

MIS AND E-BUSINESS (CAC301)

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Syllabus

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UNIT 2

The Network Infrastructure for E-Commerce

What is BROADBAND?

- *A high-capacity transmission technique using a wide range of frequencies, which enables a large number of messages to be communicated simultaneously.*
- *Broadband commonly refers to Internet access via a variety of high-speed wired and wireless networks, including cable, DSL, FiOS (Fiber Optic Strands), Wi-Fi, WiMAX, 3G, 4G, and satellite, all of which are faster than earlier analog dial-up by a huge magnitude.*

Introduction to I-Way

- *Information Superhighway is a high-speed global communications network that can carry data, voice, video, and other services around the world using technology such as the satellite, optical fiber and cellular telecommunications.*
- *Basically, the term I-way describes a high-capacity (broadband), interactive (two way) electronic pipeline to the home or office that is capable of simultaneously supporting a large number of electronic commerce applications and providing interactive connectivity between users and services and between users and other users.*
- *It is envisioned to provide very high speed access to information in all forms (text, graphics, audio, video) via a wired or wireless connection.*

Introduction to I-Way

- *The information superhighway is a term coined by American Vice President Albert Gore when giving a speech on January 11, 1994 describing the future of computers accessing and communicating over a world-wide network.*
- *In simple words, it is the global information and communications network that includes the Internet and other networks and switching systems such as telephone networks, cable television networks, and satellite communication networks used for e-commerce and many more other purposes.*

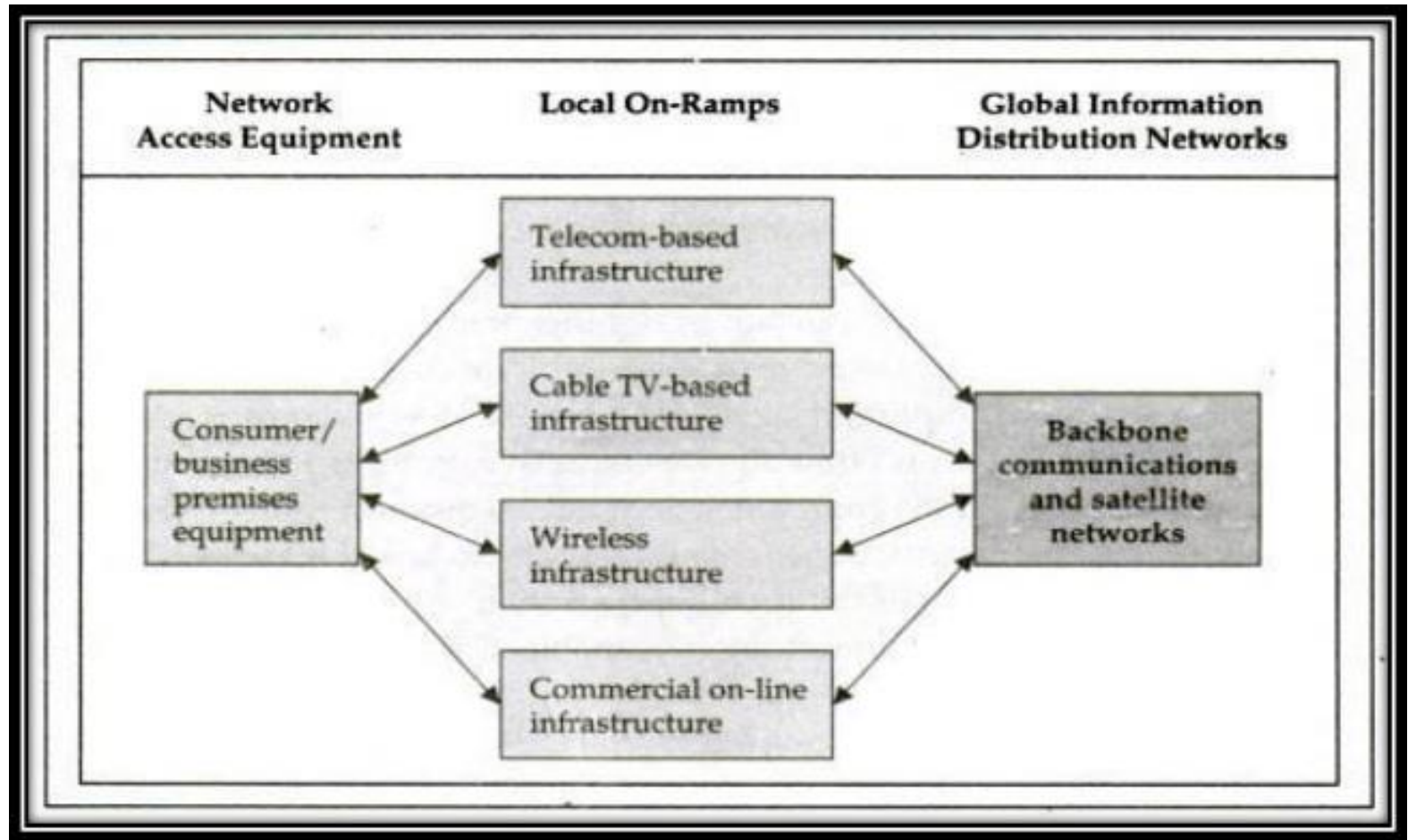
Introduction to I-Way

- *The I-way has emerged as the basic network infrastructure for all types of E-commerce activities due to its capability to provide integrated voice, data, and video services.*
- *I-way has changed the way business advertises, market or sell their products and services.*
- *A physical network, an infrastructure of modern high-speed that links everyone at home or office to everything else.*
- *In practicality it is identical to Internet provided — connections are broadband — they are continuously running.*
- *As Internet develops into I-way, changes will take place in infrastructure not in Internet.*

Market Forces Influencing I-Way

- **Users**
 - *Becoming information publishers*
- **Consumers, End users, or Businesses**
 - *Consuming information about products/services*
- **ISPs**
 - *Commercial, government, or private*
- **Value Added Information Providers**
 - *Includes third party brokers, intermediaries, originators of services who add value to services provided by others.*

Components of I-Way



Components of I-Way

Network Access Equipment

- *This component is at the consumer end and enables the consumer to access the network.*
- *These are the gadgets appropriated to utilize the sound and media intuitive substance of e-commerce.*
- *This component of the I-way includes hardware and software vendors, who provide physical devices such as routers and switches, access devices such as computers and set-top boxes, and software platforms such as browsers and operating systems.*

Components of I-Way

Local On-Ramps or Access Roads

- *This component provide the communication backbone for the transmission of data and information.*
- *It simplify linkages between businesses, schools, and homes to the communications backbone.*
- *This component is often called the “last mile” in the telecommunications industry.*
- *The access providers can also be differentiated into four categories:*
 - *Telecom based infrastructure*
 - *Cable TV based infrastructure*
 - *Wireless based infrastructure*
 - *Computer based online infrastructure*

Components of I-Way

Global Information Distribution Network

- *This component provides the infrastructure for connecting across the countries and continents.*
- *They include such networks as the long-distance telephone lines, satellite networks, and the Internet.*
- *Most of the infrastructure for the I-way already exists in the vast network of fiber optic strands, coaxial cables, radio waves, satellites, and copper wires spanning the globe.*
- *Linking all the components of the I-way will require large capital investments in “open” systems (interoperable equipment that uses common standards) and installing gateways between various networks.*
- *A final requirement is switching hardware and software to move huge amounts of data effortlessly over such a complex network.*

Internet as Network Infrastructure

Computer Network Concept

- *Networks are built with a mix of computer hardware and computer software.*
- *A network connects computers, but can also connect other devices such as shared printers, removable media drives, scanners, and other equipment.*
- *Networks enable people to share resources:*
 - *Resources include printers, hard disks, and applications.*
 - *Can greatly reduce the costs of providing these resources to each person in a company.*

Internet as Network Infrastructure

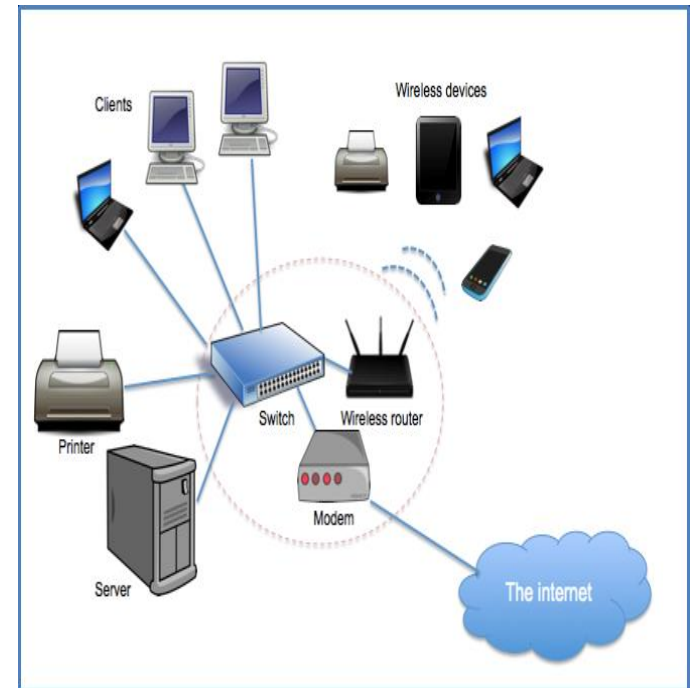
Computer Network Concept

- *Several terms are used to describe network devices.*
 - *Hosts, nodes, workstations, peers, servers, and clients*
- *A host (also known as “network host”) is a computer or other device that communicates with others on a network.*
 - *Hosts on a network include clients and servers that send or receive data, services or applications.*
- *Hosts typically do not include intermediary network devices like switches and routers, which are instead often categorized as nodes.*
- *A node is also a broader term that includes anything connected to a network, while a host requires an IP address.*
- *In other words, all hosts are nodes, but network nodes are not hosts unless they require an IP address to function.*

