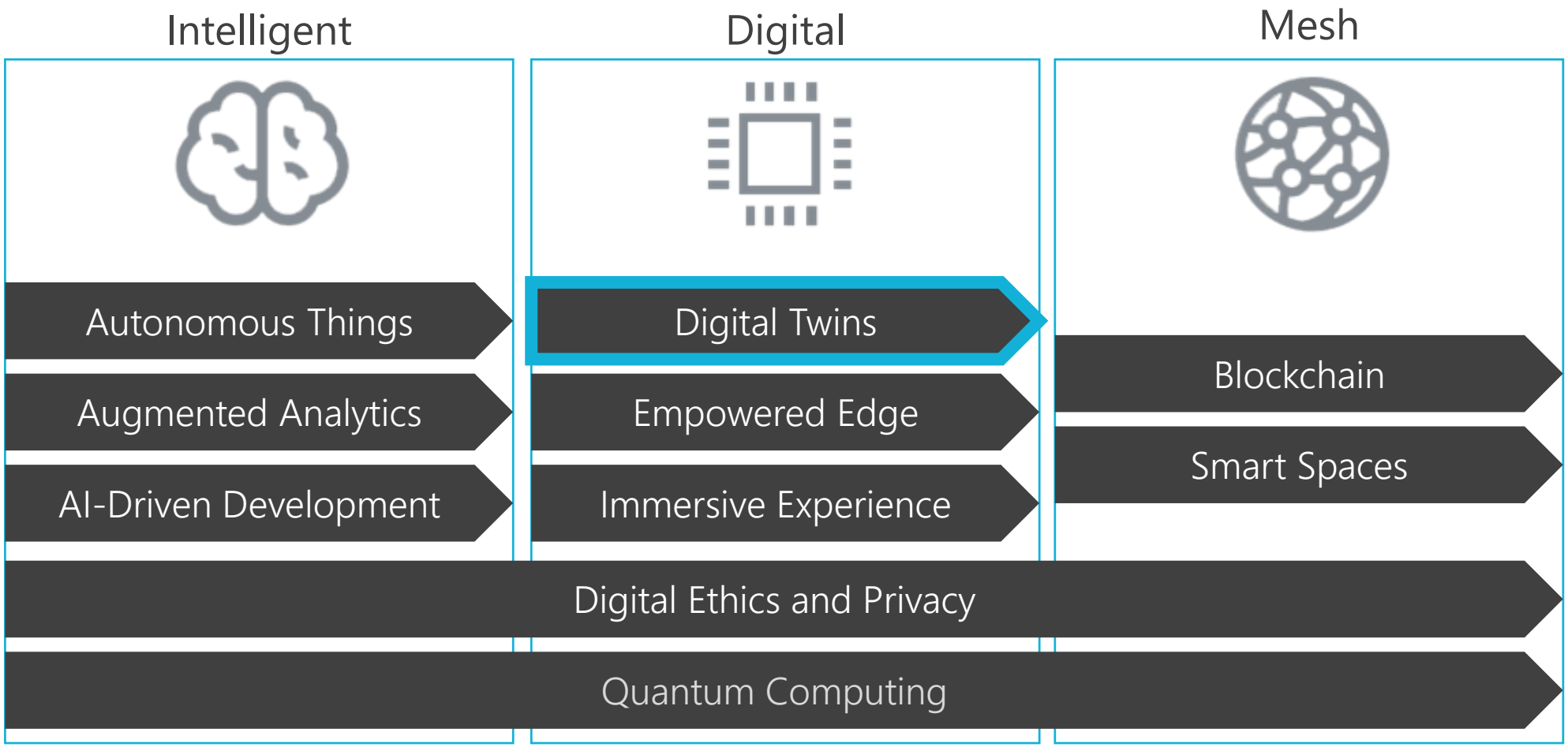
Bentley®
Advancing Infrastructure

Managing Project Digital Twins with ProjectWise

Stefan Sigvardsson

Business Development Manager
Project Delivery - EMEA

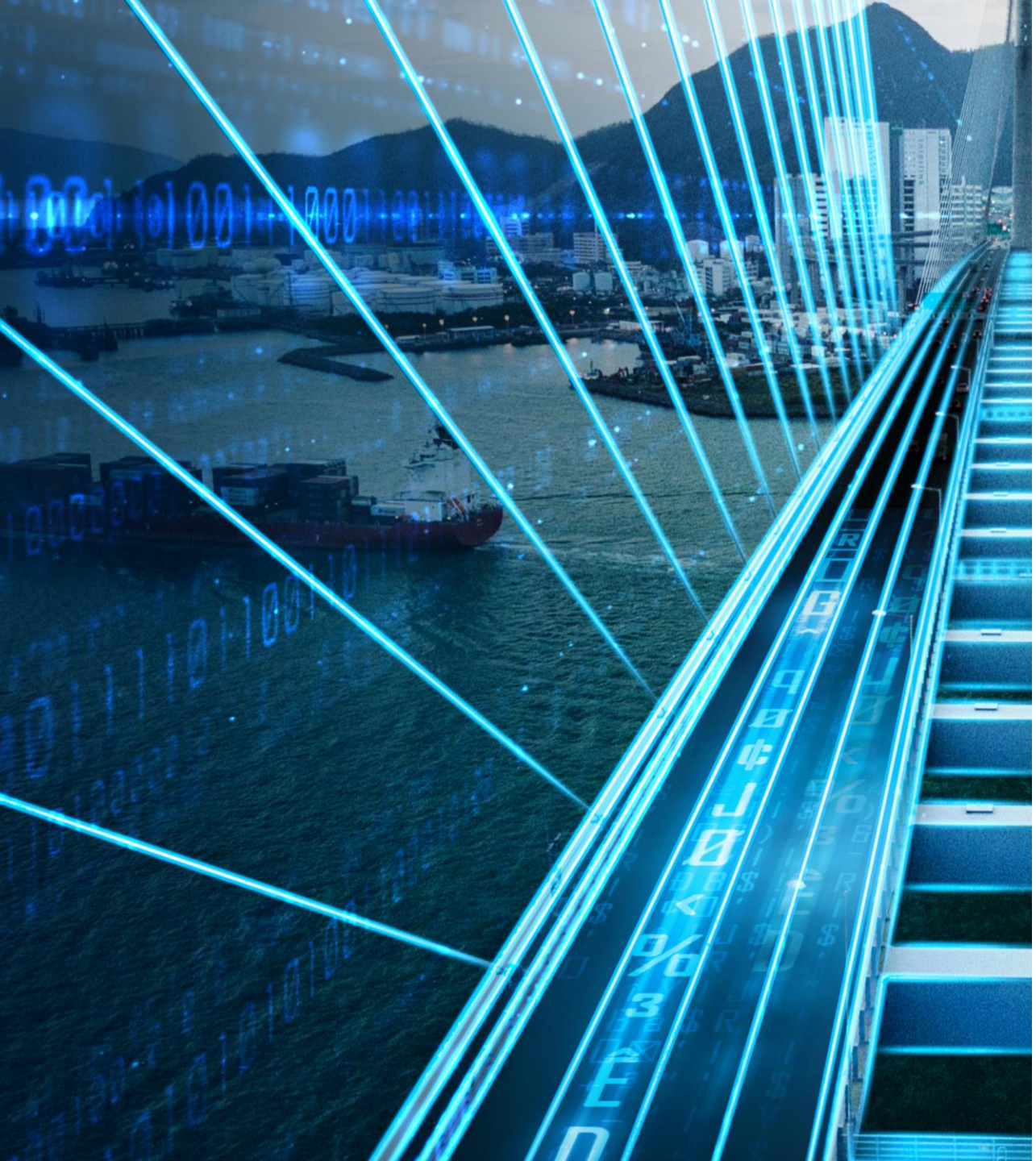
Gartner: Top 10 Strategic Technology Trends for 2019



Source: Gartner (October 2018)

What are the challenges with conventional processes ?

- Lack of visibility and control
- Inability to predict and preempt problems before they occur
- Limited freedom to rapidly adapt to change
- A plateau of operational efficiency
- Static digital representation



What are the opportunities with digital twin delivery?

- Ability to understand and predict change over time
- Continuous performance testing and dynamics; self optimizing
- Predictive maintenance and intelligent recommendations
- Ability to interact with other smart infrastructure & autonomous things

IBM

Watson Internet of Things | Explore IoT | Solutions | Trending

Trending > Trending >

Digital twin: Helping machines tell their story

A digital twin is a virtual representation of a physical object or system across its lifecycle, using real-time data to enable understanding, learning and reasoning

Smarter With Gartner

What are you looking for?

Prepare for the Impact of Digital Twins

September 18, 2017
Contributor: Christy Pettey

TRENDS

Forbes

Billionaires Innovation Leadership Money Consumer Industry

107,866 views | Mar 6, 2017, 02:06am

What Is Digital Twin Technology – And Why Is It So Important?

Bernard Marr Contributor

While the concept of a digital twin has been around since 2002, it's only thanks to the Internet of Things (IoT) that it has become cost-effective to implement. And, it is so imperative to business today, it was named one of Gartner's Top 10 Strategic Technology Tr

Quite simply, a digital tw
This pairing of the virtu
monitoring of systems t
downtime, develop new
simulations.

Thomas Kaiser, SAP Ser
are becoming a business
process and forming the
Companies that fail to re

Deloitte. University Press

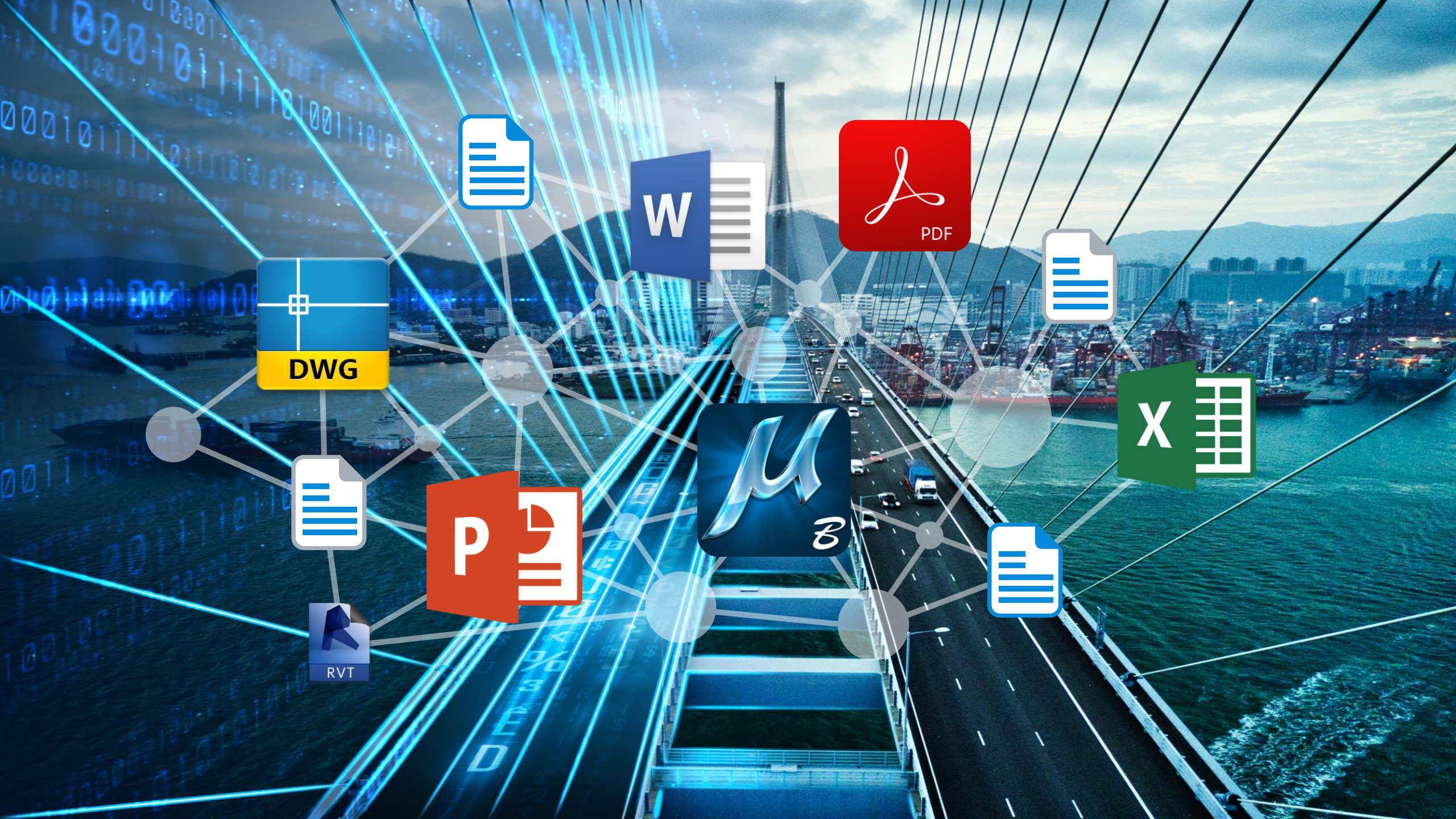
A Deloitte series on Industry 4.0, digital manufacturing enterprises, and digital supply networks

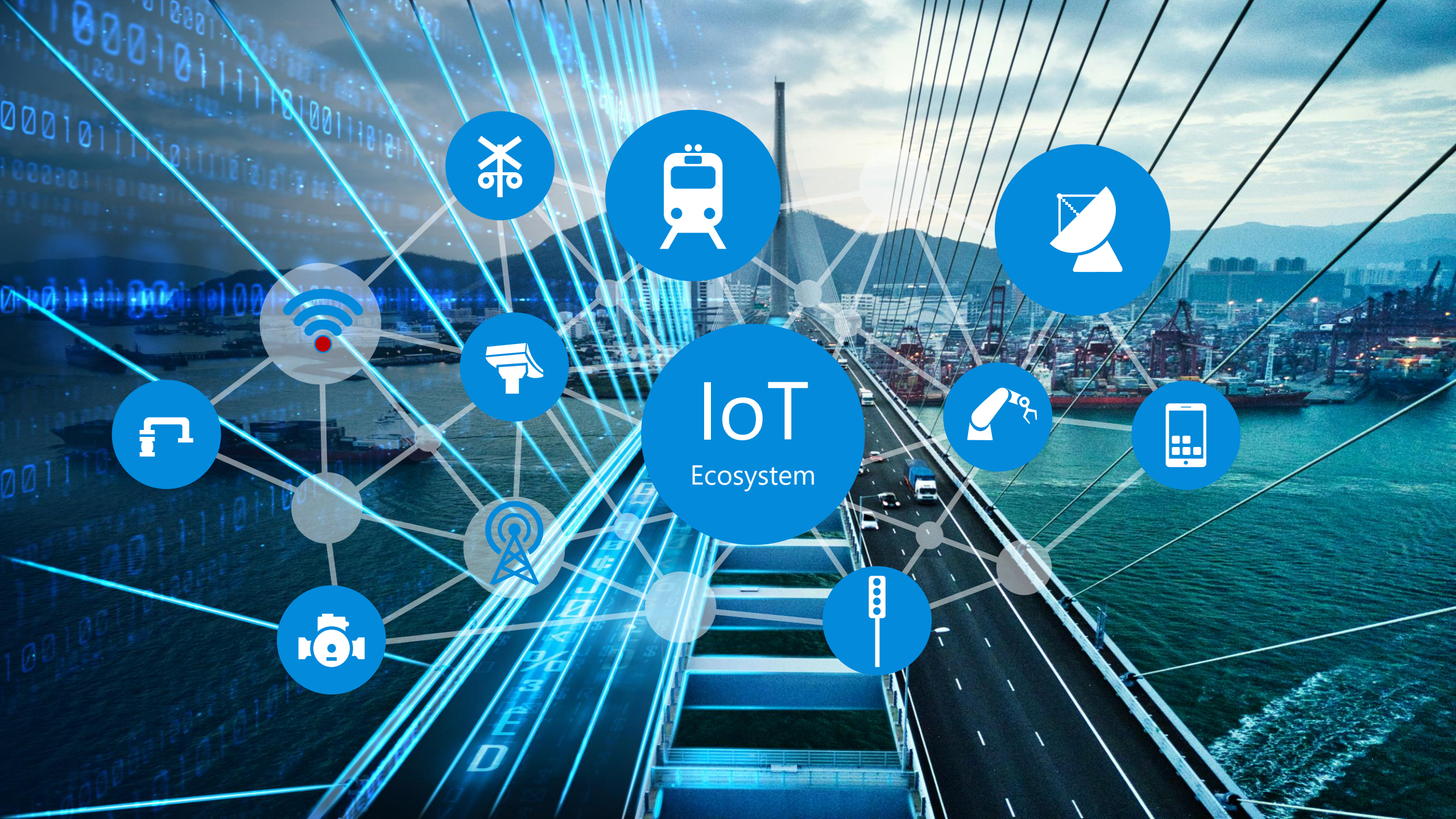
Industry 4.0 and the digital twin

Manufacturing meets its match


CAD
BIM
Digital Twin
Bentley


.....but what is it?


