Comments on Rural Broadband Strategy

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Recommendations for the definition of broadband:

The Rural Broadband Strategy should include the goal of residential broadband delivery at 100 mbps, symmetrical speeds AND sustained rates within the next five years, with 1000 mbps (gigabit) connectivity being the goal for the year 2020.

All new definitions for broadband speeds should be symmetrical AND sustained. Any providers that deliver asymmetrical speeds shall not be considered "broadband" providers, but rather they should be clearly identified as "baseband" providers.

Problems encountered in delivering wireless broadband to rural areas:

Most wireless ISPs (WISPs) in remote rural America do not have the ability to offer 1.5 mbps due to saturated frequencies in the unlicensed bands. Currently, a WISP operating in the 2.4 GHz unlicensed band only has three non-overlapping frequencies (channels). In real-life, a WISP with 10 to 50 clients per frequency/channel can only reliably achieve 2 mbps for both upstream and download traffic combined.

As an example, we operate four 90-degree wireless access points on a single tower. All four access points use overlapping channels in the 2.4 GHz spectrum which then provide a 360 degree coverage. There are a total of 300+ clients ranging from 1 mile to 15 miles. A single 1.5 mbps up/down client can and often does fully saturate the available bandwidth for other clients, resulting in dead or really slow internet connections for everybody else.

The problems limiting total throughput to other clients include the following:

- Almost all bandwidth can be consumed by a single client

- Limited 2.4 GHz unlicensed spectrum forces us to use overlapping channels. All access points and clients talking to the access points bleed over and interfere with traffic on other channels.

- Because some clients are close (1 mile) and other clients are distant (5 to 18 miles), there are issues with round-trip packet-time (ACK). Many distant clients can only achieve a total download throughput of 100k or less.

- Clients are also creating noise and interference problems due to the growing popular use of home wireless networks. All client antennas (CPE's) and access-points (APs) are in error-recovery most of the time. Client wireless RF noise emanates from *home-wireless-networks*, *wireless-keyboards*, *wireless-mice*, *wireless-outdoor-temperature-thermometers*, *blue-tooth-devices*, *cordless-phones*, *wireless-video-cameras*, *wireless-headphones*, *wireless-speakers*, and any other device using un-licensed RF frequencies.

- Portable wireless notebook computers are outselling desktop computers, and home wireless networks are much more popular than home wired networks. It is estimated that one of every three notebooks uses a home wireless network - somewhere. Every new client wireless device and wireless network creates even more total noise a WISP must be forced to work through. The total unlicensed noise floor (interference) is doubling every 6 months.

What is needed for WISPs operating in rural America.

Last mile wireless, the final wireless link from an access point to a client: A WISP needs to be able to operate 30 non-overlapping channels that can each sustain 100 mbps on each channel. This equates to a total maximum non-overlapping capability of 2.2 gbps (half duplex) load.

(30 channels * 50 clients * 1.5 mbps) = 2.2 gbps

Each channel can then be placed into a 12 degree antenna, and 30 antennas can surround a primary tower. A tower equipped like this can then support 7 clients per channel operating at 10 mbps, or 210 clients equally surrounding the tower using all 30 channels, or 1,500 active clients operating at 1.5 mbps.

At this time - there is not enough unlicensed spectrum to support current and future expected growth/demands for the rural consumers on the Internet. Solutions to help wireless ISPs include:

#1); Allow WISPs providers to operate and utilize additional channels in the unlicensed 2.4 GHz spectrum. Permit the use of channels 12 (2.467 GHz), 13 (2.472GHz) and 14 (2.484 GHz) by WISP providers. These channels should only be permitted to be used by WISP providers where the WISP maintains all wireless routers and access points on these channels. These additional frequencies should not be available for wireless home networks - only WISP usage.

#2); In the 2.4 GHz and 5GHz bands, permit WISP providers to use double the transmit power of wireless home networks. This should apply to all Point-to-Point networks and Point-to-Multipoint networks where the WISP maintains all wireless routers and access points operating at the higher power. Additionally, any radio operating at twice the normal allowed power must utilize an outdoor antenna.

#3); Allow the use of federally owned frequencies and white spaces for additional broadband frequencies. These new frequencies need to be capable of supporting the broadband requirements of entire rural communities. This new spectrum needs to support multi-point connections where there may be 10 to 200 rural homes. This new multi-point band needs to support at least four non-

overlapping channels operating at 1 gbps throughput per channel and have the ability to be utilized by client CPE's up to 20 miles from the access point.

#4); Allow the use of additional new low-frequency multi-point channels (below 300 MHz) which can penetrate trees and make reliable non-line-of-site connections on the back side of a mountain. Many of our residents live in low areas or thickly forested areas where there are no possible means to deliver broadband internet access.

It would be ideal if this new low-frequency band can support a total multi-point throughput of at least 20 mbps to 100 mbps. These new channels should only be utilized by WISPs where the WISP maintains all wireless routers and access points on the WISP network. Additionally, these new WISP managed low-frequencies should only utilize outdoor antennas and be capable of achieving 30 mile non-line-of-site connections.

In addition, the FCC should expand Universal Services to include the goals of delivering affordable broadband services to every residence in the United States.

Finally, the Rural Broadband Strategy should include recommendations to dedicate public resources to build fiber optic open access backbones which rural communities can connect to, such as the Northwest Open Access Network (NoaNet) throughout the United States. The presence of these backbones is similar to the public interstate highway system that links our great nation together.