Session III: **Agents for Advanced Telecommunication Services**

Chair: Thomas Magedanz, *IKV++*

EC/ACTS Project MONTAGE (AC325)

Agent-based TINA Access Session Supporting Retailer Selection in Personal Mobility Context

Kimmo Raatikainen
kimmo.raatikainen@cs.helsinki.fi
University of Helsinki
Department of Computer Science

Presentations Outline

- About the MONTAGE project
  - ⇨ objectives, background
- MONTAGE Concepts
  - ⇨ business cases, retailers, dynamic model
- MONTAGE Access Session
- MONTAGE Service Session
- Conclusions

MONTAGE Objectives

- To exploit agent technology in personal mobility, accounting and charging
- To demonstrate the role of agents in telecommunications service provision
- To assess the added value of agents for all involved stakeholders

MONTAGE Background

- TINA Business Model
  - Retailer
- TINA Access and Service Sessions
  - User Agent - Provider Agent
  - Service Session Manager
- OSAM Access Session from DOLMEN (EC/ACTS and TINA Aux. Project)
  - User Agent Home/Visited

MONTAGE Business Cases

- BC1: User requests a subscribed service away from the Home Retailer Domain
- BC2: User requests a service from any retailer without subscription
- BC3: User, while away from the Home Retailer Domain, requests a subscribed service but the service is not offered by any retailer nearby

Retailers in MONTAGE - 1/2

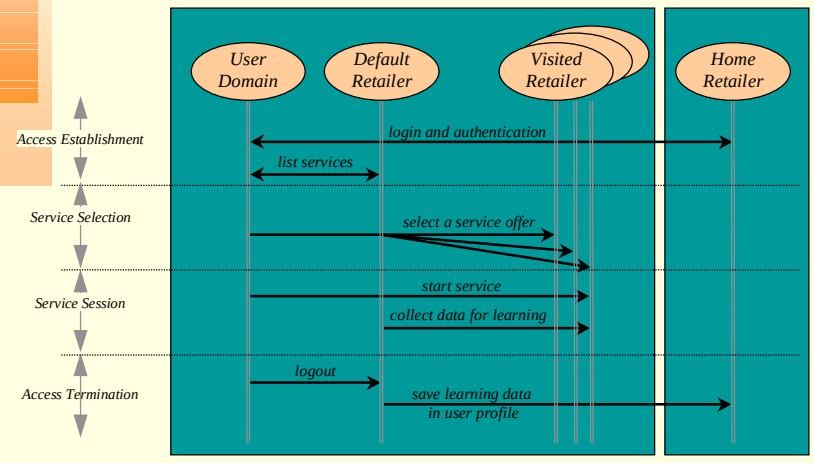
- Home Retailer
  - ⇨ a specific retailer, to whom a user has a subscription for one or more services.
- Default Retailer
  - ⇨ the initial access session level contact point in foreign network environment.

Retailers in MONTAGE - 2/2

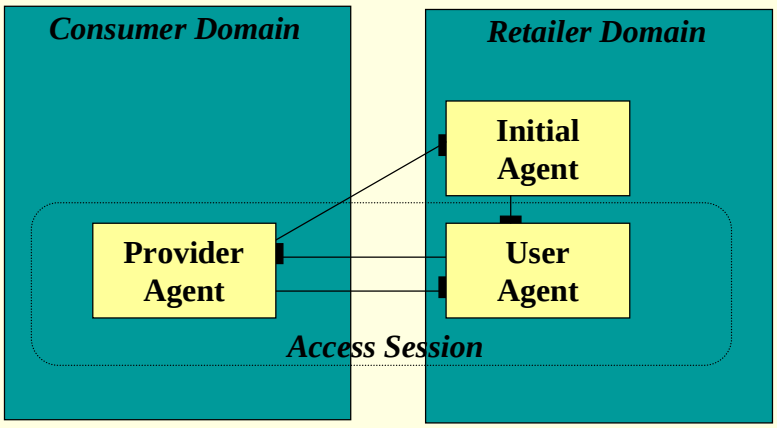
- Candidate Retailer
  - any retailer, who is not the home retailer and with whom the user can establish access and service sessions.
- Selected Retailer
  - the retailer whose service offer is chosen as a result of a dynamic selection process.

