A Meta-Level CIDOC-CRM Model for Representing Intangible Heritage Patterns

The Case of the Tuna Canning Industry in the Low Guadiana

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Motivation

- Cultural heritage comprises both tangible and intangible elements
- CIDOC-CRM has become the most widely adopted semantic model for cultural heritage documentation
- However:
  - CIDOC-CRM has been deliberately developed at the factual level, focusing on specific historical instances (e.g., activities happened at a specific time by specific actors)
  - It lacks support for higher-level conceptual structures associated patterned forms of (intangible) heritage: recurring activities, practices, collective behavior, tradition, …

- *How to model an activity pattern of (intangible) heritage interest?*
  - Examples*:* pottery production, metalworking, textile production, burial practices, farming cycles, seasonal mobility, trade routes, maritime transport, cooking, … … …

Case Study: Industrial practices and process

- The case of the low Guadiana canning industry

(a) Aerial photography of Vila real de Santo Antonio in 1960

(b) Aerial photograph of Ayamonte, 1963

The warehouses of the various canning factories and the port of Vila real de Santo Antonio and Ayamonte

Source: (a) Alexandre Tavares da Fonseca. Centro Portugues de Fotografia, Cota: PT/CPF/TAV/VA/0078/000003. (b) File 582, Ayamonte Municipal Archive.

Case Study: Industrial practices and process

- The case of the low Guadiana canning industry

Geodatabase of the canning industries documented in the first phase of the research.

A total of 73 assets (old canning fabrics) were documented in a preliminary inventory

Case Study: Industrial practices and process

- The case of the low Guadiana canning industry

(a) Tuna fishing technique known as "Almadraba"

(b) Tuna cutting head technique known as "Ronqueo"

(c) Women workers at Ramirez industry

A process or technique (intangible) linked to mobile elements and immovable spaces/buildings

Source: Exhibition catalogue dedicated to the Canning Industry. Archive of Vila Real de Santo Antonio.

Case Study: Industrial practices and process

- The **tuna canning process** from fishing to commercialization

Carried out by group of ***men workers***

1. Tuna Capture (“Almadraba tecnique”)
2. Transportation to the fabrics
3. Tuna measurement
4. Cut of the Tuna (known as “roqueo”)
5. Blood removal
6. Cooking
7. Dry — ***women or men workers***

