



# 디지털 트윈을 활용한 IoT 솔루션 구축

마이크로소프트  
오일석

# 커넥티드 솔루션의 진화



디지털 트윈은

실세계,

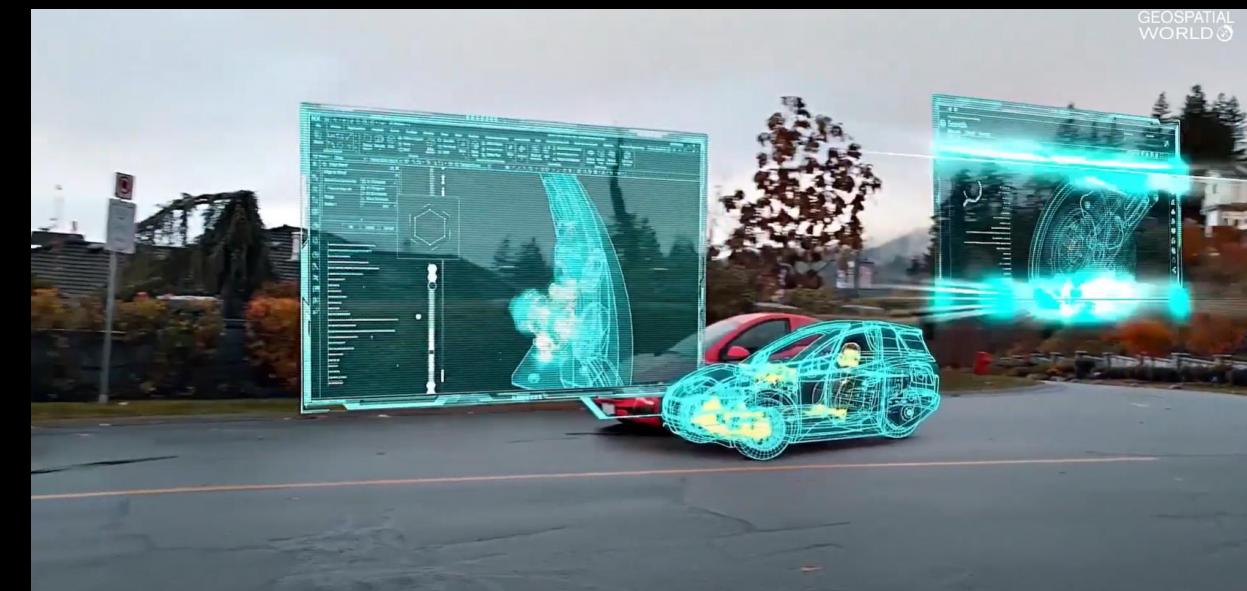
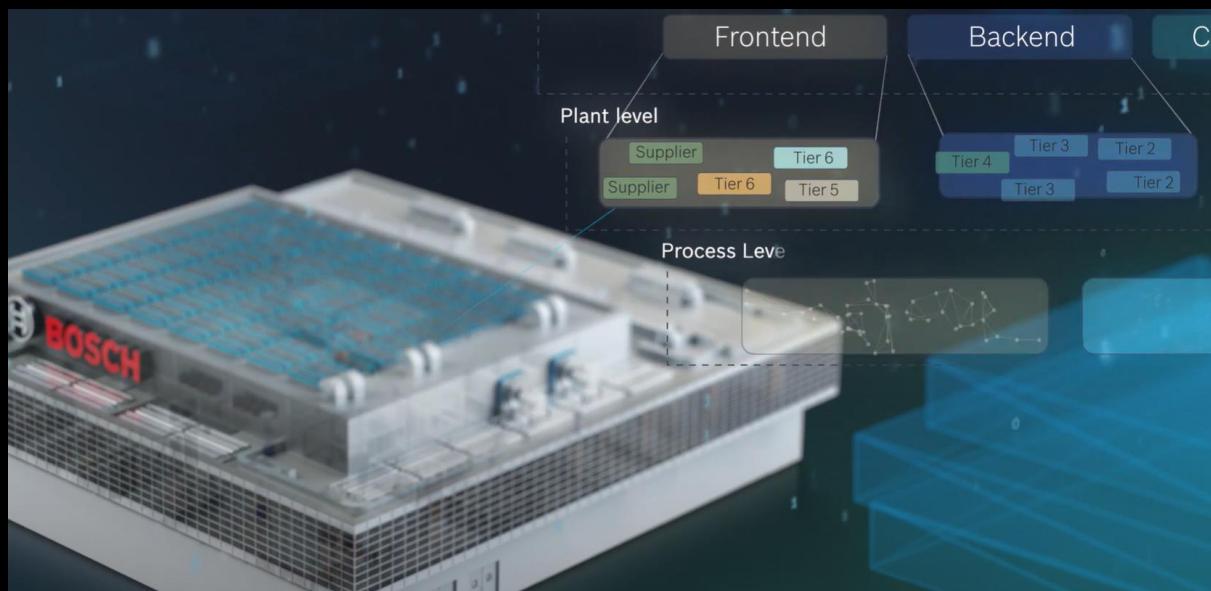
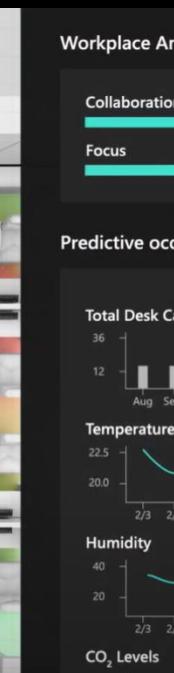
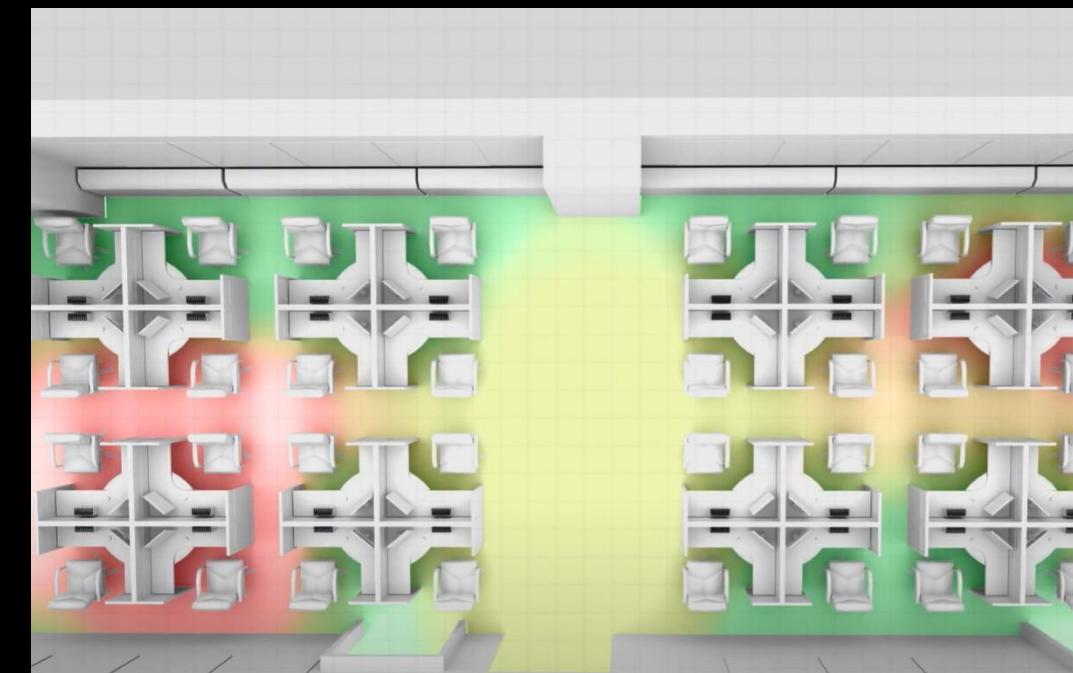
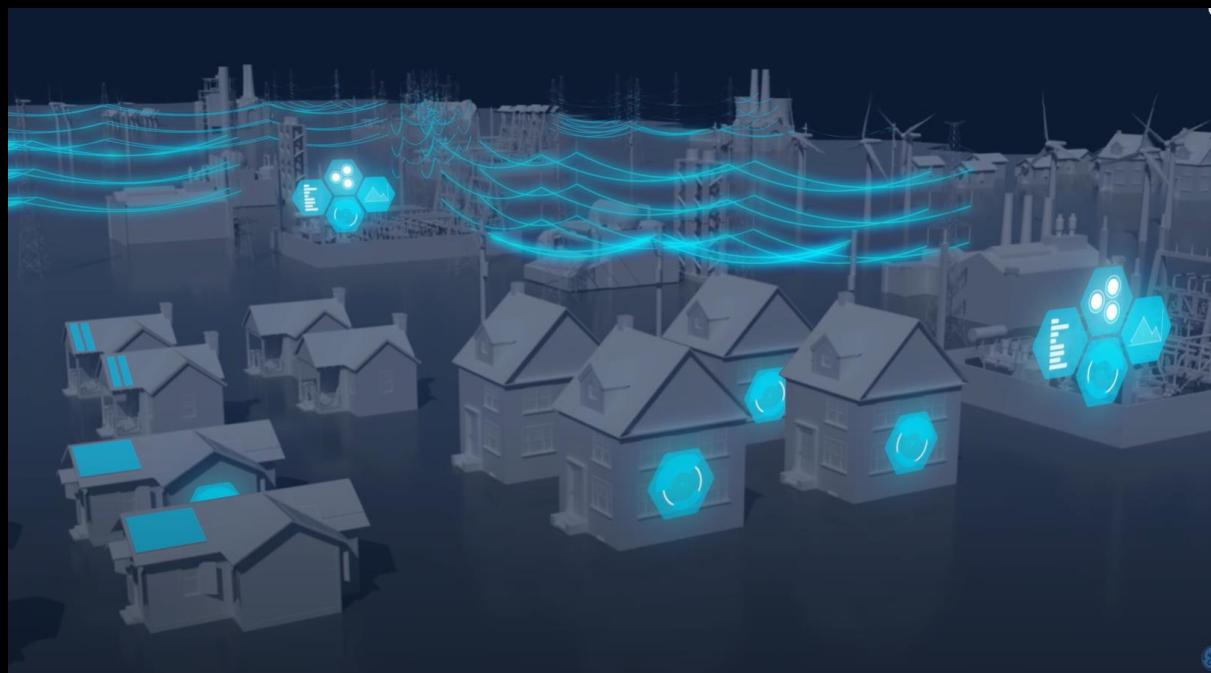
장소,

