ifcXMLNetwork: A visualization to explore and understand relationships between elements in an ifcXML file

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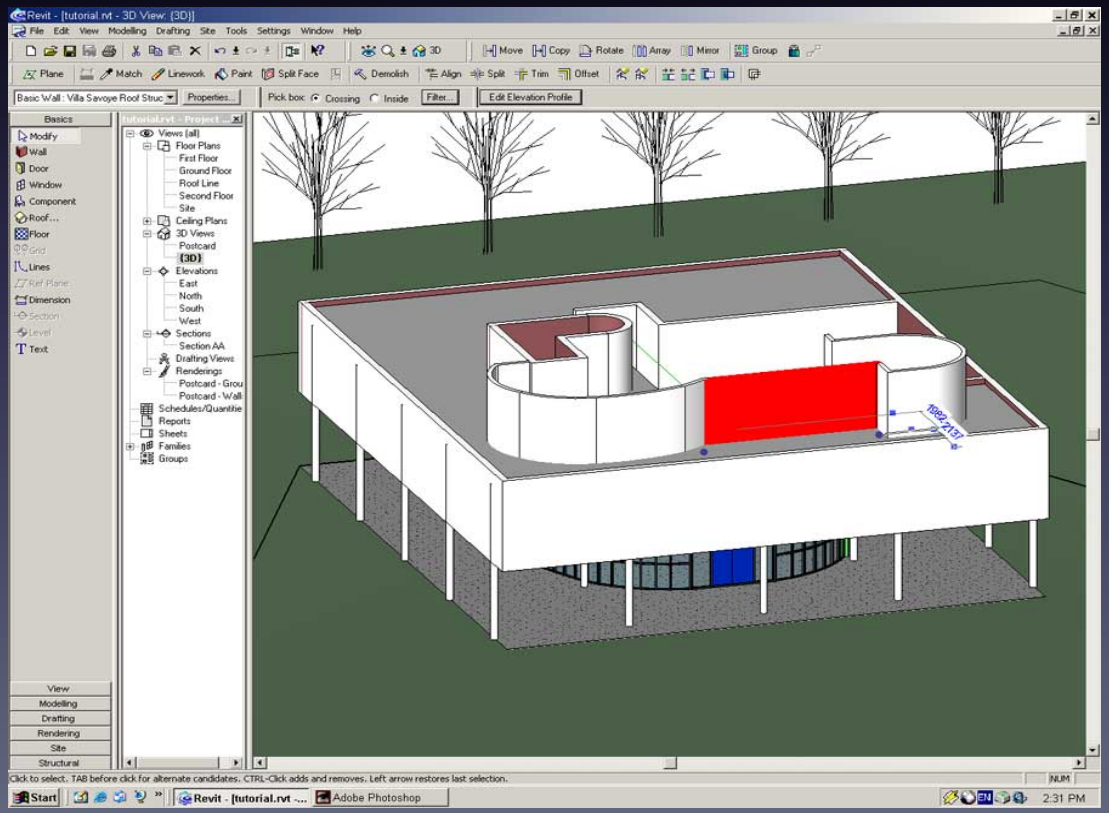
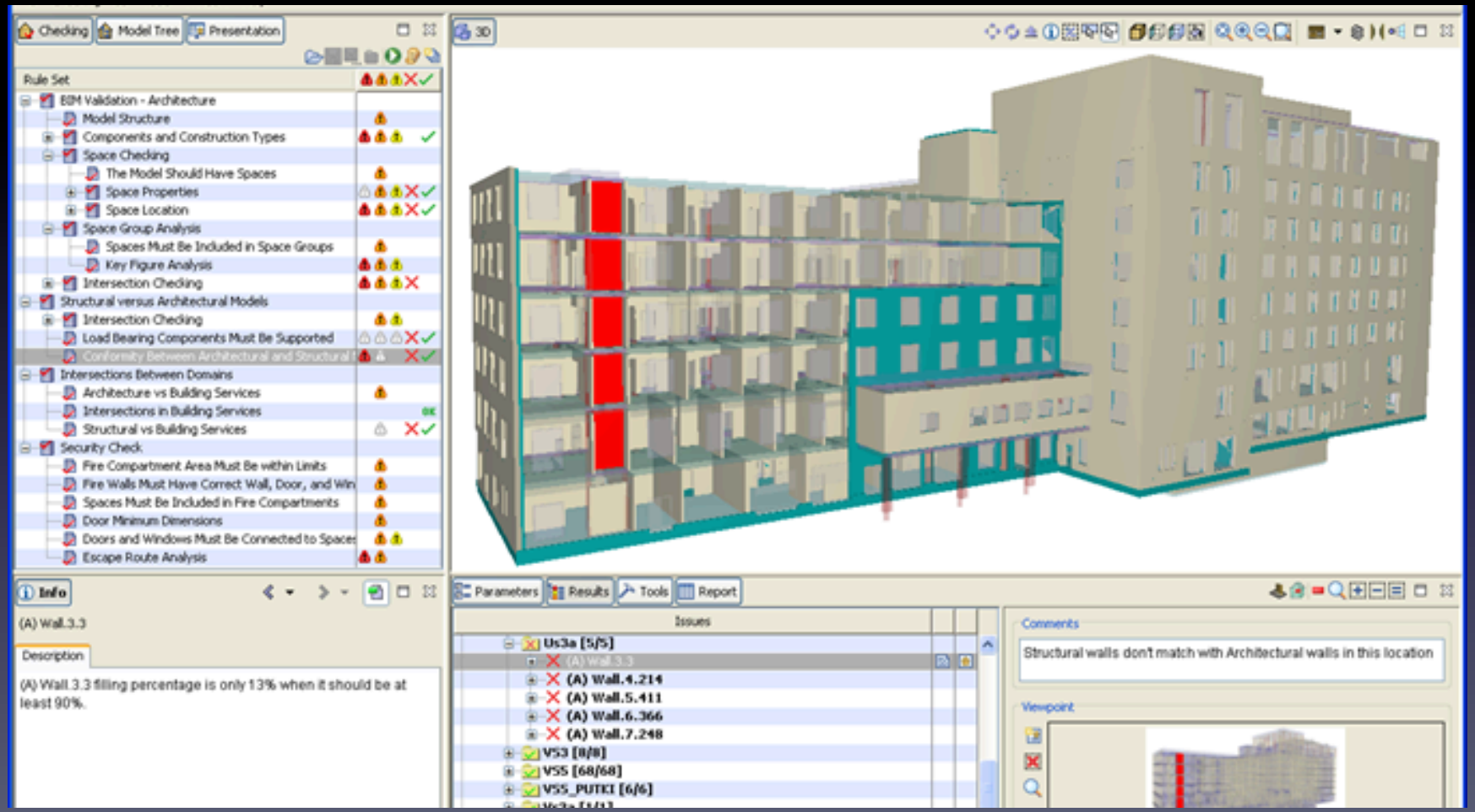
BIM: Building Information Model

