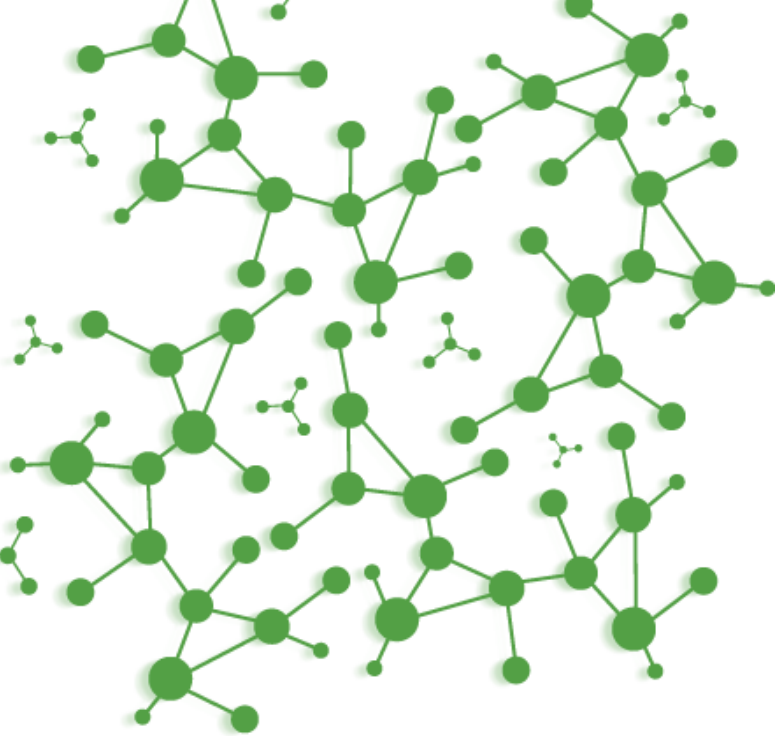

Small-cell backhaul with software-optimized commercial chipsets

A conversation with Lee Gopadze, CEO Proxim Wireless

By Frank Rayal
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Frank Rayal. Hello, and welcome to this conversation with **Proxim Wireless**. My name is Frank Rayal. This conversation is part of a Senza Fili report on small-cell backhaul that gives an update on small-cell backhaul solutions and on the evolution of mobile operator requirements for small-cell backhaul. Today we're talking with Lee Gopadze, CEO of Proxim Wireless. Proxim is a leading vendor of licensed- and unlicensed-spectrum backhaul systems used for video, mobile, backhaul and network applications.

Lee, tell us about the background of the company and its heritage.

Lee Gopadze. Proxim Wireless has been in the manufacturing of wireless communications equipment for about 25 years. We have, during that period of time, developed a cross-layer software capability called WORP, which stands for Wireless Outdoor Router Protocol, and to date have placed more than 2 million units into the marketplace with about 250,000 different companies around the world. We operate primarily out of our headquarters location in Milpitas, California, with an R&D center in Hyderabad, India, an operations center in Taipei, Taiwan, and sales offices around the world.

Frank Rayal. When it comes to small-cell backhauls, you have a new product. That's the Tsunami MP-8200 platform that you're targeting specifically for that market in addition to other applications. Tell us more about this product and how it meets the requirements of small-cell backhaul.

Lee Gopadze. First of all, let's talk a little bit about some of the things that we believe small-cell backhaul will need, and often these are competing requirements. Low equipment cost, low operational cost, guaranteed throughput, high capacity in terms of the number of units that can be serviced, deterministic service flows, RF signal propagation capability and the very physical size of the unit we think are all important characteristics of small-cell backhaul units, and ones that we intend to address through our 8200 platform and units that will come out about midyear of this year.

As we look at the 8200, it is a small-cell backhaul product that can be used both in a point-to-point and in a point-to-multipoint mode.

In a point-to-point mode, the unit will approach 250 mbps of throughput using the highest modulation capabilities.

