

A Tale of Two Rural Broadband Victories

How broadband advocates in Humboldt and Del Norte counties overcame financial, political and geographic challenges to achieve route diversity.



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Executive Summary

Rural Humboldt and Del Norte counties lacked reliable Internet connectivity even after telecom companies extended fiber-optic systems to reach Humboldt County in 2003 and Del Norte County in 2007.

During storms, fires and construction accidents, the fiber-optic links connecting each community to the Internet backbone were repeatedly damaged—resulting in crippling losses of Internet service for businesses, schools, hospitals and governments, as well as frustration for residents using the Internet for everything from motor vehicle registration to movie viewing.

The solution was route diversity that could only be achieved by additional large-capacity fiber-optic links to the Internet. With diverse connections to the Internet backbone, broadband blackouts go unnoticed because data traffic is either already moving along both circuits or is instantly transferred from the broken circuit to the functioning circuit while repairs are made to the severed line.

Both communities have achieved route diversity—Humboldt in December 2011 and Del Norte in January 2014. Each county now enjoys tangible benefits such as greater capacity for data and voice communications, which facilitates more competition and potentially higher value Internet service for lower prices; higher download and upload speeds; and broader geographic extent of Internet service.

And they have secured the intangible but highly valuable benefit of uninterrupted access to the Internet.

But the process for both counties was extraordinarily difficult and time consuming. With relatively small populations, neither county was highly attractive for telecom companies looking for major broadband projects.

Traversing the mountainous terrain separating these coastal communities from the Central Valley alone was considered impossible by some telecom industry veterans.

To achieve their victories, broadband advocates in each county had to forge and maintain coalitions of public and private interests that could navigate the financial, political, bureaucratic and geographic waters that lay before them.

The public subsidies that ultimately made each project possible were only available for narrow purposes: improving telemedicine in Oregon and bringing broadband to unserved and underserved households in California. Advocates and their partners in the telecom industry were able to leverage this funding to subsidize the larger goals of improving reliability and Internet data capacity for their entire communities.

"The private sector couldn't do it alone," said Humboldt County Supervisor Mark Lovelace. "They needed the assistance of the public and non-profit sectors that did all the groundwork, the market studies and reports."

While the Del Norte and Humboldt County fiber-optic projects each had their own particular twists and turns on the route to success, it is hoped by the sponsors of this paper that the lessons learned on these two journeys will provide guidance to other California communities still lacking reliable broadband service, as well as relevant insights to officials and policy-makers overseeing such projects.

Humboldt County's 10-year Battle for Reliable Broadband

Humboldt County is just over 250 miles north of the Silicon Valley, global center for the IT industry with world-class broadband capacity. Yet, as recently as 2010, only half of Humboldt County's residents could access broadband. This factor, along with the area's remoteness and small population, has hampered the development of IT and Internet firms in the county, with significant impacts on employment.



While high-speed digital subscriber line (DSL) service became available as early as 2000, it was limited to certain more populated areas. Local Internet Service Providers (ISPs) couldn't meet the demand for additional broadband service from businesses, institutions and residents because of cost and capacity issues. ⁱ

Just finding spots for our guys to stay was a challenge. There are not a lot of motels anywhere near [PG&E'S Highway 36 transmission right of way].

~ Steve Autenreith, Senior Vice President, 3 Phase

This situation was intolerable for IT entrepreneurs who either grew up locally or chose to move here for the region's quality of life. Some faced the prospect of moving their companies out of the area in order to grow or survive. And economic development specialists watched in frustration as out-of-town companies considered then rejected relocating to the area because they couldn't get enough broadband. ⁱⁱ

By 2001, AT&T (then Pacific Bell, a division of SBC) had announced plans to install a \$30 million fiber-optic line along Highway 101 from Ukiah in the south to Eureka (the original plan included Crescent City as well). But by 2002 the project had stalled as SBC entered a dispute with California Department of Transportation (Caltrans) over the fees the agency would charge the telecom provider for use of the highway right of way.

Local broadband advocates publicly supported SBC in its negotiations with Caltrans, but in October 2002, the parties were still at an impasse over \$2 million to \$3 million in fees for the last 21 miles.

