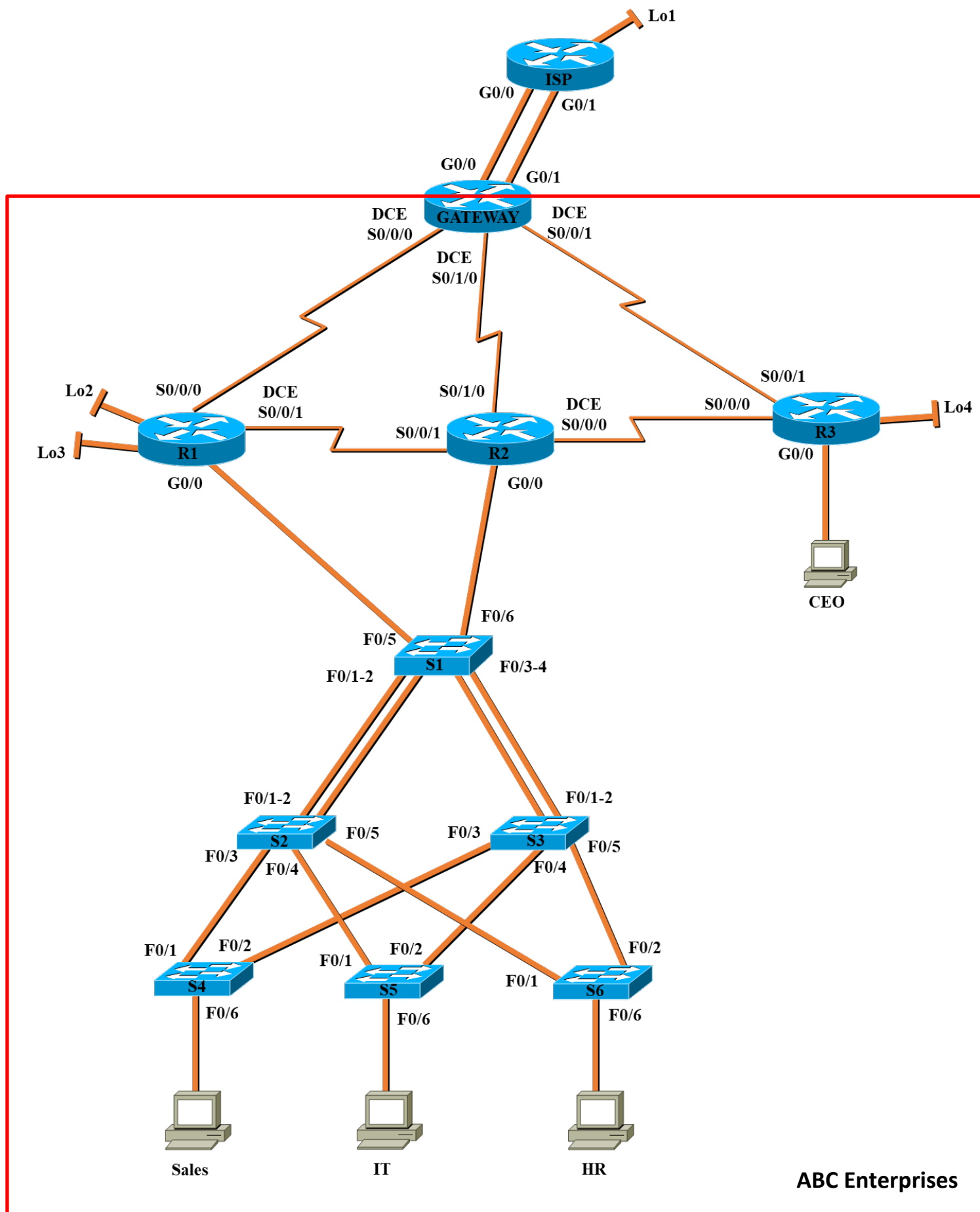


**3811ICT Advanced Network Architectures – Assignment (15%)**  
**(Due Date: 11:59pm, Friday 22 Sept 2023)**

**Important:**

1. This is an individual assignment.
2. You must use Packet Tracer v8.2.1 to complete this assignment.
3. The assignment must be completed on the provided Packet Tracer .pka file only. Do not create your own Packet Tracer file as that will not be able to be marked.
4. Please rename your Packet Tracer file to  
FirstName\_LastName\_sNumber\_Assignment.pka
5. You will also need to write a report. Please name your report as  
FirstName\_LastName\_sNumber\_Assignment.pdf or  
FirstName\_LastName\_sNumber\_Assignment.docx

