Department of Telecooperation

The Evolution of the Web: Information – Communication - Cooperation

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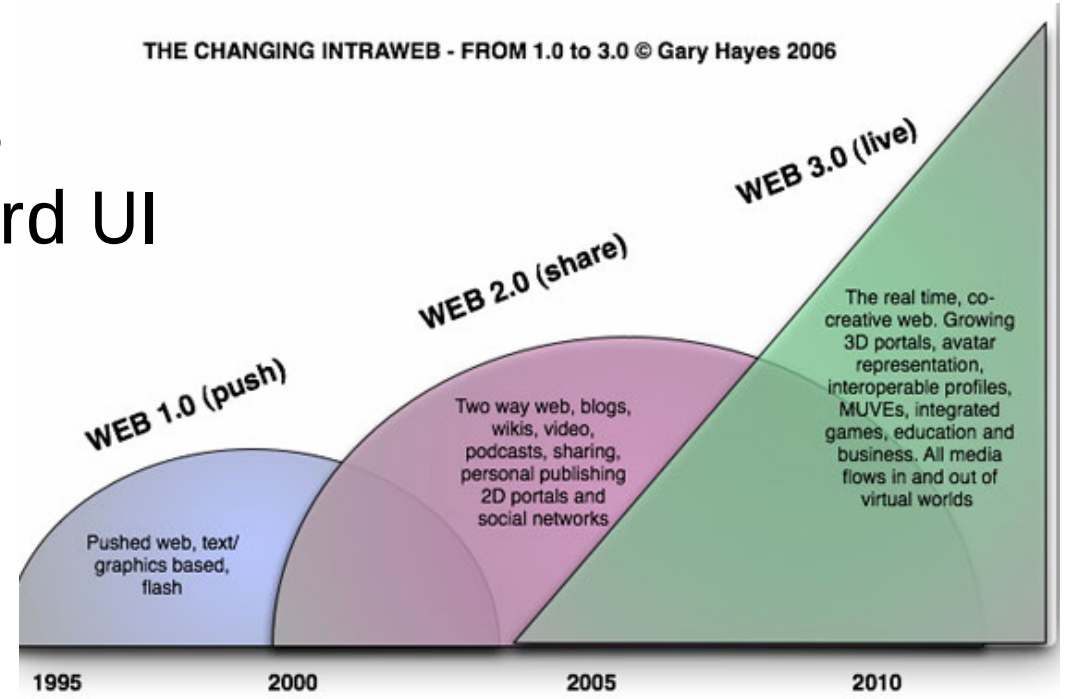
Outline of the talk

- Information
  - meta data, ubiquitous access, digital media
- Communication
  - discrete/continous media, non-standard UI
- Cooperation
- Conclusions



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Information

Trend I: Metadata

- Basic principles
  - Annotate data (text) with data about data (metadata)
  - Metadata give additional information (and meaning?)
  - Metadata to be interpreted by „machines“ (software) not by humans
  - (standardised) languages to annotate data with metadata

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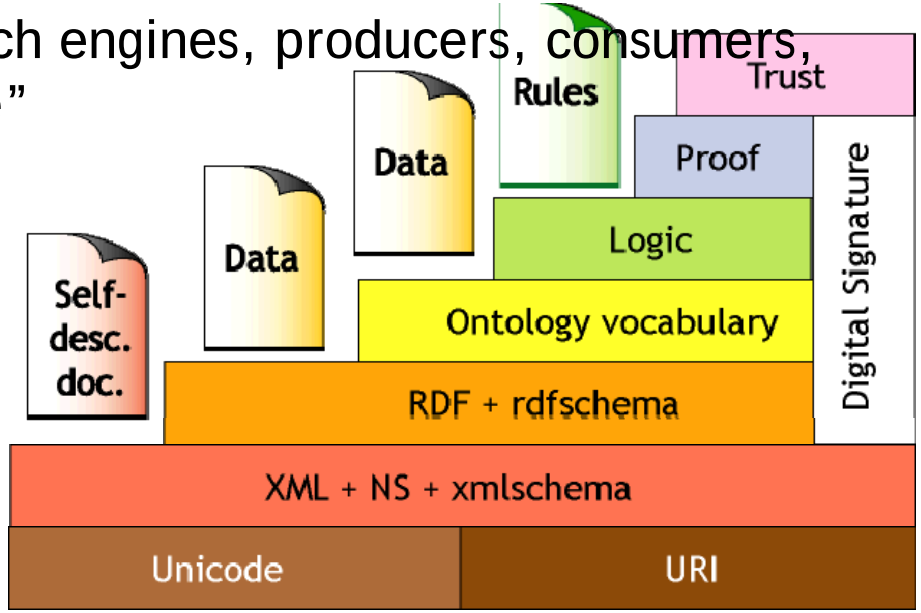
Trend I: Metadata – Semantic Web

- What would we need to make this work?
  - A **standard representation** of characters and a **global naming scheme**
  - A **standard syntax** for describing data (metadata) and the properties of data
  - Standard **vocabularies**, so search engines, producers, consumers, etc., "speak the same language"
  - A standard means of describing **relationships** between data
  - The means to support **trust** and **security**
    …and lots of **resources** with metadata attached



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Trend II: Ubiquitous Access

- wireless networks
- mobile / wearable devices
- always on
- what does it mean to be „off“?

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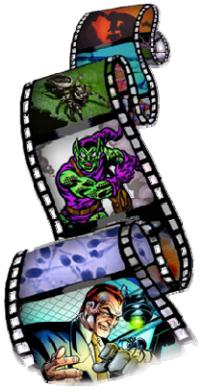
Trend III: Digital media

- Your personal entertainment center



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Challenges in Information Exchange

- world wide standards across all layers
  - IP protocols
  - electronic data interchange, semantic web
  - internet of things
- ubiquitous access
- digital media
- performant, reliable transmission

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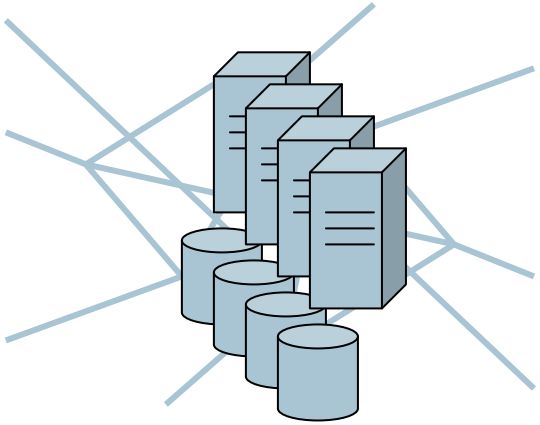
Performance Evaluation of Web-Based IS

user requests

user perceived performance (delay, response time)



system performance (utilisation, throughput)

Performance = F (Workload, System)

What is the effect on performance if workload is subject to change?

