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16th Technology Forum

Embracing Opportunities in the AI Era

Innovate with AI for Enhancing Public Services

Digital Twin & AI – The new Future of Public Services

Jul 2023

INspire HK
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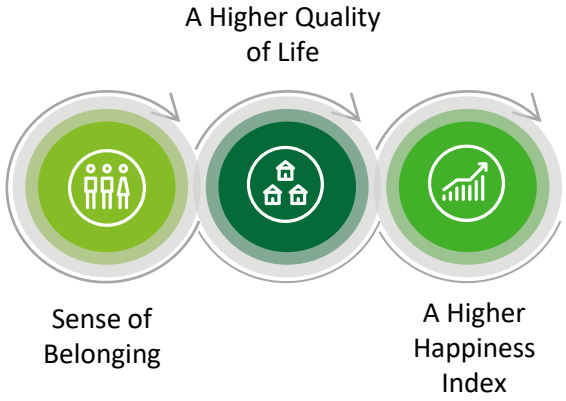
MAKING AN IMPACT THAT MATTERS since 1845

Deloitte Point of View on Smart City

Our Thought for A Smart City

How a Smart City Can Help The Society



Global Trends in Smart City Development

In Asia, specifically China, the government has been largely promoting rural revitalisation (鄉村振興) for years, which helps China achieve the highest urbanization growth rate globally and a vast space for development in the future.

- Driven by its new-type urbanisation strategy, China has seen rapid urbanization with a **compound annual growth rate over 1%** in the past decade.
- Asian countries/regions have higher urbanisation growth rates than that of American countries, demonstrating a huge potential for growth.

Sources: National Bureau of Statistics, Deloitte Research

What We Have Learnt From Past Experience

Smart Cities Require:

1. **Effective Overall Strategic Planning**
2. **Data Security**
3. **Sustainable innovation**
4. Not be restricted within certain models
5. Cooperation between **governments, businesses and the public**

What a Smart City Need

Cities are not necessarily smart in its full sense. The local governments shall develop smart cities with their own characteristics based on their own needs, and by doing so to leverage smart city projects to facilitate economic and social development and build a happy society with high quality of life

Deloitte Point of View on Smart City

In Hong Kong Smart City Blueprint 2.0, which was issued by HKSAR government, 6 categories are mentioned and they are “Government”, “People”, “Environment”, “Economy”, “Living” and “Mobility”.

In this presentation, Deloitte will focus on “Smart Government” and “Public Services” to share our ideas and offerings based on new technology, i.e. **Building Information Modelling (BIM), Internet of Things (IoT) and Digital Twin**.

BIM in HKSAR government

Hong Kong Smart City Blueprint has laid down the direction on the adoption of BIM in supporting the development of Smart Cities.

The Development Bureau has also stipulated guidelines for the mandatory BIM uses for certain applications in public works projects with a view to enhancing the overall productivity of the construction industry.

In order to further foster BIM adoption in Hong Kong, Lands Department has taken up the following initiatives to support the adoption of BIM in related projects of Government Bureaus and Departments (B/Ds):-

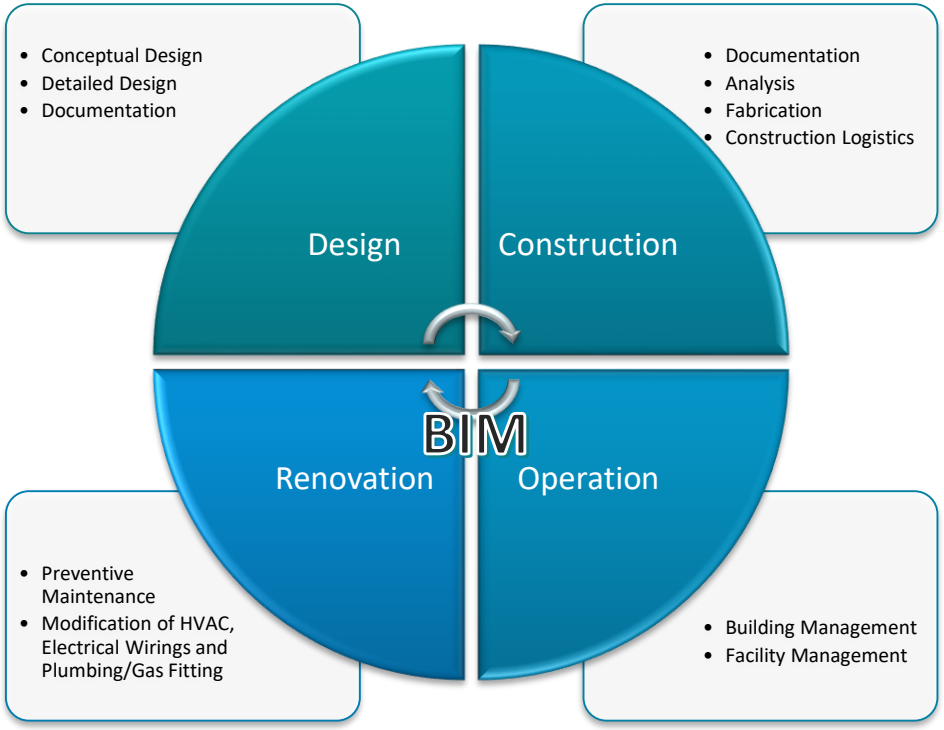
- Establishing and maintaining the Government BIM Data Repository (a data sharing platform) for all BIM data collected from works departments;
- Spearheading the development of BIM/GIS integration to support government applications; and
- Collaborating with different B/Ds and Construction Industry Council in enabling the use of BIM technology in compliance checking of electronic building plans.

