Smart-M3 Information Sharing Platform

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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

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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

Smart Space

SIB

SIB

SIB

KP

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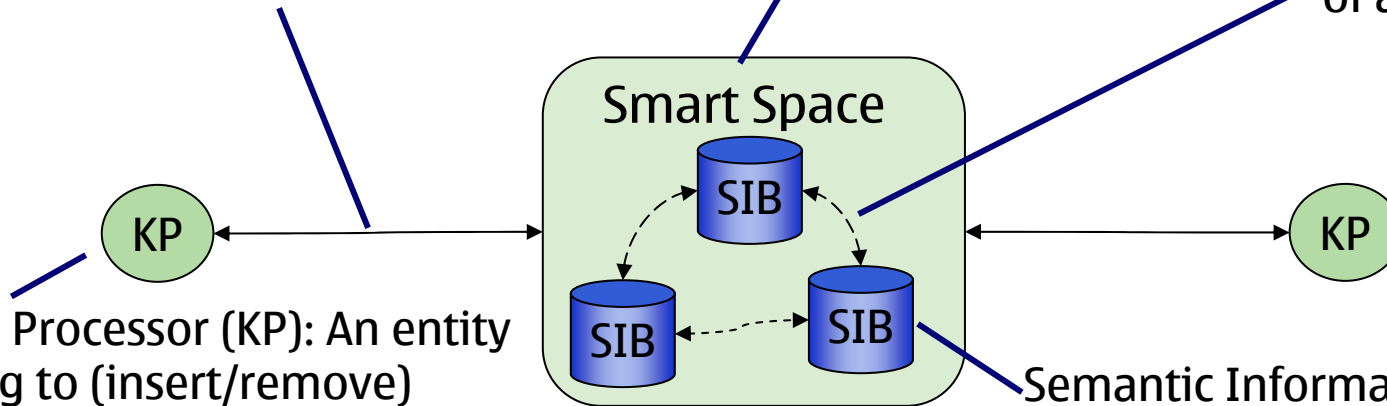
Knowledge Processor (KP): An entity contributing to (insert/remove) and/or reading (query/subscribe) content according to ontology relevant to its defined functionality. A KP needs one or more partner KPs for useful sharing of content, implying an agreed semantics for the used ontology

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.
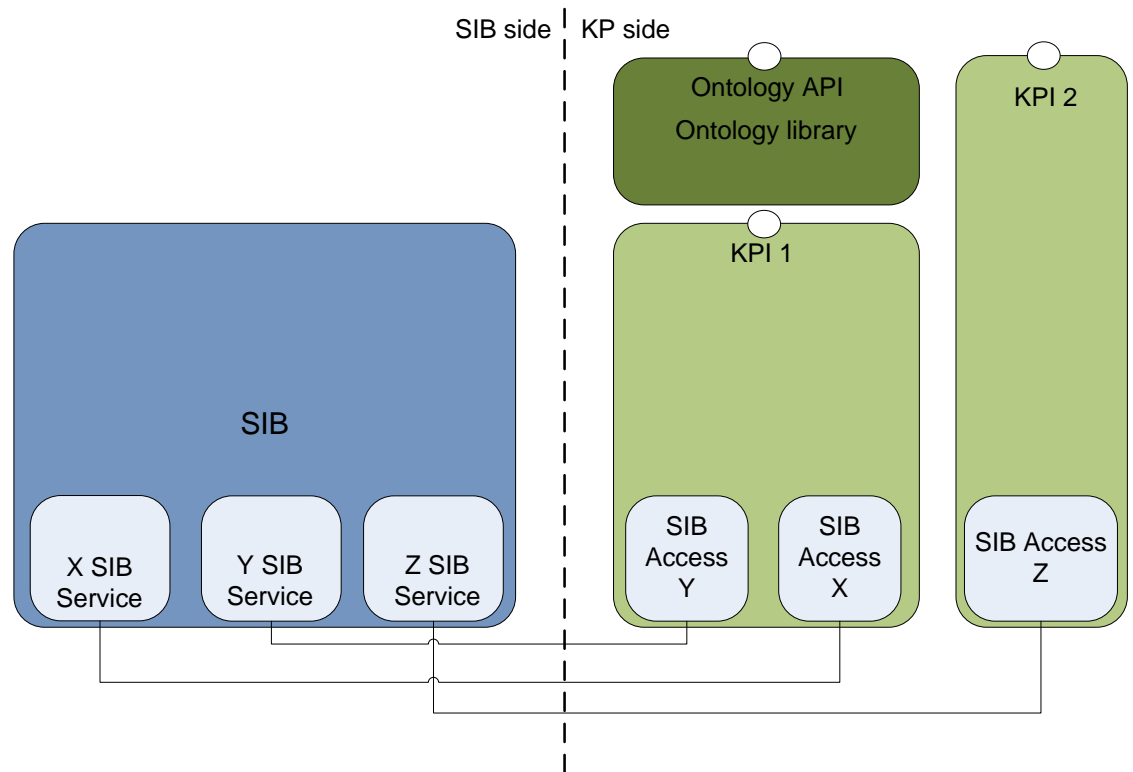
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Smart Space Access Protocol

