

SRI LANKA INSTITUTE OF INFORMATION TECHNOLOGY

Communication Systems

4th Year 2nd Semester 2016

02- Assignment

NAME: Chaturagama J.M.A

SID: IT12045822

DATE: 17 Sep. 2016

CS Assignment 2

1) 1G network

1G technology was invented in the 1980. The key idea behind 1G was that the geographical area is divided into cells, each served by a “ base station”.1G comprised of the following technologies Mobile Telephone Systems (MTS), Advance Mobile Telephone systems (AMTS), Push to Talk (PPT) and Improved Mobile Telephone Service (IMTS). Some advantage of 1G network.

- Licensed spectrum
 - Clear spectrum for exclusive use by mobile technology and base stations provide access for subscribers
- Frequency reuse
 - Reusing frequencies without interference though geographical separation so overcome that neighboring cells operate on different frequencies
- Mobile Network
 - Coordinated network for seamless access and seamless mobility. Integrated transparent backhaul network provides seamless access

Issues with 1G:

Analog cellular phones are not very secure. Anyone with an all-band radio receiver connected to a computer can record the 32-bit serial numbers and phone numbers of subscribers when calling can listen in on any conversation. This loophole was exploited in many scandalous ways. There were also reported thefts of airtime. Anyone could collect a large database by driving around and go into business by reprogramming stolen phones and reselling them.

2G network

2G cellular telecom networks were commercially launched on the GSM standard in Finland by Radiolinja in 1991. [1] 2G used digital signals for voice transmission and had a speed up to 64 kbps. It also provided the facility of Short Message Service (From now on, referenced as SMS) and used the bandwidth range of 30 - 200 KHz.

Technologies under 2G:

2G comprised of the following Mobile technologies: General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA), and Global System for Mobile Communication (GSM) and Enhanced Data Rates for GSM Evolution (EDGE).

Some key benefits of 2G Network over its predecessors was that, Digital Encryption was supported by 2G systems which had higher penetration efficiency thereby being more efficient

on network spectrum. Moreover, 2G introduced several data services for mobile, the most prominent one being the famous SMS text messages. After 2G was launched, the previous mobile telephone systems were coined as 1G Systems. Although it has been eons since its inception, 2G networks are still used in many parts of the world

Issues with 2G:

In less populated areas, the weaker digital signal deployed on higher frequencies may not be sufficient to reach a cell tower. Analog Signals have a smooth decay curve while digital has a steppey one. This was seen as both an advantage as well as a disadvantage. Under good conditions, digital sounded better. Under slightly bad conditions, analog experienced static, while digital has occasional dropouts. As conditions worsened, digital signals started to completely fail, while analog got worse gradually, generally holding a call longer and allowing at least a few words to get through. While digital calls tend to be free of static and background noise, the lossy compression used by the codecs takes a toll; the range of sound that is conveyed is reduced. You hear less of the tonality of someone's voice talking on a digital cell phone, but you will hear it more clearly

3G network

International Mobile Telecommunications-2000 (IMT-- 2000), better known as 3G or 3rd Generation, is a generation of standards for mobile phones and mobile telecommunications services fulfilling the International Telecommunication Union. [3]It uses Wide Band Wireless Network with which clarity is increased. The data are sent through the technology called Packet Switching. Voice calls are interpreted through Circuit Switching. Along with verbal communication it includes data services, access to television/video, new services like Global Roaming. It operates at a range of 2100MHz and has a bandwidth of 15-20MHz used for High-speed internet service, video chatting.3G uses Wide Band Voice Channel that is by this the world has been contracted to a little village because a person can contact with other person located in any part of the world and can even send messages too[3].

Technologies under 3G:

2G comprised of the following Mobile technologies: 3G Technology comprises of Wideband CDMA, WLAN, Bluetooth, Universal Mobile telecommunication Systems (UMTS), High Speed Downlink Packet Access (HSDPA). Data are sent through packet switching. Voice calls are interpreted using circuit switching. It also provides facilities such as Global Roaming Clarity in voice calls, Fast Communication, Internet, Mobile T.V, Video Conferencing, Video Calls, Multi Media Messaging Service (MMS), 3D gaming and Multiplayer-Gaming.

Issues with 3G:

Although the usage price of 3G technology has greatly reduced since its inception due to wider adoption, it still is very costly as compared to 2G technologies. Due to high bandwidth transmission of 3G technologies, power consumption greatly increases which results in reduced

device battery life. The data consumption of 3G at times becomes so heavy due to the high transmission rates that it puts a big load on the network; to alleviate which, many cellular operators implemented data usage caps which were disadvantageous to customers

4G network

In March 2008, the International Telecommunications Union-Radio communications sector (ITU-R) specified a set of requirements for 4G standards, named the International Mobile Telecommunications Advanced (IMT-Advanced) specification, setting peak speed requirements for 4G service at 100 megabits per second (Mbit/s) for high mobility communication (such as from trains and cars) and 1 gigabit per second (Gbit/s) for low mobility communication (such as pedestrians and stationary users).[4] A 4G system not only provides voice and other 3G services but also provides ultra-broadband network access to mobile devices. Applications vary from IP telephony, HD Mobile Television, video conferencing to gaming services and cloud computing. One of the initial devices to access 4G network was USB wireless modem which was later followed by cellular phones with WiMax and LTE technology.

