TEC
TELECOMMUNICATION ENGINEERING CENTRE

NEWSLETTER
टी ई सी संचारिका

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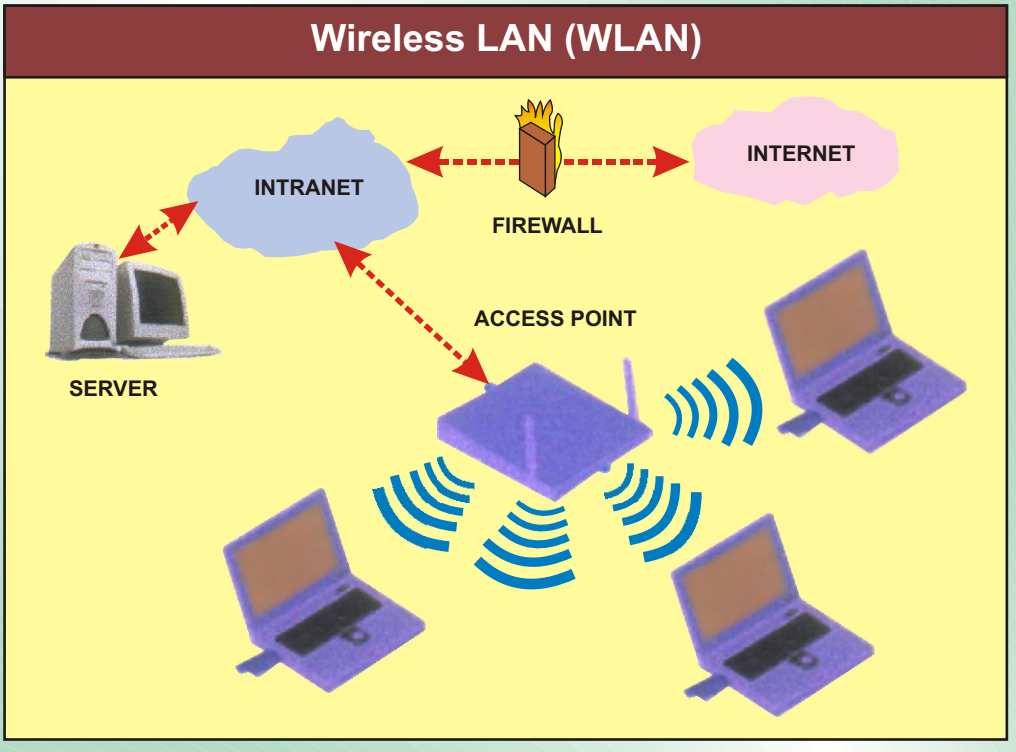


IN THIS ISSUE

Wireless LAN (WLAN)

A Wireless Local Area Network (WLAN) is a radio access system designed to provide location independent network access between computing devices by using radio waves rather than the usual cabling infrastructure. A WLAN provides all the features and benefits like Ethernet but without the limitations of being connected by a cable. This provides greatly increased freedom and flexibility. It can either replace or extend a wired LAN to provide added functionality.

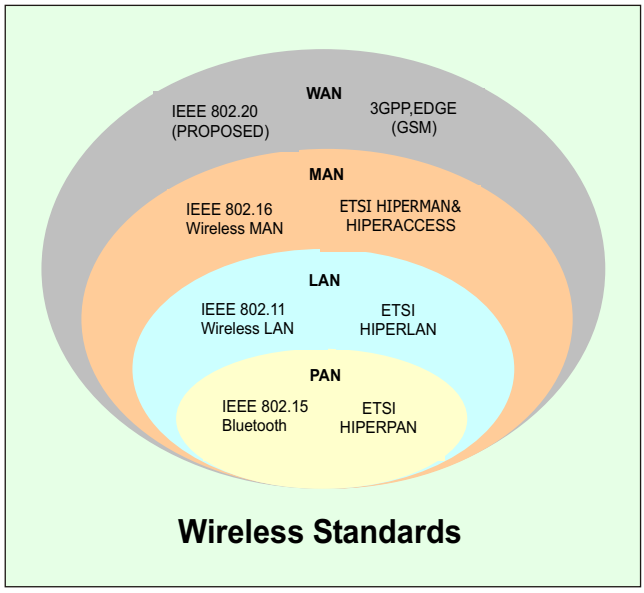
The IEEE has established a hierarchy of complementary wireless standards. These include IEEE 802.15 for the Personal Area Network (PAN), IEEE 802.11 for the Local Area Network (LAN), 802.16 for the Metropolitan Area Network (MAN) and the proposed IEEE 802.20 for the Wide Area Network (WAN). Each standard represents the optimised technology for a distinct market and usage model and is designed to complement the other. The proliferation of home and business wireless LANs and commercial hotspots based on the IEEE 802.11b standard is driving the demand for broadband connectivity back to the Internet, which IEEE 802.16 is expected to fulfill by providing the outdoor, long range connection back to the service provider.

