dictionary of multimedia and internet applications: a guide for developers and users. francis botto

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M

MacGregor, Scott A member of the ISG (Interactive Systems Group) at Microsoft assigned with the task of developing the GUI that came to be known as Windows.

Macintosh *(See Apple Macintosh.)*

Macintosh Classic Reincarnation of the Apple Macintosh computer originally launched in 1984, supplied with HyperCard, integral mono monitor, based on a Motorola 68000 running at 8 MHz, supporting 1 to 4 Mbyte RAM, containing no expansion slots as standard, but with AppleTalk network capability and SCSI controller.

Macro A short program or series of instructions. Macros are useful for automating processes, or for performing tasks that would otherwise take a great deal of time to implement. Typically macros are written when the user interface is restrictive for a given task or for particular usage habits. They are also written when there is no predefined command or option that will perform a desired task. Sometimes certain predefined macros can be improved upon or edited so as to perform different tasks. Sophisticated word processors such as Microsoft Word, WordPerfect and Word Pro have indigenous macro languages. Standard macro languages include Visual Basic for applications.

(See VBScript and Visual Basic.)

Macro level Links which exist at the macro level relate comparatively large documents or 'chunks'. They are said to exist at a high level, forming part of the chunk-based model of hypertext and hypermedia.

Macromedia Director A tool used to create interactive movies; it is produced by Macromedia. The resulting productions may include Lingo

scripts, and may be deployed over the Web using Macromedia Shockwave technology.

(See Lingo, Shockwave and Streaming.)*

Macromedia SoundEdit A wave file recorder and editor.

Macromedia xRes A graphics program that provides a number of manipulation tools.

Magazine drive A CD-ROM or DVD drive capable of reading from a number of discs. It may provide an inexpensive alternative to daisychaining.

(See CD-ROM and DVD.)

Magnetic tape A cost-effective means of storing large amounts of data where random access is not required, for example for data backup, archive purposes, and submission of CD-ROM data to replication companies. Used to back up hard disks, tape streamers offer a safety net in the event of a catastrophic system failure. Subsequent data recovery simply involves reading the tape contents back to a functioning hard disk.

(See ZIP.)

Mail bomb An e-mail message which contains a virus or other entity likely to be hostile to receiving systems, which include servers and clients.

(See Security.)

Mailing list An electronic forum using e-mail to exchange information.

`main ()` A C++ program must have a **`main ()`** function, which begins and ends with open `{` and close `}` braces. This is the first function called when the program is run, and can be used to define variable types.

(See C++.)

Mainframe A powerful computer that typically offers centralised processing, serving a number of connected dumb terminals. In terms of its positive characteristics, a modern mainframe may:

- process data at speeds beyond those attainable on desktop systems and those based on conventional 32 bit and 64 bit processors, which might be CISC or RISC
- provide long-term archiving of data
- be a massively parallel processing (MPP) architecture, where processes are run concurrently, offering efficient scalable processing
- offer industrial strength operation through robust operating systems and applications

- provide easy diagnosis of faults, as they are isolated to the network or to the mainframe itself, though the mainframe with all its electronics and mass storage remains a complex fault diagnosis domain
- provide effective migration paths to client/server architectures
- prove a more durable IT solution in terms of longevity, because mainframe technology advances more slowly than microcomputer technology.

The key disadvantages of mainframe computers revolve around the following factors:

- high initial cost
- high cost of ownership brought about by comparatively high maintenance and servicing bills
- fault tolerance is at a low threshold, because a mainframe fault may render an entire IT solution inoperable. However, the fault tolerance of the connected mass storage (which may be shared) might be high
- the dumb terminals are typically green-screen, but there is scope for renovation *(See Application renovation.)*
- mainframe languages like COBOL tend to be old-fashioned, though this is a changing situation.

(See PC.)

MAPI (Messaging Application Program Interface) A standard that permits e-mail messages to be sent from any application. Originally developed by Microsoft, it is a DLL containing C functions that allows developers to exploit Windows messaging. Calls to the DLL may allow applications to be given e-mail functions.

Marquee A Microsoft ActiveX Control which scrolls a message across the bottom of Web pages. The messages might be promotions, adverts, announcements etc.

(See ActiveX.)*

Mass storage device A device used to store data. Can be assumed to be magnetic, optical or magneto-optical.

(See CD-ROM, DVD, Hard disk and RAID.)

Master disc A glass disc from which CDs are manufactured.

Mastering system A system used to produce a glass master disc or CD master which is used in the replication of CD-ROMs and CDs.

Master/slave processing An architecture where a master computer is connected to slave (intelligent) computers, which are connected to dumb

terminals. Processing is distributed from the master computer, which can be assumed to be a mainframe, to the slave systems.

(See Client/server.)

Maximise A process by which an application or document window is enlarged to a size that might extend to that of the full screen size. Windows application and document windows contain a Maximise button near the top right-hand corner; a Maximise option also exists on the Control menu, which is invoked by clicking the Control button/icon in the top left-hand corner of the window.

(See Minimise.)

Mbone (Multicast backbone) A virtual infrastructure to deliver multicast packets over the Internet. It is composed of tunnels and provides limited bandwidth, but enough for audio/visual data. A restriction mechanism integrated in MBONE routers or mrouters drops packets over tunnels where a predefined threshold rate is exceeded. Mrouters forward multicast packets to specified destinations. The Mbone topology maps are available at www.cs.berkeley.edu.

(See IP multicast and www.cs.berkeley.edu.)

MCA (Micro-channel Architecture) A standard 32 bit PC expansion bus developed and introduced by IBM in mid-1987 as part of its PS/2 (Personal System) range of computers. The launch of the PS/2 is also remembered as providing the PC with an analogue graphics port through VGA (Video Graphics Array) and MCGA (Multi-Colour Graphics Adapter). It also marked the introduction of OS/2 1.0 with its GUI (Graphical User Interface) in the form of Presentation Manager.

(See Local bus.)

MCI (Media Control Interface) An interface commonly referred to as the Windows multimedia extensions; it is integral to the Microsoft Windows multimedia extensions built into Windows 3.1 (and higher). There is a suite of drivers together with a command set able to control connected MCI-compliant multimedia devices.

MCIS (Microsoft Commercial Internet System) An evolving suite of servers used to architect Web solutions. The servers are Windows NT-compliant, and include:

- Address Book
- Chat
- Content Replicator

- Internet Locator
- MCIS Mail
- MCIS News
- Membership
- Merchant Server
- Personalisation.

(See Address Book, Chat, Content replicator, Internet Locator, MCIS Mail, MCIS News, Membership, Merchant Server and Personalisation.)

MCIS Mail A Windows NT-based server which can be used to implement mailboxes across multiple Web sites. DPA (Distributed Password Authentication) and SSL (Secure Sockets Layer) are supported. E-mail protocol support includes:

- POP3 (Post Office Protocol)
- SMTP (Simple Mail Transfer Protocol)
- MIME (Multipurpose Internet Mail Extensions).

(See DPA, MIME, POP3, SMTP and SSL.)

MCIS News A Windows NT-based server which is part of the MCIS and supports electronic conferencing and newsgroups. It supports the NNTP (Network News Transport Protocol) together with its extensions.

(See MCIS.)

MDI (Multiple Document Interface) A user interface in which each document occupies its own window.

Media Player A Windows program able to play a variety of different media files. With the appropriate driver selected and installed using the Control Panel it can be used to play various different media types including:

- CD-DA
- Midi files
- Wave (.WAV) files
- Video files.

When launched it shows controls common to typical audio/visual appliances, including Play, Pause, Stop and Eject. Finer control over playing various media files and tracks is provided by a horizontal scroll bar.

(See Video and Wave audio.)*

Media type A conduit for communicating information. Speech, text, audio, still images, computer animations and video are media types. The balance of multimedia elements (or media types) is determined by content,

volume of multimedia material, budget, the authoring station used and the delivery systems targeted.

Megabyte (Mbyte, MB) A megabyte (Mbyte) equates to 1024 Kbyte. Sometimes it is wrongly referred to as 1000 Kbyte, as is the case when some manufacturers specify hard disk data storage capacities. Derived from 20 address lines resulting in 2^{20} (1 048 576) memory addresses.

Meiko *(See MPP and Transputer.)*

Membership A Windows NT-based server which is part of the MCIS and allows visitors to become members of your site.

(See MCIS.)

Memex An information and storage system concept which was put forward in the 1940s by the visionary Vannevar Bush, Science Advisor to President Roosevelt and administrator of the wartime Manhattan Project. He believed that all published information should be made available through access points, and clearly set out the advantages of association through links. Calling the system Memex, and describing it as a sort of private file and library, he thought that some kind of workstation would be used with user-interaction accommodated through mechanical levers. If there were errors in his vision, they were a total underestimation of the sheer quantity of information that would be published in the future, and an overestimation of the technology of the day, i.e. microfilm, facsimile and telegraph. It was Bush's misfortune to live in the era of valves. The solid state transistor had yet to be invented, and it was some thirty years before the first reasonably sophisticated microprocessor was made commercially available. As such, Memex remained in the minds of a select few.

(See As We May Think, Bush, Vannevar, Hypertext, Multimedia, Web and Xanadu.)

Merchant Server A Windows NT-based server which is part of the MCIS and permits the construction of virtual shopping sites. *(See E-commerce and MCIS.)* The server consists of a:

- Controller, which is used to define language, currency, date and other preconfigurable parameters
- Router, which is an ISAPI (Internet Service Application Programming Interface) DLL. This routes requests from the client to relevant parts of the Store Server, and routes responses to those requests back to the client browser

- Store Server, which is the system's backbone, and functions to implement tasks such as order requests and to interact with the backend database.

