Production Optimization of Automotive Body Shop

think 2018

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Please note

General Motors has declined to participate in the presentation. It was too late to change the title. The content of this presentation does not reflect General Motors case study but experience of various automotive clients with the solution

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Contents

Production Optimization Overview

OEE Losses and Plant Performance Analytics

- Automotive Body Shop Throughput Optimization

Programing and Deploying Use Cases

Production Optimization Overview

$5 Trillion

As Per McKinsey Industry-wide Manufacturing Losses / Waste estimated to be $5 Trillion Per Annum

Source: The great re-make: Manufacturing for modern times, Jun 2017

Get Plant Performance Insights And Advice For Best Action

Production Optimization

Achieve Throughput to Potential

Eliminate Waste

Productivity Losses

Equipment Related
- Machine Availability Loss
- Quality Loss
- Performance Loss

Process Related
- Energy Loss
- Yield Loss

Management Related
- Labor Loss
- Material Availability Loss

Predict, Pinpoint, Prescribe

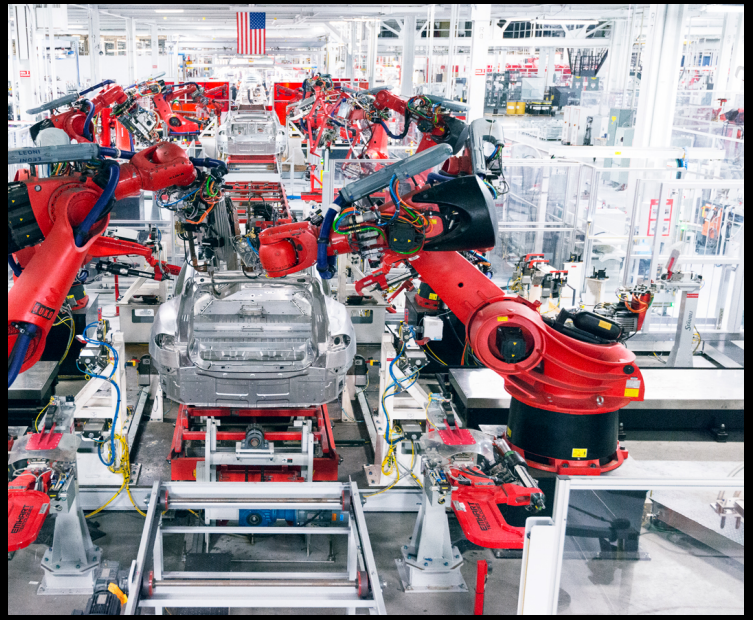
Process Manufacturing

Throughput Optimization Use Case

with

IBM Plant Advisor

Discrete Manufacturing

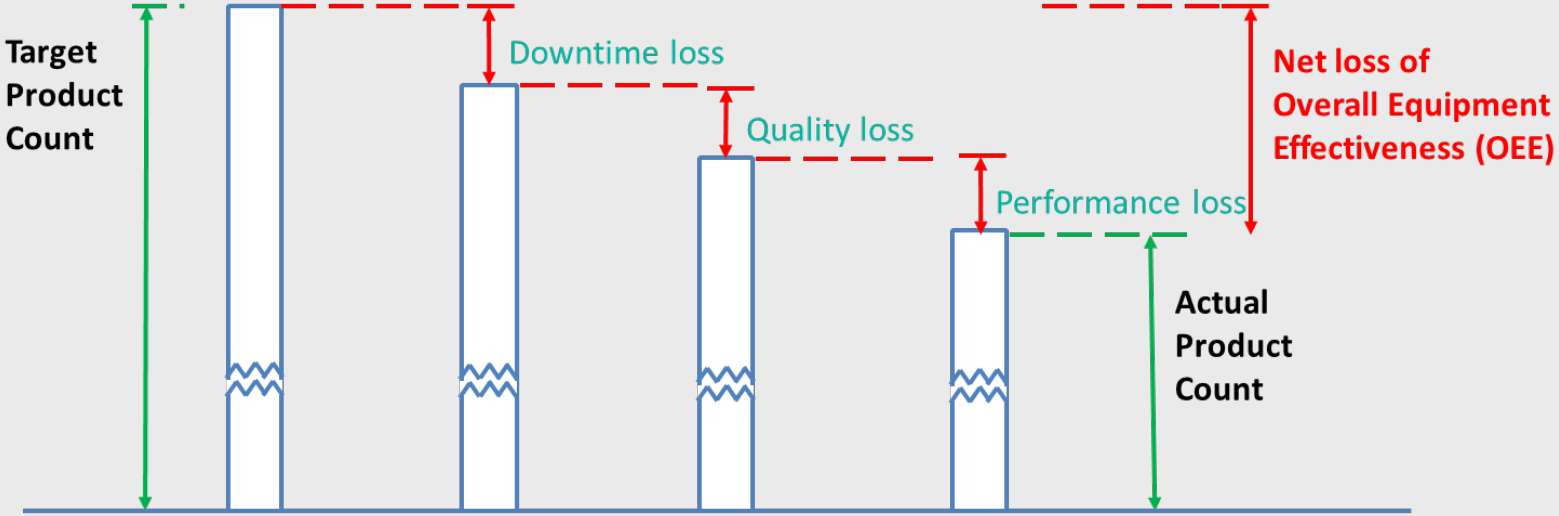


OEE Maximization Use Case

with

IBM Plant Performance Analytics

What if we could predict & pinpoint potential OEE losses at machine level and prescribe optimized remedy?



