WP5
Reference Architecture Framework

Nicolas Naville
CSTB
WP5: Snapshot

Objectives

- Define the high level specifications of DigiPLACE
- Propose a Reference Architecture Framework for digital construction platforms in Europe

Purpose

- Define and share a common vision of how digitalization is expected to transform the construction sector
- Make sure that a proper framework is set up to support this vision based on agreed principles

Tangible Outcomes

- Selection of 35 key use cases of digital platforms, from a discussion among partners and stakeholders
- Definition of high level specifications for the RAF
- WIP: definition of the RAF scenarios, SWOT analysis
WP5: Tasks and Deliverables

**Tasks**

- **T5.1 (M6-M13):** Use case analysis and high-level specifications (lead: PoliMi)
- **T5.2 (M9-M16):** Defining the Reference Architecture Framework (lead: CSTB)

**Deliverables**

- **D5.1 (M13 – September 2020):** Platform specifications
- **D5.2 (M16 – December 2020):** Architecture guidelines
DigiPLACE key outputs

The vision
of the digital transformation of European construction industry, expressed as key use cases, in order to achieve the core objectives (e.g., climate, resource use, health, productivity, competitiveness...)

The required architecture
to support this vision, in terms of digital tools, services and platforms, interoperability, data and knowledge sharing...

How to get there
Research effort, pilot projects, regulations, deployment of new services...
Identification of key use cases: the methodology

**Step 1**
- Analysis of the results of previous WPs in terms of use cases
- **First clustering of the different topics to address and potential use cases**

**Step 2**
- **Collection of contributions from partners and AB members**
- Based on a table of use cases
- Objective: get a more comprehensive list of the topics to address, identify priorities and different points of view

**Step 3**
- **Workshops on 5 identified areas**

**Step 4**
- Further analysis and synthesis
- **Selection of 35 key use cases**
The 5 identified areas

- Common language, interoperability, standards
- Rules & Regulations, public services
- Data and knowledge sharing
- Environmental performance
- Business, market and collaboration

- 5 working groups on 5 main areas
- Not disconnected issues, but rather different viewpoints to address all the issues, with some overlap
## The working groups

<table>
<thead>
<tr>
<th>Working Group</th>
<th>Group leader</th>
<th>Date of the workshop</th>
</tr>
</thead>
<tbody>
<tr>
<td>WG1 Common language, interoperability, standards</td>
<td>BSi</td>
<td>July 13, 2020</td>
</tr>
<tr>
<td>WG2 Regulations, public services</td>
<td>Ministries from France, Germany and Italy</td>
<td>July 10, 2020</td>
</tr>
<tr>
<td>WG3 Data and knowledge sharing</td>
<td>POLIMI</td>
<td>July 15, 2020</td>
</tr>
<tr>
<td>WG4 Environmental performance</td>
<td>LIST / ECTP</td>
<td>July 15, 2020</td>
</tr>
<tr>
<td>WG5 Business, Market and Collaboration</td>
<td>CSTB</td>
<td>July 3, 2020</td>
</tr>
</tbody>
</table>
Identifying DigiPLACE key use cases: a dual approach

Construction sector use cases

- Related to the digital transformation of construction
- Supporting the underlying objectives: productivity gains, improved environmental performance,
  - ...

Supported by...

DigiPLACE RAF guidelines

- Guidelines for construction platforms architecture
- Guidelines for standards implementation
- Proposal of tools and services
- Guidelines for public services/ regulations
  - ...

Designed to support...
Use case example: digital building permit

- Use case description: digitalized building permit application using BIM models. Semi-automated compliance checking

Related DigiPLACE RAF guidelines

- Use of Open BIM standards
- Dedicated information requirements
- Need of ontologies for urban planning rules
- Required public tools & services
- ...
Identification of key use cases: main outputs

- Synthesis of the discussions for each area
- Identification and analysis of the main trends and topics to address
- **Selection of 35 key use cases**, to provide a synthetic view and serve as a shared base for the definition of the RAF
### Key use cases: Area 1 - Common language, interoperability, standards

<table>
<thead>
<tr>
<th>Identified topics</th>
<th>Selected key use cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to standards</td>
<td>Free and neutral accessibility of the standards.</td>
</tr>
<tr>
<td></td>
<td>Publish all kinds of standards in a publicly available repository.</td>
</tr>
<tr>
<td></td>
<td>Mapping between standards at the document and entity levels</td>
</tr>
<tr>
<td>Use of standards</td>
<td>Engage with a broad community, provide standards implementation guidelines to end users, and collect feedback from end users</td>
</tr>
<tr>
<td>Standards for improved data usage in the operation phase</td>
<td>Using digital twin with BIM and linked data in the operation phase, enabling an ecosystem of digital twins</td>
</tr>
<tr>
<td>Interoperable product data databases</td>
<td>Seamless access to products data, readable by machines, and automatic matching between manufacturers’ products and BIM data</td>
</tr>
<tr>
<td>Contracts</td>
<td>Have computer interpretable definitions of exchange requirements</td>
</tr>
</tbody>
</table>
### Identified topics

