Predictive Maintenance Walkthrough

A sample journey in a predictive maintenance use case

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a cisco company

Forward-looking statements

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- Name
- Company/organisation
- Role
- Are you currently using Splunk?
- What are you interested in using Splunk for?

Enroll in Today's Workshop

Tasks

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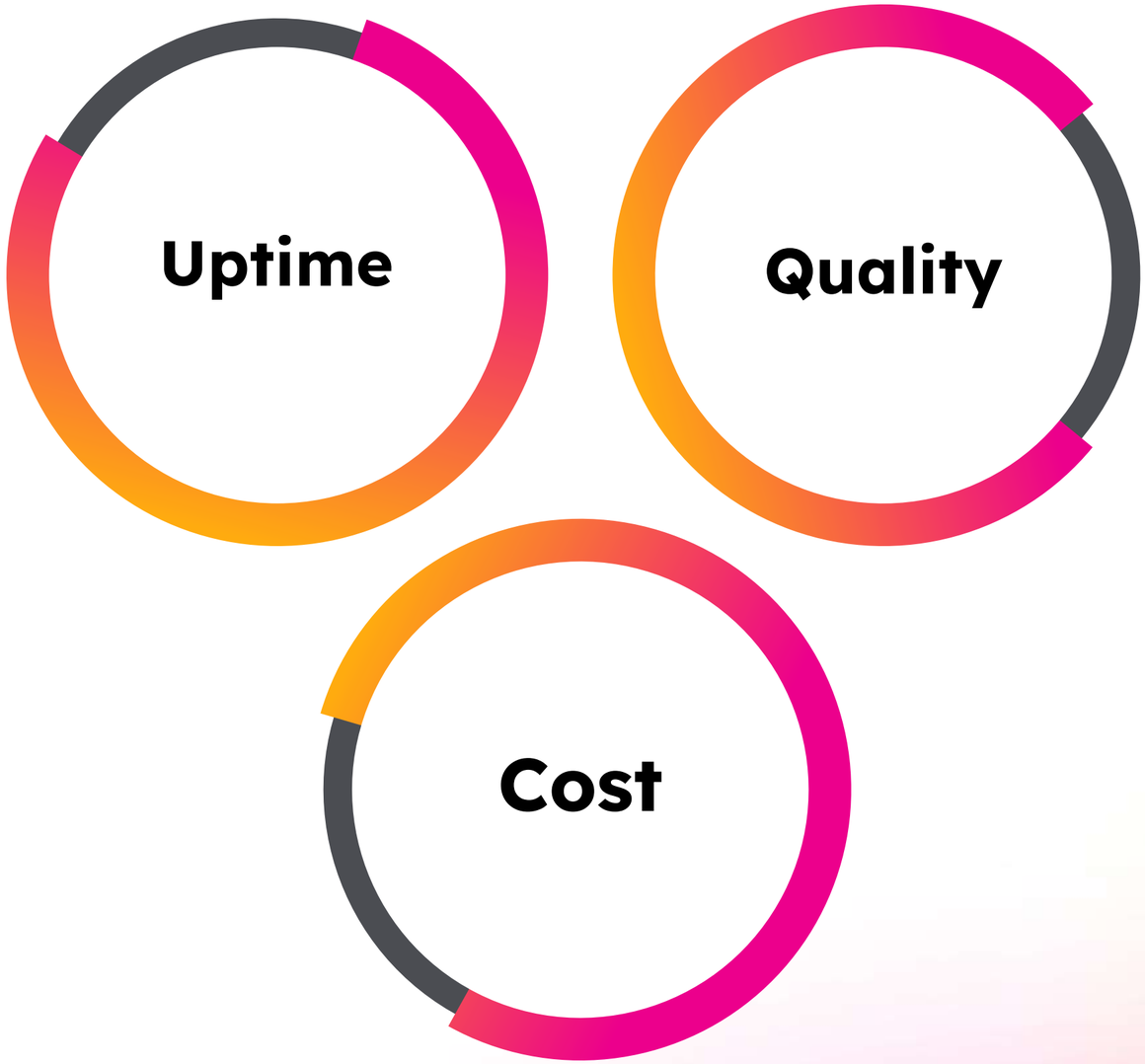
2. Enroll in the Splunk Show workshop event: https://show.splunk.com/event/<eventID>
3. Download a copy of today's slide deck: https://splk.it/PM-Walkthrough-Attendee

Goal

Enroll in today's event

Manufacturing Priorities

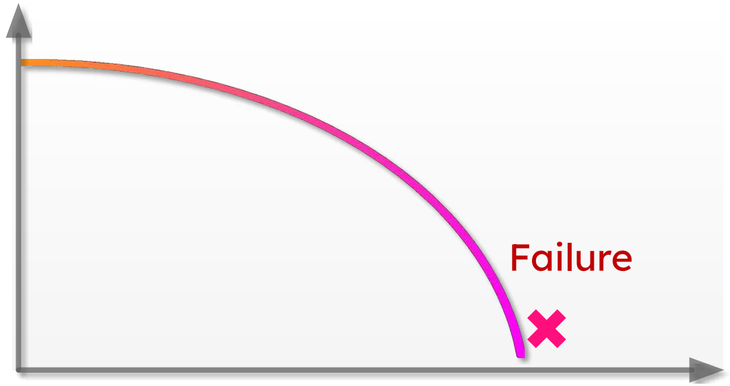
Data Driven



Maintenance strategies and methods

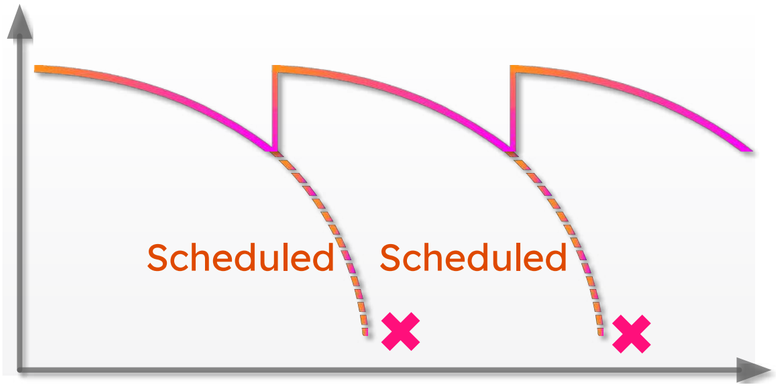
Types of maintenance performed globally

Reactive Maintenance



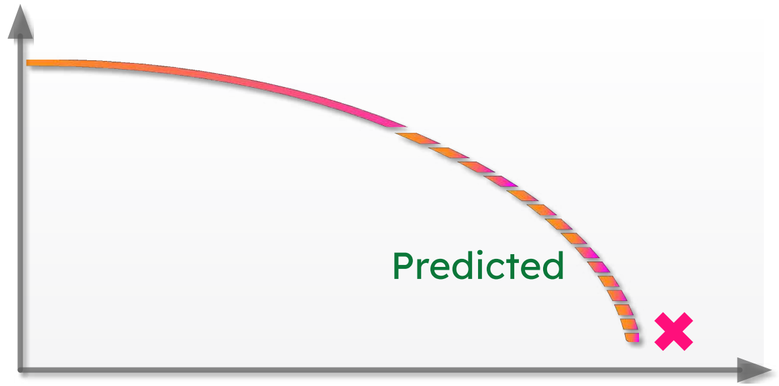
Highest Downtime costs

Preventive Maintenance



High maintenance expense – time, availability, materials

Predictive Maintenance



Optimal availability, cost savings, organizational efficiency

Equipment Downtime Costs Millions of $

$25M / Day[1]

Liquefied Natural Gas Platform

$7M / Day[1]

Offshore Oil Platform

$1.3M / Hour[2]

Auto Manufacturing

"Predictive Maintenance is the Holy Grail of Industrial IoT"

- Heather Ashton, manufacturing industry analyst at IDC[3]

1. MIT Sloan Review, "GE's Big Bet on Data and Analytics"
2. ThomasNet, "Downtime Costs Auto Industry $22k/Minute"
3. TechTarget, "Predictive maintenance software points to machinery problems"

Splunk Use Cases for Manufacturing

Predictive Operations

Improve uptime and performance of complex infrastructure, services and applications across manufacturing and production environments

Predictive Quality

Predictive Maintenance

IT and OT Cybersecurity

Protect assets, infrastructure and customer data while reducing risks from internal and external threats

Incident Investigation

ICS Security Monitoring

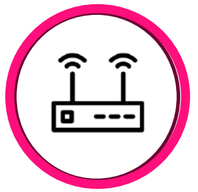
Threat Detection

Real-time and Historical Data

IT and OT Monitoring

Provide greater visibility and monitoring across IT and OT infrastructure

IT and OT Applications, systems and services

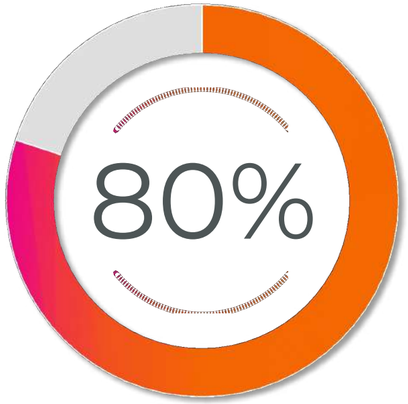


IT and OT Network Monitoring

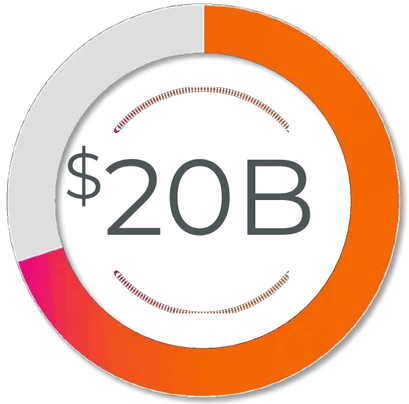
ICS System Operations and Health

Predictive Maintenance Matters

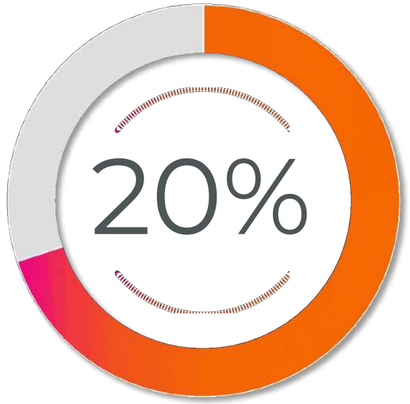
Using data for Faster, more informed decision making



