UGANDA CHRISTIAN UNIVERSITY
A Centre of Excellence in the Heart of Africa

FACULTY OF ENGINEERING, DESIGN AND TECHNOLOGY
DEPARTMENT OF COMPUTING AND TECHNOLOGY
TRINITY 2025 WORKSHOP PRACTICE **LAB**

LAB CATEGORY*:* Networking (Lab 5)

DATE TO BE UNDERTAKEN: Friday **29th May 2025**

VENUE: Ankrah Auditorium

OBJECTIVES

By the end of this lab, students were able to:

- Enable and configure the DHCP server with IP pools for VLANs 11–13, 21–23, and 31–33.
- Enable and verify the TFTP server, and back up running configurations from all switches.
- Configure client computers across all VLANs to obtain IP addresses via DHCP.
- Configure default routing so that all VLANs can reach the service provider through Core-1 and Core-2.
- Secure all switches (Sw-Engineering, Sw-Sales, Sw-HR, Sw-Servers) with SSH, user authentication, and domain setup.

PRE-REQUISITES

- Prior understanding of VLANs, inter-VLAN routing, and trunking.
- Completion of Day 2's VLAN planning and logical design diagram.
- Familiarity with Cisco CLI commands and switch interface configuration.

LAB REQUIREMENTS

- Cisco Packet Tracer (or equivalent physical lab setup)
- 2 multilayer switches: **Core-1** and **Core-2**
- 3 access switches: **Sw-Engineering**, **Sw-Sales**, **Sw-HR**
- 1 server running **DHCP and TFTP** services in VLAN 100 (IP: 10.10.10.10)
- PCs, IP Phones, Tablets, Laptops, Wireless Routers
- Lab network diagram + configuration worksheet (per group)
- Diagramming tool (e.g., draw.io) or whiteboard for network topology updates

EXPECTED DELIVERABLES (By End of Day)

Network Services

- DHCP pools created for:
    - Engineering: VLANs **11 (Data)**, **12 (Voice)**, **13 (Wi-Fi)**
    - Sales: VLANs **21 (Data)**, **22 (Voice)**, **23 (Wi-Fi)**
    - HR: VLANs **31 (Data)**, **32 (Voice)**, **33 (Wi-Fi)**
- TFTP service running and **switch configurations backed up** from:
    - Sw-Engineering, Sw-Sales, Sw-HR, and Sw-Servers

Switch & Host Configuration

- All **client devices** configured to obtain IPs via **DHCP**
- DHCP relay (via ip helper-address) configured on all VLAN interfaces on Core switches
- **Correct IP address assignment** and **gateway reachability** tested for:
  - PCs, IP Phones, Tablets, Laptops

Routing & Internet Reachability

- **Default static routes** added on Core-1 and Core-2 to forward traffic to:
  - R1 (10.10.100.1) from Core-1
  - R2 (10.10.100.10) from Core-2
- **Ping success** verified from clients to ISP subnet (100.10.100.0/30)

Secure Management Configuration

- SSH enabled on all switches with:
  - **Domain name**: students.ucu.ac.ug
  - **Username**: admin, privilege 15
  - **Secret password**: cisco
- Management IPs assigned on **VLAN 200**:
  - Sw-Engineering → 172.16.200.1
  - Sw-Sales → 172.16.200.2
  - Sw-HR → 172.16.200.3
  - Sw-Servers → 172.16.200.4

Topology & Documentation

- **Updated topology diagram** reflecting:
  - VLAN segmentation
  - Trunk links between access switches and core switches
  - Port-channel (LACP) between Core-1 and Core-2
  - HSRP roles per VLAN (if previously configured)
- **Configuration report** includes:
  - CLI command snippets for DHCP, TFTP, SSH, Routing
  - Screenshots of DHCP leases, TFTP backups, SSH connections
  - Ping test results to local VLANs and ISP routes

Lab Configuration Table – Interfaces, IPs, and Roles

Device	Interface	IP Address / VLAN	Purpose / Notes
DHCP/TFTP Server	NIC (FastEthernet0)	10.10.10.10 / VLAN 100	Provides DHCP and TFTP services

