A secured Wireless and Ethernet Network Connection *(Campus Area Network-CAN)* Using Cisco Networking Protocol that Provides data Network connectivity for University students, teachers, staff and guest

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Abstract— **In This Project a Campus Area Network (CAN) has been configured among the Science Faculty, ARC Faculty, BBA Faculty, Law Faculty, Boys Halls, Girls Halls, First Administrator Building, Second Administrator Building, Engineering Building, Medical Building of Islamic University, Bangladesh in order to establish a better and easy communication and Internet access with the help of Open Shortest Path First routing protocol(OSPF).**

OSPF *is* Secure and popular protocol for modern communication. This project uses OSPF routing protocol to simulate the CAN network for Islamic University, Bangladesh using Packet tracer simulator software

Index Terms—**CAN, ARC, OSPF, Modern communication.**

I. INTRODUCTION

A. Project Background:

Information and communication are two of the most important strategic issues for the success of every enterprise. While today nearly every organization uses a substantial number of computers and communication tools (telephones, fax, and personal handheld devices), they are often still isolated. While managers today are able to use the newest applications, many departments still do not communicate and much needed information cannot be readily accessed.

To overcome these obstacles in an effective usage of information technology, computer networks are necessary. They are a new kind (one might call it paradigm) of organization of computer systems produced by the need to merge computers and communications. At the same time they are the means to converge the two areas; the unnecessary distinction between tools to process and store information and tools to collect and transport information can disappear. Computer networks can manage to put down the barriers between information held on several (not only computer) systems. Only with the help of computer networks can a borderless communication and information environment be built.

Computer networks allow the user to access remote programs and remote databases either of the same organization or from other enterprises or public sources. Computer networks

provide communication possibilities faster than other facilities. Because of these optimal information and communication possibilities, computer networks may increase the organizational learning rate, which many authors declare as the only fundamental advantage in competition

B. Objective

The main objective of this project is to design an configure a Campus Area Network.The specific objectives of this project are listed as followed:

- ✓ Create interconnection of Local Area Network within a limited geographical area.

- ✓ Creating wireless zone.

- ✓ Transfer data with maximum security

- ✓ Give the facility to communicate each Islamic University Building very easily and shortly.

- ✓ To implement communication very simply.

- ✓ Access Internet.

C. Project Scope

The scopes of this project are to reduce total cost of ownership by extending the life of older systems. Make it easier for users to locate and access resources on the network. Support roaming users by providing access to their documents and system information from multiple computers. Lastly, this simulated project should be used for future implementation on real network.

II. NETWORKING COMPONENT

Component used in the Islamic University computer network:

- ➢ nodes (computers)

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- ➢ a connecting medium (wired or wireless)

- ➢ Specialized network equipment like routers or hubs.

In the case of the Internet, all of these pieces work together to allow our computer to send information to another computer that could be on the other side of the world.

IP Configuring
Router R0 interfaces configuration:
R1>no
R1>enable
R1#config t

R1(config)#int fa0/0
R1 (config-if)#ip address 192.168.3.2 255.255.255.0
R1 (config-if)#no shut
R1 (config-if)#exit

R1 (config)# int fa1/0
R1 (config-if)# ip address 10.0.112.1 255.255.240.0
R1 (config-if)#no shut
R1 (config-if)#exit

R1 (config)# int s2/0
R1 (config-if)# ip address 10.0.96.1 255.255.240.0
R2 (config-if)# clock rate 64000
R1 (config-if)#no shut
R1 (config-if)#exit

R1 (config)# do wr

Router R1 interfaces configuration:
R1>no
R1>enable
R1#config t

R1(config)#int fa1/0
R1 (config-if)#ip address 10.0.176.1 255.255.240.0
R1 (config-if)#no shut
R1 (config-if)#exit

R1 (config)# int fa0/0
R1 (config-if)# ip address 192.168.5.2 255.255.255.0
R1 (config-if)#no shut
R1 (config-if)#exit

