Oregon Broadband Middle-Mile Infrastructure Planning Group

Report and Recommendations

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Actionable Recommendations

In May 2021, at the request of Rep. Pam Marsh, together with Sen. Lee Beyer and Rep. Mark Owens, an *ad hoc* committee of fifteen Oregon broadband leaders with expertise in network technologies and business models was convened as the Oregon Broadband Middle-Mile Infrastructure Planning Group. We identified two fundamental goals for Oregon's upcoming broadband investments. The first is assuring the delivery of robust broadband services to all Oregonians. The second objective is attaining broadband availability in currently underserved communities with network speeds and consumer pricing on par with Oregon's largest cities. In this process, we incorporated many key learnings from the pandemic around the societal importance of broadband and remaining gaps in service delivery and adoption.

This executive summary presents our most immediately actionable recommendations (the order of presentation is thematic and does not convey item prioritization by the planning group).

1. **Ensure a robust, capable state broadband office:** The Oregon Broadband Office (OBO) needs sufficient personnel and robust external partnerships to achieve its mission, to assess the overall need, to track federal programs and initiatives in other states, to review community proposals, and to allocate and oversee State administered broadband funding. Due to the nature of the underlying technologies and consumer requirements, broadband networks evolve much more quickly than other public infrastructures – such as highway, electric power, and water systems. Leveraging the guidance of the Oregon Broadband Advisory Council (OBAC) and other groups, the OBO will need to keep pace.

2. **Establish a 'future-proof' residential bandwidth standard:** We recommend that Oregon move beyond the current FCC standard (25 Mbps down, 3 Mbps up) to the level of 100 Mbps symmetrical (that is, both up and down). This threshold should support changes in use patterns with the inevitable evolution of technology in the foreseeable future.

3. **Accelerate Oregon's broadband mapping:** The State should track the status of last-mile broadband speeds statewide. This would entail a rich repository of accurate, longitudinal broadband data sets, including the state of built infrastructure, consumer affordability, and digital literacy and equity considerations. The data repository should utilize both provider reported and end user (crowdsourced) data. This Oregon-led effort should be integrated with concurrent national mapping efforts. Due to their distinct organizational requirements, connectivity levels for businesses and community anchor institutions (including the Tribes) should be tracked separately from residential data.

4. **Establish a central repository of middle-mile network infrastructure maps:** The OBO should establish and maintain a limited-access repository of middle-mile fiber route information to assess community access and resiliency as well as the anticipated asset performance and lifetime. Any recipient of public broadband funding should be obligated to submit as-built data from funded middle-mile builds and associated infrastructure to the repository. All Oregon middle-mile providers should be encouraged to contribute additional middle-mile infrastructure information under standard, data-protecting terms.

5. **Cultivate a richer array of local Internet exchanges statewide:** The State should encourage and potentially help fund the development of additional exchanges in

southern and eastern Oregon to provide the performance, resiliency, and cost-effectiveness benefits of local traffic exchange to citizens in these regions. These exchanges should be provisioned in hardened facilities (i.e., secure, backup power) open to all providers and with sufficient space for content distribution and other caching servers to reduce middle-mile network load into smaller communities.

6. **Develop and evolve effective strategies for making public broadband investments:** We endorse the approach of competitive, community-based broadband grant programs at the outset for accelerating improvement in the most cost effective, timely manner. However, a wide disparity exists in the overall readiness of counties and regions to compete in state and federal funding programs. To address this gap, the OBO should prioritize the development of the statewide broadband mapping program. In addition, the OBO will need to develop a plan for supporting chronically underserved areas and may need to provide other forms of assistance, such as engineering and grant writing.

7. **Apply some broadband funding to develop needed middle-mile network extensions:** The planning group identified at least 37 Oregon communities without robust middle-mile connectivity to support the delivery of last-mile broadband services. Especially if a community's non-redundant connection is an aerial installation in a setting with either wildfire or geotechnical risk, the lack of middle-mile resiliency places the entire community at peril of losing its external connectivity at a time of heightened danger. Collaboration with the Tribes to ensure their resilient middle-mile connectivity is critical.

8. **Ensure future growth and equitable access for publicly funded network assets:** Infrastructure substantially capitalized through public funding should be provisioned to provide sufficient capacity for network growth and expansion over time. State funding awards should assure the ongoing right of qualified providers to access unused capacity within these publicly funded assets under commercially reasonable terms.

9. **Recognize the roles of State and local governments as important stakeholders in broadband deployment:** Processes for accessing ODOT, other State, and local rights-of-way for fiber builds as well as associated construction permitting processes should be streamlined and coordinated wherever possible. The OBO should work with communities to spur the adoption of uniform franchise agreements and rights-of-way ordinances.

10. **Take a 'whole of government' approach to solving the broadband problem:** We recommend that the State form a limited-term, action-oriented interagency task force, led by the OBO, to support fast-tracked broadband deployment, to eliminate roadblocks, to minimize other delays, and to maximize access to federal funding opportunities.

11. **Consider the full spectrum of technologies needed to connect all Oregonians:** While we endorse fiber-based connectivity as the most 'future-proof', last-mile investment, some Oregonians living in very rural and frontier settings still fall beyond the cost-effective reach of fiber, even during a time of unprecedented public capitalization. The OBO should work to assure the integration of high-speed fixed wireless and low Earth orbit satellite (LEOS) technologies as critical components of the broadband ecosystem.

