_r=0

Broadband Opportunity Council Report and Recommendations, August 20, 2015
https://www.whitehouse.gov/sites/default/files/broadband_opportunity_council_report_final.pdf

BroadbandUSA: Guide to Federal Funding of Broadband Projects, National Telecommunications and Information Administration (NTIA), September 2015. http://www2.ntia.doc.gov/files/broadband_fed_funding_guide.pdf .

Acknowledgements