BIMERR
RENOVATION 4.0

Project Acronym:	**BIMERR**
Project Full Title:	**BIM-based holistic tools for Energy-driven Renovation of existing Residences**
Grant Agreement:	**820621**
Project Duration:	**42 months**

DELIVERABLE D4.8
Integrated BIMERR Interoperability Framework 1

Deliverable Status:	**Draft**
File Name:	**BIMERR_D4.8-v1.2**
Due Date:	**30/06/2020 (M18)**
Submission Date:	**30/06/2020 (M18)** **06/10/2020 (revised version)**
Task Leader:	**UBITECH (T4.5 & T4.6)**

Dissemination level	
Public	x
~~Confidential, only for members of the Consortium (including the Commission Services)~~	

This project has received funding from the European Union's Horizon 2020 Research and innovation programme under Grant Agreement n°820621

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REVISION CONTROL

Version	Author	Date	Status
0.10	UBITECH	22/05/2020	Draft ToC
0.50	UBITECH	19/06/2020	Draft Sections 1, 3, 6, 4
0.60	SUITE5	28/06/2020	Draft Sections 2, 5
0.70	UBITECH	29/06/2020	Draft version to be circulated for Internal Quality Check
0.80	XYLEM	30/06/2020	Final Draft reviewed
1.00	UBITECH	30/06/2020	Submission to the EC
1.20	UBITECH	6/10/2020	Revised version incorporating comments from the mid-term review

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ACRONYMS

Acronym	Meaning
API	Application Programming interface
BIF	BIMERR Interoperability Framework
BIMERR	BIM-based holistic tools for Energy-driven Renovation of existing Residences
DoA	Description of Action
BISP	Business Information Secure Provisioning
BIQB	Business Information Query Builder
BSM	Building Semantic Modeling
BICE	Building Information Collection & Enrichment

EXECUTIVE SUMMARY

The current deliverable D4.8 “Integrated BIMERR Interoperability Framework 1” aims at presenting, on the one hand, an overview of the Integrated BIMERR Interoperability Framework in terms of the interaction and communication of the several subcomponents which compose its overall architecture with reference to both D4.4 BIMERR Building Semantic Modelling tool 1 and D4.6 BIMERR Information Collection & Enrichment Tool 1, and on the other hand, to elaborate on both the Building Information Secure Provisioning Tools and the Building Information Query Builder based on their current status until M18. Having said that, in the context of the Building Information Secure Provisioning (BISP) component, an Attribute-Based Access Control mechanism (ABAC) mechanism is developed, which will supply the data consumers with the requested data to the supported format. Additionally, BISP will apply the relevant access policies based on the predefined strategies for the data that will have been stored into the BIF. At the same time, in the frame of the Building Information Query Builder (BIQB), a query builder mechanism is implemented in order to facilitate searching, acquiring and requesting via an API the building data of interest for an application through the BIMERR Interoperability Framework.

Towards the accomplishment of the aforementioned goals, both components are composed of seven subcomponents in total. On the one hand, the Business Information Secure Provisioning component consists of four subcomponents namely the Access Policy Manager, the Policy Enforcement Business Logic, the Access Request Transformation Handler and the Attributes Handler. And on the other hand, the Building Information Query Builder contains three subcomponents namely the Data Query Builder, the Model Query Builder and the Query handler. All these subcomponents have been developed by relying on several state-of-the-art technologies, which ensure the proper delivery of their core functionalities.

Moreover, all these subcomponents constitute the backbone of the BISP and BIQB components and their functionalities, which will be described in the present document according to their current status. More specifically, the technology stack of the components will be documented, along with their installation instructions, the APIs that have been exposed through these components and the end-to-end usage walkthroughs they offer to their users. In their initial releases, both the Building Information Secure Provisioning component and the Building Information Query Builder are not anticipated to fully implement all the envisaged functionalities, but depends on certain assumptions, imposes a set of restrictions, and requires a more effective integration with the different components within the BIF.

The final iteration of the Integrated BIMERR Interoperability Framework that is planned to be released on M30 according to DoA[1], will focus on enhancing the end-to-end user experience based on the

feedback acquired during the first implementation phase of the Integrated BIMERR Interoperability Framework, which is composed of the respective components and their interaction, the BIMERR applications development and the experimentation in the pre-validation sites, while introducing a set of already planned extensions and new functionalities.

1. INTRODUCTION

1.1 Scope and Objectives of the Deliverable

The current deliverable constitutes a demonstrator aiming at documenting the technical activities undertaken within the context of both T4.5 Building Information Secure Provisioning Tool Creation and T4.6 Building Information Query Builder Creation, along with the specification of the main integration points in terms of the Integrated BIMERR Interoperability Framework. These integration points, which will be described in the present document, will provide a coherent overview of the integrated BIF, by highlighting the interaction among several BIF components and especially emphasizing in how both Building Information Secure Provisioning component and Building Information Query Builder contribute to the main objective of BIF, which is to ensure semantic interoperability in the context of the BIMEER project. Based upon this principle, the Building Information Secure Provisioning allows the data providers to define access policies on their data that are stored in the BIF and will be requested from the BIF by other BIMERR applications, while the Building Information Query Builder exposes a query mechanism, with which the data consumers will be able to construct the proper search query and acquire only the data that their application needs from the BIF. In order for these requirements to be fulfilled, the involved partners of both aforementioned tasks provided their input in terms of the data and data models that will be exchanged.

Taking into account the aforementioned statements with regard to BIF components and the integration part, the main objective of D4.8 is to provide a comprehensive documentation of the integrated BIF, by highlighting the key technical aspects of both BISP and BIQB and their interaction with the other components of BIF, in compliance with both the requirements and BIMERR architecture. More specifically, D4.8 presents the functionalities of both BISP and BIQB components in terms of the integration plan with BIF by providing a comprehensive technical analysis, which covers the actual software that has been developed and delivered. Having said that, the key points of the aforementioned approach of the technical description can be summarized by:

- The description of the key integration points among the components of BIF.
- The technical analysis of the functionalities of both BISP and BIQB.
- The specification of the technology stack upon which both BISP and BIQB are based.
- The documentation of the Application Programming Interfaces (APIs), i.e. endpoints which will enable the required communications and information exchanges between the different subcomponents and / or within the BIF.

- The declaration of any assumptions and restrictions considered during the 1st release of both BISP and BIQB.
- The installation instructions, so that both components can be deployed.
- The description of a usage walkthrough through a set of step-by-step screenshots to explain in detail each component's intended use.
- The identification of the accompanying licensing of each subcomponent.

Due to the fact that both BISP and BIQB components follow an agile methodology in terms of development, the outcomes of the current deliverable, which document the current state of the components until M18 and their first implementation phase, will be complemented by their second release, which is planned to be released at M30. The second and final release will comprise of enhanced functionalities by incorporating all the intended features in compliance with the BIMERR DoA, by taking into account the updated outcomes of the design, specification and activities performed in WP4, as well as the feedback that will be continuously collected during the pre-validation activities of WP8.

1.2 RELATION TO OTHER TASKS/DELIVERABLES

The BIMERR Deliverable D4.8 documents the technical activities undertaken in the frame of both Task T4.5 “Building Information Secure Provisioning Tool” and T4.6 “Building Information Query Builder”. The main objective of this document is to provide a coherent version in terms of technical implementation for both BISP and BIQB components, by taking under consideration the input from the following BIMERR deliverables:

- D3.1 “Stakeholder requirements for the BIMERR system”[2], where the key BIMERR stakeholders and their requirements are documented, along with a thorough description of the business scenarios, use cases and system requirements tailored to the project's goals, setting the skeleton for the BIMERR framework.
- D3.5 “BIMERR system architecture”[3] 1st version, where the first version of the BIMERR architecture is provided, outlining the interaction of the BIF components, along with the technical description of both the BISP and BIQB components and their corresponding functionalities and integration.
- D4.4 “Building Semantic Modelling Tool 1”[4] that is utilized for the input in terms of the development of the Building Information Query Builder component ensuring consistency between the interfaces displaying the BIMERR data models among the respective components.
- D4.6 “BIMERR Information Collection & Enrichment Tool 1”[5] (BICE) that is utilized for the design of BISP, which will lead to the efficient and secure export of data to the appropriate BIMERR

applications and stakeholders in accordance with the applicable data access policies that their provider has defined. Moreover, BICE will be the basis on which the Building Information Query Builder will be built in order to search for building-related data (based on their metadata and/or actual data).

