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# ATIEC 2021

16 September  
2021

## BEST

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### Semantics and SWIM

Presentation by: Scott Wilson,  
EUROCONTROL



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# Content

**Introduction: SWIM and Semantics**

**BEST**

research

outcomes

leveraging

**Next Steps**



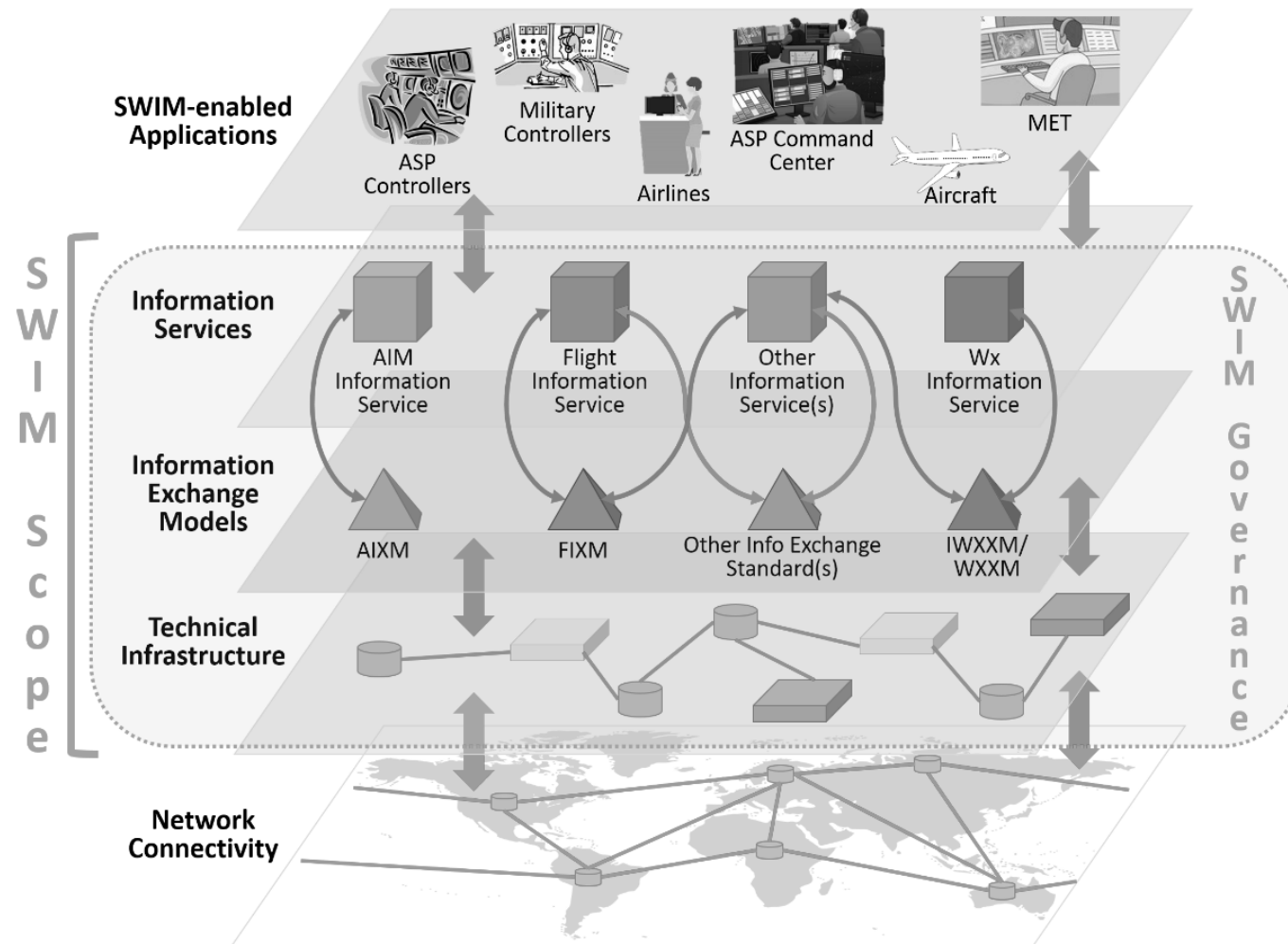


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# What is SWIM?

SWIM emphasizes interoperability





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# What is

What does it mean?