The Merchant Server can be used to implement sites which allow customers to:

- peruse product databases
- purchase items using a shopping cart metaphor
- receive e-mail confirmation of orders placed.

The Merchant Server permits the vendor to:

- query customer details and purchase habits
- conduct promotions
- conduct marketing campaigns
- create membership accounts using IDs and passwords
- offer membership discounts
- integrate ActiveX, OLE and COM components into the server
- use ODBC-compliant databases
- secure credit card transactions using the SET (Secure Electronics Transfer) protocol together with Verifone's vPOS application.

(See Server.)

Message A request sent from one object or component to another, commonly used in OO systems. The message will be of a standard or proprietary format, with address information and appropriate data. The messages might require an acknowledge message before the originating component may continue processing. OO client/server architectures use messages and underlying protocols as their collective glues.

(See Glue.)

Message format A template for a message, which includes headers and user data payload.

Metadata A term used to describe data that indicates the information types and subjects. The data may be stored in an information storage and retrieval system. In the context of the Web, metadata such as indexes and URLs are gathered and stored by search engine implementations. This provides clients with the ability to search and retrieve documents from the Web.

(See Search engine.)

Metaphor An emulation or representation of a process or entity. A flat file database can be a card-box metaphor, for example. Equally, a GUI can be a desktop metaphor.

Method An item of code (or procedure) attached to an object. It defines the object's behaviour in terms of how it will respond to an expected event such as a mouse click, and to other stimuli. Other events might be the reception of messages from other objects, and the underlying methods might interpret them and initiate an appropriate response. The response might be an acknowledge message or a return value such as the contents of a variable.

(See Java, OOP, OpenScript and Visual Basic.)

MHz (megahertz) A measurement that equates to one million cycles or pulses per second. It is commonly used to describe the clock speed of computers, thus providing an indication of speed of operation. A 50 MHz machine will therefore yield 50 million clock cycles per second, and a single clock cycle will have a duration of 1/50 000 000 of a second.

Micon (Motion icon) An animated icon represented by a number of frames run in a continuous loop. Invented by Hans Peter Brondmo, these manifest more clearly the purpose, feature, application or program to which options lead. Micons manifest more clearly the information, features or applications to which screen options are tagged. It is reasonable to assume that they will consolidate with the current (commercial) user interface approach, coexisting for some time with the generally accepted buttons and icons.

Microbend A bend in an optical fibre link, which increases attenuation.

Micro-channel Architecture *(See MCA.)*

Microcomputer A computer in which the circuitry making up the CPU is accommodated on a single chip.

(See Mainframe, MPP, Pentium, Processor and SMP.)

MicroJava A processor from Sun Microsystems which is optimised for the Java programming language. It is used in network devices, telecommunications hardware and consumer games.

(See Java and Sun Microelectronics.)*

Microsoft A large software producer and vendor which was founded jointly by Bill Gates and Paul Allen. Microsoft is a leading computer software company targeting mainly the PC platform. Its best known products are Windows, Microsoft Office and the MS-DOS operating system. It also produces multimedia titles, and has recently extended its operations to the Internet through the Microsoft Network (MSN) and numerous related ventures.

Microsoft ActiveX SDK An SDK dedicated to the creation of ActiveX controls, compatible with Visual C++ 4.2 (or higher).

(See ActiveX.)*

Microsoft Beethoven: The Ninth Symphony A multimedia transcription of Beethoven's famous symphony which is recorded using Red Book Audio. It embodies a detailed interactive dissection of the work as well as a biography of the composer.

Microsoft CD-ROM extensions (*See CD-ROM extensions*.)

Microsoft Cinemania A multimedia title that provides a database of mainstream movies. It embodies theme tunes, movie excerpts, movie stills, photographs of popular actors, and biographies of actors and directors.

Microsoft Commercial Internet System *(See MCIS.)*

Microsoft Design-Time Control SDK An SDK that is used to create Design-Time ActiveX Controls, which, as their name suggests, are active only during design. The resulting controls may be used with FrontPage, InterDev, Visual C++, Visual Basic etc.

(See Microsoft FrontPage, SDK and Visual InterDev.)

Microsoft DirectX SDK A toolset that is used to develop multimedia elements, which includes:

- Direct3D for three-dimensional graphics
- DirectDraw for 2-D graphics
- DirectInput for connectivity to input devices such as joysticks
- DirectSound for exploiting sound card/software capabilities
- DirectPlay for connecting to remote applications.

Microsoft Encarta A multimedia encyclopaedia.

Microsoft Forms 2.0 ActiveX Control A suite of ActiveX Controls included in Visual Basic Control Edition.

(See Visual Basic Control Edition.)

Microsoft FrontPage A Web page development package marketed and sold by Microsoft, which:

- includes Explorer, which is used to display the navigation scheme integrated in Web pages
- includes Editor, which is used to design Web pages
- includes Web Server, which is used to publish and test Web pages before their deployment over the Internet or a compatible IP network

- can be used to integrate ActiveX controls and Java applets in Web pages
- does not require programming skills
- can be used to create Web pages that interact with ODBC-compliant databases
- includes the Server Extensions, which are building blocks for driving predefined functionality gains through your Web site implementation.

FrontPage is bundled with Windows NT Server, and is also available separately.

(See PWS, ToolBook, Visual InterDev and Web Server.)

Microsoft GIF Animator A Microsoft animation program which can be used with the Microsoft Image Composer.

(See Animation and Autodesk Animator Pro.)

Microsoft Index Server A search engine which may be used to find information on a Web site. It is included with Microsoft IIS, as is the Crystal Reports reporting engine.

(See Crystal Reports and IIS.)

Microsoft Internet Client SDK A comprehensive set of tools, components and utilities for ICPs, Internet developers and Web authors.

Microsoft Internet Explorer *(See Internet Explorer.)*

Microsoft Internet News A technology which allows Web browser users to subscribe to newsgroups, submit messages and read messages. Microsoft Internet News is invoked from Internet Explorer by selecting Read News on the Go menu.

(See Internet Explorer.)

Microsoft MDK (Multimedia Developers Kit) A collection of tools that may be used to develop sophisticated multimedia titles.

Microsoft NetShow A streaming technology server which may be integrated into a Web site/application. Its inclusion results in the ability to serve client browsers with streaming audio, video and multimedia. Web site and Web application developers may integrate it into IIS-based Web application solutions.

(See ASF, IIS, Multimedia and Streaming.)*

Microsoft Office An integrated software package, which features the following applications in some or all versions of the package:

- Word word processor
- Excel spreadsheet
- Access database
- Outlook contact management program
- PowerPoint presentation program.
- Publisher desktop publishing program

(See Application software, Microsoft and Windows.)*

Microsoft Office for Developers A development solution for building and distributing Office-based business solutions.

Microsoft Proxy Server A server implementation which may be used to deliver Internet access across an enterprise. The Internet Service Manager is used to manage the Proxy Server as well as the Chat and Mail servers. The Microsoft Proxy Server:

- is compatible with Intel and Risc platforms
- uses caching algorithms to optimise access to LAN data
- includes an Auto-dial features that connects the user with the ISP if the user's requested data does not reside in the cache
- assigns users with access rights to specified Web sites.

(See Server.)

Microsoft SDK for Java A superset of the JDK, it includes Microsoft class libraries, a JIT compiler and the Microsoft Virtual Machine for Java.

(See Java.)*

Microsoft SQL Server A relational database management system (RDBMS) which provides multi- and concurrent user access to enterprise data. The Microsoft SQL Server's utilities include:

- SQL Enterprise Manager, which provides management features
- SQL Service Manager, which provides start and stop functions
- Interactive SQL for Windows, which permits sessions with multiple SQL servers
- SQL Security Manager, which provides access to security features
- SQL Setup, which can be used to upgrade MS SQL Server, as well as to change default settings
- SQL Client Configuration Utility, which is used to manage SQL Server client software configurations
- SQL Performance Monitor, which offers performance readings
- SQL Server Web Assistant, which permits the generation of Web pages that use SQL Server data
- SQL Trace, which is used to track SQL Server user habits.

(See Server.)

Microsoft Transaction Server A transaction manager. A Microsoft solution for integrating transaction processing in Web applications. Its component architecture includes:

- Transaction Server Explorer, which is used for administration and management purposes
- Transaction Server Executive, which is a DLL providing functions used by the application's server components.
- ActiveX Server Components, which is used to deploy ActiveX server components
- Server Process, which hosts the application's components
- ODBC Resource Dispenser, which manages database connectivity
- Shared Property Manager, which gives access to a Web application's properties
- Microsoft Distributed Transaction Coordinator, which coordinates transactions, and is integrated in Microsoft SQL Server 6.5

Other transaction managers include CICs and Encina.

(See ACID and Server.)

Microsoft Video for Windows (VfW) *(See Video for Windows.)*

Microsoft Visual Basic (*See Visual Basic*.)

Microsoft Web Wizard SDK A tool that can be used to create Wizards which can be used to build Web sites using tools like FrontPage and Visual InterDev. Tools created using the Design-Time Control SDK can be used with the Web Wizard.

Microsoft Windows *(See Windows.)*

Microsoft Windows CE (Compact Edition) A version of the Windows OS designed for palmtops, organisers and other small-scale systems, including those targeting the consumer market.

