



RESEARCH DATA ALLIANCE

Joint Session: IG RDMinEng & sUAS Data IG

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- (1) CRC - University of Notre Dame
- (2) UK Atomic Energy Authority
- (3) University of Stuttgart
- (4) RWTH Aachen University
- (5) TU Delft

Meeting Notes:

https://bit.ly/P15_RDMinEng_sUASdata

Programme

10:00 Welcome and the programme for the session

10:05 Introduction to IG small Unmanned Aircraft data (sUAS data IG)

10:10 Introduction to IG Research Data Management in Engineering (RDMinEng)

10:15 Presentation 'Manual annotation of engineering data'

10:30 Presentation 'Automated annotation of drone data'

10:45 Presentation 'Metadata scheme for computational engineering - EngMeta'

11:00 Break out sessions

11:20 wrap up and end of the session

Breakout rooms

- Breakout Room 1 - Collaboration between IGs
- Breakout Room 2 - Engineering Metadata
- Breakout Room 3 - Manual annotation of engineering data or Engineering and Open Science
- Breakout Room 4 - Suggestions??

IG RDMinEng - Why?

- High data heterogeneity
- Numerous proprietary data formats
- Lack of systematic acquisition/curation of data/software in infrastructures
- The key engineering “data” is often software
- Little conventions, e.g. in file naming and data/software documentation
- Close cooperation with industry
- Lack of interfaces between industry and academia
- Data locked up in silos with strong access constraints
- Little interoperability

IG RDMinEng - Timeline

- November 2018 - P12 - Botswana - First BoF meeting
- January 2019 - IG RDMinEng Charter finalized a
- August 2019 - Endorsed
- October 2019 - P14 - Helsinki - Kick-off meeting

IG RDMinEng - Focus Groups

- Engineering and Open Science
- Engineering-specific DMP
- Metadata for Engineering
- Data Annotation

Focus group: DMP

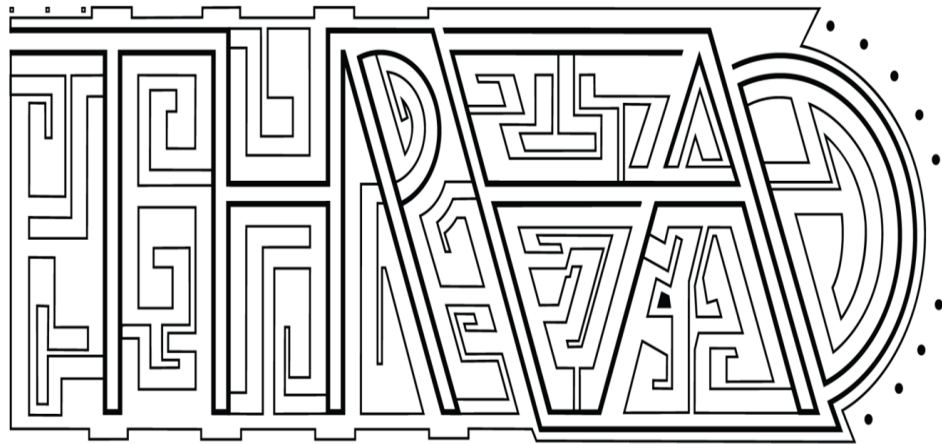
Engineering-specific DMP

- preliminary work from RWTH Aachen University and Technical University of Darmstadt
 - starting point: a generic template
 - modifications on 4 questions, 30 answer options, 84 help text
- The focus will be on discipline-specific guidance
- WG to discipline-specific guidance on DMPs - charter: work in progress
- other disciplines: Social Science, Medicine, Biology, Chemistry

Contact: Daniela Hausen - hausen@ub.rwth-aachen.de

FAIR and the Digital Thread

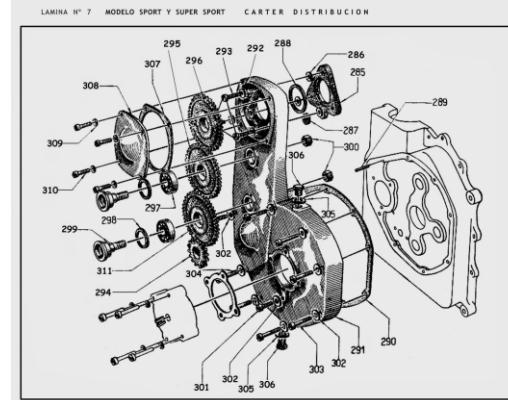
Shaun de Witt, UKAEA (shaun.de-witt@ukaea.uk)



© Nelly <https://workingnotworking.com/projects/146264-ariadne-s-thread>

First a bit about me...

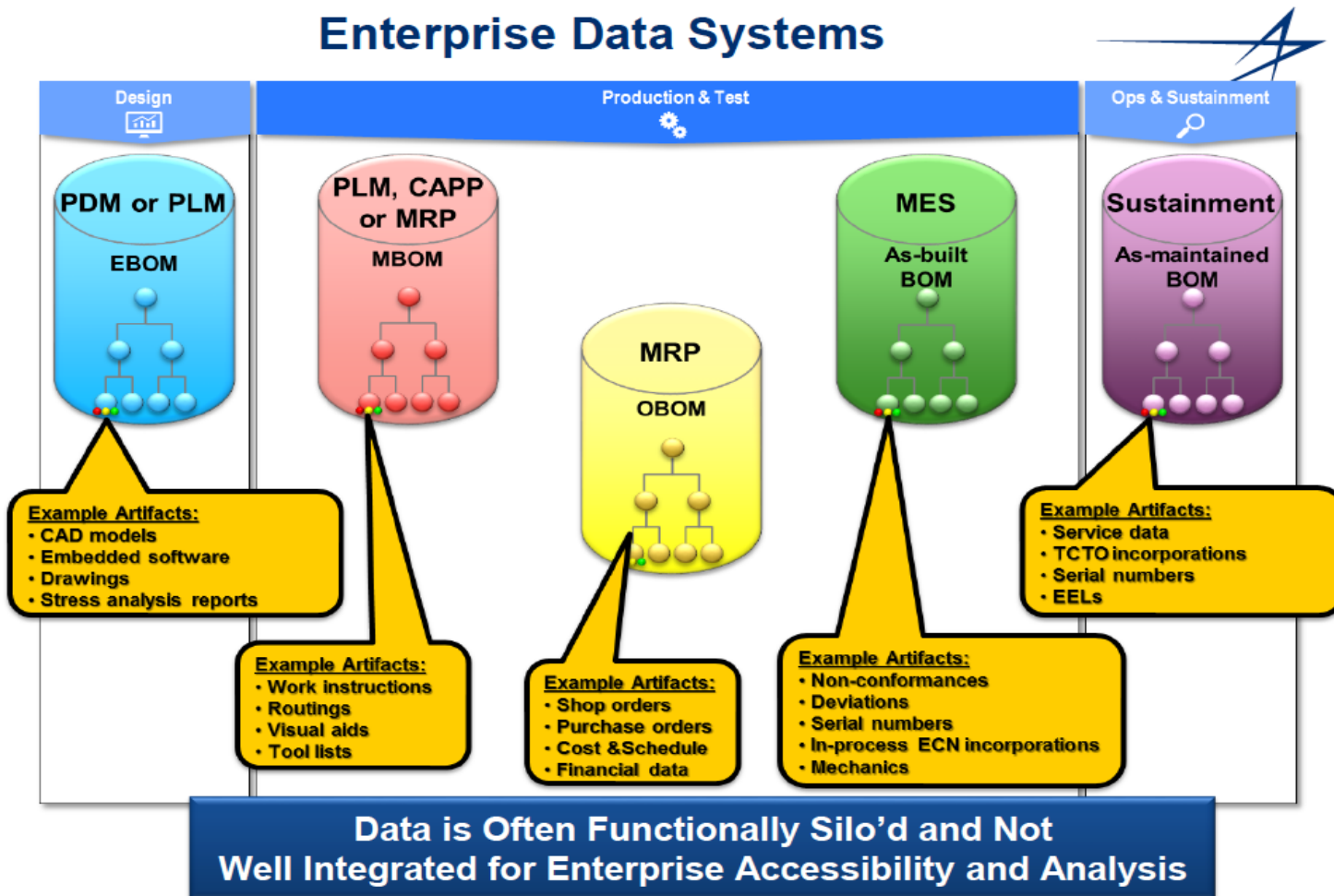
- First – I am not an engineer!
 - But am working on an engineering project
- Engineers love their acronyms as much as scientists!
 - PLM (Product Lifecycle Management)
 - PPLM (Product and Process Lifecycle Management)
 - BOM (Bill of Materials)
 - BIM (Building Information Management)
 - SCM (Supply Chain Management)
- Also engineers generally don't like change (even more so than scientists)
 - CAD has become common, but still used to generate physical blueprints



What is a 'Digital Thread'

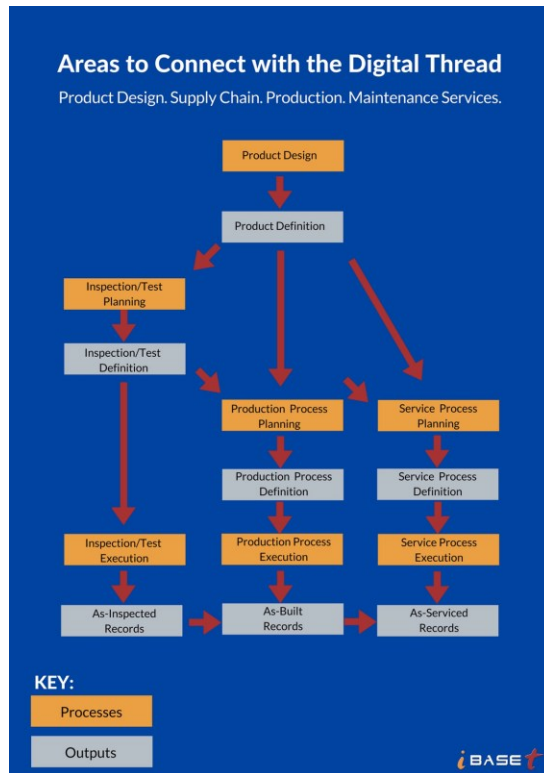
- Describes the framework which connects data flows and produces a holistic view of an asset's data across its product lifecycle
- Describe the traceability of a 'digital twin' back to the requirements, parts and control systems that make up the physical asset.

Many Tools – Many Silos



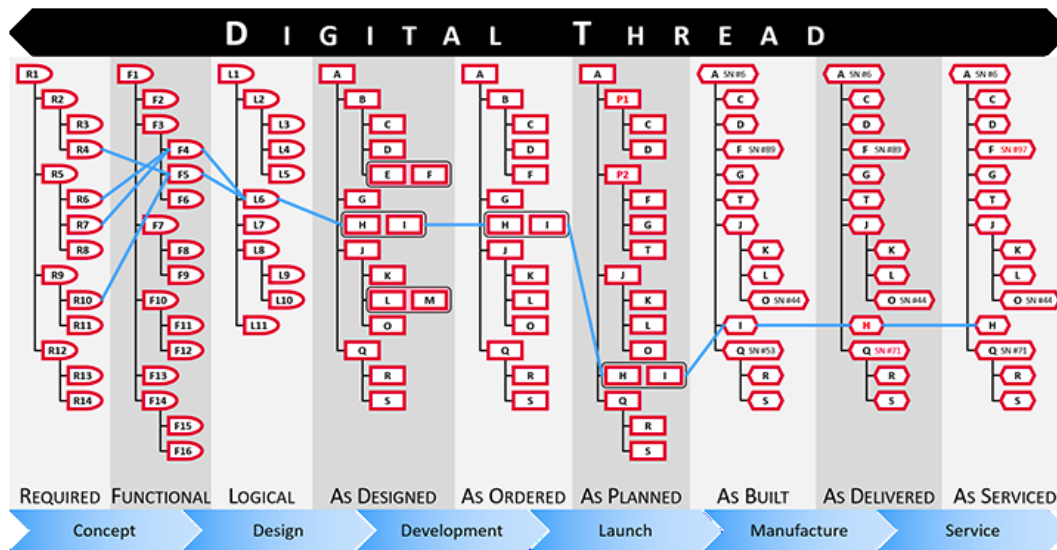
COPYRIGHT 2017, LOCKHEED MARTIN CORPORATION. ALL RIGHTS RESERVED.