Availability, Quality and Performance Constraints Contribute to OEE loss resulting in lower Throughput

IBM Plant Performance Analytics

Predict and Localize potential constraints to productivity

Turn plant floor data into actionable insights for plant management. Predict availability, performance and quality losses at individual device and station level. Calculate potential OEE impact of the losses.

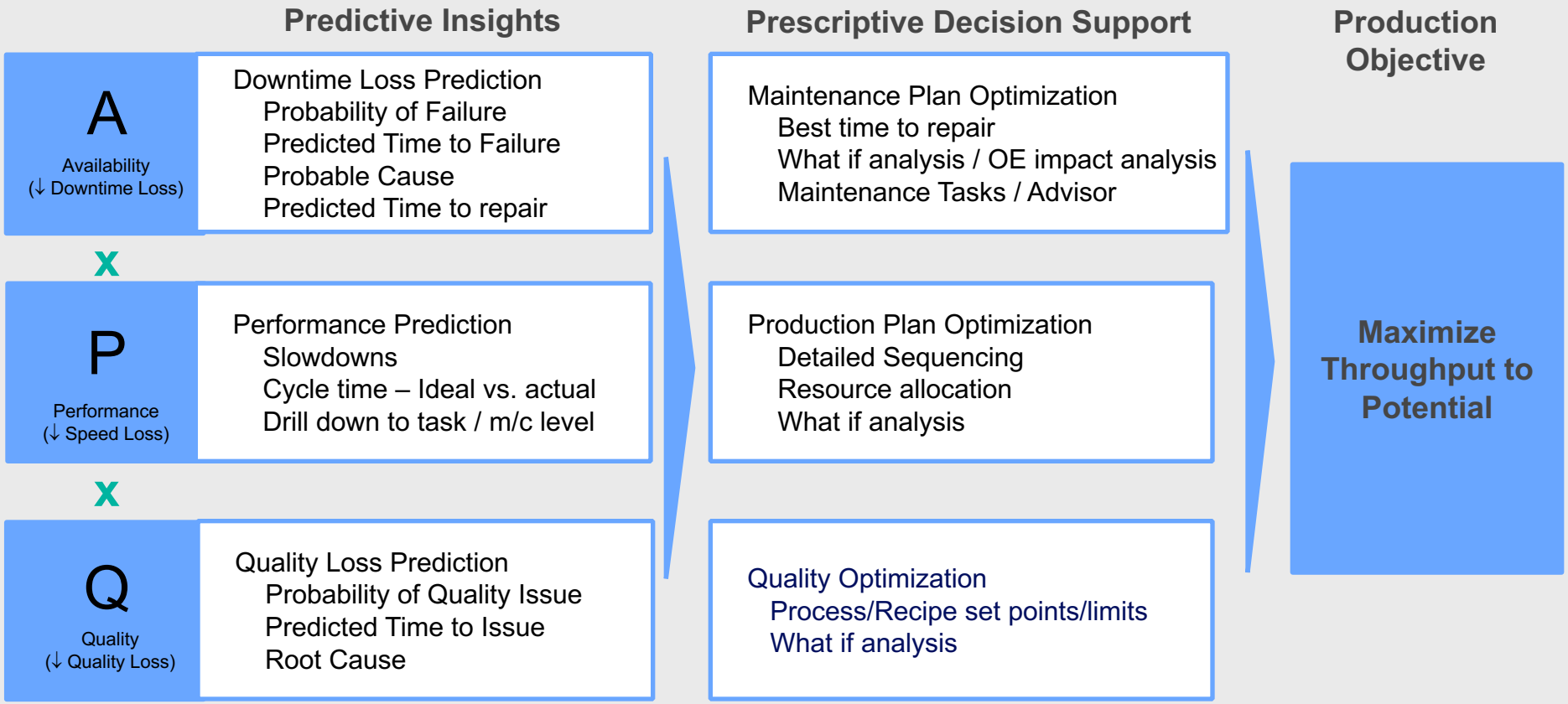
Prescribe remedies to mitigate productivity risks

Use machine learning to recommend best course actions based on data collected from plant floor. Optimization algorithms that prioritize maintenance tasks and recommends best time to repair machines.

Achieve Throughput to Potential w/ Industry Content

Reduce unplanned downtime, slow downs. Avoid costly reworks and recalls. Achieve OEE improvement while reducing operations costs due overtime, material waste, spare parts and emergency maintenance

Predictive and Prescriptive Capabilities that Maximizes OEE



OEE Losses in Automotive Body Shop

Automotive Body Shop Processes & Equipment

Processes

Weld

- Spot weld
- Stud Weld
- Laser Weld

Sealing

Riveting

- Self Piercing Rivets

Equipment

Robots – 200 to 500

Weld guns – 100 to 400

Clamps – 100 to 500

Fixtures – 200 to 500

Pallets

Automotive Body Shop

Issues

Process Faults / Failures – Weld Quality

- Spot Weld - C-Factor, High / Low Current
- Sealants - High / Low Volume dispensing
- Stud Weld – High / Low Pressure

Machine Failure – Downtime

- Robots – Servo, Gearbox
- Inverter failure

Slowdowns

- Clamps, Fixtures – leaks, seals

We typically design body-in-white assembly lines for 20% over capacity. If the target OEE is 60 frames an hours, we design for 72 frames. But the cost of higher capacity is exponentially higher.

