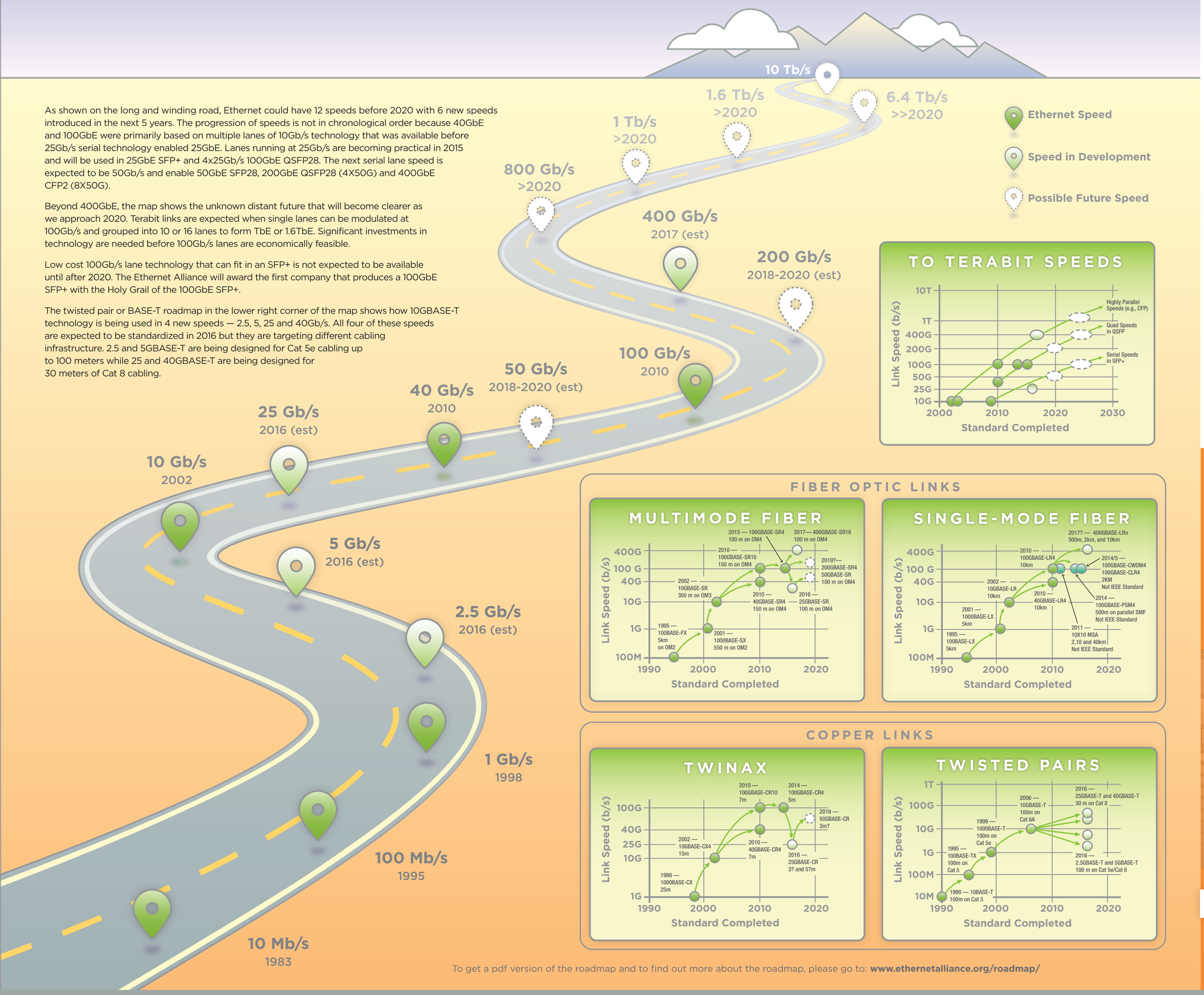
2015 ETHERNET ROADMAP



As shown on the long and winding road, Ethernet could have 12 speeds before 2020 with 6 new speeds introduced in the next 5 years. The progression of speeds is not in chronological order because 40GbE and 100GbE were primarily based on multiple lanes of 10Gb/s technology that was available before 25Gb/s serial technology enabled 25GbE. Lanes running at 25Gb/s are becoming practical in 2015 and will be used in 25GbE SFP+ and 4x25Gb/s 100GbE QSFP28. The next serial lane speed is expected to be 50Gb/s and enable 50GbE SFP28, 200GbE QSFP28 (4X50G) and 400GbE CFP2 (8X50G).

