Building the ubiquitous applications environment

MobiLife, Ambient Networks, and SPiCE

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TAKING YOU FORWARD

Why am I here?

- Contextual services is an important future development
  - But not yet ripe for standardization
- Ericsson has participated in research - we want to contribute to standardization
  - Ambient Networks: Service Interface (mediating network connectivity)
  - SPICE: Middleware architecture, control, and management
  - MobiLife: User applications, especially user control (e.g. Privacy and Group management)
- Our partners in the projects agree – so I represent more than 60 companies and universities altogether, in that sense
- We have together, with the support of the European Union 6th Framework programme for research, invested several hundred man-years into this
- All the material mentioned is publicly available – for comments, use, and partnering

What is the ubiquitous web?

- What is the web?
  - Access method to structured information
    - Not just by people

- What is ubiquitous?
  - Cf. Mark Wieser
    - "Available everywhere"
      - Pervasive, Ambient are synonyms

- What is the ubiquitous web?
  - Structured information available everywhere, for everyone

What is Context?
cf. MobiLife *Friday* Scenario (D1.1)

- Definition [Dey and Abowd]: "**Any information** that can be used **to characterize the situation of an entity.** An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves."

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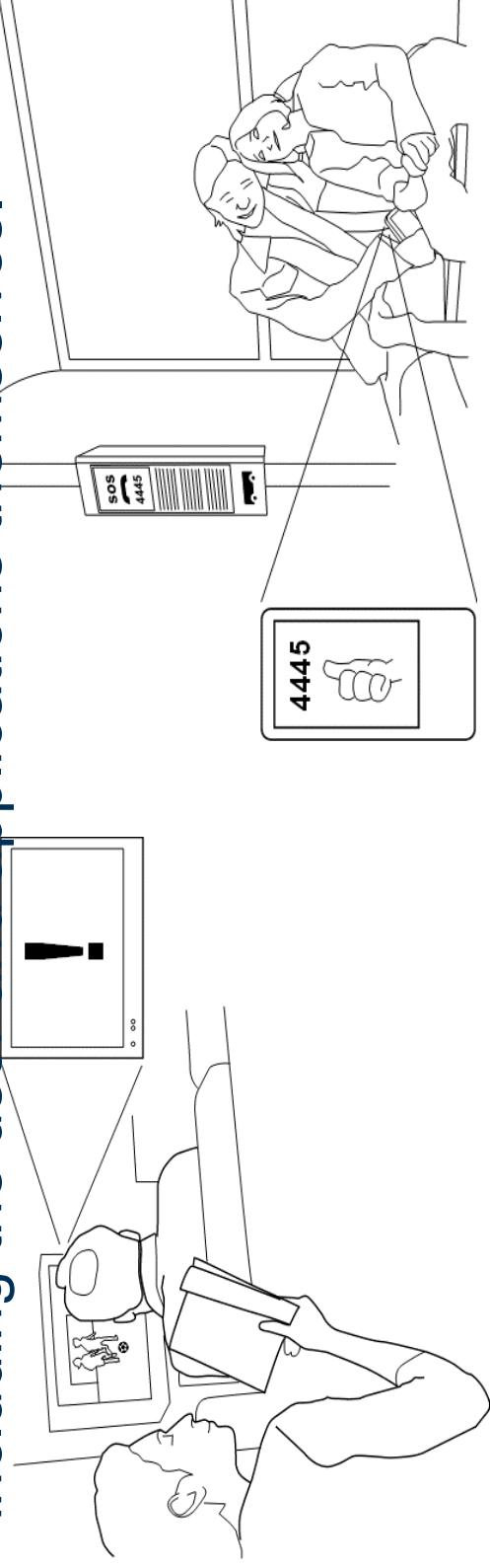
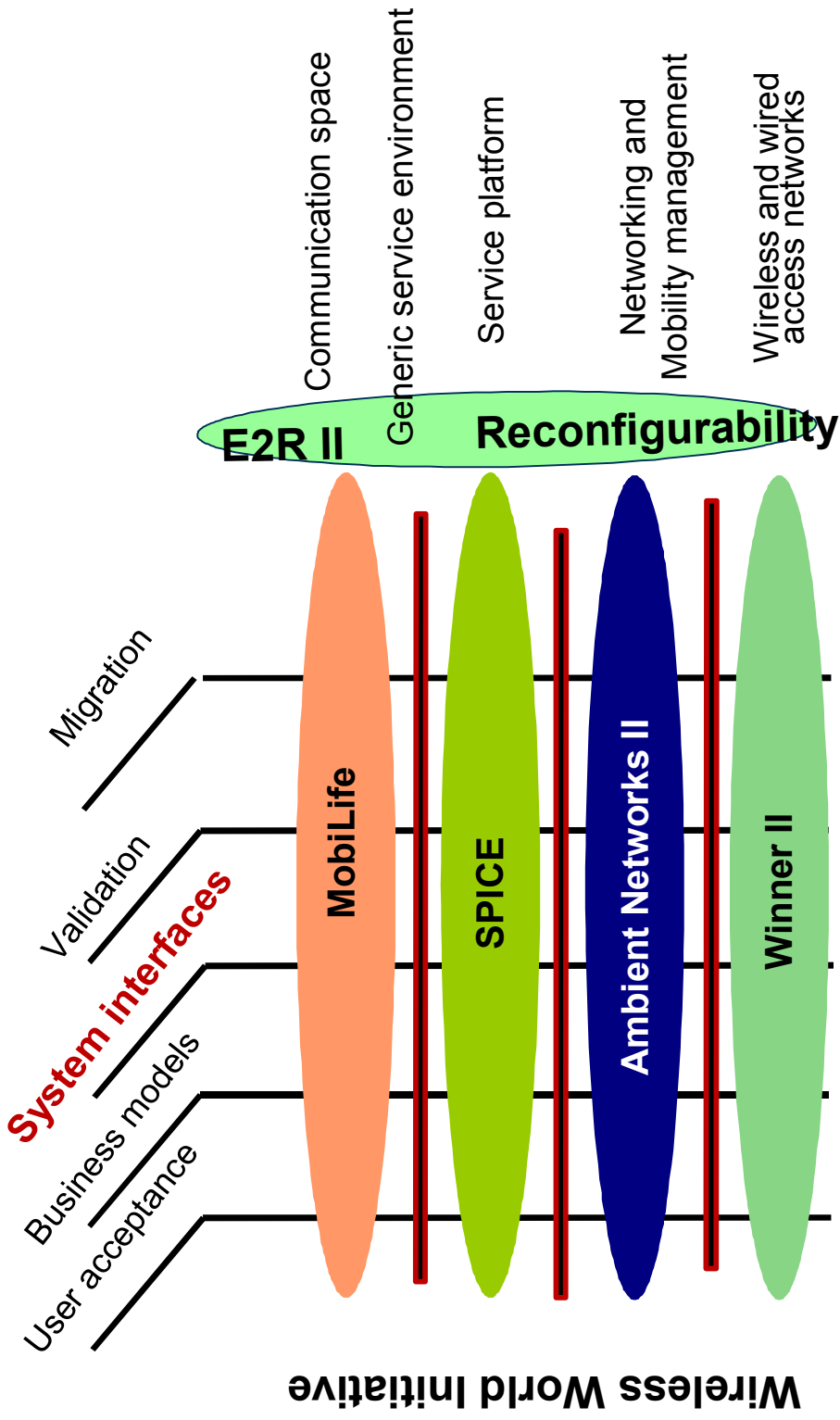# The key concepts

MultiSphere Concept

Diagram courtesy of WWRF
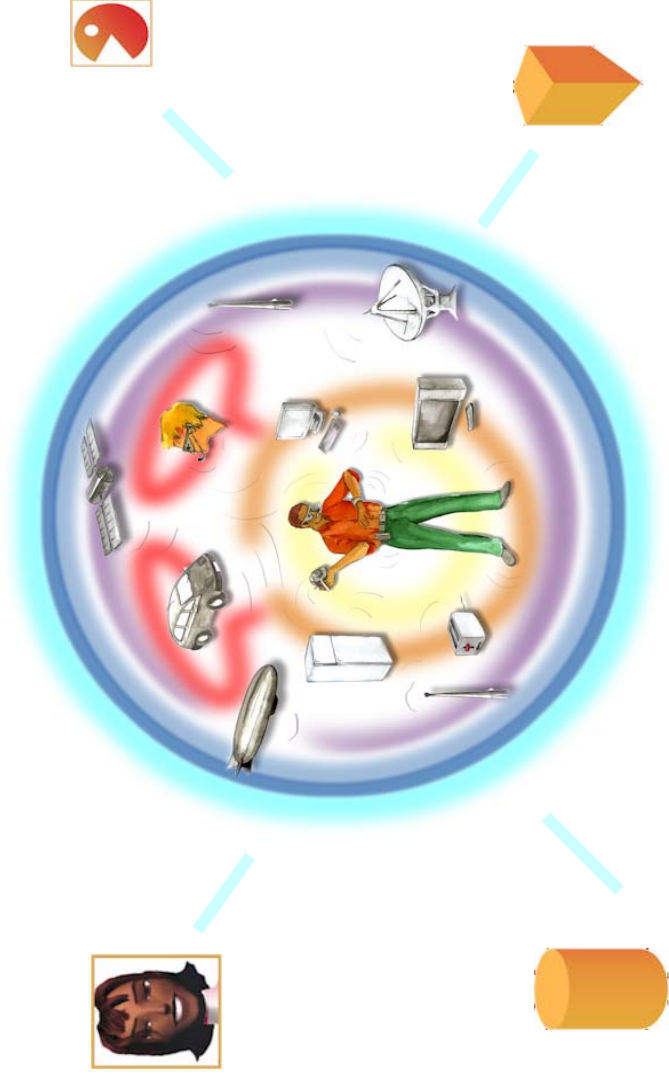
User Centricity

User-centricity means that the users' needs, expectations and requirements will be considered and supported by all system levels, from access and core networks to service platforms and applications

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Nicer architecture picture

E2R II — Reconfigurability

Communication space
Generic service environment
Service platform
Networking and Mobility management
Wireless and wired access networks

MobiLife
SPICE
Ambient Networks II
Winner II

Migration
Validation
System interfaces
Business models
User acceptance

Wireless World Initiative

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Services in small, ad-hoc groups
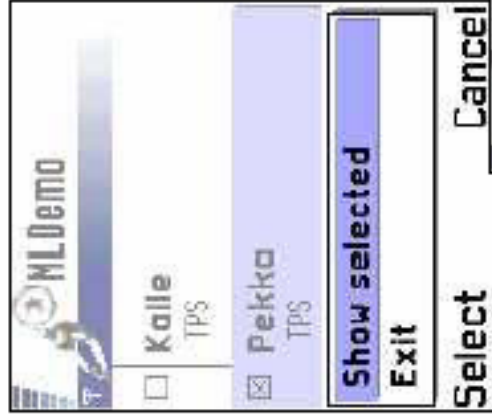
Privacy, Information Sharing

Sharing wellness information for sport and competition applications (here: heartbeat information)

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Family Services

Social Aspects
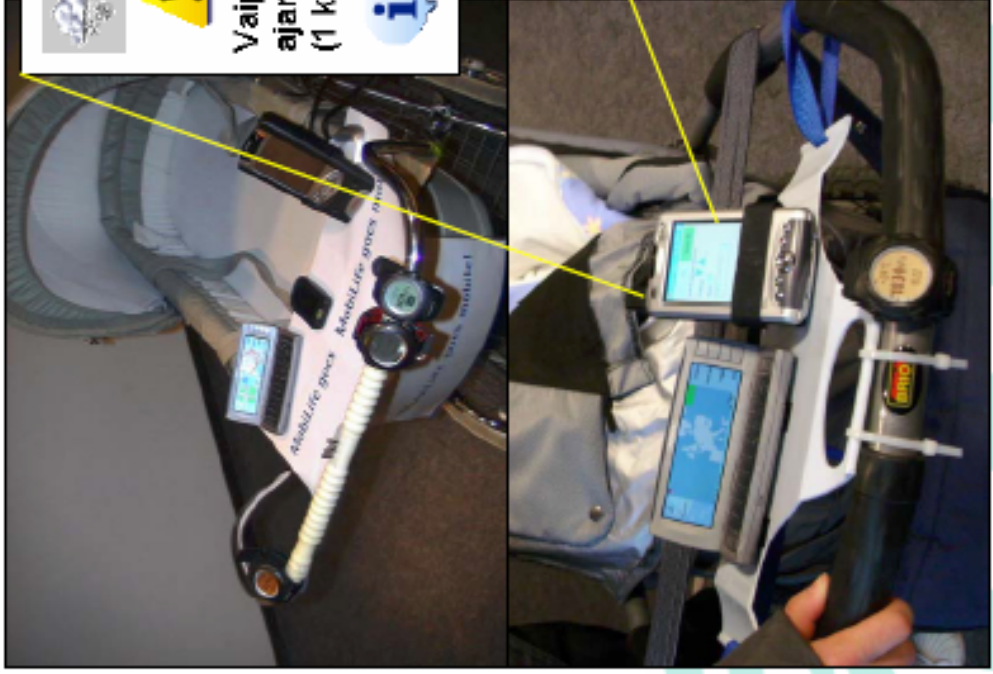
Vaippa märkä

5°C Märkä vaippa

Vaippa on ollut märkä 35 sek ajan. Palvelut 50 m säteellä (1 kpl):

