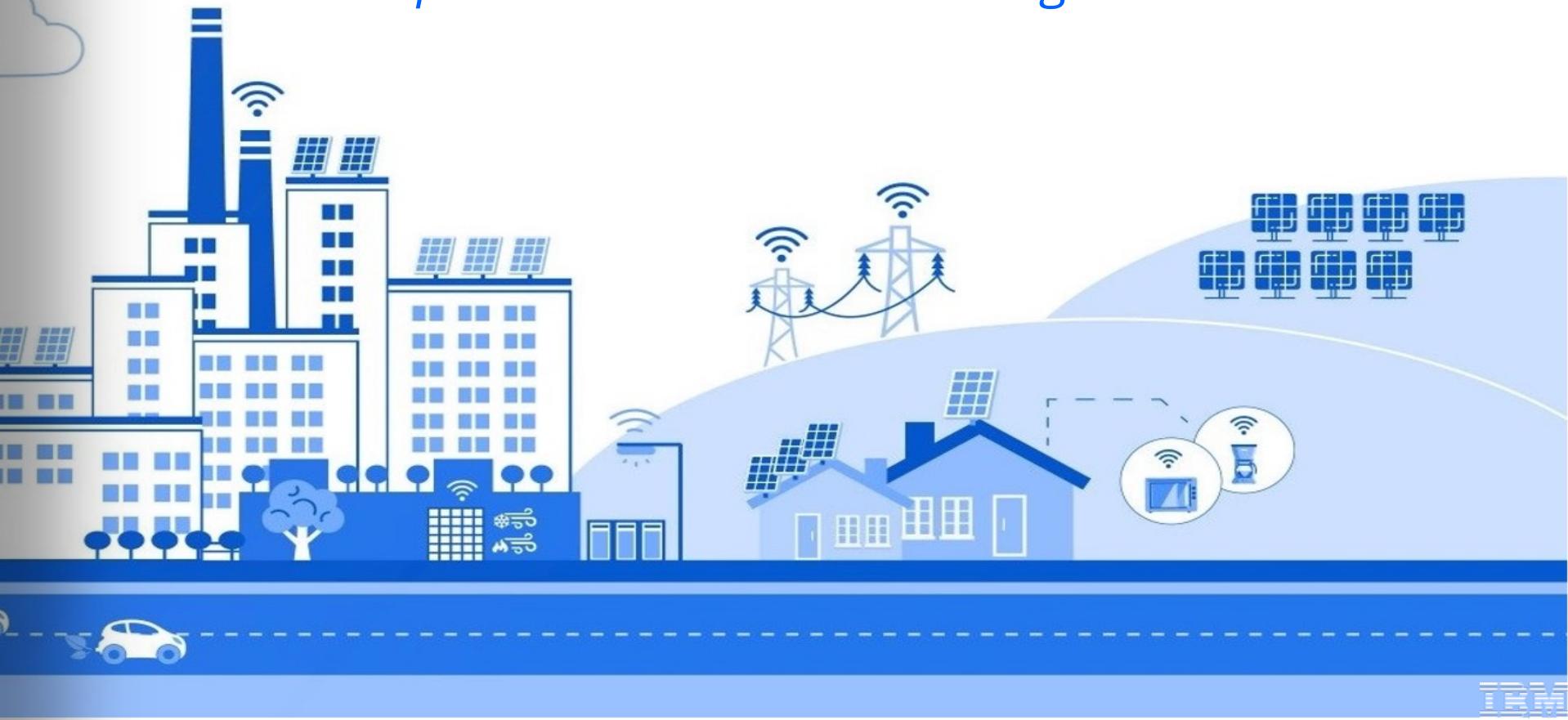


Maximo Monitor

Enterprise Scale Asset Monitoring



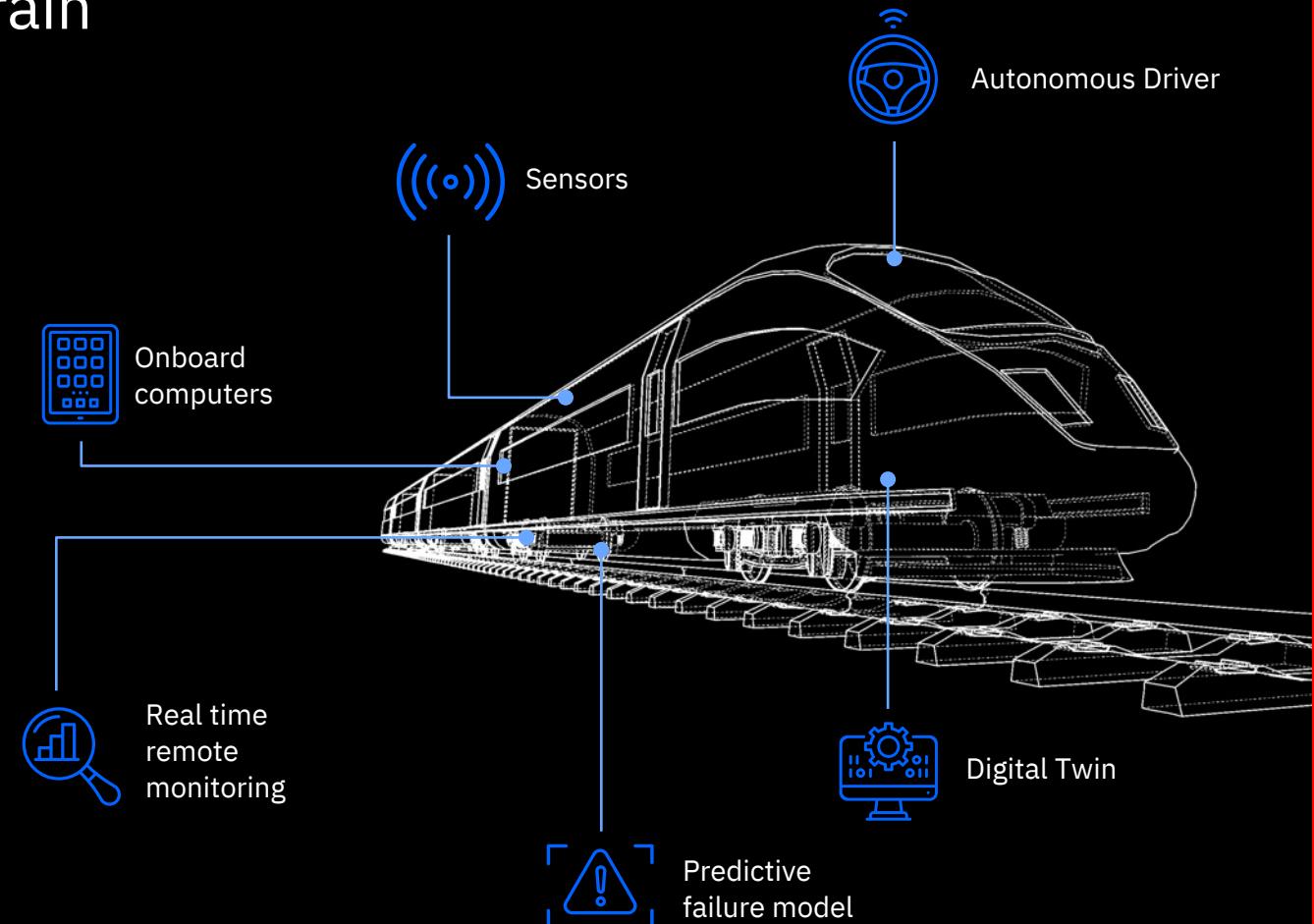
The Modernized Train (example)

15%-50%

Reduced Operational Cost

10%-20%

Increased Up time
& Availability



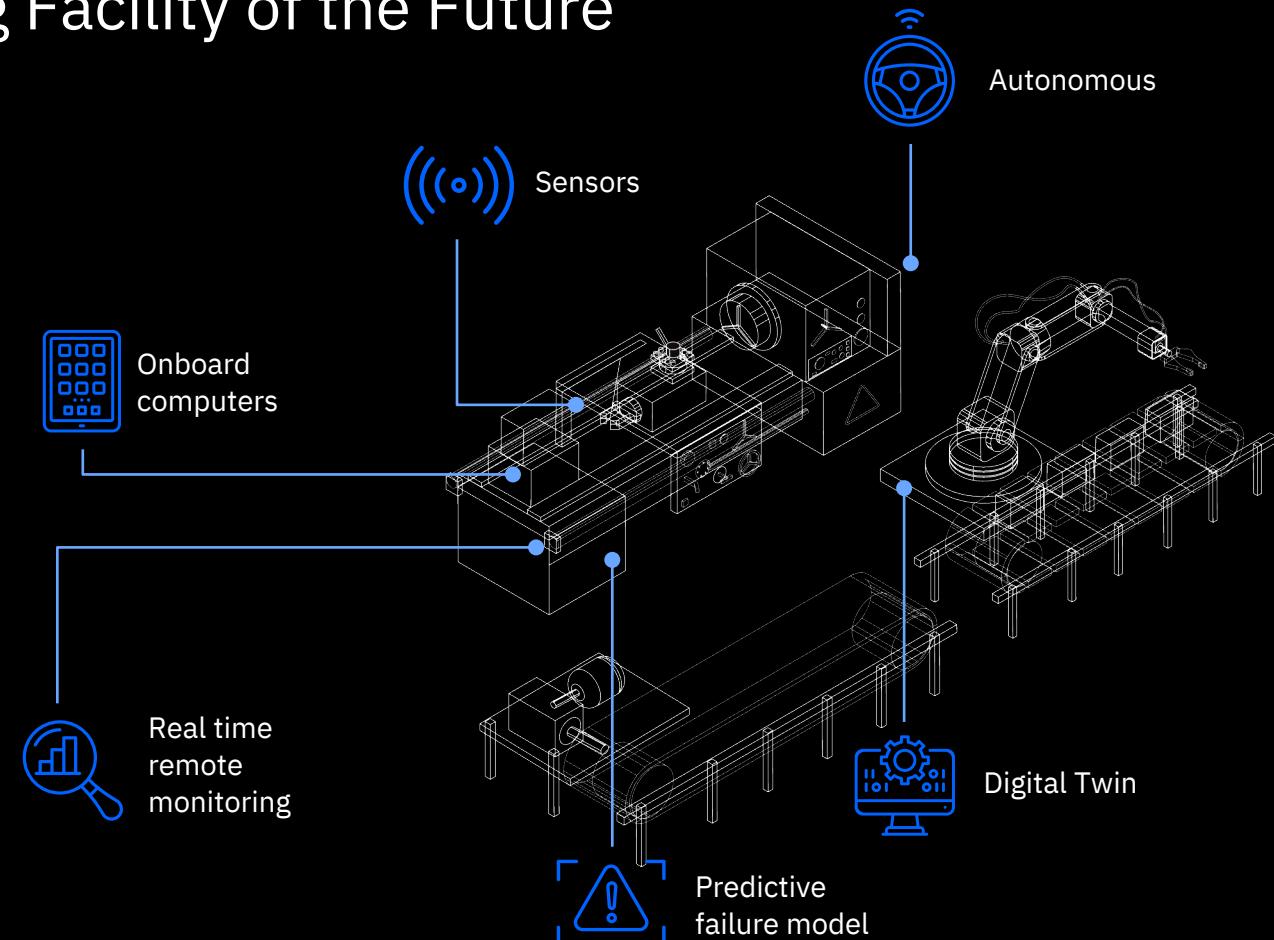
The Manufacturing Facility of the Future (example)