Microsoft Windows Sound System A business audio system and proprietary sound system standard for the Windows environment. The full implementation consists of a 16 bit sound card, microphone and a suite of Windows applications. Many sound cards and sound features offer compatibility with the Microsoft Windows Sound System standard.

(See Speech recognition and ViaVoice.)

Microwave radio Short wavelength radio waves that have a frequency above 1000 MHz (1 GHz).

Middleware 1. A software implementation or glue which exists between the client and the server. It makes the network protocols and other server workings transparent to the client. (*See Glue.*) 2. Database middleware connects client applications with back-end applications, and consists of:

- an application programming interface (API)
- network and database translators.

(See Glue.)

MIDI (Musical Instrument Digital Interface) An industry-standard file format and specification for producing and playing electronic music using computers and compatible devices such as MIDI keyboards and MIDI guitar interfaces. It covers hardware, cables, connectors, data protocols (MIDI messages) and file formats. The single most significant advantage of MIDI is the compactness of the resultant so-called MIDI song files. These consume a fraction of the data capacity required by digitised wave form audio such as .WAV files. A one-hour stereo MIDI file may consume around half a Mbyte. Even using compression techniques, an equivalent .WAV file would consume literally hundreds of Mbyte.

(See Sound card and Wave audio.)

MIDI sequencer A program used to create or edit MIDI files. Midisoft Recording Session is a popular sequencer program supplied with numerous sound cards. In many respects it is a typical sequencer offering the sorts of editing facilities commonly found in similar programs. You can cut or copy selected tracks from one recording and paste them into another. At a much lower, and detailed, level you can add, copy, cut and delete musical notes.

(See MIDI.)

MIDI studio A system consisting of hardware, software and (usually) an interfaced musical instrument, which is most often a keyboard. The first thing you need to create your own MIDI studio is an appropriate sound card. The software required to create and edit your own MIDI songs is called a sequencer. Almost all sound cards come with a MIDI sequencer. You may get the Midisoft Recording Session MIDI sequencer or CakeWalk. The final piece of hardware required is a MIDI keyboard, which provides an easy method of entering sequences for the various MIDI tracks. Companies such as Roland and Yamaha are famous for the manufacture of MIDI keyboards, and it is certain that your local music store has a range of their MIDI compliant keyboards.

(See MIDI.)

MIME (Multipurpose Internet Mail Extensions) A standard specification which permits e-mail messages to include multimedia elements. It supports:

- ASCII alternatives, such as foreign language character sets
- images
- multiple objects
- audio
- video
- PostScript.

Included in served files is a MIME code, which has a type and subtype denoting the media included. Types of media such as HTML and GIF may obviously be displayed by any browser. Others, such as MPEG video, require HELPER programs. MIME was developed by Nathaniel Bernstein of Bellcore and by Ned Freed of Innosoft.

(See E-mail.)

Mini disc A recordable audio digital distribution medium. It offers almost CD-quality sound. Physically compact, it consists of a 2.5 in diameter disc. It offers random access and is rewritable. It can be applied as a computer DSM.

Minimise A process by which a window containing an application or document is reduced to an icon or button. Windows application and document windows contain a Minimise button near the top right-hand corner; a Minimise option also exists on the Control menu, which is invoked by clicking the Control button/icon in the top left-hand corner of the window.

MIPS (Million Instructions Per Second) A unit for measuring raw computer/processing speed.

Mirroring A function of a hard disk controller that writes data to more than one disk drive simultaneously.

Mirror site An Internet site that duplicates the functionality of another site. Mirror sites help to provide an improved service for users by lowering usage demands on individual sites.

M-JPEG (Motion-Joint Photographic Experts Group) A type of video that uses individual frames compressed according to the JPEG algorithm. It gives full frame updates as opposed to the predominantly partial frame updates of MPEG-1 video. M-JPEG video therefore provides random access points and lends itself to non-linear editing. In this respect it is more

flexible on playback because applications can simply show any frozen frame of an M-JPEG sequence or play any selected frames of a sequence either backwards or forwards. Another advantage of M-JPEG is that it can be compressed into other formats, including MPEG-1/2. A principal disadvantage of M-JPEG, however, is its comparatively low overall compression ratio.

(See MPEG-1 and MPEG-2.)

MMX Technology A set of extensions (or additional instructions) that gives a processor improved multimedia performance. The Intel Pentium and Pentium II processors have MMX Technology. The addition of MMX results in dramatic performance gains in video and 3-D graphics. MPEG refused to adopt the whole of Intel's now obsolete DVI (Digital Video Interactive) technology as a video standard, allegedly causing Intel to abandon its initial plans for an Intel processor with built-in DVI functionality. Intel once announced that it would integrate the functionality of its i750 DVI chipset into a general-purpose processor design. However, the year of 1995 saw Intel unveil its MMX Technology, which is not an acronym but a trademark. MMX delivers performance gains to multimedia-, graphics- and video-related applications that range from 3-D animation programs to videoconferencing. The array of multimedia-related standards, such as those of the MPEG continuum and those that have yet to emerge, fits within the open framework that is MMX Technology. This gives ISVs the freedom to adopt current, emerging and even proprietary compression standards. MMX Technology delivers improved matrix manipulation through some 57 new instructions and gives higher levels of concurrency through Single Instruction Multiple Data (SIMD). Fred Pollack, an Intel Fellow (1997), once stated, 'Preliminary tests have shown performance benefits between 50 and 400 per cent, depending upon the application.'

(See DCT, MPEG and Pentium.)*

MNP 2-4 (Microcom Networking Protocol) A standard error correction protocol used in modem-based communications.

MNP 5 (Microcom Networking Protocol) A standard compression algorithm used in modem-based communications.

Modal A term used to describe interaction where the user moves between different modes of program operation. The multimedia authoring tool Asymetrix ToolBook is modal, in that the user switches between Read and Design modes.

(See OpenScript and ToolBook.)

Mode 1 and Mode 2 CD-ROM data block formats. Data blocks supported by all fully specified CD-ROM drives. One hour Mode 1 disc yields 527 Mbyte data capacity and Mode 2 gives 602 Mbyte data capacity. A Mode 1 data block will yield just 2048 bytes (2 Kbyte) user data, while Mode 2 offers 2.28 Kbyte user data.

(See CD-ROM and DVD.)

Modem (modulator/demodulator) A hardware device used for modulating and demodulating data normally received and transmitted over voice-grade communications systems. It may be:

- an internal modem that consists of an expansion card that plugs into the expansion bus
- an external modem connected to the serial port of a computer. It typically measures about 15 cm by 10 cm by 2.5 cm
- an external PCMCIA (Personal Computer Memory Card International Association) modem that is little bigger than a credit card.

A 56.6 Kbps standard analogue modem exceeds the proven bandwidth limit calculated using Shannon's theorem. The higher speed is achieved using PCM and a digital link between the telephone company and the ISP. 56.6 Kbps modems are asymmetrical, offering wider downstream bandwidths; thus downloading times are shorter than those of uploading. The ITU has considered two industry standards:

- X2
- K56flex

The resulting V.90 standard was specified provisionally and finally released in 1998. (*See 56 600 and Shannon's theorem*.) Important elements of a modem include:

- a processor or CPU that is responsible for processing commands and possibly for compression also
- a PROM (Programmable Read-Only Memory) variant used to store modem software such as the AT command interpreter. The specification of certain modems can be improved by upgrading the PROM
- a quantity of RAM (Random Access Memory) which may provide the dual role of buffering and assisting in data compression. (*See Buffer*.) RAM sizes typically vary from 4 Kbyte to 16 Kbyte
- a quantity of NVRAM (Non-Volatile RAM) in order to store AT command entries and S registers.

(See Access technology and Shannon's theorem.)

Moderator A person that checks all contributions to newsgroups before posting them.

MOLAP An OLAP implementation which supports Multidimensional Database Management Systems (MDBMS), which may be assumed to use proprietary data storage techniques.

(See Data warehouse, DBMS, OLAP and RDBMS.)

Monitor A display device used with computers, multimedia and digital video playback systems. Desktop systems may be assumed to include CRT (Cathode Ray Tube) displays, but increasingly flat-screen TFT displays are being used. Notebooks and other portable systems may be assumed to integrate LCD (Liquid Crystal Displays), TFT or DSTN display technology. The principal technical factors that dictate a monitor's specification are its:

- screen size
- supported resolutions
- non-interlaced and interlaced screen refresh rates (in the case of CRT-based designs
- supported number of colours, which is irrelevant with CRT-based designs.

(See Display.)

Moore, Gordon A founder of the Intel Corporation.

Moore's Law A law stating that the number of devices that can be integrated onto a single silicon will double annually. The founder of Intel Corporation, Gordon Moore, authored his law in the 1960s.

Morphing An animation technique where one image is evolved into another. Its full name is polymorphic tweening. Numerous commercial morphing programs exist. Using such programs, the first step in the creation of a morphing animation might involve loading two bitmaps. The animation program can then be used to produce an animation which merges one of the bitmaps into the other. Modern morphing programs for Windows are able to create animations in the .AVI format, so providing full compatibility with all fully specified presentation programs and multimedia authoring tools. Morphing animation effects provide a means of enhancing the appeal of many multimedia presentations and applications.

Mosaic An early Web browser, which originated from the National Center for Supercomputing Applications (NCSA). Modern Web browsers, which support Java and its variants, include Netscape Navigator, Microsoft Internet Explorer and HotJava.

(See Browser.)

