



**Rockwell  
Automation**

**Empower your  
Connected Enterprise  
with FactoryTalk<sup>®</sup>  
InnovationSuite** powered by PTC

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**Rockwell  
Automation**

# TechEd





IIoT



Fit for Purpose



Data Analytics



Edge Computing



AI



Augmented Reality

# Agenda

**1** OUR IIOT  
VISION

**2** OVERVIEW OF  
FactoryTalk®  
InnovationSuite

**3** QUESTIONS

Open Discussion – please ask Questions



# OUR IIOT VISION

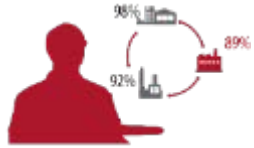
# ANALYTICS

The *discovery*, *interpretation*, and *communication* of meaningful patterns in data. Analytics relies on the application of statistics, computer programming and operations research to quantify performance.



ENTERPRISE

DESCRIPTIVE



Which facility performed the best?

DIAGNOSTIC



Why is Site A throughput behind plan?

PREDICTIVE



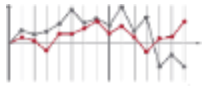
I predict that Site A will be behind plan soon.

PRESCRIPTIVE

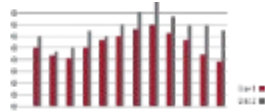


What action should I take to avoid Site A from falling behind plan?

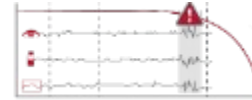
SYSTEM



Is Line 1 running ok?



Why is Line 1 quality poor?

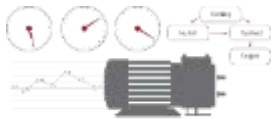


I predict that Line 1 quality is moving out of tolerance.



What action should the operator take to avoid poor quality?

DEVICE



Am I running ok?



Why did a fault happen?



I predict a fault will happen soon.



What action should be taken to avoid the fault?

# Enabling the Industrial Internet of Things (IIoT)

## The Connected Enterprise

### Customer Outcomes



Faster Time to Market



Lower Total Cost of Ownership



Improved Asset Utilization



Enterprise Risk Management



### INFORMATION SOLUTIONS CAPABILITIES – Cloud | On-Premise | Edge



SCALABLE EXECUTION SYSTEMS

AUTO DISCOVERY



SCALABLE ANALYTICS

ZERO CONFIG DASHBOARDS



MOBILITY & COLLABORATION

ORCHESTRATION & WORKFLOW



CONNECTED SERVICES

PEOPLE IN THE IIOT

### ROCKWELL AUTOMATION IIoT INFRASTRUCTURE – Integrated Architecture®

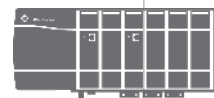
### SMART CONNECTED ASSETS – Ethernet/IP Enabled Network



SENSORS & ACTUATORS



INTELLIGENT MOTOR CONTROL



CONTROLLERS



MOBILE / DISPLAYS



MACHINES & EQUIPMENT

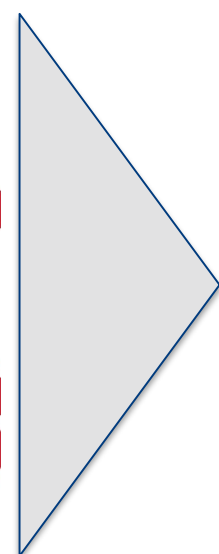
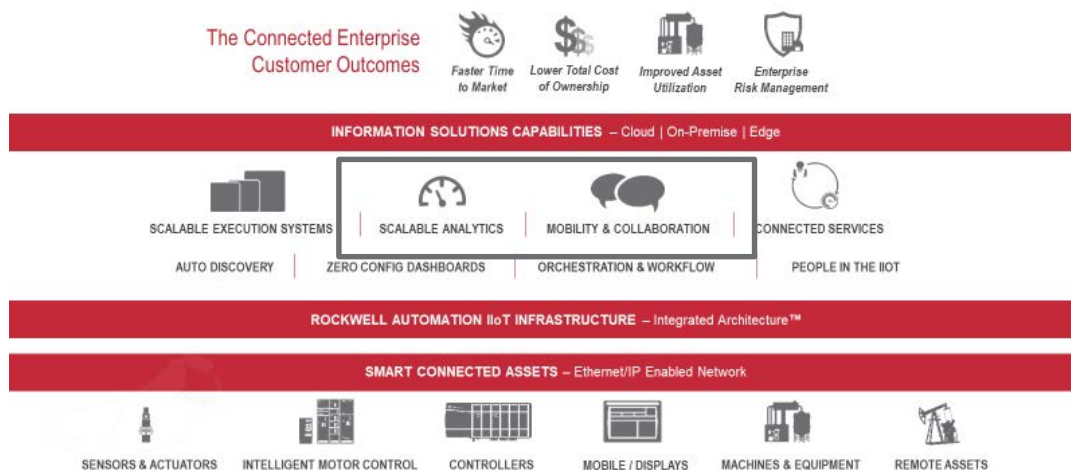


REMOTE ASSETS



# Analytics and Mobility

## Enabling the Industrial Internet of Things (IIoT)



### Scalable Analytics

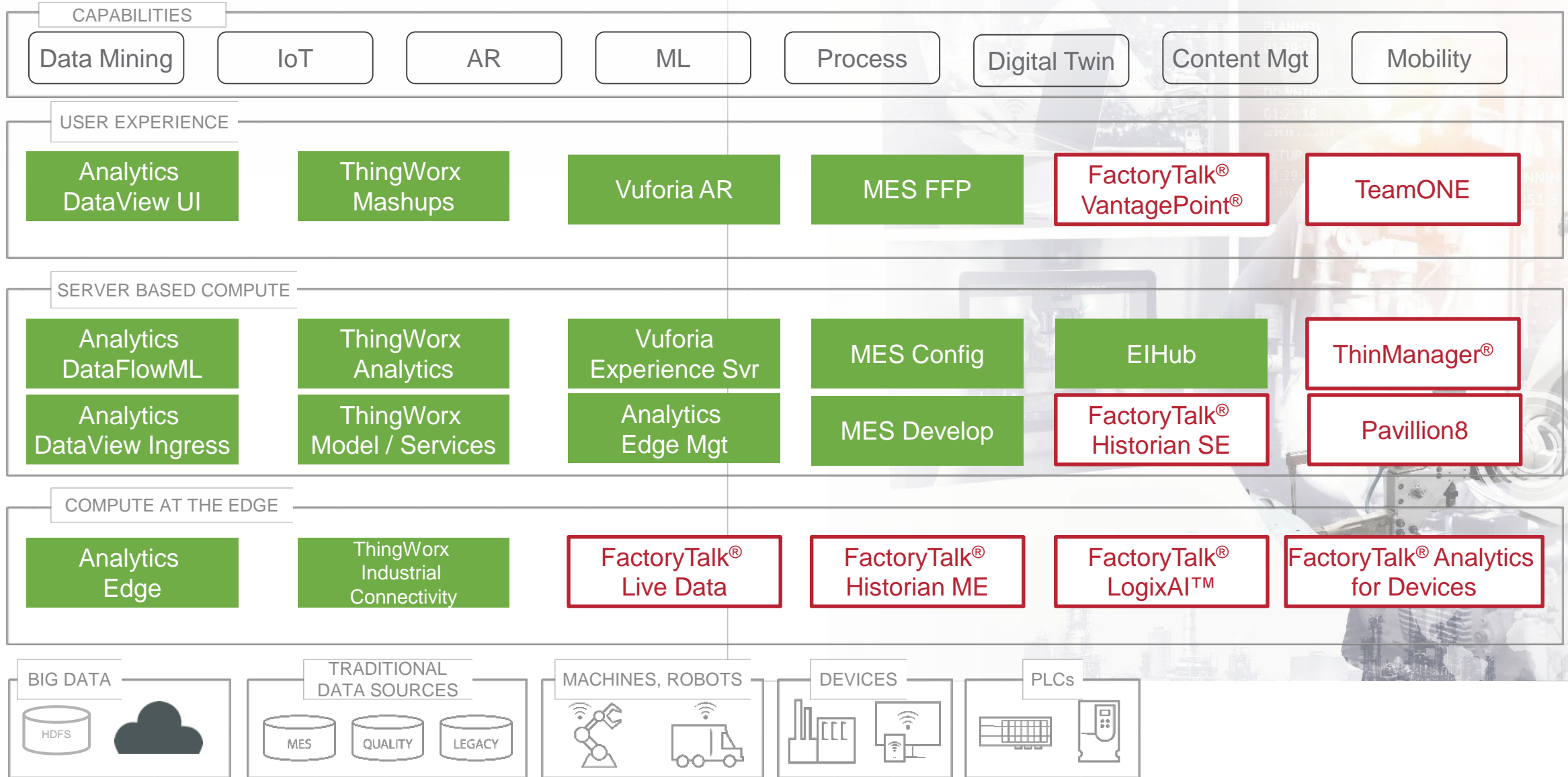
- IoT Platform
- Data Mining and Analysis
- Machine Learning & Data Science
- Data Historization & Process Analysis
- Digital Twin

### Mobility & Collaboration

- Mobility
- Augmented Reality
- Content Management

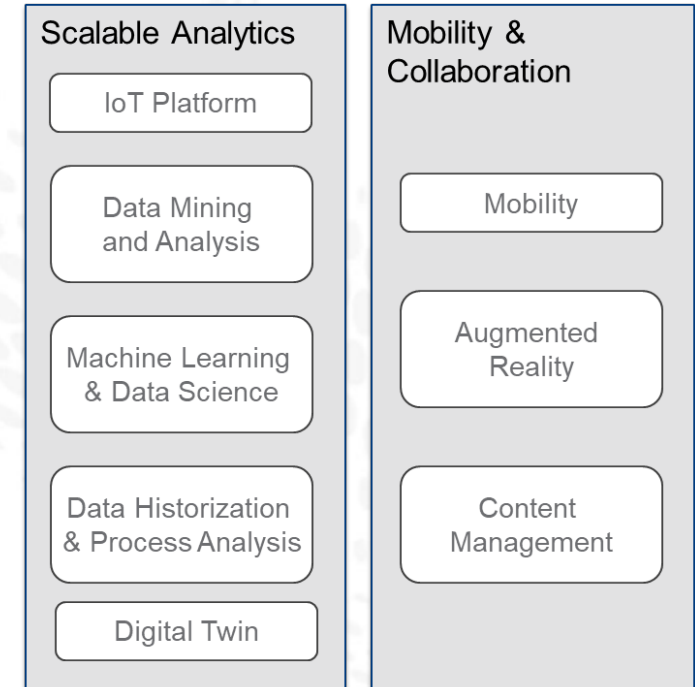
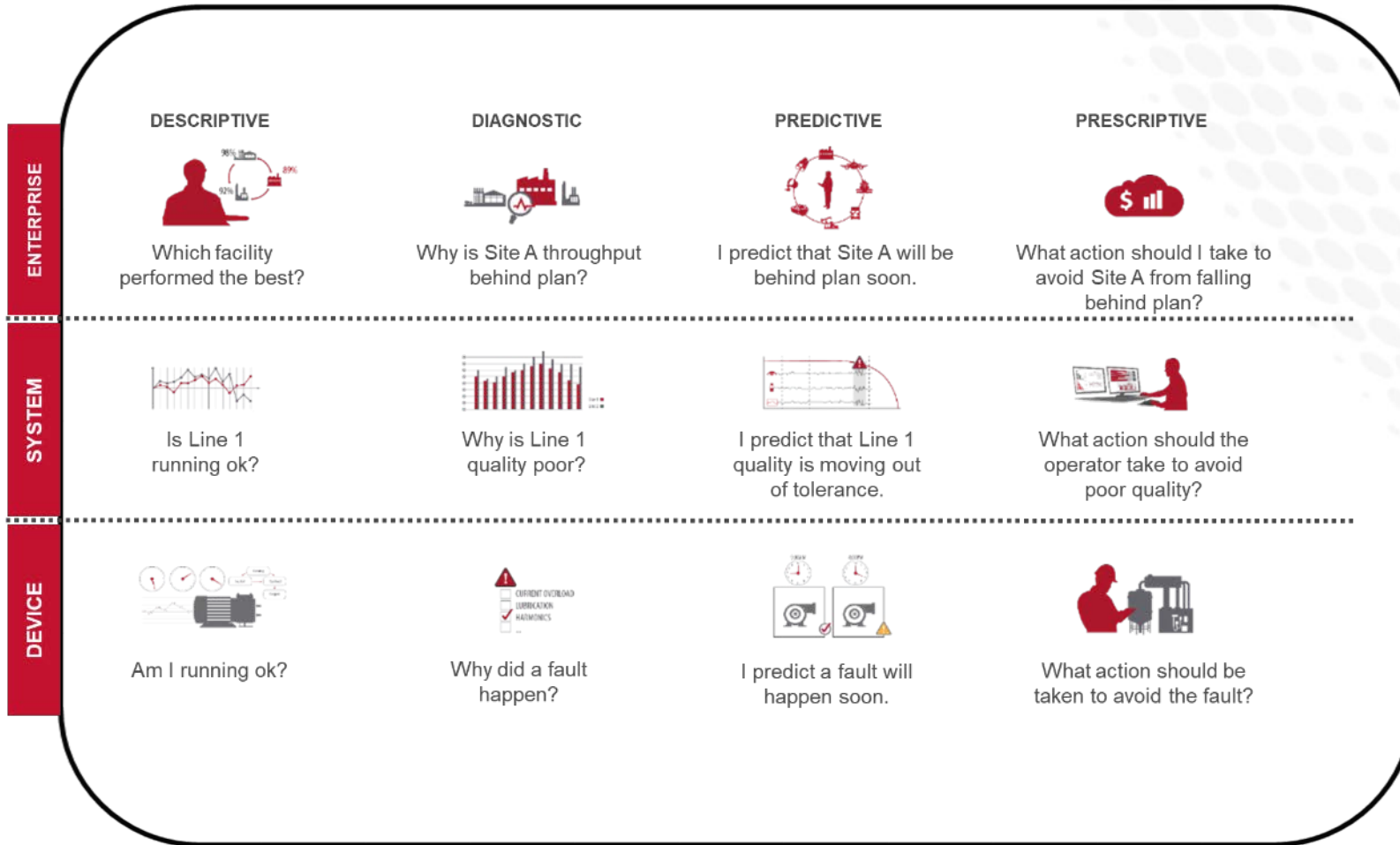
# High-Level Architecture

## FactoryTalk® InnovationSuite and Complimentary Portfolio



# Customer Needs meets Our Digital Transformation Capabilities

Through Scalable Analytics



## The Analytics Paradigm – With FactoryTalk® Analytics

DATA

LOGIC

INSIGHT



That analytical model must be scored or used to make calculations which results in insight

**DataFlowML (Score Logic)**  
**ThingWorx (Insight)**

Use historical **data** as basis for creating **logic** in the form of analytical models

**ThingWorx (Data) ThingWorx Analytics (Create Logic)**

Users Interact with analytics to drive decisions within **ThingWorx** (*fast answers to known questions*) or **DataView** (*Quickly Discover Answers to New Questions*)

