

Design and Implementation of Network Architecture for Electronic Engineering Department

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Abstract— Computer networks have become extremely important in our present-day society. University already has a computer network infrastructure to support various activities both administrative and academic. Networking is one of the most essential ways of sharing information and eLearning. In this paper, a network design is implemented to connect the different networks in a department and to get full knowledge of WLANs and the basic processes of designing a campus WLAN. MikroTik router is used to interface the different networks. Cisco wireless router is used for the wireless network access in the network.

Keywords—MikroTik router, TP-Link CPE, PoE switch, Wireless Local Area Network (WLAN)

I. INTRODUCTION

Along with the constant development of social economy, computer networks have changed people's lifestyle in many aspects. Local area network, which is widely applied, plays a more and more important role in medical treatment, military, education and science. With LANs, work and study efficiency is improved, but it also brings some problems. Wired LAN couldn't change the structure of networks casually according to actual situations. In terms of campuses, most campuses now have their own wired local area network, but teachers and students need a more convenient way to access the network. With Wireless LAN (WLAN), teachers and students can use the same device to get connected to the network at anytime and anywhere. Therefore, in that case, WLAN is the most efficient way to extend the wired local area network, especially on campus. Fig. 1 shows the network architecture of EC Department.

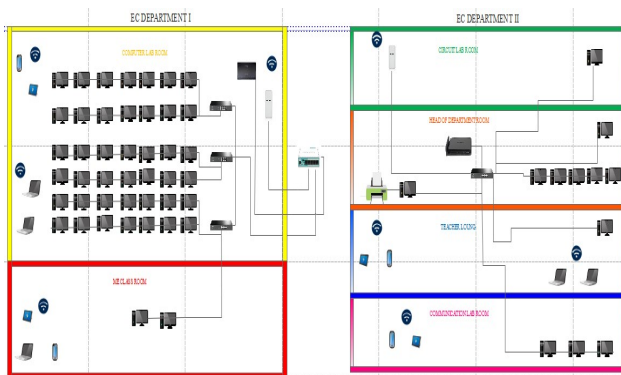


Fig. 1 Network Architecture for EC Department

II. DESIGN IMPLEMENTATION

In hardware implementation, TP-Link CPE is used as client mode to create the wireless network between EC Department 1 and Department 2. TP-Link PoE switch provides the power and data on the CPE that is connected to the internet port of MikroTik router. This MikroTik router includes five Ethernet ports, one is WAN and other is LAN. Fig. 2 and Fig.3 show how to connect the hardware devices.

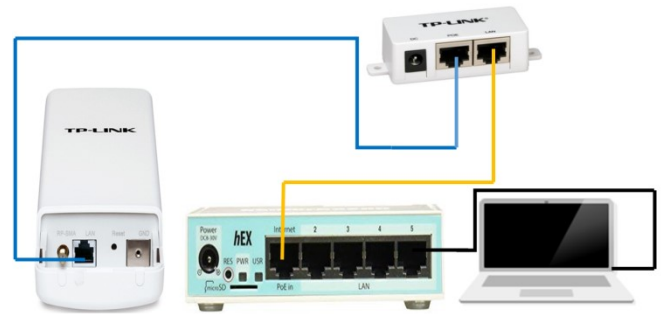


Fig. 2 TP-Link CPE and MikroTik Router Connection



Fig. 3 Cisco Wireless Router, MikroTik Router and TP-Link Switch Connection

In software implementation, there are three main portions such as TP-Link client configuration, MikroTik router configuration and Wireless router configuration.

III. TP-LINK CLIENT CONFIGURATION

In this section, configuration of TP-Link CPE in client mode for wireless network between two departments describes step by step. Firstly, log onto the Client's management page. Open a web-browser (Internet Explorer, Mozilla Firefox etc.) and type the IP address 192.168.1.254 in the address bar, and then press

enter. Then type in the username and password, which are both 'admin' in default and clicks 'ok'.

