Boosting D3FEND: Ontological Analysis and Recommendations

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Content

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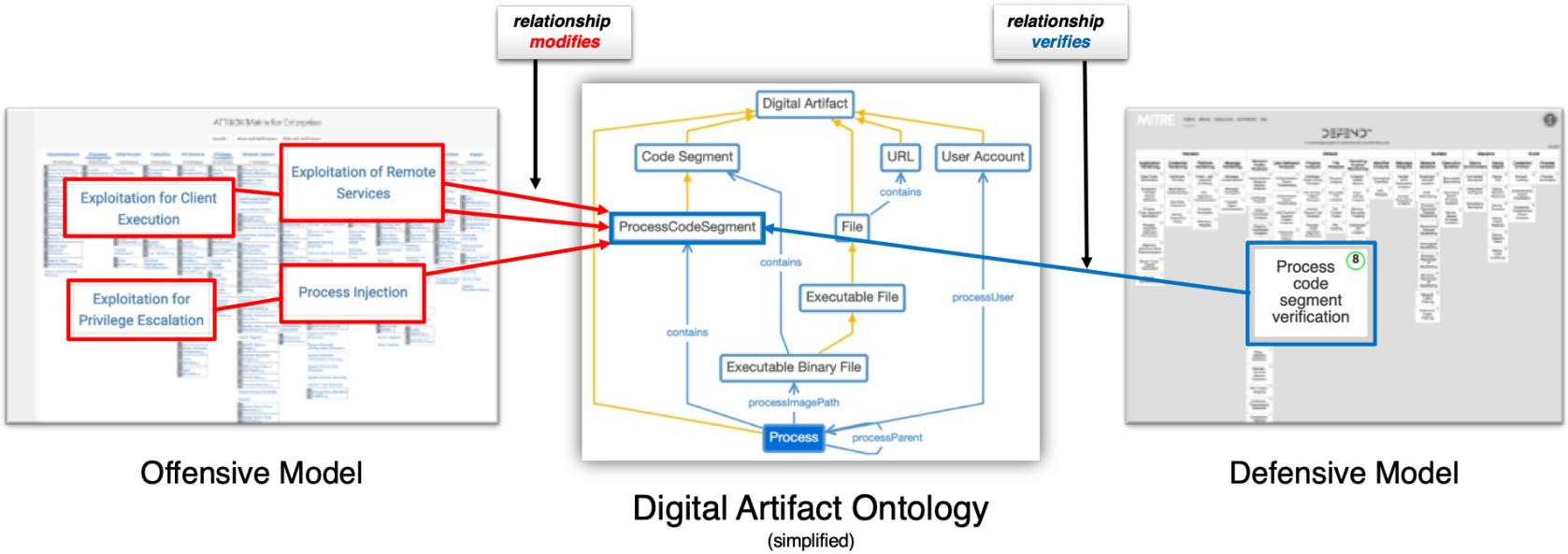
- But what happens in case of lack of foundations? Is this a problem? 🤔



"D3FEND is (...) a knowledge graph of cybersecurity countermeasure techniques. (...) it is a catalog of defensive cybersecurity techniques and their relationships to offensive/adversary techniques. The primary goal of the initial D3FEND release is to help standardize the vocabulary used to describe defensive cybersecurity technology functionality."
(`https://d3fend.mitre.org/faq/`)

D3FEND is getting more popular in cybersecurity

Swimlane
https://swimlane.com › blog › clou... · Vertaal deze pagina

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22 aug 2023 — The **MITRE ATT&CK** and **D3FEND** frameworks can be valuable tools for organizations looking to **secure** their **cloud** environments.

