

An Approach to Modern Wireless Networks

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Abstract: - Over the past three decades we have been witnessing the confluence of communications and computation. This revolution has been enabled by the wiring together of computers. The next phase of this revolution appears to be the effort to network mobile users and embedded devices, and more generally to allow the formation of spontaneous ad-hoc networks. Over the next few years it is anticipated that the dominant access networks will be wireless. It is this topic that is the subject of this workshop. There are several issues, covering theoretical mathematical and computational aspects that arise in the design and analysis of wireless networks.

Key Words: -
WNC, Wi-Fi, FWD, WLAN, WEP, PVN.

I. INTRODUCTION

The wireless industry has grown at an awesome pace over the past decade. While the term wireless network may technically be used to refer to *any* type of network that is wireless, the term is most commonly used to refer to a telecommunication network whose interconnections between nodes is implemented without the use of wires, such as a computer network .

- a. Wireless telecommunications networks are generally implemented with some type of remote information transmission system that uses electromagnetic waves, such as radio waves, for the carrier and this implementation usually takes place at the physical level or "layer" of the network. Figure 1 and 2 showing an simple wireless communications.
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In designing these protocols, several fundamental mathematical issues arise. Many questions surround how one may best utilize the wireless medium, which is fundamentally a shared medium. Others concern how messages should be routed between nodes whose location may be changing, and what the dynamics of such adaptive distributed routing algorithms are. Yet others deal with how users should regulate their own traffic streams so as to serve the common good. Still more relate to what kind of service quality can be provided by wireless networks to their users. Answering these questions involves the use of fields such as probability theory, discrete mathematics, information theory,



dynamical systems, etc [1]-[4].

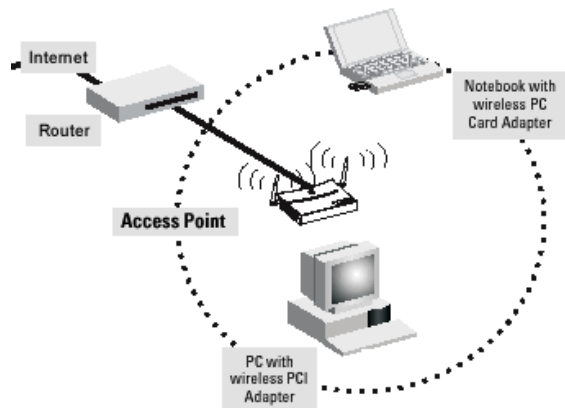


Figure 1: Simple Wireless Communication modules

Figure 2: Simple Wireless Communications

These involve coding, modulation, multiple access, power control, routing, congestion control, and transport, among others and figure 3 showing the block diagram of Radio Network. Many layers of the protocol stack need to be properly designed.

II. TYPES OF WIRELESS NETWORKS

A. *Wireless LAN*: One type of wireless network is a WLAN or Wireless Local Area Network. Similar to other wireless devices, it uses radio instead of wires to transmit data back and forth between computers on the same network. Figure

3 shows an illustration of wireless L.A.N making use of radio signals[5], [7]-[8].

B. *Wi-Fi* : Wi-Fi is a commonly used wireless network in computer systems which enable connection to the internet or other machines that have Wi-Fi functionalities. Wi-Fi networks broadcast radio waves that can be picked up by Wi-Fi receivers that are attached to different computers or mobile phones [5], [7]-[8].

C. *Fixed Wireless Data (FWD)*: Fixed wireless data is a type of wireless data network that can be used to connect two or more buildings together in order to extend or share the network bandwidth without physically wiring the buildings together. Below is the figure 4 showing an type of fixed wireless network[5], [7]-[8] .

