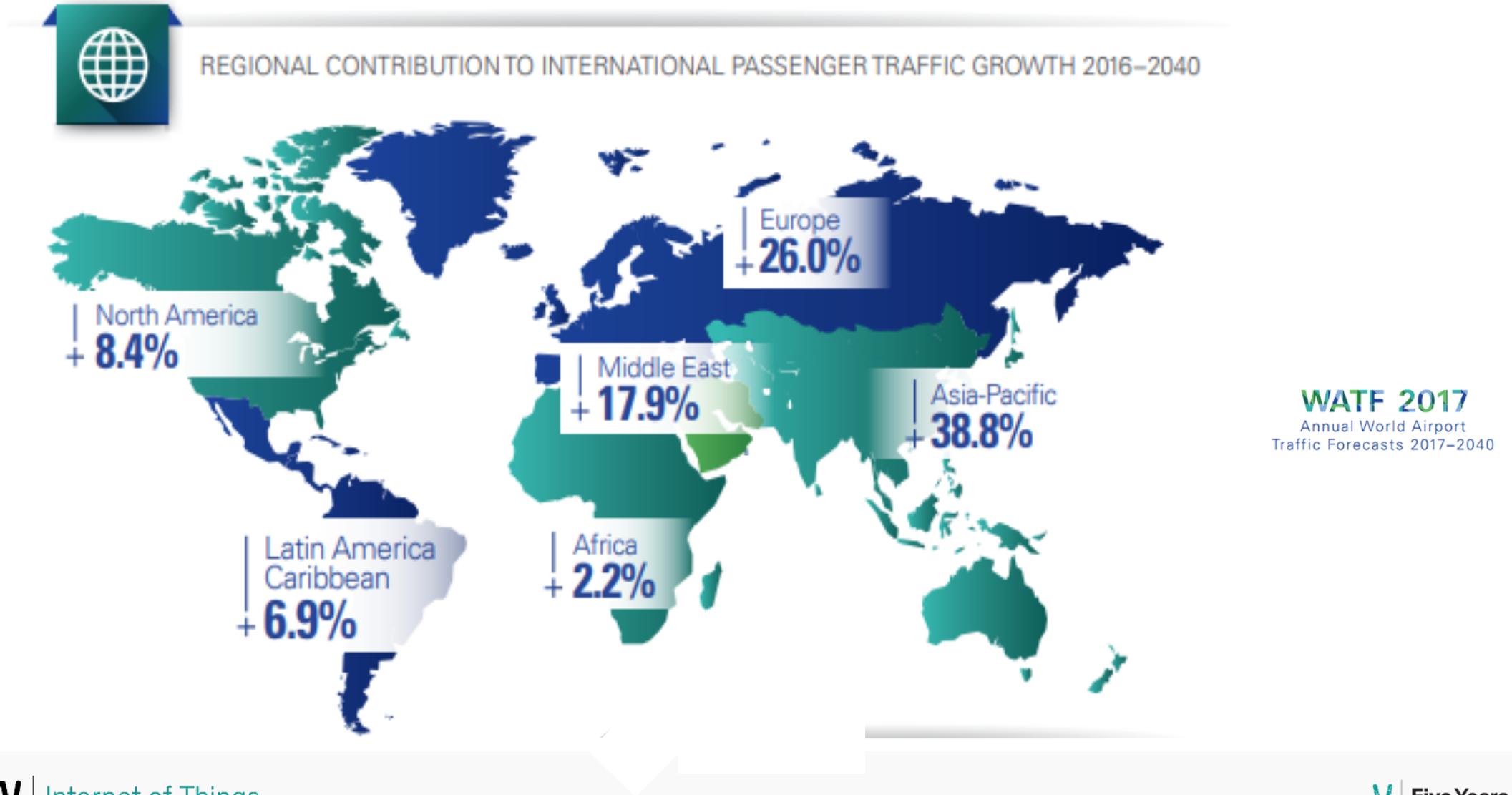




Arrow Electronics & Smart Airports

Enabled by IBM Watson IoT Platform and IBM Maximo®

Rapid growth in passengers create stress points for airport operations, infrastructure and passenger comfort



European Airports: Growth & Pressure

By 2030 we expect 58,000 daily movements in the sky, as opposed to the 33,000 we have on average per day today

- > According to a 2018 study by EUROCONTROL, the continent's airports will be unable to process as many as 160 million new passengers by 2040.
- > A key problem facing the industry is a lack of capacity to manage passenger growth using existing facilities and staff levels.
- > Solving airport capacity problems will require greater operational efficiency

Source: <https://www.airport-technology.com/features/airports-in-europe/>

136.5 million new passengers in 2018



The total number of passengers using Europe's airports reaching a new record of 2.34 billion in 2018.

