

# ENSC 894:Communication Networks

FINAL PROJECT PRESENTATION

SPRING 2014

## Simulation of General Packet Radio Service (GPRS) Network

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Team 5



# Roadmap

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- Introduction
- Related Work
- Project Goal
- OPNET model Upgradation
- Conclusion and Future Work
- References

# Introduction

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## A GPRS Network

- A data service that provides packet switched routing functionality in the infrastructure
- Radio channels can be concurrently shared between several users
- 1 to 8 radio interface timeslots can be allocated per TDMA frame, supporting a speed up to 150kbit/s
- Average transmission speed is 28.8 – 40 kbit/sec

# Introduction

## A GPRS Network

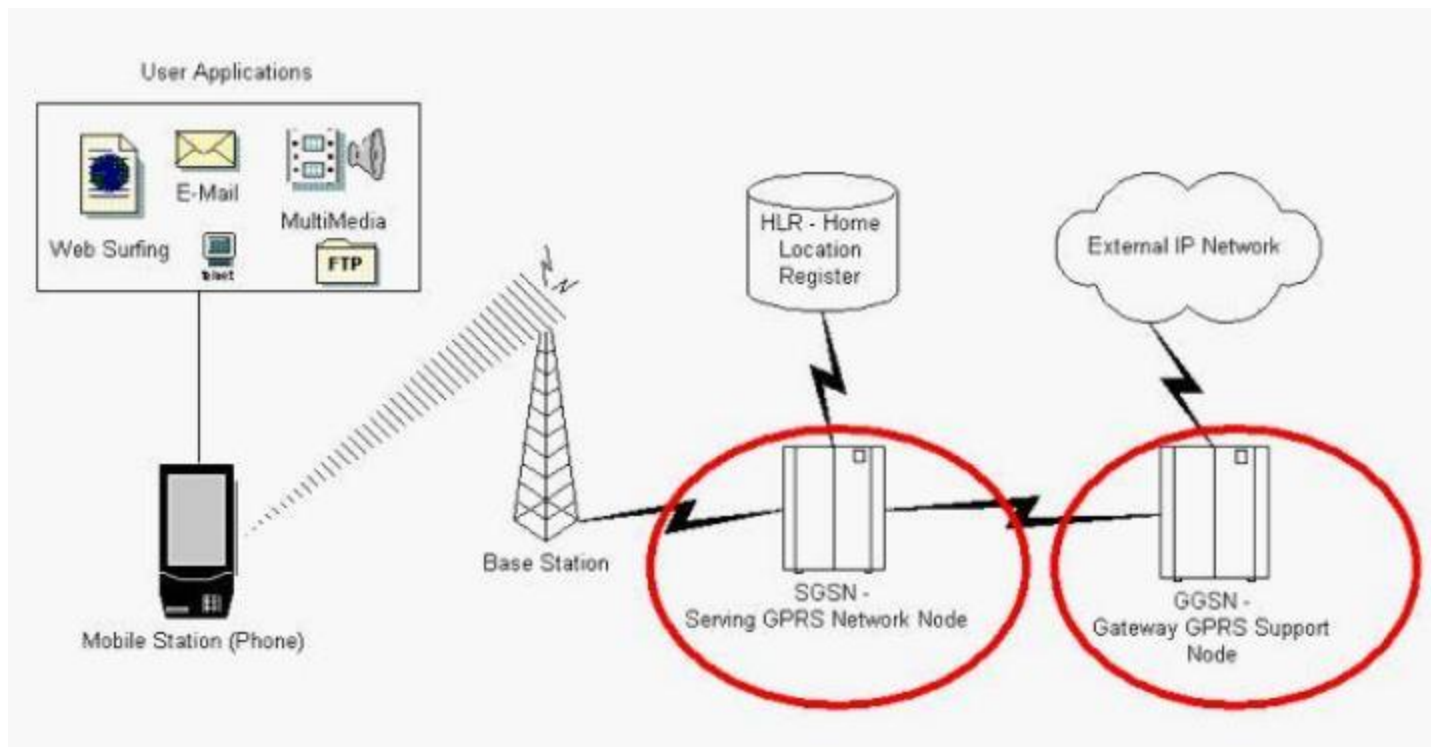


Figure 1 : General Packet Radio Service Network

# Introduction

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## ■ GPRS introduces two nodes

### Serving GPRS support node (SGSN)

- keeps track of the location of a mobile station,
- handles access control
- connects to HLR with a Signaling system.

### Gateway GPRS support node (GGSN)

- provides interworking with external packet switched networks
- connects to SGSN with an IP backbone

# Related Work

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- GPRS OPNET models
  - Simulation of GPRS Network  
Model ID: 484 ( Contributed Model Library) V 9.0
    - signaling and transmission behavior
    - available in V 16.0
  - Mobile Application Part Protocol implementation  
Model ID: 546,507 V 9.0.2
    - represents an application layer protocol
    - supports signaling exchanges with HLR and EIR

# Related Work

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- GPRS OPNET models
  - Enhanced GPRS OPNET model  
Model ID: 619 V 10.0
    - implementation of LLC layer, the BSS and cell update procedure
  - GPRS OPNET model
    - implementation of the RLC/MAC and the BSSGP
    - No model available

LLC- Logical Link Control

BSS- Base Station Subsystem

RLC/MAC- Radio Link Layer/Medium Access Control

BSSGP- Base Station Subsystem GPRS protocol

# Project Goal

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- Upgrade GPRS OPNET model
  - Any changes to the implementation of the data layers and improvement to the functionality requires the OPNET model to be able to run in the latest versions of OPNET modeler.
  - To update the GPRS OPNET model ( Model ID: 619) which includes (484,507,546)



# Project Goal

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- Upgrade GPRS OPNET model (Contd..)

