



REAL TIME PATTERN & ANOMALY DETECTION

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ThingWorx Analytics Product Strategy

June 8, 2016

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A decorative graphic in the top-left corner consisting of several overlapping, colorful lines (pink, yellow, blue) that form a shape resembling a 'W' or a cluster of lines.

AGENDA

- Device Monitoring
- ThingWatcher Overview
- Using ThingWatcher
- Early Access

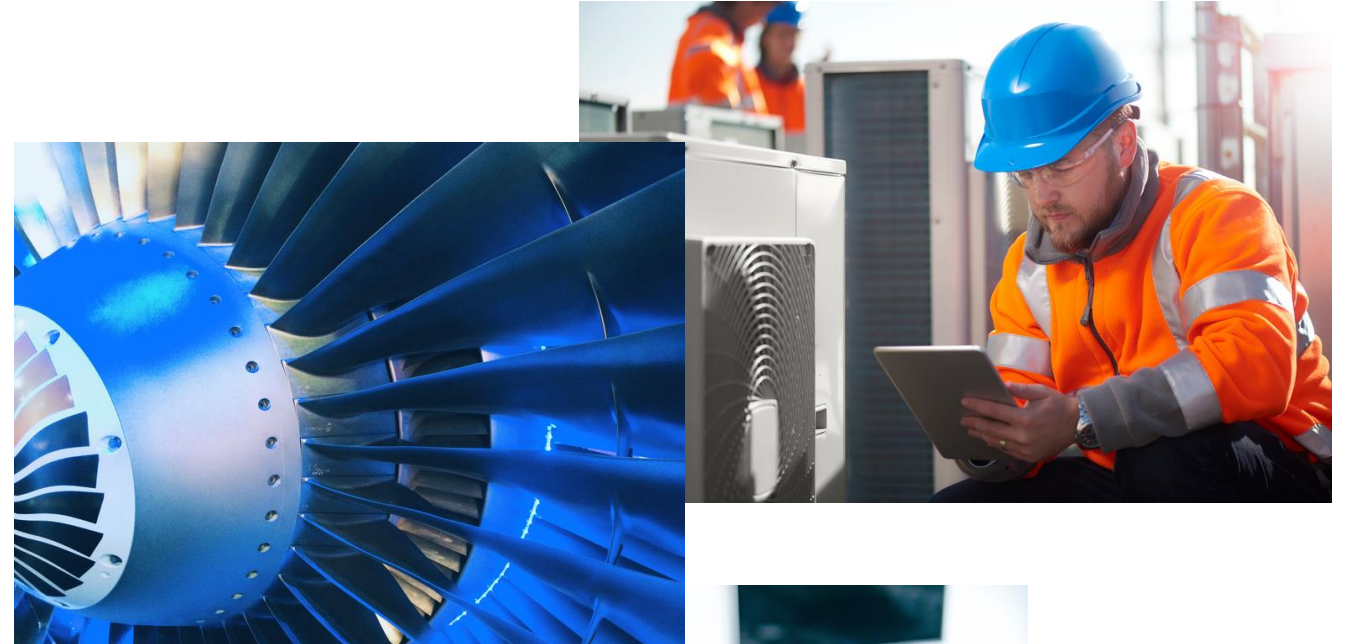
Decorative geometric shapes in green, blue, yellow, and pink are scattered in the corners of the slide. A large green triangle points towards the top left. A blue triangle points towards the bottom left. A yellow triangle points towards the bottom left. A pink triangle points towards the bottom left.

KEY POINTS

- Automated anomaly detection offers significant advantages over other device monitoring solutions
- ThingWatcher, an upcoming ThingWorx Analytics product, offers a simple way to build anomaly detection into your products
- Early access to ThingWatcher is available now: contact dmagnoni@coldlight.com if you are interested

DEVICE MONITORING

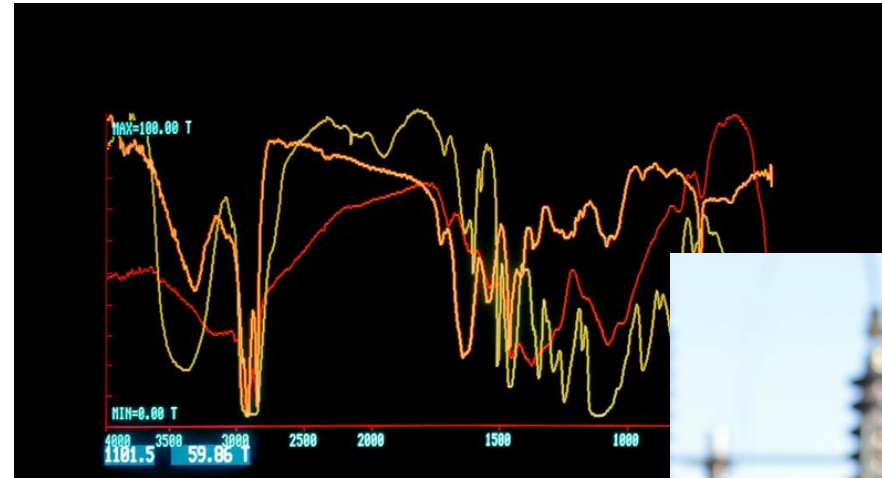
- Goals: uptime, cost reduction
- Different approaches
 - Predictive Maintenance
 - Rules-based monitoring
 - Predictive Failure Analysis
 - Anomaly Detection



