

Digital Transformation for Cities and Communities

Episode #8: Network capabilities and emerging technologies to support IoT-enabled verticals

IoT-based Civil Engineering Infrastructure Health Monitoring

In Session 2: IoT-enabled verticals and related IoT network capabilities

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140th Anniversary
Towards **2031**

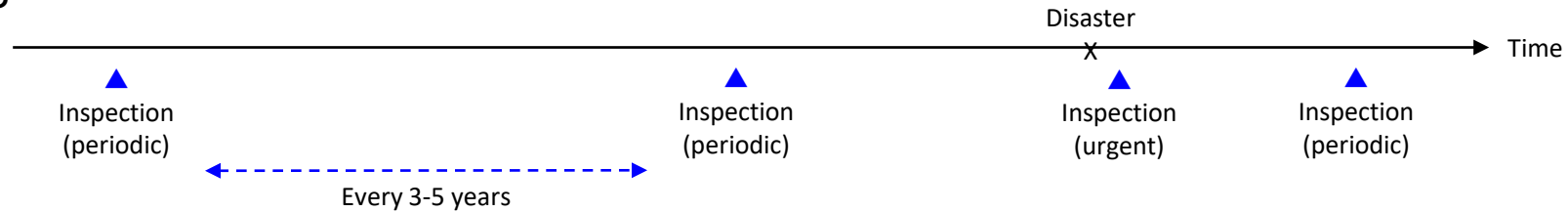
Current Status of Infrastructure Maintenance

- Increase the number of civil engineering infrastructure (road, bridge, tunnels, etc.) that have been operated for 30 to 50 years.
 - In Japan, [43% of bridges and 34% of tunnels](#) will be over 50 years old by 2023.
- Issues for infrastructure maintenance:
 - Based on **visual inspection** by an expert civil engineer.
 - **A shortage of civil engineers** due to the aging population and the declining youth.
 - **Financial problems** for operators of civil engineering infrastructures (especially local government) due to the increasing inspection costs.

**New maintenance methods using IoT technologies
are expected**

What is Civil Engineering Infrastructure Health Monitoring?

- Both of traditional “inspection” and “health monitoring” have the same purpose for **maintaining safety and integrity** of the civil engineering infrastructure
- With a different approach:
 - “Inspection” measures the condition of a civil engineering infrastructure at a particular point in time and evaluates it against criteria.



- “Health monitoring” measures the condition of a civil engineering infrastructure constantly or multiple times (always, regularly, or irregularly, at least more than 2 times) and compares them to find changes.



Use cases of Civil Engineering Infrastructure Health Monitoring



Bridge pier monitoring



Tension monitoring for cable-stayed bridge

Other use cases

- Floor slab crack monitoring
- Structural deformation monitoring
- Salt-air Damage monitoring
- Others...

