RE56 Labs

STUDENTS

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WORK SUBJECT

HO: HANDOVER AND SELECTION/RESELECTION IN GSM/UMTS

DOCUMENT VERSION

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1. PURPOSE OF THE SYSTEM FUNCTION

In mobiles networks, handover and selection/reselection functionalities are needed to ensure mobility of users. Indeed, when a user move and change location, the network must be able to update the selected cell so the user does not lost the network and stay with a good connection. Handover and selection/reselection cover around the same needs but are used in different circumstances.

Selection is needed when the mobile has to select its first cell. It means that it's not currently connected to any network (the user switched it on or the network has been lost because of a lack of coverage). Reselection is used when the mobile is already connected and either idle or in packet switching (data transmission). Although the term reselection is used for both of the cases, reselection in idle mode and reselection in data transmission are different mechanisms and use different algorithms.

Handover is needed when the mobile user is currently used in circuit switching (classic voice call). Handover can be inter-system or intra-system. It is qualified by soft or hard depending on the conditions that you'll see in the table below.

Idle mode, when the mobile is switched on - SELECTION	
GSM	**UMTS**
RxLev : Signal strength received	RxLev : Signal strength received Ec/Io : Interferences
C1	Pilot CPICH / RSCP / SINR of cells belong to Broadcast Allocation List

Idle mode / data packet transfers mode - RESELECTION		
Data transmission	**Idle**	
GPRS/EDGE	**UMTS**	**GSM**
Based on RxQUAL	RSCP and SINR	RxLev : Signal strength received
Reselection using C'1, C31 and C32 criteria.	Reselection using the active set and monitored set with the parameters above	Reselection using C1 and C2 criteria

Connected mode - HANDOVER	
UMTS	**GSM**
RSCP / Ec/Io	The mobile scans the BCCH and return the best candidates based on RxLEV / RxQUAL
Handover using the active set and monitored set with RSCP and Ec/Io parameters, plus the SIR on the TCH and the thresholds	Handover using C1 and C2 criteria

2. INPUT DATA AND PARAMETERS

- ***is_calling*** *is a boolean indicating if the user is trying to do a call (in circuit switcing)*
- ***is_data_transmitting*** *is a boolean indicating if the user is using data or not.*

- ***hysteresis*** *is a number to define an hysteresis between two signal strength. Avoid flapping scenarii.*
- ***ntimes*** *is a number indicating how many times the check has to be done before performing the operation (handover or reselection). Avoid flapping scenarii.*

- ***update_strength(cell(s))*** *updates the strength of the cells given in parameters at the mobile location.*
- ***measure_landscape(type)*** *is a function that returns the cells of desired type (UMTS or GSM) which has been detected at mobile location.*

3. DESCRIPTION OF FORMULA AND ALGORITHM

3.1 Measurements

Measurements are KPI on downlink done by the UE and on uplink done by the Base Station. The KPI are used in order to take the decision on the link control : received power level, data rate, quality etc. Decisions are power control : selection, reselection or handover.

1. Free space propagation - Friis formula

Calculate the power received at the mobile from an antenna depending on distance and frequency used

⇨ **Pr = Pe + Ge + Gr + 27.55 - 20 log(F) – 20 N log(d)**

Pr = Power received at the mobile (in dBm)
Pe = Power emitted by the base station (in dBm)
Ge = Gain at base station in (dBi), for the simulation, we don't use it
Gr = Gain at mobile station in (dBi), for the simulation, we don't use it
F = Frequency of the used wave (in MHz)
d = Distance between the mobile and the base station (in m)
N= Diffraction factor = 1.5

2. SINR calculation

Give the signal interference ratio at the mobile for an antenna depending on the others signals received at this location. This formula is used for GSM.

⇨ **SINR(a) = Pr(a) / ∑(Pr(other signals))**

SINR(a) = Signal interference ratio at the mobile for signal a
Pr(a) = Power received at the mobile for signal a in Watt
∑(Pr(other signals))= Sum of all signals except signal a which are received at the mobile location (in Watt)

3. Signal Interference Noise Ratio (Ec/No)

This is the received energy per chip (Ec) of the pilot channel divided by the total noise power density (No). In other words, the Ec/No is the RSCP divided by the RSSI.