R1 (config)# int s2/0
R1 (config-if)# ip address 10.0.160.1 255.255.240.0
R2 (config-if)# clock rate 64000

R1 (config-if)#no shut
R1 (config-if)#exit

R1 (config)# int s3/0
R1 (config-if)# ip address 10.0.192.1 255.255.240.0
R1 (config-if)#no shut
R1 (config-if)#exit
R1 (config)# do wr

Router R2 interface configuration:
R2>no

R2>enable
R2#config t

R2(config)#int fa1/0
R2(config-if)# ip address 10.0.224.1 255.255.240.0
R2(config-if) #no shut
R2 (config-if)#exit

R2(config)#int fa0/0
R2(config-if) ip address 192.168.6.2 255.255.255.0
R2(config-if) no shut
R2 (config-if)#exit

R2(config)#int s2/0
R2(config-if) ip address 10.0.144.1 255.255.240.0
R2(config-if) no shut
R2 (config-if)#exit

R2 (config-if)#do wr

Router R3 interface configuration:
R3>no
R3>enable
R3#config t

R3(config)#int fa1/0
R3(config-if)# ip address 10.0.176.1 255.255.240.0
R3(config-if)# no shut
R3 (config-if)#exit

R3(config)#int fa0/0
R3(config-if ip address 192.168.4.2 255.255.255.0
R3(config-if) no shut
R3 (config-if)#exit

R3(config)#int s2/0
R3(config-if) ip address 10.0.128.1 255.255.240.0
R3(config-if) no shut
R3 (config-if)# clock rate 64000
R3 (config-if)#exit
R3 (config-if)#do wr

Router R4 interface configuration:
R4>no
R4>enable
R4#config t

R4(config)#int fa0/0
R4(config-if) ip address 10.0.64.1 255.255.240.0
R4(config-if) no shut
R4 (config-if)#exit

R4(config)#int fa1/0
R4(config-if) ip address 10.0.80.1 255.255.240.0
R4(config-if) no shut
R4 (config-if)#exit

R4(config)#int s2/0
R4(config-if) ip address 10.0.48.1 255.255.240.0
R4(config-if) no shut
R4 (config-if)# clock rate 64000

R4 (config-if)#exit

R4(config)#do wr

Router R5 interface configuration:
R5>no
R5>enable
R5#config t

R5(config)#int fa0/0
R5(config-if)ip address 192.168.2.2 255.255.255.0

R5(config-if) no shut
R5 (config-if)#exit

R5(config)#int fa1/0
R5(config-if) ip address 10.0.16.1 255.255.240.0
R5(config-if) no shut
R5 (config-if)#exit

R5(config)#int s2/0
R5(config-if) ip address 10.0.32.1 255.255.240.0
R5(config-if) no shut
R5 (config-if)# clock rate 64000
R5 (config-if)#exit

R5 (config-if)#do wr

Router R6 interface configuration:
R6>no
R6>enable
R6#config t

R6(config)#int fa0/0
R6(config-if)#ip address 10.0.208.1 255.255.240.0
R6(config-if) #no shut
R6 (config-if)#exit

R6(config)#int s1/0
R6(config-if) ip address 10.0.192.2 255.255.240.0
R6(config-if) no shut
R6(config-if)# clock rate 64000
R6 (config-if)#exit

R6 (config-if)#do wr

R8 interface configuration:
R8>no
R8>enable
R8#config t

R8(config)#int s1/1
R8(config-if) ip address 10.0.160.2 255.255.240.0
R8(config-if) no shut
R8 (config-if)#exit

R8(config)#int s1/4
R8(config-if) ip address 10.0.96.2 255.255.240.0
R8(config-if) no shut

R8 (config-if)#exit

R8(config)#int s1/0
R8(config-if) ip address 10.0.32.2 255.255.240.0
R8(config-if) no shut
R8 (config-if)#exit

