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Critical Collaboration: A Use Case on Combining Partnerships and Technology to Improve Communities

Part 1: Designing a blown fiber system for widespread broadband in rural Colorado

Critical Collaboration: A Use Case on Combining Partnerships and Technology to Improve Communities

Internet access has become recognized as the fourth utility in addition to water, gas and electricity, because it impacts every part of our lives in our rapidly changing world – from work to school to home. With the introduction and accelerated advancement of technologies, having access to affordable, redundant and abundant broadband is quickly becoming the critical infrastructure of our time.

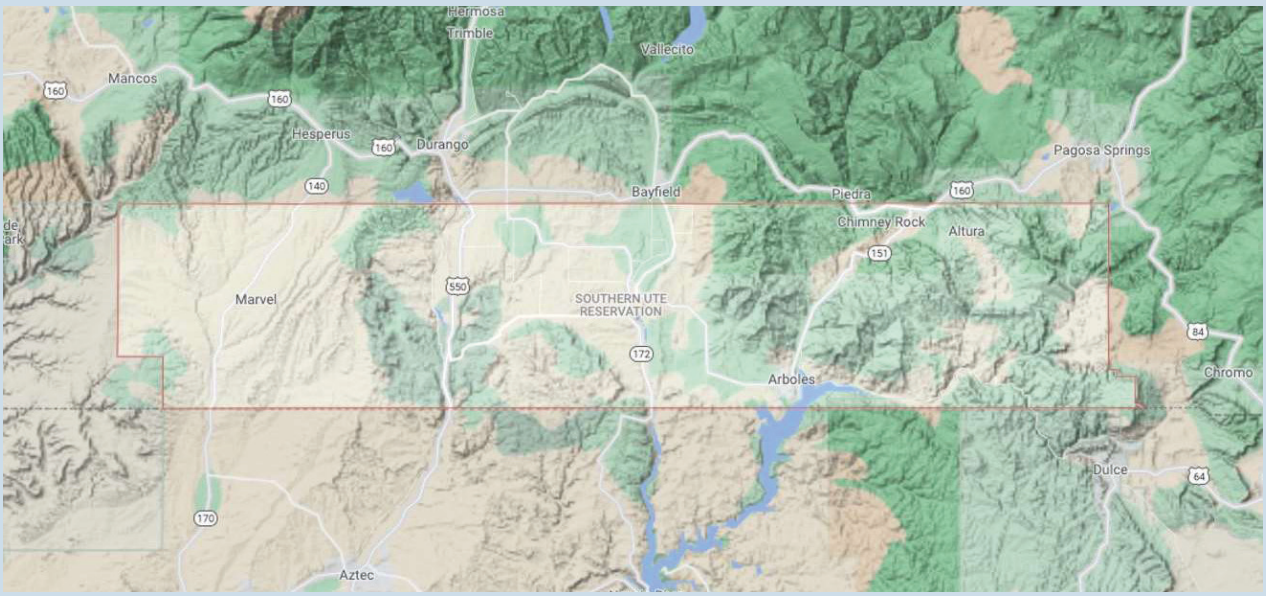
During the pandemic the importance of an Internet connection, or lack thereof, came to the forefront, affecting everyone's lives as the main link to the outside world, especially during lockdown. From home offices to home schooling to entertainment, digital networks that deliver the Internet (through broadband technology) to our homes, and the services that ride on those networks leapt from an ancillary "nice to have" to something that is vital to economic activity and the quality of our daily lives. Most people were only able to work if they could do so online.

Job hunters without online access were unable to apply for positions that would allow them to work via the Internet if they did have a proper broadband connection.

