Using PySpark with Databricks Structured Streaming

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Agenda

1. **Introductions and use case**
2. **Who, what, and why of Spark and databricks**
3. **Lambda Architecture: Design Principles**
4. **Wrap-Up: Solution Architectures**

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VISION

Accelerate innovation by unifying data science, engineering, and business

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PRODUCT

Unified Analytics Platform powered by Apache Spark

WHO WE ARE

- Founded by the creators of Apache Spark
- Contributes **75%** of the open source code, **10x** more than any other company
- Trained **100k+** Spark users on the Databricks platform

Who's Using it Today

Amgen adopted Databricks to migrate to a **Modern Big Data Platform on the Cloud**, enabling accelerated drug discovery that involves petabytes of data from multiple biotech field; using Databricks, researchers can use more data during drug development while easily collaborating across teams, leading to greater productivity and new insights

Shell adopted Databricks for **Predictive Supply Chain Analytics** to optimize their global inventory of spare parts – reducing legacy batch scoring jobs that took longer than 40 hours to less than 45 minutes – and save millions of dollars in operational efficiencies

Viacom adopted Databricks to increase customer retention and loyalty by analyzing petabytes of **Streaming Data** on video quality in real time to improve user experience; this is a machine learning use case on massive amounts of streaming data; the result was higher an increase in customer retention by 3.5x – 7.0x

HP adopted Databricks to support their **Consumer IoT** and **Machine Learning** use cases. HP's data scientists use sensor readings from > 20 M connected devices to create new marketing campaigns for HP Ink; using Databricks the data scientists eliminated the need for DevOps efforts and were able to focus on training more models.

Databricks Customers Across Industries

Financial Services

Healthcare & Pharma

Media & Entertainment

Data & Analytics Services

Technology

Public Sector

Retail & CPG

Consumer Services

Marketing & AdTech

Energy & Industrial IoT

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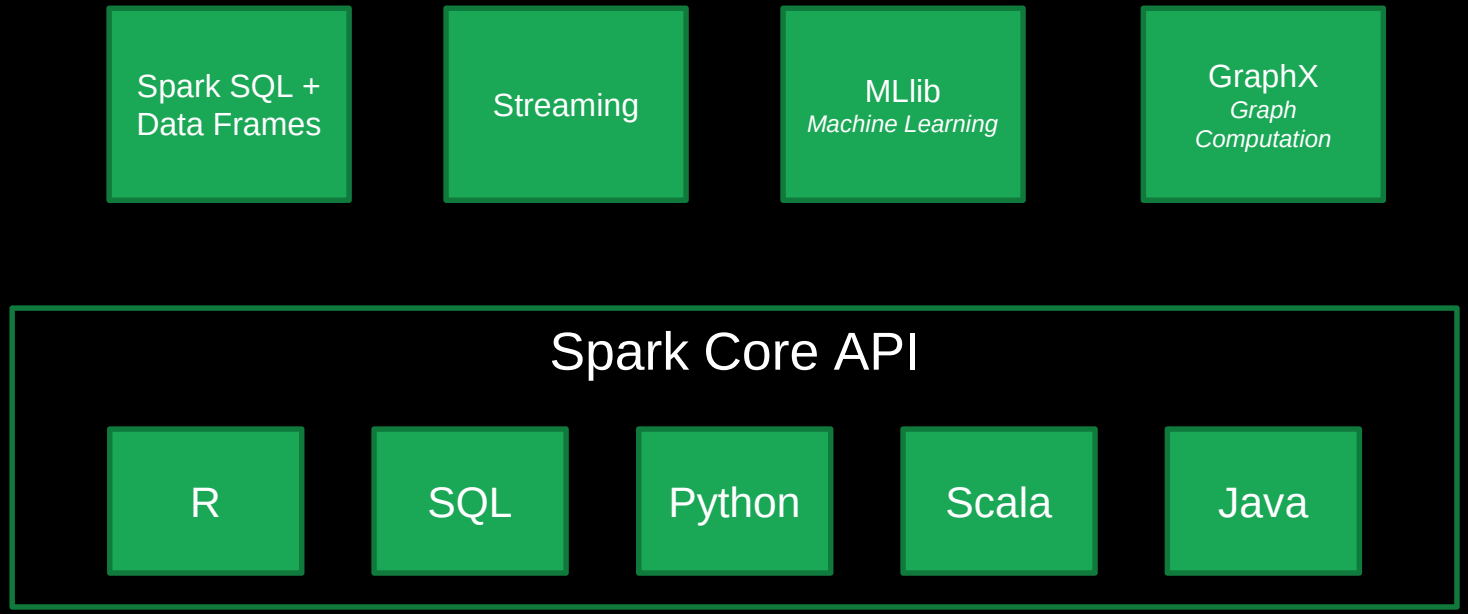
Open source data processing engine built around **speed**, **ease of use**, and **sophisticated analytics**

