



CRM Family of Models

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CRM & Extensions

Standards, Mapping and Data Transformation

Making Standards

The good with standards is there are so many!

When you have a standard,

You need to transform to the standard

You need to renew and adapt the standard

You need to transform to the renewed standards

Why not just transform data?

There are too many transformations, you need a standard



CRM & Extensions

CIDOC, CRM and SIG

CIDOC is the International Committee for Documentation of ICOM the International Council of Museums

CIDOC CRM is the Conceptual Reference Model of CIDOC

CIDOC CRM SIG is the CIDOC CRM Special Interest Group

- founded Aug. 2000 as **Working Group of CIDOC**;
- **open to non-ICOM** members. Membership is by organisation and a representative,
- to develop the CIDOC CRM as **ISO standard** for information integration of cultural-historical data **across institutions**,
- to act as forum for dissemination and development of **good practice** of documentation for **publication** and global **integration** of cultural-historical data,
- to act as forum to foster adequate **technology compatible** with CIDOC recommendations



CRM & Extensions

The CRM Supports Science and Humanities

Phases of the scholarly/scientific process:

- **collecting** and organizing **evidence** (observation and primary sources)
- **connecting** facts via the things involved (**synopsis**)
- **interpreting** facts – contextualizing and hypothesis building (dependency & impact)
- **presenting** results - publication

Problem: Billions of facts, artefacts and documents **possibly** shed light on the past in unexpected contexts **across all** disciplines and sciences

The CIDOC CRM (ISO21127:2006,2014)

- is made for **integrating and connecting evidential** data and derived facts
- It contains the most **basic** relationships to describe of what happened in **the past at a human scale**, i.e., people and things **meeting in space-time**, parts and wholes, use, influence and reference.
- more detailed kinds of discourse **require extensions...**



CRM & Extensions

Metadata Are Not Enough!

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**



“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..... “



CRM & Extensions

Finding Aids Do Not Integrate

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



About...