15%-50%

Reduced Operational Cost

10%-20%

Increased Up time
& Availability



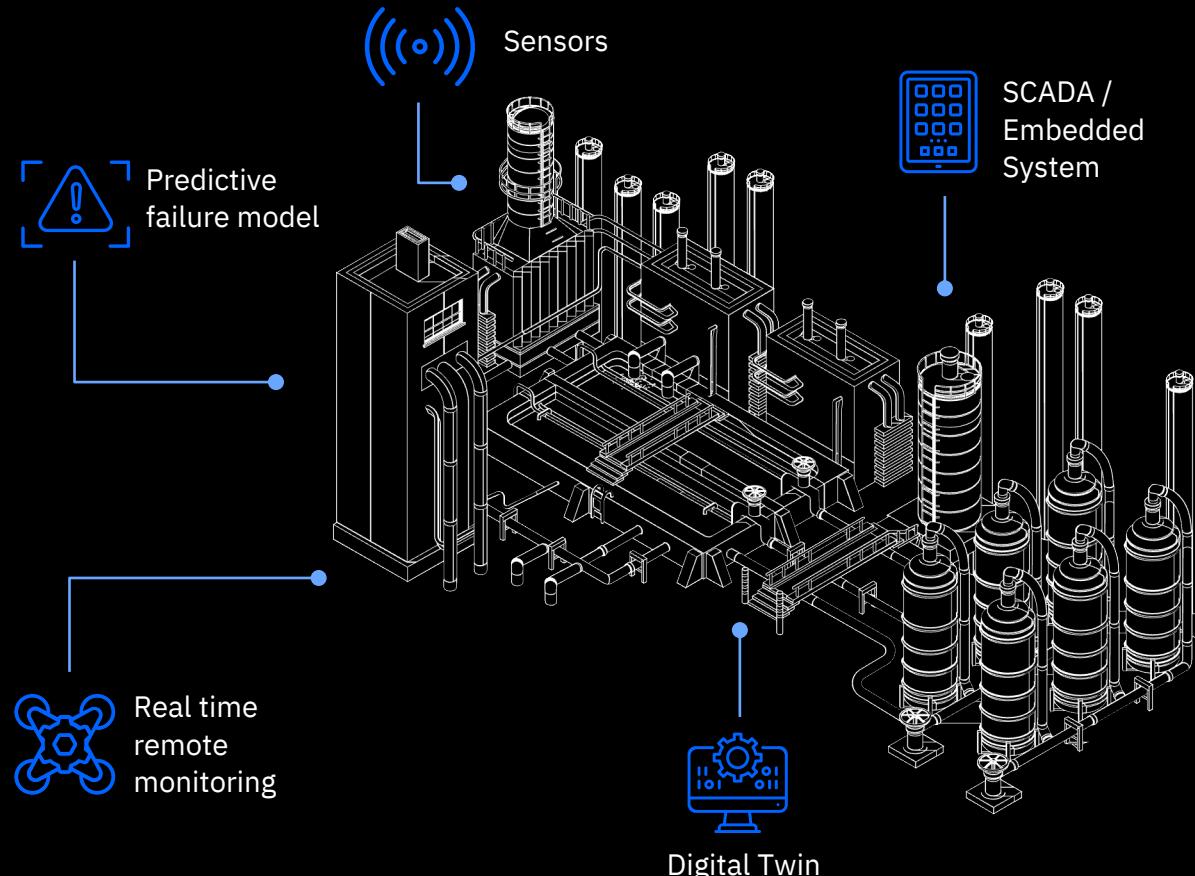
The Chemical Facility of the Future (example)

15%-25%

Reduced Operational Cost

5%-10%

Increased Up time
& Availability



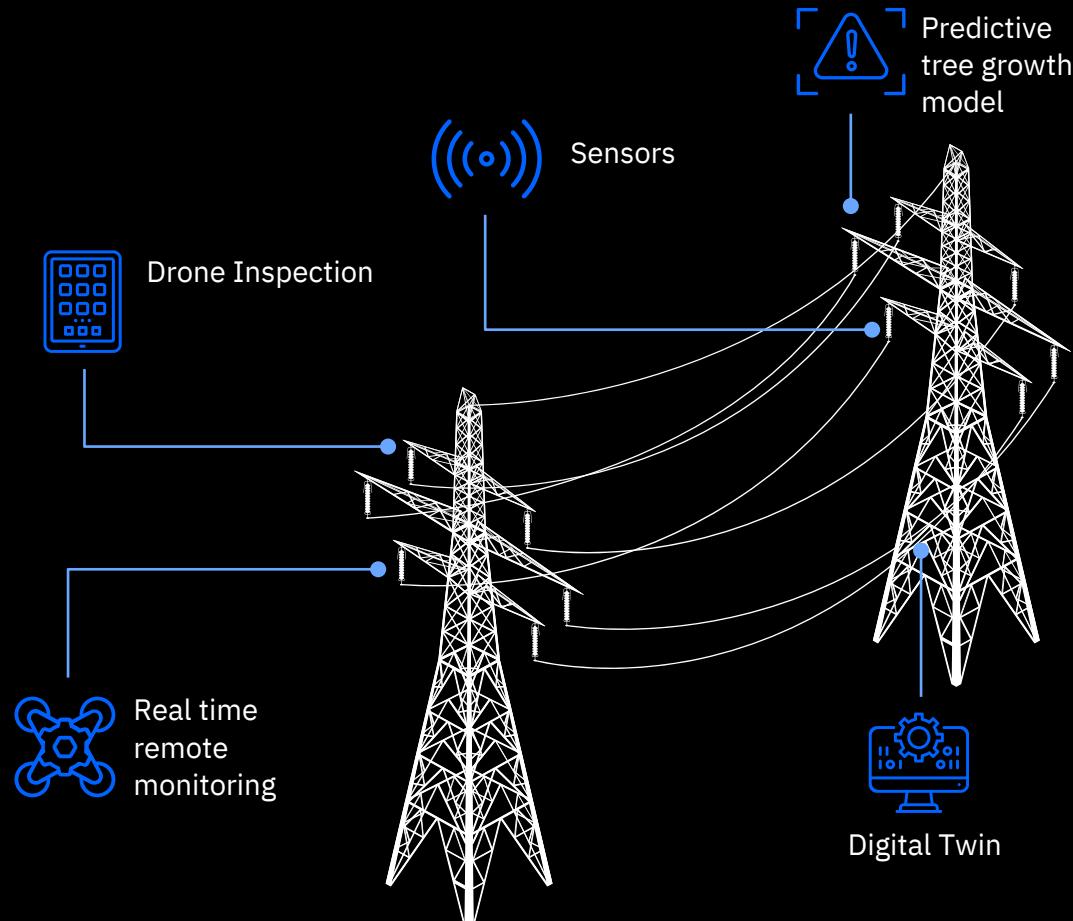
The Utility of the Future – T&D (example)

15%-25%

Reduced Operational Cost

5%-10%

Increased Up time
& Availability



SCADA/MES systems have been in place for years... so what is different now?



Connectivity is becoming ubiquitous allowing for enterprise-wide remote monitoring



Cloud computing & big data allow massive amounts of data to be aggregated



Cost and power consumption of IoT sensors are significantly reduced



IoT platforms offer increased standardization, openness, and scalability



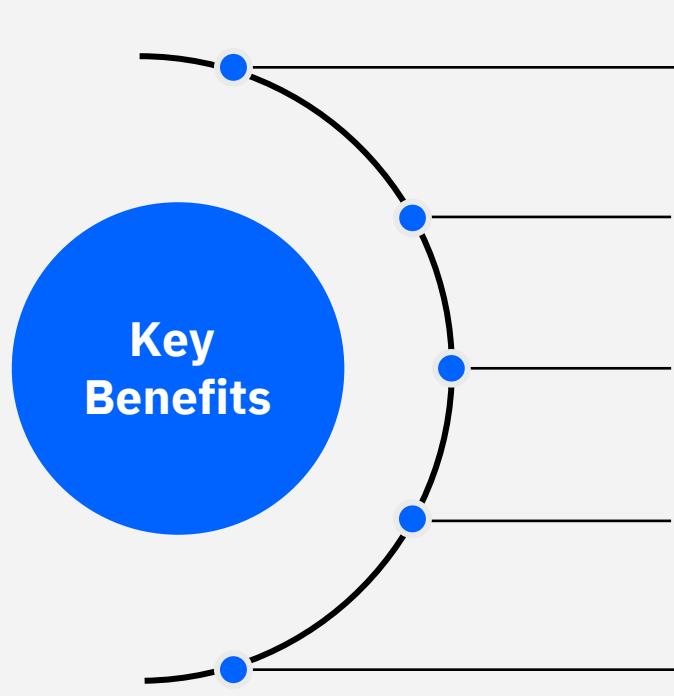
More data is available about processes/equipment and operating context



Proven AI technology and tools exists to cleanse and transform data into actionable insights

Key Benefits of IBM Maximo Monitor

Monitoring solution that enables real-time visibility, root-cause troubleshooting, and AI driven alerts at scale



Connecting the Enterprise

Data integration from multiple sources of data about operating state.



Operate at Scale

Ability to scale and visualize operations across enterprise through single dashboard.



AI-Powered Anomaly Detection *(at scale)*

Advanced analytics and AI that can quickly detect issues and leverage data from operating history.



Root Cause Analytics

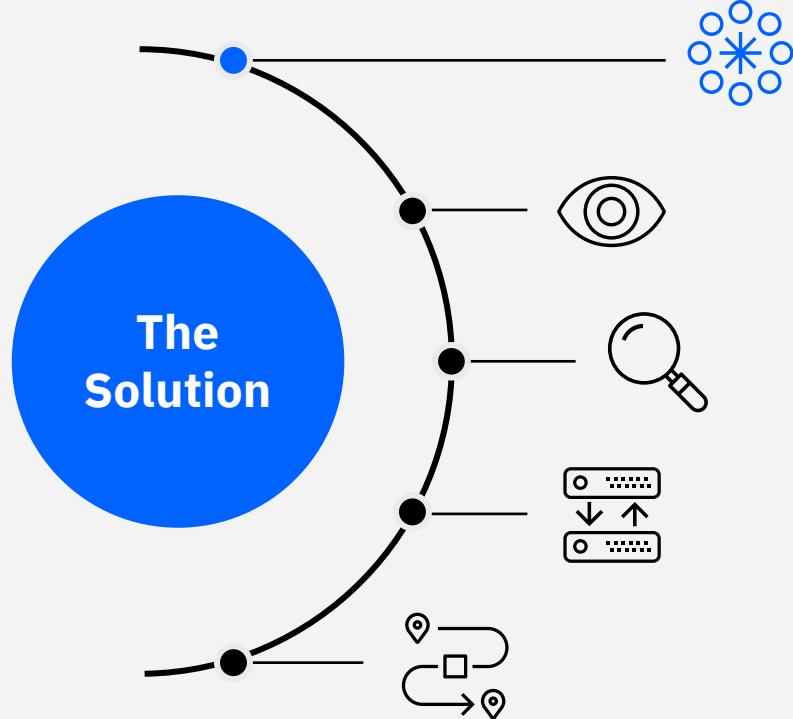
Alert notifications and drilldown capabilities for resolution teams.



Journey to Predict

Monitor is the foundation for predictive maintenance and asset health.

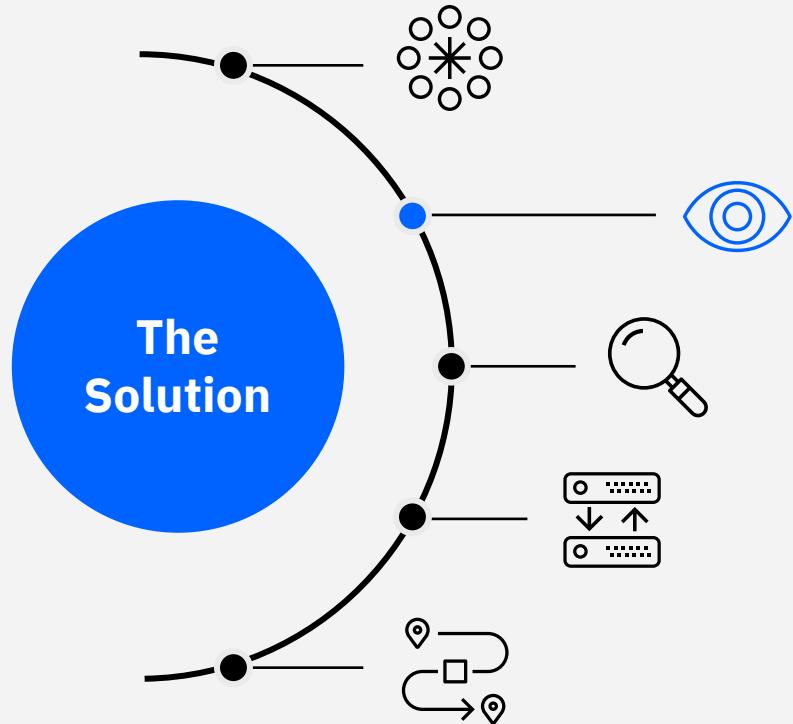
IBM Maximo Monitor



Connected enterprise

- Connects OT data sources
- Reduces operating costs through continuous inspections
- Improves asset and operational availability

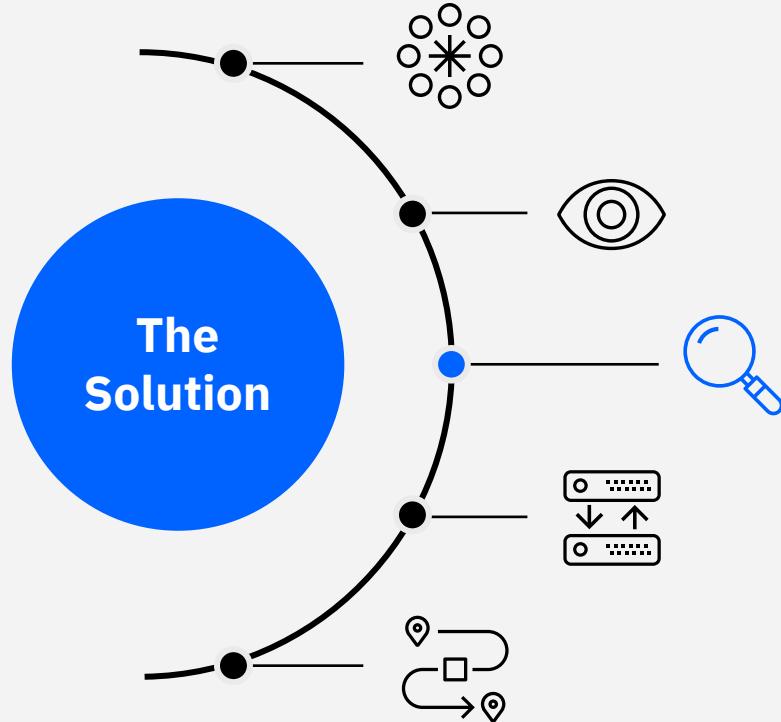
IBM Maximo Monitor



Visibility at scale

- Asset Hierarchy view
- Configurable dashboard for customized views
- Scales easily across processes and sites
- Improves operational control
- Supports remote monitoring