Technologies under 4G:

4G comprised of the following Mobile technologies:

Long Term Evolution (LTE) Standard based on the GSM/EDGE and UMTS/HSPA, 3rd Generation Partnership Project (3GPP), Multiple In Multiple Output (MIMO) smart antenna technology, Orthogonal Frequency Digital Multiplexing (OFDM), 802.16e - Worldwide Interoperability for Microwave Access (WiMAX), 802.20 - Mobile Broadband Wireless Access (MBWA)

Issues with 4G:

3G and 4G components made for one continent is not always compatible with another continent due to carrying frequency bands. Another prominent issue in 4G systems is to make higher bit rates available in larger portion of the cell, especially to users in an exposed position in between several base stations. In current research, this issue is addressed by macro-diversity techniques, also known as group cooperative relay, and also by Beam-Division Multiple Access (BDMA).[5] Pervasive networks are a hypothetical amorphous concept where the user can be simultaneously connected to several wireless access technologies and can seamlessly move between them. This technology has not yet been efficiently implemented.

- 2) **Packet loss** - Packets are sent from the source to the destination across several routers. Each router may get packet streams from many sources at the same time. When the packet arrival process fills the buffer of any of the routers, some packets are dropped. The network in this case is said to be congested. Packet loss may produce great damage to the received multimedia signal

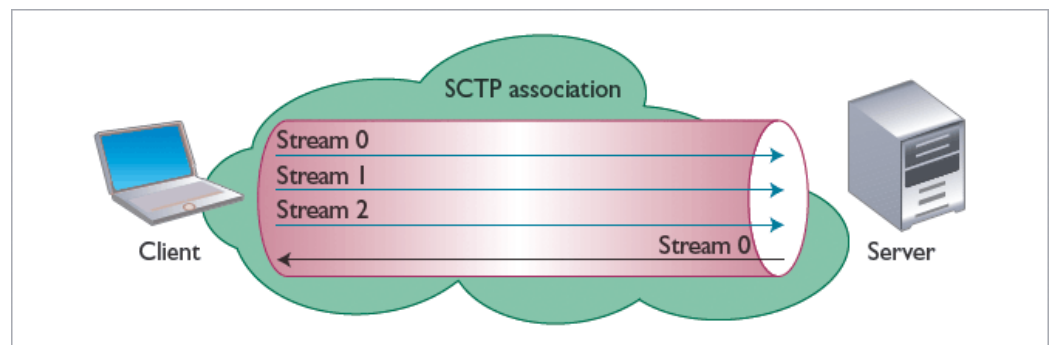
Packet Delay - To understand the effect of packet delay on multimedia quality, we take the case of voice transmission. Timing is an important characteristics of voice. Two syllables of a word are

uttered with an interval. This interval is as much a part of the voice as the uttered syllable. If additional delay is inserted between syllables, the rhythm of voice is lost. Long delay may force conversation to be half-duplex or introduce echo. Delay below 150 ms is acceptable. For long distance communication delay between 150 and 400 ms is also acceptable.

Network Jitter - It is the variance of the inter-packet arrival time at the receiver. Network jitter occurs due to the variability in queuing and propagation delays. To alleviate from jitter, a jitter buffer is used. The receiver holds the first packet in the buffer for a while before playing it out. The amount of the hold time is the measure of the size of the jitter buffer.

- 3) HDLC was defined by ISO for use on both point-to-point and multipoint data links
 - Broadly HDLC features are as follows:
 - Reliable protocol
 - selective repeat or go-back-N
 - Full-duplex communication
 - receive and transmit at the same time
 - Bit-oriented protocol
 - use bits to stuff flags occurring in data
 - Flow control
 - adjust window size based on receiver capability
 - Uses physical layer clocking and synchronization to send and receive frames
- 4) PPP is a protocol that can be used to establish communication between any two communicating devices that need to exchange information. Information is exchanged in the form of structured data packets. The point-to-point links that utilize this protocol should be able to support full-duplex communication. PPP provides 3 major services
 - Encapsulation packets over serial link.
 - The Link Control Protocol (LCP) to maintain, test and terminate the data-link connection
 - The Network Control Protocol (NCP) to allow simultaneous encapsulation of multiple network layer protocols across the same data-link which is referred to as protocol Multiplexing
 - Authentication, with PAP or CHAP, is used as a security measure with PPP. Authentication allows the dial-up target to identify that any given dialup client is a valid client with a pre assigned username and password.
 - Password Authentication Protocol (PAP):
 - Passwords are sent across the link in clear text
 - The remote node is in control of the frequency and timing of the login attempts.
 - Challenge Handshake Authentication Protocol (CHAP):
 - Encryption and Hashing
 - The access server is in charge of the frequency and timing of the login attempts
 - Authentication is done upon initial link establishment and may be repeated any time after the link has been established.
- 5)
 - a. ARP –ARP associates an IP address with its physical address. On a typical physical network, such as a LAN, each device on a link is identified by a physical or station address that is usually imprinted on the NIC.

