

Agent-Based Information Sharing for Ambient Intelligence

Andrei Olaru

AI-MAS Group, University Politehnica Bucharest
LIP6, University Pierre et Marie Curie, Paris

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- Introduction
- Layers
- Sharing
- Agents
- Application
- Context
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- Results
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Agent-Based Information Sharing for Ambient Intelligence

overview



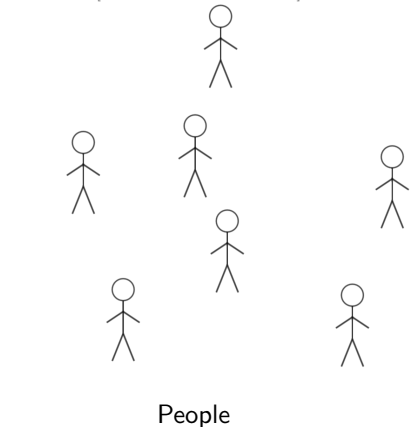
Ambient Intelligence – or Aml – is an ubiquitous electronic environment that supports people in their daily tasks, in a proactive, but "invisible" and non-intrusive manner. [Ramos et al., 2008, Weiser, 1993]

■ What is Aml?

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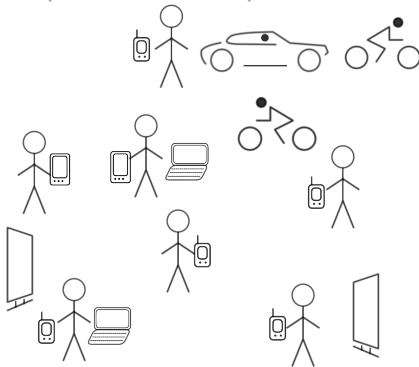


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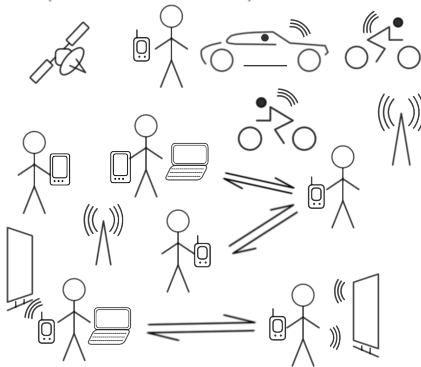
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People · Devices



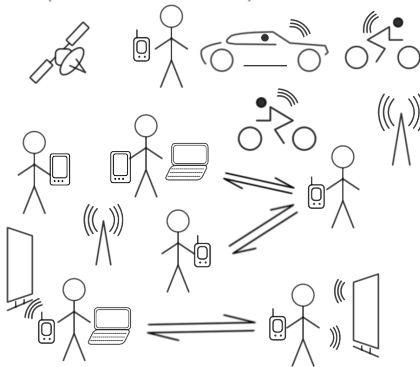
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People · Devices · Communication



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People · Devices · Communication

Problem: How to get the **relevant** information to the **interested** users?



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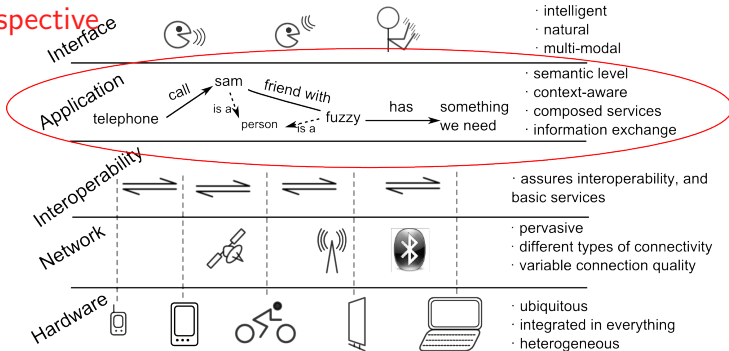
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(layers based on [Seghrouchni, 2008])

