

WEBSTER'S NEW WORLD™

TELECOM DICTIONARY

*A comprehensive reference for
telecommunications terminology*

*More than 4,600 telecommunications terms and
acronyms defined and explained*

*Clear, up-to-date coverage of recent data communications
terminology, including VoIP, SANs, 802.11n, and Bluetooth*

RAY HORAK

WE DEFINE YOUR WORLD®

Webster's New World® Telecom Dictionary

Published by

Wiley Publishing, Inc.

10475 Crosspoint Boulevard

Indianapolis, IN 46256

www.wiley.com

Copyright © 2008 by Wiley Publishing, Inc., Indianapolis, Indiana

Published simultaneously in Canada

ISBN: 978-0-471-77457-0

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

Library of Congress Cataloging-in-Publication Data

Horak, Ray.

Webster's New World telecom dictionary / Ray Horak.

p. cm.

ISBN 978-0-471-77457-0 (pbk.)

1. Telecommunication—Dictionaries. I. Title.

TK5102.H65 2007

621.38203—dc22

2007024232

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600. Requests to the Publisher for permission should be addressed to the Legal Department, Wiley Publishing, Inc., 10475 Crosspoint Blvd., Indianapolis, IN 46256, (317) 572-3447, fax (317) 572-4355, or online at <http://www.wiley.com/go/permissions>.

Limit of Liability/Disclaimer of Warranty: The publisher and the author make no representations or warranties with respect to the accuracy or completeness of the contents of this work and specifically disclaim all warranties, including without limitation warranties of fitness for a particular purpose. No warranty may be created or extended by sales or promotional materials. The advice and strategies contained herein may not be suitable for every situation. This work is sold with the understanding that the publisher is not engaged in rendering legal, accounting, or other professional services. If professional assistance is required, the services of a competent professional person should be sought. Neither the publisher nor the author shall be liable for damages arising herefrom. The fact that an organization or Website is referred to in this work as a citation and/or a potential source of further information does not mean that the author or the publisher endorses the information the organization or Website may provide or recommendations it may make. Further, readers should be aware that Internet Websites listed in this work may have changed or disappeared between when this work was written and when it is read.

For general information on our other products and services please contact our Customer Care Department within the United States at (800) 762-2974, outside the United States at (317) 572-3993 or fax (317) 572-4002.

Trademarks: Wiley, the Wiley logo, Webster's New World, the Webster's New World logo, We Define Your World, and related trade dress are trademarks or registered trademarks of John Wiley & Sons, Inc. and/or its affiliates, in the United States and other countries, and may not be used without written permission. All other trademarks are the property of their respective owners. Wiley Publishing, Inc., is not associated with any product or vendor mentioned in this book.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

REF
TK
5102
H65
2008

BRI (Basic Rate Interface)

signaling purposes. Also known as 2B+D, the combination of two B channels at 64 kbps each and the D channel at 16 kbps yields a three-channel configuration at a total signaling rate of 144 kbps over a conditioned, four-wire, twisted-pair local loop within 18,000 feet of the service central office (CO). A single BRI line can support up to 16 devices (e.g., telephones, facsimile machines, computers, and video cameras) that contend for access to the BRI channels through a terminal adapter (TA), also known as an ISDN modem. BRI also can support as many as 64 individual service profile identifiers (SPIDs), which are equivalent to directory numbers, one per terminal device. Many carriers offer BRI variations such as 0B+D and 1B+D targeted at specific applications such as credit card verification and telemetry, but all share the same BRI technology and the same signaling rate of 160 bps.

The BRI interface between the CO and the customer premises is known as the U interface or Reference Point U, which runs at a signaling rate of 160 kbps, carrying two 64 kbps B channels, one 16 kbps D channel, and 16 kbps of overhead for framing, echo cancellation, and an embedded operations channel (EOC) for line testing and monitoring. In order to support this transmission rate in full duplex (FDX) mode over a physical two-wire, logical four-wire, twisted-pair local loop, the 2B1Q (2 Binary 1 Quaternary) encoding technique, with echo cancellation, is used in North America. In European and many other countries, the line coding technique employed is 4B3T (4 Binary 1 Ternary), a block code that combines four bits to represent one ternary signal state. See also *0B+D*, *1B+D*, *2B1Q*, *4B3T*, *bonding*, *EOC*, *FDX*, *four wire*, *ISDN*, *local loop*, *Reference Point U*, *signaling and control*, *signaling rate*, *SPID*, *TA*, and *two-wire*.

bridge 1. A simple, protocol-specific device that interconnects two or more links in a circuit, reading the destination address of an incoming data frame and forwarding to the next link in the direction of the target device. A bridge also acts as a repeater, amplifying, reshaping, and retiming the input signal. A bridge does not perform complex processes on the data frames, and neither does it attempt to evaluate the network as a whole to make end-to-end routing decisions. 2. A simple, protocol-specific device that interconnects two or more segments in a local area network (LAN), or two or more LANs of the same architecture (e.g., Ethernet-to-Ethernet). A bridge reads the destination address of an incoming data frame and forwards it to the next segment in the direction of the target device. A bridge also acts as a repeater, amplifying, reshaping and retiming the input signal to extend the physical reach of the LAN. Bridges operate at the lower two layers of the OSI Reference Model, providing Physical Layer and Data Link Layer connectivity. Specific bridge protocols include source routing protocol (SRP), source routing transparent (SRT), spanning tree protocol (STP). See also *architecture*, *circuit*, *Data Link Layer*, *encapsulating bridge*, *filtering bridge*, *frame*, *LAN*, *link*, *OSI Reference Model*, *Physical Layer*, *protocol*, *repeater*, *router*, *self-learning bridge*, *SRP*, *SRT*, and *STP*.

bridged tap A section of cable that is not on the direct physical path between the user premises and the central office (CO), but is bridged, i.e., temporarily spliced, onto the path. A bridged tap results in multiple appearances of the same cable pair, usually as a result of old drops to premises where previous subscribers had telephone service, but that were not removed when they disconnected service. Bridged taps cause signal distortion due to reflection and are best removed, especially if high frequency services such as ADSL are to be provisioned over the cable pair. See also *ADSL*, *cable*, *CO*, *distortion*, *drop*, *pair*, *premises*, and *reflection*.