In a point-to-multipoint mode the unit will deliver as much as 150 mbps to each one of the nodes to which a base station is attached. Coupled with the MAC-polling protocol that we use on the product and the class-of-service and quality-of-service characteristics of the product, and the cost, we think it is an able competitor for people who are interested in a small-cell backhaul to look at, either in the 5 GHz or in the 6 GHz band.

Frank Rayal. So this product mainly operates in the unlicensed-spectrum bands?

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Lee Gopadze. It operates in the United States in the unlicensed-spectrum bands. In other areas of the world where both 5 and 6 GHz are licensed spectrum, the product operates within those same bands but they are licensed. So, for example, in Russia the product works at between 5.9 GHz and 6.4 GHz, which is licensed spectrum in Russia.

Frank Rayal. Lee, you mentioned software features that your company wraps under the headline of WORP. Can you tell us more about that?

Lee Gopadze. WORP is a cross-layer software product or protocol that we have developed over about the last 10 years. One way to understand it is to look at LTE and WiMAX protocols. What you would find is that WORP compares favorably in a throughput, quality-of-service, and class-of-service comparison with those particular protocols. What WORP has that is perhaps unique is its ability to deliver low latency, low jitter in a very flat network architecture.

Our point-to-point links typically operate at less than 3 ms latency; our point-to-multipoint links operate typically at less than 10 ms latency. Both of those are significantly below what you would find in a standard WiMAX offering or even in some of the earlier versions of LTE. We developed the WORP protocol primarily because we service the video surveillance market, where both latency and pixelization are very important to the agencies, many of whom are government agencies.

Frank Rayal. You have also mentioned flexible channel planning in your product. How does that work, and what does it do?

Lee Gopadze. If you look at most Wi-Fi products, they are available in 20 and 40 MHz channel sizes. Our channel sizes actually go down to 5 MHz, which allows the operator – be they a carrier or for other backhaul needs, such as video – to use small bits of spectrum that are available.

Outdoors is a very different environment than indoors, so much of what we do today is focused on allowing operators, both network operators as well as agencies, to use small bits of spectrum and still maintain very high throughput. In the outdoor world, finding a 20 MHz or a 40 MHz channel is often very difficult in urban areas, so we combine small channels with high throughput in order to deliver what we believe the market needs in the outdoor and urban areas.

Frank Rayal. When it comes to comparing your solution with other solutions that are in the same class, what are some of the differentiating features? You talked about WORP; any other things that you can share with us?

Lee Gopadze. I think it goes back to our ability to control the basic chipsets. We use what you might call a COTS, or a commercial off-the-shelf, chipset. Typically, that chipset will normally be sourced through someone like Atheros or one of the other major chipset vendors. When you look at those chipsets, typically what you find in standard 802.11n Wi-Fi where there is a relatively low utilization of available data rate versus throughput, in the 50% to 60% range.

What WORP does is actually increase the efficiency of the throughput. We regularly see WORP providing as much as 80% or 85% of the available data rate in relation to the channel size. If you have a 300 mbps data rate, you will see WORP ensuring that the throughput is as much as 250 mbps.

The other advantage is that WORP allows us to increase both the transmit power and the receive sensitivity, as well as expand the range of the product.

For example, most standard Wi-Fi chipsets work from about 5.15 to about 5.825 GHz. We are actually able to stretch that, using WORP, down into the 4.9 GHz range and as high as 6.4 GHz. We start out with a Wi-Fi chipset and end up with a software-defined radio with performance-monitoring asymmetric bandwidth control, where drops in packets due to interference are detected by WORP and then addressed by either retransmitting the packet or increasing the available signal strength to make sure that the link is secure and stable over time.

Figure 1 Tsunami MP-8200 Wireless Backhaul System.
Source: Proxim

Frank Rayal. You mentioned dropping packets, and that can be all due to interference. Using backhaul in unlicensed band has been a point of debate in the wireless community. Some operators see no problem with that; some of them are less amenable to deploying an unlicensed-band solution.