What is the effect on performance if the system is subject to change? (consider also interdependencies with changes in the workload)

How / Is it possible to study those questions using a simulation model of the system?

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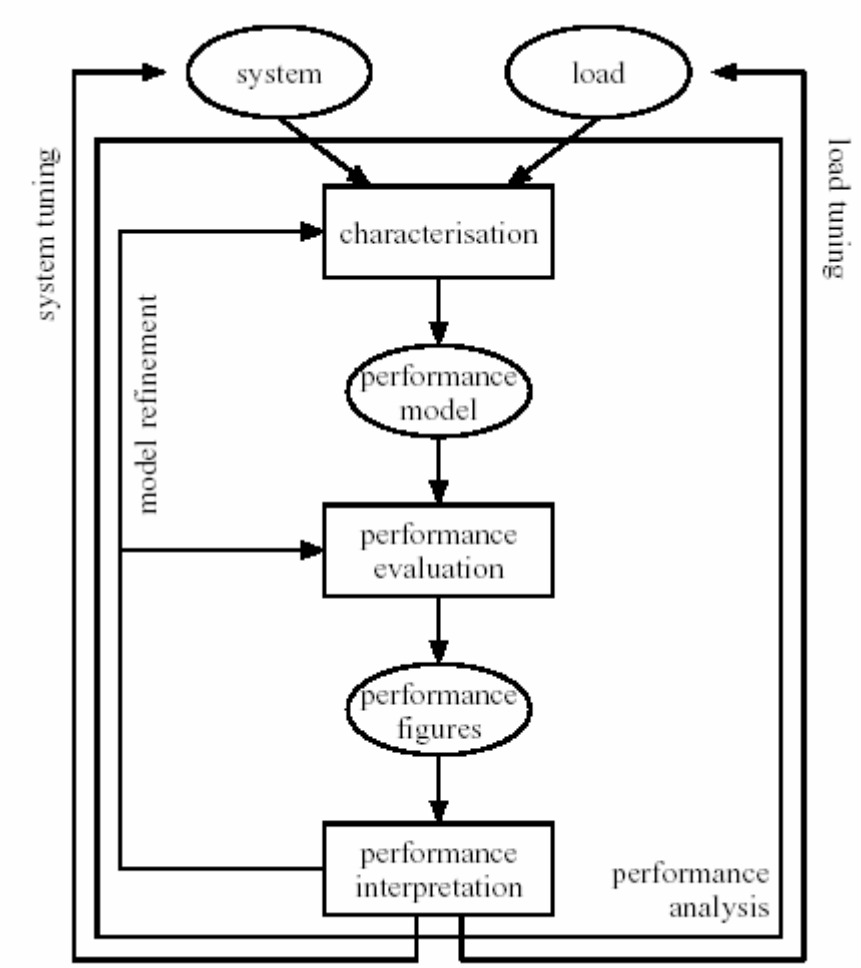
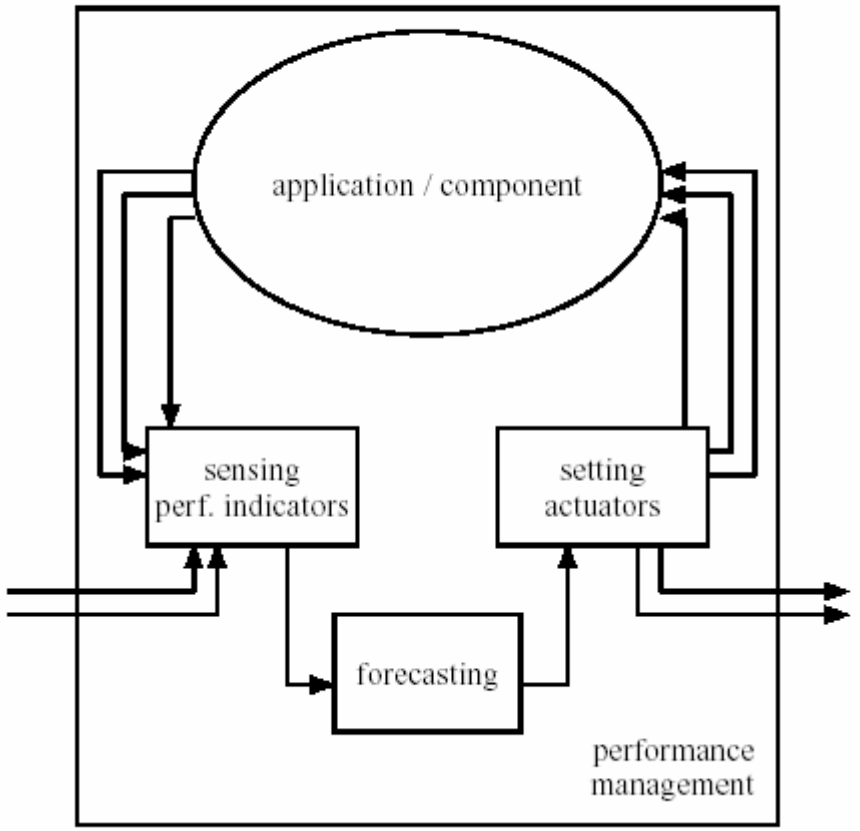
Performance Management





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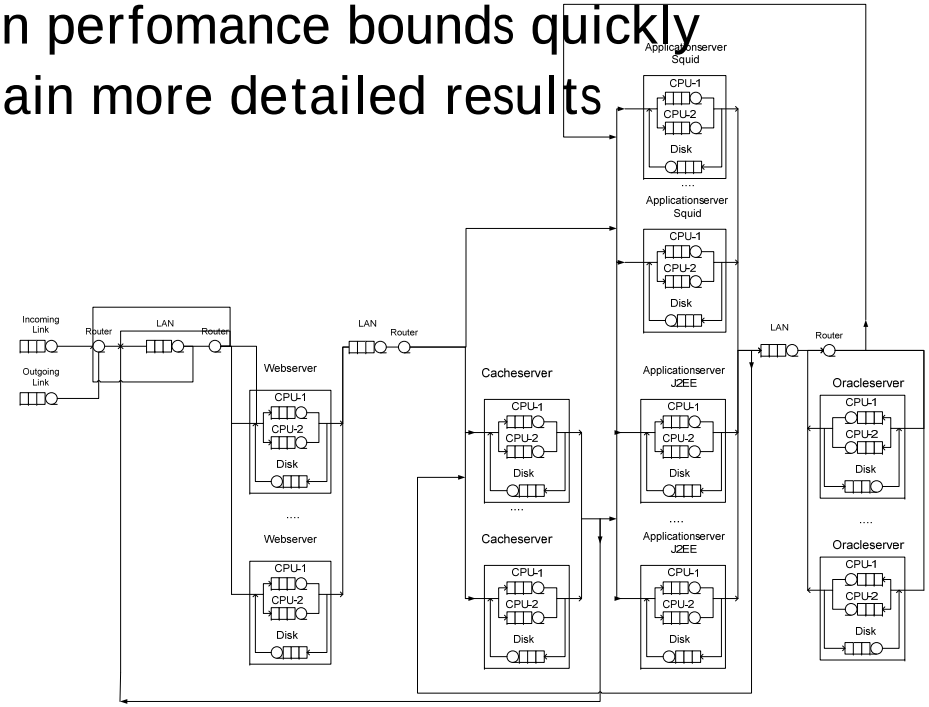
Performance Evaluation of Web-Based IS

