

## Appendix D

### Glossary

**3DES:** Algorithm using the DES three times to increase the encryption security.

**AAAA:** Type of record used in DNS servers to store an IPv6 address.

**AAL (ATM Adaptation Layer):** Set of ATM-based protocols that provide different transmission services (voice, video, data, and so on) to ATM network users.

**AAL 5:** The AAL normally used to support connection-oriented VBR services and used prevalently for the classical IP over ATM traffic.

**access control:** A function used to decide whether a given request for a resource can be accepted.

**ACK (acknowledgment):** Notification sent from one network to another to acknowledge that some event (for example, receipt of a message) has occurred; acknowledgments can be present in different layers of the OSI reference model.

**adaptive routing:** See **dynamic routing**.

**address:** An identifier of an interface or a set of interfaces.

**address mask:** See **netmask**.

**address resolution:** Process to determine the relationship between an IP address and a link layer address (for example, in the LAN's case, a MAC address).

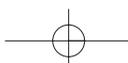
**adjacent nodes:** Nodes reachable by a single hop.

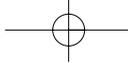
**advertisement:** Broadcast message used to notify all nodes of the availability of a certain service.

**AFI (Authority and Format Identifier):** In the OSI reference model, the first of the two parts into which the IDP field of the NSAP address is subdivided; it identifies the authority that issued the address and its format.

**agent:** A server or a relay.

**AH:** See **Authentication Header**.





## Appendix A: JavaBeans API Reference

**All-Node:** The multicast address (**FF02::1**) of all nodes connected to a link.

**All-Router:** The multicast address (**FF02::2**) of all routers connected to a link.

**ANSI (American National Standard Institute):** Voluntary organization composed of corporate, government, and other members that coordinate standard-related activities in the fields of, among other things, communications and networking. ANSI is a member of the IEC and of the ISO.

**anycast:** The unicast address of a group of interfaces belonging to different nodes. A packet that is sent to an anycast address is delivered to only one interface of the group (the nearest to the source, coherently to routing metrics).

**API (Application Programming Interface):** A set of functions used to access the network services independently from the implementation.

**APNIC (Asia-Pacific Network Information Center):** The service center for Internet information in the Asia and Pacific area.

**application:** A program that performs a function directly for a user. Examples of applications are Telnet, FTP, and mail.

**area:** Hierarchical partition of a network identified by a field of the layer 3 address (network).

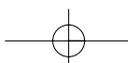
**ARP (Address Resolution Protocol):** A protocol of the IPv4 architecture used to map an IPv4 address to a Data Link layer address (frequently MAC). ARP can be implemented only on physical networks that support the broadcast. See also **address resolution**.

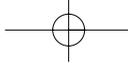
**ARP server:** Server used to implement the ARP Protocol on NBMA networks. See also **ATMARP**.

**AS:** See Autonomous System.

**asymmetric reachability:** A type of asymmetrical link in which it is correct to reach node B from node A, but not node A from node B.

**ATM (Asynchronous Transfer Mode):** CCITT standard used to convey, through fixed-length cells, different kinds of information (data, voice, video, and so on). In the Internet world, this abbreviation is frequently synonymous with Another Terrible Mistake.





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**ATM switch:** A multiport hardware set used to switch ATM cells. Cells are transferred from one physical connection to another, sometimes undergoing a variation in VCI/VPI fields.

**ATMARP (ATM Address Resolution Protocol):** Modified version of the ARP protocol, operating on a server, that can handle the mapping between IP addresses and ATM addresses.

**Authentication:** The verification of the identity of a person or a process.

**Authentication Header (AH):** Header with the function of guaranteeing the authenticity and the integrity of a packet. It guarantees that the packet-fixed fields have not been modified during the transmission.

**automatic tunnel:** Tunnel IPv6 on IPv4 where the endpoint of the IPv4 tunnel is determined by the IPv6 address with an embedded IPv4 address.

**Autonomous System (AS):** A set of routing domains under a common administration. See also **routing domain**.

**backbone:** The top level in a hierarchical network.

**bandwidth:** The difference between the highest and the lowest frequencies available for network signals. The term is also used to describe the rated throughput capacity of a given network medium or protocol.

**Bellman-Ford:** Alternative name used for distance vector algorithms.

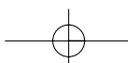
**best-effort:** The behavior of some connectionless protocols, such as IP, that make their “best effort” to deliver a packet without guaranteeing the delivery itself or how long the packet will take to reach its destination.

**BGP (Border Gateway Protocol):** Path vector routing protocol, standardized by the IETF, used by exterior routers of an autonomous system to announce the network’s addresses.

**B-ICI (Broadband Inter-Carrier Interface):** NNI between different public networks.

**BIND (Berkeley Internet Name Daemon):** Implementation of a DNS server developed and distributed by the University of California at Berkeley.

**binding cache:** A cache where the mapping between home addresses and care-of addresses of mobile hosts are stored.



**B-ISDN (Broadband ISDN):** A wide band version of ISDN that can offer transmission speed up to a 622 Mb/s.

**black hole:** A network configuration that discards packets without signaling it. The presence of black holes is detected by the Neighbor Unreachability Detection procedure.

**BOOTP (BOOTstrap Protocol):** TCP/IP network architecture protocol that allows a diskless machine to bootstrap on a local network.

**border router:** A synonym for **exterior router**.

**bps:** Bits per second, speed unit in data transmissions.

**bridge:** Routing device that operates at the Data Link layer (Layer 2) of the OSI reference model. MAC-bridges are frequently used to interconnect local networks.

**broadband:** A high-speed transmission, usually higher than 2 Mb/s.

**broadcast:** Data packet that will be sent to all nodes on a network.

**brouter:** A network device that bridges some packets and routes other packets. The bridge/route decision is based on different protocols.

**BSD (Berkeley System Development):** An implementation of the UNIX operating system developed and distributed by the University of California at Berkeley.

**buffer:** A storage area used to compensate for differences in processing speed between source and destination.

**cache:** A small storage area used in a node to store information temporarily.

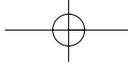
**care-of address:** The IPv6 address acquired by a mobile host by connecting to a foreign network.