Motherboard The principal electronic assembly within a computer. It accommodates the processor, RAM (random access memory), external memory cache, expansion bus and any co-processors that might be included. It may also include additional subsystems such as a hard disk controller, video controller and even sound facility. Many designs have old-fashioned ISA (Industry Standard Architecture) expansion slots which are used to connect expansion cards such as hard disk controllers and graphics cards. ISA was introduced by IBM in the 1980s to accompany the Intel 80286 processor, which was used in the IBM PC AT. The bus is 16 lines or bits wide and runs at a relatively slow clock speed of below 10 MHz. The ISA bus was not redeveloped by IBM to run faster; instead it introduced the now obsolete MCA (Micro-channel Architecture) bus, a 32 bit variant included in the IBM PS/2 range of systems launched in mid-1987. The PS/2 launch was a milestone in the history of video in the PC environment because it marked the beginning of the VGA (Video Graphics Array) standard through which the PC finally had been given reasonably advanced colour graphics through an analogue port. The MCA bus requires compatible expansion cards, whether they be graphics cards, video capture cards, CD-ROM controllers, or hard disk controllers. Such is the inseparability of the terms MCA and PS/2 that compatible expansion cards are advertised as PS/2 cards. In the late 1980s, around the same time that MCA was launched, nine major PC manufacturers referred to as the 'gang of nine' joined forces to develop the EISA (Extended Industry Standard Architecture) bus, which is a 32 bit bus. Many high end PCs use the EISA bus, for which highly specified expansion cards exist. The real key to opening up the expansion bus and tapping into the clock speeds of the processor's external data bus, however, came through the arrival of so-called local bus slots and ancillaries. Local bus standards emerged in the early 1990s through the VESA (Video and Electronics Standards Association), and so-called VLB (Vesa Local Bus) expansion slots are now common. Usually they accompany ISA slots, but they may also accompany PCI slots. A VLB graphics card will offer better performance than a comparable ISA variant, so widening the PC video bandwidth attainable. An alternative to VLB slots has emerged through Intel's PCI (Peripheral Component Interconnect) bus, which offers slightly better performance than VLB. Generally either local bus standard will suffice to make a system faster and better equipped for video playback, capture and editing. Certain motherboards feature ISA, VLB and PCI slots. To help speed up the processor a memory cache is provided. This can be either internal, forming part of the actual processor, or external, where it is included on the motherboard. External cache memory is of a static design and does not require the cyclic refreshment that normal dynamic RAM does. External cache memory sizes typically vary between 128 Kbyte and 1 Mbyte. In future it is possible

that external memory caches might be replaced by using interleaved system memory composed of static and dynamic RAM.

Mouse A hand-held input device. By dragging it on a flat surface one has a means of moving a screen pointer/cursor in both *x* and *y* directions. It is typically connected to the serial port, but may also be wireless. It has one, two or three push buttons that are used to make selections, either by pressing a button once (single-clicking) or by pressing a button twice in succession (double-clicking). The mouse is also used for dragging (moving) objects to move them from one point to another, or for resizing windows by dragging their borders. Dragging is carried out by holding down the mouse button above an object or window border and then moving the mouse appropriately. Modern notebook systems use mechanism-free touchpads instead of the traditional mouse.

MPC-3 (Multimedia PC) A multimedia hardware standard issued by the Multimedia PC Marketing Council. The initial specification, MPC-1, has advanced to become MPC-3, which includes MPEG video playback. The base case specification, which is normally exceeded, includes:

Processor

- 75 MHz Intel Pentium processor (or equivalent).

RAM

- 8 MByte.

Mass storage

- 3.5 in floppy drive.
- 500 MByte hard disk (uncompressed user data capacity).
- An average access time less than or equal to 20.2 ms.

CD-ROM

- Audio output and volume control.
- On-board buffers for read-ahead buffering.
- The ability to read the following disc formats: Audio CD, CD-ROM, CD-ROM XA, CD-I, PhotoCD, CD Recordable and Enhanced Music CD, and VideoCD.
- Supports an average data transfer rate of at least 550 Kbyte/s, and offers an average access time of less than or equal to 250 ms.

Sound card

- The ability to record and play stereo, 8 bit and 16 bit wave audio at the following sampling frequencies: 8, 11.025, 16.0, 22.05 and 44.1 kHz.
- Offer wave table sound synthesis, featuring 16 simultaneous melody voices and six percussive voices.
- Include the OPL3 chip (or compatible device) for FM synthesis.

Graphics and video

- PCI 2.0 bus graphics controller.
- MPEG-1 video playback hardware and/or software.

Modem

- 28 800 bps modem.

Operating system

Windows 3.11 or equivalent (including Windows 95/NT).

(See MPEG and Multimedia.)*

MPEG-1 (Moving Picture Experts Group) An internationally agreed digital video compression standard. It is used widely for local playback and for streaming multimedia over the Internet and other IP and multimedia networks. *(See MPEG-2.)* The early days of digital video were plagued by the problem of how digital video data should be compressed, thus illuminating the need for international standards for the digital storage and retrieval of video data. Sponsored by the then ISO (International Organization for Standardization) and CCITT (Committée Consultatif Internationale Télégraphique et Téléphonique), the Moving Picture Experts Group (MPEG) was given the task of developing a standard coding technique for moving pictures and associated audio. The group was separated into six specialist sub-groups, including Video Group, Audio Group, Systems Group, VLSI Group, Subjective Tests Group and DSM (Digital Storage Media) Group. The first phase of MPEG work (MPEG-1) covered DSMs with up to 1.5 Mbps transfer rates, for storage and retrieval, advanced Videotex and Teletext, and telecommunications. The second phase (MPEG-2) of work addressed DSMs with up to 10 Mbps transfer rates for digital television broadcasting and telecommunications networks. This phase would cling to the existing CCIR 601 digital video resolution, with audio transfer rates up to 128 Kbps. MPEG-1 was finally agreed, developed and announced as long ago as December 1991. MPEG participants included leaders in: computer manufacture (Apple Computer, DEC, IBM, Sun and Commodore); consumer electronics; audio-visual equipment manufacture; professional equipment manufacture; telecom equipment manufacture; broadcasting; telecommunications; and VLSI manufacture. University and research establishments also played an important role. It provided a basis for the development of Video CD, which was specified publicly by Philips in late 1993. This is an interchangeable format that can be played using both PCs fitted with appropriate MPEG video cards and compatible CD-ROM drives and Philips CD-I players fitted with Digital Video cartridges. Its development is constant, so as to accommodate the increasing data transfer rates of both DSMs and other video distribution

transports. MPEG-1 compression is optimised for DSMs with data transfer rates of up to 1.5 Mbps. MPEG-2 accommodates DSMs and video distribution transports capable of supporting higher data transfer rates of up 10 Mbps. MPEG-4 video compression is designed to transmit video over standard telephone lines. An MPEG video stream generally consists of three frame types:

- intra
- predicted
- bi-directional.

Central to MPEG encoding is the use of reference or intra (I) frames, which are complete frames that exist intermittently in an MPEG video sequence. The video information sandwiched between intraframes consists of that which does not exist in the intraframes. Information that is found to exist in the intraframes is discarded or 'lossed'. Intraframes can act as key frames when editing or playing MPEG video as they consist of a complete frame. Generally, editing compressed MPEG video is difficult owing to the paucity of authentic access points. However, editable MPEG files do exist, one type of which is backed by Microsoft. Additionally an MPEG video stream composed entirely of I frames lends itself to non-linear editing. The quality of MPEG video depends on a number of factors ranging from the source video recording quality to the use of important MPEG parameters that affect the overall compression ratio achieved. Contrary to popular belief, the logical operations that provide a basis for obtaining high-quality MPEG video are by no means the preserve of expensive video production bureaux. Equipped with a reasonably specified PC and a basic understanding of MPEG video, there is nothing to stop you producing good quality White Book-compatible video on your desktop. Probably the most obvious elements that influence MPEG video quality include the analogue or digital source recording, the video source recording format and the video source device specification. It can be assumed that the higher resolution S-VHS format will provide slightly better results than VHS, but there will not be a dramatic improvement in resolution because the MPEG SIF is standardised at 352 × 288 pixels for PAL. If you are also digitising the soundtrack of the source video recording you will probably obtain the best results with camcorders and VCRs that offer hi-fi quality stereo sound. When capturing a video file so that it may eventually be compressed, it is important to choose an appropriate capture frame rate, capture frame size and image depth. The capture frame rate should be set for 25 fps for PAL and 30 fps for NTSC. Frame rates that differ from these will cause the MPEG video sequence to run at the wrong speed, and it will not be White Book-compliant. The capture frame size should correspond with the MPEG-1 SIF, which is 352 × 288 pixels for PAL and 352 × 240 pixels for NTSC.

Authentic MPEG requires a true colour image depth of 24 bits per pixel, giving a total of over 16.7 millions colours which are generated by combining 256 shades of red, green and blue. The quality of captured audio that is used as an input audio stream obviously depends upon the sample size, recording frequency and whether mono or stereo is chosen. You can assume that your wave audio recorder or video capture program will offer sampling rates of 11 KHz, 22 KHz and 44.1 KHz and sample sizes of 8 bit and 16 bit. While higher sampling rates and larger sample sizes yield improved audio quality, the resultant audio stream can consume an unacceptably large portion of the available MPEG-1 bandwidth. With regard to careful adjustment of the MPEG compression parameters there is not much you can do if the MPEG encoding software provides no control over them. If it does, then it can be assumed that a greater number of I frames can improve the quality slightly, though this will introduce an overhead in terms of lowering the compression ratio.