12. **Recognize that broadband adoption is not just a technical issue:** For a successful outcome, state broadband planning must fully consider the significant human and socioeconomic factors – beyond the necessary details of technology deployment – such as service and device affordability, digital literacy, and digital equity and inclusion efforts.

Introduction

In the spring and early summer of 2021, at the request of Rep. Pam Marsh, working in conjunction with Sen. Lee Beyer and Rep. Mark Owens, an *ad hoc* committee of Oregon broadband leaders with expertise in network technologies and business models was convened as the Oregon Broadband Middle-Mile Infrastructure Planning Group. These fifteen individuals were charged to assess the status of middle-mile network infrastructure and associated economic considerations in Oregon and to make recommendations initially to both the interested set of legislators and the Oregon Broadband Office (OBO). Stuart Taubman of Zayo and Steve Corbató of Link Oregon served as co-chairs for the planning group (the full membership list is presented in Appendix I). Link Oregon supported this effort through an active email list and a weekly series of well-attended virtual meetings with engaged discussion.

Rep. Marsh provided the following early problem statement for the group on April 22:

> *Attaining digital equity for all Oregonians is about more than availability. Cost differentials caused by population density variations impact construction costs and length of a return on investment. More fundamental than that though are the huge disparities in cost of data transport from communities across the State back to the nearest Internet Exchange. Those costs can vary by a factor of 20X or more depending on distance and competition amongst transport providers. This situation makes it almost impossible for citizens of, and communities around our State to realize the same opportunity that affordable broadband access provides. We must find a solution to this issue if Oregon is going to realize its full potential.*

At this moment, both the State of Oregon and the federal government are poised to make significant capital investments to address persistent deficiencies in broadband deployments across both rural and urban areas and to close concurrently limiting gaps in digital equity and literacy. When all current and anticipated funding sources are considered, the aggregate investment could exceed $1 billion in Oregon. *In particular, the currently envisioned federal bipartisan infrastructure compromise sets aside $40 billion in broadband funding for direct allocation to the States, so Oregon can expect at least $500 million through this channel.* The planning group considers this period to be a truly unique opportunity ("once in a career") with a significant sense of urgency given the federal spending timelines[1]. With the likely time-limited national focus on this challenge, mapping and design work will need to progress expeditiously, and funding decisions will need to be made both strategically and carefully. This sea change in the public investment environment for broadband provided a significant context for the planning group's discussions and recommendations.

Much of the current focus on broadband improvement rightfully emphasizes the delivery of capable last-mile connections supporting Oregon residences and businesses. However, the

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[1] The non-profit broadband advocacy group Connected Nation is carefully tracking relevant federal programs and posting updates at this web site: https://connectednation.org/current-broadband-funding

planning group believes that as a critical component of enhancing the broadband ecosystem, the viability of robust middle-mile connectivity supporting broadband service delivery over the last mile also should be assessed. Where gaps exist, they should be considered for investment through the existing and emerging funding programs. Especially if a non-redundant connection is an aerial installation in a setting with wildfire risk, close to a highway, or on a geotechnically vulnerable route, the lack of middle-mile redundancy places an entire community at risk of losing its broadband connectivity at a time of heightened danger. In the box below, we highlight Oregon communities that the planning group has identified as lacking sufficient or resilient middle-mile connectivity. While much of Oregon has future-proof middle-mile connectivity, it is communities such as these that may well merit additional extended *middle-mile investments*.

These Oregon communities still lack resilient middle-mile connectivity

Through the planning group's discussions and working knowledge of fiber infrastructure across the state, a set of Oregon communities still lacking resilient middle-mile connectivity was identified. While this list should not be considered authoritative or complete, its scale does highlight the need for better integrated mapping of middle-mile assets across Oregon and continued investment in extending middle-mile connectivity to smaller communities.

Notably, as of this writing, the nation's largest active wildfire, the Bootleg Fire in Klamath and Lake Counties, has threatened a *non-redundant, mostly aerial-fiber deployment ~100 miles in length* that is the Internet lifeline for Lakeview, Bly, Plush, Adel, and other communities.

- **Adel** (Lake County)
- **Antelope** (Wasco County)
- **Ashwood** (Jefferson County)
- **Beatty** (Klamath County)
- **Bly** (Klamath County)
- **Christmas** Valley (Lake County)
- **Clarno** (Wasco County)
- **Condon** (Gilliam County)
- **Crescent Lake Jct**. (Klamath County)
- **Elkton** (Douglas County)
- **Elsie** (Clatsop County)
- **Enterprise** (Wallowa County)
- **Fossil** (Wheeler County)
- **Granite** (Grant County)
- **Imnaha** (Wallowa County)
- **Jewell** (Clatsop County)
- **Joseph** (Wallowa County)
- **Kimberly** (Grant County)
- **Lakeview** (Lake County)
- **McKenzie Bridge** (Lane County)
- **Mist** (Columbia County)
- **Mitchell** (Wheeler County)
- **Monument** (Grant County)
- **Paisley** (Lake County)
- **Pine Hollow** (Wasco County)
- **Plush** (Lake County)
- **Seneca** (Grant County)
- **Shady Cove** (Jackson County)
- **Shaniko** (Wasco County)
- **Sprague River** (Klamath County)
- **Spray** (Wheeler County)
- **Sumpter** (Baker County)
- **Tygh Valley** (Wasco County)
- **Ukiah** (Umatilla County)
- **Unity** (Baker County)
- **Wallowa** (Wallowa County)
- **Wamic** (Wasco County)

Key Concepts and Definitions

Broadband Ecosystem – To achieve greater speeds, all parts of the downstream infrastructure must be capable of supporting the traffic; otherwise, speeds will be limited by the outdated or inadequate components.