PREDICTIVE MAINTENANCE / ENGINEERING ANALYSIS



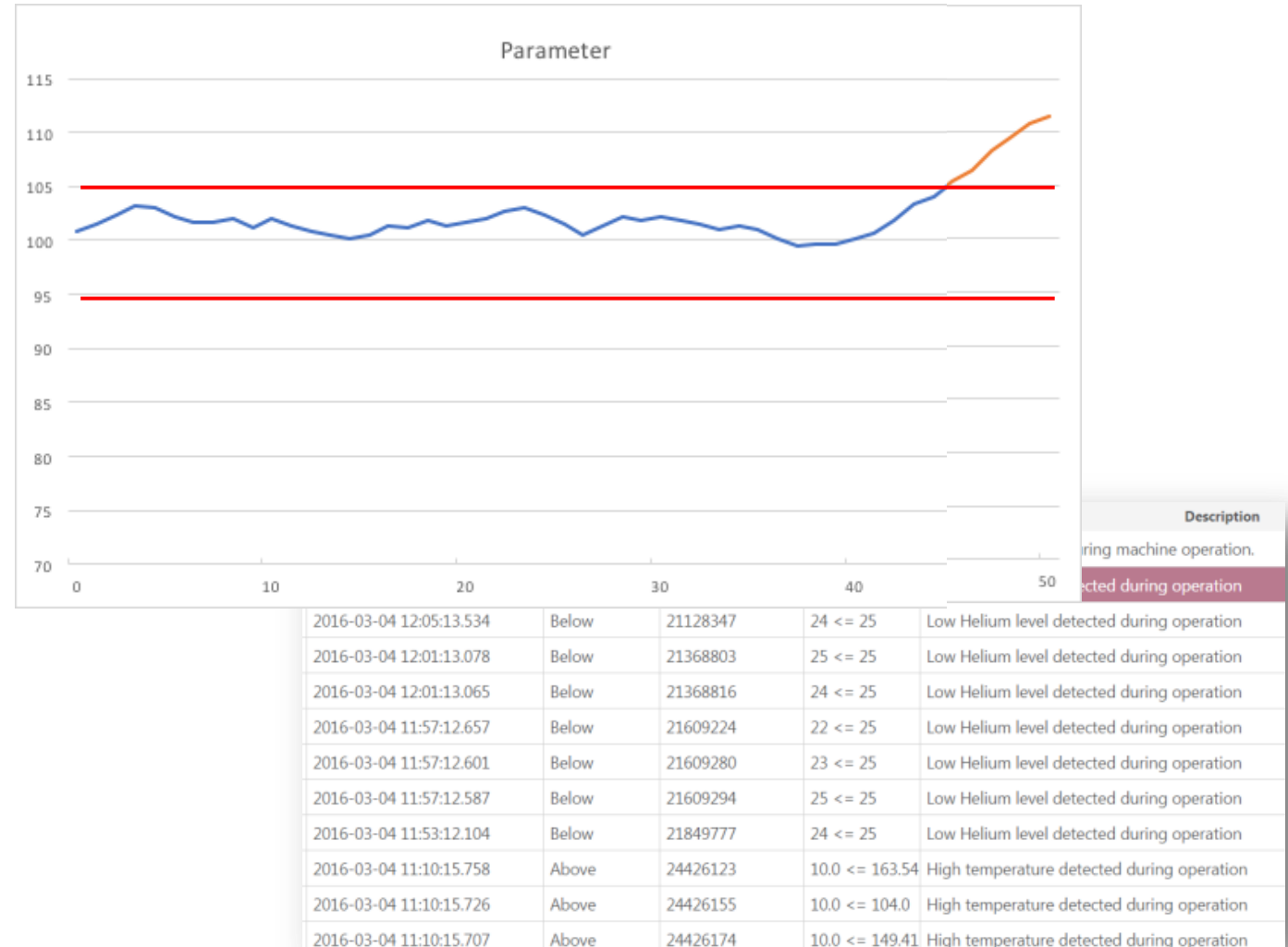
- Engineering analysis, often in comparison to calculated or previously measured values
 - E.g., vibration analysis vs. installation
- Benefits
 - Accurate
- Drawbacks
 - Difficult to manage
 - Expensive and time-consuming



RULE-BASED MONITORING



- Typically simple rules
- Benefits
 - Usually easy to set and monitor
 - Broad applicability
- Drawbacks
 - No warning prior to reaching rule trigger point
 - Difficult to use with complex signals