Internet as Network Infrastructure

Computer Network Concept

- A typical network like the one in figure has three basic hardware components:
 - One or more servers or host computers (including microcomputers and mainframes)
 - Clients (PCs)
 - A circuit or network system, which is the path over which they communicate



Internet as Network Infrastructure

Computer Network Concept

- *In addition, servers and clients also need special-purpose network software that enables them to communicate.*
- *The server stores data and software that the clients can access.*
 - *Organizations can have several working together over the network with client computers to support the business application.*
- *The client is the input-output hardware device at the user's end of a communication circuit.*
 - *It provides users with access to the network, the data and software on the server, and other shared resources.*



Internet as Network Infrastructure

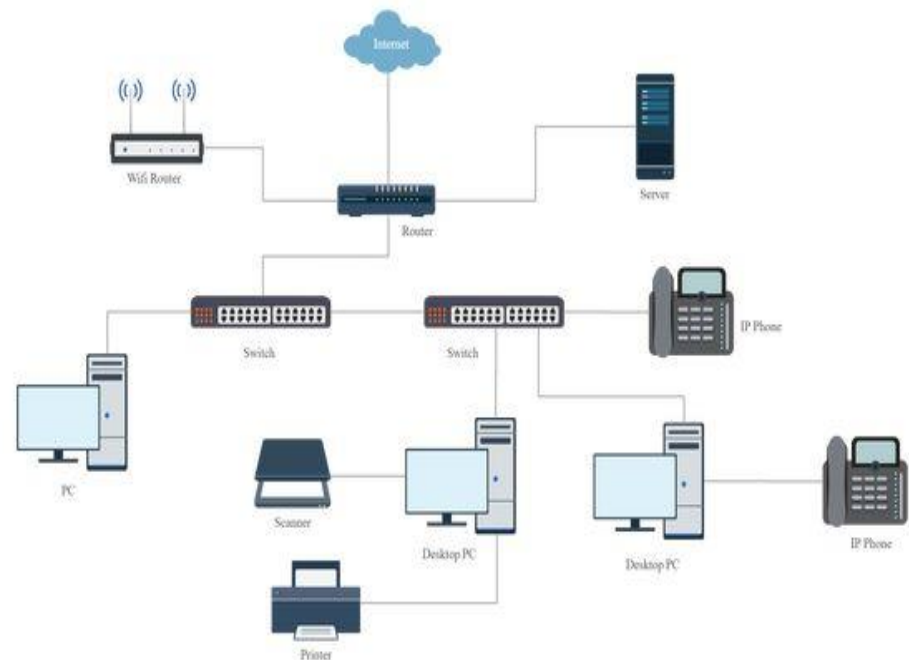
Computer Network Concept

- *In fact, now a days network does not need a computer designated specifically as a server.*
 - *Most modern client computers are designed to support the dual roles of both client and server, sharing resources to the network and, at the same time, accessing resources from the network.*
- *The circuit (cable plant or transmission media) is the pathway through which the data or information travels.*
- *Traditional wired networks typically use copper wire, although fiber-optic cable and wireless transmission hybrid systems are common.*
- *There are also devices in the circuit that perform special functions such as hubs, switches, routers, bridges, and gateways.*

Internet as Network Infrastructure

Network Device Roles

- *Figure alongside shows a small network that has client PCs and specialized server connected by a hub or switch and cables that make up the circuit.*
- *In this network, messages move through the hub to and from the computers.*
- *All computers share the same circuit and take turns sending messages.*



Internet as Network Infrastructure

Network Device Roles: Hub & Switch

- *Each computer, client, or server has a network adapter, or network interface card (NIC).*
- *In the case of a wireless network, the network adapter sends and receives radio frequency messages, not that different from a walkie-talkie or cell phone.*
 - *The network adapter also determines the low level protocol used by the computer to communicate on the network.*
 - *Network adapters running on one protocol cannot communicate with network adapters running on a different protocol.*

Internet as Network Infrastructure

Network Device Roles: Hub & Switch

- *In older networks, hubs are used as central points where the cables leading out to network PCs come together.*
- *A hub is simply a connection point that does not provide any sophisticated control.*
- *In current networks, you are more likely to see a switch rather than a hub.*
- *From the outside, both look much the same, but a switch is a more sophisticated communication device that helps control and manage the data passing between the PCs.*

Internet as Network Infrastructure

Network Device Roles: Router

- *The router enables computers on one network to communicate with computers on other networks, but at the same time provide a level of isolation between the networks.*
- *Routers are a key part of the Internet, which is, at its core, a massive set of interconnected networks.*
- *A gateway is used to connect dissimilar networks and devices. For example, a gateway can be used to connect PCs on a LAN to a mainframe computer.*

Internet as Network Infrastructure

Network Device Roles: Router

- *Like routers, bridges connect a network to other networks.*
- *Bridges do not provide the same level of isolation as routers, but can be used in some situations where routers cannot be used.*
- *Another device, called a **brouter**, combines the functionality of a bridge and router in the same device.*

Internet as Network Infrastructure

Understanding Client & Server

- *Client/Server describes the relationship between two computer programs in which one program, the client, makes a service request to another program, the server, which fulfills the request.*
- *The basic difference between clients and servers is the software that they run:*
 - *Clients, as you might guess, run a client operating system.*
 - *Common client operating systems include Microsoft Windows 7/9/10, and MacOS.*
 - *Servers run either a server operating system or network operating system.*
 - *Common server OS include Windows Server systems such as Windows 2003 Server and Windows Server 2008, as well as most Linux versions.*
 - *Either one enables the computer to act as a server, by running the software necessary for central security management.*

Wireless Application Protocol (WAP)

- **Wireless**

- *Lacking or not requiring a wire or wires pertaining to radio transmission.*

- **Application**

- *A computer program or piece of computer software that is designed to do a specific task.*

- **Protocol**

- *A set of technical rules about how information should be transmitted and received using computers.*

WAP – Introduction

- *Wireless Application Protocol (WAP) commonly known as WAP is used to enable the access of internet in the mobile phones or PDAs.*
- *An open, global specification that empowers mobile users with wireless devices to easily access and interact with internet information and services instantly.*

WAP – Introduction

- *WAP is an application communication protocol.*
- *WAP is used to access services and information.*
- *WAP is inherited from Internet standards.*
- *WAP is for handheld devices such as mobile phones.*
- *WAP is a protocol designed for micro browsers.*
- *WAP enables the creating of web applications for mobile devices.*
- *WAP uses the mark-up language WML (not HTML).*
- *WML is defined as an XML 1.0 application.*
- *The WAP is the leading standard for information services on wireless terminals like digital mobile phones.*
- *The WAP standard is based on Internet standards (HTML, XML, and TCP/IP).*

Importance & Benefits of WAP

- *WAP allows wireless device users to access information from internet over wireless network, without spending a much time and cost.*
- *WAP allows mobile devices to communicate with application servers and information databases through the internet.*
- *Applications can be dynamically downloaded, uploaded, and run on a WAP devices.*
- *WAP benefits the developers that develop wireless application.*
- *WAP benefits the companies that manufacture wireless devices.*
- *WAP benefits the network operators or service providers.*
- *WAP benefits the end-users that use applications.*

History of WAP

- **June 1997**

- *Phone.com (formerly Unwired Planet) co-founded the WAP Forum with Ericsson, Motorola and Nokia (the world's three largest wireless handset manufacturers), to provide a worldwide standard for the delivery of Internet-based services to mass-market mobile phones.*

- **September 1997**

- *The four co-founders initially published the architecture for this standard.*

- **January 1998**

- *The founding companies established the WAP Forum, Ltd. to administer the WAP specification process.*
- *Membership in the WAP Forum was opened to invite and facilitate contributions from across the entire wireless industry to the WAP specification work and drive the continuing evolution of WAP.*

History of WAP

- *February 1998*
 - *The first draft specification was published.*
- *May 1998*
 - *WAP Version 1.0 was announced.*
- *September 1998*
 - *The WAP Forum announced the election of officers and the expansion of the board of directors.*
 - *Chuck Parrish, Executive Vice President of Phone.com, Inc. was elected to the position of Chairman of the WAP Forum Board of Directors.*

