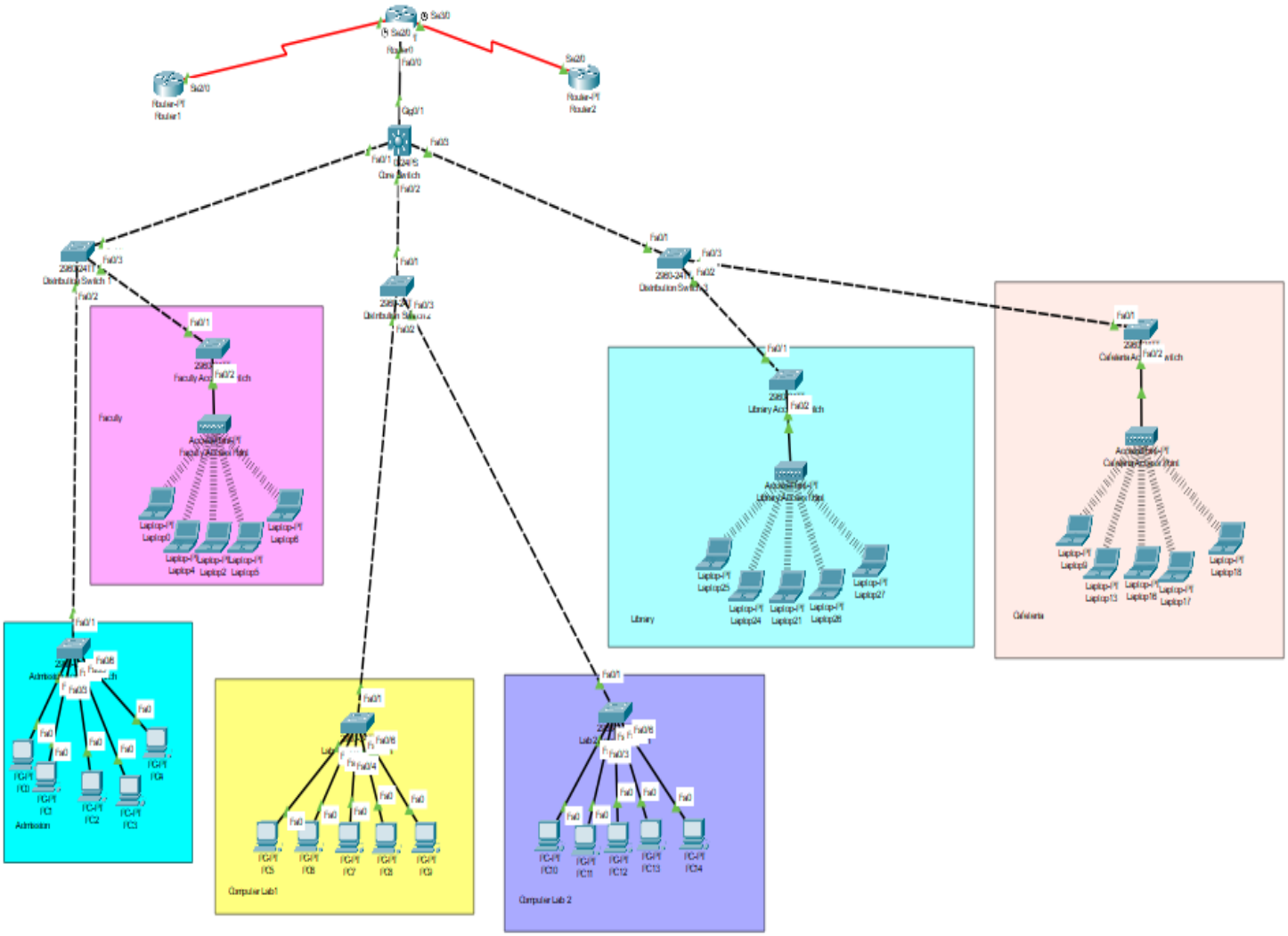

Data Communication and Computer Networks 2

Assignment 02

Secure and Scalable Network Design for EduLink Academy

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Introduction

This report presents the design and implementation of a scalable and secure network for EduLink Academy, developed in accordance with the assignment guidelines. The network leverages a three-tier architecture composed of core, distribution, and access switches to facilitate efficient traffic management. VLANs were utilized to logically segment the network, ensuring performance optimization and security. Dynamic routing protocols like OSPF were configured for seamless communication between campuses, while BGP was implemented for external network connectivity.

Wireless connectivity was configured for specific VLANs to support laptops, and secure authentication protocols were applied to ensure data protection. Port security and access control lists (ACLs) were introduced to restrict unauthorized access and bolster the network's overall security posture. The configurations are documented in detail, along with screenshots, to illustrate each task performed. To align with the practical scope of the project, we made certain assumptions and optimizations to simplify the design and improve its clarity, as outlined in this report.

Assumptions

1. Device Allocation

- Each access switch connects to:

  - ✓ 5 PCs for VLANs 10, 30, and 40 (wired VLANs)
  - ✓ 5 wireless laptops for VLANs 20, 50, and 60 (wireless VLANs)
  - ✓ This deviates from the assignment's original device count for simplicity and consistency

2. Wireless Authentication

- Wireless networks were configured with WPA2-PSK authentication to ensure secure connectivity.

3. BGP Configuration

- The BGP implementation assumes that Router 0, Router 1, and Router 2 act as part of an external autonomous system (AS).

- Static assignments were used for AS numbers for simplicity:

  - ✓ Router 0: AS 65001
  - ✓ Router 1: AS 65002
  - ✓ Router 2: AS 65003

- Default BGP route advertisements were configured to enable connectivity between the AS and the internal network.

4. Dynamic Routing

- OSPF was used within EduLink Academy's internal network to handle inter-campus routing, ensuring fast convergence and efficient path selection.

5. Redundant Configurations

- To avoid redundancy, repetitive configurations (e.g., trunk links) were documented once and referenced throughout the report.