In February 2003, Redwood Region Economic Development Commission (RREDC) and Redwood Technology Consortium (RTC, a business association) filed a complaint to the California Public Utilities Commission against Caltrans over the fees. "It was primarily a symbolic gesture because Caltrans is not a regulated utility," recalled Gregg Foster, a vice president at Redwood Capital Bank who was then executive director of RREDC. SBC and Caltrans reached agreement in 2003, and the line was completed in September of that year.

But even prior to that event, local broadband advocates, led by the RTC business group, had already begun to advocate for a second fiber-optic link. "The fiber advocacy we did in 2001 and 2002 educated people about the importance of broadband," recalled Tina Nerat, owner of technology consulting firm NERATECH.

"But as soon as it was completed, we told the community 'We're not done. We've got more to do to create truly reliable Internet connectivity.'"

"The coalition that formed to pressure Caltrans and SBC to finish the first line never waned," recalled Connie Stewart, Executive Director of the California Center for Rural Policy at Humboldt State University. "The second we got the first fiber victory, everyone said 'This is great. Thank you very much but now we need more. We need route diversity for reliability, and we need 100 percent of our community to have Internet access across the region.'"

Affirming the local advocates' perceptions, an August 2003 study on the telecom needs of educational institutions noted that relying on the SBC (now AT&T) fiber link alone would jeopardize the use of advanced technology in schools. "While SBC plans to retain the current microwave systems as a redundant path, the capacity [is insufficient] to ensure quality of service for some of the applications that may be in use within schools. Teachers' ability to depend on network delivered resources is a major factor in teachers' willingness to utilize online resources."

By 2006, major disruptions in Internet service due to cuts in the AT&T fiber link underscored the need for route diversity (sometimes referred to as "redundancy," though the two are not quite the same). With redundant or diverse connections to the Internet backbone, broadband blackouts go unnoticed because data traffic is either already moving along both circuits or is instantly transferred from the broken circuit to the functioning circuit while repairs are made to the severed line.

Without route diversity, fiber outages that occurred in December 2006 and January 2007 resulted in impacts ranging from "complete disabling of core functions to time-consuming and costly delays" for businesses, hospitals, schools and other institutions. Both outages occurred when schools and many non-retail businesses were closed. Had they occurred on busier days, the impacts would have been more severe. ⁱⁱⁱ

According to *Blackout*, a report commissioned by RREDC, lack of more reliable Internet connections would have grave implications for the county's economy. One IT company said remaining in Humboldt County would destroy its reputation unless Internet connectivity became more reliable. A financial services firm was delaying the creation of 40 new professional positions due to lack of reliable Internet service. Other employers foresaw similar limitations on their ability to grow and expand locally, and economic development specialists predicted that businesses considering relocating to Humboldt County would move elsewhere if Internet access were not improved.

Leveraging Public Funds

Humboldt County business, community and institutional leaders became increasingly sophisticated in meeting the economic and political challenges to achieving the route diversity that the county needed.

Humboldt State University President Rollin Richmond and Humboldt Area Foundation Executive Director Peter Pennekamp were appointed to then-Governor Arnold Schwarzenegger's California Broadband Task Force in 2007. The only rural representatives on the task force, they played key roles in raising \$250,000 from the California Emerging Technology Fund, a \$60 million fund that was created as a condition of several large telecom mergers in 2005, with the goal of eliminating the digital divide.

With matching funds from Humboldt Area Foundation, RREDC, McLean Foundation and the Headwaters Fund, a local consortium known as Redwood Coast Connect had funding to study broadband supply and demand issues in Del Norte, Humboldt, Mendocino and Trinity counties. The resulting study published in early 2009 helped validate the business case for private investment in a second fiber-optic line. ^{iv}

The private sector couldn't do it alone. They needed the assistance of the public and non-profit sectors that did all the groundwork, the market studies and reports [and] the public funding.