Wireless LAN Standards

Today, the main wireless LAN standards are IEEE 802.11 series of IEEE and HiperLAN standardised by European Telecommunications Standards Institute (ETSI).

IEEE 802.11

Issued in 1997, this was the first standard in the IEEE 802.11 family. It operates in the 2.4 GHz band using either Frequency Hopping Spread Spectrum (FHSS or FH), or Direct Sequence Spread Spectrum (DSSS or DS). It can deliver up to 2 Mbit/s per access point.



IEEE 802.11b (Wi-Fi)

This standard is now popularly known as 'Wi-Fi' (Wireless Fidelity). It was set in 1999 and is an evolution of the original IEEE 802.11 standard. It also operates in the 2.4 GHz unlicensed ISM (Industrial, Scientific & Medical) band, but only uses DSSS. It can deliver up to 11 Mbit/s per access point. The maximum range possible with 802.11b is 100 meters.

IEEE 802.11a

IEEE 802.11a operates in a new license free radio band at 5 GHz using Orthogonal Frequency Division Multiplexing (OFDM) modulation. It enhances the speed per channel from the 11 Mbit/s of the 802.11b standard to 54 Mbit/s. Up to eight non-overlapping channels (or eight access points) can be used, compared with three in the 2.4 GHz band. The maximum range possible with 802.11a is 50 meters and the power consumption is more compared to 802.11b.

3G or WLAN ?

Among the goals of 3G wireless systems are support for multimedia applications and a wide range of services. The International Telecommunication Union (ITU) requires that 3G systems support data services at minimum transmission rates of 144 kbit/s in mobile (outdoor) and 2 Mbit/s in fixed (indoor) environments. Other attributes of 3G systems include wide area coverage with high mobility. Wide area coverage allows 3G systems to be deployed to provide near ubiquitous coverage. However, the licensing cost of spectrum and the system configuration to offer ubiquitous coverage result in high costs for deploying 3G networks. Wireless local area networks (WLANs) have experienced phenomenal growth, even during the recent telecommunications downturn. The success of the Internet and the availability of inexpensive laptops with WLAN cards have spurred the demand for wireless data leading to the growth of WLANs. Because of their operation in the unlicensed spectrum, WLANs are subject to interference from other users of the band. WLANs' coverage ranges about 30-300 m. Therefore, they are suitable only in high-density areas, and thus not able to provide ubiquitous coverage. However, WLAN technology is relatively inexpensive and quick to deploy. Although WLANs were originally designed for extending the reach of LANs in corporate environments, they are becoming increasingly popular for providing IP connectivity in residential, small office home office (SOHO), campus environments and public hotspots.

Do WLANs and 3G wireless have to compete, or can they be complementary? This topic has attracted much attention in industry as well as academia. Both WLAN and 3G are capable of providing higher speed wireless connections that cannot be offered by earlier cellular technologies. Therefore, they seem to compete. However, each technology has niche market applications. WLANs can cover only small areas and allow limited mobility, but provide higher data rates. Therefore, WLANs are well suited to hotspot coverage, where there is a high density of demand for high-data rate wireless services requiring limited mobility. On the other hand, 3G wireless systems, with their well-established voice support, wide coverage, and high mobility, are more suited to areas with moderate or low-density demand for wireless usage requiring high mobility. In that sense, they are complementary. Therefore, WLANs and 3G wireless compete in certain segments while complementing in others (more often). The integration of 3G wireless and WLANs is highly significant to make wireless multimedia and other high-data-rate services a reality for a large population. A multimode 3G/WLAN terminal can access high-bandwidth data services where WLAN coverage is offered, while accessing wide area networks using 3G at other places. However, this approach alone will only allow limited multi-access functionality. To make multi-access solutions effective, we need an integrated solution providing seamless mobility between access technologies, allowing continuity of existing session. 3G/WLAN integration promises to offer these capabilities seamlessly. In the standards arena, work is going on in both the 3G Partnership Project (3GPP) and 3GPP2 on 3G/WLAN integration.