D. *Wireless MAN*: It is a type of wireless network that connects several Wireless LANs.

E. *WiMAX* : WiMAX is the term used to refer to wireless MANs [5].

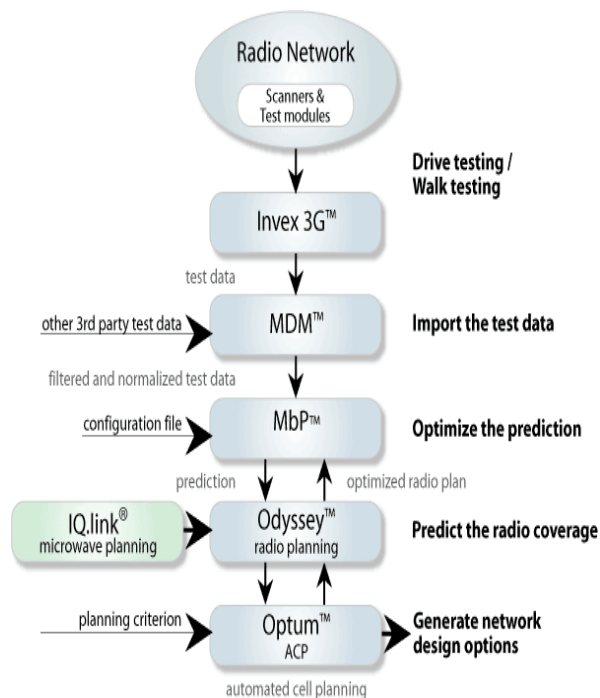


Figure 3: Block Diagram of Radio Network

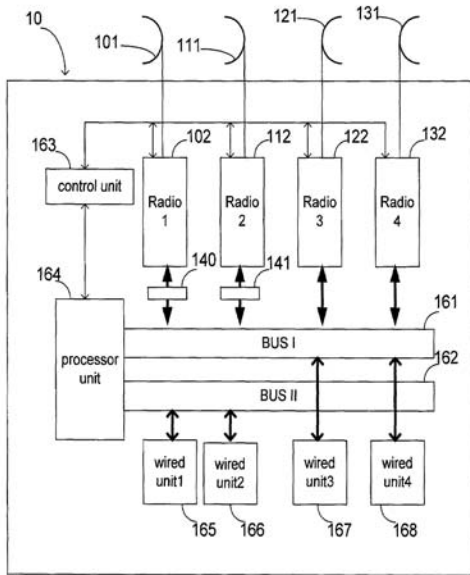


Figure 4: Type of Fixed Wireless Network.

III. MOBILE DEVICES NETWORK

A. *Global System for Mobile Communication (GSM)*: The GSM network is divided into three major systems which are the switching system, the base station system, and the operation and support system (Global System for Mobile Communication (GSM)). The cell phone connects to the base system station which then connects to the operation and support station; it then connects to the switching station where the call is transferred where it needs to go Global System for Mobile Communication (GSM). This is used for cellular phones, is the most common standard and is used for a majority of cellular providers. The G.S.M networks make use of the Private Virtual networks. Figure 5 showing the Private Virtual Network (PVN) [5].

B. *Personel Communication Service (PCS)*: PCS is a radio band that can be used by mobile phones in North America. Sprint happened to be the first service to set up a PCS.