- SSAP is the main integration point in Sofia IOP
  - Implementations conforming to SSAP spec can interoperate with others
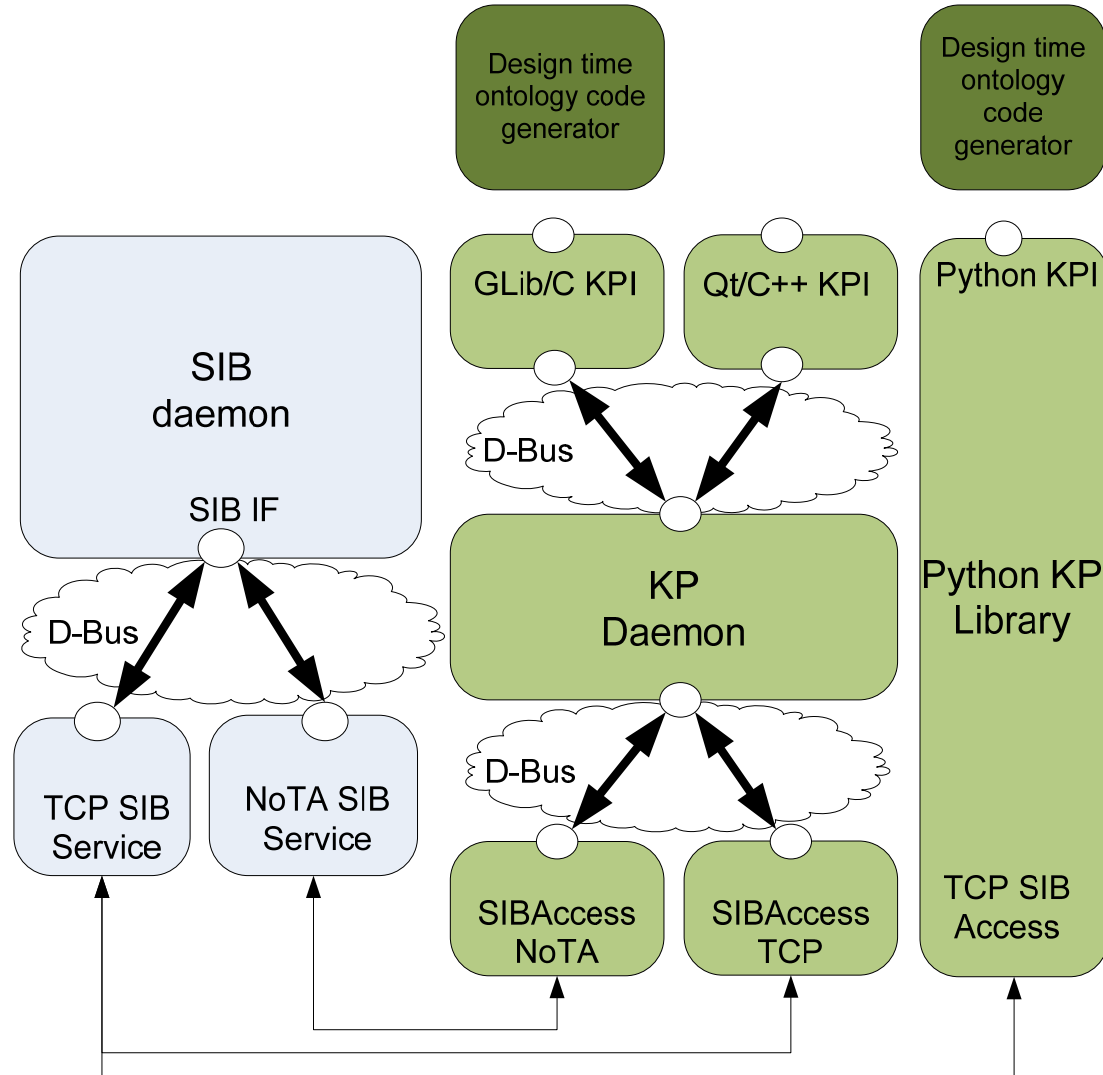
SSAP operations:

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

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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

SIB side | KP side

Ontology API
Ontology library

KPI 2

KPI 1

SIB

X SIB Service

Y SIB Service

Z SIB Service

SIB Access Y

SIB Access X

SIB Access Z

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Smart-M3 Implementation Architecture

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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

Service A

Service B

Service C

Application 1

Application 2

KP 3
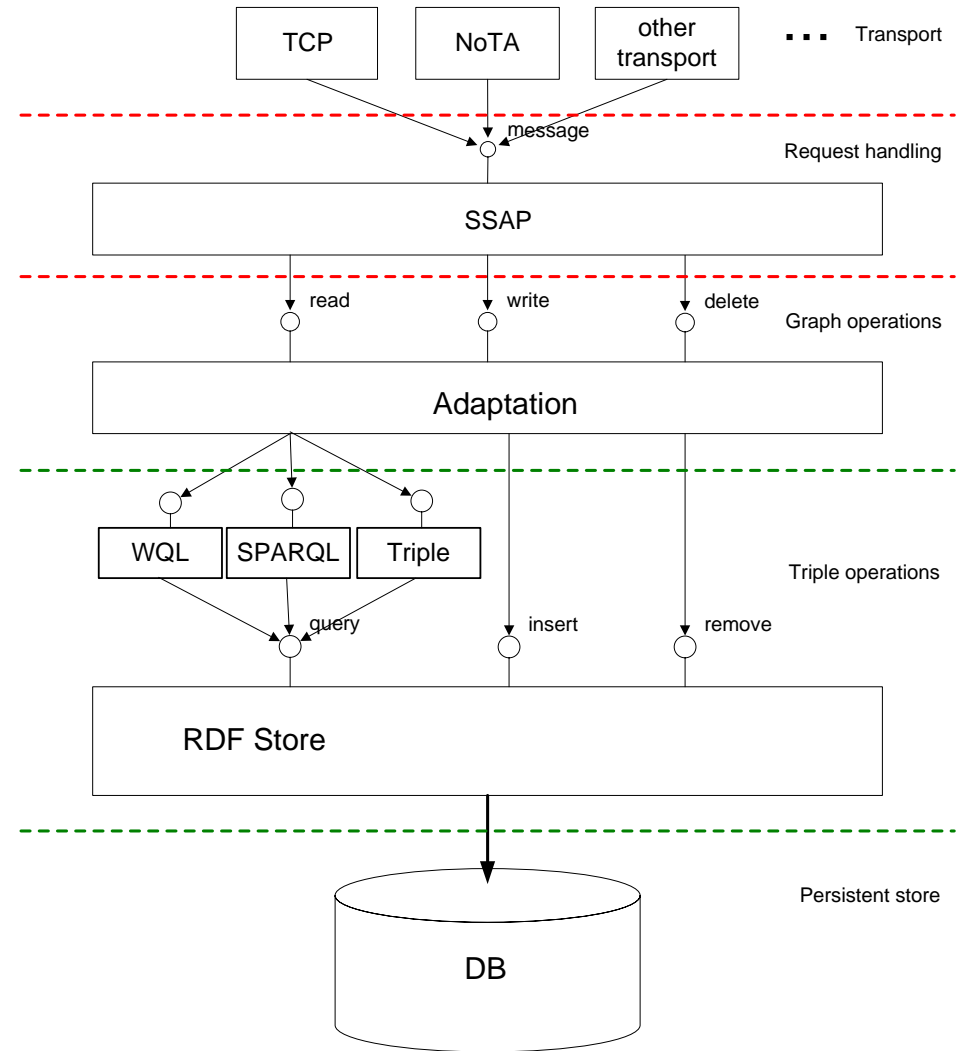
KP 1

KP 2

KP 4

Information

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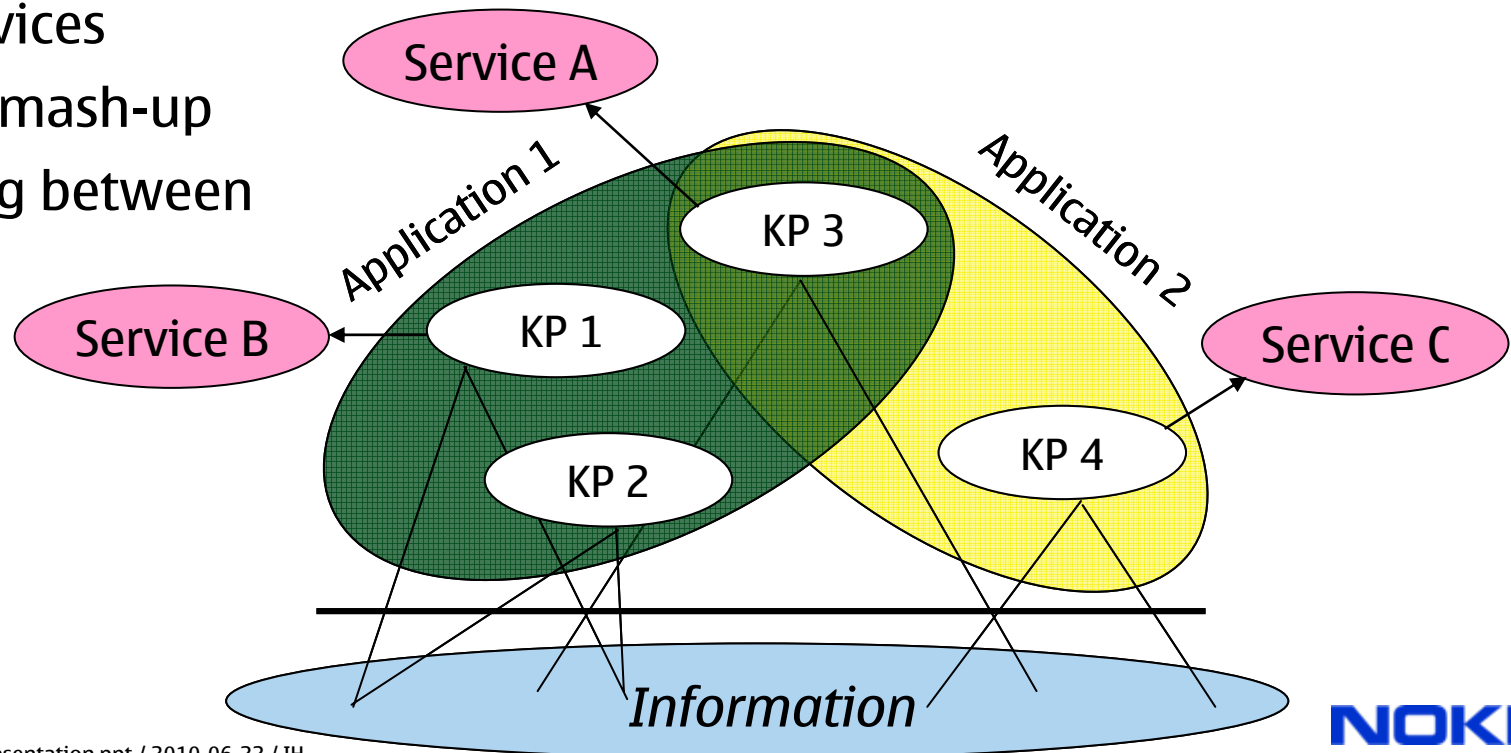
Demos and Case studies

- Smart meeting room (SPIIRAS)

- Home smart space (aka SuperTux) (NRC)

- Car smart space (NRC & CRF)

- Home sensor network (VTT)

- Healthcare smart space (UNIBO)

- Building automation (Posintra)

- Sofia demonstrators

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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

Transport

| TCP | NoTA | other transport | • • • |

message — Request handling

SSAP

read   write   delete — Graph operations

Adaptation

| WQL | SPARQL | Triple | — Triple operations

query   insert   remove

RDF Store

Persistent store

DB

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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 API generators for C/GLib, C and Python KPIs
- Sofia ADK currently for Java KPI

Application logic

Ontology API

insert,remove, query, subscribe

KPI

TCP   NoTA   other transports   ...