✓	Simulation of GPRS Network	484
✓	MAP Protocol implementation	507,546
✓	Enhanced GPRS OPNET model	619
✓	<b>GPRS OPNET model</b>	<b>X</b>

# OPNET upgradation

- Automatic device and attribute conversion

- opnet model library
- 70 % no conflict
- identify models and compile one by one

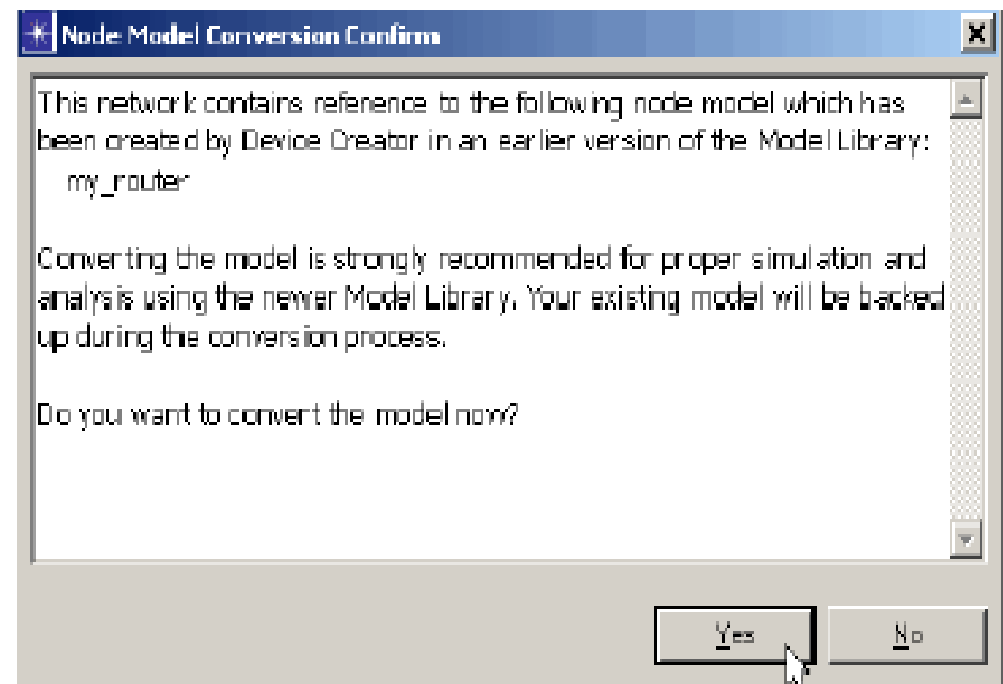


Figure 2: Dialog box

# OPNET upgradation

- Automatic device and attribute conversion

- custom model
- modify code
- modify attributes
- modify attribute properties

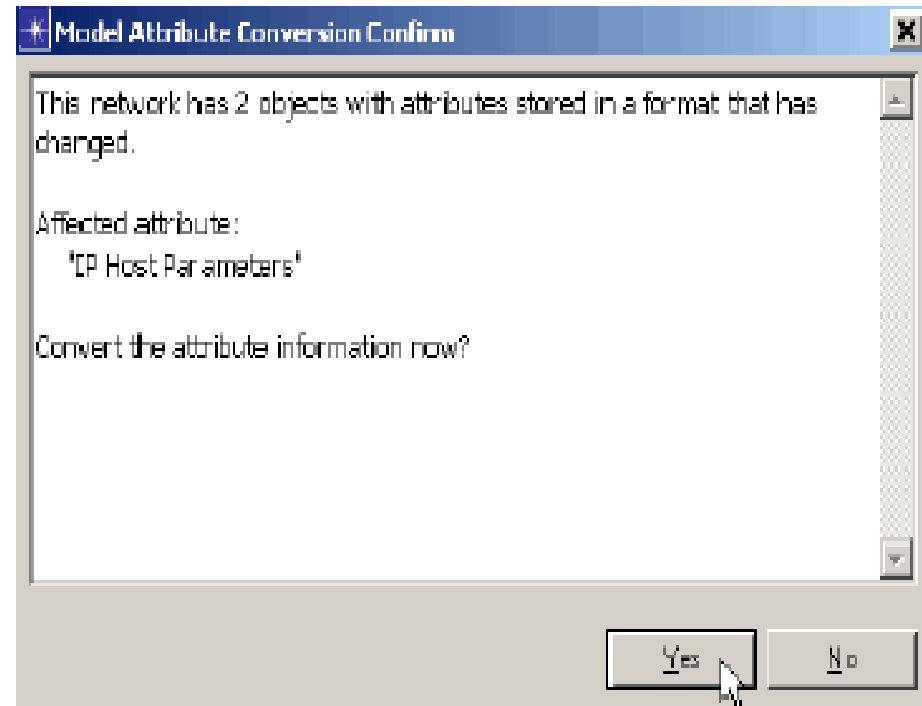


Figure 3: Dialog box 1

# OPNET upgradation

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- Custom models
  - merge custom changes in to new models
  - product release notes will mention high-level changes to the model suite
  - export the old and new process models files to XML
  - compare the two files

# OPNET upgradation

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- Comparison tools
  - UNIX *diff* command
  - Microsoft's *Windiff*
  - mergely
  - Diff checker

# OPNET upgradation

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- Tool used : Microsoft's *Windiff*
  - specially designed to compare program source code
  - Errors – undeclared identifier, linked error, undefined reference to 'main'
  - cout undeclared, loop definitions