Dynamic Model

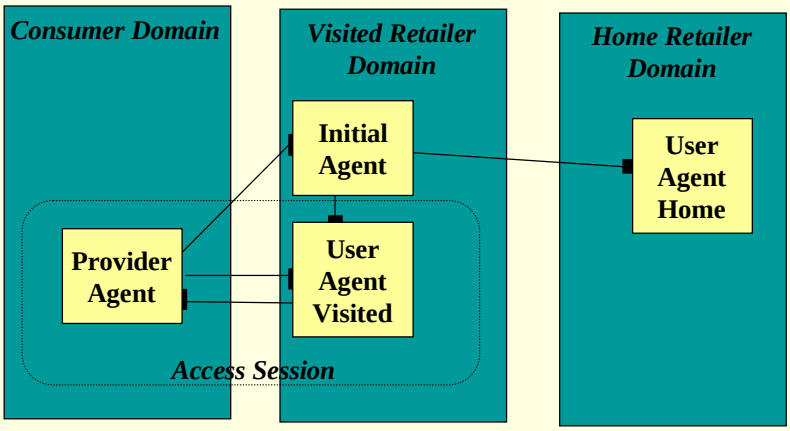
Access and service session scenarios



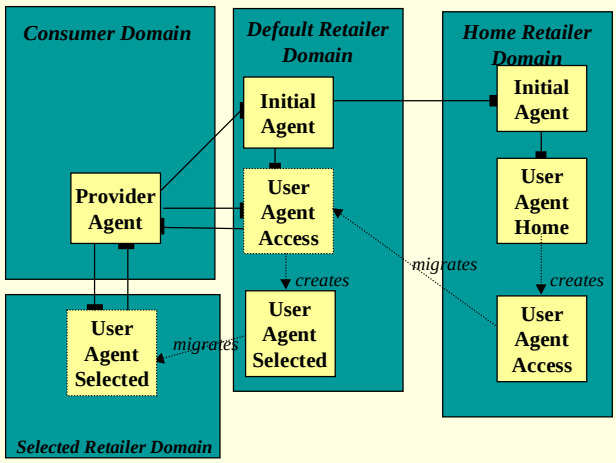
TINA Access Session



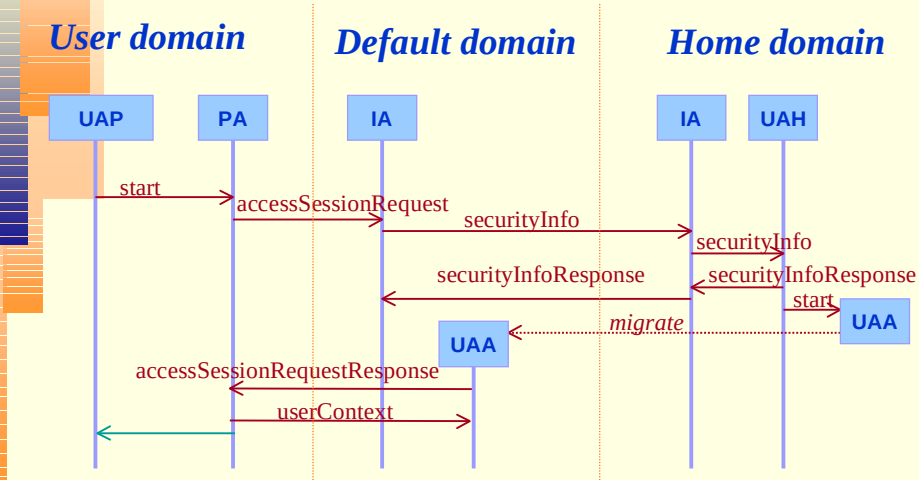
OSAM Access Session

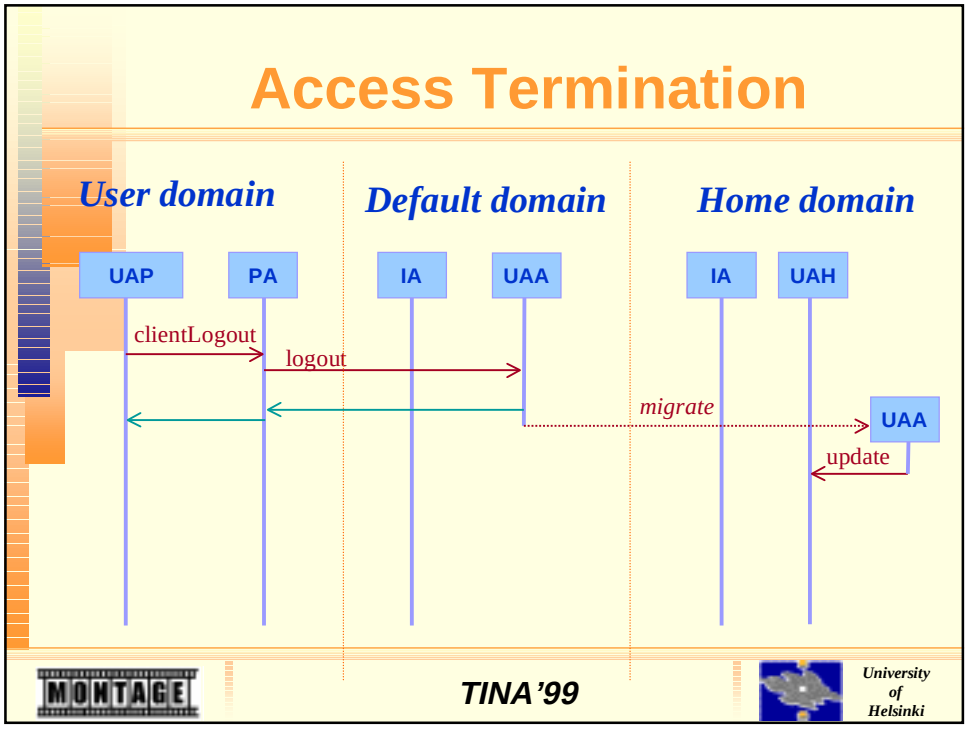


MONTAGE Access Session



Access Establishment




Access Termination
User domain
Default domain
Home domain
UAP
PA
IA
UAA
IA
UAH
clientLogout
logout
migrate
UAA
update
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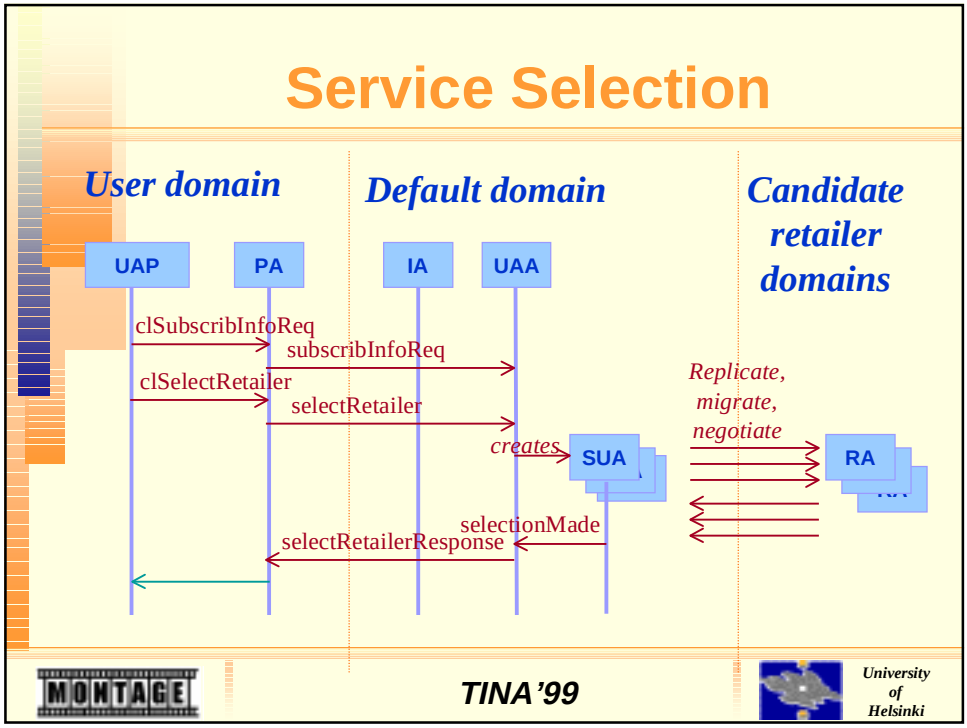
Service Selection
User domain
Default domain
Candidate retailer domains
UAP
PA
IA
UAA
clSubscribInfoReq
subscribInfoReq
clSelectRetailer
selectRetailer
creates
SUA
Replicate, migrate, negotiate
RA
selectionMade
selectRetailerResponse
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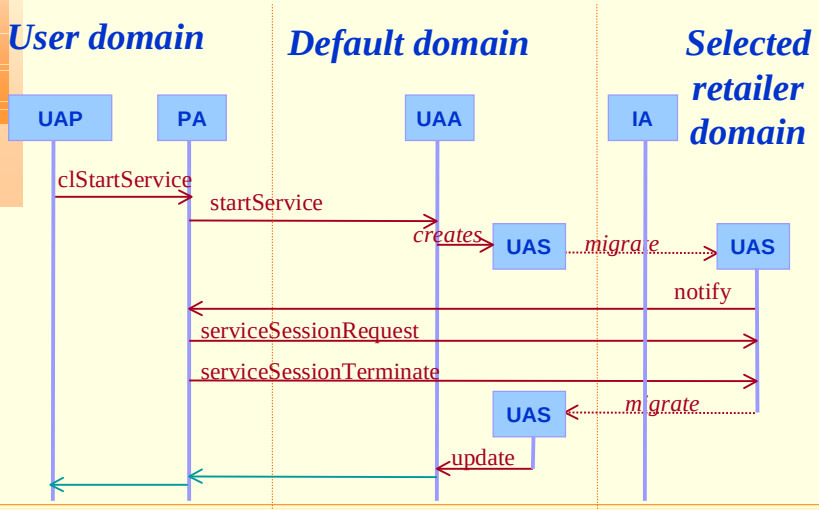
Service Selection Criteria

- Selection criteria considered
  - ⇨ max *utility*
  - ⇨ min *charge*
  - ⇨ max *net benefit* = max (*utility* - *charge*)
- A simple and scalable user-utility model, based on the user profile
- An algorithm for efficient local negotiation between user and retailer agents

Service Execution



Conclusions

- Agent technology is useful to implement TINA User Agent when is user is mobile
- Agents make it convenient to personalize and differentiate services
- Personalization can be based learning user preferences
- Demo available - User trial in autumn

Realizing Nomadic Communication with Mobile Agents: Strategies and their Evaluation

Axel Küpper, Anthony S. Park
RWTH Aachen, Lehrstuhl für Informatik IV

Nomadic Communication: Introduction and Problems

UMTS and the Virtual Home Environment (VHE)

Home Domains vs Mobile User Agents

Some Simulation Results

The AMASE Agent Platform

Nomadic Communication
Characteristics

Terminal Mobility

[keeps registraton/call between retailer and customer while in motion]

Session Mobility

[allows to interrupt sessions and to resume them later, possibly from another terminal or another network]

Personal Mobility

[enables a customer to be identifiable regardless of the terminal, the terminal type, and the retailer he is currently registered with]

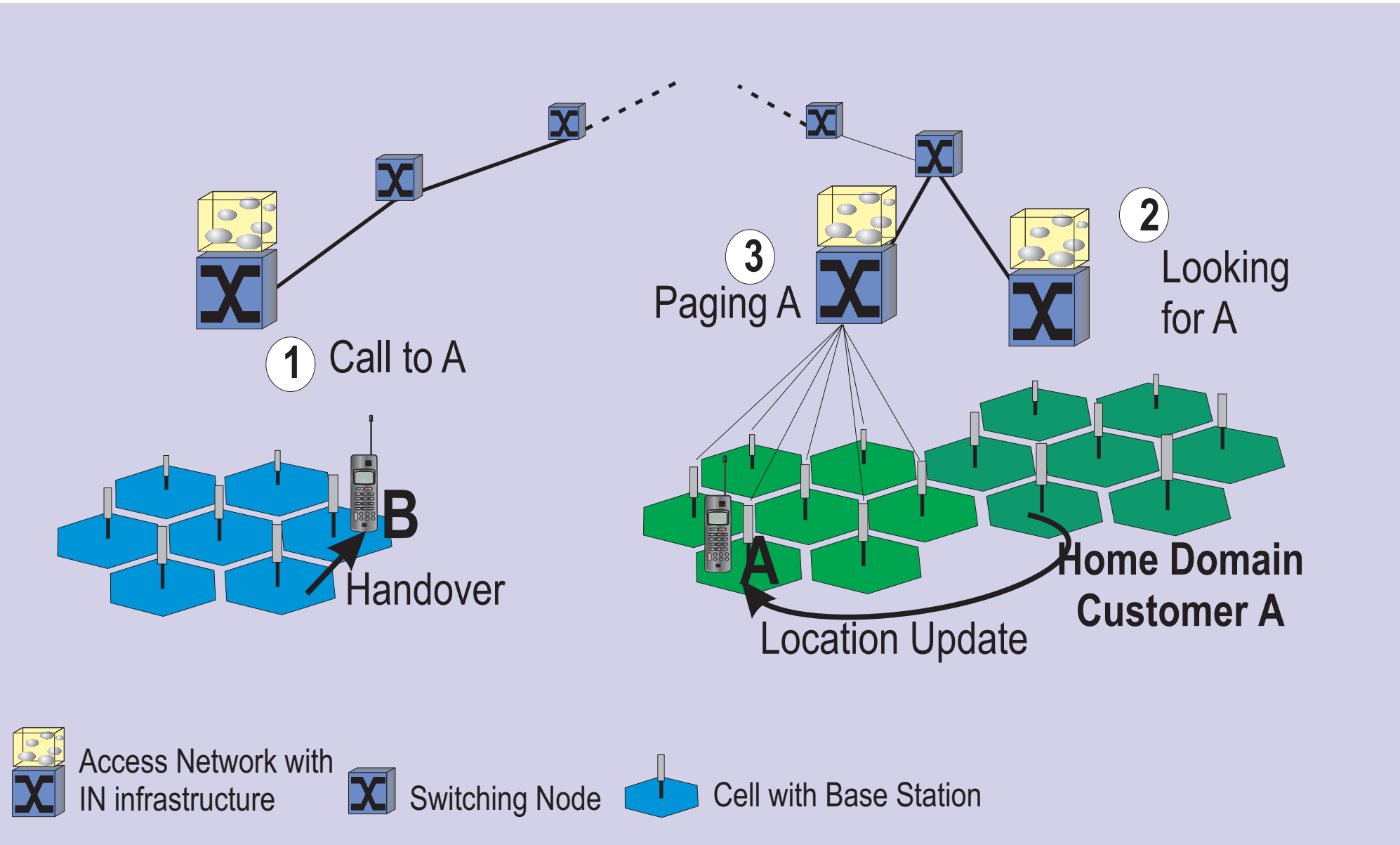
Nomadic Communication
Problems

Convergence
- conventional fixed networks (PSTN, ISDN,...)
- mobile cellular networks (GSM, UMTS/IMT2000,...)
- Internet
- local networks (DECT, WLAN, ...)

