CFIHOS – Update to THTH autumn webinar.

16th November 2022

Jason Roberts

CFIHOS (JIP36) Data Model Working Lead
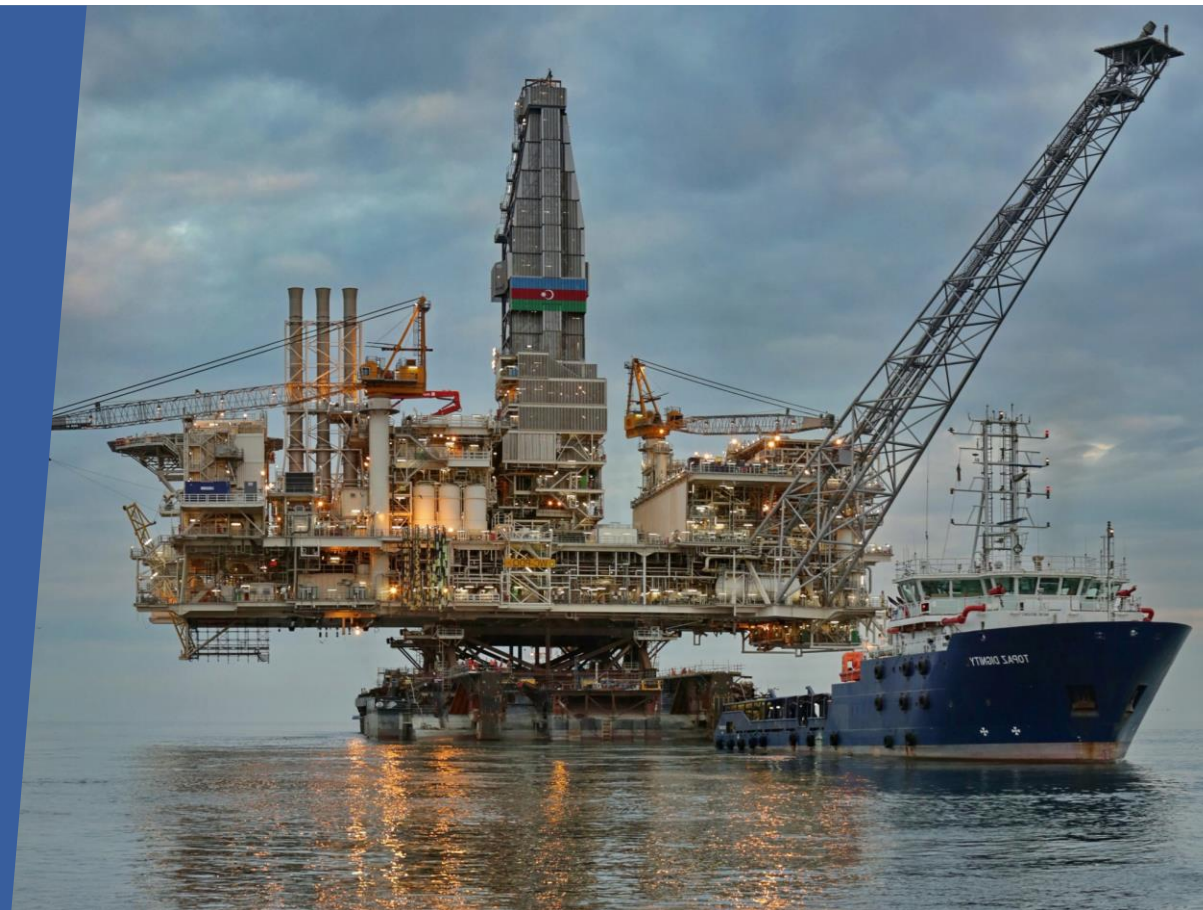
Agenda

Agenda Item
CFIHOS – Purpose and key elements
Membership
MoU Partners
Our priorities aligned to our roadmap
CFIHOS – Who is implementing it
Questions

CFIHOS - Purpose

CFIHOS purpose is to create a handover specification that can be implemented by operators, contractors and equipment manufacturers and suppliers to standardize the specification of information handover requirements for a project.

That is required to own, operate, maintain a facility safely, efficiently and demonstrate compliance to the regulator.

This will significantly lower the lifecycle cost associated with incorrect and missing information required to operate a facility.

CFIHOS Key Elements

Technical Specification Document
Requirements, rules and principles for information handover