(See MPEG-2.)

MPEG-2 (Moving Picture Experts Group) An improved version of MPEG-1 video compression, supported by DVD technology. It was developed for media and networks able to deliver 10 Mbps data transfer rates. MPEG-1 was developed for narrow-bandwidth media, such as the original single-speed CD drive variants, which offered average data transfer rates of approximately 150 Kbyte/s or 1.2 Mbps. MPEG-2 video may contain considerably more audio and video information than MPEG-1. The most noticeable improvement is the higher playback screen resolutions that are possible, making possible D1 or CCIR 601 quality. DCT is the key to MPEG-2, as it is to MPEG-1 and JPEG (or even M-JPEG). As is the case with MPEG-1, MPEG-2 requires decoding solutions, which may be hardware-based, such as set-top boxes (STBs) or equivalent hardware implementations integrated in computers. Applications of MPEG-2 video include video on demand, multimedia videoconferencing. It may also be stored and delivered using DVD variants. MPEG-2 variables include:

- the `aspect_ratio_information` variable, which dictates pixel aspect ratios, and not that of the total frame
- `frame_rate_code`, which stores the playback frame rate
- `repeat_first_field` and `top_field_first`, which indicate to the decoder which frames may be repeated so as to maximise playback frame rate. (This was not possible with the MPEG-1 specification. However, the process of frame duplication is not new, and there have long been many graphics cards able to do this with AVI video frames.)
- `frame_rate_extension_d`, `frame_rate_extension_n` and `frame_rate_code`, which contain playback frame rate information

- `mb_height`, which determines the pictures' macroblock sizes, and permits values that are multiples of 32.

The prevalent MPEG-2 resolution is 720 × 480 pixels running at the NTSC frame rate of 30 Hz. Movie and PAL playback frame rates are possible. See: *Information Technology–Generic Coding of Moving Pictures and Associated Audio*. ISO/IEC 13818.

(See D1 and DCT.)

MPEG frames An MPEG video sequence consists of partial frames in the form of Predicted (P) frames and Bi-directional (B) frames, and full frames or Intra (I) frames. I frames are compressed in a similar way to JPEG (Joint Photographic Experts Group) images and do not rely on image data from other frames. They exist intermittently, perhaps between every ninth or thirtieth frame, and provide non-linear entry points. Increasing the frequency of I frames provides a greater number of valid entry points, but the compression ratio of the overall file diminishes proportionately. Realistically, the compression ratios achieved using MPEG can be assumed to be around 50:1. Higher compression ratios lead to an unacceptable loss of quality, and it is wise to forget the 200:1 ratio which MPEG is supposedly capable of producing. Normally this is achieved through a pretreatment process which dramatically reduces the number of frame pixels. I frames and the following P and B frames are termed Groups of Pictures (GOPs), and the occurrence of each frame may be predefined through the careful adjustment of MPEG parameters prior to encoding. However, this fine level of control over compression parameters may not be provided by low-cost MPEG encoding programs.

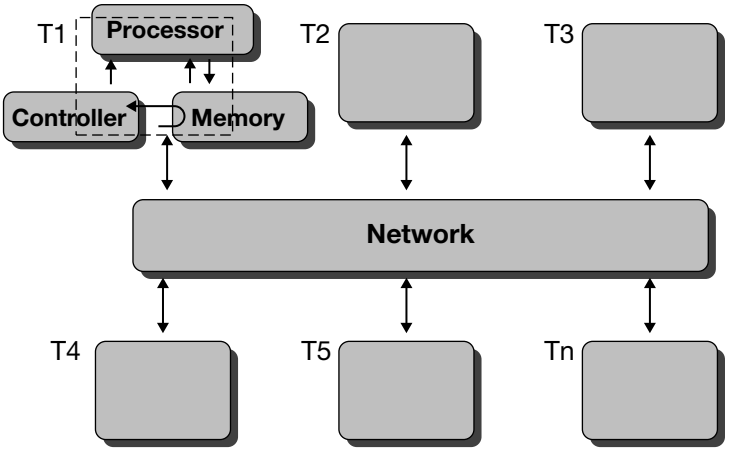
MPEG video production The process of creating MPEG video. As expected, MPEG-1 video production has also become increasingly popular, using comparatively inexpensive video capture hardware and encoding software. These provide a gateway to producing Video CD or White Book-compatible MPEG-1 video that can be integrated into multimedia productions, embedded into applications in the form of OLE objects, or used as non-interactive pop videos, movies and documentaries. Using a White Book-compatible CD-R recorder you can produce a Video CD with over 70 minutes of linear MPEG-1 video. This is a bridge format that can be played on a variety of different systems and appliances, including appropriately specified PCs and Macintoshes, Multimedia PC-3s, CD-I players fitted with DV (Digital Video) cartridges, Karaoke players and 3DO players fitted with MPEG decoders. An alternative to such video production is to use the services of a fully equipped bureau. The decision as to whether the services of a bureau should be used is driven by a number of obvious key factors that

include the amount of encoding you require, for which you will be charged on a per-minute basis. Other factors include the person-hours and hardware/software costs required to encode the MPEG-1 video yourself, and the resultant video quality, which will relate not only to the way in which the MPEG-1 encoding parameters are applied, but to the video source recording, the video source format and captured digital video file. It comes as a surprise to many to learn that bureaux are not bound to produce noticeably superior MPEG-1 video than that produced using low-cost MPEG encoding software. Their use of expensive real-time MPEG encoder cards is driven by the need to produce MPEG video as quickly as possible, as opposed to achieving optimum quality. Generally, however, it can be assumed that a reputable bureau will produce Video CD-compatible MPEG-1 video that is of an acceptably high quality and will certainly meet commercial standards. The production of MPEG-1 video using encoding software begins with the capture of a video sequence from a source recording, which might be in the VHS or S-VHS formats. Film studios and production companies might rely upon professional and broadcast quality formats such as Digital Betacam or D1 for their source recordings. (*See D1*.) The capture process can be carried out using an appropriate video capture card such as Spea's Crunch It used in conjunction with a video capture program. You can use almost any Windows video capture software, including Asymetrix Digital Video Producer, Microsoft Video for Windows VidCap or the VideoMaestro Video Capture program. These provide adequate control over capture parameters, allowing you to a set a capture frame rate of 25 fps, a true colour image depth of 24 bits providing 16.7 million colours per captured pixel, and an acceptable frame resolution of 352 × 288 pixels. This resolution equates to the MPEG Source Input Format (SIF) which is achieved by omitting odd or even lines from a standard interlaced PAL (Phase Alternating Line) signal. This is an exceptionally 'lossy' procedure, omitting a great deal of picture information and losing video quality. It is this single operation that limits the quality of video that can be achieved using MPEG-1, though it has to be implemented in order to confine the video stream to the narrow bandwidth of about 1.5 Mbps. If you are unable to capture video at 25 fps, you can increase the frame rate following video capture using Video for Windows VidEdit or an equivalent digital video editing program. The increased frame rate is achieved merely by duplicating frames, but it does mean that the finally encoded MPEG video stream will at least be an authentic one. If you capture video with a soundtrack, it is necessary to separate the video and audio components into different files. Using VidEdit this can be achieved by first making the audio track active and then selecting the whole video sequence using Selection from the Edit menu. Then by selecting Extract from the File menu, the soundtrack can be saved as a Windows wave file or

in any other format that is compatible with the MPEG encoding software. If necessary, delete the audio soundtrack and then save the video sequence. This general sequence of events is echoed using other digital video editing programs. An alternative to capturing audio and video simultaneously is to record them separately. A wave audio soundtrack can be recorded using a video capture program or a Windows wave audio recorder/editor such as Creative Wave Studio. This may result in higher quality video capture than might otherwise be possible, though it will probably lead to video and soundtracks that have different play times. Consequently, when mixing or 'multiplexing' them together using MPEG encoding software, the audio and video information will not be synchronised correctly, which will be most noticeable with sequences that are lip-synched or during 'hits', where sounds and visual events correspond. This may be remedied by opening the video file using a video editor such as VidEdit and then inserting the wave audio file as its soundtrack. A video editing program can be used to synchronise audio and video streams, usually by introducing a time offset for the audio track. By then separating the file into video and wave audio files, once again using the video editing program, the play times should become equal. This will help ensure that they are synchronised after multiplexing using the MPEG encoding software. Although some MPEG encoders will automatically alter the length of the input audio file so that it matches the length of the input video file, this does not guarantee that the audio and video material is synchronised correctly when multiplexed. It should be added that the synchronisation of audio and video information can also be carried out at the decoding stage. Having obtained audio and video input files in an appropriate format, they can be compressed or encoded separately into MPEG audio and MPEG video streams. Using MPEG encoding software this may take some time, particularly when creating the MPEG video stream. It is therefore advantageous to have a Pentium-class system, which may reduce the encoding time to around two to three times the period required for real-time MPEG encoding. The final stage of encoding is to mix or multiplex the MPEG audio and video streams into an MPEG system stream. Using PixelShrink, encoding and multiplexing jobs can be implemented in batches, so relieving you of a degree of tedium. To test and evaluate the quality of the compressed system stream you will need a fully specified MPEG player. You can use software-only players, but these will not allow you to evaluate the video adequately, as they may play video only, and are more likely to play the file at an incorrect speed, which is usually too slow.

(See MPEG-2.)

