

Secure Campus Area Network Systems Project

Title: Secure Campus Area Network Systems

Objective: To design and implement a secure, scalable, and efficient campus area network (CAN) that connects multiple departments, branches, and servers while maintaining high performance and data security.

Description: This project focuses on building a campus-wide network infrastructure integrating various departments such as Computer Science, Business Management, Engineering, and Healthcare. The network includes multiple VLANs, routers, switches, servers (FTP, Email, DHCP, Web), and wireless access points to provide connectivity for PCs, laptops, tablets, and smartphones. The system ensures secure communication through router configurations, subnetting, and access control mechanisms.

Key Features: Segregated VLANs for each department Centralized DHCP and DNS services Secure routing between branches using static and dynamic routes Integrated Wireless LAN Controller (WLC) Server Room with Email, Web, and FTP services Branch connectivity with static IP and serial communication Enhanced network monitoring and scalability

Tools Used: Cisco Packet Tracer, Networking Devices (Router, Switch, Access Point), WLC, Server, PC, and Laptop.

Outcome: A fully functional, secure, and efficient campus network that supports departmental communication, resource sharing, and scalability for future expansions

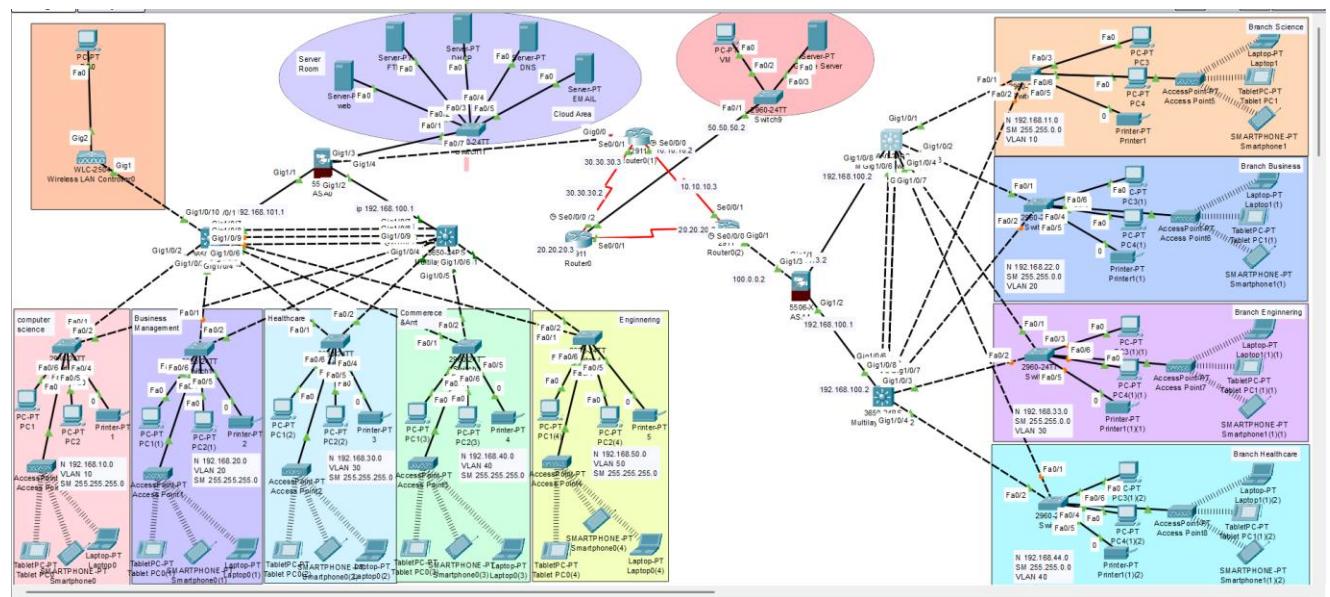
Project Synopsis:

The **Secure Campus Area Network System (SCANS)** is designed to interconnect multiple departments within a university or corporate campus environment.