10-100x faster than MapReduce (Hadoop)	Easier to program Python, SQL, R, Java, Scala	APIs for SQL, machine learning, deep learning, streaming, graph
Storage agnostic, allowing federation & simple data access	More interactive data exploration	1000+ contributors across 250+ companies

Apache Spark Ecosystem



Do you know Databricks?

Databricks makes building big data and AI applications simple, fast, easy, and collaborative with our **Unified Analytics Platform** powered by Apache Spark™ and built for cloud.

Apache Spark™ provides a **single processing engine** for your big data and AI workloads including batch/ETL, streaming, SQL, graph, machine learning and deep learning workloads on petabytes of data on cloud data lakes. The result is higher productivity and faster time to insights and outcomes for your clients.

Databricks' founders are the original creators of Apache Spark™ and we have engineered our **platform as a service** for the cloud to improve elasticity, ease of use, performance, reliability, and cost-effectiveness compared to alternatives.

Get more from Big Data & AI Projects

- Do More -
Higher productivity
without DevOps or cluster administration

- With More Data -
At scale (volume and variety)
with better cost/performance and elasticity

- More Reliably -
Avoid project delays due to bugs/breaks
and simplified data pipelines

- With a Lower TCO -
Lower cloud and personnel costs
and pay only for what you use

- More Secure -
Satisfies industry security requirements
(e.g. GDPR, HIPAA, and PCI)

- Enable AI & ML -
Reach the potential of AI & ML use cases

AI is a Game Changing Opportunity

LOTS OF NEW DATA

Customer Data

Click Streams

Sensor data (IoT)

Video/Speech

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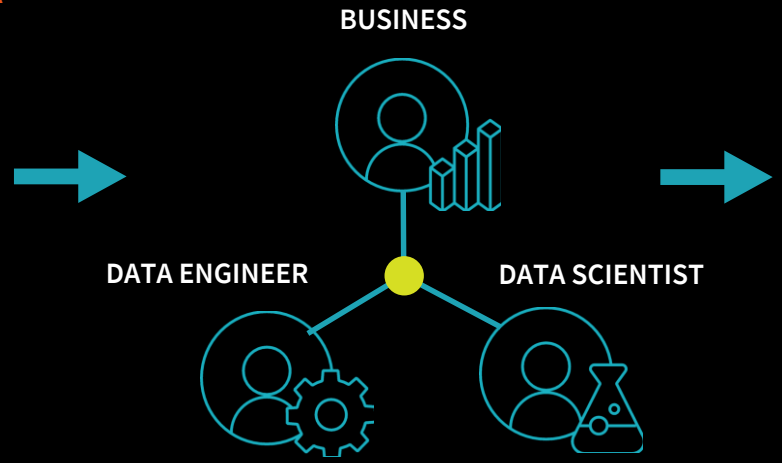

OPPORTUNITY

Fraud Detection

Genome Sequencing

Recommendation Engine

Predictive Maintenance

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Machine Learning Requires
Collaborative Experimentation on Big Data