DWG
W
PDF
X
P
RVT


IoT
Ecosystem

Digital Twin

Digital representation

Digital representation of a physical asset, process or system

Continuously surveyed

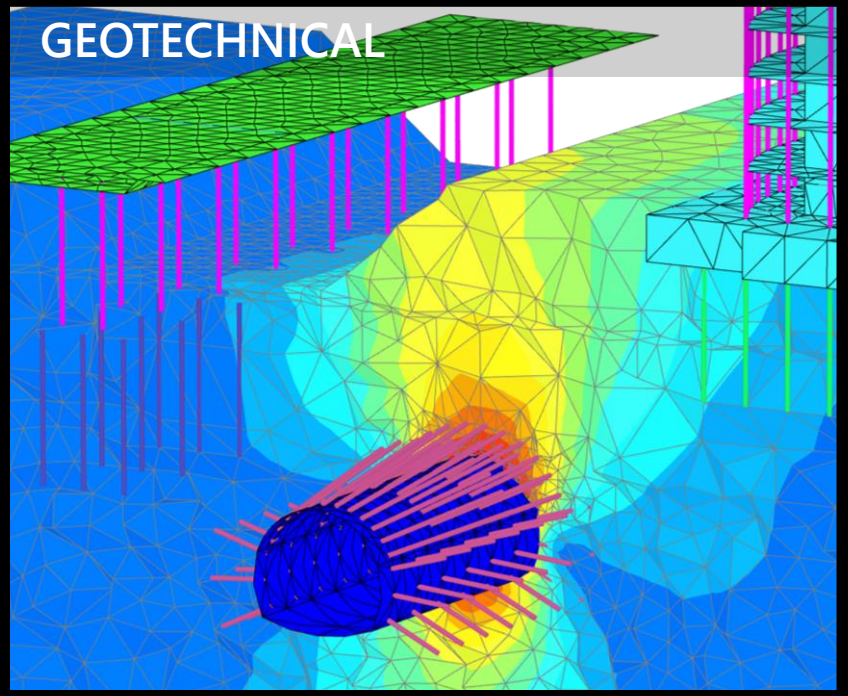
Continuously synchronized from multiple sources

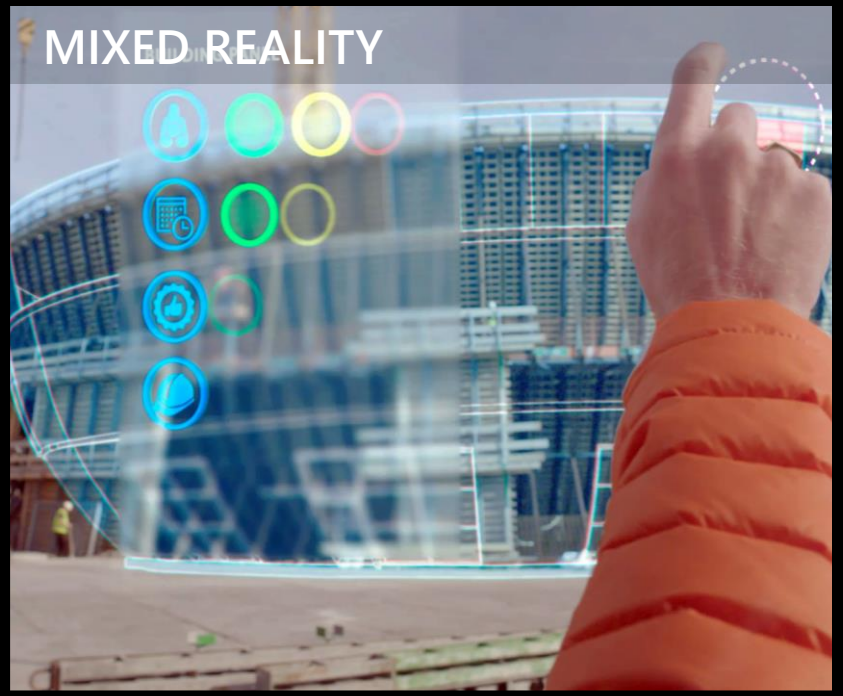
Generates insights

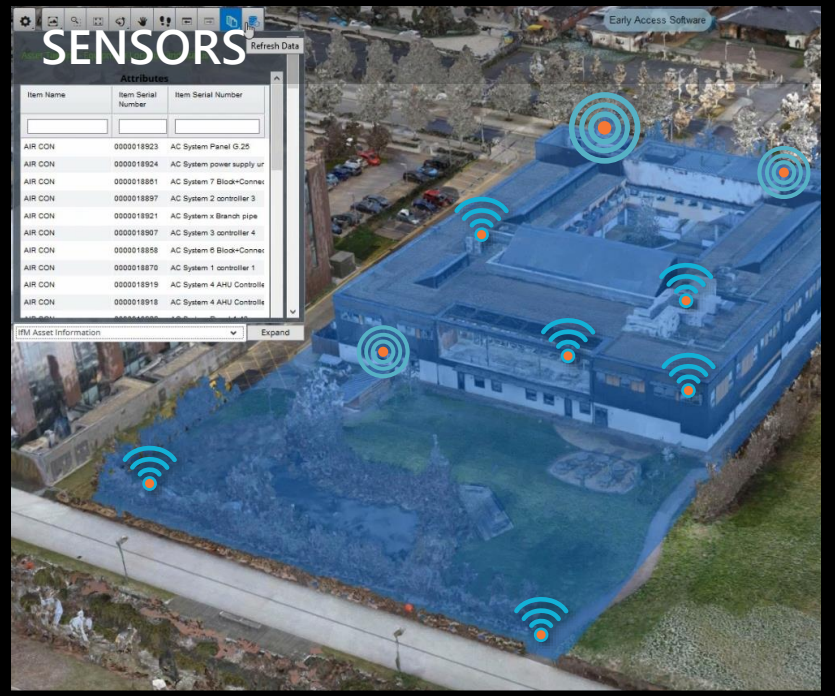
Predictability and performance optimization


3D – 4D
15
FEB
2018
JAN
FEB
MAR
APR
MAY


REALITY MODELING


GEOTECHNICAL

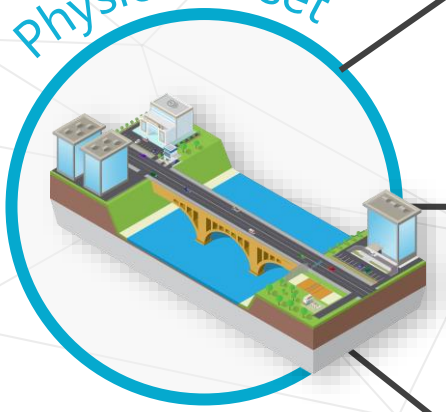

MIXED REALITY


SENSORS
Refresh Data
Attributes
Item Name
Item Serial Number
Item Serial Number
Expand


AI – ML

What is a Digital Twin

An iTwin enables you to visualize the asset, track change, and perform analysis to better understand and optimize asset performance.



Engineering

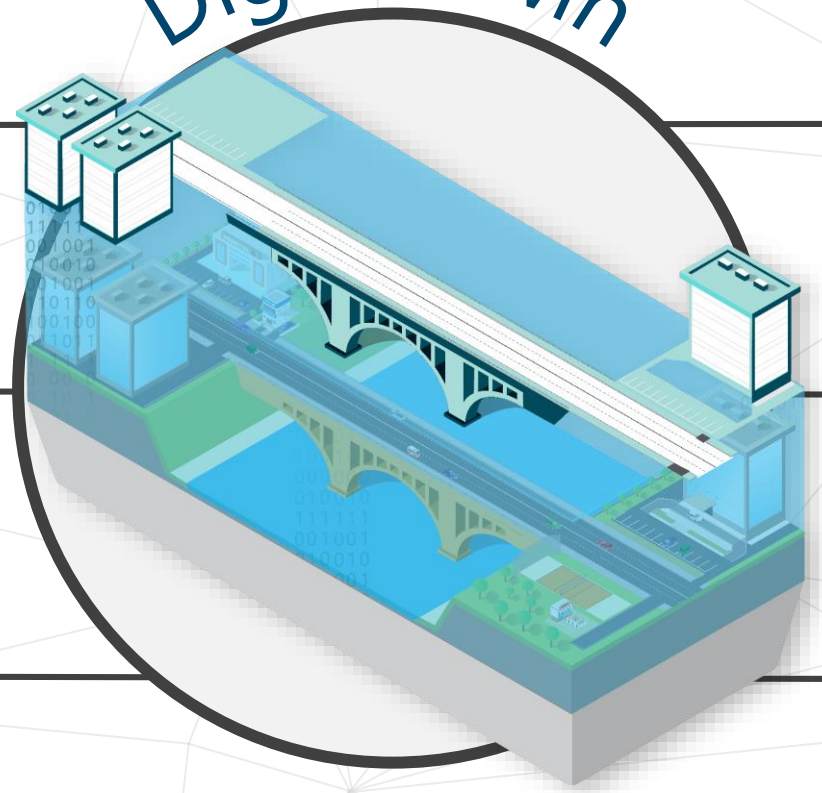
- Specs
- Drawings
- Documents
- Models
- Analyses
- Geotech
- OEM specs

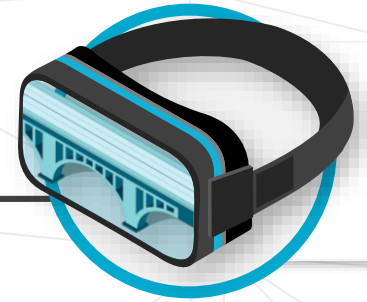
Operations

- IoT feeds
- Sensors
- Drones
- Cameras
- LiDAR
- Point clouds

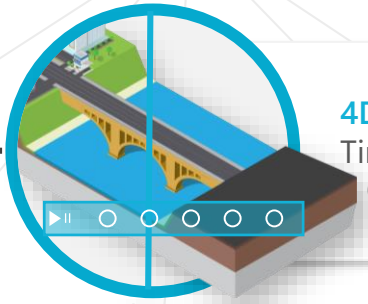
Information

- Asset tags
- Work orders
- Maintenance records
- Inspection records





3D/XR
Immersive Visualization



4D
Timeline of Change

AI/ML
Analytics Visibility

iTwins are continuously updated with data from the physical asset. This data is used to understand and model the asset's performance.

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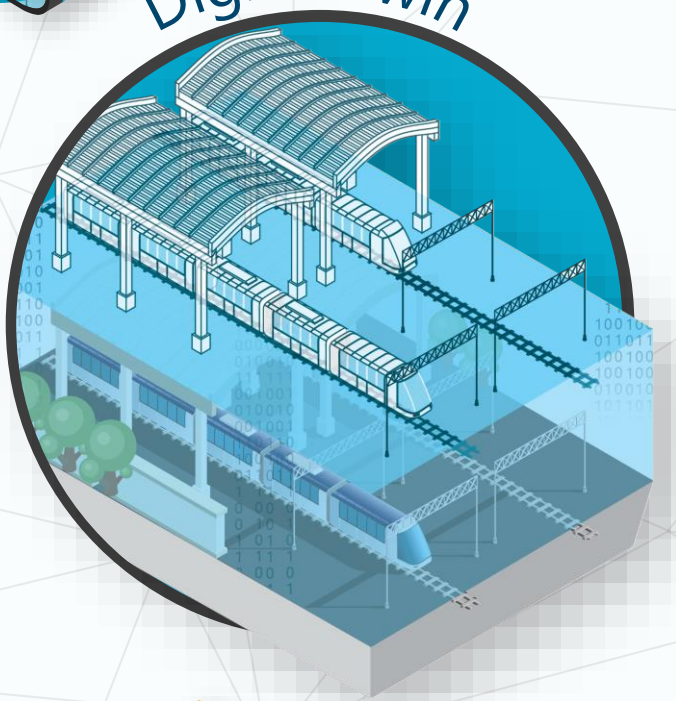
DIGITAL TWIN WORKFLOWS

Planning

- Site survey
- Reality Capture / 3D Mesh

Design

- Stakeholder engagement
- Planning and visualization
- Quality review
- Change tracking



Operations

- HSSE training
- Operator training

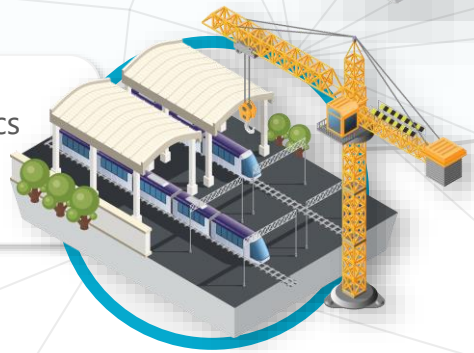
- Maintenance planning
- Shutdowns
- Verify before execution

- Remote inspection
- Leak detection
- Corrosion detection

Analysis

- Pedestrian simulation
- Flood simulation

Construction



- Simulate logistics
- Progress
- Status review

An iTwin spans the entire asset lifecycle. Users at all stages can make better informed decisions for better outcomes.

