

Reference Tables

Fiber Optic Modems

Fiber Optic Modems	Max. Data Rate (kbps)	Interface	Sync/ Async	Carrier Control	Typical Max. Range* (km)	Rack Options	Single Mode Option	Laser Diode Option	Line Connectors		
									ST	FC	SC
FOM-485	115.2	RS-485	A	Yes	5.4	No	No	No	Yes	Yes	Yes
FOM-5A, FOM-6A	19.2	V.24	A	Yes	3.0	No	No	No	Yes	Yes	Yes
FOM-6MP	38.4	V.24	A	No	46	No	Yes	Yes	Yes	Yes	No
FOM-20	256	V.24, V.35, V.36, X.21, RS-530, G.703 codirectional, Ethernet	S/A	Yes	140	Yes	Yes	Yes	Yes	Yes	Yes
FOM-40, FOMi-40, FOMi-40CD	1544/2048	V.24, V.35, RS-530, X.21 G.703 codirectional, E1/T1, Ethernet	S	Yes#	100	Yes	Yes	Yes	Yes	Yes	Yes
FOM-E1/T1, FOMi-E1/T1, FOMi-E1/T1CD	1544/2048	G.703	S	No	144	Yes	Yes	Yes	Yes	Yes	Yes
FOM-E3	34,368	G.703	S	No	110	No	Yes	Yes	Yes	Yes	Yes
FOM-T3	44,736	G.703	S	No	110	No	Yes	Yes	Yes	Yes	Yes
FOM-E3/ETH	34,368	10/100BaseT VLAN bridge	S	No	110	No	Yes	Yes	Yes	Yes	Yes
FOM-T3/ETH	44,736	10/100BaseT VLAN bridge	S	No	110	No	Yes	Yes	Yes	Yes	Yes
FOMi-E3	34,368	G.703, HSSI	S	No	110	Yes	Yes	Yes	Yes	Yes	Yes
FOMi-T3	44,736	G.703, HSSI	S	No	110	Yes	Yes	Yes	Yes	Yes	Yes

* Typical ranges. Precise range should be calculated based on optical budget and fiber cable conditions. To derive the number of miles, divide by 1.6

Only in FOM-40

RAD Rate Converters

Service Rate	64 kbps G.703	n x 64 kbps	T1	Fractional T1	E1	Fractional E1	E3 & Fractional E3	T3 & Fractional T3	STM-1 & Fractional STM-1	OC-3 & Fractional OC-3
48 kbps or 56 kbps	SPD-703-1									
n x 56/64 kbps			ASM-40 FCD-T1 FCD-T1L FCD-T1LC DXC Family	FCD-T1 FCD-T1L FCD-T1LC DXC Family	ASM-40 FCD-E1 FCD-E1L FCD-E1LC DXC Family	FCD-E1 FCD-E1L FCD-E1LC DXC Family	DXC Family	DXC Family	DXC Family	DXC-100
E1		DXC Family	DXC-2 DXC Family	DXC-2 DXC Family	ASM-40 FCD-E1 FCD-E1LC DXC Family	DXC-2 DXC Family	DXC Family	DXC Family	DXC Family	DXC-100
T1		DXC Family	DXC-2 DXC Family	DXC-2 DXC Family	DXC-2 DXC Family	DXC-2 DXC Family	DXC Family	DXC Family	DXC Family	DXC-100
E3		DXC Family	DXC Family	DXC Family	DXC Family	DXC Family	DXC-100	DXC-100	DXC-100	DXC-100
T3		DXC Family	DXC Family	DXC Family	DXC Family	DXC Family	DXC-100	DXC-100	DXC-100	DXC-100
STM-1		DXC Family	DXC Family	DXC Family	DXC Family	DXC Family	DXC-100	DXC-100	DXC-100	DXC-100
OC-3		DXC-100	DXC-100	DXC-100	DXC-100	DXC-100	DXC-100	DXC-100	DXC-100	DXC-100

