Distributed service environment (smart spaces) security model development

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Agenda

- Motivation;
- Goal and tasks;
- Current Smart-M3 security;
- Security model development;
- Smart-M3 security realization:
  - HIP-agent;
  - smart space RDF-graph mapping to the virtual file system (VFS);
- What was done?
- Future research and development;

Motivation

- access control mechanism for the smart space platform, for example Smart-M3;
- protection information mechanism of the space;
- research information security within the smart space area.

Goal and Tasks

The project goal

- Development a security model for distributed service environment (smart spaces, SS), access control algorithms and test developed components as a part of the SS Smart-M3 platform;

The main tasks of the project

- investigation of the basic security models and creation own security solutions;
- development a security model for Smart Spaces;
- modeling and development security model components for the Smart-M3 platform;
- testing developed components and algorithms within the Smart-M3 platform;

Smart-M3 security

What do we have?

- access control at triple level [1];
- context-based and access control policies;
- security objects as triple patterns;

What do we want?

- identification and authentication mechanism of the SS subjects;
- authorization and access control mechanism of SS subjects;
- data privacy;

[1] A.D'Elia, J.Honkola, D.Manzaroli, T.S.Cinotii – Access Control at Triple Level: Specification and Enforcement of a Simple RDF Model to Support Concurrent Applications in Smart Environments, 2011.

Security model development

Identification and authentication of space subjects:

- HIP, PAM;

Authorization and access control of space subjects:

- discretionary security model;
- smart space RDF-graph mapping to the virtual file system (VFS);
- named graphs;
- access control ontology;
- security extensions for smart space database.

Smart-M3 security realization

Identification and authentication mechanisms

- prospective architecture of HIP-agent;
- interaction of HIP-agent components.

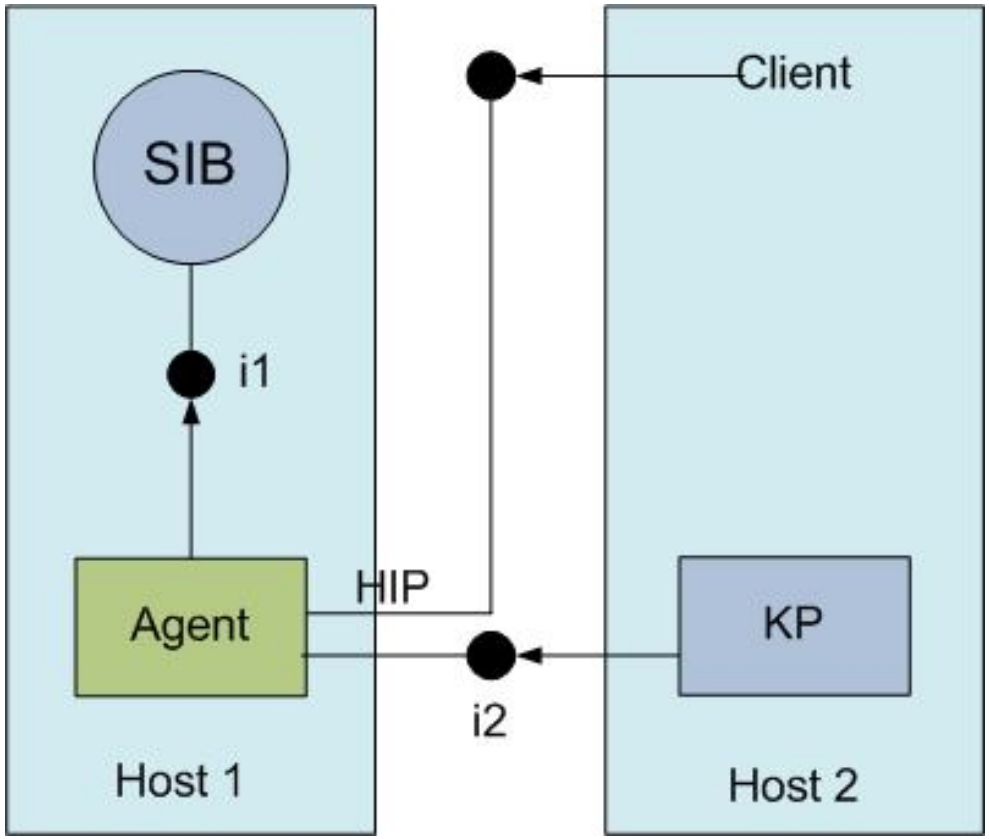
Authorization and access control mechanisms

- smart space RDF-graph mapping to the VFS;
- intermediate solution of the graph mapping;
- implementation mechanism to the Smart-M3 platform.

