Introduction

UNIT-1

→ The Guglielmo Marconi transmitted the first wireless radio signal through the Italian hillside in 1894

→ The Amplitude Modulation (AM) radio sets of 1920's to the multiple wireless devices of the 21's Century

→ The 21'st Century has become an important technology is Wireless technology

→ Today's business and technology press and replete with a myriad of terms and Abbreviations as CDMA (code division Multiplexing, & Global System for Mobile Communications (GSM), TDMA (Time division Multiple Access), 802.11, WAP (Wireless Application protocol (WAP), 3G, General packet Radio Service (GPRS) Blue tooth, i-mode, - - -.

→ These new Wireless technologies and services is a beginning of Wireless revolution.

→ It projected to experience high growth in future 2004.

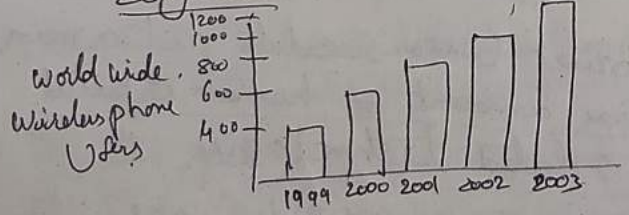
→ The market projects other wireless technologies such as. WLAN and Bluetooth.

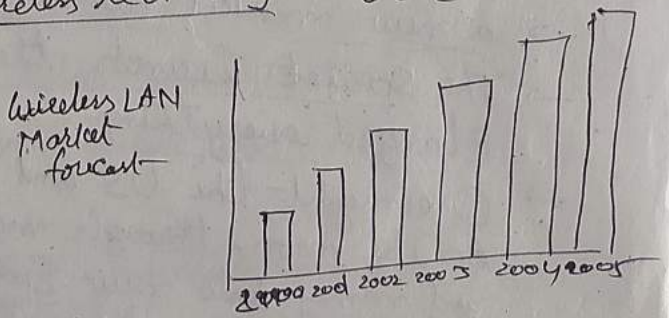
→ The IDC (International Data Corporation), the WLAN equipment market grew 80% in 2000 also in future this was installed in airports, hotels, academic settings and Corporations.

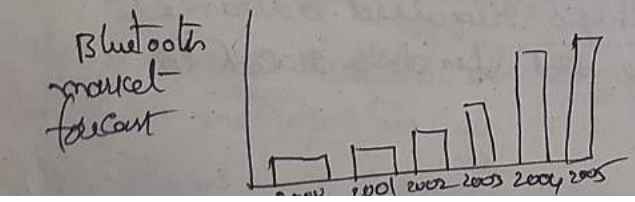
→ The forecast for Bluetooth, a new short range. (less than 10m). This wireless technology is used as interconnecting devices and Peripherals like printers, PDA's, keyboards and cellphones.

→ In 2005, nearly 1 billion. Bluetooth-enable devices will be shipping world wide.

→ Expected the advances in wireless technologies over the last 20 years.







History of Wireless Technologies

→ Wireless Technologies started in 19th Century with the development of Marconi's wireless telegraphy, patented in 1896 in England, transmission of Wireless Radio Waves across great distances.

→ The Marconi technology uses dots and dashes of the morse code.

→ The intial User was limited to applications like Ship to Ship and ship to be shore Communications

→ Following Marconi's success the American Inventor Reginald Fessenden Completed the first true radio broad Cast in 1906 and start the Wireless Revolution

→ In 1920's GE (General Electric), AT&T, newly created Radio Corporation of America (RCA) were creating first real Wireless Industry, the AM radio.

→ Overnight, everyone gone into broadcasting, newspapers, banks, public Utilities, department stores, Universities, and Colleges, Cities and towns, pharmacies, hospitals.

→ The Consumer demand for radio, in 1929 over 6 million radios were used in US, with a new mechanism for receiving Content and Information.

→ The wireless technologies expanded despite the global depression in 1930's, other new technology such as Frequency Modulation radio and television were developed.

→ In the World war II further accelerated wireless development as the military provided significant resources to further product development.

→ a new market Wireless Technologies started.

→ The Soviet launch the Sputnik satellite in 1957 changed everything.

→ Overnight, the US and Soviet Union raced to put a man on the moon, through massive amount of human capital and money into new Space related technologies

→ Communication with Space ships required advanced Wireless Communication Systems and Vendors raced to new Wireless System.