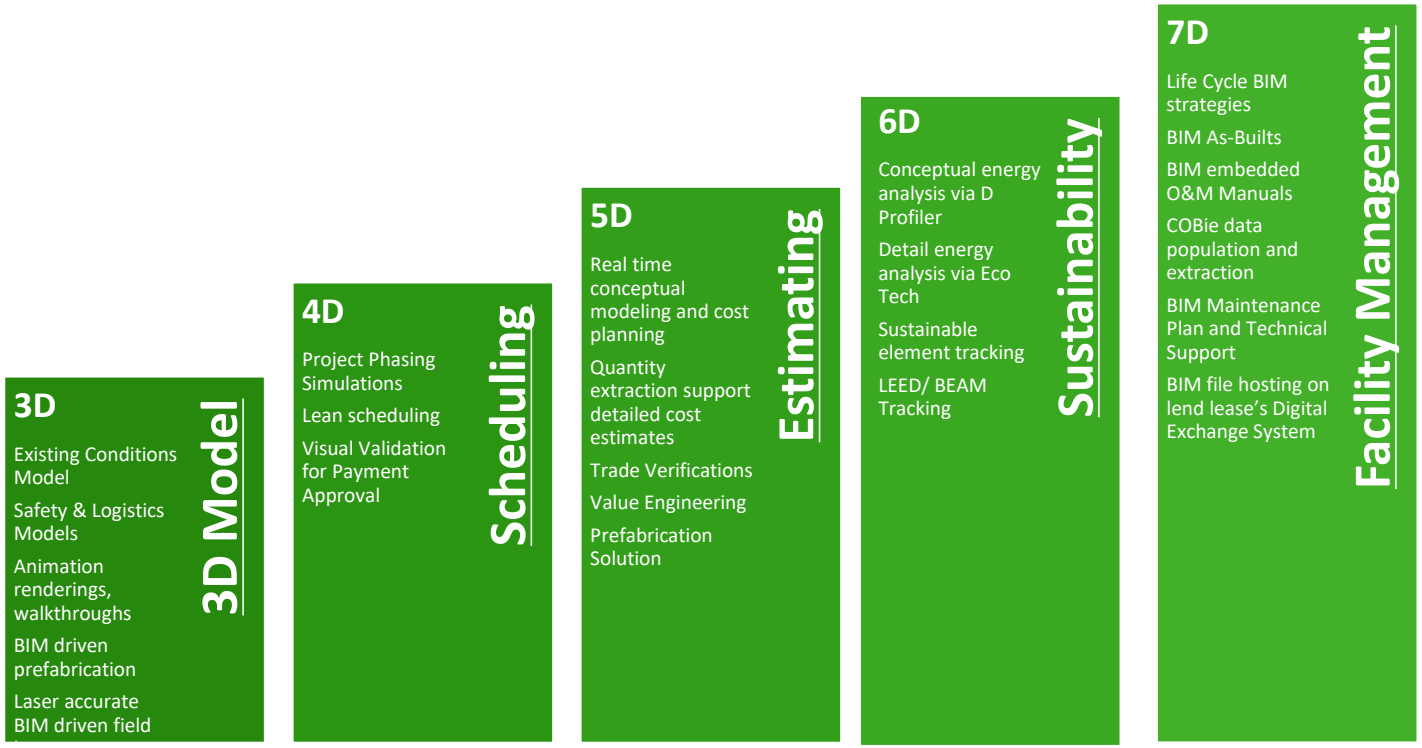
Source: Lands Department - https://www.landsd.gov.hk/en/spatial-data/BIM-data-management.html

BIM Definition

BIM is the process of generating and managing building data during its design, construction and during the building or assets life cycle.

Typically, the process uses three-dimensional building modelling software to increase productivity of consultants and contractors during the whole asset life cycle.





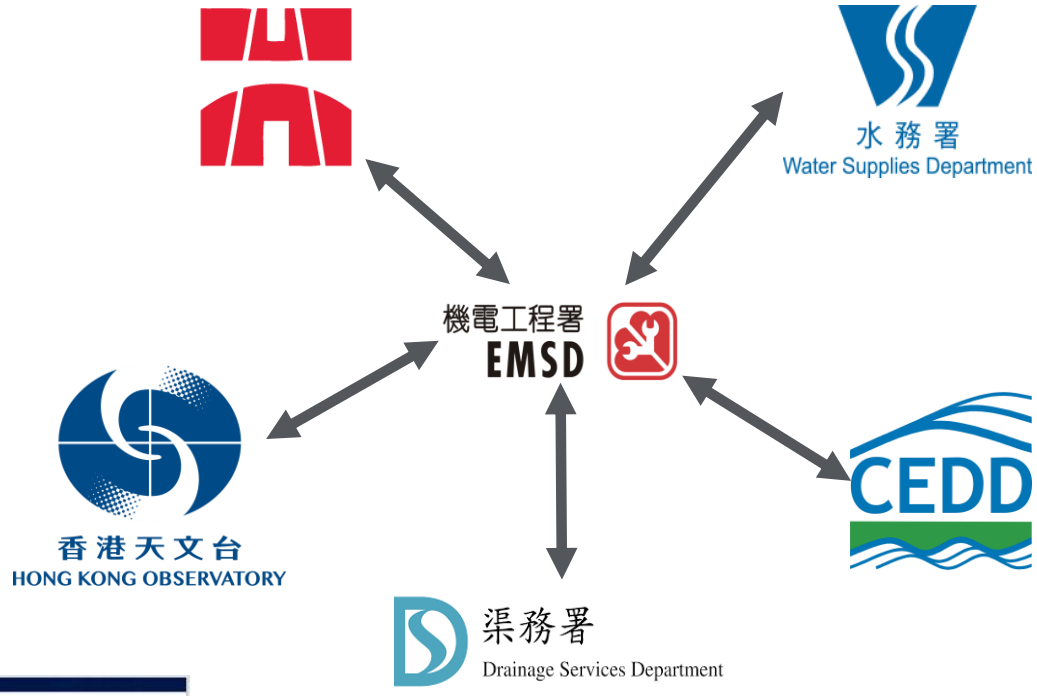
Source: HKCIC https://www.bim.cic.hk/en/bim_in_hk/what_is_bim

