Internet of Things

Opportunity
Challenges
Solutions

GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2015

ELYSIUM Parker Aerospace NORTHROP GRUMMAN BOEING

ANALYZING INTERNET OF THINGS USING BIG DATA ECOSYSTEM

Internet of Things matter for...

- **Industrial Manufacturers**
- **Transportation**
- **Healthcare, Life Sciences**
- **Financial Services**
- **Retail**
- **Telecom and Media**

IOT MARKET OPPORTUNITY

- "IoT will grow to a $19 trillion industry by 2022." (Cisco, revised)
- "Incremental revenue will exceed $300 billion by 2020." (Gartner)
- "The Industrial Internet of Things will transform companies and countries, opening up a new era of economic growth and competitiveness." (Accenture)
- "This will inevitably create entirely new markets to buy and sell algorithms, generating significant incremental revenue for existing companies and spawning a whole new generation of specialist technology start-ups." (Gartner)

The Power of 1

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Driving Outcomes That Matter

Increasing
Freight Utilization Rail

Predictive
Maintenance Healthcare

Predictive
Diagnostics Power

One Percent Improvement Equals

$27B
Industry Value by
Reducing System
Inefficiency

$63B
Industry Value by
Reducing Process
Inefficiency

$66B
Industry Value with
Efficiency Improvements
In Gas-fired Power
Plant Fleets

Source: General Electric

THE INTERNET OF THINGS JOURNEY

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STORE

- Structured
- Unstructured
- High Volume
- High Velocity

ANALYZE

- Predictive Analytics
- Machine Learning
- Advance Data Science
- Real-time Analytics

DEVELOP

- Advanced Analytic Pipelines
- Real-time Analytical Applications
- Global Scale Data-Driven Applications
- Enterprise, Consumer, IoT, and Mobile

INNOVATE

- Agile Dev Expertise
- DevOps
- Hybrid Cloud
- Continuous Delivery
- Closed Loop Applications

ENTERPRISE PAAS

AGILE DEVELOPMENT

PREDICTIVE ANALYTICS

BIG DATA

LARGE ENTERPRISE BIG DATA TROUBLE

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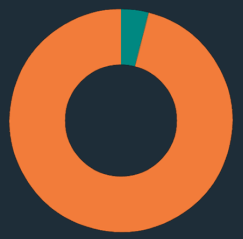
80% of CEOs thinking data mining and analysis are strategically important [1]

0% of CIOs think their IT infrastructure is fully prepared for big data [3]

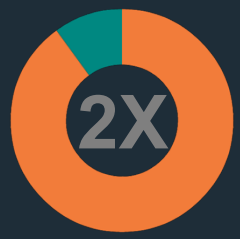
44% of new applications failed to meet performance expectations [5]

But…



4% of companies use analytics effectively [2]

30% of companies have deployed advanced analytics, 11% big data analysis [4]



90% of companies allocate at least 2X more cloud capacity than needed to ensure performance [6]

(1) 2015 PWC CEO Survey; (2) 2013 Baine and Company - The Value of Big Data (3) 2014 IT Infrastructure Conversation - IBM; (4) Ernest and Young - 2014 Enterprise IT Trends and Investments; (5) 2014 Riverbed Tecnologies - The Transformers; (6) 2014 ElasticHosts CIO Study