**CATNIP:** An alternative proposal for the IPv6 standard, dropped during the selection phase.

**CCITT (Consultative Committee for International Telegraph and Telephone):** The most important international organization responsible for the development of telephone and data communication systems standards. This organization is now part of the International Telecommunications Union, which recently reorganized, and CCITT was renamed the ITU-TSS.

**cell:** Short packet with fixed length (in ATM, 53 octets).

**Cell Switching Router (CSR):** Internetworking device that integrates routing IP and switching ATM functions.



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**CERT (Computer Emergency Response Team):** Organization that works with the Internet community to improve and guarantee the security of the network.

**CIDR (Classless Inter-Domain Routing):** Technique that allows routers to group routes together to cut down on the quantity of routing information carried by the core routers.

**circuit switching:** Commutation technique to transmit digital data or analog signals that allow transmission systems to create a short delay and constant bandwidth temporary circuit.

**Classifier:** A part in an internetworking device in which packets are classified by their belongings to flows.

**client:** A host that requests a service of another host.

**client-server:** Interaction model in a distributed system in which a program sends a request to another program and waits for a reply. The program that requests is called a *client*; the one that replies to the request is called a *server*.

**CLNP (ConnectionLess Network Protocol):** OSI network layer protocol that does not require a circuit to be established before data are transmitted, as documented in ISO 8473.

**CLNS (ConnectionLess-mode Network Service):** OSI network layer service that does not require a circuit to be established before data are transmitted (also called *datagram protocol*). The delivery of the packet is not guaranteed, and the correction of errors procedures must be implemented by upper layers.

**CMI (Cluster Member Identifier):** In MARS, a station in a multi-cast group.

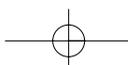
**configured tunnel:** IPv6 over IPv4 tunnel where the endpoint of the IPv4 tunnel is determined by the information configured on the node performing the encapsulation.

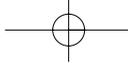
**congestion:** Traffic in excess of network, device, or circuit capacity.

**connectionless-mode service:** Service implemented by a connectionless protocol that doesn't guarantee the PDU's delivery.

**connection-mode service:** Reliable service implemented by a connected protocol.

**CONS (Connection-mode Network Service):** Network layer reliable service where PDUs are exchanged through a connection protocol.





**core gateway:** The primary router in Internet. A synonym for **core router**.

**core router:** TRD's router.

**cost:** Metric associated to a link or to a path.

**CRC (Cyclic Redundancy Check):** Binary string computed on a packet to test its integrity during the reception phase.

**CSR:** See **Cell Switching Router**.

**cut-through:** In NBMA networks, a kind of routing that doesn't take into account LLG borders.

**cyberspace:** A term coined by William Gibson in his fantasy novel *Neuromancer* to describe the world of computers and the society that gathers around them.

**datagram:** packets transmitted by a connectionless protocol. Also a synonym for **IP packet**.

**datagram service:** See **connectionless-mode service**.

**data link:** The second layer of the OSI reference model. This layer provides reliable transit of data across a physical link.

**DCC (Data Country Code):** One of the possible formats of OSI NSAP addresses for use by private networks. Adapted from the subnet-network model of addressing in which the ATM layer is responsible for mapping network layer addresses into ATM addresses.

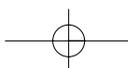
**DCE (Data Communication Equipment):** A term used in CCITT standards to identify devices and connections of a communication network that comprise the network end of the user-to-network interface; modems and interface cards are examples of DCEs, which connect to DTEs.

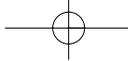
**default route:** Routing table entry that is used to direct frames for which a next hop is not explicitly listed in the routing table.

**deprecated address:** An address associated with an interface whose use by upper layer protocols is deprecated.

**DES (Data Encryption Standard):** Standard encryption algorithm used for data encryption.

**DES-CBC (DES Cipher Block Chaining):** A particular use mode of DES standard.





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**DHCP (Dynamic Host Configuration Protocol):** Server-based protocol for the automatic configuration of IP networks (for example, addresses and prefixes).

**distance vector:** Distributed routing algorithm that computes routing tables based on an iterative exchange of routing tables between adjacent routers. Also called **Bellman-Ford** algorithm.

**distributed routing:** Dynamic routing technique in which routing tables are computed by an algorithm distributed on routers.

**DLCI (Data Link Connection Identifier):** Value that specifies a PVC or an SVC in a Frame Relay network.

**DNS (Domain Name Server):** Service for the translation of names into addresses and vice versa in the TCP/IP network architecture, based on a distributed and replicated database.

**dotted decimal notation:** Used for TCP/IP addresses, it refers to the common notation for addresses in the form  $\langle n.n.n.n \rangle$ , where each number  $n$  represents, in decimal, 1 byte of the 4-byte IP address.

**downstream:** From source to destination.

**DSAP (Destination Service Access Point):** Acronym used to identify the destination address in the OSI reference model.

**DSP (Domain Specific Part):** In the OSI reference model, the second of the two parts into which the NSAP address is subdivided.

**DTE (Data Terminal Equipment):** Term used in the CCITT standards for devices such as computers, protocol translators, and multiplexers; DTEs are usually connected to DCEs.

**dual IP layer:** Network architecture that allows hosts to use IPv4 and IPv6 protocol stacks at the same time.

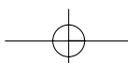
**Dual IS-IS:** See **integrated IS-IS**.

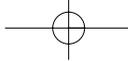
**dual stack:** See **Dual IP layer**.

**DVMRP (Distance Vector Multicast Routing Protocol):** Routing protocol for IP multicast traffic, based on a distance vector philosophy and used in Mbone.

**dynamic routing:** Technique to dynamically compute and update routing tables as a function of the state and topology of the network.

**E1:** The 2.048 Mb/s transmission channel in the European plesiochronous hierarchy.





**E3:** The 34.368 Mb/s transmission channel in the European pleisochronous hierarchy.

**EGP (Exterior Gateway Protocol):** The first EGP protocol. See also **Exterior Gateway Protocol**.

**egress router:** Router that connects an NBMA network to another network (for example, to a LAN).

**EIGRP (Extended IGRP):** extended version of the IGRP protocol.

**e-mail:** Electronic mail.

**encapsulation:** Technique used by protocols in which a lower layer adds information to the upper layer PDU by adding a header.

