

# From Open Data to Operations - Building AI Governance Infrastructure

Noel McLoughlin  
Principal Engineer TD



# DISCLAIMER - My presentation and demo is based on personal Open-Source contributions and collaboration outside FINOS



Personal

<https://github.com/noelmcloughlin/>



Community

<https://github.com/linkml/linkml>



Industry Experiments

<https://github.com/lmodel/>

# My Open-Source interest – Model driven Technology



# LinkML Community Open Source Project

JOURNAL ARTICLE

## LinkML: an open data modeling framework

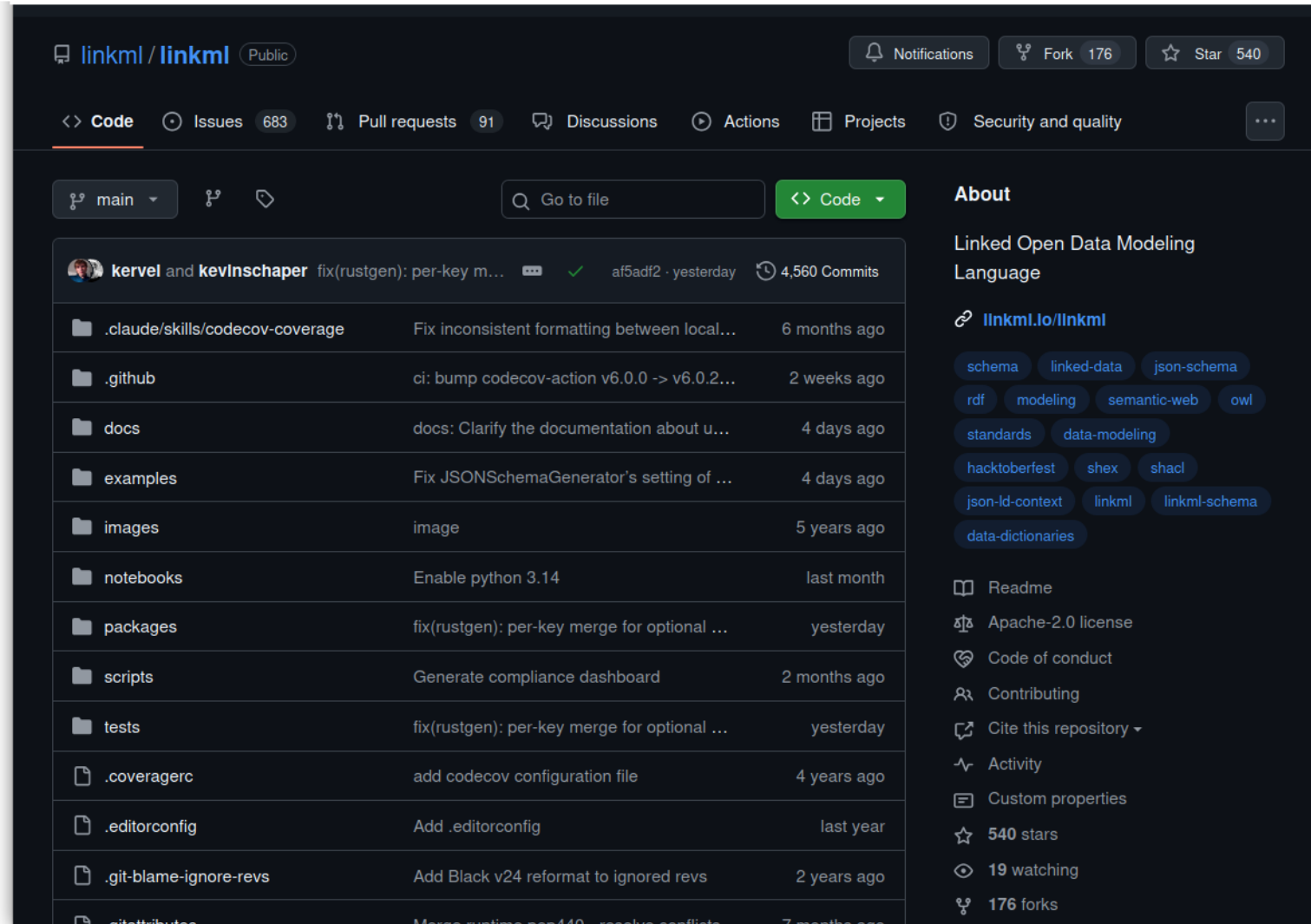
Sierra A T Moxon , Harold Solbrig, Nomi L Harris, Patrick Kalita, Mark A Miller, Sujay Patil, Kevin Schaper, Chris Bizon, J Harry Caufield, Silvano Cirujano Cuesta ... Show more

GigaScience, Volume 15, 2026, g1af152, <https://doi.org/10.1093/gigascience/g1af152>

Published: 12 December 2025 [Article history](#) ▼

### LinkML Community Members (listed in alphabetical order):

Richard M. Bruskwiech, Seth Carbon, Eric Cavanna, John-Marc Chandonia, Shreyas Cholia, Ben Dichter, Emiley A. Eloef-Fadrosch, Vincent Emonet, Shahim Essaid, James A. Fellows Yates, Joseph Flack, Satrajit S. Ghosh, Damien Goutte-Gattat, Dorota Jarecka, Dazhi Jiao, Marcin P. Joachimiak, Vlad Korolev, Volodymyr Lapkin, **Noel McLoughlin**, Sierra D. Miller, Michael Milton, Josh Moore, Moni Munoz-Torres, B. Nolan Nichols, Tim E. Putman, Justin T. Reese, Victoria Savage, Philip Stroemert, Jeremy Teoh, Anne Thessen, Isaac To, Puja Trivedi, Vincent Vialard, Trish Whetzell



The screenshot shows the GitHub repository for LinkML. The repository is public and has 176 forks and 540 stars. It is managed by kervel and kevinschaper. The repository contains 683 issues, 91 pull requests, and 4,560 commits. The repository structure includes folders for .claude/skills/codecov-coverage, .github, docs, examples, images, notebooks, packages, scripts, tests, .coveragerc, .editorconfig, .git-blame-ignore-revs, and .gitattributes. The repository is licensed under Apache-2.0 and has a code of conduct. It is also available on the LinkML website (linkml.io/linkml) and has a README, contributing guide, and citation information.

File/Folder	Description	Last Commit
.claude/skills/codecov-coverage	Fix inconsistent formatting between local...	6 months ago
.github	ci: bump codecov-action v6.0.0 -> v6.0.2...	2 weeks ago
docs	docs: Clarify the documentation about u...	4 days ago
examples	Fix JSONSchemaGenerator's setting of ...	4 days ago
images	image	5 years ago
notebooks	Enable python 3.14	last month
packages	fix(rustgen): per-key merge for optional ...	yesterday
scripts	Generate compliance dashboard	2 months ago
tests	fix(rustgen): per-key merge for optional ...	yesterday
.coveragerc	add codecov configuration file	4 years ago
.editorconfig	Add .editorconfig	last year
.git-blame-ignore-revs	Add Black v24 reformat to ignored revs	2 years ago
.gitattributes	Merge runtime pep440... resolve conflicts	7 months ago

HEALTH

# How AI helped treat a newborn's ultra rare disease. 'It was almost like a light switch.'

An AI tool, Biomedical Data Translator, helped doctors at Mayo Clinic find a treatment for Jorie Kraus

Get Alerts Email Share



Two-year-old Jorie Kraus with her father, Dave Kraus, at the STAT Breakthrough Summit West in San Francisco on Tuesday. Jack Simpson for STAT



By **Casey Ross** May 19, 2026  
Chief Investigative Reporter, Data & Technology

SAN FRANCISCO — In the first, tenuous weeks of her life, Jorie Kraus and her parents faced her possible death repeatedly. Muscles throughout her tiny body simply didn't work properly. Her heart. Her legs. Her larynx. Even the involuntary action of breathing was labored, and constantly faltering.

Behind this "AI" headline was LinkML ...

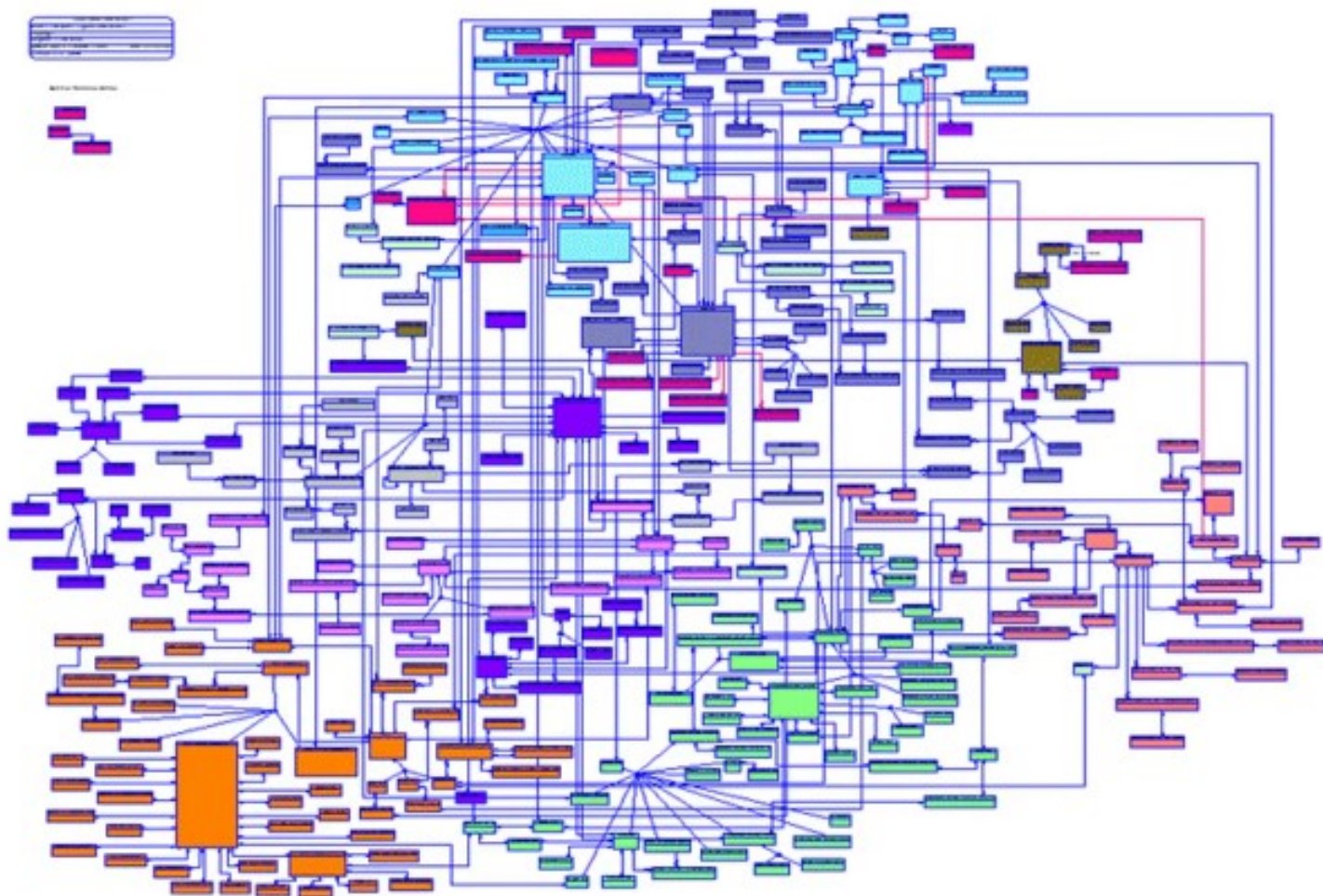
### AI depends on Data:

- with comprehensive contextual metadata
- being labelled with standardized labels
- being linked

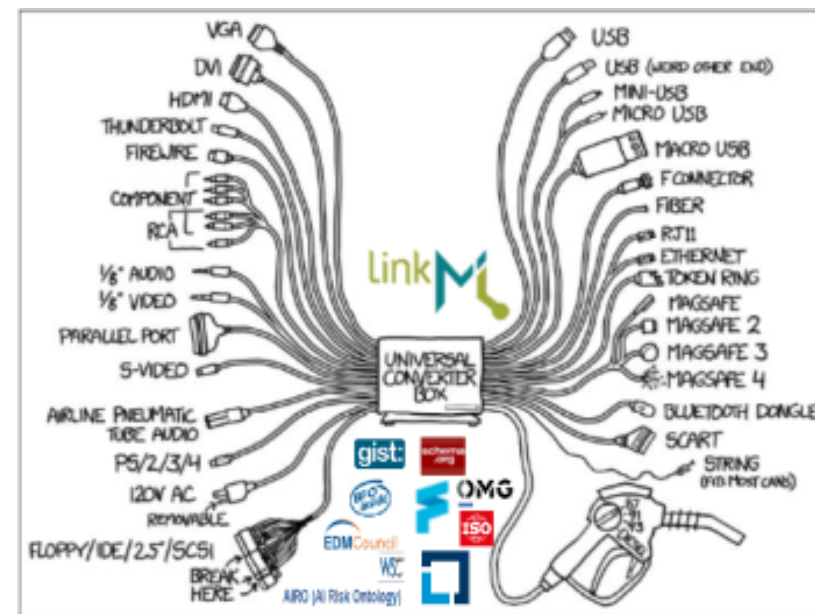
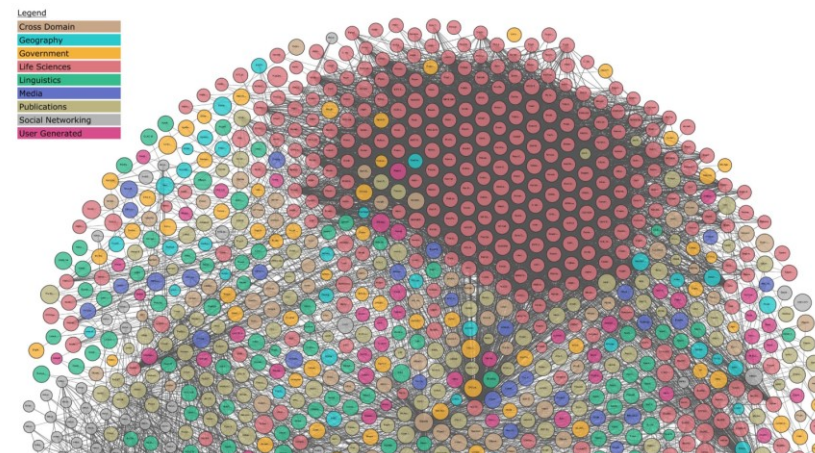
### LinkML is foundation for AI ready data

- Social glue
- Schema Language, Tools
- Data Management and extraction

And our institutional data looks like this \*



Can we retrofit Linked Data semantics?



\* See "What is Data-Centric Architecture", Dave McComb, DCAF 2021, creator of <https://datacentricmanifesto.org>

# Stretch Goal: Compliance at speed of AI

Open Standards, Obligations, Incidents, and Whitepapers

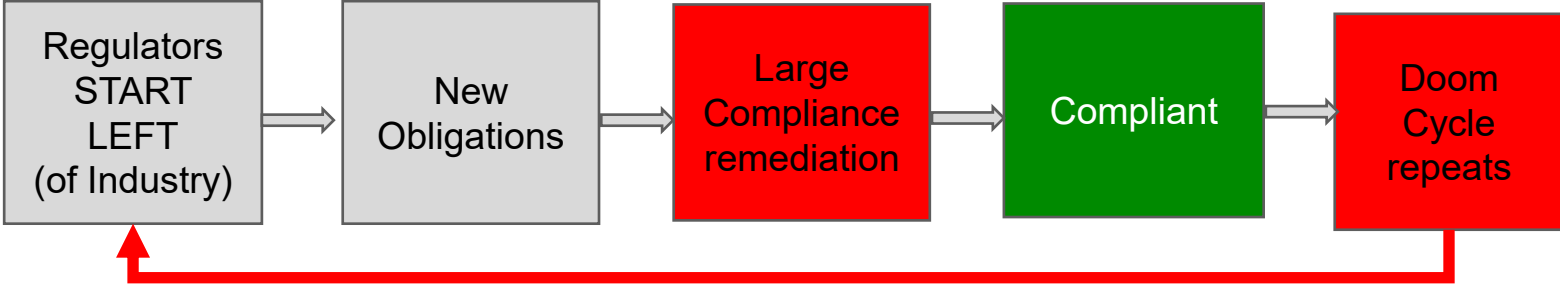
NIST, CISA, EU, FED, ISO, IEC, W3C, etc.

causes

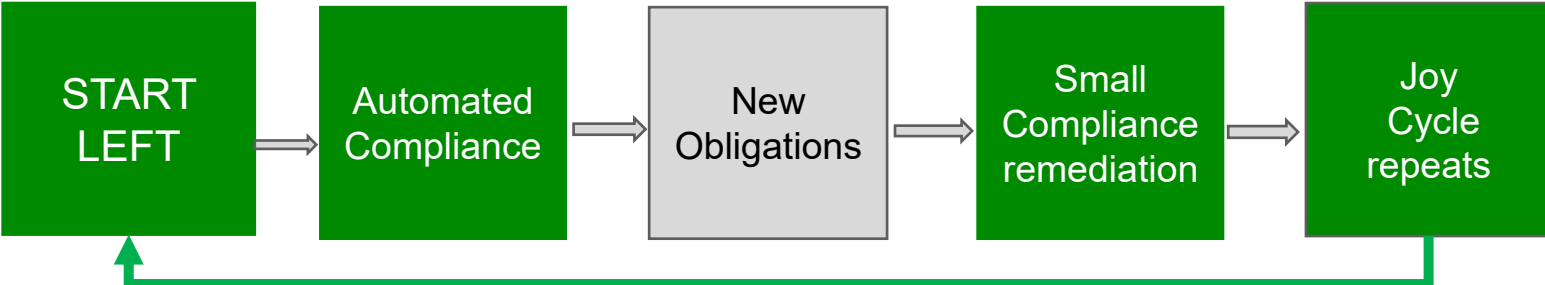
influences

Open Curation

## TODAY'S STATE: Compliance Doom Cycle



## IDEAL FUTURE STATE: **Start Left** Compliance Joy \*



\* Standards provide common structure & language & defensibility - identifiers, reusable Ontologies, Curation pathways.

# Linked Data Standards



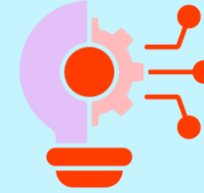
# Linux Foundation Pathways to Open Data

*"Open Data definition - Data infrastructure with the technical and legal requirements in place to make the data freely accessible for universal use, reuse, and redistribution".*

**Data silos hamstring research & innovation**, and have become increasingly onerous alongside growing data needs to train AI models.



Open data is freely accessible for universal use, leading to **new avenues for innovation, greater reliability, & increased trust.**



The unique qualities of data as compared to software — such as **maintenance, quality, privacy, & license diversity** — make its openness challenging.



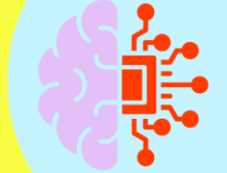
**Significant human resources** are required for cleaning, standardizing, & maintaining a dataset.



The financial & resource **costs of dataset maintenance** engender a **tradeoff between the quality** of the data & the **cost** of accessing it.



**While a lack of standardization makes datasets unusable, AI tools** offer opportunities to better manage unstructured data.



**Data privacy concerns** stem from compliance with regulations such as GDPR, which create **a climate of risk aversion.**



**Proprietary control** over data gives companies greater certainty around compliance & quality while **reducing the fear of losing competitive advantage.**



**"Semi-open" data platforms** allow for collaborators to share best practices and other pre-competitive data while maintaining their competitive advantage.



**Overture Maps Foundation** has built an **open, agnostic, & standardized geospatial data platform** for data owners & service providers to leverage.



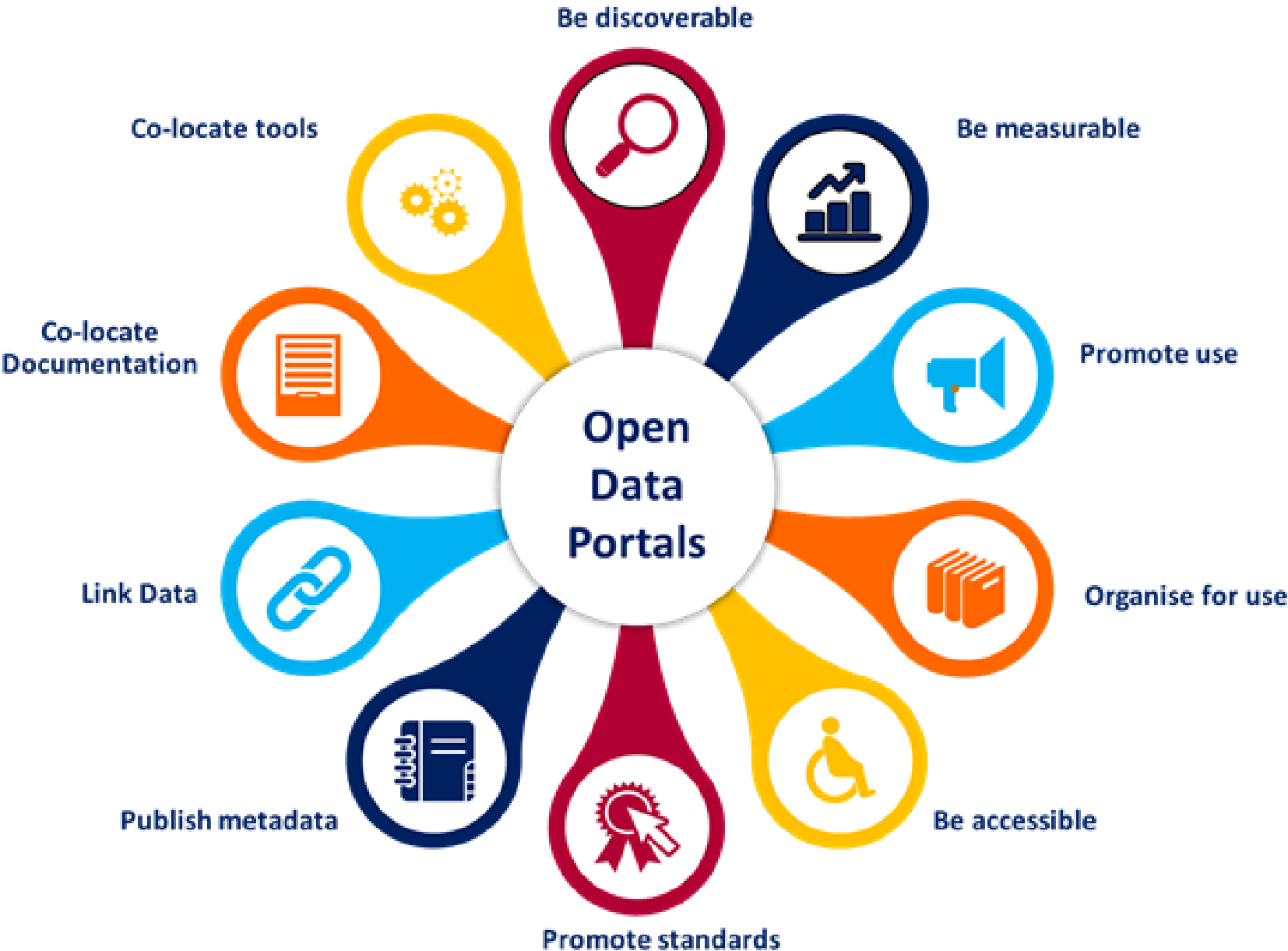
Building open data infrastructure requires a **reworking of current data collection & sharing processes.**



