



# THINGWORX ANALYTICS: ADVANCED PREDICTIONS & SIMULATION FOR IOT

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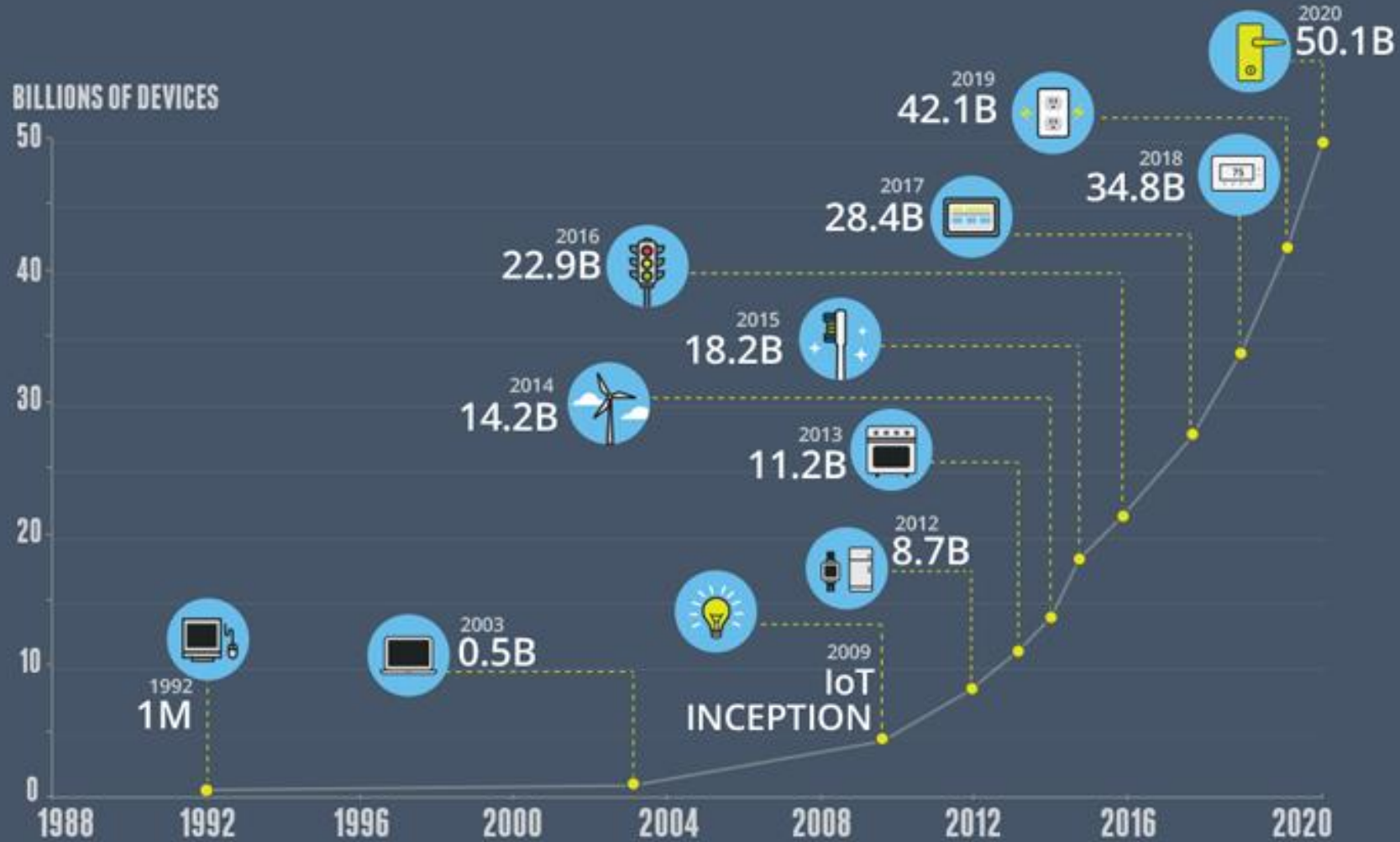
# KEY POINTS

- Analytics is a critical component of any IOT Solution
- ThingWorx Analytics provides automated model generation, prediction, and data mining capabilities and is embedded within ThingWorx
- Data is a critical fuel for any analytics solution
- Predictive Analytics is no longer restricted to the PhD's of the world and is available to the masses.