Airport Management Challenges

Global airport traffic growth of **6% per year** is negatively impacting airport operations, infrastructure and passenger comfort

- > Difficult customer journeys through the airport
- > Delayed or lost baggage
- > Flight delays and gate changes
- > Compromised passenger experience and safety
- > Assets breaking down without warning causing high-cost repairs
- > Reduced airport non-aeronautical revenue



Source: Airports Council International, 2018

Drivers for Smart Airports



Optimize Operational Efficiency



Optimize Capital Expenditures

Overall airport satisfaction is

4.21

Airport facilities have the lowest score of any category at

3.94



Excellent Customer Experience



Increase Airport Revenue

An increase of every 1% in customer experience translates to a 1.5% increase in non-aeronautical revenue.

Source: Airports Council International, 2018

Improving Performance of Key Assets Improves Airport KPIs

Remotely monitor key assets, predict equipment failure and initiate proactive maintenance workflows



- ✓ Optimize operational efficiency
- ✓ Optimize capital expenditures
- ✓ Excellent customer experience
- ✓ Increase revenues

Reduce wait times; **minimize** lost/mishandled baggage

Decrease flight delays, lost revenue, passenger inconvenience and operational costs

Increase safety and reduce inconveniences in traversing airports, increase commercial dwell time; **maximize** asset utilization; minimize operating costs

Baggage Handling



Potable Water Cabinet



Moving Walkways

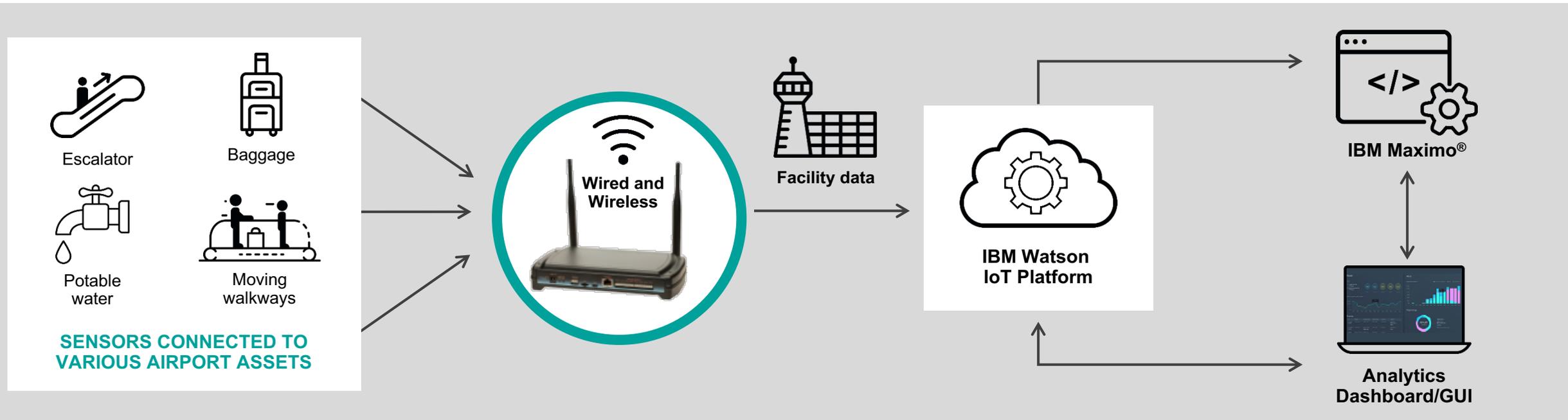


Escalators



Arrow Airport Asset Management Solution

Proven hardware, software and cloud services from industry leaders



Supported by a flexible and secure Watson IoT platform.

OUR IoT PLATFORM HELPS YOU:

Connect and manage

all your devices, networks, and gateways.