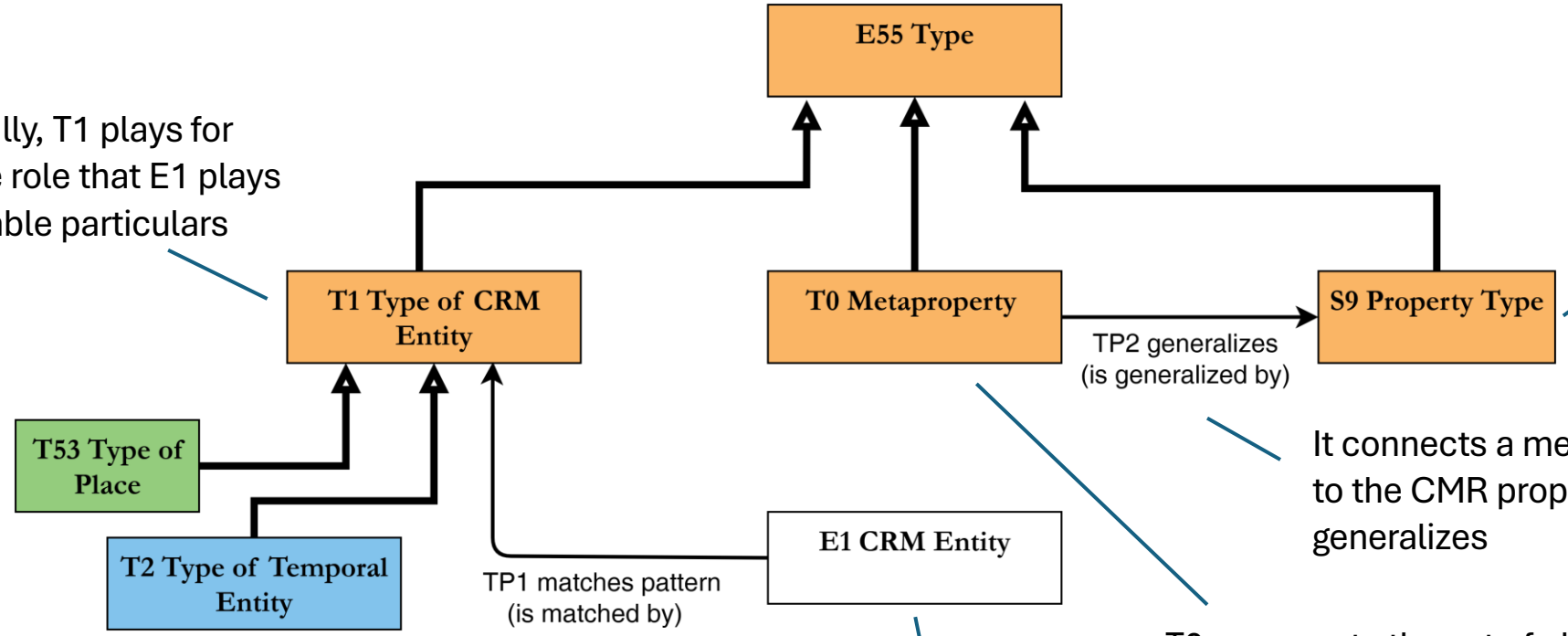
women workers

8. Cooling (Arrefecer)
9. Cleaning
10. Placement of tuna in baskets

11. Placement of tuna in tins
12. Olive oil addition
13. Seaming
14. Inspection
15. Tins fitted in steel baskets
16. Sterilization
17. Cleaning tins
18. Package in cases

women or men workers

The MetaCRM model



Conceptually, T1 plays for "types" the role that E1 plays for identifiable particulars

CRM properties

It connects a metaproperty to the CMR property it generalizes

T0 represents the set of all metaproperties, i.e., properties that link instances of MetaCRM classes with either instances of other MetaCRM classes or instances of CRM classes

TP1 links an instance of a CRM class to an instance of a MetaCRM class

Identifiable particulars

The MetaCRM model – Metaproperties

- Each property of CIDOC-CRM has the following six metaproperties (instances of T0 Metaproperty):

	Example:
ustyp_<crm_property> = **us**ually…*<crm_property>*…to **ty**pe	*ustyp_P14 carried out by: T39 Type of Actor*
uspar_<crm_property> = **us**ually…*<crm_property>*…to **par**ticular	*uspar_P14 carried out by: E39 Actor*
mutyp_<crm_property> = **mu**st…*<crm_property>*…to **typ**e	*mutyp_P14 carried out by: T39 Type of Actor*
mupar_<crm_property> = **mu**st…*<crm_property>*…to **par**ticular	*mupar_P14 carried out by: E39 Actor*
notyp_<crm_property> = must **no**t…*<crm_property>*…to **typ**e	*ustyp_P14 carried out by: T39 Type of Actor*
nopar_<crm_property> = must **no**t…*<crm_property>*…to **par**ticular	*ustyp_P14 carried out by: E39 Actor*

Each metaproperty starting with “mu” (“must have”) is a subproperty of the corresponding metaproperty starting with “us” (“usually has”).

The MetaCRM model – Metaproperties

- usually associated to

Mnemonic	Description	Explanation	Example
ustyp	usually … to a type	An instance of a meta-class (for example an activity pattern, i.e. instance of T7 Type of Activity), is usually associated with the CRM property (e.g., P14 carried out by) to another instance of a meta-class (e.g. **the type of actor who usually carried out the activity**, i.e. instance of T39_Type_of_Actor).	ustyp_P14 carried out by
uspar	usually … to a particular	An instance of a meta-class (e.g. an activity pattern, i.e. instance of T7 Type of Activity), is usually associated with the CRM property (e.g., P14 carried out by) to a particular instance of a CRM class (e.g. **a particular actor who usually carried out the activity**, i.e. instance of E39_Actor).	uspar_P14 carried out by

