ENSC 835
HIGH PERFORMANCE NETWORKS

PROJECT PRESENTATION

Fall 2003

GPRS -
Wireless links, Base Station Controller and Cell update

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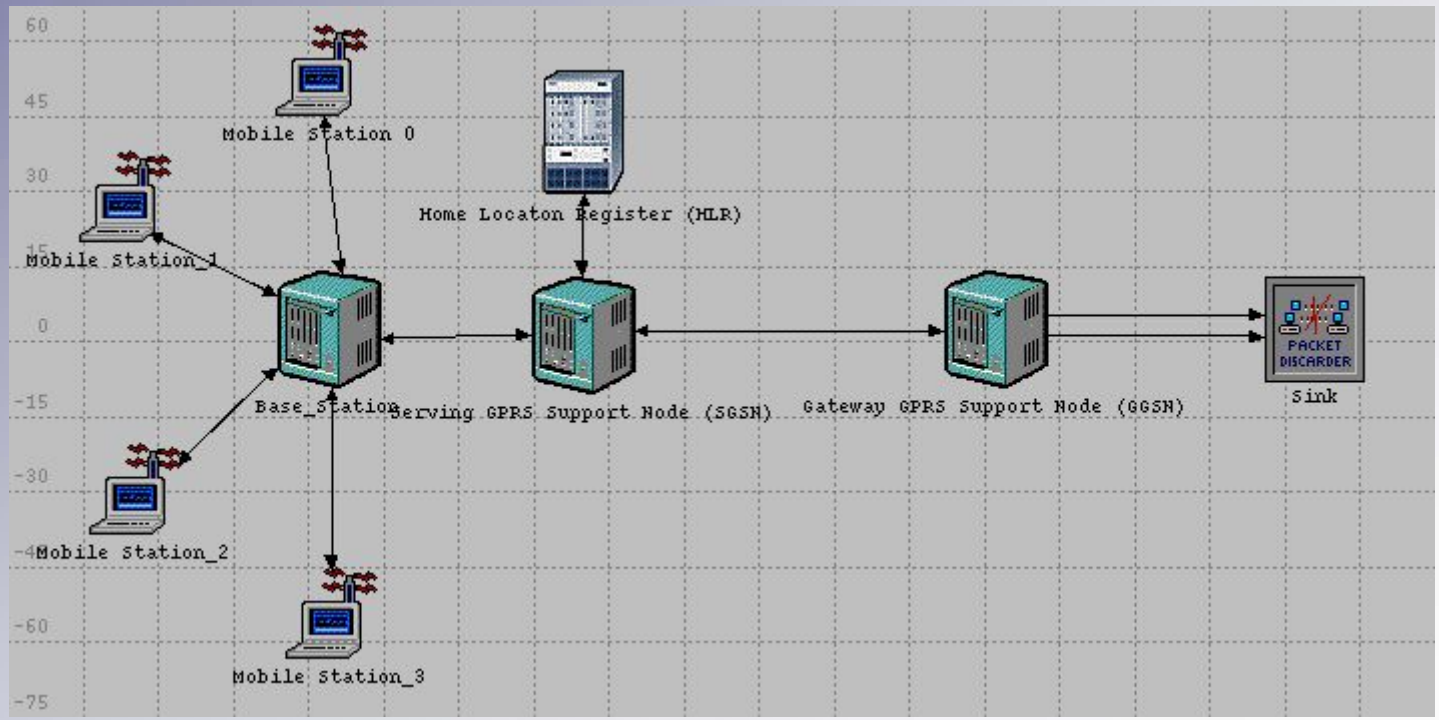
Roadmap

- Project goals
- GPRS overview
- GPRS cell update
- Implementation
- Simulation
- Future work
- References

Project goals

- Enhance the existing GPRS OPNET model
  - Replace wired conncections with wireless links
  - Implement the Base Station Controller
  - Simulate the cell update
- Verify the implementations through simulations



GPRS - General Packet Radio Service

GPRS is an addition for packet switching to the Global System for Mobile communication (GSM)

GSM and GPRS are standardized by the European Telecommunications Standards Institute (ETSI)

