IT Infrastructure Overview
    * It is a combination of various set like,
        - Hardware
            - Computers
            - Servers
            - Network Devices
            - Storage Devices
            - Printers / Scanners etc.
        - Software
            - Operating System
            - Applications
                - SAP, ZOHO, RPS LMS
        - Network
            - Internet Connectivity
            - Broadband, Fiber Optic & Lease Lines etc.
        - Storage
            - HDD, SSD, Cloud Storage etc.
            - Database Management system
        - Security
            - Firewalls
            - Antivirus
            - Encryption
            - Regulatory Compliance
        - Services
            - Cloud Services
            - Security Services
        - Human Resources
             Team will work to create a proper business value.

Services Scenario
    Personal Accounts
    Work Accounts / Organizational Accounts

    ayushofficial651@gmail.com
    ayush.m@rpsconsulting.in

Public email providers
    - Gmail
    - Outlook
    - Hotmail

Types of IT Infrastructure
    - Traditional IT Infrastructure (On-Premise)
    - Cloud Based IT Infrastructure
    - Hybrid Infrastructure

Importance of IT Infrastructure
    - Business Continuity
    - Scalability
    - Cost Efficiency
    - Security

IT Infrastructure Design Considerations
    - Performance
    - Redundancy and Reliability
    - Scalability
    - Less Cost & Better Productivity

Computer
    That word is taken by the Latin language word "Compute"
Word based meaning
    - A machine that is able to calculate
Technical Terms
    - A computer is an electronic device
    - That takes raw data as input
    - Process it under the set of instructions called "software"
    - Gives the output and save the result for future use.

```
How Computer works ?
    Input ---> Process ---> Output

Computer Hardware Classification
    - Parts of Computer Hardware / Peripheral Devices
        * Input Devices
        * Output Devices
    - Components of the Computer
         * Cabinet
         * Power Supply Unit (PSU) / Switch Mode Power Supply (SMPS)
         * Motherboard
         * Random Access Memory (RAM)
         * Processor
         * Storage - Hard Disk Drive (HDD) / Solid State Drive (SSD)
         * Optical Drive - CD/DVD Drive (optional)
         * Graphics Card (optional)

Components of Motherboard
    - CPU Socket
    - Chipset
    - Memory Slots / DIMM Slots
    - Expansion Slots
    - Storage Interfaces
    - Input / Output Ports
    - Power Connectors
    - BIOS Chipset
    - CMOS Battery
    - Cooling System (Fan & Heatsinks)


BIOS - Basic Input Output System
    * Read only chip placed on the motherboard
    * Used to perfom the routine task of the computer system
    Two types of BIOS are there
        - Legacy BIOS
        - UEFI (Unified Extensible Firmware Interface) BIOS
    BIOS has 4 Functions
        - POST (Power On Self Test)
        - Bootstrap Loader
        - Setup Utility Program (optional)
        - BIOS Drivers

Storage
    - Partition Scheme
        * MBR (Master Boot Record)
            - Max Partition Size : 2 TB
            - Maximum Allowed Partition: 4 Primary + 1 extended
            - BIOS Support: Legacy BIOS
            - No Redundancy
        * GPT (GUID Partition Table)
            - Max Partition Size : 9.4 ZB (Zetta Bytes)
            - Maximum Allowed Partition: 128 Primary Paritions
            - BIOS Support: UEFI
            - Stores multiple copies of the partition data
    - Partition Type
        * Primary Partition
            - Storing the OS and used for boot
        * Extended Partition
        logical partitions (only in MBR)
        * Logical Partition
            - Partition created inside the extended partition
    - File System
        * FAT (File Allocation Table)
        * NTFS (New Technology File System)
        * exFAT (extended FAT)
        * EXT4 (Fourth Extended File System)
        * APFS (Apple File System)
Recall - Session
```

IT Infrastructure Overview

* Hardware, Software, Networking Devices, Storage, Services, Human Resources, Security

