



Using Predictive Analytics in Industrial IoT Applications

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August 27, 2018



Agenda

- Industrial IoT Overview
- AWS Use Cases for Industrial IoT
- Deep Dive and Architecture for Predictive Maintenance
 - Sample Jupyter Notebook
- Deep Dive and Architecture for Predictive Quality
- Q&A

IoT Transforms Traditional Industrial Processes

IoT brings sensors, machines, cloud computing, analytics, and people together to improve productivity and efficiency



Manufacturing



Mining



Oil & Gas



Agriculture

IoT Drives New Industrial Market Trends

Convergence of business, process, and government standards like Industry 4.0 and Society 5.0



Mass production



Mass customization



Buy



Lease



Pay upfront



Pay as you go

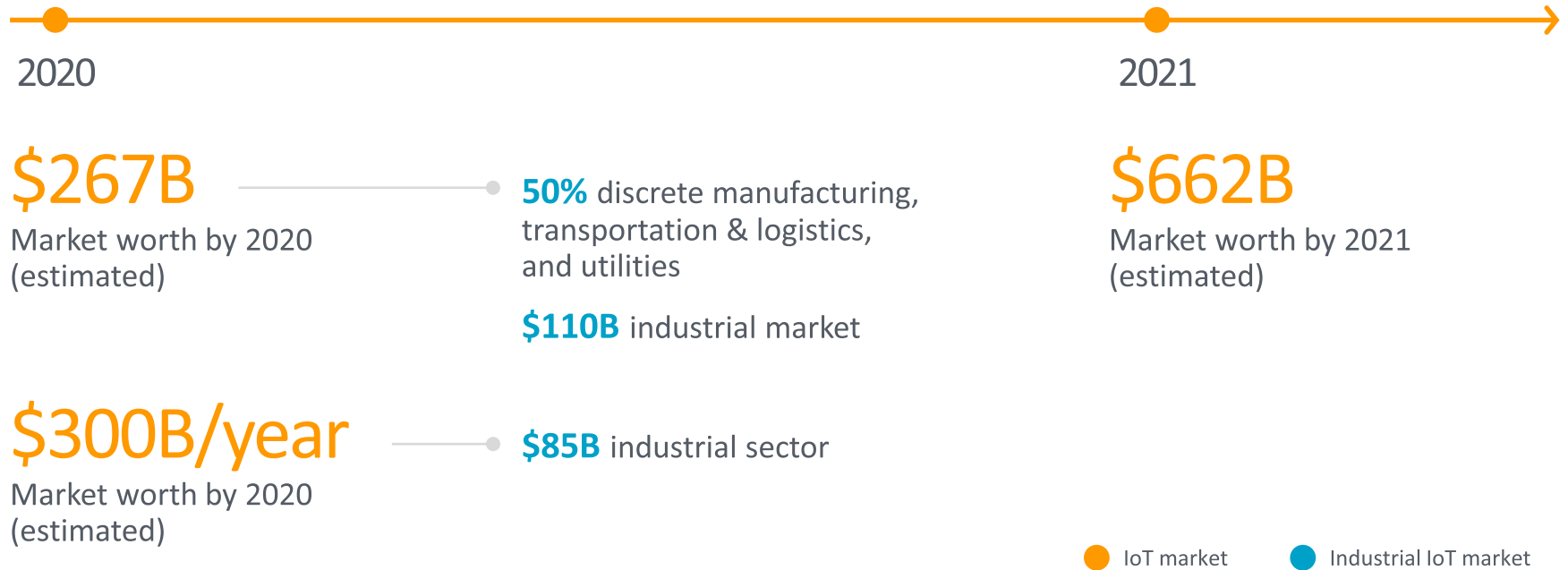


Manual



Automatic

IoT Drives Growth in the Industrial Market



But Customers Face Challenges



Security

Keep devices and data secure