Deregulation & Competition
- customers may change registration/subscription dynamically
- customer availability in foreign domains
- profile availability in foreign domains
- life-long personal id

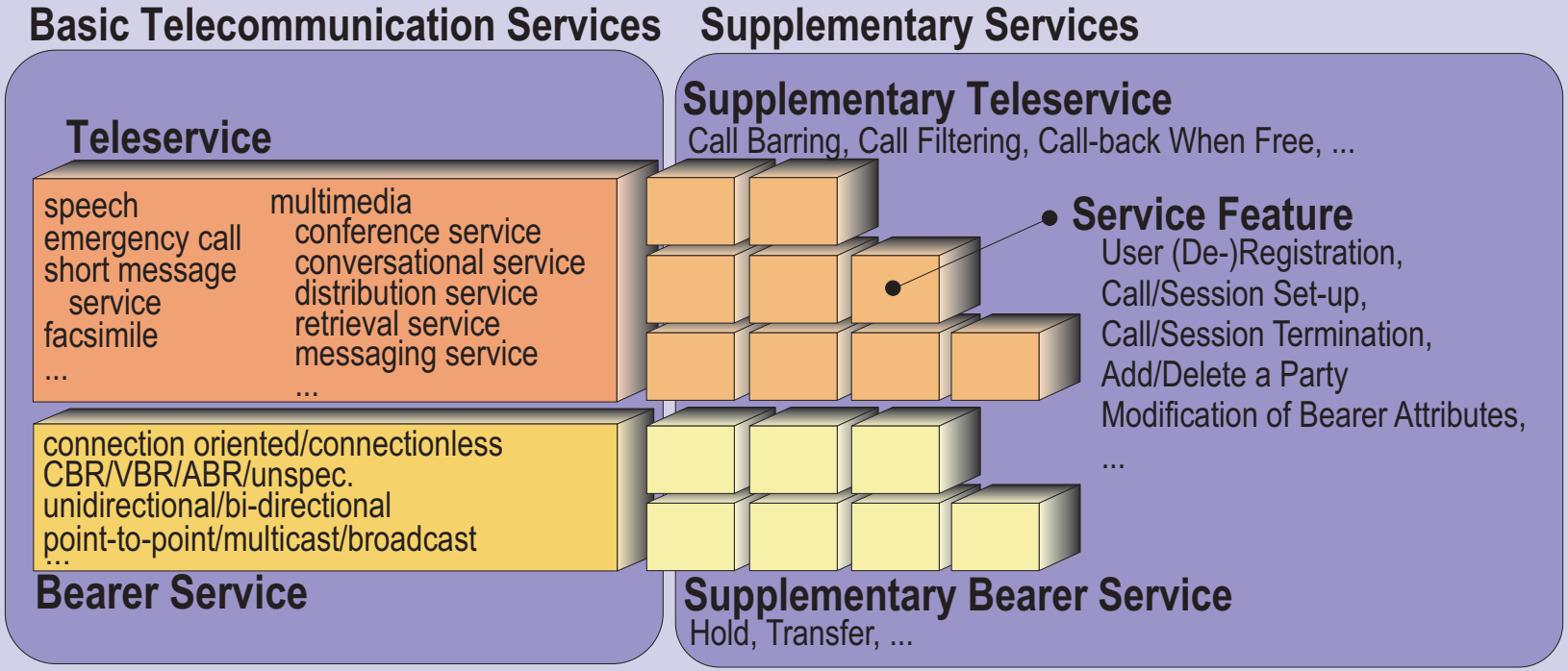
Performance
- nomadicity is expected to be costly in terms of signaling traffic

UMTS
Mobility Management



UMTS

Service Architecture & Virtual Home Environment

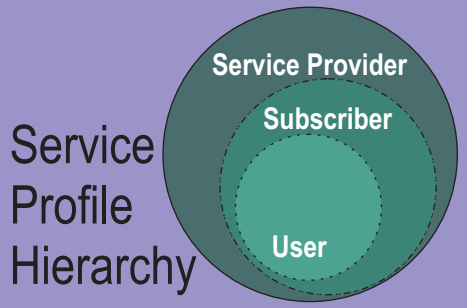


Virtual Home Environment (VHE)

personalised service portability across network boundaries and between terminals

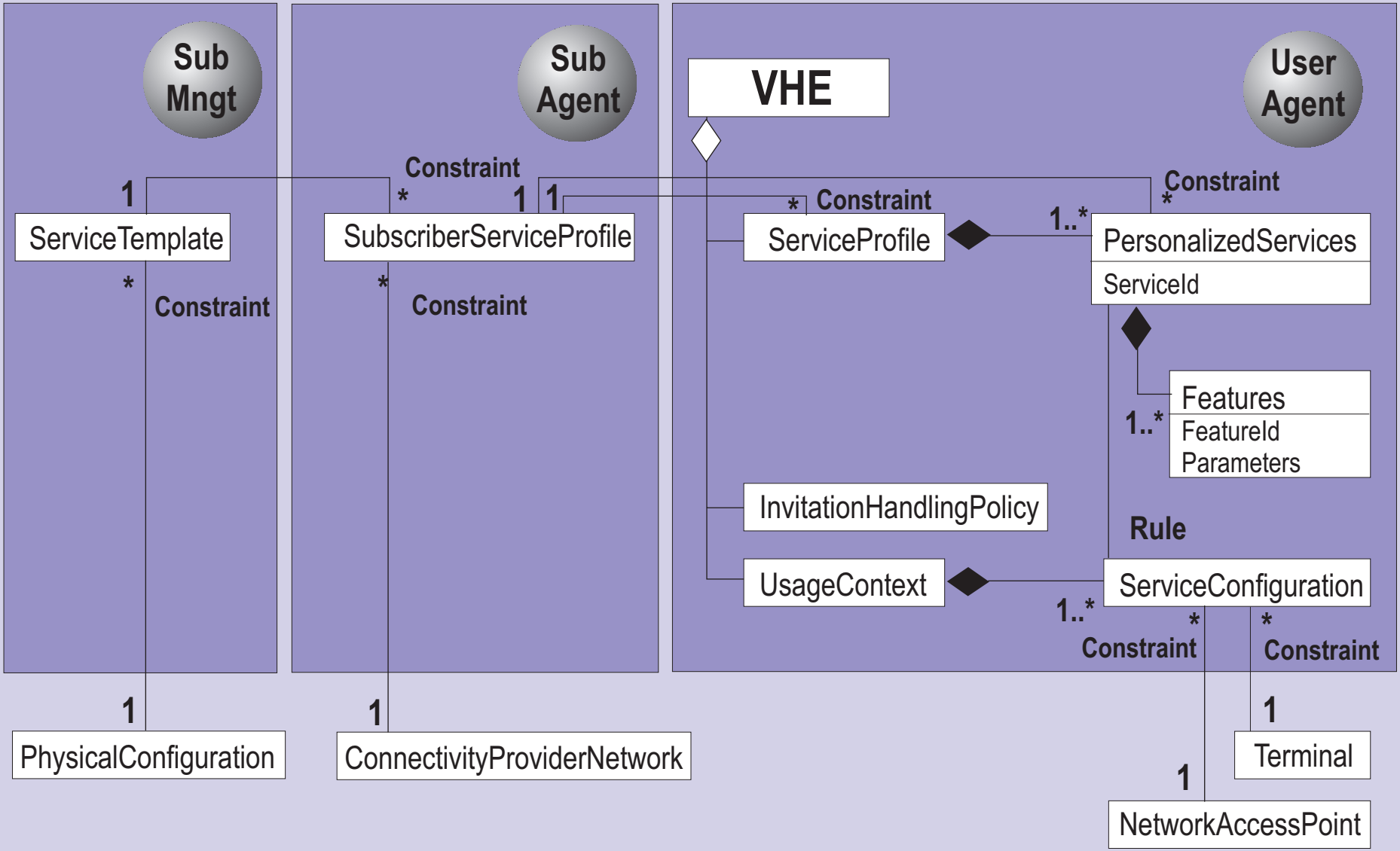
"look and feel" of the working environment