Data Model
For structuring data and documents about assets

Process & Guidance Documents
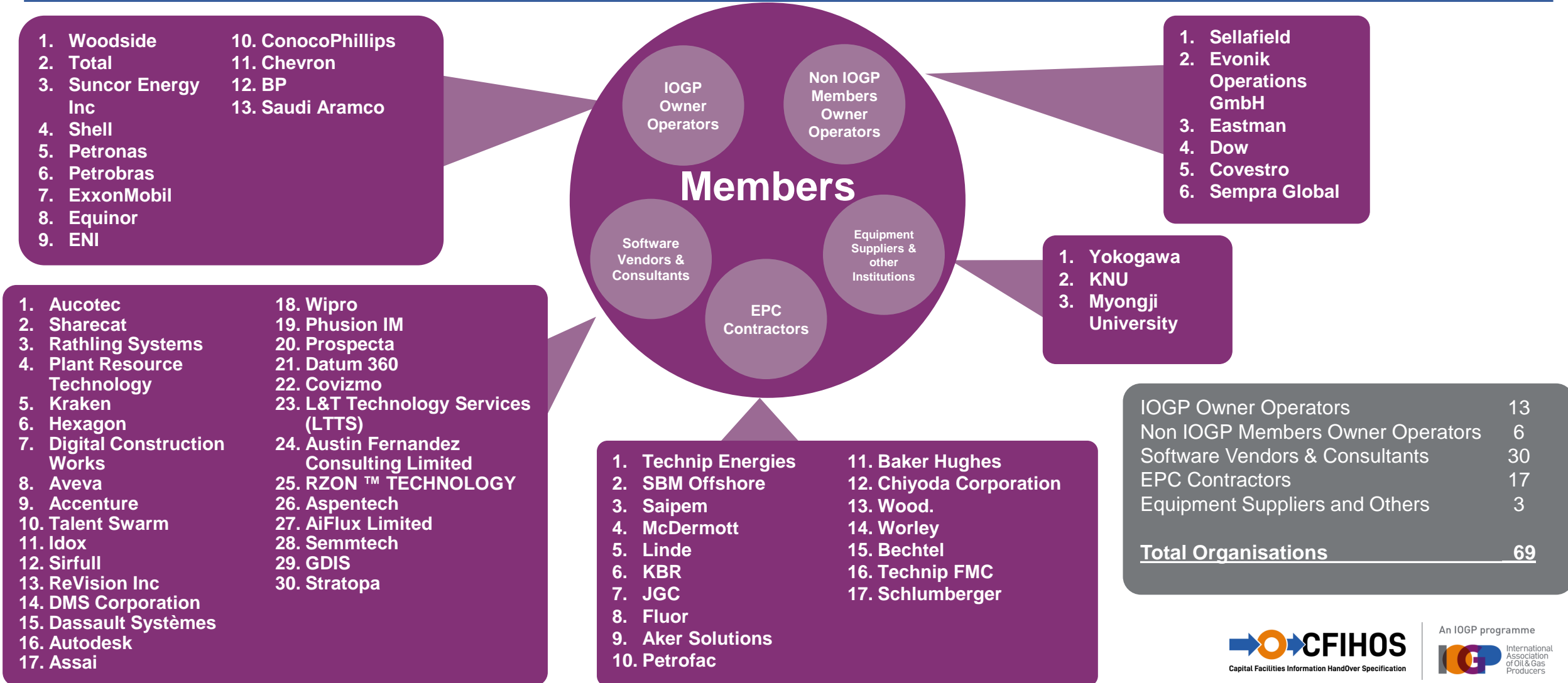Outlining implementation steps (and do's & don'ts)

Reference Data Library (Dictionary)
Consistent naming of equipment, properties & documents

Current CFIHOS Membership is 69 organizations across multiple industry sectors, with 370+ Individual participants.

We are talking to an additional 23 organizations about participation

IOGP Owner Operators / Non IOGP Members Owner Operators

1. Woodside
2. Total
3. Suncor Energy Inc
4. Shell
5. Petronas
6. Petrobras
7. ExxonMobil
8. Equinor
9. ENI
10. ConocoPhillips
11. Chevron
12. BP
13. Saudi Aramco

1. Sellafield
2. Evonik Operations GmbH
3. Eastman
4. Dow
5. Covestro
6. Sempra Global

Members

- IOGP Owner Operators
- Non IOGP Members Owner Operators
- Software Vendors & Consultants
- EPC Contractors
- Equipment Suppliers & other Institutions

Software Vendors & Consultants

1. Aucotec
2. Sharecat
3. Rathling Systems
4. Plant Resource Technology
5. Kraken
6. Hexagon
7. Digital Construction Works
8. Aveva
9. Accenture
10. Talent Swarm
11. Idox
12. Sirfull
13. ReVision Inc
14. DMS Corporation
15. Dassault Systèmes
16. Autodesk
17. Assai
18. Wipro
19. Phusion IM
20. Prospecta
21. Datum 360
22. Covizmo
23. L&T Technology Services (LTTS)
24. Austin Fernandez Consulting Limited
25. RZON ™ TECHNOLOGY
26. Aspentech
27. AiFlux Limited
28. Semmtech
29. GDIS
30. Stratopa

Equipment Suppliers & other Institutions

1. Yokogawa
2. KNU
3. Myongji University

EPC Contractors

1. Technip Energies
2. SBM Offshore
3. Saipem
4. McDermott
5. Linde
6. KBR
7. JGC
8. Fluor
9. Aker Solutions
10. Petrofac
11. Baker Hughes
12. Chiyoda Corporation
13. Wood.
14. Worley
15. Bechtel
16. Technip FMC
17. Schlumberger

IOGP Owner Operators	13
Non IOGP Members Owner Operators	6
Software Vendors & Consultants	30
EPC Contractors	17
Equipment Suppliers and Others	3
Total Organisations	**69**