History of WAP

- **June 30, 1999**
 - *WAP version 1.1 was announced.*
- **July 1999**
 - *Chuck Parrish was elected to the position of Vice Chairman.*
- **October 1999**
 - *WAP Developer Registration and Content Verification Program was launched.*
- **December 1999**
 - *WAP version 1.2 was ratified.*
- **April 2000**
 - *The WAP Forum announced its new Interoperability Product Certification Program.*

Objectives of WAP

- *To bring Internet content and advanced data services to digital cellular phones and other wireless terminals.*
- *To create a global wireless protocol specification that will work across different wireless network technologies.*
- *To enable the creation of content and applications that scale across a very wide range of wireless bearer networks and wireless device types.*
- *To embrace and extend existing standards and technology wherever appropriate.*

Long Term Goals of WAP

- *Work toward a unified information space.*
- *Work toward common standards and technologies.*
- *Enable the delivery of sophisticated information and services to mobile wireless terminals.*

Advantages of WAP

- *Simplicity of use*
- *Mobility*
- *Personalized*
- *Easy to carry*
- *Increased sales for devices, infrastructure and gateway manufacturer*
- *Time saving*

Disadvantages of WAP

- *Battery life*
- *Small display screens*
- *Speed of access*
- *Limited availability*
- *Price*
- *Lack of user habit*
- *Limited memory*
- *Limited bandwidth*

Usage/Applications of WAP

- **Corporate Applications:**

- *Sales force automation where sales people use their WAP enabled handsets to get instant, direct access to the latest pricing, latest news, competitive information any time, anywhere.*

- **Online Services:**

- **Banking**

- *Users can get their current balance, transfer funds between accounts and receive fax of a mini-statement.*

- **Electronic Commerce**

- *Subscribers can use their handset just like their PC to purchase products and services over the Web.*

Usage/Applications of WAP

- **Tele Services**
 - **Prepaid Services:**
 - *With a WAP-enabled phone, prepaid subscribers can see their current balance with the press of a button.*
 - *By pressing another button, they can also recharge their account by entering a credit card or voucher number into the handset.*
- **Personal Productivity:**
 - **Email**
 - *Using WAP users can keep track of their email right from their handset.*
- **Others include:**
 - *Mobile Banking, Mobile Commerce, Interactive Chat, Auctions, Games, Ringtones, etc.*

WAP Services

- **WAP Push**

- *WAP Push enables enterprises to initiate the sending of information on the server using a push proxy.*
- *This capability was introduced in WAP 1.2, but has been enhanced in WAP 2.x.*
- *Applications that require updates based on external information are particularly suited for using WAP Push.*
- *Examples include various forms of messaging applications, stock updates, airline departure and arrival updates, and traffic information.*
- *Before WAP Push was introduced, the wireless user required to poll the server for updated information, wasting both time and bandwidth.*

WAP Services

- **User Agent Profile (UAProf)**
 - *The UAProf enables a server to obtain information about the client making the request.*
 - *In WAP 2.x, it is based on the Composite Capabilities/Preference Profiles (CC/PP) specification as defined by the W3C.*
 - *It works by sending the information in the request object, allowing wireless servers to adapt the information being sent according to the client device making the request.*
- **External Functionality Interface (EFI)**
 - *This allows the WAP applications within the WAE (Wireless Application Environment) to communicate with external applications, enabling other applications to extend the capabilities of WAP applications, similar to plug-ins for desktop browsers.*

WAP Services

- ***Wireless Telephony Application (WTA)***
 - *The WTA allows WAP applications to control various telephony applications, such as making calls, answering calls, putting calls on hold, or forwarding them.*
 - *It allows WAP WTA-enabled cell phones to have integrated voice and data services.*
- ***Persistent Storage Interface***
 - *WAP 2.x introduces a new storage service with a well-defined interface to store data locally on the devices.*
 - *The interface defines ways to organize, access, store, and retrieve data.*

WAP Services

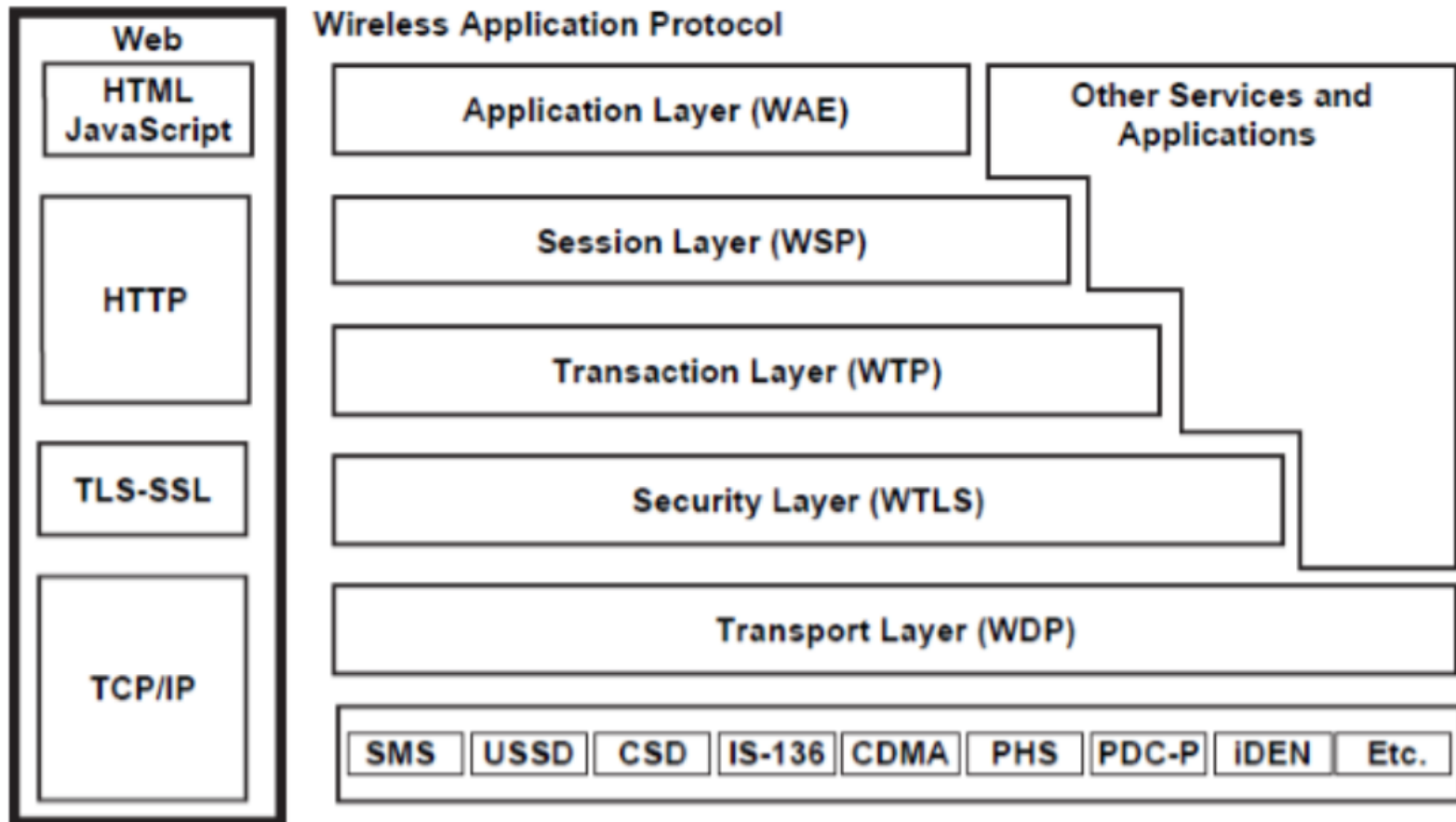
- **Data Synchronization**

- *For data synchronization, WAP 2.x has adopted the SyncML solution.*
- *SyncML provides an XML-based protocol for synchronizing data over both WSP (Wireless Session Protocol) and HTTP.*

- **Multimedia Messaging Service (MMS)**

- *MMS is the framework for rich-content messaging.*
- *Going beyond what is possible for SMS, MMS can be used to transmit multimedia content such as pictures and videos.*
- *In addition, it can work with WAP Push and UAProf to send messages adapted specifically for the target client device.*

WAP Architecture



WAP Architecture

- *It provides a scalable and extensible environment for application development of mobile.*
- *This is achieved using layered design of protocol stack. The layers resemble the layers of OSI model.*
- *Each layer is accessible by layers above as well as by other services and applications through a set of well defined interface.*
- *External applications may access session, transaction, security and transport layers directly.*

Wireless Application Environment (WAE)

- *WAE is the uppermost layer in the WAP stack.*
- *It is general purpose environment based on combination of WWW and mobile telephony technologies.*
- *Its primary objecting is to achieve interoperable environment that allows operators and service providers to build applications that can reach wide variety of wireless platforms.*
- *It uses URL and URI for addressing.*
- *Language used is WML and WML script.*
- *WML script can be used for validation of user input.*

Wireless Telephony Application (WTA)