British Standard Gauge (BSG) See BSG.

broadband 1. In the Wide Area Network (WAN) domain, broadband is an imprecise term referring to a circuit or channel providing a relatively large amount of bandwidth. The ITU-T defines broadband in Recommendation I.113 as a transmission rate faster than the primary rate (referring to ISDN), which translates into 1.544 Mbps in North America and 2.048 Mbps in most of the rest of the world. The U.S. Federal Communications Commission (FCC) does not define broadband, but defines high-speed services as supporting a data rate of at least 200 kbps in at least one direction and advanced telecommunications capability as at least 200 kbps in both directions. Asymmetric digital subscriber line (ADSL) generally is described as a broadband access technology, even though many ADSL services operate at less than T1 and E-1 rates. In this context, ADSL certainly operates at much higher rates than the predecessor modem

B-UNI (Broadband User Network Interface) Also known as the *Public UNI*. In asynchronous transfer mode (ATM), the specifications for the interface between an ATM endpoint or private ATM switch and an ATM switch in a public network. See also *ATM*, *ATM reference model*, *Private UNI*, and *UNI*.

burglar alarm circuit Also known as a *dry copper pair*. A twisted pair that is not electrified, that is, has no associated electronics. Providers of digital subscriber line (DSL) services and burglar alarm services order dry copper pairs from the telco and place their own electronics on them. All they want is a pair of wires from one point to another. As a point of interest, the first central telephone exchange was invented by E.T. Holmes, a young man whose father, in 1858, had originated the idea of protecting property by electric wires connected to a central alarm office. Holmes obtained telephone numbers 6 and 7 and attached them to a wire in his office. He then placed six box telephones on a shelf in his office. Any of these telephones could be switched into connection with the burglar alarm wires and any two of the six wires could be joined by a wire cord. At night, when the telephone operator was off duty, the telephone network reverted to a burglar alarm network. See also *dark fiber*, *twisted pair*, and *xDSL*.

burst tolerance (BT) See *BT*.

bursty transmission Referring to asynchronous communications, which is characterized by long periods of inactivity interspersed by sudden short periods of intense activity, such as keystrokes, data file transfers, or packet traffic. See also *asynchronous*.

bus A common electrical conductor shared by multiple related devices. There may be a number of buses in a given system, such as a switch or router. A single bus may consist of multiple (e.g., 16 or 32) conductors.

BUS (Broadcast and Unknown Server) In LAN Emulation (LANE), a network-based server that handles broadcast and multicast traffic, as well as initial unicast frames before address resolution. See also *broadcast*, *LANE*, *multicast*, *server*, and *unicast*.

bus topology A network structure in the form of a multipoint electrical circuit. The original 802.3 local area networks (LANs), commonly referred to as Ethernets, employed thick coaxial cable specified in 10Base5. The network was in the form of a physical bus topology, as illustrated in Figure B-5. All devices connected to the cable, and communicated over a single, shared channel on a shared electrical circuit. Each coaxial cable segment was limited to 500 meters due to issues of signal attenuation at the relatively high carrier frequency. Each segment supported as many as 1,024 ($2^{10} = 1024$) network addresses, each of which was associated with an attached device, such as a workstation or peripheral device. Ethernet segments could connect through bridges, which function as signal repeaters. The total route length of the entire Ethernet was limited to 2.5 kilometers, which is a function of both signal propagation time and medium access control (MAC) mechanisms. Subsequently, the 10Base-T specification allowed workstations and peripheral devices to interconnect through a hub, with each device connecting directly to a hub port over unshielded twisted pair (UTP). The physical topology is that of a star, but the logical topology is that of a bus. That is to say that, although the devices connect to the hub over circuits that emanate from the hub like the rays of a star, they interconnect through a collapsed bus housed within the hub. Bus networks employ a decentralized MAC method known as carrier sense multiple access (CSMA). A tree topology is a variation on the bus theme, with multiple branches off the trunk of the central bus. See also *10Base-T*, *802.3*, *attenuation*, *bridge*, *bus*, *carrier*, *CSMA*, *MAC*, *star topology*, *topology*, and *UTP*.

busy The condition that exists when a central office (CO), PBX, destination telephone circuit, or other voice telecommunications component is in use at its full capacity and not available to accept additional calls. If a caller attempts to place a call to a device that is in a busy condition, the device returns a busy signal in the backward direction. For a telephone, busy is the same as off hook. See also *busy signal*.

busy/DA call forwarding (busy/Don't Answer) call forwarding) A voice telephone system feature method that allows a station user to program the system to automatically forward calls from the primary, or target, station to another station or perhaps a voice mail system after if the station either is engaged (i.e., busy, or off-hook) or does not answer after a selectable number of rings. See also *call forward*.

busy hour

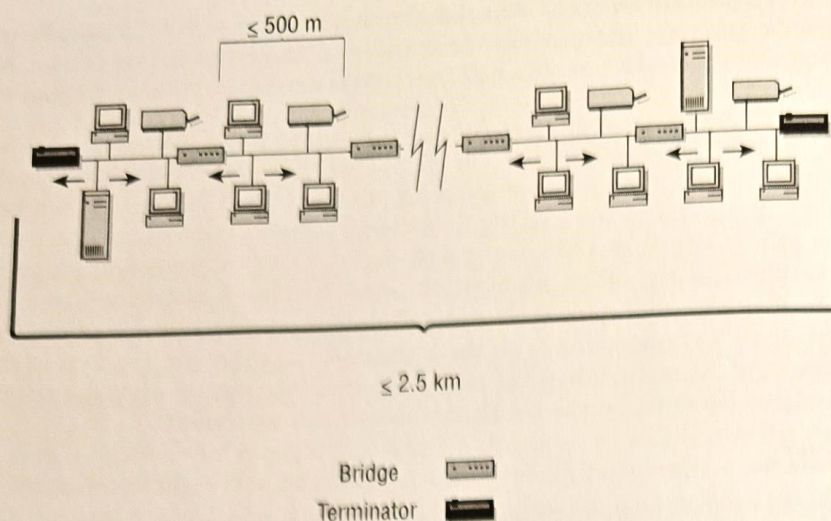


Figure B-5

busy hour In traffic engineering, the busiest 60-minute period of the day, ideally as determined by empirical traffic studies. See also *traffic engineering*.

busy hour call attempts (BHCAs) See *BHCAs*.

busy hour call completions (BHCCs) See *BHCCs*.

busy hour traffic (BHT) See *BHT*.

busy lamp field A modular component of a special telephone set typically used by the receptionist or operator of a key telephone system (KTS), a busy lamp field is an array of line status lamps. A busy lamp field allows the operator to view the status, e.g., busy or available, of the stations.

busy out To invoke a feature of a telecommunications system that rejects incoming calls. See also *do not disturb*.

busy signal An audible (or visual) signal indicating to the calling party that the called circuit is engaged and, therefore, unavailable. In the public switched telephone network (PSTN), a central office (CO) sends the busy signal in the backward direction, i.e., back to the caller. A fast busy signal, or reorder tone, is an indication to the calling party that network resources are not available to process the call. See also *PSTN*.

