

Context-aware Communication Services

Research & Experiences

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Introduction

- Motivation
- Geek Solution
- What do we want?
- What do we have
- Can we do better?

Context-aware Services

Session Initiation Protocol

Real World Experiences

Thank you!

Introduction



Motivation

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Observation of Daily Communication

- irrelevant communication
 - ◆ tele-marketing, surveys, out-of-office announcements
- annoying disruptions
 - ◆ meetings, dinner, movie, theater, tennis match, etc.
- caller unaware – not knowing the availability of the callee
 - ◆ lack of coordination leads to phone tag, missed opportunities, etc.
- interaction overload – decreasing latency increases junk
 - ◆ bombarded by irrelevant communication versus noticing timely communication (like flight changes)
- device overload
 - ◆ overwhelmed by managing and choosing the right channel
 - different media = different device = different address



Geek Solution

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What do we want?

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- Filtering of incoming communication requests
 - ◆ handle incoming communication requests
 - ◆ redirect/terminate calls
 - ◆ apply e-mail filter like mechanisms
- Avoiding unnecessary communication
 - ◆ caller does not want to be disturbed
 - ◆ callee wants to save time for unsuccessful calls
- Customized services
 - ◆ services that fit user's needs
 - ◆ develop & deploy mechanisms to create 'own' services
 - ◆ convenient and safe development and execution environment
 - ◆ "wizard"-like support



What do we have

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Evolution of Communication Services

- POTS
 - ◆ Basic Call
 - ◆ alerting → phone rings
 - ◆ user goes on hook/off hook
- ISDN/IN
 - ◆ Supplementary Services
 - ◆ calling party number can be displayed
 - ◆ user may switch services on/off
- Mobile
 - ◆ Multimedia Service
 - ◆ callers categorized and attributed (ring tones, pictures)
 - ◆ user manages profiles



Can we do better?

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- Secretariat
 - ◆ hub of incoming communication
 - ◆ call handling based on
 - callee's context
 - experience and knowledge
 - ◆ multi-modal interface to specify rules
 - ⇒ communication is efficiently handled according to the **context** of the users
- Human Face-to-Face Communication
 - ◆ learned from early childhood
 - ◆ follows certain rules
 - ◆ 'good' feeling for right starting point
 - ⇒ communication and interaction between humans always happen in a specific situation, a certain **context**, and in a particular environment
- Context is the key concept



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Context-aware Services

- Efficient Communication
- Context- Extended Service Model
- Context Definition
- Context Spiral Model
- System Architecture
- Presence Information Data Format – PIDF

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Context-aware Communication Services



Efficient Communication

Introduction

Context-aware Services

● Efficient Communication

● Context- Extended Service

Model

● Context Definition

● Context Spiral Model

● System Architecture

● Presence Information Data

Format – PIDF

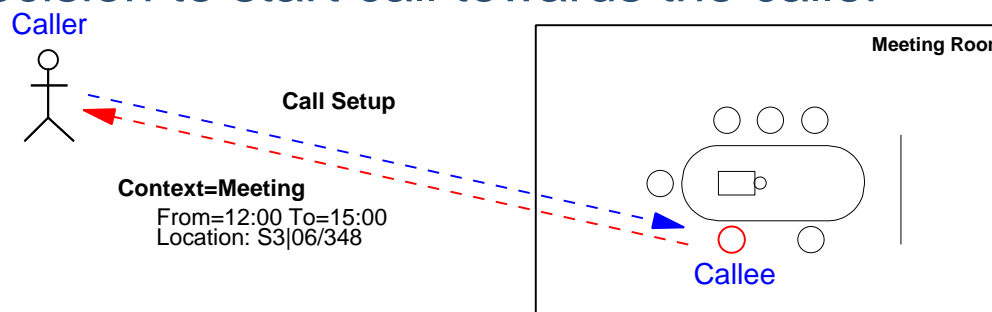
Session Initiation Protocol

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Thank you!

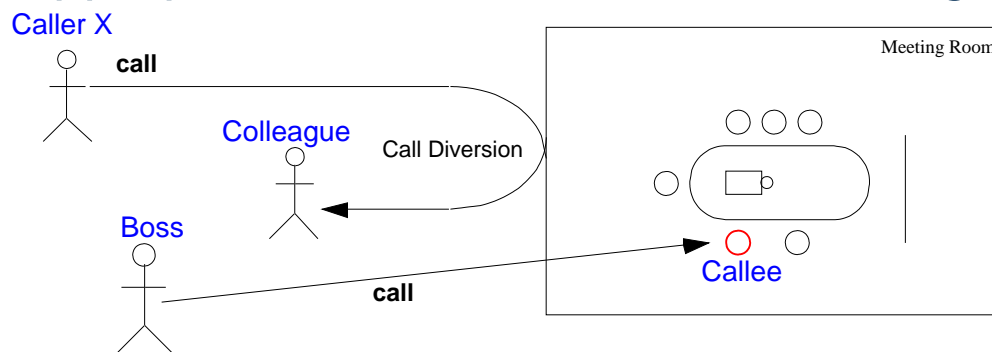
● Context Sharing

- ◆ caller can avoid unnecessary “calls” (alertings)
- ◆ shift decision to start call towards the caller