1970's – The first Wireless Networks

→ The first wireless phone systems appeared in the US in 1970's.
→ Based on the technology developed at AT&T Bell labs in 1940's are analog operated on limited frequency range, handle only low volume of simultaneous calls.
→ The demand for mobile voice grew in during 1970's, require more users support, mobility between cells.
→ Using cell sites <1km in diameter, operators designed the systems first time enabled calls to be transferred from cell site to cell site.
→ The first system of this type to be installed was AT&T Advanced Mobile Phone Services (AMPS), developed in Chicago in 1979.
→ Similar Systems were developed and installed in Europe, and Japan in early 1980's.
→ In 1981 The New york City system could only handle 24 simultaneous calls and the network operators limited total subscriber base to only 700.
→ Early mobile handsets were large and heavy.
→ The government allocated radio spectrum primarly for military and law enforcement purpose.
→ In 1980's US world took divergent policies to promote development of new wireless networks.
→ In Europe and Asia, the policy thrust was driven toward development of a single wireless voice standard (GSM).

In 1980's – Wireless Markets Start to Evolve.

→ By AMPS system, preasure grew on US Govt. to allocate additional radio spectrum for wireless Communication.
→ The FCC (Federal Communications Commission) was tasked to regulate the market demand.
→ In the spring 1981, FCC announced intention to allocate 40 MHz of spectrum in major metropolitan markets in US.
→ The Spectrum enabled 666 channels for Cellular Communication in each metropolitan city market.
→ It shows more capacity.

→ The FCC first focused on 300 metropolitan areas in Country. (4)
→ To promote Competetion FCC award each market two licenses.
(a) to local phone Company license.
(b) for non wireline Company license.
→ Under the policies of President Ronald Regan's administration, but it was also influenced by the US Govt breakup of the AT&T phone monopoly.
→ ~~The initial~~ In 1983, the FCC began awarding spectrum licenses in the major markets.
→ In Oct 1983, Ameritech, one of the Seven Baby Bells launched first Commercial System in Chicago and Signed 3000 Subscribers.
→ In Europe the mobile phone market developed quite differently.
→ The European administrators were developed new policies for European wireless market.
→ The new policies are.

(a) State owned telephone monopolies — The state owned telephone monopolies provided local and long distance phone services.
→ Competetion was minimal. also privitogition.
→ most Countries only had one phone carrier.
→ promote new wireless voice market without AT&T.

(b) Geography — the western Europe is a much smaller area than US has much higher population density.
→ This means that the physical cost of developing networks would be Considerably less than in US.

(c) Mobile population: The creation of European Common Market encouraged the creation of Pan-European Commerce and trading.
→ The population's mobility placed a premium on Cross border Compatability between wireless markets.

→ 1982' the Conference of European Posts and Tele Communications Administrations (CEPT) which Consisted of 26 Countries Administrators. Concerned to establish European wireless TeleCommunications market.
→ It defined two decisions by (CEPT). They are.
(a) establish a European wireless teleCommunications market.
(b) establish a task force to define the standard.

→ CEPT agreed to allocate wireless spectrum in the 900 MHz. to each country for new wireless networks.

→ Although it would still take ten years before the first European standard based GSM System would commence operation, the CEPT-early decision helped create a successful, and robust wireless market place.

→ The developing the GSM standard, the individual nations like UK, France, Germany launched analog based wireless systems, very similar to AMPS.

→ The late 1980's the CEPT had developed GSM standard and mobile operators from 13 European Countries signed a MOU (Memorandum of Understanding)

→ The GSM settled on digital system instead of analog.

→ Selecting proved to be a very prescient choice, better spectrum allocation, better signal quality, an easy interface with ISDN-based landline services, better security.

The 1990s – Wireless Networks Mature

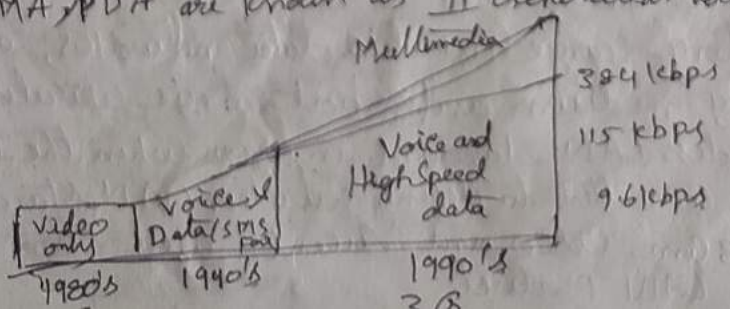
→ During 1990's wireless Technologies finally burst into the main stream.