In addition, D4.8 will offer a better understanding on the data provisioning alternatives of building-related data to the BIF, to all BIMERR applications that are delivered in WP5 "As-is Building Information Extraction & Model Population Tools", WP6 "Process Management Tools & End-User Apps for On-site Stakeholders" and WP7 "Renovation Decision Support System". Such applications are also expected to provide feedback and lessons learnt from the real-life application of the BIF as a whole towards the delivery of its final release. Finally, D4.8 and the BIF (including BISP and BIQB) are naturally part of the system level software integration and pre-validation activities performed in WP8 and thereafter in the validation and evaluation activities of WP9.

1.3 STRUCTURE OF THE DOCUMENT

In order to address all the aspects relevant to the scope of D4.8, the present deliverable has been structured as follows:

- Section 1 introduces the work performed and the scope of this deliverable along with its relevance to other BIMERR tasks and the deliverable's structure.
- Section 2 provides an overview of the BIMERR Interoperability Framework by highlighting the main integration points of both Building Information Secure Provisioning and Building Information Query Builder in terms of their engagement into the integrated BIF. Furthermore, the overall of the Building Interoperability Framework (BIF) is described.
- Sections 3 and 4 provide a comprehensive documentation of both the Building Information Secure Provisioning and Building Information Query Builder components, which relies on their main functionalities and what these components are expected to support from the technical point of view.
- Section 5 offers an end-to-end usage walkthrough through step-by-step instructions accompanied by appropriate screenshots to explain in detail each component's intended use.In Section 6, conclusions are provided along with the release plan for the second and final iteration of the Integrated BIMERR Interoperability Framework.

2. BIMERR Interoperability Framework

2.1 Overview

The scope of Integrated BIMERR Interoperability framework is to ensure the interoperability for the building-related data that will be exchanged among the BIMERR applications in the context of the project, effectively providing a semantic interoperability layer.

The BIMERR Interoperability framework consists of four subcomponents, namely the Building Semantic Modeling component (BSM), the Building Information Collection & Enrichment component (BICE), the Building Information Query Builder component (BIQB) and the Building Information Secure Provisioning component (BISP). Due to the fact that both the BSM and BICE components have already been documented in D4.4 and D4.6 respectively, the focus in terms of the architecture in this deliverable mainly lies on the documentation of the Building Information Query Builder and the Building Information Secure Provisioning components.

In brief, as also presented in the Deliverable D3.5 (and depicted in Figure 2-1), the Building Information Secure Provisioning tool consists of four subcomponents that can be summarized as follows:

- The **Access Policy Management**, which on the one hand validates an access request against the specified access policies through its API, and on the other hand facilitates the definition and the management of the policies for a specific dataset through a user interface.
- The **Policy Enforcement Business Logic**, which is responsible for handling several access requests and in return provides the response based on the predefined access policies.
- The **Access Request Transformation Handler**, which prepares any incoming access request to the internal format. Subsequently, the reconstructed request, extended by additional attributes, is manipulated in such a way so that the relevant access policies rules are validated.
- The **Attributes Handler**, which collects the requested additional attributes which are needed in order to validate an access policy. These attributes include the attributes of the subjects, resource, action, environment and heavily depend on the available data, as well as the complexity of the defined access policy. Indicatively, the subject can be represented by a user, a resource by a dataset and an action by the privileges that have been granted for the user with regard to the uploaded dataset.

In the same philosophy, in accordance with D3.5, the three subcomponents that compose the Building Information Query Builder are:

- The **Data Query Builder**, which provides the user with the capability to define the search parameters, which conform to the actual data query.
- The **Model Query Builder**, which provides the users with the capability to define the data model parameters that they need to retrieve, which imply a data model query.
- The **Query Handler**: which transforms and manipulated the different parts that constitute a query, which is sent to the Building Information Secure Provisioning component to check the applicable access policies and to the Data Handler (of BICE) to handle the data acquisition.

2.2 ARCHITECTURE

The architecture that the Building Information Secure Provisioning tool has been built upon, is in accordance with what was presented in the BIMERR Architecture and D3.5. The components that compose its architecture are those which are specified in Section 2.1 and are illustrated in Figure 2-1.

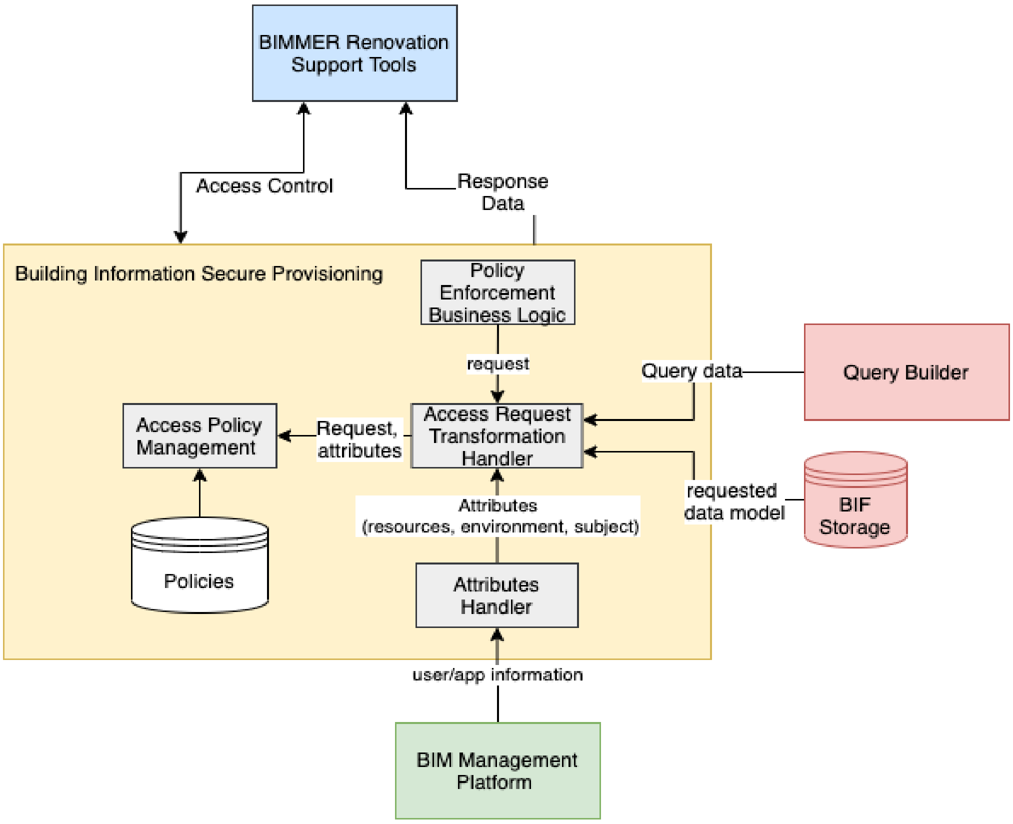


Figure 2-1: Architecture of the Building Information Secure Provisioning

The Building Information Secure Provisioning component is responsible not only for the definition of the access policies by the data provider that uploads a dataset to BIF, but also for handling the requests for data in BIF from the different data consumers (i.e. BIMERR applications), providing them with access based on the defined policies. Towards this direction, the user interface of the *Access Policy Management* displays the available attributes and data that will be used in the frame of the definition of the access policies. In order to retrieve the attributes, the *Access Policy Management* performs a request to the *Access Request Transformation Handle*r, which transforms all the necessary information that has been gathered by the *Attributes handler* from the BIMMER Platform. As soon as the access policies have been defined for a dataset and a user constructs a query through the Building Information Query Builder, the Query Builder passes the necessary parameters to the *Access Request Transformation Handler* and subsequently the *Policy Enforcement Business Logic* performs a request to get all the necessary info and by taking under consideration the defined access policies that have been retrieved by the *Access Policy Management*, BISP returns the proper response.

The architecture of Building Information Query Builder is depicted in the Figure 2-2.

