

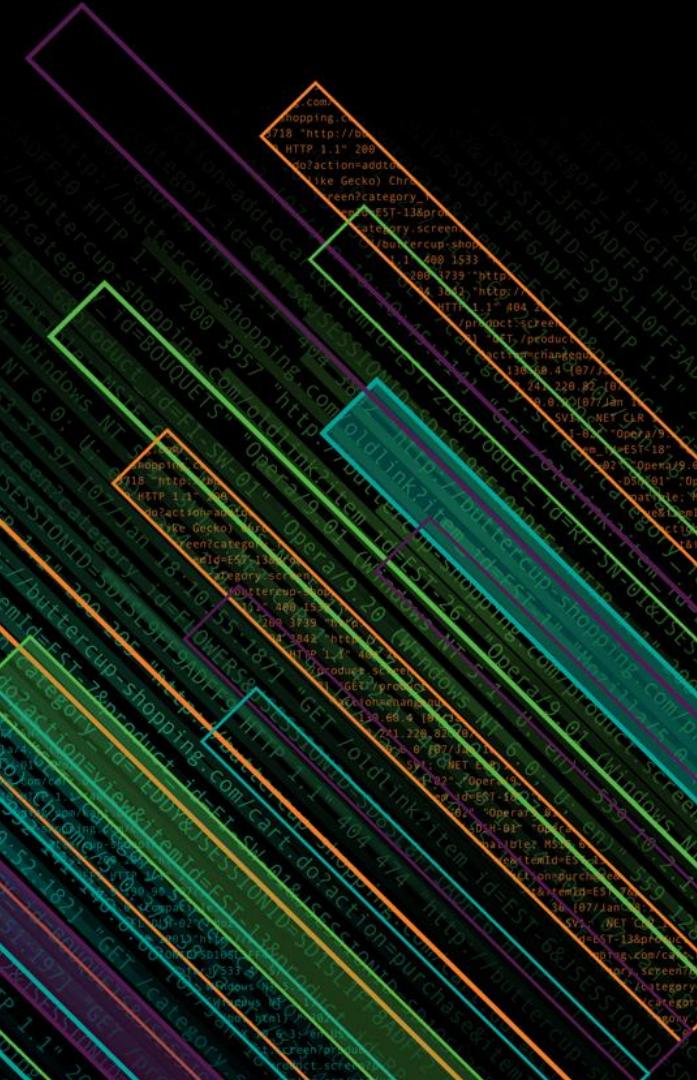


Splunk for Industrial IoT:

Taking Your Operation from Reactive to Data-Driven

Erick Dean | Director of Product Management - IoT

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OUR MISSION

**Making machine data
accessible, usable and
valuable to everyone.**

What is Machine Data?

MANUFACTURING

Operational technology (OT) and Sensor data

Industrial controls, SCADA, actuator and other equipment

IDC estimates that by 2025, more than a quarter of data created in the global datasphere will be real time in nature, and real-time IoT data will constitute more than 95% of this.

