

A Uniform Taxonomy for PV System Operations and Maintenance Data

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The NEED to Scale PV Processes

2021

Solar panels in the US currently provide 3% of the national electricity

2035

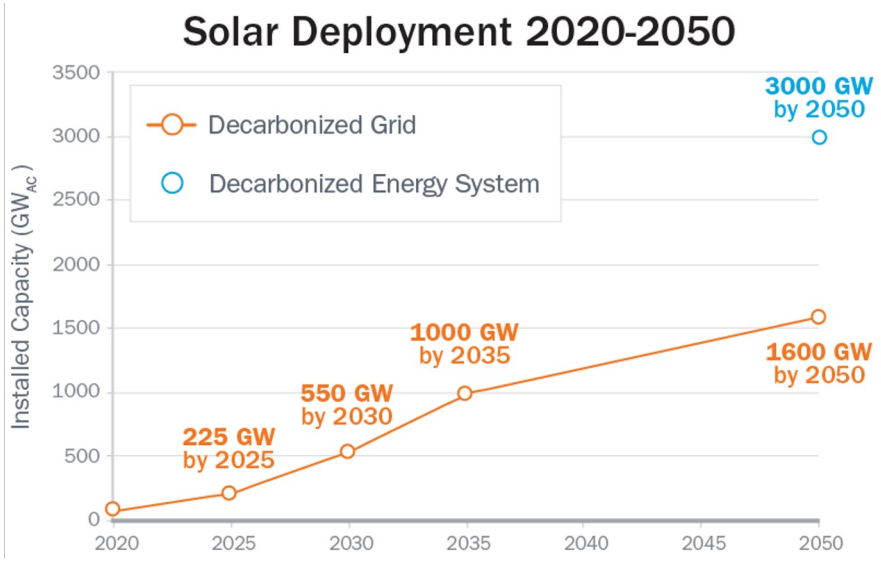
By 2035, solar energy could power 40% of the nation's electricity

2025

To get there, the US has to install an average of 30 GW of solar between 2021-2025

2030

And install an average of 60 GW of solar between 2025-2030



In order to reach these projections, the U.S. would need to **DOUBLE** its **installed solar power** every year for the next four years, and then **double it again by 2030**.

Source: Solar Futures Study - Produced by the U.S. Department of Energy Solar Energy Technologies Office (SETO) and the National Renewable Energy Laboratory (NREL) and released on September 8, 2021

Data Friction adds to System and O&M Costs

Example: Terms for GHI used by APIs offering irradiance data

- `G(h)`
- `ghi` (interval-beginning timestamp, unit of W/m^2)
- `ghi` (interval-end timestamp, unit of Wh/m^2)
- `GHI`
- `GHI` (interval-beginning except at 1-minute resolution, then interval-ending)

Different names, different units, different timestamp conventions

A lack of common interfaces across O&M activities:

- Plethora of non-interoperable services
- Inconsistent data

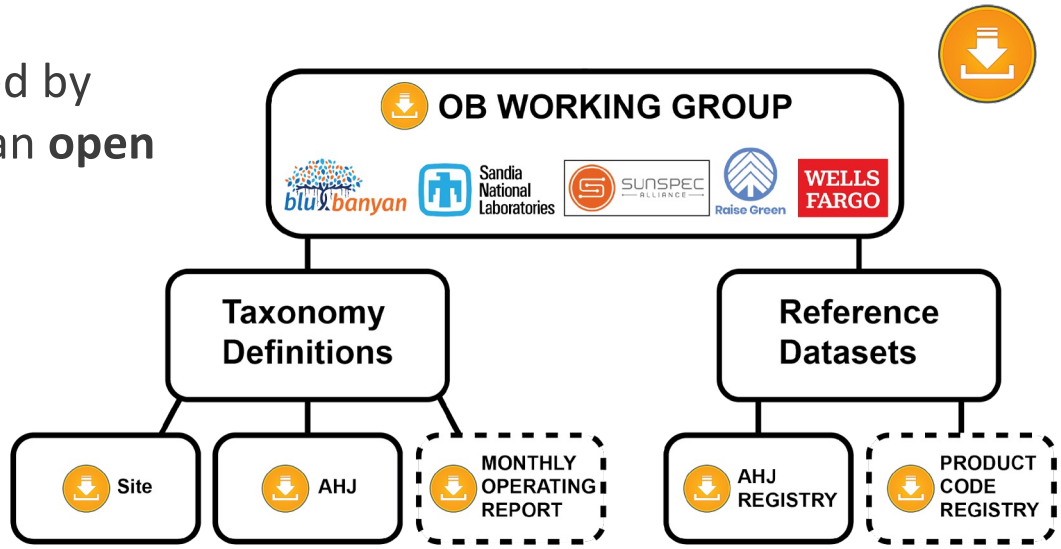
The Orange Button (OB) Initiative

Vision: Harmonize solar data across the system life-cycle, from sales through operations

The OB Technical Working Group (chaired by BluBanyan, and Sandia) seeks to create an **open data exchange standard** for the solar PV industry.

A data exchange standard comprises:

- A taxonomy
- Tools to access reference data sets
- A compliance test suite (future work)



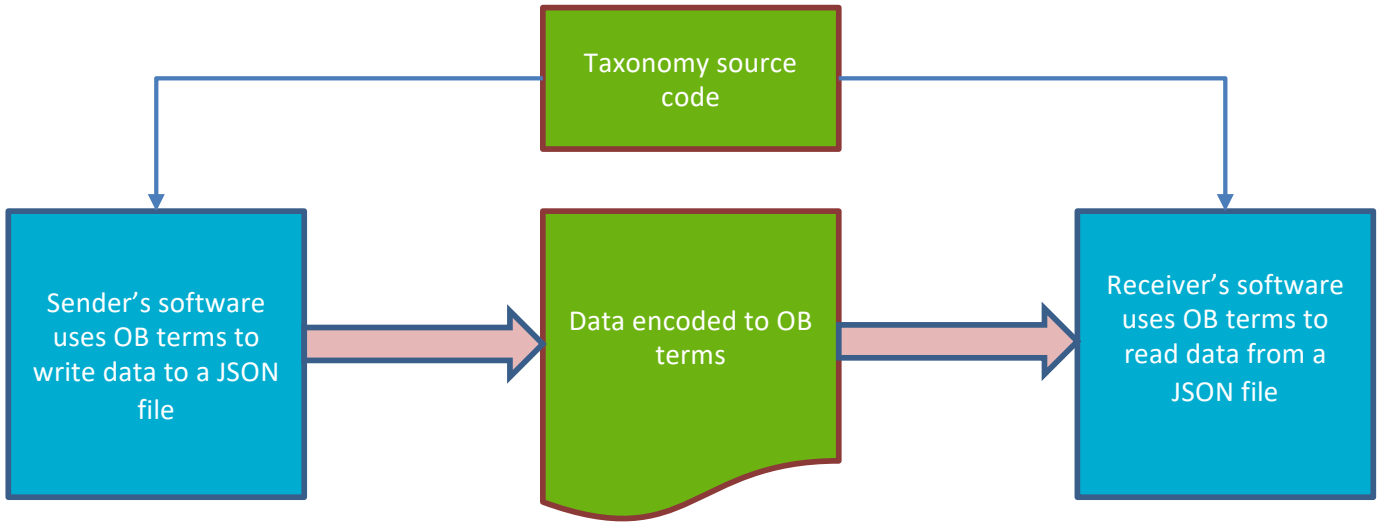
What is a taxonomy?