- *WTA provides a means to create telephony services using WAP.*
- *It uses WTA Interface (WTAI) which can be evoked from WML and for WML script.*
- *The repository makes it possible to store WTA services in device which can be accessed without accessing the network.*
- *The access can be based on any event like call disconnect, call answer, etc.*
- *Sometimes, there can be notification to user based on which WTA services are accessed by users.*
- *The notification is called WTA service indication.*

Wireless Session Protocol (WSP)

- *WSP provides reliable, organized exchange of content between client and server.*
- *The core of WSP design is binary form of HTTP.*
- *All methods defined by HTTP 1.1 are supported.*
- *Capability negotiation is used to agree on common level of protocol functionality as well as to agree on a set of extended request methods so that full compatibility to HTTP applications can be retained.*
- *An idle session can be suspended to free network resources and can be resumed without overload of full-blown session establishment.*
- *WSP also supports asynchronous requests.*
- *Hence, multiple requests will improve utilization of air time.*

Wireless Transaction Protocol (WTP)

- *WTP is defined as light-weight transaction-oriented protocol suitable for implementation in thin clients.*
- *Each transaction has unique identifiers, acknowledgements, duplicates removal and retransmission.*
- *Class 1 and Class 2 enable user to confirm every received message, however, in Class 0, there is no acknowledgement.*
- *WTP has no security mechanisms and no explicit connection set-up or tear-down phases.*

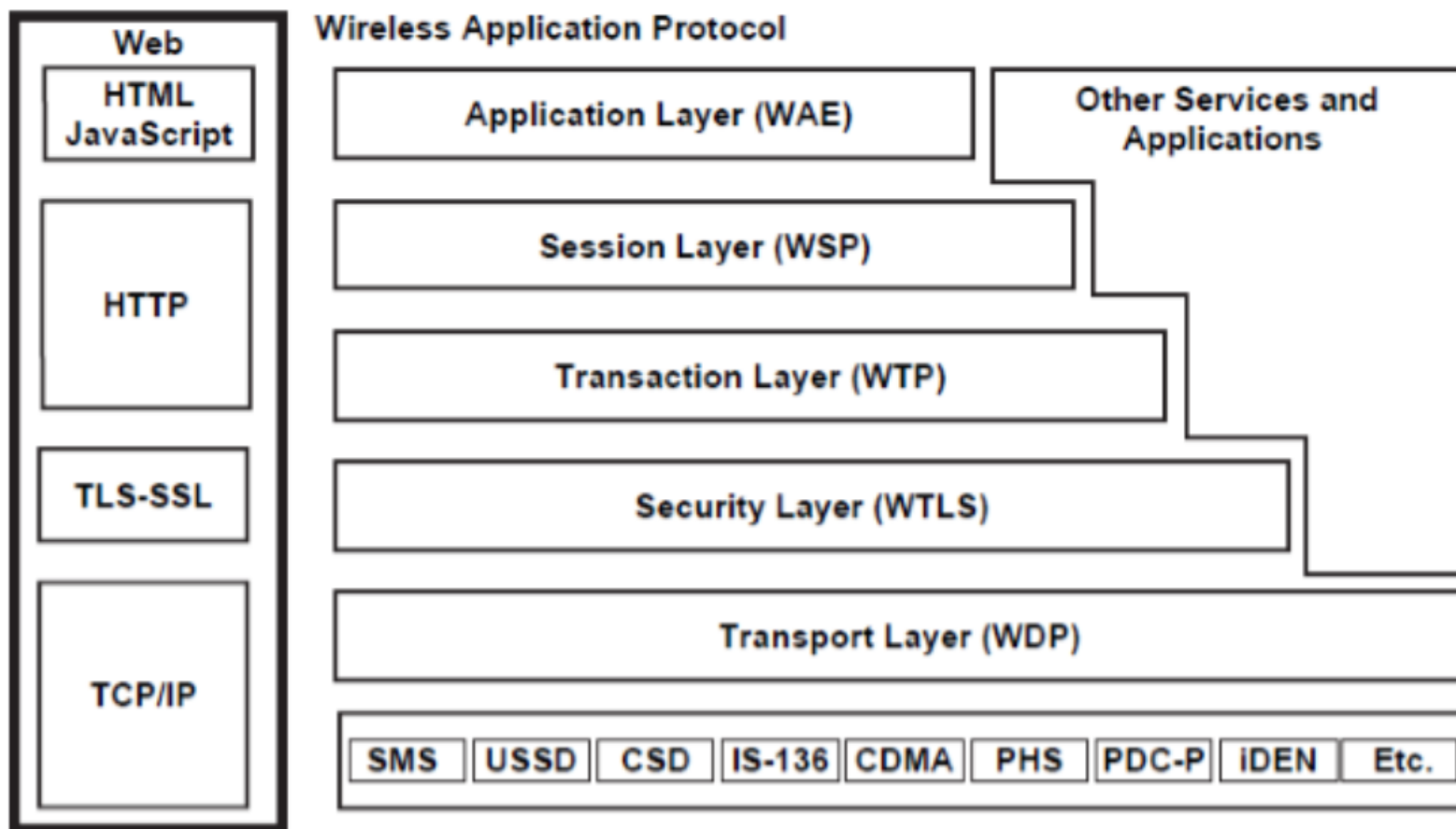
Wireless Transport Layer Security (WTLS)

- *WTLS is security protocol based on industry standard Transport Layer Security (TLS).*
- *It provides Transport Layer Security between a WAP client and the WAP Gateway / Proxy.*
- *The goals of WTLS are data integrity, privacy, authentication, Denial-of-service protection.*
- *It has features like datagram support, optimized handshake and dynamic key refreshing.*

Wireless Datagram Protocol (WDP)

- *WDP provides application addressing by port numbers, optional segmentation and reassembly, optional error detection.*
- *It supports simultaneous communication instances from higher layer over a single underlying WDP bearer service.*
- *The port number identifies higher level entity above WDP.*
- *The adaptation layer of WDP maps WDP functions directly on to a bearer based on its specific characteristics.*
- *On the GSM SMS, datagram functionality is provided by WDP.*

WAP Architecture



What is Wireless?

- The word wireless means “*having no wires*”.
- In networking terminology, wireless is the term used to describe any computer network where there is no physical wired connection between sender and receiver, but rather the network is connected by radio waves and/or microwaves to maintain communications.
- Wireless networking utilizes specific equipment such as NICs and Routers in place of wires (copper or optical fiber).

DSL

- *DSL (Digital Subscriber Line) is a technology for bringing high-bandwidth information to homes and small businesses over ordinary copper telephone lines.*
- *DSL refers to different variations of DSL, such as ADSL, HDSL, & RADSL.*
- *ADSL is one of the type of DSL Technology.*

ADSL

- *ADSL is a form of DSL, a data communications technology that enables faster data transmission over copper telephone lines.*
- *ADSL is capable of providing up to 50Mbps, and supports voice, video, and data.*
- *ADSL is the #1 Broadband Choice in the World with over 60% market share.*
- *ADSL is now available in every region of the world.*