INSIGHT

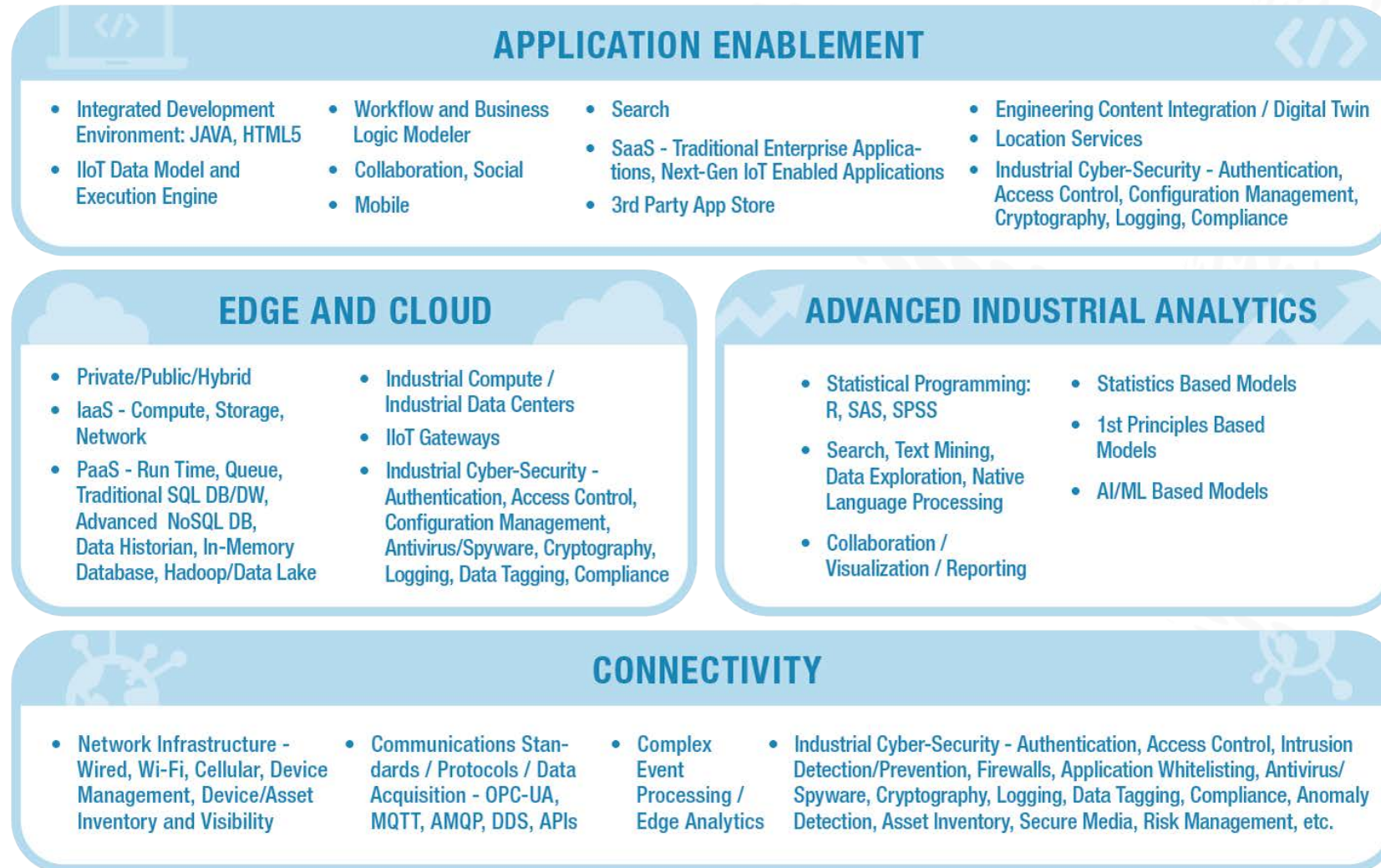


# FactoryTalk<sup>®</sup> InnovationSuite



IloT Platform

## Definition of an Application Enablement Platform



Source: LNS Research 2018

# What are the things in an Industrial Landscape

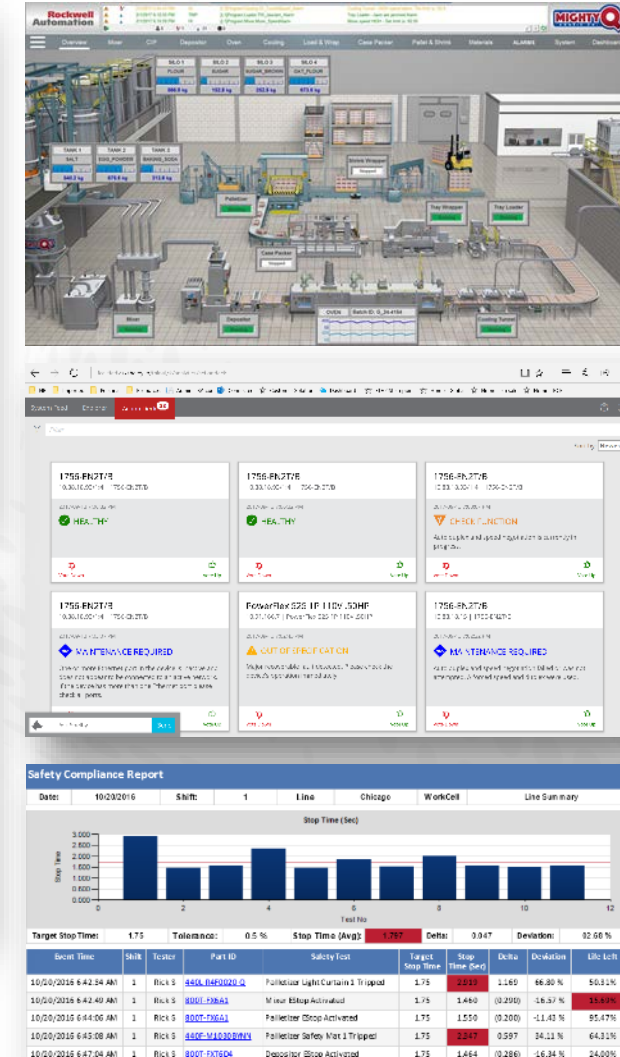
## OT Assets

- Sites
- Production Line
- Machines and Equipment
- Smart Sensors
- Production Assets

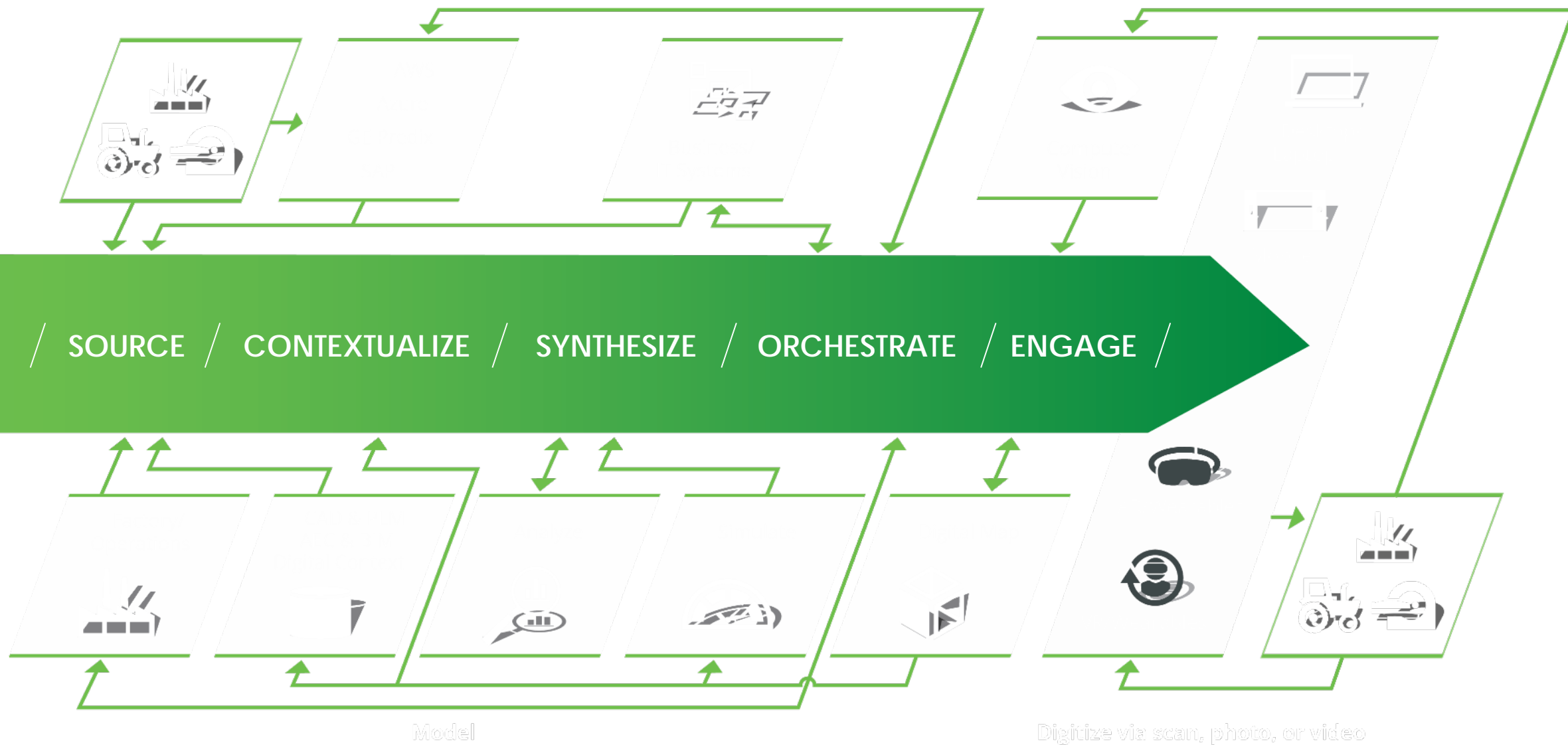


## IT Assets

- Orders and Batches
- Reports and Analysis (SSRS...)
- Analytics (Storyboards...)
- Webpages (Reports, Configuration and UI)

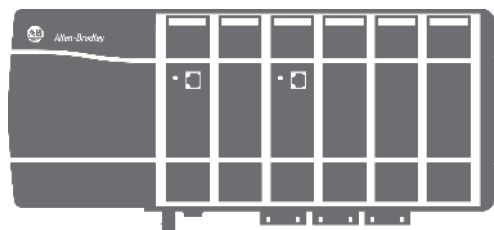






# Typical Things to Integrate into your IIoT Solution

These cover a large portion of the Rockwell Automation portfolio



## Live Data

FactoryTalk® Live Data or  
ThingWorx Industrial  
Connectivity



## Time Series Data

FactoryTalk® Historian ME  
or SE, Files, ThingWorx  
Industrial Connectivity



## Transactional Data

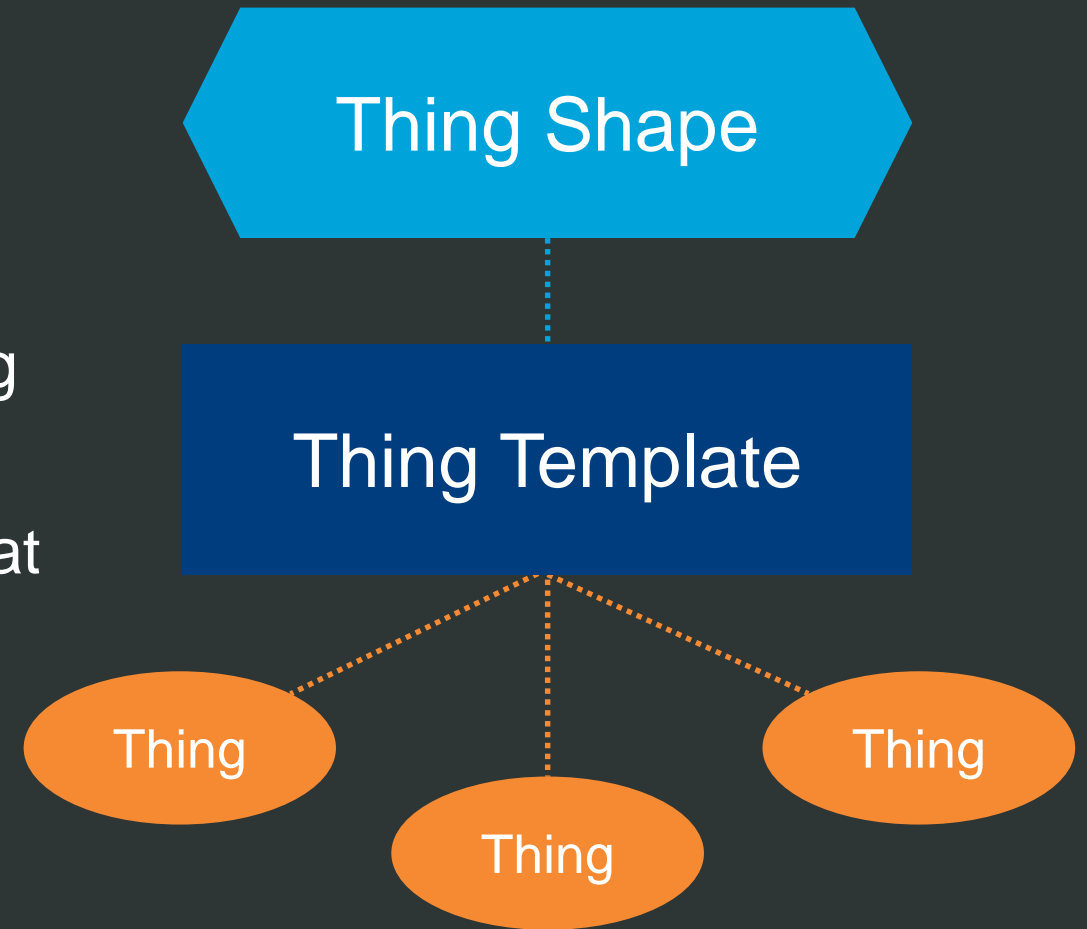
FactoryTalk®  
ProductionCentre®,  
EnergyMetrix or Metrics



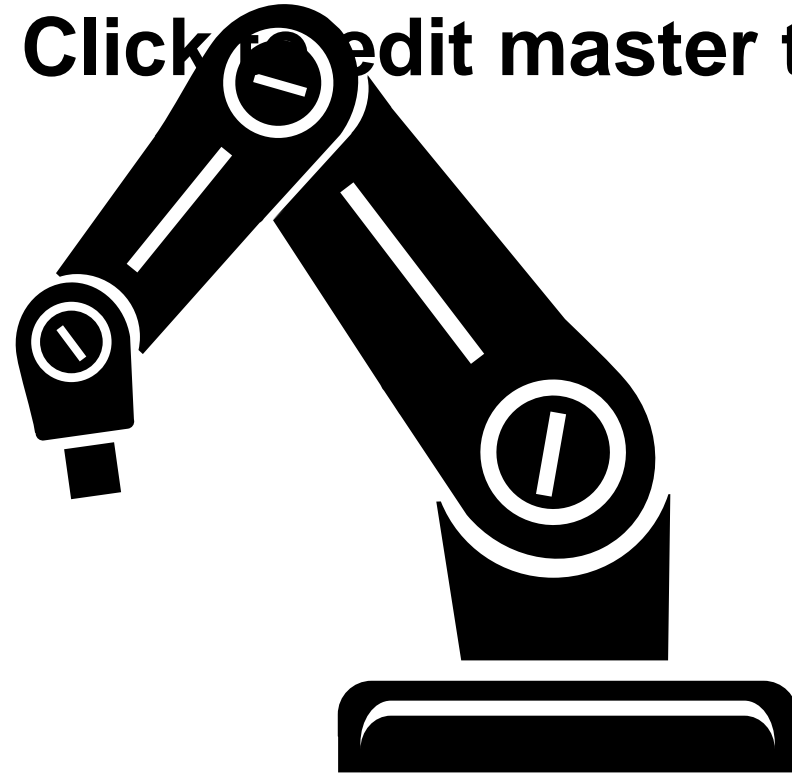
## Web Services & Pages

FactoryTalk® Performance,  
Quality, Analytics DataView,  
Microsoft SSRS,  
VantagePoint®...

- **ThingModel:** a collection of entities that represent things, process, and systems
- **Things:** provide context to data, the building blocks for applications
- **Things:** have structure and relationships that represent physical objects



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Properties

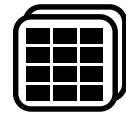
Events

Mashups

Services

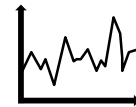
Subscriptions

Maintenance Schedule



Relational data

Weld  
Temperature



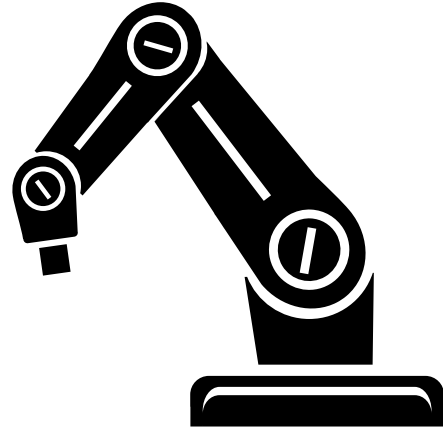
Time series data

Operator blog



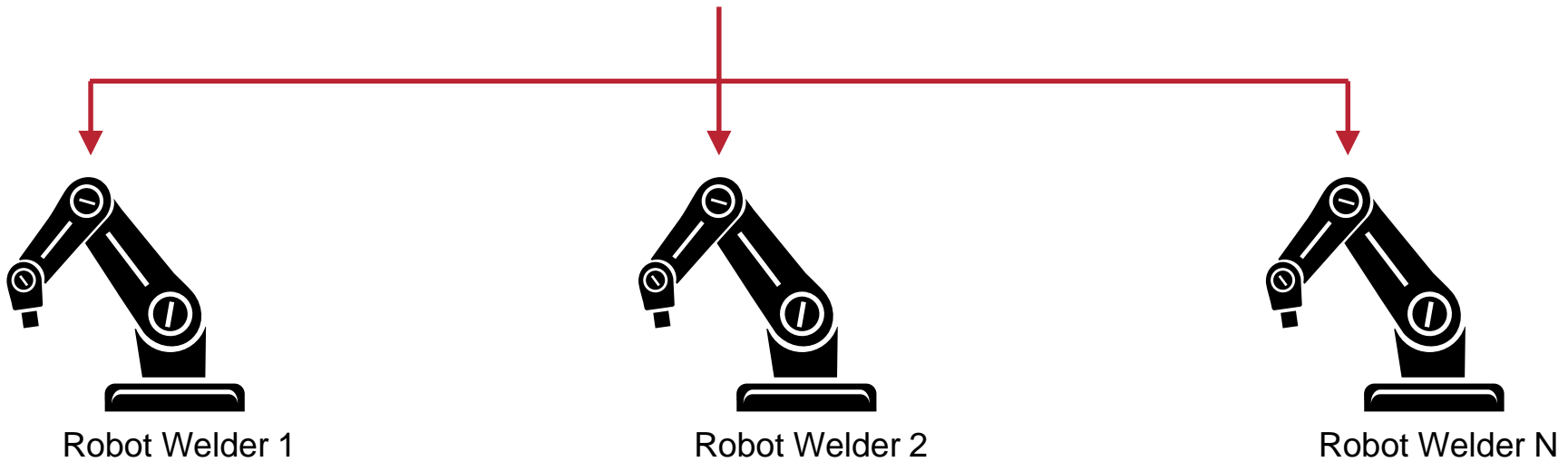
Social data

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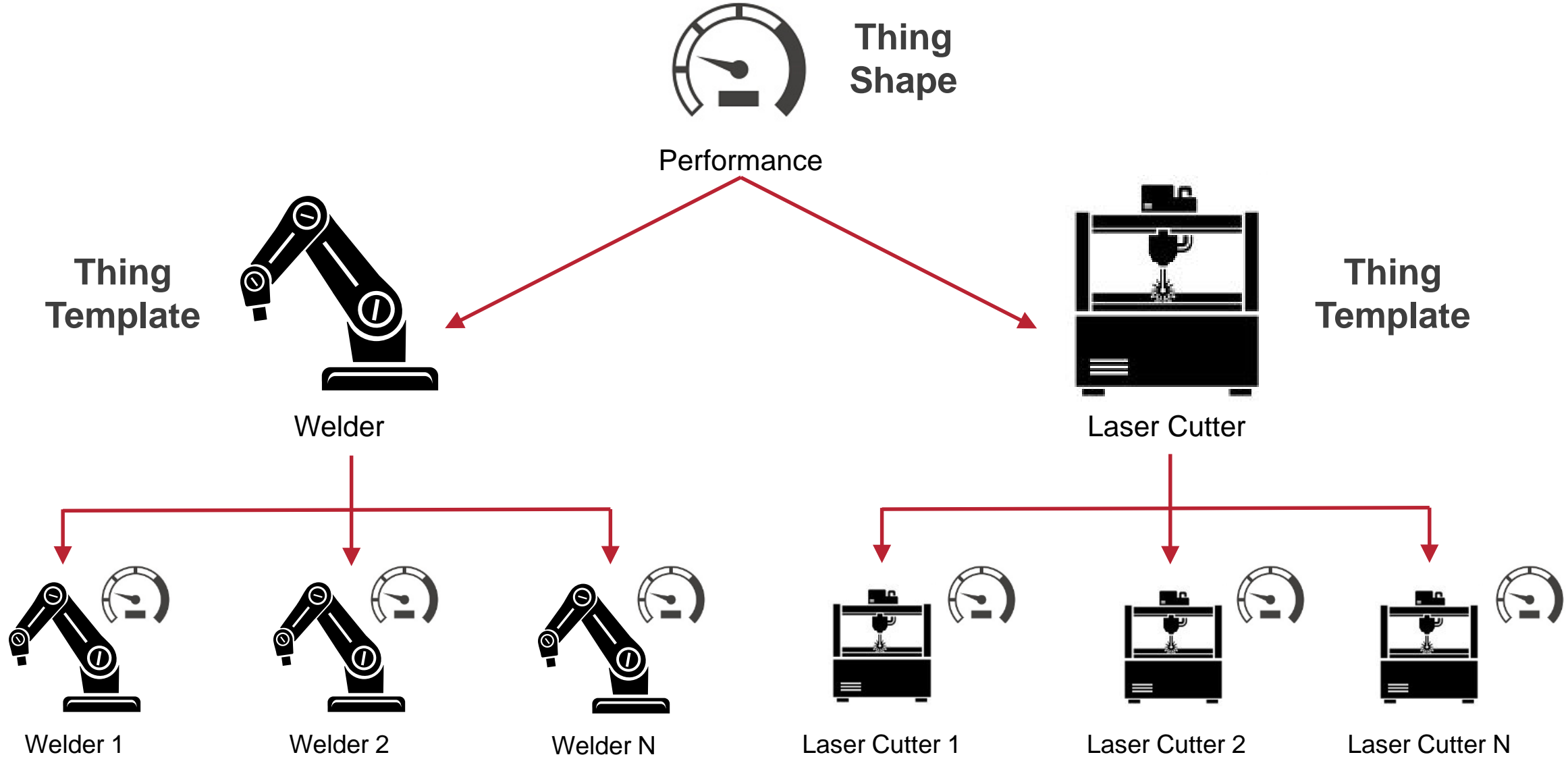


