34th Annual INCOSE international symposium

hybrid event

Dublin, Ireland
July 2 - 6, 2024

Practical SE data management at scale

5th of July 2024

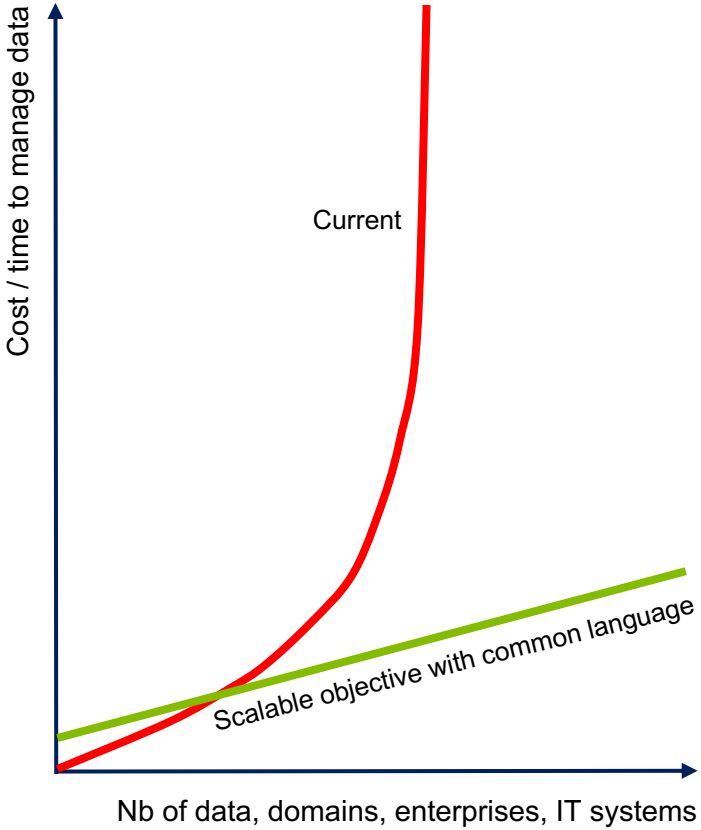
Presented by Thomas BARRÉ (thomas.barre@airbus.com)

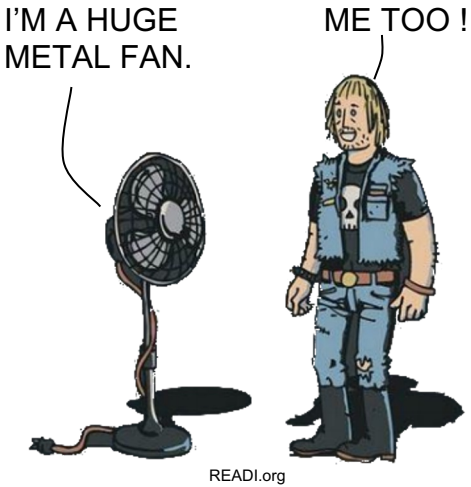
AIRBUS

The vision

Data is the new gold.
Digital continuity is the key to co-operations & data-based studies

From the pain to the solution



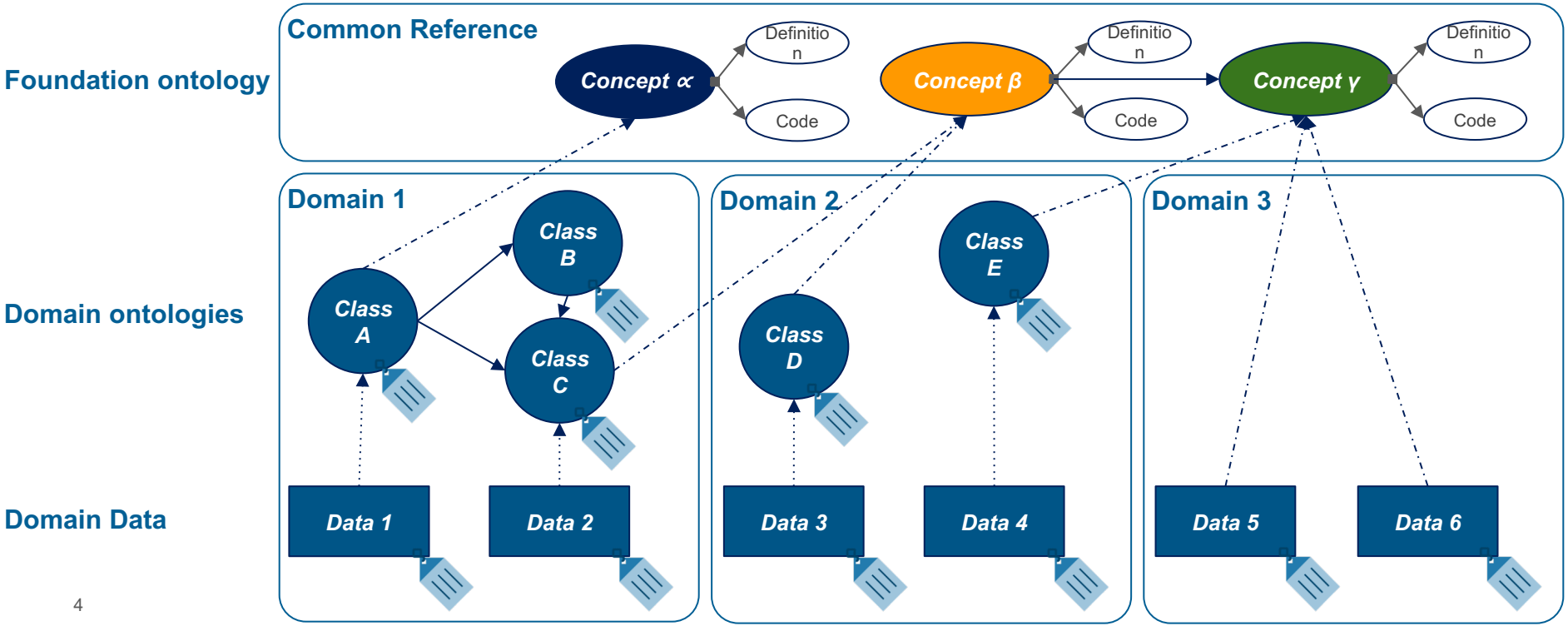


The ambition of this language
based on proven international standards
is to value data by providing practical solutions
to clarify, federate & query data,
at marginal cost and time, even at scale

Value proposal - common reference concept

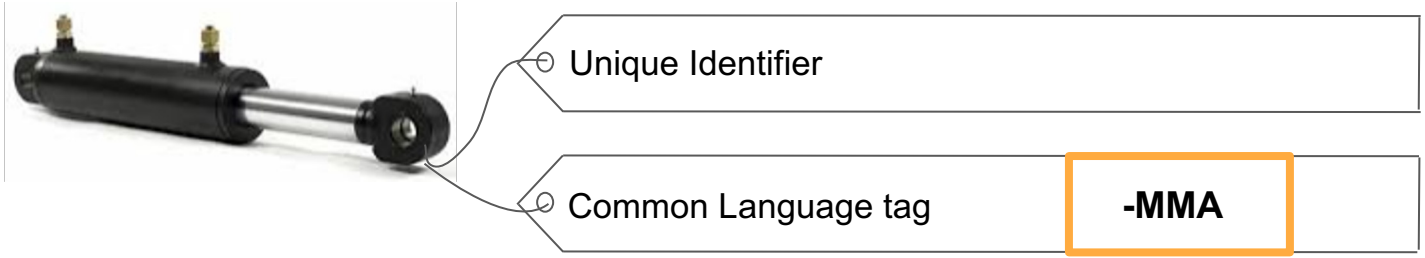
Tag — link to common reference concept (e.g. using codes)

The innovation is to use a common business language on tags as bridge between data sets: now new & legacy data are understood & operated across silos (domains, enterprise, IT solutions, …), at marginal cost and time



Value proposal - Example

This language is used to provide meaning to data thanks to tag applied on top of unique identifiers



MMA (hydraulic cylinder): system for providing mechanical movement or force, powered by fluid displacement or pressure, providing movement corresponding to a liquid volume.