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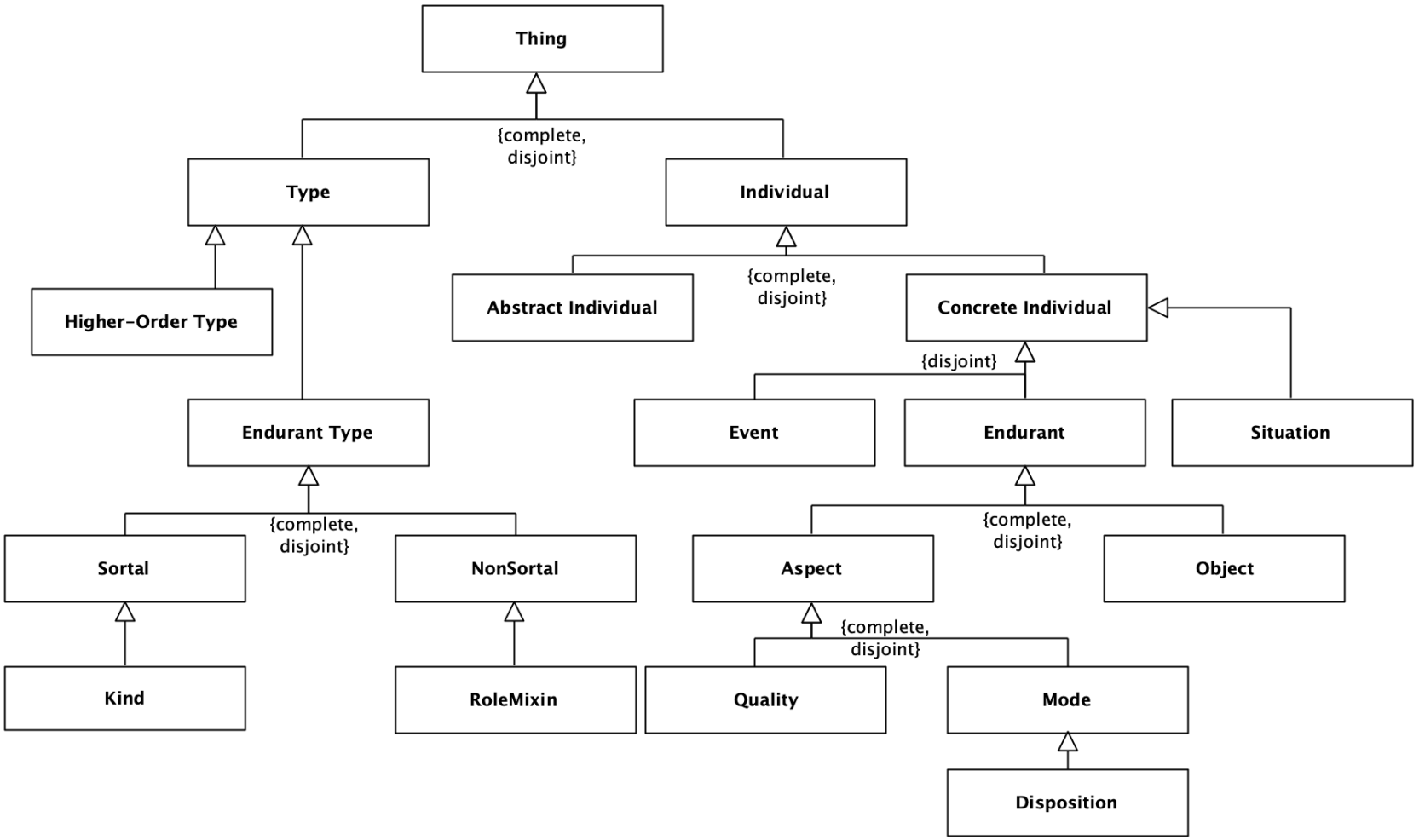
