System Architecture for Billing of Multi–Player Games in a Wireless Environment using GSM/UMTS and WLAN Services

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Content

- Introduction, Motivation, Goal, and Approach
- System Architecture
- Billing Approaches
- Business Cases and Related Reference Model
- Protocol
- Conclusion and Outlook

Introduction and Motivation

- No single killer application, but set of new services are required for 3G networks for a sufficient return of investment

- New services with tremendous revenue potential and their related QoS parameters are:
  - video: high (variable) bandwidth requirements [1,2,3]
  - multi-player games: tight delay requirements [3]

- Here we focus on multi-player services

- Omnipresent 2/2.5G and future 3G networks provide insufficient QoS support for multi-player games (large ping times)

Goal

To generate a system architecture that enables high quality games among multiple wireless users and simultaneously enables the network and game service providers to charge for this kind of service in a fair manner.

Approach

- Our system architecture relies on wireless **vertical** communication conducted over GSM/UMTS for Register & Billing & Updates & Services

- During the game the players exchange information over wireless **horizontal** communication conducted over wireless LANs

- Taking advantage of GSM/UMTS and WLAN characteristics

System Architecture Entities

The system architecture consists of five main entities:

1. Multi-Player Network
2. Wireless Overlay Communication System
3. Billing Entity
4. Gaming Service Provider
5. IP Backbone

Multi-Player Network

- Formed by a multi-player group
- By definition all users want to play the same game together
- All wireless terminals have one **horizontal** air interface
- At least one terminal of the group has a **vertical** air interface → bridging terminal
- Local gaming server placed at the bridging terminal

Overall System Architecture

Card Games   All Types   Proxy Architectures
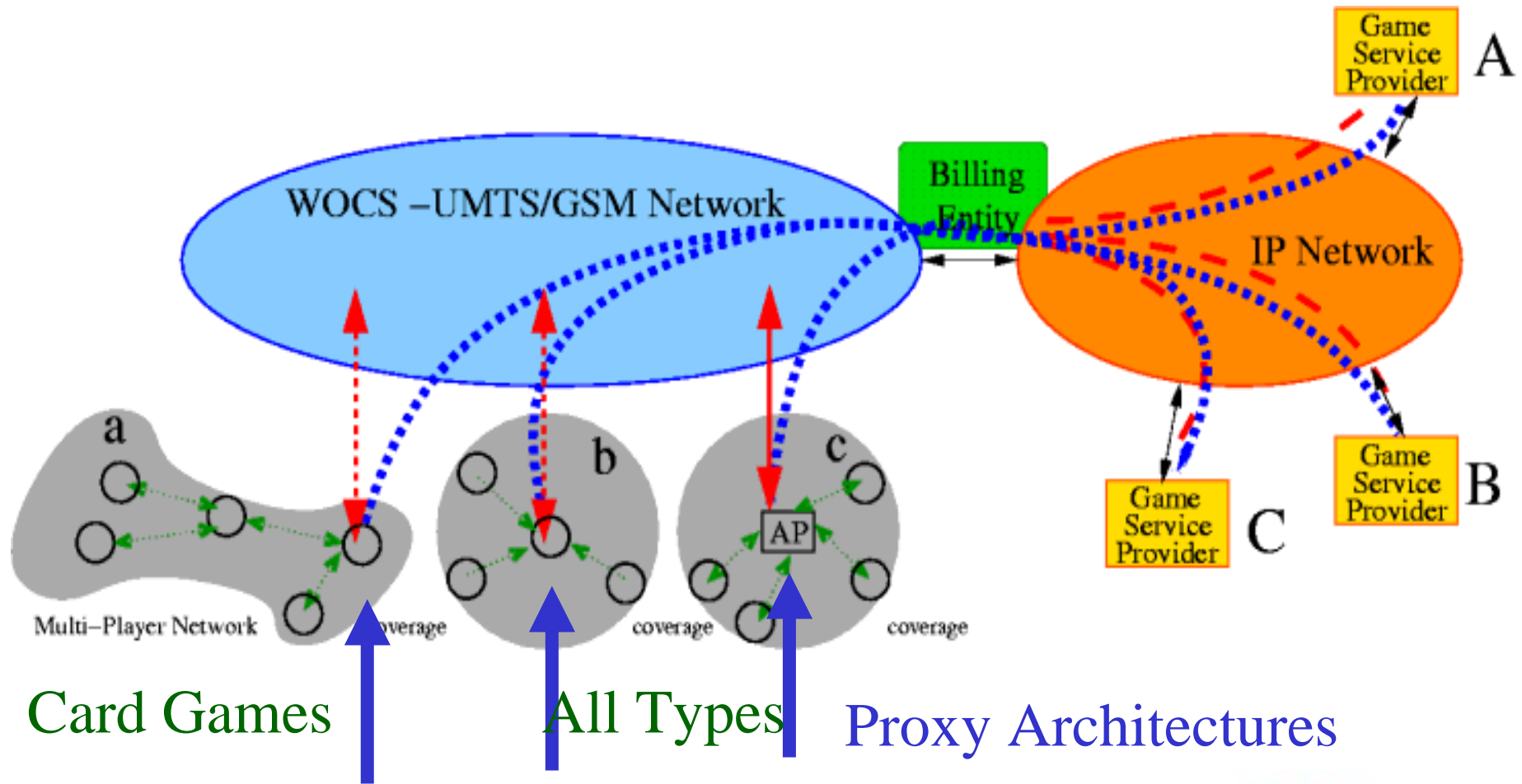
Billing Entity

