Architecture for 3G and 802.16 Wireless Networks Integration with QoS Support

QShine '05

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Introduction (1/2)

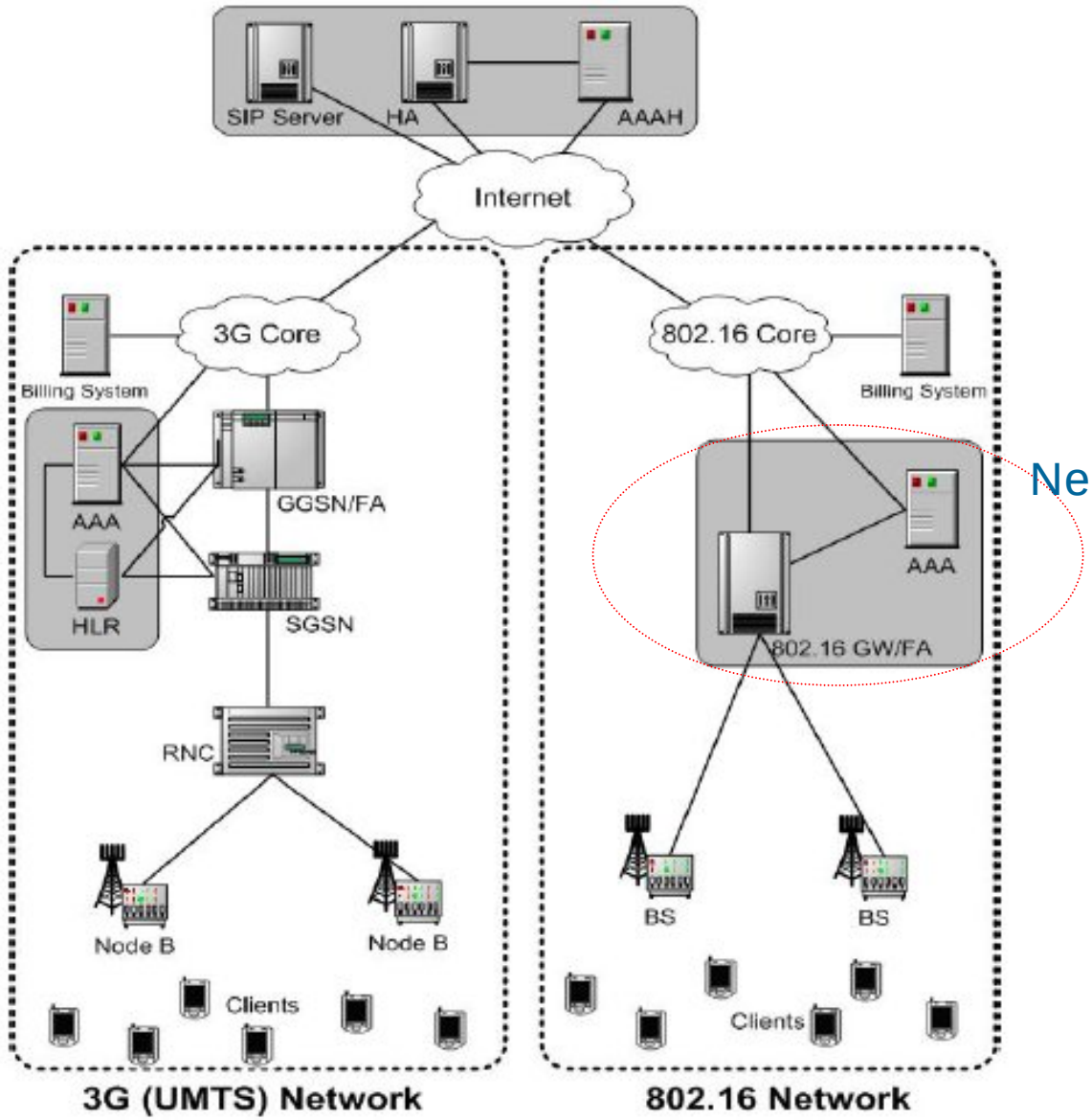
- 3G and 802.16 networks have different characteristics in terms of data rates, coverage, deployment and protocols, both networks provide explicit support for QoS.