Computer Hardware

* Pheripheral Devices
  - Printer
  - Scanner
  - Speaker
  - Monitor
* Components of the Computer
  - Cabinet
  - PSU (Power Supply Unit) / SMPS (Switch Mode Power Supply)
  - Motherboard
    - Types of the motherboard
      * Form factor based
        - Mini ATx
        - Micro ATx
        - Pico etc.
      * Chipset Based
        - H110, Q270, G31
      * Processor Socket
        -PGA (Pin Grid Array)
        - LGA (Land Grid Array)
    - Components of the motherboard
      - CPU Socket
      - DIMM Slots / Memory Slots / RAM Slots
      - Expansion Slots
      - North Bridge
      - South Bridge
      - BIOS
      - CMOS
      - Cooling System (Fan + Heat Sink)
      - I/O Ports
      - AGP Slots
      - Power Socket
  - RAM (Random Access Memory)
    - DRAM (Dynamic RAM)
    - SRAM (Static RAM)
    - DDR (Dual Data Rate)
    - DIMM - FOr Desktops & SO-DIMM - For Laptops
  - Processor
    - Socket
    - Core
    - Logical Core
    - Multi Threading
    - Hyper Threding
    - Processor Manufacturer
      * Intel
        * i-series processors - Desktops and workstations
        * Xenon series processors - Servers
      * AMD (Advanced Micro Devices)
  - Storage (Hard Disk / Solid State Drive)
    - Hard Disk - Storage on the magnetic disk
      - 3.5 Disk - Desktops
      - 2.5 Disk - Laptop
    - Classification of Hard Disk
      - Desktop Hard Disk - Used in workstations and Desktops
      - Survillance Hard Disk - in CCTV Systems
    - Types of Disk
      - SATA - Serial Advanced Technology Attachment - SATA Power Connector
      - PATA - Parallel Advanced Technology Attachment - Molex Power Connector
    - Solid State Disk - chip Based Storage
      - Types of SSD
        * SATA SSD
        * NvMe / M.2 SSD
  - Optical Drive (CD / DVD)
  - Graphics Card

```
North Bridge
    RAM, CPU, AGP
South Bridge
    BIOS, I/O, PCI, EIDE, USB

BIOS (Basic Input Output System)
    - For the routine task of the system
    - Types of BIOS
        * Legacy - old
            - MBR (Master Boot Record)
        * UEFI(Unifed Extensible Firmware Interface) - new
            - GPT (GUID Partition Table)
    - Functions of the BIOS
        * POST (Power on Self Test)
        * Bootstrap Loader
        * Setup Utility Program
        * BIOS Drivers

Storage
    - Partition Scheme
        * MBR (Master Boot Record)
            - Max Partition Size: 2 TB
            - Max Allowed Primary Partition: 4 (3+1) + Extended
            - Supoorts for Legacy BIOS
        * GPT (GUID Partition Table)
            - Max Partition Size: 9.4 ZB
            - Max Allowed Partition: 128 Primary Partition
            - Supports UEFI BIOS
            - It is redudant
    - Partition Type
        * Types of the partition
            - Primary
                * Storing the OS and used for booting.
            - Extended
                * Multiple Logical Partitions (only in MBR)
            - Logical
                * Partition created inside the extended partition
    - File Systems
        * FAT ( File Allocation Table)
        * NTFS (New Technology File System)
        * APFS ( Apple File System)
        * exFAT (extended FAT)
        * EXT4 ( Fourth extended File System)
        * ReFS (Resilient File System)

********************************************************************************
*****
Day-02

Client - Request for the data / service
Server - Fullfil that service / data request

What is Software ?
        - Software is a collection of instructions, data and programs
        - Software is intangible
    Types of the Software
        - System Software
            * Directly communicate with computer hardware
            * Acts like a bridge between user and computer
            * Example: Operating Systems
                Different OS Platform
                    - Windows
                        Client - Win 7,Win 8,Win 10,Win 11
                        Server - Win Server 2012, Win Server 2016, Win Server 2019, Win
                        Server 2022
                    - Linux
                        Client - Cent OS, Fedora, Ubuntu
                        Server - RHEL (Red Hat Enterprise Linux), Suse Linux
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                    - Mac
                        Client - Mac OS X Tige, Mac OS X Public
                        Server - Mac OS X Server 1.0 etc.
                    - Android / iOS
        - Application Software
            * Designed for end user to perform speciic task
            * Not directly communicating with computer hardware
            * Need any system software to work.
            Example: Web Browsers, Accounting Software, Multimedia Softwares etc
        - Utility Software
            * Types of the software that is used to manage application / system software
            Example - Disk Defragmenter, Disk Cleanup Tools, Windows Administartive Tools
        - Middleware Software
            * Connect different applications to provide the required service
            * Example: Database: MySQL Connector
                       API Middleware: Express.js
        - Programing Software
            * Provode tools for developers to write, test and debug the code.
            * Examples:, Visual Studio, Eclipse, GCC, Java Compiler etc.
        - Driver Software
            * Allow the operating system to communicate with hardware
            * Example: Audio Drivers, Video Drivers, Graphics Drivers etc.

Operating System Functions
    Disk Management (diskmgmt.msc)
    Memory Management (resmon)
    Task Management (taskschd.msc)
    User Management (lusrmgr.msc / netplwiz)
    File Management (fsmgmt.msc)
    Process Management (taskmgr)
    Service Management (services.msc)
    Device Management (devmgmt.msc)
    Program Management (appwiz.cpl)
    Log Management (eventvwr)
    Network Management (ncpa.cpl)

Computer Network
    * A group of two or more than two Devices
    * Used to share information and resources
Types of Network
    * Based on the Geographical Area
        - PAN (Personal Area Network)
        - LAN (Local Area Network)
        - CAN (Campus Area Network)
        - MAN (Metropolitan Area Network)
        - WAN (Wide Area network)
    * Based on the Connectivity Method
        - Wired Network
        - Wireless Network
    * Based on the Network Design
        - Peer to Peer Network
        - Client-Server Network
    * Based on the Network Topology
        - BUS
        - RING
        - STAR
        - TREE
        - MESH
        - HYBRID

Data Transmission Modes
    * Simplex
    * Duplex
        - Half-Duplex
        - Full Duplex

* Broadcast
* Multicast
* Unicast
```