Nuorisotalo ark 10-18, la-su 15-20

20. 5. 2005 10:59:03

Helping families with babies in unknown environments

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Keep track of your activities
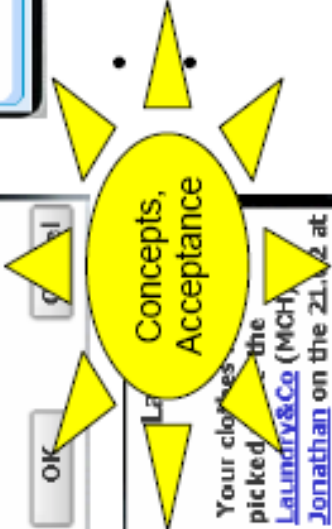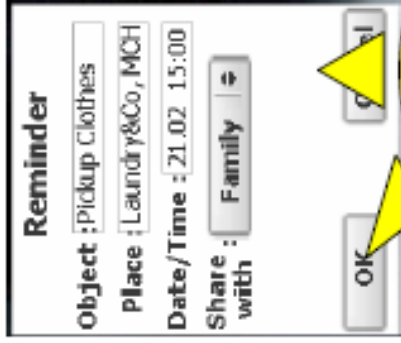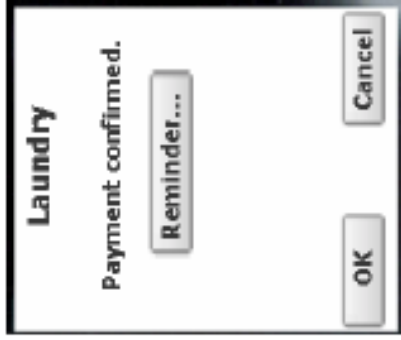
- Display Context
- Interaction with buddy and groups

Concepts, Acceptance
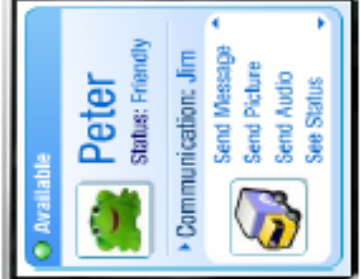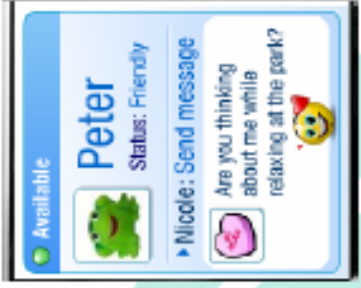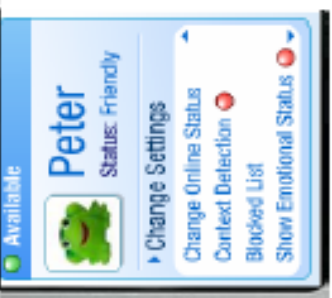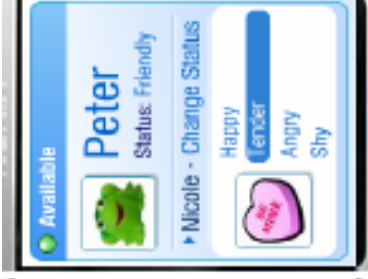
- Family members share reminders

Sport sensors

- Suunto sport sensors:
  - T6 watch
  - Foot pod (walking distance & speed)
  - Heart rate belt

Context Watcher

GPS | **Sport**
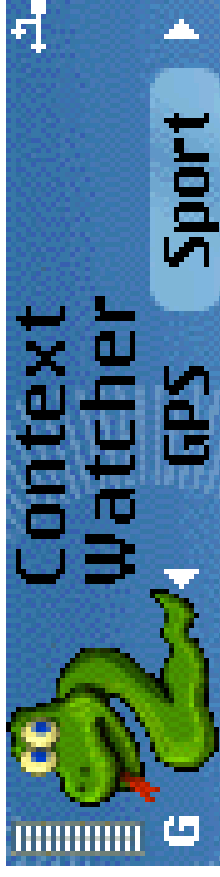
Success
Found all 1 readings.

HR
77.0 bpm

Sensor
3338 A (0, HR7C66.bpm)

Options | **Exit**

Context Watcher

GPS | Sport

Success

Connect device
Discover sensors
Get readings
Show buffer
Close device

Select | Cancel

154
24:30.5
avg.67

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Points of my interest

- Finds points of interest in the neighbourhood

- Currently a limited number of categories, only in The Netherlands

- Shows address, phone and distance information

- Selecting a category will start a search, selecting a POI will display detailed information

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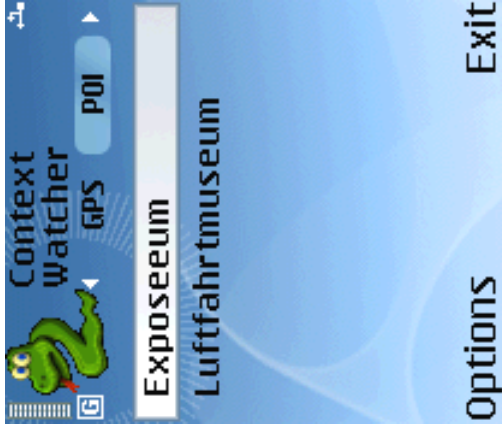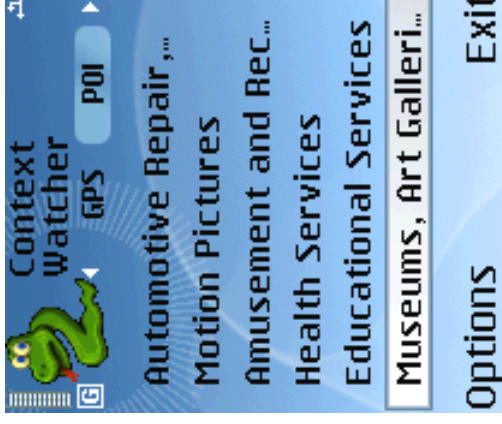
Exchanging context information with buddies

- Making your buddies aware of your:
  - Speed
  - Location
  - Activity
  - Heart rate & condition

MobiLife Evaluation and Trials

CONTROL ROOM

TEST ROOM

FOCUS GROUP ROOM

1st evaluation round (Oct-Nov 2004)

ualitative user research

7 family interviews (10 in Italy, 7 in Finland)

ltogether **61 people involved**

~3 scenarios discussed with each family

2nd evaluation round (Apr-May 2005)

emi-structured interviewing

rganised in Italy and Finland

'sessions'

rganised by research questions

3rd evaluation round (Sep-Nov 2005)

ME and customer developer interviews in Italy; expert reviews for pre-test sessions; comparc....ating field studies with probe 1s

drawing exercise focusing on family social
network and means of communication

session with ~20 football players and ~20 parents

The three aspects of usefulness

Applicability (relevance)

- Using the information for something meaningful and valuable to me
  - Information is available only when it is relevant
  - Implies filtering is applied before information is made available in the user plane
- Annoyance is a negative value

Control (filtering)

- Information is only there when I want it
- Information is only given out when I want it
- Privacy is a special case of control
  - Anonymity is being there, but not telling who you are

Availability

- Information is there when I need it
  - I am connected to the information
  - I am connected to the network
  - The information (source) is connected to the network

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Context Management in the Ubiquitous Web

2006-02-05

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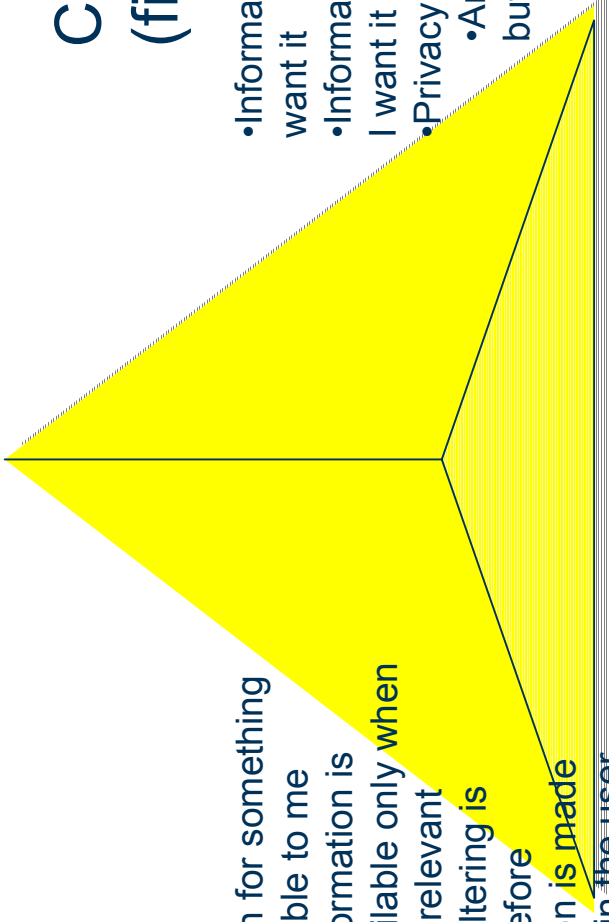
Challenges of the service paradigm

Discovery: How are services found?

– Finding the service that solves a given problem

– Finding the service that needs to be used

– Not finding services which are not available to me

Invocation: How to interact with the service

– Who can invoke a service?

– What messages to send...in what order

– What is the message format

– What information the service expects

  ▪ What information the service report

Use: How to use the information received to solve the problem

– How the client select the information to send

Availability: Where and how to reach services

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Ambient Concept

Ambient Networks:
- **Common Control Services**
- **Networks at the Edge**
- **Scalable Auto-configuration**