THE DATA DIVIDE

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BIG DATA CHASM

Digital universe is estimated to grow from 4.4 ZB in 2013 to 44 ZB in 2020

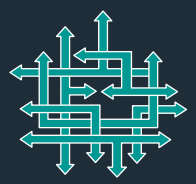
35%
Will contain valuable information

>5%
Of potential useful data is analyzed

<0.5%
being operationalized

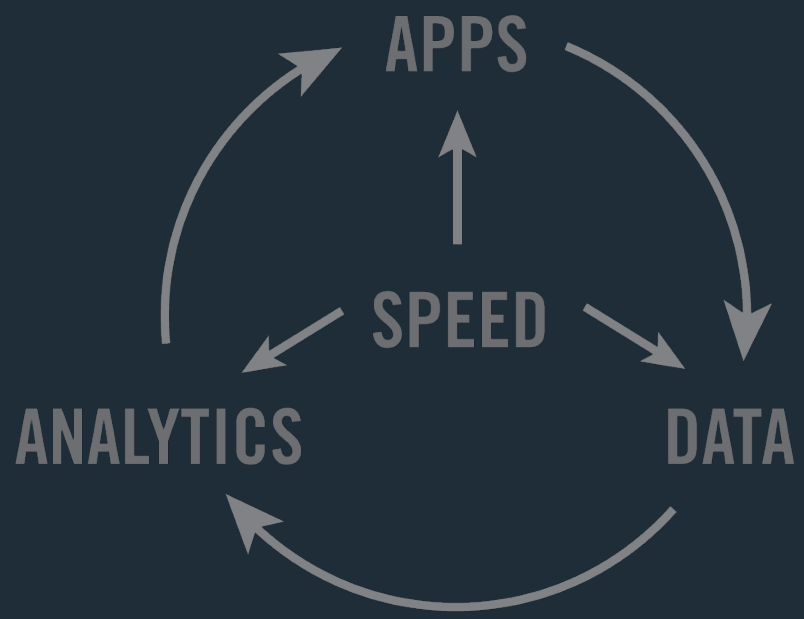
Ease-of-Use more pressing issue than cost *

Fragmentation



Complexity

Constraints



* Dimensional Research, March 2015, Internet of Things Meets Big Data and Analytics: A Survey of IoT Stakeholders

Better analytics would increase ROI

Nearly 90 percent of IoT project stakeholders believe that more flexible analytics would significantly increase ROI. *

* Dimensional Research, March 2015, Internet of Things Meets Big Data and Analytics: A Survey of IoT Stakeholders

JOURNEY TO AN AGILE DATA-DRIVEN ENTERPRISE

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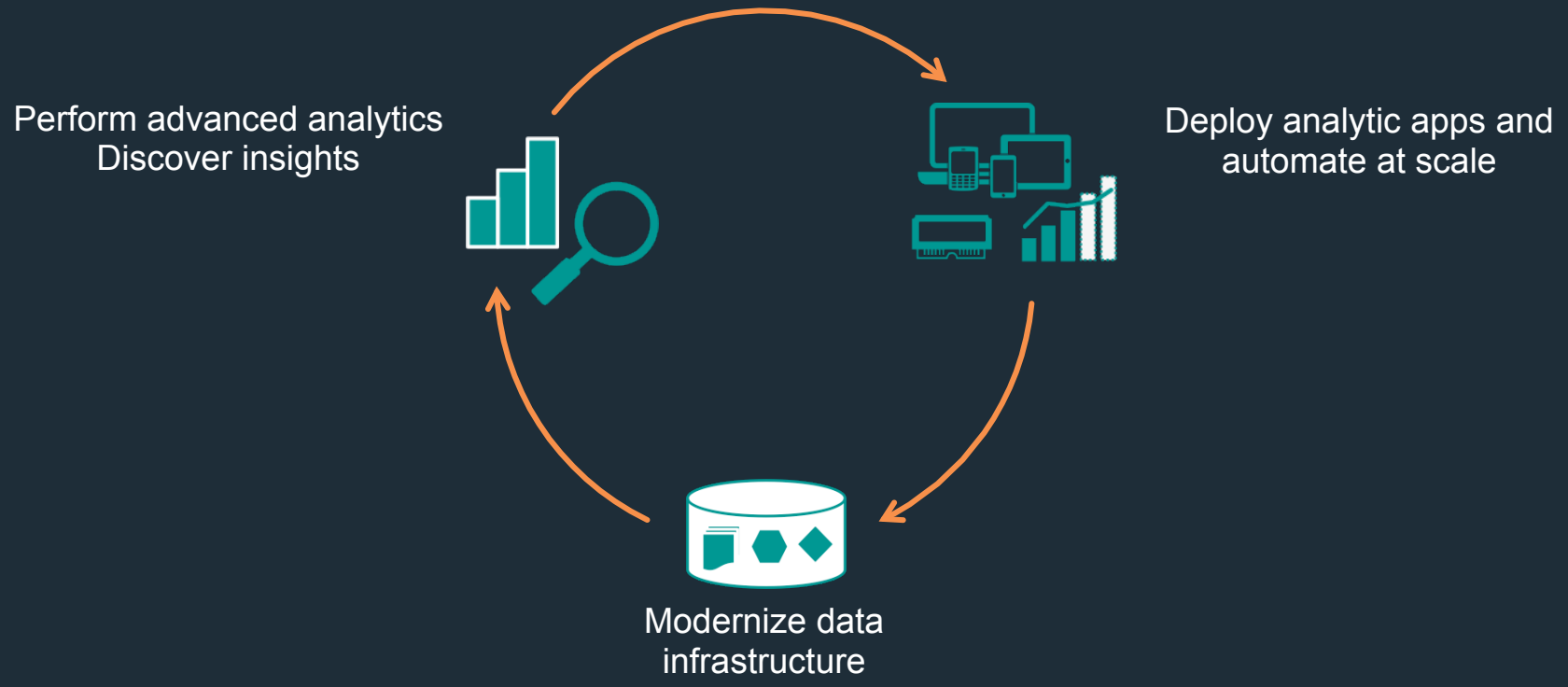

