



Interoperability between Geospatial and Building Information Models. An OGC/bSI Integrated Digital Built Environment Call for Sponsors

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Chapter 1. Join us to Boost IDBE Interoperability

Over the last decade, impressive progress has been made in developing open standards for geospatial and AECO (architecture, engineering, construction, and operations) views of city buildings and infrastructure. Today, standards supporting the integration of the two are missing. The geospatial community has its roots in a geographic information systems view of the world, i.e., focuses on analytical and visualization tasks for geographic data. The AECOM community with their Building Information Model (BIM) data on the other hand focuses on reliable digital representations of a built asset like buildings or infrastructure during its development with detailed plans for the entire lifecycle of construction, operation, and maintenance. With progress being made on both sides, the integration potential for data from both sides seems better than ever before. The market for integrated full life-cycle geospatial/BIM data, including all phases of DBFM (Design, Build, Finance, Maintain) is constantly growing and there is an increasing demand for service provisioning throughout the entire lifecycle of DBFM projects.

The [Open Geospatial Consortium \(OGC\)](#), supported by [buildingSMART International \(bSI\)](#), invites interested organizations to sponsor an OGC Innovation Program initiative that explores the current state-of-the-art in geospatial and BIM data integration based on meaningful real-world use cases. Both communities build on different data modeling approaches with respect to fundamental concepts, semantics, access, level-of-detail, and several other aspects. With open standards such as CityGML, LandInfra/InfraGML, IndoorGML, and IMDF on the geospatial side and IFC (Industry Foundation Classes), ISO19650, and the openCDE API portfolio on the BIM side maturing, it is now time to learn what level of interoperability is already achieved and how to expand this most efficiently. The following questions shall be addressed: Does the integration at an API level meet use case requirements? Where are the main integration hurdles and obstacles? What modifications need to be applied to existing standards to further satisfy the markets' demands for integrated solutions? The goal of this pilot is not to achieve full integration of data from the geospatial and BIM side, which might be hard to achieve, but to understand the current level of interoperability and the path towards better integrated solutions.

Sponsors of the IDBE Pilot will push forward the integration of both the geospatial and BIM perspectives and will benefit from the analysis of the current integration capabilities. The analysis is expected to lead to further joint standardization work between OGC and bSI. Thus, sponsors support the convergence of geospatial and BIM models, which will lead to substantial savings during the full design, build, finance, and maintain process. To get in contact, please use the [OGC Innovation Program contact form](#). **Response period ends September 30st, 2021.**

Chapter 2. OGC Innovation Program

The OGC Innovation Program (OGC IP) is an innovative, collaborative, and hands-on engineering and rapid prototyping program. In the IP, OGC members bring forward technology and technology integration challenges. These challenges are refined and mapped to a set of requirements, use cases, and implementation scenarios and eventually addressed in different types of initiatives. These initiatives bring OGC vendors and research institutions together with sponsoring organizations. Coordinated and managed by the OGC IP Team, each initiative has the goal to stepwise increase Technology Readiness Levels (TRL) for geospatial IT solutions, including software architecture, interface design, information and data models, as well as related standards and specifications. Run globally, the Innovation Program further validates and tests geospatial technology based on OGC standards and identifies future OGC standardization work items.

Depending on sponsors' interest, OGC will organize a [Pilot](#) or [Plugfest](#) Innovation Program initiative. A pilot unites technology users with technology solution providers in a fast-paced collaborative prototyping environment to test and evaluate implementation of existing or candidate standards. Pilots serve as an incubator to prioritize, encourage, and accelerate the pace at which standards-based capabilities are deployed to improve interoperability within a specific domain or user community. OGC Plugfests are initiatives where vendors cooperatively test (and possibly refine) their standards-based products in a hands-on engineering setting. Plugfests, located at TRL (Technology Readiness Level) 6-8, are used to (1) assess the degree to which different products in the marketplace interoperate based on their implementation of standards and (2) advance the interoperability of geospatial products and services based on OGC standards in general or within specific communities.

