
AWS
re:Invent
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AMZ301

Avoiding mechanical issues with predictive maintenance & Amazon Monitron

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Learning objectives

Understand why predictive maintenance matters to Amazon

Understand what Amazon Monitron is

Understand options for integrating Amazon Monitron with other AWS services

Understand the benefit Amazon Monitron has provided to Amazon

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Agenda

Working backwards from the customer

Typical preventative maintenance

Predictive maintenance as a service

Amazon’s implementation of Amazon Monitron

Operational impact

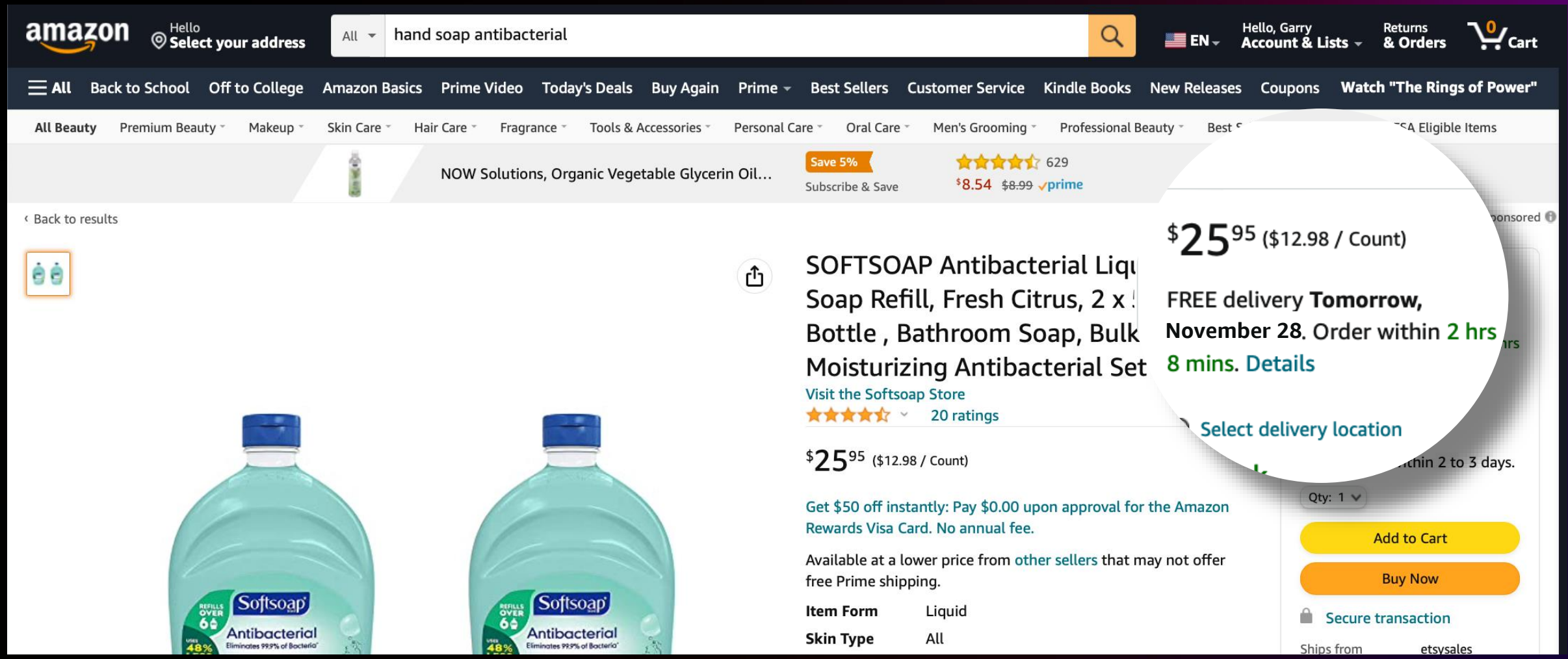
Lessons learned

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Working backwards from the customer

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The customer promise



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On-time delivery



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Lifecycle of a package



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Conveyors, conveyors, conveyors



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10 miles of conveyors
800+ motors
500+ belts

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And more conveyors



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A customer order will travel across tens of miles of conveyor belts

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Delay means broken customer promise



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Maintenance strategies

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Industrial maintenance strategies



PHASE I

Reactive

Source: Deloitte

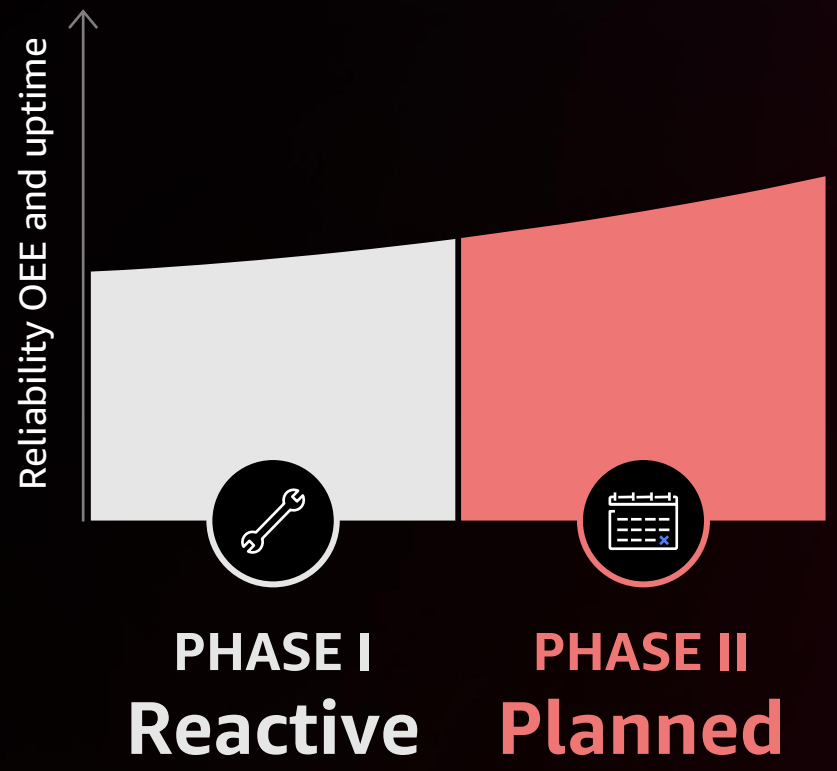
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Not recommended



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Industrial maintenance strategies



Source: Deloitte

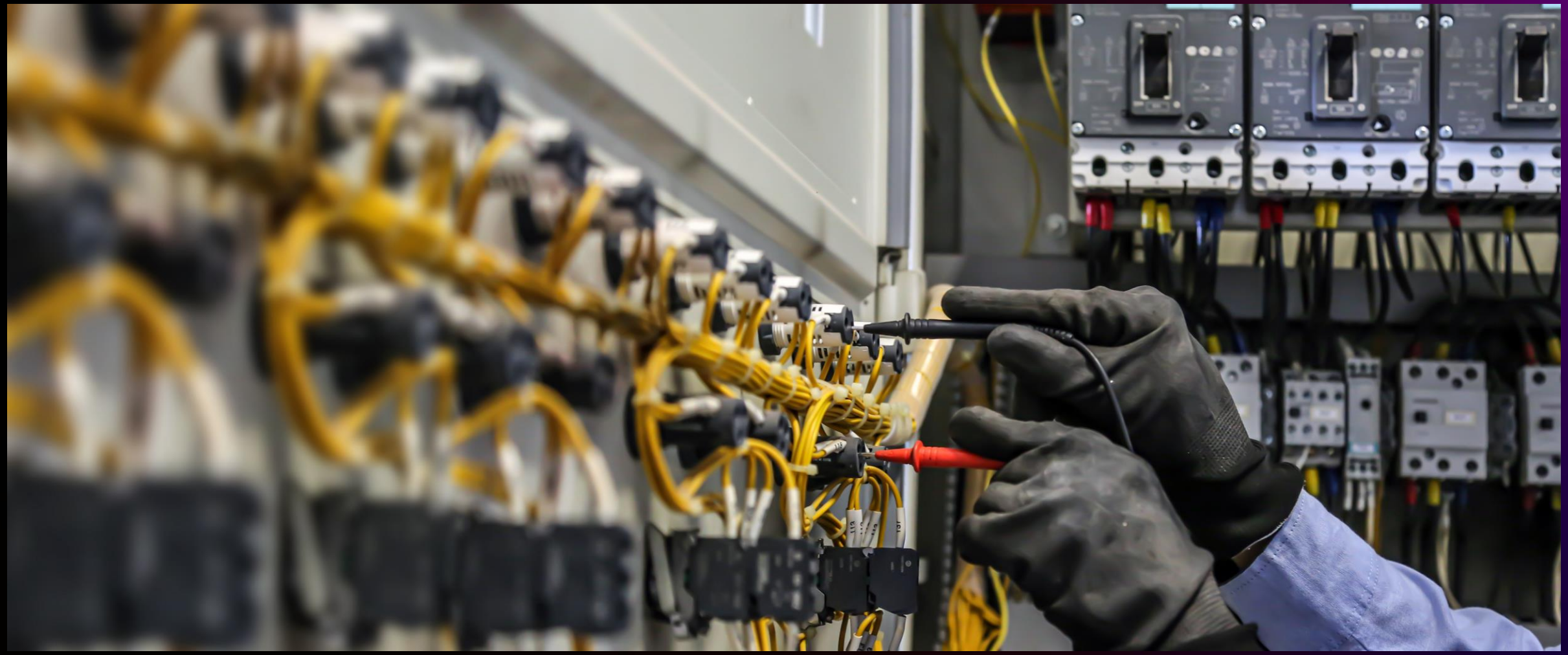
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Non-invasive