personal address book

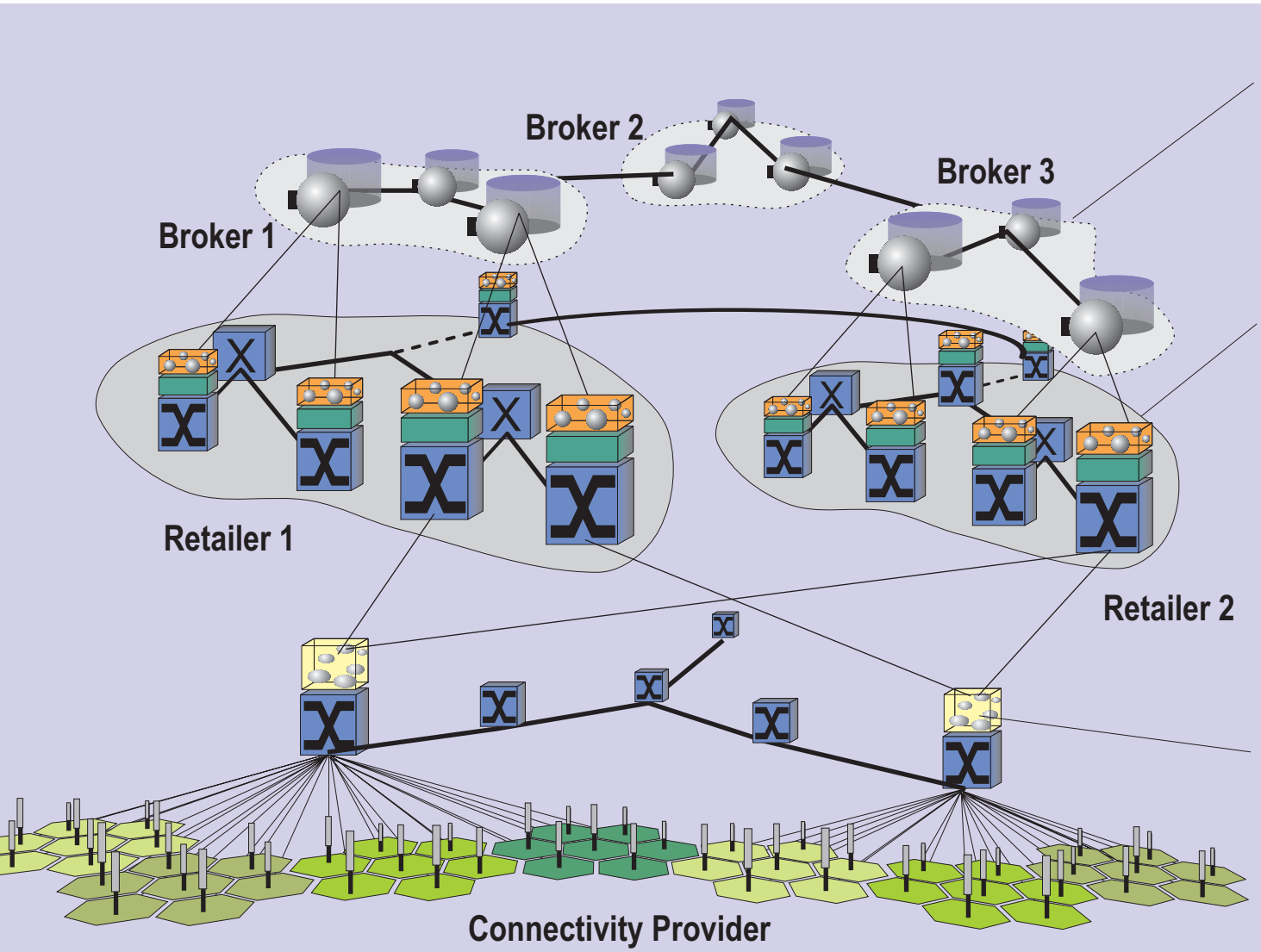


Virtual Home Environment

Information Modeling



Dividing Mobility Management between Stakeholders



Broker Federation

- Localization Mechanisms (for finding UAs and other objects)

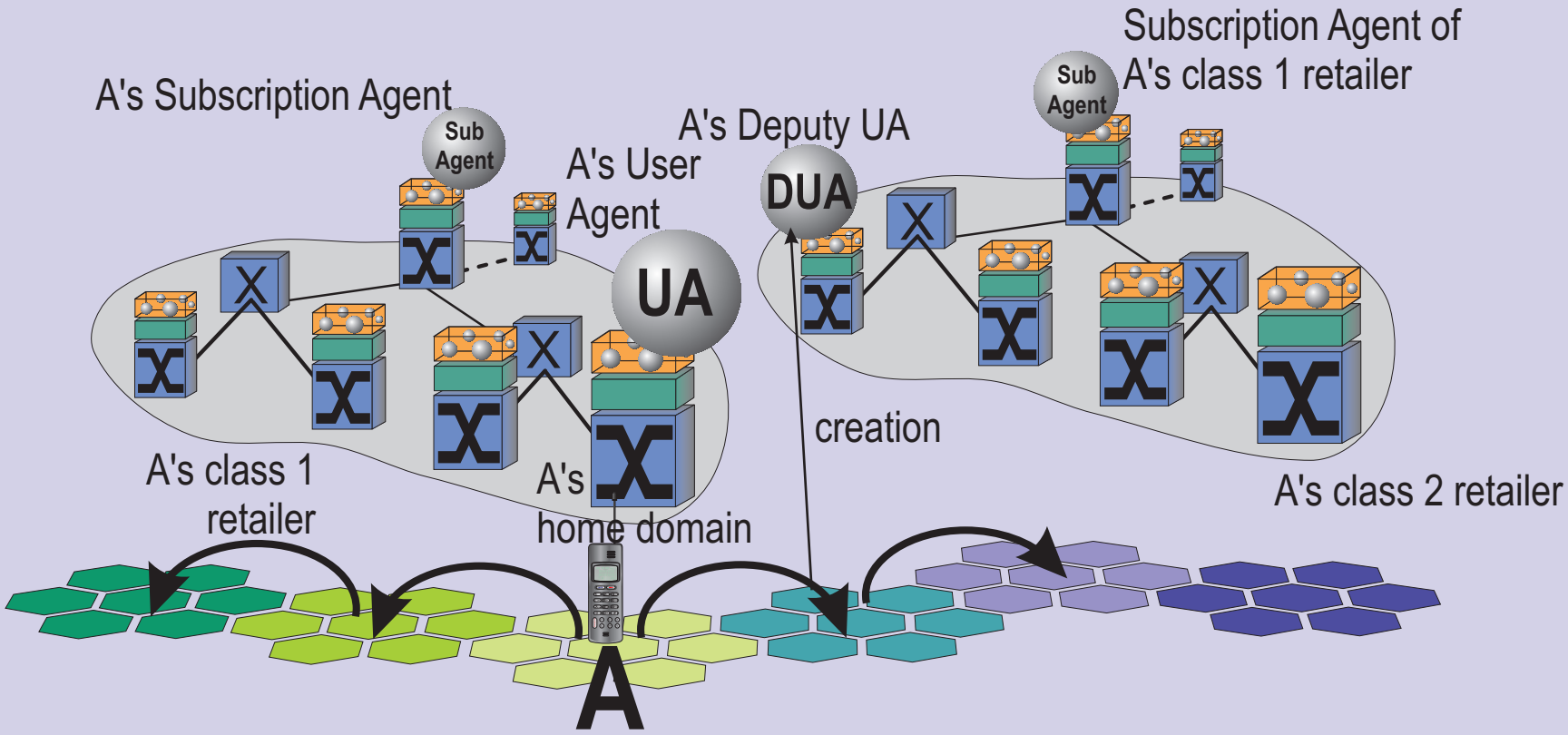
Access Networks

- contain and execute UAs, USMs, SSMs
- Location Update
- Domain Update
- (De-)Registration
- Attach/Detach

IN Node

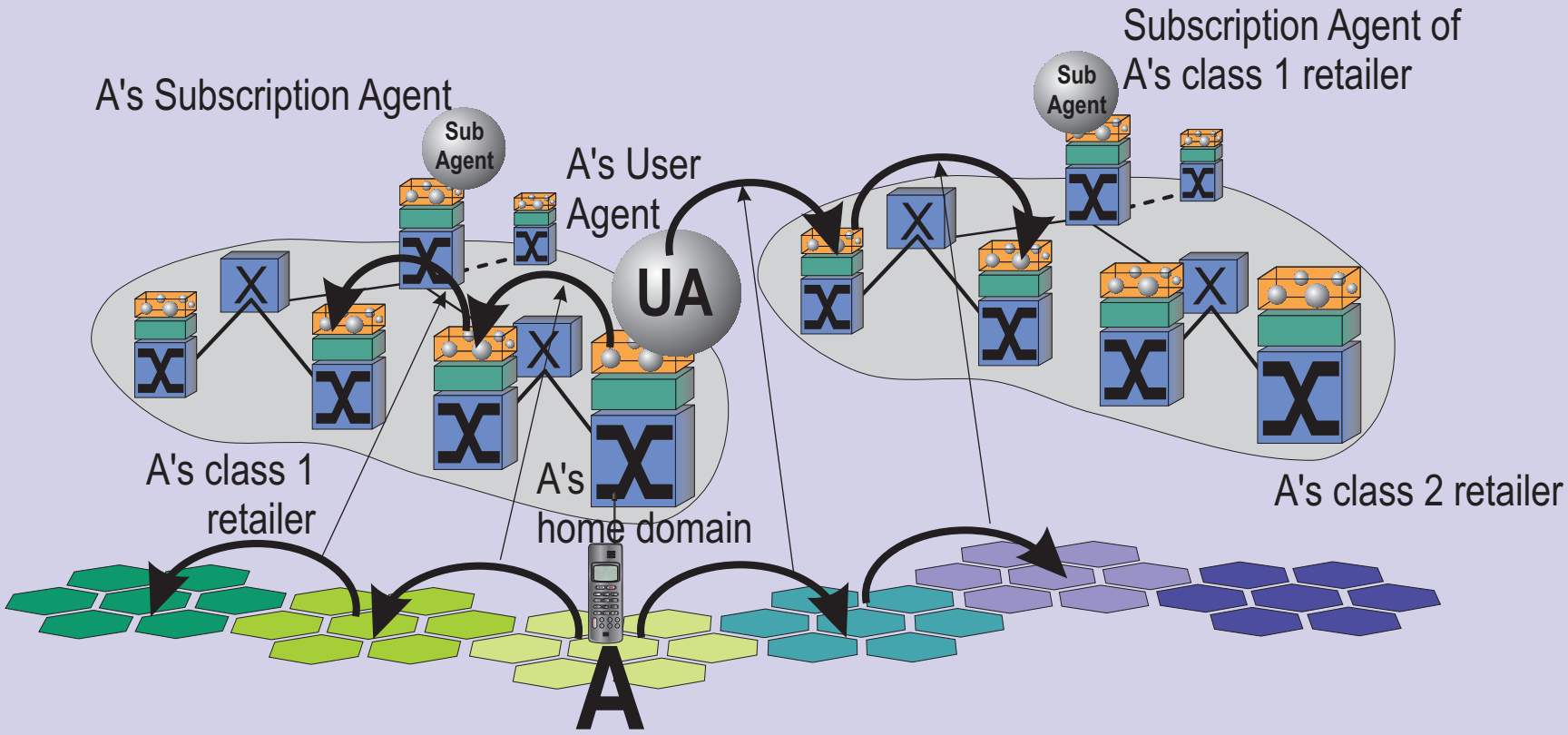
- Paging
- Handover
- ...