Last Mile – The connection from the final provider service location (node) to the end user (consumer). Like any system, the end user's effective speed will be no greater than the bandwidth of this connection. Average last-mile construction costs vary depending on the build distance, population density, terrain, and competitive landscape.

Middle Mile – In general, these connections across the state tie together two or more provider nodes (or, in industry vernacular, *points of presence, or* POPs). At the operating level, this definition recognizes that standards are not universal and that it often is not cost effective to deliver access along the path at every possible point. Network planners must cost effectively support the primary goal of why the infrastructure is being installed. Over time, new nodes in communities and at end-user locations may be developed.

Access Points – These are locations along a middle-mile route where a network provider can allow access to distribute connectivity. Depending on the design and demand, access points may be separated by long distances. In addition, real estate limitations at the access point may restrict its use for broadband distribution.

Access Nodes – To leverage the middle-mile route between full nodes (or POPs), some smaller access nodes may be required to support distribution to smaller communities. The access nodes may exist as part of the middle-mile core or may be a separate location that connects to the middle mile to establish connectivity. Often, this access is contemplated after the middle mile network is in place. The chosen technologies should be adaptable and scalable since the distribution may require network planning considerations beyond the original design. The development of these nodes may add significant cost to a network deployment.

Edge Nodes – Locations which serve as common interconnection points between service providers and large enterprises to exchange traffic at the edge of a network. Under current best practices, these locations usually have one or more network switches to serve as an Internet Exchange, provide facilities for fiber interconnection, and also host servers for content caching.

Vision for a Connected Oregon

Our vision for long-term success in Oregon broadband includes the following principles:

1) **Broadband as an essential service**. It is important for high-speed Internet service to be affordable and reliable for all communities around Oregon. As the tenth largest state by area, Oregon needs to establish structures to support the extension of broadband in urban, rural, and frontier communities. To achieve this objective, private and public

entities must be supported by State policies that reduce return on investment barriers in smaller communities, particularly those that lack one or more foundational components to implement a broadband strategy.

2) **State Broadband Program**. The Federal Communications Commission (FCC) today defines bandwidth thresholds at the end-user premises of 25 Mbps download and 3 Mbps upload as the minimum standard for broadband nationally. Experience during the pandemic has taught us that this definition is not sufficient to support modern technology usage and requirements. Oregon should strive for higher standards than the FCC promotes where it is economically affordable with the infrastructure in place on which to build. Where the infrastructure is not in place today, Oregon needs targeted programs to build the infrastructure that will support these standards. The upcoming infrastructure investments by the federal government appear to prefer fiber at middle mile. This could take several years to achieve. Other last-mile technologies may achieve the necessary speeds at the premises, but the requisite middle-mile speeds can only be achieved on fiber.

3) **'Future-proof' Bandwidth Standard**[2]. We recommend that Oregon go beyond the current FCC standard to a level of 100 Mbps symmetrical (that is, both up and down). While this recommendation establishes a target, Oregon will need to enhance the broadband ecosystem with comprehensive long-term planning that allows private and public entities to build sufficient digital infrastructure to make universal, affordable, and reliable broadband feasible. Once achieved, the bandwidth throughput (already expected to be sustainable most of the time) should anticipate future growth and consider the evolution of technology capabilities. For example, our neighbors to the north in Washington State recently adopted a legislated objective of delivering 150 Mbps symmetrical to every home and business statewide by 2028.

4) **Growing and Adding Exchanges**. In some very populous areas like Portland and Salem, the delivered broadband speeds exceed the current FCC threshold by factors of ten times or greater. For example, Portland consumer providers support 1 Gbps speeds or greater. These concentrated population centers not only contribute to supporting residential end users, but also serve as central hubs/exchanges for other localities. Expanding Internet exchange capability throughout the state over time will reduce barriers to greater Internet speeds in the broadband ecosystem.

5) **Additional Edge Nodes**. These will assist with broadband affordability and reliability for smaller communities. The State's support of the establishment of edge POPs will reduce the need to backhaul all traffic to one location in the local community and deliver Internet service directly. (From this location, the community may still need to backhaul to common middle-mile locations, but it reduces the need). Such a middle-mile solution would require fiber to achieve the greatest long-term investment available today.

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[2] The long-time Internet advocacy group Electronic Frontier Foundation recently made the case for a symmetrical, high-speed bandwidth standard in this blog post:
https://www.eff.org/deeplinks/2021/07/future-symmetrical-high-speed-internet-speeds.