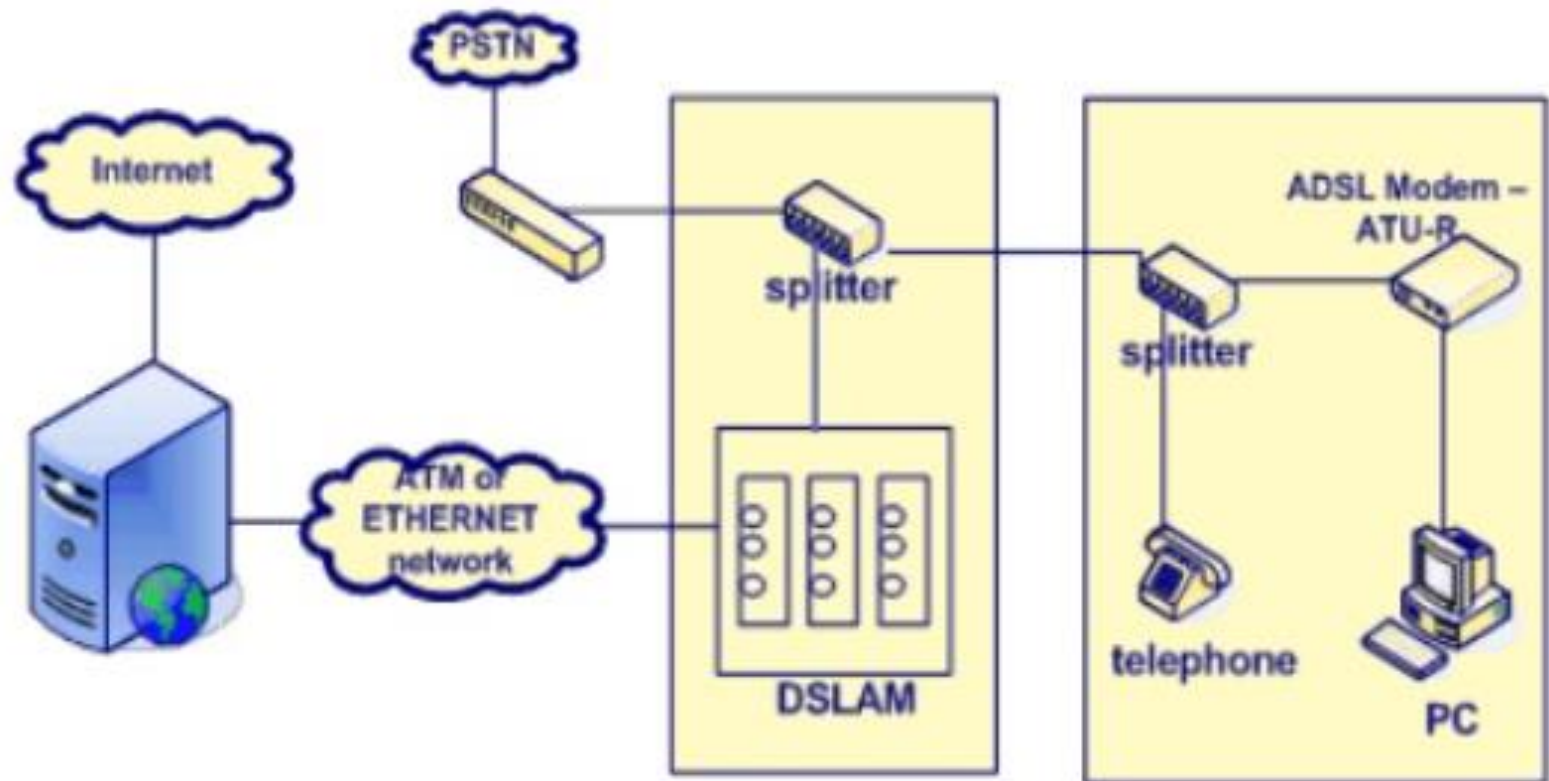
ADSL

- *Asymmetric* — The data can flow faster in one direction than the other. Data transmission has faster downstream to the subscriber than upstream.
- *Digital* — No type of communication is transferred in an analog method. All data is purely digital, and only at the end, modulated to be carried over the line.
- *Subscriber Line* — The data is carried over a single twisted pair copper loop to the subscriber premises.

ADSL Speed Factors

- *The distance from the local exchange.*
- *The type and thickness of wires used.*
- *The number and type of joins in the wire.*
- *The proximity of the wire to other wires carrying ADSL, ISDN, and other non-voice signals.*
- *The proximity of the wires to radio transmitters.*

ADSL Architecture



Wireless ADSL

- *Without any cable it provides broadband data transfer.*
- *This service is used at hotspots such as airports, hotels, shopping centers, universities, conference halls, etc.*
- *If you have WLAN technology in your laptop, phone, or etc. you can use this service.*
- *If you don't have this technology in your PC you can take a card that has the WiFi capability and fix it to your PC than you can use this service.*
- *It uses access point which is a wireless spread to the ADSL connections.*

Advantages of ADSL

- *Faster downloads compared to dial-up or ISDN.*
- *No need for a second phone line — by allowing voice and data transfer at the same time (you can use the phone as normal while connected to the Internet).*
- *Because ADSL transfers data digitally it doesn't need to convert the data from digital to analog and back again.*
- *ADSL connections are always on, which makes the usual long wait to connect a thing of the past.*

Limitations of ADSL

- *ADSL connections are not available to everyone, you need to be within 3 miles of an ADSL enabled exchange.*
- *The hardware costs can be quite significant as you will need a special ADSL modem and ADSL filters to use the service, most ISPs allow you to hire these items which can reduce the initial cost.*
- *Because ADSL connections are always on, you will need a firewall to protect your PC.*
- *The limit for ADSL service is 18,000 feet (5,460 meters).*
- *At the extremes of the distance limits, ADSL customers may see speeds far below the promised maximums.*

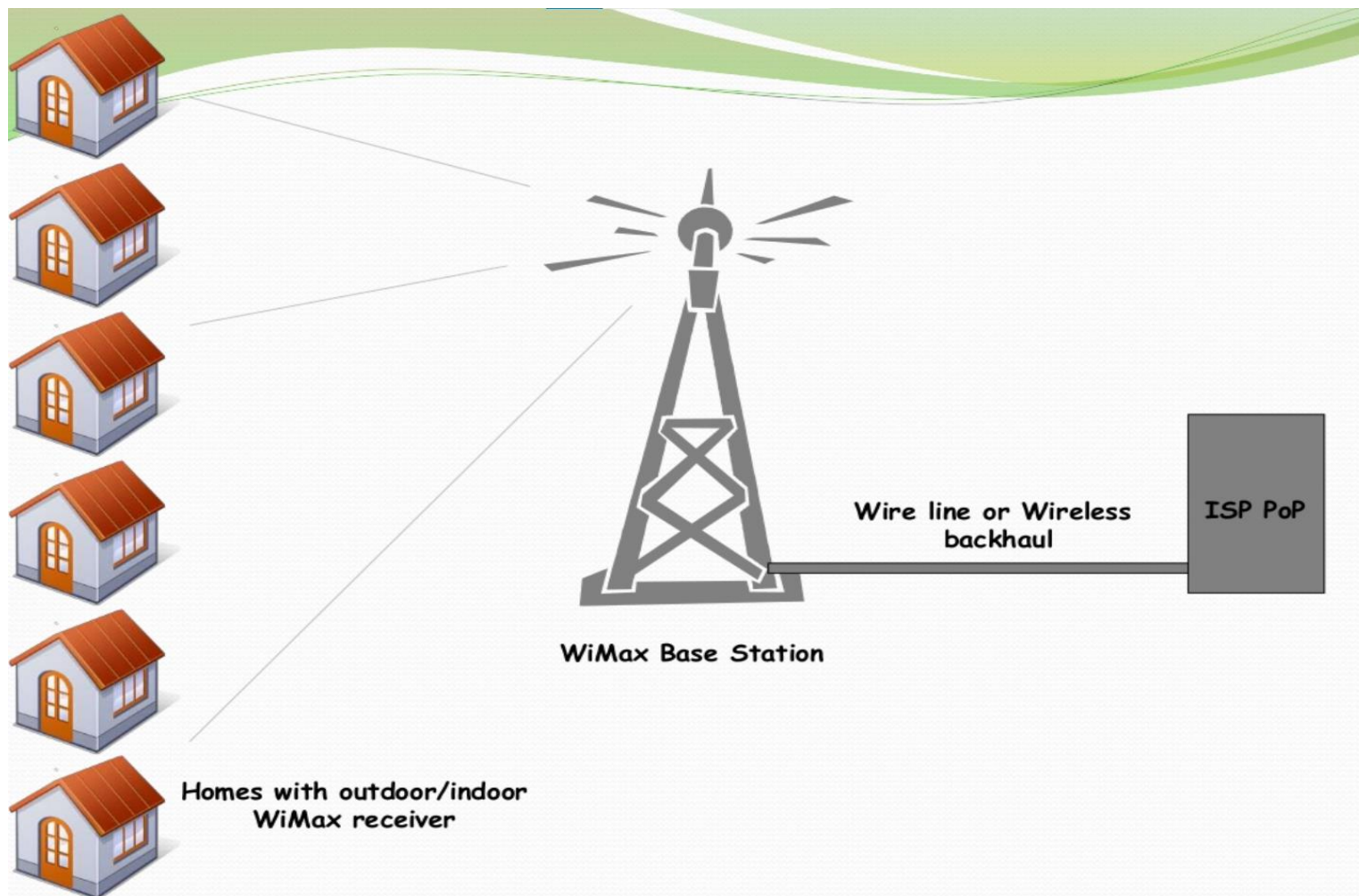
WiMax

- *WiMax or Worldwide Interoperability of Microwave Access, is a wireless Internet service designed to cover wide geographical areas serving large number of users at low cost.*
- *WiMax is the synonym given to the IEEE 802.16 standard defining the wide area wireless data networking.*
- *There are two parts of WiMax:*
 - *WiMax Tower*
 - *WiMax Receiver*
- *WiMax stations connect directly to the Internet with a wired connection.*

Working of WiMax

- *WiMax uses microwave radio technology to connect computers to the Internet in place of wired connections such as DSL or cable modems.*
- *It works very much like cell phone technology in that reasonable proximity to a base station is required to establish a data link to the Internet.*
- *Users within 3 to 5 miles of the base station will be able to establish a link using NLOS (Non Line Of Sight) technology with data rates as high as 75 Mbps.*
- *Users up to 30 miles away from the base station with an antenna mounted for LOS (Line Of Sight) to the base station will be able to connect at data rates approaching 280 Mbps.*

Working of WiMax



Advantages/Disadvantages of WiMax

- **Advantages**

- *Bandwidth Flexibility*
- *Pricing + Contract Flexibility*
- *Quick Installation*
- *Interpenetration*

- **Disadvantages**

- *WiMax can operate at higher bit rates or over longer distances but not both.*
- *Omni directional antennas are used. i.e. radiates equal radio power in all directions perpendicular to an axis, with power varying with angle to the axis, declining to zero on the axis.*