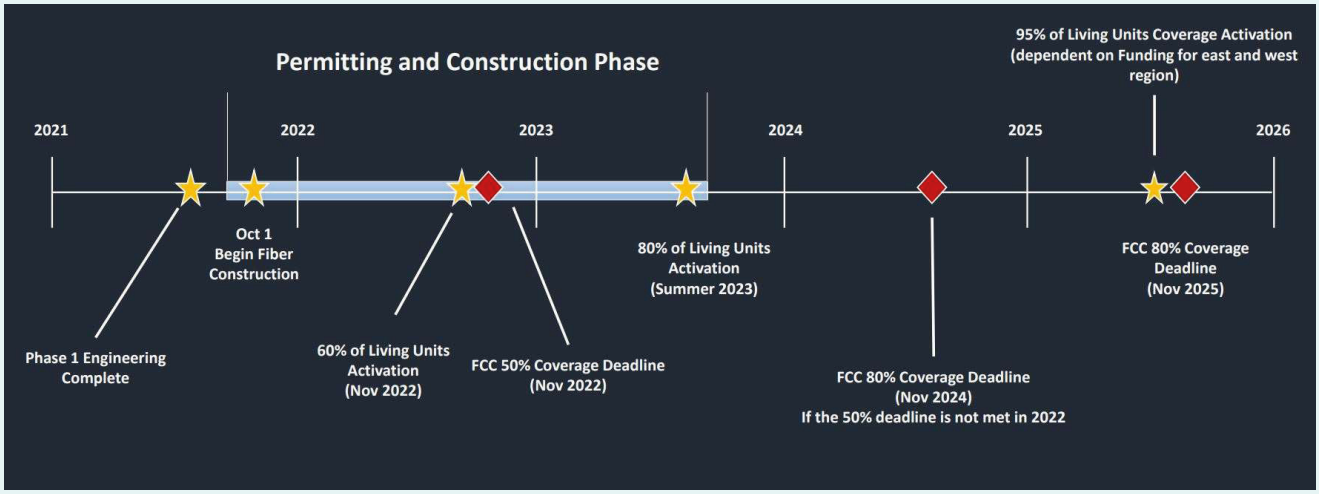
Many would agree that not having access to advanced broadband networks would be equivalent to being in the dark without electricity. To address the growing needs of broadband, both the private and public sectors are building networks all over the globe to support the Internet needs of today and the foreseeable future. Advanced broadband networks are creating enormous shifts in local, state, national and global societies, as well as markets, businesses and institutions. It is essential for all communities to develop the infrastructure (both physical and virtual) that connects to advanced broadband services for its citizens, its workforce, and its visitors.

However, there is a vast majority of homes and businesses in far-reaching rural areas that do not have any means to connect to the Internet. This is referred to the "digital divide." The digital divide typically exists between those in cities and those in rural areas, including tribal lands. Rural areas and reservations are costlier and more difficult to provide advanced broadband network. The Southern Ute Indian Tribe (SUIT) is taking action to deploy high-speed broadband within the exterior boundaries of the Southern Ute Reservation, which consists of 1,058 square miles located in Southwestern Colorado bordering Northwestern New Mexico. At the onset of the COVID pandemic, the Tribe realized 86% of the Reservation's 6,800 (tribal and non- tribal) homes and businesses do not have broadband connectivity due to non-existent infrastructure. And 94% of those that do have internet do not meet the FCC's minimum bandwidth which is to download at 25 Mb/s and upload speeds of 3 Mb/s. The Tribe's Southern Ute Shared Services (SUSS) upgraded Wi-Fi in locations where high-speed broadband exists so local families could access fast connections while remaining in their vehicle close to tribal buildings in order to engage in remote work and school.

As part of the Tribal Broadband Modernization Project, and prior to COVID, the Tribe researched partners to engineer and construct a multi-phase plan, that will deliver broadband to 95% of homes within 5 years. Bonfire Engineering and Construction (Denver, CO) was selected as the Tribe's engineering and construction partner. Bonfire in turn, partnered with Hexatronic U.S. (Lexington, KY) to be their primary supplier of the fiber optic infrastructure needed to build the Tribe's end-to-end Fiber to the Home (FTTH) solution. Together as an ecosystem, Bonfire and Hexatronic continue to engage tribal stakeholders to collaborate and communicate step-by-step to make sure that they will design and install the most cost-effective, reliable, and scalable system that will not only remove the digital divide but bring digital equity to current members and future generations.