Services

Ambient Control Space

Ambient Connectivity

2.5 G

3G

4G

WLAN

Fixed

Corporate

Community — **CAN**

Home — **HAN**

Vehicular — **VAN**

Personal — **PAN**

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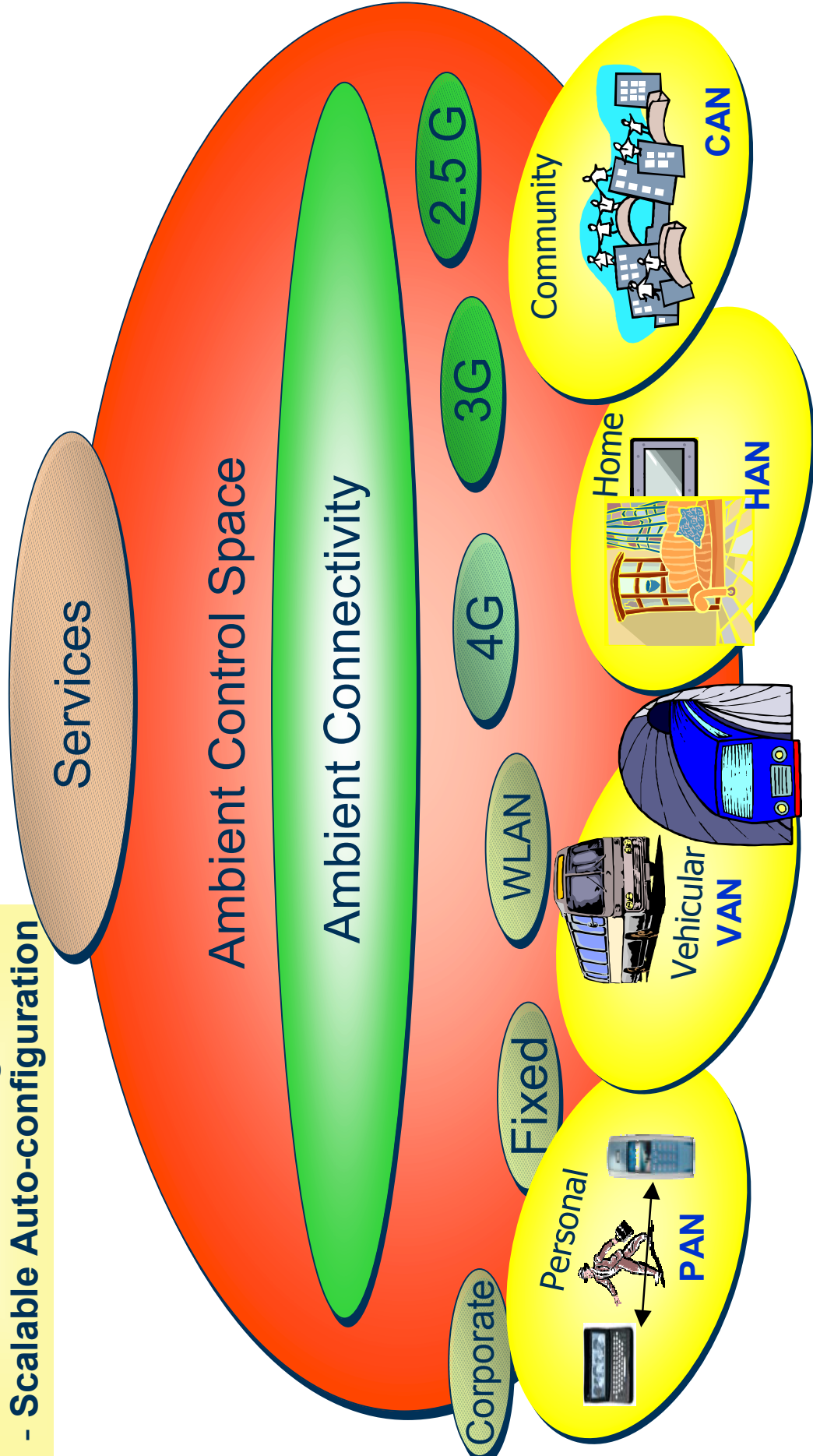
The Ambient Networks high-level architecture

Ambient Network 1
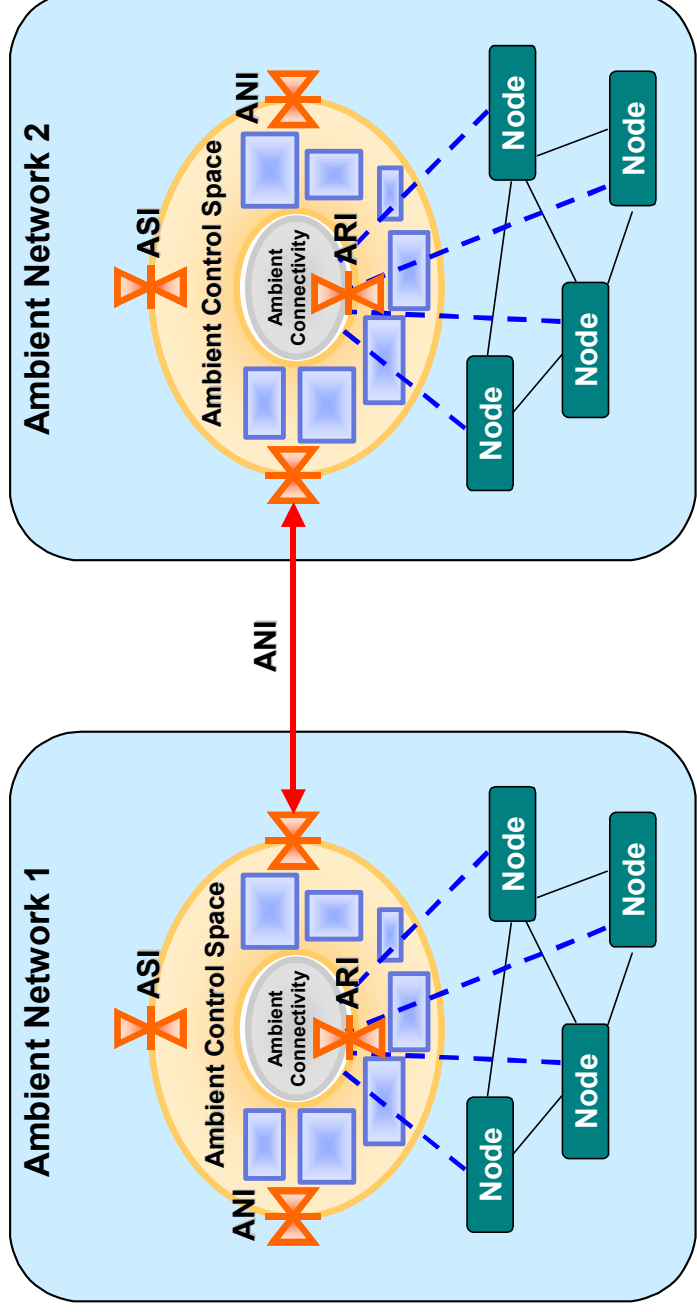
Ambient Network 2

- Networks are endowed with a set of control plane functions, which together comprise the Ambient Control Spaces, (ACS)
- The underlying data transfer and other user plane capabilities of the existing or new networks are accessed and controlled through a reference point called Ambient Resource Interface (ARI).
- Together, these expose an Ambient Service Interface (ASI) to upper layer services and applications running within the network.
- Internetwork co-operation between different ACSs is mediated through an integrated set of protocols at the Ambient Network Interface (ANI).

Source: Ambient Networks

Context Management Framework

- ## Generic model of Context Providers (CP)
  - Encapsulated data sources
  - Virtual context providers

- ## Context Representation Framework
  - Well-founded context meta model
  - Context vocabularies (schemata) and mappings

- ## Context reasoning
  - Low level (e.g. probabilistic reasoning)
  - High level (e.g. logic inference)

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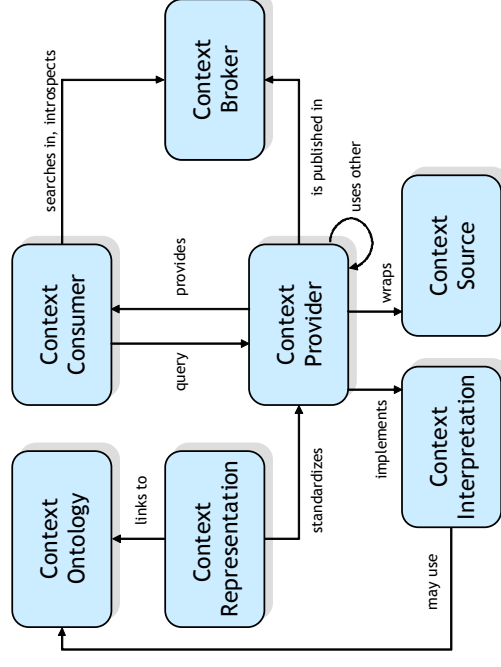
Context Mgmt Framework Building Blocks
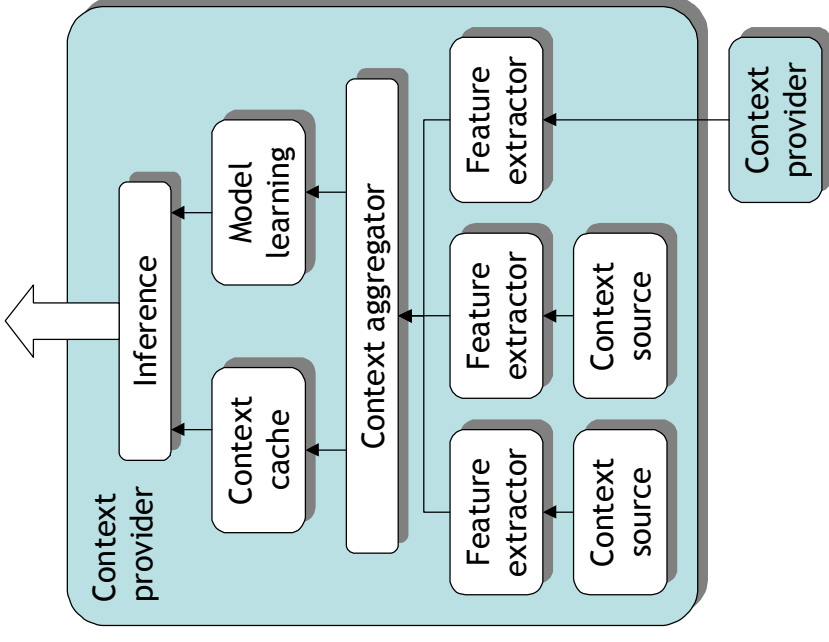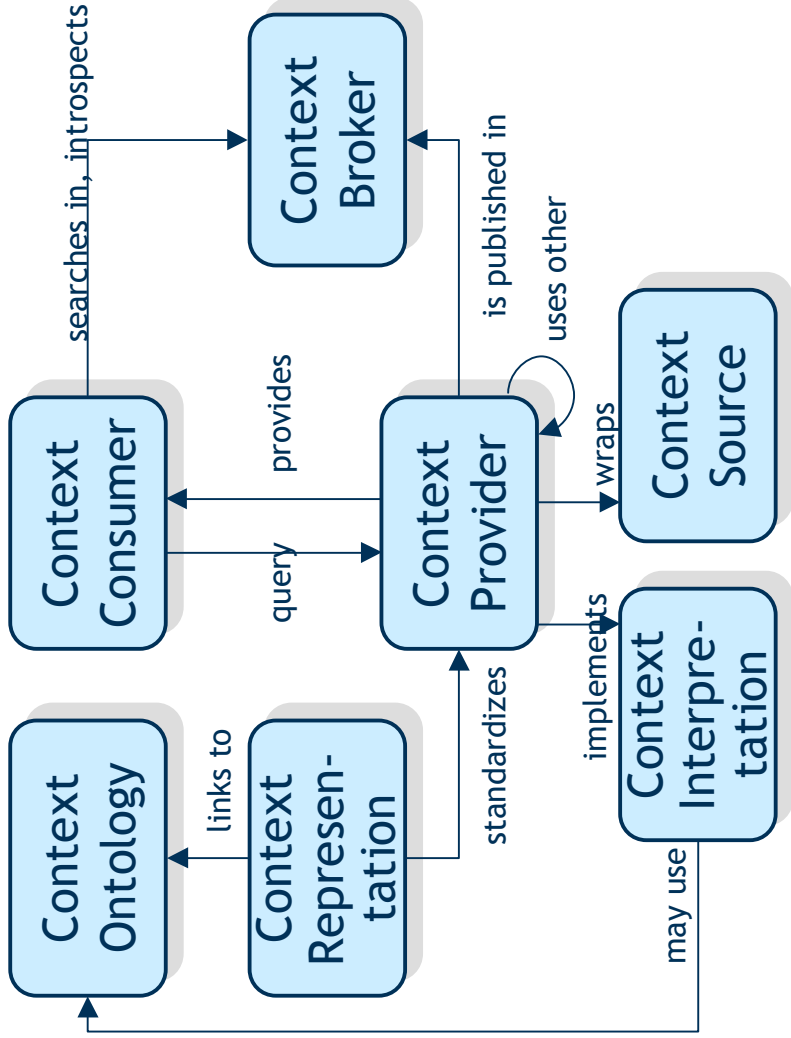
- Initial "Cookbook" for context-aware applications and services available

Interfaces

- **Context Providers** (CP) are defined in the Context Awareness Function (CAF). CPs encapsulate context data (both simulated and real ones) as context information for consumption by CCs. Many different CPs can co-exist together providing both individual and group entity context information to a multiplicity of CCs.

- **Context Consumers** (CC) are also defined in the CAF. CCs consume context data as context information provided by CPs.

- **Context Source** (CS) are also defined in the CAF. CSs are devices that deliver raw data, e.g. sensors.

- **Platform Independent Functional Interfaces** (PIF) represent component interfaces that do not rely on a specific technology. They will be defined in the ongoing specification work.

- **Management Interfaces** (MI) represent platform independent interfaces with the role of providing interfaces that allow the management of the respective component.

- **Management Actions** (MA) represent management actions that the Operational Management Function (OMF) can execute.