> ### *All middle-mile fiber is not the same!*
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> When evaluating a community's middle-mile fiber resiliency or assessing the need for additional public investment to construct a new route, we advise Oregon policy and decision makers to keep a set of interdependent considerations in mind. Existing fiber builds can be differentiated by the following criteria:
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> - Physical characteristics: fiber type, age, and estimated capacity (number of fiber pairs installed, maximum bandwidth per fiber pair)
> - Design considerations: placement (buried vs. aerial), path redundancy, network purpose (i.e., express vs. local – a highway analog is I-5 vs. 99W), spacing and location of access points
> - Resiliency factors: environmental risks (wildfire, geotechnical, inundation due to tsunami or flood), human risks (accident, vandalism)
> - Business considerations: availability of unused fiber pairs and equipment colocation space under commercially reasonable terms
>
> In cases such as outdated fiber, capacity exhaustion, aerial installations in fire-prone areas, or non-resilient connectivity, both sound engineering and overall public benefit considerations frequently can provide the justification for new middle-mile fiber builds along previously built corridors.

A Network Engineering Perspective

The premise behind these efforts is that affordable broadband can be solved through concentration on significant POP(s) to the consumer end location. The challenge is that each Service Provider will size their routers to manage traffic. As the largest city, Portland likely will be the closest location to backhaul traffic. This creates a single point of failure in the design. For a sustainable, long term solution to the digital challenge, we agree that reliability and resiliency are as important as broadband speeds; the significance of a service outage grows due to the increasing dependence of critical services (e.g., E-911, telehealth, law enforcement) on the network.

Example – Consider the analogy that Internet usage through the state is like a major water distribution system. Imagine that all water systems for urban and rural communities in Oregon route to Portland. In this concept, water treatment centers in rivers and streams along the way do not exist because service providers need concentration of traffic to make it economically viable enough to exchange traffic. This situation is analogous to the fact that Portland, Seattle, San Jose, and Los Angeles are major exchange points on the West Coast for the Internet. Using

the analogy, view Portland as the closest place to which water is routed. These routes may follow natural highways, or sometimes go through densely forested areas. What if the route to a community is cut off due to a landslide or an earthquake on the way to Portland? Is this acceptable? Planning these networks to support Internet connections requires some risk consideration. Similarly with the Internet, what if a node on the network lost its connections back to Portland?

To our engineering mindsets, broadband availability is important for rural communities, but reliability as well as diversity of Internet Exchanges are also important concepts for the State to recognize. A community's broadband Internet needs are met when Internet service is reliably available and stable. Otherwise, a community could be out of service for a significant period, and the impact of such an outage grows as more users depend on higher speed services. If a community in eastern Oregon, for example, had access to a diverse route to Portland, that investment would support current and future demand while ensuring greater reliability.

However, we believe that the State should prioritize investment in areas where insufficient capacity exists before considering building diverse routes. Furthermore, cost-benefit analysis and risk assessment should be conducted before determining whether to support investment in diverse routes where an area is already meeting broadband speed standards.

Recommendations

To achieve the goal of a more capable, robust, resilient, and scalable broadband ecosystem throughout Oregon, we recommend that the State consider the following steps to advance and grow the ecosystem:

1) Identification of last-mile broadband speeds in all areas of the state
   a. The federal and many state governments have sought to establish a common view of gaps in broadband deployment. A state mapping effort that is continually updated will help identify these deficiencies throughout Oregon.
   b. This effort would produce a rich repository of accurate, longitudinal broadband data sets, including provisioned infrastructure status, affordability, and digital literacy and equity considerations.
      i. The repository should utilize both provider-reported and end user-launched (crowdsourced) data.
      ii. Particular emphasis should be placed on insuring the inclusion of broadband availability and adoption data from Oregon's nine federally recognized Tribes and their members.
      iii. The Oregon effort should be integrated with concurrent federal mapping efforts through the NTIA (currently, the NBAM initiative) and the FCC.
      iv. The repository must protect all collected and stored personally identifiable information (PII), and privacy concerns should be addressed through external review.

   v. To assess progress and community needs, summary analytics should be available to the public with more granular access provided to community officials and local broadband action planning teams.

  c. This program to characterize broadband speeds across the State should differentiate locations by their purpose (e.g., residence, small business, school, hospital, government office). The bandwidth and related network requirements of businesses and community anchor institutions typically far exceed those of single-family residences, and the data repository should reflect this distinction. Anchor institutions are of particular importance to rural communities for their economic impacts and societal benefits.

2) Broadband office staffing

  a. The Oregon Broadband Office needs sufficient personnel and robust external partnerships to achieve its mission, to assess the overall need, to track federal programs and initiatives in other states, to review community proposals, and to allocate and oversee State-administered broadband funding.