Downtime

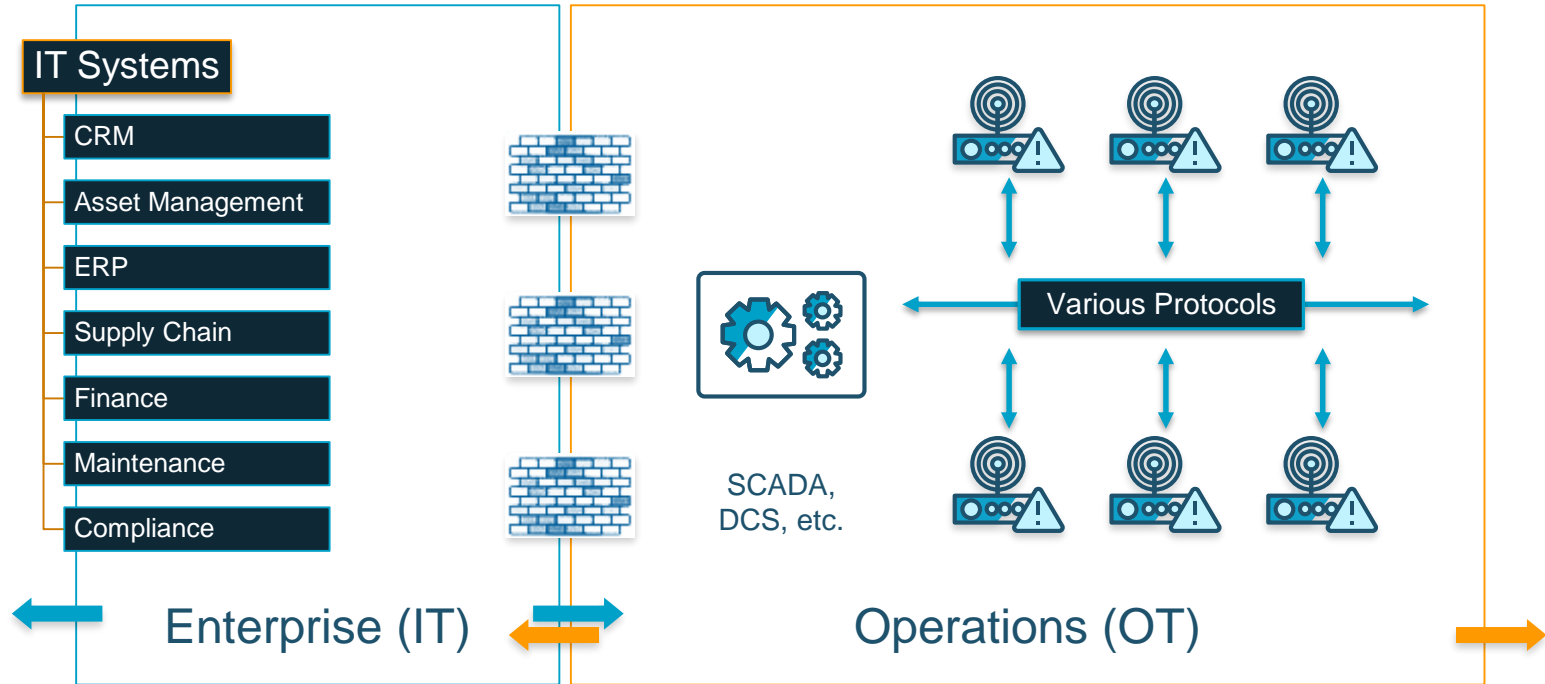
Operate at top performance even without cloud connectivity



Legacy equipment

Onboard Greenfield and Brownfield devices

Challenge: Brownfield Environments



ISA 95 & ISA 99 Industrial Edge Architecture

L5 Cloud

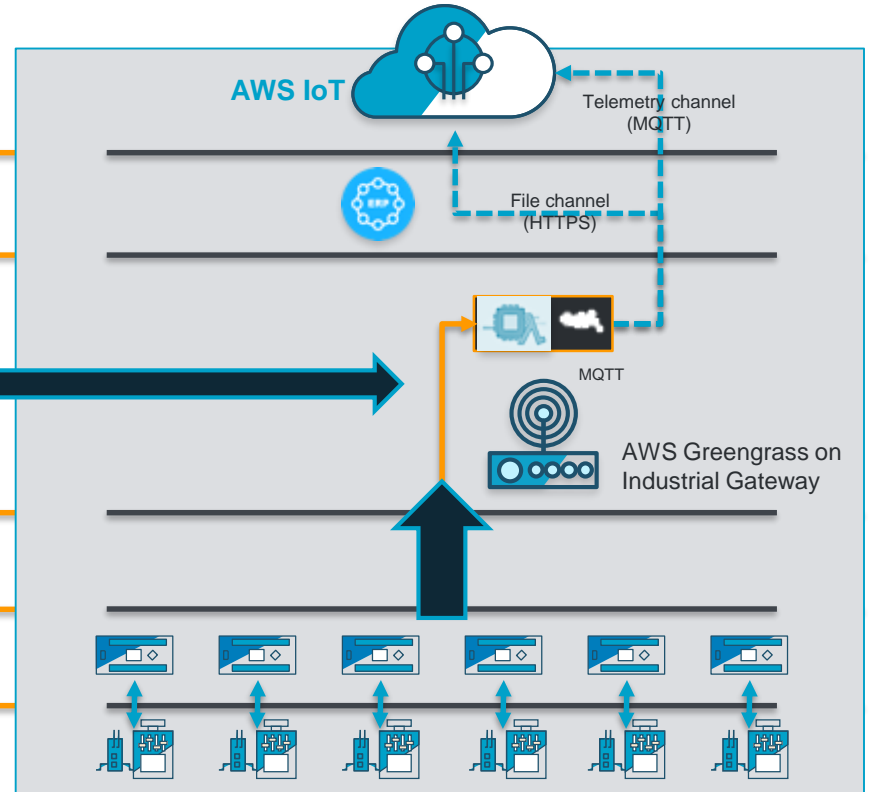
L4 ERP/SAP

L3 MES

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

L1 PLC

L0 Industrial Equipment



AWS Helps You Overcome Challenges with Software and Services for Key Use Cases



Predictive
maintenance



Predictive
quality



Asset condition
monitoring



Predict Failure Before Business Operations are Impacted



Reduce costs



Avoid unplanned production outages



Plan optimal maintenance work schedule



Predictive maintenance

Predict Failure Before Business Operations are Impacted

Requirements

Ingest sensor data from devices in plants and offsite

Securely connect billions of devices to the cloud and manage trillions of messages