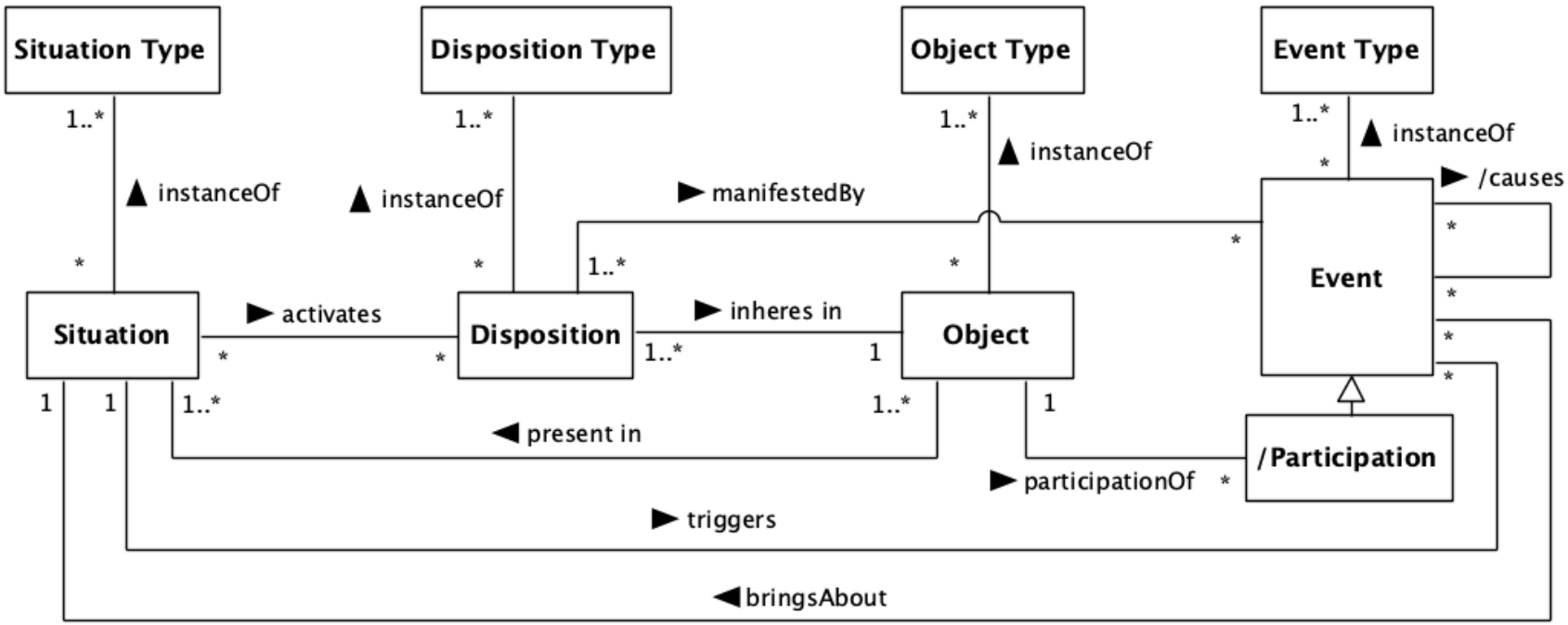
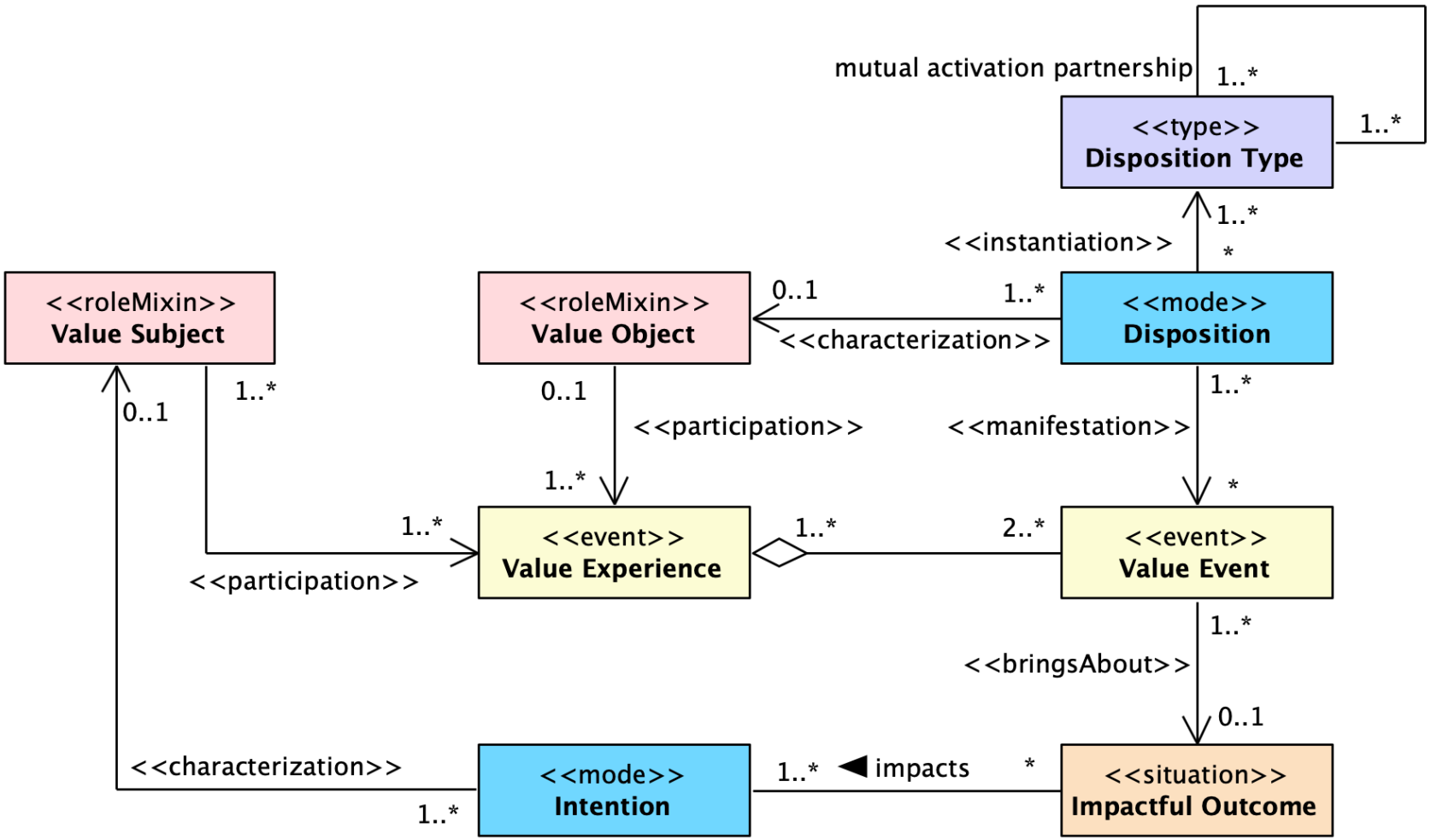
Unified Foundational Ontology (UFO)