Beyond 400GbE, the map shows the unknown distant future that will become clearer as we approach 2020. Terabit links are expected when single lanes can be modulated at 100Gb/s and grouped into 10 or 16 lanes to form TbE or 1.6TbE. Significant investments in technology are needed before 100Gb/s lanes are economically feasible.

Low cost 100Gb/s lane technology that can fit in an SFP+ is not expected to be available until after 2020. The Ethernet Alliance will award the first company that produces a 100GbE SFP+ with the Holy Grail of the 100GbE SFP+.

The twisted pair or BASE-T roadmap in the lower right corner of the map shows how 10GBASE-T technology is being used in 4 new speeds — 2.5, 5, 25 and 40Gb/s. All four of these speeds are expected to be standardized in 2016 but they are targeting different cabling infrastructure. 2.5 and 5GBASE-T are being designed for Cat 5e cabling up to 100 meters while 25 and 40GBASE-T are being designed for 30 meters of Cat 8 cabling.

TO TERABIT SPEEDS

FIBER OPTIC LINKS

MULTIMODE FIBER

SINGLE-MODE FIBER

COPPER LINKS

TWINAX

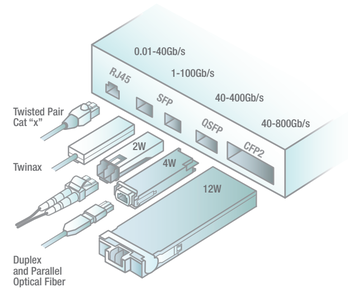
TWISTED PAIRS

MEDIA AND MODULES

Ethernet is wired technology and supports a variety of media including backplanes, twisted pair, twinax, multimode fiber and single-mode fiber. Most people know Ethernet by the twisted pair or Cat "x" cabling with RJ45 connectors because close to a billion ports a year are sold. Cat 8 is the latest generation of twisted pair cabling that will be used in 25GBASE-T and 40GBASE-T.

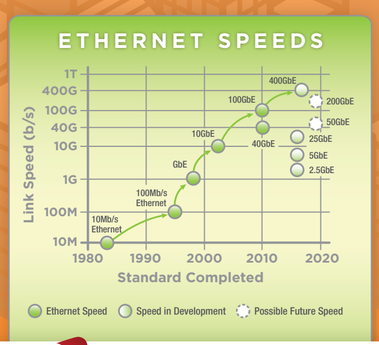
Another popular copper interface is Twinax copper cables that are also known as direct attach cables (DAC)s. DACs may be passive or active and provide very low cost connectivity to servers. Passive DACs are limited to 25 meters or less while active optical cables can go hundreds of meters.

For links longer than 100 meters, fiber optics are required and the graphic below shows three of many module types. The SFP family is the most popular module and supports a single channel or lane in each direction and duplex fibers. The QSFP family supports 4 channels while the CFP2 supports up to 10 channels and duplex or parallel fibers. For 40GbE and beyond, the electrical interface to the module is being defined in IEEE and supports a variety of optical interfaces from IEEE and other sources.



2015 ETHERNET ROADMAP

THE PAST, PRESENT AND FUTURE OF ETHERNET



ethernet alliance

www.ethernetalliance.org

Designed by Scott Kipp

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$9.95

To get a pdf version of the roadmap and to find out more about the roadmap, please go to: **www.ethernetalliance.org/roadmap/**

ETHERNET ECOSYSYTEM

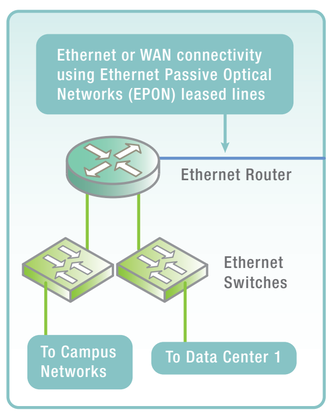
Represented as a city, the Ethernet Ecosystem is divided into four quadrants that are interconnected by multiple MANs that are typically not Ethernet. While each quadrant has overlapping technologies and requirements, this map organizes the environments with a broad brush. Specific implementations may vary considerably.

