ARCADIS

Digital Twins Implementation using Azure and Forge

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AUTODESK. UNIVERSITY

About the speakers

ARCADIS Design & Consultancy for natural and built assets

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Automation Lead for Arcadis North America

- Web and mobile app developer
- AR & VR Expert
- Robotic Process Automation Certified developer
- Blogger, youtuber, trainer

François Appéré

BIM Lead for Arcadis North America

- Masters degrees in Civil Engineering & BIM Management
- Bridge design - Infrastructure project management
- Change management
- New technologies
- …Outdoors lover

Learning Objectives

LEARNING OBJECTIVE 1

Know more about Digital Twin and its applications

LEARNING OBJECTIVE 2

Discover how to create an Azure Digital Twin Service and send sensor/device data to Azure

LEARNING OBJECTIVE 3

Understand how to bring 3D BIM Model, Live data and analytics on one page

LEARNING OBJECTIVE 4

Discover how to combine Forge and Azure to create Digital Twin

Agenda for today

- Few words about Arcadis
- Arcadis Digital vision
- What is a Digital Twin?
- Digital Twin implementation
- Live demonstration

Arcadis at a Glance

We are the leading global natural and built asset design & consultancy firm working in partnership with our clients to deliver exceptional and sustainable outcomes through the application of design, consultancy, engineering, project and management services.

2018

Best Management Consulting Firms

Forbes

#5

Top 225 International Design Firms (2018)

Engineering News Record

#12

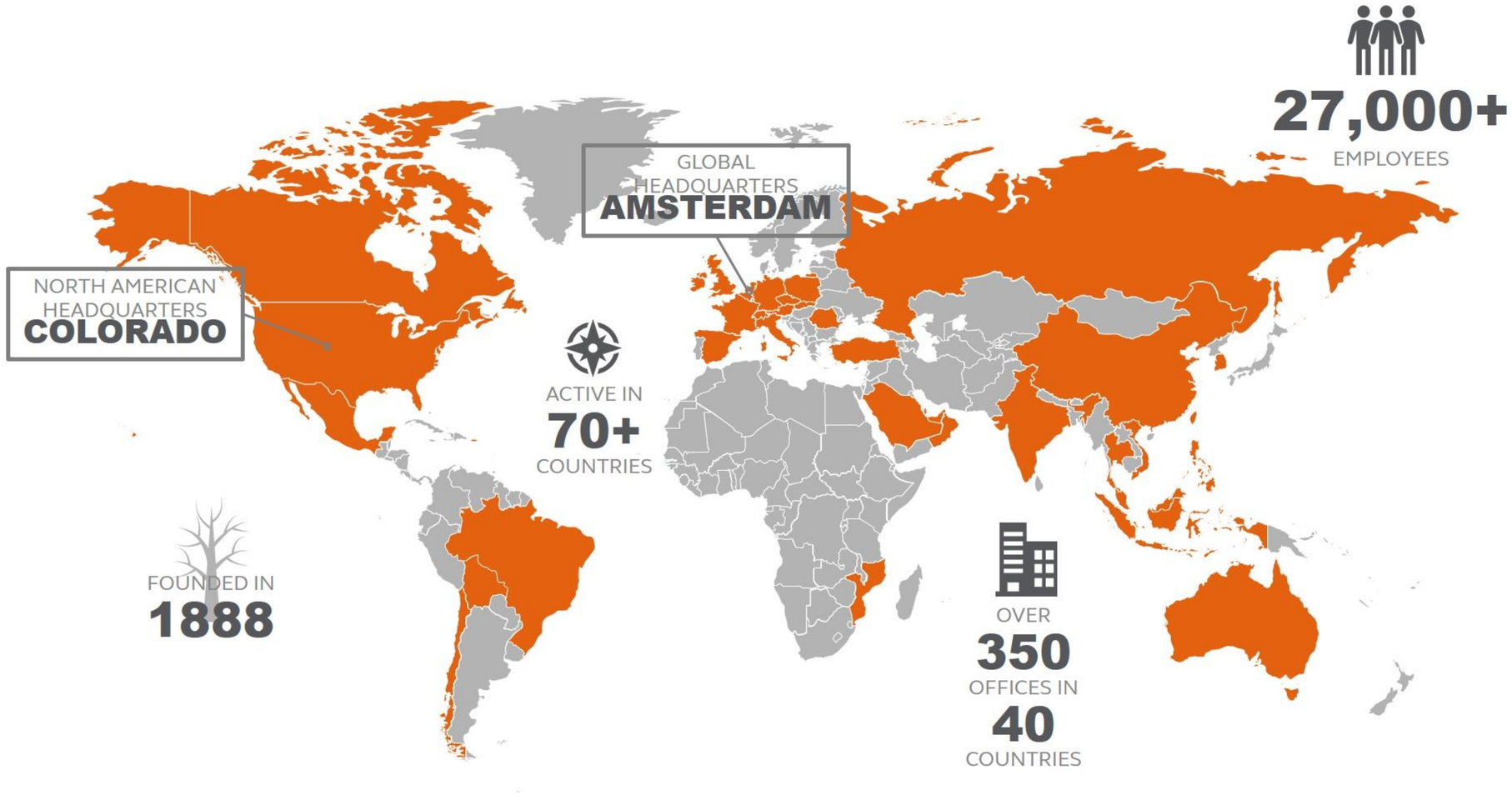
Top 200 Environmental Firms (2018)