● Context Filtering

- ◆ system avoids disturbing calls for callee
- ◆ selects appropriate service to handle incoming calls





Context- Extended Service Model

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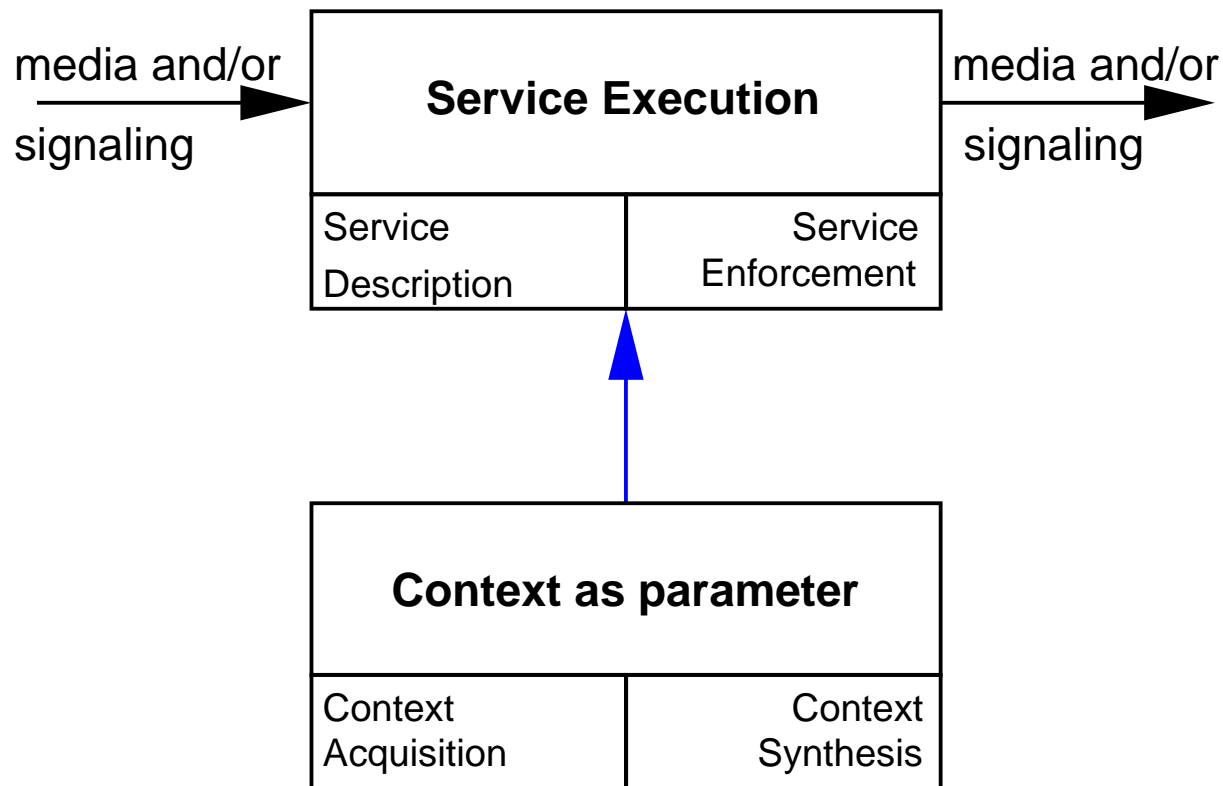
Session Initiation Protocol

Real World Experiences

Thank you!

● Concept

- ◆ put user into focus
- ◆ disappearing (technical) helper
- ◆ context to adapt service control
- ◆ context to trigger new services





Context Definition

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● Context Definition

- ◆ Circumstances in which an event occurs [Dictionary Def]
- ◆ A *Context* ξ is an abstract and meaningful description of the relationship between objects and their environment. A context is a rich object consisting of *context features* and can be approximated by a characteristic function χ . A *context label* λ is assigned to each context.