Hardest Part of AI isn't AI, it's Data

"Hidden Technical Debt in Machine Learning Systems," Google NIPS 2015

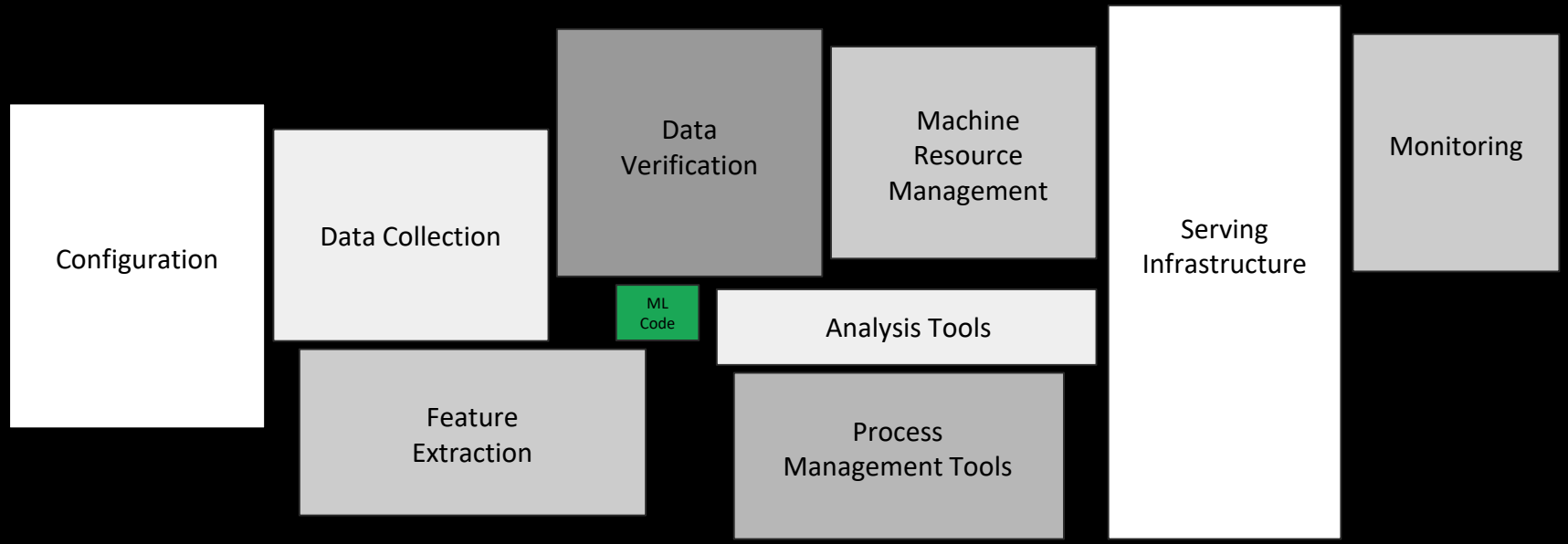

Figure 1: Only a small fraction of real-world ML systems is composed of the ML code, as shown by the small green box in the middle. The required surrounding infrastructure is vast and complex.

