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COMPARATIVE STUDY OF BLUETOOTH, 802.11 AND HIPERLAN

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ABSTRACT

This manuscript presents comparison of various wireless services. Wireless network are used to communicate with different device which may be computer or any other consumer devices like ATM machines, Mobile Internet, LANs, etc. The wireless communication is used at commercial as well as personal use also to achieve the higher speed of data transfer, easy communication and utilization of the devices. In this area as infrastructural facilities are increased wireless services are widely used and gaining popularity among users this dissertation will help to identify advantages, limitations of wireless services (Like 802.11(IEEE 802.11), HIPERLAN, Home–RF (Home Radio Frequency), and Bluetooth) based on comparison of various parameters.

Keywords: AP - Access Point, ARRL - American Radio Relay League, BSS - Base Service Set, CA - Collision Avoidance, CDMA -Code Division Multiple Access

I. INTRODUCTION

The demands for mobility were increased in our daily life, that's why it leads to develop and change over from wired LANs to the wireless LANs (WLANs). Wired LAN can give the high bandwidth to the user based on requirement and consuming services like video conferences, streaming video etc. based on this users demands much from WLAN so they will not accept too much degradation in performance to achieve mobility and flexibility. It makes expert to do some changes of WLANs designs in future.

In this dissertation first we will discuss the different Wireless LAN standards available for the deployment. And then we will study on the evaluation of the Wireless LAN standards based on security issues. And at last analysis of the available Wireless LAN standards and a feasible solution for future deployment is discussed.

Wireless LANs are based on the cellular architectures where the system is subdivided in to cells, where each cell (called Base Service Set or BSS*) which is controlled by a base station (called Access point or AP).

Wireless LAN standards are currently explored in many communication technologies which are like:

1. IEEE 802.11
2. HIPERLAN/2

II. CLASSIFICATION OF WIRELESS LAN

Wireless LANs can be broadly distributed into two categories:
1) Ad hoc wireless LANs, 2) Wireless LAN with infrastructure

1) Ad hoc wireless LANs

In ad-hoc networks, several wireless nodes join together to establish a peer-to-peer communication which is illustrate in figure-(1). Each client communicates directly with the other clients within network. An Ad-hoc mode is designed such that only the clients within transmission range (within the same cell) of each other can communicate. If a one client in an ad-hoc network wishes to communicate outsides of the cell, a member of the cell MUST operate as agate way and perform routing. They usually need no administration. Networked nodes distribute their resources without a main server.

2)Wireless LAN with infrastructure

In wireless LANs with foundation, there is a high-speed wired or wireless backbone which is illustrated in figure-(2).Wireless nodes access the wired backbone through access points. These access points acquiesce the wireless nodes to share the available network resources calmly. Prior to communicating data, wireless clients and access points must establish a relationship, Oran association. Only after an association is established can the two wireless stations exchange data.

III. WIRELESS LAN STANDARDS

There are many wireless LAN solutions available now a days, with number of levels of standardization and interoperability. Currently two solutions are leads which are HomeRF and Wi-Fi* (IEEE ** 802.11b).using these two 802.11 technologies enjoy the large number of industry support and are targeted to solve Enterprises, Home and even public “hot spot” wireless LAN needs.

IEEE 802.11

The IEEE finalized the initial standard for wireless LANs, IEEE 802.11 in june 1997. That initail standard specifies a 2.4GHz operating frequency with data rate of 1 and 2 Mbps.

With this standard one could choose to use either frequency hopping or direct sequence there are two non compatible forms of spread spectrum modulations. Because of

relatively low data rates as compared to Ethernet, prodcts based on the initial standard did not flourish as many had hoped.

[1] Either using FHSS (Frequency Hopping Spread Spread Specturm) or DSSS (Direct Sequence Spread Spectrum).

802.11a

The OFDM (Orthogonal Frequency Division Multiplexing) provides up to 54Mbps and runs on the 5GHz band.

802.11b

It is also known as Wi-Fi or Higher Rate 802.11, uses DSSS and applies to wireless LANs. It most commonly used for private use at home. It provides an 11Mbps transmission rate and has a fallback rate of 5.5, 2 and 1 Mbps. [9]

802.11g

It provides more than 20Mbps broadcasting rate, utilize to LANs and it will be works on the 2.4(GHz) band.

