COS 207 –Network Operating System Assignment

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Task 1 – Constructing a Ubuntu Linux Networking using LAN

1.1 Introduction to Ubuntu Linux Networking

One of the first multi-user operating systems created in the 1970s and 1980s, Unix, is the foundation of Linux. Although Unix started out as a single operating system, several commercial versions were created throughout time. Linux, a free operating system with features similar to Unix (or at least an operating system kernel), first surfaced in the 1990s. Linux gained popularity in the 2000s in the usual Unix domains of workstations and servers, and it has been expanding in the desktop space as well (though it still lags behind Microsoft Windows in terms of installs). Ubuntu Linux is an open-source, free operating system based on Unix that was primarily created for desktop (and laptop) use. The goal is to provide an intuitive Linux distribution. In server contexts, Ubuntu Linux is also widely used, particularly for networking functions like web-service hosting, VPNs, and routing. In each section, we have showcased the tools and methods that make Ubuntu a popular network operating system for a variety of applications.

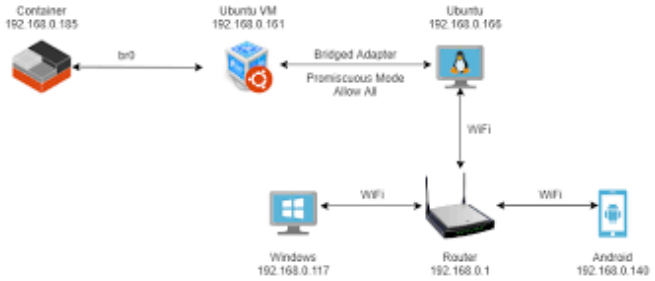

Figure 1.1 - Ubuntu Linux Networking

The following sections go into further detail of Ubuntu's networking capabilities, including server management, security measures, routing protocols, setup tools, and troubleshooting tools. Each section focuses on the methods and resources that make Ubuntu a well-liked network operating system for various applications.

a. Network Configuration

Netplan is a Linux system tool for network configuration abstraction, allowing administrators to outline necessary interfaces for various deployments. It meets the demand for simple, YAML-based setups, enabling administrators to handle multiple back ends using standard network configuration. Network interface names identify Ethernet ports. The configuration is visible to the user of the computer, and computers set up as DHCP clients have no control over the settings they get from the DHCP server.
The following are the most typical configurations that DHCP servers give to DHCP clients:
Netmask and IP address

IP address of the default-gateway to use

IP addresses of the DNS servers to use

DHCP Configuration Methods for DNS Servers

• Manual Allocation (MAC Address): DHCP determines each network card's hardware address.

• Dynamic Allocation (Address Pool): DHCP assigns an IP address for a predetermined lease time.
• Configuration attributes are distributed dynamically and on a "first come, first served" basis.
• Automatic Allocation: DHCP gives a device a persistent IP address automatically.
• Unlimited lease duration: Both approaches are considered "automatic" as they assign an address without additional work.

b. Routing and Protocols:

Internet Protocol (IP) and Transmission Control Protocol (TCP) combine to form TCP/IP, a network protocol. While TCP guarantees that data flow across connections is delivered in the same sequence, IP manages network packet routing using the IP Datagram. IP address, netmask, network address, and broadcast address are all part of the TCP setup. While nameserver addresses convert network hostnames into IP addresses, gateway addresses are used to connect to certain networks or hosts. To match a particular subnetwork, a more suitable broadcast address is configured. TCP/IP setup requires valid nameserver addresses.

IP Routing Overview

• Technique for defining and identifying TCP/IP network pathways.

• Two main types: static and dynamic.

• Static routing: Simple, predictable, low overhead, manual addition of IP routes.

• Dynamic routing: Uses specialized protocols like RIP, depends on extensive networks.

• Provides less manual configuration, better scalability, and flexibility.

c. **Security and Access Control:**

• Security Policies and Firewalls: Contains Uncomplicated Firewall (UFW) for simple iptables configuration.
Only authorized users can access network resources thanks to access management. For more controls, use PAM and OpenSSH to handle secure shell access.
• Encryption: Provides safe data transfer by supporting TLS and SSL protocols. Additionally offered are tools for encrypting folders or file systems.
• VPNs: OpenVPN and WireGuard are supported for safe data transfer.
• Security Updates: Patches vulnerabilities on a regular basis. For system security, automatic updates can be configured.
• Application security: By making sure that only necessary apps and services are operating, it lowers the attack surface.
Setting up, executing, and managing apps and services all depend on server management.

d. Server Management:

• User and Access Management: Adduser and usermod are two commands that allow for the effective addition and management of users.