→ The Intel co-founder Gordon Moore predicted that the no. of transistors that could fit in a single chip would double approximately every 18 months.

→ By the 1990's the benefits of Moore's law resulted in rapidly faster and cheaper Silicon chips for PC's and wireless phones. the Component prices for handsets fell considerably.

→ In 1991 the first Commercial GSM networks began offering service starting in Scandinavia.

→ A year later Australia became the first operator to offer GSM service outside Europe. GSM and other network standards TDMA, CDMA, PDA are known as II Generation networks.



→ In 1992 the first International roaming agreement between two European Carriers – Vodafone and Telecom Feerland. (6)
→ The adopting of Universal technology standard, Europe was able to offer the ability to travel and place calls throught Europe from single mobile phone.
→ The FCC policies created a cellular market Comprised of different technologies and Compelelors in the market.
→ Unlike GSM, where the Interconnecting networks was relatively straight forward.
→ Furthermore, local wireless Carries failed to see the benefits of roaming and were more interested in protecting the local market than offering nation wide services.

The mid 1990's – Other Wireless Networks Emerge

→ In early 1990's the operators worked on improving the network functionality, adding features such as two way paging and the ability to send alphanumeric messages.
→ The paging market quickly diverged into two Competing standards – one for Europe other for out side Europe (FLEX)
→ The maindifference was that Ermes was Conceived in a very GSM like fashion with Collaboration from numerous operators throughout Europe, while FLEX was Conceived and developed by the US wireless heavy weight Motorola
→ In 1992 the baby bells pooled resources to create a new packet based wireless data Network CDPD (Cellular Digital Packet Data).
→ This CDPD is based on TCP/IP.
→ The CDPD was designed to run on the legacy AMPS network hardware; infrastructure Costs were quite low.
→ By the End of 20th Century, CDPD Covered the 50 largest metropolitan acrros US.
→ Besides long-range wireless data networks, efforts on developing medium and short range wireless standards.
→ The wireless LAN standeard in 1990 when the IEEE started 802.11 committed to define wireless LAN standard.
→ Intel, 3 Com, Cisco and Lucent were soon producing wireless LAN products.

→ For near range (<10m) wireless networks, the bluetooth Special Interest Group (SIG) was found in May 1998 by Ericsson, IBM, Intel, Nokia and Toshiba.
→ By 2001, the bluetooth SIG counted over 1800 members and the first bluetooth enabled products started appearing on the market.

The late 1990's – The Wireless Internet Emerges

→ another disruptive technology – world wide web (www)
→ initially Commercialized to Netscape Communications Corp.
→ The web's popularity was driven by the ability to easily uncover a vast amount of info to connect people over the globe.
→ An early pioneer was – Unwired planet, which was founded in 1995 and by Dec' 1995 had been awarded a US patent
→ within 2 years unwired planet had successfully convening mobile heavy weights Nokia, Ericsson, Motorola to create WAP forum in 1997.
→ WAP 1.0 was released on late 1997 and finally ratified in mid 1998.
→ in 1999 operators begin slowly launching WAP services.
→ The Bluetooth and Wireless LAN were equally unimpressive.
→ Bluetooth and 802.11 technologies suffered considerably.
→ The bluetooth enabled devices were few and far between and carried high prices
→ This weakness especially worried Corporate Customers.
→ So uptake WAP, bluetooth and wireless LAN are slower than expected?,
as Economics – wireless internet capable cell phone are often quite expensive.
– with bluetooth, the new chipsets are still quite expensive, leading high prices.
– If eventually decrease many services will be attractive.

(b) User Experience –

→ The Initial Wireless Internet Experience was Underwhelming.

→ Users accustomed to full color displays on high speed PC-based Connections were subjected to 4 line black-and-white displays over slow connections.

→ Content providers were also slow to optimize existing wired content delivery over a wireless network.

(c) Security – Wireless Services like weather and Sports scores are minimal, value added services like stock trading, wireless access to Corporate networks, and transactions are higher level.

→ In Jan 2001, only 12% of wireless users indicated a willingness to Conduct transactions over a wireless device, which 32% in June 2000.