- Building information modeling (**BIM**) is a process involving the generation and management of digital representations of physical and functional characteristics of places.



IFC Viewers


Checking
Model Tree
Presentation
Rule Set
BIM Validation - Architecture
Model Structure
Components and Construction Types
Space Checking
The Model Should Have Spaces
Space Properties
Space Location
Space Group Analysis
Spaces Must Be Included in Space Groups
Key Figure Analysis
Intersection Checking
Structural versus Architectural Models
Intersection Checking
Load Bearing Components Must Be Supported
Intersections Between Domains
Architecture vs Building Services
Intersections in Building Services
Structural vs Building Services
Security Check
Fire Compartment Area Must Be within Limits
Fire Walls Must Have Correct Wall, Door, and Win
Spaces Must Be Included in Fire Compartments
Door Minimum Dimensions
Doors and Windows Must Be Connected to Spaces
Escape Route Analysis
3D
Info
(A) Wall.3.3
Description
(A) Wall.3.3 filling percentage is only 13% when it should be at least 90%.
Parameters
Results
Tools
Report
Issues
Us3a [5/5]
(A) Wall.4.214
(A) Wall.5.411
(A) Wall.6.366
(A) Wall.7.248
VS3 [8/8]
VS5 [68/68]
VS5_PUTEI [6/6]
Comments
Structural walls don't match with Architectural walls in this location
Viewpoint

Problems?