BWA (Broadband Wireless Access) Wireless local loop (WLL) technologies supporting broadband performance to individual end users. BWA technologies include both radio frequency (RF) and infrared (IR) solutions. RF-based solutions include Local Multipoint Distribution Service (LMDS), Multichannel Multipoint Distribution Services (MMDS), and Wireless Interoperability for Microwave Access (WiMAX). Free space optics (FSO) systems are wireless optical transmissions using wavelengths in the infrared range. See also *broadband*, *FSO*, *IR*, *LMDS*, *local loop*, *MMDS*, *RF*, *WiMAX*, and *WLL*.

byte (B) A character in a computer coding scheme. A byte is a unique set of adjacent bits with a unique meaning in a computer coding scheme. A byte generally comprises eight (8) bits that represent a letter in an alphabet (e.g., a, A, z, or Z), a diacritical mark (e.g., ~ or `), a single digit number (e.g., 0, 1, 2, or 3), a punctuation mark (e.g., ,, ., or !), or a control character (e.g., paragraph break, page break, or carriage return). The size of a byte is specific to the coding scheme involved. For example, ACSII employs a coding scheme of seven (7) bits, so a byte is actually seven information bits, although the addition of a parity bit

home page Also known as *page* and *Web page*. A document that serves as a starting point on a Web site. A home page typically contains hypertext and navigation buttons that allows the user to navigate the site by clicking them with a mouse and invoking hyperlinks to other pages and even other sites. See also *hyperlink*, *hypertext*, and *WWW*.

HomePlug A set of standards for in-house broadband over power line (In-house BPL). HomePlug allows a device to connect to a LAN directly through the in-building low voltage (LV) electric lines (110 volts at 50–60 Hz, or 220 volts at 50 Hz). Loosely based on Ethernet standards and using a variation of the CSMA/CA access control technique, HomePlug 1.0 supports up to 16 nodes sharing bandwidth up to a theoretical maximum of 14 Mbps. HomePlug-compatible devices include PCs, routers, bridges, switches, and any other devices that use RJ-45 or universal serial bus (USB) physical interfaces. The devices plug into a HomePlug adapter that is about the size of a typical LV transformer or power adapter, and that plugs into any electrical outlet on the premises. HomePlug uses of a version of orthogonal frequency division multiplexing (OFDM) specially tailored for powerline environments. HomePlug 1.0 specifies 84 equally spaced subcarriers, within each of which several differential modulation techniques are employed. Security is through 56-bit Data Encryption Standard (DES). Attenuation in HomePlug networks is influenced not only by signal propagation through the copper conductors, but also by splices and various components such as fuse boxes, surge suppressors, and circuit breakers. HomePlug currently offers a range of as much as 300 meters without repeaters and deals with issues of electromagnetic interference (EMI) through the mechanisms of forward error correction (FEC) and automatic repeat request (ARQ). See also *Access BPL*, *bandwidth*, *BPL*, *broadband*, *CSMA/CA*, *DES*, *EMI*, *Ethernet*, *FEC*, *In-house BPL*, *LAN*, *modulation*, *LV*, *OFDM*, *propagation*, *RJ45*, *subcarrier*, *transformer*, and *USB*.

home run An inside cable and wire star configuration in which each telephone or data jack connects directly to a common point, such as a demarcation point (demarc), wiring closet, or key service unit (KSU). The alternative is a shared loop that connects multiple jacks to one or two pairs that connect to the demarc or KSU. See also *daisy chain* and *loop*.

hook switch See *switch hook*.

hoot 1. shout, or holler. 2. Something or someone hilarious, as in "Billy Bob is a real hoot, don't y'all reckon?" See also *hoot 'n' holler*.

hoot and holler See *hoot 'n' holler*.

hoot 'n' holler An always-on two-way voice system that operates on a point-to-point or point-to-multipoint basis over physical four-wire dedicated circuits, with one transmit pair and one receive pair. A hoot 'n' holler system operates much like a full duplex paging system or intercom system. A typical application allows front desk or service counter personnel to press a button on a handset or a speakerphone and establish a point-to-multipoint connection to speakers, also known as *squawk boxes* or *holler horns*, positioned throughout the manufacturing or assembly floor, or the warehouse, where the personnel can respond by hooting (shouting) and hollering (shouting) into one of the microphones positioned around the area. Telephone companies use hoot 'n' holler systems to contact and converse with central office personnel who can just holler back rather than stopping what they are doing, perhaps climbing down a ladder, and running to answer a telephone, or perhaps just ignoring the call altogether. In such an application, multiple central office systems might be connected back to a central test and dispatch center by dedicated four-wire circuits. Financial and brokerage firms make extensive use of hoot 'n' holler systems for communicating market updates and instructions to brokers and traders on the trading floor. News agencies, publishers, power plants, refineries, and salvage yards all make extensive use of such systems.

hop 1. A small, quick jump. 2. In networks, the journey a signal makes across a transmission link between two devices such as bridges, hubs, switches, or routers. There often are multiple links in an end-to-end circuit between two devices. Therefore, a frame may make multiple hops as it transverse a physical path from one workstation to another. An IP packet typically makes a significant number of hops as it

transverses the Internet. See also *bridge*, *circuit*, *frame*, *hub*, *Internet*, *LAN*, *link*, *packet*, *router*, and *switch*. **3.** In radio communications, one skip of a radio wave from an earth station to the ionosphere and back. See also *ionosphere*, *radio*, and *waveform*. **4.** In satellite communications, one roundtrip of a signal from an Earth station to a space station (i.e., satellite) and back to an Earth station. See also *satellite* and *signal*. **5.** In frequency hopping spread spectrum (FHSS) radio communications, a small, quick jump from one frequency channel to another in a carefully choreographed hop sequence. See also *channel*, *FHSS*, and *frequency*.

