



# The State of Industrial IoT

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GE Digital

# The Predix Cloud



Machine Connectivity

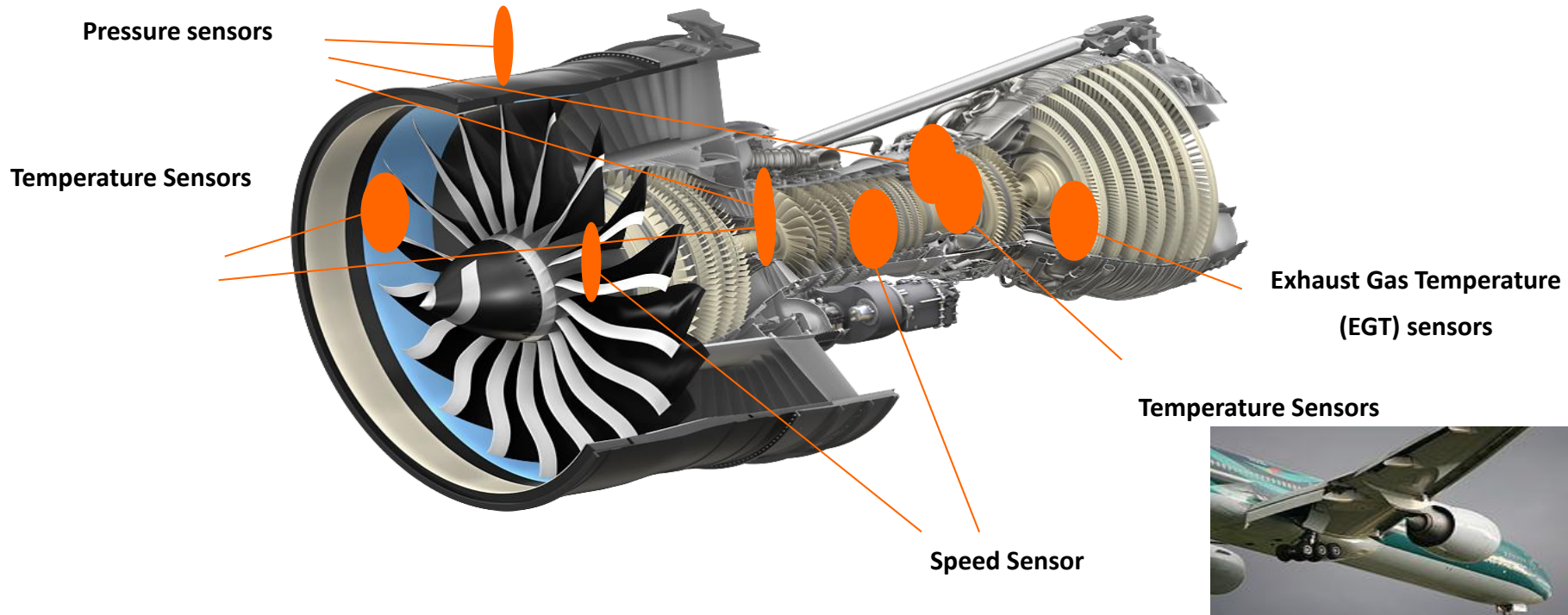
Industrial Big Data

Enhanced Security

Service Interoperability

Developer Insight

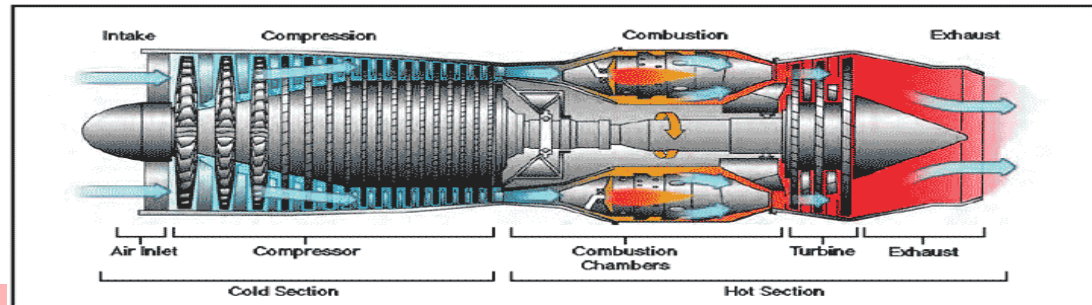
# Today - Jet Engine (Genx) Sensors



\* Simplified view of some of the sensors

# Making “Sense” of the “Sensors”

- EGT = Exhaust Gas Temperature
- The temperature of the exhaust gases as they enter the tail pipe, after passing through the turbine
- A good indicator of the health of engine (just like human body temperature)
- Recording & interpreting the EGT can help to detect several jet engine problems.



