Using AWS IoT for Industrial Applications
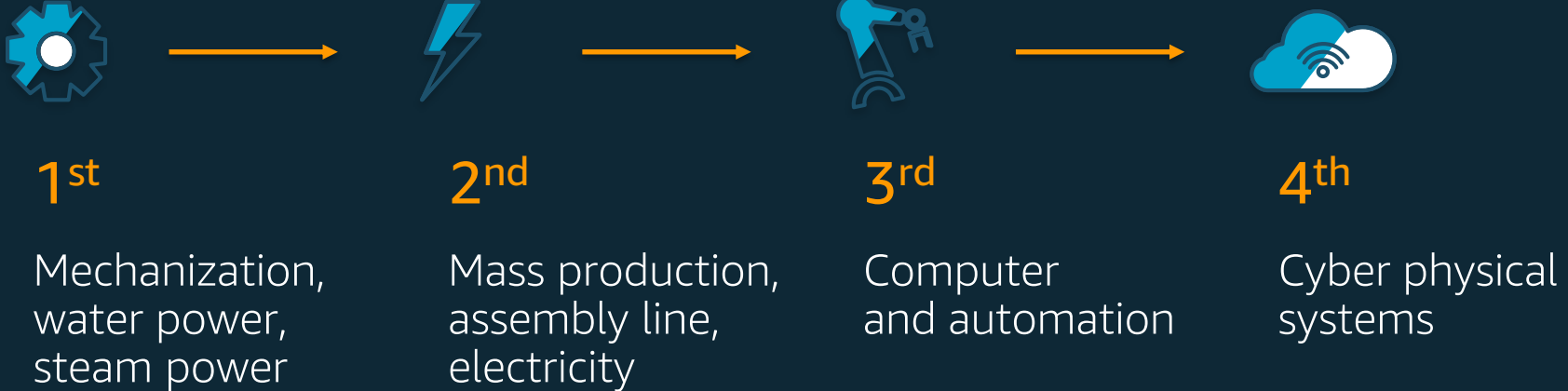
Neel Mitra, Enterprise Solutions Architect, AWS

May 18, 2018

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Agenda

- Industrial Revolution
- Challenges & Opportunities with IIOT
- Art of the Possible with AWS
- Use Cases
    - Predictive Maintenance
    - Predictive Quality
    - Asset Condition Monitoring
- Customer Story - Panasonic Aviation
- Q & A

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The Industrial Revolution

1st

Mechanization,
water power,
steam power

2nd

Mass production,
assembly line,
electricity

3rd

Computer
and automation

4th

Cyber physical
systems

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Industrial IoT Market

Focused on next-generation manufacturing that generates a convergence between industry, business, and internal functions and processes

Industrie 4.0 in Germany

Society 5.0 in Japan

Made in China 2025

Trends

Mass production
↓
Mass customization

Buy
↓
Lease

Pay upfront
↓
Pay as you go

Manual
↓
Automatic

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Industrie 4.0
What's changed?

- Increasing need to optimize and predict system performance

- Need for geographically scattered assets that function together as a system

- Scalable systems that support a growing volume of instrumentation and data accessibility

- Improve security of devices and systems

- Integrate multiple protocols and standards

- Solutions require a mix of legacy and newer equipment including intelligent sensors and actuators
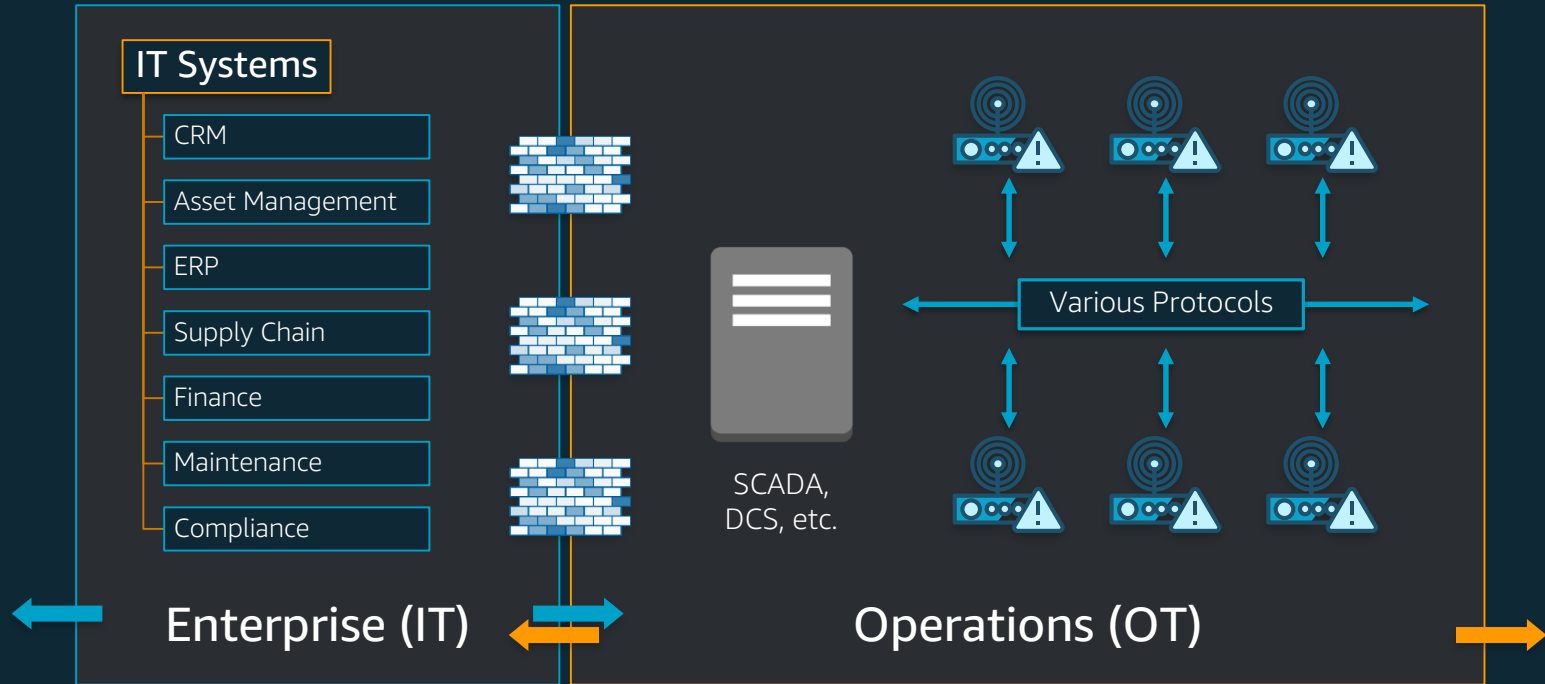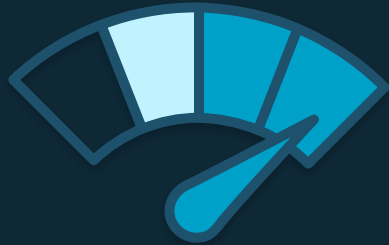
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Challenges

Security

Downtime

Legacy Equipment

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Challenge: Brownfield Environments

IT Systems
- CRM
- Asset Management
- ERP
- Supply Chain
- Finance
- Maintenance
- Compliance

SCADA, DCS, etc.

