

Output System

BIOS

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In computing, BIOS (, BY-oss, -ʔohss; Basic Input/Output System, also known as the System BIOS, ROM BIOS, BIOS ROM or PC BIOS) is a type of firmware used to provide runtime services for operating systems and programs and to perform hardware initialization during the booting process (power-on startup). On a computer using BIOS firmware, the firmware comes pre-installed on the computer's motherboard.

The name originates from the Basic Input/Output System used in the CP/M operating system in 1975. The BIOS firmware was originally proprietary to the IBM PC; it was reverse engineered by some companies (such as Phoenix Technologies) looking to create compatible systems. The interface of that original system serves as a de facto standard.

The BIOS in older PCs initializes and tests the system hardware components (power-on self-test or POST for short), and loads a boot loader from a mass storage device which then initializes a kernel. In the era of DOS, the BIOS provided BIOS interrupt calls for the keyboard, display, storage, and other input/output (I/O) devices that standardized an interface to application programs and the operating system. More recent operating systems do not use the BIOS interrupt calls after startup.

Most BIOS implementations are specifically designed to work with a particular computer or motherboard model, by interfacing with various devices especially system chipset. Originally, BIOS firmware was stored in a ROM chip on the PC motherboard. In later computer systems, the BIOS contents are stored on flash memory so it can be rewritten without removing the chip from the motherboard. This allows easy, end-user updates to the BIOS firmware so new features can be added or bugs can be fixed, but it also creates a possibility for the computer to become infected with BIOS rootkits. Furthermore, a BIOS upgrade that fails could brick the motherboard.

Unified Extensible Firmware Interface (UEFI) is a successor to the PC BIOS, aiming to address its technical limitations. UEFI firmware may include legacy BIOS compatibility to maintain compatibility with operating systems and option cards that do not support UEFI native operation. Since 2020, all PCs for Intel platforms no longer support legacy BIOS. The last version of Microsoft Windows to officially support running on PCs which use legacy BIOS firmware is Windows 10 as Windows 11 requires a UEFI-compliant system (except for IoT Enterprise editions of Windows 11 since version 24H2).

Input–output model

In economics, an input–output model is a quantitative economic model that represents the interdependencies between different sectors of a national economy

In economics, an input–output model is a quantitative economic model that represents the interdependencies between different sectors of a national economy or different regional economies. Wassily Leontief (1906–1999) is credited with developing this type of analysis and was awarded the Nobel Prize in Economics for his development of this model.

MIMO

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Multiple-Input and Multiple-Output (MIMO) (/ˈmaːmoʊ, ˈmiːmoʊ/) is a wireless technology that multiplies the capacity of a radio link using multiple transmit and receive antennas. MIMO has become a core technology for broadband wireless communications, including mobile standards—4G WiMAX (802.16 e, m), and 3GPP 4G LTE and 5G NR, as well as Wi-Fi standards, IEEE 802.11n, ac, and ax.

MIMO uses the spatial dimension to increase link capacity. The technology requires multiple antennas at both the transmitter and receiver, along with associated signal processing, to deliver data rate speedups roughly proportional to the number of antennas at each end.

MIMO starts with a high-rate data stream, which is de-multiplexed into multiple, lower-rate streams. Each of these streams is then modulated and transmitted in parallel with different coding from the transmit antennas, with all streams in the same frequency channel. These co-channel, mutually interfering streams arrive at the receiver's antenna array, each having a different spatial signature—gain phase pattern at the receiver's antennas. These distinct array signatures allow the receiver to separate these co-channel streams, demodulate them, and re-multiplex them to reconstruct the original high-rate data stream. This process is sometimes referred to as spatial multiplexing.

The key to MIMO is the sufficient differences in the spatial signatures of the different streams to enable their separation. This is achieved through a combination of angle spread of the multipaths and sufficient spacing between antenna elements. In environments with a rich multipath and high angle spread, common in cellular and Wi-Fi deployments, an antenna element spacing at each end of just a few wavelengths can suffice. However, in the absence of significant multipath spread, larger element spacing (wider angle separation) is required at either the transmit array, the receive array, or at both.

Input/output

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In computing, input/output (I/O, i/o, or informally io or IO) is the communication between an information processing system, such as a computer, and the outside world, such as another computer system, peripherals, or a human operator. Inputs are the signals or data received by the system and outputs are the signals or data sent from it. The term can also be used as part of an action; to "perform I/O" is to perform an input or output operation.

I/O devices are the pieces of hardware used by a human (or other system) to communicate with a computer. For instance, a keyboard or computer mouse is an input device for a computer, while monitors and printers are output devices. Devices for communication between computers, such as modems and network cards, typically perform both input and output operations. Any interaction with the system by an interactor is an input and the reaction the system responds is called the output.

The designation of a device as either input or output depends on perspective. Mice and keyboards take physical movements that the human user outputs and convert them into input signals that a computer can understand; the output from these devices is the computer's input. Similarly, printers and monitors take signals that computers output as input, and they convert these signals into a representation that human users can understand. From the human user's perspective, the process of reading or seeing these representations is receiving output; this type of interaction between computers and humans is studied in the field of human–computer interaction. A further complication is that a device traditionally considered an input device, e.g., card reader, keyboard, may accept control commands to, e.g., select stacker, display keyboard lights, while a device traditionally considered as an output device may provide status data (e.g., low toner, out of paper, paper jam).