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Context Broker

- Directory for Context Providers
  - CP registers in Context Broker (*advertisement*)
  - CC (consumer) searches for CP in Context Broker

- CP combination
  - A CP looks for other CPs in order to fulfill its task
    - *E.g.: a "weather" CP may ask the Broker for any "temperature" or "rain level" CP*

Any application (e.g. a CP)

Context Consumer

Find CP

CB

ontology

CPs

Register CP

Later, call CP
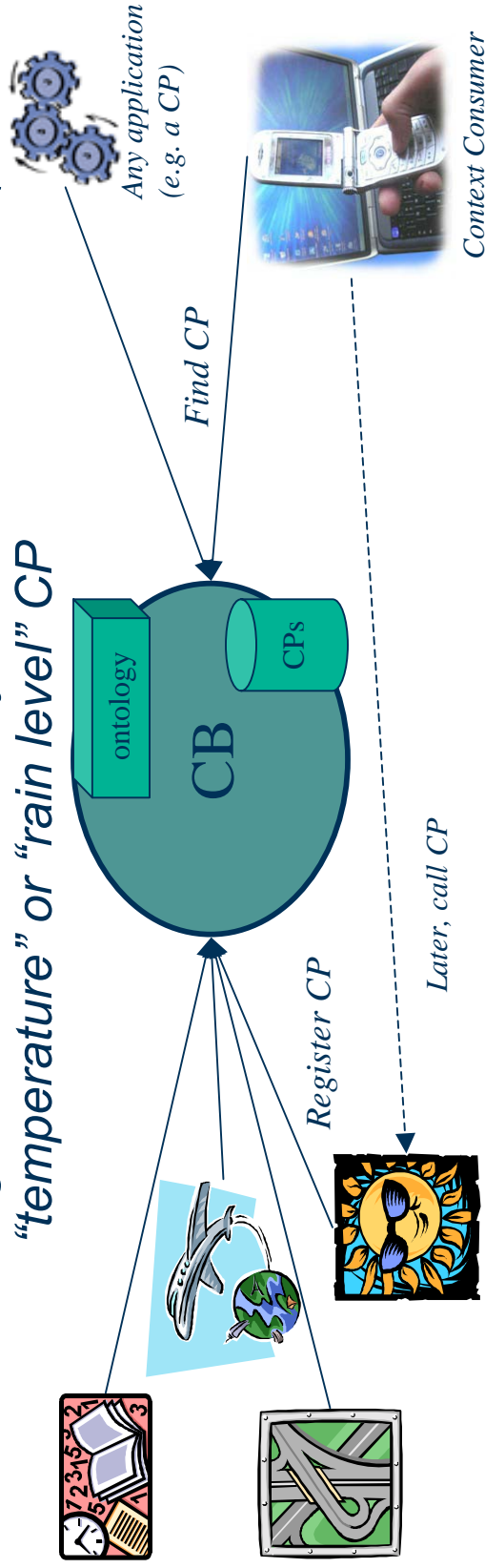
Different Levels of Context Usage

- MobiLife CMF enables context providers from different domains and of different types

- Access to and usage of provided context can be at different levels

→ MobiLife applications to highlight/use different aspects

Full

Low

High

Top
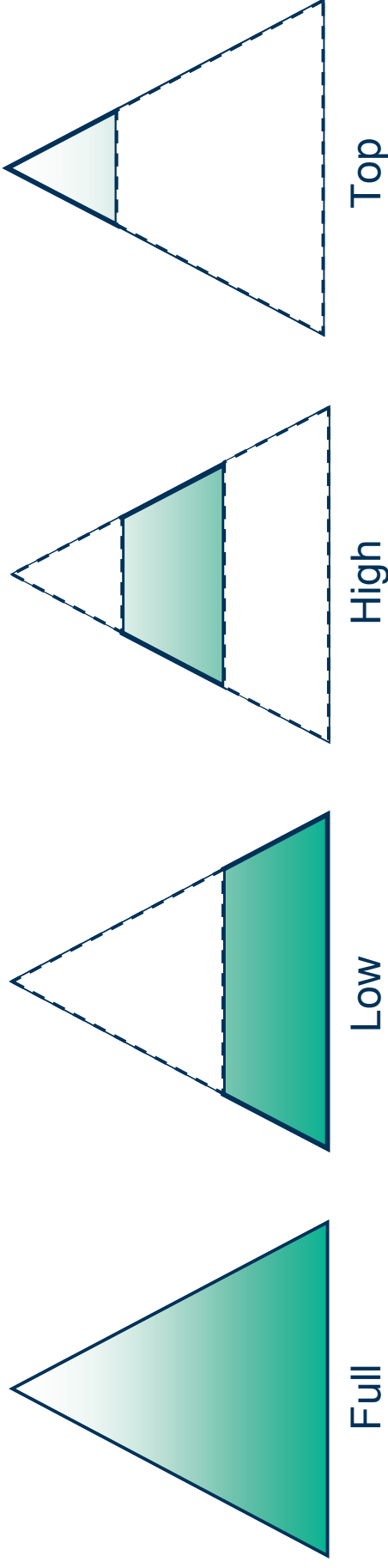
Challenges of Context Abstraction

Top-level Context

High-level Context

Low-level Context

consistent

Conflict Detection and Resolution

qualitative

Context Interpretation

quantitative

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Context Management in the Ubiquitous Web

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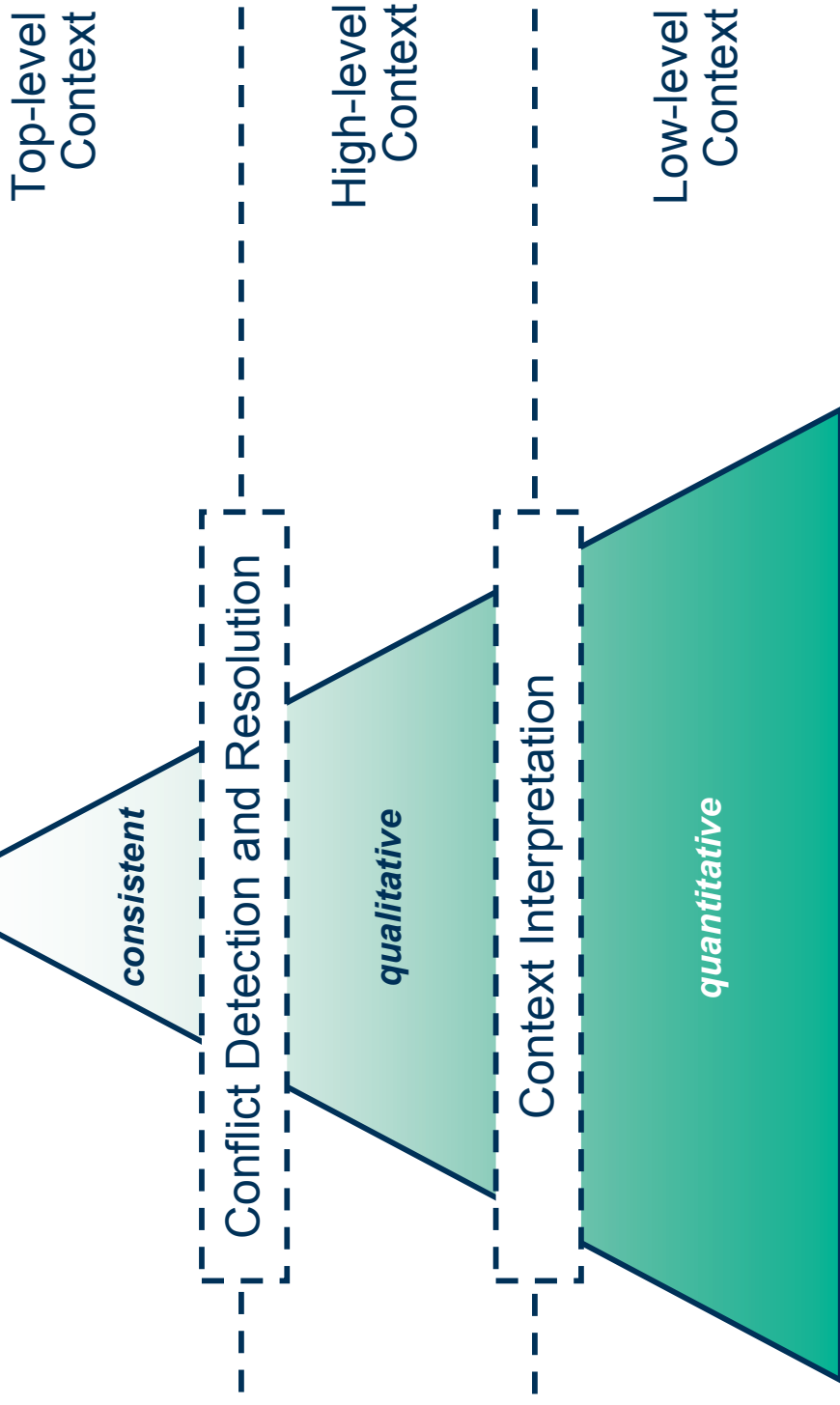
Personal Context and Individual Profile Components

- **Context Gathering and Interpretation**
  - Collects raw sensor data, user behaviour, device and modality discovery information
- **Context Inference**
  - Generates an operational personal context
  - Includes modality recommendation for user interface adaptation
- **Individual Profile Management**
  - Stores any kind of preferences about users
- **Learning Mechanism**
  - Learns from the interpreted data and the profile information to generate updated profile information
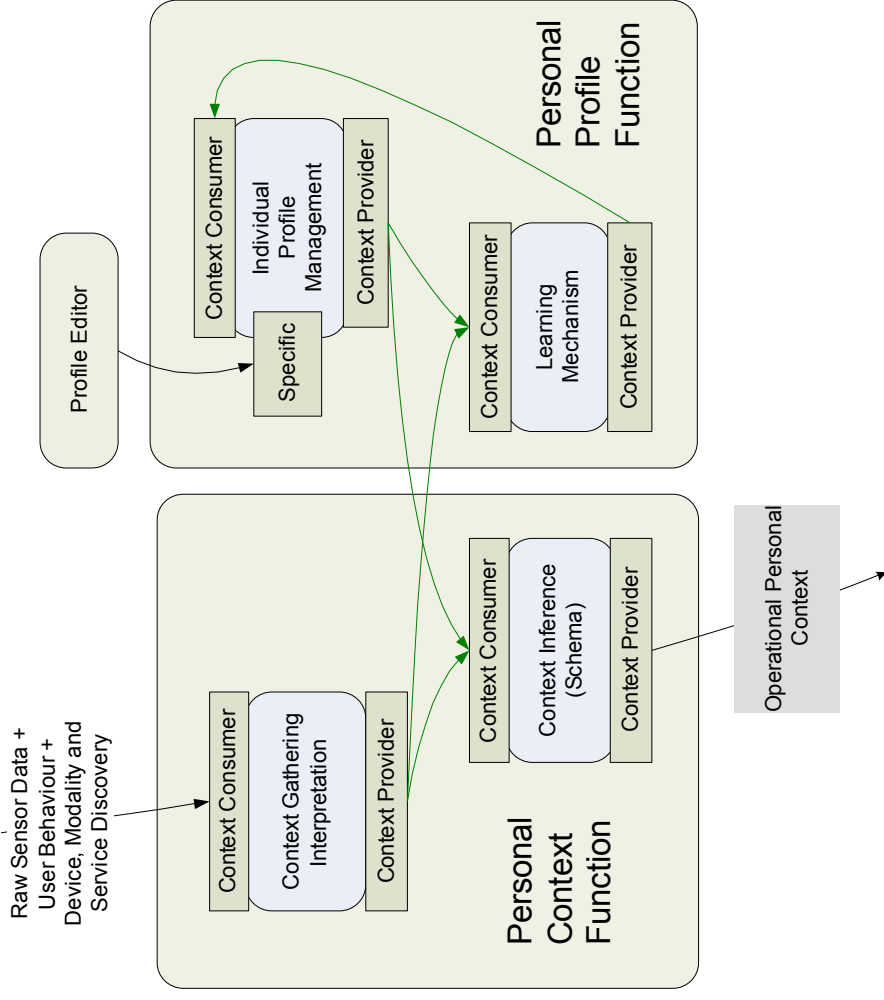
Group Management

- Groups are the key to user interaction
  - You structure your world in terms of groups
  - Groups share context, profiles, and policies
    - Group initiator can set these
    - Group context, profile, and policies can be learned automatically

- You can be in a group with more than people
  - Groups of machines
  - Groups of services

