IoT Architecture and Design Patterns

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September 2017

Abstract

IoT Architecture and Design Patterns

This presentation will provide a short overview of IoT systems architecture. An introduction to the IoT World Forum reference model will be made focusing on the requirement for an IoT Edge computing (Fog) layer within the model, and common IoT system deployment patterns will be highlighted.

An overview of the Cisco IoT Kinetic system will be given as an example of a distributed edge computing architecture, and an Oil & Gas industry IoT use case will be presented that demonstrates a large-scale example of FoG computing.

Examples of other real-world problem areas from the resources sector will be featured where IoT systems can provide significant business value.

“Leveraging machine generated data for consumer/business productivity, enhanced experiences and monetisation.”

What is IoT? - Cisco Systems

It Always Starts with a Business Problem…

Preventative Maintenance

Real-time Quality Detection

OEE (Overall Equipment Efficiency)

Personnel Safety

Remote Monitoring

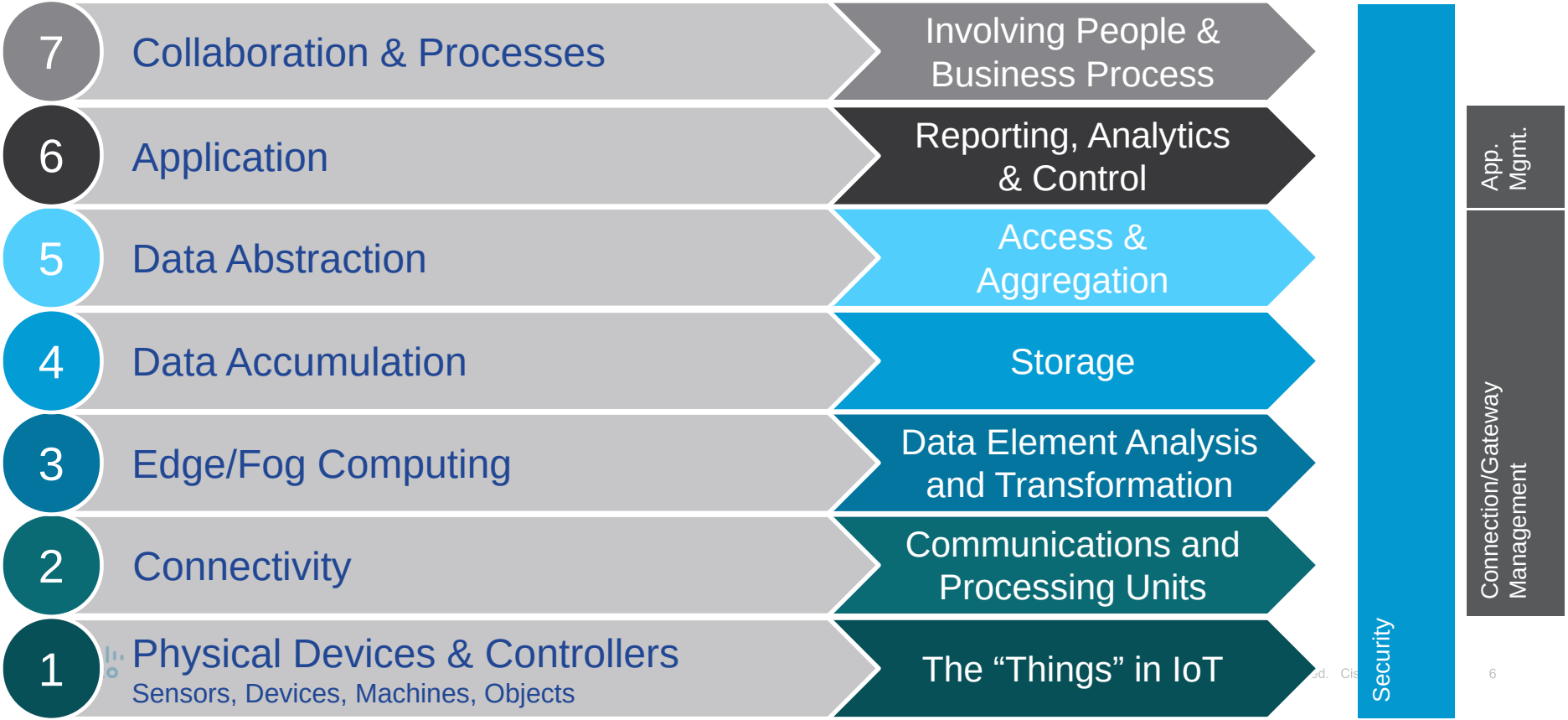
Condition-Based Maintenance

Asset Tracking & Management

Real-time Quality Detection

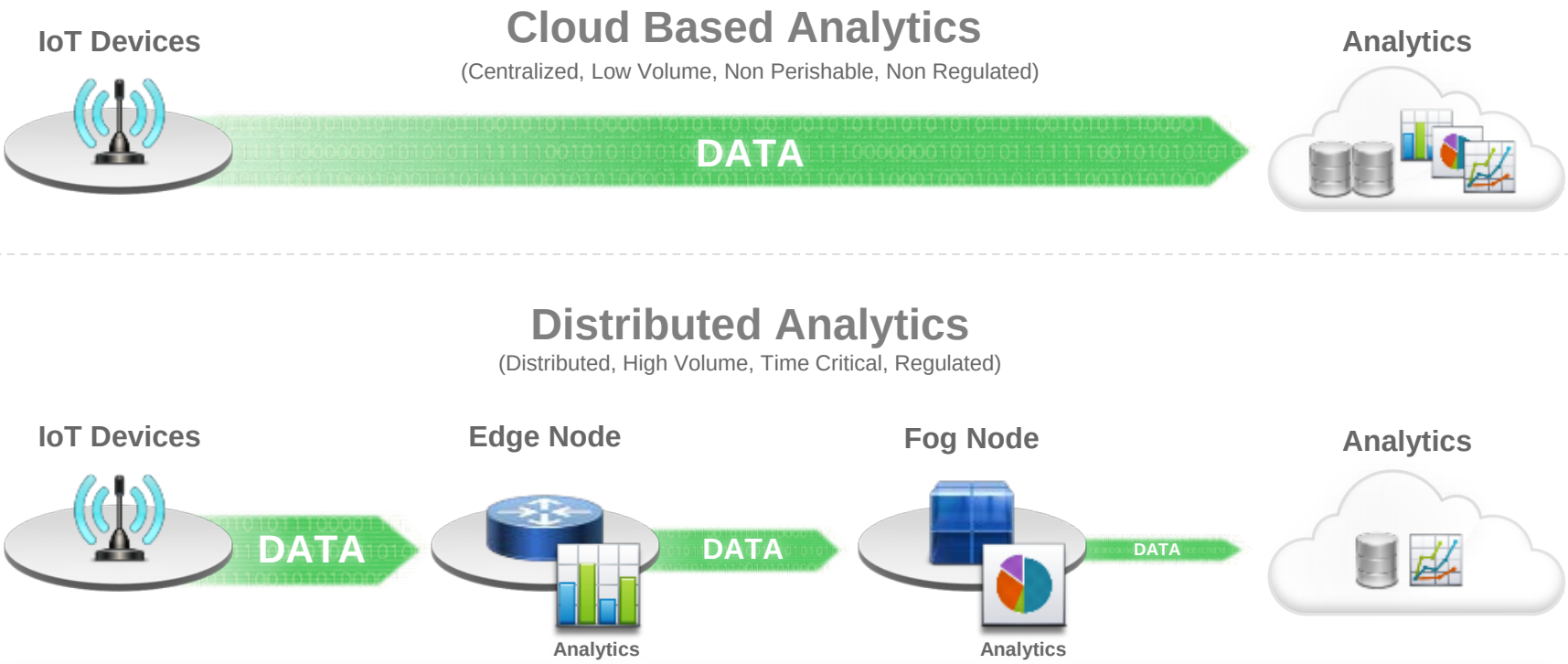
The Essence of an IoT Project

IoT World Forum Reference Model



Edge and Fog Computing - Why is this Unique?

Bring Analytics to the Data

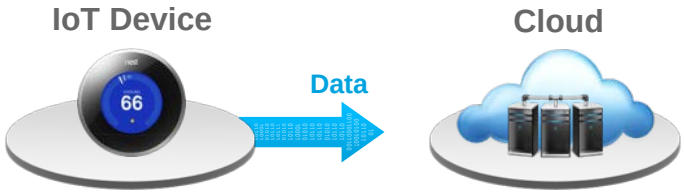


Why Compute at the Edge?