- How to propose an architecture for integrating 3G and 802.16 networks, focusing on the QoS aspects, while providing seamless mobility?

Introduction (2/2)

- Loosely-coupled vs. Tightly coupled
- Why the paper choose the loosely-coupled model?
  - Each of the networks being integrated do not need to be modified to meet the requirements of integrating with another specific network.
  - The data traffic for the 802.16 network is never injected into the 3G core, thus preserving the traffic patterns of the 3G network.
  - In the tightly-coupled scenario, the 3G core network must expose its interfaces to the 802.16 network.

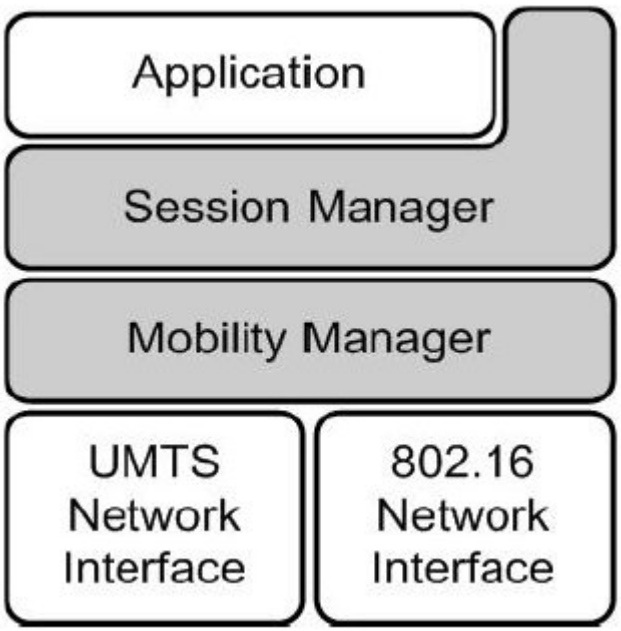
Integrated Network Architecture



New Components

- 802.16 Network
  - 802.16 Gateway
  - AAA server
- 3G Network
  - AAA server
- Common Entities
  - Home Agent (HA)
  - Home AAA server (AAAH)
  - SIP server

Mobile Node Software Architecture



- Mobility Manager
  - It is responsible for providing transparent switching between the networks.
- Session Manager
  - QoS
  - A feedback system of the network characteristics to the application.