- “A taxonomy is… a semantic architecture - it is about naming things and making decisions about how to map different concepts and terms to a consistent structure.”[1]
  - More than a dictionary or variable list because a taxonomy can provide hierarchical structure and can attach metadata to values
- A taxonomy provides
  - Consistency (agreement on terms)
  - Connections (related terms can be grouped together into information objects), and
  - removes Ambiguity (terms can possess primitive data such as a timestamp and a unit) (credit to [1]).

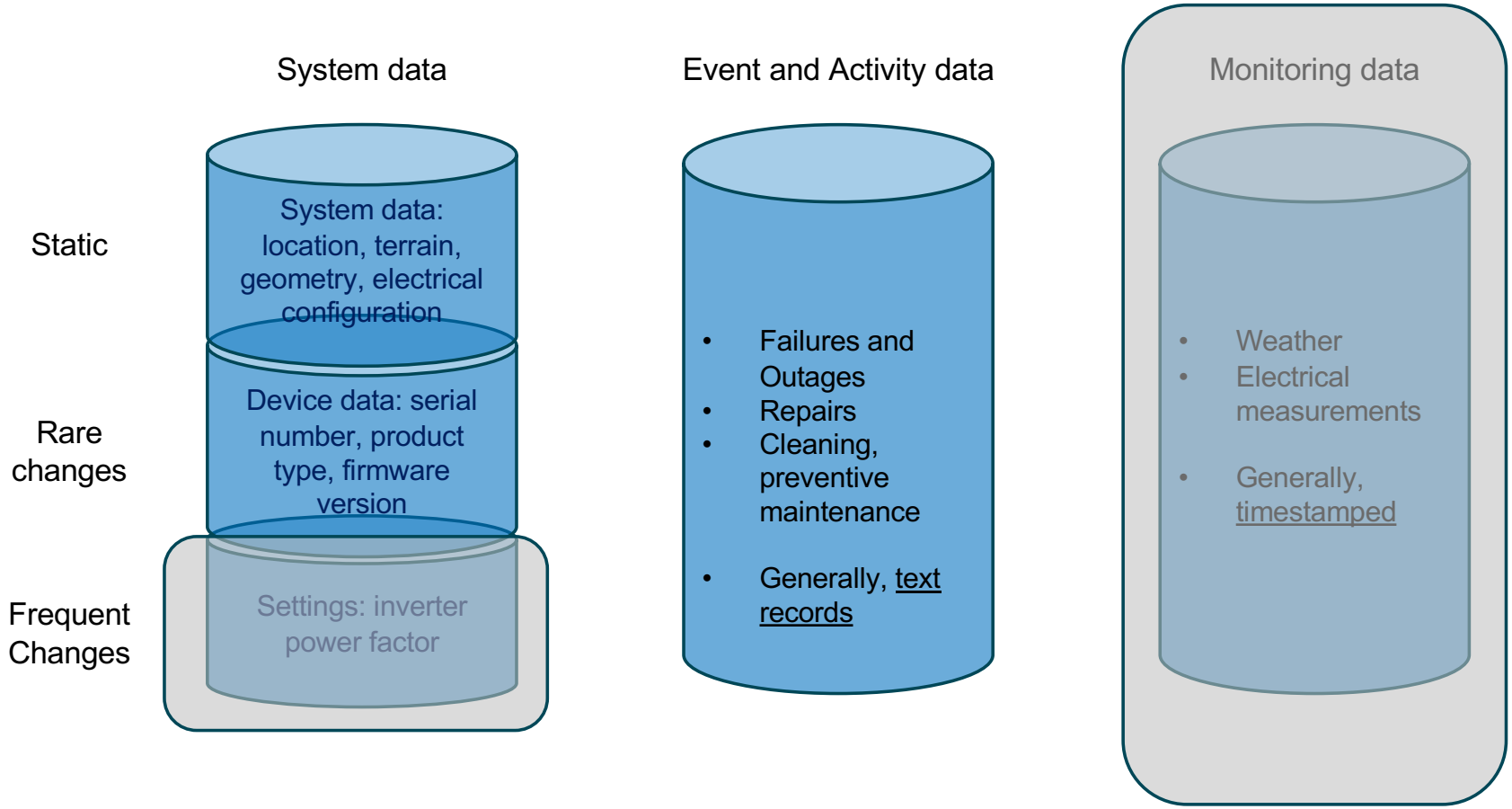
1. https://www.earley.com/insights/why-taxonomy-critical-master-data-management-mdm