~Supervisor Mark Lovelace

An earlier study funded by the County of Humboldt with a California Community Development Block Grant focused on potential routes and business models. Conducted by FirstMile.US, the study evaluated two routes across Highway 299, either underground in the Caltrans right of way or along Pacific Gas & Electric Co.'s (PG&E) electric transmission lines. ^v

These reports provided broadband advocates, including county supervisors, with evidence of the need for additional broadband service and the potential economic benefits. "These studies showed this critical infrastructure could help our businesses grow and create jobs," said Jacqueline Debets, economic development coordinator for the County of Humboldt.

At the state level, concern over the lack of broadband service in rural areas led the California Public Utilities Commission (CPUC) to create in December 2007 the California Advanced Services Fund (CASF) to provide grants to telecom companies seeking to develop new infrastructure to reach unserved and underserved communities. The Legislature affirmed the CPUC's creation of CASF program with SB 1193, signed by Governor Schwarzenegger in September 2008.

Would-be provider lacked financial backing

While CASF ultimately provided key financing for the fiber optic link to Humboldt County, the process in 2009 and 2010 was fraught with difficulty due largely to the lack of performance of the first company approved for CASF funding.

In February 2009, Broadband Associates International was approved by the CPUC to receive \$7.83 million in CASF funding to develop a fiber-optic link from the I-5 Internet backbone to the Eureka area along Highway 299.

Both Broadband Associates and IP Networks, another telecom firm with its eye on the Highway 299 route, applied later in 2009 for federal rural broadband

funds that were available through the American Recovery and Reinvestment Act (ARRA). Broadband Associates was denied in the first round, while IP Networks' proposal was deemed worthy of a second round of review, during which it was asked to show evidence of matching funds.

At this point, Broadband Associates argued that IP Networks should not receive ARRA funds because Broadband Associates' project had received CASF funding and would serve the area. The firm represented its own effort as "a complete plan to service the entire region." It also claimed to have letters of support from anchor tenants. IP Networks did not receive an ARRA grant.

However, Broadband Associates was unable to secure investors or customer commitments sufficient to design and construct the project. The firm also failed to receive permission from Caltrans for its proposed shallow micro-trenching method which would have installed the fiber at 12" of depth rather than the transportation agency's required 42".^{vi}

The firm's lack of capital or a viable plan to raise capital and its lack of movement to comply with Caltrans' requirements became obvious by spring 2010. Broadband advocates and officials from Humboldt and Trinity counties asked the CPUC to rescind its grant; and the CPUC did in July 2010.

As events would unfold, IP Networks was able to fund a comparable—but less ideal project—without ARRA monies.

Second Route Option Proves Viable

IP Networks became involved through a lucky combination of circumstances. Gregg Foster, executive director of Redwood Region Economic Development Commission (RREDC), one of the most active proponents of route diversity, left the agency in 2007 to become director of business development at Lost Coast Communications (LCC). Foster and LCC's then-President Patrick Cleary agreed that improving broadband connectivity would continue to be a focus of Foster's work.

"It would be good for the local economy and therefore good for our advertising business," said Cleary, who is now executive director of Humboldt Area Foundation. "As an afterthought, we also thought maybe we could make some money at it."

Thinking that electric transmission lines would provide a viable route for a second broadband link, Foster and Cleary wrote a letter to PG&E's San Francisco headquarters. "We introduced ourselves as a small community radio group and asked to meet with them and talk about getting access to their right of way," recalled Foster. "Lo and behold, they responded



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Humboldt Area
Foundation

positively."

"I was stunned when they called us back," said Cleary. "I've written a lot of letters to big corporations and have rarely received that kind of response." Jack Maccoun, the PG&E executive on the phone, told Cleary: "I'm going to be in Ferndale next week. Can I come and see you?"

At that meeting, Foster and Cleary learned that PG&E had its own interest in seeing a new fiber-optic system built from the Central Valley to the Humboldt Coast: achieving more reliable Internet connectivity for its Humboldt Bay Power Plant which had recently been repowered with new reciprocating engines.