Work order data

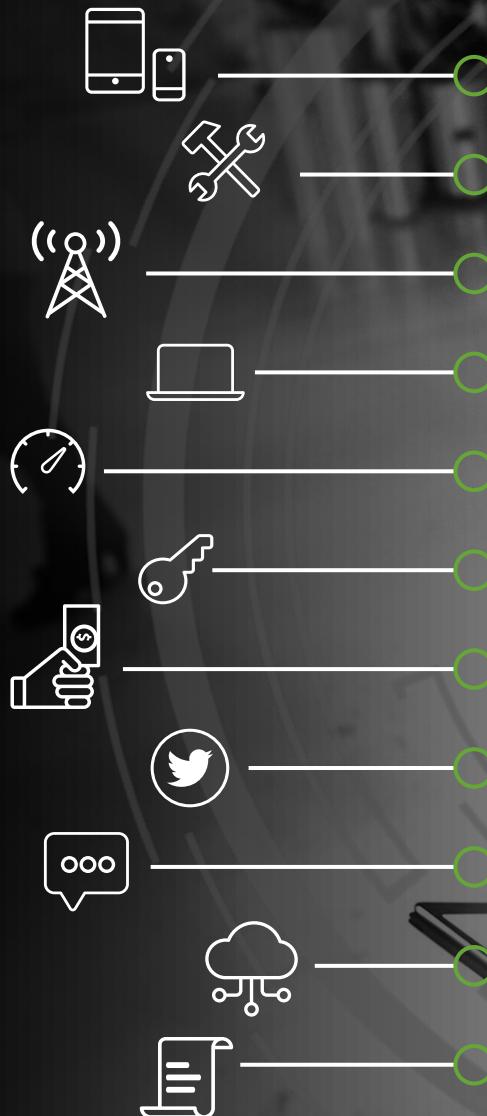
Alarms, location and inventory data

Maintenance work order processes need to be defined and managed as an integrated part of the production order, materials procurement and logistics processes.

Security data

Firewall data, endpoint data

A 2018 security study revealed 147 vulnerabilities in 34 separate SCADA mobile applications.



Industrial Data Contains Critical Insights

SOURCES



Alarms and Events



Work Order



Sensor Data

Industrial Data Contains Critical Insights



SOURCES



Alarms and Events

Alarm Date

05/27/2014T10:24:17GMT applicationId="safetyObs" eventType="safety" assetID="CV1002384-1045" employeeId="114635" jobSite="PLEC-2014-GC" observationId="184568-451124-256" observation="Control Valve handle extracted to manual position. No lockout/tagout or other tag visible. Process is running." observationCriticality="5" imageId="PLEC-2014-GC-184568-451124-256" imageUri="https://mybucket.s3.amazonaws.com/PLEC-2014-GC-184568-451124-256.png"



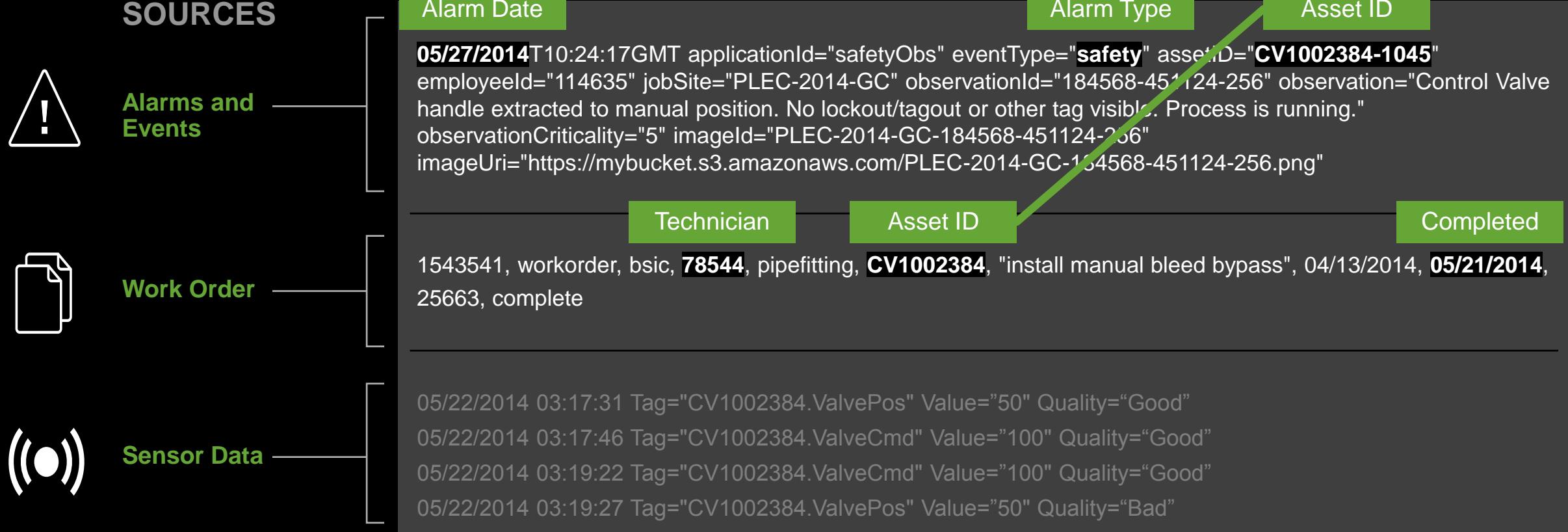
Work Order

1543541, workorder, bsic, 78544, pipefitting, CV1002384, "install manual bleed bypass", 04/13/2014, 05/21/2014, 25663, complete