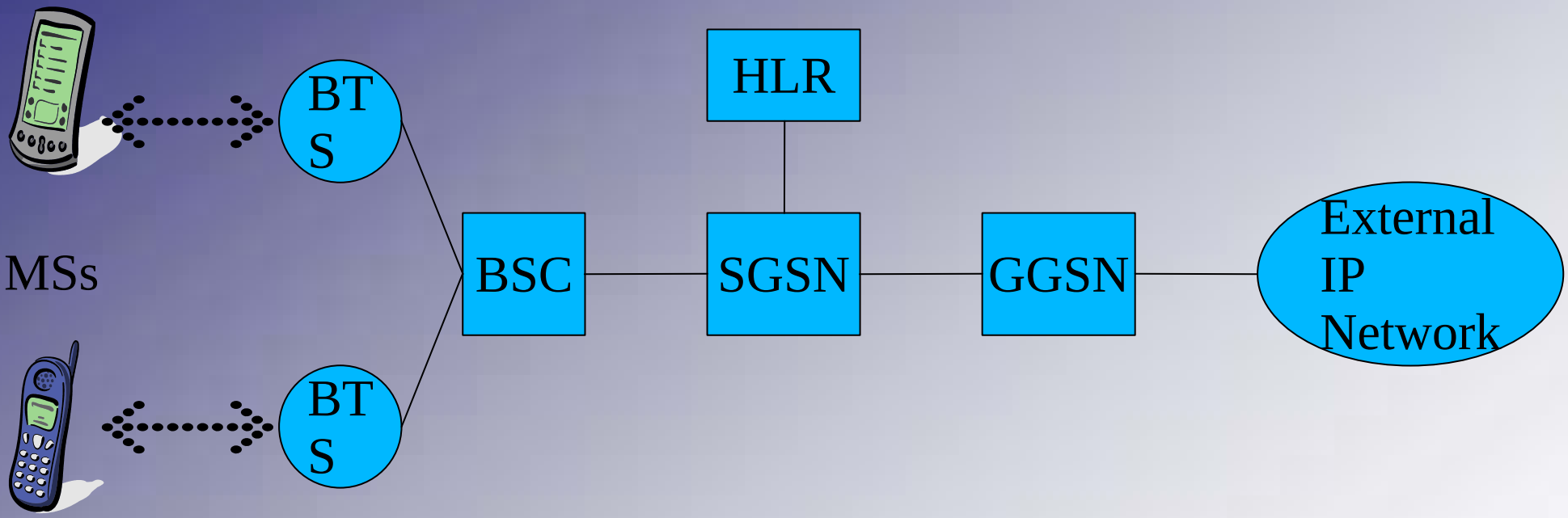
GSM is a connection oriented service, which uses FDMA, TDMA and supports 9.6 kb/s

GPRS supports up to 171.2 kb/s through multislot capability and different channel coding schemes

Advantages of GPRS

- Limited bandwith is used more efficiently
- Users can be billed by traffic volume instead of time
- “Always on connection”
- GPRS is suitable for upcoming applications:
  - Navigation systems with up to date maps and traffic messages
  - WAP (Wireless Application Protocol), Location based services
  - Email, Instant messaging

GPRS Network



MS: Mobile Station
BTS: Base Transmitter Station
BSC: Base Station Controller
HLR: Home Location Register
SGSN: Serving GPRS Support Node
GGSN: Gateway GPRS Support Node

GSM - Frequencies

Frequencies: 900 MHz and 1800 MHz,
1900 Mhz in North America

PCS (Personal Communication System) 1900:

Uplink (MS ? BTS)	1850.2 MHz ? 1909.8 MHz
Downlink (BTS ? MS)	1930.2 MHz ? 1989.8 MHz
Channel Bandwidth	200 kHz

