Agenda

- Unplanned downtime and the maintenance maturity curve

- Amazon Monitron monitoring solution

- Amazon Lookout for Equipment Predictive Maintenance (PdM) applications

Typical cost of unplanned downtime

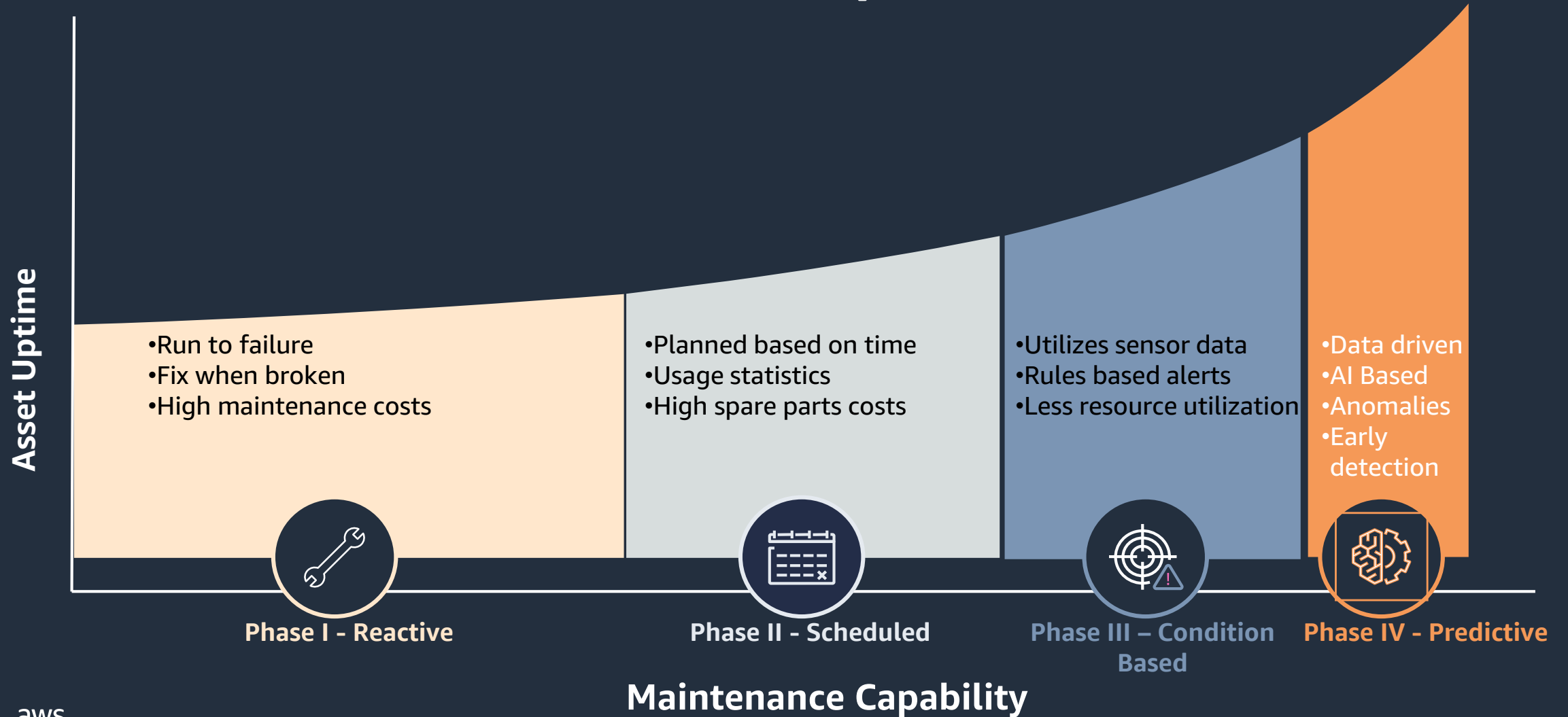**The cost of unplanned downtime is significant for all industry sectors:**

- Lost revenue
- Work-in-progress losses
- Safety concerns
- Environmental concerns

https://www.arcweb.com/industry-best-practices/trends-technologies-plm

**Automotive panel stamping
$43,000 per hour**

**CPG packaging
$15,000 per hour**

**Oil platform crude separation
$20 million per incident**

**Pharmaceutical batch
$500,000 per batch**

**Paper drying line
$31,000 per hour**

Predictive maintenance solutions can be difficult and costly to implement

Require installing expensive sensors
Building sensors can be an expensive and iterative process