Industrial Maintenance operations are primarily reactive



Significant Losses resulting from unplanned downtime*

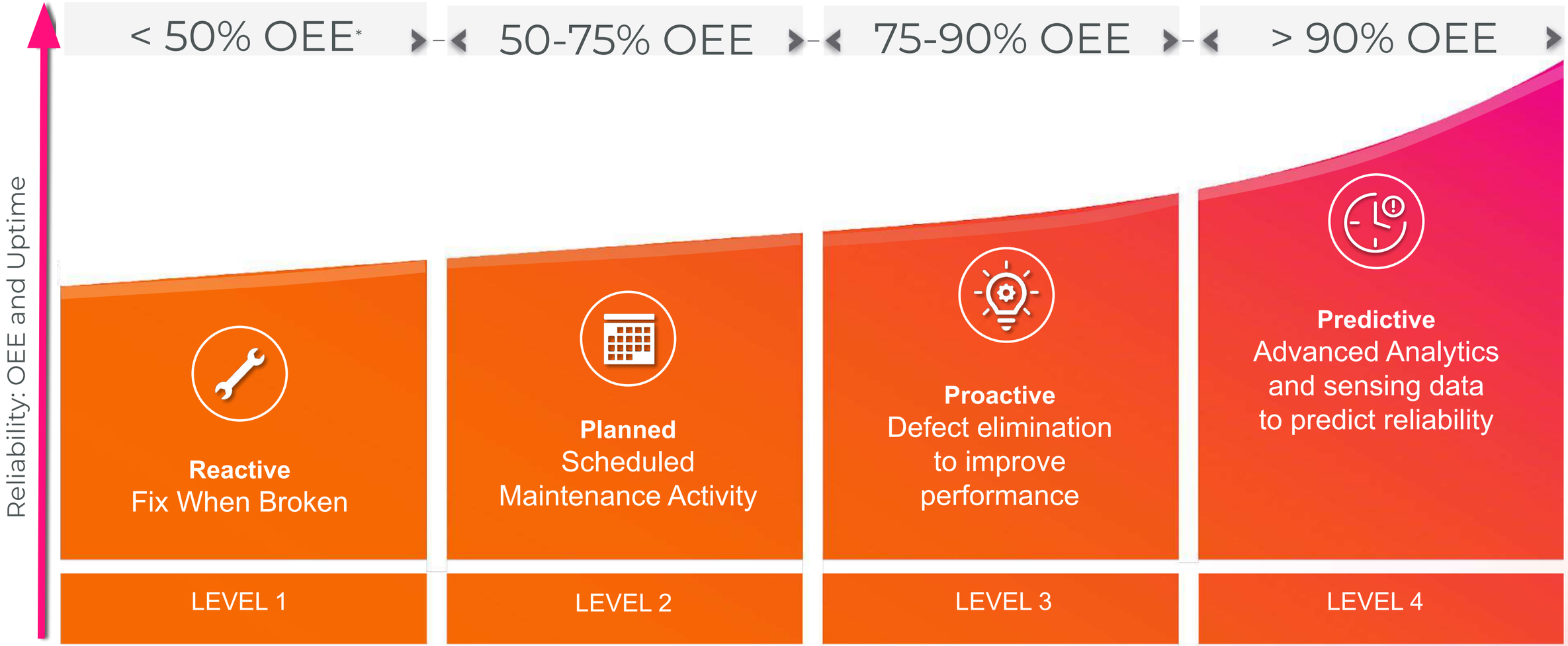


Uptime, availability, cost improvements from Digital Transformation

*ARC Advisory Group

Reaching New Levels of OEE

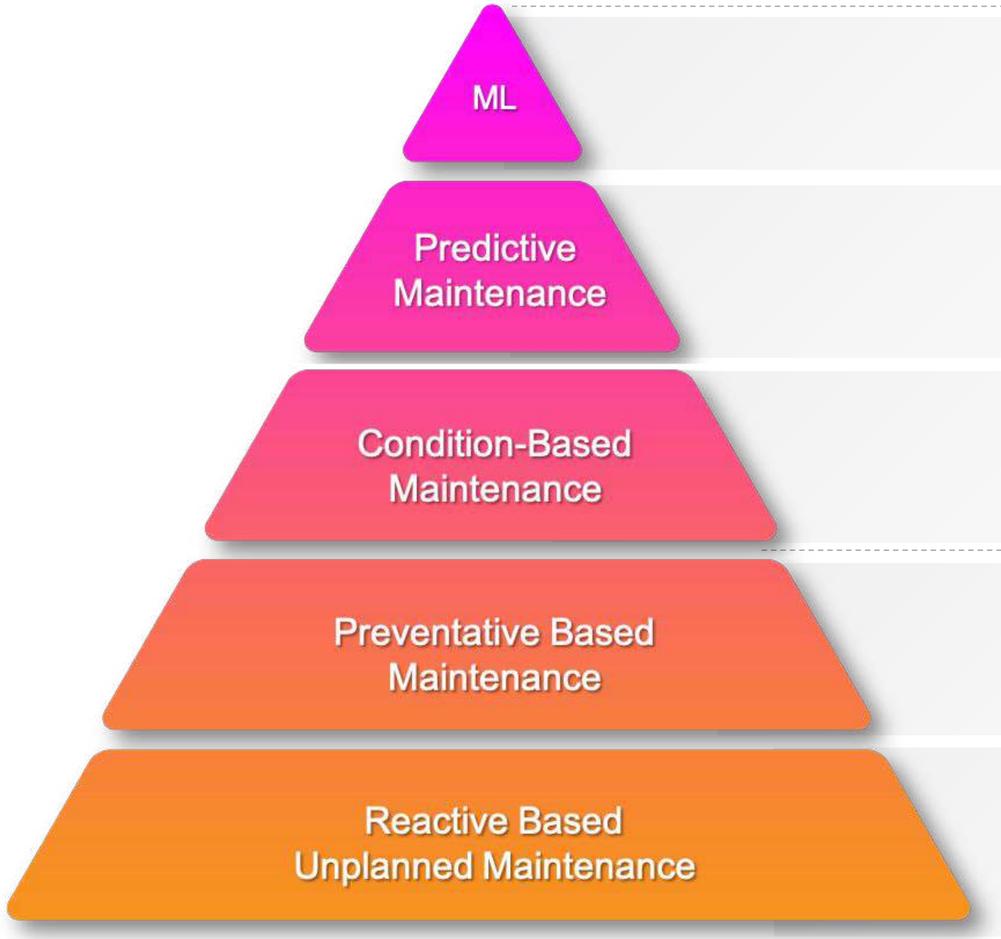
Maintenance Maturity



*Deloitte Analysis: Original Equipment Effectiveness

Predictive Maintenance With Splunk

Data Driven Problem solving



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- Advanced machine learning and AI driven maintenance
- Real-time analytics to predict machine reliability
- Rules-based logic for sensor data

Scheduled and planned maintenance based on usage or time

Repairs completed after equipment has already broken down

“Predictive maintenance increases equipment uptime by 10 to 20% while reducing overall maintenance costs by 5 to 10% and maintenance planning time by 20 to 50%. ”

Deloitte, Predictive Maintenance and the smart factory.

Why Splunk for Predictive Maintenance

A Catalyst for change

90%

▼ **Unplanned Downtime**

Cost Optimization

Improved availability by preventing costly incidents

95%

▼ **Reduced Alerts**

Operational Efficiency

Staff devoted to the issues that matter most

15%

▲ **Efficiency**

Availability

Improved equipment uptime availability and reduced costly outages

>90%

▲ **OEE**

Reliability

Vastly improved OEE capabilities utilizing advanced ML and forecasting

Splunk Essentials for Predictive Maintenance

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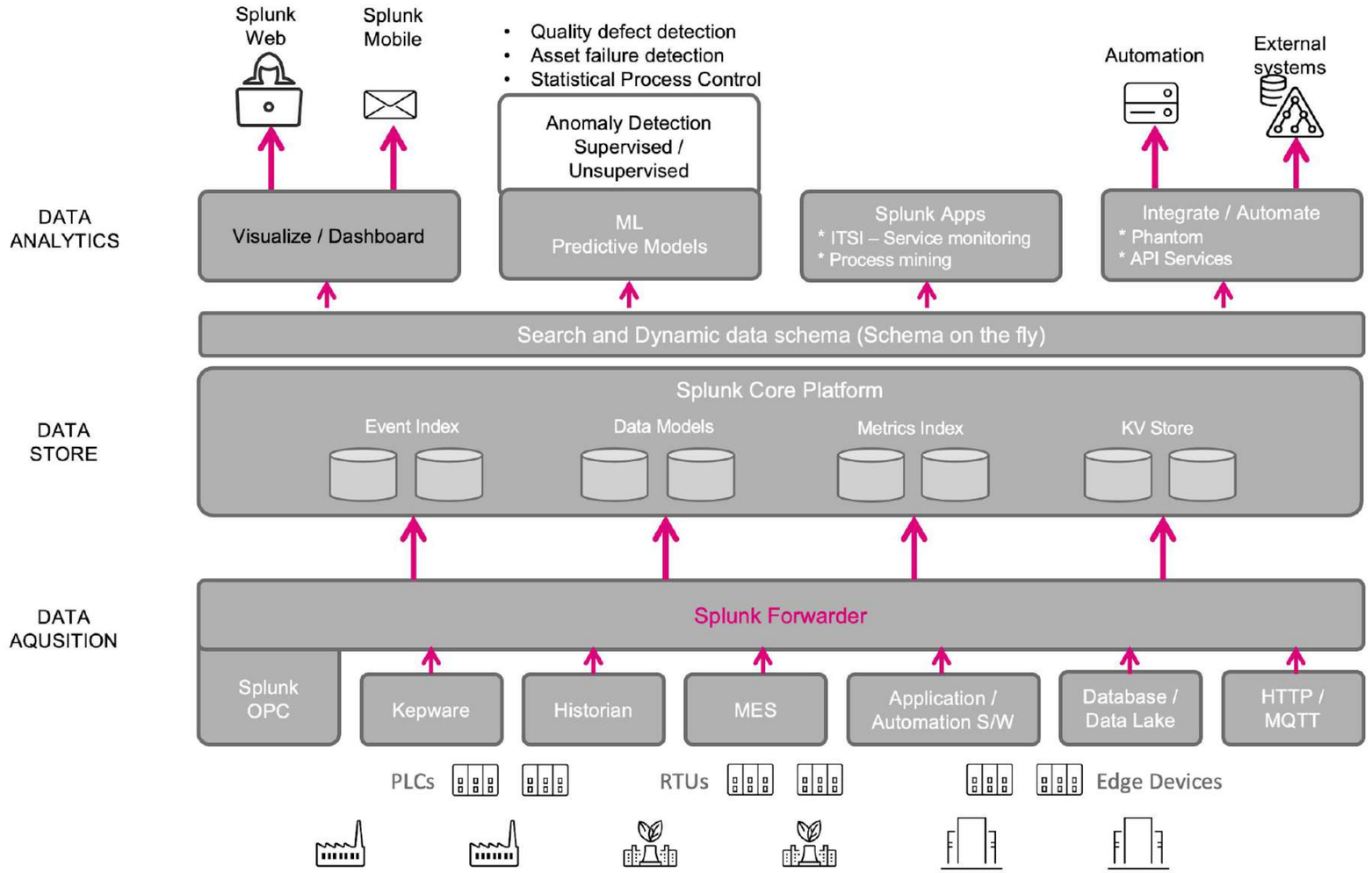
Implementing Splunk