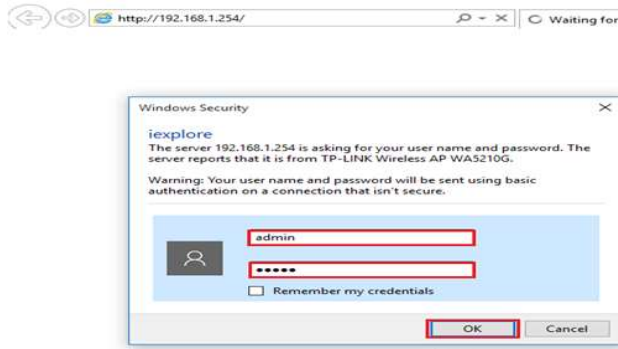


Fig. 4 Connecting to TP-Link

Configures the operation mode to AP Client Router and connect to the wireless network. Click on "Wireless" on Wireless Mode Setting, and then select the Client. SSID (Network Name) of the AP will be connected in Client mode in automatically by surveying as shown in Fig. 5.

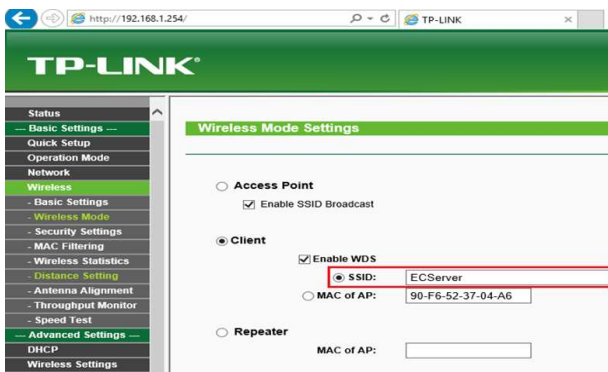


Fig. 5 Access Point Surveying

Go to "Wireless" on Wireless Security and configure the wireless security. They must make sure the Security type of the AP. Select WPA-PSK/WPA2-PSK is automatic as the most secure option. Once configure, click Save as shown in Fig. 6.

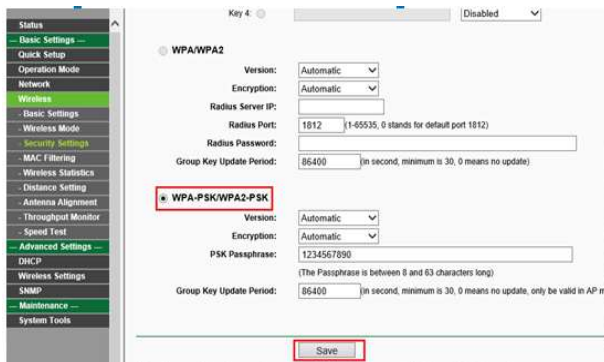


Fig.6 Wireless Security

Go to DHCP; click DHCP Settings and select enable the DHCP Server Select Save as shown in Fig. 7.



Fig.7 Client Information

IV. MICROTİK ROUTER CONFIGURATION

This section includes the configuration of MikroTik router with interfacing software "Winbox". As first step, open the Winbox, operating system and click on search button located after Connected To: input box. Connected Ethernet's MAC will appear now. Click on the MAC address. MikroTik router default username is admin and password is blank. So, type admin in the login input box and password field left blank and then click on 'Connect' button as shown in Fig. 8.

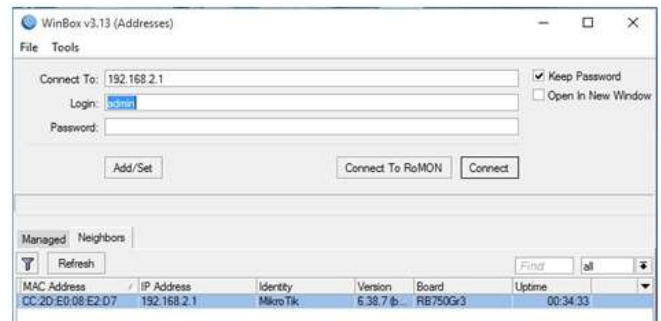


Fig. 8 Connecting to MikroTik Router

On the left menu, MikroTik graphical user interface (GUI) will appear now. Click on "Quick Set" and then choose "Automatic" in the IP address for WAN and LAN as shown in the Fig. 9.