● Properties

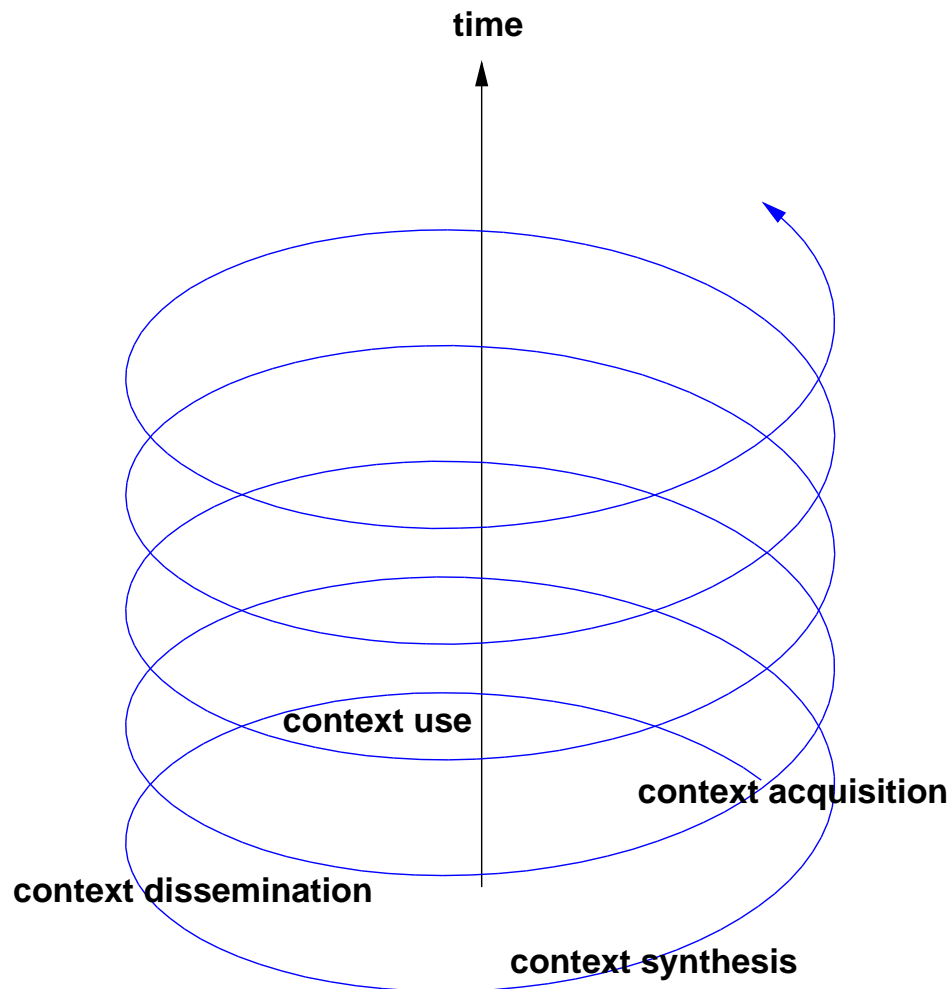
- ◆ enabling effect
 - new class of services
 - disappearing from the user's perception
- ◆ automation
 - triggering of actions
- ◆ reduction
 - of input and output

⇒ for the system a context is just a label (e.g. data structure)



Context Spiral Model

How to handle context



- Acquisition
 - ◆ sensing
 - ◆ data fusion
- Synthesis
 - ◆ feature extraction
 - ◆ aggregation
 - ◆ decision making
- Dissemination
 - ◆ store context (data)
 - ◆ distribute context (data)
- Use
 - ◆ apply context

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System Architecture

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● System Architecture

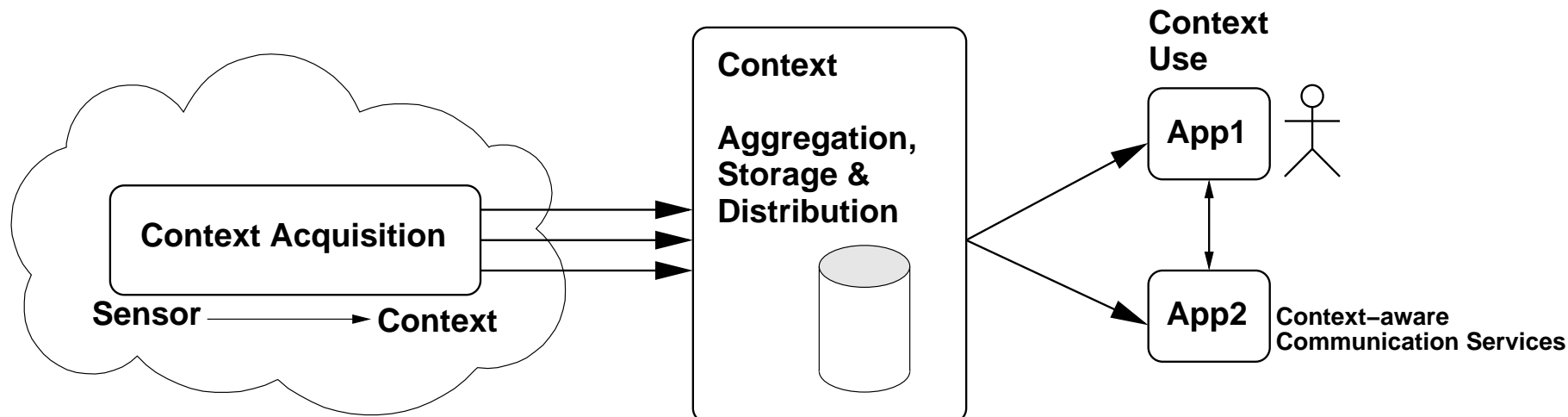
- Presence Information Data Format – PIDF

Session Initiation Protocol

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- Design recommendation
 - ◆ divide context acquisition from context use
 - ◆ provide framework for program developer
 - ◆ provide communication mechanisms to distribute context