WiMax vs. WiFi

<i>WiMax</i>	<i>WiFi</i>
<i>WiMax is a long range system.</i>	<i>WiFi is shorter range system.</i>
<i>WiMax provides services analogous to cell phone.</i>	<i>WiFi is more analogous to a cordless phone.</i>
<i>It uses a mechanism based on setting up connections between the base station and user device.</i>	<i>WiFi has introduced a quality of service mechanism similar to fixed Ethernet, where packet can receive different priorities based on their tags.</i>

Wi – Fi

- *Wi-Fi stands for Wireless Fidelity.*
- *Wi-Fi is a wireless technology that uses radio frequency to transmit data through the air.*
- *Wi-Fi is a universal wireless networking technology that utilizes radio frequencies to transfer data.*
- *Vic Hayes has been called the “father of Wi-Fi”.*
- *Wi-Fi allows you to use your computer or other device to connect to the Internet from anywhere there is a Wi-Fi access point (often known as a hot spot).*
- *It is also known as 802.11 networking.*
- *The big advantage of Wi-Fi is its simplicity.*

WLAN

- *WLAN stands for Wireless Local Area Network.*
- *Sometimes it is also called as Local Area Wireless Network (LAWN).*
- *Norman Abramson, a professor at the University of Hawaii, developed the world's first wireless computer communication network, ALOHA net (operational in 1971).*
- *WLAN is a wireless computer network that links two or more devices within a limited area such as a home, school, computer laboratory, or office building.*
- *WLAN is marketed under the Wi-Fi brand name.*
- *Wireless LANs have become popular in the home due to the ease of installation and use.*

Advantages of WLAN

- ***Installation speed and simplicity***
 - *No cable to pull*
 - *Few transmitters/receivers for multiple users*
- ***Reduced cost-of-ownership***
 - *Mobile devices are less expensive than computer workstations*
 - *No need to build wiring closets*
- ***Mobility***
 - *Access to real-time information*
 - *Provides service opportunities*
 - *Promotes flexibility*
 - *Supports productivity*

Disadvantages of WLAN

- ***Cost***
 - *Wireless network cards cost 4 times more than wired network cards*
 - *The access points are more expensive than hubs and wires*
- ***Environmental Conditions***
 - *Susceptible to weather and solar activity*
 - *Constrained by buildings, trees, terrain*
- ***Less Capacity***
 - *Slower bandwidth*

WMAN

- *WMAN stands for Wireless Metropolitan Area Network.*
- *It is designed to extend over an entire city.*
- *It may be a single network such as cable television network available in many cities.*
- *A MAN uses distribute queue dual bus.*
- *Range: within 100 KM (a city).*

Advantages of WMAN

- *It provides a good back bone for a large network and provides greater access to WANs.*
- *The dual bus used in MAN helps the transmission of data in both direction simultaneously.*
- *A MAN usually encompasses several blocks of a city or an entire city.*

Disadvantages of WMAN

- *More cable required for a MAN connection from one place to another.*
- *It is difficult to make the system secure from hackers and industrial espionage (spying) graphical regions.*

1G First Generation

- *Refers to the first generation of wireless telephone technology.*
- *Introduced in 1980s and completed in early 1990s.*
- *Range 2.4kbps to 5.6kbps.*
- *Allow voice calls within a country.*
- *Based on Analog Telecommunication Standards.*
- *First ever codeless phone to work on 1G network was Motorola DynaTAC 8000X.3*
- *AMPS (Advanced Mobile Phone Service) was first launched in USA in 1G mobile systems.*
- *Initially served only niche markets for the military, certain government agencies and users in special industries.*



1G First Generation

- *Consist of various standards like Advance Mobile Phone Service (AMPS), Nordic Mobile Telephone (NMT), Total Access Communication System (TACS).*
- *Uses frequency modulation techniques for voice signals and all the handover decisions were taken at the Base Stations (BS).*
- *The spectrum within cell was divided into number of channels and every call is allotted a dedicated pair of channels.*
- *Data transmission between the wire part of connection and PSTN (Packet Switched Telephone Network) was done using packet-switched network.*

1G First Generation

DISADVANTAGES OF 1G TECHNOLOGY

- *Poor Voice Quality*
- *Poor Battery Life*
- *Large Phone Size*
- *Lack of Security (resulting in mobile cloning)*
- *Limited Capacity*
- *Poor Handoff Reliability*

2G Second Generation

- *Based on GSM (Global System for Mobile communication).*
- *Launched first in Finland in the year 1991.*
- *Range up to 15 to 40 kbps.*
- *Uses digital signals instead of analog signal and SIM (Subscriber Identity Module) card.*
- *First to offer data services and SMS and MMS service.*
- *Usage accounts for over 80% of all subscribers around the world.*

2G Second Generation

- *Makes use of a CODEC or compression-decompression algorithm for compressing and to multiplex digital voice data.*
- *The technologies used in 2G are either TDMA (Time Division Multiple Access) or CDMA (Code Division Multiple Access).*

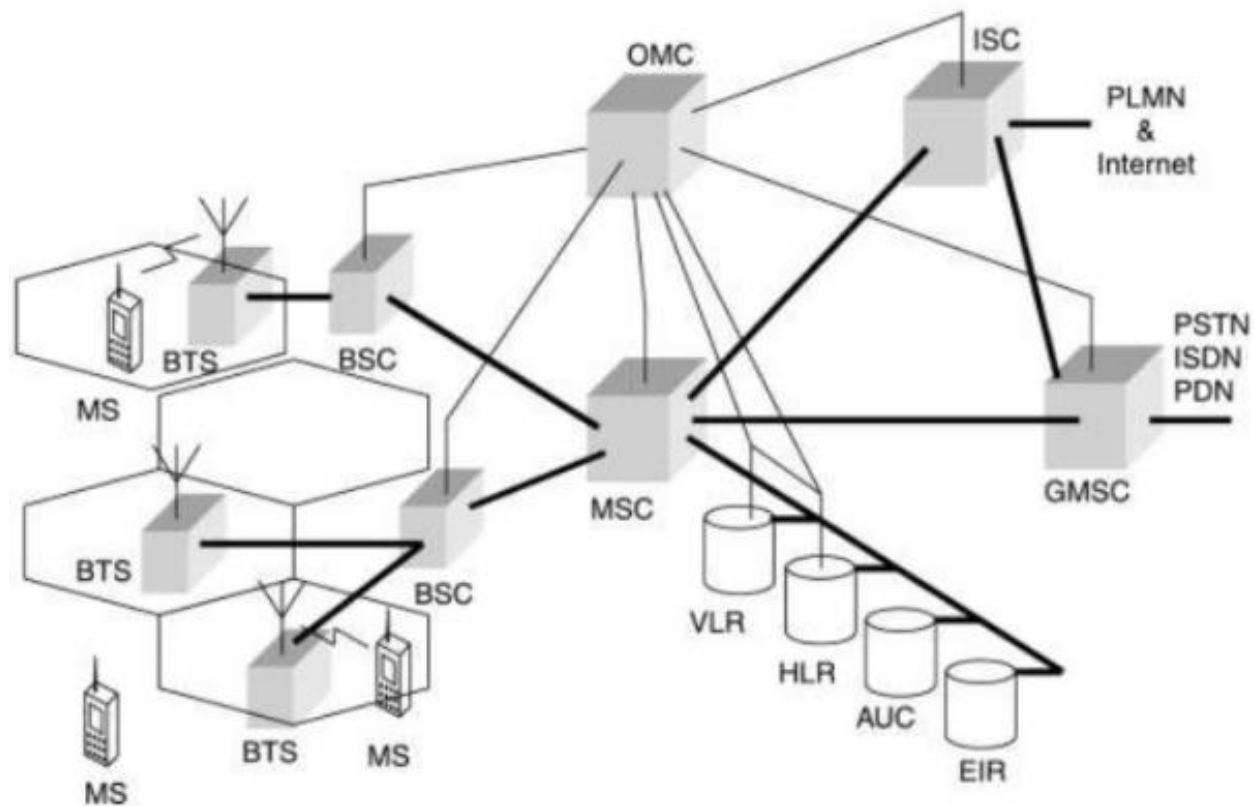


2G Second Generation

DISADVANTAGES OF 2G TECHNOLOGY

- *2G's digital signals are very dependent on location and proximity.*
- *Analog has a smooth decay curve while digital has a jagged steppe one (i.e. with rough & sharp large and flat area).*

GSM Architecture



AUC Authentication Center
 BSC Base Station Controller
 BTS Base Transceiver Station
 EIR Equipment Identity Register
 GMSC Gateway MSC
 HLR Home Location Register
 ISC International Switching Center

ISDN Integrated System Digital Network
 MS Mobile Station
 MSC Mobile Switching Center
 OMC Operation and Maintenance Center
 PDN Packet Data Network
 PLMN Public Land Mobile Network
 PSTN Public Switched Telephone Network
 VLR Visitor Location Register

2.5G Generation

- *2.5G brings standards that are midway between 2G and 3G, including the General Packet Radio Service (GPRS), Enhanced Data rates for GSM Evolution (EDGE), Universal Mobile Telecommunications Systems (UMTS), etc.*
- *Implemented a packet-switched domain in addition to the circuit-switched domain.*
- *2.5G is sometimes described as 2G Cellular Technology combined with GPRS.*