Task 1: Design and Implement (VLAN and VTP Setup)

VLAN creation in core switch

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name Admissions
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name Faculty
Switch(config-vlan)#exit
Switch(config)#vlan 30
Switch(config-vlan)#name ComputerLab1
Switch(config-vlan)#exit
Switch(config)#vlan 40
Switch(config-vlan)#name ComputerLab2
Switch(config-vlan)#exit
Switch(config)#vlan 50
Switch(config-vlan)#name Library
Switch(config-vlan)#exit
Switch(config)#vlan 60
Switch(config-vlan)#name Cafeteria
Switch(config-vlan)#exit
Switch(config)#exit
Switch#
```

Assigning ports to VLAN 10

```
Switch#
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface range fa0/2-6
Switch(config-if-range)#switchport mode acess
                                    ^
% Invalid input detected at '^' marker.

Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show interface status
Port      Name               Status       Vlan       Duplex  Speed Type
Fa0/1                        connected    trunk      auto    auto  10/100BaseTX
Fa0/2                        connected    10         auto    auto  10/100BaseTX
Fa0/3                        connected    10         auto    auto  10/100BaseTX
Fa0/4                        connected    10         auto    auto  10/100BaseTX
Fa0/5                        connected    10         auto    auto  10/100BaseTX
Fa0/6                        connected    10         auto    auto  10/100BaseTX
```

Assigning ports to VLAN 20 (Wireless)

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#exit
Switch#show vlan brief

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/3, Fa0/4, Fa0/5, Fa0/6
                                                 Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                 Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                 Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                 Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                                 Fa0/23, Fa0/24, Gig0/1, Gig0/2
10   Admissions                        active
20   Faculty                           active    Fa0/2
30   ComputerLab1                      active
40   ComputerLab2                      active
50   Library                           active
60   Cafeteria                         active
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
Switch#
```

Assigning ports to VLAN 30

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface range fa0/2-6
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 30
Switch(config-if-range)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

Assigning ports to VLAN 40

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface range fa0/2-6
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 40
Switch(config-if-range)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

Assigning ports to VLAN 50 (Wireless)

```
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 50
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show vlan brief

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/3, Fa0/4, Fa0/5, Fa0/6
                                                 Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                 Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                 Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                 Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                                 Fa0/23, Fa0/24, Gig0/1, Gig0/2
10   Admissions                        active
20   Faculty                           active
30   ComputerLab1                      active
40   ComputerLab2                      active
50   Library                           active    Fa0/2
60   Cafeteria                         active
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
```

Assigning ports to VLAN 60 (Wireless)

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 60
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/3, Fa0/4, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                                Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                                Fa0/23, Fa0/24, Gig0/1, Gig0/2
10   Admissions                       active
20   Faculty                          active
30   ComputerLab1                     active
40   ComputerLab2                     active
50   Library                          active
60   Cafeteria                        active    Fa0/2
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Trunk configuration in the core switch

```
Switch#
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/1
Switch(config-if)#switchport trunk encapsulation dot1q
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport trunk encapsulation dot1q
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch(config-if)#exit
Switch(config)#interface fa0/3
Switch(config-if)#switchport trunk encapsulation dot1q
Switch(config-if)#switchport mode trunk

Switch(config-if)#
```

Trunk configuration in distribution switches

```
Switch#
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/1
Switch(config-if)#switchport mode trunk
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

Router Trunk Configuration

```
Switch>
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface gig0/1
Switch(config-if)#no shutdown
Switch(config-if)#switchport mode trunk
Command rejected: An interface whose trunk encapsulation is "Auto" can not be configured
to "trunk" mode.
Switch(config-if)#switchport trunk encapsulation dotlq
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

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

Distribution Switch 1 to Access Switch 1 and 2 (Trunk Configuration)

```
Switch#enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch(config-if)#exit
Switch(config)#interface fa0/3
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up

Switch(config-if)#exit
```

Distribution Switch 2 to Access Switch 3 and 4 (Trunk Configuration)

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch(config-if)#exit
Switch(config)#interface fa0/3
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up

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

Distribution Switch 3 to Access Switch 5 and 6 (Trunk Configuration)

```
Switch#
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch(config-if)#exit
Switch(config)#interface fa0/3
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up

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

VLAN brief for distribution switches

Distribution Switch 1 brief

```
VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/4, Fa0/5, Fa0/6, Fa0/7
                                                 Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                 Fa0/12, Fa0/13, Fa0/14, Fa0/15
                                                 Fa0/16, Fa0/17, Fa0/18, Fa0/19
                                                 Fa0/20, Fa0/21, Fa0/22, Fa0/23
                                                 Fa0/24, Gig0/1, Gig0/2
10   Admissions                        active
20   Faculty                           active
30   ComputerLab1                      active
40   ComputerLab2                      active
50   Library                           active
60   Cafeteria                         active
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
```

Distribution Switch 2 brief

```
VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/4, Fa0/5, Fa0/6, Fa0/7
                                                 Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                 Fa0/12, Fa0/13, Fa0/14, Fa0/15
                                                 Fa0/16, Fa0/17, Fa0/18, Fa0/19
                                                 Fa0/20, Fa0/21, Fa0/22, Fa0/23
                                                 Fa0/24, Gig0/1, Gig0/2
10   Admissions                        active
20   Faculty                           active
30   ComputerLab1                      active
40   ComputerLab2                      active
50   Library                           active
60   Cafeteria                         active
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
```

Distribution Switch 3 brief

```
VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/4, Fa0/5, Fa0/6, Fa0/7
                                                 Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                 Fa0/12, Fa0/13, Fa0/14, Fa0/15
                                                 Fa0/16, Fa0/17, Fa0/18, Fa0/19
                                                 Fa0/20, Fa0/21, Fa0/22, Fa0/23
                                                 Fa0/24, Gig0/1, Gig0/2
10   Admissions                        active
20   Faculty                           active
30   ComputerLab1                      active
40   ComputerLab2                      active
50   Library                           active
60   Cafeteria                         active
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
```

VTP server in the core switch

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vtp mode server
Device mode already VTP SERVER.
Switch(config)#vtp domain EduLink
Changing VTP domain name from NULL to EduLink
Switch(config)#vtp password EduLink123
Setting device VLAN database password to EduLink123
Switch(config)#exit
Switch#
```