- b. RARP - RARP finds the logical address for a machine that only knows its physical address.
 - c. DHCP Protocol - Dynamic Host Configuration Protocol Used for dynamic allocation of IP addresses used for hosts that run only client applications Allows for host-specific configuration parameters to be delivered from a DHCP server to a host.
 - d. The Internet Control Message Protocol (ICMP) is a helper protocol that supports IP with facility for
 - Error reporting
 - Simple queries
 - e. IGMP Protocol – helps build up multicasting groups and maintain membership lists so that mean IGMP know how members are join and leave a group
 - f. SNMP- which stands for Simple Network Management Protocol, is a communication protocol that lets you monitor managed network devices including Routers, Switches, Servers, Printers and other devices that are IP enabled all through a single management system/software. Main functions of SNMP
 - Monitor inbound and outbound Traffic flowing through the device
 - Early Detection of faults within network devices along with Alerts/Notifications
 - Analyzing data collected from devices over long periods of time to identify bottlenecks and performance issues
 - Ability to remotely configure compatible devices
 - Access and Control devices remotely that are connected via SNMP
- 6) SCTP (Stream Control Transmission Protocol) is a protocol for transmitting multiple streams of data at the same time between two end points that have established a connection in a network.



Features	SCTP	TCP
Connection oriented	yes	yes
Full duplex	yes	yes
Reliable data transfer	yes	yes
Partial Reliable data transfer	Optional	no
Ordered data delivery	yes	yes
Unordered data delivery	yes	no
Flow control	yes	yes
Congestion control	yes	yes
Multistreaming	yes	no

Multihoming	yes	no
Path MTU discovery	yes	yes
Protection against SYN flooding attacks	yes	no
Allows half-closed connections	no	yes
Time wait state	For vtags	For 4 tuple

- 7) Congestion in a network may occur if the load on the network—the number of packets sent to the network—is greater than the capacity of the network—the number of packets a network can handle. Congestion control refers to the mechanisms and techniques to control the congestion and keep the load below the capacity.

Congestion control refers to techniques and mechanisms that can either prevent congestion, before it happens, or remove congestion, after it has happened. In general, we can divide congestion control mechanisms into two broad categories: open-loop congestion control (prevention) and closed-loop congestion control (removal).

8)

- a. Ipvsec- provide security for a packet at the network level. IPSec helps to create authenticated and confidential packets for the IP layer
- b. VPN- virtual private network) is a technology that is gaining popularity among large organizations that use the global Internet for both intra- and inter organization communication, but require privacy in their internal communications

9)

- a. SDN- It is an emerging technology in networking which allows the administrator to manage network services through abstraction of lower-level functionality. This technology separate the network control and forwarding functions making the control of the network directly programmable. The Open Flow is the foundation for SDN solutions.
- b. NFV- It is the process of using the virtualization techniques to virtualize the network services currently carried out by dedicated hardware. The goal of this method is to separate the services from hardware and host them in VMs. Once the current services runs in a hypervisor, the services can be operated on standard x86 servers.
- c. OTT- Is any app or service that provides a product or service using the Internet which bypass the traditional method of distributing the particular product or service. Most of those services are typically related to media and communication
- d. Home network- A private collection of devices like computers, mobile phones, gaming consoles which are connected to a switch or router at home, is a home network.

- e. IoT- It is a concept of expanding the existing network in the world. The goal of this development concept is to have network connectivity to almost all the everyday objects.
- f. LiFi- Light fidelity is the method of bidirectional communication using visible light. LiFi communication travel at very high speed.
- g. BYOD- Refers to the policy which permits the employs to bring their personally owned devices into their workplace and to use the privileged company applications and information.

10)

- a. Security- Wired networks gets on top of this also since it is recruited between devices. But recently Wi-Fi also able to achieve a reasonable level in security, especially by hiding signal making it harder for unauthorized devices to pick up.
- b. Reliability- Here wired networks has the advantage. Though wireless networks are open, wired networks are physically restated between two devices.
- c. Usability- wireless networks are easy to deploy and maintain. It is a plug and play type infrastructure. You can easily connect up to 200 devices. But wired networks are comparatively difficult to maintain and deeply since they are mainly based on wires.