hop sequence In frequency hopping spread spectrum (FHSS) radio communications, the sequence of small, quick jumps between frequency channels. See also *channel*, *FHSS*, and *frequency*.

horizontal cable A type of inside cable designed for horizontal use in non-plenum areas. While horizontal cable must be fire retardant, the National Electrical Code (NEC) specifications are not as demanding as those governing the use of plenum cable or riser cable. See also *NEC*, *plenum*, *plenum cable*, and *riser cable*.

host **1.** The central computer in a mainframe or midrange computer environment to which the networks and terminals connect. See also *computer*, *mainframe computer*, *midrange computer*, *network*, and *terminal*. **2.** In telecommunications, local area networks (LANs), and networks, in general, a server that functions to provide programs or data files to client computers. See also *client*, *LAN*, *telecommunications*, *network*, and *server*. **3.** In the Internet, any computer that can serve as a source or destination for data transfers. An Internet host has a unique Internet Protocol (IP) address and unique domain name. See also *domain*, *Internet*, and *IP*.

hosted PBX Synonymous with IP Centrex. See *IP Centrex*.

hot spare Synonymous with hot standby. See *hot standby*.

hotspot A location where with a sufficiently strong signal from an accessible Wi-Fi wireless LAN (WLAN). Many thousands of public hotspots are available in the United States and many developed countries. Most hotspots are made available through for-profit companies that charge on a daily or monthly basis, although municipalities increasingly deploy free public Wi-Fi networks as a public service. Companies and individuals often unknowingly offer public hotspots by failing to activate Wi-Fi security options provided in 802.11i, more commonly known as Wi-Fi Protected Access (WPA). See also *802.11i*, *Wi-Fi*, *WLAN*, and *WPA*.

hot standby Referring to a redundant system or processor that is not only turned on and warmed up, but is active and prepared to immediately assume the responsibilities of the primary system in the event it suffers a catastrophic failure. Synonymous with *hot spare*.

HSCSD (High-Speed Circuit Switched Data) A 2G+ upgrade to GSM designed to improve data transmission rates. HSCSD improves channel throughput from 9.6 kbps to a maximum of 14.4 kbps in GSM host networks operating at 1800 MHz by lowering overhead through the use of improved mechanisms for forward error correction (FEC). HSCSD also supports the concatenation of multiple time slots per frame in support of higher speeds. As examples, two concatenated time slots yields a transmission rate of up to 28.8 kbps, three yields 43.2 kbps, and four yields 57.6 kbps. See also *2G*, *channel*, *concatenation*, *FEC*, *frame*, *GSM*, *overhead*, *throughput*, *time slot*, and *transmission rate*.

HSDPA (High Speed Downlink Packet Access) Sometimes characterized as a 3.5G cellular radio technology, HSDPA is an upgrade to Universal Mobile Telecommunications System (UMTS) that increases theoretical downlink data rates to 14.4 Mbps, although current implementations support speeds more typically in the range of 400–700 kbps, bursting up to 3.6 Mbps for short periods of time using an adaptive modulation technique to throttle bit rates up and down as the link permits. Work has begun in the 3rd Generation Partnership Project (3GPP) on standards for High Speed Uplink Packet Access (HSUPA). See also *3GPP*, *cellular radio*, *downlink*, *link*, *modulation*, and *UMTS*.

LAN (Local Area Network) A LAN is a packet network designed to interconnect host computers, peripherals, storage devices, and other computing resources within a local area, i.e., limited distance. LANs conform to the client/server architecture, a distributed computing architecture that runs applications on client microcomputers against one or more centralized servers, which are high-performance multiport computers with substantial processing power and large amounts of memory. A LAN might serve an office, a floor of a building, and entire building, or a campus area, but generally does not cross a public right-of-way such as a street. The distance limitation generally is in the range of a few kilometers, at most, although that is sensitive to the transmission media employed, which include coaxial cable, twisted pair, optical fiber, infrared (IR) light, and radio frequency (RF) systems. Raw bandwidth ranges up to 10 Gbps, although actual throughput generally is much less. LANs generally are private networks, although public wireless hotspots offering wireless Internet access currently are popular. Most LAN standards are set by the 802 Working Group of the Institute of Electrical and Electronic Engineers (IEEE), with examples being 802.3 (Ethernet) and 802.11a/b/g (Wi-Fi). A personal area network (PAN) such as Bluetooth, is much more limited in geographic scope than a LAN. LANs and LAN segments can be interconnected over a metropolitan area network (MAN) or wide area network (WAN). LANs operate at Layer 1, the Physical Layer, and Layer 2, the Data Link Layer, of the OSI Reference Model. See also 802.3, 802.5, 802.11, architecture, bandwidth, Bluetooth, client/server, coaxial cable, Data Link Layer, Ethernet, hotspot, IEEE, IR, MAN, optical fiber, OSI Reference Model, PAN, Physical Layer, RF, throughput, Token Ring, twisted pair, WAN, and Wi-Fi.

landline 1. A traditional telephone connected to the PSTN by a traditional wire (or fiber) local loop that terminates in a fixed location, rather than a cellular mobile telephone connected to a cellular network via radio technology. A cordless telephone is considered part of a landline as the local loop terminates in a fixed base station on the subscriber premises, even though the connection to the base station is wireless. A wireless local loop (WLL) is considered a landline, as it is terrestrial and connects two fixed points. See also *local loop* and *WLL*. 2. A telecommunications system that uses traditional terrestrial cabled, or conducted, transmission media such as copper or fiber optics, and wireless systems such as microwave, rather than mobile wireless radio technologies such as cellular or, especially, non-terrestrial satellite.