VTP client in distribution switches

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vtp mode client
Setting device to VTP CLIENT mode.
Switch(config)#vtp domain EduLink
Changing VTP domain name from NULL to EduLink
Switch(config)#vtp password EduLink123
Setting device VLAN database password to EduLink123
Switch(config)#exit
Switch#
```

VTP client in access switches

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vtp mode client
Setting device to VTP CLIENT mode.
Switch(config)#vtp domain EduLink
Changing VTP domain name from NULL to EduLink
Switch(config)#vtp password EduLink123
Setting device VLAN database password to EduLink123
Switch(config)#exit
Switch#
```

Task 2: Dynamic Routing (OSPF)

OSPF configuration on Router 0

```
Router>
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.10.0 0.0.0.255 area 0
Router(config-router)#network 192.168.20.0 0.0.0.255 area 0
Router(config-router)#network 192.168.30.0 0.0.0.255 area 0
Router(config-router)#network 192.168.40.0 0.0.0.255 area 0
Router(config-router)#network 192.168.50.0 0.0.0.255 area 0
Router(config-router)#network 192.168.60.0 0.0.0.255 area 0
```

```
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
00:23:32: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.1.1 on Serial2/0 from LOADING to FULL,
Loading Done

00:25:02: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.2.1 on Serial3/0 from LOADING to FULL,
Loading Done
```

OSPF configuration on Router 1

```
Router>
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
00:23:32: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.60.1 on Serial2/0 from LOADING to FULL,
Loading Done
```

OSPF configuration on Router 2

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
00:25:02: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.60.1 on Serial2/0 from LOADING to FULL,
Loading Done
```

Router 0 to Router 1 OSPF connection

Router0	Router>	enable	enable
Router0	Router#	configure terminal	configure terminal
Router0	Router(config)#	interface se2/0	interface Serial2/0. 0
Router0	Router(config-if)#	ip address 192.168.1.1 255.255.255.0	ip address 192.168.1.1 255.255.255.0
Router0	Router(config-if)#	no shutdown	no shutdown
Router0	Router(config-if)#	exit	exit

Router 0 to Router 2 OSPF connection

```
Router>
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface se3/0
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#exit
Router(config)#
Router(config)#exit
Router#
```

Router 1 configuration

Router1	Router>	enable	enable
Router1	Router#	configure termina	configure terminal
Router1	Router(config)#	interface serial se2/0	interface Serial
Router1	Router(config)#	interface se2/0	interface Serial2/0. 0
Router1	Router(config-if)#	ip address 192.168.1.1 255.255.255.0	ip address 192.168.1.1 255.255.255.0
Router1	Router(config-if)#	no shutdown	no shutdown
Router1	Router(config-if)#	exit	exit

Router 2 configuration

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface serial2/0
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

Router(config-if)#exit
Router(config)#exi
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
t
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Task 3: Wireless Networks

Access switch VLAN 20 trunk for wireless

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch(config-if)#switchport trunk encapsulation dotlq
                                 ^
% Invalid input detected at '^' marker.

Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show interfaces trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/1       on           802.1q         trunking      1
Fa0/2       on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/1       1-1005
Fa0/2       1-1005

Port        Vlans allowed and active in management domain
Fa0/1       1,10,20,30,40,50,60
Fa0/2       1,10,20,30,40,50,60

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/1       1,10,20,30,40,50,60
Fa0/2       1,10,20,30,40,50,60
```

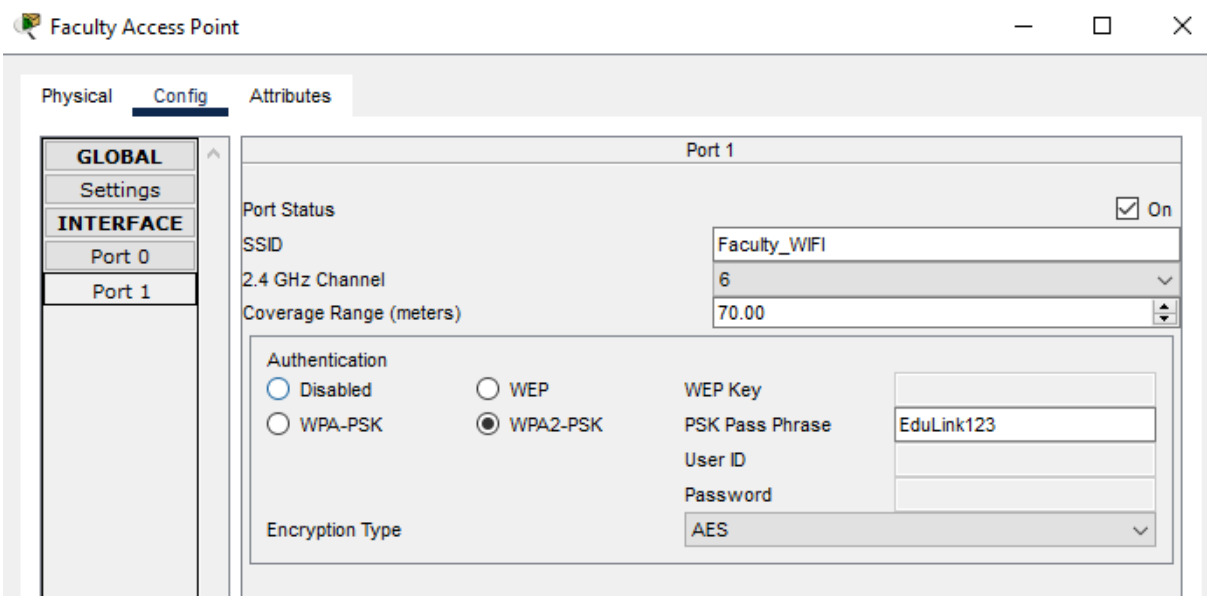
Access switch VLAN 50 trunk for wireless

