Goal of the document:

The goal of this document is to describe a scenario that Lan will use in order to combine the data from CityGML and IFCXML.

Problem Description:

The scenario that we consider is the problem of looking at operation and maintenance requests. We consider the case where these requests are either looking for equipment or a room in a specified building, such as someone made a request for maintenance to look at the temperature in “core chem Physics office A249”, since it was too cold (14 degrees). In order to answer the queries, we need locate the target item in the giving building, in the above example, the target item will be a room, and then we will look at the heater or air conditioner in that room to see if we need to adjust it or fix it. To simplify our problem, the inputs will be a building name, a room name, and an equipment name (if there is specified one). The output will be the clear location of the room in the building (such as room number and floor number) and the location of the building in a campus-wide range (such as the coordinate of latitude and longitude). Right now, I can not specify how I am going to represent the location, because it depends on the schemas of IfcXML and GIS. Also, we need to consider the visualization of the results.

The Actual Observation of CIRS IFC Data from Solibri Model Checker:

The IFC schema is too complicated to directly look at, so for now I viewed the features and their properties for the CIRS building in IFC format in the Solibri Model Checker. Later I will write code to directly explore the IFC data to check if I can get more information from it. In sum, for now I can get the properties and relationship of walls, slabs, columns, spaces (I have to testify if the spaces match the exact rooms), openings (windows and doors), stairs, furniture (it cannot specify the exact name of the furniture, such as tables, chairs), light texture, flow terminals (such as wash basins, toilets), objects (all the objects if they cannot name them). I cannot find other mechanical components, such as electrical equipment, heating system, pipes….

Let’s first look at the properties of spaces and equipment such as flow terminals:

I list the properties most related to our requests (an example is giving later appendix):

Spaces:

Model, Name, Number, Type, Floor, Area, Height, Space Boundries (walls, slabs and door consist the space), Relation (what are in the space…) and so on.

Flow terminals:

Model, Name, Floor, Material, Relation (the space where it belongs) and so on.

Analysis and Strategies:

In order to answer the above operation and maintenance queries:

Case 1: these queries are looking for equipment

1. We can find the space information where the equipment is contained in the “relation” property, so we can get the room number and floor information (done). One problem is that I need to confirm that the space is matched to the actual real room where the equipment is stored, if the space number, name and area are the same as the room (to do). (IFC data)
2. We will extract the properties of the room, such as room number and floor information (done). (IFC data)
3. Next, we will work on finding the path to this building from a campus view. We need the GIS data which provides the geospatial information of the building to locate it in the campus range just like the way the map works (to do). (GIS data)

Case 2: these queries are looking for rooms

The step 2-3 from case 1.

In order to facilitate the process of analyzing the requests, below lists the work we will do:

1. First we need to extract the information from IFC. To do so, we need the IFCXML file which is an XML format of the IFC data, because XML data is easy to extract based on the meaningful tags (I will list the related tags later once I successfully convert to IFCXML).
2. The relation properties in IFC schema provide the relationships of objects and other objects related to themselves to find the links between building components, such as equipment and its located room, a space and its located building.
3. Next, we need to create a database to store the extracted IFC data.
4. One way is to build inside the 3DCityDB which has the CityGML data already, which consider as a way of integration of IFC and CityGML.
5. The other way is to build another database, so the queries will be answered on it and 3DCityDB.

Further details will be considered such as the schemas, foreign keys to link between both of them and intermediate schemas on which the queries will be answered.

In conclude, from either rooms or equipment, we can find the room information, and location in the building, the building information (BIM). Therefore, we just need the geographic information of the campus (GIS) to locate the building, and then the operation requests are solved.

The challenges are we need to check if the IFC models have all the mechanical components and equipment information, also if they accommodate the additional information of the equipment, such as the manufacturer, serial number, maintenance history information, service manual, and spare part information about the specific equipment that needs to be maintained or repaired or replaced. Also, the efficient way of extracting the needed information from IFC is our study goal.

**A wash basin:**

**Identification**

Model: CIRS Arch

Discipline: Architecture

Name: Sink-Wall-Rectangular: 19" x 17":19" x 17":4204858

Type: Undefined

Layer: P-SANR-FIXT

System:

Geometry: Boundary Representation

GUID: 2dfdyW6$n5BwJMEdNWw\_pd

BATID: 4204858

**Location**

Building: Building.b.1

Floor: Level 3

System:

Top Elevation: 2'-11 7/8"

Bottom Elevation: 1'-6 15/16"

Distance to Next Floor: 10'-9 1/2"

Global Top Elevation: 317'-11 3/8"

Global Bottom Elevation: 316'-6 1/2"

Global X: 1,037'-1 5/8"

Global Y: 404'-5 1/16"

**Material**

Metal - Steel, Polished 0'

Porcelain - Ivory 0'

**Relations**

|  |
| --- |
| Containment: |

Space.10.3 : FEMALE WR[3334]

|  |
| --- |
|  |

**Space.10.3 : FEMALE WR[3334]**

**Identification**

Model: CIRS Arch

Discipline: Architecture

Name: FEMALE WR

Number: 3334

Type: FEMALE WR

Occupant

Layer: A-AREA-IDEN

Space Group Type:

Geometry: Extrusion

GUID: 2Q2UoAOVj5GxlNWYc54Cic

BATID:

**Location**

Building: Building.b.1

Floor: Level 3

Zone:

Top Elevation: 8'

Bottom Elevation: 0'

Distance to Next Floor: 5'-9 3/8"

Global Top Elevation: 322'-11 1/2"

Global Bottom Elevation: 314'-11 1/2"

Elevation With Flooring : 0'

Global X: 1,025'-6 13/16"

Global Y: 394'-8 5/8"

**Quantities**

Area: 112.26 sq ft

Height: 8'

Perimeter: 42'-8 13/16"

Area of Doors: 23.86 sq ft

Area of Windows: 0.00 sq ft

Volume : 898.09 cu ft

**Relations**

**Space Boundaries**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | Door: | M\_Single-Flush:0915 x 2134mm | 0.007416141732284281 | | Slab: | Floor:\*Solid Wood Floor (with raised flr) | 0.40036665108130315 | | Slab: | Floor:\*Solid Wood Floor w/ raised flr and tile | 9.525267657543614 | | Wall: | Basic Wall:M\_A7 tile both sides | 8.959043643764996 | | Wall: | Basic Wall:M\_A7 | 6.921147755683565 | | Wall: | Basic Wall:M\_A7 tile one side | 8.95712802208938 | | Wall: | Basic Wall:\*Int. Wood Stud - Shear 382 - washroom | 6.923626713129929 | |  |  |
| **Space Boundary Area** |  |  |
| Reference Perimeter Net Area: 318.01 sq ft  Area of Walls: 341.87 sq ft  Area of Windows: 0.00 sq ft  Area of Doors: 0.08 sq ft  Area of Columns: 0.00 sq ft  Area of Beams : 0.00 sq ft  Area of Floor: 106.84 sq ft  Area of Ceiling: 0.00 sq ft  **GSA Space Areas**  GSA BIM Area: 112.26 sq ft  **Pset\_SpaceCommon**  CeilingCovering: GYP  FloorCovering: CT-1  Reference: FEMALE WR 3334 |  |  |
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