MODERNIZE DATA INFRASTRUCTURE

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REQUIREMENTS	BENEFITS
Elastic, Scale-out storage and processing	Higher quality analytics Lowered storage/processing cost
Flexible data types and pipelining	ETL on demand: low operational cost Expanded use cases
Cloud friendly and open-source based	Less fragmented ecosystem Reduced vendor lock-in

ADVANCED ANALYTICS

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REQUIREMENTS	BENEFITS
Massive stream processing	Internet of Things use cases Rapid time to insights
SQL- compliant batch and interactive queries	Leverage existing skills and tools Rapid time to insights
Machine learning and advanced analytics	Solve business problems Predictive insights: proactive execution

ANALYTIC APPS AND AUTOMATION AT SCALE

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REQUIREMENTS	BENEFITS
Resilient, scale-out messaging and object storage	Reduced time to insights Flexible ingestion: low operating cost
Agile analytic app-dev with enterprise PaaS	Reduced time to action Low ‘analytics ⇔ app-dev’ integration cost
Low-latency, distributed in-memory transactions	High performance: low operating cost Transactional safety: business critical ops

AGILE – What is it?

TRANSPARENCY	All aspects are visible and known
INSPECTION	Identify unacceptable variances
ADAPTABILITY	Adjust quickly and effectively

Migrating from a Reactive, Static and Constrained Model…

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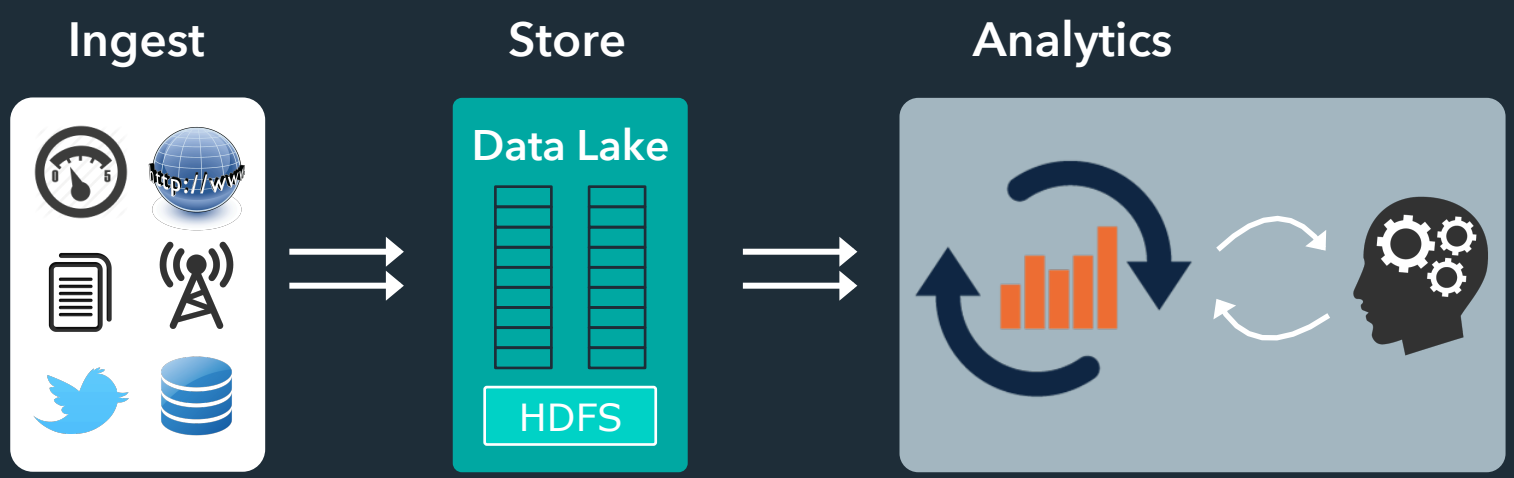