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CFIHOS MOU Partners

MOU Partner	Objectives	Location
Mimosa (ISO 18101 OIIE)	Extend Open Industrial Interoperability Ecosystem (OIIE) specification with CFIHOS content for inclusion in ISO 18101. Info share.	USA
Standards Norway and READI	Test alignment between the virous Norwegian industry developments and CFIHOS	Norway
PCA (15926, READI)	Align CFIHOS RDL and ISO15926 RDL management approach. Info share.	Norway
SEIIA	Info share, adoption in Sweden and translation into Swedish	Sweden
THTH	Info share, adoption in Finland	Finland
USPI (ISO15926, FL3DMS, ORCHID)	Ensure that FL3DMS and CFIHOS can be used in an integrated way in projects and assets (data model, reference data). Mature both standards for transition to IEC/ISO. Update Orchid roadmap.	The Netherlands
EVOLEN	Info share. Translation of CFIHOS to French language.	France
DEXPI & DECHEMA	Info share. Ensure that DEXPI and CFIHOS can be used in an integrated way in projects and assets. Focus is to either align classes or to map classes between the standards	Germany
New: CII-AWP	Extend CFIHOS data model with CII AWP requirements. Ensure that CII AWP and CFIHOS can be used in an integrated way in projects (data model, reference data).	USA
New: ISO 14224	Enable population of CMMS systems configured according to ISO 14224 using CFIHOS data without manual intervention. Develop backward and forward mapping between CFIHOS and ISO 14224 equipment classification and attributes to allow for easier translation.	International
New: NAMUR	Align CFIHOS data model with NAMUR instrumentation connectivity/wiring standard currently under development. Consider alignment with IEC 61987 - Properties of individual Equipment.	Germany
New: NEOM	Info Share, Promote and align CFIHOS in the Water Industry	Saudi Arabia

CFIHOS – Our priorities aligned to our roadmap

Status
- 🟢 On Track
- 🟠 Behind Schedule
- 🔴 Intervention Req.

Theme	Specification to the Supply Chain	Implementation Guidance honouring Industry Standards	Project Execution and Exchange between Stages	Population of Operating & Maintenance Systems	Communication/ Marketing/ Adoption
Lead	Anders Thostrup	Jean-Luc Hoffert	Ian Cornwell	Erin Jones	Jan Shumate

Priorities

Specification to the Supply Chain (Anders Thostrup):
- Complete delivery of property groupings Complete add/mapping of 🟢
- JIP33 Alignment 🟠
- Develop data model capability to capture spare parts 🟢
- Aligning document classification to content 🟠

Implementation Guidance honouring Industry Standards (Jean-Luc Hoffert):
- Establish new WG to investigate what EPCs desire to receive, what are OOs currently communicating and how can CFIHOS provide guidance to 'standardize' this; 🟠
- Develop a proposal around restructuring CFIHOS documents as necessary to support more fulsome mapping by 2H22 🔴

Project Execution and Exchange between Stages (Ian Cornwell):
- Deliver training on the existing CFIHOS capability to support a maturity model Incorporate AWP capability into CFIHOS 🟢
- Develop proposal to address implementation of UOM to ensure CFIHOS users can do what they want; socialize and implement 🟠

Population of Operating & Maintenance Systems (Erin Jones):
- Complete mapping of 14224 to CFIHOS; properties, as well as how to implement boundaries 🟠
- Develop plan to incorporate ISO/IEC 81346 mapping after DISC-sponsored Equinor/TotalEnergies & Evolen Pilot proposals 🟠

Communication/Marketing/Adoption (Jan Shumate):
- Capture input from OO & EPCs on software conformance needs 🟠
- Grow marketing capability and expand audiences we access 🟠
- Develop educational material to develop consistent understanding of CFIHOS 🟠
- Get 4 case studies shared from implementations 🟠

V 1.5.1 planned for Q4 this year and V2.0 planned of Q3 2023 (plan validated at our F2F)

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CFIHOS – Who is implementing it

We have survey and anecdotal evidence from our membership that since the release of version 1.5 there has been a significant increase in the adoption of CFIHOS across the supply chain in multiple industry sectors.

IOGP OOs
- AkerBP
- Chevron
- Equinor
- ExxonMobil
- TotalEnergies
- PETRONAS
- Shell
- Suncor
- ENI

Other OOs
Oil & Gas
- Sempra Infrastructure

Chemicals
- Eastman

Water
- NEOM

Nuclear
- Sellafield

EPCs
- Aker Solutions
- Wood.
- Linde
- KBR
- Technip Energies
- Bechtel
- Fluor
- McDermott
- Petrofac
- Saipem
- Worley
- JGC
- Schlumberger

Software
- AVEVA
- Hexagon
- Siemens
- Kraken
- ShareCat
- DMS365
- Aucotec

Consultants /Services
- Kraken
- Accenture

Equipment
- Baker Hughes

Others
- Korea University

We are aware of many others, both members and non members that are in the process of implementing CFIHOS

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Plant breakdown structure : the attributes view