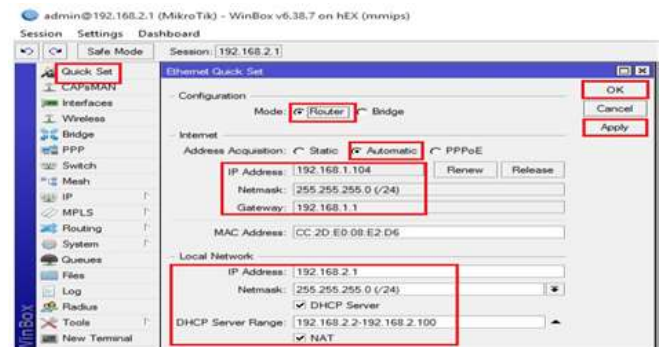


Fig. 9 WAN and LAN Configuration

V. CISCO WIRELESS ROUTER CONFIGURATION

Configuration of the Cisco Linksys-E1200 router is described in this section. Go to Internet Setup on the side menu and select “Automatic Configuration-DHCP” for WAN setup that is connected to TP-Link CPE with DHCP service. And then click Enabled (DHCP Server Setting) by assigning the IP address range for Network Setup as shown in Fig. 10.

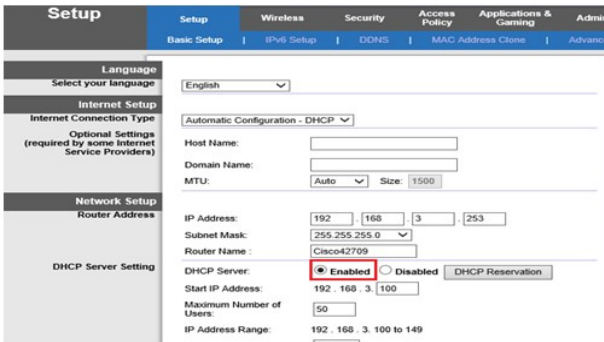


Fig. 10 DHCP Server Setting

For configuration of wireless network, click “Wireless” from the main menu and select the Wireless Network Name (SSID). Enter a name for COMLAB network’s SSID (Wireless Network Name). After it have entered a name, select the “Enabled” radio button for Wireless SSID Broadcast and then select “Save Setting”. Fig. 11 shows the configuration of wireless setting in Cisco router.

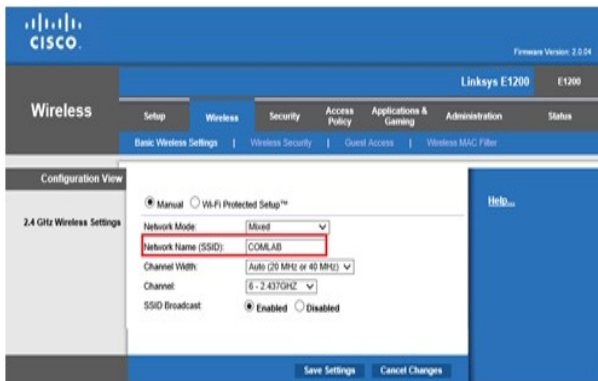


Fig. 11 Wireless Access Point

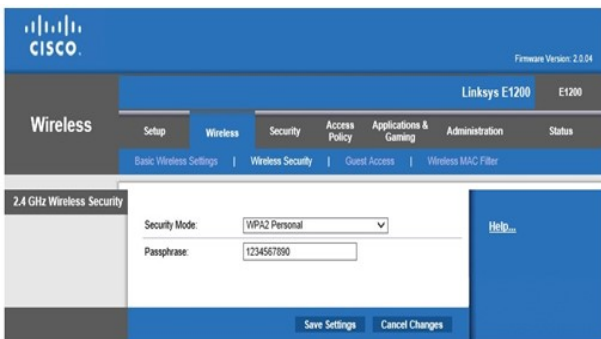


Fig. 12 Wireless Security

From the Wireless menu, click “Wireless Security”, and then select “WPA2 Personal” in Security Mode. Enter the desired password in the Passphrase as shown in Fig. 12.

