

Synthesis of Hypermedia using Ontologies and Rules

Antonino Lo Bue

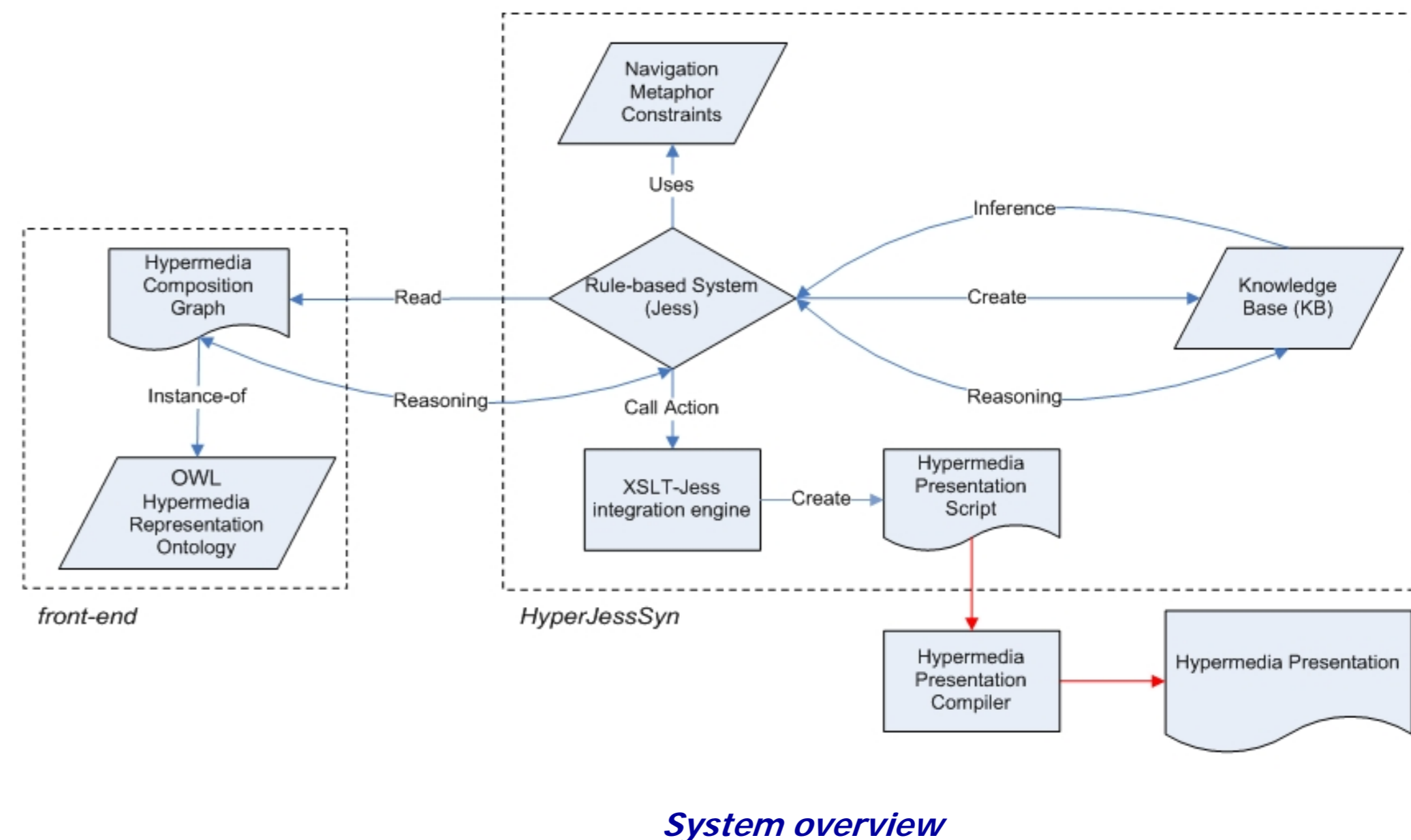
Medialab Laboratory, ICAR-CNR Sezione di Palermo, Via Ugo La Malfa 153, 90146 Palermo, Italy
 mail: ninokeys@hotmail.com web: http://medialab.pa.icar.cnr.it



