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BLOCKCHAIN BIM

BIM Objects Evolution for Heritage Future Asset Management

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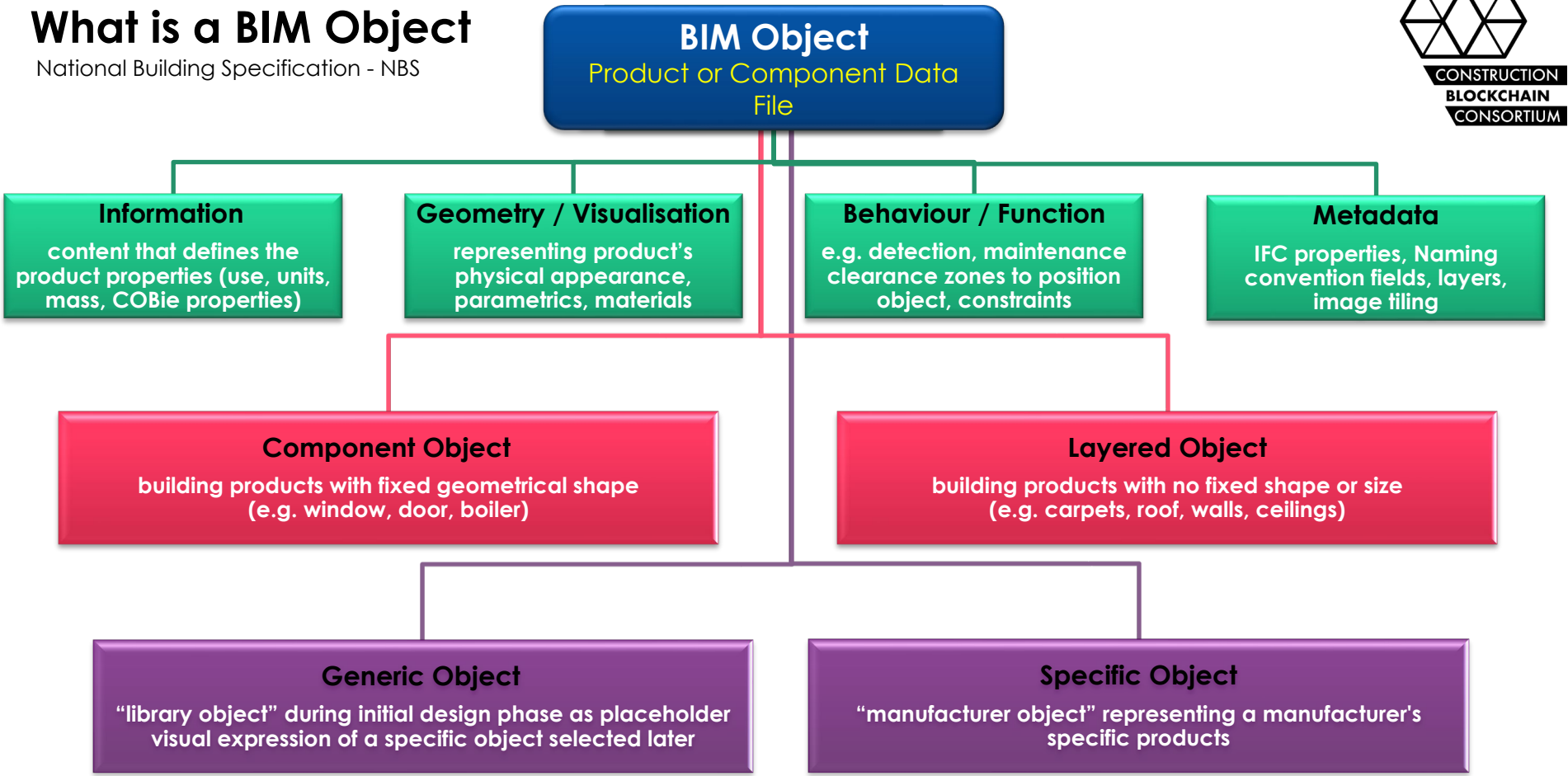
Agenda

1. BIM Objects in AEC Industry
2. BIM Objects in Heritage
3. Heritage Classification for Asset Management

BIM Objects in AEC Industry

What is a BIM Object

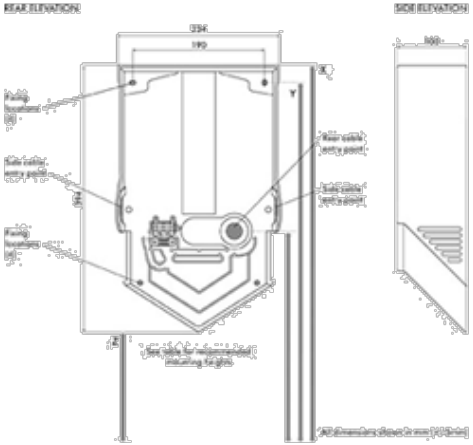
National Building Specification - NBS



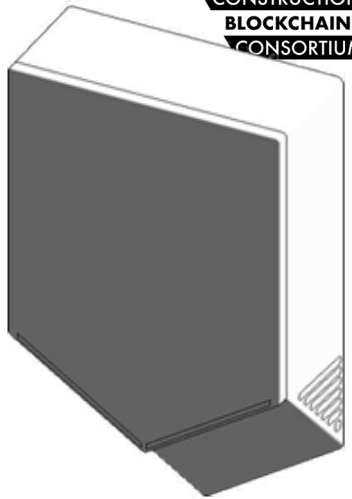
What is a BIM Object

NBS National BIM library
https://www.nationalbimlibrary.com/en/about-bim-objects/