Building infrastructure to capture and securely transfer the data
Setting up a more secure connectivity and data pipeline to the cloud can be a complex and undifferentiated task

Analyzing sensor data for potential failures
Developing an analytics backend requires sophisticated software development capabilities and data science skills
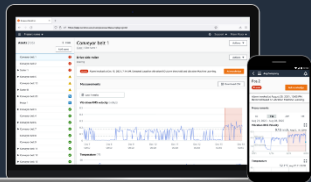
Amazon Monitron

REDUCE DOWNTIME WITH END-TO-END MACHINE MONITORING

Monitron sensors

Monitron gateway

Monitron app

End-to-end system—sensors, gateway device, and mobile or desktop app

Easily tracks and reviews developing faults

Enables predictive maintenance for machinery, including motors, pumps, bearings, and gearboxes

No development work or ML expertise required

Amazon Monitron system workflow

Site

Monitron gateway
Automatically transfers simulated sensor data to cloud

Bluetooth 5

Asset

Monitron sensor
Captures vibration and temperature data

Cloud

AWS Cloud
Analyzes sensor data using asset ISO standards and ML algorithms

Monitron app
Set up hardware and receive notifications on abnormal equipment condition

aws
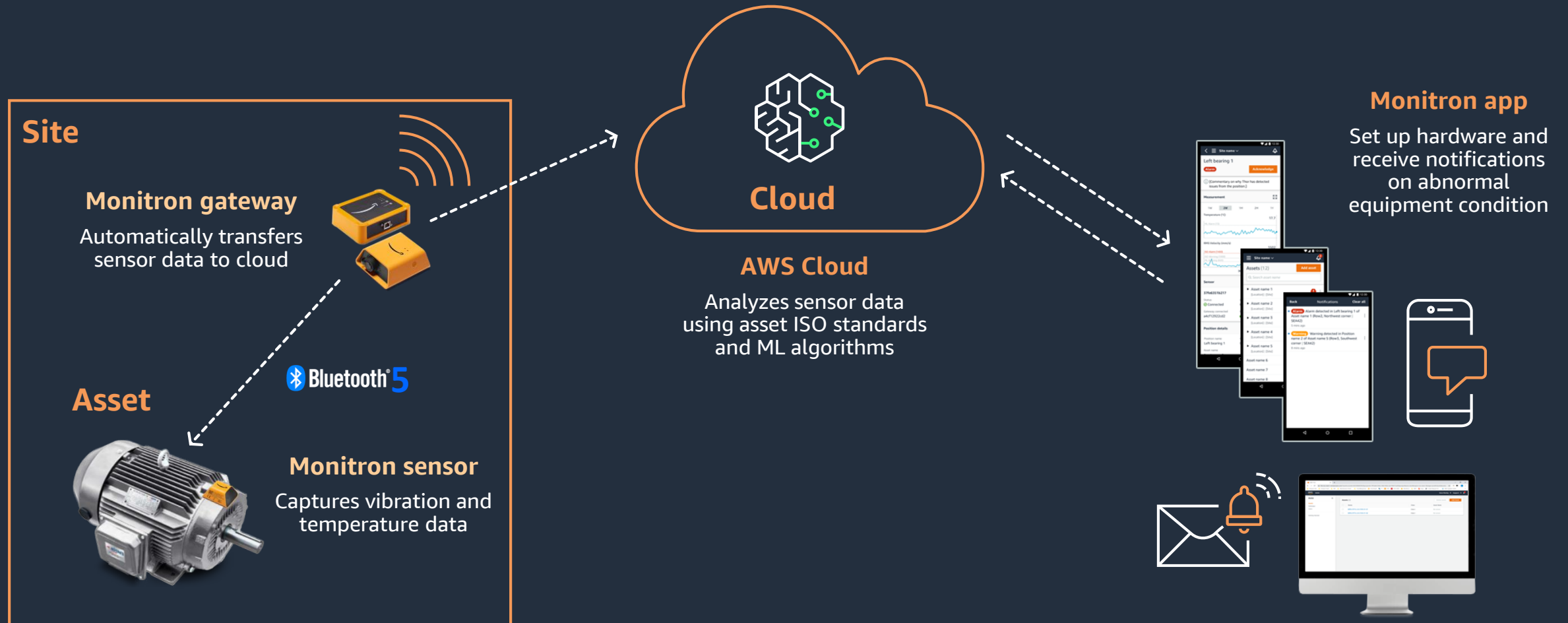
Monitron use case-Amazon fulfillment center