Various Protocols
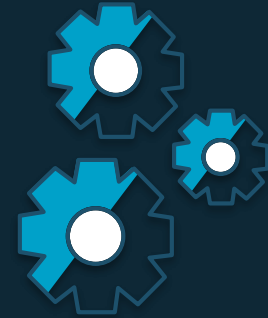
Enterprise (IT)

Operations (OT)

Opportunities
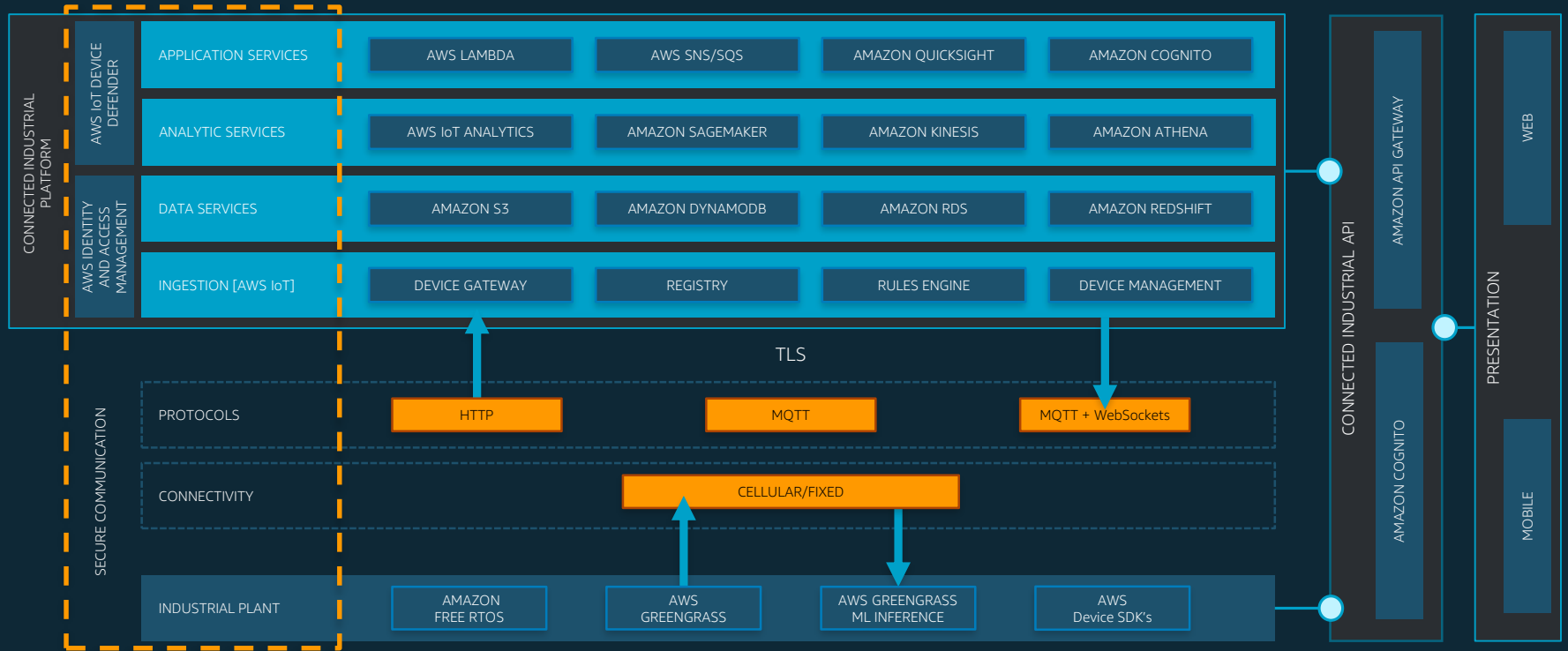## IoT Drives Manufacturing Innovation

Here-and-now
Real-time Remote
Monitoring

Predictions,
Machine Learning,
and Edge AI

Smart Factory
Closed Loop Automation
and Intelligence

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AWS Industrial IoT Technology Stack

CONNECTED INDUSTRIAL PLATFORM

AWS IoT DEVICE DEFENDER

AWS IDENTITY AND ACCESS MANAGEMENT

SECURE COMMUNICATION

APPLICATION SERVICES	AWS LAMBDA	AWS SNS/SQS	AMAZON QUICKSIGHT	AMAZON COGNITO
ANALYTIC SERVICES	AWS IoT ANALYTICS	AMAZON SAGEMAKER	AMAZON KINESIS	AMAZON ATHENA
DATA SERVICES	AMAZON S3	AMAZON DYNAMODB	AMAZON RDS	AMAZON REDSHIFT
INGESTION [AWS IoT]	DEVICE GATEWAY	REGISTRY	RULES ENGINE	DEVICE MANAGEMENT

TLS

PROTOCOLS	HTTP	MQTT	MQTT + WebSockets
CONNECTIVITY		CELLULAR/FIXED	
INDUSTRIAL PLANT	AMAZON FREE RTOS / AWS GREENGRASS / AWS GREENGRASS ML INFERENCE / AWS Device SDK's		

CONNECTED INDUSTRIAL API

AMAZON API GATEWAY

AMAZON COGNITO

PRESENTATION

WEB

MOBILE

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ISA 95 & ISA 99 Industrial Edge Architecture

L5 Cloud

L4 ERP/SAP

L3 MES

L2 AB CIP Protocol/Modbus/OPC/Other Industrial Protocols

L1 PLC

L0 Industrial Equipment

AWS IoT

Telemetry channel (MQTT)

File channel (HTTPS)

MQTT

Greengrass on Industrial Gateway

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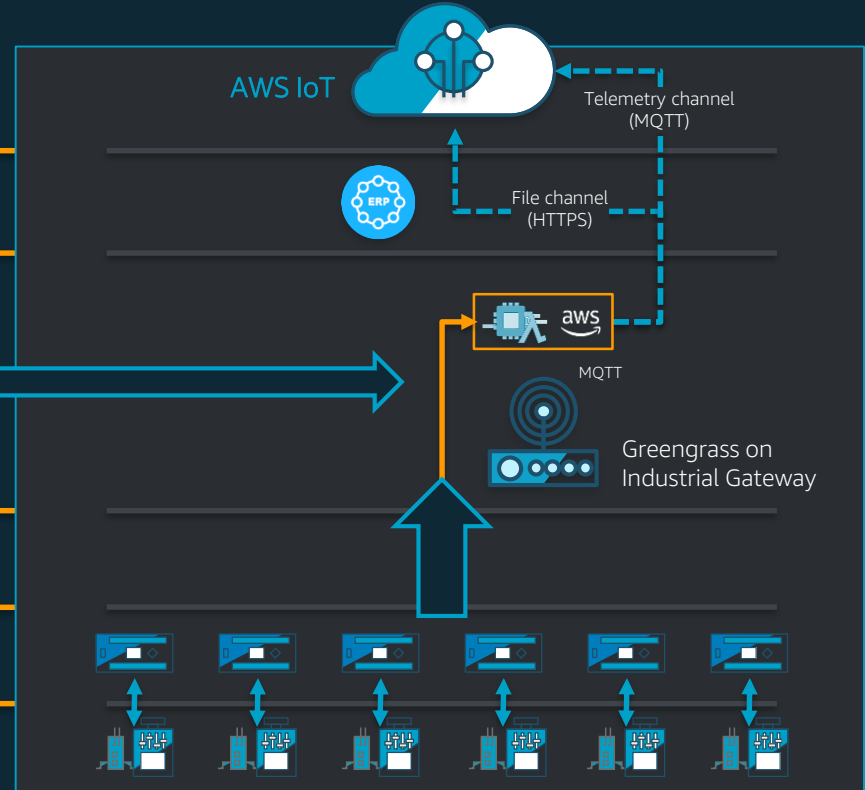
Popular Industrial IoT Use Cases