Home Domain Strategy



- each customer is associated with a home domain
- home domain contains customer-related ressources (UA, USM, ...)
- DUA is created whenever customer moves to coverage area of a class 2 retailer

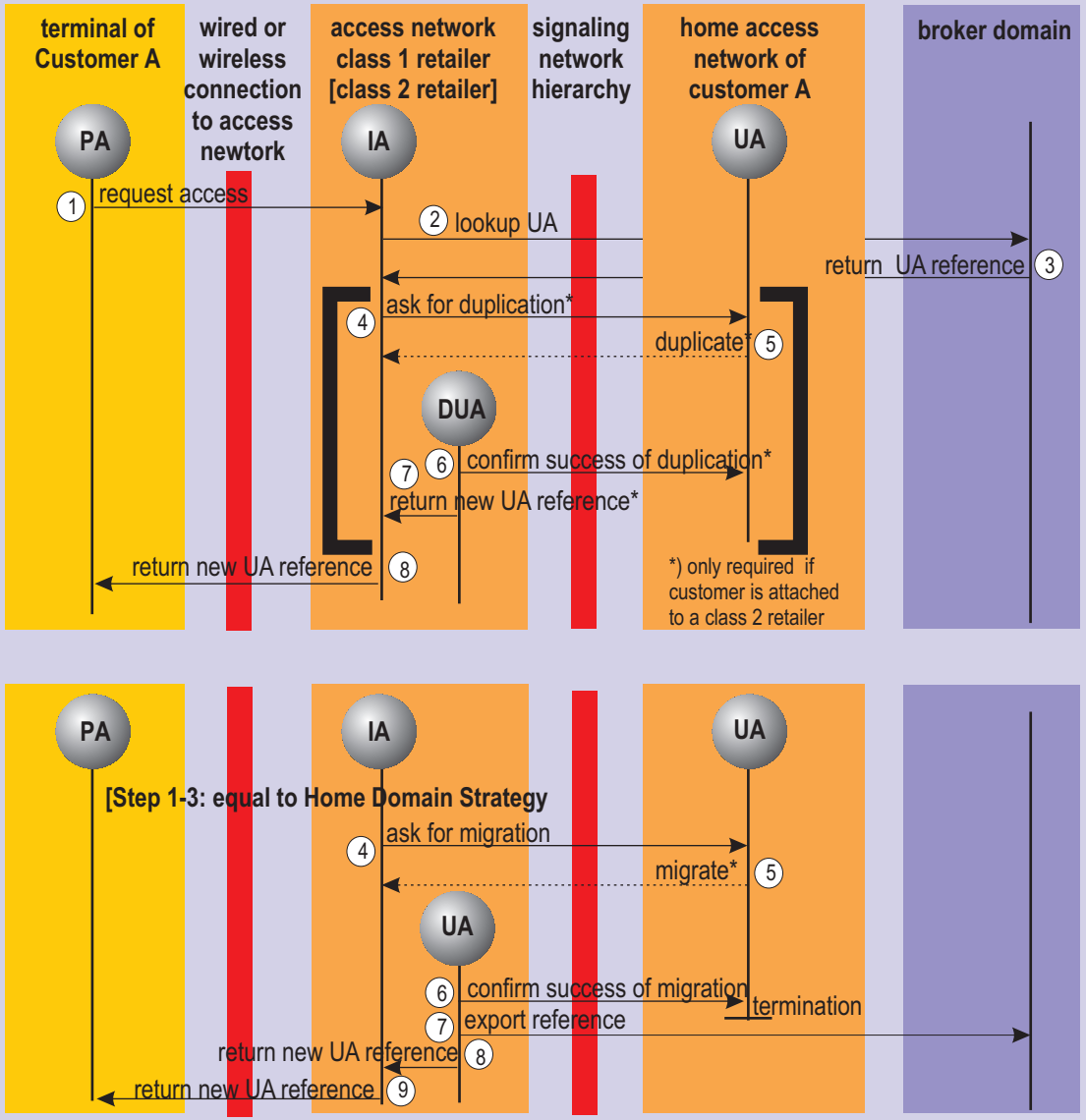
Mobile User Agent Strategy



- UA is capable of following the movement of his customer by hopping between access networks
- migration is performed when the customer registers with a terminal or when he crosses the boundaries of an access node's coverage area