Southern Ute Reservation consists of 1,058 square miles located in Southwestern Colorado bordering Northwestern New Mexico.



The Challenge: Delivering Digital Equity

The goal was to close the digital divide and to plan out the pathways and technology to eventually provide all the homes within the exterior boundaries of the Reservation with higher-speed, lower-cost broadband. This would entail detailed planning, communication of the project to tribal members, and finally tribal approval. Bonfire representatives attended the Tribal Member General Meeting and worked with SUSS to participate in the education process. The primary function of SUSS is to provide information technology-related services supporting and enabling the vision, mission and business outcomes for the Southern Ute Indian Tribe and its business and governmental entities. In the General Meeting Jeff Engman, CIO of SUSS, presented the goals, timeline, phases of the design and installation processes:

- Design a robust network to cover 95% of the Reservation homes by 2025
- Place all fiber and new towers in previously disturbed locations.
- Maximize non-Tribal funding sources.
- Use local contractors where possible.
- Build an Internet Service Provider (ISP) model to activate the new network.
- Drive down the cost of high-speed internet.
- Create training and support programs for tribal members.
- Create expanded career opportunities for tribal members
- Bring digital equity to tribal members

The Approach

Cooperative collaboration among all parties involved was key to assuring there would be no adverse impact to cultural and archaeological resources. "Developing in Indian Country and on tribal lands requires additional steps to ensure protection of tribal and cultural resources and sacred places. Bonfire and Hexatronic respect the need for these added steps and have worked closely with the tribes Cultural Preservation Department to learn and modify our project to ensure there is no impact to any cultural resources," stated Brian Hollister, CEO of Bonfire. Hollister compared working with the tribal community and understanding their culture as similar to understanding international installations. For this project, each phase must get approved by all stakeholders, in addition to the federal government, national, state, and local codes – although according to the NEC Codes, tribal communities can authorize their own codes and requirements.

It takes a highly collaborative effort between tribal entries and Bonfire to ensure adherence to all the requirements from Federal, State, Country, and Local agencies. Bonfire engaged with these different parties to make sure the design was approved before shovels hit the ground. This includes communications and approvals from Tribal Council Affairs, Cultural Preservation Department, Department of Natural Resources (for compliance and permitting), Safety & Environmental Compliance Management Group (SECMG), La Plata County, City of Bayfield, Town of Ignacio, Colorado Department of Transportation, Colorado Governor's Office of Information Technology and U.S. Department of Congress for additional grants.

After presenting the plans, SUSS and Bonfire recommended a system based on blown fiber technology. This installation would take place in multiple phases through 2026. They also engaged with the residents and with the Tribal Council to complete a feasibility study as well as speed test data to find out the different data speeds in the many locations of the Reservation. This would aid in selecting the location of new wireless towers and the conduit paths. They assured that permitting and construction would adhere to all environmental and cultural protection requirements and ensured there would be no adverse impact to cultural and archaeological resources.

Using Government Funding the Right Way

COVID exposed our country's lack of broadband connectivity, especially in underserved rural areas and within Indian Country. As a result, the National Telecommunications and Information Administration (NTIA), under the U.S. Department of Congress offered grants for various sectors to further the deployment and use of broadband and other technologies in the U.S., laying groundwork for sustainable economic growth; improved education, public safety, and health care; and the advancement of other national priorities.

Recently the NTIA received more than 280 applications for the Tribal Broadband Connectivity Program, as part of the approved $980 million grant program. "The COVID-19 pandemic brought the need for affordable accessible broadband access on tribal lands into stark relief," said U.S. Secretary of Commerce Gina M. Raimondo. "This program's nearly $1 billion in funding is an important step forward in closing the digital divide for Native American, Alaska Native, and Native Hawaiian communities, but it will take an even greater investment to help fully connect every person in every community."