Using the appropriate package manager to install and update software is known as software installation and management. Mail, database, and web servers are examples of common server applications.

• Hosting and Web Services: Tools like Apache, Nginx, MySQL, PostgreSQL, PHP, and Python integrations are widely used for hosting web services.

• Configuring the Firewall and Network: Netplan makes IP settings easier, while UFW streamlines firewall rules.

• Monitoring and Troubleshooting: Ping, traceroute, and system logs are some of the tools that network administrators use to diagnose and fix problems. Server performance and health data are tracked by sophisticated monitoring systems like Munin or Nagios.

e. Network Troubleshooting:

Network troubleshooting is a critical aspect of Ubuntu Linux networking, focusing on diagnosing and resolving issues to maintain a reliable network. Here are some essential tools and techniques:

• Ping: Measures latency and confirms network connectivity.

• Traceroute/Tracepath: Tracks the packet path to find any failed hops or bottlenecks.

• Tcpdump: Gathers and examines network traffic to identify complicated problems.

• Netstat/SS: Verifies open ports and active network connections.

• Nmap: Provides information on network topology and security by locating devices and open ports.

• Ubuntu Linux continues to be a top network administration solution because to its broad toolbox and emphasis on dependability.

1.2 Introduction to IPv4 and IPv6

Internet Protocol Version 4 (IPv4)

The Internet Protocol (IP) was invented in 1978 and its fourth version, known as IPv4, was decided in 1981. The majority of Internet traffic is directed by it, which functions at the network layer of the OSI Model and the Internet layer of the TCP/IP model. IPv4 has a best effort delivery approach, which makes sure packets get to their destination without preventing duplicate transmission or assuring correct sequencing. With 4.3 billion distinct IP addresses, IPv4 was in short supply as more devices connected to the internet.

Internet Protocol Version 6 (IPv6)

The Internet Engineering Task Force (IETF) created IPv6, the most recent version of the Internet Protocol, in 1991 to combat weariness. 3.4 times more unique addresses are possible with its 128-bit address than with IPv4's 32-bit addresses. IPv6 is more effective for contemporary internet setups with IoT devices and high-demand applications since it also adds routing, network configuration, and security capabilities. Compared to IPv4, which uses 32-bit addresses, IPv6 utilizes a 128-bit address, enabling 2128 addresses, or around 3.4×1038 addresses, or more than 7.9×1028 times as numerous. There are around 4.3 billion addresses available with IPv4.

	IPv4	**IPv6**
Addressing Format	32 bit addressing	128 bits
Address Representation	Decimal	Hexadecimal
Addressing Mode	Unicast, Broadcast, Multicast	Unicast, Multicast, Anycast
Total number of addresses	4,294,967,296 unique addresses	340,282,366,920,938,463,463,374,607,431,7 addresses 68,211,456 unique addresses
Network Bit Representation	Subnet mask in dotted decimal notation or prefix length	Prefix length notation only

Here is the advantages and disadvantages of IPv4 and IPv6

Pros of IPv4

- Internet systems are easy to use and straightforward.
- It is compatible with most websites.
- Known technology
- Simple deployment

Cons of IPv4

- A restricted quantity of distinct IP addresses
- Limited capacity to scale

- There aren't many IP addresses accessible overseas.
- Absence of built-in internet security safeguards

Pros of IPv6

- More IP addresses
- The automatic setup of stateless addresses
- Better results outside of the United States
- An complete network is represented by a single routable IP address.
- Easier use of DHCPv6

Cons of IPv6

- Not yet widely accepted
- In order to accommodate more addresses, addresses are longer.
- The costly transition to new routing equipment