- Components
 - ◆ context aggregation network
 - ◆ context server
 - ◆ context-aware communication services



Presence Information Data Format – PIDF

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Exchanging context/presence information

- Purpose of notation
 - ◆ store all relevant information incl. history
 - ◆ provide interoperability to PIDF clients
- Joint work with tzi (Ott, Kutschner)
- Added tags for context
 - ◆ <context> element:
 - <current-context>
 - <where>, <privacy>
 - <future-context>, <past-context>
 - ◆ <sensor> element:
 - <auth-class>, <owner>, <decay function>
 - <value>, <unit>, <type>, <dependability>



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Context-aware Services

Session Initiation Protocol

- Session Initiation Protocol – SIP
- Communication Services
- Service Creation
- CPL Example
- Extension of CPL
- CPL Editor

Real World Experiences

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Session Initiation Protocol



Session Initiation Protocol – SIP

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Session Initiation Protocol

● Session Initiation Protocol – SIP

● Communication Services

● Service Creation

● CPL Example

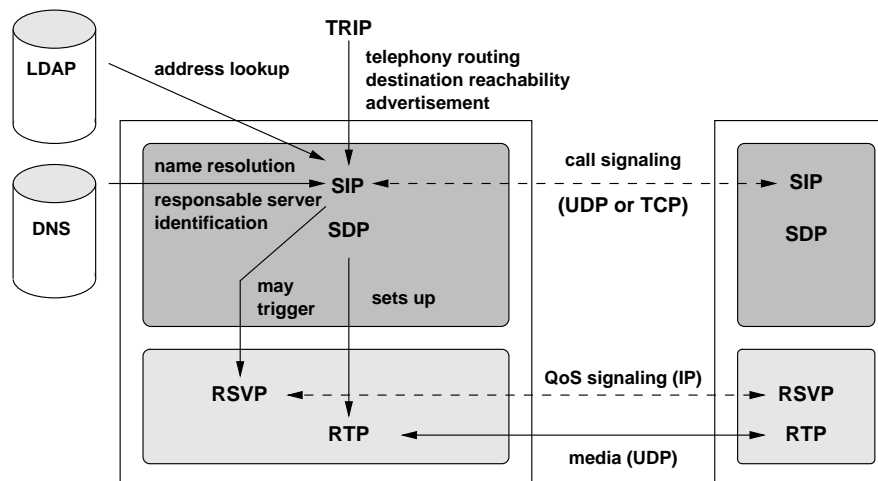
● Extension of CPL

● CPL Editor

Real World Experiences

Thank you!

Application Level Signaling Protocol



- Concept

- ◆ fast in the core, smart at the edges
- ◆ horizontal integration (of protocols)
- ◆ request/response transaction model
 - register users, setup, modify, terminate sessions
- ◆ components
 - end-systems (UA), SIP proxies, Registrars

- Protocol extensions

- ◆ subscribe/notify event package
- ◆ SIP for instant messaging
- ◆ SIP security extensions
- ◆ QoS extensions



Communication Services

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SIP

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Demand for new services

- Distinction of provider
 - ◆ argument for customers to change provider
 - ◆ and technology (PSTN → IP Telephony)
- Public Switched Telephone Network
 - ◆ service provided by the network
 - ◆ rather closed group for standardization
- IP Telephony
 - ◆ service intelligence in the end-systems
 - ◆ open standards
 - ◆ users have access to the network
- Two principle services classes (here)
 - ◆ end-system services
 - ◆ 3rd party call control services running on a server



Service Creation

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Call Processing Language (CPL) [RFC 2824]

- 3rd party call control
 - ◆ XML-based script language
- Simple, extensible, not Turing-complete language
 - ◆ no loops, variables, recursion
 - ◆ no execution of external programs
- Call processing action represented as Directed Acyclic Graph
 - ◆ bounded and predictable
 - ◆ finite memory and time
- Components
 - ◆ switches
 - address, time, string, priority, ...
 - ◆ actions/subactions
 - re-direct, proxy, reject, ...