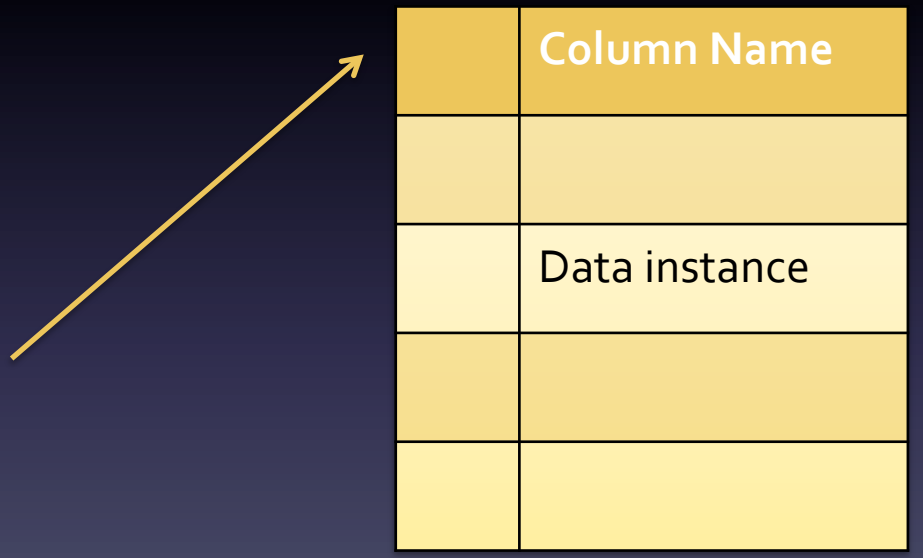
- IFC Viewers concentrate on spatial properties of BIM models.
- Relationships between different kind of elements are not directly shown.
- This information is hard to retrieve from ifcXML files. Data in different elements connected through reference identifiers.

ifcXML


- <IfcWallStandardCase id="I46">
<GlobalId>3MOsHIDNf9nAORk6F$pGmY</GlobalId>
+ <OwnerHistory>
<Name>Basic Wall:Interior - 6 1/8" Partition (2-hr):133257</Name>
<ObjectType>Basic Wall:Interior - 6 1/8" Partition (2-hr):262</ObjectType>
+ <ObjectPlacement>
+ <Representation>
<Tag>133257</Tag>
</IfcWallStandardCase>
- <IfcRelVoidsElement id="I64">
<GlobalId>2xzs9PRmT0nh66mJZe7UGt</GlobalId>
+ <OwnerHistory>
- <RelatingBuildingElement>
<IfcWallStandardCase xsi:nil="nil" ref="I46" />
</RelatingBuildingElement>
- <RelatedOpeningElement>
<IfcOpeningElement xsi:nil="nil" ref="I72" />
</RelatedOpeningElement>
</IfcRelVoidsElement>
- <IfcOpeningElement id="I72">
<GlobalId>22MNdaNJf5YvWeuJDWbew2</GlobalId>
+ <OwnerHistory>
<Name>Single-Flush:30" x 80":30" x 80":144728:1</Name>
<ObjectType>Opening</ObjectType>
+ <ObjectPlacement>
+ <Representation>
</IfcOpeningElement>
- <IfcRelFillsElement id="I52">
<GlobalId>0ouI3MQ9r8FvK596Mgkjar</GlobalId>
+ <OwnerHistory>
- <RelatingOpeningElement>
<IfcOpeningElement xsi:nil="nil" ref="I72" />
</RelatingOpeningElement>
- <RelatedBuildingElement>
<IfcDoor xsi:nil="nil" ref="I39" />
</RelatedBuildingElement>
</IfcRelFillsElement>
- <IfcDoor id="I39">
<GlobalId>3RcTPG0t190QscFhI7eB_o</GlobalId>
+ <OwnerHistory>
<Name>Single-Flush:30" x 80":30" x 80":144728</Name>
<ObjectType>30" x 80"</ObjectType>
+ <ObjectPlacement>
+ <Representation>
<Tag>144728</Tag>
<OverallHeight>6.66666666666667</OverallHeight>
<OverallWidth>2.5</OverallWidth>
</IfcDoor>

