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PULSE BROADBAND

FTTH COST PROJECTIONS OF FEASIBILITY STUDY

HUACHUCA CITY, AZ

October 11, 2017

Pulse Broadband LLC has been engaged by Huachuca City, AZ to complete a detailed feasibility study for building a Fiber-to-the-Home network and the ability for accessing double play telecom services (Internet and VoIP Telephone) offered to the residents and businesses of Huachuca City.

Pulse completed an on-site field review by Pulse technical outside plant staff. We utilized this visit to evaluate some of the initial assumptions built into the model and review the condition of the plant. Finally, we completed detailed cost projection to evaluate economic feasibility. It is our pleasure to provide the results of this independent feasibility study.

It is our opinion that the probability of financial success for building and operating a FTTH network **is likely** for Huachuca City, AZ. Several fundamental reasons support our conclusion, including:

1. **Our field review resulted with no show stoppers.** The electric plant is within normal ranges of fiber readiness. No major barriers are present. Drop distances are similar to other builds of varying density and costs should be input to the model accordingly. Fiber readiness, make-ready, and drop distances were inspected and compared to our real-world data.
2. **Limited Competition.** Huachuca City faces very limited competition in its footprint. A full Fiber-to-the-Home product should be a welcome alternative for residential and business High Speed broadband needs.

We look forward to working with Huachuca City on this important strategic, regional infrastructure project which will bring the capability of gigabit broadband access to your municipal buildings, residents and business. We've included a narrative at the beginning of the report to provide credibility for any reader unfamiliar with Pulse and NRTC. Please distribute our report for any required business purposes and include my contact information as needed.

Sincerely,

Eric Freesmeier, CEO
eric@pulsebroadband.net
(314) 324-7347

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About Pulse Broadband

Pulse was formed with the sole purpose of partnering with rural America to bring fiber technology to underserved areas. Since our formation in 2008, we have partnered with electric cooperatives, municipal entities, and private groups to build successful FTTH projects. In addition to our fiber design and construction management expertise, we offer a full suite of telecom services, from feasibility studies of a new network to back office support services for existing companies, to meet our customer's needs. This 360° view of the industry, along with our years of hands-on experience, give Pulse the distinction of being one of the true leaders in the rural Fiber-to-the-Home industry.

There is no project too small, or too large, which is outside the scope of our expertise. Each project has been unique and our collaborative approach with every owner has brought a customized solution. The variations and complexities of each project have given us invaluable real-world experience. These experiences enable us to take a deep-dive with each new client to ask the right questions, inspect critical areas, and discover hidden problems to ensure our studies, models, and designs produce the most accurate outcomes.

Pulse Broadband is a full-service firm offering feasibility studies, financial model, fiber design, technology selection, construction management, vendor (bandwidth, VoIP, video and network management) negotiations, and back office support. Our working knowledge in each of these critical areas allows us to make more informed decisions in all phases. Whichever service our clients need; this holistic approach gives them the confidence that they are setup for success.

NRTC and Pulse Broadband – A Powerful Combination

NRTC has a long and successful history of teaming with nationwide providers to bring the benefits of technology to rural America. Pulse Broadband, a company that has extensive experience working with electric utilities on prominent fiber optic projects, is a notable example. The two companies forged a partnership in the summer of 2015. Working together, NRTC and Pulse offer a powerful combination of services. On August 31, 2016 NRTC and Pulse Broadband completed a transaction for NRTC to acquire 100% of Pulse Broadband LLC. The acquisition will enable NRTC to accelerate its efforts to provide a full range of technology solutions to its electric and telephone members in the areas of broadband and communications services.

NRTC provides products and services developed specifically to meet the needs of rural utilities and their customers, such as integrated smart grid technologies and energy efficiency solutions, broadband access, full service Internet access and support, wireless technologies, mobile phone service and programming distribution rights for video providers.