* Anycast

Network Media / Transmission Medium
    * Guided Medium (Wired)
        - Co-Axial Cable (Cable TV) - BNC Connector
            - Types of the Co-Axial Cable
                * Thicknet Cable (10Base5)
                * Thinnet Cable (10Base2)
        - Twisted pair Cable (Ethernet) - RJ45 & RJ11 Connector
            - Types of Twisted Pair Cable
                * STP (Shielded Twisted Pair Cable)
                * UTP (Un-shielded Twisted Pair Cable)
        - Fiber Optic Cable (Expensive Solution but provide high Speed and used in Ethernet) - FC, SC, LC Connector
            - Types of Fiber Optic cable
                * Single Mode Fiber Optic Cable
                * Multi mode Fiber Optic Cable
    * UnGuided Medium (Wireless)
        - Infrared (AC Remote, TV Remote)
        - Radiowaves (WiFi)

Recall

Network Devices
    * NIC
    * Hub
    * Bridge
    * Switch
    * Router
    * Modem
    * Gateway
    * Repeater
    * Access Point
    * Firewall
    * VPN

Protocol
    - Set of rules to access and manage any service
Examples
    TCP/IP Transmission Control Protocol / Internet Protocol
    HTTP - Hyper Text Transfer Protocol - 80
    HTTPS -Hyper Text Transfer Protocol Secure - 443
    DNS - Domain Name System - 53
    FTP - File Transfer Protocol - 21
    SMTP - Simple Mail Transfer Protocol - 25, 587,465
    IMAP - Internet Mail Access Protocol - 143,993
    POP - Post Office Protocol - 110,995
    UDP - User Datagram Protocol
    DHCP - Dynamic Host Configuration Protocol - 67 (Server), 68 (Client)
    ICMP - Internet Control Message Protocol
    SNMP - Simple Network Management Protocol - 161, 162
    SSH - Secure Shell Host - 22
    RDP - Remote Desktop Protocol - 3389
    TLS - Transport Layer Security - 443,993,995
    SSL - Secure Socket Layer - 443, 465, 993
    ARP - Address Resolution Protocol
    RIP - Routing Information Protocol - 520
    SIP - Session Initiation Protocol - 5060, 5061
    STP - Spanning Tree Protocol
    BGP - Border Gateway Protocol - 179

