AUTODESK UNIVERSITY

A Framework for Creating an Autodesk Forge-Powered Innovation Hub at VINCI

CS502139

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Product Owner

Anthony HINDI
BIM Manager

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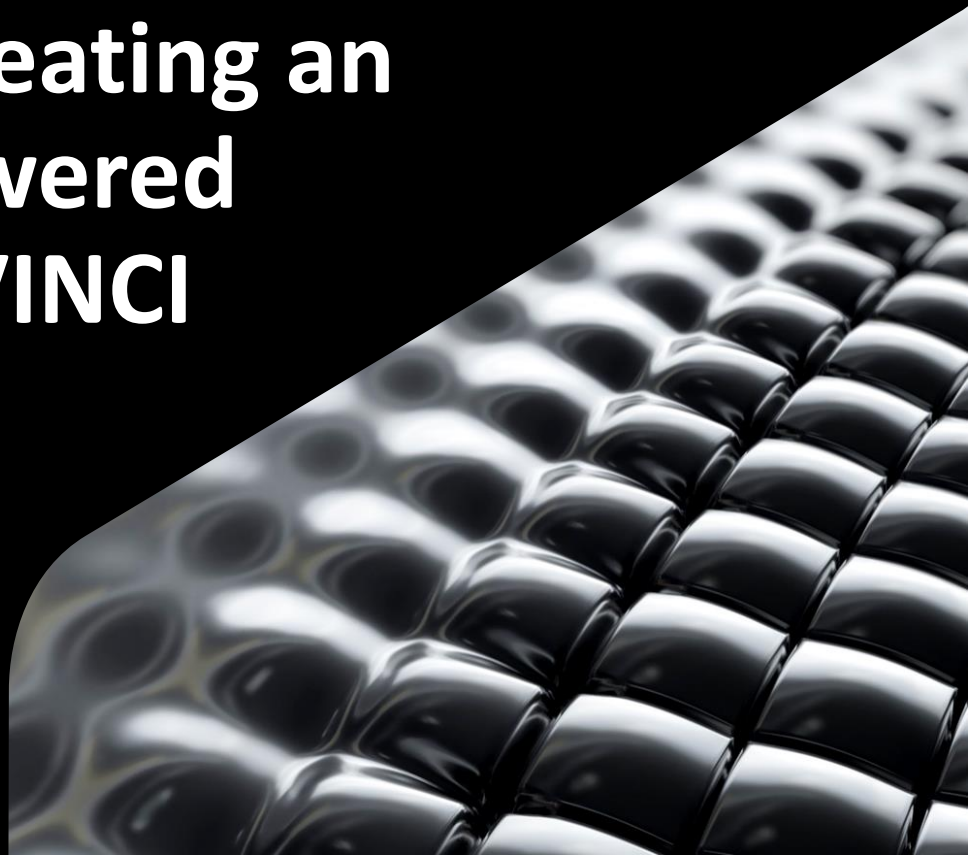
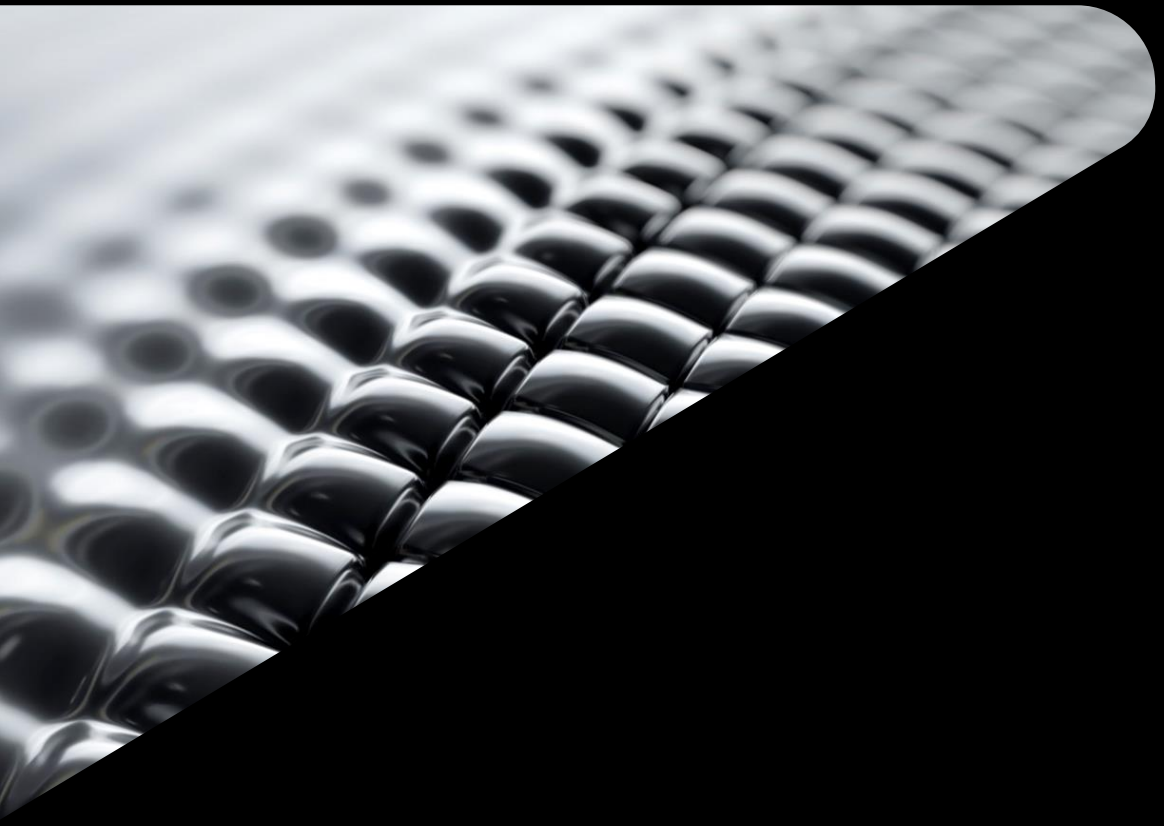
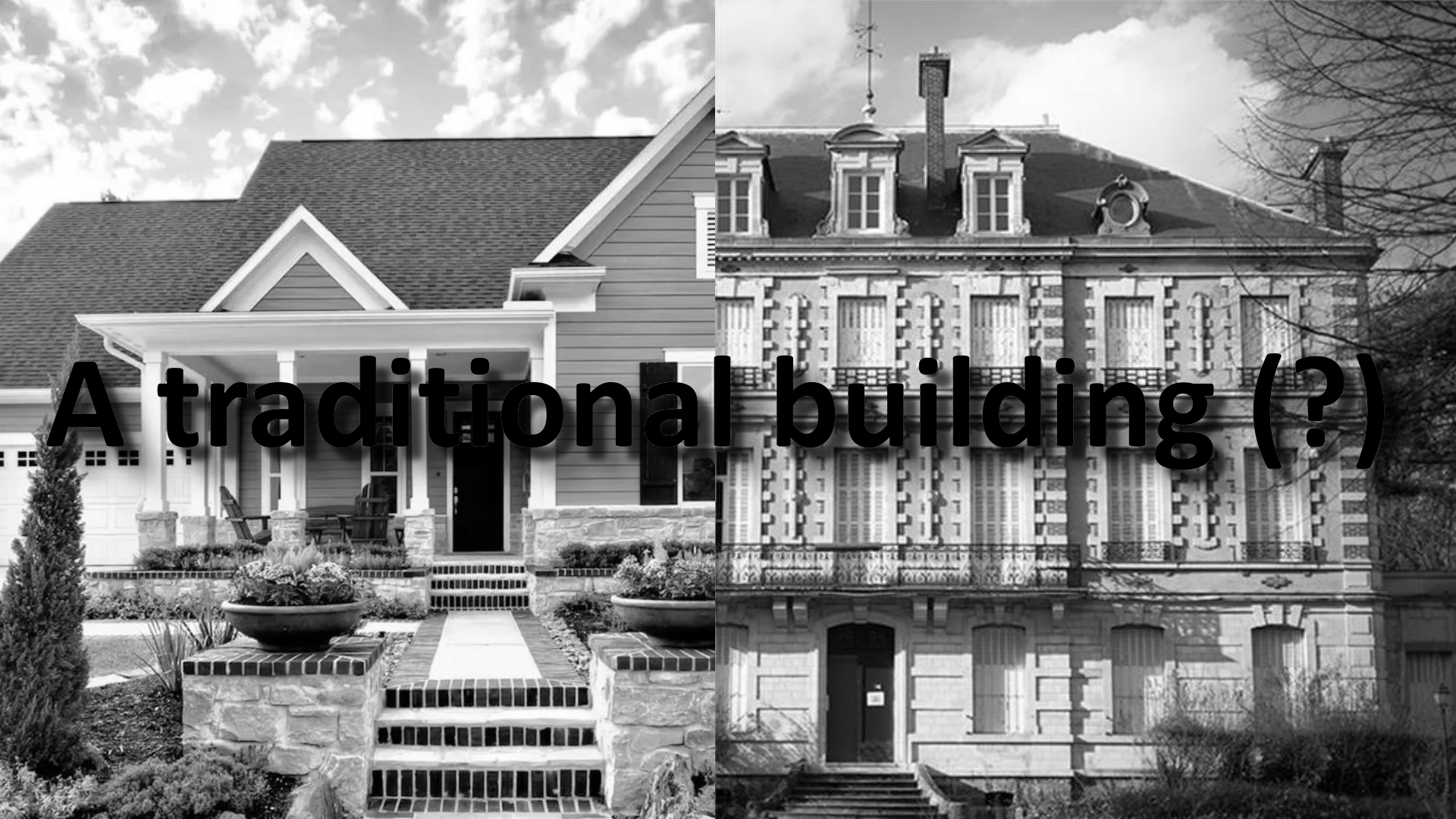
Lead Developer