There may not be enough network bandwidth	**Data Reduction**
Most of the data is not interesting	**Filtering**
The use of data may be at the edge	**Latency Optimization**
Computation can be optimized for some purposes	**Partitioning**
Data normalization	**Application Simplification**
Data redirection based on the content of the data	**Dynamic Changes**
Data time stamping for later forensic analytics	**Analytic Support**

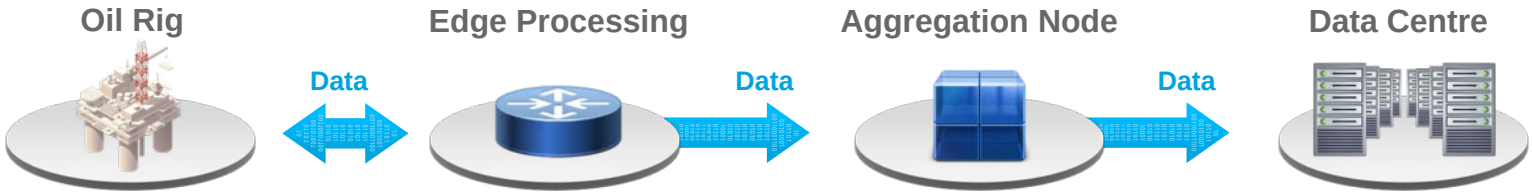
General IoT Patterns

2 Tier



3 Tier

4 Tier



Open Source IoT Platforms for Data “Switching”

http://iot-dsa.org/

nodeAPI

nodeAPI, also known as IOT Blueprint, is the common open communication method for all DSA modules.

DSLink

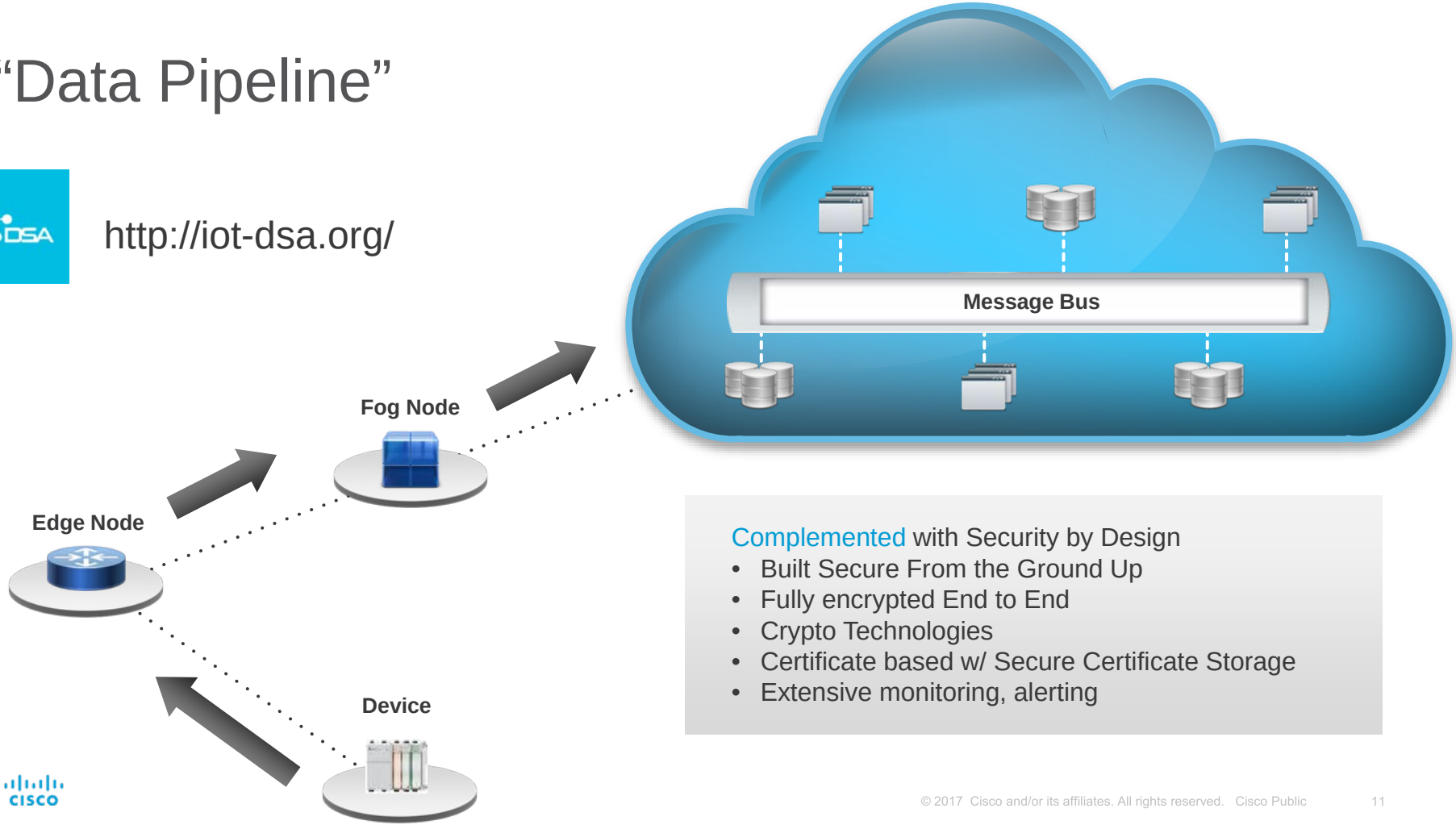
DSLink enables data exchange with other connected nodes by abstracting field-bus and unknown protocols.