Predictive Maintenance

Predictive Quality

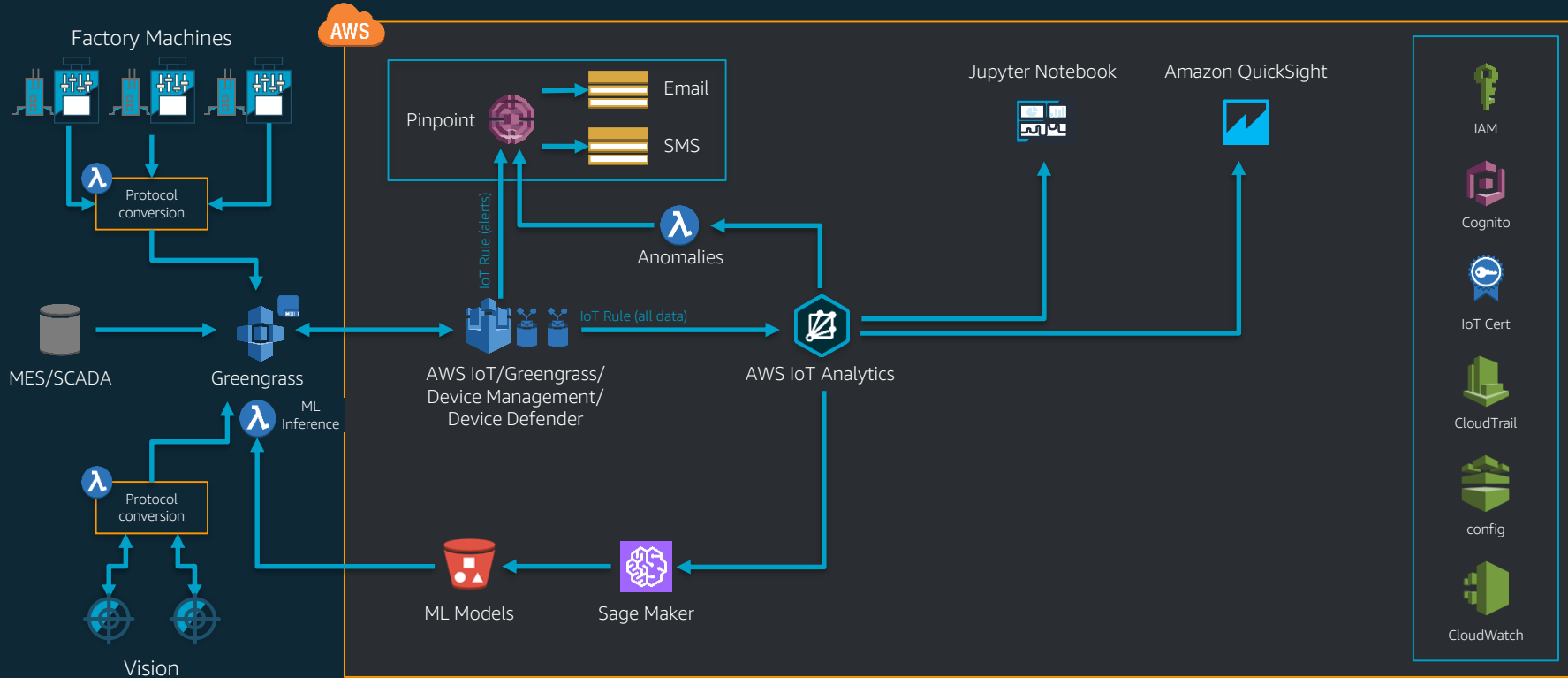**Asset Condition Monitoring**

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Use Case
Predictive Maintenance

Understand current health of equipment and predict machine failure before business operations is impacted

- Ingest sensor data from PLC's, MES and Vision Systems

- Improve performance in the factory by monitoring OEE

- Monitor condition of factory machines

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Predictive Maintenance Architecture

Predictive Maintenance Architecture
with AWS IoT Analytics

Factory Machines

AWS

Pinpoint → Email

→ SMS

IoT Rule (alerts)

Anomalies

Jupyter Notebook

Amazon QuickSight

MES/SCADA

Greengrass

IoT Rule (all data)

AWS IoT/Greengrass/
Device Management/
Device Defender

AWS IoT Analytics

Protocol
conversion

ML Inference

Protocol
conversion

ML Models

Sage Maker

Vision

IAM

Cognito

IoT Cert

CloudTrail

config

CloudWatch
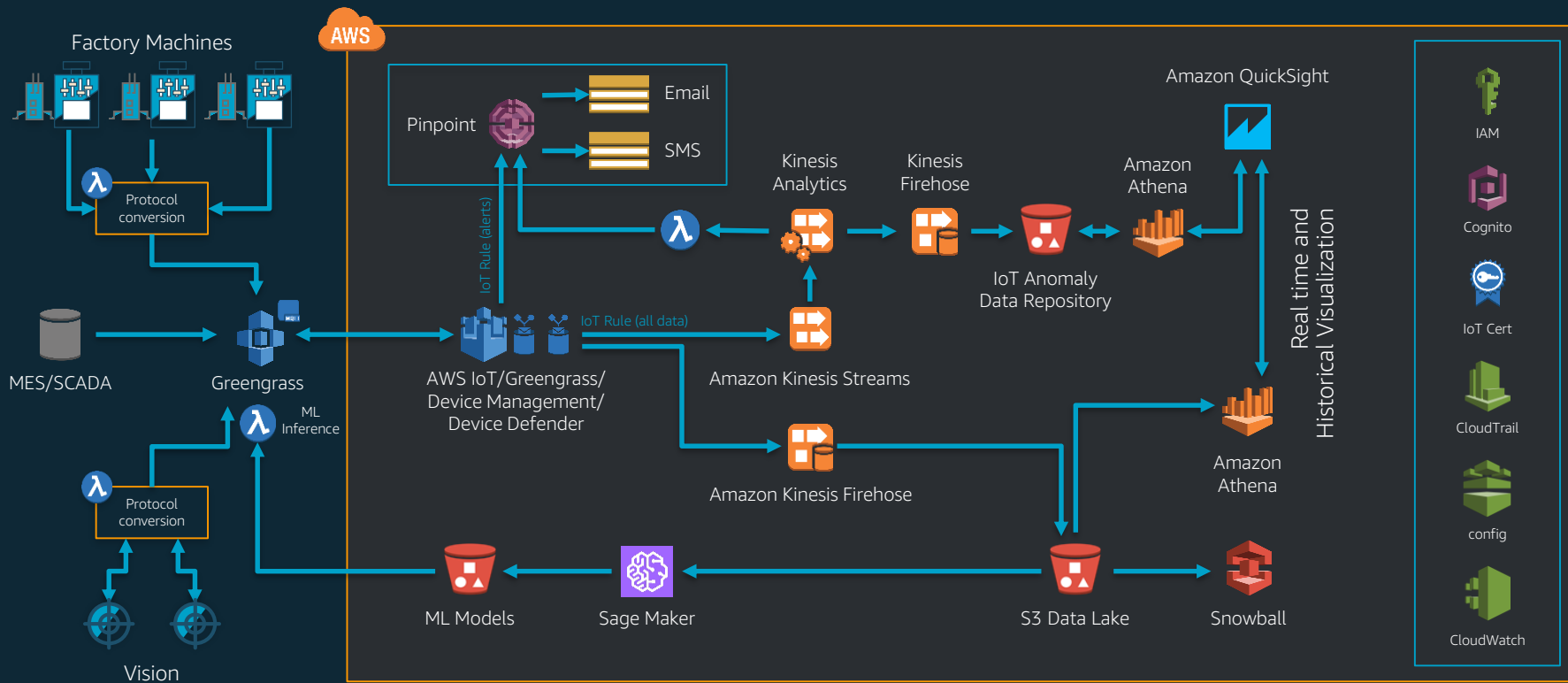
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Problem