“Robot Welder”

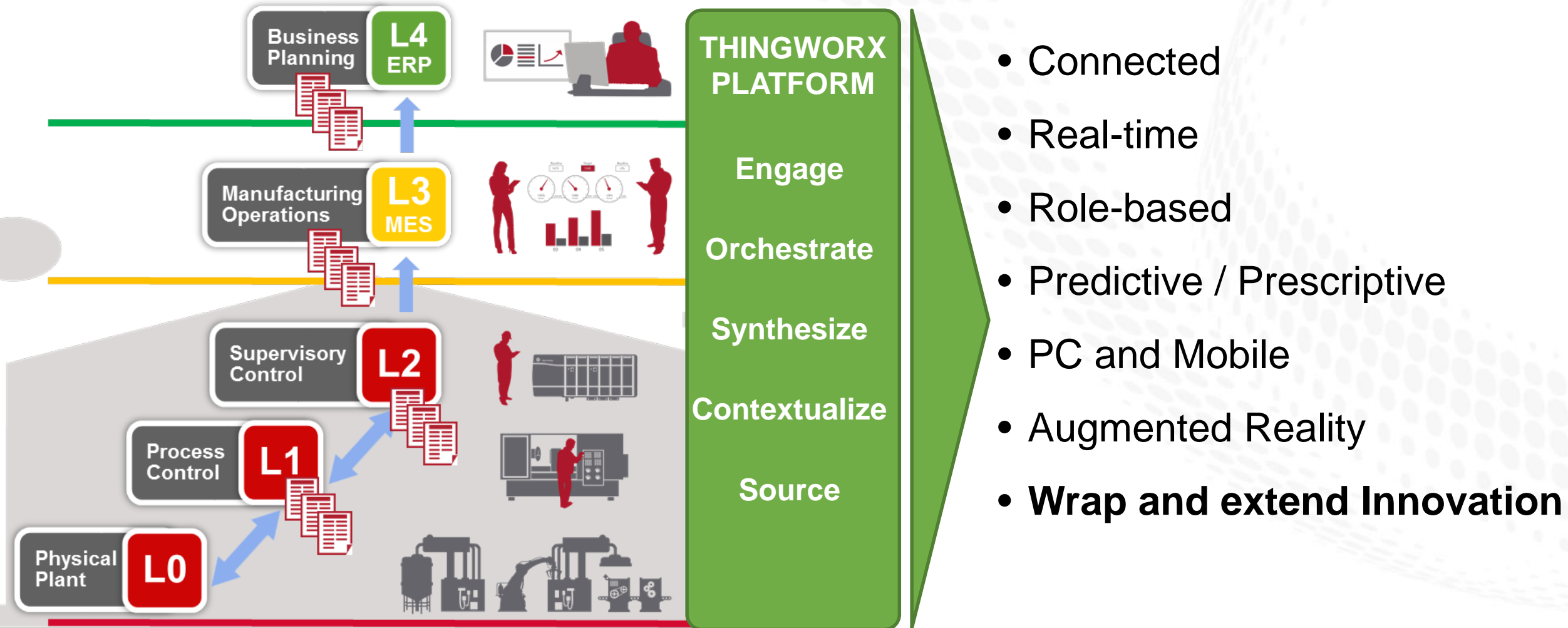
- Hierarchical model
- Object oriented
- Portable
- Re-usable



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# ThingWorx IIoT Platform



Transform your performance by giving your operations teams unprecedented capabilities to see, understand and act in real time. ThingWorx manufacturing apps accelerate your time-to-value and offer unmatched flexibility.

## ThingWorx Production KPI



Plant Manager



### Optimize Production Performance

Real-time monitoring of production status and critical KPIs. Detect and react instantly to production schedule and quality issues.

## ThingWorx Asset Advisor



Maintenance



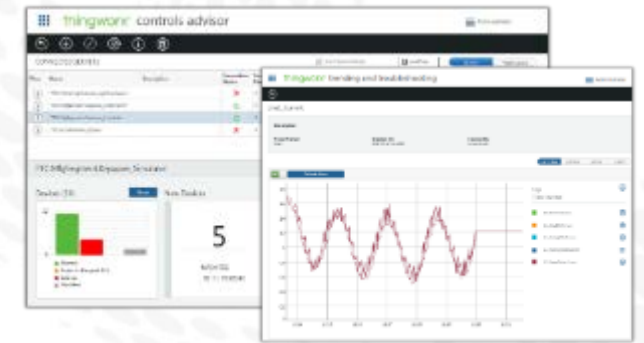
### Reduce unplanned downtime

Real-time monitoring of the status and health of critical production assets. Detect anomalies to identify potential issues that could result in unplanned downtime.

## ThingWorx Controls Advisor



Controls Engineer







### Ensure OT Network Data Quality

Unified real-time monitoring of all connected end points and related data elements on the OT system network. Rapidly and flexibly trend data to troubleshoot issues



# ThingWorx Manufacturing Accelerators & Apps


Jumpstart your digital manufacturing transformation journey

<p><b>ThingWorx Controls Advisor</b></p> <p>Controls Engineer</p> 	<p><b>ThingWorx Asset Advisor</b></p> <p>Maintenance</p> 	<p><b>Partner apps</b></p> 	<p><b>Customer apps</b></p> 
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**THINGWORX  
MFG  
APPS**

<p><b>Integrations</b></p> <ul style="list-style-type: none"> <li>MES</li> <li>Quality</li> <li>ERP</li> <li>Smart Tools</li> </ul>	<p><b>ThingModel</b></p> <ul style="list-style-type: none"> <li>Job Order</li> <li>Assets</li> <li>Crew</li> <li>Shift</li> </ul>	<p><b>Business Logic</b></p> <ul style="list-style-type: none"> <li>KPIs</li> <li>SPC</li> <li>Re-order</li> <li>APM</li> </ul>	<p><b>Widgets</b></p> <ul style="list-style-type: none"> <li>OEE</li> <li>Trending</li> <li>Work instr.</li> <li>Asset view</li> </ul>
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**THINGWORX  
MFG  
ACCELERATOR**

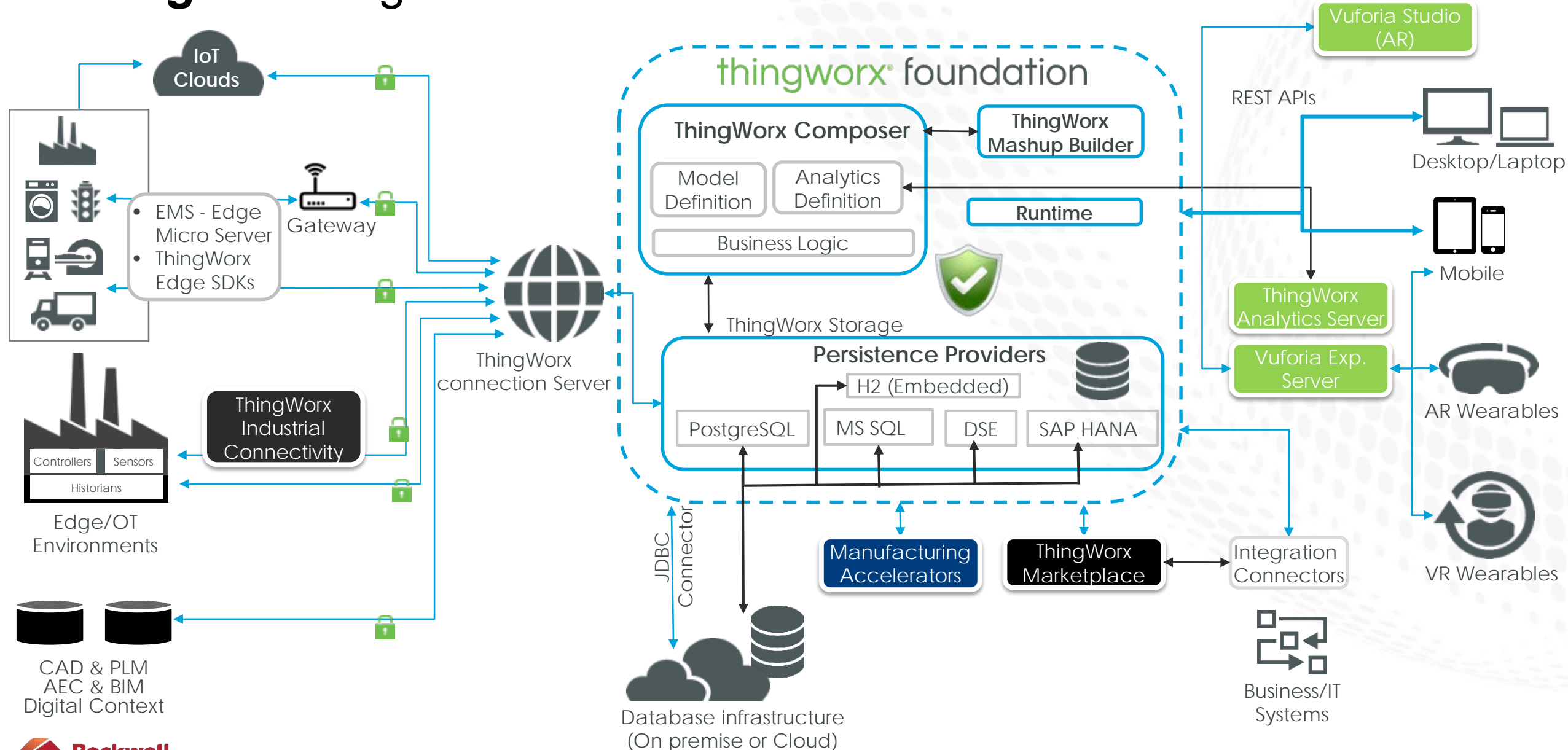

 **/ SOURCE / CONTEXTUALIZE / SYNTHESIZE / ORCHESTRATE / ENGAGE /**


**THINGWORX  
PLATFORM**

# FactoryTalk® InnovationSuite Map Industrial Internet of Things (IIoT)



# ThingWorx High level architecture



# ThingWorx Mashup Design Concepts

The final product



HOME LINE PROCESS INVENTORY SAFETY ENERGY MAINTENANCE

MENU

ajellis

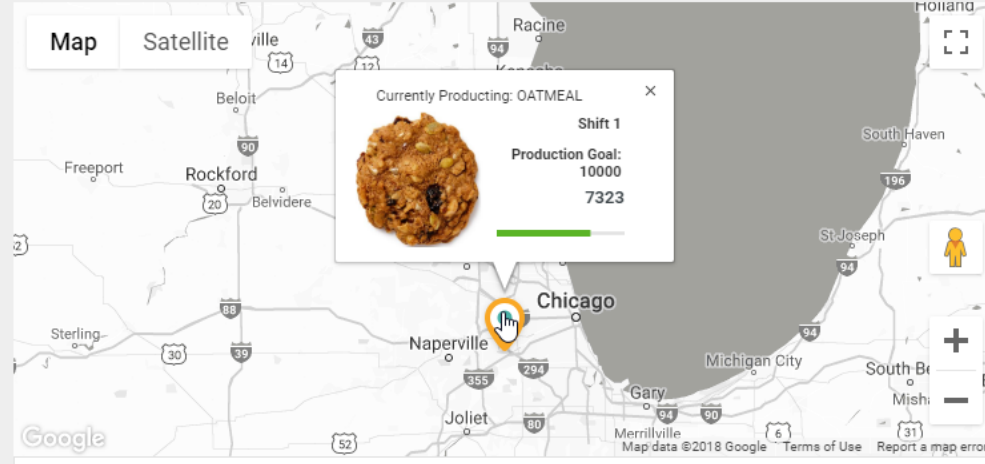
USER

NAVIGATION

- Mighty Q's Corporation
  - Europe
    - Brussels
  - Asia
    - Singapore
  - United States
    - Chicago

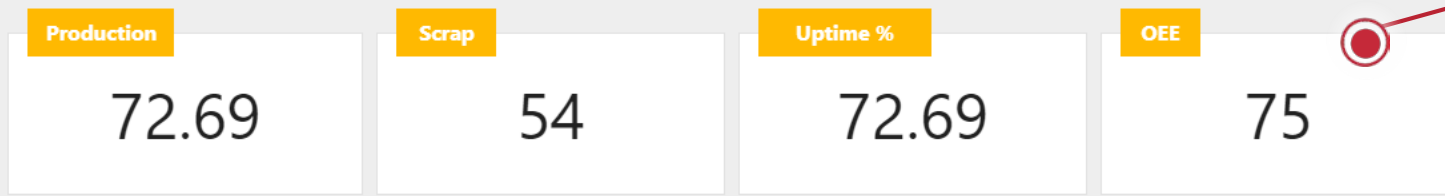
## Chicago

PLANTS PERFORMANCE CHART



CURRENT WEATHER 31.8°F

Plant Address  
180 Harvester Dr, Burr Ridge, IL 60527



WIDGETS

# ThingWorx Mashup Design Concepts

The design environment



The screenshot shows the ThingWorx Mashup Design environment for a mashup named "MightyQ.DHome". The interface includes a top navigation bar with "SEARCH" and "+ NEW" options, and a toolbar with "View Mashup", "To Do", "Save", "Cancel", and "More" buttons. Below the toolbar are tabs for "General Information", "Design", "Custom CSS", "Permissions", "Change History", and "View Relationships".

On the left side, there is a "Widgets" panel with a "Filter Widgets" search box and a list of widgets including "Advanced Data Filter", "Auto Refresh", "Autocomplete", "Back Button", "Bar Chart", "Blog", "Bubble Chart", and "Button". Below this is a "Mashup" panel with a "Filter Properties" search box and a table of properties:

Name	Value
-T- Id	mashup-root
-T- Type	Mashup
-T- DisplayName	Mashup
Description	
CustomClass	
-T- CSSFile	
Master	MightyQ.Maste...
Style	/ / / /
TitleBar	

The central area is a "Canvas" with a "Preview" button and a "Default Language" dropdown. A "Tree" widget is visible on the canvas. Below the canvas is a "Connections" panel showing a "To-Do" list with a "Mashup" widget connected to "Things\_MightyQ\_MightyQ", "Things\_WeatherDataConf...", and "GetAllWeatherData".