Prospective architecture of HIP-agent

Identification and authentication of the client:

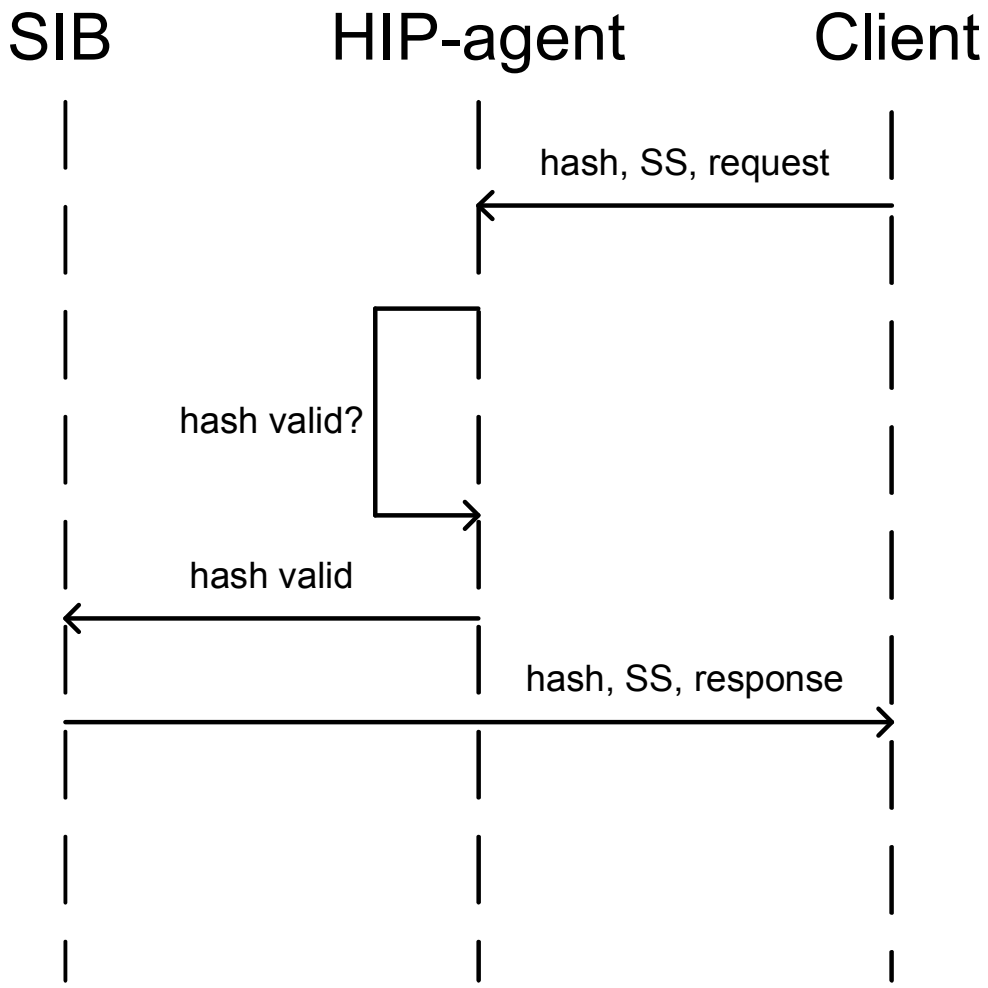
1. Client connection request to the SS;
2. Request intercepting by the HIP-agent;
3. Protocol-based HIP identification and authentication of the client.



Interaction of HIP-agent components

The process of connecting the client to the space:

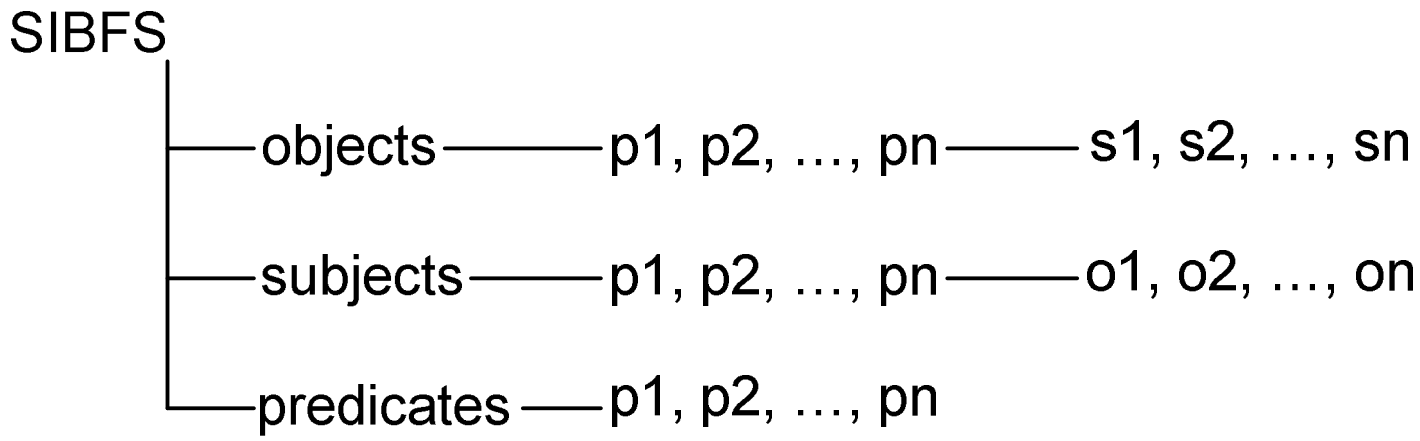
1. Transmission the client hash key to HIP-agent;
2. Checking validity of the hash key;
3. Identification and authentication of the client;
4. Connection to the SS.



Smart Space RDF-graph mapping

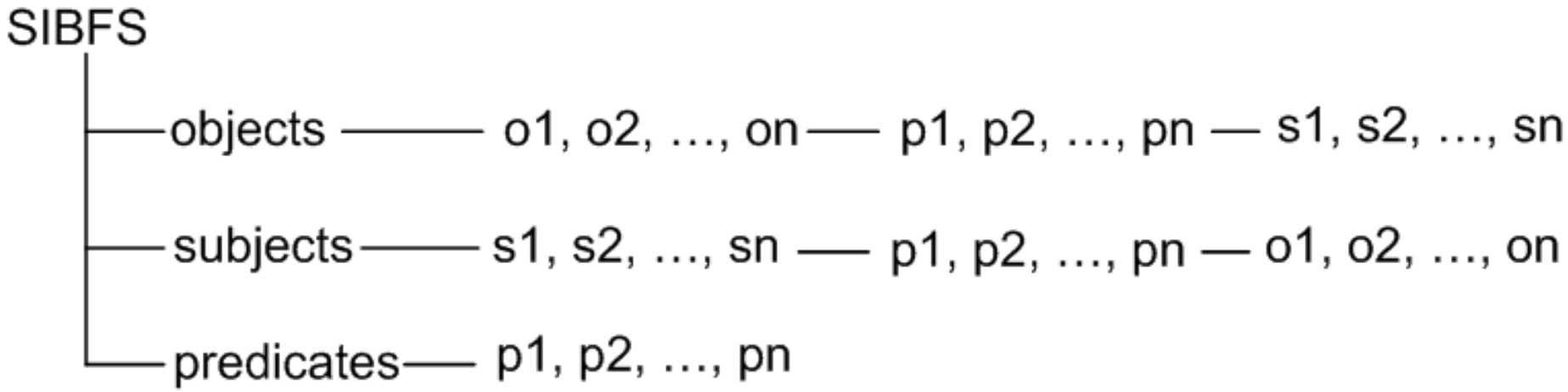
- information of SS is stored in a relational database, smart space database (SQLite);
- information of SS is presented in triple form (S, P, O);
- set of triples stored in specific database tables;

Solution: The virtual FS, that mapping information of SS in a certain directory structure.



The updated directory structure of VFS

- provide more accuracy right to triplets (information) of the space;

