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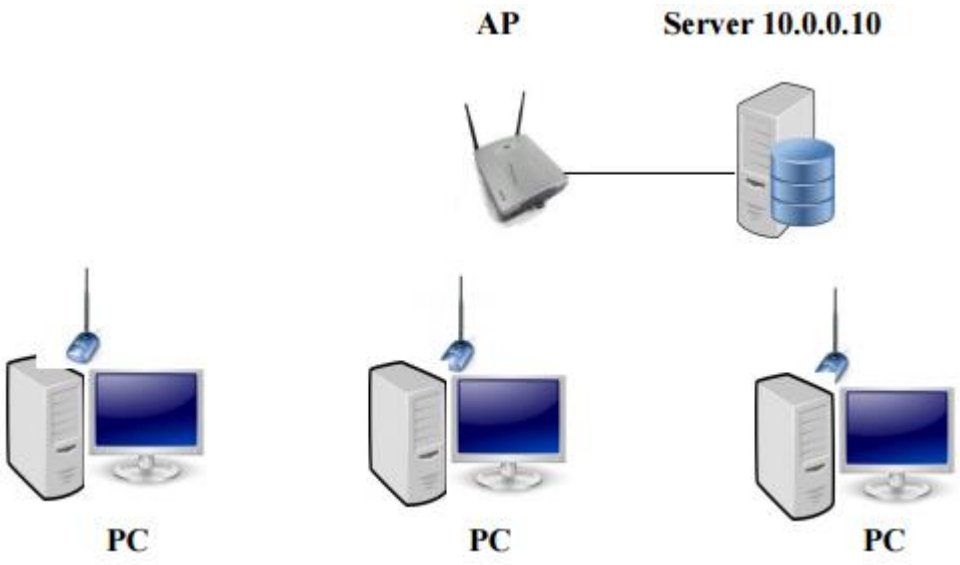
Report of measuring

Title: Wireless communications

Task: Using wireless technology and transmission protocol C-Kermit download file from server, rename file and upload the file back to server. As transmission technology, can be used wireless modems.

Scheme:



Introduction to problematics:

The purpose of this laboratory is to use wireless technology and transmission protocol C-Kermit download file from server, rename file and upload the file back to server. As transmission technology, has used wireless modems.

For this task has been necessary a AP, two computers (Client and Server) and a wireless antenna USB and the Kermit software for data transmission.

Elaboration:

Theoretical Part:

What 802.11?

802.11 is an IEEE standard for MAC and Physical Layer for Wireless Local Area Network (WLAN).

Why Standard?

- Multi Vender inter operability
- Protects customer investment
- Economies of scale
-

Why not Wireless Ethernet?

Ethernet is simple, widely used, cheap but:

Collision Detection

- Not possible in wireless
- Would require a full duplex radio
- Receiver sensitivity

Carrier Senses

- Hidden Stations

Mobility

Power Save

802.11 Versions

802.11 - 1997

Maximum data rate: 2Mbps

2.4Ghz band

Indoor Range: 20 meters

Outdoor Range: 100 meters

Wide range of Physical layers

802.11a - 1999

Maximum data rate: 54Mbps

5.1 - 5.8Ghz band

Indoor range: 35 meters

Outdoor range: 120 meters

54 Mbps

802.11b - 1999

Maximum data rate: 11Mbps

2.4Ghz band

Indoor Range: 38 meters

Outdoor Range: 140 meters

11 Mbps

802.11g - 2003

The current industry adopted specification

Maximum data rate: 54Mbps

2.4Ghz band (backwards compatible with 802.11b)

Indoor range: 38 meters

Outdoor range: 140 meters

54 Mbps

IEEE Standard	Frequency/Medium	Speed
802.11a	5GHz	Up to 54Mbps
802.11b	2.4GHz	Up to 11Mbps
802.11g	2.4GHz	Up to 54Mbps
802.11n	2.4GHz/5GHz	Up to 600Mbps

Diference between 5 GHz and 2.4 GHz frequency bands

Network Speed

The Gigahertz (GHz) range that a wireless device is using does not necessarily determine the maximum speed of the wireless network. A Wireless-A device that runs on the 5 GHz band can also support a maximum data rate of up to 54 Mbps, which is exactly the same data rate that a Wireless-G device running on the 2.4 GHz band supports. The environment in which the network will be set up is what really should be considered.

Interference

A 5 GHz network has a lower chance of picking up interference because most wireless devices such as Bluetooth devices, cordless phones, microwave ovens, and computers use the 2.4 GHz frequency.

Range

The 5 GHz band has a shorter range compared to a 2.4 GHz band because in radio frequencies, the **higher the frequency the shorter its range**. In other words, if you are using a lower frequency like the 2.4 GHz, the **distance it will cover will be greater than the 5 GHz band**.

Application

It is recommended to select the 2.4 GHz if you will be using computers to access the Internet for simple browsing and email. These applications do not take too much bandwidth and work fine at a greater distance.