What is your take on that, and how do you strengthen the communication channel so that there is less interference or a more robust communication link?

Lee Gopadze. I think you have to look at it in terms of distance, throughput, and channel or packet stability. As you look at a particular environment, you want to maximize the modulation that you are able to push, to 64 QAM, or 16 QAM. Then you want to have a relatively short distance so that the signal strength is maintained relatively high, and then you want to control the latency and the other performance characteristics of the signal.

By using WORP, we increased the throughput, number one. Number two, by using a polling architecture rather than standard Wi-Fi, we created an environment very similar to what you find in a WiMAX product, where each station speaks when spoken to. Then by overlaying this with a high level of CoS and QoS, we are able to maintain a high-performance real-time environment.

I think a measure of this reliability is the fact that we are used by multiple law-enforcement agencies around the world to deliver video packets over secure links at secure installations. Video is a very demanding application, particularly high-definition video. We see pixelization happening very often. With our particular product – it is one of the reasons that the County of Los Angeles has bought it, among other customers – you do not get that pixelization. Our product is designed today to typically work out as far as five miles.

As we look at small-cell backhaul, we are seeing distances dramatically shorter than that, maybe as little as 300 to 500 meters. So we're very comfortable, within those parameters, that most of the time we'd be using 64 QAM or 16 QAM, which gives us a high available data rate and, therefore, addresses the need for significant throughput. The cost factor weighs in, as well.

Frank Rayal. When it comes to the business case of small-cell deployments, cost has been a major issue that prevents operators from going through this type of deployment. How does your product address the cost issue?

Lee Gopadze. It addresses it from a couple of standpoints. First of all, the product is built on a commercial off-the-shelf chipset, which means that we start out with a lower overall cost in general. We are not building specialized chipsets in order to address the need, and therefore, the cost of the internal electronics starts to come down dramatically as well.

The second way that we address cost is in total cost. When you look at many products on the market, they are using plastic housing and a variety of low-cost features. We do not think that is the way to do it. We have significant experience in building IP66 and IP67 enclosures, which will withstand the test of time, and that is why you see MTBF of our products is upwards of 200,000 hours. The last thing is the enterprise market, which is our primary market and is a very cost-conscious market around the world. We sell in India, China, Russia, as well as the United States, and carriers in all of those markets are very cost conscious. If you look at point-to-point microwave products, they often cost $5,000 to $15,000 per link. Typically, our products are less than $3,000 per link and will deliver as much as 240 to 250 mbps for a single location.

Frank Rayal. I am very curious about the spectrum issue, because you operate in unlicensed spectrum in many countries, and licensed in others. There have recently been moves by the FCC to provide more bandwidth in the 5 GHz band for Wi-Fi and other unlicensed applications. You mentioned that there are some new rules in the 6 GHz band. Can you elaborate on that?

Lee Gopadze. There is a rulemaking before the FCC today to allocate about 200 more MHz in the 5 GHz spectrum band here in the United States. That obviously portends well for using 5 GHz, potentially, as an outdoor product for small-cell backhaul. At the same time, the 6 GHz spectrum here in the United States has typically been reserved for long-distance microwave products, where you have large dishes and split-mount installations with both an IDU and ODU.

The FCC is in the process of finalizing rules that will allow all-in-one enclosures so it is an all-outdoor unit. The minimum size of the antenna has come down to about 1 meter now, right around 3 feet, and they are even looking at potentially allowing point-to-multipoint operations. They have not created a rulemaking for that, but it is a subject of discussion by the technology group at the FCC.

We see all of these things as positive indicators that the 5 GHz band will continue to grow in terms of the spectrum that is made available to it, and that there is the potential to use the 6 GHz band in a very efficient manner outdoors, as well, for small-cell deployment.

Frank Rayal. Do you have any plans for developing licensed-band solutions? What do you think about having backhaul in the licensed bands?