CFIHOS DATA MODEL BASICS
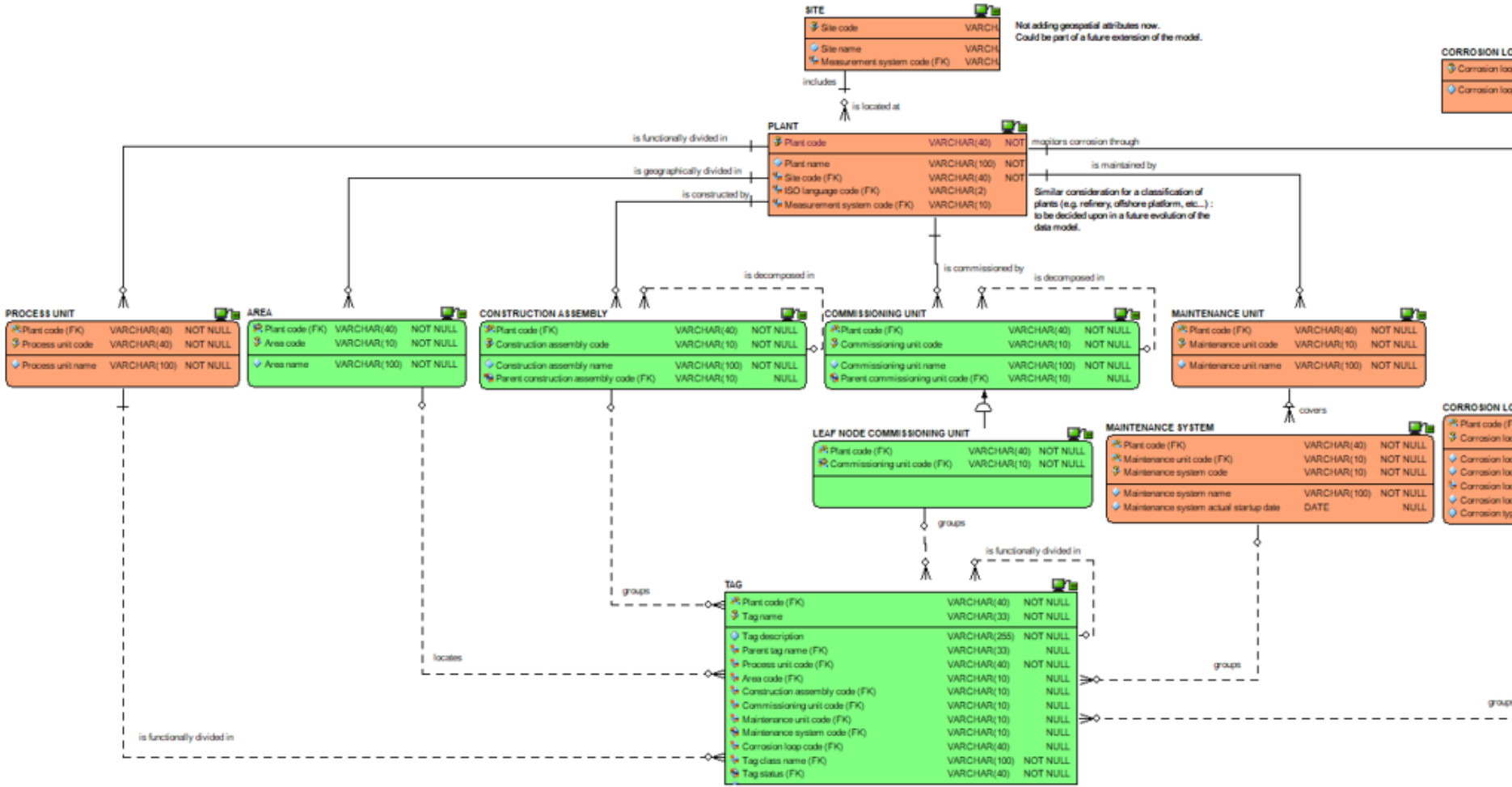
What is a Data Model?

What is a Data Model?

👍 A data model is an abstract model that organizes elements of data and standardizes how they relate to one another and to the properties of real-world entities.

What is a Data Model?

What is a Data Modelling?

Data modelling is the process of creating a data model.

Any information is useless unless delivered in a format that can be consumed **by business users**. Data modelling translates **the business requirements** into a data model that can be used to support business processes and scale analytics.

Why does CFIHOS need a data model?

"IHO" in CFIHOS : Information Hand-Over

If two or more parties need to be able to exchange, or hand-over, some information (information = documents and data), they must be able to talk the same language:

- Use the same words

- Have the same understanding of what these words mean and how they are connected, i.e. the business rules they must comply with

… and that is exactly what a data model tries to achieve

Good Data Model
1. Capturing Business Requirements
2. Pictures Communicate Better than Words
3. Provides Structure for the RDL
   - Promote Reuse, Consistency, Quality
   - Identify and Manage Redundant Data
4. Bridge between Business and Technical Personnel
5. Software Agnostic
6. Critical in Managing Integration Between Systems

What type of Data Model?

Levels of Data Modelling

Anybody who needs to understand a set of data for a specific purpose would benefit from depicting their data in the form of a data model. The majority of the examples we have seen to date relates to relatively high level business data models (Conceptual Data Models).

	Level	Description
	Governance	Used for governance, ownership and strategic prioritisation issues.
	Conceptual	Used for scoping of (possible or target) solutions, and for broad integration issues, to ensure all pieces of the IT landscape fit together.
	Logical	Used to set the common standards and definitions that ensure interoperability and allow for data consolidation across processes and systems.
	Functional or Application	Meant for design and configuration of solutions, building training material and for quality monitoring.
	Physical	Used to specify and build solution components like database tables and interfaces.

Enterprise-wide Standard ↑
Solution Specific ↓

Logical Data Model

👍

Aim is for Interoperability

Note: we do also have a physical model "alive" on SQL Server, used for testing practical implementation, but not part of standard

What type of Data Model?