Engineering News Record

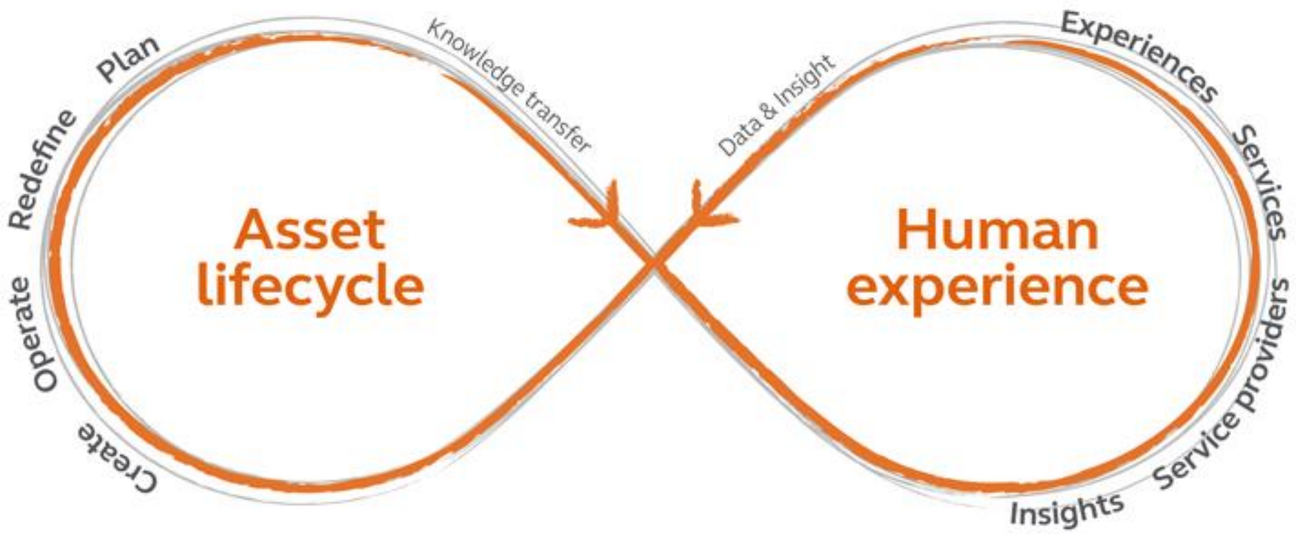
We Address the World's Most Pressing Challenges

Global Reach

Our global network seamlessly brings together our knowledge and experience of projects worldwide…



Arcadis digital vision

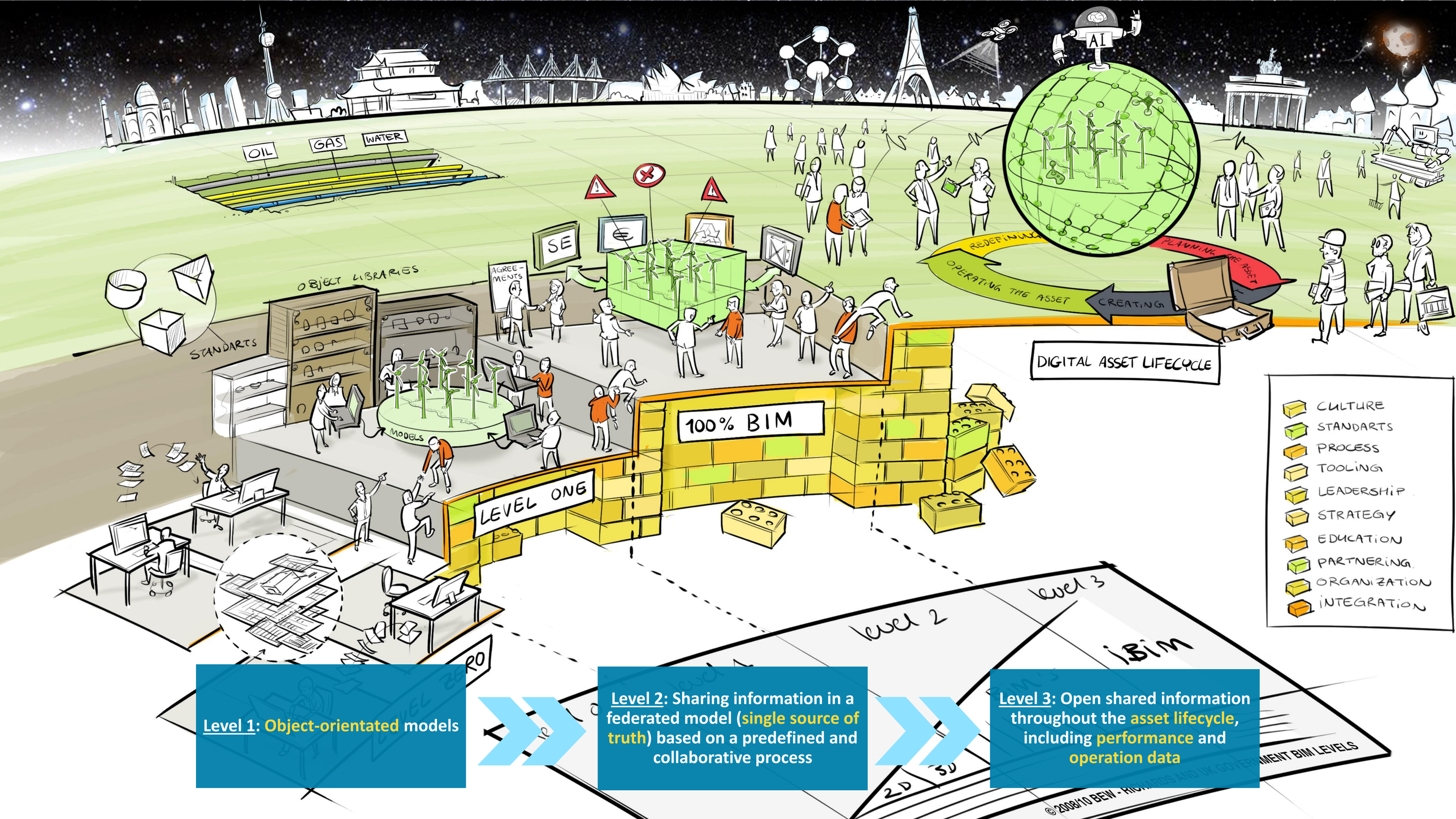


The Arcadis Infinity Loop

The Arcadis Infinity Loop shows the continuous interaction of asset knowledge and human insights that will lead to enhancements in how we plan, create, operate and redefine natural and built assets.