Architectural Example



How to get started

Splunk Essentials for Predictive Maintenance App

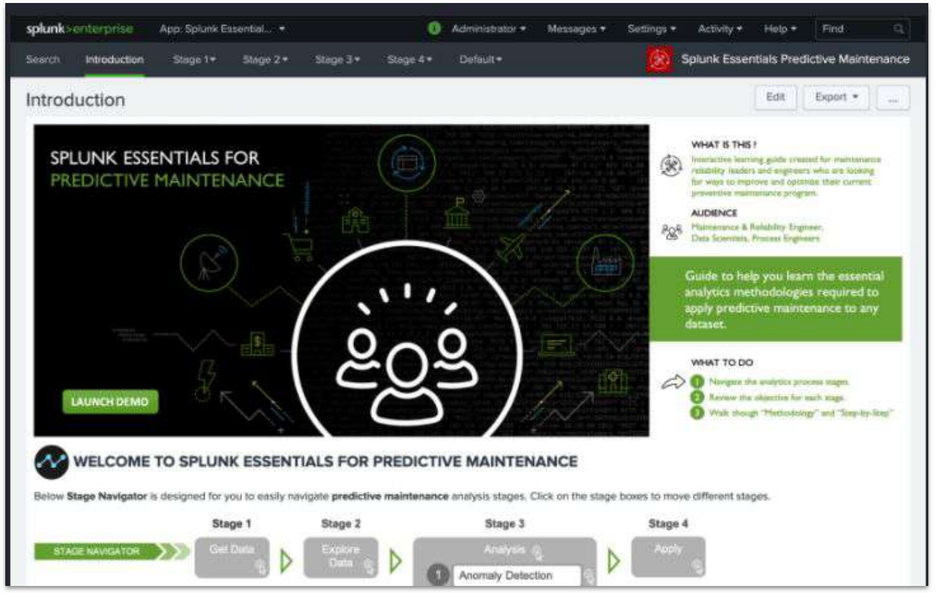
Splunk App – Designed for you to learn and apply predictive maintenance

- Includes sample data sets
- Key analytics techniques on how to understand and design your analysis model
- Step-by-step guides on using Splunk for predictive maintenance analysis + algorithm creation.

Splunk Essentials for Predictive Maintenance

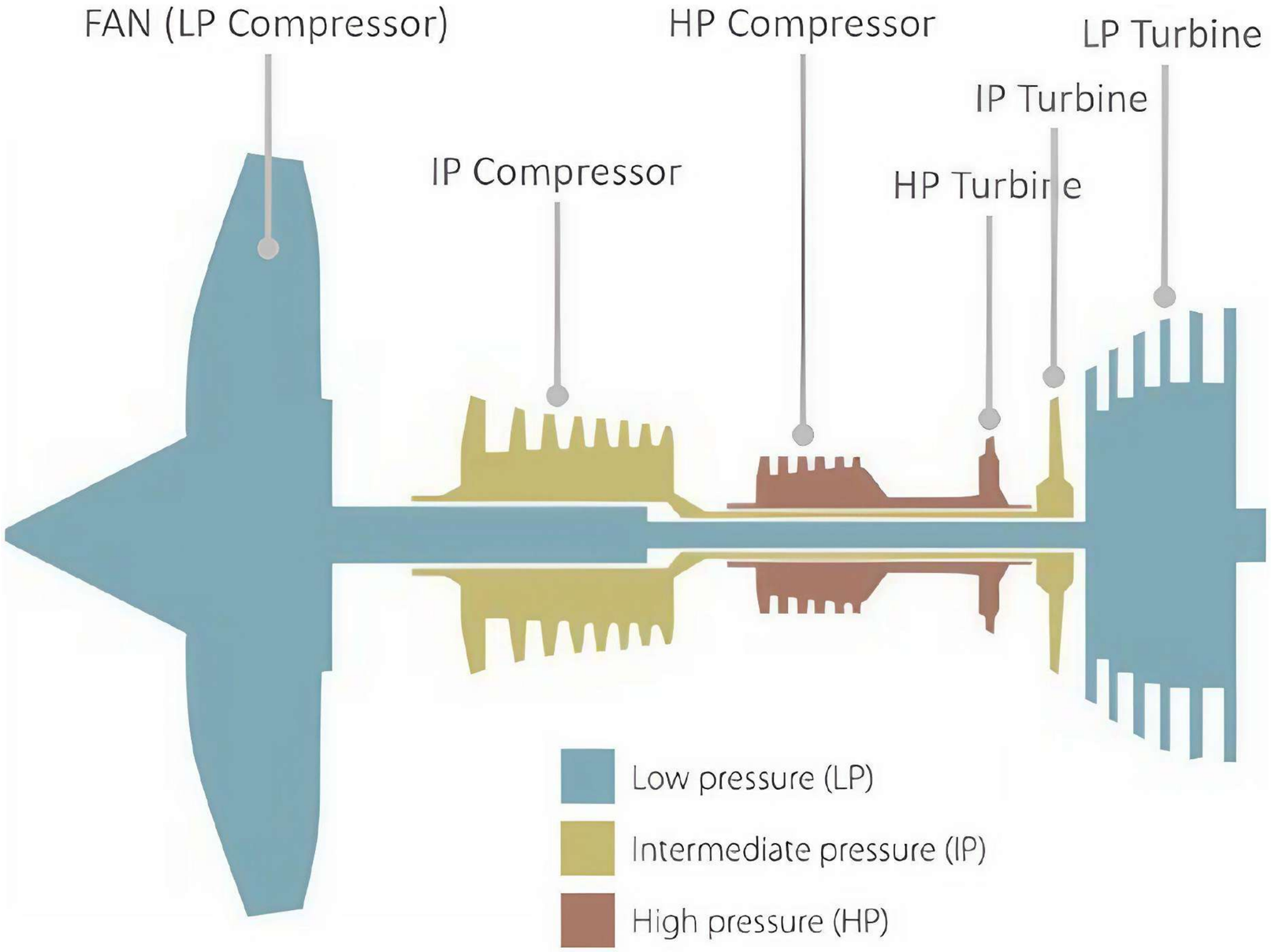
4 ratings

Splunk Built



Jet engine maintenance

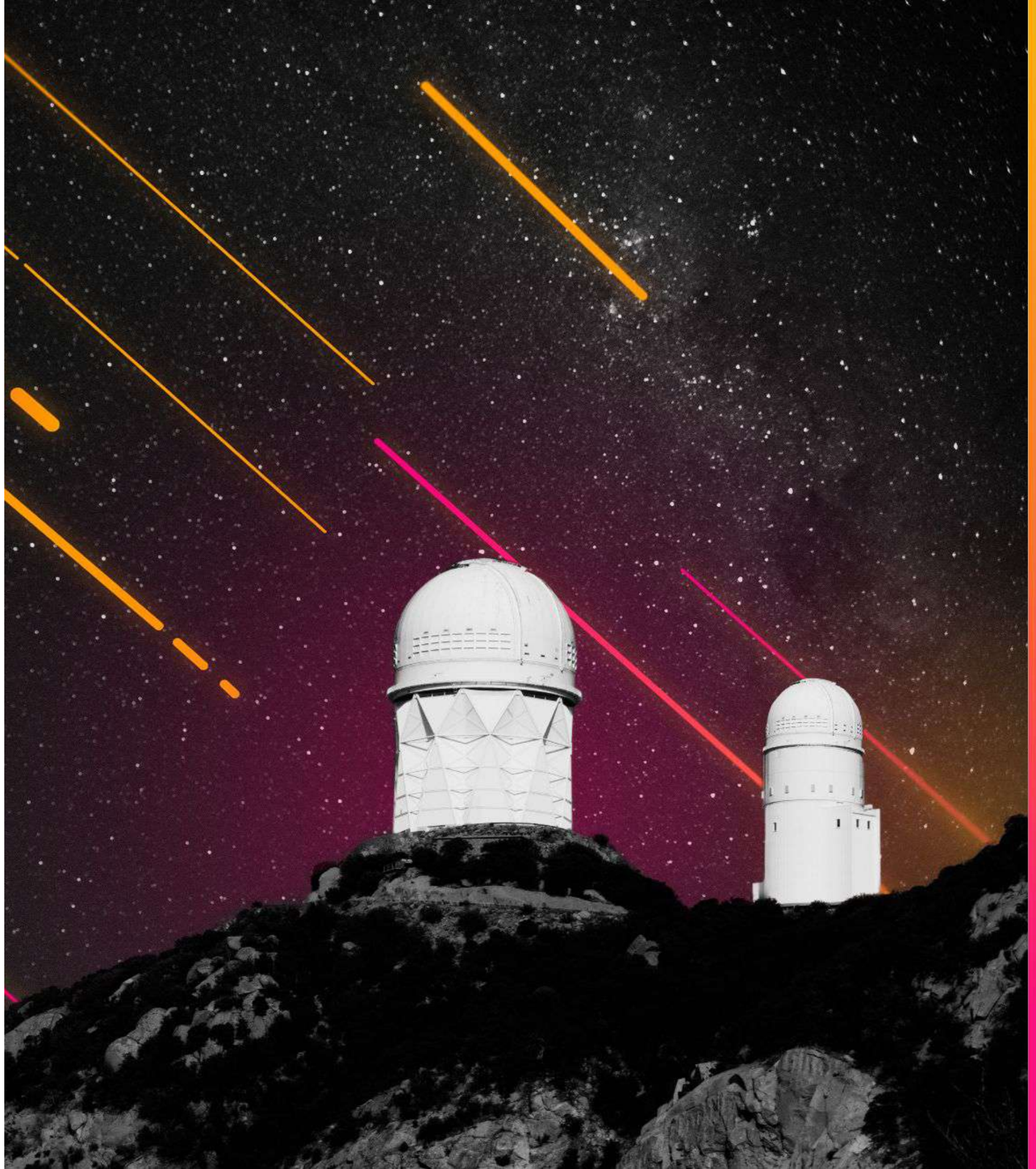
Sample use case ....