Open data requires **incentivizing collaboration** around a pre-competitive layer while **incorporating checks & balances** in the governance structure.



# Portals to Open Data

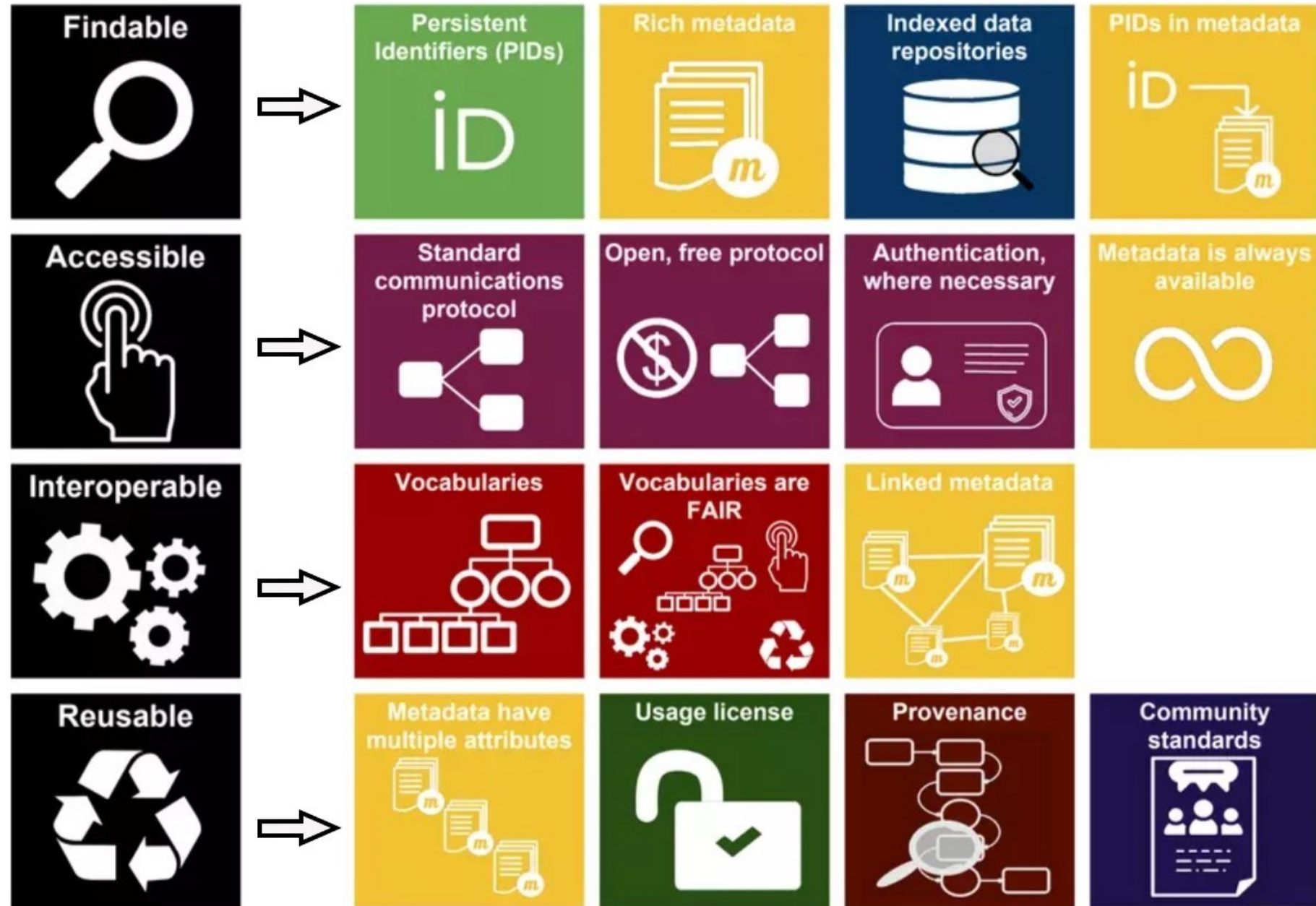


*"Ten ways portals can organize for sustainability and added value by examining what is required on the other side of the equation - meeting and provoking demand".*