Sync Modem Selection Guide

Synchronous Modems	Max. Data Rate (kbps)	Interface	Wire Number	Carrier Control	Approx. Range		Transformer Isolated	Rack Option	Multipoint	Line Connectors				
					km+ @ 24 AWG	Data Rate (kbps)				Terminal Block (Default)	RJ-11 or RJ-12	RJ-45	DB-15	Coax BNC
SRM-55C	19.2	V.24	4	Yes	5.0	9.6	Yes	No	Yes	Yes	Yes	Yes	No	No
ASM-10/8	19.2	V.24	2/4	Yes	13.0	9.6	Yes	Yes	Yes	Yes	No	No	No	No
ASM-20	256	V.24, V.35, V.36, RS-530, X.21, G.703 (codirectional, Ethernet)	4	Yes	7.5	64	Yes	Yes	Yes	Yes	No	No	No	No
ASM-31 ASMi-31	128		2	No*	8.0	64	Yes	Yes	No	Yes	No	Yes	No	No
ASM-40	2048	V.24, V.35, V.36, RS-530, X.21, IP, G.703 (codirectional, HDB3), Ethernet	4	Yes	1.8	2048	Yes	Yes	No	Yes	No	No	Yes	Yes
ASMi-52/52L	2.3/4.6 Mbps	V.35, X.21, RS-530, E1, Ethernet	2/4	No	4.0	2048	Yes	Yes	No	Yes (52L)	No	Yes (52L)	No	No
ASMi-54/54L	22 Mbps	E1, Ethernet	8	No	2.4	5700	Yes	Yes	No	No	No	Yes	No	No
ASM-61	10 Mbps	Ethernet	2	No	1.2	10,000	Yes	No	No	No	No	Yes	No	No

* End-to-end control signal passing is available
 + To derive the number of miles, divide by 1.6

RAD Interface Converters

DCE \ DTE	G.703 2 Mbps	G.703 1.544 Mbps	G.703 (Co-directional)
V.24			SPD-703-1
V.35	ASM-40 RIC-E1	ASM-40 RIC-T1	SPD-703-1
V.36	ASM-40 RIC-E1	ASM-40 RIC-T1	SPD-703-1
X.21	ASM-40 RIC-E1	ASM-40 RIC-T1	SPD-703-1
RS-530	ASM-40 RIC-E1	ASM-40 RIC-T1	SPD-703-1
Ethernet	RIC-E1	RIC-T1	



Glossary

For the complete glossary see www.rad.com

A

Abis: A GSM term for an interface linking between the BTS (base transceiver station) and the BSC (base station controller). Other GSM interfaces are the A between the BSC and the MSC (mobile switching controller), and the E between the MSC and the PSTN.

ACR (Adaptive Clock Recovery): A method in which the clock is distributed over the PSN as an inband TDM stream and regenerated using the packets' time-of-arrival information, independently of the physical layer. The clock stream format is a standard pseudowire flow, simplifying interoperability with third-party equipment. In addition, bandwidth consumption can be minimized by using a multicast pseudowire for clock distribution. Today, pseudowire gateways incorporating high performance adaptive clock recovery mechanisms are already deployed and meet stringent GSM/UMTS requirements.

Asynchronous Transmission: A transmission method that sends units of data one character at a time. Characters are preceded by start bits and followed by stop bits, which provide synchronization at the receive terminal. Also called start-stop transmission.

B

Backhaul: Transporting traffic between distributed sites (typically access points) and more centralized points of presence. See Cellular Backhaul.

Bandwidth: The range of frequencies passing through a given circuit. The greater the bandwidth, the more information can be sent through the circuit in a given amount of time.

Best Effort: A QoS class in which no specific traffic parameters and no absolute guarantees are provided.

Bridge: A device interconnecting local area networks at the OSI Data Link Layer, filtering and forwarding frames according to media access control (MAC) addresses.

Broadband: Wideband technology capable of supporting voice, video and data, possibly using multiple channels.

BSC (Base Station Controller): Provides the intelligence behind the BTSs. Typically a BSC has tens or even hundreds of BTSs under its control.

BTS (Base Transceiver Station): The equipment which facilitates the wireless communication between a user's handset and the network. BTS can also be referred to as RBS (radio base station), Node B (in 3G networks) or simply BS (base station).

C

Carrier Ethernet: A ubiquitous service based on standardized equipment and protocols providing seamless connectivity between high speed Ethernet-based LANs and WANs. Carrier Ethernet is characterized by industry-defined attributes for service level agreements, provisioning, system-wide management, and carrier-class OAM. Originally implemented in the core network, Carrier Ethernet is now being extended to the edge and access segment.

Carrier Ethernet Deployment: Carrier Ethernet deployment is picking up pace as Ethernet becomes a widely-accepted, carrier-grade service suite. However, it depends on service providers' ability to cost-effectively overcome two key challenges: the diversity of existing access and transport networks, and the need to meet user expectations for SLA accountability.

