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Smart Factory

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Optional subtitle

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Executive Overview

Key trends in industry and use case introduction

The Internet of Things (LOT) Landscape

24BN
Connected "things"
by 2020
(Gartner 2017)

IoT spans industries representing
62%
of GDP among G20 nations
(Oxford Economics 2014)

MARKET
Fast growing global IoT market – customers still in discovery phase

IoT market will grow
27%
CAGR in the next 5 years (Markets & Markets 2017)

82%
of companies **say they are unable to identify all of the devices** connected to their network
(ForeScout 2017)

CLIENTS
Strong need for consulting guidance when implementing IoT

93%
of companies **believe that digital technologies will change their business models disruptively** within the next 12 months

15%
of companies **believe that they have the right resources & know-how** for the implementation

94%
of businesses **will be using IoT by the end of 2021**
(Microsoft 2019)

GROWTH
IoT is becoming a major driver of economic value

$440+BN
will be spent by consumers and businesses on IoT in 2020

$570BN
Revenue that managed services for IoT devices will earn in 2020

Why Should You Care About "Smart Manufacturing?"

CAPABILITIES

Increased process efficiency and output through **data/insight driven process optimization and visibility**

Reduced downtime and increased asset utilization through **real-time monitoring of assets and predictive maintenance analytics**

Increased agility of supply chain planning processes by providing **real time visibility of equipment status and disruptive events** in manufacturing

Increased accuracy and reliability of production processes through **real-time process control and automation**

Reduced time to market through **real-time scheduling of processes**

Improve worker safety by **automating dangerous processes and monitoring the environment** in real-time

EXAMPLE BENEFITS

Cost Reduction

- **10%** reduction in maintenance costs
- **20%** downtime reduction

Enhanced Yield

- **30%** reduction in scrap

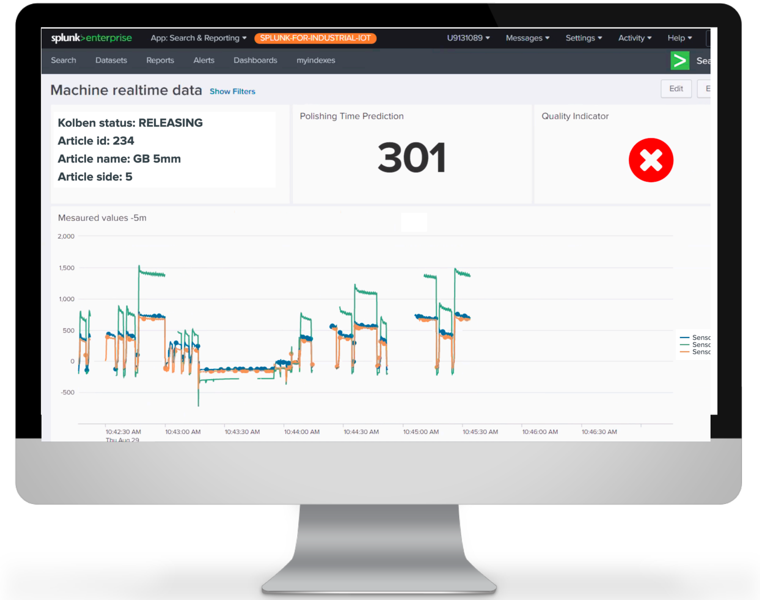
Improved Productivity

- **50%** increase in quality testing productivity using cameras, sensors, and AI
- **90%** improvement in defect detection

The Typical Challenges to Address with New Smart Capabilities

CHALLENGES	IMPACT	OPPORTUNITY
Outdated data ingestion tools	**Unable to monitor and analyze large amounts of data** in real-time	**Adopt high-performing and scalable ingestion approach** for leading analytics
Rigid existing data structures	**No flexibility** to incorporate new changes in the overall environment	**Stand up agile innovation approach** that can rapidly translate data to value for continuous improvement
Data complexity due to manufacturing machine turnover	Ingestion and assessment processes are **difficult to navigate**, causing siloes	**Enhance data models** to enable synchronous data flows between industrial infrastructure
Unanticipated machinery breakdowns leading to increased downtime	Production losses and delays leading to **increased maintenance costs**	**ML and advanced analytics to predict and forecast** maintenance
Lack of visibility into causes of breakdowns and repair requests	**Limited root cause analysis or predictive methods to foresee product failures** earlier	Multi-variate predictive methods to **optimize production processes** in real time
Inefficient testing to assess inadequate production quality levels	**Increased root cause detection time**, which prevents optimal utilization	**Targeted insight-based testing** to optimize quality operations

The Case Study: Building The "Smartest" Factory On Planet Earth

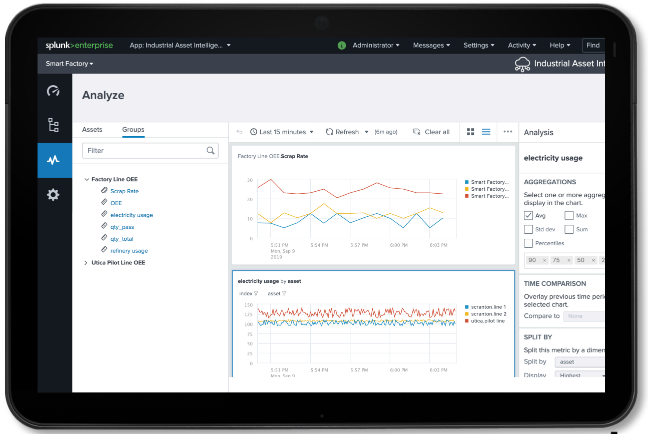


THE SITUATION

- **Gemstone and crystal manufacturer** with global multi billion business
- Looking to **reduce production waste** by improving the quality and accuracy of its end-to-end monitoring capabilities
- Facing **heterogenous machine park**, out-of-date ingestion tools and **complicated data structures** unable to monitor and analyze **large amounts of data in real-time**