⇨ **Ec/No = 10*log (RSCP / RSSI)**

The better this value is, the better can a signal of a cell be distinguished from all overall noise. That is the indicator we use as the SINR (Signal to Interference Noise Ratio) for UMTS measurements.

4. Interference level for GSM

Measured in unallocated time slots.

5. Quality of reception: RXQUAL

RXQUAL is a value between 0 and 7 where each value corresponds to an estimated number of bits errors in a number of bursts. Greater is RXQUAL, Greater is the Bit Error Rate (and worse it the connection). There is a table of correspondence between RXQUAL, BER and SINR.

<table>
<tr><th>RXQUAL</th><th>BER</th><th>SINR</th></tr>
<tr><td>0</td><td>BER < 0.2 %</td><td>≥ 9 dB</td></tr>
<tr><td>1</td><td>0.2 % < BER < 0.4 %</td><td rowspan="2">7 - 8 dB</td></tr>
<tr><td>2</td><td>0.4 % ≤ BER < 0.8 %</td></tr>
<tr><td>3</td><td>0.8 % ≤ BER < 1.6. %</td><td rowspan="3">5 – 6 dB</td></tr>
<tr><td>4</td><td>1.6 % ≤ BER < 3.2 %</td></tr>
<tr><td>5</td><td>3.2 % ≤ BER < 6.4 %</td></tr>
<tr><td>6</td><td>6.4% ≤ BER < 12.8 %</td><td rowspan="2">< 5 dB</td></tr>
<tr><td>7</td><td>12.8 % ≤ BER</td></tr>
</table>

In the real world, BER is computed based on the bursts received by the MS and using some error detection algorithms. Since we will not have these data in our simulation, we will use the carrier to interference ratio as it is used for radio network planning. Indeed, there is a strong link between the C/I value and the BER that can be expected.

In order to understand how C/I on GSM is computed, we need to keep in mind that each antenna use a group of 8 frequencies with a width of 200 KHz each. Interference can come from other cells that use the same frequency, as well cells which use close frequencies, named adjacent cells. The adjacent cells have an impact on radio link quality because of the spreading due to multipath link between antenna and MS. Closer is the radio frequency used but the neighbor cell, greater is the impact on the quality link of the service cell. To ensure an overall C/I greater than 9dB, we use protection ratio depending on how close is the frequency of the neighbor cell with the frequency of the service cell.

We classify depending on the frequency used as below:

	A3	A2	A1	Co-Channel	A1	A2	A3	

Remember that each frequency is 200 KHz wide. So only the three closest frequencies signals are considered for C/I calculation (as well as co-channel frequency, i.e. signals with the same frequency). To take into account all these interference, we use this formula:

$$C/I = \frac{C}{\sum Icochannel + R1.\sum IA1 + R2.\sum IA2 + R3.\sum IA3}$$

$\sum Icochannel$ refers to the sum of signal strength interferences for frequencies using the same “channel”, $\sum IA1$ refers to the sum of signal strength interferences for frequencies classified in A1, and so on.

R1, R2, and R3 are given fixed parameters also called protection ration:

$R1 = 0.015$
$R2 = 10^{-5}$
$R3 = 10^{-6}$

6. Received level: RXLEV

Received level from neighbors cells: RXLEV_NCELL(n)
The neighbor cells are transmitted by the current cell.

7. QSI/QSC

If the UMTS layer is covered by the GSM layer, the GSM always measures and the UMTS measurements are optional. QSI on idle mode and QSC on connected mode are parameters on the GSM RxLev of serving cell to control the measurement of UTRAN neighbor cells.