BUSINESS NEED

Amazon expects its fulfillment centers to meet customer promises for timely order delivery. Packages at fulfillment centers daily traverse miles of conveyor and sorter systems, so it's crucial for the miles of conveyor and sorting systems to operate reliably.

SOLUTION

Amazon Customer Fulfillment reduced unplanned equipment downtime hours significantly using Amazon Monitron and can better fulfill customer orders on time.

SCALE

- 33 fulfillment centers
- 25,000 sensors
- 700 gateways
- 9,000 assets

IMPACT

- 69% reduction in unplanned equipment downtime hours
- Increased staff productivity
- $22.75 million saved by avoiding unplanned downtime, lost production hours, and late shipment costs
- Achieved return on investment in under 1 year

amazon

"

Using Amazon Monitron, technicians go from being reactive to proactive. You're no longer waiting for something to break down. You're already there planning and working on it

Luke Grice-Lowe
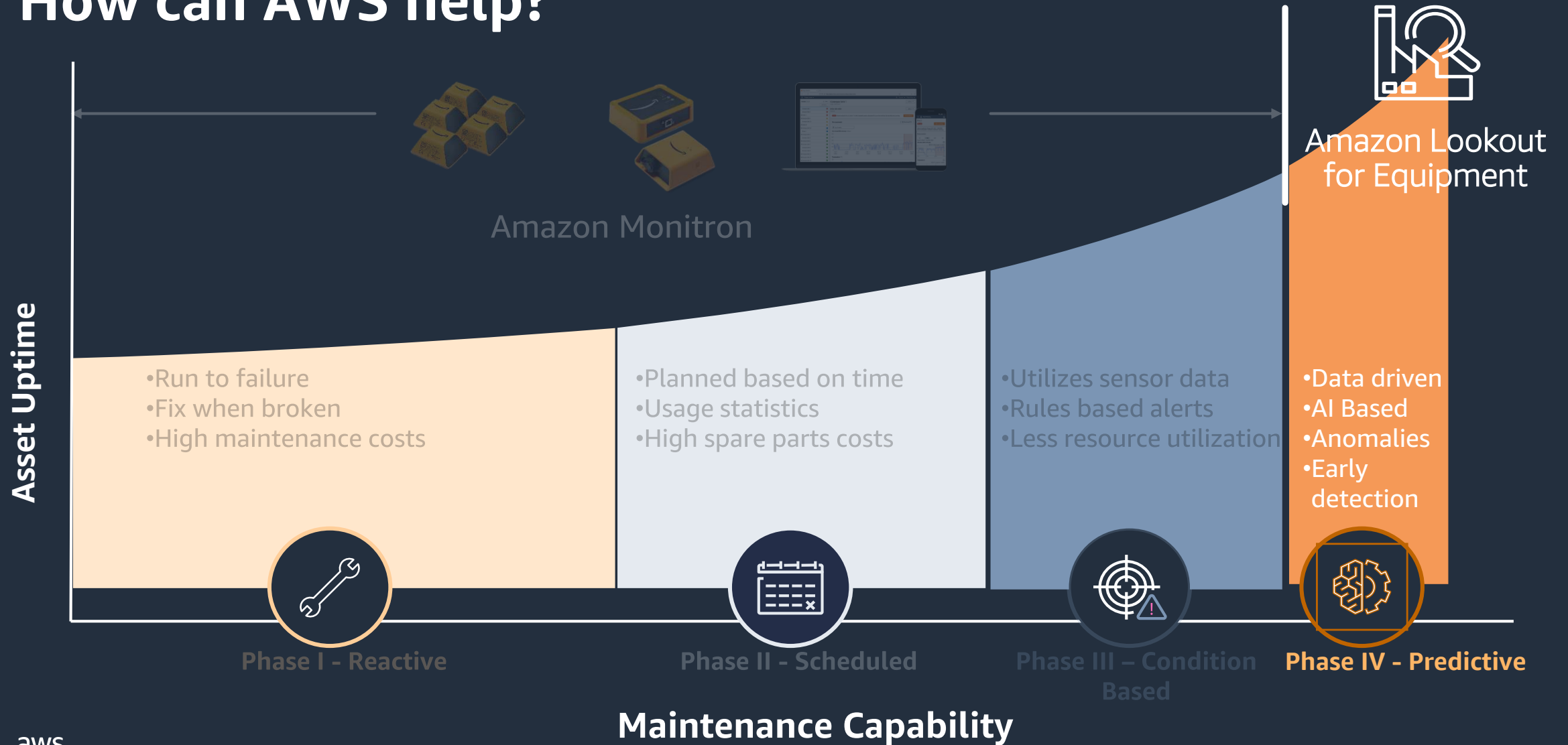Reliability Engineer,
Amazon Customer Fulfillment