AWS IoT Capabilities

Run edge software and services like Amazon FreeRTOS and AWS Greengrass for local triggers, actions, and data sync

Securely connect to AWS IoT Core

AWS IoT Device Defender fleet audit and protection



Predictive maintenance

Predict Failure Before Business Operations are Impacted



Predictive maintenance

Requirements

Build and train predictive models based on device data

Deploy models on devices

Detect anomalies

Trigger alerts

Predict failures

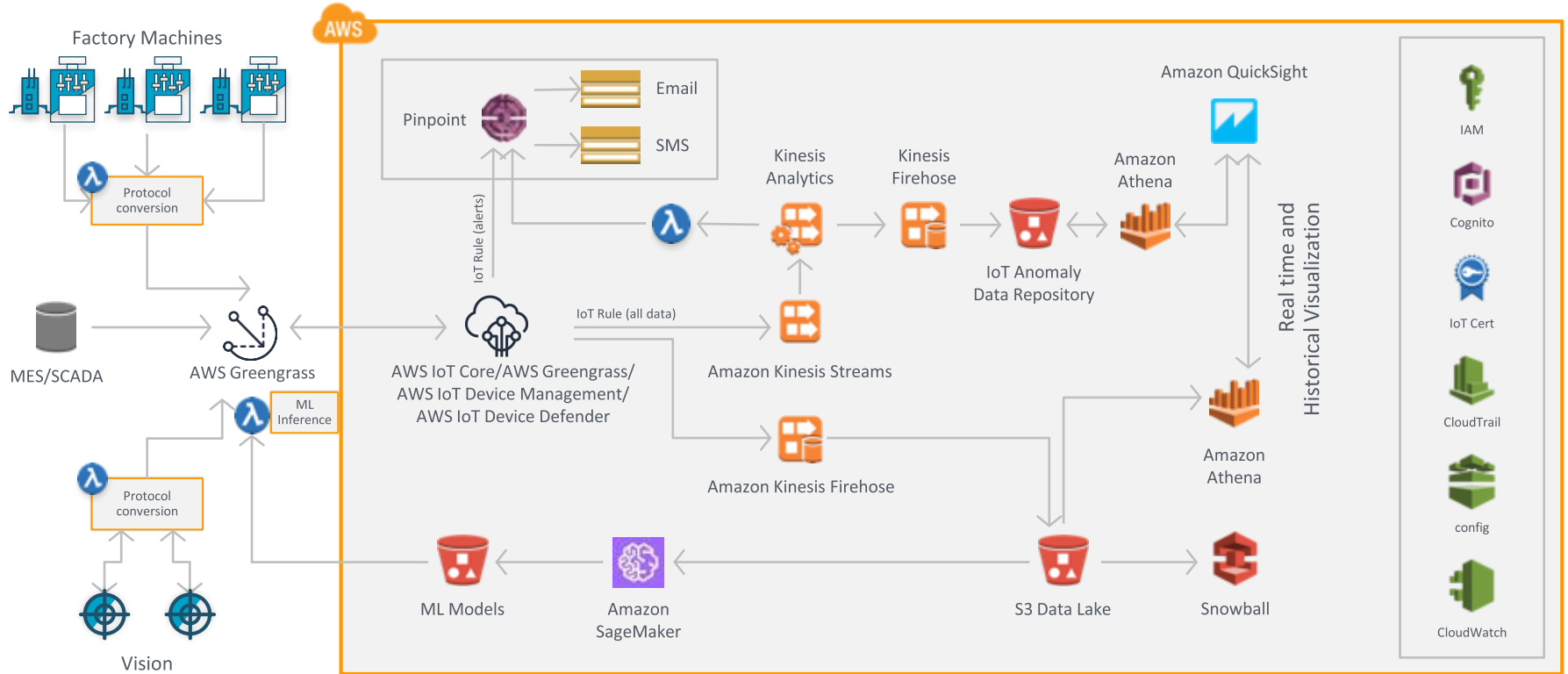
AWS IoT Capabilities

AWS IoT Analytics collects, processes, and analyzes IoT data. Use built-in templates for predictive maintenance