Traditional Model



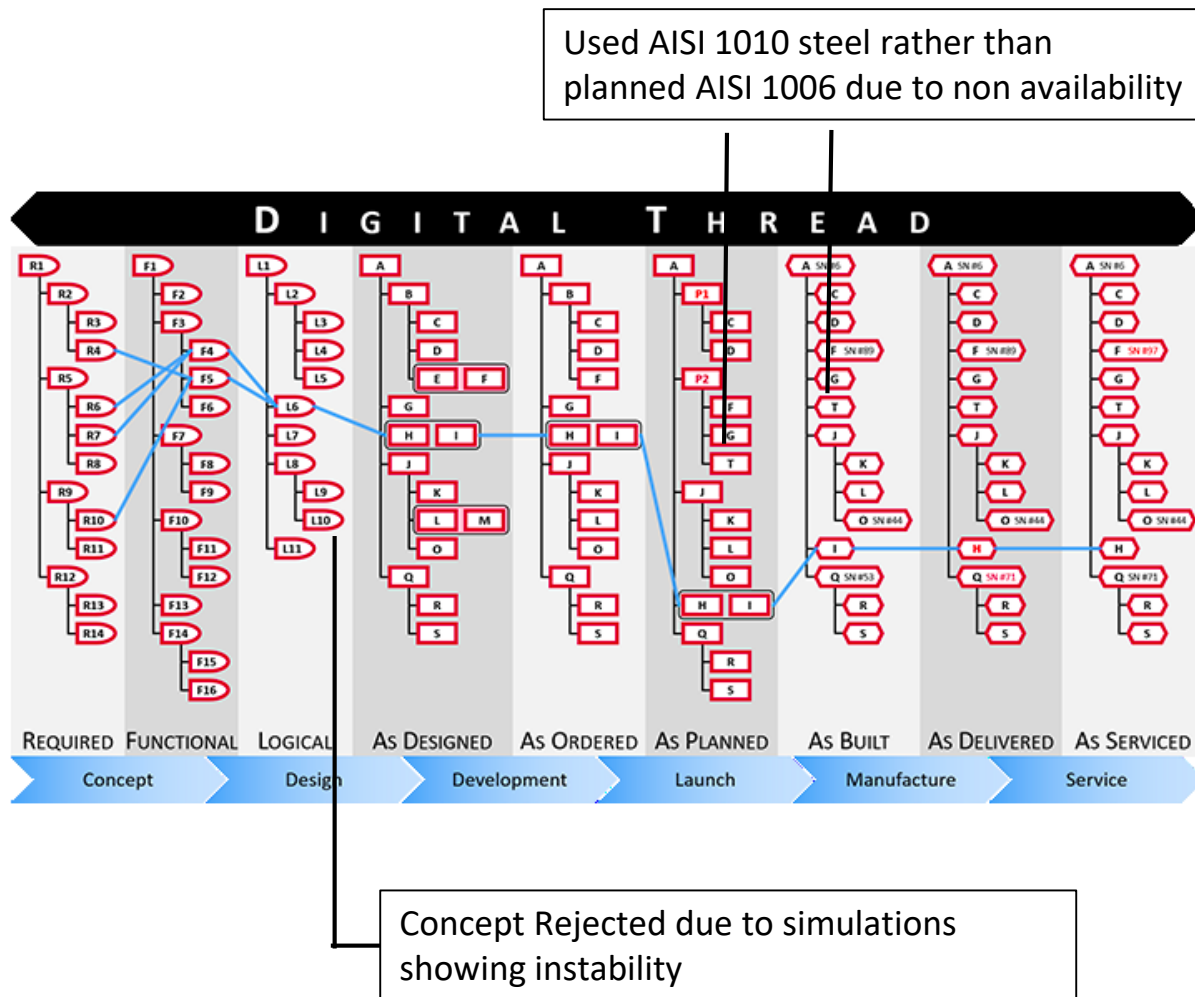
- Isn't this just Product Lifecycle Management?
- Personal opinion is it depends on the complexity of the product...
 - o A screw, a paperclip, a hammer, a frying pan... Yes
 - o A bicycle, a kettle, a dishwasher... Yes probably
 - o A computer, a television, camera... maybe
 - o A car, an aeroplane, a power station... probably not
- Does not scale well to complex systems with multiple parts being delivered by multiple organisations each of whom use their own bespoke PLM systems, or even when spanning across multiple disciplines within an organisation

Visualising the Digital Thread



- Basic digital thread allows us to trace the derivation of a 'component' back through to original requirements...
- But what both digital thread and PLM fail on is recording assumptions and the question of **WHY?**

Enhanced Digital Thread



- Annotations are used to
 - o convey additional information about a resource
 - o Describe an association between two resources
- Annotations follow W3 standard
 - o <https://www.w3.org/TR/annotation-model/#annotations>



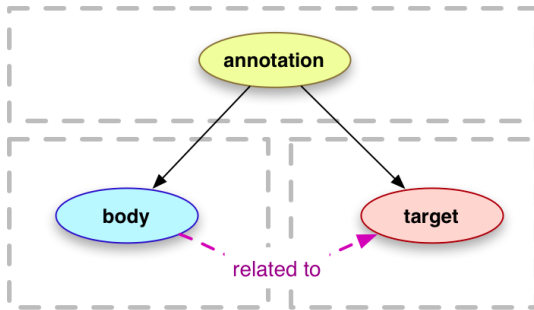
Examples of Annotations

Taken from or adapted from Web Annotation Data Model(<https://www.w3.org/TR/2017/REC-annotation-model-20170223/>)

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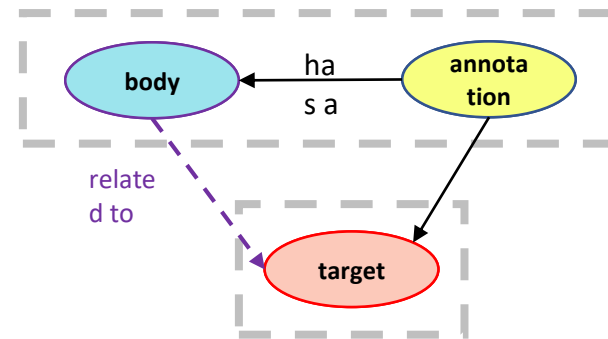
Simple Annotations

Alice has written a post that makes a comment about a particular web page. Her client creates an Annotation with the post as the body resource, and the web page as the target resource.



```
{
  "@context":
    "http://www.w3.org/ns/anno.jsonld",
    "id": "http://example.org/anno1",
    "type": "Annotation",
    "body": "http://example.org/post1",
    "target": "http://example.com/page1"
}
```

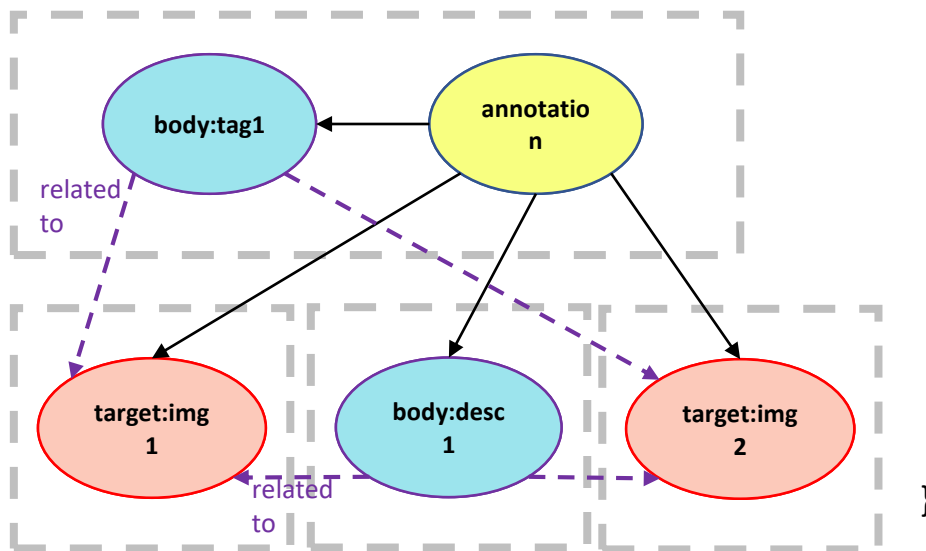
Emily writes a comment about how much she likes an image on a photo sharing website. Her client creates an Annotation with the comment embedded within it, and adds that it is in French and formatted using HTML.



```
{
  "@context":
    "http://www.w3.org/ns/anno.jsonld",
    "id": "http://example.org/anno5",
    "type": "Annotation",
    "body": {
      "type": "TextualBody",
      "value": "<p>j'adore !</p>",
      "format": "text/html",
      "language": "fr"
    },
    "target": "http://example.org/photo1"
}
```

A more complex example

Hannah associates a tag and a description with two images using a single annotation.

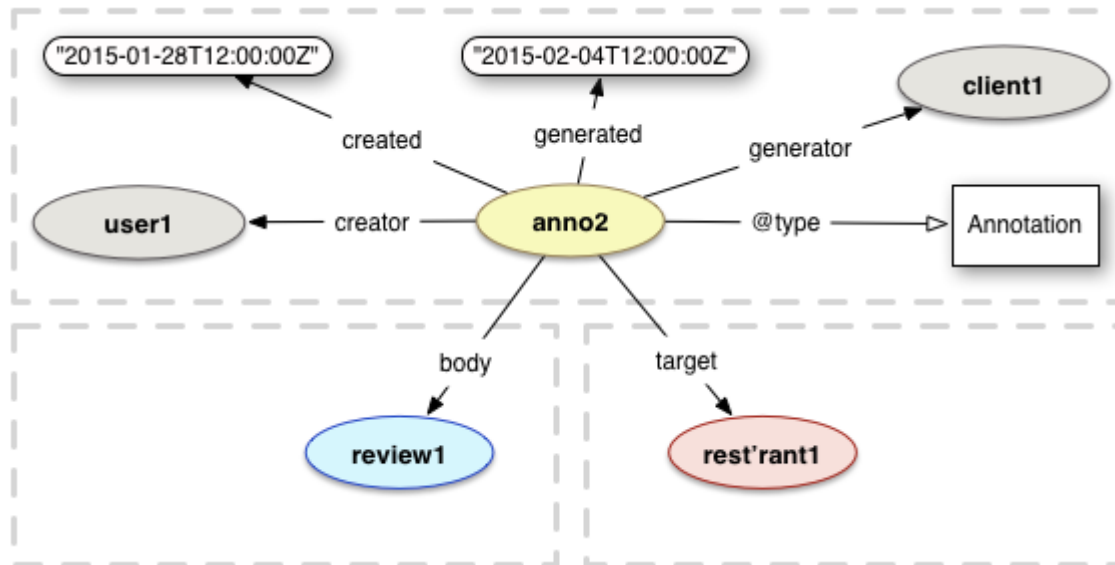


```

{
  "@context": "http://www.w3.org/ns/anno.jsonld",
  "id": "http://example.org/anno9",
  "type": "Annotation",
  "body": [ "http://example.org/desc1",
    {
      "type": "TextualBody",
      "value": "tag1"
    }
  ],
  "target": [
    "http://example.org/img1",
    "http://example.org/img2"
  ]
}
  
```

A more useful example

Beatrice writes a review of a restaurant online, and wishes to be associated with that review so that her friends know that it was her review and can trust it. Her client adds her account's identity, and its own identity, to the Annotation.

