

Smart-M3 Information Sharing Platform

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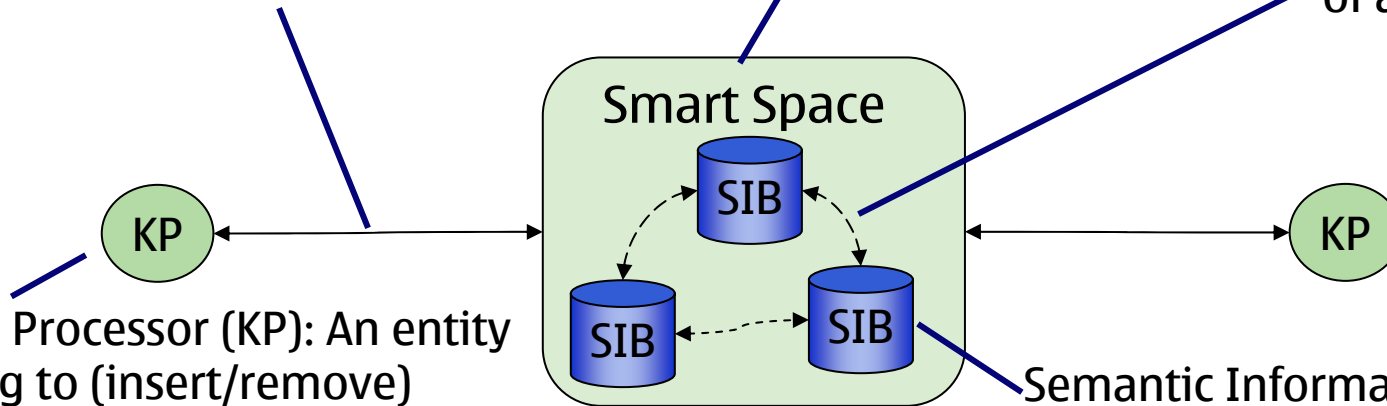
- Digital convergence and interoperability
- Ubiquitous computing – communicating devices everywhere
- The “Giant Global Graph” of Semantic web
- Dynamic and local semantic web
- Serendipitous interoperability

Overview

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

Smart Space: a named search extent of information

Physical distribution of a Smart Space



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 co-operation with other SIBs for one Smart Space. A SIB may be a concrete or virtual entity.

Smart Space Access Protocol

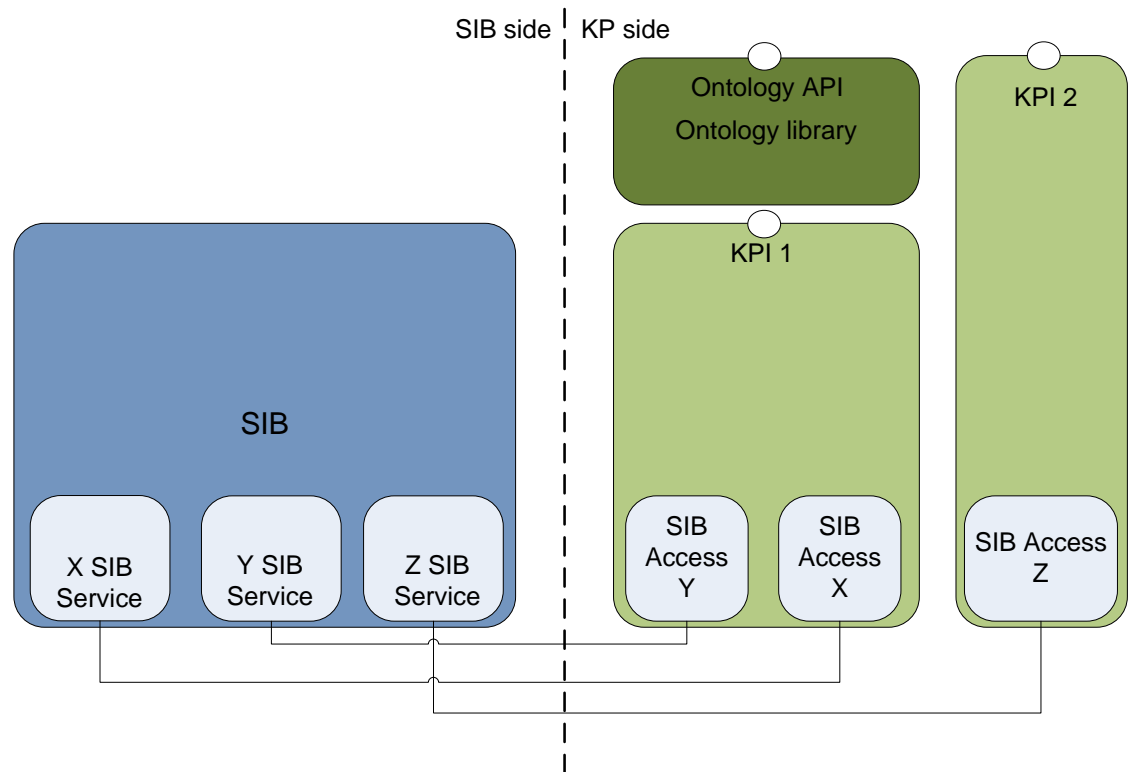
- SSAP is the main integration point in M3
 - Implementations conforming to SSAP spec can interoperate with others