This initiative will be supported by buildingSMART International, a vendor-neutral and not for profit body that leads the development of open digital information flows across the built asset industry. Its mission is to proactively support industry participants who want to develop open standards for planning, design, procurement, assembly and operation of buildings and infrastructure worldwide. It provides the international network plus the necessary technical and process support. Its members, who range from across the built environment spectrum, collaborate under the buildingSMART organization. buildingSMART is engaged with other international standards bodies such as ISO, the European Committee for Standardisation (CEN) and the Open Geospatial Consortium (OGC). Its core Industry Foundation Class (IFC) standards achieved ISO approval in 2012.

Chapter 3. Use Cases

The following use cases illustrate how interoperable built environment data can generate value. The pilot or plugfest should focus on two or three use cases and we are open to discuss and consider alternatives.

3.1. Use Cases Inventory/Portfolio Use Case

A manager of a building portfolio wants to analyze the current state of a number of buildings in the same city. The manager needs a standardized API to obtain information from various buildings. The API needs to support access to simplified descriptions of buildings (compared to BIM detail, e.g. rooms and relevant building installations, for example water pumps). Focus needs on specific aspects, such as

- Identifying and querying asset information from different information sources (differently structured input data)
- Geometry: Is it sufficient to define faces or is Constructive Solid Geometry required?
- Detail of a building: What do I need to know about the building for a specific use case, including both geometry and properties?
- Zooming in and out in time.
- Semantics: do we understand the same thing when we talk about an object? (i.e. do we have the same definition for a roof, column, window, etc?).
- Aggregate across buildings (i.e. how much roof space of a particular roof type or pump type do we have?).
- Identify how a building portfolio fits into the wider community/neighbourhood.

3.2. Condition Assessment Use Case

Based on use case 3.1, additional datasets, such as high resolution aerial imagery, will be accessed to determine the condition of objects of the individual assets (buildings as well as other objects such as roads, railway tracks, etc.), which is subsequently being recorded as an attribute of the object.

The condition assessment use case can be extended to incorporate additional datasets, for example imagery or Lidar from ground based mobile mapping systems or scans of the interior of assets like buildings.

A possible extension to this use-case could be the comparison between the real world situation to the designed situation in IFC. Challenges like comparing the faceted geometry from (city)GML to the semantic geometry like the alignment curve from IFC will be investigated.

3.3. Building Occupancy Use Case

This use case re-assesses the maximum occupancy of a building, story, or room under COVID restrictions. It uses APIs to generate a detailed view from a big picture view and includes the following elements:

1. Create a simplified description of a building(s)
 - a. How many rooms are in the building? (extract or derive information from CityGML and BIM data)
 - b. Link from one representation to the other, i.e., from room X in CityGML to room X in IFC/BIM (requires the analysis of principle differences between GML geometry and CSG geometry from IFC)
2. Host these simplified building representations using different, existing technologies
3. Create a Web service Architecture to connect to these building data
4. Provide a simple application to calculate the occupancy and building assessment use cases based on a simple set of rules

3.4. Extensions to the Core Set of Use-Cases

The following use case “Path-finding” currently goes beyond what is planned for this initiative. It is provided here to illustrate the next analysis and integration steps and would only be addressed if substantial sponsors’ interests require its implementation. The use case allows the integration of additional standards, such as IndoorGML with Sensor Things API and Moving Features. The use case emphasizes the extraction of navigable spaces (rooms and corridors) to compute a network for distinct groups of users, e.g. management teams and visitors in a public building (school, hospital, office). The use case would include the development of an API to harvest appropriate building components and corresponding networks and would focus on the following aspects:

1. Extract geometry of spaces (rooms, corridors, doors, openings, etc) according to a predefined user profile
2. Construct a navigation network
3. Host the geometry and the network using different system architectures and technologies
4. Create an app to compute a navigation path for a user of the specified groups.
5. Link with existing outdoor network and compute indoor-outdoor path