Source : IEEE communications, November 2003

IEEE 802.11g

It offers a bandwidth of 54 Mbit/s using the 2.4 GHz radio band, providing higher speed over the current 802.11b standard. It is also backward compatible with existing 802.11b.

HiperLAN

HiperLAN, standardised by the European Telecommunications Standards Institute (ETSI), currently operates in the 5 GHz band and supports data rates up to 54 Mbit/s.

WLAN Architecture

There are two categories of equipment in 802.11 standard : Station and Access point.

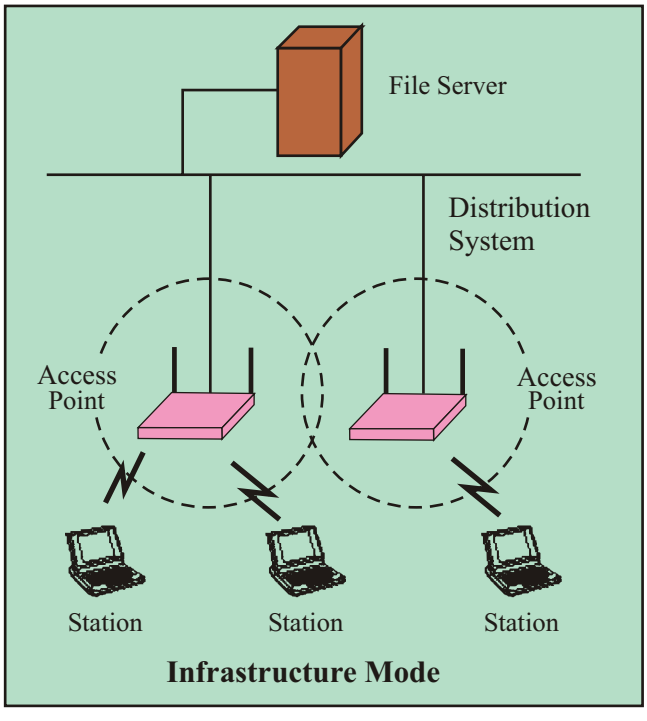
The wireless station is any station having a Network Interface Card (NIC) that supports wireless communication. The station has access to the wireless medium and radio contact to an Access Point.

The Access Point is the equipment that allows the wireless system to interact appropriately with the wired one. In other words, the Access Point performs an important function called *bridging*.

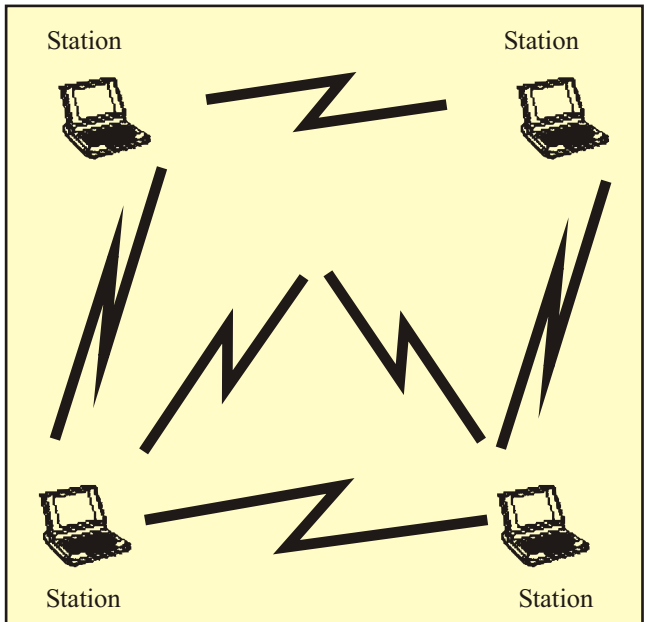
A typical Access Point comprises a radio, a wired network interface and bridging software conforming to the IEEE bridging standard. The access point can be visualised as a base station for the wireless system. Communication for many wireless systems can be funnelled to the access point and directed to the wired network.