Conceptual Data Model (CDM)	Logical Data Model (LDM)	Physical Data Model (PDM)
Basic Entity-Relationship (ER) Concepts are applied on CDM defining Entity and relationship without too much detail	LDM apply all ER Concepts including normalisation	PDM describe the ER concepts in the technology specific terms to enable a physical implementation in, for example, a SQL server database, an OData API and so on
Includes high-level data constructs and relations (no keys)	Includes entities (tables), attributes (columns or fields) and relationships (keys)	Includes tables, columns, keys, data types, validation rules, database triggers, stored procedures, domains, and access constraints
Uses general high-level data constructs from which Architectural Descriptions are created in non-technical terms	Is independent of technology (platform, DataBase Management System (DBMS))	Includes Primary Keys and indices for fast data access
May not be normalised	Is normalised	May be de-normalised to meet performance requirements based on the nature of the database

Where we aim the CFIHOS Data Model

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What makes a good data model?

What makes a good data model?

Good Data Model

- Communication (easy to understand)
- Completeness
- No redundancy
- Elegance (neat and simple)
- Stability and flexibility
- No one answer

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What makes a good data model? - Normalisation

In data modelling, normalisation helps in creating a good data model. As data is added, modified and deleted, a normalised data model makes a big difference in keeping the data correct.

Normalisation reduces the redundancy of fact data. This makes it easier to enforce data quality, to quickly re-use cross entity and maintain data.

- Improves Understanding
- Ensure Data Integrity
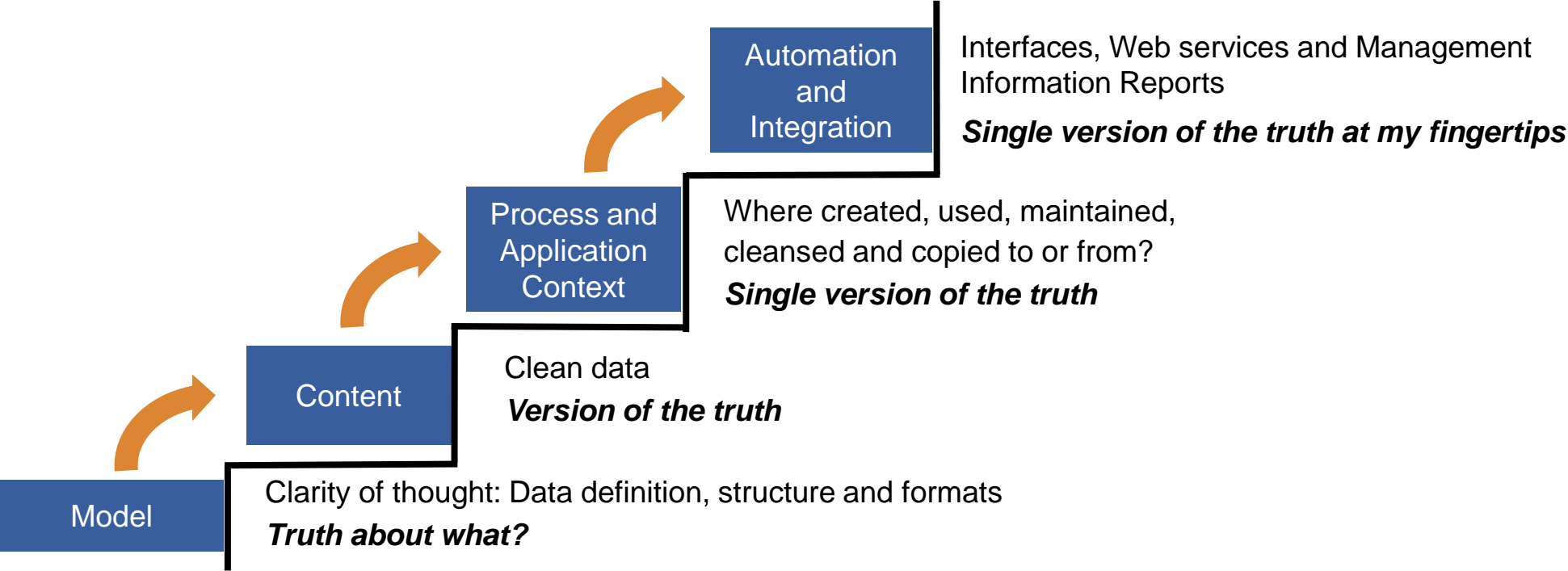- Easier to Query
- Removes Duplicated Data

- Improved Data Quality
- Reduction in Timescales
- Easier to Maintain
- Less Cost

This is crucial in defining and managing the rules CFIHOS use to create, maintain and manage all RDL data published as part of the standard.

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Where does the Data Model fit in the CFIHOS Standard?

Data Model Outputs

Publicly Available @ CFIHOS Standards - JIP36

CFIHOS Element

Real Implementation $$$

| Automation and Integration | Interfaces, Web services and Management Information Reports
Single version of the truth at my fingertips |

| Process and Application Context | Where created, used, maintained, cleansed and copied to or from?
Single version of the truth |

| Content | Clean data
Version of the truth |

| Model | Clarity of thought: Data definition, structure and formats
Truth about what? |

Specification Document

Reference Data Library

Data Model

Scope and Procedure

Data Model

Using the Data Model (C-DM-001)

Data Dictionary (C-DM-002) - Full version (V.1.5)

Using the Data Model

Data dictionary (full version)