CPL Example

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Context-aware Services

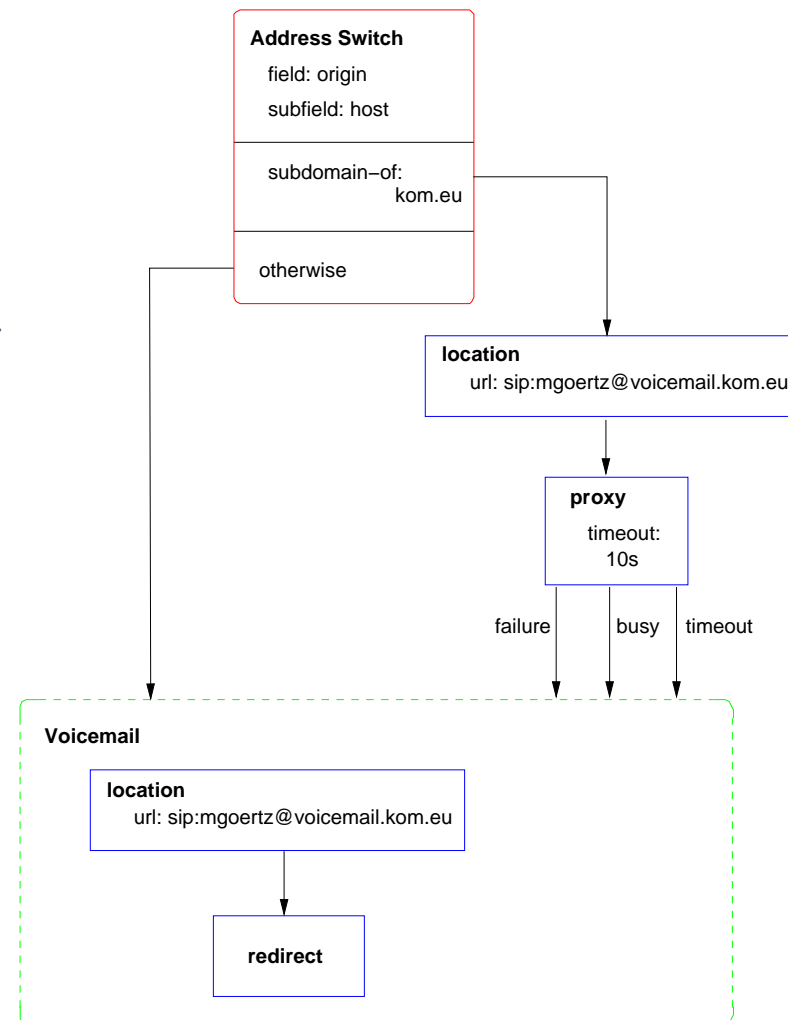
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```
<cpl>
  <incoming>
    <address-switch field="origin" subfield="host">
      <address subdomain-of="kom.eu">
        <location url="sip:mgoertz@kom.eu">
          <proxy timeout="10">
            <busy> <sub ref="voicemail" /> </busy>
            <noanswer> <sub ref="voicemail" /> </noanswer>
            <failure> <sub ref="voicemail" /> </failure>
          </proxy>
        </location>
      </address>
    </address-switch>
  </incoming>
  <subaction id="voicemail">
    <location url="sip:mgoertz@voicemail.kom.eu">
      <redirect />
    </location>
  </subaction>
</cpl>
```





Extension of CPL

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Providing methods to develop context-aware communication services

- New Elements

- ◆ Context-Lookup

- provide context to CPL-Engine
- query Context Server

- ◆ Context-Notify

- context is shared on request
- send context using NOTIFY-Messages

- ◆ Context-Switch

- select next path depending on current context

- ◆ Answer-Switch