SSAP operations:

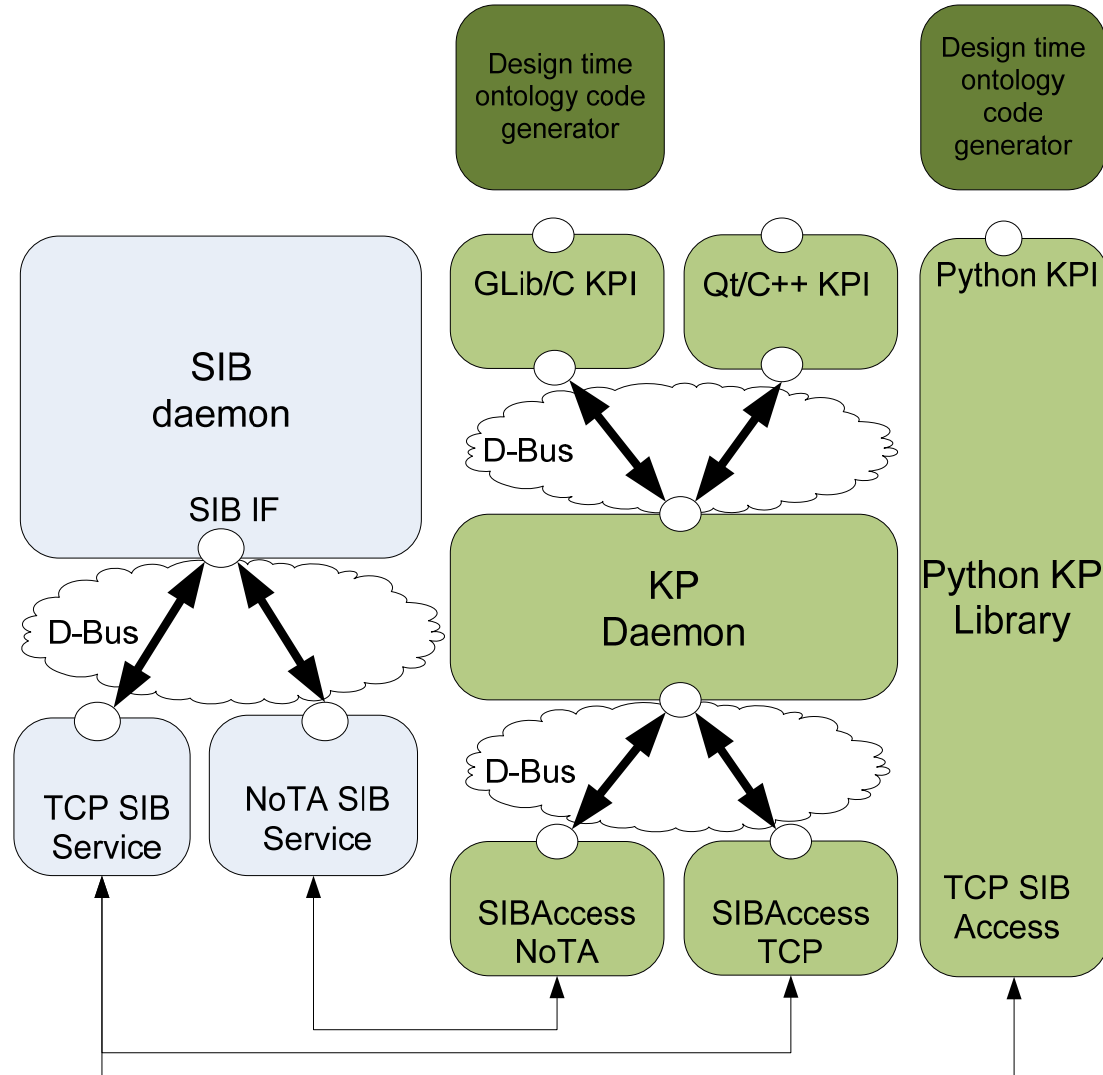
Join	Join a named smart space
Leave	Leave a smart space
Insert	Insert information to smart space
Remove	Remove information from smart space
Update	Update information in smart space
Query	Query for information in smart space using a supported query language
Subscribe	Set up a persistent query to receive notifications when results change
Unsubscribe	Cancel an existing subscription