UFO-B: Ontology of Events



Reference Ontology for Security Engineering (ROSE)



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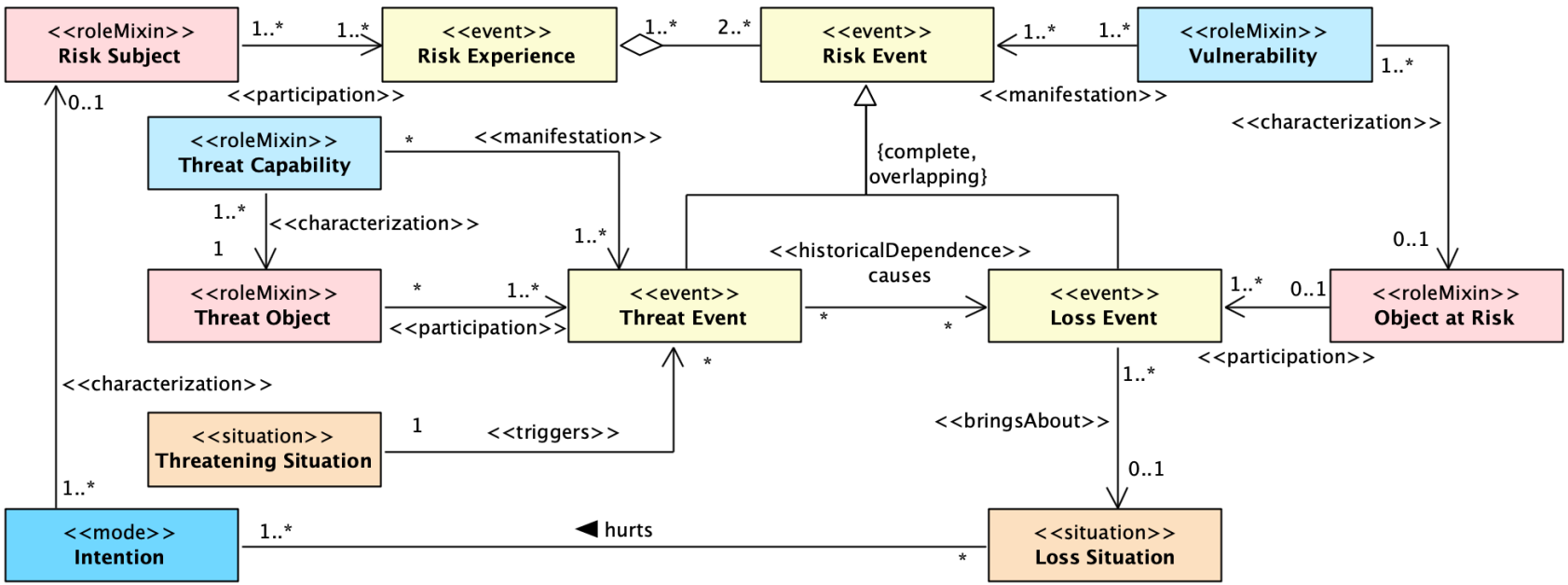