- select appropriate next path depending on current context

- implemented in VOCAL and SER CPL-Engines



CPL Editor

Creation of Services by script writing – not user friendly → GUI

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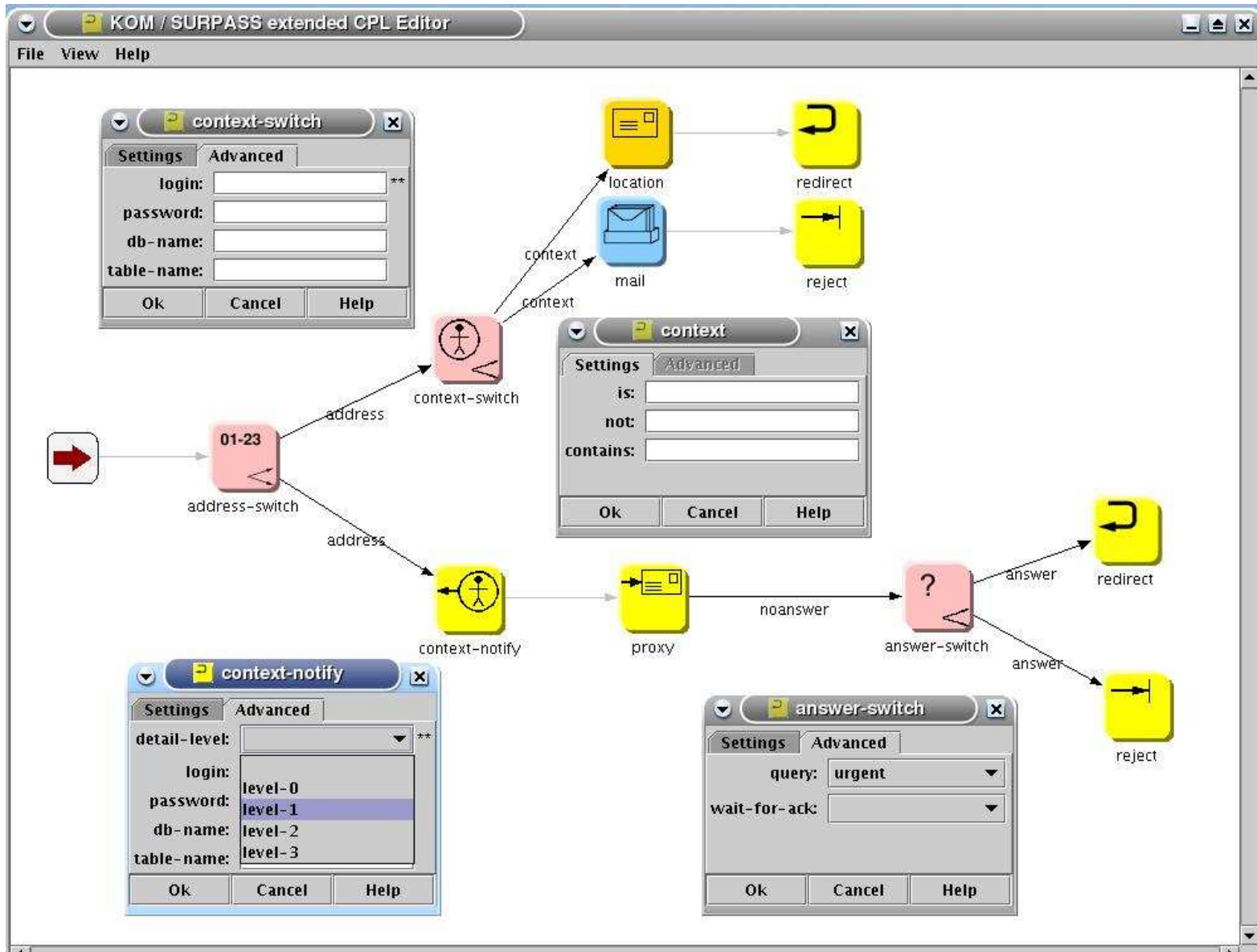
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- CPL Engine VOCAL
- Implementation / SER
- CPL Engine SER
- The next step
- Summary
- Demo Setup – Context-aware Call Diversion

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Real World Experiences



Implementation / VOCAL

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Call Diversion

Thank you!

SIP suite from VOVIDA

- Open source SIP Server / (www.vovida.org)
- “all in one” packet with multiple server-processes:
 - ◆ Provisioning (maintenance / management)
 - ◆ Marshall (Message processing / conversion)
 - ◆ Authentication
 - ◆ Redirect / Registrar
 - ◆ Call Detail Record (Billing)
 - ◆ Heartbeat Server
 - ◆ Policy Server



CPL Engine VOCAL

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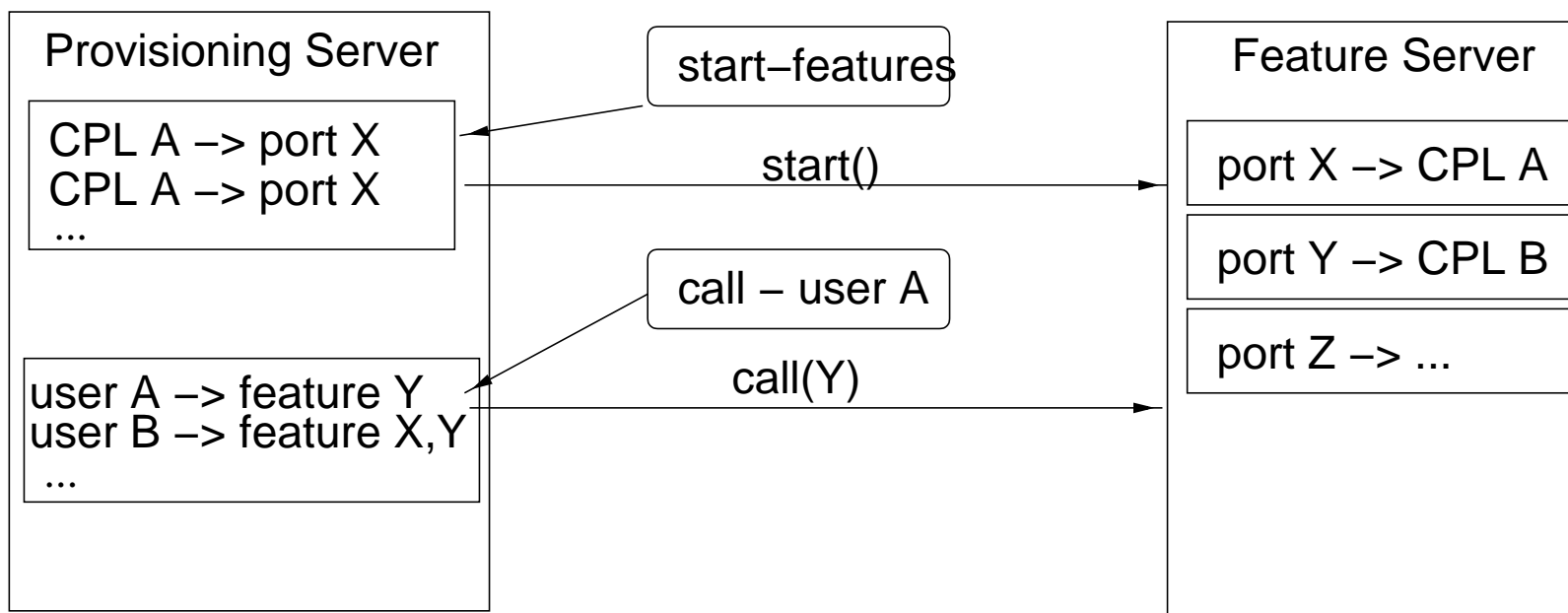
● Demo Setup – Context-aware
Call Diversion

Thank you!

● Properties

- ◆ executing on incoming/outgoing calls