## **Semantics**

the meaning of language constructs

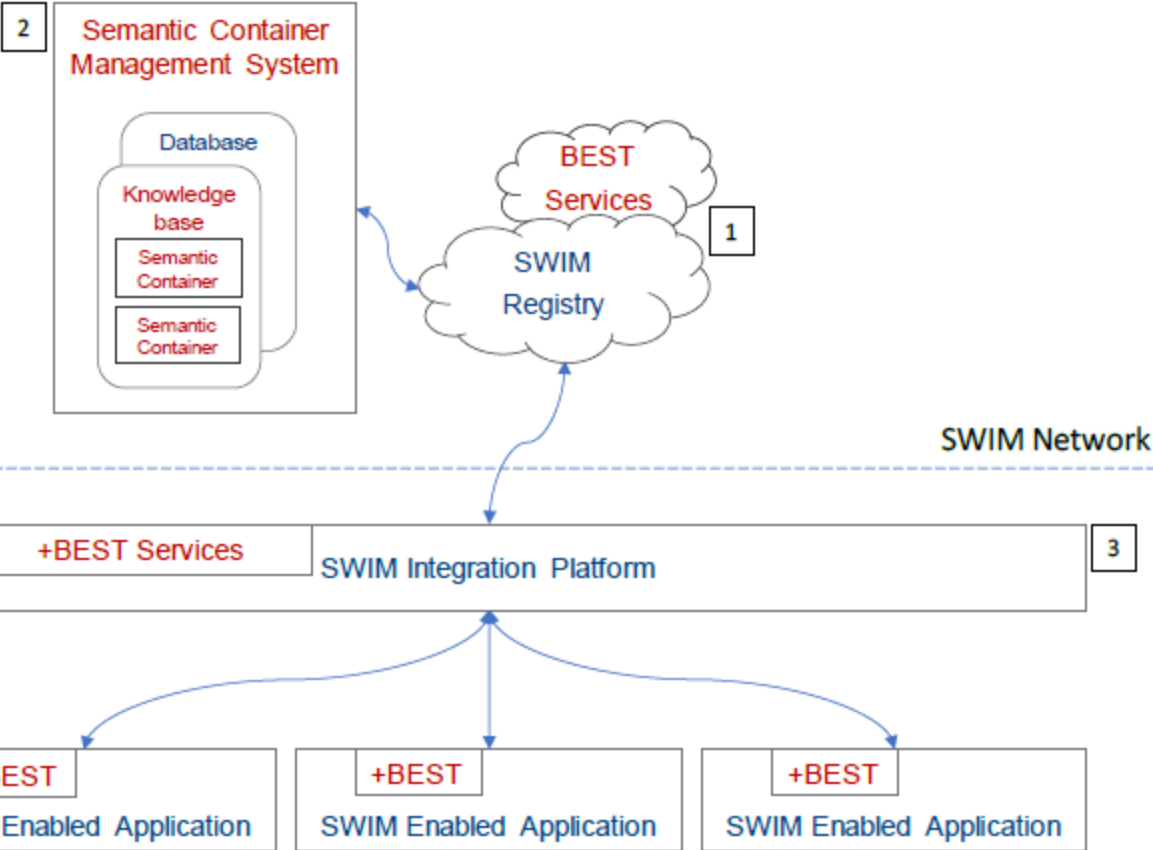
## **Semantic interoperability**

the ability of computer systems to exchange data with unambiguous, shared meaning

## **Semantic technology**

enables machine computable logic, inferencing, knowledge discovery, and data federation between information systems





# It is BEST?

VIM by making smart use of



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### What is SWIM?

SWIM is the answer to achieving *global interoperability* and *service orientation* in air traffic management.



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# What was researched?

automated generation of Web Ontology Language (OWL) ontologies from existing information standards