Integrate information

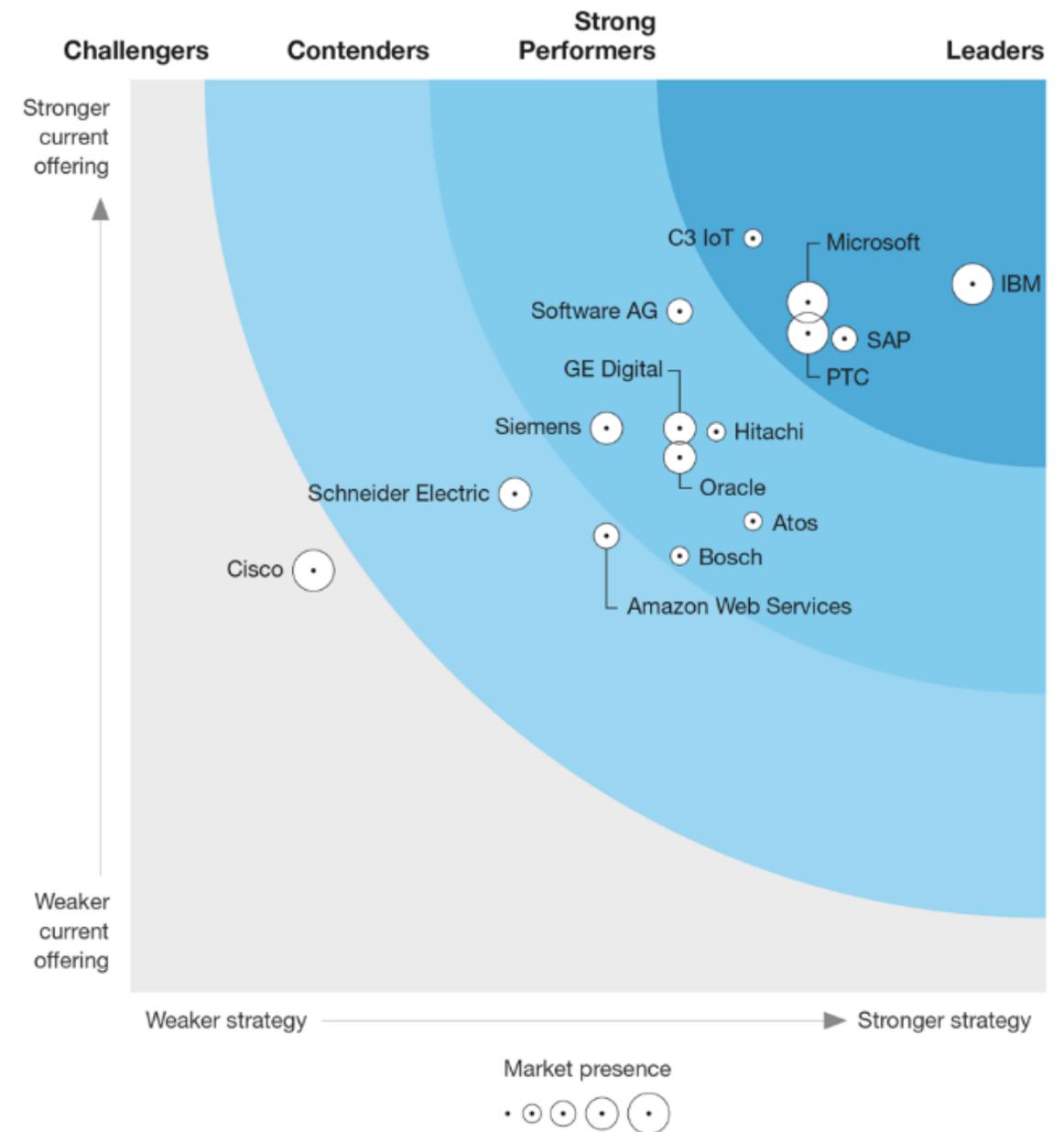
from devices, people, and other sources.

Gain insights

from real-time, AI-driven analytics in the cloud.

Manage risk

with visibility and blockchain-backed IoT data.