2.5G Generation

FEATURES INCLUDE

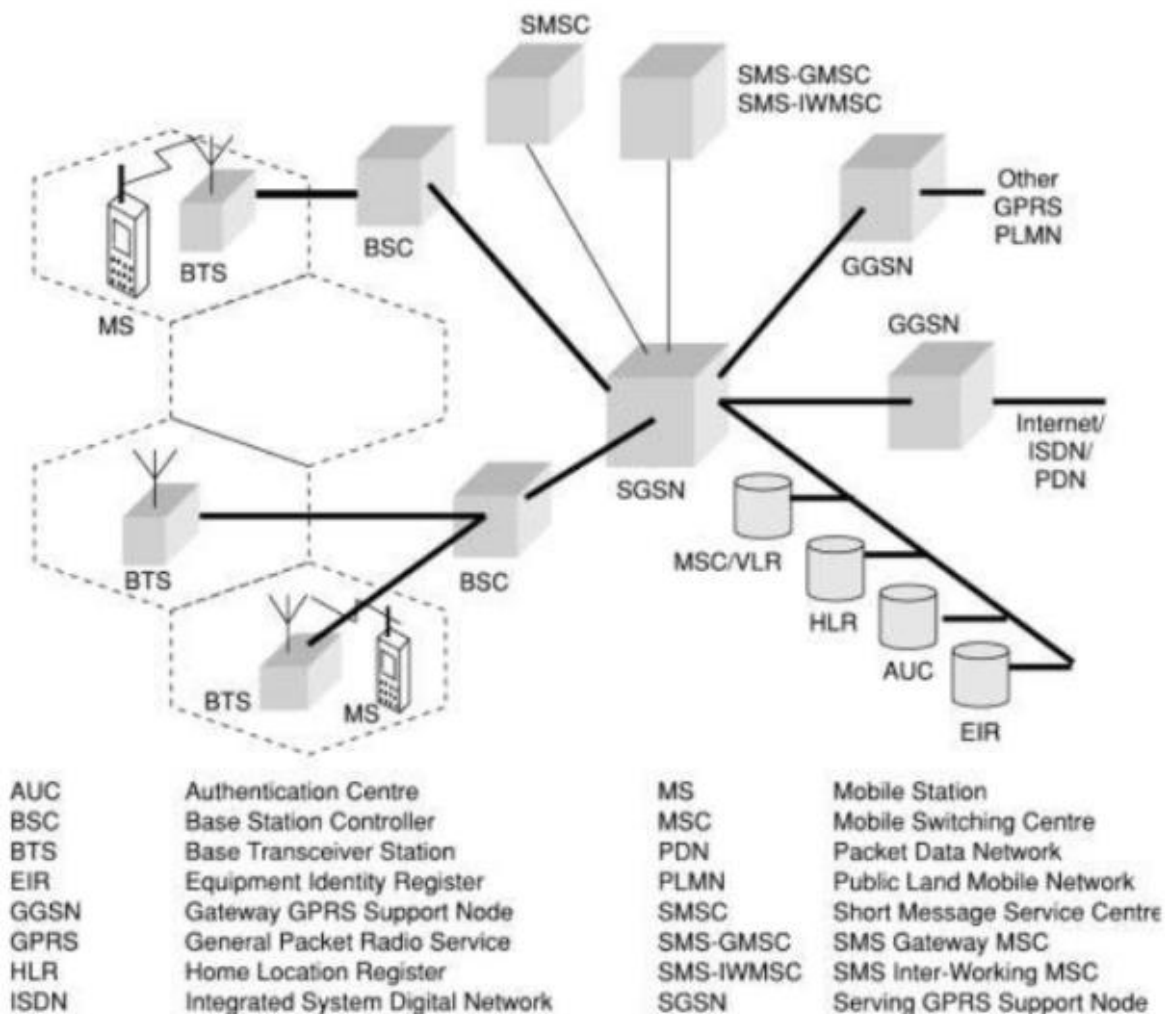
- *Phone Calls*
- *Send / Receive E-mail Messages*
- *Web Browsing*
- *Speed: 64-144 kbps*
- *Camera Phones*
- *Takes 6-9 minutes to download a 3 minutes MP3 song*



2.5G Generation

- *In 2.5G, GPRS uses GSM architecture for voice data, but to offer packet data service a new class of network nodes called GSN (GPRS Support Node) has been introduced.*
- *There are two types of support nodes*
 - *SGSN (Serving GSN)*
 - *GGSN (Gateway GSN)*
- *This helps GPRS to efficiently transport high speed data over the current GSM and TDMA-based wireless network infrastructure.*

GPRS Architecture



3G Third Generation

- *The concept for IMT-2000 was born at the ITU as 3G in the year 2000.*
- *First to enable video calls.*
- *The transfer rate for 3G networks is between 128 and 144 kbps for devices that are moving fast and 384 kbps for slow ones (like for pedestrians).*
- *For fixed wireless LANs, the speed goes beyond 2Mbps.*
- *3G is a set of technologies and standards that include W-CDMA, WLAN, and cellular radio, among others.*

3G Third Generation

- *High transmission speeds makes it suitable for modern smartphones which requires constant high-speed internet connection for many of their applications.*
- *Finds application in wireless voice telephony, video calls, GPS and mobile TV apart from mobile Internet access and wireless Internet access.*

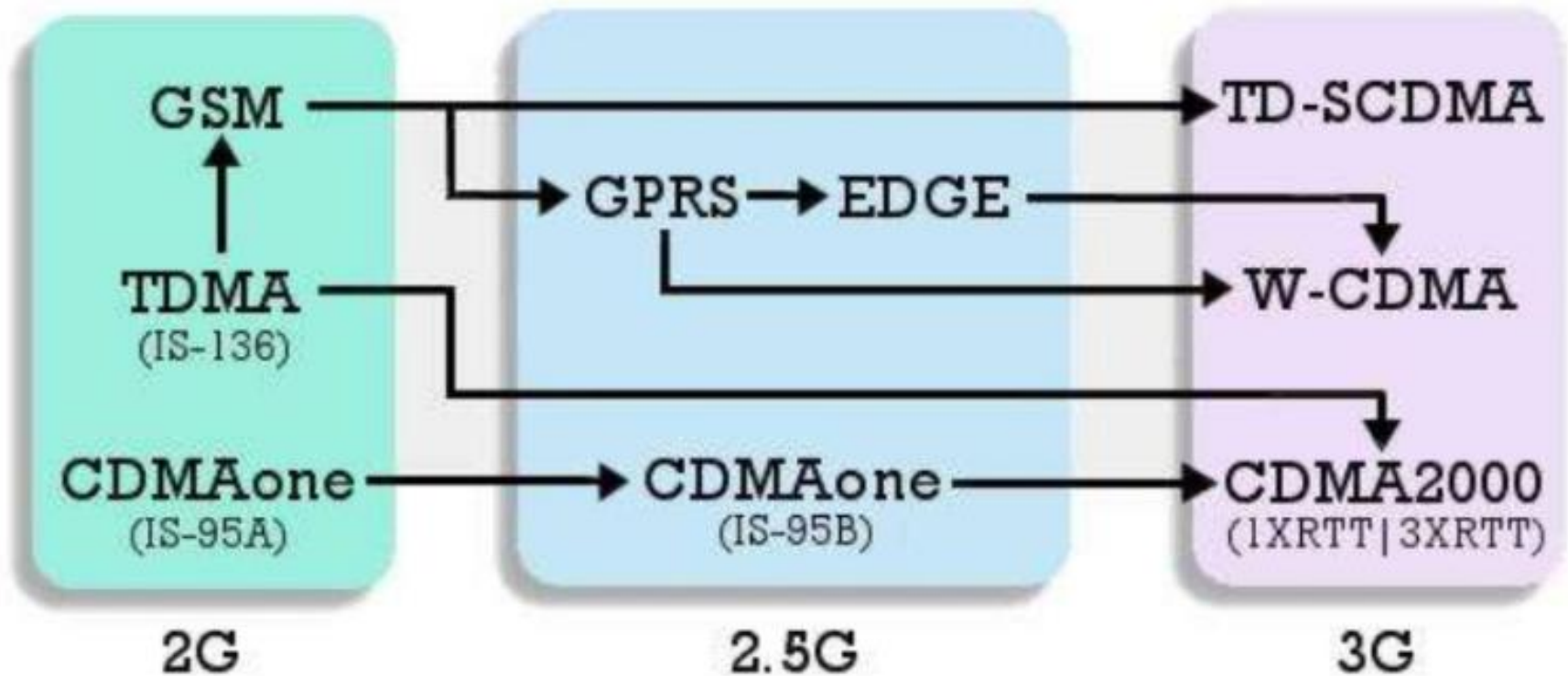


3G Third Generation

- *Getting from 2G to 3G lead to the establishment of two distinct 3G families: 3GPP and 3GPP2.*
- *3GPP was formed to foster deployment of 3G networks that descended from GSM.*
- *3GPP technologies evolved as GPRS, EDGE, WCDMA, and HSDPA.*
- *3GPP2 was formed to help North American and Asian operators using CDMA2000 transition to 3G.*