LANE (LAN Emulation) A specification (January 1995) from the ATM Forum (since merged into the MFA Forum) for an ATM service in support of native Ethernet (802.3) and Token Ring (802.5) local area network (LAN) communications over an ATM network. Software in the end systems (e.g., ATM-based hosts or routers, known as *proxies*), of the ATM network emulates a native LAN environment. LANE acts as Layer 2 bridge in support of connectionless LAN traffic, with the connection-oriented ATM service being transparent to the user application. In LANE, a LAN emulation client (LEC) connects to the ATM network over a LANE user-to-network interface (LUNI). The network-based LAN emulation server (LES) registers the LAN medium access control (MAC) addresses and translates them into ATM addresses using the address resolution protocol (ARP). Each LEC is assigned to an emulated LAN (ELAN) by an optional network-based LAN emulation configuration server (LECS). Each LEC also is associated with a broadcast and unknown server (BUS) that handles broadcast and multicast traffic, as well as initial unicast frames before address resolution. LANE traffic generally is Class C variable bit rate (VBR) traffic in message mode, and is supported over ATM Adaptation Layer Type 5 (AAL5). See also 802.3, 802.5, AAL5, ARP, ATM, ATM Forum, broadcast, BUS, Class C ATM traffic, connectionless, connection-oriented, ELAN, emulation, Ethernet, host, Layer 2, LEC, LECS, LES, LUNI, MAC, message mode service, MFA Forum, multicast, proxy, router, Token Ring, unicast, and VBR.

LAN emulation (LANE) See *LANE*.

LAN emulation client (LEC) See *LEC*.

LAN emulation configuration server (LECS) See *LECS*.

LAN emulation server (LES) See *LES*.

LANE user-to-network interface (LUNI) See *LUNI*.

LAPB (Link Access Procedure, Balanced)

LAN switch An intelligent, active hub that establishes, maintains, and changes logical connections over physical circuits. Switches flexibly connect transmitters and receivers across networks of interconnected ports and links, thereby allowing network resources to be shared by large numbers of end users. LAN switches are packet switches that can support multiple simultaneous transmissions, reading the destination address of each frame and forwarding it directly to the port associated with the target device. LAN switches are classified as workgroup switches or backbone switches. A workgroup switch serves the needs of a group of users who work together and, therefore, share common resources and intercommunicate frequently. Through the use of workgroup switches, a great deal of traffic can be confined to relatively small LAN segments and overall LAN congestion can be reduced considerably. High capacity backbone switches interconnect workgroup switches and provide connections to routers, as required. LAN switch architectures are several. A shared bus switch has a single high-speed bus that is shared by all incoming and outgoing ports on a time-division multiplexing (TDM) basis. A matrix switch contains multiple interconnected high-speed internal buses in a multi-bus switching matrix that can provide full bandwidth to multiple, simultaneous transmissions. If there are congestion issues in a matrix switch, it may have the ability to subdivide its capacity, with the buses becoming shared buses. A cut-through switch quickly reads the address of the data frame and quickly flows it through the switching matrix, bit by bit. A store-and-forward switch temporarily buffers and examines each incoming frame for errors through a CRC check before forwarding it through the switching matrix to the output port. Fragment-free switching, is similar to cut-through except for the fact that the switch stores the first 64 octets of the frame before forwarding it. As most errors occur at the beginning of a frame, this approach eliminates the possibility that runt frames (i.e., truncated frames) will be transmitted.

LAPB (Link Access Procedure, Balanced) Pronounced *lap bee*. A bit-oriented protocol that is part of the X.25 protocol suite, LAPB runs at Layer 2, the Data Link Layer, of the OSI Reference Model. The LAPB frame comprises a header and trailer that encapsulate the packet formed by the X.25 packet layer protocol (PLP) at the Network Layer. The LAPB frame provides a mechanism for transporting packets across a link, ensuring that frames of data are ordered correctly and are free from error. LAPB is a balanced protocol that operates in asynchronous balanced mode (ABM), referring to the fact that the devices have a balanced, rather than a master/slave, relationship. LAPB is a derivative of the High-level Data Link Control (HDLC) protocol, which, in turn, is based on the IBM Synchronous Data Link Control (SDLC) frame. Figure L-1 illustrates the LAPB frame and its component fields.

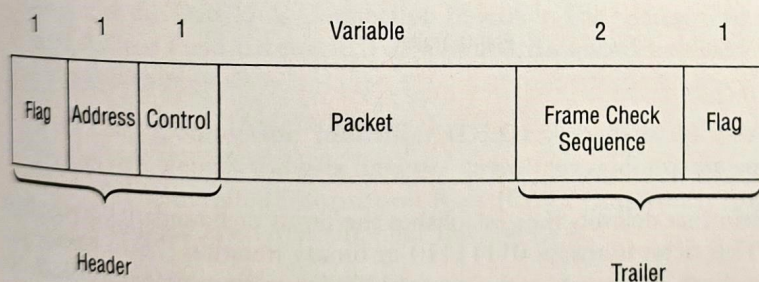


Figure L-1

The fields in the LAPB frame are as follows:

- **Flag:** A specific one-octet field that delimits (i.e., establishes the limits or boundaries of) the beginning and end of the frame. This octet is always 01111110 in binary notation (7E in hexadecimal notation), which is prevented from appearing in the payload by bit stuffing.
- **Address:** A one-octet field that indicates the sending station in command frames and the receiving station in response frames. User addressing is the responsibility of the logical channel identifier (LCI) field contained in the packet layer protocol (PLP), which is one layer above LAPB in the X.25 protocol stack.

macrobend A relatively large bend in an optical waveguide, such as a fiber optic cable. A technician may need to bend a cable around a corner, for example, or may need to coil some cable in a span to provide necessary slack in the event that the cable must be spliced in the future, perhaps to repair a break. A technician placing a macrobend in a cable must consider the minimum allowable bend diameter in order to prevent either damage to the cable or bending loss, i.e., loss of signal strength resulting from an excessive bend. See also *bend diameter*, *bending loss*, and *microbend*.

macrocell In radio systems, an imprecise term referring to a relatively large area of coverage, perhaps an entire metropolitan area of 50 miles in diameter. A macrocell is larger than a microcell and much larger than a picocell. See also *cell*, *microcell*, and *picocell*.