Value proposal - The origin

ISO/IEC 81346 Reference Designation System (RDS)

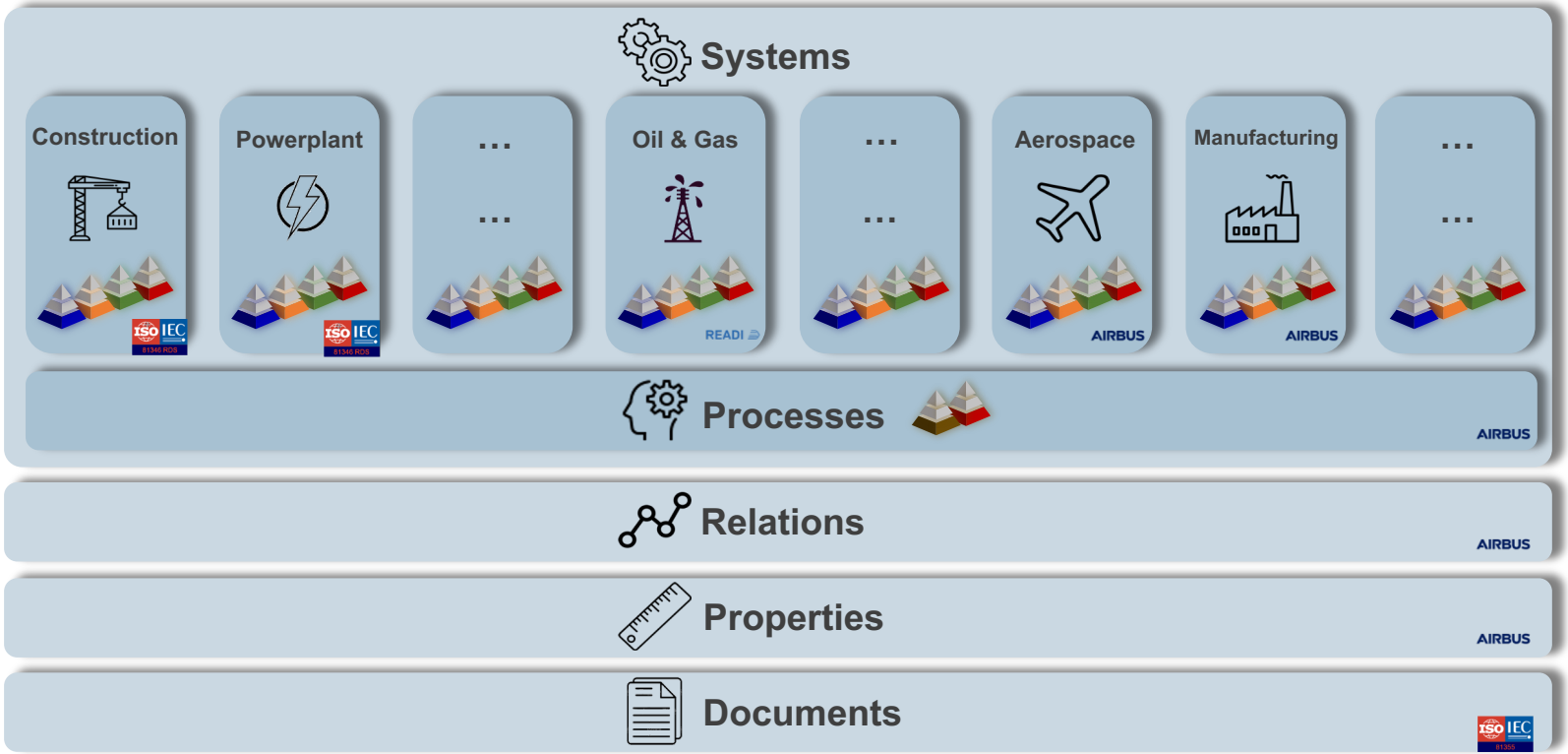
It's all about creating a common language™

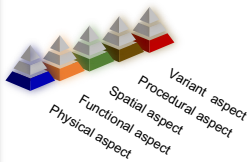
www.81346.com

A common framework

The common reference is a set of structured concepts definitions and its associated designation language

It is made of 15 000 definitions & relations between them





The reference model in action

Aircraft: + Spatial | = Functional | - Physical

Process: # Procedural

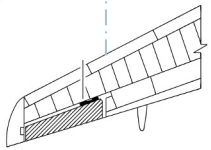
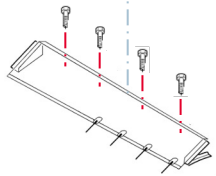
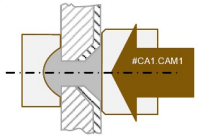
Manufacturing: = Functional | - Physical | + Spatial

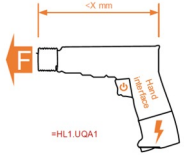
Building: + Spatial | = Functional | - Physical

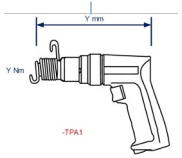
*This language is used to designate and federate data (**digital thread**) across silos using the same framework*

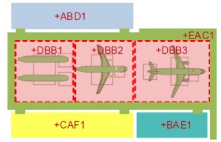
+DCA	=BE	-QPC	#CAL	=UQA	-TPA	+DBB	+GBA	=HG	-XDB
Space allocation	Roll system	Aileron	To rivet	Riveting	Torquing tool	Station	Hangar	Electrical distribution	Socket

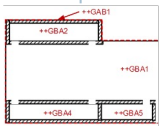
-UQA
Fastener
$AAAAAD
Diameter

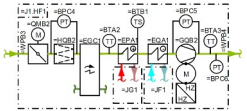













=BE
+DCA
-QPC
-UQA
$AAAAAD
#CAL
deformation

Direction system creating roll movement
Equipment operation space providing equipment movement space
Open flow controlling object for directing a flow by variable means
Object for localising other objects, by static jointing, with rigid and permanent mechanical means
Width of circle, cylinder or sphere
Process of joining objects or materials, shaping by irreversible assembling, by

=UQA
-TPA
+DBB
+GBA
=HG
-XDB

Object for localising other objects, by static jointing, with rigid and permanent mechanical means
Object for transforming other objects of matter by shape forging
Space designed for active technical systems which support human activities of fabricating and preparing products
Space defined by physical boundary, designed to host one or more activity spaces
Technical system supplying other systems with electrical energy
Interfacing object for low voltage electric power, with for pluggable connections

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The challenge

About **220.000** bolts types

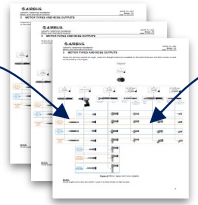
About **500.000** tools physical types

How to provide the list of applicable torquing tools per fastener?

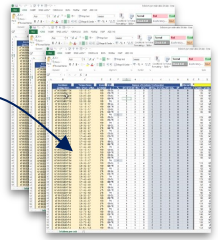
Torquing Tool Configurator (TTC)

Examples of data sources

MANUALS



HANDBOOKS



TECHNICAL MATRICES

ASNA2536P

Ordering application

Common Reference

220.000 bolts & 500.000 tools
fully described by 61.000.000 tags
in 2 months by 3 people

Graph Database

User interface to select appropriate tools

Automatic suggestion of definitions

Type: system | Domain: aircraft | Aspect: physical | AI Method: Convolutionnal Neural Network

How many Epochs for the Train ?

10

0 100

GO !

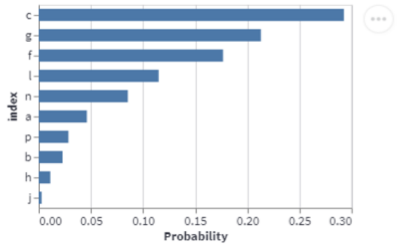
Please enter some words to be defined

motor

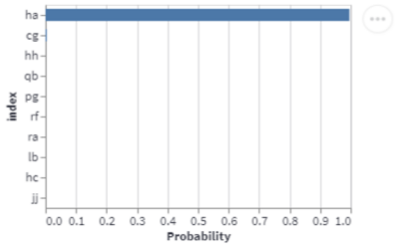
Here is my best guess :

Probability	Class Code	Class Name	Class Definition
0.996	HA	Engine system	supply system for thrust

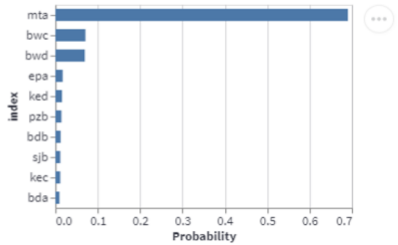
Higher Abstraction Level



Intermediate Abstraction Level



Elementary Abstraction Level



Automatic suggestion of definitions thanks to machine learning: the quickest way to select your tag

From table to graph

From a Human Operable Table to Human & Machine Operable Graph

Import a .xlsx file

Drag and drop file here

Limit 200MB per file

Browse files

Specify the project name

Create Project !