HIPERLAN 1/2

European Telecommunications Standards Institute (ETSI) ratified in 1996 with High Performance Radio LAN (HIPERLAN 1) standard for providing high-speed communication up to 20Mbps between portable devices in the 5GHz rang. Same like IEEE802.11, HIPERLAN/1 adopts carrier sense multiple access protocol to connect end user devices together.

On higher stage of that, HIPERLAN/1 supports synchronous traffic for different type of data such as video, audio, text, etc.

Later, ETSI rolled out in 2000, a flexible Radio LAN standard called HIPERLAN-2. It designed to provide high speed access up to 54Mbps at PHY layer to a various networks including 3G networks, ATM networks and Internet Protocol based networks and also for private wireless LAN system. Basic applications include data, audio and video with specific Quality of Service parameters taken into account.

HIPERLAN/2 has a very high transmission rate up to 54 Mbps and it achieved by making use of a modularization method called Orthogonal Frequency Digital Multiplexing (OFDM). OFDM is particularly efficient in time-dispersive environments.

Bluetooth

Bluetooth is a short-range RF-based connectivity for portable devices with its functional specification released in 1999 by the Bluetooth Special Interest Group.

Bluetooth communicates on a 2.45GHz frequency. It has been set aside by international agreement for the use of industrial, scientific and medical devices (ISM). One of the ways Bluetooth devices avoid to interfering the other systems is by sending very weak signals of 1 mill watt.

Bluetooth range can be up to 10 meters because of low power and it is its one limitation. Bluetooth uses a technique called spread-spectrum frequency moving. In this technique, a device will use 79 individual, randomly chosen frequencies with a designated range changing groom one to another on a regular basis.

Bluetooth devices come in two classes and both using peer-to-peer communication to speak. Class 3 devices operate at 0dBm range and are capable of transmitting 30 feet through walls or other objects and the other class is termed as class 1 products. These devices operate at 20dBm, which allows for the single to travel about 300 feet through walls or other solid objects.

IV. WLAN TECHNOLOGIES AND STANDARDS

WLAN technologies and standards is reviewed in the bellow. These technologies and standards include UHF narrowband, HIPERLAN.

UNF Narrowband

The term narrowband refers to the narrow band of RF spectrum, 12.5 KHz to 25 KHz, used to transmit data. Existing narrow band systems transmit on both licensed and unlicensed frequencies and operate at higher power levels than spread spectrum systems. The output is that UHF narrow band systems are able to transmit the greatest distance (35 to 50 kilometers) of all WLAN technologies.

However, UHF narrow band has a number of disadvantages. These include regulatory barriers when operating at data rates above 56 Kbps and the instability of frequencies at which the technology operates (i.e. interference and propagation anomalies). In addition, UHF narrow band packet radio systems require considerable knowledge and effort to install. Commercially packaged answers are not available and systems must be custom built. Elements involved in typical system installation include assembling tools, build and maintenance of antennas, verifying radio link performance, and installing network software.

HIPERLAN

What is HIPERLAN?

The HIPERLAN stands for High Performance Radio LAN and it was initiated by the RES-10 group of the ETSI as a pan-European standard for high-speed wireless local networks. So it is called HIPERLAN-1, the first defined technology by this standard group and it was started in 1992 and completed in 1997. Unlike IEEE 802.11, which was based on products, HIPERLAN-1 was based on certain functional requirements specified by ETSI. CEPT released spectrum at 5 and 17 GHz for the implementation of the HIPERLAN in 1993.

Standard of HIPERLAN:

HIPERLAN is a European family of standards on digital high speed wireless communication in the 5.15-5.3 GHz and the 17.1-17.3 GHz spectrum developed by ETSI. The committee responsible for HIPERLAN is RES-10 which has been working on the standard since November 1991.

The standard serves to ensure the possible interoperability of different manufacturers' wireless communications tools that proceed in this spectrum. The HIPERLAN standard only define a common air interface including the physical layer for wireless communications tools, while leaving decisions on higher level configurations and functions open to the equipment manufacturers. Figure -5shows the OSI reference model of HIPERLAN within the physical layer.