Understanding the Data

- Schema: Structure of ifcXML file.
- Object: Real world object.
- Properties: Information about objects.
- Elements [Relational and Non-relational]: Similar to tables in relational databases.
- Data instances: Rows of data in tables.
- Attributes: Column name in table



Tasks and Encoding

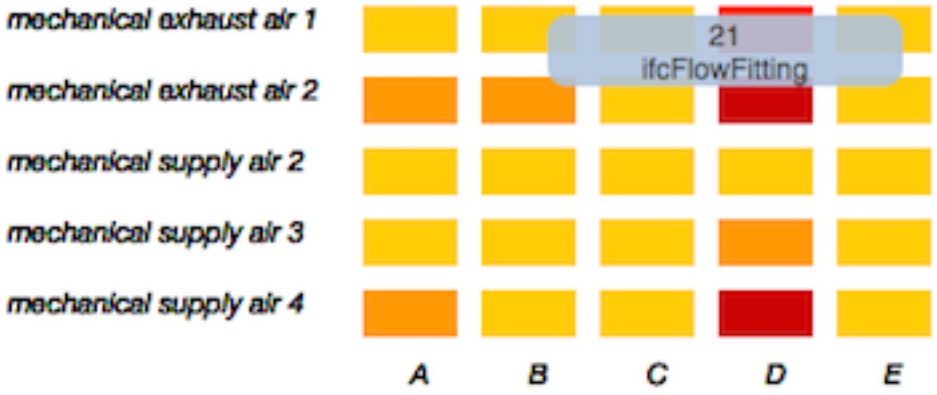
→ Summarize

Overview

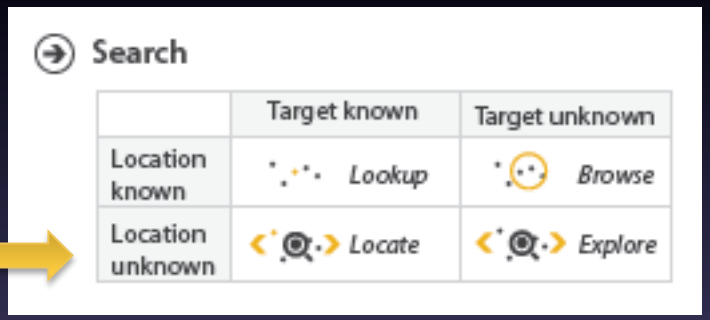
X-Axis: Common non-relational elements amongst subsystems

Y-Axis: Systems defined in the ifcXML file

A.ifcFlowSegment, B.ifcFlowFitting, C.ifcBuildingElementProxy
D.ifcDistributionPort E.ifcFlowTerminal