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch(config-if)#
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show interfaces trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/1       on           802.1q         trunking      1
Fa0/2       on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/1       1-1005
Fa0/2       1-1005

Port        Vlans allowed and active in management domain
Fa0/1       1,10,20,30,40,50,60
Fa0/2       1,10,20,30,40,50,60

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/1       1,10,20,30,40,50,60
Fa0/2       none


Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#no shutdown
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show interfaces trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/1       on           802.1q         trunking      1
Fa0/2       on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/1       1-1005
Fa0/2       1-1005

Port        Vlans allowed and active in management domain
Fa0/1       1,10,20,30,40,50,60
Fa0/2       1,10,20,30,40,50,60

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/1       1,10,20,30,40,50,60
Fa0/2       1,10,20,30,40,50,60
```

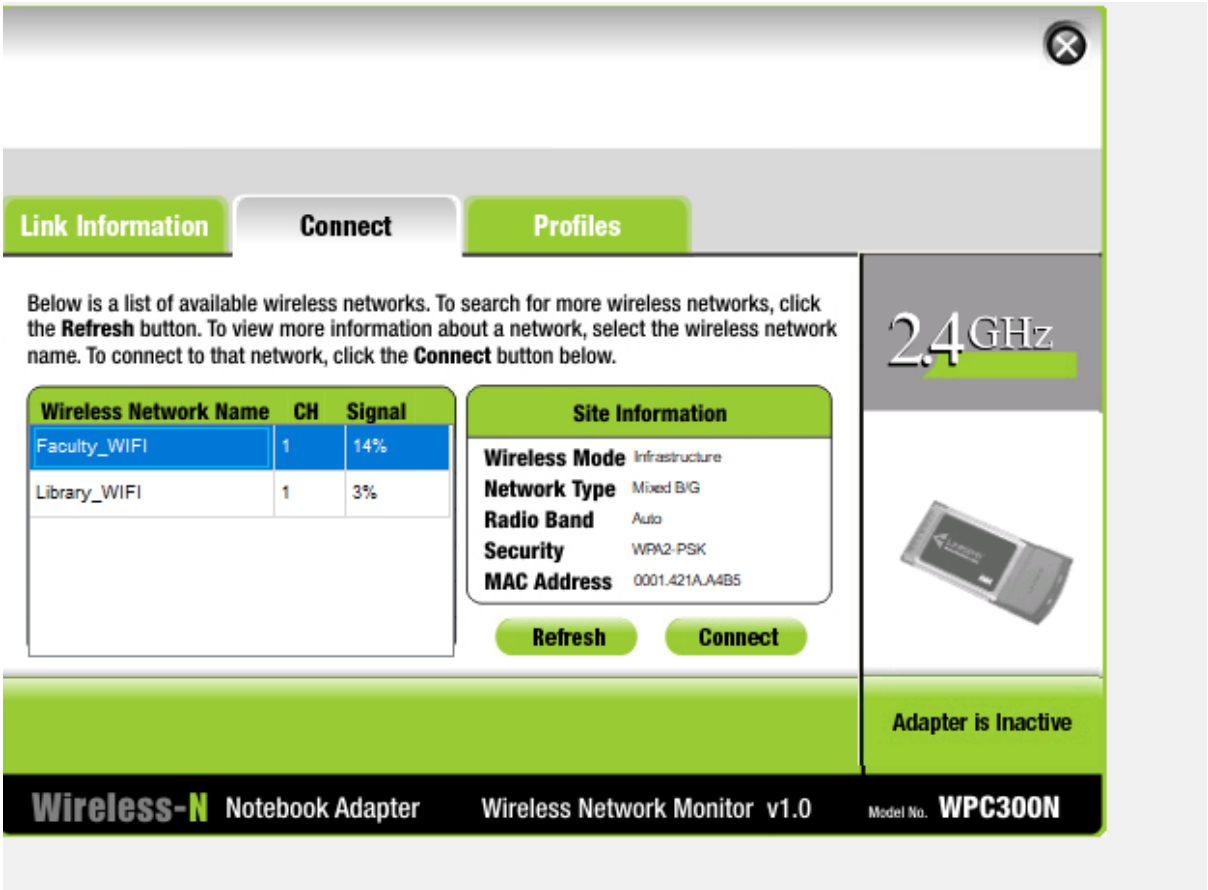
Access switch VLAN 60 trunk for wireless

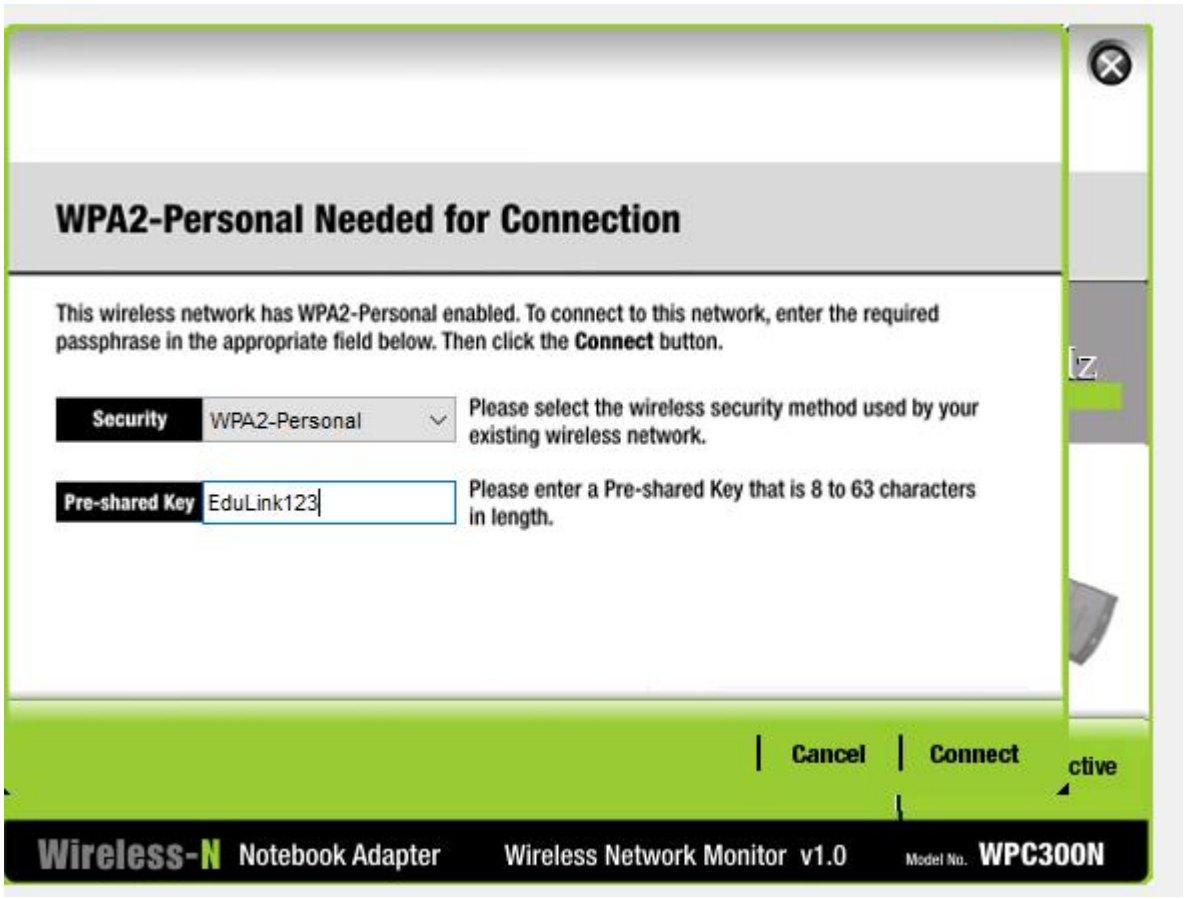
```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up

Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show interfaces trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/1       on           802.1q         trunking      1
Fa0/2       on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/1       1-1005
Fa0/2       1-1005

Port        Vlans allowed and active in management domain
Fa0/1       1,10,20,30,40,50,60
Fa0/2       1,10,20,30,40,50,60

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/1       1,10,20,30,40,50,60
Fa0/2       none

Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#no shutdown
Switch(config-if)#exit
Switch(config)#exit
Switch#
```

Wireless access point configuration for VLAN 20 (Faculty Wi-Fi)

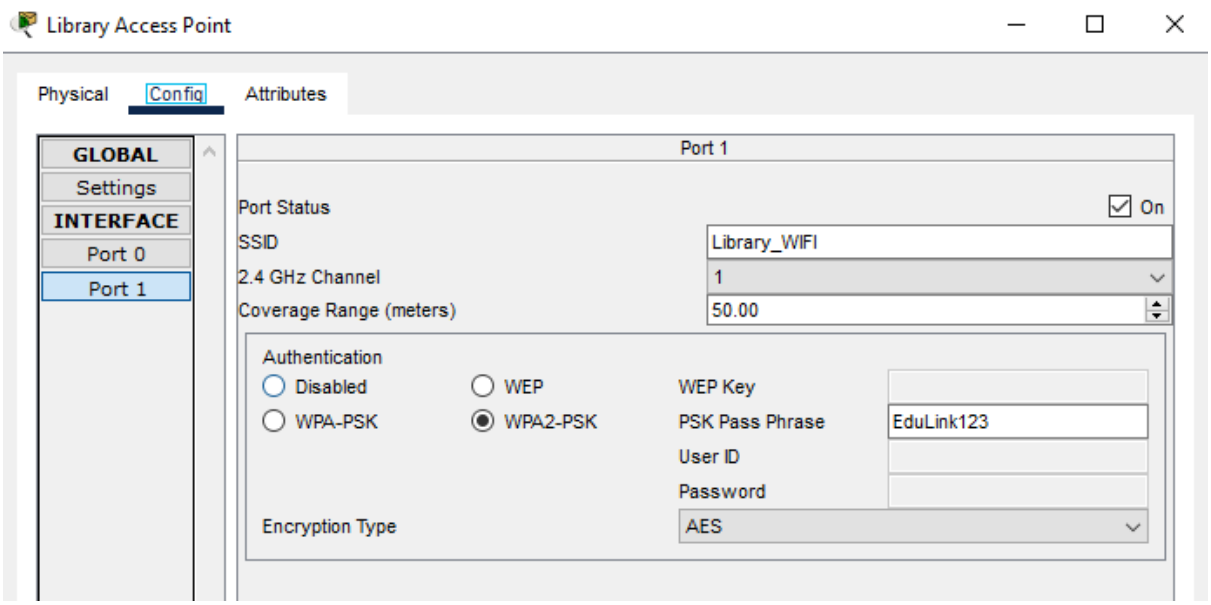


Wireless laptop connection to VLAN 20 (Faculty Wi-Fi)

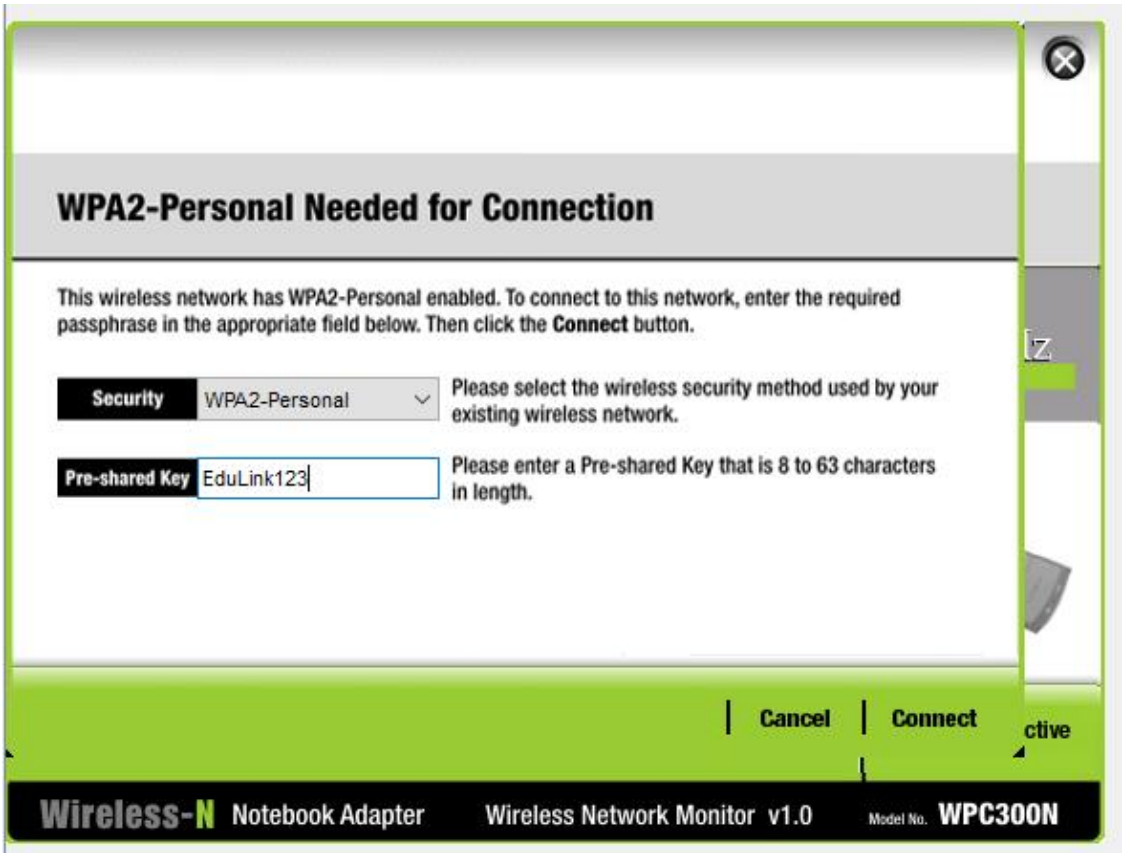




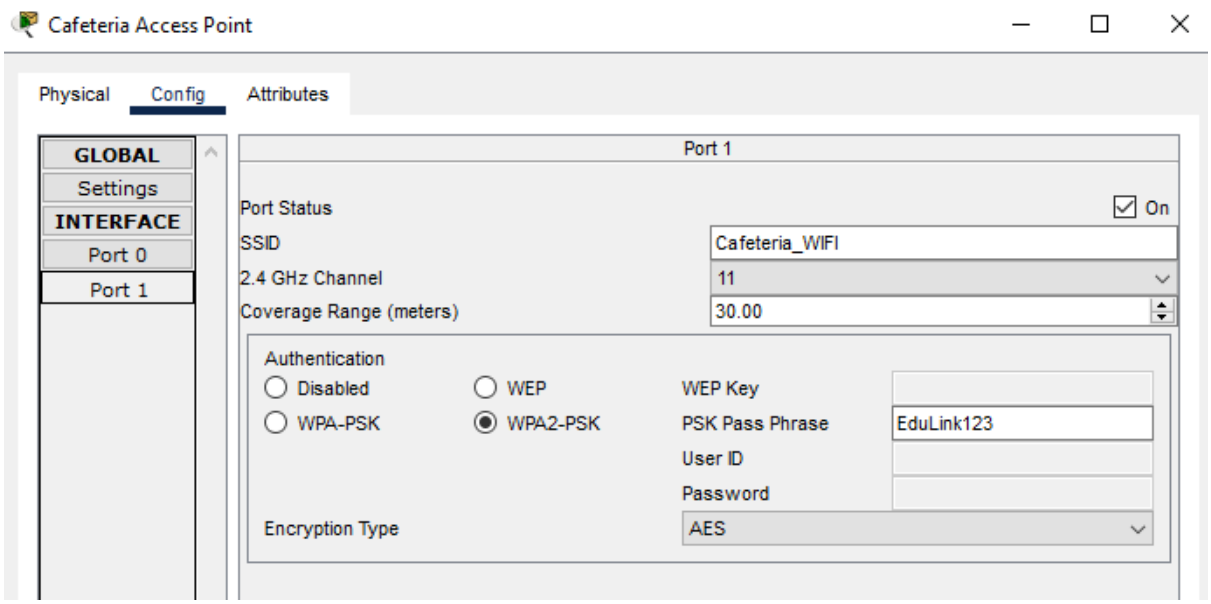
Wireless access point configuration for VLAN 50 (Library Wi-Fi)



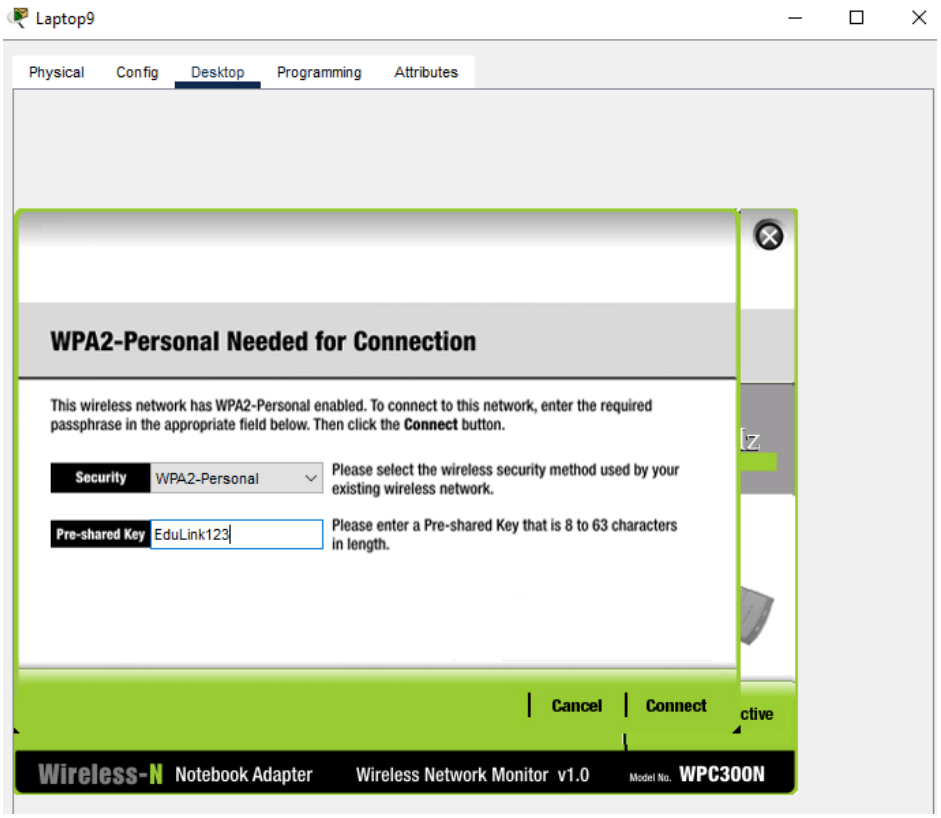
Wireless laptop connection to VLAN 50 (Library Wi-Fi)



Wireless access point configuration for VLAN 60 (Cafeteria Wi-Fi)



Wireless laptop connection to VLAN 60 (Cafeteria Wi-Fi)




Laptop9
Physical
Config
Desktop
Programming
Attributes
Link Information
Connect
Profiles
More Information
Infrastructure Mode
2.4GHz
You have successfully connected to the access point
Signal Strength
Link Quality
Adapter is Active
Wireless-N Notebook Adapter
Wireless Network Monitor v1.0
Model No. WPC300N

Task 4: Security (Port Security and ACLs)

Port security on Access Switch 1

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface range fa0/2-6
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport port-security
Switch(config-if-range)#switchport port-security maximum 5
Switch(config-if-range)#switchport port-security violation shutdown
Switch(config-if-range)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)         (Count)
-------------------------------------------------------------------------
        Fa0/2        5          0                0          Shutdown
        Fa0/3        5          0                0          Shutdown
        Fa0/4        5          0                0          Shutdown
        Fa0/5        5          0                0          Shutdown
        Fa0/6        5          0                0          Shutdown
-------------------------------------------------------------------------
```