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Invasive



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Typical challenges



Frequency of inspection



Human dependency



Safety concerns



Service interruption

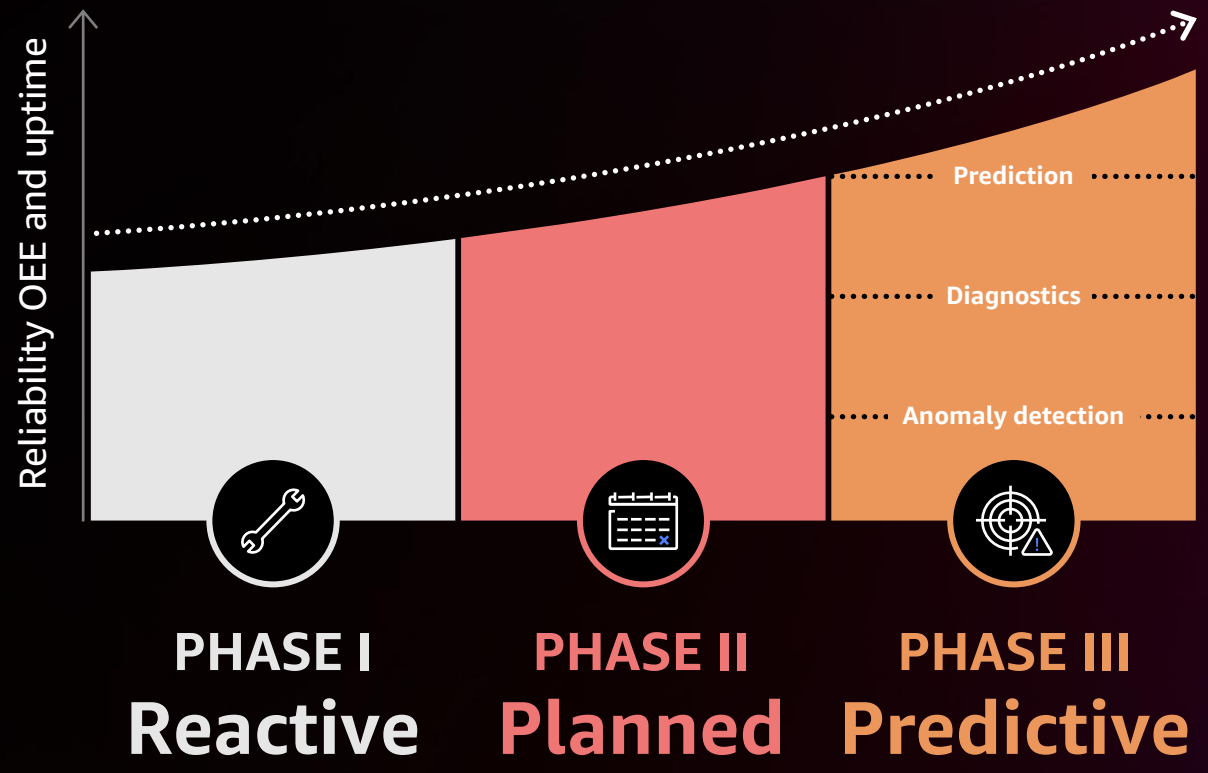


Cost of disruption

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Industrial maintenance strategies



Source: Deloitte

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Difficult and costly to implement



- Require installing expensive sensors
- Ability to capture and transfer data
- Analyze sensor data for failures

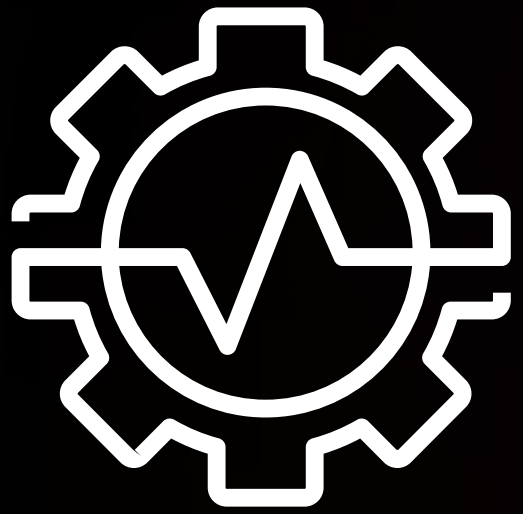
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Customers want a managed, end-to-end, predictive maintenance solution

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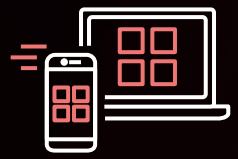
Amazon Monitron