Maccoun set up a meeting for Cleary and Foster with PG&E colleagues in San Francisco. At that meeting, the executives walked Cleary and Foster to the nearby office of IP Networks, a company that had a long-standing relationship with PG&E to lease its electrical distribution infrastructure to provide fiber-optic service to IP Networks' customers in the Bay Area. "The challenge then became trying to convince IP Networks that there was enough business up here to make it happen," said Cleary. With Connie Stewart and other local broadband advocates, Foster and Cleary introduced IP Networks' executives to potential major customers. IP Networks saw enough market potential to devote staff resources to developing the project.

Given the dismal state of the economy, IP Networks, with backing from RREDC and other broadband advocates, applied for an ARRA grant to build the system along Highway 299—the first time the company had ever sought public funds. "The thought was that if we're going to seek government funding, we might as well seek it for the most populated route," said Stewart. "Highway 299 was the preferred route because it passes through 16 communities as opposed to four on the Highway 36 route."

As described above, Broadband Associates opposed the ARRA funding, pointing out that it—not IP Networks—had received a CASF grant, and the application was unsuccessful.

With encouragement from Stewart, IP Networks applied for CASF funding of a fiber-optic system on PG&E's 121-mile transmission system along Highway 36. In November 2009, the CPUC approved \$4,212,982 million, 40 percent of IP Networks' \$10,532,455 budget. In keeping with CASF's mission, the funding was designed to serve 527 rural households that had no broadband Internet access or inadequate service.

That "last mile" service to those households would be provided by Wireless Internet Service Provider (WISP) 101Netlink, which had reached agreement with IP Networks to connect to its new fiber in three locations. "Prior to reaching that agreement, we had to identify the service areas along the fiber route, determine how many people in those areas we could serve efficiently, then make deals with landowners to place relays to distribute our services to those areas," said Seth Johannesen, president of 101Netlink. "I was on the project for one year before the deal was completed."

The fact that the Highway 36 fiber-optic system would also meet the needs of coastal Humboldt County's residents, businesses and institutions for more reliable broadband connectivity was a side benefit.

To the Finish Line

After the November 2009 approval by the CASF, IP Networks' staff spent more than 18 months finalizing its agreements with major customers— Suddenlink, AT&T and Verizon—and working with its consultants to design and engineer the route, prepare necessary environmental analyses, submit permit applications to the U.S. Forest Service, which managed most of the land, and secure right-of-way agreements with private landowners whose property was crossed by PG&E's transmission lines. In some cases, PG&E's rights did not include telecommunications capabilities, and new right-of-way agreements had to be negotiated. ^{vii}

Engineering was performed by Sargent & Lundy (Phoenix) and the project was constructed by 3 Phase Construction (Farmington, NH).

During engineering and construction, project costs increased to approximately \$14 million due in large measure to unexpected requirements that about half of the cable installed on the project use optical ground wire (OPGW) cable, installed above the electrical conductors (wires) with helicopters. IP Networks had expected to use primarily all-dielectric self-supporting (ADSS) cable that could be installed manually below the conductors. ^{viii}

Because of the length of the project and the remote location of the more than 850 transmission towers, the engineering phase did not include evaluation of every structure, and some required upgrading. Once construction began in July 2011, unexpected costs arose on many occasions. "Inevitably a project of this nature is engineered one way, but once you get into implementation there are lot of changes needed," said Ed Greenfield, Director of Northern California Operations, Level 3, the large telecom provider that purchased IP Networks in June 2013.

"You might need a cross-arm to provide extra strength to the structure or find out that the legs of the structure aren't lined up in a way that you can attach the cable as designed. We had to re-design on the fly, performing some changes in the field while taking others back to formal engineering to review," said Greenfield.

Low clouds and fog resulted in many hours and days when helicopters could not be flown safely.

According to Steve Autenreith, senior vice president of 3 Phase, the most difficult aspect of the 121-mile-long project was its remoteness. With up to 50 linemen working on the project at times, "just finding spots for our guys to stay was a challenge. There are not a lot of motels anywhere near there."

Suspicious growers took some convincing



We certainly ran into people who questioned whether we should be accessing their back roads but we didn't have any serious incidents.