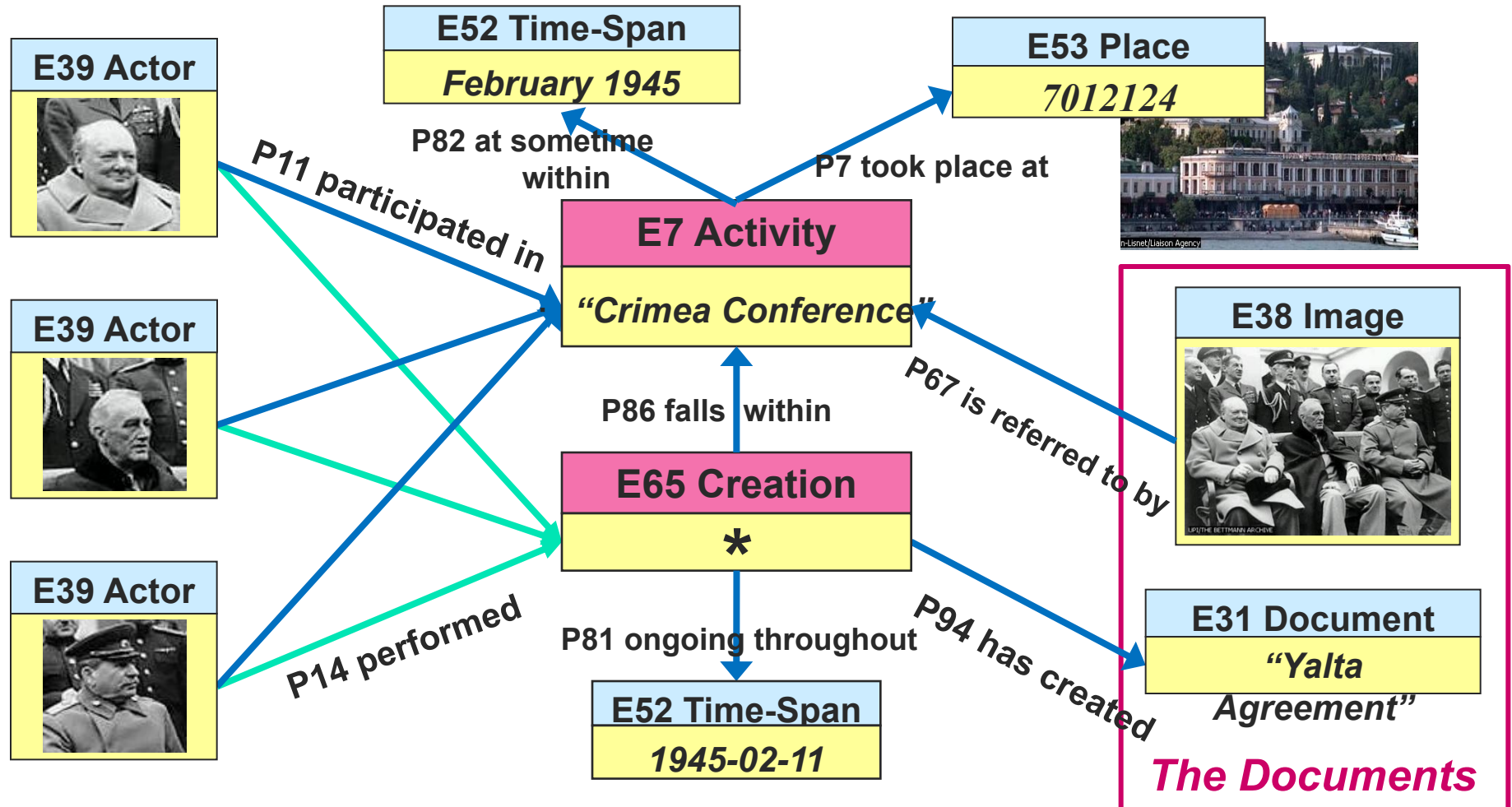
Photos, Persons





CRM & Extensions

CRM: Explicit Events, Identity in Reality



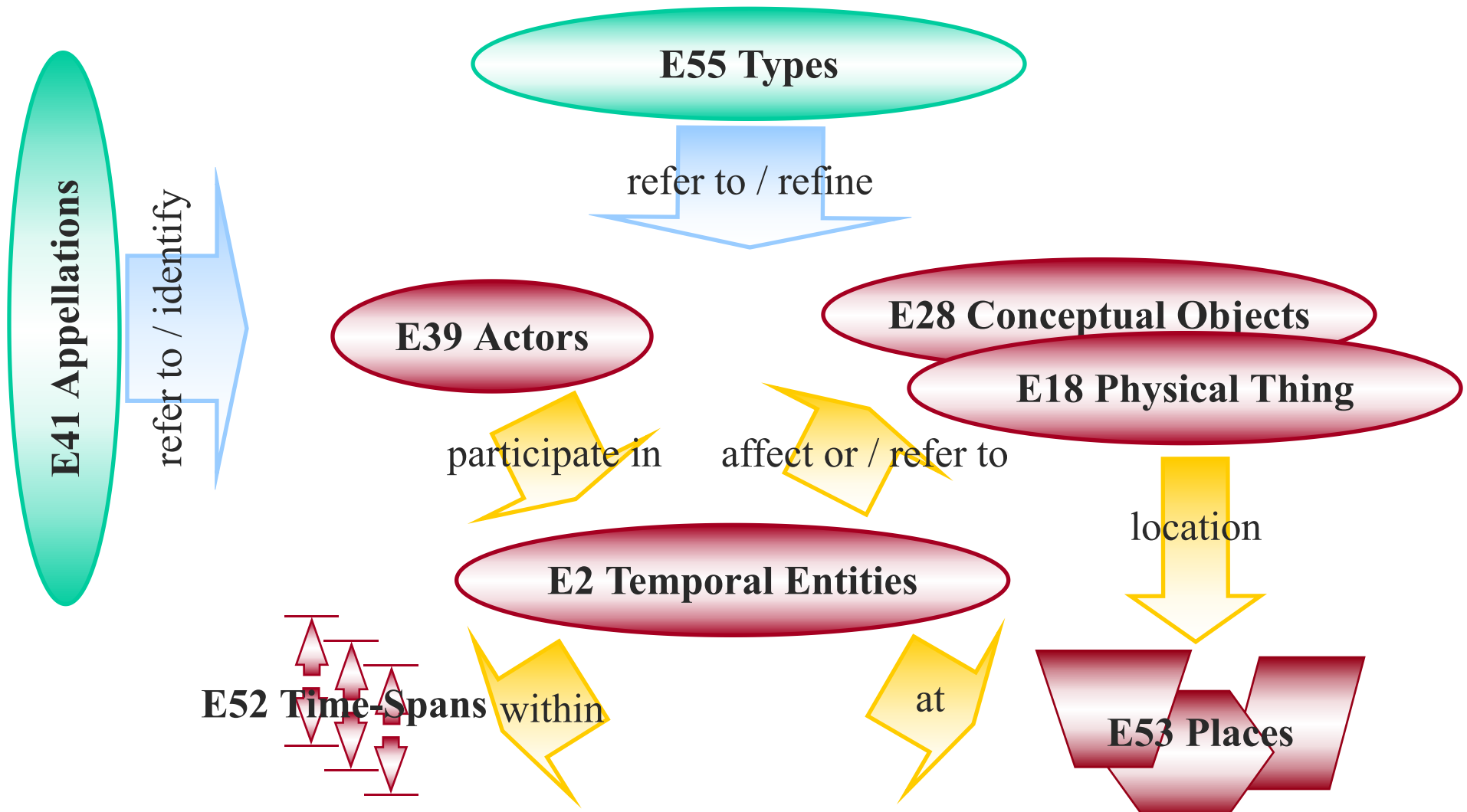
The World !

*provenance =>
<= aboutness*



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Top-level classes useful for integration





CRM & Extensions

Extension by Specialization Hierarchies

- E2 Temporal Entity
 - Properties: P4 has time-span (is time-span of): E52 Time-Span
- IsA ↑
- E4 Period
 - Properties: P7 took place at (witnessed): E53 Place
 - P9 consists of (forms part of): E4 Period
- IsA ↑
- E5 Event
 - Properties: P12 occurred in the presence of (was present at): E77 Persistent Item
 - P11 had participant (participated in): E39 Actor
- IsA ↑
- E7 Activity
 - Properties: P14 carried out by (performed): E39 Actor
 - P20 had specific purpose (was purpose of): E5 Event
 - P21 had general purpose (was purpose of): E55 Type
 - P16 used specific object (was used for): E70 Thing
 - P125 used object of type (was type of object used in) E55 Type



CRM & Extensions

The CIDOC CRM...

- ...captures the underlying semantics of relevant documentation structures in a **formal ontology**.
- Ontologies are **formalized knowledge**: clearly defined concepts and relationships about **possible states of affairs** in a (real) domain
- Ontologies can be understood by people and processed by machines to enable data exchange, data integration, query mediation etc.
 - Data structures can be **explained by ontologies** intellectually and formally (“mapping”)
 - Data can be **transformed** between data structures automatically when they relate to a **common ontology**.
 - Data structures and databases **deviate** from the ontology in well-defined ways for dealing with **contradictory** and incomplete knowledge.
 - Data structures may be **adapted to local language** and details.



CRM & Extensions

CRM: “What happened (to...) ?”

Example:

Amphora of Tuthmosis III

Identifier: A2409

Classification: Amphora

Event: **Type:** Excavation

Agent: Stylianos Alexiou

Date: 1951, October

Place: Katsampas, Tomb of the "blue coffin", Heraklion

Event: **Type:** Deposition

Place: Katsampas, Tomb of the "blue coffin", Heraklion

Period: LMIII A1 (14th century BC)

Event: **Type:** Production

Place: Egypt

Period: 18th Dynasty, reign of Tuthmosis III (15th century BC)

(inferred from inscription...)





CRM & Extensions

Utility of the CIDOC CRM...

- Good ontologies can be **extended** without affecting **interoperability**.
- Semantic interoperability in cultural heritage can be achieved with an “**extensible ontology of relationships**” and explicit **event** modeling
- The CRM provides a **shared explanation** rather than the prescription of a common data structure.
- The ontology is a **language** that S/W developers and domain experts can **share**. Therefore it needs interdisciplinary work. That is what CIDOC has provided.



CRM & Extensions

Extending the CRM

The CRM standardizes only *stable* concepts for information *sharing*.

- local extensions are encouraged for subjective concepts and local practices
- ➔ using the CRM starts with 1 property and does not restrict data to CRM

We have now created a *modular* structure

- Maintaining a core so that all extensions are (property) specializations
 - ➔ All more detailed facts can be reached by querying core concepts
 - ➔ For being interoperable, no more restriction of data to a “core vocabulary”!
- **What is “core” is not historical, not community domination, but the *dynamic* result of applying *functional* principles.**

CRM is an *open invitation to extend* it by sharing, respecting and evolving common concepts:

The CRM becomes an open “family of models”



CRM & Extensions

Outcome: CRM compatible Extensions

FRBRoo: modelling the new library practice of IFLA (approved)

- a causal model of intellectual creation and derivation
- how to identify intellectual content
- the thing and the word: integrating museum and library perspectives

PRESSoo: modelling journals and serials (approved)

CRMInf: who said that? – from data to knowledge (under review)

- integrating data with their scholarly **justification**
- being validated with scholarly **annotations**



CRM & Extensions

Outcome: CRM compatible Extensions

CRM_{sci}: a Scientific Observation model (under review)

- generalizes over **INSPIRE, OBOE, SEEK, Darwin Core**
- generalizes concepts of **units of matter** and their “(physical) **genesis**”
- introduces concept of **observation** and data **evaluation**
- validated in **archeology, biodiversity** and **geology**

CRM_{archaeo}: an Excavation model (under review)

- introduces concepts of stratigraphy and excavation
- being validated by archaeological records

CRM_{BA}: a Building Phases Model (under review)

- introduces concepts morphological and physical building units
- reconstruction of building phases from stratigraphy of walls



CRM & Extensions

Outcome: CRM compatible Extensions

CRMgeo: a Spatiotemporal model (to be reviewed)

- integrates CRM with OGC standards
- a complete model of phenomena occupying spacetime for reasoning with incomplete spatial data at different times.
- integrates geometry- and semantics-derived topological relations
- core concepts being integrated into CRM

CRMdig: a model of Digitization processes (to be reviewed)

- provenance of digital data from empirical processes

CRMsoc: a model of social activities and institutions? (initiated)