Body Shop Line Builder.

Automotive Body Shop

Data for Machine Learning

Event Log Data

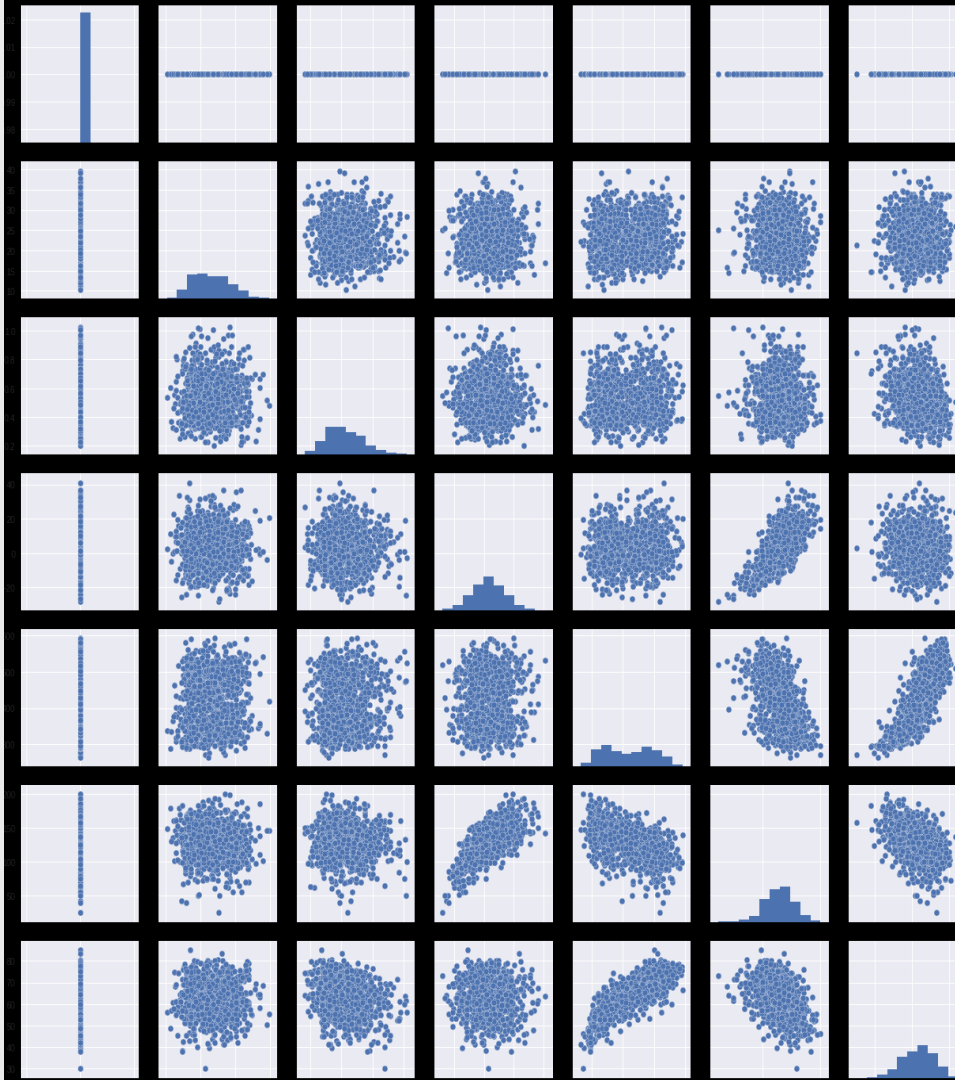
- Warnings, Faults, Stops from Controllers
- Downtime Logs