THE CHALLENGE

- A "**Smart Manufacturing**" initiative shall deliver a **data driven end-to-end manufacturing process** enabling the full value potential of IoT in manufacturing
- Technical **requirements were immense** – beyond any boundaries seen so far:



THE DATA (NON-EXHAUSTIVE)

- Order number
- Material
- Original Geometry
- Machine Measurements
- Cutting Program
- Geometry Corrections
- Machine Corrections

Our Vision: "The Crystal Factory Of The Future"

Highlighted = Quick Win

Knowledge Capture

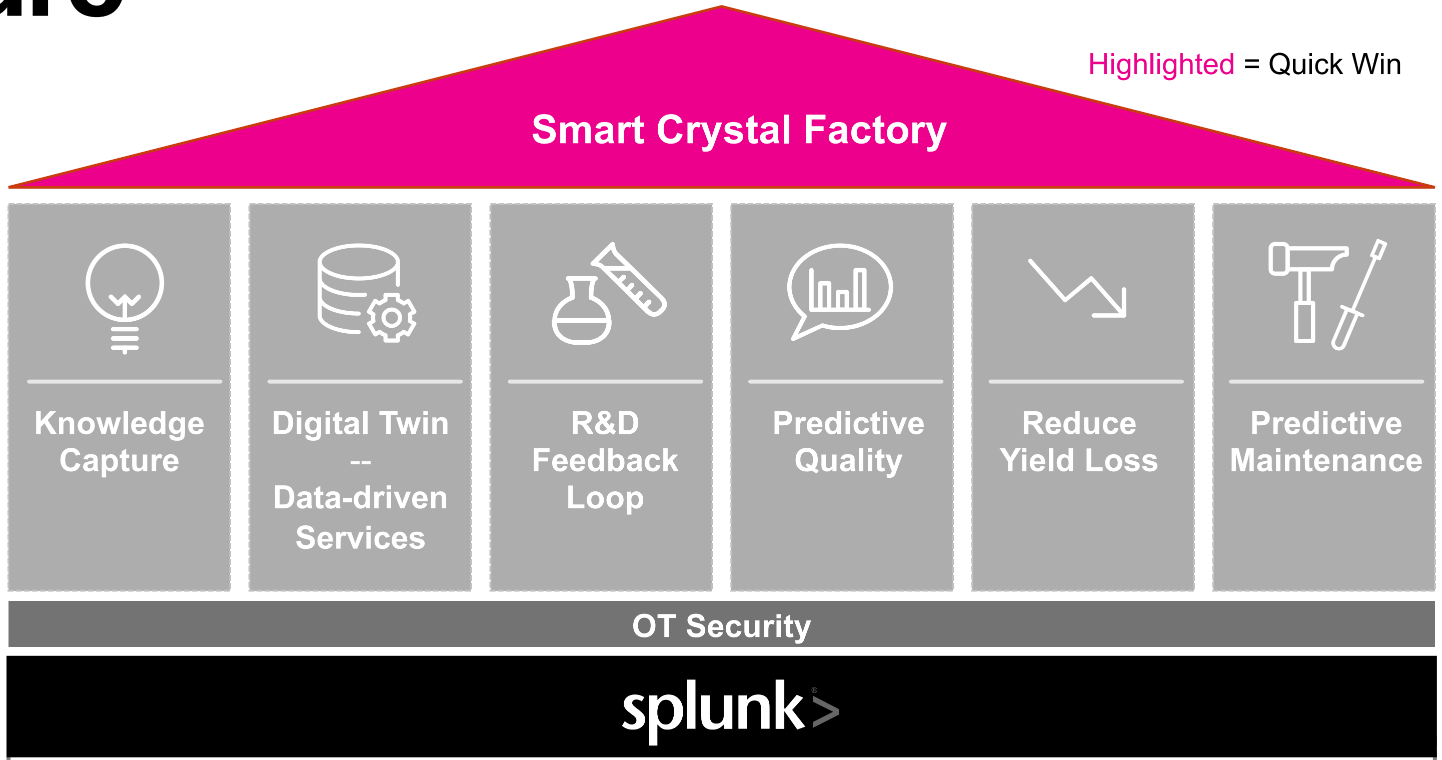
- Root cause analysis automation
- Rule-based recommendation

Digital Twin – Data Driven Services

- Visibility of Machine Data
- New service levers for customers
- New revenues

R&D Feedback Loop

- Closed loop manufacturing
- Indirect R&D time reduction
- Simulation capability



- Process Triggering
- Data Lake Integration
- Alerting
- OPC Integration – Open Platform Communications
- Real-time Data Ingestion
- Condition-based monitoring
- Real-time Data Analysis
- Data Visualization
- On-demand Self Diagnostics
- User-defined Reports / Views (Plan vs. Asset (worker))

Predictive Quality

- Defect detection
- QA process efficiency
- Optimize polishing time
- Brand impact
- Traceability / Compliance