Port security on Access Switch 2

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport port-security
Switch(config-if)#switchport port-security maximum 5
Switch(config-if)#switchport port-security violation shutdown
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)         (Count)
-------------------------------------------------------------------------
        Fa0/2        5          0                0          Shutdown
```

Port security on Access Switch 3

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface range fa0/2-6
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport port-security
Switch(config-if-range)#switchport port-security maximum 5
Switch(config-if-range)#switchport port-security violation shutdown
Switch(config-if-range)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)        (Count)
---------------------------------------------------------------------
        Fa0/2        5          0                0         Shutdown
        Fa0/3        5          0                0         Shutdown
        Fa0/4        5          0                0         Shutdown
        Fa0/5        5          0                0         Shutdown
        Fa0/6        5          0                0         Shutdown
---------------------------------------------------------------------
```

Port security on Access Switch 4

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface range fa0/2-6
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport port-security
Switch(config-if-range)#switchport port-security maximum 5
Switch(config-if-range)#switchport port-security violation shutdown
Switch(config-if-range)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)        (Count)
---------------------------------------------------------------------
        Fa0/2        5          0                0         Shutdown
        Fa0/3        5          0                0         Shutdown
        Fa0/4        5          0                0         Shutdown
        Fa0/5        5          0                0         Shutdown
        Fa0/6        5          0                0         Shutdown
---------------------------------------------------------------------
```

Port security on Access Switch 5

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport port-security
Switch(config-if)#switchport port-security maximum 5
Switch(config-if)#switchport port-security violation shutdown
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)         (Count)
-----------------------------------------------------------------------
        Fa0/2         5           0                0          Shutdown
-----------------------------------------------------------------------
```

Port security on Access Switch 6

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fa0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport port-security
Switch(config-if)#switchport port-security maximum 5
Switch(config-if)#switchport port-security violation shutdown
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)         (Count)
-----------------------------------------------------------------------
        Fa0/2         5           0                0          Shutdown
-----------------------------------------------------------------------
```

Access control list (ACL) configuration

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#access-list 101 deny ip 192.168.10.0 0.0.0.255 192.168.20.0 0.0.0.255
Router(config)#access-list 101 permit ip any any
Router(config)#interface fa0/0
Router(config-if)#ip access-group 101 in
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show access-lists 101
Extended IP access list 101
    deny ip 192.168.10.0 0.0.0.255 192.168.20.0 0.0.0.255
    permit ip any any
```

Task 5: Documentation and Advanced Routing (BGP)