Connect



API

Analyze



API

Optimize

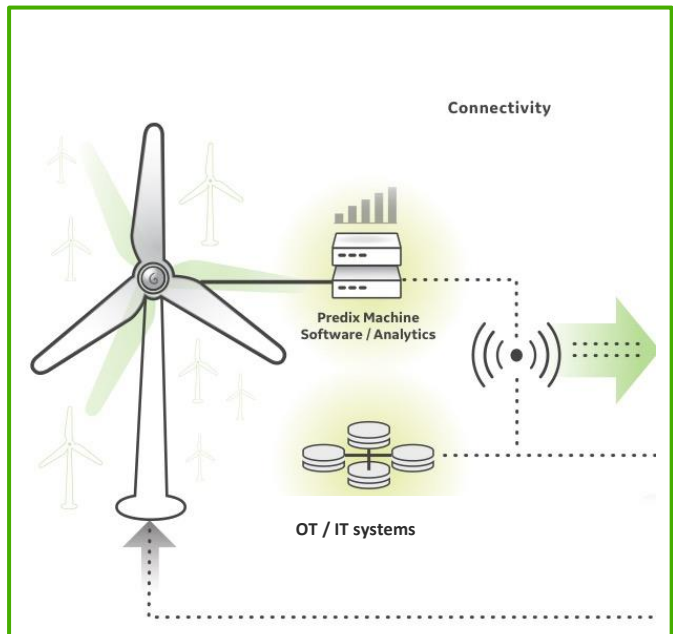


API

# Predix

your cloud platform for the Industrial Internet

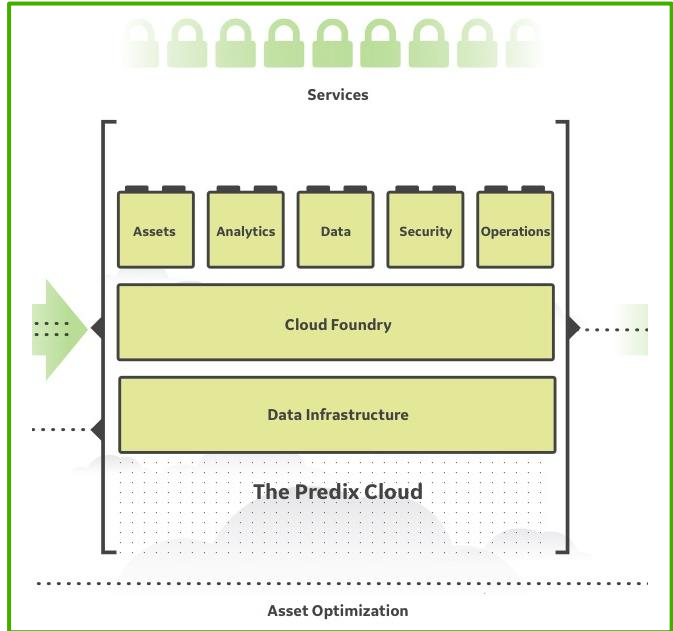
# Connect ALL your OT / IT Systems



- **ANY** asset (GE, non-GE; new, old)
- **ANY TIME, ANY PLACE** connectivity
- **EDGE** analytics
- **PUSH** software updates
- **SECURED** device management