<table>
<thead>
<tr>
<th>Building permit</th>
<th>Digitalized building permit application and delivery, with semi-automated compliance checking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rules compliance checking</td>
<td>Making available tools to check the compliance of a project with the various existing regulations and certifications (European, national, local), at any stage of a project</td>
</tr>
<tr>
<td>Access to construction rules</td>
<td>Provide easy and harmonised digital access to local, national or European rules</td>
</tr>
<tr>
<td>Environmental, health and toxicity regulations</td>
<td>Integrate LEVELS framework in tools, services and platforms, to promote its use and generalization</td>
</tr>
<tr>
<td>Cadastre/land register and Territorial Digital Twin</td>
<td>Urban or National digital twin to provide easy and standardized access to territorial data (e.g.: 3D view, cadastre, town planning, utility networks...)</td>
</tr>
<tr>
<td>Public procurement</td>
<td>Manage calls for tenders for BIM projects and/or enable linking with (public, national) call for tenders’ platforms</td>
</tr>
<tr>
<td>Building logbook</td>
<td>Digital / BIM-based building logbook, to ensure the continuity of information about a building</td>
</tr>
<tr>
<td>Large infrastructures’ data</td>
<td>Sharing data of large public infrastructures and transnational projects</td>
</tr>
</tbody>
</table>
## Key use cases: Area 3 – Data and knowledge sharing

<table>
<thead>
<tr>
<th>Identified topics</th>
<th>Selected key use cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data sharing, open data and data analytics</td>
<td>Access to European technical databases, public administration databases and research databases</td>
</tr>
<tr>
<td></td>
<td>Access to performance data of products, seamless information exchange regarding products, connection between existing local databases</td>
</tr>
<tr>
<td></td>
<td>Sharing of private data (e.g.: on projects, assets, costs....)</td>
</tr>
<tr>
<td>Sharing of digitalization best practices</td>
<td><strong>Sharing of BIM and digital best practices through a European platform</strong></td>
</tr>
<tr>
<td>Sharing of innovation patterns</td>
<td><strong>Give access to innovation and research results to small and medium companies</strong></td>
</tr>
<tr>
<td>Reskilling of workforce</td>
<td>Online training modules for digital transition</td>
</tr>
</tbody>
</table>
# Key use cases: Area 4 – Environmental performance

<table>
<thead>
<tr>
<th>Identified topics</th>
<th>Selected key use cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing of environment-related data</td>
<td>Sharing of projects environmental LCA data</td>
</tr>
<tr>
<td></td>
<td>Management and access to national EPC databases</td>
</tr>
<tr>
<td>Access to environmental performance data</td>
<td>Access to environmental performance data of products (generic or manufacturers products) to be used in LCA calculation</td>
</tr>
<tr>
<td>Management and access to national EPC databases</td>
<td>Provide access to CPR environment-related data of products in a harmonized digital format</td>
</tr>
<tr>
<td>Integration of LEVEL(s) framework</td>
<td>Support the widespread use of LEVEL(s) in tools and services, integrate it in a common European data space, and provide tools to compare environmental performance of construction projects</td>
</tr>
<tr>
<td>Life Cycle Assessment</td>
<td>Environmental LCA calculation with BIM at different stages of the project, link between BIM and EPD</td>
</tr>
<tr>
<td>Sharing of environmental best practices</td>
<td>Standardise the presentation of best practices associated to environmental performance of projects, processes, buildings or products</td>
</tr>
</tbody>
</table>
### Key use cases: Area 5 – Business, market and collaboration

<table>
<thead>
<tr>
<th>Identified Topics</th>
<th>Selected key use cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to BIM and other services, marketplaces</td>
<td>Directory of public and private BIM platforms</td>
</tr>
<tr>
<td></td>
<td>Ensure a level of interoperability between the different proprietary platforms (easier access to services, data portability...)</td>
</tr>
<tr>
<td>Collaborative platforms, Common Data Environments</td>
<td>Easily accessible BIM and collaboration toolkit, especially for SMEs</td>
</tr>
<tr>
<td></td>
<td>Common guidelines for implementing common data environments</td>
</tr>
<tr>
<td></td>
<td>Guidelines to ensure interoperability / data exchange between different CDEs</td>
</tr>
<tr>
<td>Digital supply chain, Industry 4.0</td>
<td>BIM approach in the call for tender phase</td>
</tr>
<tr>
<td></td>
<td>E-catalogues, integration of manufacturers’ BIM objects into BIM models</td>
</tr>
<tr>
<td>Contractualisation, Smart Contracts, Blockchain</td>
<td>Integration of construction equipment in digital supply chain, use of construction equipment data</td>
</tr>
<tr>
<td></td>
<td>BIM-related contracts standardisation: sharing of best practices, contract agreements templates</td>
</tr>
<tr>
<td></td>
<td>Implementation of innovative solutions to ensure trust, data traceability and smart contracting (eg blockchain technologies)</td>
</tr>
<tr>
<td>Others</td>
<td>Integration of project tools with ERP, CRM and other business management tools</td>
</tr>
</tbody>
</table>
High level specifications