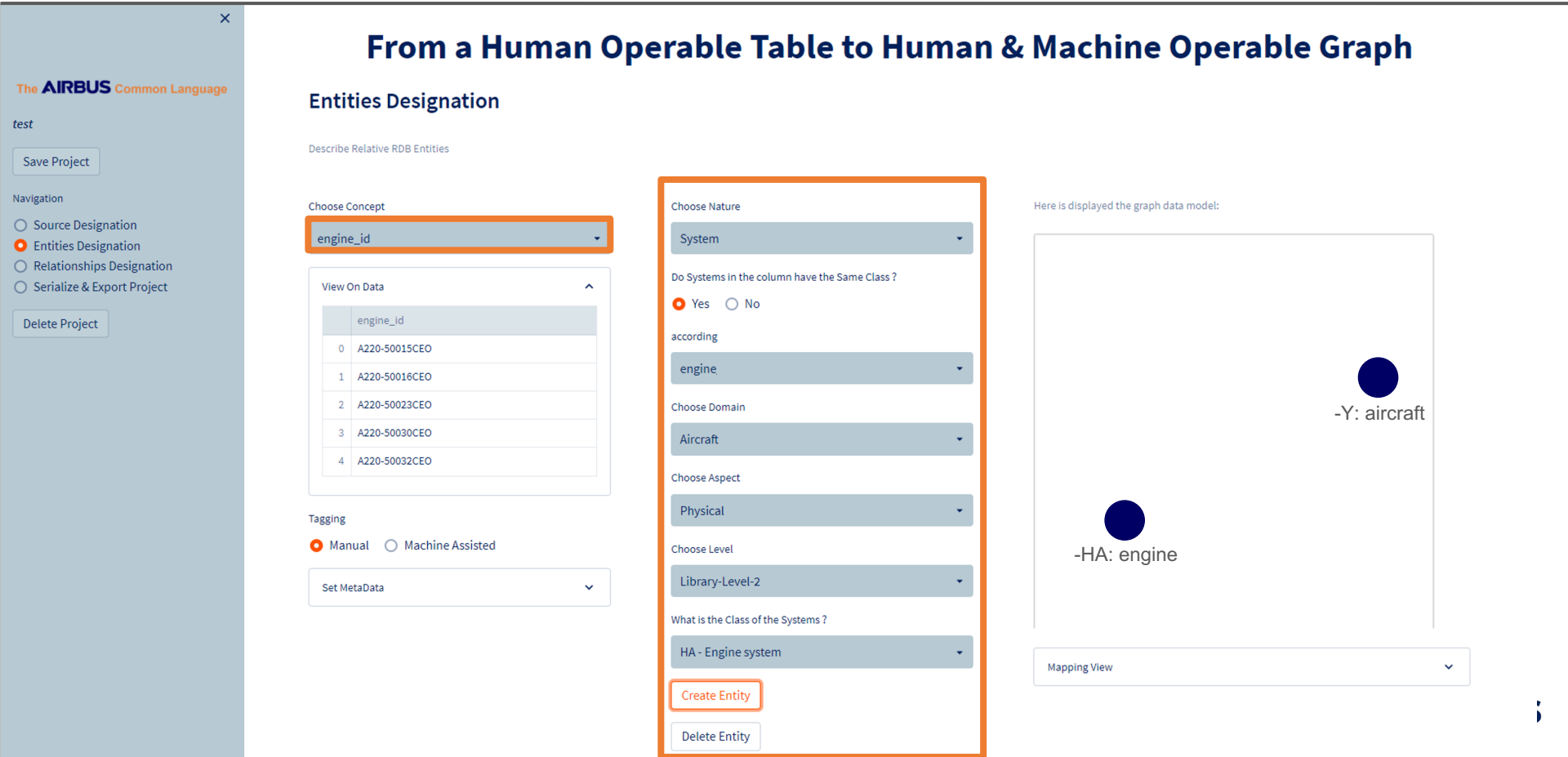
AIRBUS

From table to graph

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	skywise_aircraft	title	aircraft_msn	delivery_date	total_flight_hours	owner_code_ica	aircraft_model	engine_	engine_option	engine_variant	final_assembly_	customer_handc	customer_handover_time	
2	A220-50015	A220 HB-JBF (5	MSN50015	3/8/2017	9722.27	86L	A220-100	A220-50015CEC	CEO	PW1524G		HDV-A220-50015		
3	A220-50016	A220 HB-JBG (5	MSN50016	4/3/2017	9674.91	86L	A220-100	A220-50016CEC	CEO	PW1524G		HDV-A220-50016		
4	A220-50023	A220 N104DU (5	MSN50023	12/31/2018	8913.52	DAL	A220-100	A220-50023CEC	CEO	PW1519G	Mirabel	HDV-A220-50023		
5	A220-50030	A220 N111NG (5	MSN50030	6/6/2019	6338.08	DAL	A220-100	A220-50030CEC	CEO	PW1519G	Mirabel	HDV-A220-50030		
6	A220-50032	A220 N113DQ (5	MSN50032	5/20/2019	6722.18	DAL	A220-100	A220-50032CEC	CEO	PW1519G	Mirabel	HDV-A220-50032		
7	A220-50044	A220 N125DU (5	MSN50044	9/30/2019	7135.02	DAL	A220-100	A220-50044CEC	CEO	PW1519G	Mirabel	HDV-A220-5004	2019-09-27T13:00:00Z	
8	A220-50047	A220 N128DU (5	MSN50047	11/21/2019	4642.32	DAL	A220-100	A220-50047CEC	CEO	PW1519G	Mirabel	HDV-A220-5004	2019-11-17T13:00:00Z	
9	A220-50051	A220 N132DU (5	MSN50051	10/22/2020	4893.57	DAL	A220-100	A220-50051CEC	CEO	PW1519G	Mirabel	HDV-A220-5005	2020-03-12T13:00:00Z	
10	A220-50071	A220 (50071)	MSN50071	8/22/2023		AIB	A220-171	A220-50071CEC	CEO	PW1500G	Mirabel	HDV-A220-50071		
11	A220-50074	A220 (50074)	MSN50074	9/22/2023		AIB	A220-171	A220-50074CEC	CEO	PW1500G	Mirabel	HDV-A220-50074		
12	A220-50076	A220 (50076)	MSN50076	10/24/2023		AIB	A220-171	A220-50076CEC	CEO	PW1500G	Mirabel	HDV-A220-50076		
13	A220-50079	A220 (50079)	MSN50079	12/15/2023		AIB	A220-171	A220-50079CEC	CEO	PW1500G	Mirabel	HDV-A220-50079		
14	A220-50080	A220 (50080)	MSN50080	1/22/2024		AIB	A220-171	A220-50080CEC	CEO	PW1500G	Mirabel	HDV-A220-50080		
15	A220-50081	A220 (50081)	MSN50081	2/8/2024		AIB	A220-171	A220-50081CEC	CEO	PW1500G	Mirabel	HDV-A220-50081		
16	A220-50086	A220 (50086)	MSN50086	5/3/2024		AIB	A220-171	A220-50086CEC	CEO	PW1500G	Mirabel	HDV-A220-50086		
17	A220-50090	A220 (50090)	MSN50090	8/6/2024		AIB	A220-171	A220-50090CEC	CEO	PW1500G	Mirabel	HDV-A220-50090		
18	A220-50097	A220 (50097)	MSN50097	11/19/2024		AIB	A220-171	A220-50097CEC	CEO	PW1500G	Mirabel	HDV-A220-50097		
19	A220-50098	A220 (50098)	MSN50098	11/28/2024		AIB	A220-171	A220-50098CEC	CEO	PW1500G	Mirabel	HDV-A220-50098		
20	A220-50101	A220 (50101)	MSN50101	1/21/2025		AIB	A220-171	A220-50101CEC	CEO	PW1500G	Mirabel	HDV-A220-50101		
21	A220-50102	A220 (50102)	MSN50102	1/30/2025		AIB	A220-171	A220-50102CEC	CEO	PW1500G	Mirabel	HDV-A220-50102		
22	A220-50106	A220 (50106)	MSN50106	3/17/2025		AIB	A220-171	A220-50106CEC	CEO	PW1500G	Mirabel	HDV-A220-50106		
23	A220-50107	A220 (50107)	MSN50107	4/1/2025		AIB	A220-171	A220-50107CEC	CEO	PW1500G	Mirabel	HDV-A220-50107		
24	A220-50108	A220 (50108)	MSN50108	4/9/2025		AIB	A220-171	A220-50108CEC	CEO	PW1500G	Mirabel	HDV-A220-50108		

AIRBUS

From table to graph



From table to graph

The AIRBUS Common Language

test

Save Project

Navigation

- Source Designation
- Entities Designation
- Relationships Designation
- Serialize & Export Project

Delete Project

From a Human Operable Table to Human & Machine Operable Graph

Relationships Designation

Describe Relative RDB Relations between Entities

What is the Start Node of the Relation ?

engine

What is the Class of the Relation ?