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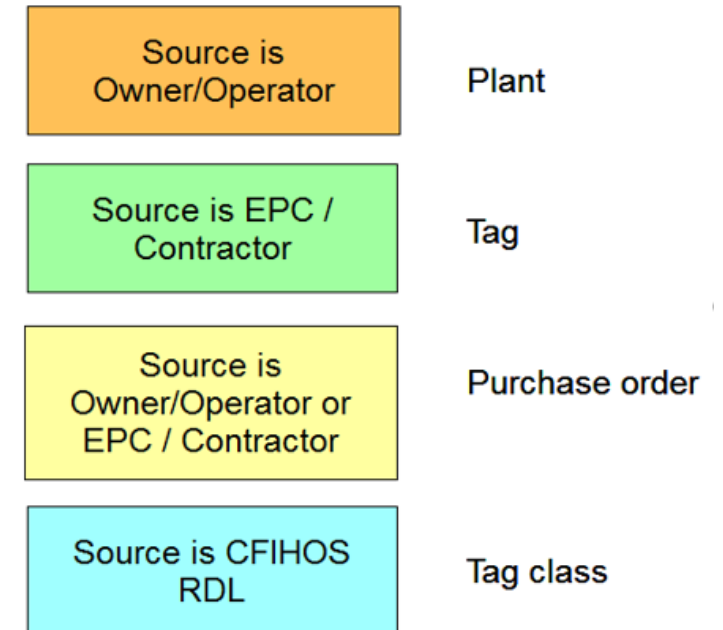IOGP International Association of Oil & Gas Producers

How to read the data model

The logical data model is made of 4 « types of objects » :

- **Entities** *(note : in the physical model, this would be « tables », or « pick list »)*
  - Entities must have a definition. The definition will be in dictionary style, and represent a single occurrence of that entity
    - *Example : [A tag is defined as] An object designed for performing functional requirements and serving as a specification for equipment".*
- **Relationships** *(physically : foreign key constraints)*
  - Relationships must have a verb, at least in one direction, to express how the two entities relate
    - *Example : A company **designs** tags*
  - Relationships must have a « cardinality », i.e. is it identifying or not, is it optional or mandatory ?
    - *Example : A company designs **zero, one or more** tags, a tag is **always** designed by a company.*
- **Attributes** *(physically : columns)*
  - Attributes must have a definition
    - *Example : [A tag safety critical item indicator is defined as] An indication whether the tag is a safety critical element.*
  - Attributes must have a format and an indication whether they are optional or mandatory
    - *Example : A tag name has a variable character length, up to 33 characters, and is mandatory.*
- **Identifiers** *(physically : primary keys)*
  - Identifiers must contain at least one attribute
    - *Example : A tag class is uniquely identified by its tag class name*

Not part of the data modelling technique, but useful for communicating, a "colour" standard have been adopted to indicate the most likely source of the data.

Examples :

Source is Owner/Operator	Plant
Source is EPC / Contractor	Tag
Source is Owner/Operator or EPC / Contractor	Purchase order
Source is CFIHOS RDL	Tag class

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How to read the data model

ISO CURRENCY

First type of object in a data model diagram : an entity (in a logical model; a "table" in a physical model).

Think about it as a spreadsheet. If something can be represented as a spreadsheet (multiple rows, one or more columns) then it may be an entity.

It is represented as a rectangle, with its name in it, or...

ISO CURRENCY

A currency, as recognized by the ISO organization in its 4217 standard
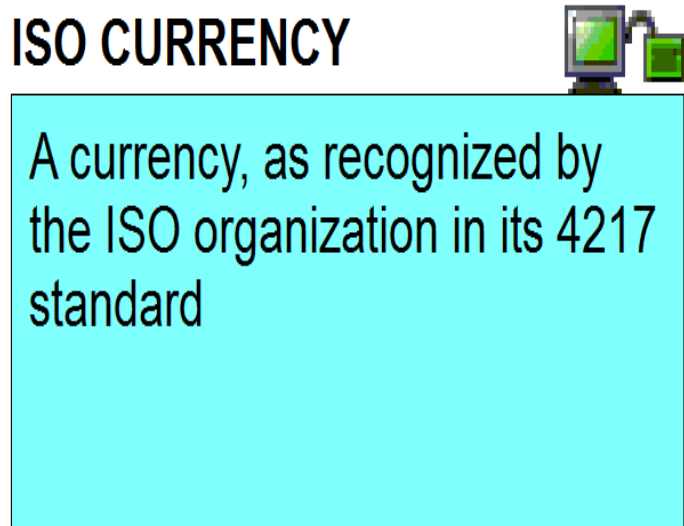
... like this (definitions are thus part of / embedded in the data model), or ...

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How to read the data model

ISO CURRENCY
- 🔑 ISO currency code
- ◇ ISO currency name

ISO CURRENCY
- 🔑 ISO currency code
- ◇ ISO currency name
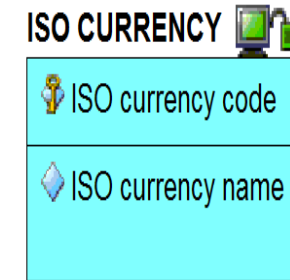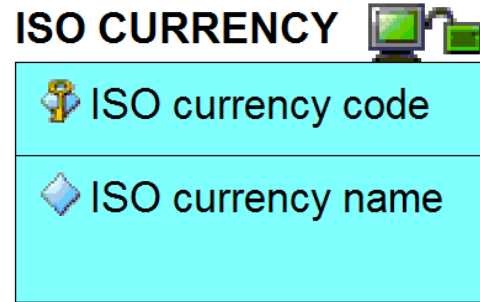
... like this.