Central Office (CO): Telephone company switching office. This is where you would find the local Telco switch that connects to your telephone.

Channelized E1/T1: E1 or T1 service that is divided into individual 64 kbps channels (or channels that are multiples of 64 kbps such as a 256 kbps channel made from four 64 kbps channels), as opposed to unchannelized service, which uses the entire bandwidth of the E1 (2.048 Mbps) or T1 (1.544 Mbps). Channelized E1 or T1 lines can consist of switched lines with inband signaling or leased lines.

CIR (Committed Information Rate): Defined in a customer's SLA and represents the average bandwidth that the service provider guarantees to the user, regardless of network conditions.

Circuit Emulation: A connection over a virtual circuit-based network providing service to end users that is indistinguishable from a real point-to-point, fixed-bandwidth circuit. Services based on circuit emulation (Circuit Emulation Services or CES) offer traditional TDM trunking (at $n \times 64$ kbps, fractional E1/T1, E1/T1 or E3/T3) over a range of transport protocols, including ATM, IP, MPLS and Ethernet.

Circuit Emulation Service: New technology for offering circuit emulation services over packet switched networks. The service offers traditional TDM trunking (at $n \times 64$ kbps, fractional E1/T1, E1/T1 or E3/T3) over a range of transport protocols, including IP, MPLS and Ethernet.

Clock: A term for the source(s) of timing used in synchronous transmission.

CO (Central Office): Telephone company switching office. This is where you would find the local Telco switch that connects to your telephone.

CORBA: The acronym for Common Object Request Broker Architecture, OMG's open, vendor-independent architecture and infrastructure that computer applications use to work together over networks. One of its most important uses is in servers that must handle a large number of clients, at high hit rates, with high reliability, such as network management systems.

CPE (Customer Premises Equipment): Generally refers to communications equipment located at the customers' premises for use with communication service providers' services. In some cases, these are customer-owned or leased; in other cases, these are the property of the service provider.

Cross Connect: A network device used by telecom carriers and large enterprises to switch and multiplex low speed voice and data signals onto high speed lines and vice versa. It is typically used to aggregate several E1/T1 lines into a higher speed electrical or optical line as well as to distribute signals to various destinations.



D

DCME (Digital Circuit Multiplication Equipment): Performs voice compression over TDM and IP networks to reduce bandwidth requirements for microwave, wireline and costly satellite links while preserving voice quality.

DiffServ or DS (Differentiated Services): QoS method to differentiate and control IP traffic so that the traffic's relative priority can be determined on a per-hop basis.

Digital Cross Connects (DACs): Come large and small, handling only a few ports up to a couple of thousand. Narrowband, wideband and broadband cross connects support channels down to DS0, DS1 and DS3 respectively. (See Cross Connect.)

DSCP (Differentiated Services Code Point): A field in the header of IP packets for packet classification purposes.

DS0 (Digital Subscriber Level Zero): A 64 kbps unit of transmission bandwidth. A worldwide standard speed for digitizing one voice conversation, and more recently, for data transmission. Twenty-four DS0s (24 x 64 kbps) equal one DS1.

DS1 (Digital Signal Level 1) Channel: Framing specification used in transmitting digital signals at 2.048 Mbps on an E1 facility or 1.544 Mbps on a T1 facility.

DS2 Channel: For an E1 line, an 8.45 Mbps channel that consists of four DS1 channels; for a T1 line, a 6.312 Mbps channel that consists of four DS1 channels.

DS3 Channel: A 44.736 Mbps line consisting of seven DS2 channels. A DS3 line is also called a T3 line.

E

E&M Signaling: Voice transmission system that uses separate paths for signaling and voice. The "M" lead (mouth) transmits signals to the remote end of the circuit while the "E" lead (ear) receives incoming signals.

E-LAN: Services consisting of multipoint connections, in which each EVC connects more than two UNIs. This service type enables any-to-any connectivity among disparate locations across metro or wide area networks. E-LANs also support bandwidth granularity and differentiated services which make them ideal for transparent LAN networking.

E-Line: An Ethernet service in which each EVC links only two UNIs in a point-to-point connection. E-Line services are available as either one of two service variants: Ethernet Private Line and Ethernet Virtual Private Line.