An Oil and Gas company had the inability access their IoT data. Other business units within the enterprise owned and controlled the assets in the field and while many had IoT data, they were not in a position to have that data leave their on-premise environment.

Solution

By using AWS IoT, this customer is able to preprocess the IoT data coming from their field assets, enrich that data with various internal and external data sources, and provide a time-series optimized data store. This empowers their in-house data science team to build and train machine learning models on top of data sets derived from the data store.

Impact

The customer's goals were to validate their hypothesis that IoT data, with proper analysis, provides meaningful value to the enterprise. In the near future, the customer expects to take the anomaly detection models they authored and test them for deployment at the edge.

Use Case
Predictive Quality

Quickly pinpoint product quality issues related to factory output, rather than equipment performance

- Ingest industrial sensor data from PLC's, MES, and Vision Systems

- Improve product quality and uptime in the factory by monitoring OEE

- Monitor quality of finished products using Vision Systems

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Predictive Quality Architecture
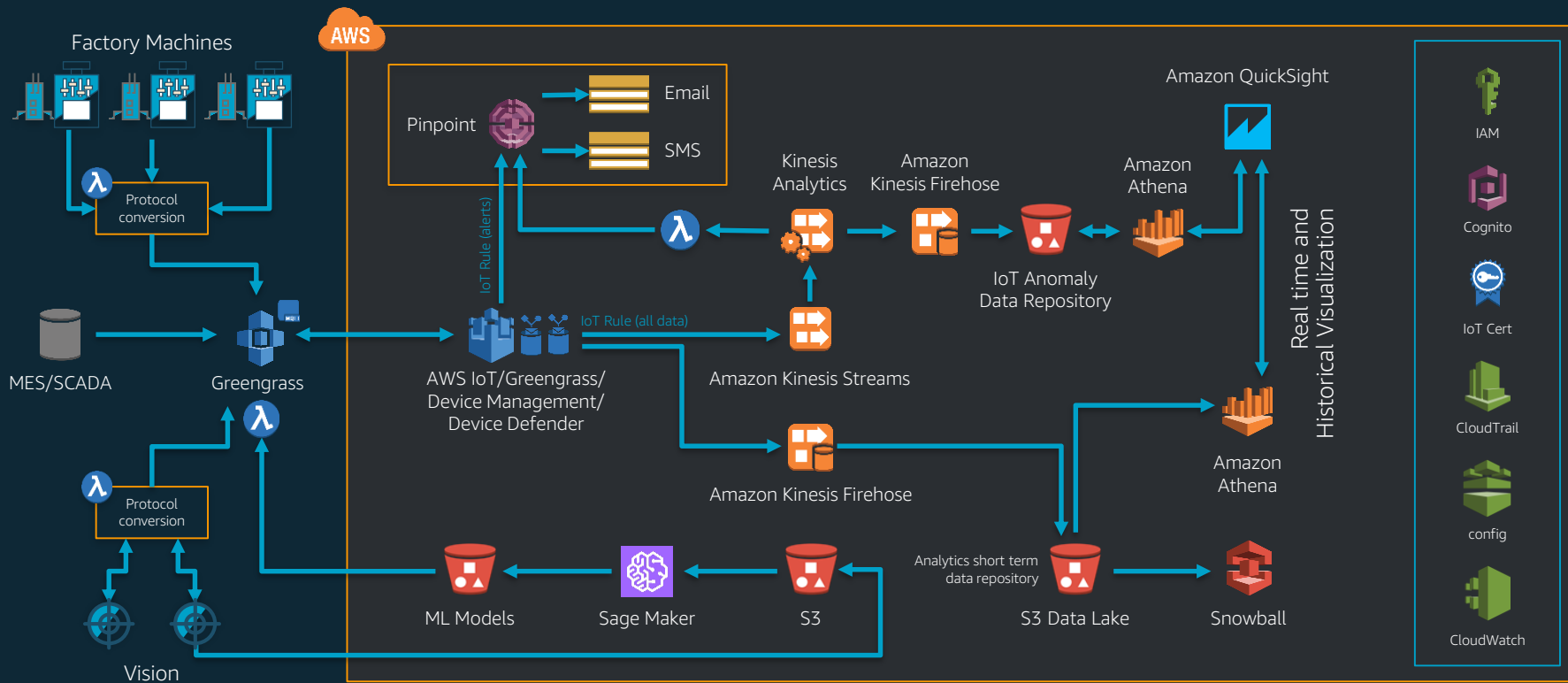
Predictive Quality Architecture
with AWS IoT Analytics
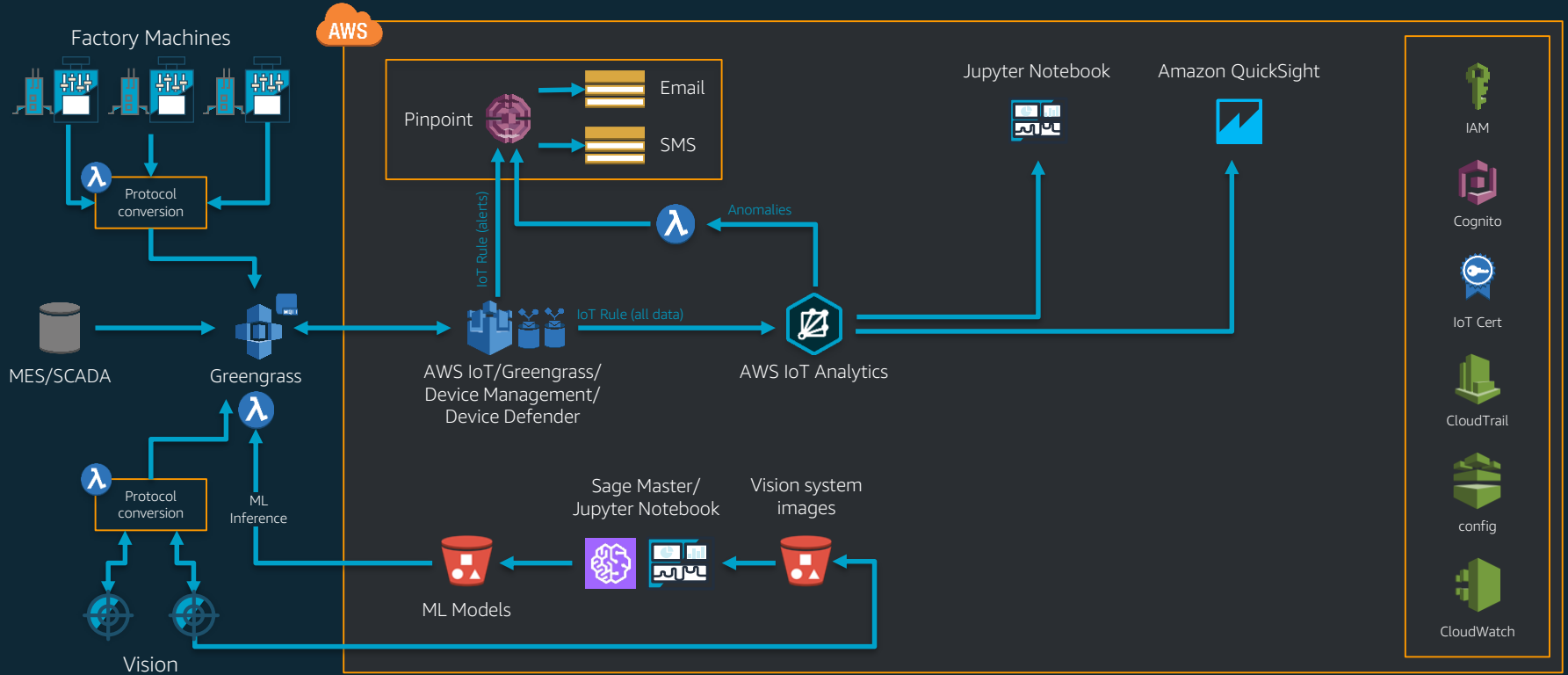
Problem