Here you represent what are the different attributes of your entity (logical term) / the different columns of your table (physical term).

Rows are never represented in a data model.

Second type of object in a data model diagram : an attribute (in a logical model; a "column" in a physical model).

The attributes that come above the line in the box are those that, when combined, allow for a unique identification of an instance of that entity (in logical terms; physically the(se) column(s) form the primary key of that table. The attributes above the line form the "identifier" of the entity (a sort of "fourth type" of object in the logical data model).

Iso currency code	Iso currency name
AUD	Australian Dollar
BRL	Brazilian Real
EUR	Euro
GBP	Pound Sterling
HKD	Hong Kong Dollar
JPY	Yen
USD	US Dollar

How to read the data model

ISO CURRENCY

ISO currency code	N
ISO currency name	N

For these attributes (/columns) you can also capture if it is mandatory or optional.

ISO CURRENCY

ISO currency code
ISO currency name

qualifies the price of

Third type of object in a data model diagram : a relationship (in a logical model; a "foreign key constraint" in a physical model).

Four different variants to these relationships : the first case here where the identifier of the first entity is passed as non identifying element of the other entity.

EQUIPMENT

Equipment code
Plant code (FK)
Tag name (FK)
Equipment class name (FK)
Manufacturer company name (FK)
Model part name (FK)
Equipment manufacturer serial number
Equipment actual purchase date
Vendor company name (FK)
Equipment actual installation date
Equipment actual startup date
Equipment price
ISO currency code (FK)
Equipment warranty end date

You can now "read" the following business rules from the above model :

An ISO currency is uniquely identified by its ISO currency code.

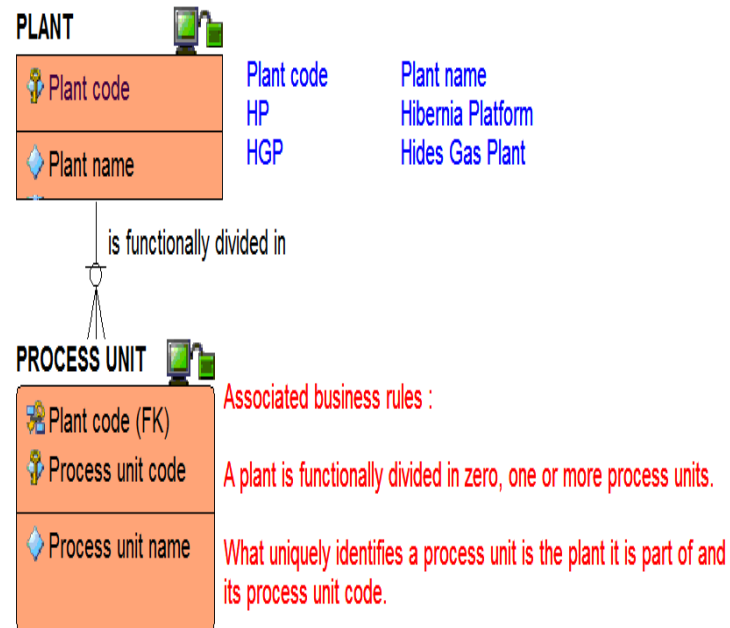An ISO currency has one and only one name.

Associated business rules :

An ISO currency qualifies the price of zero, one or more equipments.

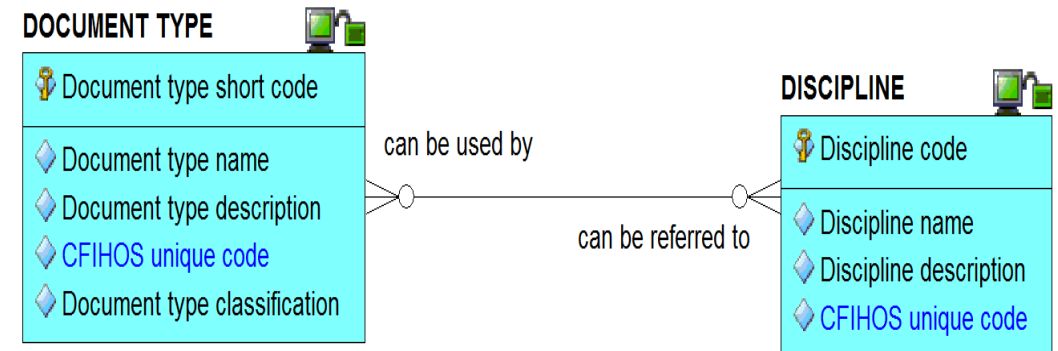An equipment has its price qualified by maximum one ISO currency.

How to read the data model

Third variant, here, where the relationship between 2 entities is a "many-to-many"

PLANT

Plant code	Plant name
HP	Hibernia Platform
HGP	Hides Gas Plant

Plant code

Plant name

is functionally divided in

Second variant of relationships :

here, where the identifier of the first entity is passed as identifying element of the other entity.

PROCESS UNIT

Plant code (FK)

Process unit code

Process unit name

Associated business rules :

A plant is functionally divided in zero, one or more process units.

What uniquely identifies a process unit is the plant it is part of and its process unit code.