- A complementary desk work on platform functionalities
- Analysis based on mindmaps
- Scenarios analysis based on use cases
## High level specifications

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Relation with use cases</th>
</tr>
</thead>
</table>
| Common language scenario        | Standard for improved data usage in the operation phase  
                                | Environmental regulation, health and toxicity regulation  
                                | Data sharing, open data  
                                | Data analytics  
                                | Access to standard  
                                | Use of standard  
                                | Rules checking compliance  
                                | Access to construction rules  
                                | Data sharing, open data  
                                | Contractualisation, Smart Contracts, Blockchain |
| Integrated rules scenario       | Data analytics  
                                | Sharing of digitalization best practices  
                                | Sharing of innovation patterns  
                                | Life Cycle Assessment  
                                | Access to BIM and other services, marketplaces  
                                | Collaborative platforms, Common Data Environments  
                                | Digital supply chain, Industry 4.0  
                                | Contractualisation, Smart Contracts, Blockchain |
| Integrated design process scenario | GIS Data, integration of BIM and GIS data  
                                | Environmental regulation, health and toxicity regulation  
                                | Data analytics  
                                | Sharing of environment-related data |
| Improved product performance scenario | Contracts  
                                | Digitalized building permit  
                                | Rules checking compliance  
                                | Cadastre/land register and Territorial Digital Twin  
                                | Public procurement  
                                | Building logbook  
                                | Data analytics  
                                | Life Cycle Assessment  
                                | Contractualisation, Smart Contracts, Blockchain |
| Securization of market and player scenario | Integrated product data bases  
                                | Integration of LEVEL(s) framework |
| CE mark, smart CE scenario      |                                                                                                                                                         |
High level specifications

Integrated rules scenario

Integrated design process
Structure and content of DigiPLACE Reference Architecture Framework

DigiPLACE Reference Architecture Framework

A comprehensive set of common guidelines for building and implementing interoperable digital platforms for the construction sector across Europe (public or private, local or European...)

Different types of guidelines

- General guidelines for implementing digital platforms (interoperability, open standards, data security & privacy...)
- A referential of tools and services to be developed/generalized in order to support key use cases
- Special focus on required public services and regulations, both at EU and MS levels
- ....
Definition of DigiPLACE RAF: preliminary outline

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General architecture requirements derived from WP3 and WP4</td>
</tr>
<tr>
<td>2</td>
<td>Analysis of a selection of key topics/use cases in terms of architecture requirements</td>
</tr>
<tr>
<td>3</td>
<td>Structuration and synthetic formulation of the RAF</td>
</tr>
<tr>
<td></td>
<td>- General requirements (standards...)</td>
</tr>
<tr>
<td></td>
<td>- Private tools and public tools/services, interactions between them</td>
</tr>
<tr>
<td>4</td>
<td>Focus: perimeter of public platforms, European and nation</td>
</tr>
</tbody>
</table>
High level structure of the RAF

Standards and other general requirements

Private digital platforms and tools

Public

Public services (eg building permit)

Regulations

Public digital platforms and tools (eg public big data platform)

European

National
Key topics to develop (1/2)

- Interoperable product databases, object catalogues and integration into BIM processes, optimize the supply chain
- European Big data platform (which data to share? Link with European common data spaces...)
- Easily accessible BIM and collaboration toolkit, especially for SMEs, role of public platforms
- Ensure a level of interoperability between proprietary platforms, fair competition
- Provide common guidelines for implementing common data environments, and ensure interoperability / data exchange between different CDEs
- Data management along the lifecycle, digital twin (eg interlink, digital twin with linked data...)
Key topics to develop (2/2)

- Environment: Integration of LEVEL(s) in platforms, EPD databases and EPD for BIM, LCA tools, sharing of EPC national databases, circular economy, material passports
- Digitalized building permit
- Building logbook
- Access to rules, rules checkers
WP5: Progress Update (M1-M12)

Work done

- T5.1 – Key use cases and high level specifications

Tangible outcomes

- Selection of 35 key use cases
- High level specifications

Deliverables issued

- D5.1: Platform specifications
WP5: Outlook – Planned Progress (M13-M24)

Next steps / actions

- T5.2 Reference Architecture Framework:
  - Workings sessions (Oct-Nov)
  - SWOT analysis of the different scenarios
  - Consultation of the CoS on key use cases and RAF

Planned outcomes

- Reference Architecture Framework
- SWOT analysis to identify key aspects to consider for the strategy roadmap (WP6)

Deliverables Due

- D5.2 (December): Architecture guidelines