Packet Radio Access

Where wireline services are not available or practical, delivering Ethernet over a point-to-point wireless access network can make a previously unattainable connection practical. Also, where mobility is required, broadband wireless services from mobile service providers may provide an effective connectivity option.

**Terrestrial Microwave**

A microwave link uses microwave frequencies (above 1 GHz) for line of sight radio communications (32 to 48 KM, 20 to 30 miles) between two directional antennas. This is also known as point-to-point (PtP) Microwave. Microwave link transceivers are now available with standard Ethernet interfaces that can be used to deliver Carrier Ethernet services. The distance and throughput that can be achieved is a function of frequency and antenna size. For example, 100 Mbps Fast Ethernet can be achieved reliably over 13 km (8 miles) at 11 GHz but will perform poorly over 24 km (15 miles) due to rain fade at that frequency. 100 Mbps Fast Ethernet can be achieved reliably up to 48 km (30 miles) at 6 GHz.

The use of microwave links avoids the need to install cables between communication equipment. Microwave links may be set up over licensed frequencies (filed and protected by government agencies) or over unlicensed frequencies (through the use of low power within unlicensed regulatory limits).

**Broadband Wireless**

**EVDO** (Evolution of Existing Systems for Data Only) is a commonly available upgraded service of cellular providers with CDMA (Code Division Multiple Access) systems. EVDO Rev. A allows for a maximum data transmission rate of approximately 3.1 Mbps on the forward (downstream) channel. The EVDO Rev. A system uses the same reverse channel which limits the uplink data transmission rate to approximately 1.8 Mbps. The EVDO system has an upgraded packet data transmission control system that allows for bursty data transmission rather than for more continuous voice data transmission.

**GSM** (Global System for Mobile) is the most popular standard for mobile phones in the world. Its promoter, the GSM Association, estimates that 80% of the global mobile market uses the standard. Release '97 of the standard added packet data capabilities, by means of General Packet Radio Service (GPRS). The latest versions of packet data communications are UMTS (Universal Mobile Telecommunications System) and HSDPA/HSPA+ (High-Speed Downlink Packet Access/ High-Speed Packet Access). These technologies enable download speeds of up to 42 Mbps (22 Mbps in upload). One of the main advantages of HSPA+ is its optional all-IP capability that is using native Ethernet connection to the base station. Note that these are base station rates that are shared amongst all active users served by a particular base station.

**LTE** (Long Term Evolution) is the name given to a project within the Third Generation Partnership Project (3GPP) to improve the UMTS mobile phone standard to cope with future technology evolutions. Goals include improving spectral efficiency, lowering costs, improving services, making use of new spectrum and re-farmed spectrum opportunities, and better integration with other open standards. Being based on an all-IP infrastructure and native Ethernet connectivity, LTE provides peak download rates of up to approximately 300 Mbps and peak upload rates of approximately 75 Mbps. Note that these are base station rates that are shared amongst all active users served by a particular base station.

**WiMax** (Worldwide Interoperability for Microwave Access) was created by the WiMAX Forum and is a wireless point-to-multi-point data transmission technology that is based on the IEEE 802.16 standards. Its latest version, 802.16e, adds mobility and better support for quality of service as well as symmetrical transmission capability of typically 40 Mbps for fixed and 15 Mbps for mobile implementation. Peak rate of the base station can reach 70 Mbps. As a "last mile" broadband wireless access, WiMAX can be used in the following applications: replacement to legacy T1/E1, delivery of triple-play services, backhaul technology for Wi-Fi hotspots and mobile backhaul and for mobile emergency response services.

**Access Technologies for Mobile Backhaul**

For mobile backhaul, there are of variety of access technologies, depending on the type of radio capability. Base stations of 2G and older 3G networks have TDM interfaces making Ethernet over PDH (either E1/T1 or bonded T1/E1) the prevailing option. 4G eNodeBs and LTE base stations have Ethernet interfaces. For these, either fiber or PON could be the ideal option, but since fiber is not available in all locations, some will use Point-to-Point microwave towards an aggregation node. The choices are summarized in the figure 2 (at right).
### Example(s)

| Figure 1 - Carrier Ethernet over Packet Wireless |
| ![Carrier Ethernet over Packet Wireless](image1.png) |

| Figure 2 - Access for CE Mobile Backhaul |
| ![Access for CE Mobile Backhaul](image2.png) |

### Related and Further Reading

[Access Technologies for Carrier Ethernet](#)

### Categories

- Carrier Ethernet
- Access