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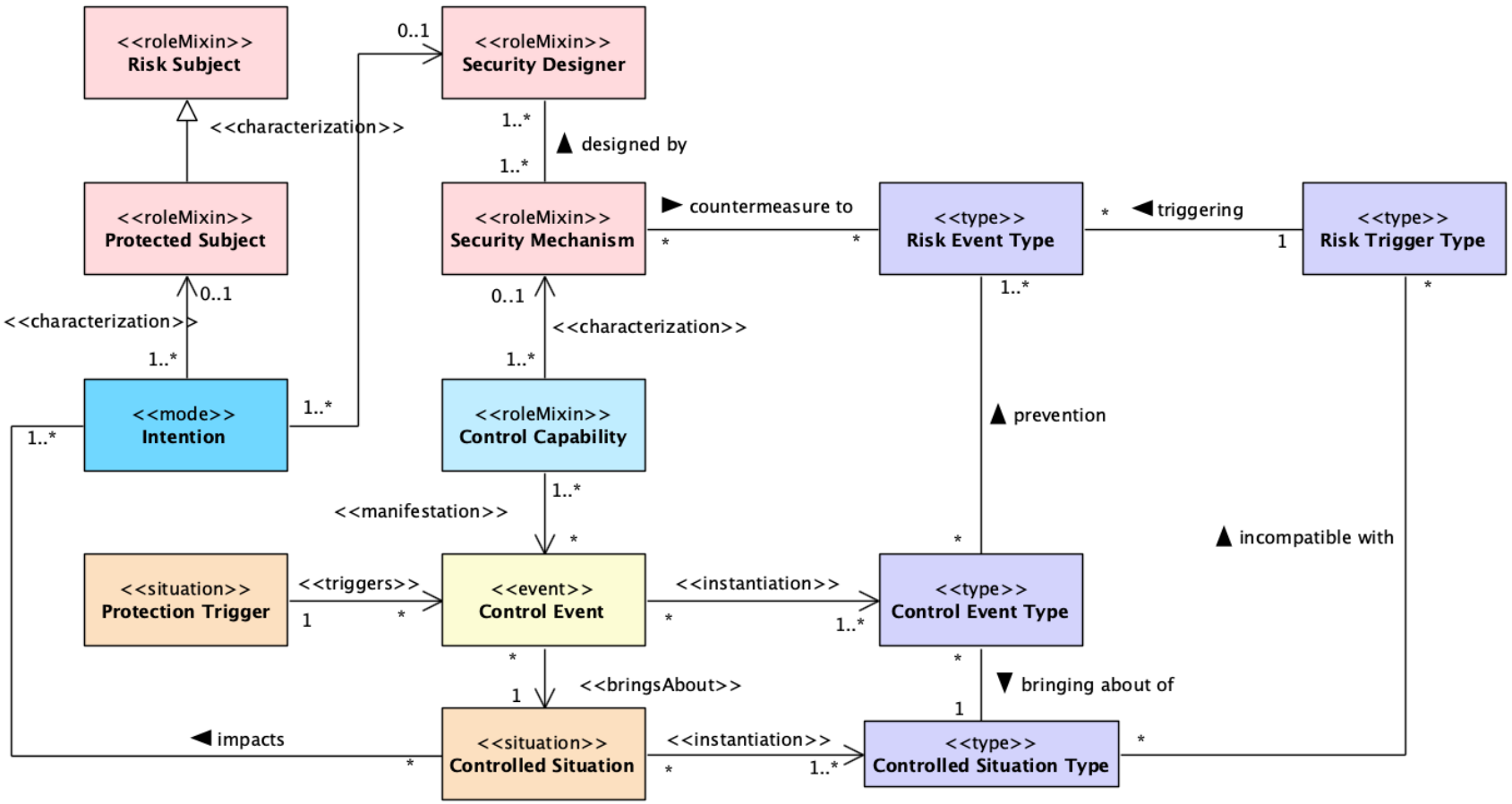