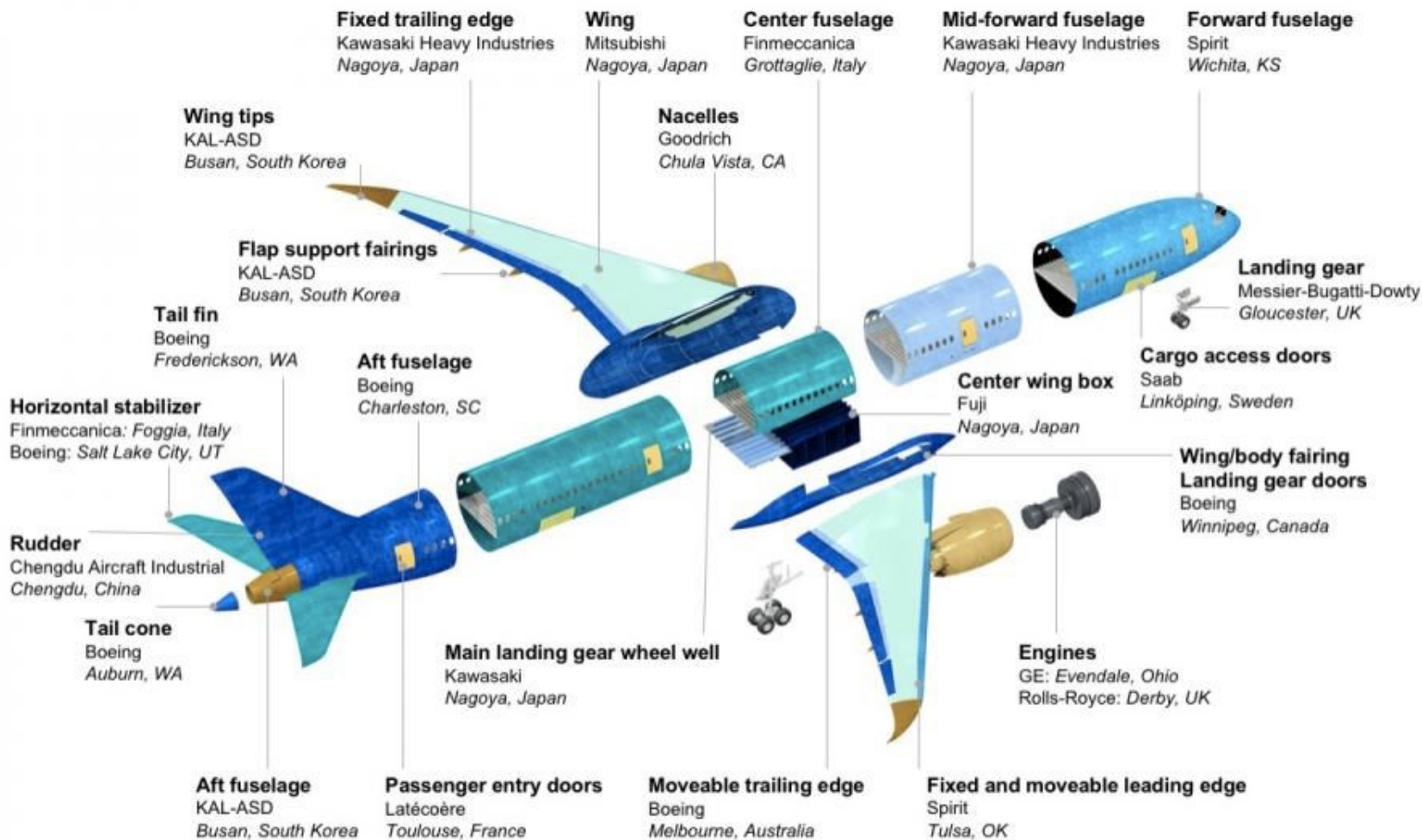


```
{
  "@context":
    "http://www.w3.org/ns/anno.jsonld",
  "id": "http://example.org/anno2",
  "type": "Annotation",
  "creator": "http://example.org/user1",
  "created": "2015-01-28T12:00:00Z",
  "generator":
    "http://example.org/client1",
  "generated": "2015-02-04T12:00:00Z",
  "body": {
    "id":
      http://example.net/review1
  },
  "target":
    "http://example.com/restaurant1"
}
```

Tying the Digital Thread using Annotations

Popular PLM Tools

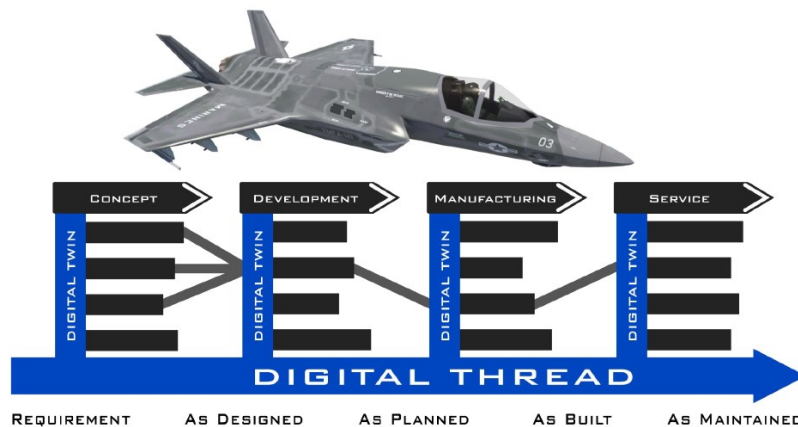
- Aras Innovator
- Autodesk Vault
- Dassault Enovia
- Siemens Teamcenter [®] already supports annotations, but these are tied to objects and can not be used to link items
- But all are based on ‘centralisation’
 - o In the modern world things are not built centrally but come from a global supply chain, each component of which may have it’s own PLM tool
 - o Common W3C Annotations for information exchange can provide the ‘Glue’ for linking to get full product lifecycle



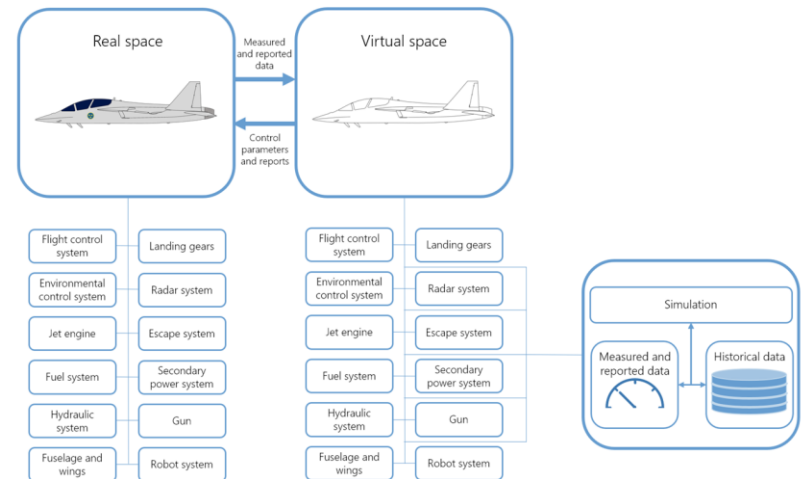
Copyright © 2015 Boeing. All rights reserved.

Towards a Digital Twin

- The digital thread is a record of a product or systems lifetime, from its creation to its removal.

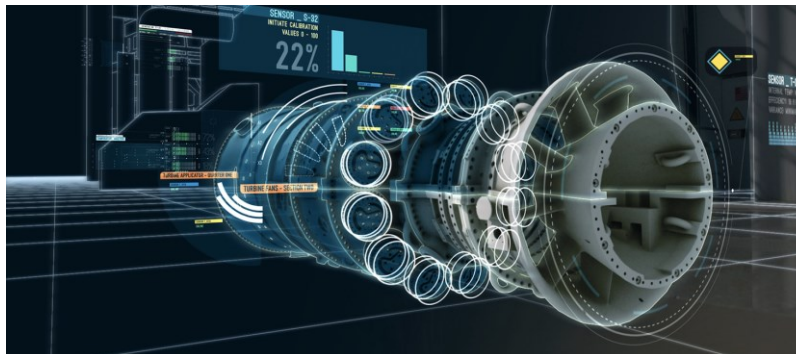
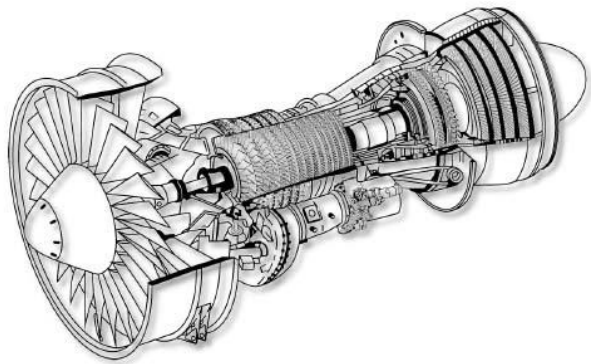


- The digital twin is the current representation of a product or system



Summary

- The engineering world of the 21st century is very different from that of the 20th
 - o But most engineering is still trying to use the same tools and concepts
- Digital thread and digital twin offer benefits in terms of traceability and cost saving
 - o Better scheduled maintenance, quicker fault diagnoses with forward and backward traceability
- Annotations can be used in engineering to provide a way of tying together digital threads from a globally connected supply chain
 - o Currently introducing to internal UKAEA project

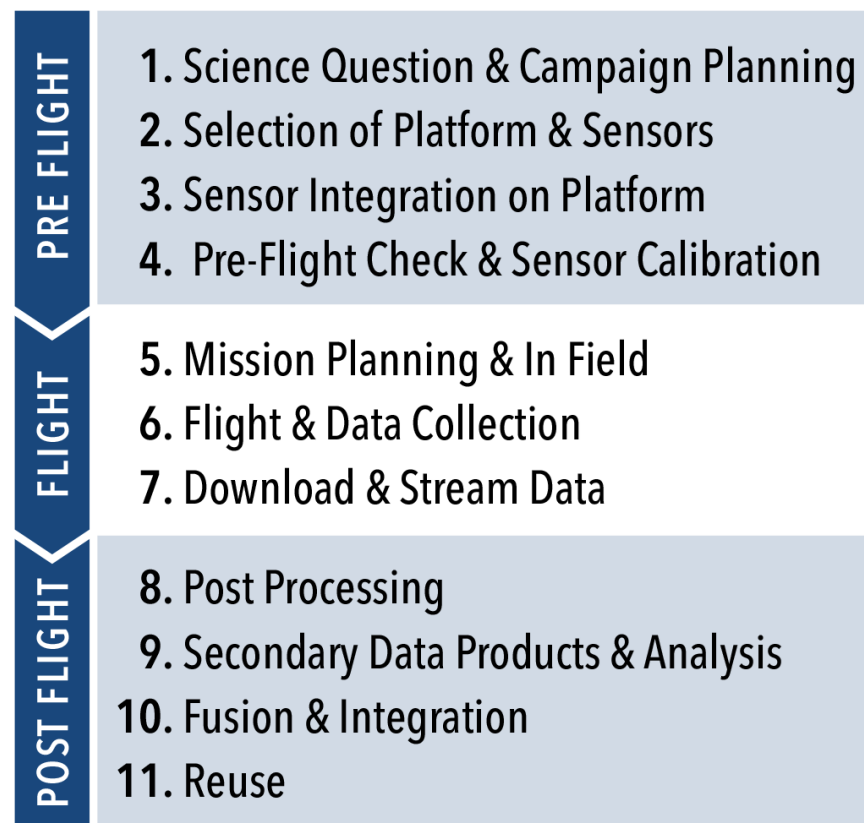


Introduction to sUAS data IG

- Started in 2016
- Case Statement:
<https://tinyurl.com/z5gf4zr>
 - sUAS are increasingly a common platform for data collection across industry and academia and many domains.
 - This nascent domain presents unique challenges and opportunities that will benefit from global common/community discussion and engagement [1]



