Devices and Interoperability Ecosystem (DIEM) Project

Interoperability Work Package (IOP)

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Main Contributions -Development Tools-:

1) An **Ontology Library Generator** (in **Python** and **C**): creates a static API from an OWL-DL Ontology containing classes, its properties and Get & Set methods.

2) A **Middleware framework:** Abstracts the communication with the persistence layer. Provides to the generated ontology API: RDF Triple handling, synchronous and asynchronous querying.

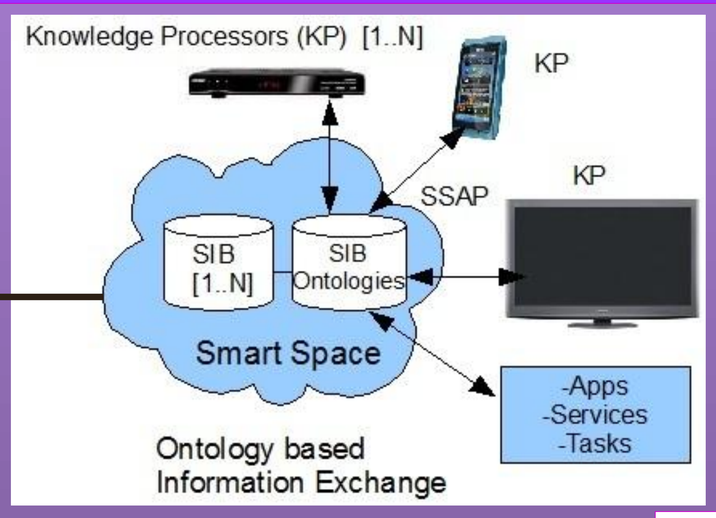
3) **PythonRules** module for modelling behaviour in the Smart Space.

4) **OWL** as a **Scripting** Language.

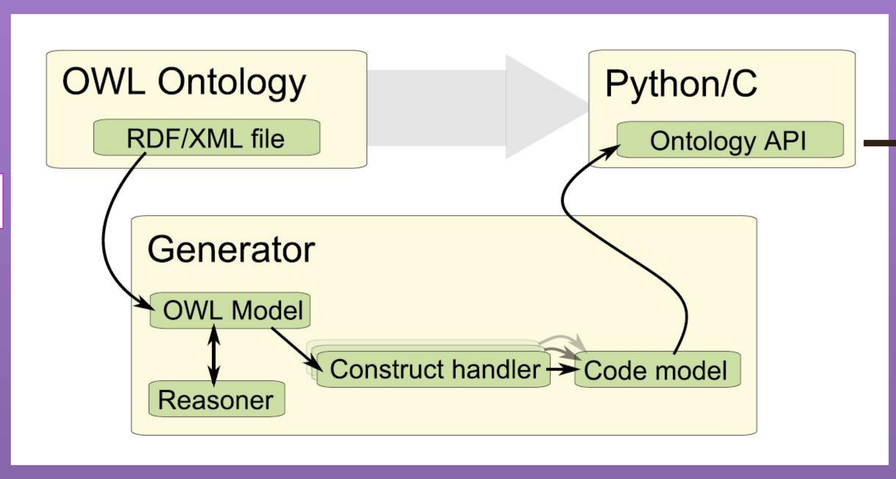
DELIVERABLES:
- D5.6.7 New Release of Ontology Library Generator for Python.
- D5.8.5 Report: On Using Smart-M3 in the Personal Information Ecosystem.
- D5.9.2 Python runtime bindings for the Smart-M3 behavior.

MASTER THESIS:
- ***Semantic Interoperability in Smart Environments***. Lakshman Veer.Ponguwala.
- ***Calendar synchronization in a RDF-based smartspace environment***. Emil Karlsson.
- ***Ontology driven application prototyping in a smartspace environment.*** Jon von Weymarn.

PUBLICATIONS:
- ***Ontology driven Smart Space Application Development***. M. Mohsin Saleemi, Natalia Díaz Rodríguez, Espen Suenson, Johan Lilius and Ivan Porres. Book Chapter in Semantic Interoperability: Issues, Solutions, Challenges. River Publishers. 2011.
- ***A Framework for Context-aware Applications for Smart Spaces***. M. Mohsin Saleemi, Natalia Díaz Rodríguez, Johan Lilius and Iván Porres. The 4th conference on Smart Spaces ruSMART 2011, August.
- ***OWL Web Ontology Language as a Scripting Language for Smart Space Applications***. Espen Suenson, Johan Lilius, Ivan Porres. International Symposium on Rules, RuleML 2011, July.
- ***End-user's Service Composition in Ubiquitous Computing using Smartspace Approach***. ICIW 2011 : The Sixth International Conference on Internet and Web Applications and Services, March 20-25, 2011 - St. Maarten, The Netherlands Antilles.
- ***Framework for Smart Space Application development***. A. Kaustell, M. Mohsin Saleemi, T. Rosqvist, J. Jokiniemi, J. Lilius, and I. Porres. IWSI 2011: International Workshop on Semantic Interoperability. 28-30 January, Rome Italy.
- ***Programming Biomedical Smart Space applications with BioImageXD and PythonRules***. *N. Díaz, P. Kankaanpää, M.M. Saleemi, J. Lilius, I. Porres.* 4th International SWAT4LS Workshop Poster at Semantic web applications and tools for life sciences.



Tools



Rule Expression embedding into Python language

Since the end-user should not deal with the RDF store directly, a PythonRules module is presented to translate Python logic expressions to the SIB API (*Query, Subscribe, Insert, Remove, Update*).

AIM: Design a **Rule syntax** for allowing users -with knowledge of basic programming- easy definition of Rules to model Smart Space applications.

Python Rule Syntax:

With() // When() >> Then()

- **With** class handles Existence Assumptions in the Smart Space.
- **When** class handles Conditions.
- **Then** class handles Actions.

```
def main(args):
    app = QtGui.QApplication(sys.argv)
    smartSpace = ('x', (TCPConnector, ('127.0.0.1', 10010)))
    phoneKP = PhoneKP.create(smartSpace)
    #Definition of Rules
    sys.exit(app.exec_())
```

Knowledge Processor Programming

```
user = User(1, "Researcher", "Peter", True, False)
room = Room("B4050", "ICT House", "Turku", True)

condition1 = lambda: user.isBusy()
condition2 = lambda: room.getOccupied()
conditions = [condition1, condition2]
action = lambda: user.setVoiceMail(True)
myRule = With([user, room]) // When(conditions) >> Then(action)
diem.addRule(myRule)
```

RULES are stored and passed to a rule **Inference Engine** which, based on given/sensed (sensors, RFID, devices, etc) atomic context information, will **infer** higher level **Context Information**.

Examples of APPLICATION DOMAIN for the Smart Space Development framework:
- Office and personal domain. Home automation.
- BioMedical and healthcare domain.
- Elderly monitoring systems, special needs self-care etc.

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