

# Mobile and Broadband Access Networks

## Lab session OPNET: UMTS - Part 1

### Background information

Liesbeth Peters, Abram Schoutteet,  
Bart Slock, Eli De Poorter

## 1 Introduction to the OPNET UMTS model

### 1.1 UMTS background

Figure 1 illustrates the **UMTS Model Architecture**.

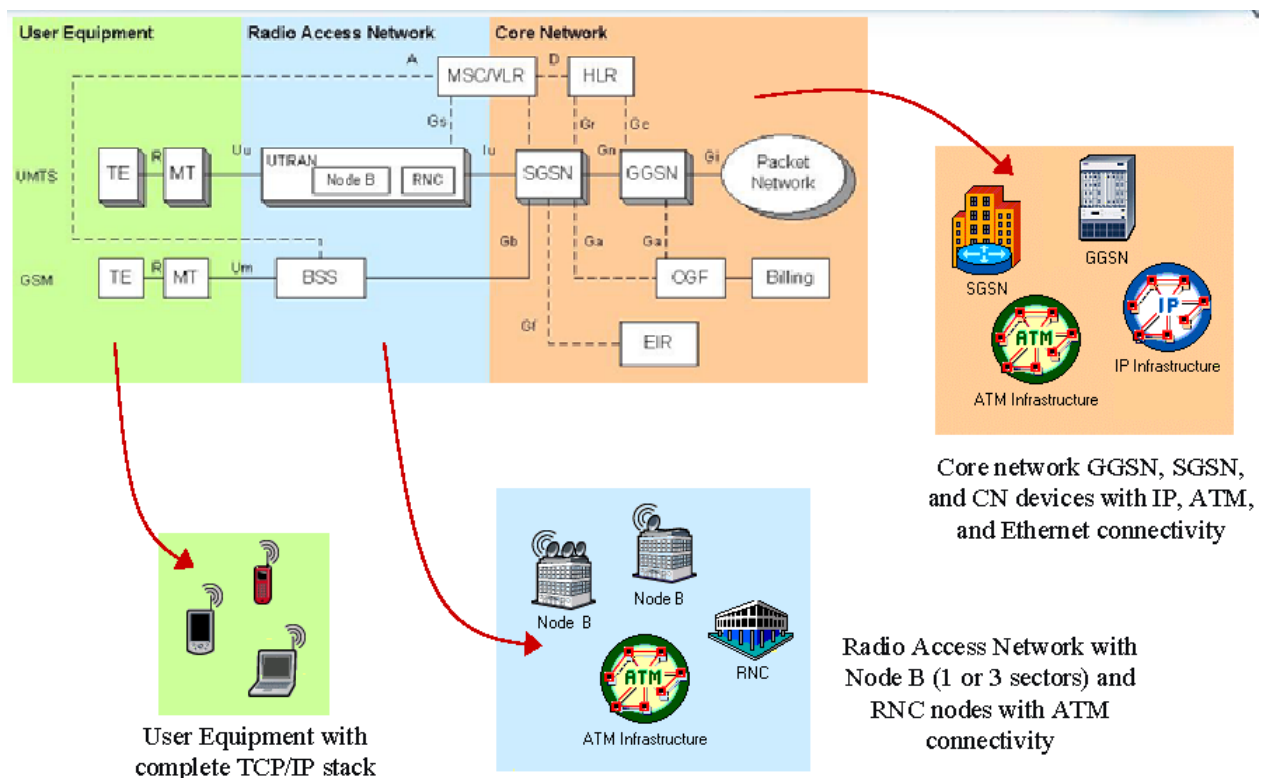


Figure 1: UMTS Model Architecture

The OPNET UMTS model suite has **two categories of node types**:

- Station models (Figure 2): Use these to model raw traffic at specified bit rates

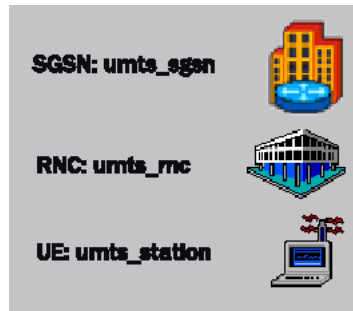


Figure 2: UMTS station models

- Full-stack models (Figure 3): Use these to model application traffic that travels over the full IP stack through an IP network.