- Different billing approaches are possible
- Billing entity is located in the WOCS are in the Internet
- Inspired by the successful service model of NTT DoCoMo (i-mode platform) we distinguish three approaches
  - Separate Direct Billing
  - Separate Indirect Billing
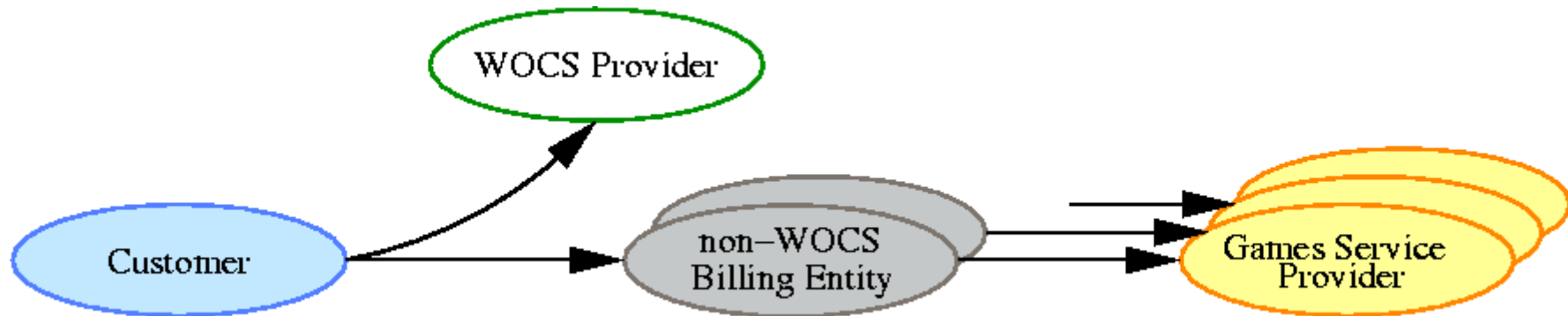 - Transparent Billing