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

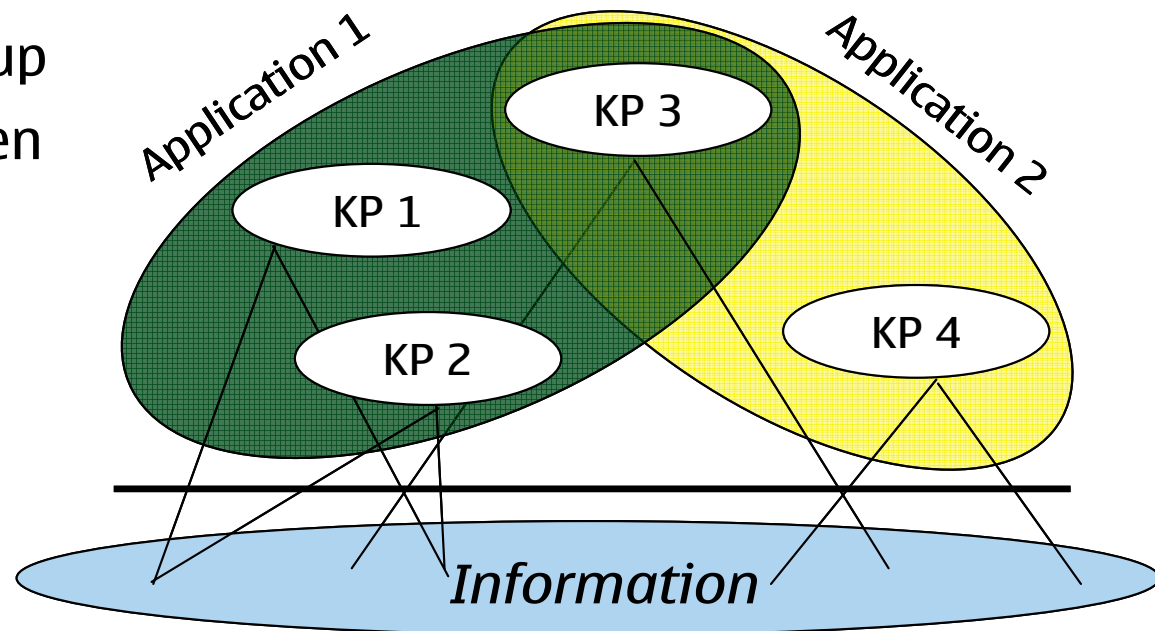


Smart-M3 Implementation Architecture



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

