**Term list: Informatics session 1, Computer hardware, software, and networking, v. 1.0.1**

Application software

Computer programs that carry out tasks for computer users. Application software can be general purpose for a wide variety of users (word processors, spreadsheets) or domain-specific for particular types of work (instrument managers, LIS, EHR).

Arithmetic/Logic Unit (ALU)

A component of the CPU (or a CPU core) that processes data by performing numerical or logical operations.

ASCII

An older data standard for representing a limited character set using one byte per character.

Bandwidth

The maximum reliable data rate of a network. Usually expressed as “bits per second.”

Binary file

A file that encodes data directly as ones and zeros, may be proprietary (ie, defined only for a particular computer program and developer).

BIOS

Basic input-output system. Stores basic information about the structure of a computer and its startup sequence in a form that cannot be deleted. Also stores some editable data and date/time information, which is preserved by a small rechargeable battery on the motherboard. Since this is relatively constant and does not (normally) disappear when the computer is turned off, it is sometimes called “firmware” indicating characteristics between hardware and software.

Bit

The smallest unit of computer data, 0 or 1.

Bus

Inside computers, a communications circuit that connects to and transfers data between multiple devices.

Byte

A collection of 8 bits, which can represent values from 0-255. Bits are usually processed as bytes for convenience and speed.

Cache

High speed memory on the CPU chip that functions as a local data store and swaps with RAM periodically.

Central processing unit (CPU)

The main chip in a computer where data processing, program interpretation, and computer control occurs. Most CPUs are now multi-core and can carry out multiple tasks in parallel.

Client

Often refers to a computer that is used by a person. In a server setting, any computer that connects to the server to use its capabilities (even if automatic).

Clock

A chip that defines the length of individual data processing and communication steps. Current clock speeds are in the GHz range (billions of cycles per second).

Core

A component of a CPU or GPU that carries out computation. A core consists of a control unit, an arithmetic and logic unit (ALU), and a small amount of cache memory.

Complex data type

A data type made up of several primitive data types that together represent a real world object or concept in a useful way. Each primitive data type is a data element of the complex data type.

CSV

A structured text data format that uses commas to separate data elements represented as character strings (Unicode or ASCII) in tabular data. Related formats include quoted CSV (data elements also have quotes around them) and tab-delimited text (data elements are separated by tab characters).

Data element

 See complex data type.

Data model

Definition of one or a set of related complex data types. A data model will list each data type with its data elements, and may provide value and cardinality (repeatability) constraints for the data elements. If several complex data types are included, the model may define their relationships and interactions.

Delimited file

A text file (Unicode or ASCII) in which data elements are separated by defined characters (delimiters).

Device driver

A computer program that communicates with and controls specialized hardware, either inside of or attached to a computer. Typically used by the operating system rather than by computer users.

Disk drive and solid state drive

Data storage that maintains data when power is disconnected (ie, non-volatile memory). Disks write data to spinning platters while solid state “drives” write data to non-volatile chips that maintain their state without power. Solid state memory units are typically faster than single disks.

Domain name

An alphanumeric name for a computer on the Internet. Typically three or four groups of characters separated by periods (www.virginia.edu). Automatically converted to numeric IP addresses by domain name servers before being used for communication.

Domain name server

A server on the Internet or in a large local network that participates in the domain name database system. Converts alphanumeric domain names to fully-numeric IP addresses that are required for Internet communication.

DSL

Digital Subscriber Line. A protocol for carrying network communications on phone lines. Typically used by phone companies that act as internet service providers. ADSL is “asymmetric digital subscriber line,” which has higher download speed than upload speed.

Ethernet

The most widely used communication protocol in local area networks. Typical implementations can cover a maxium distance of about 100 meters.

Flat file

A text data file containing a character string encoded in Unicode or ASCII but not otherwise defined by a standardized internal structure. Also called “unstructured data.”

G4, G5

Digital communication protocols used for cellular connections. Longer range than Wifi; traditionally slower than Wifi but the difference will diminish with G5.

Graphical processing unit (GPU)

A specialized, highly parallelized data processor that can be mounted on a separate card or integrated into the motherboard. Originally developed for processing graphical output, GPUs are now widely used for parallel processing of a variety of types, including bioinformatics analysis and machine learning. GPUs contain hundreds to thousands of cores in arrays that are constrained to execute the same instructions at the same time. In this way they differ from multi-core CPUs, in which the cores process instructions independently and can carry out different types of tasks at the same time.

Heat sink

A device with metal fins for dissipating heat. Typically attached to CPUs, system bus elements, and other heat-producing elements in a computer to prevent excessive heat build-up. May also have fans attached.

IP address

A numerical address designating a device located on the Internet. Expressed as 4 numbers of 0-255 separated by periods (4 bytes or 32 bits, IP version 4). There are now more devices on the Internet than can be represented by this form of address, and that has led to the development of IP version 6, which uses 128 bits and a slightly different format (colon separators rather than periods). IPv6 is expected to replace IPv4 in coming years.

ISP

Internet Service Provider. A vendor who manages internet traffic and sells access to the internet to organizations and individuals.

JSON

Javascript Object Notation. An open structured text format in which data elements are organized into name-value pairs and set off by braces and brackets.

LAN

Local Area Network. A cluster of connected computers in an organization or home using short-range communication protocols.

MAC address

Media Access Control. The Mac address is a unique identifier for each NIC allows reliable transmission of communications.

Modem

Stands for “modulator-demodular.” Device used by internet service providers to convert some types of WAN communications to LAN communications.

