TELECOMMUNICATIONS IN RURAL OREGON TODAY
(Comments at the Eastern Oregon Telecommunications Forum)
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1. The Role of Telecommunications in Rural Communities

Reliable and affordable telephone and broadband services are essential to the economy and the quality of life in rural Oregon. Broadband services are essential for all businesses, government, health care and education institutions and consumers, not just information-intensive businesses. Telecommunications infrastructure is as important to the rural economy as electricity, clean water and transportation. Rural communities have a transportation disadvantage compared to urban communities because of greater distances, but there is no reason in the information age for rural communities to suffer a telecommunications disadvantage. Telecommunications can give rural communities a more level playing field in the economic competition with urban communities.

Most Oregon communities have pretty good telephone service, but have great difficulty recruiting call centers, information-intensive businesses or telecommuters unless they have diverse routing (for reliability) and sufficient broadband capacity. Reliable broadband services are also essential for health care, education and government applications, including public safety. Telehealth, distance learning, e-government, and e-commerce are more important to rural communities than to urban communities because of they have lower population densities, greater travel distances and fewer local services. Rural folks need telecommunications as a substitute for transportation even more than urban folks. Most urban folks do not realize how much "drive time" is required to conduct business and government in rural Oregon. We thank the Public Utility Commission for holding this meeting in rural Oregon. Those of you who drove long distances from urban locations now understand better what rural folks go through to get to all of their meetings. All of us who live in parts of rural Oregon other than La Grande also had long drive times. Broadband infrastructure suitable for telecommuting, including from rural Oregon to government offices in Salem, can make a significant difference to the economy and the quality of life in rural communities.

Unlike other critical infrastructure, which is usually provided by governments, telecommunications infrastructure is usually provided by private businesses including some that are subject to state Public Utility Commission (PUC) and Federal Communications Commission (FCC) regulation. The private sector, understandably, does not make investments unless the expected return on investment is greater than other investment opportunities. Except for small rural telephone companies with no urban properties, those investment opportunities are usually greater in urban locations, because the urban market is larger and competitive pressures are greater there. Nevertheless, some private sector telecommunications providers engage in political, legal or regulatory attempts to block public investment in rural telecommunications infrastructure, even when they are not willing or not able to make the investment themselves.

Instead of wasting legal and lobbying dollars in a public-private fight, we in Oregon need to find a way to build cooperative public-private partnerships so that public monies can be used to bridge the gap when private sector return on investment calculations are not sufficient to justify private-sector-only investments. We also need to protect the legal right of the public sector to install and operate telecommunications infrastructure in locations where the private sector is unable or unwilling to invest in infrastructure that is essential for economic and community development.

2. Telecommunications in Oregon Today

Rural Oregon has better telecommunications infrastructure than most, if not all, other states, at least in Qwest territory in Oregon, thanks to the infrastructure investment made as a result of Senate Bill 622 from several legislative sessions ago. There is more broadband service availability and more reliable network capacity as a result of the five self-healing fiber optic rings serving different parts of Oregon. For these areas of the state, the current focus should be on how best to use that economic competitive advantage to recruit new businesses, to grow existing businesses and develop the applications that will utilize the technology to improve quality of life. In particular we need to work on public sector applications in health care, education and government as well as electronic commerce and other business applications.

Some parts of rural Oregon served by some of the other Oregon telecommunications companies were left relatively farther behind after that Qwest infrastructure investment. For example, we need diverse routing out of regions such as the south coast, where periodic cuts of the single fiber serving the region are a major economic disadvantage and a public safety hazard. We need broadband services in communities without access to broadband, such as Union, Elgin and Enterprise, whose local economies could benefit from Digital Subscriber Line (DSL) or other broadband services.

Even in places with the best current infrastructure and services the current advantage will be short-lived as other states catch up and as the rapid changes in information technology continue. We will need to run fast to avoid falling behind other states and regions and to maintain our economic competitive advantage.