DSBroker

DSBroker broadcasts the presence and data-structures of connected DSLinks to other subscribing DSLinks and DSBrokers.

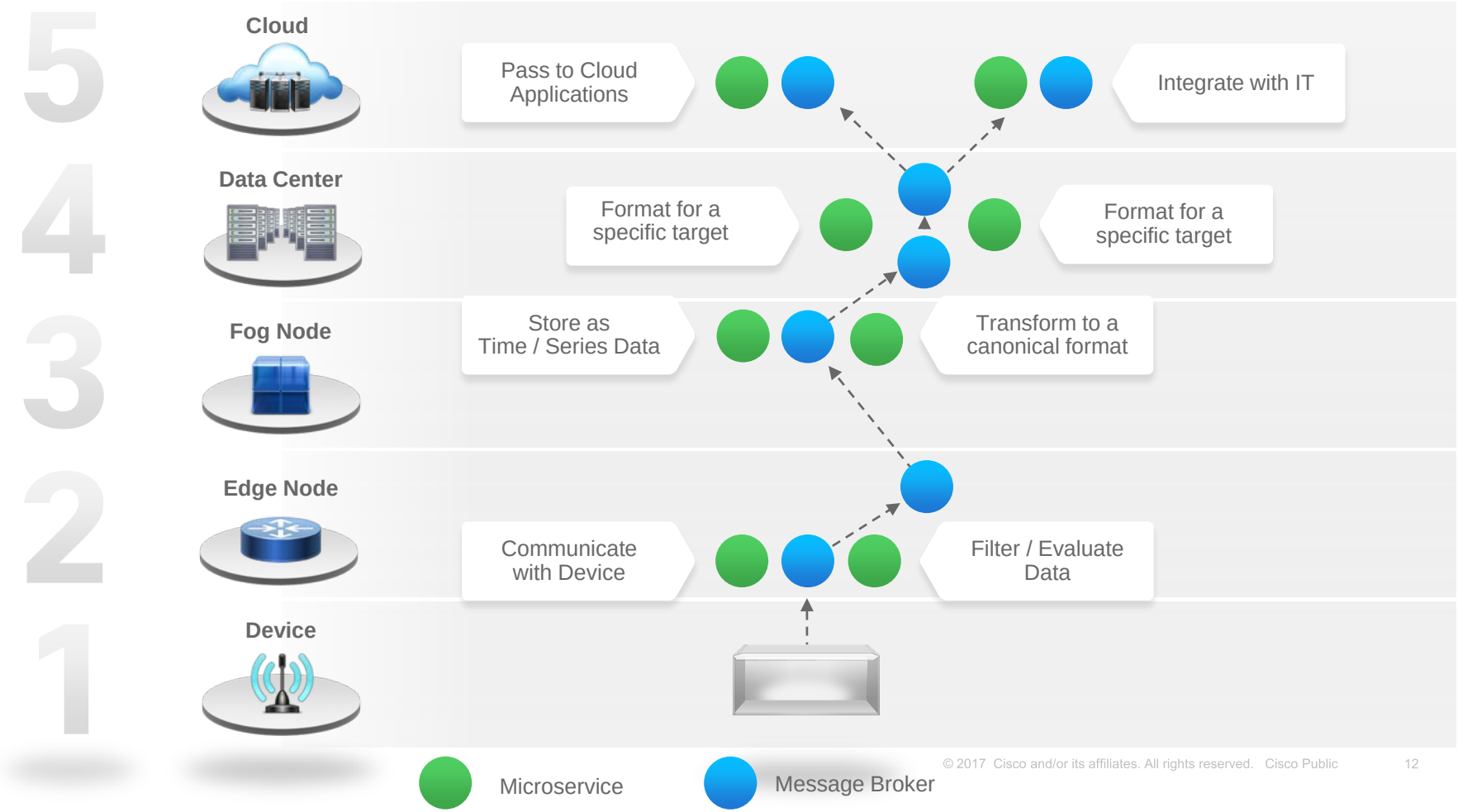
“Data Pipeline”