WP3
Group Awareness
Group Models, Context
Trust & Privacy
Policies & Enforcement

"Mary"   "Peter"   "Paul"

Wide Area
Local Area
Personal Area
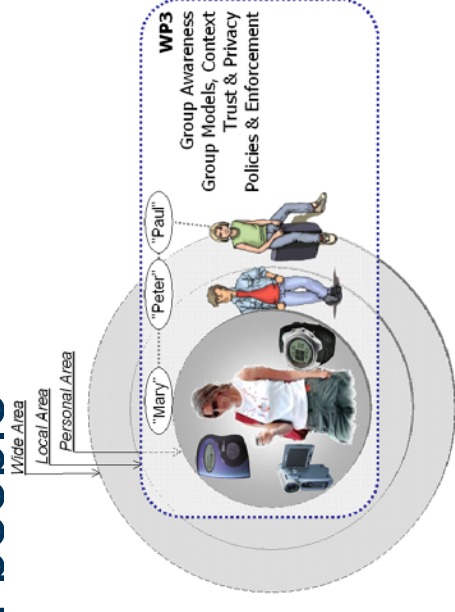
Group Context

- Everything that defines the current state of the group
  - Example of context behaviour
    - Momentary/Permanent
    - Tied to location/Ubiquitous
    - Open /Closed
    - Trust in all/Trust in some
    - Volatile/Stable

1. Context generation
2. Group/Context Creation
3. Context Templates
4. Context/Group Repository
5. Data Mining
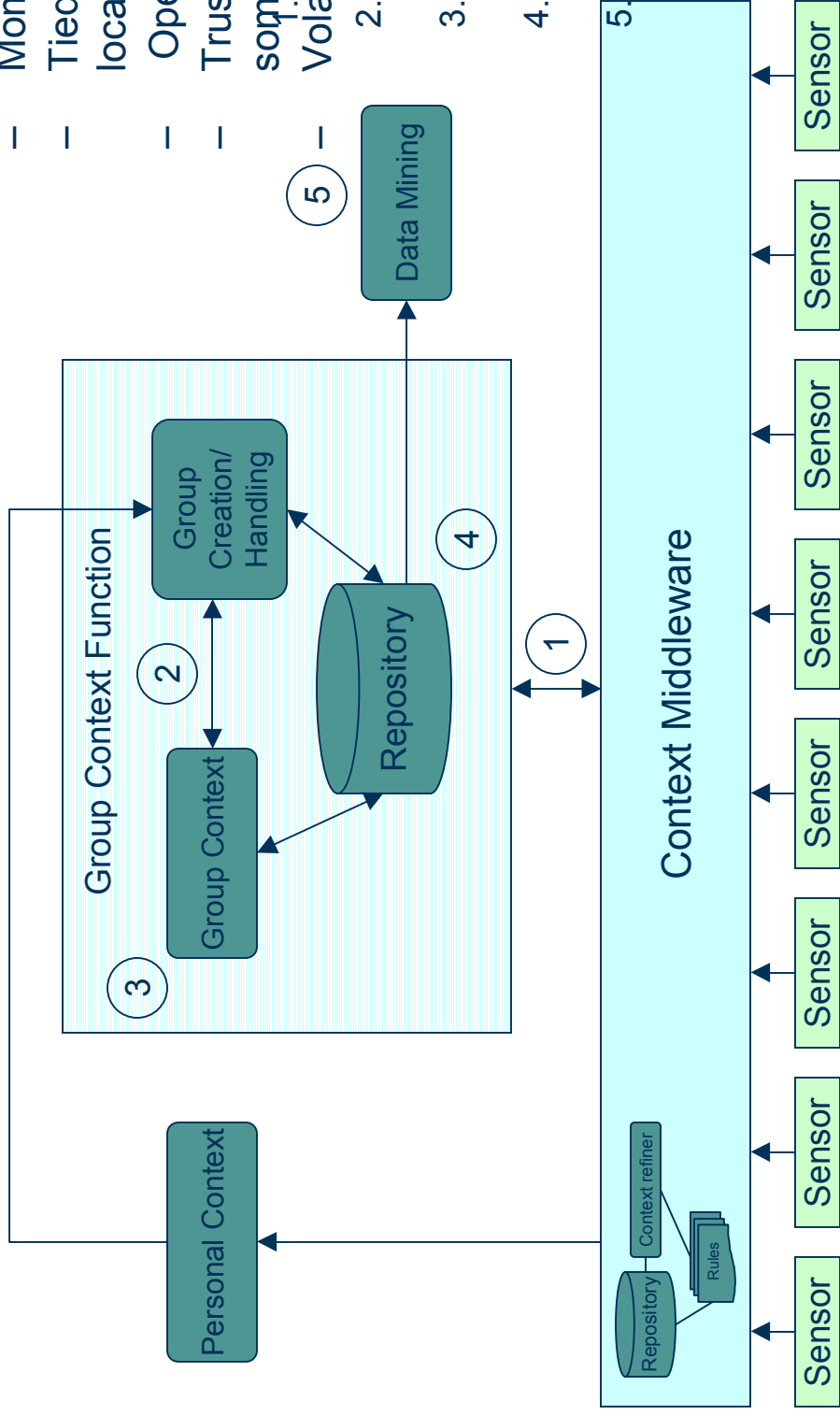
Trust & Privacy - Requirements

- User must be in control of his personal data
  - User must be given the opportunity to give consent on giving out data

- Must be possible to merge user policies for data management
  - To create group profiles
    - What happens when users do not agree on the policies?
    - Several groups are created

- Trust and privacy must work without the user being present
  - Disconnected operation of trust engine (including the user policies)
    - One instance of the trust engine per user and data object

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Context Management in the Ubiquitous Web

2006-02-05

Status of ML Trust & Privacy work

- Trust engine (conceptually) on all context provider interfaces
- User interacts with policies in trust engine at startup
- Data with low sensitivity can be made accessible in a more simplified way
- The GAF can be used to include trust in the group context
  – Through a query interface on the trust engine
- The policy language includes
  – References to the (unique) MobiLife entities
  – MobiLife methods
- Trust engines can interact using the trust engine API
  – Other components of the MobiLife system can also interact with trust engines through the API
  – Interaction does not imply changing data, only querying

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Security is orthogonal?

- Since trust is created by user perception, security is orthogonal to trust

- System must be secure enough to be trusted
    - How much is "enough"?
        - Depends on user perceptions

- Standard technologies can be leveraged
    - Since we use XML, we can use
        - XML Encryption
        - XML Signature
        - HTTP-S and TLS
        - Public Key Infrastructure
        - Etc.
    - All these have their problems, but in this context they are "good enough"

Accessing the application
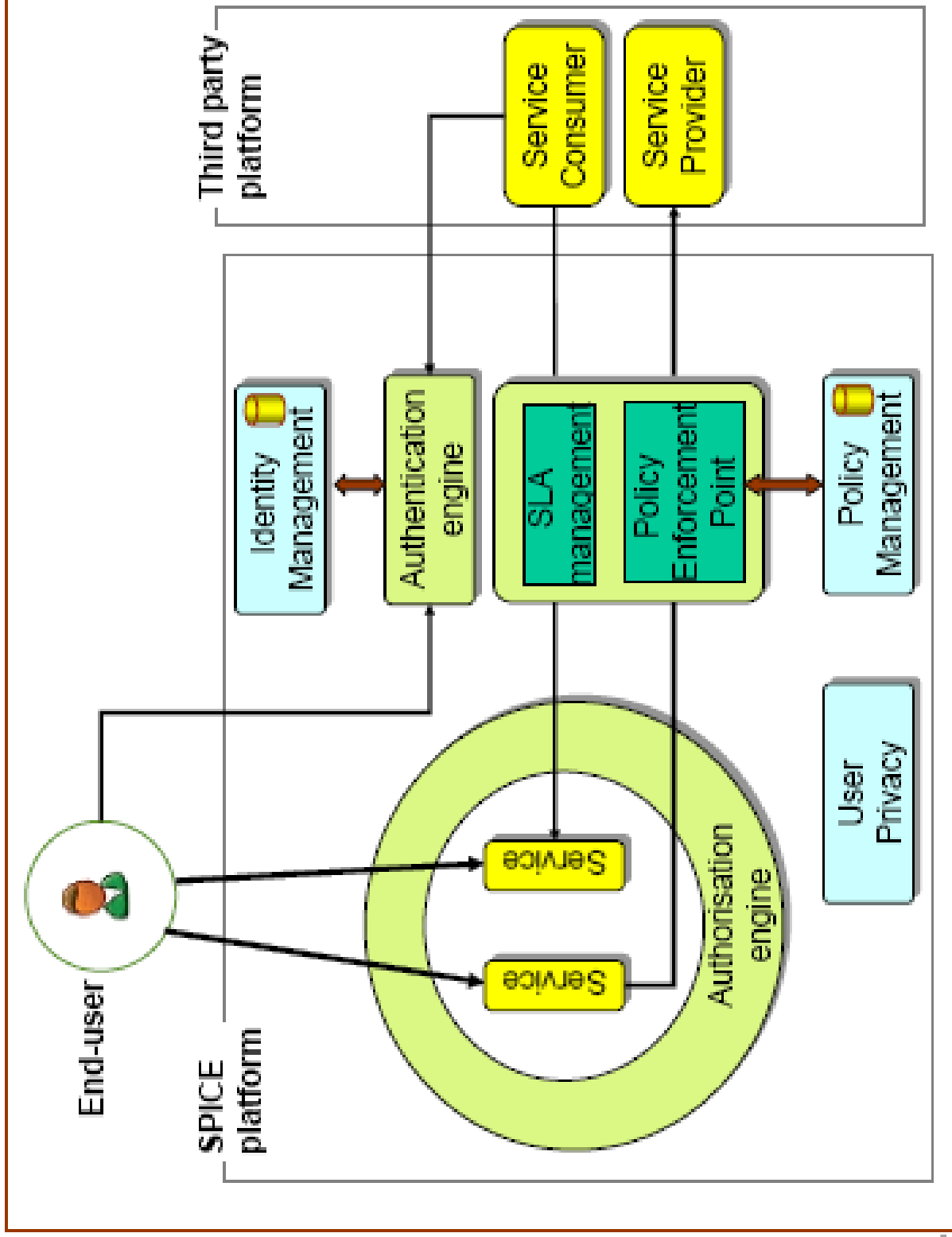
SPICE service infrastructure
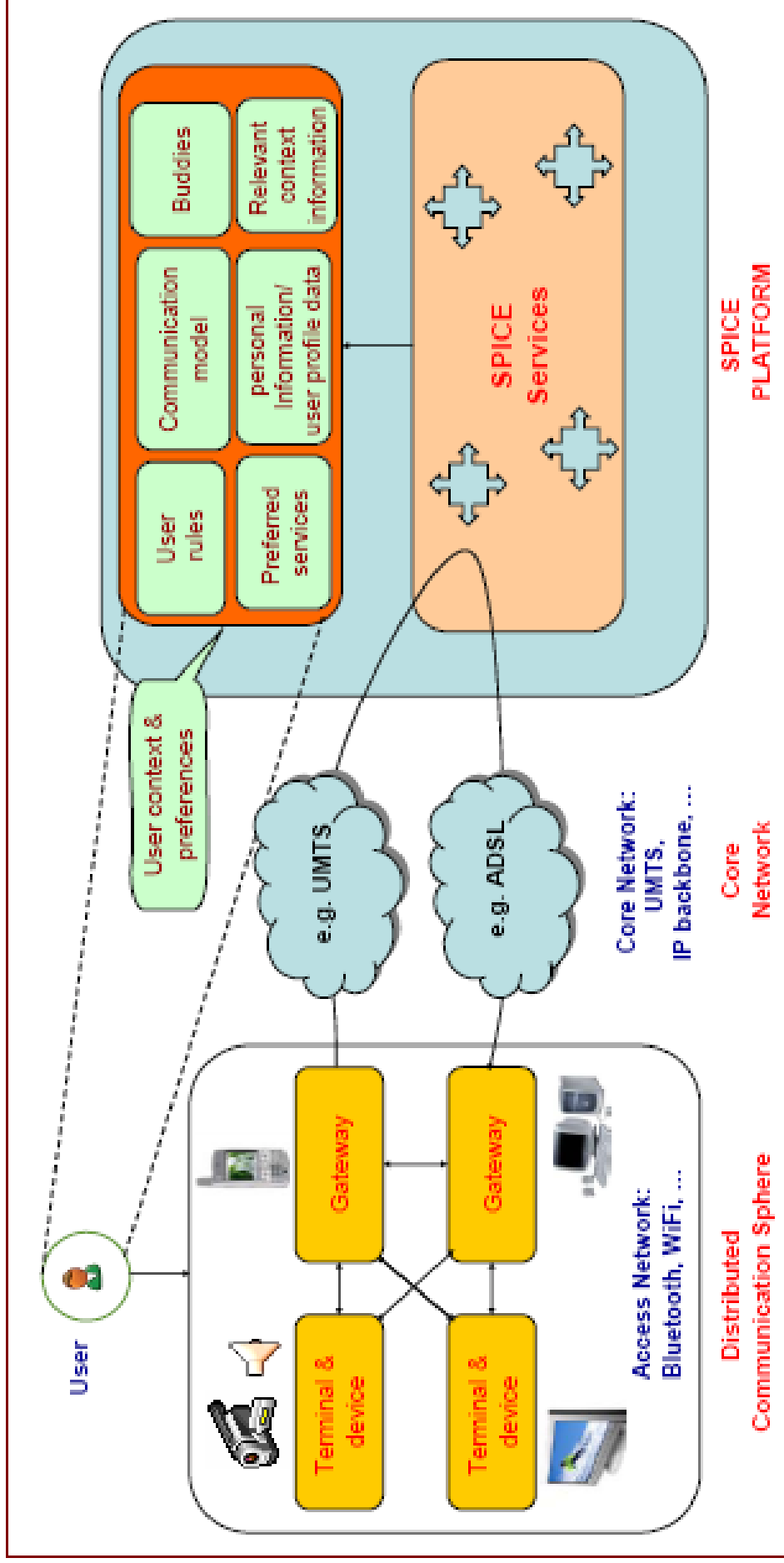
Semantic Application Services