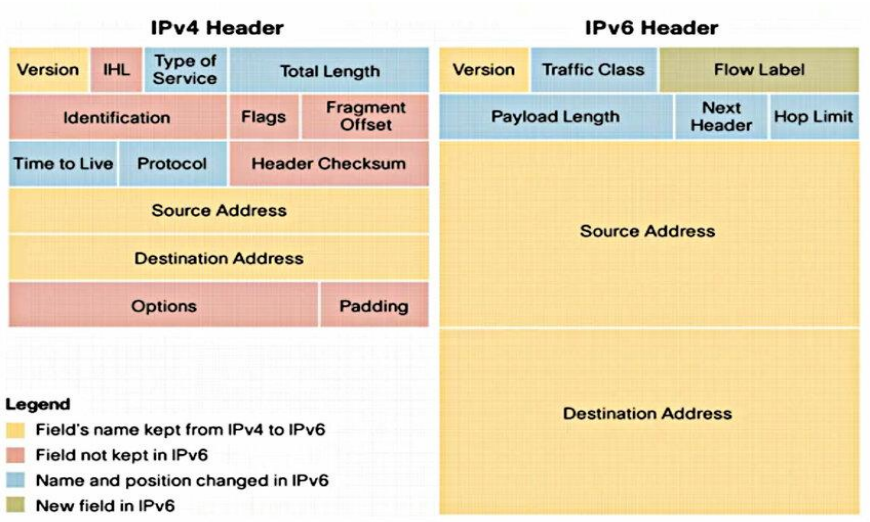

Figure 2.1 - Comparison of IPv4 and IPv6 headers

1.3 Hardware Used in LAN

For seamless communication between linked devices, Local Area Networks (LANs) need specialized hardware. An outline of key LAN hardware, including its features, applications, and variations, is provided below.

1. Router

- **Characteristics**:

Guides packets of data between several networks.

Devices on the network are given IP addresses.

Both wired and wireless communication are supported.

- **Usage**:

Establishes an internet connection to a LAN.

Data is routed between devices in various subnets.

Figure 3.1 - Router

2. Switch

- **Characteristics**:
  - Operates at the data link layer.
  - Establishes connections between devices in a LAN and forwards data using MAC addresses.
  - Facilitates full-duplex communication.

- **Usage**:
  - It makes it easier for devices connected to the same network to communicate with one another.
  - By using intelligent packet forwarding, network congestion is decreased.

Figure 3.2 - Switch

3. Hub

Characteristics:

- Operates at the physical layer.
- Broadcasts information to every device that is linked, irrespective of who is receiving it.
- Can cause network traffic congestion.

Usage:

- Legacy devices in small networks (rarely used today).
- Simple data transmission without filtering.

Figure 3.3 - Hub

4. Network Interface Card (NIC)

Characteristics:

- A hardware component installed in devices.
- Provides Ethernet or Wi-Fi connectivity.

- Offers Wi-Fi or Ethernet connectivity.
- Supports 10 Mbps to 10 Gbps or higher speeds.

Usage:

- Enables devices to connect to a network.
- Transforms digital information into transmission signals.

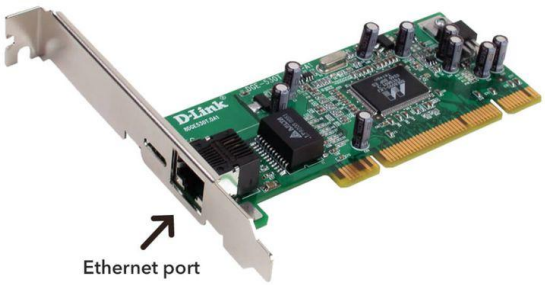

Figure 3.4.1 - Wired NIC

Figure 3.4.2 - Wireless NIC

5. Access Point

- **Characteristics**:
  - Provides wireless connectivity.
  - Serves as an intermediary between wired and wireless networks.
  - It has the ability to increase a wireless network's range.

- **Usage**
  - Establishes a LAN connection for wireless and mobile devices.
  - Used for seamless Wi-Fi coverage in large homes and offices.

Figure 3.5 - Access Point

Differences between all five mentioned above:

Hardware	Function	Layer	Key Feature	Usage
Router	Connects networks, assigns IPs	Network Layer	Routes data between networks	LAN-to-WAN or subnet connectivity
Switch	Connects devices, forwards data intelligently	Data Link Layer	Uses MAC addresses	Internal LAN communication
Hub	Connects devices, broadcasts data	Physical Layer	No filtering, high congestion	Legacy small networks
Network Interface Card (NIC)	Enables device-to-network connection	Data Link/Physical Layer	Wired or wireless connectivity	Device-to-network connection
Access Point	Extends wireless connectivity	Data Link Layer	Wi-Fi bridge to LAN	Wireless LAN extension

1.4 Configuring Ubuntu Linux on a LAN

sudo ubuntu-drivers install

This command installs proprietary hardware drivers for your system. It automatically identifies the drivers that are most appropriate for your system, including Wi-Fi devices and graphics cards (NVIDIA). ***Sudo*** is to execute because it modifies system-level configurations. It checks available drivers using the ***ubuntu-drivers*** tool. After installing Ubuntu, it is frequently used to install drivers for proprietary hardware, such as graphics cards and Wi-Fi adapters.

```
ubuntu@ubuntu:~$ ifconfig
Command 'ifconfig' not found, but can be installed with:
sudo apt install net-tools
ubuntu@ubuntu:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 204 kB of archives.
After this operation, 811 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble/main amd64 net-tools amd64 2.10-0.1ubuntu4 [204 kB]
Fetched 204 kB in 2s (119 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 211034 files and directories currently installed.)
Preparing to unpack .../net-tools_2.10-0.1ubuntu4_amd64.deb ...
Unpacking net-tools (2.10-0.1ubuntu4) ...
Setting up net-tools (2.10-0.1ubuntu4) ...
Processing triggers for man-db (2.12.0-4build2) ...
```