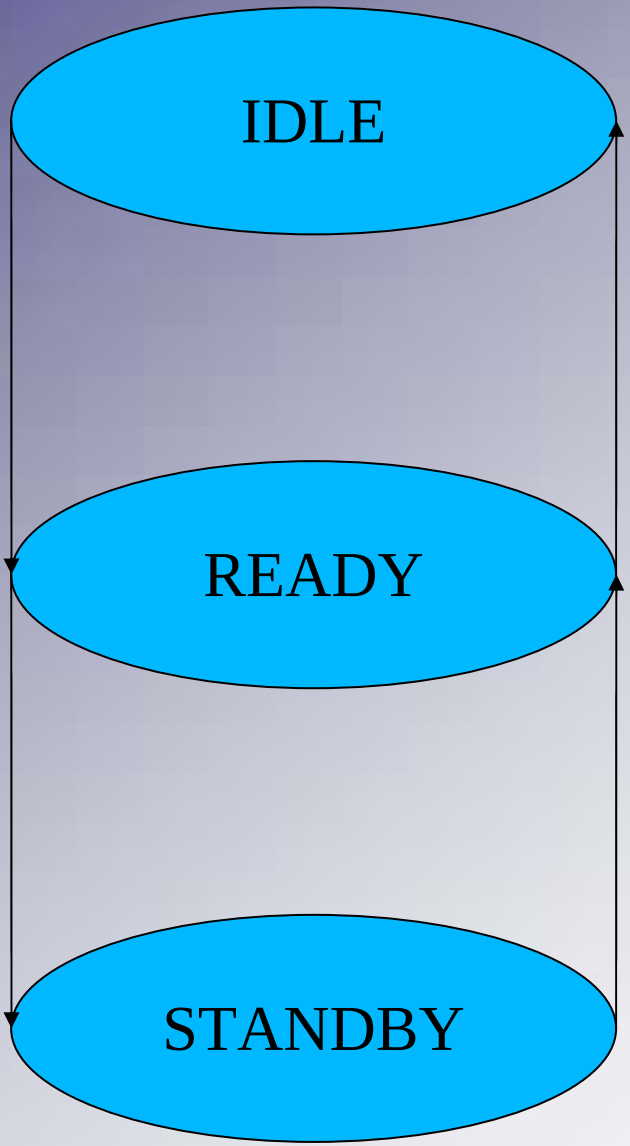
Each BTS can use a set of frequencies

Uplink and downlink frequencies are used in pairs

The first frequency of a BTS is also called BCCH (Broadcast control channel) frequency, because the BCCH is transmitted in one of the timeslots

The BCCH frequency is used by the MS for channel measurements

MS GMM States



GPRS attach

GPRS detach

READY timer expiry or Force to STANDBY

PDU transmission

GMM: GPRS mobility management
PDU: Packet Data Unit

Cell update (1)

The MS has to perform channel measurements of up to 32 BTSs at least every 5 seconds

It maintains a table with the 6 best BTSs

A cell update has to be performed if the reception from another BTS is better than from the current one

Cell update (2)