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Digital Twin Requirements

Must be trustworthy

INFRASTRUCTURE
ENGINEERING
DIGITAL TWIN

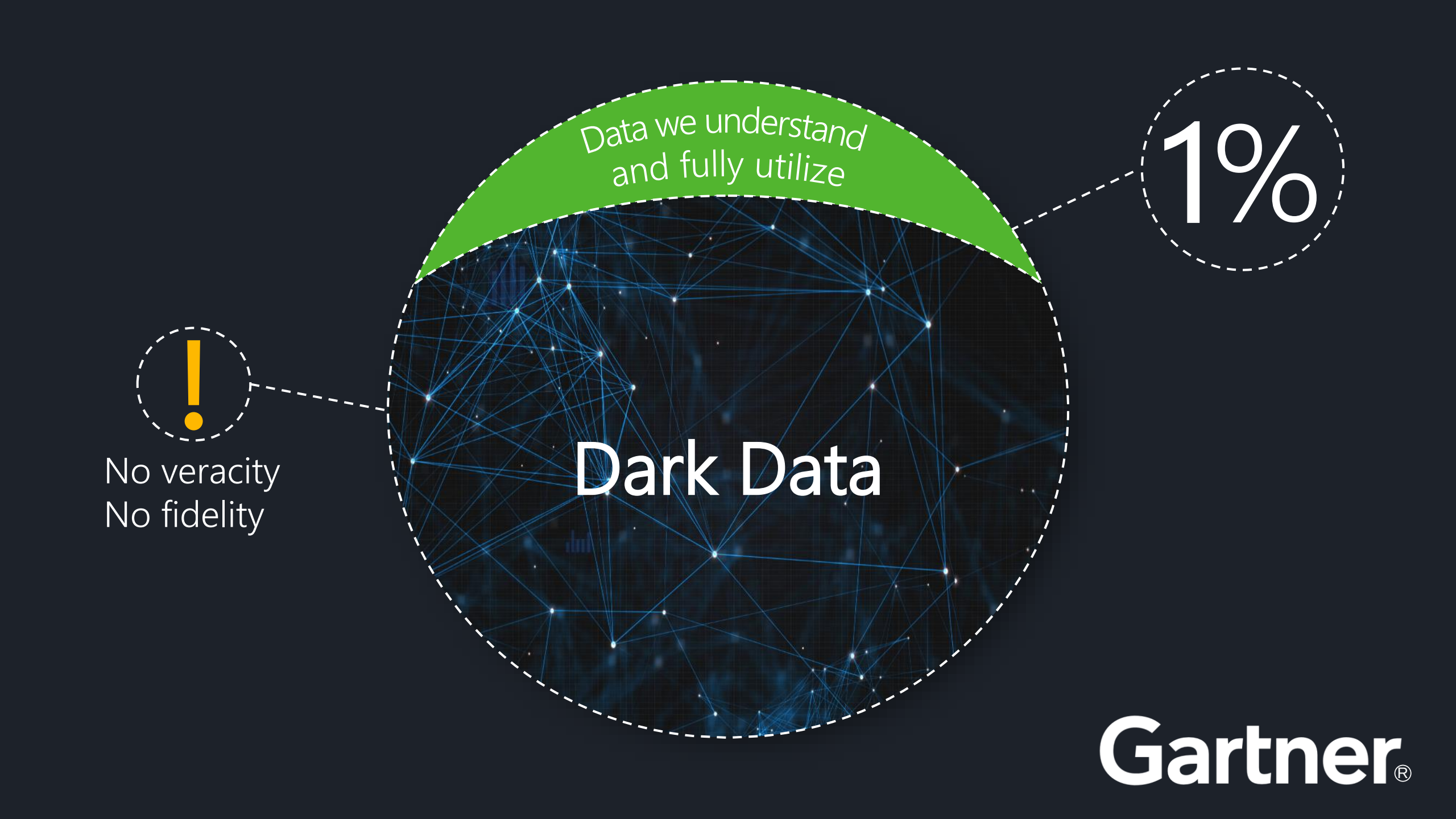
Must be trustworthy

Data is the new infrastructure

Enables innovation

Creates value

Needs to be shared safely and securely

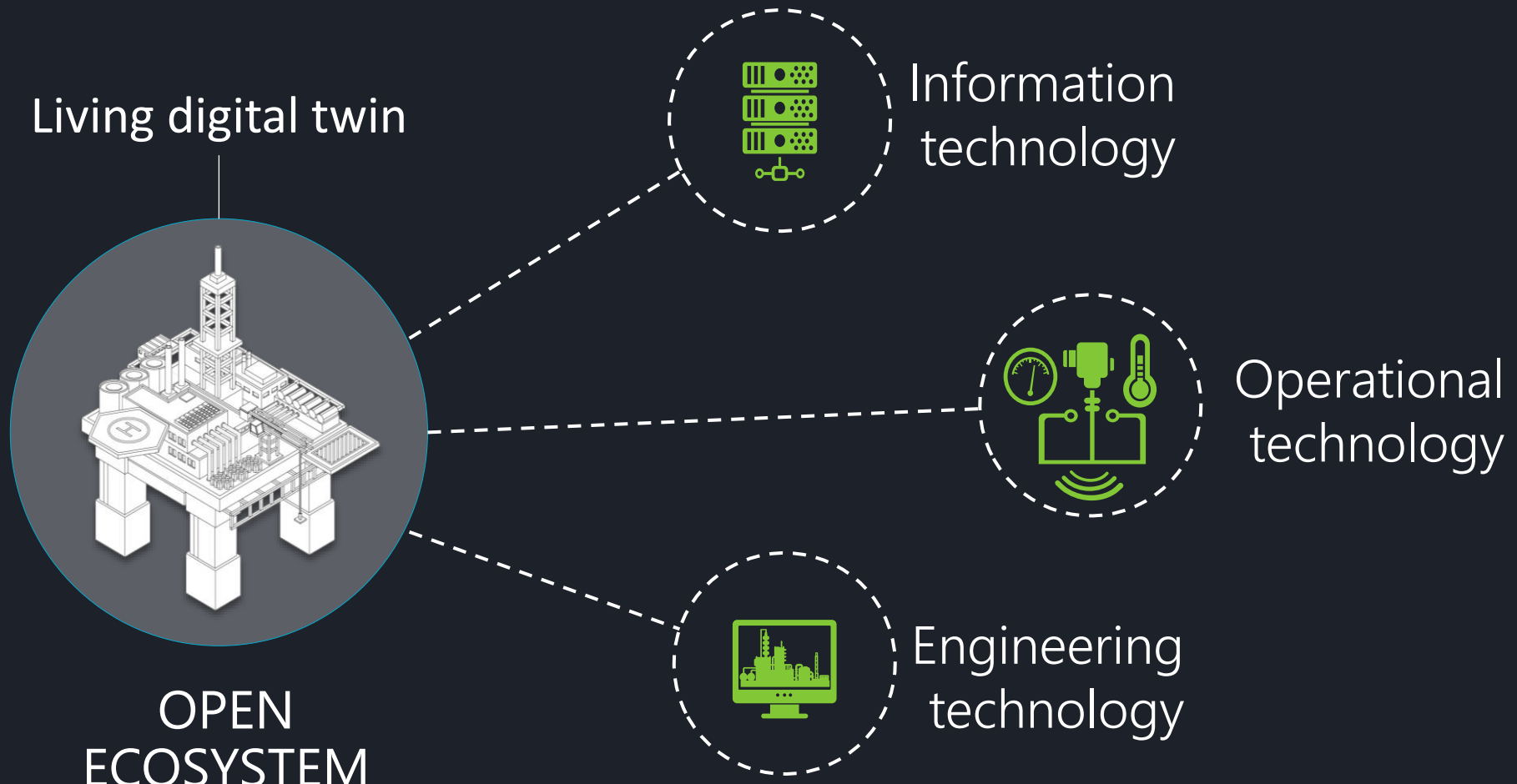

Data we understand and fully utilize
1%
Dark Data
No veracity
No fidelity
Gartner®

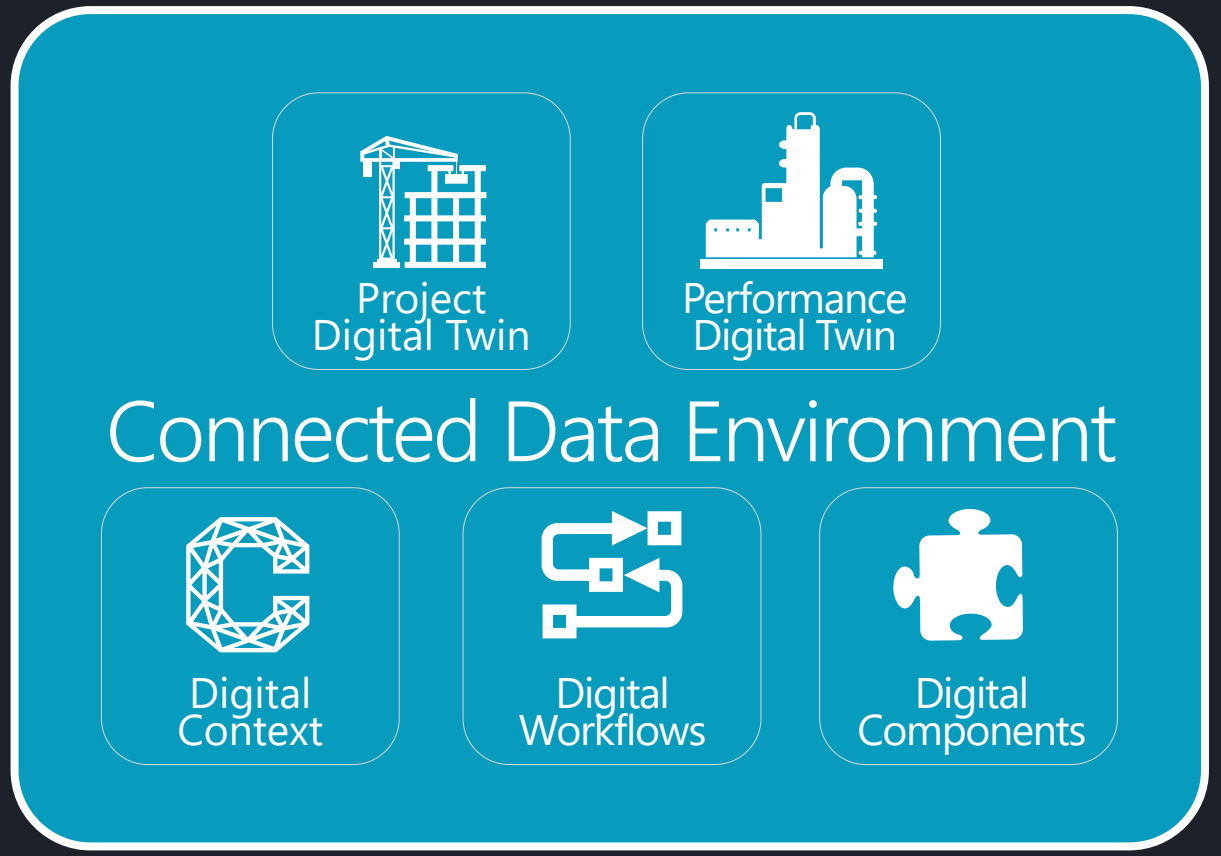
Digital Twin Requirements

- Must be trustworthy
- Must be open

INFRASTRUCTURE
ENGINEERING
DIGITAL TWIN

- Must be open


Living digital twin
Information technology
Operational technology
Engineering technology
OPEN ECOSYSTEM


Project
Digital Twin
Performance
Digital Twin
Connected Data Environment
Digital
Context
Digital
Workflows
Digital
Components

Living digital twin

iModelHub

iTwin Services

Visualization

ContextShare

Real-world

Digital Twin Requirements

INFRASTRUCTURE
ENGINEERING
DIGITAL TWIN

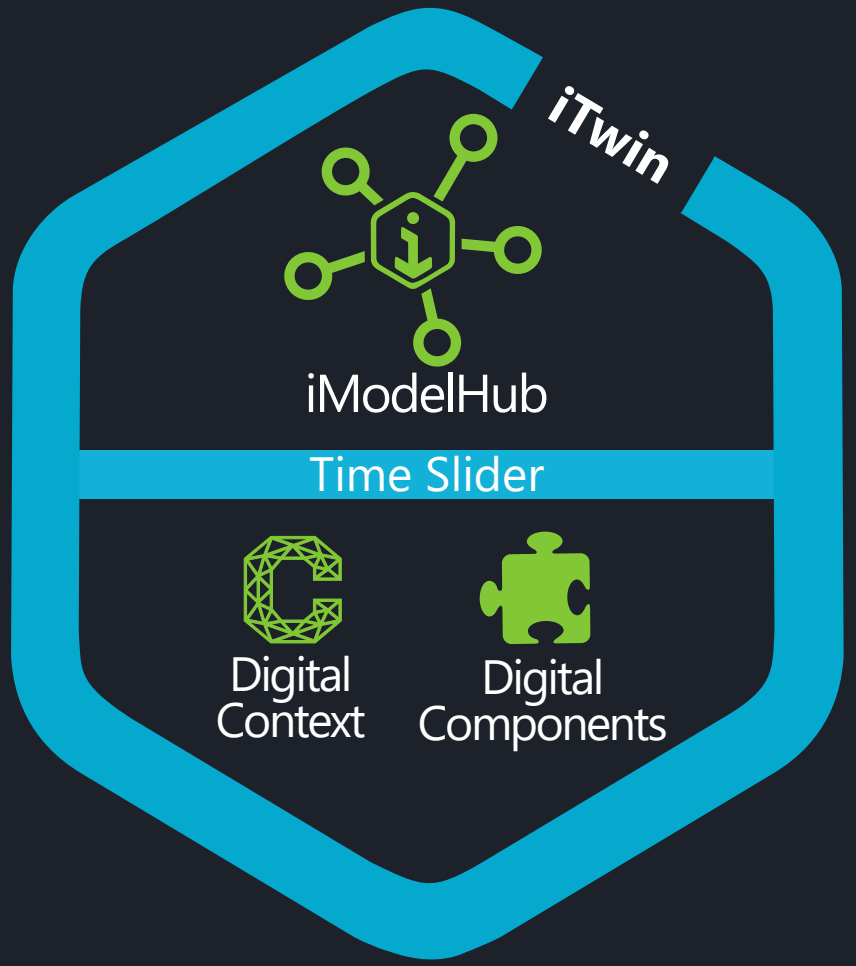
- Must be trustworthy
- Must be open
- Must function effectively