IEEE 802.11 Architecture Modes

The wireless stations and access points are configured in two modes : Infrastructure mode and Adhoc mode.



Infrastructure Mode



Adhoc Mode

In infrastructure mode, all stations in a system connect to an Access Point and not directly to one another. In adhoc mode, the stations interconnect directly, without communicating through an Access Point.

The Infrastructure mode comprises Access Points and Stations in the same radio coverage that form a *basic service set (BSS)*. Several basic service sets connected to form a distribution system, creating one larger network and extending the wireless coverage area. This distribution is called an *extended service set (ESS)*. The IEEE 802.11 specification does not further detail the architecture of a distribution.

The architecture in 'adhoc mode' is a set of Stations that communicate without an Access Point. This on-the-fly mode does not require connection with the wired network and is easily assembled and disassembled. There is no Access Point and part of its functionality is performed by the Station nodes. Each node communicates with the other directly.

Medium Access Control

IEEE 802.11 standard uses distributed Medium Access Control (MAC) protocol based on CSMA/CA *(Carrier Sense Multiple Access/ Collision Sense)* mechanism. CSMA/CA is used by most wireless LANs in the ISM (Industrial, Scientific & Medical) band. It specifies how the wireless node uses the medium i.e. when to listen, when to transmit. It is extremely unusual for a wireless device to be able to receive and transmit simultaneously, if it uses the same frequency and that is the reason why IEEE 802.11 uses Collision Avoidance (CA) rather than Collision Detection (CD) which is used for wired LAN.

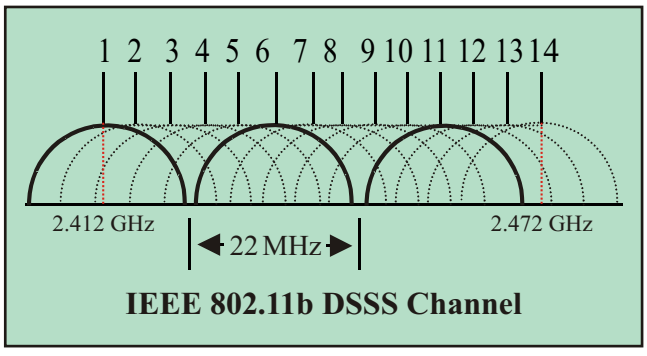
Since it is impractical for wireless devices to communicate with all other devices directly, IEEE 802.11 implements a network allocation vector (NAV), a value that indicates to a station the amount of time that remains before the medium will become available. In that sense, NAV can be considered as virtual carrier sense mechanism.

IEEE 802.11b (Wi-Fi)

IEEE 802.11b is currently the most widely used wireless LAN standard. The 2.4 GHz radio frequency band is also used in other wireless standards, such as Bluetooth and cordless phones. Bluetooth was designed for use by cordless devices and is not intended to be a wireless LAN technology. It is referred as a Personal Area Network (PAN) technology. As Bluetooth and 802.11b operate at the same radio frequency, they can cause interference with each other. Consequently, LANs using the 802.11b standard will suffer from the presence of a Bluetooth device.

IEEE 802.11b DSSS Channel allocations

Fourteen channels are defined in the IEEE 802.11b Direct Sequence channel set. Each DS channel transmitted is 22 MHz wide, but the channel separation is only 5 MHz. This leads to channel overlap such that signals from neighbouring channels can interfere with each other. In a 14-channel DS system, only three non-overlapping and non-interfering channels 25 MHz apart are possible such as Channels 1, 6, and 11. This channel spacing governs the use and allocation of channels in a multi-Access Point environment such as an office or campus. Access Points are usually deployed in *cellular* fashion within an enterprise where adjacent Access Points are allocated non-overlapping channels. Alternatively, they can be collocated using Channels 1, 6, and 11 to deliver 33 Mbps bandwidth to a single area (of course, 11 Mbps to a single client). The channel allocation scheme is illustrated in the following figure.