QSI / QSC	Value in dBm
0	< - 98
1	< -94
2	< -90
3	< -86
4	< -82
5	< -78
6	< -74
7	Always
8	> -78
9	> -74
10	> -70
11	> -66
12	> -62
13	> -58
14	> -54
15 (default)	never

8. Distance between MS and BTS: MS_BS_DIST

Evaluated with Timing Advance.

9. Received Signal Code Power (RSCP)

That is the power level the pilot channel of a cell is received and usually expressed in mW. With this parameter, difference cells using the same carrier can be compared and handover or cell reselection can be taken.

⇨ **RSCP = 10^(RXLev/10) * 256**

10. Received Signal Strength Indication (RSSI)

That is the signal power (in mW) over the complete 5MHz carrier which includes all components received, including the signals from the current and neighboring cells on the same frequency.

⇨ **RSSI = Σ 10^(RXLev/10) + Noise**

3.2 Cell selection and reselection in idle mode (GSM)

Cell selection and reselection are processes, performed by a GSM mobile station in idle mode. Selection enables the MS to select the best suitable cell.

When the MS is turned on, it will try to contact a public GSM PLMN, the MS will select a proper cell and extract the control channel parameters and prerequisite system messages. The quality of radio channels is important. C1 > 0 ; C1 is computed every 5 seconds.

⇨ **C1 = RxLEV - RxLevAccessMin - MAX(MS_TxPwrMaxCCH – MS_MaxRFPower, 0)**

RxLev = the received signal level at the MS (in dBm)
RxLevAccessMin = the minimum received signal level the MS is allowed to access the network (in dBm)
MS_TxPwrMaxCCH = maximum emitted power allowed to the MS to access the BTS
MS_MaxRFPower = maximum emitted power of the MS defined by the MS class

Please notice that if the regarded cell is not in the same location area (LA) as the current selected cell, we will provide the C1 calculation with a negative offset. The reason is that changing LA requires changing location update (LU) procedure that consumes network signaling capacity.

Reselection consists of having the best fitted cell selected when the mobile station (MS) moves and change cell. To perform the reselection mechanism, the mobile station do measurements of the BCCH (Broadcast Control Channel) signals and keep the 6 strongest carriers based on their signal strength.

The C2 criterion is used for cell ranking in the GSM cell reselection process. Because we have hierarchical cell structures with micro-cells as well as larger cells covering the same areas, we improve the C1 parameter for micro-cells. This mechanism will avoid for a mobile station moving fast to get attached in micro-cell instead of a larger cell.

⇨ **If T < penality_time then**
    C2 = C1 + Cell_Reselect_Offset – Temporary_Offset
  Else
    C2 = C1 + Cell_Reselect_Offset
  End

T : timer triggered when the regarded cell is entering the 6 best candidate cells for reselection.
CELL_RESELECT_OFFSET : used to prioritize one cell in relation to the others
PENALTY_TIME and TEMPORARY_OFFSET : given by the BCCH. This is used to penalize the cell when its just enters the list of the strongest carriers.

Procedure for (C1, C2)

Mobile computes C1 and C2 values for the serving cell and the neighbor cells at least every 5 seconds.

A cell-selection is triggered if one of the following events occurs:

- ⇨ the pass loss criteria has become too high (C1 < 0)
- ⇨ the serving cell has become barred
- ⇨ downlink signaling failure is experienced
- ⇨ a neighbor cell has C2 higher than the serving cell for a period of 5 seconds. If LA of the neighbor cell is not the same as L1 of the serving cell, C2 of neighbor cell must exceed C2 of serving cell for at least CELL_RESELECT_HYSTERESIS for T seconds. If a reselection occurred in the last 15 seconds, the C2 value of the neighbor cell must exceed C2 value for the serving cell by at least 5dB for 5 seconds
- ⇨ a random access attempt is still unsuccessful after Max retrans repetition, Max retrans being a parameter broadcast on the control channel

3.3 Cell reselection for GPRS / Edge

The pass loss criterion C'1 is used as a minimum signal level criterion for GPRS cell reselection.

⇨ **C’1 = RXLEV – GPRS_RXLEV_ACCESS_MIN**

GPRS_RXLEV_ACCESS_MIN is provided by the BCCH of the regarded cell.