# BACKGROUND

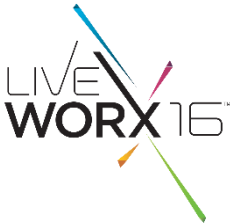
# GROWTH IN THE INTERNET OF THINGS

THE NUMBER OF CONNECTED DEVICES WILL EXCEED **50 BILLION** BY 2020



Source: Cisco

# CHALLENGE OF TRADITIONAL ANALYTICS IN IOT



## Operational Reporting

Business Intelligence



## Data Visualization or Discovery

Business Intelligence



## Legacy Predictive

Business Analytics



Narrow Insights

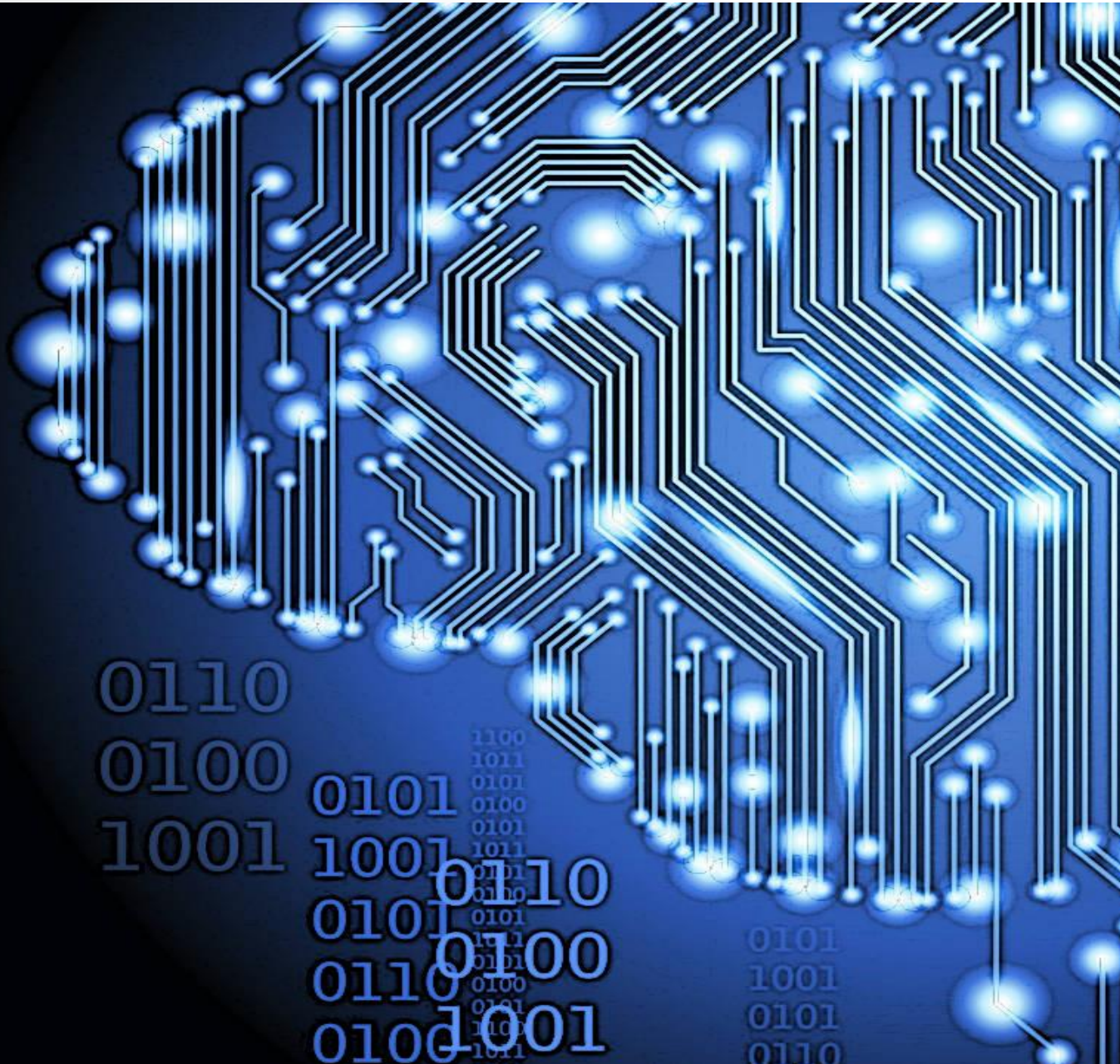
Manual Discovery

Too Complex

Too Slow – Not Real-Time



# WHAT IS MACHINE LEARNING (ML)?



Machine learning simply refers to a form of **artificial intelligence** that enables a computer to **automatically learn** by using algorithms that understand data and result in **automated advanced analysis, predictions and recommendations.**

# WHAT IS PREDICTION



Historical Data

Predicted Time Period

Now

- Definition: “a statement about what will happen or might happen in the future”<sup>1</sup>
- Example: Who is going to win the Red Sox game?
- Example: What is the stock market going to do today?
- Example: Who is going to win the presidential election?
- Example: When is my machine going to break?

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# MATURING TECHNOLOGY

- From 1950s through early 2000s, one breakthrough or event every few years
- Starting roughly around 2008/2009, multiple breakthroughs per year
- Why Now?
  - Field has matured
  - Abundance of data
  - Abundance of compute: Machine learning is computationally expensive.
  - More examples of “real” applications have given credibility to the field. Not just science experiments