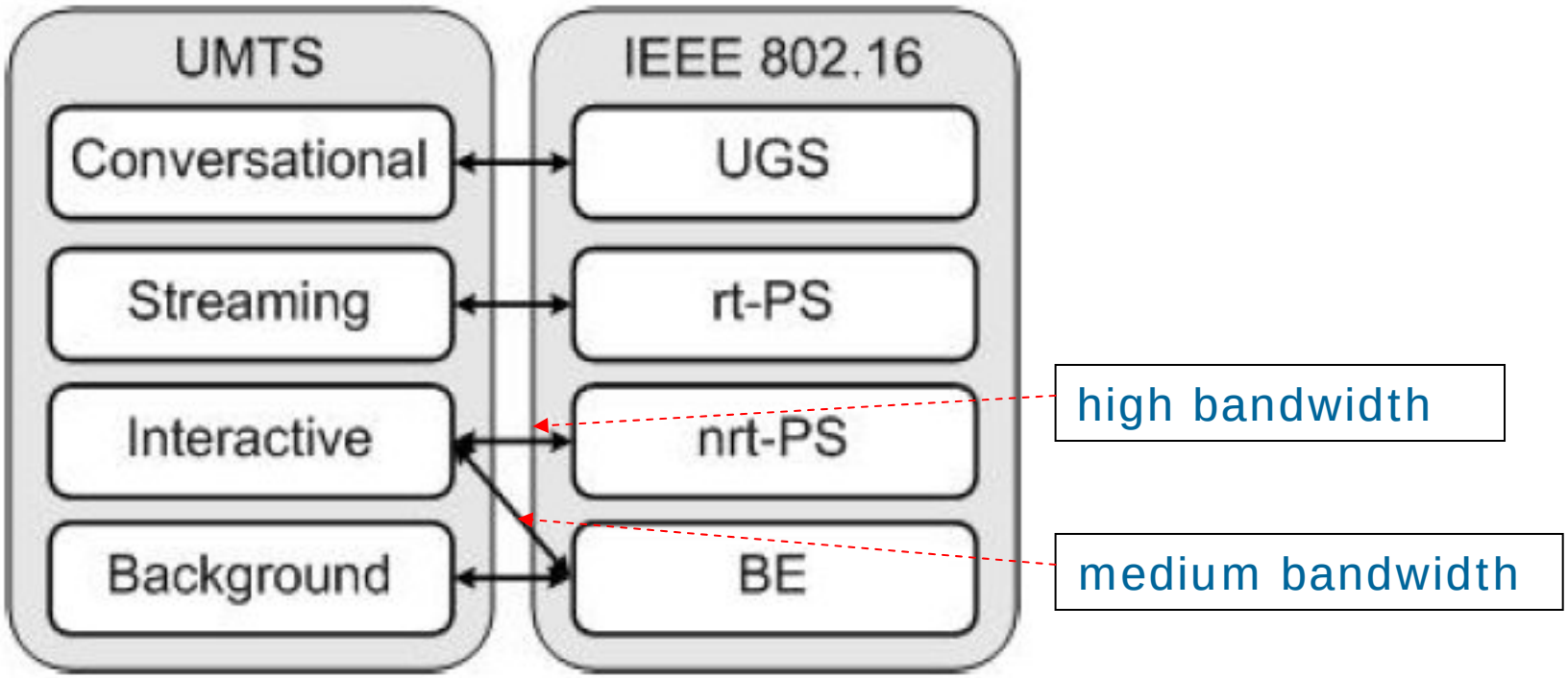
QoS Provisioning in the Integrated Architecture

- QoS Session Activation
  - Mobile Node QoS
    - Handled by session manager
  - Network Infrastructure
    - QoS profile and authorization
- QoS Classification Mapping
- Network Layer QoS
- Session Layer QoS

QoS Provisioning in the Integrated Architecture

- QoS Session Activation
- QoS Classification Mapping
- Network Layer QoS
- Session Layer QoS

Mapping between UMTS and 802.16 QoS Classes



Non-Real-Time QoS Class Mapping

Application Bandwidth Requirements	Example Application	UMTS	802.16
High	File transfer	Interactive	nrt-PS
Medium	Web browsing	Interactive	BE
Low	Email	Background	BE