Reduce Yield Loss

- Waste reduction avoiding scrap
- Reduce handling fees for warranty claims

Predictive Maintenance

- Smart Maintenance
- Scheduling of Repair
- Avoid downtime
- Reduce maintenance Opex

Our IIoT Taxonomy: "Smart Manufacturing" Architecture

Industrial internet of things (IIOT) and the smart factory

MONITOR /PREDICT **MANAGE** **CONTROL**

IT

Business Planning & Logistics	L4	**ENTERPRISE APPLICATIONS** ERP, CRM, SRM, PLM, Asset Management Mobile Solutions · Cloud Solutions
Execution	L3	**MANUFACTURING & BUSINESS PLANNING** MES, EMI, LIMS, SQC, SPC, Historian, EBR, DHR, PLM
Operations & Control	L2	**MONITORING & CONTROL** HMI, SCADA, PLC, DCS
Operations & Control	L1	**BASIC PROCESS MONITORING** I/O Devices, Sensors Level Sensor · Temperature Controller · Chart Recorder · Pressure Regulator
Sensors & drive	L0	**PHYSICAL PRODUCTION PROCESS** Process Manufacturing/ Discreet Manufacturing Valves · Pipes · Gears · Tanks

OT

The Approach: Accenture and Splunk Partnering for Next Level IoTAnalytics

Industrial Assets

Consumer and Mobile Devices

OT

IT

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Engineers | **Data Analysts** | **Security Analysts** | **Business Users**

Search | **Alert** | **Visualize** | **Predict** | **Develop**

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External Lookups/Enrichment

Asset Info | **Maintenance Info** | **Data Stores**

Operating Model

- Combined Splunk / Accenture Team in an **engineering partnership approach**
- Leveraging **onshore / nearshore IoT factory**
- Highly **integrated team** with client's engineering, data science and IT departments

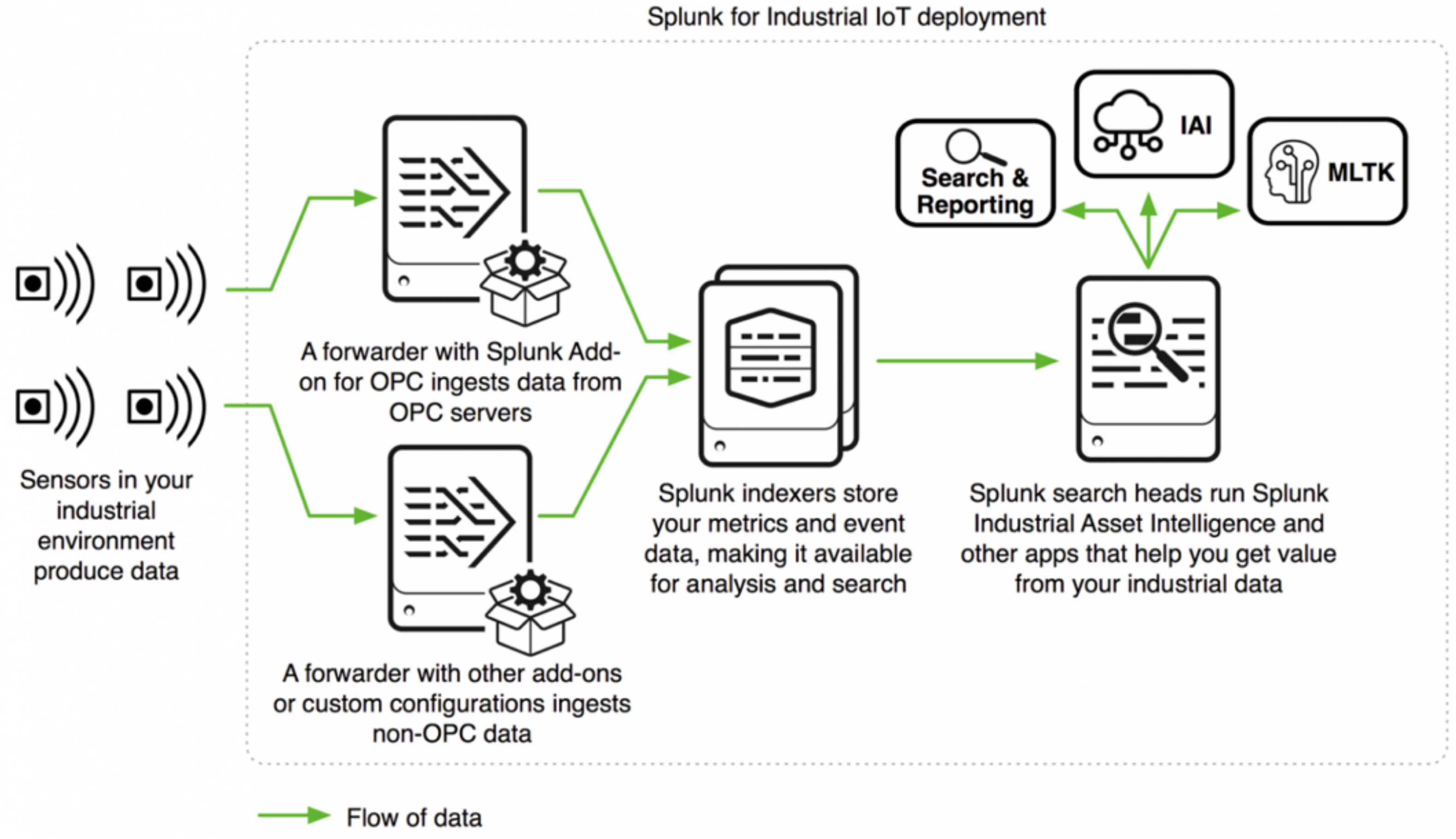
Methodology

- **Agile delivery** approach
- **MVP approach** to achieve tangible results early
- **Joint engineering** to stretch boundaries of product performance and scalability