BAA - System composes

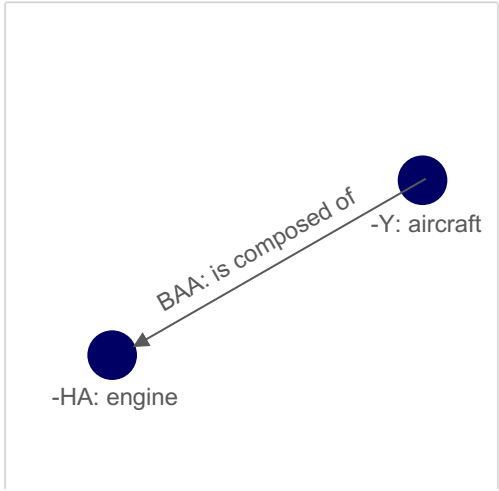
What is the End Node of the Relation ?

skywise_aircraft

Create Relation

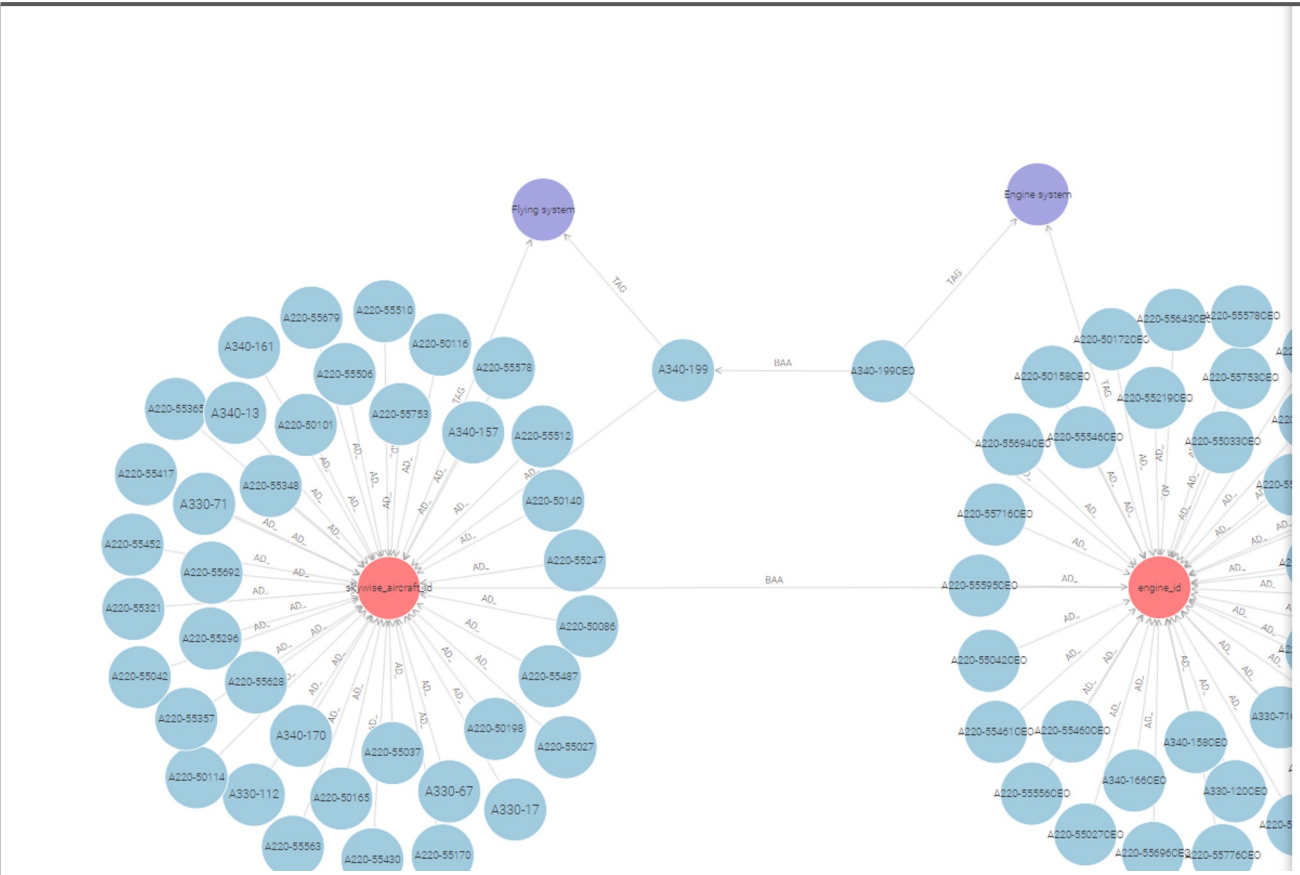
Delete Relation

Here is displayed the graph data model:



Mapping View

From table to graph



Engine system

Engine system[en]

Types:

ACL:Physical_Component

OWL:NamedIndividual

RDF Rank:

0

Search instance properties

SKOS:example

Engine (including nacelle), motor, powerplant, jet, jetengine, turbofan [en]

SKOS:prefLabel

Engine system [en]

SKOS:definition

Supply system for thrust [en]