The signal level threshold criterion parameter C31 for hierarchical cell structure (HCS) is used to determine whether prioritize hierarchical GPRS cell reselection applies.

⇨ **C31(serv) = RxLev(serv) – HCS_THR(serv)**

If Priority_Class(neighbor) = Priority_Class(serv) then
C31(neighbor) = RxLev(neighbor) – HCS_THR(neighbor)
Else
If T < GPRS_Penality_Time then
C31(neighbor) = RxLev(neighbor) – HCS_THR(neighbor) - GPRS_Temporary_Offset
Else
C31(neighbor) = RxLev(neighbor) – HCS_THR(neighbor)
End if
End If

PRIORITY_CLASS : give cells different priory depending on their type
HCS_THR : signal threshold for applying HCS GPRS reselection
T : timer that is started from 0 at the time the cell inters in the list of strongest carriers.
GPRS_PENALTY_TIME : give a duration for which the temporary offset GPRS_TEMPORARY_OFFSET is applied.

The cell-ranking criterion parameter (C32) is used to select cells among those with the same priority and is defined for the serving cell and the neighbor cells

⇨ **C32(serv) = C'1(serv)**

If Priority_Class(neighbor) = Priority_Class(serv) then
If T < GPRS_Penality_Time then
C32(neighbor) = C1(neighbor) + GPRS_RESELECT_OFFSET(neighbor)
- GPRS_Temporary_Offset
Else
C32(neighbor) = C1(neighbor) + GPRS_RESELECT_OFFSET(neighbor)
End if
Else
C32(neighbor) = C1(neighbor) + GPRS_RESELECT_OFFSET(neighbor)
End If

As well as for C1 criterion, the parameter GPRS_CELL_RESELECT_HYSTERESIS cab be substracted from the C32 criteria of the neighbor cells. This hysteresis is also substracted from C31 criterion if requested by network.

When the neighbor cell does not belong to the same area location (LA) as the serving cell, RA_RESELECT_HYSTERESIS is substracted from the C32 criterion of the neighbor cell.

In case cell selection occurred within the previous 15 seconds, all neighbor cells are penalized by 5dB in oder to avoid ping-pong between cells.

1. Procedure for (C'1, C31, C32)

Mobile computes the values for C'1, C31, C32 criteria for the serving cell and the non serving cells at least every second. A cell reselection is then triggered if one of the following events occurs:

- ⇨ The pass criterion parameter C'1 indicate that the pass loss to the cell has become too high (C'1 < 0)
- ⇨ A nonserving suitable cell is evaluated to be better than the serving cell. The best cell is the cell with the highest C32 value among
- ⇨ The cells that have the highest priority class among the cell that fulfill C31 >= 0
- ⇨ All cells, if no cell fulfill the criterion C31 >= 0
- ⇨ Downlink signaling failure is experienced
- ⇨ The cell on which the mobile is camping has become barred
- ⇨ A random access attempt is still unsuccessful adter MAX_RESTRANS_RATE attempt.

2. **Notice that the cell on which the mobile was camped on must not be returned to within 5 seconds**

3.4 Cell handover

Handover is performed the MS is in dedicated mode. Handover is decided by the network based on the MS measurements and the antenna measurements as well. Multiples causes for handover are defined.

Handover decision based on the measurements taken by the MS and the BTS, the decision of handover is taken following that rules.

