C Spire Rural Broadband Consortium

case study

Established WISP Business Model – Clustered Town Environment

1 INTRODUCTION

The C Spire Rural Broadband Consortium has examined a couple of examples of deploying broadband in clustered towns. One small, clustered town in rural Mississippi was chosen to determine the feasibility, viability, and challenges of bringing broadband to this environment. C Spire (the Operator), in conjunction with an established wireless Internet service provider (WISP), deployed a micro fixed wireless access network with wireless backhaul to serve the town to evaluate the feasibility of one type of 3rd party engagement model. Because the buildings in these towns are clustered with line of sight (LOS) between buildings, a micro-cellular network was deployed. This case study describes the fixed wireless deployment with an Established ISP business model in the small, clustered town.

2 MARKET DESCRIPTION

The small town in rural Mississippi contains a population of more than 550 and a household count of about 150. The town is primarily made up of homes with a few government buildings, businesses, and other facilities throughout the town. While the town encompasses a 1.1 square mile area, most of the buildings are clustered within a 0.1 square mile area. Most buildings in the clustered area are visible (LOS) to a centrally located town-owned water tower, marked with a blue triangle in **Figure 1**. The town has a flat morphology, with some mature trees scattered throughout. There are a handful of additional structures located to the north and south of the main clustered area that officially belong to the town's zip code that are not shown in **Figure 1**.

FIGURE 1:
Clustered small town in Rural Mississippi

Internet service in the town was limited to satellite along with some very limited DSL availability. The satellite service providers provide up to 35 Mbps service. Cellular service in the town was relatively poor as the closest cell tower is an Operator-owned Operator-fiber-fed asset about 10 miles from the town. Due to this underservice, the town and its local government were passionate about their need for broadband. An underserved community willing to aid in the success of a broadband buildout solidified this market candidate as a good case study.

3 TECHNOLOGY OPTIONS CONSIDERED

As with other case studies [1-3], a variety of technology options were considered, including fiber and fixed wireless access, and fiber, LEO, and microwave backhaul (**Figure 2**). Both technical feasibility and economic viability were analyzed.

- **ACCESS:**

  Direct Fiber Connection

  - Impractically expensive due to distance from town (10 miles)

  Macro Fixed Wireless

  - Existing operator-owned operator-fiber fed macro tower 10 miles from the town
  - Pros: Feasible to include on the owned tower
  - Cons: Too far from the town to serve broadband wireless

  Micro Fixed Wireless

  - Build smaller hub in town and use Gbps microwave link from operator infrastructure to the hub
  - Pros: Reasonably high speed and reliability, and low cost. LOS exists to most potential consumers
  - Cons: Has multiple points of failure, and if the micro host loses service, all the consumers will experience an outage

- **BACKHAUL:**

  - Fiber: Impractically expensive due to distance from town
  - Wireless: Feasible with long-range microwave link
  - LEO satellites – Technically feasible, especially as the small town has relatively small capacity needs but not currently available; more expensive than a microwave link in this scenario