Our Vision Statement

We Improve Quality of Life by better understanding the human experience and connecting it with our scalable asset knowledge.

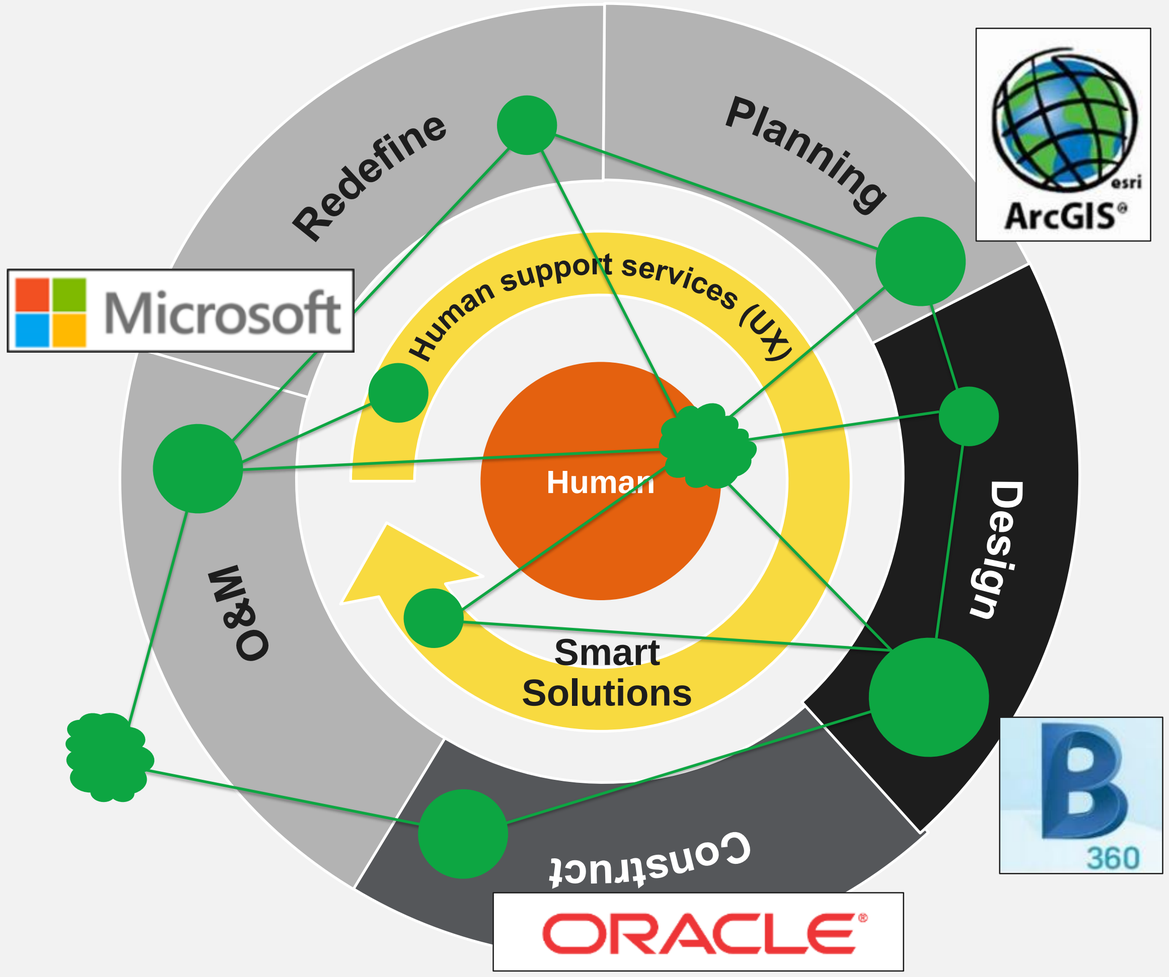


Level 1: Object-orientated models

Level 2: Sharing information in a federated model (single source of truth) based on a predefined and collaborative process

Level 3: Open shared information throughout the asset lifecycle, including performance and operation data

DIGITAL ASSET LIFECYCLE



The Digital Asset Lifecyle approach is a critical step in realizing our vision

ARCADIS

Digital Asset Lifecycle connects & augments our solutions

- An asset centric platform focused on improving quality of life in a digital world.
- Focusing on the Human Experience.
- Connecting D&E, REM, O&M, PgM, CCM around the asset wheel.
- Move towards universal BIM and GIS adoption, accelerate automation and integrate Data Analytics.
- Moving towards our vision.

Digital Twin

Trends fueling Digital Twins

- The amount of data available to capture about an asset at all stages of its lifecycle are growing exponentially.

- By 2020, 1 million new devices an hour will be coming online, with smart offices creating 150 GB per day, smart cities by then will produce 250PB of data per day.

- The cost of computationally power halves about every 18 months.

- BIM and GIS are commonly known as key enablers for the creation of a digital twin to support this change.