PREDICTIVE FAILURE ANALYSIS



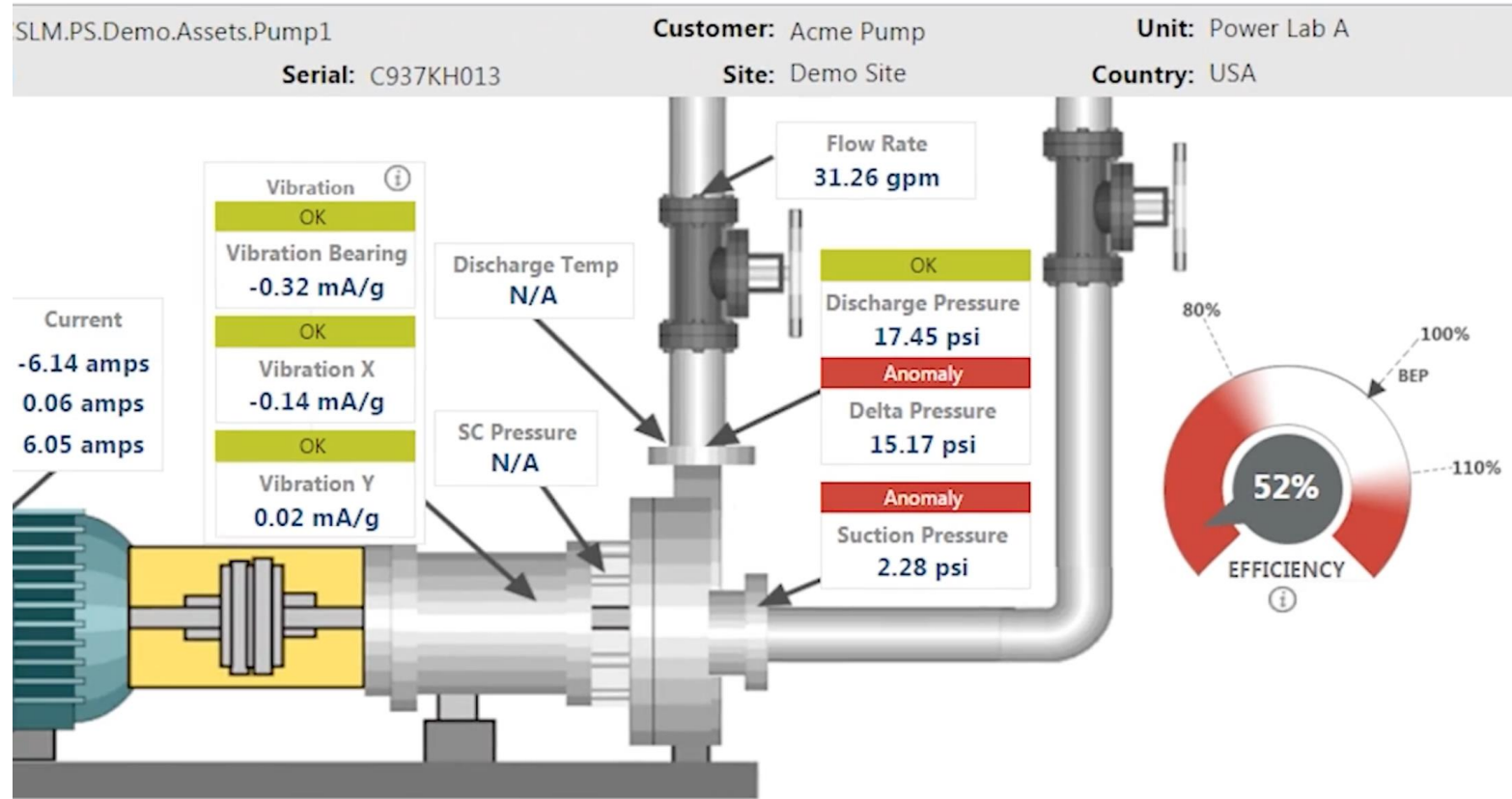
- Predictive failure analysis using machine learning techniques
- Benefits
 - Easier to manage and scale than manual predictive failure analysis
 - Accurate for a wide variety of conditions
- Drawbacks
 - Requires training dataset including historical machine and failure information
 - More effort to manage than rules-based monitoring