# OPNET upgradation

```
File Edit View Merge Help
diffuse (BASE)          diffuse
2248 def setCharMode(self):
2249     if self.mode == LINE_MODE:
2250         self.cursor_column = -1
2251         self.setCurrentChar(self.current_li
2252     elif self.mode == ALIGN_MODE:
2253         self.dareas[self.align_pane].queue_
2254         self.cursor_column = -1
2255         self.align_pane = 0
2256         self.align_line = 0
2257         self.setCurrentChar(self.current_li
2258         self.mode = CHAR_MODE
2259         self.updatePrompt()
2260
2261     # sets the syntax hightlighting rules
2262     def setSyntax(self, syntax):
2263         if self.syntax is not syntax:
2264             self.syntax = syntax
2265             # invalidate the syntax caches
2266             for pane in self.panes:
2267                 pane.syntax_cache = []
2268
2269             # force all panes to redraw
2270             for darea in self.dareas:
2271                 darea.queue_draw()
2272
2273     # returns True if any pane contains edits
2274     def hasEdits(self):
2275         for pane in self.panes:
2332 def setCharMode(self):
2333     if self.mode != CHAR_MODE:
2334         if self.mode == LINE_MODE:
2335             self.cursor_column = -1
2336             self.setCurrentChar(self.curren
2337         elif self.mode == ALIGN_MODE:
2338             self.dareas[self.align_pane].qu
2339             self.cursor_column = -1
2340             self.align_pane = 0
2341             self.align_line = 0
2342             self.setCurrentChar(self.curren
2343             self.mode = CHAR_MODE
2344             self.emit('cursor_changed')
2345             self.emit('mode_changed')
2346
2347     # sets the syntax hightlighting rules
2348     def setSyntax(self, s):
2349         if self.syntax is not s:
2350             self.syntax = s
2351             # invalidate the syntax caches
2352             for pane in self.panes:
2353                 pane.syntax_cache = []
2354             self.emit('syntax_changed', s)
2355             # force all panes to redraw
2356             for darea in self.dareas:
2357                 darea.queue_draw()
2358
2359     # gets the syntax
2360     def getSyntax(self):
2361         return self.syntax
2362
2363     # returns True if any pane contains edits
2364     def hasEdits(self):
2365         for pane in self.panes:
```

Figure 4: Microsoft Windiff tool

# OPNET upgradation

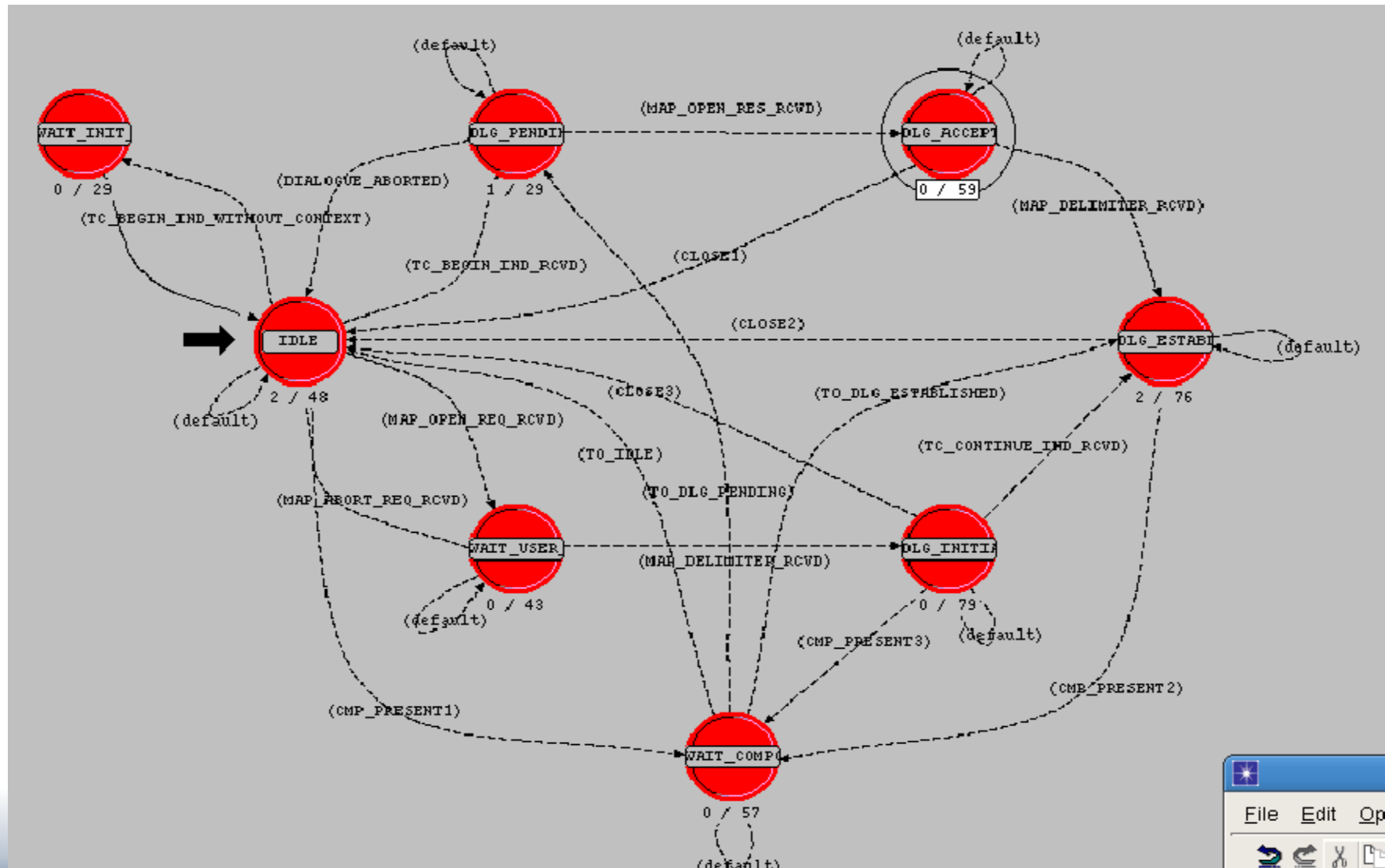
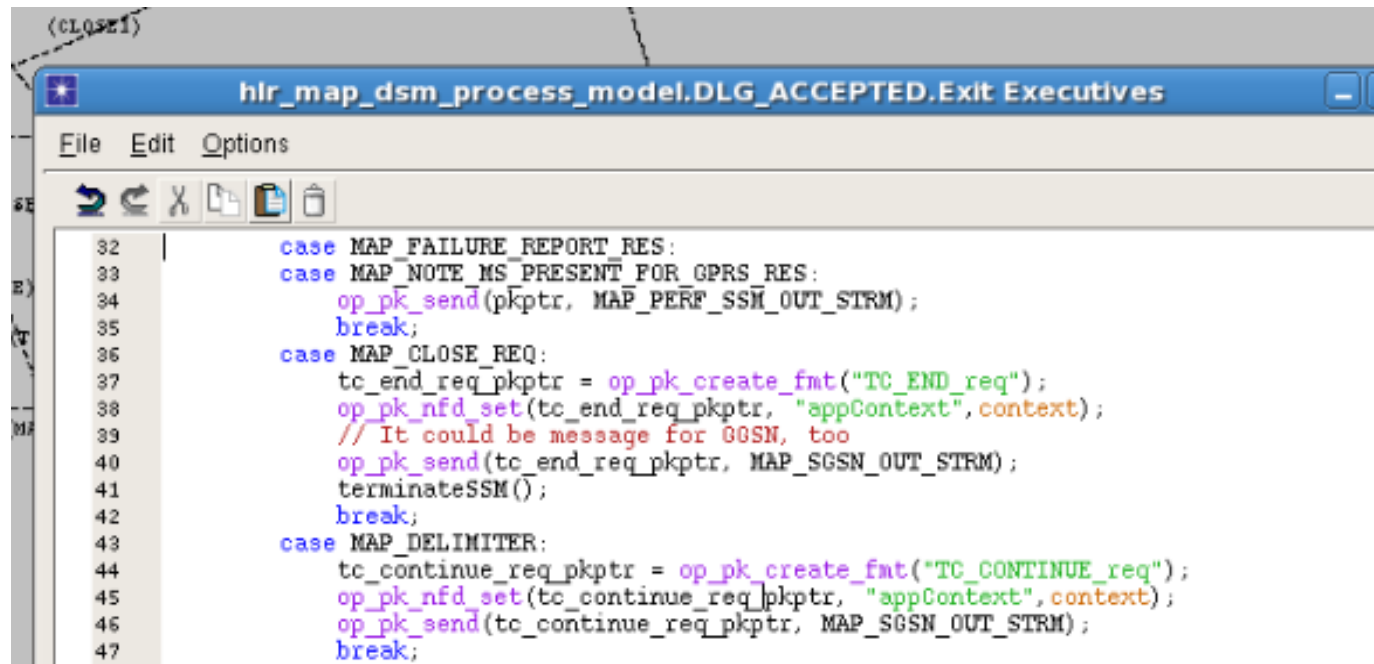