VI. TEST AND RESULTS

To display the testing results, graphical and ping command are used. Fig. 13 shows the testing results for wireless network in Computer and Control Lab room using Cisco Wireless Router. This is the ping test results for Laptop PC with Wifi Access named COMLAB.

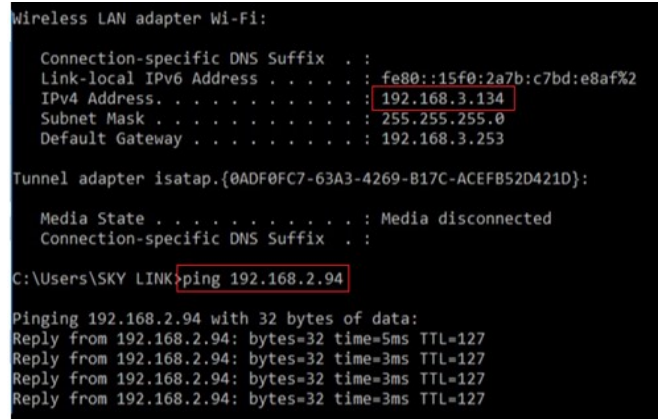


Fig. 13 Testing Result for Wireless Network

Fig. 14 shows how to test the network connections of MikroTik Router and wireless access point in department 2 using Ping commands.

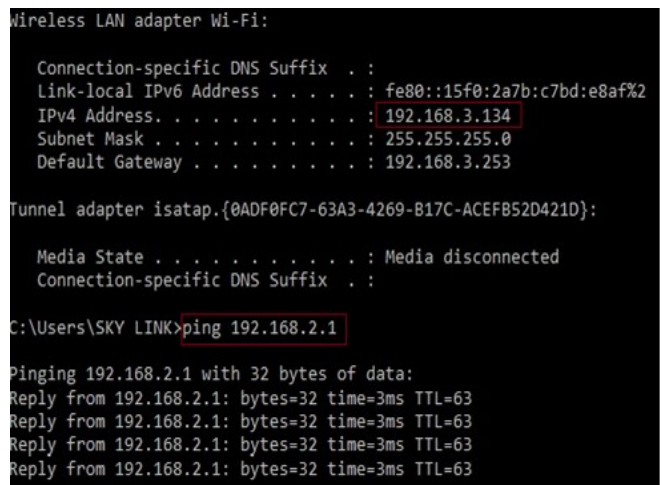


Fig. 14 Testing Result for MikroTik and Cisco Router

To test main network connection for this thesis, will have to ping from the Department 2(Computer and Control Lab room) to Department 1(Head of Department room). Thus, Fig. 15 and Fig. 16 show network connection testing results for Laptop PC to TP-Link Access Point in Department 1.


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Connection-specific DNS Suffix . : 
Link-local IPv6 Address . . . . . : fe80::15f0:2a7b:c7bd:e8af%2
IPv4 Address. . . . . : 192.168.3.134
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.3.253

Tunnel adapter isatap.{0ADF0FC7-63A3-4269-B17C-ACEFB52D421D}:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : 

C:\Users\SKY LINK>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:
Reply from 192.168.1.1: bytes=32 time=9ms TTL=62
Reply from 192.168.1.1: bytes=32 time=5ms TTL=62
Reply from 192.168.1.1: bytes=32 time=4ms TTL=62
Reply from 192.168.1.1: bytes=32 time=5ms TTL=62
    
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Fig. 15 Testing Results for TP-Link Access Point

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Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . : 
Link-local IPv6 Address . . . . . : fe80::15f0:2a7b:c7bd:e8af%2
IPv4 Address. . . . . : 192.168.3.134
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.3.253

Tunnel adapter isatap.{0ADF0FC7-63A3-4269-B17C-ACEFB52D421D}:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : 

C:\Users\SKY LINK>ping 192.168.1.106

Pinging 192.168.1.106 with 32 bytes of data:
Reply from 192.168.1.106: bytes=32 time=5ms TTL=126
Reply from 192.168.1.106: bytes=32 time=5ms TTL=126
Reply from 192.168.1.106: bytes=32 time=4ms TTL=126
Reply from 192.168.1.106: bytes=32 time=4ms TTL=126
    
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Fig.16 Testing Results for E-Library PC in HoD Room

To show the complete testing results, PCs in Computer and Control Lab room available to connect the E-Library PC and Web Server implementing in Head of Department room. Fig. 17 provides the successful results for connecting the E-Library. Computer in Department 2 can search E-Library on web server via browser (<http://server> IP). Fig. 18 shows E-Library web page on PC in computer room.

