

# Top Level Ontologies: CDBB/IMF

Digital Twins and Data Ontologies Event  
2 December 2020

Chris Partridge

# The National Digital Twin: Key milestones

2018	Gemini Principles	a paper setting out the proposed principles to guide the national digital twin and the information management framework that will enable it
2018	Roadmap	a prioritised plan for five core streams responsible for the delivery of the information management framework
2020	Pathway towards an Information Management Framework: a 'Commons'	a 'Commons' for a digital built Britain and a high level summary. The approach to delivering a National Digital Twin for the United Kingdom
2020	A survey of Top-Level Ontologies A Survey of Industry Data Models and Reference Data Libraries	these form the foundation for the work described in 'The Pathway towards and Information Management Framework'. The survey papers identify the requirements and inform the ontological choices for a Foundation Data Model (FDM). The FDM, built upon a top-level ontology, is a key component of the IMF and a basis for ensuring consistent data across the National Digital Twin
2020	(forthcoming) TLO Recommendation	the choice of TLO for the FDM

# The pathway towards an Information Management Framework

<https://www.cdbb.cam.ac.uk/news/pathway-towards-IMF>

The FDM is built upon a top-level ontology

1. **Foundation Data Model (FDM)** – a high level definition of the structure and meaning of data to enable the consistent sharing of data across Digital Twins and the ecosystems they support
2. **Reference Data Library (RDL)** – the particular set of classes and the properties we will want to use to describe our digital twins
3. **Integration Architecture (IA)** – the protocols that will enable the managed sharing of data



# The survey papers



<https://www.cdbb.cam.ac.uk/news/publication-top-level-ontologies-and-industry-data-models>

*A survey of Top-Level Ontologies*

- *to inform the ontological choices for a Foundation Data Model*

*A Survey of Industry Data Models and Reference Data Libraries*

- *to identify requirements for, and provide input to, a Foundation Data Model*

The survey papers are the first outputs from the FDM project

They will inform the development of an FDM which will be tested on CIH's Platform and is the starting point - a "seed" - for the National Digital Twin

The publication of these surveys is a big step forward towards building a framework that enables effective information management across the built environment

# A Survey of Top-Level Ontologies: A framework

## Appendix E: Summary of Framework Assessment Matrix Results



### A survey of Top-Level Ontologies

To inform the ontological choices for a Foundation Data Model

Version 1



31  
ontological  
choices

37 top  
ontologies  
shortlisted  
and  
assessed

category	vertical aspect								
	parent-arity		transitivity	boundedness			stratification	formal generation	
relation	type-instance	super-sub-type	super-sub-type	type-instance			type-instance	whole-part	
characteristic				downwards	fixed finite levels	number of fixed levels		fusion	complex
choice	single or unconstrained	single or unconstrained	yes or no	bounded or unbounded	fixed or not-fixed	[a number]	stratified or unstratified	yes or no	yes or no
BFO	unconstrained	single	yes	bounded	fixed	2	stratified	no	no
BORO	unconstrained	unconstrained	yes	bounded	not-fixed	not applicable	unstratified	yes	yes
YAMATO	not assessed	single	yes	bounded	fixed	2	stratified	yes	yes
HQDM	unconstrained	unconstrained	yes	bounded	not-fixed	not applicable	unstratified	yes	yes
IDEAS	unconstrained	unconstrained	yes	bounded	not-fixed	not applicable	unstratified	yes	yes
ISO 15926-2	unconstrained	unconstrained	yes	bounded	not-fixed	not applicable	unstratified	yes	yes
UFO	unconstrained	unconstrained	yes	bounded	not-fixed	not applicable	stratified	no	no
GFO	unconstrained	single	yes	bounded	not-fixed	not applicable	unstratified	yes	yes
KR Ontology	not yet assessed	unconstrained	yes	not yet	not	not assessed	not assessed	not	not assessed
DOLCE	unconstrained	single	yes						
ConML+CHARM	unconstrained	single	yes						
CIDOC (ISO 21127-2014)	unconstrained	unconstrained	yes						

The ontological choices shape the architecture of the ontology

To inform the ontological choices for a Foundation Data Model

# Making an ontological assessment

Two useful tools – among many

## Ontological Framework Assessment

category	type	relation	characteristic	choice	
general	ontologically committed			--not set--	
	commitment level			--not set--	
	subject			--not set--	
	categorical			--not set--	
vertical aspect	parent-arity	type-instance		--not set--	
		super-sub-type		--not set--	
	transitivity	super-sub-type		--not set--	
	boundedness	type-instance	downwards		--not set--
			fixed finite levels		--not set--
			number of fixed levels		--not set--
	stratification	type-instance		--not set--	
	formal generation	whole-part	fusion		--not set--
			complement		--not set--
	relation class-ness	type-instance	fusion		--not set--
super-sub-type		complement		--not set--	
horizontal aspect	spacetime			--not set--	
	locations			--not set--	
	properties			--not set--	
	endurants			--not set--	
	immaterial			--not set--	
universal	mereology			--not set--	
	interpenetration			--not set--	
	materialism			--not set--	
	possibilia			--not set--	
	criteria of identity			--not set--	
	time			--not set--	
	indexicals: here and now			--not set--	
higher arity			--not set--		

## Evidence-based Conceptual Prototyping

Mining the ontological requirements for a domain

For an example based upon UNICLASS see:

<https://www.academia.edu/44210409>  
<https://www.academia.edu/44326217>

or  
<https://borosolutions.net/multi-level-types-uniclass-multi-2020>

Both can be applied to any data schema (or data)



A Survey of Industry Data Models and Reference Data Libraries

To identify requirements for, and provide input to, a Foundation Data Model

Version 1



THE END