비지니스 프로세스,

사람

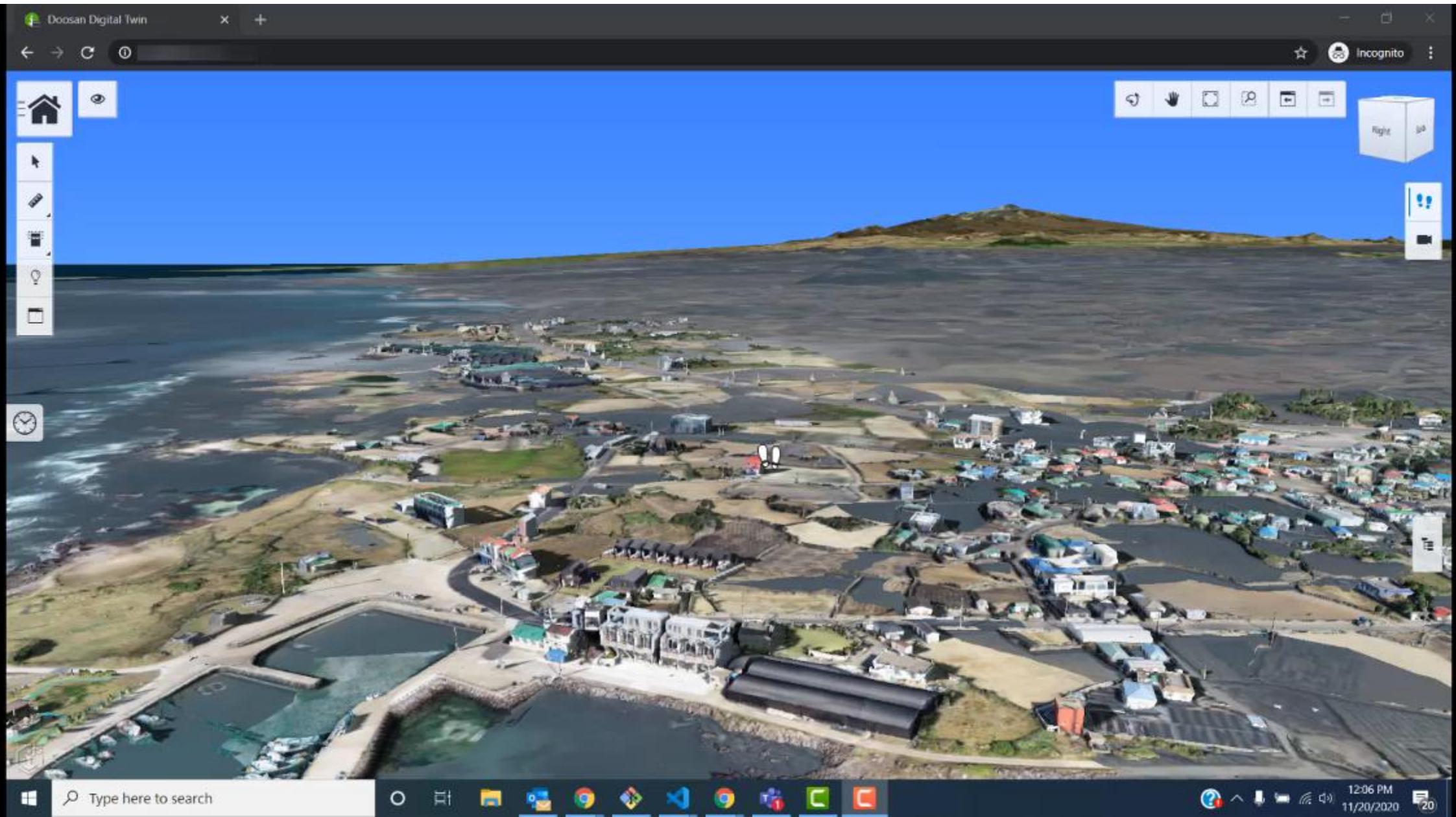
의 “복제 모형”