IBM Maximo Monitor

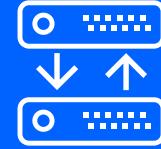
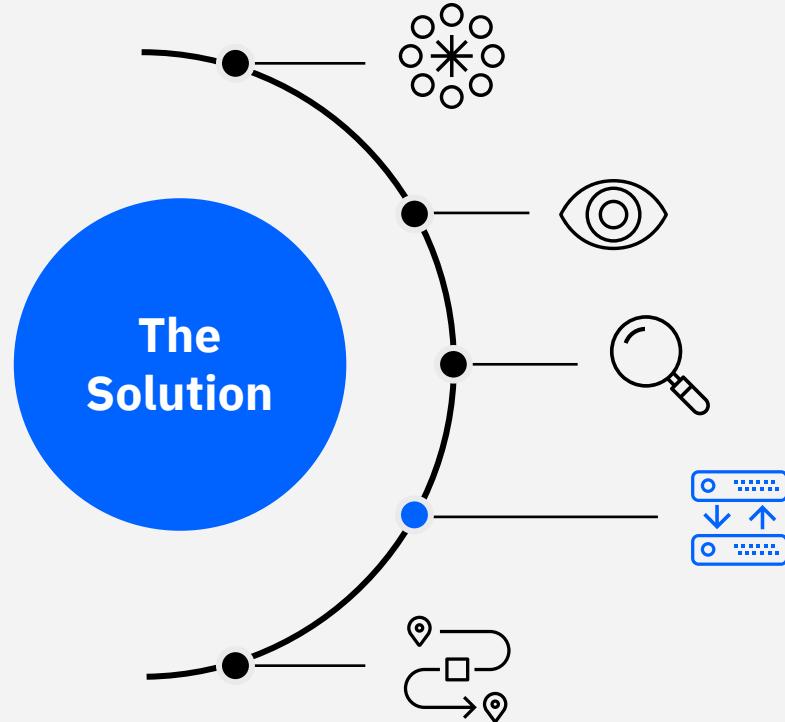


Ai-powered anomaly detection

-

- Leverages IBM's market leading position in AI
- Drives understanding beyond traditional fixed-parameter alerts
- Understand the patterns in the noise that are easily missed

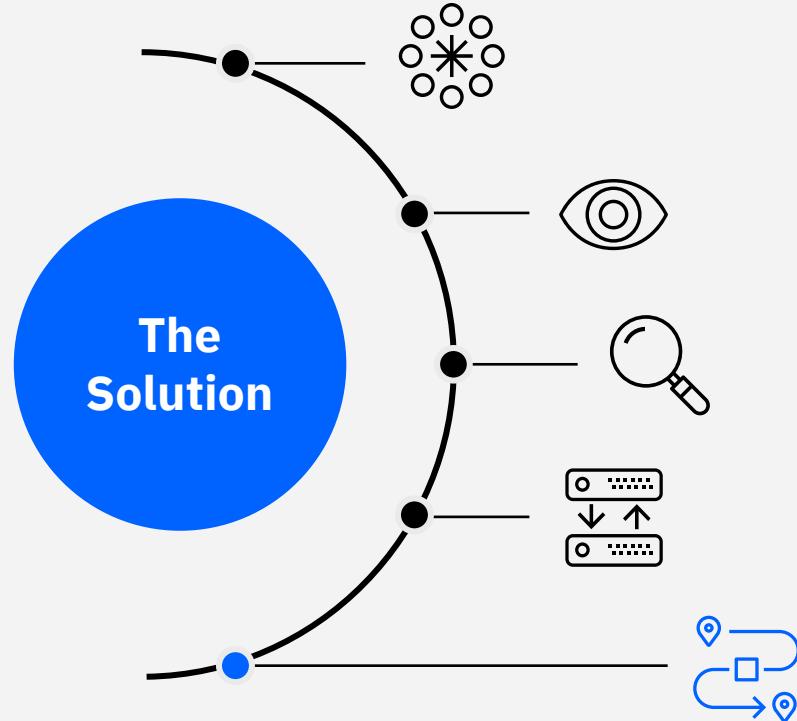
IBM Maximo Monitor



Root cause analytics

- Enables drill-down for intelligent intervention
- Access historical data for forensic analysis of failure trends
- Workflow integration to fast-path resolution

IBM Maximo Monitor



Journey to Predict

- Extract immediate value from your data
- Gain access to IBM's massive AI and Analytics investments

The Path to Value

Catch Failures
Sooner and
Prevent Failures



Decrease
Unplanned
Downtime

50%

Increase Efficiency
of Repair



Increase first-time
fix rate and improve
meantime to repair

60%

Improve Production
Efficiency



Increase
Revenue

20%

Reduce Unnecessary
Inspections



Labor costs savings
by auto-detection
of asset condition

By Millions

Increased ROI

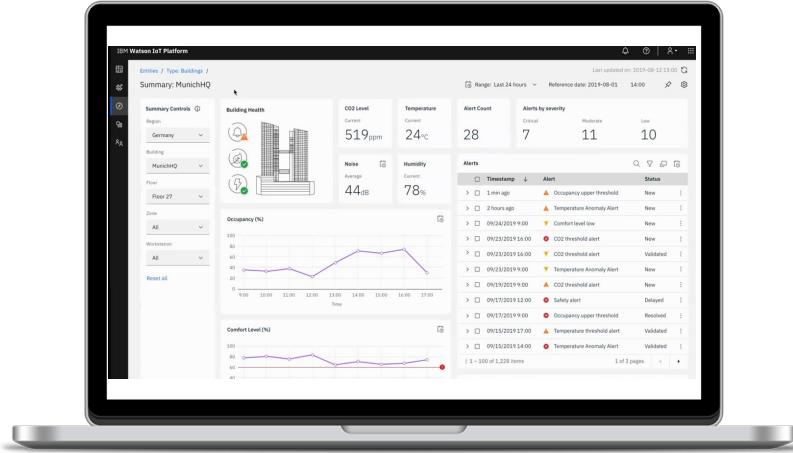


“Peak demand hit 77,460 megawatts Tuesday afternoon, an all-time high. In May, the Electric Reliability Council of Texas, which operates the grid, predicted in its annual seasonal assessment that the net peak this summer would come in at 77,317 megawatts on Aug. 10.”

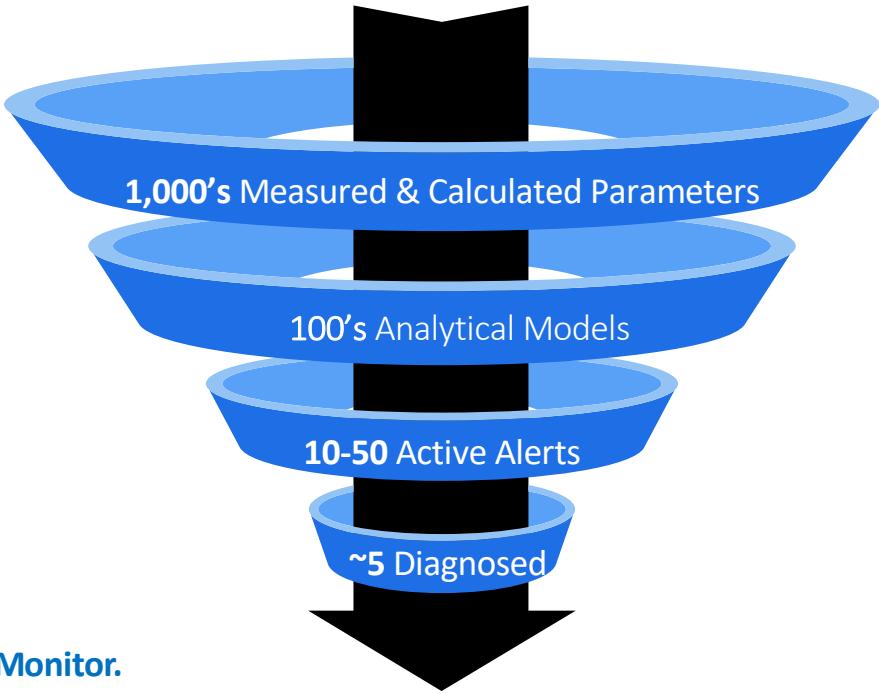
— Austin American Statesman, July 7, 2022

Asset Monitoring

Why?



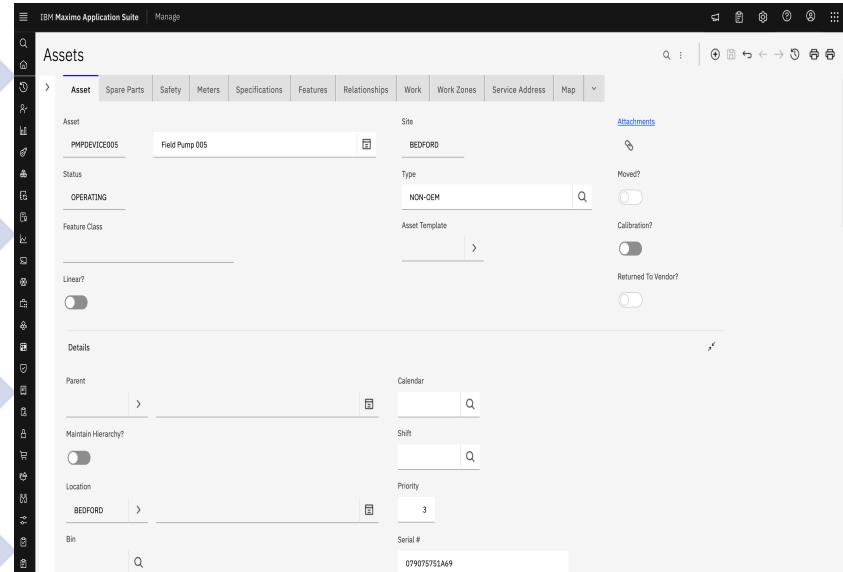
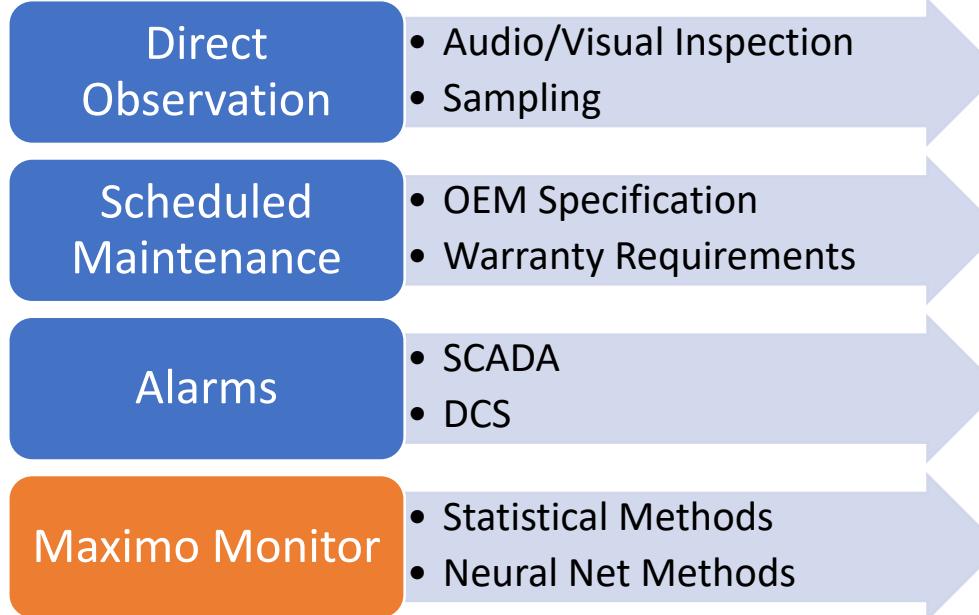
10,000's Process Data Points



Human insight. Technology enabled through IBM Maximo Monitor.