R8(config)#int s1/5
R8(config-if) ip address 10.0.48.2 255.255.240.0
R8(config-if) no shut
R8 (config-if)#exit

R8(config)#int s1/2
R8(config-if) ip address 10.0.144.2 255.255.240.0
R8(config-if) no shut
R8 (config-if)#exit

R8(config)#int s1/3
R8(config-if ip address 10.0.128.2 255.255.240.0
R8(config-if) no shut
R8 (config-if)#exit
R8 (config)#do wr

Linksys Wireless router R0 Configuration :

In this topology we have three 16 device (PC,Laptop, Smart Phone, Tablet Pc) connected with Linksys Wireless routers R0

The Default configuration on this router is:

➢ DHCP is configured and enabled on Wireless router

➢ IP pool for DHCP is 192.168.0.100 to 192.168.0.149

➢ PC are configured to receive IP from DHCP Server

➢ No security is configured

➢ Default SSID is configured to Default

➢ Topology is working on infrastructure mode

➢ Default user name and password is admin

➢ IP of wireless is set to 192.168.0.1

We need to set :

➢ IP of Linksys Wireless router R0 will set to 192.168.2.1

➢ IP pool for DHCP will set to 192.168.2.100 - 192.168.2.149

➢ Default SSID will set to **Boy'sHall**

➢ Default user name will set to **admin** and password be **cseiu**

Configuring Linksys Wireless router R0 by following step –

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Double click on Device and select Web Browser. Then give http://192.168.2.1 in the address bar to acces Linksys Wireless router R0 .

Based on Question give –

- ✓ Put admin as admin
- ✓ Password as cseiu
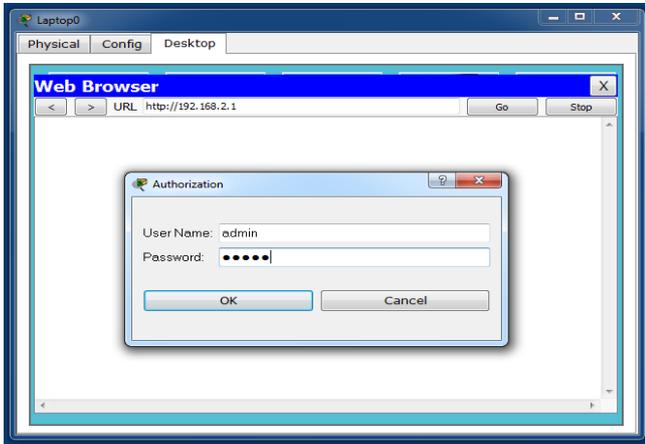
IP & Pass setting for Linksys Wireless router R0 :
After Clicking OK this will bring GUI mode of Wireless router R0. Scroll down screen to Network Step and Set the ip address to 192.168.2.1 and select subnet mask 255.255.255.0.Then Save this configuration.
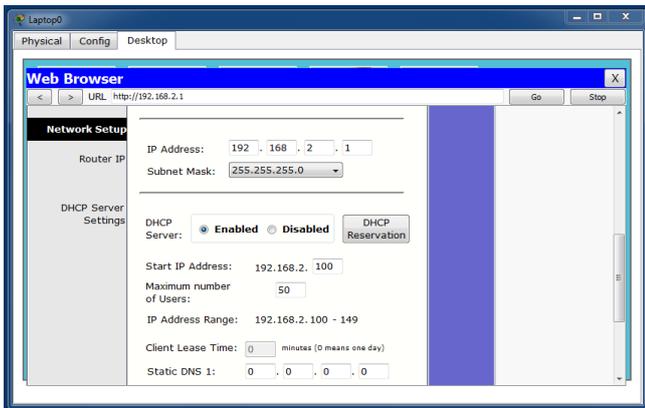
Close the above browser windows and again open the browser with new IP address, enter in the R6 GUI with default username and password. Then we can change IP address range that will be connect to this router. Go in end of page and click on save setting this will save setting click on continue for further setting.
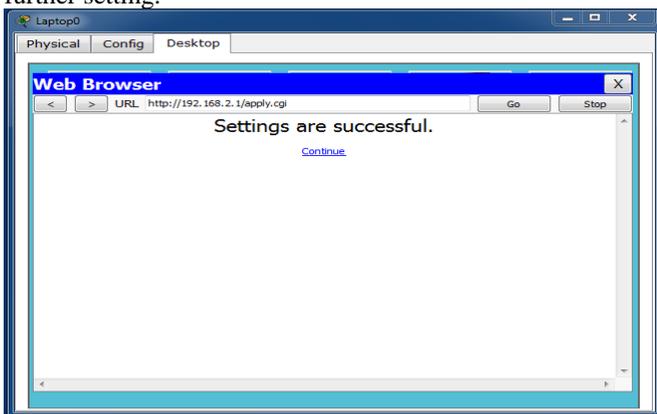
Now select Administration from top Manu and change password to **cseiu** and go in the end of page and Click on Save Setting
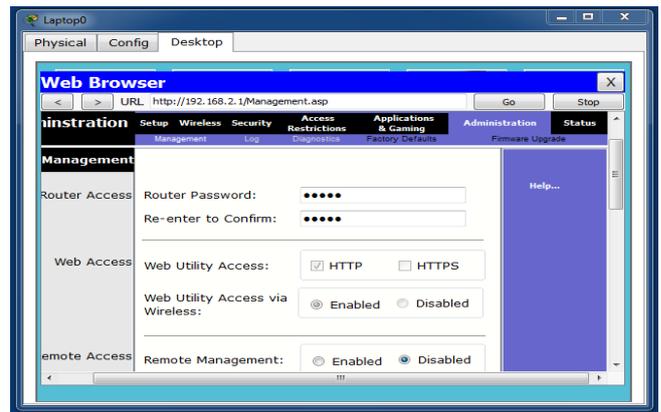
Click on continue for further setting. This time it will ask to authenticate again, give new password **cseiu** this time.