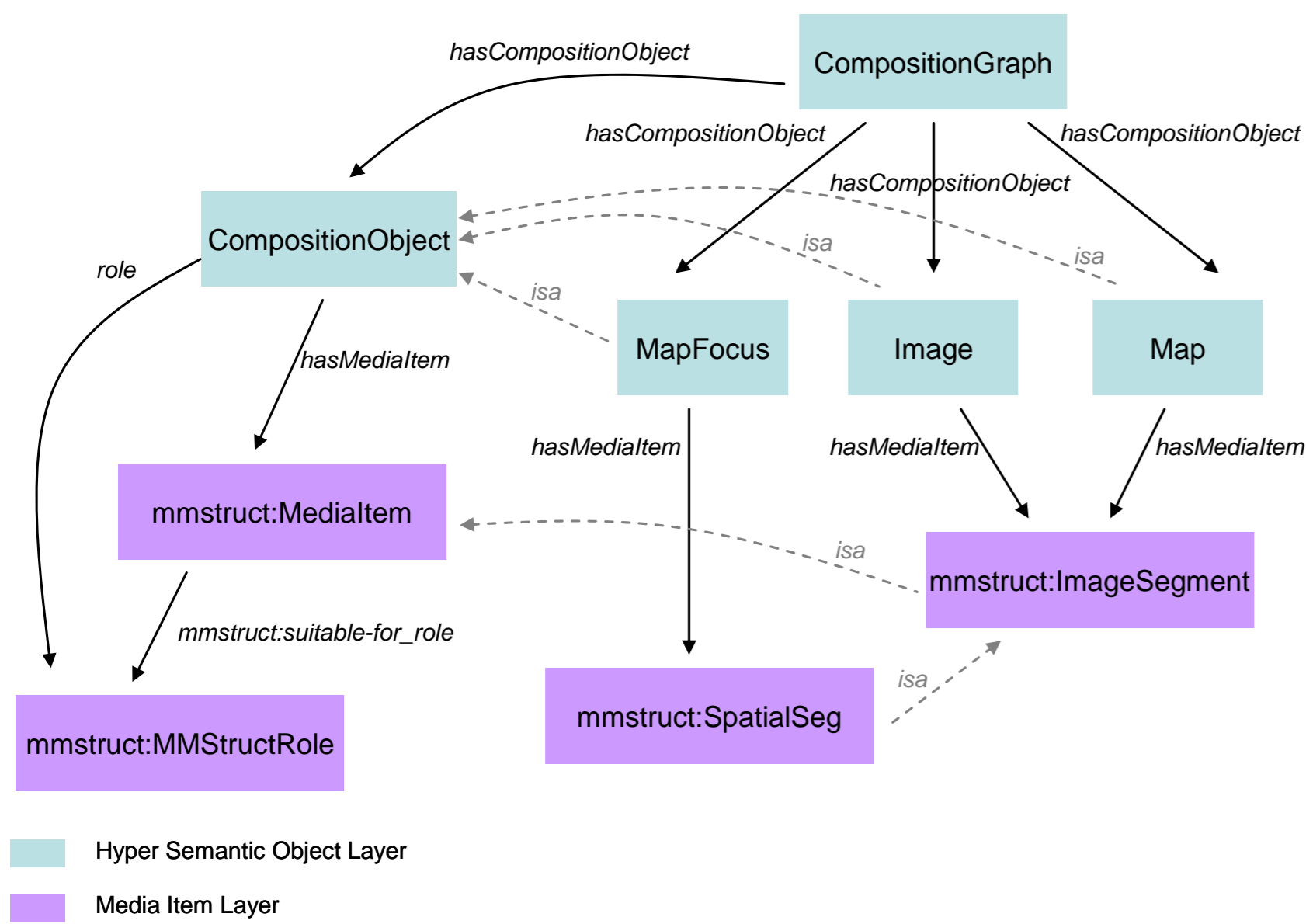
Focus of this work is a rule-based system for semi-automatic generation of hypermedia presentations from semantic graphs. HyperJessSyn is a back-end service of an authoring platform being developed at ICAR Medialab laboratory*, which uses logic programming and Semantic Web technologies for synthesizing hypermedia documents, according to descriptions of the discourse structure and the presentation metaphor [1,2].