Digital Twin: some definitions

A Digital Twin is:

- an integrated multiphysics, multiscale, probabilistic simulation of an as built vehicle or system that uses the best available physical models, sensor updates, fleet history, etc. to mirror the life of its corresponding flying twin (Glaessgen & Stargel, 2012)
- A coupled model of the real machine that operates in the cloud and simulates the health condition with an integrated knowledge from both data driven analytical algorithms as well as other available physical knowledge (Lee, Lapira, Bagheri, and Kao, 2013)
- A fit for purpose digital representation of an asset to capture real time data throughout (parts of) its life cycle to enhance performance and optimize efficiency (van Baalen, 2019)

Digital Twin features & applications

Visualization

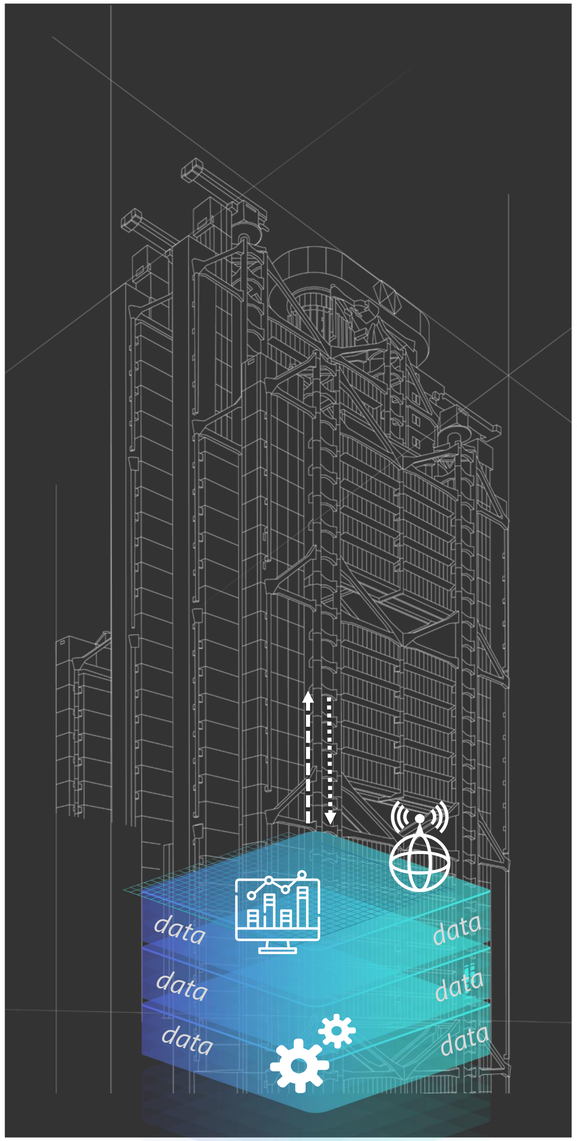
- Overlay real-life and live pictures / videos, 3D models of the physical asset
- Foundation for immersive visualizations

Analytics

- Store data
- Run continuous analytics from historical data
- Provide useful insights

Live

- Collect and display live data from the physical asset
- Used for asset monitoring



Simulations

- Used to run different data-driven simulations

Automation

- Bi-directional system which can control the behavior of physical assets

Behavior

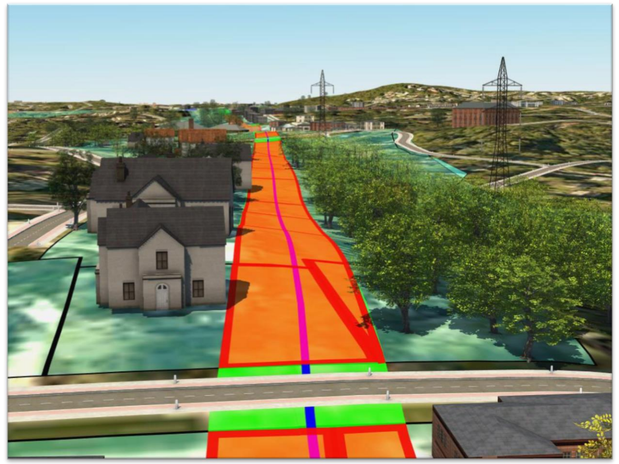
- Functionality
- Dynamics
- Ifs and buts

Predictions

- Provide predictions on the future behaviors of assets by combining historical data and various scenarios

What makes a good Digital Twin?