- ◆ every feature has own process/port
- ◆ transform CPL script to feature FSMs at first call

VOCAL





Implementation / SER

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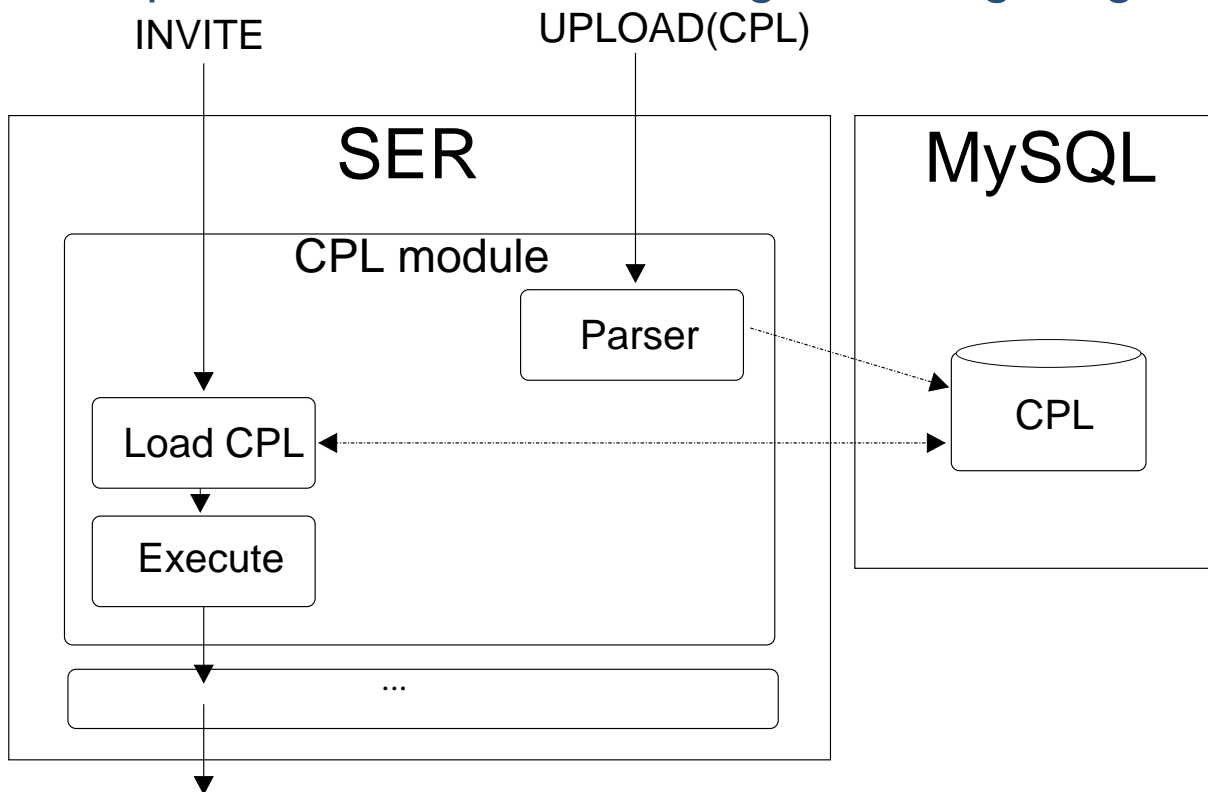
Sip Express Router – SER

- Open Source SIP server
(www.iptel.org/ser/)
 - ◆ lightweight basic installation:
 - only Redirect / Registrar
- Modular / Plugins
 - ◆ authentication
 - ◆ MySQL
 - ◆ web interface
 - ◆ CPL
 - ◆ 3rd party modules



CPL Engine SER

- CPL script parsed after upload
- binary CPL script stored in external MySQL db
- script can be executed during incoming/outgoing call



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● **CPL Engine SER**

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The next step

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Self-learning mechanisms

● Drawbacks

- ◆ writing rules takes time
- ◆ rules become outdated and must be modified/replaced

● Automatic adaption of rules

- ◆ provides user friendly handling
- ◆ user intervention: only by “feedback”

● Dynamic evaluation model building

- ◆ based on a set of user feedbacks and the related sensor values in this situation