Coding based
No real-time information
Based on expensive ETL

Hard to change
Labor intensive
Inefficient

To Pro-Active, Self-Improving, Machine Learning Systems

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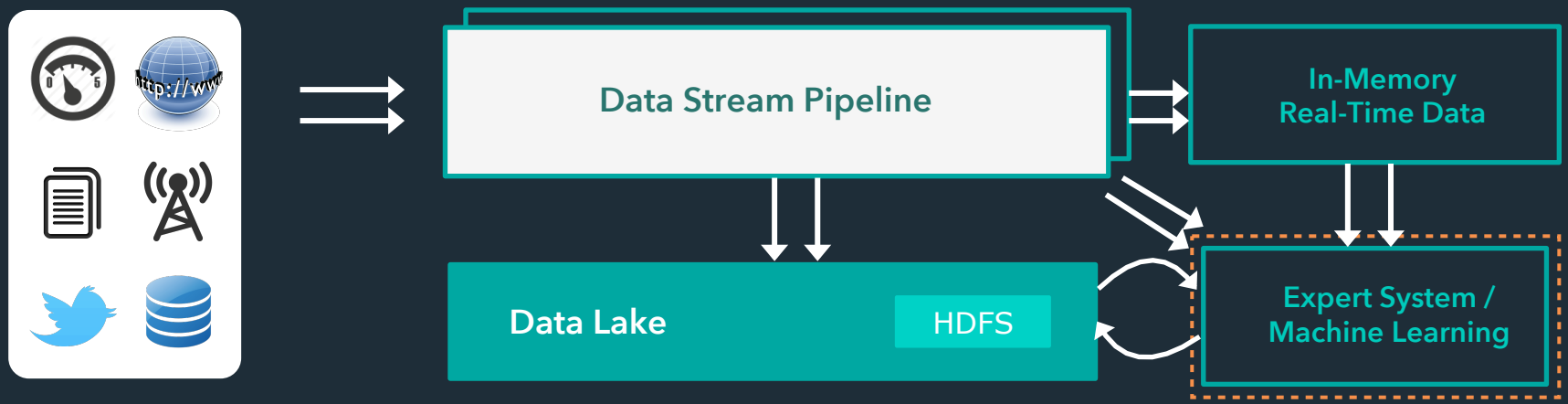

Multiple Data Sources
Real-Time Processing
Store Everything

Continuous Learning
Continuous Improvement
Continuous Adapting


“
50-80% OF THE TIME ON DATA SCIENCE PROJECTS IS SPENT ON DATA WRANGLING
”
New York Times Research: http://www.nytimes.com/2014/08/18/technology/for-big-data-scientists-hurdle-to-insights-is-janitor-work.html