MPP (Massively Parallel Processing) Computing using multiple processors, which may operate independently and concurrently as well as



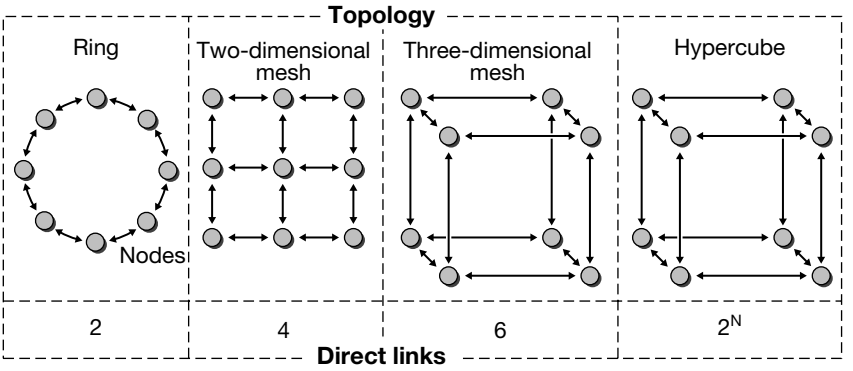
MPP DM-MIMD architecture

interacting with one another through interprocess communications. The strict definition of MPP is a system which offers scalability, where resulting processor gains increase in multiples that equate to the processing power of a single unit processor. For example, the collective processing power of an MPP system with *n* processors should increase by *x* MIPs per added processor(s). The processors may have their own memory and I/O capabilities, and may constitute complete computers or use shared memory. The processors also exhibit channels of interconnection between other processors. These connections constitute the network, and its bandwidth naturally influences the collective processor power of the system. The network is not to be confused with external, industry-standard networks such as IP and Ethernet. An MPP network is internal, with the rationale of optimising system performance by permitting the processors to communicate as quickly as possible. Typical network topologies include *ring*, *two-dimensional mesh*, *three-dimensional mesh* and *hypercube*. The resulting MPP interconnection network may be specified in terms of its:

- link bandwidth, or the rate at which data may be sent via a direct link, which is a function of clock speed and data bus width
- switching latency, which might be defined as the period between a processor data request and the reception of that request; this is a function of clock speed, network topology and the physical location of the serving processor in the network; the farther away it is, the more extended the switching latency.

The processing power of an MPP may be measured in:

- millions of floating point operations per second (MFLOPs)



- billions of FLOPS (Giga FLOPs or GFLOPs)
- trillions of FLOPS (Tera FLOPs or TFLOPs) – in future
- millions of instructions per second (MIPs)
- SPECmarks.

The optimum processing yield depends on distributing processes evenly across the processor array, matrix or network. Program algorithms may perform this function of *dynamic load balancing*, which is carried out in real time. A common denominator in current networks is that not all processors are connected directly. MPP architectures are divided between:

- Multiple Instruction Multiple Data (MIMD)
- Single Instruction Multiple Data (SIMD).

MIMD architectures feature memory, which may be:

- distributed
- shared.

The SIMD architecture has a single controller driving multiple slave processors, each with independent storage. The distributed memory DM MIMD architecture has a multiplicity of such processors and controllers. An MPP architecture variant may be explained in terms of its electronic storage, controller(s) and processor(s). Leading MPP manufacturers include Cray, Thinking Machines, Intel and nCube. Concurrent programming languages include Occam, which has its origins in Inmos (UK) where it was developed as part of the Transputer parallel processor. Java is the first mainstream programming language which supports the parallel programming model. Languages that are optimised for parallel processing systems offer authentic concurrency. One of the earliest transputer-based supercomputers was developed by Meiko though the Computing Surface. This was used in the development of DVI, and modern transputer-based implementations are used as video on demand servers. Among the advantages of such parallel processing systems is scalability, where for example

growing numbers of subscribers to a Vod service may be accommodated through additional processors, and even complete servers.

(See NUMA, Parallel programming, SMP and Transputer.)

MSCDEX (*See CD-ROM extensions*.)

MSDN (Microsoft Developer Network) A Web site targeting developers using Microsoft tools and technologies. Hyperlinks to the site are also included on hybrid CD-ROMs included with the Microsoft Visual Studio.

(See www.msdn.com.)

MS-DOS (Microsoft Disc Operating System) A PC operating system that was the successor to Digital Research's CP/M (Control Program for Microprocessors). It achieved the status of worldwide standard because of its inclusion in the IBM PC XT. The operating system evolved into numerous versions, including DR-DOS by Digital Research and PC-DOS by IBM. The complete MS-DOS implementation included numerous utility programs, including `MSCDEX`, which is the program name of the Microsoft CD-ROM Extensions, and enables DOS to address the full data capacity of a CD-ROM, as well as providing developers with a command set that can be used to write CD-ROM device drivers. Other utilities include `FDISK`, which is used to create and delete primary DOS partitions and extended partitions on hard disks; `DOSSHELL`, which can be used to manage files, edit files and run programs; `FORMAT`, which can be used to format hard and floppy disks; and `BACKUP`, which can be used to backup files. MS-DOS embodies many other programs and utilities.

MSN (Microsoft Network) A superset of the Web, providing additional services that are comparable to those of CompuServe.

MTBF (Mean time between failures) An average period time that indicates the frequency at which a device, component, subsystem or complete system will fail.

(See MTTR and Reliability.)

MTTR (Mean time to restore) The average period required to return a failed system to its fully operational state.

(See MTBF and Reliability.)

Multi-field key (*See Key field*.)

Multimedia A broad term which may be applied to a system or process which embodies and combines various different media. Modern (digital)

multimedia may comprise computer animations, text, still images, digital audio, synthesised sound, digital video and interactivity. Unlike linear non-interactive media such as broadcast television, it provides users with a choice of numerous meaningful paths. The underlying technology has spawned offshoots, of which the most notable will be video-telecommunications and videoconferencing. Distribution media disc-based multimedia include Compact Disc – Read Only Memory (CD-ROM). Other less well-known distribution media include Compact Disc Interactive (CD-I) and CD-ROM XA (Extended Architecture) discs. The 12 cm diameter CD-ROM and CD-I discs typically support up to about 660 Mbyte data storage capacity. A single-sided, single-layer DVD-ROM disc supports 4.7 Gbyte, and supports MPEG-2 video playback. Increasingly, however, multimedia networks are being used, and the most significant of these is the ubiquitous Internet.

(See Hypertext and Web.)

Multimedia authoring tool A software tool intended for the development of multimedia. Many such tools require no programming skills.

(See Authorware, IconAuthor and ToolBook.)

Multimedia delivery A phrase occasionally used to describe the process of delivering or deploying multimedia locally, over a multimedia network or over the Internet.

Multimedia delivery system (*See Multimedia system/appliance*.)

Multimedia design team A team given the task of designing and developing a multimedia application. It may consist of experts in all disciplines required to generate the multimedia title, including:

- a producer/director to enforce an appropriate degree of creative control and oversee the amalgamation of media types
- a project manager to ensure that the budget and schedule are observed and adhered to
- high-level language programmers to design the retrieval system or to write other routines
- a multimedia author to implement the interactive design
- content provider/advisors who possess expertise in the material/information to be communicated
- an associate producer
- a project planner
- an interface designer
- an animation director

- a writer
- an art director
- a lead programmer
- a quality Assurance (QA) manager
- a sound designer
- an audio visual (A-V) designer
- a 3-D modeller
- a video editor
- graphic designers/computer graphics artists, to produce original artwork
- sound engineers for recording etc.
- studio technician(s)
- various production staff
- Web site/Internet developer(s).

How many of the aforementioned experts should be included depends upon the complexity of the material and what percentage, if any, of the production process is contracted out.

Multimedia development (*See Authoring.*)

Multimedia origins The origins of multimedia are frequently connected with the emergence of the term 'hypertext', and with an earlier means of information storage and retrieval devised in the 1940s. Not until the late 1980s did the technology for truly interactive multimedia emerge. The term 'multimedia' was first used in the 1960s to describe simple tape-and-slide presentations. The first breakthrough in optical storage was Philips' LaserVision, a videodisc system capable of storing still video, motion video and audio data (each in analogue form). Launched in 1978 (and in Europe in 1982) as a consumer product for playing video films, LaserVision quickly led to IV. This yielded the first taste of video in a computer environment. The real significance of LaserVision was that it provided a basis for the development of Compact Disc–Digital Audio (CD-DA) (1982), which in turn led to the announcement of CD-ROM and later to CD-I. Philips issued the first provisional CD-I specification in June 1986, making it commercially available for the consumer in 1991 (USA) and 1992 (Europe). 1986 also saw the launch of CUBIC-CT by Creative Labs, Inc. (Santa Clara). This system delivered music, had voice input and output and enhanced graphics, and used an electronic mass storage device. It was not a success, and Creative Labs now attribute its commercial failure to a lack of software. It is reasonable to state that CUBIC-CT was the world's first digital multimedia system. In July 1987 Compact Disc–Video (CD-V) was launched. This provides a means of storing digital audio and digital video. In response to CD-I, Intel made available an equivalent technology for the PC. Called DVI, it was initially demonstrated by RCA and General Electric at the

Microsoft CD-ROM conference of 1987. (DVI was originally pioneered for video distribution.) The DVI chipset was accommodated on two boards in 1990 and 1991, one for motion video delivery and another for video and audio capture. Philips' response to DVI was to instigate the development of CD-ROM XA (Extended Architecture). Like DVI this was initially intended to open up the PC market. Announced by Philips, Sony and Microsoft in August 1988, it currently permits (near) CD-I delivery in the PC environment. It is important to note that CD-ROM XA is not 100 per cent downwardly compatible with CD-I. Microcomputer graphics was technically immature for much of the 1980s. The Apple computer supported colour graphics, but like all other machines of the early 1980s it was slow and limited regarding pixel resolution and numbers of colours. More powerful computer graphics systems, such as the Cromenco SDI existed but were prohibitively expensive. PC computer graphics matured as late as mid-1987 when IBM released the Video Graphics Array (VGA) standard, which included an analogue monitor port. Initially launched as part of the Personal System/2 (PS/2) range, it raised the standing of PC computer graphics. In advance of the PC, the Macintosh included an analogue monitor port approximately three years earlier; and in 1987 Apple launched HyperCard, the most successful and best-known microcomputer hypermedia product. It is logical to conclude that the collective technology we now call digital multimedia was first realised by Creative Labs in 1986 through CUBIC-CT. HyperCard became the first major hypermedia product from a leading producer. In terms of the consumer market, multimedia technology came of age in April 1991 (USA) with the launch of the Commodore CDTV.