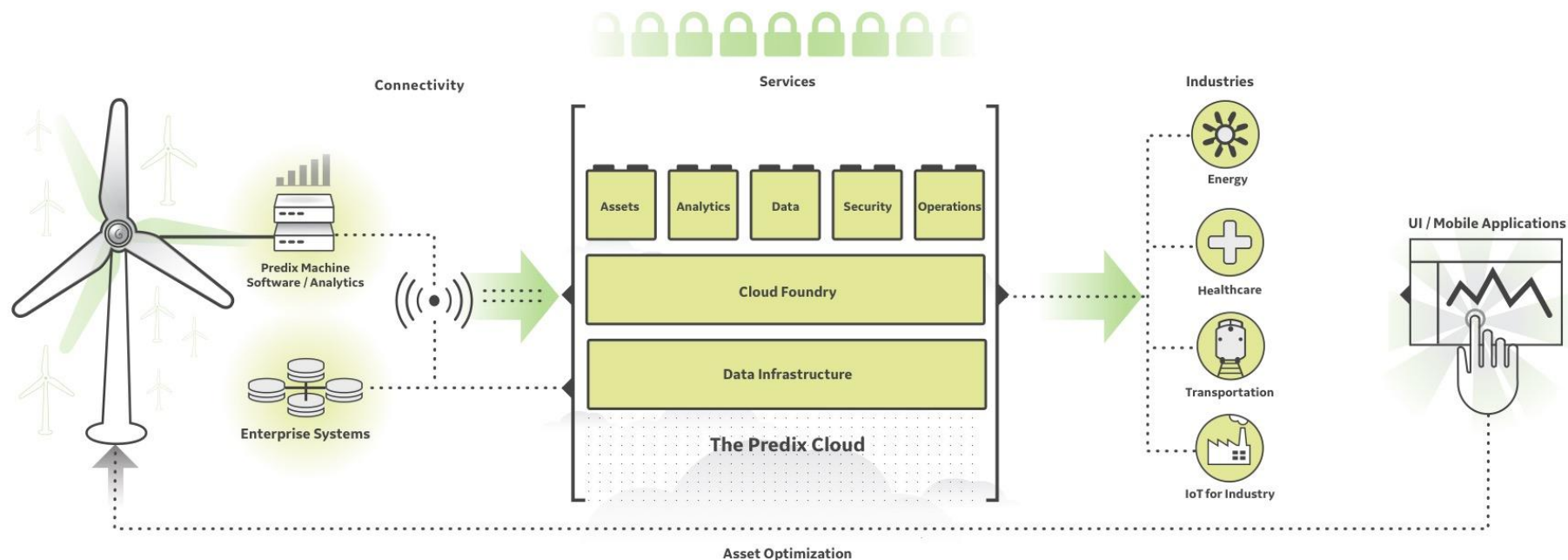


# Digitize, Analyze, Monetize in the Cloud



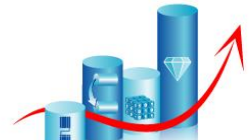
- **ASSET DATA** models, from pipe to plant
- **ANALYTIC** modeling (R, Matlab, ...)
- Packaged **DATA SCIENCES** (GE, partners)
- Data at **SCALE** (fast, vast)
- **METERING** and **COSTING** (BizOps)

# End-to-end platform, machine to cloud





# An example use case...





Predix

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https://demo-apm.predix.com/main/alarms/#/alarms/filter/688/90944DA137274E31AD31FADBEFBB58CF/Engine%20Oil%20Leak%20Alert/showFilterDetails

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Predix

⚠️

Alerts

All Alerts

Unclaimed

My Alerts

more filters

👤

Alert Profiles

📁

Cases

📊

Analysis

📈

Dashboard

📦

Assets

📍

Analytics

👥

User Management

⚙️

Setup

⚙️

Asset Ingestion

📅

Audit Logs

👤

David Cronin ^

⚙️

Unclaimed

+

Sort by: Time Received ▾

☐ Auto-Refresh (30s)