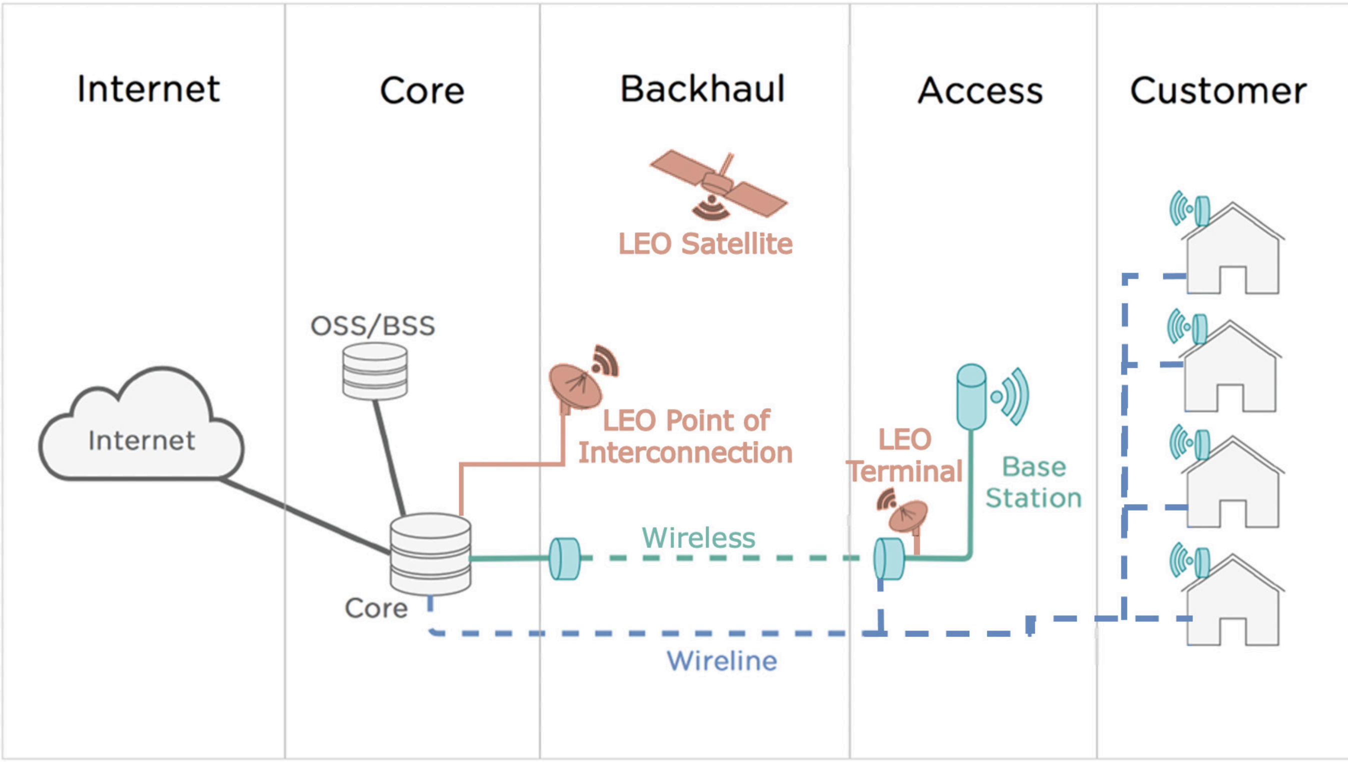

FIGURE 2:
Broadband Connectivity Options Considered

4 MARKET DESIGN AND COST

4.1 DESIGN

During the initial technology design analysis, the distance between the town and existing infrastructure, both fiber backhaul and tower assets, led to an easy choice, microwave backhaul with fixed wireless access. When analyzing which type of fixed wireless access to use, the town was identified as a likely candidate for a micro fixed wireless deployment due to its clustered, mostly LOS morphology. With internet-capable infrastructure nearly 10 miles away, using a macro deployment was challenging. Backhaul was provided to the in-town water tank via a microwave link, and the water tank was used as the starting point for a micro-cellular deployment.

Technically, however, because only one tower (four sectors) covers the entire town and the tower is taller than the average building height, the deployment could be considered a macro-site deployment. If the more remote buildings should need to be connected, one of the connected buildings can be used as a hub site to provide access to buildings on the outskirts of town.

Note that the town also desired an improvement in mobility (voice and data) service, making that a requirement to use their infrastructure. As the town infrastructure was researched, it was discovered that the town did not fully own the water tower. The water tower itself was owned by the town, but the land under it was owned by the county. The time required for the Operator to research the ownership and to come to terms with both town and county (lease renewal) added to the time and cost of the project significantly.

4.2 DEPLOYMENT COSTS

Once the town's water tower land lease was renewed, the costs of both the mobility and fixed service were negotiated, decreased, renegotiated, and then approved so that construction could begin. Because installation on a water tower requires a significant amount of welding, the time and cost to deploy multiple sectors and multiple technologies were higher than average for a small town. In fact, access installation costs were nearly four times that of access equipment. **Table 1** shows the breakdown of the costs for the fixed wireless solution, both equipment and construction as well as the estimated operational costs associated with this type of system. The mobility service construction costs are not included. Only half of the actual backhaul construction costs are shown as the mobility service shares half the backhaul link. Customer equipment installation is based on an estimated 25% take rate of the total number of households.