IoT in HKSAR Government

To assist digitalisation of HK E&M equipment, the Electrical and Mechanical Services Department (EMSD) is building a government network of wireless sensors installed throughout Hong Kong to support various smart applications for the improvement of public service quality.

EMSD will collaborate with different Government Bureaus and Departments (B/Ds) for providing application by using Government-Wide IoT Network (GWIN), which is low power and private LoRa (Long Range) network, and sensors. Those applications include, but not limited to,

- Flood Monitoring, and
- Smart Parking System



Source: EMSD - https://www.emsd.gov.hk/en/engineering_services/project_management_consultancy/highlights_of_work/gwin/index.html

The rise of a connected Smart City – a consolidated BIM & IoT

Technology is playing a key role in helping organisations (public and private sectors) respond, recover, and thrive in the post-COVID world. The importance of capturing real-time data, consolidating with structural data & geo data (GIS), and acting upon the insights becomes increasingly vital and fundamental for a Smart City (City of the Future).

Cost Reduction

Using data from IoT solutions, operators can proactively make better decisions, leading to increased efficiency and reducing operational costs.

Security and Safety

Remote monitoring and control of critical asset supports operators in determining trends and patterns, and report any abnormality.

Revenue/ Satisfaction Growth

With data-driven or insight-driven decision to be enabled from such interconnected systems, a customised offering can be created for end users/ citizens, leading to potential revenue/ satisfaction boost.

Quality Control

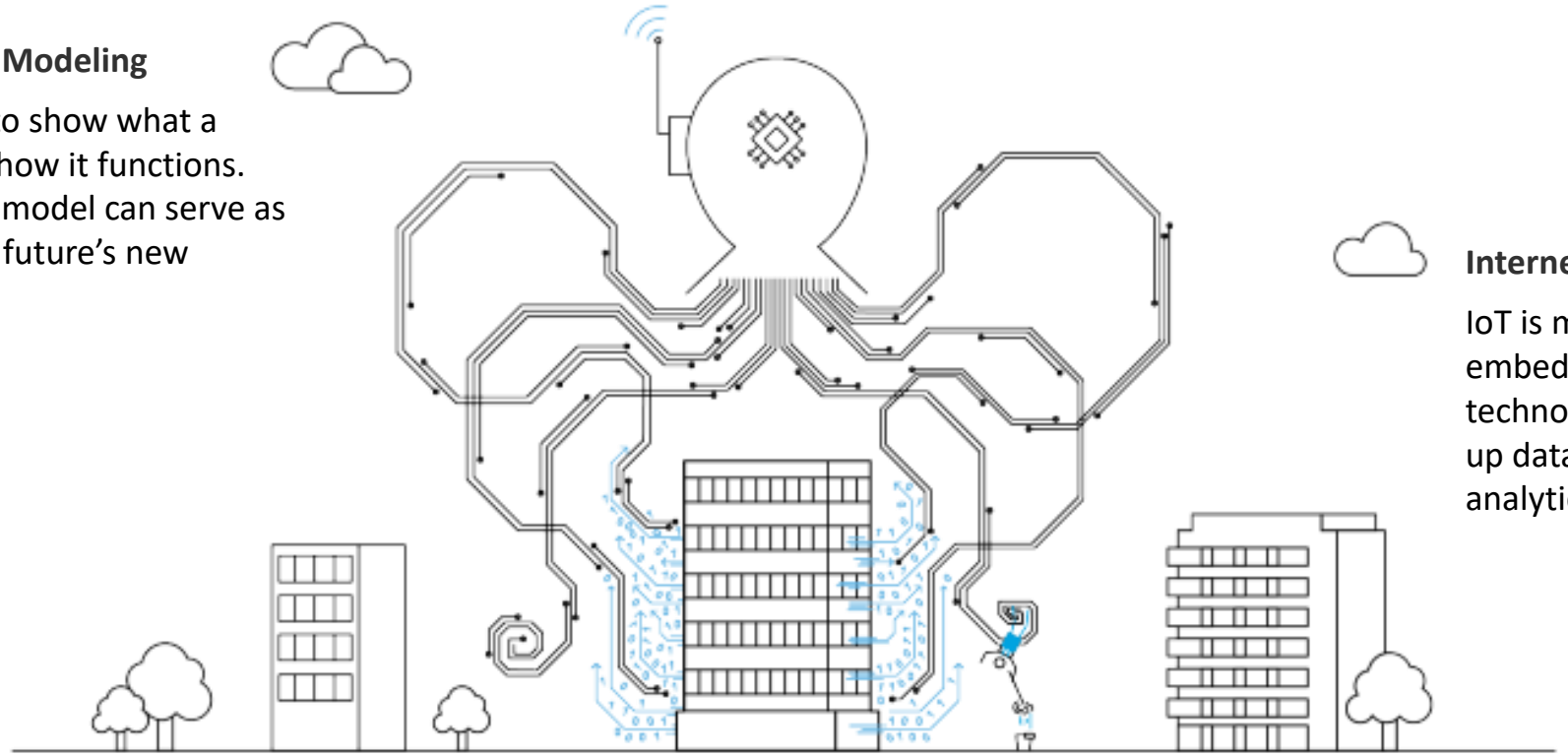
Assessing process historical data from sensors or edge devices helps operators manage the product's quality.