1. **Quality is too low i.e. RXQUAL is too high (in uplink or downlink)**

- ⇨ **RxQUAL_Uplink > L_RxQUAL_Uplink_H**
- ⇨ **RxQUAL_DownLink > L_RxQUAL_ DownLink _H**

2. **Received level (RXLEV) is too low (in uplink or downlink)**

- ⇨ **RXLEV_DownLink < R_RXLEV_DownLink _H**
- ⇨ **RXLEV_Uplink < L_RXLEV_Uplink _H**

3. **Distance between MS and BTS is too large (usually > 35 km)**

- ⇨ **MS_BS_Dist > MS_Range_Max**

4. **A neighbor cell is more favorable**

- ⇨ **RXLEV_NCELL(n) - RXLEV_DL > HO_MARGIN**
  RXLEV_NCELL(n) > RXLEV_MIN(n)

As we have seen in reselection, we can use a timer to prevent a fast moving mobile phone to connect to micro-cell where a larger cell is available. We replace HO_MARGIN by HO_MARGIN_TIME as above

- ⇨ **If T < DELAY_TIME then**
  HO_MARGIN_TIME = HO_MARGIN(n) + HO_STATIC_OFFSET(n)
  Else
  HO_MARGIN_TIME(n) = HO_MARGIN(n) + HO_STATIC_OFFSET(n) - HO_DYA_OFFSET(n)
  End If

Eventually, we can provide the mechanism which is presented and based on the explaining below

```
If RXLEV too low then
    intercell HO due to level
Else if MS_BS_DIST is too large
    intercell HO due to distance
Else if a neighbor cell is more favorable
    intercell HO due to power budget
Else if RXQUAL is too high
    intracell HO due to quality
End if
```

When a handover is decided, we also need to change to the best cell. Actually, the same mechanisms as we have seen for reselection are available to execute a handover toward a right cell.

3.5 Pseudo-code

```
Start

 /* The Mobile Station is turn off : idle mode */

 /* We have decided that GSM is the priority network for idle mode and voice call */
 /* We have decided that UMTS is the priority network for data transmission */

 /* Some measures like the hysteresis and the thresholds are write in the code, we chose the values according
   on what we see during the TD. Their values won't change */

 /* To be sure that a network is really available, we do the test five time, and then link up */

 Turn on the MS
 MS do measurements

 /* CELL SELECTION */

 If GSM is available
   Link up GSM Network
 Else /* GSM is not available */
     If UMTS is available
       Link up to UMTS Network
     Else   /* GSM is not available UMTS is not either */
       No network available
     End
 End

 /* CELL RESELECTION ; Idle Mode */

 /* The user is moving */
 /* We stay in the same cell : nothing changes but the MS is always doing measurements */
 /* We move to another cell */

 If GSM is available
   Link up GSM Network
 Else /* GSM is not available */
     If UMTS is available
       Link up to UMTS Network
     Else   /* GSM is not available UMTS is not either */
       No network available
     End
 End

   /* CELL RESELECTION ; Data packet transfer mode */

  /* The user uses data – UMTS is the priority network for data transmission */

 If UMTS is available
   Link up UMTS Network
 Else /* UMTS is not available : we have to use 2G+ network */
     If GPRS is available
       Link up to GPRS Network
```

```
      Else   /* GPRS is not available UMTS is not either */
        No network available
      End
  End


  /* CELL HANDOWER */

  /* The user is now calling and moving */
  If GSM is available
    Link up GSM Network
  Else /* GSM is not available */
      If UMTS is available
        Link up to UMTS Network
      Else   /* GSM is not available UMTS is not either */
        Cut the call /* No network available */
      End
  End

End
```

4. OUTPUT DATA

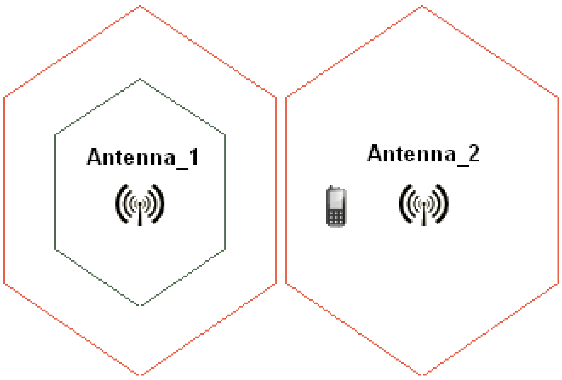
The main function simulates the operations that the mobile or network must take depending on the situation. The function performs simulation of selection/reselection on GSM and UMTS, soft handover (UMTS to UMTS) and hard handover (UMTS to GSM, GSM to UMTS, and GSM to GSM).