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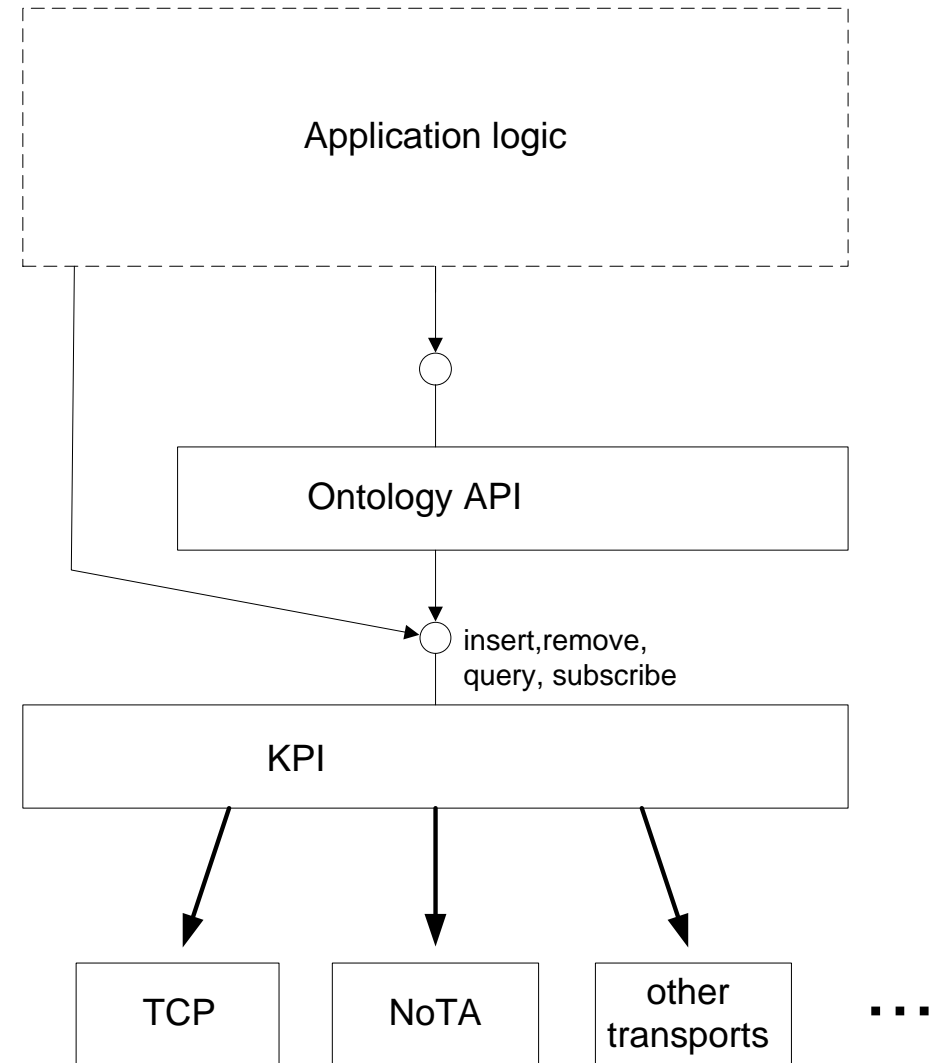
Future development

- Reasoning support for SIB

  - Generic: ontology based reasoning

  - Domain-specific: rules engine in SIB

- New operations for SIB

  - Enforced locking of subgraphs

- Access control

  - Joining – who can join a smart space

  - Information – who can access specific information in smart space

- Extension interface in Smart-M3 SIB

  - Customization possibilities

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Conclusions

- Smart-M3 is an information sharing platform and an implementation of a core component in Sofia IOP

- 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 (Finnish-Russian University Co-operation in Telecommunications)

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