Introduction to sUAS data IG



Introduction to sUAS data IG

Outputs to date

1. 8 meetings
2. In collaboration with ESIP: A Minimal Information Framework for Drone Data
3. [1]: *Emergent Challenges for Science sUAS Data Management: Fairness through Community Engagement and Best Practices Development* ([MDPI](#))
4. Drones4Good event at Khama Rhino Sanctuary Botswana
5. LANDRS project (ongoing)

Introduction to sUAS data IG

- **Key partner communities**
 - ESIP Drone Cluster
 - OGC UxS DWG
 - ANDS E2SIP drone community

*Update on the Linked And Networked DRoneS
project:*
DEVELOPMENT PHASE



UNIVERSITY OF NOTRE DAME
CENTER FOR RESEARCH COMPUTING

Overview

1. LANDRS overview and goals
2. LANDRS Ontology
3. LANDRS Toolkit Technology Stack
4. Drone Data Buddy Demonstrator
5. Planned adopters and extensions

LANDRS: Goals

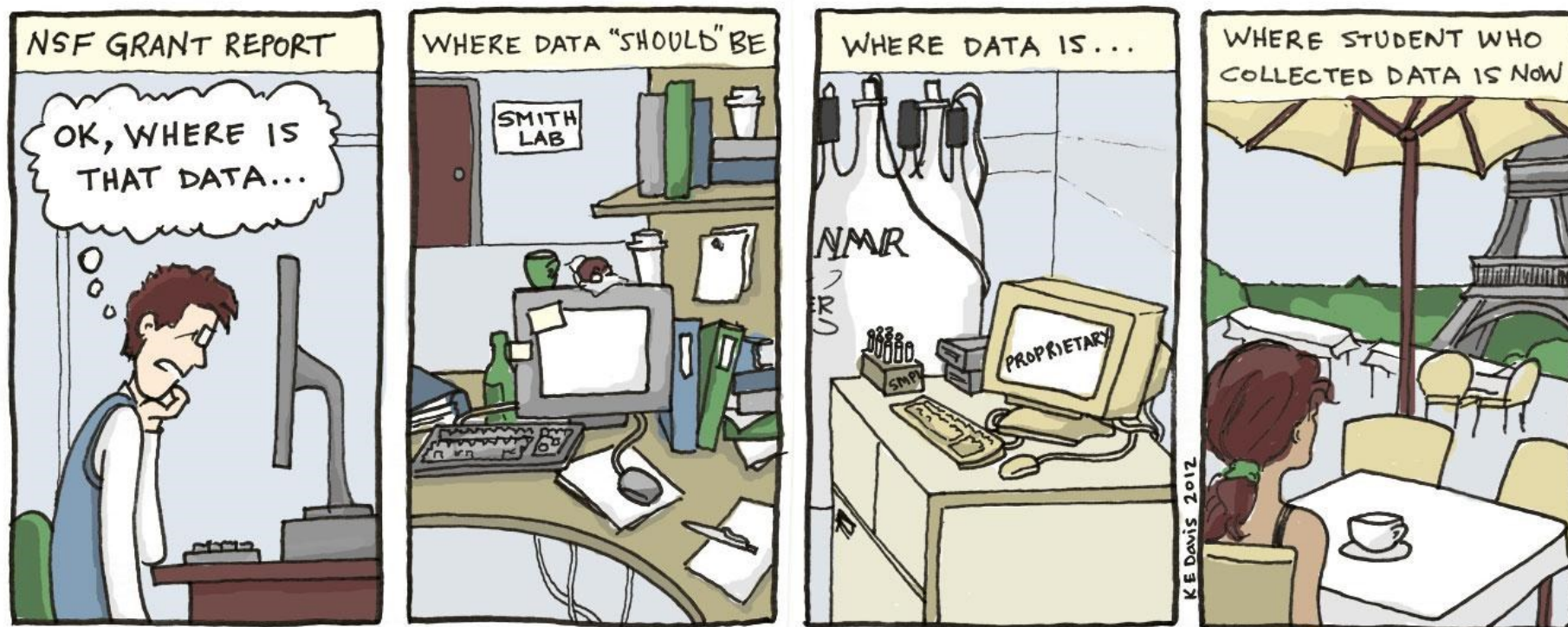
Problem: Complex and painful drone data pipeline costs significant data value

Goal: Allow users to capture the lost value by providing standards based APIs for building drone data wrangling tools.

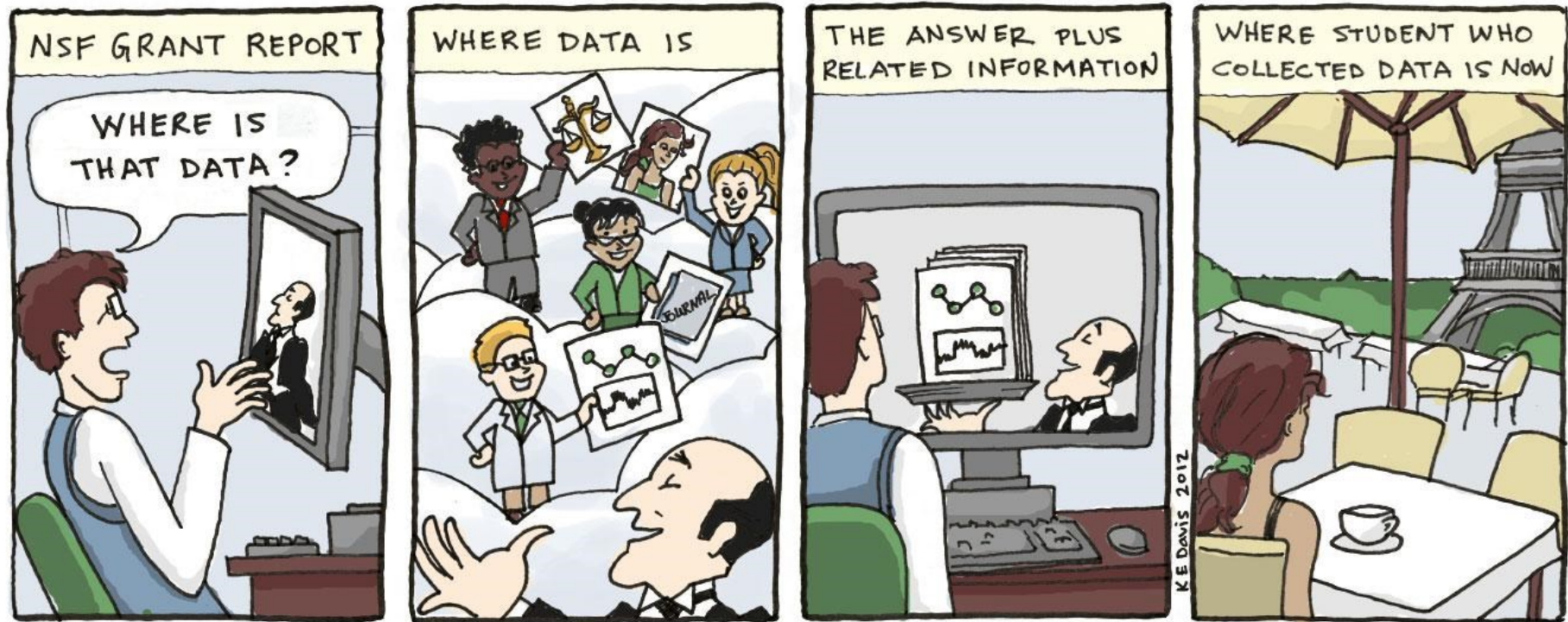


**Linked-data
API for
Networked
DRoneS**

Our current world



If we can enable smart agents with smart data



The Issue



<https://xkcd.com/927/>

Building on Existing Standards



Spatial Data on the Web Best Practices

W3C Editor's Draft 18 February 2020

Semantic Sensor Network Ontology

W3C Recommendation 19 October 2017 (Link errors corrected 08 December 2017)



Extensions to the OWL-Time Ontology temporal aggregates

W3C Editor's Draft 18 February 2020



Hydra Core Vocabulary

A Vocabulary for Hypermedia-Driven Web APIs

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Building on Existing Standards

Environment Ontology

Keywords:

Class: atmospheric carbon dioxide

Term IRI: http://purl.obolibrary.org/obo/ENVO_01000451

Definition: Atmospheric carbon dioxide is an environmental material composed of carbon dioxide in its gaseous form present in an atmosphere.

Annotations

- http://www.geneontology.org/formats/oboInOwl#created_by: ORCID:0000-0002-4366-3088
- <http://www.w3.org/2000/01/rdf-schema#comment>: This could also be considered a part of an environmental material like air.
- [in_subset](#): [envoPolar](#)

SWEET Ontologies

[chat](#) [on slack](#) on channel #sweetontology

Introduction

Official repository for Semantic Web for Earth and Environmental Terminology (SWEET) Ontologies.



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5 stars of LD Vocabulary Use



- There is dereferencable human readable information about the used vocabulary



- The information is available as machine-readable explicit axiomatization of the vocabulary



- The vocabulary is linked to other vocabularies
- Metadata about the vocabulary is available
- The vocabulary is linked to by other vocabularies



- Forked Open Source Zazuko Ontology Manager
<https://zazuko.com/products/ontology-manager/>
- LD Community of Developers
- schema.landrs.org
(live but not yet beta)

Propose Terms for Voting

[Thing](#) > [Product](#) > [Flight Controller Board](#)

Flight Controller Board

Canonical URL: <http://schema.landrs.org/schema/FlightControllerBoard>

Quick links: [Proposals](#) [Conversation](#)

Description

A flight controller (FC) is a small circuit board of varying complexity. Its function is to direct the RPM of each motor in response to input. A command from the pilot for the multi-rotor to move forward is fed into the flight controller, which determines how to manipulate the motors accordingly.

**Comment on
Terms**

Sub Class Of

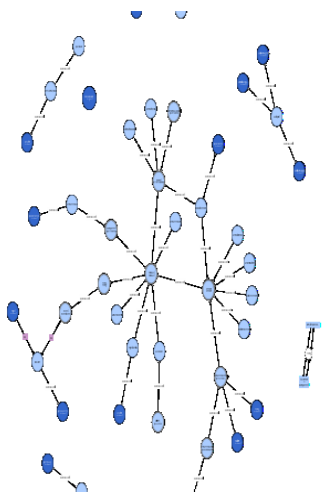
<http://www.w3.org/2000/01/rdf-schema#subClassOf>

- <http://schema.landrs.org/schema/Product>
- <http://www.w3.org/ns/sosa/system>

Properties

Property	Expected Type	Description
This resource does not have any properties.		

<https://www.landrs.org/ontology/>



Landrs Schema

language **en**

Release 2020-02-01

Revision:

0.0.1

License:

License <https://creativecommons.org/publicdomain/zero/1.0/>

Visualization:

Visualize with WebVow!

Cite as:

Landrs Schema, Revision: 0.0.1.

Provenance of this page

Abstract

This ontology is developed as part of the Sloan Funded LANDRS project to advance UxV data interoperability

[back to ToC](#)

1. Landrs Schema: Overview

This ontology has the following classes and properties.