Combining BIM & IoT to enhance insight-driven decision

Having an IoT enablement alone appears to be sufficient at a glance, however, combining environment data (structural building layout or even Geo-data) using BIM/ Real-time Rendering Engine technologies do offer a more comprehensive insights with better causal relationship among multiple factors be established, which is of added-value to identify root causes of operating issues, thus enabling improvement to be delivered in an effective/efficient manner.

Building Information Modeling

BIM uses 3D models to show what a facility looks like and how it functions. BIM's virtual building model can serve as a data foundation for future's new service model.

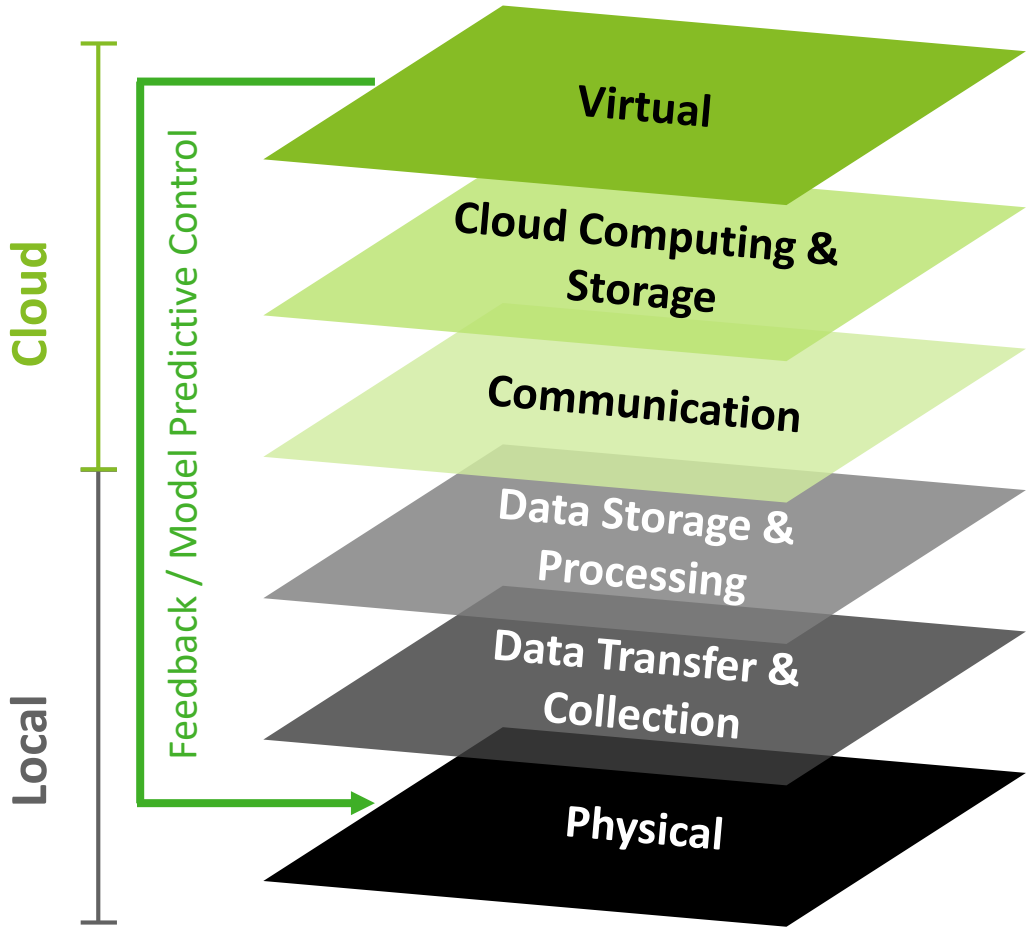


Internet-of-Thing (IoT)

IoT is made up of everyday objects embedded with sensors and other technology that allow them to pick up data and pass it on to other for analytic or reporting purposes.

Combining BIM & IoT to enhance insight-driven decision (cont.)

Six-layer architecture of Digital Twin



	Visualization, Emulation & Simulation	To provide human centric visualization, insights, design and simulation.
	Cloud-Based Information Repositories	To store data on cloud and execute computing intensive tasks.
	IoT Gateway	To enable device-to-cloud communication.
	Local Data Repositories	To store and process acquired data.
	Local Controllers	To control installed devices and facilitate data transfer.
	Physical Devices & Sensors	To measure and acquire data from the physical environment.

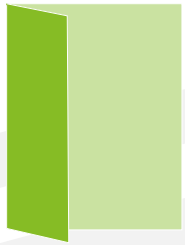
From BIM & IoT to Digital Twin with A.I.