"

https://www.youtube.com/watch?v=0XRjuX7WRt0

aws

--AI INDUSTRIAL SERVICES--

How can AWS help?

Amazon Lookout for Equipment

Amazon Monitron

Asset Uptime

- Run to failure
- Fix when broken
- High maintenance costs

- Planned based on time
- Usage statistics
- High spare parts costs

- Utilizes sensor data
- Rules based alerts
- Less resource utilization

- Data driven
- AI Based
- Anomalies
- Early detection

Phase I - Reactive

Phase II - Scheduled

Phase III – Condition Based

Phase IV - Predictive

Maintenance Capability

Implementing Predictive Maintenance is difficult

Every asset is unique

Operating environment

Age/model/manufacturer

No. of and type of sensors (tags)

Maintenance history

Changes over its lifecycle

Downtime events are rare

Failures are rare events

Labeled failures can be subjective

Num. of and type of sensors (tags)

One asset can have many failure modes
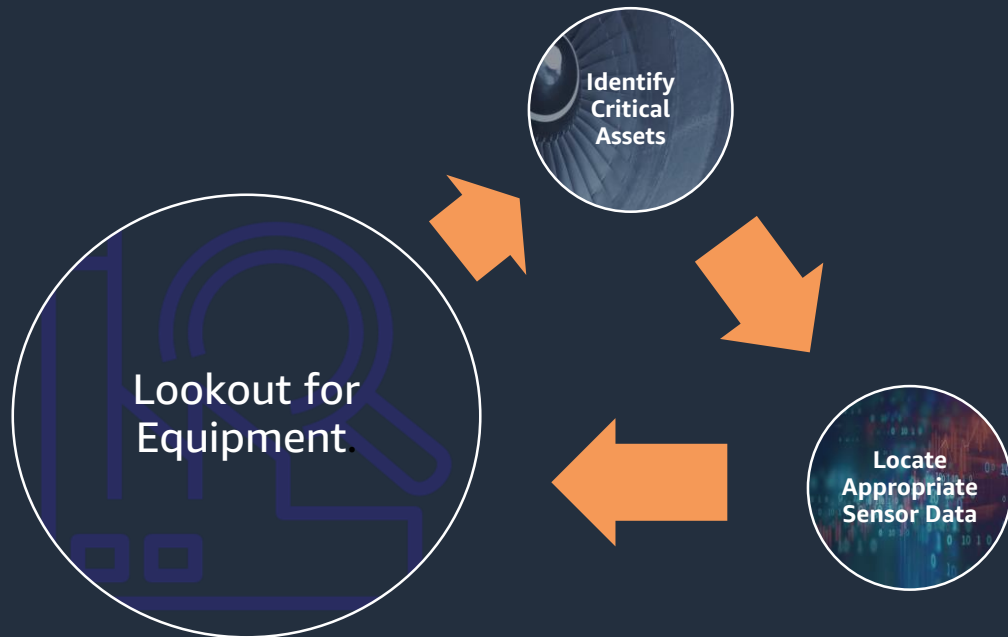
Some failures have no symptoms

