



DELOS Task 5.5 - Ontology-Driven Interoperability

DELOS NoE All Tasks Meeting

Martin Doerr

Center for Cultural Informatics
Institute of Computer Science
Foundation for Research and Technology - Hellas

**Paris, France
January 30-31, 2006**



Ontology-Driven Interoperability

Task Objectives

“Ontology- driven interoperability” refers to:

- **Mediation, data transformation and schema integration**
- using ontologies to describe the **common semantics across multiple domains**
- i.e. **relationships** and high-level concepts behind (meta)**data structure** elements to be used in mediators and data transformation.
- (not “interoperability of domain ontologies”)



Ontology-Driven Interoperability

Example: Meetings and Metadata

| | |
|------------------------|---|
| Type: | Text |
| Title: | Protocol of Proceedings of Crimea Conference |
| Title.Subtitle: | II. Declaration of Liberated Europe |
| Date: | February 11, 1945. |
| Creator: | The Premier of the Union of Soviet Socialist Republics The Prime Minister of the United Kingdom The President of the United States of America |
| Publisher: | State Department |
| Subject: | Postwar division of Europe and Japan |

Metadata

Documents

About...

“The following declaration has been approved:
The Premier of the Union of Soviet Socialist Republics,
the Prime Minister of the United Kingdom and the President
of the United States of America have consulted with each
other in the common interests of the people of their countries
and those of liberated Europe. They jointly declare their mutual
agreement to concert...
....and to ensure that Germany will never again be able to
disturb the peace of the world..... “



Ontology-Driven Interoperability

Example: Meetings and Metadata

| | |
|--------------------|----------------------------------|
| Type: | Image |
| Title: | Allied Leaders at Yalta |
| Date: | 1945 |
| Publisher: | United Press International (UPI) |
| Source: | The Bettmann Archive |
| Copyright: | Corbis |
| References: | Churchill, Roosevelt, Stalin |

Metadata



Photos, Persons





Ontology-Driven Interoperability

Example: Meetings and Metadata

TGN Id: 7012124
Names: Yalta (C,V), Jalta (C,V)
Types: inhabited place(C), city (C)
Position: Lat: 44 30 N,Long: 034 10 E
Hierarchy: Europe (continent) ← Ukrayina (nation) ← Krym (autonomous republic)
Note: ...Site of conference between Allied powers in WW II in 1945;
Source: TGN, Thesaurus of Geographic Names

Places, Objects

About...