Figure 5 : HLR\_MAP process model



# OPNET upgradation

- Code modified



```
32     case MAP_FAILURE_REPORT_RES:
33     case MAP_NOTE_MS_PRESENT_FOR_GPRS_RES:
34         op_pk_send(pkptr, MAP_PERF_SSM_OUT_STRM);
35         break;
36     case MAP_CLOSE_REQ:
37         tc_end_req_pkptr = op_pk_create_fmt("TC_END_req");
38         op_pk_nfd_set(tc_end_req_pkptr, "appContext", context);
39         // It could be message for GGSN, too
40         op_pk_send(tc_end_req_pkptr, MAP_SGSN_OUT_STRM);
41         terminateSSM();
42         break;
43     case MAP_DELIMITER:
44         tc_continue_req_pkptr = op_pk_create_fmt("TC_CONTINUE_req");
45         op_pk_nfd_set(tc_continue_req_pkptr, "appContext", context);
46         op_pk_send(tc_continue_req_pkptr, MAP_SGSN_OUT_STRM);
47         break;
```

Figure 6 : HLR\_map code modification

# OPNET upgradation

- Code modified (contd.)

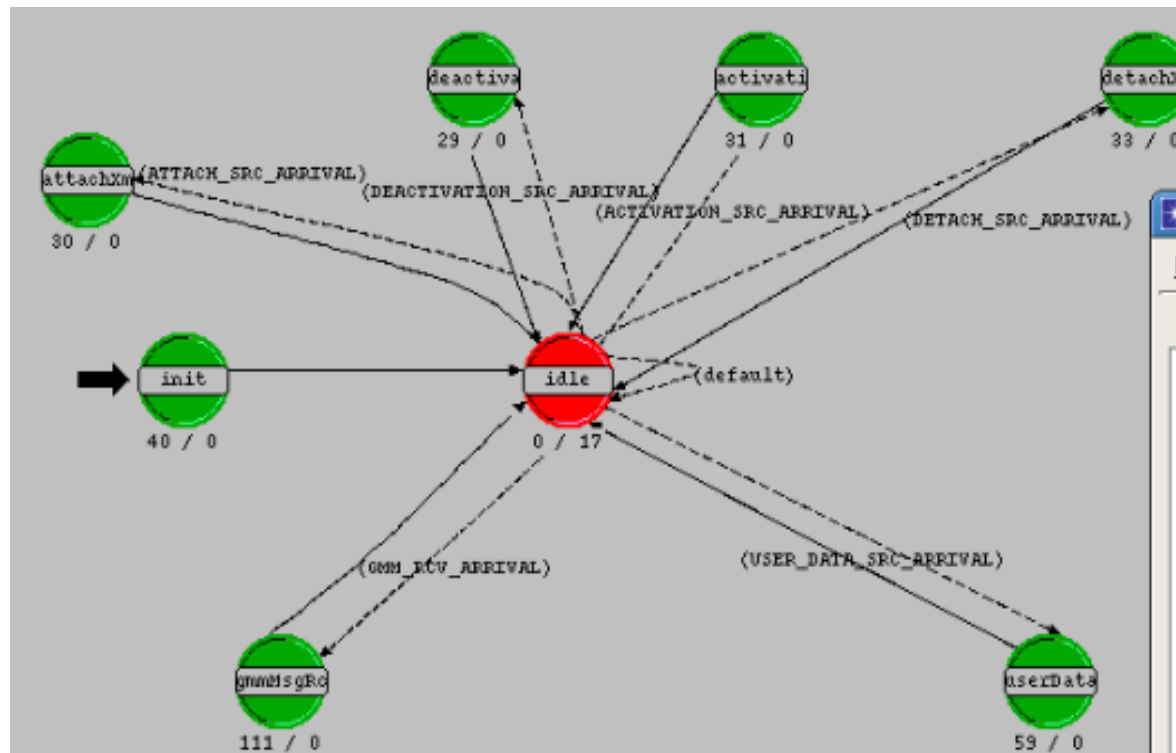
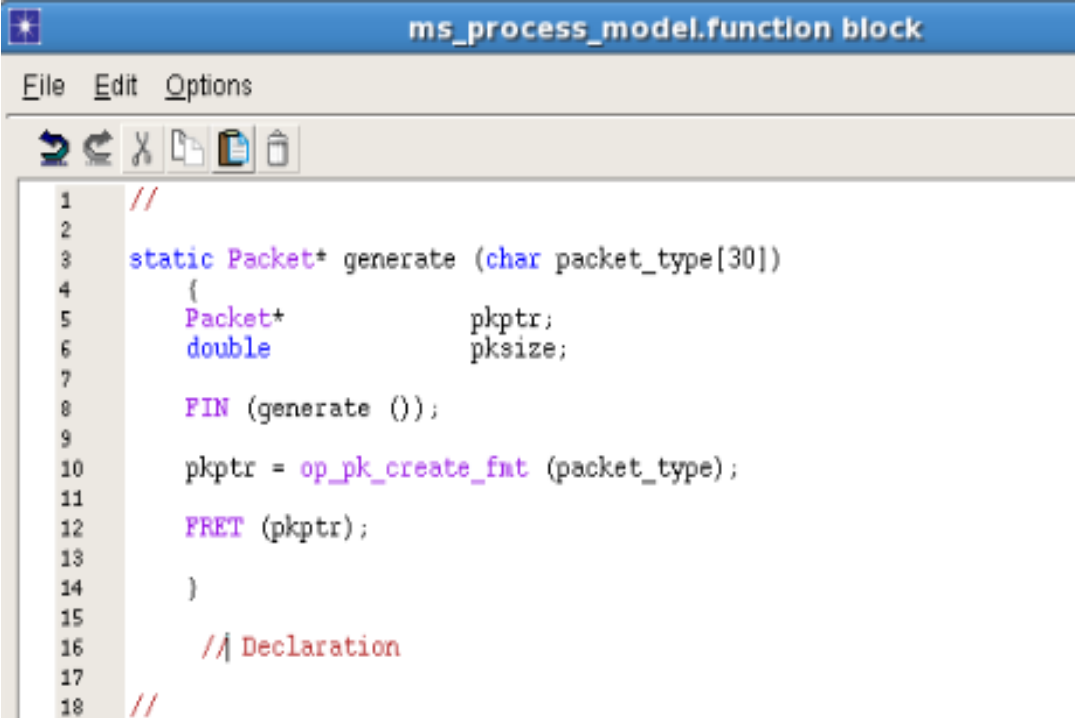


Figure 7 : MS\_process code modification

# OPNET upgradation

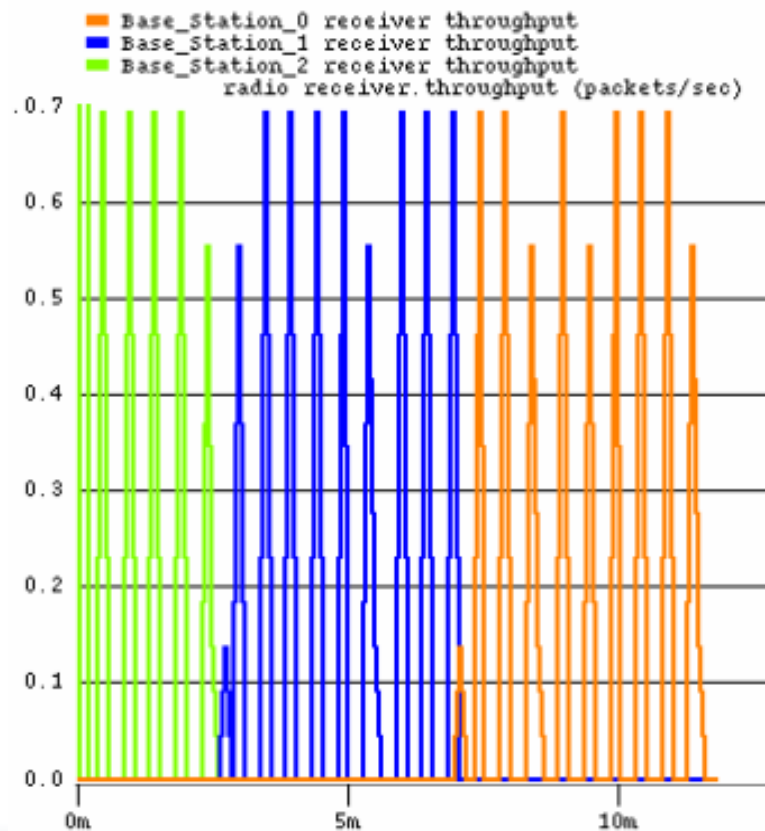
- Code modified(contd..)



