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**Backbone** A core high-speed transmission line which serves a number of networks. Switches and bridges provide the physical connections between it and the multiple networks for which it provides bi-directional data traffic paths. A backbone is comparable to a main artery in human anatomy, which divides into smaller veins and capillaries that might be thought of as switches and networks. A backbone might comprise ATM backbone switches, which comprise a number of ports for connection to networks. Enterprise backbones that have ATM backbone switches offer scalability and fault tolerance, and are based on internationally agreed standards.

*(See ATM and Frame relay)*

**Backbone switch** A device that acts as a distribution point for data traffic flowing on a backbone. ATM backbone switches have a number of ports for connection to multiple networks and/or devices. ATM backbone switches are:

- scalable, because upsizing is possible through the replacement or addition of switches; downsizing is also possible where switches are removed or replaced
- fault-tolerant
- based on internationally agreed standards.

Specifications for ATM backbone switches include the:

- number of ports per switch
- number of calls that the switch can route per second
- speed of the backplane, or its data transfer rate in bits per second; the number of ports per switch.

Makers of ATM backbone switches include 3Com Corporation, Cabletron Systems, DEC, Cisco, FORE systems and NEC.

**Backdoor** A flaw in the security defences of a system or a network. For

## Backdrop

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example, modem access, either inbound or outbound, may bypass the network collective security infrastructures.

*(See Firewall and Security.)*

**Backdrop** A background image or colour in a multimedia presentation or title that remains constant for a given number of frames.

**Back-end application** A term used to describe a server-side application, which may drive or provide services for client applications and systems. The latter tier is the front-end, with which the user interacts. Between the back- and front-end applications is middleware or glues, which exist at a number of levels. These may bind together and coordinate application logic, data and presentation distributed across the back- and front-ends.

*(See Application, Client/server, Front-end and Glue.)*

**Background** 1. Multi-tasking operating systems, such as Windows 98, Windows NT and OS/2 Warp, are able to run applications in the background of others. Background applications and tasks generally receive less processing time and run more slowly. 2. A background sound may be added to a Web page using FrontPage or other Web development tools. The sound technology used may be wave audio or MIDI.

*(See FrontPage, MIDI and Wave audio.)*

**Background mode** In Windows, background mode permits the background colour to be toggled between opaque (on) and transparent (off).

**Backtracking** The process of retracing a user's path of interaction. Using Windows Help systems the Back button provides a means of doing this. All fully specified authoring tools – such as Multimedia ToolBook – and Help System development tools allow the developer to integrate a backtracking feature in applications. Web browsers also feature backtracking controls.

*(See Hypertext and Multimedia.)*

**Backward-compatible** A hardware component, program object, language compiler, program or operating system that is compatible with an earlier version.

**Bandwidth** The rate at which data is transferred to, or from, a computer or appliance, using a medium that might be physical or wireless. Media and their bandwidths include:

- A single-speed CD-ROM has a bandwidth of 1.2 Mbps (or 150 Kbyte/s), and generally CD-ROM drives exhibit data transfer rates which are broadly multiples of 150 Kbyte/s.

- A single ISDN line will provide a bandwidth of 64 Kbps, whereas B-ISDN may offer multiples of that rate.
- The average bandwidth of a 24-speed CD-ROM drive is about 3600 Kbyte/s.
- ADSL has a downstream bandwidth of between 1.5 Mbps and 8 Mbps. Typically it is 1.5 Mbps.
- ADSL upstream bandwidth of the order of 16 to 640 Kbps, which can be a function of the line length. Typically it is 384 Kbps.

*(See Access technology, ADSL, ATM, B-ISDN, CD-ROM, DBS, DVD and ISDN.)*

**Base case** A system that is specified as being a base case is the minimum implementation, or the bottom of a product range. A base case MPC-3 will have only the essential elements of the official specification, as will a base case NC.

*(See MPC and NC.)*

**BASIC (Beginners All-purpose Symbolic Instructional Code)** A high-level language developed by Kemeny and Kurtz in the 1960s. Early implementations for personal computers include the BASIC interpreter developed by Microsoft founders Bill Gates and Paul Allen in the mid-1970s for the MITS Altair, the world's first affordable computer. Interpreted languages differ from compiled languages in that they are not compiled into object code (such as an .EXE file) before execution. Instead, the source code is interpreted in real-time when the program is run. In the late 1970s and early 1980s, almost every microcomputer (or personal computer) had its own BASIC interpreter stored in a ROM variant. Even the original IBM PC XT had a BASIC ROM. It was at this time that Acorn Computer (UK) introduced Structured BASIC, advancing the language to structured programming. *(See Structured programming.)* Structured BBC BASIC gave procedures and routines names, such as PROCfind, for instance, and were ended using commands like ENDPROC. BBC BASIC was also recursive in that procedures could be called from within procedures. Its most unusual feature, however, was the ability to include 6502 assembly language code within the high-level listing itself. This feature gave it flexibility, and helped programmers increase the speed of program execution by confining certain procedures to assembly language or machine code. This functionality evades many of the industry-standard languages of today. The structured programming model adopted by BBC BASIC made the GOTO command redundant, and later did the same to line numbers, though BBC BASIC did include the GOTO command. Until the advent of structured programming, the flow of program execution was directed solely using the GOTO <line

