



The Challenges of talking about IFC5

The many views one can have of IFC5



IFC5 is a name for something that doesn't exist

Thus having discussions about it has proven challenging because all involved have a view point

Those Viewpoints are often from non-converging perspectives

How we converge?



Why Make IFC5

- Existing IFC too Complex to Implement
- Too Onerous to Extend
- Market Demands for New Kinds of Workflow Support

Key Items from the end users of IFC

- Easy to Extend/ Localize/ Customize to Specific Needs
- Distributed, Decentralized, Hosted, Hybrid , Federated
- Granular Data
- Additive Workflows – UK SignIDs >
- Non-Linear/Concurrent Development (Design, Construct, Renovate Concurrently)
- Combine with Other Data; (Geotechnical, Point Cloud, GeoSpatial, Documents, Systems...)
- Relationships too Complex and yet not useful to end user
- Easy To Find Change



The ask is not new...

Container/ Multi-model Discussion



buildingSMART - Munich - 2016-10-13 - Greg Schleusner HOK

Overview

Container or Link Holder to connect and package currently unlinked data

- BIM/ GIS/ analysis
- Multiple Version - Design/Fabrication - Design Options - Design Dif. Representations- Items in Systems Across Model
- Create New Concepts not in one model - Assemblies, Packages, Multi-CAD, Point Cloud Groups
- Edges of container transient boundaries via links
- Parent Child
 - Construction Splitting
 - FM Renovation model “cut out”

The other stuff - not just models

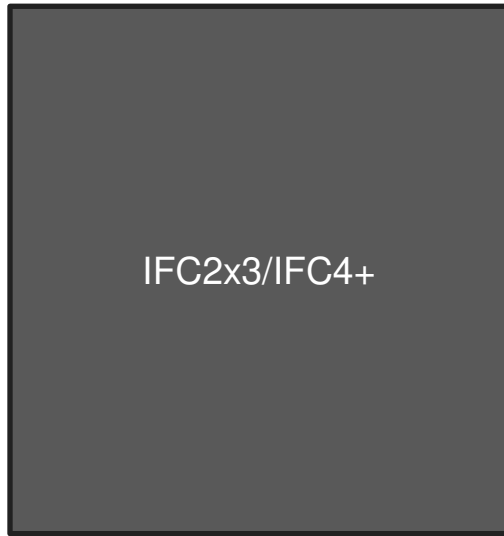
...

Examples of other things

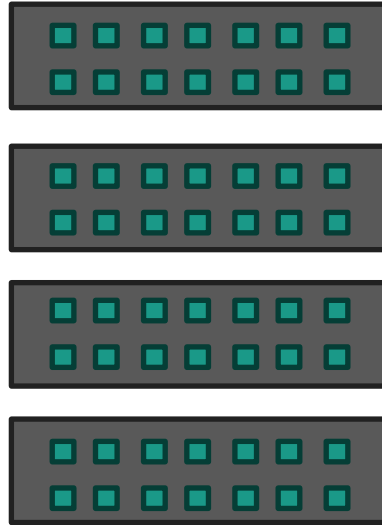
- Point Clouds
- Physical Material Definitions-
 - Rendering
 - Simulated Mockups
- Daylighting - Analysis
- Facade Modeling
- Specifications
- 3D Sketching
- Mechanical Fabrication
- Options, Phasing
- Assemblies
- Branching
- Graphics
- Lean
- Video
- LCA
- Cradle to Grave
- Autonomous Vehicles
- HDR
- Alembic
- Submittals
- VR
- LOD
- Structure Documents for Plan Review
- Parametric Modeling
 - Definitions
 - Results Caches
- Material Selection
- Acoustics
- Dynamic Construction Simulation
- Multi-CAD (Mesh, Multi-Resolution Mesh, Solid, Surface, Sub-Divisional Surfaces)
- Game Engines ...LOD
- Visibility
- Machine Learning
- Drones
- Animation
- Modular Construction
- Photogrammetry
- Diagrams
- New Materials
- Complete Material Audit Trail
- 3D Printing
- Mobile Platforms
- CityModels
- Position and location tracking
- RFID
- Rating Systems
- <http://www.openvdb.org>
- Voxel Data
- Block Chain

How did we get to ECS?