The 5 GHz has a wider wireless spectrum available compared to the 2.4 GHz, which leads to significantly **better performance** as the 5 GHz is commonly used for usage that requires uninterrupted

throughput. That is why it is recommended for media streaming and transferring music, pictures, and video throughout your home network.

Practical Part:

Steps that has made:

1. Interconnect devices according to scheme on the top of the report.
2. Configure wireless with Network Manager
3. Get information from wireless: channel, frequency, bit rate, Link Quality, ...
4. Test connectivity with server: ping -c 10 10.0.0.10
5. For data transmission use program kermit.
6. Send and receive file with Server.
7. Get from kermit: time of transmission, size of file and effective rate

Setup and file transmission with program kermit:

```
(/home/student/) C-Kermit>set network type tcp/ip
(/home/student/) C-Kermit>set tcp reverse-dns-lookup off
(/home/student/) C-Kermit>set host 10.0.0.10 10012
 Trying 10.0.0.10... (OK)
 Negotiations.. (OK)
(/home/student/) C-Kermit>receive // Receive file from Server
(/home/student/) C-Kermit>statistics /verbose // Get information from wireless
 protocol              : Kermit
 status               : SUCCESS
 remote system type     : UNIX
 files transferred      : 1
 files not transferred  : 0
 characters last file   : 104857600
 total file characters  : 104857600
 communication line in  : 109638952
 communication line out : 62
 packets sent           : 4
 packets received       : 27428
 damaged packets rec'd  : 0
 timeouts               : 0
 retransmissions        : 0
 parity                 : none
 control characters     : 2855674 prefixed, 24165464 unprefixed
 8th bit prefixing      : no
 locking shifts         : no
 window slots used      : (streaming)
 reliable:              : negotiated
 clearchannel:          : negotiated
 packet length          : 3999 (send), 4000 (receive)
```

```
 compression           : yes [~] (39807)
 block check type used  : 3
 elapsed time          : 00:00:34 (33.726 sec)
 effective data rate    : 3109100 cps
(/home/student/) C-Kermit>^C...
(/home/student/) C-Kermit>mv file100M.bin pas0127.bin // Edit name of the file that has received
(/home/student/) C-Kermit>send pas0127.bin  // Send file to the server
(/home/student/) C-Kermit>statistics /verbose  // Get information from wireless
 protocol              : Kermit
 status               : SUCCESS
 remote system type     : UNIX
 files transferred      : 1
 files not transferred  : 0
 characters last file   : 104857600
 total file characters  : 104857600
 communication line in  : 45
 communication line out : 109693787
 packets sent          : 27427
 packets received       : 4
 damaged packets rec'd  : 0
 timeouts              : 0
 retransmissions        : 0
 parity               : none
 control characters     : 2855674 prefixed, 24071815 unprefixed
 8th bit prefixing      : no
 locking shifts         : no
 window slots used      : (streaming)
 reliable:             : negotiated
 clearchannel:          : negotiated
 packet length          : 3999 (send), 4000 (receive)
 compression           : yes [~] (817927)
 block check type used  : 3
 elapsed time          : 00:00:21 (21.031 sec)
 effective data rate    : 4985771 cps
```

Regarding to effective data rate, the value is referred to characters per second. To convert this value to bits per second is only necessary multiply by 8 (because each character is equivalent to 8 bits).

For example:

4985771 cps = (4985771 * 8) bps = 39886168 bps

There are many factors that affect Wireless Networking Performance that are dependent on various areas within the network itself from the technology of the devices used, the local environment the signals will travel through, the fundamental physics behind wireless transmission and more.
Some of these cannot be avoided and measures must be taken to try to minimize the negative affect that these factors will have on the network performance but others can be resolved completely either though equipment upgrading or good network planning.

Obvious Factors Affecting Wireless Networking Performance:

- Physical Obstructions
- Network Range & Distance between Devices
- Wireless Network Interference
- Signal Sharing

Quite Well Known Factors Affecting Wireless Networking Performance:

- Network Usage & Load
- Poorly Deployed Antennas
- Local Environment Characteristics
- Spectrum Channel Limitations
- Signal Reflection
- Wireless Signal Restriction

Conclusion:

By performing this task it was possible to understand several aspects about wireless communications.

It also possible realize that higher frequency corresponds to shorter its range, low frequency corresponds to bigger its range and higher frequency leads to better performance, hence lower frequency leads to worse performance.

There are many factors that affect Wireless Networking Performance that are dependent on various areas within the network itself from the technology of the devices used, the local environment the signals will travel through, the fundamental physics behind wireless transmission and other factors.

References:

Ing. Pavel Nevlud lessons
http://www.pec.org.pk/sCourse_files/Wireless_Networks_Technlogy/Introduction%20to%20IEEE%20802.ppt
http://www.linksys.com/us/support-article?articleNum=134478
http://www.4gon.co.uk/solutions/technical_factors_affecting_wireless_performance.php