In computer architecture, the combination of the CPU and main memory, to which the CPU can read or write directly using individual instructions, is considered the brain of a computer. Any transfer of information to or

from the CPU/memory combo, for example by reading data from a disk drive, is considered I/O. The CPU and its supporting circuitry may provide memory-mapped I/O that is used in low-level computer programming, such as in the implementation of device drivers, or may provide access to I/O channels. An I/O algorithm is one designed to exploit locality and perform efficiently when exchanging data with a secondary storage device, such as a disk drive.

Standard streams

standard output (stdout) and standard error (stderr). Originally I/O happened via a physically connected system console (input via keyboard, output via monitor)

In computer programming, standard streams are preconnected input and output communication channels between a computer program and its environment when it begins execution. The three input/output (I/O) connections are called standard input (stdin), standard output (stdout) and standard error (stderr). Originally I/O happened via a physically connected system console (input via keyboard, output via monitor), but standard streams abstract this. When a command is executed via an interactive shell, the streams are typically connected to the text terminal on which the shell is running, but can be changed with redirection or a pipeline. More generally, a child process inherits the standard streams of its parent process.

Output

output in Wiktionary, the free dictionary. Output may refer to: The information produced by a computer, see Input/output An output state of a system,

Output may refer to:

The information produced by a computer, see Input/output

An output state of a system, see state (computer science)

Output (economics), the amount of goods and services produced

Gross output in economics, the value of net output or GDP plus intermediate consumption

Net output in economics, the gross revenue from production less the value of goods and services

Power (physics) or Work (physics) output of a machine

Dependent variable of a function, in mathematics

Output (album)

GEM (desktop environment)

handling the actual output. The former was known as GDOS (Graphics Device Operating System) and the latter as GIOS (Graphics Input/Output System), a play on the

GEM (for Graphics Environment Manager) is a discontinued operating environment released by Digital Research in 1985. GEM is known primarily as the native graphical user interface of the Atari ST series of computers, providing a WIMP desktop. It was also available for IBM PC compatibles and shipped with some models from Amstrad. It was available on the BBC Master computer with an Intel 80186 co-processor. GEM is used as the core for some commercial MS-DOS programs, the most notable being Ventura Publisher. It was ported to other computers that previously lacked graphical interfaces, but never gained traction. The final retail version of GEM was released in 1988.

Digital Research later produced X/GEM for their FlexOS real-time operating system with adaptations for OS/2 Presentation Manager and the X Window System under preparation as well.

IO.SYS

MS-DOS 2.0 and higher and Windows 9x. Loads COMMAND.COM (or other operating system shell if specified). Displays the boot splash in Windows 9x. If LOGO.SYS

IO.SYS is an essential part of MS-DOS and Windows 9x. It contains the default MS-DOS device drivers (hardware interfacing routines) and the DOS initialization program.

Time-invariant system

"time-varying system". Mathematically speaking, "time-invariance" of a system is the following property: Given a system with a time-dependent output function

In control theory, a time-invariant (TI) system has a time-dependent system function that is not a direct function of time. Such systems are regarded as a class of systems in the field of system analysis. The time-dependent system function is a function of the time-dependent input function. If this function depends only indirectly on the time-domain (via the input function, for example), then that is a system that would be considered time-invariant. Conversely, any direct dependence on the time-domain of the system function could be considered as a "time-varying system".

Mathematically speaking, "time-invariance" of a system is the following property:

Given a system with a time-dependent output function ?

y

(

t

)

$\{\displaystyle y(t)\}$

?, and a time-dependent input function ?

x

(

t

)

$\{\displaystyle x(t)\}$

?, the system will be considered time-invariant if a time-delay on the input ?

x

(

t

+

?

)

$\{\displaystyle x(t+\delta)\}$

? directly equates to a time-delay of the output ?

y

(

t

+

?

)

$\{\displaystyle y(t+\delta)\}$

? function. For example, if time ?

t

$\{\displaystyle t\}$

? is "elapsed time", then "time-invariance" implies that the relationship between the input function ?

x

(

t

)

$\{\displaystyle x(t)\}$

? and the output function ?

y

(

t

)

$\{\displaystyle y(t)\}$

? is constant with respect to time ?

t

:

$\{\displaystyle t:\}$

?

y

(

t

)

=

f

(

x

(

t

)

,

t

)

=

f

(

x

(

t

)

)

.

$\{\displaystyle y(t)=f(x(t),t)=f(x(t)).\}$

In the language of signal processing, this property can be satisfied if the transfer function of the system is not a direct function of time except as expressed by the input and output.

In the context of a system schematic, this property can also be stated as follows, as shown in the figure to the right:

If a system is time-invariant then the system block commutes with an arbitrary delay.

If a time-invariant system is also linear, it is the subject of linear time-invariant theory (linear time-invariant) with direct applications in NMR spectroscopy, seismology, circuits, signal processing, control theory, and other technical areas. Nonlinear time-invariant systems lack a comprehensive, governing theory. Discrete time-invariant systems are known as shift-invariant systems. Systems which lack the time-invariant property are studied as time-variant systems.

Single-input single-output system

a single-input and single-output (SISO) system is a simple single-variable control system with one input and one output. In radio, it is the use of

In control engineering, a single-input and single-output (SISO) system is a simple single-variable control system with one input and one output. In radio, it is the use of only one antenna both in the transmitter and receiver.

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