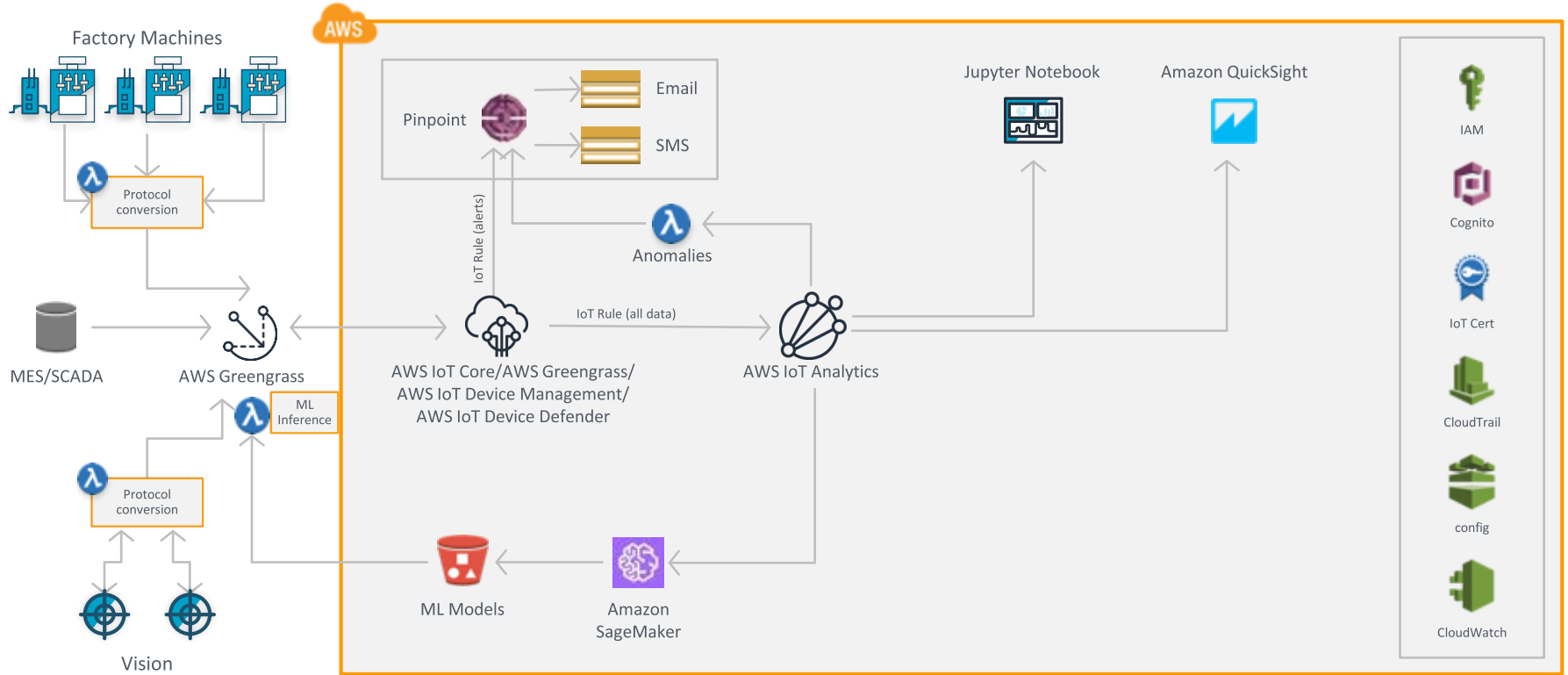
Run predictive models on devices using AWS Greengrass

Use AWS Greengrass Machine Learning Inference to take local action even without cloud connectivity

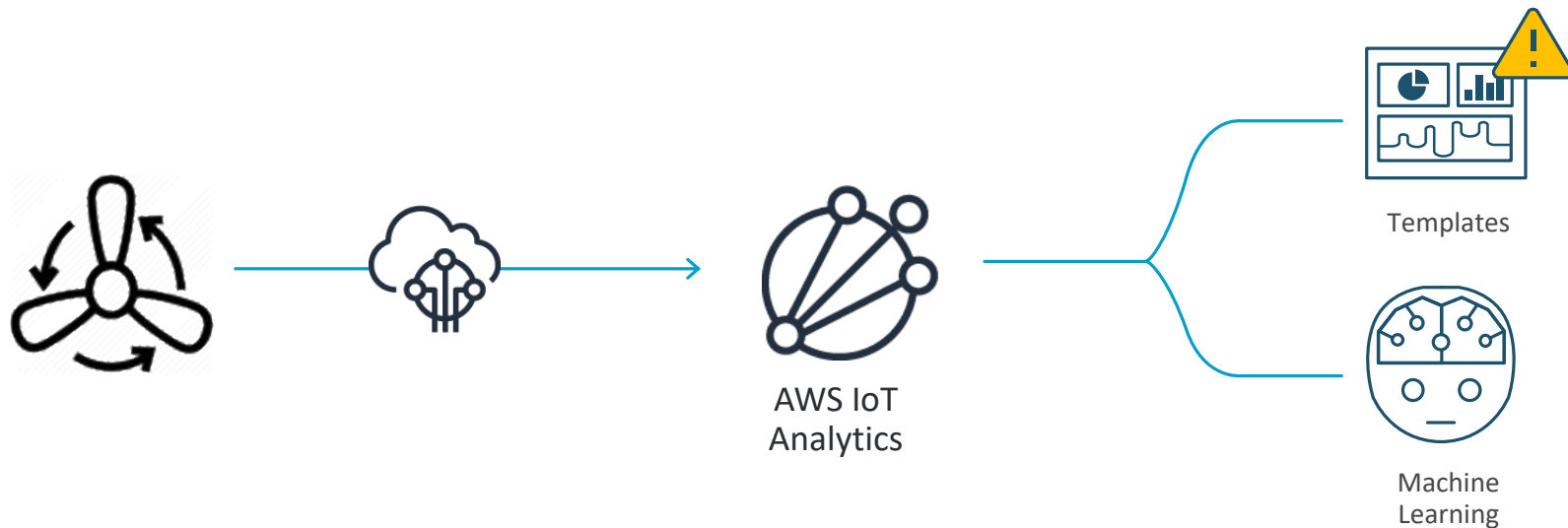
Predictive Maintenance Architecture



Predictive Maintenance Architecture with AWS IoT Analytics



Using Insights to Solve Problems Before They Arise



Predictive Failure Profiling

- Pre-built templates to build and deploy predictive analytics including failure profiling, forecasting events, asset usage patterns and fleet segmentation.
- *A food shipment company uses AWS IoT Analytics to predict when HVAC systems will fail on their connected vehicles so the vehicle can be rerouted and quickly docked to prevent shipment damage.*