The discourse structure is formalized by an OWL semantic graph which contains a semantic description of media composition structure, while presentation metaphor is encoded within XSLT templates and used as navigation constraints in rules.

The right figure depicts service overview. The authoring front-end service generates the OWL semantic graph. HyperJessSyn (a rule-based system in Jess) populates the knowledge base by querying the semantic graph. It applies inference rules to interpret, from the OWL graph, semantic and navigation relations among media instances. It uses as well production rules to turn physical attributes of MPEG-7 media contents descriptions in a tailored XMT-A/MPEG-4 hypermedia script via XSL transformations, using methods of the *XSLT-Jess integration engine* to create the script. Finally the *Hypermedia Presentation Compiler* produces the resulting hypermedia presentation.



System overview



Sketch of Hypermedia Representation Ontology

The semantic graph (called *Hypermedia Composition Graph*) depicting the discourse structure is an instance of a representation ontology (*Hypermedia Representation Ontology*) which specifies concepts and roles concerning media composition.

The ontology makes use of the OWL DL semantics subset and defines two levels of abstraction for media segments:

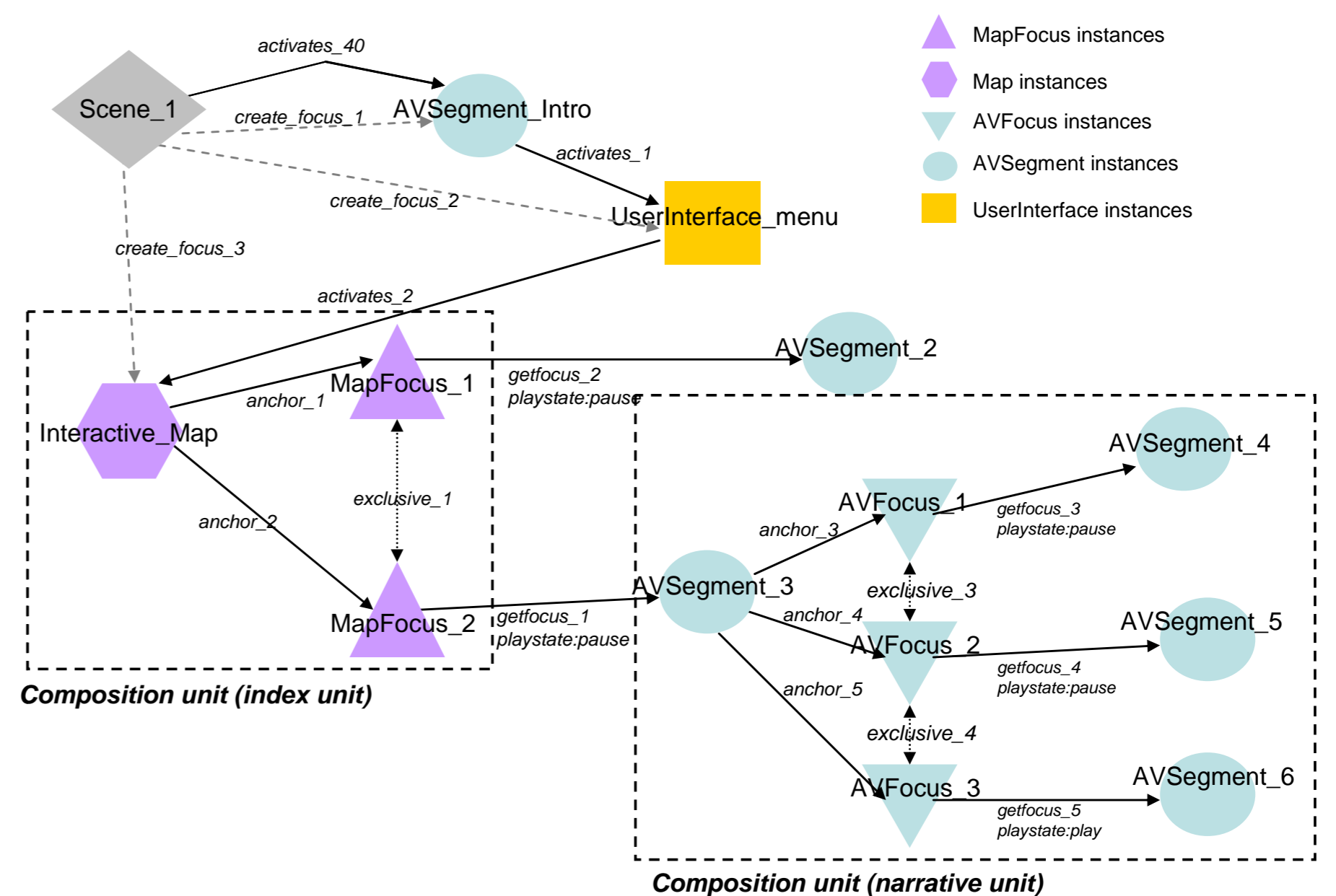
- ◆ The **Media Item layer** - which allows distinguishing structural and semantic features of media (like media types and formats and media content annotations)
- ◆ The **Hyper Semantic Object layer** - which depicts composition features, relations and roles (like presentation, linking, and synchronization)