Valmet delivers technology and automation with multiple dependent processes running in parallel. Data analytics is needed to optimize Valmet's customers' processes.

Solution

Valmet is building a new digital twin capability to allow paper mill operators view equipment and process data during production runs. AWS IoT Analytics is at the core of this solution training ML models for paper quality forecasting and scheduling metrics generation for digital twin view-generation.

Impact

AWS IoT Analytics allows Valmet to combine historical models of equipment performance with live data from current operations to glean insights that help them to further provide solutions that enable their customers to produce paper with lower costs and optimum quality.

Valmet
F O R W A R D

Use Case
Asset Condition Monitoring

Monitor and scale industrial equipment and understand asset condition for one or more monitored parameters of assets

- Ingest sensor data from PLC's, MES, and Vision Systems

- Improve performance in the factory by monitoring OEE

- Monitor condition of factory equipment through sensor data—temperature, vibration, error codes, etc.

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Condition Monitoring Architecture
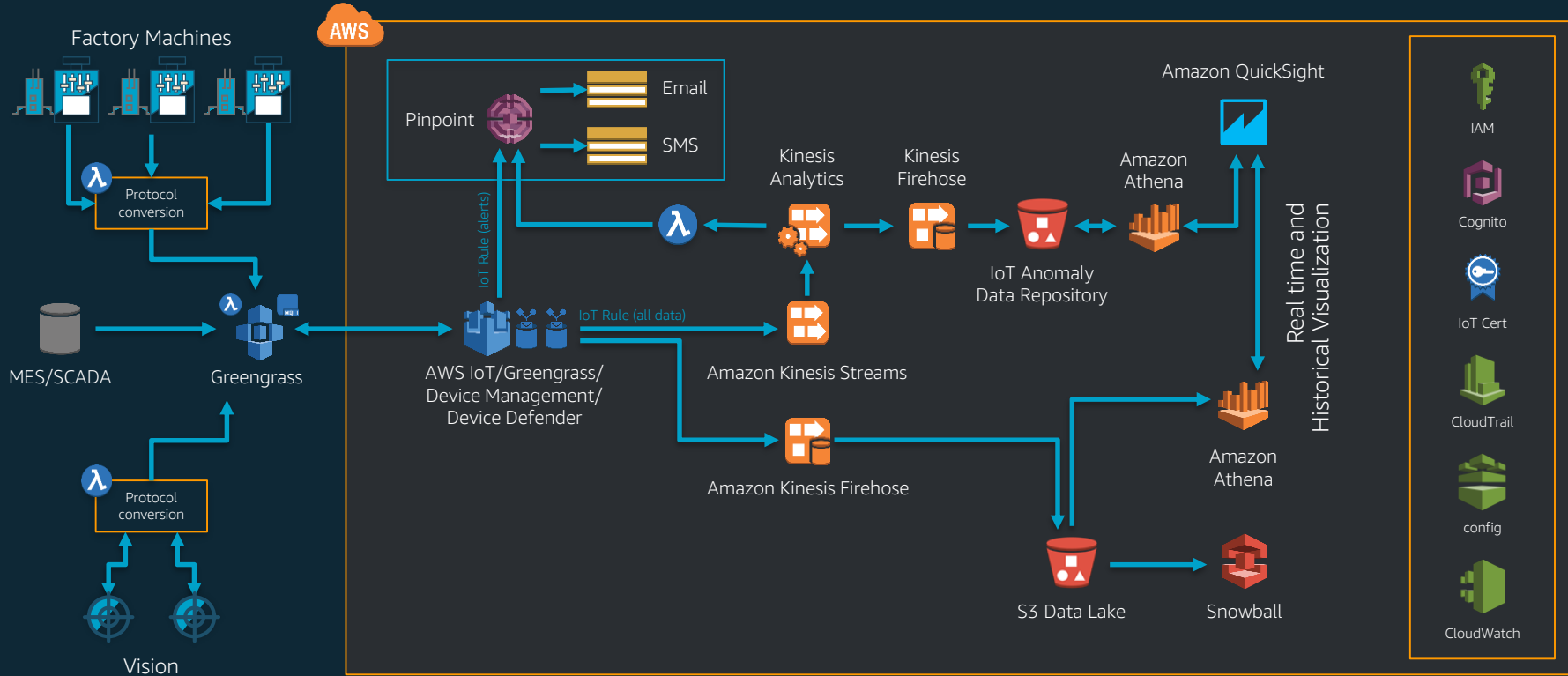
Condition Monitoring Architecture
with AWS IoT Analytics
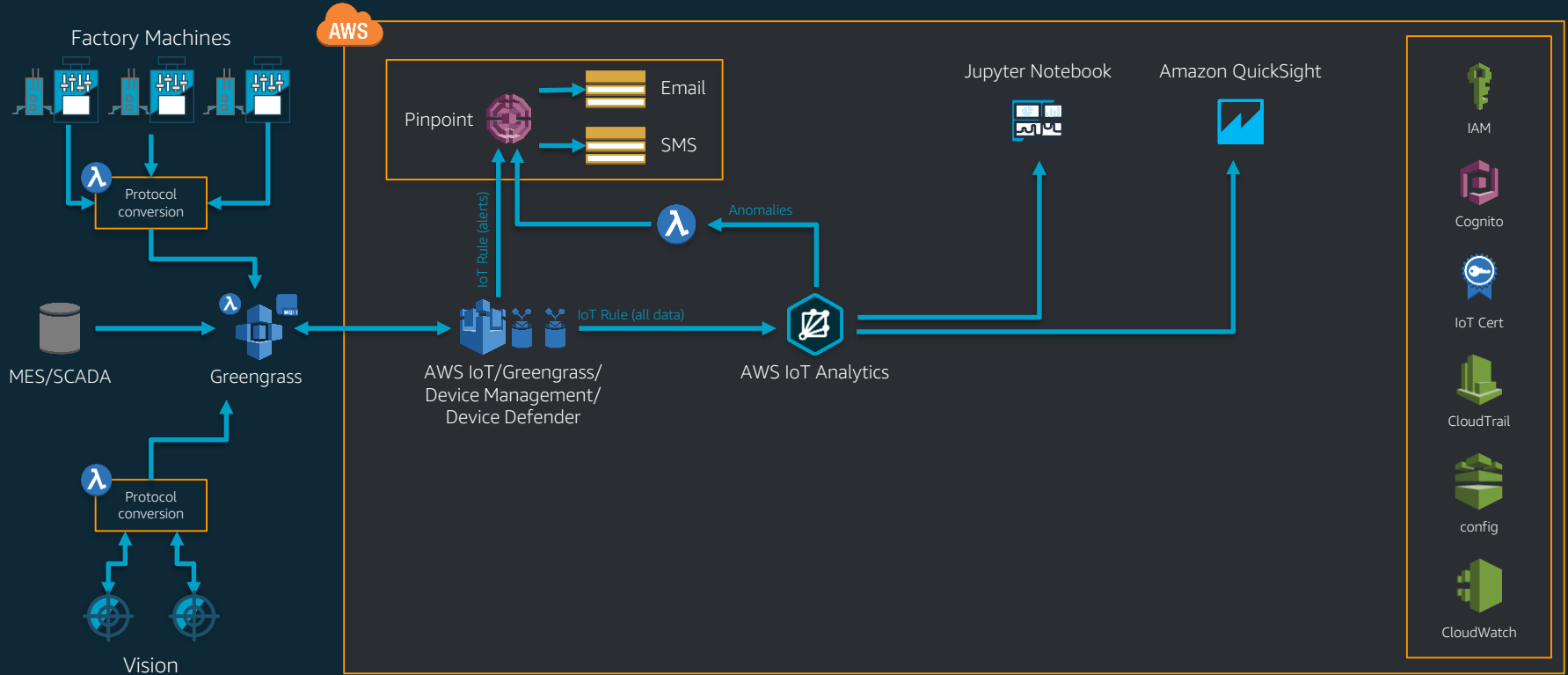
Problem