This network provides **high-speed communication, centralized security, inter-VLAN routing, and controlled Internet access** using Cisco devices.

The system integrates **routers, multilayer switches, access switches, firewalls, wireless controllers, and end devices** (PCs, laptops, tablets, smartphones, and servers) to ensure **efficient, secure, and scalable** network operations.

Topology:



Objectives:

- To design a fully functional Campus Area Network (CAN) with multiple departments.
- To provide secure communication between departments using VLANs and firewall protection.
- To configure inter-VLAN routing using a multilayer switch.
- To implement Internet connectivity through the ASA Firewall.
- To connect both wired and wireless devices efficiently.

Network Overview

Component	Description
Core Layer	Multilayer switch (Cisco 3650-24PS) for inter-VLAN routing and backbone connection.
Distribution Layer	Departmental access switches (Cisco 2960-24TT).
Access Layer	PCs, laptops, printers, smartphones, and wireless access points.
Firewall	Cisco ASA 5506-X ensures secure traffic between internal and external networks.
Router	Cisco 2911 connects the internal network to the external WAN.
Server Room	Web, FTP, DNS, Email servers with internal and cloud connectivity.
Wireless LAN Controller (WLC)	Manages wireless access points and mobile device connections.

IP Addressing Scheme:

VLAN / Department	Network Address	Subnet Mask	Default Gateway	VLAN ID
Computer Science	192.168.10.0	255.255.255.0	192.168.10.1	VLAN 10
Business Management	192.168.20.0	255.255.255.0	192.168.20.1	VLAN 20

VLAN / Department	Network Address	Subnet Mask	Default Gateway	VLAN ID
Healthcare	192.168.30.0	255.255.255.0	192.168.30.1	VLAN 30
Commerce & Art	192.168.40.0	255.255.255.0	192.168.40.1	VLAN 40
Engineering	192.168.50.0	255.255.255.0	192.168.50.1	VLAN 50
Server Room	192.168.101.0	255.255.255.0	192.168.101.1	VLAN 101
Firewall Network (Inside)	192.168.100.0	255.255.255.0	192.168.100.1	VLAN 100
Firewall Network (Outside)	203.0.113.0	255.255.255.0	203.0.113.2	External Zone

Project Description:

Computer Science Department (VLAN 10)

- Network: **192.168.10.0/24**
- Devices:
 - PCs: 2 (192.168.10.2, 192.168.10.3)
 - Printer: 1 (192.168.10.4)
 - Wireless Access Point
 - Tablets, Smartphones, Laptops connected via Wi-Fi

 **Business Management Department (VLAN 20)**

- Network: **192.168.20.0/24**
- Devices:
 - PCs: 2 (192.168.20.2, 192.168.20.3)
 - Printer: 1 (192.168.20.4)
 - Wireless Access Point
 - Tablets, Laptops, Smartphones

 **Healthcare Department (VLAN 30)**

- Network: **192.168.30.0/24**
- Devices:
 - PCs: 2 (192.168.30.2 192.168.30.3)
 - Printer: 1 (192.168.30.4)
 - Access Point
 - Tablets, Smartphones

 **Commerce & Art Department (VLAN 40)**

- Network: **192.168.40.0/24**
- Devices:
 - PCs: 2 (192.168.40.2, 192.168.40.3)
 - Printer: 1 (192.168.40.4)
 - Access Point
 - Tablets, Smartphones

 **Engineering Department (VLAN 50)**

- Network: **192.168.50.0/24**
- Devices:
 - PCs: 2 (192.168.50.2, 192.168.50.3)

- Printer: 1 (192.168.50.4)
 - Access Point
 - Tablets, Laptops, Smartphones
-

6. Server Room (Cloud Area)

- VLAN 101 – Network: **192.168.101.0/24**
 - Servers:
 - Web Server – 10.20.30.5
 - FTP Server – 10.20.30.6
 - DNS Server – 10.20.30.7
 - Email Server – 10.20.30.8
-

7. Security Implementation

- **Firewall (ASA 5506-X):**
 - Inside: 192.168.100.1
 - Outside: 203.0.113.2
 - Filters incoming/outgoing packets.
 - NAT/PAT configured for Internet access.
- **Access Control Lists (ACLs):**
 - Applied on the router and firewall for secure access control between VLANs.