Amazon Monitron



ISO and ML-based analytics



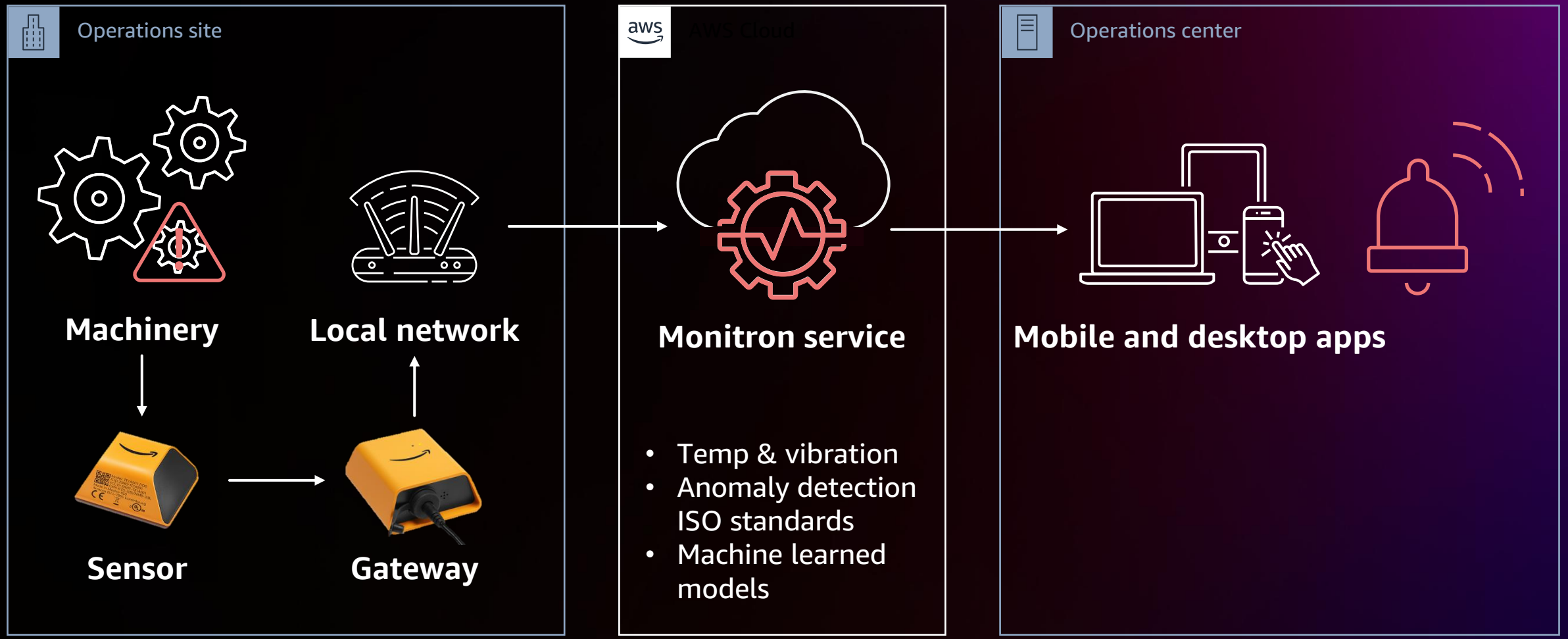
Timely notifications



Managed sensors and gateways

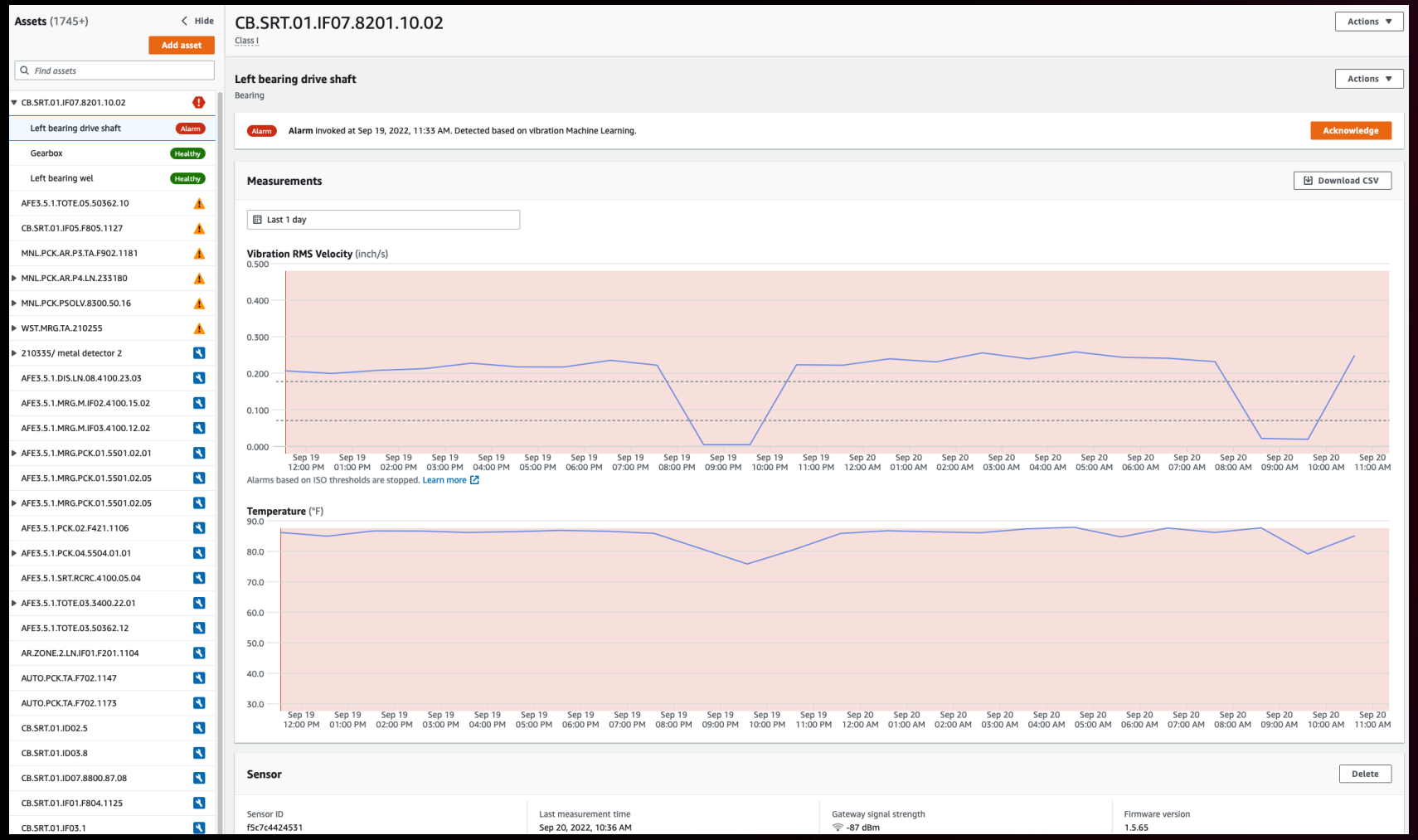
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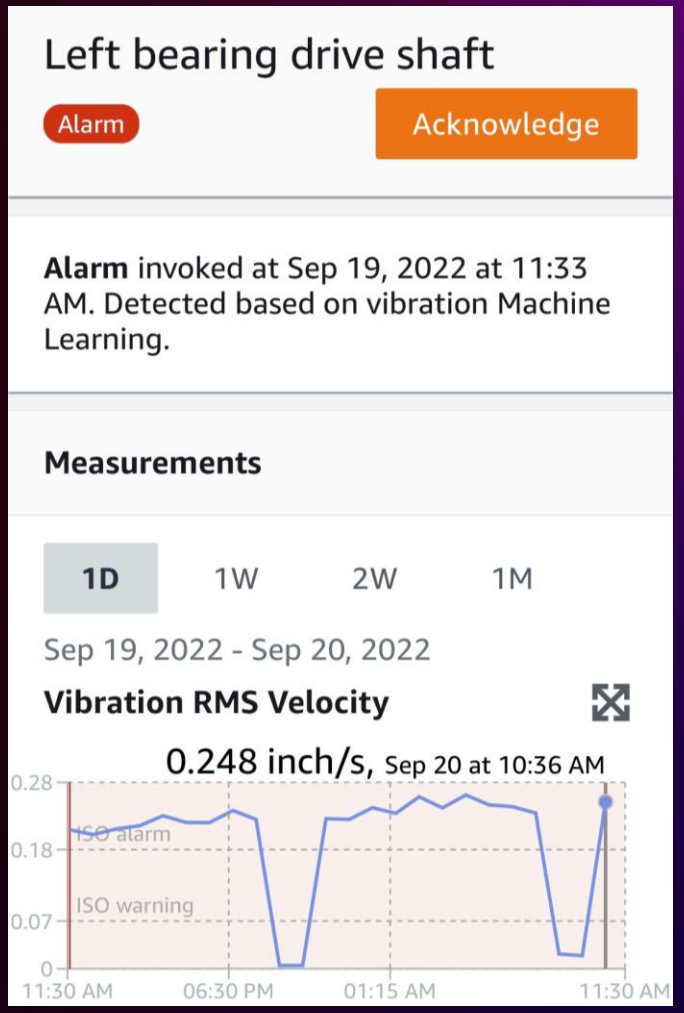
End-to-end managed solution



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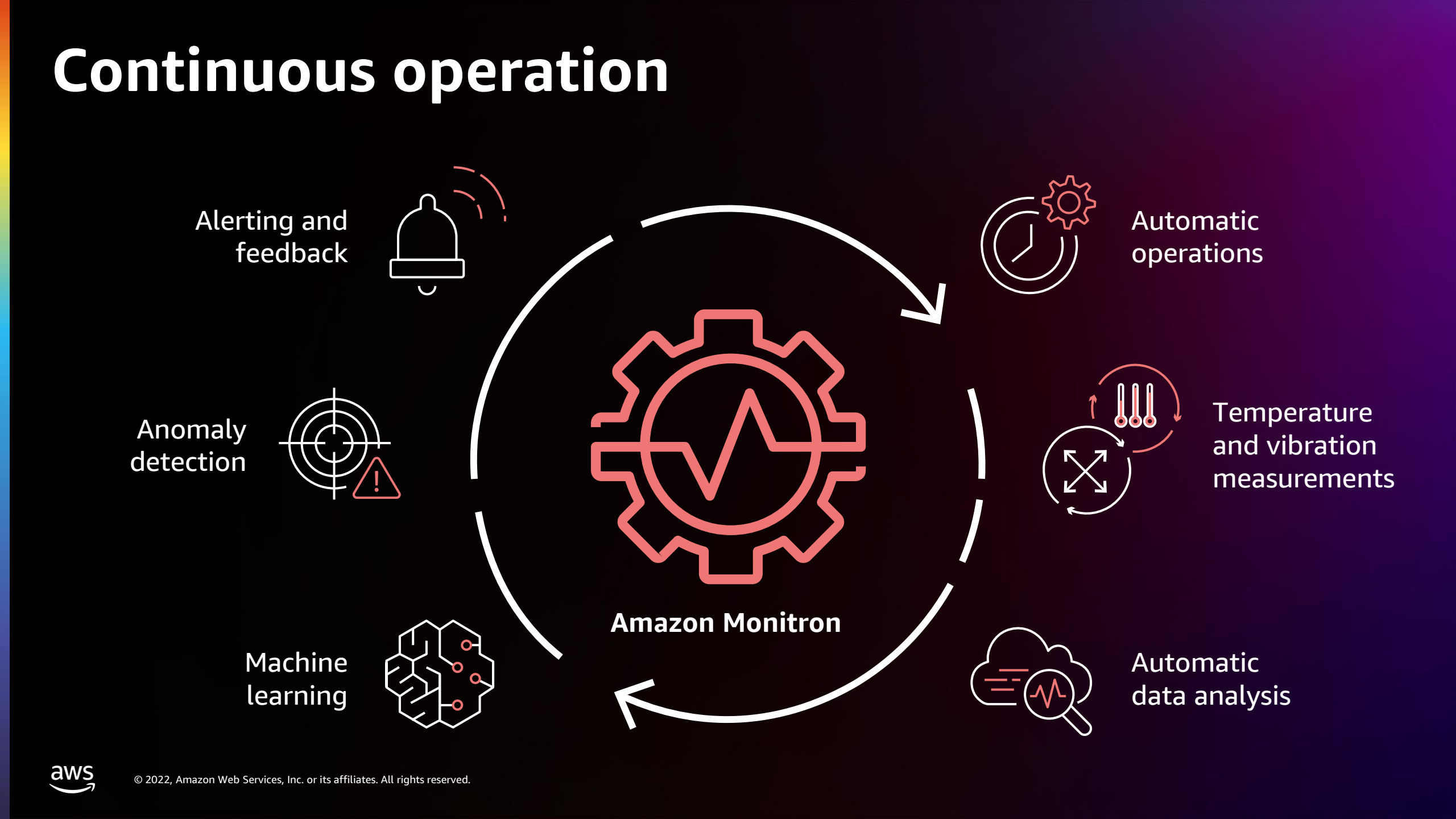
Desktop and mobile app