Still…

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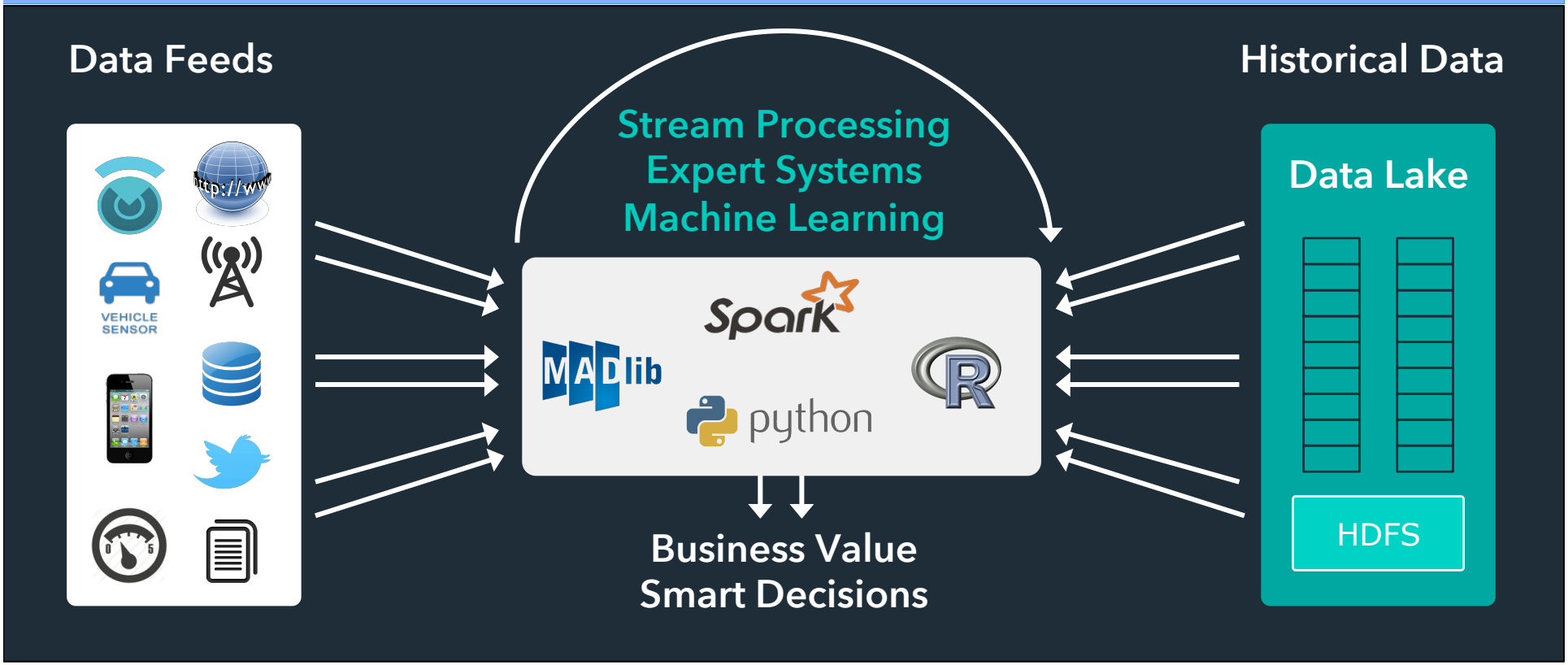

Data Streaming Needs an Agile, Scalable, Automated and Fast Solution

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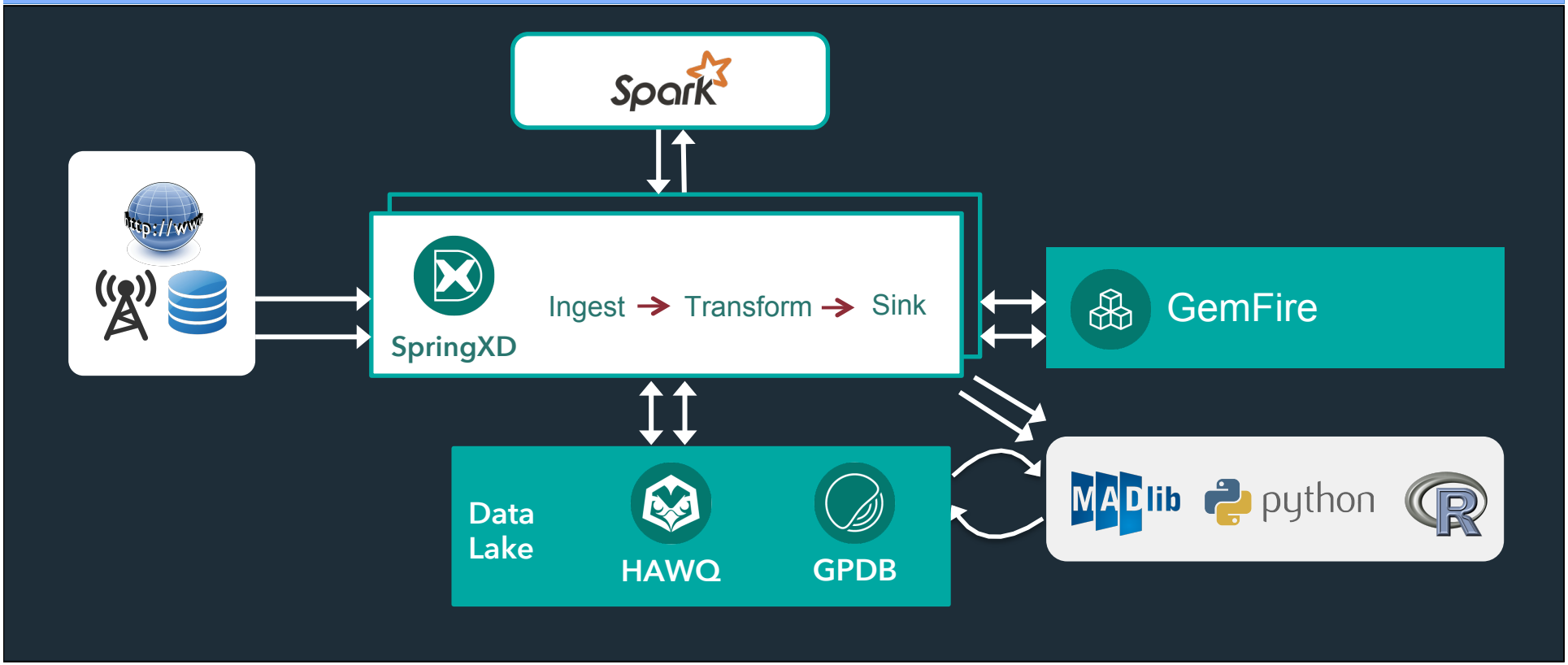