http://iot-dsa.org/

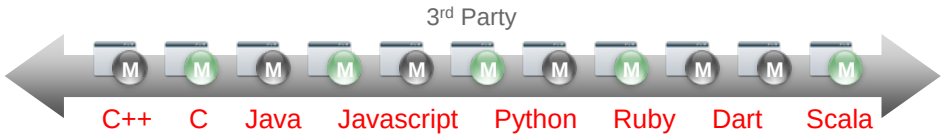


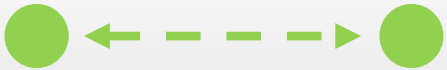
Complemented with Security by Design

- Built Secure From the Ground Up
- Fully encrypted End to End
- Crypto Technologies
- Certificate based w/ Secure Certificate Storage
- Extensive monitoring, alerting



An Open System

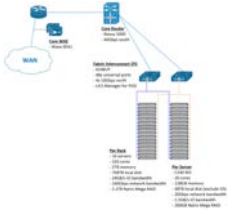


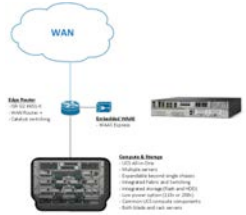


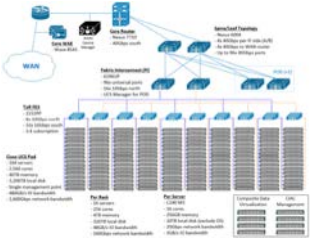
Networking
+
Gateway & Connection Management
+
Microservices
+
IoT Cloud Services
+
IoT Vertical Applications

Case Study: 7,000 Oil Wells x 1GB Data/Day/Well = 7TB Data/Day

(Over a 3G Network Bandwidth)