SSID Setting :
Now click on wireless tab and set default SSID to boyshall.
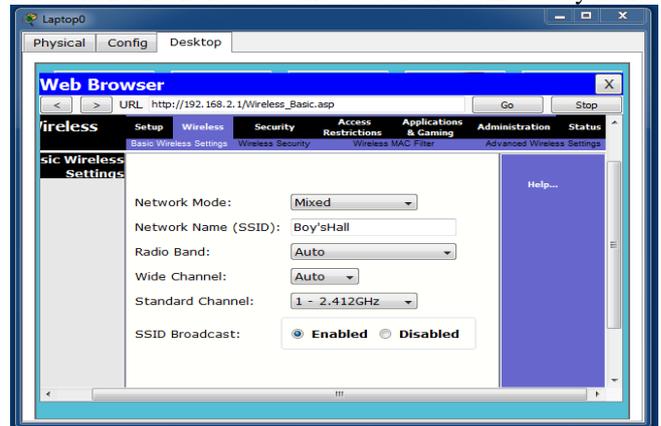
Setting Gateway :
- ✓ Click **Linksys Wireless router R0**
- ✓ Go to the config windows
- ✓ Select Internet
- ✓ Set default gateway to 192.168.2.2 to access next neighbour Router R5.
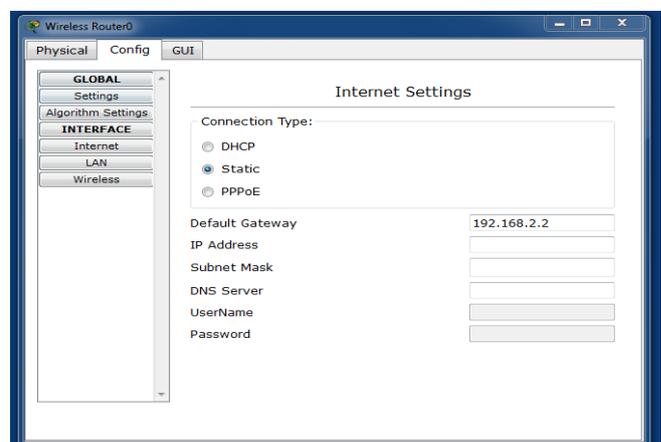
Setting SSID in Devices (PC's,Laptop, Smart Phone & Tablet Pc) :