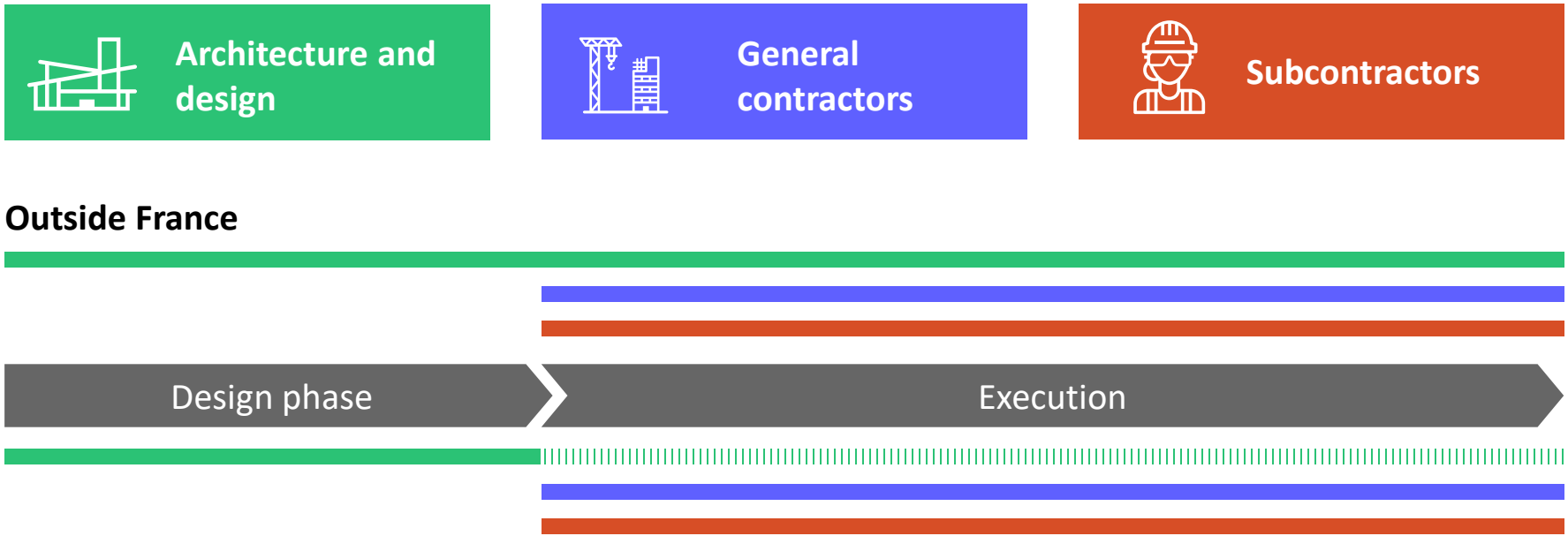




Acknowledging Differences


A traditional building (?)

Difference in typical construction project



One size fits all

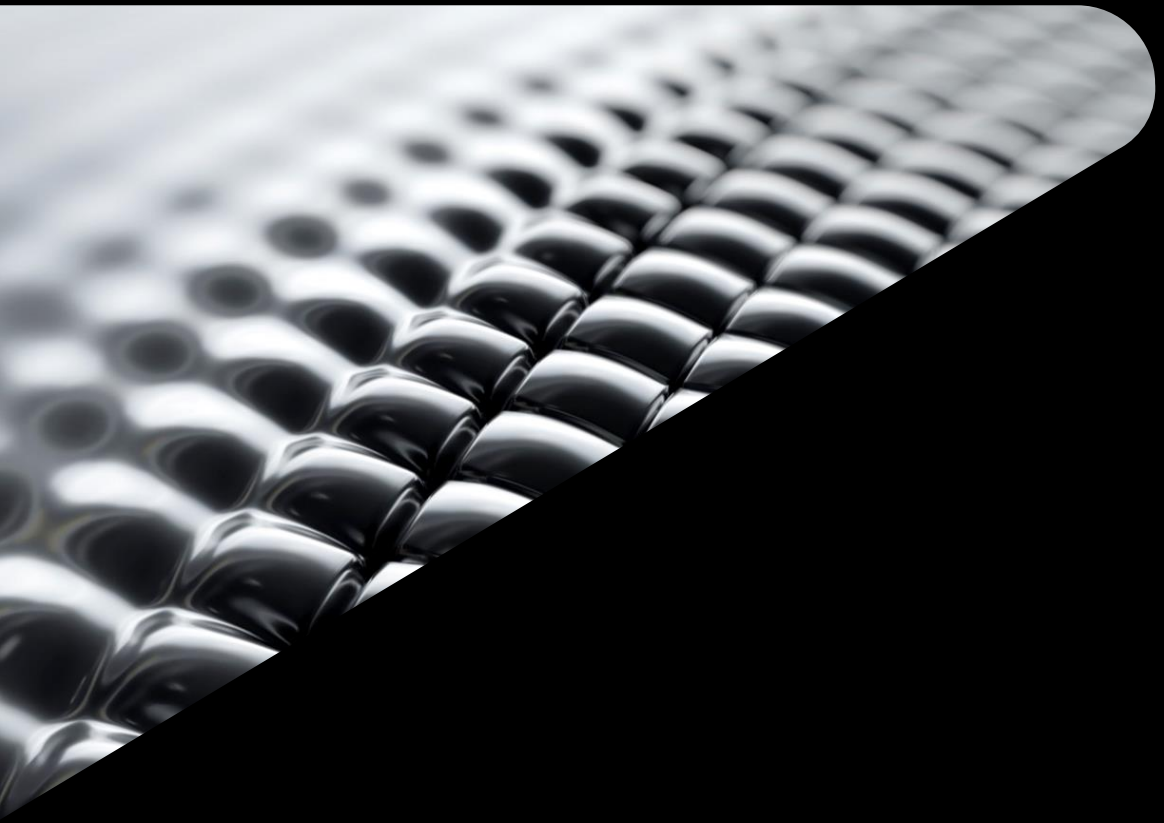
One size does not fit all

Speakers

André SANTOS DE ANDRADE
Product Owner

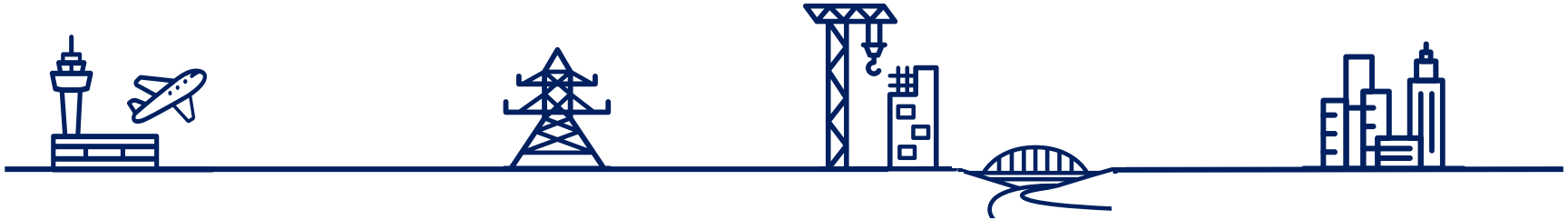
Eric Felipe ARAUJO MOREIRA
Lead Developer