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Service Profile

Who provides the service

Classification in Business taxonomies

Typical inputs

Type of service

Product of the service

Typical output

Conditions that result from the run of the service

Conditions that need to be satisfied for the service to run correctly

```
<profile  rdf:ID="BravoAir" >
<serviceName>BravoAir </serviceName>
<contactInformation rdf:resource="#BAco"/>
<type rdf:resource="#Airline"/>
<product rdf:resource="#FlightReserv"/>
<serviceCategory
rdf:resource="#NAICS_Airline"/>
<hasInput rdf:resource="#Dep_Airport"/>
<hasInput rdf:resou...
<hasOutput rdf:reso...
<preconditions/>
<effects/>
```
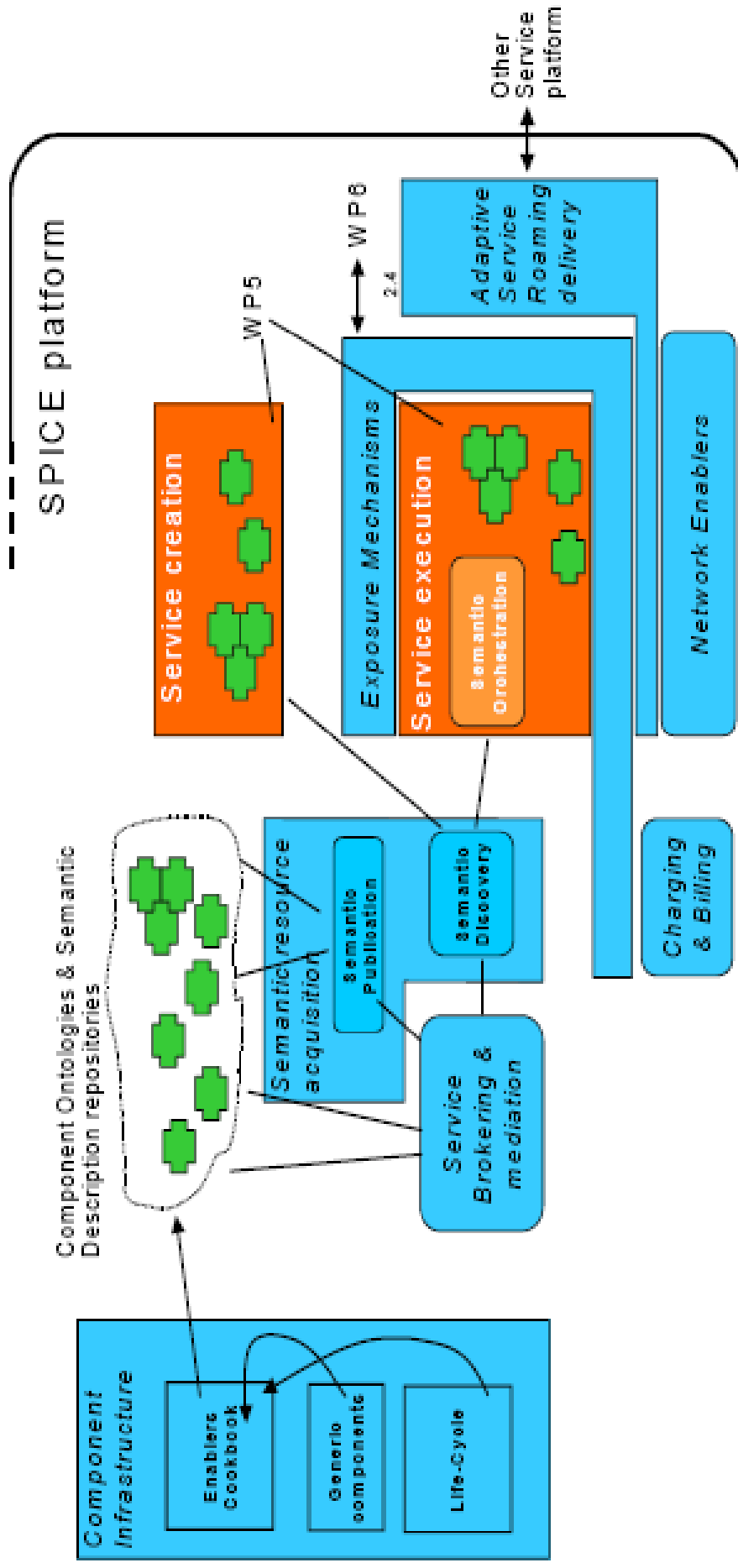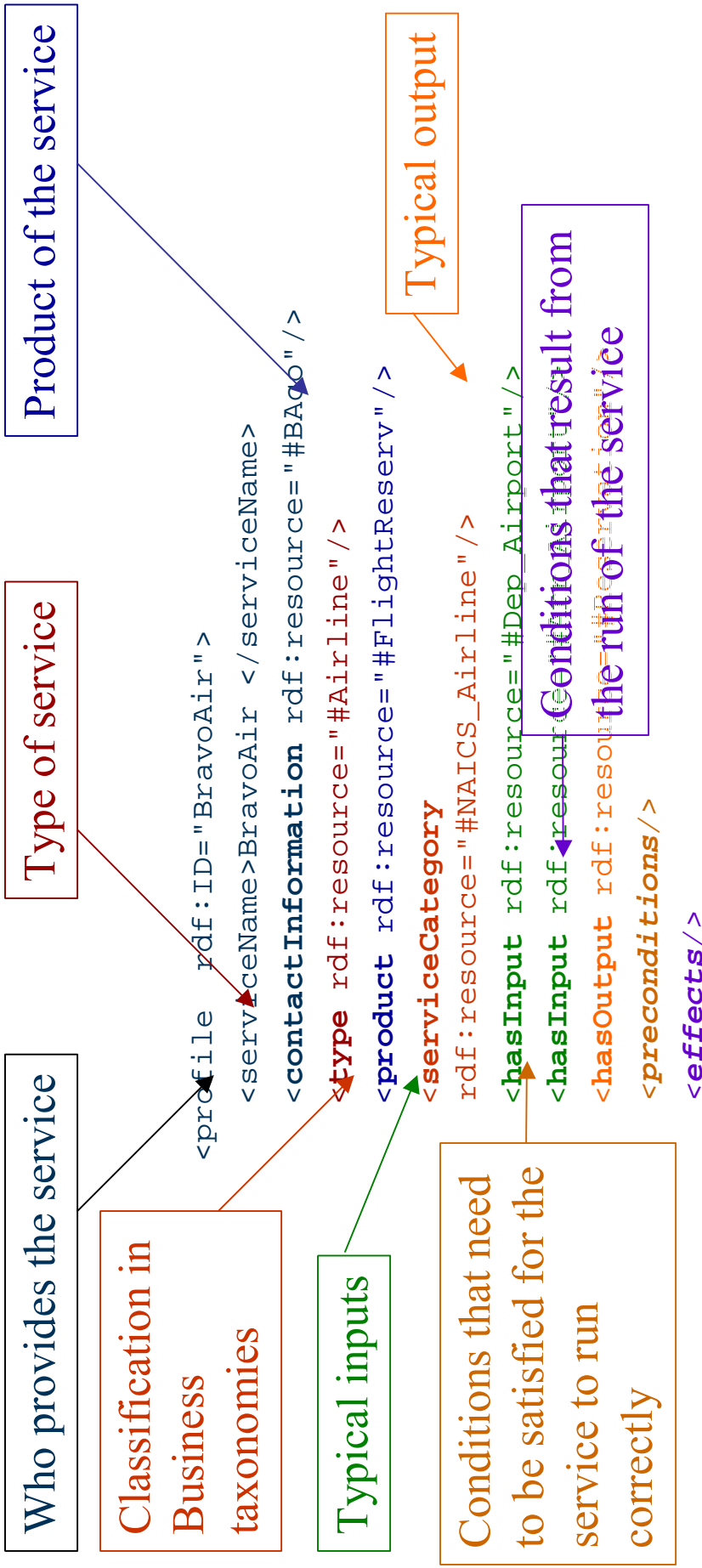
NOTE: the OWL-S Profile is an OWL object, it should be specialized to include information that is needed by the specific applications/infrastructures

Baseline Ontology (agent.owl)

Object Properties:

fellowstudent (transitive, symmetric)
colleague (transitive, symmetric)
friend (symmetric)
businesspartner
organisation
supervises
familymember (transitive)
- brother (inverse=sister)
- father
- mother
- sister (inverse=brother)
- spouse

Datatype Properties:

firstname,homecity,
homecountry,homeemail,
homefax,homepage,
homephone,
homepostalcode,
homestreet,lastname,
mainphone,
mobilephone,pager,
title,workcity,work,
country,workemail,
workfax,workphone,
workpostalcode,
workstreet

Owner

Student
Person ⊓ (∃fellowstudent Owner)

Friend
Person ⊓ (∃friend Owner)

Colleague
Person ⊓ (∃colleague Owner)

Supervisor
Person ⊓ ∃supervises Owner)

Family
Person ⊓ (∃familymember Owner)

Business_partner
Person ⊓ ∃ businesspartner Owner)

Person

Sebastian Boehm
Martin Kaluza
Marko Luther
Matthias Wagner
Robert Hirschfeld
Wolfgang Kellerer
Kathrin Boehm
Martina Eckert
Steve Jobs

