

Q&A with Gary Schulz, VP of Engineering at wireless backhaul provider Ubiquiti Networks

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Ubiquiti Networks is a San Jose, Calif.-based company that provides wireless broadband backhaul solutions, particularly in emerging markets. The company's VP of engineering at its Chicago Design Center, Gary Schulz, discussed Ubiquiti's philosophy and products with RCR Wireless News.

RCRWN: Tell us a little about Ubiquiti.

Schulz: Ubiquiti is the world's largest and most profitable manufacturer of wide-area wireless broadband gear. The company was founded by Robert Pera in 2005. Almost immediately Ubiquiti created a niche for providing very cost-effective solutions focused on next-generation communications technologies. Recently, Ubiquiti has moved to proprietary platforms and technology development of greater complexity and higher levels of performance.

RCRWN: How did Ubiquiti's new R&D group in Chicago start?

Schulz: We started the Chicago Design Center to push the cost/performance philosophy to the extreme. We saw this as an opportunity to make a completely new line of products, throwing away the usual thought process that constrains much of the competition into thinking rigidly. My career before leaving Motorola Canopy was becoming increasingly driven by so-called market research with management taking a top-down approach to drive engineering

into “safe” directions. There was too much time studying and not enough time doing. I always loved the challenge of developing disruptive products — Canopy was and AirFiber is — and I saw the opportunity to start the Chicago Design Center as the logical next step. We assembled a passionate group of engineers and technologists who love testing the boundaries of what is possible.

When Robert spoke to me about this opportunity he made it perfectly clear that there would be no limits and no overhead getting in the way. I was impressed with the lack of fear that typically bars true innovation like budget, resources or even ego. There has been a significant investment in R&D in terms of dollars and expertise so expect to see many follow-up products that will continue to dramatically shift market expectations.

RCRWN: What’s the motivation behind AirFiber?

Schulz: The first AirFiber product is a really different approach to solving a big dilemma for operators looking to greatly expand their capacity for tomorrow. We wanted to do a really different kind of product, one that removed the status quo limitations and conventional thought process that seem to make much of the wireless industry rather stale and overtly conservative. Ubiquiti is going to keep revolutionizing the wireless industry with some incredibly powerful solutions. At the end of the day, it is passion and motivation that delivers radically new and effective solutions. “Safe” is no fun. Worrying about making something that pleases everyone can result in some pretty mediocre solutions. What can be a little surprising to some people is that when you remove the dictate that a given engineering solution needs to be everything to everybody you can get some really compelling and creative outcomes. We definitely achieved this with AirFiber. The performance levels that we are experiencing are forcing a big step response into the market and this is only the very start of where we are heading to deliver previously unavailable performance at lower and lower cost to the end user. I wish I could say more, but Ubiquiti is going to radically change the way people think of getting bandwidth to customers. This is only the first step.

RCRWN: Ubiquiti describes AirFiber as “unique, cost-effective and disruptive.” What makes it disruptive?

Schulz: AirFiber is a revolutionary high-speed wireless backhaul product delivering real throughputs at levels dramatically higher than the competition regardless of price. In order to do this, the design team needed to invent a lot of new processes and algorithms that were not available off-the-shelf. AirFiber has been built by Ubiquiti from the ground up to be a very powerful and versatile software-defined platform.

We architected and designed an all-new high performance modem and a sophisticated and versatile radio, while being very cognizant of the costs involved. Difficult design choices needed to be made because the platform needed to be without any bottlenecks — a critical requirement for very high speeds. We settled on a slightly unorthodox approach that took a right angle turn from the industry norms of single-carrier systems. The radio we came up with is state-of-the-art, consisting of two multiplexed transmitters and two multiplexed receivers for unparalleled versatility and performance. The radio platform is capable of supporting full duplex/frequency division duplexing (FDD) operation and a newly developed Ubiquiti proprietary access method called Hybrid Division Duplexing. HDD permits incredibly high levels of performance in terms of throughput and latency while still maximizing spectral efficiency normally associated with TDD systems.

We did away with all the RF losses associated with conventional systems running at [millimeter-wave] frequencies so the link budgets are very robust. We introduced a revolutionary new MAC to control this versatile platform with very high efficiency, so that the performance is nearly transparent to the end user.

Other firsts for this market include a one-piece fully integrated “monocoque” injection molded dual antenna assembly. This single mechanical element integrates the radio housing, connector interface bulkhead, dual high isolation reflector antennas, molded-in AZ-EL mounts and heatsink supports. This single piece involved a lot of engineering effort, but the pay-off is very high performance due to the ability to hold high dimensional tolerances in critical areas, and it’s lightweight with very low cost.

We also elected to take a different direction in the modulation formats used. We elected to develop a high performance OFDM system for several reasons. One reason relates to the overall performance benefits that we can

obtain through the use of multiple-input, multiple-output spatial multiplexing. This gives AirFiber a big performance edge because of the high spectral efficiency and inherent tolerance to less than ideal propagation channels in the presence of reflections and multipath.

Our solution is not limited by the processing speed of the CPU so there are essentially no limits to the packet processing rates. Packet handling is all done with dedicated high-speed hardware accelerated processing.

We invented a lot of the algorithms necessary to keep the amplitude and phase tightly controlled because we elected to design what is possibly one of the widest bandwidth zero intermediate frequency radios ever done for mass production. This results in a basically spurious-free radio that has great spectral shape because we generate and decode all the signaling at baseband and then up/down convert all the way to 24 GHz in one single conversion. Unfortunately, there were no commercial parts available to perform a lot of these functions so we needed to find ways to modify circuits intended for other applications.

Despite all the effort to keep performance high and costs under control, we still needed the solution to be robust. In fact, the entire mechanical assembly has been tested to MIL-STD-810G and things like vibration using extended versions of IEC 60068-2-6 (9 hours). This level of testing is normally reserved for MIL-Spec systems with price tags many times the cost of AirFiber.

RCRWN: What are some of the trends you see in backhaul deployment?

Schulz: We are working toward supplying the projected increased demand for backhaul products driven by the never-ending need for increased capacity. The need for increased bandwidth by more and more people generally necessitates the proliferation of smaller cells. We see a time when there will be the need for aggregated traffic loads that will demand incredibly high-data rates and that is why we pushed the envelope to substantially higher than 1 Gbps with this first product.

The industry will require access to large amounts of bandwidth at lower and lower costs to be competitive. Up until now it didn't make economic sense to deploy a picocell capable of 100 or so [megabits per second] throughput when the cost of the backhaul is higher than the cell-site equipment. Ubiquiti will provide solutions to make this large-scale rollout possible. We currently enable WISP's access to this sort of capacity/cost but at some point the larger carriers will need to take the plunge into cost-effective transport for high data rate traffic. We will work to blur the artificial boundaries between unlicensed and licensed spectrum so that to the operator, the experience is totally seamless. We will work to make sure we can stay ahead of the demands of the more progressive carriers and traditional WISP's with solutions that are easily deployed, highly flexible and of course cost-effective. This is what Ubiquiti does best.