On the right side, there is a "DATA+" panel with a table of data:

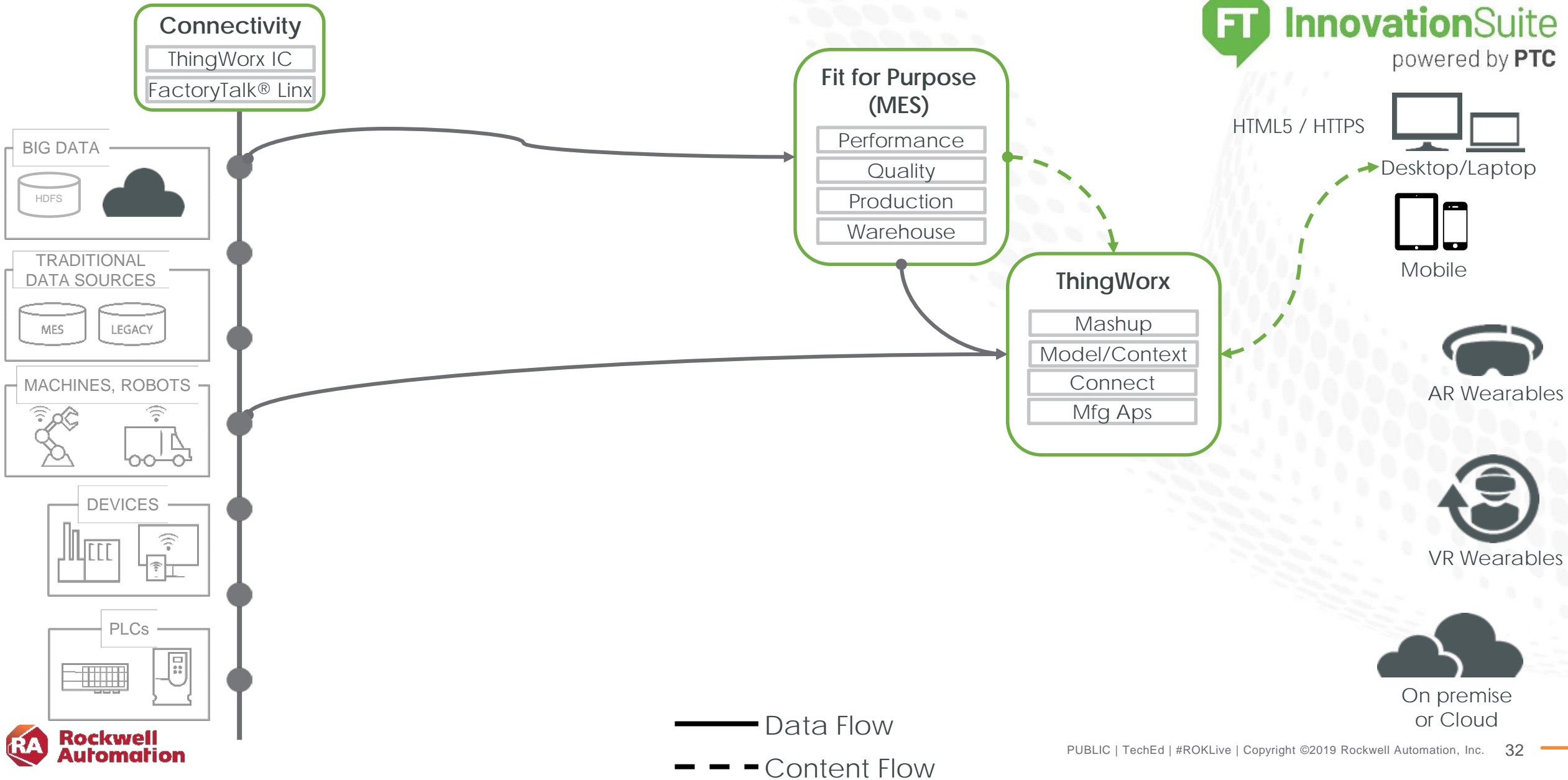
Name	Value
DynamicThingTemplates_MightyQ_PL...	
EntityName	
GetProperties	
Things_MightyQ_MightyQ	
GetCorpNetworkProperties	
Things_WeatherDataConfigAndServices	
GetAllWeatherData	

Red callout boxes with lines pointing to specific elements are labeled: "ACTIONS" (pointing to the "More" button), "WIDGETS" (pointing to the "Autocomplete" widget), "PROPERTIES" (pointing to the "DisplayName" property), "DATA+" (pointing to the "EntityName" data row), "CANVAS" (pointing to the central workspace), and "EVENTS" (pointing to the "GetAllWeatherData" connection).



Fit for Purpose

# FactoryTalk® InnovationSuite Map Fit for Purpose Applications

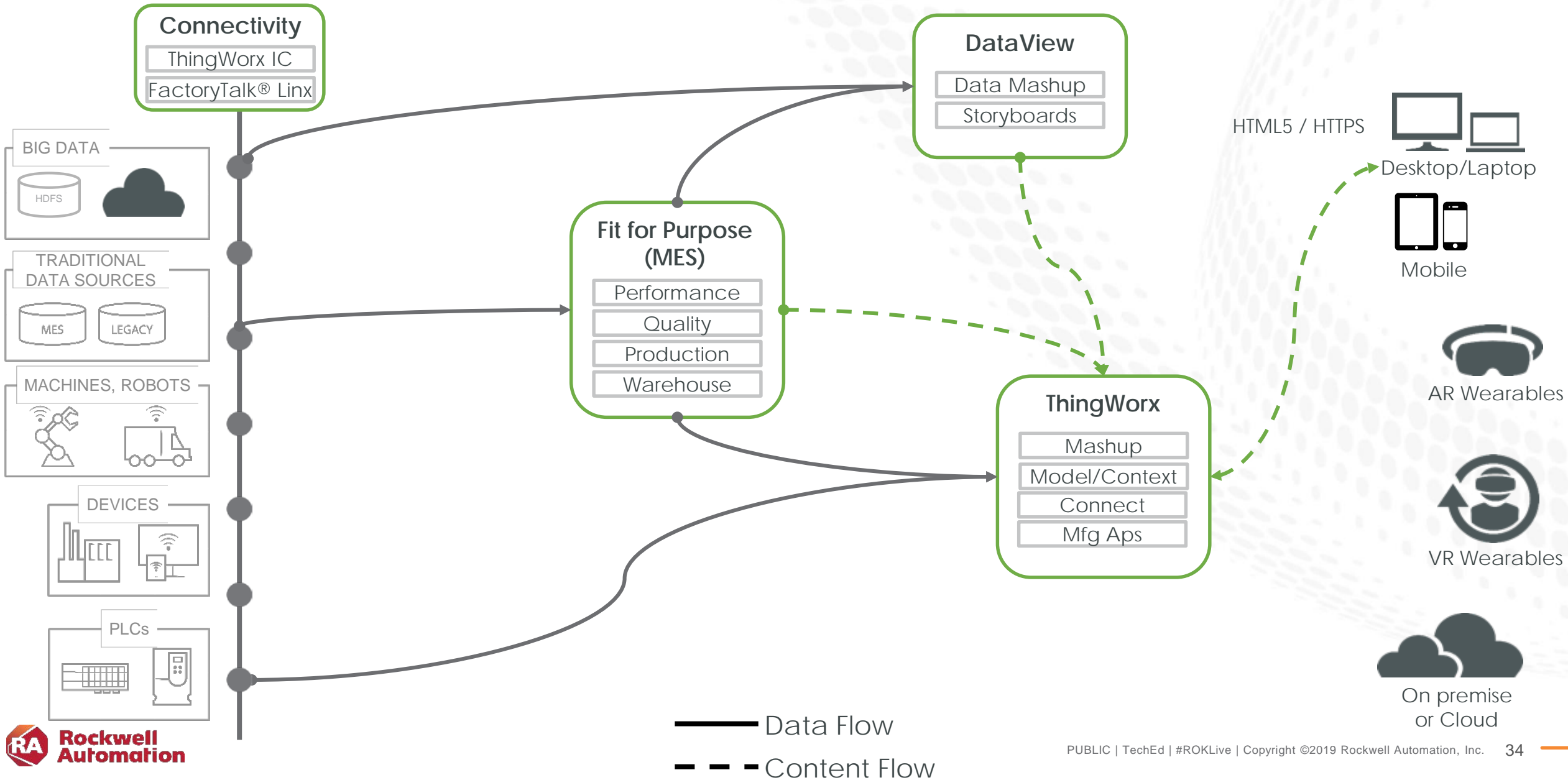




Data Analytics



# FactoryTalk® InnovationSuite Data Analytics



# DataView

FactoryTalk<sup>®</sup> Analytics

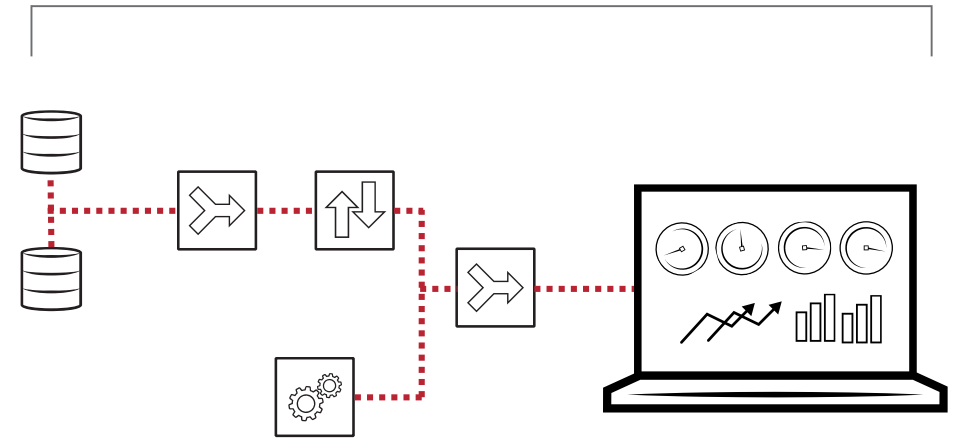
- **Eliminate the need for expensive infrastructure associated with traditional warehousing**
- **Reduces time to value by reducing dependence on data architects and data scientists, which allows the users to interact and explore in a self-service manner**

## Features

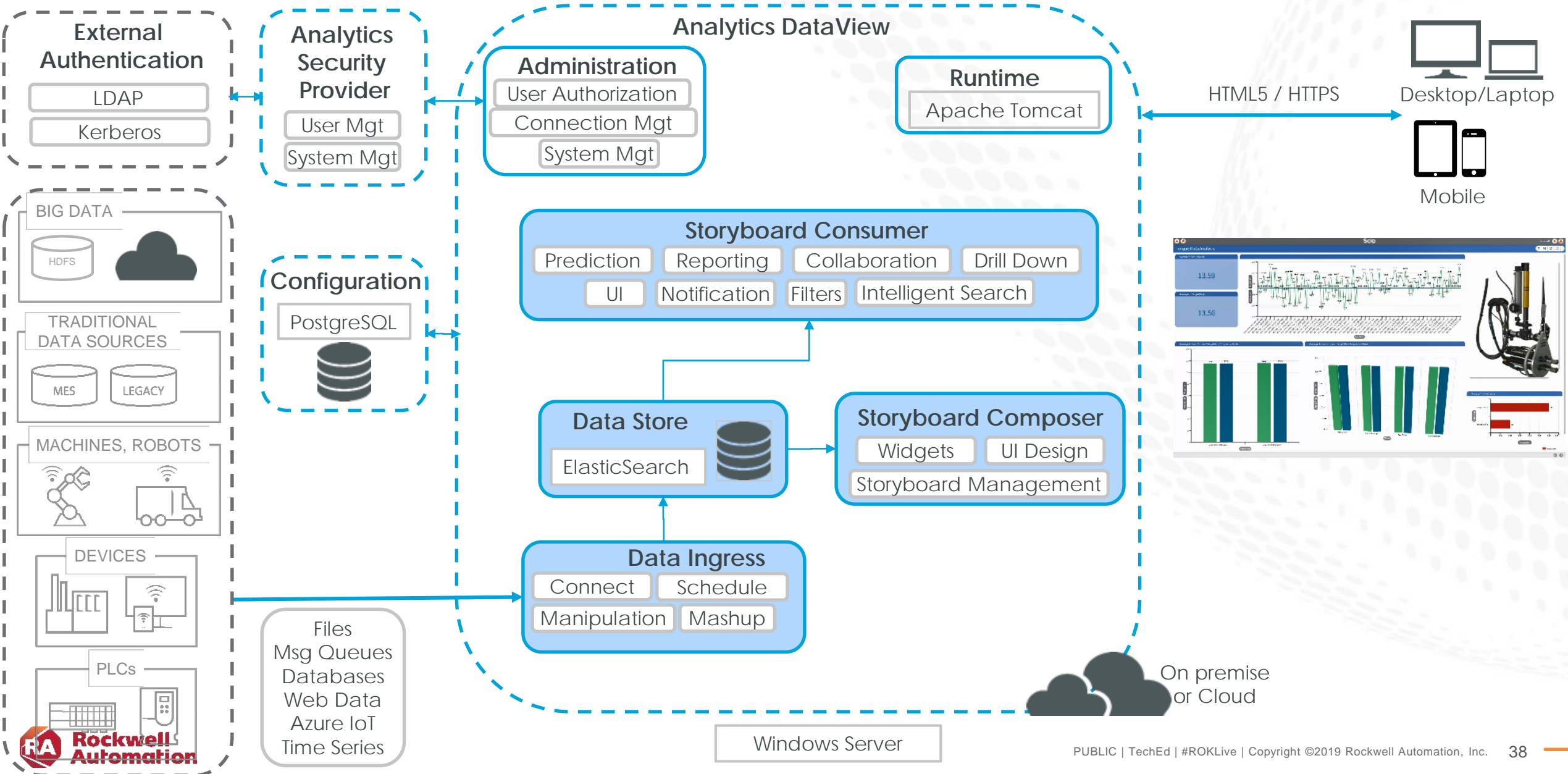
- Easily fuse data together without relying on an IT workflow
- Eliminate the need for a complex data schema
- Find relationships in data
- Self-service storyboards
- Easily share data relationships with others within an organization
- Mobility, Collaboration, Alerts and Notification built in

# DataView

FactoryTalk<sup>®</sup> Analytics

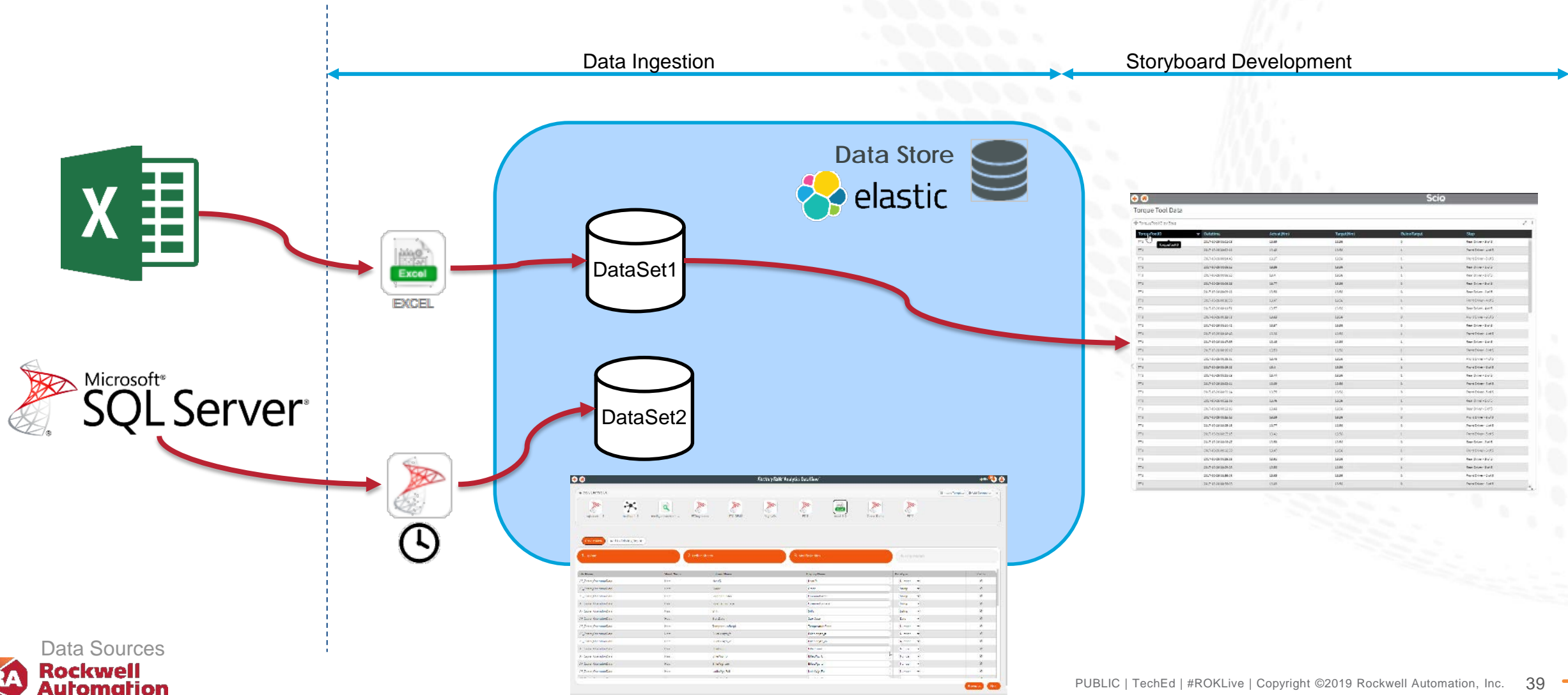


# Analytics DataView High level architecture



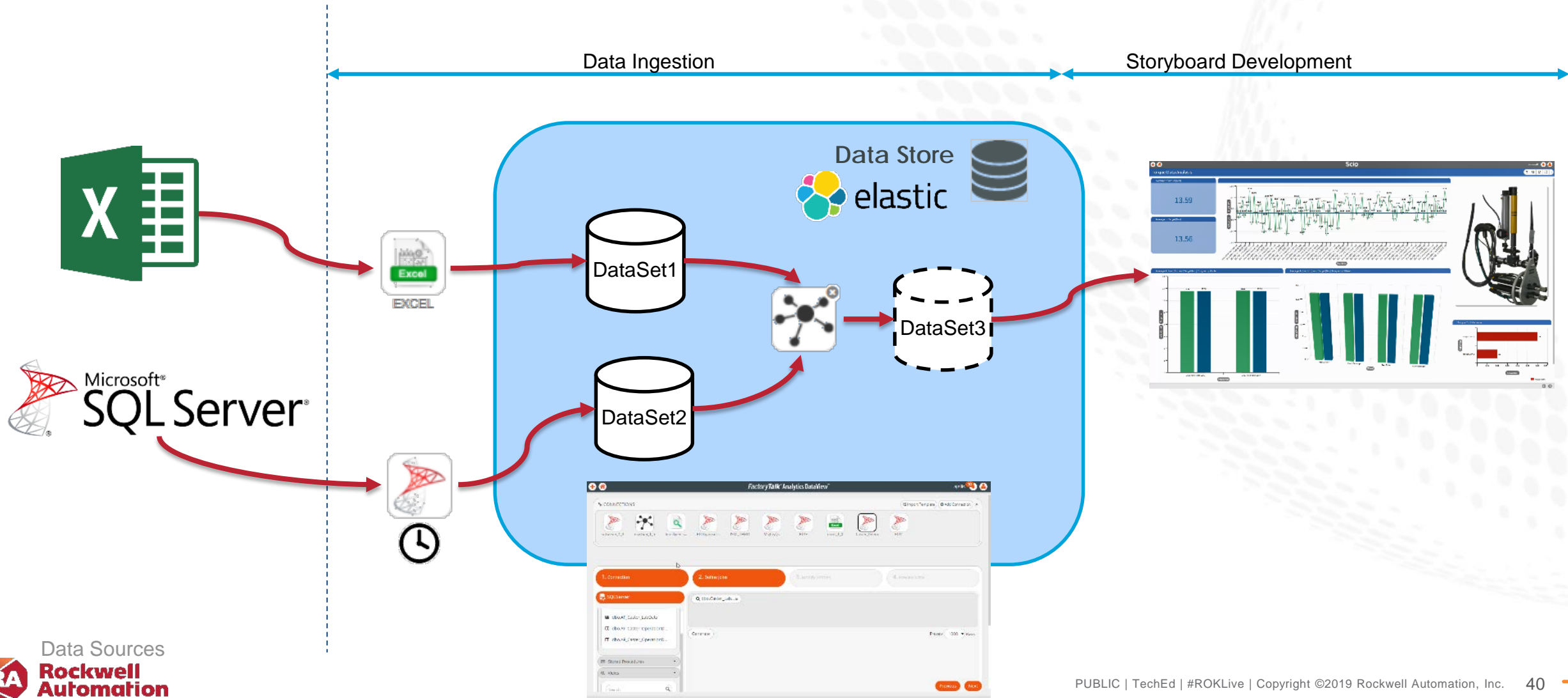
# FactoryTalk® Analytics™ DataView

Data Ingestion



# FactoryTalk® Analytics™ DataView

Data Mash Up or Fuse



# Integrating DataView and ThingWorx

## User Experience

Ingest Data and Develop your Storyboard

Provide Context for your Storyboard

**Find Storyboard**

**Merge Data Sets**

**Filter for Context**

My Storyboards

- AJE\_Caster\_Lab f... (Aug 14, 2018)
- Caster All Data (Aug 10, 2018)
- AJE\_PTC Story Pr... (Aug 6, 2018)
- AJE\_PTC Story O... (Aug 6, 2018)
- AJE... (Aug 6, 2018)