1. Network Configuration Overview

◆ Devices Used

- **Routers:** 2 × Cisco 2911
- **Firewall:** Cisco ASA 5506-X
- **Multilayer Switch:** Cisco 3650-24PS
- **Access Switches:** Cisco 2960-24TT (per department)
- **Servers:** Web, FTP, DNS, and Email
- **Wireless LAN Controller (WLC):** Cisco WLC-2504
- **End Devices:** PCs, Laptops, Tablets, Smartphones, Printers

2. VLAN Configuration (Department-Wise)

Each department is isolated using VLANs for security and management.

On the Multilayer Switch (Core Switch – 3650-24PS)

```
Switch(config)# vlan 10
```

```
Switch(config-vlan)# name Computer_Science
```

```
Switch(config-vlan)# exit
```

```
Switch(config)# vlan 20
```

```
Switch(config-vlan)# name Business_Management
```

```
Switch(config-vlan)# exit
```

```
Switch(config)# vlan 30
```

```
Switch(config-vlan)# name Healthcare
```

```
Switch(config-vlan)# exit
```

```
Switch(config)# vlan 40  
Switch(config-vlan)# name Commerce_Art  
Switch(config-vlan)# exit
```

```
Switch(config)# vlan 50  
Switch(config-vlan)# name Engineering  
Switch(config-vlan)# exit
```

```
Switch(config)# vlan 101  
Switch(config-vlan)# name Server_Room  
Switch(config-vlan)# exit
```

3. Assign VLAN Interfaces

```
Switch(config)# interface vlan 10  
Switch(config-if)# ip address 192.168.10.1 255.255.255.0  
Switch(config-if)# no shutdown
```

```
Switch(config)# interface vlan 20  
Switch(config-if)# ip address 192.168.20.1 255.255.255.0  
Switch(config-if)# no shutdown
```

```
Switch(config)# interface vlan 30  
Switch(config-if)# ip address 192.168.30.1 255.255.255.0  
Switch(config-if)# no shutdown
```

```
Switch(config)# interface vlan 40  
Switch(config-if)# ip address 192.168.40.1 255.255.255.0  
Switch(config-if)# no shutdown
```

```
Switch(config)# interface vlan 50  
Switch(config-if)# ip address 192.168.50.1 255.255.255.0  
Switch(config-if)# no shutdown
```

```
Switch(config)# interface vlan 101  
Switch(config-if)# ip address 192.168.101.1 255.255.255.0  
Switch(config-if)# no shutdown
```

4. Trunk Configuration (Connecting Access Switches):

Computer Science Department (VLAN 10)

```
Switch(config)# interface gigabitEthernet1/0/2  
Switch(config-if)# switchport mode trunk  
Switch(config-if)# switchport trunk allowed vlan all  
Switch(config-if)# no shutdown  
Switch(config)# interface fa0/1  
Switch(config-if)# switchport mode access  
Switch(config-if)# switchport access vlan 10 (change VLAN as per department)  
Switch(config-if)# no shutdown
```

IP Configuration for PCs and Printers:

Device IP Address	Subnet Mask	Default Gateway
PC1 192.168.10.2	255.255.255.0	192.168.10.1
PC2 192.168.10.3	255.255.255.0	192.168.10.1
Printer 192.168.10.4	255.255.255.0	192.168.10.1

Business Management Department (VLAN 20)

```
Switch(config)# interface gigabitEthernet1/0/3
```

```
Switch(config-if)# switchport mode trunk
```

```
Switch(config-if)# switchport trunk allowed vlan all
```

```
Switch(config-if)# no shutdown
```

```
Switch(config)# interface fa0/1
```

```
Switch(config-if)# switchport mode access
```

```
Switch(config-if)# switchport access vlan 20 (change VLAN as per department)
```

```
Switch(config-if)# no shutdown
```