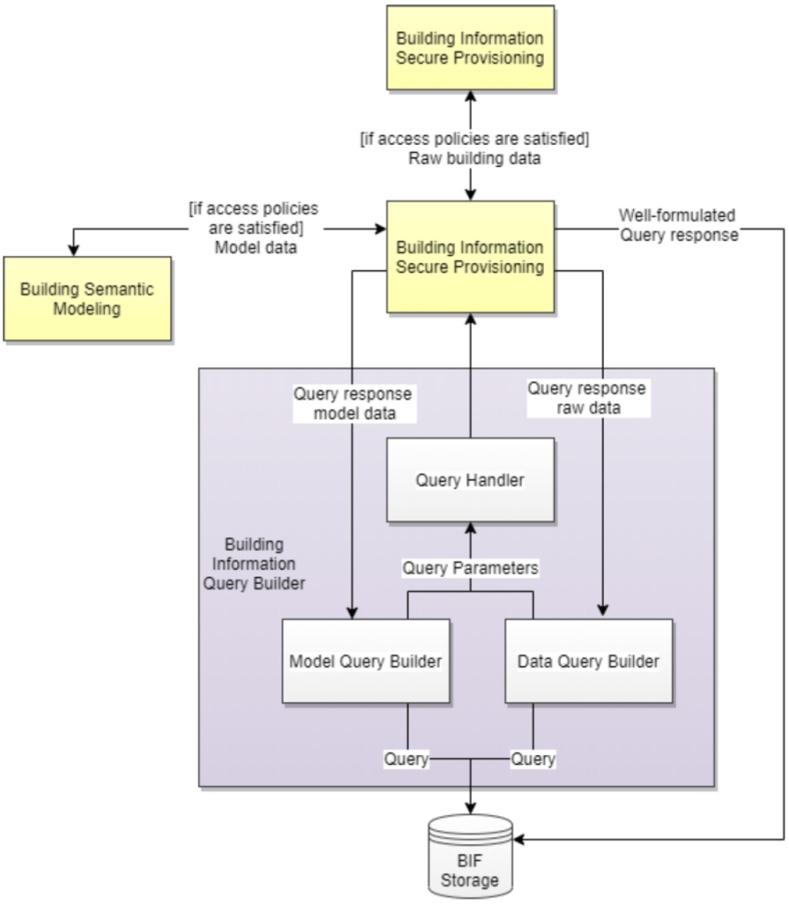

Building Information Secure Provisioning
[if access policies are satisfied] Raw building data
[if access policies are satisfied] Model data
Building Semantic Modeling
Building Information Secure Provisioning
Well-formulated Query response
Query response model data
Query response raw data
Query Handler
Building Information Query Builder
Query Parameters
Model Query Builder
Data Query Builder
Query
Query
BIF Storage

Figure 2-2: Architecture of the Building Information Query Builder

The Building Information Query Builder practically offers different options to the application developers acting as BIF data consumers to find the data their application needs and acquire them via the BIF API (that BIQB effectively exposes and whose access manages through appropriate security mechanisms). A search query is defined over the metadata with the help of the *Data Query Builder* or the asset's data model with the help of the *Model Query Builder*. The search queries are resolved by the *Query Handler* that resolves the query with the help of BISP and returns as results the data assets which a user is authorized to access. Through the combined functionalities of the *Data Query Builder* and the *Query Handler,* the user is then able to save a query, configure its results and acquire them directly from the BIF APIs while at the same time, in the background, BISP enforces the necessary access policies and BICE appropriately prepares the requested data.

2.3 INTEGRATED INTEROPERABILITY FRAMEWORK

The BIMERR Interoperability Framework consists of a number of components implemented with different technologies, addressing different functionalities as documented in the BIMERR Deliverables D4.4, D4.6 and D4.8. To this end, the proper integration of these components was number one priority from the very early stages of the BIF development activities. The integration activities have been performed with the help of REST and GraphQL endpoints, as well as through the messaging functionality (that is mostly part of BICE).

The first version of the BIMERR Building Information Framework (BIF) is deployed at: https://bimerr.s5labs.eu/ - note: registration is restricted.

3. Building Information Query Builder

3.1 Overview

The Building Information Query Builder (BIQB) is responsible for facilitating the underlying background data search operations to ensure the necessary building-related data are retrieved from the BIF in a secure and trustful manner. In BIF, data search typically entails efficiently retrieving data from the BIF data storage (i.e. the Data Storage & Indexing subcomponent of the Building Information Collection & Enrichment component) and granting access to the exact data an authorized application needs (considering the applicable access policies in BISP as described in Section 4). The BIQB locates the appropriate datasets, extracts the required data from the datasets according to the search parameters and filters (with the help of the BICE and BISP), and makes them available upon request to the BIMERR applications (that are authorized by BISP) through the BIF APIs.

In particular, the Building Information Query Builder offers the following functionalities:

- **Definition of search queries in a user-friendly way:** BIQB allows users (i.e. application providers) to define the search parameters based on metadata and on concepts of the BIMERR data models that should be present in the query results, through a faceted search functionality.
- **Definition of building data retrieval in a configurable manner:** BIQB allows users (i.e. application providers) to select the datasets they wish to acquire (among the ones they are authorized to access, according to the data providers' access policies that are resolved in BISP), and to define which exact fields of the data they need, which fields also represent query parameters that they intend to use to filter the data and what API method they prefer to acquire the data from the BIF. The users view the unique, automatically created query identifier for future use/reference by the BIMERR applications and can quickly test it to check what results they retrieve from the BIF.
- **Direct access to query results for the authorized BIMERR applications**: BISQ allows the authorized applications to retrieve data through the BIF API by using the same API method they had selected in the query configuration, providing the query identifier and the selected query parameters. At any moment, an authorized BIMERR application requests for data, the applicable access policies are also resolved by BISP.
- **Persistence and reuse of search query configurations and retrieval configurations** in the BIF Storage & Indexing.
- **Management of API keys**: BISQ creates and manages API keys for the different BIMERR applications that have search scope and no expiry date (at the moment, for the project's purposes).

3.2 Technology Stack and Implementation Tools

The Building Information Query Builder builds on state-of-the art technologies across three layers:

- The Presentation Layer, containing the User Interface that is developed in VueJS and TailwindCSS.
- The Business Logic Layer, containing the different packages of the Backend that are based on the NodeJS web framework, ExpressJS.
- The Data Access Layer that essentially refers to the BIF Storage and Indexing that has been set up in the Building Information Collection & Enrichment component and utilizes PostgreSQL, ElasticSearch, MinIO and PostgresSQL, for the BIQB needs.

The different layers along with their related technologies are depicted in the Figure 3-1.

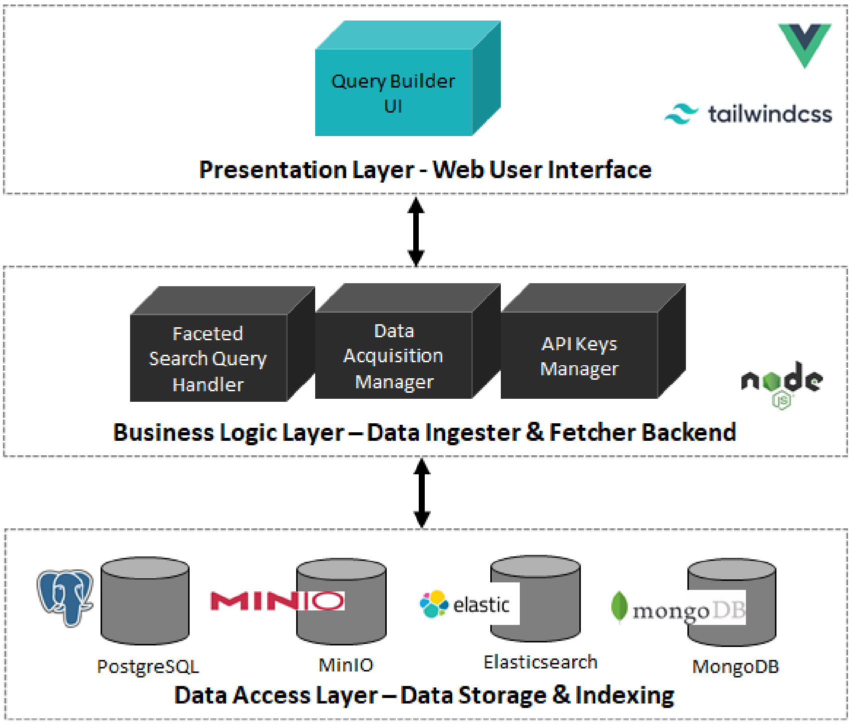

Query Builder UI
tailwindcss
Presentation Layer - Web User Interface
Faceted Search Query Handler
Data Acquisition Manager
API Keys Manager
node
Business Logic Layer – Data Ingester & Fetcher Backend
MINIO
elastic
mongoDB
PostgreSQL
MinIO
Elasticsearch
MongoDB
Data Access Layer – Data Storage & Indexing

Figure 3-1: Architecture of the BIMERR Building Information Query Builder Component

The BIQB is written in TypeScript and utilizes the open source technologies defined in Table 3-1.