For the Tribe's Tribal Broadband Modernization project, SUSS applied for $15 million for the tribal broadband project to install conduits and fiber to fixed wireless access points and deploy fiber distribution hubs within the community.

The project's additional funding sources includes:

$2.8M from the Tribal Capital allocated for the survey and engineering costs as well as for the fiber conduits to the towers; $10M from the State of Colorado for the construction of towers and fiber lines and $832K from the Bureau of Indian Affairs (BIA). BIA funds were helpful in getting the initial engineering effort to move forward.

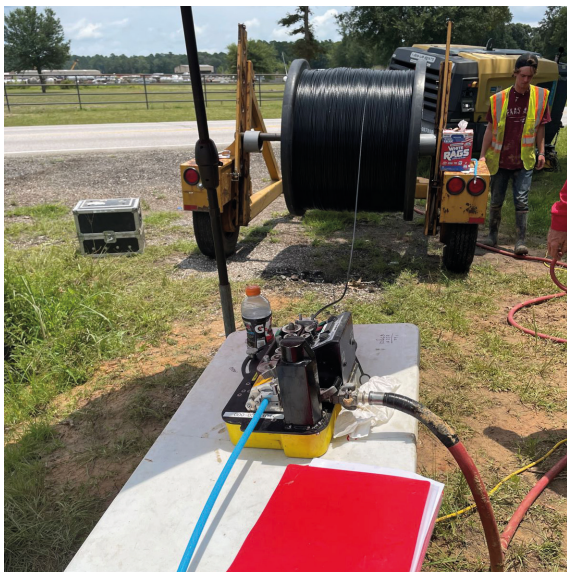
Getting Technical: Understanding Optical Fiber Infrastructure

Fiber optic cable offers the highest bandwidth and fastest speeds and has proven to be the most reliable and consistent media with the lowest latency. Benefits of broadband deploying fiber optic cabling include engaging in remote schooling or online classes; working from home; at-home healthcare services; Wi-Fi calling on a cell phone (if supported); at-home entertainment via "streaming" services like Netflix; and regional business development opportunities. Following a detailed analysis, blown fiber technology was selected as the preferred fiber optic system, where cost, speed of deployment, flexibility, and future scalability are of utmost importance.

High-count Viper fiber optic cable from Hexatronic

"Another challenge is getting widespread cellular coverage that could grow throughout the community, especially in outlying rural areas," states David Cleary, PhD, CTO of Bonfire. "After reviewing the different types of optical cabling systems, we proposed a micro cabling solution utilizing blown fiber technology over traditional fiber optic cables for many reasons including scalability, cost, conduit (size and minimal disturbance of tribal land) and most importantly is the flexibility it provides the Tribe and its future partners," he explains. "This allows fibers to be installed as a backbone for future wireless cellular carrier or ISP partner to utilize" he adds.

When compared to traditional cabling techniques, such as cables pulled in or jetted into large (traditional) conduits, blown cabling systems utilize much smaller micro tubes or microducts to blow lightweight optical fiber bundles or micro cables through predefined pathways at speeds of up to 500 feet per minute (~150 m).



A high-powered air compressor blows the micro fiber cables through the microducts at speeds of 500' per minute.

The micro tubes are manufactured from tough but flexible materials and are sized to accommodate up to 864 fibers per micro tube within a microduct. In the case of the Tribal project, these microducts will be buried underground.

"Cost reduction and system benefits of blown fiber systems over traditional fiber systems are attributed to OSP material reduction, faster installation time, less fiber connection points, simplified repair and maintenance and a migration path for future evolving applications," states Beni Blell, Vice President of Sales for Hexatronic U.S. "Overall, blown fiber systems have proven to deliver the lowest total cost of ownership to system operators, both CAPEX and OPEX," he further states.