Title: Yalta, Crimean Peninsula
Publisher: Kurgan-Lisnet
Source: Liaison Agency

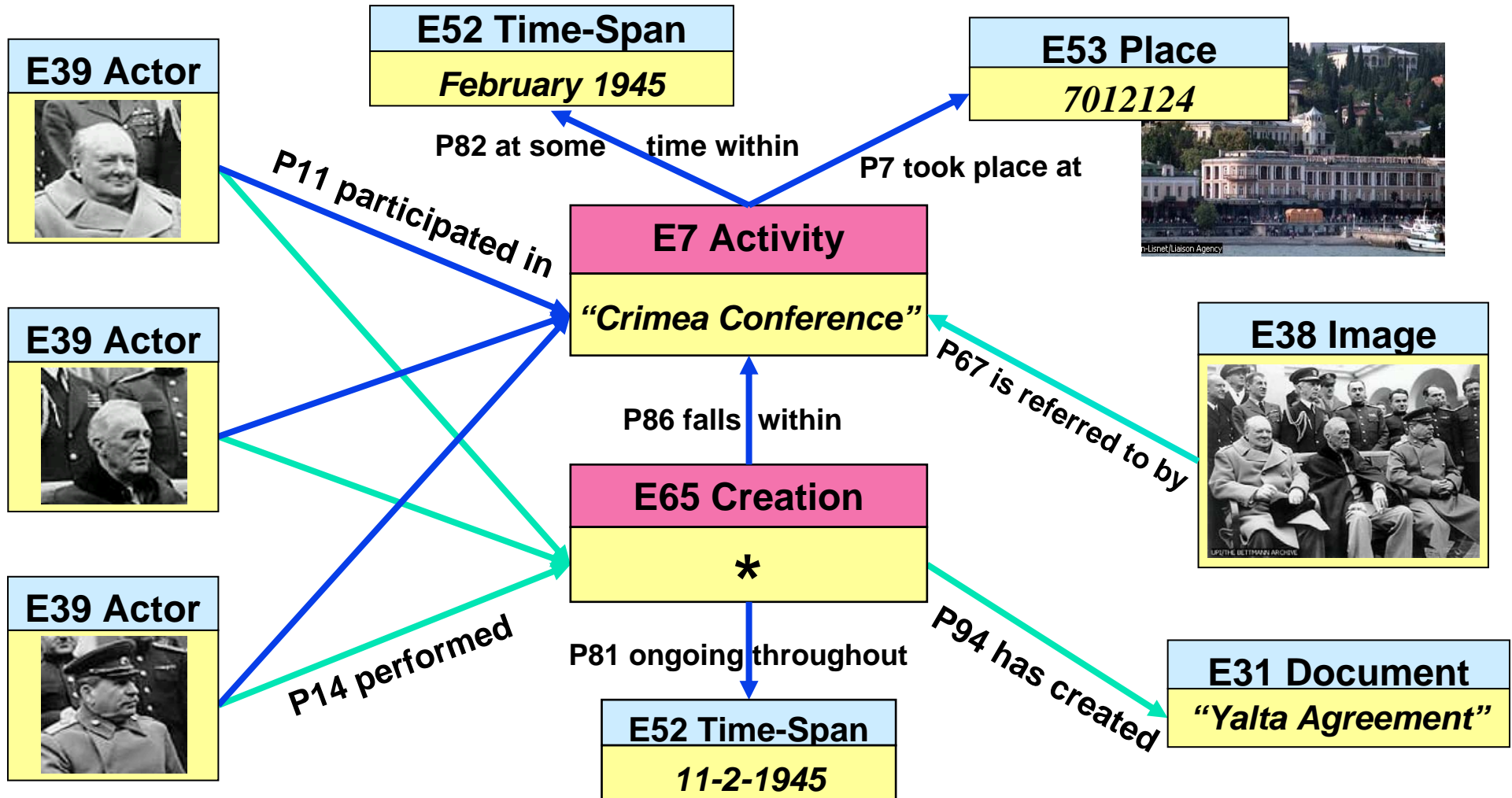


Kurgan-Lisnet/Liaison Agency



Ontology-Driven Interoperability

Example: The ISO21127 Solution





Ontology-Driven Interoperability

Challenges:

Mapping individual terms cannot connect information via contextual relations. Dublin Core has very limited capabilities to do so. Metadata registries and “crosswalks” do hardly connect complementary information.

If we do not model the fundamental relationships in our information assets, we have **no chance** to go ever beyond a finding aids scenario.

Task 5.5 challenges:

1. Someone has to make a **generic core ontology**. This is a hard engineering task: Ontology engineering, philosophy, domain expertise. The **CIDOC CRM – FRBR harmonization** is a major step. It means **reengineering** based on functional requirements.
2. **Poor** and **rich** schema integration. Schema heterogeneity cannot be solved without categorical data => need to connect the core ontology with harmonized domain ontologies (vocabularies).
3. Transition between metadata and integrated knowledge networks.
4. Demonstration: Using CIDOC CRM-FRBR to show 2. and 3.



Ontology-Driven Interoperability

Example: the CIDOC CRM (ISO21127)

The CIDOC Conceptual Reference Model (ISO/FDIS 21127)

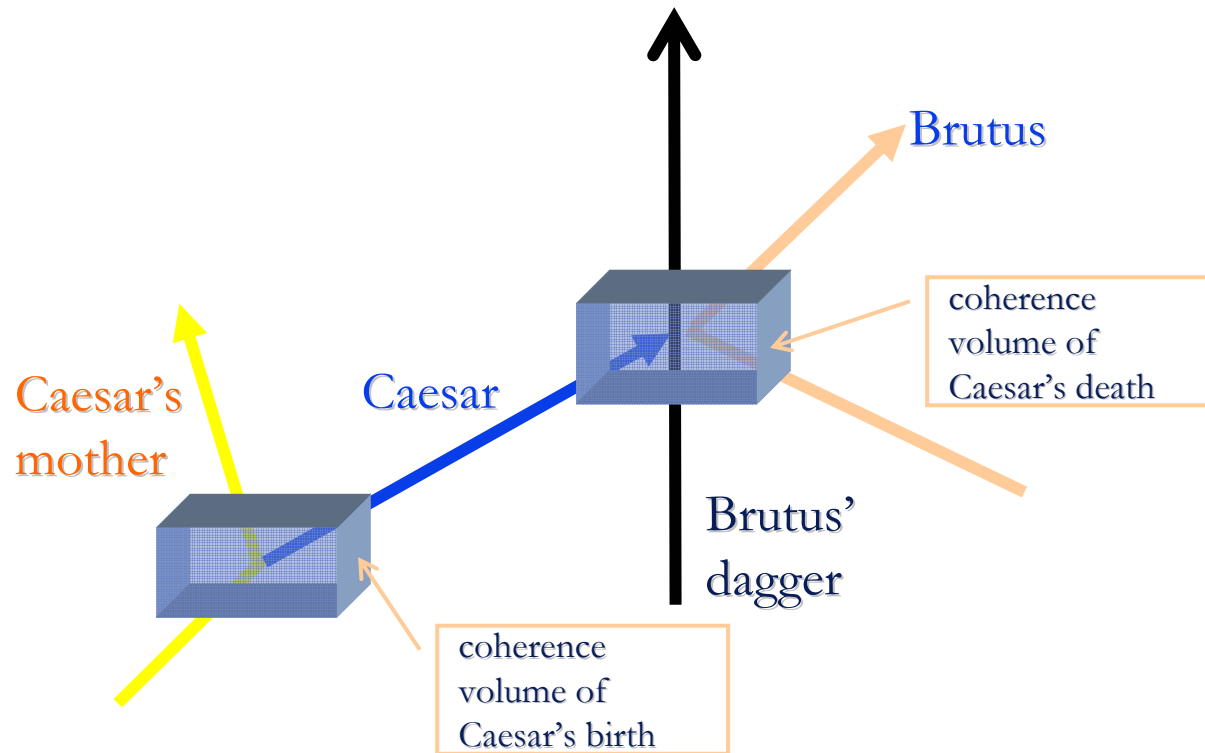
- ◆ is a **core ontology** describing the underlying semantics of data schemata and structures from all museum disciplines and archives.
- ◆ It is result of long-term **interdisciplinary work** and agreement of ICOM/CIDOC, lead by FORTH.
- ◆ In essence, it is a **generic model** of recording of “what has happened” in human scale, i.e. a class of discourse.
- ◆ It can generate huge, meaningful **networks of knowledge** by a simple abstraction: history as meetings of people, things and information.
- ◆ **It bears surprise**: more effective metadata structures and linking schemes can be derived from it.