Figure (4.1)

Ifconfig is a legacy command used to view and configure network interfaces. It displays IP addresses, MAC addresses, subnet masks, and other interface details.
The **net-tools** package, which contains legacy networking utilities like *ifconfig, netstat, and route*. These tools are not included by default in many newer Linux distributions.

```
ubuntu@ubuntu:~$ sudo ubuntu-drivers install
udevadm hwdb is deprecated. Use systemd-hwdb instead.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libmspack0t64 libxmlsec1t64-openssl open-vm-tools zerofree
Suggested packages:
  open-vm-tools-containerinfo open-vm-tools-salt-minion
The following NEW packages will be installed:
  libmspack0t64 libxmlsec1t64-openssl open-vm-tools open-vm-tools-desktop
  zerofree
0 upgraded, 5 newly installed, 0 to remove and 0 not upgraded.
Need to get 1004 kB of archives.
After this operation, 4145 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble/main amd64 libmspack0t64 amd64 0.11-1.1build1 [40.0 kB]
Get:2 http://archive.ubuntu.com/ubuntu noble/main amd64 libxmlsec1t64-openssl amd64 1.2.39-5build2 [84.1 k
B]
Get:3 http://archive.ubuntu.com/ubuntu noble/main amd64 open-vm-tools amd64 2:12.3.5-5build3 [737 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble/main amd64 open-vm-tools-desktop amd64 2:12.3.5-5build3 [136
kB]
Get:5 http://archive.ubuntu.com/ubuntu noble/main amd64 zerofree amd64 1.1.1-1build5 [7888 B]
Fetched 1004 kB in 2s (460 kB/s)
Selecting previously unselected package libmspack0t64:amd64.
```