Classes

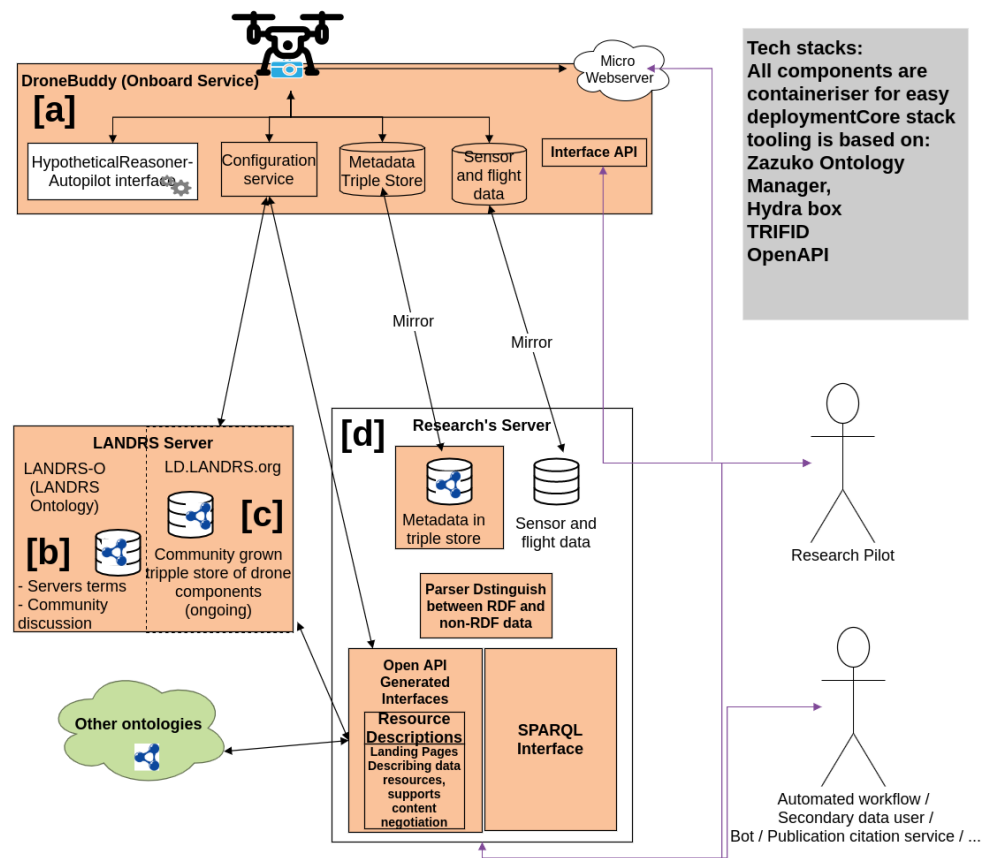
Airframe	Automated Robot	Autonomous Robot	Autopilot	Component	event	Event	Flight Control System	Flight Controller Board
Ground Control Station	Mission	Motorized Vehicle	p o component type	Payload	Product	Remotely Piloted Robot	robot	Robot
Robotic Vehicle	Sensor Payload	Surface Vehicle	Thing	Underwater Vehicle	unmanned aerial vehicle			
Unmanned Aerial Vehicle	Unmanned Aerial Vehicle	Unmanned Aircraft Component			Unmanned Aircraft System	Unmanned Aircraft System		
Unmanned Vehicle	Unmanned Vehicle	Unmotorized Vehicle	UxV Body	Vehicle				

Object Properties

component	hasWhole	Winston ODP Component p
-----------	----------	-------------------------

Building LD Applications

Drone Data Buddy example application



LANDRS SPARQL End Point

zozukoTrifid

Query X +

https://ld.landrs.org/query

```
1 PREFIX sosa: <http://www.w3.org/ns/sosa/>
2 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
3 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
4 SELECT * WHERE {
5   ?sub rdf:type ?obj
6 }
7 LIMIT 10
```

Press CTRL - <spacebar> to autocomplete

Table Response Pivot Table Google Chart Geo

Showing 1 to 10 of 10 entries (in 0.052 seconds)

Search: Show 50 entries

sub	obj
1 http://schema.landrs.org/mission	https://data.nasa.gov/ontologies/atmonto/ATM#Flight
2 http://schema.landrs.org/Payload	http://www.w3.org/2000/01/rdf-schema#Class
3 http://ld.landrs.org/schema/Thing/drone/#s/FlightControllerBoard	http://schema.landrs.org/FlightControllerBoard
4 https://ld.landrs.org/actuator/35-207306-844818-0/T5008	http://www.w3.org/ns/sosa#Actuator

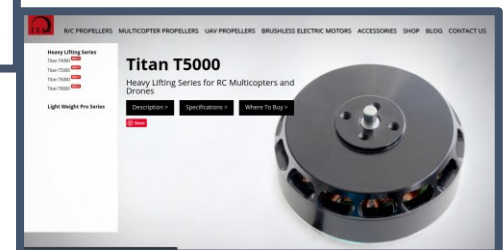
https://ld.landrs.org/actuator/35-207306-844818-0/T5008

<https://ld.landrs.org/actuator/35-207306-844818-0/T5008>

type	Actuator
sameAs	https://www.xoarintl.com/brushless-electric-motors/titan/titan-T5000-heavy-lifting-series/
comment	<p> XOAR Titan T5000 Brushless Electric Motor Heavy Lifting Series offers all multicopters and drones manufacturers, engineers, pilots and enthusiasts the best performance and reliable propulsion system with XOAR Precision Pair Propellers. XOAR Titan Brushless Electric Motors are specially designed with top grade materials and unique design to work with XOAR Precision Pair Propellers in order to offer the best balance in weight and performance. XOAR Titan T4000 Heavy Lifting Series includes T5008 - KV320, T5010 - KV300, T5012 - KV300, T5015 - KV285 which supports All Up Weight (AUW) for quadcopter, hexacopter, octocopter from min. 6.24 Kg, 9.36 Kg, 12.48 Kg to max. 12.4 Kg, 18.6 Kg and 24.8 Kg respectively. See below for more detailed specs and performance data. </p>
label	XOAR Titan T5008 Brushless Electric Motor Heavy Lifting Series
isHostedBy	FlightControllerBoard



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Hydra and SHACL

Shapes Constraint Language (SHACL)

W3C Recommendation 20 July 2017



 [zazuko](#) / [hydra-box](#)

 Used by 18  Watch 7  Star 9  Fork 1

[Code](#) [Issues 26](#) [Pull requests 1](#) [Actions](#) [Projects 0](#) [Wiki](#) [Security](#) [Insights](#)

Hydra Box - SPARQL to Linked Data APIs for Web developers

[hydra](#) [rdf](#) [linked-data](#) [api](#) [hypermedia-api](#) [hateoas](#) [sparql](#)

hydra-box

[Hydra](#) is a machine readable description for APIs. Hydra Box extends the API description with links to the actual code, which provides the API. Hydra Box will use such an API description to start a server which provides the API and dynamically loads the required code for it.



[landrs.org](#)

Hydra and SHACL

Example shapes graph

```
ex:PersonFormShape
  a sh:NodeShape ;
  sh:property [
    sh:path ex:firstName ;
    sh:name "first name" ;
    sh:description "The person's given name(s)" ;
    sh:order 0 ;
    sh:group ex:NameGroup ;
  ] ;
  sh:property [
    sh:path ex:lastName ;
    sh:name "last name" ;
    sh:description "The person's last name" ;
    sh:order 1 ;
    sh:group ex:NameGroup ;
  ] ;
  sh:property [
```

Name

first name: John

last name: Doe

Address

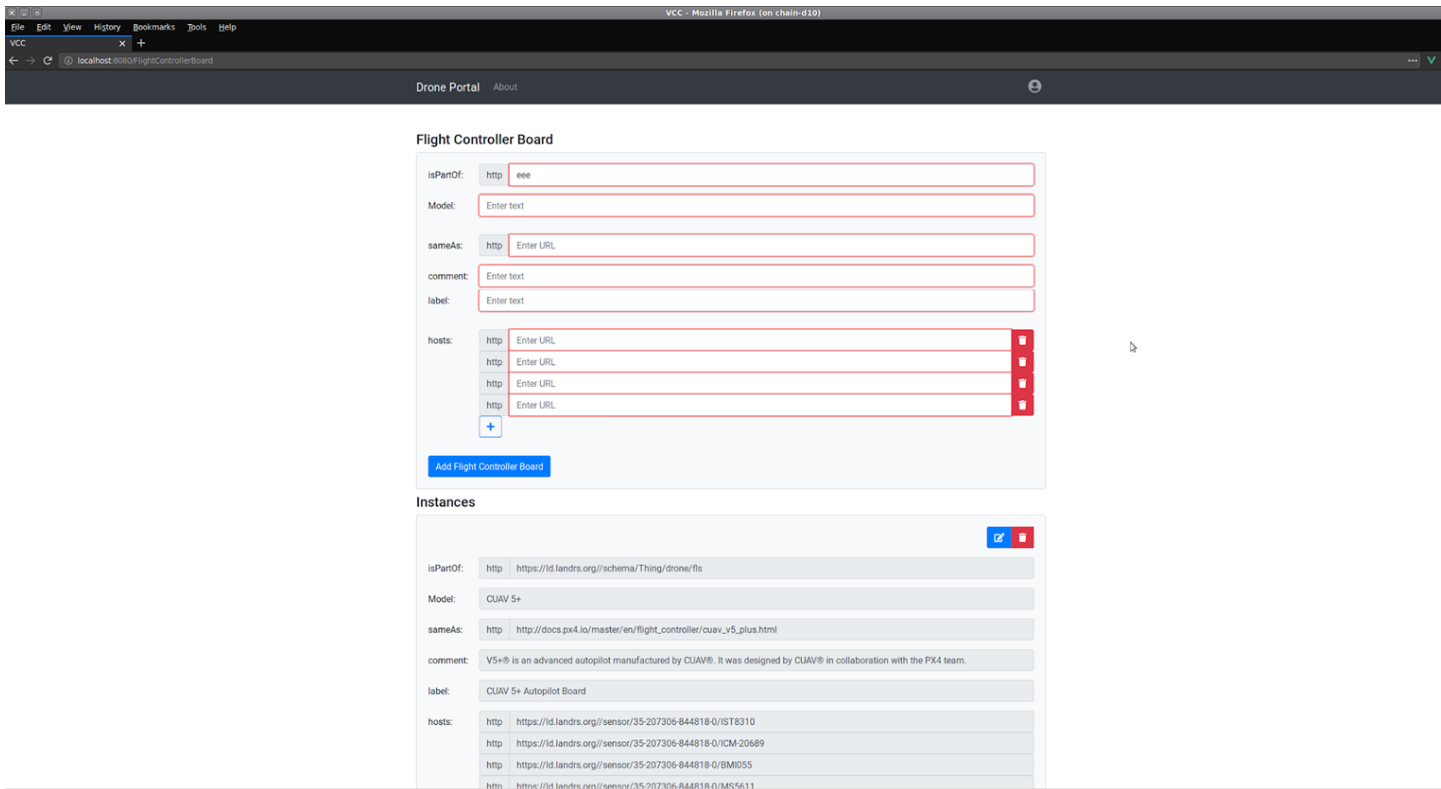
street address: 123 Silverado Ave

locality: Cupertino

zip code: 54321

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LANDRS Hydra and SHACL



The screenshot shows a web browser window with the URL `localhost:8080/FlightControllerBoard`. The page title is "Drone Portal" and "About". The main content area is titled "Flight Controller Board" and contains a form with the following fields:

- isPartOf:** `http` `eee`
- Model:** Enter text
- sameAs:** `http` Enter URL
- comment:** Enter text
- label:** Enter text
- hosts:** A list of four `http` Enter URL fields, with a "+" button to add more.