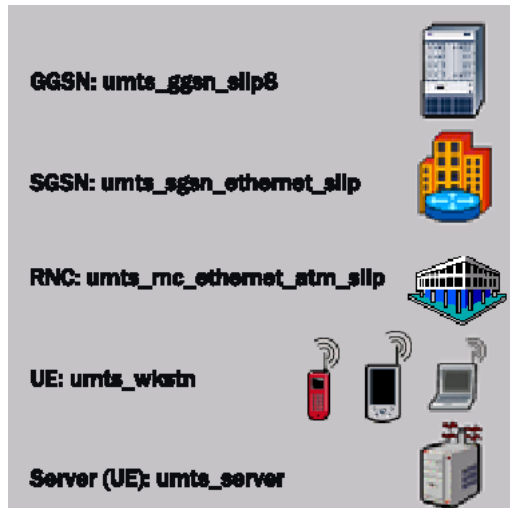


Figure 3: UMTS full-stack models

The resulting possible UMTS **network configurations** are illustrated in Figures 4 and 5.

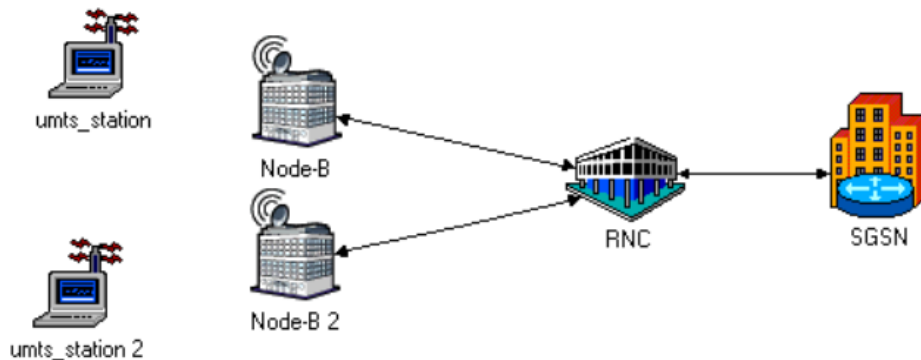


Figure 4: Simple UMTS network using raw traffic generation

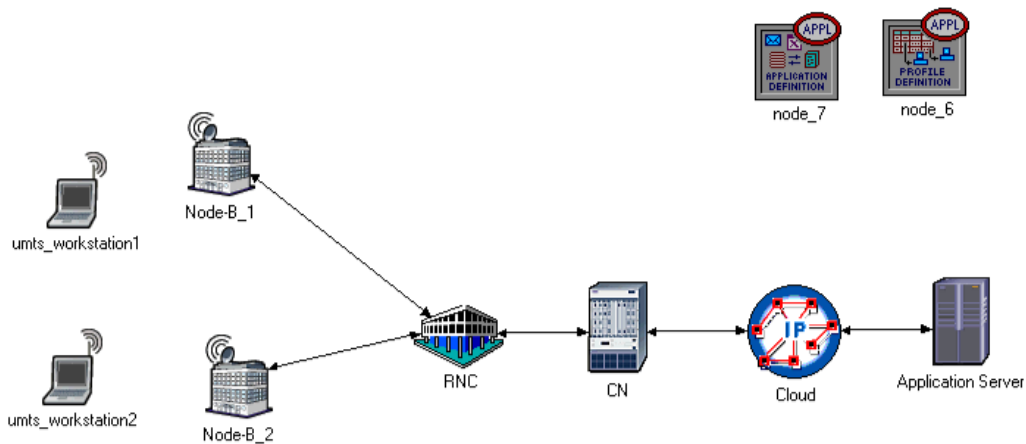


Figure 5: Simple UMTS network using application traffic

## 2 UMTS Practicum CASE 1: Soft Handover Probability

### 2.1 Background

The probability a user is in soft handover mode is an important parameter for radio network planning. As an excessive amount of soft handovers causes an overhead on system resources used, it is important to be able to set system parameters to an appropriate level resulting in a number of handovers that optimizes network performance.

The soft handover probability is the amount of users having multiple link connections relative to the total user population. The soft handover probabilities can be measured using **two different methods**. Either time ratios are used or this ratio is calculated directly by dividing numbers of users.

In the soft handover algorithm, illustrated in Figure 6, **the handoff threshold value** determines the maximum difference in measured quality there can exist between the pilot signal of the best cell in the Active Set of a mobile station and the pilot channel of any another cell in that Active Set. When the handoff threshold value increases, a larger

population of candidate signals will exist in the Active Set (limited by the Active Set Size), as a larger difference in Eb/No is allowed.