automated alignment checking



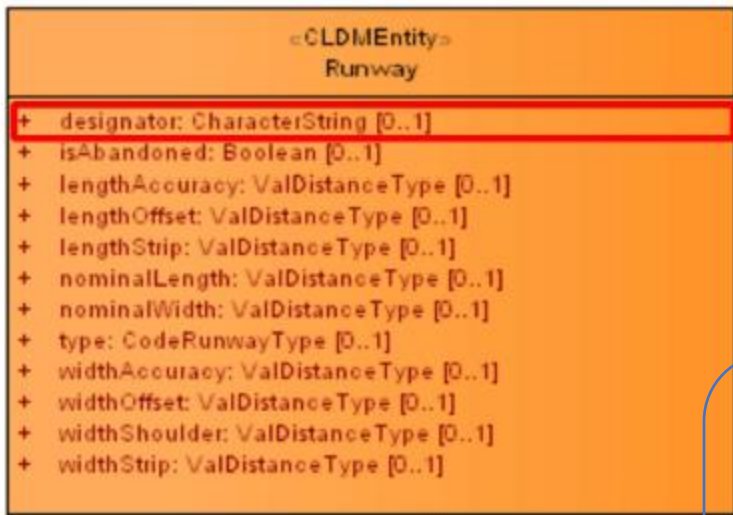
create semantic container descriptions



scalability, modularization, governance aspects



## UML Representation



## OWL Representation

```
<!-- http://www.best-project.org/owl/AIRM#Runway-designator -->  
  
<owl:DatatypeProperty rdf:about="&airm;Runway-designator">  
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>  
  <rdfs:label>designator</rdfs:label>  
  <rdfs:comment>The designator of a runway, used to uniquely identify  
  <rdfs:subPropertyOf rdf:resource="&airm;Runway_DP_" />  
  <rdfs:range rdf:resource="&xsd:string" />  
</owl:DatatypeProperty>
```



# AIRM



# AIRM



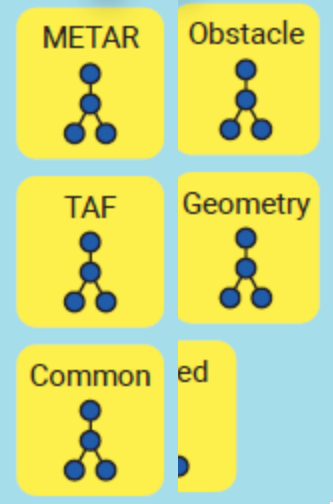
# ?

ogy

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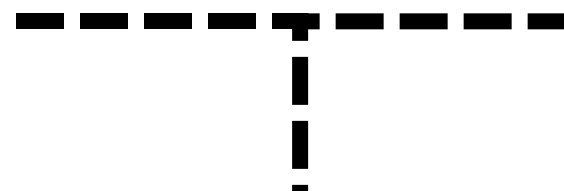
# What was done?

Alignment checking using ontology matching

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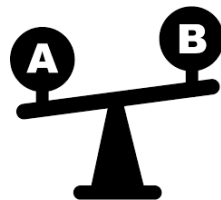
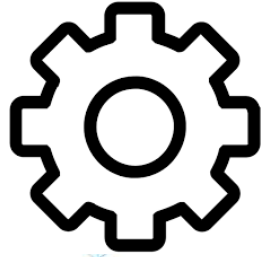
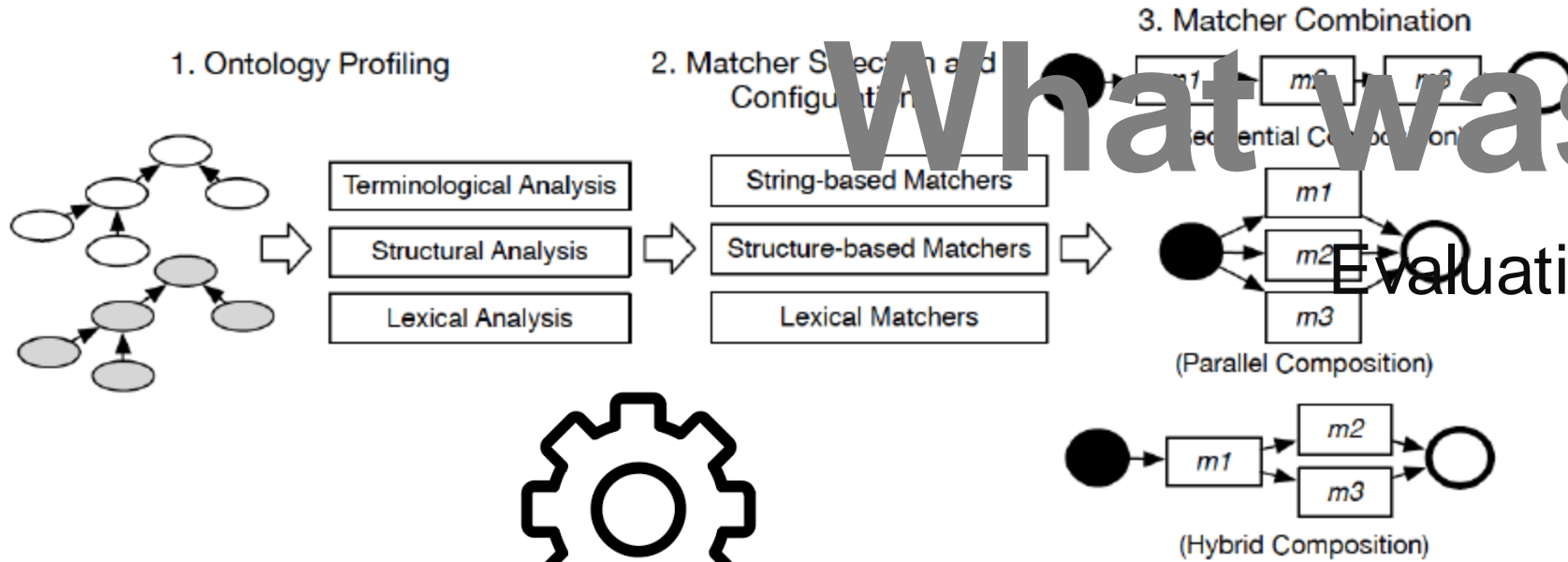
IWXXM