**~ Steve Autenreith,
Senior Vice President, 3 Phase**

Allaying fears and hostility among marijuana growers in the remote region also required special efforts—especially as construction continued into the fall harvest season. "As the crews were stringing cable across Eastern Humboldt, they learned that there's certain economic activity going on. And people in that business don't like to see strangers in the backwoods and helicopters flying overhead," said Supervisor Mark Lovelace.

Lovelace and others assisted IP Networks staff to tell growers what the linemen were doing. "We wanted folks to know that there were going to be helicopters and ground crews out there but that they would just be stringing fiber, not spying or calling the cops," said Lovelace.

3 Phase crew members were encouraged to talk with local residents at grocery stores and restaurants. "We made sure our presence was known. We communicated through blogs, websites and local leaders that we were there just to do the work," Autenreith said. "We certainly ran into people who questioned whether we should be accessing their back roads but we didn't have any serious incidents."

In December 2011, the fiber-optic project was completed, bringing tangible benefits—broadband service for remote residents and businesses who had no service or spotty service; greater capacity for data and voice communications (which facilitates more competition and potentially higher value Internet service for lower prices); higher download and upload speeds; and broader geographic extent of Internet service—and the intangible benefits of uninterrupted access to the Internet.

Of the 10-year journey that it took to reach this milestone, Lovelace reflected, "The private sector couldn't do it alone. They needed the assistance of the public and non-profit sectors that did all the groundwork, the market studies and reports. And they needed the public funding that would open up new markets for them while ensuring that Humboldt County got both route diversity and service to un-served and under-served communities." Noting the range of parties involved, Lovelace concluded: "It's not clear the project would have worked had we not had all the players that we had."

Del Norte County Leverages Oregon Telehealth Funding

The Del Norte County Board of Supervisors identified better Internet connectivity as an economic development priority in 1999. Along with upgrades to other transportation infrastructure—the airport, harbor, sewer and Highway 199 that links the coastal community to Interstate 5 in Oregon—improvements to telecom and Internet infrastructure—"teletransportation"—were viewed as vitally important to diversifying the region's economy in the wake of the timber industry's downsizing. ^{ix}

To build the case for telecom providers to invest in a fiber-optic line, Del Norte County's Tri-Agency Economic Development District (TAEDA) commissioned a market study by John Irwin of J Irwin Consulting who had facilitated the development of rural telecom infrastructure in Oregon. Irwin's research, and a presentation he made to Charter executives in Vancouver, helped demonstrate potential growth in demand for Internet services that would result from a fiber-optic project. This helped give Charter Communications confidence in the return on investment that it could earn from extending its existing fiber-optic system from Brookings, Oregon, to Crescent City. ^x

Leaders, residents and businesses celebrated the completion of Charter's 10 Gigabyte per second (GBPS) fiber-optic broadband link in 2007. But the tenuous nature of relying on only one fiber-optic link to the Internet backbone became evident when outages occurred. One example: in 2012, an unusual coastal snowstorm near Lincoln City, Oregon—250 miles north of Crescent City—toppled a utility pole. A snow plow then snagged Charter's fiber and pulled out three miles of it within 20 minutes. The outage shut down broadband and dial-up Internet access in Del Norte County for two days. ^{xi}

In 2012, a snowplow accident 250 miles north of Crescent City shut down broadband and dial-up Internet access in Del Norte County for two days.

Establishing a second fiber-optic link to the major Internet data networks along Interstate 5 also emerged as a priority for Sutter Coast Hospital, the region's only hospital. Without consistently reliable high-speed Internet service, the hospital staff had limited ability to confer in real time with specialists outside the area and bring other benefits of telemedicine to Del Norte County.

At the time, Sutter Coast Hospital was also paying a premium for broadband that it needed to link with Sutter's California hospitals due to the circuitous route that its Internet data had to travel: north to Bandon, Oregon, east to Roseburg, Oregon, and south into California along the Interstate 5 corridor. ^{xii}

"There was also a great need to create that ring in Southwest Oregon and Northwest California," said Irwin. "Even Citizens Communications, which is now Frontier, had stranded telephone exchanges in the Illinois Valley [between the Oregon border and Grants Pass] that they wanted to serve from their coastal network. The potential for additional commercial transport was evident."