Detect Anomalies to Predict Pump Failure

- 1 Run Amazon FreeRTOS on vibration sensors to securely collect data and connect to AWS Greengrass enabled device
- 2 The AWS Greengrass enabled device runs the predictive model locally to identify when vibrations hit dangerous levels. AWS Greengrass triggers alert to maintenance staff when anomalies are detected. When Internet connectivity is available, the AWS Greengrass device sends data to the cloud for analytics filtering out “normal” data
- 3 AWS IoT Analytics analyzes vibration data and adds time stamp and device information such as serial number pulling from AWS IoT Core. Sends updated model to the AWS Greengrass enabled device



Predictive maintenance



StanleyBlack&Decker

Problem

Stanley Black and Decker finds it unsustainable to ingest, transmit, store, query, and analyze all data generated at the edge and more specifically on construction sites or rural areas with constrained network resources

Solution

AWS Greengrass enables Stanley Black and Decker to monitor and filter data at the edge of the network enabling applications to send asset health and predict any mechanical failures before they occur. Edge-based applications built on AWS Greengrass will help detect and compare vibrations emitted by high value tools to historical signatures that indicate everything from normal operations to imminent failure

Impact

Instead of trying to use all the data Stanley Black and Decker will utilize AWS Greengrass to focus on the right data. Applications include remote troubleshooting of hydraulic assets by technicians, maintenance interval tracking, fuel savings, and alerts



Problem

Wärtsilä needed to accurately predict, when the marine engines they manufactured needed to get serviced. Understanding and predicting the service schedule is vital for Wärtsilä to increase their service and parts revenue

Solution

Accenture worked with AWS account SAs, AoD SAs, and Salesforce SAs to architect an IoT solution using Salesforce and AWS IoT Core to collect data and build predictive models. The solution developed is scalable and extensible beyond just this use case, as Wärtsilä has 14,000 ships with 35,000 engines installed. There are great possibilities for sensor driven IoT use cases

Impact

The entire solution should result in an increase in parts/service sales for Wärtsilä and higher customer retention