Home Domains vs Mobile User Agents

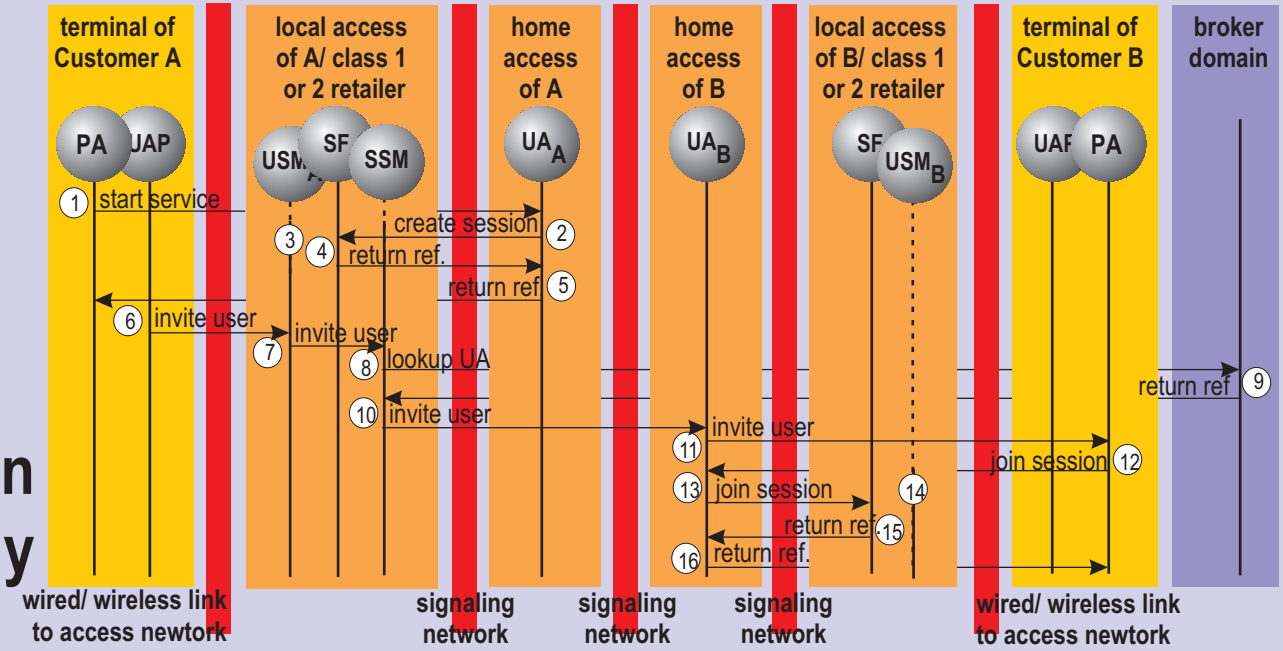
Login



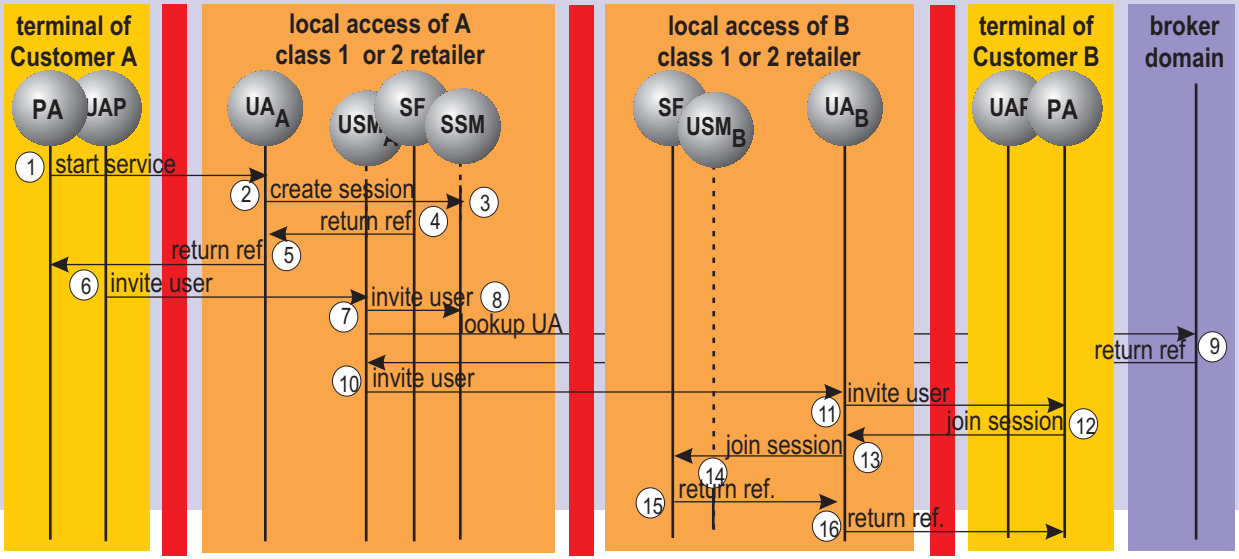
Home Domains vs Mobile User Agents

Session Setup

Home Domain Strategy



Mobile User Agent Strategy



Pros and Cons

HD Strategy

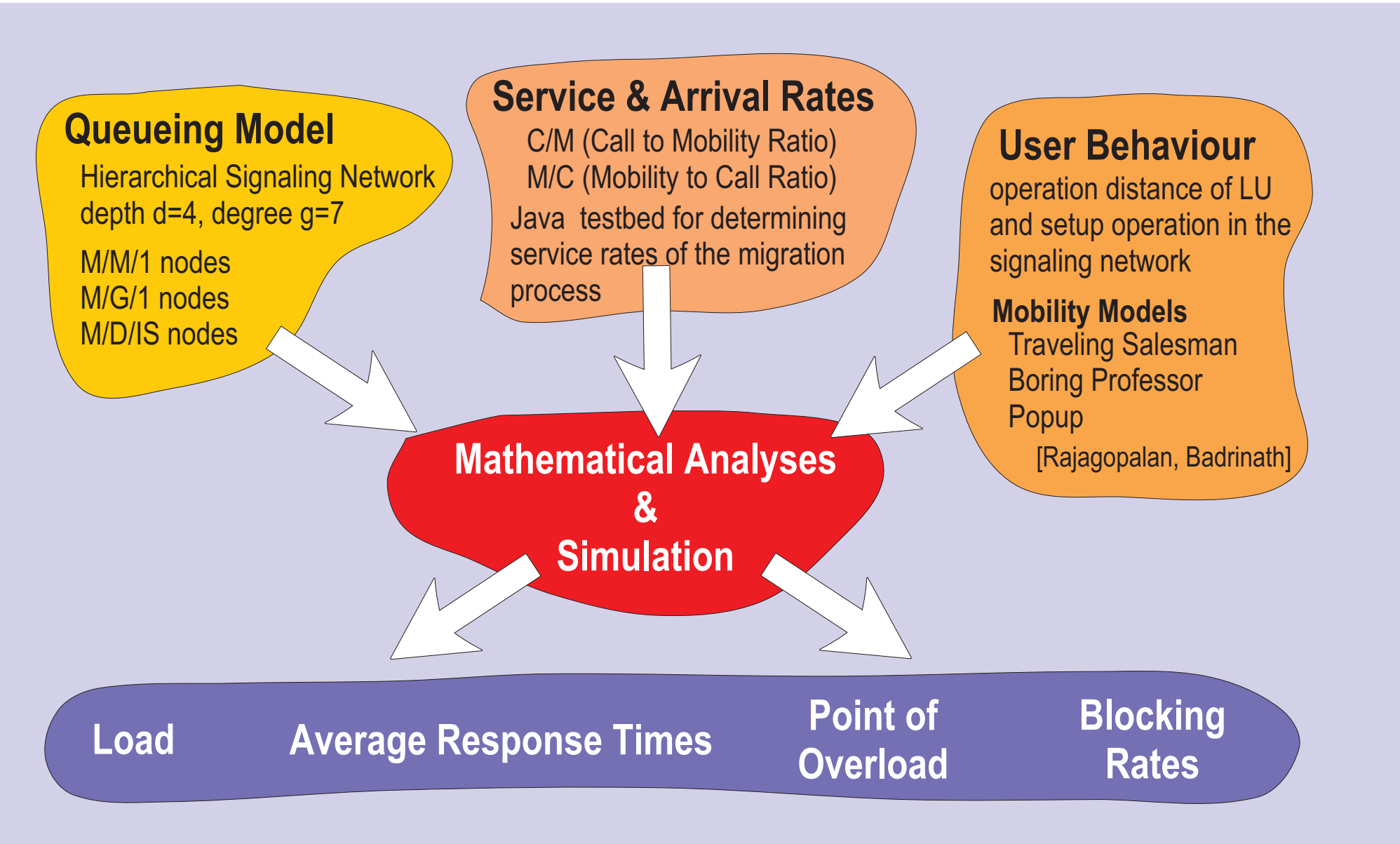
- ✗ requires modifications on the computational modeling
- ✗ requires modifications in the DPE
- ✓ hierarchical numbering scheme and simple lookup mechanisms in the broker federation
- ✗ personal id would be lost if customer changes to another retailer
- ✗ UA is bound to a certain retailer
- ✗ customer has to manage several profiles embedded in several UAs

MUA Strategy

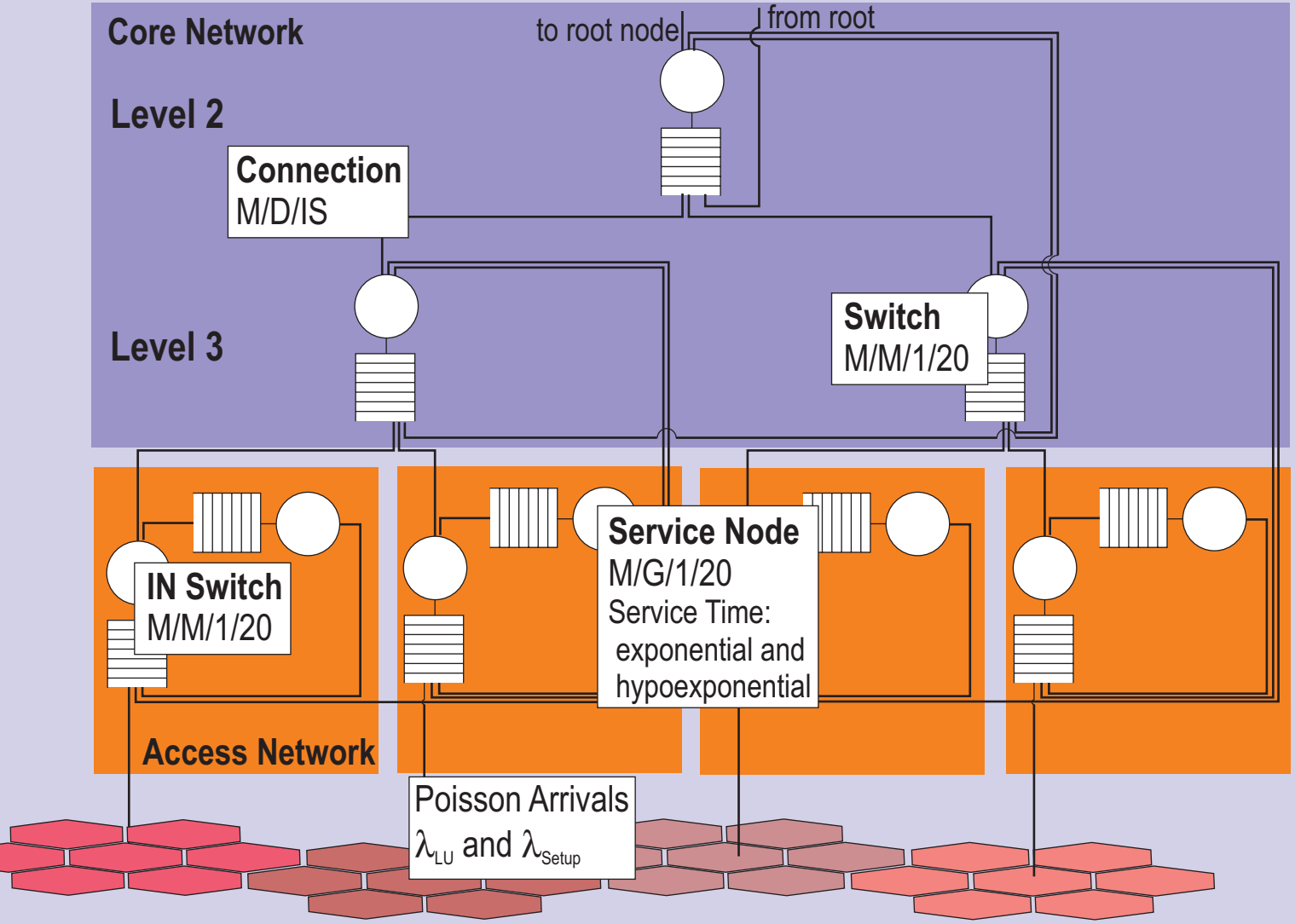
- ✗ requires modifications in the DPE
- ✗ requires flat numbering scheme and expensive lookup mechanisms in the broker federation
- ✓ enables life-long personal id
- ✓ UA is seen as the customer's property that can be moved between different retailers
- ✓ one profile in one UA

??? Signaling Traffic ???