The Orange Button taxonomy

- Open-source, public, free-to-use
  - JSON compliant with the OpenAPI 3.0 specification
  - Javascript style conventions
  - https://www.github.com/Open-Orange-Button/Orange-Button-Taxonomy.git
- Editor at https://openobeditor.sunspec.org
- Documentation at www.orangebutton.io (dated)



O&M Data Modeling – Focus on Text Data

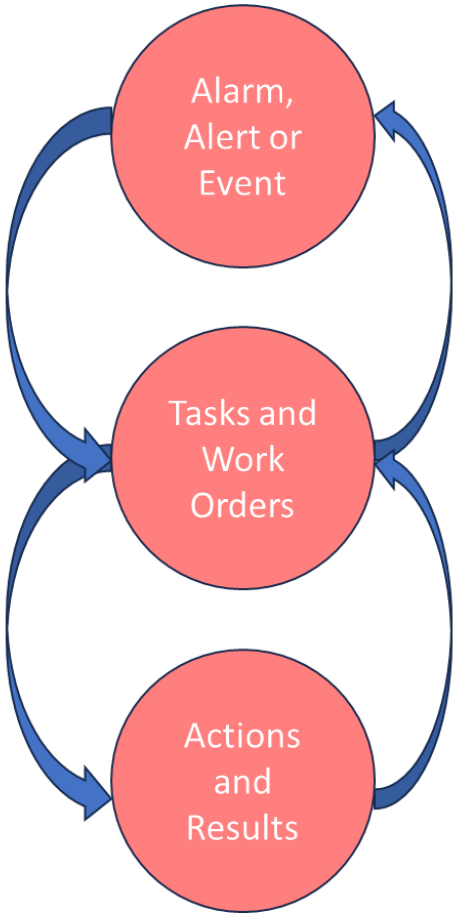


Five Primary Objects Support the Typical Workflow

Issue: a condition that may merit investigation or action
E.g., monitoring data show inverter is offline

Task: an action in response to an **Issue**
1. Check for inverter faults
2. Check fuses and breakers
3. Test string voltages