The *Hypermedia Composition Graph* describes linking and synchronization relations among *composition objects* which are the building blocks (e.g. map, image and video sub-regions, interface controls, text) for the hypermedia presentation.

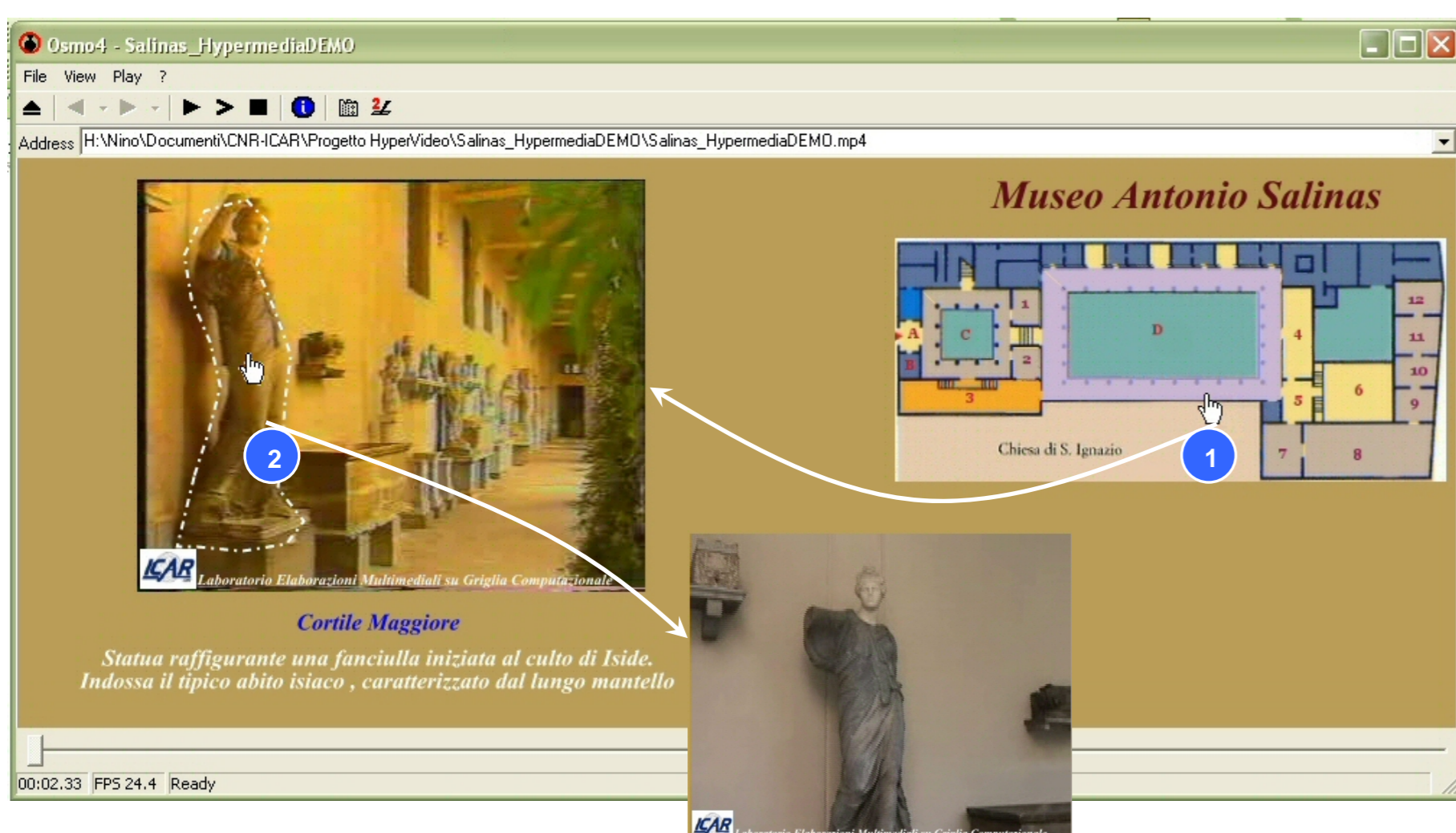
Specific clusters of *composition objects* constitute composite units (*composition units*) playing rhetoric roles in hypermedia like *narrative units*, which act as units of discourse narration (e.g. an hypervideo sequence), or *index units*, which act as indexes and selectors for discourse narration (e.g. an interactive map).