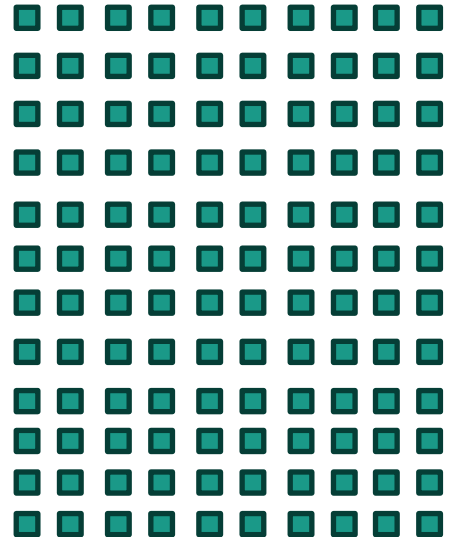
MONOLITHIC FILE



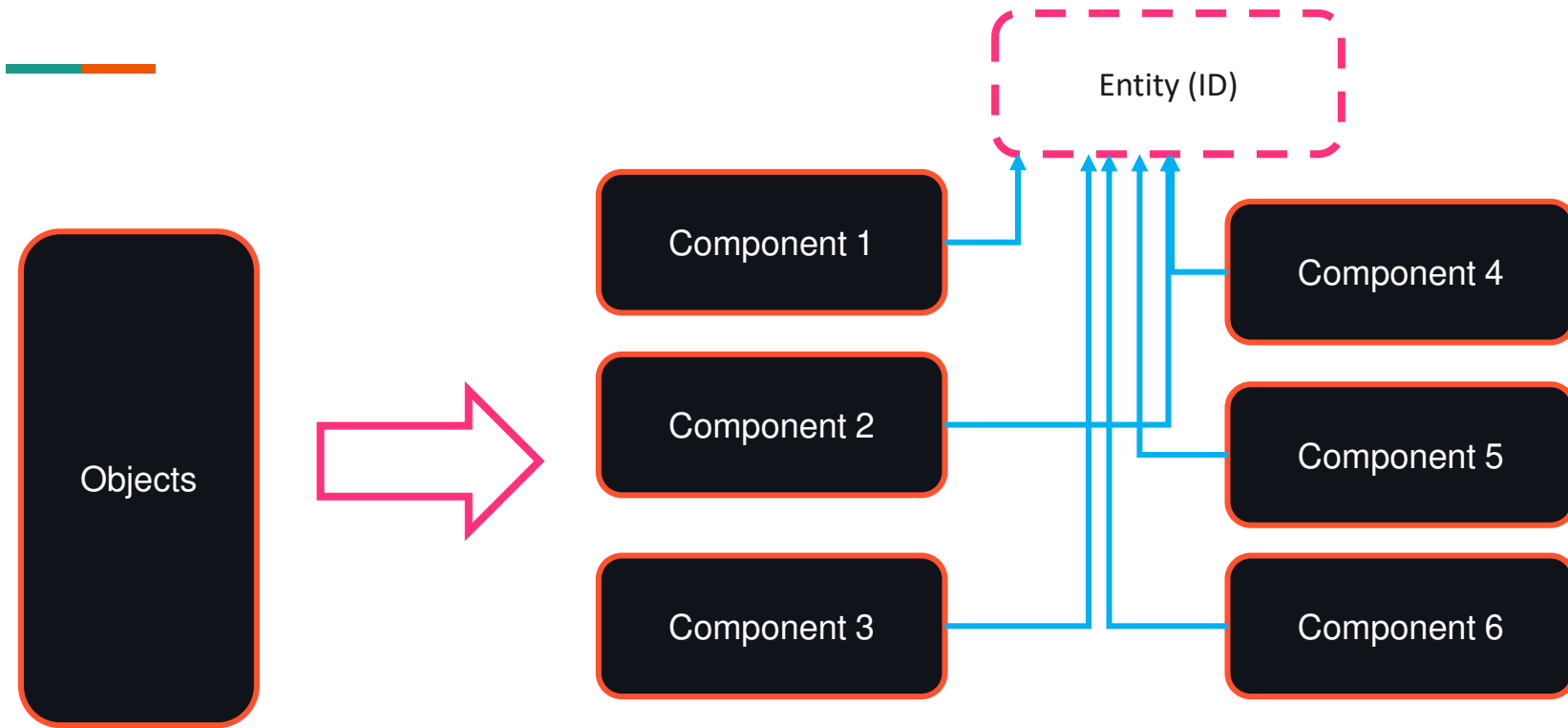
ECS



LINKED DATA



ENTITY COMPONENT SYSTEM



Use cases

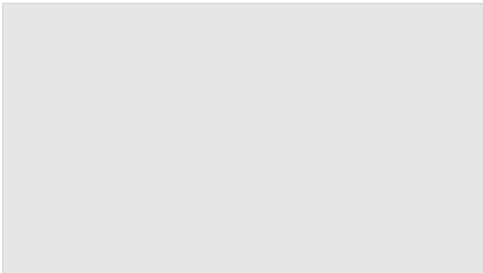
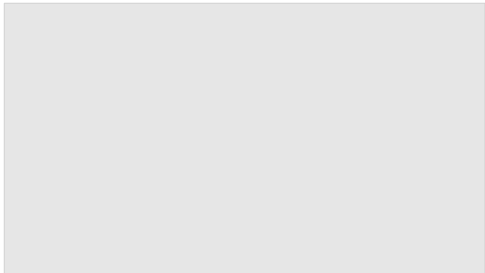


Simple

- One time send of a Bundle of Data to a receiving Party