MAE (Merit Access Exchange or Metropolitan Area Exchange) The exact meaning of the acronym is lost in the mists of time; it means either Merit Access Exchange or Metropolitan Area Exchange. In either case, MAE now is just MAE, a registered trademark of MCI, now (September 2007) a Verizon company, and is an official Network Access Point (NAP) at which an Internet service provider (ISP) can access the Internet backbone and exchange traffic with other ISPs. Some NAPs are known as NAPs, some as Internet Exchanges (IXs), and some as MAEs. Tier 1 MAEs are located in San Jose, California (MAE West); Vienna, Virginia (MAE East); Miami, Florida; and Paris, France. Tier 2 MAE sites currently are located in Chicago, Illinois; Dallas, Texas; Los Angeles, California; and New York, New York. See also *Internet*, *ISP*, *IX*, and *NAP*.

mailbox A partition of computer memory designated for the temporary storage of messages intended for an individual, department, company, or other authorized user entity. Mailboxes can be associated with e-mail, facsimile mail, or voice mail systems.

mail transfer agent (MTA) See *MTA*.

mail user agent (MUA) See *MUA*.

main distribution frame (MDF) See *MDF*.

mainframe computer Also referred to colloquially as big iron and heavy metal. A large, expensive, and often highly redundant computer designed to support a large organization, handle intensive computational tasks, support a large number of users, and make use of large volumes of secondary storage. The largest mainframes are capable of supporting thousands of simultaneous users and use terabytes of secondary storage. Notably, mainframes are employed in a centralized computing architecture, which is opposite the distributed architecture of local area networks (LANs) and the Internet. The term originally described the main frame that contained the central processing unit (CPU) of computers in the days when all computers were heavy metal. See also *Internet*, *LAN*, *minicomputer*, and *personal computer*.

maintenance and administration terminal (MAT) See *MAT*.

make and break See *soft handoff*.

malware (malicious software) Software that is harmful or evil in intent. See also *spyware*, *Trojan horse*, *virus*, and *worm*.

MAN (Metropolitan Area Network) A public data network that serves an entire metropolitan area, or perhaps a portion of a metropolitan area such as a city or a suburb, commonly serving to interconnect Local Area Networks (LANs). A number of carriers offer Metropolitan Ethernet services, for example. MANs can be interconnected across a Wide Area Network (WAN). See also *LAN* and *WAN*.

managed service provider (MSP) See *MSP*.

management information systems (MIS) See *IS*.

.net (network) Pronounced *dot net*. Originally, the Internet generic Top Level Domain (gTLD) reserved exclusively for network access providers, such as Internet Service Providers (ISPs). The domain is now unrestricted. This is an unsponsored domain. See also *Internet*, *gTLD*, *ISP*, and *unsponsored domain*.

Net (InterNet) See *Internet*.

Net neutrality (InterNet neutrality) The principle that the cost of Internet access should not be sensitive to the nature of the content. As Internet content has become increasingly stream-oriented and bandwidth-intensive, the demands on the network for bandwidth and congestion management have become more pronounced. Service providers have responded with increased bandwidth and various quality of service (QoS) mechanisms that prioritize various traffic types, such as audio, video, and voice. Net neutralists oppose price differentials associated with prioritized traffic types. Those opposed suggest that neutrality will discourage innovation and investment. See also *bandwidth*, *congestion*, *Internet*, *QoS*, and *stream-oriented*.

Netscape Communicator A software suite that includes the Netscape Navigator Web browser, an editing program, voice conferencing, an e-mail client, and a calendaring system. See also *browser*, *client*, *conference call*, *e-mail*, *Netscape Navigator*, and *Web*.

Netscape Navigator A Web browser featuring simultaneous image loading and continuous document-streaming speed performance. The software was developed at Netscape Communications Corp. by a team led by Marc Andreessen, the creator of the original Mosaic browser, and was first commercially available in late 1994. Netscape Navigator subsequently was packaged in the Netscape Communicator application software suite and lost its individual identity. In 1998, Netscape began work on an open source version known as Mozilla. In 1999, Netscape was acquired by America Online (AOL), which packaged Netscape software as part of AOL service. See also *browser*, *Mosaic*, *Mozilla*, *software*, and *Web*.

network (net) A fabric of elements that work together much as the fabric or mesh of a net to support the transfer of information. A network includes all links, amplifiers and repeaters, multiplexers, switches, routers, and other intermediate devices involved in establishing, maintaining, and terminating a session between a transmitter and a receiver. A network may take the form of a local area network (LAN), metropolitan area network (MAN), personal area network (PAN), or wide area network (WAN). See also *LAN*, *MAN*, *PAN*, and *WAN*.

Network Access Point (NAP) See *NAP*.

network access server (NAS) See *NAS*.

Network Address Translation (NAT) See *NAT*.

network architecture The design and framework of a network, including the characteristics of individual hardware, software, and transmission system components and how they interact in order to ensure the reliable transfer of information. Prior to the development of such architectures, interoperability between the various systems of a single manufacturer was unusual, and it certainly did not exist between the products of multiple manufacturers. IBM's Systems Network Architecture (SNA) and the Digital Equipment Corporation's (DEC's) Digital Network Architecture (DNA), aka DECnet, corrected these shortcomings within the IBM and DEC domains, but they still did not interoperate. Truly open systems architectures still remain in the distant future, although great strides have been made in this regard through the Open Systems Interconnection (OSI) model fostered by the International Organization for Standardization (ISO). Network architectures tend to be layered, which serves to enhance their development and management. While they primarily address issues of data communications, they also include some data processing activities at the upper layers. These upper layers address application software processes, presentation format, and the establishment of user sessions. Each independent layer, or level, of a network architecture addresses different functions and responsibilities. The layers work together, as a whole, to maximize the performance of the process. See also *ISO*, *OSI Reference Model*, and *SNA*.

NMT 900 (Nordic Mobile Telephone 900 MHz) A 1G analog cellular radio technology developed and placed into service in the early 1980s in Scandinavian countries. NMT 900 operates in the 900 MHz band, employing frequency division multiple access (FDMA) to derive 1999 channels with a width of 12.5 kHz. NMT 900 employs frequency division duplex (FDD) to achieve bidirectional communications, with the downlink in the 935-960 MHz band and the uplink in the 890-915 MHz band. Within each channel, frequency modulation (FM) is employed. See also *1G, analog, cellular radio, channel, downlink, FDD, FDMA, FM, and uplink*.

NN (Network Neutrality) Referring to Internet neutrality. See *Net neutrality*.

NNI (Network-to-Network Interface) The boundary or point of interaction between network service providers. The NNI is both a physical and logical point of demarcation. The NNI serves the technical boundary where protocol issues are resolved and as the point of division between the responsibilities of the individual service providers. NNIs are defined for asynchronous transfer mode (ATM) and frame relay, as examples. See also *ATM, logical, frame relay, physical, and protocol*.