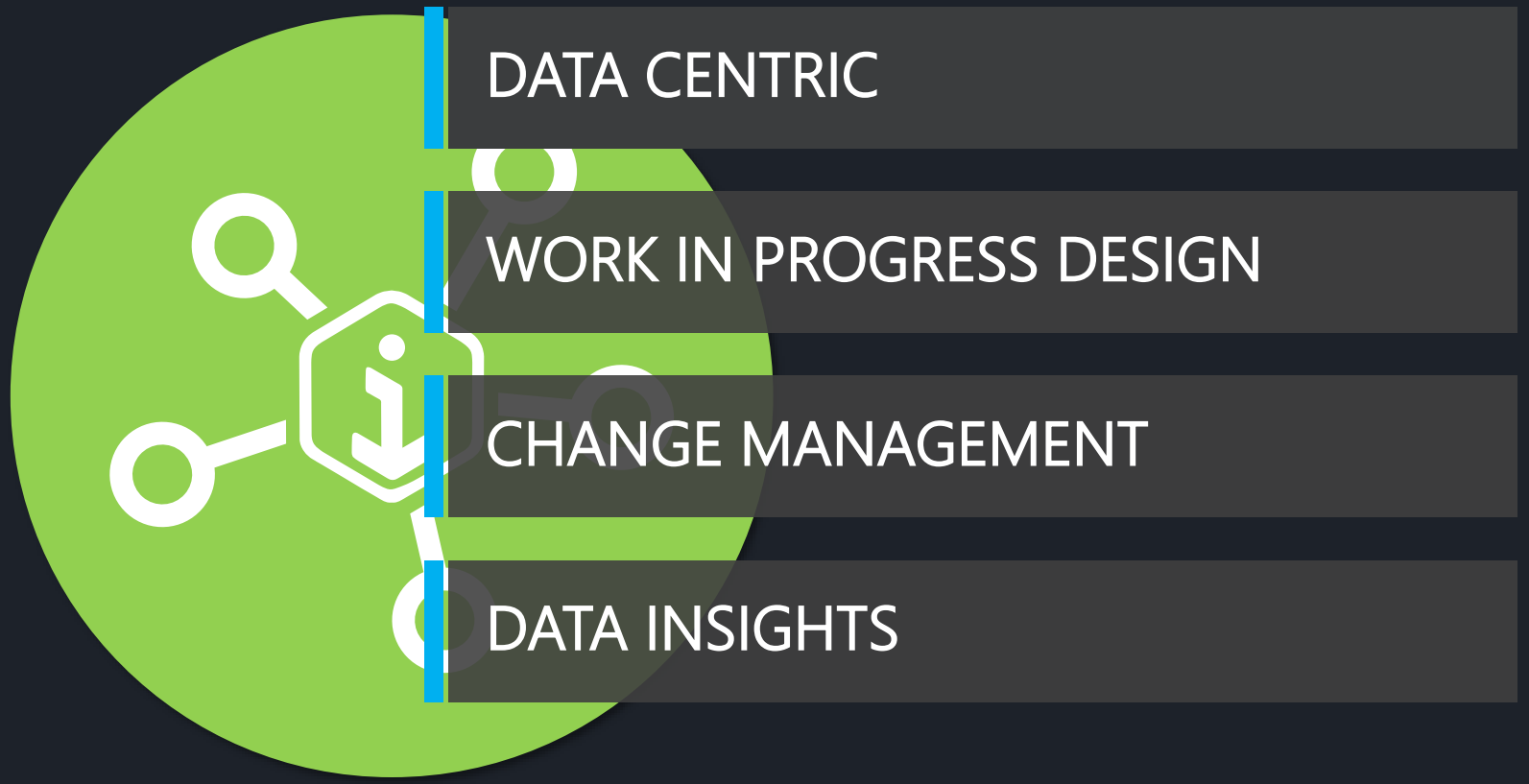
ALIGNMENT

ACCOUNTABILITY

ACCESSIBILITY


2009
Advancing
iModels


iTwin
iModelHub
Time Slider
Digital
Context
Digital
Components

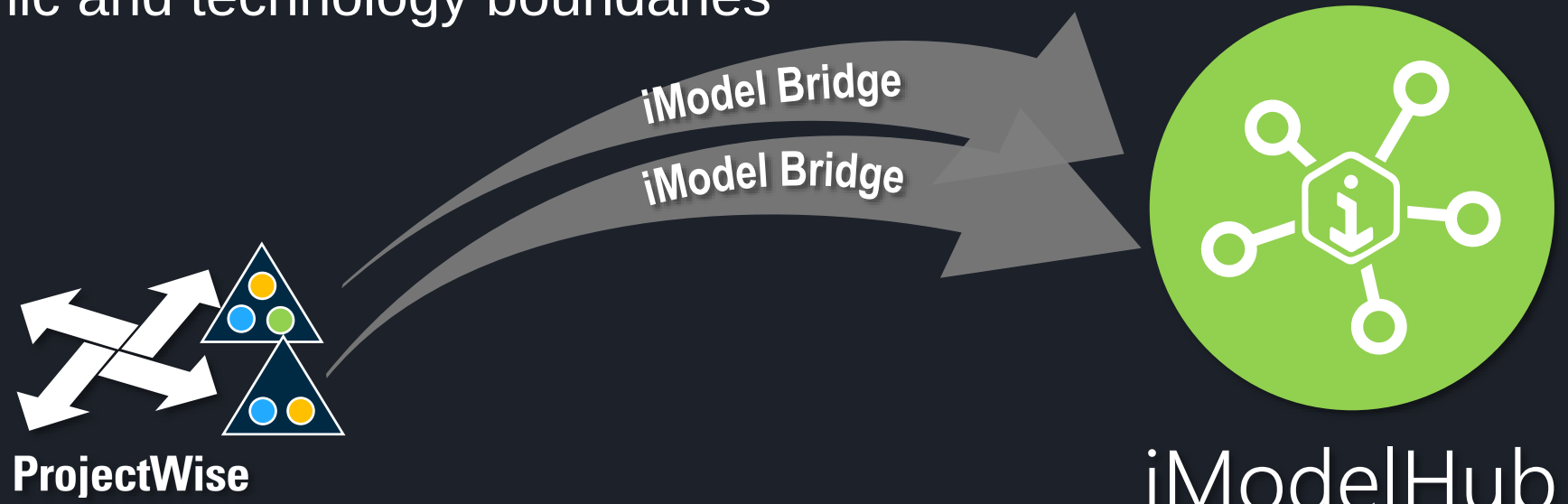

DATA CENTRIC
WORK IN PROGRESS DESIGN
CHANGE MANAGEMENT
DATA INSIGHTS

iModelHub

- RELATIONAL DATABASE
- NOT CLIENT-SERVER ARCHITECTURE
- POWERFUL SQL QUERIES
- SCALE UP

ProjectWise is the Source of Content for your Digital Twin

- Project information is centrally stored and shared through ProjectWise
  - Collaborate with multi-discipline teams
  - Coordinate work-in-progress engineering
  - Standards management
  - Design application integration
  - Manages complex relationships and dependencies
  - Removes geographic and technology boundaries



ProjectWise for your Digital Twin

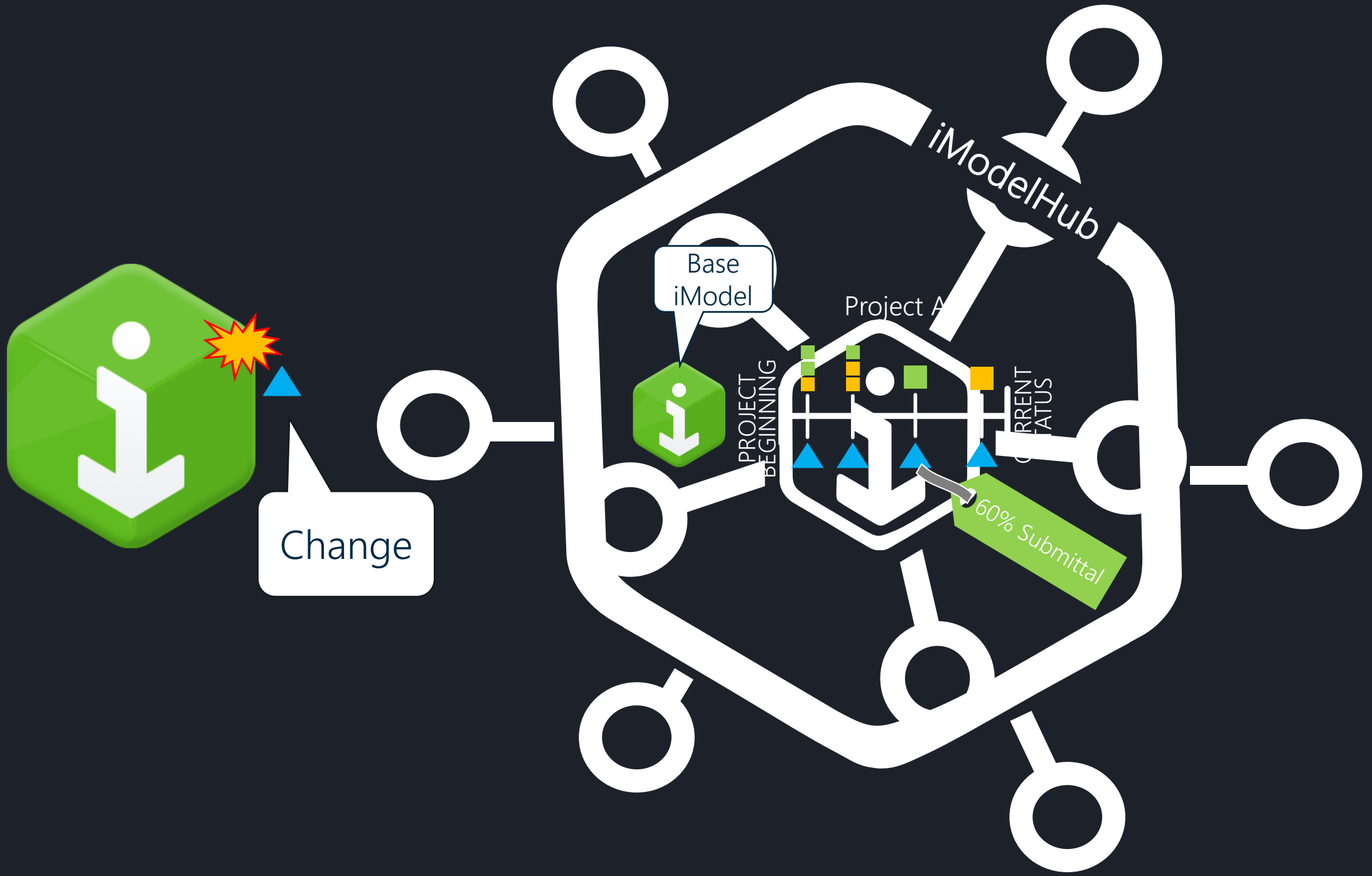
Bentley Automation Service includes a new plug-in to automate syncing of changes with the project iModel by utilizing iModel Bridges

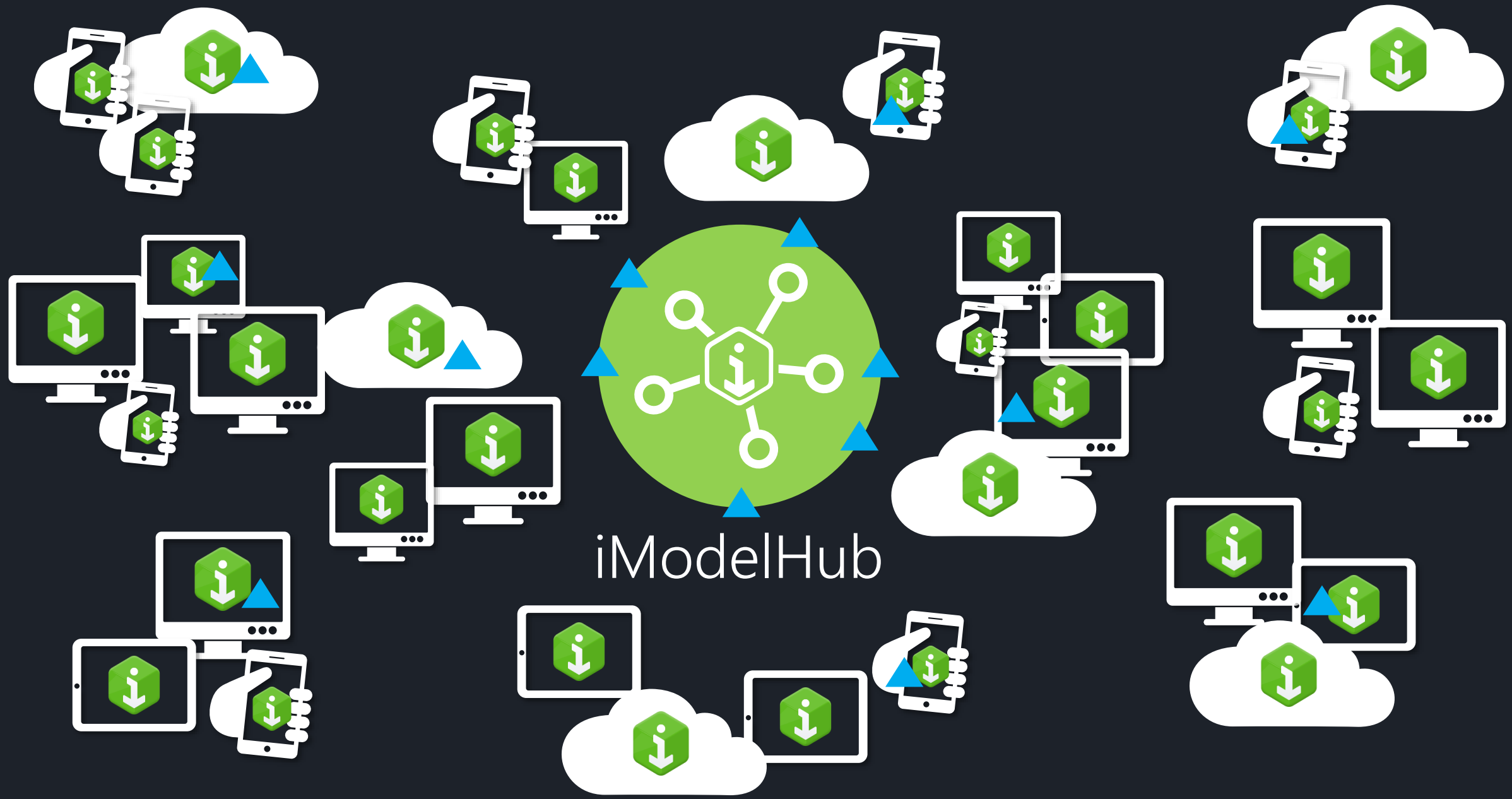
ProjectWise Projects (aka cloud projects) are key to the ProjectWise and digital twin workflows

BIM managers easily define the content for digital twins from the ProjectWise Web via the iModel mapping tool