**Encrypted Security Payload:** Encapsulation technique using encryption to guarantee that only the receiver can read the data field.

**Encryption:** Manipulation of a data packet to guarantee that only the real receiver can extract its content. It is implemented by using standard algorithms, such as DES.

**End Routing Domain (ERD):** A routing domain in which routes are computed primarily to provide intra-domain routing services.

**ES (End System):** OSI term used to identify a node that can act only as a source or a final destination of the user's data and that doesn't feature the routing functions.

**ES-IS (End System to Intermediate System):** OSI protocol, specified in ISO 9542, for the neighbor greetings between router and end node and to associate Network layer addresses to Data Link layer addresses.

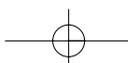
**ESP:** See **Encrypted Security Payload**.

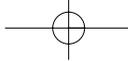
**Ethernet:** Local network CSMA/CD; sometimes it is used for an IEEE 802.3 LAN.

**extension header:** A header, in addition to the IPv6 header, providing additional services (for example, fragmentation and source routing). It is placed between the IPv6 header and the upper layer header.

**Exterior Gateway Protocol (EGP):** Generic term applied to each protocol used to advertise reachability and routing information among different ASs. The term *gateway* is obsolete, and the term *router* is preferred.

**exterior router:** A router that connects different ASs.





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**FCS (Frame Check Sequence):** Check information to test whether a CRC-based PDU is correct.

**FDDI (Fiber Distributed Data Interface):** Ring topology LAN, specifying a 100-Mbps token-passing network using fiber optic cable.

**FIB (Forward Information Base):** A synonym for **routing table**.

**FIFO (First-In, First-Out):** A storage buffer in which the first packet in is the first to go out. These buffers are useful to manage data bursts, allowing a computer to elaborate data at a constant, homogeneous, and average speed instead of at peak speed.

**filterspec:** In RSVP, a process that screens network traffic based on predefined criteria.

**firewall:** A computer or a router designated as a buffer between any connected public network and a private network to implement security.

**flooding:** Nonadaptive routing protocol in which a router sends packets out to all adjacent routers.

**flow:** Stream of IP packets that have some common characteristics (for example, the same source and destination addresses and the same application).

**flow control:** Technique to guarantee that a transmitting entity does not overwhelm a receiving entity with data, by reducing or stopping the transmission of new data on links.

**flow label:** Field of the IPv6 header used to identify the flow with the source address.

**flowspec:** In RSVP, the way to specify the QoS parameters.

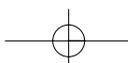
**foreign network:** A network to which a mobile host can connect while traveling.

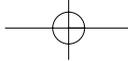
**fragment:** A piece of a larger packet that has been subdivided into smaller units.

**frame:** Generic term for a Data Link layer PDU.

**frame relay:** Standard for the implementation of public or private packet switching networks, based on a connected Data Link layer protocol in which virtual permanent circuits are defined.

**FTP (File Transfer Protocol):** Application protocol, part of the TCP/IP protocol stack, used for transferring files between network nodes.





**gated (gate daemon):** A software program that implements different routing protocols (available on the public domain at anonymous FTP server `gated.cornell.edu`). See also **EGP**, **OSPF**, **RIP**, and **routed**.

**gateway:** Device used to connect two different network architectures through the conversion of some application protocols of an architecture into the homologous protocols of another one. In the TCP/IP protocol, the term is improperly used as a synonym for **router**.

**global address:** A worldwide unique address.

**hacker:** A person who fraudulently tries to access a network and the hosts connected to it.

**HBH (Hop By Hop):** A particular kind of Extension Header used to transmit options that must be processed by all the nodes of the path.

**HDLC (High-level Data Link Control):** Data Link layer protocol used in WANs derived from SDLC and belonging to a family of protocols including LAP-B, LAB-D, LAP-F, and LLC.

**header:** First part of a PDU containing control information.

**hierarchical coding:** Technique for information coding used in multimedia applications that can adapt themselves to the bandwidth available on the network.

**hierarchical routing:** Technique to manage the routing in a wide network by subdividing it into several hierarchical levels (for example, inter-area routing and intra-area routing).

**home address:** The network address of a mobile host when at home.

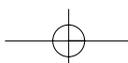
**home agent:** A router answering to Neighbor Discovery messages on behalf of another node (for example, in the case of mobile nodes).

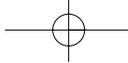
**home network:** The network to which a mobile host is connected when at home.

**hop:** The passage of a data packet between two network nodes (for example, between two routers). Frequently used as routing metric in the Network layer.

**host:** In the IP network architecture, every node that isn't a router.

**HTML (HyperText Markup Language):** Language used to create hypertext documents on WWW servers and accessible through the HTTP protocol.





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**HTTP (HyperText Transfer Protocol):** The protocol used by WWW to transfer HTML files.

**hub:** LAN concentrator, usually with repetition functions.

**hypertext:** Electronically stored text, written with particular languages (for example, HTML), that allows direct access to other text by way of encoded links.

**IAB (Internet Architecture Board):** Board of internetwork researchers who discuss issues pertinent to Internet architecture.

**IANA (Internet Assigned Number Authority):** Technical organization that delegates authority for IP address-space allocation and domain-name assignment on the Internet to other organizations.

**ICMP (Internet Control Message Protocol):** In the TCP/IP network architecture, a Network layer protocol used with neighbor greetings functions, to report errors and to provide other information relevant to packet processing.

**ICMPv6 (ICMP version 6):** Version 6 of the ICMP protocol to be used with IPv6.

**IDI (Initial Domain Identifier):** In the OSI reference model, the second of the two parts into which the IDP field of the NSAP address is subdivided.

**IDP (Initial Domain Part):** In the OSI reference model, the first of the two parts into which the NSAP address is subdivided.

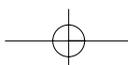
**IDPR (Inter-Domain Policy Routing):** An IETF proposal for a routing algorithm between link state autonomous systems that allows the implementation of the policy routing.

