The Fourth Generation or 4G is a term used to describe the next generation of complete evolution in wireless communications space. A 4G network is capable of providing a comprehensive IP based telecom solutions where voice, data and streamed multimedia can be given to users in a seamless manner and at much higher data rates than previous generation networks.

{K2Splitter} The Fourth Generation or 4G is a term used to describe the next generation of complete evolution in wireless communications space. A 4G network is capable of providing a comprehensive IP based telecom solutions where voice, data and streamed multimedia can be given to users in a seamless manner and at much higher data rates than previous generation networks.

Though, there is no formal definition for 4G, however there are certain objectives defined for the same.

Presently there are two technologies which are capable of supporting the requirement of 4G deployment: WiMAX from the IEEE Forum and Long Term Evolution (LTE) from 3rd Generation Partnership Project (3GPP) Forum. Many comparisons have been made between these technologies, but with no clear winner. Therefore, the deciding factor for commercial deployment of any of these Technologies may be based on the business model.

Purpose/Objective of 4G

The new mobile broadband customer services like wireless broadband access, multimedia messaging services (MMS), video chat, mobile TV, HDTV content, digital video broadcasting in addition to legacy vanilla services like voice and data need very high data rates and quality of service. 4G technology systems support all these services and provide high quality of service experience along with high download speeds to its customers.

International 4G working groups have defined the following objectives for 4G wireless communications

It is spectrally efficient system/technology i.e. No of bits/sec/Hz

High network capacity accommodating more users per cell and providing higher speeds to existing subscribers.

Normal data rates of 100 Mbps while in mobility and up to 1 Gbps while the user is stationary.

Smooth hand offs across all networks.

High quality of service for next generation services like MMS, HDTV, Mobile TV, and Digital Video Broadcast.

Interoperability with existing wireless networks.

An all IP packet Switched network.

Key Components of Technology in 4G:

Access Technology Techniques

Unlike previous generation telecom technologies, it uses Orthogonal Frequency Division Multiple Access (OFDMA) as compared to time division multiple access (TDMA), frequency division multiple access (FDMA), code division multiple access (CDMA) access technologies used in 2G, 3G. OFDM exploits the frequency selective channel property. In OFDM, a digital signal is further split into narrowband frequencies, modulated by Data and then remultiplexed to create the OFDM carrier. The main advantages of using OFDM are high spectral efficiency, low RF interference and lower multipath fading/distortion. It further reduces equalization complexity by enabling equalization algorithms in frequency domains.

Adaptive Modulation and Coding

Adaptive Modulation and Coding mechanism reacts to instantaneous variations in Channel conditions and accordingly modify the modulation and coding formats. AMC also allows different data rates to be allocated to different users.

Adaptive Hybrid Automatic Repeat-reQuest (ARQ)

Efficient and Reliable Medium Access Control (MAC) – MAC layer performance is extremely important for reliable link performance over the busy wireless channels. In order to achieve this an ARQ - Automatic repeat request technique is used where in Transmitter breaks up the packets received from higher layers with smaller sub packets which are then transmitted sequentially. If a sub packet is received incorrectly then the transmitter is requested to retransmit this.

Improved Modulation

64 QAM - Quadrature Amplitude Modulation is used in 4G which is spectrally most efficient modulation scheme available as on day.

Software Defined Radios (SDR)

SDR allows software modifications and implementation in some of the functional modules of radio equipment e.g. modulation/demodulation module, signal generations/processing module, coding and link layer protocols etc. It helps in achieving the convergence of diverse wireless standards which is the hall mark of 4G technology.

MIMO, Smart Antennae

Smart or intelligent Antennae is a multi Antenna concept where Radio beam tends to follow the user. This is achieved through Beam Forming which further improves the Antenna gain. These Intelligent Antenna are also used to provide RX/TX Diversity.

iPv6 Complaint Internet Addressing

For 4G technology deployment, iPv6 has evolved as a natural choice to support large number of devices. iPv6 uses 128 bits for addressing (total 3.4*10 to the power 38) as compared to 32 bits of addressing (total of 4,294,967,269 address) used in iPv4. This requirement of large number of availability of addresses was necessary as 4G is using complete IP based interfaces and protocols for backbone and Core which will allow every device to talk to each other, following similar protocols.

4G/LTE Business Model

Mobile broadband services are expected to grow significantly i.e. from existing nearly 50 million subscriber to more than 200 million subscribers worldwide by year 2015. Mobile internet needs very high bandwidths and hence mobile data network traffic is expected to grow worldwide to nearly 2 million terabytes per month from existing traffic of nearly 50K terabytes per month.

However the increase in network traffic must also result in increased revenue generations for the telecom companies maintaining the affordability of the services. Trends indicate that 4G/LTE is going to result into increase in revenues/profits for service providers. Technology reveals that 4G/LTE reduces cost per bit exponentially as compared to GPRS in 2G and HSPA in 3G. Cost per bit in 4G is approximately 10 per cent as compared to the cost per bit in GPRS in 2G and 40-50 per cent as compared to high speed packet access in 3G.

Depending upon the trends of average revenue per user (ARPU) in markets where 4G/LTE is already commercially deployed, it is expected that ARPU towards mobile Broadband shall be in the range of Rs 250 and above as compared to less than Rs 150 ARPU range for GSM 2G and sub Rs 100 ARPU for CDMA.

Challenges

There are certain challenges in deploying 4G/LTE Networks with the telecom providers. Some of these challenges are:

End to end equipment availability and maturity of network performance and ensuring quality of service.

Interworking with legacy network i.e. core, transmission, access, terminals so that existing deployments are not wasted in any way.

Large bandwidth requirements on transmission media both towards backbone and metro level backhaul. Also converting *time-division multiplexing* backbone Network to multiprotocol label switching based IP backbone Network for supporting all IP network requirements.

End terminal availability and cost/affordability.

Copyright © 2010, tele.net.in All Rights Reserved