Subnet Mask : 255.0.0.0
10.0.1.23
10.0.2.34
10.1.3.5
11.2.4.5

Subnet Mask : 255.255.0.0
184.10.14.11

184.10.14.15
184.14.15.14
183.10.25.16
183.10.16.25
183.10.75.65
183.15.14.25

Subnet Mask : 255.255.255.0
192.168.1.10
192.168.1.14
192.169.2.10
192.168.2.10
192.168.5.14
193.25.15.45
Recall
    Network Devices
        Switch
        Hub
        Router
        Bridge
        Gateway
        VPN
        Firewall
        Repeater
        NIC
        Modem
        Load Balancer

    Protocol and Port Number
        - To identify and work with any service.
        - Protocol is a set of rules
        - Using port number to run specific service.
        - Examples: HTTP, TCP/IP, SMTP, DHCP etc.

    OSI Model
        - Introduced by ISO
        - It has 7 layers
            - Application, Presentation, Session, Transport, Network, Data Link, Physical
        - Layer 3 device name : Router : IP Address
        - Layer Device name : Switch : MAC Address
        - Data, Data, Data, Segments, Packets, Frames, Bits / Signals (Protocol Datagram Unit)
        - Protocols used in layer 3 : RIP, OSPF, BGP, HSRP etc.
        - Protocols used in layer 2 : VLAN, VTP, Etherchannel etc.
    Addresses
        Addressing System Types
            - Logical Addressing
                - IPv4 and IPv6 (32 Bits & 128 Bits)
            - IPv4 Classes
                (Large)A : 1-126
                (Medium)B : 128-191
                (Small)C : 192-223
                (Multicast Purpose)D : 224-239
                (Research & Development)E : 240-255
            Writing IPv4 in Decimal Nubmber System
            IP Address contain information of Network+Host
            we are using the subnet mask to find the network and host portion in IP Address

            - Physical Addressing
                - MAC Address / BIA / Hardware Address (48 Bits)
    Subnetting
        - To seprate a large network in small small groups
        - It will reduce the amount of IP wastage

Types of Switches
    * Unmanaged Switch (Cannot make any configuration)
    * Managed Switch (Configure as per the requirement)

Cisco Networking Devices has it's own OS called as IOS (Internetwork Operating System)
    Modes of Cisco IOS
        * User Exec Mode [Switch>]
        * Privilaged mode [Switch#]
        * Global Configuration Mode [Switch(config)#]
        * Interface Mode [Switch(config-if)#]

Basic Switch Configuration
    - Set Hostname
    - Set Banner Message
    - Set VLAN 1 IP
    - Set Enable Password

Configure Telnet
    enable
    configure terminal
    hostname SW1
    enable password 1234
    interface vlan 1
    ip address 192.168.1.1 255.255.255.0
    no shutdown
    exit
    username wipro password 1234
    line vty 0 4
    login local
    transport input telnet
    exit
    do wr

    Test the configuration
        ping 192.168.1.1
        telnet 192.168.1.1

VTP (VLAN Trunking Protocol)
    * Cisco proprietry protocol
    * Works on layer 2 of OSI Model
    * Allow to manage the VLANs on multiple switches dynamically

Importance of the VLAN
    * Centralized Management of VLAN
    * Consistency
    * Reduce the Administrative efforts
    * Supports Large Networks

How VTP works
    * The VTP Server switch maitains a VLAN Database
    * When there are any changes made, server sends the VTP Advertisements
    * VTP Client Switches receive the update and sync their VLAN database
    * Trunk links carry the VTP Message accross the switches.

