

**Wyoming Unified Network
A Leap into a New Era**

Information Communications Technology (ICT) Innovations

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Executive Summary

Wyoming Governor Matt Mead established the goal of increasing the economic growth and diversity of the State's economy nine days into his first term in January 2011. The Governor has defined and continues to execute on a plan of action helping create a robust economy that is both diversified and sustainable. Governor Mead understood Wyoming has significant advantages for technology including its cool climate, reliable energy sources, accommodating business environment and spirit of true innovation. Through leveraging these advantages, the technology sector has seen tremendous growth with the influx of international technology leaders developing data centers and service delivery points in Wyoming, businesses relocating and information technology professionals targeting Wyoming as a place to work and live. These growth points have only been achieved because of the Governor's commitment and execution of information technology innovation, which is second to none.

Beginning in October 2013 through November 2014 and with the support of the Wyoming State Legislature, Governor Mead empowered and lead his team to realize true innovation. True innovation creates positive yet disruptive change, solves real life issues and is a catalyst for economic growth. The result of this innovation was the design, engineering, partnering and establishment of a core 100 gigabit, redundant, statewide network backbone, known as the Wyoming Unified Network (WUN). The Governor was able to achieve this success for Wyoming by leveraging innovation in numerous areas including technology, the supply chain, procurement, business and service models and operational strategy.

- Wyoming builds paradigm shifting 100Gbps IPv6 backbone connecting school districts and State offices via ethernet.
- From funding to lights-on in six months.
- School districts gain Internet2 and see 40 fold increases in capacity.
- Wyoming data centers can connect directly to backbone providing protected services to State agencies and school districts, expediting opportunity to move to cloud and lower local IT infrastructure costs.
- State becomes anchor tenant, dramatically increasing broadband investment throughout Wyoming. Many cities gain either 10 Gbps or 100 Gbps access from multiple vendors thanks to Wyoming partnerships with private industry.
- Already in production, this backbone currently exceeds the White House's ConnectED educational broadband targets for 2018.



Business Problem and Solution Description

The State network team was tasked with the objective to consolidate two distinct and separate networks; the Wyoming Equality Network and the State Agency Network into a unified enterprise network that could accommodate the Governor's vision to grow the Wyoming technology sector. This effort would support the needs of the school districts, provide required functionality to over one hundred diverse state agencies, boards and commissions, enhance local economies and provide connectivity to the State's citizens.

The innovative solution is known as the Wyoming Unified Network (WUN). The well designed and engineered topology has created a world-class enterprise network with streamlined network infrastructure, superior bandwidth and exceptional quality of service. The WUN provides redundancy, is scalable for future expansion, creates a technology roadmap for the State and has Lowest Corresponding Price (LCP) a service provider charges to nonresidential customers. The State Chief Information Officer was tasked with this project and was made responsible to establish a team to successfully executive the Governor's vision.

Significance of the Project

The significance was the intelligent and multi-discipline approach the Governor envisioned to improve the state's economy, spur sustainable growth, improve the effectiveness of state government and redesign service models through innovation in numerous diverse areas. The Governor harmonized the output of these innovations to rethink and create positive and multidimensional enhancements for Wyoming that not only benefit its citizens today, but will continue to provide countless advantages to the state's citizens long into the future.

A key to the success of the WUN, a privately built, yet State managed fiber backbone, was creating an appropriate market for commercial Internet Service Providers (ISP). Governor Mead directed the team to establish a public-private partnership with every broadband provider in Wyoming and identify where each had significant fiber infrastructure by region. These partnerships were accomplished through relationship building, negotiation and harnessing the purchasing power of the State. Governor Mead also designated a task force to simplify access to highway easements dramatically enhancing the deployments of both long and mid haul fiber optic connectivity throughout Wyoming. This added fiber now provides additional and faster Internet capabilities, on demand and more affordable than ever before.

These partnerships created culminates with the innovative and harmonized use of leased, data link layer (OSI Layer 2) lines providing 100 Gbps bandwidth service from



commercial ISP locations to eight State, carrier-neutral sites. The eight Wyoming communities housing these hubs were selected based on geographic location, private industry fiber demarcation points and routes, regional technology support, back-up power availability, heating/cooling, secure 24-hour access and optimal space overall. This design allowed each ISP to bid on State circuit connectivity, with a myriad of technologies and mediums to provide transport.

The WUN has been designed and engineered utilizing three redundant core rings providing multiple levels of redundancy to ensure reliability. This ring redundancy provides a backup path in an event that any part of a network is disrupted. All WUN routing is managed by the State which allows direct IPv6 connections to entities without the cross-connect limitations often encountered in hosted solutions. Cross-connect limitations include cross-talk and noise that negatively affect network performance. By initiating these direct connects, the State network team aggregates all of the connections, leveraging the fiber installations of any vendor, whether the topology is ring or mesh. The team then extends the service via aggregate points into every Wyoming community. By encouraging private partners to maintain secondary connections to core locations, the WUN leverages the substantial supplemental backhaul of these providers to simulate layers of network mesh that creates multi-dimensional redundancy ensuring instantaneous failover, optimized load balancing and almost unlimited scalability.

Benefit of the Project

Technology is moving to become the fourth largest industry within Wyoming, one of the original goals of Governor Mead. Reaching this goal is an incredible accomplishment based on the characteristics of Wyoming, which include a geographically large state, very low population, initially minimal interest from service providers and an immature technology infrastructure.

The WUN is a precedent setting technology project yielding benefits to every quadrant, industry sector and vertical market in Wyoming. The WUN supports State government through a strong return on technology investment while providing connectivity, redundancy, resilience, funding efficiencies, accountability and transparency. This capability is allowing Wyoming to abandon its legacy data centers and transition easily into a true cloud infrastructure.