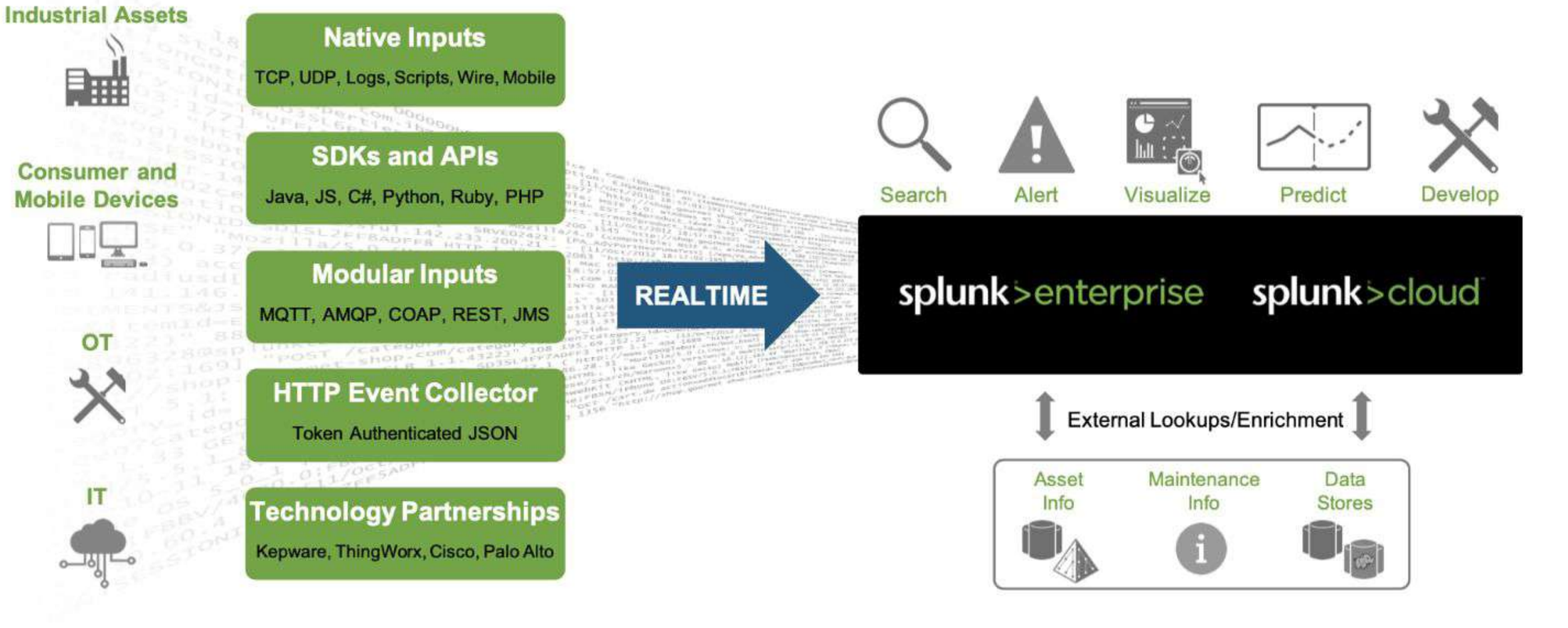
Typical steps

Common to most ML workflows

- Get data in
- Explore data
- Analysis
- Apply



Get Data in …



Explore and prepare data

Exploration of asset metrics

- Identify “features”
- Understand how the asset works
- Understand how the metrics change over time

Normalization (standard scaling)

- Most ML algorithms work better with “features” having the same scale
- Normalization with “Standard Scaling” makes easier to see and compare trends and behaviors

Capturing an event window

- Event windowing is a technique to capture a full data cycle of the subject you want to analyze
- After normalization, the full data cycles that reflect "a maintenance cycle" become clear

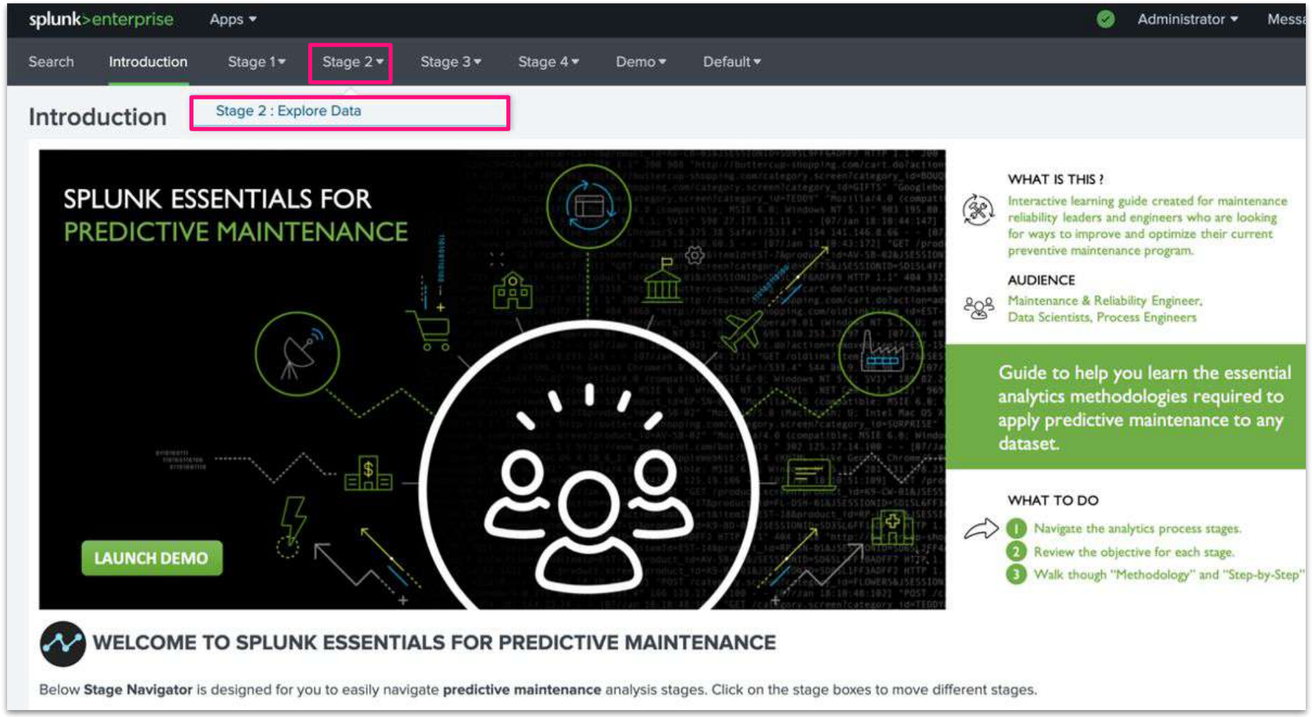
Dataset feature analysis

- By exploring the dataset, we can understand which features of the data are related to or correlated with maintenance performance metrics
- Box Plot visualization

Explore and prepare data activity

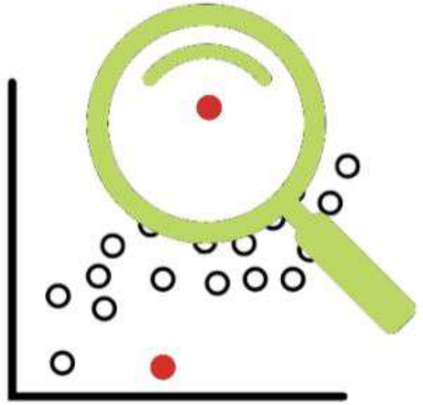
Click on “Stage 2: Explore Data”

Explore the “Content Navigator” sections



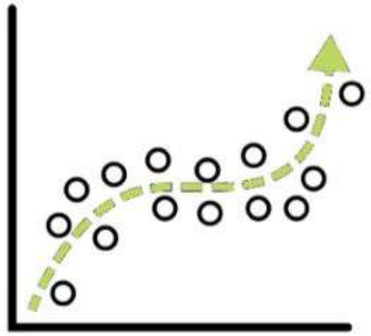
Analysis

Anomaly detection



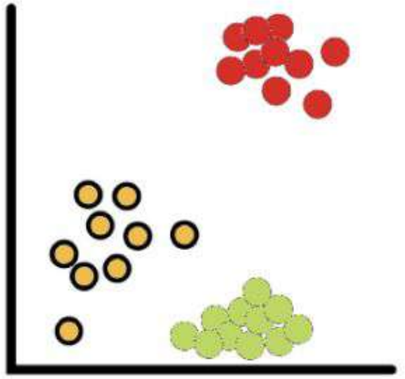
Deviation from past behavior
Deviation from peers
(aka Multivariate AD or Cohesive AD)
Unusual change in features