Baseline Ontology

Address Book
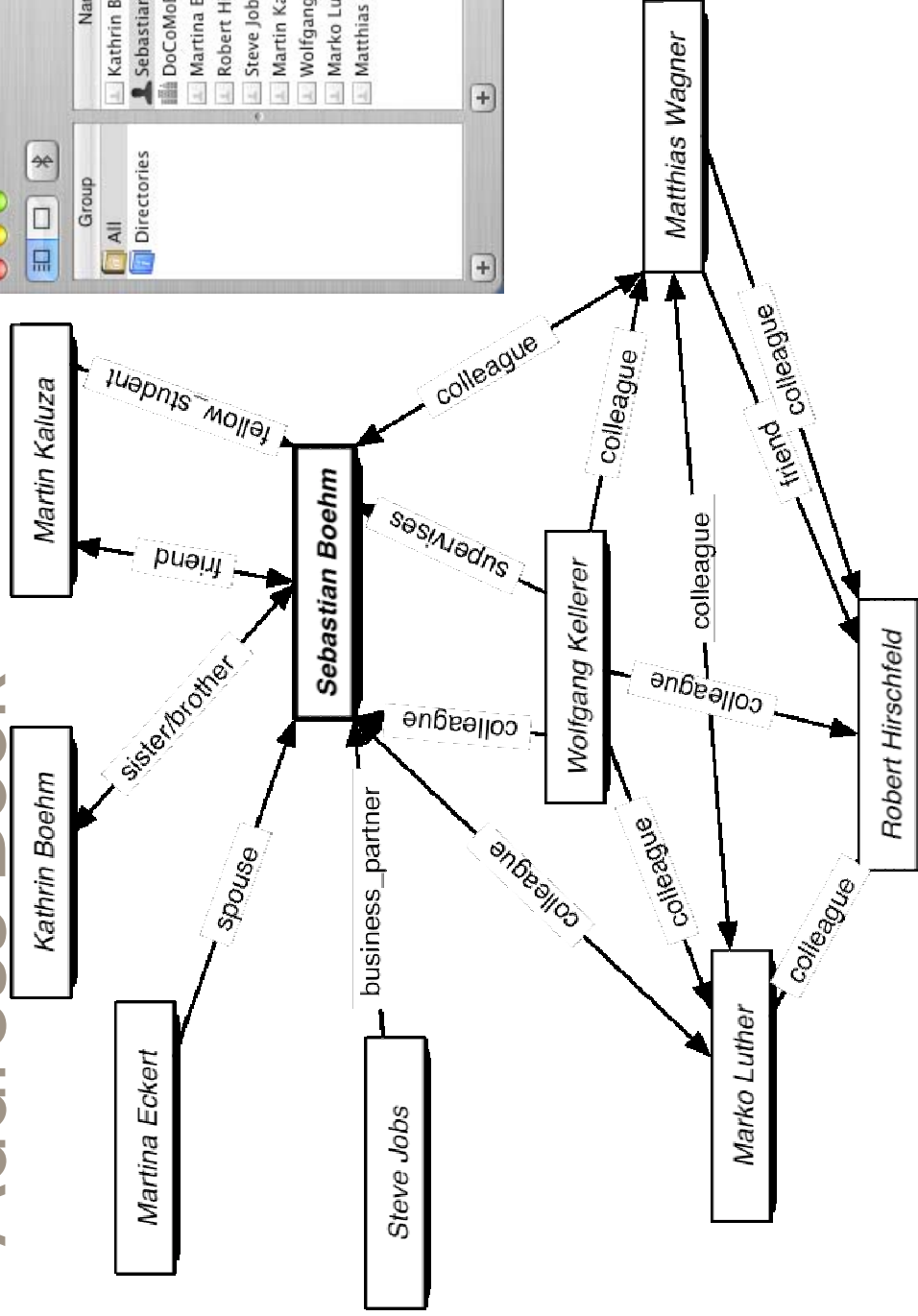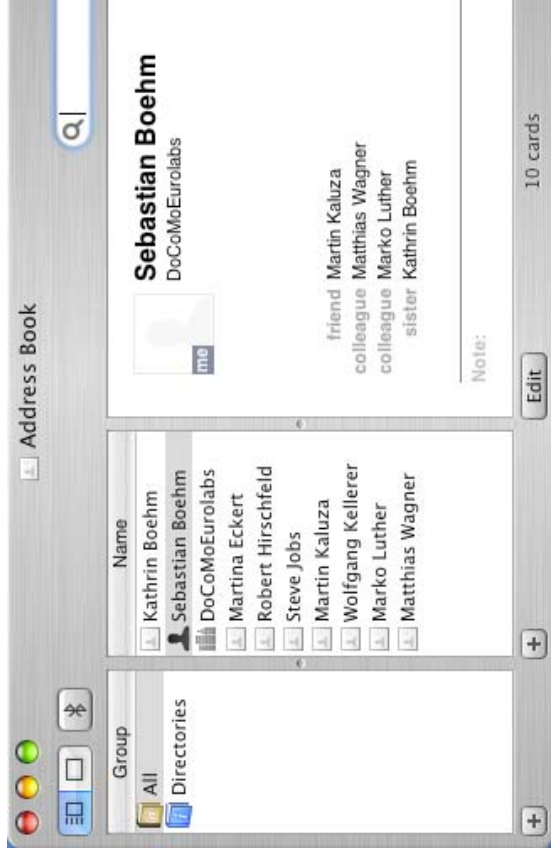
Baseline Ontology
location.owl

Object Property: location

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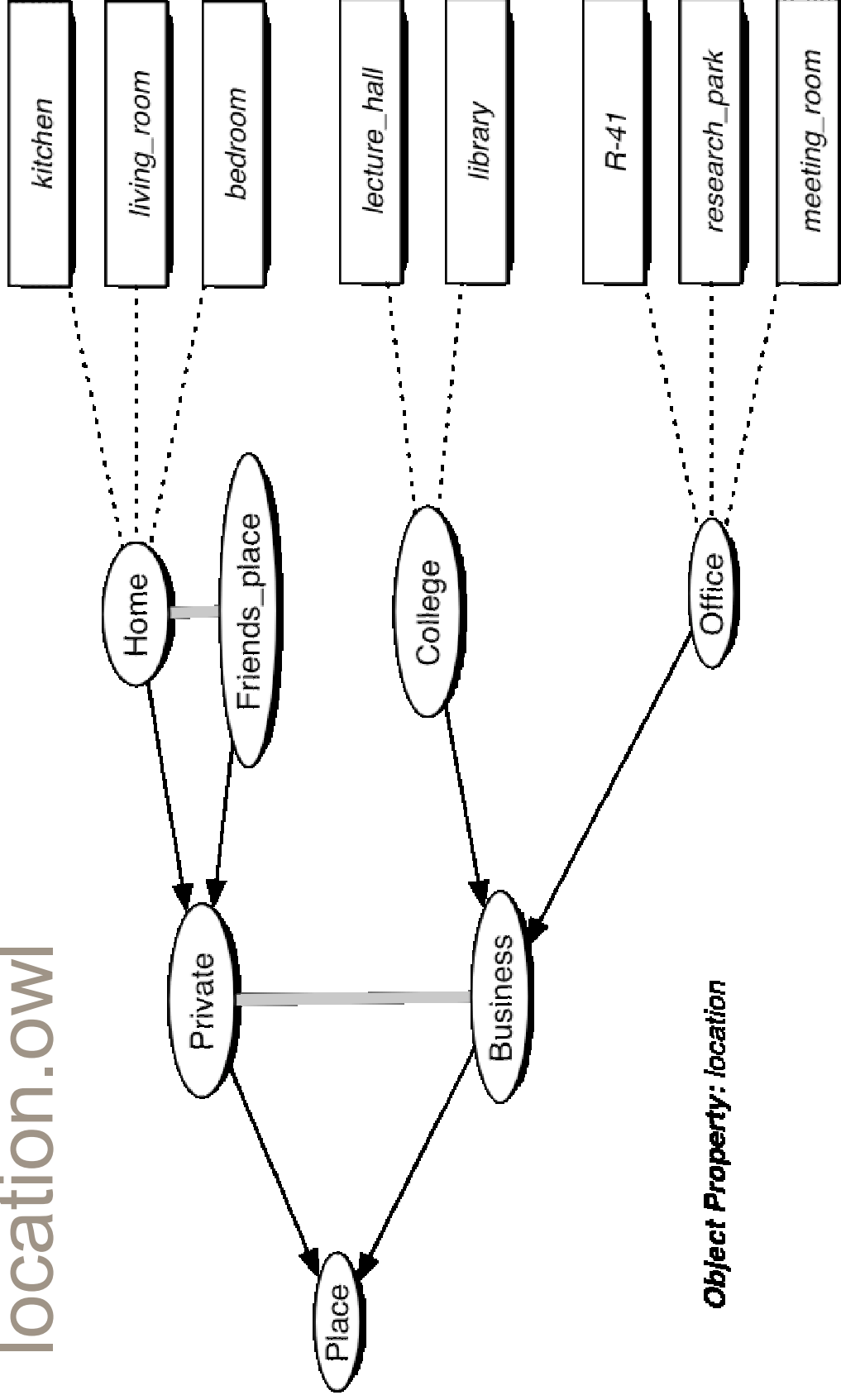
The Projects

The Ambient Networks Project
Dynamic merging of heterogeneous networks & network resources

Project data

- Part of EU 6th FP
- Start: 2004-01-01
- Duration: 2 years
- 2 more phases
- Size:
  - 190 person years
  - 21 M Euro
- 41 legal partners:
  - 10 Vendors
  - 10 Operators
  - 15 Academia
- Coordination: Ericsson AB

Project Goals

- Easy and dynamic composition of disparate networks
- Adaptive and self configuring mobile network components
- Comprehensive integrated security framework
- Validating the Ambient networks concept

Progress Highlights

- Scenario result submitted to WWI and WWRF
- Architectural framework ready D1-8
- Detailed results in each WP published
- Deliverables according to plan
- WWI Symposia

Addressed areas

- **Architecture**
- **Multi-access**
- **Composition**
- **Mobility**
- **Media Delivery**
- **Context Management**
- **Security**
- **Network Management**

Ambient Control Space

Ambient Connectivity

Services | Services

Corporate | Fixed | WLAN | 4G | 3G | 2.5 G

Personal — PAN

Vehicular — VAN

Home — HAN

Community — CAN

Network A — Ambient Control Space — Ambient Connectivity — Context Provisioning — Security — Connectivity Controller — Multiaccess — Domain Management — Mobility — Media Delivery

Network B — Ambient Control Space — Ambient Connectivity — Context Provisioning — Security — Connectivity Controller — Multiaccess — Domain Management — Mobility — Media Delivery

Network A+B

ASI — Ambient Service Interface

ANI — Ambient Network Interface

Ambient Networks phases

Work-Areas	Phase 1 Establishing the Ambient Networks Concept and its Feasibility	Phase 2 Technology Development	Phase 3 System Synthesis
I: Concepts and Architecture	Concepts & Architecture Design	Architecture: Scalability/Evolvability	Architecture, Standards
II: Key Technical Problems	Feasibility, Functions of AN Control Space	Detailed Specification, Technical Development, Performance	Optimisation for Performance and Deployment
III: Business Interfaces and Commercial Viability	Business Feasibility	Business Interfaces	Market Dissemination
IV: Prototyping and Validation	Usability/Networks Test Cases	Usability/Networks Prototypes	Integration across WWI, Validation, Market Dissemination
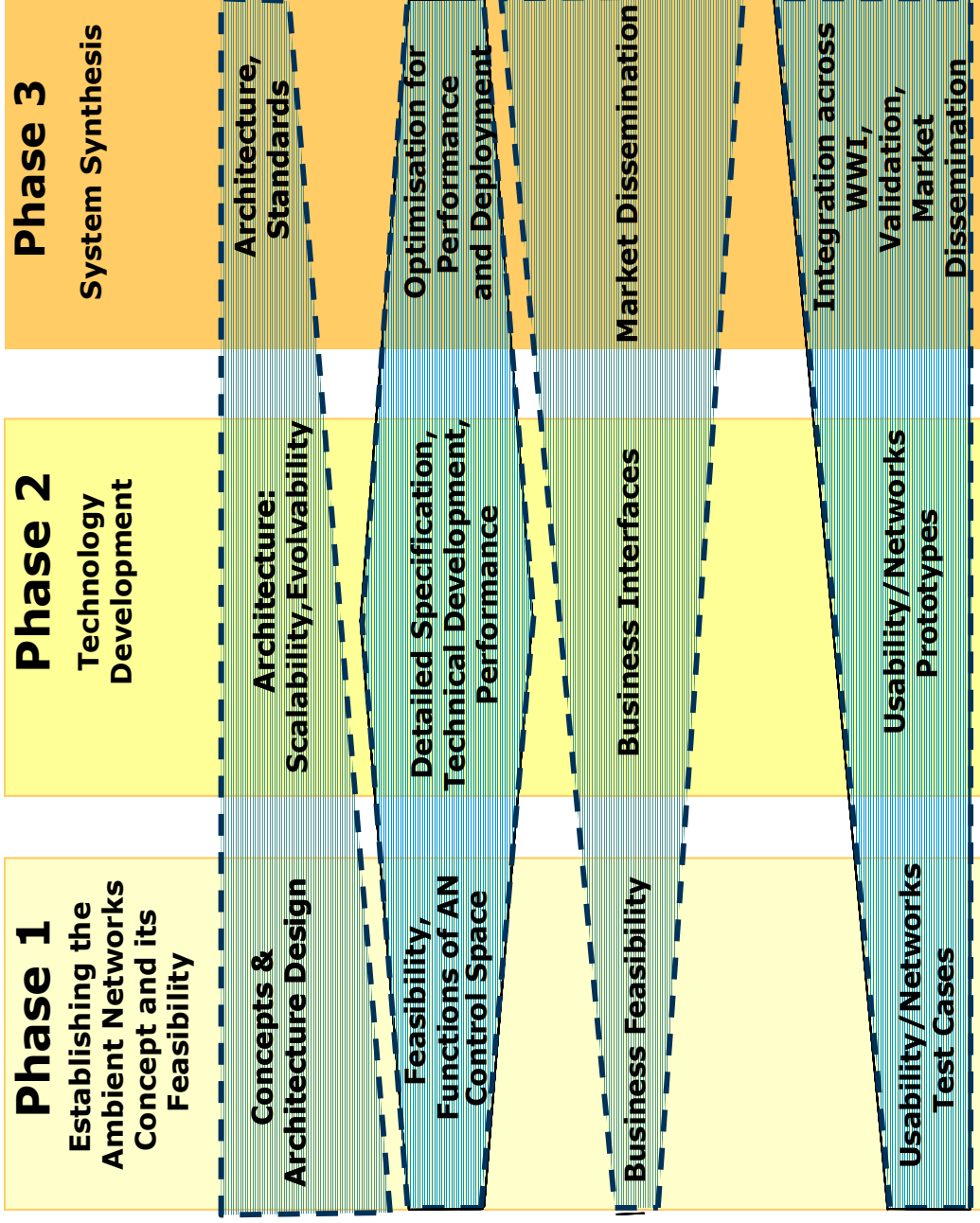
AN Partners and Geography

Motorola Japan

National ICT Australia
(Univ. of New South Wales)

Elisa Communications
Nokia
VTT

Ericsson
KTH Royal Inst. of Technology
SICS
TeliaSonera

Aachen Univ.
Daimler-Chrysler
DoCoMo
Fraunhofer FOKUS
Panasonic
Siemens
TU Berlin
Lucent

Budapest Univ.