AWS Helps You Overcome Challenges with Software and Services for Key Use Cases



Predictive
maintenance

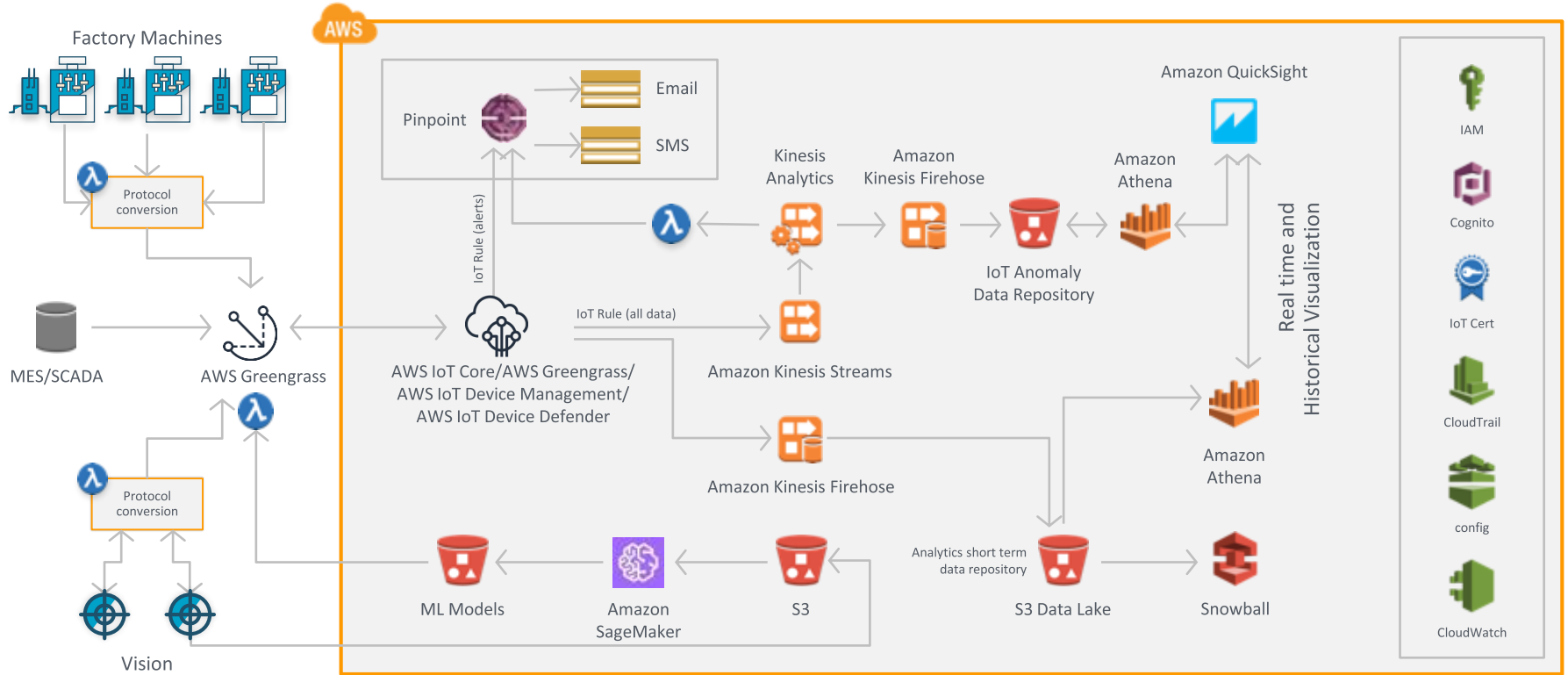


Predictive
quality

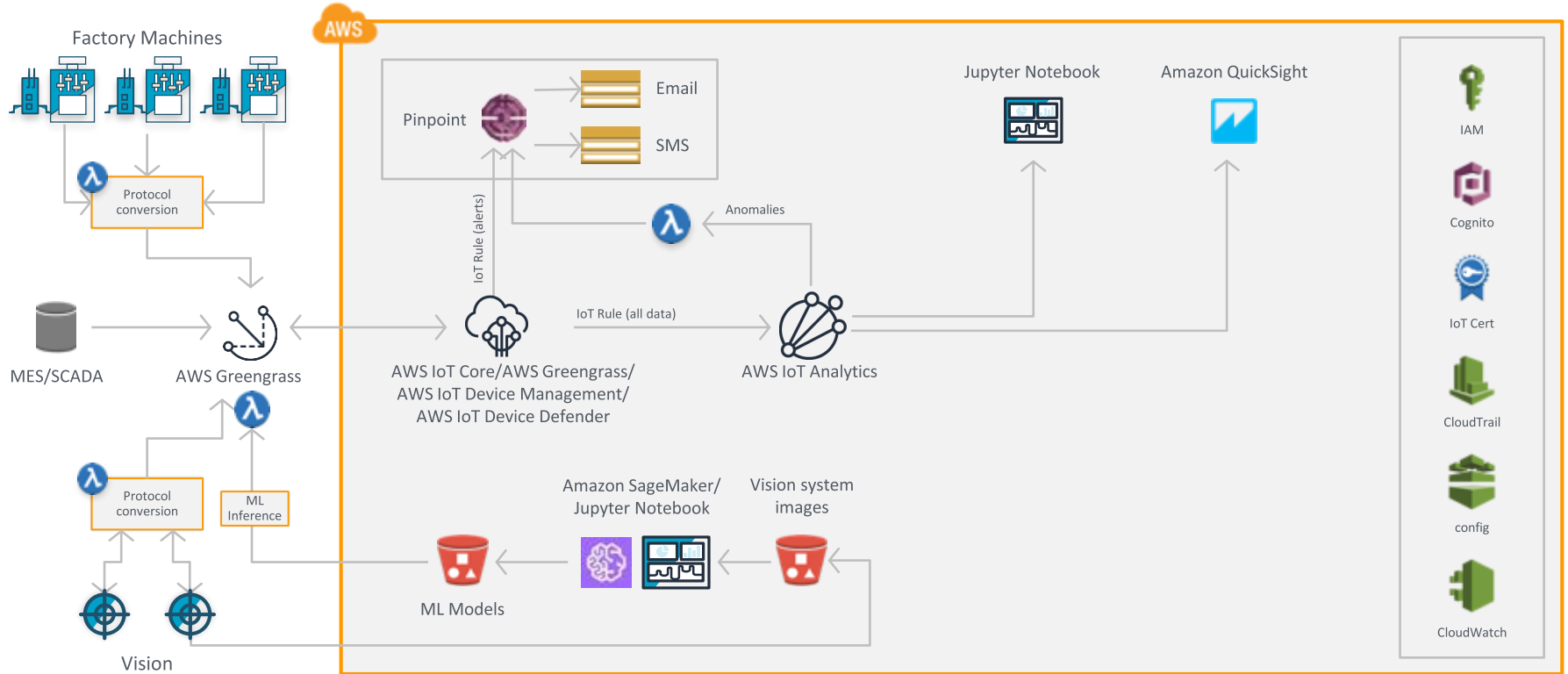


Asset condition
monitoring


Predictive Quality Architecture





Predictive Quality Architecture with AWS IoT Analytics




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** Gather data, run sophisticated analytics, and take actions on your IoT devices from edge to the cloud

 -  **Security** Built-in device authentication and authorization to keep your IoT solutions secure