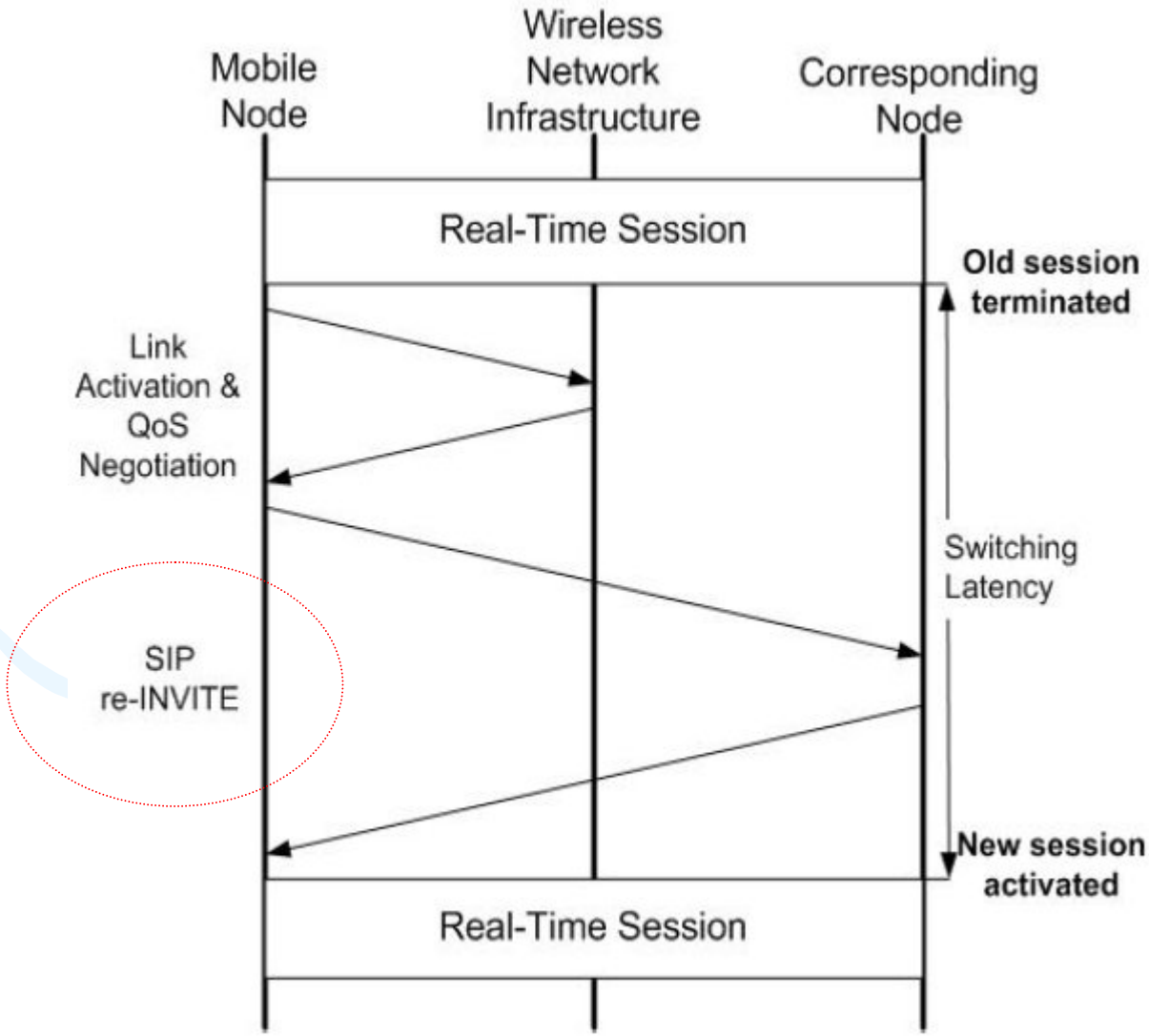
QoS Provisioning in the Integrated Architecture

- QoS Session Activation
- QoS Classification Mapping
- Network Layer QoS
  - DiffServ
- Session Layer QoS