Telenor

Consorzio Ferrara Ricerche
Telecom Italia LAB

Lucent
BT
NEC
Univ. College London
Univ. of Surrey
Vodafone

KPN/TNO

Alcatel
France Telecom

Critical Software
INESC Porto

Telefonica I+D
Univ. of Cantabria

Univ. of Ottawa
Concordia Univ.

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Context Management in the Ubiquitous Web

2006-02-05

The Ambient Networks Consortium

- Ericsson
- Alcatel
- Lucent
- NEC
- Nokia
- Panasonic
- Siemens
- Daimler-Chrysler
- Motorola Japan

- BT
- DoCoMo
- Elisa Communications
- France Telecom
- KPN/TNO
- Telefonica I+D
- Telenor
- TeliaSonera
- Telecom Italia LAB
- Vodafone

- SICS
- Aachen University
- Budapest University of Technology and Economics
- Fraunhofer FOKUS
- INESC Porto
- KTH Royal Institute of Technology
- TU Berlin
- University College London,EE +CS
- University of Cantabria
- Consorzio Ferrara Ricercha
- University of Surrey
- VTT

- National ICT Australia (University of New South Wales)
- University of Ottawa
- Concordia University

- **Critical Software ,S.A.**

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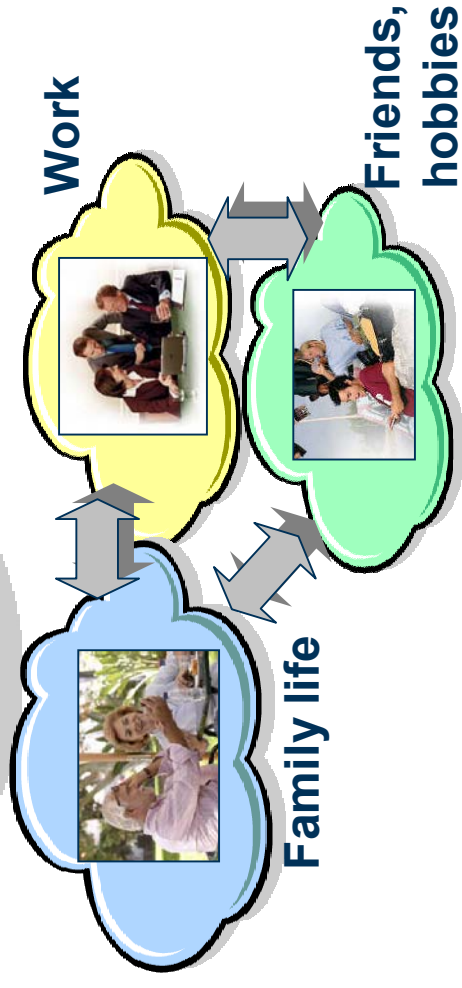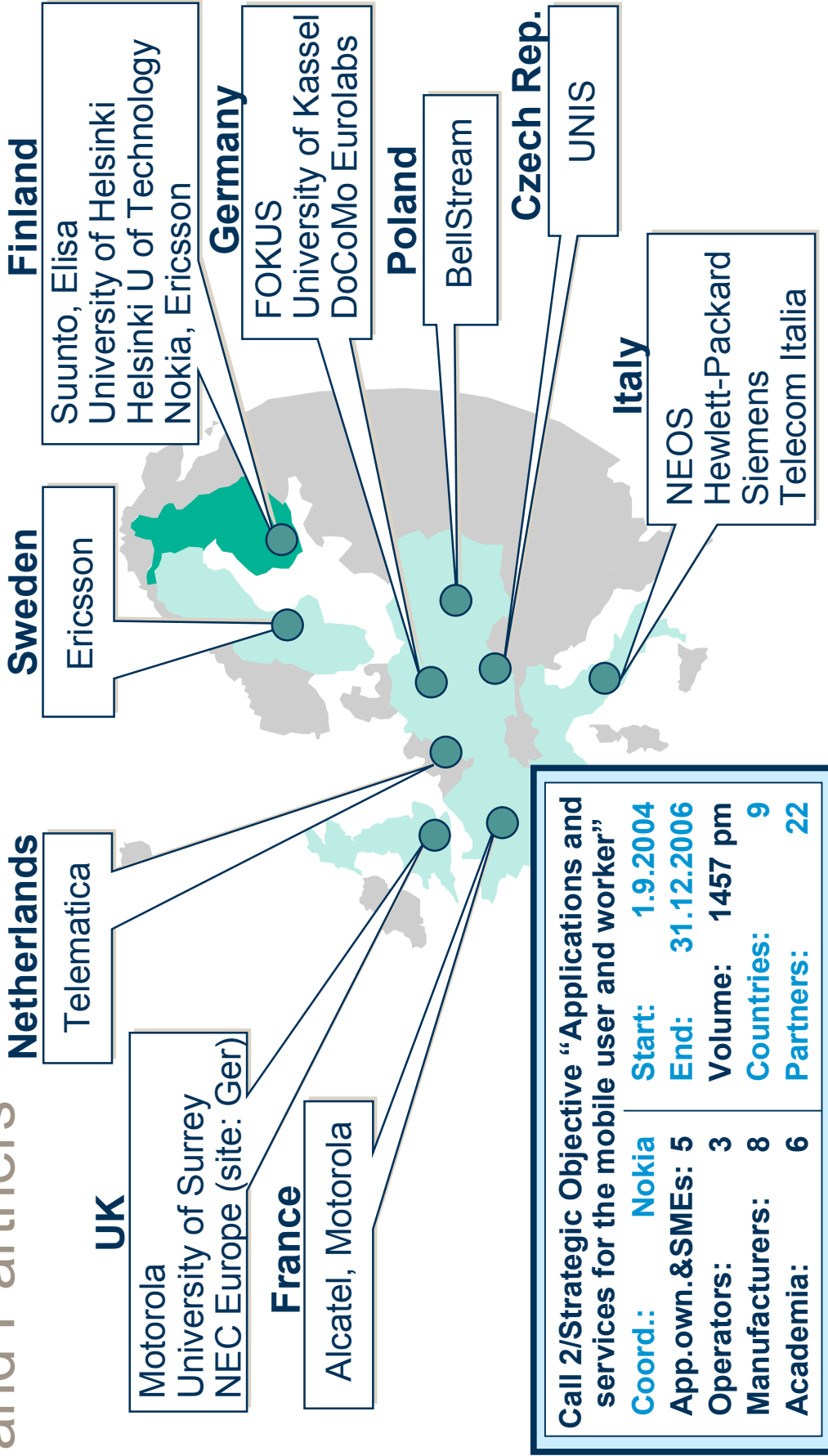# Life Goes Mobile with MobiLife

Vision and Challenges

Vision: Mobile & wireless applications and services become everyday things

Challenge: How to help people, especially families, in making their everyday life easier

Work

Friends, hobbies

Family life

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Life Goes Mobile with MobiLife Facts

and Partners

Finland
Suunto, Elisa
University of Helsinki
Helsinki U of Technology
Nokia, Ericsson

Germany
FOKUS
University of Kassel
DoCoMo Eurolabs

Poland
BellStream

Czech Rep.
UNIS

Italy
NEOS
Hewlett-Packard
Siemens
Telecom Italia

Sweden
Ericsson

Netherlands
Telematica

UK
Motorola
University of Surrey
NEC Europe (site: Ger)

France
Alcatel, Motorola

Call 2/Strategic Objective "Applications and services for the mobile user and worker"		
Coord.: **Nokia**	**Start:**	**1.9.2004**
App.own.&SMEs: 5	**End:**	**31.12.2006**
Operators: 3	**Volume:**	**1457 pm**
Manufacturers: 8	**Countries:**	**9**
Academia: 6	**Partners:**	**22**

Spice

- **SPICE** (**S**ervice **P**latform for **I**nnovative **C**ommunication **E**nvironment) proposal submitted to IST Call 4
  - Coordinator: France Telecom
  - Technical manager: Alcatel

- **Vision**: to design, develop, evaluate and prototype an extendable overlay architecture and framework that supports :
  - Easy and quick service creation of intelligent and ambient-aware services
  - Cooperation of multiple heterogeneous execution environments
  - Pan-European seamless delivery of services across operator domains, networks and terminals

- • **Consortium** composition: 25 partners
  - Operators: FT, Telecom Italia, T-Systems, Telenor, DoCoMo Eurolabs, TP
  - Vendors: Alcatel, Ericsson, Nokia, Siemens, NEC, Bull
  - SMEs: Neos, Iris, Volantis
  - Research Centres / Academics: Telematica Instituut, Fraunhofer Fokus, Univ of Kassel, Univ of Surrey, Univ of Turin, NTNU Trondheim, Univ of Brussels
  - Operational PM support: Alma

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Now What?

Standardization Proposals

- We want to bring the following to standardization:
    - Privacy Management using policies
    - Group Management
    - User Profiles
    - Ontology work
    - Ambient Network interfaces

- We have already started – but you can help
    - Group management is in the process of being proposed to OMA PAG
    - User profiles are investigated as an extension to GUP in 3GPP
    - Ontologies will be submitted to the Semantic Web WG in W3C

- Public deliverables on the project websites are there for your use

- Ericsson will drive standardization where possible – but we are only one company, and others are needed to help

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You can participate

- Installation is easy
- Install Python for Series 60 on your phone (version 1.1)
  http://www.forum.nokia.com/main/0,,034-821,00.html
- Download the Context Watcher from
  https://bscw.ist-mobilife.org/bscw/bscw.cgi/0/37370
  or send a mail to
  koolwaaij@telin.nl
- Send the Context Watcher app to your phone via "Send to > BlueTooth > Your phone"
- Start Python
- Start script via "Run script"

Context watcher

- **Reality is our laboratory**
  - Real life experiments
  - Do not put individuals in a monitored environment, but give them the monitors in their daily environment
  - Record context information, reason with it and provide new applications and services

- **Context watcher**
  - Records location automatically, best effort
  - Uses location for additional services
    - As input parameter to map, POI and weather services
    - For reasoning to deduce personal locations
    - For sharing with buddies, friends and colleagues
    - For storage of historic data
  - Note: Not implementing trust engine (yet)

Johan Hjelm

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Context Management in the Ubiquitous Web

2006-02-05

Find out more

- Welcome to the WWI workshop with more presentations
  - Yokosuka Research Park, March 30
  - Please see http://www.wireless-world-initiative.org/Mocca_WWI_Symposium_Japan_2006/index.html

- See the project websites
  - http://www.ist-mobilife.org (with public deliverables)
  - http://www.ambient-networks.org

- Work is ongoing on finalizing the concepts, and create platforms for user testing

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TAKING YOU FORWARD