NRTC strives to be members' trusted technology partner. While the products, services and solutions NRTC offers evolve based on changes in technology and member needs, its mission and cooperative principles remain the same – Member Focused. Technology Driven.

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On-Site Review

Huachuca City Team

Bob and Alan were on-site to conduct a field verification analysis of Huachuca City's service area. Huachuca City was very active and supportive of Pulse's efforts while in Arizona. We are appreciative of all efforts from the Municipal staff in Huachuca City. In our experience, this collaborative approach helps ensure the successful construction and deployment of a fiber project.

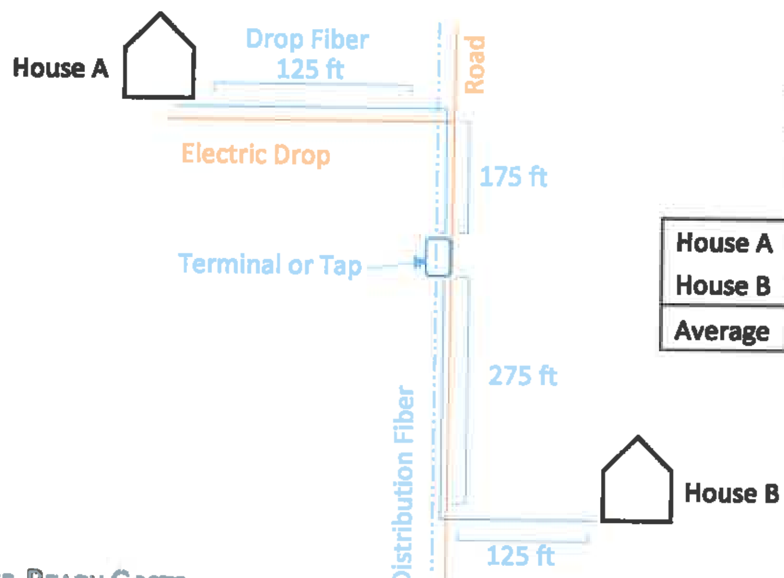
Condition of Plant

Bob and Alan were on-site to inspect portions of Huachuca City's plant for the potential broadband network build. They reviewed over 100% of the 31 miles which make up Huachuca City's service area and new build needed. They use their experience to inspect possible construction and event issues that may arise, following technical specifications as outlined by the National Electric Safety Code (NESC) and RUS.

Drop Distances

Drop distance is a critical input into the financial model. Drop distance is a combination of length from the primary plant to the meter and along the main plant to the terminal. The service area for Huachuca City is similar to other urban builds. Based upon our previous field reviews, Pulse estimates an average drop length of 350 feet. This figure is in line with service areas consisting of various densities. We recommend Huachuca City includes slightly more cost to the financial model to remain conservative in cost estimate. The estimated drop length for Huachuca City would be about 350 feet.

The illustration below describes how drops will be built into the fiber design. The figures represent a common rural drop.



	Drop Fiber		
	Along Distribution	Transformer to Meter	Total
House A	175	125	300
House B	275	125	400
Average	450	250	350

Make-Ready Costs

Make-Ready is another critical cost in calculating the total cost of construction. The cost of make-ready may be affected by issues such as; tree trimming, congestion, etc. and by density. Based upon our on-site field review, Pulse has calculated a make-ready estimate of $3168 per aerial mile this is mostly estimated for the wreck out of the existing COX cable plant. This value has been input into the financial model accordingly.

Conclusion

The field review confirmed a few assumptions to build into the financial model:

- The Huachuca City team is motivated, organized and willing to ask for guidance on the project. These are critical qualities of the management team that will lead a fiber project.
- The electric plant does not contain any showstoppers. The electric plant is within normal ranges of fiber readiness. No major barriers are present. Make-ready issues are common to similar builds. Costs should be input in the range of $3168 for make-ready per mile.
- Drop distances are similar to other builds with varying density. Costs should be input in the range of $754 per drop or $263,900 and includes ONT.