QoS Provisioning in the Integrated Architecture

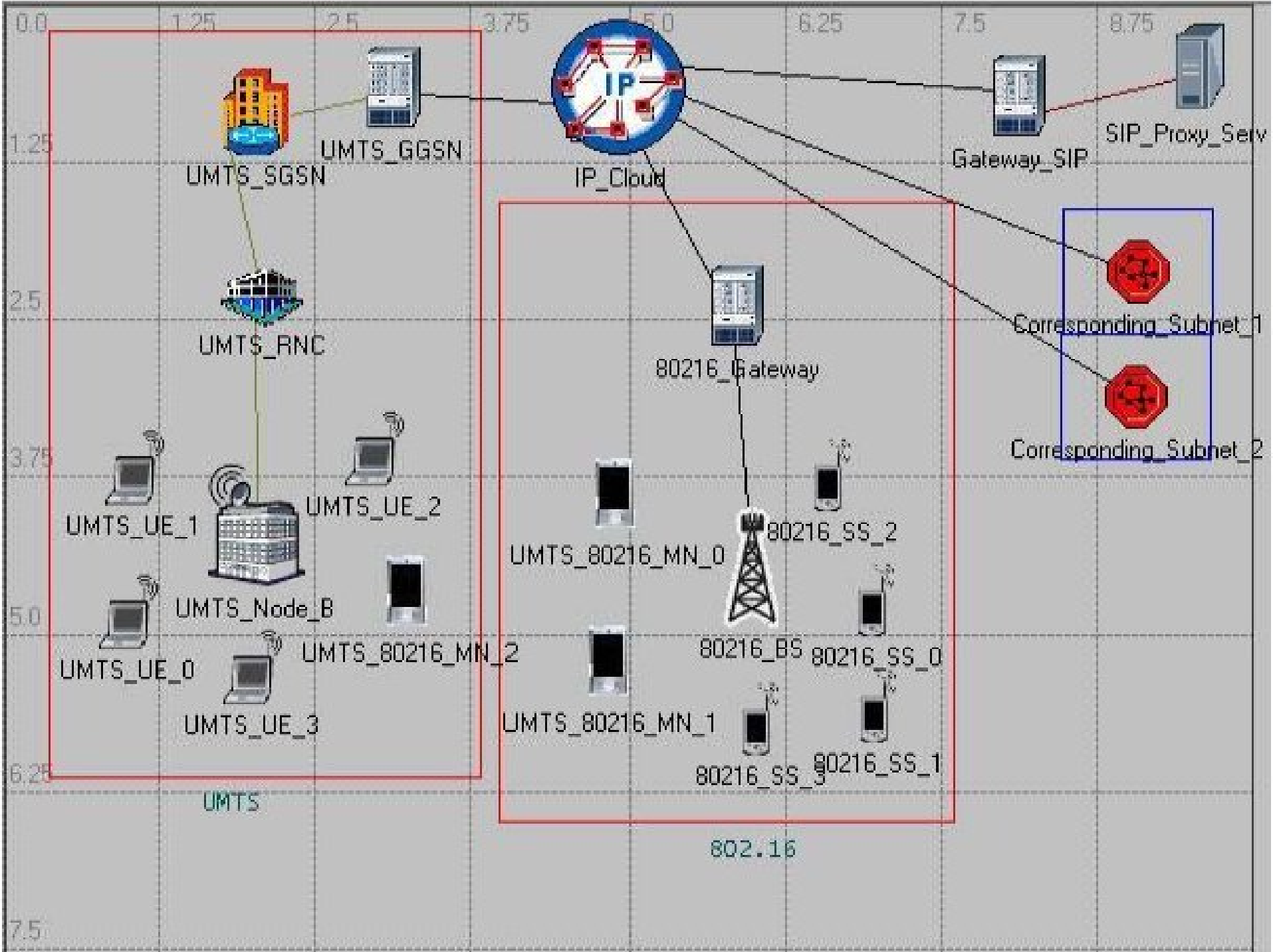
- QoS Session Activation
- QoS Classification Mapping
- Network Layer QoS
- Session Layer QoS
  - Non-Real-Time Session Mobility
    - Mobile IP
  - Real-Time Session Mobility
    - Supported by SIP