Anthony HINDI
BIM Manager



VINCI

VINCI SA (DG.PA) Group



CONCESSIONS

VINCI Autoroutes
&
VINCI Airports

ENERGY

VINCI Energies

CONSTRUCTION

VINCI Construction

REAL ESTATE

VINCI Immobilier

VINCI SA (DG.PA) Group

Revenue

€ 26.3 B France
€23.1 B International

Net income

Attributable to owners of the parent

Employees

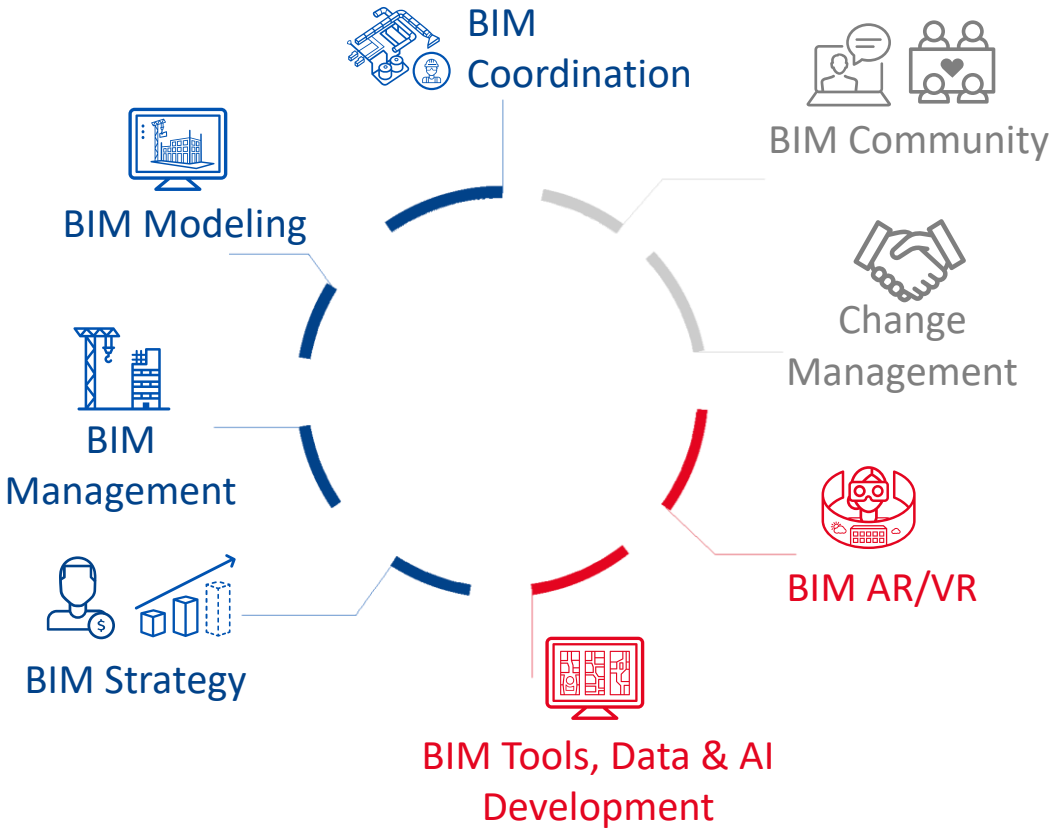
3200 business units

Countries

280 000 worksites

BIM CENTRAL UNIT – Engineering Dept.

- 40 employees
- 10+ years of experience
- More than 3M m^2 of BIM Projects
  - Airports and train stations
  - Mixed-use buildings
  - Skyscrapers
  - Residential buildings



BIM Tools, Data & AI Development

Involved global engineering teams

A network of 700 active members discovering new BIM workflows and functionalities every day.

Customer-Centered Specifications

Each team can ask for a **customized development.**

We assist our clients to identify their needs.

AGILE Development

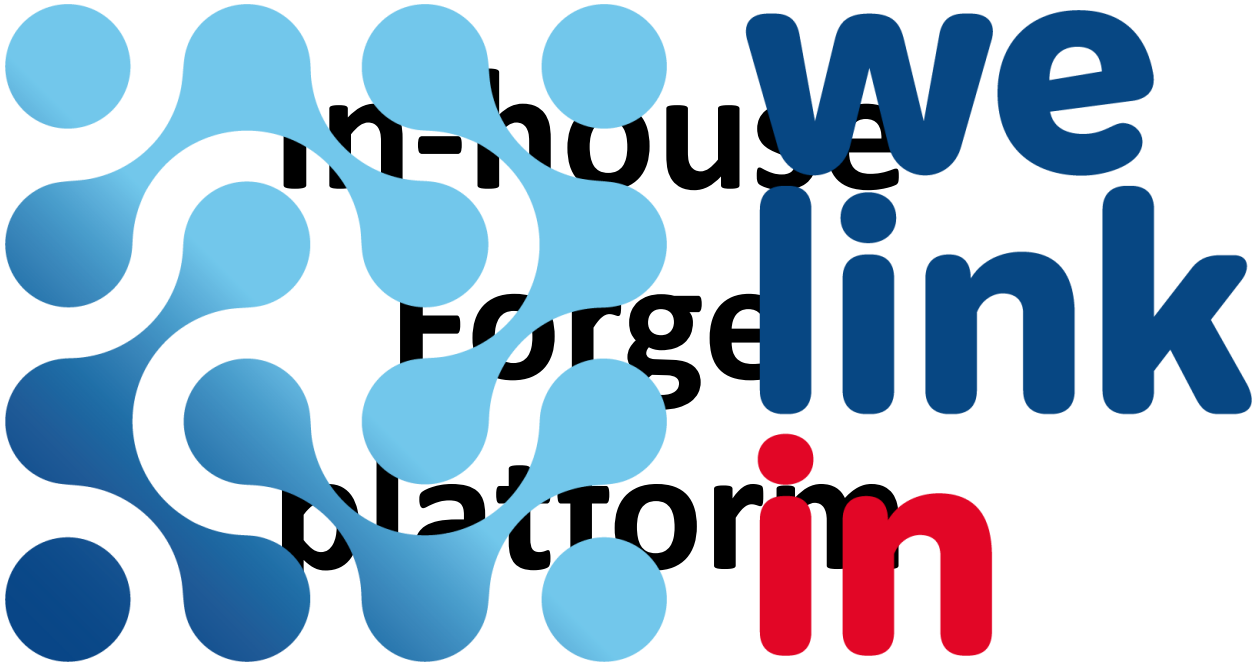
We develop applications **step-by-step** with our internal **beta community.**

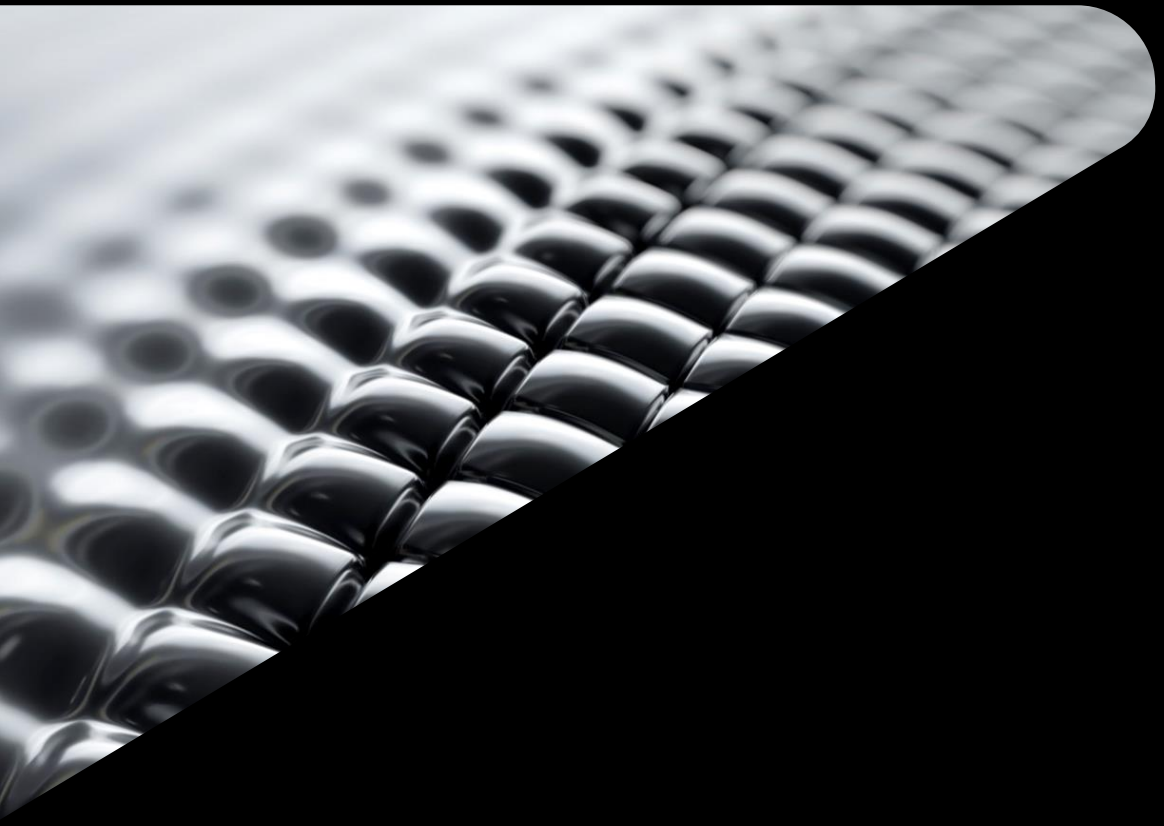
These apps are adjusted and maintained in a mid-term and long-term **BIM strategy.**

A Tailored Solution Deployment

Each project has its **idiosyncrasies**: We **tailor** our solutions based on **project scope and users' requests**.