Product data sheets/
technical infomation



Dimensions and
product geometry



BIM object

**Information &
Behavioural Data**

File formats:

- IFC
- Autodesk Revit
- Bentley AECOsim
- Nemetscheck Vectorworks
- Graphisoft ArchiCAD

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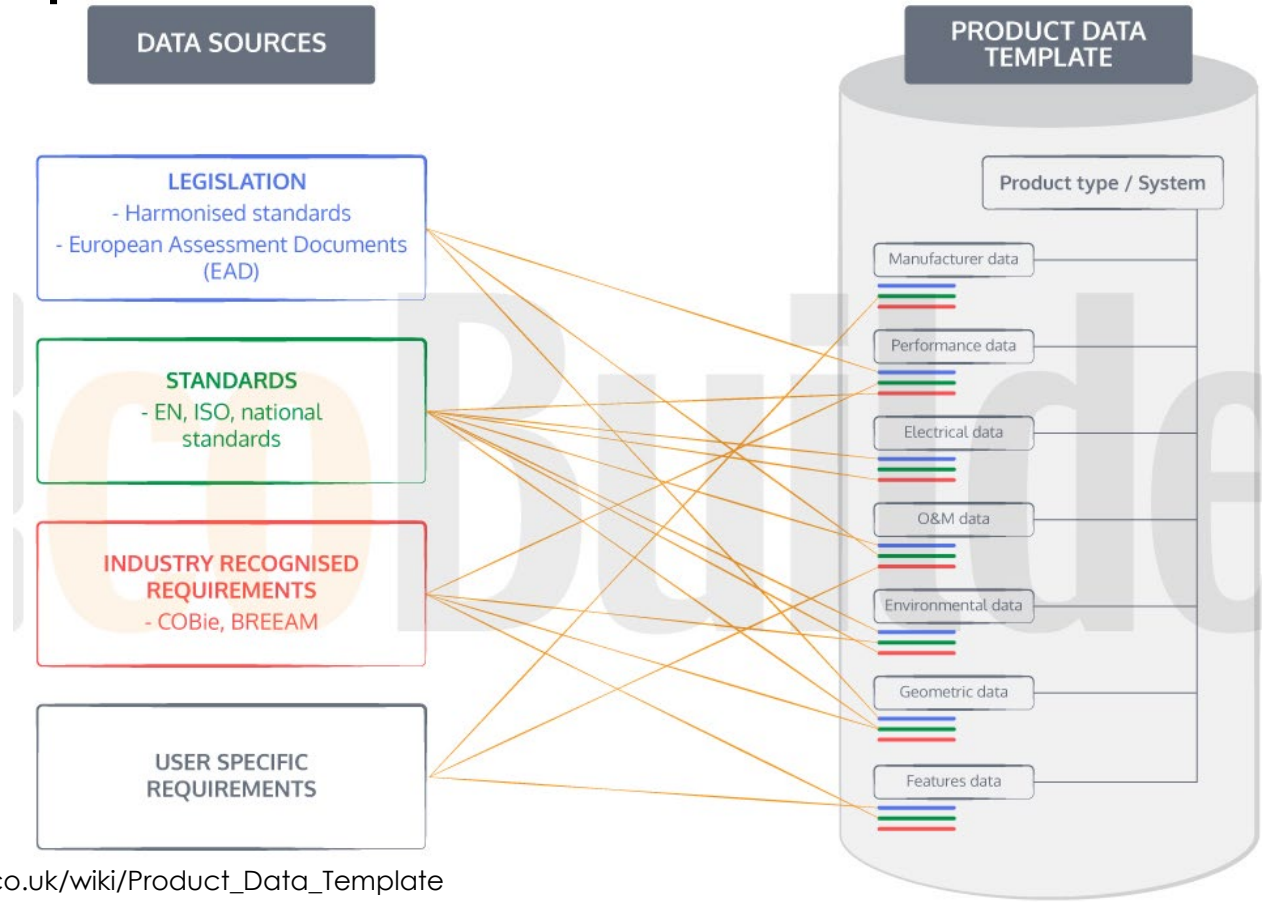
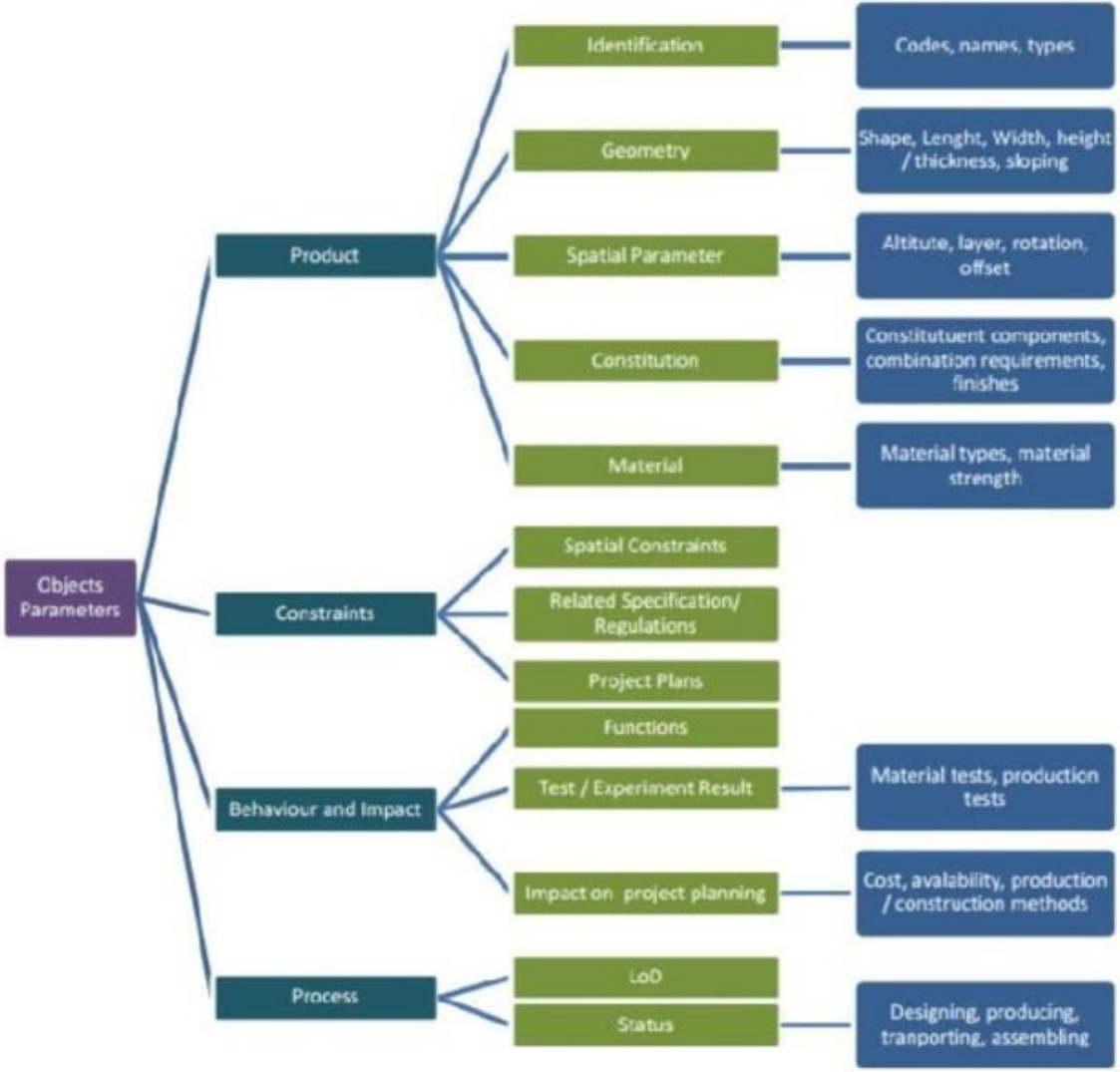
Product Data Template