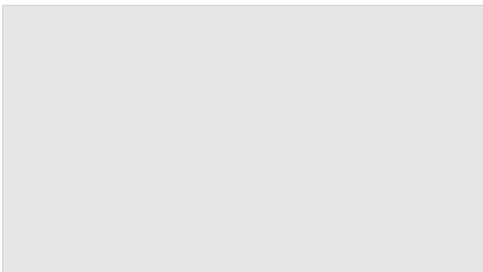
Complex

- Stream Data Live as it is created
- Allow Recipient to Augment
- Allow Other Non-IFC Data to be Attached
- Multiparty, Multi Step

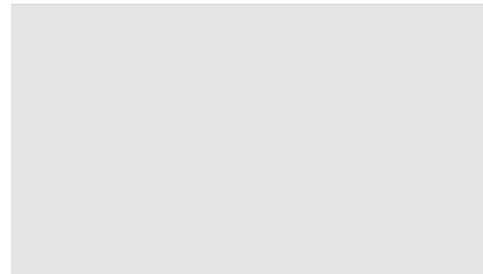
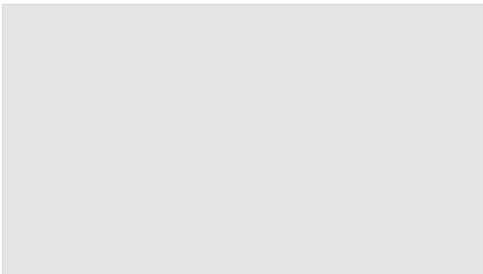
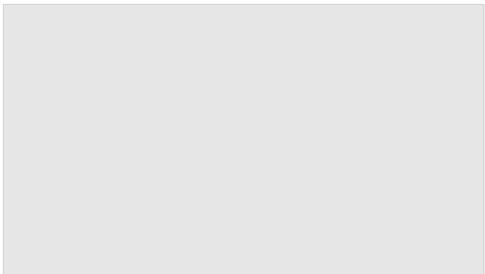