E-Tree: Also called rooted multipoint, a multicast service in which one or more of the UNIs are classified as "Roots," while all other UNIs are designated as "Leaves." Traffic delivery is permitted between a Root and a Leaf, in both directions, but is prohibited between Leaves. E-Tree services are best suited for IPTV applications.

E1: A 2.048 Mbps line, common in Europe, that supports thirty-two 64 kbps channels, each of which can transmit and receive data or digitized voice. The line uses framing and signaling to achieve synchronous and reliable transmission. The most common configurations for E1 lines are E1 PRI, and unchannelized E1.

E1 PRI Line: An ISDN line that consists of thirty-two 64 kbps channels. This type of line uses 30 B channels for user data, one x 64 kbps D channel for ISDN D-channel signaling, and one framing channel. The B channels can be all switched, nailed up, or a combination of switched and nailed up. This type of PRI line is a standard in Europe and Asia called G.703.

E3: The European standard for high speed digital transmission, operating at 34 Mbps.

Echo Cancellation: Improves the quality of voice transmissions. It eliminates the echo that results from the reflection of the telephony signal back to the caller, which can occur in a 4-wire to 2-wire hybrid connection between the CPE and the telephones or PBX. The longer it takes the signals to return to the caller, the more perceptible the echo.

EFM (Ethernet in the First Mile): Also known as IEEE 802.3ah, a collection of protocols defining Ethernet in the access networks, i.e., First/Last Mile. EFM also addresses other issues required for mass deployment of Ethernet services, such as operations, administration and maintenance (OAM) and compatibility with existing technologies (e.g., spectral compatibility for copper).

EIR (Excess Information Rate): Defines an average rate of Ethernet frames that are allowed into the network on a best-effort basis. Service performance for these frames is not guaranteed and depends on available bandwidth. EIR offerings enable carriers to generate more revenues from a given network capacity without compromising the quality of premium or real-time CIR services by oversubscribing available bandwidth.

Encapsulation: Encapsulating data is a technique used by layered protocols in which a low level protocol accepts a message from a higher level protocol, then places it in the data portion of the lower level frame. The logistics of encapsulation require that packets traveling over a physical network contain a sequence of headers.

EPL (Ethernet Private Line): A service similar to a leased line that features a single Ethernet virtual connection per physical user interface. It is considered a port-based service, since all the traffic coming into the UNI is mapped to the same EVC. EPL may be delivered as a best-effort service with no performance guarantees, or with SLA-based rate and performance commitments.

Ethernet Converter: Low cost and simple devices for connecting Ethernet over E1, T1, E3, T3, STM-1/OC-3 and STM-4/OC-12 access lines.

Ethernet Demarcation: A key element in Carrier Ethernet transport and services, Ethernet demarcation provides a clear separation between the user and the network, allowing carriers to extend network visibility up to the user premises.



Ethernet OAM (Operation, Administration and Maintenance): A set of functions designed to monitor network operation in order to detect network faults and measure its performance. Carrier-class Ethernet services require automated end-to-end management and monitoring, including OAM capabilities such as connectivity verification, fault detection, performance monitoring, and alarm indication.

Ethernet over PDH (Plesiochronous Digital Hierarchy): A method for carrying Ethernet traffic over PDH network lines such as E1/T1 or E3/T3. It is one of several technologies available to service providers who wish to offer new carrier-class Ethernet services over existing legacy infrastructure.

Ethernet over SDH: Although SDH networks were originally engineered to transport voice traffic, many carriers are using their ubiquitous SDH infrastructure to deploy Ethernet services. Recent developments in next-generation SDH have made these networks more cost-effective and user-friendly for Ethernet traffic.

Ethernet over SONET: Although SONET networks were originally engineered to transport voice traffic, many carriers are using their ubiquitous SONET infrastructure to deploy Ethernet services. Recent developments in next-generation SONET have made these networks more cost-effective and user-friendly for Ethernet traffic.

Ethernet QoS: One of the key attributes of Carrier Ethernet services, by which the service provider offers business users bandwidth, delivery, and performance guarantees for selected traffic, and allocates the necessary network resources accordingly. Performance guarantees usually refer to parameters such as frame delay, delay variation, frame loss, and availability.

EVC (Ethernet Virtual Connection): The logical connection between two or more UNIs, in a point-to-point or multipoint-to-multipoint topology. The bandwidth allocated to an EVC cannot exceed the maximum bandwidth of the UNI.