Object-Oriented model



IoT

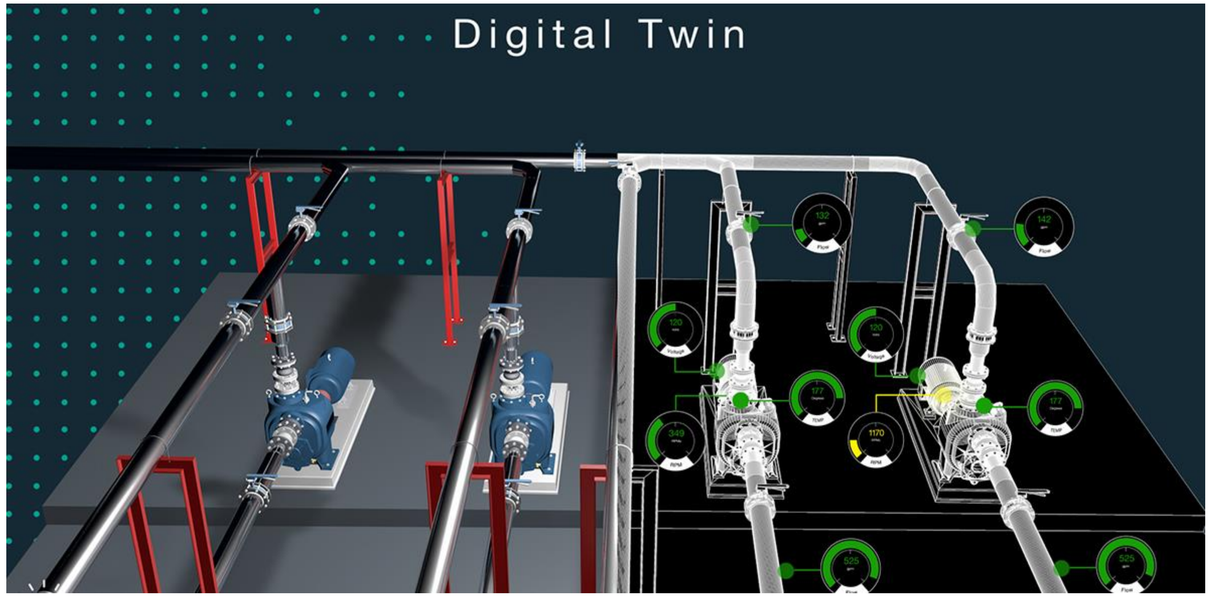
CX

- A Digital Twin should be informed by the purpose it serves, in the right context.
- Its development is a progressive process.
- A Digital Twin is a “tool” to achieve broader goals.
- A Digital Twin is the combination/integration of multiple platforms and technologies.

Digital Twin Implementation

What is needed

- Media (3D Model)
- Sensors
- Cloud service
- Database



Autodesk Forge

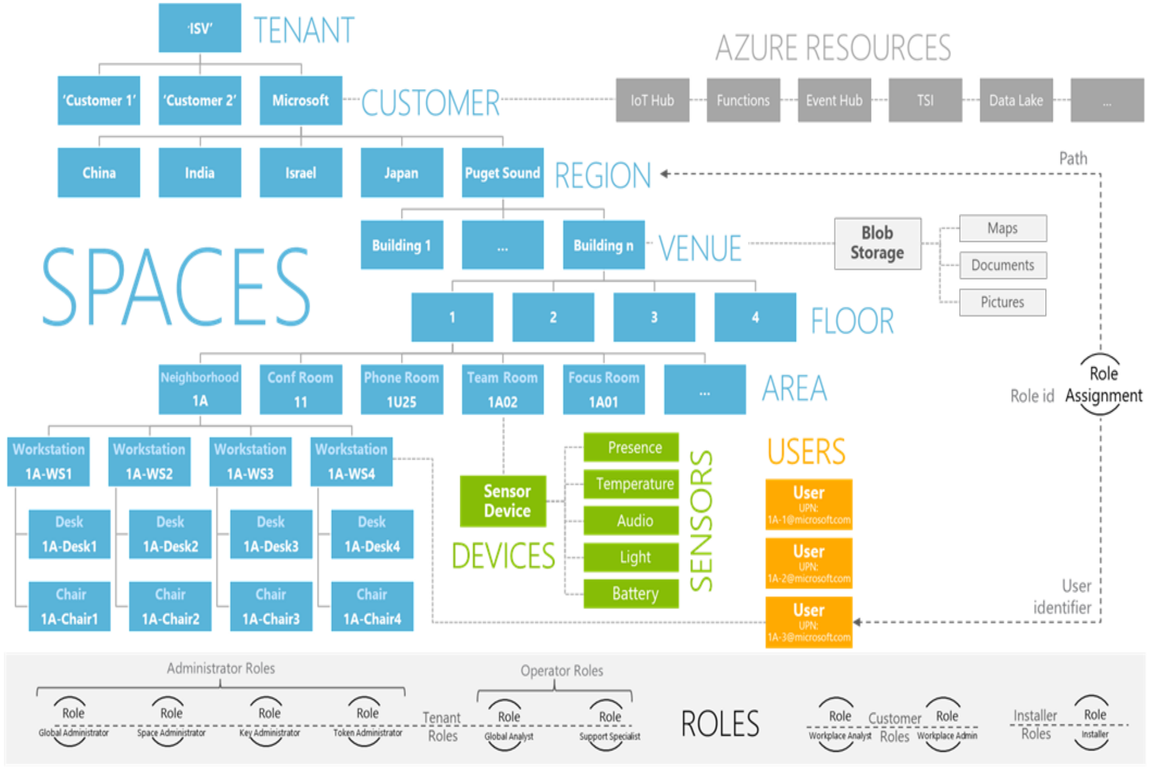
Autodesk Forge is cloud platform that brings the power of design and engineering to cloud. Its set of APIs to view models/docs, manage data and design automate in our own applications on any platform.