- System Model
  - Queueing network model formalism
    - Solved analytically to obtain perfomance bounds quickly
    - Solved by simulation to obtain more detailed results
  - **High level** model
    - Single Resource Model
      - Single / Multiple Class
    - Load Dependent Resource
      - Single / Multiple Class
    - Multiple Resources
      - Single / Multiple Class
  - **Detailed** models
    - Simulator



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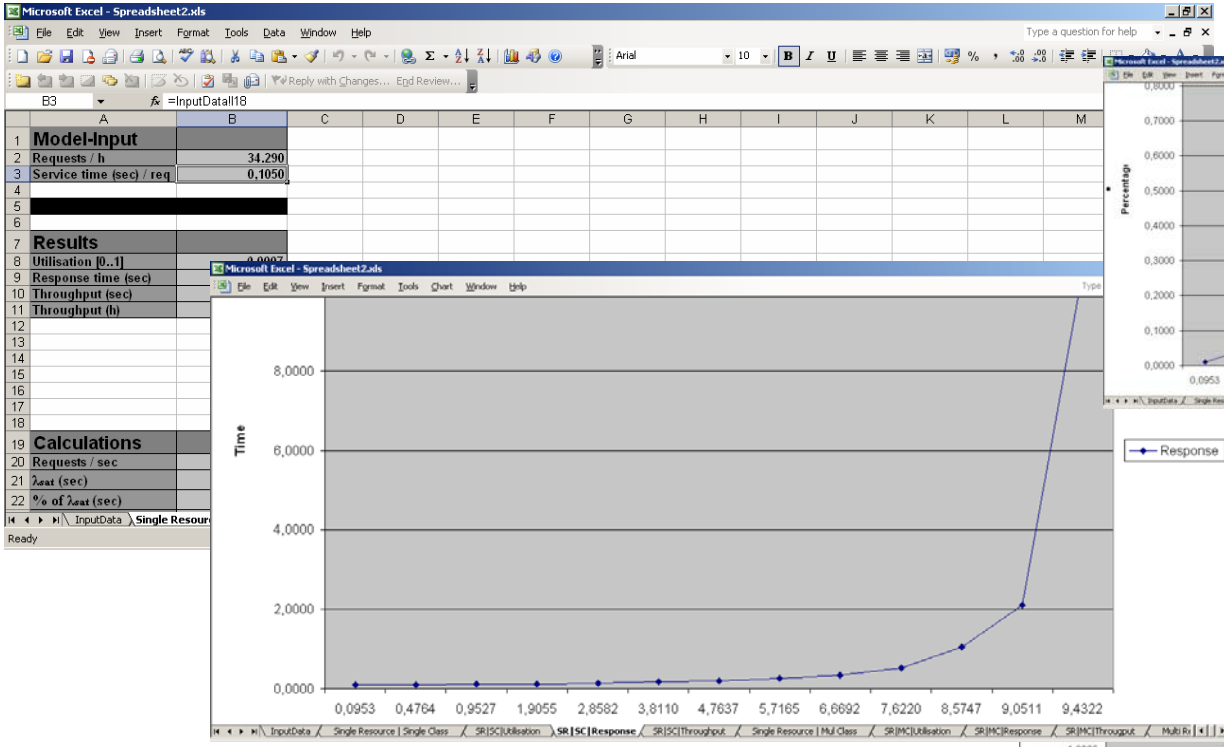
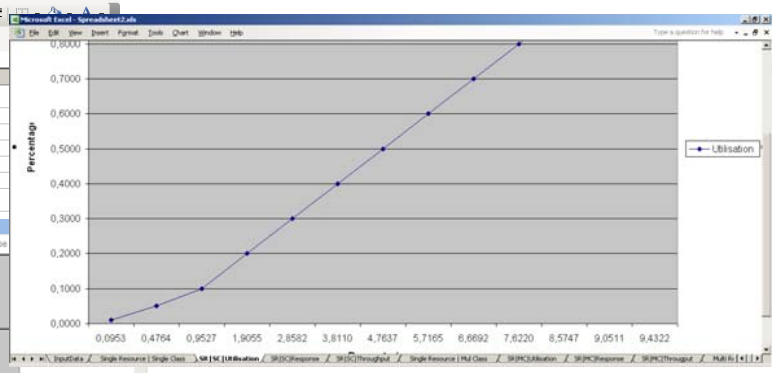
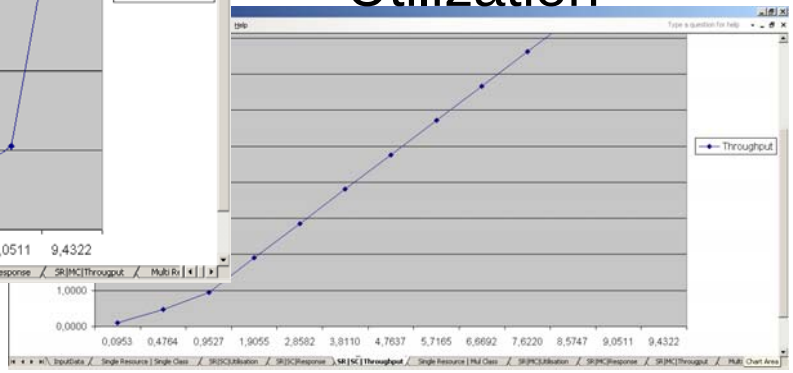
Performance Evaluation of Web-Based IS



Response Time



Utilization



Throughput

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Performance Evaluation of Web-Based IS

