March 17, 2023

AM Data Management Working Group
Additive Manufacturing Common Data Model

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Overarching Goal

- Make Additive Manufacturing (AM) data FAIR – Findable, Accessible, Interoperable, and Reusable

- Lack of a common vocabulary, common representation, and common exchange formats all hinder these goals

- According to GO FAIR, the FAIR Principles include:
  - Findable: "Metadata and data should be easy to find for both humans and computers."
  - Interoperable: "(Meta)data use a formal, accessible, shared and broadly applicable language for knowledge representation." and
  - Reusable: "… metadata and data should be well-described so that they can be replicated and/or combined in different settings."

Common Data Model in context of CDD and CDEF

Common Data Dictionary >>

- **build ID** – globally unique identifier of a build, of type string

- **powder lot ID** – globally unique identifier of a lot of powder, of type string

- **powder reuse number** – the number of times the powder has been reused, of type int ≥ 0

- *ASTM F3490-21*

Common Data Model >>

```
Build is a class,
  defined by buildID with a single
  value of type string,
  defined by powderLot with values
  of type PowderLot. // by saying "with
  values" I am stating that a single build
  could use multiple powder lots

PowderLot is a class,
  defined by powderLotID with a
  single value of type string,
  defined by powderReuseNumber with
  a single value of type int.
```

Common Data Exchange Format

```
{
 "Build": {
  "buildID": "abc123-build",
  "powderLot": [
    { "powderLotID": "def456-powder",
     "powderReuseNumber": 2 },
    { "powderLotID": "ghi789-powder",
     "powderReuseNumber": 0 } ]
 }
}
```
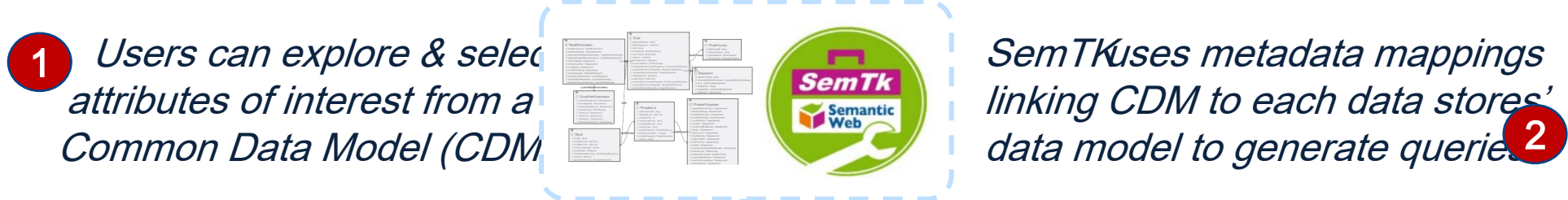
Defines terms, but no structure/relationships – good for humans, not machines

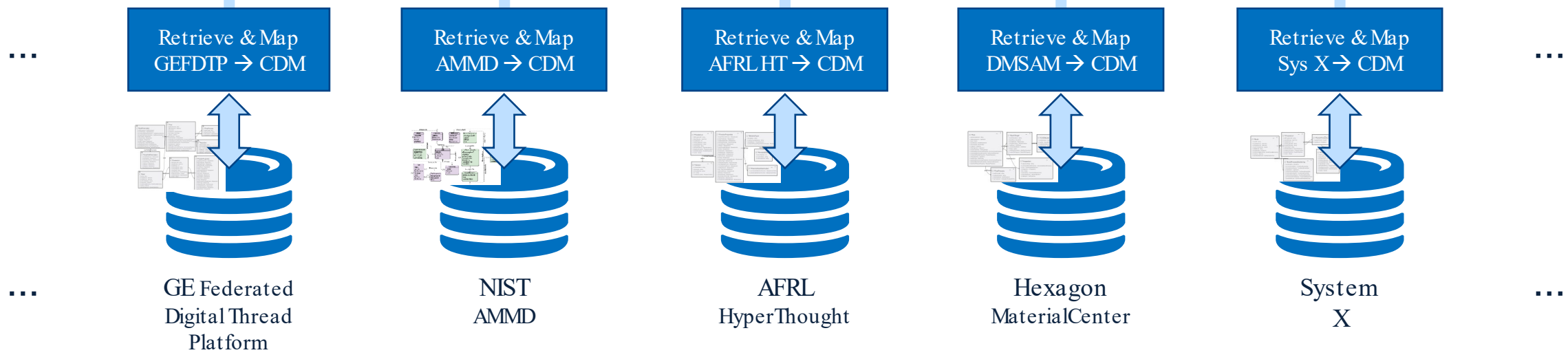Defines logical structure and relationships in a human - and computer -readable format

Defines format for systems to share data, aligned to the CDM in both structure and terms

The CDEF is built to exchange data modeled by the CDM, which puts structure around the CDD. So, the CDEF builds upon the CDM, which in turn builds upon the CDD.

Making Additive Manufacturing Data FAIR through a Common Data Model

1 *Users can explore & select attributes of interest from a Common Data Model (CDM)*

2 *SemTk uses metadata mappings linking CDM to each data stores' data model to generate queries*

3 *Data retrieved from stores and mapped to CDM for integration*

Retrieve & Map GEFDTP → CDM	Retrieve & Map AMMD → CDM	Retrieve & Map AFRL HT → CDM	Retrieve & Map DMSAM → CDM	Retrieve & Map Sys X → CDM

...

GE Federated Digital Thread Platform

NIST AMMD

AFRL HyperThought

Hexagon MaterialCenter

System X

...

Use a Common Data Model to make additive manufacturing data *Findable, Accessible, Interoperable,* and *Reusable*

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GitHub repo: https://github.com/kaggour/AM-CDM

Excerpts from CDM (written in SADL)

Base

Material

System

Process

Build

Test-Inspection-Characterization

Semantic Application Design Language (SADL)
https://github.com/SemanticApplicationDesignLanguage

dependency flow

Base

Material

Test-Inspection-Characterization

Material-centric view (visualized in SemTK)

Base

Material

Build

Test-Inspection-Characterization

Semantics Toolkit (SemTK) –
https://github.com/ge-semtk/semtk

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