https://www.designingbuildings.co.uk/wiki/Product_Data_Template



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Information in a BIM Object

Lu, W., Chen, K., Wang, J. and Xue, F., 2017, July. Developing an open access BIM objects library: A Hong Kong study. In *Proceedings of the Joint Conference on Computing in Construction* (pp. 407-414).

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Evolution of BIM Objects Standardisation

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- **NBS BIM Object Standard** – introduced 2011
  - NBS BIM Object Standard v2.1 – 2019 (create all types of data information, geometry, function, metadata)

- **BS 8541 (1-6)** - Library objects for architecture, engineering and construction:
  - Part 2:2011 - Recommended 2D symbols of building elements for use in building information modelling
  - Part 1:2012 - Identification and classification. Code of practice
  - Part 3:2012 - Shape and measurement. Code of practice
  - Part 4:2012 - Attributes for specification and assessment. Code of practice
  - Part 5:2015 - Assemblies. Code of practice
  - Part 6:2015 - Product and facility declarations. Code of practice

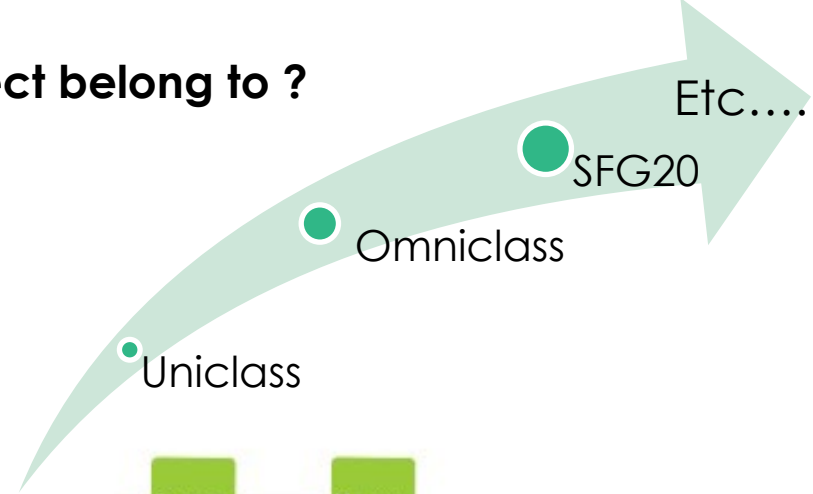
- **buildingSMART Data Dictionary (bSDD)** - a 'vocabulary' that details what objects should be called
  - online service of **classifications** and their properties, allowed values, units and translations