- Simulation

```
Hauptmenu
1...Loadfile generieren
2...Simulationsparameter ändern
3...Simulation starten
4...Programm beenden

Ihre Wahl:
```

```
Anzahl an Requests, die beim Lauf berücksichtigt werden: 900000

Server: 1:1:1:1

Gesamtanzahl an Pakettypen: L: 0 M: 900000 H: 0

Guide-Weg1: 427500 / Guide-Weg2: 427500 / Scout: 45000
(Guide-Weg1: W-C-A-S-A-C-W  Guide-Weg2: W-C-W  Scout: W-A-S-A-W)

Avg Response-time-Web: 0.022868780865248985
Avg Response-time-Cache: 1.4355428056935715
Avg Response-time-App: 0.56015012108550122
Avg Response-time-SQL: 0.14774841357174157

Max Response-time-Web: 0.023461235978310357
Max Response-time-Cache: 109.55067837191191
Max Response-time-App: 6.836005976095584
Max Response-time-SQL: 0.16059717217187258

Avg-Response-time System: 2.1663101212160636
Max-Response-time System: 116.57074275615768

Timeouts-Web: 0
Timeouts-Cache: 854823
Timeouts-App: 45062
Timeouts-SQL: 0
```


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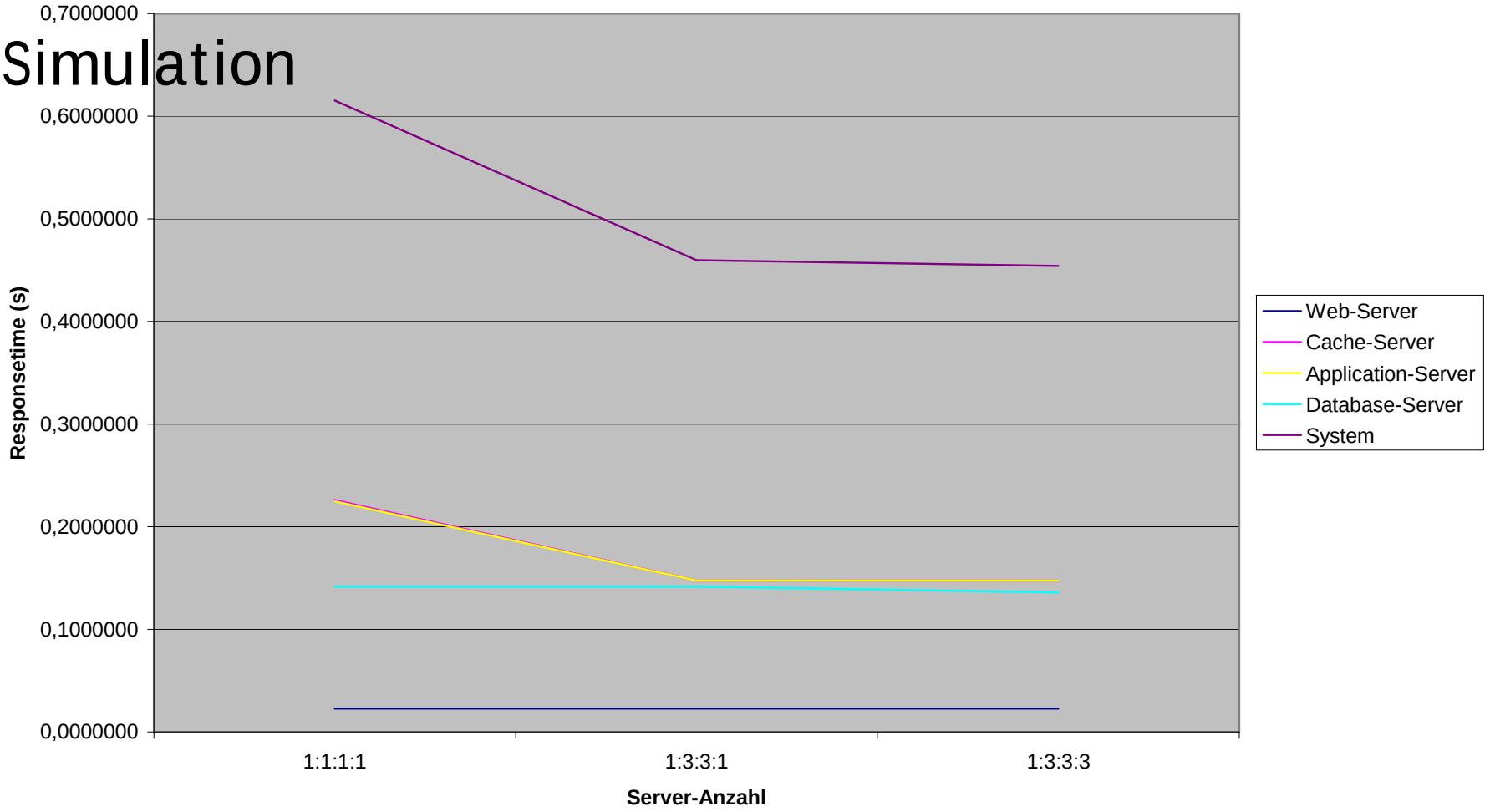
Performance Evaluation of Web-Based IS

- Simulation



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Performance Evaluation of Web-Based IS

- Major problems
  - Model calibration and validation
  - Lack of **measurement** methodology and tools

- Cooperation / Spin Off
  - Dynatrace

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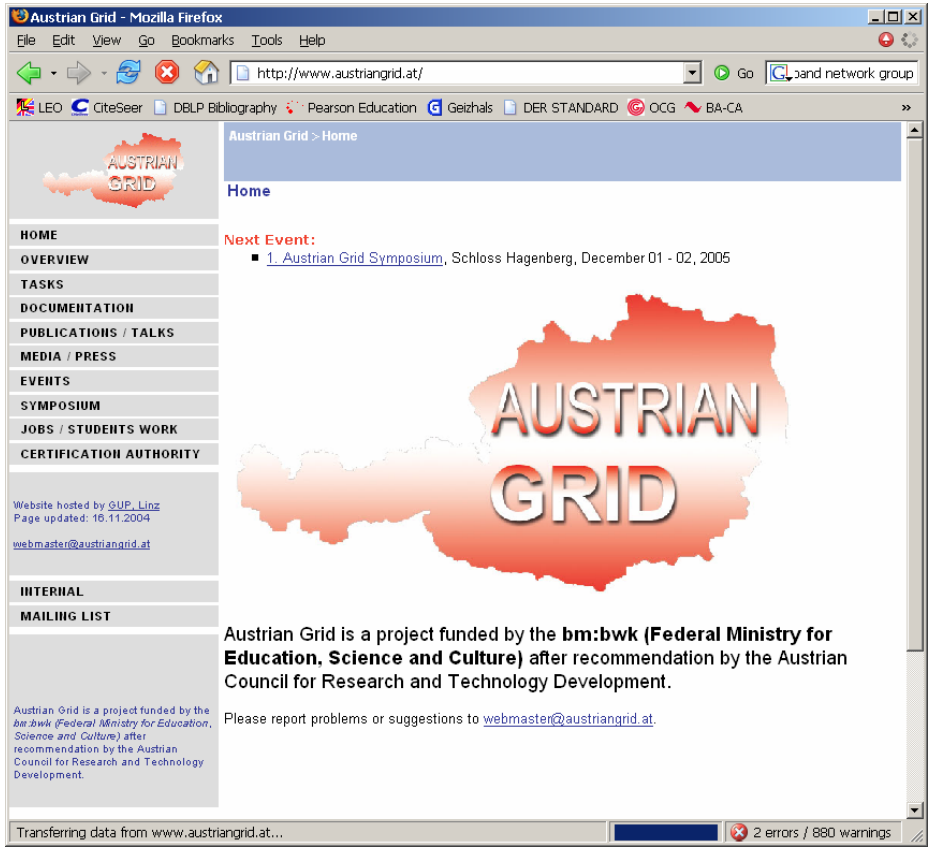
AustrianGrid