During the standardization process, a couple of HIPERLAN-1 prototypes were developed; However, no manufacturer adopted this standardization process consider this effort an unsuccessful attempt. Later on HIPERLAN standardization moved under the ETSI BRAN project with a new and more structured organization. This figure shows Divisions of the HIPERLAN activities.Figure -6shows the Divisions of the HIPERLAN activities.

We have HIPERLAN-2, which aims at higher data rates and intends to accommodate ATM as well as IP type access. This standardization process is under development. They have coordinated with the IEEE 802.11a in the PHY layer specification and current work on the MAC to support Quos is under progress. Other versions of HIIPERLAN are HIPER-ACCESS for remote access and HIPER-LINK to interconnect switches in the backbone. In the United States, these activities are under IEEE 802.16 for LMDS. Only HIPERLAN-1 and

-2 are considered WLANs and will be discussed in this chapter. Most of the emphasis is on HIPERLAN-2 which has attracted significant from cellular manufacturers such as Nokia and Ericsson.

HIPERLAN-1 Requirements and Architecture

The original "functional requirements" for the HIPERLAN-1 were defined by ETSI. These requirements were

- Data rates of 23.529 mbps
- Coverage of up to 100 m
- Multi-move ad hoc networking capability
- Support of time-bounded services
- Support of power saving
- Short range - 50m
- Low mobility - 1.4m/s
- Networks with and without architecture
- Support isochronous traffic
- audio 32kbps, 10ns latency
- video 2Mbps, 100ns latency
- Support asynchronous traffic
- data 10Mbps, immediate access

The frequency of operation was 5.2 (GHz) not licensed bands that were published by CEPT in 1993, so many years before publication of the U-NII bands. The difference between this standard and the IEEE 802.11 was perceived to be the data rate, which was an order of magnitude higher than the original 802.11 and emphasis on ad hoc networking and time-bounded services.Figure – 7shows the overall architecture of an ad hoc network.

In HIPERLAN-1's ad hoc network architecture, a multi-hub topology is considered that also allows overlay of two WLANs. As shown in this figure, the multi-hub routing extends the HIPERLAN communication beyond the radio range of a single node. Each HIPERLAN node is either a forwarder, designated by "F", or a non-forwarder. A non-forwarder node retransmits the received packet, if the packet does not have its own should select at least one of its neighbors as a forwarder. Inter-HIPERLAN forwarding needs bilateral cooperation and agreement between two forwarder and non-forwarder nodes need to periodically update several databases. In figure solid lines represent peer-to-peer communications between two terminals and dashed lines represent the connections for forwarding. Three of the terminals 1, 4 and 6 are designated by letter "F" indicating that they have forwarding connections. There are two overlapping HIPERLANs, A and B, and terminal 4 is a member of both WLANs which can also act as a bridge between the two. This architecture does not have an infrastructure, and it has a large coverage through the multi-hub.

HIPERLAN-1 did not generate any product development, but it had some pioneering impact on other standards. The use of 5 GHz unlicensed bands, first considered in HIPERLAN-1, is operation.Used by IEEE 802.11a and HIPERLAN-2. The multi-hub feature of the HIPERLAN-1 is considered in the HIPERLAN-2 to be used in an environment with a connection to wired infrastructure.