Evolved HSPA (High Speed Packet Access): Also known as MIMO (multiple-input multiple-output) HSPA, HSPA Evolution and HSPA+, an upgrade to the 3GPP's HSPA standard providing theoretical downlink speeds of up to 42 Mbps. HSPA+ is generally regarded as an interim phase between the 3.5G HSPA technology and 4G LTE (long-term evolution).

EVPL (Ethernet Virtual Private Line): A service where a single UNI supports several EVCs simultaneously. In industry terms, such an attribute is called "service multiplexing" or "flow-based service," as the UNI bandwidth is shared between several EVCs. Each EVC can be assigned a different delivery priority, so that users can prioritize their traffic according to their needs.

G

G.8264: An ITU-T standard specifying the Synchronization Status Message (SSM) format for Synchronous Ethernet.

GFP (Generic Framing Procedure): Defined by ITU-T G.7041, it allows efficient mapping of variable length, higher layer client signals, such as Ethernet, over a transport network like SDH/SONET. Recently, GFP has been extended to lower speed PDH networks.

Gigabit Ethernet Converters: Typically link copper cabling (UTP) with fiber optics or multimode fiber with single mode fiber cables, to enable transport of Gigabit Ethernet traffic over diverse media.

Grooming: In telecommunications, the process of separating and segregating channels by combing, such that the broadest channel possible can be assembled and sent across the longest practical link. The aim is to minimize de-multiplexing traffic and reshuffling it electrically.

IEEE C37.94: A standard providing plug-and-play transparent communications between different manufacturer's Teleprotection and multiplexer devices using multimode optical fiber. The standard defines clock recovery, jitter tolerances, physical connection method, and the equipment-failure actions for all communications link failures.

Interface: A shared boundary, defined by common physical interconnection characteristics, signal characteristics, and meanings of exchanged signals.

Interface Converters: Devices that convert physical media, data rates and transmission protocols, allowing service interworking between different communication interfaces

Inverse Multiplexing: A method in which the inverse multiplexer slices the data stream into equal portions and transmits each portion over an available circuit. The receiving end adjusts for network-induced delay and reassembles the data packets into their proper order. Therefore, an inverse multiplexer allows lower speed channels across a network to be combined into a single, higher speed data stream.

IP (Internet Protocol): A networking protocol for providing a connectionless service to the higher transport protocol. It is responsible for discovering and maintaining topology information and for routing packets across homogeneous networks. Combined with TCP, it is commonly known as the TCP/IP platform.

IP Address (Internet Protocol Address): Also known as an Internet address, a unique reference number used by devices attached to a network when sending information through a local LAN, wide area WAN or the Internet networks.

IP DSLAM: A central office (CO) device for delivering digital subscriber line services that link DSL connections to a single high speed broadband (IP) line.

IP Telephony: The transmission of voice over an Internet Protocol (IP) network. Also called Voice over IP (VoIP), IP telephony allows users to make phone calls over the Internet, intranets, or private LANs and WANs that use the TCP/IP protocol.

ISDN (Integrated Services Digital Network): A carrier-provided service that allows a variety of switched digital data and voice transmissions to be accommodated simultaneously. ISDN is available as BRI, PRI and B-ISDN.



J

Jitter: The deviation of a transmission signal in time or phase. It can introduce errors and loss of synchronization in high speed synchronous communications.

Jitter Buffer: Variation in the arrival times between packets, also called jitter, causes unnatural-sounding voice instead of a smooth voice stream. If a packet does not arrive in time to fit into the voice stream, the previous packet is replayed. This can seriously detract from voice quality. Since the jitter buffer adds to the overall delay of voice transmissions, the optimal jitter buffer should fit the network's differential delay. Adaptive jitter buffering continuously monitors the network delay and adjusts the queuing period accordingly.

Last Mile: Sometimes referred to as Local Loop, the final leg of delivering communications connectivity to a resident or customer. Typically seen as an expensive challenge because "fanning out" wires and cables is a considerably expensive and physically difficult task.

LCAS (Link Capacity Adjustment Scheme): A method to dynamically increase or decrease the bandwidth of virtual concatenated containers in SDH. The LCAS protocol is specified in ITU-T G.7042. It allows on-demand increase or decrease of the bandwidth of the virtual concatenated group in a hitless manner. This brings bandwidth-on-demand capability for data clients like Ethernet when mapped into SDH containers.