The MetaCRM model – Metaproperties

- must associated to

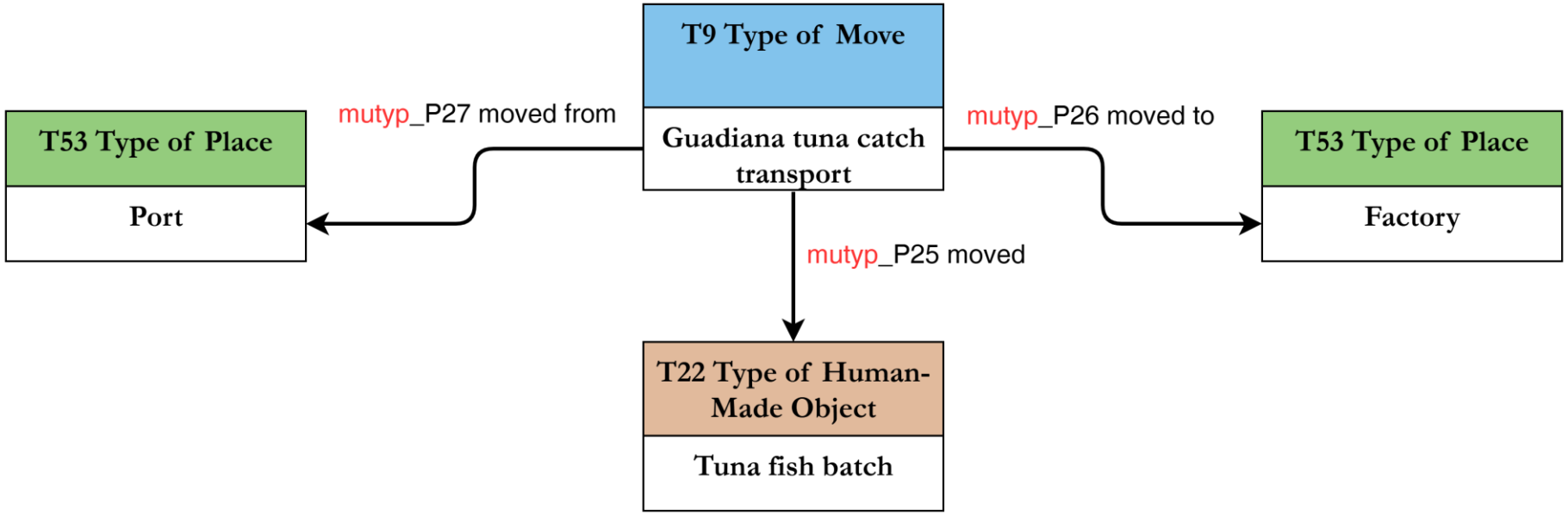
Mnemonic	Description	Explanation	Example
mutyp	must … to a type.	An instance of a meta-class (e.g. an activity pattern, i.e. instance of T7 Type of Activity), must always be associated with the CRM property (e.g., P14 carried out by) to another instance of a meta-class (e.g. **the type of actor who must always have carried out the activity**, i.e. instance of T39_Type_of_Actor).	mutyp_P14 carried out by
mupar	must … to a particular.	An instance of a meta-class (e.g. an activity pattern, i.e. instance of T7 Type of Activity), must always be associated with the CRM property (e.g., P14 carried out by) to a particular instance of a CRM class (e.g. **a particular actor who must always have carried out the activity**, i.e. instance of E39_Actor).	mupar_P14 carried out by