- Content can include Models, Drawings and Sheets

iTwin Services utilize Document Codes, passed from ProjectWise to the digital twin, for a richer usability experience


iModelHub
Base
iModel
Project A
PROJECT
BEGINNING
CURRENT
STATUS
60% Submittal
Change

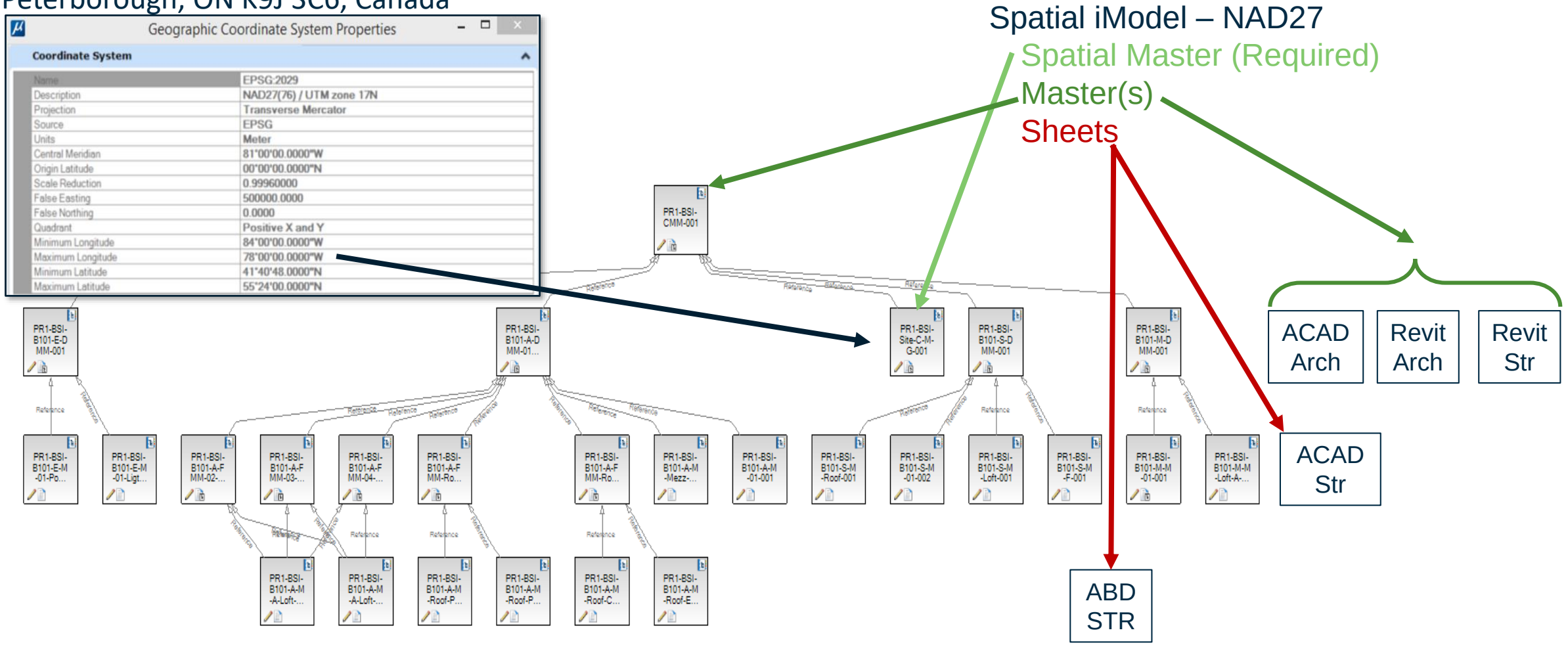

iModelHub

iModelBridge Automation

- **Users can contribute the content of engineering models in ProjectWise to the iModel in the iModelHub without changing existing workflows, applications or formats.**
- ProjectWise Admin creates an iModelBridge job per ProjectWise Datasource
- The BIM manager maps data to an iModel in ProjectWise Web
  - iModel Bridge job reads the iModel mapping
  - PW Admin no longer has to know what input is needed
- All input set files, including references, have an affinity to a specific application for processing
  - i.e. OBD file processed with the OBD Bridge, MicroStation file processed with the MicroStation Bridge
  - Happens automatically!
- Changes are continually sync’d with the iModel in the Hub

iModel Content

140 Sherbrooke St,
Peterborough, ON K9J 3C6, Canada



iModel Mapping Options

- Spatial Root Model (Required)
  - ✓ Geospatially located
  - ✓ All references are processed
  - ✓ If this file fails - the entire job will fail
- Master Model (Optional)
- Sheet (Optional)

Bentley

iModel Mapping Options

- Spatial Root Model (Required)
  - ✓ Geospatially located
  - ✓ All references are processed
  - ✓ If this file fails - the entire job will fail
- Master Model (Optional)
  - ✓ Master files not in the reference tree of the spatial root
  - ✓ All references are processed
- Sheet (Optional)

Bentley

iModel Mapping Options

- Spatial Root Model (Required)
  - ✓ Geospatially located
  - ✓ All references are processed
  - ✓ If this file fails - the entire job will fail
- Master Model (Optional)
  - ✓ Master files not in the reference tree of the spatial root
  - ✓ All references are processed
- Sheet (Optional)
  - ✓ Include specific 2D sheet models
  - ✓ If sheets are explicitly mapped, then only those are synchronized
  - ✓ In this case, Bridges will not look for other sheet models in the spatial root/master model + reference files

Bentley

ProjectWise Share

https://projectshareportal.bentley.com/#/177bd28e-b470-431d-9914-1d3dfa5ca701

Home | Bentley Systems Inc | Assets | Projects | AM-DEMO-LOFTS Lofts Mixed Use Project | 49 | Jo Wright

ProjectWise Share

Share

Lofts 01

All

In Progress

Manage Connections

Lofts 01 > Designs

New | Search Designs...

Name	Version	Description	File Name	File Size	Date Modified
_bbes					May 7, 2018, 12:21 PM
A101.dgn		A101.dgn	A101.dgn	204.5 KB	May 6, 2019, 2:48 PM
A_Composition Drawing.dgn		A_Composition Drawing.dgn	A_Composition Drawin...	756 KB	May 15, 2018, 3:47 PM
A_Composition Energy.dgn		A_Composition Energy.dgn	A_Composition Energy....	82.5 KB	May 15, 2018, 3:47 PM
A_Composition Render.dgn		A_Composition Render.dgn	A_Composition Render...	239.5 KB	May 15, 2018, 3:47 PM
A_Discipline Master.dgn		A_Discipline Master.dgn	A_Discipline Master.dgn	5.94 MB	May 15, 2018, 3:47 PM
A_Grocery-Mezz.dgn		A_Grocery-Mezz.dgn	A_Grocery-Mezz.dgn	1.74 MB	May 15, 2018, 3:47 PM
A_Grocery.dgn		A_Grocery.dgn	A_Grocery.dgn	6.25 MB	May 15, 2018, 3:47 PM
A_Loft Core.dgn		A_Loft Core.dgn	A_Loft Core.dgn	1.26 MB	May 15, 2018, 3:47 PM
A_Loft Exterior.dgn		A_Loft Exterior.dgn	A_Loft Exterior.dgn	2.13 MB	May 15, 2018, 3:47 PM
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Bentley

OpenRoads Designer

OpenBuildings Designer

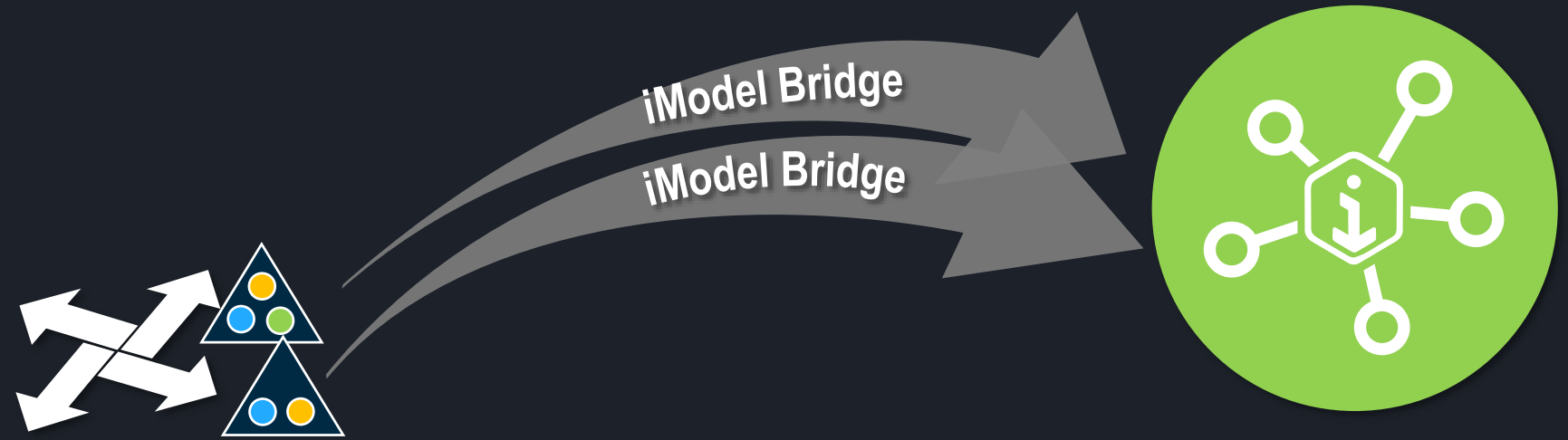
MicroStation

AUTODESK® DWG™

AUTODESK® REVIT®

. . .

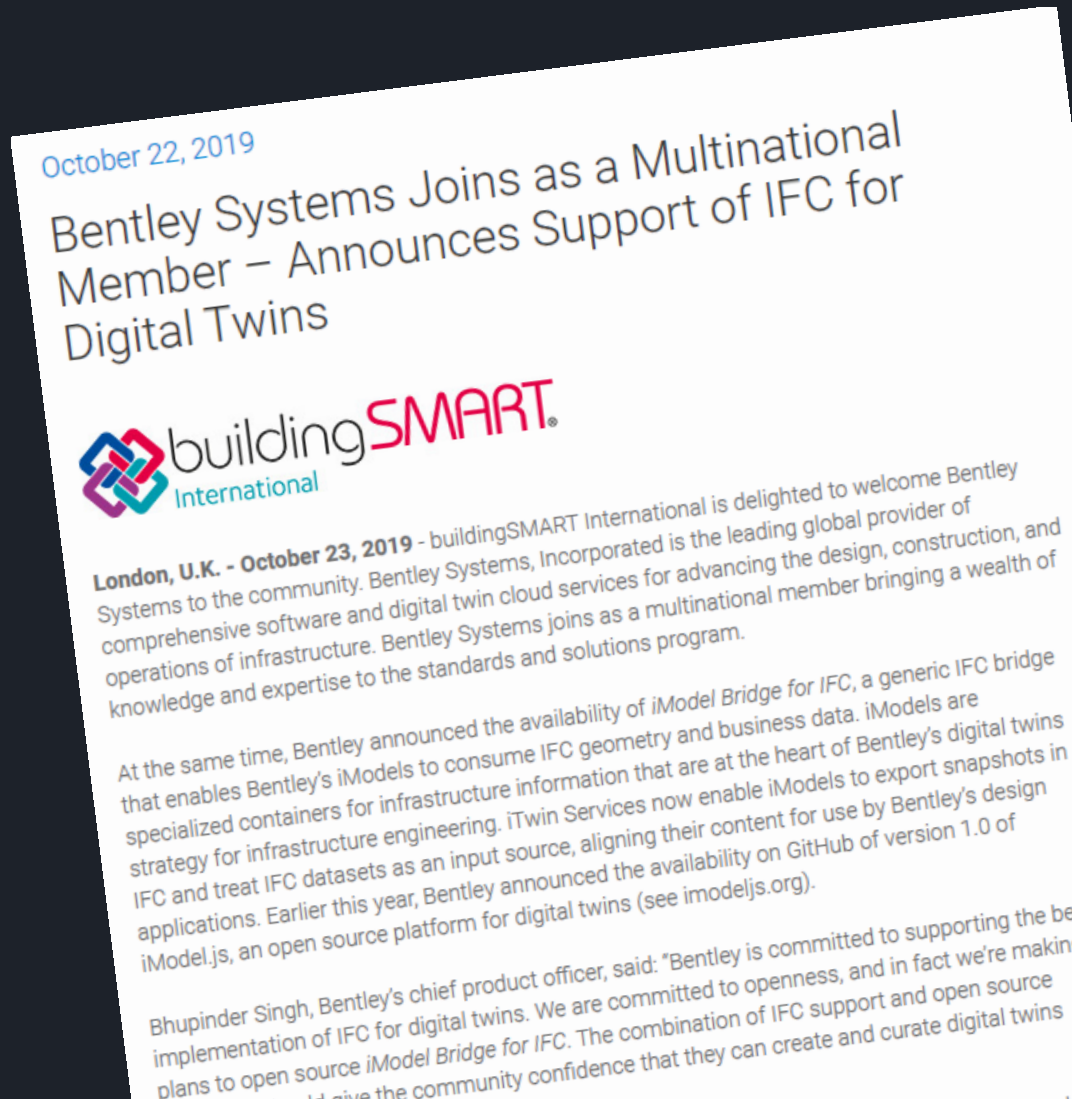
ALIGNMENT



ProjectWise

iModelHub

iModel Bridge for IFC



October 22, 2019

Bentley Systems Joins as a Multinational Member – Announces Support of IFC for Digital Twins

buildingSMART International

London, U.K. - October 23, 2019 - buildingSMART International is delighted to welcome Bentley Systems to the community. Bentley Systems, Incorporated is the leading global provider of comprehensive software and digital twin cloud services for advancing the design, construction, and operations of infrastructure. Bentley Systems joins as a multinational member bringing a wealth of knowledge and expertise to the standards and solutions program.

At the same time, Bentley announced the availability of *iModel Bridge for IFC*, a generic IFC bridge that enables Bentley's iModels to consume IFC geometry and business data. iModels are specialized containers for infrastructure information that are at the heart of Bentley's digital twins strategy for infrastructure engineering. iTwin Services now enable iModels to export snapshots in IFC and treat IFC datasets as an input source, aligning their content for use by Bentley's design applications. Earlier this year, Bentley announced the availability on GitHub of version 1.0 of iModel.js, an open source platform for digital twins (see imodeljs.org).