두산 풍력발전 디지털 트윈 사례



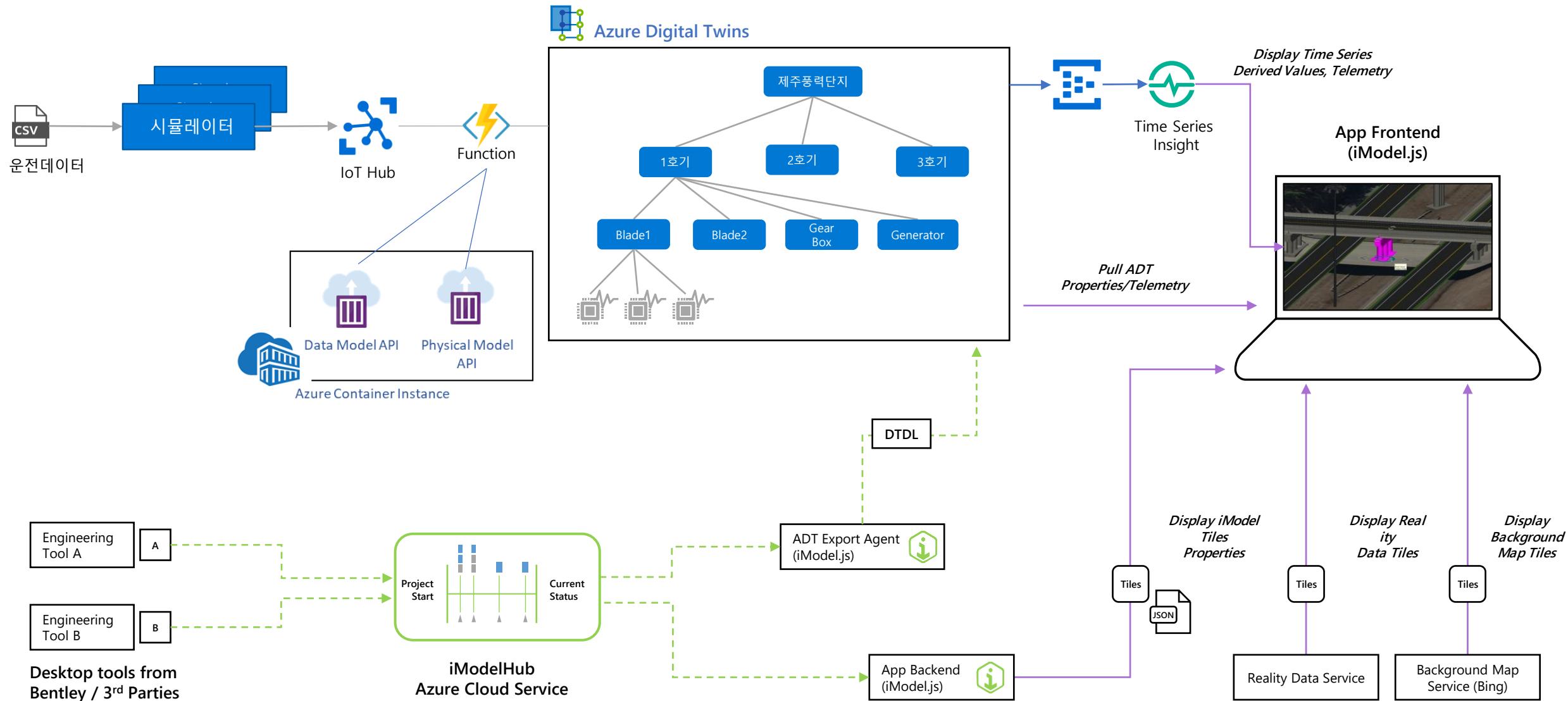
Type here to search



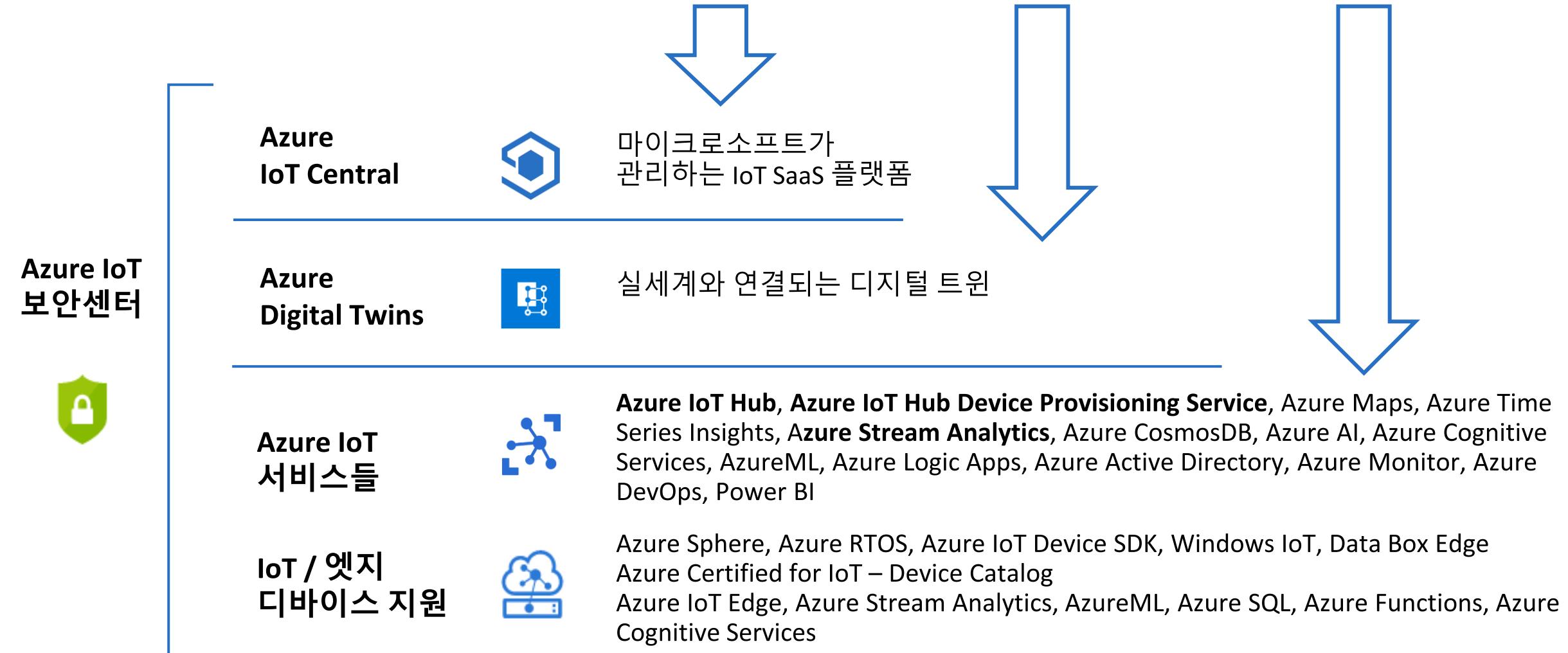
12:06 PM  
11/20/2020



# 두산 풍력 발전 디지털 트윈 아키텍쳐



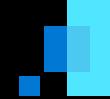
# Azure IoT 솔루션 개발의 3단계 접근법



# Azure Digital Twins

실세계를 모델링하여 IoT 솔루션 개발

현재 상태의 모니터링 및 제어, 과거 데이터 추적, 미래 예측



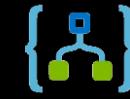
오픈소스  
모델링 언어



라이브 실행 환경

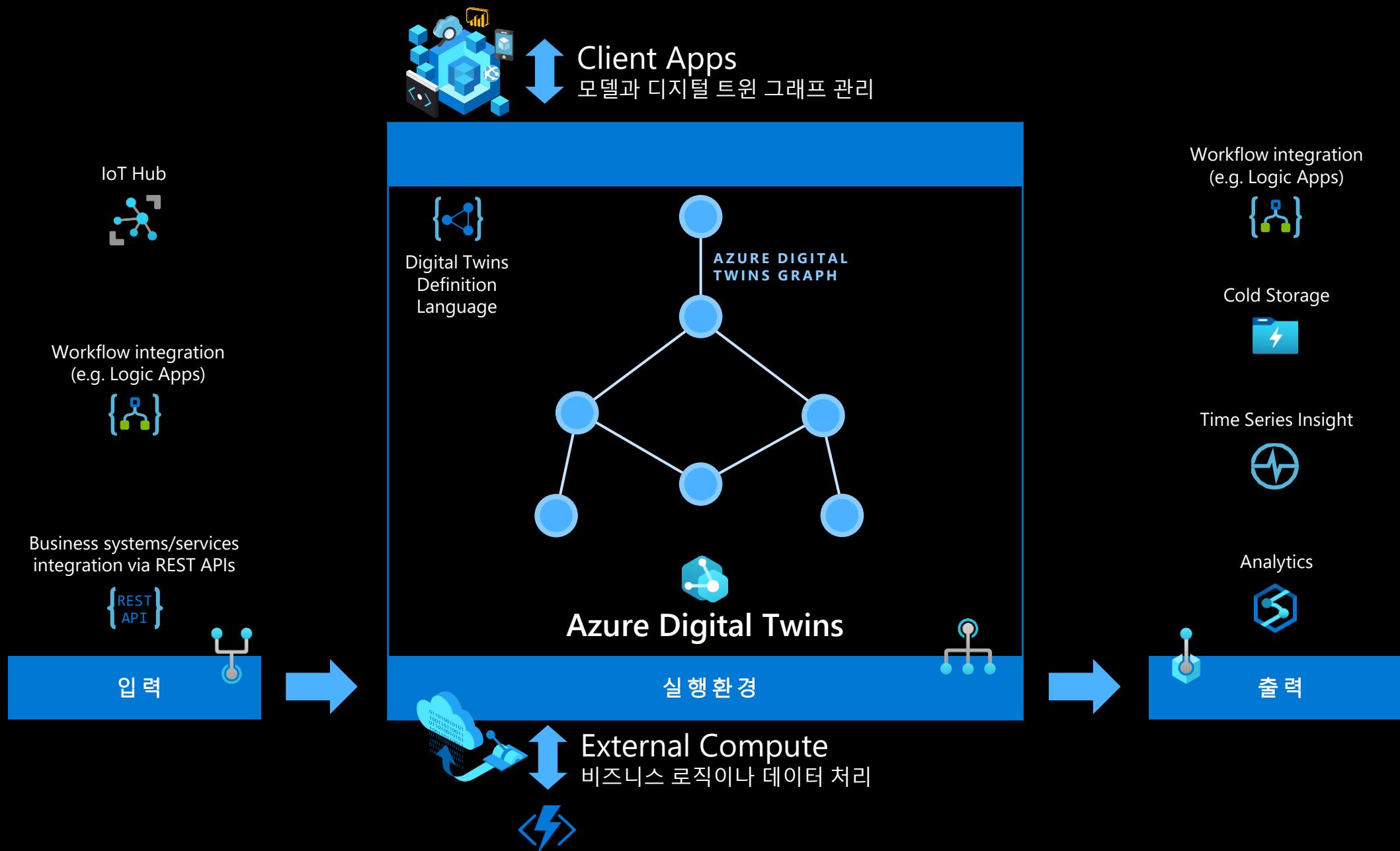


IoT 또는 다른  
시스템에서 입력

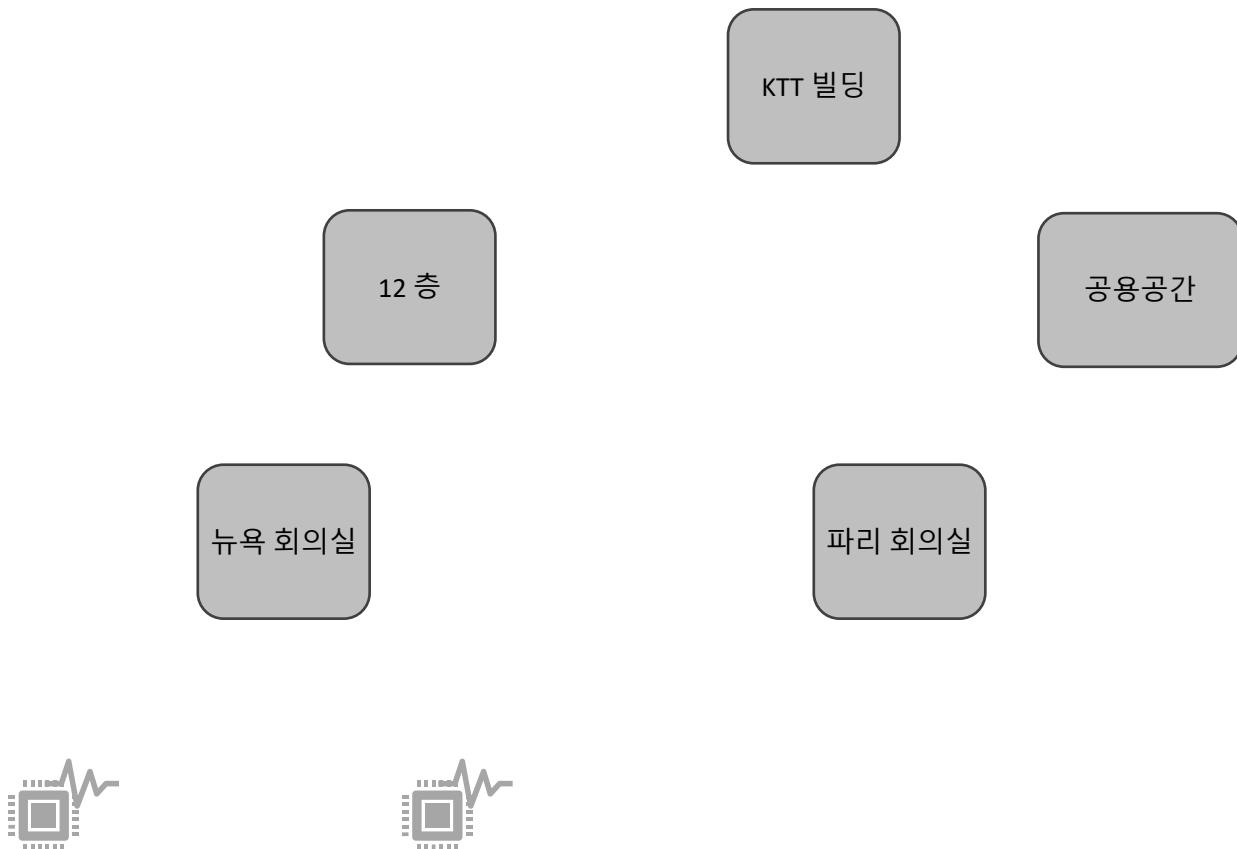


TSI, 스토리지, 분석  
시스템으로 출력

# Azure Digital Twin?



# 모델링을 위한 엔티티 정의

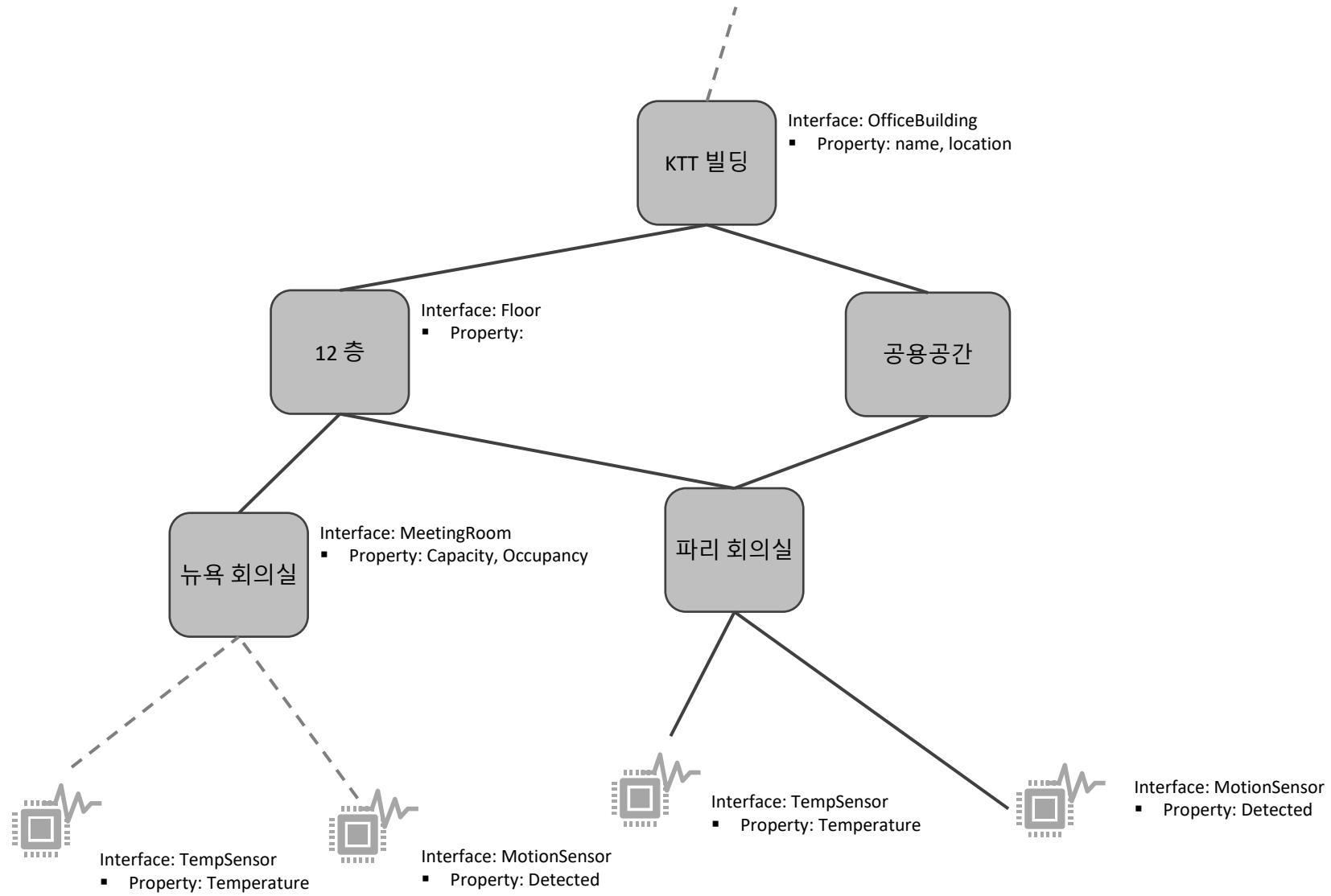