ACL:hasCode

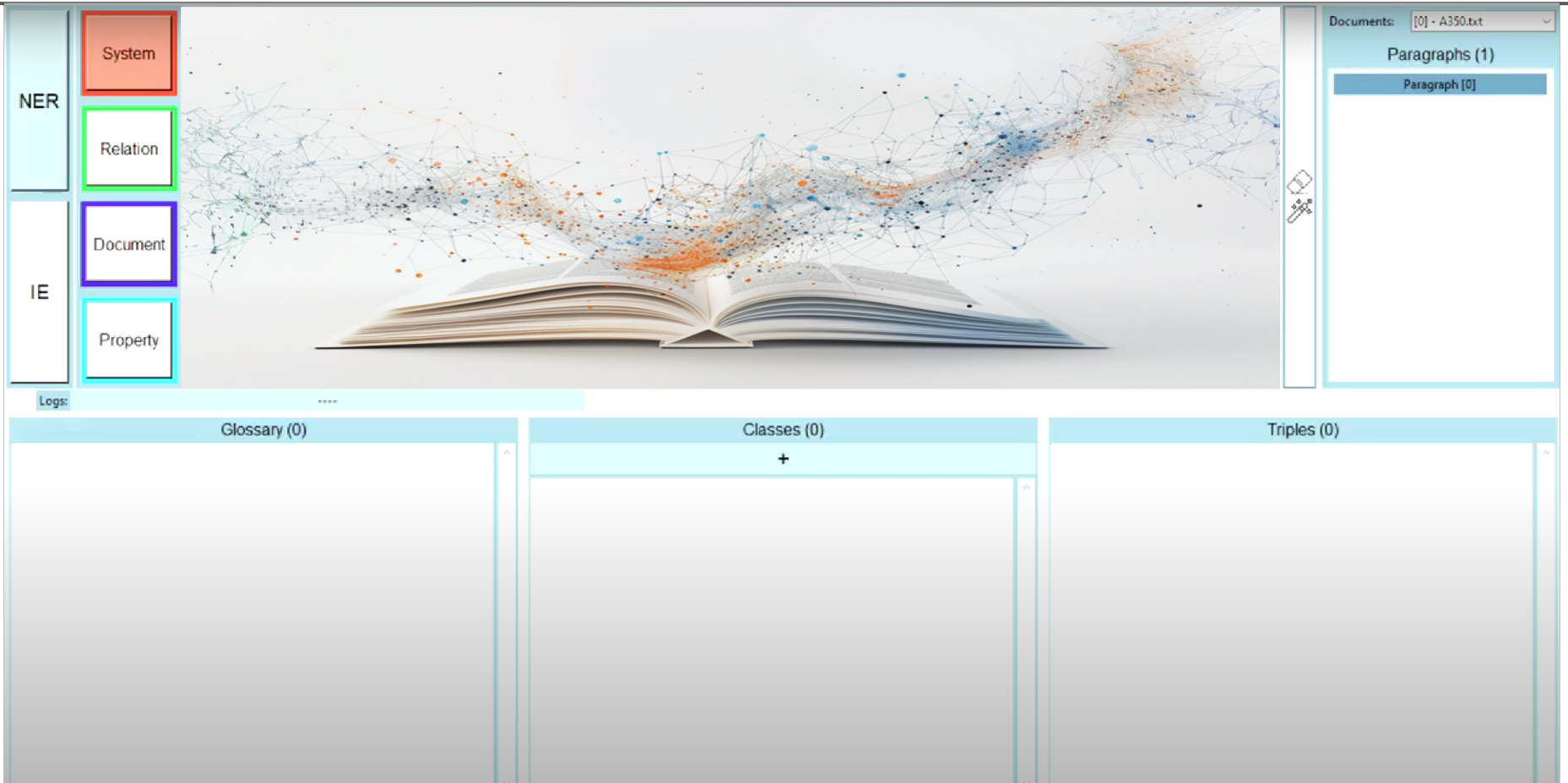
HA

SKOS:notation

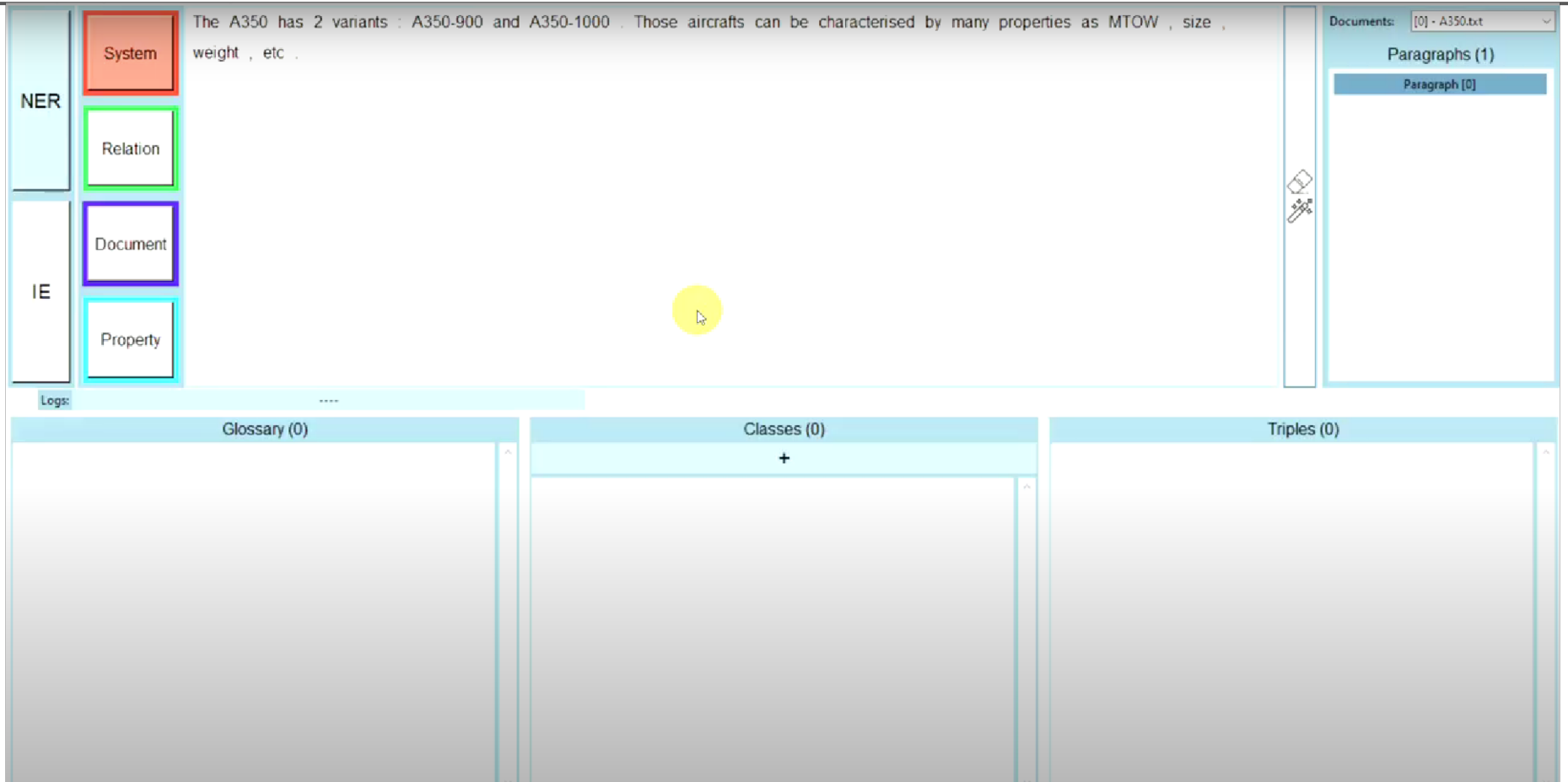
HA

Without modeling expertise, by answering to basic questions, tables are converted into graphs with explicit definitions