The MetaCRM model – Metaproperties

- must not associated to

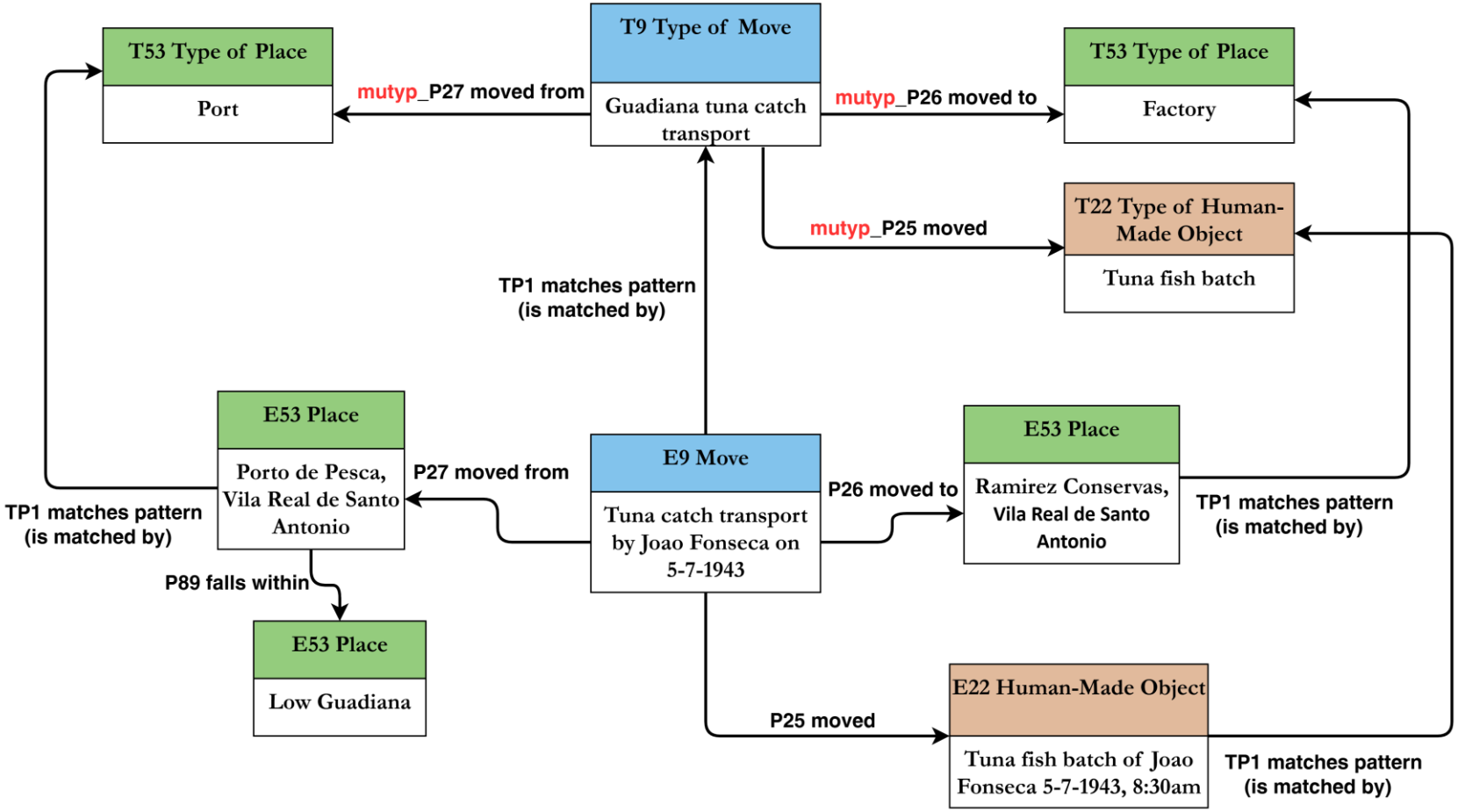
Mnemonic	Description	Explanation	Example
notyp	must not … to a type	An instance of a meta-class (e.g. an activity pattern, i.e. instance of T7 Type of Activity), must not be associated with the CRM property (e.g., P14 carried out by) to another instance of a meta-class (e.g. the **type of actor who must not have carried out the activity**, i.e. instance of T39_Type_of_Actor).	notyp_P14 carried out by
nopart	must not … to a particular	An instance of a meta-class (e.g. an activity pattern, i.e. instance of T7 Type of Activity), must not be associated with the CRM property (e.g., P14 carried out by) to a particular instance of a CRM class (e.g. a **particular actor who must not have carried out the activity**, i.e. instance of E39_Actor).	nopar_P14 carried out by

