



Nebraska Capital Projects Fund

Company: Skywave Wireless, Inc.

Project: Cuming County Area 1

Document: Attachment E – Technical Capability Statement

Approximate Locations Passed: 137

Approximate Fiber Miles: 72

Experience

Skywave has built and maintained its broadband network since 2003. Skywave has operated dial-up, fixed-wireless, microwave, and fiber optic networks. In 2012 Skywave started designing, building, and maintaining an all FTTP (fiber to the premise) network and has since expanded to surrounding communities. It currently offers speeds up to 1000/1000 Mbps for residential customers, and speeds greater than 1000/1000 Mbps for business customers. A brief excerpt from June 2022 477 data is included at the end of this document demonstrating greater than 100/100 Mbps service.

Overall Network Design

ITU G.984 GPON standard will be utilized to provide **last mile** broadband services. This GPON standard has a capacity of 2.488 Gbps downstream by 1.244 Gbps upstream. Updated versions support up to a 1:128 split ratio. Physical distance between the user and the provider can be up to 40Km with class C+ optics. GPON technology can easily achieve sub 1ms latency. A few factors like distance and equipment used can affect this number slightly, however it still remains one of the fastest distribution technologies. With Quality of Service (QoS) standards and extremely low latency, GPON is capable of delivering the highest (5 - excellent) mean opinion score (MOS). This architecture will easily allow Skywave to provide the minimum 100/100 Mbps required by this program.

Skywave's **middle-mile/backhaul** network uses the IEEE (Institute of Electrical and Electronics Engineers) standards and consists of many point-to-point fiber connections. It is designed with redundancy and performance considerations. Enhanced Interior Gateway Routing Protocol (EIGRP) is used to create an industry standard resilient network. Star and ring topologies are utilized.

Skywave's **interconnection architecture** consists of multiple upstream connections to the Internet. It currently has over 30Gb of upstream connections to the Internet that are scalable as needed. These connections are physically separated by almost 90 miles to provide geographic redundancy. It utilizes Border Gateway Protocol (BGP) along with ring topologies on its edge routers to create failsafe redundant connections to the internet. It also is a member of the Omaha IX (internet exchange) where it peers with many different providers (Google, Facebook, Akamai, Netflix...). For added redundancy, Skywave receives full internet routes from multiple providers at separate locations.



Skywave's FTTH network is designed with **scalability** and ultra-low latency as top priorities. All of Skywave's fiber network nodes are connected either with its own fiber or on partner fiber via an eLan service network. This allows Skywave to monitor all its links and increase bandwidth when demand is needed. Usually, bandwidth increases can happen in real time and do not require any build outs. This puts Skywave at the leading edge for its ability to scale its network as demand increases.

The **design and features** Skywave utilizes in its network always have reliability in mind. Skywave utilizes its own fiber and partner fiber to create redundant middle mile connections to its nodes. All FTTH nodes are built with redundant power systems and generators. Skywave believes that network uptime is one of the most important things it can provide for its customers.

Useful Life of Network

Skywave has built and maintained its fiber optic network for over 10 years now. One reason why 99% of Skywave's fiber network is underground is for longevity. Underground fiber plants are easier to maintain and are protected from the harsh Nebraska weather. Skywave also protects most of its fiber lines inside plastic conduit. While other companies usually do not install the customer's drop cable inside of conduit, Skywave does. This helps protect the customer's drop from accidental damage.

Several components of every FTTP network are to be considered when determining useful life of the network as a whole. Fiber optic cables are designed to last well past 20 years. Many older cables are still in use today. Newer technologies have also helped to increase the expected life of these networks. Skywave is still using the same hardware platform that it installed over 10 years ago. GPON technology is ahead of the demand for bandwidth and hardware vendors are designing hardware to last. Skywave foresees that the useful life can be well over 15 years for hardware platforms and longer as those platforms are maintained and updated as hardware vendors progress. Hardware platform costs are a small part of the overall expense of the network. Skywave designs and engineers its network in an effort to extend its useful life to 30 years or more.

Network Management and On-going Operations

Skywave utilizes multiple software platforms for link monitoring. Alarms are utilized to notify technicians when any link is experiencing high load as described previously. Alarm events are researched and links are upgraded if needed. Skywave has many years of experience maintaining and provisioning its current FTTP network.

Skywave will continue for the 15-year period and beyond to maintain internal staff that monitors and rectifies any issues with performance or capacity on the network. The useful life of the facilities is estimated to be 20 years for budgetary purposes, but will likely last far longer than that with maintenance and upgrades. The on-going maintenance of the fiber optic network is handled by the Outside Plant department. Skywave has several crews of experienced fiber optic installers. Everything that is needed to maintain and service the network Skywave has in-house. This allows Skywave to keep its costs down and response times up without having to rely on outside contractors.

The technical staff handles all of the provisioning and maintenance of the fiber optic electronics and CPE equipment to provide services to its customers. IT staff also handles interconnection equipment and devices. Internal ticketing systems and procedures are used to provision all services from start to finish. All departments communicate using this system. This allows Skywave to provide



quick response and excellent customer service.

This project specifically will be resilient and sustainable in the long term. The project location is near current service areas and will be able to be managed and maintained with Skywave’s current staff and equipment. The new service area will be maintained along with existing service areas. This includes physical maintenance of outside plant, such as fixing broken handholes, post-construction settling, additional splicing and service drops as new customers are added, and scheduled inspections of plant components for damage. Electronics maintenance includes migration to new components as the original equipment reaches end of life and interim firmware updates to maintain devices. Monitoring and adapting interconnection routes and capacities is also part of ongoing maintenance.

477 Data – June 2022

| frn | provider id | brand name | location id | technology | max advertised download speed | max advertised upload speed | low latency | business residential code | state usps | block geoid | h3 res8 id |
|----------|-------------|------------------------|-------------|------------|-------------------------------|-----------------------------|-------------|---------------------------|------------|-----------------|----------------|
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417320 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002088 | 88260e1021ffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417322 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002086 | 88260e102dffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417346 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002114 | 88260e1021ffff |
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| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417347 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002085 | 88260e102dffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417348 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002082 | 88260e1029ffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417326 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002047 | 88260e1067ffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417353 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002053 | 88260e1067ffff |
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| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417330 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002058 | 88260e102dffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417360 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002049 | 88260e1067ffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417362 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002044 | 88260e102dffff |
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| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417363 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002092 | 88260e1021ffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417332 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002077 | 88260e102dffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417366 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002084 | 88260e102dffff |
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| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417337 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002080 | 88260e102dffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417372 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002087 | 88260e102dffff |
| 21644448 | 270074 | Skywave Wireless, Inc. | 1089417342 | 50 | 1000 | 1000 | 1 | X | NE | 310219632002106 | 88260e1021ffff |