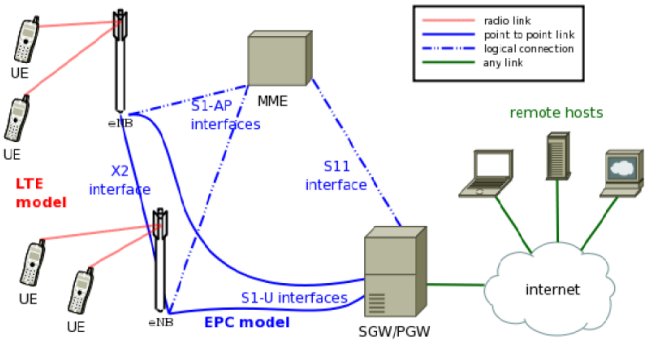
LTE Auto handover

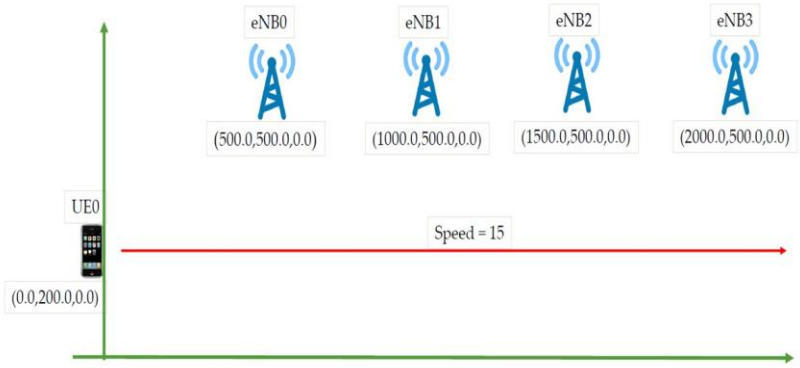
1 Objective

The objective is to comprehend the handover process in LTE environment as the UE moves between different eNBs. The UE is connected to a remote host via the LTE network and uses UDP application. As the UE moves away from the range of one eNB and comes closer to another eNB, the SNR associated with the serving eNB drops while that of the new eNB rises. When the SNR from the serving eNB drops below a threshold, the handover process will be initiated and the existing network connection of that UE will be transferred to the new eNB offering higher SNR.



Overview of the LTE-EPC simulation model

2 System Description



A sample scenario of UE0 being attached to eNB0 initially and initiating multiple handovers when moving towards right

- The use of EPC allows IPv4 networking with LTE devices. Assume point-to-point connections between the various EPC entities (PGW, MME, eNBs) in the LTE Network. To implement this, instantiate a PointToPointEpcHelper. LteHelper takes a EpcHelpertype (P2PEpcHelper in our case) using the following command SetEpcHelper(). This will generate the entire EPC network with the proper connections(P2P) connected to the LteHelper which sets up the rest of LTE network (eNBs and UEs)

- The PGW node handles internet traffic to/from the LTE Radio Access Network. After setting up the EPC, PGW node (as well as others) is available. Access it using GetPgwNode() that would returns a Node object. Since the UE needs to be connected to a remote host via the PGW, create the remote-host node with the help of NodeContainer. Explicitly connect the PGW node

to the remote host which will simulate our Internet connection for the entire LTE network. Use the simplest connection (Point-to-Point) between the PGW and remote host and setup the interference and IP addresses accordingly (similar to first.cc)

- Use the A2A4Rsrqtype of handover algorithm in this simulation. Handover algorithm is defined as an attribute within LteHelper. Set the HandoverAlgorithmType to A2A4RsrqHandover Algorithm. Use LteHelper to set the two attributes of the handover algorithm: ServingCellThreshold → 30 and NeighbourCellOffset → 1

- Mobility is required for the UE to make sure handover is triggered. Setup Constant Velocity for UE by using ConstantVelocityMobilityModel.

- Set the Default Gateway for the UE using IPv4StaticRouting. It is also required to route the packets between the internet host and the LTE network

- The application will send/receive UDP packets. Use two PacketSinkHelper objects, to instantiate the receive side of downlink/uplink sockets by using UdpSocketFactory

- Define parameter - Traffic Flow Template (TFT), which is a struct that identifies the type of traffic that will be mapped to the dedicated EPS bearer. Use DedicatedEpsBearer for the application, which is an attribute in LteHelper. Use the data type NGBR_VIDEO_TCP_DEFAULT

- Use LteHelper to set the X2 interface between the eNBs. Towards a simpler measurement, use the downlink SNR and throughput as the metrics as the UE moves in and out of range of different eNBs to understand the handover process.

3 Simulation Tasks

- After writing the script, run the simulation for the time by which the UE, going in the same direction, will be at the end of coverage area of the last eNB.

- Use two specific trace files physical layer stats: EnablePhyTraces() and Rlc(LTE mac module) stats: EnableRlcTraces()

- Measure the stabilized SINR value for this UE from the PhyStats traces during simulation.

- Measure the downlink throughput (Received Packet/Time) for UE at difference location.

- Plot (i) received SINR versus time (GNUPlot, MATLAB, etc) (ii) throughput versus time

- Distinguish the times of handover in the SINR plot. At what times and what values of SINR trigger handover? Tabulate your observations.

Expected deliverables:

Your submission should include the items given below on the following day of your deadline.

NS3 simulation code

Results in the form of plots and tables

Report with detailed answer to each task, observations and conclusions derived from the study (About 3 pages without script)