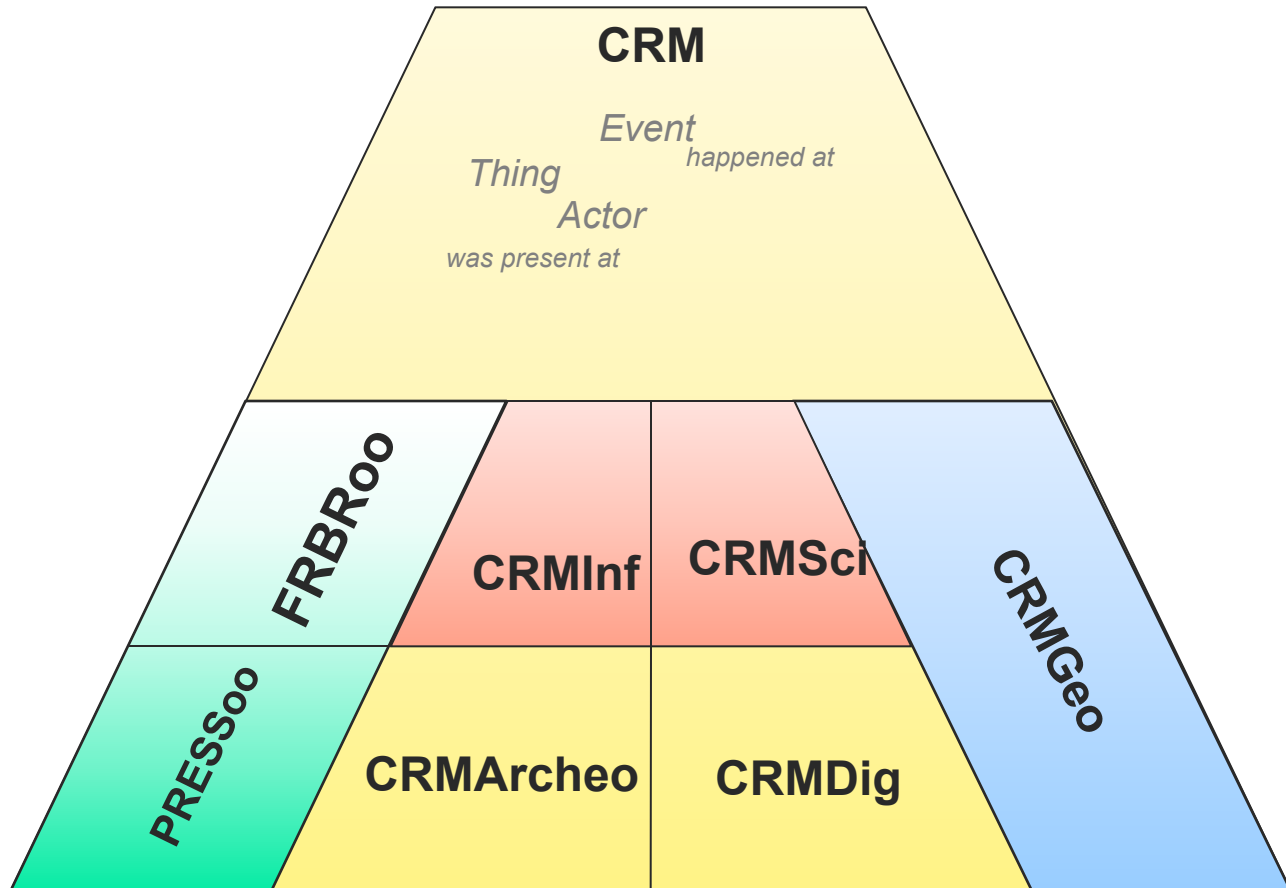
- to be developed with you!



CRM & Extensions

CIDOC CRM extension suite

CIDOC
Conceptual Reference Model (CRM)



*Few concepts,
high recall*

*Special concepts,
high precision*





CRM & Extensions

FRBR₀₀ :

“who’s idea was that?”

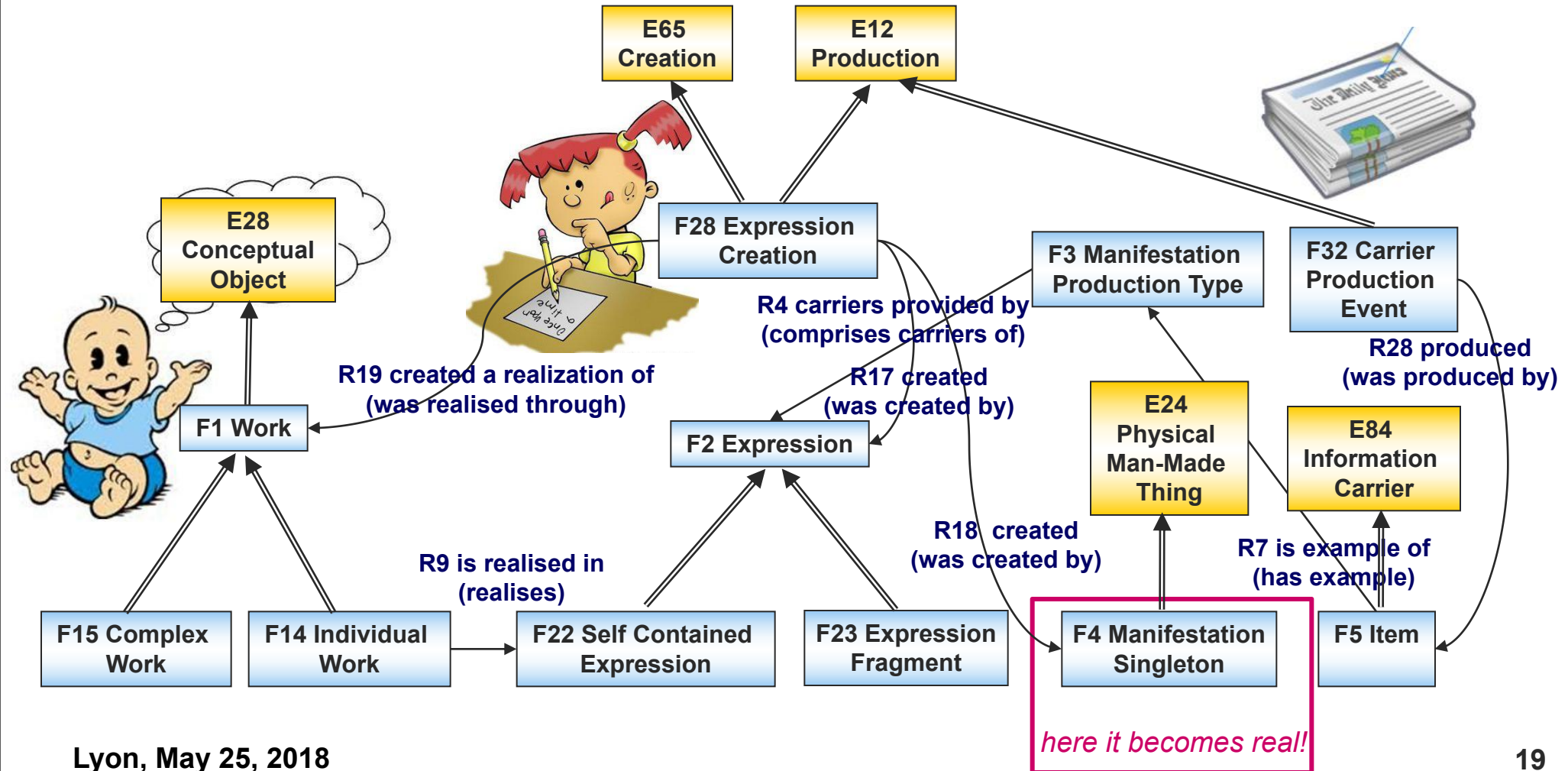
“do you have a translation of...?”