AUTOMATED ANOMALY DETECTION

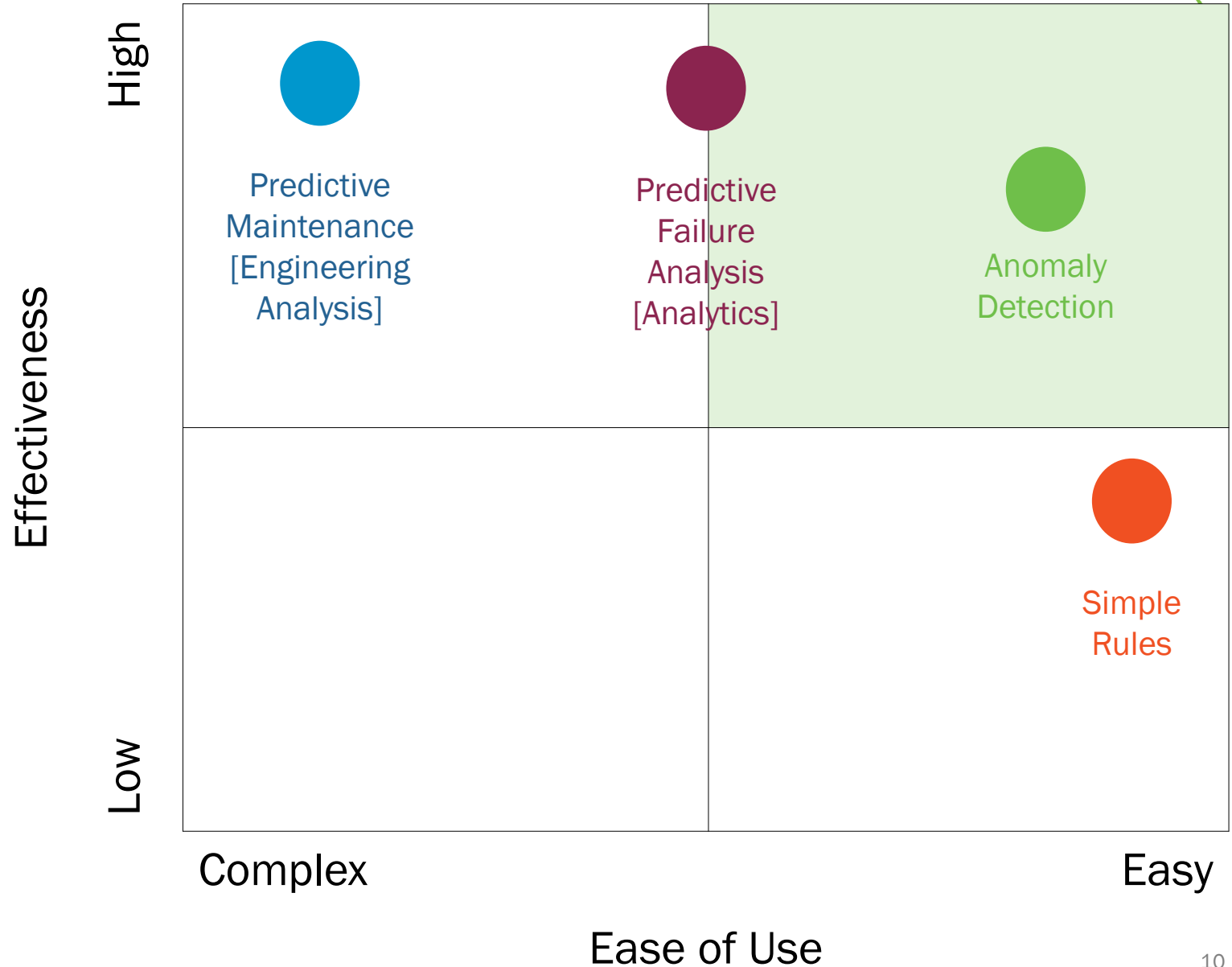


- Anomaly detection reveals behavior changes
- Benefits
 - Easy to manage and scale
 - No historical data required
 - Good accuracy
 - Useful in complex situations
- Drawbacks
 - Not as accurate as predictive failure analysis
 - Requires training time to learn the signal
 - Not suitable for all signals



EASE OF USE VS. EFFECTIVENESS

- Automate Anomaly Detection balances ease and effectiveness
- Easy to use
 - Learns automatically
 - No historical data needed
 - Apply at edge or cloud
- Effective
 - Detects simple and complex anomalies
 - Can provide insight before failures



THINGWATCHER OVERVIEW

THINGWATCHER: STANDALONE ANOMALY DETECTION



ThingWatcher™ (Beta)
Find anomalies in real time. Observes and Learns the normal state pattern for EVERY reading and then monitors for anomalies on EACH input stream individually.

ThingPredictor™
Predict future outcomes. Subscribe your Things to relevant Outcome Based Predictions (time to failure, errors per hour, etc.)

ThingOptimizer™
Improve future performance and results. Works in conjunction with ML Server to identify the key factors causing a given outcome, and what factors to change and by how much, to improve that outcome

ThingWorx ML Server™
TW ML Server Automates or extends your Data Science practice with Predictive Modeling and Prescriptive Analytics. No algorithm expertise required.

ML Server Learns from historical performance and uses AI technology to automatically build, validate and maintain Predictive Models that can be used by ThingPredictor and prescriptive instructions that can be used by ThingOptimizer