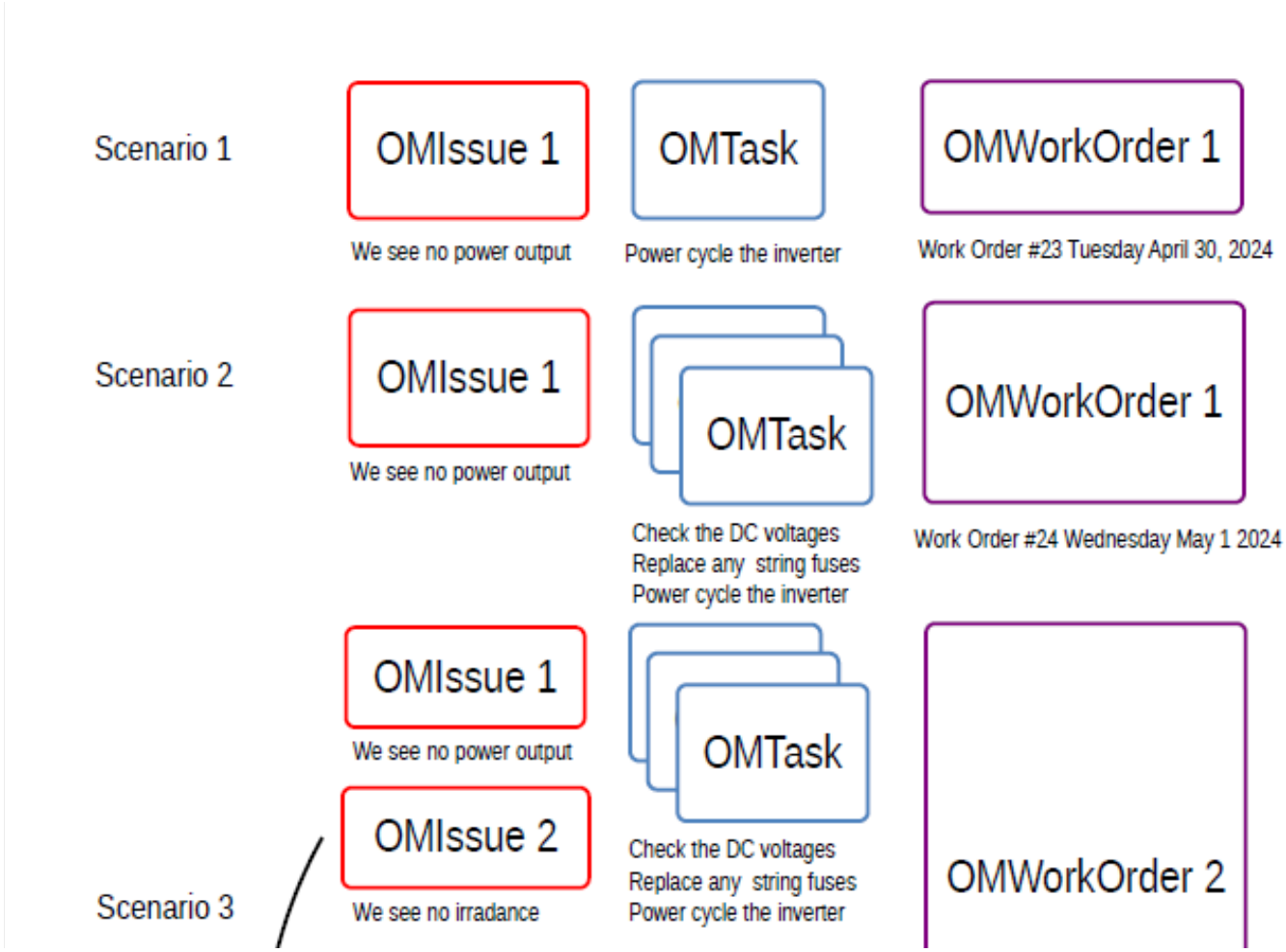
Work Order: a group of (prioritized) **Tasks** with schedule, assigned team, equipment, instructions (access, safety), ...