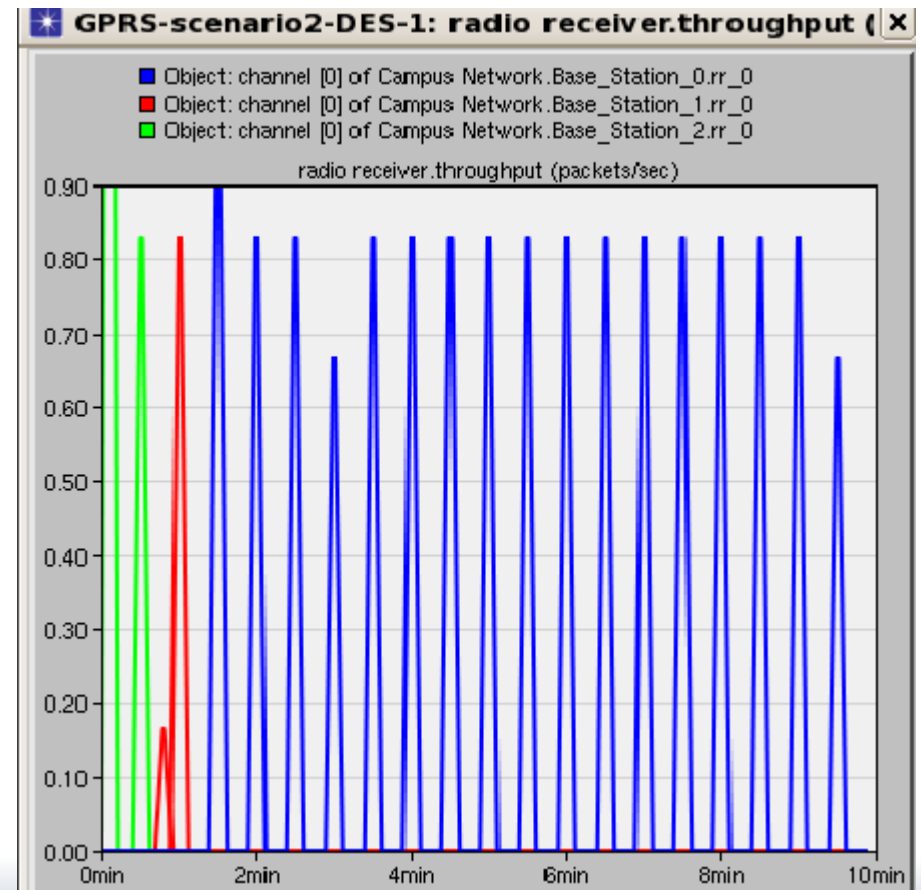
```
1 //
2
3 static Packet* generate (char packet_type[30])
4 {
5     Packet*      pkptr;
6     double       pksize;
7
8     PIN (generate ());
9
10    pkptr = op_pk_create_fmt (packet_type);
11
12    PRET (pkptr);
13
14 }
15
16 // Declaration
17
18 //
```