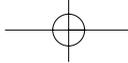
**IDRP (Inter-Domain Routing Protocol):** Inter-domain path vector routing protocol derived from BGP.

**IEC (International Electrotechnical Commission):** The European Union commission that issues and distributes standards for electrical products and components.

**IEEE (Institute of Electrical and Electronics Engineers):** Professional organization whose activities include the development of communications and network standards. IEEE LAN standards are the predominant LAN standards in use today.

**IEEE 802:** The IEEE committee working in the field of standardization of LANs that also defined the worldwide used MAC addresses on 48 bits.





**IESG (Internet Engineering Steering Group):** Steering committee for the Internet engineering.

**IETF (Internet Engineering Task Force):** ISOC working group responsible for the standardization and the development of the TCP/IP network architecture.

**IGMP (Internet Group Management Protocol):** Protocol used in IPv4 for multicast groups management. In IPv6, IGMP functions are included in ICMPv6.

**IGP:** See **Interior Gateway Protocol**.

**IGRP (Interior Gateway Routing Protocol):** IGP routing protocol developed by Cisco Systems to address the problems associated with routing in large, heterogeneous networks.

**IKMP (Internet Key Management Protocol):** Protocol for the encryption keys management.

**Initialization Vector:** Binary string used in association DES-CBC to introduce a casualness factor in the encryption process.

**Integrated IS-IS (previously called Dual IS-IS):** Routing protocol based on the OSI IS-IS routing protocol but supporting IP and other protocols; integrated IS-IS propagates reachability information of all protocols through the same LSP at the same time.

**Integrated Service Internet:** Proposal to extend the Internet architecture to support multimedia traffic.

**inter-area routing:** The routing between two or more logical areas.

**interface:** The device used to interconnect a node to a link.

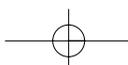
**interface token:** A link layer interface identifier that is unique (at least) at the link layer. Usually derived from the interface's MAC address.

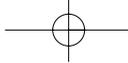
**Interior Gateway Protocol (IGP):** Generic term applied to each protocol used to advertise reachability and routing information within an AS. The term *gateway* is obsolete; it is replaced by *router*.

**interior router:** A router managing connections only within an AS.

**internet:** When used with lowercase *i*, it is short for *internetwork*, which is implemented by routers.

**Internet:** The largest global internetwork, based on the TCP/IP network architecture.





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**Internet draft:** The preliminary issue of a document, to be discussed by the Internet community. Internet drafts circulate for six months, after which they expire or they are revised or they become RFCs.

**Internet protocol suite:** The network architecture best known as TCP/IP.

**INTERNIC (INTERnet Network Information Center):** The Northern American service center providing information about the Internet.

**intra-area routing:** Routing within a logical area.

**Intranet:** A company's private network based on the Internet model.

**invalid address:** an address not assigned to any interface.

**IP (Internet Protocol):** In TCP/IP network architecture, the Network layer data protocol.

**IPAE (IP Address Encapsulation):** A temporary solution toward SIP.

**IP in IP:** A temporary proposal toward IPv6.

**IPng (IP new generation):** Term used for IPv6 during the standardization phase.

**IP spoofing:** Counterfeiting of the source address in order to attack the security of an IP node.

**IP Switch:** Internetworking device that integrates routing IP and switching ATM functions.

**IP Switching:** Integrated technique for ATM switching and IP routing, based on the use of IP switches.

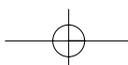
**IPv4 (IP version 4):** The only IP version used until 1996.

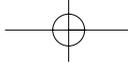
**IPv4 address:** The 32-bit address assigned to host and router interfaces using the IPv4 network architecture; written in dotted decimal format.

**IPv6 (IP version 6):** The new IP version described in this book.

**IPv6 address:** The 128-bit address assigned to host and router interfaces using the IPv6 network architecture; written as eight hexadecimal digits separated by : (colon).

**IPv6 address compatible IPv4:** An IPv6 address algorithmically derived from an IPv4 address.





**IPv6 over IPv4 tunneling:** Encapsulation of IPv6 packets in IPv4 packets to allow the IPv6 packets to be transmitted in IPv4 routing infrastructures. Two kinds of tunnels are available: configured and automatic.

**IPv7:** An alternative proposal for the IPv6 standard, dropped during the selection phase.

**IPX (Internetwork Packet eXchange):** Network layer protocol used by Novell; it is similar to XNS and IP.

**IS (Intermediate System):** OSI term used for a node (usually a router) that can route layer 3 messages to other nodes.

**ISDN (Integrated Service Digital Network):** An evolution of the telephone network, based on the digital technology, that allows telephone networks to transport data, voice, and other source data from 64 kbps to 2 Mb/s.

**IS Internet:** See **Integrated Service Internet**.

**IS-IS (Intermediate System to Intermediate System):** in the OSI network architecture, the interdomain Network layer protocol to compute the routing tables.

**ISO (International Standard Organization):** International organization that is responsible for a wide range of standards, including those relevant to networking. The ISO developed the OSI reference model.

**ISOC (Internet SOciety):** Organization for the development of the Internet network and of the TCP/IP network architecture.

**ISO-IP:** Old name of the ISO CLNP protocol.

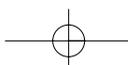
**ISO-TP4 (ISO Transport Protocol class 4):** Layer 4 protocol (transport) standardized by the ISO.

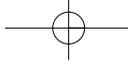
**ISP (Internet Service Provider):** A public or a private organization that provides Internet services. Often simply called *provider*.

**ITU (International Telecommunication Union):** United Nations agency that develops worldwide standards for telecommunications technologies.

**ITU-T (ITU Telecommunications):** Organization that carries out the functions of the former CCITT.

**IV:** See **Initialization Vector**.





## Appendix D: Glossary

**label swapping:** Routing technique used in connection protocols and, in particular, in ATM. Each packet is labeled as belonging to a connection or to a flow by a label used by switches/routers to route packets to their destinations. As the meaning of the label is univocal only at the single link layer, the label is replaced (swapped) by each switch/router.

**LAN (Local Area Network):** High-speed, low-error data network covering a relatively small geographic area (up to a few thousand meters). LANs connect workstations, peripherals, terminals, and other devices in a single building or other geographically limited area.