↺

1

Engine Oil Leak Alert

Mining Truck 5AS04968

Wyoming Mining District

Jul 21

Ready

2

Fuel Inlet Issue

TURBINE

Combined Cycle Sites

Mar 03

Ready

End of List

1

Engine Oil Leak Alert ⓘ

07/21/2016 4:23 PM

Mining Truck 5AS04968

Wyoming Mining District

MINING-TRUCK-5AS04968

Disposition: None

Claim Alert

ALERT INFORMATION

Alert ID

Event Time

Alert Source

Owner

3802

07/21/2016 11:23 PM

OrchestrationManager

None

ANALYSIS

📄

Standard View

🔗

NOTES

Jayant Thomas 7/21/16 4:56 PM ✕

Potential engine oil leakage identified

Enter a note here

Add Note

EVIDENCE

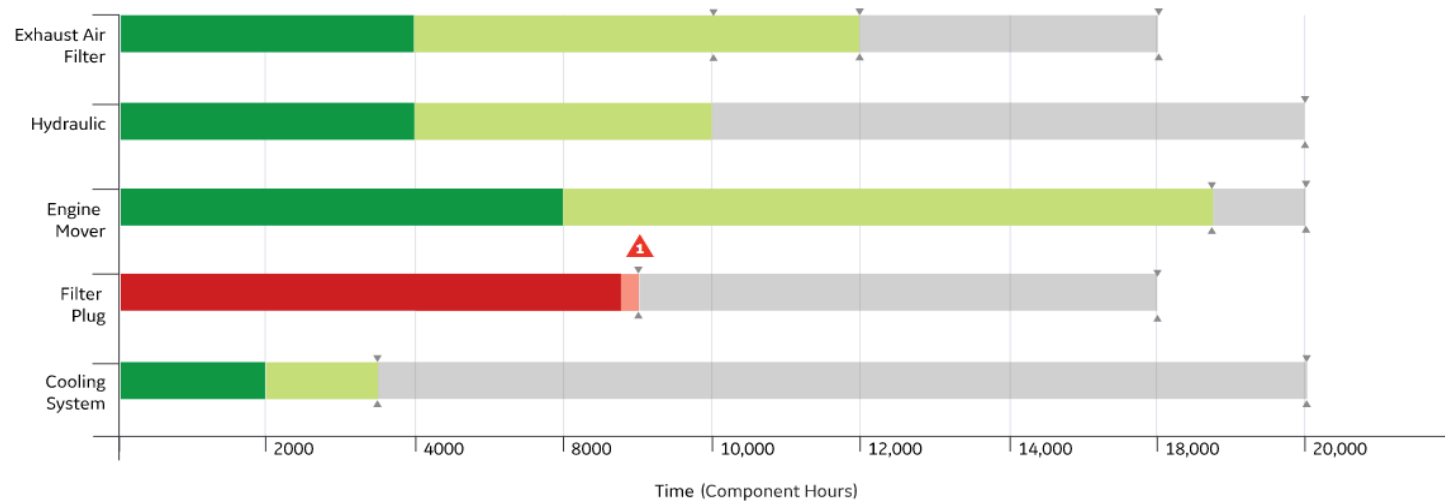
📄

Evidence – borescope inspection result

Added 7/21/2016 by Jayant Thomas

## EAGLE BUTTE MINE

USED HOURS    USEFUL LIFE    MAXIMUM LIMIT



Predix

×

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🔒

https://demo-apm.predix.com/main/cases/#/unclaimed/details/50AD775DADC54A6FBB25633521BC17AE

☆

🔍

☰

☰

Predix

⚠️ Alerts

👤 Alert Profiles

📦 Cases

Unclaimed Cases

My Cases

Open Cases

Awaiting Cases

Closed Cases

📊 Analysis

📊 Dashboard

📦 Assets

📈 Analytics

👥 User Management

⚙️ Setup

⚙️ Asset Ingestion

📅 Audit Logs

👤 David Cronin ^ ⚙️

Cases

Sort by: **Creation Time** ▼

1

Engine Oil Leak Case

Mining Truck 5AS04968

Jul 21

Open

2

ROTOR\_JOURNAL\_BEARINGS\_V.B..

BFP\_1

Jul 18

Open

4

Performance - Recirc Issue

TURBINE

Jul 16

Open

4

Combustor Cold Spot

BFP\_1

May 29

Closed

4

Nacelle Temperature Increasing

Majestic G53

May 12

Closed

3

Sticking PCV Valve

TURBINE

Apr 08

Open

5

Oil Pressure Low

TURBINE

Apr 08

Open

5

Mill Shaft Brg Temp

TURBINE

Apr 08

Open

5

High Blade Position Spread

Apr 08

1

Engine Oil Leak Case

Mining Truck 5AS04968

Status **Open** ▼

Jul 21, 2016, 16:35:20

Claim Case

▼

CASE INFORMATION

Case ID

10061

External Case ID

[Click to Add](#)

Creator

Jayant Thomas

Owner

None

REPORT

Symptoms

Failure mode - Engine oil leak..