IEEE 802.11b DSSS Channel

Wi-Fi Alliance

Interoperability of WLAN products based on IEEE 802.11b products is tested and certified by the Wireless Ethernet Company Alliance (WECA), which is now known as the Wi-Fi Alliance. Interoperable wireless products passing the Wi-Fi Alliance tests can carry the Wi-Fi label.

IEEE 802.16

IEEE 802.16 standard defines the WirelessMAN air interface specification for wireless metropolitan area networks (MANs). IEEE 802.16 complements Wi-Fi by providing wireless broadband backhaul to 802.11 hotspots and last mile broadband connectivity to homes that may have wireless (802.11) networks. It provides for up to 50 km service area range, allows users to get broadband connectivity without requiring direct line of sight with the base station, and provides shared data rates of up to 70 Mbps, which is sufficient to simultaneously support more than 60 businesses with E1/T1-type connectivity and hundreds to homes with DSL-type connectivity with a single base station. In addition, the standard is designed to deliver latency sensitive services such as voice and video.

In January 2003, the IEEE approved the 802.16a standard which covers frequency bands between 2 GHz and 11 GHz. This standard is an extension of the IEEE 802.16 standard for 10-66 GHz published in April 2002. These sub 11 GHz frequency ranges enable non line-of-sight performance, making the IEEE 802.16a standard suitable for last-mile applications where base stations may need to be unobtrusively mounted on the roofs of homes or buildings rather than towers on mountains.

As currently defined through IEEE Standard 802.16, a wirelessMAN provides network access to buildings through exterior antennas communicating with central radio base stations (BSs). The wirelessMAN provides an alternative to cabled access networks, such as fiber optic links, coaxial systems using cable modems, and digital subscriber line (DSL) links.

In this scenario, with WirelessMAN technology bringing the network to a building, users inside the building will be connected with conventional in-building networks such as, for data, Ethernet (IEEE Standard 802.3) or wireless LANs (IEEE Standard 802.11).

What is a hotspot ?

In a survey conducted in UK, only 29% of home PC users correctly identified a hotspot. One percent believe a Wi-Fi hotspot is a 'posh hot tub', one percent a sun bed and two percent of respondents believe it is 'something smelly that had been left in the sun for too long'. One percent think it is a microwave ready meal and two percent of respondents identified it as a new HiFi. Of married respondents one percent incorrectly identified a Wi-Fi hotspot as trouble with wife. Five percent of all home PC users believe that it is a night club, whilst this rises to 10% amongst single people.

Source : Internet

Wi-Fi Hotspots

Wi-Fi hotspot is an area covered by a wireless access point, typically set up for the internet so that people can connect to Web without cables. These include airports, coffee houses, convention centres, hotels, and other public areas with a high demand for wireless data. It is difficult to know exactly the number of Wi-Fi hotspots set up worldwide. Currently there may be more than 35,000 Wi-Fi hotspots worldwide (free hotspots as well as commercial). New York city has over 1000 hotspots. India has more than 100 hotspots. These numbers are increasing rapidly with each year. Asia is expected to be a dominant player.

Source : Internet

WiMAX

Worldwide Interoperability for Microwave Access (WiMAX) alliance, is a non-profit corporation that was formed by leading communications component and equipment companies to help promote and certify the compatibility and interoperability of broadband wireless access equipment that conforms to the IEEE 802.16 standard. 802.16a compliant equipment is expected to be available in second half of 2004 and WiMAX expects to see volume deployments by operator in 2005.

802.16 and 802.20 are two different technology approaches targeted at distinct markets. 802.16 provides high speed, enterprise and consumer last mile broadband access. 802.20 provides high speed connectivity to mobile, consumer devices be they cell phones, PDAs or laptops. 802.16 is a wireless equivalent to cable or DSL, while 802.20 provides services very similar to 3G, but with a data centric instead of voice centric focus.

802.20 is still in the very early stages of standards development and is not expected to be completed before the end of 2004 with interoperability several years beyond that.

Source : WiMAX website

Security and other issues

In the data communication environment, mobility is usually the opposite of security. Today, in a wireless LAN, the tradeoff between security and mobility needs to be carefully weighed.