Financial Projections

Huachuca City Service Area Statistics

Huachuca City supplied a map for their service area. This map was utilized in the financial model to give an accurate cost estimation for construction and make ready. Based upon the information received, and information collected during and following the on-site review, Pulse calculated a service area consisting of:

- 825 residential locations
- 30 small businesses
- 31.5 Total miles consists of 2 UG miles for 6.4% UG

Capital Budget Assumptions

Capital costs to construct the network will be approximately $940,708. The timeline anticipated for the build is six months based on achievable milestones.

Financial Highlights

Residential - Monthly			
Take Rate	Construction Cost per Customer	Operational Cost per Customer	Total Cost per Customer
40%	$ 10	$ 25	$ 35
45%	$ 9	$ 22	$ 31
55%	$ 8	$ 19	$ 26
65%	$ 7	$ 16	$ 23

Commercial - Monthly*			
Residential Take Rate	Construction Cost per Customer	Annual Cost per Customer	Total Cost per Customer
40%	$ 22	$ 53	$ 75
45%	$ 20	$ 48	$ 67
55%	$ 16	$ 40	$ 56
65%	$ 14	$ 34	$ 48

*assumes a 100% commercial take rate

Disclaimer

These forward-looking statements reflect Pulse's best professional judgment based on currently known factors but involve significant risks and uncertainties. We are confident in our abilities to project the fiber and telecommunications industries, but actual results could vary materially dependent on changes in the market conditions.

1 Gb pipe => 53.00

10% Home Value added

Ammon 57 → 43.00 @ 75% Take Rate

150 - is Const Design

ONT = 400.00

The Ammon Model: Open Access Virtual Infrastructure

Open Access Virtual Infrastructure (OAVI) makes the actual *infrastructure* available to the end user through the use of virtualization, rather than the infrastructure's *service(s).*

Why this matters:

OAVI enhances consumer choice by separating the underlying physical infrastructure from the network service(s). Each end user is empowered by being presented with his own infrastructure. As a result, every user has the ability to receive and/or deliver services across the infrastructure by utilizing a self-provisioned network or by joining a network provided by any other user by joint agreement.

This is a change from the traditional Open Access Network (OAN) model where there is simply an "organizational separation" between the infrastructure owner and the service provider(s). For example, the traditional 2 layer OAN model consists of a single entity *network* owner and operator, and expects multiple retail service providers to deliver services over the network, while the traditional 3 layer OAN model requires a separate *network* owner and operator, with the same expectation of multiple retail service providers. The OAVI model consists of an *infrastructure* operator and *infrastructure* users.

OVAI supports net neutrality as the infrastructure owner is providing infrastructure to all users without discrimination rather than network service(s). The infrastructure owner's incentives are clarified by creating a clear separation between the physical infrastructure and the multiple user networks operating across the infrastructure. The specific characteristics of each individual network, including performance, are determined by the user(s) infrastructure selection and network provisioning. Therefore, the treatment of the data lies outside of the infrastructure operator's purview. User costs are not based on network utilization but on infrastructure consumption.

OAVI represents a shift from traditional models where both providers and subscribers are often charged for network usage without relation to infrastructure costs, availability or capacity. In other words, if the infrastructure owner is compensated for reselling infrastructure rather than network services the natural effect will be the creation of a marketplace wherein competitive forces will reduce the cost of network services to simple commodity pricing. The incentives for openness and efficiency will be maintained. Resulting network availability, including bandwidth, will transition from scarce to abundant. OAVI, therefore, presents the infrastructure as a utility.

OAVI enables innovation as the barrier(s) to virtual infrastructure ownership are eliminated. In a true OAVI model there is no distinction between providers and subscribers, as all users on the infrastructure have equal access to the infrastructure through virtualization.

OAVI also reduces costs through infrastructure sharing made possible by virtualizing the infrastructure thereby allowing multiple instances of the infrastructure to be presented to users.