Moore’s Law

An observation made by Gordon Moore in 1965 that the number of transistors in integrated circuits doubles approximately every two years.

Motherboard

The main circuit board of a computer. Contains the sockets for the CPU, RAM, and specialized device circuit boards (“cards”), and provides the system buses.

Network gateway

A network device that converts between one network protocol and another (eg, WAN communications to LAN communications, or between two different WAN or LAN protocols).

Network hub

A device that sends network communications to multiple attached devices (usually arranged in a star pattern). A hub normally sends all communications to every device and leaves it up to the devices to determine which messages are addressed to them.

Network interface card (NIC)

A circuit board that converts data to a form that is transmissible over the network, ie, it provides an interface to the network. The NIC may fit into a slot or be integrated into the motherboard.

Network switch

A device that sends network communications to multiple attached devices (usually arranged in a star pattern). A switch evaluates the addresses of messages and sends the messages only to the network branch that contains the device to which they are addressed. Switches are more expensive than hubs but are more secure because they eliminate the ability to listen to all network communications from one branch.

Non-volatile memory

Memory that is persistent even if power is lost. Disk storage, solid-state storage, and tape storage are non-volatile. Data in non-volatile memory is relatively safe (but should be backed up).

Operating system

The main controlling computer program, which manages other programs run by users and provides services that all programs can use. Examples are Unix, Linux, Windows, and MacOS.

Packet switching

A form of network in which data to be communicated is broken down into small segments (packets), which are sent independently over the network and reassembled at the destination. There are reliability benefits to this approach, in that a packet switching network can reroute around a disconnection even if it occurs part way through transmission of a data set (assuming there are alternative routes). The Internet is a packet switching network.

Peripherals

A general term for external devices that are attached to a computer (mouse, keyboard, display, printer, etc.) via integrated connectors (on the motherboard) or specialized cards.

Pixel

Stands for “picture element.” In a colored image, a single colored dot of an image made up of many dots. These types of images are termed “bitmapped” or “raster” images. Full color pixels are typically represented as 3 bytes or 24 bits (red, green, and blue brightness with 256 levels of each). Some programs use 4 bytes with the final byte providing additional information such as transparency if a program constructs images in layers.

Primitive data type

A basic data type that is represented in binary and from which more complex data types can be built. Boolean values (True/False), integers, decimal numbers (also called “floating point” numbers), characters, and character strings are examples of primitive data types.

Program

A sequence (or collection of sequences) of instructions that a computer can carry out to accomplish a task. The instructions are typically stored in a data file that is tagged as “executable.” When the computer reads an executable file, it carries out the initial set of instructions that organize the computer and the remainder of the instructions to accomplish the task or tasks. Non-executable files differ from programs in that when they are read their contents are stored in memory and not treated as instructions. Programs are also called “software” because of their ephemeral nature, and to distinguish them from hardware that exists as physical objects.

RAID array

Redundant Array of Inexpensive Disks. A non-volatile high-capacity storage unit that is made up of multiple hard drives. RAIDs have advantages in reliability because data is normally written to several locations at once, and speed because data can be written to multiple disks simultaneously.

RAM

Random Access Memory. The main memory of a computer. Each byte location in RAM can be addressed separately. RAM is volatile memory because its contents are lost when power is cut or the computer is turned off.

Resource Description Framework (RDF) triple

A set of three data elements that represent two concepts (a subject and an object) that are connected by a third concept (a predicate) that expresses the relationship between the first two.

Router

A network device that mediates between networks and allows communications to cross from one network to another only if they are addressed a device in the second network.

RTF

Rich Text Format. An open standard word processing file specification for representing text and formatting information using only character data (the formatting information is carried by special character sequences).

Server

A computer that provides services to other computers primarily over a network. Typically accessed by multiple users through their own computers which are called “clients.”

String

A sequence of characters, typically represented using the Unicode or ASCII standards.

Structured text

Character data (Unicode or ASCII) that uses one of several standard formats to improve the ability of computers to process the data compared with free-form text. These formats may distinguish data elements using separator characters (delimited files), brackets and name-value pairs (JSON), or tags that contain data (XML).

System software

Computer programs that manage the computer itself. Examples are the operating system and device drivers.

TCP/IP

A suite of protocols that define how data is transmitted between devices across the Internet (and in local networks that use Internet protocols). Transmission Control Protocol defines how data is broken down into packets, how the packets are transmitted accurately, and how they are reassembled at the destination. Internet Protocol defines the form and use of IP addresses for packet transmission and other communications.

Text file

A data file consisting of Unicode or ASCII characters. The characters may represent words, numbers or other symbols. Text files are typically readable by text editing software, spreadsheets, and data processing programs.

Unicode

A standard for representing text characters including numerals and symbols as one- or two-byte integers. Unicode can represent many more characters than the older ASCII standard and currently supports character sets for all active languages (a useful large subset for Chinese), many scientific and business symbols, emojis, etc.

Volatile memory

Memory that loses its value when the computer is shut down or there is a loss of power. Under those circumstances, data in volatile memory is lost.

WAN

Wide area network. Separate protocols and media specifications from LAN communications, designed to transmit data over miles.

Wifi

Standards for medium-range digital communications over radio waves.

XML

Extensible Markup Language. An open text file format in which data elements are denoted by tags of the form “<tagname> data </tagname>”. Tags can be nested and tag schemas can be defined yielding flexible and meaningful data representations, but the format tends to require more characters than other forms of structured text and thus produce longer files.



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