Supervised Learning



Early warning of failure – predictive maintenance
Predicting Events
Trend Forecasting
Detecting influencing entities

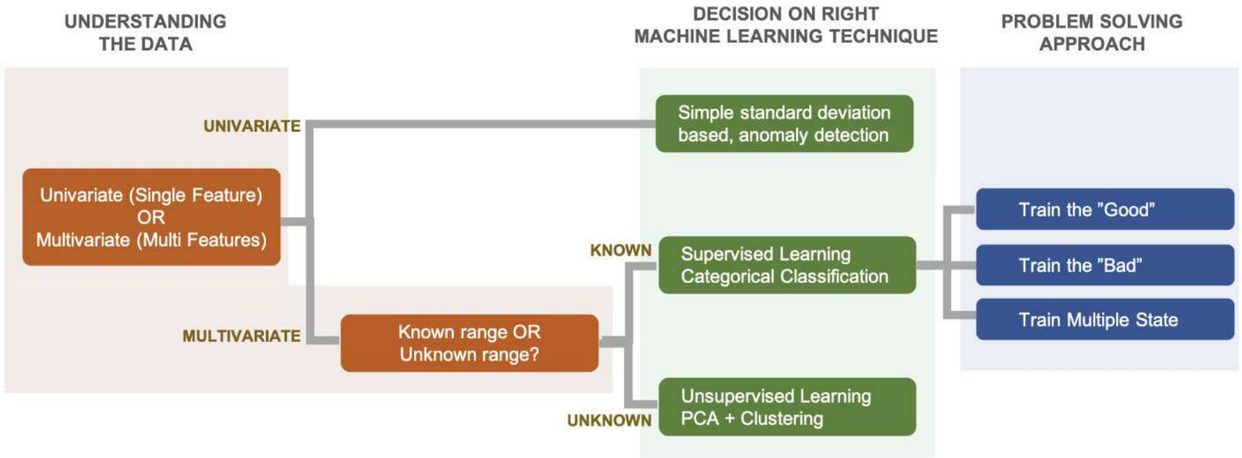
Unsupervised Learning

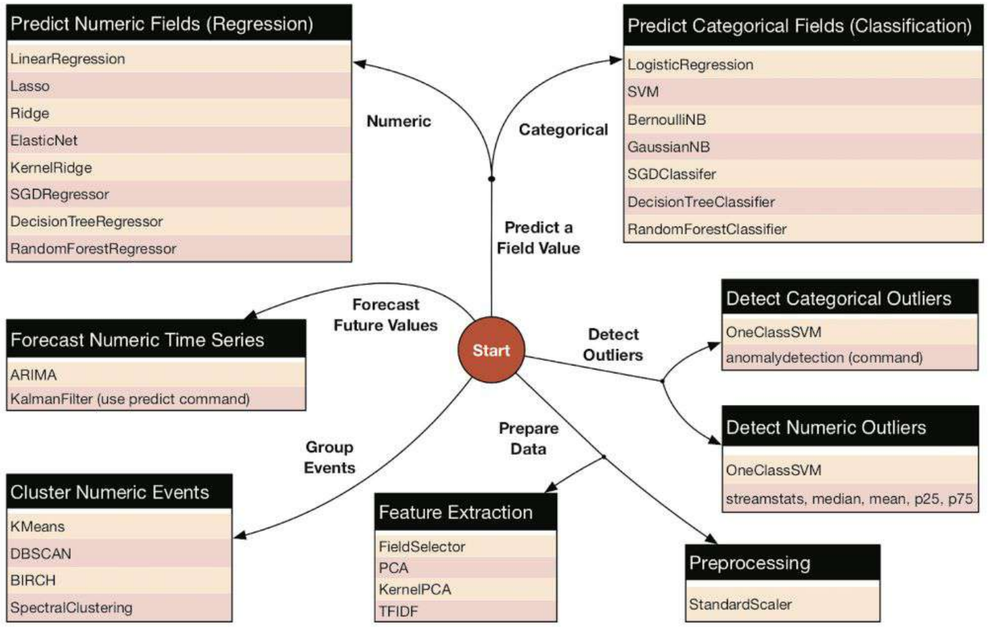


Identify peer groups
Event Correlation
Reduce alert noise

Choosing the right analysis method

Leveraging MLTK

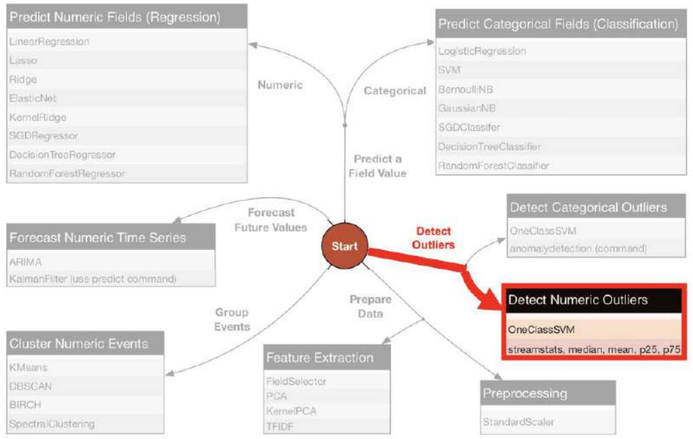




Method analysis summary

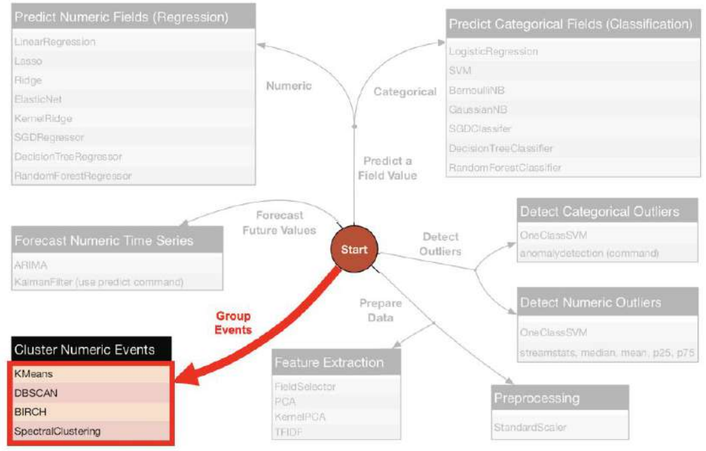
1) Anomaly Detection

Detect numerical outliers



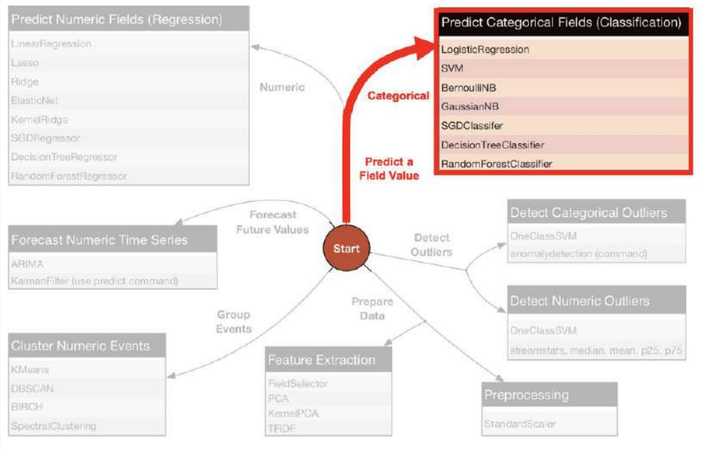
2) Unsupervised Learning

Cluster numerical events



3) Supervised Learning

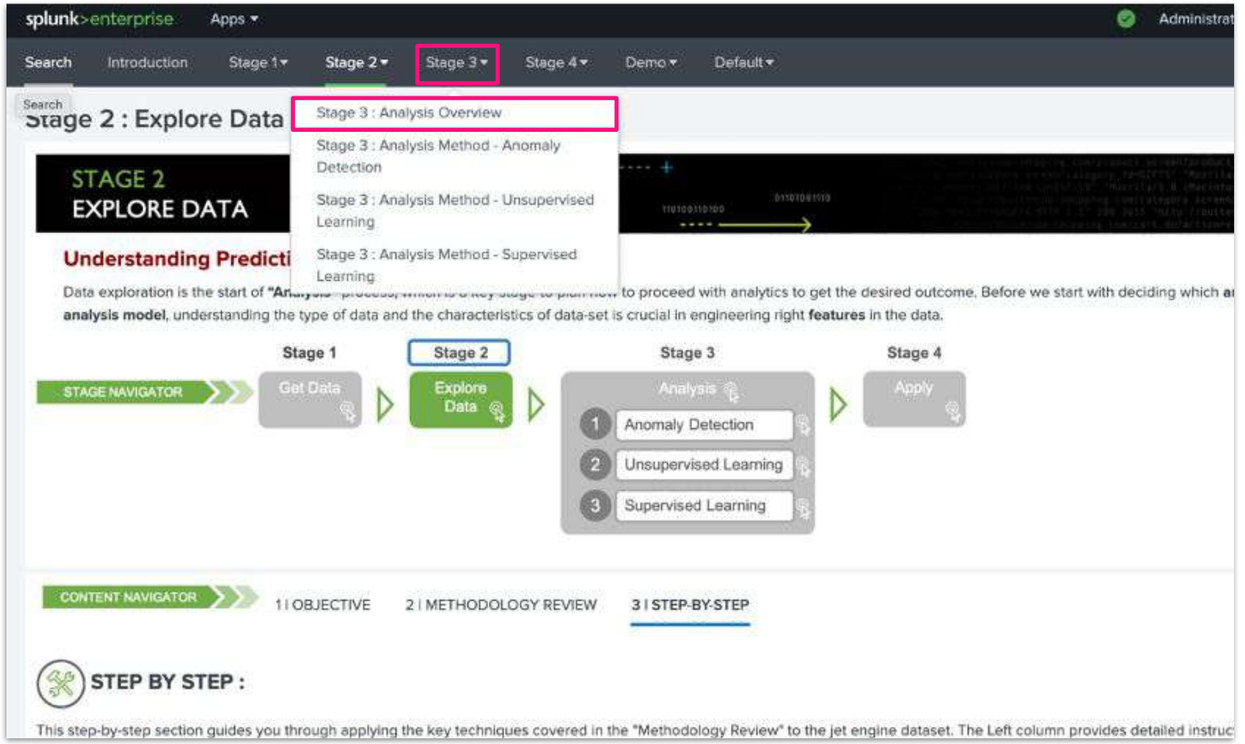
Predict categorical fields

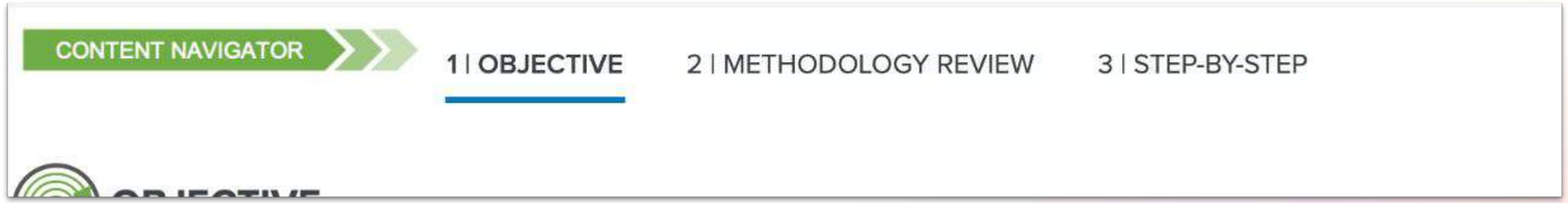


Analysis activity

Click on “Stage 3: Analysis Overview”

Explore the “Content Navigator” sections

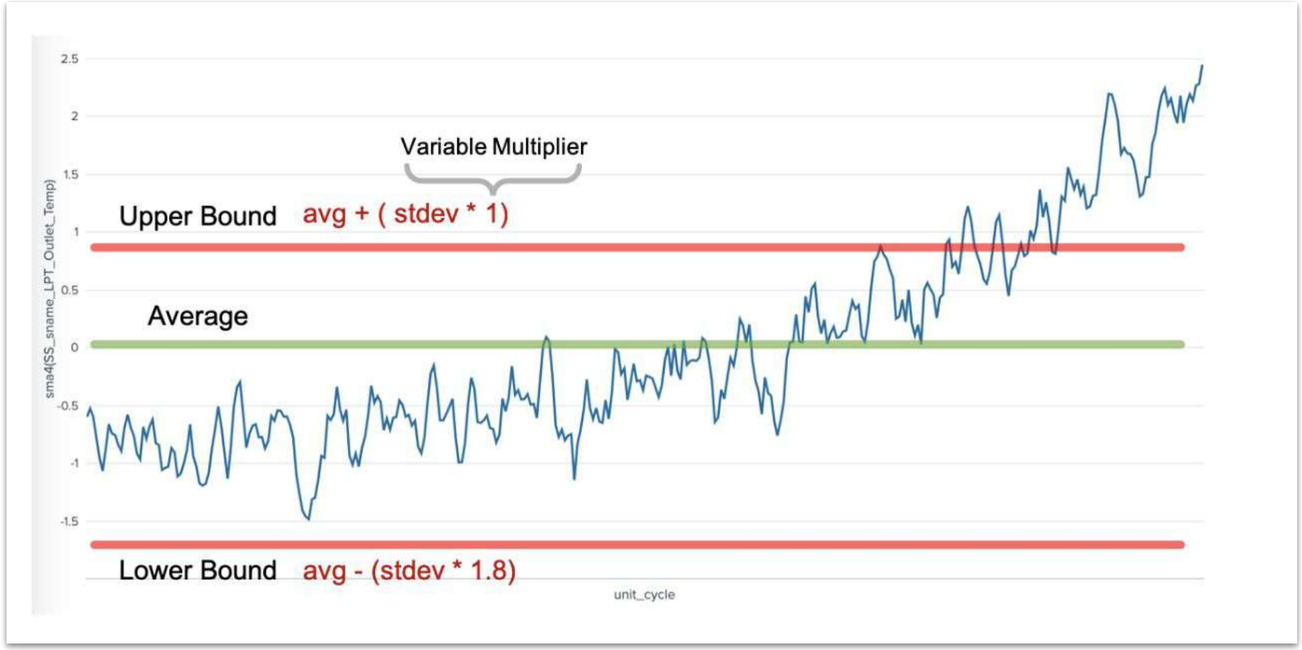




Anomaly detection

Click on “Stage 3: Analysis method - Anomaly Detection

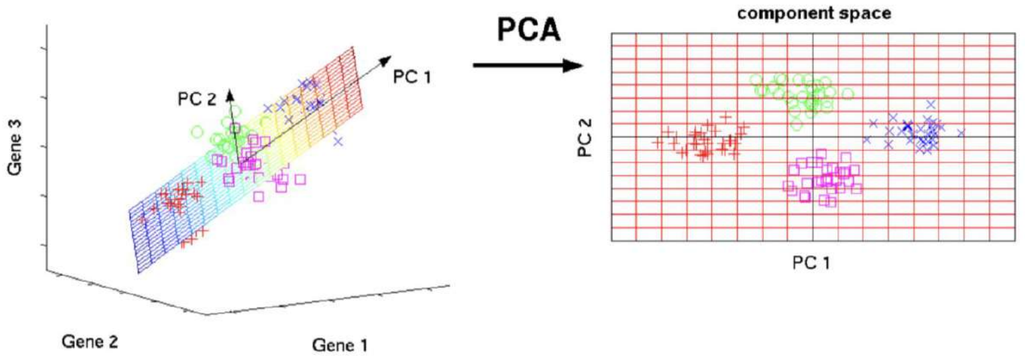
- Use only math functions
- No learning algorithm