Data Streaming Reference Architecture

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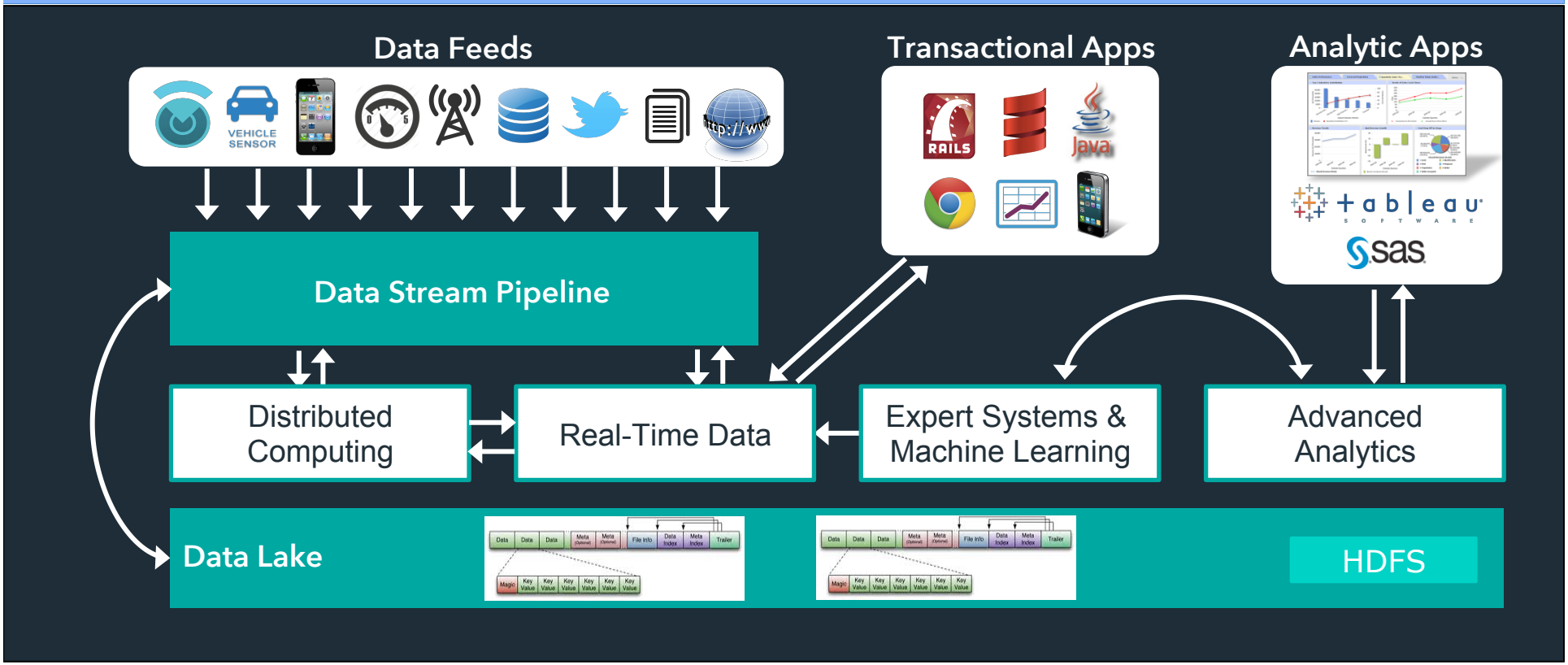