VTP Modes
    * VTP Server Mode
    * VTP Client Mode
    * VTP Transparent Mode

VTP versions
    * VTPv1 - Basic VLAN Management, does not supports the extended VLANs (1006-4096)
    * VTPv2 - Supports Token Ring VLANs, Improved consistency checks
    * VTPv3 - Supoorts extended vlan range (1006-4096), select primary server,
    authentication

Etherchannel
    * Layer 2 Protocol
    * Used to group multiple physical links into one logical link
    * Maximum we can group 8 physical links into one logical link
    * By grouping the links it will increase the bandwidth
    * Also it will make the connection redundant
Protocol used to configure the Etherchannel

    * PAgP (Port Aggregation Protocol) - Cisco Proprietary - Only used in cisco devices
        - Auto : Passively wait for the otherside to initiate the etherchannel
        - Desirable : Actively initiate the Etherchannel Negociation
    * LACP (Link Aggregation Control Protocol) - IEEE 802.3ad Standard / Open Protocol - in used all devices
        - Active : Actively tries to form an Etherchannel by sending LACP packets
        - Passive : Waits for the other side to initiate the Etherchannel

Recall

Remote Management of Networking Devices
    * Telnet
    * SSH (Secure Shell Host)

Switches and the Switching

    * Basic Switch Configuration
        - Set Hostname
        - Set Banner Message
        - Set IP Address to VLAN 1
        - Set Enable Password
        - User creation can be done
        - Configure SSH (if enable the remote access)

    * VLAN (Virtual Local Area Network)
        - Seprtae the network into groups
        - Maintain the security
        - Reduce broadcast traffic
        - Types of VLAN
            - Static VLAN (Based on Ports)
            -Dynamic VLAN (Based on the MAC Address)
        - VLAN Ranges
            1 - Default VLAN
            2-1001 - Custom VLAN Ranges
            1002-1005 - Reserved for the legacy purpose (this can't be used by admin)
            1006-4096 - Extended VLAN Range
        - VLAN Port Modes
            - Access Mode - To assign the VLAN membership
            - Trunk Mode - To carry the VLAN traffic between the switches
        - Commands used in VLAN
            - vlan <ID>
            - name <name>
            - int range <port range>
            switchport mode access
            switchport access vlan <vlanid>

    * VTP (VLAN Trunking Protocol)
        - Used to manage the VLAN Configuration on multiple switches
        - It is a CIsco Proprietary Protocol
        - Works on Layer 2 of OSI Model
        - Versions of VTP
            - VTPv1 - Doesn't support extended VLAN range
            - VTPv2 - Supports token ring networks, Improved consistency checks
            - VTPv3 - Supports extended range, select primary server, authentication
        - Prerequsites to run VTP
            - All switch must be in a same VTP domain
            - IP Addresses assigned on the switches (optional)
            - Switches must be connected through the Trunk Link
        - VTP Modes
            - Server Mode - Create, Delete and Modify VLAN that will be replicated to the clients
            - Client Mode - Get the update from the server, but not permitted to manage VLAN by own
            - Trasparent Mode - Only forward the traffic to the client switches without updating it's VLAN database.

