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Micro-Level Modelling in ERA Ontology

Ghislain Atemezing | 11.06.2025 | RDF 2025. Cluj, Romania







Ontology Building – A matter of consensus Scope of RINF TWG micro-level

- Scope:
 - Ensure that RINF elements are connected (OP internal track connectivity, OP-SoL track connection)
 - Provision of accurate geo description
- Objectives:
 - To propose a data presentation and data input for railway elements and the corresponding technical characteristics at different levels of granularity
 - Review of multi-level approach (micro, meso and macro)
- Outputs:
 - To propose modifications for meso-macro alignment
 - Intermediate & final reports and relevant presentations during the WG meetings
 - Any other suggestion for improvement of the model that might come up during the work of this TWG

EUROPEAN A Journey towards Ontology revision & implementation

UNION





Sample Rail network – an example



Operational point and sections of line





Goal of the modelling – Locate the operational point over topology





Reuse of the external ontologies

- > Time ontology validity and parameter time applicability (W3C)
- **GeoSPARQL** for the accurate geographical and schematic representation
- > Organisation for the organizational data model (W3C)

	owl:Class
·····Þ	rdfs:subClassOf
propertyName>	owl:ObjectProperty
LinearElement	erailinearElementSection rdfsisubclassOF erailinearElement equivalent with LinearElementSection
owl:DatatypeProperty - not re	epresented on the diagrams
	Legend



Topology



- Net Elements inherit the **era:Feature** characteristics (geographic, schematic, validity)
- Net Relations define connectivity and navigability relations between net elements
- Linear Elements (sections)
- Non-linear Elements







RINF Index	Name	Ontology	
111012	Tracks connectivity to	era:connectedTo	
1.1.1.0.1.2	operational points		
1.2.4.1	Internal connection	era:connectedTo	

era:connectedTo property defines a connection between two tracks.

- Symmetric if a track A is connected to track B, then track B is also connected to track A.
- Irreflexive a track cannot be connected to itself.

The navigability is based on topology and operational rules like:

- Turnout and switch configurations
- Running direction
- Operational rules and signal dependencies

Simplified connectivity of tracks

Connected to OP

Represents a bidirectional connection between two Track instances.

IRI: http://data.europa.eu/949/connectedTo

Parameter of Track

General Information

Number: 1.1.1.0.1.2 1.2.4.1

Deadline:

12 months after publication of Article 7 Guide

Belongs to parameters group

Running track generic information (1.1.1.0.0)

Data Format

Data Presentation Track



Topology positioning and geographical location





Functional diagram

Infrastructure elements as network entities:

- Sections of line
- Operational points
- Tracks (running tracks, sidings)
- Platform (edges)
- Tunnels
- Signals
- Etc.





Validity and applicability features

Any subclass of era:Feature inherits the temporal features through the **era:validity** property

- Infrastructure entities
- Topology elements
- Relative positions

Parameters' applicability is itself a temporal feature, defining the time interval in which a value of a parameter is applicable. There are 4 possible value types:

- Nominal values
- Planned temporary restrictions
- Permanent restrictions
- Planned temporary closure





Main classes used for the RINF technical characteristics



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RINF data model conceptual diagram







Ontology Metrics





- Evolved from analyzing RINF data model limitations to defining a structured, multi-layered approach
- Went beyond the initial scope to align with EU
 Commission's vision for RINF as the single source of truth

Major Developments

- ✓ Clear semantics integrating legacy multi-layer views
- ✓ Semantical data model ERA Ontology 3.1.x
- ✓ Open-source code GitLab (EPL 1.2 license)
- ✓ Alignment with all TWGs outcome
- Implemented a pipeline for providing data aligned with v.3.1.0 of ERA Ontology

Work in progress

- ✓ Improving validation rules for consistency
- ✓ Harmonization of SKOS concepts with other registers
- ✓ Preparation of a full RDF sample compliant with ERA ontology V3.1.x
- ✓ Support for data providers (IMs)

ERA Ontology. Version 3.1.1



Release: 2025-05-12

Modified on: 2025-05-12 This version:

https://data-interop.era.europa.eu/era-vocabulary

Latest version:

https://data-interop.era.europa.eu/era-vocabulary

Previous version:

https://gitlab.com/era-europa-eu/public/interoperable-data-programme/e

Revision:

v3.1.1

Issued on:

2025-05-12

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Designated RINF Topical Working Groups



ERA Ontology useful links



Mirrored from ssh://****@gitlab.com/era-europa-eu/private/OPDU/SOT/era-ontology/ERA_Ontol Pull mirroring updated 26 minutes ago.

<pre>% main → era-ontology / + →</pre>	Find file Edi
ATEMEZING Ghislain authored 3 weeks ago	7a298fc

Name	Last commit
🗅 .github/workflows	added create release workflow a
🗅 Examples	fixed typos in switch.ttl example
🗅 era-kg	update to version-independent DOI
🗅 era-shacl	updates for release v3.1.1
🗅 era-skos-deprecated	moved the deprecated TrainProte
🗅 era-skos-pre-regulation	Migrate SKOS concept schemes
🗅 era-skos	updates for release v3.1.1
🗅 governance	solved inconsistencies

- ERA Ontology
 - Public GitLab repository <u>EU Agency for Railways</u> (ERA) / Public / Interoperable data programme / ERA Ontology group / ERA Ontology
 - Release v3.1.0– 31st of March 2025 <u>https://data-interop.era.europa.eu/era-vocabulary/v3.1.0/</u>
 - Latest version- May 12, 2025 <u>https://data-interop.era.europa.eu/era-vocabulary/</u>
 - RINF Application Guide Technical Annex browsable version <u>data-interop.era.europa.eu/era-</u><u>vocabulary/rinf-appGuide/</u>

How to contribute

- <u>Issues page</u> for flagging issues and <u>Contribution</u> <u>instructions</u> are available.
- Issues list used for comments and proposed changes (by the time of edit – 87 open; 21 closed)

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