# OPNET upgradation

## Comparison of Simulation results



old model

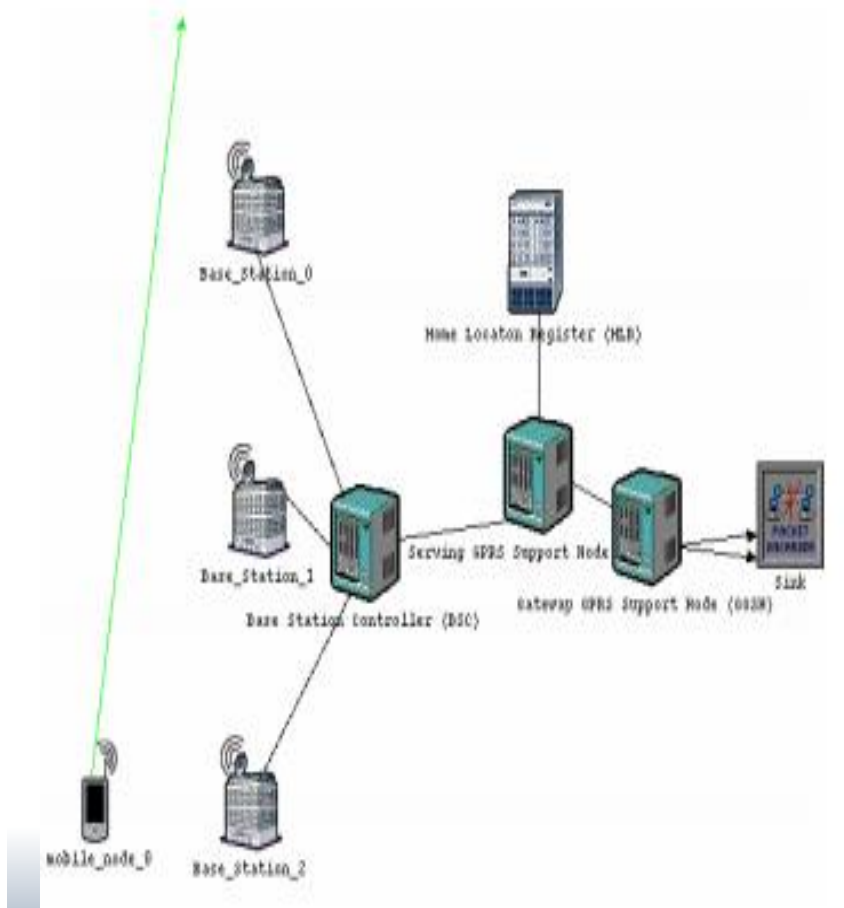


new model

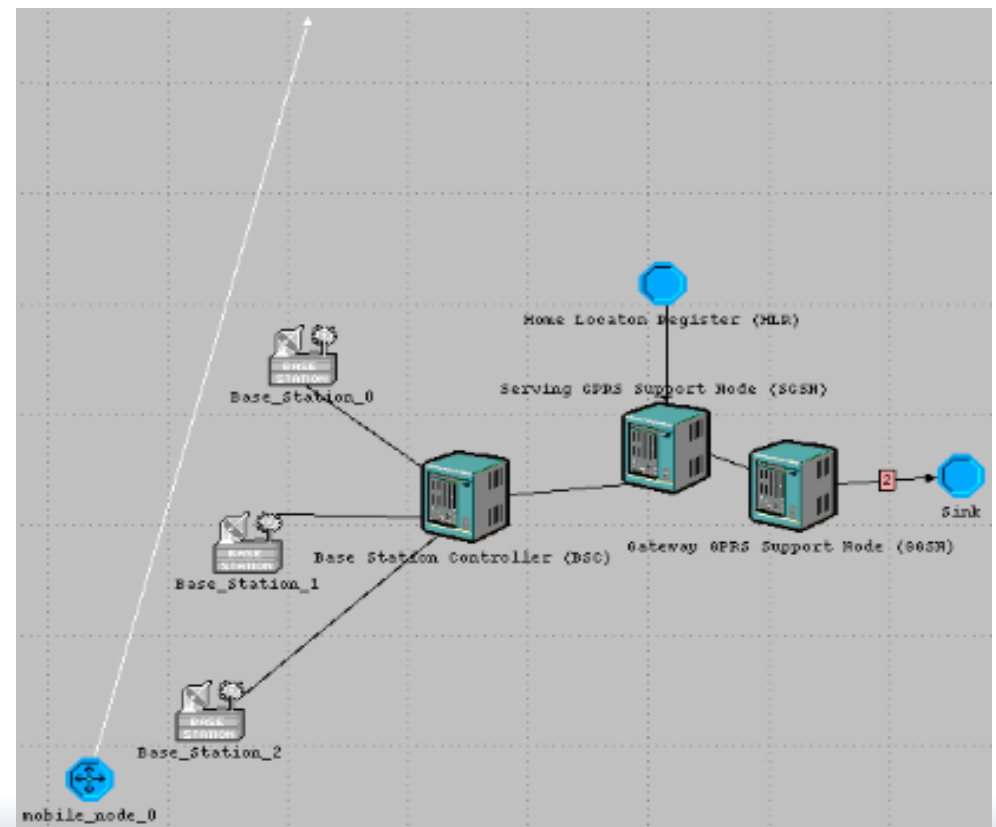
Figure 9 : Receiver throughput of Base station 0,1 &2 of the old model and new model