Sensors & Smart Devices

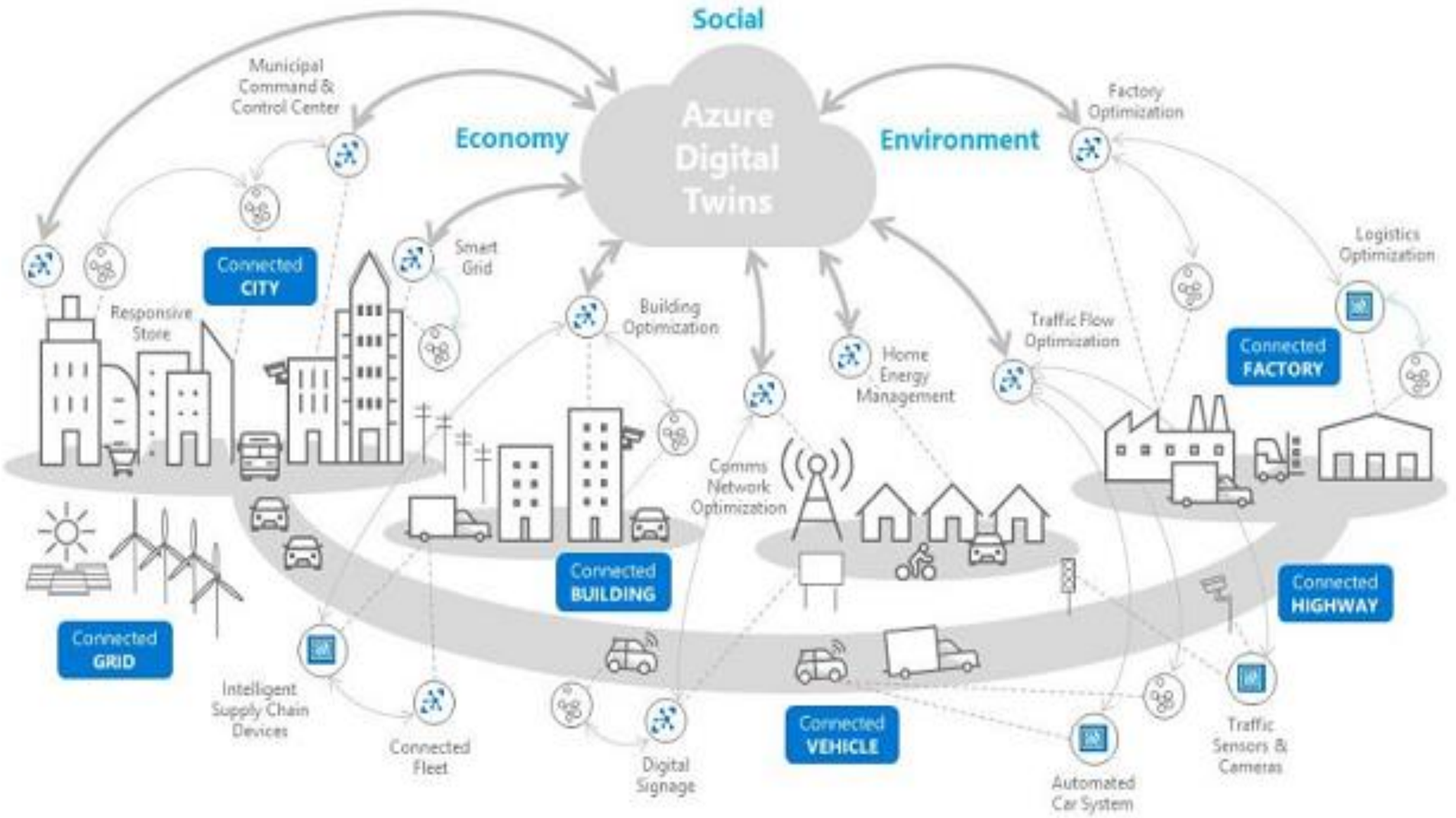
- Depending on the type of built or natural asset industry ready sensors and devices should be chosen.
- Some devices comes with direct apis with which we can get data, manipulate the device.
- Advice to look if it works well with clouds like Azure, AWS.
- Azure certified devices:
- https://catalog.azureiotsolutions.com/alldevices

Microsoft Azure Digital Twin Service

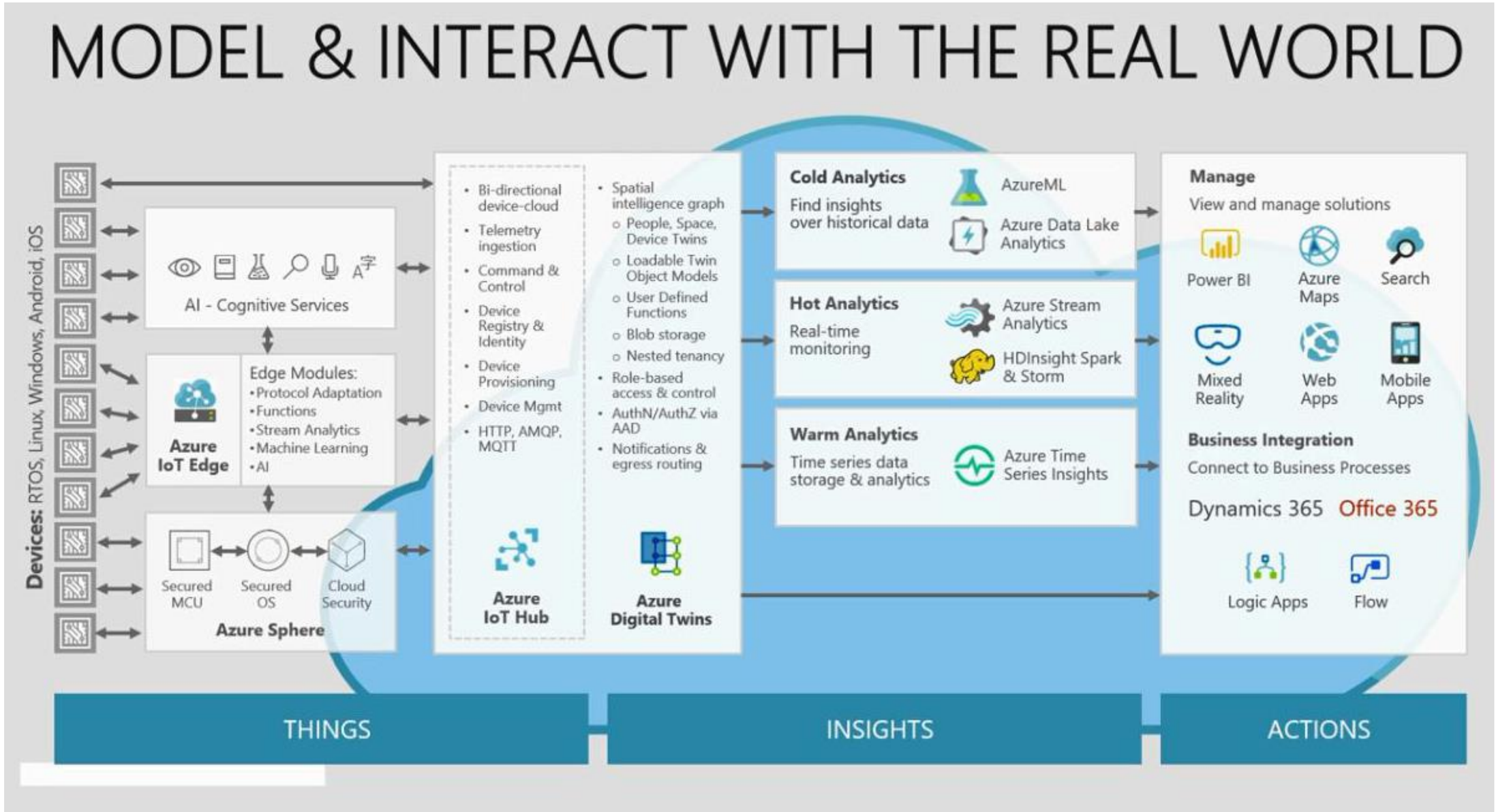
Azure Digital Twins is an IoT service that helps you create comprehensive models of physical environments. Create spatial intelligence graphs to model the relationships and interactions between **people, places, and devices**. Query data from a physical space rather than disparate sensors. And, build reusable, highly scalable, spatially aware experiences that link streaming data across the physical and digital world.