A Global Mining Company was looking to measure rough roads on mines as potholes can cause damage to mining equipment that is extremely expensive. The Mining Company was looking to understand the degradation of mining equipment, such as Excavators.

Solution

The Global Mining Company turned to AWS to place gateways and vibration sensors on trucks. The customer collects data from equipment, which allows them to identify potholes and other problems on mining routes that can contribute to equipment degradation.

Impact

AWS IoT allows the Global Mining Company to continuously monitor equipment status, health, and performance to detect issues in real-time. It also helps the company detect road issues and identify equipment degradation over time to minimize unexpected downtime.

Industrie 4.0 Tenets and Why AWS?

Interoperability	Local AWS Lambda with AWS Greengrass to integrate protocol other than MQTT & HTTP
Virtualization	AWS IoT Shadows work in both local AWS Greengrass and the AWS Cloud with thing types and custom attributes
Decentralization	Leverage 11 AWS Regions to subscribe to AWS IoT topics using selective rules
Real-Time Capability	AWS Greengrass achieves lower latency with local devices to support critical automated decision making for mission critical industrial use cases
Service-Orientation	Multiple layers of AWS Lambda functions addressing increasingly deeper layers that can be orchestrated with AWS Step Functions invoked by AWS IoT or Amazon API Gateway
Modularity	AWS Greengrass for a hybrid end-to-end process with local real-time processing and cloud agility for stream processing, analysis and archival
Security	AWS IoT Device Defender secures your fleet of industrial devices by continuously auditing the security policies associated with your devices to ensure they are secure at all times
Analytics and Insight	AWS IoT Analytics cleans, filters, transforms, and enriches IoT data before storing it in a time-series data store for analysis and advanced analytics
Lifecycle Device Management	AWS IoT Device Management makes it easy to securely onboard, organize, monitor, and remotely manage industrial devices at any scale

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What Sets AWS Industrial IoT apart?

✓	**Industrial IoT Vision**	Reference architectures built for popular industrial use cases so you can quickly get started
✓	**Service Breadth and Depth**	AWS IoT services allow you to gather data from, run sophisticated analytics on, and take actions in real-time on your diverse fleet of IoT devices from edge to the cloud
✓	**Security**	Built-in device authentication and authorization to keep your IoT solutions secure. Continuously audit policies associated with your devices, monitor your device fleet for abnormal behavior, and receive alerts if something doesn't look right. You can even take corrective actions
✓	**Scalability**	Reliably scale to billions of devices and trillions of messages
✓	**IoT Analytics and Machine Learning**	Sophisticated analytics including pre-built machine learning models for common IoT use cases, and machine learning inference at the edge capabilities
✓	**Partner Network and Community**	Rich ecosystem of technology and consulting partners such as Intel, TI, Microchip, Bsquare, C3 IoT, Splunk, and Accenture
✓	**Trusted and Proven**	Customers such as Pentair and Kempii have achieved business outcomes such as increased revenue and faster time to market

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PANASONIC AVIONICS CORPORATION

Panasonic

PANASONIC AVIONICS
CONNECTING THE BUSINESS AND PLEASURE OF FLYING

MISSION

Delight passengers & enhance customer value

VISION

Become an indispensable partner to our customers, bringing innovative, reliable solutions and services to aviation, maritime and other markets.