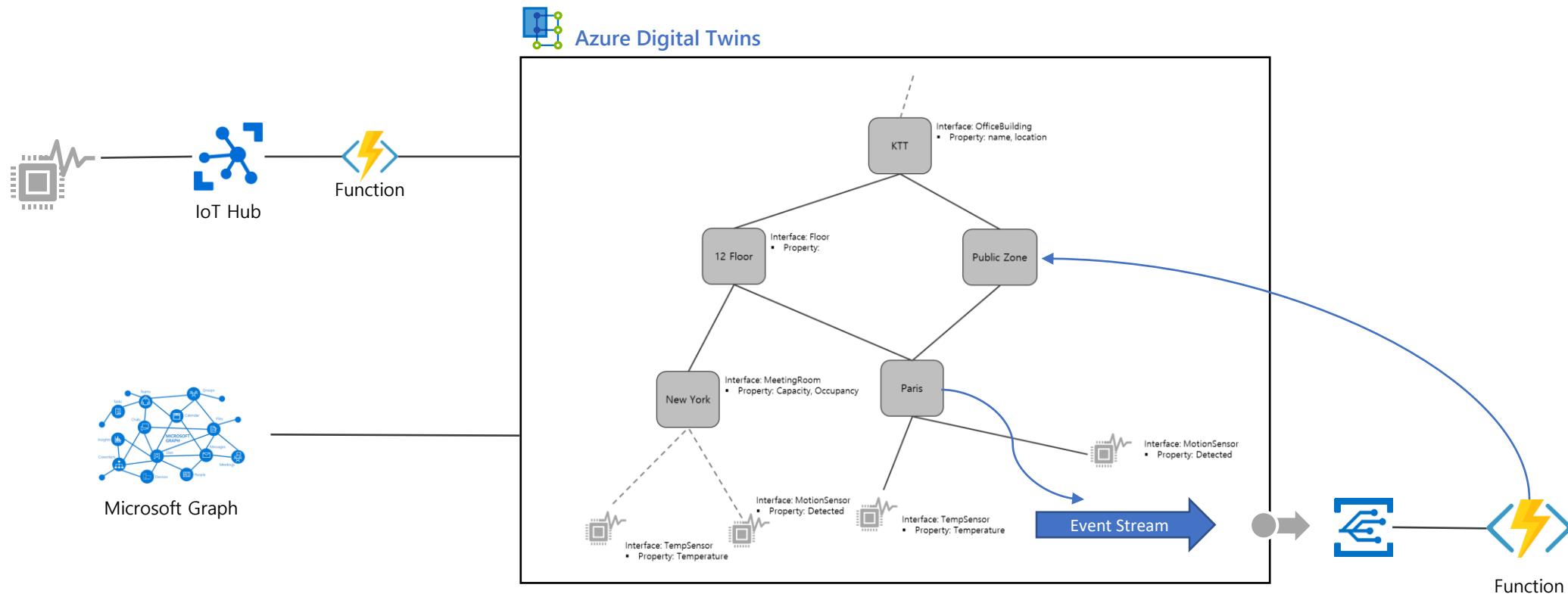
# 트윈 모델링- DTDL (Digital Twin Definition Language)

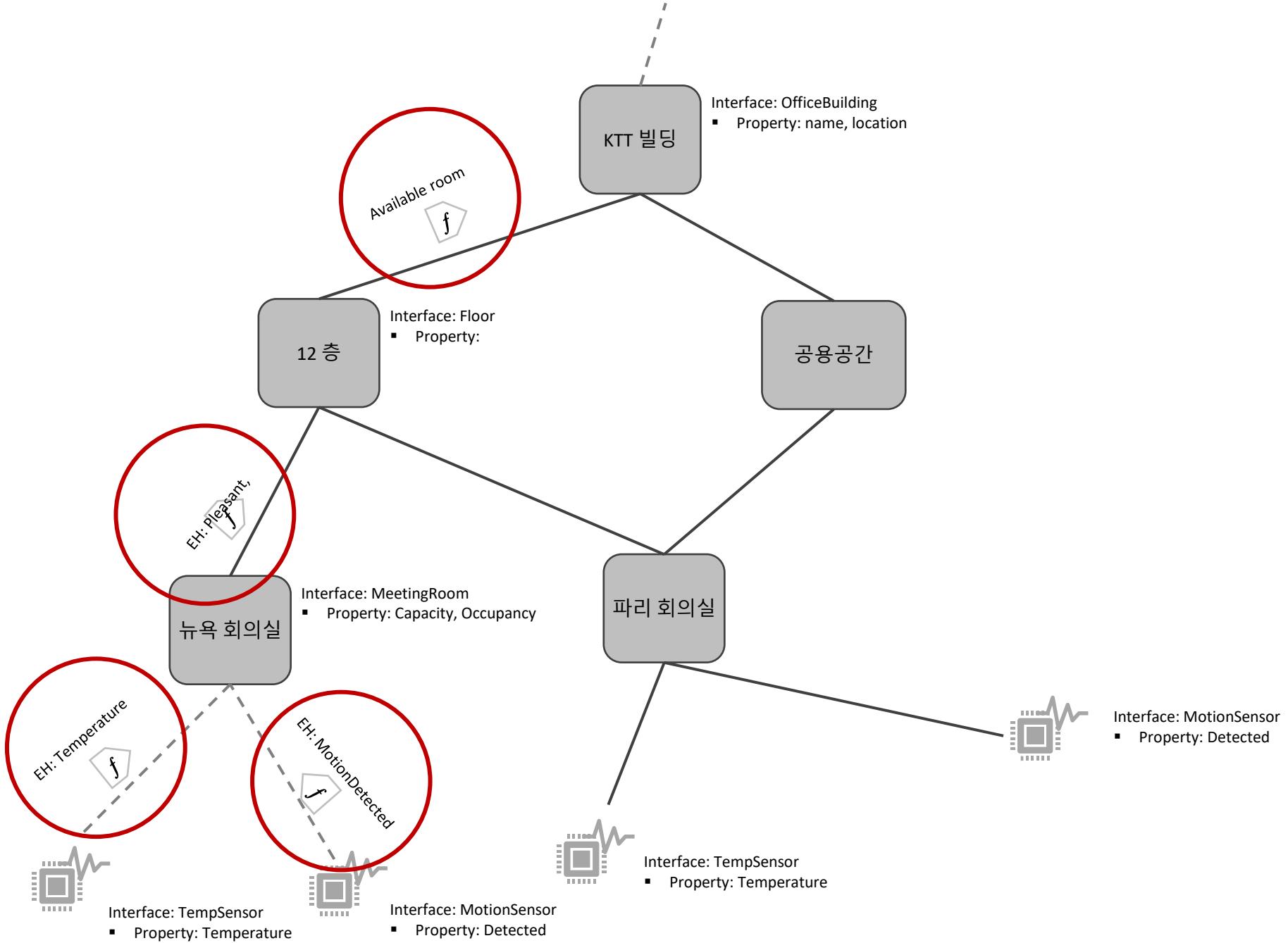
```
{  
    "@id": "dtmi:example:Floor;1",  
    "@type": "Interface",  
    "contents": [  
        {  
            "@type": "Relationship",  
            "name": "contains",  
            "target": "dtmi:example:MeetingRoom;1"  
        },  
        {  
            "@type": "Relationship",  
            "name": "isAssociatedWith",  
        },  
        ...  
    ],  
    "@context": "dtmi:dtdl:context;2"  
}
```