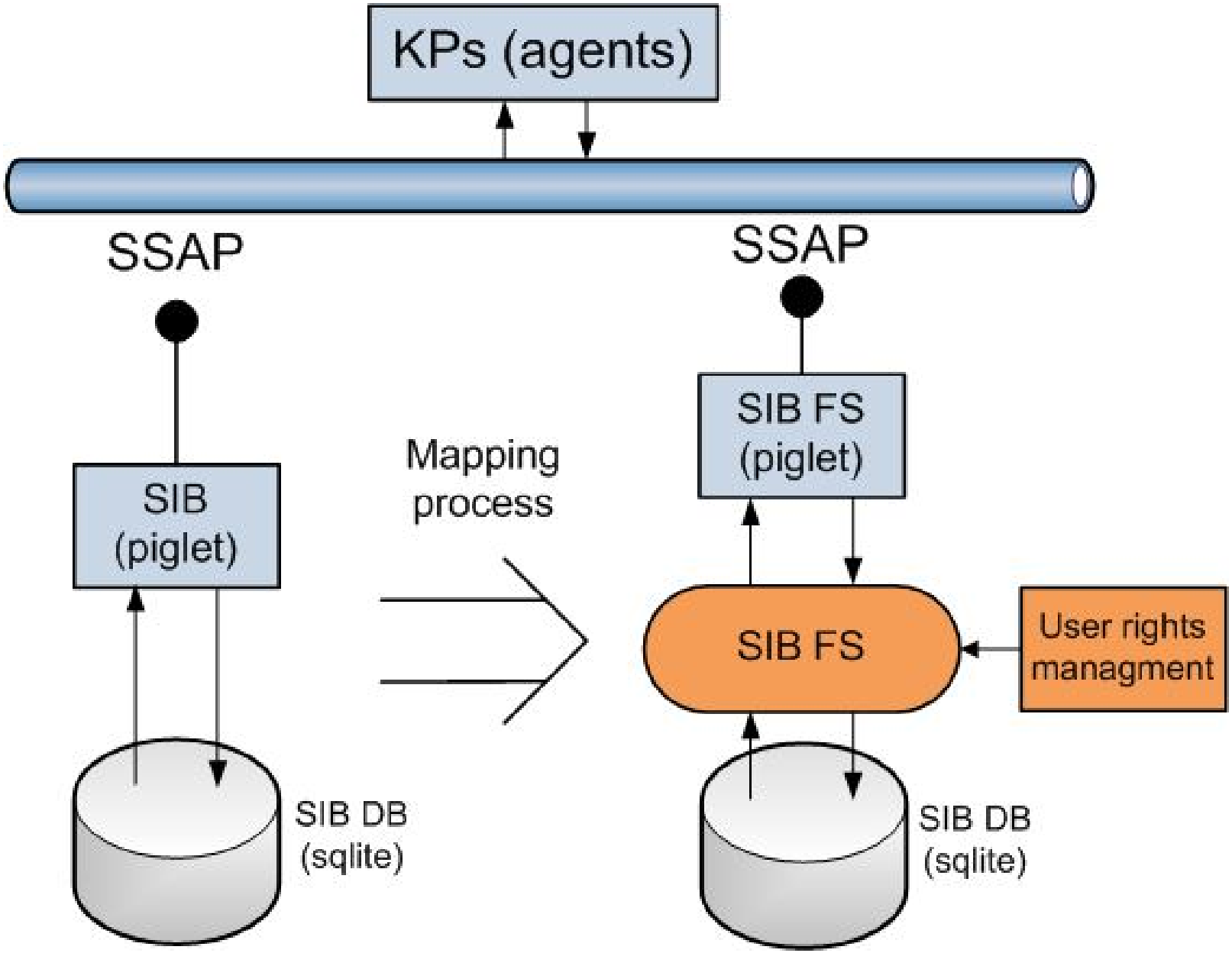


The intermediate solution of the graph mapping

- Working with SS database: get all triples and save them in memory of data structure (SQLite):
  - receiving all objects, subjects, predicates and their values;
- Creating a VFS directory structure based on the data:
  - creating of virtual FS using FUSE technology (fusekit), setting permissions;

Implementation mechanism to the Smart-M3 platform

- modification of Smart-M3 platform piglet module:
  - piglet proxy creation for new extensions;
  - replacement of all smart space database operations to mapping FS operations;
  - determine and verify client access permissions;
- testing operations on the client side.


KPs (agents)
SSAP
SSAP
SIB
(piglet)
Mapping
process
SIB FS
(piglet)
SIB FS
User rights
managment
SIB DB
(sqlite)
SIB DB
(sqlite)

What was done?

- analyzed and designed the HIP protocol-based mechanism of identification and authentication;
- the mechanism of authorization and SS subjects access control by mapping RDF-graph to the virtual file system is developed; mechanism tested in the Smart-M3 platform;
- the implementation process of HIP-agent and mapping mechanism to the Smart-M3 platform is started;

Future research and development

Main

- HIP-agent development;
- implementation of mapping model to Smart-M3 platform;
- set permissions tool development for mapping FS;

Additional

- named graph authorization system development;
- adding developed mechanisms to new version of Smart-M3 platform (Redland);

Questions & Answers

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