Victoria University of Bangladesh

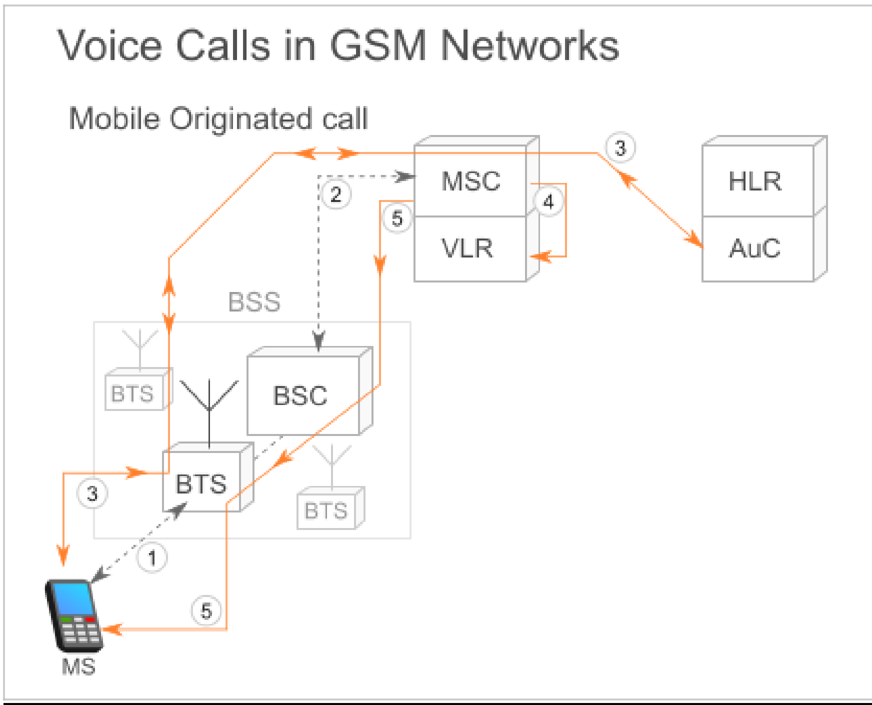
Name: Md. Ziaul Hoque “Sohel”
Student ID: 2221220031

Course Title: Computer Networks
Course Code: CSE 323
Batch: 22nd(evening)

Ans to the Que No 2(A)

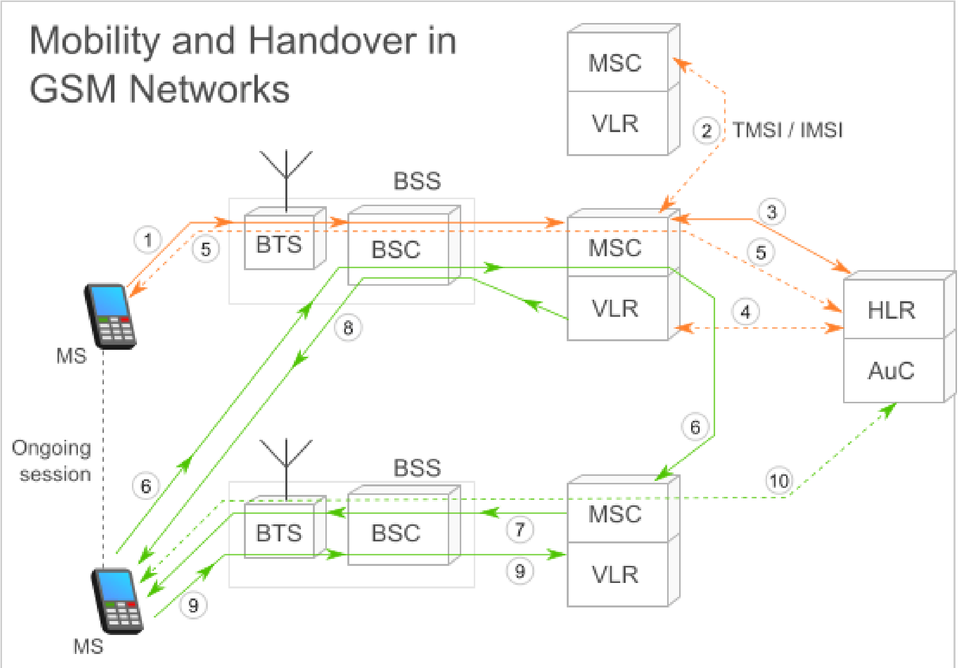
Mobile-originated call:

A call originating from a mobile device (MS) in the GSM network is routed through the core network to the destination party. To connect to the GSM network, an MS first connects to a radio network, which is in charge of handling messaging between devices and the core network. An MS is constantly communicating with the Base Station Subsystem of the radio network to send and receive signals. The steps to establishing a GSM voice call are illustrated below.



Handover Call:

Mobility and handover functions are required whenever MS location changes occur, and depend on whether the device is engaged in a call session (when handover is required) or not (mobility management). In GSM networks the location of a device is always known to the network and updated whenever necessary. Location updating is needed in the case an MS roams to a different location area. An MS is constantly listening to signals from the radio network (to detect whether it is paged for an incoming message) and in its turn communicates its location to the radio network whenever it enters a new location area. When not in a call, the MS connects to the cell that has the strongest signal, and when it detects a stronger signal from a different cell, it will disconnect from the current one and connect to the new one. If the MS moves to a new cell of the same location area, it is not necessary for it to reconnect (authenticate) to the network. If instead it goes into the range of a new Location Area, a location update procedure is initiated. Essentially, the MSC/VLR in the home network must register the new location so that the device can be available to other devices trying to send it a communication. Mobility procedures are shown in orange below:



Ans to the Que No 2(B)

Network Performance Measures:

• Relative to traffic:
-Bits per second
-Packets per second
-Unicast vs. non-unicast packets
-Errors -Dropped packets
-Flows per second
-Delay (RTT)
-Jitter (delay variation)

• Channel utilization :: the average fraction of
time a channel is busy [e.g. Util = 0.8] – when overhead is taken into account (i.e.,
excluded from useful bits, channel utilization is often referred to as channel efficiency

• Throughput :: bits/sec. successfully transmitted [e.g. Tput = 10 Mbps]

Types of Routing Algorithms:

Routing algorithms can be broadly categorized into two types, adaptive and nonadaptive routing algorithms. They can be further categorized as shown in the following diagram –

Adaptive Routing Algorithms
Adaptive routing algorithms, also known as dynamic routing algorithms, makes routing decisions dynamically depending on the network conditions. It constructs the routing table depending upon the network traffic and topology. They try to compute the optimized route depending upon the hop count, transit time and distance. The three popular types of adaptive routing algorithms are –

Centralized algorithm – It finds the least-cost path between source and destination nodes by using global knowledge about the network. So, it is also known as global routing algorithm.
Isolated algorithm – This algorithm procures the routing information by using local information instead of gathering information from other nodes.

Distributed algorithm – This is a decentralized algorithm that computes the least-cost path between source and destination iteratively in a distributed manner.

Non – Adaptive Routing Algorithms

Non-adaptive Routing algorithms, also known as static routing algorithms, construct a static routing table to determine the path through which packets are to be sent. The static routing table is constructed based upon the routing information stored in the routers when the network is booted up.

The two types of non – adaptive routing algorithms are –

Flooding – In flooding, when a data packet arrives at a router, it is sent to all the outgoing links except the one it has arrived on. Flooding may be uncontrolled, controlled or selective flooding.
Random walks – This is a probabilistic algorithm where a data packet is sent by the router to any one of its neighbors randomly.