	Cost Estimate
Backhaul Design	2.39%
Core Design	2.39%
Access Design	3.59%
Backhaul Construction	6.24%
Access Construction	66.33%
Customer Acquisition	2.45%
Customer Equipment Installation	8.42%
Provisioning	1.63%
Billing (OSS/BSS)	1.63%
Network Monitoring	1.63%
Equipment Replacement	3.27%
Total	100%

TABLE 1:
Cost Breakdown of Fixed Wireless solution

5 BUSINESS MODEL

5.1 3RD PARTY ENGAGEMENT

Initially, the town was envisioned as an operator-only model (i.e., C Spire-only model). Because C Spire is also the primary cellular/mobility operator in the area, some synergies could have been realized. However, due to the distance from other fixed broadband markets, the C Spire resources to install and maintain this market are located hours away. The time required to travel to and from the market would take those resources away from other, bigger markets. As a result, a 3rd party enablement model was deemed more effective in terms of cost and time.

Table 2 shows the two engagement models considered, the Operator-only and the Established ISP model. A WISP who served neighboring towns was contacted to see if they would participate in this new third party engagement model; this WISP became the Established ISP. The Operator obtained the town agreements, performed the initial network design, and installed the backhaul equipment. The cost of the access construction was split with the Established ISP. Then the access network was turned over to the Established ISP to run and maintain. Likewise, consumer engagement activities, including acquisition, installation, provisioning, and billing, were the responsibility of the Established ISP. The backhaul microwave link remained the property of the Operator and is monitored and maintained by the Operator.

	Engagement Models	
	Operator-Only	Established ISP
Network Design		
Backhaul		
Core		
Access		
Construction		
Backhaul		
Access		
Customer Acquisition		
Customer Equipment Installation		
Provisioning		
Billing (OSS/BSS)		
Maintenance + Operations		
Network Monitoring		
Equipment Replacement		

Key

Operator Provides	
Partner Provides	
Both Provide	

TABLE 2:

Engagement Model Comparison

5.2 PAYBACK PERIOD

As construction was barely completed as of the writing of this paper, some costs and revenues are estimated or projected based on past experience. Three business cases were analyzed, one for the Operator-Only model and two for the Established ISP model.

In the first Established ISP model, all costs are assumed to be the same as those from the Operator-Only model, just shared with or partially taken on by the Established ISP as indicated in **Table 3**. As a result, the total cost of the deployment remains the same, as shown in **Figure 3**.

However, the typical Established ISP cost structure is a little different from that of the Operator. For instance, the Established ISP charges an upfront customer installation fee that significantly defrays those ongoing costs. In addition, their ongoing maintenance and operation costs are significantly lower, probably due to the difference in size and scope (i.e., variety of businesses and operations) of the WISP compared to the Operator. To reflect this, the second Established ISP model adjusts the Established ISP costs to align more closely with their normal operations, resulting in a lower overall cost of deployment, as indicated in **Figure 3**.