Time Series data Parameters

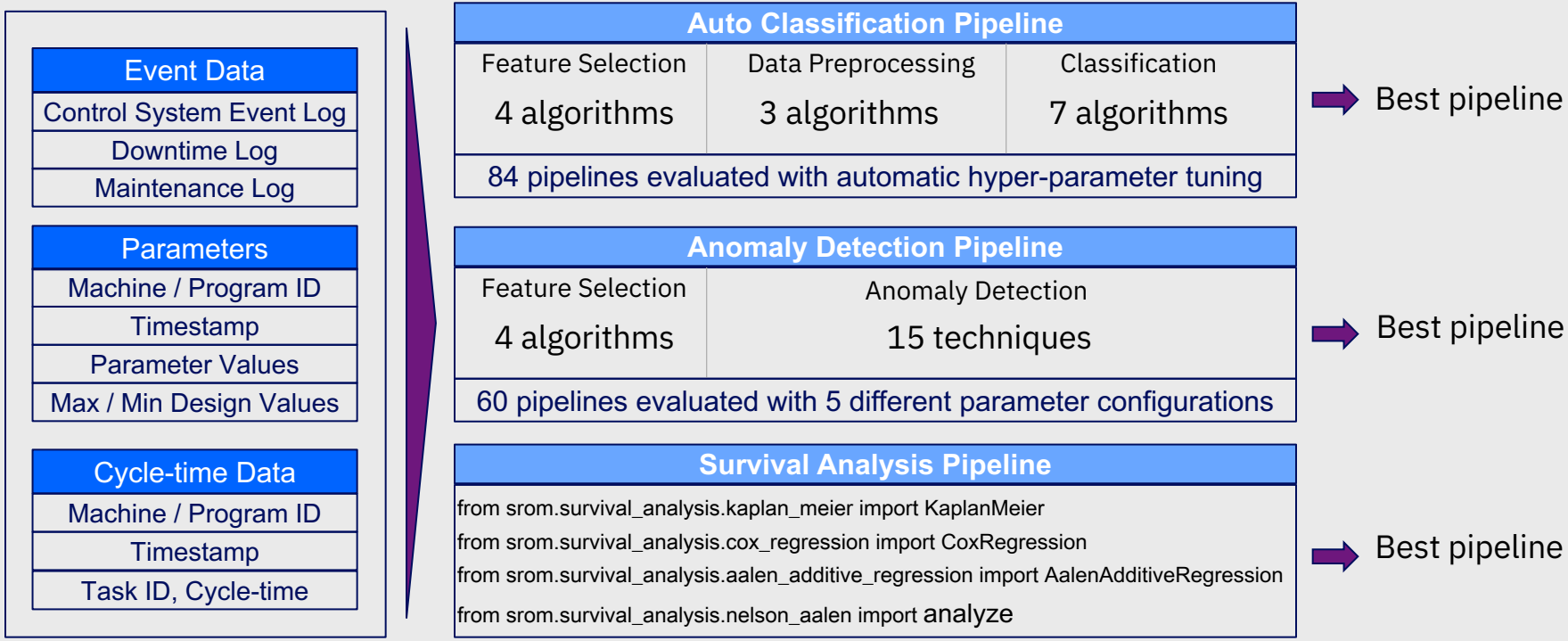
- Per Operation / Program Run

Cycle Time

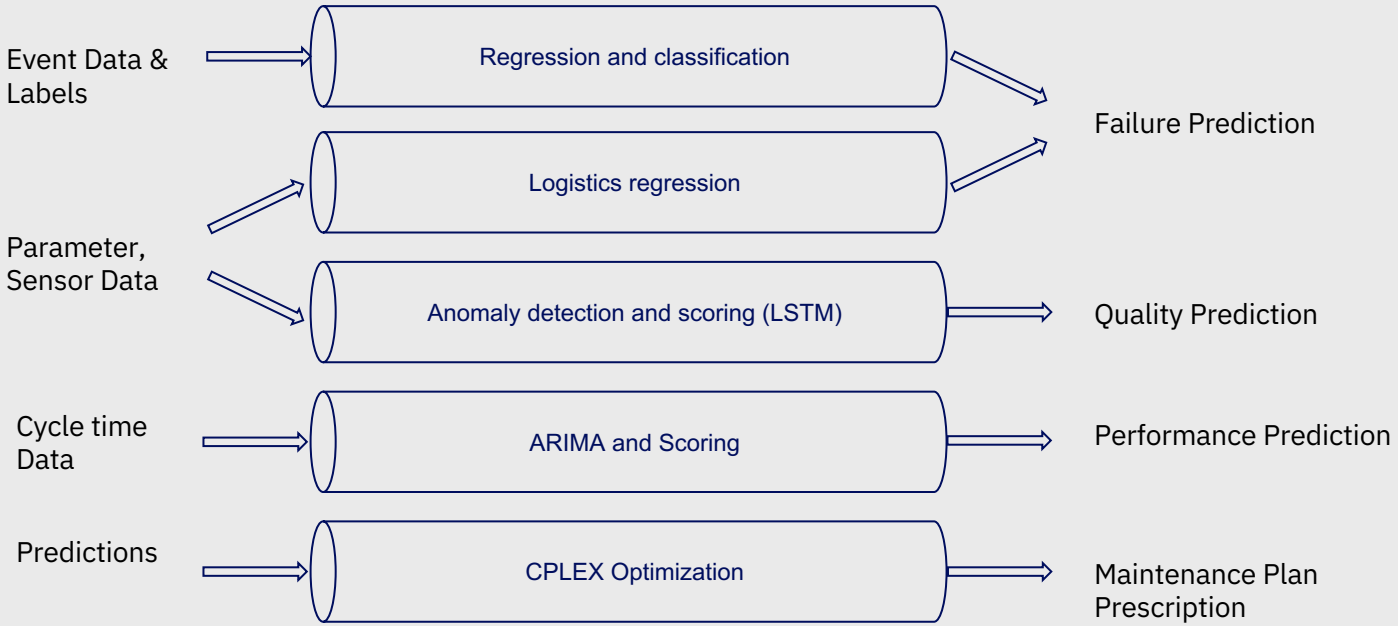
- Hierarchical tasks adding up to takt time
- Task-wise cycle time, design max, min



Industrial Machine Learning Pipelines for Model Selection



Flexibly Deploy Analytical Models in Cloud or Edge



Deliver Analytical Model Templates that predicts OEE losses for specific processes