(See Multimedia.)*

Multimedia presentation A multimedia-based presentation that might combine audio, MIDI, video, text, animation and graphics. It might be presented on a desktop or even notebook computer using their attached display, or it might be presented using an LCD projector. Popular multimedia presentation programs include Microsoft PowerPoint, which is included with Microsoft Office. Multimedia authoring tools such as ToolBook, IconAuthor and Authorware may also be used, but these are not dedicated to the production of presentations.

Authoring an interactive multimedia presentation When creating a multimedia presentation the aim of the author is to communicate information as effectively as possible. The media types required to do this depend upon the intended audience. It is true to say that a presentation to customers in a bank may be more effective if interesting animations, video and soundtracks are included. A multimedia presentation to financiers and investors, on the other hand, may require a greater proportion of text and charts giving factual information. However, it could be

argued that multimedia with video, animations and effects is a persuasive medium, irrespective of the audience. You must have heard or read that overused statement that people remember 10 per cent of what they read, 20 per cent of what they hear, 30 per cent of what they see and 70 per cent of what they see and hear. There is disagreement generally about the factual accuracy of this much repeated statement, although that people do, in fact, remember a great deal more that they see and hear is widely agreed. Your job as a multimedia author is to create a presentation that will be memorable for the right reasons, and leave the audience with a clear understanding of the information you are conveying. But you have to be subtle; you cannot hammer home important points by repeating salient points over and over. Remember: you are not briefing a platoon or detachment of soldiers for an important mission. Do not author a presentation that is an obvious attempt to brainwash people. Equally, do not fall for that elementary error of turning up the volume too high. Ear-piercing wave audio or MIDI music is unlikely to have the desired effect. And be sure not to arrange loudspeakers so as to be right next to certain people in the audience. Keep all loudspeakers at least five metres away from members of the audience. This raises the matter of seating arrangements. Ensure that you leave the name of each member of your audience in an appropriate seating position. For example, important members should be seated more centrally, and closer forward, so that they have a direct view of the screen and yourself, and where they may benefit from a good stereophonic and perhaps surround sound effect. Less important members should be seated at the periphery of the room or auditorium. Returning to the content of the actual presentation, it is important to create an appropriate blend of media types. Achieving the right balance should not be too difficult if you simply bear in mind that too much of any one may cloud the messages and information you are trying to put across. The opposite to overworking certain media types can also have a negative effect. A dull presentation without animation, video or interesting music might bore people and make them desperate to leave, making the whole presentation an instantly forgettable experience.

Text in presentations Almost all Windows presentation programs use TrueType fonts. There are a wide variety of these available and you can normally buy inexpensive collections of them. Choosing appropriate fonts to use in your presentation does not require the expertise of a print designer but simple common sense, in most instances. The fonts you choose should be legible and suit the nature of the presentation. Straightforward legibility is obtained by choosing the correct font and point size. Fonts that resemble ornate writing styles with fancy serifs should be avoided; although you may find that you can get away with using them for the first letter of a word, or as a drop capital. Generally fonts with a symmetrical geometric appearance are more legible than others. Particularly good examples include families of Arial, Helvetica, Futura or Futurist. With regard to type styles used, you might find it useful to embolden or italicise certain portions of text purely to highlight salient points. Take care with italics, as this can reduce legibility. In terms of the suitability of the fonts used, common sense should tell you which ones to use. For example, a traditional Times Roman is a

font with credibility and should be used perhaps for more formal presentations, possibly to an audience of investors or board members. Generally you can mix different fonts on the same screen, but do bear in mind that there are limits, if you are conventional that is. If you are unconventional, you can mix as many fonts as you please, though we are not recommending that you do this. Text foreground and background colours are also important and should be chosen in terms of suitability. A closer investigation into colour will indicate the reactions that different colours evoke in people. However, once again common sense may play an important role in your choice of colours.

Graphics The numerous different methods of obtaining digital images include:

- scanning photographs and illustrations
- using a digital camera
- using a still video camera
- using a video frame grabber
- using photographs processed onto Photo CD
- using royalty-free collections of clip art and clip photos
- drawing them using a graphics program
- capturing a frame from a captured video sequence
- capturing charts from databases, spreadsheets and graphing programs
- photographic library.

The graphics you include may simply improve the look of your presentation or perform a function, such as a chart to illustrate sales figures. With regard to using photographic images, these should be relevant and not included simply because you found a good one in a royalty-free collection that vaguely relates to the subject of your presentation. The cheapest method of obtaining original photographs is to use Photo CD, although how good an image you achieve rather depends on how good a photographer you are, as well as on camera quality. A compact camera will not give the same results as a professional medium format camera like a Hasselblad. If you require a good quality photograph and your budget does not run to hiring a professional photographer, consider hiring an automated medium format camera; this will give excellent results and will be almost as easy to use as an automatic 35 mm camera.

Graphics in presentations Graphics files come in numerous different formats, including PCX, Compuserve GIF, Windows BMP and so. Some of these are more efficient than others, offering a more compact means of storing pictures. Perhaps the best known image file format for storing compressed still images is JPEG (Joint Photographic Experts Group). Which image file formats you use may depend upon the graphic import filters in you presentation program. For example if it will not import JPEG files then you will have to work in another file format. Numerous software programs are available that convert image file formats, including the shareware program PaintShop Pro and the conventionally marketed program HiJaak Pro. Ideally you should choose an image file format that requires comparatively small file sizes and short loading times. The image depth you choose can be a function of your presentation platform, which must have the

appropriate graphics card. Many authors find an image depth of 8 bits per pixel and the resultant 256 colour graphic images perfectly acceptable. Which image depth is used can also depend on the graphics themselves; if they are cartoon-like images, then there may be little point in opting for an image depth greater than 8 bits. Photographic images, on the other hand, are different, and to obtain realistic images you may need 16 bit 65K colour images, or even 24 bit 16.7 million colour images. Needless to say, file sizes grow in proportion to the image depth chosen; a 16 bit file of an image will be twice the size of the same image stored with an 8 bit depth. When including a number of different images in a presentation, you may have to create a common optimum palette using the presentation program itself or another graphics program. This is to avoid any problems you might encounter with palette switching.

Sound choice Sound, in the form of dialogue, music and effects, can mean the difference between a good and bad presentation. Music is not to be underestimated; its mood-changing characteristics can be persuasive with even the hardest business people. The sound you include may take the form of MIDI songs, wave audio or CD audio. Wave audio is ideal for recording dialogue. Its technical quality is important, and 8 bit wave audio recorded at a low sampling rate will be inferior to 16 bit CD-quality audio recorded at 44.1 kHz. The quality of script and spoken voice are not be overlooked either. MIDI is useful for music only. The single most significant advantage of MIDI is the compactness of the MIDI song files. These consume a fraction of the data capacity required by digitised waveform audio such as .WAV files. However, the .WAV file representation file is authentic: it is not composed from a rigidly defined set of sounds as you would find in MIDI files. For example, a MIDI representation of a recital of Beethoven's Ninth Symphony would be basic and noticeably synthetic, though sound cards that use actual samples of musical instruments are a great improvement on those that use synthesiser chips only. A wave file, on the other hand, could be used to record the actual performance of, say, the London Philharmonic playing Beethoven's Ninth. Using 16 bit samples at a rate of 44.1 kHz, a wave file can produce a CD-quality recording. However, MIDI files can be edited using various MIDI applications. Also, you can speed up or slow down MIDI files to sync them with animations. For many multimedia authors, the process of composing a MIDI sequence is something best left to MIDI professionals. MIDI song producers will compose original soundtracks to suit your multimedia title or presentation. Though this approach will lead to professional quality MIDI songs, the cost can be high, and it is hardly something you would do if authoring an in-house multimedia title. A cheaper alternative is provided by collections of clip music MIDI files that are in the public domain and can be used without payment of royalties to their owners. The many companies that produce collections of such clip music include large companies like Voyetra and Twelve Tone Systems. There are many other companies that produce clip music collections. Check with computer magazines such as *Windows Sources* (McGraw-Hill) and with CD-ROM dealers for information about clip music. CD audio may be used if you find an interesting royalty-free clip music track. Using many presentation programs you can play CD tracks or even a section of a track using MCI commands. There

are numerous other media devices that can be controlled using MCI commands. Such MCI-compatible devices may well provide an alternative to using CD.