## Bastion host

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`number>` command. After structured programming, the next significant advancement for BASIC came when visual and object-oriented programming (OOP) arrived. Such Visual Basic development tools allowed programmers to draw objects in order to, perhaps, create a user interface. All the programmer then needed to do was to add code to the objects in order to define their behaviour in response to events such as mouse clicks. The BASIC syntax has changed dramatically, though it continues to be a procedural high-level language, and one that is considerably more than a language for novice programmers. It can be used to tackle demanding programming projects, and is considerably more portable than the early interpreted versions for popular microcomputers.

*(See Visual Basic and BBC BASIC.)*

**Bastion host** A host that is critical to a network's security and Firewall architecture. This is the focus of network management and security monitoring, and is a network's principal defence against illegal use. A dual-homed host may play the role of a bastion host.

*(See Firewall.)*

**Batch file compression** A technique by which several files may be compressed into a single file for distribution, archiving or backup purposes. It is appropriate for modem-based file transfer and DSM-based distribution. It can be used to compress any binary file. In the context of video distribution its main disadvantage is the fact that end-users have to decompress or unpack the files before they can be played. Decompression can be carried out using an installation program, a program such as PKUNZIP or, in the case of a self-extracting compressed file by simply typing the name of the compressed file. Standard batch file compression programs include WinZip.

**Baud rate** The rate at which data is transferred from one point to the next, which broadly equates to bps. More precisely it is a measure of logic/bit changes per second over media which may be physical or wireless. It is named after French telegraphic communications pioneer J. M. E. Baudot (1845–1903). It is a rarely used term nowadays, and is replaced by bps (bits per second), which is not quite the same thing.

*(See Modem.)*

**BBC BASIC** A version of BASIC introduced with the BBC micro-computer in 1982. It supported structured programming where top-down analysis could be used design and develop software.

## BBC procedures

BBC BASIC procedures are defined using the syntax:

```
100 DEF PROCTRANSFORM
110 FOR X%=1 TO 2
120 INPUT A%(X%)
130 NEXT
150 ENDPROC
```

## BBC functions

BBC BASIC functions have the syntax:

```
100 DEF FUNCTION(X%)
110 INPUT X%
120 ENDFUNCTION
```

## BBC variables

BBC BASIC supports global and local variables, which may be

- integer

```
100 A%=100
```

- floating point

```
100 X=125.23
```

- string

```
100 INPUT$="Please enter the time."
```

## BBC loop structures

A for ... next loop:

```
100 FOR X%=1 TO 2
120 INPUT A%(X%)
130 NEXT
```

A Repeat ... until loop:

```
100 REPEAT
120 INPUT A%(X%)
130 UNTIL A%(X%)= 100
```

## BBC arrays

Two-dimensional string and numeric arrays (with two rows and 1000 columns) are defined thus:

```
100 DIM A$(2,100)
110 DIM A%(2,100)
```

## BBC comments

Program comments have the REM prefix

## BBC reserved words

Built-in functions include `ABC`, `SIN` and `COS`.

(NB. Several BBC BASIC emulators for the PC may be found on the Internet.)

*(See Visual Basic.)*

**BBS (Bulletin Board Service)** A dial-up service that is independent of the Internet. It can be used for publishing information, distributing files and electronic conferencing.

**BCPL (Basic Combined Programming Language)** A high-level programming language, BCPL was designed by Martin Richards in 1967 as a compiler-writing and system programming tool. It was based on CPL (Combined Programming Language), which was developed jointly by Cambridge and London Universities. BCPL is a forerunner to C and C++.

*See: BCPL the Language and its Compiler, Martin Richards and Colin Whitby Stevens, Cambridge University Press 1980.*

*(See C, C++, Java, JavaScript, VBScript and Visual Basic.)*

**Bend** A bend in an optical fibre results in increased attenuation. Such losses can be used to determine the degree to which a fibre is bent. This forms the basis of operation for many gloves and suits used in VR, where the fibres run along the lengths of fingers or limbs.