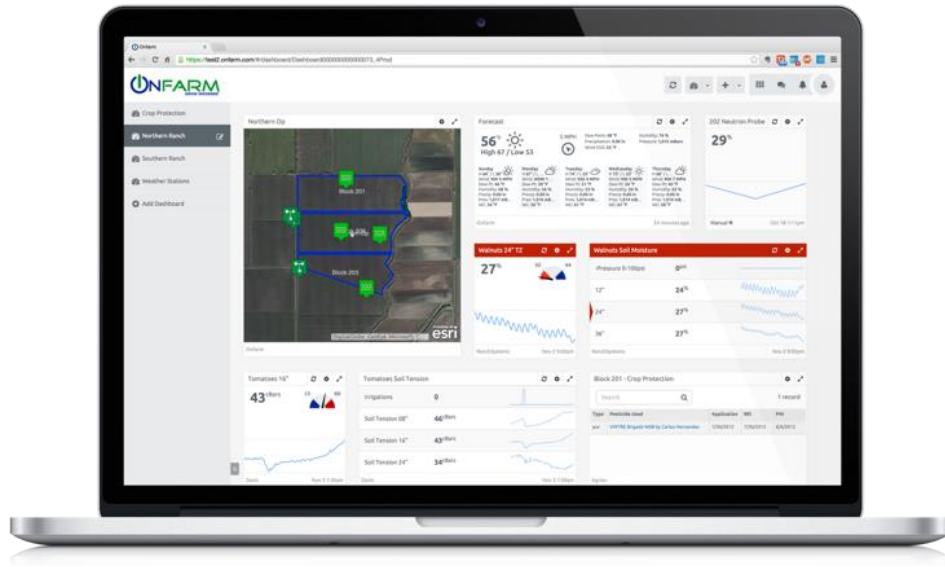


# THINGWORX ANALYTICS

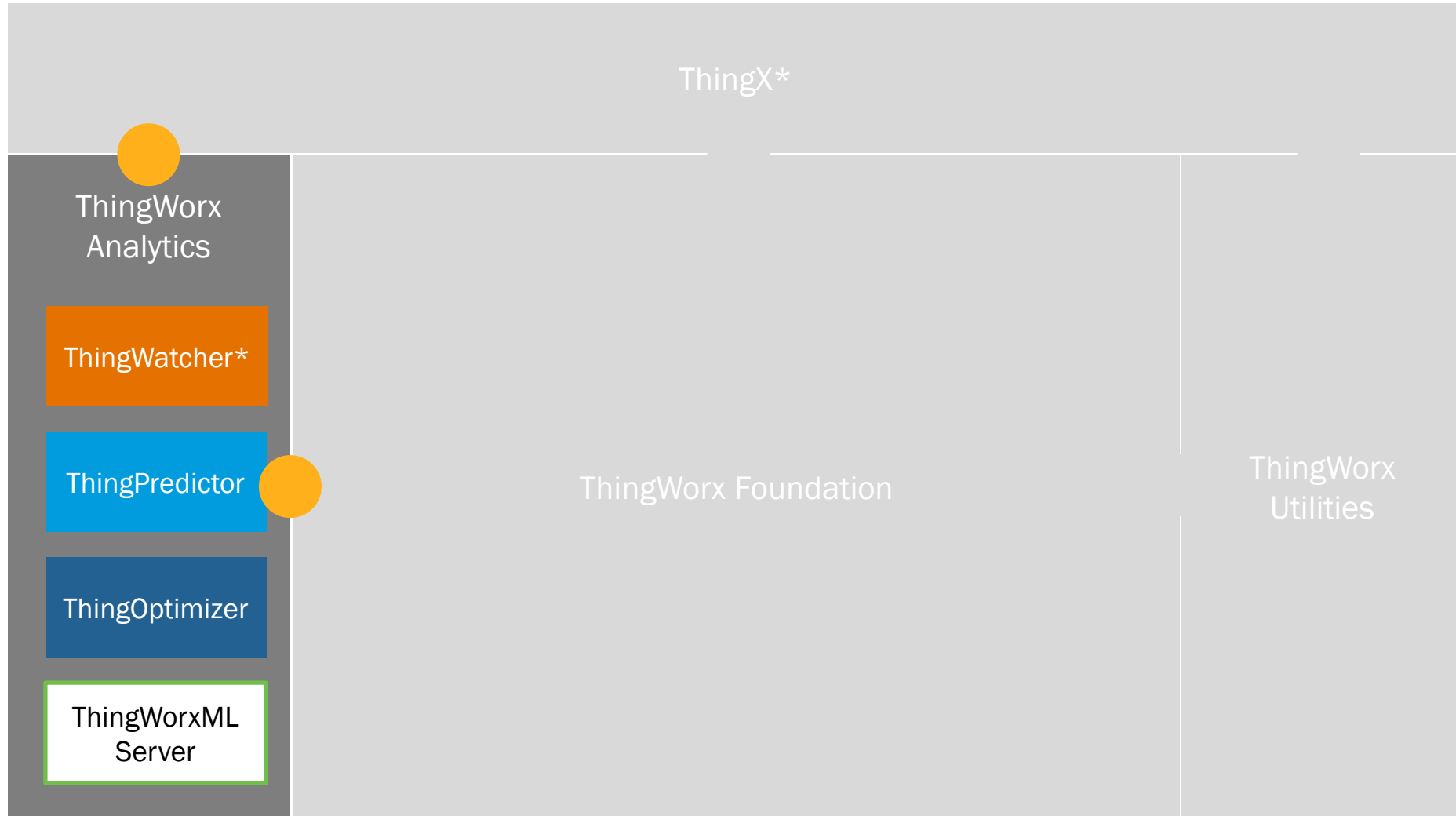
# WHAT IS THINGWORX ANALYTICS?

ThingWorx Analytics is an integrated capability of the ThingWorx IoT technology platform that enables developers to **quickly and easily** add **real-time pattern & anomaly detection, predictive analytics and simulation** to the solutions they build.