A Tailored Solution Deployment



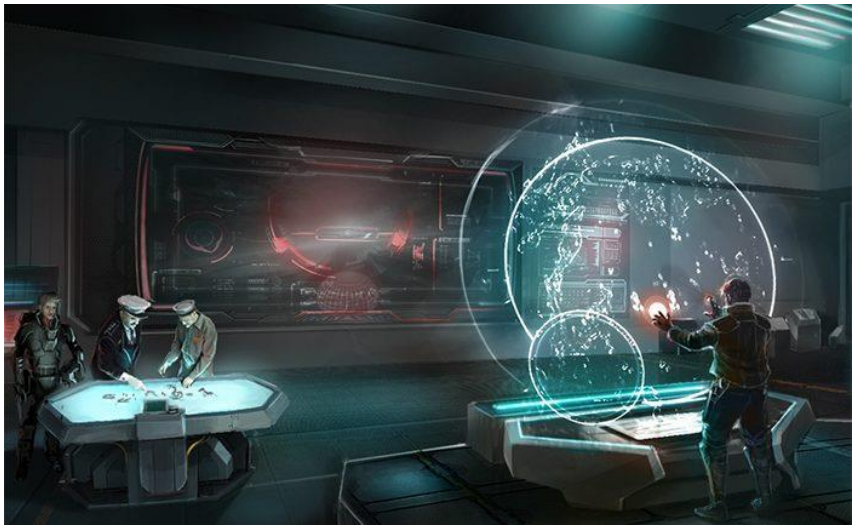


How it all started?

How it all started ?

- Delivering construction documents to the client :

Expectation



Reality

- Creating a **cloud-based platform** to deliver the final construction documents and plans to our client;

Features come from stakeholders

Three main features developed and sponsored by internal clients

BIM Management request

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BIM Model QC and quantity take-Offs

Construction site request

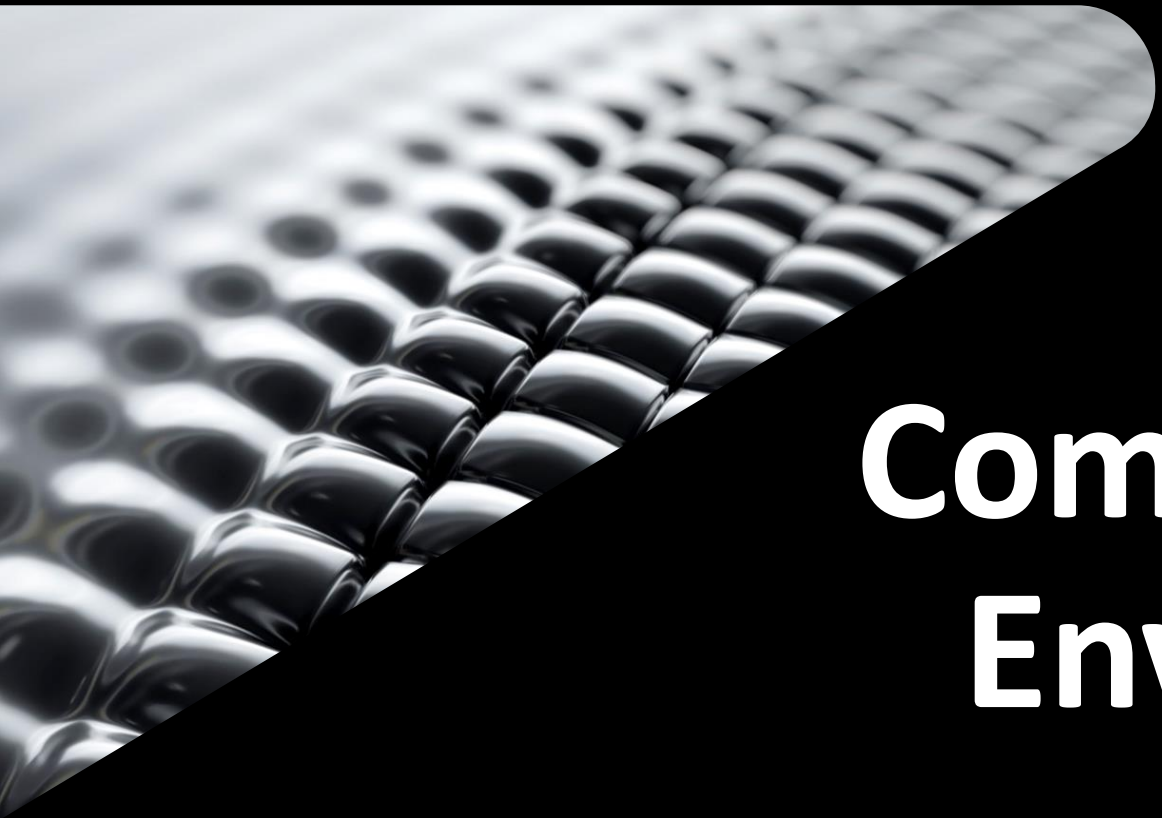
↓

Site QC and Construction logistics plan

Project owners' request

↓

As built models and documents



Common Data Environment

Common Data Environment

What is the need, who uses it and how is it used?

Real estate and developers

- Program analysis
- Development follow-ups
- 3D visualization

Design and consultants

- Coordination & Clash detection
- Analysis & Simulation
- VR & Immersion

Contractors

- QC/QA: Models vs Site
- Logistics
- Site ⟷ Office communication
- QTOs

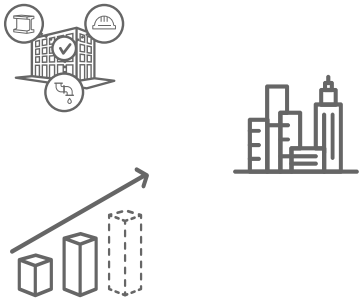
Facility Managers

- Open API
- Links between documents and BIM Objects→ Digital twin
- Parameters and Information access

Common Data Environment

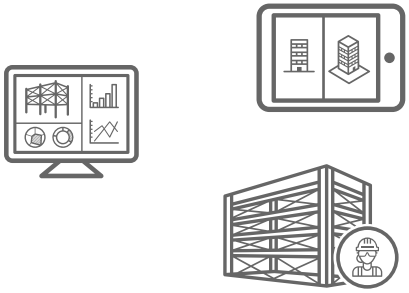
Multiple platforms used on a same project by different actors

Real estate and developers

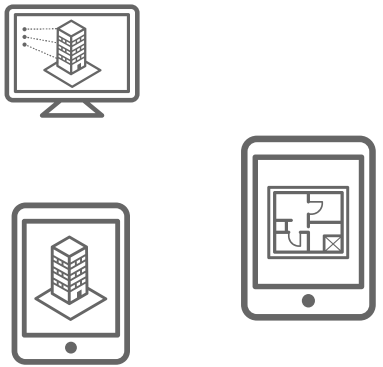


Design and consultants

Contractors



Facility Managers



Common Data Environment

Welinkin is a cloud-based platform that can be used throughout all project phases and by different actors