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Continuous operation



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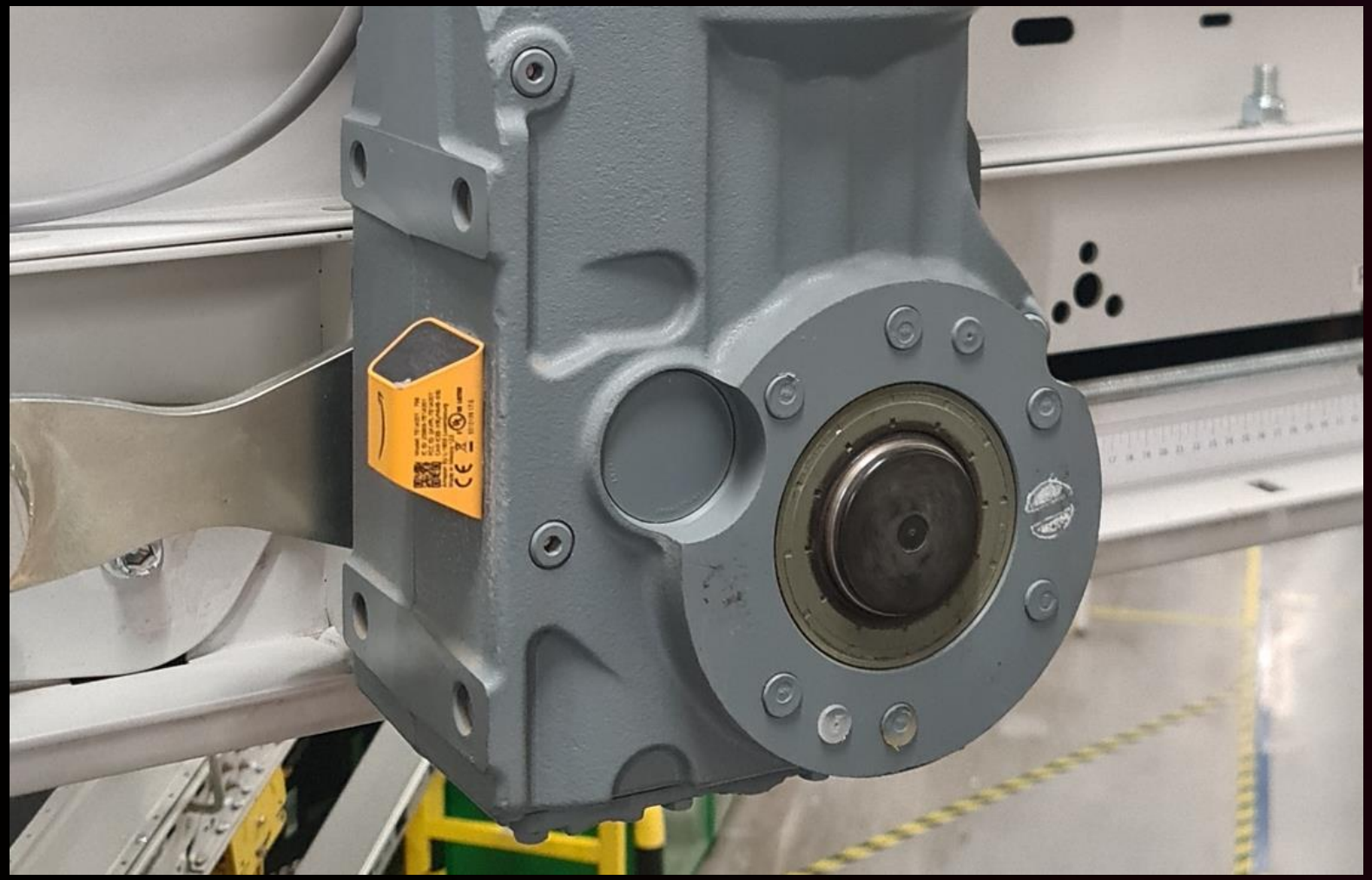
Amazon’s implementation of Amazon Monitron

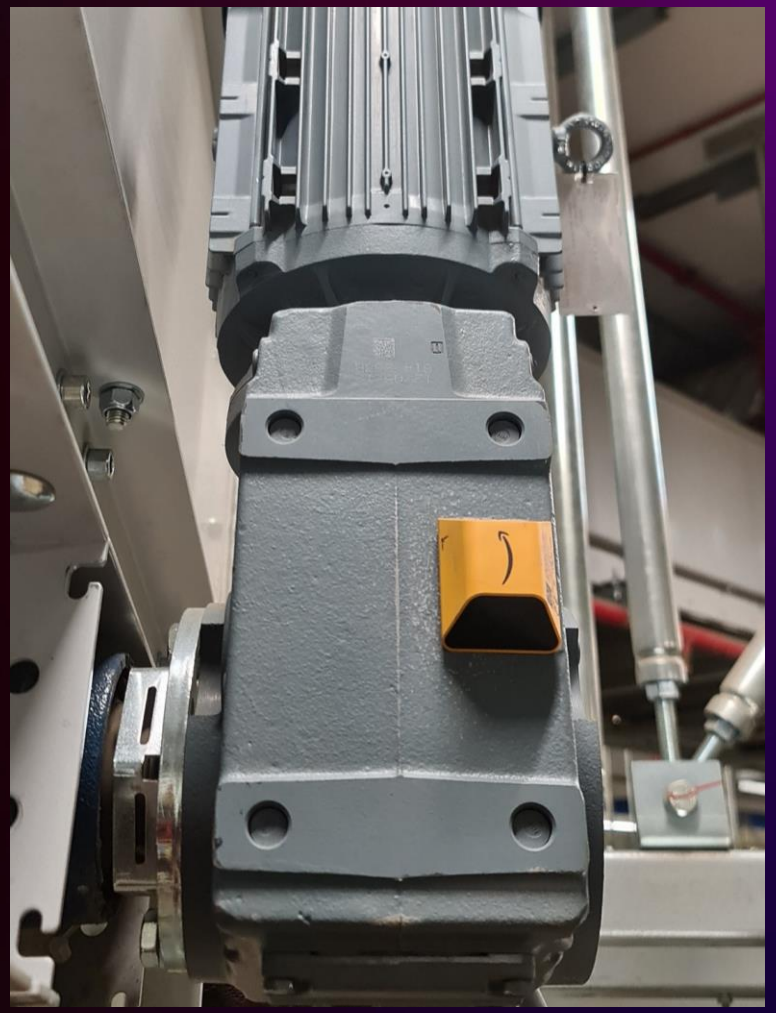
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9-month pilot
33 fulfillment building
25,000 sensors
700 gateways
9,000 assets