Core-1 Multilayer Switch

Interface	IP Address / VLAN	Notes
Vlan11	172.16.11.252	HSRP active for Engineering-Data
Vlan12	172.16.12.252	HSRP active for Engineering-Voice
Vlan13	172.16.13.252	HSRP active for Engineering-WiFi
Vlan21	172.16.21.252	HSRP active for Sales-Data
Vlan22	172.16.22.252	HSRP active for Sales-Voice
Vlan23	172.16.23.252	HSRP active for Sales-WiFi
Vlan31-33	172.16.31-33.253	HSRP standby for HR VLANs
Vlan100	10.10.10.252	Server VLAN – DHCP Relay active

Vlan200	172.16.200.252	Management VLAN – HSRP active
FastEthernet0/1	—	Trunk to Sw-Engineering
FastEthernet0/2	—	Trunk to Sw-Sales
FastEthernet0/3	—	Trunk to Sw-HR
FastEthernet0/4	—	Trunk to Sw-Servers
FastEthernet0/24	10.10.100.1 (p2p /30)	Link to R1
FastEthernet0/23	10.10.100.14 (p2p /30)	Link to R2
Gigabit0/1-2	EtherChannel (Po1)	To Core-2; VLANs 11-33,100,200 allowed

Core-2 Multilayer Switch

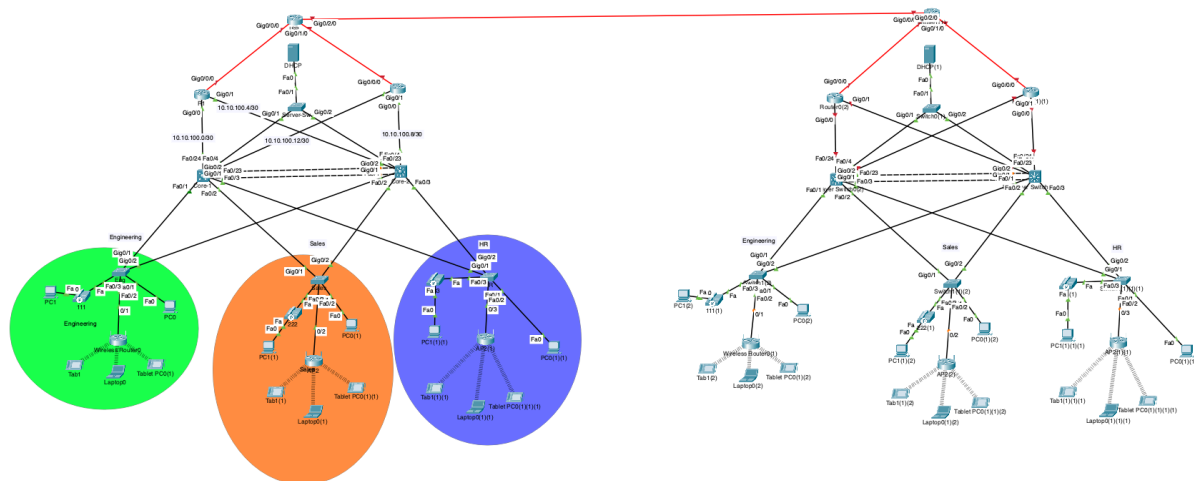| Interface	IP Address / VLAN	Notes
Vlan11-23	172.16.X.253	HSRP standby for Engineering & Sales VLANs
Vlan31	172.16.31.252	HSRP active for HR-Data
Vlan32	172.16.32.252	HSRP active for HR-Voice
Vlan33	172.16.33.252	HSRP active for HR-WiFi
Vlan100	10.10.10.253	Server VLAN
Vlan200	172.16.200.253	Management VLAN
FastEthernet0/1	—	Trunk to Sw-Engineering
FastEthernet0/2	—	Trunk to Sw-Sales
FastEthernet0/3	—	Trunk to Sw-HR
FastEthernet0/4	—	Trunk to Sw-Servers
FastEthernet0/24	10.10.100.10 (p2p /30)	Link to R2
FastEthernet0/23	10.10.100.6 (p2p /30)	Link to R1
Gigabit0/1-2	EtherChannel (Po1)	To Core-1; VLANs 11-33,100,200 allowed

Access Switches

Switch	VLAN IP (VLAN 200)	G0/1 → Core-1	G0/2 → Core-2	Notes
Sw-Engineering	172.16.200.1	Trunk (11-13,200)	Trunk (11-13,200)	SSH enabled
Sw-Sales	172.16.200.2	Trunk (21-23,200)	Trunk (21-23,200)	SSH enabled
Sw-HR	172.16.200.3	Trunk (31-33,200)	Trunk (31-33,200)	SSH enabled
Sw-Servers	172.16.200.4	Trunk (100,200)	Trunk (100,200)	TFTP/DHCP server trunk