Table 3-1: Technologies and libraries used in the Building Information Query Builder Component, along with their licenses

Name of the Library	Version	License
NodeJS	12	MIT
Express.js	4.16.1	MIT
Sequelize	5.21.10	MIT
PostgreSQL	12.2	PostgreSQL License (similar to BSD/MIT)
MongoDB	4.4	Apache License 2.0
MinIO	-	Apache License 2.0
Elasticsearch	7.6.0	Elastic License
Vue.js	2.6.11	MIT
TailwindCSS	-	MIT
Pandas	1.0.3	BSD 3-Clause

3.3 API Documentation

The services of the Building Information Query Builder component communicate with the other BIF components and services through its internal REST API controller, consuming the data that are needed in order to function properly, and shall be documented in detail in the final BIQB release in D4.9. Furthermore, the communication between the front-end and back-end of the Building Information Query Builder is typically through internal APIs, yet they serve inter-subcomponent integration purposes and are not documented at this point in detail.

3.4 Assumptions and Restrictions

The Building Information Query Builder has a number of assumptions and restrictions which are presented below:

- Data search is currently performed over the metadata and the data structure / model of the building data that have been ingested as a dataset in BICE. However, provisions have been made to easily search for specific building renovation-related information, such as specific buildings, spaces, zones or projects.
- The data are retrieved from the BIQB in the JSON format except for data that have been ingested in BIF as objects and range from images to IFC files. Such a restriction is imposed by the fact that the Data Handler in BICE transforms all data that have been ingested to the JSON format prior to their further manipulation and storage.

- It is possible to select multiple datasets from which to simultaneously retrieve data but currently such a multiple selection is restricted to three datasets. With the help of the BIMERR data models and the dataset's mapping to them, the results are automatically merged (based on their common fields) and returned to the requesting application. More advanced linking, control and error handling over the linking of the different datasets will be provided to the users during the configuration stage, in the final BIQB release.
- API pagination for data retrieval is partially supported when the results concern only one dataset. In case of multiple datasets, API pagination is not supported yet, but the users get a limited set of the results.
- The datetime data that are retrieved from the BIF follow the UTC timezone and there is no option to request and retrieve building data in other timezones.

3.5 Installation Instructions

The Building Information Query Builder User Interface is served as a web application and does not require the installation of any component by the user. Detailed instructions for the Building Information Query Builder deployment are provided in the related private code repository and all subcomponents are already packaged as Docker containers to speed up the process.

3.6 Licensing

The Building Information Query Builder is a closed source component.

4. Building Information Secure Provisioning Component

4.1 Overview

The Building Information Secure Provisioning component aims at providing protection, confidentiality and integrity for data and data models that have been stored in BIMERR platform and requested by potential data consumers through BIF. To this end, BISP relies on an Attribute-Based Access Control (ABAC) mechanism, which allows the data providers to protect and share their data sets, by utilizing dynamic enforcement of attributes in policies, even when they do not have any prior knowledge of the potential individual data consumers in the system. Additionally, the BISP component handles the requests that are intended to be performed against the data or data models stored in BIMERR by a specific actor.

Taking into account the introductory statements of the current section, the core functionalities of the Building Information Secure Provisioning component can be summarized as follows:

- **Definition of access policies**: As soon as a data provider uploads a dataset on BIF, the Business Information Secure Provisioning component allows a user to define the relevant access policy by providing a User Interface, which collects the necessary data for the formulation of those expressions that will represent this access policy.
- **Enforcement of access policies**: The user-defined access policies will have to be transformed in such a way, so that they can be taken under consideration during some specific access requests. Due to this end, the business logic layer is utilized, in order for the access policies to be stored into BISP local database in the proper format, which subsequently will be used for the access control of several data requests.
- **Immediate access control decision**: Once the access policies are defined for the specific dataset and these policies have been transformed in the proper format, the BISP is ready to handle any request against the data set for which access policies have been defined. In order to do so, the BISP will retrieve the necessary information from both the Identity Provider and BIF by consuming, their available APIs and subsequently, as soon as this information has been processed, the proper response will be returned to the data consumer.

4.2 Technology Stack and Implementation Tools

The Building Information Secure Provisioning component has been built on state-of-the-art technologies across 3 layers:

- The Presentation Layer, containing the Access Policy Manager that is developed in Vue.js;
- The Business Logic Layer, containing the different packages of the Model Lifecycle Access Policy Backend that are based on NodeJS with express.js and Sequelize;
- The Data Access Layer that essentially refers to the BIF Storage & Indexing and utilizes PostgreSQL, for the model lifecycle access policy needs.

Such layers along with the different technologies are depicted in the Figure 4-1.

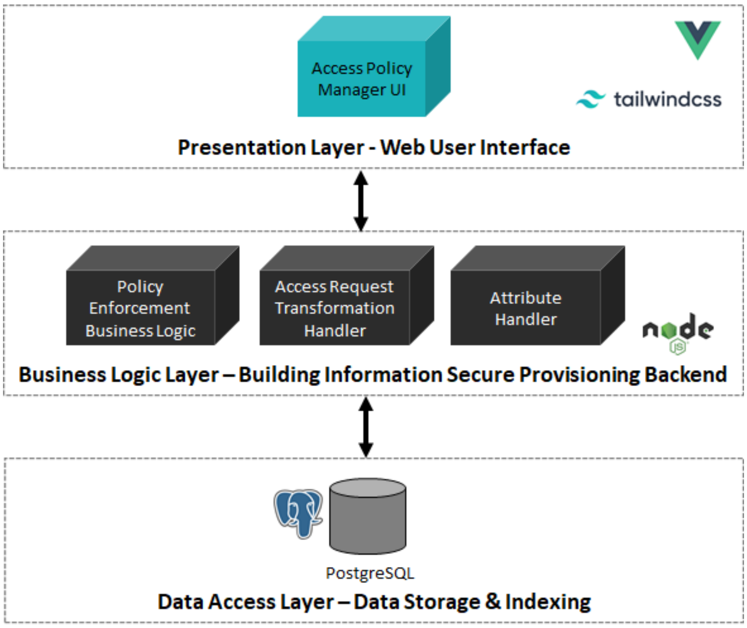

Access Policy Manager UI
tailwindcss
Presentation Layer - Web User Interface
Policy Enforcement Business Logic
Access Request Transformation Handler
Attribute Handler
node
Business Logic Layer – Building Information Secure Provisioning Backend
PostgreSQL
Data Access Layer – Data Storage & Indexing

Figure 4-1: Architecture of the BIMERR Building Information Secure Provisioning Component

The Building Information Secure Provisioning component is written in Node.js and utilizes the following open source technologies as depicted in Table 4-1:

Table 4-1: Technologies and libraries used in the BISP, along with their licenses

Name of the Library	Version	License
NodeJS	12	MIT
Express.js	4.16.1	MIT
Sequelize	5.21.10	MIT
PostgreSQL	12.2	PostgreSQL License (similar to BSD/MIT)
Vue.js	2.6.11	MIT
Vue Query Builder	0.8.2	MIT

4.3 API Documentation

The services of the Building Information Secure Provisioning component communicate with the other components and services through its internal REST API controller, consuming the data that is needed to function properly. These endpoints, which constitute the main integration points with the other BIMERR components, have been documented from the perspective of the integration with BIQB and the BIMERR Identity Provider.