# OPNET upgradation

## Comparison of Simulation results (Contd.)



Old model



new model

Figure 10 : GPRS project setup of the old and new model

# OPNET upgradation

## Comparison of Simulation results (Contd.)

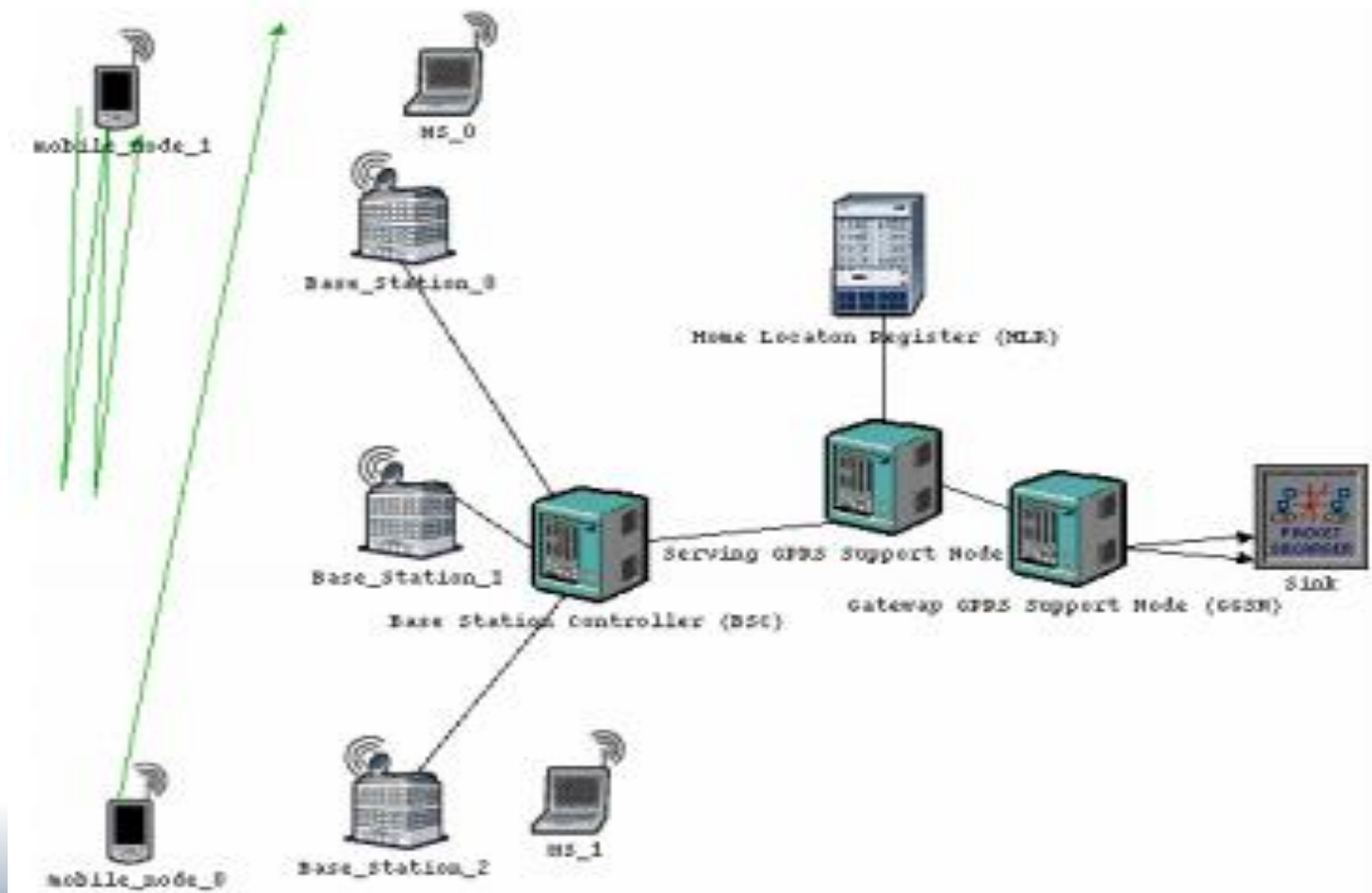
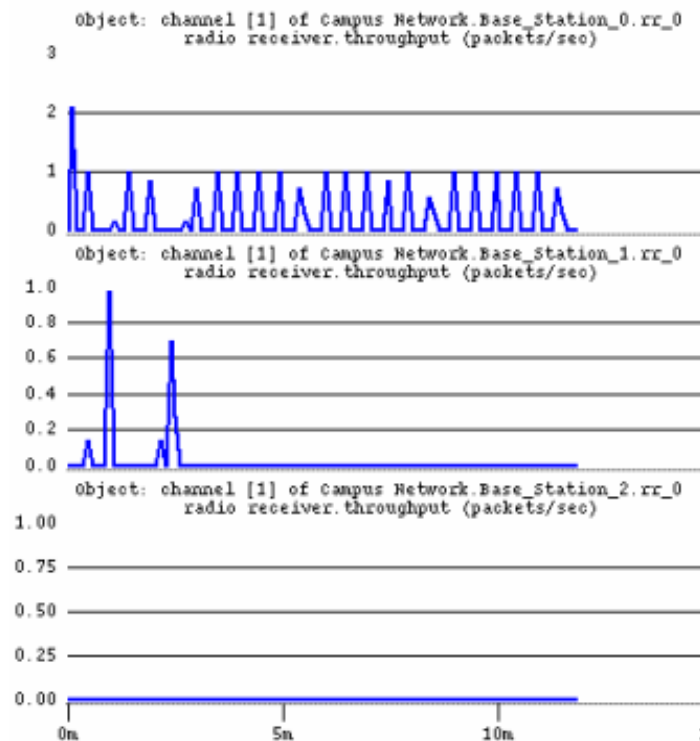