Ontology-Driven Interoperability

History as Meetings of Things and People...

t

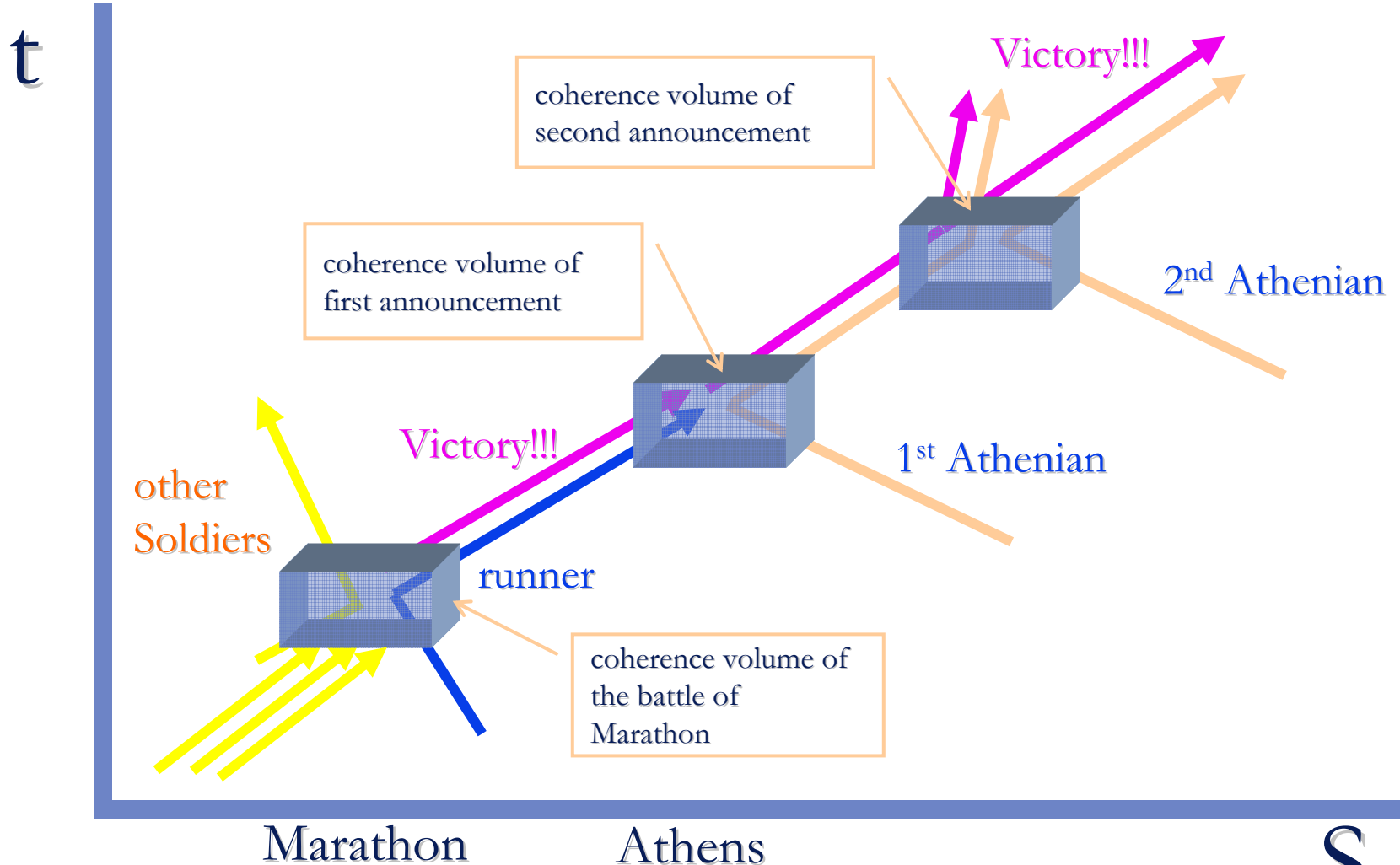


S



Ontology-Driven Interoperability

Meetings of Information and People and Things





Ontology-Driven Interoperability

CIDOC CRM-FRBR Harmonization

Harmonization progress:

- Three working meetings with FRBR and CIDOC CRM experts.
- Draft definition of **ooFRBR**, covering FRBR entities and attributes with 36 classes with scope notes and 51 properties,
- **Completely** subsumed by the CRM (minimal improvements).
- Available in graphics, OWL, TELOS, and text with scope notes and a scholarly introduction (82 pages).

Still to be done (JPA2/3)

- the FRBR “Relationships”,
- FRAR (Authority records),
- modeling equivalence with performing arts.



Ontology-Driven Interoperability

CIDOC CRM-FRBR Harmonization

Harmonization progress:

- Draft definition of **ooFRBR**, covering FRBR entities and attributes with 36 classes with scope notes and 51 properties, in graphics, OWL, TELOS, and text with a scholarly introduction. **Completely** subsumed by the CRM (minimal improvements).
- Still to be done: the FRBR “Relationships”, FRAR (Authority records), modeling performing arts.