Real estate and developers

Design and consultants

Contractors

Facility Managers

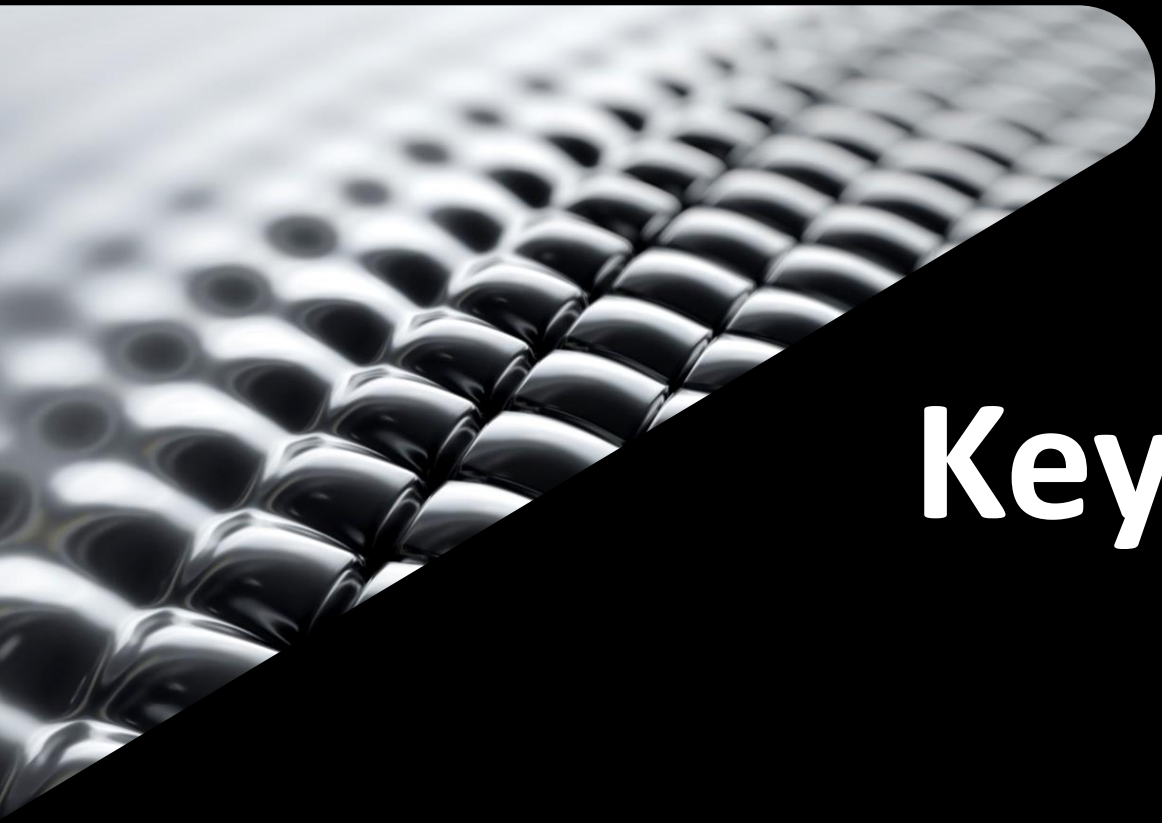
INITIATION & CONCEPTION

PLANNING

LAUNCH & EXECUTION

MONITORING & CONTROL

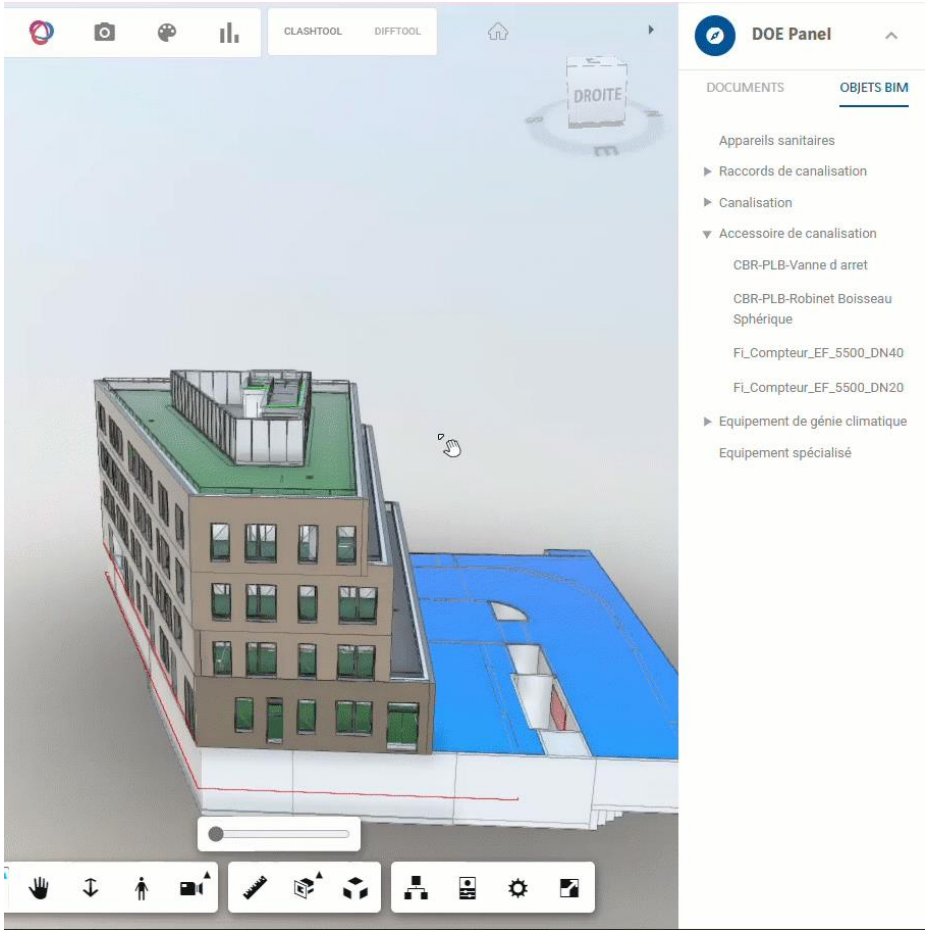
PROJECT CLOSURE



Key Features

As-built on steroids

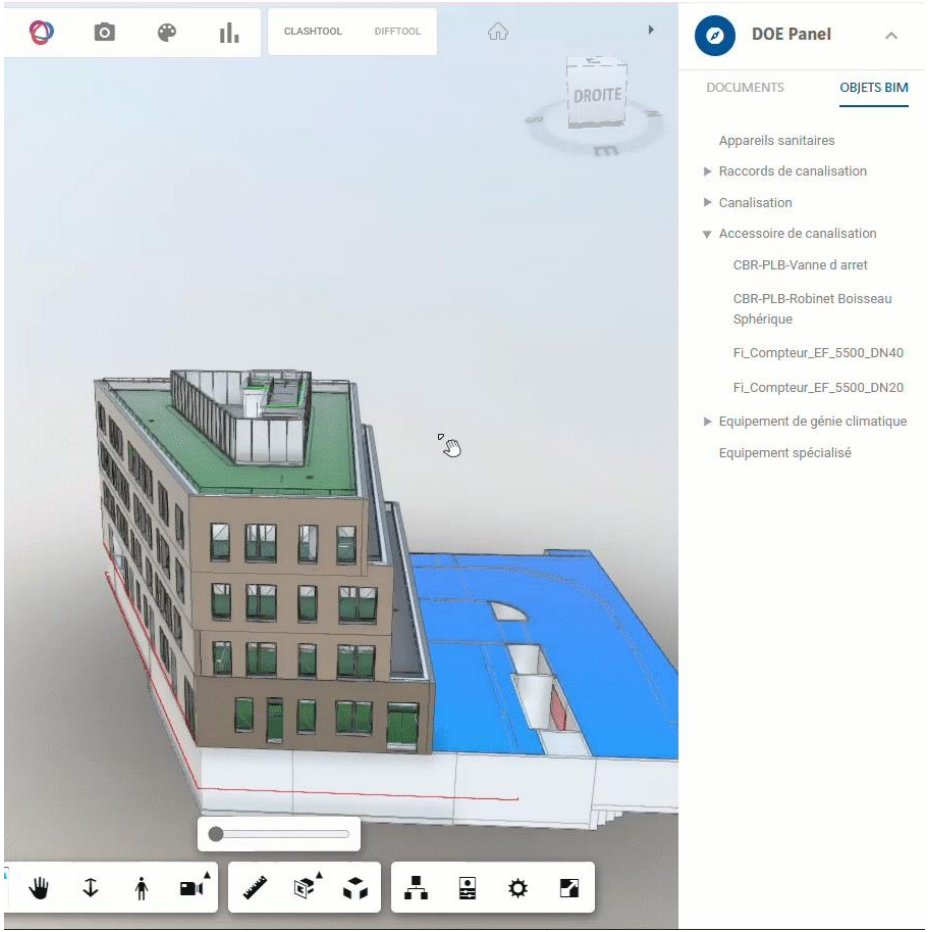
- All documents are available on the cloud; Everyone can access the data at anytime
  - Project owner can manage access rights to the system
  - The file delivery is often on a hard / flash drive
- The service's ambition is to link the as-build 3D models to their corresponding files
  - Each BIM object in the model is associated with their relevant files such as technical specification, plans and others.
  - The link between the BIM objects and documents is maintained over time.
- With an open API strategy, facility manager can access the data and use it with his **FM solution**;



As-built on steroids

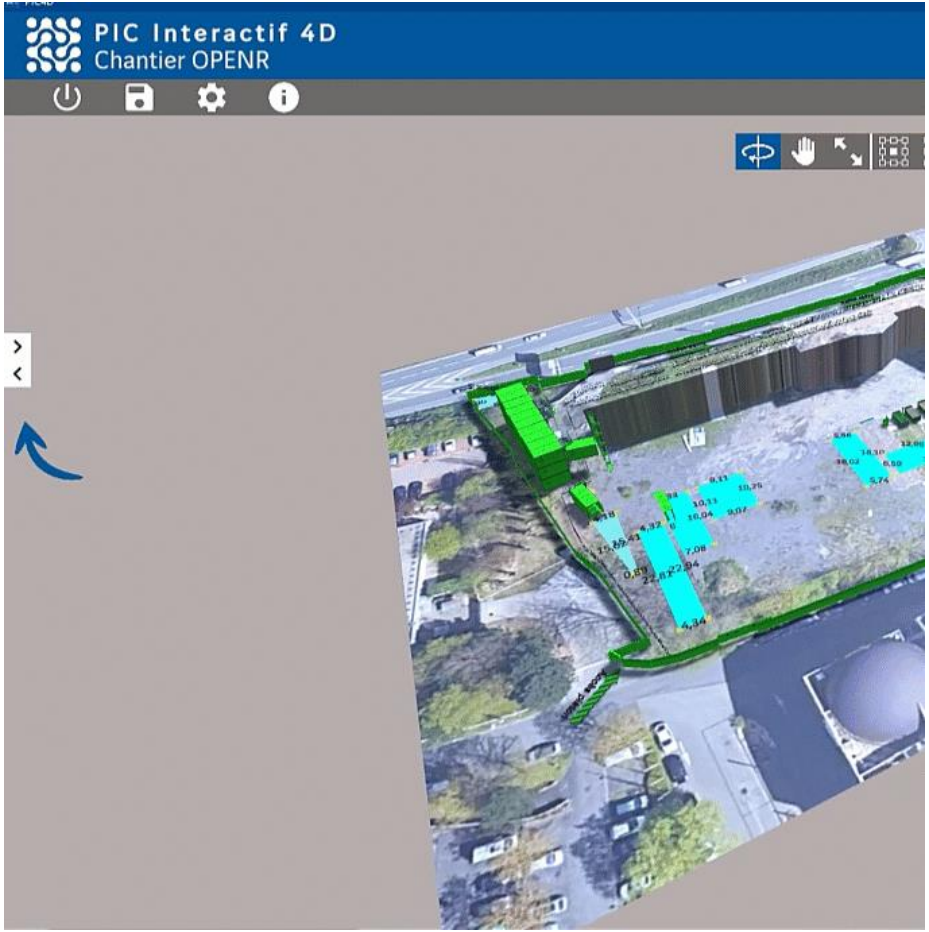
Technical standpoint

- The object-document link is made via a designated parameter
- The link remains flexible regarding the number of objects and files
- Link might be done either in Revit or in the platform
- Fully compatible with BIM model and document versioning