CRM & Extensions

The Externalization

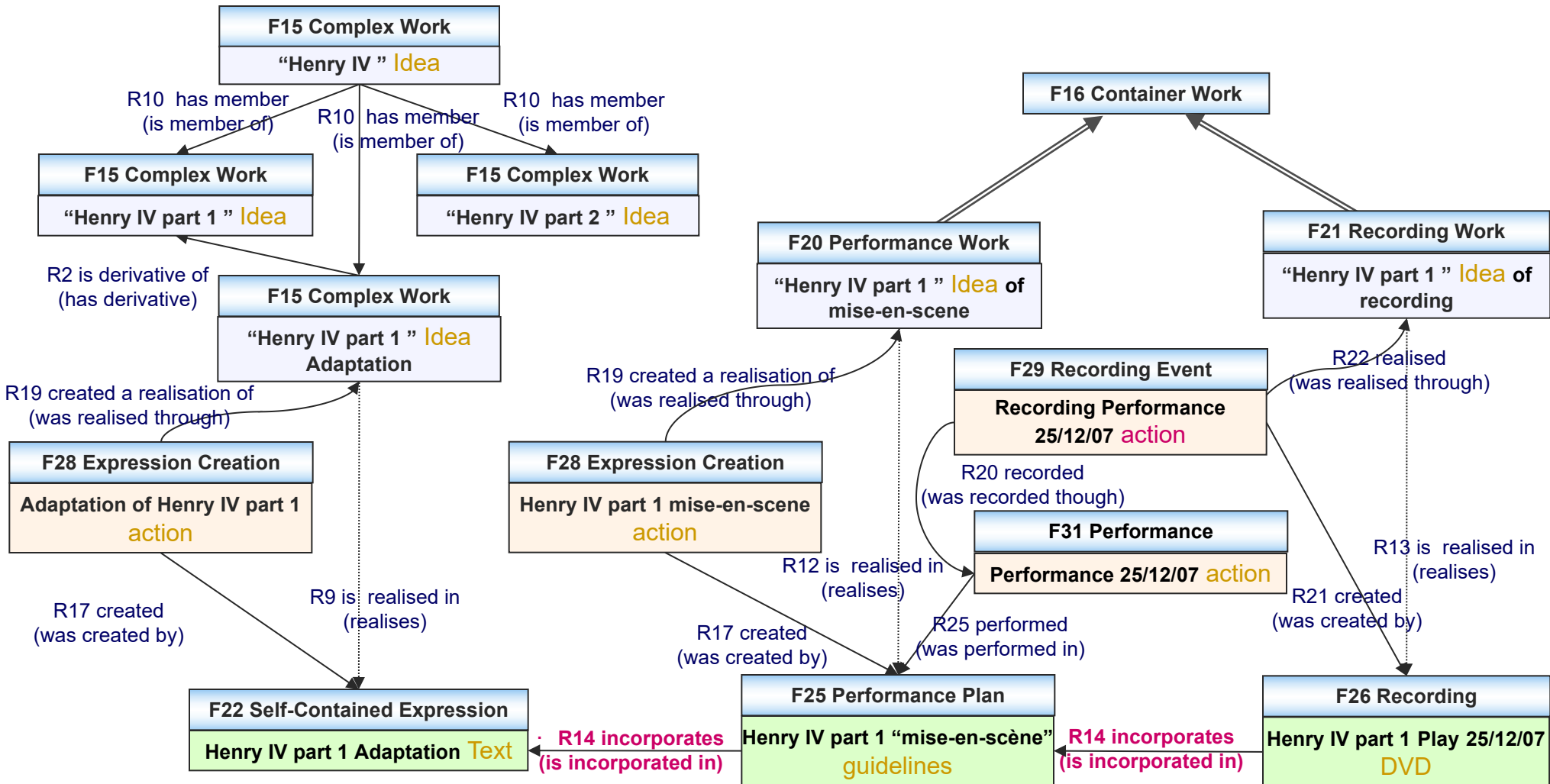
A Causal Interpretation of FRBR





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Performing Arts : An “Added Value” Chain





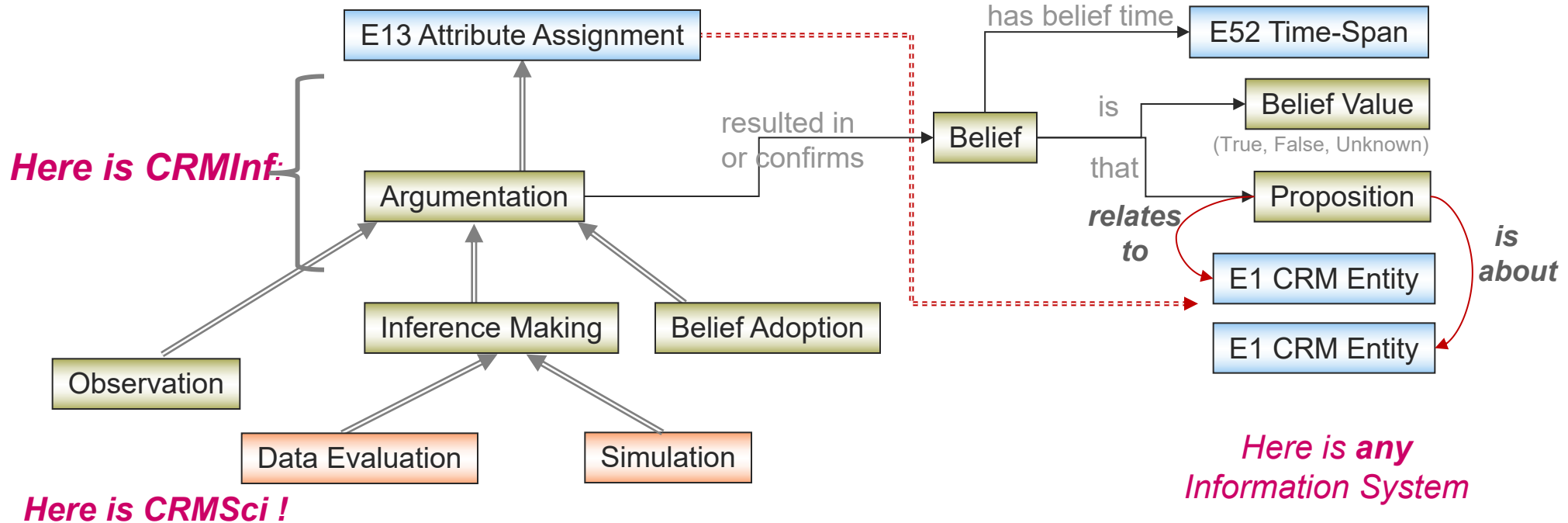
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CRMInf :
“why is it true that?”