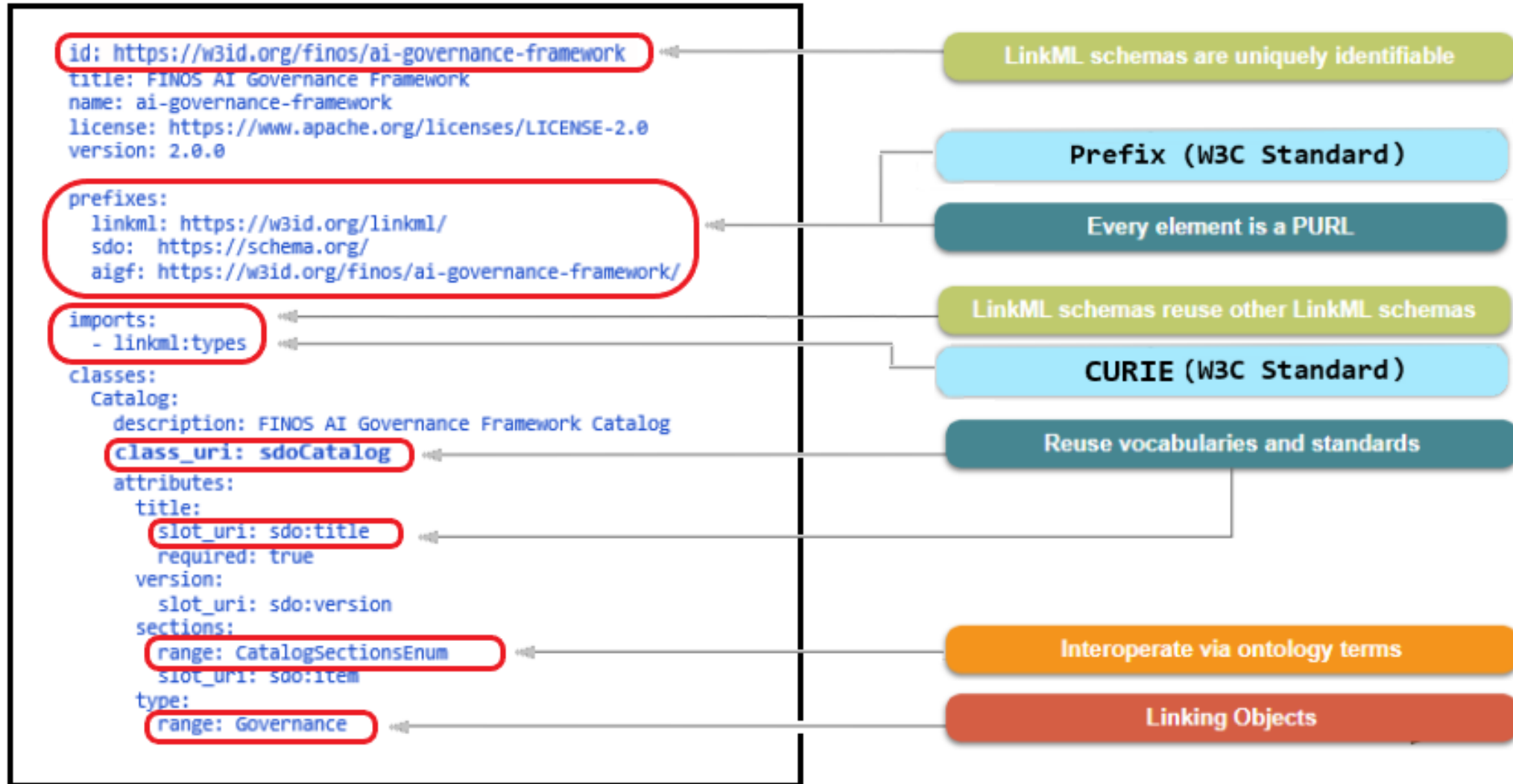
# FAIR Open Data

## Principles

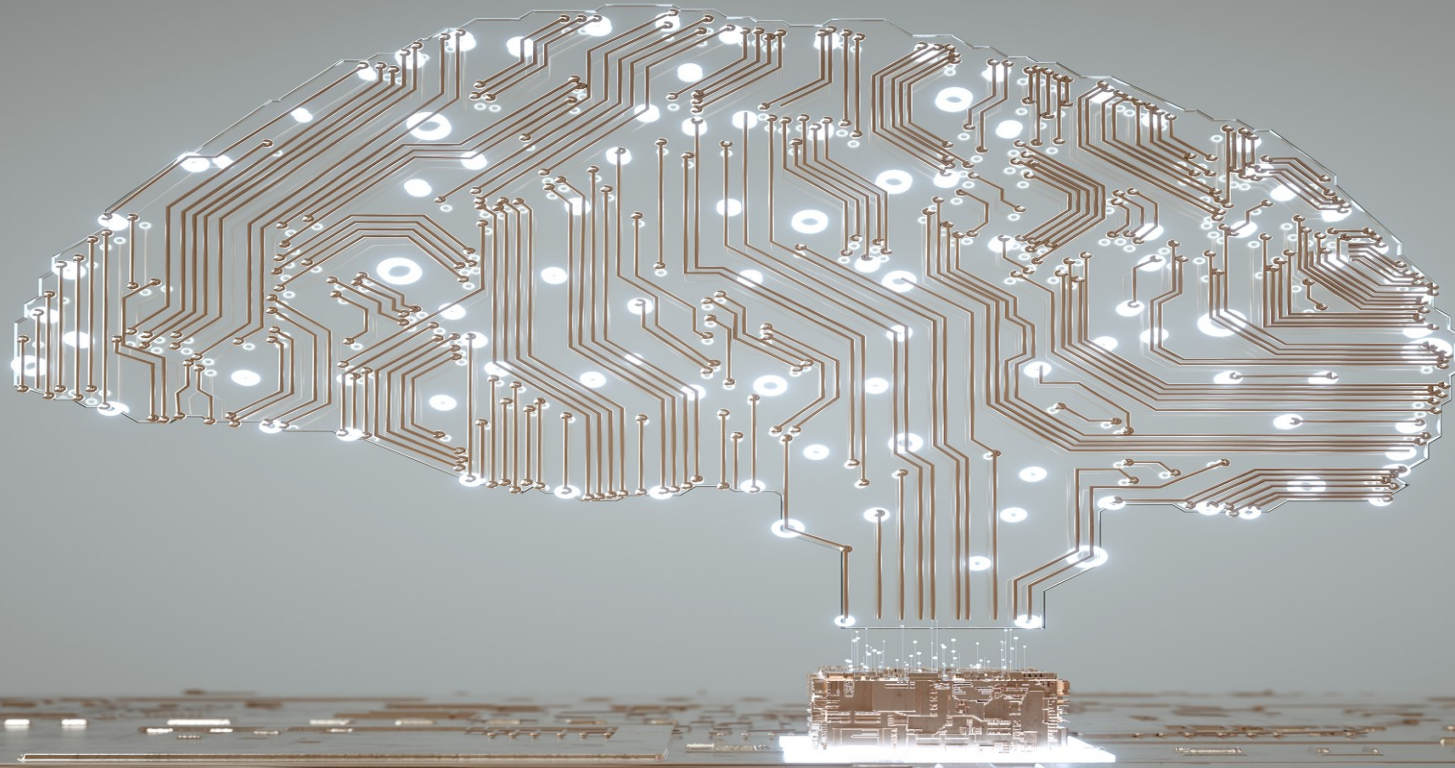
Findable  
Accessible  
Interoperable  
Reusable



# LinkML is a FAIR Schema Language

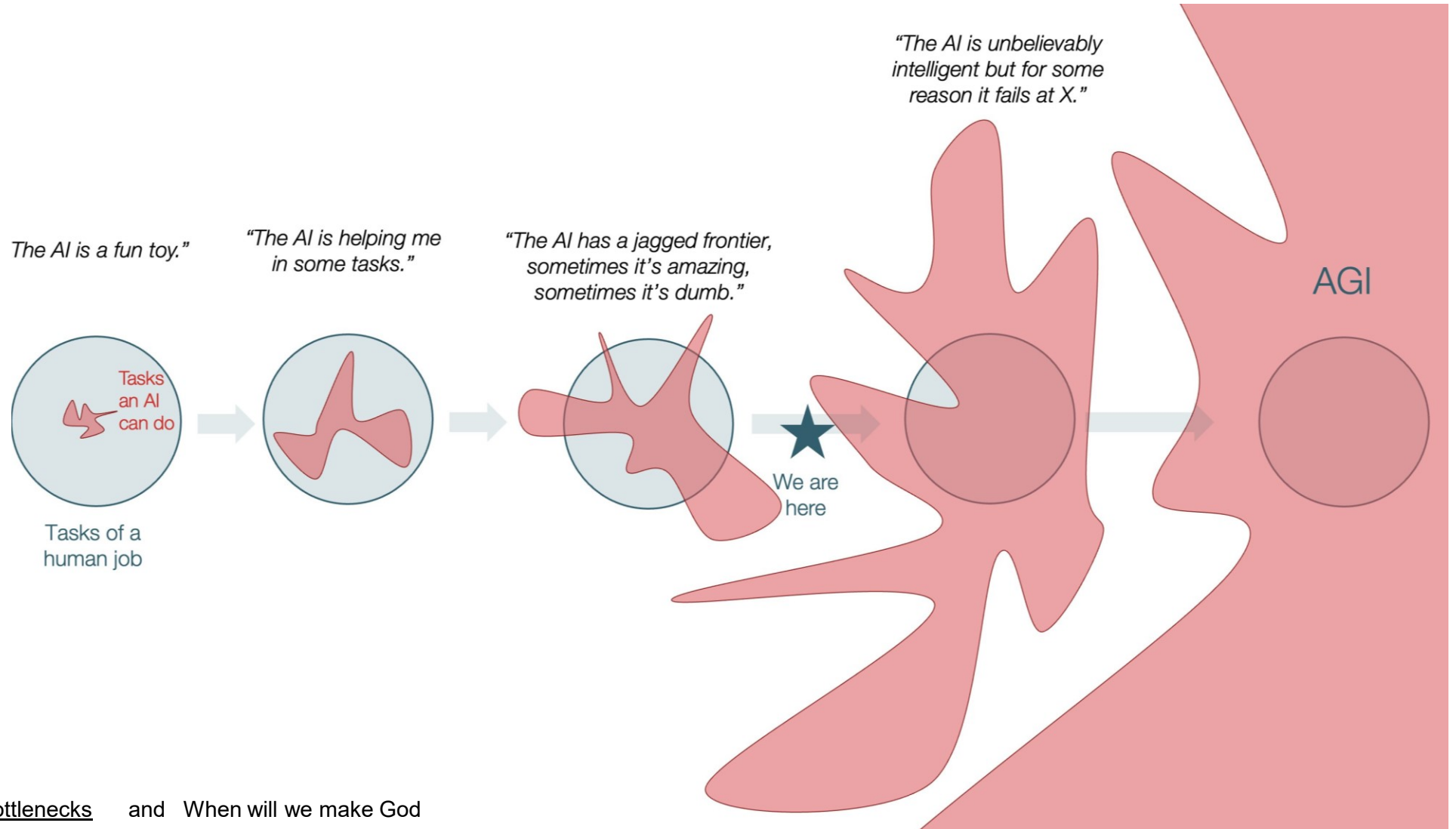


# AI Risk Model



# Artificial General Intelligence (AGI)

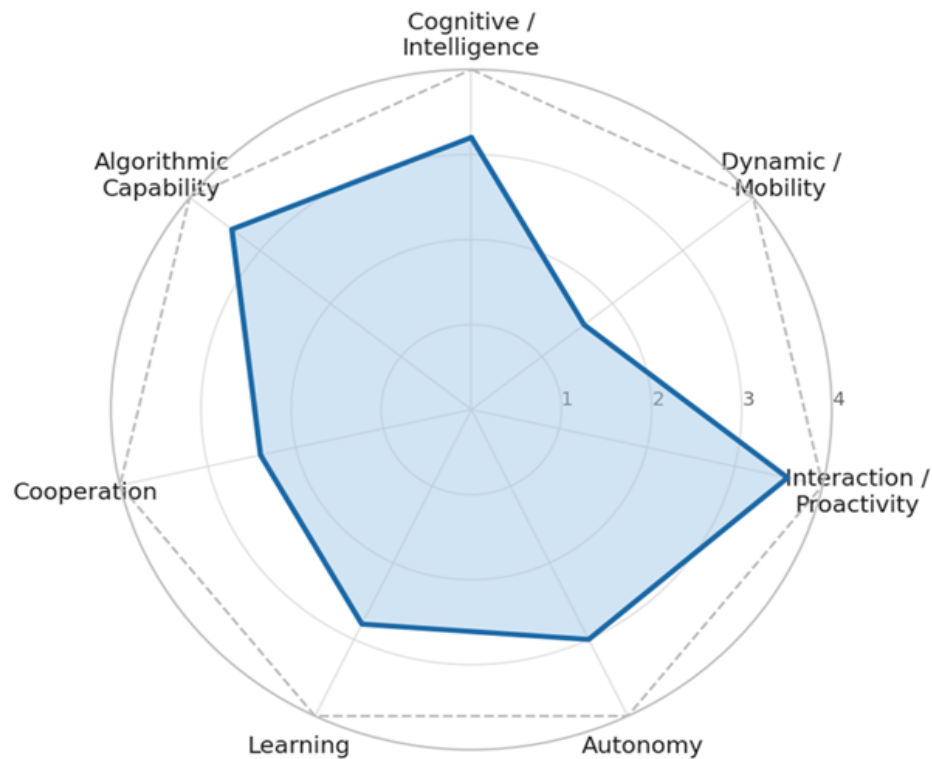
*"Bottlenecks can create the impression that AI will never be able to do something, when progress is held back by a single jagged weakness. When that weakness becomes a **reverse salient**, and AI labs suddenly fix the problem, the entire system can jump forward ... What does it matter if AI is relatively bad at running a vending machine, if the AI still becomes better than any human?"*



# AI AUTONOMY CHANGES THE RISK MODEL (TODO)

Use these definitions when scoring an AI system (1-4) on the radar chart.

## Dimensions of AI Agency



Sample profile shown for illustration only

**Cognitive / Intelligence:** From reflex response to model-based, inference, prediction, and evaluation-driven behavior.

**Dynamic / Mobility:** Whether the agent itself, its sensors, or its effectors can move or reconfigure.

**Interaction / Proactivity:** Inactive -> reactive -> deliberative/proactive behavior in response to environmental change.

**Autonomy:** Controlled -> dependent -> autonomous operation with increasing independence from external control.

**Learning:** Conservative -> remembering -> learning agent, based on whether capability improves through experience.

**Cooperation:** Individualistic -> competitive -> collaborative interaction with other agents or teams.

**Algorithmic Capability:** Underlying computational power available to the agent; foundational across all other dimensions.

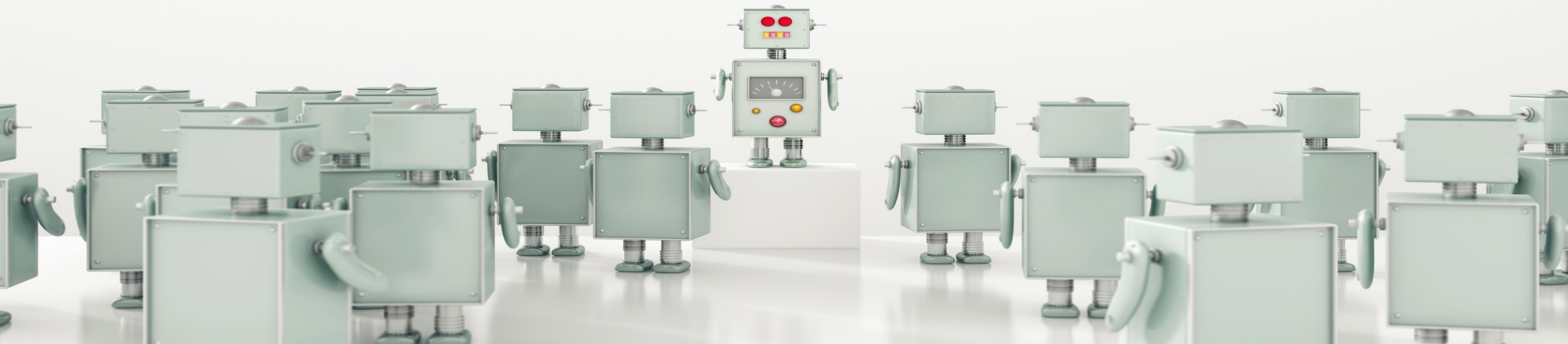
# We MUST govern AGI – not other way around

*Humans are rising!*

With a "START LEFT" mindset, DevSecOps posture, and the power of "NIST Reciprocity", they are building something bigger than compliance – **an Open GRC movement**.