DOCUMENT TYPE

Document type short code

Document type name

Document type description

CFIHOS unique code

Document type classification

can be used by

can be referred to

DISCIPLINE

Discipline code

Discipline name

Discipline description

CFIHOS unique code

Associated business rules :

A document type can be used by zero, one or more disciplines.

A discipline can be referred to in zero, one or more document types.

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How to read the data model

DOCUMENT TYPE
- 🔑 Document type short code
- ◇ Document type name
- ◇ Document type description
- ◇ CFIHOS unique code
- ◇ Document type classification

Document type name
acceptance test procedure
assembly diagram
bill of quantities

DISCIPLINE
- 🔑 Discipline code
- ◇ Discipline name
- ◇ Discipline description
- ◇ CFIHOS unique code
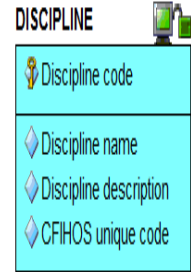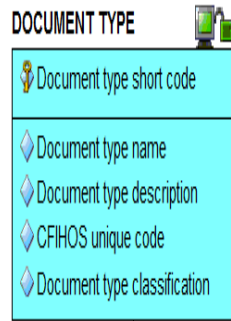
Discipline code	Discipline name
EA	Electrical
IN	Instrumentation

is used for

is used by

DISCIPLINE DOCUMENT TYPE
- 🔑 Discipline code (FK)
- 🔑 Document type short code (FK)
- ◇ Discipline document type short code
- ◇ Discipline document type description
- ◇ Asset type reference

Many to many relationships must always
be "resolved" through an "intersection"
entity, that indicates what are the
authorized or possible combinations

Discipline	Document type name
EA	acceptance test procedure
EA	assembly diagram
IN	acceptance test procedure
IN	assembly diagram
IN	bill of quantities

Last variant of relationships : the subtyping

here, the identifier of the subtypes is the same as the one
of their "parent" but they have different attributes and that
is why it is worth distinguishing them..

PROPERTY
- 🔑 Property name
- ◇ Property definition
- ◇ Property data type
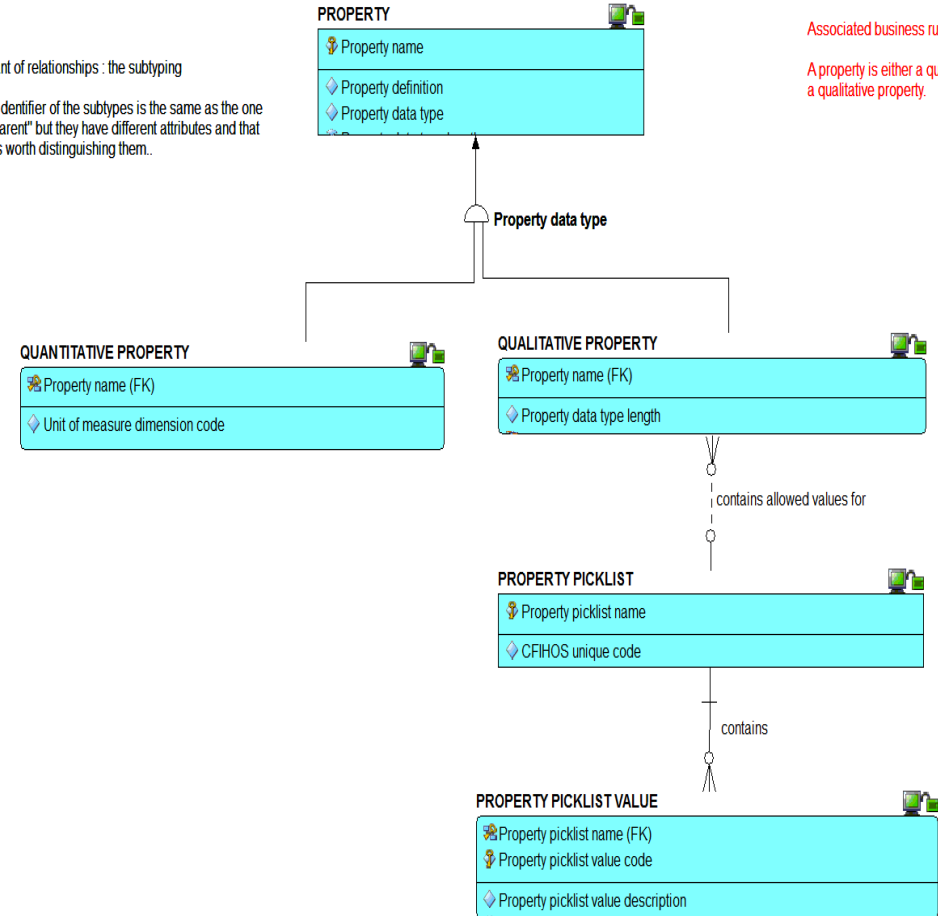
Associated business rule :

A property is either a quantitative property, or
a qualitative property.

Property data type

QUANTITATIVE PROPERTY
- 🔑 Property name (FK)
- ◇ Unit of measure dimension code

QUALITATIVE PROPERTY
- 🔑 Property name (FK)
- ◇ Property data type length

contains allowed values for

PROPERTY PICKLIST
- 🔑 Property picklist name
- ◇ CFIHOS unique code

contains

PROPERTY PICKLIST VALUE
- 🔑 Property picklist name (FK)
- 🔑 Property picklist value code
- ◇ Property picklist value description

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Questions?

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