Data Streaming Reference Architecture

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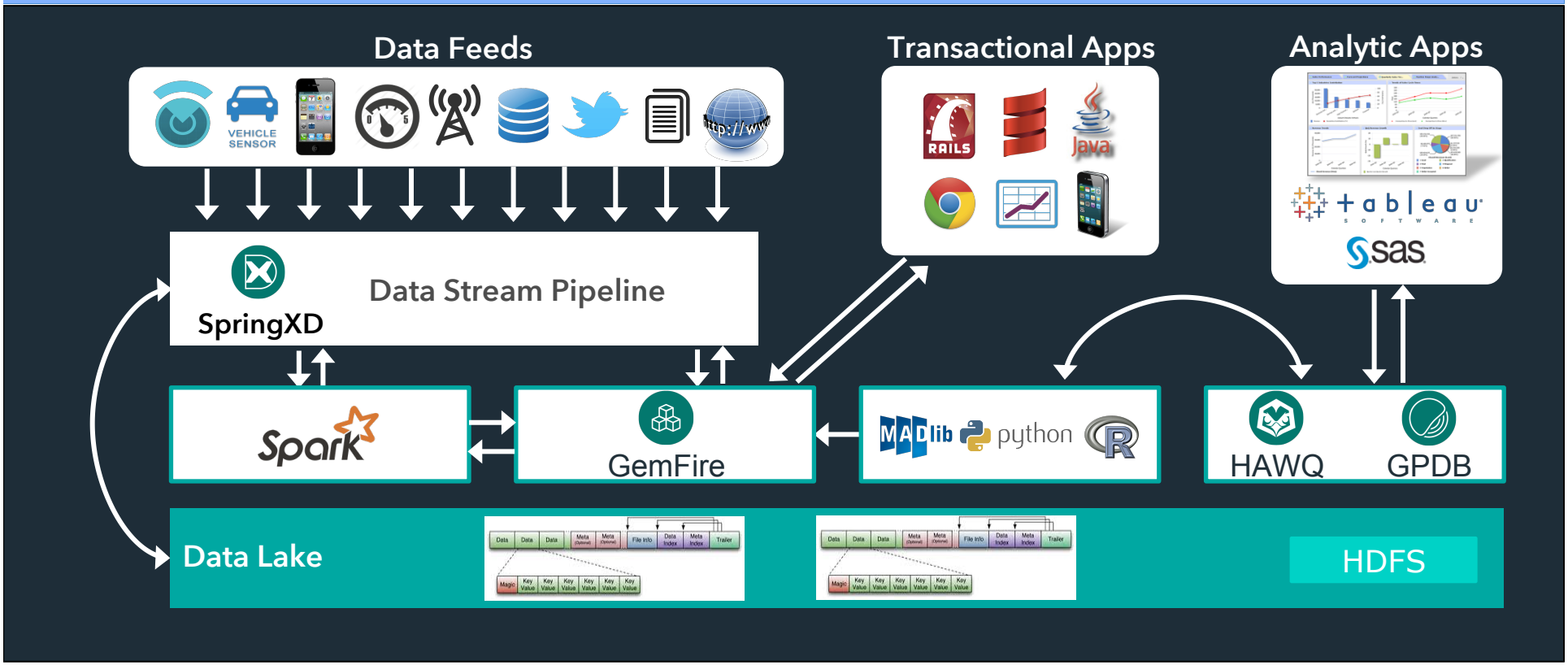

THE INTERNET OF THINGS JOURNEY WITH PIVOTAL

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Data Engineering

- Spring XD
- Spark
- Pivotal HD & Open Data Platform

Data Science

- Spring XD
- Pivotal Greenplum Database
- Pivotal HAWQ

Pivotal Labs

- Spring XD
- Pivotal GemFire
- Redis
- RabbitMQ
- Spring IO
- Groovy
- Pivotal BDS on PCF
- Pivotal Cloud Foundry