Billing Approach I
Separate Direct Billing

WOCS Provider

Customer

Games Service Provider
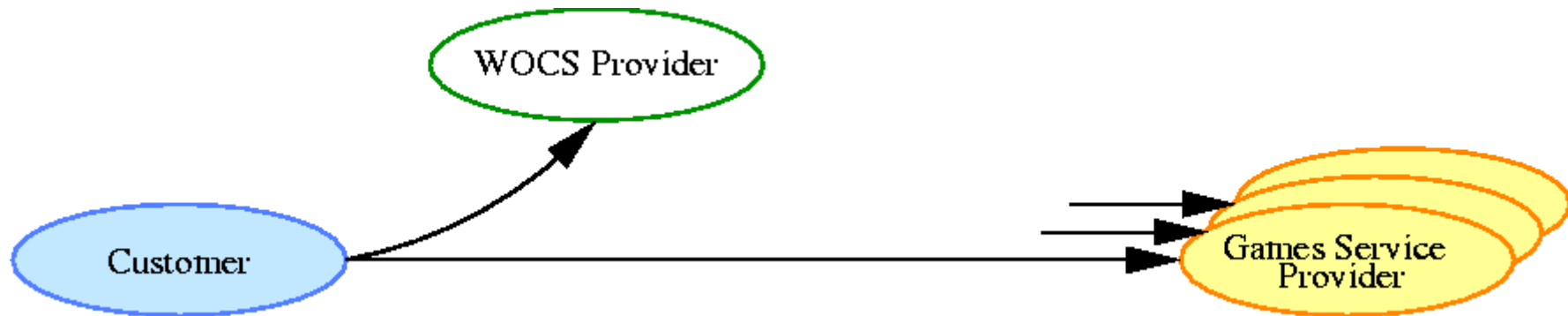
- WOCS providers charge for each wireless connection

- Game service providers charge for their services

- Customer receives multiple bills

Billing Approach II
Separate Indirect Billing

- WOCS providers charge for each wireless connection
- multiple IP based billing server
- Customer receives multiple bills

Billing Approach III
Transparent Billing

- WOCS and game service providers have an agreement for the billing fees (i-mode)

- Customer receives one unique bill from the WOCS for all services

- Billing entity is a inherent entity of the WOCS

Business Cases and Related Reference Model

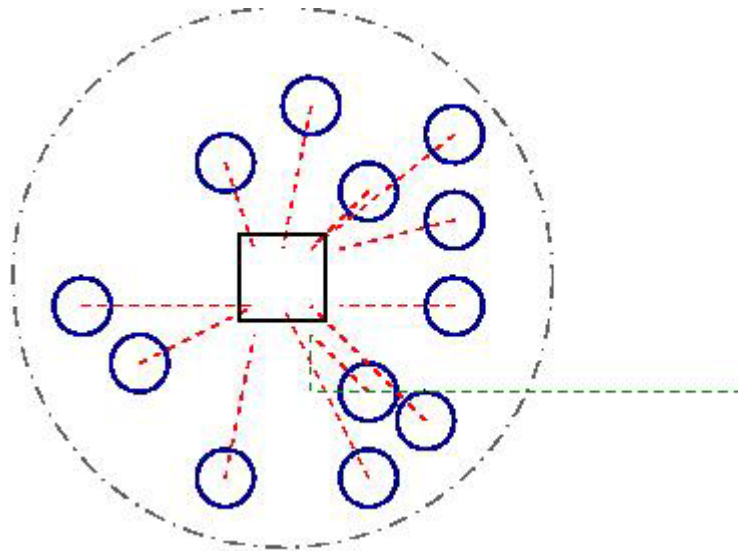| Topology	Vertical Connection	
	Wireless	**Wired (HOTSPOT)**
Ad-Hoc	Parking Lots Traffic Jams	Theme Parks
Cellular	Summer Camps Cruise Ships	Airports Train stations