- 속성 (Properties)
- 원격데이터 (Telemetry)
- 명령 (Commands)
- 관계 (Relationships)
- 컴포넌트 (Components)

# 모델을 이용하여 디지털 트윈 생성 및 관계연결

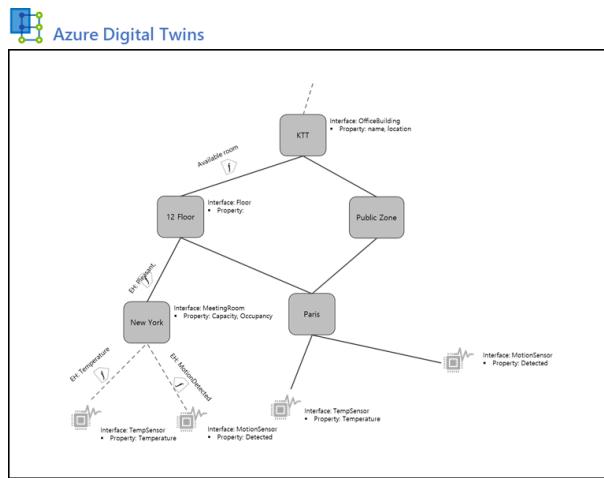






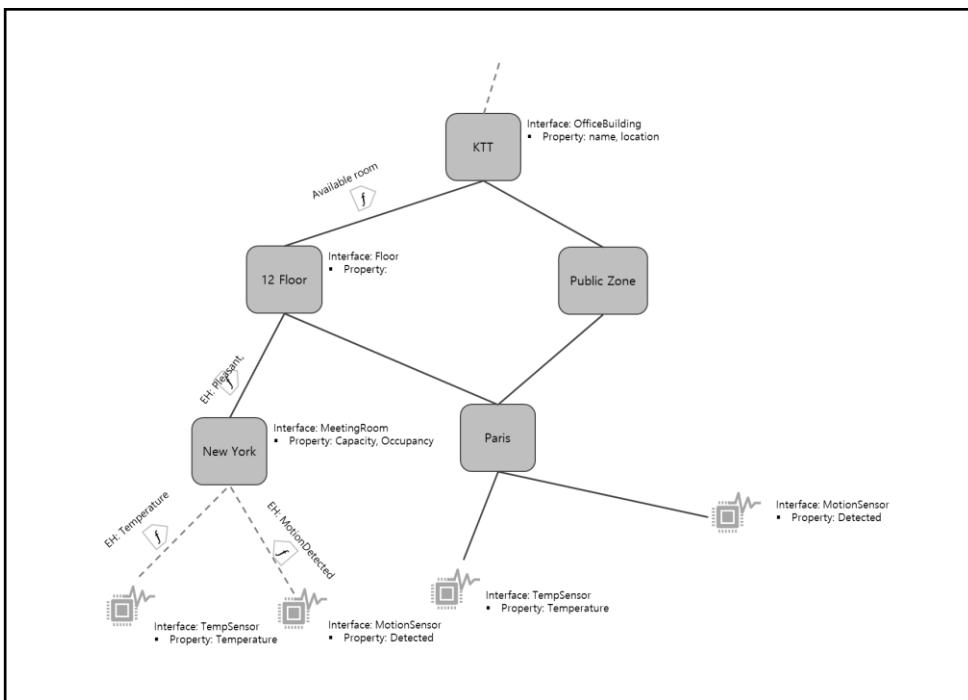
Device ID: 0014983

```
{  
    temperature: 32,  
    motionDetection: false  
}
```