ThingWorx Analytics is designed to be used by those without expertise in complex mathematics, statistics or machine learning.



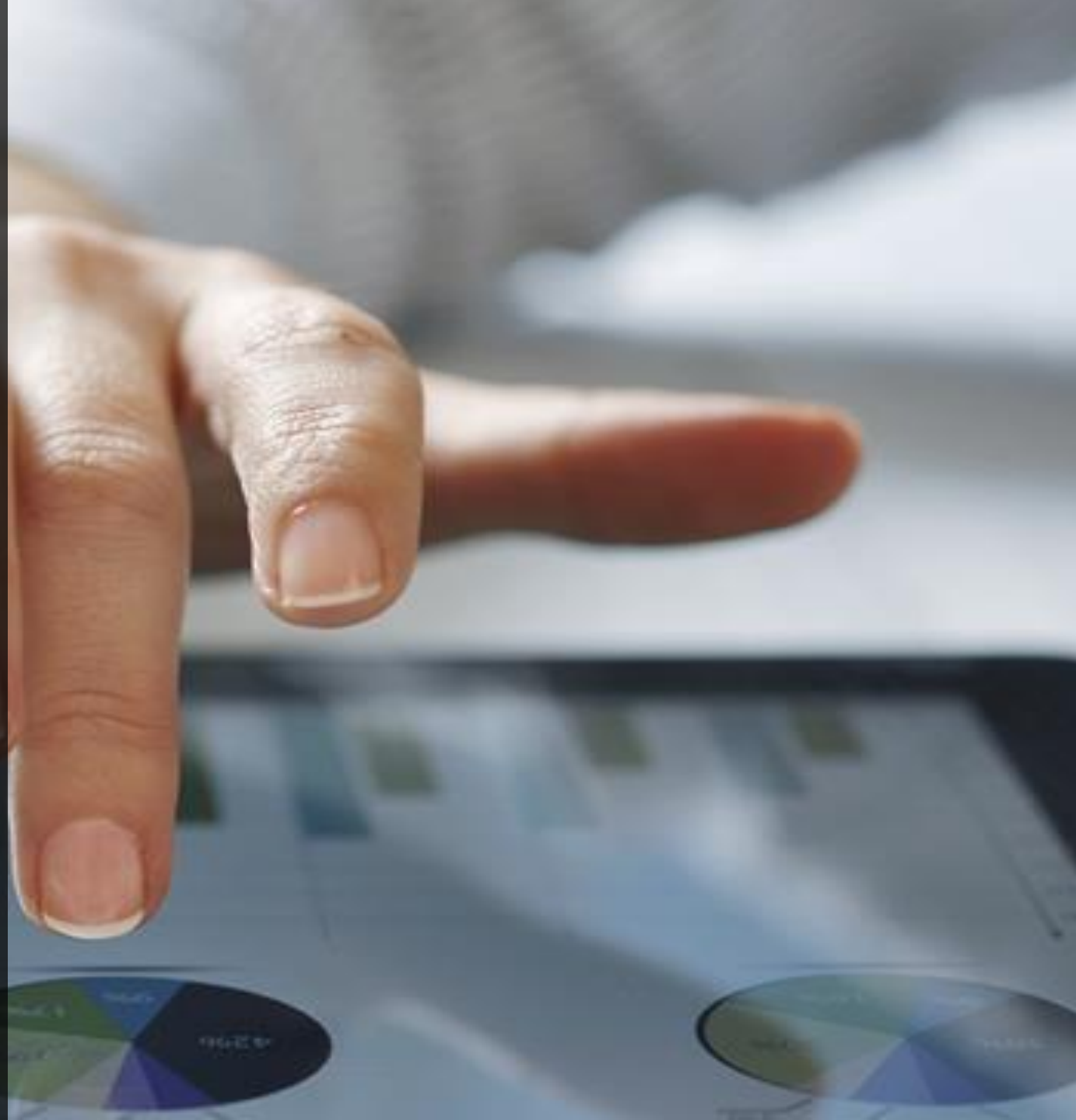
# THINGWORX ANALYTICS



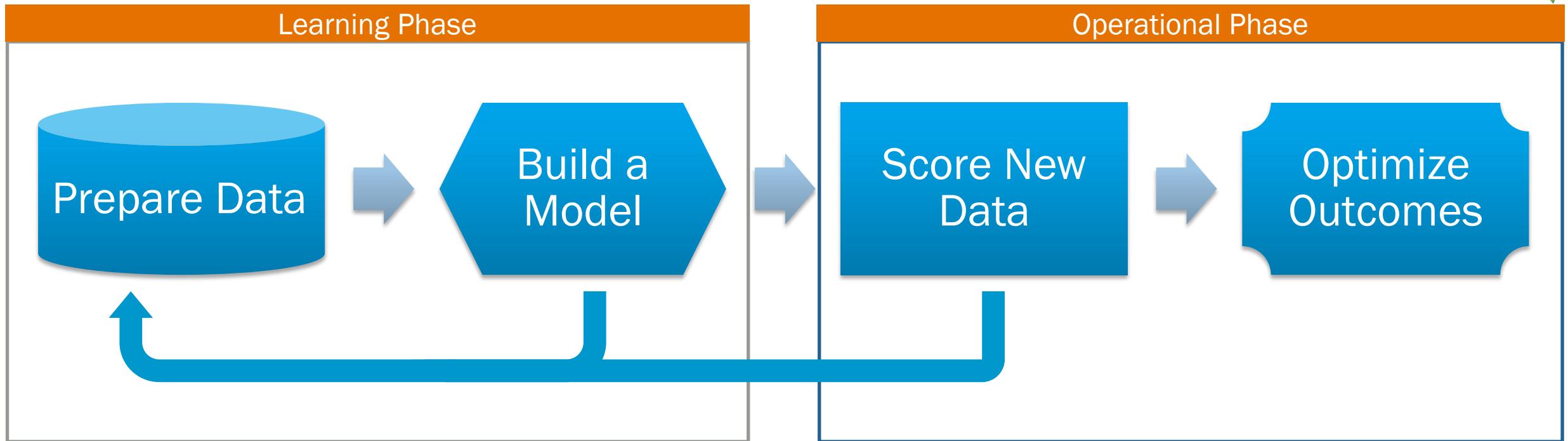
\*beta

## Making Real-Time IoT Analytics Easy

- There is no longer the time to wait to “see what the data says.”
- Insight and action must be tied together into real-time operational intelligence.
- The scale demand for “information now” outpaces older ways of building and deploying enterprise analytics and advanced analytical models.
- An IoT solution without real-time operational analytics capabilities significantly diminishes value.
- There’s a clear need to “operational analytically-driven solutions” within every IoT application.