The WUN connects to the Front Range GigaPop (FRGP) from two directions over the Bi-State Optical Network (BiSON ring), placing Wyoming directly on Internet and Internet2. Wyoming peers with Microsoft and Google in Denver, Colorado. This peering



removes a massive amount of State traffic from traversing the public Internet and helps protect the traffic from the continually changing and dangerous cyber threat environment of the Internet. In addition, the WUN can connect directly to Wyoming located data centers, creating a closed economy with contractor preference for delivering cloud solutions directly to any education or government facility in the State. This ability places statewide commercial data centers “On Net” presenting an unparalleled opportunity for innovation in Wyoming’s technology ecosystem.

The dramatic success has attracted the attention of large players in the technology sector. Microsoft has committed to building a \$750,000 data center adjacent to the WUN. Salesforce is targeting the delivery of cloud services through Wyoming’s massive capacity. Google has heralded Wyoming’s partnership in leveraging the best in application and data services.

Governor’s Mead successful implementation has seen the State “leapfrog” into a new era of technical dominance. The WUN project has boosted capacity to 100 gigabits compared to the past 2.5 gigabit network and is deployed utilizing IPv6. Many schools have seen a 3,300% increase in broadband speeds. The Governor’s first area of focus was education. Governor Mead has given Wyoming students real time, unfettered access to the world’s knowledge and enables interactive learning, which has been shown to improve academic success, lower dropout rates and encourage non-traditional students to return to school through the use of online learning and curriculums.

The State has executed twenty-three master service agreements with vendors interested in being a part of the WUN. Vendors have worked proactively to upgrade equipment and create connectivity to local communities that would have been too small to otherwise warrant the technology investment. With new high capacity equipment in place, ISPs can offer enhanced services, at an affordable price, to businesses and citizens. The State is investing in companies that choose to build in Wyoming.

The WUN provides redundancy and agility, and has eliminated the legacy single points of failure while delivering huge increases in uptime and capacity. Through procurement innovation, new contracting vehicles were developed by the State enhancing the way the State engages ISPs and other vendors. A result of this innovation is a forty time increased in capacity. When Governor Mead took office in 2011, only two school districts had Ethernet capability. Now all twenty-three counties and forty-eight school districts have moved to Ethernet.



The increased capacity of the WUN has enabled the State to improve its digital service offerings through identifying and supporting specific technology that can scale effectively and provide the increased bandwidth for more complicated citizen facing services allowing for intrastate agency collaboration to design and develop enhanced State enterprise portals and citizen facing applications. The WUN provides measureable improved efficiency in the delivery of State agency programs while allowing each agency to meet their individual missions.

The project has been cost effective through the use of strong return on investment drivers. In October 2013, the State Chief Information Officer provided the proposed WUN project to the State Legislature. The project was then funded for fiscal year 2015 and 2016. The \$15.8 million investment was backed by the State's general fund along with educational funding. The State enterprise segment portion of the network is sustained with general funds in the amount of \$3.9 million dollars yearly and the current education portion of the network is sustained with School Foundation funds in the amount of \$6.8 million dollars yearly for an annual cost of \$10.8 million. The budget for the WUN will be sustained at a standardized amount per year starting in fiscal year 2017 and 2018 in the amount of approximately \$12 million dollars per year.

The initial 100 gigabit connections were awarded to ISPs who provided the lowest bids with the highest quality of service. By partnering with the ISPs, the State has shown cooperation and good faith in not competing with these vendors, but instead by using their infrastructure. This concept entices ISPs to invest and expand into rural Wyoming increasing their customer base while dramatically improving connectivity in the State between State agencies, business and Wyoming citizens. The WUN has proven to be a cost effective network that delivers continual return on information technology investment.

Wyoming stands as a model for demonstrating how adoption and utilization of transformational and innovative technology aligned with improved State business processes can yield optimized services, sustainability and availability in alignment with State strategic initiatives while reducing cost and complexity.

Through the strong leadership of Governor Mead, designing an innovative and executable plan, leveraging technology experts and meeting all challenges aggressively, the WUN has met the stringent predefined benefits that were used as project acceptance criteria. These benefits include:

- Ethernet technology in every county in Wyoming.



- Implemented high speed, scalable Ethernet connection to all school districts.
- Enhanced the partnership with the University of Wyoming by joining the BiSON Ring.
- Extended research access to Internet2.
- Developed the connection to the Front Range GigaPop (FRGP).
- Peered and partnered with international technology leaders like Google and Microsoft.
- Created of a strategic approach to demonstrate value to the Wyoming State Legislature in order to receive the approval for \$15.8 million dollars in funding to build the network.
- Completed the 100 gigabit redundant rings built into eight core locations in Cheyenne, Sheridan, Basin, Casper, Riverton, Jackson, Laramie and Rock Springs.
- Removed capacity choke points that were creating challenges for school districts and State agencies.
- Enabled and enhanced the ability to deploy IPv6 and Bring Your Own Device (BYOD) capabilities.
- Provided secure connections to private data centers within Wyoming who serve school districts and State agencies.
- Provided educational institutions the opportunity to partner with Wyoming companies to establish enhanced information technology service delivery, innovation, cost savings and scalability.

Governor Mead met the goal of improving the economic growth and diversity of the State's economy through innovation in technology. He has strategically created a technology culture that is agile, innovative and motivated to meet the challenges of reinventing how and what technologies government uses and how government deliver technology services now and in the future. The technology culture in Wyoming continues to evolve and is poised and ready to meet the high expectations of Wyoming's agencies, educators, businesses and citizens by leveraging the Wyoming Unified Network; a transformative and innovative information technology communication project.

