Simulation of General Packet Radio Service (GPRS) Network

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Roadmap

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Introduction

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
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

- **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

HLR- Home Location Register; EIR- Equipment Identity Register
Related Work

- 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

- 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

- Upgrade GPRS OPNET model (Contd..)

- Simulation of GPRS Network 484
- MAP Protocol implementation 507,546
- Enhanced GPRS OPNET model 619

- GPRS OPNET model X
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

- Custom models
  - merge custom changes into 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

- Comparison tools
  - UNIX `diff` command
  - Microsoft’s `Windiff`
  - mergely
  - Diff checker
OPNET upgradation

- 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

Figure 4: Microsoft Windiff tool
OPNET upgradation

Figure 5: HLR_MAP process model
OPNET upgradation

- Code modified

Figure 6: HLR_map code modification
Code modified (contd.)

Figure 7: MS_process code modification
OPNET upgradation

- Code modified (contd..)

Figure 8: MS_process code modification
Comparison of Simulation results

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

Comparison of Simulation results (Contd.)

Figure 10: GPRS project setup of the old and new model
Comparison of Simulation results (Contd.)

Figure 11: GPRS project setup_scenario 2
Comparison of Simulation results (contd..)

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

- 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

- [http://www2.ensc.sfu.ca/~ljilja/papers/opnetwork04_renju.pdf](http://www2.ensc.sfu.ca/~ljilja/papers/opnetwork04_renju.pdf)
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