# GENERALIZED PREDICTION PROCESS



- End result of Learning phase is a model that can be used during operational phase. No measurable improvements yet, just prep. May be tangential improvements as data and process is analyzed.
- Operational phase is where field improvements happen. New data is fed back to build progressively better models.

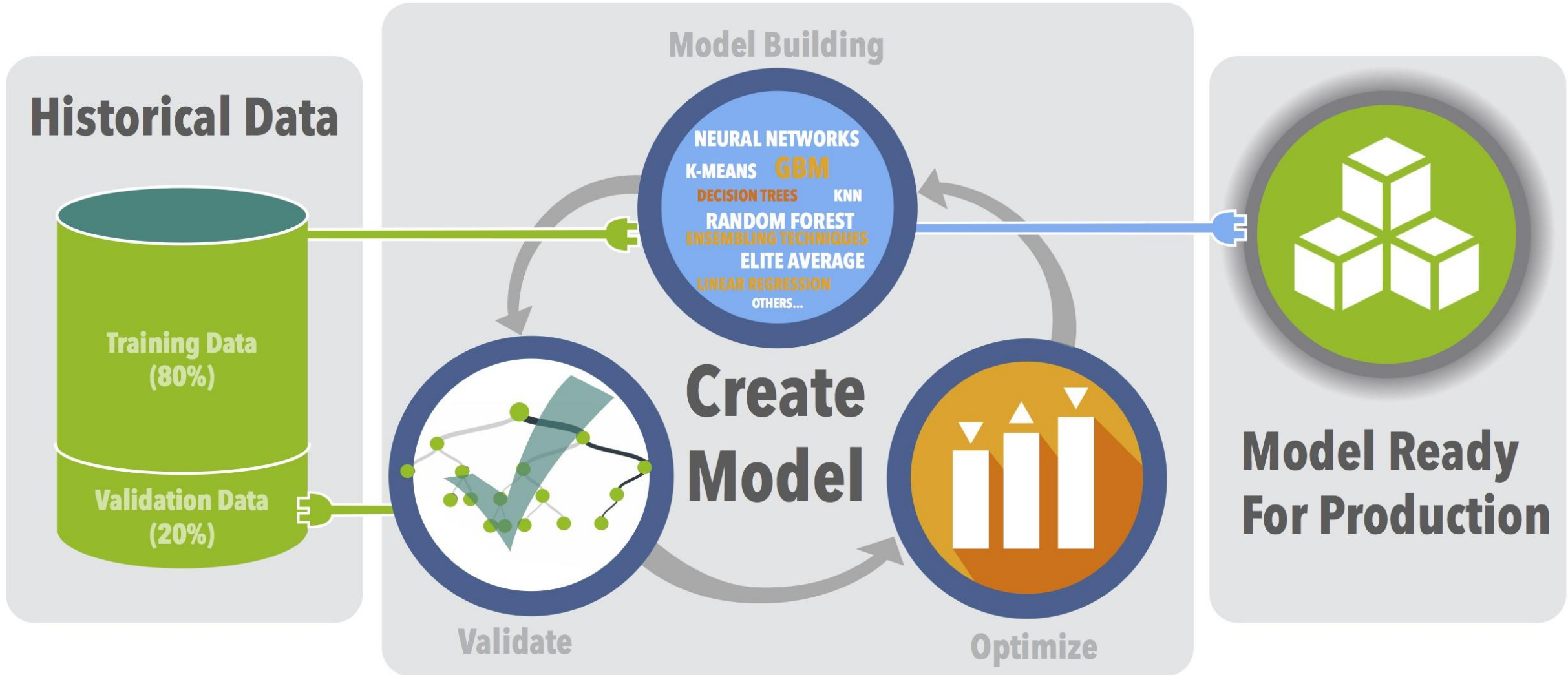


## Good Data is Critical to understand the Patterns

- Without data, system has nothing to learn from.
- Data cleanliness is important. System can handle noise but makes it harder to discern insights.
- Breadth of data allows system to get a more complete view of the Thing.
- Depth of data allows system to learn from different patterns. Includes more history from same machine as well as other machines.
- How much data do I need?
- If you have no historical data, check out ThingWatcher.