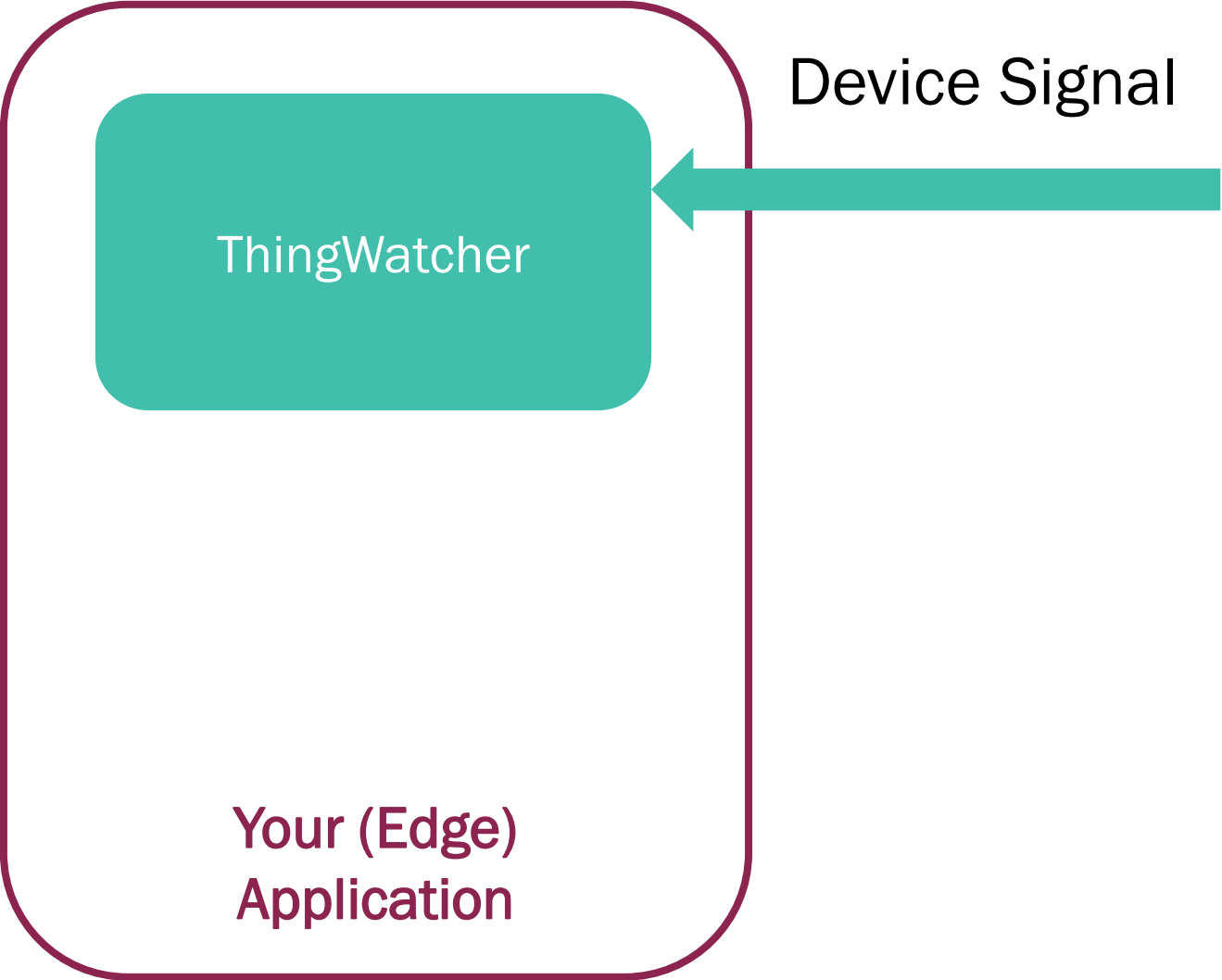
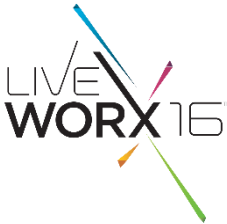
HIGH LEVEL OPERATION: BUILT INTO YOUR APPLICATION



ThingWatcher

Your (Edge)
Application

HIGH LEVEL OPERATION: MONITORS A SINGLE SIGNAL



Vibration



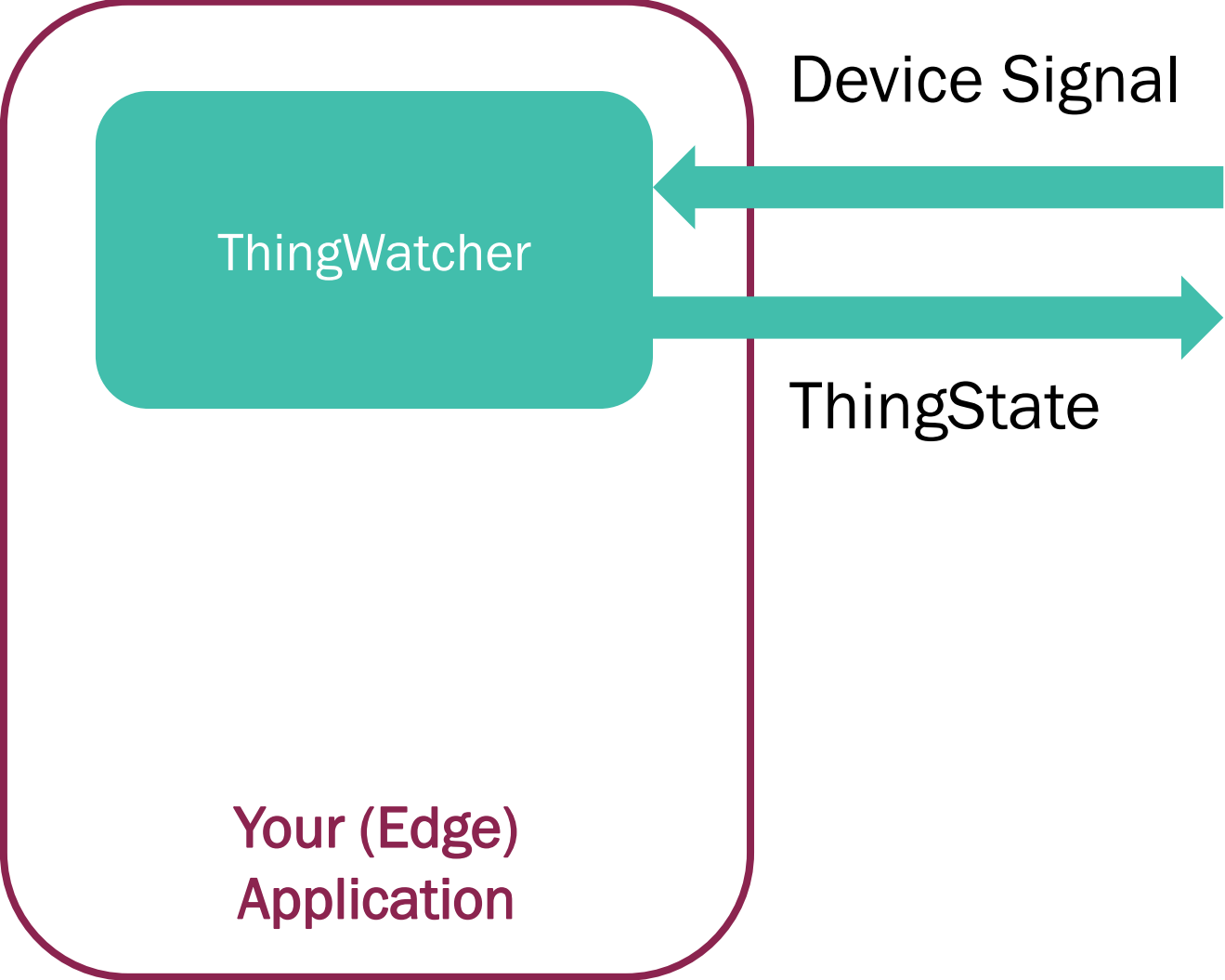
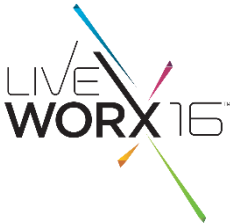
Voltage 2