Technical Implementation

Using Splunk for Industrial IoT and external tools

Primer: Introduction to Splunk for Industrial IoT



Splunk's Premium Offering for Industrial IoT

Bundle consisting of:

- **Splunk Enterprise**
- **Machine Learning Toolkit**
- **OPC TA**: Emerging industry standard to onboard data from industrial equipment supported by new Splunk TA
- **Industrial Asset Intelligence (IAI)**: Powerful self-service app integrating glass tables / monitor views with customized metrics workbench functionalities

Technical Building Blocks

3 Focus Areas for Technical Implementation

1

Data Ingestion and Predictive Model Refresh

- Analyze machine data based on a Ensure real-time data ingestion of all production data and forwarding of data to corporate data lake
- Build and update predictive models

2

Real Time Data Visualization and Scoring

- Use Splunk as an intermediate layer for real-time dashboards
- Trigger predictive model execution leveraging existing advanced analytics technologies and not MLTK

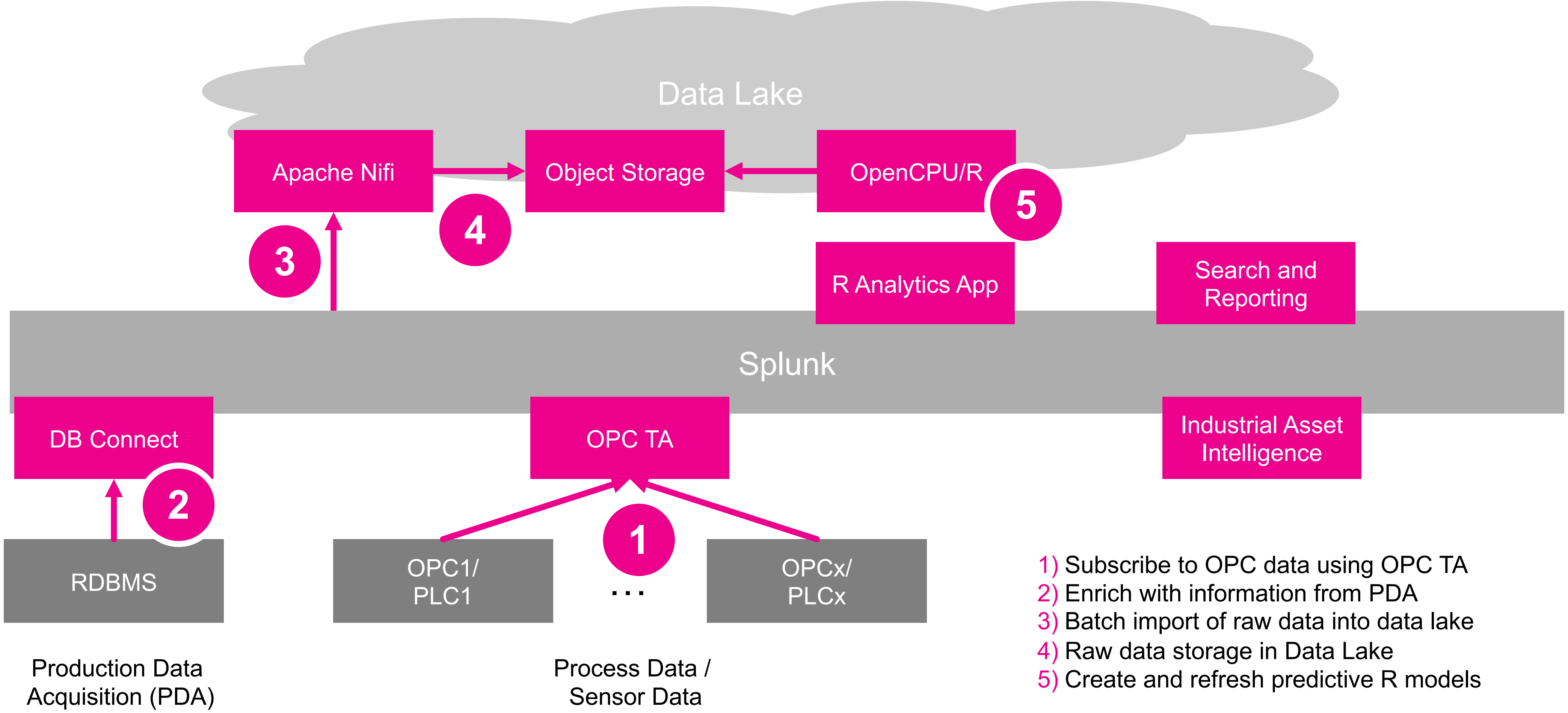
3

Self-Service Monitoring and Diagnostics

- Analyze machine data based on a predefined asset hierarchy
- Provide drag and drop access and functionalities for non-IT personnel