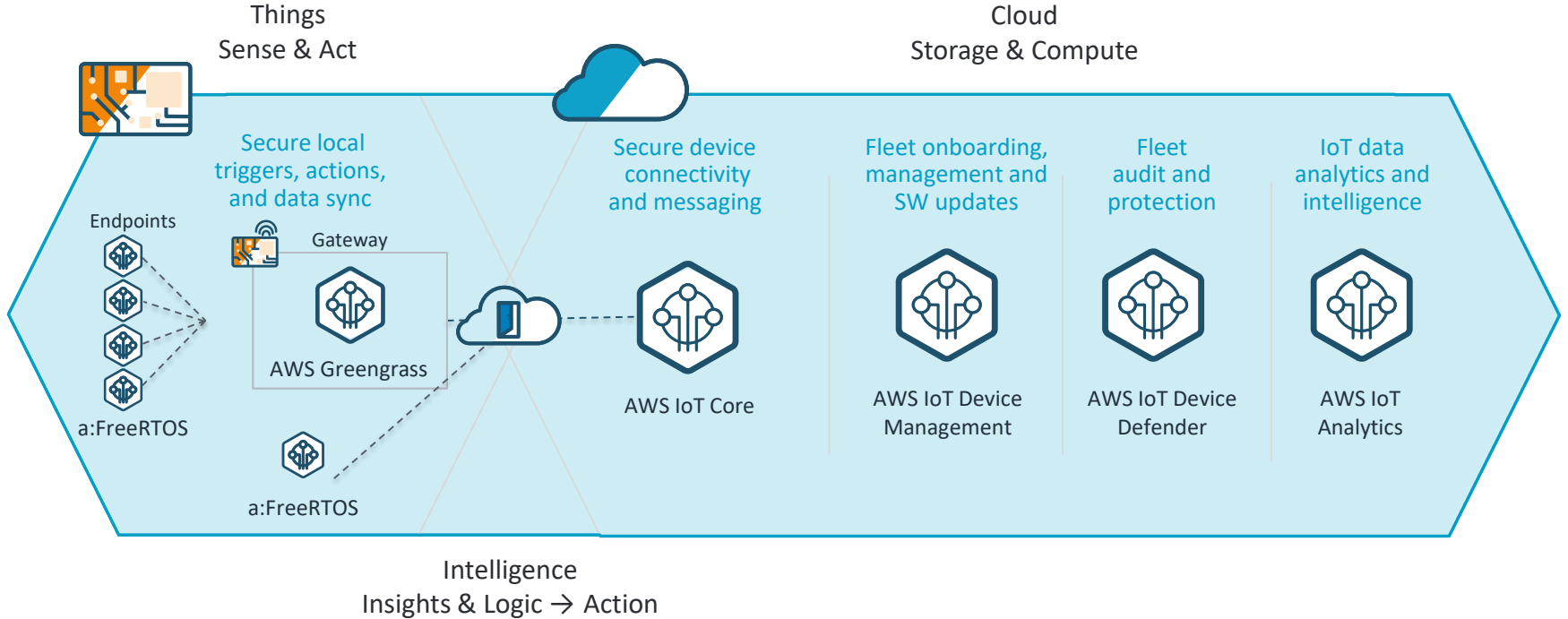
 -  **Scalability** Reliably scale to billions of devices and trillions of messages

 -  **IoT analytics and machine learning** Sophisticated analytics including pre-built Machine Learning (ML) models and ML inference at the edge

 -  **Partner network and community** Rich ecosystem of technology and consulting partners

 -  **Trusted and proven** Industrial customers have achieved business outcomes such as increased revenue and faster time to market
-

AWS IoT Services

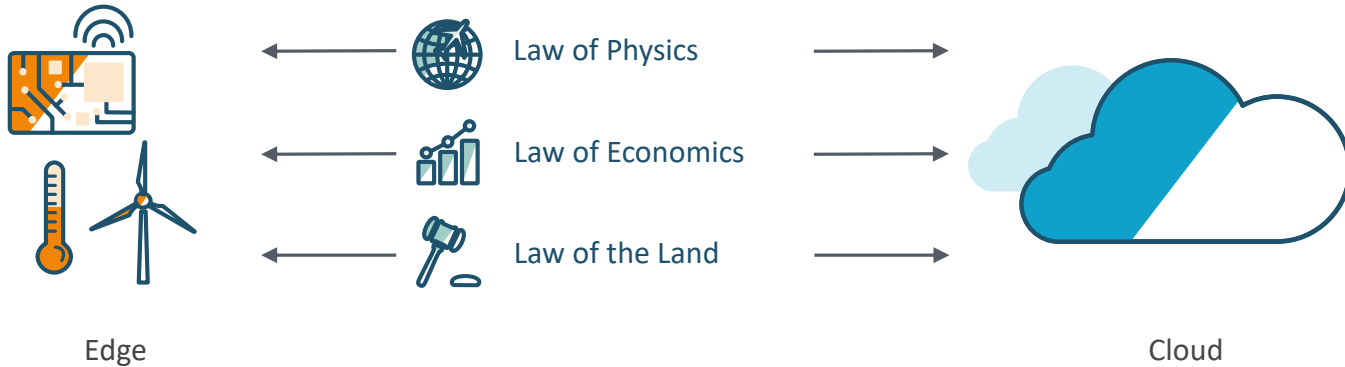




AWS Greengrass

Extend AWS IoT to the Edge

AWS Greengrass extends AWS IoT onto your devices, so that they can act locally on the data they generate, while still taking advantage of the cloud.