Topics solved:

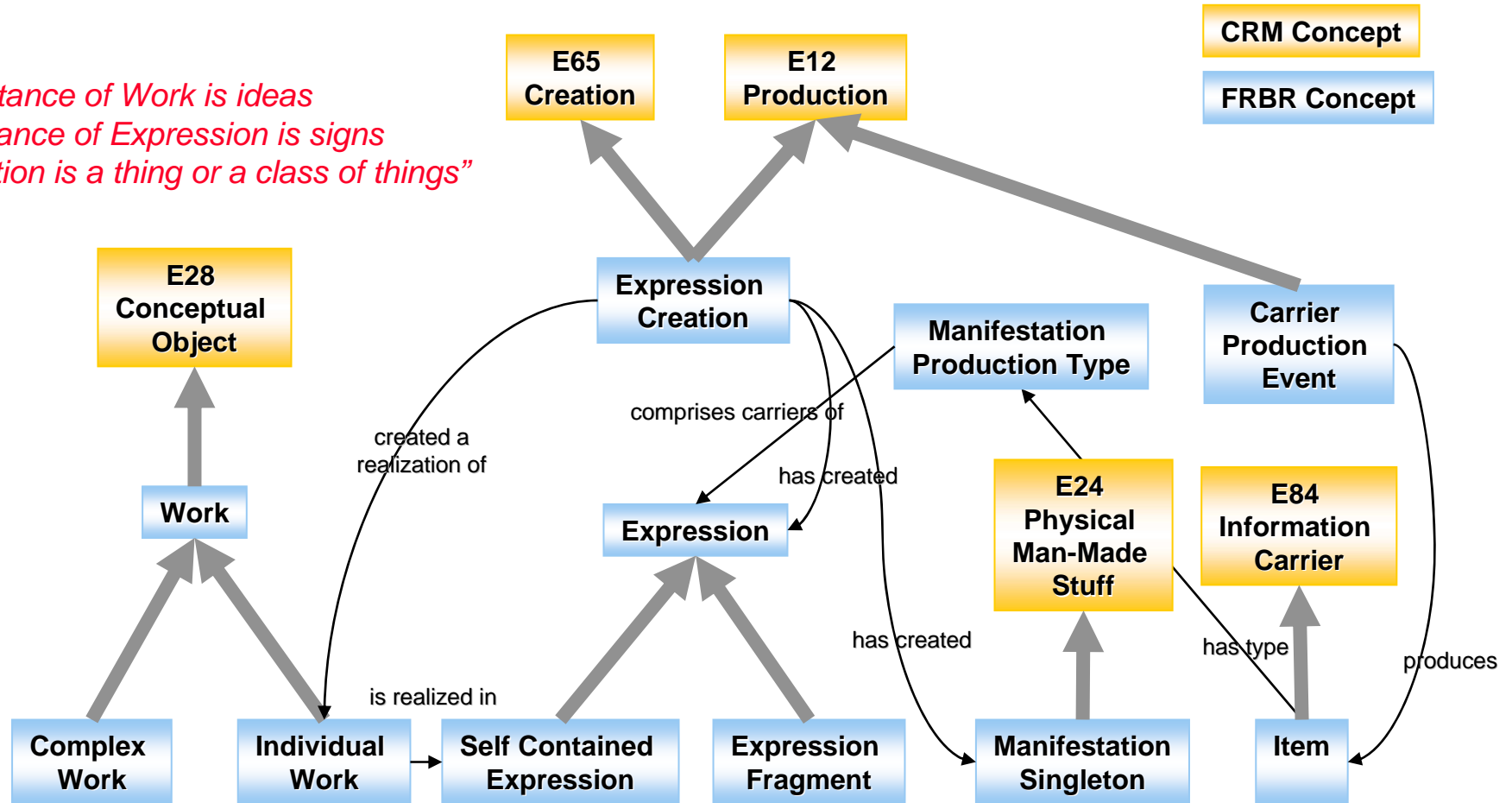
- Explicit **modeling of the processes** behind FRBR attributes.
- The **substance** of Work, Expression and Manifestation
- Conception of a Work. What is its **identity**, its **parts**? Can a work **be continued** by other persons? Can it contain other Work, and in which sense?
- Expression fragments, parts, aggregates and collections: criteria of **completeness**, **containment**, **reuse** and intellectual contribution.
- What is the contribution and product of the **publisher**.
- What is the **first realization** of a work in a symbolic form? What is the role of a manuscript, of a digital file, a written diskette in that process?
- The equivalence of **electronic** and material **publishing**.