3) Mapping of existing and new network infrastructure

  a. *Ad hoc* tracking is possible as permitting is required for builds; private and public groups may be able to identify previously built infrastructure.

  b. However, A proactive effort to maintain an infrastructure inventory would benefit both public and private groups. The information could be utilized to construct paths that minimize ground disruption, identify gaps in areas that have not been considered, and motivate investments for areas where desired broadband speeds yet are not sustained by the existing infrastructure.

  c. The information must be kept securely with controlled access to protect the critical infrastructure. In today's broadband environment, a small group of bad actors can use such information to target critical network infrastructure. Access should be restricted to protect proprietary information and sensitive infrastructure.

  d. In particular, the OBO should establish and maintain a limited-access repository of middle-mile fiber route information to assess community access, resiliency, and anticipated asset performance and lifetime (e.g., strand count, age, and fiber type). In addition to the specific fiber routes, this repository should contain information about all associated infrastructure – network access locations, cell towers, small cells, and data centers.

  e. Any recipient of public funding through the State should be obligated to provide as-built middle-mile fiber data from the funded builds to this repository, and all middle-mile providers should be encouraged to contribute additional middle-mile information under standard, data-protecting terms.

  f. As an outcome of the planning group's discussion of this topic, several members collaborated on an initial map of principal middle-mile segments statewide and have shared this map with the OBO.

4) Internet exchanges

  a. Portland (NWAX), Eugene (WIX), and now Bend (COIX) have established non-profit Internet exchange facilities operating to provide improved network

performance and resilience and to provide cost benefits to the participants by 'keeping traffic local' to the service region.

    b. The State should encourage and potentially help fund the development of additional exchanges in southern and eastern Oregon to provide the same benefits to members of those communities. These exchanges should be provisioned in hardened facilities and provide an Ethernet switching fabric and fiber interconnection panels for peering as well as space for content distribution and other caching servers to reduce middle-mile network load into the smaller communities.

5) Strategies for distributing state and federal investments in community broadband

    a. Multiple sources of funding exist to achieve a return on the investment required to grow the infrastructure, so no community needs to be disadvantaged by its size.

    b. Different funding sources may address separate parts of the broadband ecosystem.

    c. Infrastructure does take time to plan and build. Grants are just one area. Any grant should consider the long-term sustainability of the approach it is funding.

    d. The use of competitive broadband grant programs for communities and regions is endorsed at the outset for accelerating improvement in the most cost effective and timely manner.

    e. However, we have observed a wide disparity in the competitiveness of communities in terms of their access to information concerning actual broadband deployment and their readiness and resources to compete in federal and state grant programs.

    f. To address this gap, the OBO should prioritize the development of its broadband mapping program to enable the delivery of accurate and consistent data to proposal development teams and, in the case of State-managed programs, proposal reviewers.

    g. Ultimately, with the aim of achieving the most complete statewide broadband coverage, the OBO likely will need to facilitate additional assistance in the form of engineering consulting to maximize the efficient, cost-effective use of state and federal funding.

    h. Considering the long-standing Tribal broadband challenges and the distinct federal funding channels now available to begin toaddress these, the OBO should work closely with Oregon's Tribes to ensure that their broadband requirements and network deployments are considered in a coordinated fashion with other middle-mile and general broadband improvement projects statewide.

    i. The OBO should engage in a public-private initiative that actively assesses the state of our broadband deployment and associated technological readiness over time. In response, the State may need to take directed action, when possible, to reduce the number of underserved areas for the state.

    j. The aspirational goal for supporting underserved communities should be to provide speeds equivalent to the most populous cities in Oregon and at a similar cost to consumers. This may require a phased plan that enhances service in the

near term while not necessarily providing speeds equivalent to those of the most populous locations. The state of technology and infrastructure at the time of submission could require this form of staged deployment.

6) Access to publicly funded network assets
   a. Infrastructure, such as conduit, fiber, and supporting facilities, substantially capitalized through public funding should be provisioned sufficiently to allow capacity (e.g., with additional fiber strands) for network growth over time and for potential use by other providers. Frequently, this latter use can facilitate the provision of resilient connectivity for a community.
   b. As a condition of the funding award, the right of qualified providers to access unused capacity on these publicly funded assets (under commercially reasonable terms) should persist over the projected lifetime of the funded assets. Several group members adopted the term *equitable access* for this concept.

7) Role of Municipalities as Stakeholders in Broadband Deployment
   a. Through their own policies and processes, municipal governments can have a profound impact on the state of broadband within their communities.
   b. The OBO should work with municipalities to spur the broader statewide adoption of a uniform franchise agreement.
   c. Excessive franchise and property taxation of broadband assets can serve as an obstacle to broadband deployment and even external investment.
   d. Communities lacking resilient middle-mile connectivity (some are noted in the box on page 6) may need franchise and/or property taxation levels lowered to incent the required construction.

8) Construction Permitting and Right-of-Way Access
   a. Coordinate, thoughtful approaches to building infrastructure are important since providers prefer to only dig once, to avoid impacting other providers (as well as residents and motorists), and to leverage existing paths whenever possible.
   b. The Oregon Department of Transportation (ODOT) has a significant responsibility to ensure uniform policies governing use of rights of way on Interstate and state highways with the objective of using these vital public assets to support Internet and broadband deployment in an expeditious, cost-effective, and equitable manner.
   c. In ranking projects for execution and permitting, ODOT should give underserved and unserved areas some priority. ODOT projects currently are prioritized by transportation-based processes [e.g., Statewide Transportation Improvement Program (STIP) and Oregon Transportation Commission (OTC)] that are driven by transportation needs and do not consider network infrastructure. Ways to account for connectivity benefits to underserved and unserved areas should be developed.
   d. On a regular basis, OBO should work with local county and city partners to identify areas with broadband challenges. Based on these partners' recommendations, the OBO should prioritize removing barriers through public private partnerships and/or funding contributions.