KTT빌딩-12층 뉴욕룸  
쾌적하고 사용 가능

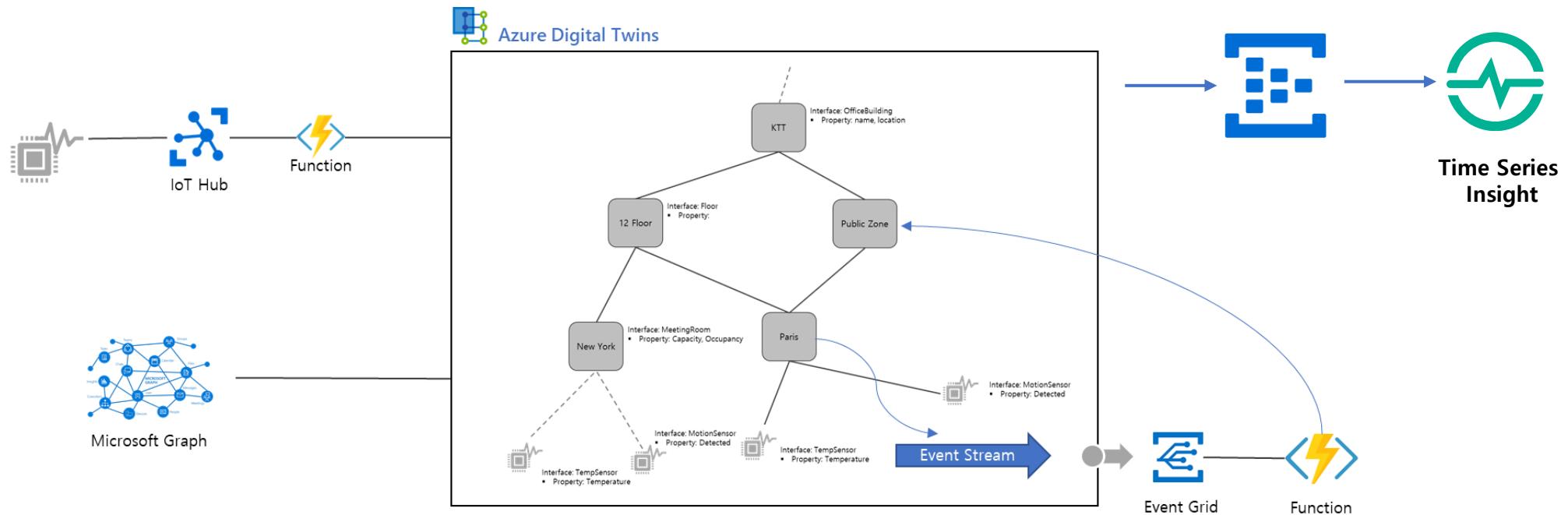
# Digital Twins Graph Queries



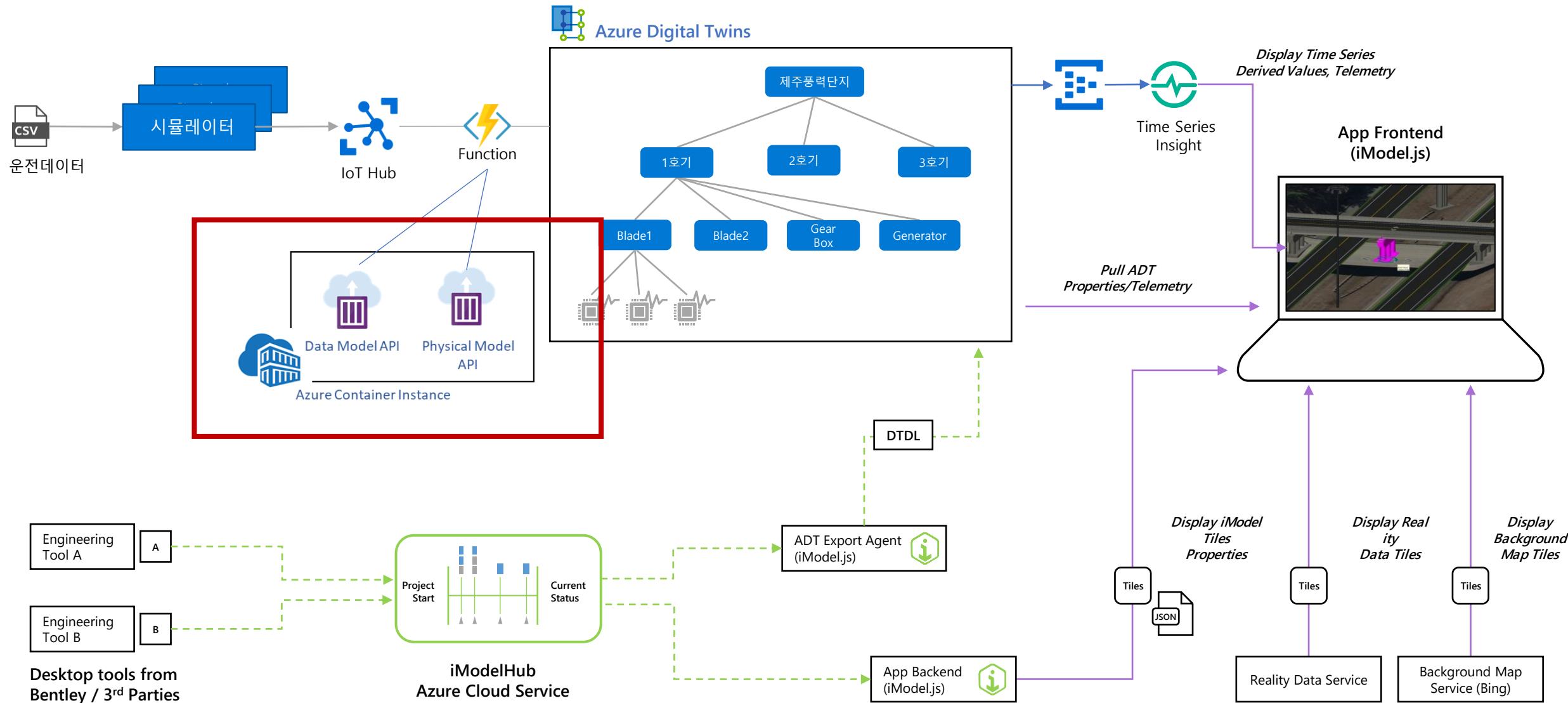
12층에 쾌적한 온도의 사용가능한 미팅룸

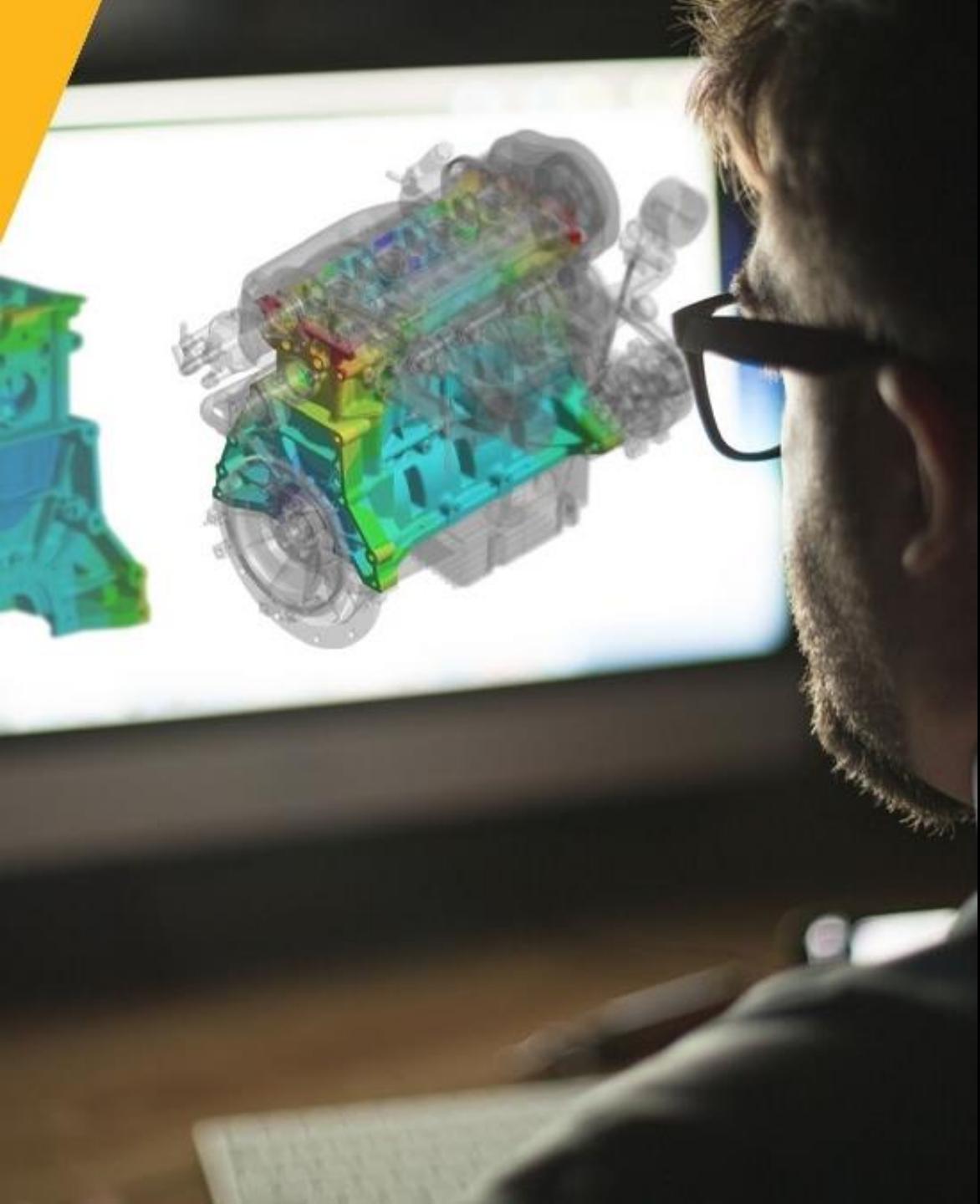
```
SELECT Room  
FROM DIGITALTWINS Floor  
JOIN Room RELATED Floor.Contains  
WHERE Floor.$dtId = 'floor11' AND  
Room.Availability = true AND  
Room.Pleasant = true AND  
IS_OF_MODEL(Room, 'dtmi:contosocom:MeetingRoom;1')
```

# Historical Data



# 두산 풍력 발전 디지털 트윈 아키텍쳐

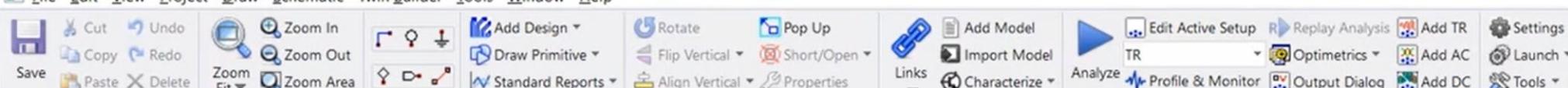




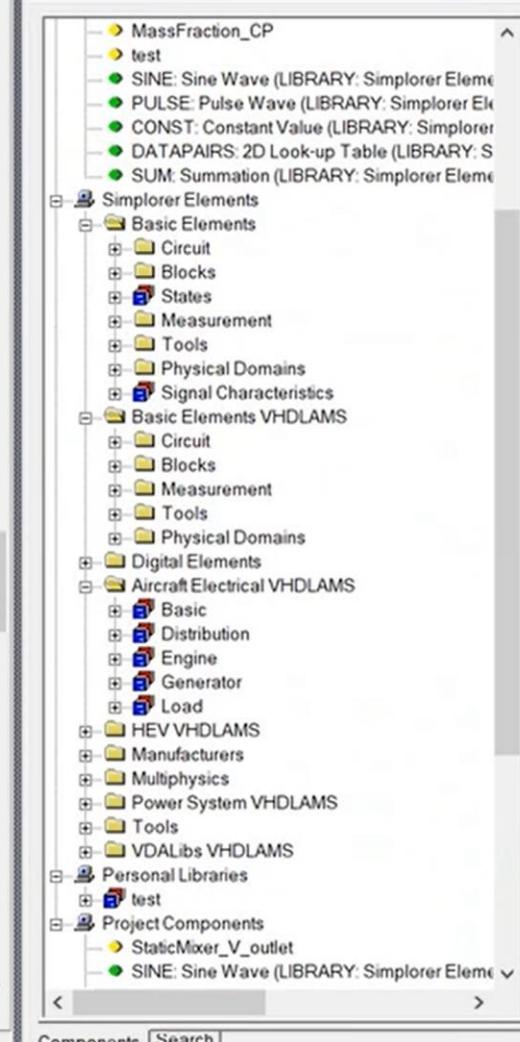
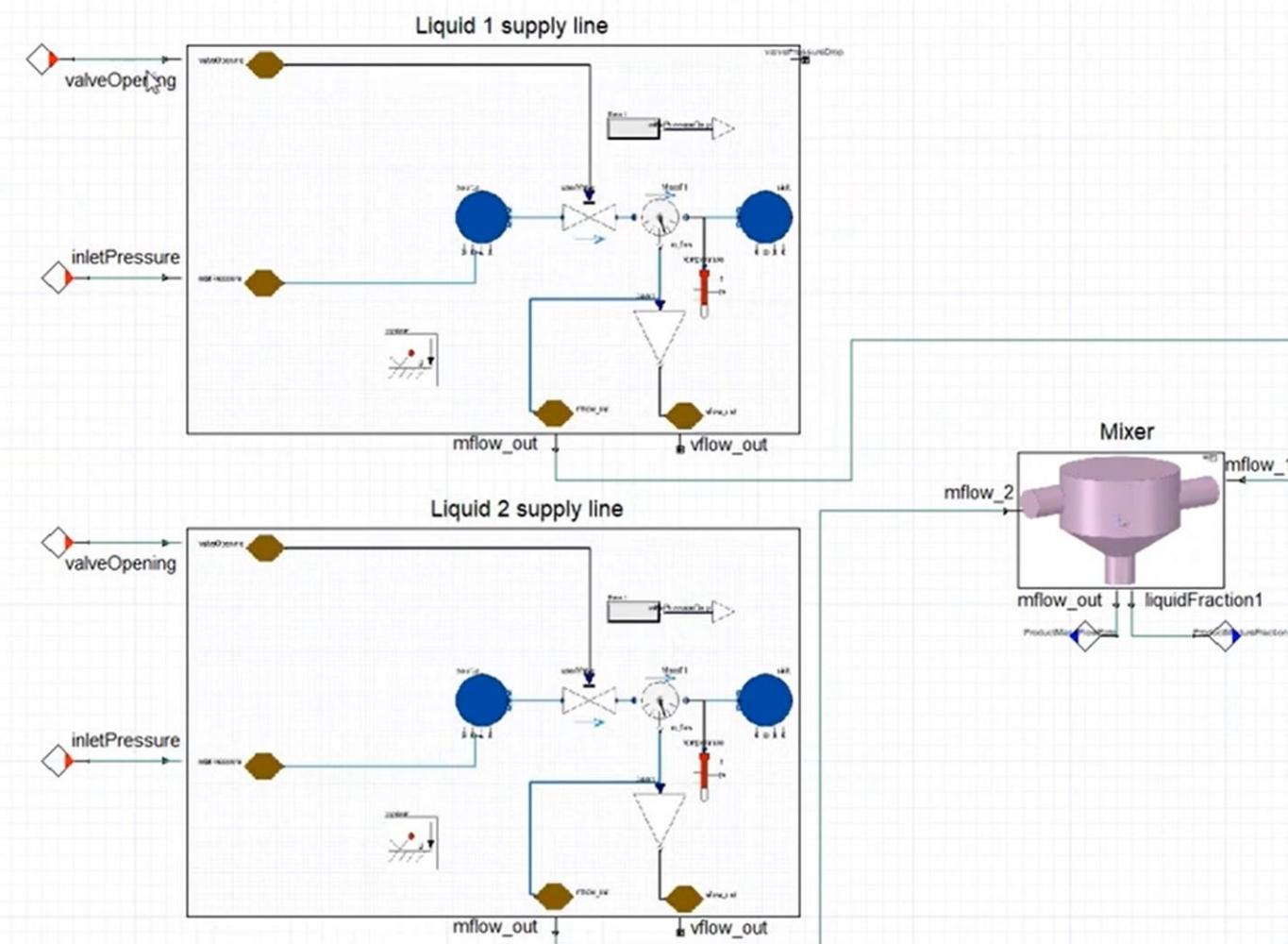
# Ansys

