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Q1. (a) Differentiate between open source software and applications software?

What is Open-Source Software?

It all started with Richard Stallman who developed the GNU project in 1983 which fueled the free software movement which eventually led to the revolutionary open-source software movement.

The movement catapulted the notion of open-source collaboration under which developers and programmers voluntarily agreed to share their source code openly without any restrictions.

The community of people working with the software would allow anyone to study and modify the open-source code for any purpose they want. The open-source movement broke all the barriers between the developers/programmers and the software vendors encouraging everyone to open collaboration. Finally, the label "open-source software" was made official at a strategy session in Palo Alto, California in 1998 to encourage the worldwide acceptance of this new term which itself is reminiscent of the academic freedom.

The idea is to release the software under the open licenses category so that anyone could see, modify, and distribute the source code as deemed necessary.

It's a certification mark owned by the Open Source Initiative (OSI). The term open source software refers to the software that is developed and tested through open collaboration meaning anyone with the required academic knowledge can access the source code, modify it, and distribute his own version of the updated code.

Any software under the open source license is intended to be shared openly among users and redistributed by others as long as the distribution terms are compliant with the OSI's open source definition. Programmers with access to a program's source code are allowed to manipulate parts of code by adding or modifying features that would not have worked otherwise.

What is Application Software?

Unlike open source, there are some software the source code of which can only be modified by the individual or organization who created it.

The owner or publisher of the software holds intellectual property rights of the source code exclusively. We call this type of software "Application software" because only the original owner(s) of the software are legally allowed to inspect and modify the source code.

In simple terms, Application software is software that is solely owned by the individual or the organization that developed it. Application software, as the name suggests, are exclusive property of their creators or publishers and anyone outside the community are not allowed to use, modify, copy or distribute modified versions of the software.

The owner of is the exclusive copyright holder of the software and only he has the rights to modify or add features to the program's source code. He is the sole owner of the program who can sell it under some concrete conditions which should be followed by the users in order to avoid any legal disputes.

Unlike open source software, the internal structure of Application software is not exposed and the restrictions are imposed upon the users by the End User License Agreement (EULA), the conditions of which are to be legally followed by the end users regarding the software.

Examples of Application software include iTunes, Windows, mac OS, Google Earth, Unix, Adobe Flash Player, Microsoft Word, etc.

Difference between Open-Source and Application Software

Control of Open-Source and Application Software

The idea alone that developers and programmers are allowed to examine and modify the source code as deemed necessary shouts aloud control. More control means more flexibility, which means non-programmers can also benefit from the open collaboration. Application software, on the contrary, restricts control only to the owner of the software.

Security of Open-Source and Application Software

Because anyone with the required knowledge can add or modify additional features to the program's source code to make it work better, it allows better sustainability of the software as in discrepancies in the software can be rectified and corrected repeatedly. As developers can work without any restrictions, it allows them to rectify errors that might have missed by the original developers or publishers.

Driver Support of Open-Source and Application Software

Open-source software packages often have missing drivers which is natural when you have an open community of users with access to every single line of code. The software may include code modified by one or more individuals, each subject to different terms and conditions. The lack of formal support or sometimes use of generic drivers can put the project at risk. Application software means closed group support which means better performance.

Usability of Open-Source and Application Software

Unlike open-source projects, Application ones are typically designed keeping in mind a limited group of end users with limited skills. They target a small knit circle of end users unlike projects accomplished within open source communities. Users outside the programming community won't even look at the source code let alone modify it.

Opacity of Open-Source and Application Software

The viewing restrictions barred the end users from modifying the code let alone debugging it effectively with no control over possible workarounds. The internal structure of Application software is strictly closed-access meaning they lack transparency which makes it virtually impossible for users to even suggest modifications or optimizations to the software. Open source, on the other hand, promotes open collaboration which means lesser bugs and faster bug fixes with fewer complexities.

Summary of Open-Source Verses Application Software

Open-source refers to the software whose source code is available for anybody to access and modify, while Application software refers to the software which is solely owned by the individual or publisher who developed it. Unlike open-source software, Application software is managed by the individual or the organization that holds exclusively the intellectual property rights of the source code and nobody outside the circle is allowed to view the code let alone inspect it. The main difference between the two is that open source projects have the ability to evolve as they can be iterated upon by millions of developers located across the globe.

(b) Write different features of system software?

System Software

There are two main types of software: systems software and application software. Systems software includes the programs that are dedicated to managing the computer itself, such as the operating system, file management utilities, and disk operating system (or DOS).

System software is a software that provides platform to other software. Some examples can be operating systems, antivirus software's, disk formatting software, Computer language translators etc. These are commonly prepared by the computer manufacturers. These software consists of programs written in low-level languages, used to interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.