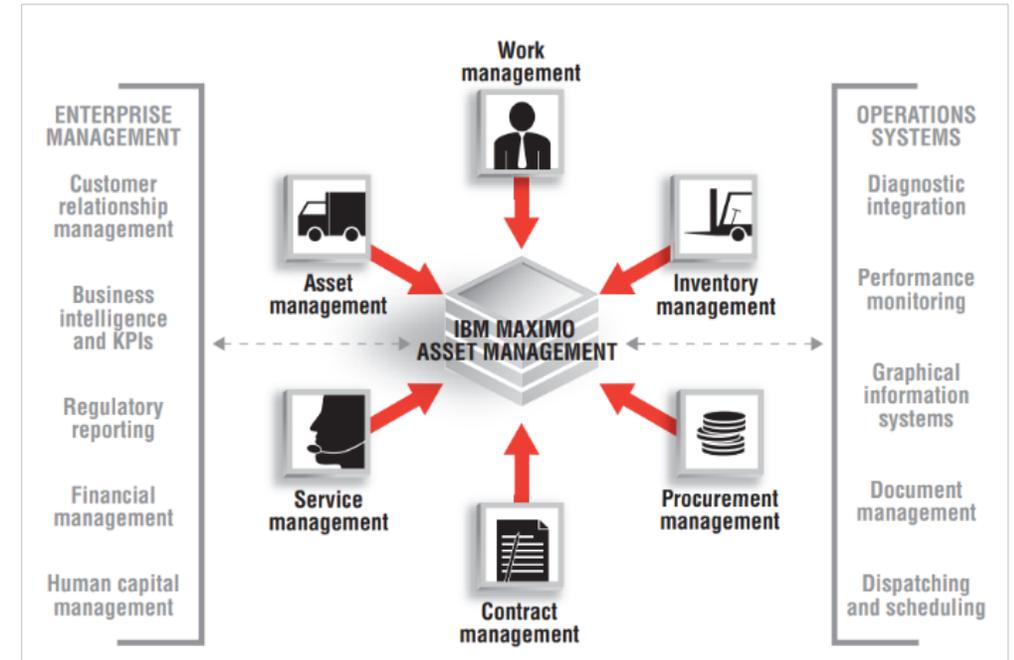
Source: Forrester Research Inc. "The Forrester Wave™: Industrial IoT Software Platforms, Q3 2018," by Michele Pelino and Paul Miller with Christopher Voce, Clare Garberg, Renee Taylor, Diane Lynch, August 9, 2018

IBM Maximo – Leader in Asset Management

Maximize asset reliability across the airport enterprise

Key Features:

- > **Manages critical assets** from a single system, providing better visibility and control of operations enterprise-wide
- > **Better tracks and manages efforts to respond** to industry regulatory requirements, including monitoring airport security assets to better comply with government mandates
- > **Consolidates all asset-related information** in a centralized repository, for more accurate reporting and more effective asset planning
- > **Develops more efficient** work management preventive solutions for preventive and predictive maintenance
- > **Helps reduce the costs** of acquiring and maintaining the assets that are critical to airport success



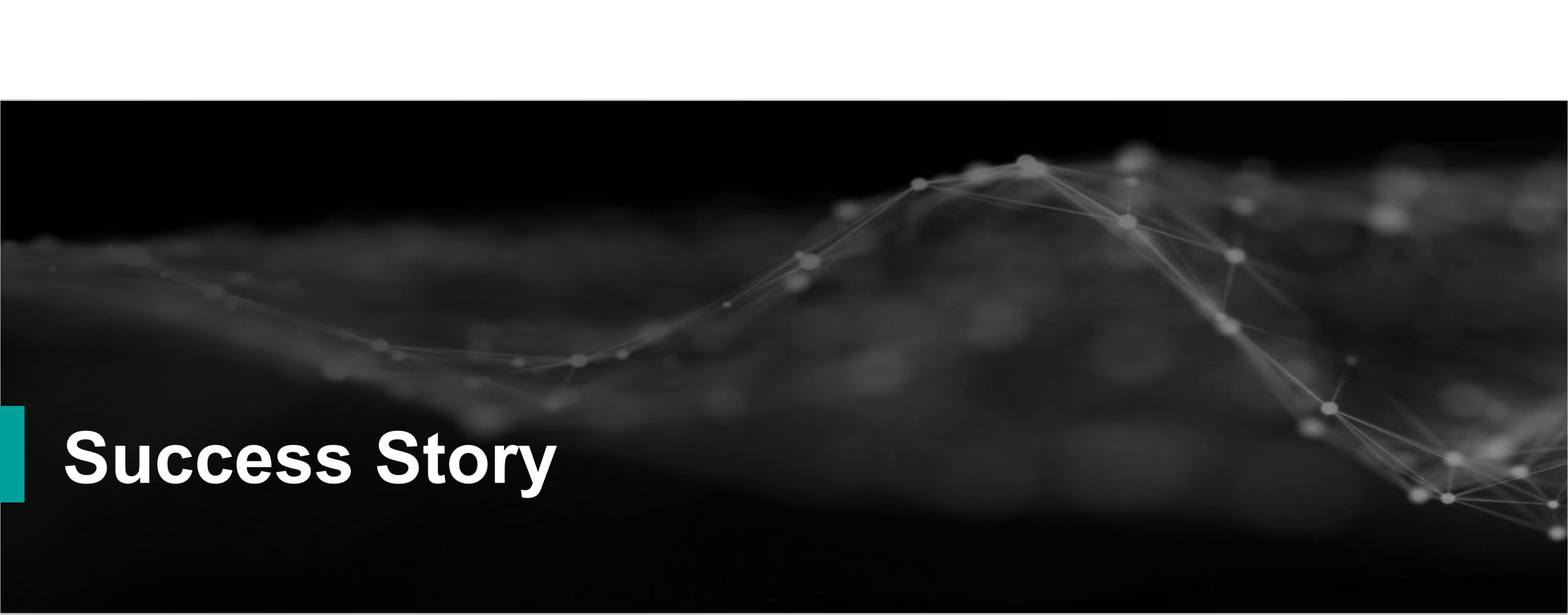
IBM Maximo Asset Management provides a single, unified platform that supports a wide range of asset and service management functions in the airport