WORLD LEADER IN INFLIGHT ENTERTAINMENT AND CONNECTIVITY (IFEC)

OUR CUSTOMER BASE

300 IFE CUSTOMERS

9,000+ AIRCRAFT WITH IFE

66 CONNECTIVITY CUSTOMERS

2,000+ AIRCRAFT WITH CONNECTIVITY

541 AIRCRAFT WITH PHONE

745 AIRCRAFT WITH LIVE TELEVISION

3800+ AIRCRAFT COMMITTED TO CONNECTIVITY

OUR GLOBAL FOOTPRINT

60+
LINE STATIONS

7 REPAIR STATIONS
LOCATED ACROSS
6 COUNTRIES

● REPAIR SHOP
● LINE MAINTENANCE STATION

>1,300	**>2,700**	**500,000**	**$195M**	**99%**	**1,700**	**180,000**	**36 YEARS**
TECHNICAL SERVICES PERSONNEL (OF 4,500 PAC EMPLOYEES)	AIRCRAFT UNDER CONTRACT	SERVICE EVENTS EACH YEAR	GLOBAL INVENTORY AT LINE STATIONS	PARTS AVAILABILITY AT THE LINE	MEDIA LOADED EACH MONTH	REPAIRS ANNUALLY	OLDEST LRU REPAIRED IN 2016

Panasonic

17-Apr-18   30

NEXT

CLOUD

Industry's first global data analytics centric IoT infrastructure

New Value-Added Solutions Tailored to Key Airline Needs

LOYALTY
A personalized digital platform, available throughout the entire travel thread

MARKETPLACE
A comprehensive retail platform revolutionizing the sale of goods and services

THEATRE
An incredible cinematic experience, offering the highest level of entertainment

Core Infrastructure and Services

NEXT CLOUD
Industry's first global data analytics centric IoT infrastructure

NEXT ONLINE
Connectivity services and network designed to enable the ultimate digital cabin

NEXT XT (Hardware and Software Platform)
Innovative hardware and software empowering services and solutions
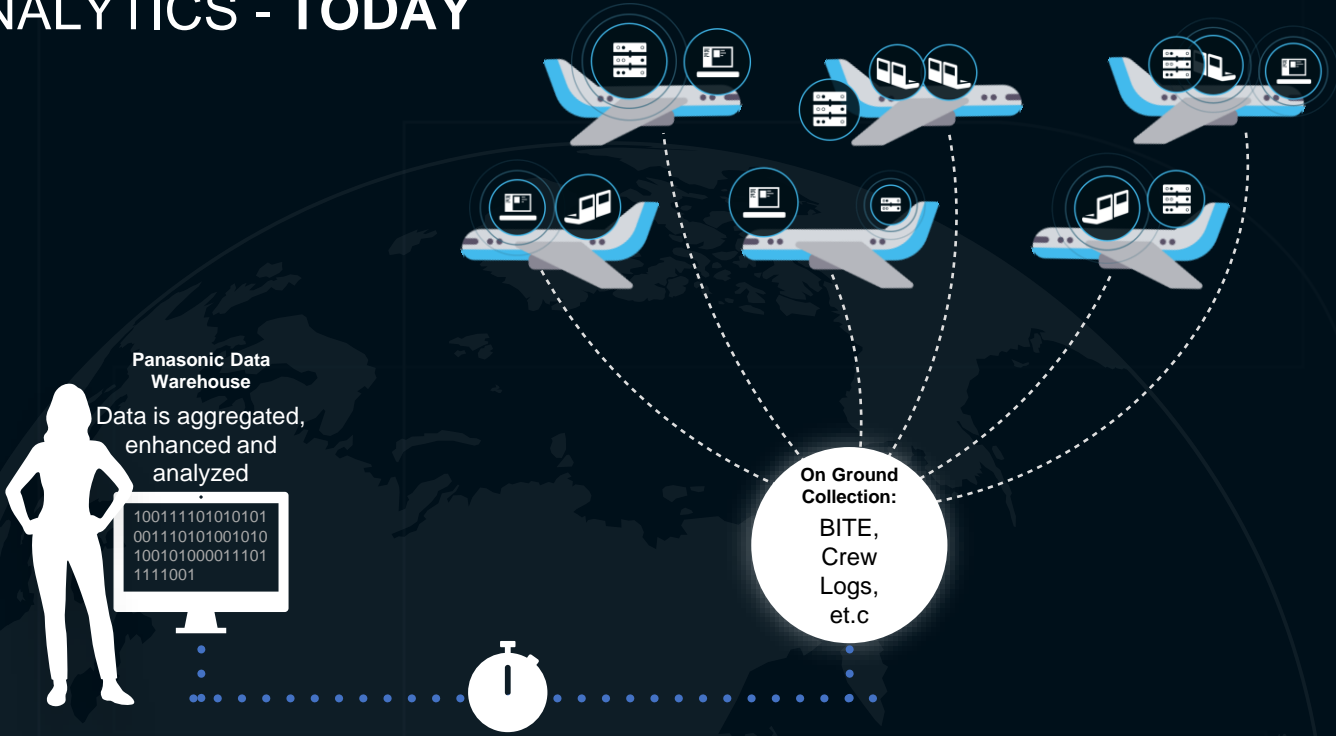
Panasonic

Panasonic Data Warehouse

Data is aggregated, enhanced and analyzed

100111101010101
001110101001010
100101000011101
1111001

On Ground Collection:

BITE, Crew Logs, et.c

IOT AND ANALYTICS - **TOMORROW**

CLOUD

SEATBACK
& DEVICES

CREW
INTERFACE

ONBOARD
SERVERS

17-Apr-18   34

VALUE :
IOT AND ANALYTICS

Through the use of AWS IoT and IoT Analytics we're able to lower time to insight, increase operational efficiency, and reduce our spare inventory costs.

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VALUE :
IOT AND ANALYTICS

Through the use of AWS IoT and IoT Analytics we're able to lower time to insight, increase operational efficiency, and reduce our spare inventory costs.

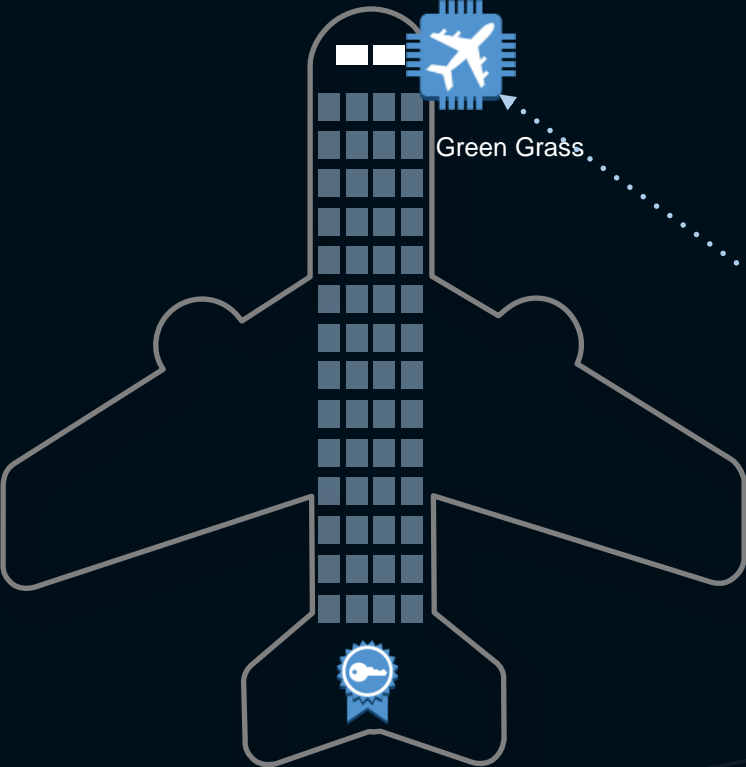Schedule field engineer and parts for "just in time delivery"