NOC (Network Operations Center) (pronounced *knock*) Also known as *network control center (NCC)*. A centralized location from which a large, complex network and its component subnetworks and network elements can be monitored, and faults or performance failures can be identified, diagnosed, isolated, and often corrected. See also *network, network element, and subnet*.

node 1. A junction point at which two or more circuits interconnect in a data network. A bridge, for example, interconnects two or more segments of a local area network (LAN). See also *bridge, circuit, LAN, and network*. 2. In a switched network, a switching point that comprises a point of interconnection for circuits, a data switch, and control facilities. In the public switched telephone network (PSTN), for example, a great many circuits terminate in a central office (CO) and a tandem office, each of which comprises one or more switches and Signaling System 7 (SS7) network control logic, multiplexers, a wide variety of other devices. See also *access node, CO, PSTN, service node, SS7, switch, and tandem switch*. 3. A device such as a station, bridge, computer, repeater, server, switch, or other device that connects to a network. 4. In the IBM Systems Network Architecture (SNA), a physical device such as a computer, communications processor (e.g., FEP), terminal controllers, or terminal. See also *SNA*.

noise Unwanted disturbances superimposed on a signal and interfering with its integrity. Noise can be introduced by equipment or can be the result of natural phenomena. Noise can take a number of forms, including amplitude noise, cross-talk, echo, intermodulation noise, harmonic distortion, impulse noise, random noise, and white noise.

nominal In name only, but not in reality. A T1 circuit sometimes is described as having a nominal transmission rate of 1.5 Mbps, although in reality the signaling rate is 1.544 Mbps and its payload is 1.536 Mbps. It is easier to say one point five Megabits per second or one and a half Megabits per second than one point five four four Megabits per second. It is not exact, but it is close enough for all but the most obnoxious purists. Similarly, an E-1 is generally described as having a transmission rate of 2 Mbps, although in reality the signaling rate is 2.048 Mbps and the payload is 1.92 Mbps. See also *payload, signaling rate, and transmission rate*.

non-blocking A switch that provides a guaranteed talk path for every terminal; in other words, there exists a 1:1 (one-to-one) relationship between ports and time slots. Such a configuration is expensive, generally considered excessive and, therefore, unusual in all but the most intense applications scenarios, such as call center ACDs and backbone data switches. See Figure N-1. See also *ACD, backbone, blocking, and call center*.

P.861 The ITU-T standard defining the Perceptual Speech Quality Measurement (PSQM) method of objectively evaluating voice transmission quality. PSQM is an automated method developed to measure the perceived quality of real-time voice as impacted by compression codecs. An enhanced version known as PSQM+ was later developed to measure the effects of packet loss and other network impairments. PSQM compares a distorted voice sample to an original, clear voice sample and uses a complex analytical process to evaluate the difference in terms of factors that influence the perceptions of human listeners. The ultimate distortion score corresponds closely with the mean opinion score (MOS) yielded by the panel of human listeners employed using the P.800 method. P.861 was withdrawn and replaced by P.862, defining the Perceptual Evaluation of Speech Quality (PESQ). See also *codec, compression, MOS, P.800, P.862, and PSQM*.

P.862 The ITU-T standard defining the Perceptual Evaluation of Speech Quality (PESQ) method of objectively evaluating transmission quality. A companion to the more subjective P.800, PESQ is an automated method that addresses the effects of filters, jitter, and coding distortions. PESQ replaced the Perceptual Speech Quality Measurement (PSQM) method, which was viewed as limited in certain applications. PESQ is considered to be an intrusive test method as it inserts a reference signal into the device under test. See also *ITU-T, P.800, PSQM, and toll quality*.

PABX (Private Automatic Branch eXchange) Generally synonymous in contemporary usage with private branch exchange (PBX), PABX refers to an automatic PBX, as compared to a manual PBX, or cordboard. The term *PBX* is preferred in North America, and PABX in much of the balance of the world. See *PBX* for more detail.

packet 1. In the generic sense, referring to the manner in which data are organized into discrete units for transmission and switching through a data network. The data unit can be known as a block, frame, cell, or packet, depending on the protocol specifics. The packet comprises a header, payload, and sometimes a trailer, again depending on protocol specifics. The packet can be a user packet containing user data, or a signaling and control packet for various network monitoring, alerting and alarming, maintenance, and other administrative purposes. The payload can be a complete message, a fragment or segment of a message, or an aggregation of bits or bytes that form a short portion of a long data stream associated with a voice or video call. See also *bit, block, byte, cell, data stream, fragment, frame, header, message, payload, protocol, segment, and trailer*. 2. In a technology-specific sense, a packet is a data unit in an internetwork, such as the Internet or other packet-switched network in which routers interconnect networks and subnetworks to exchange traffic between nodes. In terms of the OSI Reference Model, a packet is defined in Layer 3, the Network Layer. Blocks, cells, and frames are defined in Layer 2, the Data Link Layer, and have local significance, only. See also *block, cell, datagram, Data Link Layer, frame, Internet, Network Layer, OSI Reference Model, packet switch, and router*.

packet assembler/disassembler (PAD) See *PAD*.

packet-filtering firewall A security firewall that examines all data packets, forwarding or dropping individual packets based on predefined rules that specify where a packet is permitted to go, in consideration of both the authenticated identification of the user and the originating address of the request. See also *authentication, firewall, proxy firewall, security, and stateful inspection firewall*.

packet Internet groper (ping) See *ping*.

packet layer protocol (PLP) See *PLP*.

Packet over SONET (POS) See *POS*.

packet switch A device that switches data organized into packets, discrete sets of data that may take the specific form of packets, frames, or cells depending on the network technology specifics. For example, packet switches switch packets in networks based on the Internet Protocol (IP), frames in networks based on the Frame Relay or Ethernet protocol, and cells in those based on the Asynchronous Transfer Mode

PCM-encoding of the analog signal, with the sampling performed by the same chips as contained in the A-to-D converter. However, variations on PAM remain widely used. Quadrature amplitude modulation (QAM) is such a variation. See also *amplitude, channel bank, DS-1, modulation, PCM, and QAM*.

PAMS (Perceptual Analysis Measurement System) An automated testing mechanism designed to objectively measure to quality of speech transmission. PAMS uses a sensory model to compare the degraded signal received to the original, unprocessed analog signal prior to encoding and transmission. PAMS is analogous to the mean opinion score (MOS) defined in P.800, which is a much more subjective approach involving a panel of human listeners. See also *P.800*.