Ontology-Driven Interoperability

CIDOC CRM-FRBR Harmonization

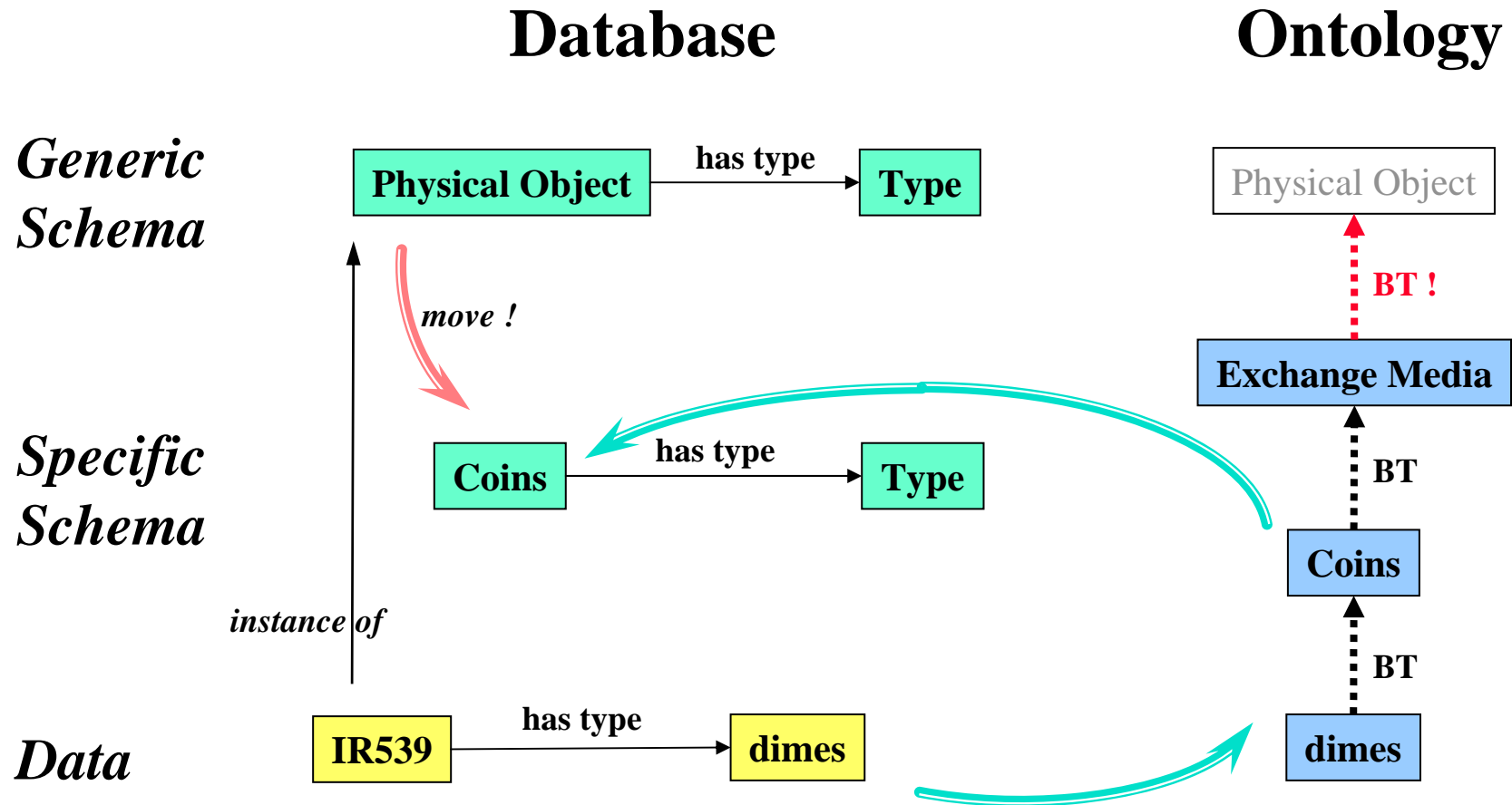
*“The substance of Work is ideas
The substance of Expression is signs
Manifestation is a thing or a class of things”*