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The Three Sources of Scientific Knowledge



CRMSci:

Knowledge from observation, data evaluation and (computer)simulation

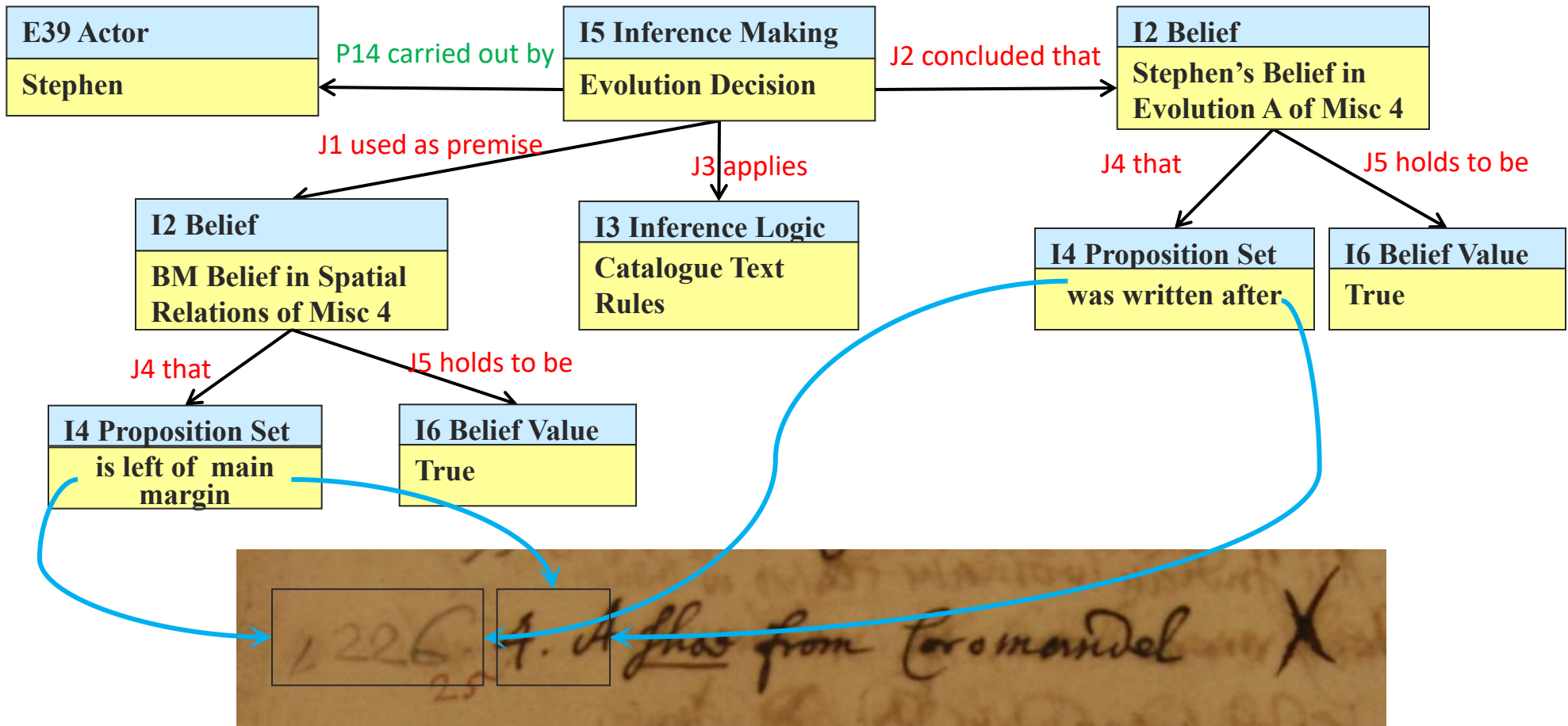
(engineered from OBOE, SEEK, INSPIRE Darwin Core etc)





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Modelling my Beliefs in Evolutions A, B and C



Hans Sloane collection inventory entry



CRM & Extensions

CRMsci

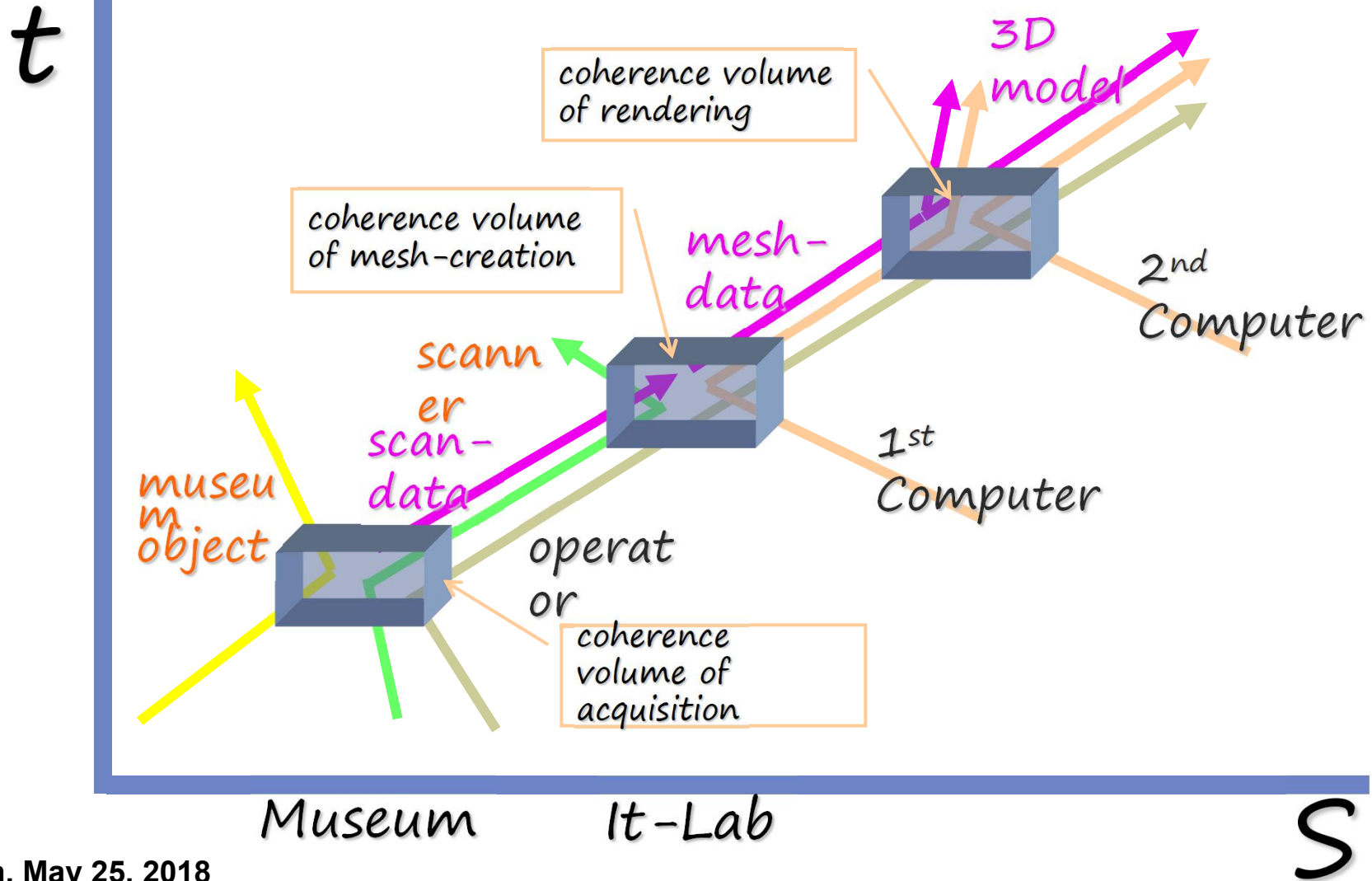
“what have you seen there?”

