1 Architecture

- Role-based Access
- Revision Control
- Lua
- RuleML
- Activity/I
  nference
- Object
  Memory
  Server
- OMM+
- RDFa
- Microdata
- Mapper
- HTML5
- Java
- REST
- User
- Application
- PiVis
- Mapper
- SQL-DB

2 Data Input

- Lightweight Editor for Ontology Files (Leo)
  - Support for using semantic data ad-hoc
  - Easily create OWL Allbox from fixed Tbox
  - End user smart assistance during data input
  - Admin mode allows to reduce visible relations to minimum
- Configurable SOL-DB Converter
  - Extraction of existing DB-data to data formats and storage to OMM blocks
  - Conversion, data format, and block layout can be configured and fixed by user

3 Data Storage

- OMM+, OMS, Revision Control

- Memory storage based on W3C OMM-XG Model (http://www.w3.org/2005/11/repository/omm/)
  - Object Memory Model for structuring and declaring memory data
  - Allows data partitioning to blocks with dedicated meaning
  - Each block indicates payload with a set of describing metadata
  - XML-based file representation

- OMM+ extends Model
  - RDFa and Microdata representation for embedding memory data to web pages
  - Binary representation with configurable data mapper (e.g. for RFID labels)
  - Additional defined blocks with fixed payload structure (e.g. for named graph like structures)

- Object Memory Server (OMS)
  - Centralized server based framework for memory management
  - Covers a large amount of memories within one service instance
  - Utilizes OMM+ as data exchange format
  - Provides revision control capabilities for
    - Storage of memory lifetime changes and access
  - Revert to earlier memory state for demonstration purposes
  - Access to older memories

4 Data Access

- REST, Role-based Access

- Challenges:
  - Flexible and secure access to memory data based on existing standards
  - Extensible RESTful interface provided by OMS for memory interaction
    - Command set is grouped to functional sets
    - Feature negotiation allows applications to detect
      which functions are available
    - Storage interface allows access to and manipulation of OMM-blocks
    - Additional feature modules uses for activity (see below)
    - OMS allows to define access restriction to entire memories
  - OMS-wide queries allow reverse lookup of memories that fulfill requested conditions

- Role-based Access
  - Object memories may contain sensitive data
    (e.g. private or confidential data)
  - OMS allows to define access restriction to entire memories or single memory blocks
  - Restrictions can be bound to simple secrets (like username/password) or X.509 certificates (including certificate chains)
  - Additional use-cake realized with RFID-based new German ID card (nPa eID)

5 Activity

- Lua-Scripts, Data Inference

- Challenges:
  - Equip object memories with processing logic for monitoring and inference tasks
  - Activity Modules based on LUA-scripts
    - LUA-based scripts extend memory functionality and are triggered by external calls or periodically
    - OMS operator can upload scripts to memories and end users can enable and configure scripts for each memory

- Data inference based on in-memory rules
  - Memory can bring with a set of rules (e.g. alerts on threshold exceedance) that should be monitored during its lifetime
  - Conclusions may trigger external events (e.g. e-mail) or generate new block data

6 Visualization

- PiVis

- Challenges:
  - Make heterogeneous memory data available to end users

- Visualization Framework for Object Memory Data
  - Requirements: Extensibility, Reusability, Customizability
  - Solution: Data processing and visualization pipeline
  - Each pipeline
    - Starts with a Data Source Plugin
    - May contain several Filter Plugins
  - And ends with a Visualization Plugin
  - Plugins are semantically annotated regarding input/output types and capabilities
  - Backward-chaining algorithm automatically creates pipeline based on given data and requested visualization
  - Implementation done with Java and JavaFX Scene Graph used within several demonstrator systems

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