Open Curation (digital schemas, obligations, mappings, crosswalks, test data) builds Secure Linked Data Supply Chain fueling each companies own "**Secure Software Supply Chain**" with structure, traceability, and confidence.

**Human oversight moves higher – into harmonization, curation, and trust.**



# Open GRC Curation

## Reciprocity as trust-substrate for enablement

### reciprocity



#### Definitions:

📖 Mutual agreement among participating organizations to accept each other's security assessments in order to reuse information system resources and/or to accept each other's assessed security posture in order to share information.

#### Sources:

[NIST SP 800-39](#) under Reciprocity

📖 Mutual agreement among participating enterprises to accept each other's security assessments in order to reuse information system resources and/or to accept each other's assessed security posture in order to share information.

#### Sources:

[CNSSI 4009-2015](#)

[NIST SP 800-12 Rev. 1](#) under Reciprocity



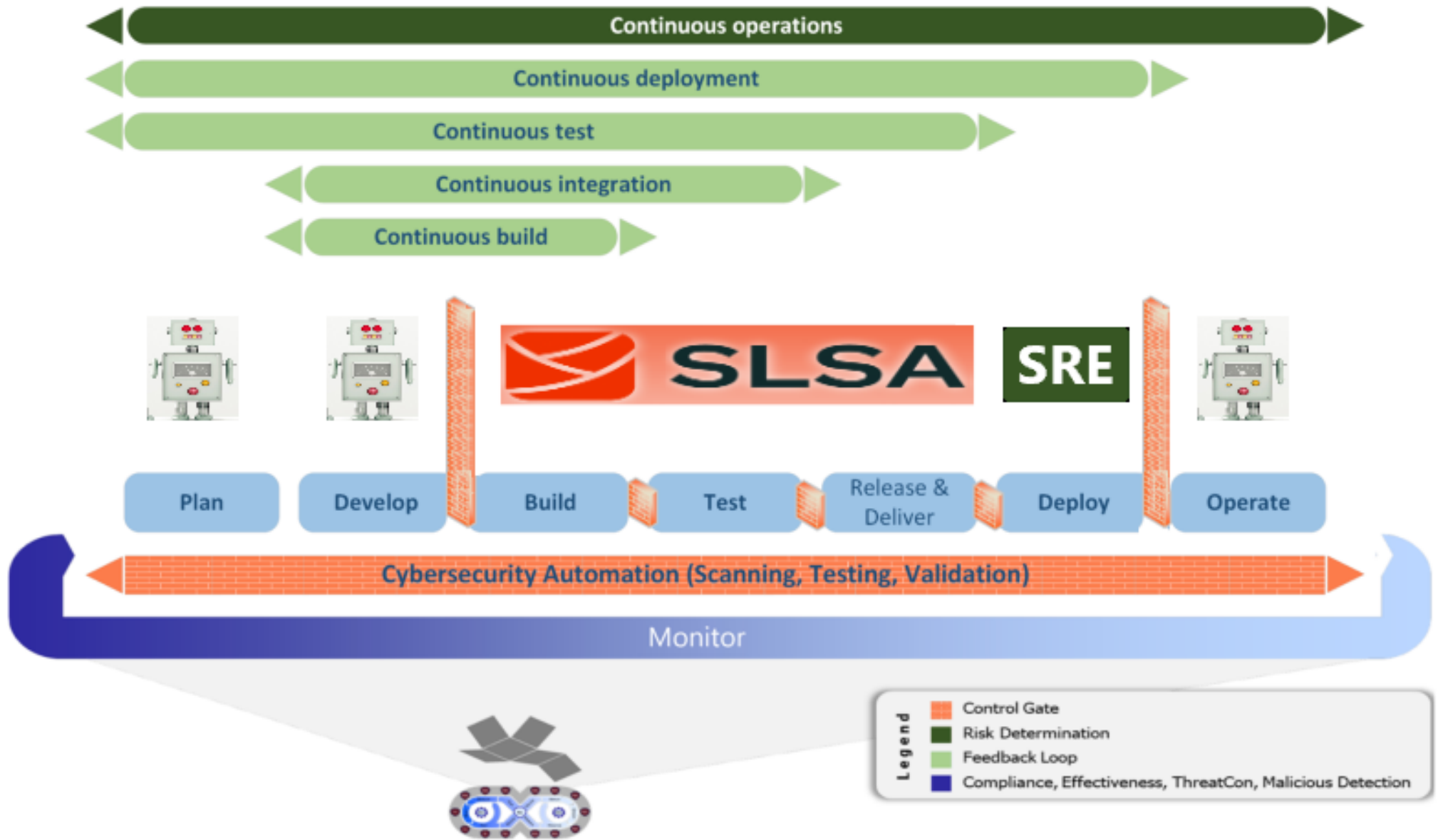
### Reciprocity

Accept each other's security assessments to reuse system resources and/or to accept each other's assessed security posture to share information.

# DevSecOps Architecture: AI and Supply Chains



# DevSecOps Infinity Loop unfolded – Where does AI fit?

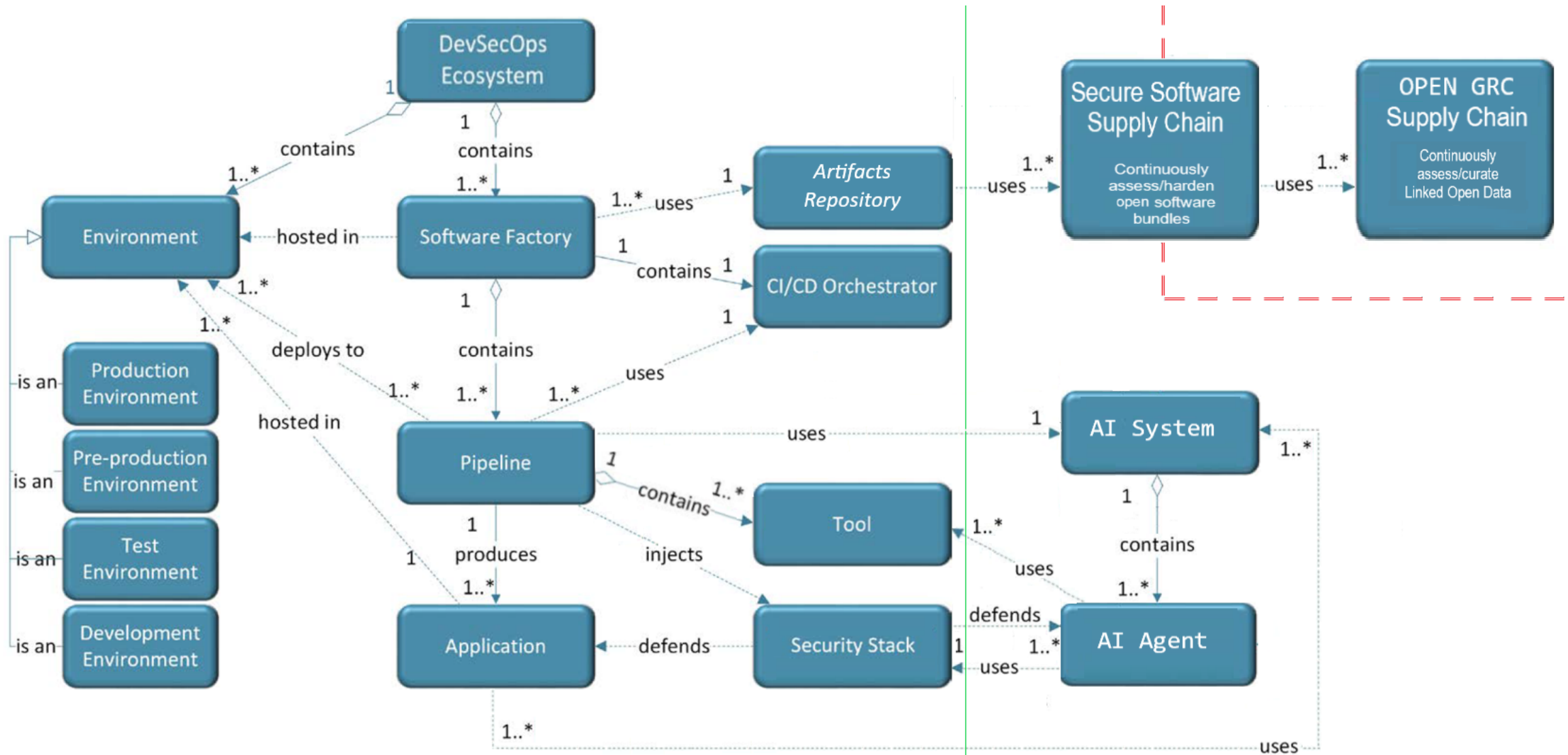


DevSecOps Lifecycle Phases, Continuous Feedback Loops, & Control Gates

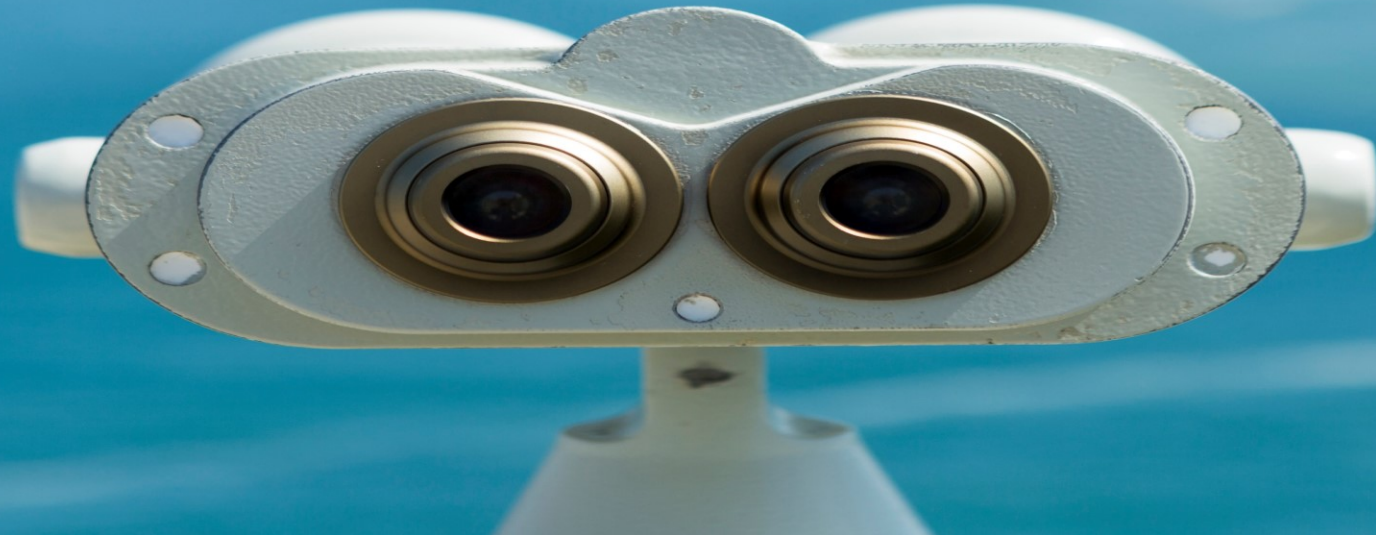
Modified version of image published by [US DoD DevSecOps Reference Design](#)