Bhupinder Singh, Bentley's chief product officer, said: "Bentley is committed to supporting the best implementation of IFC for digital twins. We are committed to openness, and in fact we're making plans to open source *iModel Bridge for IFC*. The combination of IFC support and open source give the community confidence that they can create and curate digital twins

ProjectWise Explorer

Datasource Folder Document Export View Tools Window Help

Search Interface Manager

Address pw:\\PC-PWISU2.bentley.com:pc-YII_2017\Documents\BARTA\BARTA Projects\BSI 100 West Station\Building\S Go

- Marketing
- naou-tli
- NAOUAE
- PC-U2Geo
- PRG
- ProductDesign
- Project Delivery Advancement Team
- Project Delivery Americas
- PW-test1
- PWCS Catalog Data
- Reg-Sales-NAOU
- RSO Global
- Sales-ProjectDelivery
- Sales Infrastructure Owners
- TSG
- User-Advocacy-Team
- YII_2017 (BENTLEY\Buddy.Branham)
  - Documents
    - Application Data
    - BARTA
      - BARTA Projects
        - BSI 100 West Station
          - _WorksetStandards
          - Bridge
          - Building
            - Package
            - Retail Archtecture
            - Stuctural
              - 2D Model
              - 2D Sheets
              - 3D Model
                - Design Insights
                - Update 2
                - Update 3
          - Civil Site
          - Photos
          - Rail
          - Reality Model
          - Train Station
          - Saved Searches
        - BSI200 - Peterborough Geospatial Investigation
        - BSI300 - Medical Complex-Córdoba
        - BSI400 - W01 - Intersection of I-9 and SR 32
        - BSI900 - Adelaide Tower
        - Gas Authority, Inc
        - Wedraw Drafters, Inc - New Employee Training
      - Planning
    - Demo1
    - dmsSystem
    - Geospatial Map
    - Projects

Name	PW_CODE	PW_DESCRIPTI...	PW_FILTER	PW_FILTER2	PW_SORT...
Design Insights					
Update 2					
Update 3					
04 Masterl Oakland west Station.i.dgn					
Architectural Oakland west Station RVT_04.i.dgn					
E-Second_Floor.dgn					
Master Structural Oakland west Station_04.dgn					
Oakland West Bart LR Station.dgn					
S-First_Floor.dgn					
S-Ground_Floor.dgn					
S-Roof.dgn					
S-Second_Floor.dgn					

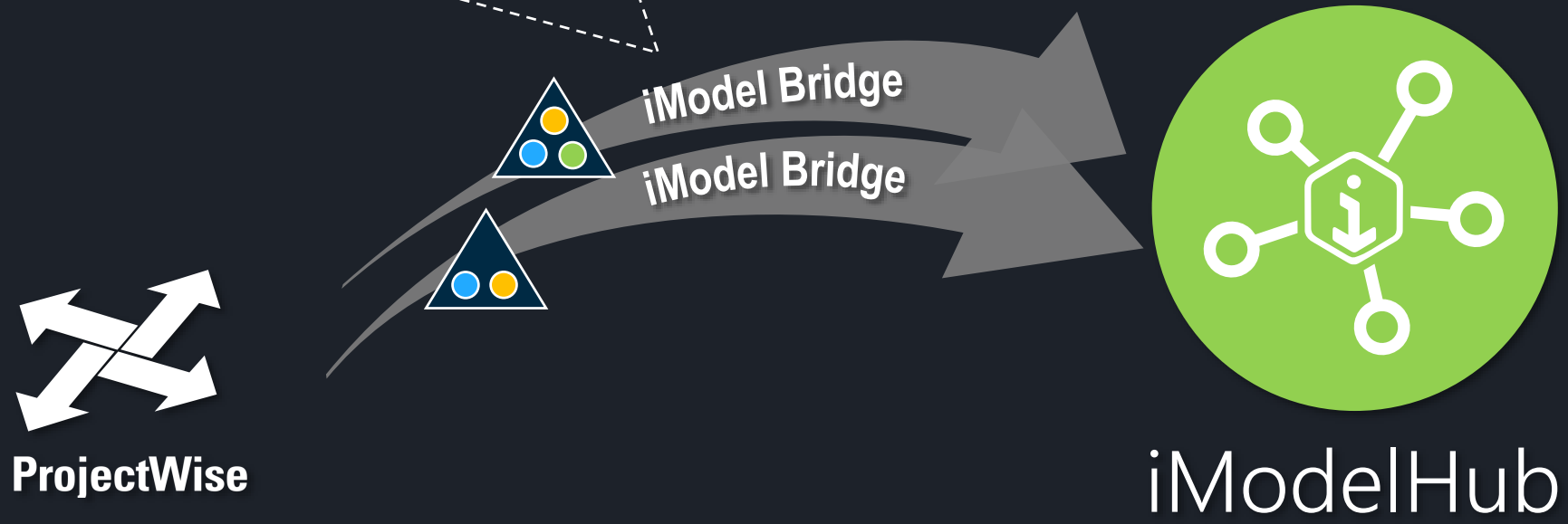
Project Properties | Folder Properties | Project Portal | Dependency Viewer | Access Control

Properties (Project Type - Civil)	
Project Number	BSI500
Project Name	West Station LR Expantion
Owner	California Department of Transportation
Project Description	Replace existing Platform with joint commuter / Light rail with retail
Route	West Line
Station-Start	
Station-End	
Project Length	2400 ft
Project Location	Alameda County, CA
Country	United States
Budget	3500000
Start Date	6/1/2017
End Date	9/28/2018
General Contractor	Robbins Railway Construction
Project Manager	Bill Bailey
PM Phone Number	(530)865-00002
Project Status	Design
Percent Complete	30
Home Folder Properties	
Folder Name	BSI 100 West Station
Folder Description	West Station

Transferred 7 files in 0:14, 0 bytes total

9:31 AM

- Detects incremental changes
- Transforms data into aligned structure
- Aggregates changed from many sources into a single, consistent iModel



ACCOUNTABILITY

ProjectWise

BSI 100 West Station ★

Project Details

Registered:	Thursday, August 31, 2017
Modified:	Friday, September 15, 2017
Industry:	Rail and Transit
Asset Type:	Stations and Platforms
Latitude:	37.804139°
Longitude:	-122.293271°
Time Zone:	Singapore Standard Time
Data Center Location:	East US

ProjectWise Connections	0
ContextShare Connection	
SharePoint Connections	0

Edit Project Details

Team Members

- AB Abeesh Basheer
- AM Adam McCarthy
- AG Akshay Govekar
- AN Alexander Nikitin
- AK Alexey Krylov

Manage Members

Notifications

No notifications

ProjectWise Connection Services

- Share
- Deliverables Management
- Performance Dashboards
- Issue Resolution
- Field Data Management
- Project Synchronization