Data Ingestion and Predictive Model Refresh

Data Flow



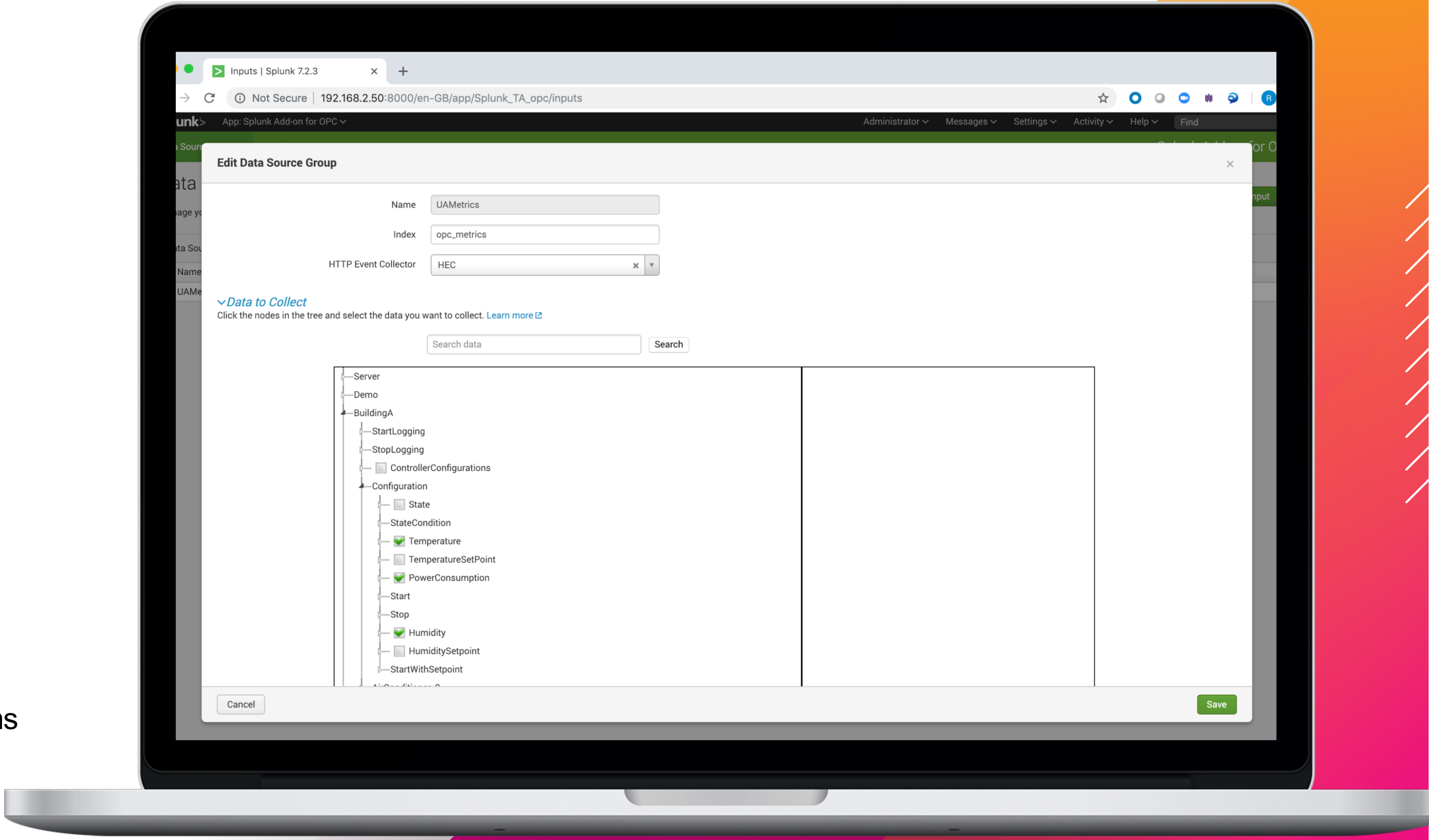
1) Subscribe to OPC data using OPC TA
2) Enrich with information from PDA
3) Batch import of raw data into data lake
4) Raw data storage in Data Lake
5) Create and refresh predictive R models

Splunk OPC TA

Core Component for High Volume Data Ingestion

Key Achievements and Benefits

- Subscribe to huge amount of variables
- Achieve sampling intervals down to 8 ms