- Mobility WP Objectives
  - Study the potentials and technical feasibility of integrating mobile nodes into the grid
  - Develop demonstrations scenarios and prototypes of mobile node integration
  - Evaluate the performance, efficiency, and effectiveness of mobile node integration
- Duration / Funding
  - 04/2003-12/2009, BMVIT
  - 01/2010-04/2010 beantragt



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EuroNGI / EuroFGI

- Project Objectives
  - To create and maintain the most prominent European centre of excellence in Next Generation Internet design and engineering, leading towards a leadership in this domain
- Project Duration / Funding:
  - 2003-2008, EU FP6+FP7

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Communication

I Communication using discrete media

- How can discrete media be represented so that they can be transmitted over computer networks?
  - Digitizing and coding
- How can data be transmitted over computer networks?
  - Networking architectures, protocols and standards
- What are the specific challenges in using discrete media for communication?
  - Basics from information and communication theory
  - Focus on standardising syntax and semantics
    - Electronic data interchange, semantic web
  - Focus on selected applications
    - Instant messaging, SMS, Web logs, file sharing systems

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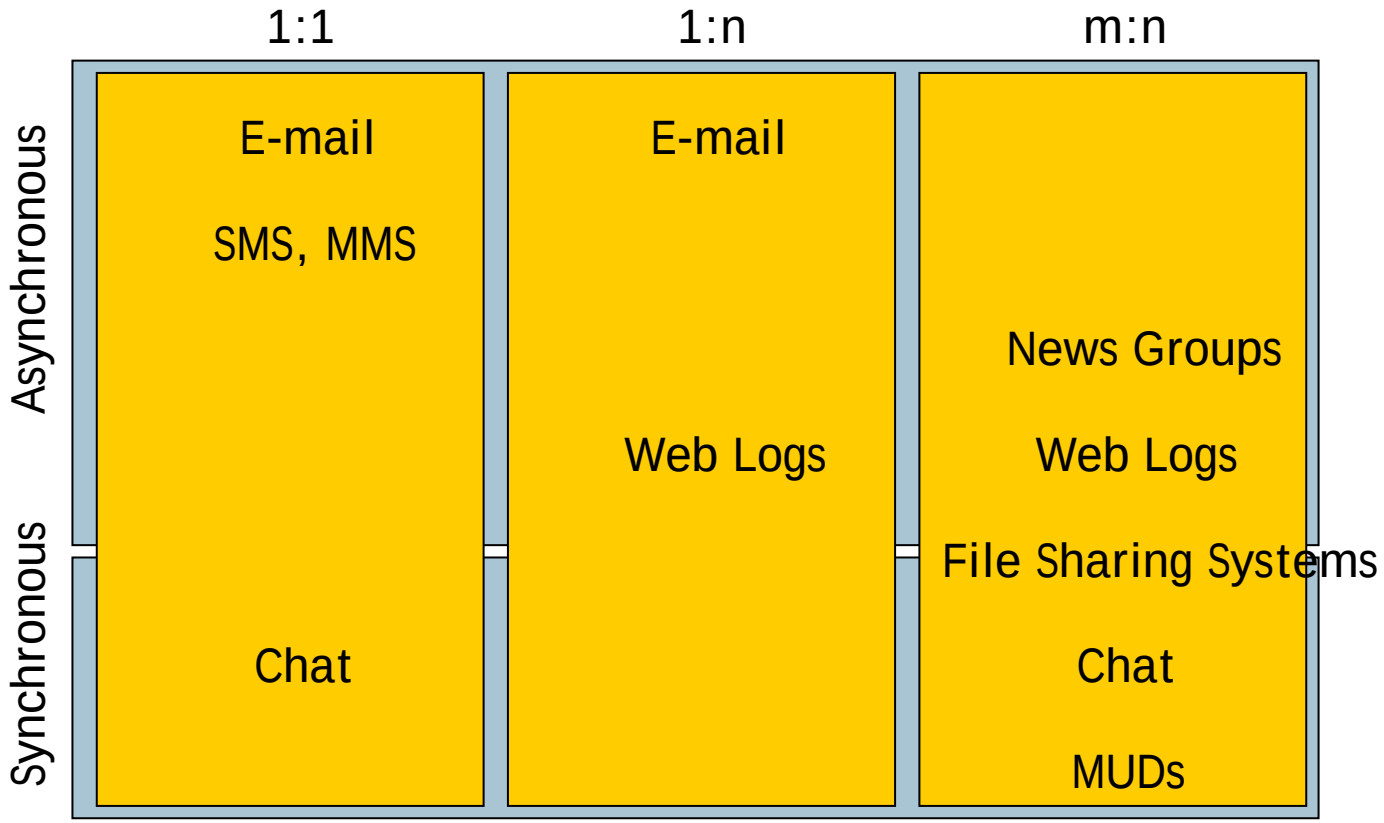
I Communication using discrete media

- Classification of applications



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II Communication using continuous media

- How can continuous media be represented so that they can be transmitted over computer networks?
  - Digitizing and coding
- How can data be transmitted over computer networks?
  - Basics of MM streaming
  - Application level protocols
    - (HTTP), RTSP, RTP, RTCP, SIP, H.323
  - Beyond best effort
    - Quality of Service
    - Resource Allocation: IntServ, DiffServ

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II Communication using continuous media

- Media Synchronisation
  - Asynchronous
    - No well-defined timing relation ship between objects
    - E.g. Text entry on keyboard
  - Synchronous
    - Well defined temporal relationship betwe of different streams
    - E.g. Video with sound
  - Isochronous
    - Well defined temporal relationship between objects of same stream
    - E.g. sound