As result we know on which cell the mobile is connected, who the active cell's neighbors are etc.

Remark : We'll see it in details when we'll show the implementation and the results.

5. VALIDATION ON ONE EXAMPLE

5.1 The network



We have decided to use that network for our example. There are two GSM cells (the red one) and one UMTS cell (the black one). There is one mobile, turn off at the beginning.

To start, we turn on the mobile …

Remember : GSM Network is priority for idle mode and voice call.

5.2 The values to start

At the begging, when we turn on the mobile, we have this different value:

- The emitted strength (Pe) by the GSM antenna is 38dBm and the frequency is 900 MHz.
- The minimum received signal level the MS is allowed to access the network (RxLevAccessMin) = -90 dBm, and Cell_Reselect_Offset = 0, because they are the same GSM cells.

5.3 Measurements

We measure, 10 times, the RxLEV of the mobile with the antenna 1 and 2, then we do an average. The distance changes a little, because the mobile moves the measures. The formula uses to calculate RxLEV is the Friis formula:

$$\mathbf{RxLEV = Pe + 27.55 - 20 \log(Frequency) - 20 * 1.5 \log(Distance)}$$

Distance between the mobile and the antenna 1 in meter	RxLEV with Antenna_1 (dBm)	Distance between the mobile and the antenna 2 in meter	RxLEV with Antenna_2 (dBm)
300	-67,8484878	100	-53,5348502
295	-67,6295107	105	-54,1705292
293	-67,5408788	107	-54,4163635
298	-67,7613381	102	-53,7928553
305	-68,0638454	95	-52,8665583
296	-67,6736015	104	-54,0458504
290	-67,4067901	110	-54,7766307
295	-67,6295107	105	-54,1705292
301	-67,8918451	99	-53,403906
299	-67,8049858	101	-53,6644914
Average	-67,7250794	Average	-53,8842564

After that, we calculate C1 with this formula:

⇨ **C1 = RxLEV – RxLevAccessMin**

For Antenna_1, C1 = 22,2749206 dBm. For Antenna_2, C1 = 36,1157436 dBm.

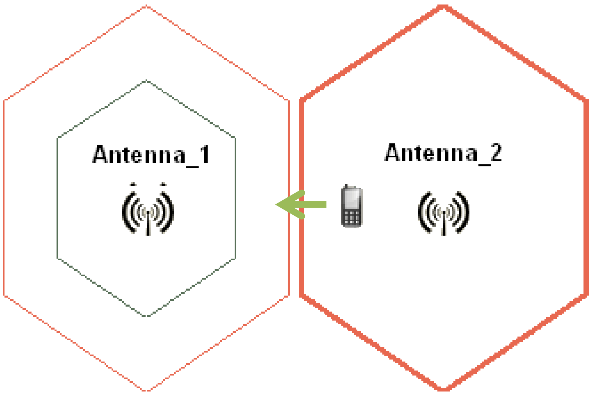
So C1 > 0, for the two antennas, we can measure C2 with this formula:

⇨ **C2 = C1 + Cell_Reselect_Offset**

For Antenna_1, C2 = 22,2749206 dBm. For antenna 2, C2 = 36,1157436 dBm.

The Antenna_2 has the best C2.

5.4 Decision



After the measurements, the mobile is going to join the Antenna_2 which has the best C2.

If we continue the simulation, we can decide that the mobile is going to go next to Antenna_1, as shown by the green arrow. Remark that the MS is always doing measurements. When it's going to be next to border between the two cells it will redo the calculations for C1 and C2 criteria ...