e. ODOT should be funded to seed broadband expansion for carriers through conduit construction when road improvement projects occur in these underserved areas.

f. In some cases, ODOT should be allowed to exchange fiber and/or conduit in support for underserved areas' availability or resilience.

g. Under a "dig once" mantra, the OBO and ODOT should be charged to make local groups aware of fiber construction projects and to encourage the installation of additional capacity for future growth and expansion. This will accelerate the deployment of broadband and could benefit areas limited by the lack of middle mile infrastructure. City and County Rights-of-Way groups would benefit from the awareness that certain broadband permitting processes impact the expansion of broadband availability in their area.

h. Both state and local agencies with permitting responsibilities for broadband construction should be encouraged to streamline processes and expedite review to the greatest extent possible given the critical public need in many communities and the time-limited performance periods associated with many broadband infrastructure grants. Permitting prioritization should be assigned to the areas that have the greatest demonstrated need.

i. Delays involving permitting on federal lands (e.g., USFS, BLM) have been a recurring challenge for Oregon middle-mile builds. The OBO and as needed, the Oregon Congressional delegation, should be prepared to advocate with the appropriate federal agency on behalf of public-private partnerships and other publicly funded broadband builds.

j. In addition to the aforementioned highway corridors, the OBO should track other existing rights of way (e.g., railways, water and natural gas pipelines, electrical transmission corridors) in the state and should encourage their use for middle mile builds wherever feasible.

9) Wireless Towers and Satellite

a. Areas of the state are burdened by lack of cellular coverage adequate for both current and future technologies. Part of this challenge stems from the hilly and mountainous nature of Oregon. Another factor is the distance limitation of cellular coverage and the expense of proliferating towers in the most remote parts of the state.

b. Coordinating with local communities through broadband action teams, ODOT, OBO, and other State entities, Oregon would benefit from lowering the financial burden to placing towers in remote locations. In conjunction with the ongoing broadband projects, a common plan could be incorporated into the effort to increase both broadband and cellular connectivity for these underserved areas.

c. Even with significant public investment to enable fiber-based connections to previously unconnected or under-connected homes, there will be a significant number of locations across the state (estimated at the level of 5-10% of the population) where the cost of this buildout would exceed the maximum amount provided. In these remote frontier locations, the consumers will need to rely on emerging Low Earth Orbit Satellite (LEOS) providers and/or various terrestrial

wireless options. The OBO and broadband legislation should be mindful of this service base and should ensure that these residents' connectivity is mapped similarly to ground-based connections.

    d. How LEOS and fixed wireless providers maintain robust, resilient, and cost-effective interconnections with the terrestrially based service providers operating in Oregon should be an area of active focus in the coming years. The OBO should consider LEOS and fixed wireless solutions in any service expansion to very high-cost areas to ensure the most efficient use of public funding and the inclusion of all Oregonians.

10) Last-Mile Service in Underserved Communities

    a. Some rural locations face an above-average cost to extending middle-mile connectivity, and a rural solution is not usually cost effective based on a rate-of-return analysis. In these situations, the State should support subsidizing service provider investment to allow for various considerations. This likely will not be a 'one-size-fits-all' approach. The end goal is affordable Internet access in every community; the problem may have different solutions by different providers.

    b. The State should consider subsidies that support investment in long-term (ten years or longer) solutions that enhance availability and reliability.

    c. The State should also consider stipends to lower (but not remove) ongoing costs such that the total cost to invest in underserved communities is similar to the level required in more populous sections of the state.

    d. There must be a balance on this investment. Reasonable rates may be afforded to other service providers as well.

    e. The State should recognize that traditional, below-cost telecommunications service (i.e., copper-based landline service), even when broadband capabilities are limited, serves as a barrier to entry for new providers. In addition, duplicative construction of these network routes (frequently referred to as *overbuilding*) may create a hardship for incumbent providers because they continue to experience regulatory burdens, based primarily on now legacy technologies and including the obligation to provide basic telephone service, that are not imposed on new entrants. Any publicly funded buildout of broadband to an area should be afforded some form of traditional regulatory relief or perhaps reevaluated in a broader consideration of telecommunications regulatory reform and modernization.

11) Role of State Government

    a. Convening a broadband provider advisory forum

        i. As with other critical public services such as electric power, the State should convene a group of a cross-industry experts in the delivery of Internet and broadband services – from both business and technical perspectives – to provide regular, technically-based advice on the current state, emerging gaps, and future trends around broadband in Oregon.

        ii. A primary charge for the group would be to advise on the scalability, resiliency, and durability of Oregon broadband infrastructure and to provide input from approaches and lessons learned in other states

      iii. The advisory forum should draw from broadband and network infrastructure providers in the private and public sectors.

      iv. The role of this new group should be aligned carefully with the more publicly oriented and broadly focused groups in this sector, such as the Oregon Broadband Advisory Council (OBAC).

  b. Forming a limited-term, inter-agency task force to support fast-tracked broadband deployment to eliminate roadblocks, minimize other delays, and maximize access to federal funding opportunities.

      i. This group should be led by the Oregon Broadband Office.

      ii. The task force would be charged to assist OBO in streamlining deployment and ensuring that Oregon remains on target to achieve identified statewide broadband goals within the designated time frames.

      iii. Potential agency participants would be Business Oregon (through OBO), Enterprise Information Service (EIS), Oregon Department of Transportation (ODOT), Public Utility Commission (PUC), Oregon Housing & Community Services (OHCS), the Office of Tribal Affairs, Oregon Health Authority (OHA), Oregon Department of Education (ODE), Higher Education Coordinating Commission (HECC), the State Library, and the Governor's Office.

      iv. The objective is to create a focused, maximally efficient team drawn from across state government to accelerate resolution of the state's broadband challenges during the upcoming, time-limited period of federal funding.