**LAN emulation:** Technique to emulate LAN IEEE 802.3 or IEEE 802.5 functions on an ATM network.

**LAP (Link Access Procedure):** Data Link layer protocol in the HDLC protocol stack.

**LAP-B (LAP Balanced):** LAP protocol used in X.25 networks.

**LAP-D (LAP Data):** LAP protocol used in ISDN networks.

**LAP-F (LAP Frame):** LAP protocol used in Frame Relay networks.

**layer:** A tier in the design of the modern network architecture. Each layer performs typical functions laying on lower layers and using protocols. The TCP/IP architecture consists of five layers, and the OSI consists of seven layers.

**LEC (LAN Emulation Client):** An ATM station emulating IEEE 802.3 or IEEE 802.5 station functions.

**LECS (LAN Emulation Configuration Server):** A software process of an ATM network that enables configuration of the emulation of one or more IEEE 802.3 or IEEE 802.5 LANs.

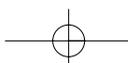
**LES (LAN Emulation Server):** A software process associated to a LAN on ATM emulation service with the main function of mapping MAC addresses into ATM addresses.

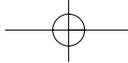
**link:** In hypertext, a pointer that can be used to access text or an application.

**link:** A communication channel over which nodes can transmit at the Data Link layer (that is, at the Layer 2 of the ISO/OSI reference model). Examples of links are Ethernet, PPP, X.25, Frame Relay, and ATM, or tunnels on other protocols such as IPv4 or IPv6.

**link layer address:** A layer 2 (Data Link) interface address.

**link local address:** IPv6 addresses valid only within a link.





**link MTU:** The MTU (that is, the maximum packet size) that can be transported on a link without being fragmented.

**link state:** Distributed routing algorithm to compute the routing tables where a router informs all other network routers about the state of links directly connected to it, by means of an LSP packet.

**LIS (Logical IP Subnetwork):** IP subnetwork defined by the net-mask parameter; a physical network is associated to each LIS to allow all stations connected to that LIS to transmit directly (without using routers).

**LLC (Logical Link Control):** In IEEE 802 standard, the higher of the Data Link layer sublayers; protocol of the HDLC stack.

**LLC/SNAP (LLC SubNetwork Access Protocol):** A particular form of type 1 LLC encapsulation used for non-OSI protocols, such as IPv4 and IPv6.

**LLG (Logical Link Group):** A set of IPv6 stations that share the same prefixes and are connected to the same ATM network.

**load splitting:** Balancing of the load on alternative paths.

**longest prefix match:** The process to determine which prefix covers a given IPv6 address. In the case that more than one prefix covers the address, the longest one is chosen.

**LSA (Link State Advertisement):** A synonym for **LSP**.

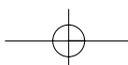
**LSP (Link State Packet):** Multicast packet used by link-state protocols. This packet contains information about neighbors and path costs; it contains the list of the adjacent nodes.

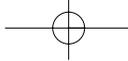
**MAC (Medium Access Control):** The lower of two sublayers of the Data Link layer that arbitrates the access to shared media; the MAC sublayer provides the Logical Link Control sublayer with connectionless services.

**MAC address:** Data Link layer address, MAC sublayer, used in LANs, 48 bits long, and assigned by the network card manufacturer; it is written as six hexadecimal couples divided by the - character.

**MAN (Metropolitan Area Network):** High-speed network that spans a metropolitan area.

**MARS (Multicast Address Resolution Server):** A server that registers the participation of nodes to multicast groups on an NBMA network.





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**MBONE (Multicast backBONE):** A network designed by point-to-point tunnels on the Internet to experiment with multicast applications.

**MCS:** See **MultiCast Server**.

**MD (Message Digest):** Summary of a packet computed by applying to the packet itself a function similar to a CRC. It is used to solve authentication problems.

**MD2, MD4, MD5 (Message Digest 2, 4, 5):** Algorithms used to compute the message digest.

**MODEM (MOdulator-DEModulator):** Device for the transmission of digital data over analog communication facilities (telephone lines) by an appropriate conversion (for example, FSK, QAM, DPSK).

**MOSPF (Multicast OSPF):** OSPF extension to manage IP multicast packets.

**MPEG (Moving Picture Experts Group):** Algorithm for the compression of video images.

**MTU (Maximum Transmission Unit):** Maximum packet size, in bytes, that a particular interface can manage.

**multicast:** A single address for a set of interfaces belonging to different nodes. A packet sent to a multicast address is delivered to all interfaces belonging to the set.

**multicast link:** A multiple access link that allows the sending of a packet to all nodes (or to a subset of them) by a single transmission at the link layer.

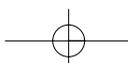
**multicast server:** A server associated to an NBMA network that receives packets on a point-to-point VC and retransmits them to all members of the multicast group by a point-to-multipoint VC.

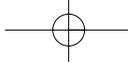
**multihomed:** A network belonging to many routing domains; a host with more than a connection to a network but not acting as a router.

**name:** String of digits that univocally identify an entity.

**NBMA (Non Broadcast Multiple Access):** Term describing a multiaccess network where, from a station, it is possible to reach all others, but that either does not support broadcasting or in which broadcasting is not feasible. An example of NBMA is given by X.25 and ATM networks.

**ND:** See **neighbor discovery**.





**neighbor advertisement:** Message of the ICMPv6 protocol in reply to a request to translate an IPv6 address into a link layer address.

**neighbor discovery:** Process of the ICMPv6 protocol for the automatic configuration of neighbor relations on a link.

**neighbor greetings:** Definition frequently used to describe protocols exchanging packets with neighbors.

**neighbors:** Nodes connected on the same link.

**neighbor solicitation:** Message of the ICMPv6 protocol to request the mapping of an IPv6 address into a link layer address.

**neighbor unreachability detection:** Process to test the reachability of neighbor nodes and for the detection of black holes.

**netmask:** A 32-bit mask used in IPv4 to specify the subnetwork address.

**network:** Collection of computers, printers, routers, switches, and other peripherals and devices that can communicate with each other over some transmission medium. It can be made of a combination of LANs and WANs.

