EMERGING TECHNOLOGIES

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FAITH • INTEGRITY • EXCELLENCE

OBJECTIVES

1. Understand the impact that emerging technologies will have in the future.
2. Define the use of emerging technologies –
   a) Cloud Computing,
   b) Big data concept and analytics,
   c) Data Centre and virtualization,
   d) internet of things,
   e) 4G/5g Mobile technologies,
   f) optical computing,
   g) quantum computing and quantum cryptography,
   h) virtual reality and wearable computing.
4. Define the ways in which certain technologies will impact homes of the future.
5. Describe some emerging technologies and their uses that are extreme.

4G & 5G TECHNOLOGIES

1G

- Developed in 1980s & completed in early 1990s
- Based on analog system
- Speed up to 2.4 kbps
- AMPS (Advance Mobile Phone System) was launched by the US & it was the 1G mobile system
- Allows user to make voice calls in 1 country

2G

- Developed in late 1980s & completed in late 1990s
- Based on digital system
- Speed up to 64 kbps
- Services such are digital voice & SMS with more clarity
- Semi global facility
- 2G are the handsets we are using today, with 2.5 having more capabilities

3G

- Developed between late 1990s & early 2000s until present day
- Transmission speed from 125 kbps to 2 Mbps
- Superior voice quality
- Good clarity in video conference
- E-mail, PDA, information surfing, on-line shopping/ banking, games, etc.
- Global roaming

WHAT IS 4G?

- In March 2008, the International Telecommunications Union-Radio communications sector (ITU-R) specified a set of requirements for 4G standards, named the IMT-Advanced.
- Set peak speed requirements for $G service at 100 Mbit/s for high mobility communication and 1 Gbit/s for low mobility communication.
- The peak bit rate is further improved by smart antenna arrays for multiple-input multiple-output (MIMO) communications.
- A 4G system does not support traditional circuit switched telephony service, but all-Internet Protocol (IP) based communication such as IP telephony.

INTRODUCTION

- 4G is the fourth generation of mobile phone mobile communication technology standards.
- It is a successor to the third generation (3G) standards.
- A 4G system provides mobile “ Ultra Broadband speed”– to be counted in gigabytes per second.
- This technology is currently available in some countries but it is still being perfected

3G VERSUS 4G

Technology	3G	4G
Developed	2001	2010
Services	Voice quality & always on Broadband Data	data & voice over IP, LTE
Standard	IMT-2000 (UMTS, WCDMA, CDMA2000)	Single Standard based on LTE Advanced
Architecture	Circuit & Packet Switched	Packet Switched
Multiplexing	CDMA	OFDM+ MIMO, W-OFDM, MC-CDMA
Core Network	PSTN & Some IP Networks	Completely IP based
Data Rates	384 Kbits/s to 3.1 M bits/s	100 M bps to 1G bps

SYSTEM KEY COMPONENTS OF 4G

- System standards
  - *LTE Advance , WiMAX 2*
- Multiplexing and access schemes
  - *OFDM+ MIMO, W–OFDM, MC-CDMA*

IPv6 SUPPORT

Advanced antenna systems

- *Multiple antenna technologies are used to achieve high rate,*
  high reliability and long communication range.

- Software-defined radio (SDR)
  - *Standards constituted by a 4G device can be realized using SDR*

APPLICATION OF 4G

- Mobile web access
- IP telephony
- Gaming services
- High-definition mobile TV
- Video conferencing
- 3D television
- Cloud computing

WHAT IS 5G?

- 5G Wireless: 5th generation wireless technology
- Complete wireless communication with almost no limitations
- Can be called REAL wireless world
- Has incredible transmission speed
- Concept is only theory not real

WHAT DOES IT OFFER?

- Next major phase of mobile telecommunication & wireless system
- 10 times more data capacity than others
- Expected speed up to 1 Gbps
- More faster & reliable than 4G
- Lower cost than previous generations
- High connectivity
- Large phone memory, more dialing speed, more clarity in audio & video

KEY CONCEPTS

- Real wireless world with no more limitations with access & zone issues
- Wearable devices
- IPv6, where a visiting care of mobile IP address is assigned according to location & connected network
- One unified global standard
- Smart radio
- The user can simultaneously be connected with several wireless access technology
- Multiple concurrent data transfer path

KEY CONCEPTS

<table>
<tr><td>Application layer</td><td rowspan="2">Application (Service)</td></tr>
<tr><td>Presentation layer</td></tr>
<tr><td>Session layer</td><td rowspan="2">Open Transport Protocol (OTP)</td></tr>
<tr><td>Transport layer</td></tr>
<tr><td rowspan="2">Network layer</td><td>Upper network layer</td></tr>
<tr><td>Lower network layer</td></tr>
<tr><td>Datalink layer</td><td rowspan="2">Open Wireless Architecture (OWA)</td></tr>
<tr><td>Physical layer</td></tr>
</table>

OPEN WIRELESS ARCHITECTURE (OWA)

- OSI layer 1 & OSI layer 2 define the wireless technology.
- For these two layers the 5G mobile network is likely to be based on Open Wireless Architecture (OWA).
- Physical layer + Data link layer = OWA

NETWORK LAYER

- All mobile networks will use mobile IP
- Each mobile terminal will be FA (Foreign Agent)
- A mobile can be attached to several mobiles or wireless networks at the same time
- The fixed IPv6 will be implemented in the mobile phones
- Separation of network layer into two sub-layers:
  - *Lower network layer (for each interface)*
  - *Upper network layer (for the mobile terminal)*

OPEN TRANSPORT PROTOCOL (OTP)

- Wireless network differs from wired network regarding the transport layer.
- In all TCP versions the assumption is that lost segments are due to network congestion.
- In wireless, the loss due to higher bit error ratio in the radio interface.
- 5G mobile terminals have transport layer that is possible to be downloaded & installed – Open Transport Protocol (OTP)
- Transport layer + Session layer = OTP

APPLICATION (SERVICE) LAYER

- Provides intelligent QoS (Quality of Service) management over variety of networks.
- Provides possibility for service quality testing & storage of measurement information in information database in the mobile terminal.
- Select the best wireless connection for given services.
- QoS parameters, such as, delay, losses, BW, reliability, will be stored in DB of 5G mobile.
- Presentation layer + Application layer = Application

FEATURES OF 5G

- High resolution for crazy cell phone users
- Bi-directional large BW
- 25 Mbps connectivity speed
- Enhanced & available connectivity just about the world
- Uploading & Downloading speed of 5G touching the peak (up to 1 Gbps)
- Better & fast solution
- High quality service based on policy to avoid error
- Support virtual private networks
- More attractive & effective
- Provides subscriber supervision tools for fast action

APPLICATION OF 5G

- Wearable devices with AI (Artificial Intelligence) capabilities
- Pervasive (Global) networks
- Media independent handover
- Radio resource management
- VoIP (Voice over IP) enabled devices
- With 6th sense technology