Leased Line: A permanent telephone connection between two points that is rented for exclusive use from a telecommunications common carrier. In contrast to a normal dial-up connection, a leased line is always active. Typically, the highest speed data connections require a leased line connection. For example, a T1 channel is a type of leased line that provides a maximum transmission speed of 1.544 Mbps.

Local Loop: Sometimes referred to as Last Mile, the physical wires that run from the subscriber's telephone set, PBX, or key telephone system to the telephone company's central office. Increasingly, the Local Loop now goes from the main distribution frame at the customer premises to the telephone company. The subscriber is responsible for connecting his wires from the box at the customer's premises to his phone, PBX, or key system.

Loopback: A type of diagnostic test in which the transmitted signal is returned to the sending device after passing through all or part of a communications link or network.

M

MAC-in-MAC: An IEEE 802.1ah standard for layering the Ethernet network into customer and provider domains with complete isolation among their MAC addresses. It enables service providers to separate customer traffic from management traffic and also save on VLAN IDs.

Master Clock: The source of timing signals (or the signals themselves) that all network stations use for synchronization.

MEF (Metro Ethernet Forum): A non-profit organization chartered with the mission of accelerating the adoption of optical Ethernet as the technology of choice in future metro networks worldwide. Ethernet was chosen for

its relative simplicity and popularity with end users, as well as for lowering costs of Ethernet equipment.

MLPPP (Multilink PPP): Connects multiple links between two systems as needed to provide extra bandwidth. Remotely accessing resources through MLPPP allows for an increase in overall throughput by combining the bandwidth of two or more physical communication links, such as analog modems, ISDN and other analog/digital links.

N

NMS (Network Management System): The system that controls the network configuration, fault and performance management, and diagnostic analysis.

NNI (Network to Network Interface): Marks the demarcation point between two provider networks and defines the responsibility boundaries for each for maintenance and operations purposes. Eventual adoption of E-NNI standards at the hand-off point will provide for more uniform SLAs between off-net and on-net traffic.

NTR (Network Timing Reference): A highly accurate standardized method for frequency distribution in DSL-based Last Mile segments. A network reference clock (i.e., a service clock) is distributed from the DSLAM to the CPE by mapping its clock information to the DSL modem transmission. Depending on the specific DSL technology, this is achieved by either directly locking the DSL symbol clock to the reference clock or by mapping to the DSL-frame-phase-difference-bit information between the reference clock and the DSL free-running symbol clock. The advantages of NTR lie in its high level of accuracy and in the fact that it eliminates the need for advanced synchronization hardware in the DSL modem/IAD, thereby reducing the overall cost of the solution.

P

Packet: An ordered group of data and control signals transmitted through a network, as a subset of a larger message.

Packet Switching: A data transmission technique, which divides user information into discrete data envelopes called packets, and sends the information packet by packet.

POP (Point of Presence): An access point to the rest of the network.

Port: The physical interface to a computer or multiplexer, for connection of terminals and modems.

Prioritization: Also called CoS (class of service), classifies traffic into categories such as high, medium, and low. The lower the priority, the more "drop eligible" is a packet. E-mail and Web traffic are often placed in the lowest categories. When the network gets busy, prioritization ensures critical or high-rated traffic is passed first, and packets from the lowest categories may be dropped.

Protocol: A formal set of conventions governing the formatting and relative timing of message exchange between two communicating systems.



Pseudowire: Point-to-point connections set up between pairs of provider edge routers. Their primary function is to emulate (typically Layer 2) native services like ATM, Frame Relay, Ethernet, low rate TDM, or SONET/SDH over an underlying common packet switched network core (MPLS, IP, or L2TPv3). To achieve this, each of these technologies is encapsulated into a common MPLS format. Pseudowires are defined by the IETF PWE3 (Pseudowire Edge to Edge Emulation) working group.

S

SDH (Synchronous Digital Hierarchy): The European standard for using optical media as the physical transport for high speed long-haul networks.

SFP (Small Form-Factor Pluggable): A compact optical transceiver used in telecom and datacom applications. It is a popular industry format supported by most fiber optic component vendors. The primary advantages of this approach are hot pluggability, field replacability, and mix and match optical reach and type. Using the SFP platform, RAD has engineered a "System on an SFP" for extension of Ethernet and LAN over E1/T1 and E3/T3 connections and TDM over Ethernet.