“how did you calculate that?”



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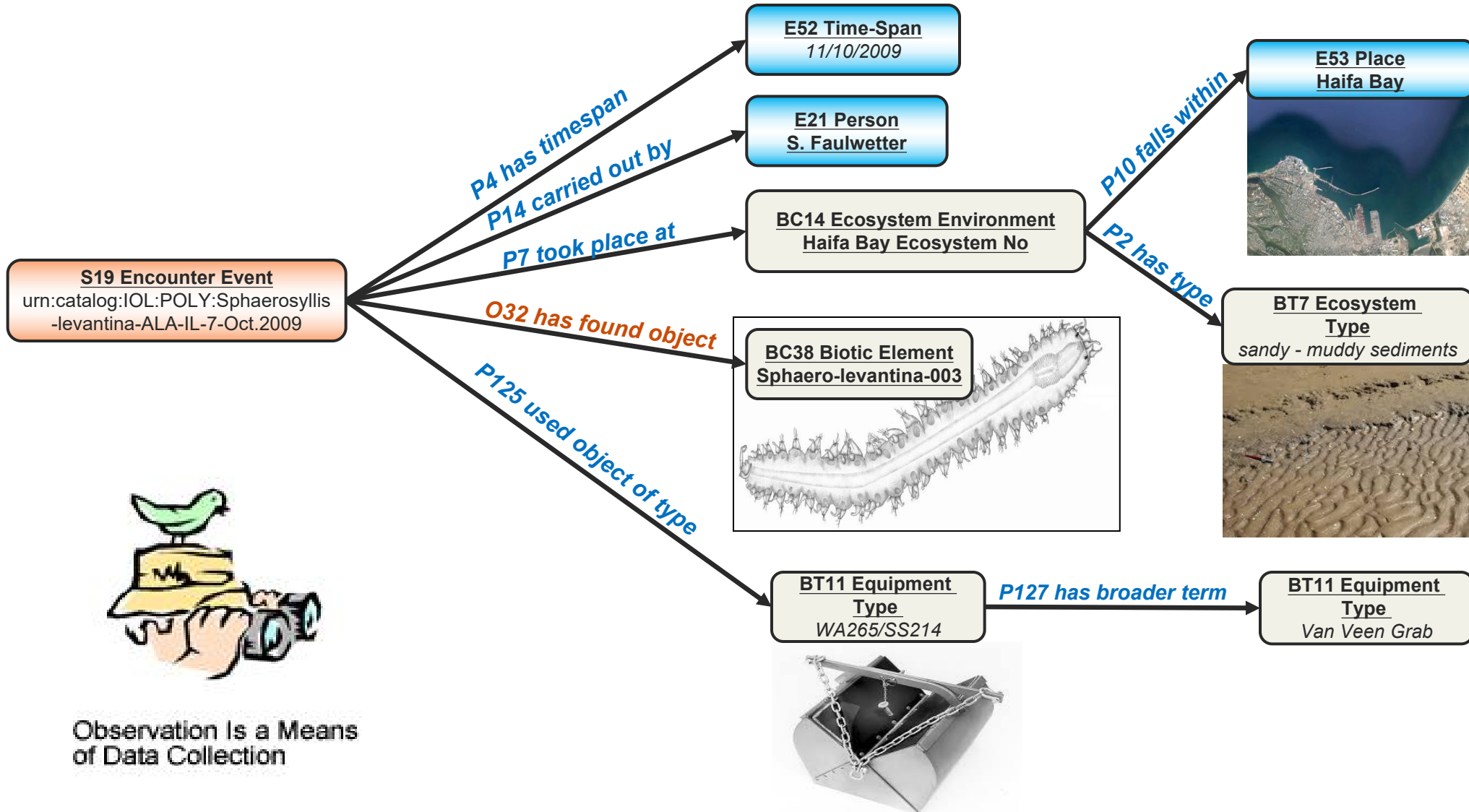
Scanning and 3D Model Creation as Meetings





CRM & Extensions

Biodiversity App: "Occurrence Discourse"





CRM & Extensions

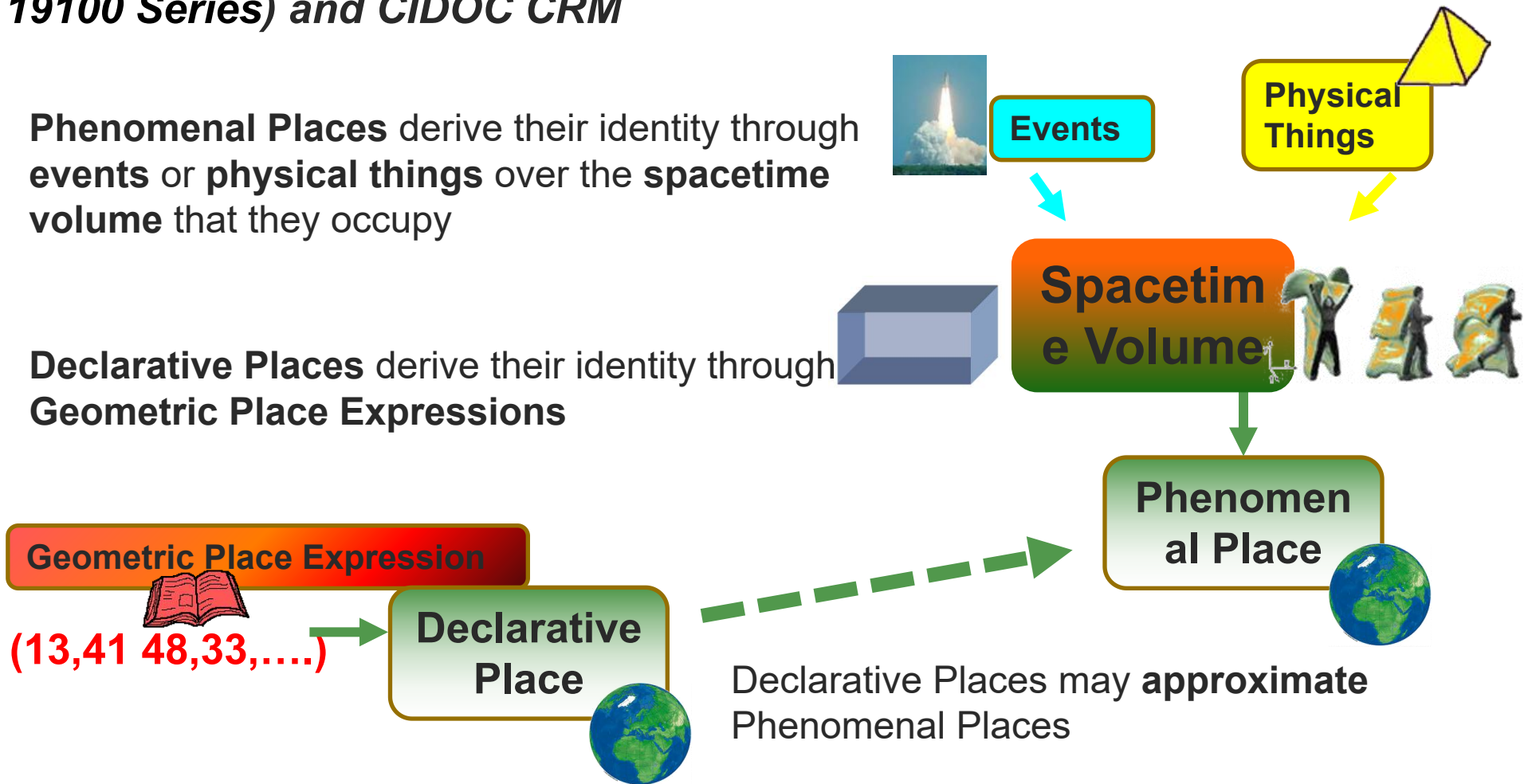
CRMgeo:
“where was it then really?”