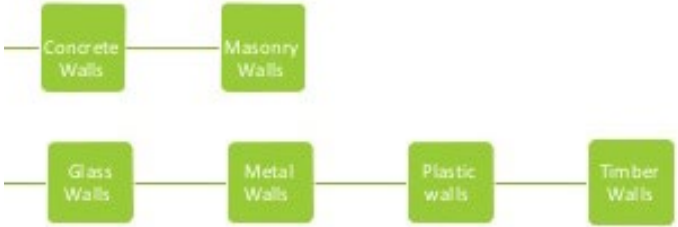
- **buildingSMART Industry Foundation Classes Schema (IFC)** - BIM objects should be structured to IFC class name and property sets, irrespective of software platform creating object. IFC schema is a standardized data model that codifies
  - ***identity and semantics*** (name, machine-readable unique identifier, object type or function)…
  - ***characteristics or attributes*** (such as material, color, and thermal properties)
  - ***relationships*** (including locations, connections, and ownership)
  - ***abstract concepts*** (performance, costing)
  - ***processes*** (installation, operations)
  - ***people*** (owners, designers, contractors, suppliers, etc.)

- **Construction Operations Building Information Exchange (COBie)**

BIM Objects & Classification in Heritage

What system does the object belong to ?





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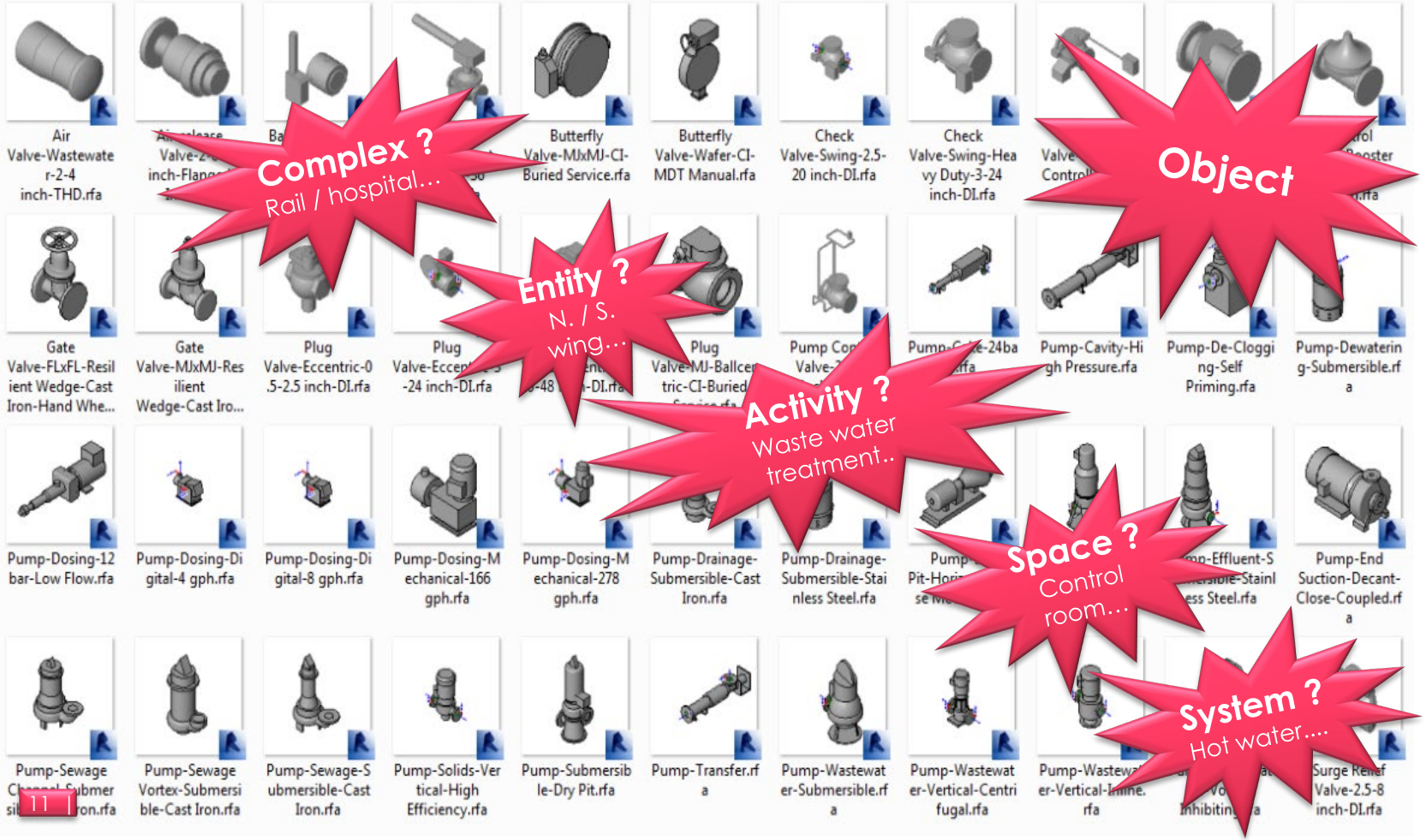

What system does the object belong to ?