Sharing Device: A device that enables sharing of a single resource (modem, mux or computer port) among several devices (terminals, controllers or modems).

SHDSL (Single-pair High-speed Digital Subscriber Line): ITU-T G.991.2 standardized method of extending the range of copper telephone lines for broadband services. SHDSL technology is used to transport data symmetrically at rates of 192 kbps to 2.3 Mbps over 2-wire, or 384 kbps to 4.6 Mbps over 4-wire. The latest SHDSL standard is SHDSL.bis. Based on ITU-T G.991 and ETSI TS 101524, SHDSL.bis uses TC-PAM 16 or TC-PAM 32 line coding and multi-pair bonding technology to reach transmission rates up to 5.69 Mbps on one pair (2-wire) for a rate up to 22.8 Mbps over 8-wire.

Short Haul Modem: A modem designed for use in transmitting over relatively short distances across unloaded metallic circuits. Also called a line driver or limited distance modem (LDM).

Silence Suppression: In a telephone conversation, only about 50% of the full duplex connection is used at any given time. This is generally because only one person talks while the other person listens. In addition, voice packets are not sent during interword pauses and natural pauses in the conversation, reducing the required bandwidth by another 10%. Silence suppression frees this 60% of bandwidth on the full duplex link for other voice or data transmissions.

SIP (Session Initiation Protocol): A real-time signaling protocol for Internet conferencing, telephony, video, events notification and instant messaging. SIP initiates call setup, routing, authentication and other feature messages to endpoints within an IP domain.

SLA (Service Level Agreement): A formal negotiated agreement between customers and their service provider, or between service providers. It records the common understanding about services, priorities, responsibilities, guarantees, etc., with the main purpose to agree on the level of service. For example, it may specify the levels of availability,

serviceability, performance, operation, or other attributes of the service like billing and even penalties in the case of violation of the SLA.

SONET (Synchronous Optical Network): A North American standard for using optical media as the physical transport for high speed long-haul networks. SONET basic speeds start at 51.84 Mbps and go up to 2.5 Gbps.

SSH (Secure Shell): A network protocol that allows data to be exchanged over a secure channel between two computers. Encryption provides confidentiality and integrity of data.

Sync-E (Synchronous Ethernet): Defined in ITU-T standards G.8261, G.8262 and G.8264, uses the Ethernet physical layer to accurately distribute frequency, using clock mechanisms similar to those of SDH/SONET. Unlike timing distribution in emulation services, where clocking information is carried in the same flow as the data payload, in Synchronous Ethernet the BITS clock of the Ethernet physical layer is disciplined to a PRC, regardless of the higher layer transmission protocols used. As Sync-E is a link-by-link frequency distribution scheme, it requires the entire clock distribution path (i.e., all the network nodes involved) to be Sync-E compliant.

T

T1: A digital transmission link with a capacity of 1.544 Mbps used in North America. Typically channelized into 24 DS0s, each is capable of carrying a single voice conversation or data stream. T1 uses two pairs of twisted pair wires.

T3: A digital transmission link with a capacity of 45 Mbps, or 28 T1 lines.

TCP/IP (Transmission Control Protocol/Internet Protocol): A protocol platform, known also as the Internet protocol suite, that combines both TCP and IP. Widely used applications, such as Telnet, FTP and SMTP, interface to TCP/IP.

TDM (Time Division Multiplexer): A device which divides the time available on its composite link among its channels, usually interleaving bits (Bit TDM) or characters (Character TDM) of data from each terminal.

TDMoIP® (TDM over IP): A standard-TDM pseudowire technology developed and patented by RAD. Other TDM pseudowire technologies are SAToP and CESoPSN.

Telnet: The virtual terminal protocol in the Internet suite of protocols. It lets users on one host access another host and work as terminal users of that remote host. Instead of dialing into the computer, the user connects to it over the Internet using Telnet. When issuing a Telnet session, it connects to the Telnet host and logs in. The connection enables the user to work with the remote machine as though it were a terminal connected to it.

Terminal Adapter: A device that allows analog voice and data devices to work through an ISDN connection. The terminal adapter is a protocol converter that adapts equipment not designed for ISDN, such as phones, faxes and modems.



TETRA (Terrestrial Trunked Radio): A wireless communications standard for Professional Mobile Radio (PMR) and Private Access Mobile Radio (PAMR) applications. It is a digital format, i.e. speech is transmitted as binary data, which makes it far more difficult to monitor or eavesdrop.