**IFC4x to 5 Transition
Topics**

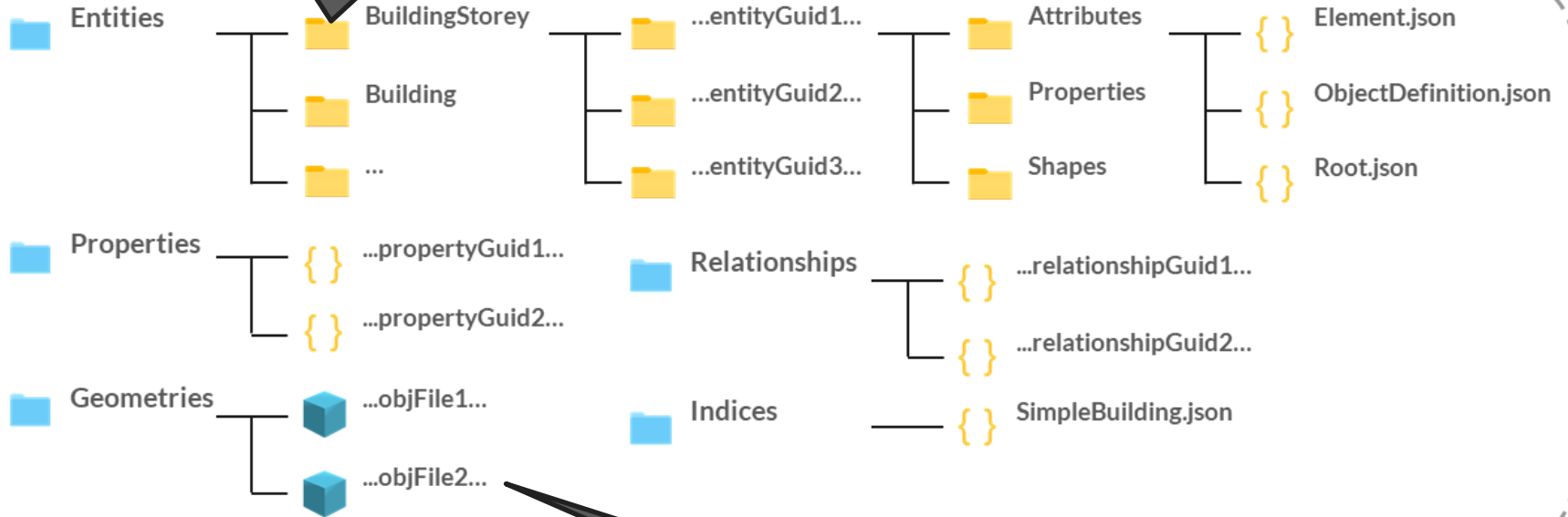
**IFC4x to 5 Transition
Topics**



**IFC4x to 5 Transition
Topics**



Implementations Need to
Make Choices



But no single
implementation is going
to solve all workflows



Points to a Few paths...

1. Pure Standard Approach
2. Simple Reference Data Structure
3. Canonical Implementation
4. Multi-Implementation Overlays

1. Pure Standard

- Modern Schema Representation for Components
 - Geometry Handled as Individual Components
- Components
- Machine Readable Connections Between Datasets
- Stable IDs for Entities
- Class Structure becomes Classifications
- Composability
 - Assemblies and Flexible Placement
 - General Requirements but not dictating that any implementation solves everything
- Can be adapted to multiple use cases
 - Standard General Requirements
- Only IFC Data is IFC Data
 - BSI Condoned Properties, Classifications, Geometry
 - Other User data can be stored in the same implementation, but its not IFC Data

