Topic

Gigabit Wireless Ethernet Over Digital Microwave

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Gigabit Wireless Ethernet

Point to Point Wireless Digital Microwave
Extremely high frequency
      60GHz unlicensed
      80GHz licensed
Alternative to fiber in certain situations
Layer 2 Transport

Summary

Gigabit wireless Ethernet is a developing market for point to point short haul data connectivity. The technology provides a viable alternative to fiber when fiber paths are unavailable or too costly.

Discussion

A number of manufacturers are now providing point to point wireless connectivity via digital microwave. Originally developed for the channelized voice carrier market, this technology is migrating into the enterprise Ethernet space for transport of Internet and LAN communications.

There is growing pressure for connectivity solutions for enterprises with departments that build or lease space in nearby communities. In the past these applications were served by dark fiber, however the carriers have largely stopped offering that service, instead pushing customers toward metro Ethernet that can cost upwards of several thousand dollars per month. Construction of duct bank to install fiber can cost $500 per linear foot. A single gigabit wireless Ethernet connection, on the other hand, costs about $30,000 and can be deployed quickly with no recurring costs.

The Technology

Products typically fall into the 60GHz band for unlicensed applications or 80GHz for licensed applications. Beamwidths are very tight at these millimeter wavelengths, typically on the order of one degree. Because of this, and uncluttered spectrum at those frequencies, licenses are inexpensive and easy to obtain. The unlicensed 60GHz band has a drawback to consider: oxygen absorption of radio energy has a peak at that frequency. As a result, power budgets must be somewhat higher.

Toward 10Gbs and Beyond

Several vendors have demonstrated 10Gbs product versions in the lab, though these are not commercially available because a market has not yet emerged for them. From a technology perspective there are few obstacles to the development

of 10+Gbs digital microwave. Current 1Gbs products use simple modulation techniques. Higher throughput is possible by utilizing higher order modulation techniques such as QAM, 16-QAM, etc. Because these modulation techniques are more phase sensitive, the amplifiers used must operate comfortably in their linear regions. This means that 10+Gbs systems will use more power to achieve the same bit error rate performance as 1Gbs systems.

Multiplexing

Digital microwave systems can achieve a limited degree of multiplexing by aggregating links. Polarity can be used to double the channel availability. Because the systems have narrow ($\sim$1°) beamwidths, multiple mast locations can be used for additional systems. However, implementers should not expect to see the 100+ channels available over fiber on the ITU DWDM grid.

Reliability

Poor performance during heavy rains and tropical storms ("rain fade") has been in the past a significant issue. The current generation of high frequency digital microwave can operate with three to five "nines" of reliability over distances of two to four kilometers.

Several manufacturers offer adaptive rate transmission schemes which are able to sense bit errors and lower the transmission speed to maintain connectivity during these brief periods.

Fiber does not suffer from episodic degradation but this should be balanced against occasional fiber cuts which result in lengthy outages, particularly for aerial paths.

For Further Information

Since this technology is not standardized, normative references are not available. Vendor information is available at

1. BridgeWave: http://www.bridgewave.com/products/80Ghz.cfm

2. GigaBeam: http://www.gigabeam.com/Products/GiCORE7080GHz.aspx

3. Proxim: http://www.proxim.com/products/gigalink/index.html

4. Rayawave: http://www.rayawave.com

5. Loea: http://www.loeacom.com