1-2 Vetted and Actionable Escalations

Pathways to a Service Request/Work Order

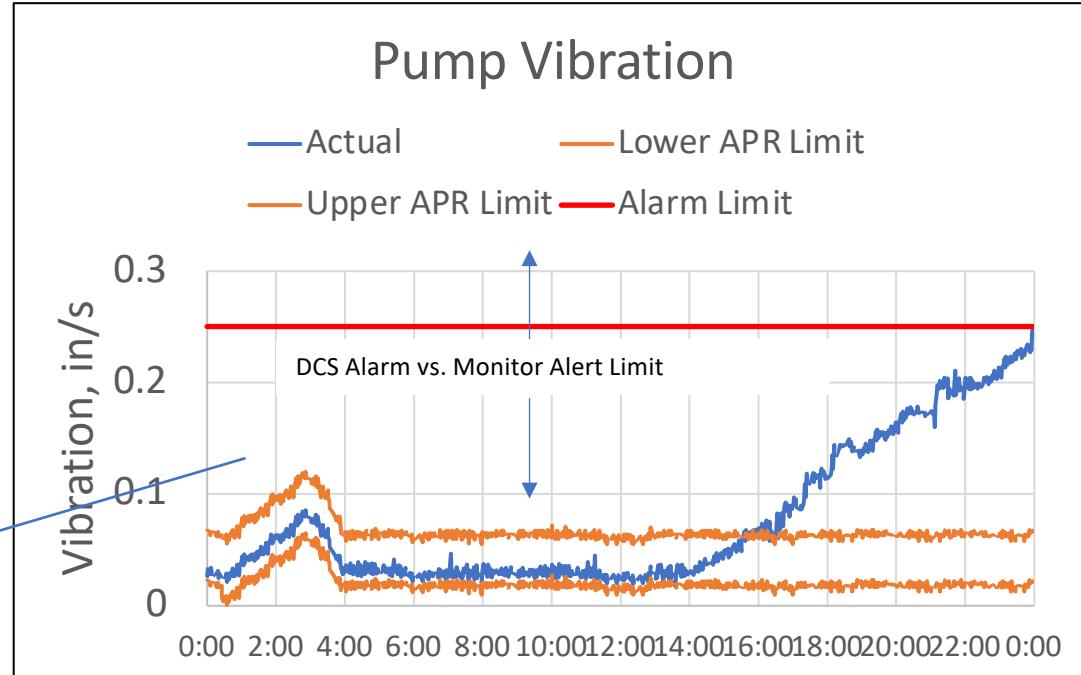


Asset Monitoring

Different from traditional SCADA or DCS Alarms

- Learns behavior based on historical data
- Accounts for factors such as load/ambient
- Dynamic alerting ranges
- Early detection of emerging issues

Alerting limits account for changes in load/ambient/other factors



IBM Maximo Monitor

Monitoring with AI-based Anomaly Detection at Enterprise-Scale



Solution

- Enterprise Scale Monitoring
- AI-based anomaly detection



Capabilities

- Ingest data through MQTT and SCADA connectors
- Easily Configurable dashboard: No-Code Widgets
- Enterprise-wide view of operation
- Shared Asset Hierarchy with Manage
- Feed Meters with Monitor data for Condition Based Maintenance
- Generation of Service Requests



Business Value

- Reduce unplanned downtime
- Shorten duration of outages
- Increase production output
- Decrease wasted time investigating false-positive alerts



OT Data Pipeline

SCADA, Historian, PLC, ICS, Sensors, Devices, EMS, MES, BMS



Monitor



Connectivity at Scale

Omnio Connectors, Asset Hierarchy, Asset Management



No-Code AI/Analytics

AI-based Anomaly Detection, Meta Model, Analytics Catalog



Customizable UI

Summary Dashboard, Pre-Built Widgets, Configurable Rules & Alerts



Maximo Applications



Maximo Manage

Maximo Health & Predict

Flow of Insights

Asset Data Dictionary - A Common source of truth

Integrated MAS capabilities provides common and integrated user experience for Assets and Data

- Asset and location hierarchies
- Asset raw, processed and predicted data
- Asset alerts, alarms and failures
- Asset maintenance history
- Asset dashboards

The image displays four screenshots of the IBM Maximo software suite, illustrating its integrated capabilities for asset management:

- Top Left:** IBM Maximo Health and Predict. This dashboard shows a map of a facility with various assets. A specific asset, "Reciprocating Pump 73", is highlighted. The details pane shows the asset's ID (123456), name, location (446 W 2nd St, Irving, TX 75060), and a description: "This is a placeholder for the asset descriptions". It also displays current values for vibration (43.12), pressure (58.99), and energy (3.09), along with historical data points (0.54). A "Replace bad actor" button is present.
- Top Right:** IBM Maximo Health and Predict. This view focuses on a single asset, "123456 Reciprocating Pump 73". The "Asset information" section provides detailed data: Type (Rotodynamic), Model (ACF 1008), Serial number (A13919332), Installation date (06/2014), and Health score (68). The "Health details" section includes a pie chart showing the distribution of health contributors: Condition (35%), Weather (15%), Remaining useful life (30%), and Age (20%).
- Middle Left:** IBM Maximo Asset Monitor. This interface shows a hierarchical tree of assets under "System hierarchy". The selected node is "rotodynamic-47". Below the tree, a table lists five "Vibration_Anomaly_Alert" events from 2019-10-23 at 14:00, all categorized as "High". A modal window titled "Select work orders" is open, listing various work orders with their scheduled dates, WO numbers, descriptions, and statuses. One entry, "WO0847362 Investigate torque Open", is highlighted.
- Middle Right:** IBM Maximo Application Suite. This screenshot shows the "Assets" module. It includes a search bar, a "Drilldown" feature for selecting children assets, and a list of assets like "Centrifugal Pump 100GPM/600FT HD" and "PUMP001". A "Details" panel on the right shows the asset's ID (11401), location (9840), parent (11400), and failure class (PUMPS). A large blue "Edit" button is prominent at the bottom right.

Asset Hierarchy

Monitor

Hierarchies Locations Assets >

- tenant1
- CLIENT-ABC
 - DUBLIN
 - ALPHAVILLE
 - TRANSPORTATION
 - SOUTHERN_EXPRESS
 - Sensor: Speed-sensor-south
 - Sensor: Vibration-sensor-south
 - ZONE1_SOUTH
 - TRAIN_1: TRAIN
 - ENGINE_1: ENGINE
 - Compressor: Compress...
 - Compressor: Compress...
 - NORTHERN_EXPRESS

- Represent a business as a hierarchy of assets
- Create a dashboard at different levels to aggregate data across different assets
- Roll up metrics up to different levels of the hierarchy...like the org or site level



tenant1 / CLIENT-ABC / ALPHAVILLE / TRANSPORTATION /

TRAIN_1: TRAIN

Asset

Alerts Asset Summary +

Last updated on: 08/29/2022 16:08:01

Alerts by status Last 24 hours

New	Acknowledged	Validated	Resolved
50	--	--	--

Alerts Search

Time	Name	Source	Owner
08/29/2022 15:28:22	high_speed_alert	Compressor_2	Select owner
08/29/2022 15:28:22	High_speed	Compressor_2	Select owner



Asset Hierarchy setup in Monitor

- Monitor 1st scenario if Manage is not installed at all or yet
- Import a CSV file into Monitor to represent the organization of assets in your business

Example: System hierarchies

- ^ Workspace: Monitor-ACME-Manufacturing
- ^ Organization: Client-123
- ^ Site: Alphaville
 - ^ System: Transportation system
 - ^ Category: Network south
 - ^ Category: Train 1
 - Device: Compressor C1
 - Device: Compressor C2
 - Device: Compressor C3
 - ^ Category: Train 2
 - Device: Compressor C4
 - Device: Compressor C5
 - ^ System: Maintenance

Import a hierarchy

Define the structure of the hierarchy by using a CSV template file and import the hierarchy.

About this task

Figure 1 describes how the CSV file was created:
Example: CSV template

Organization	Site	System	Category type	Category	Parent category	Parent category type	Device ID	Device type
C-level-123	Alphaville	Transportation	Train network	Network south	Train network			
C-level-123	Alphaville	Transportation	Train	Train 1	Network south	Train network		
C-level-123	Alphaville	Transportation	Train	Train 2	Network south	Train network		
C-level-123	Alphaville	Transportation	Train	Train 1	Network south	Train network	Compressor1	Compressor
C-level-123	Alphaville	Transportation	Train	Train 1	Network south	Train network	Compressor2	Compressor
C-level-123	Alphaville	Transportation	Train	Train 1	Network south	Train network	Compressor3	Compressor
C-level-123	Alphaville	Transportation	Train	Train 1	Network south	Train network	Compressor4	Compressor
C-level-123	Alphaville	Transportation	Train	Train 1	Network south	Train network	Compressor5	Compressor

Description:

- Creates an organization node, a site node, and a system. Creates the top-level category, Network south, under the transportation system.
- Creates category train 1 under the transportation system.
- Creates category train 2 under the transportation system.
- Assigns devices or compressors to trains.

Note:

- Description fields are hidden in the example.

3rd Party content dashboard card (Nov '22)

- Add content from your business to the Monitor dashboards
- 3rd party content can display anything (links, charts, images, videos, tables, etc.) as long as the content stays in the card
- Add 3rd party content by specifying the contents URL or by associating the card with a dimension



- ^ LOGICAL
- PaintingRobot: 73000
- PaintingRobot: 73001
- PaintingRobot: 73002
- ▼ WELDING ZONE 1
- ▼ PHYSICAL

73000
Last 7 days

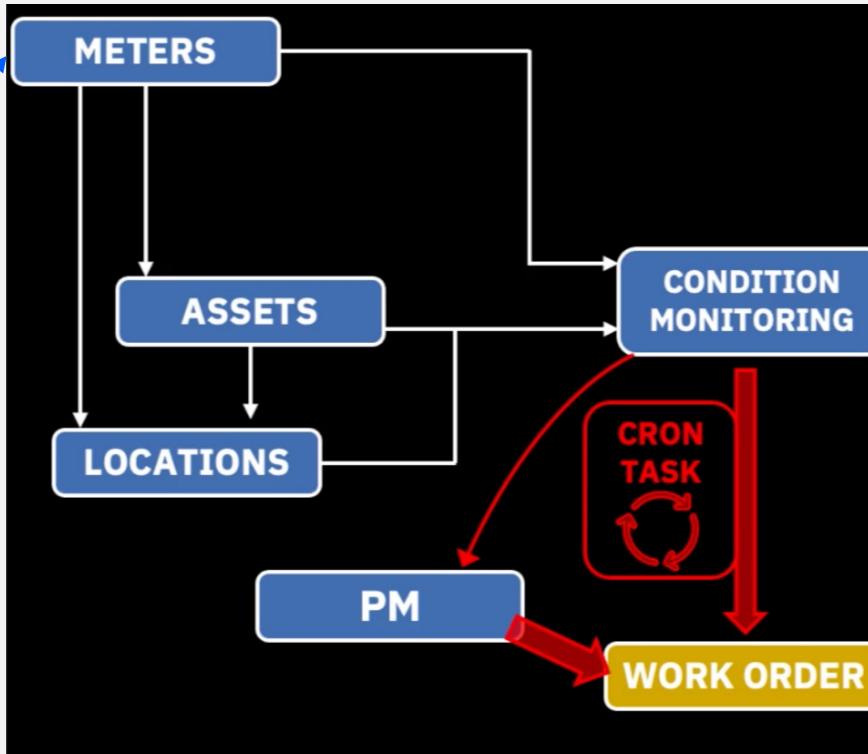


demo.ndx.ro
deviceid: 73000
firmware: 1.13
resource: 73000
manufacturer: GHI Industries
startDate: 2022-08-22T22:02:00.000Z
endDate: 2022-08-29T22:02:00.000Z

Condition Monitoring

Intelligent Asset Management

- Feed the Manage meters from metrics in Monitor



Screenshot of the IBM Maximo Application Suite - Condition Monitoring screen. The screen shows a list of condition monitoring points, their details, and configuration options. A specific point is selected for configuration:

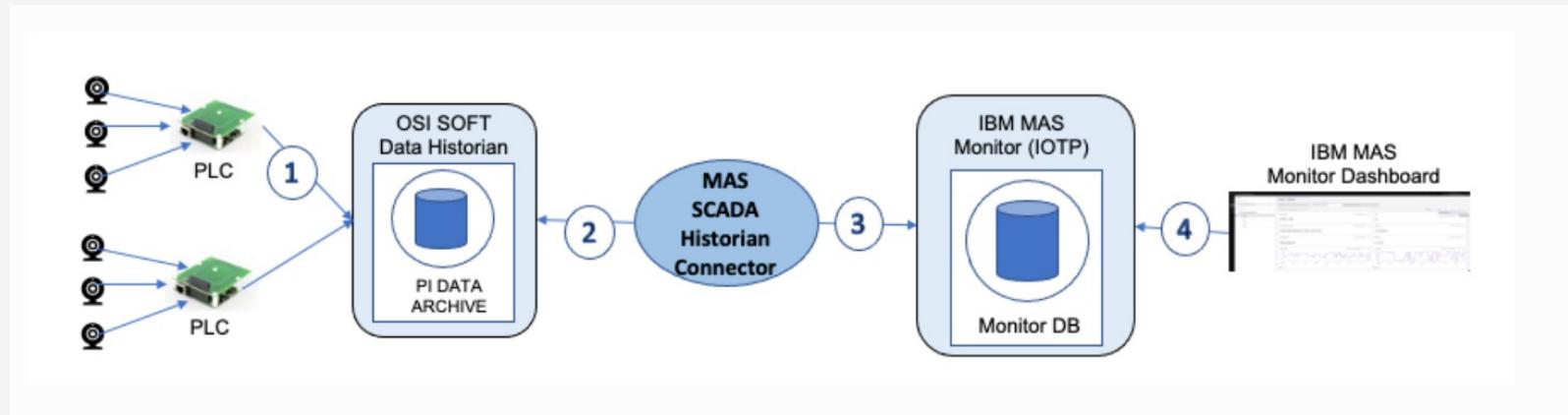
Point	Location	Asset	Meter	Unit of Measure
AH001T	Pump Temperature	AH001	TEMP-F	DEG F
Upper Limits	Upper Warning Limit	Upper Action Limit	Upper Limit PM	Upper Limit Job Plan
	90.000	100.000		INS-SUBSYS
				General Inspection of Major Subsystems
Lower Limits	Lower Warning Limit	Lower Action Limit	Lower Limit PH	Lower Limit Job Plan
	50.000	40.000		INS-SUBSYS

Ingest data from Aveva PI

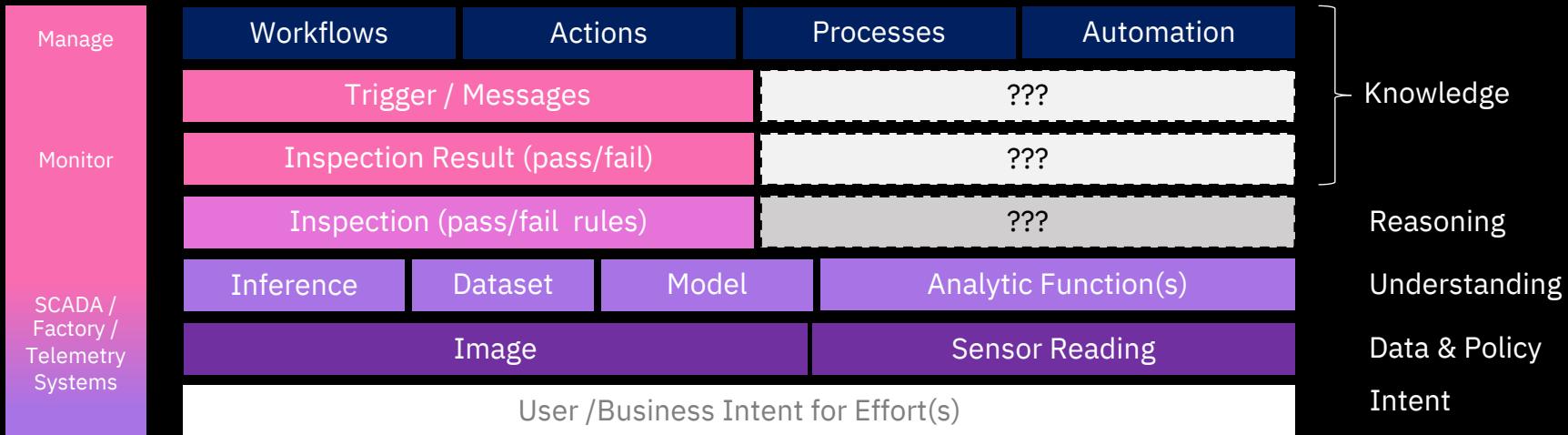
- Ingest data directly into Monitor from PI by using code on [Github](#) instead of using AppConnect
 - Uses MQTT data ingestion rather than putting data directly into the database
 - Provides enhanced performance

Note: The same connector code also works with Ignition

<https://ibm-watson-iot.github.io/mas-scada-historian-connector/>



Value stack



IBM's goal is to enable application providers, partners, and customers to choose where they want to invest in this value stack. We want to consume low value data, and produce high value insights, that can drive your business. Monitor is a key pipeline in that flow.



Scott, a remote engineer at an IBM partner detects a problem with a massive induced draft fan assembly.

Step 1. Ingest data into the system

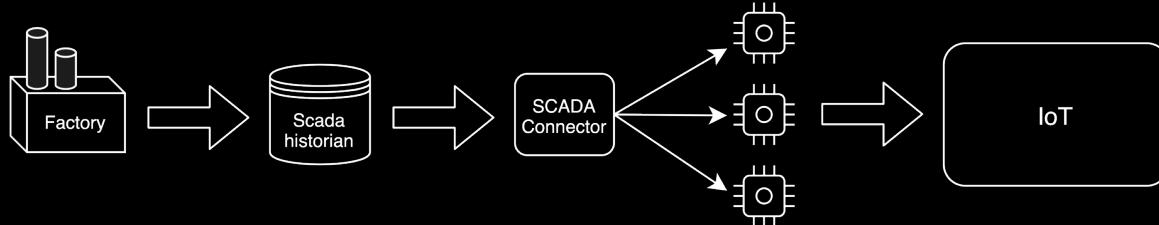
Step 2. Explore the asset hierarchy to understand what's happening in the system

Step 3. Utilize regression models to compare actual vs expected

Step 4. Surface actionable alerts to create a service request

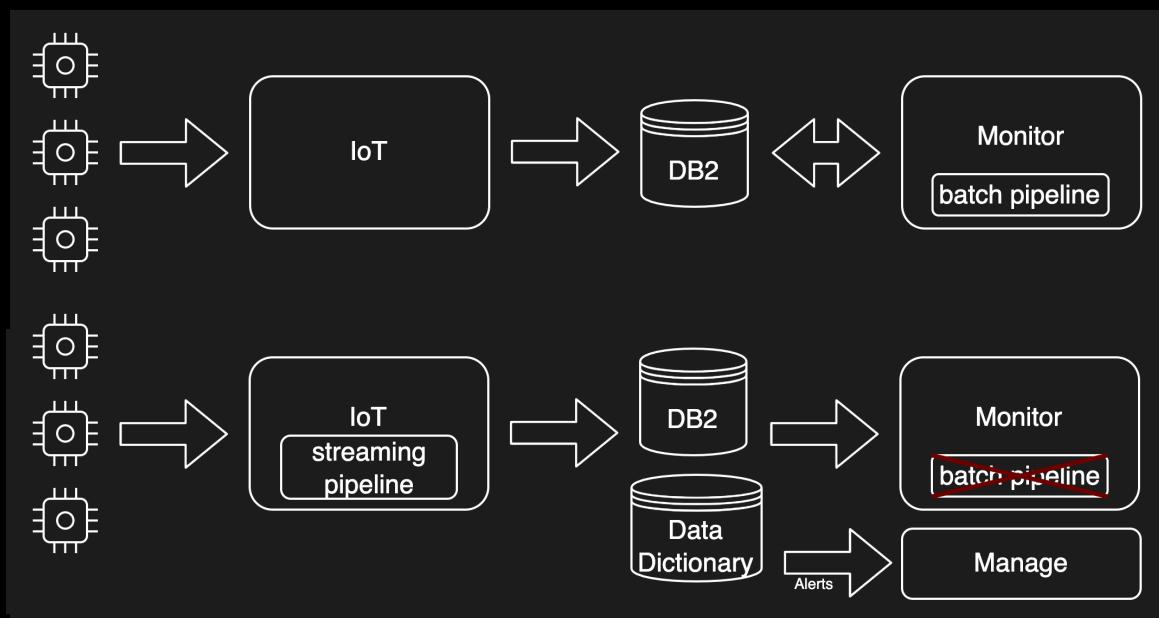
Ingestion and Analytics Pipeline

Incoming Data



Current Processing

Batch processed every 5+ minutes



MAS 8.9 (Nov '22)

Processed as soon as it arrives

- Data available for dashboards immediately
- Alerts generated immediately

Streaming pipeline performance (Nov '22)

Simulating 1 Million Fans

Injecting 4 Million data readings (4 variables per fan)

Each device publishes a reading once every 60s

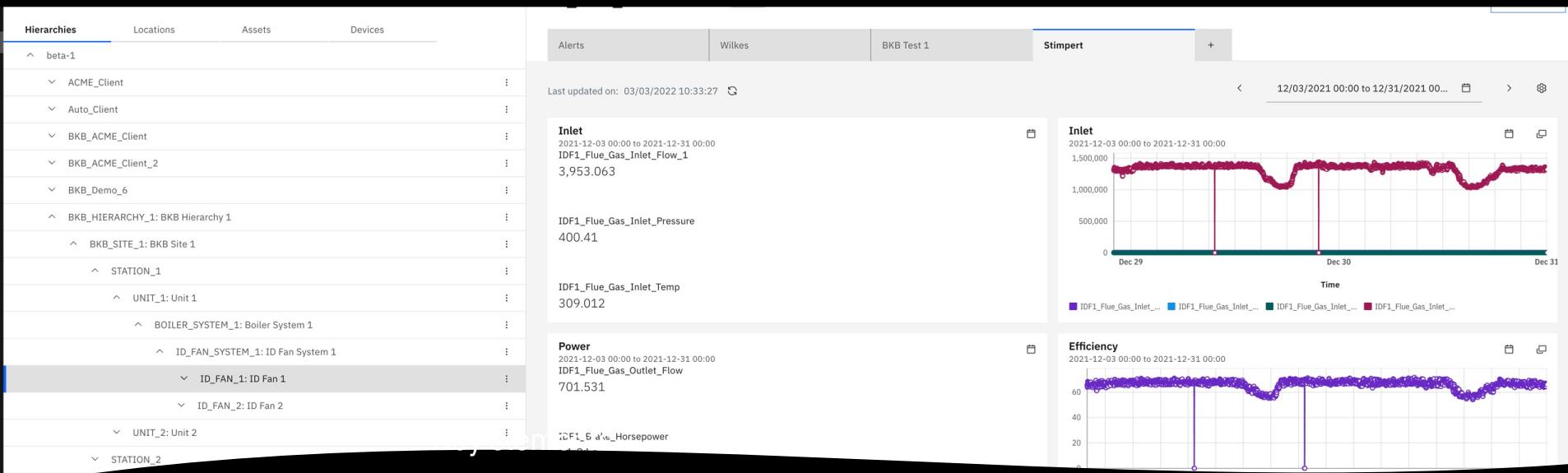
- This means that there are **4,000,000 scaling functions** being applied every minute

- Which are then merged via **4,000,000 compose operations** every minute

- Which are inputs to **1,000,000 predictor function** executions every minute

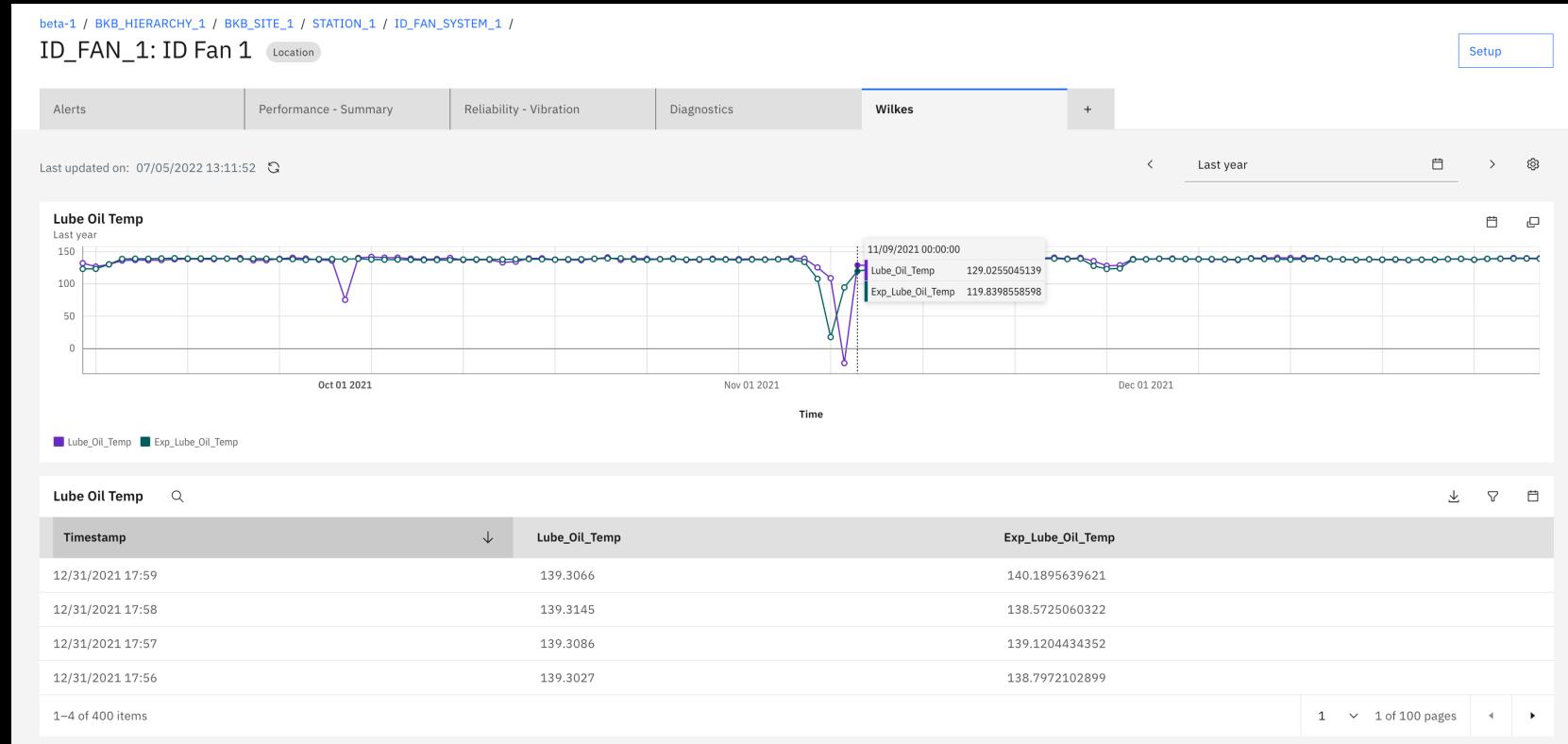
- 9,000,000 ops/min
- ~300,000 msg/sec consumed across pipeline runtime
- 232,000 msg/sec produced across pipeline runtime