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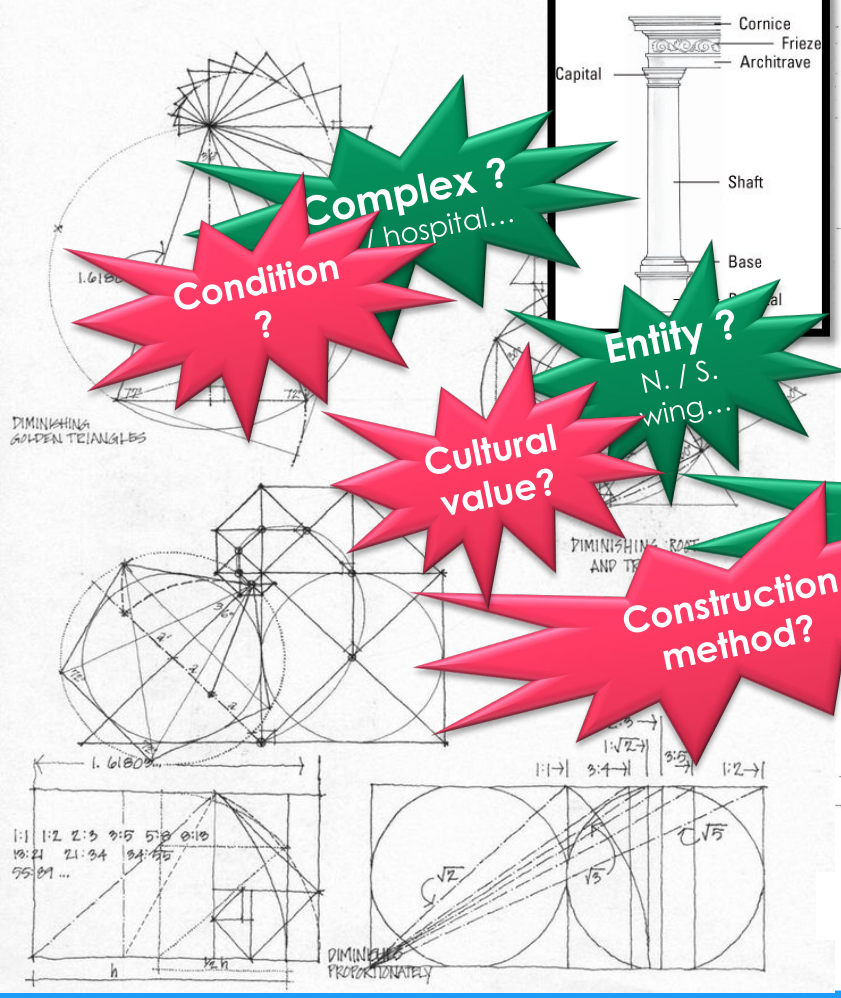

Complex ?
/ hospital...

Condition ?

Entity ?
N. / S.
wing...

Cultural value?

Activity ?
...e water

Construction method?

Heritage Object

Object

Space ?
Control

Geometric ratio?

Architectural style ?

What about HERITAGE ??

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More Hierarchical Attributes

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What's missing…

- *Architectural age*
- *Construction restrictions*
- *Condition (deterioration, material durability etc.)*
- *Maintenance constraints*
- *Heritage value*
- *Reflectance attributes.....*

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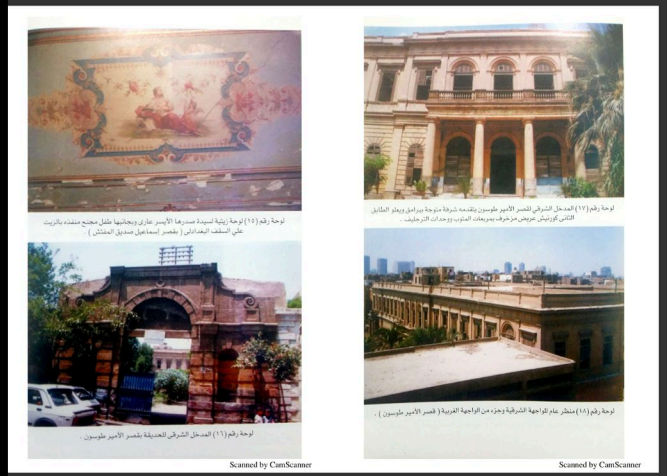
Framework for Restoration of Heritage using BIM
FRESH-BIM

British Council Grant
- Newton Fund
Institutional Links

Toson Palace
(Cairo - 1869)
(Baroque / Renaissance…)