- ◆ Methods: Bayesian net / neural net / fuzzy logic / decision trees

Self organizing sensor evaluation

- self description (type/location/relation) for sensors
- automatic discovery, selection, query of sensors
- provides scalability



Summary

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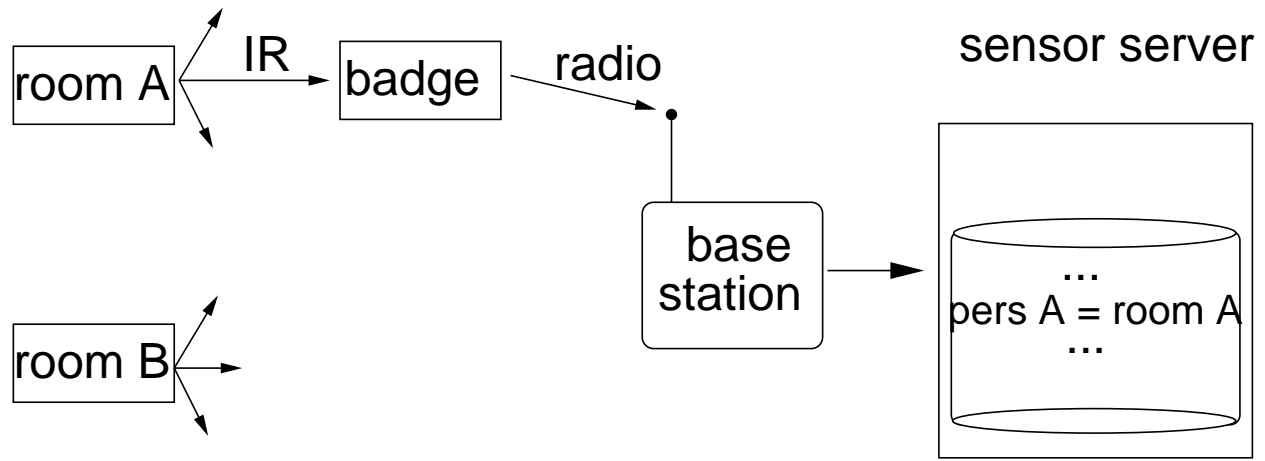
- Communication
 - ◆ has become ubiquitous
 - ◆ demand to handle communication
- Services
 - ◆ distinction between different providers
 - ◆ might become driving force of IP Telephony
 - ◆ demand for customized services
- Context
 - ◆ provides information to make communication more efficient
 - ◆ allows to build customized and adaptive services
 - ◆ support whole chain from sensors to context representation
- Call Processing Language – CPL
 - ◆ provides mechanism to build and deploy safe services
 - ◆ have been enhanced to consider context information
 - ◆ changes implemented in wide spread CPL-engines



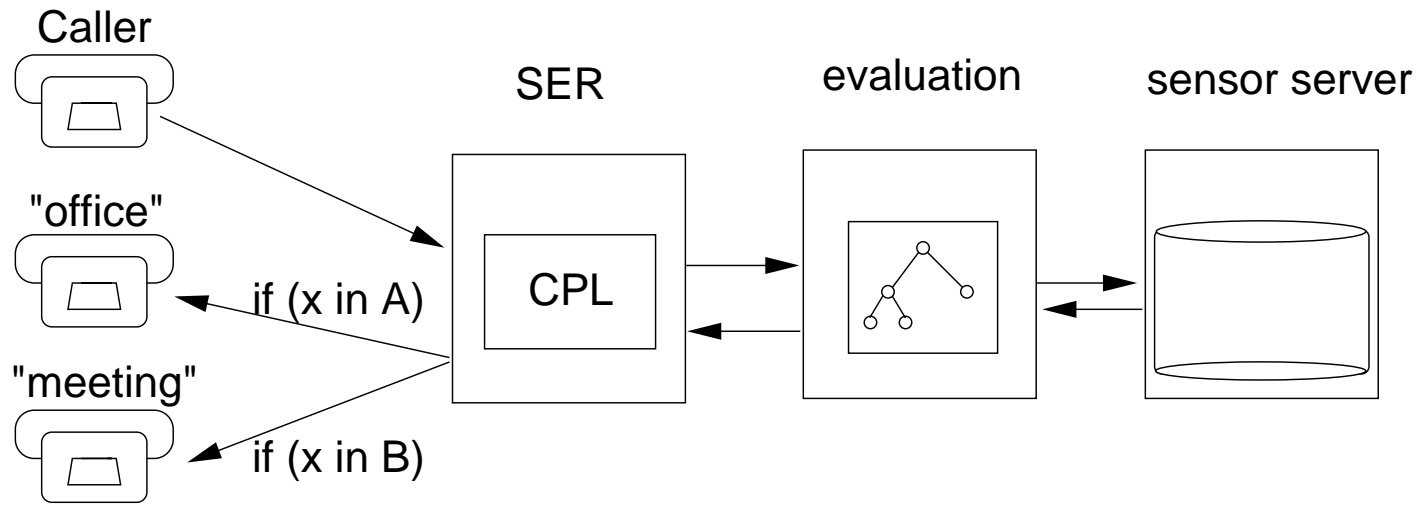
Demo Setup – Context-aware Call Diversion

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LOCATION TRACKING



CALL HANDLING





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