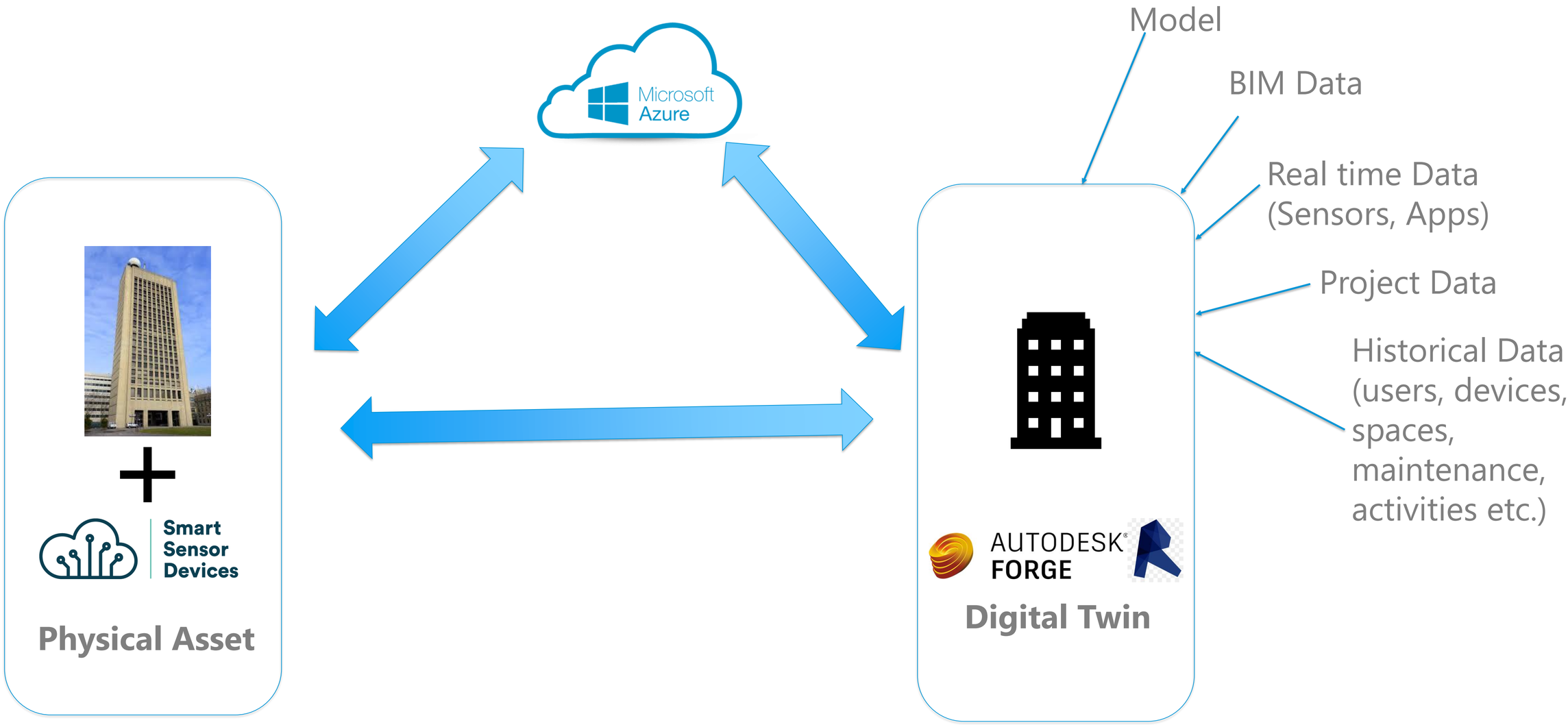
Microsoft Azure Digital Twin Service



Understanding Azure Digital Twin Service



Architecture

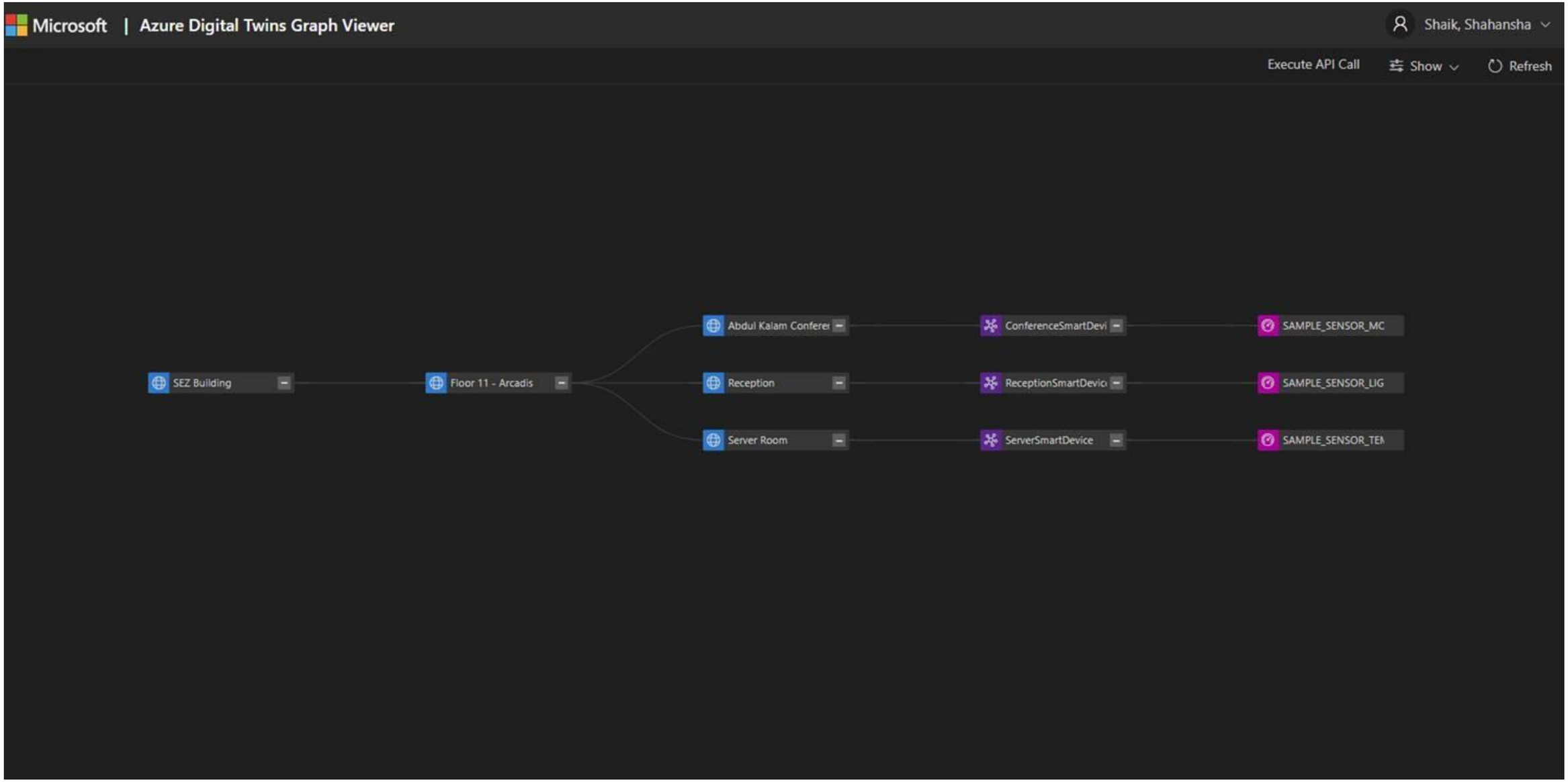


Digital Twin Demos

Digital Twin Sample

- Scan the QR Code directly from your camera with IOS Device (Iphone / Ipad).
- Download Google Lens app and scan the QR Code.

Azure Graph Viewer



Azure Digital Twin APIs

- Create, delete, update spaces, users, sensors and devices
- Send and receive data from sensors
- Receive data into web application
- Check status

Development Stack

Software

- Autodesk Revit & Forge
- Azure Digital Twin Service
- Node.JS
- Sql Server
- D3.js

Sensors and devices used

- Heat sensor
- Light intensity sensors
- Motion detection sensors
- Cctv cameras
- Raspberry PI
- Depending on the requirements

Implementation Team

- Domain experts
- IoT Expert
- Cloud Expert
- Web developers (Backend and frontend)
- Ecosystem partners (Clients, Vendors, Software providers, cloud provider etc)

Platforms

Digital Twin can be developed on different platforms

- Web – Node.js, .Net
- IOS – Ojb C, Swift
- Android – Java
- IOS, Android and Web using Apache Cordova & Ionic
- Windows desktop – C#
- AR HoloLens – Unity (C# /JS)
- VR Oculus & HTC – Unity (C# /JS)

Digital Twin Where and Why?

- Every object in this world will soon have a digital twin either its built or natural, living or non-living.
- Every industry has its use cases for digital twins. Industries like Manufacturing like Tesla, retail, AEC, **Smart Cities**, Medical etc. are using digital twins.
- Digital twin can be helpful throughout the lifecycle of asset (Planning, designing, implementing / construction, monitoring, predicting, operations and maintenance, demolition and re-building)
- Digital Twins will be helpful in visualizing, monitoring, getting insights, health and safety, decision making, scenario planning and predictions.

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