Data Ingestion and Predictive Model Refresh

Technical summary

Integrate with Existing Data Lake

Integrate with Existing Data Lake

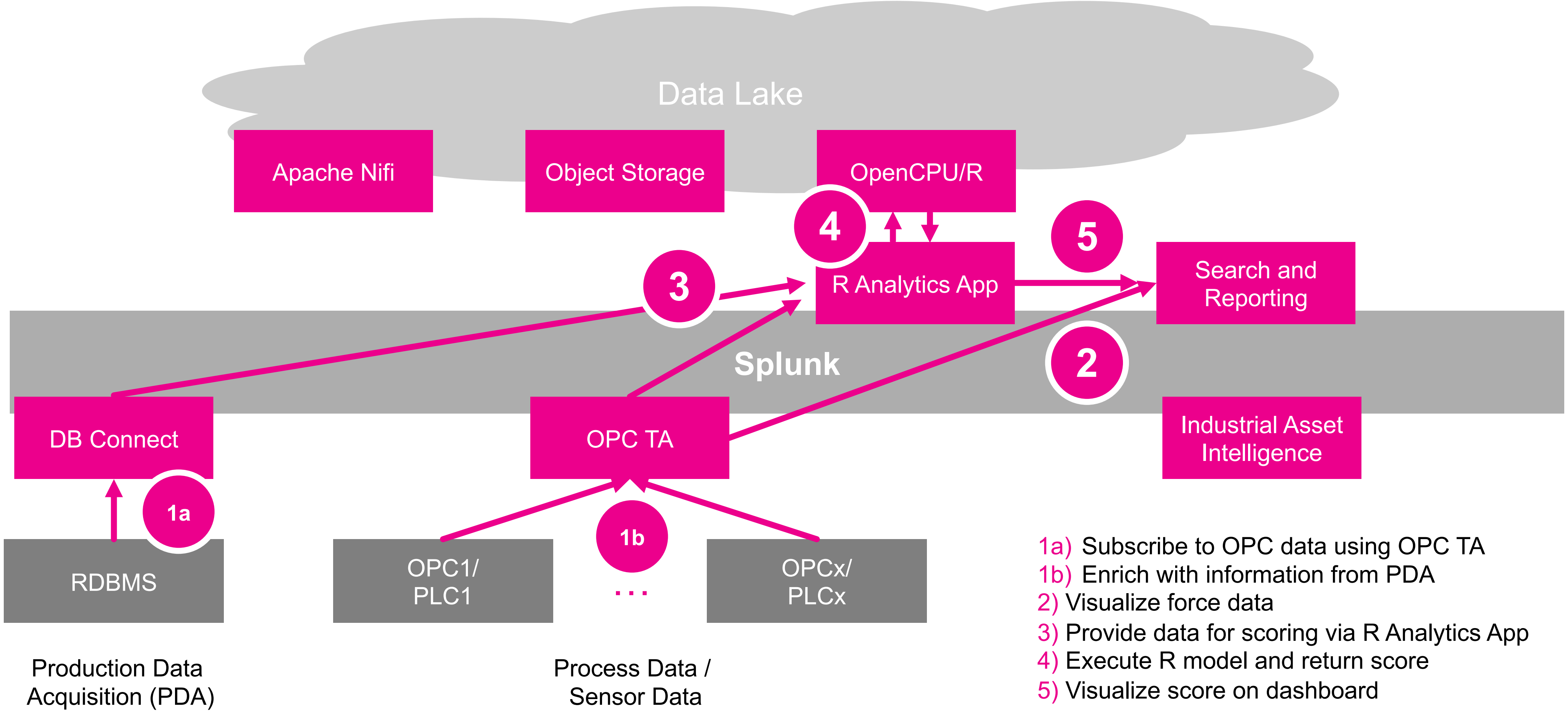
Import OPC data using GUI or scripts

Export Data using Pipelines

Use External Languages (R or Python)

Real Time Data Visualization and Scoring

Data Flow



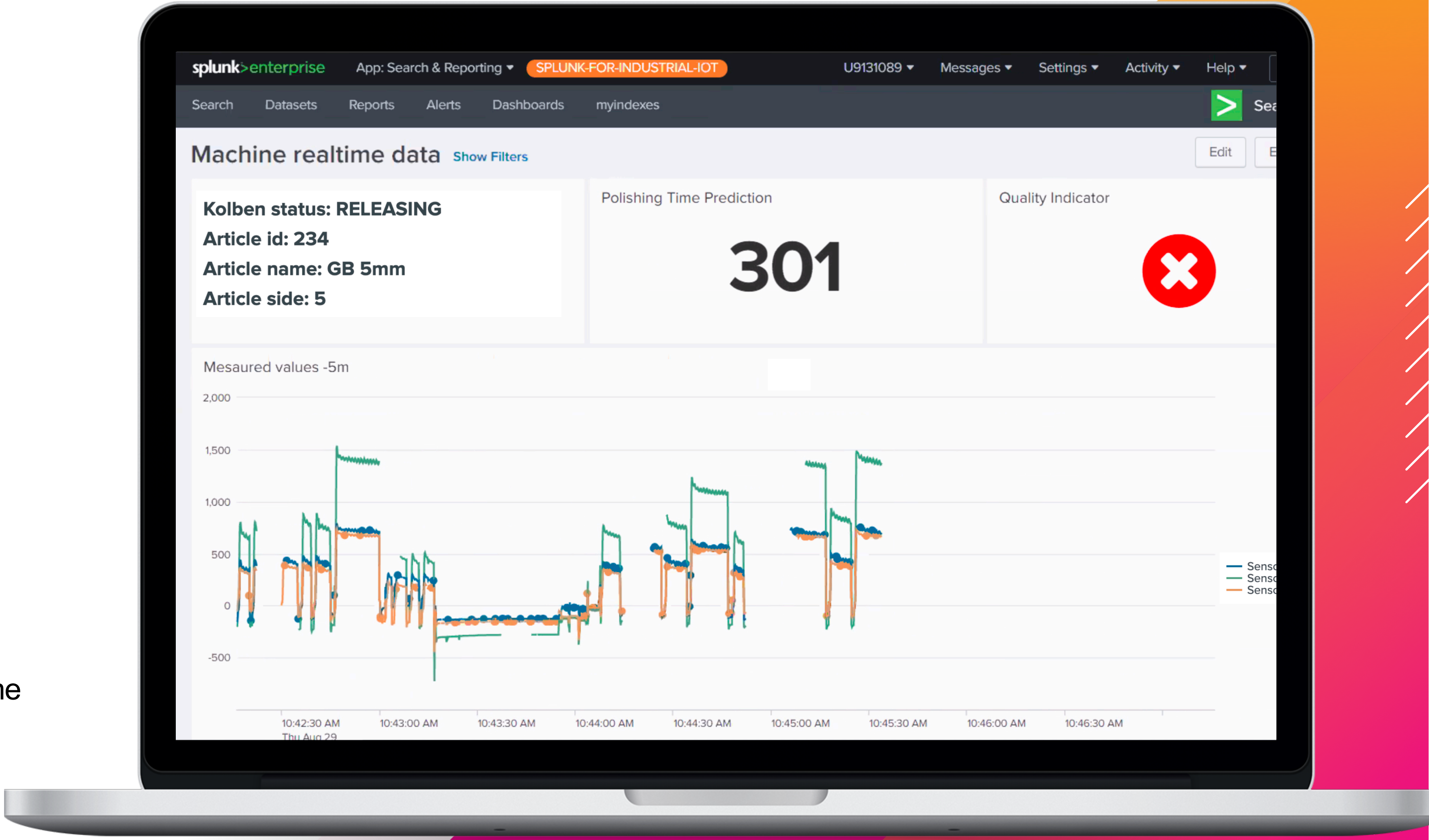
1a) Subscribe to OPC data using OPC TA
1b) Enrich with information from PDA
2) Visualize force data
3) Provide data for scoring via R Analytics App
4) Execute R model and return score
5) Visualize score on dashboard