7-way microduct from Hexatronic

The key technologies used in the blown fiber system include pre-terminated air blown fiber units, hand-held and easy-to-use installation tool for blowing of fibers, high-performance low- friction ducts and duct assemblies and a complete range of accessories. The capacity of the network can quickly be increased by inserting new fibers in spare microducts as needed. The system also minimizes the number of fiber splice joints in the network compared to traditional cable solutions.

"Working with Bonfire, our objective is to provide 2.5 GHz from the antennas to the customers, plus put in the middle-mile fiber to support these antennas," states Jeff Engman. "We want to make sure that the new system can support 50 Mb/s downstream and 10 Mb/s upstream which more than doubles the minimum FCC requirements of 25 Mb/s and 3 Mb/s downstream and places the Tribe's broadband ahead in a position to meet future technological advancement and connectivity requirements" he adds.

The Solution: Delivering Digital Equity Through Shared Values and Communication

"The first phase of the project will involve a 52- mile-long feeder system utilizing a 7-way microduct whereby only one of the tubes will initially be blown through with a 144-fiber cable," states Mark Turner, Business Development Manager for Hexatronic. "This allows for six other spare microducts for future use. Each of the 16mm/12mm (16 mm OD, 12 mm inside diameter) are capable of accommodating up to 288 fibers. If traditional fiber optic cable and conduits had been selected, the system would have required three 1 ¼" conduits versus the single microduct system, and was much more costly," stated David Cleary, PhD, CTO from Bonfire.

"Establishing strong relations and open communication lines between vendors and a tribal sovereign nation like Southern Ute Indian Tribe is critical to the success of this installation," notes Brian Hollister. After the approval of the proposed plan, SUSS, Bonfire and Hexatronic put together the detailed schematics and scheduling for the initial phases to include the installation of the main cell towers, backbone conduit and connecting fiber from one of the seven microducts to a fiber distribution hub for future FTTH connectivity to the individual homes. Using geospatial and drone technology, they were able to locate where new towers could be placed and map out the routes for the conduit locations.

The first phase, scheduled to start in late Fall 2021 and end in late Fall of 2022 focuses on building a temporary storage and a construction yard and next place two new towers (totaling 4) followed up by installing 52 miles of conduit and fiber. It was stipulated in the design that there would be total avoidance of any wetlands, ditches, rivers, driveways using boring technology and any areas known to have endangered species such as the New Mexico Meadow Jumping mouse. Bonfire designed the conduit/fiber pathway to be placed along already existing State, County, local, or oil & gas right-of-way roads to minimize the ground disturbance.

"We had to eliminate one of the proposed towers because it would have been in the line of sight between the sun rising in the east and sacred tribal lands. The Tribe also wanted to make sure that it wasn't in the line of sight of the locations of two of our traditional ceremonial Sun Dance and Bear Dance grounds," explains Jeff Engman.

The new communication towers will be 80 feet tall to optimize coverage while minimizing visibility. Tree type towers were explored but not selected as they are taller and more visible. For reference, an average electrical pole is 50 feet tall.

To minimize the digging, the least invasive digging technique was chosen which includes plowing then boring and lastly trenching (all using separate equipment). During any excavation work, there will be a representative from the tribe on site to monitor the activity and ensure no artifacts of cultural significance are unearthed. 75% of Phase 1 construction will be plowing a utility depth of 4'. Plowing will be done in 1 to 2-mile segments and is a three-pass process where a trench is ripped with the plow, then conduit is placed on the second pass, and lastly the land is filled and compressed in the same day. Boring, which will be 24%, includes a 6'x 6' bore pit at the end of the bore hole. The work area is 30'x 30' at the start and at end of each bore. Trenching is only 1% of Phase 1 construction and includes short segments of 2- foot-wide trenches. This uses an 8' wide work area and room for trench spoils which is why it is the most invasive.