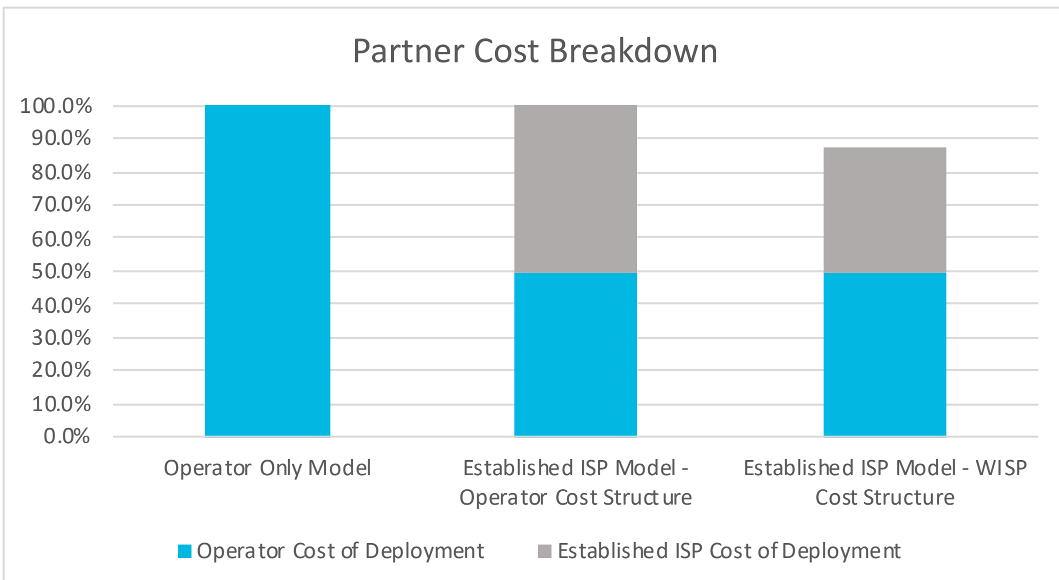

FIGURE 3:
Cost of Deployment Comparison Summary

Figure 4 shows the payback period for each of the three cost models shown in **Figure 3**. The Operator-Only model would result in a significantly longer payback period (more than 7 years) than either of the shared model approaches. If a new employee were needed to support the new market, or even be needed part-time, the payback period increases to more than 12 years.

Note that while costs are calculated for each model as shown in **Figure 3,** revenue is calculated differently between the Operator-Only model and the Established ISP models, as the Operator and Established ISP have different standard consumer fees. If the Operator charged the same consumer fee, the payback period for the Operator-Only model would decrease to ~5 years. Increasing the total number of consumers improves the business case for the customer-facing ISP in all three models. For example, if 50% of the available households purchased service, the payback period for the Operator-Only model improves to less than 4 years and improves for the Established ISP to less than 2 years. If the Operator takes a classical backhaul provider roll, the Operator payback period in the Established ISP model does not change. However, if a revenue-shared approach based on the number of consumers is taken, both parties are impacted.

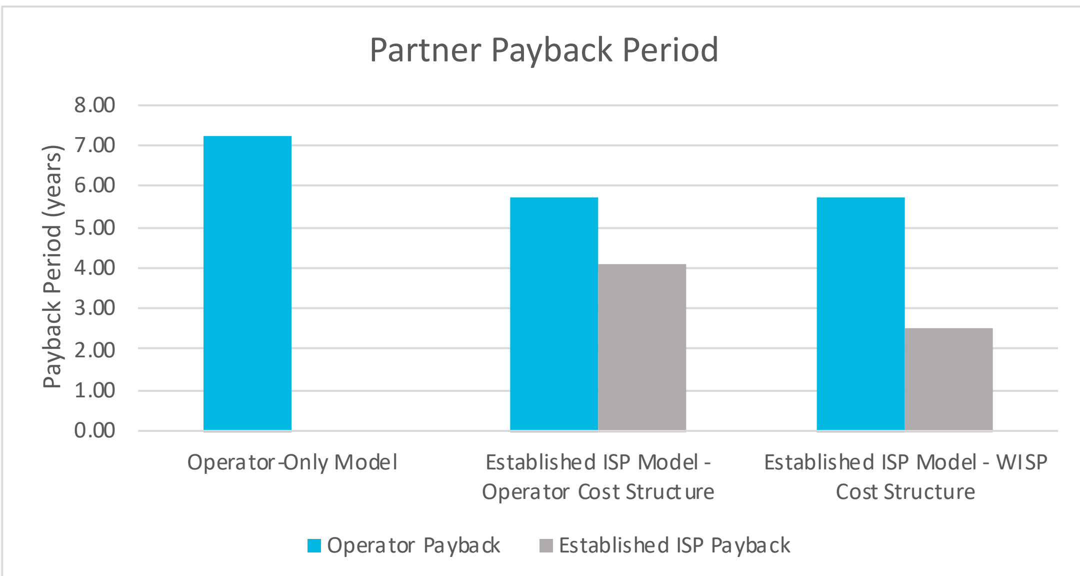

FIGURE 4:
Payback Period Comparison

6 CONCLUSION

For this test case, a micro fixed wireless access network was deployed in a small, clustered Mississippi town fed by a microwave backhaul link, as shown in **Figure 5**. The town enabled access to its water tower for deploying access and backhaul equipment. The Established ISP business model was used to provide service to end-users. While the Operator designed and built most of the network, a local WISP is the consumer-facing entity. Sharing and splitting costs enables both the Operator and the Established ISP to reduce expected payback periods. While some assumptions were made in order to estimate payback, this study indicates the 3rd party enablement model provides economic advantages to the serving parties that will ultimately provide advantages to underserved areas.