1. **BIM**

BIM model

- Static
- 3-dimensional
- Accurate digital representation of building

2. **Internet of Things (IoT) & Cloud Computing**



IoT & Cloud Computing

- Real-time data acquisition
- Analytics and pre-processing
- Large coverage

3. **Digital Twin**

Digital Twin

- Dynamic
- Human centric design and visualization

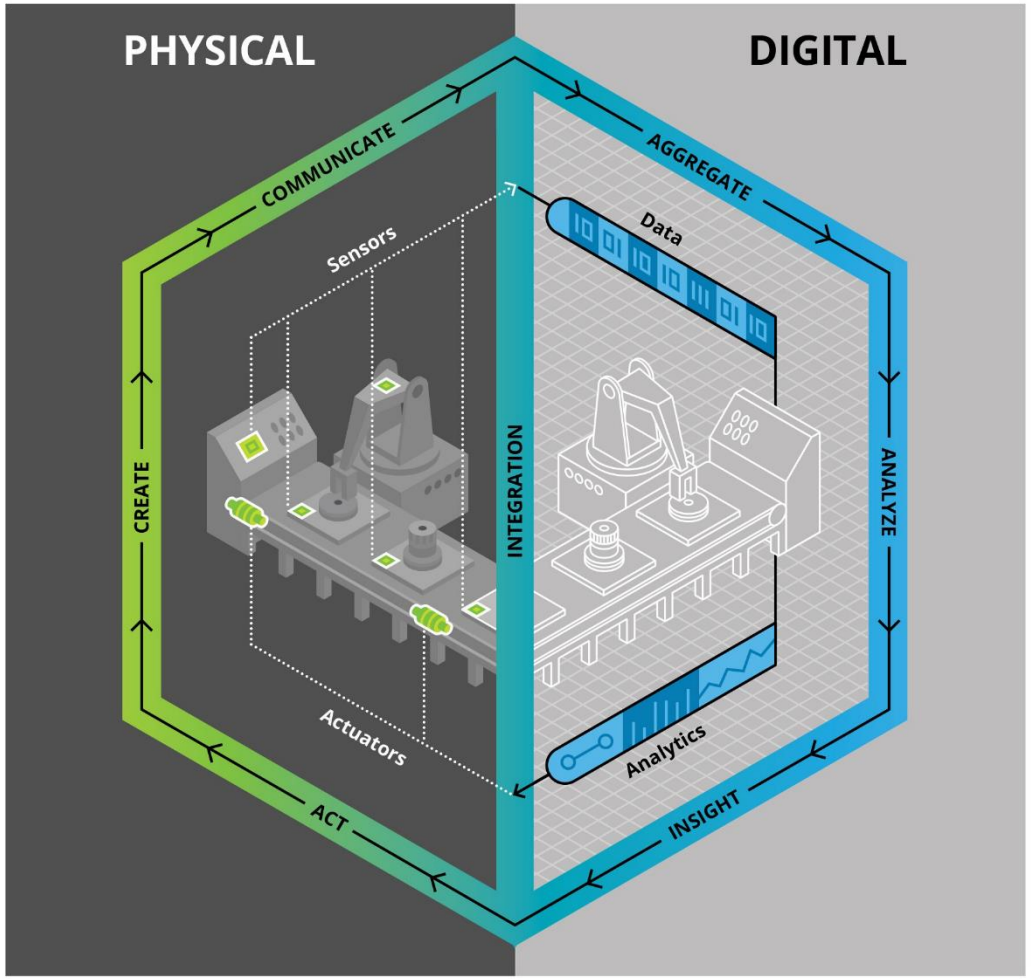
4. **Machine learning (ML)-based model predictive control (MPC)**

ML-MPC

- A.I. supported control system
- Maximized cost and energy efficiencies

Digital Twin Application

Journey between the physical and digital worlds



Source: Deloitte University Press.

Deloitte University Press | dupress.deloitte.com

The digital twin serves as a virtual replica of what is actually happening on the factory floor in near-real time. Thousands of sensors distributed throughout the physical process collectively capture data along a wide array of dimensions: from behavioural characteristics of the productive machinery and works in progress (thickness, colour qualities, hardness, torque, speeds, and so on) to environmental conditions within the physical environment itself. These data are continuously communicated to and aggregated by the digital twin application.

The digital twin application continuously analyses incoming data streams. Over a period of time, the analyses may uncover unacceptable trends in the actual performance of the physical process in a particular dimension when compared with an ideal range of tolerable performance. Such comparative insight could trigger investigation and a potential change to some aspect of the manufacturing process in the physical world.

This is the journey of interactivity between the physical and digital worlds, which beside figure endeavours to convey. Such a journey underscores the profound potential of the digital twin: thousands of sensors taking continuous, nontrivial measurements that are streamed to a digital platform, which, in turn, performs near-real-time analysis to optimize a business process in a transparent manner.