## Twin Builder: Physics-Based Digital Twins

- Ansys는 Azure Digital Twins와 IoT Hub를 이용하여 물리기반 디지털 트윈모델이 물리적인 장비를 더 잘 예측하고 진단하도록 Twin Builder을 개선
- 물리기반 디지털 트윈모델을 빠르고 쉽게 배포
- 실제 시나리오에서 제품의 작동과 변화를 분석
- 실시간으로 모니터링하고 최적화하는 프로세스
- 직원 교육 개선
- 적은 유지비로 보다 정확한 예측

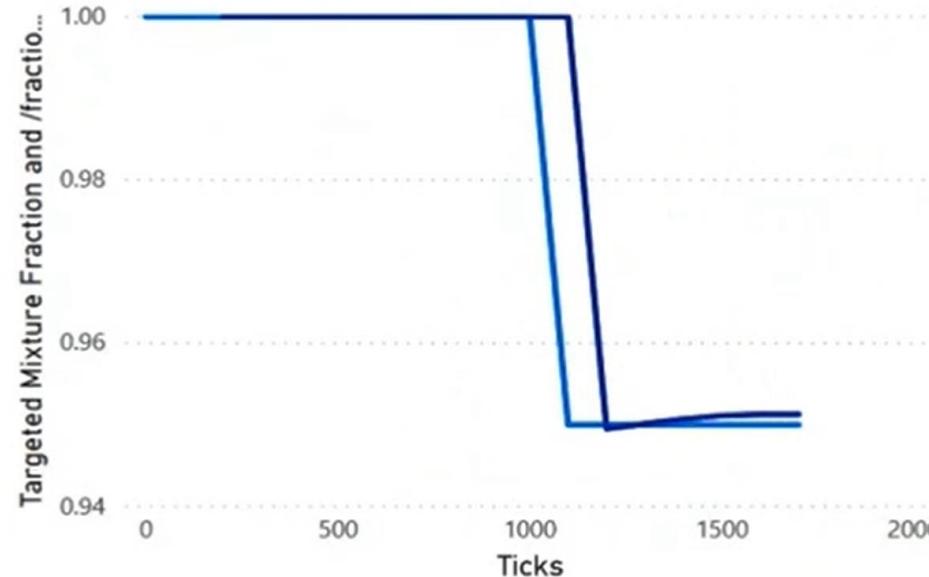


- StaticMixer\_demo\_schematic\_new\_inputs
  - rom
  - Ports
  - SubSheet1: TwinBuilder1
    - Ports
    - Analysis
    - Optimetrics
  - Analysis
  - Optimetrics
  - Results
  - Definitions



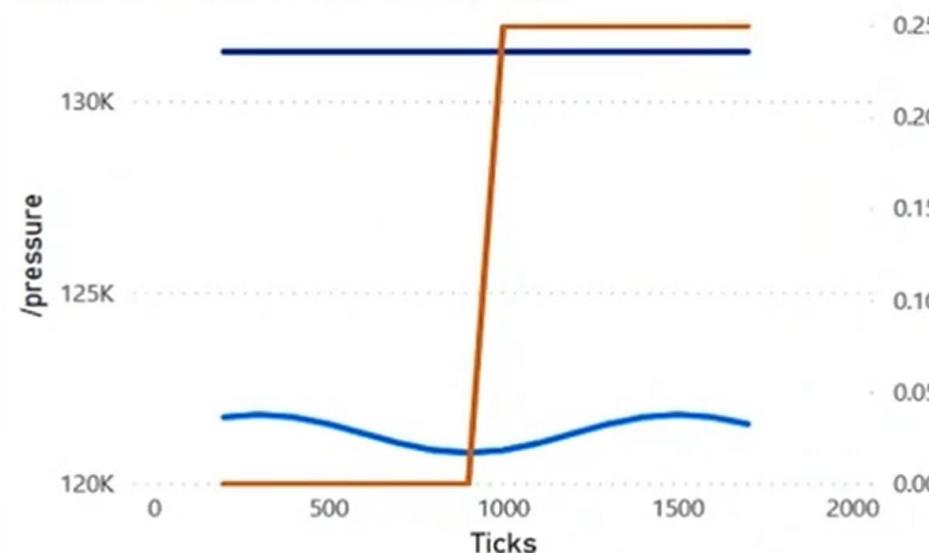
## Simulation Deviations

● Targeted Mixture Fraction ● /fractionLiquid1



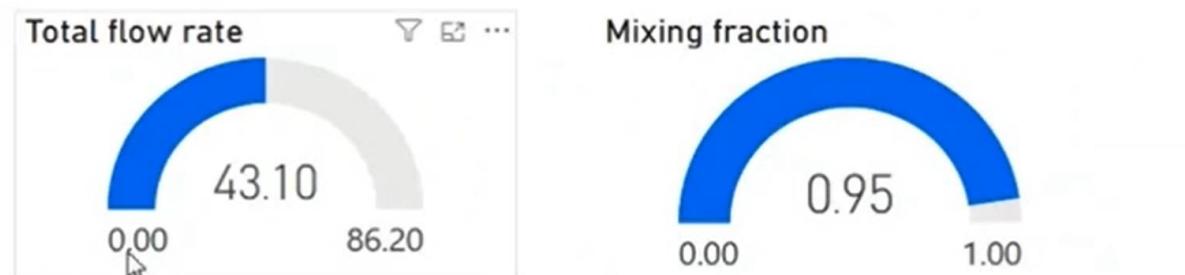
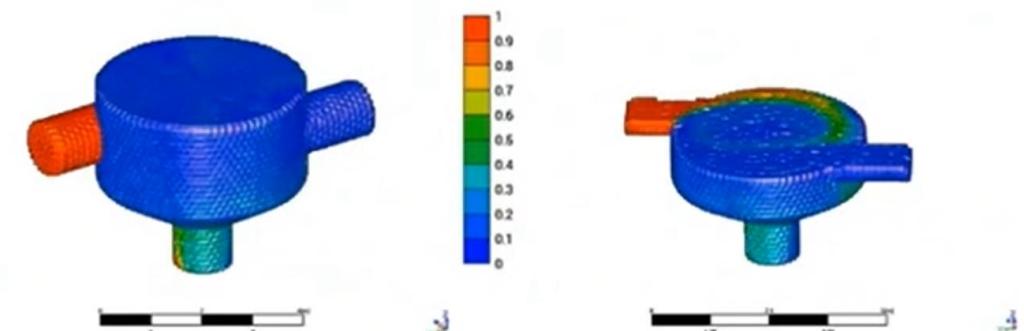
## Operating conditions

● /pressure ● /pressure ● Valve 2/Opening



# Ansys

The Digital Twin generates 3D visualization images of liquid 2 mass fraction distribution. This helps analyzing the mixing uniformity which has a direct impact on the resulting product quality.