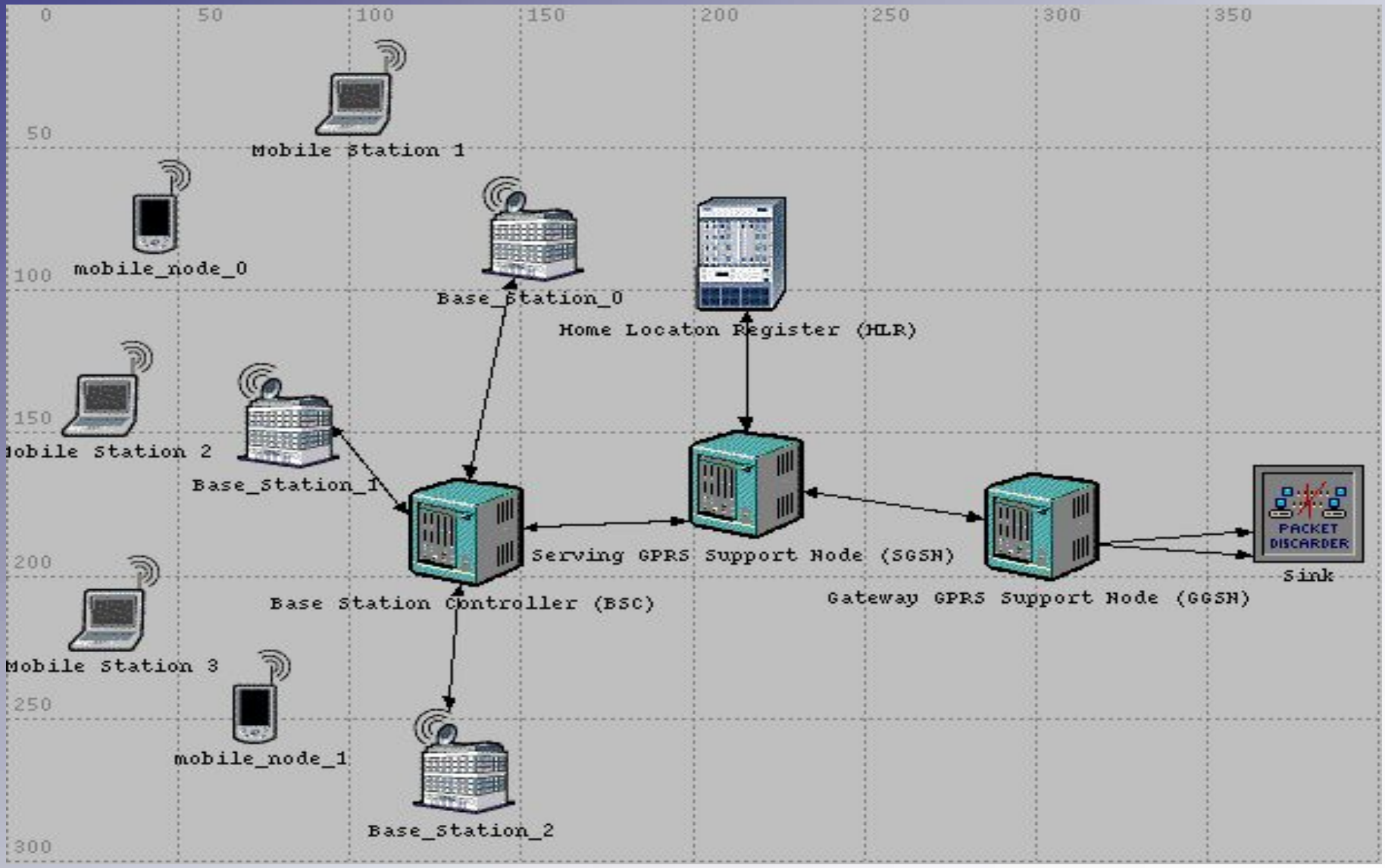
In GSM the MS sends the measurements to the BSC which makes the decisions about a handover to another cell

The GSM handover would cause a very heavy signalling burden for GPRS [4]. Therefore the cell update was introduced in GPRS:

- A MS in Ready State sends a Link Layer Control (LLC) frame from the newly selected cell to inform the SGSN about the new location
- In Standby State the SGSN is not informed, the SGSN has to page the MS if it wants to send downlink data to a MS in Standby State