Digital Twin Requirements

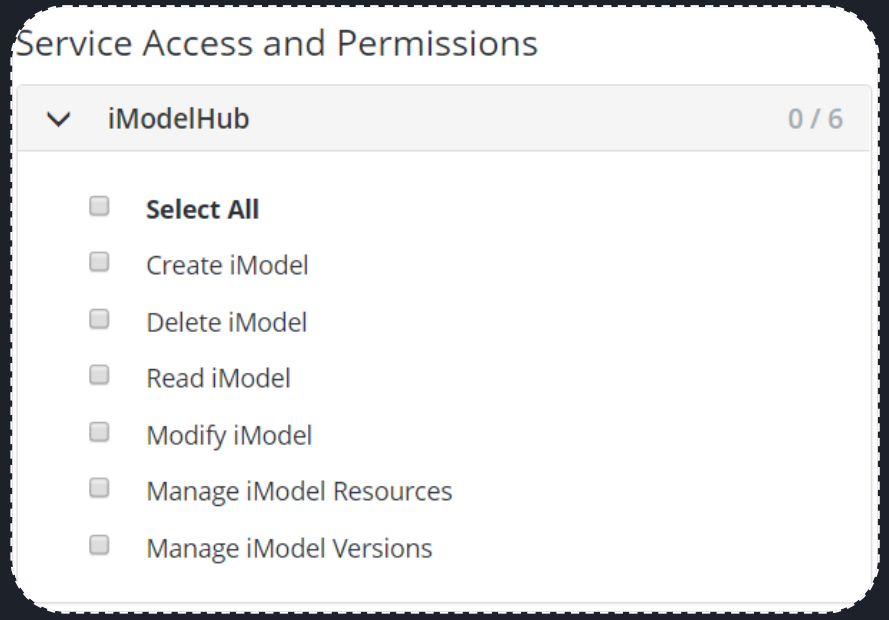
INFRASTRUCTURE
ENGINEERING
DIGITAL TWIN

- Must be trustworthy
- Must be open
- Must f[illegible]ely
- Must be secured

HIGHEST LEVELS OF SECURITY PROVIDED BY MICROSOFT AZURE

USER AUTHENTICATION

PROJECT BASED ROLES

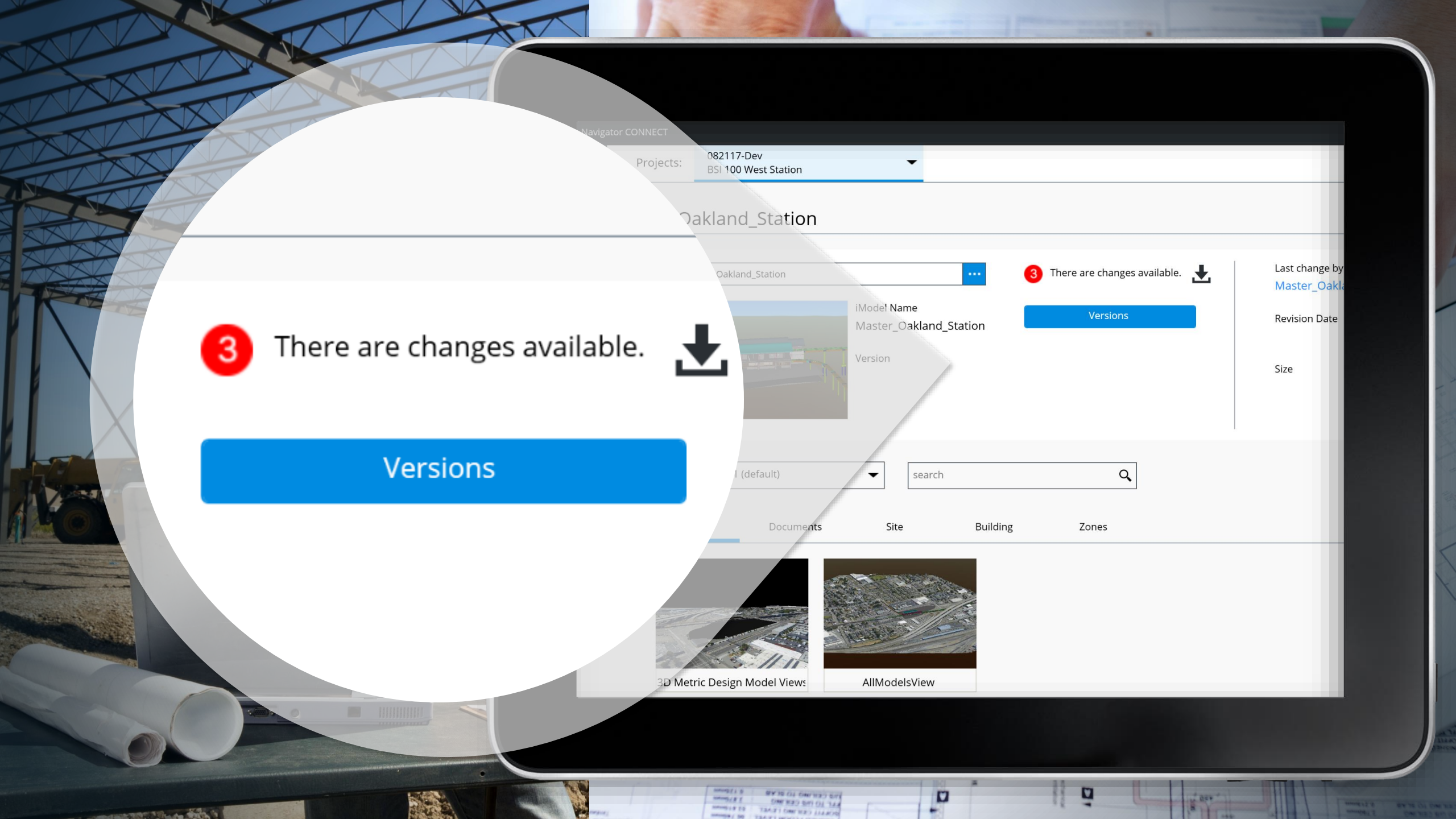


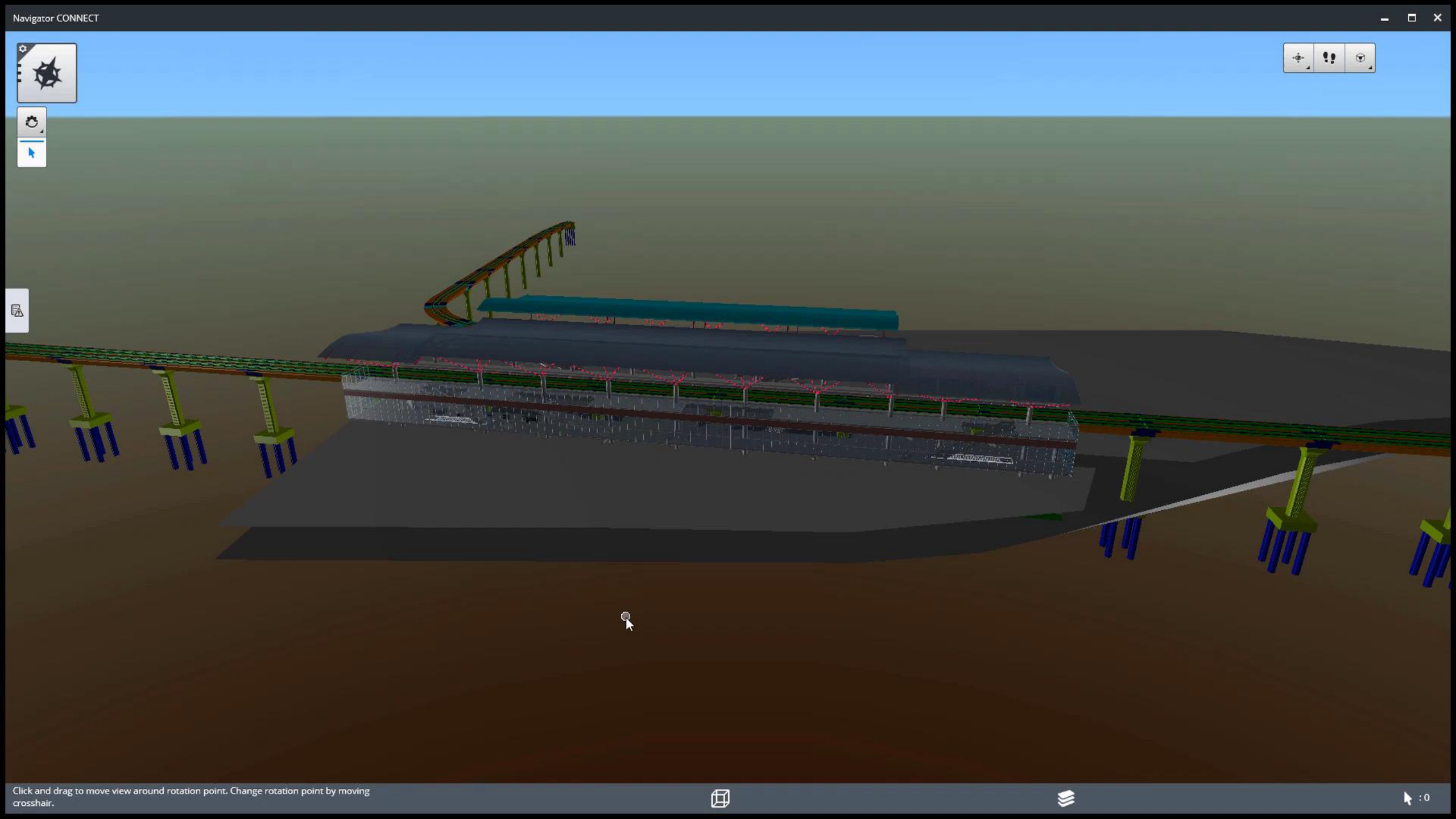
Digital Twin Requirements

INFRASTRUCTURE
ENGINEERING
DIGITAL TWIN

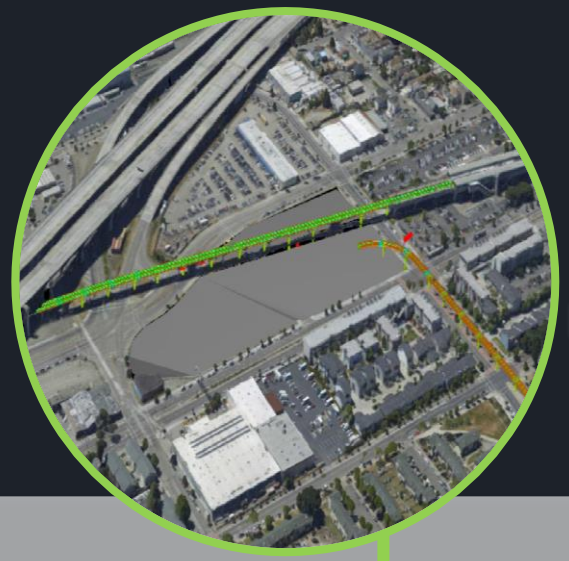
- Must be trustworthy
- Must be open
- Must function effectively
- Must enable value
- Must enable value

ACCESSIBILITY


Navigator CONNECT
Projects:
082117-Dev
BSI 100 West Station
Oakland_Station
Oakland_Station
3
There are changes available.
Versions
iModel Name
Master_Oakland_Station
Version
Last change by
Master_Oakl
Revision Date
Size
(default)
search
Documents
Site
Building
Zones
3D Metric Design Model Views
AllModelsView
3
There are changes available.
Versions


Navigator CONNECT
Click and drag to move view around rotation point. Change rotation point by moving crosshair.
: 0

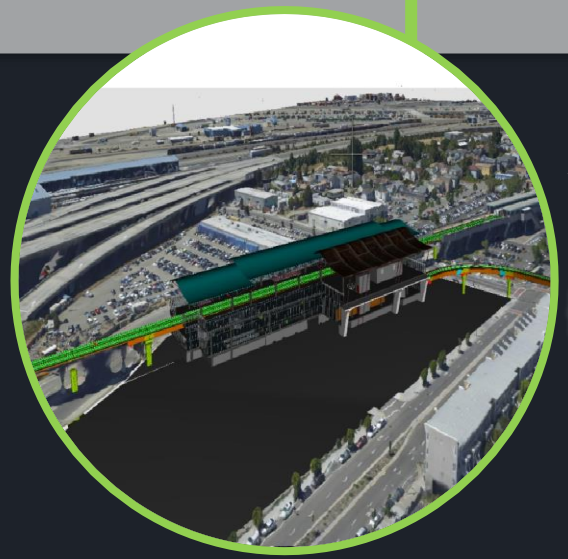
Connected Project Visibility



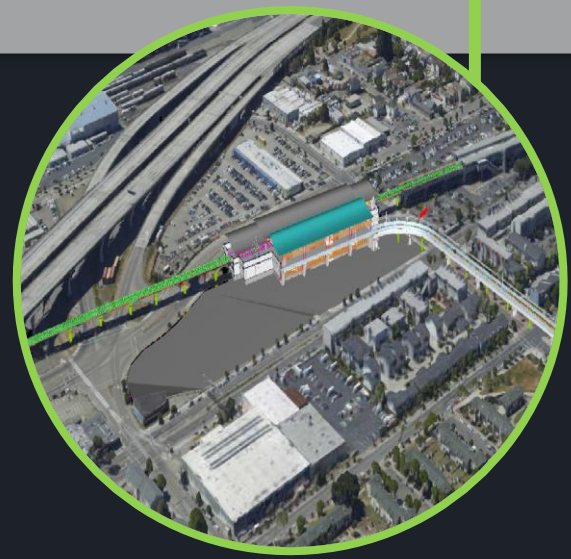
30%
Project Start
"Site Context"

90%
Revision
"Revised Structural"

Jan | Feb | Mar | Apr | May | June

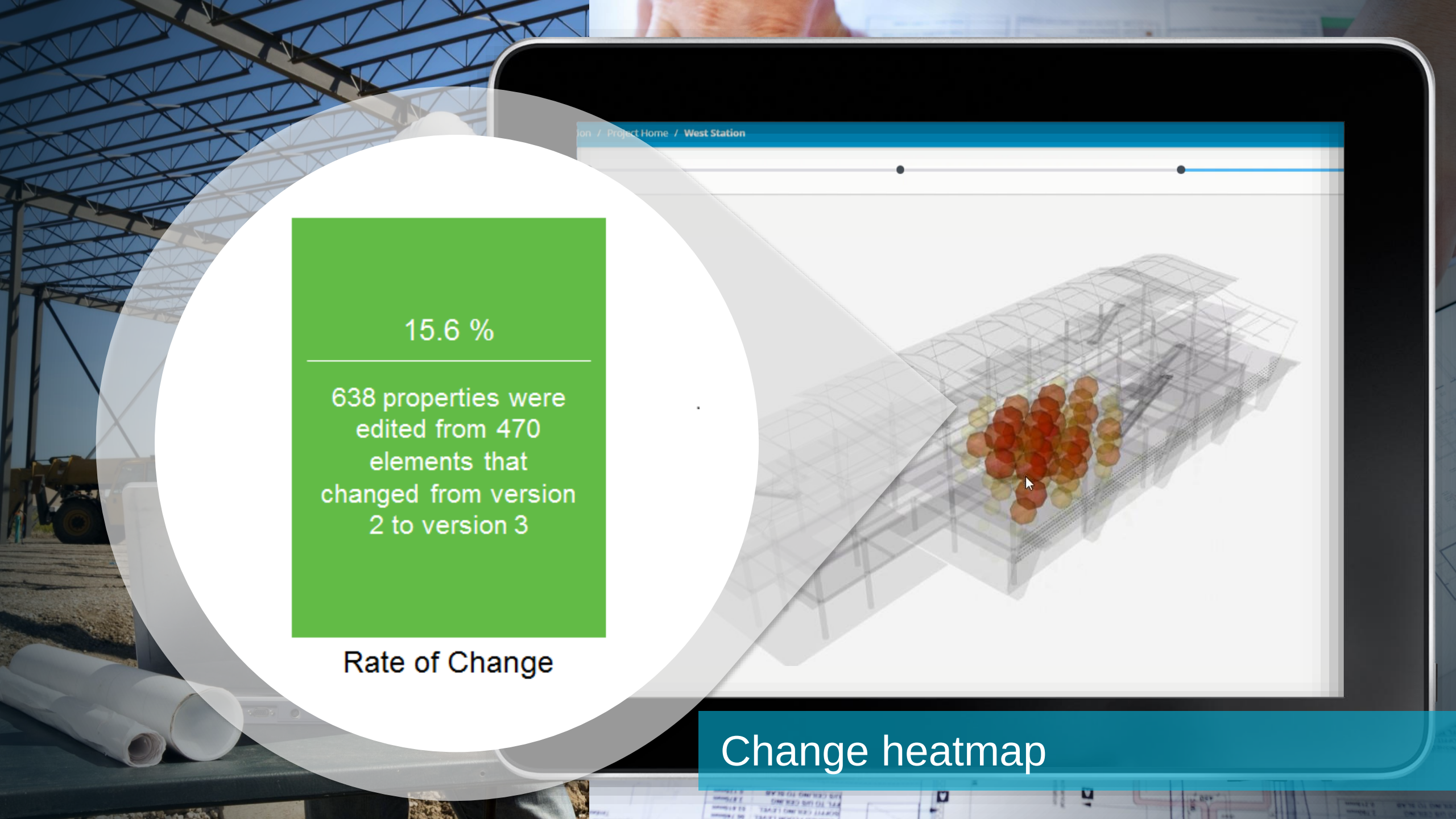


Architectural
"Retail Proposal I"
60%

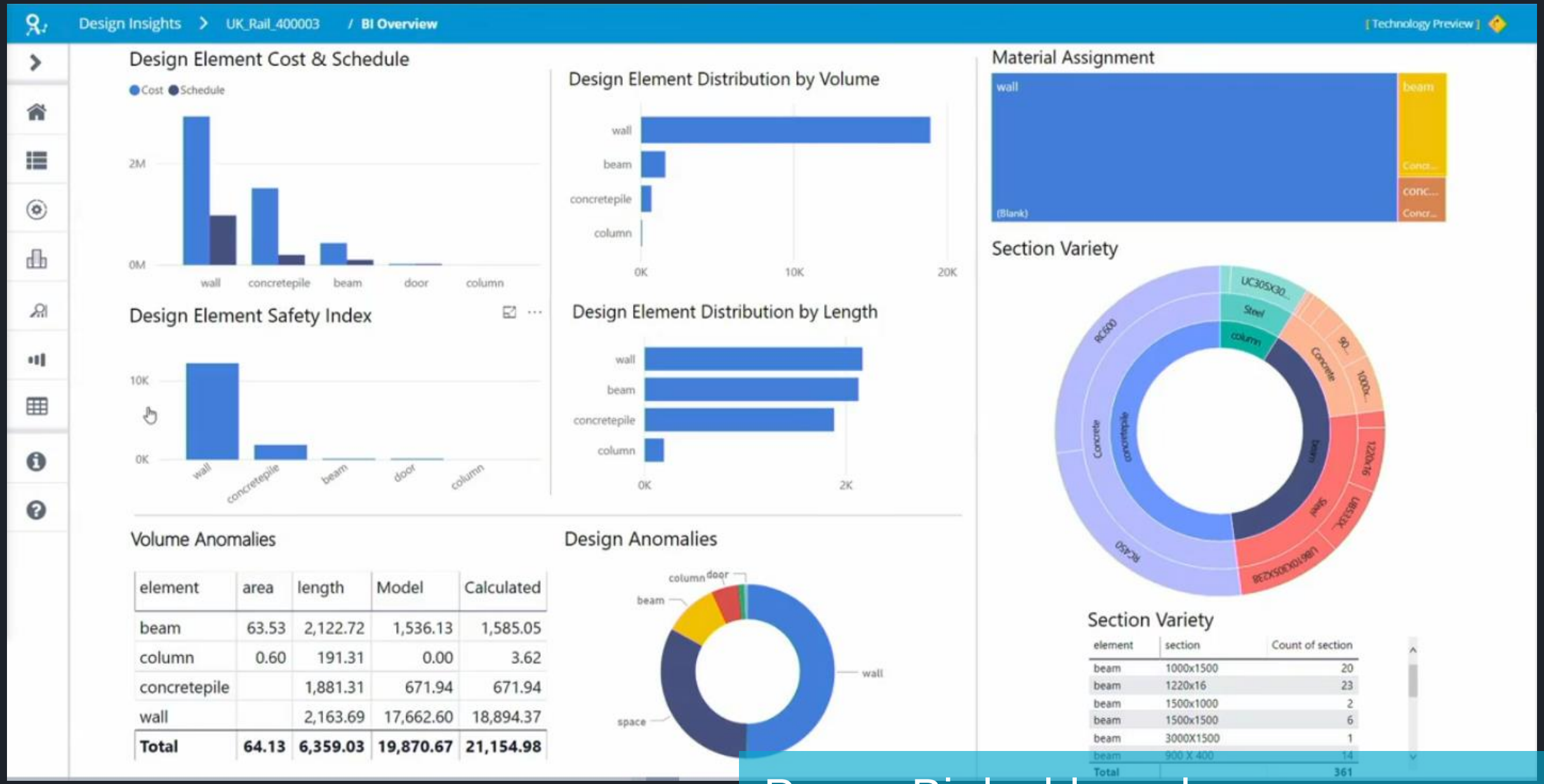


Architectural
"Final Retail"
100%

Change Impact



Change heatmap



Power Bi dashboards

File Number

PW1-BEN-Z0-XX-M3-A-00001

Document Code / Archite

Code fields

Asset/Project		PW1
Originator	-	BEN
Zone	-	Z0
Level/Location	-	XX
Type	-	M3
Role	-	A
Serial No	-	1

PW1-BEN-Z0-XX-M3-A-00001

Advanced

Document Properties | Project Properties

Projects: 082117-Dev
BSI 100 West Station

Master_Oakland_Station

iModel

Open last Viewed

# of 3D Models	50
# of Sheets	10
File Size	500 mb

Version

You have the latest version

Version	12
Date	August 21, 2017
Updated By	Joe Granville

Would you like to change the version?