The first integration point presents the interaction between Building Information Secure Provisioning and Building Information Query Builder components. In this case, BIQB validates the user access for multiple datasets by performing a GET request against BISP. Subsequently, BISP receives as input the authenticated user's username and a list with the dataset IDs and returns as response the IDs of the datasets the user has access to. To this end, the details of the respective API call are presented in ANNEX II: INTEGRATION POINT TABLES (Table II-1).The second integration point presents the interaction between Building Information Secure Provisioning component and the Identity Provider, which has been developed for the authorization of the users. In this case, as soon as BISP performs a connection with the Identity Provider service by using the proper client, it executes a GET request to the API that is exposed by the Identity Provider and receives the information of its interest, such as lists of users, roles, groups and BIMERR applications. To this end, the details of a representative API call that collects the available users are presented in ANNEX II: INTEGRATION POINT TABLES (Table II-2).Furthermore, the communication between the front-end and back-end of the Building Information Secure Provisioning component is typically through internal APIs, yet they serve inter-subcomponent integration purposes and are not documented at this point in detail.

4.4 Assumptions and Restrictions

The Building Information Secure Provision component has a number of assumptions and restrictions which are presented below:

- The body of the REST API call request from all the BIMERR components must be in JSON format.
- The REST API responses from BISP will be in JSON format.
- The BISP tool applies a basic error handling strategy in the case that there is failure of any kind during the execution of an applicable access policy.
- Every dataset can have only one applicable access policy, which is composed of a set of rules.

- Due to the fact that the development of several BIMMER application is ongoing, the environmental attributes that will be used for the definition of the access policies have not been specified completely. Therefore, the BISP component takes into account the available attributes during the process of the definition of access policies.
- The potential users (BIF data providers and data consumers) of the BIMERR interoperability framework, as well as their datasets, can be registered to (or removed from) the BIF any time, requiring a dynamic mechanism of controlling data access and being agnostic to the underlying datasets respecting the relevant access policies of each party.
- The BISP must handle the access policies applied by each party and respond to any level of complexity they might have defined.

4.5 Installation Instructions

The Building Information Secure Provisioning tool is served as a microservice and does not require the installation of any component by the user. Although detailed instructions for the Building Information Secure Provisioning tool are provided in the related private code repo and all subcomponents are already dockerized to speed up the process, some indicative information with regard to the main installation parts are presented in the current section (as it is helpful for the WP8 integration activities).

Towards the direction of an easy and scalable deployment of this microservice, all its subcomponents have been included into a docker-compose file.

More specifically, the docker-compose file consists of:

- The PostgreSQL installation, which is the local database of this microservice.
- The server installation, which depends on the PostgreSQL installation. Due to this end, the database must have been deployed first.

As previously mentioned, the commands that have to be used in order for the BISP to be deployed, can be found in the related private code repo.

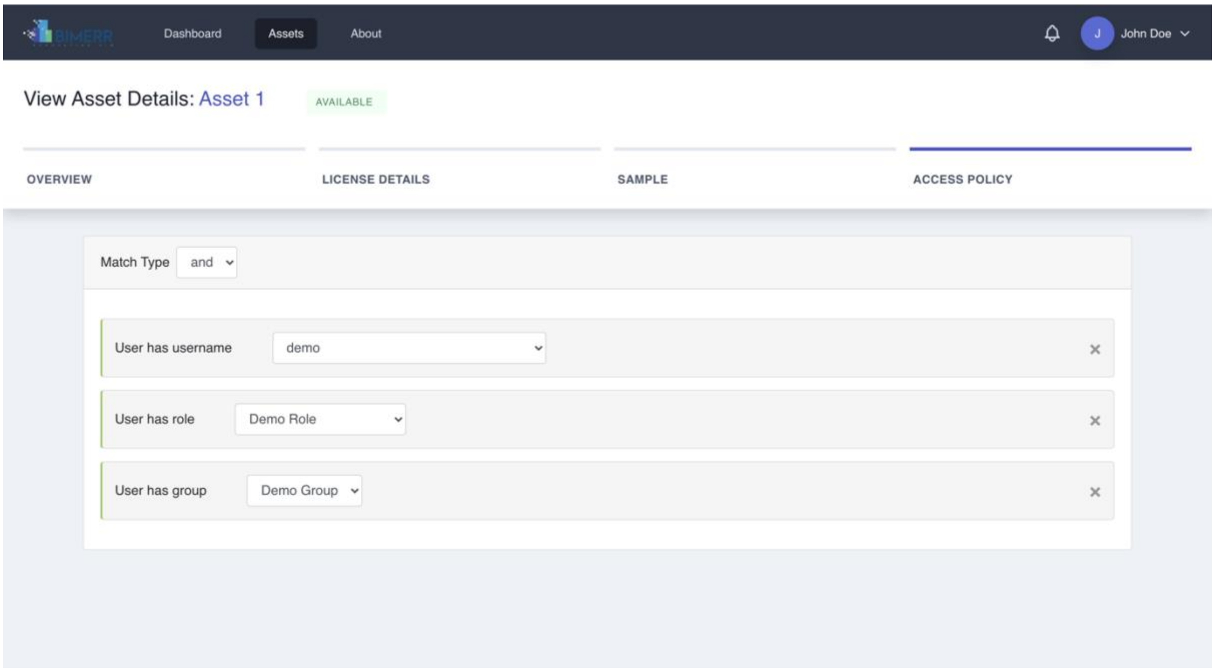
4.6 Licensing

The Building Information Secure Provisioning tool is a closed source component.

5. END-TO-END USAGE WALKTHROUGH TO THE BIMERR INTEROPERABILITY FRAMEWORK

5.1 CREATE ACCESS POLICY FOR A DATASET

As soon as the dataset has been uploaded (following the process defined in the BIMERR Deliverables D4.6 and D4.4), the users can view their data assets and define the access policies for a specific dataset (for which they view the metadata), as depicted in Figure 5-1. In order for the users to apply the access policies, the button “Add Rule” must be pressed and then the specific attributes will be displayed. From that point on, the attributes and the data that will compose the rules of the access policies will be available. For instance, in Figure 5-1, the users can select to apply policies for specific users, roles, groups and applications.



View Asset Details: Asset 1 AVAILABLE

Match Type: and

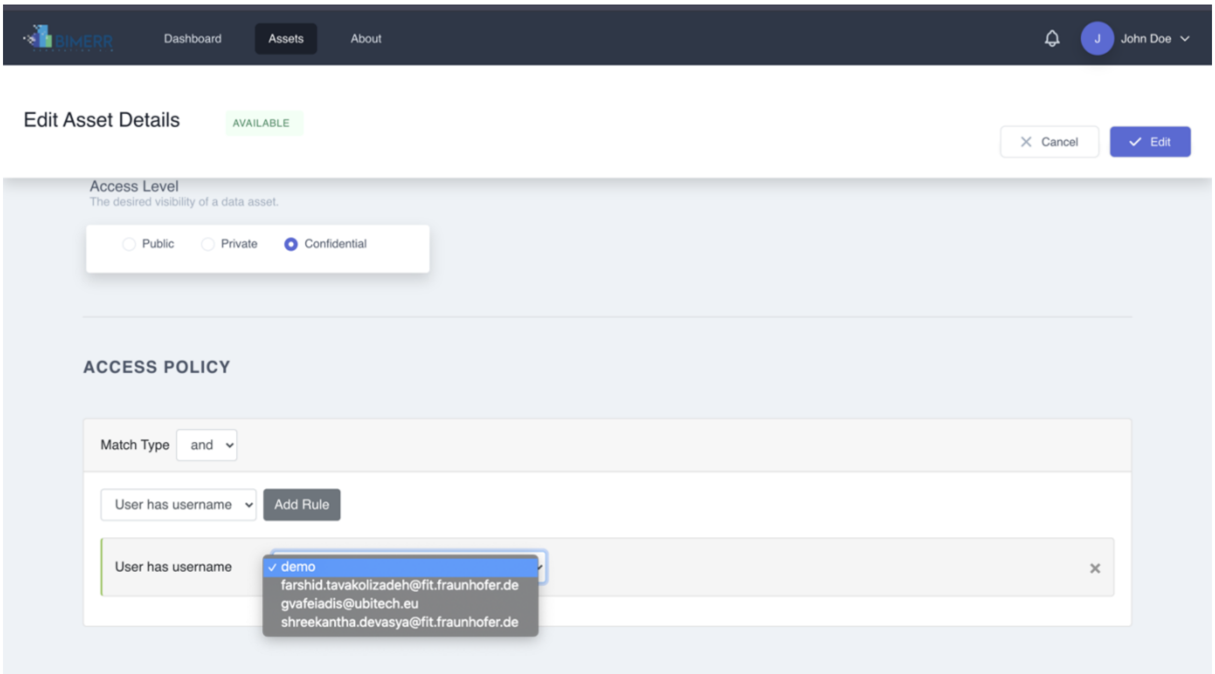
User has username: demo

User has role: Demo Role

User has group: Demo Group

Figure 5-1: Define an Access Policy in Asset’s Metadata

Furthermore, the access policies can be edited or canceled at any time as shown in both Figure 5-2 and Figure 5-3.