**network address:** In IPv4, the part of the IP address identifying the network. The network address can belong to A, B, and C classes.

**network architecture:** Design, organization, and set of rules that govern the design and functions of hardware and software components of a computer network.

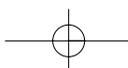
**network mask:** See **netmask**.

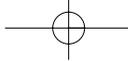
**next hop:** The next node toward which to transmit a packet. The node must be reachable at link layer (that is, must be on-link) and therefore must be a neighbor.

**NFS (Network File System):** Protocol developed by Sun Microsystems, based on the TCP/IP network architecture that allows a set of computers to share the file systems.

**NHRP (Next Hop Resolution Protocol):** Similar to the ARP protocol, this protocol is used by routers to dynamically discover the MAC address of other routers and hosts connected to NBMA networks (for example, ATM networks).

**NHS (Next Hop Server):** A server used by the NHRP protocol.





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**NIC (Network Information Center):** Organization that serves network users by providing user assistance, documentation, training, and other services.

**NIS (Network Information Service):** A set of services provided by a NIC to the users of a network. Also a protocol developed by Sun Microsystems for the administration of network-wide databases.

**NNI (Network to Network Interface):** Interface between two ATM switches. The two types of NNI are the P-NNI and the B-ICI.

**NNTP (Network News Transfer Protocol):** The protocol used to request, copy, and send articles to News.

**NOC (Network Operations Center):** Organization responsible for maintaining a network.

**node:** A device that uses the IP protocol.

**NSAP (Network Service Access Point):** Network layer address in the OSI architecture.

**NTP (Network Time Protocol):** A protocol used to synchronize the clock of computers connected to a network with millisecond precision.

**octet:** OSI term to describe a string of 8 bits (that is, a byte).

**off-link:** An IPv6 address not assigned to any interface connected to the link.

**on-link:** An IPv6 address assigned to an interface connected to the link.

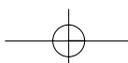
**OOB:** See **Out Of Band**.

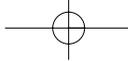
**OSI (Open System Interconnect):** International standard program created by the ISO to develop standards for data networking that facilitate multivendor equipment interoperability. It consists of seven layers: Physical, Data Link, Network, Transport, Session, Presentation, and Application. This standard is described in the ISO document 7498.

**OSPF (Open Shortest Path First):** Link state protocol to compute routing tables used in the TCP/IP network architecture.

**OUI (Organization Unique Identifier):** The three octets assigned by the IEEE to an organization operating in the field of networks.

**Out Of Band:** The technique for the distribution of encryption keys outside the frequencies or channels normally used for information transfer.





**overhead:** A worsening of performance due to the need to process and/or transmit more information.

**packet:** Term normally used to indicate a PDU. In this book, *packet* is synonymous with *PDU* at the IP layer.

**packet sniffing:** Reading of transmission packets to learn their content, for network diagnostics reasons or to try to access reserved information fraudulently.

**packet switching:** Commutation technique to group digital data in PDUs and to route them on transmission media shared by network nodes.

**Pad1:** A one octet padding option.

**PadN:** A two or more octets padding option.

**path:** An ordered set of links that connect a source with a destination.

**path MTU:** The minimum link MTU of all the links in the path between source and destination.

**payload:** The data field of an IP packet or of an ATM cell.

**PC:** Personal Computer.

**PDH:** See **Plesiochronous Digital Hierarchy**.

**PDU (Protocol Data Unit):** Set of data transmitted between entities of the same layer, usually called *packet*.

**PID (Protocol Identifier):** Protocol identifier on two octets, used in the LLC/SNAP enveloping.

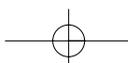
**PING (Packet InterNet Groper):** A program used to test the reachability of an IP node.

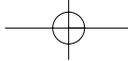
**PIP (Paul's Internet Protocol):** A proposal for the IPv6 protocol merged with SIPP.

**Plesiochronous Digital Hierarchy (PDH):** Hierarchy for multiplexing almost synchronous numerical signals. In Europe, the following levels have been defined: E1 = 2048 Mbps, E2 = 8448, E3 = 34.368, and E4 = 139.264 Mbps. In the U.S., the following levels are used: T1 = 1544 Mbps and T3 = 44.736 Mbps.

**P-NNI (Private NNI):** NNI interface to be used on private networks. It defines the physical aspects, the signaling procedures to create and to pull down SVCs, and the ways to determine SVCs routings.

**point-to-point:** A kind of link interconnecting exactly two interfaces.





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**policy routing:** Routing scheme that forwards packets to specific interfaces based on user-configured policies.

**POP (Point Of Presence):** Physical access point to a long distance carrier interchange.

**POP (Post Office Protocol):** Protocol used to manage the electronic mail in a client-server mode.

**port:** Point of access to application protocols in the TCP/IP network architecture.

**PPP (Point-to-Point Protocol):** Data Link layer protocol of the HDLC stack for point-to-point links with multiplexing capacity among Network layer protocols, standard in multivendor environments.

**pps (packets per second):** Also written *p/s*.

**preferred address:** An address associated with an interface for which use by upper layer protocols is allowed without limitations.

**preferred lifetime:** The time an address remains preferred (that is, the time before it becomes deprecated).

**prefix:** The first part of an IPv6 address common to all nodes belonging to the same subnet (connected to the same link).

**probe:** Neighbor Solicitation packets sent to a neighbor node to test its reachability.

**protocol:** Formal description of a set of rules and conventions that govern how devices on a network exchange information.

**protocol stack:** A set of related communications protocols organized by layers that cooperate to provide some network functions.

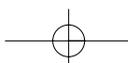
**protocol type:** Field of the Ethernet v.2.0 frame that indicates the upper layer protocol contained in the data field.

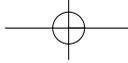
**provider:** See **ISP**.

**provider-based address:** IPv6 global addresses obtained from an ISP.

**proxy:** An entity that participates with protocols on behalf of another entity.

**proxy ARP:** Technique that allows the subdivision of an IPv4 subnet into two physical networks. The router connecting physical networks responds to the queries from the ARP on behalf of nodes connected to other physical networks.