Today's wireless LAN authentication mechanisms tend to be based on the IEEE 802.1x standard which describes authentication per port. In the case of a wireless LAN access point, an adaptation has been made to treat different radio frequencies as individual ports. By default, today's access points come with Wired Equivalent Privacy (WEP) to encrypt transmission in the air, WEP is based on RC4 technology (proprietary encryption technology distributed by RSA Data Security Inc) with static keys assigned by the administrator to PCs and access points.

Wireless LAN throughput varies with distance like any radio technology. Furthermore, obstacles and interference dramatically reduce encryption technology distributed by RSA Data Security, Inc. with static keys assigned by the administrator to PCs and access points. Although IEEE 802.11b mentions an on air throughput of 11 Mbit/s, it is not same as that of 11 Mbit/s wired Ethernet LAN. Encoding and radio overheads consume significant bandwidth.

Power Consumption of a device when equipped with a wirelessLAN card is an important factor, since wireless devices are primarily powered by battery.

The Wi-Fi Alliance is currently working on solutions for well known issues, like security and global mobility. The IEEE is also working on security and increased bandwidth with the aim of achieving 100 Mbit/s over the air.

Approvals issued by TEC during the period January 2004 to March 2004

Type Approvals.....	110
Interface Approvals.....	61
Service Test Certificates.....	30
Total	**201**

Approvals issued by TEC upto 31.03.2004

Type Approvals.....	6649
Interface Approvals.....	3869
Service Test Certificates.....	1629
Grand Total	**12147**

IMPORTANT ACTIVITIES OF TEC DURING JANUARY TO MARCH 2004

A. Preparation of GRs/IRs & Technical documents

Following GRs/IRs and Technical documents were issued:

GRs

Location Based Applications & Services
Lawful Interception System for GSM Network
Network Switching Sub-system of IMPCS
Base Station Sub-system of IMPCS
Standards for ISP traffic intercept and Monitoring system
IP Based Centrex System
12V SMPS Power Supply for CDMA FWTs system
High Speed Internet Leased Line Access Line Doubler (HILALD)
Intelligent System and Service description for GSM system.
Optical Fibre Cable for Coastal area and high sub soil water conditions.
Composite Optical test instrument (consisting of OTDR, Light Source and Power Meter).
MSC based Core Network for CDMA 2000 1x.
Packet Core Network for CDMA 1x.
CDMA Repeater.
1W to 20 W Ku band Satellite RF Transceivers (RFTs)
1.2m Earth Station Antenna in C band

Revised GRs

Fraud Management and Control Centre.
GSM Mobile Stations & Fixed Cellular Terminals
18 GHz, 4x2 Mbps Integrated Digital Microwave Equipment
RF Step Attenuator (DC to 2.5 GHz)
BGP/ MPLS Virtual Private Network
SDH, STM-1, 13 GHz Microwave Equipment.
Extra large Size Digital Local-cum-Tandem Exchanges.
Limits and method of Measurement of Radio Disturbance characteristics of Telecommunication Terminal Equipment

B. Tests and Field trials

Tests/field trials have been carried out for:
CNEMM of OCB 283 of M/s Alcatel.
Wireline Access Network (WAN) of M/s Lucent technologies & M/s Alcatel.
Billing Server A1331 of M/s Alcatel.
C-DOT SBM-VE Switch.
MLLN for BSNL.
ISDN testing in CDOT AN-RAX.
Optical Fibre Cables for field trial of Passive Network Technologies at Ludhiana.

C. Other Activities

Manufacturer Forum conducted for

- CDMA 2000 1x EV-DO system
- Remote Station for CDMA 2000 1x system
- Location Base Information system (LBS)
- Lawful interception & Monitoring system for IMPCS (LIS)
- Network Switching Subsystem (NSS) of IMPCS Network and Base Station Sub-system (BSS)
- Protocol Analyser
- Fraud Management and Control System
- Line Access Gateway
- 40/30/20m Ground Based Tower for cellular system

Application & Guidelines prepared for Integrated Fibre Termination and Distribution System (Type-1, Type-2 and Type-3).

R25 Software Version approval for OCB 283 issued

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