Digital construction logistics

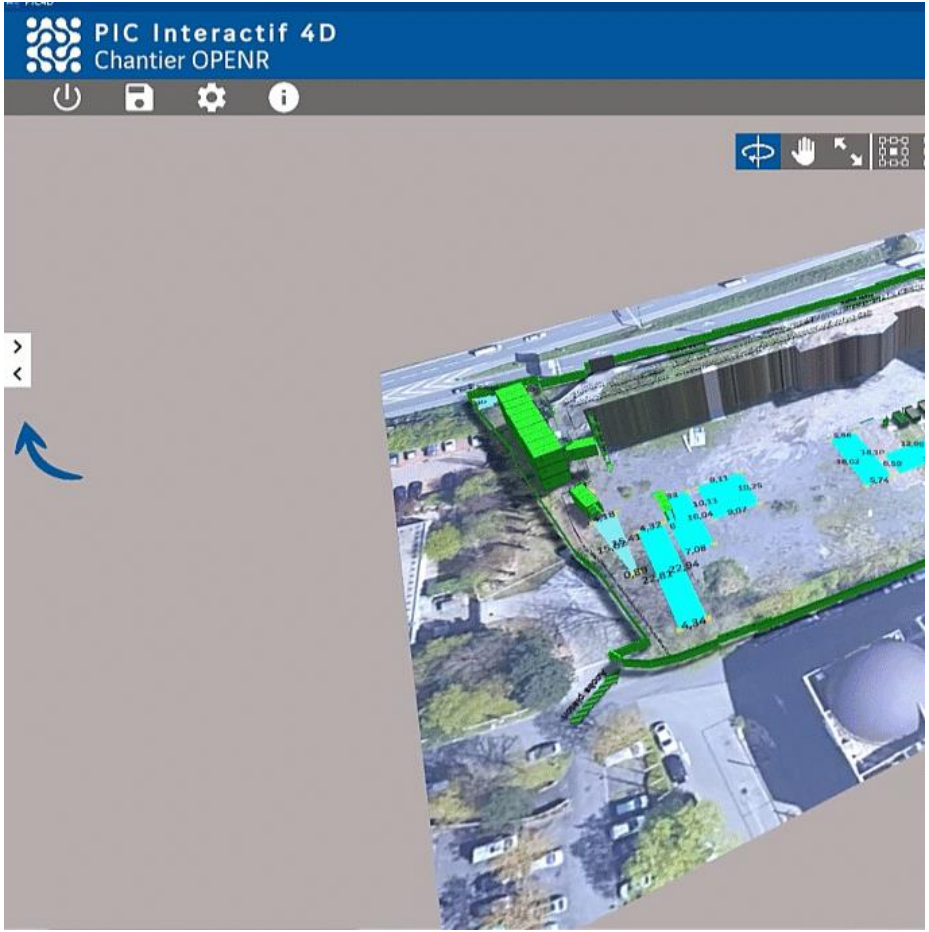
- Forge is the superglue of our CDE, but we also count on other technologies
  - The 3D digital site installation is powered by Unity
  - More than 4000 objects and families were developed internally
  - Adding the 4th dimension to the classic 3D site installation
- The model is updated at each logistic meeting
  - Meetings are usually made on a weekly basis
  - The resulting model is available to everyone, anytime



Digital construction logistics

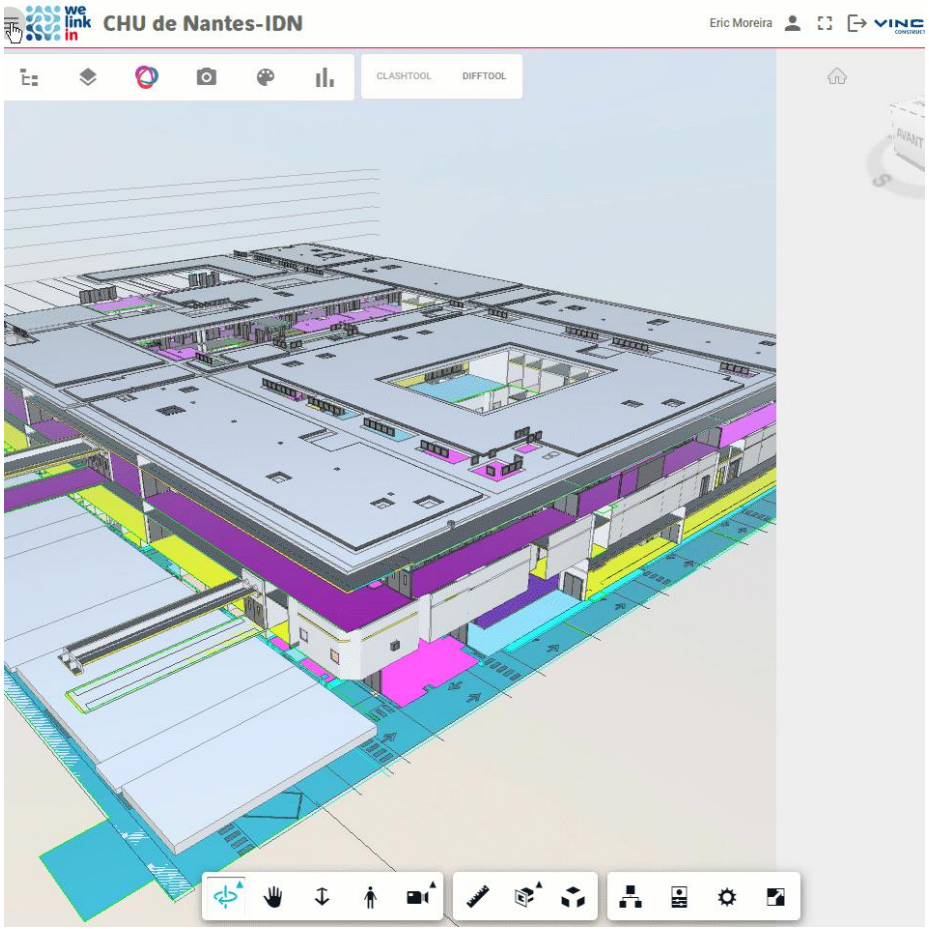
Technical standpoint

- Developed before the internal CDE initiative
- Unity based, autonomous tool
- Linked with the CDE, but requires additional configuration
- Unity Reflect for Revit made this configuration easier and more reliable
- Unity development team based in Bordeaux



A takeoff before Takeoff

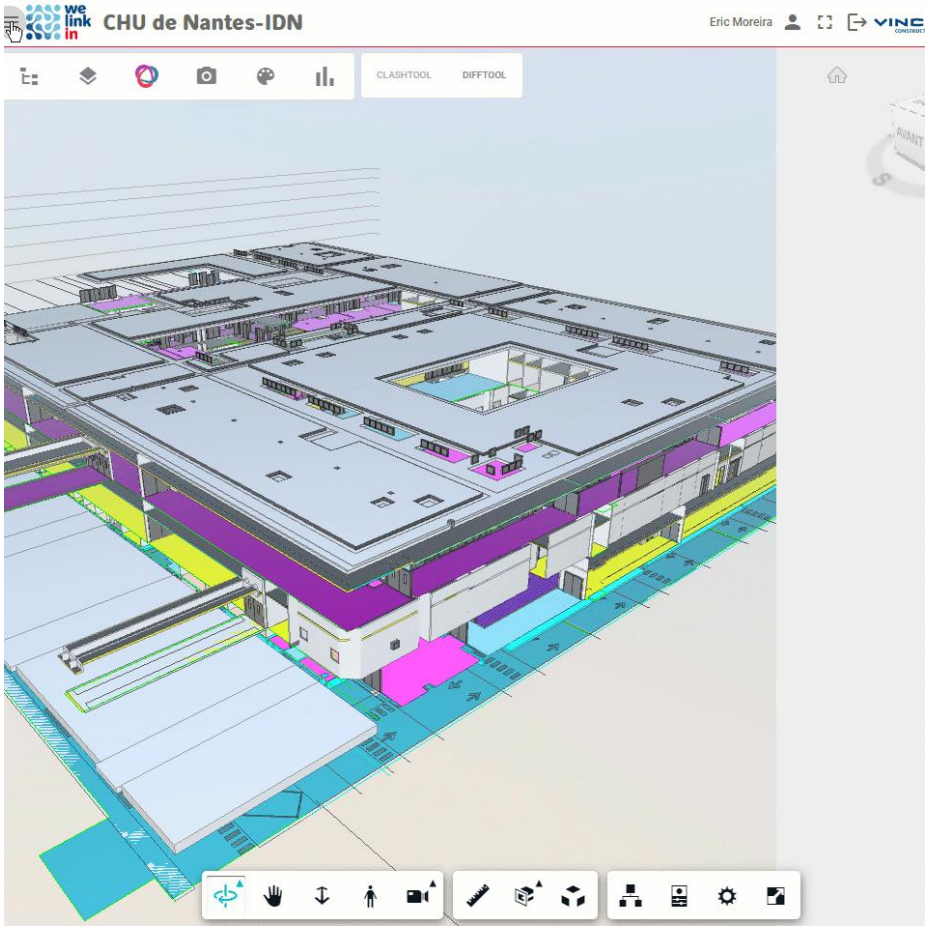
- BIM managers are constantly asked to export quantities from Revit
  - Repeated requests causes waste of time
  - Data reliability might be compromised if quantities are exported from local models
- Onsite workers are autonomous to export relevant quantities
- High utility for other actors as well
  - Subcontractors
  - Procurement
  - Project owners