**proxy server:** A server responding to the messages from application protocols on behalf of another node (for example, in the case of the HTTP protocol).

**PTT (Post, Telephone, and Telegraph):** Government agency that provides telecommunications within one nation.

**PVC (Permanent Virtual Connection):** Virtual circuit that is permanently established by the network administrator.

**QoS (Quality of Service):** In OSI and ATM architectures, the measure of performance for a transmission system that reflects its transmission quality and service availability.

**random delay:** A delay introduced before the transmission of a packet to prevent the transmission of different nodes at exactly the same time.

**RARP (Reverse Address Resolution Protocol):** Protocol in the TCP/IP stack that provides a method to obtain a Network layer address starting from a Data Link layer address.

**reachability:** Whether the one-way “forward path” to a node is functioning properly.

**real time:** Type of traffic, usually associated with multimedia applications, that needs limited and constant delays.

**reassembly:** The reconstruction of a packet after it has been fragmented by either the source or an intermediate node.

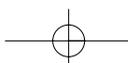
**redirect:** A message of the ICMPv6 protocol generated by a router to advertise a better hop toward a given destination.

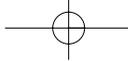
**relay:** A node that acts as an intermediate device in the transmission of a packet between other two nodes (for example, between client and server).

**relaying:** Transmitting a PDU between two entities of the same layer in the same node (for example, in bridges, the transmission of a MAC PDU between MAC layers of two LAN cards).

**RFC (Request For Comments):** Document series used as the primary means for communicating information about the Internet. Some RFCs are designated as standards about the TCP/IP network architecture.

**RH:** See **Routing Header**.





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**RIP (Routing Information Protocol):** Protocol to compute routing tables, suitable for small networks.

**RIPE-NCC (Réseaux IP Européens Network Information Centre):** European service center for information about the Internet.

**route:** Routing path; in IP routers, each reachable subnet has a route.

**routed (route daemon):** A software program that implements the routing protocol RIP. See also **gated**.

**router:** A node that can route packets to the nodes at IP layer.

**router advertisement:** Message of the ICMPv6 protocol to inform nodes that a router connected to the link exists.

**router solicitation:** Message of the ICMPv6 protocol to request routers to announce themselves on a link.

**routing:** The process of finding a path to a destination host; the path that an IP packet must traverse to reach its destination.

**routing by network address:** Routing technique mainly used in connectionless protocols.

**routing domain:** A hierarchical partition of the network containing a group of hosts and routers; routers share the same routing information, compute tables using the same IGP, and are managed by a common administrator.

**routing domain confederation:** A set of routing domains seen as a unique entity and identified by a unique IPv6 prefix.

**routing header:** Extension header used to implement the source routing in IPv6.

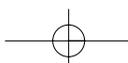
**routing layer 1:** See **intra-area routing**.

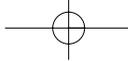
**routing layer 2:** See **inter-area routing**.

**routing QoS based:** A routing technique that determines paths on the basis of the kind of service requested.

**routing table:** A table containing useful information for routing algorithms such as, for each destination, the line to be used, its cost, and the number of hops.

**RPC (Remote Procedure Call):** The extension of the conventional call procedure that allows execution of the procedure called on a remote node.





**RSA:** The encryption algorithm by public key invented by Rivest, Shamir, and Adleman, from whom the acronym comes.

**RSVP (Resource reSerVation Protocol):** Protocol used in IP networks to reserve network resources.

**SA (Security Association):** Agreement between two or more nodes about security algorithms and about the related parameters to be used during the packets exchange. Every SA is identified by the SPI.

**SAP (Service Access Point):** Point where a layer provides upper layer services.

**SAR (Segmentation And Reassembly):** One of the two sublayers of the AAL, responsible for dividing into cells (at the source) and re-assembling a message from cells (at the destination).

**Scheduler:** Function of an internetworking device that decides which packet to transmit among those queued, to guarantee the QoS.

**SDH:** Synchronous Digital Hierarchy.

**SDU (Service Data Unit):** Unit of information from an upper layer protocol that defined a service request to a lower layer protocol.

**SEAL (Simple and Efficient ATM Adaptation Layer):** Old name of AAL 5.

**server:** A host that offers a specific service to another host.

**service provider:** A company that installs telecommunications networks to provide users with a set of public services (such as telephone, cable TV, data transmission, and so on).

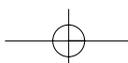
**shared media:** A kind of link that allows the communication between many nodes but where nodes are configured without a complete prefixes list; for this reason, nodes connected to the shared medium can ignore neighbors. Examples of shared media are SMDS and B-ISDN.

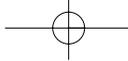
**singlecast:** A synonym for **unicast**.

**SIP (Simple IP):** A proposal for the IPv6 protocol, which was then combined with PIP and became SIPP.

**SIPP (Simple IP Plus):** The proposal on which the IPv6 protocol is based; born from the fusion of SIP and PIP.

**site local address:** IPv6 address valid only within a site (a set of subnetworks belonging to an organization).





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**SLIP (Serial Line IP):** A protocol used to transport IP on serial connections. Predecessor of PPP.

**SMDS (Switched Multi Megabit Data Service):** A public service for data transmission at speeds between 1.5 and 45 megabits per second.

**SMTP (Simple Mail Transfer Protocol):** In the TCP/IP network architecture, the protocol providing electronic mail services.

**SNMP (Simple Network Management Protocol):** TCP/IP protocol to manage network devices; became a *de facto* standard.

**socket:** The interface used by UNIX BSD to access network services.

**SONET:** Synchronous Optical NETWORK; the U.S. version of SDH.

**source routing:** Routing technique mainly used in IBM architectures and in IEEE 802.5; it consists of the specification, during the PDU generation, of the sequence of nodes that the PDU will traverse.

**SPF (Shortest Path First):** Term frequently used to describe Dijkstra's algorithm, in which all paths to all destinations are computed starting from the network graph; used by link state packet routing protocols.

**SPI (Security Parameter Index):** The SA to be used in a packet exchange. Used both by AH and by ESP.

**SSAP (Source Service Access Point):** Abbreviation used to describe the source address.

**static route:** An entry in a static routing table, manually written by the network administrator.

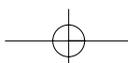
**static routing:** Routing technique in which routing tables are statically determined during the network configuration. See also **static route**.