Business and Reference Model I
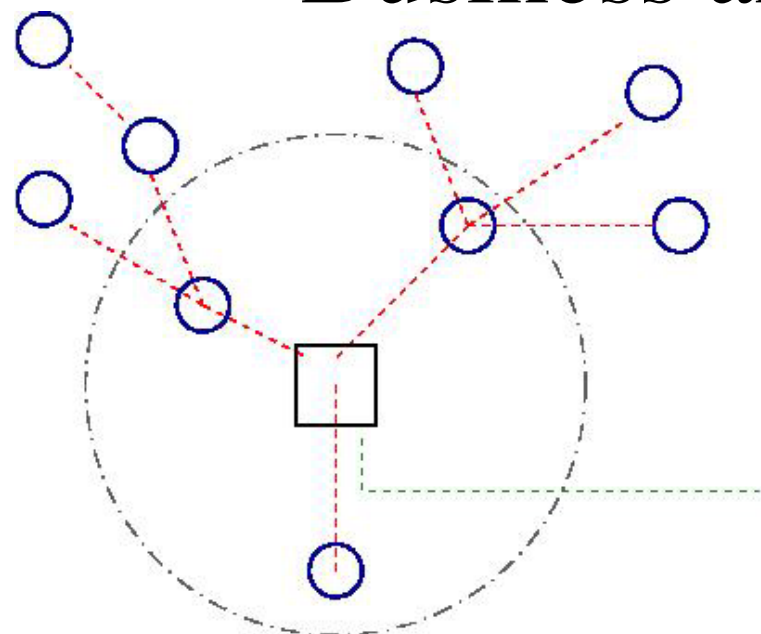
- - - - - wireless vertical connection

- - - - - wireless horizontal connection

□ bridging terminal/ access point

o wireless terminal

- - - - - coverage of bridging terminal

- one wireless bridging terminal
- multiple wireless terminals communicating through bridging terminal.
- ad-hoc (multi-hopping) to enlarge coverage

- Tourist Information Guide
- Summer Camp
- Construction Site
- Traffic Jam, Parking Lot

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Business and Reference Model II

- - - - - wireless vertical connection

- - - - - wireless horizontal connection

☐ bridging terminal/ access point

○ wireless terminal

- - - - - coverage of bridging terminal

- one wireless bridging terminal
- multiple wireless terminal communicating through bridging terminal.
- all nodes are in the range of the bridging terminal
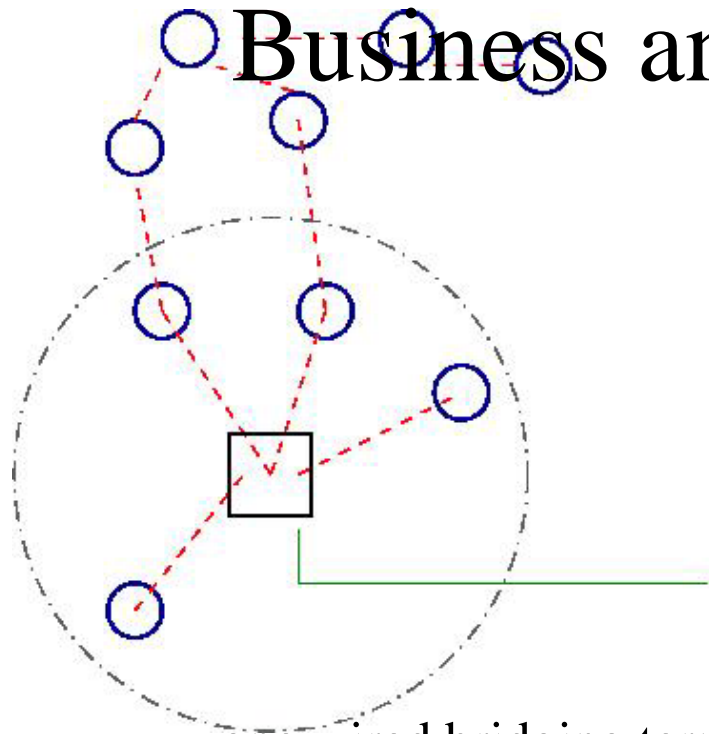
- Body Networks
- Cruise Ship

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Business and Reference Model III

— wired vertical connection

- - - - wireless horizontal connection

☐ bridging terminal/ access point

○ wireless terminal

-·-·- coverage of bridging terminal

– one wired bridging terminal

– multiple wireless terminal communicating through bridging terminal.