AIXM



# What was done?

Evaluating ontology matching



Manually created reference alignments



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METARs<MUC-FRA,23/2/2017>

--- Membership Condition ---

Data item type: METAR

Origin: DWD

Location: Route MUC-FRA

Time: 2017-02-23

---Administrative Metadata---

Data format: XML

Last change: 2017-02-23T11:00:00

# What was done?

## Semantic containers

The **description** includes a membership condition and administrative metadata, such as provenance, quality, and technical metadata.

Content

The **content** is a set of data items from multiple sources that fulfil the membership condition

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```
<METAR>
  <raw_text>
    PHTO 161053Z
    24005KT 10SM
    FEW027 BKN070 20/18
    A3013 RMK AO2
    RAB21E46 SLP201
    P0000 T02000178
  </raw_text>
  ...
</METAR>
```

<M

<M

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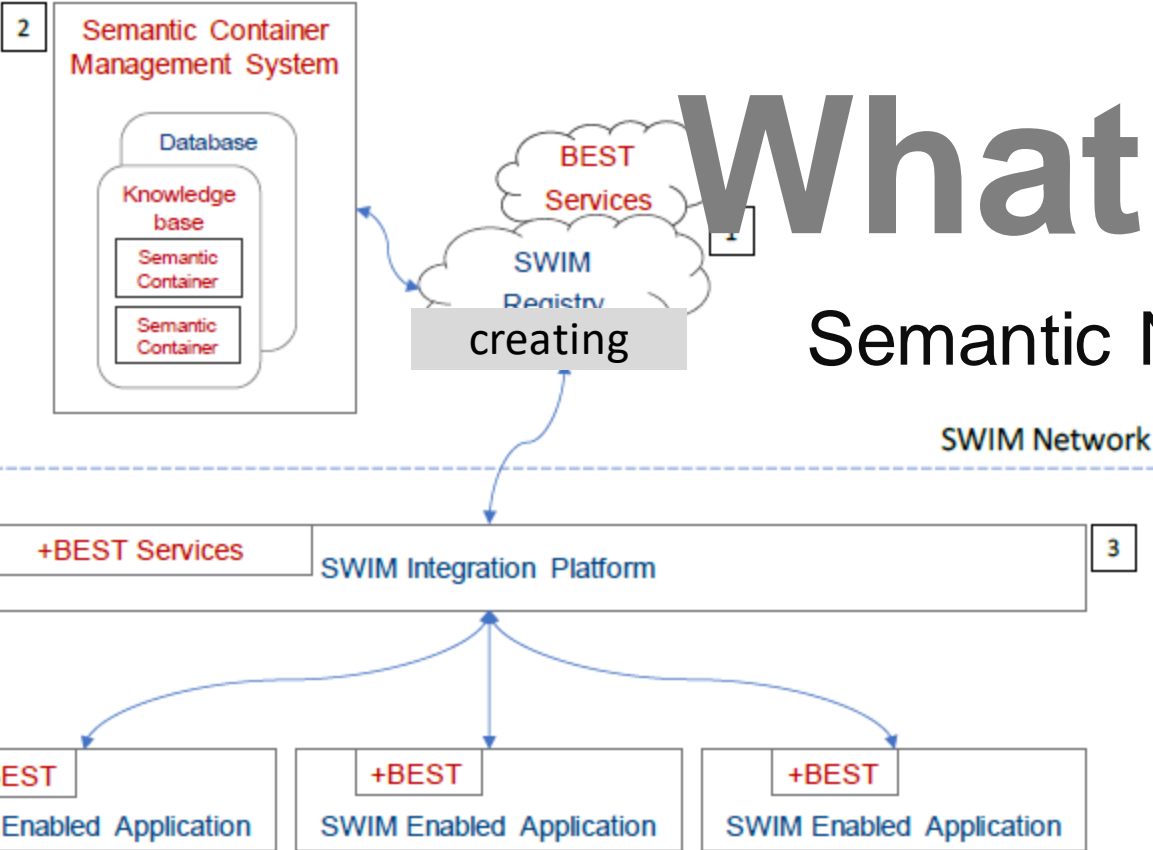
<M

<M



# What was done?

## Semantic NOTAM - Integrating into SWIM



discovering

integrating

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applying



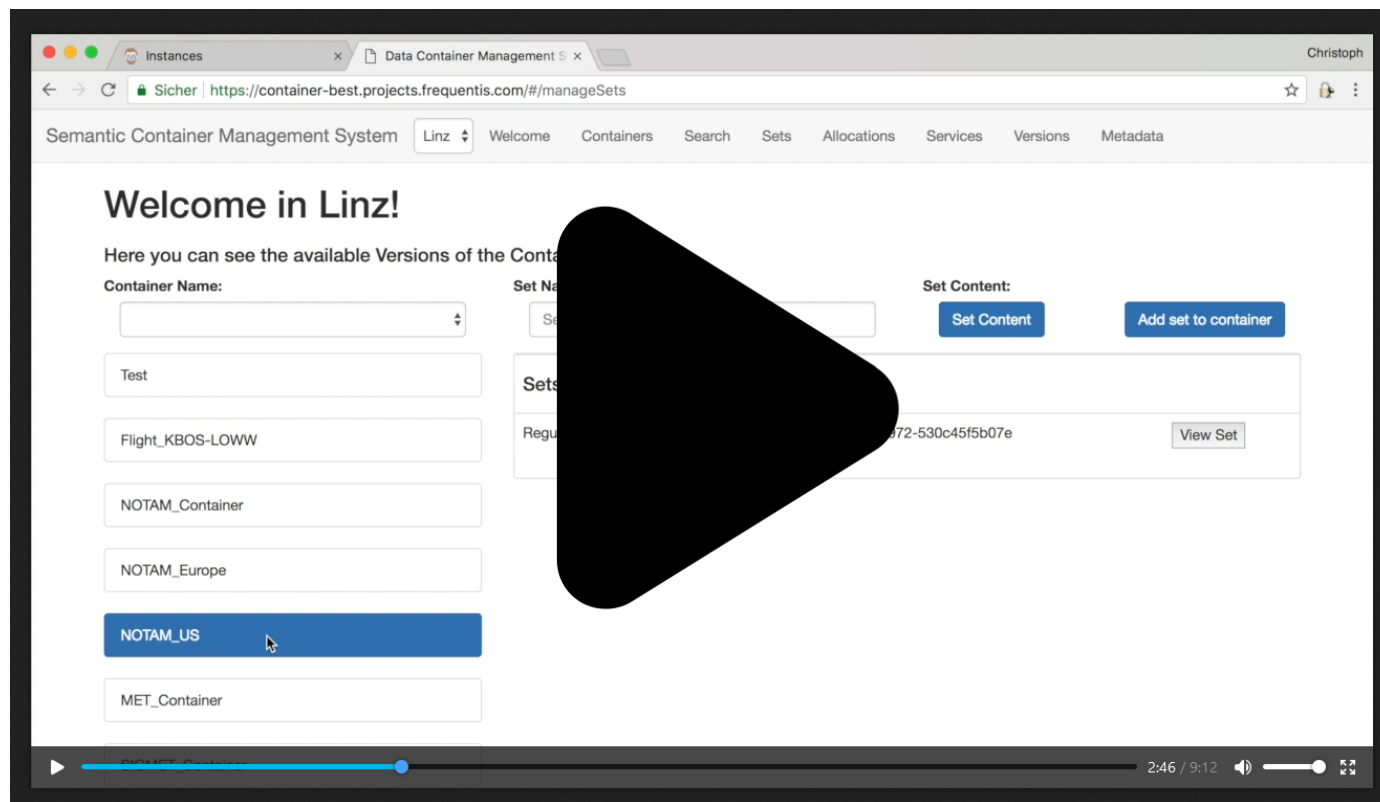
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# What was done?

Semantic NOTAM



Video is available in the video booth