FactoryTalk Analytics DataView

Overview

Good Parts: 1,191,830

Bad Parts: 10,301

Total Parts: 1,202,131

Total Downtime: 502.8

Downtime Incident Count by Product

Product	Count
Raspberry	26.2%
Berry	45.05%
Green Tea	28.75%

Downtime Duration by Product

Product	Duration
Berry	226.27
Green Tea	37.68
Raspberry	47.53

Rockwell Automation asset advisor

CHI\_Line1\_Filler1

Model Number: RA-1256

Serial Number: ABZD9823

Description: Filler 1 - CHI Lin

Location: Building 1

Related Lines: CHI\_Line1

Running 94 days 3 hrs

Cart Maint. Prediction: 4.70 days **Cart 12**

OEE (%): 75.39

MTTR (mins): 6.21

Availability (%): 93.57

MTBF (hrs): 296.22

Alerts: No active

Weekly total: 0

Navigation

**Context**

Filler

87,110

87,191

147.63

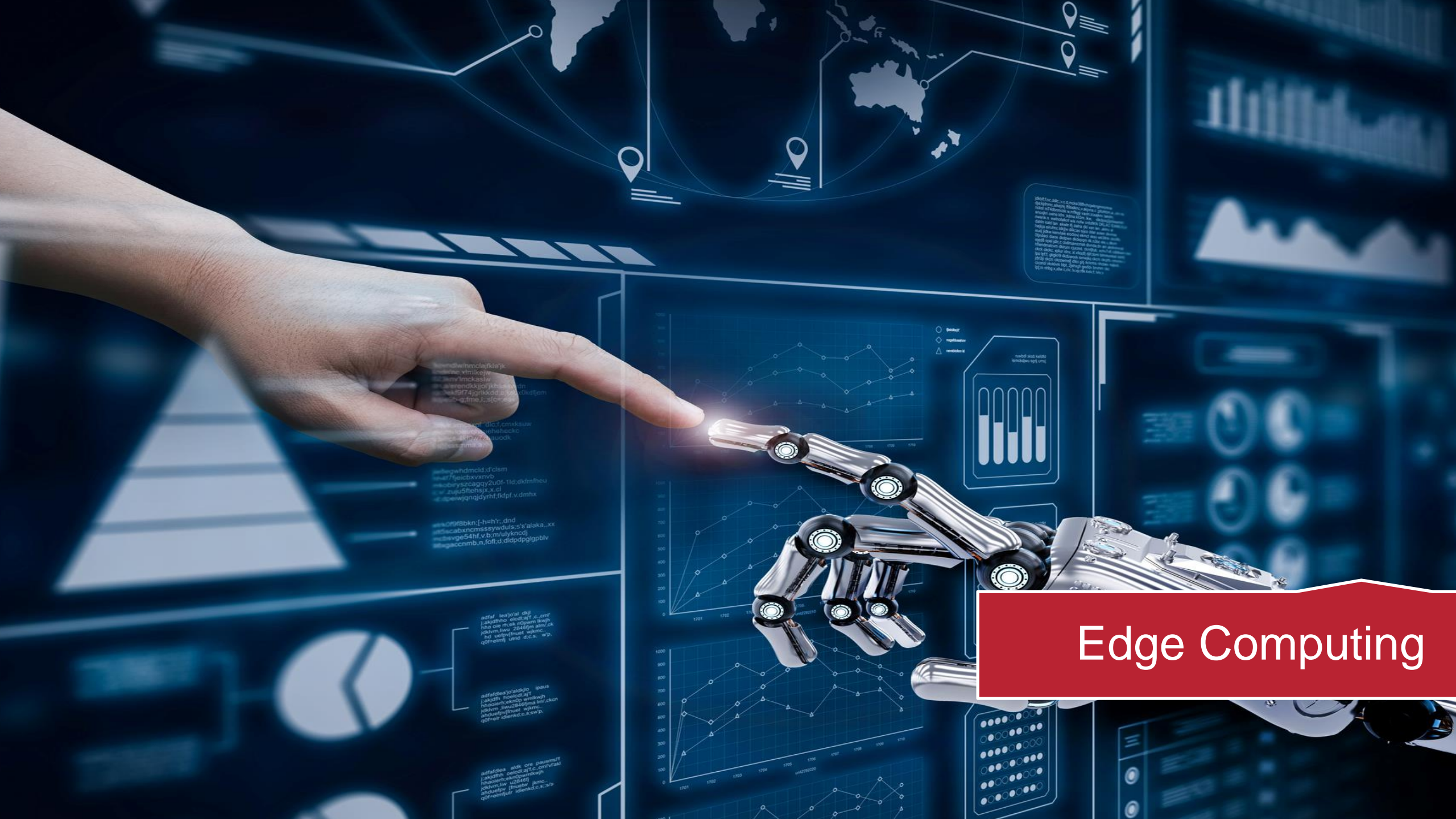
Downtime Incident Count by Product

Product	Incidents
Berry	49
Green Tea	39
Raspberry	42

Downtime Duration by Product

Product	Duration
Berry	62.42
Green Tea	37.68
Raspberry	47.53

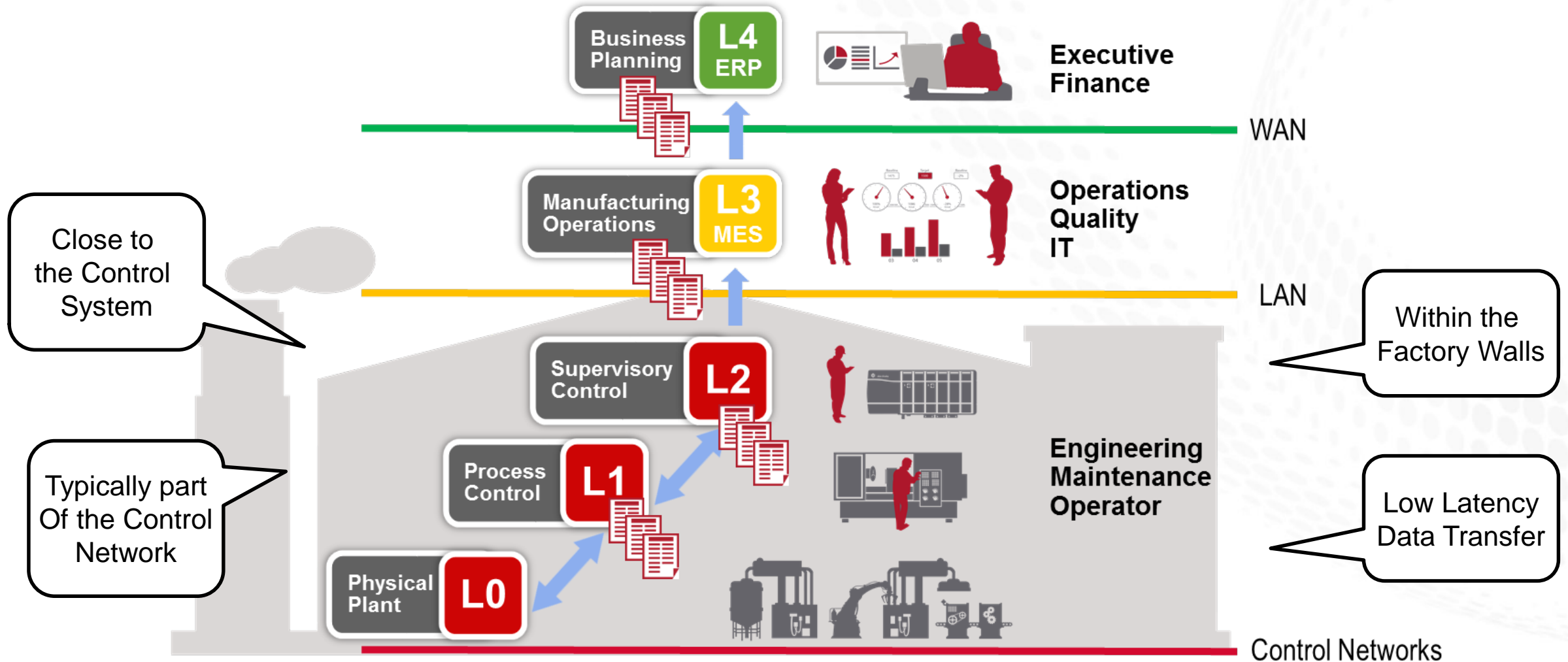
Other Data



# Edge Computing

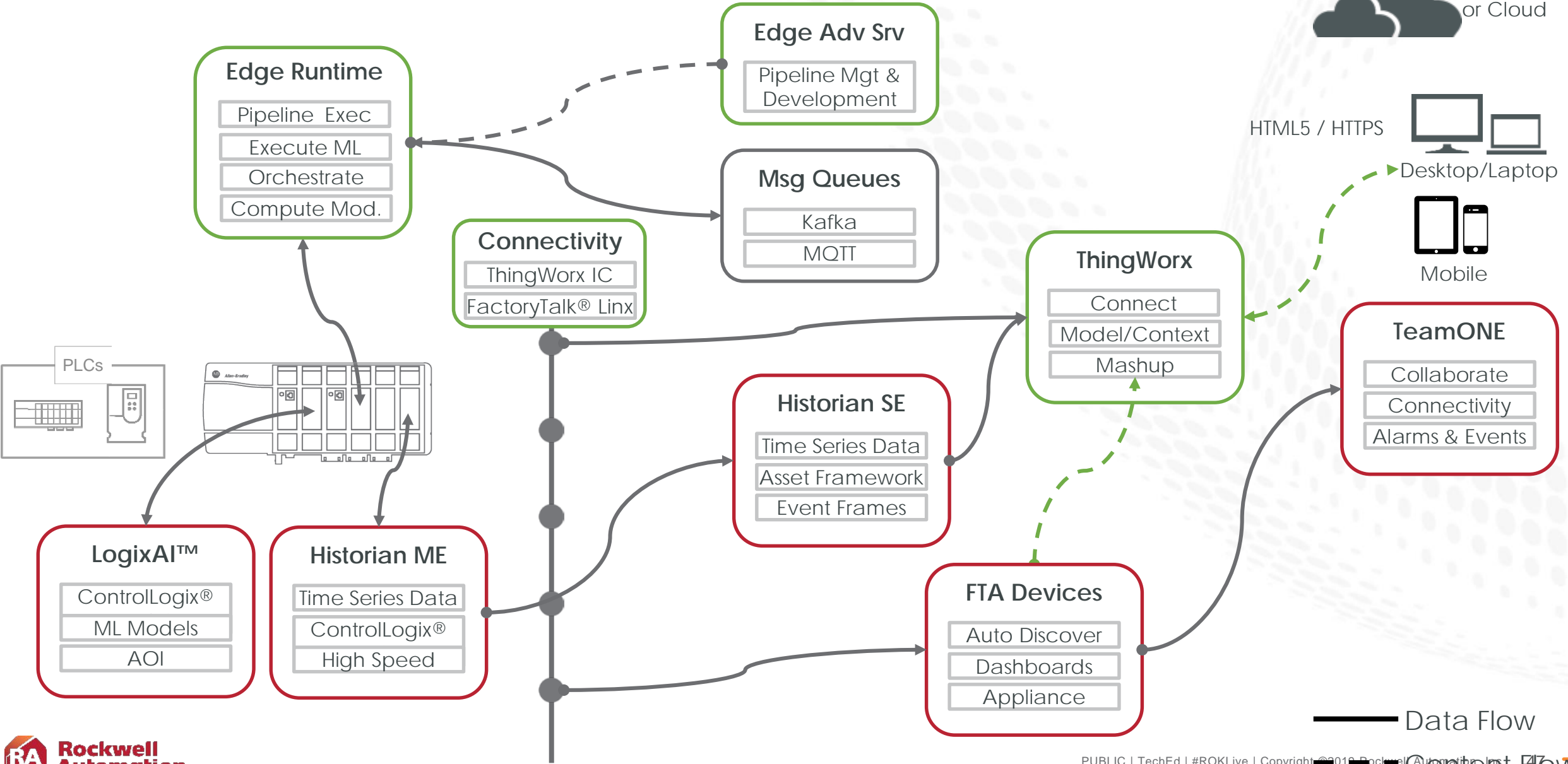
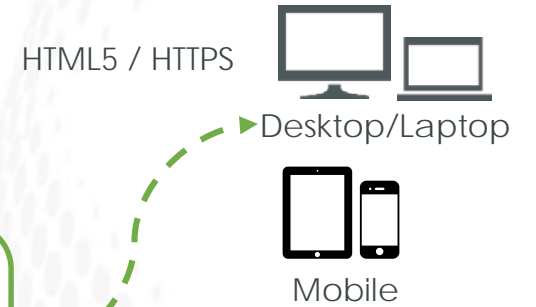
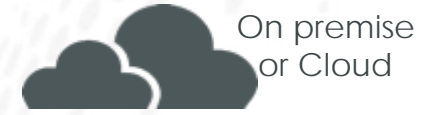
# What is the Edge?