Lee Gopadze. We think there is certainly an opportunity for that. We have products in the 18 to 23 GHz bands today. They are split-mount products in that they have an ODU and IDU. We do not think that that is an appropriate architecture for small-cell backhaul. We are actively looking at spectrum both in 3.5 GHz, and 28 to 31 GHz where, here in the United States, there is the ability to use that product.

Again, the very architecture of WORP means that, as long as we have a hardware platform, it is relatively easy for us to port WORP over to that hardware platform – for example, at 3.5 GHz – and to provide the same set of operating characteristics that we would at 5 or 6 GHz.

WORP is a cross-spectrum software capability. Our job becomes much easier: instead of developing both software and hardware for a particular spectrum band, all we are doing is looking at implementing a new chipset on the PCBA that we already have in place.

Frank Rayal. Looking at the evolution of your product, how do you see that going forward? What are the next features and plans for your product line?

Lee Gopadze. Later this year we will see a smaller-sized platform coming out. Frank, I think you mentioned that you had seen the 8160 on our website. That size of platform is where we are driving a lot of our product development towards. We believe that is absolutely critical for small cells.

The other area that we are driving is our software product. Today our software operates in mobile environments up to about 70 mph. We think it is important to increase that, so we are currently almost finished with a new revision of software that will drive that up to about 180 mph. This focuses on one of our primary market segments, which is intelligent transportation systems and high-speed trains and trams that are being constructed all over the world.

Frank Rayal. Any final thoughts on the small-cell market and the positioning of the Tsunami product line in that market?

Lee Gopadze. We are doing a couple of things in that area. We will actually be presenting to IWPC next month in their small-cell backhaul forum, which will address some of the small-cell backhaul requirements and how, from a performance standpoint, we think that we fit in well with the requirements of small-cell backhaul. We are also looking at 3.5 GHz, which is another spectrum area that we think has some value for small-cell backhaul.

So, a combination of expanding the spectrum bands that we operate in, reducing the size of the product, and ensuring that the existing class-of-service and quality-of-service characteristics are maintained. We think this gives us a protocol that is RF-spectrum agnostic and meets many of the needs of small-cell backhaul, whether you are here in the United States or in other parts of the world. Then, at some point in time,

we probably need to be talking with some of the vendors who are providing the front-end, the radio-access network and the small cells, to see if incorporating our product with theirs makes sense over time.

Frank Rayal. There is a lot of work to be done in that space, and that's the good thing here. Lee, I would like to thank you very much for joining us in this conversation.

Lee Gopadze. I appreciate it Frank.

Frank Rayal. This conversation is part of Senza Fili's report on small-cell backhaul, which provides an overview of small-cell backhaul solutions along with in-depth conversation like this one from leading vendors who participated in the report. The report can be downloaded from the Senza Fili website at **www.senza-fili.com**.

Acronyms

CoS	Class of service
COTS	Commercial off-the-shelf
FCC	US Federal Communications Commission
IDU	Indoor unit
IP66	IP Code, Ingress Protection Rating: dust tight, powerful water jets
IP67	IP Code, Ingress Protection Rating: dust tight, immersion up to 1 m
IWPC	International Wireless Industry Consortium
LTE	Long term evolution
MAC	Medium Access Control [Layer]
MTBF	Mean time before failure
ODU	Outdoor unit
PCBA	Printed circuit board assembly
QAM	Quadrature amplitude modulation
QoS	Quality of service
R&D	Research and development
RF	Radio frequency
WORP	Wireless Outdoor Router Protocol

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About the author

Frank Rayal is a telecom industry professional with over 20 years of experience working with network operators and system vendors to develop and deploy innovative wireless solutions. He's is a founding partner at Xona Partners a boutique management and technology advisory firm specialized in TMT and a founding member of small cell backhaul pioneer BLiNQ Networks. Frank held senior product management, marketing and business development positions at Ericsson, Redline, and Metawave. He holds a BS in Electrical Engineering from Case Western Reserve University, Cleveland, OH, and a MSc in Electrical Engineering and an MBA from the University of Toronto, Canada. Frank is a Senior Member of the IEEE, and a member of Professional Engineers Ontario.