Throughput: The amount of information transferred through the network between two users in a given period, usually measured in the number of packets per second (pps).

Timeslot: A portion of a serial multiplex of timeslot information dedicated to a single channel. In E1 and T1, one timeslot typically represents one 64 kbps channel.

Timing over Packet Standards: Various methods and standards developed to ensure that accurate time and frequency is distributed in packet-based networks.

ToS (Type of Service) Field: In a QoS scheme, an eight-bit field that lets values from 0 to 15 be assigned to request special handling of traffic (for example, minimize delay, maximize throughput). The ToS field is being phased out in favor of DSCP.

Traffic Management: Set of actions and operations performed by the network to guarantee the operability of the network exercised in the form of traffic control and flow control.

Traffic Policing: Mechanism whereby any traffic which violates the traffic contract agreed to at connection setup, is detected and discarded.

Traffic Shaping: A method for smoothing the bursty traffic rate that might arrive on an access virtual circuit so as to present a more uniform traffic rate on the network.

Trunk: A single circuit between two points, both of which are switching centers or individual distribution points. A trunk usually handles many channels simultaneously.

U

UNI (User to Network Interface): An interface supplied by the service provider that represents the customer's access point to an Ethernet service. It marks the crossover point between the provider's network and the user. A UNI can include one or more EVCs.

V

VCAT (Virtual Concatenation): An inverse multiplexing technique used to split SDH/SONET bandwidth into logical groups, which may be transported or routed independently.

VLAN (Virtual LAN): A network architecture which allows geographically distributed users to communicate as if they were on a single physical LAN by sharing a single broadcast and multicast domain.

VLAN-Aware: A device that is doing the Layer 2 bridging according to the VLAN tag in addition to the standard bridging parameters. A VLAN-aware device will not strip or add any VLAN header.

VLAN Stacking: A mechanism specified in IEEE standard 802.1ad ("Provider Bridges") to extend the IEEE VLAN tagging standard (802.1Q). Also known as double VLAN tagging or Q-in-Q, VLAN stacking allows service providers to assign service VLAN tags (S-VLAN) to Ethernet frames that are already marked with customer VLAN tags (C-VLAN), resulting in hierarchical or "stacked" VLAN tags.

VLAN Stripping: Removal of VLAN tags from a network frame.

Voice Compression: Newer voice compression algorithms try to model 64 kbps PCM (G.711) more efficiently using fewer bits to reduce the bandwidth required, while preserving the quality or audibility of the voice transmission. Vendors such as RAD support low bit rate voice compression algorithms such as ITU G.723.1 and G.729A to permit the greatest number of simultaneous multiple calls while maintaining high quality voice. In this way, compressed voice systems (CVS) can offer greater bandwidth savings, reduced network congestion and high quality voice transmissions.

VoIP (Voice over IP): Set of facilities for managing the delivery of voice information using the Internet Protocol (IP). Voice information is sent in digital form in discrete packets over the Internet instead of in analog form over the public switched telephone network (PSTN). A major advantage of VoIP is that it avoids the tolls charged by ordinary telephone service.

VPN (Virtual Private Network): A restricted network that uses public wires to connect nodes. A VPN provides a way to encapsulate, or "tunnel," private data cheaply, reliably, and securely through a public network, usually the Internet.

Y

Y.1731: ITU-T standard Y.1731 is an Ethernet OAM (operations, administration and maintenance) standard for testing an Ethernet service and for monitoring its performance.

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1588-2008: Previously known as pre-standard 1588v2, the latest version of Precision Time Protocol (PTP) for frequency and time of day distribution over packet switched networks. It is based on timestamp information exchange in a master-slave hierarchy.

1588v2: Also known as 1588-2008, the latest version of Precision Time Protocol (PTP) for frequency and time of day distribution over packet switched networks. It is based on timestamp information exchange in a master-slave hierarchy.

802.1ag: IEEE standard also known as "Connectivity Fault Management (CFM)," an Ethernet OAM (operations, administration and maintenance) standard for testing an Ethernet service over any path, whether a single link or end-to-end.

802.3ah: IEEE standard 802.3-2005, also known as 802.3ah clause 57, an Ethernet OAM (operations, administration and maintenance) standard for testing the status of a single Ethernet link within a network. It is also known as Ethernet Link OAM and EFM (Ethernet in the First Mile) OAM.