IP Configuration for PCs and Printers:

Device IP Address	Subnet Mask	Default Gateway
PC1 192.168.20.2	255.255.255.0	192.168.20.1
PC2 192.168.20.3	255.255.255.0	192.168.20.1
Printer 192.168.20.4	255.255.255.0	192.168.20.1

Healthcare Department (VLAN 30)

```
Switch(config)# interface gigabitEthernet1/0/4
Switch(config-if)# switchport mode trunk
Switch(config-if)# switchport trunk allowed vlan all
Switch(config-if)# no shutdown
Switch(config)# interface fa0/1
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 3 (change VLAN as per department)
Switch(config-if)# no shutdown
```

IP Configuration for PCs and Printers:

Device IP Address	Subnet Mask	Default Gateway
PC1 192.168.30.2	255.255.255.0	192.168.30.1
PC2 192.168.30.3	255.255.255.0	192.168.30.1
Printer 192.168.30.4	255.255.255.0	192.168.30.1

Commerce & Art Department (VLAN 40)

```
Switch(config)# interface gigabitEthernet1/0/5
Switch(config-if)# switchport mode trunk
Switch(config-if)# switchport trunk allowed vlan all
Switch(config-if)# no shutdown
Switch(config)# interface fa0/1
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 40 (change VLAN as per department)
Switch(config-if)# no shutdown
```

IP Configuration for PCs and Printers:

Device IP Address	Subnet Mask	Default Gateway
PC1 192.168.40.2	255.255.255.0	192.168.40.1
PC2 192.168.40.3	255.255.255.0	192.168.40.1
Printer 192.168.40.4	255.255.255.0	192.168.40.1

Engineering Department (VLAN 50)

```
Switch(config)# interface gigabitEthernet1/0/6
Switch(config-if)# switchport mode trunk
Switch(config-if)# switchport trunk allowed vlan all
Switch(config-if)# no shutdown
Switch(config)# interface fa0/1
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 50 (change VLAN as per department)
Switch(config-if)# no shutdown
```

IP Configuration for PCs and Printers:

Device IP Address	Subnet Mask	Default Gateway
PC1 192.168.50.2	255.255.255.0	192.168.50.1
PC2 192.168.50.3	255.255.255.0	192.168.50.1
Printer 192.168.50.4	255.255.255.0	192.168.50.1

Configure each Access Switch (2960) — per VLAN:

enable

configure terminal

hostname CORE-3650

! Create VLANs

vlan 10; name Computer_Science

vlan 20; name Business_Management

vlan 30; name Healthcare

vlan 40; name Commerce_Art

vlan 50; name Engineering

vlan 100; name Core_Link

vlan 101; name Server_Room

exit

! Create Layer-3 SVIs (gateways)

interface Vlan10

ip address 192.168.10.1 255.255.255.0

no shutdown

interface Vlan20

ip address 192.168.20.1 255.255.255.0

no shutdown

interface Vlan30

ip address 192.168.30.1 255.255.255.0

no shutdown

```
interface Vlan40
ip address 192.168.40.1 255.255.255.0
no shutdown

interface Vlan50
ip address 192.168.50.1 255.255.255.0
no shutdown

interface Vlan101
ip address 192.168.101.1 255.255.255.0
no shutdown

interface Vlan100
ip address 192.168.100.2 255.255.255.0
no shutdown
```

```
! Enable IP routing
```

```
ip routing
```

```
! Configure physical trunk ports toward each access switch (example ports)

interface GigabitEthernet1/0/1
description to_SW-CS
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 100
switchport trunk allowed vlan 10,20,30,40,50,100,101
no shutdown
```

```
interface GigabitEthernet1/0/2
description to_SW-BM
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 100
switchport trunk allowed vlan 10,20,30,40,50,100,101
no shutdown
```

```
interface GigabitEthernet1/0/3
description to_SW-HC
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 100
switchport trunk allowed vlan 10,20,30,40,50,100,101
no shutdown
```

```
interface GigabitEthernet1/0/4
description to_SW-CA
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 100
switchport trunk allowed vlan 10,20,30,40,50,100,101
no shutdown
```

```
interface GigabitEthernet1/0/5
```

```
description to _SW-ENG  
switchport trunk encapsulation dot1q  
switchport mode trunk  
switchport trunk native vlan 100  
switchport trunk allowed vlan 10,20,30,40,50,100,101  
no shutdown
```