Model for the Performance Evaluation



Queuing Model



Degree = 7
Depth = 4

1 root node
7 nodes of level 2
49 nodes of level 3
343 access nodes

Service & Arrival Rates and Customer Behavior

Arrival Rates

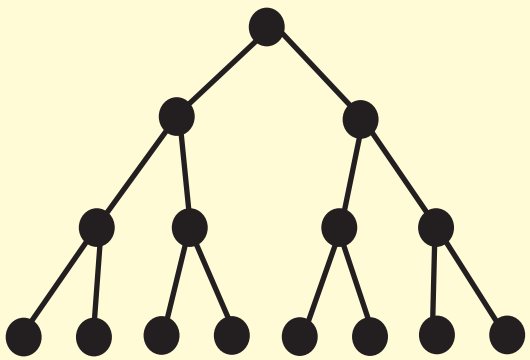
# LU/Login per access network	10,000/[h]
initial C/M ratio	0.1

Service Rates

Invocation on COs	1.0/[ms]
Switching	2.0/[ms]
Serializing	0.1/[ms]
De-Serializing	0.2/[ms]
Object Creation	0.5/[ms]

Call and Movement Behavior

$$P(L_x = i) = e^{-\alpha_x (d-i)} \frac{1 - e^{-\alpha_x}}{1 - e^{-\alpha_x d}} \text{ with } 1 \le i \le d, \alpha \ge 0 \text{ and } x \in \{Set-up, LU\}$$



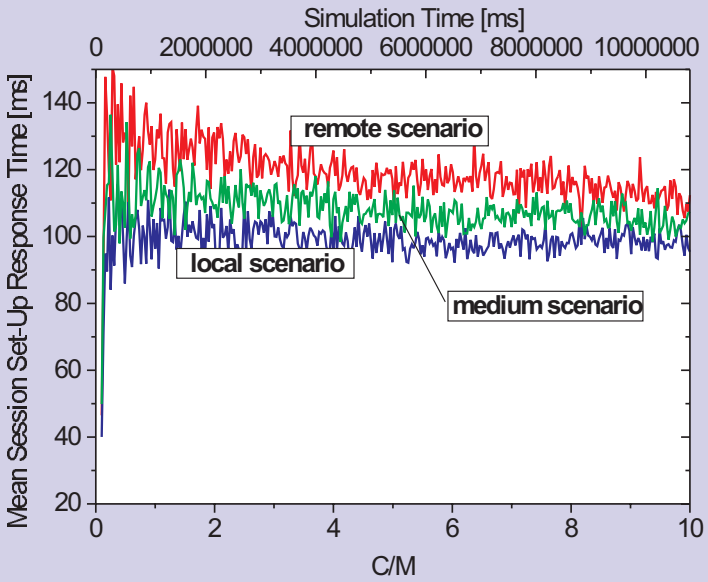
	α=0.9	α=0.5	α=0.1
	local scenario	**medium scenario**	**remote scenario**
level 1	0.04100212087	0.1015363241	0.2138382204
level 2	0.1008489440	0.1674050972	0.2363277824
level 3	0.2480483765	0.2760043446	0.2611825922
level 4	0.6101005586	0.4550542339	0.2886514052