Small rural telephone carriers currently depend on the per-minute subsidy from long distance carriers for termination of long distance calls, even though their costs do not depend on the minutes of use. (Costs are based on peak load capacity, not minutes of use.) That subsidy was created by regulators in the monopoly era to keep local rates artificially low (to please urban consumers) by using higher than cost long distance rates to subsidize local service. Now, wireless providers and Internet providers are taking long distance traffic (and revenues) from the public switched wireline network, reducing total revenues and thereby putting further pressure on universal service subsidy funds. Large urban-based carriers propose a “bill and keep” regime that would do away with per minute terminating access charges. As a result, smaller rural carriers are at serious risk. Both federal and state universal service funds are already under pressure and may be unable to take up the slack. We need to plan ahead to avoid disaster in rural communities. In principle, it would be a good idea to have both Federal and Oregon Universal Service Fund support for broadband services. In practice, it may not be fiscally prudent at this time to expand the obligations of funds that may not be sufficient to meet current obligations to support expensive special-purpose telephone technology. Instead we need to rethink how best to facilitate the transition to lower cost digital technology that can support multiple applications.

Rural telephone carriers get payments from three sources in addition to monthly payments from customers for basic local telephone service. These include subscriber line access charges (the $6.50 per month per residential line for access to the long distance network we see on our phone bills), inter-carrier compensation (primarily the payments long distance carriers make to local carriers for originating or terminating long distance calls), and subsidy from State and Federal universal service funds (USF) (from two USF surcharges on all our telephone bills). Access charges, inter-carrier compensation and universal service fund payments are all interconnected. Push in the balloon on one of these fronts and the costs and consequences will pop out in one of the others. The underlying costs do not go away when payments from one of these sources are reduced. The part of the funding system most at risk now is compensation from long distance carriers to local carriers. Now that long distance service is more competitive, that traditional source of subsidy will go away as people and businesses choose lower priced alternatives to traditional wireline long distance service, including cellular and Voice over Internet Protocol (VoIP). The only certainty we have is that there are not enough funds in the present system to keep all of the current subsidies flowing at the current level AND pay for the capital costs of conversion to new and different broadband networks with a different underlying cost structure. What is worse, most of the regulatory decisions affecting the transition will be made in Washington, DC, not in Oregon. Unfortunately, Washington DC is a long way away from the rural Oregon communities that will suffer if the transition is botched. For example, if the FCC accepts the recommendation of the Universal Service Joint Board to provide Federal Universal Service Fund support for only the primary line to each business or household, the economy of rural Oregon could suffer seriously. It would be preferable to use whatever funds are available to support all rural lines at a lower rate than to provide a subsidy for some lines but not others. Higher prices on some lines will drive customers to wireless and Internet alternatives (or to do without), thereby reducing the revenues carriers need to cover their fixed costs and increasing the need for subsidy. That is a recipe for a death spiral for rural carriers, not a credible way to help them transition to a broadband digital future.

Oregon should try to get ahead of the curve with transition planning, not just react after disaster occurs. Rural Oregon is most at risk in the coming transition, because inter-carrier compensation and/or universal service funds are likely to decline, and there is no reasonable alternative source of funds in sight. We will need to dismantle and reassemble the flow of funds structure in the telephone industry that grew up in the age of regulated monopoly and is most inappropriate for the transition to a competitive broadband digital world. Absent regulatory incentives to the contrary, the private sector will make most of its investment in new technologies and networks in their urban properties because of the larger urban market and higher expected return on investment, and because of competitive pressures in urban areas.

The economy of rural Oregon is at risk in the transition from regulated telephone monopolies to an unregulated (or much less regulated) competitive marketplace for broadband telecommunications services. Parts of rural Oregon do not have any broadband services. Much of rural Oregon lacks any telecommunications competition. For example, the wireless (cellular) telephone services urban residents and businesses take for granted (and use regularly for long distance calling at lower costs than wireline phones) are available in only a portion of rural Oregon. Urban residents wishing broadband services can often choose between DSL services from their telephone provider or cable modem service from their cable company. Rural residents are lucky if they have any access to broadband. Many have no access. Even when DSL is available in a rural town, many rural residents live too far from the central office to be able to qualify for DSL service. Since what services are available typically have no competition, we cannot depend on competitive pressures in rural Oregon to keep prices low and quality high.