HyperJessSyn make use three kinds of rules:

- ◆ **Mapping rules** - which parse the *Hypermedia Composition Graph* and populates the Knowledge Base (KB)
- ◆ **Inference rules** - which infer from the KB informations about the hypermedia structure and detect *composition units* in the graph asserting synchronization relations amongs media objects
- ◆ **Production rules** - which activate external procedures like queries for retrieving data about media objects (from MPEG-7 descriptions or other metadata) and call XSL transformations for the creation of *Hypermedia Presentation Script*. The script contains the structure of the final hypermedia presentation inferred from the semantic graph.



Example of Composition Graph



Snapshots of hypermedia presentations in MPEG-4 format (Osmo4® player) and SMIL format

Present service prototype implementation allows synthesizing hyper-guides of an exhibition (e.g. a museum), according to just one passive navigation metaphor, namely the *virtual visit* of a taxonomy of topics, but the chosen architecture is scalable to other metaphors augmenting the KB with appropriate sets of rules.

Formalization of discourse models and sets of rules for active presentation metaphors is matter of current research.

Current target format for hypermedia encoding is XMT-A/MPEG-4. Adoption of the W3C SMIL synchronization language is another topic of current activity.

References

- Project CNR-ITC "Multimodal and Multidimensional Contents and Media WP: Indexing Annotation and Retrieval of Images and Video for Hypermedia Synthesis."
 * Demo of HyperJessSyn service implementation available at http://medialab.pa.icar.cnr.it/Synthesis/index_en.php
 [1] Machi, A., Nicotra, F., Pipitone, A., Tripiciano, M.: *Combining Domain Ontologies and MPEG-7 Classification Schemes in Semantic Media Annotation and Retrieval for Hypermedia Synthesis*. Submitted to: 2nd International Conference on Semantics And digital Media Technologies (SAMT '07), December 5-7, 2007, Genova, Italy.
 [2] Machi, A., Lo Bue, A.: *Synthesis of Hypermedia using OWL and Jess*. Accepted to: AI*IA 2007: Artificial Intelligence and Human-Oriented Computing, 10th Congress of the Italian Association for Artificial Intelligence, September, 10-13, 2007, Rome, Italy.