Figure (4.2)

```
ubuntu@ubuntu:~$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.204.131  netmask 255.255.255.0  broadcast 192.168.204.255
        inet6 fe80::20c:29ff:fef7:d8af  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:f7:d8:af  txqueuelen 1000  (Ethernet)
        RX packets 1852  bytes 1918337 (1.9 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 690  bytes 95783 (95.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 177  bytes 16899 (16.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 177  bytes 16899 (16.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Figure (4.3)

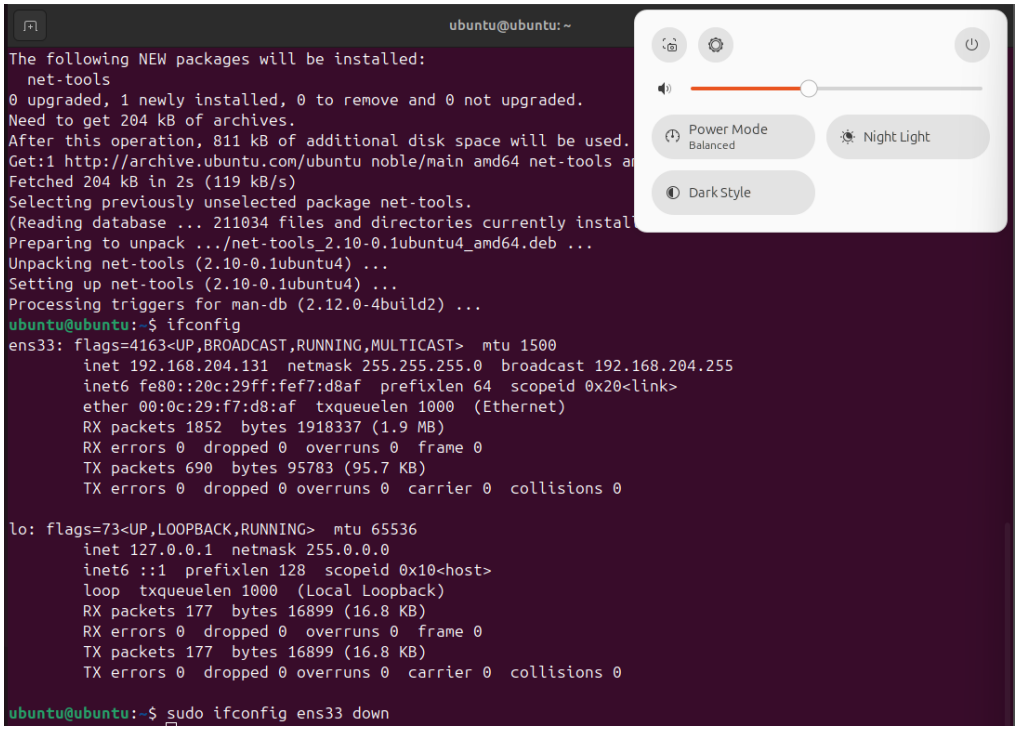

Figure (4.4)

sudo ifconfig ens33 up - Activates the specified network interface (*ens33*). The *ens33* interface is commonly found in virtualized environments, like VMware or VirtualBox. It is used to bring a network interface online after it has been disabled or reconfigured.

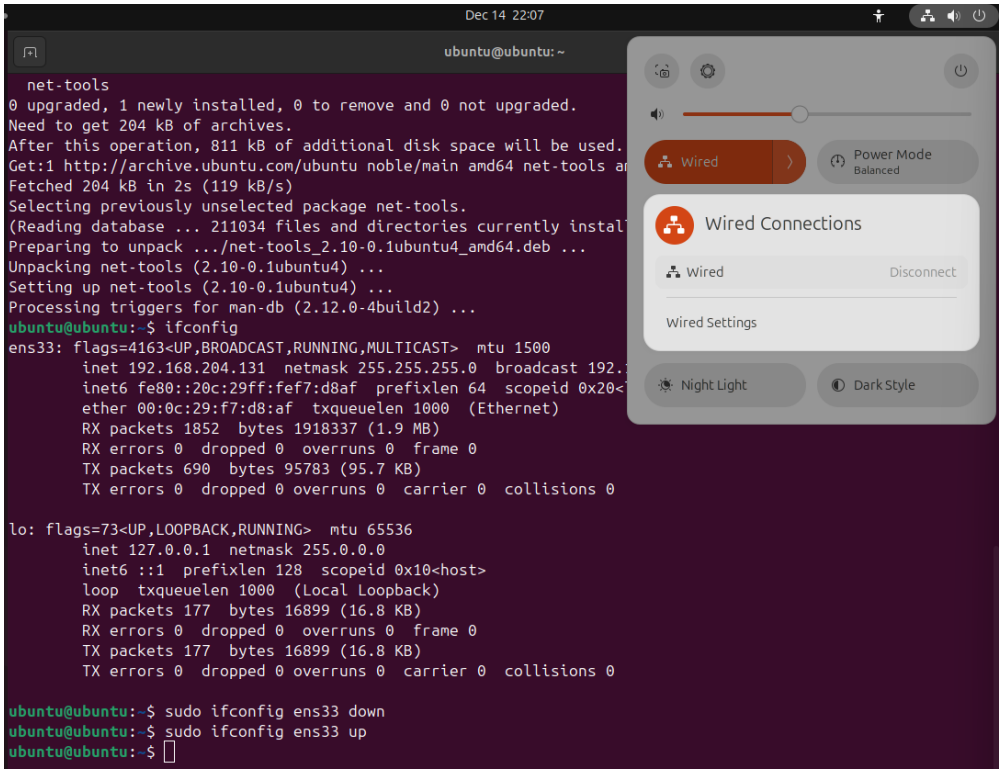

Figure (4.5)

sudo ifconfig ens33 down - Disables the specified network interface (*ens33*). The interface will no longer send or receive network packets until it is brought back up. It is useful troubleshooting or reconfiguring network interfaces or isolating issues by disabling certain interfaces.

1.5 Assigning IP address to the LAN

There are three main ways to assign IP addresses to devises to network, depending on the setup and preferences.

In **static IP addressing** - each device's IP address is manually configured. For critical components like servers or printers, this method guarantees consistent and fixed IP addresses for devices.

Dynamic IP Addressing Using **DHCP** - devices obtain IP addresses automatically from a **DHCP server**.

SLAAC (Stateless Address Autoconfiguration) – Only IPv6 network devices can automatically generate an IP address without a DHCP server using **SLAAC**. This uses the router's **Router Advertisement (RA)** messages.

APIPA (Automatic Private IP Addressing) - When a DHCP server is unavailable, devices assign themselves an Automatic Private IP Address (APIPA) in the 169.254.x.x range.

Here this system have used Static IP Addressing, and the details of IP Addresses which are assign to each department are shown below in separated figure.

Name	Interface	IP Address
