

Backhaul using smart microwave

by Shai Yaniv, Director of Product Management at Ceragon

Operators struggle with the ever-increasing demands for data capacity and the need to ensure high quality of service and user experience. Wireless backhaul solutions based on point-to-point microwave can support these requirements, but this will be done by systems that are more than mere dumb pipes. Smart microwave solutions, which are network and traffic aware, and which address operators' needs for efficiency, reliability, low cost and power reduction, will help drive next generation services, making them affordable and profitable.



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Prior to the iPhone launch in mid-2007, AT&T hurried to rollout a major upgrade of its 3G mobile data service, in anticipation of a tenfold increase in network traffic. Appetite for mobile data and the number of smartphones and data-centric devices has only increased since then. In fact, data traffic over cellular networks should grow almost 40-fold until 2015, and UK firm Coda Research anticipates that in the US, mobile video will account for over 60 per cent of all mobile data usage. Can backhaul networks support such staggering capacities?

Network operators, utility companies, public safety organizations and enterprises are all struggling to meet the immense

demands for data that are required by today's applications. At the same time, they must plan and prepare for the continued growth.

Microwave everywhere else

When examining the wireless vs. wireline alternatives, fibre's nearly unlimited capacity immediately stands out. However, the fibre option is not always practical. Whether due to deployment restrictions (rough geographical terrain) or regulatory restrictions (dense metropolitan areas) laying out fibre infrastructure may be too costly and time-consuming. In such cases, wireless, or more accurately, wireless backhaul based

on point-to-point microwave, emerges as the best solution.

Microwave backhaul solutions are capable of delivering high bandwidth, carrier-grade Ethernet and TDM services. Microwave is suitable for all capacities up to several Gbps over a single link - and may be scaled up to multiple Gbps using aggregated links techniques. Unlike fibre, wireless solutions can be set up quickly and are much more cost-efficient on a per-bit basis from day one.



The end of the fat pipe era

Today, microwave backhaul offers much more than fat pipes connecting two endpoints. Microwave has evolved over the years and has accumulated advanced service features such as service and network topology awareness - features that until recently were only available using expensive external boxes for switching and routing traffic.

As networks become more complex, and user experience and quality of service become major differentiators between operators, the role of microwave systems within those networks is changing. Microwave backhaul should be much more than a dumb pipe. It must be smart.

The capacity characteristic of today's traffic requires attributes different from those of the installed base of legacy backhaul. One example could be the peak-to-average ratio; a 4:1 peak-to-average traffic ratio is not uncommon in backhaul networks. The microwave solution must be traffic aware in order to manage multiple applications with differentiated quality of service levels. For instance, voice calls consume relatively low bandwidths and require high priority with minimal latency. Web browsing or ftp downloads on the other hand, require high data volumes, but the user's quality of experience is less affected by latency issues.

Moreover, to ensure quality of service, a smart microwave backhaul solution should also be aware of network topology. It should integrate Carrier Ethernet functionality and be able to independently re-route traffic in case of network failure.

Microwave support for 4G backhaul?

The answer to the question of whether microwave can cope with future capacity requirements is a simple yes. Microwave can support multi Gigabit Ethernet over a single link, and real-life performance really depends on the available frequency resources, as depicted in the table. Advanced microwave supports high spectral efficiency and can better utilize the available spectrum. This translates into much more capacity at a given channel. Other, more developed microwave systems offer advanced lossless compression techniques, as illustrated in the table, that allow even more capacity over a given wireless link with additional support for burst peak-to-average issues.

Spectrum Channel Bandwidth	Microwave Radio Throughput	Ethernet Throughput with Enhanced Lossless Compression [up to Mbps]
10MHz	60	160
14MHz	85	235
28MHz	185	500
30MHz	197	530
40MHz	254	700
50MHz	336	920
56MHz	365	1000

Modulation: 256QAM

In our non-perfect world, most backhaul networks are not 'greenfield' infrastructures, but rather existing backhaul networks that are evolving. This evolution requires a smooth and risk-free migration plan from legacy networks to next-generation, packet-based communications. This is paramount for network operators - in common with electrical companies implementing smart grid applications. Replacing legacy TDM networks with IP based networks requires careful planning as it involves a gradual process, with a hybrid network having to provide simultaneous support of TDM and IP/Ethernet communications.

What makes wireless backhaul smart?

Service aware traffic management - Service aware traffic management refers to the ability to differentiate packets by type. The transmitted data stream may be composed of E1/DS1s, ATM, IP, or Ethernet. These packets may come from multiple sources and may have different quality requirements. Smart backhaul can prioritize the different flows and preserve the requirements of contractual service level agreements (SLA).

Service aware traffic management - The overall system gain of a backhaul system greatly affects capital investment and service quality. Sensitive receiver threshold performance enables superior system gain, regardless of the transmission power. From a business standpoint, high system gain affects the capital investment. For example, high system gain allows operators to reduce the number of links required to cover a given distance. It also allows the usage of smaller, less costly, antennas (this might also reduce rent fees when leasing tower-space from a

third party). Last, high system gain provides superior network availability and quality of service in harsh weather conditions.

Power consumption - With the telecom industry taking its share of social responsibility and striving to conserve energy, power consumption is a key component of a backhaul solution. Obviously, low power consumption is also critical for achieving lower total cost of ownership targets, particularly in private networks.

Smart wireless backhaul will have an advanced power consumption scheme, based on real-time usage and environmental conditions. Smart power consumption can provide up to 50 per cent reduction in power consumption.

Minimal footprint - The common backhaul node integrates equipment from multiple vendors handling various wireless and wireline functionalities, so physical space is scarce, particularly if environmentally hardened outdoor units are required. Equipment designed with a minimal footprint helps to squeeze the maximum capacity into physical rack space.

Resiliency and modularity - With network requirements constantly evolving, any microwave backhaul solution implemented today must be modular and inherently capable of supporting the new challenges and requirements of tomorrow. Topology awareness is an important feature, since a smart wireless backhaul will assure that the traffic will get from point A to Point B even if there is a network failure by recalculating an alternate path.

When high capacity is not enough

Operators today struggle with the ever increasing demand for more data capacity and the need to ensure high quality of service and user experience. Wireless backhaul solutions based on point-to-point microwave can support these requirements, but this will be done by systems that are more than mere 'dumb pipes'. Smart microwave solutions, which are network and traffic aware, and which address operators' needs for efficiency, reliability, low cost and power reduction - will help drive next-generation services, making them affordable and profitable. ●