To improve reliability and Internet data capacity for Del Norte County, a telecom provider would have to install a second fiber-optic cable.

Southern route explored

Two major potential route options existed: Highway 101 south, connecting with AT&T fiber terminating in Eureka in Humboldt County; and the PacifiCorp electric utility right-of-way that ran roughly parallel to Highway 199 from Gasquet to Grant's Pass. ^{xiii}

Irwin and Charter Communications' Sales Engineer Keith Grunberg began investigating the feasibility of running fiber along both routes even before Charter's initial fiber-optic cable reached Crescent City from the north.

Irwin set up a meeting with Humboldt County broadband advocates in 2008 to explore this option, and at that meeting Arcata Economic Development Corp. agreed to consider providing up to \$1 million in low-interest loans for the project from the Headwaters Fund. ^{xiv}

Due in part to Mr. Grunberg's communications with broadband advocates in Humboldt County, he leaned toward the southern route. "I attended the Redwood Coast Annual Broadband Forum in 2008 and met with several folks down there about getting a fiber project built from Arcata [south of Trinidad] to Crescent City," said Grunberg. "That looked a little more promising."

Telecom and Internet providers AT&T and Suddenlink—the front-line customers for any new fiber-optic telecom circuit—showed interest in "route diversity because the Eureka area was pretty much an island as well," said Grunberg.

The global financial crisis of 2008 and the February 2009 bankruptcy of Charter derailed that project. But the drive for route diversity did not end. Grunberg and Irwin teamed up to implement the funding strategy that would ultimately succeed. ^{xv}

Renewed Viability with Oregon Telehealth Funding

Due to its small population of just over 28,000 people, the potential market in Del Norte County for the expanded menu of Internet services that would become available with a second fiber-optic link did not represent enough potential income to justify investment by a private telecom provider. ^{xvi}

It was the high-speed data communications needs of Sutter Coast Hospital that enabled the project to receive public funding and go forward.

To address the Internet connectivity challenges of rural health care institutions like Sutter Coast Hospital, the Federal Communications Commission (FCC) established in 2006 the Rural Health Care Pilot Program (RHCPP) to fund

broadband projects. In 2007, the FCC approved \$417 million for 69 statewide or regional "broadband telehealth networks" in 42 states and three territories.

The non-profit Oregon Health Network (OHN) received \$20.2 million, the fifth largest funding amount, to build broadband infrastructure that would give health care providers and health educators "a level of interactive service and access once only imagined in rural and underserved communities." xvii

According to Irwin, a co-founder of OHN and board member of OHN's parent, the Telehealth Alliance of Oregon (TAO), the TAO conceived a

strategy that required competitive bidding for every funded route. "This created opportunity for telecom providers to build in extra capacity to rural areas and resulted in a great expansion of middle-mile routes in the state," said Irwin.

Nothing would have happened for the foreseeable future had not individuals persisted in identifying the need and demand for services, developed the business case, and persevered over somewhat lengthy time-frames to see the projects to completion.

~ John Irwin, Telecommunications Consultant



Del Norte County is in California; however, given its proximity to the border, the county is economically and socially tied to Oregon. "We gravitate toward Oregon. Our telephone and electric power systems are tied into Oregon," said Del Norte County Supervisor David Finigan. Sutter Coast is registered as an Oregon hospital, a fact that would enable it to receive OHN funding.

Grunberg had already informally evaluated the prospects for a fiber route along Highway 199. "I frequently drove from Grant's Pass to Crescent City, and I would look to see where there the utility poles were located," he said. Even this cursory evaluation showed that stringing fiber across the rugged and remote wilderness, much of it in the Smith River National Recreation Area, would be difficult.

Irwin encouraged Grunberg, providing maps and the demand profile that Grunberg would need to convince Charter's senior management to invest in the project.