Sensor Data

05/22/2014 03:17:31 Tag="CV1002384.ValvePos" Value="50" Quality="Good"
 05/22/2014 03:17:46 Tag="CV1002384.ValveCmd" Value="100" Quality="Good"
 05/22/2014 03:19:22 Tag="CV1002384.ValveCmd" Value="100" Quality="Good"
 05/22/2014 03:19:27 Tag="CV1002384.ValvePos" Value="50" Quality="Bad"

Industrial Data Contains Critical Insights



Industrial Data Contains Critical Insights



SOURCES



Alarms and Events

Alarm Date

05/27/2014T10:24:17GMT applicationId="safetyObs" eventType="safety" assetID="CV1002384-1045" employeeId="114635" jobSite="PLEC-2014-GC" observationId="184568-451124-256" observation="Control Valve handle extracted to manual position. No lockout/tagout or other tag visible. Process is running." observationCriticality="5" imageId="PLEC-2014-GC-184568-451124-256" imageUri="https://mybucket.s3.amazonaws.com/PLEC-2014-GC-184568-451124-256.png"

Alarm Type

Asset ID



Work Order

Technician

Asset ID

Completed

1543541, workorder, bsic, **78544**, pipefitting, **CV1002384**, "install manual bleed bypass", 04/13/2014, **05/21/2014**, 25663, complete

MTBF

Asset ID

Quality

Sensor Data

05/22/2014 03:17:31 Tag="**CV1002384.ValvePos**" Value="50" Quality="Good"

05/22/2014 03:17:46 Tag="CV1002384.ValveCmd" Value="100" Quality="Good"

05/22/2014 03:19:22 Tag="CV1002384.ValveCmd" Value="100" Quality="Good"

05/22/2014 03:19:27 Tag="CV1002384.ValvePos" Value="50" Quality="Bad"

Factories of the Future Need Operational Intelligence to Survive and Compete

REAL-TIME MONITORING



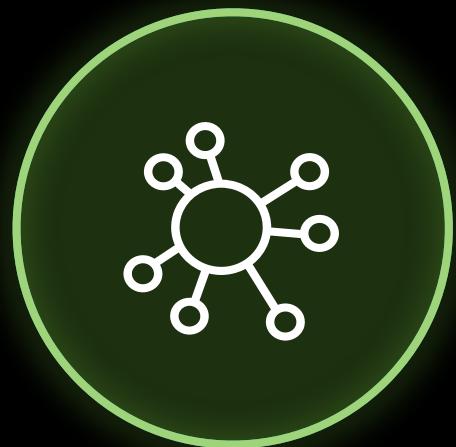
Data aggregation across disparate systems

PREDICTIVE ANALYTICS



Condition based and predictive maintenance to reduce costs

OT
SECURITY



Mitigating cyber security risks due to outdated software and controls

Splunk for Industrial IoT

Real-time visibility and predictive analytics



Real-time
Monitoring



Diagnostics and
Troubleshooting



OT Security



Predictive
Maintenance

Industrial Asset
Intelligence

Search and
Reporting

Machine Learning

splunk[®]

Platform for Machine Data

Data Integrations (OPC, MQTT, Kepware, OSIsoft..)



Sensor (metric) data



Unstructured (event) data

splunk[®] .conf18

Enhance Visibility of Industrial Control Systems

Gain real-time visibility of SCADA applications

Set alerts on key metrics. Proactively discover system issues before they result in production downtime.