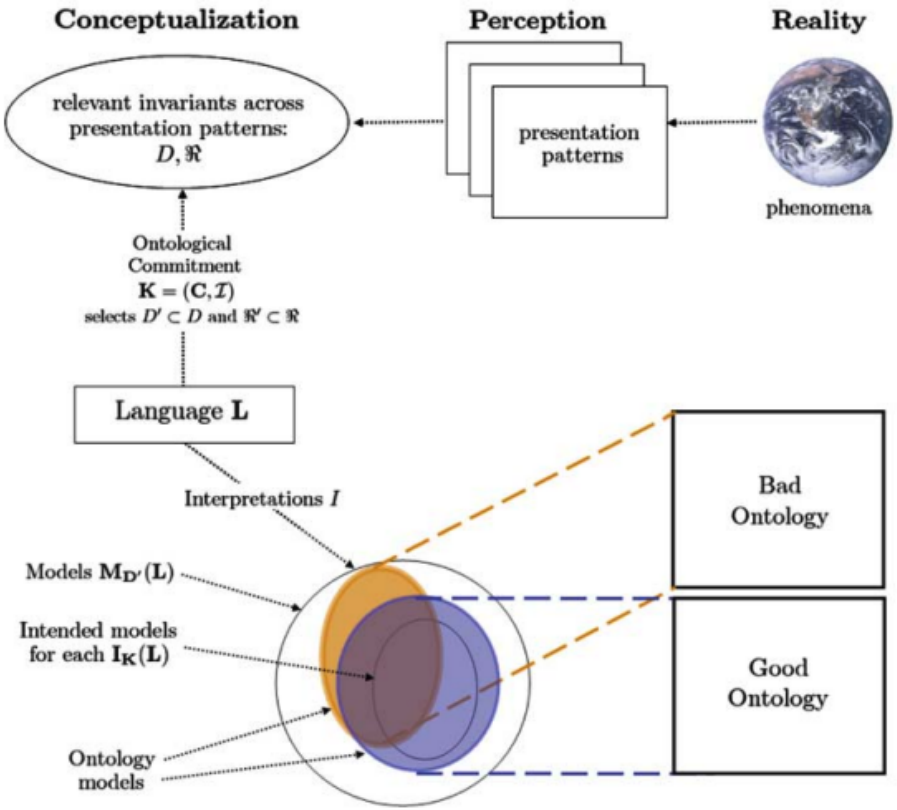
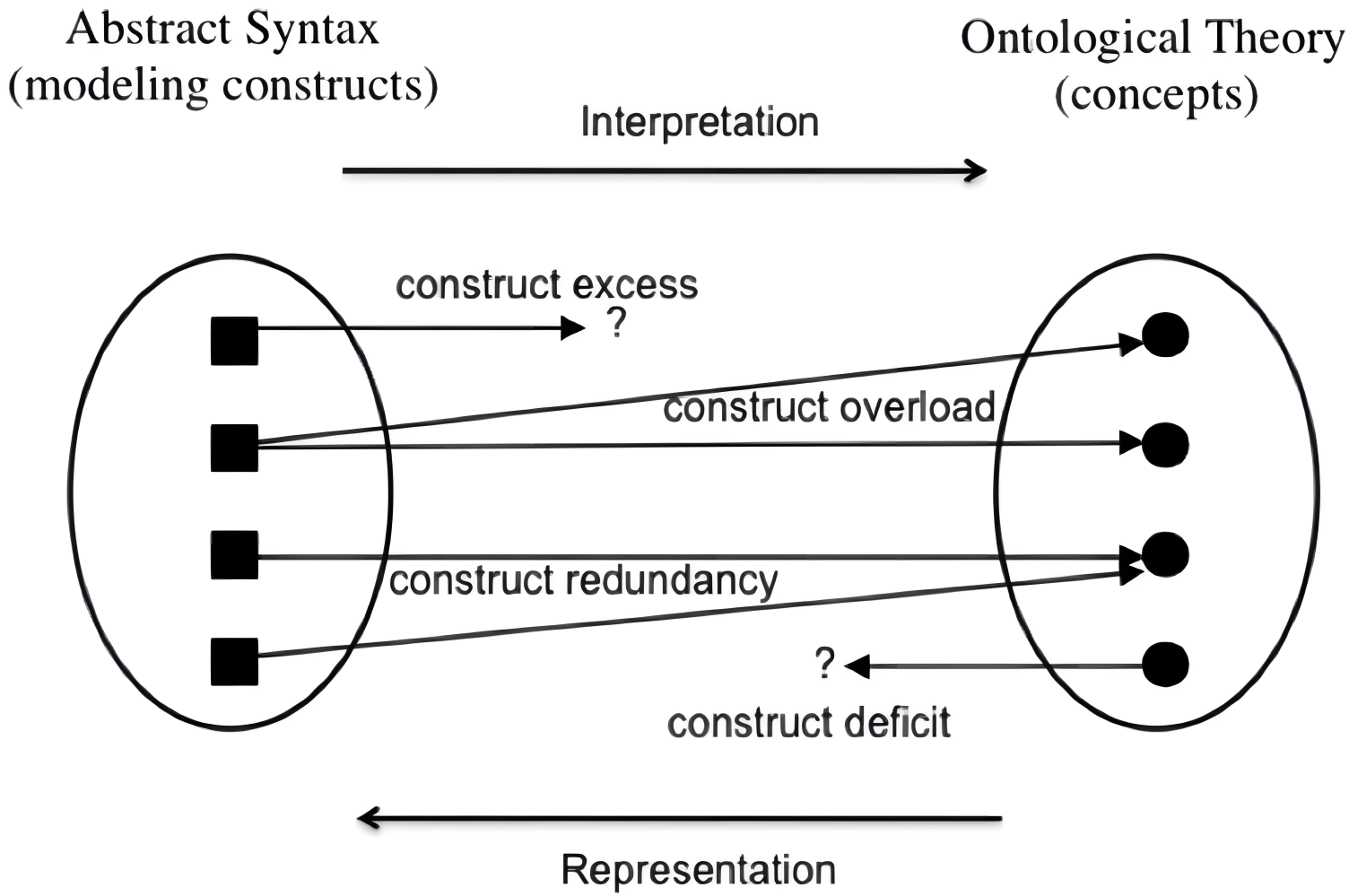