If we are going to use data, the mobile will check if it is able to join UMTS Network …

6. BIBLIOGRAPHY USED

- UMTS, Services, Architectures et WCDMA, *Javier Sanchez and Mamadou Thioune*, Hermes
- Réseaux mobiles, *Sami Tabbane*, Hermes
- Simulating soft handover and power control for enhanced umts, *V. Vassiliou, J. Antoniou, A. Pitsillides, and G. Hadjipollas,* Department of Computer Science in University of Cyprus
- GSM UMTS Cell Reselection and Handover, *Ericsson*

7. SOFTWARE DEVELOPMENT

7.1 Computing language

To implement our software we chose use **java** language. Java is a computer programming language that is concurrent, class-based, object-oriented, and designed to eliminate language features that cause common programming errors in the others high level programming languages.

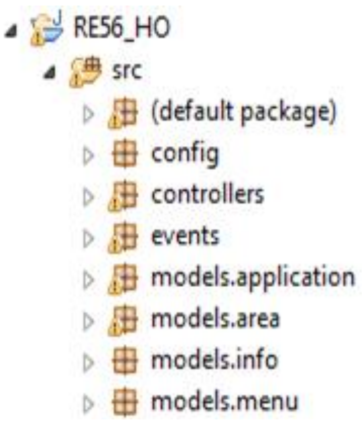
7.2 Environment

We used **Eclipse** to develop the application and we shared the sources thanks to **GitHub**.

Eclipse is an Integrated Development Environment developed by IBM. It's an open source IDE that works on all the operating systems. IDE are really useful because of the libraries : we just have to start to write a function and it helps to finish. It permits too to avoid unexpected errors.

GitHub is a web-based hosting service for software development projects, created in 2008, that use the Git revision control system. We used a free account for open source projects. That way, we can share the code with our co-workers, revise projects, edit other people’s work, and interact with the other members. It's really efficient, thanks to a version control application : multiple people are allowed to work simultaneously without work getting overwritten or erased.

7.3 Content of the different files



// Define the different parameters like cell’s color and dimensions
// Management of different cells, area and menus
// Manage the user’s interventions
// Define the model app. : there is only one MS and it’s a private network
// Delimit the area

// Neighbor list of the Active Set

// RxLEV / Noise / Time etc.
// Updates measurements
// State of the mobile / Position on the map / speed etc.
// Call the functions for the right use

- models.mobile // Manage the mobile moving on the map
  - ActiveSet.java
  - CellMeasurement.java
  - Measure.java
  - MeasurementSet.java
  - Mobile.java
  - Module.java
  - ModuleGSM.java
  - ModuleUMTS.java
  - Motion.java

- models.network
  - Antenna.java // Id, position, type, Location Area Controller
  - AntennaManager.java // Antenna management
  - Cell.java // Each antenna is included in a cell which got its own parameters
  - CellGSM.java
  - CellManager.java
  - CellUMTS.java
  - LocationArea.java // Location Area / Neighbors etc.
  - LocationAreaManager.java
  - Network.java // GSM / GPRS / EDGE / UMTS
- models.network
- models.utilities
  - Formulas.java // Here are the ≠ tables, the conversion's formula.
  - LoadImage.java // Here are the ≠ pictures for the buttons
  - ParseXMLFile.java
  - SpringUtilities.java // Used to bring into line and standardize the cells
- views.application // Use to manage the display
- views.area
- views.info
- views.menu
- JRE System Library [jre7]
- config
- gimp
- img

7.4 Our program

Thanks to the MMI, the user is able to change few parameters like the power of the antenna, the offset, the hysteresis, the neighbors of a cell, the mobile's speed etc. (the right part of the application)

We can decide if the mobile is in idle mode or in calling or even data transmitting by selecting a mode on the right part of the application.

Once all parameters are ok, we can launch the application. The user is able to move the mobiles thanks to the keyboard's arrows or via the mouse.

The mobile is moving on the map, and when a cell is active, its outlines are bold.
At the bottom, we can see how fluctuate the RxReceived from the Antenna selected, how change the SINR.

And if we are in call or in data transmission mode, there is an indicator to show the throughput variations.

In that way we can see what kind of cell is selected : UMTS or GSM when we use the mobile for something or another thing ...

N.B : On the lower part of the screen, there is a console where we can see what happen for the mobile.