Example: SMIL

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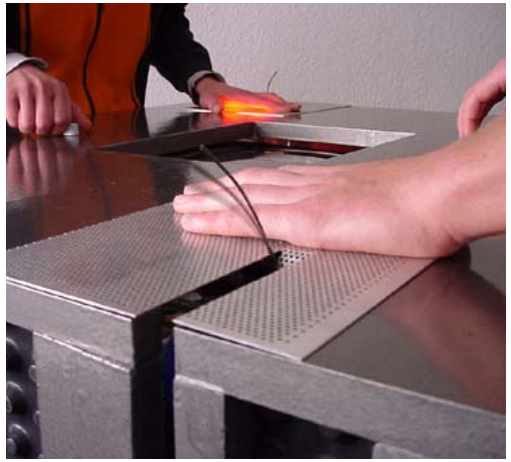
III New Interaction Modalities

- Multimodal Interaction
  - Sensors
    - visual, auditory, olfactory, gustatory, somatic stimuli, kinesthetic and vestibular cues
  - Control
    - mouth, face, eyes, (full) body, breath, biological reactions (heart rate, skin resistancy, muscle, neural activity, …)



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III New Interaction Modalities

- full body interaction

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III New Interaction Modalities

Brain Computer Interface
© TU Graz

Remote Controlled Human?

http://www.forbes.com/business/innovators/2005/08/04/technology-remote-control-humans_cx_lh_0804remotehuman.html

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Challenges in Communication

- communication management
- designing for multimodal interaction
- usability
- high-level performance characterisation

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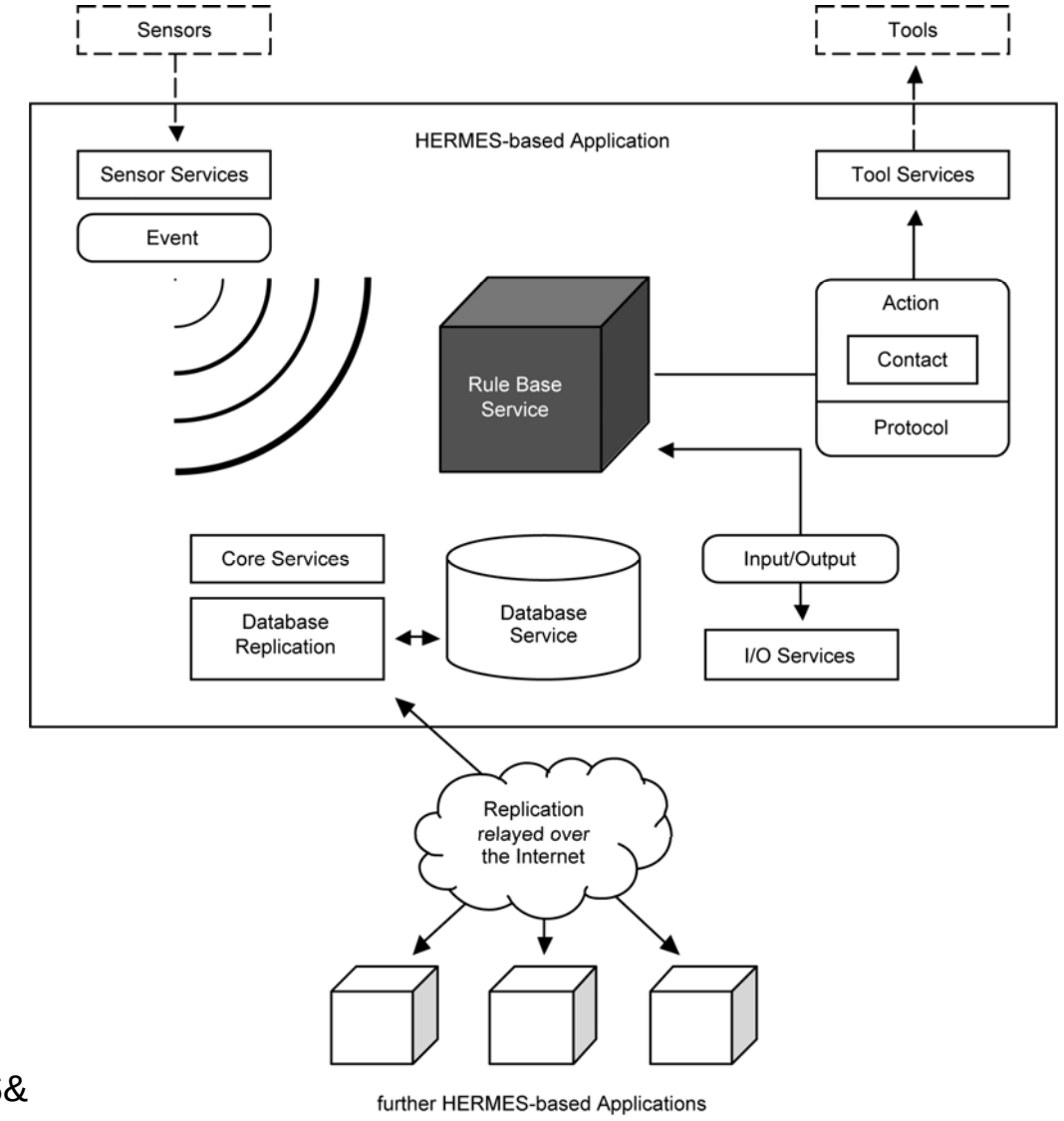
Ubiquitous Communication Management



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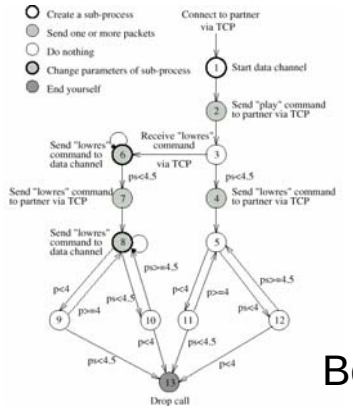
Simulating User Behaviour



User Behaviour

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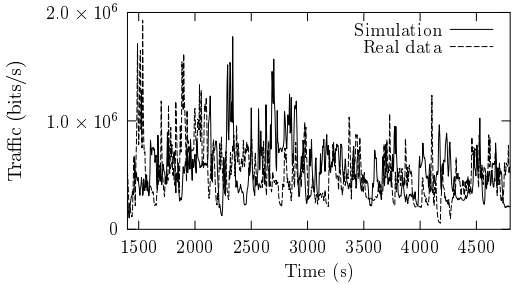

Traffic Characteristics

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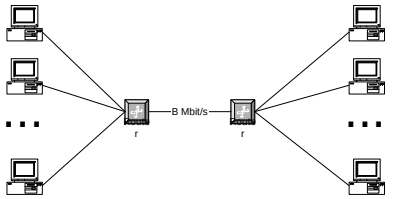
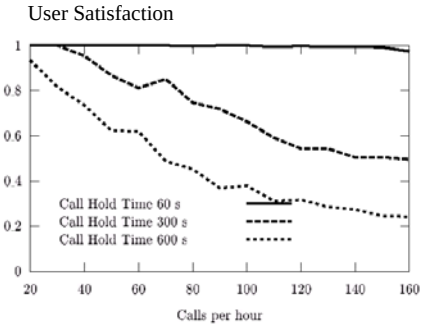
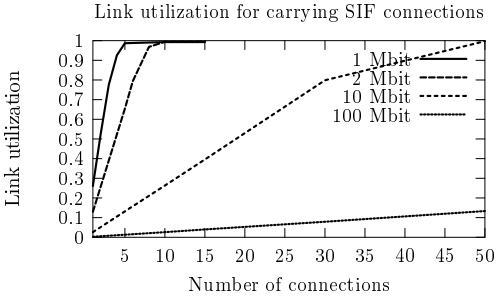