## 1. Network Topology



## **2. Task Description**

As the network engineer for a medium-sized business ABC Enterprises, you have been given the task of designing and implementing the network topology for its new office network. Based on their business requirements, you have produced the following technical design:

1. A network topology diagram as shown in the previous page.
2. The network is connected to the Internet Service Provider (ISP) through its GATEWAY router. The main connection to the ISP is via the G0/0 connection, while the G0/1 connection serves as a backup. The Lo1 connection on the ISP router serves as the Internet.
3. The single-area OSPF routing protocol is used in the network.
4. The network topology has several LANs (or VLANs), i.e. the CEO LAN, the Sales VLAN, the IT VLAN, and the HR VLAN. There is also a Management VLAN for the switches. Note that in this assignment, the loopback interfaces Lo2, Lo3, and Lo4 are used to simulate additional LANs in the network topology. The host requirements for the LANs are shown in the table below:

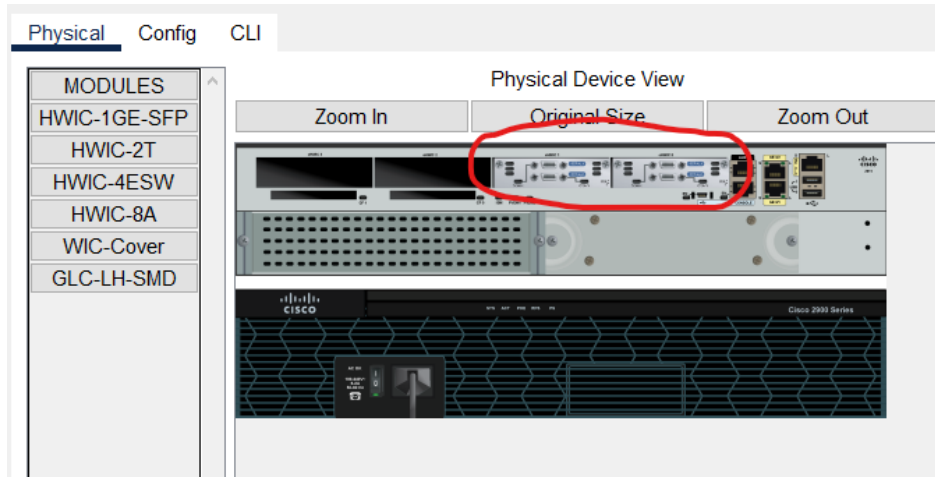
LAN	Host Requirements
CEO	5 hosts
Sales	100 hosts
IT	200 hosts
HR	50
Management	20 hosts
Lo2	230 hosts
Lo3	120 hosts
Lo4	80 hosts

5. ABC Enterprises has been allocated the IPv4 network address 132.234.80.0/21 and the IPv6 network address 2001:DB8:ACAD::/60 for the internal network addressing. To minimise wasted address space, you will use VLSM to assign IPv4 addresses to the devices and interfaces in the network topology. For IPv6 addressing, each separate network will be allocated a prefix of /64.

Based on the information in the technical design above, you will implement the following Tasks in this assignment.

## Task 1: Build the Network and Configure Basic Device Settings

You will set up the network topology shown in Page 2. For routers Gateway and R2 which have three (3) serial connections, you will need to add two serial interface cards to the router as shown below:



Configure all routers and switches with the basic device settings. Use **cisco** for all passwords in this assessment, except for the enable secret password, which is **class**. For SSH, use username **admin** and password **cisco**. Use **cisco.com** as the domain name.

## Task 2: Network Addressing

- The IP addresses for the connections between the GATEWAY and ISP routers, and the IP addresses for the Lo1 interface on the ISP router are given in the table below:

Device	Interface	IP Address/Prefix
ISP	G0/0	200.100.100.1/30
		2001:DB8:CAFE::1/64
	G0/1	200.100.100.5/30
		2001:DB8:ACAE::1/64
	Lo1	50.50.50.50/24
		2001:50:50:50::50/64
GATEWAY	G0/0	200.100.100.2/30
		2001:DB8:CAFE::2/64
	G0/1	200.100.100.6/30
		2001:DB8:ACAE::2/64

- As stated in the technical design, ABC Enterprises has been allocated the IPv4 network address **132.234.80.0/21** and the IPv6 network address **2001:DB8:ACAD::/60** for the internal network addressing. To minimise wasted address space, you will use VLSM to assign IPv4 addresses to the devices and interfaces in the network topology.