PAN (Personal Area Network) A wireless personal area network (WPAN). See *WPAN*.

panel switch A type of electromechanical circuit switch developed by the Bell System for use in large metropolitan areas, where it was felt that the more conventional step-by-step (SxS) would not scale properly. As the first common control switch, the panel switch used a store-and-forward technique in which the digits dialed by the end user were stored in a register, or temporary buffer. Once the complete telephone number had been dialed, the register sent the dialed digits either to a translator for translation into routing instructions, or directly to the sender, which then sent the appropriate dialed digits across a trunk or to local switching equipment. A panel switch was so called because the line selector system operated on a system of ladders. As a selector received each dialed number, it would rise up a ladder in a vertical panel mounted on a frame. Panel switches were first placed into service in the 1920s, through the 1930s, and remained in service until the late 1970s, at which point they were replaced by electronic common control (ECC) switches. See also *ECC* and *SxS*.

PANS (Pretty Advanced New Services, Pretty Advanced Network Services, Peculiar And Novel Services) A term that appeared in the 1970s to distinguish new PSTN services from POTS (Plain Old Telephone Service). PANS includes custom calling services such as caller ID and name ID, call waiting, conference calling, and three-way calling. The term really never caught on. See also *POTS* and *PSTN*.

PAP (Password Authentication Protocol) A commonly used mechanism for password protection in support of remote users attempting to log on to a Point-to-Point Protocol (PPP) server. While PAP is easy to use, passwords typically are sent to the remote access server (RAS) in plain text (i.e., in the clear, or unencrypted). PAP demands the user's login name and password, and continues to do so until they both are supplied correctly. A hacker who knows the login name can use password-guessing programs to keep trying, in hopes that he can hit on the right combination and gain access. See also *CHAP, hacker, in the clear, PPP, and RAS*.

paper A flexible material consisting of thin, flat, felted sheets made of pulped wood, rags, or other fibrous materials laid down on a fine screen from a water suspension. Applications for paper include packaging, structural material, fabric substitute, and wall coverings. In days of yore, before the paperless office, people actually wrote and printed words and drew images on paper. See also *paperless office*.

paperless office In 1975, *Business Week* magazine predicted that the office of the future would be entirely paperless due to the impact of computers, in general, and particularly, the personal computer. The thought was that information would be communicated electronically, and that paper would be redundant. During that time, many companies, such as Southwestern Bell Telephone Company, converted paper business records to microfilm or microfiche. Microfilm soon became obsolete, as computer systems, computer networks, and electronic storage technologies began to truly impact business operations in the office of the early 1980s. Paper mail gave way to facsimile and e-mail in the 1980s and 1990s. Many print magazines largely converted to electronic format. In truth, contemporary business and commerce would not exist as we know it (not to mention the forestlands that would have been turned into deserts due to the untold billions of trees that would have been ground into pulp), if we had not advanced beyond the paper office of the 1960s. However, we still print hard copies of electronic documents, and seem to consume more paper with each passing year. So much for the paperless office. See also *lead balloon*.



W Symbol for watt. See *watt*.

WACS (Wireless Access Communication System) A U.S. specification for cordless telephony that was modified to an industry standard known as Personal Access Communications Services (PACS) and ultimately evolved into Personal Communications Services (PCS). See also *cordless telephone* and *PCS*.

WAIS (Wide Area Information Service) A UNIX-based system of servers that enables users to specify the databases requested for search, and to conduct a subject-matter search on the basis of keywords. See also *browser*, *server*, and *UNIX*.

Walkabout An early wireless telephony trial conducted in Canberra, Australia, in support of pedestrian traffic. Walkabout was based on CT2+ digital cordless telephony standards. See also *cordless telephone*, *CT2+*, and *digital*.

walkie talkie A portable handheld radio transmitter-receiver invented in 1938 by Al Gross while a high school student in Cleveland, Ohio (United States). The device caught the attention of the Office of Strategic Services (OSS), predecessor to the Central Intelligence Agency (CIA). The OSS recruited Goss, who then lead the effort to develop the walkie-talkie for clandestine and military uses. Code-named Joan/Eleanor, the first walkie talkie system comprised a ground unit, Joan, and an airborne unit, Eleanor. The system allowed OSS agents behind enemy lines to communicate with aircraft in a manner that virtually defied detection at the time. See also *Gross, Al*.

WAN (Wide Area Network) A network that covers a wide geographic area such as a state, province, region, or country. The Public Switched Telephone Network (PSTN) is a voice-oriented WAN. The Internet is a data-oriented public WAN. WANs can serve to interconnect LANs and MANs. See also *LAN* and *MAN*.

WAN Interface Sublayer (WIS) See *WIS*.

WAP (Wireless Access Protocol) A carrier-independent, device-independent, transaction-oriented protocol employed in Web-enabled cellular networks in support of text, graphics, and audio. The best performance is achieved when accessing Web sites written in WML (Wireless Markup Language), which is similar to HTML. The alternative is transcoding from HTML to WML, which is accomplished through gateways. A much simpler, but much less attractive technique is Web clipping, which strips the graphic content out of Web pages. Security over the wireless link is provided through Wireless Transport Layer Security (WTLS). WAP is employed outside of Japan, where the i-Mode microbrowser technology is employed. See also *browser*, *carrier*, *cellular*, *i-Mode*, *protocol*, *Web*, and *WML*.

WARC (World Administrative Radio Conferences) Now known as the World Radio Conferences (WRC). See *WRC*.

warrior's code A code of conduct that defines what warriors can and cannot do if they wish to continue to be regarded as warriors, rather than murderers or cowards. For the warrior who adheres to such an informal code or to more formal rules of engagement, certain actions are unthinkable, even in the most dire or extreme circumstances. Within a decade of the introduction of firearms to Japan in 1543, the Japanese were arguably the best gun makers in the world, and there were more guns per capita in Japan than in any other country in the world. The warrior code of the Samurai, however, viewed the use of guns in warfare as dishonorable. Centuries of tradition demanded that Samurai warriors engage in elaborate rituals prior to combat, which was conducted man-to-man and hand-to-hand between gentleman warriors. Under pressure from the Samurai, the Emperor of Japan gradually reduced the number of authorized gun factories to zero and, over time, subsequently reduced the number of gun repair shops to zero. By the time