Splunk Search and Reporting App

Provide real-time and historical insights

Key Achievements and Benefits

- Single dashboard showing near real-time sensor data alongside machine corrections
- Enrich with key prediction results like predictive polishing time and predicted quality



Real-time Data Visualization and Scoring

Technical summary

Create Comprehensive, Near Real-time Dashboards

Leverage External Advanced Analytics Frameworks

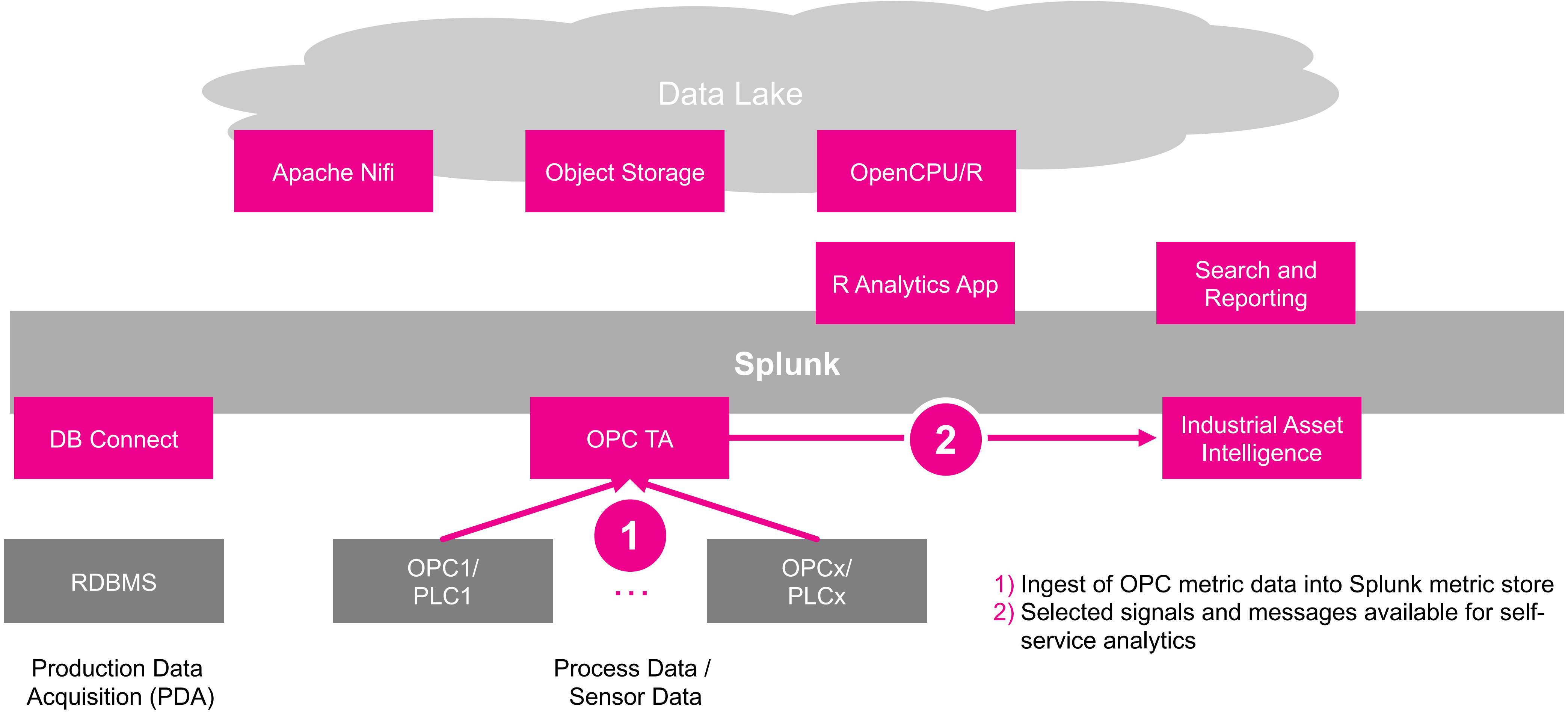
Combine Sensor Data with Scoring Results