The MetaCRM model – Application Example

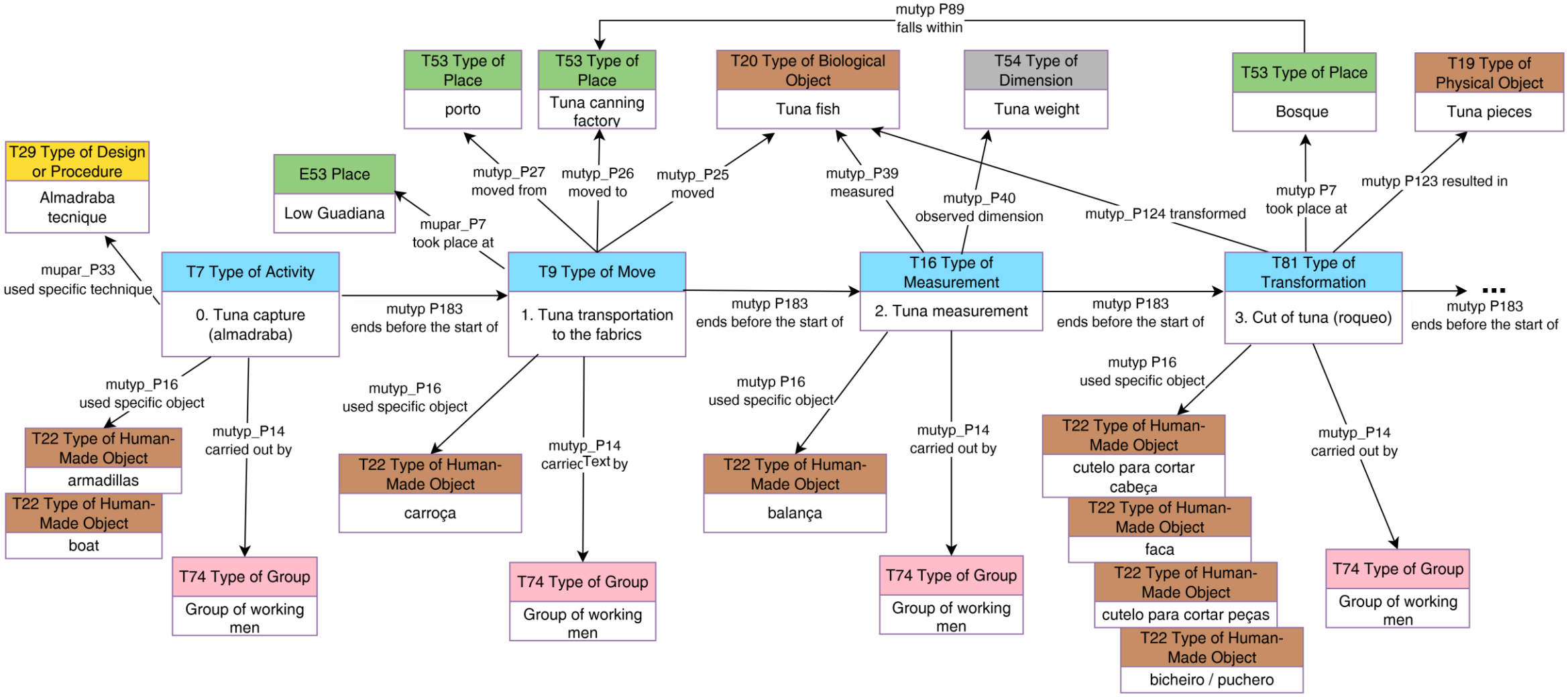


The MetaCRM model – Application Example

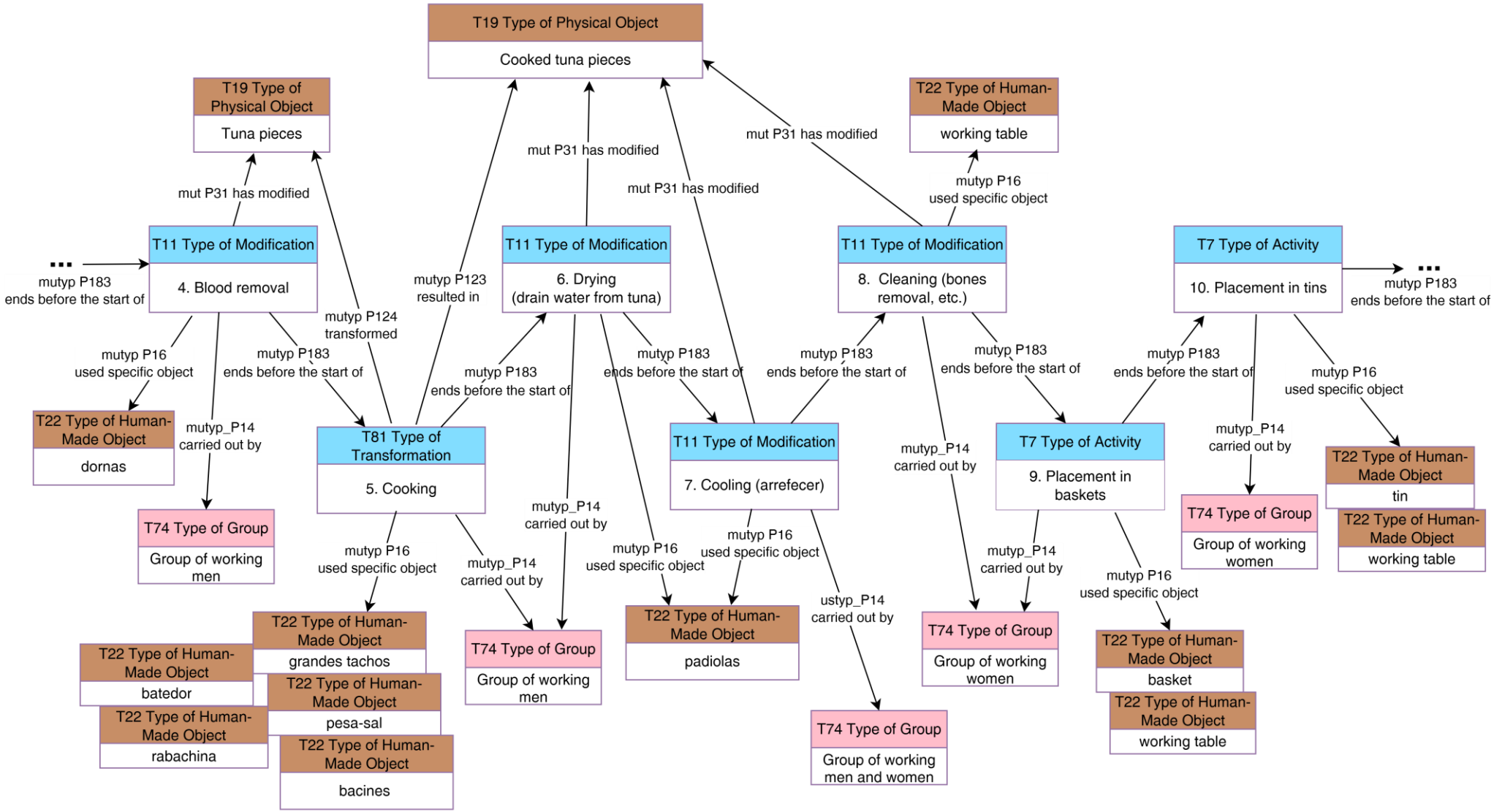
- Connecting MetaCRM instances to CRM instances



Modelling the tuna production activities with MetaCRM
(1/2)



Modelling the tuna production activities with MetaCRM
(2/2)



Querying the Data

- Example questions that can be answered include:
  1. Find activity types that must be carried out by groups of women workers.
  2. Find activity types that succeed the “cooking” activity type in their correct order.
  3. Find objects and/or techniques used in the “tuna capture” activity type.
  4. Find activity types that take place within the factory.
  5. For a given historical tuna-canning factory (e.g., Fábrica de Conservas de Pescado Ramirez), list which stages of the general workflow were realised there.
  6. Find particular historical events that instantiate (match) the activity type “tuna capture”.
  7. Find the activities that used a specific type of tool.
  8. Find activities of historical/cultural interest that took place in Portugal during the period 1850-1910.

Querying the Data

- Example questions that can be answered include:
  1. Find activity types that must be carried out by groups of women workers.