- You will assign IPv6 addresses to the devices and interfaces in the network topology with each network allocated a prefix of /64.
- The end-devices in the Sales, IT and HR VLANs will use DHCP to obtain their IPv4 addresses and other relevant network information.
- The end-devices in the Sales, IT and HR VLANs will use SLAAC to obtain their IPv6 addresses and other relevant network information.
- The CEO PC will be assigned the 2<sup>nd</sup> available address in the CEO LAN.
- The Lo2, Lo3 and Lo4 interfaces will be assigned the 1<sup>st</sup> available address in their respective LANs.
- The Management VLAN is not assigned any IPv6 addresses.

### Task 3: Switches Configurations

- All switches are configured with their relevant VLANs, access and trunk ports.
- All switches are configured with relevant security configurations.
- EtherChannel is implemented between the switches S1-S2 and S1-S3.
- The Spanning Tree is configured such that one of the switches will be the root bridge for all VLANs.

### Task 4: Network Routing

- Inter-VLAN routing (IPv4 and IPv6) using the router-on-a-stick method is implemented on the respective devices.
- First hop redundancy using the HSRP protocol (for IPv4 only) is implemented on the R1 and R2 routers.
- Single-area OSPF routing (IPv4 and IPv6) is implemented on all the internal routers in the network topology. Note that for the Lo2, Lo3 and Lo4 interfaces, they need to be configured as point-to-point networks so that their full network address will be advertised. Please refer to Section 2.2.12 in the NetAcad ENSA course, and also refer to page 4 in Lab 3B: Configuring Multiarea OSPFv3 for more information on point-to-point network and loopback interfaces.
- Configure the GATEWAY and ISP routers to ensure IPv4 and IPv6 connectivity between ISP's Lo1 interface and all the devices in the internal network.

### 3. Marking Scheme

#### **Network Connectivity Tests [20 marks]**

- Verify network connectivity with the following tests:
  - The end devices in the Sales, IT, HR, and CEO LANs can ping each other on IPv4 and IPv6
  - The end devices in the Sales, IT, HR, and CEO LANs can ping the Lo2, Lo3 and Lo4 interfaces on IPv4 and IPv6
  - The end devices in the Sales, IT, HR, and CEO LANs can ping ISP's Lo1 interface on IPv4 and IPv6
  - Verify the first hop redundancy functionality by disabling the active router and ensuring traffic will be redirected via the standby router

#### **Written Report [80 marks]**

You will need to document your design decisions in a report. Your written report must contain all relevant information to enable other network engineers to understand how the network was implemented and more importantly, be able to replicate your work.

In particular, it must have the following information:

- Include the table below to show your VLSM calculations for the IPv4 address assignment. You can add more columns to the table if you would like to include additional information that you used during the VLSM calculations. [10 marks]

Network/LAN	Hosts Required	Prefix	Subnet Mask	Subnet Address

- Include a table showing the IP addresses assigned to the various devices in the network topology. An example table is shown below. [10 marks]

Device	Interface	IP Address/Prefix	Default Gateway
ISP	G0/0	200.100.100.1/30	
		2001:DB8:CAFE::1/64	
	G0/1	200.100.100.5/30	
		2001:DB8:ACAE::1/64	
	Lo1	50.50.50.50/24	
		2001:50:50:50::50/64	

- Describe the DHCP design and configurations to enable the end devices to obtain IPv4 addresses dynamically. You will need to include a screenshot of the DHCP settings on the DHCP server and DHCP relays (if any) [5 marks]
- Describe the security configurations implemented on the switches. You will need to include a screenshot of the security settings on one of the S4, S5 or S6 switches. [5 marks]
- Describe the configuration of VLANs, access ports and trunk ports in the switches. You will need to include the table below as well as screenshots of the access port and trunk port settings on all switches. [15 marks]

VLAN	Name	Interface Assigned

- Describe and justify your choice of the EtherChannel protocol implemented in the switches. You will need to include a screenshot of the EtherChannel settings on one of the S1-S2 or S1-S3 pair switches. [3 marks]
- Describe how STP is configured and justify your decision on which switch is configured to be the root bridge. You will need to include a screenshot of the STP settings on the root bridge. [2 marks]
- Describe the inter-VLAN routing configurations and include screenshots of its settings on the relevant devices. [5 marks]
- Describe how HSRP protocol is configured on R1 and R2 to enable IPv4 first hop redundancy. You will need to include screenshots of the HSRP settings on R1 and R2. [5 marks]
- Describe the OSPF configurations on the internal routers. You will need to include screenshots of the OSPF settings on all of the internal routers. [15 marks]
- Describe the configurations on the GATEWAY and ISP routers that ensures connectivity between ISP's Lo1 interface and all the devices in the internal network. You will need to include screenshots of the configuration settings on the GATEWAY and ISP routers. [5 marks]