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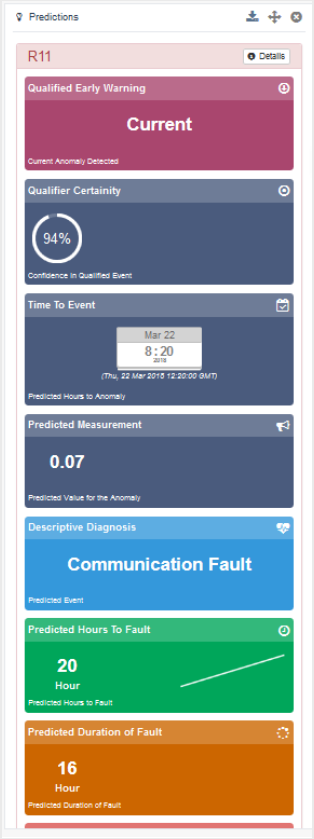
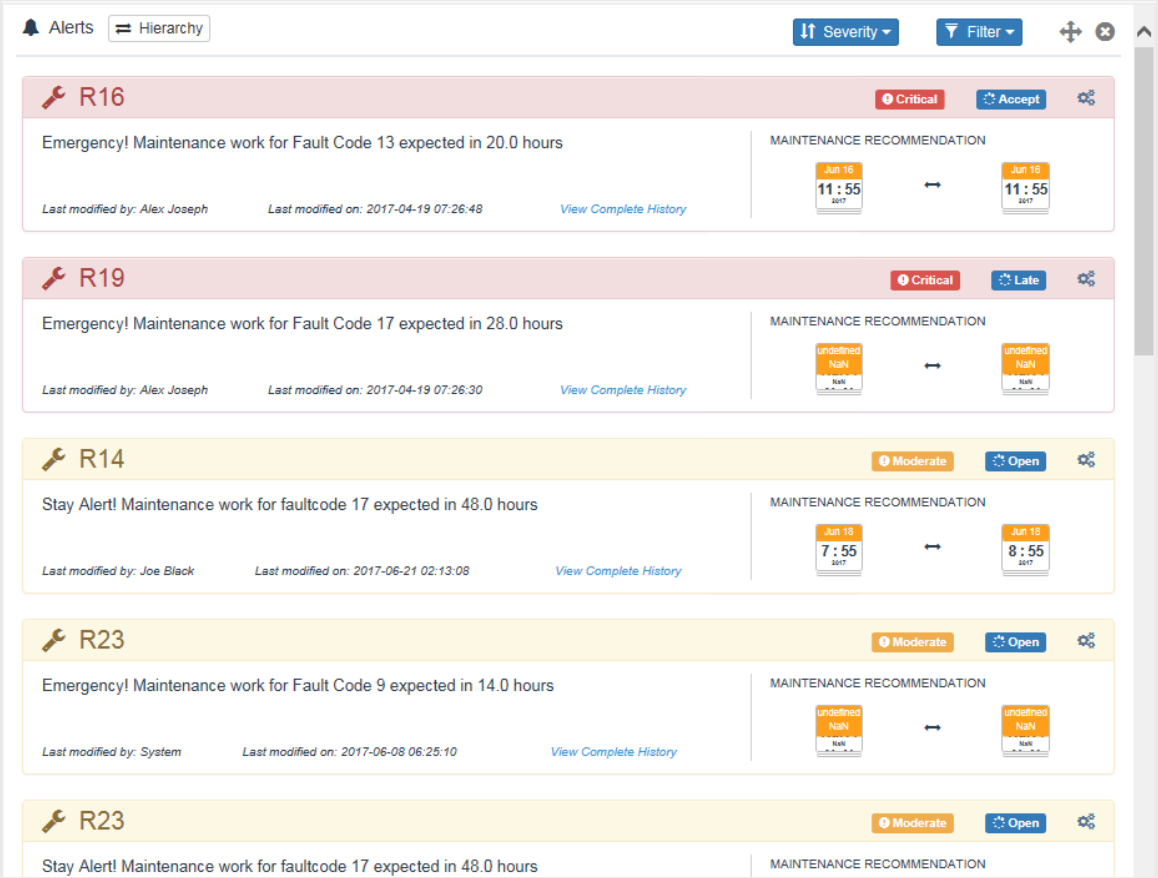
Issue Predictions and Alerts