Rockwell Automation Definition

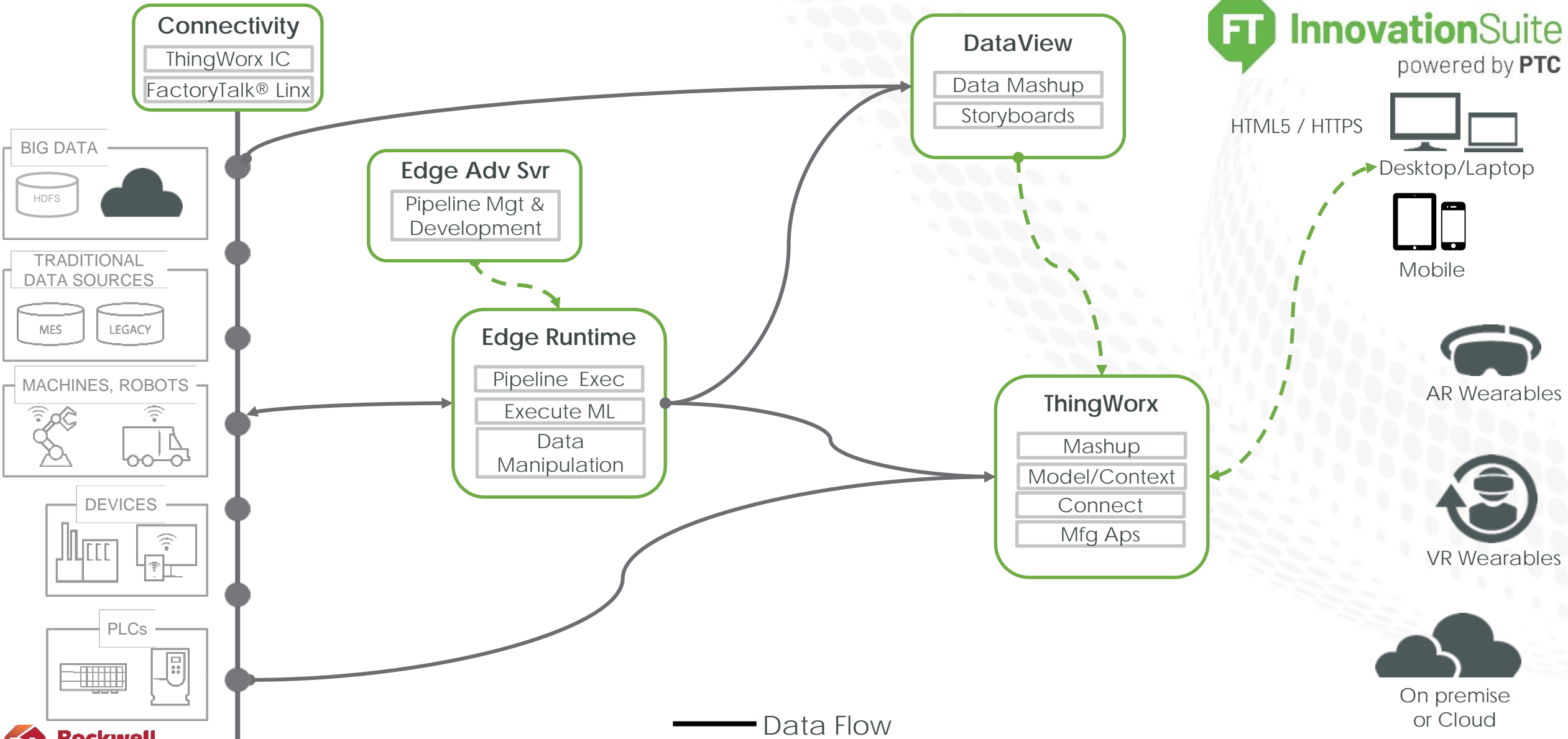




# Analytics at the Edge High level data flow



# FactoryTalk® InnovationSuite Map Edge Computing

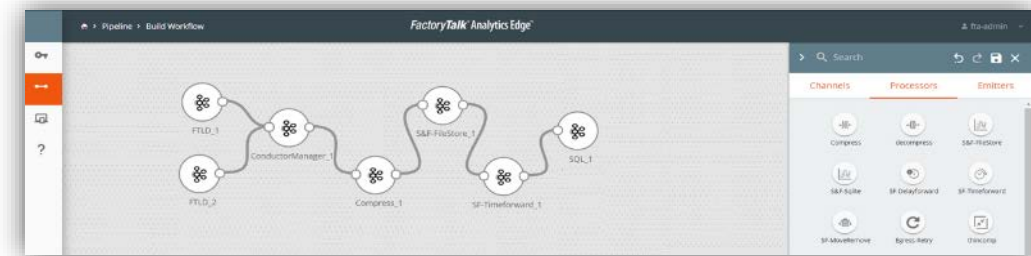
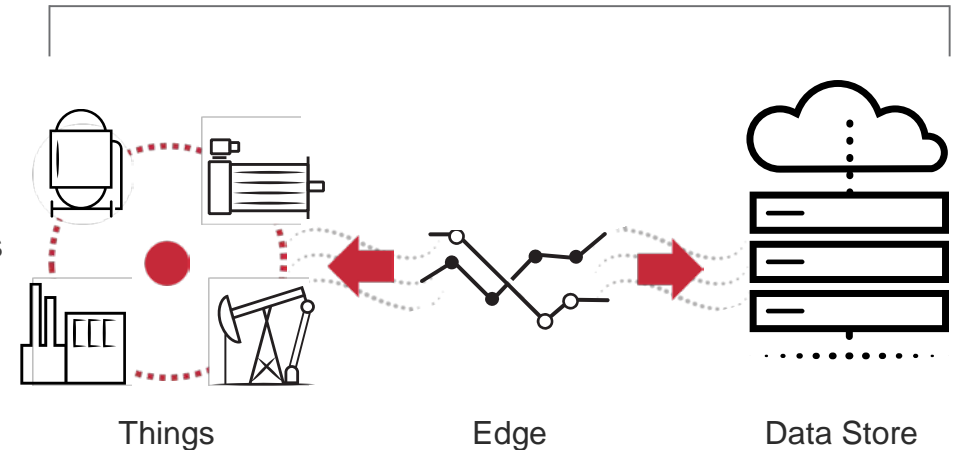


— Data Flow  
 - - - Content Flow

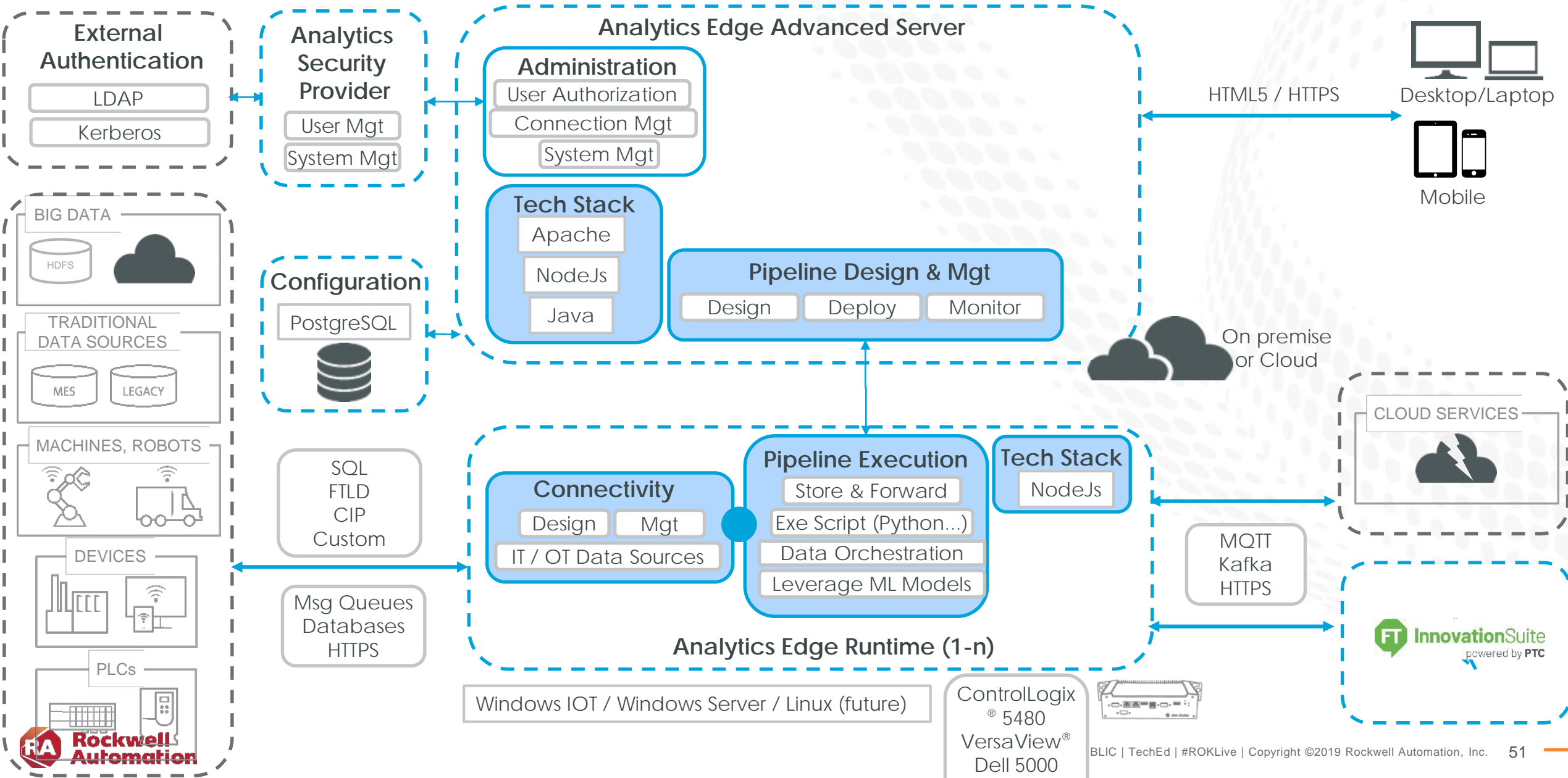
- **Make rapid decisions as close as possible to the data and consumer**
- **Increase efficiency of manufacturing analytics**
- **Reduce Information Layer infrastructure costs**
- **Improve access to information instead of data for all systems**

## Features

- Python based Machine Learning (SCIKIT library support) for data pipelines
- Java based Machine learning (H2O ML support) for data pipelines
- Custom python function support for pipelines
- Math function library for data pipelines
- Accessing the data in your intelligent devices
- Pre-process data for effective analytics
- Enable bidirectional transactional type data
- Execute closed loop edge level machine learning
- Allow the development of custom applications and connectors
- Intuitive on-Premise and remote device management



# Analytics Edge High level architecture



# Edge End Points Various data flows

On premise or Cloud

**Edge Adv Srv**  
Pipeline Mgt & Development

**Msg Queues**  
Kafka  
MQTT  
RabbitMQ

**DataView**  
Data Mashup  
Storyboards

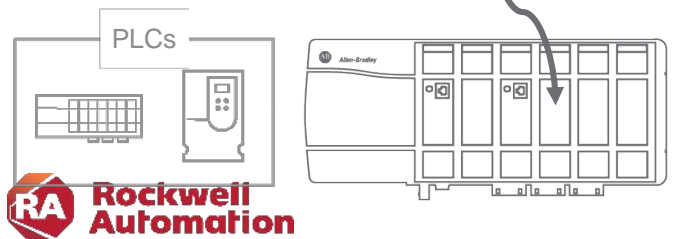
**Cloud**  
AWS  
Azure IOT  
Other / ML

**ThingWorx**  
Connect  
Model/Context  
Mashup  
ML

**DataFlowML**  
Data Orchestration  
Execute ML

**Database**  
MS SQL  
Other

**Edge Runtime**  
Pipeline Exec  
Execute ML  
Custom Processor  
Orchestrate  
Compute Mod.



HTML5 / HTTPS

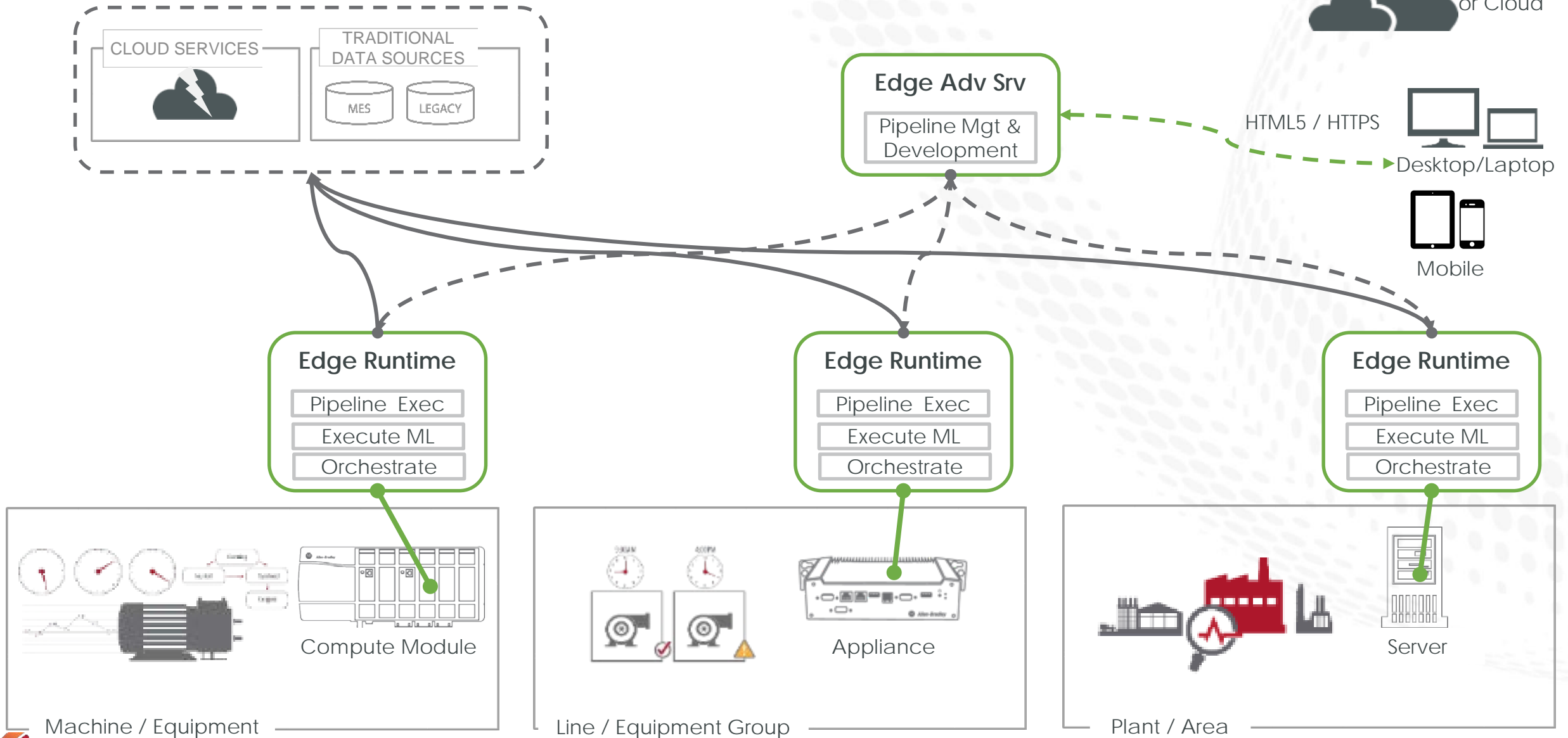


— Data Flow

— Content Flow

# Edge Deployments High level data flow

On premise or Cloud





AI

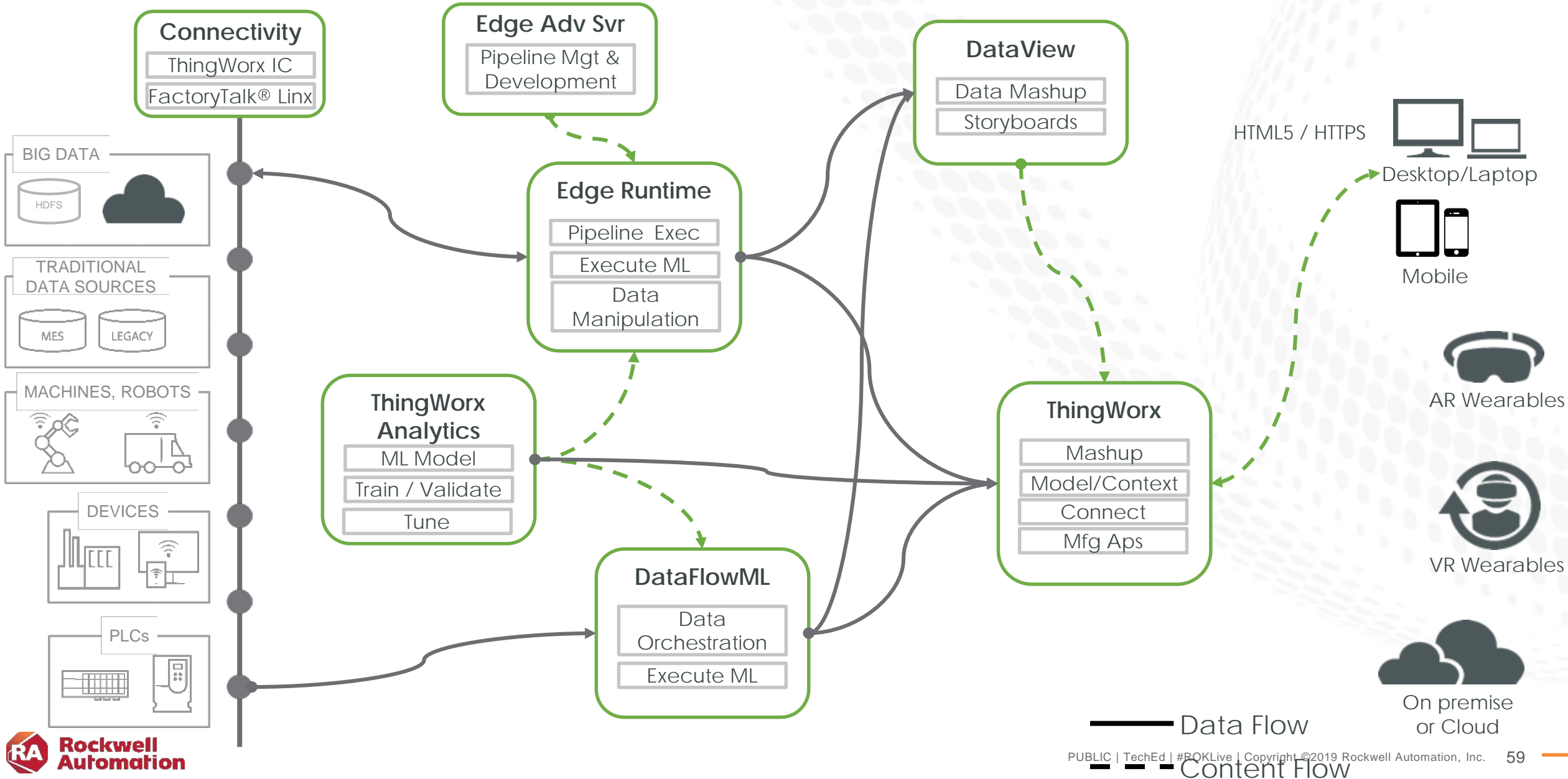
# Notes

- TW
  - With Apps
- FFP
  - Perf, Qua, prod, Warehouse
  - With TW
- DV
  - With TW
- Edge
  - Feeding TW
- AI
  - Model Development (Train)
  - Operationalize
    - With TW
- AR
  - With TW