Advanced Use Cases

Civil Engineering Infrastructure Health Monitoring



Slope monitoring

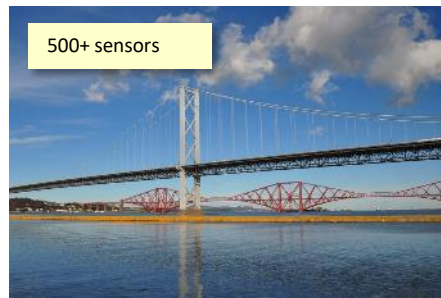


Pylon monitoring

World-wide Use Cases



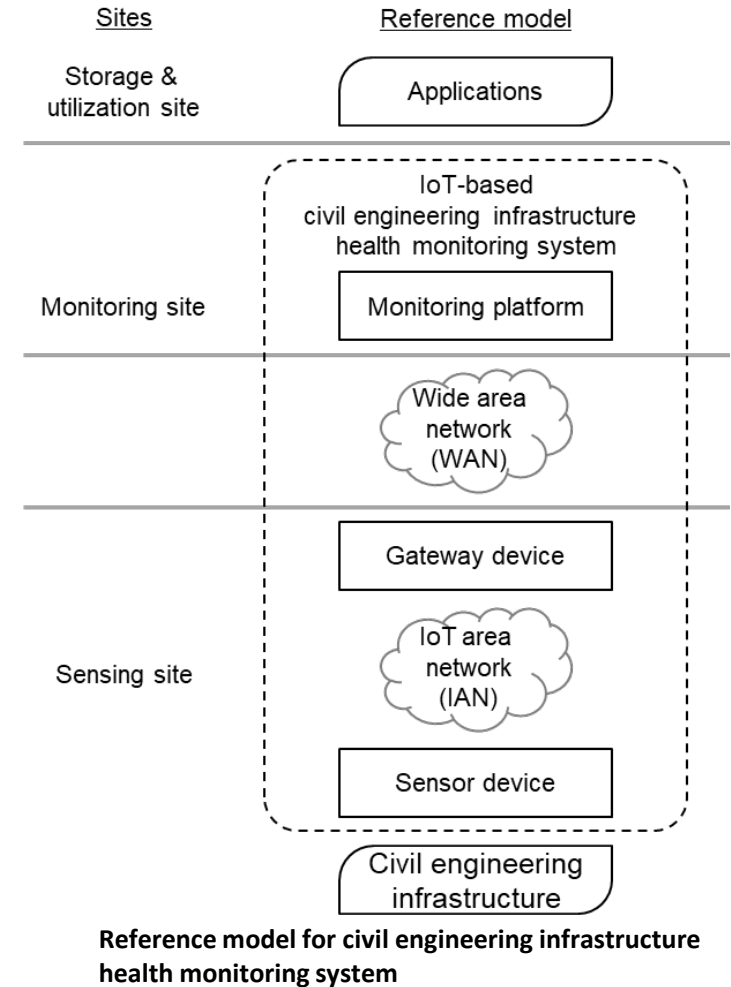
Saint Anthony Falls Bridge (Minnesota, U.S.)



Forth Road Bridge (Scotland, U.K.)

Civil Engineering Infrastructure Health Monitoring System

- Civil engineering infrastructure health monitoring system provides:
 - To find change in state of civil engineering infrastructure.
 - To collect data via networks (and so on).
 - To store data for long term, and use data when needed.
- Civil engineering infrastructure health monitoring system has 2 specific characteristics:
 - **Association between sensing data and sensor location**
 - **Long term operation**