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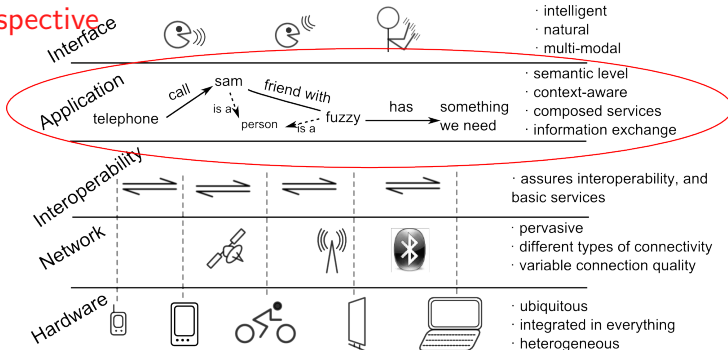
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(layers based on [Seghrouchni, 2008])

Hardware



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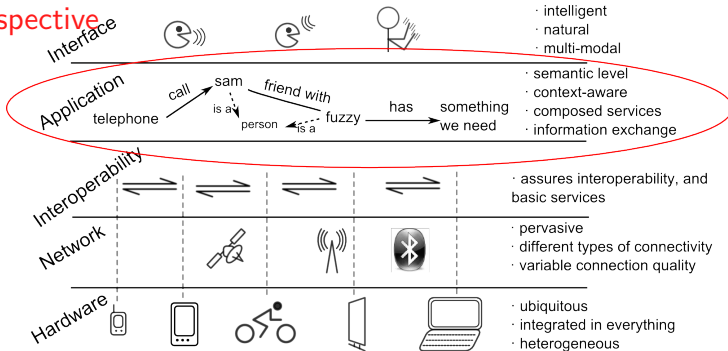
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Hardware · Network



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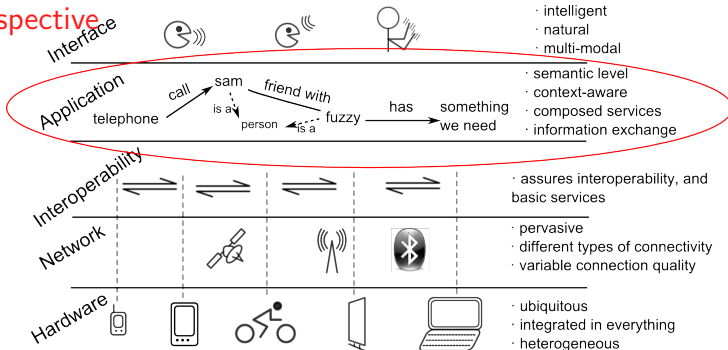
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(layers based on [Seghrouchni, 2008])

Hardware · Network · Interoperability



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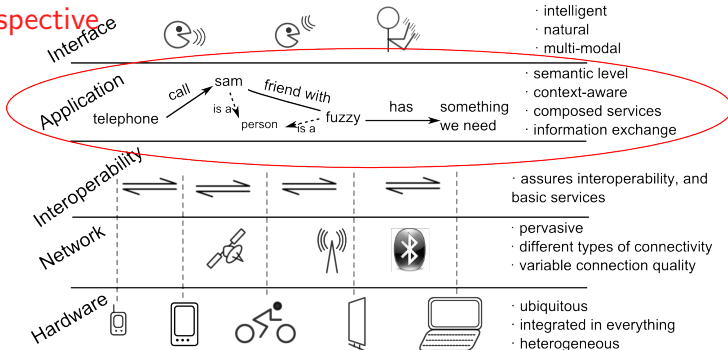
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Hardware · Network · Interoperability · Application



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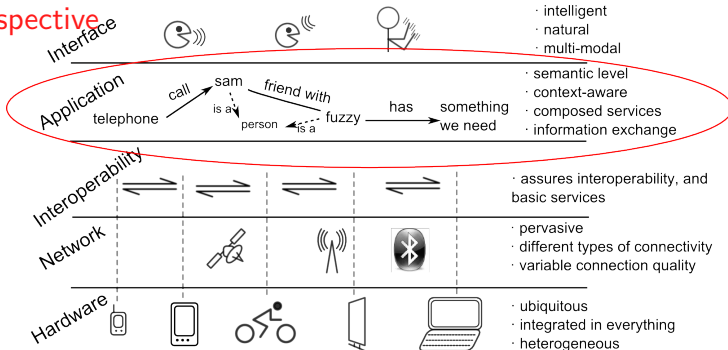
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(layers based on [Seghrouchni, 2008])