Ans to the Que No 3(A)

Answer:

$A_1^6/6!$	6	$A_1^6/6!$						
$A_1^5/5!$	5	$A_1^5/5!$	$A2A_1^5/5!$					
$A_1^4/4!$	4	$A_1^4/4!$	$A2A_1^4/4!$	$A_2^2/2!\ A_1^4/4!$				
$A_1^3/3!$	3	$A_1^3/3!$	$A2A_1^3/3!$	$A_2^2/2!\ A_1^3/3!$	$A_2^3/3!\ A_1^4/4!$			
$A_1^2/2!$	2	$A_1^2/2!$	$A2A_1^2/2!$	$A_2^2/2!\ A_1^2/2!$	$A_2^3/3!\ A_1^2/2!$	$A_2^4/4!\ A_1^2/2!$		
A1	1	A1	A2A1	$A1A_2^2/2!$	$A1.A_1^2/2!$	$A1.A_2^4/4!$	$A1.A_2^5/5!$	
1	0	1	A2	$A_2^2/2!$	$A_2^3/3!$	$A_2^4/4!$	$A_2^5/5!$	$A_2^6/6!$
		Channel 0	1	2	3	4	5	6
		1	A2	$A_2^2/2!$	$A_2^3/3!$	$A_2^4/4!$	$A_2^5/5!$	$A_2^6/6!$

A1=2

A2=3

$A_1^6/6!$	0.0889
$A_1^5/5!$	0.267
$A_1^4/4!$	0.667
$A_1^3/3!$	1.333
$A_1^2/2!$	2

$A_2^2/2!$	4.5
$A_2^3/3!$	4.5
$A_2^4/4!$	3.375
$A_2^5/5!$	2.025
$A_2^6/6!$	1.013

$A_1^6/6!$	6	0.0889						
$A_1^5/5!$	5	0.267	0.801					
$A_1^4/4!$	4	0.667	2.001	3.0015				
$A_1^3/3!$	3	1.333	3.999	5.9985	5.9985			
$A_1^2/2!$	2	2	6	9	9	6.75		
A1	1	2	6	9	9	6.75	4.05	
1	0	1	3	4.5	4.5	3.375	2.025	1.013
		Channel 0	1	2	3	4	5	6
		1	A2	$A_2^2/2!$	$A_2^3/3!$	$A_2^4/4!$	$A_2^5/5!$	$A_2^6/6!$

The blocking probability of A_1 traffic,

Bl= 0.0889+0.801+3.0015+5.9985+6.75+4.05+1.013 = 21.7

The blocking probability of A_2 traffic

B_2 = 0.0889+0.801+3.0015+5.9985+6.75+4.05+1.013 = 21.7

Ans to the Que No 4(A)

Traffic intensity/user = $\lambda.t_h$
= 1.(1/60).2.5
= 0.042 Erl/user

For each cell, n = 20, B = 10%

From Erlang's table, The offered traffic, A=17.61Erls.

Number of users/cell = 17.61/0.042 = 419

Total number of users = 700×419 = 293300

Penetration rate = (Number of users/Total population) ×100

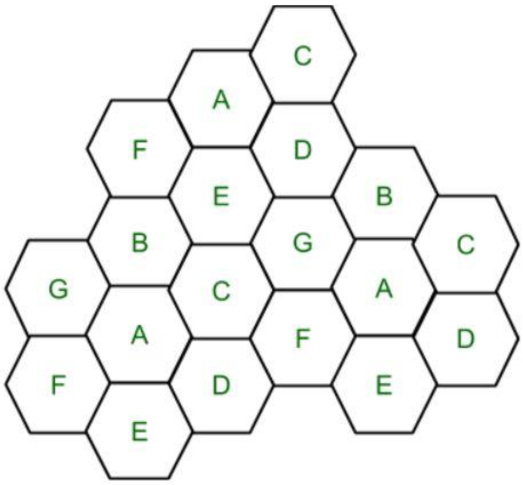
=(293300/4 × 10^6) 100

= 7.33%

Ans to the Que No 4(B)

Frequency Reuse:

Frequency Reuse is the scheme in which allocation and reuse of channels throughout a coverage region is done. Each cellular base station is allocated a group of radio channels or Frequency sub-bands to be used within a small geographic area known as a cell. The shape of the cell is Hexagonal. The process of selecting and allocating the frequency sub-bands for all of the cellular base station within a system is called Frequency reuse or Frequency Planning.