*(See LED and Optical fibre.)*

**BER (bit error rate)** A measurement of how error-free the storage or transmission of data is. Typically expressed as the average number of bits in which one bit-error will occur. CD-ROM has appropriate error detection and correction codes. In Mode 1 CD-ROM data blocks, 4 bytes are reserved for error detection and 276 bytes are reserved for error correction. The three layers of error detection and correction integrated in the CD-ROM format include CIRC, EDC and ECC. Typically the bit error rate of CD-ROM equates to  $10^{-18}$ , which amounts to one error for every 1 000 000 000 000 000 000 bits.

**Berners-Lee, Tim** The original architect of the World Wide Web, and inventor of its accompanying HTML (Hypertext Markup Language). The birthplace of HTML is considered to be CERN in Geneva. These origins led the original server to be referred to as the CERN server. The conceptual birth of the Web might be accredited to the visionary Vannevar Bush through his momentous article, 'As We May Think'. Theodore Nelson is also significant (but much more contemporary), through his work *Literary Machines* and the project Xanadu. If Vannevar Bush and Ted Nelson were responsible for putting forward the concept of the Web, then Tim Berners-Lee must be considered its architect.

*(See HTML, HTTP, IP, Web and Xanadu.)*

**Beta copy** A test copy of a software product that has yet to be com-

mercially released. Usually beta copies are distributed externally to beta test sites.

*(See Alpha.)*

**Bi-directional** 1. A highly compressed frame in an MPEG-1 data stream. *(See MPEG\*.)* 2. A link which offers upstream and downstream data transmission. 3. A link in an information structure that can be followed in either direction.

**Bi-directional link** A link in a hypertext-based information structure, such as a Web application, which may be followed in either direction.

**Big Blue** A nickname for IBM. It originates from the fact that early IBM mainframes were painted blue.

**Binary** A counting system comprising only two states, either '1' or '0'. All electronic files are stored in binary form. Binary files generally contain executable programs and program data.

**BIOS (Basic Input Output System)** A program stored in firmware on all PCs which includes low-level code for implementing I/O operations, startup code and the setup program. The setup program permits the system to be configured, and is invoked by pressing a specific key (possibly Del or F1) during the memory check when the system is booting.

**B-ISDN (Broadband ISDN)** An access technology that offers a wider bandwidth than conventional (narrow bandwidth) N-ISDN, which offers data transfer rates of 64 Kbps per single connection. Low-end B-ISDN implementations include multiple 64 Kbits/s channels. For instance video-conferencing architectures that feature full motion, full-screen video might include  $6 \times 64$  Kbps channels, yielding a collective bandwidth of 384 Kbps. *(See Access technology and ISDN.)*

**Bit** A single indivisible item of binary data that might be '1' or '0'.

**BitBlit** 1. BIT-Block Transfer: a method of copying areas of an image from one point to the next. 2. BIT-Boundary Block Transfer: a Windows GDI (Graphics Device Interface) function that moves rectangular geometric shapes such as windows and dialogue boxes.

**BitEdit** An 8 bit bitmap editor supplied with Video for Windows (VfW) and Asymetrix Multimedia ToolBook.

## Bit error rate

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**Bit error rate** (*See BER.*)

**Bitmap** An image represented by pixel data which defines each pixel. The pixel data is referred to as a bitmap. Can provide intricate control over graphics, resulting in high quality.

(*See DCT, Image compression and JPEG.*)

**Bitmapped display** Graphic controller and display partnership, where pixel data representing each pixel is stored in memory

(*See Bitmap.*)

**Black box** A conceptual view of software or hardware, where the internal architecture and operation are ignored. All that is considered are input and output values.

**BLOB (Binary Large Object)** An item of binary data that is of no specific type, but is identified simply as containing some sort of digital data. It may be a graphic, a video file, a midi file, a wave audio file, a program file or any type of digital data. PC database programs that support the BLOB field type include Paradox for Windows, which can be used to create databases of video files.

(*See DBMS and OODBMS.*)

**Block** 1. A segment of code that is enclosed within opening and closing braces ( { and } ). 2. A block of 2352 bytes on a CD/CD-ROM track.

(*See CD-ROM.*)

**Block address** (*See Absolute addressing.*)

**Blue Book** A specification for multi-session CDs which was announced by Sony, Philips, Apple and Microsoft.

(*See CD-ROM.*)

**BMP** A graphics file format that tends to lead to larger files than more compressed variants such as GIF and JPEG.

(*See GIF and JPEG.*)

**BNC** A connector consisting of a round socket and plug which are locked together with a twist. It was invented by the engineers Neill and Concelman at Bell Laboratories.