Support Marketplace, Theater and Loyalty
- Insert targets adds
- Purchase most favorited, watched, anticipated movies
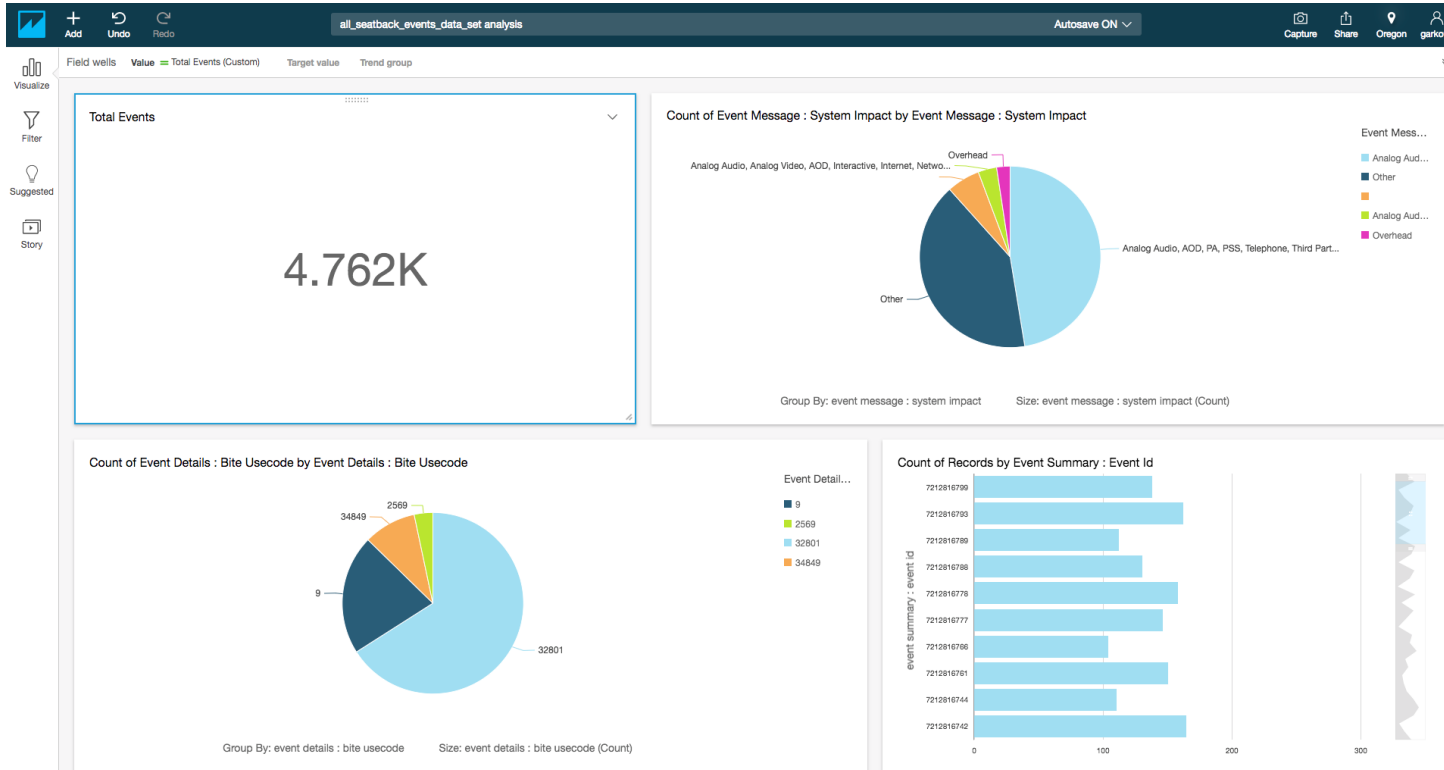- Reward customers based on IFEC usage

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PANASONIC IOT ANALYTICS
SOLUTION

IOT AND ANALYTICS SOLUTION

VPC

IoT Analytics Channel

IoT Analytics Pipeline

IoT Analytics Data Store

IoT Analytics Data Set

Green Grass

IOT Service

Rule(s)

to IoT Analytics

Forward to DynamoDB

DynamoDB

QuickSight Dashboard
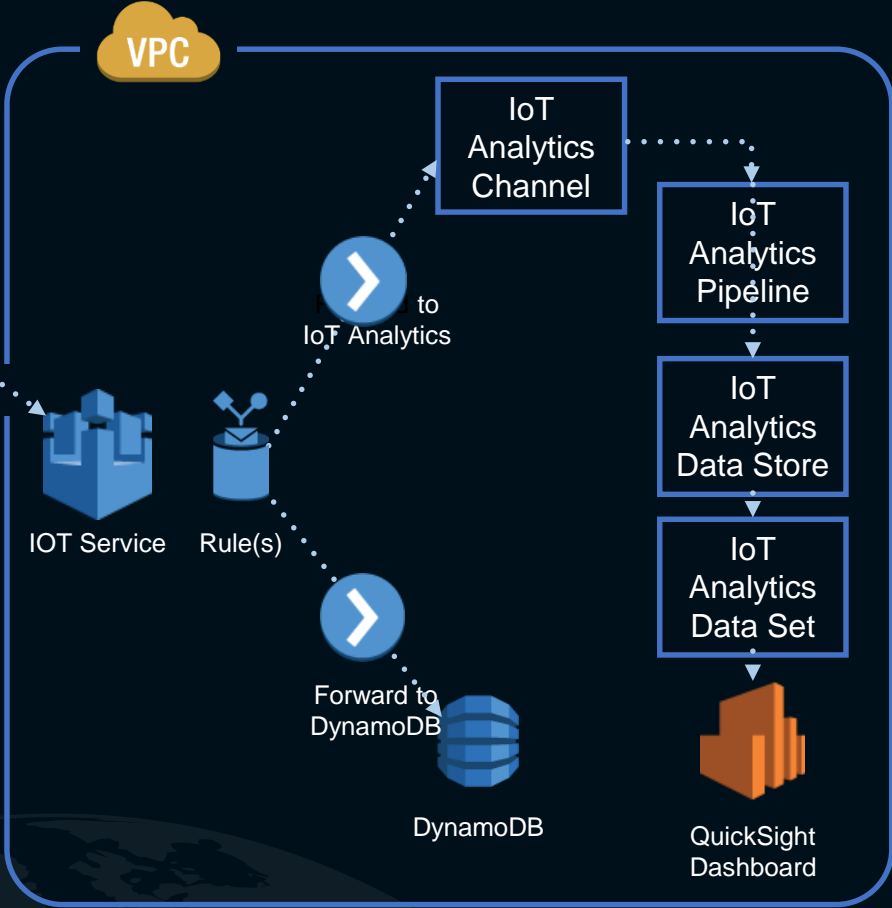
QUICKSIGHT DASHBOARD

IoT Analytics data set is used to create data source in QuikSight and visualize the analyzed data

SOULTION : IOT AND ANALYTICS - TOMORROW

Thank you!