Uplink to Firewall (routed link):

```
interface GigabitEthernet1/0/8  
description to _ASA5506_inside  
no switchport  
ip address 192.168.100.2 255.255.255.0  
no shutdown  
ip route 0.0.0.0 0.0.0.0 192.168.100.1  
write memory
```

ASA Firewall (inside ↔ outside) & NAT:

```
! Enter ASA  
enable  
configure terminal  
hostname ASA5506
```

```
! Inside (to CORE)  
interface GigabitEthernet1/2
```

```
nameif inside  
security-level 100  
ip address 192.168.100.1 255.255.255.0  
no shutdown
```

```
! Outside (to Router2911)
```

```
interface GigabitEthernet1/1  
nameif outside  
security-level 0  
ip address 203.0.113.2 255.255.255.252  
no shutdown
```

```
route inside 192.168.10.0 255.255.255.0 192.168.100.2  
route inside 192.168.20.0 255.255.255.0 192.168.100.2  
route inside 192.168.30.0 255.255.255.0 192.168.100.2  
route inside 192.168.40.0 255.255.255.0 192.168.100.2  
route inside 192.168.50.0 255.255.255.0 192.168.100.2  
route inside 192.168.101.0 255.255.255.0 192.168.100.2
```

```
! Default route to Router (outside next-hop)
```

```
route outside 0.0.0.0 0.0.0.0 203.0.113.1  
nat (inside,outside) dynamic interface
```

```
write memory
```

Router Configuration (Gateway to ISP):

```
Router(config)# interface Serial0/0/0
```

```
Router(config-if)# ip address 30.30.30.1 255.255.255.252
```

```
Router(config-if)# no shutdown
```

```
Router(config)# interface Serial0/0/1
```

```
Router(config-if)# ip address 20.20.20.1 255.255.255.252
```

```
Router(config-if)# no shutdown
```

```
Router(config)# ip route 0.0.0.0 0.0.0.0 30.30.30.2
```

```
Router(config)# interface Serial0/0/0
```

```
Router(config-if)# ip address 30.30.30.2 255.255.255.252
```

```
Router(config-if)# no shutdown
```

```
Router(config)# interface Serial0/0/1
```

```
Router(config-if)# ip address 10.10.10.1 255.255.255.252
```

```
Router(config-if)# no shutdown
```

```
Router(config)# ip route 0.0.0.0 0.0.0.0 30.30.30.1
```

Conclusion:

The **Secure Campus Area Network System** successfully integrates multiple departments within a single, efficient, and secure network infrastructure. The design provides seamless communication, centralized management, and data sharing among all departments—such as Computer Science, Business Management, Commerce & Arts, Healthcare, and Engineering.

Each department is assigned a unique VLAN and IP subnet to ensure logical segmentation, improved performance, and enhanced security. The **core switch** efficiently interconnects all access switches from different branches, managing VLAN routing and traffic distribution. The **ASA firewall** adds a strong layer of protection between internal and external networks, controlling data flow and preventing unauthorized access.

Furthermore, routers are configured for WAN connectivity and external communication, linking the campus to cloud services and remote networks. All servers (Web, FTP, DNS, and Email) are securely placed in the server room to manage and distribute campus-wide services.

In conclusion, this project demonstrates a **scalable, secure, and organized network architecture** that meets the requirements of a modern educational campus. It ensures **high availability, efficient communication, data integrity, and cybersecurity**, forming a reliable foundation for future expansion and technological upgrades.

END