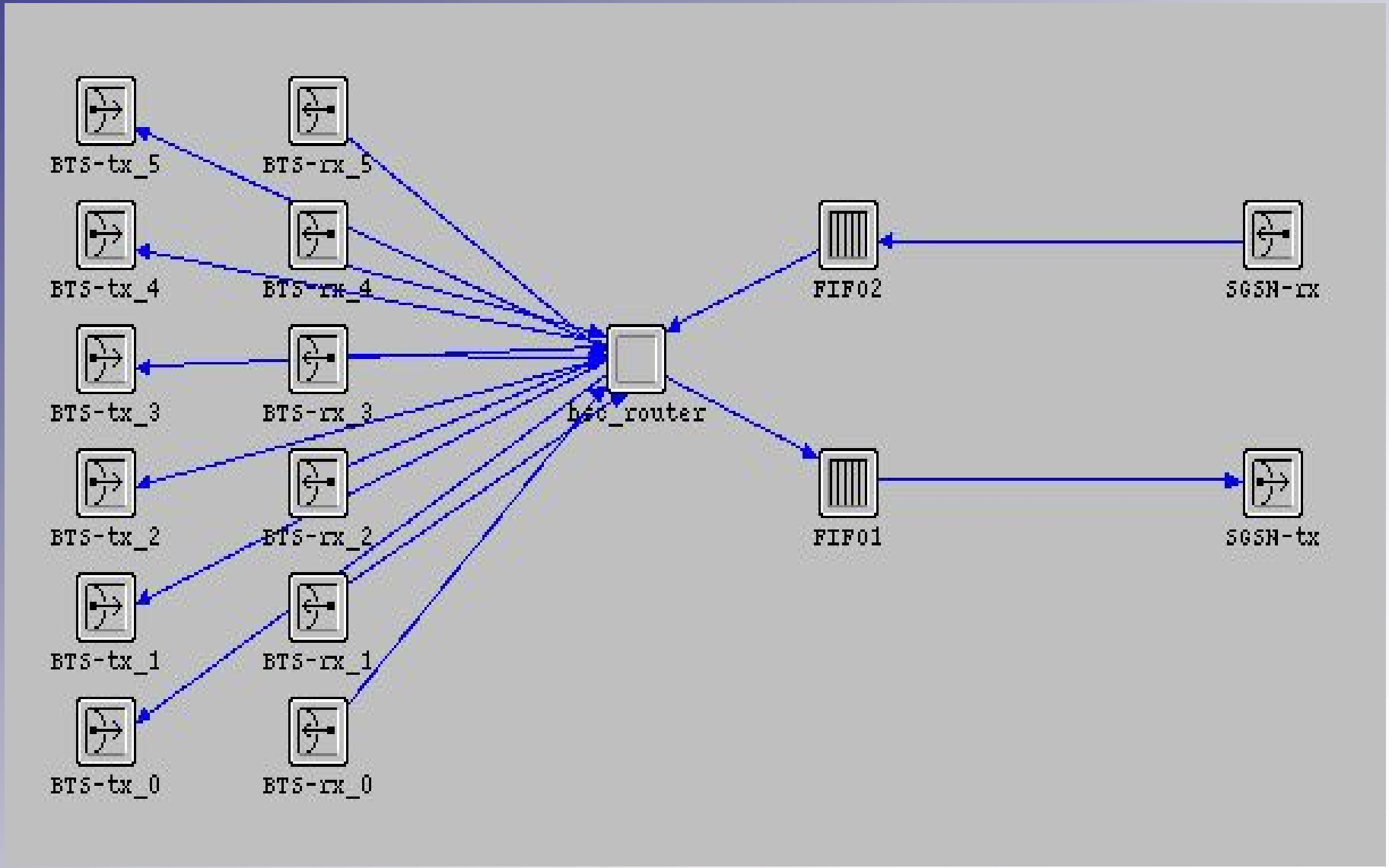
Implementation (1)

OPNET Project:



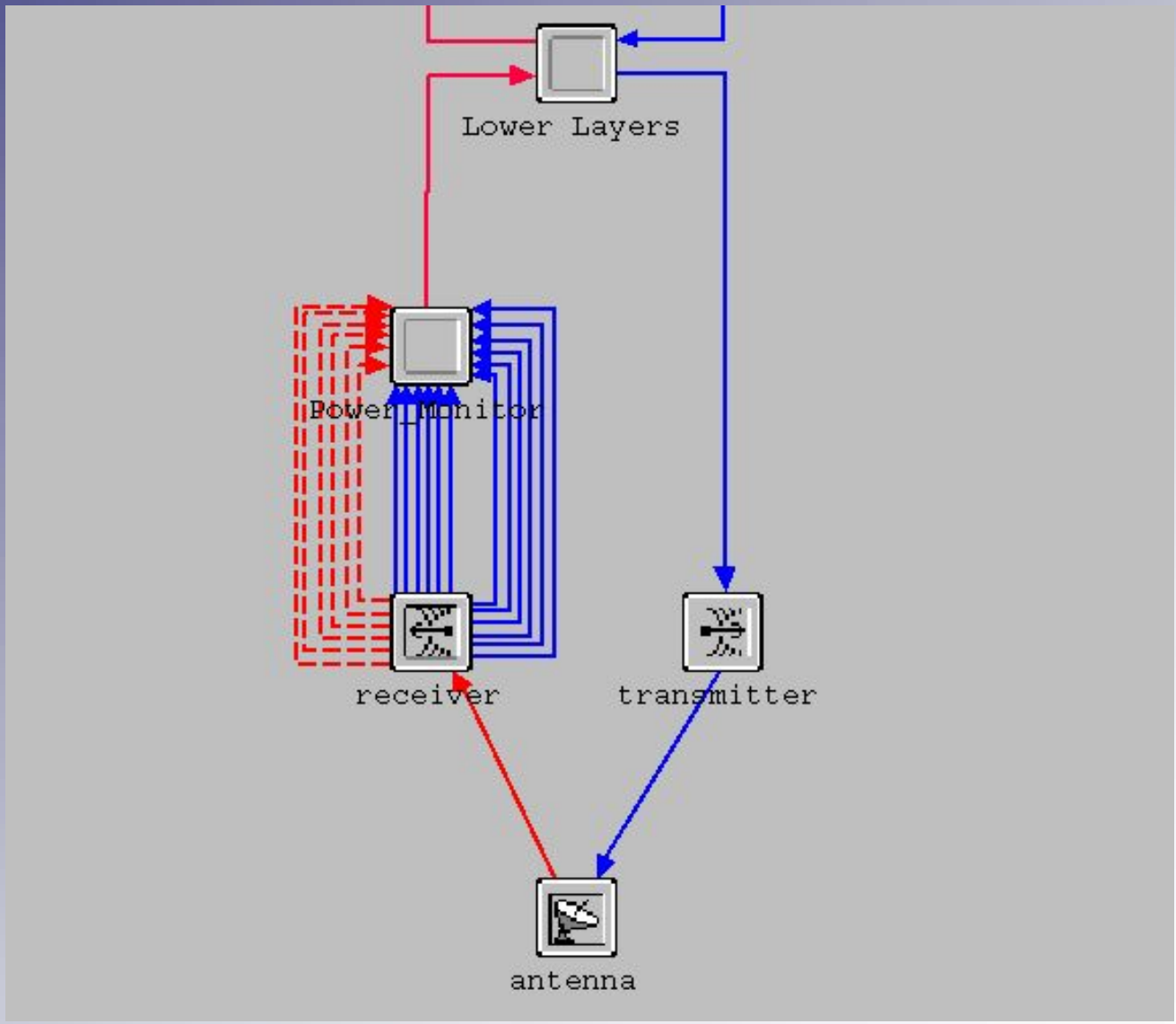
Implementation (2)

BSC Node Model:



Implementation (3)

MS Node Model:



Simulation

- Measure the End-to-End delay from the MS to the sink and the throughput and compare the results with the previous GPRS model without BSC and wireless links to verify the implementation
- Simulate cell updates between different BTSs with mobile nodes and observe the behaviour of the network
- The End-to-End delay should increase because of the implementation of the BSC

Future work

Finish the OPNET implementation and run simulations

Implementation of the MAC/RLC layers

Run simulations with genuine traffic traces

Implemention of additional QoS classes

MAC: Medium Access Protocol
RLC: Radio Link Control
QoS: Quality of Service

References

[1] Emmanuel Seurre, Patrick Savelli, Pierre-Jean Pietri, *GPRS for Mobile Internet,* Artech House, 2003

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[3] Digital cellular telecommunications system (Phase 2+);General Packet Radio Service (GPRS) Service description;Stage 2 (3GPP TS 03.60 version 7.9.0 Release 1998)

[4] Gunnar Heine, Holger Sagkob, *GPRS Gateway to Third Generation Mobile Networks*, Artech Housse, 2003

[5] Jukka Lempiainen, Matti Manninen, *Radio Interface System Planning for GSM/GPRS/UMTS*, Kluwer Academic Publishers, 2001

[6] Ricky Ng, ***Ljiljana Trajkovic, ``Simulation of General Packet Radio, Service Network,'' OPNETWORK 2002* , Washington, DC, Aug. 2002**

[7] Mikael Johansson, "Simulation of Logical Link Layer in GPRS", *Simon Fraser University*, Burnaby, Spring 2003

Summary

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QUESTIONS?