Routers

Router	Interface	IP Address	Purpose
R1	G0/0	10.10.100.2	P2P to Core-1
	G0/1	10.10.100.5	P2P to Core-2

	G0/0/0	100.10.100.2	P2P to ISP
R2	G0/0	10.10.100.9	P2P to Core-2
	G0/1	10.10.100.13	P2P to Core-1
	G0/0/0	100.10.100.6	P2P to ISP

Lab: Secure SSH Configuration, DHCP, TFTP, Routing, and

Task 1: Secure All Switches with SSH

Configure the following on each switch:

Switch	IP Address (VLAN 200)
Sw-Engineering	172.16.200.1
Sw-Sales	172.16.200.2
Sw-HR	172.16.200.3
Sw-Servers	172.16.200.4

Common SSH Configuration Commands (run on each switch):

Sw-Engineering

hostname Sw-Engineering
ip domain-name students.ucu.ac.ug
username admin privilege 15 secret cisco
crypto key generate rsa

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! Choose 1024 bits when prompted!

line vty 0 4
 transport input ssh
 login local
exit
!
ip ssh version 2

Assign the appropriate management IP on VLAN 200:

interface vlan 200
 ip address 172.16.200.1 255.255.255.0
 no shutdown

Sw-Sales

hostname Sw-Sales
ip domain-name students.ucu.ac.ug
username admin privilege 15 secret cisco
crypto key generate rsa
! Choose 1024 bits when prompted!

line vty 0 4
 transport input ssh
 login local
exit
!
ip ssh version 2

Assign the appropriate management IP on VLAN 200:

interface vlan 200
 ip address 172.16.200.2 255.255.255.0
 no shutdown

Sw-HR

hostname Sw-HR
ip domain-name students.ucu.ac.ug
username admin privilege 15 secret cisco
crypto key generate rsa
! Choose 1024 bits when prompted!

line vty 0 4
 transport input ssh
 login local
exit
!
ip ssh version 2

Assign the appropriate management IP on VLAN 200:

interface vlan 200
 ip address 172.16.200.3 255.255.255.0
 no shutdown

Sw-Servers

hostname Sw-Servers
ip domain-name students.ucu.ac.ug
username admin privilege 15 secret cisco
crypto key generate rsa
! Choose 1024 bits when prompted!

line vty 0 4
 transport input ssh
 login local
exit
!
ip ssh version 2

Assign the appropriate management IP on VLAN 200:

interface vlan 200
 ip address 172.16.200.4 255.255.255.0
 no shutdown

Note: ensure that the vlan 200 is created on all switches and also pushed through the trunks also created on the Core switches

Task 2: Configure the DHCP Server

Device: Server in VLAN 100 (10.10.10.10)
Path: Desktop > IP Config → Static IP 10.10.10.10/24
Then: Services > DHCP → Add pools as below:

Configure the following pools:

 VLAN DHCP Pools

VLAN	Pool Name	Default Gateway	Subnet	DNS
11	ENG-DATA	172.16.11.254	172.16.11.0/24	8.8.8.8
12	ENG-VOICE	172.16.12.254	172.16.12.0/24	8.8.8.8
13	ENG-WIFI	172.16.13.254	172.16.13.0/24	8.8.8.8
21	SALES-DATA	172.16.21.254	172.16.21.0/24	8.8.8.8
22	SALES-VOICE	172.16.22.254	172.16.22.0/24	8.8.8.8
23	SALES-WIFI	172.16.23.254	172.16.23.0/24	8.8.8.8
31	HR-DATA	172.16.31.254	172.16.31.0/24	8.8.8.8
32	HR-VOICE	172.16.32.254	172.16.32.0/24	8.8.8.8
33	HR-WIFI	172.16.33.254	172.16.33.0/24	8.8.8.8

Save the pools and ensure DHCP service is turned ON.

Task 3: Configure DHCP on All Clients

Device: PCs, laptops, tablets across VLANs
Steps:

- **Open Desktop > IP Configuration**

- Select DHCP
- Verify correct IP, subnet, and default gateway

Clients in each VLAN should get IPs from the respective pool.

Task 4: Enable the TFTP Service

Device: Same Server in VLAN 100
Steps:

1. Go to Services > TFTP tab
2. Ensure TFTP service is turned ON

~END OF PRACTICAL ACTIVITIES~
CONGRATULATIONS TO THOSE WHO HAVE MADE IT