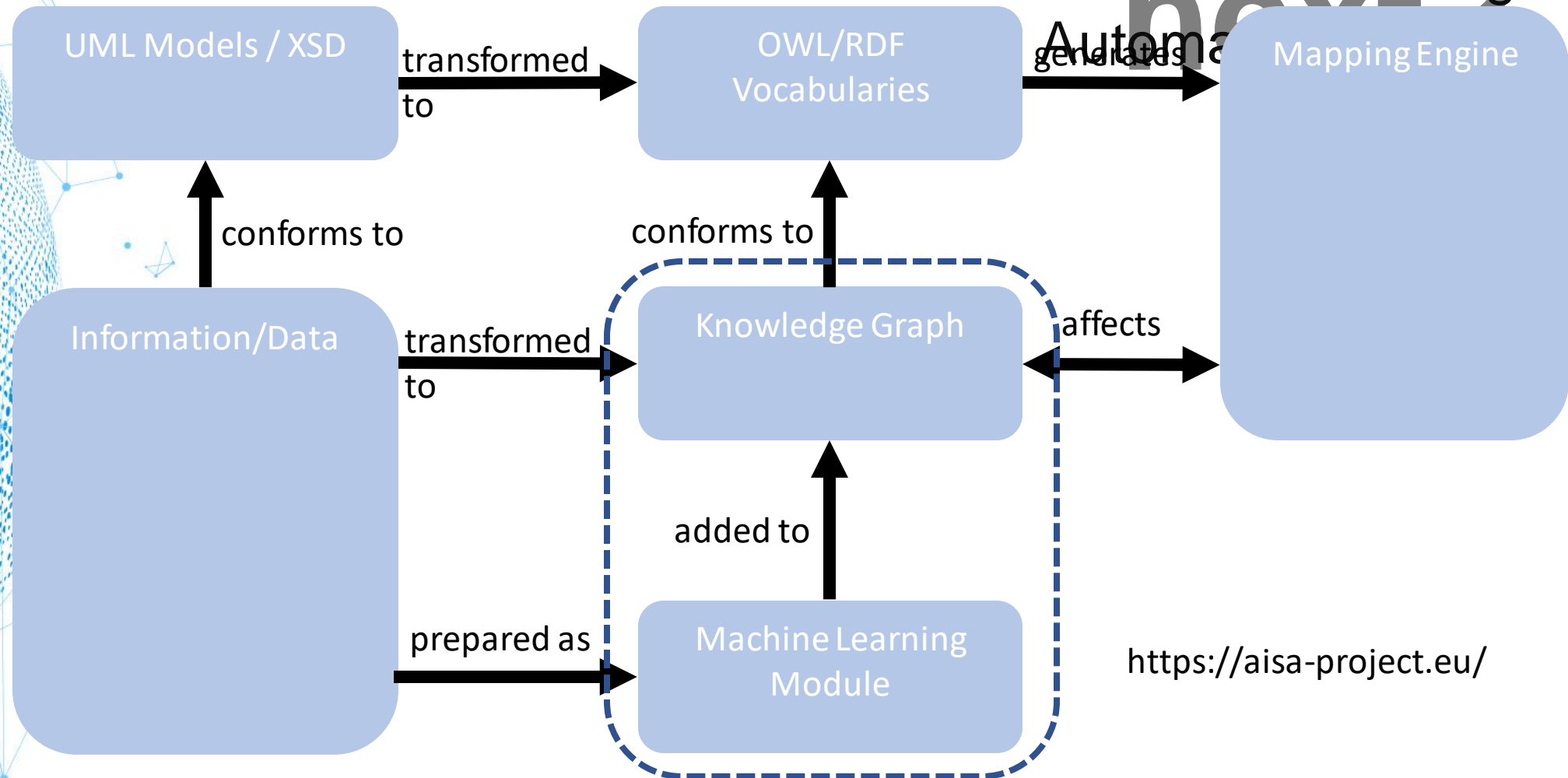


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# What happened

## AI Situational Awareness Foundation for Advancing





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AIRM

Term  
URN  
Definition



Concepts that are semantically  
correspondent with it

# What happened

AIRM semantic correspondence viewer

next?

locationIndicatorICAO

urn:aero:airm:1.0.0:LogicalModel:Subjects:BaseInfrastructure:AerodromeInfrastructure:Aerodrome@locationIndicatorI

A four-letter code group formulated in accordance with rules prescribed by ICAO and assigned to the aerodrome.

type: CharacterString

Show correspondences

Model

Concept

FIXM 4.2.0

locationIndicator

AMXM 2.0.0

idarpt

AIXM 5.1.1

locationIndicatorICAO



<https://airm.aero/developers/semantic-correspondences.html>



# AERONAUTICAL\_INFORMATION\_EXCHANGE

[http://reference.swim.aero/information-services/service-categories/CodeRegulatedInformationExchangeType#AERONAUTICAL\\_INFORMATION\\_EXCHANGE](http://reference.swim.aero/information-services/service-categories/CodeRegulatedInformationExchangeType#AERONAUTICAL_INFORMATION_EXCHANGE)

The Aeronautical information exchange regulated in Commission Implementing Regulation (EU) 2021/116, Common Project One.