Animations and effects Produced correctly, animations and effects can make a presentation more interesting. The animations can be aesthetic or functional, perhaps adding motion to a graph or chart. Popular programs that allow you to generate animation include Autodesk Animator and 3D Studio. The resultant .FLI or .FLC files can be imported into most presentation programs, and if you have Video for Windows you can convert them into the .AVI format. Actually producing an animation can be time-consuming, depending upon the type of animation you want. Bear in mind that in most cities you will find animation production companies, though you will need an appropriate budget to cover the cost of such production.

Video Easily the most persuasive of all the multimedia types, video can transform a presentation into an infinitely more engaging communication medium. Although PMPSV might be adequate for some presentations, you may prefer to use FMFSV, such as MPEG-1 and MPEG-2 video.
(See MPEG.)*

Video in presentations Often video is stored on hard disk, usually in the .AVI format. .AVI files can be created using Video for Windows together with an appropriate video capture board. All full-featured modern PC multimedia presentation programs can integrate .AVI files. Storing video in this manner can make presenting your multimedia production easier because there is a need for nothing more than an MPC-2 for playback. *(See MPEG*.)* Video quality is a function of the:

- compression techniques, where MPEG-2 can be assumed to deliver the best results
- quality of the analogue/digital video source
- quality of the analogue/digital video source device
- video capture board
- graphics card used in the presentation platform
- video capture technique: step-frame capture can result in better video quality than real-time video capture
- hard disk speed
- depth of video data
- processor speed
- size of external cache,

The second method is to use something like an MCI-compatible videodisc player and a video overlay card.

The script The script you write should convey all the messages you want to put across. A good approach is to begin by writing down the text you wish to display in each frame of your presentation. Remember, if your audience is to read the text it must be displayed using an appropriate font size. Although it probably goes

without saying, you should reinforce the text messages by repeating them verbally. Again this can be done by you or the presenter, or using recorded wave audio. The script you write is the gateway to completing your complete presentation. It will provide you with ideas as to where and when various different media types need to be included. More importantly, it provides the general sequence of events and gives you the basis for a storyboard. Say, for example, that we wanted to create a presentation advertising a special price holiday package to Australia that you might want to target at members of the public. It is a holiday package aimed at young professionals in the 18–30 age group. Because of this it needs to be upmarket while including features that may turn on young people. These features might include pop music of various sorts, lots of synthesiser sounds, punchy dialogue and interesting video and animations. The script, if appropriate, can be distributed among your audience as hand-out notes.

(See Multimedia.)*

Multimedia producer An individual given the task of captaining the production of multimedia applications/titles. Typically he/she will:

- liase with investors, if he/she is not the sole investor in the project
- often have control over the hiring of personnel, ranging from directors to programmers and multimedia production staff, who might include camera operators and even sound engineers
- be responsible for optimising the application of a given budget
- be responsible for originating marketable project ideas
- understand the technical issues that control the quality of a multimedia application
- direct personnel effectively, perhaps toward the use of contracted services and sources of multimedia or Web content
- receive praise or criticism for the complete project.

Multimedia production The process of gathering media files for inclusion in a multimedia application. Multimedia production embodies the implementation of all tasks necessary to attain (in appropriate format) audio and visual materials required. The following components are typical of the production process. The end result should be a collection of usable digital files that can be included in an application. It may involve the following processes.

- Capturing video using an appropriate video capture program and capture card.
- Editing digital video using a video editing program such as Adobe Premiere or Microsoft VidEdit supplied with Microsoft Video for Windows.
- Editing 8 bit video/graphics colour using a palette editor.
- Compressing video according to preselected parameters that are appropriate to the bandwidth of the target platform.

- Recording digital wave audio using a sound card/sound feature together with wave audio recording software.
- Editing wave audio files.
- Compressing wave audio files.
- Obtaining still images by scanning, using a still video camera or using Photo CD.
- Compressing graphics files and/or converting them into the appropriate file formats.
- Digitising text using a scanner.
- Marking up text files using a language such as HTML (HyperText Markup Language).
- Creating Web pages.
- Creating Java applets.

(See ActiveX, Multimedia, Multimedia authoring, OOP, Java, JScript, VBScript and Visual Basic.)*

Multimedia streaming Real-time delivery and playback of multimedia, which may be local or remote. Typically, it takes place over the Web or Internet, and requires a server and a client. Web applications include real-time monitoring or surveillance of remote locations, WebTV and video playback.

(See ASF, Multimedia, Streaming and Video*.)*

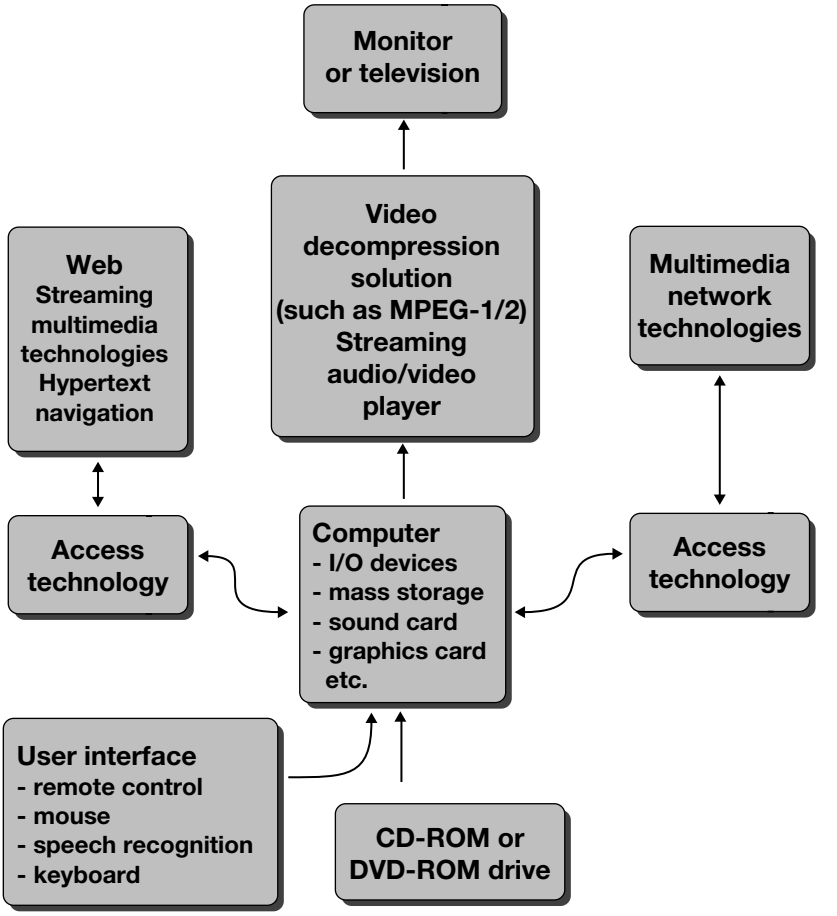
Multimedia system/appliance (See Figure on page 230). A device capable of playing multimedia titles. Examples include MPC-3, DVD-ROM-based PCs and Apple Macintosh computers. A multimedia appliance includes:

- a modem and Web browser
- an operating system, such as Windows 95/98/NT, Modular Windows, OS/2 or Mac OS
- a CD drive variant such as a CD-ROM or DVD-ROM drive
- a sound card that is at least MPC-2 compliant, able to play and record wave audio with a sampling rate of 44.1 kHz
- a stereo amplifier with accompanying speakers, or self-powered speakers, or simply a pair of headphones
- a video decoder

(See MPC-3.)

Multiple inheritance A concept where subclasses inherit methods and data from more than one superclass. It defines a class of objects, which inherit attributes and behaviour from multiple superclasses.

(See C++, Inheritance and OOP.)



Multimedia system/appliance

Multiplexing 1. A process by which an MPEG video stream is mixed with an MPEG audio stream to form an MPEG system stream. (*See MPEG* and Video capture*.) 2. A process by which multiple signals may be communicated along a single transmission path, which may be serial or parallel. The Integrated Services Digital Network (ISDN) standard uses multiplexing, which involves creating a data stream consisting of 8 bit PCM blocks. The blocks are created every 125 microseconds. By interleaving the blocks with those from other encoders, the result is time division multiplexing (TDM). In North America ISDN typically interleaves data from 24 64 Kbs sources or channels. This results in connections that provide 1.536 Mbps, although in actual fact the connection has a bandwidth

of 1.544 Mbps, because each channel's frame has a marker bit 'F', adding 8 Kbyte/s. Europe sees ISDN that typically interleaves 30 64 Kbps channels, giving 2.048 Mbps. This and the 1.544 Mbps connection are known as primary rate multiplexes. Further interleaving of primary rate multiplexes sees:

- 6, 45 and 274 Mbps in North America
- 8, 34, 139 and 560 Mbps in Europe.

PCM was conceived in 1937 by Alec Reeves, but was not applied widely for many years.

Multisync monitor A monitor that may synchronise itself with various incoming signals. There are many technical implementations of the 'multisync monitor', the simplest of which will automatically synchronise with perhaps two or three vertical frequencies. The term multisync was coined and registered by NEC. Professional versions are able to synchronise automatically with a range of horizontal and vertical frequencies. This is called the scanning range, and the greater it is, the greater the number of acceptable signal sources. Yet higher specification monitors economise on scan range, thus concentrating on the narrow band of professional graphic, controllers, beginning with VGA. Such monitors can be considered non-proprietary.

Multithreading A process by which multiple processes within the same application are executed concurrently, or what is perceived to be concurrently.

(See Parallel programming.)