Perform the following task :
- ✓ Set all devices as DHCP in IP Configuration.
- ✓ Click over device.
- ✓ Select Dextop
- ✓ Click over Pc Wireless
- ✓ Click over Connect then press Refresh and connect
- ✓ Clickn over Profiles and set Wireless Network Name as **Boy'sHall** and Save.
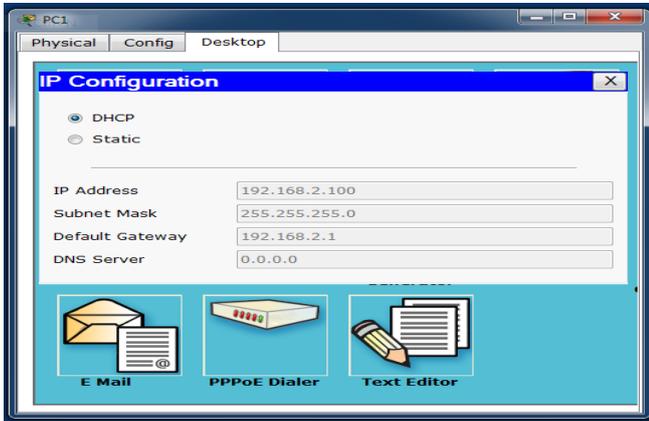
Repeat same procedure to all the devices connected to the Linksys Wireless router R0.

Configure Linksys Wireless router R1, R2, R3, R4 :

Repeat same procedure as like as **Linksys Wireless router R0.**

Linksys Wireless router R1:

SSID	Lan IP	Subnet mask	Default gateway	Pasword
ScienceFaculty	192.168.3.1	255.255.255.0	192.168.3.2	Cseiu

Linksys Wireless router R2:

SSID	Lan IP	Subnet mask	Default gateway	Pasword
Girl'sHall	192.168.4.1	255.255.255.0	192.168.4.2	cseiu

Linksys Wireless router R3:

SSID	Lan IP	Subnet mask	Default gateway	Pasword
Arc'sFaculty	192.168.5.1	255.255.255.0	192.168.5.2	cseiu

Linksys Wireless router R4:

SSID	Lan IP	Subnet mask	Default gateway	Pasword
BBAFaculty	192.168.6.1	255.255.255.0	192.168.6.2	Cseiu

Configuring OSPF:

Two basic elements are needed to configure OSPF. This are-
- ➢ Enabling OSPF
- ➢ Configuring OSPF areas

Enabling OSPF:
The command you use to activate the OSPF routing process is as follows:

Router (config)#**router ospf ?**
<1-65535>

A value in the range from 1 to 65,535 identifies the OSPF Process ID. It's a unique number on this router that groups a series of OSPF configuration commands under a specific running process. Different OSPF routers don't have to use the same Process ID to communicate. It's purely a local value that essentially has little meaning, but it cannot start at 0; it has to start at a minimum of 1.

Configuring OSPF Areas:

After identifying the OSPF process, we need to identify the interfaces that you want to activate OSPF communications on as well as the area in which each resides. This will also

configure the networks you're going to advertise to others. OSPF uses wildcards in the configuration.
Here's an OSPF basic configuration example for you:

Router#**config t**
Router(config)#**router ospf 1**
Router(config-router)#**network 10.0.0.0 0.255.255.255 area ?**
<0-4294967295> OSPF area ID as a decimal value
A.B.C.D OSPF area ID in IP address format
Router(config-router)#**network 10.0.0.0 0.255.255.255 area 0**

The OSPF Process ID number is irrelevant. It can be the same on every router on the network, or it can be different—doesn't matter. It's locally significant and just enables the OSPF routing on the router.
The arguments of the network command are the network number (10.0.0.0) and the wildcard mask (0.255.255.255). The combination of these two
numbers identifies the interfaces that OSPF will operate on and will also be included in its OSPF LSA advertisements.