**Body suit** An item of clothing that provides a means of interfacing a user with a virtual or synthesised environment. It permits user interaction to varying degrees that extend from giving simple hand signals to grasping and manipulating virtual objects; it may also provide a means of stimulating the user's sensory organs through changes in temperature, pressure, moisture levels and so on. It may be used for:

- telepresence and telemanipulation
- computer-aided design
- computer games
- translating sign language into speech
- researching the effectiveness of manual or semi-automatic processes so as to refine ergonomic environments and minimise the risk of RSI (Repetitive Strain Injury)
- sports medicine.

Low-specification suits simply sense the flexing of limbs and fingers using silica fibres of the sort commonly used for data transmission and telephone networks. A silica or optic fibre is embedded along the length of jointed limbs. The operation hinges on the fact that the losses experienced by a beam of light propagated in a silica fibre increase when the fibre is physically bent. The resultant varying signal is referred to as bend information. The light sources use LEDs (light-emitting diodes). More highly specified variants include a greater number of optic fibres or flex sensors to relay a greater number of movements. These will also contain a detection system that provides the spatial 3-D coordinates of the entire suit. The level of sophistication can extend to integrated transducers that sense angular rotation in three dimensions, temperature, pressure and moisture. Tactile feedback devices might also be included in the form of inflatable bladders.

(See *LED*, *Optical fibre* and *VR*.)

**Bookmark** A marker inserted at a specific point in a document so that it may be revisited with ease.

**Boolean** A variable type that has one of two states: either yes or no. Named after Irish mathematician George Boole who pioneered logic-based *Boolean algebra*, these variables feature in programming languages, search engines and databases. AND, OR, NOR, NAND and NOT are Boolean operators. They are also logic gates used in electronics and in the architecture of digital components, and their behaviour can be described using a truth table. A truth table is a simple table which shows the output obtained for each and every combination of inputs.

## **Borland**

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### **Borland**

*(See C++ and Inprise.)*

**Borland Turbo C++** An implementation of C, based on the object-oriented programming (OOP) model.

*(See C++, Java, Object\* and OO\*.)*

**Bottom-up analysis** A design approach, where the process begins with the design of low-level components and progresses to the design of higher level components.

*(See Top-down analysis.)*

**Bps (bits per second)** A measurement of data transfer rate. Modems are frequently specified in terms of their data transmission and reception speeds.

*(See Modem and V standards.)*

### **BRI ISDN (Basic Rate Interface Integrated Services Digital Network)**

An access technology that provides two 64 Kbps bearer (B) channels, and one 16 Kbps data (D) channel for signalling. The B channels carry user data. ISDN drives improvements through voice telephony, Internet access and videoconferencing. Internationally agreed ISDN standards are maintained by the ITU. International ISDN standards include:

- North America – National ISDN-1AT&T 5ESS
- Europe – Euro ISDN (CTR 4)
- Japan – INS-64
- France – VN-3
- Australia – AUSTEL TS013

*(See ISDN.)*

**Broadband** A term used to describe access technologies and networks that typically offer bandwidths of 2 Mbps and more, though some narrower bandwidth networks and access technologies may also be described as broadband. Broadband offers high-speed data transfer and is useful for multimedia networks.

*(See Access technology, ATM and ISDN.)*

**Broadcast quality** 1. A video recording whose quality approximates that of broadcast television. *(See MPEG\*.)* 2. A camcorder able to provide video recordings that are considered broadcast quality.

**Brondmo, Hans Peter** A Norwegian computer specialist credited with the

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invention of the motion icon (micon). He is believed to have invented it in 1989 at MIT (Massachusetts Institute of Technology).

*(See Micon.)*

**Browse (browsing)** A process of following the intricate paths through a hypertext-based information structure. The user passes to and from nodes or objects. In the context of the Internet, it has come to be known as surfing. It normally takes place at the micro-level but can also exist at the macro-level, where the user may be described as navigating as opposed to browsing. The line that divides navigating from browsing is made clearer by considering the difference between a walker and a motorist. The motorist gains a high-level view of travel, and is thus navigating. The walker's experience of a journey is infinitely more detailed, hence the walker is browsing.