Ticks	LiquidSource1/Pressure	LiquidSource2/Pressure	Valve 1/Opening	Valve 2/Opening
1100	121,073.74	131,325.00	1.00	0.25
1200	121,323.41	131,325.00	1.00	0.25
1300	121,573.50	131,325.00	1.00	0.25
1400	121,757.08	131,325.00	1.00	0.25
1500	121,825.00	131,325.00	1.00	0.25
1600	121,759.07	131,325.00	1.00	0.25
1700	121,576.95	131,325.00	1.00	0.25



# Connected Highway

Coffs Harbour Roadway in Australia

- Need: Access to sensor data to monitor health of roadway infrastructure
- Problem: Large amounts of unstructured data from disparate systems
- Solution: Digital twin to visualize streaming data and alert operators when actions need to be taken
- Benefits: Safer roadways with lower cost and more efficient maintenance

Civil IoT Viewer

## Asset Types

- Bridges
- Tunnels
- Roads

Select Elements

Identify element

Messages 0

Civil IoT Viewer

Asset Types

Bridges

- BR1-SB
- BR1-NB
- BR2-SB
- BR2-NB
- BR3-SB
- BR3-NB

Tunnels

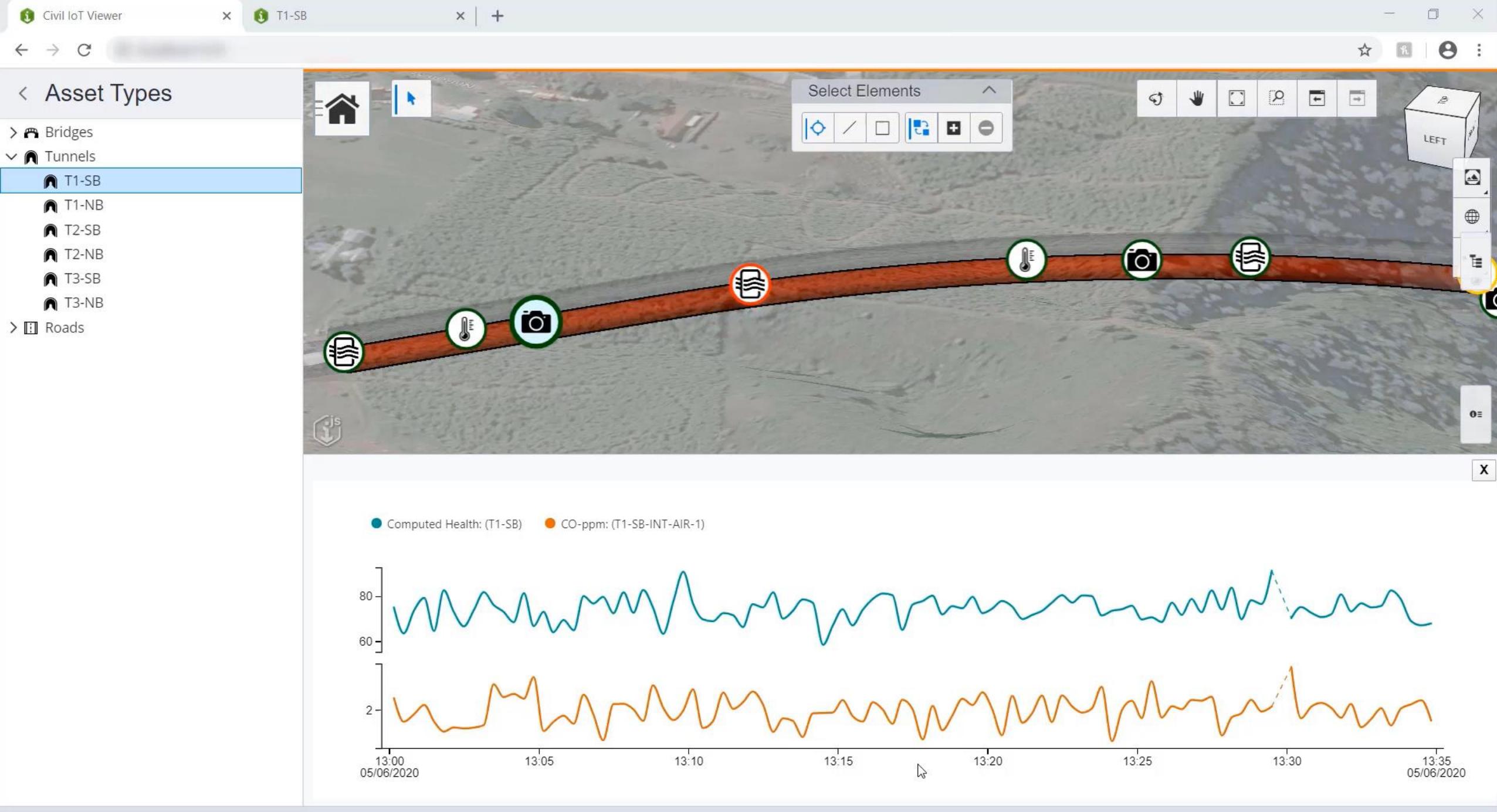
Roads

Select Elements

Identify element

Messages 0

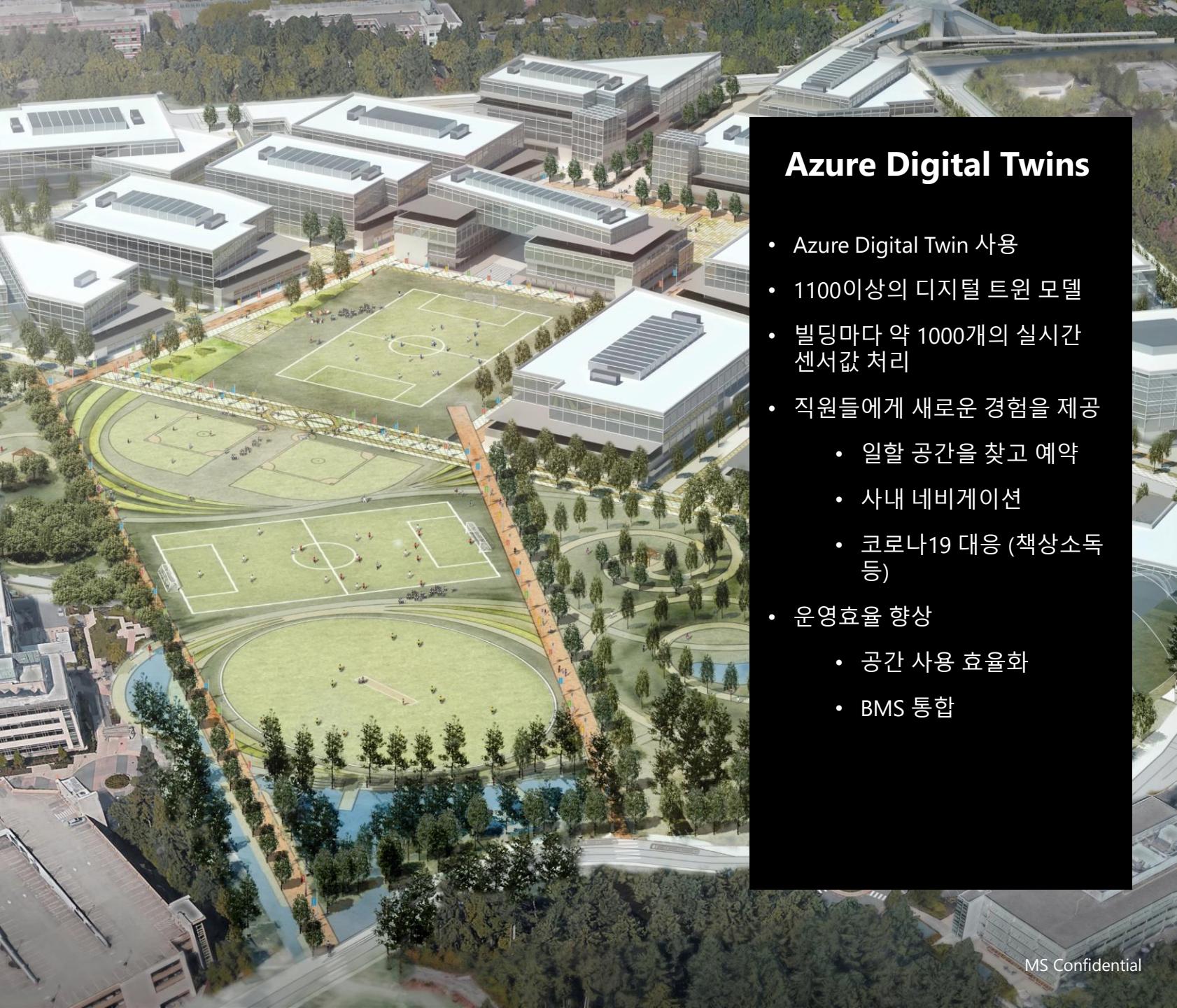
The image shows an aerial view of a highway interchange. A bridge, labeled 'BR2-NB' in the asset types list, is highlighted in green and yellow, indicating it is selected. The highway is labeled 'Pacific Hwy'. The surrounding area includes residential and industrial buildings, roads, and fields. A 'Select Elements' toolbar is visible at the top right, and a legend on the right side shows symbols for various asset types.



# 마이크로소프트 캠퍼스 현대화 비전

연결되고 누구나 접근 가능하고  
지속 가능하고 안전한 업무 공간을  
만들어 직원들에게 최고의 경험을  
제공하고

클라우드의 가능성과 파트너  
생태계를 만들기 위한  
마이크로소프트 자체의 스마트  
스페이스 프로젝트



## Azure Digital Twins

- Azure Digital Twin 사용
- 1100이상의 디지털 트윈 모델
- 빌딩마다 약 1000개의 실시간  
센서값 처리
- 직원들에게 새로운 경험을 제공
  - 일할 공간을 찾고 예약
  - 사내 네비게이션
  - 코로나19 대응 (책상소독 등)
- 운영효율 향상
  - 공간 사용 효율화
  - BMS 통합



# Azure Digital Twin 관련자로

<https://aka.ms/ADTContent>