V. FIGURES AND TABLES

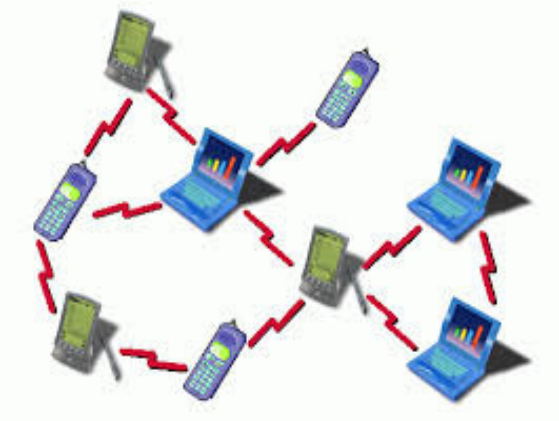

Figure: 1 Ad hoc wireless LAN

Figure: 2 Wireless LAN with Infrastructure

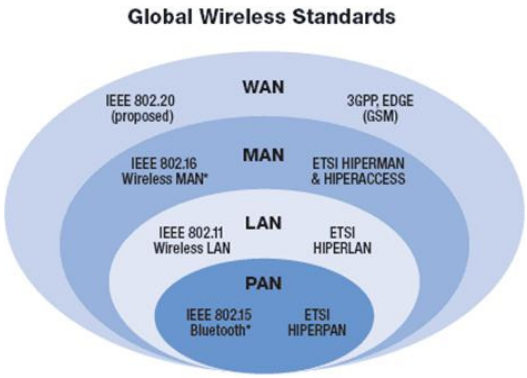

Figure: 3 Global Wireless Standerds

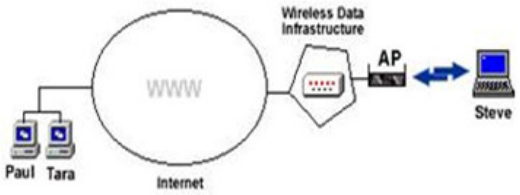

Figure: 4 WEP (Wired Equivalent Privacy)

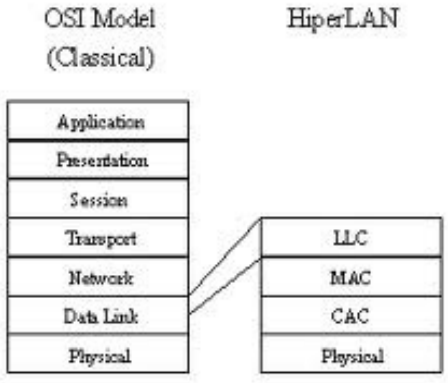

Figure: 5 HIPERLAN Reference Model

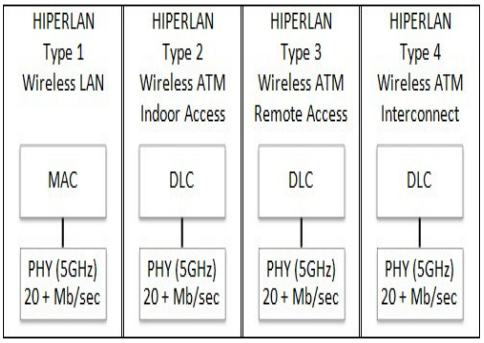

Figure: 6 Divisions of the HIPERLAN activities

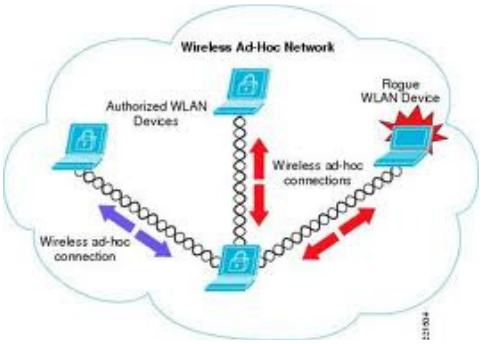

Figure: 7 Architecture of an ad hoc network

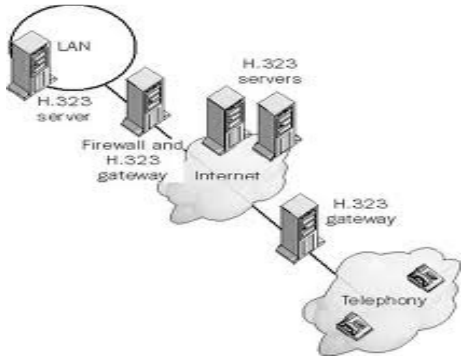

Figure: 8 Architecture of HIPERLAN

VI. CONCLUSION

The brief review of topic provided above began with the research literature and followed with a discussion of topic specific to the subject of planning, designing, and implementing wireless local area networks in a global manufacturing organization. The detailed review will be organized into different areas: WLAN technologies and standards, Wireless network security, wireless service providers, wireless tactics and strategy, and different study. Research related to WLAN technologies and standards was reviewed above.

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