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Single motor installation

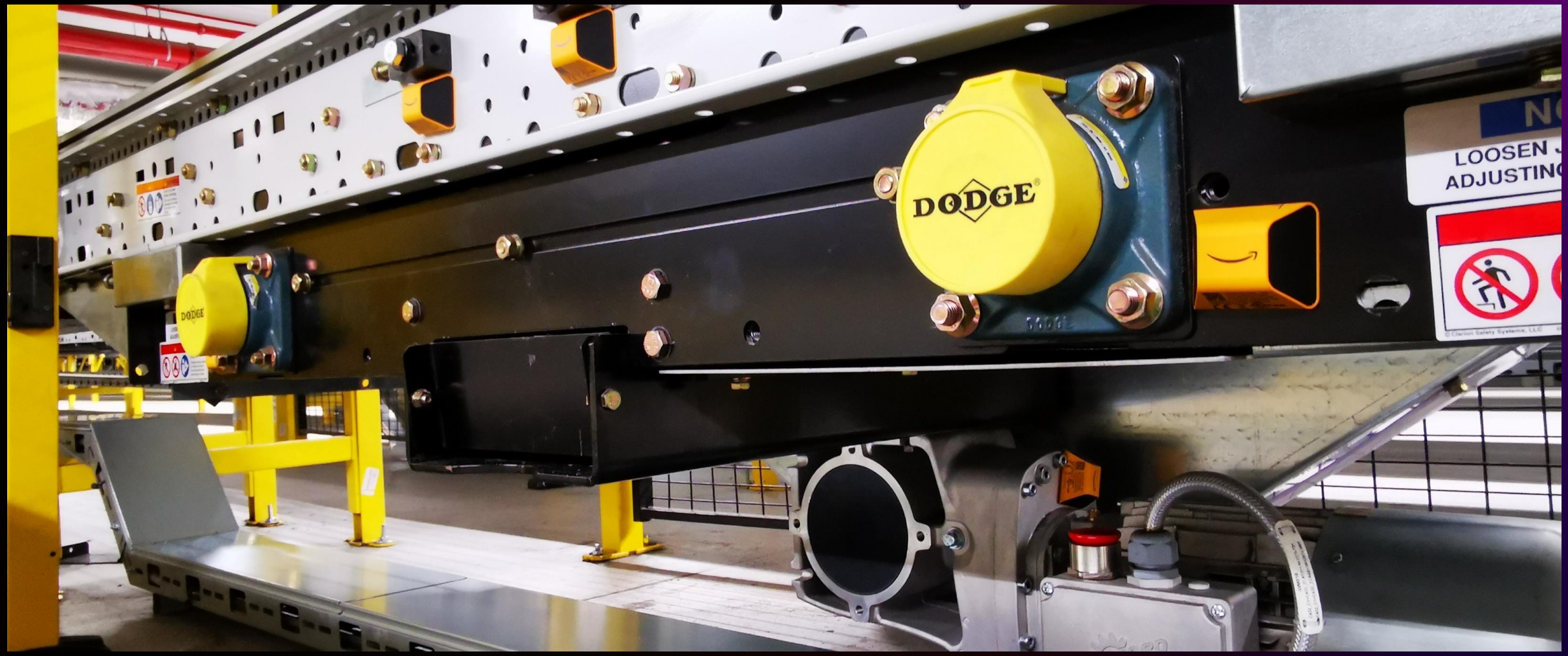




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Assembly installation

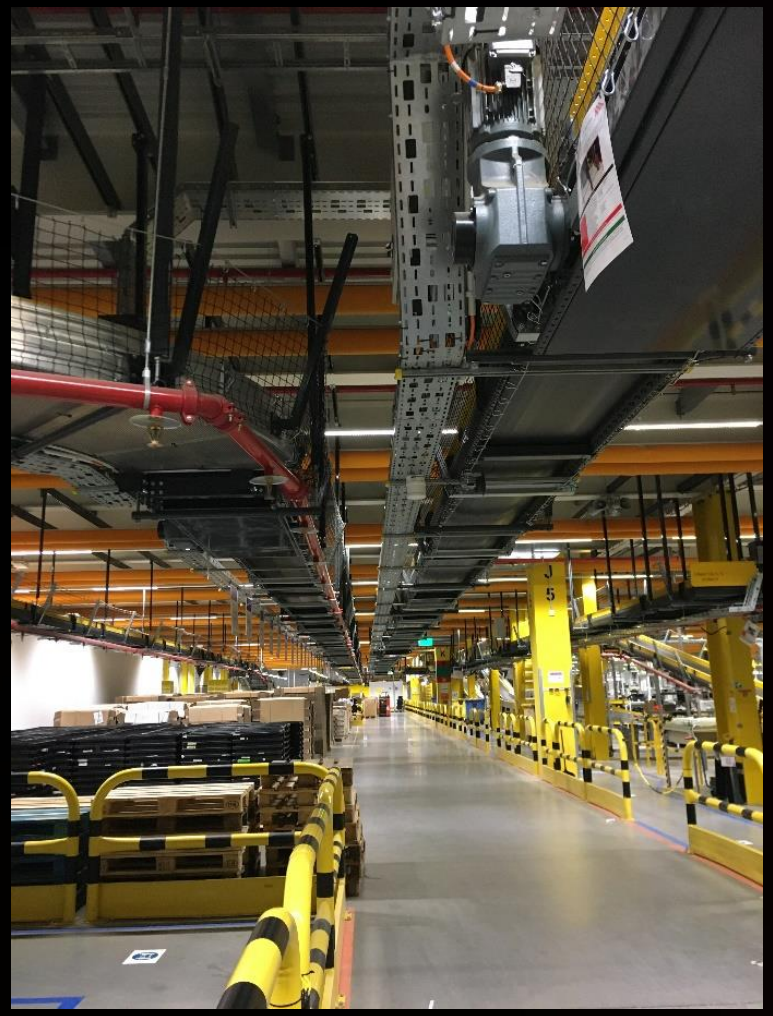


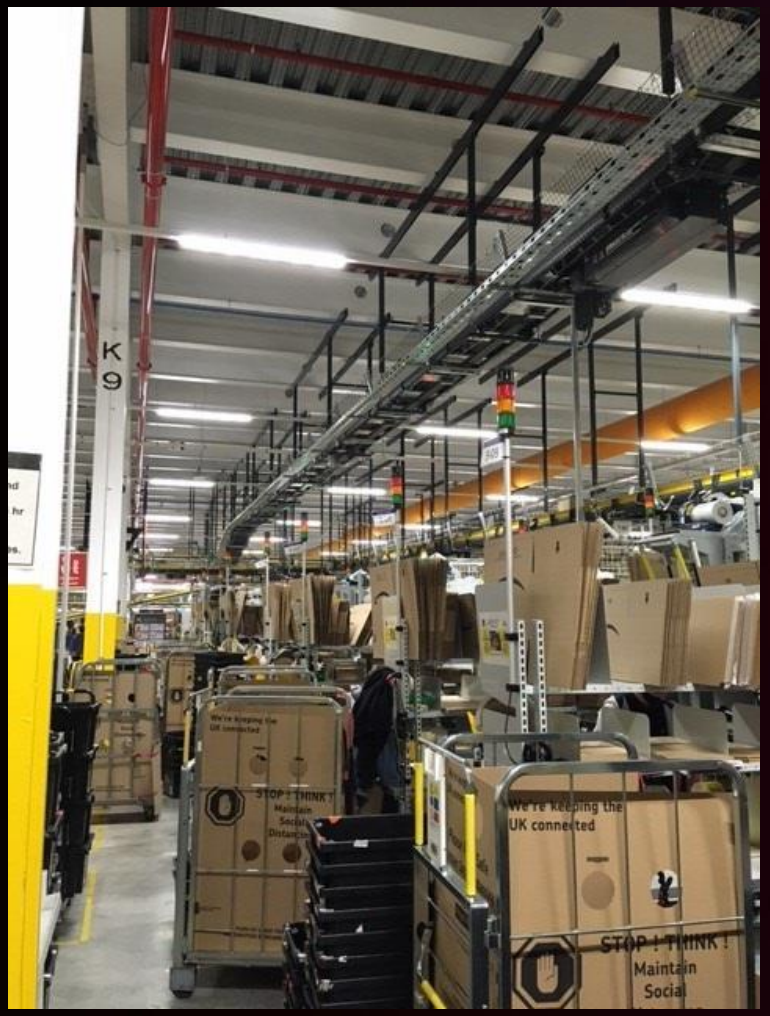
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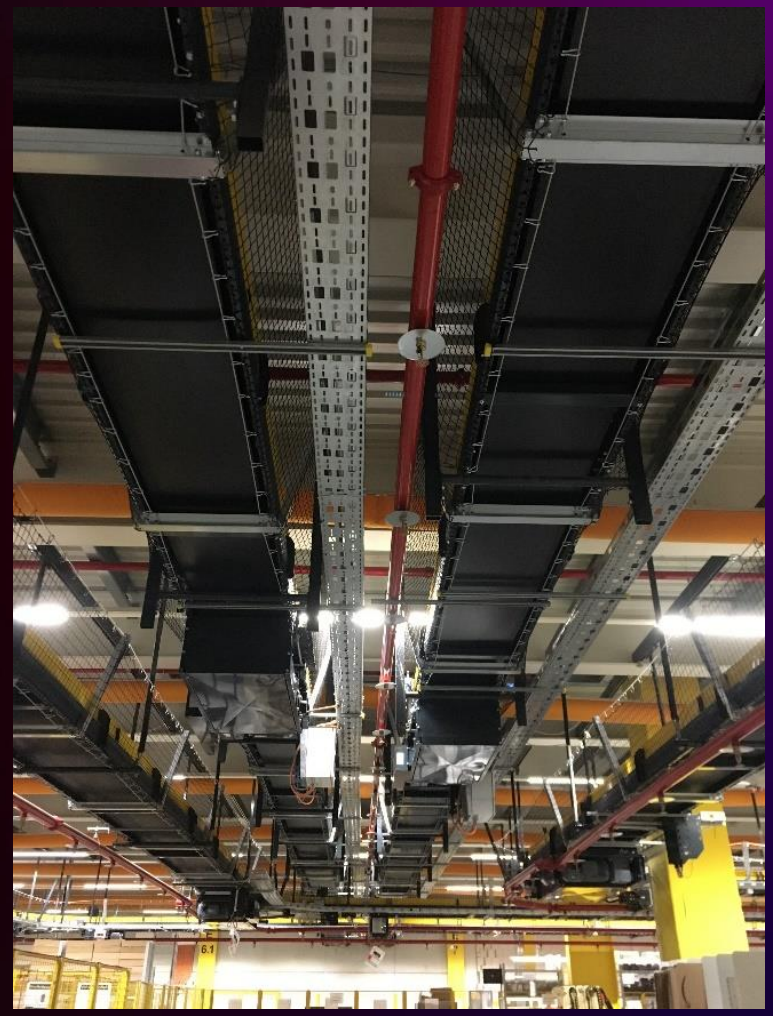
66% on critical L1
33% on critical L2

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Dangerous or hard-to-access equipment







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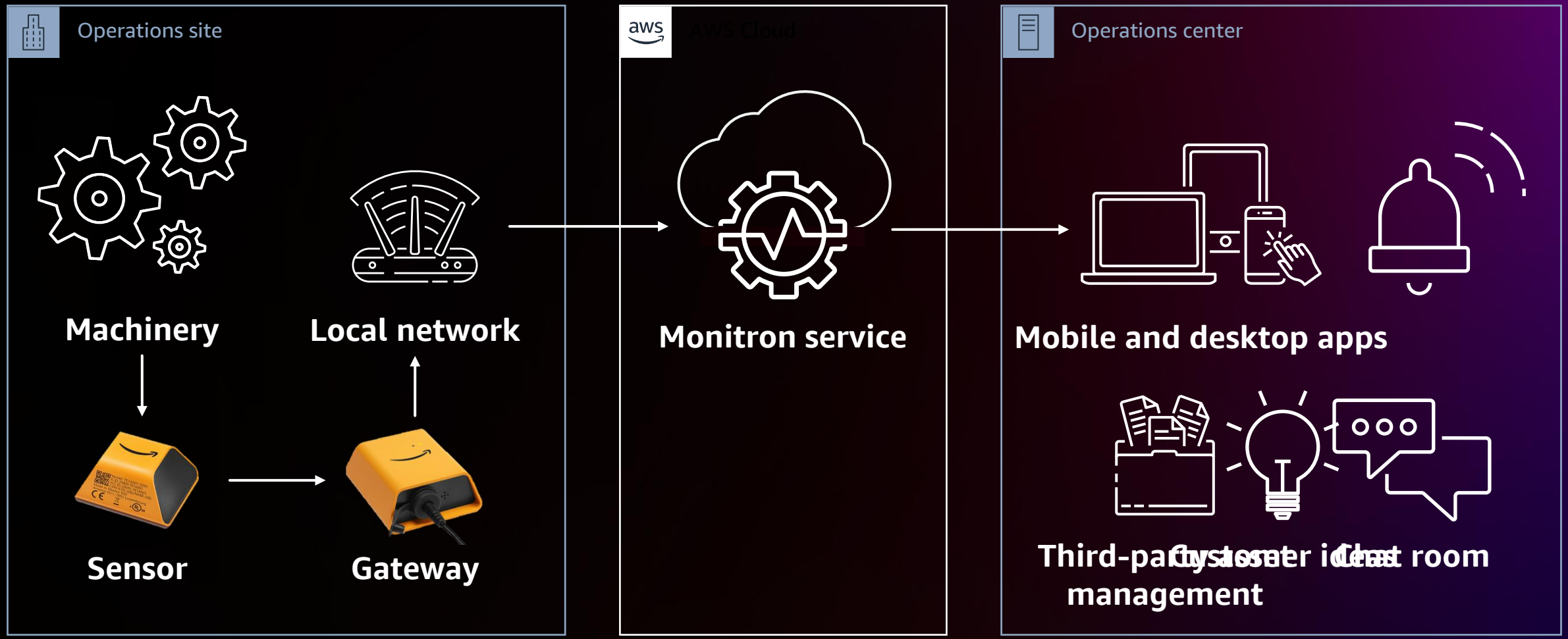
AWS building blocks