Hardware · Network · Interoperability · Application · Interface



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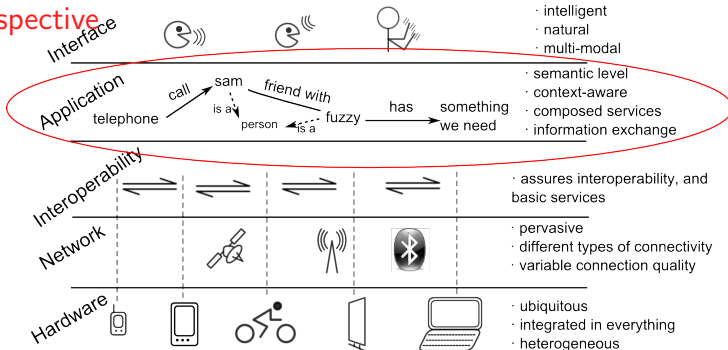
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(layers based on [Seghrouchni, 2008])

Hardware · Network · Interoperability · **Application** · Interface



· The users must get the information that is **interesting** to them.

→ **context-awareness** is needed, to calculate **relevance**.

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- Ambient intelligence must be **reliable** and **dependable**.

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- **distribution** is absolutely necessary.

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Our goal: build a multi-agent system for the context-aware sharing of information.



· Agents satisfy the needs of Aml in terms of:

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- autonomy
- reactivity
- proactivity
- planning
- reasoning
- anticipation



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- Agents also offer beliefs, goals, intentions and easier implementation of a human-inspired behaviour.



· Agents satisfy the needs of Aml in terms of:

- autonomy
- reactivity
- proactivity
- planning
- reasoning
- anticipation

· Agents also offer beliefs, goals, intentions and easier implementation of a human-inspired behaviour.

· Agents can provide the **intelligent** component of Ambient Intelligence – they are distributed, they act locally, etc.

[Ramos et al., 2008]



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Our goal: build a multi-agent system for the context-aware sharing of information.

· how can we obtain context-aware behaviour with simple agents acting locally?

· features:

- ▶ local behaviour
- ▶ simple behaviour
- ▶ small knowledge base
- ▶ use feedback and self-organization techniques
- ▶ use **simple and generic** measures for context-awareness



The measures of context-awareness are directed at local information sharing based on importance, relatedness to domains of interest, and validity in time.

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- ▶ **space-locality** – the information spreads around its source
- ▶ **pressure** – translates directly into relevance of the information – controls how fast the information spreads.
- ▶ **specialty** – specifies to which domains of interest the information is related – controls the direction of the spread.
- ▶ **persistence** – specifies for how long the information is valid – controls the time for which the information will remain in the system.



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These measures are aggregated into a measure of **relevance**.



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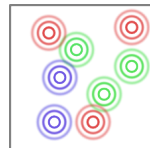
- Context

- **Application Scenario**

- Results

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- **create** a certain distribution of interest – by inserting facts with low persistence and pressure, and different specialties.



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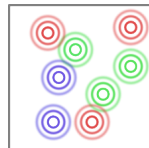
■ Context

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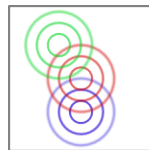
■ Results

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· create a certain distribution of interest – by inserting facts with low persistence and pressure, and different specialties.



· **test** the behaviour of the system by inserting 3 data facts, of different specialty, with medium pressure and high persistence.



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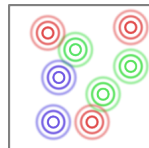
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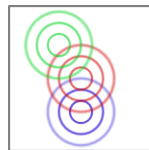
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· create a certain distribution of interest – by inserting facts with low persistence and pressure, and different specialties.



· test the behaviour of the system by inserting 3 data facts, of different specialty, with medium pressure and high persistence.



· **test** the behaviour of the system by inserting 1 data fact with high pressure.