Diagnosis

Please replace the parts

Part Number:Cat C175-20 ACERT

Recommendation

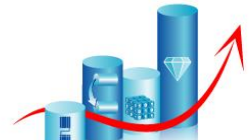
Replace Parts as per the diagnosis

ORACLE INVENTORY

21 engine(s) in stock.

EVIDENCE

# Extending Predix with Plug-able Analytics



# Catalog

Services

Analytics

Filter Categories

## Analytics

Predix provides analytics services as a framework for developing and embedding advanced analyses in business operations. This means you can better manage the execution of analytics through configuration, abstraction, and extensible modules.

### ANOMALY DETECTION ANALYTICS

#### Trend Anomaly Detection

Manage critical time series trend detection.

PREDIX

#### High-Dimension Anomaly Detection

Check multiple sensors for key time series anomaly detection.

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#### Low-Dimension Anomaly Detection

Maintain machine health with this critical time series anomaly detection.

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#### Shift Anomaly Detection

Enable key time series shift detection.

PREDIX

#### Univariate Anomaly Detection

Improve time series rates-of-change anomaly detection.

PREDIX

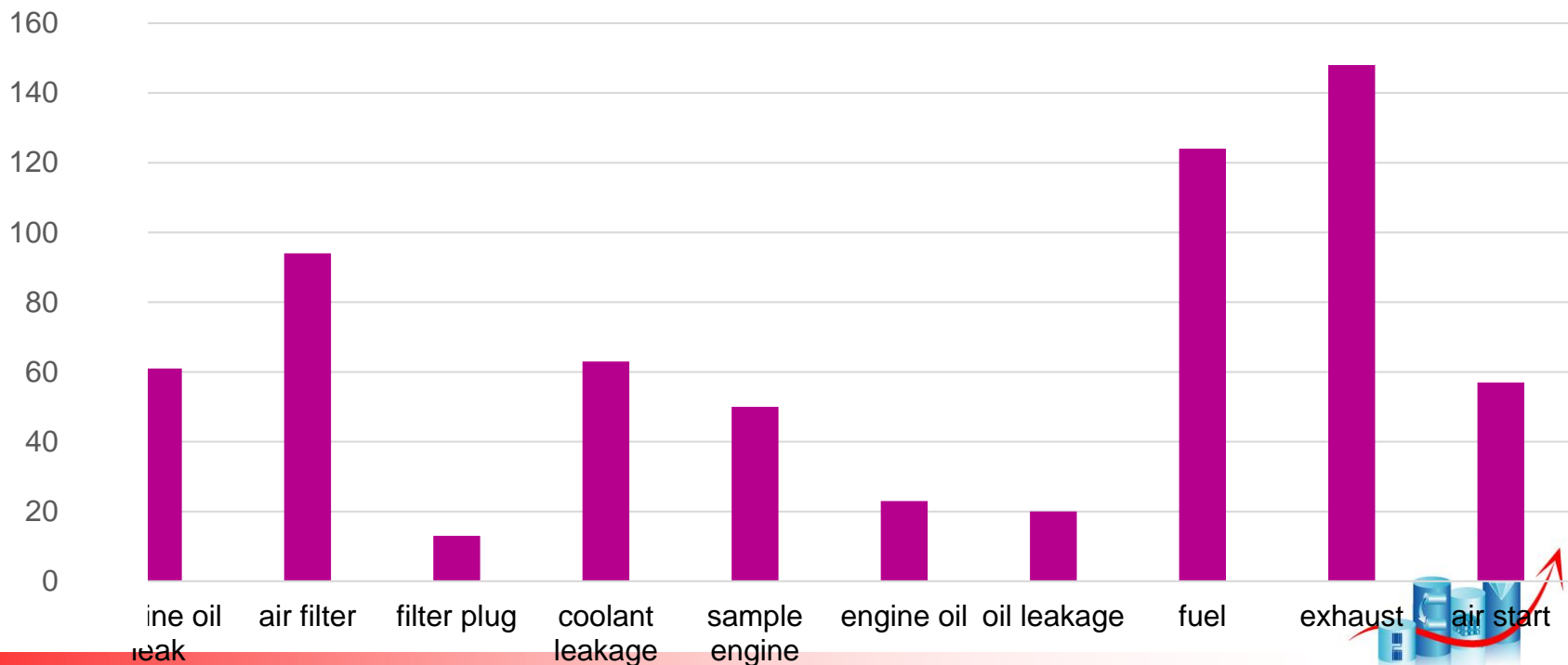
#### Temporal Anomaly Detection

Assure accurate and highly detailed time series anomaly detection.

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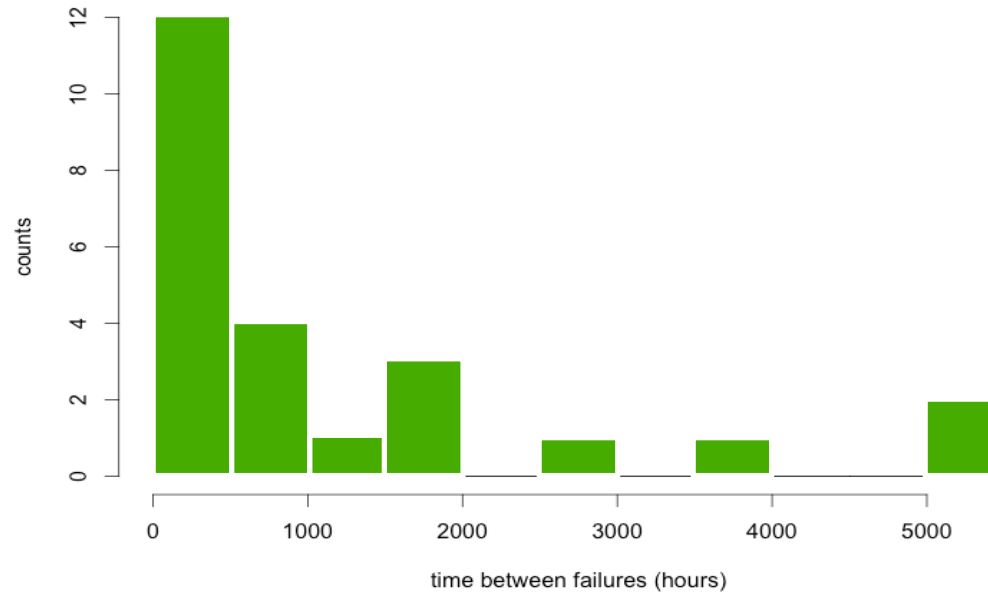