→ The America Online (AOL) in mid 1990's widely criticized for poor Customer Service, busy Signals, poor content.

→ Internet Service Provider (ISP)

→ The drastic differences are intentional, mobile devices were not intended to serve as PC replacements.

→

Category	PC	GSM cell phone
Processor Speed	1GHz	50 MHz
Memory	512 MB	32 KB
Storage	50 GB	64 KB
Battery life	3 hrs.	100+ hrs. stand by
Display	15-inch Super XGA+	5 line monochrome
OS	Windows 2000 and XP, Linux.	Proprietary OS
Bandwidth Quality	1 GBPS	14.4 KBPS

→ Alongwith that the demand for wireless services grew in 1980's. (9)

→ Despite of migration from analog to digital networks in the US eavesdropping, become a nation issue in 1997.

The Wireless Internet — Wireless security moves into the Mainstream

→ The Microsoft supported Secure Socket Layer/Transport Layer Security (SSL/TLS) encryption over HTTP in Web browsers and Web servers.

→ SSL became the standard security mechanism for transmitting

→ Unfortunately a similar SSL standard was lacking in the initial Wireless Internet.

→ WAP forum provided as SSL-like alternative called WTLS (Wireless Transport Layer Security) did not provid security in end to end Encryption.

→ During the protocol Conversion from WTLS to SSL data was Unencrypted and reencrypted, leaving data temporaly in the Unencrypted form.

Wireless Value Chain

→ The Wireless Value chain Can be divided into 5 different sectors.

→ Some Vendors operate multiple sectors and some firms are almost 100% wireless focused.

(a) Device Vendors (b) Network Operators (c) Hardware providers (d) Content providers (e) Application providers.

Category	wired	wireless
Device Vendors	Dell,	

History of Wireless Security

→ Insecurity about Wireless technologies.
→ During IInd world war, the US Navy can identify the Signals that for the Japanese attacks before.
by Captured in Security.
→ for Ex: JN-25 table Contains 45,000 5-digit no's.
It will be encoded by VArying and to digit of total 6 digital Code.
→ To Crack the Code, the team had to Subtract the Value and then determine these Values by analyzing the frequency of their Usage overtime.
→ Using the efforts of OP-20-G the US Navy was able to intercept and decrypt enough of JN-25 to determine Japanese navy's movements and learn the Japanese intent to attack.

Eavesdropping and Jamming

→ The Eavesdropping fear Consisted of two dimensions.
One is what curious Citizens Could listen in random Conversations.
Second is sinister dimension was the Govt agencies Such as CIA and FBI could intercept Conversations at will the rule of law enforcement or national Security.
→ The Eavesdropping has become a major issue according to Communications Act. 1934.
→ The Congress added the Electronic Communications Privacy, 1986.
→ In addition to eavesdropping wireless Signals can also be jammed.
→ The wireless Networks are Susceptable to the following possible breaches
(1) Interception of law enforcement data or Specialized Radio mobile, private Radio & CDPD Network.
(2) Interception of credit Card authentication over wireless networks.
(3). Stealing of Cellular air time
(4) Interception of email message on Wireless internet
(5) Physical breach of Security at Unmanned hub Stations or either Communication Centers.

	Wired	Wireless
Device Vendor	Dell, Compaq, HP, Toshiba, NEC, IBM and Apple	Nokia, Motorola Ericsson, Siemens, Palm, Compaq
Network Operators	AOL, AT&T, Prodigy, Earthlink	Verizon, Vodafone, Docomo, Sprint PCS
Hardware providers	Intel, Cisco, Lucent, Sun, IBM	Texas Instruments Ericsson, Alcatel, Simens.
Content providers	AOL, eBay, Amazon Yahoo, and MSN	Yahoo, airlines, and weather.com
Application providers	Microsoft, Oracle, SAP, Lotus and BEA	Openwave, iAnywhere Cellpoint

Device Providers

View on Security – The handset vendors are quite aware of security issues. During 1999 through 2000, many vendors offered high-end WAP handsets that offered various security features.

→ The handset vendors do have significant influence over security through their large brand building advertising efforts, which can highlight security issues and thereby generate demand.

Network Operators

→ The network operators are responsible for building, maintaining and promoting wireless networks.

→ Many network operators began as wired operators and used that position to expand the most powerful segment.

→ In the early days of wireless voice, there was little differentiation among network operators.

→ Gradually many markets opened the wireless sector to new entrants, creating more competition.