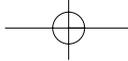
**station:** Term used in LANs to describe an ES or an IS, stressing their functions at the Data Link layer.

**stub network:** A network transporting packets only for nodes belonging to the network itself and therefore not admitting the transition traffic.

**subnet:** A subset of nodes identified by addresses with a common prefix to which a physically independent network segment corresponds.

**subnet address:** In IPv4, IP address bits that identify the subnet.





**subnet mask:** See **netmask**.

**SVC (Switched Virtual Connection):** Virtual circuit that is dynamically established on demand and is explicitly closed when transmission is complete.

**switch:** Multiport device able to commute frames at the Data Link layer.

**Synchronous Digital Hierarchy (SDH):** Numerical transmission system defined by the ITU-T and chosen to implement the transmission infrastructure of B-ISDN. Currently, it operates at the following speeds: 155 Mb/s, 622 Mb/s, 2.4 Gb/s, and 9.6 Gb/s.

**system:** Term frequently used in computer networks as a synonym for **node**.

**T1:** In U.S. plesiochronous hierarchy, the transmission channel at 1.544 Mbps.

**T3:** In U.S. plesiochronous hierarchy, the transmission channel at 44.736 Mbps.

**tag:** A synonym for **label**.

**tag switch:** Switch that routes packets by using tag information. Tag switches perform the tag swapping. See also **label swapping**.

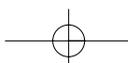
**tag switching:** Fast routing approach proposed by Cisco Systems in which traffic is routed in the function of tags associated to packets. It uses tag switches.

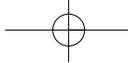
**target:** An address searched through a process of address resolution or the address of the first hop obtained through the redirection process.

**TCP (Transmission Control Protocol):** In the TCP/IP network architecture, a connection-oriented transport layer protocol that provides reliable and full-duplex data transmission. TCP is part of the TCP/IP protocol stack.

**TCP/IP (Transmission Control Protocol/Internet Protocol):** The network architecture developed in the 1970s to support the construction of worldwide internetworks, the best known of which is the Internet; it is a market and *de facto* standard.

**TDP:** Tag Distribution Protocol. Protocol used by Cisco Systems for tag distribution.





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**Telnet:** In the TCP/IP network architecture, standard terminal emulation protocol used for remote terminal connection, enabling users to log in to remote systems and to use resources as though they were connected to a local system.

**tentative address:** An address whose uniqueness is tested within a link before it is assigned to an interface.

**TFTP (Trivial File Transfer Protocol):** Simplified version of the FTP protocol, mainly used for downline loading on diskless stations.

**throughput:** Rate, usually in pps, of the real transmission capacity of a network or a part of it.

**TIB (Tag Information Base):** Table filled by the TDP and used by tag switches.

**TOS (Type Of Service):** In IPv4, similar to Quality of Service.

**TP/IX:** A proposal for the IPv6 protocol, rejected during the selection phase.

**traceroute:** A program available on many computers showing the routing path followed by a packet to reach a given destination.

**TRD (Transit Routing Domain):** A routing domain in which routes are computed primarily to carry transit (that is, inter-domain) traffic.

**triple DES:** See 3DES.

**TTL (Time To Live):** A field in the IPv4 header used to limit the life of packets temporarily in case of loops in the network.

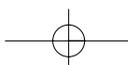
**TUBA (TCP and UDP over Bigger Addresses):** A proposal, based on the OSI standard, for the IPv6 protocol, rejected during the selection phase.

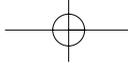
**tunnel:** Encapsulation of a protocol A into a protocol B. A considers the protocol B as if it were an IP link (that is, a Data Link layer protocol).

**tunneling:** Technique for packet transmission by using tunnels.

**UDP (User Datagram Protocol):** In the TCP/IP network architecture, a connectionless transport layer protocol used, for example, by NFS and SNMP.

**UNI (User to Network Interface):** Interface between a station and an ATM switch. The UNI standard defines both the physical aspects and the signaling procedures to create and reduce SVCs.





**unicast:** The address of a single interface. A packet sent to a unicast address is delivered only to the interface identified by that address.

**UNIX:** Operating system developed in 1969 at Bell Laboratories. Widely used in computers connected to the Internet.

**upper layer:** A protocol that operates at a higher layer in the OSI reference model. Examples are the transport protocols TCP and UDP, the control protocols such as ICMP, routing protocols such as OSPF, or protocols tunneled over IP (for example, IPX and AppleTalk).

**upstream:** From destination to source.

**valid address:** A preferred or deprecated address.

**valid lifetime:** The period of validity of an address.

**variable MTU:** A type of link without a well-defined MTU.

**VCI (Virtual Circuit Identifier):** A 16-bit field in the header of an ATM cell.

**Virtual circuit:** A circuit, implemented through a cell or packet switching network, that offers the simulation of a point-to-point connection between two points.

**VPI (Virtual Path Identifier):** An 18-bit field in the header of an ATM cell.

**VPN (Virtual Private Network):** Frequently implemented by tunneling on IP.

**W3:** A synonym for **WWW**.

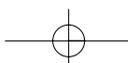
**WAN (Wide Area Network):** Data communications network that serves users across a broad geographic area and often uses transmission devices provided by common carriers.

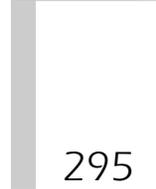
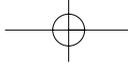
**well-known port:** In the TCP/IP network architecture, ports pre-assigned to main application protocols.

**WFQ (Weighted Fair Queuing):** Algorithm used to implement scheduling policies on internetworking devices.

**Winsock:** In Windows systems, a sockets library.

**WWW (World Wide Web):** Servers used to provide hypertext information on the Internet.





## Appendix D: Glossary

**X.25:** ITU-T standard for the homonymous packet switching network. Originally designed to connect terminals to computers, the X.25 offers a reliable and low-speed data flow service.

**XDR (eXternal Data Representation):** Standard developed by Sun Microsystems for the data representation independent from the computer architecture.