Technical Aspects:

While the purpose of this paper is not to address in detail the technical aspects of OVAI, it should be noted that an absolute commitment to the proper architectural framework is required when designing and implementing the infrastructure in order for it to be presented to the end users as a generic utility. Therefore, to meet the definition of OVAI, as used here, the user must be presented with a virtual wire from edge to edge with a minimum capacity of 1 gigabit per second. Additionally, because the infrastructure is virtualized, the user must be able to create as many virtual wires as desired on the physical infrastructure. In practice, this functionality will make it possible for a user to provide or receive multiple instances of the same or different network services on the same physical infrastructure.

Financial Model:

Experience proves that economic forces will determine the success and drive the evolution of any given model. Therefore, it is essential that the correct economic model be applied to the OAVI.

Ubiquity and economy of scale are both critical to the success of presenting infrastructure as a utility. In addition, clear incentives for the infrastructure owner must be maintained. For these reasons, an economic model similar to those used by utilities would be most applicable. The City of Ammon is an incorporated municipality in the state of Idaho which believes that an OAVI as described here could be well served by a municipal utility under the following economic model:

1. Within the municipal framework, utility infrastructure build costs are paid by the property owners desiring the utility service. This could be done via a standard municipal bond process which requires the support of the property owners who will receive the utility service.

2. Also, within the municipal framework, the utility infrastructure maintenance and operational costs are paid by the property owners with access to the utility via a monthly utility service fee. It is important to note, that under the OAVI model, the utility service is *virtualized infrastructure*.

In practical terms, the costs to the user would come in two forms:

The costs for building the infrastructure would be paid back through property tax. As an example, an average community might expect to pay $3,000 per property to build out the OAVI. If this were funded with a 20 year municipal bond at 2%, the payments would be $182.16 per year or $15.18 per month.

The costs for maintaining and operating the infrastructure would be paid with a monthly utility service fee which should average between $15 and $25 per month depending on the scale and operational costs associated with the infrastructure.

The monthly cost to the user would total between $30 and $40 per month for the first 20 years, with the potential to diminish to $15 to $25 per month after the build costs are paid. This potential to diminish, however, assumes that the monthly utility fee adequately provides for asset depreciation and replacement, as well as inflation.

It must be noted that none of these fees provides for what might be considered a retail network service unless the service desired by the user is infrastructure between two or more locations served by the OAVI. Services such as the Internet, VoIP or IPTV should be available and could be delivered across the OAVI with an agreement between the provider and the end user. In this instance the end user is the service provider's customer. Conceptually, when the end user desires a service other than his or her own, the OAVI model puts the end user in the middle of the network service provider and the infrastructure owner, thereby improving consumer choice and control.

Conclusion:

Implementing an OAVI utility with the wrong economic model would likely result in an Open Access Network with a different underlying technical architecture. Currently, infrastructure owners do discriminate by charging differing rates based on service type, service owner or whether or not they perceive a user to be a 'service provider'. They do so, paradoxically, while providing infrastructure which is isolated from those concerns and whose cost is fixed regardless of utilization. The inherent benefits of the OAVI model would be destroyed in the presence of such discrimination, as the economic model is completely disconnected from the operational model. Therefore, neither the operational or economic model will function correctly without the other.

Correctly implemented OAVI has the potential to address a national need by changing the broadband paradigm. Consider the following:

1. Most experts agree that broadband today is largely a natural monopoly.
2. Broadband regulation via antitrust and consumer-protection laws has proven deficient.
3. Broadband is arguably already a public utility.

An OAVI municipal utility has the ability to address these needs by creating a self-regulating infrastructure, and placing that regulation where it belongs: on the infrastructure, not the service. This will allow the fixed costs of building, operating and maintaining the infrastructure to be equitability apportioned amongst the users. In return the infrastructure is guaranteed and is equally available to all utility members. Network services, including bandwidth will become a commodity; open and abundantly available to all. Barriers to innovation will disappear as utility members may be providers or subscribers, or even both without discrimination in treatment or costs.