Configurable Threshold



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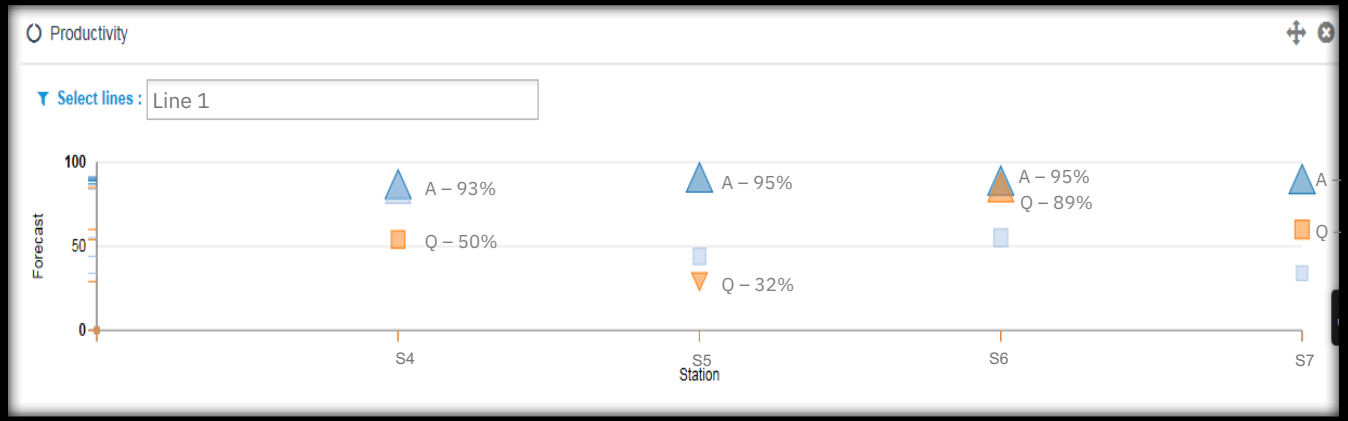
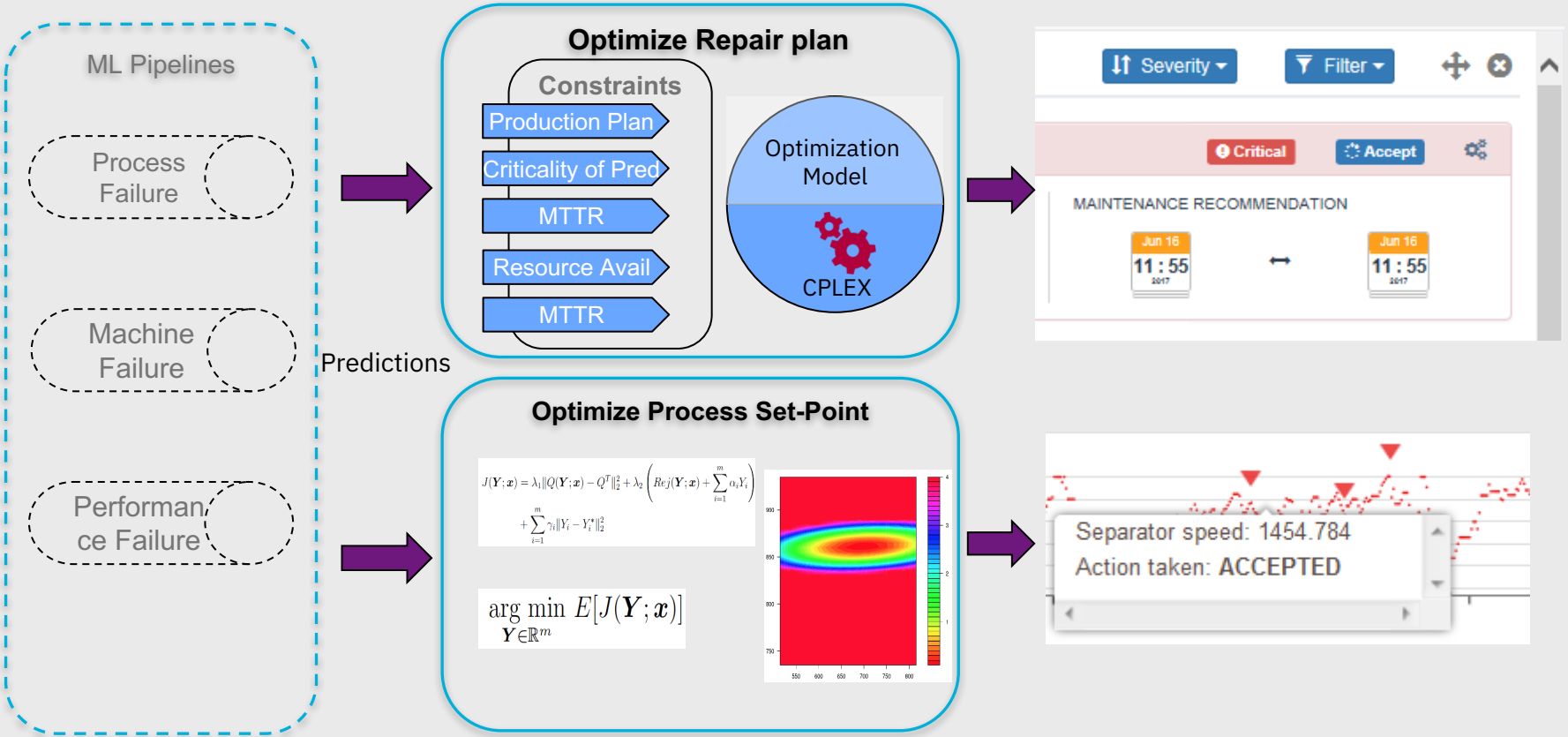
KPI Consolidation



Optimization Pipelines for Prescribing Remedy



Automotive Body Shop

Prescriptions for Remedy

Plant ME
- Prioritized Predictive Maintenance Alerts
- Analyze predictions

Supervisor
- Scheduling and Slotting
- Issue Work Order

Technician
- Work Instructions
- Tool help
- Technical docs

Connect

Predict, Optimize

Plan

Prescribe

& Execute

IOT Platform

Data from Shop Floor

PPA

Predictive Maintenance ticket

Maximo

Work Order Details

Equip. Advisor

Cognitive Advice

Machine data

Logs Maint. QA

Plan Maint.. Prod.