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX metacrm: <https://isl.ics.forth.gr/metacrm/>
SELECT ?activity ?activityLabel
WHERE {
   ?activity
       rdfs:type metacrm:T7_Type_of_Activity ;
       rdfs:label ?activityLabel ;
       metacrm:mutyp_P14_carried_out_by <http://example/group-women>
}
```

Current Implementation

- Implementation of MetaCRM for CIDOC-CRM version 7.1.3 and code to produce the RDFS for any CRM version:

  https://gitlab.isl.ics.forth.gr/cidoc-crm/metacrm/

- Namespace (resolvable): http://isl.ics.forth.gr/metacrm/

Automated Implementation

- The proposed MetaCRM model can be automatically implemented in RDFS for any version of CIDOC-CRM, using the following "**rules**":
  - **R1.** One "type" class is created for each CRM class
  - **R2.** The class hierarchy in MetaCRM (i.e., the "subclass of" relationships) maintains the class hierarchy of the CRM
  - **R3.** The six (meta-)properties are created for each forward property of the CRM
  - **R4**. The six (meta-)properties are created for each inverse (backward) property of the CRM
  - **R5.** The class "T0 Metaproperty" is defined as a subclass of E55 Type, and all metaproperties (both the forward and backward) are declared as instances of this class
  - **R6**. The property hierarchy in MetaCRM maintains the property hierarchy of the base model for each different type of metaproperty (ustyp, uspar, mutyp, mupar, notyp, nopart)
  - **R7**. Each "must have" metaproperty (starting with "mu") is a subproperty of the corresponding "usually has" metaproperty (starting with "us").
  - **R8.** The property "TP1 matches pattern" is defined with the class "E1 CRM Entity" as the domain and the class "T1 Type of CRM Entity" as the range.
  - **R9.** The property "TP2 generalises" is defined with the class "T0 Metaproperty" as the domain and with the class "S9 Property Type" as the range, and each metaproperty uses it for assigning the CRM property it generalises

Automated Implementation - Comments

- The **inverse-of** relationships of the base model are not defined in the MetaCRM model because such relationships may not be valid for all metaproperties
  - For instance, an exorcism is usually carried out by a priest, but a priest does not usually perform exorcisms. Similarly, a particular place may usually be used for a certain ceremony, but it may not be specific to the ceremony.
  - Studying these types of relationships and how to express them formally is a future work.

- The **.1 properties** of the base model can be implemented in MetaCRM for all six types of metaproperties, following the same approach as that of the base model (using property classes)
  - For example, all six metaproperties of “P14 carried out by” have the property “P14.1 in the role of” for expressing the nature of an actor’s (or actor type’s) participation.

A bit of context and related work

- The term MetaCRM was first introduced by **Martin Doerr** at the CIDOC Conference in St. Petersburg (2003) and later in the 10th CIDOC-CRM SIG Meeting in Nuremberg (2004)
  - Notions of ***Individual Metaclass*** and ***Attribute Metaclass***
  - The CIDOC-CRM "flattened" the metalevel to subclasses and instances of E55 Type, and introduced cross-categorical relations (based on explicit use cases), such as ***P125 used object of type*** generalizing ***P16 used specific object***
- MarineTLO: upper ontology for the marine biodiversity domain (**Tzitzikas et al., 2013**)
  - Categorical information about marine entities is represented explicitly at the metaclass level
  - The model demonstrates the practical value of distinguishing between categorical knowledge (e.g., species, genus, family, event types, etc.) and instance-level data
- Conceptual foundation for documenting tangible and intangible elements of a cultural object (**Carboni and De Luca, 2016**)
  - Symbolic aspects that should be connected with physical elements
  - MetaCRM, and its alignment with CIDOC CRM, is a step towards this direction
- Expressing type-specific observations and negative statements (**Velios et al., 2022**)
  - Enables the explicit modelling of empirical regularities, exceptions, and constraints derived from scholarly analysis
  - Together with MetaCRM, **typed** and **negative typed properties** form a coherent foundation for representing both generalized and counterfactual knowledge, while maintaining alignment with the core semantics of the CIDOC-CRM

Thank you!

Questions?

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