Experiment 7: Study of how call blocking probability varies with respect to the load on a GSM network

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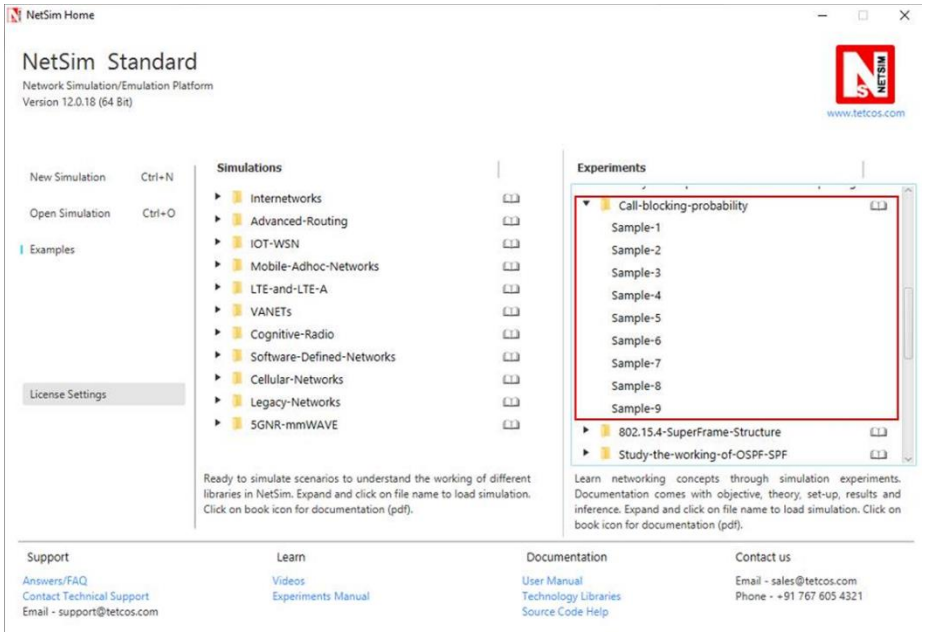
Aim:

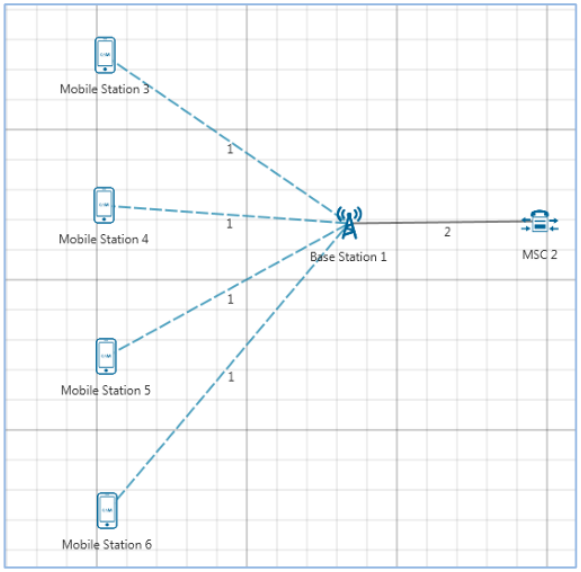
To study how call blocking probability varies as the load on a GSM network is continuously increased, using Netsim.

Procedure:

Network Setup: Open NetSim and click Examples > Experiments > Call-blocking-probability as shown below:



NetSim UI displays the configuration file corresponding to this experiment as shown below:

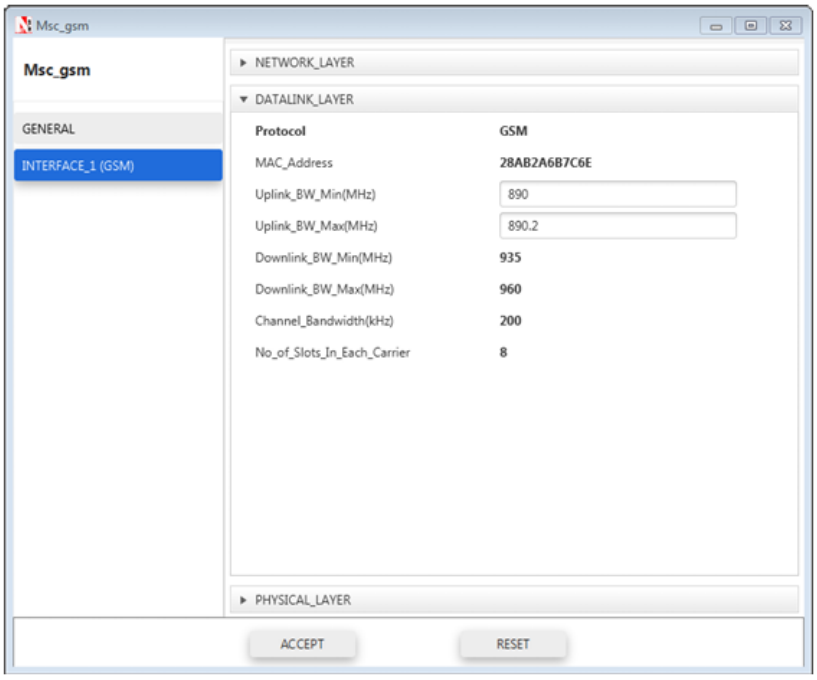


The following set of procedures were done to generate this sample:

Step 1: A network scenario is designed in NetSim GUI comprising of 4 Mobile Stations, 1 MSC, and 1 Base Station in the “Cellular Networks” Network Library.

Step 2: Ensure all the Mobile Stations are placed within the range of Base Station.

Step 3: In the Interface GSM > Data Link Layer Properties of MSC 2, Uplink BW Min and Uplink BW Max are set to 890 MHz and 890.2 MHz respectively.



Step 4: Right click on the Application Flow App1 ERLANG CALL and select Properties or click on the Application icon present in the top ribbon/toolbar. The applications are set as per the below table:

Application Properties	Application 1	Application2
Application type	Erlang_call	Erlang_call
Source_Id	3	5
Destination_Id	4	6
Call		
Duration_ Distribution	Exponential	Exponential
Duration(s)	60	60
Inter Arrival Time (sec)	10	10
IAT_ Distribution	Exponential	Exponential
Codec	Custom	Custom
Inter Arrival Time distribution	Constant	Constant
Packet Distribution	Constant	Constant
Service Type	CBR	CBR
Packet Size	33	33
Inter Arrival Time (μs)	20000	20000

Step 5: Run the Simulation for 100 Seconds.

The following changes in settings are done from the previous sample: 20000
Step 1: In the next sample, increase the number of Mobile Stations by 2 and add one more application between them.

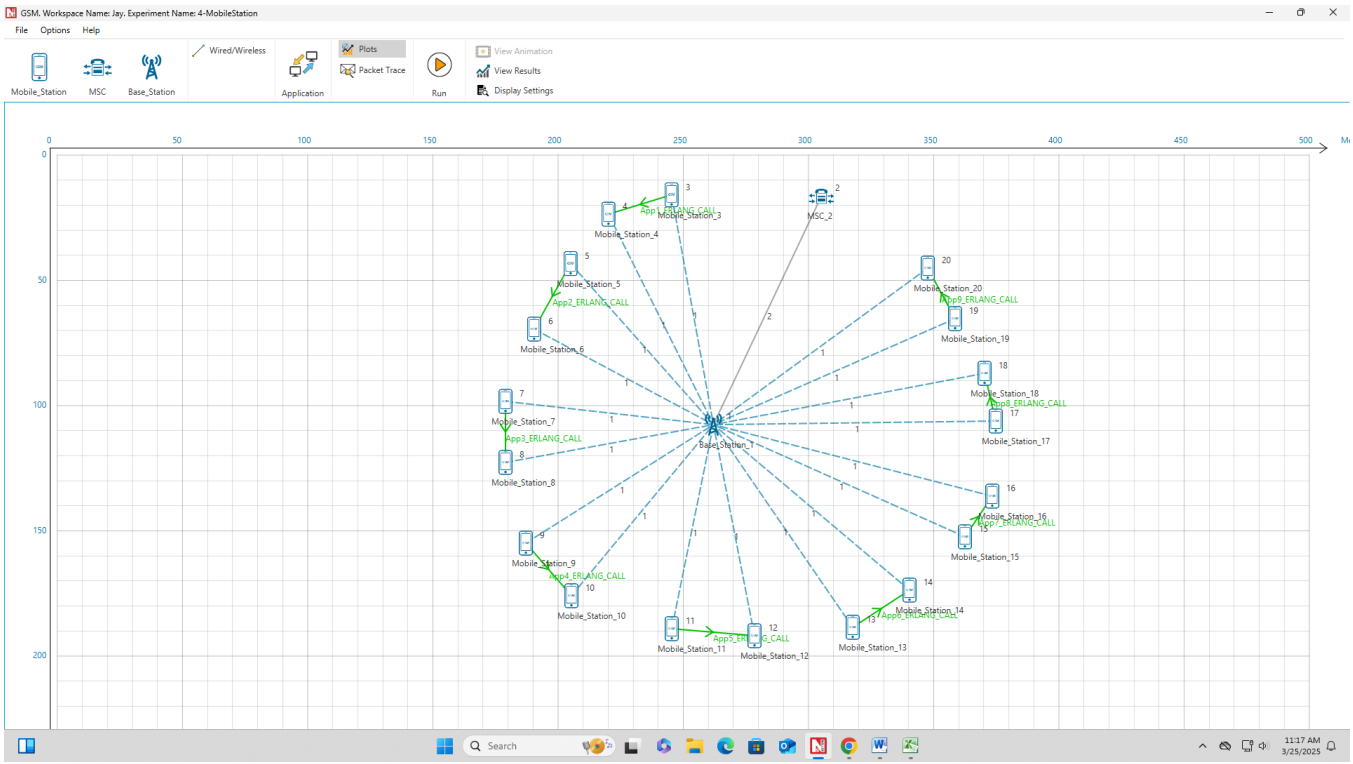
Step 2: Run the Simulation for 100 Seconds.