Asset Profiles

Maint. Plan

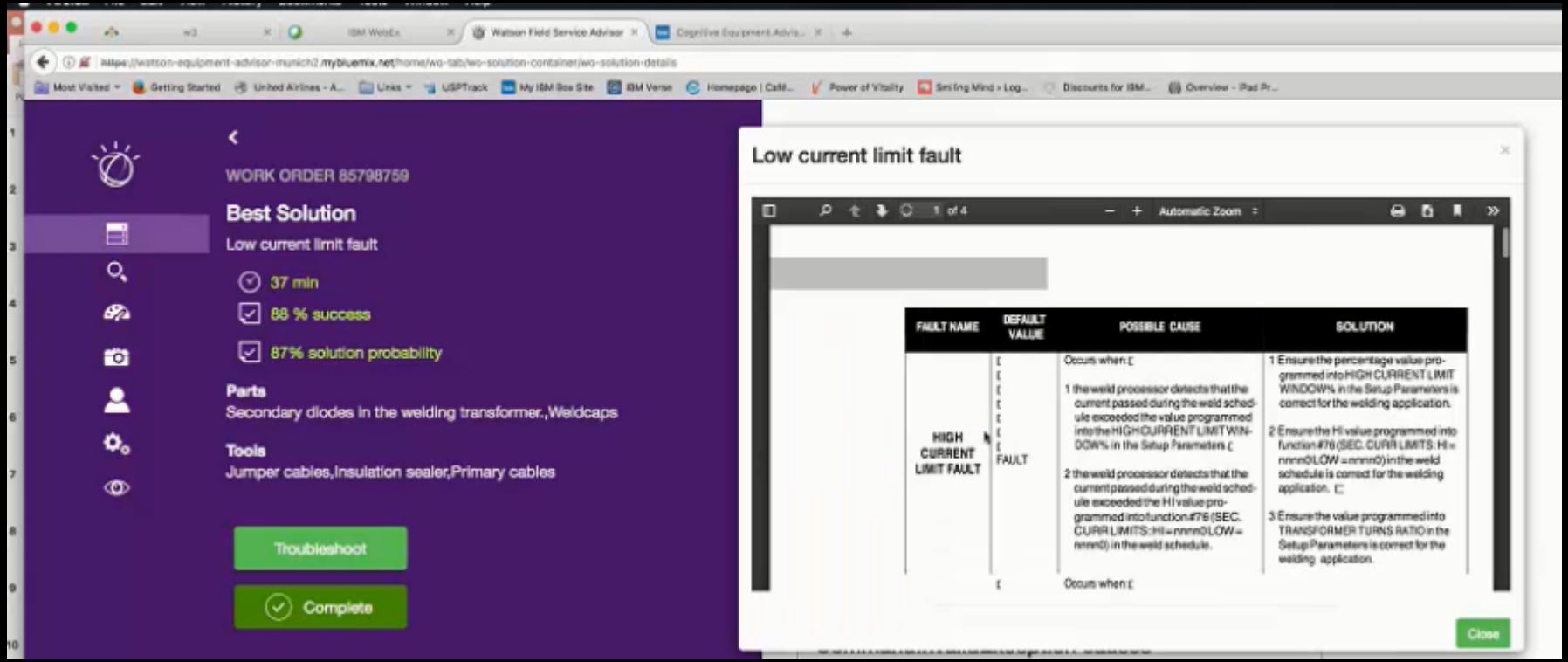
Maint Manual

Tools Docs

Reduce Cost with Targeted Maintenance
Digitally Retain Maintenance Skills
Drive towards Zero Downtime

Automotive Body Shop

Prescriptions for Remedy



Automotive Body Shop

Business Value Assessment

Business Need

- Average unplanned downtime 20 mins per day
- Overtime used to compensate the lost production time
- Average of 2-3 emergency maintenance incidents per station per month
- Total cost of overtime and maintenance $2.5M per year due to downtime

IBM Approach

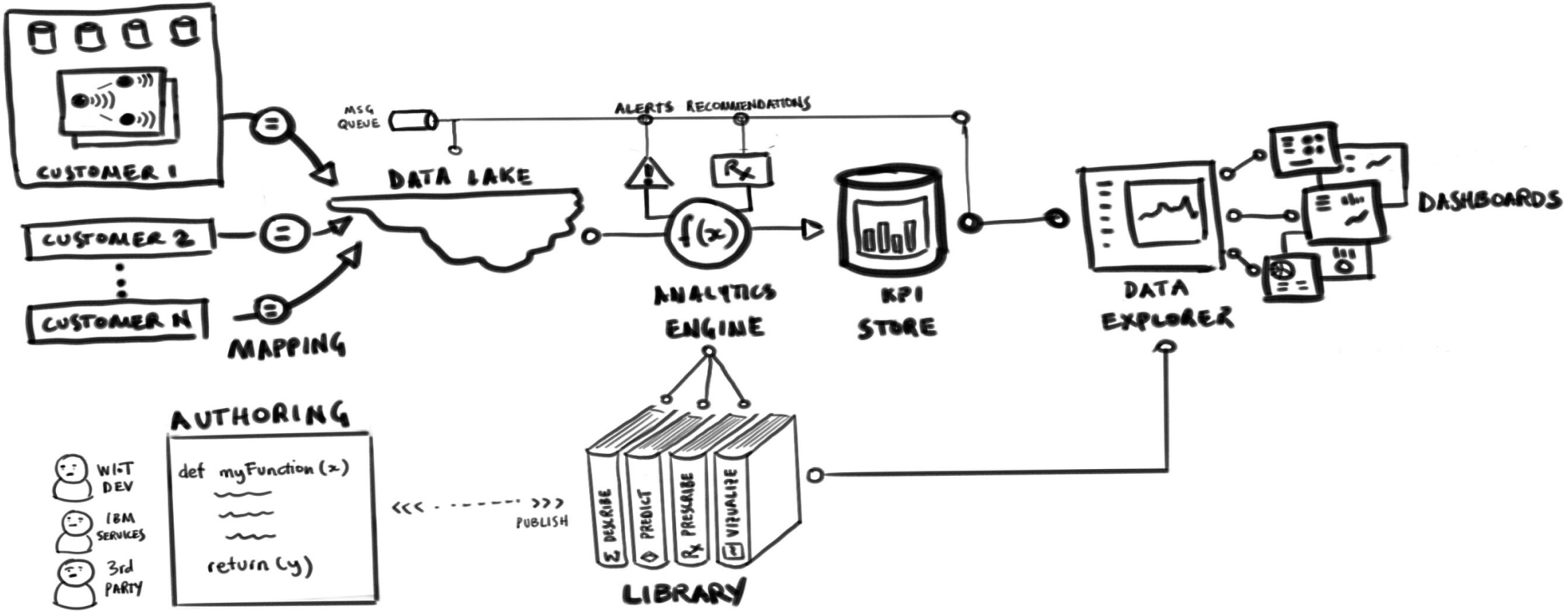
- Train advanced analytical models in PPA with historical data from the plant to analyze the % of downtime that can be predicted minimum 2 hours in advance.