Tasks and Encoding



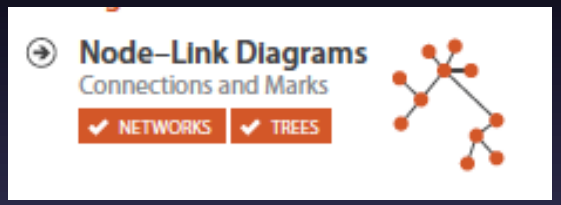
Search

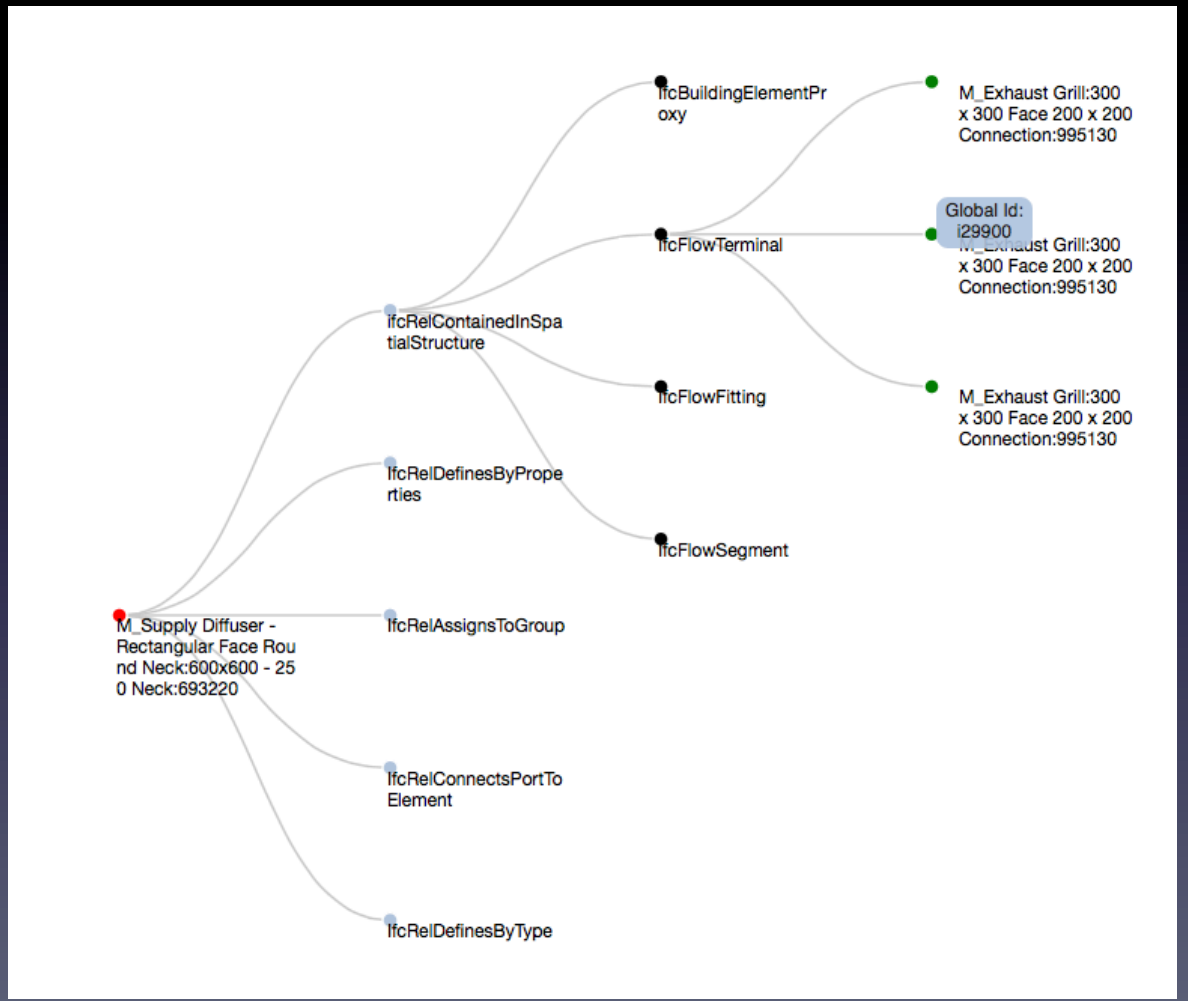
Enter identifier number to view relationship network