Ammon Model – City of Ammon Fiber to the Home (FTTH) Financial Model

The City of Ammon Idaho has deployed the first fully automated Open Access, SDN based, Virtualized Municipal Fiber Network in North America (perhaps worldwide). The financial model developed by Ammon to fund its fiber buildout is as unique and innovative as the technology behind the network.

Key Concepts in Ammon's Financial Model Include: *[Note: Items in bold are distinguishing features of the Ammon model.]*

1. Network Infrastructure funding is structured in a Local Improvement District (LID).
   [The name for this structure varies by State i.e. Special Improvement District, Business Improvement District, Special Service Area, Local Improvement District, or Broadband Improvement District.]
2. **The Lit Fiber Network Infrastructure is organized as a Utility.**
3. **Services are not part of the Utility.**
4. The municipality owns, manages, maintains and provides customer support for Utility infrastructure.
5. **The Model reinforces separation of infrastructure and services.**
6. The municipality supports the cloud environment hosting services.
7. Service Providers have a direct relationship with Subscribers.
8. This model is "Opt-in" – this means Property Owners voluntarily sign up to participate in the LID.
9. **Legal responsibility for LID funding comes from the property owners who sign up.**
10. **The model is low risk (financially) for the Municipality.**
11. **Property owners who choose <u>not</u> to participate are <u>not</u> financially responsible for LID debt or obligations.**
12. Total LID infrastructure cost divided by number of subscribers = financial obligation of each property owner.
13. **There are Three Cost Categories:**
    a. **Infrastructure Cost** – paid through property taxes *(can be paid up front or spread over 20 years)*.
    b. **Monthly Maintenance & Operations (M&O) Cost** – paid through City Utility invoice.
    c. **Cost for Subscribed Services** – paid directly to the Service Provider(s).
14. Infrastructure deployment is broken up into phases and each phase is a separate LID.
15. **The model is sustainable because it is not dependent on take rates beyond the initial take rate.**
16. **The model is sustainable because customer stickiness is very strong.**
17. **This model is sustainable because the method of funding protects the network operator from changes in the prices of services.**
18. **Monthly maintenance & operations (M&O) expenses can be suspended by subscribers.**
19. **Services can be suspended by subscribers.**
20. Infrastructure expenses cannot be suspended until the property owner LID debt is retired.
21. Equipment replacement is built into maintenance & operations (M&O) expense.
22. Late-comers pay full amount up front.
23. Actual LID assessment amount per household depends on take-rate.
24. **To address Digital Divide concerns under the LID structure, Ammon provides a free Lifeline ISP which allows users experiencing a financial hardship to use the network in 60 minute increments to access essential services (school district network, job search, other educational resources, government resources, etc).**

Ammon Model – City of Ammon Fiber to the Home (FTTH) Financial Model

Ammon FTTH Deployment Data – Phase 1

Residential Take Rate	67%-70%
Number of ISP's Signed Up to Provide Services	4
Infrastructure Allocation Per Home Owner	$3,000
Infrastructure Finance Term	20 Years
Monthly Infrastructure Expense (Fiber Optic Connection)	$17.00
Monthly Maintenance & Operations Expense (1 Gig Connection)	$17.00
Best Monthly ISP Best Value Currently (75/75 Mbps)	$19.99
Total Monthly Cost	**$53.99**

Questions?

Bruce Patterson
Technology Director at City of Ammon
bpatterson@ci.ammon.id.us

Jeff Christensen
EntryPoint Networks
jchristensen@entpnt.com

Authors

Bruce Patterson
Technology Director, City of Ammon

Jeff Christensen
President, EntryPoint

Robert Peterson
Chief Technology Strategist, EntryPoint

www.entpnt.com

ENTRY POINT NETWORKS