Below the form is a blue button labeled "Add Flight Controller Board".

The "Instances" section shows a table of instances for the "Flight Controller Board" class. The table has columns for **isPartOf**, **Model**, **sameAs**, **comment**, **label**, and **hosts**.

isPartOf	Model	sameAs	comment	label	hosts
<code>http</code>	<code>https://id.landrs.org/schema/Thing/drone/fls</code>	<code>http</code>	<code>http://docs.px4.io/master/en/flight_controller/cuav_v5_plus.html</code>	<code>V5+® is an advanced autopilot manufactured by CUAV®. It was designed by CUAV® in collaboration with the PX4 team.</code>	<code>CUAV 5+ Autopilot Board</code>
<code>http</code>	<code>https://id.landrs.org/sensor/35-207306-844818-0/IST8310</code>	<code>https://id.landrs.org/sensor/35-207306-844818-0/ICM-20689</code>	<code>https://id.landrs.org/sensor/35-207306-844818-0/BMI055</code>	<code>https://id.landrs.org/sensor/35-207306-844818-0/MS5611</code>	

Incorporating OGC API

OGC API - Features - Part 1: Core

Table 1. Overview of resources, applicable HTTP methods and links to the document sections

Resource	Path	HTTP method	Document reference
Landing page	/	GET	7.2 API landing page
Conformance declaration	/conformance	GET	7.4 Declaration of conformance classes
Feature collections	/collections	GET	7.13 Feature collections
Feature collection	/collections/{collectionId}	GET	7.14 Feature collection
Features	/collections/{collectionId}/items	GET	7.15 Features
Feature	/collections/{collectionId}/items/{featureId}	GET	7.16 Feature

- Containerised Microservices
 - Apache Jena Fuseski GeoSPARQL
 - Trifid
 - Hydrabox
 - Server Web Application Client (Forms)
 - Drone Application Client

LANDRS Toolkit: Annotation Appliance

- Containerised Microservices
 - LANDRS Web API
 - Hydrabox
 - RDFjs Filesystem Store
 - Ontologies
 - LANDRS Node Component API
 - Mavlink
 - ROS
 - Dynamic mission routing

rdf-store-fs

npm v1.0.0 build passing coverage 100%

Filesystem based RDF Store that follows the [RDF/JS: Stream interfaces](#) specification.

Best Practices Exercises

1. USGS
2. LTER
3. RDA



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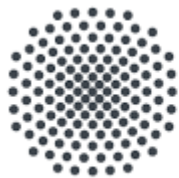


Planned Extensions

- Image Annotation
<https://www.w3.org/ns/oa>
- Jupyter-lab Metadata Service: <https://github.com/jupyterlab/jupyterlab-metadata-service>
- DIDs and Verifiable Credentials
 - <https://w3c.github.io/did-core/>
 - <https://w3c.github.io/vc-data-model/>
- 5G

Get involved

- General info: landrs@nd.edu
- [Slack Channel](#)
- Interested in a paid internship?
 - Pitch to us via [Google form](#)
- Submit an issue/propose something on [Github](#)



University of Stuttgart
Germany

Universitätsbibliothek



NFDI4ing



EngMeta

A Metadata Scheme
for Engineers

SPONSORED BY THE



Federal Ministry
of Education
and Research

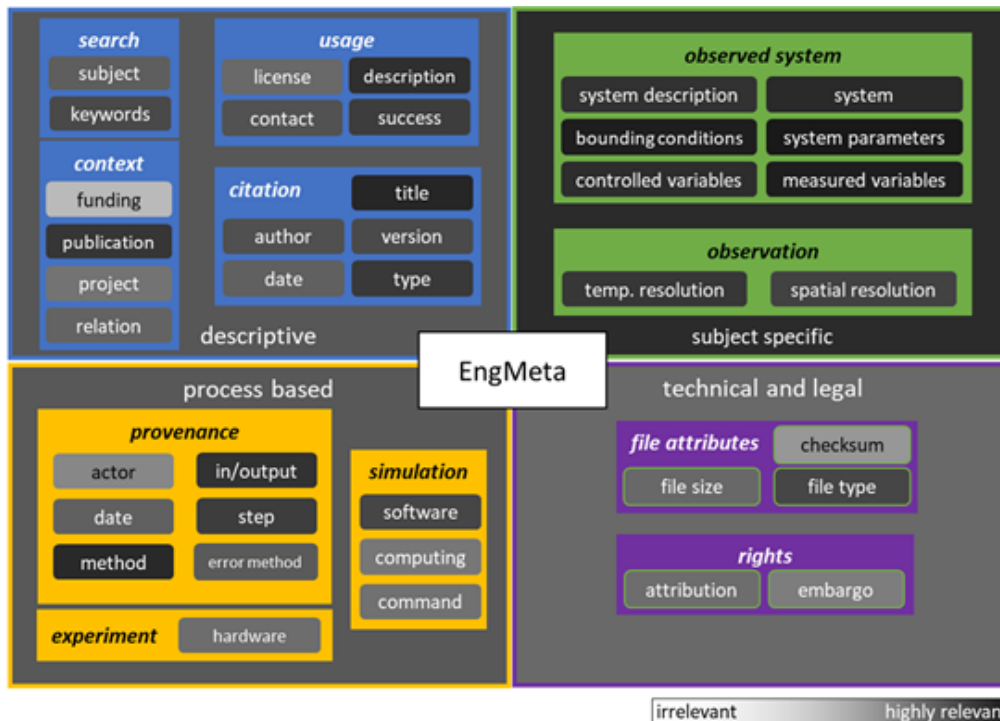
Metadata for Engineering

Situation in Engineering:

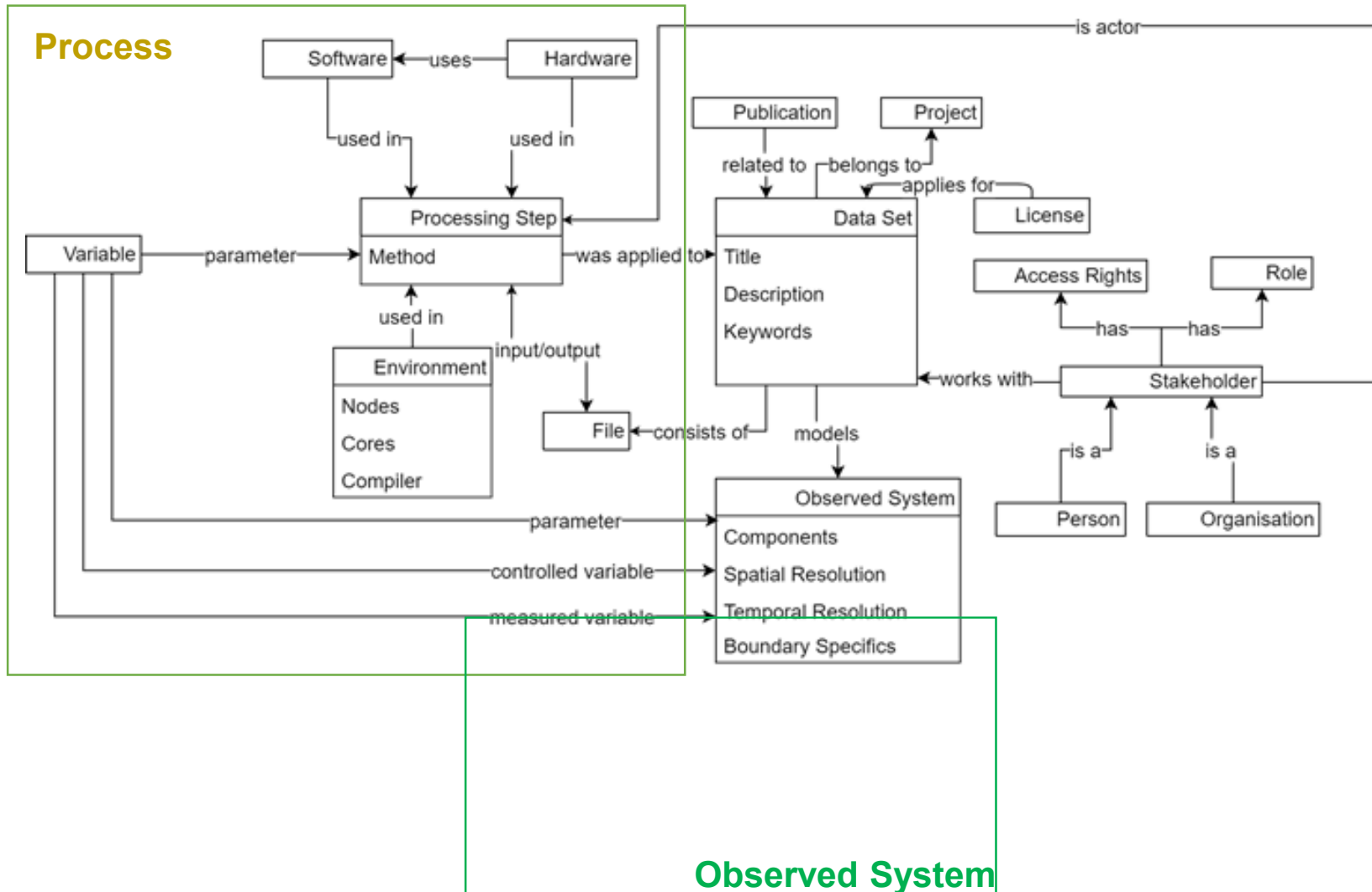
- Big data (large data files, huge number of files)
- Code as central research output
- Diverse setups, methods and formats
- Large parameter spaces
- Individual and diverse data documentation

What is relevant to describe engineering research output?

Survey of engineers at the University of Stuttgart (N=75)