– ad-hoc (multi-hopping) to enlarge coverage
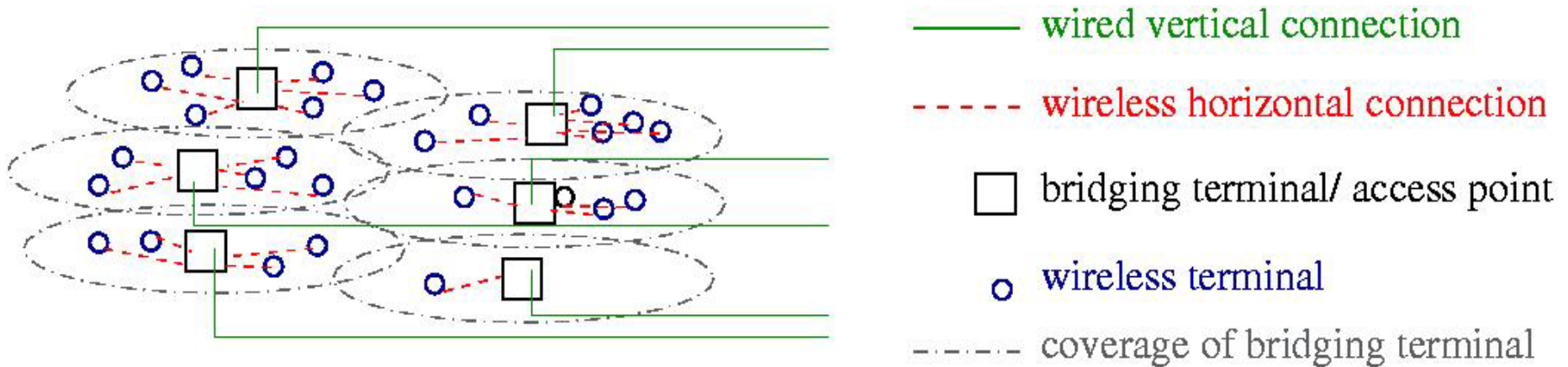
– Local Landlord

– eHome

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Business and Reference Model IV