Views | Document Code | **Sheets**

Search

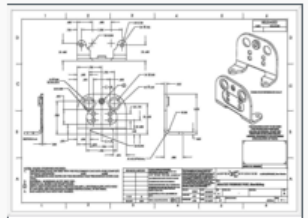
Asset/Project: All

Originator: All

Revision: A- Approved

Type: MZ - Details

Role: All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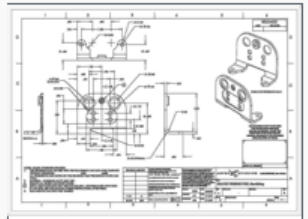
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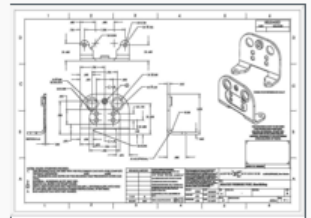
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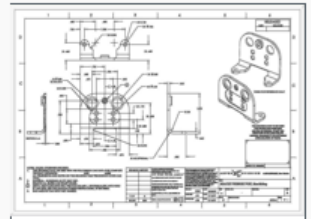
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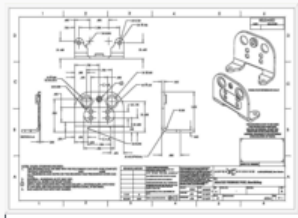
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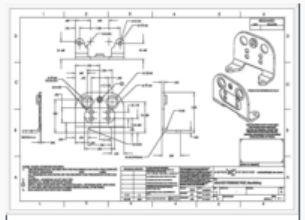
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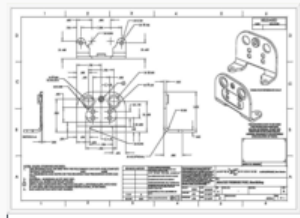
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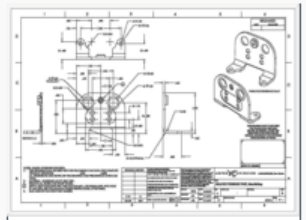
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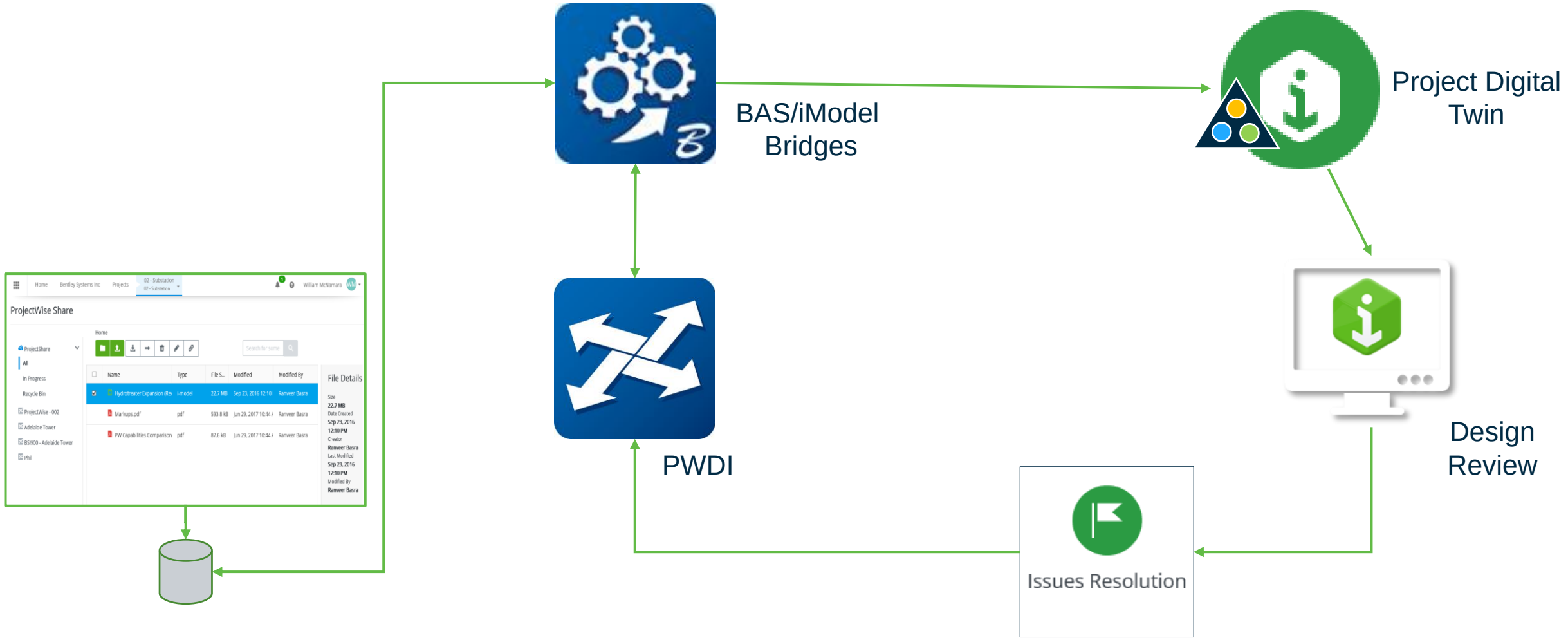
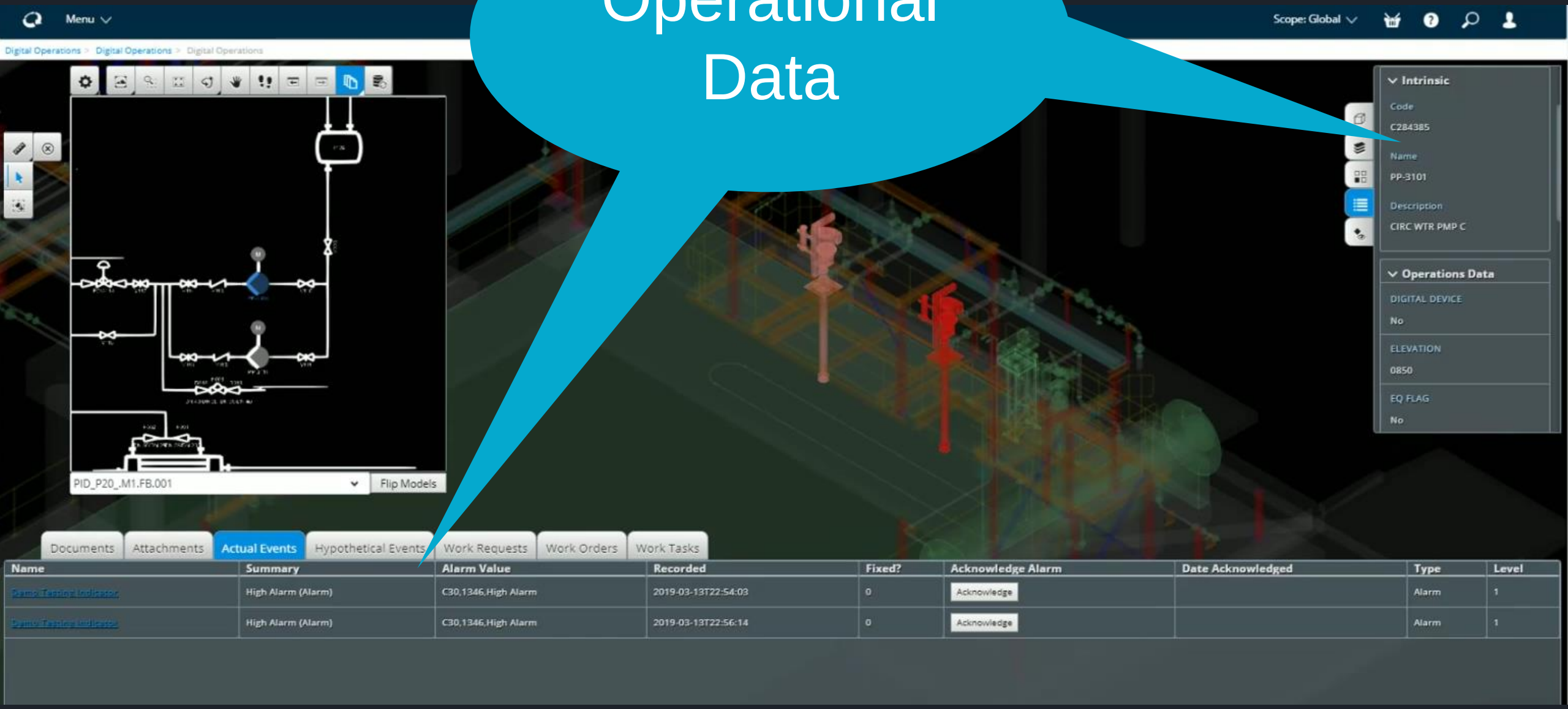
Design Review – Issues Resolution



Operational Data

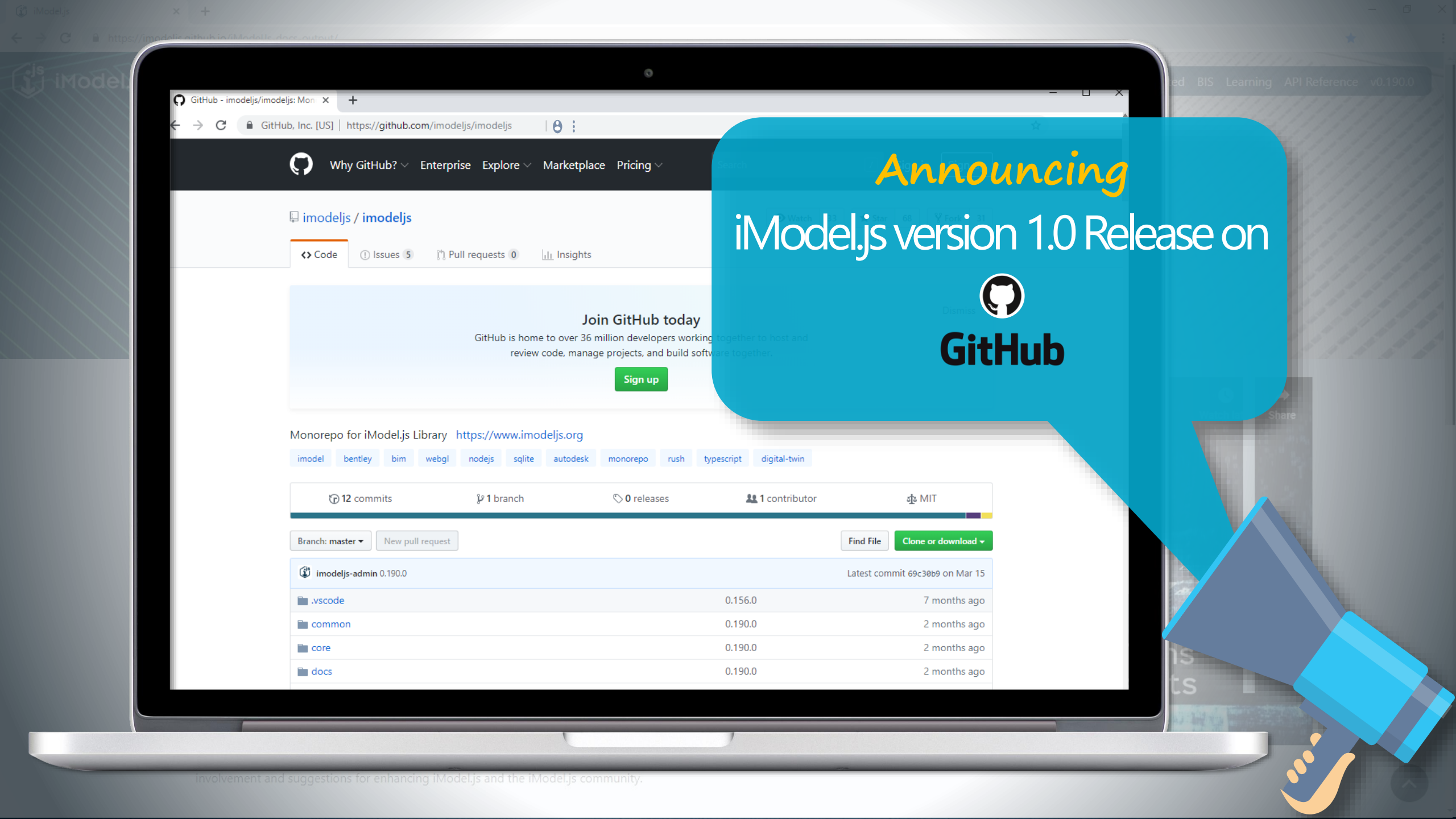


Name	Summary	Alarm Value	Recorded	Fixed?	Acknowledge Alarm	Date Acknowledged	Type	Level
Demo Testing Indicator	High Alarm (Alarm)	C30,1346,High Alarm	2019-03-13T22:54:03	0	Acknowledge		Alarm	1
Demo Testing Indicator	High Alarm (Alarm)	C30,1346,High Alarm	2019-03-13T22:56:14	0	Acknowledge		Alarm	1

Digital Twin Requirements

INFRASTRUCTURE
ENGINEERING
DIGITAL TWIN

- Must be trustworthy
- Must be open
- Must function effectively
- Must be secured
- Must enable value
- Must adapt


Announcing
iModel.js version 1.0 Release on
GitHub
GitHub - imodeljs/imodeljs: Mon
GitHub, Inc. [US] | https://github.com/imodeljs/imodeljs
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nodejs
sqlite
autodesk
monorepo
rush
typescript
digital-twin
12 commits
1 branch
0 releases
1 contributor
MIT
Branch: master
New pull request
Find File
Clone or download
imodeljs-admin 0.190.0
Latest commit 69c30b9 on Mar 15
.vscode 0.156.0 7 months ago
common 0.190.0 2 months ago
core 0.190.0 2 months ago
docs 0.190.0 2 months ago

iModel.js

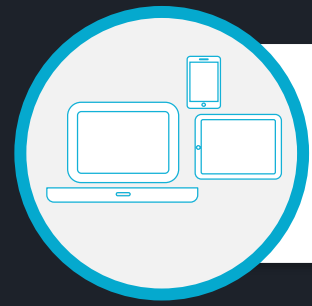
Visualization

Reality Capture

Cloud Platform

Change Management

Digital twin Management



Digital twin Authoring

Authentication

HTML 5 Based UI

Open Ecosystem

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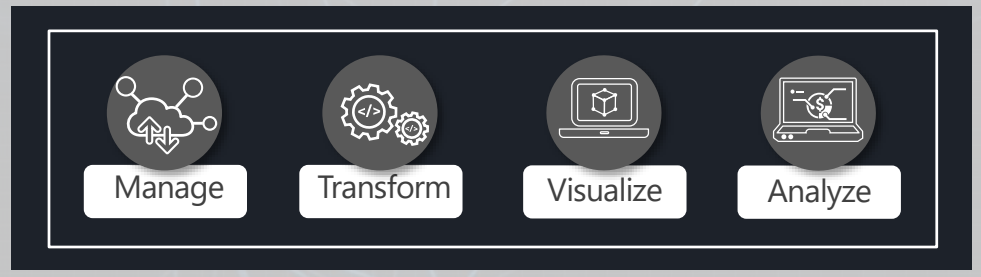
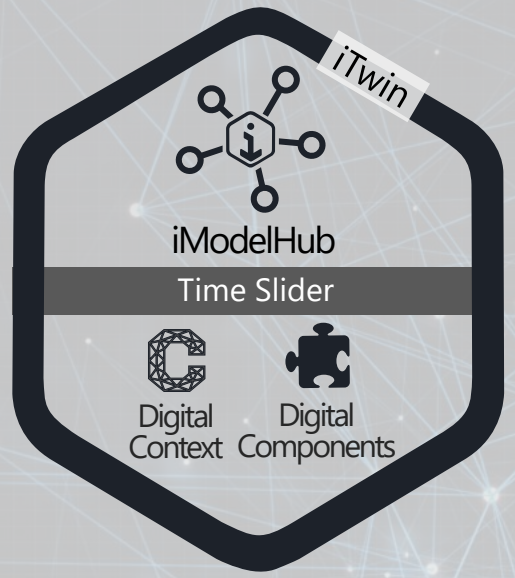
imodeljs.org



iTwin Services



Infrastructure Engineering Digital Twin

Thank you!

Stefan Sigvardsson
Project Delivery

stefan.sigvardsson@bentley.com