Edge Processing

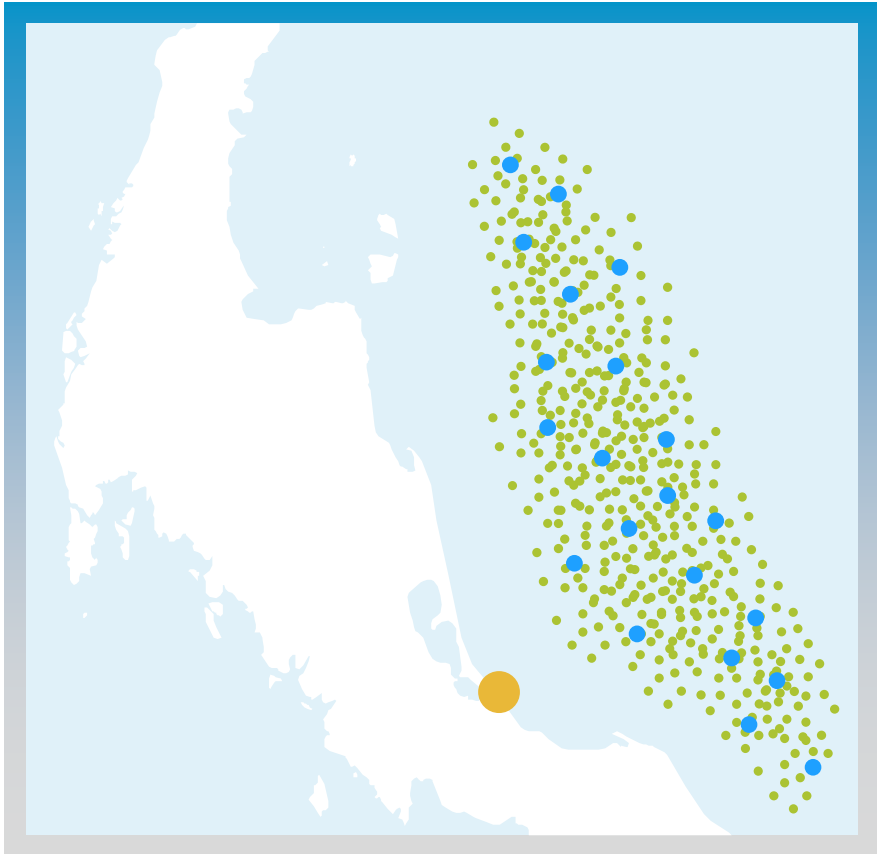
7,000 Oil Wells

Fog Processing

300 Platforms

Data Centre

IT Central



Example IoT Use Cases in the Resources Sector

Condition Monitoring – Fixed Plant

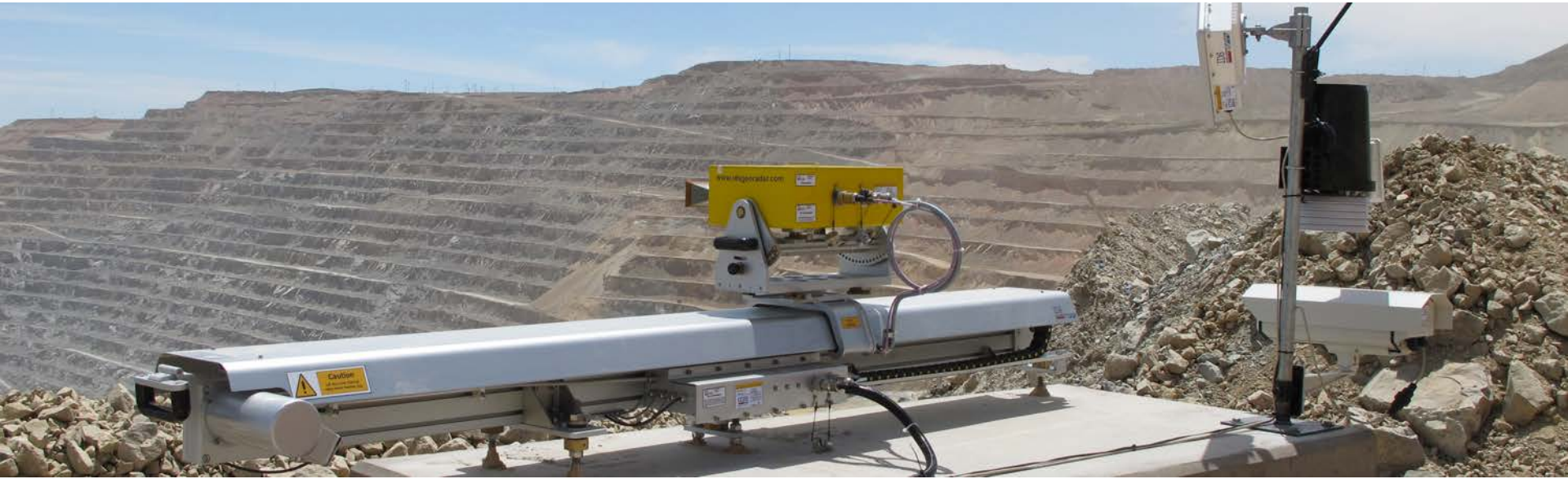
Condition Monitoring – Mobile Asset

- Remote Monitoring of Axle/Bearings
- Temperature, Vibration, Acoustics
- Trackside and on-Axle

- 312 ore cars per train – 1,256 axles, 2,512 bearings (including locomotives)
- 37,440 tonnes of ore