System Model

User-Oriented QoS Estimates



Resoure-Oriented Performance Prediction



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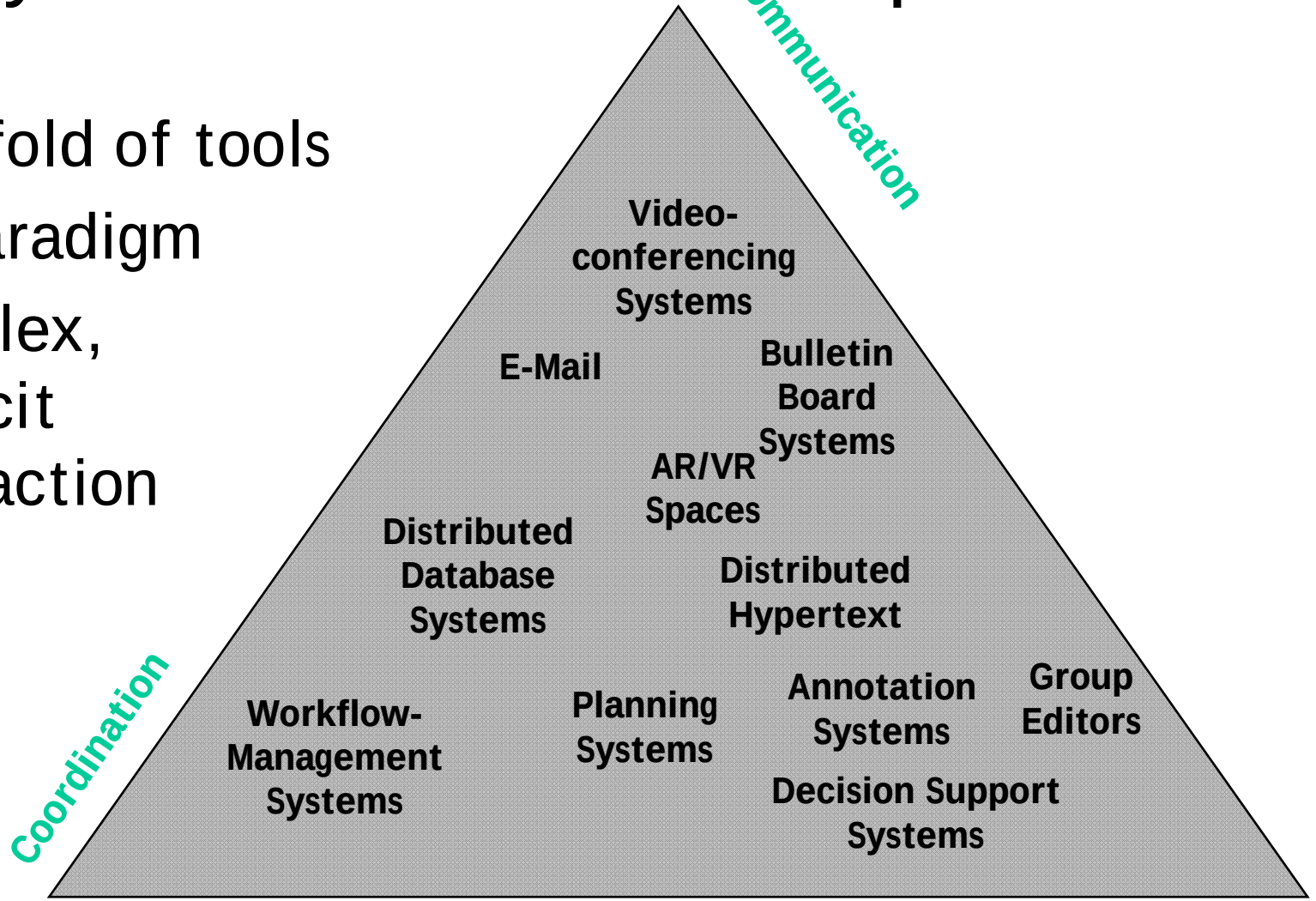
Cooperative Systems

CoopSys – The Functional Perspective

- manifold of tools
- PC paradigm
- complex, explicit interaction



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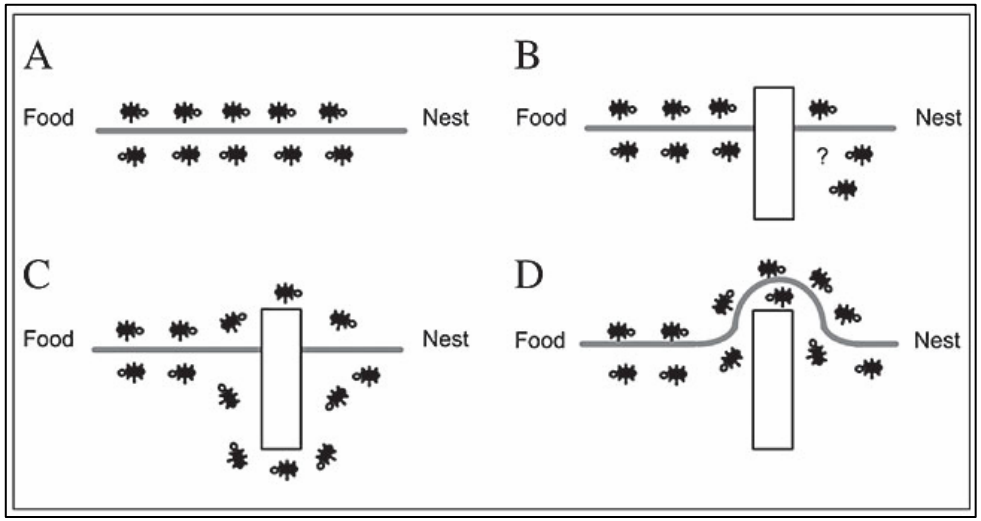
CoopSys – The Model Perspective

- Cooperative systems as an **algorithmic principle** (inspired by nature)
  - Coordinated behaviour of a group of entities oriented towards a common goal but without centralised control mechanisms
  - Example: ant colony optimisation