# Text mining of work orders to identify subcomponent failure modes

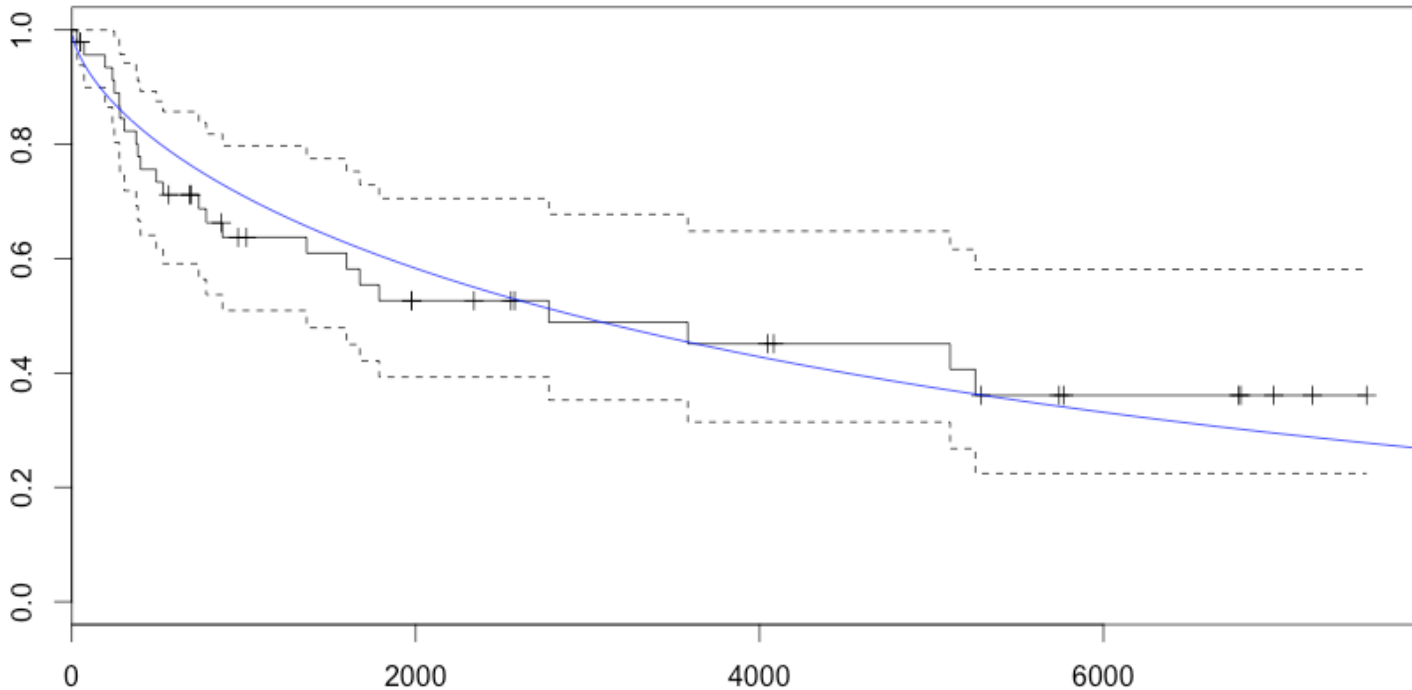