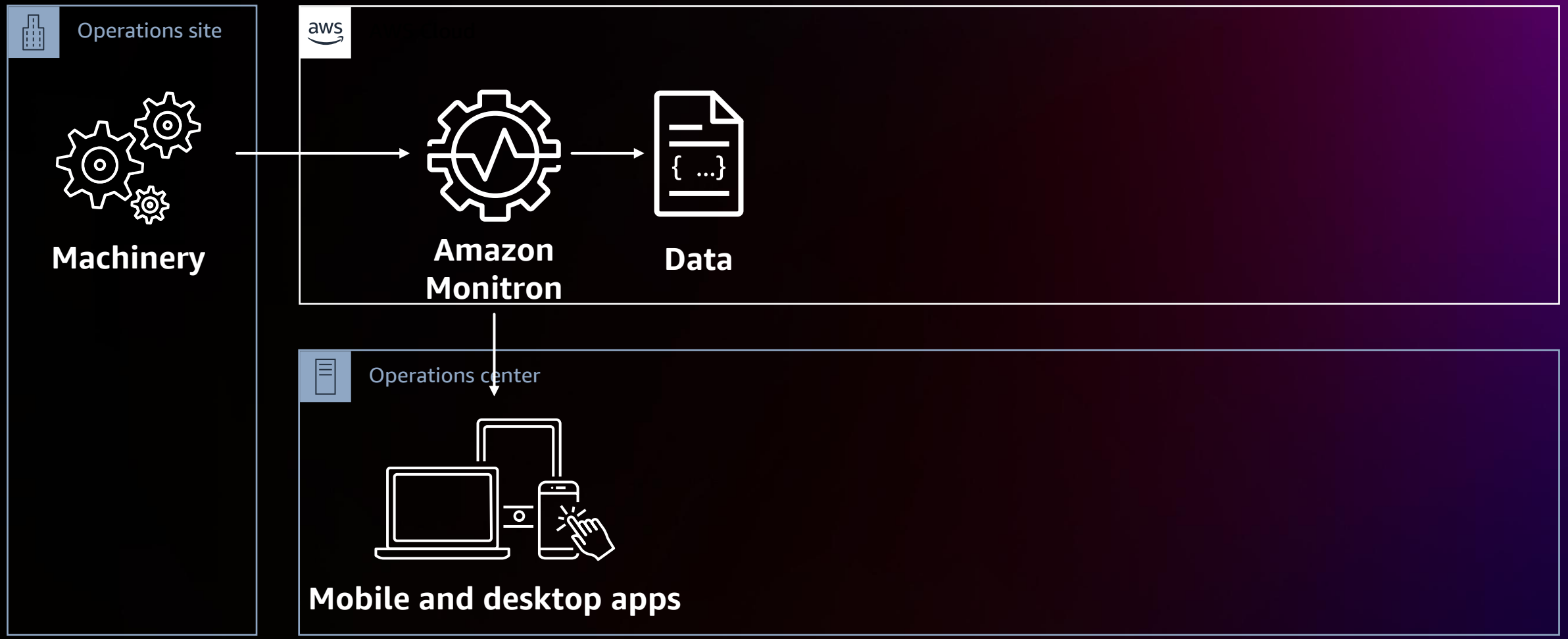
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Extended integration



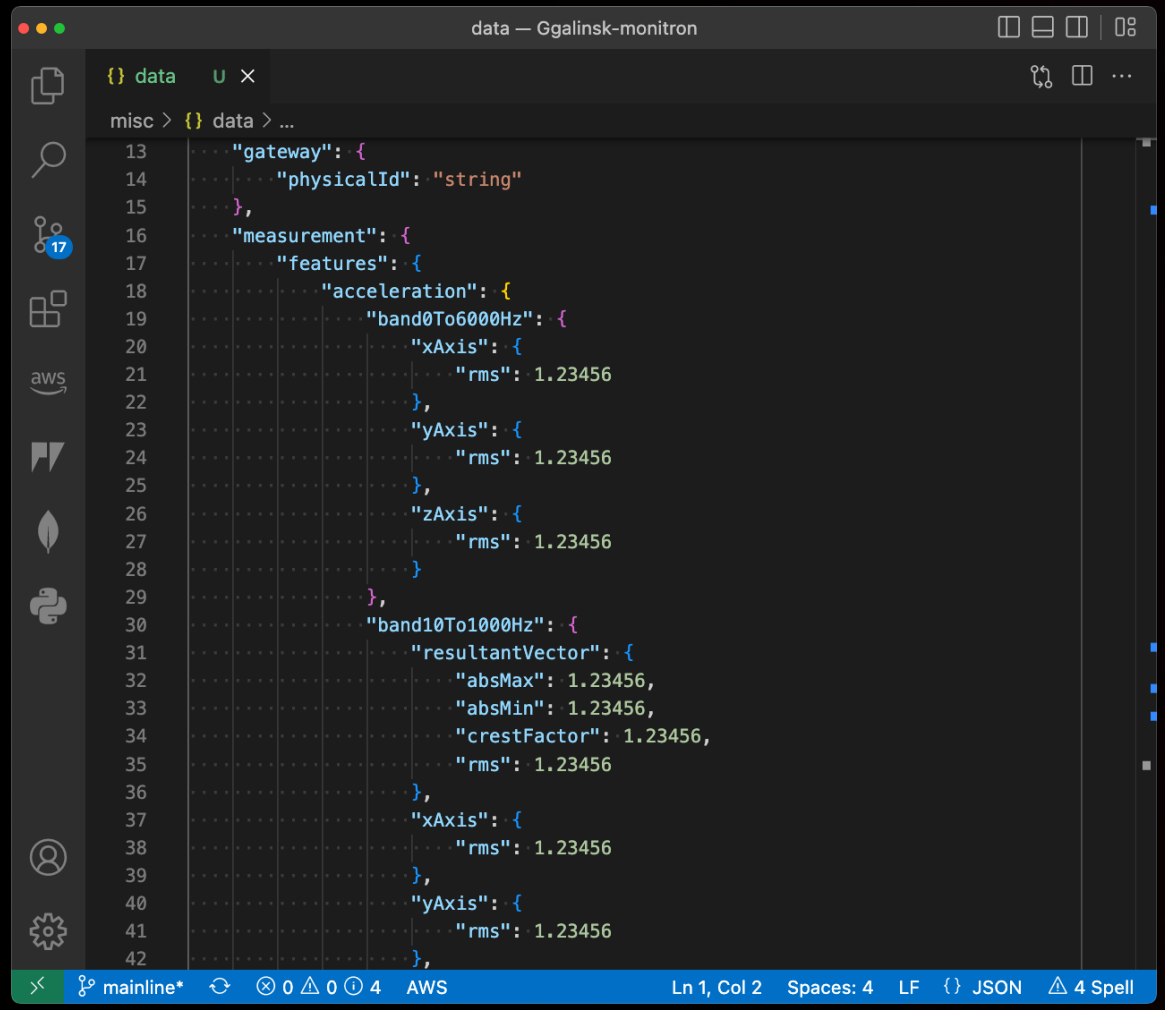
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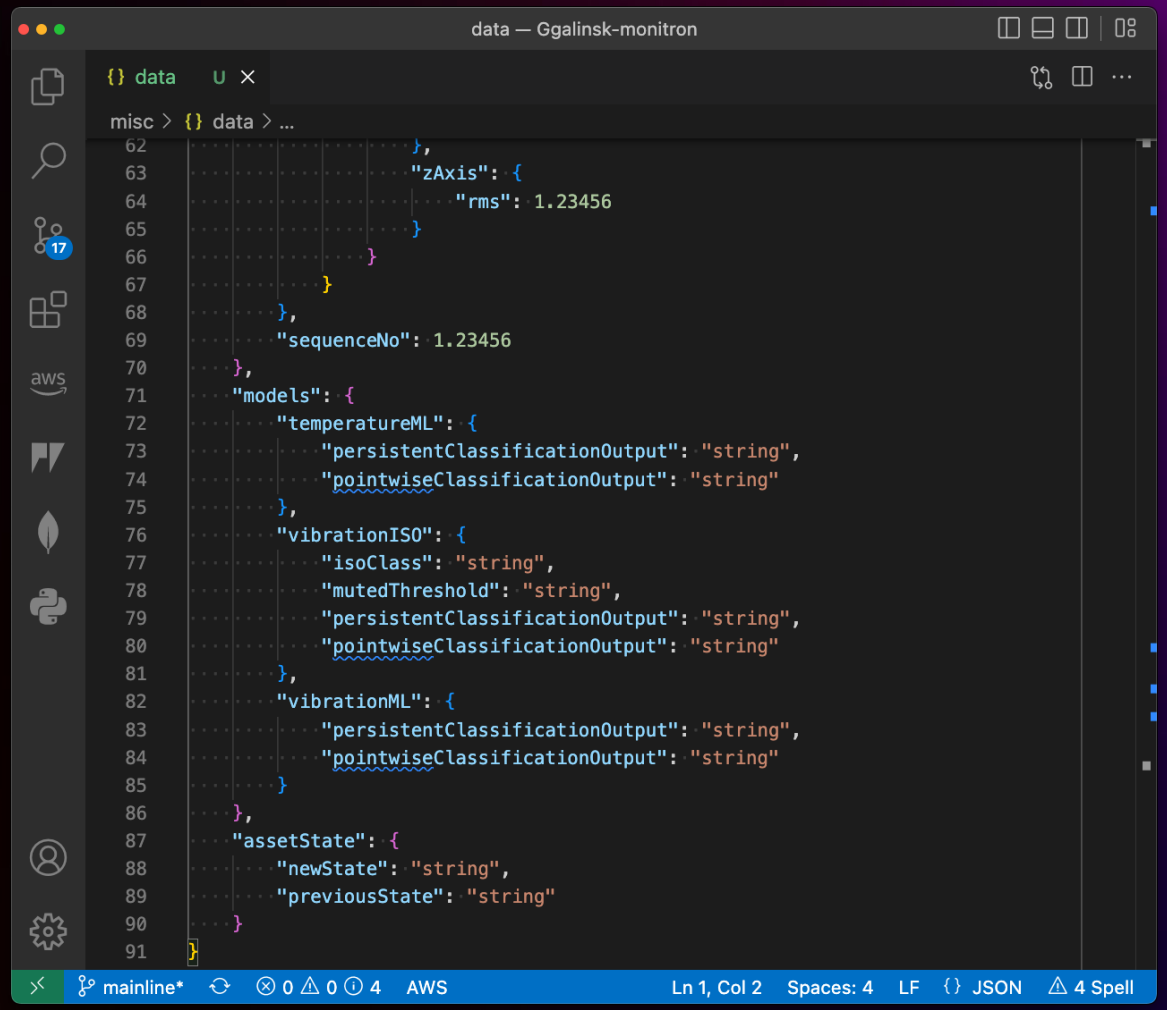
Event-driven, serverless solution