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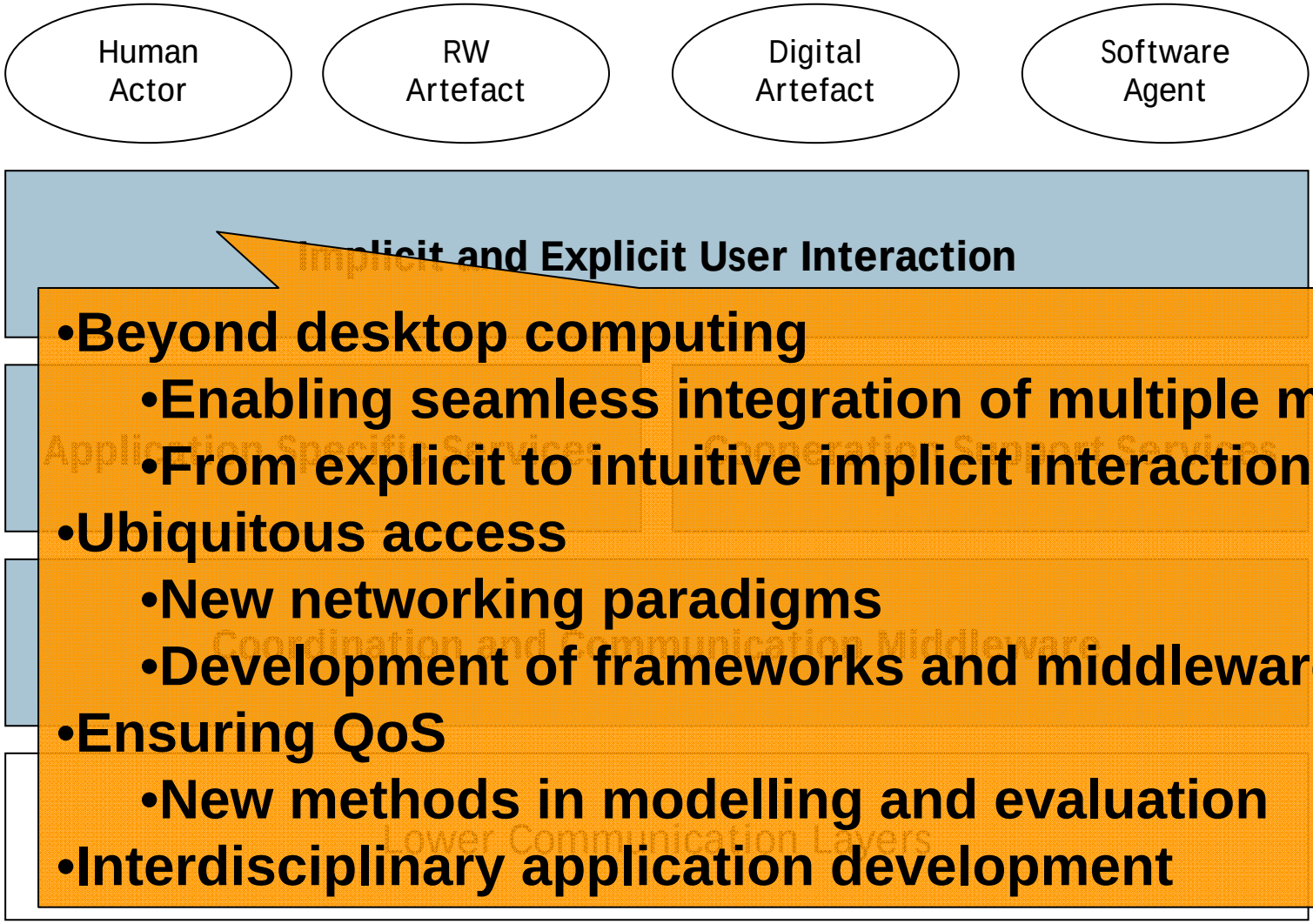
CoopSys – The Architecture Perspective



- **Beyond desktop computing**
  - **Enabling seamless integration of multiple media**
  - **From explicit to intuitive implicit interaction**
- **Ubiquitous access**
  - **New networking paradigms**
  - **Development of frameworks and middleware**
- **Ensuring QoS**
  - **New methods in modelling and evaluation**
- **Interdisciplinary application development**

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Challenges in Cooperation

- synchronisation and collaboration protocols
  - learn from distributed systems
- application development frameworks
- reference architectures
- cross-platform development
- evaluation
  - at technical level
  - from socio-economical / legal / business perspective

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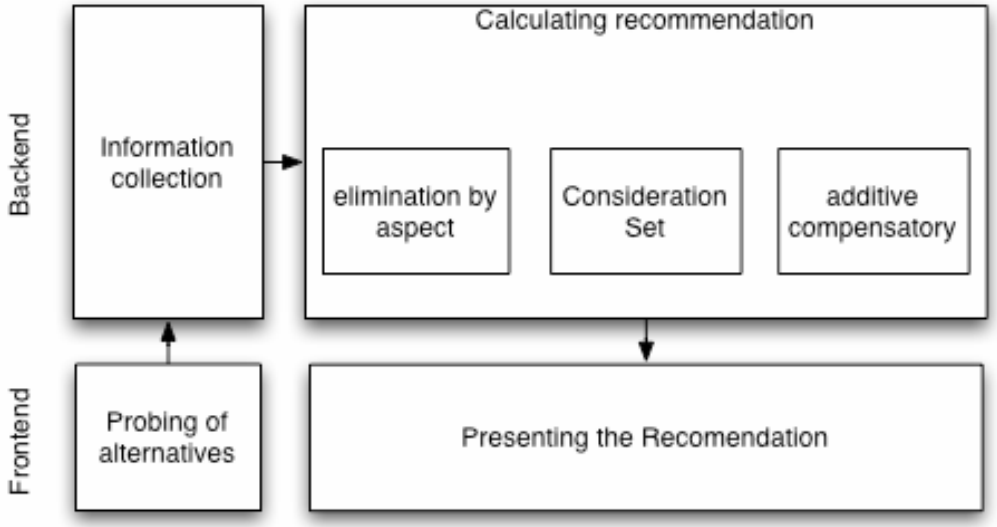
Mobile Decision Support Systems

- Group / Individual Decision Support with Mobile Devices
- **Implementation** on PDAs



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Mobile Decision Support Systems

- **Empirical evaluation** using questionnaires and formal measure of group consensus
  - Use of PDAs had positive influence on individually perceived degree of fairness
  - No significant influence on measurable group consensus
- Prototype has been extended into **recommender** system
  - Various input modalities

		Scanning the environment	
		Directed	Undirected
Identification	Triggered By device	e.g. barcode scanner	E.g. RFID reader, Image analysis
	Triggered by object	Object broadcasts ID periodically using short range wireless connections (e.g. Bluetooth)	

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Thank You!

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