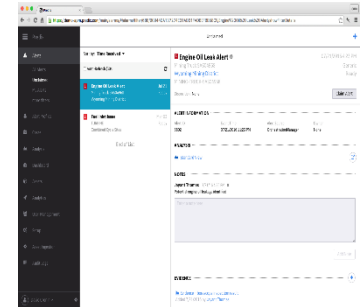
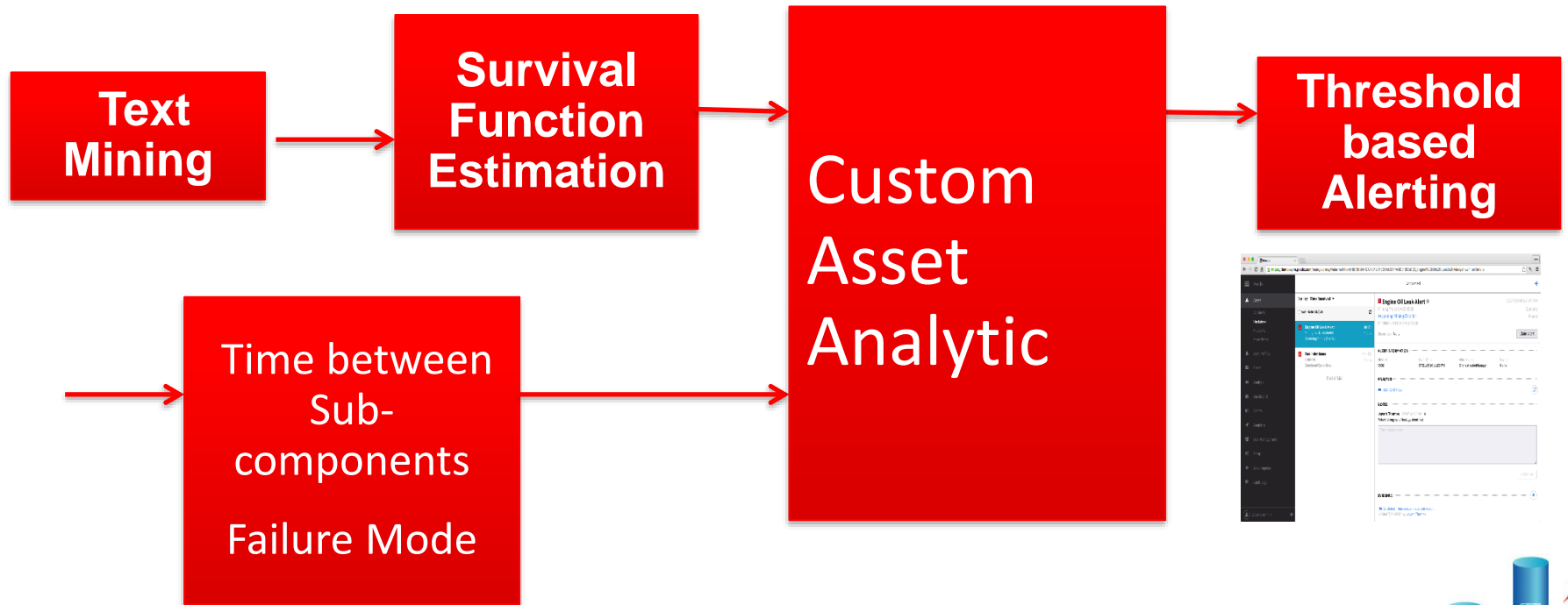
# Time-between-failure analysis for each subcomponent failure mode