12) Broadband advancement is not just a technical issue!

  a. For a successful outcome, state broadband planning must fully consider the significant human and socioeconomic factors – beyond the necessary details of technology deployment – such as service and device affordability, digital literacy, and digital equity and inclusion efforts.

  b. A desired objective of consumers obtaining consistent or *postalized* rates for retail broadband service across Oregon was raised both in this planning group's charge and frequently during the subsequent group discussions. Given the complexity of Oregon's broadband ecosystem, especially with the absence of a single provider offering services essentially statewide and with the ability to establish standard pricing, the path to achieving this goal is not immediately obvious. The State can assist in reducing the costs borne by rural consumers by a) encouraging the development of more Internet Exchanges in smaller communities (especially those with content caches) to offload traffic locally and b) expanding broadband assistance programs for those citizens in financial need (such as the currently temporary FCC Emergency Broadband Benefit program).

Appendix I. Planning Group Participants

(Organization names are provided for identification purposes only and do not imply endorsement)

- **Trent Anderson**, LS Networks, tanderson@lsnetworks.net
- **David Barber**, Oregon State University, David.Barber@oregonstate.edu
- **Steve Corbató**, Link Oregon (co-chair), corbato@linkoregon.org
- **Kurtis Danka**, Enterprise Information Services, State of Oregon, Kurtis.Danka@oregon.gov
- **Joe Franell**, Blue Mountain Networks and Oregon Broadband Advisory Council, jfranell@bluemountainnet.com
- **Keith Grunberg**, Hunter Communications, kgrunberg@hunterfiber.com
- **Leif Hansen**, LS Networks, lhansen@lsnetworks.net
- **Craig Heidgerken**, Western Independent Networks, cheidgerken@win-networks.com
- **Tre Hendricks**, Lumen, Tre.Hendricks@lumen.com
- **Daniel Holbrook**, Oregon Broadband Office, Business Oregon, Daniel.L.Holbrook@oregon.gov
- **Stuart Taubman**, Zayo (co-chair), stuart.taubman@zayo.com
- **Molly Thurston**, Link Oregon (planning group support), thurston@linkoregon.org
- **Matt Updenkelder**, Wave Broadband, matthew.updenkelder@wavebusiness.com
- **John van Oppen**, Ziply Fiber, john@ziply.com
- One additional contributor opted to be uncited to comply with corporate policy

Appendix II. Preliminary Oregon middle-mile network map (July 2021)
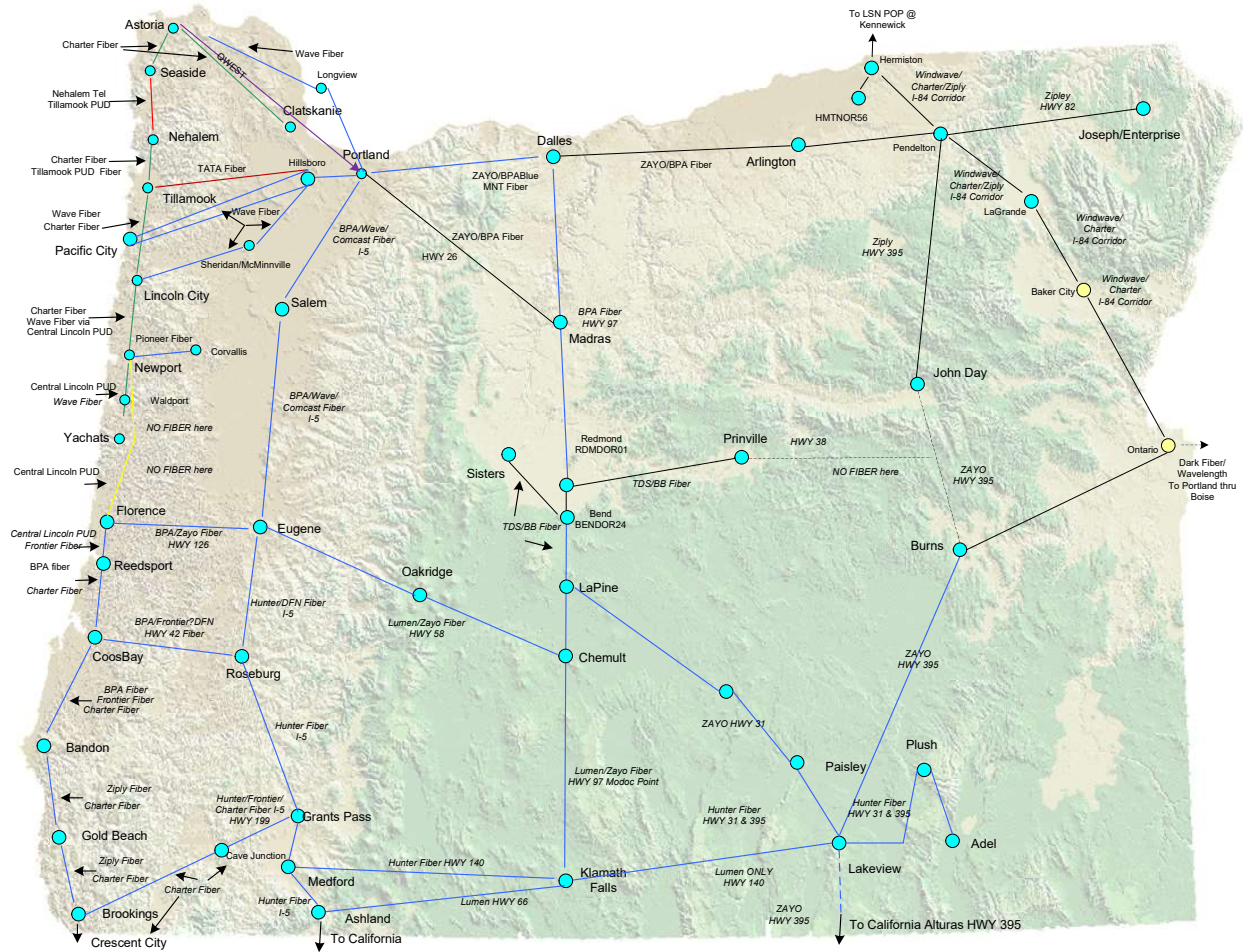
As a demonstrable outcome of the planning group's discussions, several members actively collaborated on the development of a statewide map coherently integrating middle-mile network resources from multiple providers. This initial map should be considered preliminary and non-authoritative and instead viewed primarily as a demonstration of the collaborative potential working through this team and the Oregon Broadband Office. This work product is subject to revision both in the near term with further planning group review and of course, over time with future middle-mile network development.