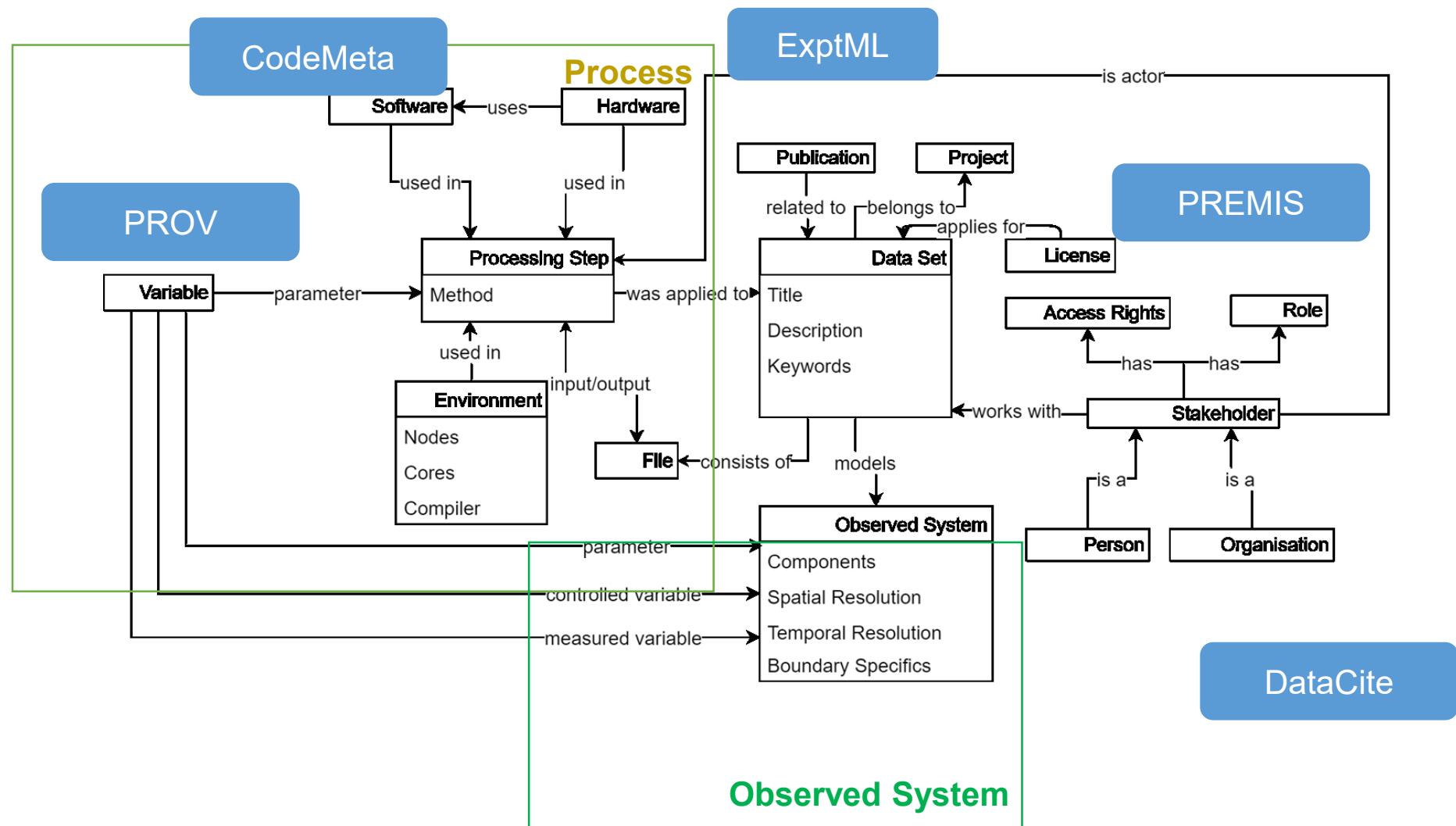


Content Model of EngMeta



Content Model of EngMeta

Underlying Standards



Available as XSD-Scheme under: <https://www.izus.uni-stuttgart.de/fokus/engmeta>

ENGMETA DOKUMENTATION
ENGMETA BEISPIELDATEI
ENGMETA SCHEMA
CHANGELOG

Iglezakis, Dorothea; Schembera, Björn, 2019, "EngMeta - a Metadata Scheme for the Engineering Sciences", <https://doi.org/10.18419/darus-500>, DaRUS, V1



Schembera, B. & Iglezakis, D. (2019). The Genesis of EngMeta - A Metadata Model for Research Data in Computational Engineering. In E. Garoufallou, F. Sartori, R. Siatry & M. Zervas (eds.), *Metadata and Semantic Research* (p./pp. 127-132), Cham: Springer International Publishing. ISBN: 978-3-030-14401-2

Schembera, B. & Iglezakis, D. (in press). EngMeta - Metadata for Computational Engineering. *International Journal of Metadata, Semantics and Ontologies*, .

EngMeta in Action

Implementation in DaRUS



Data Repository of University of Stuttgart basing on the Open-Source-Software [Dataverse](#) with configurable metadata blocks

Metadata Fields

Choose the metadata fields to use in dataset templates and when adding a dataset to this dataverse.

- ☒ Citation Metadata (Required) [\[+\] View fields + set as hidden, required, or optional](#)
- ☒ Process Metadata [\[+\] View fields + set as hidden, required, or optional](#)
- ☒ Engineering Metadata [\[+\] View fields + set as hidden, required, or optional](#)
- ☐ Astronomy and Astrophysics Metadata [\[+\] View fields](#)
- ☐ Life Sciences Metadata [\[+\] View fields](#)
- ☐ Geospatial Metadata [\[+\] View fields](#)
- ☐ Journal Metadata [\[+\] View fields](#)
- ☐ Social Science and Humanities Metadata [\[+\] View fields](#)
- ☐ Metadata for Research Software [\[+\] View fields](#)

Seeland, Anett, 2020, "EngMeta Metadata Block Configuration for Dataverse", <https://doi.org/10.18419/darus-508>, DaRUS, V1



EngMeta in Action

Example Simulation in Thermodynamics

Process Metadata ^	
Software ?	GROMACS Version: 2016.5 (http://manual.gromacs.org/documentation/2016.5/download.html)
Environments ?	ForHLR I, 11 computing nodes, PPN: 20
Engineering Metadata ^	
Data Generation ?	Simulation
Controlled Variables ?	Number of atoms (N)
	Volume (V)
	Temperature (T) : 350 [Kelvin]
Force Field ?	GAFF

EngMeta in Action

Example: Experimental Data

Process Metadata

Processing Methods

Standard cone beam scanning of the centered sample (scan time: 5:35:06)

Method Parameters

Geometric magnification : 2.9921 []

Source detector distance : 593.7497 [mm]

Source object distance : 332.122 [mm]

X-ray tube voltage : 140 [kV]

X-ray tube current : 400 [µA]

Number of vertical detector pixel : 1536 [pixel]

Number of horizontal detector pixel : 1944 [pixel]

Detector pixel size : 0.0748 [mm]

Resulting voxel size : 0.0249 [mm]

Detector exposure time : 2500 [ms]

Number of projection angles : 1440

Number of projections per angle : 1

Detector bad pixel map version : "Dexela1512_v2019-11-11"

Detector in-plane (YZ-plane) moving pattern in pixel : [(0,0),(35,35),(35,-35),(-35,35),(-35,-35)]

Detector in-plane (YZ-plane) positions according to moving pattern : 5

Number of dark images (D) : 1

Number of open beam images (ob) : 1

Position X-axis : 516.025 [mm]

Position Y-axis : 14.6391 [mm]

Position Z-axis : 14.775 [mm]

Position x-axis : -0.0362 [mm]

Position y-axis : 0.125 [mm]

Position switch detector axis : 80.0 [mm]

Position detector X-axis : 10.0 [mm]

Position detector Y-axis : 210450 [counts]

Position detector Z-axis : 197900 [counts]

Software

Octopus Reconstruction Version: 8.9.4.9

Instruments

micro-XRCT system , Version: Open and modular assembly, calibration: "Dexela1512_v2019-11-25"

X-ray source , Version: FineTec FORE 180.01C TT

Detector , Version: PerkinElmer Dexela 1512 with GOS-based DRZ-Standard scintillator

Stage X-Axis , Version: Oxis LIME S 170-1000-3-HSM

Stage Y-Axis , Version: Standa BMT167-2SL-MEN1

Stage Z-axis , Version: Oxis HVM-100-30-HSM-MS

Stage x-axis , Version: Newport M423 stage with Nanotec ST2018L0804-A actuator

Stage y-axis , Version: Newport M423 stage with Nanotec ST2018L0804-A actuator

Stage rotZ-axis , Version: Standa BMR190-2-28-MEN1

Stage switch detector , Version: HSEL 2111325086/213503 spindle (pitch 2.5 mm) with Vexta PK245M-01B motor

Stage detector X-axis , Version: Custom-made: Spindle with 5 mm pitch and Vexta PK245M-01B motor

Stage detector Y-axis , Version: Standa BMTF-750X-MEN1

Stage detector Z-axis , Version: Standa BMTF-750X-MEN1

Multi-axis controller (8 channel) , Version: Standa 8SMC4-ETHERNET

Multi-axis controller (12 channel) , Version: Standa 8SMC5-ETHERNET

Sample holder , Version: M-BK-1A with 72.5 mm extension (50 mm spacer + 12.5 mm spacer + 10 mm special holder)

Engineering Metadata

Data Generation

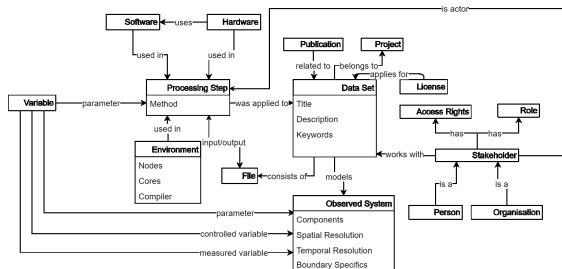
Experiment

System or Phase Components

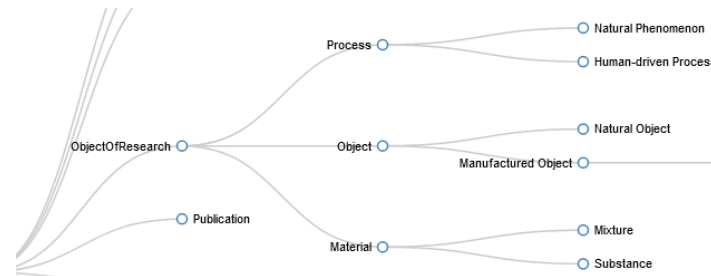
Open-pored asphalt concrete : Cylindrical core with 100 mm diameter and 50 mm length

Further development in Metadata4Ing

EngMeta



Hierarchical Model



Metadata4Ing



NFDI4Ing



Data Type Registry

D-SI

Standards

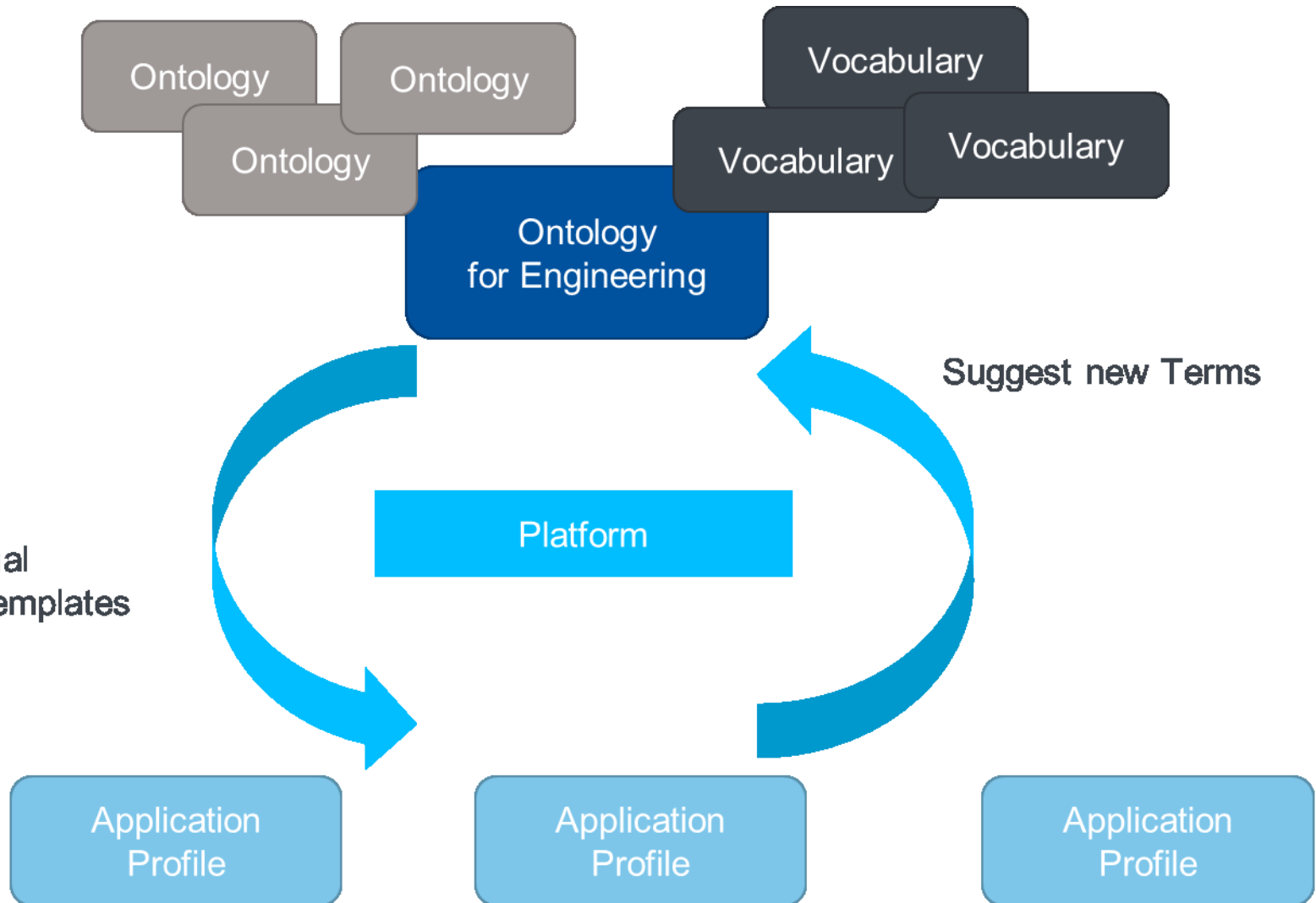
INTERNATIONAL DATA
SPACES ASSOCIATION



Platforms

Objective of NFDI4ING

A Living Ontology





University of Stuttgart
Germany

Thank you!