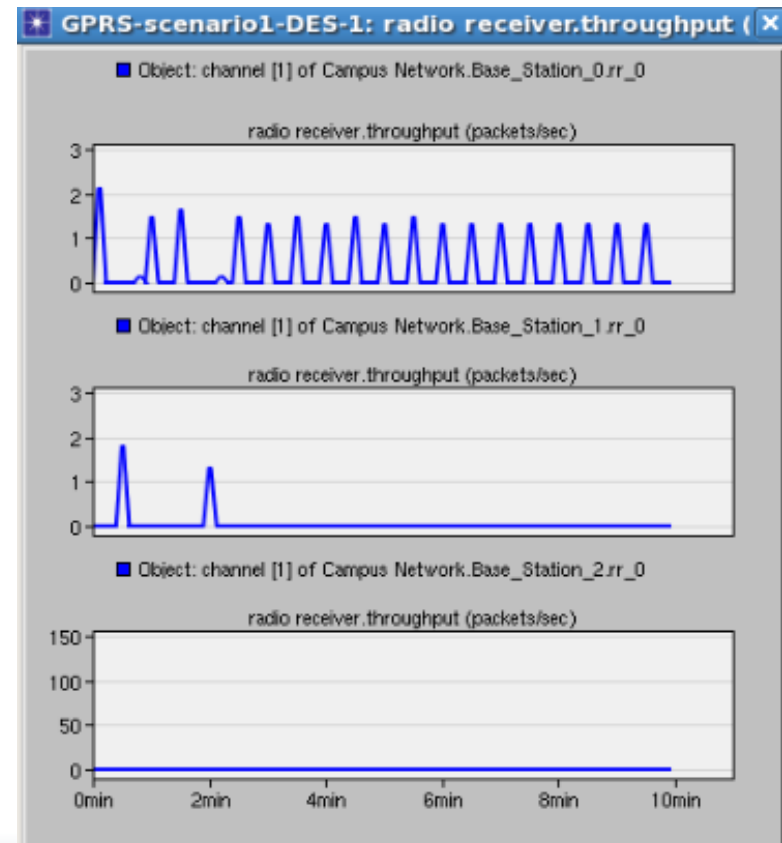
Figure 11 : GPRS project setup\_scenario 2

# OPNET upgradation

## Comparison of Simulation results(contd..)



old model



new model

Figure 12: Receiver throughput of Base station 0,1 &2 of the old model and new model

# Conclusion and Future Work

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- Successfully upgraded the GPRS model to later version of OPNET modeler
- Develop a tool to speed up the comparison process
  - compare source codes by block
  - check with common opnet debugging errors



# References

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- Ricky Ng, Ljiljana Trajkovic, "Simulation of General Packet Radio Service Network", OPNETWORK 2002, Washington, DC, Aug.2002
- M. Omeueti, R. Narayanan, and Lj. Trajkovic, "Effect of cell update on performance of General Packet Radio Service," OPNETWORK 2006, Washington, DC, Aug. 2006.
- R. Narayanan, P. Chan, M. Johansson, F. Zimmermann, and Lj. Trajkovic, " Enhanced General Packet Radion Service OPNET model, " OPNETWORK 2004, Washington, DC, Aug 2004.
- V. Vukadinovic and Lj. Trajkovic, "OPNET implantation of the Mobile Application Part protocol, "OPNETWORK 2003, Washington, DC, Aug. 2003.
- [http://www2.ensc.sfu.ca/~ljilja/papers/opnetwork04\\_renju.pdf](http://www2.ensc.sfu.ca/~ljilja/papers/opnetwork04_renju.pdf)  
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