A good ontology should not only capture intended instances but also exclude unintended ones.



GUARINO et al. What is an ontology? (2009)

Ontological Analysis



***Conjecture**: without the aid of the systematic taxonomy of a foundational ontology, ontology engineers tend to drop constraints to avoid inconsistencies as the ontology gets bigger, consequently admitting more and more unintended instances.*

Versions of D3FEND

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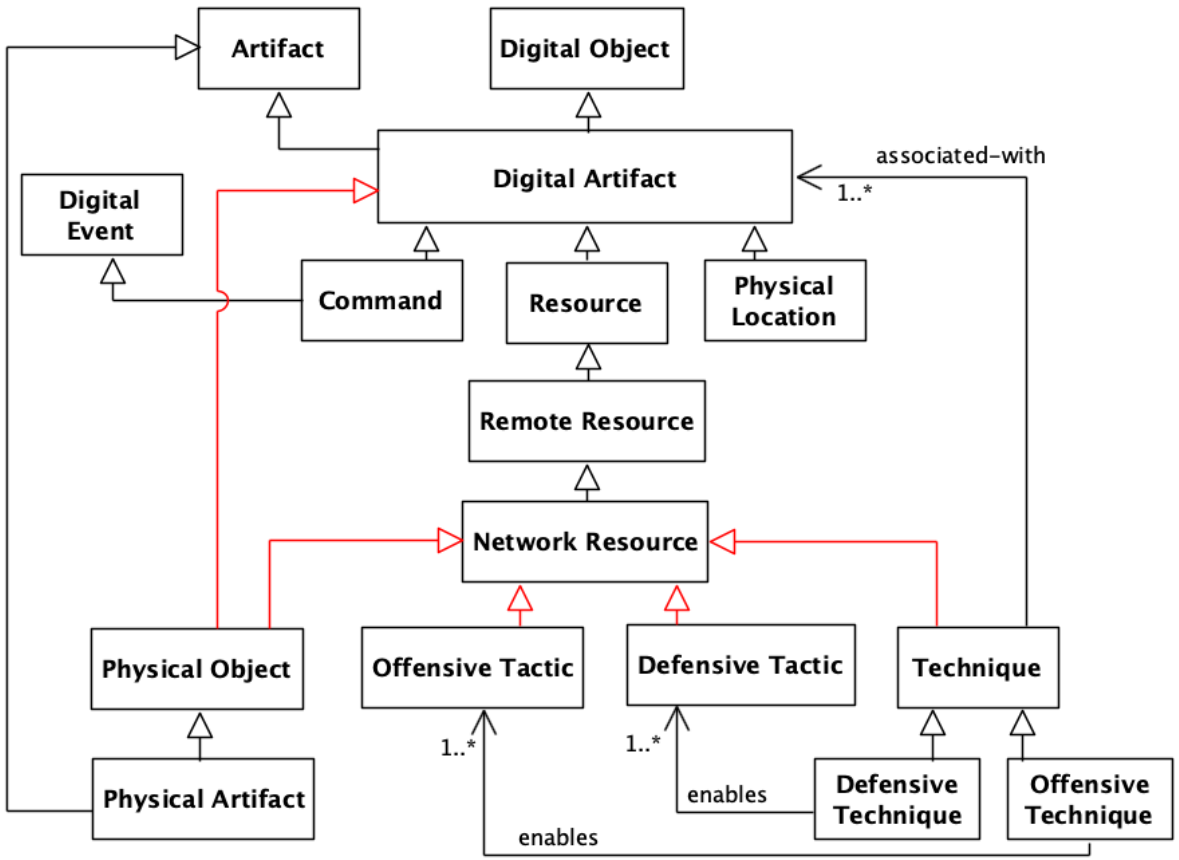
- All related files at: `https://purl.org/d3fend-analysis`

General Ontological Issues Within D3FEND

Systematic problem of ontological imprecision, particularly regarding its *lack of disjointness* among classes.