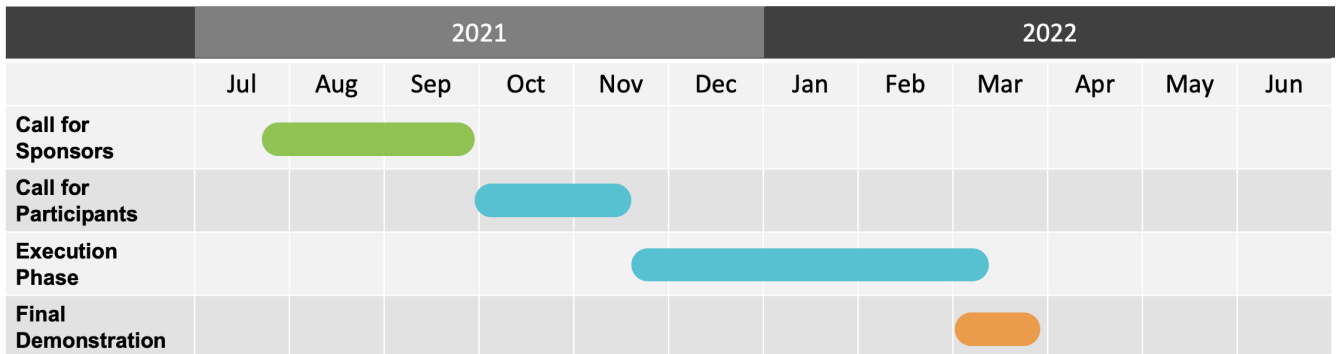
Chapter 4. Integration Challenges

At this stage, we identified a set of integration challenges that the initiative shall address. The following list of questions is not exhaustive and will be adopted to specific needs as expressed by future sponsors. Thus, it shall be seen as a starting point for a future initiative and allows setting the scene for the planned OGC Innovation Program initiative.

- What does an integration architecture look like? What level of integration is targeted by the community?
- What functionality is supported by available client software?
 - Support for multiple formats
 - In-client format conversion
 - Generalization
 - Cross-format links
- What data services are currently available, what data format do they offer?
 - Several formats will be tested to handle the integration challenges on the client side
 - Transformation services shall be explored that address parts of the integration challenge as-a-Service (aaS)
- What APIs are required to handle integration?
 - Transformation service with API from one data representation to another
 - Simplification/generalization aspects
- What integration elements are already supported by OGC APIs, in particular OGC API-Features or the buildingSMART openCDE APIs, which are considered essential elements in the integration architecture?
 - What instances are already in use?
 - What functionality has been explored and can be demonstrated?
- What is the best exchange format?
 - Common format between geospatial and AECOM?
 - Common semantics?
 - What roles does JSON play?
- What role does 3D GeoVolume API play? How to best allows access to 3D data in native formats (3D Tiles, I3S, CDB, glTF) or from the BIM perspective IFC (step part 42).

Chapter 5. Timeline

The following figure illustrates the tentative timeline. There are few constraints and timing can be adopted to sponsors' needs.



The Call for Sponsors remains open until September 30th, 2021. Afterwards, OGC will, together with the sponsoring organizations, develop the Call for Participation. This Call for Participation describes the exact requirements that shall be addressed in the pilot and will be launched publicly. Interested organizations are requested to submit their proposals by the mid November. Once all proposals are reviewed and the best organizations selected and under contract, we expect to organize a virtual kick-off meeting in late November. With the current planning, results will be presented at the OGC Member Meeting in March 2022 and made available afterwards. As said, this is a tentative timeline and can be adopted to sponsors' needs.

Chapter 6. Call to Action

If you are interested in joining this exciting opportunity to enhance interoperability and integration potential between building information and geospatial models, either as sponsors or supporters, please contact the OGC Innovation Program via the [OGC Innovation Program contact form](#). **Response period ends September 30st, 2021.** To download a PDF copy of this Call for Sponsors, please [click here](#).

You can join the initiative in various roles. This Call for Sponsors explicitly seeks organizations that can make funding available that will be used to offset costs for participants. In return, these organizations, called sponsors, can bring in their own requirements and interoperability challenges. Sponsors enter into a sponsoring agreement with the OGC. The agreement defines requirements, work items, deliverables, and budget. Together with the OGC team, sponsors develop the Call for Participation, which seeks organizations that carry out the actual work, i.e., address the requirements and work items defined by the sponsors.

If you are interested in providing data or other non-monetary support, but do not want to actively participate in the initiative, please get in contact using the form identified above.

If your organization is interested in participating actively in this initiative, either with or without cost-share requests, please wait for the Call for Participation being released. The release is currently planned for October/November 2021.