Hierarchy Dashboards



- Hierarchy dashboard views
- Alerts available at the node and parents
- Visualization of trends and model results
- Links to other data

Actual vs Expected using Regression model



Actionable Alerts to create a Service Request

	Time	Severity	Source	Name	Service Request	Owning Unit
<input type="checkbox"/>	12/31/2021 13:47:00	✖️ High	ID_FAN_1	Alert_Upper_Motor_Winding_Temperature	Create service request	
<input type="checkbox"/>	12/31/2021 13:10:00	✖️ High	ID_FAN_1	Alert_Lower_Motor_Winding_Temperature	Create service request	

Create service request in Manage

Manage service:

Manage

Reported by:

Enter user reporting

Asset

-

Location

ID_FAN_1

Site

BKB_SITE_1

Summary:

Alert triggered: at September 25, 2021 11:02 PM.

Details:

Link to dashboard: https://dashboard-beta.connectedproducts.internetofthings.ibmcloud.com/monitor/sites/301a859f-7487-4b64-ba0c-422867c83c6f/locations/d9e63af7-ef5d-4886-b3a0-450220a1d0b8/dashboards/ID_FAN_1

[Cancel](#) [Create](#)

Case Study

Novate

Business problem

- Novate is a California-based process control engineering firm
- IBM collaboration to develop a scalable, remote monitoring and support managed service for industrial manufacturers

Solution

- IBM Maximo Asset Monitor with Watson-enabled AI detects anomalies and predicts failures before they occur
- Solution leverages data from smart sensors, PLCs, PACs, and VFDs

Business Value Delivered

- Solution augments engineering professionals at Novate's Support Operations Center to provide anomaly root-cause and process implications
- Proactive intervention enables action before traditional control systems are designed to react
- Improves production reliability and reduces costly downtime



Case Study

Armstrong

Business problem

- Armstrong is a designer, engineer and manufacturer of fluid flow equipment for HVAC systems
- Aging HVAC pumps lead to inefficient and costly operations
- Seeking to customers improve efficiency with HVAC monitoring and predictive maintenance

Solution Implemented

- Intelligent cloud-based performance monitoring and tracking service that manages pump performance and delivers real-time insights
- Solution helps building owners operate and maintain HVAC systems for optimal efficiency and reduced costs

Business Value Delivered

- Reduce operating costs and a building's energy consumption and greenhouse gas emissions
- In pilot projects
 - Reduced HVAC energy use by 78% at a University in China
 - Cut CO2 emissions by 131,053 kg in a commercial tower, saving CAD 121,692 annually



Case Study

Worldwide Utility Generation Leader

Business problem

- Operational visibility is a manual process with 100s of alerts created per plant each day
- Global operations are spread across nearly 30 plants
- Process engineers in the remote diagnostic center find it difficult to manage the volume of alerts, understand the context, and investigate root cause

Solution

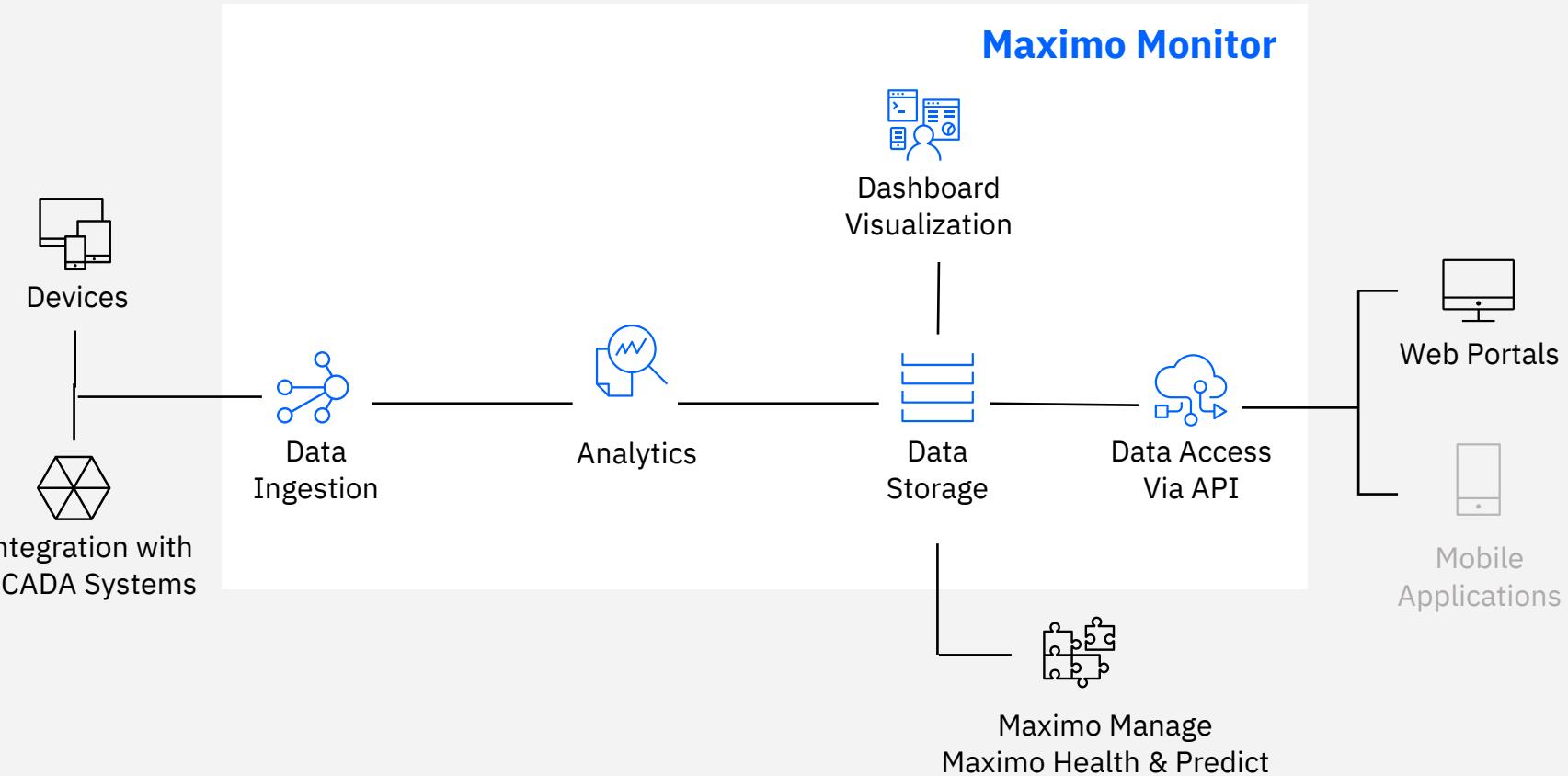
- IBM Maximo Asset Monitor with AI-powered anomaly detection
- Solution leverages historical SCADA and work order resolution data to give context and prioritization
- Globally scalable system and UI with hierarchical asset view
- Aggregates alert data across multiple systems

Business Value Delivered

- Understand the context of alerts and importance
- Surfaces the relationship between alerts and resolution
- Enables root cause investigation to improve process efficiency



IBM Maximo Monitor



Maximo Monitor

The Process



Connect

Easily connect IT & OT enterprise data & devices at scale, while mapping to asset hierarchy



Prepare



Visualize



Investigate

Maximo Monitor

The Process: Connect



Connect to IT and OT data sources with Pre-built connectors

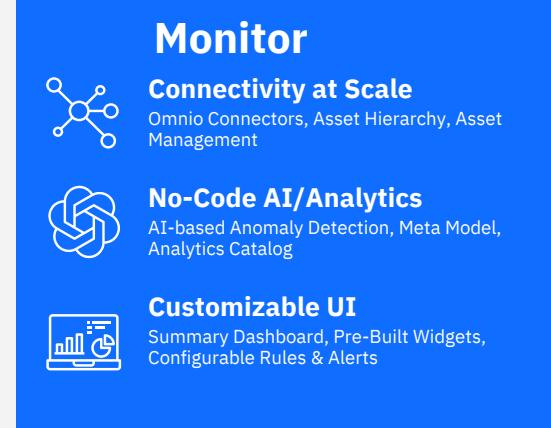


Map entity data and devices to Asset Hierarchy from Maximo Manage



OT Data Pipeline

SCADA, Historian, PLC, ICS, Sensors, Devices, EMS, MES, BMS



Maximo Applications

Maximo Manage
Maximo Health & Predict

Flow of Insights

Maximo Monitor

The Process



Connect



Prepare

—
Easily enable advanced analytics and
AI-based anomaly detection for
alerts in a low-code/no-code
environment



Visualize



Investigate

Maximo Monitor

The Process: Prepare



One click add AI-based analytics from the prebuilt catalog of functions to apply to data



Set alerts based on analytics and anomaly detection scores



View result of all calculations in the data tab before using in summary dashboard

Maximo Monitor

The Process



Connect



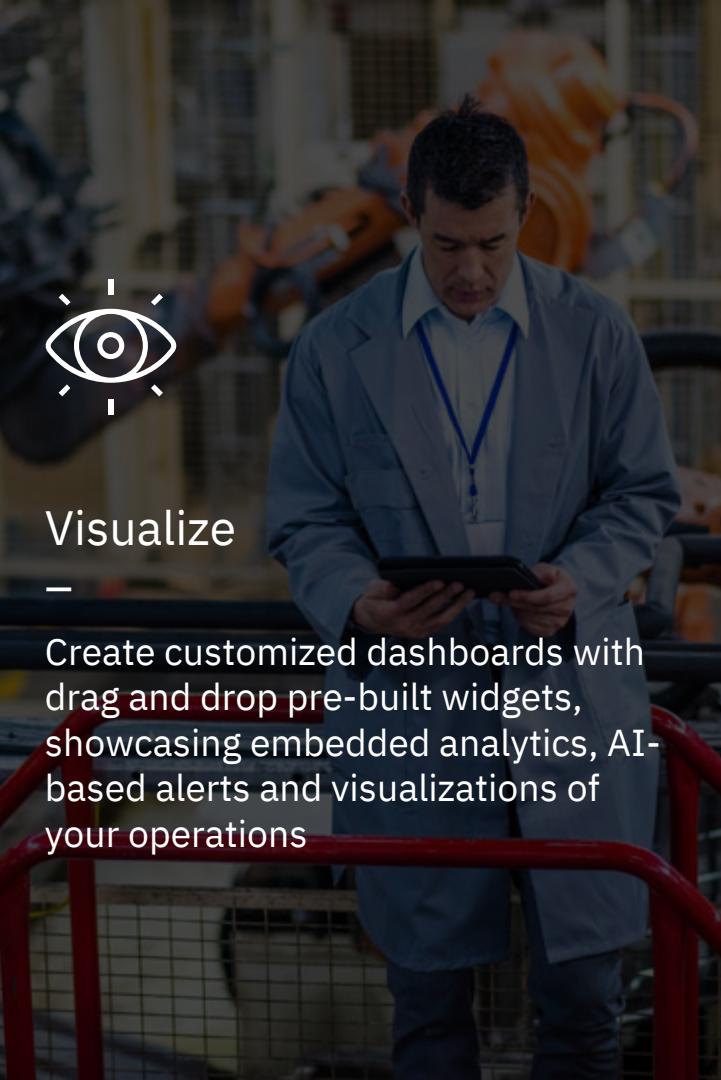
Prepare



Visualize

—

Create customized dashboards with drag and drop pre-built widgets, showcasing embedded analytics, AI-based alerts and visualizations of your operations