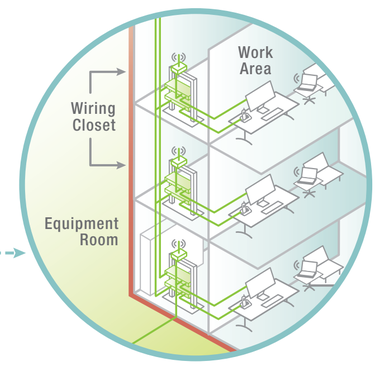
The top half of the map represents applications where cost and connectivity are driving concerns. In the home, small office and car, link distances are less than 100 meters and speeds are typically under 10Gb/s, so copper cabling and wireless are ideal. As enterprises scale in size and requirements, they shift towards fiber and 10Gb/s speeds and beyond.

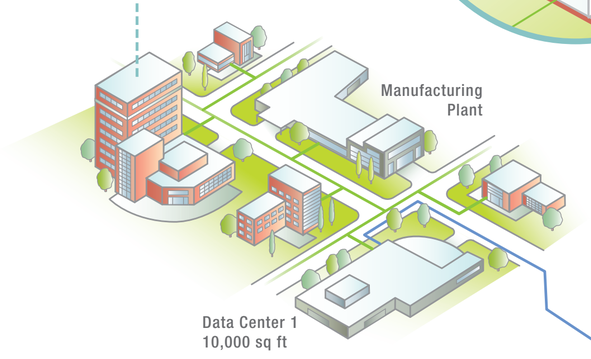
The lower half of the map captures applications that consistently push the bounds of Ethernet and require higher speeds and massive scalability. For example, service providers and hyperscale data centers will be the early adopters of 400GbE. These users may deploy hundreds of thousands of servers in data centers that span multiple football fields and consume hundreds of megawatts of power.

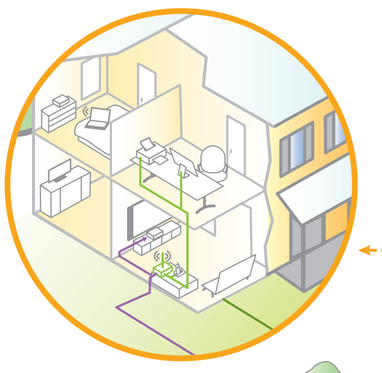
ENTERPRISE AND CAMPUS

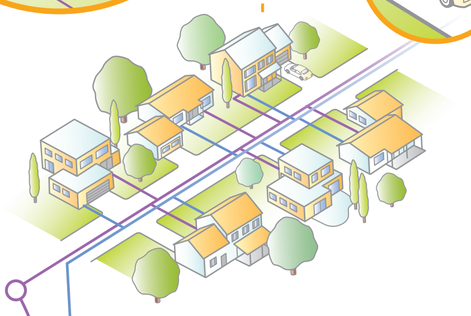
Enterprises consume more Ethernet ports than the other environments by connecting desktop computers, devices and Voice over IP (VoIP) phones. The wired Ethernet networks are supplemented with wireless access points (WAPs) that are connected to Ethernet cables. 802.11ac WAPs are driving the need for 2.5 and 5GBASE-T and eventually 10GBASE-T. Most enterprise data centers are less than 10,000 sq ft and use Cat "x" cabling to connect to servers.











Ethernet
Telecom Network
Cable Network
CD Network

RESIDENTIAL AND CONSUMER

Ethernet Passive Optical Networking (EPON) delivers Internet service to millions of residential customers around the world. Regardless of how the Internet reaches the home, residents may wire their home with Ethernet or use wireless connectivity to connect devices. From cameras to cars, Ethernet provides the network to enable sharing resources and content.

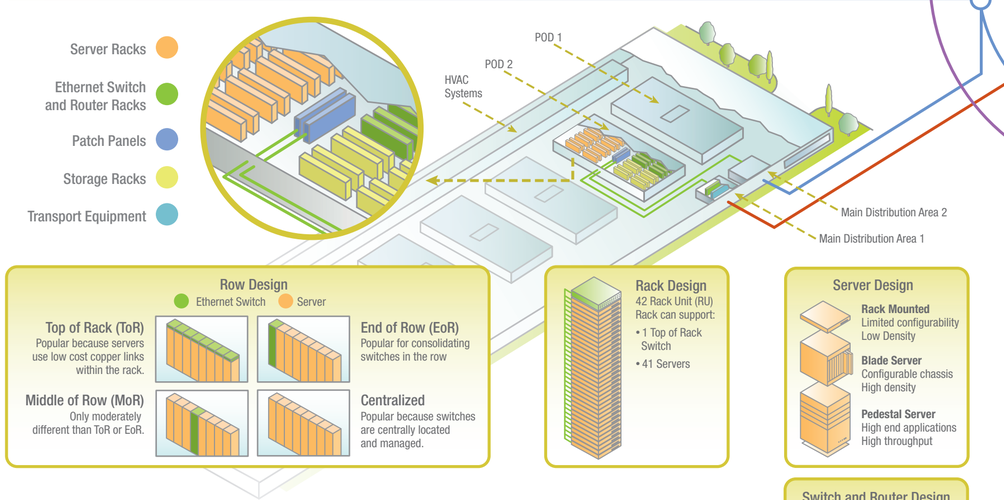
Internet Service Provider using:
- Ethernet Passive Optical Networks (EPON)
- Other PON
- Cable Modem
- DSL Modem
- Fixed Wireless
- Or Satellite