Improve reliability of critical software and systems

Catch performance issues before they happen with advanced warnings and early detection mechanisms.

When issues happen, resolve them quickly

Advanced search and investigation techniques drive better troubleshooting of problems.

Splunk Search & Reporting Application



Leverage Advanced Analytics to Stay One Step Ahead

Splunk Machine Learning Toolkit (MLTK)



Build custom machine learning models

Choose from dozens of ML algorithms to develop a model that fits your use case

Actionable intelligence

Operationalize the machine learning process of collecting and analyzing data, training data models, and continuous monitoring.

Forecast and predict operational issues

Be prepared for when equipment is close to failure or yields are likely to drop

Improve Availability and Performance of Industrial Assets

Splunk Industrial Asset Intelligence (IAI)

Gain real-time visibility across the operation

Monitor and analyze silos of data that span historians, SCADA, EAM, purchasing and inventory

Give engineers the ability to quickly diagnose issues

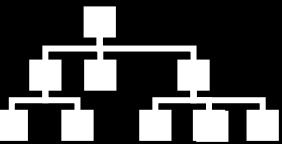
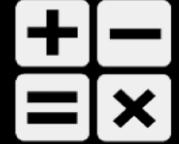
Simple visualization of disparate data allows engineers to quickly pinpoint root cause of issues

Customize for diverse set of operations

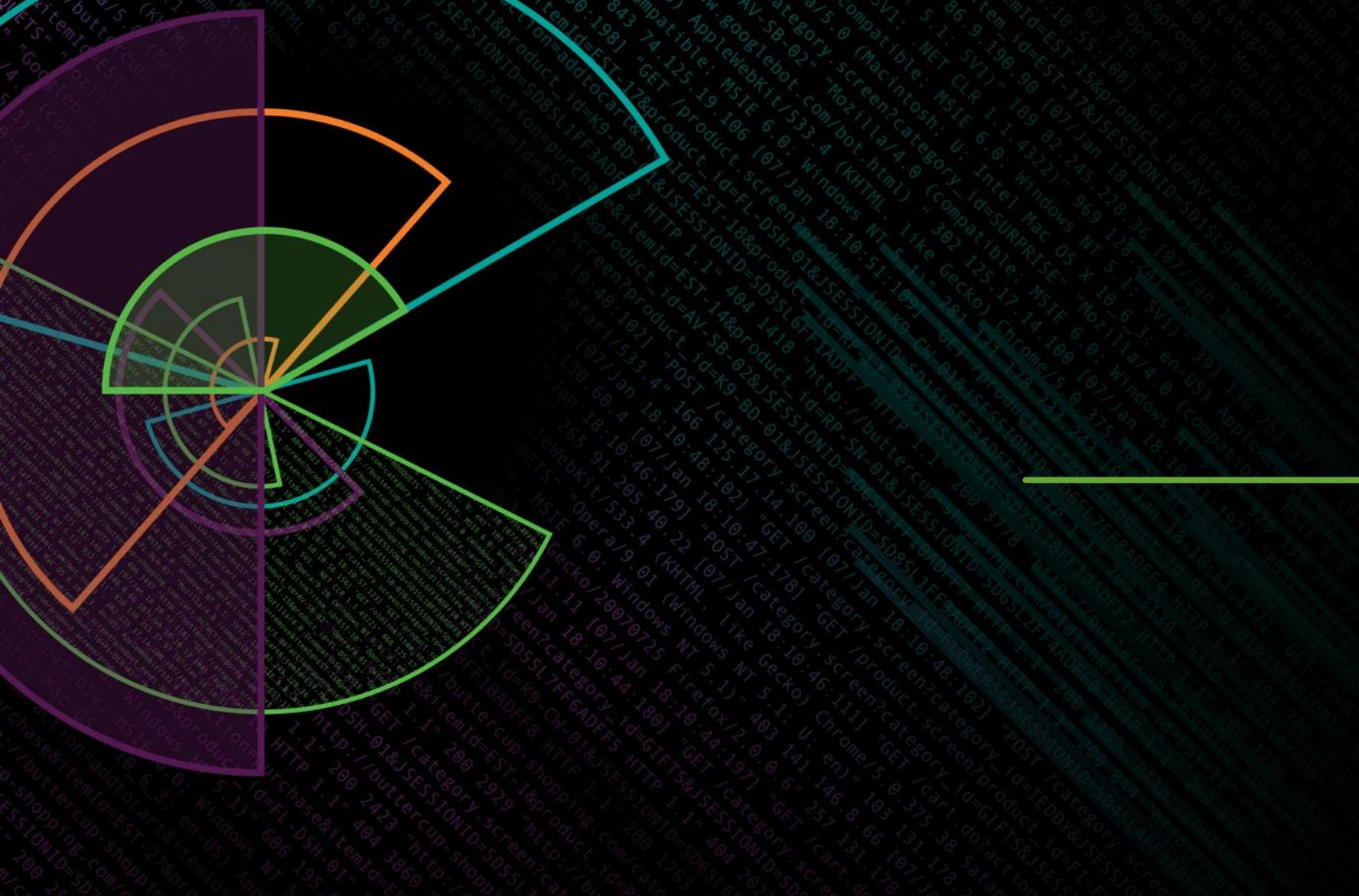
Build custom visualizations, create complex formulas, and set real-time alerts without the need for programming