Irwin and Grunberg then collaborated on facilitating Sutter Coast Hospital's application for funding of a fiber-optic project to the OHN. It didn't hurt that both individuals had worked with OHN in the past: Grunberg on other rural broadband telehealth projects in Oregon; and Irwin as board member (2004-2012) of OHN's parent, the TAO.

OHN made the bold decision to fund the project even though it was for a hospital located in California. "OHN took a real leap and used money that was designated for Oregon to cross the boundaries into California, with the permission of the California Telehealth Fund, to build that circuit," said Chris Burns, Major

Account Representative, who took over the project for Charter in 2010. "The process also required negotiating with Oregon legislators to use money designated for Oregon hospitals to help a hospital located in California."

OHN conducted a public bidding process for the project, to which Charter was the only bidder. "Other companies thought it would be just too difficult, mostly because of the different agencies that you have to get the permitting from and the difficult terrain," said Burns.

OHN provided \$920,000 of the approximately \$1.5 million cost for constructing the fiber-optic cable system running 34 miles from Gasquet, California, to Cave Junction, Oregon. (Fiber had already been extended from Grant's Pass to Cave Junction in phase one of Charter's project to develop a second fiber link to the coast; that phase was supported by approximately \$200,000 from OHN because it provided broadband for healthcare facilities along the route.)^{xviii}

Charter's decision-making process around allocating capital for its own share of the project costs was complicated by the fact that the company declared bankruptcy in February 2009. After reducing its debt by approximately \$8 billion, Charter completed its financial restructuring in November 2009.

Charter's eventual decision to invest approximately \$600,000 of its own capital in the project was made in anticipation of the additional revenue potential that it would bring. "Corporate saw the value in establishing a ring," said Grunberg. "Charter's wholesale division would benefit by selling capacity to other carriers that wanted route redundancy, including Verizon and Frontier."

"The second fiber-optic link to the coast would provide true route redundancy for all telecom providers south of Coos Bay down to Crescent City," continued Grunberg. "By tying into the fiber strands Charter put in, the providers' switching equipment would become diverse so if they lose the optical link on one side, it would automatically go to the other side. Or depending on the equipment, they could do load balancing in which traffic is live on both sides."

Frustrating Delays but Ultimate Success

The financing described above was completed in 2009. Then Charter, OHN, Sutter Coast Hospital and Del Norte County broadband advocates and potential users began a long period of waiting while regulatory agencies, primarily U.S. Forest Service offices in California and Oregon and the Federal Bureau of Land Management, evaluated Charter's permit applications.

Irwin and Burns reported that Charter anticipated a significant amount of scrutiny by regulators since the project would traverse federally owned wildlands that were home to several species listed as threatened or endangered under federal and state law, including *darlingtonia californica* (pitcher plant), northern spotted owl and marbled murrelet. Environmental studies commissioned by Charter included a plan to avoid impacts on these and other sensitive species.

However, the proposed route (confidential for security reasons) traversed existing rights of way and required no cutting of trees. Thus, Irwin, Burns and others were surprised and frustrated that the process took more than two years, a period during which Charter was storing utility poles, fiber-optic cable and other equipment for the installation at a parking lot between Cave Junction and O'Brien. ^{xix}

It is beyond the scope of this paper to assess whether the time for environmental review and permitting was inordinately long, nor to investigate the causes of such a delay. Complaints by project proponents about the time required for federal environmental reviews and permitting are common. These agencies have many priorities and limited staff—and those staff assigned to the project may not have had prior experience with fiber-optic projects. Furthermore, the lead reviewing agencies are required by law to get input from other entities such as state and federal fish and wildlife and environmental protection agencies, and in this case, state transportation departments.

Charter was able to negotiate right-of-way agreements with private property owners scattered along the project's route. However, a deal with one property owner reached an impasse when the individual asked for a price that came to more than 5 percent of the entire project's cost. That impasse was resolved when the owner sold the property to a buyer who settled for a more reasonable price. ^{xx}

There were actual side bets placed by some of the other telecom companies that we would not complete it.
~ **Chris Burns, Major Account Representative, Charter Communications**

Construction work was scheduled to begin in early spring 2013—as soon as the snow melted sufficiently to allow trucks to access the high country. But the project was delayed approximately four more months due to a change in the California Department of Fish and Wildlife's habitat designation for spotted owls. ^{xxi}

Actual construction began in March 2013, and was performed by Charter's contractor North Sky Communications (Vancouver, Wash.) and XL Communications (Fremont, Calif). As expected, the work was difficult and time consuming. "The route goes through the Siskiyou Mountains over sections as high as 3,200 feet," said Burns. "There are many sections where we go more than 1,500 feet between the poles where the fiber is suspended."