3. Infrastructure in Transition

We are in the early stages of an historic telecommunications transition similar to the transition from telegraph to telephone service. The last US telegraph company was liquidated in bankruptcy approximately 100 years after the invention of the telephone. The pace of change is now much faster as we transition from an analog narrowband circuit-switched telephone technology to a digital broadband Internet-protocol based multi-media network. I predict that less than 20 years from now the last Oregon telephone company will either be liquidated in bankruptcy or successfully converted to a broadband digital multi-media provider. The economics of dedicated analog telephony are not sustainable in a broadband multi-media digital world, even with massive universal service subsidies. The telephone network still uses narrowband analog voice transmission on copper wire (“twisted pairs”) from residential telephones to the central telephone exchange or to a neighborhood aggregation point. Most long distance telephone transmission has already converted from narrowband analog to broadband digital transmission, but the conversion of local lines has barely begun. Telephone companies now offer DSL services in selected locations over the same copper wires as the analog telephone transmission, using a higher frequency. Current DSL technology is at best a stop-gap interim technology because it is restricted to limited distances from the central office and has too little capacity for many of the new broadband applications that consumers will want, including high quality digital video transmission. To complete the transition, we will need to convert all our special-purpose analog circuit-switched voice networks to multi-purpose digital broadband packet-switched networks. And, we will need to provide quality of service capabilities on our digital networks to support voice and video applications with the quality we have come to expect.

Cable television began using coaxial cables for one-way distribution of analog television signals, and are now well into the process of converting to multipurpose bi-directional broadband digital transmission. All segments of television distribution are converting to digital media. Direct broadcast satellite television has been digital for some time. Cable companies offer digital video through cable converter boxes that support both standard analog television signals (converted back from digital to analog so people with analog TV receivers can view them) or for direct transmission to digital TVs that can receive either standard or high definition digital TV signals. They also offer broadband data transmission through data modems. Many of the major cable providers have either begun providing digital telephone service or have announced plans to start such services later this year, using "voice over Internet protocol" (VoIP) technology. Most new television receivers seen in stores these days are digital models. Over-the-air television broadcasting also has begun the conversion to digital transmission. They will return the radio spectrum currently used for analog TV broadcasts to the Federal Communications Commission (FCC) when the conversion is complete so the FCC can reassign that spectrum to other uses. High definition television, a digital service with picture quality closer to that of a theater movie screen than an analog TV, is now becoming common and is available via satellite, cable or over the air signals. Digital video disks (DVDs) are making analog video cassettes obsolete as a digital storage medium, just as digital compact disks (CDs) replaced analog cassette tapes for storing audio. The conversion of broadcast radio from analog to digital is following behind that of television. Both cable and satellite television providers include digital audio (radio) signals as part of their offerings. Digital audio receivers for direct reception of satellite radio broadcasts are available for automobiles and homes. Radio broadcasters are working out plans and standards for conversion of analog over the air radio broadcasting to digital.

The Internet is the prototypical multipurpose digital broadband network of networks, even though some of the on-ramps are still narrow-band analog modems designed to carry digital signals over analog telephone lines. Other on-ramps are digital but have limited capacity and are subject to congestion at peak user periods and are therefore not yet suitable for some desired applications, including quality video transmission. The digital signals going over the Internet use a transmission protocol call Internet Protocol (IP) which uses "packet-switching" technology in which the digital bits of each transmission (whether voice, data or video) are segmented into components that are enclosed in "packets" that include the destination address and packet sequence numbers (for easy reassembly for listening or viewing at the destination). These packets are then sent in common broadband data "pipes" along with other packets from other sources and going to other destinations, just as letters in the postal mail service share mail bags and mail trucks. This digital packet-switching technique is so much more efficient than the use of dedicated analog circuits for each transmission that most observers expect it to become the dominant transmission technique. Digital signals can be just as crisp and clear at the receiving end as they are at the origination point, unlike analog signals that degrade as they are transmitted over distances and through repeaters. (Think of copies of copies of copies made in a copying machine and losing quality with each replication.) The transmission efficiency of sharing large broadband pipes for multiple users and uses results in unit costs that can be more than ten times lower than using dedicated channels for each different use. In order to survive in competition with the newer packet transmission techniques, older networks are rapidly converting to IP technology or technology that permits IP transmission. For example, AT&T has already converted its long distance network to broadband IP transmission. Traditional analog (or dedicated digital) circuits are used only at the end points where signals enter and leave the AT&T network.