Phase 2 will include constructing up to 280 miles of fiber to the homes in higher-density communities within the Reservation, such as the City of Ignacio. The Tribe hopes to be awarded the NTIA grant by December 2021 which stipulates that they will have two years to construct the network which will provide a minimum of 100 Mb/s symmetrical and multi gigabyte level speeds. The plan is that over 50% of the homes will have FTTH by the end of 2023.

The last phase will extend the fiber and/or wireless across the entire reservation to areas with low population density, but still home to tribal members. SUSS will also partner with cellular companies to improve their coverage as well as providing EMS communication coverage to areas that are completely dark from a communication perspective.

"The impact of this digital divide is wide-ranging. Tribal Internet access is no longer a luxury, but a necessity," observes Chairman Melvin J. Baker. "The Southern Ute Indian Tribe prioritizes its economic prosperity which provides education, health care, and cultural preservation programs to tribal members. We want to impact as many as possible and make sure tribal homes are connected to high-speed internet now and into the future. Beginning and completing this project is a huge milestone for the Tribe, and while we are celebrating this moment, we are also keeping in mind future scalability," he adds. "With Bonfire and Hexatronic as our partners - our ecosystem - we are creating a game-changer opportunity to the entire reservation including all residential and businesses and creating a pathway for Indian Country."

Bios:

Melvin J. Baker, Chairman, Southern Ute Indian Tribe, was elected to lead the Southern Ute Indian Tribe in December 2020. Baker previously served 4 terms on Tribal Council, totaling nine years. Throughout his tenure, Chairman Baker worked on the development and implementation of the new Sky Ute Casino & Resort and the Southern Ute Cultural Center and Museum. As Chairman, Baker has prioritized restoring the teamwork within the tribal organization and the Tribal Broadband Modernization Project.

Jeff Engman, Chief Information Officer, Southern Ute Shared Services, is responsible for the delivery, support, and strategic direction of Information Technology services for Southern Ute Indian Tribal entities. Over the course of Mr. Engman's career he has held technical and leadership positions at Alterra Mountain Company, ConocoPhillips, and Intel Corporation. Six-years of his ConocoPhillips tenure was living and working in the Middle East for Dubai Petroleum Company, operated by ConocoPhillips. He is from Southwest Colorado, is a graduate of Durango High School and received his Bachelor's degree in Computer Information Systems from Fort Lewis College in Durango.

Brian Hollister, co-founder and CEO of Bonfire Engineering & Construction, is responsible for Bonfire's strategy, growth, profitability, and corporate culture. With more than 20 years' experience in the telecommunications business, his areas of expertise include sales leadership, operations, marketing, and business management. Brian's breadth of experience includes working for Internet Service providers like AT&T, Level3, and MCI to networking technology companies like Calix, Aktino and Vina Technologies. He is a born entrepreneur who has the unique ability to both "see the horizon" as well as "dig into the dirt" to help partners succeed. Brian is a champion of employee culture who drives growth through collaboration, engagement, and a focus on superior customer experiences.

David Cleary, PhD, and CTO of Bonfire Engineering and Construction has over two decades of experience in telecommunications and fiber access and has been active in numerous standards bodies including the International Telecommunications Union (ITU) and the Metro Ethernet Forum (MEF). He has 5 US patents relating to fiber networks and has served as co-editor of the ITU's GPON standard. As CTO and "Chief Geek" of Bonfire, Dr. Dave is responsible for strengthening business technology capabilities and developing the roadmap for new technology integration. His unique and engaging style of explaining science and technology has enabled Bonfire to establish technology partnerships and support the onboarding of new technologies with its customers.

Carol Everett Oliver, RCDD, DCDC, principal of CEO Communications, an ICT marketing firm, has authored over 100 technical articles and case studies and is a frequent speaker for both the low-voltage and electrical industries. She is currently the president-elect for the BICSI Board of Directors and will serve as president from 2022-2024.

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