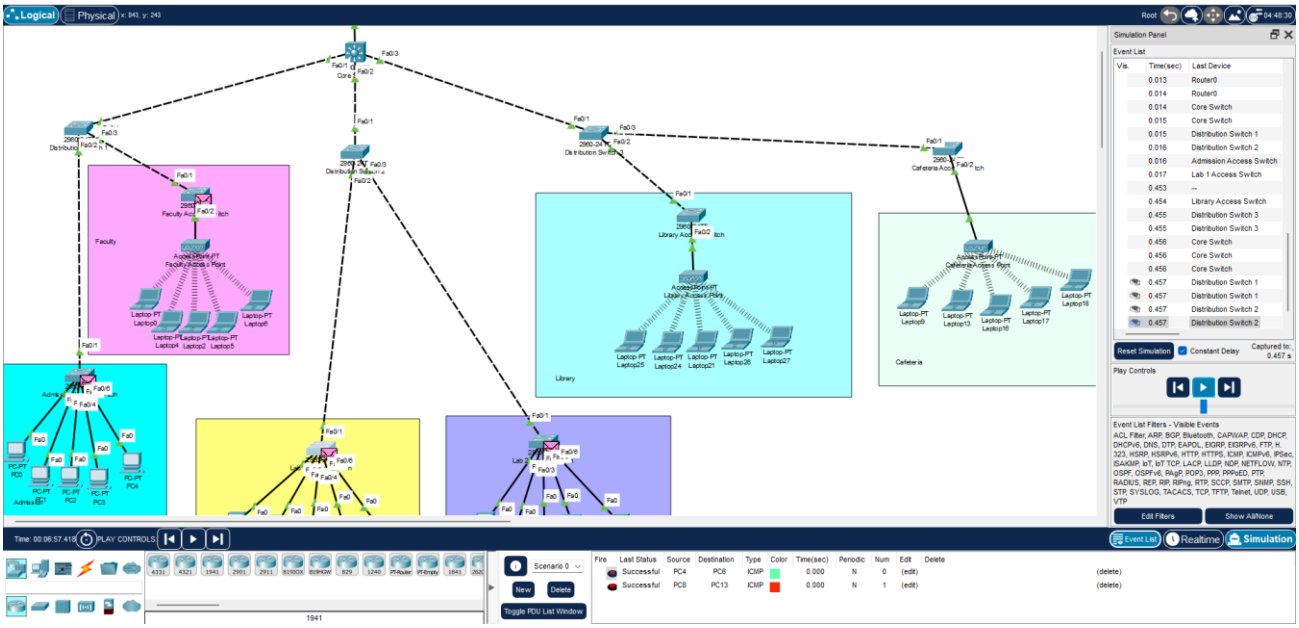
Sub-interface creation on the router for inter-VLAN routing

```
Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#ip address 192.168.10.1 255.255.255.0
Router(config-subif)#exit
Router(config)#interface fa0/0.20
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.20, changed state to up

Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 192.168.20.1 255.255.255.0
Router(config-subif)#exit
Router(config)#interface fa0/0.30
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.30, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.30, changed state to up

Router(config-subif)#encapsulation dot1Q 30
Router(config-subif)#ip address 192.168.30.1 255.255.255.0
Router(config-subif)#exit
Router(config)#interface fa0/0.40
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.40, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.40, changed state to up

Router(config-subif)#encapsulation dot1Q 40
Router(config-subif)#ip address 192.168.40.1 255.255.255.0
Router(config-subif)#exit
```

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fa0/0.50
Router(config-subif)#encapsulation dot1Q 50
Router(config-subif)#ip address 192.168.50.1 255.255.255.0
Router(config-subif)#exit
Router(config)#interface fa0/0.60
Router(config-subif)#encapsulation dot1Q 60
Router(config-subif)#ip address 192.168.60.1 255.255.255.0
Router(config-subif)#exit
Router(config)#exit
Router#
```

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fa0/0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#exit
Router#
```

Inter-VLAN routing configuration



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC4	PC6	ICMP		0.000	N	0	(edit)	
	Successful	PC8	PC13	ICMP		0.000	N	1	(edit)	

BGP configuration on Router 0

```
Router#
Router#enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router bgp 65001
Router(config-router)#network 192.168.10.0 mask 255.255.255.0
Router(config-router)#network 192.168.20.0 mask 255.255.255.0
Router(config-router)#network 192.168.30.0 mask 255.255.255.0
Router(config-router)#network 192.168.40.0 mask 255.255.255.0
Router(config-router)#network 192.168.50.0 mask 255.255.255.0
Router(config-router)#network 192.168.60.0 mask 255.255.255.0
Router(config-router)#neighbor 192.168.1.2 remote-as 65002
Router(config-router)#neighbor 192.168.2.2 remote-as 65003
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

BGP configuration on Router 1

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router bgp 65002
Router(config-router)#network 192.168.1.0 mask 255.255.255.0
Router(config-router)#neighbor 192.168.1.2 remote-as 65001
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip bgp summary
BGP router identifier 192.168.1.1, local AS number 65002
BGP table version is 1, main routing table version 6
0 network entries using 0 bytes of memory
0 path entries using 0 bytes of memory
0/0 BGP path/bestpath attribute entries using 0 bytes of memory
0 BGP AS-PATH entries using 0 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
Bitfield cache entries: current 1 (at peak 1) using 32 bytes of memory
BGP using 32 total bytes of memory
BGP activity 0/0 prefixes, 0/0 paths, scan interval 60 secs

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
192.168.1.3     4 65001       0       0        1    0    0 01:51:28        4
192.168.1.2     4 65001       0       0        1    0    0 01:51:28        4
```

BGP configuration on Router 2

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router bgp 65003
Router(config-router)#network 192.168.2.0 mask 255.255.255.0
Router(config-router)#neighbor 192.168.2.2 remote-as 65001
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show  ip bgp summary
BGP router identifier 192.168.2.1, local AS number 65003
BGP table version is 1, main routing table version 6
0 network entries using 0 bytes of memory
0 path entries using 0 bytes of memory
0/0 BGP path/bestpath attribute entries using 0 bytes of memory
0 BGP AS-PATH entries using 0 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
Bitfield cache entries: current 1 (at peak 1) using 32 bytes of memory
BGP using 32 total bytes of memory
BGP activity 0/0 prefixes, 0/0 paths, scan interval 60 secs

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
192.168.2.2     4 65001       0       0        1    0    0 01:54:31        4
```

Conclusion

The network design and implementation of EduLink Academy successfully address the assignment's requirements, thus giving a secure, scalable, and efficient infrastructure. Successful segmentation of the network by using VLANs had made communications of different departments completely isolated. Dynamic routing using OSPF allowed for intercampus communications seamlessly, and with the help of BGP, it was connected to the outside world.

WPA2-PSK was used to implement wireless connectivity securely, supporting laptops within designated VLANs. Port security and ACLs were implemented to maintain network security by restricting unauthorized access. Simplified assumptions were made such as the number of devices was limited, and configurations were standardized this improved practicality and clarity without losing any functionality of the design. This report thus acts as a guide, documenting the whole process of network implementation, configurations, assumptions, and their validations, besides showing how the design caters to the current and future needs of EduLink Academy.