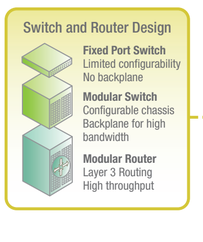
Wireless Router/ Ethernet Switch

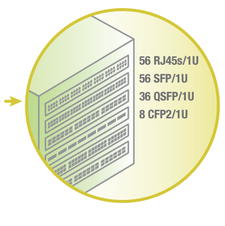
End Devices may attach via Ethernet or Wireless networks:
- Desktops and Laptops
- Cell Phones and Tablets
- Printer/Fax/Copier
- Network Attached Storage (NAS)
- Media Server
- Smart Appliances
- Televisions*
- Pan/Tilt/Zoom Camera*
- Environmental Controls*
- *PoE Devices

BACKBONE TO OTHER CITIES

BACKBONE TO OTHER CITIES

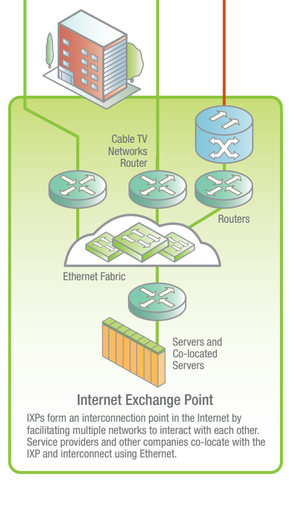


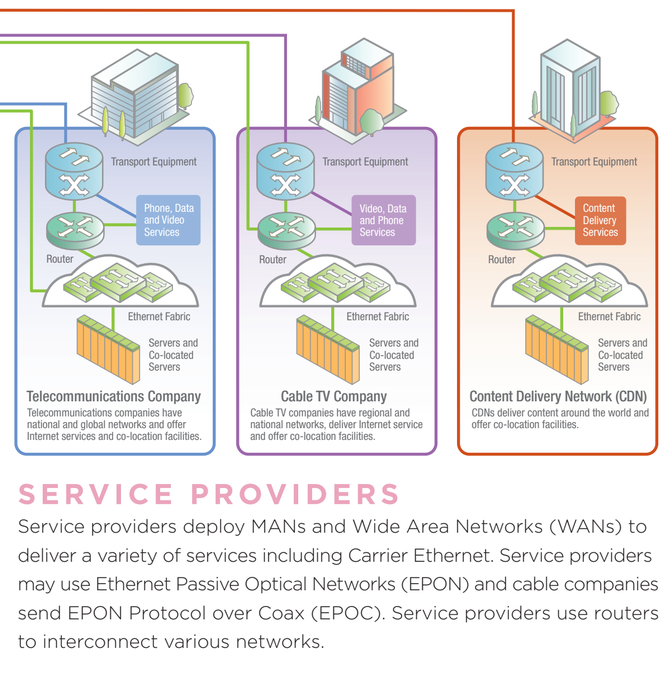




MANs

Metropolitan Area Networks (MANs) come in many varieties and deliver services to a variety of enterprises, organizations and consumers. Some MANs are based on Ethernet, but the largest MANs are based on Optical Transport Networks (OTN) technologies.





HYPERSCALE DATA CENTER

Hyperscale data centers, also known as warehouse scale computing and mega data centers, are known by their massive size and scalability. Cloud service providers, large enterprises and service providers pack over 100,000 servers that are often divided into several pods. Thousands of 25GbE servers and eventually 50GbE servers in these data centers drive the need for 400GbE to the MAN and WAN.

SERVICE PROVIDERS

Service providers deploy MANs and Wide Area Networks (WANs) to deliver a variety of services including Carrier Ethernet. Service providers may use Ethernet Passive Optical Networks (EPON) and cable companies send EPON Protocol over Coax (EPOC). Service providers use routers to interconnect various networks.