See also [CNCF Secure Software Factory](#) and [FRSCA](#)

# DevSecOps Reference Architecture: Conceptual – What adjustments are needed?



# Solution: AI Governance Knowledge Graph



# Open-Source Approach

## Build AI Governance Knowledge Graph using W3C standards – with seamless integration of FINOS AI Governance Framework

Unofficial Draft

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    - 4.3.6 Misuse
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### AIRO (AI Risk Ontology)

version a

Unofficial Draft 01 August 2025

▼ More details about this document

**Latest published version:**  
<https://w3id.org/airo>

**Latest editor's draft:**  
<https://w3id.org/airo>

**History:**  
[Commit history](#)

**Authors:**  
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[Dave Lewis](#) (ADAPT Centre, Trinity College Dublin)

**Feedback:**  
[GitHub delaramglp/airo](#) (pull requests, new issue, open issues)

**Publications**  
[\[Thesis\] Semantic Frameworks to Support the EU AI Act's Risk Management and Documentation](#)  
[\[SEMANTICS paper\] AIRO: An Ontology for Representing AI Risks Based on the Proposed EU AI Act and ISO Risk Management Standards](#)  
[\[FaCCT paper\] To Be High-Risk, or Not To Be: Semantic Specifications and Implications of the AI Act's High-Risk AI Applications and Harmonised Standards](#)

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### Abstract

AIRO (AI Risk Ontology) is an ontology for expressing risk of AI systems based on the requirements of the [AI Act](#), ISO/IEC 23894 on AI risk management and and ISO 31000 series of standards. AIRO assists stakeholders in determining "high-risk" AI systems, maintaining and documenting risk information, performing impact assessments, and achieving conformity with AI regulations.

§ 1. Introduction

The AI Act aims to avoid the harmful impacts of AI on critical areas such as health, safety, and fundamental rights by setting down obligations which are proportionate to the type and severity of risk posed by the system. It

W3C Community Group  
Final Report

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- 3. Guidance
  - 3.1 Guides
  - 3.2 Applications

### Data Privacy Vocabulary (DPV)

version 2.3

Final Community Group Report 25 February 2026

**This version:**  
<https://www.w3.org/community/reports/dpvcg/CG-FINAL-dpv-20260225/>

**Latest published version:**  
<https://w3id.org/dpv/>

**Latest editor's draft:**  
<https://dev.dpvcg.org/dpv>

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ISSUES

24)

(DPV) Specification, published by the [Data Privacy Vocabularies and Certification Agreement \(FSA\)](#). A human-readable [summary](#) is available.

[Wongkul](#) (ADAPT Centre, Trinity College Dublin), [Axel Polleres](#) (IDLab, IMEC, Ghent University), [Bud Bruegger](#) (Trinity College Dublin), [Damien Desfontaines](#) (No affiliation provided), [Danielle G. G. \(Vienna University of Technology\)](#), [Delaram Golpayegani](#) (ADAPT Centre, Trinity College Dublin), [Fajar Ekaputra](#) (Vienna University of Technology), [Georg P. Krog](#) (Signatu AS), [Harshvardhan J. Pandit](#) (AI Accountability Lab (AIAL), Trinity College Dublin), [Iain Henderson](#) (Siemens and Business), [Julian Flake](#) (University of Koblenz), [Julio Cesar \(Kantara Initiative\)](#), [Maya Borges](#) (Danish Agency for Data Protection), [Rana Sanjiv](#) (Universidad Politécnica de Madrid), [Jacob](#) (Proximus), [Simon Steyskal](#) (Siemens), [Steve](#) (Trinity College Dublin). NOTE: The affiliations are informative, do not constitute an endorsement. This page is generated automatically from existing data.

← → ↻ 🏠 🔍 <https://air-governance-framework.finos.org> ☆ 📄 🗨

# FINOS AI Governance Framework

A comprehensive collection of risks and mitigations that support on-boarding, development of, and running Generative AI solutions

version: v2 (October 20, 2025)

[Print-ready copy](#)

**Alert: FINOS will be running the AI Governance Leader Training at OSFF London !** Be in the first cohort of FINOS AI Governance Leaders and learn how to operationalise AIGF, embedding its risk, controls, and assurance concepts into existing governance and risk processes

AI, especially Generative AI, is reshaping financial services, enhancing products, client interactions, and productivity. However, challenges like hallucinations and model unpredictability make safe deployment complex. Rapid advancements require flexible governance.

# AI Governance Knowledge Graph

JOURNAL ARTICLE

## LinkML: an open data modeling framework

Sierra A T Moxon , Harold Solbrig, Nomi L Harris, Patrick Kalita, Mark A Miller, Sujay Patil, Kevin Schaper, Chris Bizon, J Harry Caufield, Silvano Cirujano Cuesta ... [Show more](#)

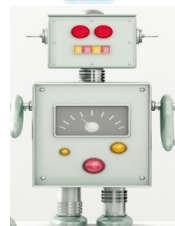
*GigaScience*, Volume 15, 2026, giaf152, <https://doi.org/10.1093/gigascience/giaf152>

Published: 12 December 2025 [Article history](#) ▼

Many **real-world projects have adopted LinkML** to leverage its core features. For example, the Biolink Model [22] is built using LinkML to define a comprehensive, ontology-aligned schema that connects concepts across diverse biological domains, enabling interoperability among tools, **datasets, and knowledge graphs**. The National Center for Advancing Translational Science Biomedical Data Translator [23] project builds on this by using the Biolink Model to

Connect concepts across domains

FINOS AI Governance Framework, CDM, Fluxnova, CALM,  
Common Cloud Controls; Linux Foundation MCP; NIST,  
ISO, OWASP, ATT&CK, SOX, NIS2, CRA, AI ACT, GDPR, etc



# AI Atlas Nexus – Knowledge Graph of AI Things – with API

<https://ibm.github.io/ai-atlas-nexus/>



- 📖 An **ontology** has been provided, that combines the AI risk view (taxonomies, risks, actions) with an AI model view (AI systems, AI models, model evaluations) into one coherent schema
- 📄 AI Risks collected from IBM AI Risk Atlas, IBM Granite Guardian, MIT AI Risk Repository, NIST Artificial Intelligence Risk Management Framework: Generative Artificial Intelligence Profile, the AI Risk Taxonomy (AIR 2024), the AILuminate Benchmark, Credo's Unified Control Framework, and OWASP Top 10 for Large Language Model Applications
- 🔗 Mappings are proposed between the taxonomies and between risks and actions
- 🔄 Use the python library methods to quickly explore available risks, relations and actions
- 🚨 Use the python library methods to detect potential risks in your usecase
- 📄 Download an exported graph populated with data instances
- ✨ Example use-case of auto-assistance in compliance questionnaires using CoT examples and AI Atlas Nexus
- 🛠 Tooling to convert the LinkML schema and instance data into a Cypher representation to populate a graph database



# AI Ontology LinkML Schema

## Persistent Identifier

<https://w3id.org/ai-atlas-nexus>

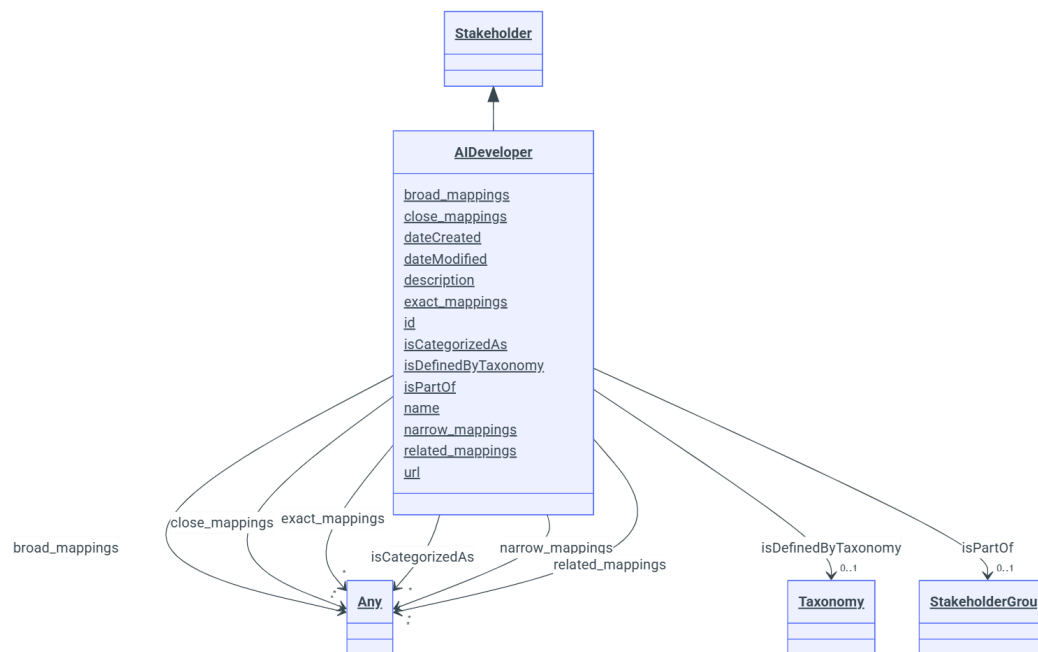
### Ontology

- Slot: adaptsModel
- ai-risk-ontology
- Slot: hasAiActorTask
- ai\_risk
- Slot: hasAiActorTask
- Class: AiAgent
- Class: AiComponent
- Class: AiDeployer
- Class: AiDeveloper
- Class: AiEval
- Class: AiEvalResult
- Slot: aievalresults
- Class: AiLifecyclePhase
- Class: AiModel
- Slot: aimodelfamilies
- Slot: aimodels
- Class: AiModelValidation
- Class: AiOffice
- Class: AiOperator
- Class: AiProvider
- Class: AiSubject
- Class: AiSystem
- Enum: AiSystemType
- Class: AiTask
- Slot: aitasks
- Enum: AIUC1ApplicationCategory

## Class: AiDeveloper

An organisation or entity that is concerned with the development of AI services and products.

