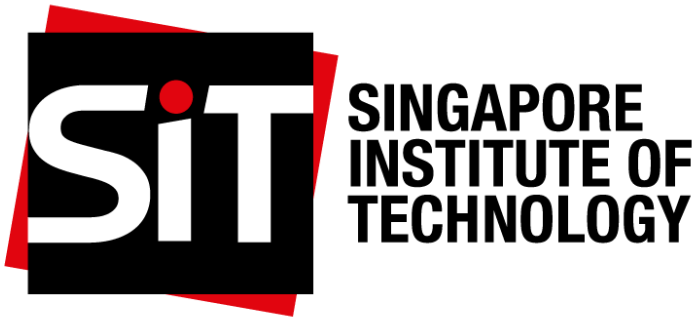

INF1006: Computer Networks
[AY 2024/2025]

Assignment 1
[Design an Enterprise Computer Network]

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Introduction

The report presents the design and implementation of an enterprise network infrastructure that we have made, spanning 2 buildings (E2 and E6). In our simulation, we use the assigned 103.30.215.0/24 address space and implement Variable Length Subnet Masking (VLSM), optimising IP address allocation while ensuring security, redundancy, and scalability.

VLSM Subnet Design and Justification

These VLANs are trunked back to a central **Administration Office Switch,** which is connected to a router for inter-VLAN communication. The topology consists of five main VLAN-segregated zones:

Zone	VLAN ID	Devices	Subnet Mask	Network Address	Usable IP Range	Justification
Network Lab	VLAN 10	2 PCs, 2 laptops, 1 switch, 1 wireless router	/26	103.30.215.0/26	.1 – .62	Accommodates 41 PCs + AP + future growth
Security Lab	VLAN 20	3 PCs, 2 laptops, 1 switch, 1 wireless router	/26	103.30.215.64/26	.65 – .126	Mirrors Network Lab requirements
Admin Office	VLAN 30	2 PCs, 1 printer, 1 switch	/29	103.30.215.192/29	.193 –.198	4 PCs + 1 printer + growth
Lab 1	VLAN 40	3 PCs, 2 laptops, 1 switch, 1 wireless router	/27	103.30.215.128/27	.129 –.158	Supports 25 PCs + AP + expansion
Lab 2	VLAN 50	3 PCs, 2 laptops, 1 switch, 1 wireless router	/27	103.30.215.160/27	.161 –.190	Supports 21 PCs + AP + expansion
E6 Servers		DNS, Web, ISP servers (3 total)	/29	103.30.215.200/29	.201 –.206	DNS + Web server + expansion
WLAN Link		Router-to-Router (2 IPs)	/30	103.30.215.208/30	.209 –.210	Point-to-point E2–E6 router connection

Network Topology

The network spans two buildings (E2 and E6), with each containing multiple VLAN zones like labs, administration offices, and servers. Each lab consists of wired PCs and laptops connected through switches and wireless routers. The core switch in the Admin Office handles VLAN trunking and connects to a central router.

Routing Configuration

Routing is configured using a router-on-a-stick method. Sub-interfaces are created on the router to serve each VLAN. These sub-interfaces are assigned gateway IPs based on their subnet. Static routing is used for simplicity and control, allowing all VLANs to access internal resources and servers.

Features Used

a. **Dynamic Host Configuration Protocol**
   DHCP is implemented on both routers to automatically assign IP configurations to end devices, reducing administrative overhead and ensuring consistent network settings. We use separate DHCP pools for each VLAN:
   - E2 Router DHCP Pools: VLAN10_POOL, VLAN20_POOL, VLAN30_POOL
   - E6 Router DHCP Pools: VLAN40_POOL, VLAN50_POOL

b. **Access Control Lists**
   Network security is enhanced through ACL implementation to restrict unauthorised access to the administration printer. ACL 100 on E2_Router and ACL 110 on E6_Router prevent students and lecturers from accessing the administration printer while permitting all other legitimate traffic.

c. **EtherChannel Link Aggregation**
   Link Aggregation Protocol is implemented across all switches to provide:
   - **Increased Bandwidth:** *Multiple physical links combined for higher throughput*
   - **Fault Tolerance:** *Automatic failover in case of link failure*
   - **Load Distribution:** *Traffic balanced across available links*

d. **Wireless Access Points**
   Each lab includes wireless access points configured using WPA2-PSK security to support students' and lecturers' personal devices. Static IP addresses are assigned to wireless infrastructure to ensure consistent connectivity.

e. **VLAN Segmentation**
   VLANs logically separate networks for security and performance by isolating organisational units, controlling broadcast domains, and simplifying management.

f. **Redundancy Implementation**
   The network incorporates multiple redundancy mechanisms — Device Redundancy, Link Redundancy, Path Redundancy, Service Redundancy

Conclusion

The network design utilises VLAN segmentation and VLSM to create a scalable, efficient and secure network for the institution. The centralised routing, dynamic addressing and DNS support ensure robust connectivity and ease of management for future expansion