Edit Asset Details AVAILABLE

Access Level

The desired visibility of a data asset.

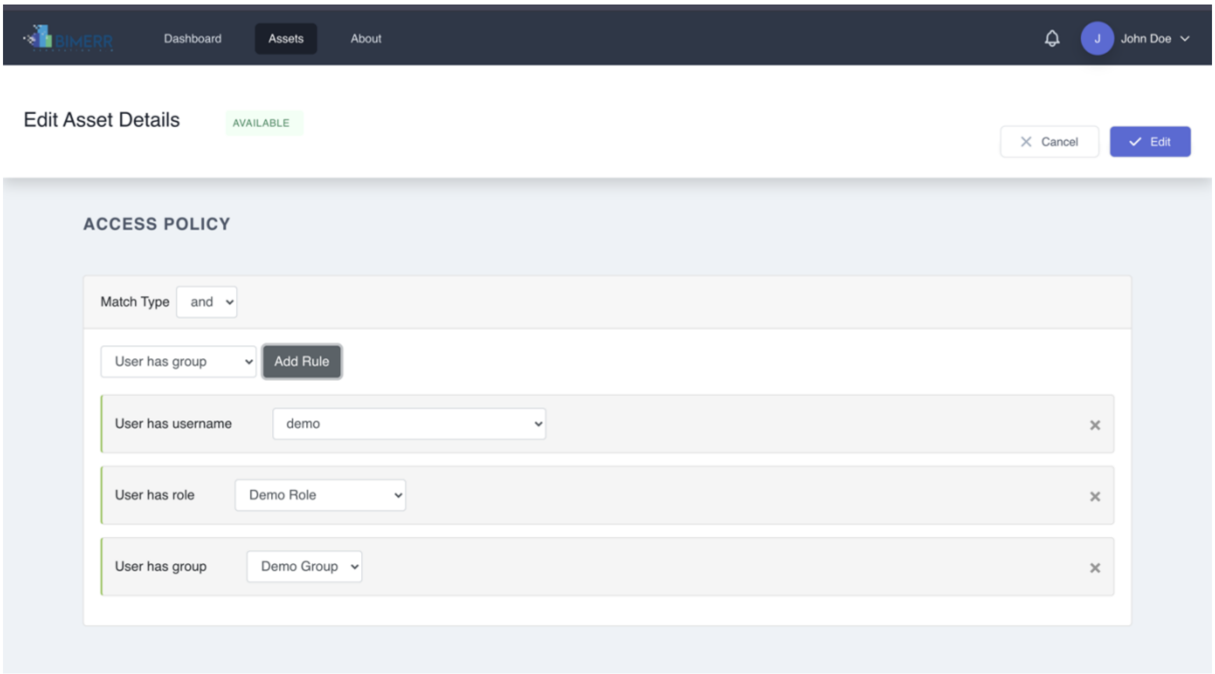
○ Public ○ Private ● Confidential

ACCESS POLICY

Match Type: and

User has username: demo

Figure 5-2: Edit User for Access Policy Definition - 1



Edit Asset Details AVAILABLE

ACCESS POLICY

Match Type: and

User has username: demo

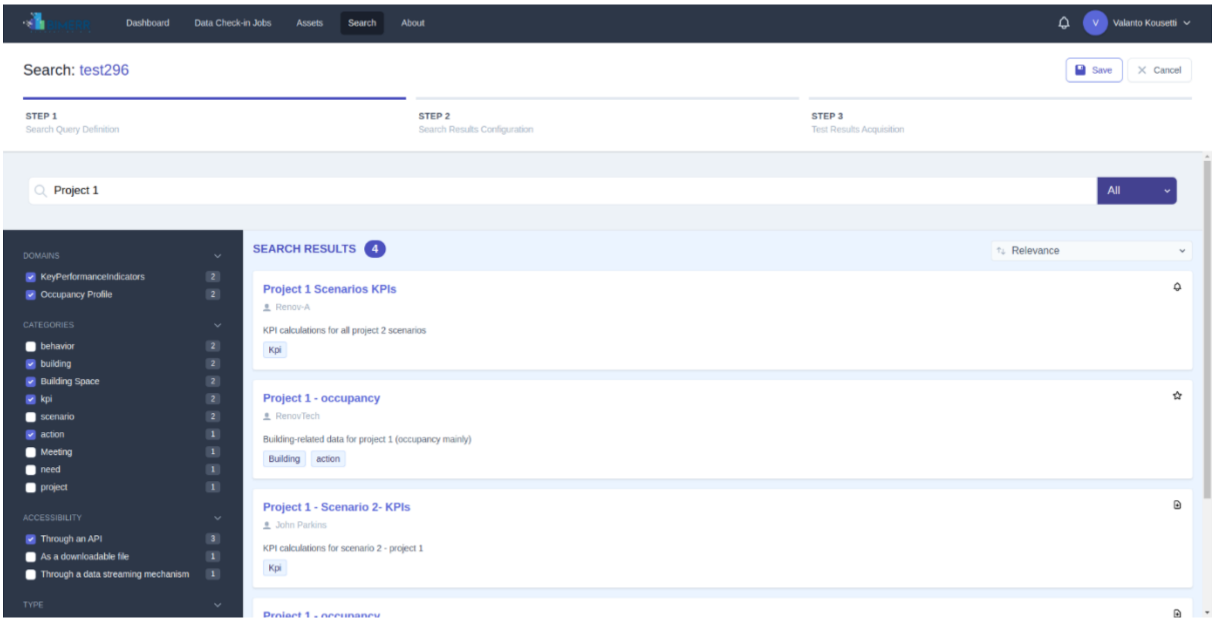
User has role: Demo Role

User has group: Demo Group

Figure 5-3: Edit User for Access Policy Definition - 2

5.2 SEARCH AND ACQUIRE BUILDING DATA

When the BIF users (that may represent developers of BIMERR-compliant applications) want to acquire data, they need to access the Building Information Query Builder (BIQB) interface that is available through the Search menu. As depicted in Figure 5-4, they are able to search for all data in the BIF or for the data associated with selected buildings, spaces, zones, projects, through a faceted search functionality. They are also able to search for data according to: (a) their data model by selecting a domain and the related fields they need to appear in the results, (b) specific metadata, e.g. categories, accessibility method, type, etc. They can view and filter only the search results they are authorized to access (with the access policies being resolved under the hood) and select the results which include the data they need. In the specific example depicted in Figure 5-4, the user simply includes a phrase like “Project 1” in the search box and selects the dataset named “Project 1 – occupancy” that contains the desired data. Note: the search results that appear are just indicative.