Benefits of Arrow's End-to-End Solution

Improve passenger experience, streamline operations, and increase revenue



- > **Proven:** Successful deployments of powerful solutions
 - > Leverages decades of Arrow hardware expertise
 - > Watson IoT, at the center of the solution, is the top rated IoT platform
 - > Maximo is deployed at hundreds of airports around the world
- > **Scalable and future-proof:** Single solution
 - > Works across all airport terminals and facilities
 - > Expandable to very large scale and extendable to additional assets types
- > **Short integration time:** Uses validated, pre-integrated solutions
 - > Arrow's OT and IT ecosystem means best in class suppliers
 - > Integration and deployment services are from verified partner network
- > **Single point of contact:** End to end solution design and procurement, deployment, support, and lifecycle management



Success Story

IoT Deployment: North America

Challenges:

- > Infrastructure reliability and performance
- > Passenger throughput
- > Improving customer experience

Solution Description:

- > The solution provides a complete IoT sensing environment in critical airport assets to predict failures before they occur
- > Sensor data is fed into the IBM Watson IoT Platform, which serves as device gateway and protocol connectivity hub for bidirectional communication between sensors and IBM Maximo
- > IBM Maximo uses that information to generate predictive alerts, notifications, and results for asset-specific dashboards

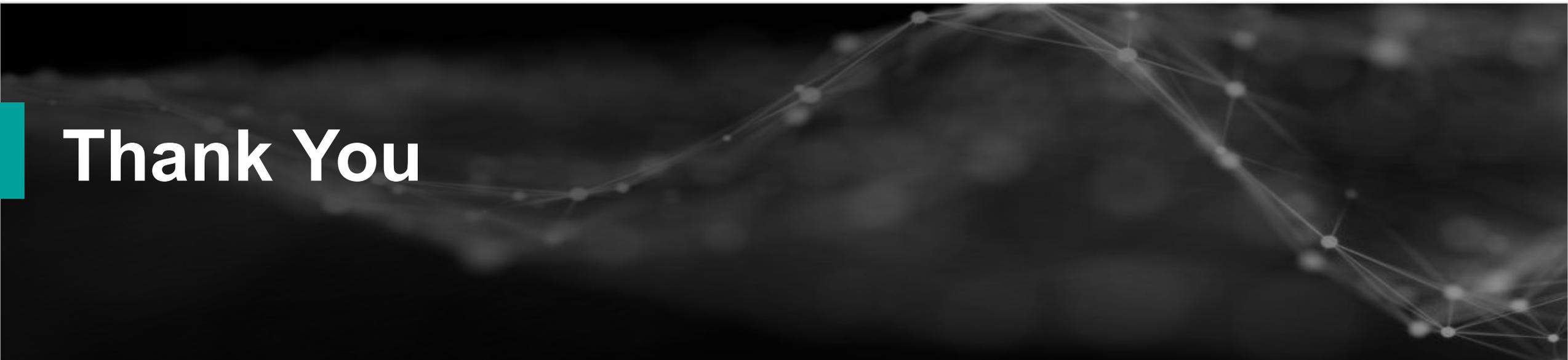
End User:

- > Large North American airport with over 100 gates

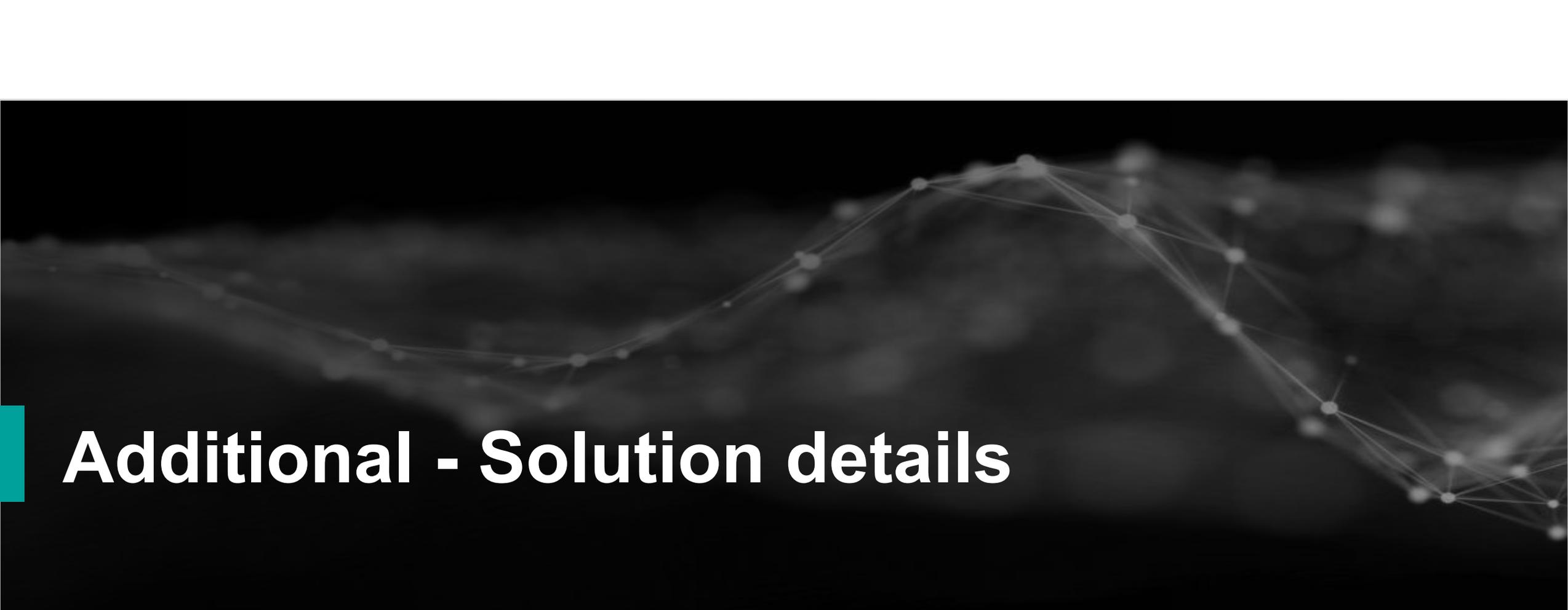


Upside:

The solution delivered major efficiency gains and uptime through real-time monitoring of assets and predictive analytics



Thank You



Additional - Solution details

Use Case: Monitor Baggage Handling Systems

Sensors Monitor

- > Motor vibration/ noise
- > Actuator vibration/noise
- > Conveyor belt noise
- > Chains and bearings vibration/noise