# METEOROLOGICAL\_INFORMATION\_EXCHANGE

[http://reference.swim.aero/information-services/service-categories/CodeRegulatedInformationExchangeType#METEOROLOGICAL\\_INFORMATION\\_EXCHANGE](http://reference.swim.aero/information-services/service-categories/CodeRegulatedInformationExchangeType#METEOROLOGICAL_INFORMATION_EXCHANGE)

The Meteorological information exchange regulated in Commission Implementing Regulation (EU) 2021/116, Common Project One.

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The screenshot displays the 'Taxonomy' browser interface. On the left, a tree view lists various concepts, with 'AERONAUTICAL\_INFORMATION\_EXCHANGE' selected. The main panel on the right provides detailed information for this concept:

- Labels and Description:**
  - preferred label: AERONAUTICAL\_INFORMATION\_EXCHANGE (en)
  - alternative label: Aeronautical Information Exchange (en)
  - type: Concept
  - definition: The Aeronautical information exchange regulated in Commission Implementing Regulation (EU) 2021/116, Common Project One. (en)
- Hierarchical Relationships:**
  - top concept of: CodeRegulatedInformationExchangeType
- Associative Relationships:**
  - related concept: AERONAUTICAL\_INFORMATION
    - preferred label: AERONAUTICAL\_INFORMATION (en)
    - alternative label: Aeronautical information (en)