Heritage Ontological Classification System

FARO: detailed scanning for components / structural analysis
Matterport: VR / AR / tagging
Back end expert system for renovation techniques



Heritage Ontological Classification Classes & Subclasses

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Assembly Category

Structural components / Attached Architectural Components
Independent Components / Cladding

Orientation

Horizontal Support / Vertical Support / Inclined Support

System

e.g. Columns / Load bearing walls. / Sanitary Fittings

Type

e.g. Doric Architrave / Ionic Frieze / Retaining Walls / Sink

Composition

e.g. Concrete. / Stone / Brick / Timber / Steel

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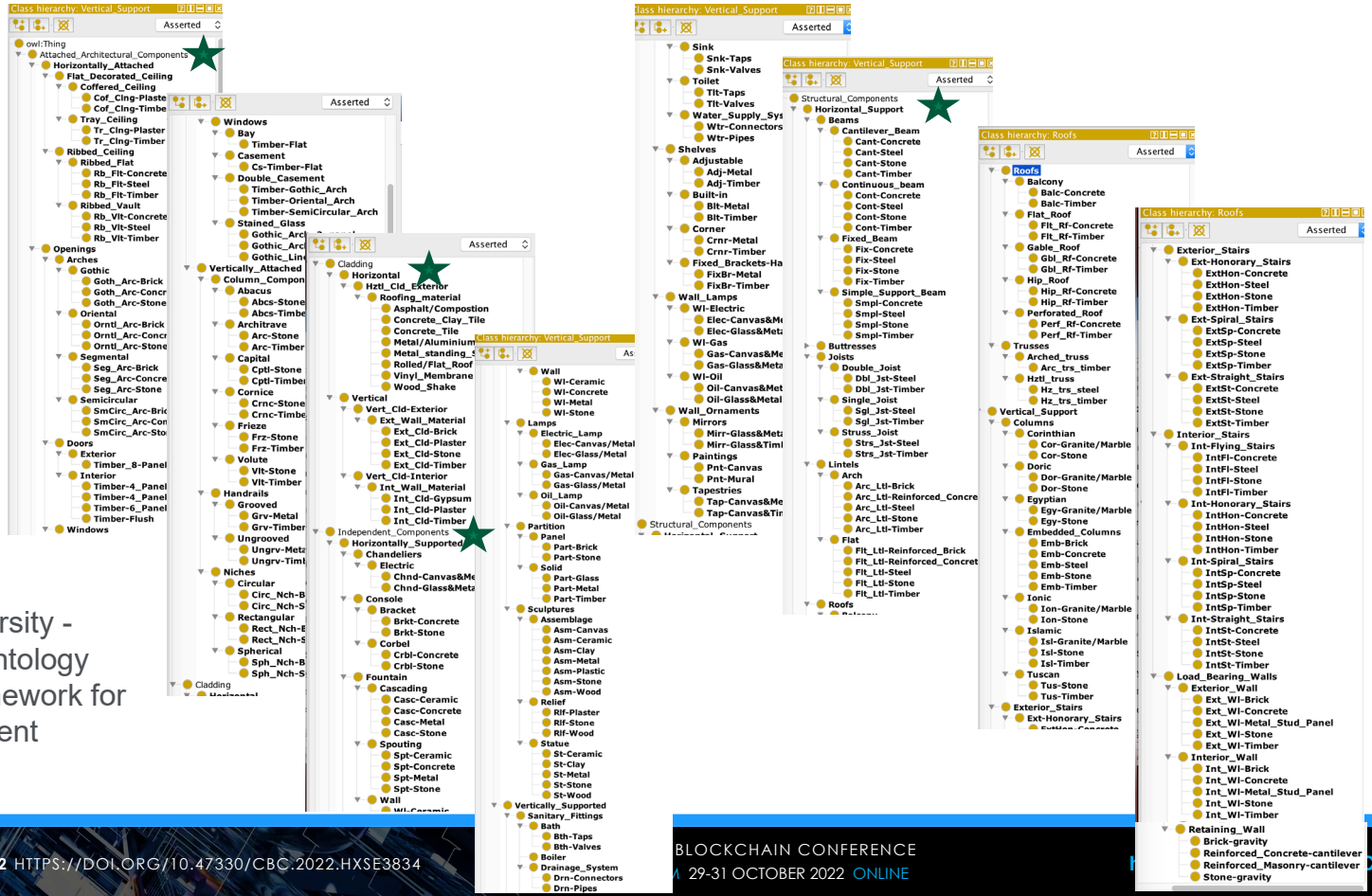
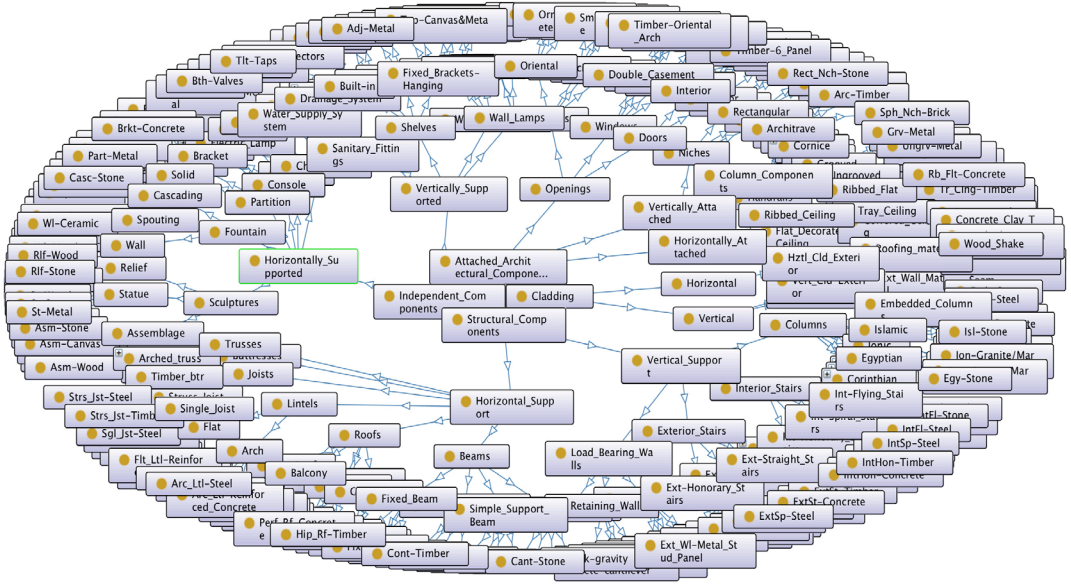
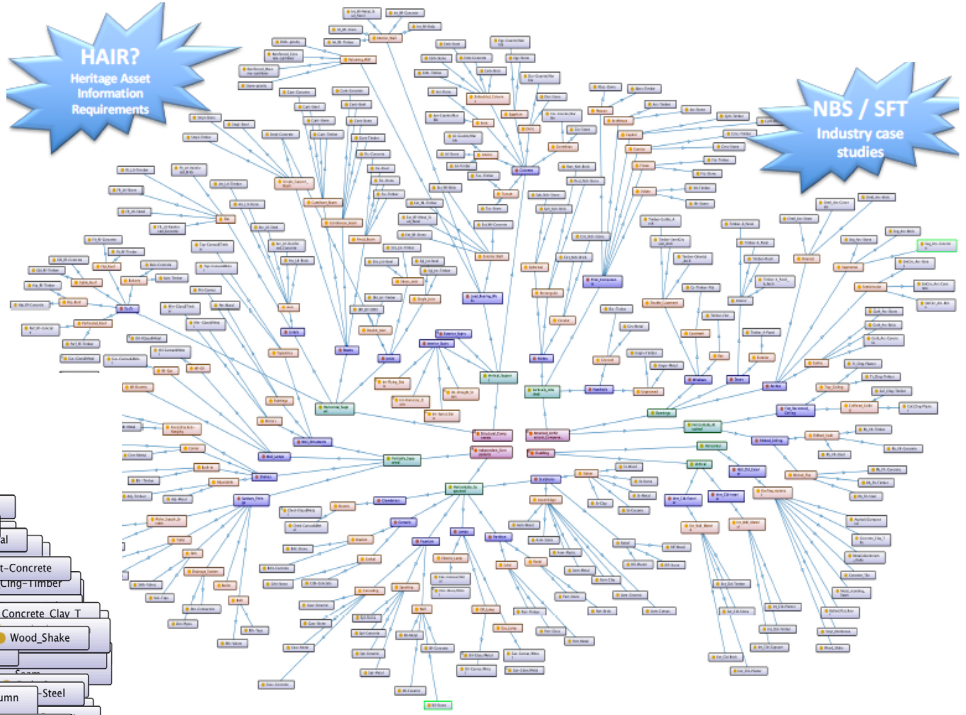
PROTÉGÉ Classes & Sub-classes