CRMgeo – Spatiotemporal information

Integration of Geoinformation (OGC ISO 19100 Series) and CIDOC CRM

Phenomenal Places derive their identity through **events** or **physical things** over the **spacetime volume** that they occupy

Declarative Places derive their identity through **Geometric Place Expressions**



Real world

Observation & Declarative Place creation



Physical Thing

Spacetime Volume

(1) Phenomenal Place

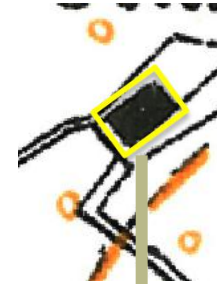


World described by information

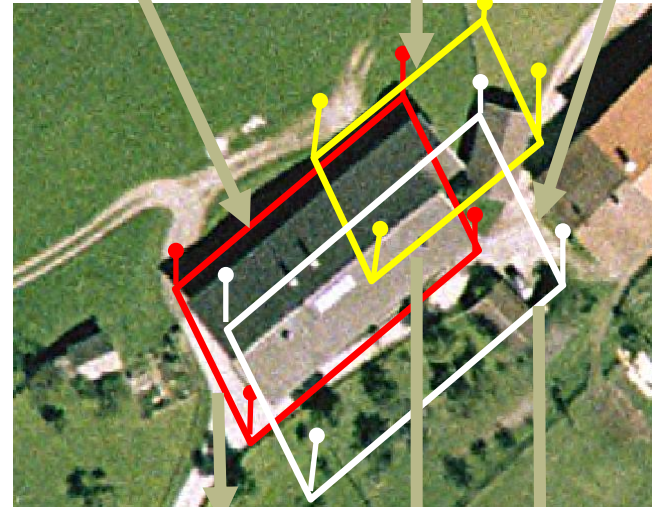
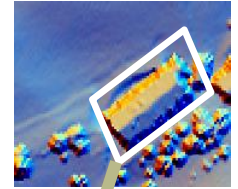
a) Orthofoto



b) Historic Map



c) Laserscan



(4) approximate

(3) Declarative Place

(3) Declarative Place

(3) Declarative Place

(2) Fuzzy zone



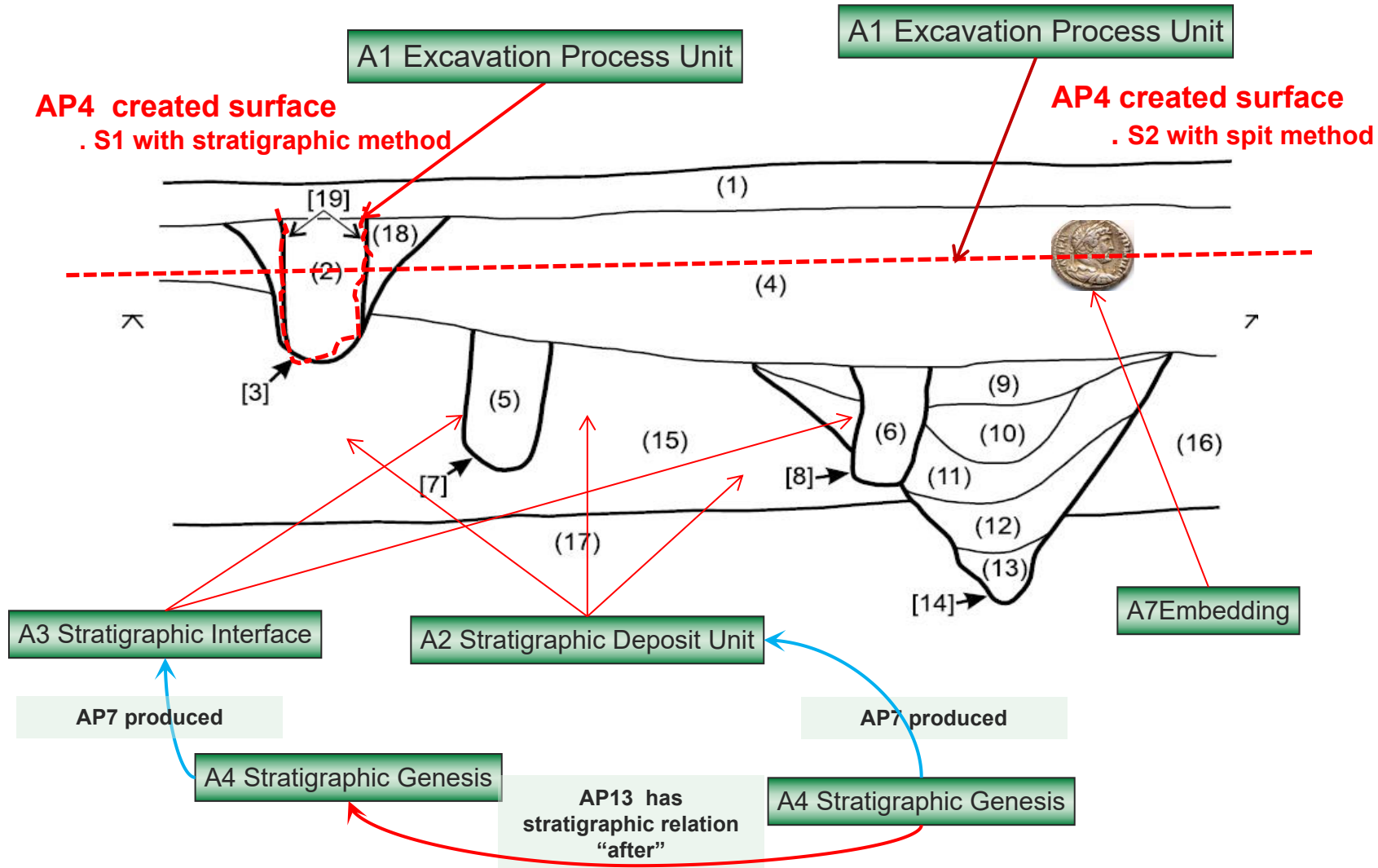
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CRMArcheo / CRM_{BA}:
“what was here before?”



