

Lect4: History of Wireless Communications

(key milestones in the development of wireless communications are listed)

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History of wireless communications

□ **Terrestrial** fixed links (telephone services) ~ **1940s**.

□ **Satellite** intercontinental links ~ **1960s**.

□ **Cellular mobile communications:**

➤ *The fastest growing industry. 1G, 2G. 2.5G, 3G, 3.9G, 4G,5G*

➤ *Number of subscribers increasing rapidly*

➤ *Financial investment → More developments → address challenges → understanding the wireless channel characteristics*

History of wireless communications

- **1820: Oersted** demonstrated that an electric current produces a magnetic field.
- **1831: Faraday** showed that a changing magnetic field produces an electric field.
- **1837: Samuel Morse** *invented Telegraph (not wireless).*
- **1864:** From that **Maxwell** predicted EM radiation existence. Formulated the basic theory of electromagnetics (which is basis of wireless comm.) [41].
- **1876: Alexander Bell** *Invention of the telephone (not wireless).*
- **1887: Hertz** verified Maxwell's theory experimentally.
- **1894:** coherer invented by **Lodge:** a sensitive device that detects radio signals and was used to demonstrate wireless communication at a 150 yards distance.

History of wireless communications

- **1895: Marconi** has demonstrated first radio signal transmission ~ 2 km.
- **1897: Marconi** patented a radio telegraph system and founded the Wireless Telegraph and Signal Company [42,43]. He demonstrated mobile wireless communication to ships.
- **1898: Marconi** experiments with a land ‘mobile’ radio system (LMR) – the apparatus is the size of a bus with a 7 m antenna.
- **1916:** The British Navy uses **Marconi’s** wireless apparatus in the Battle of Jutland to track and engage the enemy fleet.

History of wireless communications

- **1920s** : **Morse-coded ON-OFF keying** was used in mobile radio communications [44]. They were first installed and used on *Titanic* and in transatlantic ocean vessels to send emergency & distress calls [45].
- **1927**: First commercial phone service between London and New York is established using long wave radio.
- **April, 1928**: the **Detroit Police Department** installed the first one-way radio communication system, developed by the department's radio bureau, in its patrol cars [46],.
- **1933**: the **police department** in Bayonne, New Jersey, introduced the first two-way mobile radio voice system [47].
- **1945**: **Clarke** proposes geostationary communication satellites.
- **1948**: **Calude E. Shannon** characterised the limits of reliable communications [48].
- **1957**: **Soviet Union** launches Sputnik 1 communication satellite.
- **1962**: The world's first active communications satellite 'Telstar' is launched.

History of wireless communications

- **1969:** **Bell Laboratories** in the US invent the cellular concept
- **1978:** The world's first cellular phone system is installed in Chicago
- **1979:** NTT cellular system (Japan)
- **1988:** JTACS cellular system (Japan)
- **1981:** NMT (Scandinavia) 1G
- **1983:** AMPS cellular frequencies allocated (US) 1G
- **1985:** TACS (Europe) 1G
- **1991:** USDC (US) 1G

History of wireless communications

- **1991:** GSM cellular system deployed (Europe) 2G
- **1993:** DECT & DCS launched (Europe) 2G
- **1993:** Nokia engineering student Riku Pihkonen sends the world's first SMS text message
- **1993:** PHS cordless system (Japan)
- **1995:** IS95 CDMA (US) 2G
- **1998:** Iridium global satellite system launched
- **1999:** Bluetooth short-range wireless data standard agreed
- **1999:** GPRS launched to provide fast data communication capabilities (Europe) ~2.5G

History of wireless communications

- **2000:** The term 3G was set by the radio communications sector of ITU (ITU-R) through the international mobile telecommunications 2000 project (IMT-2000) (3G~ 2Mbps).
- **2000:** UK government runs the world's most lucrative spectrum auction as bandwidth for 3G networks is licensed for £22.5 billion.
- **2001:** First 3G cellular mobile network is deployed (Japan) 3G
- **2002:** Private WLAN networks are becoming more popular (US) (wireless fidelity (WiFi)) 3G
- **2003:** WCDMA third-generation cellular mobile systems deployed (Europe) 3G.

History of wireless communications

- The addition of high speed downlink packet access (HSDPA), enhanced dedicated channel (E-DCH), and high speed uplink packet access (HSUPA) to UMTS introduced **3.5G**.
- **The 3.9G term:** has been widely used to describe Mobile WiMAX (IEEE 802.16e), and third generation partnership project (3GPP)'s long term evolution (LTE).
- **2008:** The ITU-R set new requirements for mobile systems named international mobile telecommunications-advanced (IMT-Advanced).
- **2009:** six proposals were submitted for IMT-Advanced [67,68], all were based on : LTE Advanced by 3GPP, and IEEE 802.16m (WiMAX 2).
- **2011:** LTE-A was released as 4G standard (OFDM+MIMO; data-rate 1Gbps low mobility and 100Mbps high mobility).
- *The traffic of wireless networks is dramatically increasing and the limit of 4G will be approached quickly.*
- **By 2020:** the standardization work of 5G is expected to be finished.

Thank you