2. Reference/Standard Serialization (Bag of Components)

- Same as Pure Standard but Adds
- Simple Json/Binary Representation that store all data
 - Could be thought of as a “Cached” representation
- We are always going to need a file
- Simplified
- Modern Placement
- IFC Only

Translator options

```
python IFctoECstranlator.py -i BuildingSample.ifc -o outputFolder -exp folder -geo obj
```

1. Option for folder & component file or monolithic JSON

```
"Building": {  
  "8b06c7ff-c7eb-44bc-970e-76caca05d911": {  
    "Attributes": {  
      "Element": [  
        {  
          "name": "CompositionType",  
          "value": "ELEMENT"  
        }  
      ],  
      "ObjectDefinition": [],  
      "Root": [  
        {  
          "name": "Name",  
          "value": "SimpleWall"  
        },  
        {  
          "name": "LongName",  
          "value": "SimpleWall"  
        }  
      ]  
    }  
  },  
  "Properties": {  
    "8764c510-57b7-44c3-bddf-2d8686c2a2e0": {  
      "name": "Pset_BuildingCommon",  
      "propertyIds": [  
        "2f899dd7-c0a2-4db4-9595-6b8b8789ccbd",  
        "46cd43f7-e740-4add-b2f0-c030ee539a20",  
        "781d50c0-76e9-4556-a914-21eba7e3feb0",  
      ]  
    }  
  }  
}
```

2. Option for replacing functional geometry descriptions with OBJ objects for simplicity

```
v 1.0464604246132199 2.3180257471224097 3.134  
v 1.0464604246132199 2.11802574712241 3.134  
v 1.9614604246132195 2.11802574712241 3.134  
v 1.9614604246132195 2.3180257471224097 3.134  
v 1.0464604246132199 2.11802574712241 1.0  
v 1.0464604246132199 2.3180257471224097 1.0  
v -5.23853957538678 2.11802574712241 1.0  
v -5.23853957538678 2.3180257471224097 1.0  
v -5.23853957538678 2.11802574712241 5.60214861374565  
v -5.23853957538678 2.3180257471224097 5.60214861374565  
v 4.761460424613219 2.1180257471224104 5.60214861374565  
v 4.761460424613219 2.31802574712241 5.60214861374565  
v 4.761460424613219 2.1180257471224104 1.0  
v 4.761460424613219 2.31802574712241 1.0  
v 1.9614604246132195 2.11802574712241 1.0  
v 1.9614604246132195 2.3180257471224097 1.0  
v 3.10846042461322 2.11802574712241 3.1835989984128896  
v 3.10846042461322 2.31802574712241 3.1835989984128896  
f 2 1 4  
f 3 2 4  
f 6 1 2  
f 6 2 5  
f 8 6 5  
f 8 5 7
```

3. Canonical Implementation/ Serialization

- Single Serialization
- Tries to Incorporate as much Functionality as Possible
- Comes with a Library to Help Evaluate the Data
- We make Other Versions in the future if we can