Router (INSIDE)	Gig0/0	192.167.1.1
Router (OUTSIDE)	Gig0/1	10.0.0.2
Firewall (OUTSIDE)	Gig1/1	10.0.0.1
Firewall (INSIDE)	Gig1/2	192.168.1.254

Figure (5.1) – IP Addresses of Router and Firewall

Depertment Name	ID	IP Address
Management Excetuive Team	MED001	192.168.1.1
Management Excetuive Team	MED002	192.168.1.2
Management Excetuive Team	MED003	192.168.1.3
Management Excetuive Team	MED004	192.168.1.4
Management Excetuive Team	MED005	192.168.1.5
Management Excetuive Team	MED006	192.168.1.6

Figure (5.2) – IP Addresses of Management Executive Team

Depertment Name	ID	IP Address
Purchasing and Procurement	PPD001	192.168.1.17
Purchasing and Procurement	PPD002	192.168.1.18
Purchasing and Procurement	PPD003	192.168.1.19
Purchasing and Procurement	PPD004	192.168.1.20

Figure (5.3) – IP Addresses of Purchasing and Procurement

Depertment Name	ID	IP Address
Finance and Accounting	FAD001	192.168.1.25
Finance and Accounting	FAD002	192.168.1.26

Figure (5.4) – IP Addresses of Finance and Accounting

Depertment Name	ID	IP Address
Sales and Marketing	SMD001	192.168.1.41
Sales and Marketing	SMD002	192.168.1.42
Sales and Marketing	SMD003	192.168.1.43
Sales and Marketing	SMD004	192.168.1.44

Figure (5.5) – IP Addresses of Sales and Marketing

Depertment Name	ID	IP Address
Overseas Support Team	OSTD001	192.168.1.33
Overseas Support Team	OSTD002	192.168.1.34
Overseas Support Team	OSTD003	192.168.1.35
Overseas Support Team	OSTD004	192.168.1.36
Overseas Support Team	OSTD005	192.168.1.37
Overseas Support Team	OSTD006	192.168.1.38

Figure (5.6) – IP Addresses of Overseas Support Team

1.6 Testing the Network

Testing a network means checking if the network setup works as intended. Here are six ways to test network: Ping, Traceroute, Simulation Mode, Checking Configurations, Testing Protocols and Performance checking. In this report, we have used Ping test from each department.

Getting reply from ping test means successful connectivity. As the packet loss = 0, that means a good sign of network reliability. When we don't get reply from ping test, this means the Devices is Unreachable, Network Issues, Incorrect Address, And Firewall/ACLs.

i. Ping Test from Management Executive Team

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Figure 6.1 - Ping Test to Management Executive Team Department