A takeoff before Takeoff

Technical standpoint

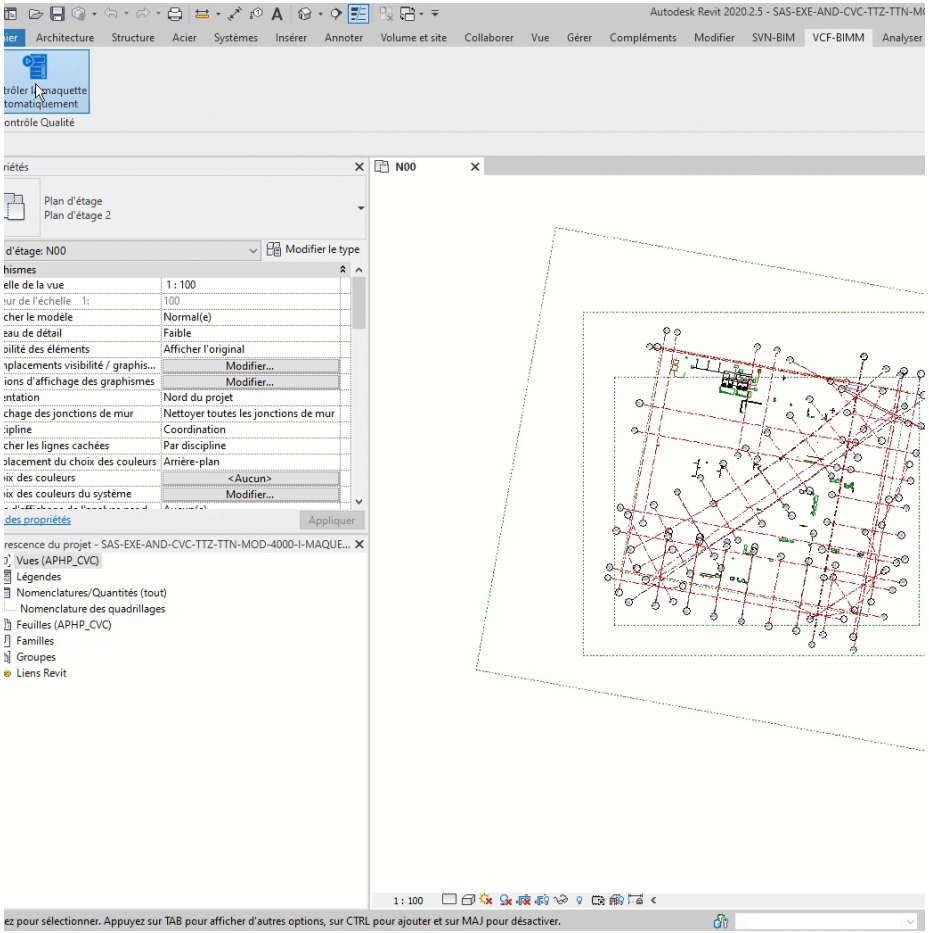
- Feature released before Autodesk Takeoff in 2021
- Quantities are sorted by model, category, family and type
- We can export them directly in Excel format for further analysis
- An example on how to add value to existing data



BIM Model audit

Automatically audit your model using FORGE

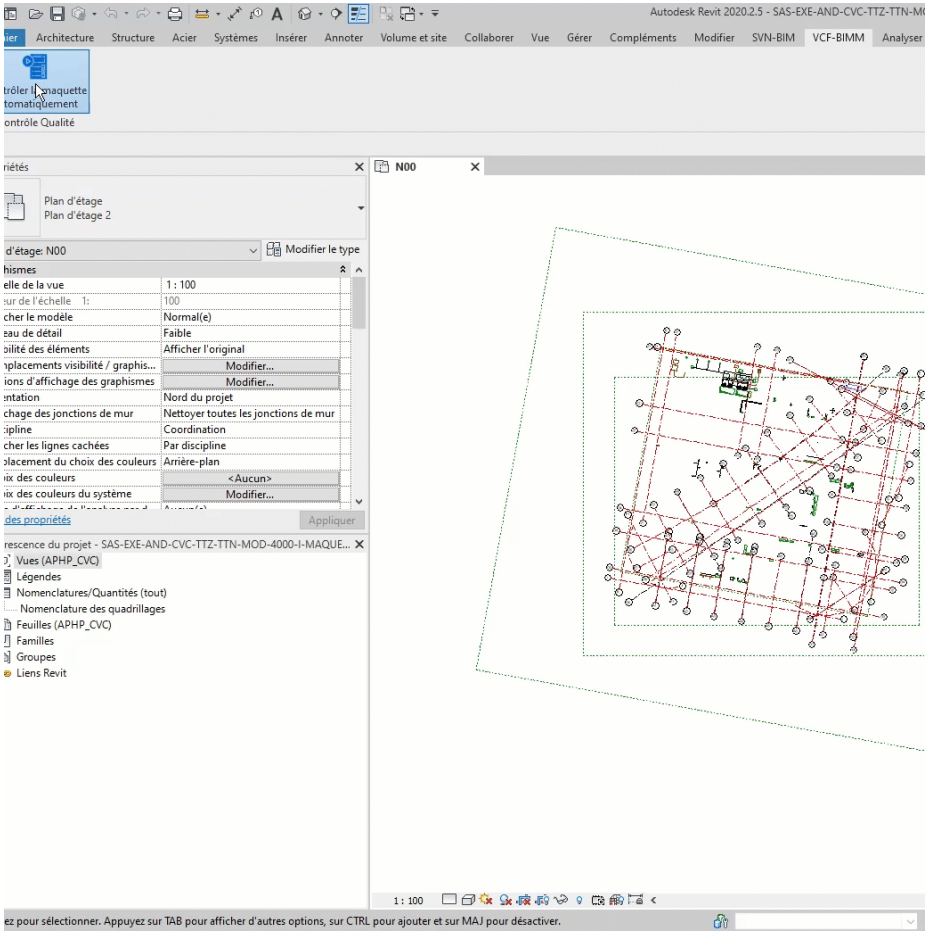
- BETA version using a Revit plugin ;
- Compare models
  - Compare the BIM model with a database set by the BIM Manager
  - Check automatically more than 20 BIM criteria
  - Validation tool for BIM Managers
- Audit several BIM Model at a time
- Export the report on Power BI
- Keep track of the 3D model health throughout the project life cycle.