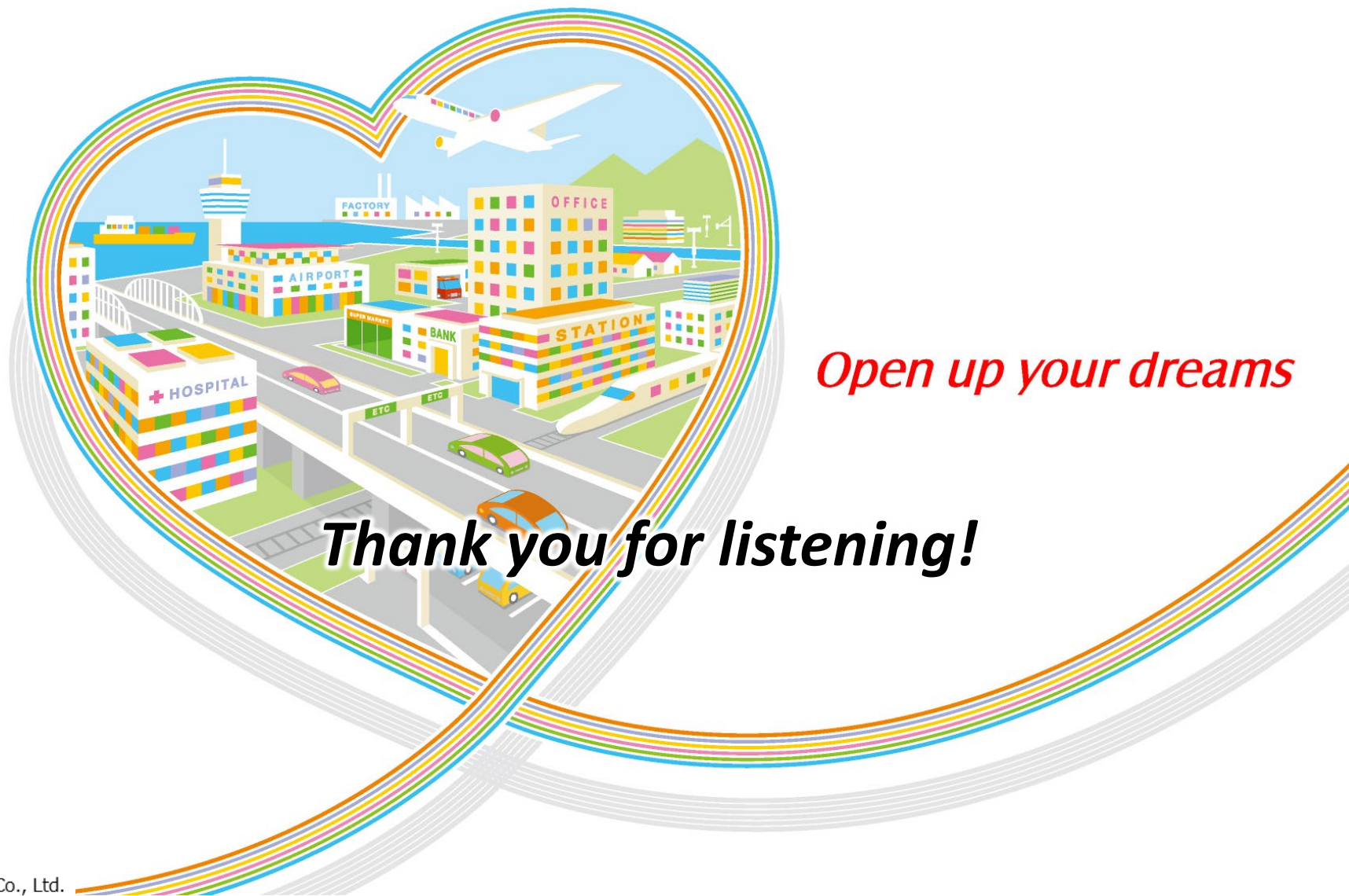
Issues on Civil Engineering Infrastructure Health Monitoring System

- In the fields of construction and civil engineering, study on [sensing methods and data analysis](#) is progressing, but [data storage for long-term, inter-system cooperation, and data sharing](#) are not given much importance.
 - As a result, [independent monitoring systems](#) for each vendor and system are in turmoil.
 - [Difficulty to compare different infrastructures](#) with the same index because the data measured for each infrastructure is different.
- **Cooperation with the construction and civil engineering field and the tele-communication field** is more important to promote systemization:
 - Construction and civil engineering field: data utilization for maintenance, inspection and abnormality detection
 - Tele-communication field: platform, network technology, and data modeling.

Standardization activities

- We initiated standardization activities for civil engineering infrastructure health monitoring system in SG20.
 - 1 Supplement(including use cases of civil engineering infrastructure health monitoring) was issued.
 - 1 Recommendation has been determined.

Doc Type	Document Title	Date
Recommendation(draft)	<p>ITU-T Recommendation Y.4214(draft) Requirements of IoT-based civil engineering infrastructure health monitoring system</p> <p><i>This Recommendation provides a reference model and specific requirements to civil engineering infrastructure health monitoring system.</i></p>	Oct, 2021 Determined
Supplement	<p>ITU-T Y Suppl. 56 ITU-T Y-series – Supplement on use cases of smart cities and communities</p> <p><i>“8.9 Infrastructure monitoring” provides use cases of civil engineering infrastructure health monitoring based on demonstration experiments in Japan.</i></p>	Dec, 2019



Open up your dreams

Thank you for listening!