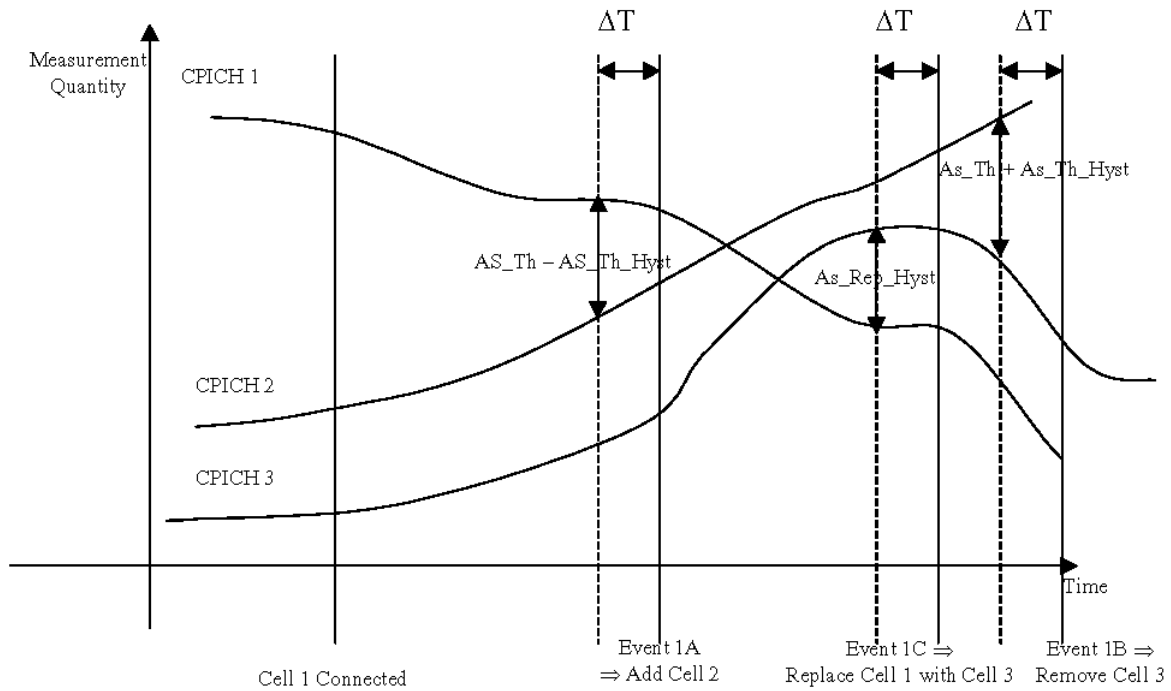


Figure 6: Example of the soft handover algorithm (maximum number of active cells = 2)

**The soft handoff window** is the zone in the network where soft handovers are possible. This implies that in this zone the strengths of the pilot signals from the two Node B's differ less than the soft handover threshold used in the system. When the Node B's are placed closer to each other, see also Figure 7, the so-called handoff window becomes smaller for the same threshold value.

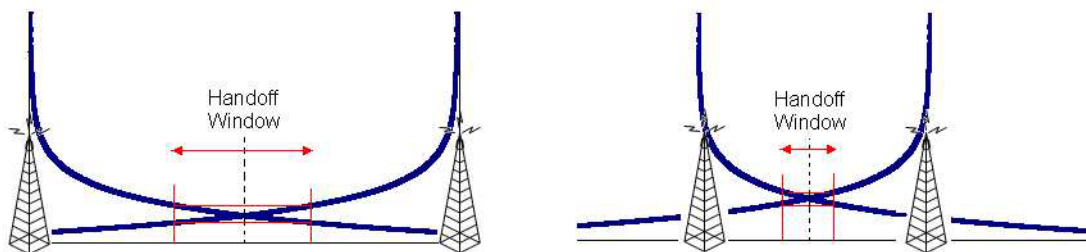


Figure 7: Comparison of handoff windows for different Node-B spacing

In this practicum, several handover issues are investigated. OPNET is used to get a better understanding of the soft vs hard handover mechanisms in UMTS systems. Investigated mechanisms include: the active set size, time of handover and handover probability.

## **Contact persons**

Liesbeth Peters (liesbeth.peters@intec.UGent.be)  
Abram Schoutteet (abram.schoutteet@intec.UGent.be)  
Bart Slock (bart.slock@intec.UGent.be)  
Eli De Poorter (eli.depoorter@intec.UGent.be)

## **Responsible teachers**

Prof. Piet Demeester (piet.demeester@intec.UGent.be)  
Prof. Ingrid Moerman (ingrid.moerman@intec.UGent.be)