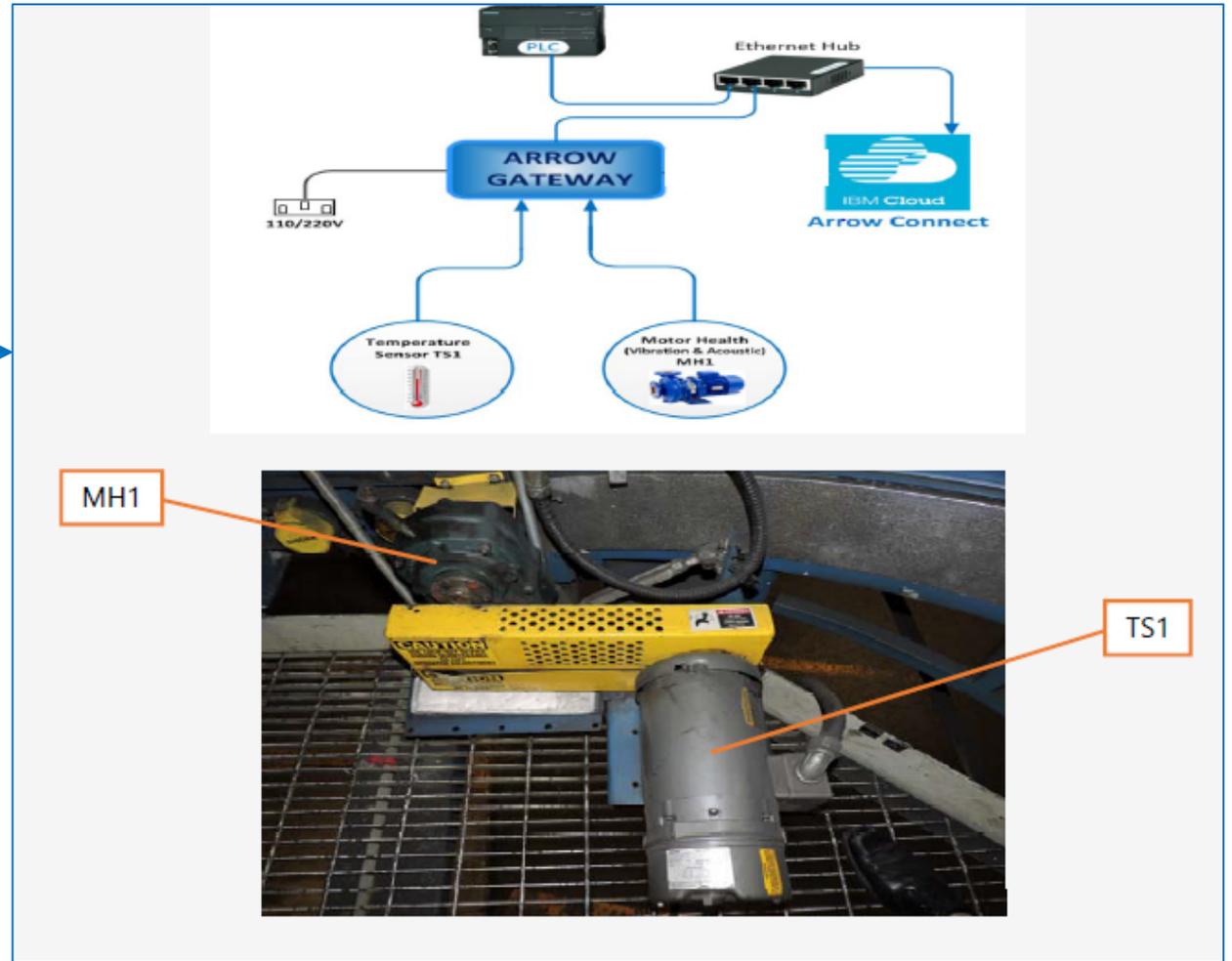


- Predict failure by monitoring vibration, noise, hydraulic fluid leaks and temperature via **motor temperature/ambient temperature sensors, 3 axis accelerometer, and fluid sensors**
- Sensor data is fed into a predictive algorithm and alerts are triggered based on sensor data

Asset Monitoring: Baggage Handling

Sensors Monitor

- > Vibration/Noise (MH1)
- > Temperature (TS1,TS2,TS3)



Use Case: Monitor Escalators/Moving Walkways

Sensors Monitor

- > Motor vibration/noise
- > Gearbox vibration/noise
- > Temperature changes in rotating parts
- > Hydraulic fluid leaks in gearboxes
- > Escalator chain vibration/noise

