Prerequisites for Cybersecurity Skilling Program

Course Details:

Duration of Program: 08 weeks (6 hours per week)

Course Duration: 48 hours

Course Language: Hindi

Overview

- This program focuses on the models, tools, and techniques for enforcing security, emphasising using cryptography.
- It provides a deeper understanding of the technical basics of cyberspace and cyber issues.
- Provides learners with a baseline understanding of common cybersecurity threats, vulnerabilities, and risks.
- Introduces real-time cyber security techniques and methods in the context of the protocol suites to introduce the need for network security solutions.

Prerequisites

1. Basics of Computer Networks
2. Operating System (Linux / Windows)
3. Bash script and Python (optional)

Basics of Operating System

An operating system (OS) is the necessary software that runs on a computer. It handles the computer's memory, processes, software and hardware. It also lets you communicate with the computer without learning to speak the computer's language. A computer is useless without an operating system. OS provide us with the interface between a computer user and hardware. All the basic tasks, such as managing file systems, memory, processes, input-output operations, and controlling peripheral devices like printers, are performed by the OS. Figure 1 shows the architecture of the operating system.

Some widespread Operating Systems include Linux, Windows, VMS, OS/400, AIX, z/OS, etc. Today, Operating systems are seen almost in every device, like mobile phones, personal computers, mainframe computers, automobiles, TV, Toys etc.

- ☐ **Microsoft Windows:** Microsoft developed the Windows operating system in the mid-1980s. There have been multiple distinct versions of Windows, but the most recent ones are Windows 11 (released in Oct 2021), Windows 10 (released in July 2015), Windows 8 (released in Aug 2012), Windows 7 (released in Oct 2009), and

Windows Vista (released in Jan 2007). Figure 2 shows the market share of operating systems where 40% of the market is captured by the Windows platform.

☐ **Linux:** The Linux kernel, an open-source operating system that resembles Unix, was initially released on September 17, 1991, by Linus Torvalds. Linux usually comes as the Linux distribution, which includes the kernel, system software, and supporting libraries, some of which are supplied by the GNU Project. Ubuntu is a Debian-based Linux distribution made up primarily of free and open-source software.
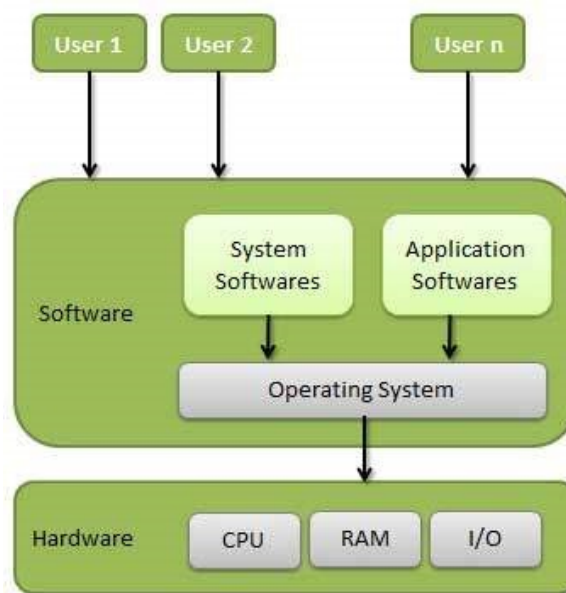

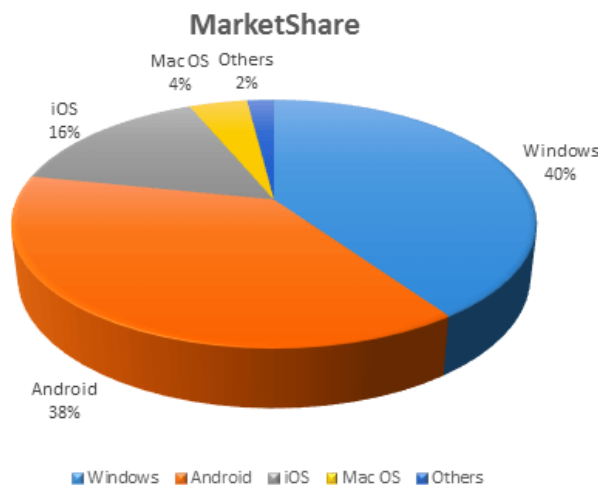Figure 1 Architecture diagram of an Operating System

Figure 2 Market Share of Operating Systems

Types of Operating System (OS)

There are a few types of operating systems:

- ☐ **Batch Operating System:**
  - ☐ Some computer processes take a long time to complete their jobs, so they must be grouped and completed to speed up the same process. A batch OS never allows for direct user interaction. Every user in this kind of OS prepares their work on an offline device, such as a punch card, and then submits it to the computer operator.
- ☐ **Multiprocessing/ Multitasking/Time Sharing OS:**
  - ☐ People seated at various terminals (shells) can utilise a single computer system concurrently thanks to time-sharing OSes. Time-sharing refers to the distribution of CPU time across many users.
- ☐ **Real Time OS:**
  - ☐ Real-time operating systems have very short processing and response times. Examples of real-time operating systems are space and military software systems.
- ☐ **Distributed OS:**
  - ☐ To give their users speedy processing, distributed systems take advantage of numerous processors that are spread across various devices.
- ☐ **Network OS:**
  - ☐ On a server, the network OS is run. It offers the ability to manage user, group, security, application, and other networking operations as well as data and users.
- ☐ **Mobile OS:**
  - ☐ Mobile operating systems (OS) are designed to run smartphones, tablets, and wearable technology.

Functions of Operating System

Management of memory, files, processes, I/O systems & devices, security, etc., are a few examples of typical operating system tasks. A few functions of OS are as follows:

1. **Process management:** This feature enables the OS to add and remove processes. Additionally, it offers systems for interprocess communication and synchronisation.
2. **Memory management:** The memory management module allocates and releases memory to applications that require it.
3. **File management:** It controls all operations involving files, including naming, storing, organising, retrieving, sharing, and protecting them.
4. **Device Management:** All devices are monitored by device management. The I/O controller is a module also in charge of this duty. Additionally, it manages the devices' allocation and de-allocation.
5. **I/O System Management:** One of the critical goals of any OS is to conceal the quirks of that hardware from the user.
6. **Management of Secondary Storage:** Systems contain multiple storage layers, including primary storage, secondary storage, and cache storage. Data and instructions must be kept in primary storage or cache for a running programme to refer to them.
7. **Security:** This module guards a computer system's data and information against authorised access and malicious threats.

Features of Operating System (OS)

The following is a list of the OS's key features:
➔ Supervisor and protected modes
➔ enables file systems and disc access.
➔ Adapter drivers Programme Execution for Network Security
➔ Multitasking I/O procedures
➔ File system manipulation, Error detection and handling
➔ Resource distribution
➔ Protection of Information and Resources

Difference between 32-Bit and 64-Bit Operating System

There are differences between 32-bit and 64-bit OS. A few of them are described as follows:

➜ Regarding memory limits, the RAM on 32-bit systems is restricted to a maximum of 4 GB, whereas a maximum of several TB (terabytes) of RAM can be used on 64-bit platforms.

➜ In terms of the processor required, the 32-bit OS can operate on both 64-bit and 32-bit processors, whereas the 64-bit OS needs the 64-bit processor.

➜ Regarding the security feature, 32-bit OS has limited security features, whereas the 64-bit OS has more evolved security features like hardware-level safeguards.

Basics of Computer Network

A network for a computer is a structure that joins two or more computers together to share and transport data. Mobile phones and servers are both examples of computing devices. These gadgets might be wireless or connected by physical connections like fibre optic cables.

Key Components of a Computer Network

A computer network is composed of two fundamental building blocks: nodes or network gadgets and links. The link joins together two or more nodes. Communication protocols specify how these links transmit the data. The origin and destination devices, which serve as the communication endpoints, are frequently called ports. Figure 3 shows the main components of computer network.
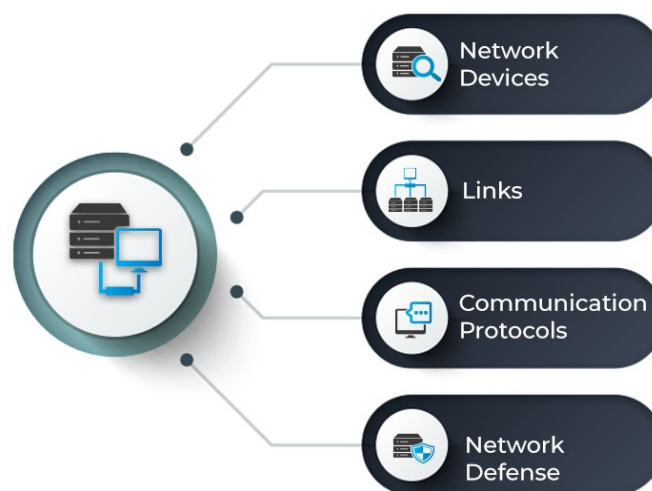

Figure 3 Main Components of a Computer Network

☐ **Network Devices:** Network devices or nodes are computing gadgets that need to be connected to a network. Some network gadgets are:

☐ **Computers, smartphones**, and other consumer electronics are examples of endpoints that consumers often instantly access. For instance, an email is created using the mail programme on a personal computer or smartphone.

☐ **Servers:** The primary computing and information storage occurs on servers, which are either application or storage servers. The servers receive all requests for particular operations or data.