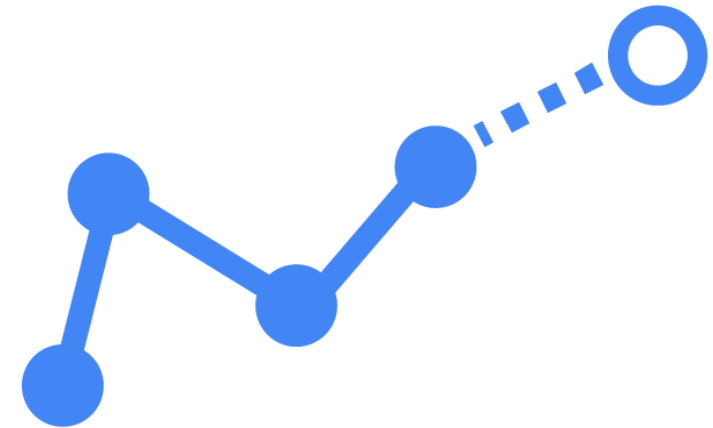
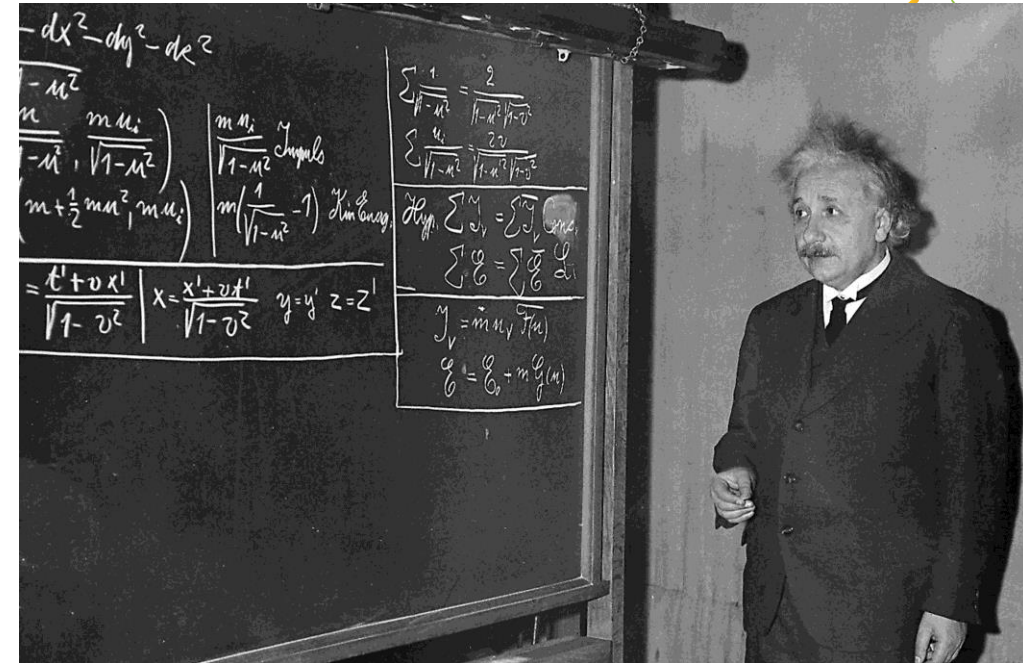


# THINGWORXML SERVER – HOW IT BUILDS PREDICTIONS



# PREDICTIONS

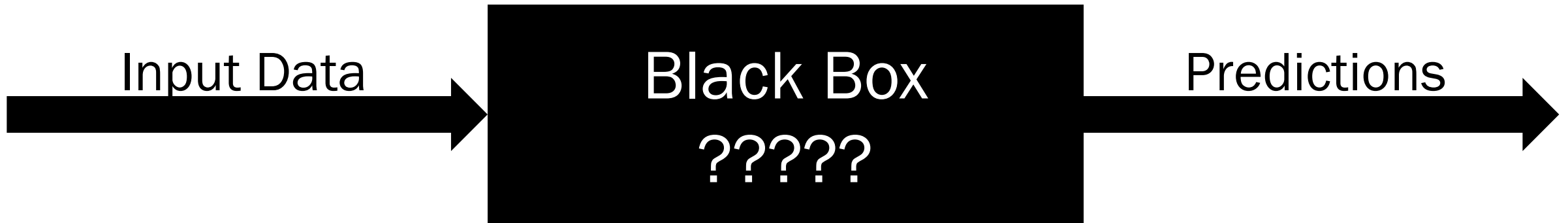
- Predict, within a level of confidence, a value.
- Score is only as good as the model and the data used to build the model. Should NOT be treated as gospel.
- Recommend periodic post-mortem analysis to understand incorrect predictions.
- Understand the cost of being wrong.
- Training a model is the equivalent of figuring out the equation. Scoring is just a matter of plugging in the variables and evaluate.
- Performance very fast relative to training. Measured in nanoseconds or microsecond vs minutes, hours, days.