URI: [airo:AIDeveloper](http://airo:AIDeveloper)



### Inheritance

- Entity
- Stakeholder

### Table of contents

- Inheritance
- Class Properties
- Slots
- Usages
- Identifier and Mapping Information
  - Schema Source
- Mappings
- LinkML Source
  - Direct
  - Induced

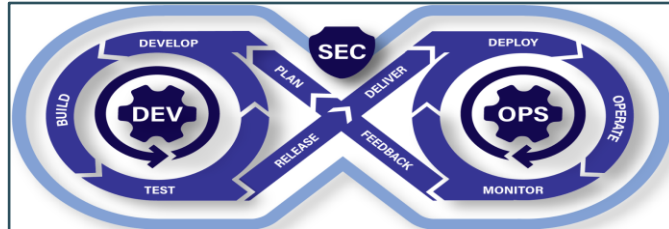
# DEMO

<https://github.com/noelmcloughlin/ai-linkmo>



# Demo Architecture

Schema-first -> single source of truth



Command Line Interface (CLI)

**Python**

Automation and CI/CD Integration



Application Program Interface (API)

**Fast API**

Interoperability and Automation



User Interface (UI)

**Svelte Typescript**

Exploration



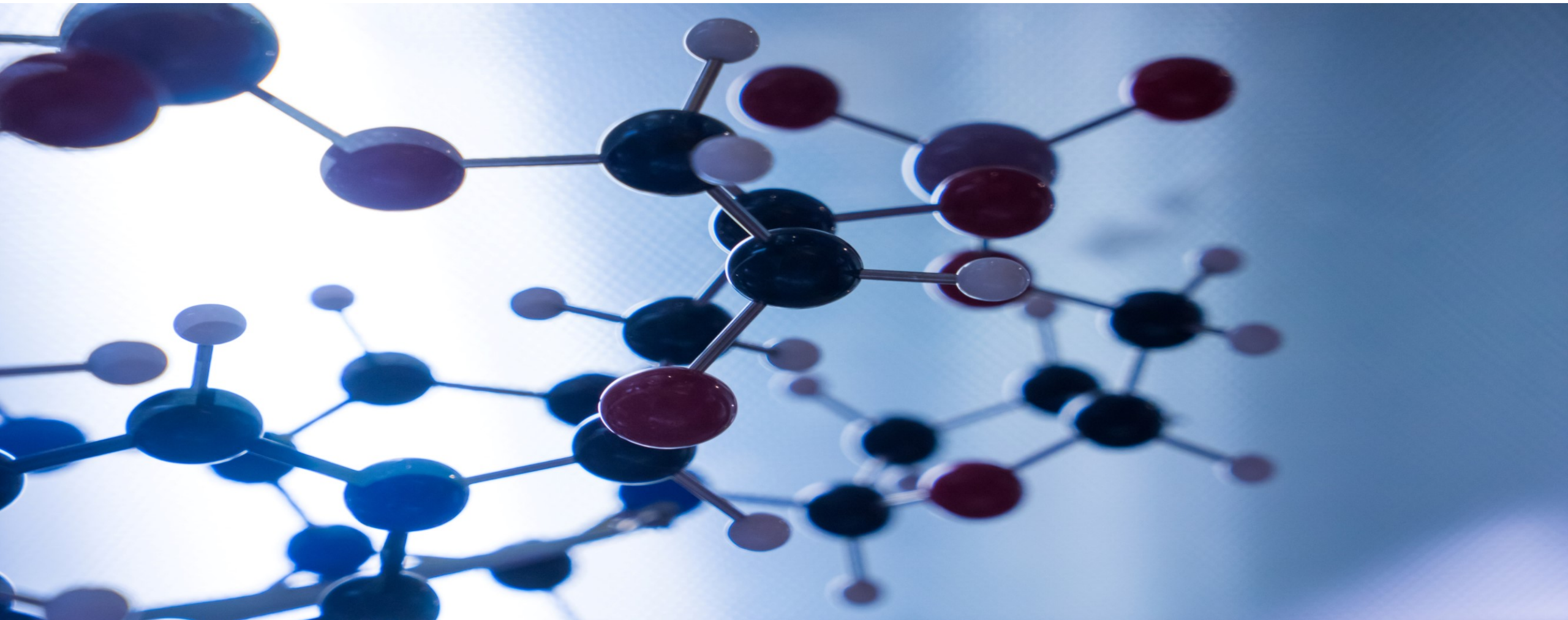
Graph DB

**Neo4J**

Relationship analysis and Regulatory Crosswalks

# Questions / Discussion

# Knowledge Graph Mappings Standards



# Mappings standard exchange format

## A Simple Standard for Sharing Ontology Mappings (SSSOM)

[Home](#)

[Introduction](#)

[Getting started](#)

[Specification](#)

[Resources for contributors](#)

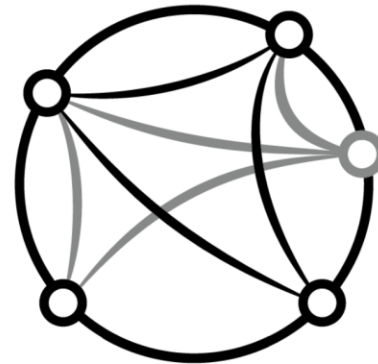
[Resources for users](#)

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[Funding](#)

[edit page](#)

## Simple Standard for Sharing Ontological Mappings (SSSOM)



SSSOM  
SIMPLE STANDARD FOR SHARING  
ONTOLOGICAL MAPPINGS

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SSSOM at a glance: Model and Exchange Format

[Basic model](#)

[Example](#)

[Quick reference for mapping metadata](#)

[Quick links](#)

[The SSSOM Core Team](#)

[Contact](#)

[Steering committee](#)

[Documentation/specification editors](#)

[Contributors](#)

[Acknowledgements](#)

The Simple Standard for Sharing Ontological Mappings (SSSOM) is a community-driven standard designed to facilitate the exchange and integration of semantic entity mappings. As data interoperability becomes increasingly crucial across various domains, SSSOM provides a standardized format to share mappings, enabling researchers and developers to more easily connect and utilize diverse datasets. By establishing a common framework, SSSOM enhances the consistency, quality, and discoverability of mappings, thereby supporting more effective data integration and analysis.

- **Standardization:** SSSOM provides a unified format for representing semantic, or ontological, mappings, making it easier for different systems and organizations to exchange mapping

**Persistent Identifier**

<http://w3id.org/sssom>

# To simplify Governance, a FAIR open mappings registry for storing, curating, managing, and sharing Open GRC artefacts with provenance would help – think "DockerHub for governance"

Potential Consortia: Mapping Commons Community (Corporate Social Responsibility), EU SEMIC Community, OSI

## Mapping Commons Registry

Search and browse mapping specifications

An open registry for data mappings aligned with the [FAIR Mappings Schema](#). Requests for additions are [welcome](#).

GitHub

**MAPPING TYPE**

- sssom 68
- linkml\_map 2

**LICENSE**

- CC0 1.0 25
- Unspecified 19
- CC BY-NC 4.0 4
- CC BY 4.0 2
- CC BY 3.0 1

**SUBJECT SOURCE**





- tmp/sssom-schema.yaml 1
- tmp/linkml-map-schema.yaml 1

**OBJECT SOURCE**


- tmp/fair-mappings-schema.yaml 2

Search mapping specifications...

70 mapping specifications

[https://w3id.org/sssom/commons/mouse-human/mappings/mp\\_hp\\_eye\\_impvc.sssom.tsv](https://w3id.org/sssom/commons/mouse-human/mappings/mp_hp_eye_impvc.sssom.tsv)   SSSOM  34% 





ID [https://w3id.org/sssom/commons/mouse-human/mappings/mp\\_hp\\_eye\\_impvc.sssom.tsv](https://w3id.org/sssom/commons/mouse-human/mappings/mp_hp_eye_impvc.sssom.tsv)

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Content [https://w3id.org/sssom/commons/mouse-human/mappings/mp\\_hp\\_eye\\_impvc.sssom.tsv](https://w3id.org/sssom/commons/mouse-human/mappings/mp_hp_eye_impvc.sssom.tsv)

Description The IMPC Mouse Morphology Mappings: Eye Morphology Test

Registries [Mouse Human Mapping Initiative](#)

[https://w3id.org/sssom/commons/mouse-human/mappings/mp\\_hp\\_hwt\\_impvc.sssom.tsv](https://w3id.org/sssom/commons/mouse-human/mappings/mp_hp_hwt_impvc.sssom.tsv)   SSSOM  34% 

ID [https://w3id.org/sssom/commons/mouse-human/mappings/mp\\_hp\\_hwt\\_impvc.sssom.tsv](https://w3id.org/sssom/commons/mouse-human/mappings/mp_hp_hwt_impvc.sssom.tsv)

License  PUBLICDOMAIN

Content [https://w3id.org/sssom/commons/mouse-human/mappings/mp\\_hp\\_hwt\\_impvc.sssom.tsv](https://w3id.org/sssom/commons/mouse-human/mappings/mp_hp_hwt_impvc.sssom.tsv)

Description The IMPC Mouse Morphology Mappings: Heart Weight Test

Registries [Mouse Human Mapping Initiative](#)

## Semantic Interoperability Community

A European Commission initiative to foster the semantic interoperability of interconnected e-Government systems.

195 followers <https://interoperable-europe.ec.europ...>

README.md

### Welcome to the SEMIC GitHub page!

What is SEMIC?

Welcome to SEMIC! The Semantic Interoperability Community (SEMIC) is a vibrant network of experts and practitioners dedicated to advancing semantic interoperability across Europe. Our mission is to enhance the sharing and reuse of data and services, supported by SEMIC specifications, innovative pilots, and a rich knowledge hub. Join us in shaping the future of seamless data exchange!

## open-semantic-interchange

Popular repositories

- OSI Public [osi-website](#) Public
- Java 531 90
- HTML 8

Repositories

Find a repository...

Type Language Sort

- OSI Public [osi-website](#) Public
- Java 531 Apache-2.0 90 15 Updated 4 days ago
- HTML 8 Apache-2.0 8 0 Updated 4 days ago

See <https://mapping-commons.github.io/> and <https://github.com/SEMICEu>

See also <https://github.com/open-semantic-interchange>

# What processes, entities, and agents were involved in curation of mappings?

## Open Curation advantages:

- Transparency and quality (many eyes)
- "Human in the loop" provenance
- lowers cost of systemic Cyber Resiliency

## Persistent Identifiers

<http://w3id.org/semavp>  
<http://w3id.org/semavp/vocab/semavp.owl>  
And for every vocabulary

made by **pyLODE 3.4.4** with the **OntPub** profile

## Semantic Mapping Vocabulary

### Metadata

#### IRI

<http://w3id.org/semavp/vocab/semavp.owl>

#### Title

Semantic Mapping Vocabulary

#### Creator

<https://orcid.org/0000-0002-7356-1779>

#### Contributor

<https://orcid.org/0000-0002-6095-8718>

<https://orcid.org/0000-0003-4423-4370>

#### License

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

#### Version Iri

<http://w3id.org/semavp/vocab/releases/2026-06-10/semavp.owl>

#### Description

The Semantic Mapping Vocabulary provides and defines terms used for creating and maintaining semantic mappings, in particular mapping metadata.