The most important features of system software include :

1. Closeness to the system
2. Fast speed
3. Difficult to manipulate
4. Written in low level language
5. Difficult to design

Q2. (a) Discuss different functions of operating system?

Operating System

An operating system (OS) is a type of system software that manages computer's hardware and software resources. It provides common services for computer programs. An OS acts a link between the software and the hardware. It controls and keeps a record of the execution of all other programs that are present in the computer, including application programs and other system software.

The most important tasks performed by the operating system are

Memory Management:

The OS keeps track of the primary memory and allocates the memory when a process requests it.

2. **Processor Management**:

Allocates the main memory (RAM) to a process and de-allocates it when it is no longer required.

3. **File Management:**

Allocates and de-allocates the resources and decides who gets the resources.

4. **Security:**

Prevents unauthorized access to programs and data by means of passwords.

5. **Error-detecting Aids:**

Production of dumps, traces, error messages, and other debugging and error-detecting methods.

6. **Scheduling:**

The OS schedules process through its scheduling algorithms.

Compiler:

A compiler is a software that translates the code written in one language to some other language without changing the meaning of the program. The compiler is also said to make the target code efficient and optimized in terms of time and space.

A compiler performs almost all of the following operations during compilation: preprocessing, lexical analysis, parsing, semantic analysis (syntax-directed translation), conversion of input programs to an intermediate representation, code optimization and code generation. Examples of compiler may include gcc (C compiler), g++ (C++ Compiler), java (Java Compiler) etc.

Interpreter:
An interpreter is a computer program that directly executes, i.e. it performs instructions written in a programming or scripting language. Interpreter do not require the program to be previously compiled into a machine language program. An interpreter translates high-level instructions into an intermediate form, which is then executes.

Interpreters are fast as it does not need to go through the compilation stage during which machine instructions are generated. Interpreter continuously translates the program until the first error is met. If an error comes it stops executing. Hence debugging is easy. Examples may include Ruby, Python, PHP etc.

Assembler:
An assembler is a program that converts assembly language into machine code. It takes the basic commands and operations and converts them into binary code specific to a type of processor.

Assemblers produce executable code that similar to compilers. However, assemblers are more simplistic since they only convert low-level code (assembly language) to machine code. Since each assembly language is designed for a specific processor, assembling a program is performed using a simple one-to-one mapping from assembly code to machine code. On the other hand, compilers must convert generic high-level source code into machine code for a specific processor.

(b) Explain the use of File Transfer Protocol and TelNet services?

File Transfer Protocol

The File Transfer Protocol (FTP) is one of the oldest Internet protocols. The technology for transferring entire files has been used since 1974. In 1985, FTP was precisely defined in the RFC 959. The idea behind the protocol is to trigger downloads and uploads with commands. This allows you to transfer files from your own device (PC, smartphone, etc.) to a server and vice versa.

In this process, the file management systems (that you know from your operating system) are available to the user. Files can be placed in folders, which can in turn be placed in other folders, giving rise to a hierarchical directory structure.

The File Transfer Protocol is often used to build websites. For example, HTML files can be transferred to the server using FTP access. Additionally, website providers can make media files available for their visitors.

How does FTP work?

The File Transfer Protocol runs within the application layer of the TCP/IP Internet protocol suite. This places it on the same layer as HTTP or POP. These protocols are characterized by the fact that they work together with programs like browsers and email clients in order to provide you with services. There is also special FTP software for the File Transfer Protocol.

These programs generally have two areas. One area displays the local directory structure including all of the files on the hard drive. The other area shows the server's memory including the files and folders located there. The software makes it possible for the user to move files between the two areas. These days, browsers and the operating system's command line can also be used for FTP.

In FTP connections, two channels are usually opened. First, the client and server establish a command channel using Port 21. The client uses this channel to send commands to the server, in response to which the server sends back status codes. Afterwards, the two sides can establish the data channel. This is used to transfer the selected files. As this is happening, the protocol is watching out for errors. If the connection is broken before the transfer has been completed, the process can be resumed after the connection has been reestablished.

We can make a distinction between active and passive FTP. In the active version, the client establishes the connection using Port 21, as described above, and tells the server which port can be used to deliver its answers. However, if the client is protected by a firewall then the server cannot send any answers, since all external connections are blocked. That's why passive mode was developed. This way, the server can send a port number to the client that the client can then use to establish a data channel. Since the client initiates the connection themselves, their firewall cannot block the transfer.