Configuring CAN (IU) with OSPF:

In our IU network we divided our network in two (2) OSPF areas as shown in figure-5.5

These areas are –
  ➢ area 0
  ➢ area 1

Routers in OSPF area 0:

Router	Coverage area
Router -R5	Engineering Building
Router -R4	Administration Building
Router –R0	Law Faculty

Routers in OSPF area 1:

Router	Coverage area
Router –R2	Medical Building
Router –R1	Administration Building
Router –R6	Law Faculty
Router –R3	For Further Use

Figure : OSPF area

Router -R5 OSPF configuration (area 0):

R5#config t
R5(config)#router ospf 1
R5(config-router)# network 192.168.2.0 0.0.0.255 area 0
R5(config-router)# network 10.0.16.0 0.0.15.255 area 0

R5(config-router)# network 10.0.32.0 0.0.15.255 area 0
R5(config-router)#do wr

Router –R4 OSPF configuration (area 0):
R4#config t
R4(config)#router ospf 1

R4(config-router)# network 10.0.48.0 0.0.15.255 area 0
R4(config-router)# network 10.0.64.0 0.0.15.255 area 0
R4(config-router)# network 10.0.80.0 0.0.15.255 area 0
R4(config-router)#do wr

Router –R0 OSPF configuration (area 0):
R0#config t
R0(config)#router ospf 1
R0(config-router)# network 192.168.3.0 0.0.0.255 area 0
R0(config-router)# network 10.0.96.0 0.0.15.255 area 0
R0(config-router)# network 10.0.112.0 0.0.15.255 area 0
R0(config-router)#do wr

Router –R2 OSPF configuration (area 1):
R2#config t
R2(config)#router ospf 1
R2(config-router)# network 192.168.6.0 0.0.0.255 area 1
R2(config-router)# network 10.0.144.0 0.0.15.255 area 1
R2(config-router)# network 10.0.224.0 0.0.15.255 area 1
R2(config-router)#do wr

Router –R1 OSPF configuration (area 1):
R1#config t
R1(config)#router ospf 1
R1(config-router)# network 192.168.5.0 0.0.0.255 area 1
R1(config-router)# network 192.168.5.0 0.0.0.255 area 1

R1(config-router)# network 10.0.176.0 0.0.15.255 area 1
R1(config-router)# network 10.0.192.0 0.0.15.255 area 1
R1(config-router)#do wr

Router –R6 OSPF configuration (area 1):
R6#config t
R6(config)#router ospf 1
R6(config-router)# network 10.0.192.0 0.0.15.255 area 1
R6(config-router)# network 10.0.208.0 0.0.15.255 area 1
R6(config-router)#do wr

Router –R3 OSPF configuration (area 1):
R3#config t
R3(config)#router ospf 1
R3(config-router)# network 192.168.4.0 0.0.0.255 area 1
R3(config-router)# network 10.0.128.0 0.0.15.255 area 1
R3(config-router)# network 10.0.176.0 0.0.15.255 area 1
R3(config-router)#do wr

Verifying OSPF Configuration:
There are several ways to verify proper OSPF configuration and operation. So show ip route command on the router R1 see if there is a troubleshooting opportunity for us:

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR

      P - periodic downloaded static route
Gateway of last resort is not set
    10.0.0.0/8 is variably subnetted, 9 subnets, 2 masks
C   10.0.0.0/20 is directly connected, Serial1/2
C   10.0.16.0/20 is directly connected, Serial1/0
C   10.0.32.0/20 is directly connected, Serial1/1
C   10.0.48.0/20 is directly connected, Serial1/3
O   10.0.64.0/20 [110/782] via 10.0.0.2, 00:21:43, Serial1/2
O   10.0.96.0/24 [110/782] via 10.0.32.2, 00:21:33, Serial1/1
O   10.0.112.0/24 [110/1562] via 10.0.32.2, 00:21:33, Serial1/1
O   10.0.176.0/20 [110/1562] via 10.0.16.2, 00:21:33, Serial1/0
O   10.0.240.0/20 [110/782] via 10.0.16.2, 00:21:33, Serial1/0
    172.16.0.0/20 is subnetted, 3 subnets
O   172.16.0.0 [110/782] via 10.0.0.2, 00:21:43, Serial1/2
O   172.16.16.0 [110/782] via 10.0.48.2, 00:21:43, Serial1/3
O   172.16.32.0 [110/782] via 10.0.48.2, 00:21:43, Serial1/3

III. ESTABLISHING INTERNET ACCESS:

Configuration :

R8(config)#access-list 12 permit /deny Network_Address wildcard.

R8(config)#ip nat inside source list 12 pool mypole overload
R8(config)#ip nat pool mypole   beginning-global-ip-address ending-global-ip-address netmask 255.255.255.0

R8(config)#int fa0/0(interface)
R8(config)#ip nat inside
R8(config)#exit

R8(config)#int fa0/1(interface)
R8(config)#ip nat outside
R8(config)#exit

R8#config t
R8(config)#access-list 12 permit 10.0.144.0 0.0.15.255
R8(config)#access-list 12 permit 10.0.224.0 0.0.15.255
R8(config)#access-list 12 permit 192.168.6.0 0.0.0.255
R8(config)#access-list 12 permit 10.0.176.0 0.0.15.255
R8(config)#access-list 12 permit 192.168.4.0 0.0.0.255
R8(config)#access-list 12 permit 10.0.80.0 0.0.15.255
R8(config)#access-list 12 permit 10.0.128.0 0.0.15.255
R8(config)#access-list 12 permit 10.0.48.0 0.0.15.255
R8(config)#access-list 12 permit 10.0.64.0 0.0.15.255
R8(config)#access-list 12 permit 10.0.96.0 0.0.15.255
R8(config)#access-list 12 permit 10.0.16.0 0.0.15.255
R8(config)#access-list 12 permit 192.168.2.0 0.0.0.255
R8(config)#access-list 12 permit 10.0.32.0 0.0.15.255
R8(config)#access-list 12 permit 10.0.112.0 0.0.15.255
R8(config)#access-list 12 permit 192.168.3.0 0.0.0.255
R8(config)#ip nat inside source list 12 pool mypole overload
R8(config)#ip nat pool mypole   193.169.15.33
193.169.15.46 netmask 255.255.255.0
R8(config)#do wr

IV.   CONCLUSION AND RECOMMENDATION

In this project work some consideration has got their destination successfully. From the very beginning of this work the target was to designing and developing a wired and wireless Campus Area Network (CAN) For Islamic university, Bangladesh Using open shortest path first (OSPF) routing protocol. After finishing the project work these goals are fulfilled satisfactorily.

For designing purpose I have used Cisco packet tracer simulator. In this simulator, I

have used several routers of two types. One is Cisco-2811 series router and another type is Linksys –WRT300N wireless router. I have used four types of connector to connect each node. These are cross-over connector, Straight-Through connector, Serial DCE & DTE and wireless connector. I have also used 2960-24TT switches. First I design the network then configure each user interface in proper method and finally configure the routing protocol OSPF.

Recommendation for Future Improvements and Innovations

Several improvement and innovation can be added to the current project to enhance its functionality and security.

In future if anyone wants then he can attach IPv6 to this network, can configured any other routing protocol, and can provide more security.

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