Smart-M3 Information Sharing Platform

Jukka Honkola jukka.honkola@nokia.com
Hannu Laine hannu.e.laine@nokia.com
Ronald Brown ronald.brown@nokia.com
Olli Tyrkkö olli.tyrkko@nokia.com
Smart-M3 Information Sharing Platform

• Digital convergence and interoperability
• Ubiquitous computing – communicating devices everywhere
• The “Giant Global Graph” of Semantic web
• Dynamic and local semantic web
• Serendipitous interoperability
Overview

Triple governance transactions using Smart Space Access Protocol (SSAP): join, leave, insert, remove, update, query, subscribe, unsubscribe

Knowledge Processor (KP): An entity contributing to (insert/remove) and/or reading (query/subscribe) content according to ontology relevant to its defined functionality. A KP needs one or more partner KPs for useful sharing of content, implying an agreed semantics for the used ontology.

Semantic Information Broker (SIB): An entity performing triple governance in possible cooperation with other SIBs for one Smart Space. A SIB may be a concrete or virtual entity.

Smart Space: a named search extent of information

Physical distribution of a Smart Space
Smart Space Access Protocol

- SSAP is the main integration point in M3
  - Implementations conforming to SSAP spec can interoperate with others

SSAP operations:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Join</td>
<td>Join a named smart space</td>
</tr>
<tr>
<td>Leave</td>
<td>Leave a smart space</td>
</tr>
<tr>
<td>Insert</td>
<td>Insert information to smart space</td>
</tr>
<tr>
<td>Remove</td>
<td>Remove information from smart space</td>
</tr>
<tr>
<td>Update</td>
<td>Update information in smart space</td>
</tr>
<tr>
<td>Query</td>
<td>Query for information in smart space using a supported query language</td>
</tr>
<tr>
<td>Subscribe</td>
<td>Set up a persistent query to receive notifications when results change</td>
</tr>
<tr>
<td>Unsubscribe</td>
<td>Cancel an existing subscription</td>
</tr>
</tbody>
</table>
Logical Architecture

- SIB and KP may use multiple communication methods

- Adding new communication methods should be straightforward

- KP Interfaces for developers may be on different abstraction levels
  - SSAP vs Ontology
Smart-M3 Implementation Architecture
Notion of Application

• Applications or scenarios?
• KPs operating on shared information and using shared services
  • KPs understand their own, non-exclusive set of information
  • Most KPs also have connection to “outside world”
• Scenarios emerge from collective actions of KPs, both in smart space and on accessible services
• “Easy” scenario mash-up
• Loose coupling between KPs
Case studies

- Smart meeting room (SPIIRAS)
- Home smart space (aka SuperTux) (NRC)
- Car smart space (NRC & CRF)
- Home sensor network (VTT)
- Healthcare smart space (University of Bologna)
- Building automation (Posintra)
Smart-M3 SIB

- Transport layer is implemented in separate processes
- SSAP layer is multi-threaded, handles execution of operations from KPs
- RDF Store and DB can be changed with relatively minor effort
Knowledge Processors

- A KP contains application logic communicating with a smart space
- Ontology API allows developers to use domain concepts instead of SSAP and RDF
- Current KPI implementations:
  - C/GLib
  - C++/Qt
  - C
  - Python
  - Java
  - Java/OSGi
  - C#/.NET
- Ontology APIs exist for C/GLib, C and Python KPIs.
Future development

• Reasoning support for SIB
  • Generic: ontology based reasoning
  • Domain-specific: rules engine in SIB

• New operations for SIB
  • Atomic conditional update

• Access control
  • Joining – who can join a smart space
  • Information – who can access specific information in smart space

• Internal KP interface in SIB
  • Customization possibilities
Conclusions

• Smart-M3 is an information sharing platform
• Extensible architecture
• Interoperability via information sharing using agreed ontologies
• Available at http://sourceforge.net/projects/smart-m3/ with BSD license
• Used in several projects / programs:
  • Sofia (Funded by European Commission and TEKES)
  • DIEM (Funded by TEKES)
  • FRUCT