Voltage 1



HIGH LEVEL OPERATION



Vibration



Voltage 2



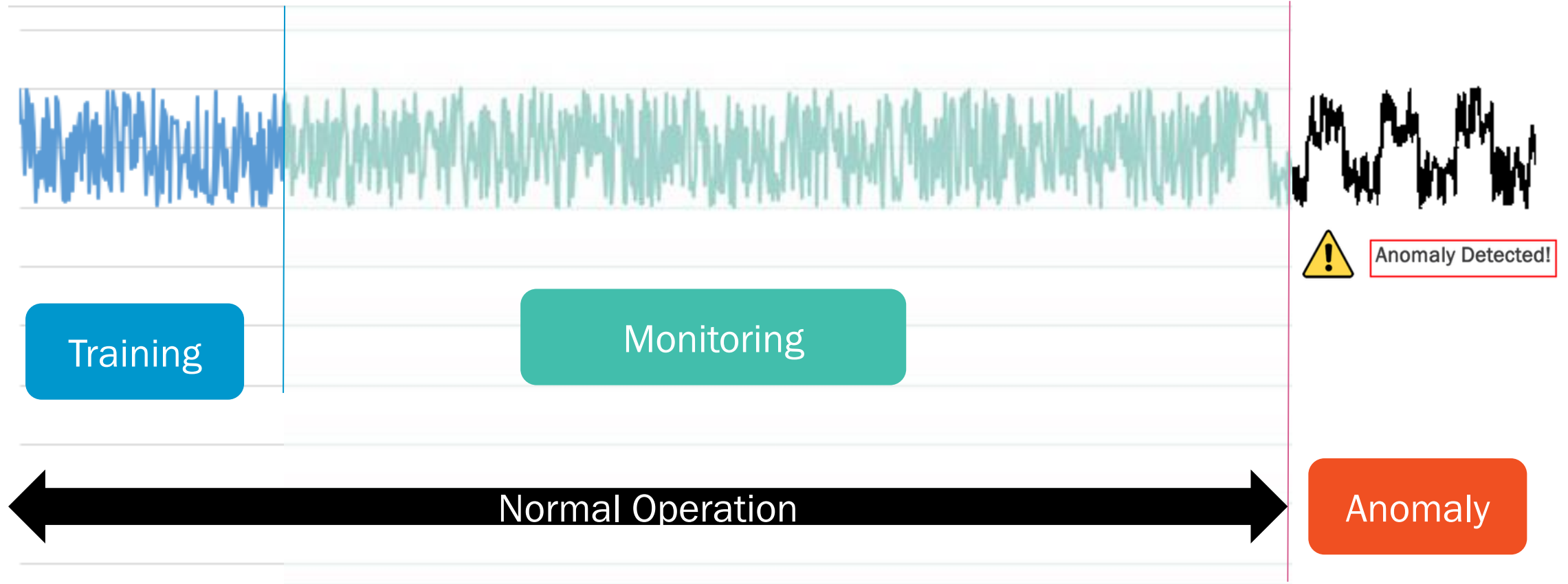
Anomaly Detected!

Voltage 1



Anomaly Detected!