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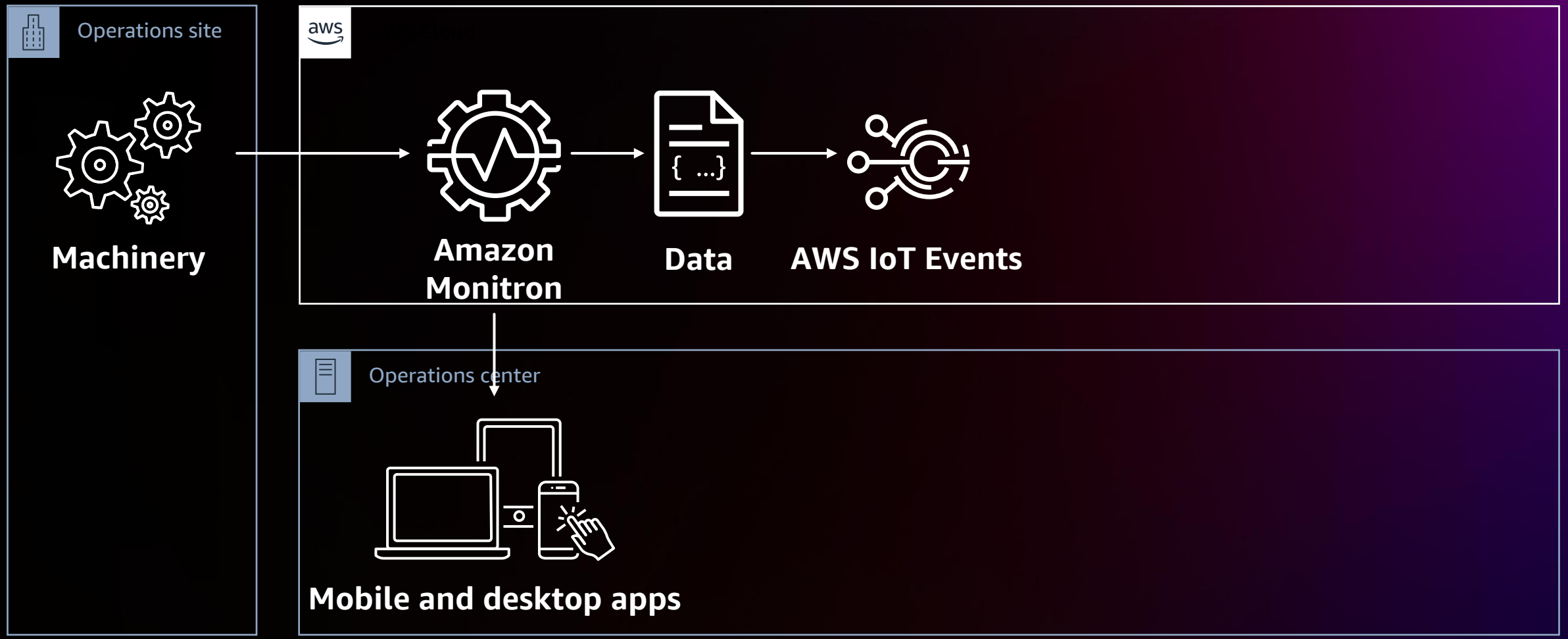
Data





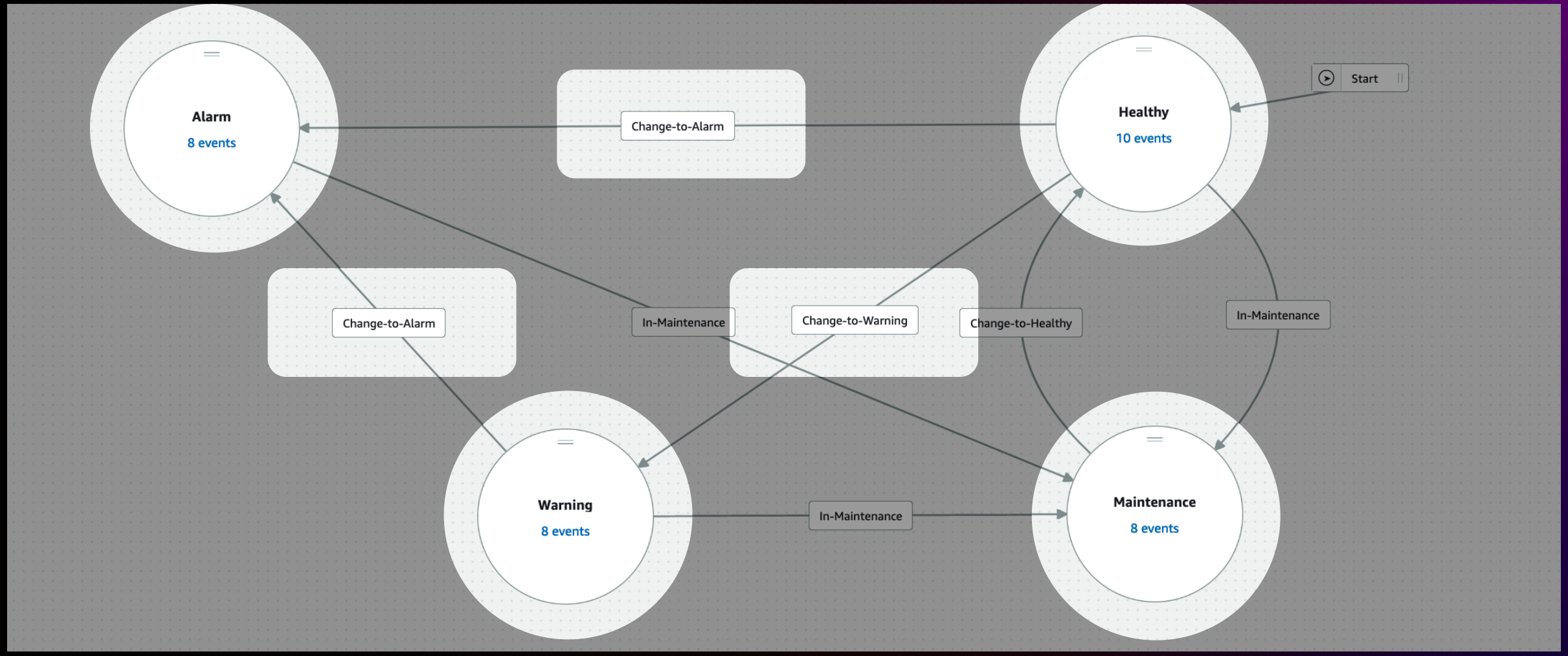
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Event-driven, serverless solution