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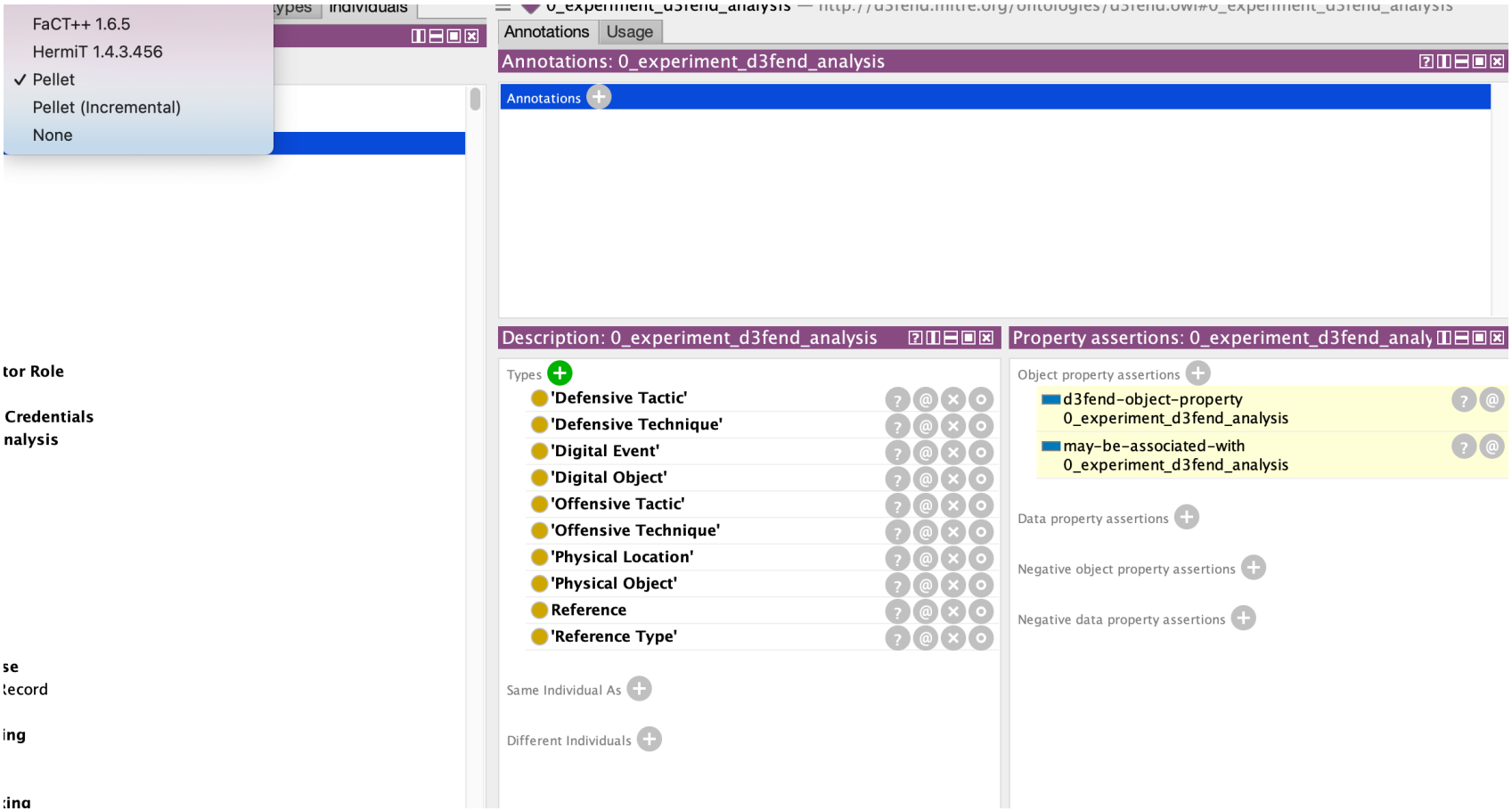
- As final evidence of the systematic lack of constraints of D3FEND, we made an experiment by creating an individual that is, *concomitantly*, everything at once.

Lack of constraints



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- Threat Object and Attacker are missing, so it is not possible to identify the Objects that are sources of a Risk Event or a Attack.

Domain-Specific Ontological Issues Within D3FEND

- The conditions that favor the appearance of a Risk Event (Threatening Situation) or the conditions that favor the occurrence of a Control Event (Protection Trigger) are absent. As a result, we cannot properly describe and assess the situations associated with risk or security.

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- The notion of Technique obfuscates the distinction between an Object (say, a Security Mechanism, its capability (say, a Control Capability), the event or process that is the manifestation of this capability (Control Event), and the resulting state of the world (Controlled Situation) that impacts (positively or negatively) an Intention of a subject.
- Vulnerability?

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- Motto: No ontology without Ontology! 🙃
- Foundational ontologies and reference domain ontologies work as ontology engineering frameworks. 🥰

Future Work

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- "CIA triad": *Confidentiality*, *Integrity*, and *Availability*. They can be used not only to specialize the subjects' Intentions (security goals) but also to specialize Loss Event and Loss Situation–Loss of Confidentiality, Loss of Integrity, and Loss of Integrity.)

Thank you! Questions?

Get in touch: 😇

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- https://sites.google.com/view/italojsoliveira
- Semantics, Cybersecurity, and Services Group: `https://www.utwente.nl/en/eemcs/scs/`