Ontology-Driven Interoperability

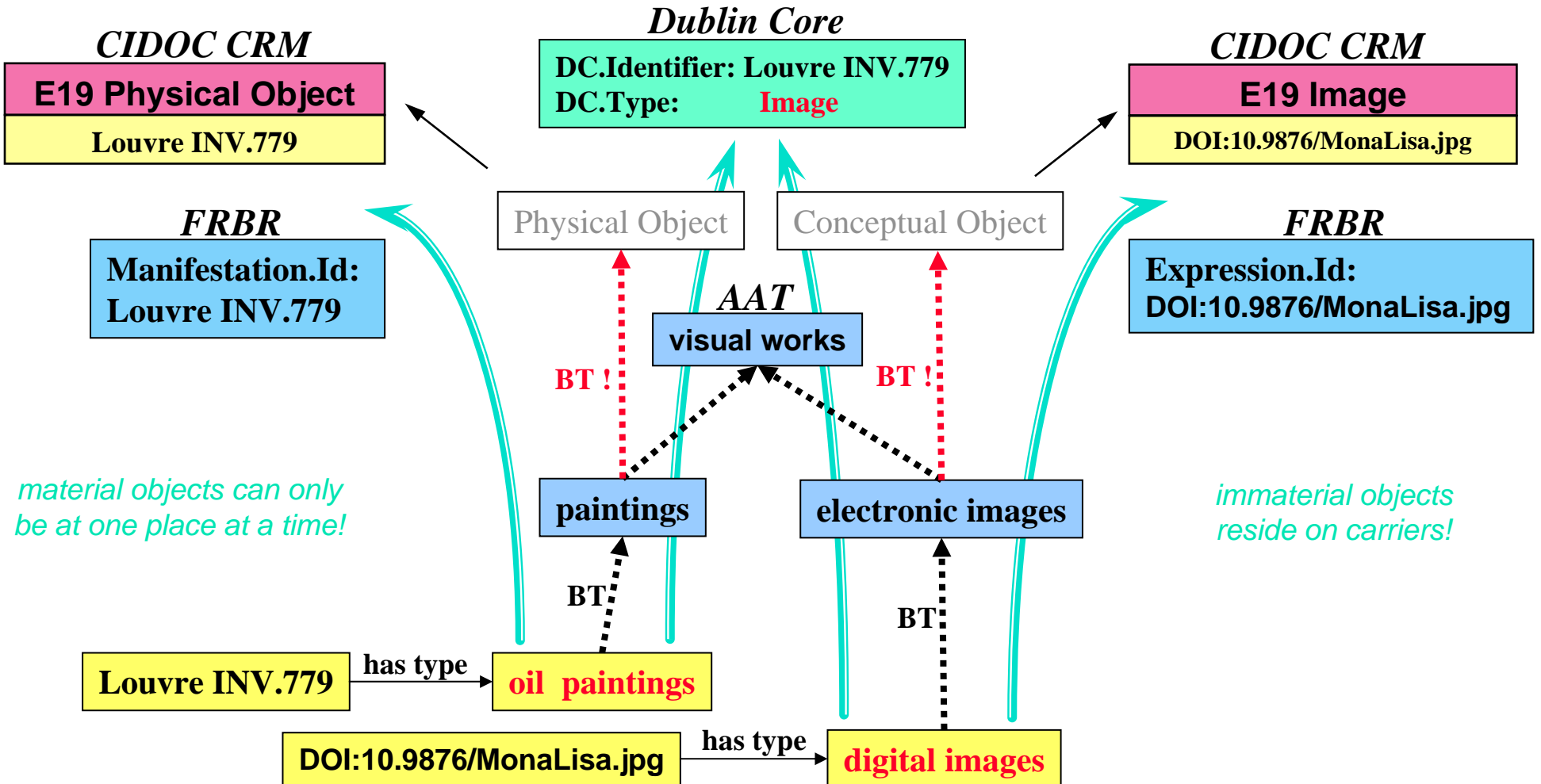
Integration of Poor and Rich Schemata





Ontology-Driven Interoperability

Resolving Schema Heterogeneity

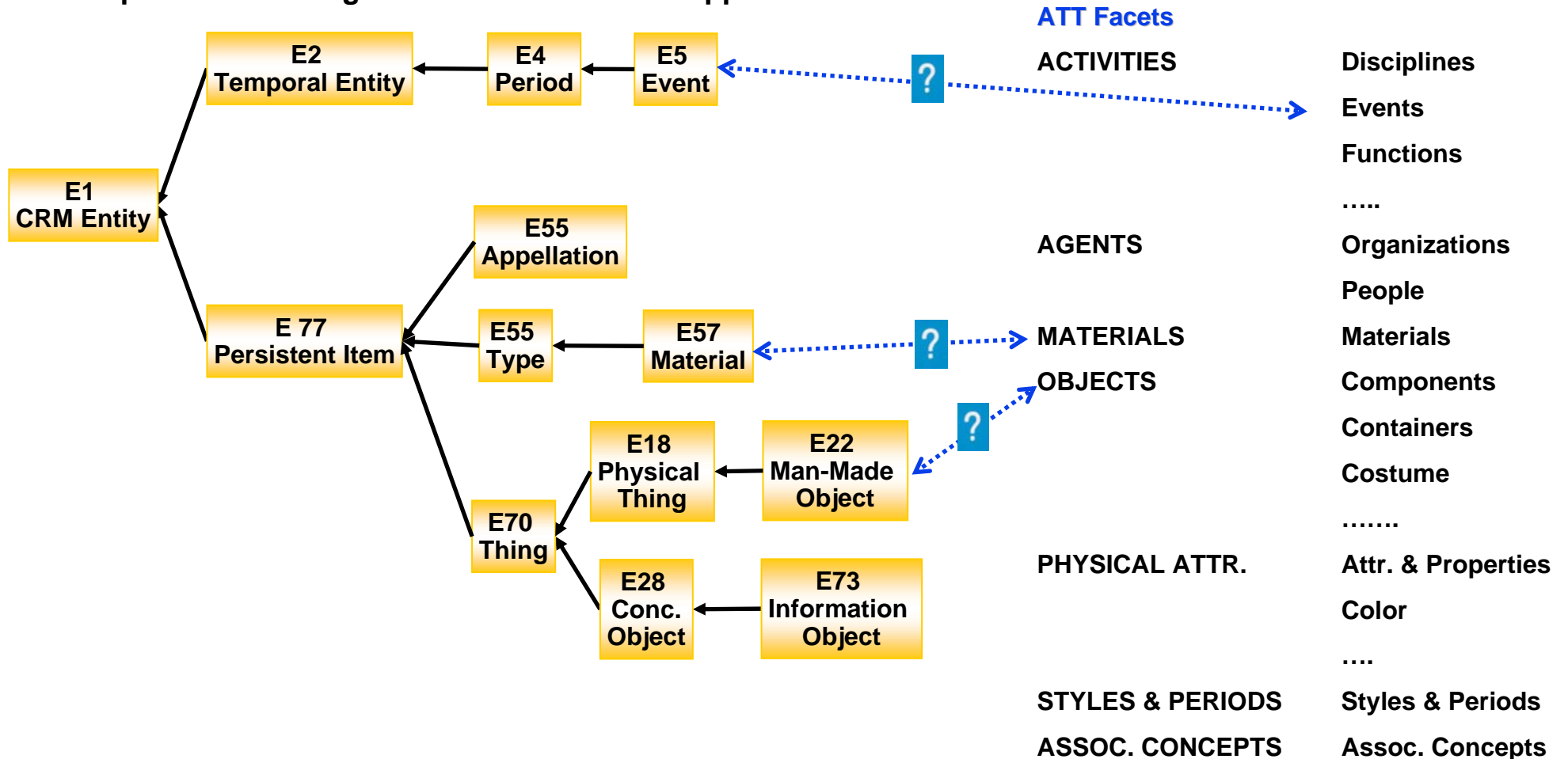




Ontology-Driven Interoperability

Core Ontology – Upper-level Matching

Example: Harmonizing CIDOC CRM with AAT Upper level

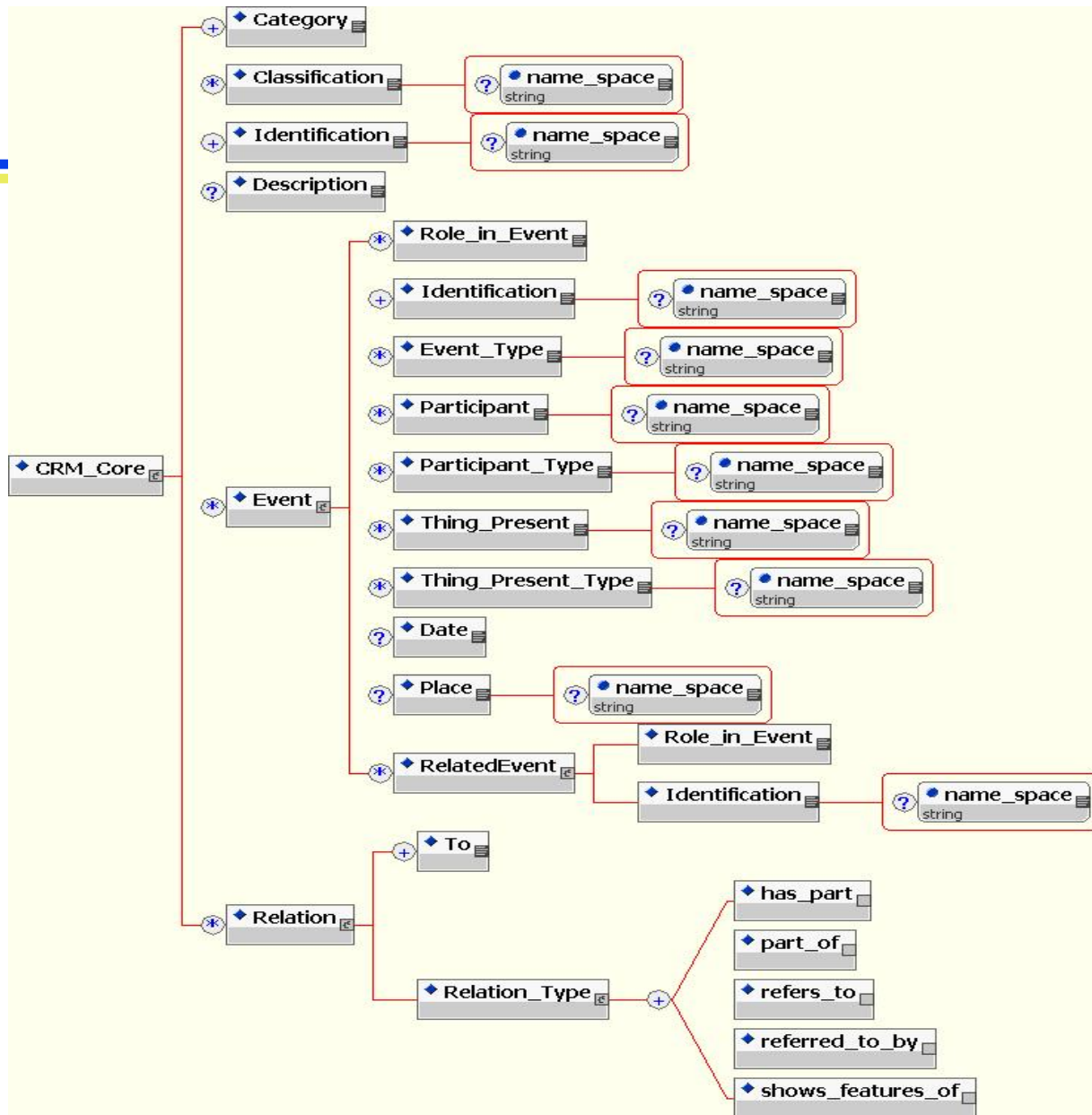




Ontology-Driven Interoperability *Demonstrator*

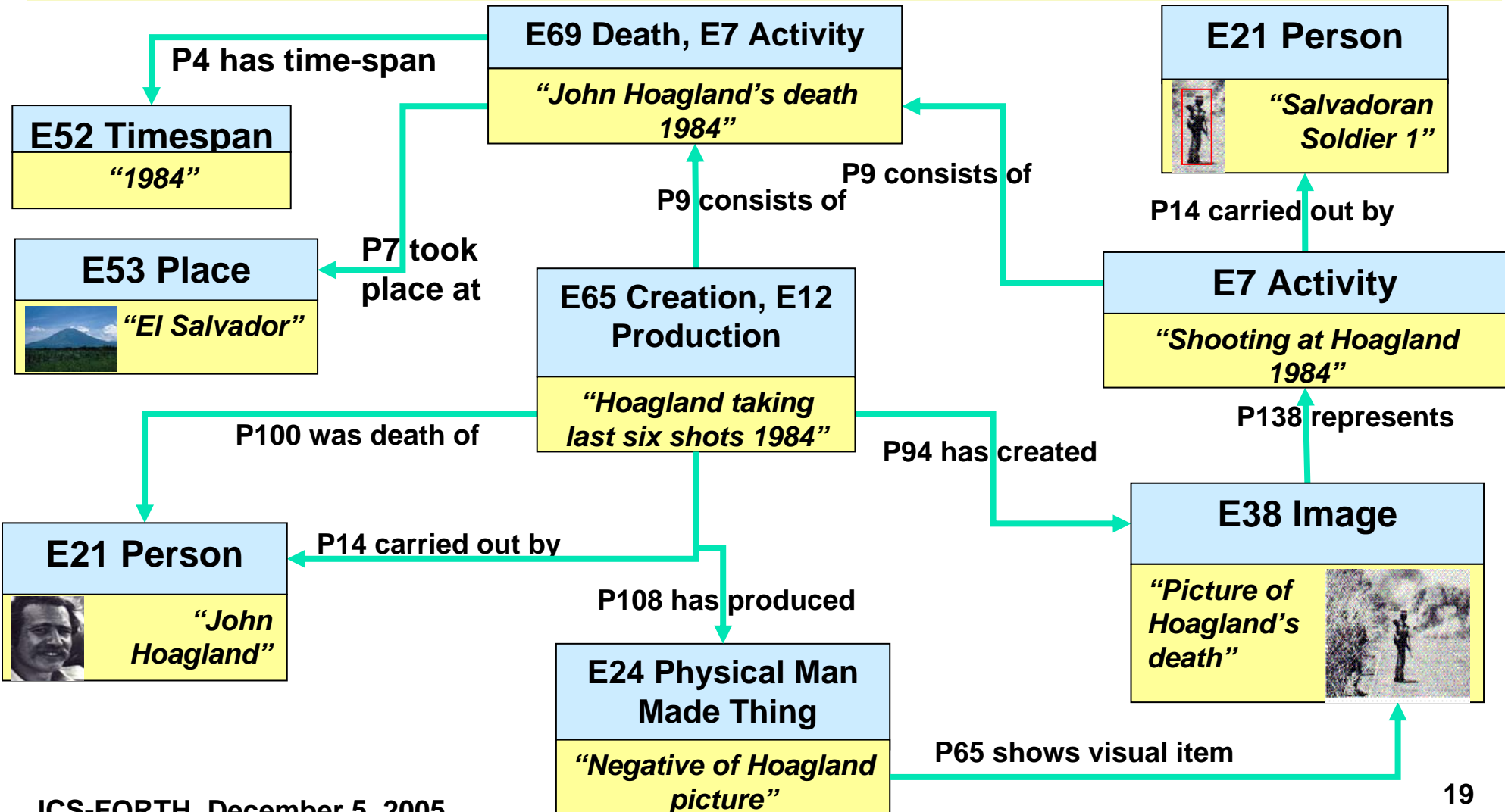
Demonstrator progress:

- Core ontology CRM-FRBR in OWL.
- GraphOnto tool supports now mapping. Evaluation of GraphOnto tool.
- Mapping DC-Types to CRM-FRBR
- Negotiation for real demonstration data
- Engineering better metadata schemas from core ontologies (inverse process):