200+ Deloitte Smart City-related Projects Globally

Canada
- Smart Resident Social Housing Service Project
- Smart Government Citizenship Service Solution
- Strategic Planning for Smart Government in York
- Vancouver Unmanned Port Logistics Strategic Planning

United States
- Smart Security - Crime Information Network Service Planning
- Montgomery Intelligent Transportation Project
- The development of the concept of cross-border cities in the US and Mexico
- Large Amman City Solid Waste Management Test
- US healthcare company's accurate supply and demand forecast
- Smart Finance Hilton Cloud System - Marketing Perfect Matching Planning
- IoT smart restaurant strategic planning

Argentina
- Smart government public component maintenance planning project
- Public official website security service under digital city

South Africa
- Aiguruni City Smart Unified Command and Control Center Project
- Durban State Government Smart Underground Pipeline Implementation Project
- Escom Smart Energy Planning
- Smart Municipality - Complaints and Maintenance Operations Management System

United Kingdom
- Smart Government Council Information and Communication Transformation
- London Digital Traffic Command System (Development of CitySynergy Digital Command System)

Portugal
- Cascais - Smart City Planning Project (CitySynergy Digital Command System Development)

Italy
- IoT smart restaurant strategic planning
- Immersive experience - enterprise consumption database planning
- Supply chain priority product data management system

Spain
- Valencia Smart City Transformation Project
- Valencia Smart Life - Lighting / Garbage / Irrigation Automation
- Malaga City Smart City Top Strategic Planning
- Malaga Smart City Data Strategy

Belgium
- Smart City Platform - E-Government Project
- Supply chain priority product data management system
- Smart Warehouse Management and Control System

Germany
- German Airlines - Hadoop platform
- Precise supply and demand forecasting model
- Intelligent Robot Customer Service System - Borderless Communication Planning
- Maternal and Child Health Management Service Planning

Sweden
- Stockholm City Digital Planning
- Stockholm Smart Education Program
- Stockholm Unmanned Port Logistics Strategic Planning
- Stokab Smart Government Technology Future Trend Plan
- Smart City Infrastructure Development Reference Model Planning

India
- New Kolkata Smart City Strategic Plan
- Blubankswar Intelligent Transportation Planning
- Central Government Smart Health Strategic Plan

Netherlands
- The Edge Smart Business Building Planning and System Development (Deloitte Headquarters, The Netherlands)
- Amsterdam Smart City Strategic Plan
- Amsterdam Smart Society Innovation Plan
- Limburg Province Smart Energy / Circular Economy Planning
- Rotterdam City Social Unemployment Relief Service Plan
- Smart Energy Management and Efficiency Optimization Strategic Planning

China
- Smart City Planning in a District of Guangzhou
- Jingan Smart City Strategic Plan for the Next Five Years
- Taipei City Unmanned Port Logistics Strategic Planning
- >20 smart cities projects

Japan
- Toyota Motor Industry Strategic Planning
- Smart Community Care Service
- Smart medical service planning

Singapore
- Smart Warehouse Management and Control System
- Smart Customer Service - Call Center Technology Pilot

Australia
- Smart medical strategic planning
- Smart Energy Strategic Planning

Our Service Offering | Digital Twin with IoT-enabled and Web-based System

Building Management & Facility Management

Background or industry pain-points:
Labor-intensive (i.e. high labor cost), low visibility of overall monitoring, inefficiency, incident-reactive approach for repair and maintenance, and slow time to respond to the incidents

Features:

- Having integrated different building systems (electricity, fire alarm system, HVAC, security, etc)
- Introducing location-based asset tracking, and preventive/ corrective maintenance management
- Supporting portfolio management of multiple premises, sites, locations

Benefits:

- Enhancing transparency and productivity in a controlled cost manner
- More transparency with the availability of predictive / automated information
- Better building performance, enhanced quality, insightful experiences in an ESG-compliant manner

Remark: It is demo use only, and needs further enhancements and customisation based on clients' requirements.

Our Service Offering | High Accuracy Digital Twin with VR-/ AR-enabled functionalities

Architecture, Engineering, and Construction Industries

Background or industry pain-points:
shortage of skillful and experienced workforce, high cost and inefficiency in projecting future scenario visualization/ simulation

Features:

- High accuracy digital twin with VR-/ AR-enabled functionalities in a 360-degree immersive environment
- BIM data-enabled scenarios for visualization
- Monitor the quality or progress of the construction works or minor works

Benefits:

- Improved transparency and visibility for scenario visualization
- More efficient and productive in a controlled cost manner

Remark: It is demo use only, and needs further enhancements and customisation based on clients' requirements.

Our Service Offering | Synthetic data generation in digital twin for AI training

Smart City, Visual Inspection of Infrastructure, Autonomous Guided Vehicle (AGV)

Background (industry pain-points):
AI is only powerful if pre-trained with lots of dataset. Yet, it is difficult to collect the data of rare scenarios such as defective objects, accidents and trespassing on railway. Synthetic data generation can bridge the gap and reduce cost of data collection.

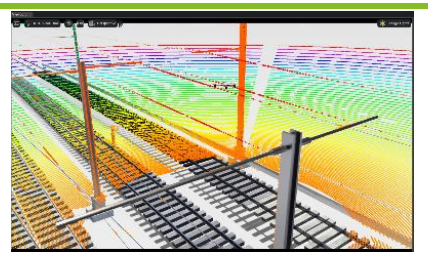
Features:

- Generation of synthetic data including photorealistic images, sensor data, depth data etc.
- Generation of uncommon scenarios such as defective objects, extreme weather to enrich AI training dataset
- Defect detection with tailor-made computer vision AI models

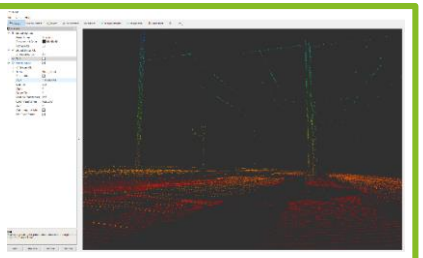
Benefits:

- Enrich AI training dataset by providing data of uncommon scenarios such as defective
- Reduce cost of data collection in reality
- Improve pre-trained AI model’ s robustness and performance

Digital twin of railway based on BIM

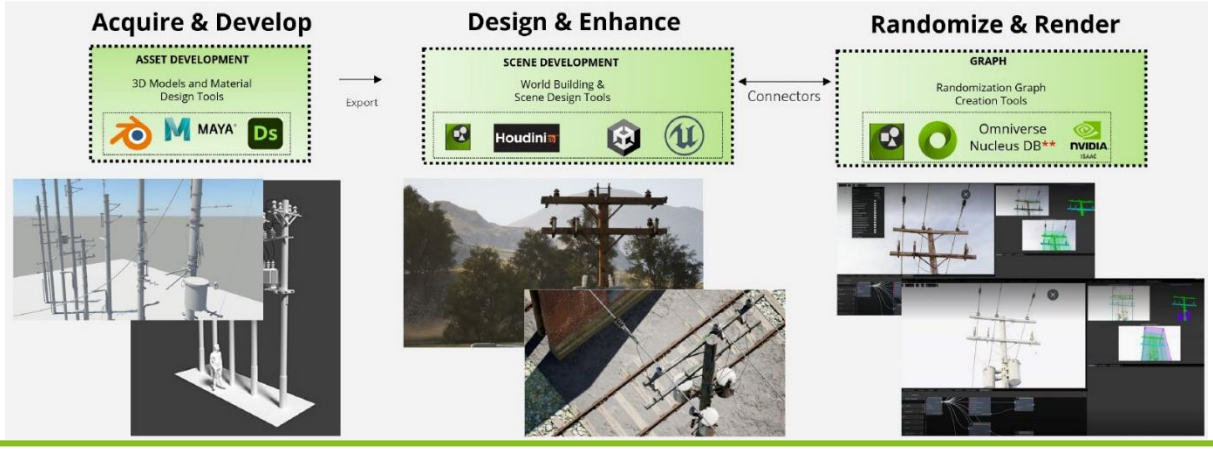


Simulated Lidar scanning in railway digital twin



Exported Lidar data for AI training

Solution Flow



Remark: It is demo use only and needs further enhancements and customisation based on clients’ requirements.

Our Service Offering | Traffic microsimulation using Unity

Smart City and Urban Planning

Background or industry pain-points:
shortage of visualization and simulation software, high cost and inefficiency in projecting future scenario visualization/ simulation

Features:

- Agent-based simulation i.e. computer simulations used to study the interactions among vehicles, people, things, places, and time by using stochastic models built with the bottom-up approach.
- To re-create and predict the appearance of complex phenomena.

Benefits:

- Bottom-up approach can explain the emergence of higher-order patterns
- Provide insights of various scenarios to decision makers
- Solving complex optimisation problems

Remark: It is demo use only and needs further enhancements and customisation based on clients' requirements.

Our Service Offering | Edge Computing with Object Detection & Pose Estimation Functions

Smart City, Smart Home, Automotive and Manufacturing (Industry4.0) Industries

Background or industry pain-points:
shortage of skillful and experienced workforce, high cost and inefficiency in projecting future scenario visualization/ simulation

Features:

Object detection:

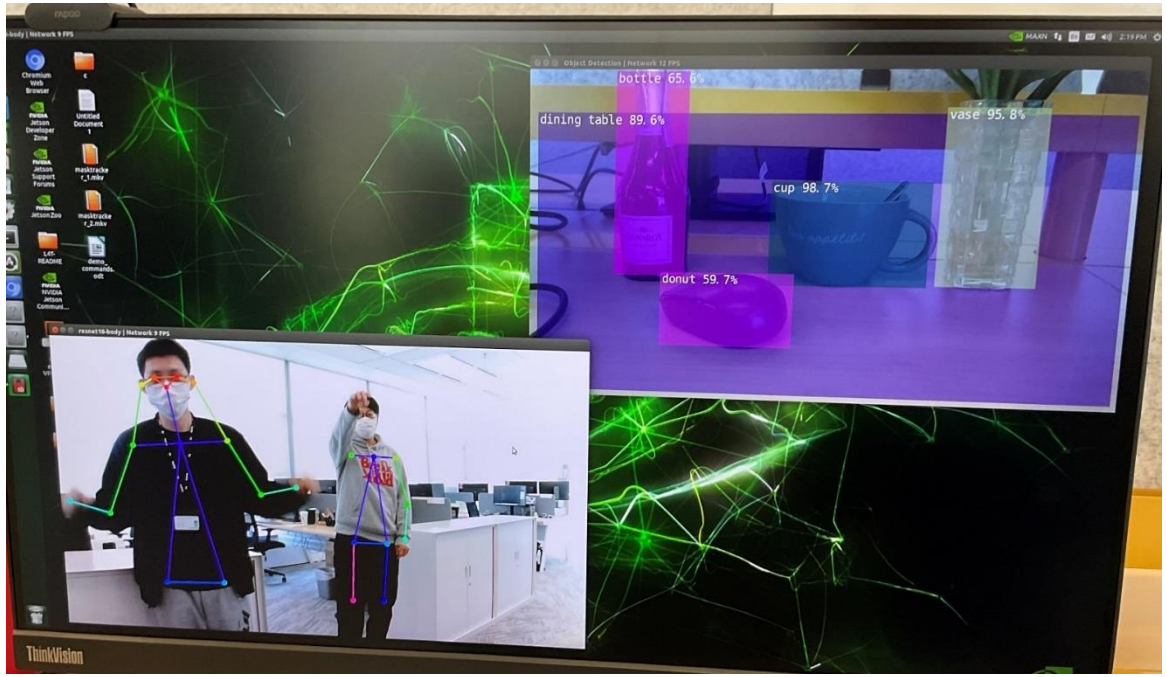
- Automatically classifies and locates all the objects in either still image / motion video
- Widely adopted in applications, among others.