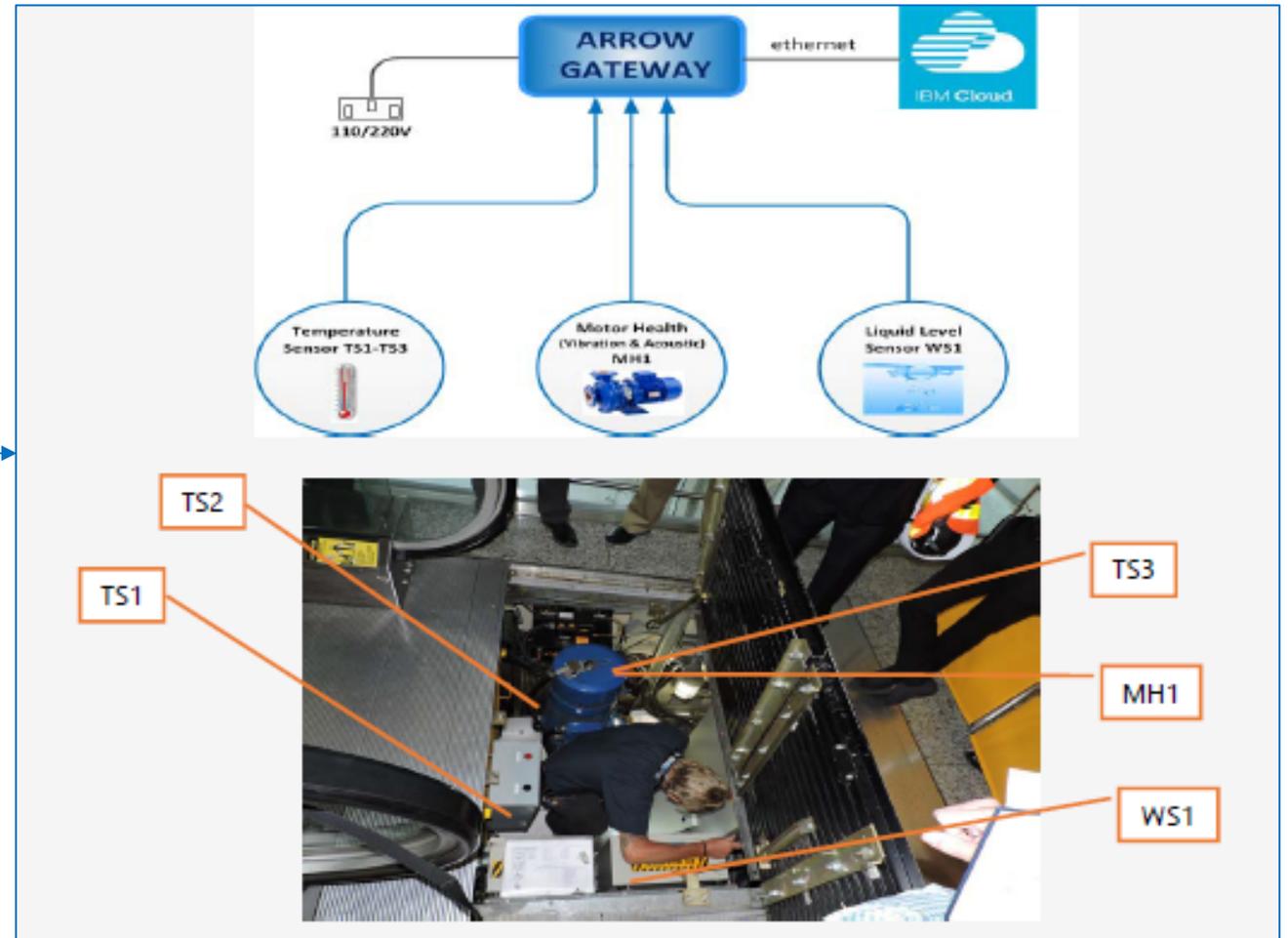
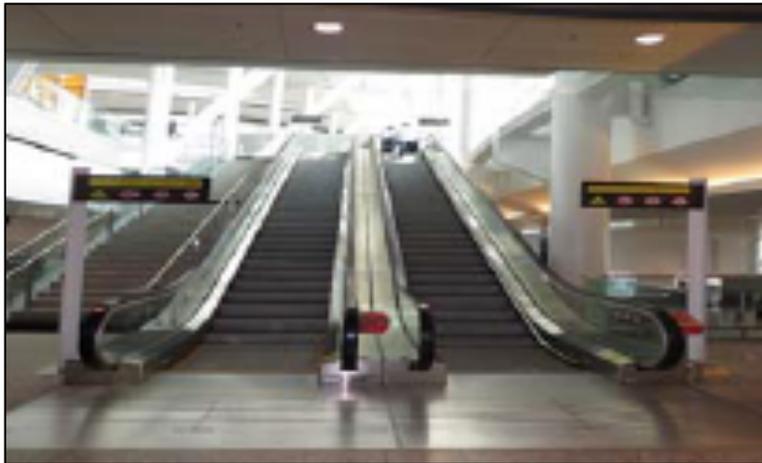


- Predict failures by monitoring vibration, noise, hydraulic fluid leaks and temperature via **motor temperature/ambient temperature sensors, 3 axis accelerometer, and fluid sensors**
- Sensor data is fed into a predictive algorithm and alerts are triggered based on sensor data

Asset Monitoring: Escalators/Moving Walkways

Sensors Monitor

- > Vibration/Noise (MH1)
- > Temperature (TS1,TS2,TS3)
- > Fluid leakage (WS1)



Use Case: Monitor Potable Water Cabinet

Sensors Monitor

- > Water flow in pipes
- > Freezing conditions
- > Water cabinet temperature
- > Cabinet door status (open/close)
- > Drain leaks



- **Ambient temperature sensor, fluid sensors** are installed in the potable water cabinet.
- Out of limit sensor readings (like freezing water) trigger a message to the facilities management.

Asset Monitoring: Potable Water Cabinets

Sensors Monitor

- > Water flow (FS1)
- > Freezing conditions
- > Temperature (TS1,TS2,TS3,TS4)
- > Door status(open/close) (DS1,DS2)
- > Drain leak(WS1)