Investigate

Maximo Monitor

The Process: Visualize



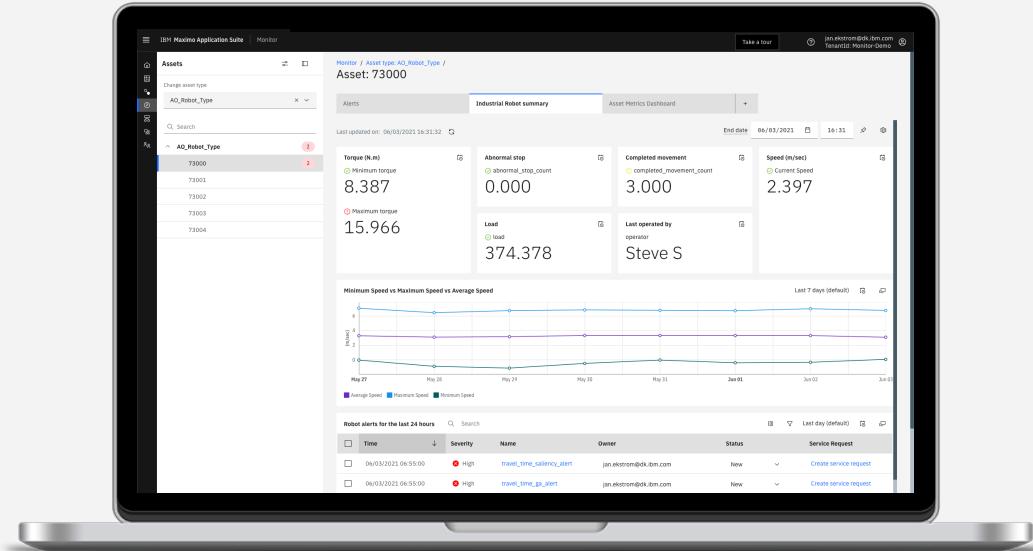
Build customized dashboards based on use case with prebuilt drag and drop widgets



Show outputs of AI-based anomaly detection and analytics, highlighting meaningful alerts within the widgets



Monitor your operations and KPIs, including key drivers for metrics like OEE, Availability, Uptime, and others



Maximo Monitor

The Process



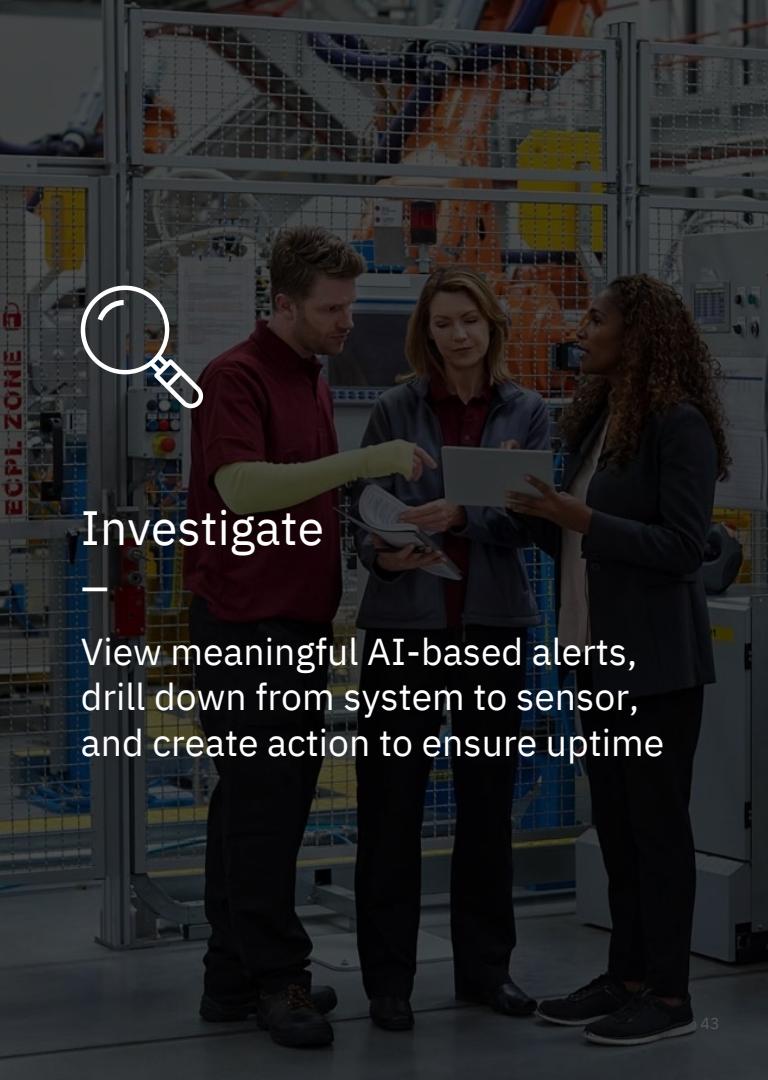
Connect



Prepare



Visualize



Investigate

View meaningful AI-based alerts,
drill down from system to sensor,
and create action to ensure uptime

Maximo Monitor

The Process: Investigate



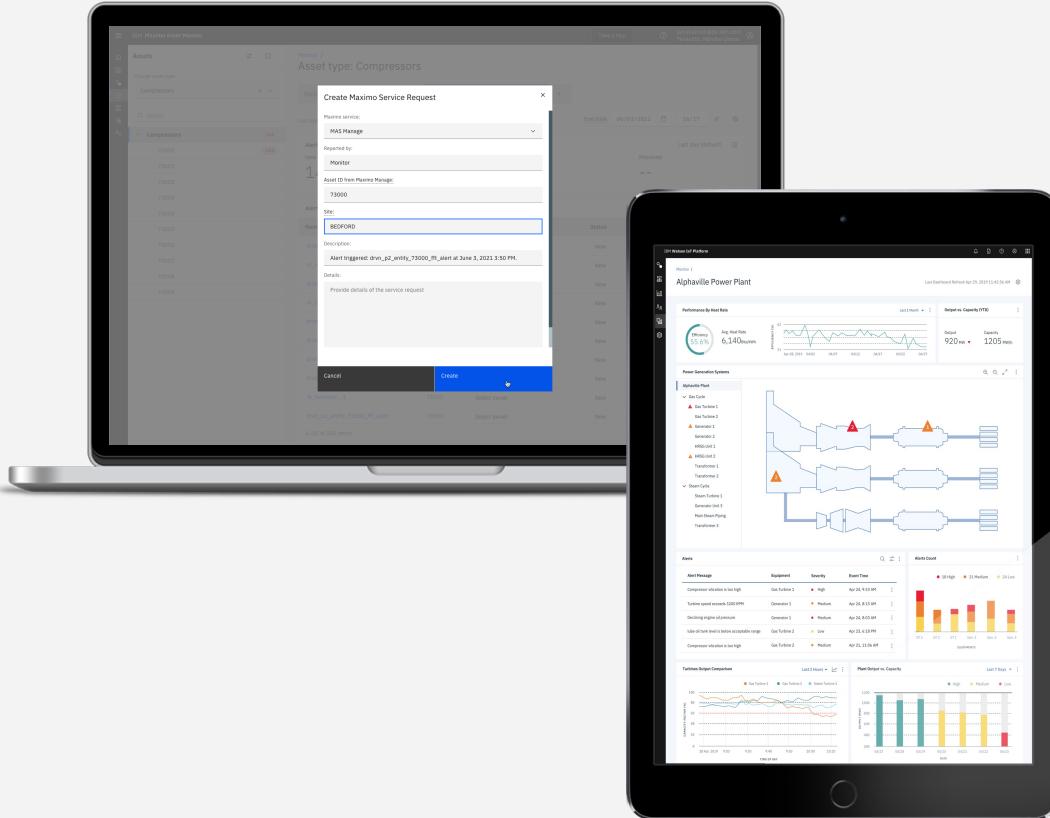
Drill down from a plant to a system, component, asset, and sensor view



Investigate problems and root causes that affect tracked KPIs



Create Automated Action based on AI-based Alerts to ensure Uptime



Integration Approaches



Bulk Data Direct integration to IoT Gateway

–
Rest API via HTTPs

Payload data is in double quoted
CSV

Can be invoked by client
Client is responsible for
scheduling, message
choreography and error handling

**Great for mini-batch e.g.
every 5 minutes or bulk load**



Message-Oriented Integration to IoT Gateway

–
MQTT message format
Can be invoked by client
Client is responsible for
scheduling, message
choreography and error handling



IBM Connector

–

Client side activity is limited to:

- Providing access to SCADA historian

IBM will:

- Extract data via secure connection and invoke data APIs
- Monitor feeds for continuity

Simpler effort for client

Data Integration Made Easy

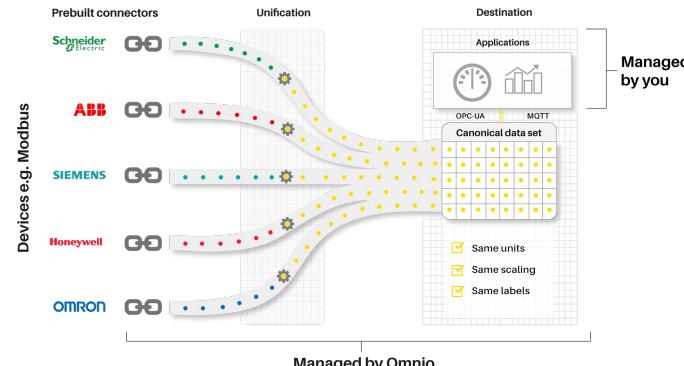


Common data integration challenges

- Many different devices from different vendors
- Different data tags, units, scaling and unsynchronized timestamps
- PLCs don't contain the right data or contain non-standardized data

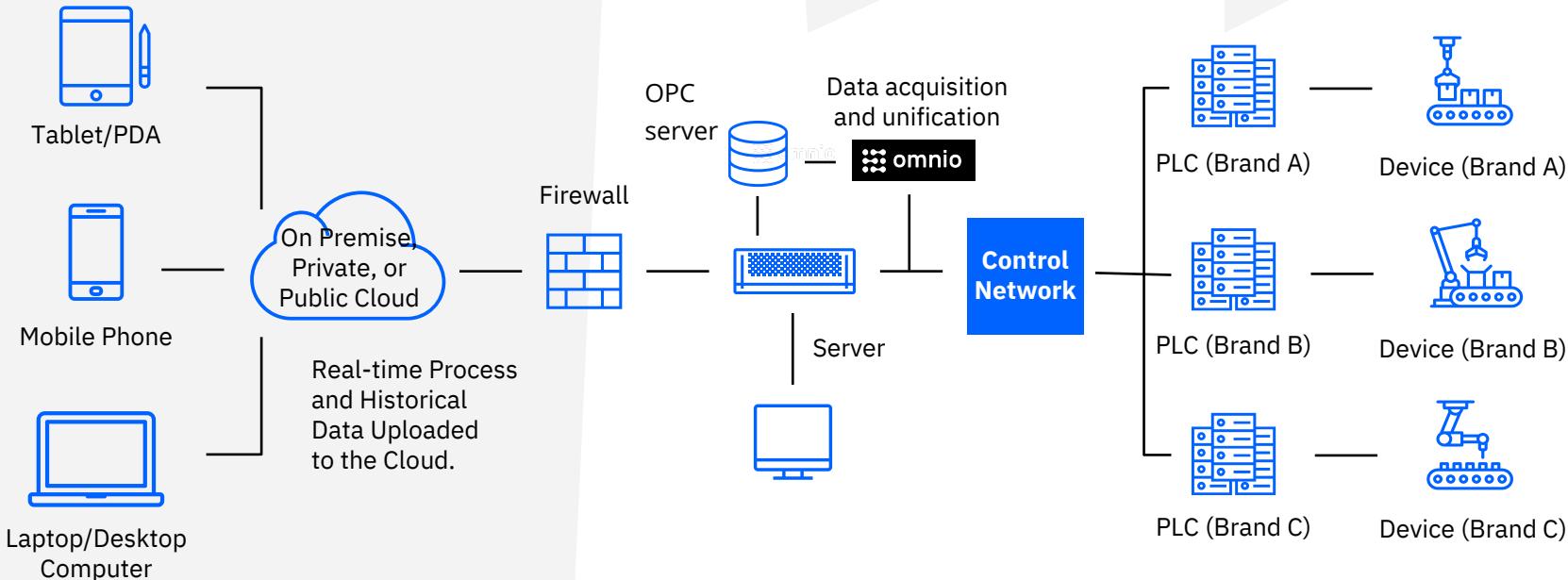
Omnio makes it easy

- Thousands of device connectors delivering unified data
- New connectors developed as per demand
- Easy scraping, browsing and unification of PLC data