View on Security → Specifically the WAP architecture meant that WAP Gap was often located on the Operator's WAP architecture WAP Gateway.

→ Because the WAP architecture did not offer many immediate alternatives.
→ Some Operators tried to bridge the gap by offering to serve as a payment providers, but these were not always met favorably.

Hardware Providers

→ This sector is almost invisible to Consumers, but it is Critical supplier to the network operators and handset Vendors.
→ The firms provide the hardware (chips and CPU) for the handset vendors as well as the Network-switching Infrastructure for Connecting wireless networks.
→ The Ericsson, Simens and Alcatel are all major hardware providers
→ The network operators desire to offer new revenue generating services on higher speed networks.

~~View~~ View on Security

→ The Security services like encryption, authentication and digital signatures function much better at higher ~~speeds~~ speeds.

Content Providers

→ The Leading wired Content providers like AOL, Yahoo, MSN, Amazon and eBay in 2000.
→ They served the Content provide as a portal.
→ a User from any geography using ISP could browse a site.
→ the Content providers still aggressively promoted wireless Services. — location based services also privacy policy

View on Security

→ Security is very important for the Content providers, especially they engaged in Commerce as opposed pure Information distribution.
→ Completely secure because of potential breaches, loss of Consumer Confidence, and erosion of brand equity.

Application Providers

→ This sector is divided into two categories.

(1) Traditional Independent Software Vendors that have modified existing wired application for wireless environments

(2) Software Vendors that have developed exclusively for wireless Environments.

→ The major S/W Vendors including Oracle, IBM, Microsoft, and SAP announced plans to make existing applications to wireless ready. — phone.com (openwave), Cellpoint and Jinny S/W

View on Security

→ a good awarness of Security

→ with roots in the wired Internet have already dealt with many of the security issues.

State of the Wireless Industry, 2001

→ The Overview is split into four geographic regions because the wireless market has evolved.

(a) North America (b) Europe (c) Japan

(d) Asia

North America Wireless Industry, 2001

→ where there were once hundreds of firms vying for the FCC wireless licenses.

→ The five dominant brands (AT&T wireless, Cingular, Nextel, Sprint, PCS, Verizon etc) that control 90% of US Subscribers

→ The digital Network Standards (CDMA, GSM, TDMA and IDEN)

→ The North American market divides into Two segments Consumer and enterprise. minimal prices, Professional, Wallace lattice

→ In 2000, new wireless gadgets appeared in North American market, Palm Computing Corporation — PDA's — Palm VII

→ Palm VII adopted. walled garden approach,
→ Palm VII suffered from the same Proxy Architecture as WAP,
→ The other major devices was Research in Motion (RIM) Blackberry interactive Pager,
→ Blackberry. Users to wireless device, email inbox, and forward cc,
→ The GSM phone satisfied most Consumers needs,
→ In 2000 enterprises were extremely attracted to wireless data services in 3 areas
(a) Improved productivity (c) Competetive advantage
(b) Improved customer service
→ In order these wireless services to succeed in US two things must happen
(a) Fix Security (b) Develop Compelling apps
→ Looking a head US wireless Voice industry faces 3 Crucial issues.
(a) Mobile party pays (b) Spectrum Allocation
(c) Technology divergence.

(a) Mobile party pays
(b) Spectrum Allocation — 3G based wireless Voice and data Networks.
→ James Murray points out, FCC allocated only 189 MHz ~~and~~ for radio Spectrum for mobile, Compared to 300 MHz in Japan & 364 MHz in UK.
→ UHV-TV stations - Apply 3G
(c) Technology divergence — different networks hurt the US wireless market in 4 ways.
(1) NO Global roaming (2) Supplier Customization
(3) Network Compatability (4) Network Infrastructure

European Wireless Industry, 2001. (14)

→ In 2001 European Operators enjoyed several benefits over operators in other regions.

(a) Stable Universal Network Infrastructure:-

→ GSM Network was Complete in Western Europe with over 110 GSM Networks.

→ 3 or four different antennae in a given Cell area.

(b) Relatively high Cost of Wired internet access

(c) Healthy non Voice Revenue stream

(d) Protected Incumbent Carriers.

→ In 1999, the Nordic mobile operators (Sonera, Telia, Telenor and Tel-denmark)

→ Despite the optimism, Europe still faces some Challenges. in 2001

(a) 3G debt loads:-