Traditional AI/ML workflow is *very* time consuming

Identify Critical Assets

Locate Appropriate Sensor Data

Retrain Models to Improve Accuracy, Data Drift, etc

Monitor

Develop Deployment Pipelines, Test in Production

Algorithm Selection, Hyper Parameter Tuning, Model Training

Ingest, Cleanse & Prepare Data

Handoff to Data Scientist

It is estimated between 45-80% of Data Scientists time is spent in Ingesting, Cleansing, & Preparing Data
*Anaconda 2020 survey and others

Lookout for Equipment

Accelerate time to value with automated machine learning

Lookout for Equipment

Increases execution speed from months to hours

Identify Critical Assets

Lookout for Equipment

Locate Appropriate Sensor Data

Scales Across the Enterprise
Lookout for Equipment specifically developed to quickly scale from 1 to 1000 assets.

Built for industrial and continuous operating equipment
Lookout for Equipment specifically developed for industrial assets such as turbines, motors, pumps, heat exchangers.

Asset agnostic, relevant from day 1 to year 30
Lookout for Equipment learns normal behavior regardless of the manufacturer, age, or application through current operating data

**Automated machine learning workflow**
Operationalize machine learning by reducing touch point, touch time, and total cost of ownership of managing ML. No data science required.

How Amazon Lookout for Equipment Works

Take in up to 300 sensors on an asset

Lookout for Equipment trains, builds, and deploys an asset specific model

Data comes out structured for actionable and relevant alerts

Sensor
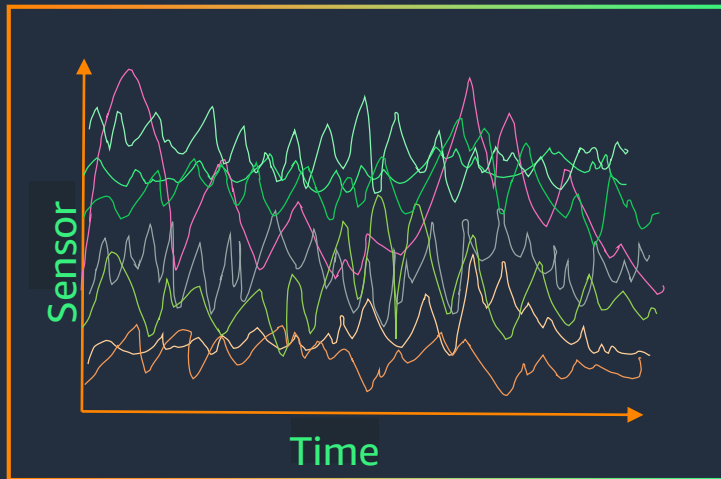
Time

Amazon Lookout for Equipment

Automatically detect abnormal machine behavior

Abnormal

Normal

TIME

Sensor 4
Sensor 8
Sensor 1
Sensor 11
Sensor 3

Toyota Motor North America Develops Predictive Maintenance Solution to Improve Assets Availability

BUSINESS NEED

- With more than 200 CNC machines per site running 24/7 preventive maintenance is time consuming and costly.
- Maintenance team have difficulty to identify high priority tasks and plan work.
- The amount of data to analyze and required skills to implement predictive maintenance are too high for average maintenance engineer.

SOLUTION

- AWS Professional Services with Toyota co-developed a Predictive Maintenance solution capable to predict failures days in advance reducing unplanned downtime and shifting unplanned work into planned work.
- The solution was implemented with AWS IoT SiteWise and Amazon Lookout for Equipment as core managed services, drastically reducing data processing infrastructure and data scientist skills required.
- With Infosys as a partner, a Single Pane of Glass application was developed to customize user experience.