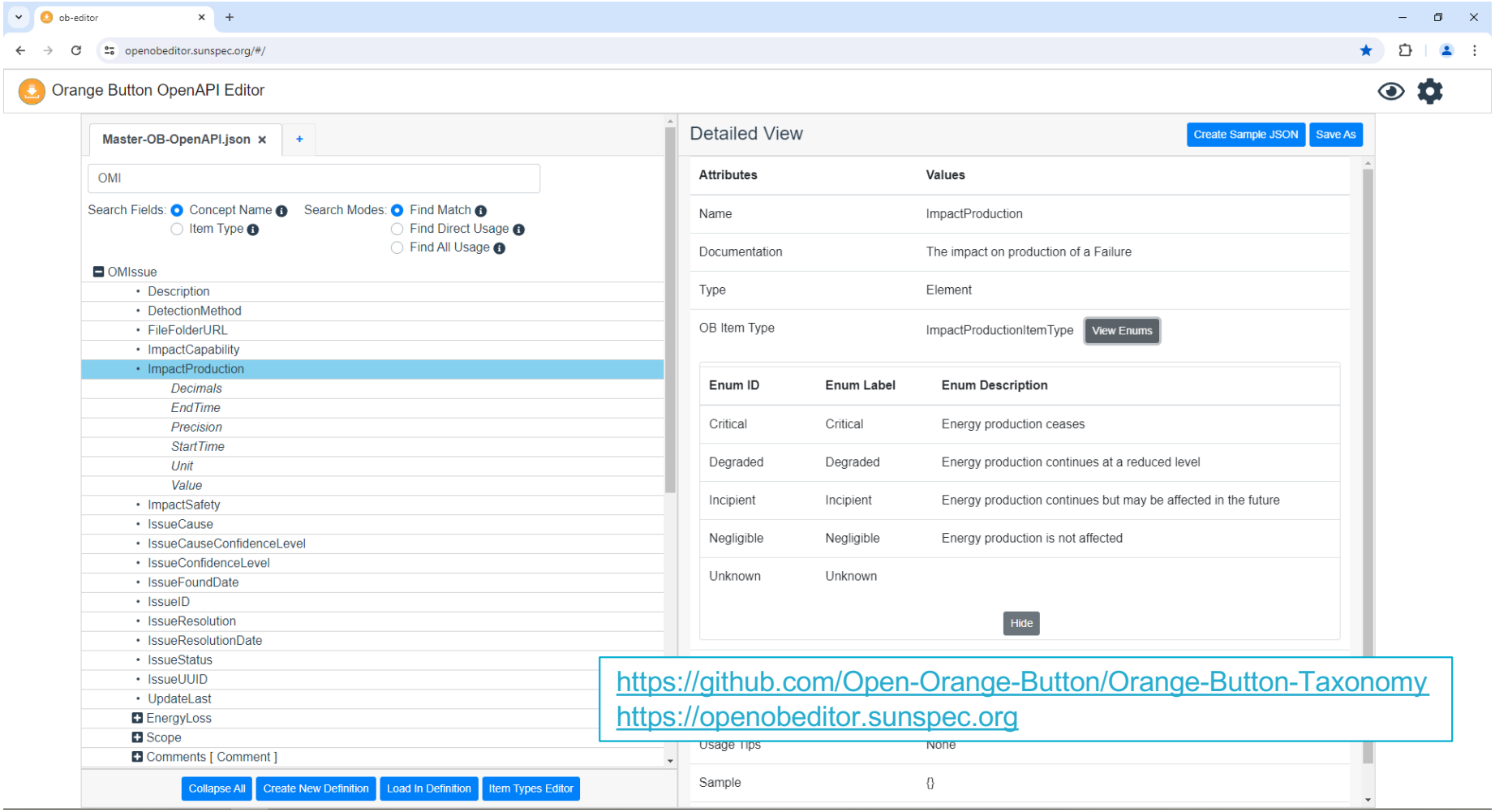
FailureRecord: data describing a failure, which is termination of the ability of an item to perform its function

TaskResult: record of actions taken and data collected
May generate new **Issues** and **Tasks**