*(See Browser, Client, Microsoft Internet Explorer and Netscape Navigator.)*

**Browser** An application that permits the user to browse the World Wide Web. The most popular Web browsers are Netscape Navigator and Microsoft Internet Explorer. Earlier implementations include Cello and Mosaic. A modern browser allows users to:

- add Web sites/pages to an address book
- navigate backwards and forwards through visited Web pages
- open a URL, which is entered using the keyboard
- playback streaming audio and video using a plug-in or ActiveX control
- playback streaming multimedia using an appropriate plug-in or ActiveX control
- send e-mail messages, though a browser is not an e-mail client/application
- specify various preferences including the appearance of Web pages when displayed
- open HTML files that might be local or remote
- chat in real-time using an appropriately enabled browser
- view Web pages that contain Java applets (using a Java-enabled browser)
- download files
- make telephone calls over the Internet using an appropriate Web phone
- take part in videoconferences using appropriate hardware and software.

*(See ActiveX control, Client/server, Java and Videoconferencing.)*

**BT (British Telecom)** A UK-based international telecommunications operator (or telco). It evolved as a state-owned enterprise, but was privatised in the 1980s.

## **BTLZ**

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**BTLZ (British Telecom Lempel-Ziv)** A data compression technique synonymous with modem-based data communications. It can be assumed to yield a compression ratio of around 4:1.

(See *Compression*.)

**Buffer** A quantity of RAM (Random Access Memory) that improves the rate at which data may be transferred between computers and peripheral devices.

(See *Queue*.)

**Bug** A hardware or software fault. The term was originally coined by Grace Hopper, a computer pioneer who did much work in developing valve computers and high-level languages. Using the Harvard Mk 2 computer she discovered a hardware fault caused by a moth caught between the contacts of a relay. After debugging the system, the unfortunate moth was entered in the computer's log at 15:45, 9 September 1945. The process of authoring or developing multimedia often requires extensive testing and debugging.

**Build** 1. A version number which denotes the version of a program or operating system. It is interchangeable with the term *development build*. 2. A word used to describe the process of developing hardware or software.

**Burst mode data transfer** 1. A heightened volume of data traffic over a network. 2. The maximum unsustainable data transfer rate from a CD-ROM drive. It is many times greater than the average data transfer rate, and is sustainable for a limited period only.

**Bush, Vannevar** A science advisor to President Roosevelt. He put forward a paradigm for information storage and retrieval in the 1940s. He may be considered the originator of the Internet concept, and of the 'relational model' for storing and retrieving information. His name, therefore, is linked with standalone multimedia as well as with multimedia on the Internet. Principal facets of the Internet such as the World Wide Web (WWW) and the many hypertext-based navigation and browsing tools have their origins in Bush's vision. His momentous article 'As We May Think' covering what he called Memex was published in *Atlantic Monthly*. Hypertext evangelist Ted Nelson admitted publicly that he may have read this article.

(See *Hypertext, Web and Xanadu*.)

**Business audio** A program that permits you to control a computer using voice commands. It is possible to do the same with dictation systems such as

IBM ViaVoice. Depending upon which system is used, you may also have proofreading and text-to-speech capabilities. Microsoft Windows Sound System is a typical example of a business audio system. Modern business audio tools are voice-independent.

*(See Speech recognition, Wave audio and ViaVoice.)*

**Business system engineering** A collective term used to describe the processes of implementing business system, which fulfils an enterprise's requirements. The business system includes:

- business processes
- IS (Information Systems)
- personnel.

**Button** An active area on a screen, which may be an iconic representation of an option, feature or application. Windows buttons are labelled with appropriate identifying text such as Close or OK. Using visual programming tools, buttons can be created simply by drawing them on screen. Once drawn they become objects that can be moved or copied. Their colour, frame thickness, fonts and other attributes can be altered, usually by right-clicking them and selecting from the options presented. As is the case with all event-driven applications development tools, the button is responsive to a mouse click. Its behaviour or response to such an event is determined by its method, which usually takes the form of a short segment of code. The method or code might run a video clip, for instance. Buttons can also be selected using the keyboard, usually by pressing the Alt key together with an appropriate letter that corresponds to a letter in the button's label. Using development tools such as MS Visual Basic, you simply draw buttons and then add methods (code) to them, thus determining their behaviour.

*(See ToolBook and Visual Basic.)*

**Byte** 1. A piece of digital information that is eight bits in length. 2. A computer magazine (*BYTE*) published by McGraw-Hill.

**Bytecode** A machine language used by virtual processors for interpretation and program execution. Such programming languages include the OO variants Java and Smalltalk. These languages are suited to heterogeneous environments, and may therefore be deployed effectively over the Web as applets. The virtual processor physically exists on the client, is implemented in software and is independent of hardware and accompanying operating systems. Bytecode may not be as responsive as native code components, where perhaps an ActiveX control is running on a Windows platform.

## Bytecode

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However, any performance difference may be eradicated through the hardware implementation of the virtual processor on the client system, in which case it ceases to be virtual.

*(See Java, Java Virtual Machine\* and OOP.)*