```
C:\>ping 192.168.1.17

Pinging 192.168.1.17 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.17:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Figure 6.2 - Ping Test to Purchasing and Procurement Department

ii. Ping Test from Purchasing and Procurement

```
C:\>ping 192.168.1.18

Pinging 192.168.1.18 with 32 bytes of data:

Reply from 192.168.1.18: bytes=32 time<1ms TTL=128
Reply from 192.168.1.18: bytes=32 time<1ms TTL=128
Reply from 192.168.1.18: bytes=32 time<1ms TTL=128
Reply from 192.168.1.18: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.18:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Figure 6.3 - Ping Test to Purchasing and Procurement Department

```
C:\>ping 192.168.1.25

Pinging 192.168.1.25 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.25:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Figure 6.4 - Ping Test to Finance and Accounting Department

iii. Ping Test from Finance and Accounting

```
C:\>ping 192.168.1.26

Pinging 192.168.1.26 with 32 bytes of data:

Reply from 192.168.1.26: bytes=32 time<1ms TTL=128
Reply from 192.168.1.26: bytes=32 time<1ms TTL=128
Reply from 192.168.1.26: bytes=32 time<1ms TTL=128
Reply from 192.168.1.26: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.26:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Figure 6.5 - Ping Test to Finance and Accounting Department

```
C:\>ping 192.168.1.33

Pinging 192.168.1.33 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.33:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Figure 6.6 - Ping Test to Oversea Support Team Department

iv. Ping Test from Oversea Support Team

```
C:\>ping 192.168.1.34

Pinging 192.168.1.34 with 32 bytes of data:

Reply from 192.168.1.34: bytes=32 time<1ms TTL=128
Reply from 192.168.1.34: bytes=32 time<1ms TTL=128
Reply from 192.168.1.34: bytes=32 time<1ms TTL=128
Reply from 192.168.1.34: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.34:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Figure 6.7 - Ping Test to Oversea Support Team Department

```
C:\>ping 192.168.1.41

Pinging 192.168.1.41 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.41:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Figure 6.8 - Ping Test to Sales and Marketing Department

v. Ping Test from Sales and Marketing

```
C:\>ping 192.168.1.42

Pinging 192.168.1.42 with 32 bytes of data:

Reply from 192.168.1.42: bytes=32 time=1ms TTL=128
Reply from 192.168.1.42: bytes=32 time<1ms TTL=128
Reply from 192.168.1.42: bytes=32 time<1ms TTL=128
Reply from 192.168.1.42: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.42:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Figure 6.9 - Ping Test to Sales and Marketing Department