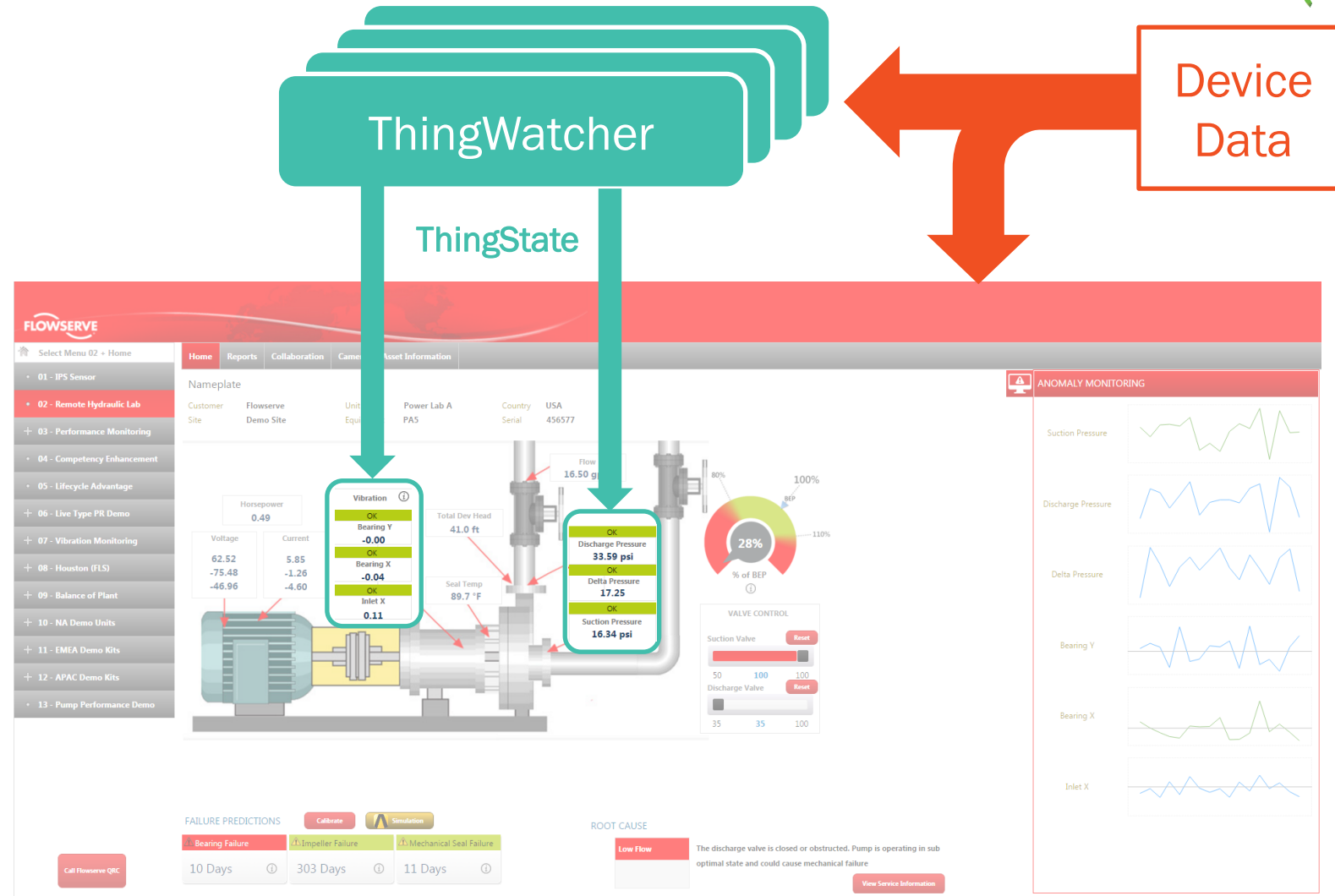
THINGWATCHER PHASES



EXPOSING THINGSTATE

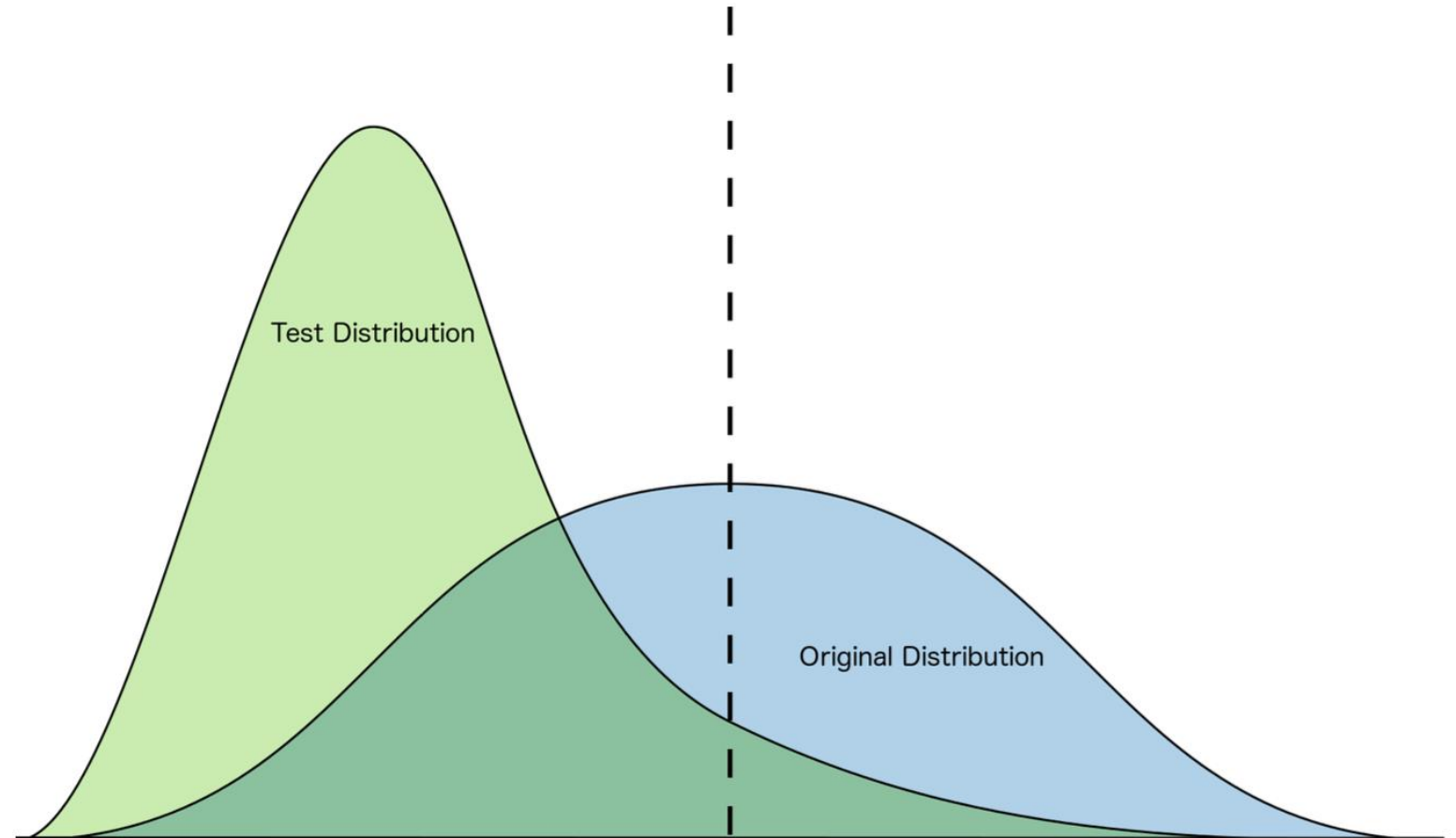


- Use ThingState to drive displays / actions
 - E.g., Flowserve demo
- Can handle any way you like
- Pending integration to make it easy to expose via Composer



UNDER THE COVERS

- Training
 - Model creation
 - Original distribution
- Monitoring
 - Evaluating incoming “test” distribution
- Anomaly test compares distributions
- Configurable sensitivity determines how different the two must be



THINGWATCHER GUIDELINES



- One signal per ThingWatcher
- Startup signal is assumed to be good
 - Make sure that things are stable before you start training
- Currently configure training time / data points
 - Must train at least one, and typically several “cycles” to ensure ThingWatcher sees enough normal
- Can configure sensitivity
 - Determines how likely you are to receive a false positive vs. false negatives
- Can also configure how many data points are used to test for anomalies
 - More data points improves accuracy, at the cost of a slower response



THINGWATCHER EARLY ACCESS



- Currently in beta status
 - GA planned for later this year
- Early access program provides software, support prior to GA
 - Goal is to obtain feedback on how it works, the current feature set, etc