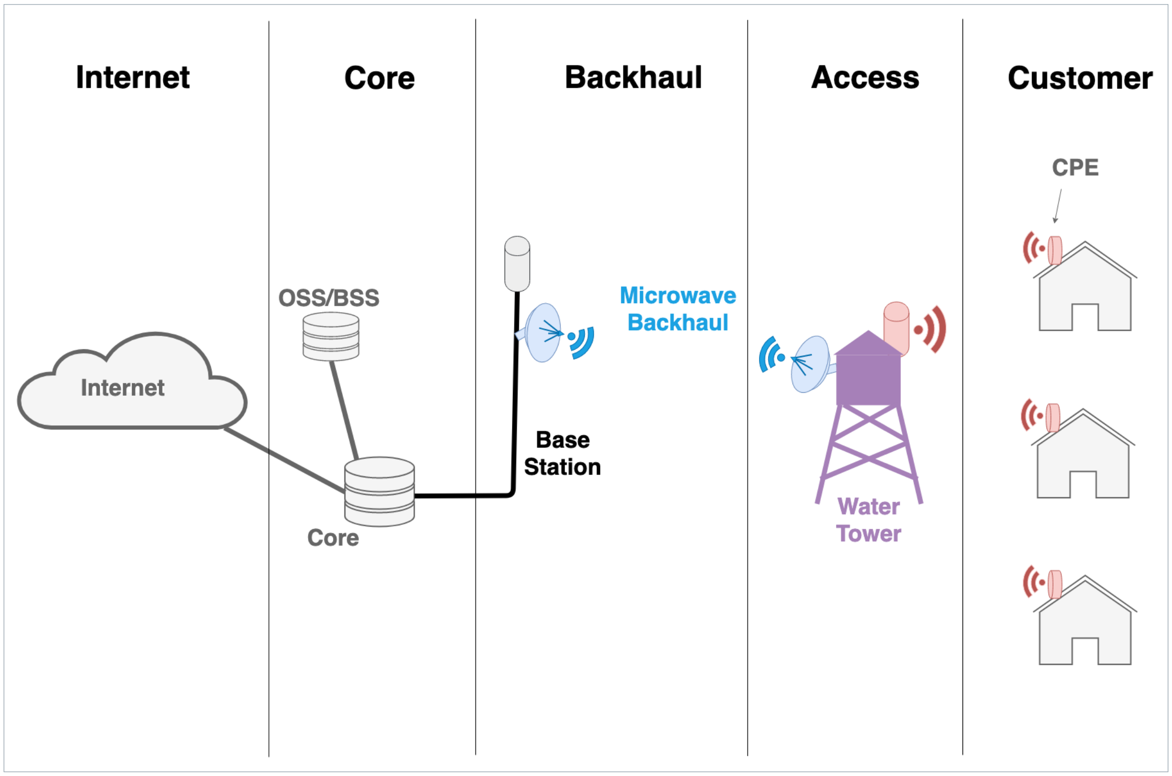

FIGURE 5:
Broadband Connectivity Solution Diagram

Because a water tower was used, construction was the highest overall cost; this likewise increases ongoing operations and maintenance (equipment replacement). Reducing these costs would significantly improve the business case. Fully automated design tools and other processes, including online infrastructure databases, would have reduced the time and cost of the network design process.

As exemplified in this case study, 3rd party enablement models can be effective in serving rural communities that are too cost-prohibitive if done by an Operator-Only service model.

7 REFERENCES

[1] "Case Study: Scattered Farmhouse Environment - Local Steward Business Model," C Spire Rural Broadband Consortium case study, June 2020, https://www.cspire.com/resources/docs/rural/ruralbroadband-casestudy1.pdf.

[2] "Case Study: Nascent ISP Business Model – LEO Satellite Backhaul," C Spire Rural Broadband Consortium case study, Oct 2020, https://www.cspire.com/resources/docs/rural/CS_RuralBroadband_CaseStudy2.pdf.

[3] "Case Study: Mixed Environment – Operator-only Business Model – 2.5 GHz Macro Access," C Spire Rural Broadband Consortium case study, Oct 2020, https://www.cspire.com/resources/docs/rural/CS_RuralBroadband_CaseStudy3_202010.pdf.

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