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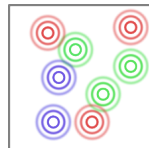
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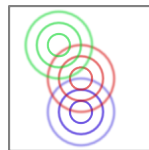
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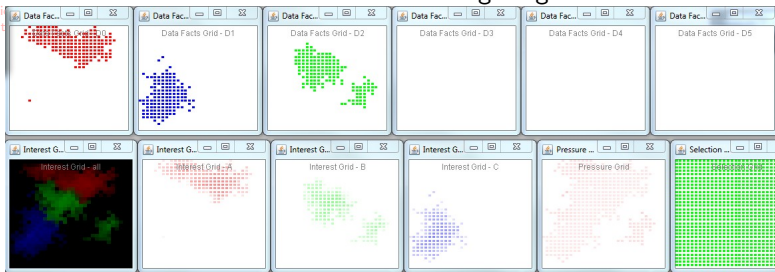
· test the behaviour of the system by inserting 1 data fact with high pressure.



Expect: control of the resulting distributions depending on their respective measures of context-awareness.



fact distribution in the agent grid



agents:

specialty

specialty for each domain

pressure

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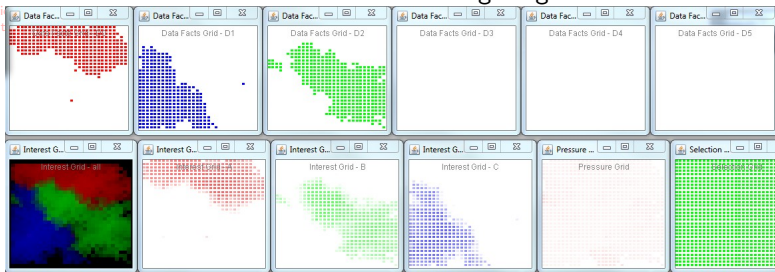
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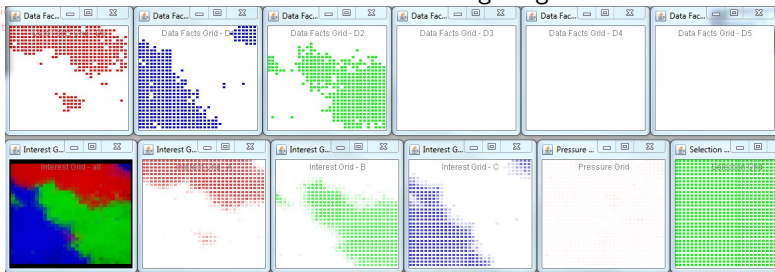
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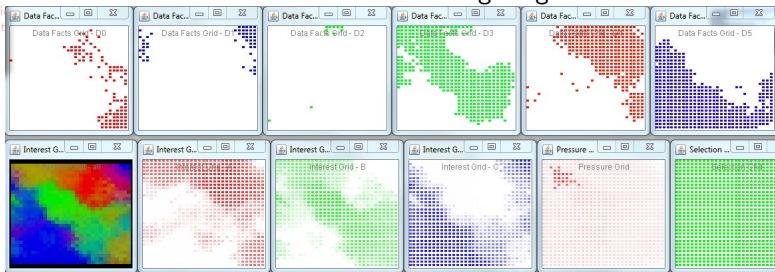
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fact distribution in the agent grid



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distribution of high-pressure fact



fact distribution in the agent grid



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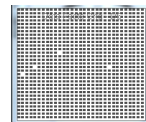


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distribution of high-pressure fact



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Why obtaining these results is not straightforward:

- ▶ agents only know about 20 facts, only few of them being about their neighbours.
- ▶ agents are both pro-active and reactive, so feedback may generate overloads in their message inbox.
- ▶ knowledge bases are very limited in size, so it is essential to have a good algorithm to sort knowledge and forget irrelevant knowledge.



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- ▶ a multi-agent system was built, with agents that have **local knowledge** and **interact locally**.
- ▶ simple **measures for context-awareness** were developed, that allow the calculus of **relevance** of facts, in function of their context, and the agent's context.
- ▶ the system was **tested** and relevant results were obtained.





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