wired vertical connection

- - - - wireless horizontal connection

□ bridging terminal/ access point

○ wireless terminal

- · - · - coverage of bridging terminal

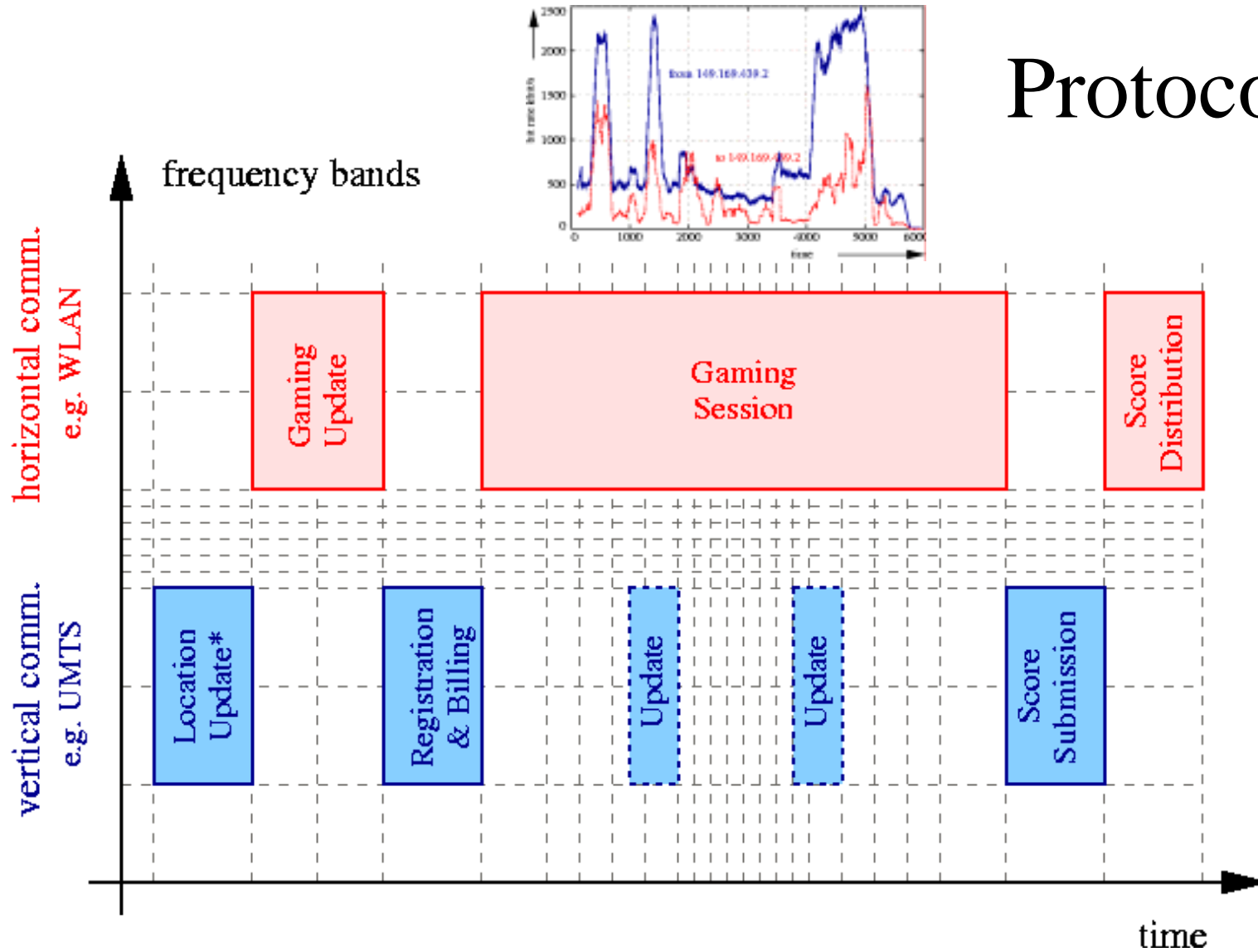– multiple wired bridging
terminals

– multiple directly attached nodes

– full coverage by bridging
terminals

– Airports
– Train stations

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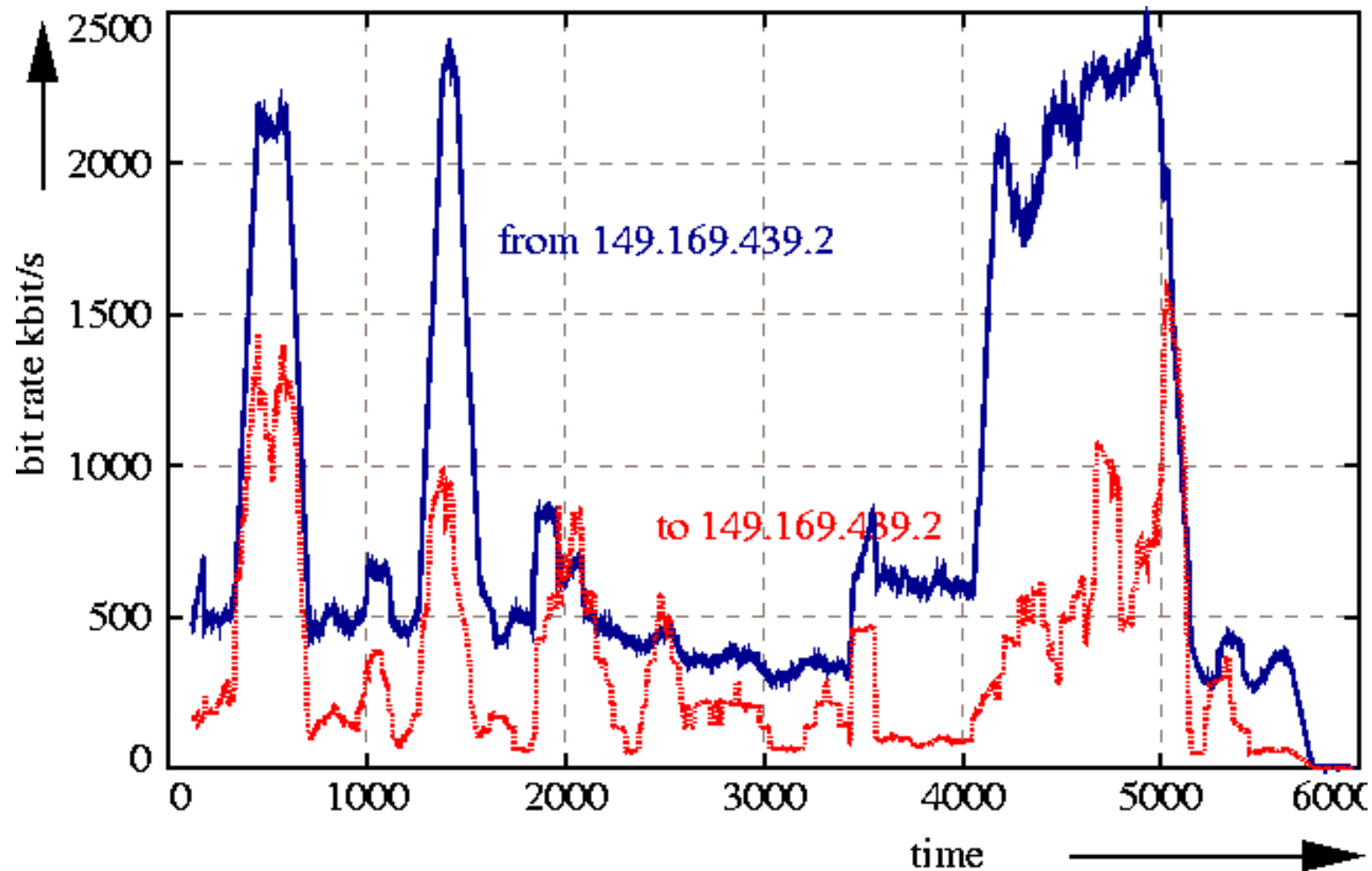ARIZONA STATE UNIVERSITY

Protocol

- Location Update
  - only for terminals with vertical communication entity
- Game Update
  - Exchange of gaming data and utilities (vertical and horizontal)
- Registration & Billing
- Gaming Session & Updates
- Score Submission/Distribution

Protocol

frequency bands

horizontal comm. e.g. WLAN

vertical comm. e.g. UMTS

Gaming Update

Gaming Session

Score Distribution

Location Update*

Registration & Billing

Update

Update

Score Submission

time

Example for Gaming Session: EverQuest

Conclusion & Outlook

C Introduction of a system architecture for multi–player sessions over wireless links

C Outsourcing of the gaming traffic leads to a more efficient use of the scare and costly 3G spectrum (higher profit per bit) – Network provider's view

C Gaming service becomes affordable with this architecture

O Fairness among a multi-player group. Can we only charge the terminal with the vertical communication? – First step is the authentication of other members of the multi-player group. WLAN integration in UMTS by acticom.

O Delay behavior of packets within the ad-hoc network

O Cheating?

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Thank you for your attention!

Q & A

Slides are available at www.acticom.de

References

[1] F.H.P. Fitzek, M. Reisslein, "MPEG-4 and H.263 Video Traces for Network Performance Evaluation", *IEEE Network*, vol 15, Nº 6, pages 40-54. Nov/Dec. 2001.

[2] F.H.P. Fitzek, M. Reisslein, "A Prefetching Protocol for Continuous Media Streaming in Wireless Environments", IEEE Journal on Selected Areas in Communications (special issue), Mobility and Resource Management in Next Generation Wireless Systems, vol 19, Nº 6, pages 2015-2028, October 2001

[3] F.H.P. Fitzek, Andreas Köpsel, Adam Wolisz, Manjunath Krishnam, Martin Reisslein, "Providing Application-Level QoS in 3G/4G Wireless Systems: A Comprehensive Framework Based on Multi--Rate CDMA", *IEEE Wireless Communications*, Special issue on 4G Technologies and Applications, April 2002