Results Achieved

- 52% of downtime could be predicted at least 2 hours in advance
- Potential cost saving of $1-2M per body shop including overtime reduction, scrap reduction and maintenance cost saving

Programing and Deploying Use Cases

Author your use cases with DSX and Our Industry Analytical Model Pipelines



Industry Analytical Models for Manufacturing Processes

Processes that can be addressed with Industry Analytical Models

Automotive Body Weld

Weld station failure, weld quality, line slowdown predictions

Paint Booth

Paint quality failure, equipment failure predictions and prescriptions

Stamping

Equipment failure, tooling failure

Paint Booth

Equipment, tool failure, process failures

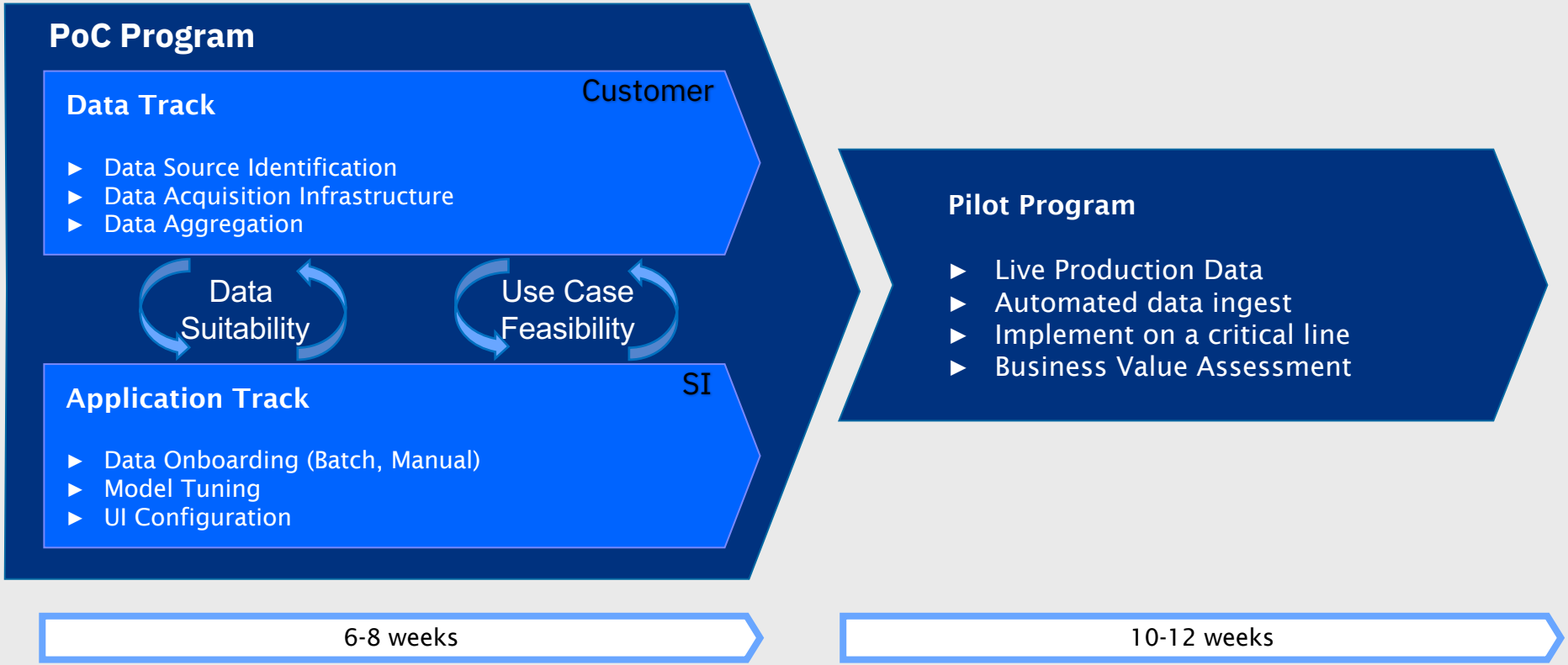
Casting

Process failures

Machining

Process failures

Implementation Projects



Takeaways

- Machine Learning and Artificial Intelligence help achieve production “overdrive” over and above waste elimination
- Existing Control System Data can be a good starting point. Will require data gathering and consolidation infrastructure
- Incrementally build use cases that offers incremental value
- Build to roll-out.

Thank you

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Color palette

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