The screenshot displays the Splunk Enterprise interface for Industrial Asset Intelligence. The top navigation bar includes 'splunk>enterprise', 'Industrial Asset Intelligence', 'Administrator', 'Messages' (with 4 notifications), 'Settings', 'Activity', and 'Help'. A blue header bar on the right says 'IAI'. The main content area has a dark sidebar with icons for 'Operation 1', 'Browse', 'Assets' (selected), 'Classes', and a search bar. Below this is a tree view of asset categories: '100_series' (selected), '100_1100' (selected), 's_engine', '100_1101' (selected), 's_engine', '100_1102' (selected), 's_engine', and '200_series'. To the right, a card for 'SIEMENS ENGINE' shows '100_series.100_1100.s_engine' as an 'Engine made by Siemens.' Below it, under 'Metrics', is a card for 'Fuel Consumption' showing '16-cylinder high-speed Cummins QSK95 diesel engine'. Two performance metrics are displayed: a green box for 'Current Consumption (gal)' at 2.47 and an orange box for 'Class AVG Consumption (gal)' at 7.04. To the right is a detailed image of the Cummins QSK95 engine.

Key Features of Splunk Industrial Asset Intelligence

- 1 Asset Hierarchy** 
 - 2 Asset Groups** 
 - 3 Formula Builder** 
 - 4 Conditions & Actions** 
 - 5 Spatial View** 
 - 6 Analyze View** 
- Build asset hierarchies and associate data to individual assets from disparate data sources
- Create & replicate visualizations, custom formulas, KPIs and alerts across fleets/groups of assets
- Create complex calculations without using SPL
- Set Splunk conditions (e.g., thresholds) and alerts (e.g., SMS, email) via a graphical UI tool
- Develop visualizations of an asset, process, or system via a drag and drop editor
- Perform ad-hoc analysis of time-series data to troubleshoot process or equipment issues

Demo





TRANSPORTATION

Real-time Fleet Analytics and Smart Asset Management

- Correlates onboard telematics, sensor and geolocation data
- Improved locomotive availability and reduced downtime drives better customer service and lowers maintenance costs
- Real-time view into locomotive health enables condition monitoring

ENERGY

Infigen Predicts Turbine Behavior and Maintenance Across 6 Wind Farms

- Monitors wind turbines and energy production across 3 wind farms
- Ensures uptime and availability of critical automated SCADA systems
- Real-time insights into revenue generated and projected energy production





MANUFACTURING

Shaw Breaks Production Records with Splunk IoT

- Real-time insights into manufacturing processes by correlating equipment, production and inventory data
 - Improved operator support and training by analyzing shift times
 - Increased equipment reliability, product quality and reduced costs