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CRM_{Marcheo}: Excavation is Observation





CRM & Extensions

CRM Digital 2.5

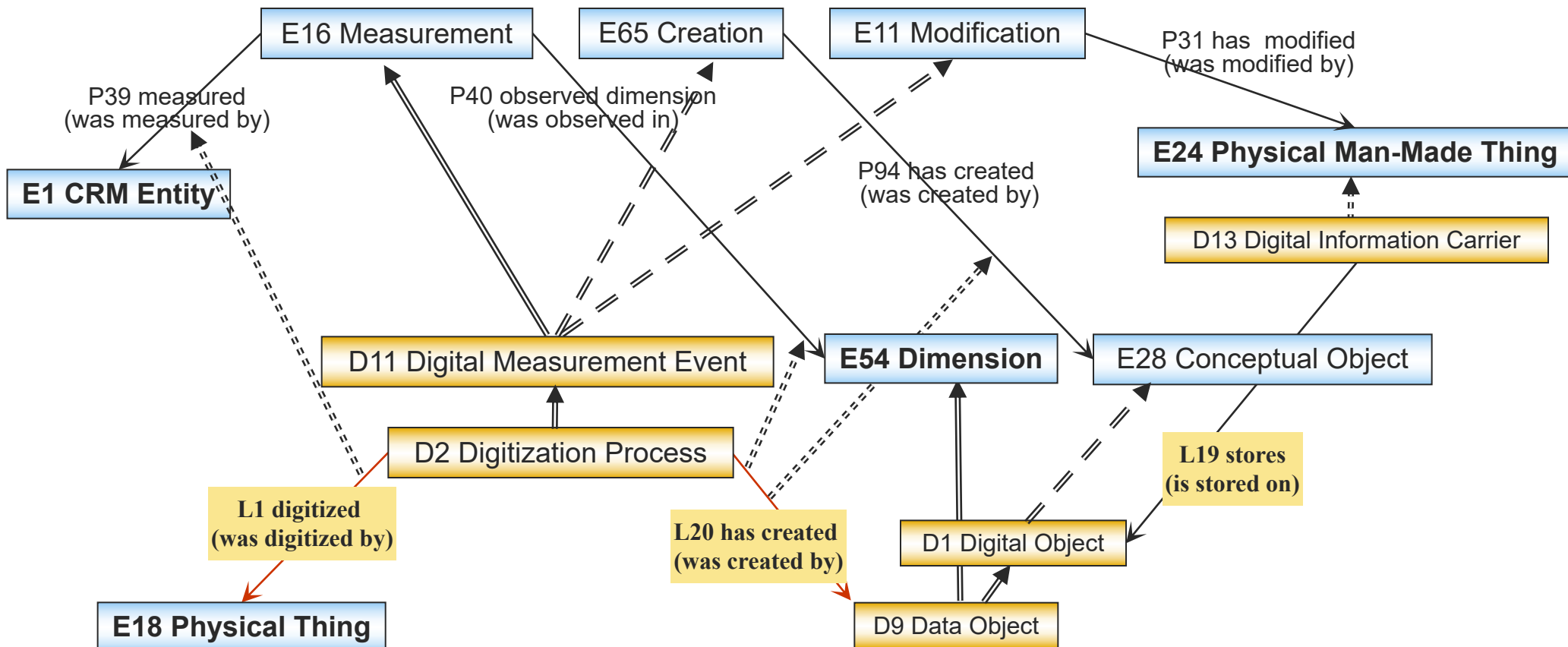
How was this measured and computed?



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CRM Digital 2.5: Digitization

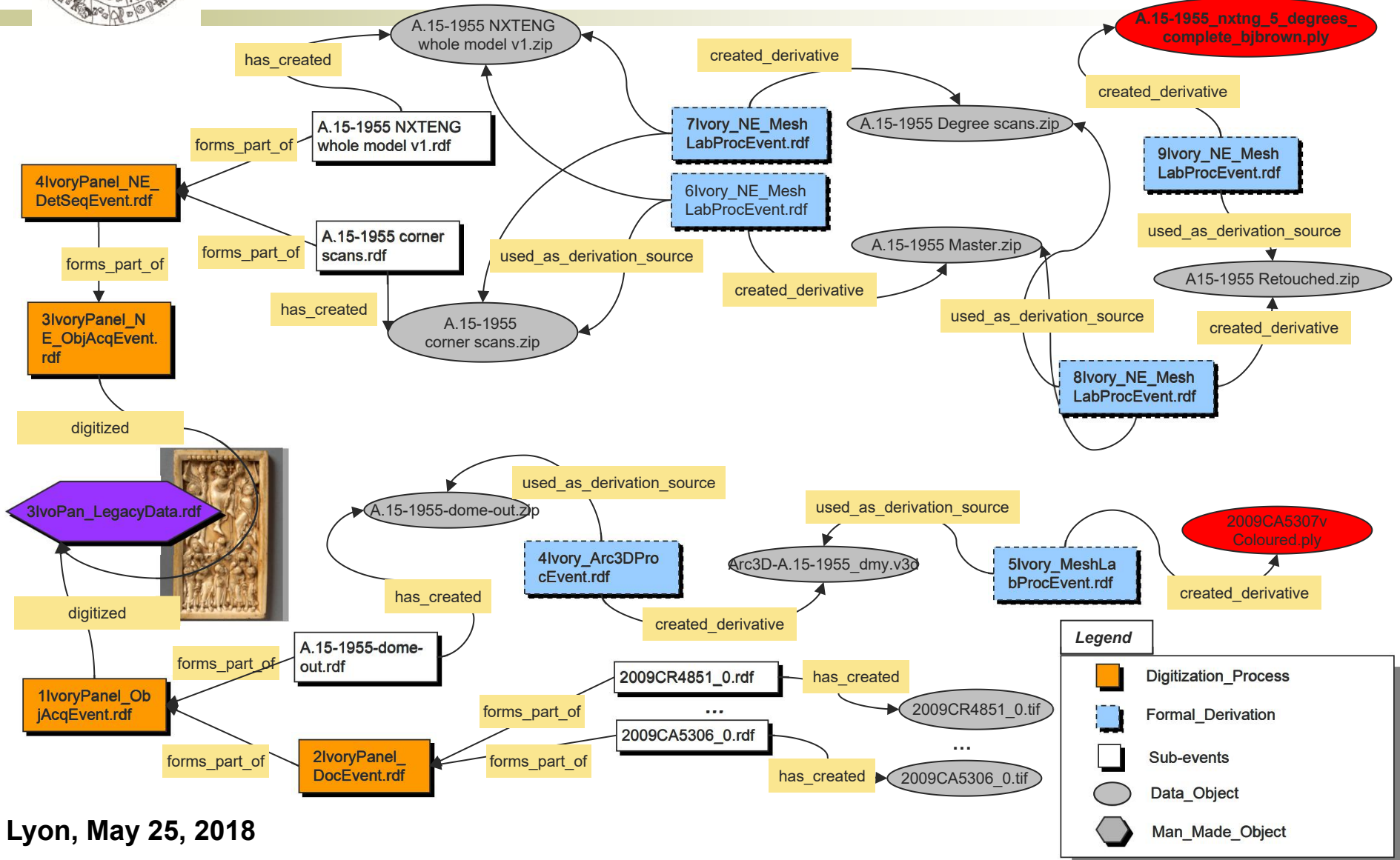
Digitization = feature transfer from physical to digital





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3D-COFORM: Concatenated Metadata





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Conclusions

**The CIDOC CRM with its extensions allows to create
*global networks of integrated knowledge***

**about *human history*, its *evidence* and scientific *observation* regardless
discipline and in surprising detail,..**

....and you can **add more detail**.

We look forward to work with you!