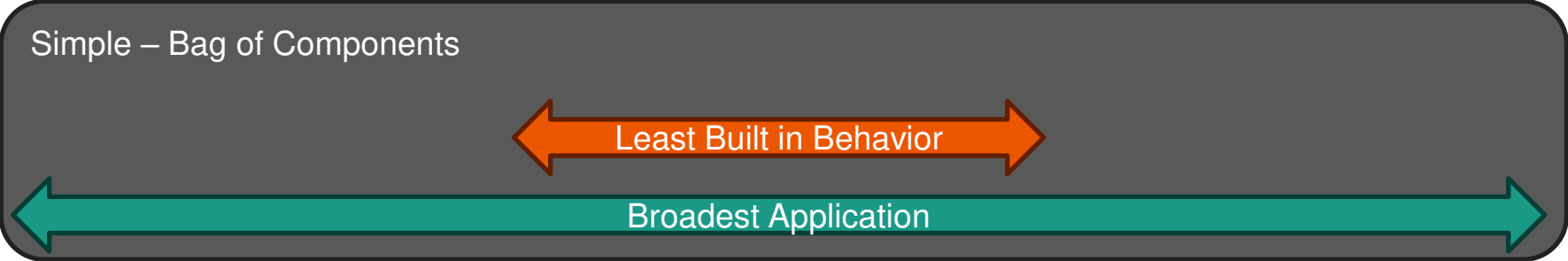
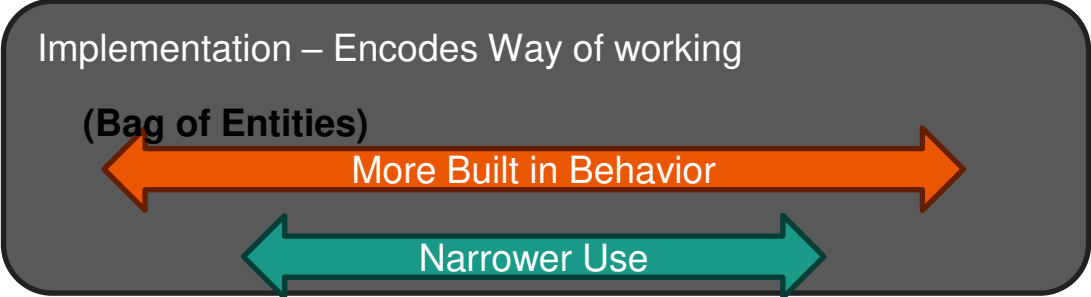
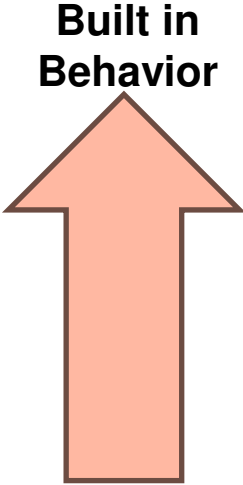
4. Multi - Implementation

- Many Ways to Use IFC
- If you can generate the “Simple JSON” that is validated, then you are using IFC
- IFC in USD, Cloud to Cloud, Database, File Structure....

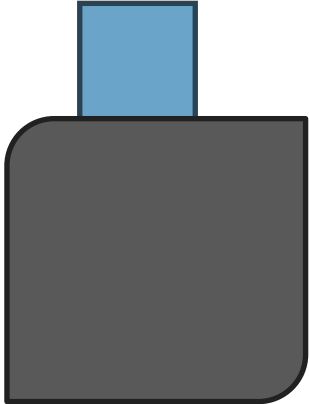
Things that would come with any of these

- Pure Standard
- Flat Representation, No Hierarchy in the Data itself
 - Any Entity can be used as: Instance, Typical, Prototype, Etc
- IFC Components Only Contain Pure IFC Data
- Simplified
 - Attributes as Parameters
 - Root> Element Hierarchy is removed from the data

Starting with the Bag of Components



Flexibility



The text description goes here!

| <input type="checkbox"/> | EntityGUID | Length | Width | Height | Perimeter | Area_Net | Area_Gross | Volume | BbLength | BbWidth | id |
|--------------------------|-------------|--------|-------|--------|-------------|-------------|-------------|--------|----------|---------|----|
| <input type="checkbox"/> | a552741e... | 0 | 0 | 8 | 372.8541... | 5040.574... | 5040.574... | 0 | 0 | 0 | 0 |
| <input type="checkbox"/> | 901c5c98... | 0 | 0 | 8 | 61.24948... | 195.6677... | 195.6677... | 0 | 0 | 0 | 1 |
| <input type="checkbox"/> | 901c5c98... | 0 | 0 | 8 | 68.8125... | 251.1627... | 251.1627... | 0 | 0 | 0 | 2 |
| <input type="checkbox"/> | 901c5c98... | 0 | 0 | 8 | 62.22916... | 199.9822... | 199.9822... | 0 | 0 | 0 | 3 |
| <input type="checkbox"/> | 901c5c98... | 0 | 0 | 8 | 67.56249... | 226.4995... | 226.4995... | 0 | 0 | 0 | 4 |
| <input type="checkbox"/> | 901c5c98... | 0 | 0 | 8 | 70.49079... | 245.2148... | 245.2148... | 0 | 0 | 0 | 5 |
| <input type="checkbox"/> | c2a56edc... | 0 | 0 | 8 | 45.97916... | 132.1041... | 132.1041... | 0 | 0 | 0 | 6 |
| <input type="checkbox"/> | c2a56edc... | 0 | 0 | 8 | 39.1875 | 93.61805... | 93.61805... | 0 | 0 | 0 | 7 |