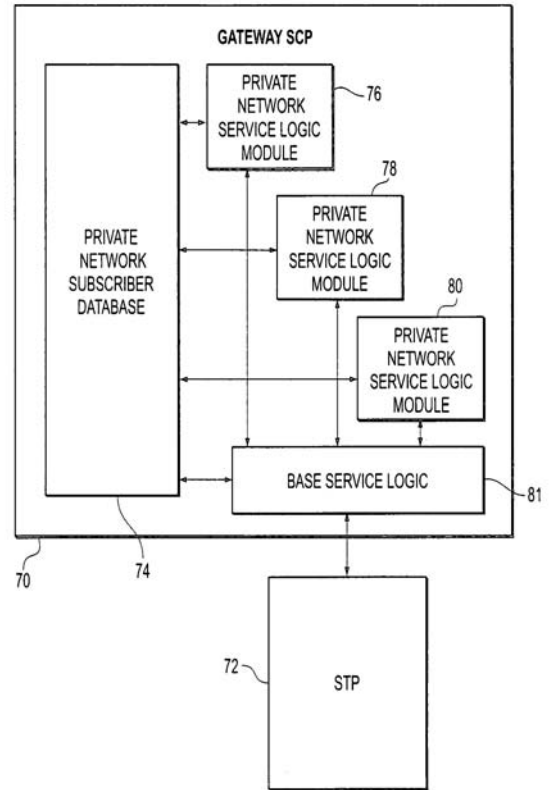


Figure 5: Private Virtual networks

C. *D-AMPS*: D-AMPS, which stands for Digital Advanced Mobile Phone Service, is an upgraded version of AMPS but it is being phased out due to advancement in technology. The newer GSM networks are replacing the older system. This technology are more commonly used now a days just because of its great performance and it is highly reliable in nature.

Wireless networks have significantly impacted the world as far back as World War II. Through the use of wireless networks, information could be sent overseas or behind enemy lines easily and quickly and was more reliable. Since then wireless networks have continued to develop and its uses have significantly grown. Cellular phones are part of huge wireless network systems. People use these phones daily to communicate with one another. Sending information over seas is possible through wireless network systems using satellites and other signals to communicate across the world. Emergency services such as the police department utilize wireless networks to communicate important information quickly.

People and businesses use wireless networks to send and share data quickly whether it be in a small office building or across the world. Another important use for wireless networks is as an inexpensive and rapid way to be connected to the Internet in countries and regions where the telecom infrastructure is poor or there is a lack of resources, like most Developing Countries.

Wireless networks allow you to eliminate messy cables. Wireless connections offer more mobility, the downside is there can sometimes be interference that might block the radio signals from passing through. One way to avoid this is by putting the source of your wireless connection in a place where the signal will have as little interference as possible. Sometimes nearby networks are using the same frequencies, and this can also cause interference within the network and can reduce its performance.

Compatibility issues also arise when dealing with wireless networks. Different components not made by the same company may not work together, or might require extra work to fix compatibility issues. To avoid this, purchase products made by the same company so that there are fewer compatibility issues. Below is the figure 6 showing an multi hop wireless network which is very compatible in nature. Multi Hop wireless networks are used to connect a large number of computers and mobiles phones which can communicate with each other ,these networks are highly compatible in nature.

Wireless networks, in terms of internet connections, are typically slower than those that are directly connected through an Ethernet cable. Though the speed is slower, most things will still move at the same speed except for things like video downloads. Though wireless technology continues to develop, it is now easier to get networks up and running cheaper and faster than ever before.

A wireless network is more vulnerable because anyone can try to break into a network broadcasting a signal. Many networks offer WEP - Wired Equivalent Privacy - security systems which have been found to be vulnerable to intrusion.

Though WEP does block some intruders, the security problems have caused some businesses

to stick with wired networks until security can be improved.



Figure 6: Multi Hop Wireless Network

Another type of security for wireless networks is WPA - Wi-Fi Protected Access. WPA provides more security to wireless networks than a WEP security set up. The use of firewalls will help with security breaches which can help to fix security problems in some wireless networks that are more vulnerable [5], [7], [9].

D. Advantages of Wireless Networks

- Convenience:** Being able to easily have connectivity wherever we are convenient. Our always on and available mindset is further empowered.
- Productivity:** The universal access to the network and Internet can translate into real savings.
- Cost:** Especially in the form of 802.11b, W-LANs is now cheap.
- Mobility:** No longer are we restricted by access to a phone or the expensive and usually unreliable cellular wireless connectivity. In some parts of the country, public WLAN is an option as providers are building small public networks [5], [7].

IV. CONCLUSION

Wireless networks allow you to eliminate messy cables. Wireless connections offer more mobility. A wireless network is more vulnerable because anyone can try to break into a network broadcasting a signal. Another type of security for wireless networks is WPA - Wi-Fi Protected Access. WPA provides more security to wireless networks than a WEP security set up. The use of firewalls will help with security breaches which can help to fix security problems in some wireless networks that are more vulnerable. Wireless telecommunications networks are generally implemented with some type of remote information transmission system that uses electromagnetic waves, such as radio waves, for the cause and this implementation usually takes place at the physical level or "layer" of the network.

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