Cambium Networks™

ePMP Scalability and Air Fairness

WISPER INTERNET, WWW.WISPERISP.COM, IS A WIRELESS ISP serving 10,000 business and residential subscribers in Illinois, Missouri, Kansas, and Arkansas. Their network is comprised of 802.11-based radios using both the licensed and unlicensed spectrum. Created in 2003, the customer base has grown consistently because of Wisper's reputation for excellent customer service.

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- Ian Ellison, CTO, Wisper Internet

Growing Pains

WISPER IS ALWAYS LOOKING TO IMPROVE NETWORK PERFORMANCE and customer service. Ian Ellison, Wisper CTO, and his technicians are always looking at the latest technology to stay on top of their game. All radios were operational, but some customers were experiencing latency and throughput issues which affected their ability to download data, upload information, and stream video. Specifically, they were looking to upgrade to gear that performs better in Near-Line-of-Sight (nLOS) situations and also provide a little bit more stability.

"We pride ourselves on our service quality," says Ellison. "We aim to provide the best technical solution that provides cost-effective connectivity to our customers. When a high bandwidth user is added to the network, it impacts all of the customers in that area. It causes stability issues, and drives up our time and cost of maintenance to deal with the issue. We have found that once we connected more than 20 subscribers on a single Access Point, things started to degrade, and that when there were more than 30 per access point, really started to fall apart. In the 2.4 GHz band, our numbers trend lower than that, probably closer to 10 to 20 subscribers per sector."

Wisper discussed the issue with Brian Young of Convergence Technologies (CTI), an experienced supplier and integrator of wireless broadband solutions. "Any radio will perform when there is no interference and there are only a few subscribers," says Young. "Today, there are many more wireless emitters, more subscribers, and those users are consuming much more bandwidth. Network operators need to re-use frequencies and synchronize their networks."

From experience with their older PMP 100, WiMAX and LTE gear, Wisper knew about the benefits of synchronization. The current GPS implementation in the hardware they were using had proven ineffective, and any attempt to use it resulted in degraded performance to the point of being unusable. Based on their experience with their current supplier, they were skeptical that it would work on an 802.11n PHY-based system, and were prepared to be disappointed. Through CTI, they were able to get an ePMP 1000 Access Point (AP) and Subscriber Modules (SM) to perform field tests.

Initial Field Tests – ATPC and Uplink/Downlink Controls

WHEN WISPER TECHNICIANS INSTALLED THE EPMP AP AND SM, and with some assistance from Cambium Networks, the results were immediate. “The system has a very flexible feature set,” says Ellison. “We were able to tune the configuration settings for the Automatic Transmit Power Control (ATPC) to manage noise isolation, and set system throughput controls to accommodate varying throughput levels and reduce throttling.”

Downlink speeds improved by 20 – 50% and uplink speeds increased by up to 200%.

Wisper was ready to take the experiment to the next level.

Scheduling Makes the Difference

THE WAY THAT SYSTEMS PROCESS INFORMATION FLOW makes a significant difference when multiple users are online.

A throughput-based scheduler will process all of the information from one user, and then move to the next. This functions efficiently in lightly loaded systems where users have comparable information transfer needs, but when one user needs dramatically more bandwidth than others, the system is constantly processing the information from that user, who becomes known as a “bandwidth hog” because all other users must wait until the system is available. The problem becomes worse when the “bandwidth hog” is under sub optimal RF conditions.

A time-based scheduler which utilizes “Air Fairness” processes information from each user by allocating a segment of time and sequencing to the next user. This system performs well when there are many simultaneous users who have different traffic levels. Regardless of the number of simultaneous users, the information from each user is processed with a minimum of wait time, and consequently, lower latency which yields higher throughput and consistent throughput. In this case, a “bandwidth hog” will not adversely impact the other users in the system by taking up more time that it is allocated.

Additional Tests

SATISFIED WITH THE PERFORMANCE OF A SINGLE EPMP AP, Wisper then expanded the ePMP test to prove performance when multiple APs are installed at one location. They replaced their existing equipment at one tower location and all of the 30 customer locations that were being served from the tower. This would give a complete performance comparison using the exact same locations at both the AP and the SMs.

With four AP sectors at the tower location, the system operated with the four APs on different channels first. This was followed by two sets of APs operating on the same 10 MHz channel in a back-to-back frequency reuse configuration aided by GPS synchronization.

Both the onboard throughput test tool and a third party speedtest.net test tool were used to perform the comparison. It was important to use the third party throughput test tool to eliminate any vendor specific bias.

All 30 subscribers immediately had better service with the same throughput increases as seen in the single AP test. When using the same frequency on opposite sides of the tower, Wisper was able to get increased throughput compared to their existing equipment, while using half of the total spectrum as they had been before, allowing for more channel re-use options.

"The customers knew we were trying out new equipment. After we saw the improvement, we didn't want to turn the ePMP system off," says Ian Ellison. "I didn't want to risk upsetting the customers. In addition, the feature set with eDetect and eAlign available blew away what we were used to working with."

Scalability and Air Fairness

Scalability	With ePMP, each Access Point can support up to 120 subscribers, while still maintaining the low latency, high throughput connection quality that customers demand. This means more paying customers for every Access Point in the network.
Air Fairness	Even if some subscribers are consuming a lot of bandwidth, the network continues to perform. With ePMP, other customers are not affected because a time-based scheduler manages throughput to all users and balances the load.

Implications for Network Operators

All network operators want to maximize customer satisfaction while growing the subscriber base. While Wisper's tower location was constrained to supporting 30 subscribers with four AP modules using four channels at one location, with ePMP they proved that they could easily satisfy those same 30 customers in two channels – and have capacity to add many more subscribers.

For new network operators starting out, ePMP provides a cost-effective solution that will perform when the network is small, and continue to satisfy customers using gaming and streaming video applications as new customers are loaded on to the network. Instead of responding to customer complaints, technicians can be adding new subscribers with confidence.

For network operators with existing networks, ePMP provides a proven solution to deploy when expanding to new areas, and an effective upgrade path to deploy as the existing network becomes constrained as subscribers are added and as existing customers continue to demand increased bandwidth to meet their video streaming needs. ePMP can be deployed at the same tower sites and subscriber locations, and provide an immediate performance boost while also providing headroom to add new subscribers and increased throughput per subscriber as the network continues to grow.