Histogram of time between failures of engine oil leakage



# Survival function estimation for each subcomponent failure mode



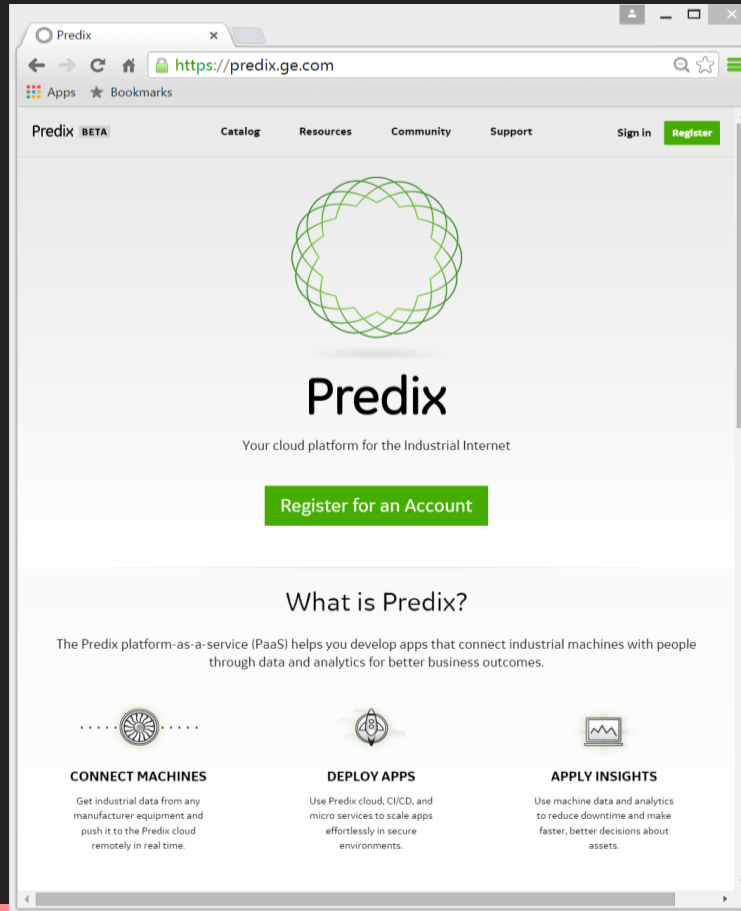


- Predix
- Alerts
- Alert Profiles
- Cases
- Analysis
- Dashboard
- Assets
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- Setup
- Asset Ingestion
- Audit Logs
- David Cronin

MINING TRUCK 5AS04968  
EAGLE BUTTE MINE

Make	Model	Origin	Type	Serial Number	Mining Area	Mine
Excel Mining Truck Company	EX-8863	USA	Mining Truck	5AS04968	Wyoming, MT	Eagle Butte Mine









# BIWA SUMMIT 2017 WITH SPATIAL SUMMIT

THE Big Data + Analytics + Spatial + Cloud + IoT + Everything Cool User Conference  
January 31 - February 2, 2017