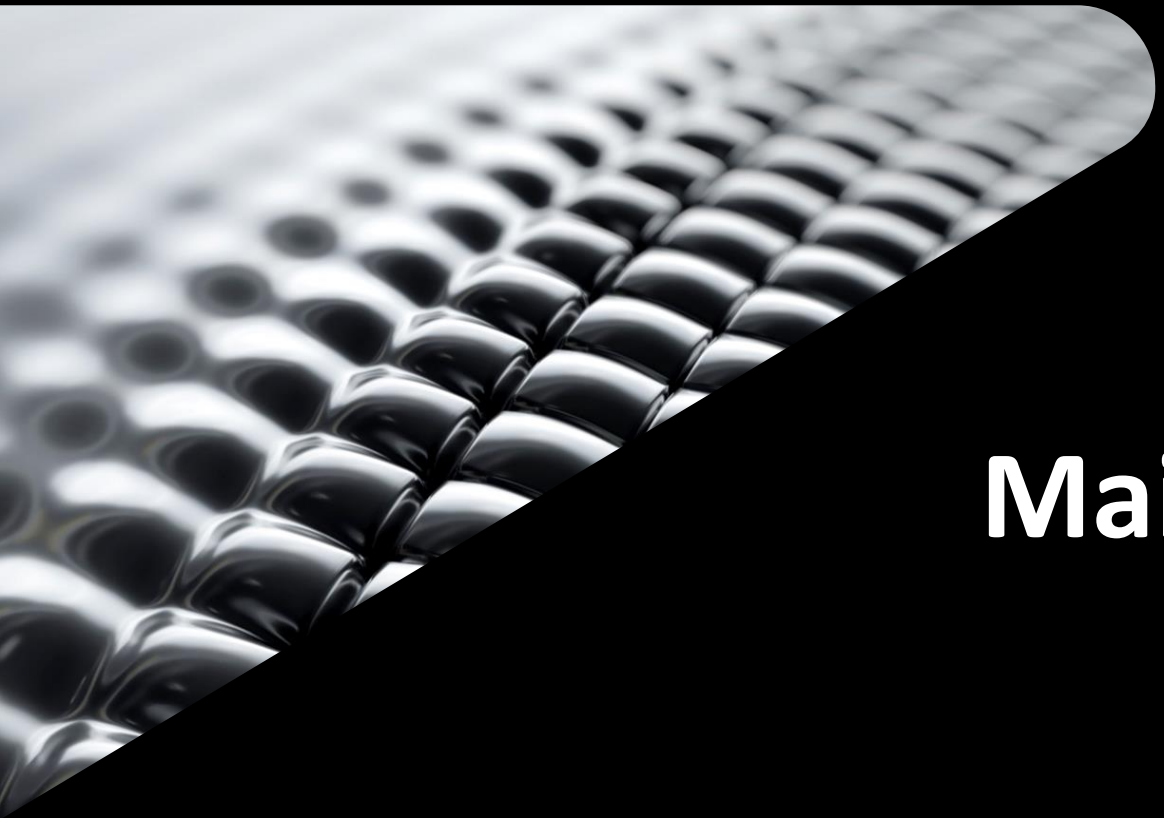


BIM Model audit

Technical standpoint

- Synergy between BIM Management, desktop and web development teams
- Consultation with BIM Management and Coordination communities
- Workflow adaptation for full web working environment
- Keep the offline version
- Possibility to upload all offline work into the web version



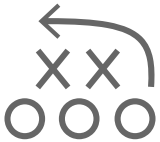


Main Challenges

Organizational & Operational

Organizational Challenges

Starting from scratch



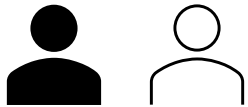
Internal resources availability assessment and team recruitment

Qualified and experienced partner selection for the development of a Proof of Concept

Project Management method and cross-functional communication

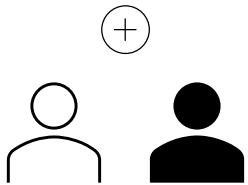
Internal Resources

- The team before the project
  - Composed by a Project Manager and a dotNET developer
- The changes to start the project
  - Recruit a product owner with construction industry knowledge
- What could not be fulfilled internally
  - A full development team with industry CDE development experience



Project Manager and dotNET Developer

Product Owner



Two new Full Stack Developers

Partner Choice

- Key requirements
  - Not only development capabilities but also construction industry know-how
  - Ideally experimented in CDE development
- Trustworthy certifications
  - Autodesk Forge Certified Systems Integrators
- Final choice
  - **Db-lab**
  - Mathieu Lalanne
  - Issam El Khalfaoui
  - Candice Hassine

AUTODESK FORGE®
Certified Systems Integrator

db-lab
WEB TECHNOLOGIES FOR BIM PRODUCTION TRACKING

Project Management

- SCRUM framework as a guide
  - This agile project management framework is the core of our development style
  - Key deliveries every 3 months; JIRA by Atlassian as the planning tool; GitHub as the code management platform
- We had to adapt due to limitations given by the context
  - Geographical distance - 500miles~800km
  - Restrictions due to COVID-19
  - Most meetings were online, with some on-site meetings for key deliveries

Operational Challenges

Starting from scratch

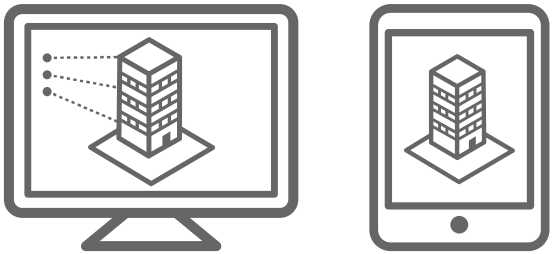
Technological choices for key features and infrastructure management

Strategic decision for data ownership and management

VINCI cybersecurity requirements and policies alignment

Tech Stack

- Key needs of our CDE
  - BIM Model Viewer
  - Document Management
  - Multiplatform
- The solutions we implemented
  - Multiplatform code base
  - Reliable data-storage
  - Forge



Microsoft Azure

AUTODESK®
FORGE

Why Forge ?

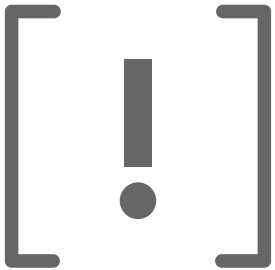
- The best viewer dealing with Revit models
- 60+ compatible formats
- Large set of APIs for the construction industry
- Active community and frequent updates and improvements
- Flexible and multiplatform-friendly

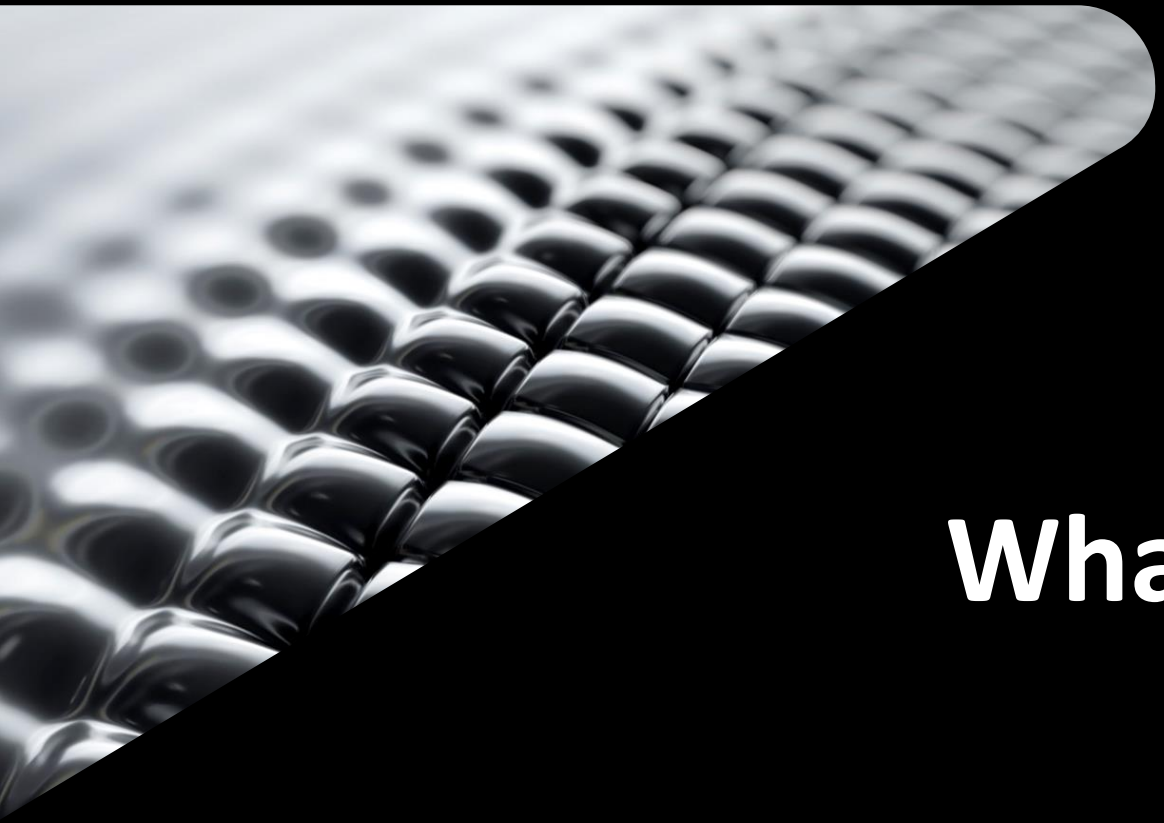
Data Ownership

- A strategic decision
  - Data is the new commodity of the 21st century
  - We took actions towards owning the data we produce
- Regulations and compliance
  - Some projects have strict data-management requirements
  - National security sensible projects requires all data to be stored in France

Cybersecurity

- Testing, testing, testing
  - Several pentests were carried out
  - Each on of them with a list of corrections to be made
- Policies already in place
  - Most security actions were already in place and had to be implemented
- Best practices
  - The IT team wrote an internal charter with the best practices in web development





What we learned

Key takeaways

- Acknowledge differences in managing construction projects is key
- Assess internal skills and partner firms' availability for the project lifecycle
- Beware of operational challenges in the long run
- Keep active communities of people who are interested in a new product for their activity
- Develop features that are sponsored by internal clients
- Validate results with the same internal sponsors who asked
- Resist the temptation to reinvent the wheel

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