Dorothea Iglezakis

e-mail dorothea.iglezakis@ub.uni-stuttgart.de

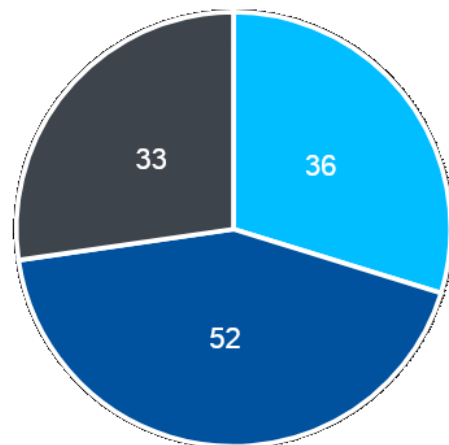
phone +49 (0) 711 685-83648

Universität Stuttgart

FoKUS – Competence Center for Research Data Management

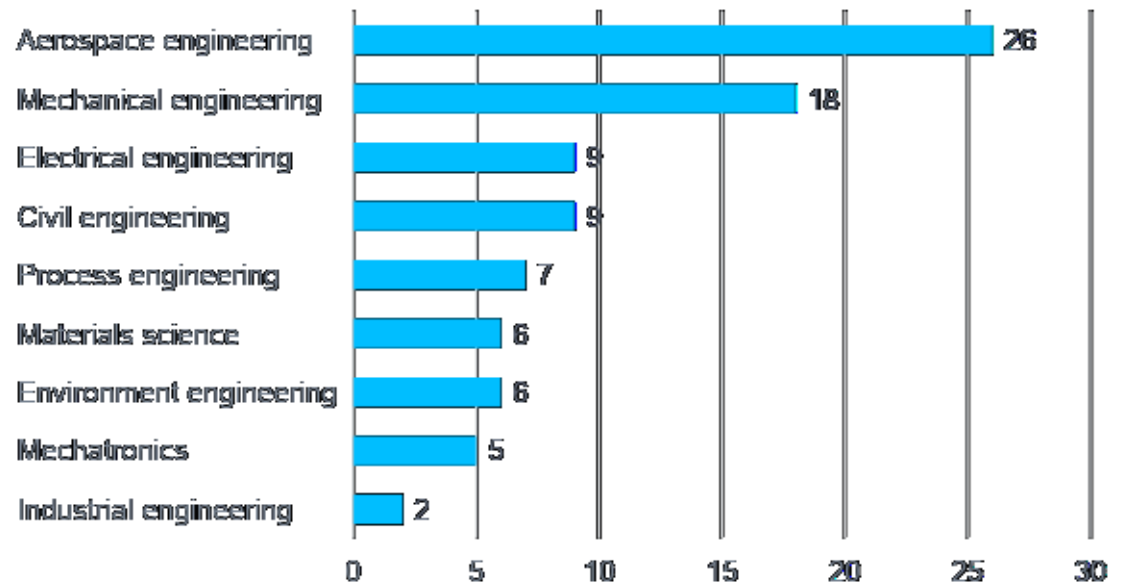
Holzgartenstr. 16, 70174 Stuttgart, Germany

Used Methods (N=75)



■ Theoretical analysis ■ Simulation ■ Experiment

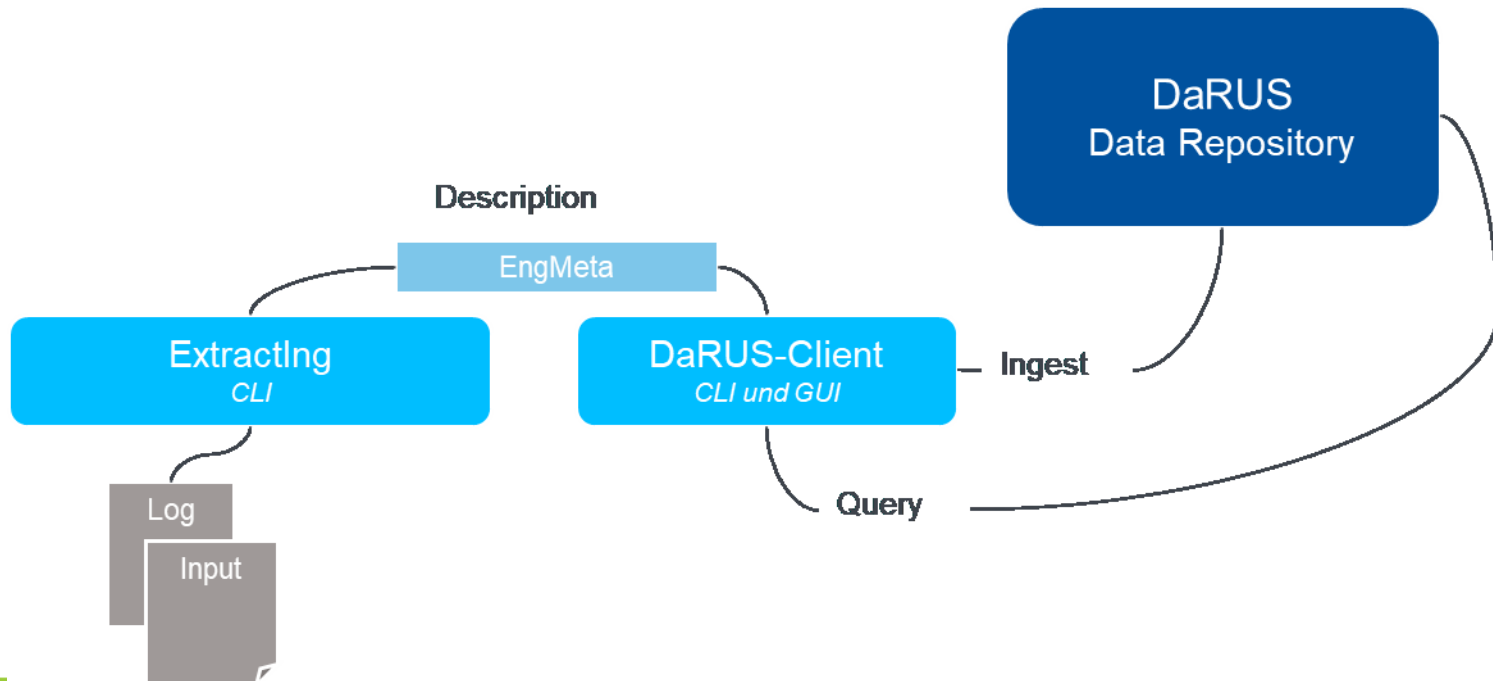
Disciplines (N=75)

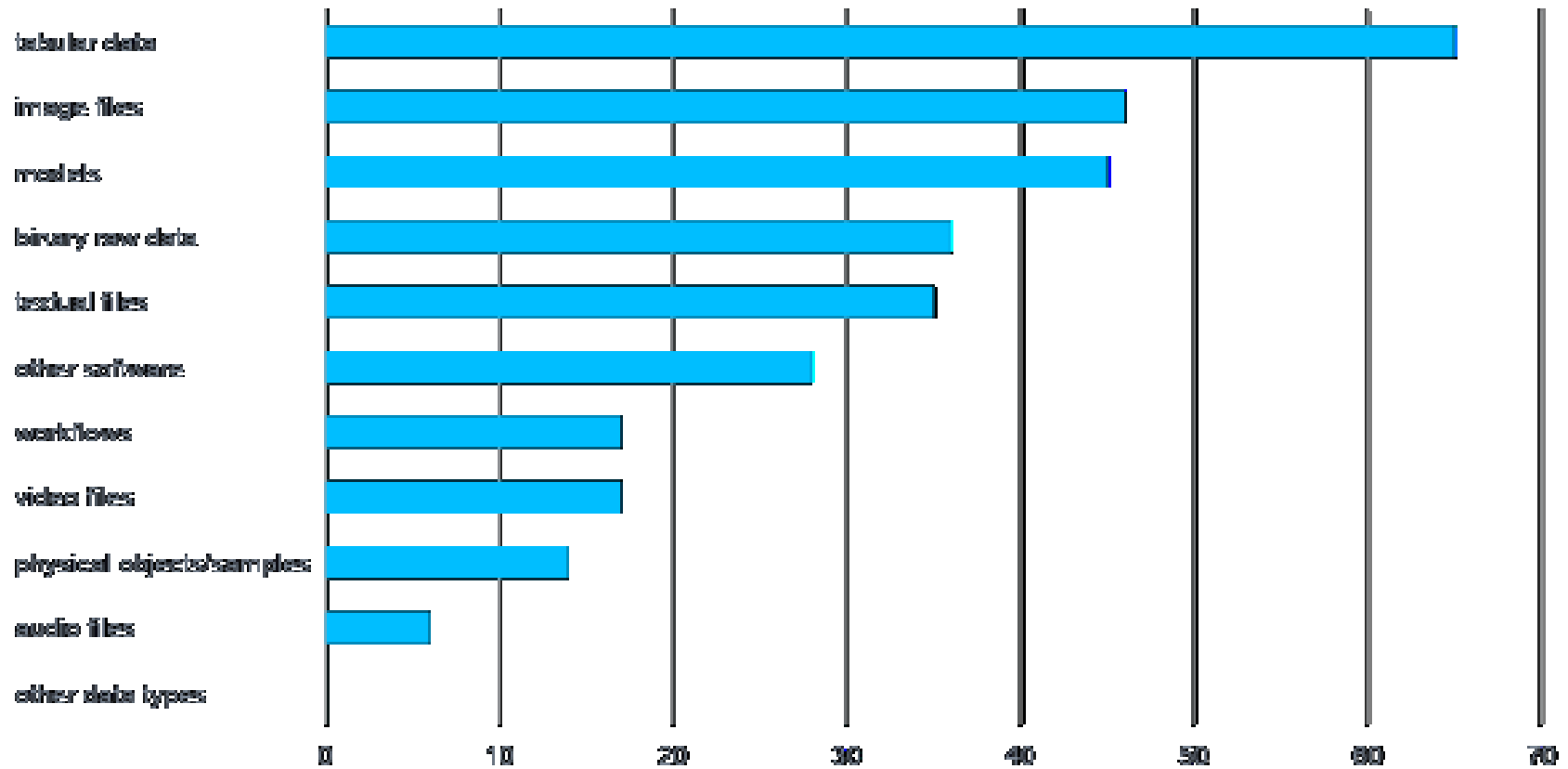


Automation

Survey at the University of Stuttgart

- Estimation of the relevance of the EngMeta metadata fields for the description of engineering data and results
- 84 participants, from that 75 engineers





Thank you!