ENTERPRISE PAAS

AGILE DEVELOPMENT

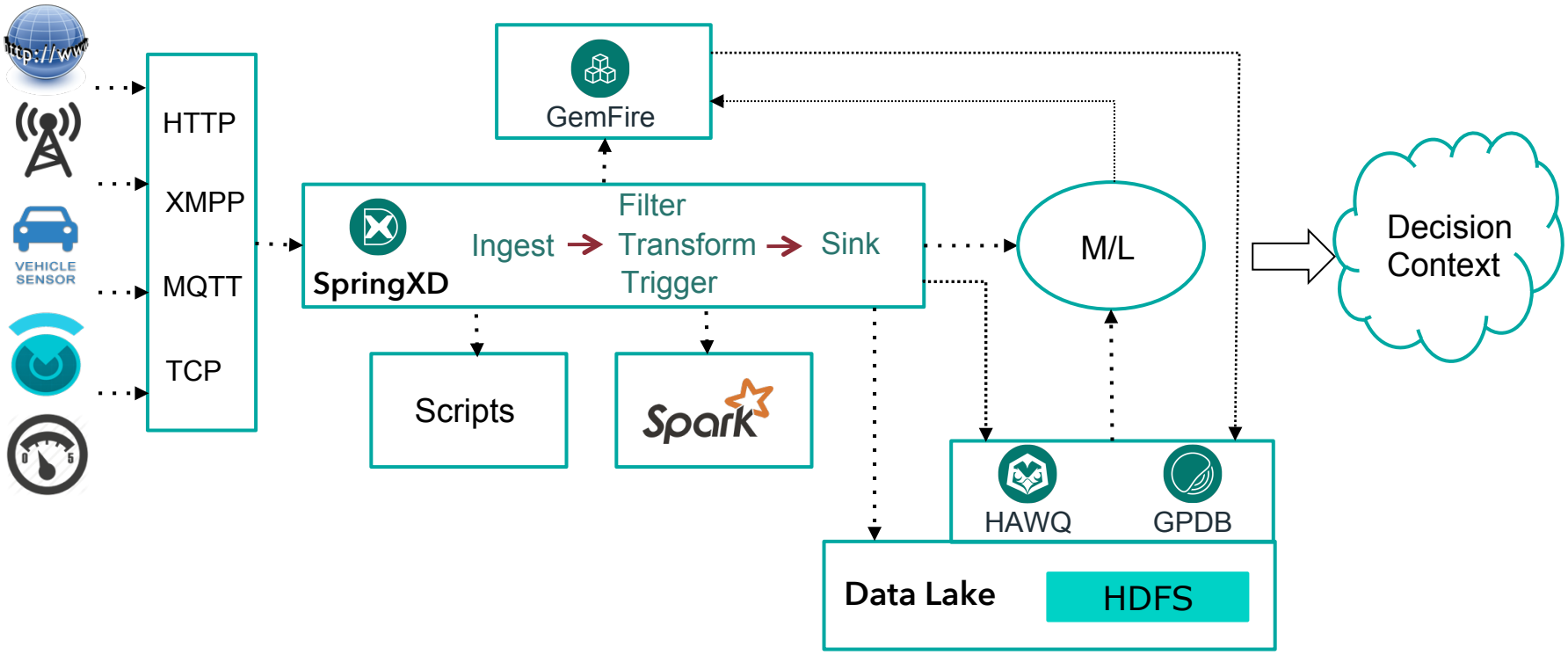
PREDICTIVE ANALYTICS

BIG DATA

TURBOMACHINERY

Energy, Maritime, Aviation

- **Goal**
  - Preventative maintenance vs. remediation
  - Increase profitability and reduce liability
  - Store and process fire-hose of data
- **Solution**
  - Ingest all data for data discovery and model development
  - Store 10 TB of HIGH VELOCITY turbine engine data in memory (GemFire)
  - VERY LOW LATENCY and HIGH SPEED data access
  - Currently realize 1 percent savings in fuel management alone



Pivotal

BUILT FOR THE SPEED OF BUSINESS