The following changes in settings are done from the previous sample:

Step 1: Similarly, increase the number of Mobile Stations by 2 up to 20 and set properties for different Samples by adding an application every time and changing Source ID and Destination ID.

Step 2: Run the Simulation for 100 Seconds.

Simulation Diagram in NetSim:



Output:

To view the output, go to the Cellular Metrics. In MS metrics, take sum of call blocking probability (It is the as ratio of Total call blocked to Total call generated).

For 2 Erlang Calls:

MS Id	Call Generated	Call Blocked	Call Blocking probability
3	4	0	0
4	0	0	0
5	2	0	0
6	0	0	0

For 3 Erlang Calls:

MS Id	Call Generated	Call Blocked	Call Blocking probability
3	4	0	0
4	0	0	0
5	2	0	0
6	0	0	0
7	2	0	0
8	0	0	0

For 4 Erlang Calls:

MS Id	Call Generated	Call Blocked	Call Blocking probability
3	4	0	0
4	0	0	0
5	2	0	0
6	0	0	0
7	2	0	0
8	0	0	0
9	2	1	0.5
10	0	0	0

For 5 Erlang Calls:

MS Id	Call Generated	Call Blocked	Call Blocking probability
3	4	0	0
4	0	0	0
5	2	0	0
6	0	0	0
7	2	1	0.5
8	0	0	0
9	2	1	0.5
10	0	0	0
11	2	1	0.5
12	0	0	0

For 6 Erlang Calls:

MS Id	Call Generated	Call Blocked	Call Blocking probability
3	4	0	0
4	0	0	0
5	2	0	0
6	0	0	0
7	2	1	0.5
8	0	0	0
9	2	1	0.5
10	0	0	0
11	2	1	0.5
12	0	0	0
13	2	1	0.5
14	0	0	0

For 7 Erlang Calls:

MS Id	Call Generated	Call Blocked	Call Blocking probability
3	4	0	0
4	0	0	0
5	2	0	0
6	0	0	0
7	2	1	0.5
8	0	0	0
9	2	1	0.5
10	0	0	0
11	2	1	0.5
12	0	0	0
13	2	1	0.5
14	0	0	0
15	2	1	0.5
16	0	0	0

For 8 Erlang Calls:

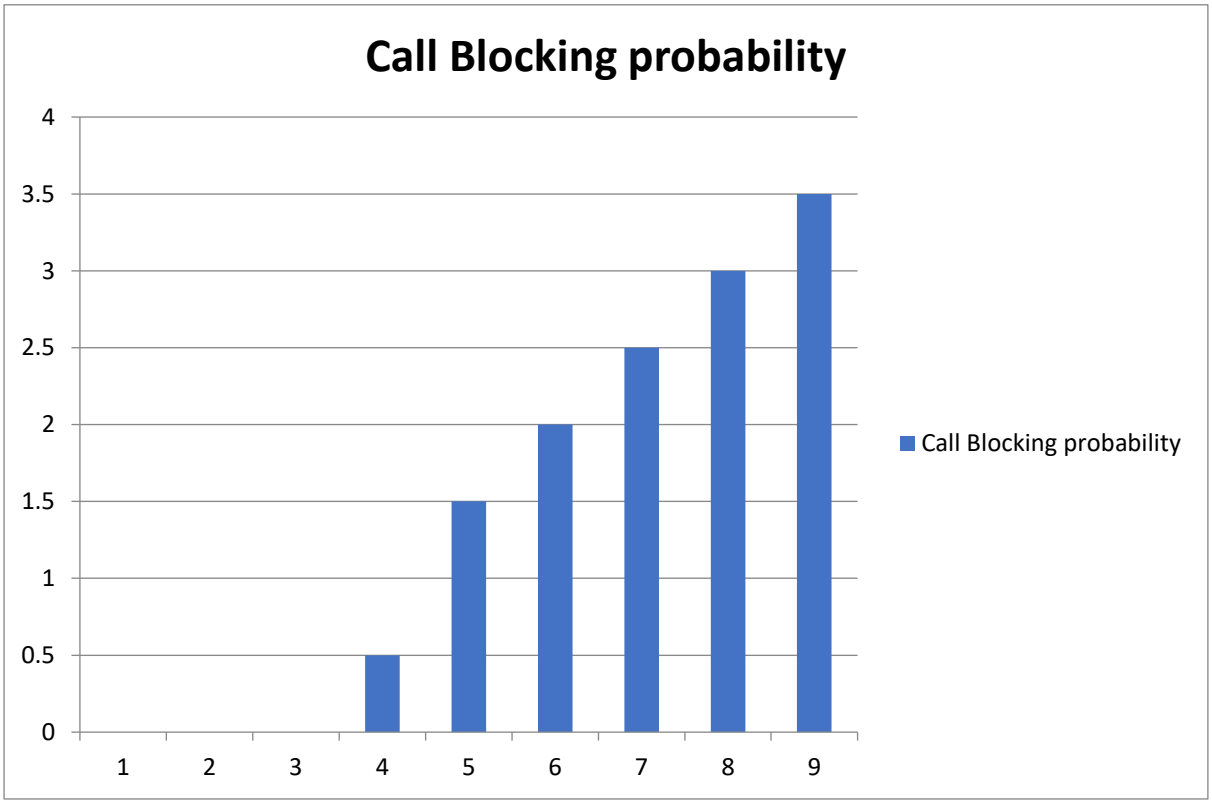
MS Id	Call Generated	Call Blocked	Call Blocking probability
3	4	0	0
4	0	0	0
5	2	0	0
6	0	0	0
7	2	1	0.5
8	0	0	0
9	2	1	0.5
10	0	0	0
11	2	1	0.5
12	0	0	0
13	2	1	0.5
14	0	0	0
15	2	1	0.5
16	0	0	0
17	2	1	0.5
18	0	0	0

For 9 Erlang Calls:

MS Id	Call Generated	Call Blocked	Call Blocking probability
3	4	0	0
4	0	0	0
5	2	0	0
6	0	0	0
7	2	1	0.5
8	0	0	0
9	2	1	0.5
10	0	0	0
11	2	1	0.5
12	0	0	0
13	2	1	0.5
14	0	0	0
15	2	1	0.5
16	0	0	0
17	2	1	0.5
18	0	0	0
19	2	1	0.5
20	0	0	0

Average Call Blocking Probability Tabulation and Graph:

Samples	Call Blocking probability
1	0
2	0
3	0
4	0.5
5	1.5
6	2
7	2.5
8	3
9	3.5



All the above plots highly depend upon the placement of Mobile station in the simulation environment. So, note that even if the placement is slightly different the same set of values will not be got but one would notice a similar trend.

Inference:

When the number of MS is increased from 4 to 20 the call blocking probability increases from 0 to 3.5. As we increase the number of mobile stations more calls are generated. This increases the traffic load on the system & more calls generated implies more channel requests arrive at the base station but the number of channels is fixed. So when the base station does not find any free channel the call is blocked. An additional observation is that the call blocking is zero until 8 MS. This is because the number of channels is sufficient to handle all call that 6 MS may generate. Only after this the base station does not find free channels and blocks calls.

Result:

Hence, how call blocking probability varies as the load on a GSM network is continuously increased was understood and call blocking probabilities were plotted using the data obtained from the simulations.