Shaw Industries

Splunk for Industrial IoT



A single place to store, access and analyze all your industrial data



Monitoring platform to ensure reliability of critical assets and systems



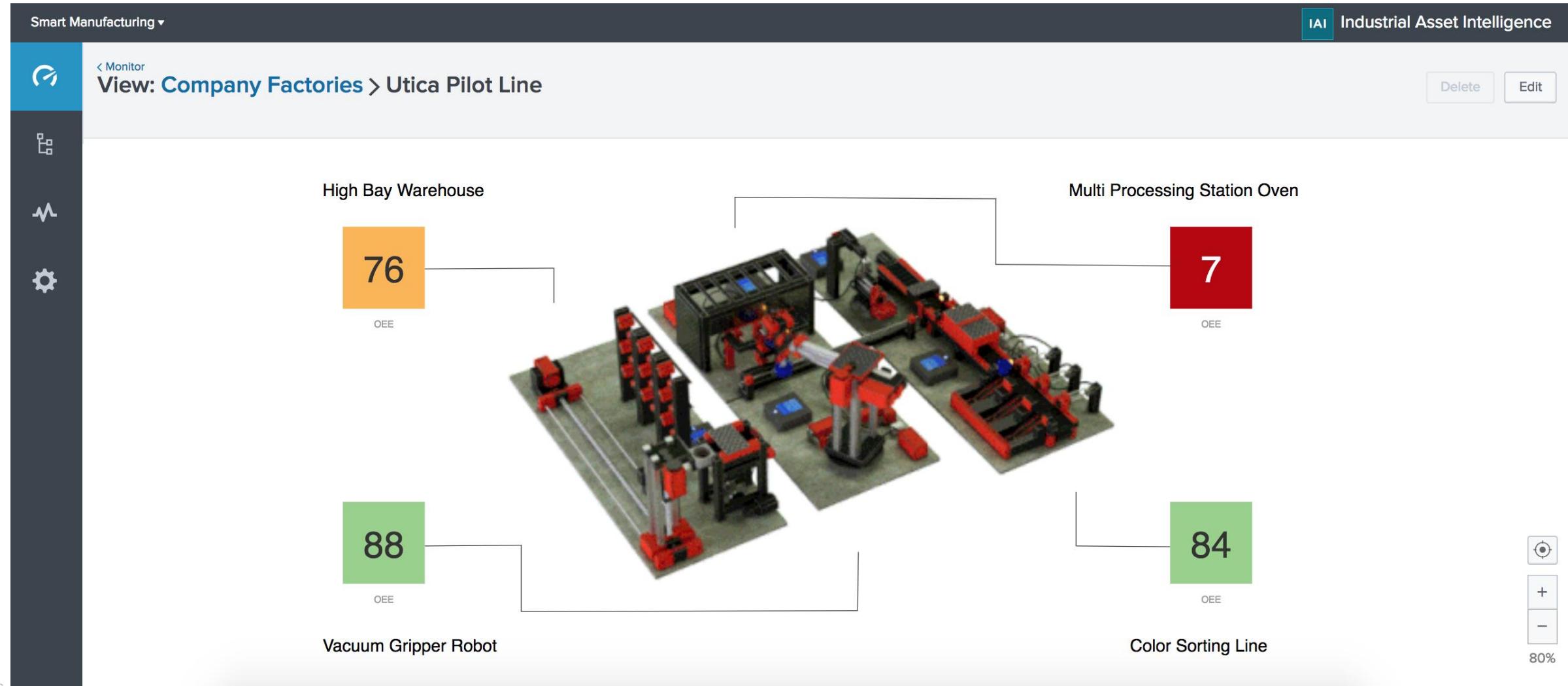
Security platform for protecting critical assets and the control systems that monitor them



Machine-learning ready platform for predictive analytics

Q&A

Spatial View



Spatial View (Edit)