### Classes

#### LLM-based matching process<sup>Ⓞ</sup>

##### IRI

<https://w3id.org/semavp/vocab/LLMBasedMatching>

##### Description

Where an LLM is used only to produce embeddings that are then compared by similarity, the process is an embedding-based (transformer-based) matching process rather than an LLM-based one. The classifier is how the model is used, not which model. Multi-step, tool-using, autonomous workflows driven by an LLM are captured by `semavp:AgentBasedMatching`.

A machine learning-based matching process in which a large language model determines matches between entities, typically through single-step or few-shot prompting, or through fine-tuning the model to judge mapping candidates or generate mappings directly.

##### Example

OLaLa prompts a large language model with the labels and surrounding context of two candidate entities and uses the model's yes/no decision as the match outcome.

##### Source

<https://doi.org/10.1145/3587259.3627571>

##### Sub Class Of

[machine learning-based matching process<sup>Ⓞ</sup>](#)

[case normalization](#)  
[composite matching process](#)  
[diacritics suppression](#)  
[digit suppression](#)  
[edit distance](#)  
[embedding-based blocking](#)  
[embedding-based matching process](#)  
[graph representation](#)  
[learning-based matching process](#)  
[hamming distance](#)  
[instance-based matching process](#)  
[LLM-based matching process](#)  
[language-based similarity measure](#)  
[lemmatization](#)  
[levenshtein distance](#)  
[lexical matching process](#)  
[lexical similarity threshold-based matching process](#)  
[link stripping](#)  
[logical consistency filtering](#)  
[logical reasoning matching process](#)  
[machine learning-based matching process](#)  
[manual mapping curation](#)  
[mapping](#)  
[mapping activity](#)  
[mapping chaining-based matching process](#)  
[mapping inversion-based matching process](#)  
[mapping review](#)  
[mapping process](#)  
[bounded path matching](#)  
[cardinality filtering](#)  
[case normalization](#)  
[composite matching process](#)  
[diacritics suppression](#)  
[digit suppression](#)  
[edit distance](#)  
[embedding-based blocking](#)  
[embedding-based matching process](#)  
[graph representation](#)  
[learning-based matching process](#)  
[hamming distance](#)  
[instance-based matching process](#)  
[LLM-based matching process](#)  
[language-based similarity measure](#)  
[lemmatization](#)  
[levenshtein distance](#)  
[lexical matching process](#)  
[lexical similarity threshold-based matching process](#)  
[link stripping](#)  
[logical consistency filtering](#)  
[logical reasoning matching process](#)  
[machine learning-based matching process](#)  
[manual mapping curation](#)

# AI Governance Mappings - Semantic Knowledge Organization System

related\_mappings  
broad\_mappings  
close\_mappings  
exact\_mappings  
narrow\_mappings

## Persistent Identifier

<https://www.w3.org/TR/skos-reference>

W3C Recommendation

## SKOS Simple Knowledge Organization System Reference



W3C Recommendation 18 August 2009

### This version:

<http://www.w3.org/TR/2009/REC-skos-reference-20090818/>

### Latest version:

<http://www.w3.org/TR/skos-reference>

### Previous versions:

<http://www.w3.org/TR/2009/PR-skos-reference-20090615/>

### Editors:

[Alistair Miles](#), STFC Rutherford Appleton Laboratory / University of Oxford  
[Sean Bechhofer](#), University of Manchester

Please refer to the [errata](#) for this document, which may include some normative corrections.

See also [translations](#).

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## Abstract

This document defines the Simple Knowledge Organization System (SKOS), a common data model for sharing and linking knowledge organization systems via the Web.

Many knowledge organization systems, such as thesauri, taxonomies, classification schemes and subject heading systems, share a similar structure, and are used in similar applications. SKOS captures much of this similarity and makes it explicit, to enable data and technology sharing across diverse applications.

The SKOS data model provides a standard, low-cost migration path for porting existing knowledge organization systems to the Semantic Web. SKOS also provides a lightweight, intuitive language for developing and sharing new knowledge organization systems. It may be used on its own, or in combination

# Example Semantic Mappings: finos\_to\_nist\_ai\_600\_1.sssom.tsv

```
# curie_map:
# finos: https://air-governance-framework.finos.org/risks/
# nist_ai_600_1: https://w3id.org/lmodel/nist-ai-600-1/
# semapv: https://w3id.org/semapv/vocab/
# skos: http://www.w3.org/2004/02/skos/core#
# license: https://www.apache.org/licenses/LICENSE-2.0.html
# mapping_date: '2026-06-04'
# mapping_set_description: FINOS AI Governance Framework risks (ri-N) to NIST AI 600-1 GenAI Profile risks.
# mapping_set_id: https://github.com/finos/ai-governance-framework/tree/main/linkml/src/ai_governance_framework/mappings/finos_to_nist_ai_600_1.sssom.tsv
# mapping_set_version: 0.1.0
subject_id      subject_label      predicate_id      object_id      object_label      mapping_justification      author_id      mapping_date      comment
finos:AIR-RC-001 Information Leaked To Hosted Model skos:relatedMatch nist_ai_600_1:2-4 2.4. Data Privacy semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-RC-001 Information Leaked To Hosted Model skos:relatedMatch nist_ai_600_1:2-9 2.9. Information Security semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-SEC-002 Information Leaked to Vector Store skos:relatedMatch nist_ai_600_1:2-4 2.4. Data Privacy semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-SEC-002 Information Leaked to Vector Store skos:relatedMatch nist_ai_600_1:2-9 2.9. Information Security semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-OP-004 Hallucination and Inaccurate Outputs skos:relatedMatch nist_ai_600_1:2-2 2.2. Confabulation semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-OP-004 Hallucination and Inaccurate Outputs skos:relatedMatch nist_ai_600_1:2-8 2.8. Information Integrity semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-OP-005 Foundation Model Versioning skos:relatedMatch nist_ai_600_1:2-8 2.8. Information Integrity semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-SEC-009 Data Poisoning skos:relatedMatch nist_ai_600_1:2-8 2.8. Information Integrity semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-SEC-009 Data Poisoning skos:relatedMatch nist_ai_600_1:2-12 2.12. Value Chain and Component Integration semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-OP-016 Bias and Discrimination skos:relatedMatch nist_ai_600_1:2-6 2.6. Harmful Bias and Homogenization semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-OP-019 Data Quality and Drift skos:relatedMatch nist_ai_600_1:2-8 2.8. Information Integrity semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-RC-022 Regulatory Compliance and Oversight skos:relatedMatch nist_ai_600_1:2-9 2.9. Information Security semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:AIR-RC-023 Intellectual Property (IP) and Copyright skos:relatedMatch nist_ai_600_1:2-10 2.10. Intellectual Property semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:UC-002 Autonomous Wealth Management skos:relatedMatch nist_ai_600_1:2-2 2.2. Confabulation semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:UC-002 Autonomous Wealth Management skos:relatedMatch nist_ai_600_1:2-4 2.4. Data Privacy semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
finos:UC-002 Autonomous Wealth Management skos:relatedMatch nist_ai_600_1:2-8 2.8. Information Integrity semapv:LLMBasedMatching https://github.com/finos/ai-governance-framework 2026-06-04
```

- Maximum accessible preferred (i.e. TSV) but other formats possible
- Mapping justification uses SEMAPV terms (i.e. **LLMBasedMatching = awaiting Human Curation**)
- The Mapping predicate is SKOS relatedMatch (pending Human Curation)
- **LLM infer meaning from semantics in this file -> burns less Tokens**

# Persistent Identifier Standards

Standardized Identifiers for common data exchange

<https://doi.org/10.16457/PYtyh153>



Persistent Identifier (PID) format

<https://w3id.org/finos>  
<https://w3id.org/linuxfoundation>

Persistent prefixes examples

<https://w3id.org/linuxfoundation/id>  
<https://w3id.org/linuxfoundation/data/id>  
<https://w3id.org/linuxfoundation/data/mappings/spdx-to-eu-act.sssom.tsv>  
<https://w3id.org/lmodel/iso27001/schema>  
[https://w3id.org/lmodel/common-domain-model/schema/cdm\\_observable\\_event](https://w3id.org/lmodel/common-domain-model/schema/cdm_observable_event)  
[https://w3id.org/lmodel/fluxnova-bpm-platform/schema/provenance/fluxnova\\_bpm\\_ai\\_provenance](https://w3id.org/lmodel/fluxnova-bpm-platform/schema/provenance/fluxnova_bpm_ai_provenance)

Persistent identifier examples

# Further reading



# Recommended reading



## Supervising the Unsleeping: Overseeing Agentic AI When it Cannot be Fully Human

Thursday, 4 June | 09:30 - 10:30 GMT | Liffey Hall 2, Level 1 | Beginner level

[BREAKOUT SESSION](#) [AI GOVERNANCE](#) [AI LITERACY](#) [AI AND MACHINE LEARNING](#) [BENCHMARKING](#)  
[CUSTOMER TRUST AND EXPECTATIONS](#) [FRAMEWORKS AND STANDARDS](#) [RISK MANAGEMENT](#) [FINANCE AND BANKING](#) [LEGAL](#)  
[TECHNOLOGY](#)

[Download the presentation slides](#) 

The EU AI Act mandates human oversight for high-risk AI systems. But oversight did not start with GenAI. Financial services had a head start with mature model risk management and validation culture due to the regulatory scrutiny and risk it faces. Here, oversight grew up in traditional data science and MRM: with dashboards and “management by exception” alerts routing anomalies to humans for review. This paradigm has been strained by GenAI, where open-ended workflows with probabilistically generated unstructured data breaks the tidy oversight metrics. Manual human review has hit the walls of scale, speed and consistency. Now, agentic AI exacerbates this further: agents plan, act and iterate at machine pace. This makes human “watch-every-output” oversight impossible, and we lose the focus point of human accountability. We unpack the core paradox: agentic aims to automate, but its autonomy creates failure surfaces that demand detailed governance, risking the benefits it promises. We lay out current best practices for governing agents: defense-in-depth controls, human-in-command checkpoints and automated monitors that prove control at scale.


### What you will learn:


- A concise history of human oversight: from quantitative, thresholder “management by exception” to agentic AI with oversight as part of the system.
- Banking’s regulatory driven enhancements: mature MRM/validation, immutable audit trails and AI-assisted evaluation.
- Concrete governance patterns for oversight of agentic AI.


### Featured in this session




**Andrew Harrison**  
AIGP, CIPP/E  
Senior AI Governance Specialist  
Booking.com  
[View bio](#) 



**Andrew Sutton**  
Visiting Fellow  
Oxford Martin School AI Governance Initiative  
[View bio](#) 



**Nicole Onuta**  
Lead AI Risk  
ING  
[View bio](#) 

# AI Agent Identity and Authorization – NIST Standard coming ...