Total Rows: 1,645



ta Floorplan Geo

...e goes here

...k descripti

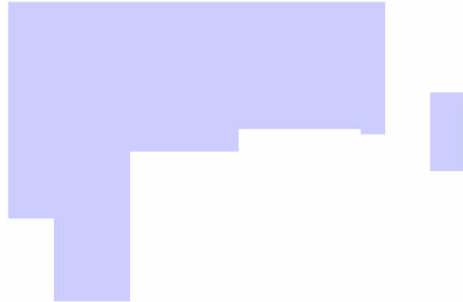
Video player controls: play/pause, stop, previous, 0:00, next, refresh, delete.





| <input type="checkbox"/> | EntityGUID | Length | Width | Height | Perimeter | Area_Net | Area_Gross | Volume | BbLength | BbWidth |
|--------------------------|-----------------------------------------------|--------|-------|--------|-----------|-----------|------------|--------|----------|---------|
| <input type="checkbox"/> | 3532741e-c865-48ac-af5e-e6034746322a-001fa552 | 0 | 0 | 8 | 372.854 | 5,040.575 | 5,040.575 | 0 | 0 | 0 |
| <input type="checkbox"/> | 901c5c98-035e-4b75-9ca5-879e8bc7ac03-001fa552 | 0 | 0 | 8 | 61.249 | 195.668 | 195.668 | 0 | 0 | 0 |

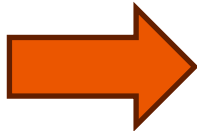
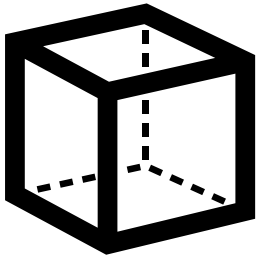
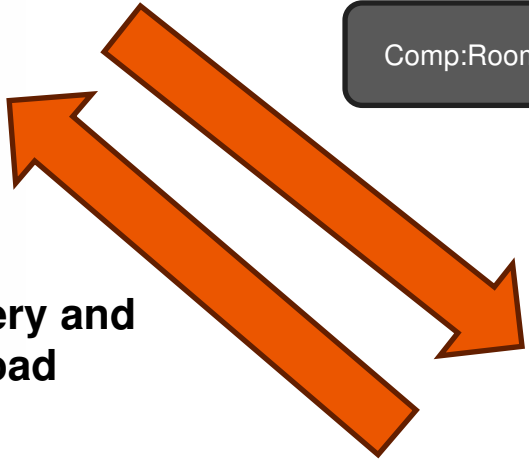
Room Data Floorplan Geo



2. Add New Component

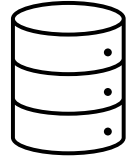
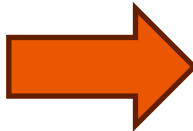
Comp:Room/Classification

1. Query and Load



Comp:Room/Geometry

Comp:Room/Measurements



The “S” in ECS



- We don't talk much about it
- But it's the backbone of most people looking at ECS implementations from Vendors
- Store the Data as Needed
- Calculate the New Components on Demand
- Merged Data could be a Calculation