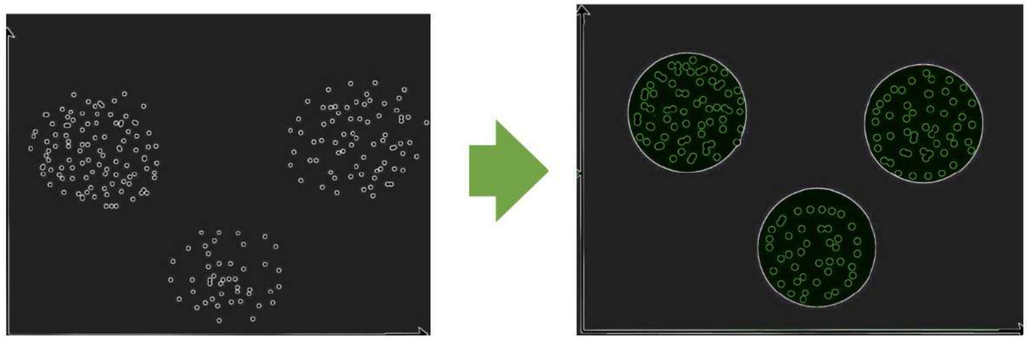


Unsupervised learning

Click on “Stage 3: Analysis method - Unsupervised Learning

- PCA & Clustering

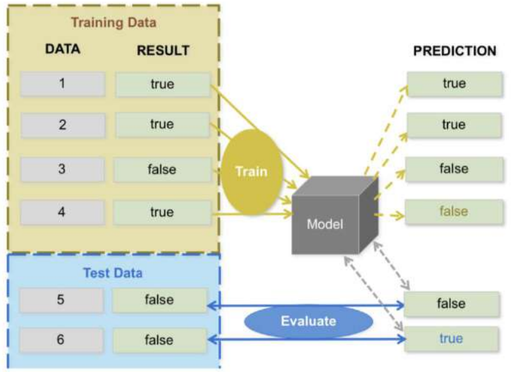


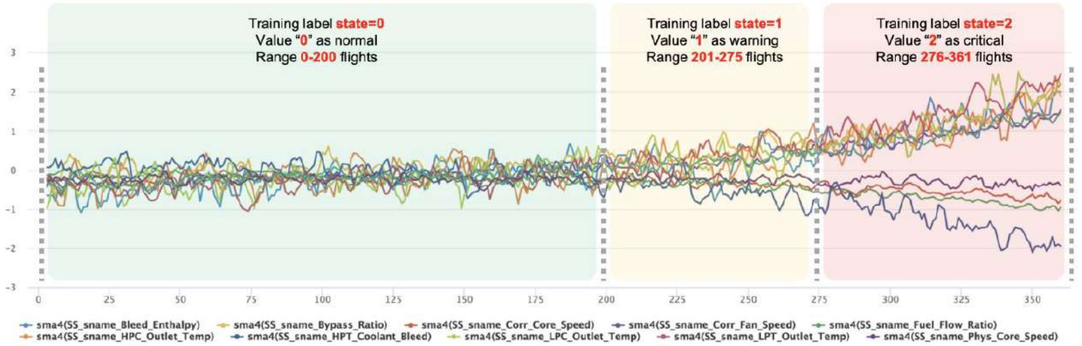


Supervised learning

Click on “Stage 3: Analysis method - Supervised Learning

- Based on known samples
  - Train good
  - Train bad
  - Train multiple states



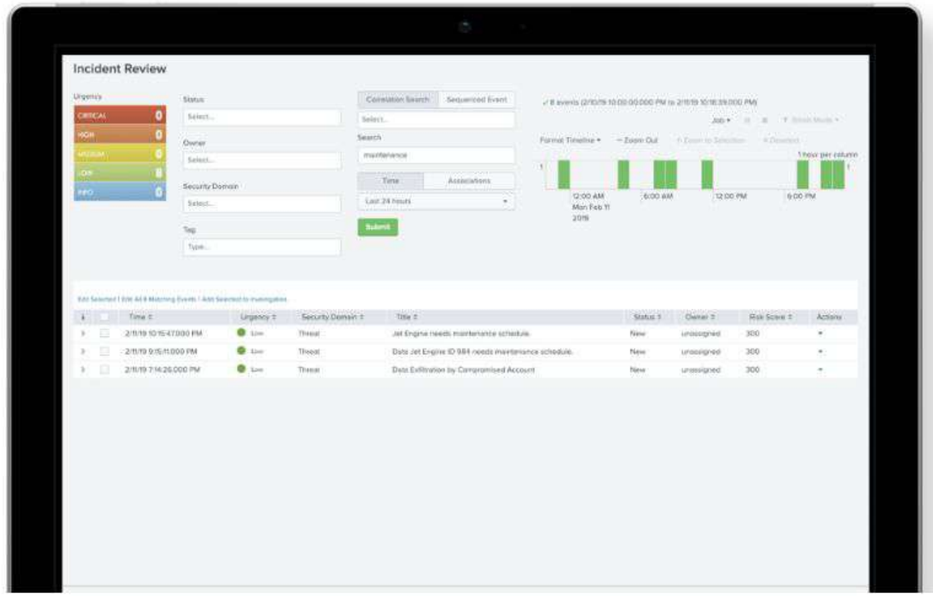


Apply

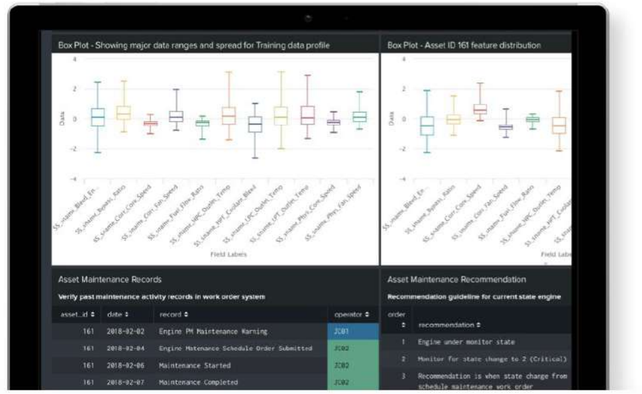
Continuously monitor model performance and maintain predictive capabilities over time

Predictive Maintenance Dashboard

Creating Alerts in Splunk Enterprise



Creating Reports in Splunk Enterprise



Sample Remaining Useful Life (RUL) Analysis

INPUTS

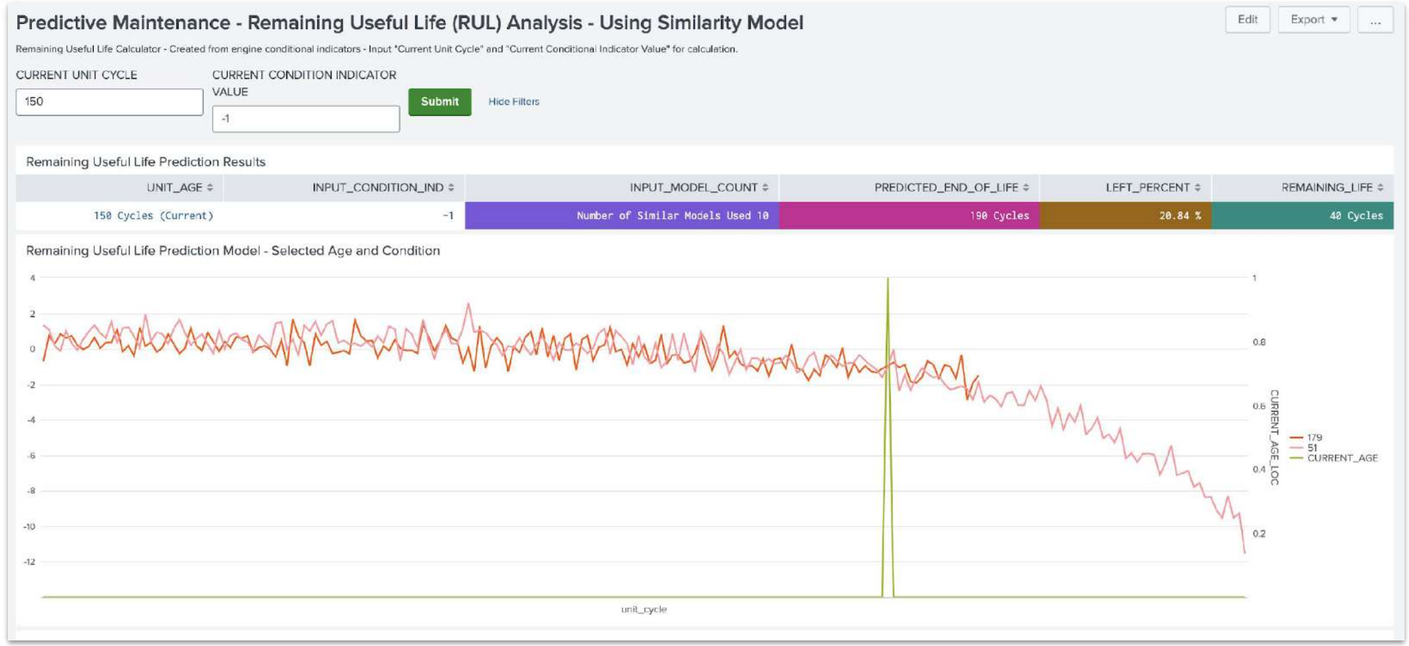
Current Unit Cycle
Current condition indicator value

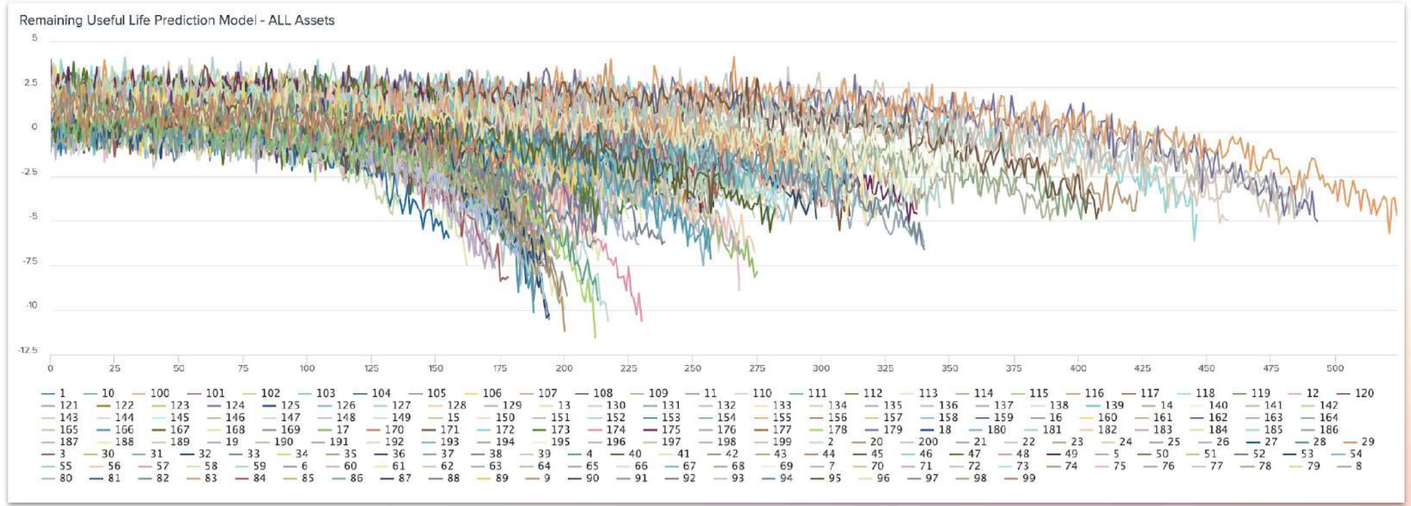
LOGIC