Gain Access to Contextual Information Using Interactivity

Understand Impact of Historical Machine Settings

Self-service Monitoring and Diagnostics

Data Flow

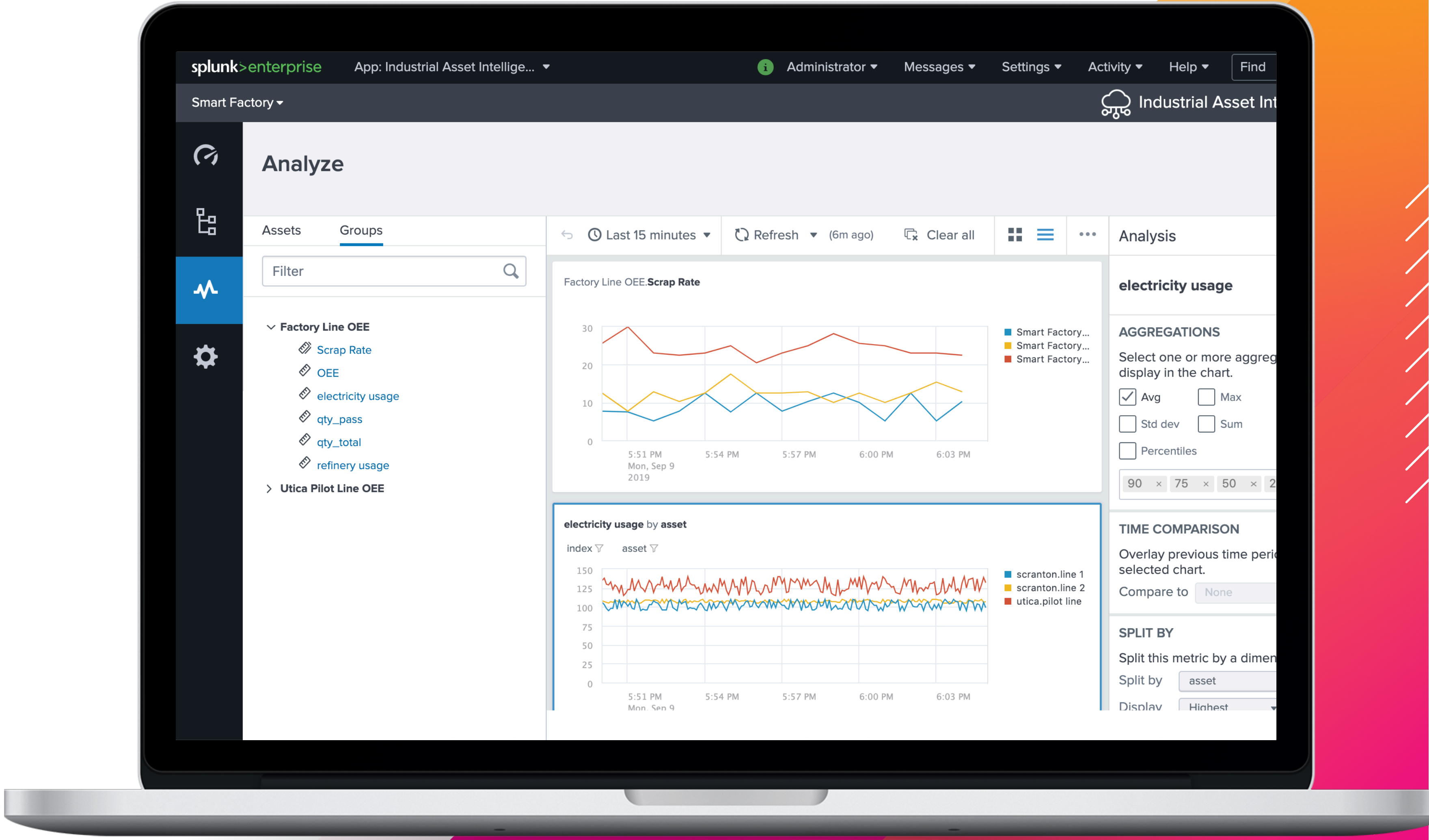


1) Ingest of OPC metric data into Splunk metric store
2) Selected signals and messages available for self-service analytics

Splunk Industrial Asset Intelligence

Key Achievements and Benefits

- Benchmark different assets of the same type
- Identify any discrepancies with regards to operational aspects



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Self-service Monitoring and Diagnostics

Technical summary

- **Create a High Level Representation of Your Assets**
- **Drill-down Multiple Levels to Narrow Down Issues**
- **Compare Several Machines Against Each Other**
- **Use Drag and Drop Interface for In-depth Time-series Analysis**
- **Visually Correlate Information from Different Sources**

Wrap-up

Summary and lessons learned

Bridging the Gap from IT to OT

Extend the use of your Splunk environment

1. Leverage your existing Splunk investments in infrastructure and people
2. Leverage Splunk's investments in emerging technologies like OPC UA and its open architecture
3. Avoid the need for complex IoT architectures and extend the use of Splunk to IoT Analytics
4. Achieve fast results and time to value using Splunk's platform capabilities

Lessons Learned

Finding the Right Approach

1. Connect with your counterparts from manufacturing or electronics early
2. Understand the capabilities of your OPC infrastructure and closely monitor server capacity and performance
3. Properly plan, align and test your OPC configuration settings according to your Advanced Analytics requirements
4. Adjust your Splunk architecture and configuration if needed

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