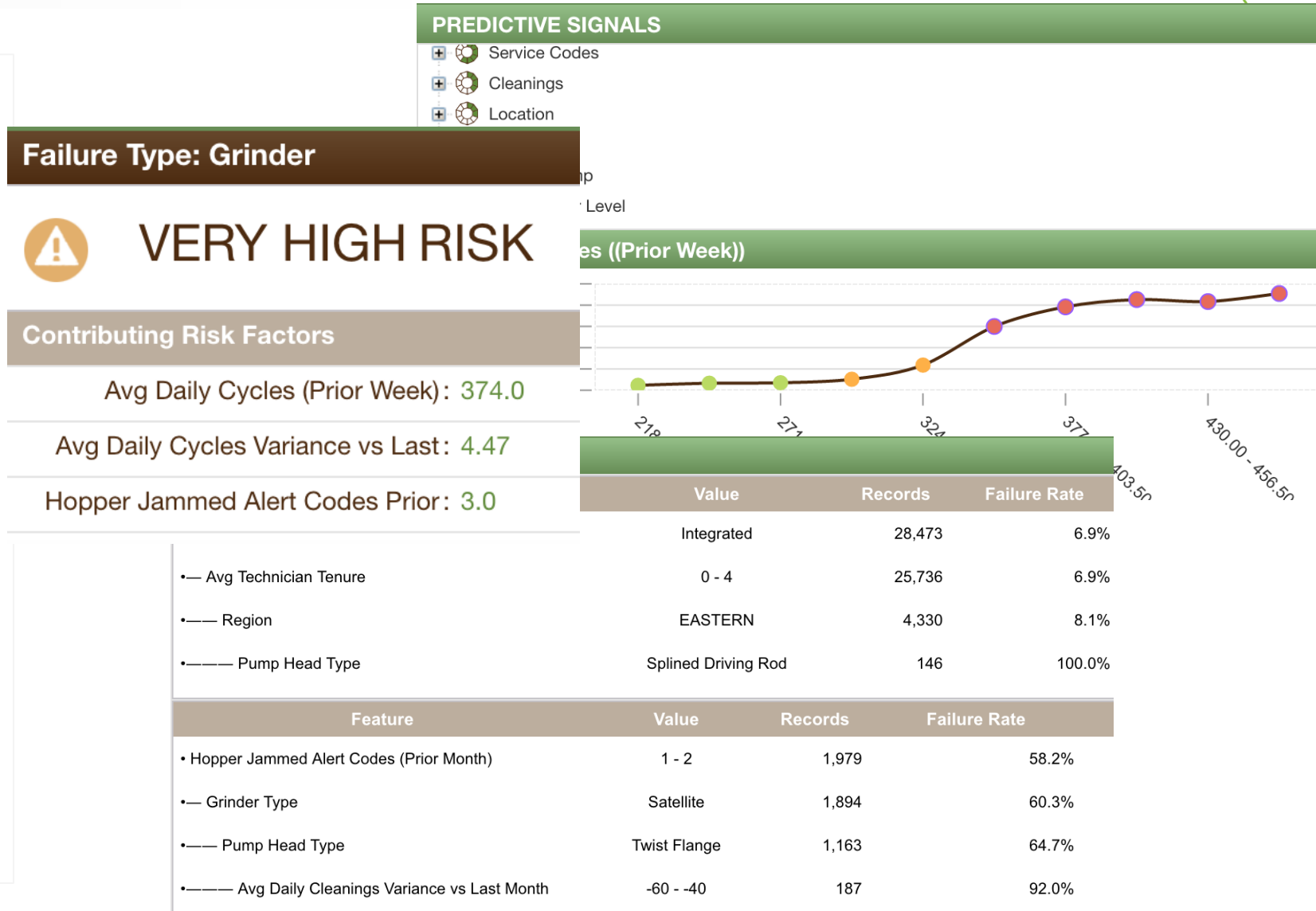
- Not just good enough to predict that a machine is going to fail. What can you do to prevent?
- Levers are features that can be adjusted. Typically there are very few levers for a given use case.
- Optimization now requires directionality for the dependent variable. Maximize, Minimize, or Constrain
- An extension is resource optimization. Different actions have different costs – advanced simulations can do the cost-benefit analysis
- Think big – think not just optimizing a machine but optimizing large processes like manufacturing lines

# WHAT'S HAPPENING IN THE BOX?



# LET'S OPEN THE BOX

- It's not good enough to make a prediction. People want to understand why.
- Contributing factors provides the user a look into why a prediction value is what it is.
- Signals shows which features are important relative to what you are trying to predict.
- Gives the user insight into how the system is looking at data
- Profiles shows groups of interest. High Performing or Low Performing examples that are statistically relevant