    * STP (Spanning Tree Protocol)
        - Used to avoid the loops in a network

```
        - Layer 2 Protocol
        - Types of STP Protocol
            STP - Standard STP, slow convergence (~50 sec)
            RSTP - Rapid STP, faster convergence (~2-3 sec)
            MSTP - Multiple STP, supports multiple VLAN Instances
            PVST+ (Cisco Proprietary) - Per-VLAN STP, seprate the STP instance per VLAN
            Rapid PVST+ (Cisco Proprietary) - Per-VLAN RSTP, faster convergence

    * Etherchannel
        - Layer 2 Protocol
        - It will group physical links to create a one logical link
        - It will increase the bandwidth and the redundancy
        - Maximum 8 physical ports can be linked in a one Etherchannel
        - Protocols Used in Etherchannel
            - PAgP (Port Aggregation Protocol)
                - Cisco Proprietary Protocol
                - Two Modes of that protocol
                    - Auto : Passively waits for the other side to initiate Etherchannel
                    - Desirable : Actively initiate the Etherchannel Configuration
            - LACP (Link Aggregation Control Protocol)
                - Open standard protocol
                - Two Modes of that protocol
                    - Active : Actively tries to form a etherchannel by sending LACP
                    packets
                    - Passive : Waits fpr the otherside to initiate the Etherchannel

Routing Types
    - Default Routing
    - Static Routing (Manual)
    - Dynamic Routing (Automatically get the paths)
        Three Types of Protocol
            - Distance Vector Routing Protocol
                - RIP (Routing Information Protocol)
            - Link State Routing Protocol
                - OSPF (Open Shortest Path First)
            - Hybrid Routing Protocol
                - EIGRP (Enhanced Interior Gateway Routing Protocol)

RIP (Routing Information Protocol)
    - Distance Vector Routing Protocol
    - It will count the number of Hops
    - Hop count is the metric
    - Maximum 15 Hops can be work in RIP, 16th will consider as a unreachable
    - Send perodic updates every 30 seconds
    - Uses UDP port 520 for communication
    - Administrative Distance value of RIP Protocol is 120
    - It determine the best path based on the number of hops between the source and
    destination
    - Easy to configure the rip protocol
Types of RIP Protocol
    - RIPv1 : Classful, no support for subnetting, no authentication
    - RIPv2 : Classless, supports VLSM & CIDR, multicasts the updates, authentication
    - RIPng : Works with IPv6 networks
How RIP protocol works
    - Each router initializes it's routing table with directly connected networks
    - Routers exchange routing updates with neighbors with every 30 seconds
    - If router learns a new route it add the increments in the hop count and update
    it's table
    - If any route becomes unreachable then it uses a hold on timer for 180 seconds
    before removing it
    - It uses flush timer of 240 seconds and then remove the entry for that path
Recall
    Routing and It's Types
        - Default Routing
        - Static Routing
            - AD value 1
        - Dynamic Routing
    Types of Routing Protocol
        - Distance Vector Routing Protocol
```

```
            - RIP (Routing Information Protocol)
                - AD value 120
        - Link State Routing Protocol
            - OSPF (Open Shortest Path First)
        - Hybrid Routing Protocol
            - EIGRP (Enhanced Interior Gateway Routing Protocol)


Wintel Basics

Windows 10

Operating systems
    - Client OS - Win 7, Win 8, Win 8.1, Win 10, Win 11
    - Server OS - Win Server 2012, Win Server2012 R2, Win Server 2016, Win Server 2019,
    Win Server 2022, Win Server 2025

Virtualization

System Restore
File and Printer Sharing


Windows Server 2019
- Minimum Installation Requirements
    Processor : 1.4 GHz 64-Bit
    RAM : 2 GB (Desktop Experience) / 512 MB (Server Core)
    Storage : 32GB

Windows Server 2019 Installation Methods
    Server with GUI - It is having the Graphical user interface.
    Server Core - It is having the command line user interface.

Windows Server 2019 Editions
    Essentials : Best for small businesses with upto 25 users & 50 devices
    Standard : Supports two virtual machines (VMs)
    Datacenter : Suitable for the large organizations with unlimited VM & Advanced
    Security
    Hyper-V Server : Free edition of windows server used for virtualization

After Installing Windows Server 2019 (Post Installation Task)
    1. Setup Administrator Password
    2. Set Static IP for the Server
    3. Enable the Remote Desktop
    4. Turn Off Internet IE Security
    5. Disable Firewall (not recommended)
    6. Rename Computer

Windows Server Roles and Fetaures
    - Roles in Windows Server
        * Primary Function or Set of Service that server perform.
        * Each role represents a major service funtion that provides services to user
        * Example: DHCP, DNS, Hyper-V, Web Server (IIS) etc.
    - Features in Windows Server 2019
        * Features is an additional capability that inhances the Server OS
        * It does not provide any primary function or service.
        * Example: Windows Server Backup, Windows Powershell, Wireless LAN Service
```