    - type: Concept
    - definition: Information resulting from the assembly, analysis and formatting of aeronautical data. (en)
    - top concept of: CodeInformationDomainType
    - related concept: AERONAUTICAL\_INFORMATION\_EXCHANGE
- Matching Relationships:**
  - has broader match: aeronautical

<https://reference.swim.aero/information-services/service-categories.html>



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# What are the next

Looking ahead

Continue to leverage semantic technologies

publish more vocabularies e.g. topics to classify ICAO digital data sets

realize opportunities for automated alignment checking

Gather more detailed requirements

identify opportunities at data level

Validate new ideas and tools as they emerge





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THANK YOU

GRACIAS  
ARIGATO  
SHUKURIA  
JUSPAXAR  
DANKSCHEEN  
TASHAKKUR ATU  
SUKSAMA  
EKHMET  
MEHRBANI  
PALDIES  
BOLZIN  
MERCİ  
BİYAN  
SHUKRIA  
TINGKI  
YAQHANYELAY  
CHALTU  
IRIRUHI  
SHACHALHYA  
SPASSIBO  
DANKSCHEEN  
JUSPAXAR  
TAVYAPUCHI  
MEDAWAGSE  
BARVA  
GOZAIMASHITA  
EFCHARISTO  
AGUYJE  
FAKAARE  
KOMAPSUNIDA  
MAAKE  
LAH  
GAEJTHO  
MERASTAWHY  
SARCO  
YUSPAGABATAM  
WABEEJA  
MAITEKA  
HUI  
UNALCHEESI  
HATURI  
GI  
EKOJU  
SIKOMO  
MARKETAI  
MINMONCHAR