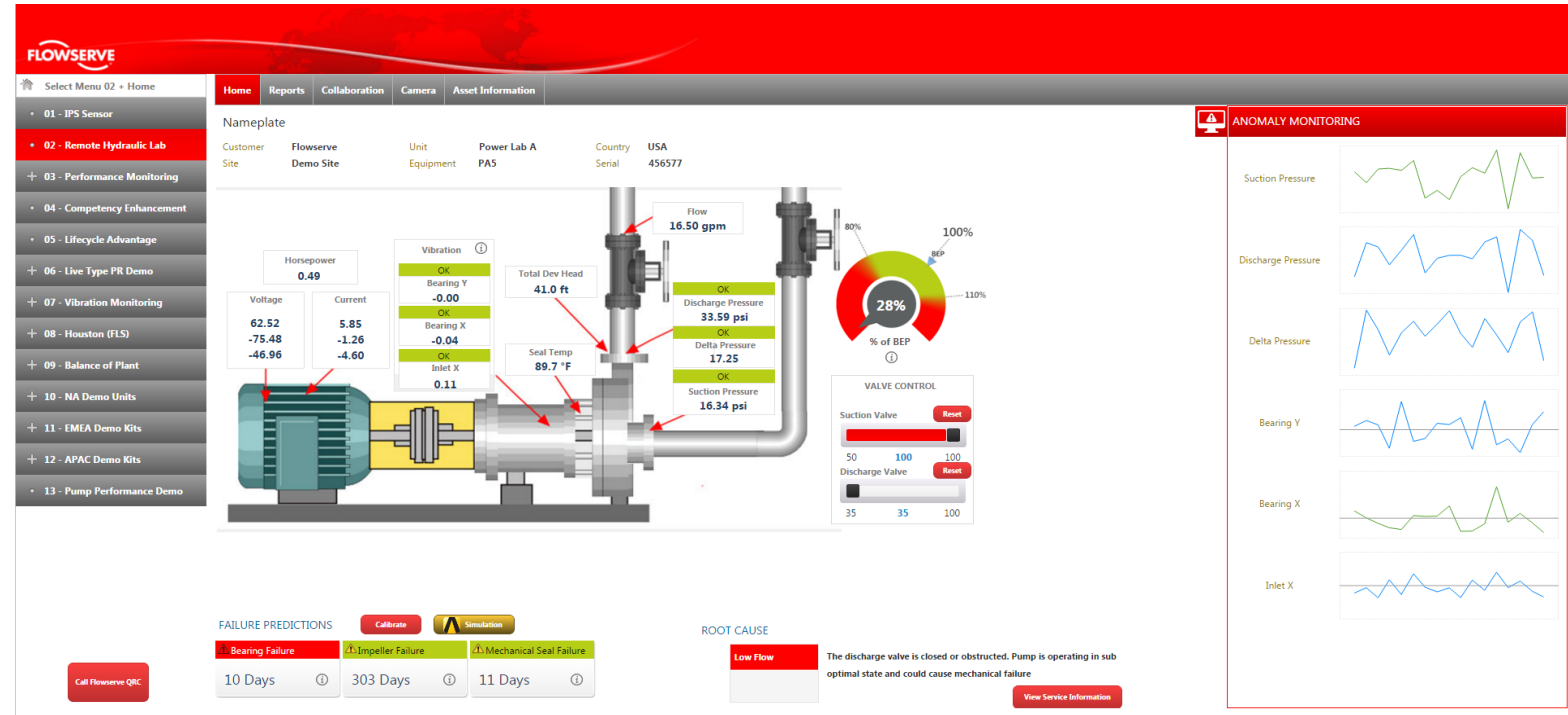
# EXAMPLES



# INTELLIGENCE INTO ACTION



- Flowserve pump example, used in various presentations & keynotes
- Shows integration of ThingWorx, Anomaly Detection, Prediction, AR in one story
- Predicts failure of critical parts of process. Model built offline, current conditions scored in realtime.
- This screenshot shows decreased lifespan of bearing



The discharge valve has been closed remotely causing low-flow of water through the pump. This has caused the prediction for bearing failure to drop to 10 days.

# GLASSBEAM ADDRESSES A KEY CHALLENGE IN IOT ANALYTICS



Over 60% of time is spent in machine data transformation & preparation before any analytics can be performed



# Hyperconverged Data Center Infrastructure Company

Customer provides a unified compute, storage, and networking solution to unlock the full potential of hyperconverged infrastructure

## CHALLENGES:

- Complex machine data that required transformation before it could become useful
- Predicting specific software and hardware failures to preempt unplanned downtimes
- Providing proactive dashboards for support staff and end customers as self service portal

## BUSINESS IMPACT:

- Lower mean time to resolution (MTTR) for escalations
- Auto case creation triggered by rules engine
- Ease of use with Single sign on inside Salesforce.com

**“Glassbeam has rapidly become the single point of truth for product support issues. Most of our engineers rely on Glassbeam analytics daily to drive up customer satisfaction metrics”**

*VP Support*



# WRAP UP

# CONCLUSION

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# GET MORE INFO

- Visit our booth
- Visit the new Developer Zone website
- Check out demos powered by advanced analytics



The image features several colorful geometric shapes, primarily triangles and lines, scattered across the white background. A large, multi-colored triangular shape is prominent on the right side, composed of various shades of blue, green, yellow, orange, pink, and purple. Several thin, colored lines (blue, pink, green, orange) radiate from the center towards the edges of the frame. 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'.

LIVE  
WORX 16™

TAKE A FRESH LOOK AT THINGS

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