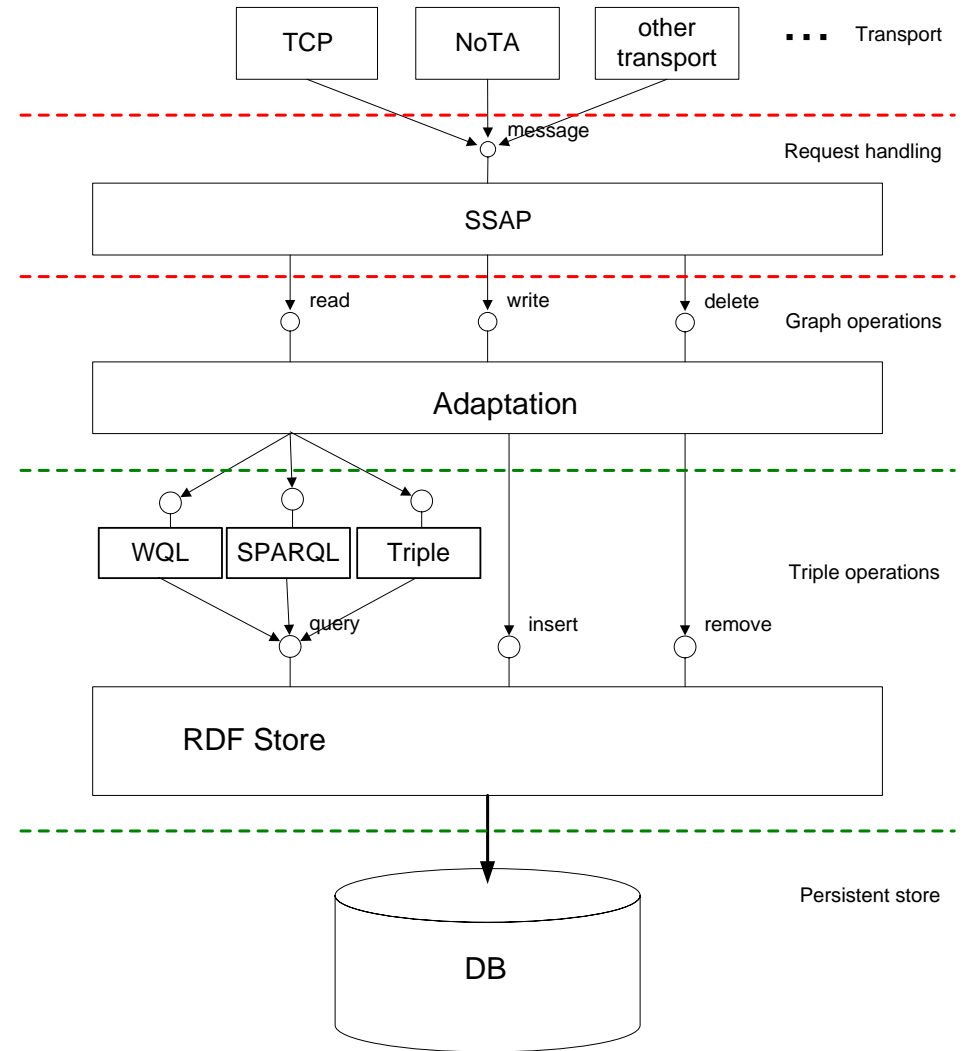


Case studies

- 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)

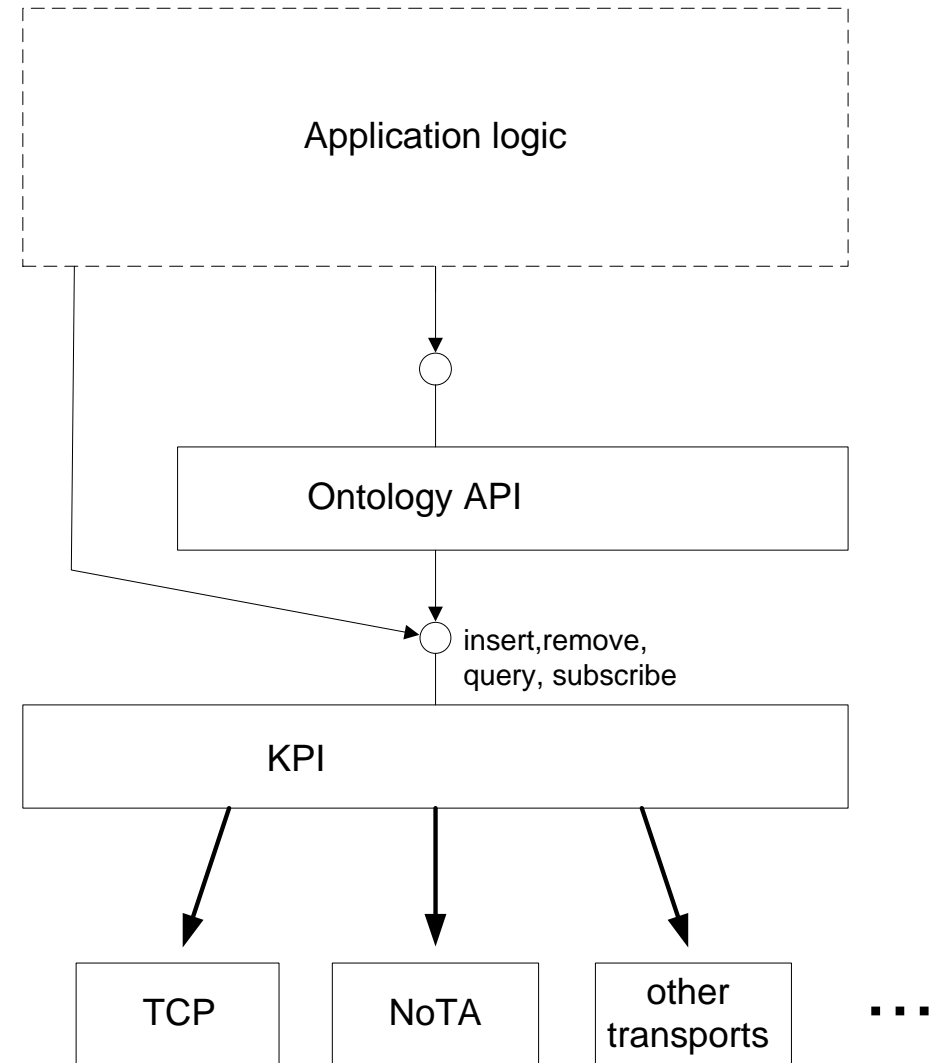
Smart-M3 SIB

- 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