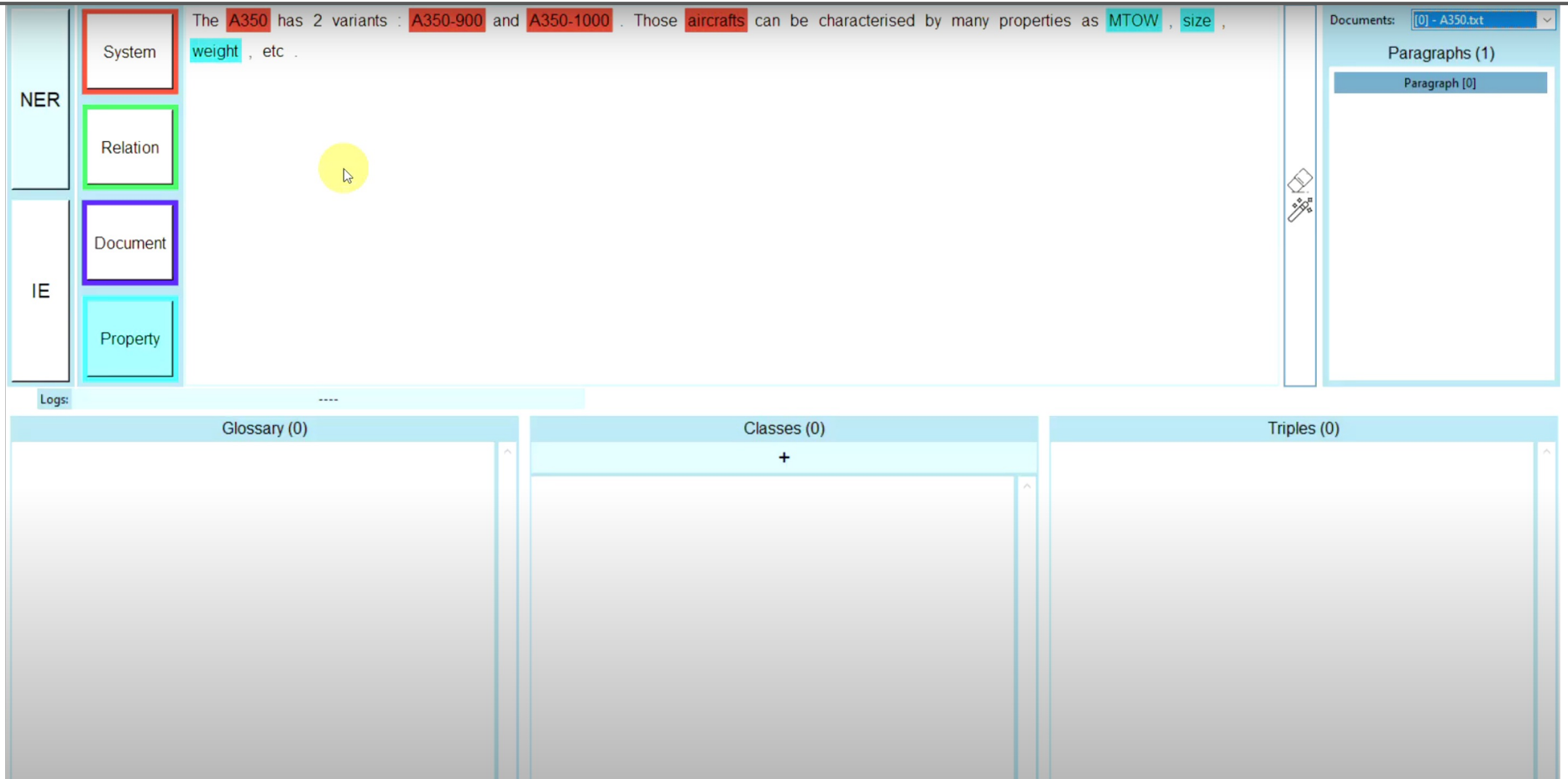
From text to graph



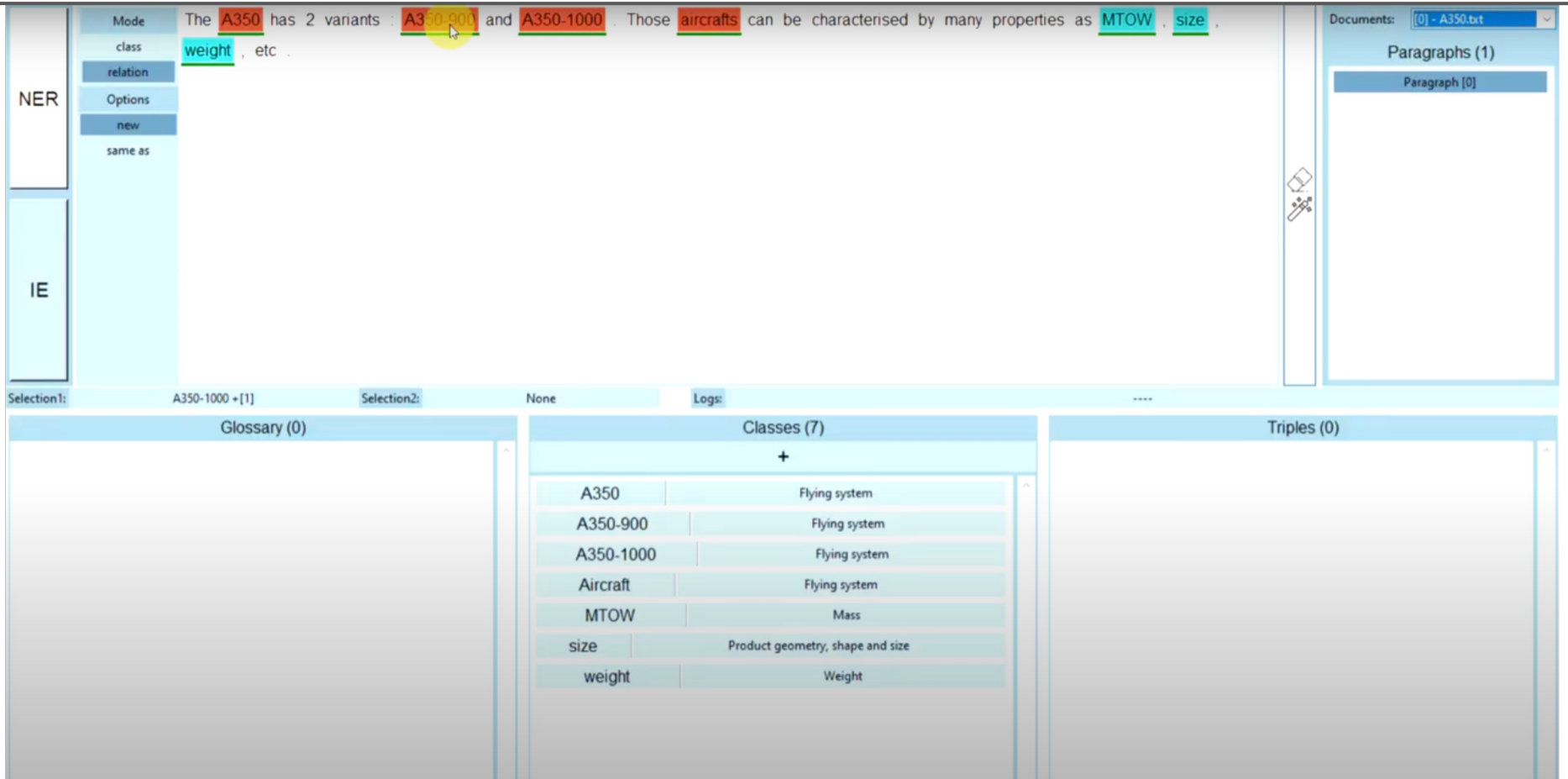
From text to graph



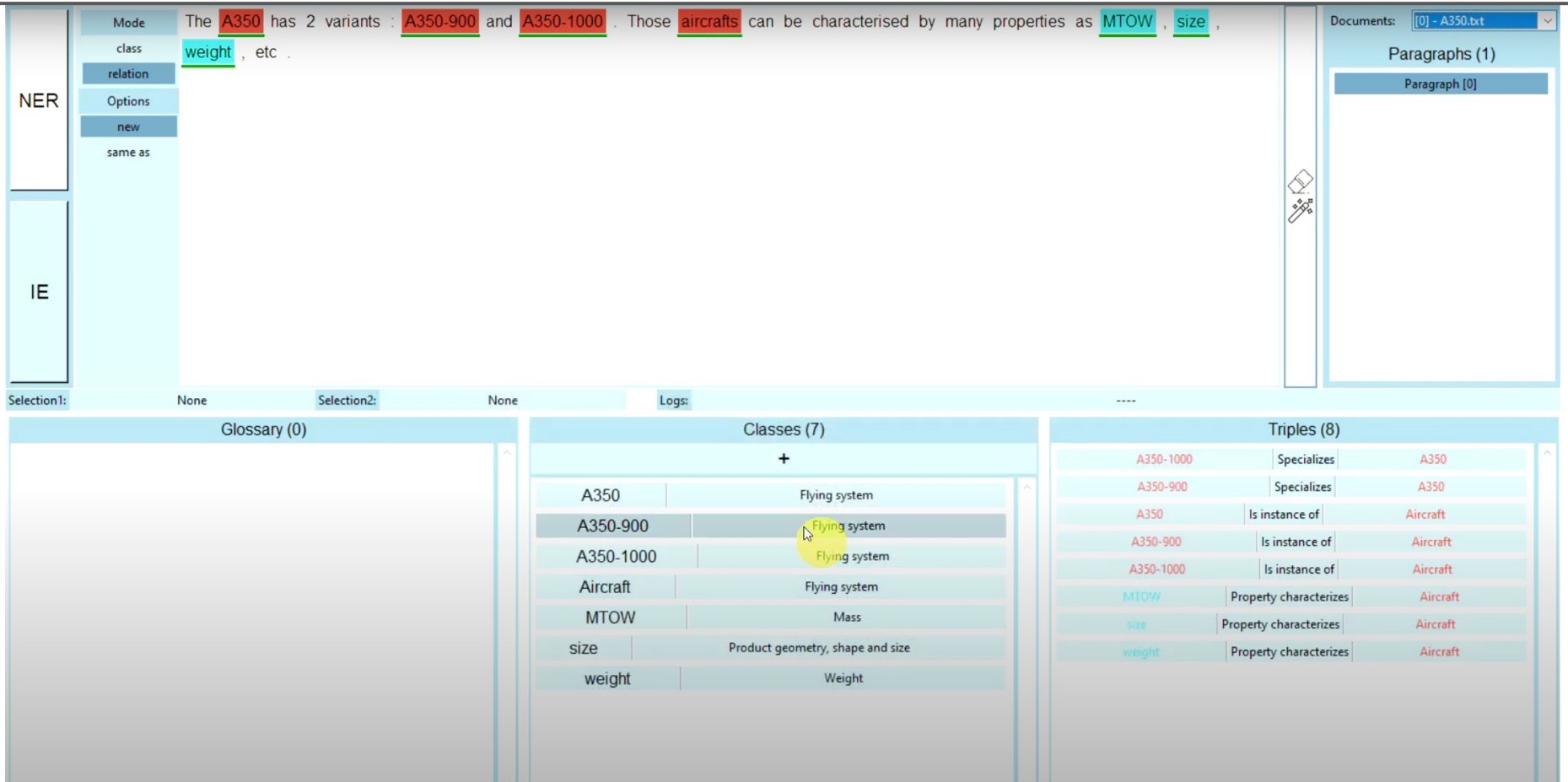
From text to graph



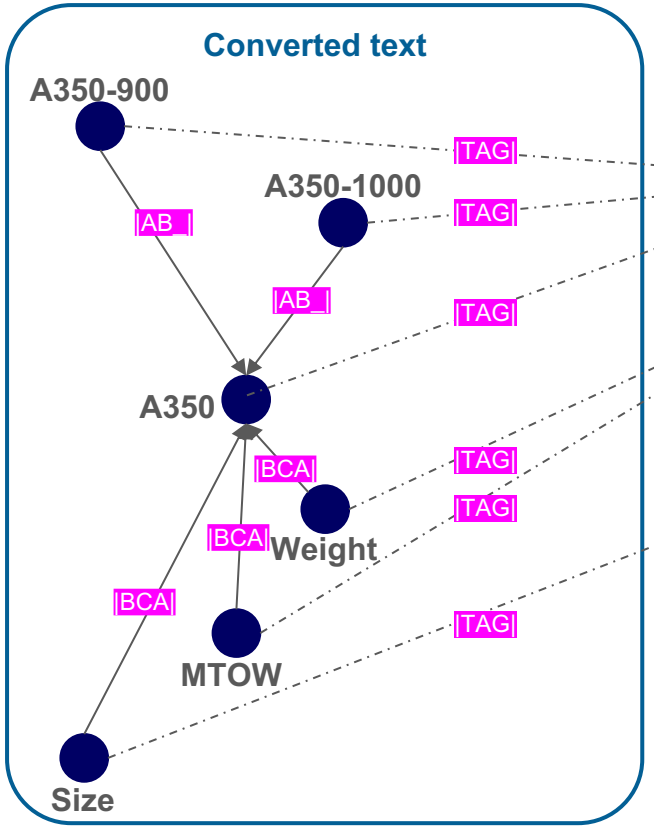
From text to graph



From text to graph



From text to graph



Common Meaning Reference

-Y **Flying system**: system moving through air or outer space

$ABATAA **Mass**: Derived quantity relating to mechanics, having dimension L^0 M^1 T^0 I^0 Th^0 N^0 