i2229 Find

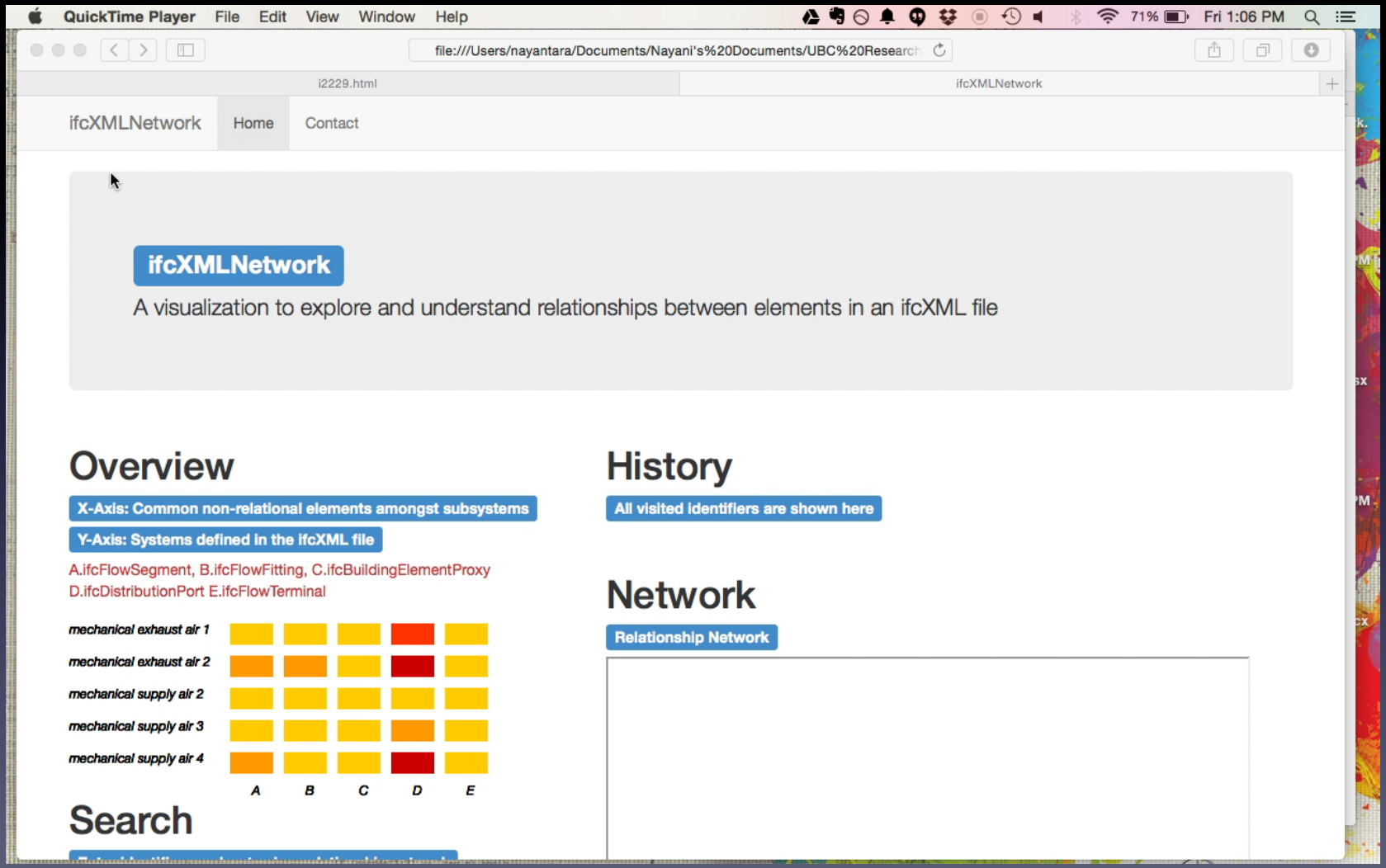
Identifier	Name
i2229	M_Supply Diffuser - Rectangular Face Round Neck:600x600 - 250 Neck:69322
i2535	M_Supply Diffuser - Rectangular Face Round Neck:600x600 - 250 Neck:81693
i64995	M_Supply Diffuser - Rectangular Face Round Neck:600x600 - 250 Neck:143335
i93651	M_Supply Diffuser - Rectangular Face Round Neck:600x600 - 250 Neck:144821
i97069	M_Supply Diffuser - Rectangular Face Round

Tasks and Encoding





Demo


QuickTime Player File Edit View Window Help
71% Fri 1:06 PM
file:///Users/nayantara/Documents/Nayani's%20Documents/UBC%20Research
i2229.html
ifcXMLNetwork
ifcXMLNetwork Home Contact
ifcXMLNetwork
A visualization to explore and understand relationships between elements in an ifcXML file
Overview
X-Axis: Common non-relational elements amongst subsystems
Y-Axis: Systems defined in the ifcXML file
A.ifcFlowSegment, B.ifcFlowFitting, C.ifcBuildingElementProxy
D.ifcDistributionPort E.ifcFlowTerminal
mechanical exhaust air 1
mechanical exhaust air 2
mechanical supply air 2
mechanical supply air 3
mechanical supply air 4
A B C D E
Search
History
All visited identifiers are shown here
Network
Relationship Network

Summary

- OVERVIEW: Common Non-relational data between subsystems.
- SEARCH: Find specific data instances through identifiers.
- HISTORY: Data instances already visited.
- NETWORK: Display relationship tree of selected data instance.

Future Work

- Add more interactivity
- Extract more information from ifcXML data and visualize other results.

Thank You