Mobility Procedure Using SIP

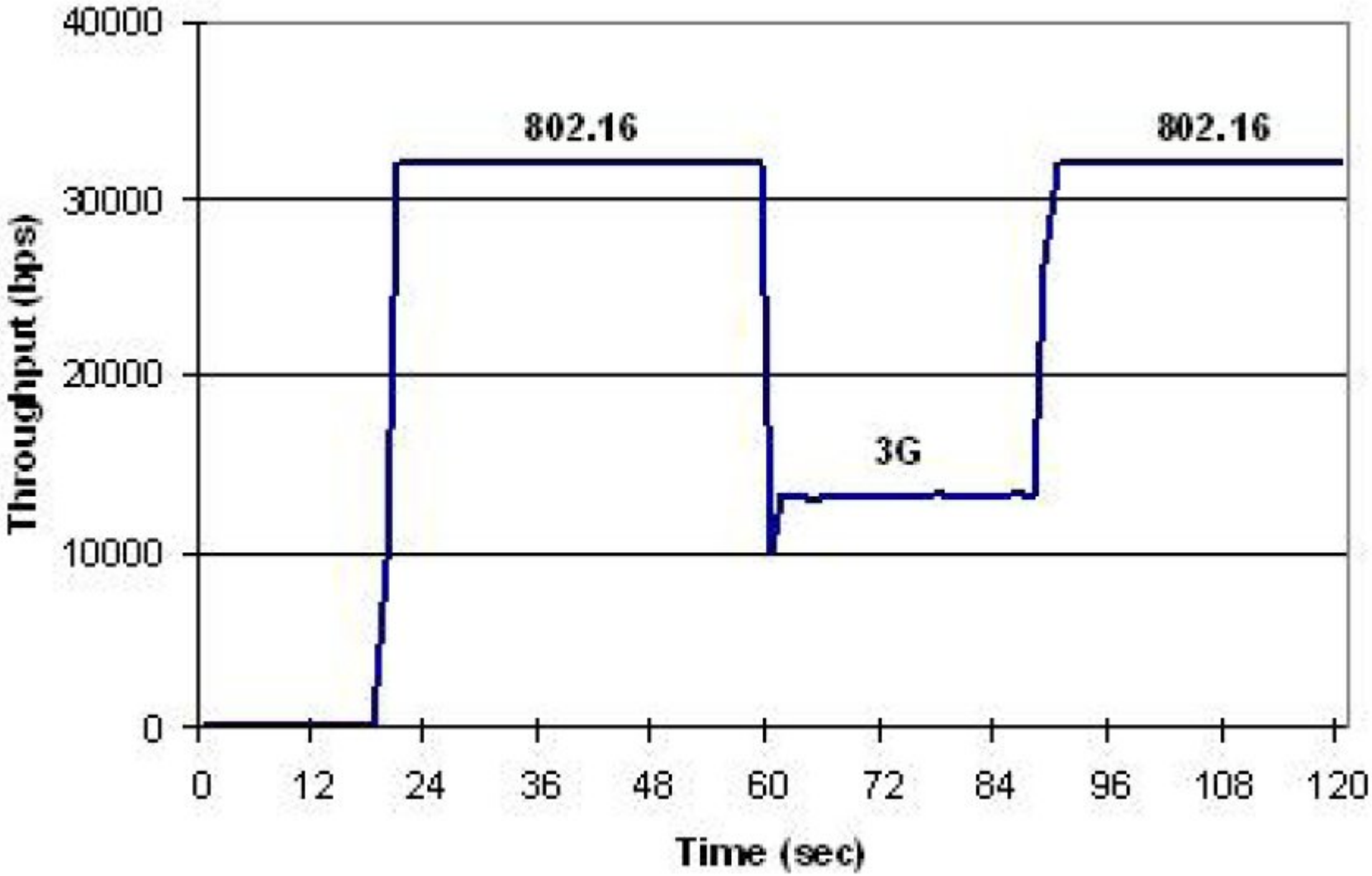


The Simulation Model

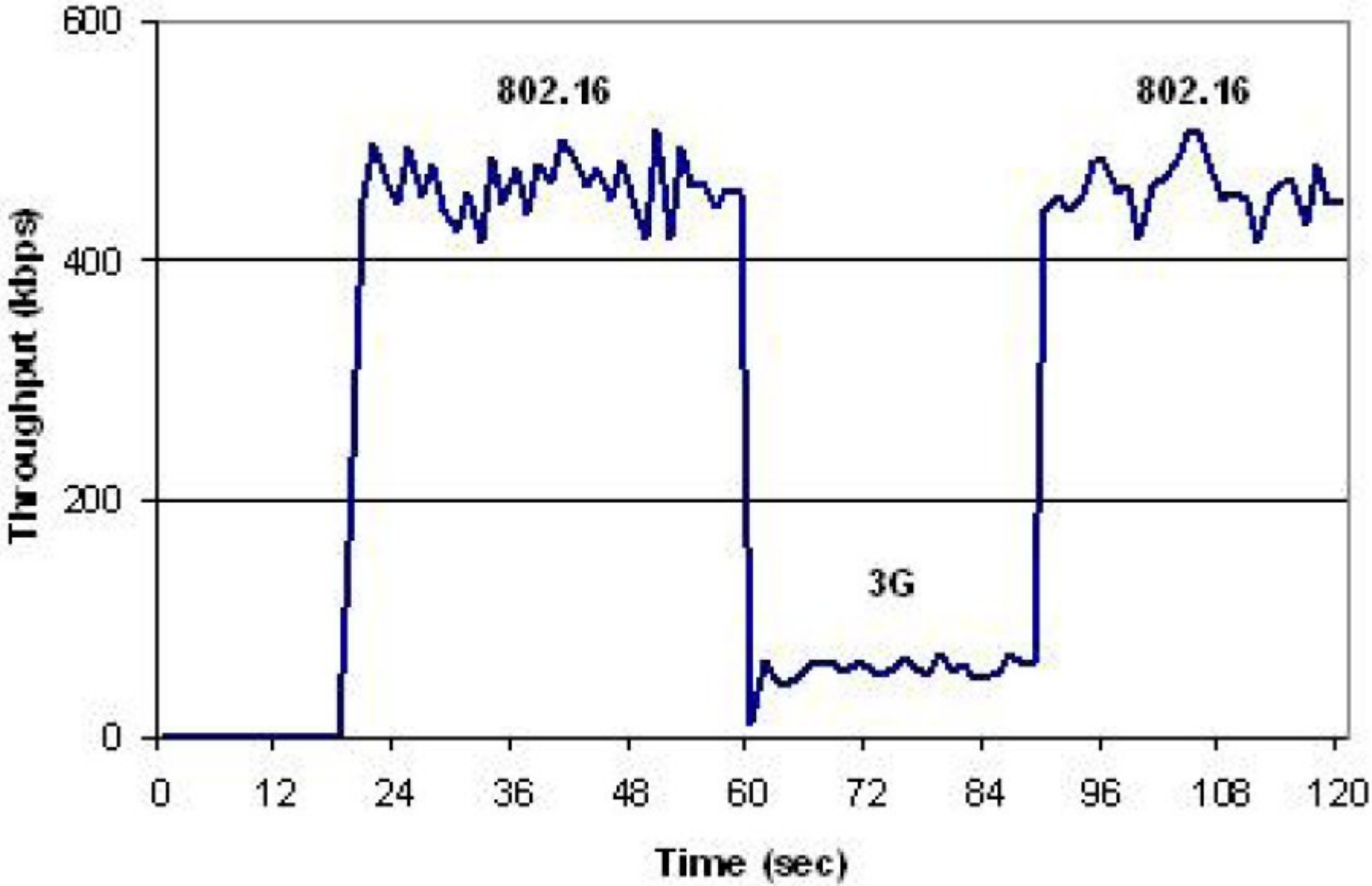
LEGEND	
Node Name	Description
UMTS_	UMTS nodes
80216_	802.16 nodes
UMTS_UE_	UMTS-only mobile nodes
80216_SS_	802.16-only nodes
UMTS_80216_MN_	Mobile nodes for integrated architecture
IP_Cloud	Internet
Corresnponding Subnet	Subnet with corresponding nodes


0.0
1.25
2.5
3.75
5.0
6.25
7.5
8.75
IP
UMTS_SGSN
UMTS_GGSN
IP_Cloud
Gateway_SIP
SIP_Proxy_Serv
UMTS_RNC
80216_Gateway
Corresponding_Subnet_1
Corresponding_Subnet_2
UMTS_UE_1
UMTS_UE_2
UMTS_80216_MN_0
80216_SS_2
UMTS_Node_B
UMTS_UE_0
UMTS_80216_MN_2
80216_BS
80216_SS_0
UMTS_UE_3
UMTS_80216_MN_1
80216_SS_3
80216_SS_1
UMTS
802.16