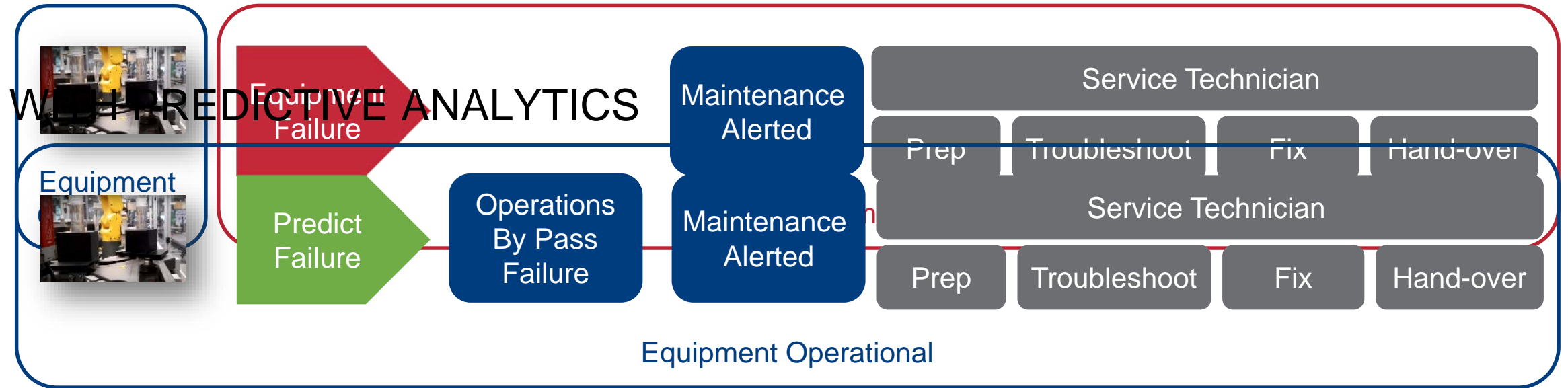




# InnovationSuite Map Analytics and Artificial Intelligence



# CURRENT SITUATION



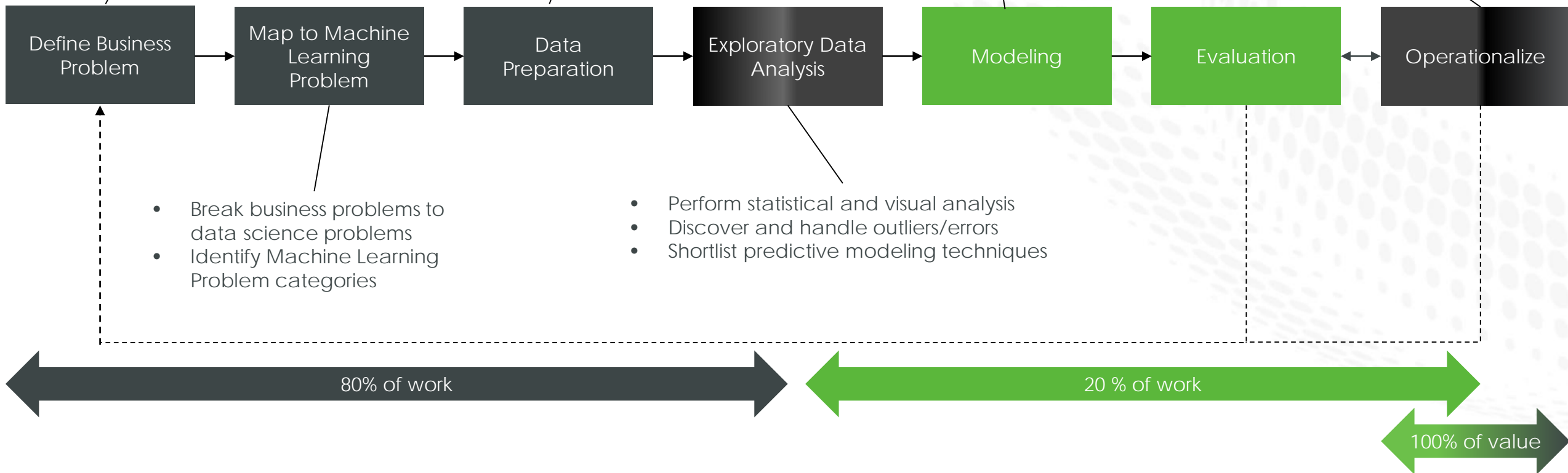
# Predictive Analytics Process

- Clearly defined business problem
- Set success criteria
- Define clear data science objectives

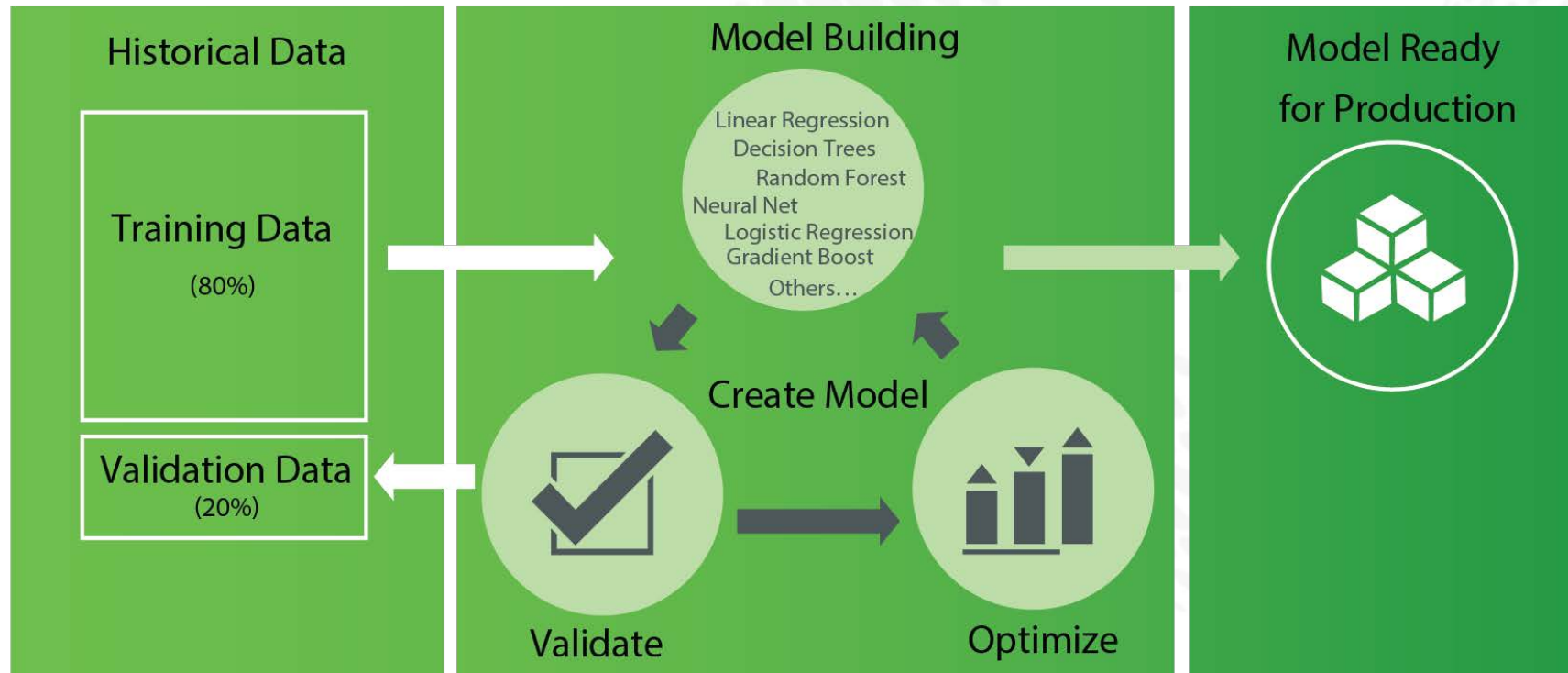
- Understand data points and constraints
- Formulate data analytics strategy
- Perform required transformation

- Experiment with multiple models
- Choose the most optimal model
- Create a feedback loop

- Put your models to work for you in production
- Data transforms need to be applied
- **Maximum value realized**



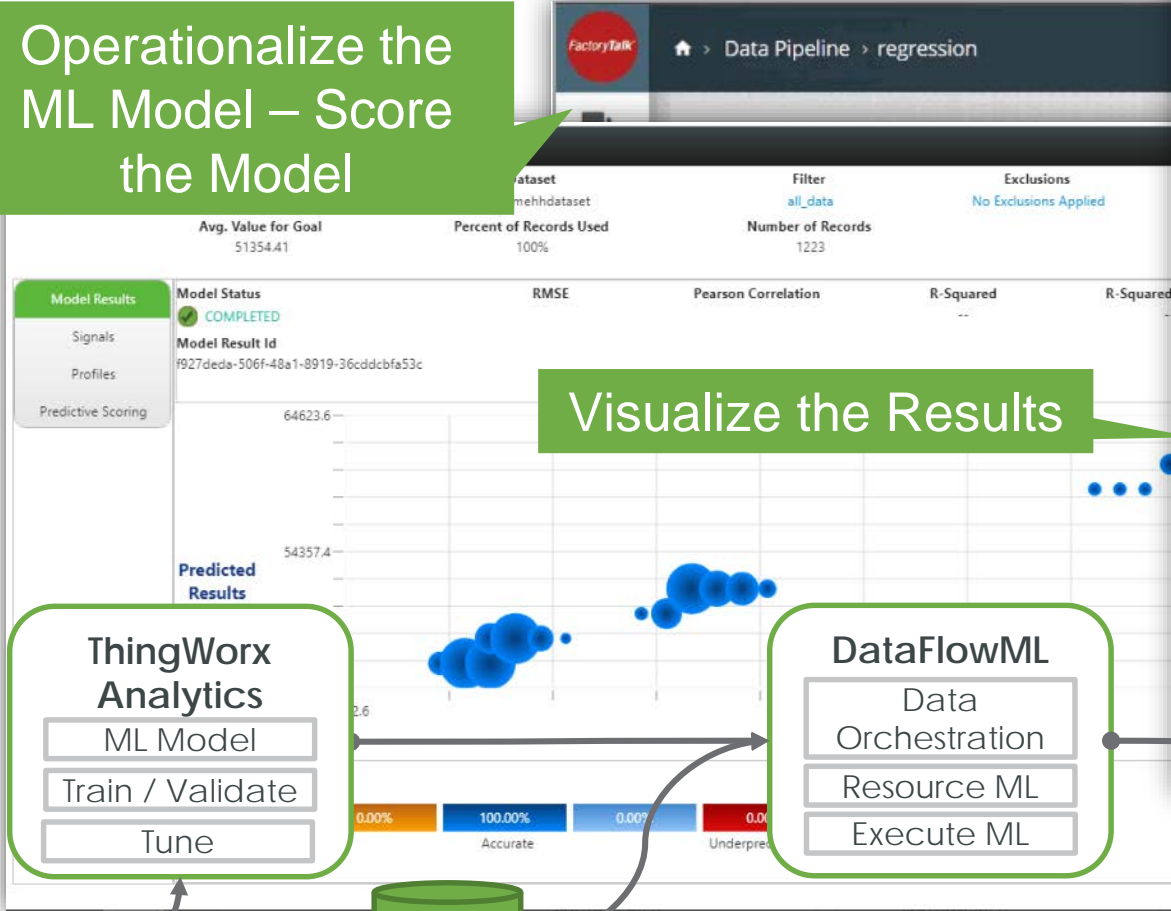
# ThingWorx Analytics Server



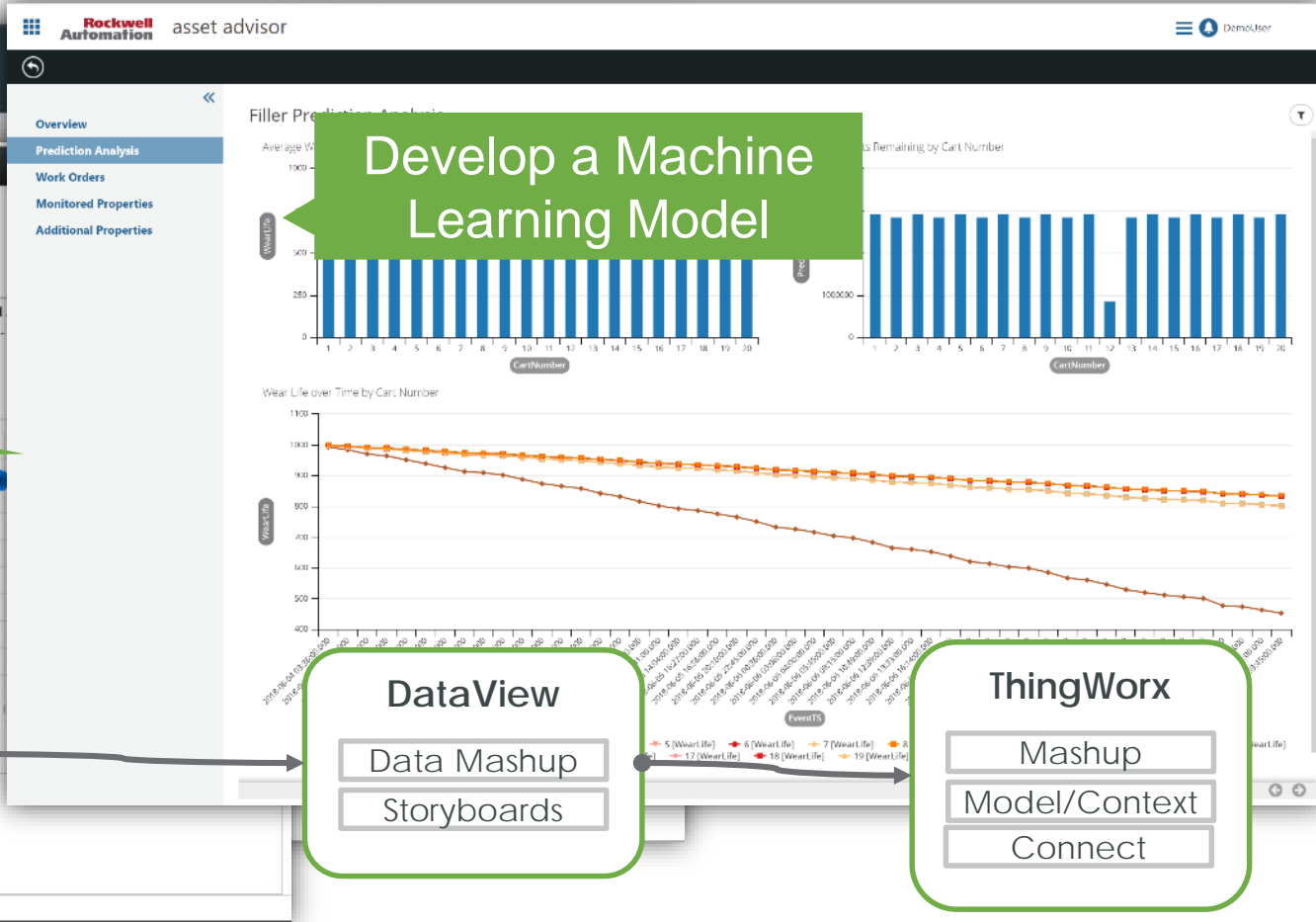
- Automated Machine Learning Modeling
- Diagnostic, Predictive and Prescriptive Analytics
- Real-time anomaly detection on data streams

- Learns from historical performance and uses AI technology to automatically build, validate, and maintain models
- Automatically identifies and reveals which data signals are most important in predicting outcomes

Operationalize the ML Model – Score the Model



Visualize the Results



Develop a Machine Learning Model

**ThingWorx Analytics**

- ML Model
- Train / Validate
- Tune

**DataFlowML**

- Data Orchestration
- Resource ML
- Execute ML

**DataView**

- Data Mashup
- Storyboards

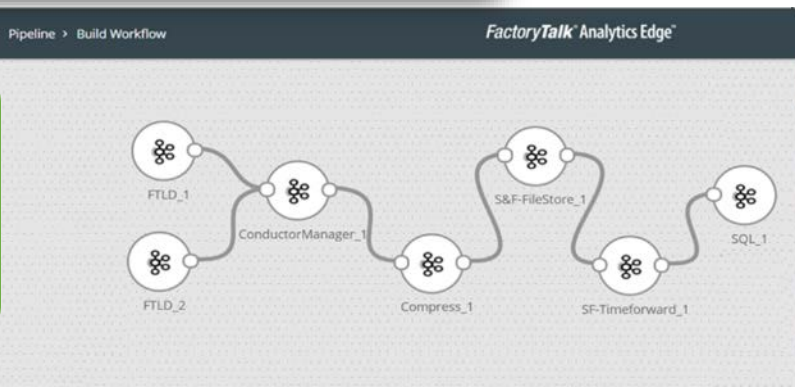
**ThingWorx**

- Mashup
- Model/Context
- Connect



**Edge Runtime**

- Pipeline Exec
- Execute ML
- Data Manipulation

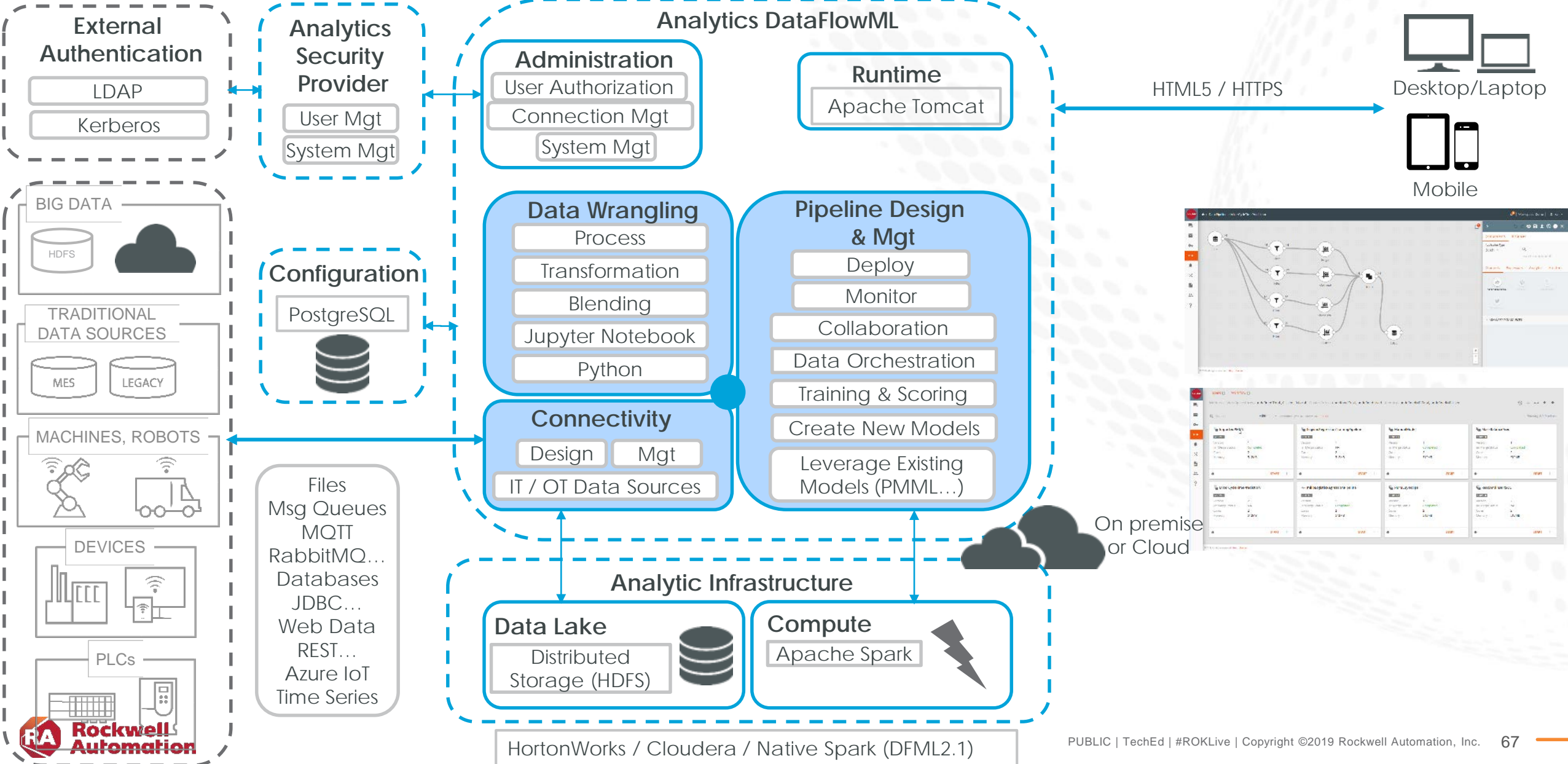


Extract Live Data needed by the ML model





# Analytics DataFlowML High level architecture





Augmented Reality





## vuforia® engine

For Developers

- Allows Apps to “see” and puts content onto the world through environments or objects