J^0, describing the property of a body which expresses itself in terms of inertia with regard to changes in its state of motion as well as its gravitational attraction to other bodies

$AAAAAA **Length**: Derived quantity relating to space and time, having dimension L^1 M^0 T^0 I^0 Th^0 N^0 J^0, describing a linear extend in space between two points, abbreviated l, L, and potentially expressed in m

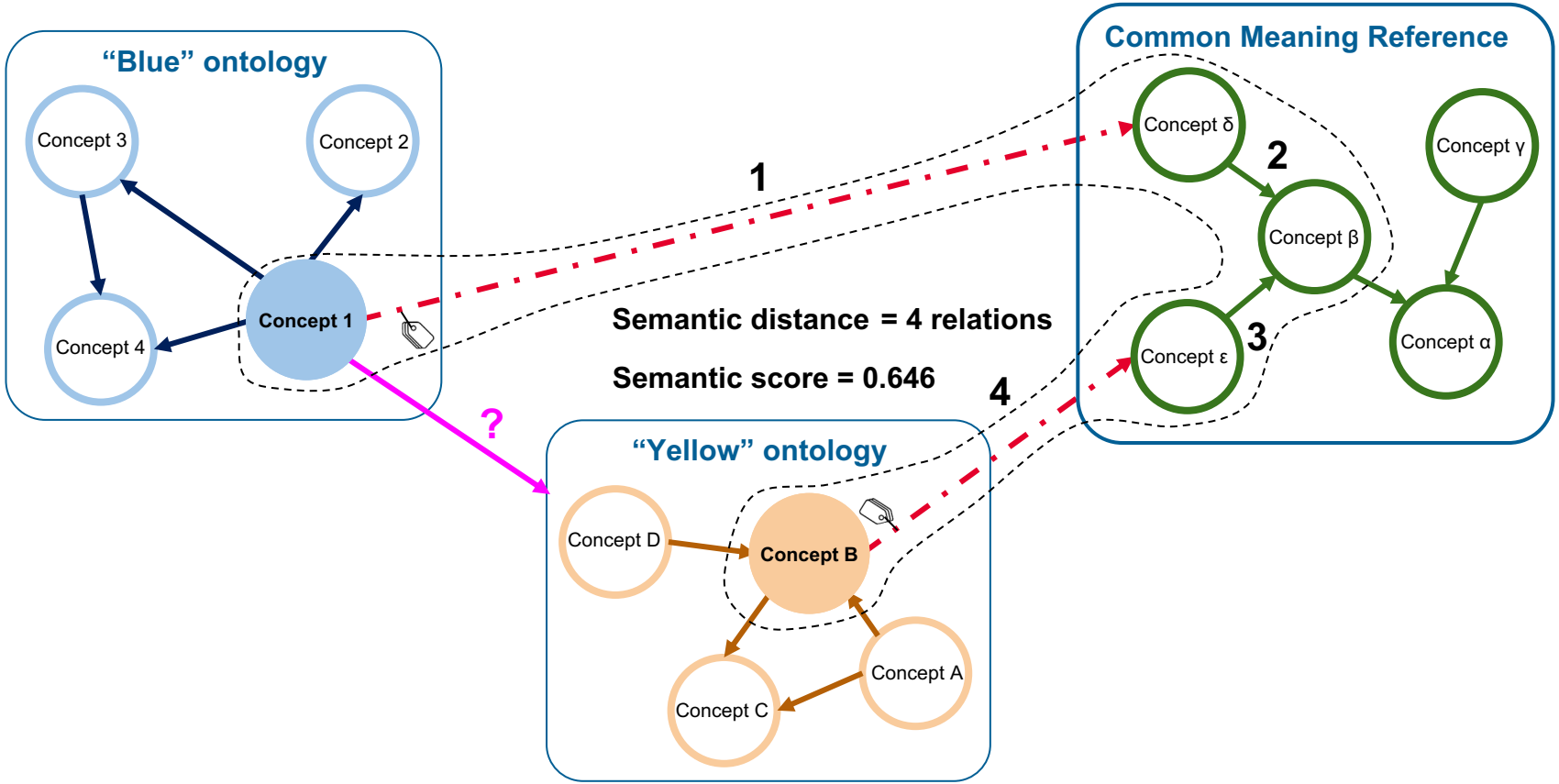
TAG **Common Language Tag**: has meaning