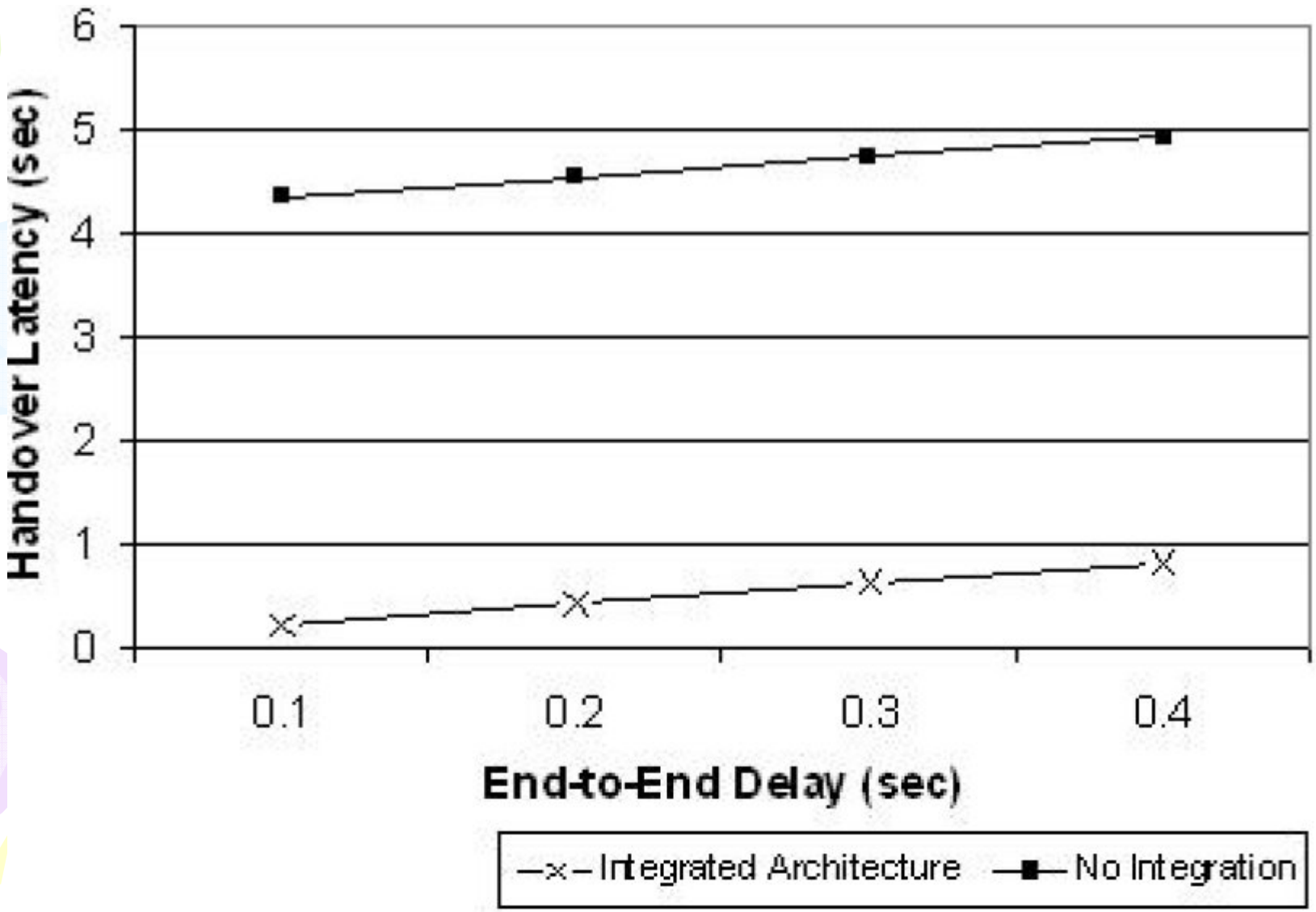
Throughput for CBR Voice Application



Throughput for VBR Video Application



Switching Latency vs. End-to-End Delay



Summary

- This paper provides an architecture for 3G and 802.16 wireless networks integration with QoS support.
  - Loosely-coupled
  - Mobility manager and session manager
  - SIP with SDP

Discussions

- SIP extension for end-to-end QoS
  - Cross layer QoS parameters transmission
- QoS classes mapping
  - Different definitions in bandwidth and services
  - Network capability
- Mobility QoS?

References

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