For most of the route, excavators were used to dig holes for the posts that would support the cable. But "in some areas where there are no trails, crews had to bushwhack through virgin undergrowth," said Burns. Poles were secured with guy-wires wrapped in yellow plastic covering for visibility to animals and people.

Some ravines were too steep for linemen to manually pull the cable up, so they had to shoot the line to the next pole using a line cannon, also known as a rope gun. Linemen then attached it to a pole, then brought it up through the brush and trees between the two poles. Some of the largest canyons could only be crossed using a helicopter. On one occasion, work was suspended due to a nearby fire. ^{xxii}

The project was completed in January 2014, several months before the OHN deadline of May 2014. Burns reported that he was always confident it would be

completed—despite the many obstacles and the prevailing opinion among some of his peers in the Southwest Oregon and Northwest California telecom industry.

"There were actual side bets placed by some of the other telecom companies that we would not complete it," said Burns. "Yes, I collected."

Social entrepreneurs made the difference

Reflecting on the public-private partnership that was required to build the project, Irwin took note of the fact that some community members still wish the project had been entirely publicly owned. "I'm not opposed to community-owned infrastructure, but telecommunications is a business, and you have to figure out how to run it like a business. Most taxpayers aren't ready for that yet," he said. "In the whole country, there are only about 300 community-owned broadband networks. Some of them have been mighty failures and some of them are fabulous. Given the fiscal status of the counties involved, that would have been very difficult to do in this case."

A common theme that Irwin sees evoked in both the Humboldt and Del Norte broadband project is the importance of the "social entrepreneurs" that drove the projects. "Nothing would have happened for the foreseeable future had not individuals persisted in identifying the need and demand for services, developed the business case, and persevered over somewhat lengthy time-frames to see the projects to completion."

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- ⁱ Interview with Tina Nerat, owner, NERATECH.
- ⁱⁱ "Future Rides on Fiber-Optic Link," Prosperity Journal, Spring 2001.
- ⁱⁱⁱ Hight, "Blackout; A study of the impacts of recent fiber-optic communications outages in Humboldt County," April 2007.
- ^{iv} Redwood Coast Connect, January 2009.
- ^v An Alternate Middle Mile Fiber Feasibility Study," FirstMile.US, June 2006.
- ^{vi} California Public Utilities Commission Resolution T-17280
- ^{vii} Interviews with Ed Greenfield, Director of Northern California Operations, Level 3; Jill Miller-Robinet, NRD fiber services manager, PG&E, and Mary Lou Smulders, former vice president of strategy and implementation, IP Networks.
- ^{viii} *ibid*
- ^{ix} Interview with Del Norte County Supervisor David Finigan.
- ^x Interview with John Irwin, owner, J Irwin Consulting.
- ^{xi} Interviews with Chris Burns, Major Account Representative, Charter Communications, and Del Norte County Supervisor Michael Sullivan.
- ^{xii} Interview with John Irwin, owner, J Irwin Consulting.
- ^{xiii} Irwin, Del Norte County Teletransportation Plan Final, 2007.
- ^{xiv} Interview with Irwin and Ross Welch, executive director of Arcata Economic Development Corp.
- ^{xv} Interviews with Keith Grunberg, former Charter sales engineer, and John Irwin.
- ^{xvi} *ibid*.
- ^{xvii} Federal Communications Commission and Oregon Health Network websites.
- ^{xviii} Interview with Chris Burns.
- ^{xix} Interviews with John Irwin and Chris Burns.
- ^{xx} *ibid*
- ^{xxi} *ibid*
- ^{xxii} Interview with Chris Burns.