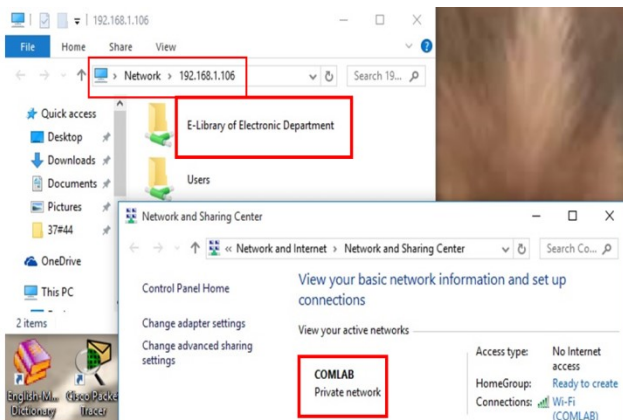


Fig.17 E-Library Connecting via Wireless Network

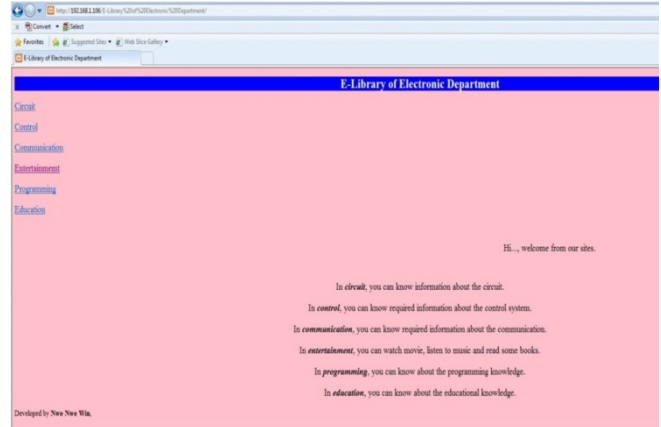


Fig. 18 Connecting to Web Server from Department 2

In this network design, user can also connect to the FTP server implementing in Department 1 via mobile phone using wireless access point named COMLAB in Department 2. Fig. 19 is the testing result for connecting to FTP server via mobile phone. Moreover, the user in Department 2 can also to view the CCTV network installing in Department 1 as shown in Fig. 20.



Fig. 19 Cisco Wireless Router Access Point

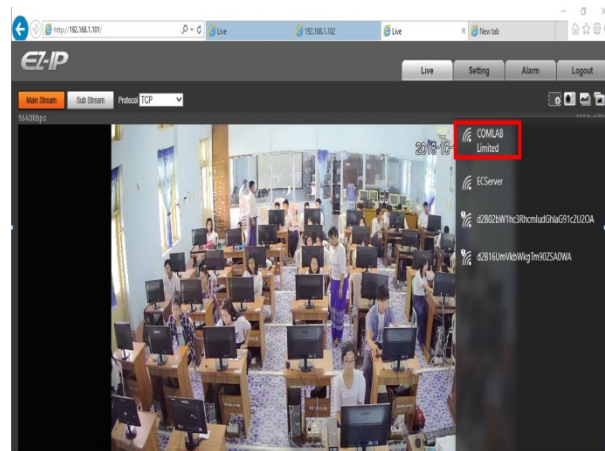


Fig. 20 Viewing the CAM1

VII. CONCLUSIONS

WLANs have been used to group clients on the network, and with the aid of a router and switch configurations, data packets routed from one device to another. This paper provides a favor to know the configurations and their features of networking devices that are used in this design such as MikroTik router, TP-Link CPE and Cisco wireless router. This paper can be modified to implement efficiently the desired network using routing protocol in MikroTik router as future work.

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