Issue / Task / WorkOrder are Iterative by Design

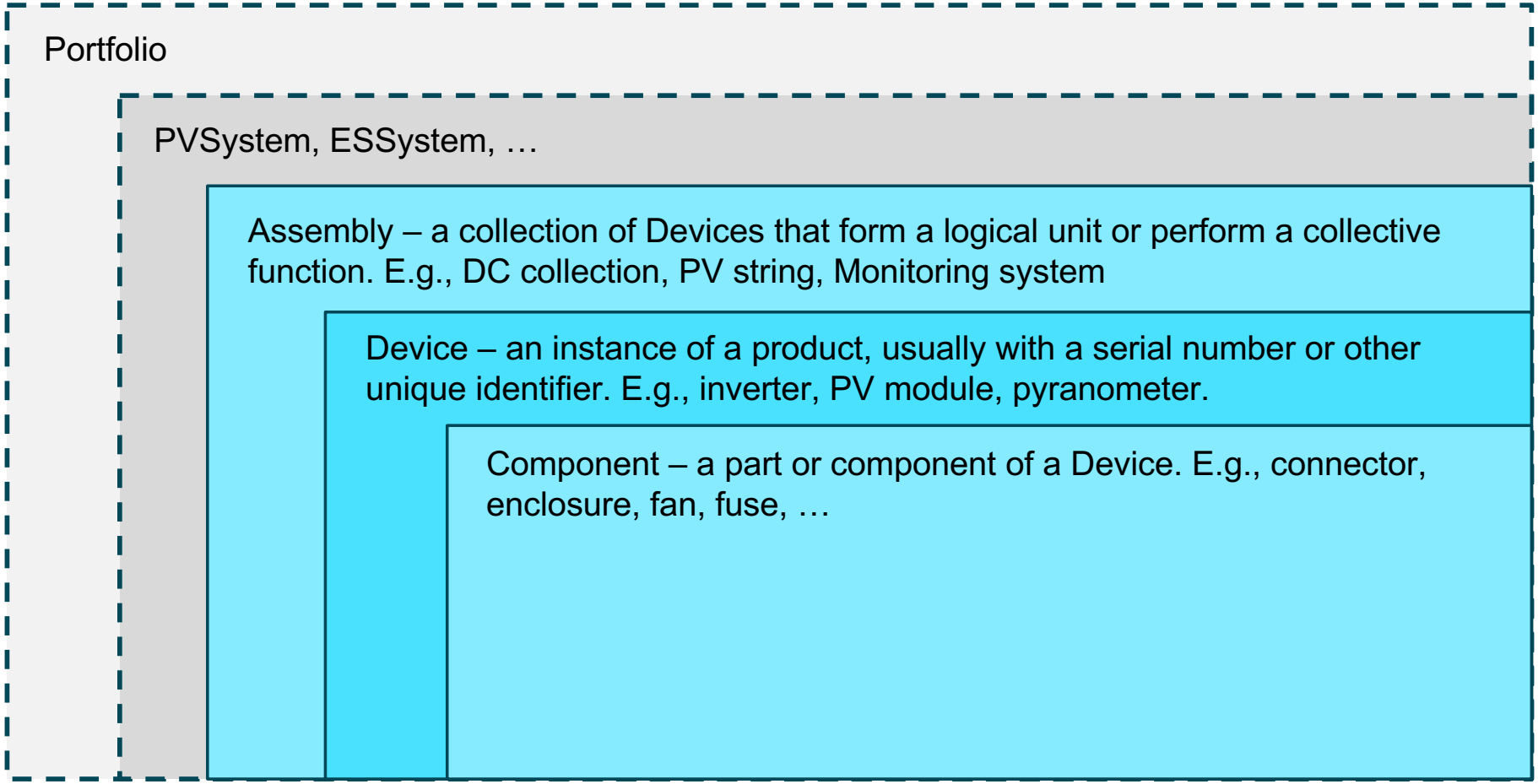


Implemented in Orange Button



https://github.com/Open-Orange-Button/Orange-Button-Taxonomy
https://openobeditor.sunspec.org

Equipment Model – work in progress



Location and Connections – work in progress

- Physical location : link to emerging PVCollada schema
  - PVCollada schema specifies model for geometric data
  - Each polygon (e.g., tracker table) carries a unique identifier
- Electrical position : Topology comprising parent / child / sibling nodes
  - Lightweight objects in OB (if not built into PVCollada schema)
  - Link nodes to PVCollada identifiers
- Mechanical connections : ?
  - Which objects (tracker tables, roof surfaces, modules, sensors) share a common plane
  - Other needs TBD

We welcome your participation

Browse the taxonomy

- https://github.com/Open-Orange-Button/Orange-Button-Taxonomy.git

  Download and save Master-OB-OpenAPI.json for development version

- https://obeditor.sunspec.org/

  Open the file you downloaded

For participation in the working group, contact

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