Pose estimation:

- Enable detecting, associating, and tracking semantic key points
- High-performance real-time pose detection and tracking

Benefits:

- Automation with high accuracy
- More efficient and productive in a controlled cost manner

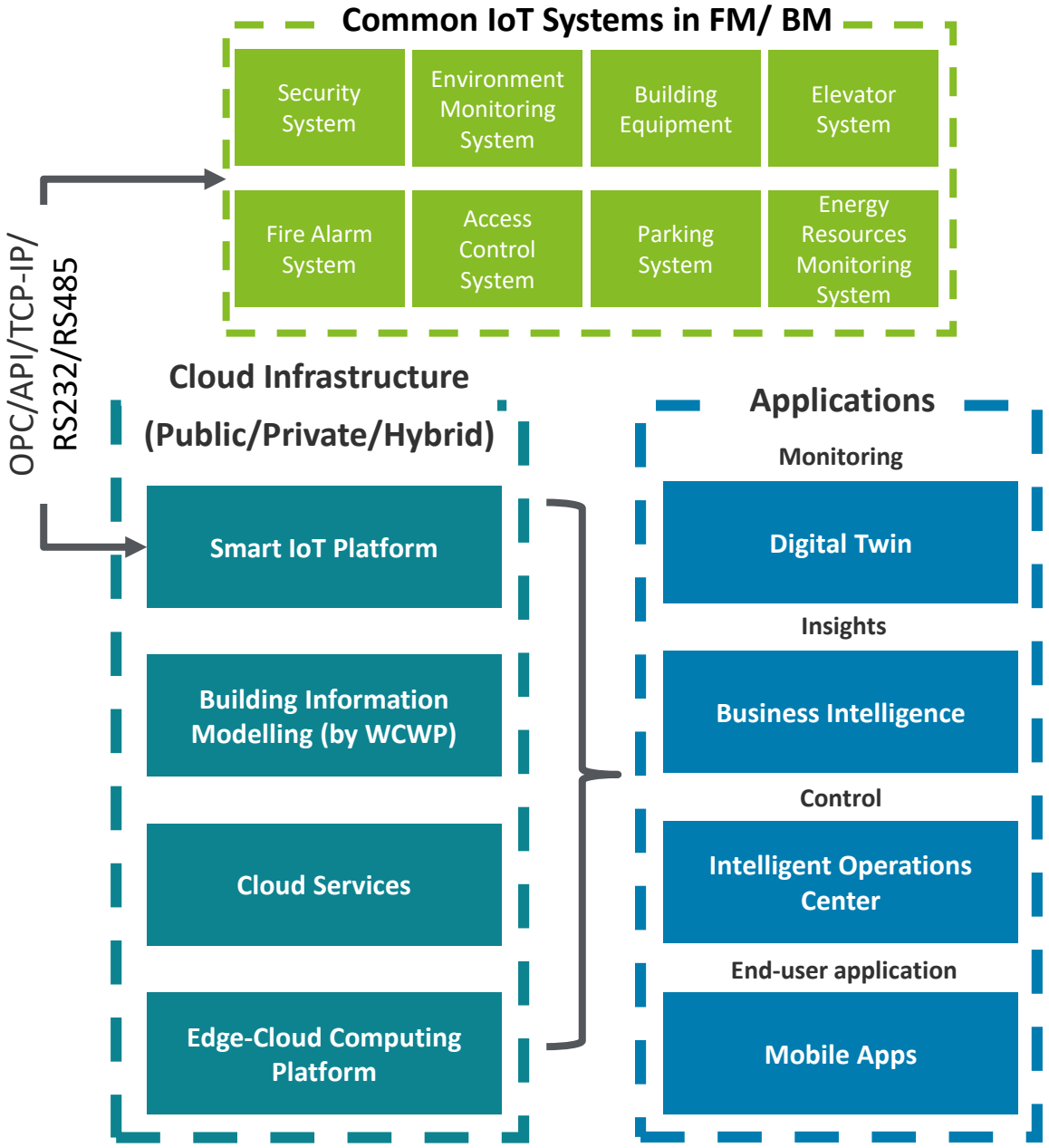


Remark: It is demo use only and needs further enhancements and customisation based on clients' requirements.

Other Service Offerings

Deloitte's Offerings

- Implementation and Smart IoT Platform;
- Standardization and integration of API of IoT systems into Smart IoT Platform;
- Setup, configuration, monitoring, and optimization of the components of cloud infrastructure;
- Creation and maintenance of Business Intelligence;
- Creation and maintenance of BIM;
- Creation and maintenance of Digital Twin;
- Implementation of Intelligent Operations Center;
- Creation and maintenance of Mobile Apps;
- Data management / analytics / insight / presentation setup;
- Data privacy and cyber risk advisory



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