AWS Greengrass

Extend AWS IoT to the Edge



Local
Messages and
Triggers

Local
Message Broker



Local
Actions

Lambda
Functions



Data and
State Sync

Local
Device Shadows



Security

AWS-grade
security



Local
Resource
Access

Lambdas Interact With
Peripherals



Machine
Learning
Inference

Local Execution
of ML Models



Protocol
Adapters

Easy Integrations
With Local Protocols

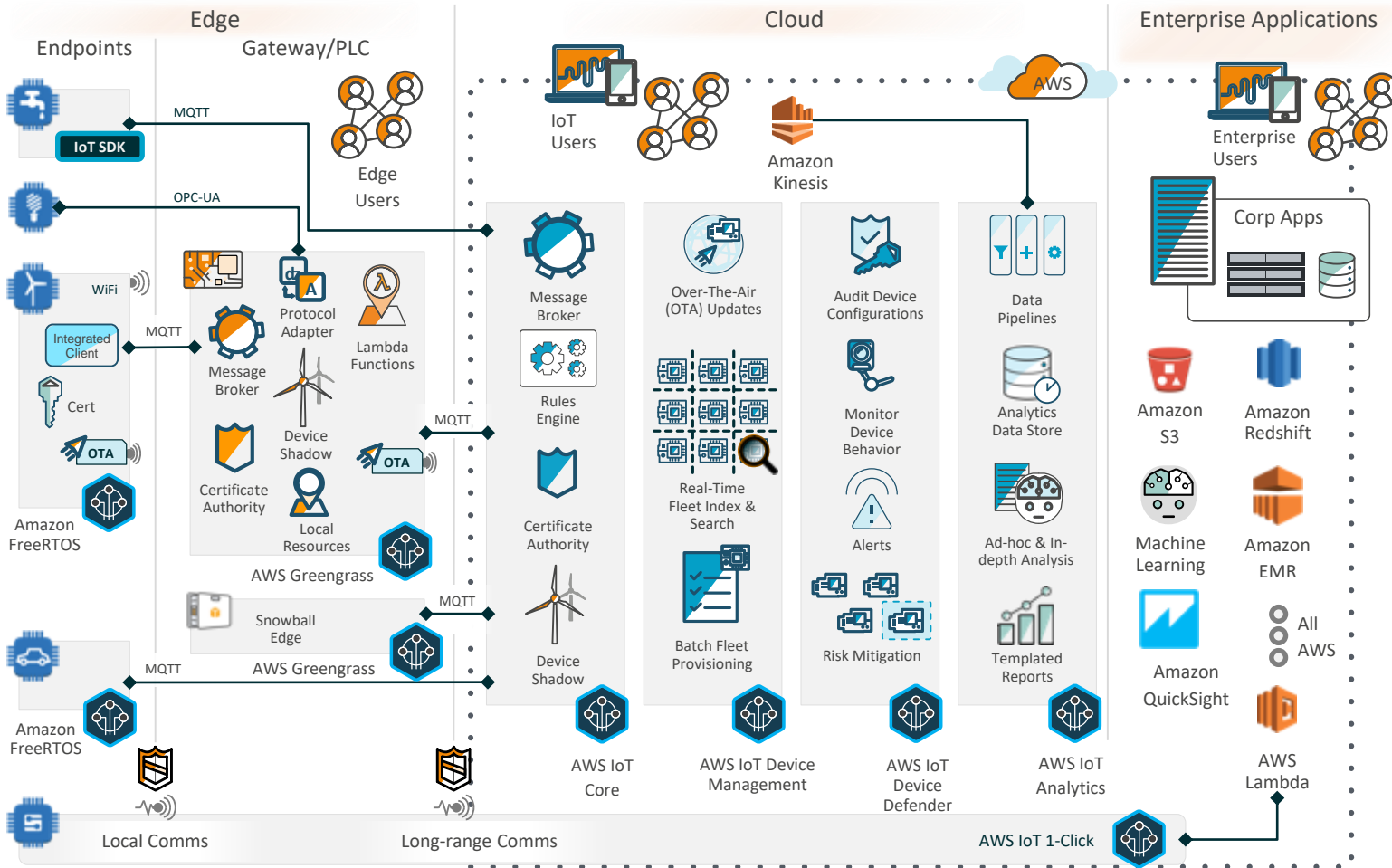


Over the
Air Updates

Easily Update
Greengrass Core



IoT with AWS



IoT Partners

Consulting / SI

Accenture, Aricent, Clearscale, CTP, Luxoft, Mobiquity, Solstice, Storm Reply, Sturdy Networks, TCS, Trek10, ...

ISV (Platform)

Ayala, Bright Wolf, BSquare, C3IoT, Mnubo, PTC, Salesforce, Splunk, Thinglogix, ...

Connectivity

Amdocs, Asavie, AT&T, Eseye, Soracom, TATA Communications, Telus, Verizon, ...

Gateway

Adlink Technology, Advantech, MachineShop, Samsung, Technicolor, ...

Edge

ARM, Broadcom, Digi, Expressif, Intel, MediaTek, Microchip, NXP, ST, TI, Qualcomm, ...

Thank You!

Learn More:

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<https://pages.awscloud.com/industrial-iot-ebook-iot-with-aws.html>