```
C:\>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Figure 6.10 - Ping Test to Management Executive Team Department

1.7 Network diagram for a medium-scale organization

This diagram shows the network design for Shinokawa Limited, a medium-scale organization, which is a Japanese telecommunication organization. The company have five departments and there are computers for each. The diagram included the existing devices which the company are using

i. Twisted Pair
ii. Interconnecting devices containing 2 switches supporting 30 nodes: Facilitate communication within departments
iii. 1 Router: Manage traffic and connect to external networks.
iv. A Software Firewall: Firewalls protect data and prevent unauthorized access.

Ubuntu Linux Network Server to provide essential services like email and file storage. Each department has its own subnet for traffic segregation and security. The diagram outlines the network's structure and function. It's crucial for efficient and secure organizational operations.

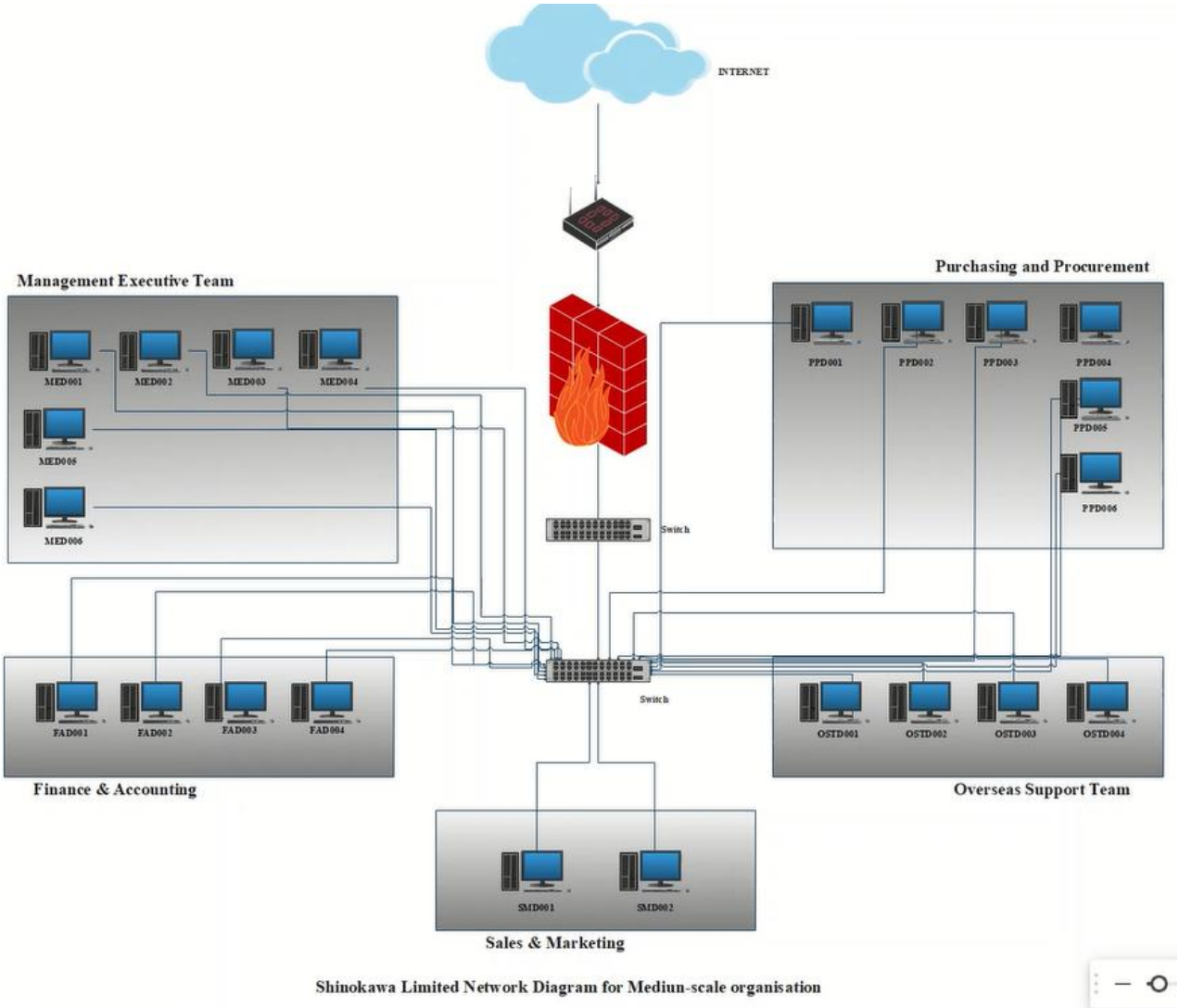

Figure 7.1 – Shinokawa Limited Network diagram for a medium-scale organization

Task – 2 Mobile Computing

2.1 Detailed Analysis of the Android Platform

Budget considerations: Android requires the smallest initial investment and is the least costly choice for network expansion. Because of the platform's numerous device manufacturer options, Shinokawa Limited is able to select hardware that meets their financial constraints. Open-source development is a popular option for companies searching for reasonably priced mobile solutions because it significantly reduces implementation expenses overall.

Performance & Speed: Depending on certain hardware combinations, the Android platform displays varying performance characteristics that can be difficult to use but also provide flexibility in device selection. While contemporary Android handsets have moderate to high processing capability, top-tier smartphones provide outstanding performance for business apps.

Market Demand: Leading the global smartphone market with a 71.4% market share as of Q4 2023, Android provides an unparalleled opportunity for widespread customer engagement. The platform's vast user base, which spans several demographic and geographic boundaries, enables Shinokawa Limited to efficiently reach a variety of clients.

Privacy and Security: Although open-source systems may have built-in security vulnerabilities, Android has significantly improved its security protocols. Using enterprise-grade security measures and implementing robust encryption can effectively eliminate potential privacy risks.

2.2 Comprehensive Assessment of the iOS Platform

Budget Dynamics: Apple's iOS platform is a premium product that costs more. The closed environment requires a substantial investment in both device acquisition and application development, with typical device costs ranging from $699 to $1,499, respectively.

Performance Features: iOS's tightly integrated hardware and software ecosystem contributes to its outstanding performance. Apple's regulated environment guarantees consistent user experiences across devices, with greater application speed and enhanced processing capabilities.

Market Penetration: iOS dominates premium market sectors, especially in developed markets, although maintaining a lesser global market share of 27.2% (Q4 2023). The platform is appealing for focused marketing methods since it draws high-value customers with substantial spending power.

Privacy Framework: With strict app store rules and strong data protection measures, Apple's iOS exemplifies industry-leading privacy standards. The isolated ecosystem of the platform reduces any external risks and enables complete user data protection.

2.3 Assessment of Windows Mobile Using the Azure Platform from Microsoft

Strategic Positioning: Microsoft's mobile platform and Azure cloud infrastructure offer unique enterprise-focused functionality. The platform's significance is currently waning, with less than 0.1% of the smartphone market, which limits its broader commercial application.

Technical Infrastructure: Windows Mobile offers scalable solutions suitable for companies requiring complex technical ecosystems due to its enterprise-grade design, while yet offering moderate performance and a high degree of cloud integration potential.

Market Dynamics: Windows Mobile has a little consumer market share at the moment, which makes it difficult for it to be widely adopted. Rather than consumer smartphone markets, the platform's main strength is in enterprise and specialist business contexts.

Comparative Mobile Platform Analysis Table

Parameter	Android	iOS	Web Mobile
Market Share	71.4% (Q4 2023)	27.2% (Q4 2023)	0.1% (Declining)
Global Devices	2.5 billion active	1.2 billion active	Negligible
Average Devices Cost	$200-$800	$699-$1499	Limited Current Production
Average Update Frequently	6-12 months	Annual	Discontinued
Privacy Rating	Moderate	High	Enterprise-Focused

(Taylor, 2022) (Anon., n.d.)

2.4 Recommendation **:** The Android Platform

Cost-effectiveness: Android is the mobile platform with the lowest development and deployment costs, which will provide Shinokawa Limited cost-effective choice that minimizes upfront implementation costs and maximizes return on technology investment.

Broad Market Penetration: Android gives the company the greatest global user accessibility, enabling it to reach an unmatched number of potential users from a range of geographic and demographic backgrounds, creating substantial opportunities for network and market expansion.

Technological Flexibility: The android platform supports numerous device configurations, which allow Shinokawa Limited to select from a range of hardware solutions. This makes it possible to develop strategies that are tailored to specific organizational needs and guarantees interoperability with various technology infrastructures.

Scalable Architecture: Android's flexible ecosystem provides a solid foundation which can easily scale across varied market segments. That allows the corporation exceptional freedom to change and grow its mobile strategy in response to increasing business demands and technical breakthroughs.

These comprehensive arguments highlight Android's strategic supremacy as the best mobile platform for achieving Shinokawa Limited's network growth goals by striking a balance between long-term scalability, market reach, technical adaptation, and economic efficiency.

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