 - CRM Core Metadata Elements, a **minimal** CRM compatible **alternative** to Dublin Core, capable to create knowledge networks (event participation, part-of, reference, similarity)
 - Transition CRM Core -> knowledge network
 - **Infosoc**, A rich data structure for museum and SMR documentation.





Ontology-Driven Interoperability Demonstrator





Ontology-Driven Interoperability *Demonstrator*

Work to be done (JPA2/3):

- Collaborative support of the ontology mapping process (study ongoing)
- Experiments with query facilities in the scenario of multiple mapped ontologies.
- Methodology of engineering metadata schemata from a core ontology.
- Mapping the upper level of a larger domain ontology to CRM-FRBR (e.g.AAT).
- Ontology-driven rich-poor schema integration: demonstrate the difference it makes for retrieval on a sample of integrated data sets from culture.



Ontology-Driven Interoperability

Conclusions

- ◆ The CIDOC-CRM / FRBR core ontology is **not** a domain ontology. It covers the semantics of the current **generic metadata schemata** in DL. E.g., FRBR is a model for general purpose libraries.
- ◆ The point for DELOS is **not** to have a methodology of how to do it. The point is to have exactly **one**, and if there are more than one, to **make them one**, one that stands intellectual and functional demands, one that is **tomorrow still valid**.
- ◆ Even though DL designers are not very much aware of the challenges of schema heterogeneity (due to focus on finding aids), ontology-driven schema integration has a vast potential for advanced DL services.
- ◆ Metadata schemata derived from this core ontology offer the basis for powerful, integrated reasoning services on deep data paths.
- ◆ We hope the demonstrator will make people better understand the issue.