Stanford University - open-source ontology editor and framework for building intelligent systems

PROTÉGÉ Onto Graf (2D & 3D)





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Example

3 Dimensions

Class 1 Assembly Category	Sub-Class2 Orientation	Sub-Class3 System	Sub-Class4 Type	Sub-Class5 Composition
Structural components	Vertical Support	Columns	Egyptian	
			Doric	
			Ionic	
			Corinthian	
			Tuscan	
			Islamic	
			Embedded Columns	Concrete
				Stone
				Brick
				Timber
				Steel
		Load bearing walls	Interior wall	
			Exterior wall	
			Retaining wall	
		Interior Stairs	Flying stairs	
			Honorary stairs	
			Spiral stairs	
		Exterior Stairs	Flying stairs	
			Honorary stairs	
			Spiral stairs	
	Horizontal Support	Beams	Simple support beam	
			Fixed beam	
			Cantilever beam	
			Continuous be	
		Joists	Single Joi	
			Doub Joists	
			S ss Joists	
		Lintels	lat	
			Arch	
		Roofs	Flat roof	
			Gable roof	
			Hip roof	
			Shed Roof	
			Butterfly	
			Mansard	
			Gambrel	
			Perforated	
			Balcony	

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Object properties

5th Dimension

Data properties

4th Dimension

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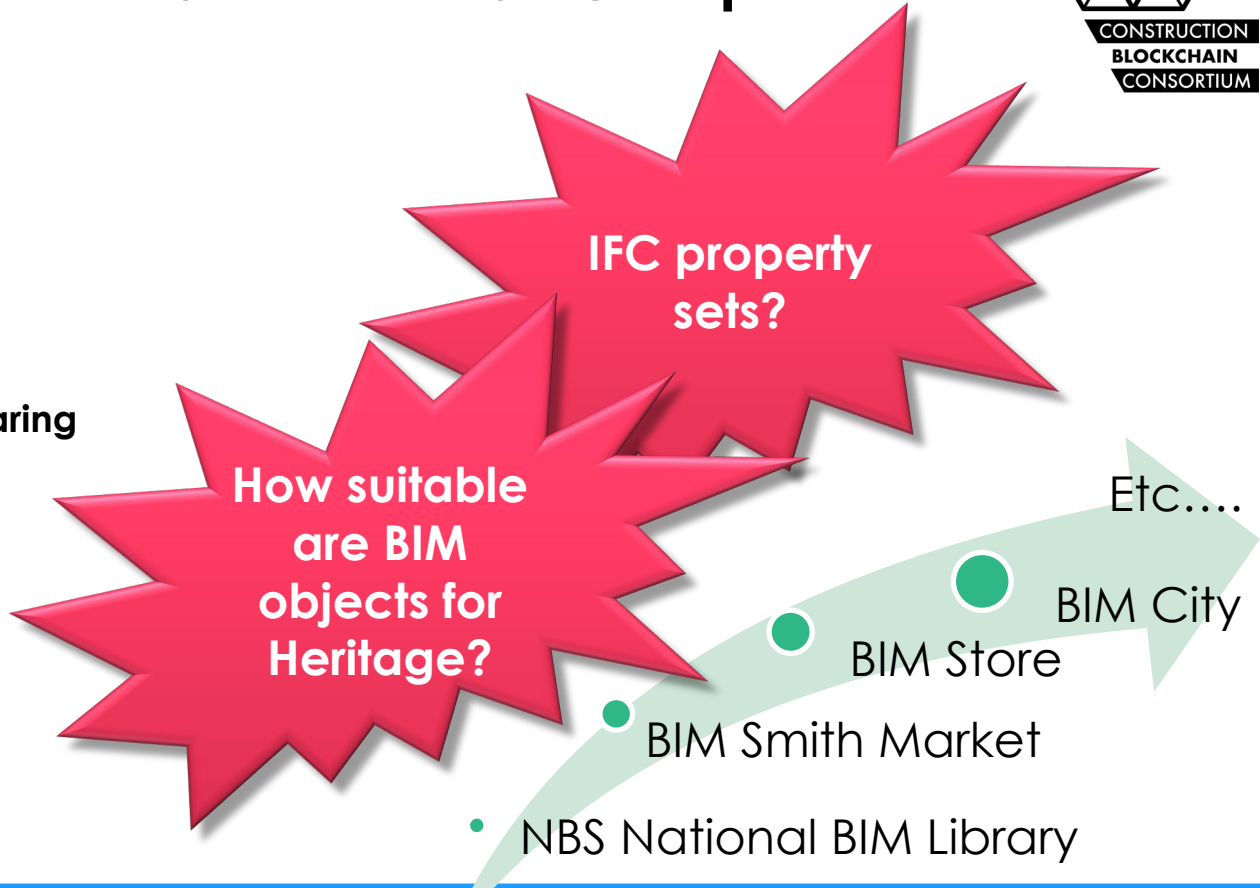
Next....

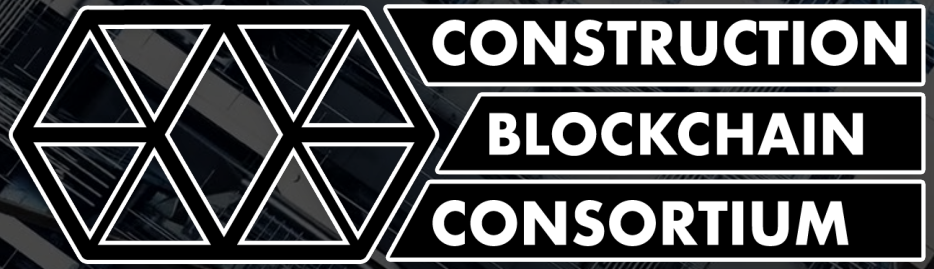
1. Add *Data Properties* - 4th D - which describe the common attributes for instances of a class i.e. the relationship between instances and their data values. In this case of sub-class level 5 giving the opportunity to document all the different components with their different characteristics that are actually available onsite.

2. Add *Object Properties* – 5th D - which describe the relationship between the instances of the different classes / sub classes and each other at sub-class 3 level. These change the relationship and relevance between different components from one heritage asset to another hence affect the way these components are maintained

Data Properties to add to Sub-class 5 ”Composition”

1. Code ID
2. Architectural style
3. Age
4. Geometric ratio
5. Origin
6. Material name
7. Allowed stresses / load bearing
8. Construction method
9. Condition (deterioration)
10. Life expectancy
11. Maintenance constraints
12. Cultural Heritage value
13. Reflectance
14. Space function





Thank you!

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