Search: test296

STEP 1
Search Query Definition

STEP 2
Search Results Configuration

STEP 3
Test Results Acquisition

Project 1

DOMAINS

- ☑ KeyPerformanceIndicators 2
- ☑ Occupancy Profile 2

CATEGORIES

- □ behavior 2
- ☑ building 2
- ☑ Building Space 2
- ☑ kpi 2
- □ scenario 2
- ☑ action 1
- □ Meeting 1
- □ need 1
- □ project 1

ACCESSIBILITY

- ☑ Through an API 3
- □ As a downloadable file 1
- □ Through a data streaming mechanism 1

TYPE

SEARCH RESULTS 4

Project 1 Scenarios KPIs
Renov-A
KPI calculations for all project 2 scenarios
Kpi

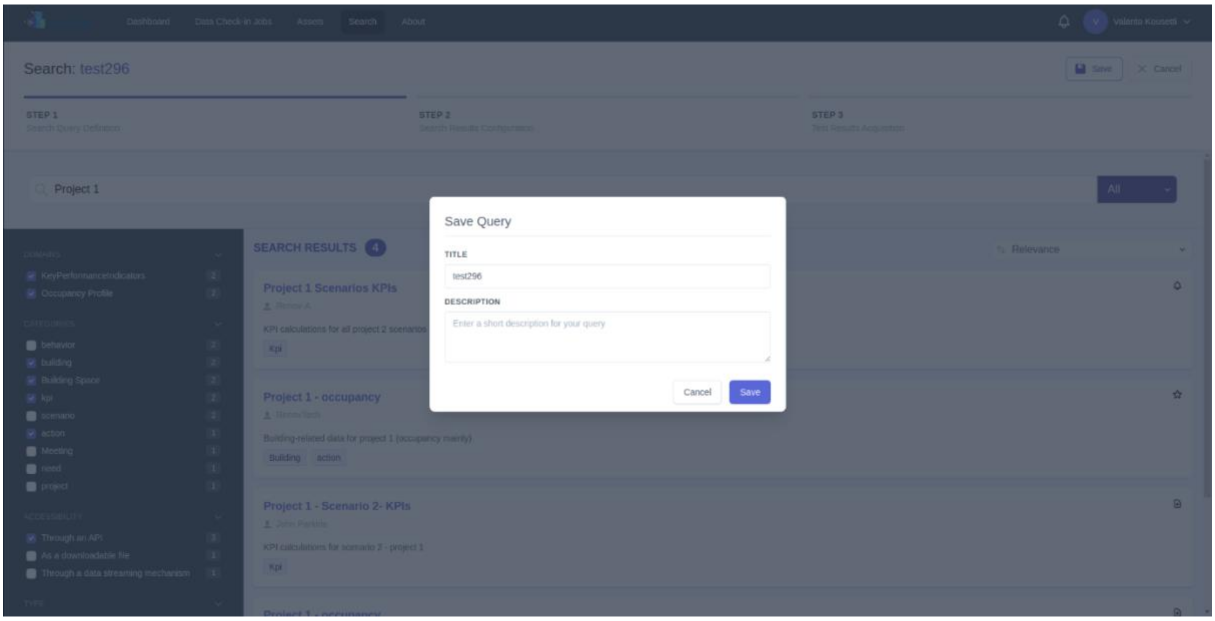
Project 1 - occupancy
RenovTech
Building-related data for project 1 (occupancy mainly)
Building action

Project 1 - Scenario 2- KPIs
John Parkins
KPI calculations for scenario 2 - project 1
Kpi

Project 1 - occupancy

Figure 5-4: Define Search Query

At any moment, the users can save the specific search query by providing a title and a description and they can view the unique query id in the URL.



Save Query

TITLE

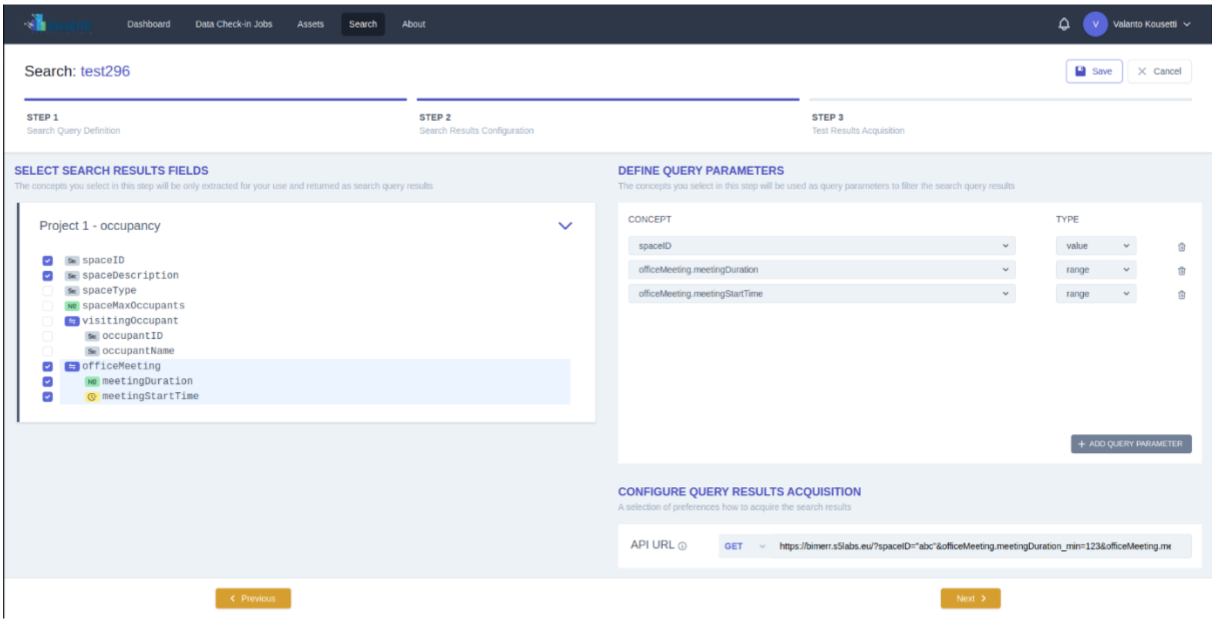
test296

DESCRIPTION

Enter a short description for your query

Figure 5-5: Save Search Query

Upon selecting the related search results from which the BIMERR application developers wish to acquire data (i.e. the dataset named "Project 1 – occupancy" in Figure 5-4), they need to select the exact fields they need from the ingested data (that comply with the BIMERR data models) and identify which of them will be used as query parameters in the API calls they will make to the BIF to acquire the specific data. For each query parameter, they need to select whether single values or a range (from-to values) will be provided. The users need to select the desired API method to retrieve such results as BIF supports both the GET method (as depicted in Figure 5-6) and the POST method (as depicted in Figure 5-7).



Search: test296

STEP 1
Search Query Definition

STEP 2
Search Results Configuration

STEP 3
Test Results Acquisition

SELECT SEARCH RESULTS FIELDS

The concepts you select in this step will be only extracted for your use and returned as search query results

Project 1 - occupancy

- ☑ spaceID
- ☑ spaceDescription
- □ spaceType
- □ spaceMaxOccupants
- □ visitingOccupant
  - □ occupantID
  - □ occupantName
- ☑ officeMeeting
  - ☑ meetingDuration
  - ☑ meetingStartTime

DEFINE QUERY PARAMETERS

The concepts you select in this step will be used as query parameters to filter the search query results

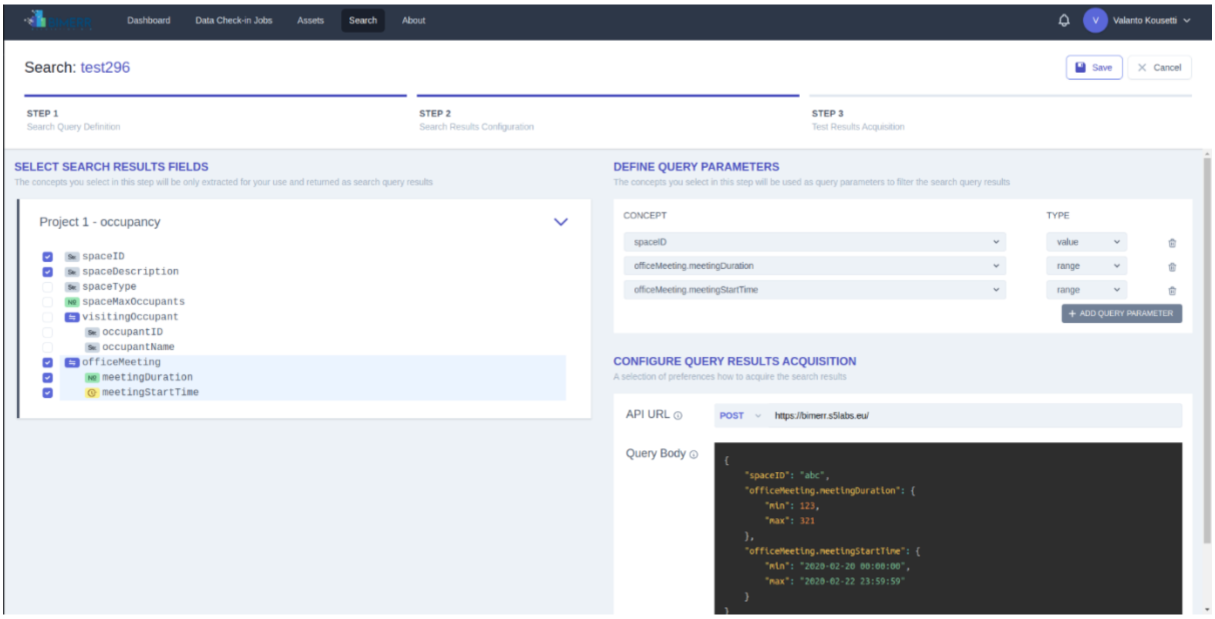
CONCEPT	TYPE
spaceID	value
officeMeeting.meetingDuration	range
officeMeeting.meetingStartTime	range