IMPACT

- 16 incidents and more than 20 hours of downtime were prevented in the first 4 months of operations (~$80K in cost saving).
- Operational Availability in focus line improved 10% compared with previous 12 months average.
- Solution scaled to 300+ assets across TMMK Powertrain and TMNA selected the solution for the region, improving data-driven decision making, infrastructure and data standardization and reducing cost of operations.
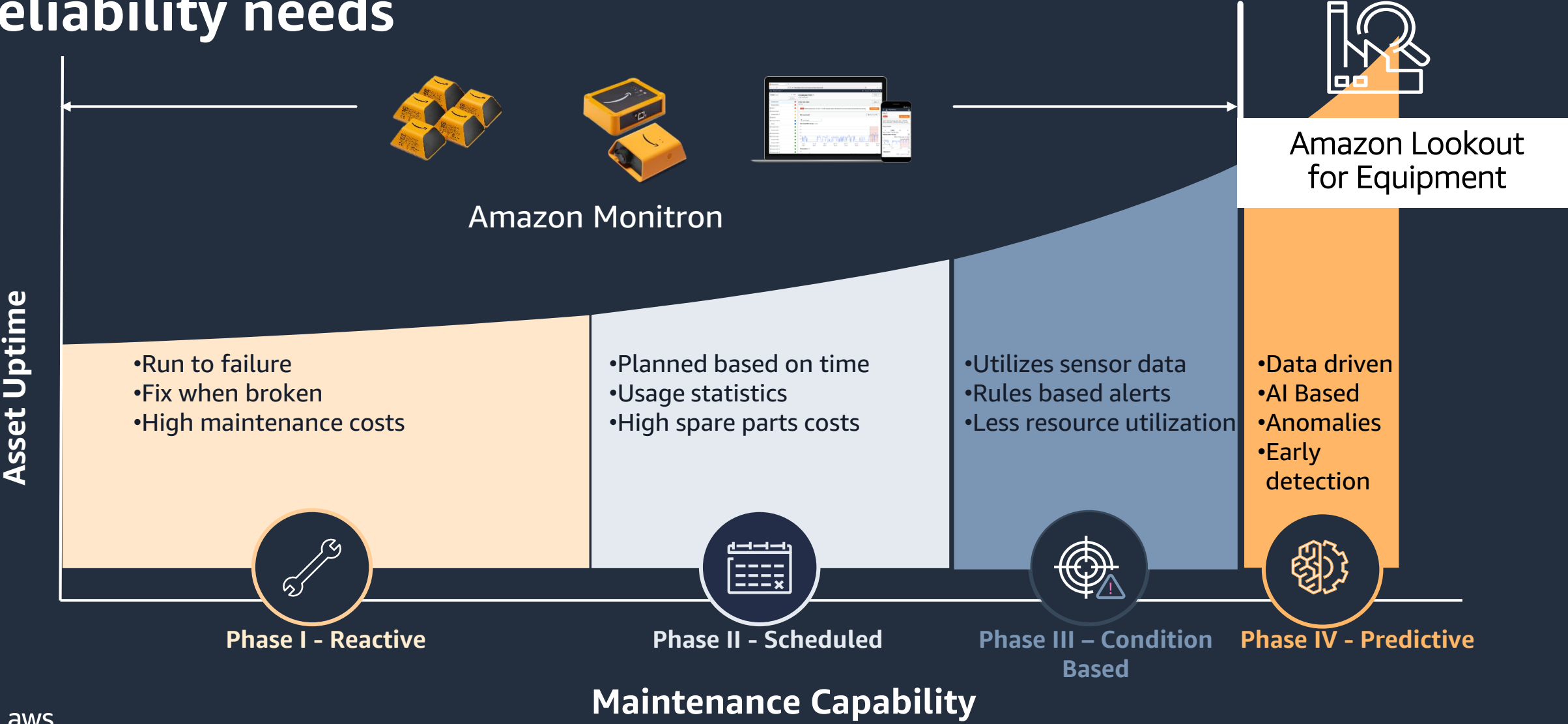
TOYOTA

"Before implementing the Predictive Maintenance solution with AWS Professional Services, the Operation Availability of our focus line was between 78%-82%, meaning we would incur around 40 hours of downtime each month. With the help of AWS Professional Services, we have found many problems in our machines, if left unnoticed would lead to critical failure. Now our OA last month is 92%, meaning the downtime hours is now around 20 hours!"

Braden Burford, Sr. Maintenance Engineer

AWS AI Industrial Services support your reliability needs

Amazon Monitron

Amazon Lookout for Equipment

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Maintenance Capability

Get started with AWS Predictive Maintenance Solutions

Amazon Monitron Starter Kit
(5 Sensors, 1 Gateway)

US, UK, Germany, France, Spain, Italy, Canada

Amazon Lookout for Equipment

Try Lookout for Equipment for 1 month free with the AWS Free Tier

aws

Thank you!

Julia Hu

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