3G Third Generation

The Road to 3G



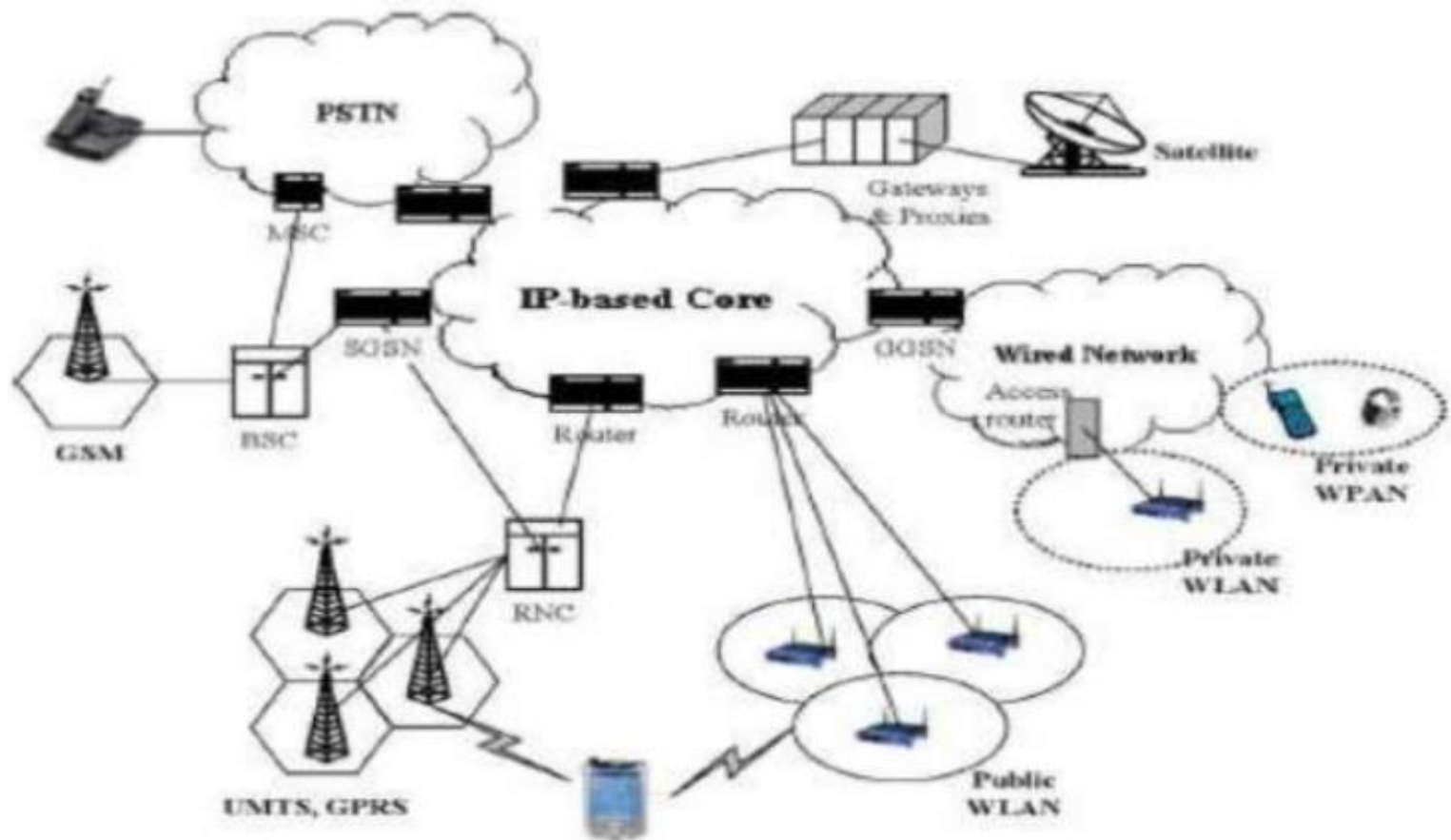
4G Fourth Generation

- *In March 2008, ITU-R specified a set of requirements for 4G standards, named IMT-Advanced.*
- *It sets peak speed requirements for 4G service at 100mbps for high mobility communication and 1gbps for low mobility communication.*
- *One of the basic term used to describe 4G is MAGIC.*
 - ***M**obile Multimedia*
 - ***A**nytime Anywhere*
 - ***G**lobal Mobility Support*
 - ***I**ntegrated Wireless Solution*
 - ***C**ustomized Personal Services*

4G Fourth Generation

- *In addition to the usual voice and other services of 3G, 4G provides mobile broadband Internet access, for example to laptops with wireless modems, to smartphones, and to other mobile devices.*
- *Two 4G candidate systems are commercially deployed*
 - *MobileWiMAX standard*
 - *Long Term Evolution (LTE) standard*
- *In USA, WiMAX is used by Sprint, LTE is used by Verizon and AT&T, HSPA+ is used by AT&T and T-Mobile.*
- *As opposed to earlier generations, a 4G system does not support traditional circuit-switched telephony service, but all-Internet Protocol (IP) based communication such as IP telephony.*

4G Fourth Generation



GSM: Global System for Mobile Communication
 UMTS: Universal Mobile Telecommunication System
 WLAN: Wireless Local Area Network
 PSTN: Public Switched Telephone Network
 WPAN: Wireless Personal Area Network
 RNC: Radio Network Controller

QGSN: Gateway GPRS Support Node
 SGSN: Serving GPRS Support Node
 GPRS: General Radio Packet Service
 RNC: Radio Network Controller
 MSC: Mobile Switching Center
 IP: Internet Protocol

4G Fourth Generation

UPSIDES

- *10 times faster than 3G*
- *Higher bandwidth*
- *Extremely high voice quality*
- *Quick downloading*
- *Easy access to Internet, IM, Social Networks, Streaming Media, Video Calling, etc.*
- *Stay connected to the Internet without any disruption.*

DOWNSIDES

- *New frequencies means new components in cell towers.*
- *Higher data prices for consumers.*
- *Consumer is forced to buy a new device to support the 4G.*
- *It is impossible to make your current equipment compatible with the 4G network.*
- *Not many areas have 4G service yet.*

5G Fifth Generation

- *5G denotes the next major phase of mobile telecommunications standards beyond the current 4G/IMT-Advanced standards.*
- *It is expected that 5G should be rolled out by 2020 to meet business and consumer demands.*
- *Significantly faster data speeds — up to 10gbps.*
- *Ultra-low latency — 1 millisecond.*

5G Fifth Generation

- *It is highly supportable to WWW (Wireless World Wide Web).*
- *In addition to simply providing faster speeds, 5G networks will also need to meet the needs of new use-cases such as the Internet of Things as well as broadcast-like services and lifeline communications in times of natural disaster.*
- *Cognitive radio technology will help to choose optimum radio access network, modulation scheme and other parameters to configure itself to gain the best connection.*

CONCLUSION

	1G	2G	3G	4G	5G
Standards used	AMPS, NMT, TACS	GSM, CDMAOne	W-CDMA, WLAN, HSPA, UMTS	LTE and WiMAX	Not yet defined
Implemented in	1980s	1990s	2000s	2010s	2020s
Frequency Bandwidth	up to 30 kHz	up to 200 kHz	up to 20 MHz	up to 100 MHz	20 – 60 GHz
Data Access Speed	2.4 to 5.6 kbps	15 to 40 kbps	Upto 2mbps	Upto 1gbps	upto 10 gbps
Features	voice only	data along with voice	Multimedia services support	IP based communication	Supportable to IOT and WWW

Security Issues Related to Wireless Communication

- **Denial of Service (DoS)**

- *Denial of service is a simple attack that relies on limiting access to services on a wired or wireless network.*
- *This hack is commonly accomplished by routing a tremendous amount of traffic at a specified target.*
- *With this approach, the high volume of traffic overwhelms the target machine and disrupts service.*
- *It is also possible for hackers to launch a denial of service attack by simply disrupting the signal on the network.*
- *This can be achieved by causing enough interference on one channel to interrupt the service.*

Security Issues Related to Wireless Communication

- **Rogue Access**

- *A common method of attack used by hackers is the use of a rogue access point that is setup within range of your existing wireless network.*
- *The concept behind a rogue access point is simple.*
- *Hackers establish these false networks to fool the people and devices in range to use those access points.*
- *This allows hackers to access data and information on legitimate devices that should be secure.*

Security Issues Related to Wireless Communication

- **Passive Capturing**

- *Passive capturing is another threat to security on your wireless network.*
- *It is accomplished by setting up devices within range of the network and “listening” to the data traffic travelling along your network and capturing that information.*
- *What hackers do with that information differs depending upon the goal of the hacker.*
- *Some attempt to breakthrough your existing security settings by analyzing network traffic, while others simply look through the non-secured traffic to potentially access sensitive information regarding business operations.*

END OF UNIT TWO