Compare a maximum of N (in this case 10) engines with

- Same current unit cycle
- Nearer (+/-) current condition indicator value

Identify expected remaining useful life on average





Appendix

Guided Walkthrough

What are we maintaining?

Understanding the assets and key performance indicators

Temperature

Temperature can indicate overload of the motor / engine

Speed

Speed of the pumps can change with various operational conditions

Current / Voltage / Fuel

Input power / fuel source consumption or flow can indicate issue

Flow

Output of the pumping activity is measure by the flow

Pressure

Another output performance measure that can indicate lack of pressure

Vibrations

As the asset wears out in various parts vibration is general health Indicators for various conditions

INDUSTRIAL PUMPS

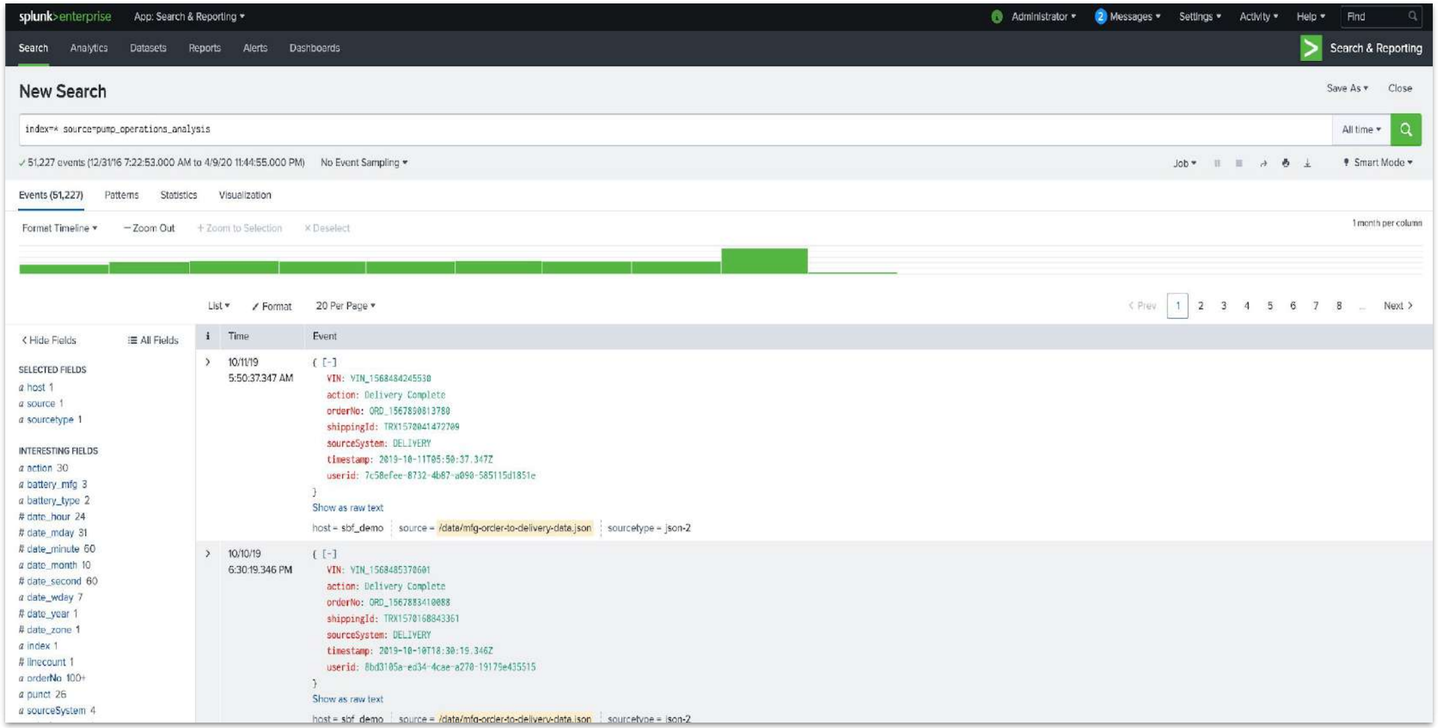
Critical assets throughout the factory plant to create vacuums, push materials