The File Transfer Protocol knows various commands and status codes. With the 32 commands – not all of which are always implemented on the server – the client instructs the server to upload or download files, organize directories, or delete files. The server answers with a status code that provides information on whether the command was successfully implemented.

As usual, you'll need access information in order to use FTP with a server. But some servers also offer anonymous FTP, with which any user can transfer files to the server using FTP or download from it without a password. Since these open FTP servers are vulnerable to security risks, the possibilities for users are usually rather limited.

Tel-Net services

Telnet is a network protocol that provides a command-line interface to communicate with a device. Telnet is used most often for remote management but also sometimes for the initial setup for some devices, especially network hardware such as switches and access points. Telnet is also used to manage files on a website.

How Does Telnet Work?

Telnet originally was used on terminals. These computers require only a keyboard because everything on the screen displays as text. The terminal provides a way to remotely log on to another device, just as if you were sitting in front of it and using it like any other computer.

Nowadays, Telnet can be used from a virtual terminal, or a terminal emulator, which is essentially a modern computer that communicates with the same Telnet protocol. One example of this is the telnet command, available from the Command Prompt in Windows. The telnet command uses the Telnet protocol to communicate with a remote device or system.

Telnet commands can also be executed on other operating systems such as Linux and mac OS, in the same way that telnet commands are executed in Windows.

Telnet isn't the same as other TCP/IP protocols such as HTTP, which transfers files to and from a server. Instead, the Telnet protocol has you log on to a server as if you were an actual user, then grants you direct control and all the same rights to files and applications as the user that you're logged in as.

Q3. (a) Explain Metropolitan Area Network (MAN) with a suitable example?

Metropolitan Area Network (MAN)

The MAN network (Metropolitan Area Network) is a high-speed network (broadband) that covers larger geographic area such as city (tens of kilometers) or districts than local area network (LAN) but smaller than wide area network (WAN) and providing the ability to integrate multiple services through the transmission of data, voice, and video, on transmission media such as copper, fiber optics, and microwaves.

The term is applied to the single network such as a cable television network, or it can be a way of connecting a certain number of LANs in a more extensive network so that resources can share from LAN to LAN and from device to device. For example, a company can use a MAN to connect the LANs of all its offices scattered around the city. Local libraries and government agencies often use a MAN to connect to citizens and private industries. It may also connect MANs within a larger area than LAN. The geographical limit of a MAN may span a city.

In MAN, different LANs connected through a local telephone exchange. Some of the widely used protocols for MAN are X.25, Frame Relay, Asynchronous Transfer Mode (ATM), ISDN (Integrated Services Digital Network), xDSL (Digital Subscriber Line), ADSL (Asymmetrical Digital Subscriber Line), WDM (Wavelength Division Modulation), etc. These protocols are quite different from those used for LANs.

A MAN can wholly own by a private company, which will be its operator, or it can be a service provided by a public service company, such as a local telephone company. Many telephone companies have a very popular MAN service called Multimegabit Data Switching Services (SMDS).

The copper pair technology positioned as the world’s largest network an excellent alternative for the creation of metropolitan networks, for its low latency (between 1 and 50 ms), excellent stability and the lack of radio interference, the MAN LOOP networks, offer speeds of 10 Mbit/s or 20 Mbit/s, on copper pairs and 100 Mbit/s, 1 Gbit/s and 10 Gbit/s through optical fiber.

The concept of the metropolitan area network represents an evolution of the concept of a local area network to a broader scope, covering larger areas that in some cases are not limited to an urban environment but can reach regional and even national coverage through the interconnection of different networks of the metropolitan area.

This type of networks is a larger version than the LAN and usually based on a technology similar to this one. The main reason to distinguish a MAN with a particular category is that a standard has adopted to make it work, which is equivalent to the IEEE standard.

WAN networks also applied in organizations, in groups of corporate offices near a city, these do not contain switching elements, which divert the packets by one of several potential output lines. These networks can be public or private.

The networks of the metropolitan area, comprise a specific geographical location “city, the municipality,” and its distance of coverage is greater than 4 km. They are networks with two unidirectional buses, each of which is independent of the other in terms of data transfer.

Examples of Metropolitan Area Network

The Metropolitan Area Network (MAN) has many and varied applications; the main ones are:

• Deployment of VoIP services (Voice over Internet Protocol), in the metropolitan area, allowing eliminating the “obsolete” traditional lines of analog or ISDN telephony, eliminating the current expenditure of these lines.

• Interconnection of local area networks (LAN).

• Deployment of Wi-Fi zones without wireless Backhaul (Femtocell) freeing all Wi-Fi channels for access, this in practice means more than 60% improvement in the connection of Wi-Fi users.

• Computer to computer interconnection.