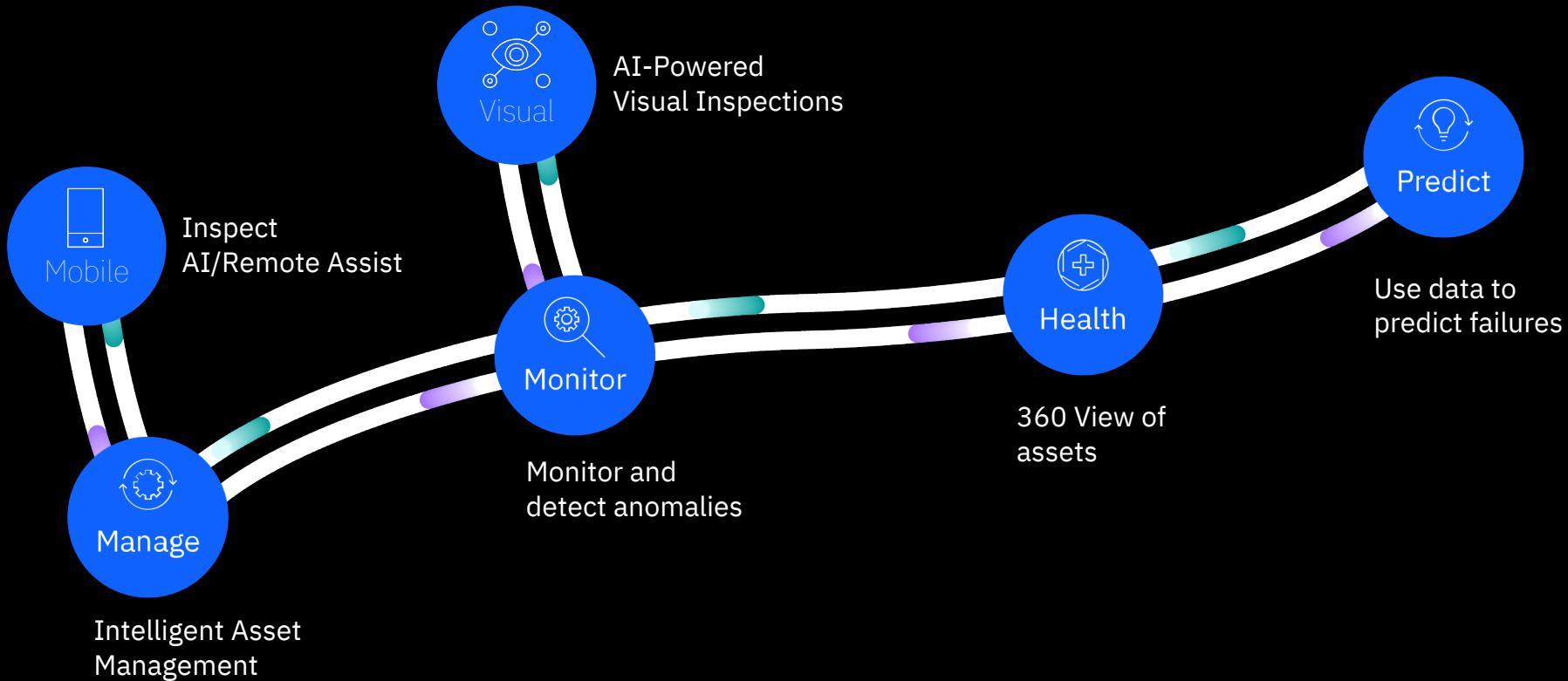


Monitoring At Scale

Connecting existing OT sources:
Devices, PLCs and OPC servers



Maximo Application Suite: Journey to the new operating model



IBM Maximo Application Suite

Remote asset monitoring, maintenance and reliability applications in a single platform

- Integrated solution
- Usage Flexibility
- Multi-cloud deployment



Maximo Application Suite

Best of class capabilities to provide complete view of your assets

Manage

Intelligent Asset Management



Monitor

Monitor and Detect Anomalies



Health

360 View of Assets



Predict

Predict Failures



Visual Inspection

AI-Powered Insights



Schedule

Schedule Work and Resources



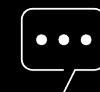
Mobile

Technician Work Execution



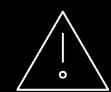
Assist

Prescriptive Assistance



Safety

Actionable Insights for Worker Safety



IBM Cloud Pak for Data | IBM Watson Studio | IBM Watson ML



Infrastructure Independent
Common Operating Environment



Ensure Success through Support

Product Manager:

Mike Lamb (mllamb@us.ibm.com)

Access to Demo Environments:

- [MAS WW demo env access](#)
- Monitor beta demo env: mllamb@us.ibm.com

Sales Leader:

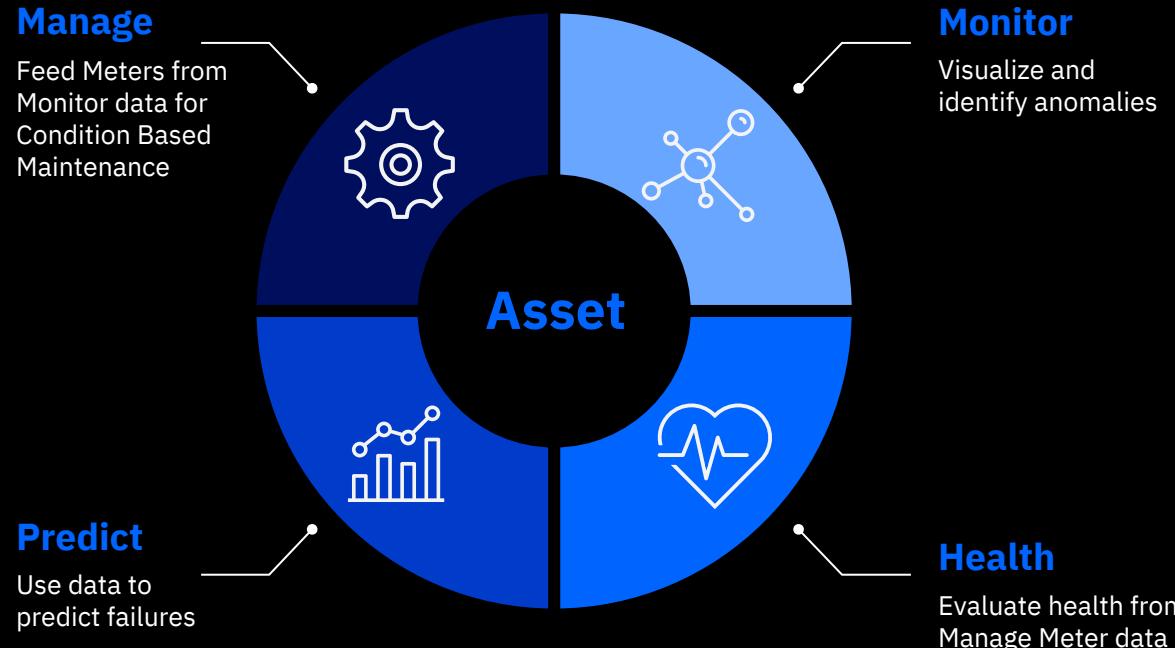
Theo Winklemann (winkelmann@us.ibm.com)

Expert Labs:

Vish Narayan (vishn@us.ibm.com)

Slack Channel Support: #ask_as-monitor

Maximo Application Suite: Journey to Intelligent Asset Management



Establish a Monitoring Strategy: 2 Day Workshop

STEP 1



Location

–

Onsite

Remote Center

Third-Party

STEP 2



Connection Approach

–

Existing SCADA Historian

Existing devices, PLCs and OPC servers
via Omnio

Install New Sensors/Meters

Upgrade Equipment

STEP 3



Drive Value

–

Reduced inspections

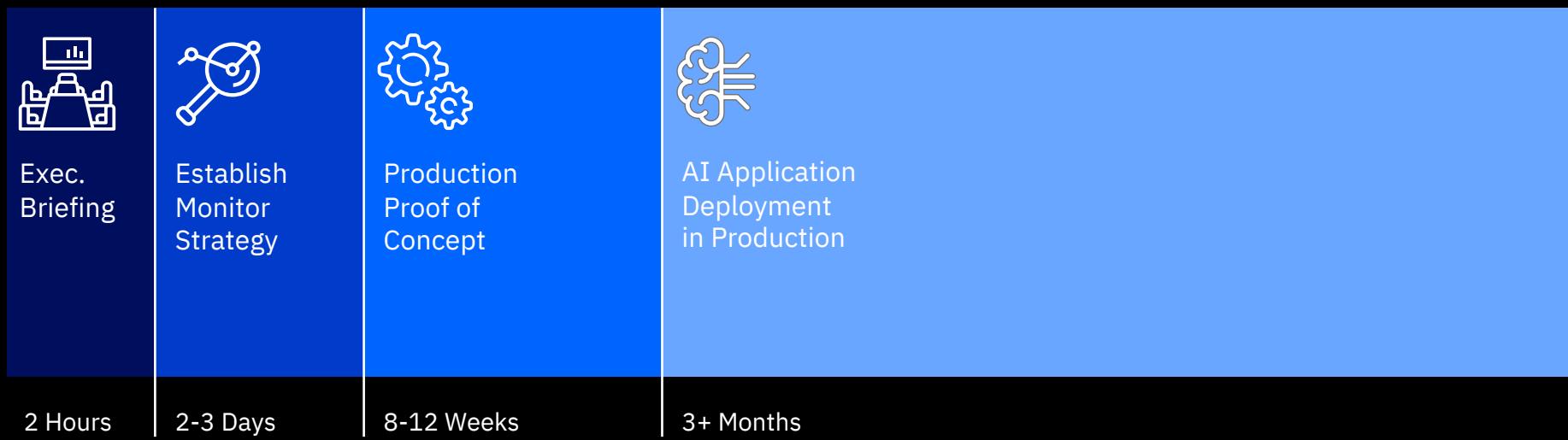
Early detection

New detection

Accountability

Fast Path to generate
Inspections and Service Requests

Proven results in days, weeks, not years



Thank You

First Lastname

Job Title

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Thank You

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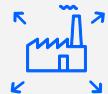
IBM Maximo

Omnio Slides

Maximo Monitor with OMNIO Technology



User-friendly software for collection of device data



Best in class for unification of device data ready for analysis in Maximo



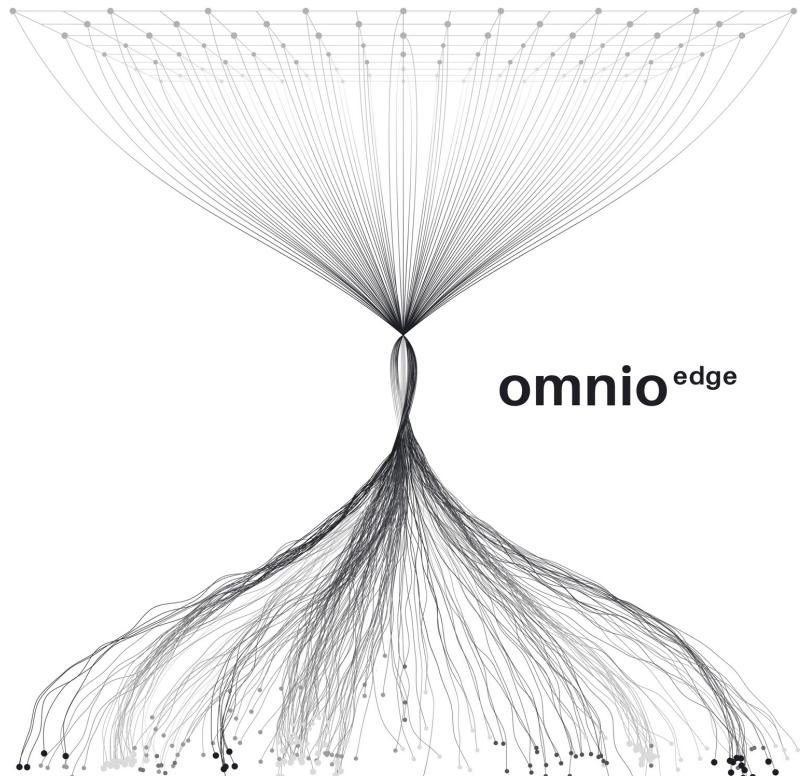
Purpose built for collection and automatic unification of data directly from existing end-devices



Purpose built for collection and unification of data from existing PLCs and OPC servers

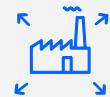
Overview

Maximo Application Suite



- End-devices • PLCs • OPC servers

Maximo Monitor with OMNIO Technology



Collect data directly from end-device such as meters, drives, breaker and switches



Data is automatically unified for easy ingestion into Maximo Monitor



User-friendly UI allows you to integrate device and collect data in a few clicks



No need to read device manuals or custom coding. Omnio has already done the hard work

End-devices

Maximo Application Suite



Device A



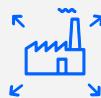
Device B



Device C

Maximo Monitor with OMNIO Technology

PLCs and OPC Servers



Easily scrape, browse and select existing data tags



Quick-view gives live data tag values



User-friendly UI for unifying existing data



Customized unification or use templates for your application's requirements

Maximo Application Suite