 - Looking for partners and customers interested in trying out ThingWatcher in a variety of use cases
 - Capacity in the early access program is limited
- Contact dmagnoni@coldlight.com if interested

WRAP UP

Decorative geometric shapes in the background: a green triangle pointing down from the top left, a blue triangle pointing up from the bottom left, a yellow triangle pointing up from the bottom left, and a pink triangle pointing up from the bottom left.

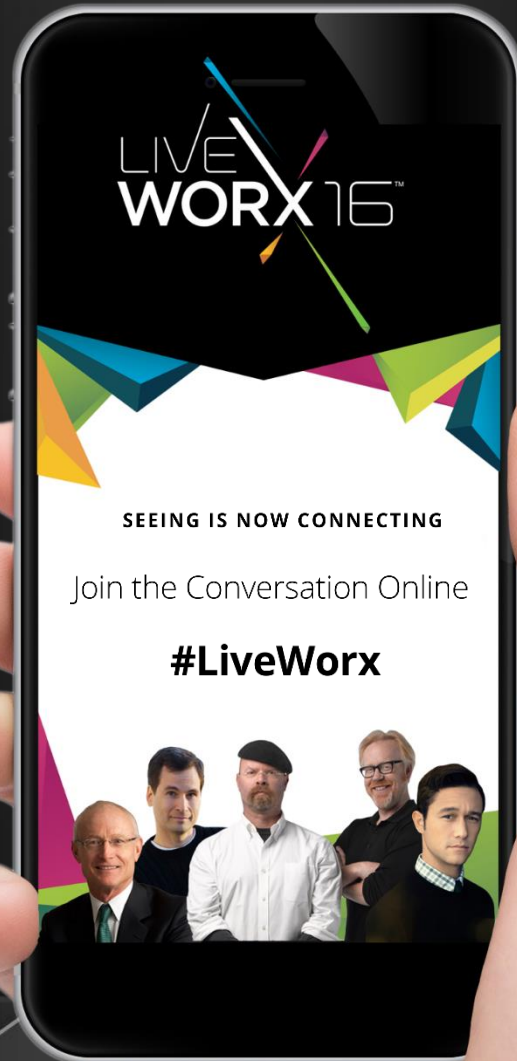
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- Check out demos powered by advanced analytics

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The image features several colorful geometric shapes, primarily triangles and lines, scattered across the background. A large, multi-colored triangular shape is prominent on the right side, composed of various shades of blue, green, yellow, orange, and purple. Several thin, colored lines (blue, pink, green, orange) radiate from the center towards the edges. The text 'LIVE WORX 16' is centered in the upper half, with 'LIVE' in a thin, outlined font and 'WORX 16' in a bold, solid black font. A small 'TM' trademark symbol is positioned to the right of the '16'.

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