CONFIGURE QUERY RESULTS ACQUISITION

A selection of preferences how to acquire the search results

API URL: GET https://bimerr.s5labs.eu/?spaceID="abc"&officeMeeting.meetingDuration_min=123&officeMeeting.me

Figure 5-6: Acquire selected building data with a GET method



Search: test296

STEP 1
Search Query Definition

STEP 2
Search Results Configuration

STEP 3
Test Results Acquisition

SELECT SEARCH RESULTS FIELDS

The concepts you select in this step will be only extracted for your use and returned as search query results

Project 1 - occupancy

- ☑ spaceID
- ☑ spaceDescription
- □ spaceType
- □ spaceMaxOccupants
- □ visitingOccupant
  - □ occupantID
  - □ occupantName
- ☑ officeMeeting
  - ☑ meetingDuration
  - ☑ meetingStartTime

DEFINE QUERY PARAMETERS

The concepts you select in this step will be used as query parameters to filter the search query results

CONCEPT	TYPE
spaceID	value
officeMeeting.meetingDuration	range
officeMeeting.meetingStartTime	range

CONFIGURE QUERY RESULTS ACQUISITION

A selection of preferences how to acquire the search results

API URL: POST https://bimerr.s5labs.eu/

Query Body:

```
{
    "spaceID": "abc",
    "officeMeeting.meetingDuration": {
        "min": 123,
        "max": 321
    },
    "officeMeeting.meetingStartTime": {
        "min": "2020-02-20 00:00:00",
        "max": "2020-02-22 23:59:59"
    }
}
```

Figure 5-7: Acquire selected building data with a POST method

Finally, the users can test the BIF API with the unique query id and sample values in the query parameters that have been selected to check whether they retrieve the desired results. At any moment, they may update the query configuration.

6. CONCLUSIONS AND PLAN FOR FINAL RELEASE

The Integrated BIMERR Interoperability Framework consists of four subcomponents and in the frame of this deliverable, both the Building Information Secure Provisioning and the Building Information Query Builder have been documented. Both components play a fundamental role in the context of several aspects such as the accessibility of data that are available in BIF, how these data can be requested through complex queries and acquired via the BIF APIs, and how the access policies can effectively be defined for these data.

As documented in this deliverable (D4.8), the core functionalities of both Building Information Secure Provisioning and Building Information Query Builder have been developed as planned in terms of back-end processing requirements and front-end user experience. The initial versions of these components complement the BIF integration activities towards its first release.

Taking into consideration the BIF evaluation and feedback by the BIMERR applications and the pre-validation sites, the final release of both Building Information Secure Provisioning and Building Information Query Builder will be designed and developed in M30. To this end, the following features have been planned for the final release of both components:

- Building Information Secure Provisioning – Final release:
  - Support access policies of any complexity level by incorporating more attributes.
  - Expose APIs for BIMERR applications to facilitate the resolution of access policies in terms of services and not only from user's perspective.
- Building Information Query Builder – Final release:
  - Increased expressivity of queries to embrace more metadata that are relevant to the AEC stakeholders depending on the final BIMERR ontologies and data models that will be documented in D4.3.
  - Improvements in search performance and configuration depending on the actual data exchanged once the BIMERR applications are in place.
  - Advanced linking, control and error handling over the linking of the different datasets.
  - Support for API pagination of results coming from multiple datasets, not just a single dataset.

ANNEX I: BIBLIOGRAPHY

[1] BIMERR (2018) Description of Action (DoA)

[2] BIMERR (2019) D3.1 - Stakeholder requirements for the BIMERR system

[3] BIMERR (2020) D3.5 - BIMERR system architecture 1st version

[4] BIMERR (2020) D4.4 - BIMERR Building Semantic Modelling tool 1

[5] BIMERR (2020) D4.6 - BIMERR Information Collection & Enrichment Tool 1

ANNEX II: INTEGRATION POINT TABLES

Table II-1: API Documentation for BISP and BIQB Integration

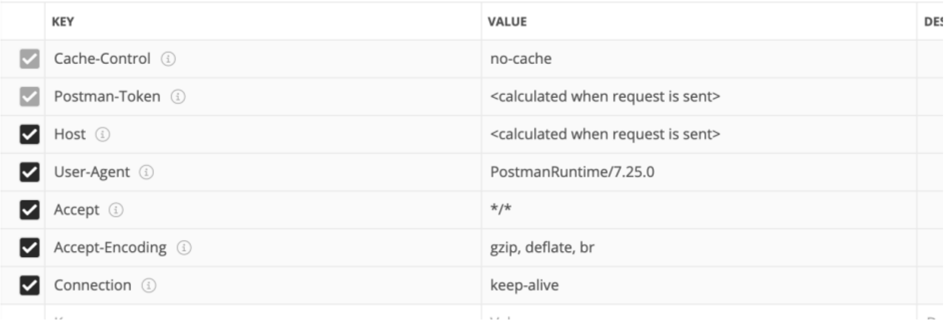
REST endpoint	localhost:3000/user-access/datasets/?username={username}&datasets=[1,2,3,4,5]
Method	GET
Request headers	 KEY VALUE DE ☑ Cache-Control no-cache ☑ Postman-Token <calculated when request is sent> ☑ Host <calculated when request is sent> ☑ User-Agent PostmanRuntime/7.25.0 ☑ Accept */* ☑ Accept-Encoding gzip, deflate, br ☑ Connection keep-alive
Response headers	Server: nginx/1.14.0 (Ubuntu) Date: Thu, 11 June 2020 13:03:20 GMT Content-Type: application/json; charset=utf-8 Content-Length: 5 Connection: keep-alive Vary: Origin X-Powered-By: Express Access-Control-Allow-Credentials: true
Response body	[1,2]

Table II-2: API Documentation for BISP and Identity Provider Documentation

REST endpoint	https://auth.fit.fraunhofer.de/kc/admin/realms/bimerr/users/
Method	GET

Request headers	headers: {
	'Authorization': 'Bearer + authorization token',
	}

Response headers	Server: nginx/1.17.1 (Ubuntu) Date: Thu, 18 June 2020 8:25:30 GMT Content-Type: application/json; charset=utf-8 Content-Length: 1807 Connection: keep-alive Vary: Origin X-Powered-By: Express Access-Control-Allow-Credentials: true

Response body	[{
	"id": "9f053f7e-4b99-43b3-b28d-32f31a6fc6e6",
	"createdTimestamp": 1589290417657,
	"username": "demo",
	"enabled": true,
	"totp": false,
	"emailVerified": true,
	"firstName": "John",
	"lastName": "Doe",
	"email": "demo@bimerr.eu",
	"attributes": {
	"description": [
	"This user is just for demo purposes"
	]
	},
	"disableableCredentialTypes": [
	"password"
	],
	"requiredActions": [],
	"notBefore": 0,
	"access": {
	"manageGroupMembership": false,
	"view": true,
	"mapRoles": false,
	"impersonate": false,
	"manage": false
	}
	}