## vuforia® studio™

For Enterprise Content Creators

- Powerful AR content creation and publishing solution for industrial enterprises



## vuforia® chalk™

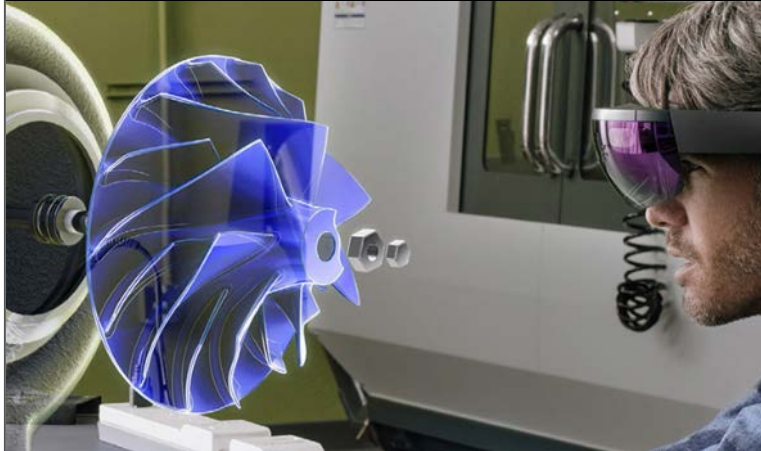
For Remote Assistance

- Allows you to “see what I see” and annotate in a shared workspace



# Click to edit master title

## VISUALIZE



Enhance the user's view of the physical world **with the overlay of real-world or hypothetical digital information**

## INSTRUCT/GUIDE



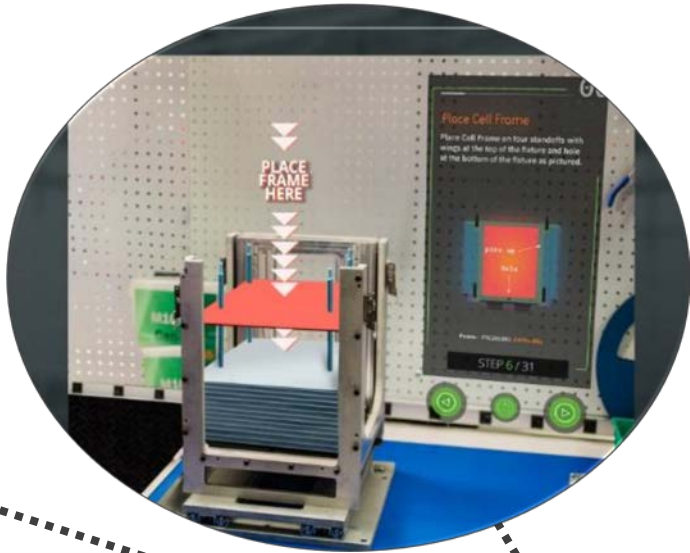
Train or guide users on how to perform a task through the **overlay of digital instructions or real-time expert guidance**

## INTERACT



Manipulate digital graphics or extend a product interface **through an AR interface**

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**Vuforia Studio** - efficiently create scalable AR experiences for industrial use cases



**Vuforia View** - access & share AR experiences across the industrial enterprise

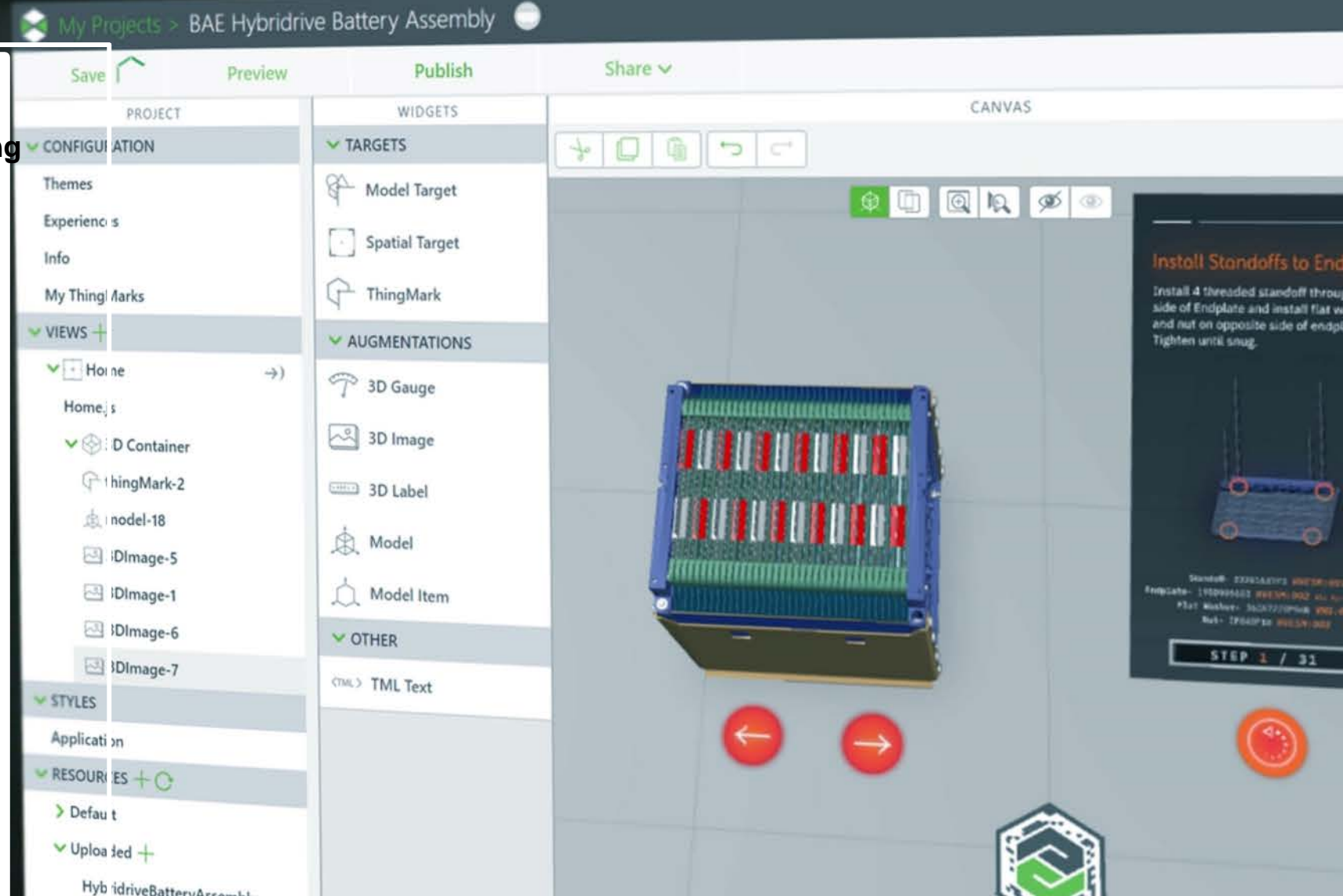
**Faster AR Authoring**  
Accelerate experience design and publishing with drag & drop interface

**Optimized for 3D CAD**  
Reuse existing 3D models & animated sequences

**Industrial IoT Connected**  
Easily incorporate real-time sensor and business system data

**CSS Editing & Styles**  
Create custom styles & IoT state-based formatting for gauges and labels

**Flexible Deployment Options**  
Secure and Certified Cloud Hosting & On-premise



# vuforia® view

## Free to Download

Simple access via Google, Apple and Windows App stores

## Universal Viewer

View experiences across the enterprise on mobile devices & digital eyewear

## Advanced Tracking

Enhance user experiences with Model and Spatial Targets

## Easily Share Experiences

Universal Links give users the most integrated mobile experience

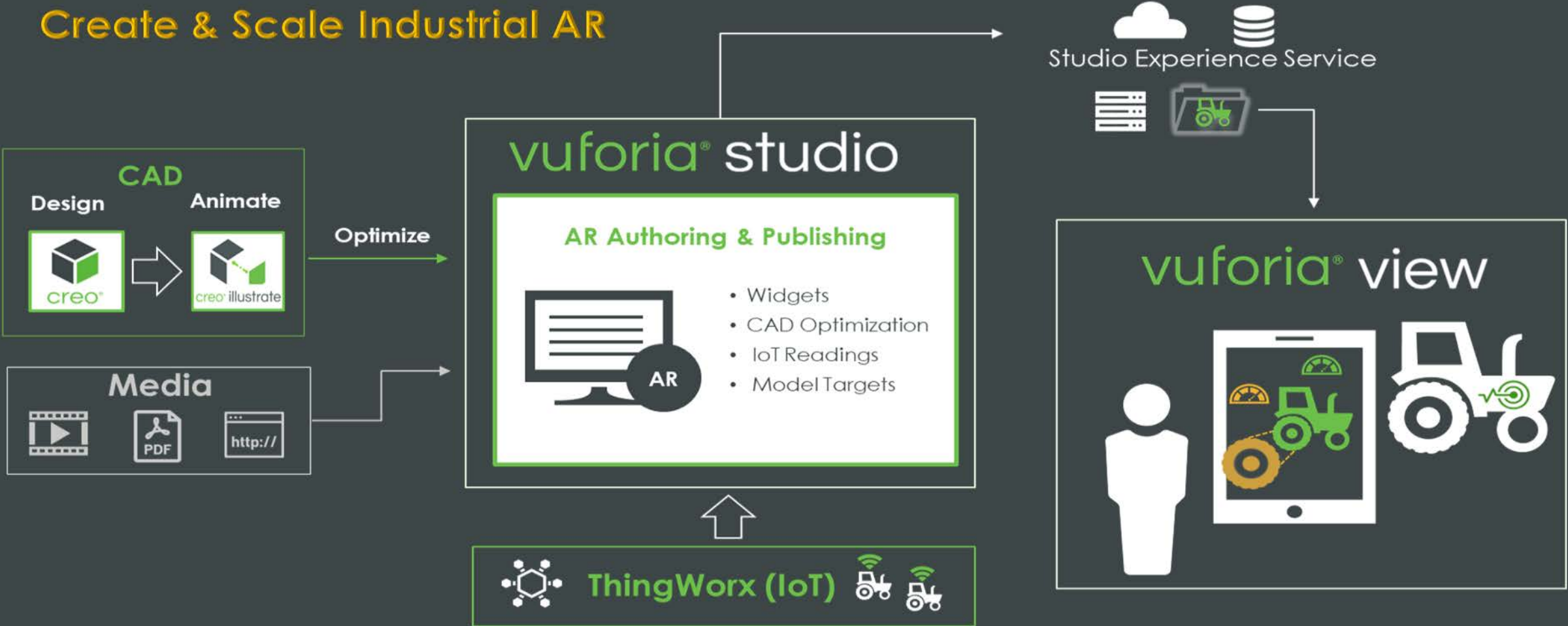
## Offline Experiences

Allow download for offline viewing of 3D experiences



# Click to edit master title

## Create & Scale Industrial AR



# View experiences on your favorite device



Mobile



3D Eyewear

M300  
VUZIX®



 **realwear**  
HMT-1

2D Eyewear

## Quickly and easily create experiences for head-mounted, tablet style devices

Improve the efficiency of your service technicians:

- Include step-by-step instructions in work procedures and workflows
- Quickly display 2D reference material on-demand
- Provide checklists that can also save and store records of task/job completion

Project Type



Mobile



3D Eyewear



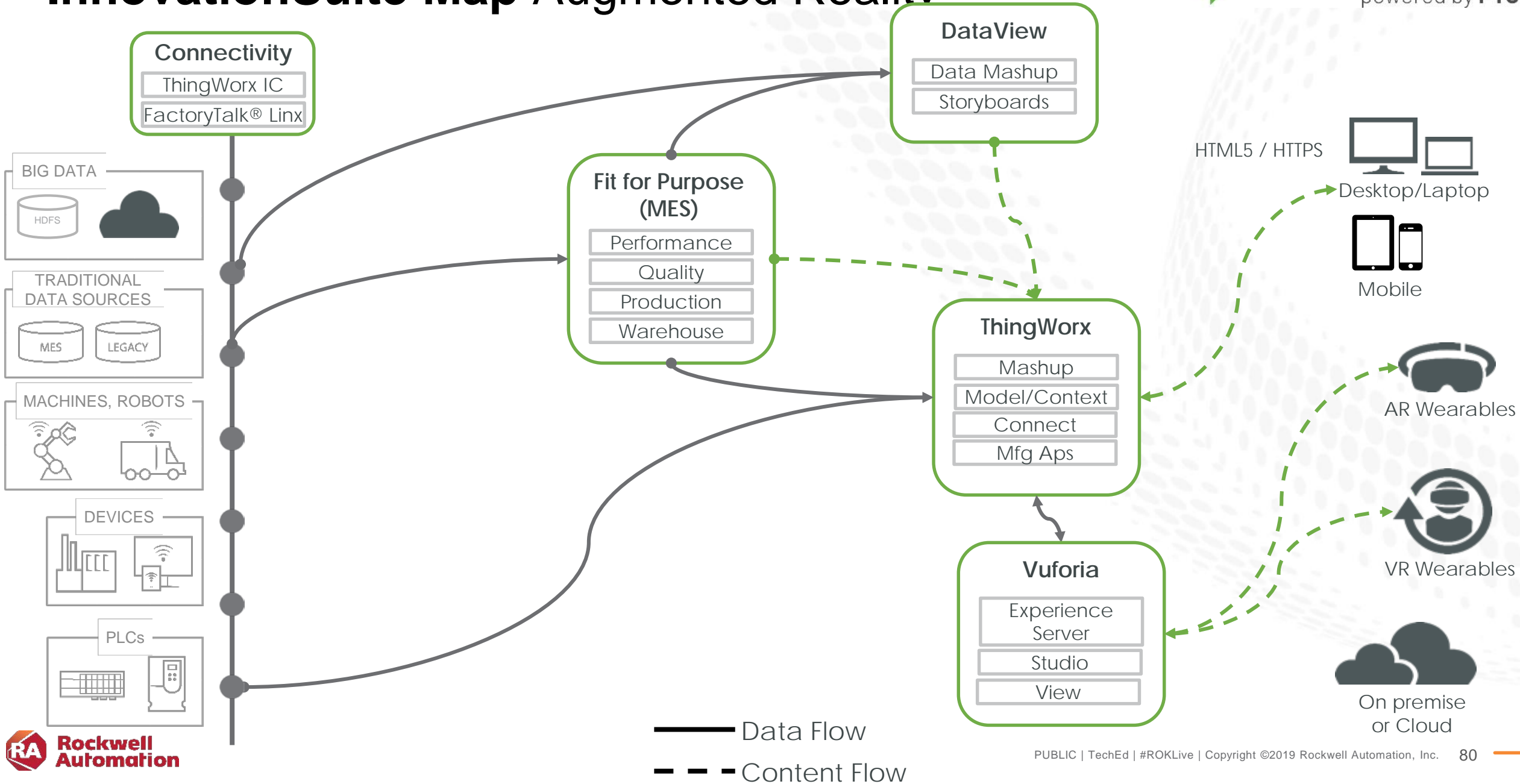
2D Eyewear



■ Assisted Reality



# InnovationSuite Map Augmented Reality



# FT InnovationSuite

powered by PTC

## IOT

Market-leading industrial innovation platform to drive digital transformation for increased operational performance and agility across all factories



## Fit for Purpose

A set of tools built on top of our FactoryTalk® ProductionCentre® MES Platform that target specific needs of Manufacturing Operations: Performance, Quality, Production and Warehouse.



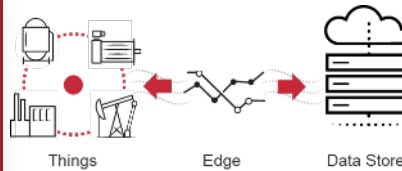
## Data Analytics

Self-service visual analysis/ Data Discovery tool. With Insightful Storyboards may be saved and shared that runs on any form factor or device



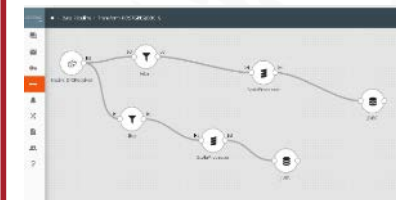
## Edge Computing

Data from real-time sources, with the ability to store and forward data, reducing loss due to latency. Enables closed loop feedback applications and provides advanced analytics in the “hardware stack”



## Analytics and AI

Solve complex Analytics, AI and Machine Learning problems. Scalable from on-premise server to cloud based infrastructures. Handles big data and unstructured data such as text, imagery, audio, etc.



## Augmented Reality

Industry-Leading augmented reality development tools to improve workforce efficiency and training



CLOUD | HYBRID | ON-PREM

# QUESTIONS

# Share your feedback

Please complete the session survey on the mobile app

events  
**ROK**



# 1

Download the **Events ROK** mobile app

# 2

Select **TechEd** and login

*Use your email and last name that you used to register for the event.*

# 3

Click on **Schedule** on the main menu

- Select the session you are attending
- Click on the survey tab
- Complete the survey and submit





**Rockwell  
Automation**

# Thank you

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[www.rockwellautomation.com](http://www.rockwellautomation.com)