• Local video surveillance systems.

• CAD / CAM transmission.

• Walkways for wide area networks (WAN).

• They also allow the transmission of voice, data and video traffic with high latency guarantees, which is why it is necessary to install a metropolitan area network at the corporate level, for corporations that have multiple dependencies in the same capital area.

(b) Define topology? Which topology would you choose to setup a local area network and why?

Topology refers to how various nodes, devices, and connections on your network are physically or logically arranged in relation to each other. Think of your network as a city, and the topology as the road map. Just as there are many ways to arrange and maintain a city—such as making sure the avenues and boulevards can facilitate passage between the parts of town getting the most traffic—there are several ways to arrange a network. Each has advantages and disadvantages and depending on the needs of your company, certain arrangements can give you a greater degree of connectivity and security.

There are two approaches to network topology: physical and logical. Physical network topology, as the name suggests, refers to the physical connections and interconnections between nodes and the network—the wires, cables, and so forth. Logical topology is a little more abstract and strategic, referring to the conceptual understanding of how and why the network is arranged the way it is, and how data moves through it.

Best topology for LAN

Star Topology

A star topology, the most common network topology, is laid out so every node in the network is directly connected to one central hub via coaxial, twisted-pair, or fiber-optic cable. Acting as a server, this central node manages data transmission—as information sent from any node on the network has to pass through the central one to reach its destination—and functions as a repeater, which helps prevent data loss.

Advantages of Star Topology

Star topologies are common since they allow you to conveniently manage your entire network from a single location. Because each of the nodes is independently connected to the central hub, should one go down, the rest of the network will continue functioning unaffected, making the star topology a stable and secure network layout.

Additionally, devices can be added, removed, and modified without taking the entire network offline.

On the physical side of things, the structure of the star topology uses relatively little cabling to fully connect the network, which allows for both straightforward setup and management over time as the network expands or contracts. The simplicity of the network design makes life easier for administrators, too, because it’s easy to identify where errors or performance issues are occurring.

Q4. In your opinion, what are the different types of common media used for storage, access and transmission of information? Explain each type in detail?

Different types of common media used for Storage, access and transmission of information

- **Magnetic Storage Device** – one of the most popular types of storage used.
    - **Floppy diskette** – A normal 3 ½ inch disk can store 1.44 MB of data.
    - **Hard drive** – An internal hard drive is the main storage device in a computer. An external hard drive is also known as removable hard drive. It is used to store portable data and backups.
    - **Magnetic strip** – Magnetic tape drive stores video and audio using magnetic tape, like tape and video tape recorders.
    - **Super disk** – A disk drive and diskette that can hold 120 MB and 240 MB of data.
    - **Cassette tape** – A magnetic storage device used for audio recording and playback.
    - **Zip diskette** – Like a floppy diskette but more advanced.
- **Optical Storage Device** – uses lasers and lights as its mode of saving and retrieving data.
    - **Blu-ray disc** – A digital optical storage device which was intended to replace the DVD format.
    - **CD-ROM disc** – An optical storage device that is read-only or cannot be modified nor deleted.
    - **CD-R and CD-RW disc** – CD-R is a recordable disc that can be written to once, while CD-RW is a rewritable disc that can be written to multiple times.
    - **DVD-R, DVD+R, DVD-RW and DVD+RW disc** – DVD-R and DVD+R are recordable discs that can be written to once, while DVD-RW and DVD+RW are rewritable discs that can be written to multiple times. The difference between the + and – is in the formatting and compatibility.
- **Flash Memory Device** – is now replacing magnetic storage device as it is economical, more functional and dependable.
    - **Memory card** – An electronic flash memory device used to store digital information and commonly used in mobile electronic devices.
    - **Memory stick** – A memory card that is removable.
    - **SSD – Solid State Drive** – A flash memory device that uses integrated circuit assemblies to save data steadily.
    - **USB flash drive, jump drive or thumb** drive – A small, portable storage device connected through the USB port.
- **Online and Cloud** – is now becoming widespread as people access data from different devices.

    - **Cloud storage** – Data is managed remotely and made available over a network. Basic features are free to use but upgraded version is paid monthly as a per consumption rate.
    - **Network media** – Audio, Video, Images or Text that are used on a computer network. A community of people create and use the content shared over the internet.
- **Paper Storage** – method used by early computers for saving information.
    - **OMR – stands for Optical Mark Recognition** – A process of capturing marked data of human from forms like surveys and tests. It is used to read questionnaires with multiple choices that are shaded.
    - **Punch card** – A piece of hard paper used to contain digital information coming from the perforated holes. The presence or absence of holes in predetermined positions define the data.