Smart Manufacturing ▾

IAI Industrial Asset Intelligence

< Monitor
View: Company Factories > Utica Pilot Line

Delete Edit

Utica Pilot Line

Asset Metrics Other < Now ▾ Preview Clear Revert All Changes Close Save

High Bay Warehouse OEE 83

Multi Processing Station Oven OEE 62

Vacuum Gripper Robot OEE 86

Color Sorting Line OEE 85

Grid On Grid Off > Configurations

Metric Name: OEE
Description:
Unit:
Associated Asset: utica.pilot.line.multi processing station oven c

Position

Layer

Width 105

Height 105

Label Box On Off

Label OEE

All Metrics Loaded

70% Delete Update

Analyze View

Smart Manufacturing ▾

IAI Industrial Asset Intelligence

Analyze

Metrics 12:24pm - 12:42pm Split all by None Refresh Clear all Analysis

Filter

Smart Factory

- scranton
- utica
 - pilot line
 - automated high bay warehouse c
 - multi processing station oven c
 - compressor
 - conveyor
 - Availability**
 - Quality**
 - Performance**
 - Performance 1**
 - OEE**
 - Temperature Change**
 - cycle time
 - qty_pass
 - qty_total
 - running
 - temperature

utica.pilot line.multi processing station oven c.QNTY_PASSED_LOW

utica.pilot line.multi processing station oven c.Quality

AGGREGATIONS

Select one or more aggregations to display in the chart.

Avg Max Min
 Std dev Percentiles

90 75 50 25 15

TIME COMPARISON

Overlay previous time period on the selected chart.

Compare to None

SPLIT BY

Split this metric by a dimension.

Split by None

FILTERS

```

130_60_4 ~ [07/Jan 18:10:57:153] "GET /category.screen?category_id=GIFTS&JSESSIONID=SD15LAFF10ADFF10 HTTP 1.1" 404 720 "http://buttercup-shopping.com/cart.do?action=view&itemId=EST_6&product_id=F1-SW-01" "Opera/9.80 (Windows NT 5.1; SV1; .NET CLR 1.1.4322)" [07/Jan 18:10:57:156] "GET /product.screen?product_id=FL-DSH-01&JSESSIONID=SD55L7FF6ADFF9 HTTP 1.1" 200 3322 "http://buttercup-shopping.com/cart.do?action=updateSession&itemId=EST_26&product_id=F1-SW-01" "Opera/9.80 (Windows NT 5.1; SV1; .NET CLR 1.1.4322)" [07/Jan 18:10:56:156] "GET /oldlink?item_id=EST-26&JSESSIONID=SD55L9FF1ADFF3 HTTP 1.1" 200 1318 "http://buttercup-shopping.com/cart.do?action=changeQuantity&itemId=EST_18&productId=EST_6&sessionId=SD10SLBFF2ADFF2 HTTP 1.1" 200 2423 "http://buttercup-shopping.com/cart.do?action=showCartSession&sessionId=SD08SLBFF2ADFF2 HTTP 1.1" 200 3865 "http://buttercup-shopping.com/cart.do?action=removeItem&itemId=EST_18&sessionId=SD08SLBFF2ADFF2 HTTP 1.1" 200 3865 "http://buttercup-shopping.com/cart.do?action=removeItem&itemId=EST_18&sessionId=SD08SLBFF2ADFF2 HTTP 1.1" 200 3865 "http://buttercup-shopping.com/cart.do?action=removeItem&itemId=EST_18&sessionId=SD08SLBFF2ADFF2 HTTP 1.1" 200 3865
    ...

```

Formula Builder

Edit: utica.pilot line.multi processing station oven c.Temperature Change

Cancel
Save

Assets
Other

Search Span **1 minute**
Time Window **1 hour**

((Smart Factory.utica.pilot line.multi processing station oven c.temperature/
 ((Smart Factory.scranton.line 1.multi processing station oven a.temperature+Smart Factory.scranton.line
 2.multi processing station oven b.temperature)/2))-1)*100

Filter

Smart Factory

- > scranton
- > utica
 - > pilot line
 - > automated high bay
 - warehouse c
 - <
 - multi processing station
 - oven c
 - > compressor
 - > conveyor
 - Availability
 - Quality
 - Performance
 - Performance 1
 - OEE
 - Temperature
 - Change
 - cycle time