Appendix III. Initial charge for planning group (May 28, 2021)

Oregon Broadband Middle-Mile Infrastructure Planning Group

Time is of the essence: first federal funding window already has opened; due August 17

Draft problem statement (Rep. Pam Marsh, April 22):

> *Attaining digital equity for all Oregonians is about more than availability. Cost differentials caused by population density variations impact construction costs and length of a return on investment. More fundamental than that though are the huge disparities in cost of data transport from communities across the State back to the nearest Internet Exchange. Those costs can vary by a factor of 20x or more depending on distance and competition amongst transport providers. This situation makes it almost impossible for citizens of, and communities around our State to realize the same opportunity that affordable broadband access provides. We must find a solution to this issue if Oregon is going to realize its full potential.*

Deliverable: Short written report with clear recommendations for Legislative audience of Rep. Marsh, Sen. Lee Beyer, and Rep. Mark Owens and, if there is concurrence, potentially shared with a broader audience

Proposed list of topics
- Upcoming federal and state broadband funding opportunities
  - FCC Emergency Broadband Benefit ($7B - open)
    - https://www.fcc.gov/broadbandbenefit
  - NTIA - communities ($288M - open) and Tribes ($1B - pending)
    - Community grants requires P3's
    - https://www.ntia.doc.gov/press-release/2021/commerce-department-s-ntia-announces-288-million-funding-available-states-build
  - U.S. Treasury block grants to States ($10B - pending)
    - *Interim* program rules for comparable Treasury program ($350B for general infrastructure) express a preference for local governments, non-profits, and cooperatives as broadband recipients
      - https://www.govinfo.gov/content/pkg/FR-2021-05-17/pdf/2021-10283.pdf
  - Proposed state broadband grants ($100M)
    - Included in Governor's FY22-23 budget as part of $1.2B total infrastructure package
  - Proposed infrastructure legislation in Congress
    - >$60B for broadband in both Dem and GOP proposals

- How we organize (meetings, document sharing, deliverable timeline)
  - Ground rules for discussion
    - Consider Chatham House Rules or a variant - *When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed.*
- Environmental assessment and level setting
  - Vision for long-term success in Oregon broadband
    - Identification of current obstacles
  - Risks
    - Other states leveraging these opportunities to move ahead of Oregon
      - https://www.nga.org/news/commentary/governors-expanding-access-broadband-2021/
  - Definitions
    - Digital equity
    - Middle-mile
    - Last-mile
    - Other concepts to define
  - Previous lessons learned
  - Role of wireless/LEO satellite
- Tangible actions for the state to take and initiatives to promote
  - Broadband mapping
    - Comprehensive statewide middle-mile fiber map with restricted access (PUC as repository?)
  - Internet exchanges
  - Architectural recommendations
    - Business
    - Technical
  - Resilience
    - Coordination on new builds
  - Extended middle mile, especially Coast
  - Highway right-of-way access (ODOT, counties, cities)
  - Access cost *postalization*
- Sustainability
  - Open access to middle-mile fiber (built with federal or state funding)
- Last-mile interconnection and recommendations
- Funding strategies and coordination
  - Centralized proposal support: grant writers, project managers
  - Facilitate public private partnership (P3) formation
  - Coordination/alignment of county/regional broadband action teams (BATs)