

MEMORANDUM FOR CHIEF DIGITAL AND ARTIFICIAL INTELLIGENCE OFFICER  
COUNCIL MEMBERS  
INTELLIGENCE COMMUNITY CHIEF DATA OFFICER COUNCIL  
MEMBERS

SUBJECT: Baseline Standards for Formal Ontology within the Department of Defense and the Intelligence Community

In April 2023, the Chief Digital and Artificial Intelligence Officer Council and the Intelligence Community Chief Data Officer Council chartered the joint Department of Defense (DoD) and Intelligence Community (IC) Ontology Working Group (DIOWG). It was tasked with developing coordinated ontologies to set the agreed definitions and standard necessary to make data machine understandable. Based on the DIOWG's recommendations, both Councils direct the use of three baselines: Top-Level Ontology, Basic Formal Ontology, and Common Core Ontology. These will set the baseline standards for formal DoD and IC ontology.

By aligning the DoD and IC ontologies to a common set of top and mid-level standards, the combined enterprise will realize significant gains in data interoperability, federated search and discovery, decreased analytic timelines, and better cost efficiency. This common approach to data ontology is key to deriving value from shared data assets at speed and scale. The DIOWG has provided additional background information on these international ontological standards in Attachment A.

The nation's warfighters and intelligence professionals will need to have a decisional advantage in the immediate future and that can only be unlocked through the sharing of interoperable data. The next steps for the DIOWG are to codify recommended principles and governance processes to manage the DoD-IC Ontology Foundry. The DIOWG collaboration site can be accessed by visiting <https://www.trmc.osd.mil/wiki/display/DIOWG/>.

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## Attachment A

### BACKGROUND:

Ontologies are used across the DoD, Intelligence Community (IC) and with other software applications to enable data sharing, insights, and interoperability across a complex network of global and disparate data and information systems. Most of these ontologies, however, were created in isolation or based on incompatible principles, limiting sustainability and interoperability opportunities. Moreover, they are often tied to existing data sources, which prove inflexible and unscalable when applied to new data streams.

The **Top-Level Ontology** (TLO) serves as a domain-neutral common architecture for multiple domain ontologies at lower levels and specifies the requirements an ontology must satisfy to support exchange, retrieval, discovery, integration, and analysis of data by computer systems. The TLO is a recognized standard under the International Organization for Standardization (ISO).

The **Basic Formal Ontology** (BFO) is an ontology that describes categories of entities at the generic level and serves as a template and foundation for all lower, domain-level ontologies; it is also an ISO standard. The BFO is lean enough to be easily teachable and learnable, yet broad enough to enable representation of entities of all types.

The **Common Core Ontology** (CCO) is a mid-level ontology that can be extended to create domain ontologies and fit-for-purpose mission ontologies, which has significant potential for achieving the goals of DoD and IC-wide understandability, integration, interoperability, and logical consistency.

### PRINCIPLES:

One of principles of the DoD-IC Ontology Foundry is common formatting to predicate DoD and IC wide best practices and ensure alignment of the meaning (i.e., semantics) of data, while giving data professionals the freedom to use various knowledge modeling and representation approaches to meet their local mission's need. Leveraging TLO, BFO and CCO standards promotes collaboration and the sharing and re-use of data and data models (using controlled vocabularies to improve consistent definitional term use) across DoD and IC, while advancing best practices, standards, and ontologies among knowledge modelers.

- TLO Standard: ISO/IEC-JTC1-21838-1:2021 <https://www.iso.org/standard/71954.html>
- BFO Standard: ISO/IEC-JTC1-21838-2:2021 <https://www.iso.org/standard/74572.html>

- CCO is comprised of eleven mid-level ontologies, designed to represent and integrate taxonomies of generic classes and relations across all domains of interest, and contains classes and relations used in many, if not all, domains of interest. This is a critical foundation for search and discovery, will not constrain any agency/element/producer from developing their own ontology nor does it constrain knowledge ontologies/knowledge graphs. The CCO is in the final process of becoming an Institute of Electrical and Electronics Engineers standard supported by the National Institute of Standards and Technology ([https://www.nist.gov/system/files/documents/2021/10/14/nist-ai-rficubrc\\_inc\\_004.pdf](https://www.nist.gov/system/files/documents/2021/10/14/nist-ai-rficubrc_inc_004.pdf))

## **RATIONALE:**

Leveraging the above practices and standards will increase value to new ontology development activities while producing consistent quality and precision mission desired outcomes (knowledge graphs, artificial intelligence and machine learning, behavior graphs, etc.). Additional benefits include:

- A base vocabulary that is to be extended to a fuller suite of ontologies that serve as the unified semantics for the content of all data sources within an enterprise.
- Allowing different groups within an enterprise to develop ontologies and still arrive at semantically interoperable models.
- Enabling a starting set of general, commonly used terms and understanding.
- Providing the maximum coverage of typical business/mission concepts with the fewest number of primitives and the least amount of ambiguity.
- Reducing the amount of time and effort required by analysts, query writers and algorithm developers to acclimate themselves and their products to different content.
- Greatly reducing the proliferation of ontologies, which in turn reduces the amount of time and effort needed to find content and in building mappings between content and naturally accelerates alignment of model interoperability.
- Enabling rapid development by creating a cycle of ever diminishing extent of new content that needs to be ontologized.