A Cellular Network:

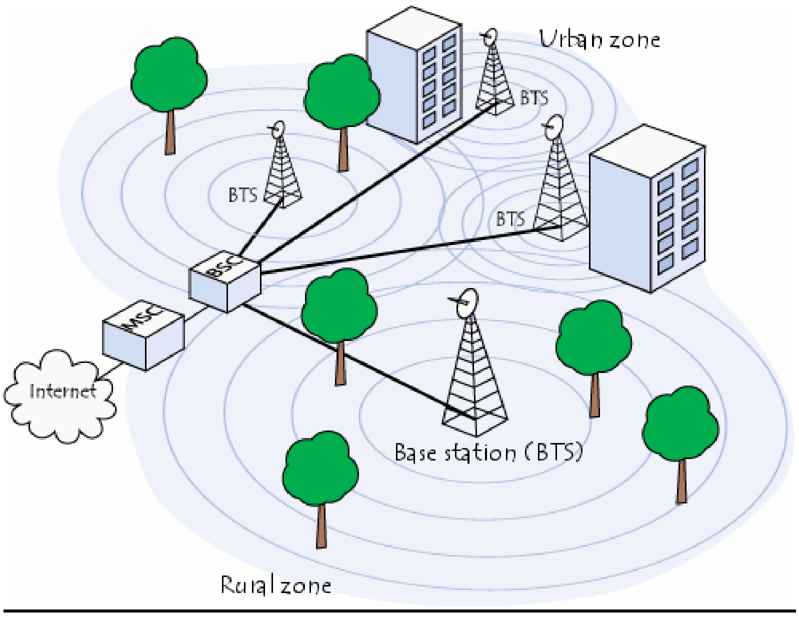
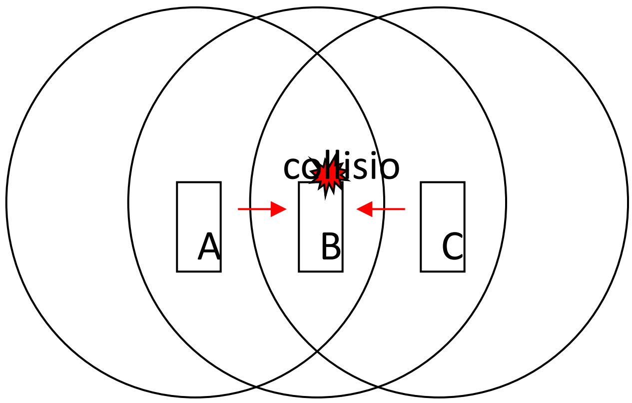


Fig: Cellular Network

Ans to the Que No 5(A)

Hidden Terminal Problem:

Suppose that computer A is transmitting to computer B (one way), but the radio range of A is too short to reach computer C. If C wants to transmit to B it can listen to the ether before starting, but the fact that it does not hear anything (since it is outside the coverage of A) does not mean that its transmission will succeed. The 802.11 standard had to solve this problem (CSMA/CA).



A and B can hear each other. B and C can hear each other. But A and C cannot hear each other.
When A is sending data to B, C cannot sense this activity and hence C is allowed to send data to B at the same time. This will cause a collision at B.

Ans to the Que No 5(B)

Cell Cluster:

Cells in a cellular network are generally "grouped" together into cell clusters. Cellular networks are generally designed as a repeated cluster pattern The number of cells in a cluster (typically 4,7, 12 or 21) is a trade-off between the traffic capacity in the cluster and its interference with the adjacent cluster of cells (where the same frequencies will be re-used).

Cell Pattern $N = 7$