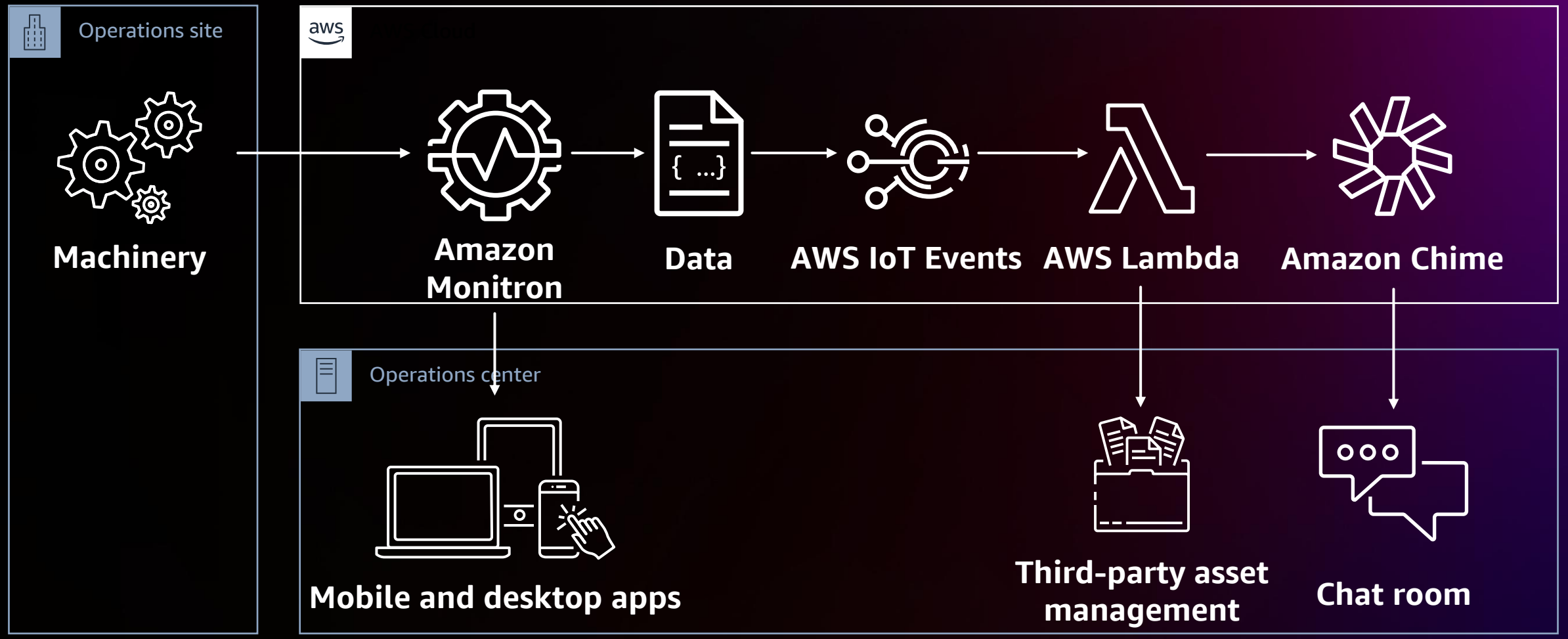
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AWS IoT Events state model



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Event-driven, serverless solution



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Chat room

In reply to message:

> RM: MONITRON - VIBRATION - ALARM
> Workorder: 1002327516
> Name: AFE3.0.1.MRG.M.LN.1091.81.3.M3
> Position: DriveRoller
> SensorId: cbd1e99a8fc9
> Trigger: ISO
> Timestamp: 2022-07-08T10:06:17.291Z

Investigated, finger guard fouling 3x belts. Have reported to shift senior and will be dealt with at next break

Monitron Webhook
RM: MONITRON SITE SENSOR HEALTH
Site:
Sensors (total): 862
Sensors (offline): 225
Gateways (total): 16
Gateways (offline): f4aa27eb381a, f02ef445637e, f09a15a89274, d0b3e565620a, f17d8780-faf3, d146028bd868, d8338e0e39b0, cd3eaf25cdb4

That's a lot of gateways to go offline in one hit on Sunday. Did we see a power cut?

RM: MONITRON - VIBRATION - WARNING
Workorder: 1002259422
Name: AFE3.0.2.RTG.LN.2080.2.10
Position: FrontETU
SensorId: c3842f1d9ac8
Trigger: ML
Timestamp: 2022-07-04T18:30:07.052Z

In reply to message:

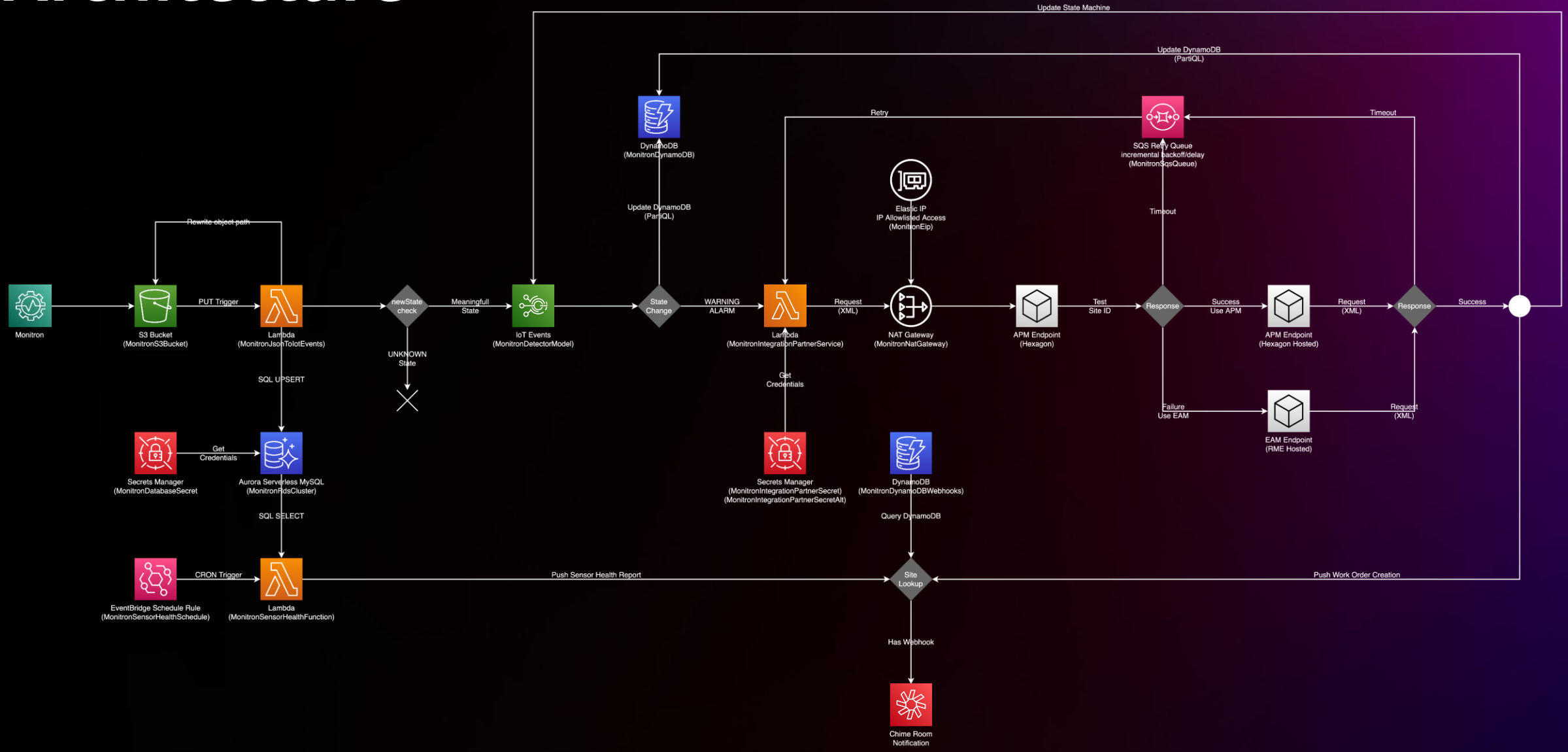
> RM: MONITRON - VIBRATION - WARNING
> Workorder: 1002259422
> Name: AFE3.0.2.RTG.LN.2080.2.10
> Position: FrontETU
> SensorId: c3842f1d9ac8
> Trigger: ML
> Timestamp: 2022-07-04T18:30:07.052Z

Tech investigating

Amazon Chime Room

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Architecture



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Architecture



Amazon
Monitron



AWS
IoT Events



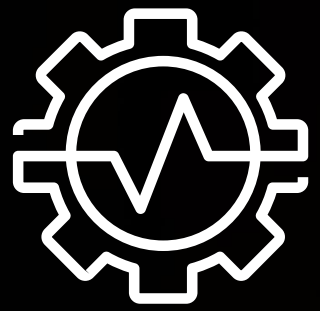
AWS
Lambda



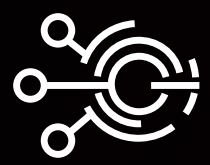
Amazon
Chime

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Event-driven, serverless solution



Amazon Monitron



AWS IoT Events



AWS Lambda



Amazon DynamoDB



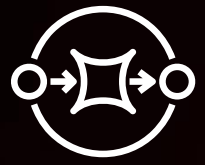
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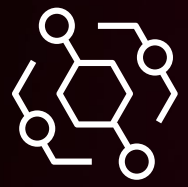
Amazon Kinesis



Amazon Chime



Amazon SQS



Amazon EventBridge



AWS Secrets Manager



Amazon S3

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Operational impact

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Increased frequency of measurements from every 4 or 12 weeks to hourly

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Reduced mechanical failures by 70%

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Track operational changes weeks in advance. Plan repair safely and without impact to operations.

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Amazon Monitron detected 4,800 potential failures, saving the business $20 million

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Lessons learned

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Everything fails all the time.
Need multiple maintenance strategies.

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Amazon Monitron is an early warning system allowing for the elimination of some manual, scheduled checks

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Easy to install and ready to scale to Amazon’s size

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Trusted by Amazon’s repair and maintenance engineering organization

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ROI of less than one year

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Questions?

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Thank you!



Please complete the session survey in the **mobile app**

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