4. Present and Future Internet

Despite the dramatically lower costs for digital transmission, the Internet, even with broadband access at both ends, is still unsuitable for many applications. Because it is a decentralized distributed network of interconnected networks, there is no centralized control. Some of the links and some of the access points are weaker than others and may not have enough capacity to permit high quality service for all users. Internet data packets are delivered on a “best efforts” basis with no guarantee of how long delivery will take or whether some packets are dropped along the way. (Since packets are numbered, a recipient that gets some, but not all, of the packets that make up a long communication, can request retransmission of the missing packets.) The two keys to making the Internet or Internet-like packet networks suitable for a wide range of multi-media applications are broadband network capacity and service quality. These two keys are inter-related. With sufficient broadband capacity throughout the network, the service quality is likely to be excellent. However, if there are bottlenecks or congestion points, then a scheme for prioritizing traffic is required for voice, video and other time sensitive applications to work reliably. The original design for the Internet called for multiple lines connecting every site on the network so that communication could be maintained even if some nodes or links were not available. However, some Internet access services, especially in rural communities, are dependent on a single link that may be cut or congested.

The Internet as we know it today is not yet the reliable broadband multi-application network we expect it to be in the future. In the United States most of the Internet currently uses version four of Internet Protocol (IPv4) software. The Internet is in the early stages of being upgraded to version six (IPv6), which will permit more address locations on the network than earlier versions and therefore accommodate expected expansion for more sites and more applications. IPv6 will also permit Quality of Service (QoS) guarantees that are not possible in the current IPv4 “best efforts” Internet. The “backbone” of the Internet is provided by a small number of large “Tier 1” providers who interconnect with each other at a number of “peering points.” Tier 1 providers do not charge each other for interconnection because they are approximately of equal size (hence the term “peering”) and because the value of each network is increased for their customers when they can connect to everybody else. Most of the Internet Service Providers (ISPs) from whom we customers get service are “Tier 2” providers that pay to lease lines from their locations to locations where they can connect with Tier 1 providers. Tier 2 providers also pay Tier 1 providers for the right to connect and to have their traffic transit the Tier 1 network. Since Oregon does not have a Tier 1 peering point, most Internet traffic between locations in Oregon travels far out of state on a long circuitous route before getting to its destination. The network routes get very complicated as each party attempts to minimize costs and maximize revenues. As a result, data packets travel through many “routers” on the way to their destination. Each router “reads” the address in the packet header and sends it on to the next point in a long chain. A small delay time is introduced at each router in the chain. That delay does not make any noticeable difference for applications such as e-mail, but can create problems for real time voice conversations and for videoconferences. Even with IPv6 software, the present Internet may not be sufficient for all of the truly broadband applications of the future. At some point we may need to transition from the current Internet to something like the experimental “Internet 2” that is now being tested by a number of academic institutions.

Telephone companies have attempted to achieve five nines of reliability, that is, to provide good quality service 99.999 percent of the time. That translates to a target of less than 5.3 minutes of “downtime” per year. Even though telephone companies do not always reach that target reliability statistic, the analog voice telephone network comes much closer to meeting it than does the Internet. Telephone companies are able to come close to the five nines target in part because they provide power for a standard telephone (but not a cordless telephone) over the phone line itself and therefore can still operate during power outages. Internet access, including DSL access using phone lines, requires local power. Internet service will not be available when either the access phone line or power to the user location is out, even if the rest of the network operated perfectly. Different reliability factors affect different Internet applications differently. As noted above, latency (delay times) can negatively impact voice and video applications. Jitter (some bits arriving faster or slower than others) can also impact voice and video applications and impair the audio quality in music applications. Security requirements are different for different applications and may be harder to achieve in a shared multi-purpose network than in a single-purpose dedicated network.

The Internet of the future will be a broadband packet-switched network providing service quality suitable for a wide range of different applications. A lot of hardware and software upgrades will be required before we reach that goal. As new applications are developed, the requirements imposed on the shared multi-purpose broadband network we call the Internet will change. We are still in the very early stages of a long transition.

Most DSL and cable modem services available today do not have adequate bandwidth and quality of service for the videoconferencing applications needed for rural health care, education and government. They are far from adequate for broadcast quality video transmission. We are a long way from shared digital networks suitable for multiple high definition television signals (from 10 to 50 megabits per second). As network capacity grows, so will the applications using them. We should plan our network infrastructure to be readily scalable to a gigabit per second of capacity and beyond. That reliable broadband digital Internet of the future is where all of us, both rural and urban, are headed. Let us make the transition as orderly as possible and without causing harm to the economy and quality of life in rural Oregon in the process.