Big Data and AI Complexity Slows Innovation

Lack of collaboration reduces data science productivity

Data pipelines produce stale data with poor performance

Multiple analytics engines increase complexity and slows innovation

Manual operations to manage big data infrastructure

Accelerate Innovation with Databricks

Increases Data Science Productivity by 5x

Improves Performance by 10-20X over Vanilla Spark

Removes Devops & Infrastructure Complexity

Unified Analytics Platform

DATABRICKS COLLABORATIVE NOTEBOOKS

Explore Data → Train Models → Serve Models

DATABRICKS RUNTIME

I/O Performance

DATABRICKS DELTA

Performance
Reliability

APACHE Spark

DATABRICKS MANAGED SERVICE

Serverless
SLA's

amazon web services

Azure

Open Extensible API's

tableau looker

Power BI

Higher Performance & Reliability for your Data Lake

Databricks Enterprise Security

IoT / STREAMING DATA

CLOUD STORAGE

DATA WAREHOUSES

HADOOP STORAGE

hadoop

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What is Lambda Architecture

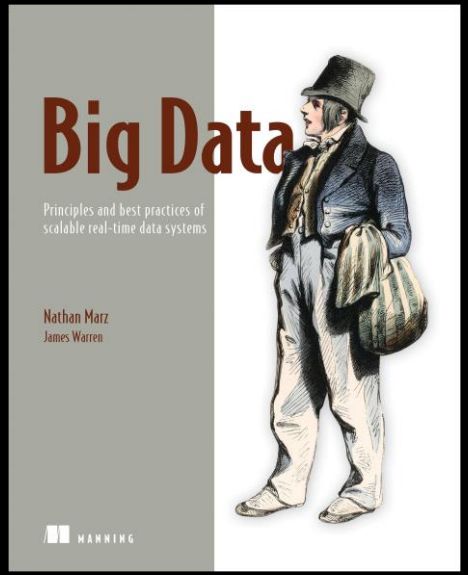
Data processing architecture

Generic, scalable, fault-tolerant

Low-latency reads, updates, ad-hoc queries

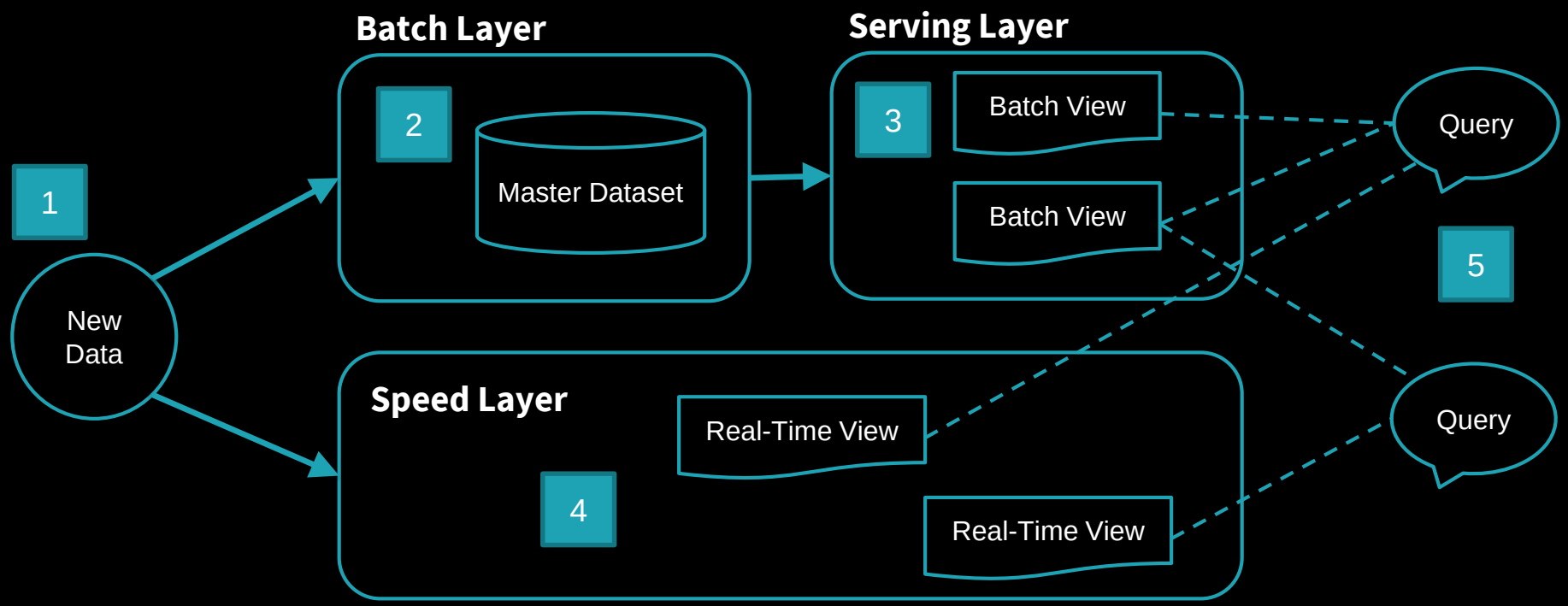
Nathan Marz - Apache Storm @ Twitter

Principles and best practices of scalable real-time data systems



Lambda Architecture

Design Principles



Lambda Architecture

Real World Examples

Fault / Fraud detection

Manufacturing / Machine Logs / Robotics

Network / Security monitoring

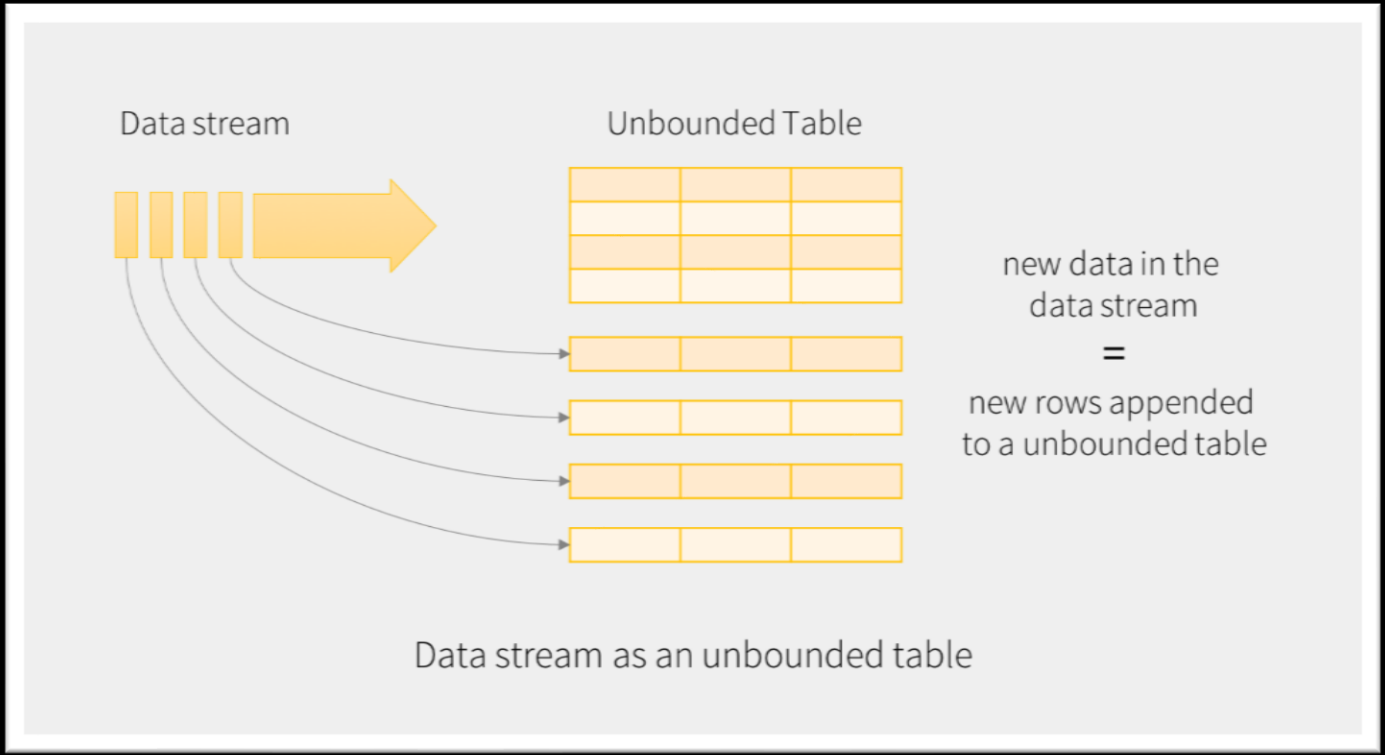
Digital Marketing / Websites Clicks / Telemetry

Portfolio Management / Algorithmic Trading

IOT / Connected devices

Lambda Architecture

Databricks Structured Streaming



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ATM Fraud Detection

Financial Services

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Data

Diverse data e.g.