☐ **Routers:** Routing is deciding which network's path packets of data will take. Routers are used for these packets to travel between networks and arrive at their destination. They improve the efficiency of extensive networks.

☐ **Switches:** Repeaters are electronic devices that receive and clean or amplify network signals. They are to networks what converters are to electrical grids. Repeaters with several ports are called hubs. They distribute the data to any open ports there may be. Bridges are more intelligent hubs that only transmit data to the intended port. A switching device is a bridge with many Ports. Switches can accept multiple data cables to enable connectivity with numerous network devices.

☐ **Gateways:** Hardware components known as gateway serves as 'gates' across two separate networks. They could be servers, routers, or firewalls.

☐ **Links:** Links are an example of media for communication that comes in two distinct varieties:

☐ **Wired:** Coaxial cables, telephone lines, twisted-pair cabling, and optical fibres are a few varieties of wired technologies that are used in networks. For the representation of data, optical fibres transmit pulses of light.

☐ **Wireless:** Radio and other electromagnetic signals can also be used to create network connections. 'Wireless' is the phrase utilised to define this type of transmission. Cellular networks, radio and technology distributed spectrums, and communication satellites, are some of the most prevalent

instances of wireless links. Wireless LANs use spectrum technology to create connections in constrained spaces.

☐ **Communication protocols:** All nodes participating in a data transmission must abide by a set of guidelines known as a communication protocol. Some popular protocols include the Internet protocol suite (TCP/IP), IEEE 802, Ethernet, wireless LAN, and cellular standards. A theoretical model called TCP/IP standardises communication in today's network. It proposes that such communication linkages have four functional layers:

   ☐ **Network access layer:** This layer specifies the physical transport of data. It covers the method by which hardware transmits data bits over actual cables or fibres.

   ☐ **Internet layer:** This layer is in charge of encapsulating data into decipherable packets and enabling data transmission and reception.

   ☐ **Transport layer:** By insuring the connection is reliable and valid, and this layer allows devices to continue talking to one another.

   ☐ **Application layer:** This layer establishes how advanced apps can connect to a network and begin data transmission.

☐ **Network Defense:** Although nodes in connections and protocols serve as a network's building blocks, it's nearly only possible for a contemporary network to function with defences. Security is crucial as enormous amounts of data are produced, transported, and analysed across networks. Firewalls, IDS (intrusion detection systems), intrusion prevention systems (IPS), network access control (NAC), content filters, proxy servers, anti-DDoS devices, and load balancers are just a few kinds of network defence tools.

Types of Computer Networks

Several factors, including the medium of transmission, network capacity, topology, and organisational goal, can be used to categorise networked computers. The many kinds of networks are classified according to a scale of geography:

☐ **Nanoscale networks:** These networks allow microscopic sensors and actuators to communicate.

- ☐ **Personal area network (PAN):** A PAN is a network that only one person uses to link together various devices, including laptops, scanners, etc.

- ☐ **Local area network (LAN):** A LAN links computers and other equipment in a specific physical location, such as an educational institution, healthcare facility, or business premises.

- ☐ **Storage area network (SAN):** Block-level storage of information is made possible via a dedicated storage area network (SAN) network. It is employed in storing apparatuses like libraries of tapes and disc arrays.

- ☐ **Metropolitan area network (MAN):** MAN stands for metropolitan area network, a huge computer network covering a whole city.

- ☐ **Wide area network (WAN):** Wide area networks (WANs) are used to connect bigger geographic areas, such as significant cities, entire states, and even entire nations.

- ☐ **Virtual private network (VPN):** VPN stands for virtual private network and is a private network that extends across a public network.

- ☐ **Cloud network:** Put a cloud network is a wide area network (WAN) whose architecture is provided by cloud services.

Books and References:

☐ Operating System Concepts – Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India, 2009.

☐ Mordern Operating Systems – Andrew S. Tanenbaum, 3rd Edition, PHI.

☐ AS Tanenbaum, DJ Wetherall, Computer Networks, 5th Ed., Prentice-Hall, 2010.

☐ LL Peterson, BS Davie, Computer Networks: A Systems Approach, 5th Ed., Morgan-Kauffman, 2011.

☐ JF Kurose, KW Ross, Computer Networking: A Top-Down Approach, 5th Ed., Addison-Wesley, 2009.

☐ W Stallings, Cryptography and Network Security, Principles and Practice, 5th Ed., Prentice-Hall, 2010

☐ https://www.tutorialspoint.com/operating_system/images/conceptual_view.jpg

☐ https://www.guru99.com/images/1/011819_0753_OperatingSy2.png

☐ https://pimages.toolbox.com/wp-content/uploads/2021/12/08135425/Main-Components-of-a-Computer-Network.jpg