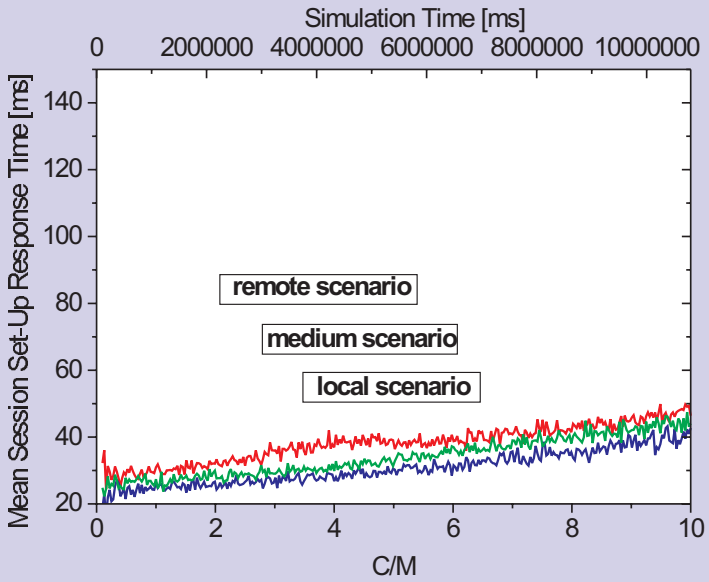
Session Setup

HD Strategy

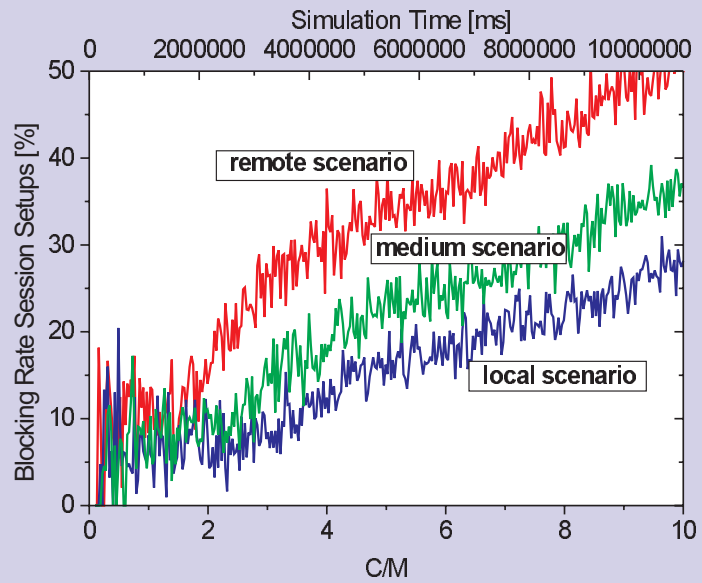
MUA Strategy

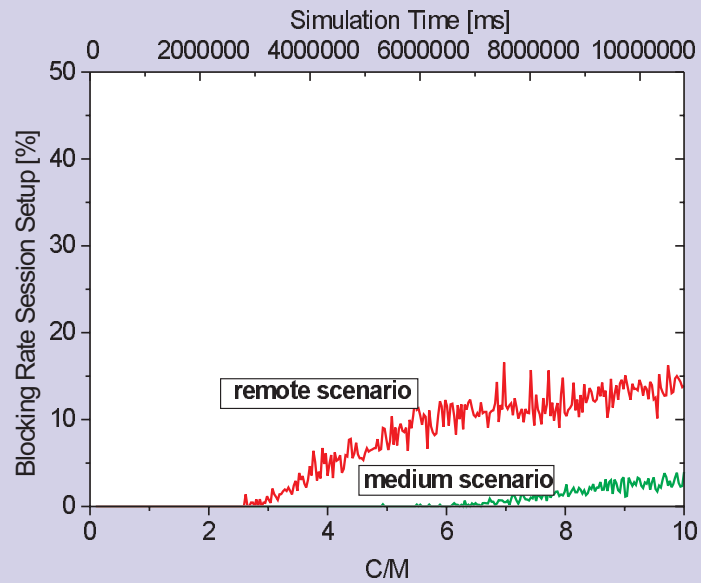
Response Times





Blocking Rates



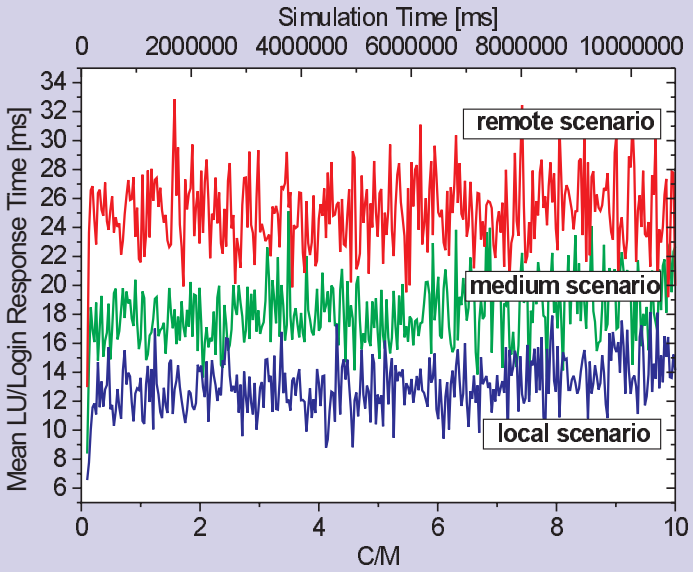


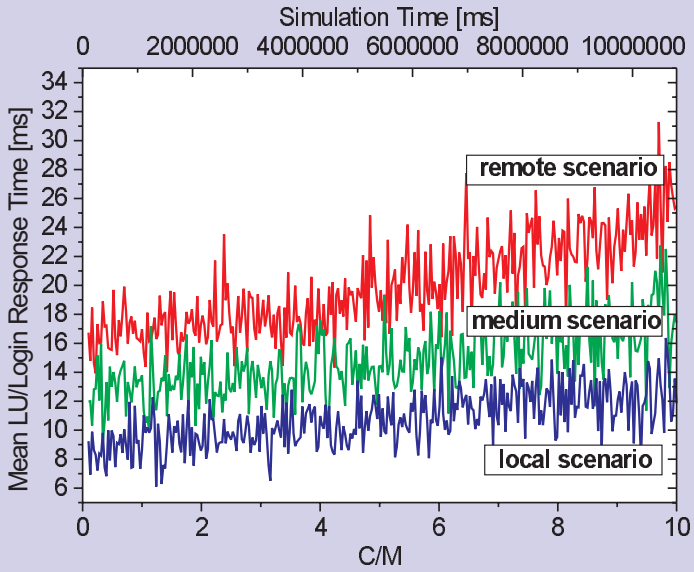
Login/Location Update

HD Strategy

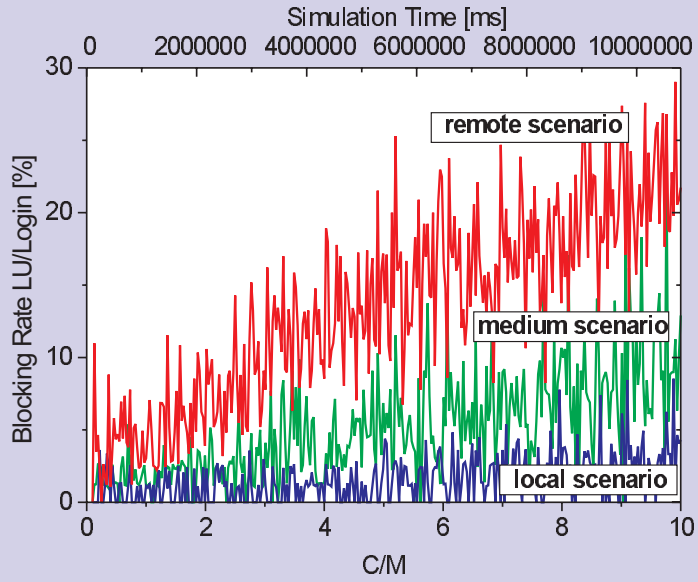
MUA Strategy

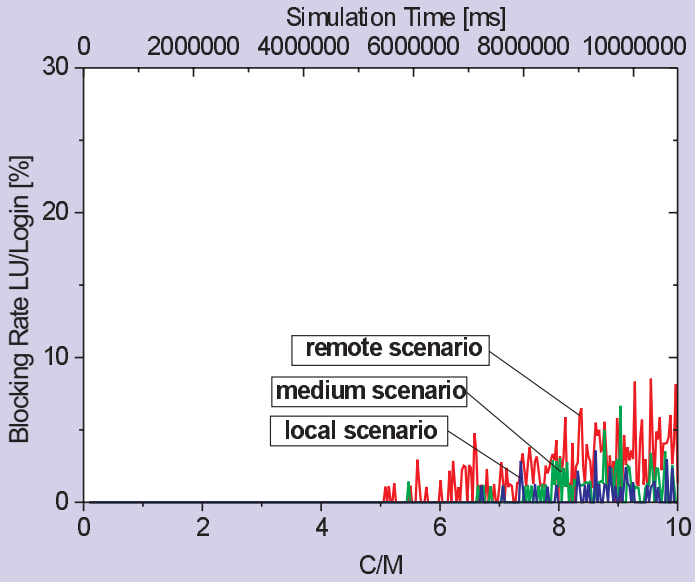
Response Times





Blocking Rates

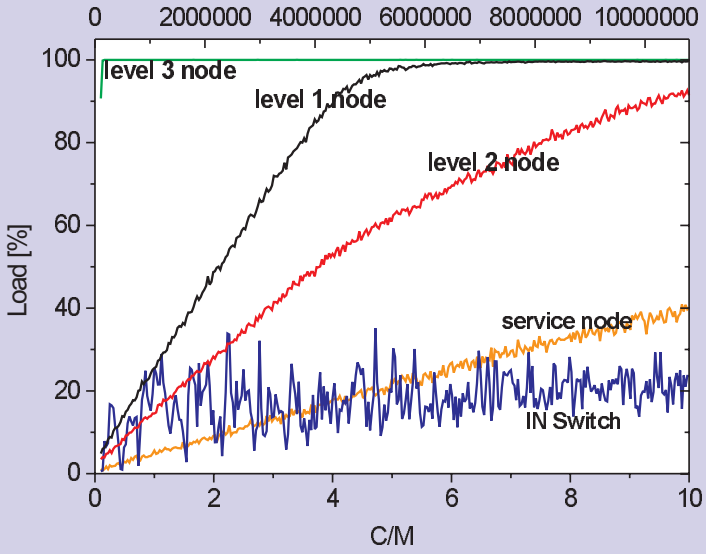




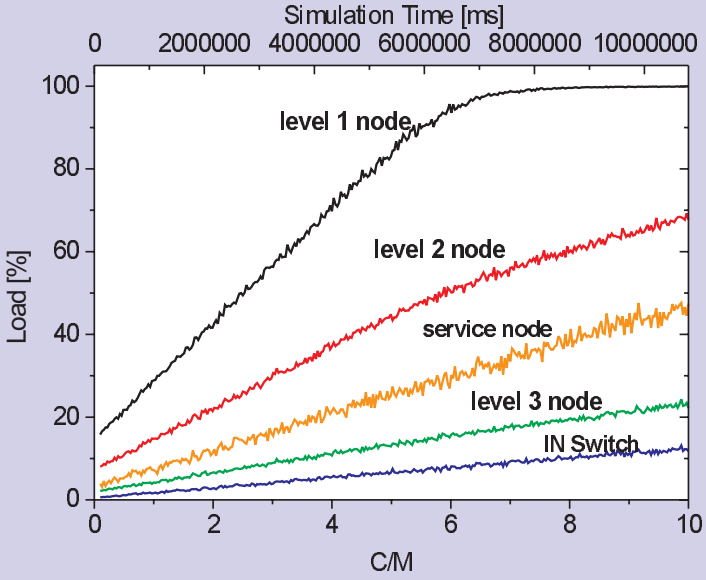
Load Service and Switching Nodes

Load

HD Strategy



MUA Strategy

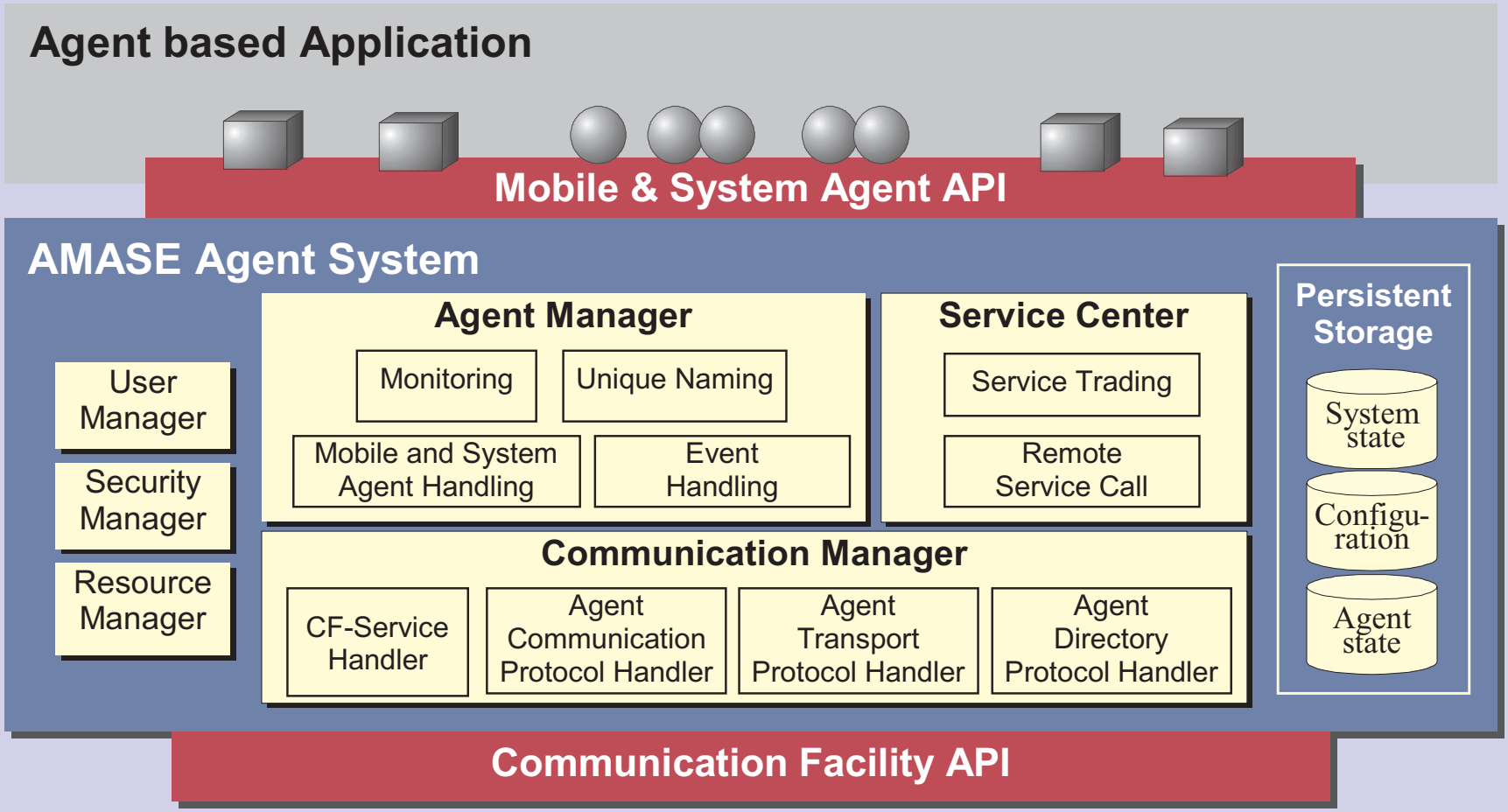


MUA Strategy

- provides shorter response times (on average)
- causes lower blocking rates
- uitilizes signaling network more efficiently

➔ Adaptive Strategies

The AMASE Agent System



Conclusions

- MUA strategy supports nomadic communication in an optimal way
- meets demands resulting from competition and mobility
- reduces signaling traffic in comparison to conventional HD-based approaches
- requires flat numbering and sophisticated lookup mechanisms in the broker federation
- AMASE Agent Platform as a prototype for realizing MUA approach

Projects:

Distributed Systems for Service and Network Management in Mobile Cellular Networks
DFG priority program *Mobile Communication*
http://dfg-mobil.rwth-aachen.de

Agent Based Mobile Access to Multimedia Information Services
ACTS CLIMATE Cluster
http://b5www.berkom.de/AMASE/