Functions

Mathematical

- abs(X)
- ceiling(X)
- exact(X)
- exp(X)
- floor(X)
- ln(X)
- log(X)
- sigfig(X)
- sqrt(X)

Statistical

Trigonometry

130,60,4
 128,241,220,82 ~ [07/Jan 18:10:57:153] "GET /category.screen?category_id=GIFTS&JSESSIONID=SD15LAFF10ADFF10 HTTP 1.1" 404 720 "http://buttercup-shopping.com/cart.do?action=view&itemId=EST_6&product_id=F1-SW-01" "Opera/9.80 (Windows NT 5.1; SV1; .NET CLR 1.1.4322)" 468 125,17 14,10
 ://buttercup-shopping.com/purchase&t
 id=EST_16&product_id=R-LL-02 "0~55:187" "GET /oldlink?item_id=EST_26&JSESSIONID=SD55L9FF1ADFF3 HTTP 1.1" 200 1318 "http://buttercup-shopping.com/cart.do?action=changequantity&itemId=EST_18&productId=AU-CUP-SHOW-THE-COM-01" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/60.0.3112.113 Safari/537.36"
 317,27,160,0,0 ~ [07/Jan 18:10:57:156] "GET /product.screen?product_id=FL-DSH-01&JSESSIONID=SD55L7FF6ADFF9 HTTP 1.1" 404 3322 "http://buttercup-shopping.com/cart.do?action=updateSession&itemId=EST_26&product_id=R-LL-02" 200 2423 "http://buttercup-shopping.com/cart.do?action=changequantity&itemId=EST_6&JSESSIONID=SD55L4FFAADDFF1 HTTP 1.1" 200 3865 "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/60.0.3112.113 Safari/537.36"
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 id=EST_16&product_id=R-LL-02 "0~55:187" "GET /oldlink?item_id=EST_26&JSESSIONID=SD55L9FF1ADFF3 HTTP 1.1" 200 1318 "http://buttercup-shopping.com/cart.do?action=changequantity&itemId=EST_18&productId=AU-CUP-SHOW-THE-COM-01" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/60.0.3112.113 Safari/537.36"
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 ://buttercup-shopping.com/purchase&t
 id=EST_16&product_id=R-LL-02 "0~55:187" "GET /oldlink?item_id=EST_26&JSESSIONID=SD55L9FF1ADFF3 HTTP 1.1" 200 1318 "http://buttercup-shopping.com/cart.do?action=changequantity&itemId=EST_6&JSESSIONID=SD55L4FFAADDFF1 HTTP 1.1" 200 3865 "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/60.0.3112.113 Safari/537.36"
 317,27,160,0,0 ~ [07/Jan 18:10:57:156] "GET /product.screen?product_id=FL-DSH-01&JSESSIONID=SD55L7FF6ADFF9 HTTP 1.1" 404 3322 "http://buttercup-shopping.com/cart.do?action=updateSession&itemId=EST_26&product_id=R-LL-02" 200 2423 "http://buttercup-shopping.com/cart.do?action=changequantity&itemId=EST_6&JSESSIONID=SD55L4FFAADDFF1 HTTP 1.1" 200 3865 "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/60.0.3112.113 Safari/537.36"

Conditions & Actions

Edit Alert

Name Condition Action

Select a name and description for your new alert.

Name: Change Alert

Description: Optional

Cancel **< Back**

Edit Alert

Name Condition Action

Define condition that triggers the alert.

When the result is: not equal to ▾ 0

Set severity to: Critical

Suppress triggering for: 60

Cancel **< Back**

Edit Alert

Name Condition Action

Define action that triggers when conditions are met. These actions are optional.

Send email **Remove**

To: (empty field)

Comma separated list of email addresses. [Show CC and BCC](#)

Priority: Important

Subject: Splunk Alert: \$name\$

The email subject, recipients and message can include tokens that insert text based on the results of the search. [Learn more](#)

+ Add Action

Cancel **< Back** **Finish**