AB_ **Specializes**: Object A makes object B suitable for a special purpose

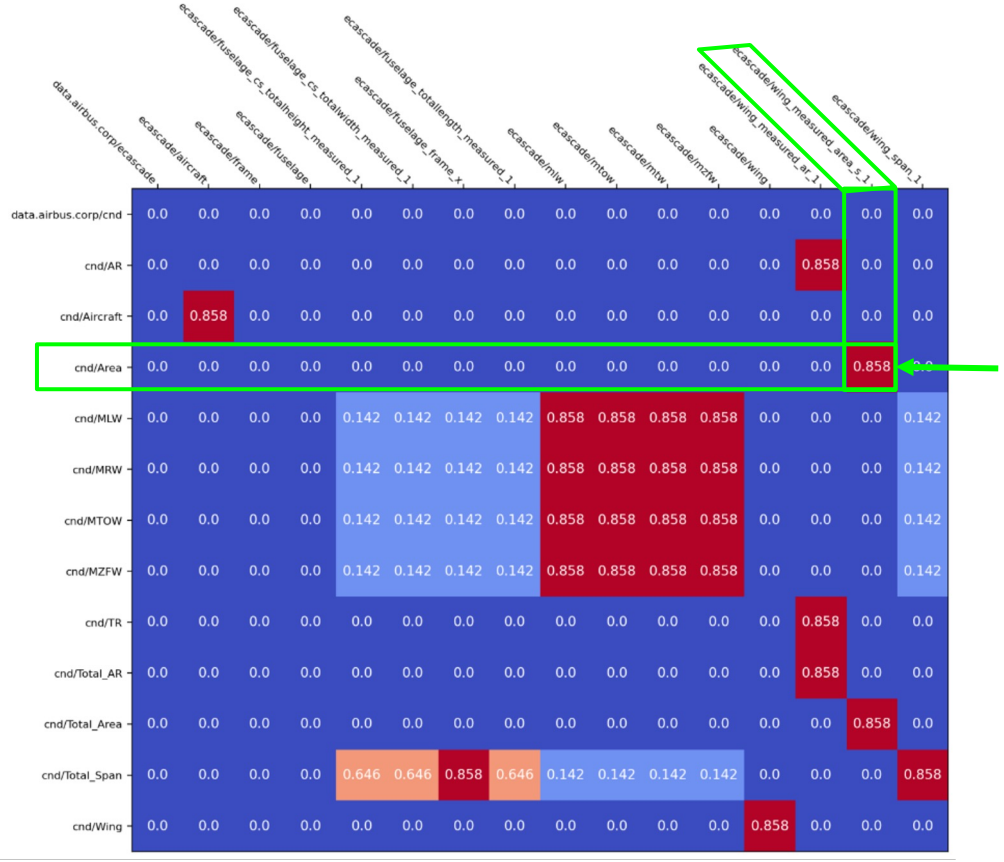
BCA **Property characterizes**: Property A characterizes object B

Even without modeling expertise, create operable graph with explicit definitions

Semantic distance through Common Reference



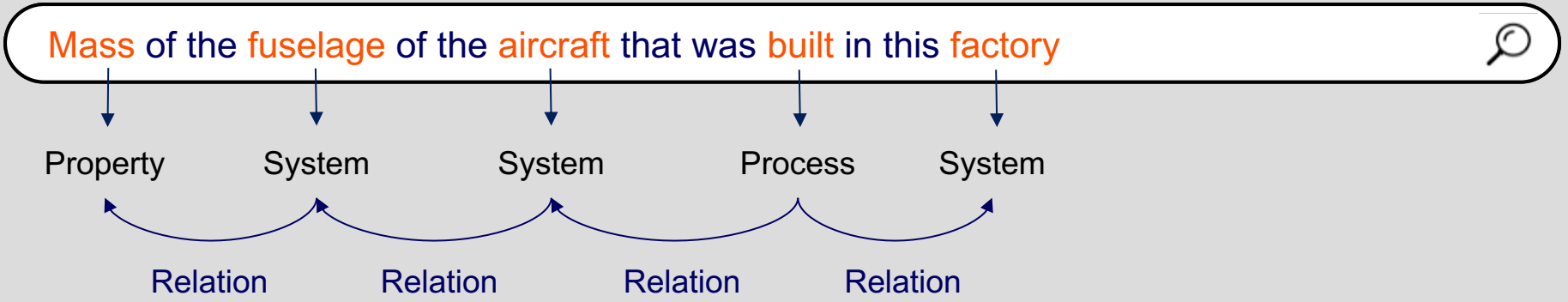
Calculate similarities matrix between ontologies' concepts



With common language & no modelling expertise it takes seconds to connect ontologies

Easy data query through common language definitions

Filter *It* *Retrieve your data through their semantics*



To retrieve all (and only) the relevant informations, search by meaning instead of words

Translate in common language ⇔ Just select key elements, their definitions & relationships

With no query language expertise any user can perform advanced searches by meaning

Executive Summary

Data assets management at scale is a must

A common language is a key enabler:

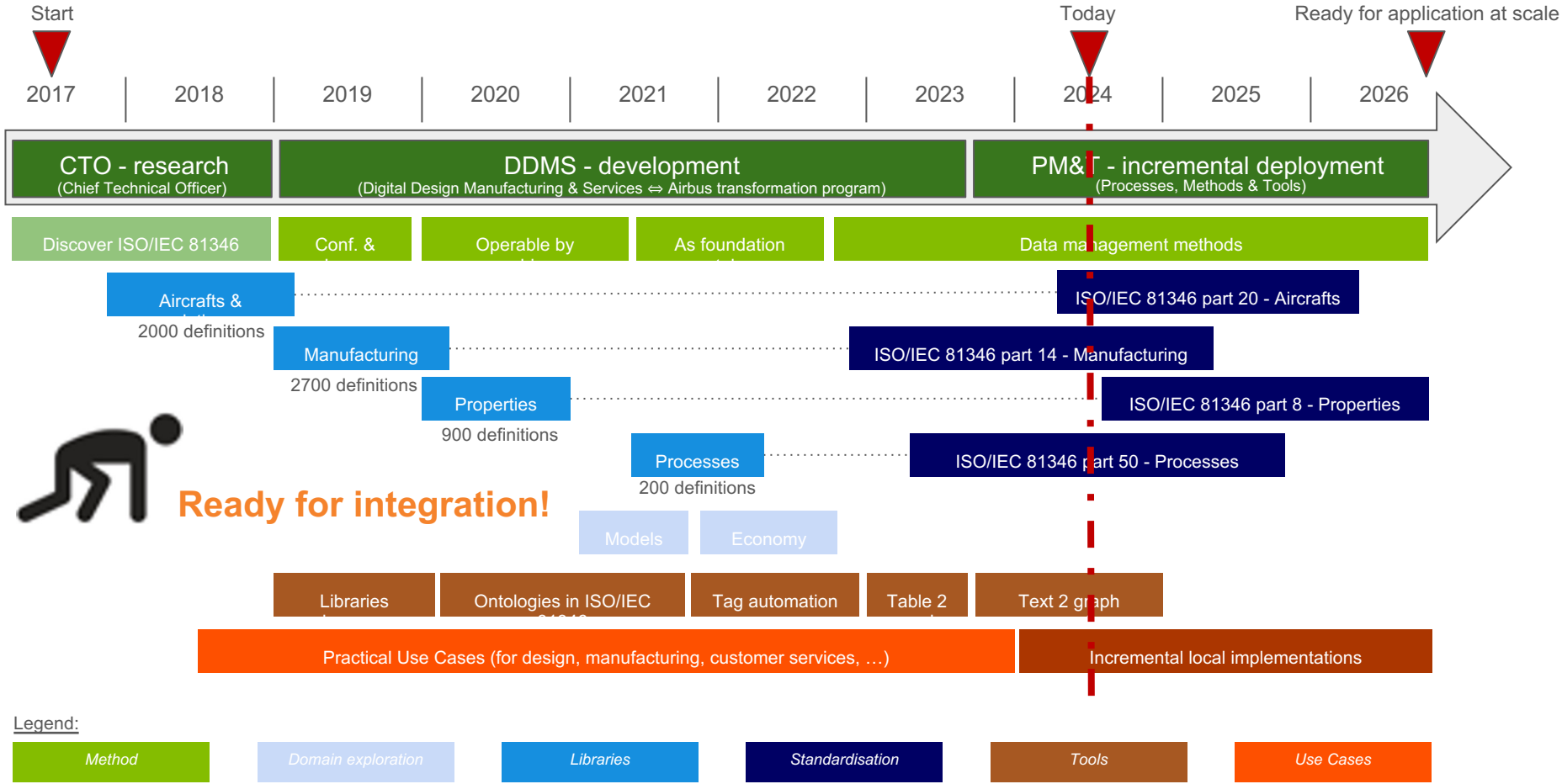
Explicit data operable by humans & machines

Robust & proven
Scalable (distributed mode, incremental deployment)
Low footprint on IT for new & legacy data

Interoperability enabler across silos
Compatible with any IT language & software

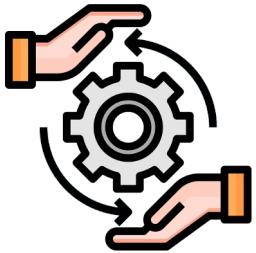
Easy to learn & to apply

The Common Language project



Join us for at scale applications!

Test



Develop

Want to try? Any question? => common.language@airbus.com

Thank you!