Data Investigation

Analyzing Metric, Events and Referential Data

Data Searching

Quickly search metrics, logs, events and referential data in full fidelity



Data Correlation

Correlation of related events, metrics, fields and associated information

Data Analysis

Automated analysis of important data fields, events and metrics

Data Visualization

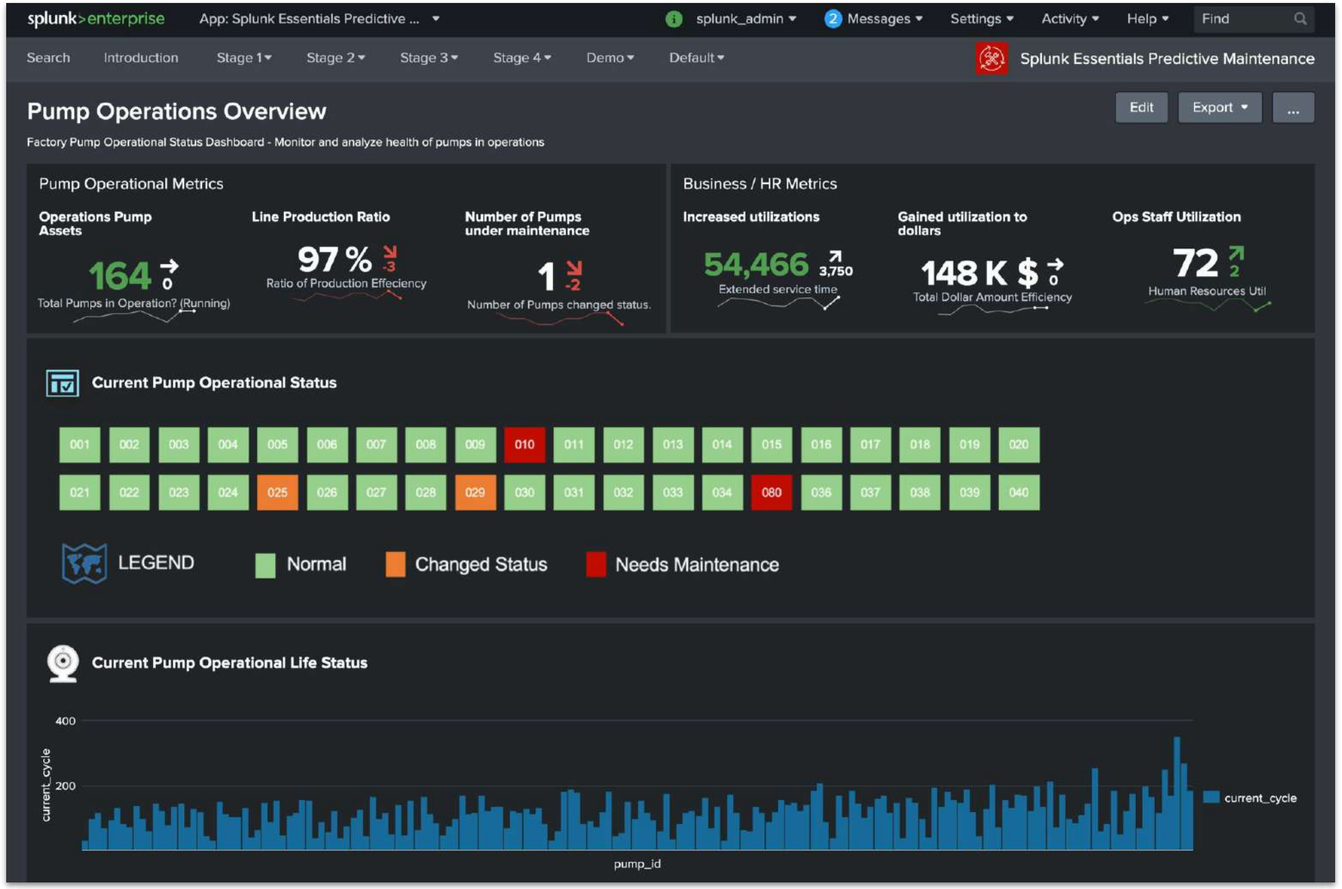
Visualizing Metric, Events and Referential Data

Alerts and Prediction

Trend and prediction analysis of operational conditions and future performance.

Status KPI’s

Full coverage of asset operational status.



Business Metrics

Business financial analysis associated with uptime, production and utilization of assets and personnel.

Historical Analysis

Asset performance over time with anomaly detection for quick investigation and preventive equipment failure

Data Visualization – Drill Down

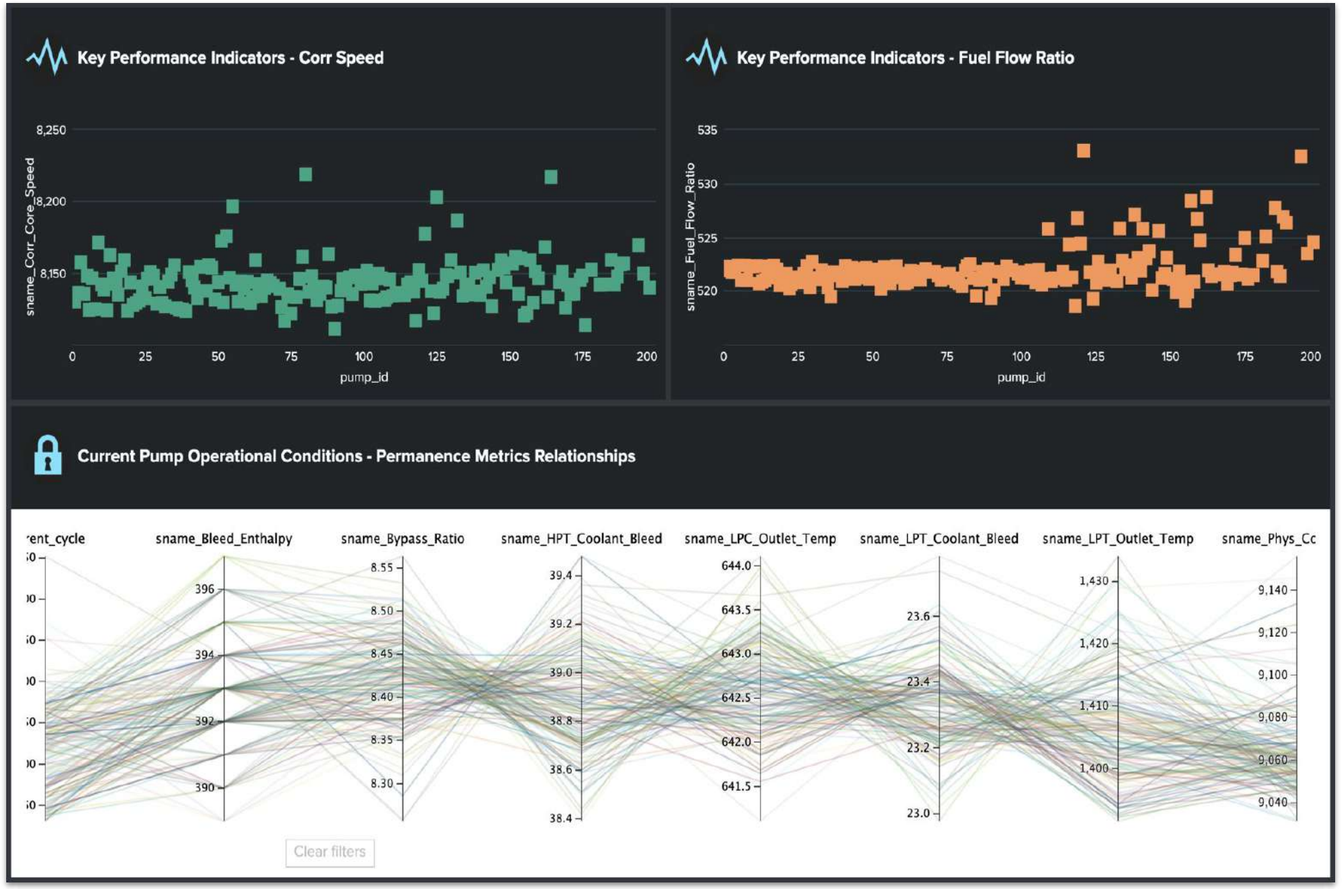
Visualizing Metric, Events and Referential Data

Metric Analysis

Detailed metric analysis of asset performance over time

Metric Correlation

Relationship mapping and analysis of asset data points to understand correlative anomalies.



Metric Analysis

Any number of metrics displayed based on vital information and key critical data points

Data Visualization – Customizable Views

Apply a lens to your information in multiple ways

Live Dashboard

KPI visualizations for at-a-glance analysis of key components

Trend Visualizations

Correlate and display data based on actionable displays

Detailed Analysis

Active bar chart and table visualization for quickly pinpointing outlier metrics or to analyze time series data

Thank you

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