Source – RailPictures.Net

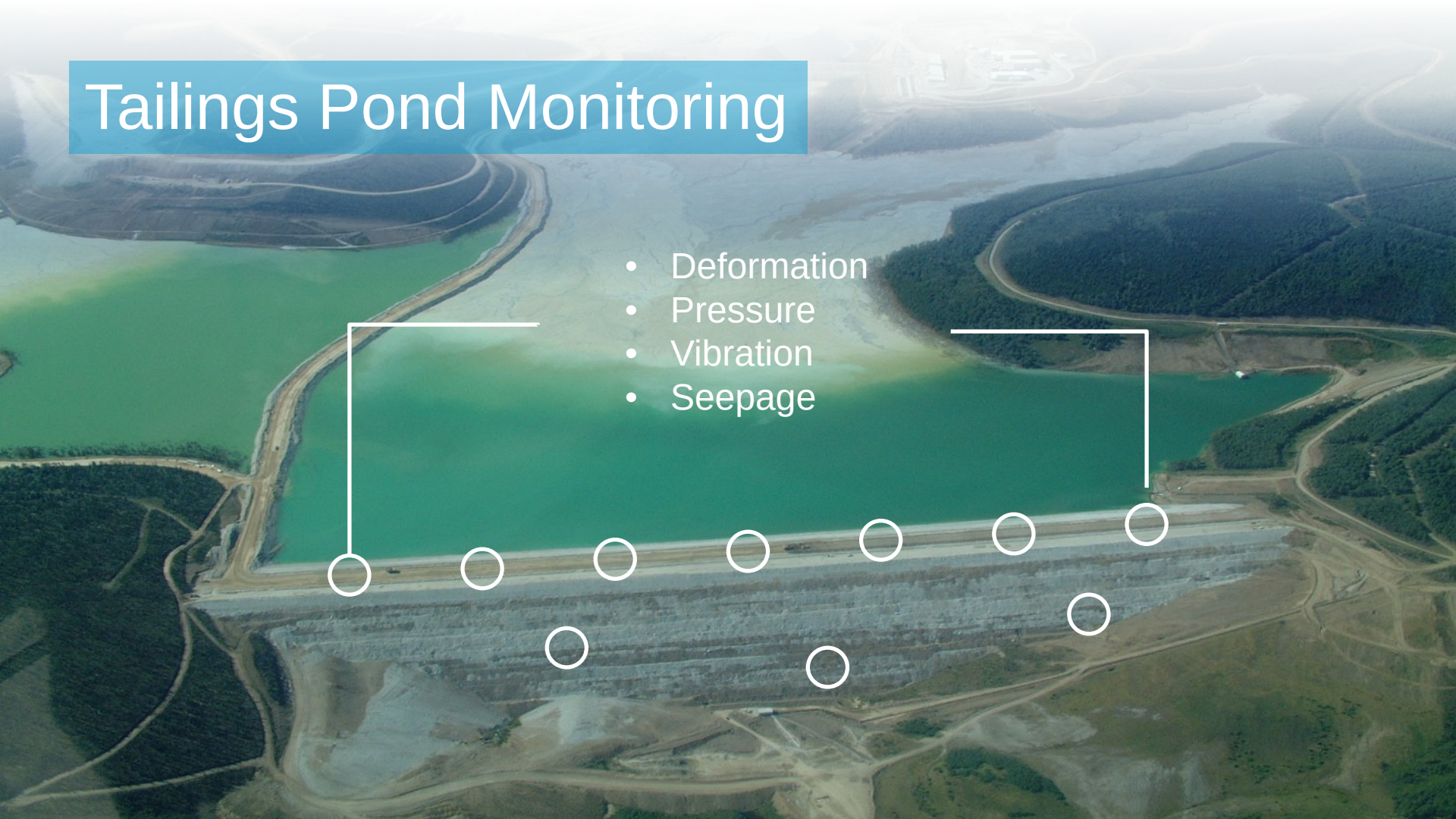
Active Slope Monitoring



- LIDAR – Active Slope Monitoring

Tailings Pond Monitoring

- Deformation
- Pressure
- Vibration
- Seepage



Environmental

Dust Suppression

- Weather
- Dust
- Sprinklers

People and Equipment Tracking

- Safety
- PPE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