- Customer Profiles
- ATM Transaction Records
- Geolocation Data
- Branch Data

ETL

High-speed data ingest, integration and processing

Visualizations

Data exploration with visual dashboards

Machine Learning

Model development with decision tree algorithm

Outcome

Reduce fraud by identifying suspicious ATM withdrawal patterns in real-time

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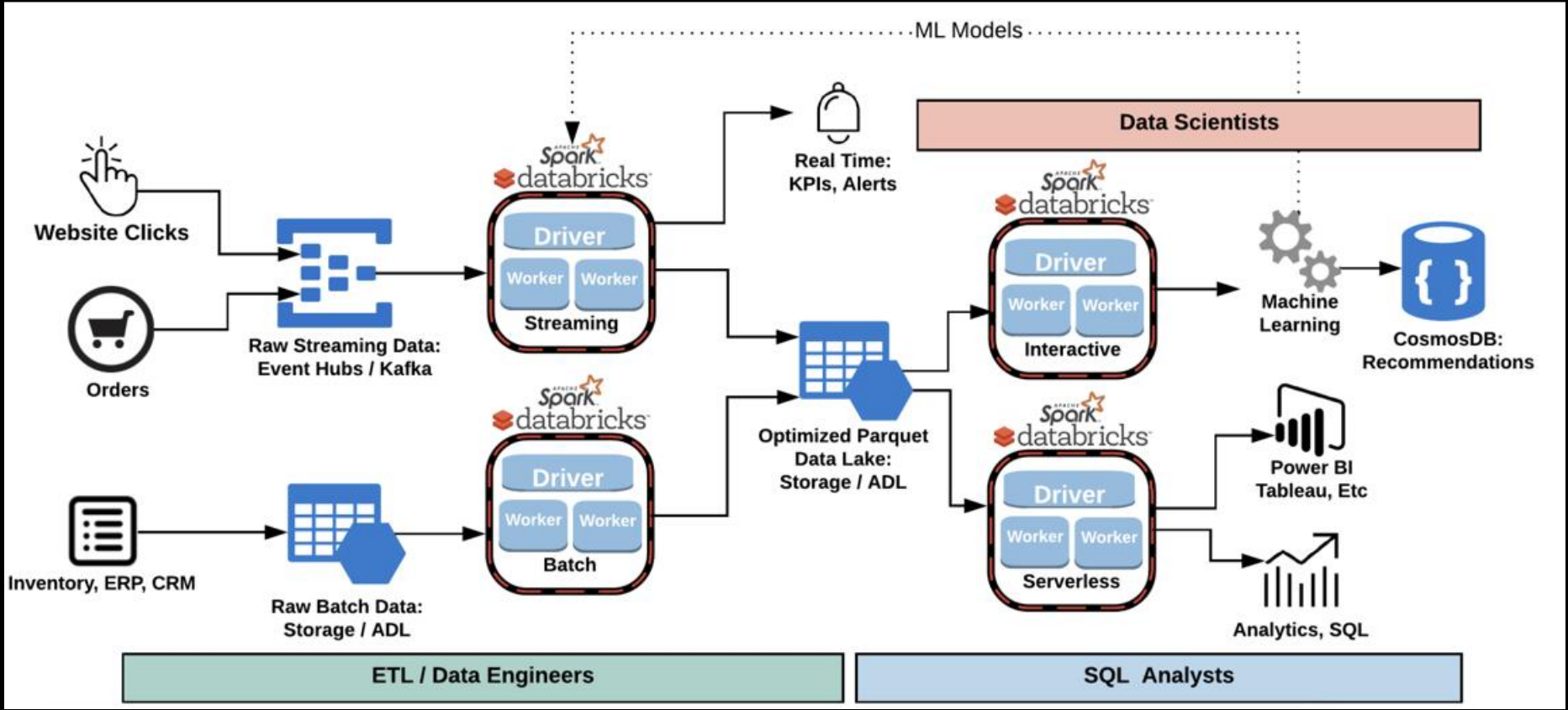
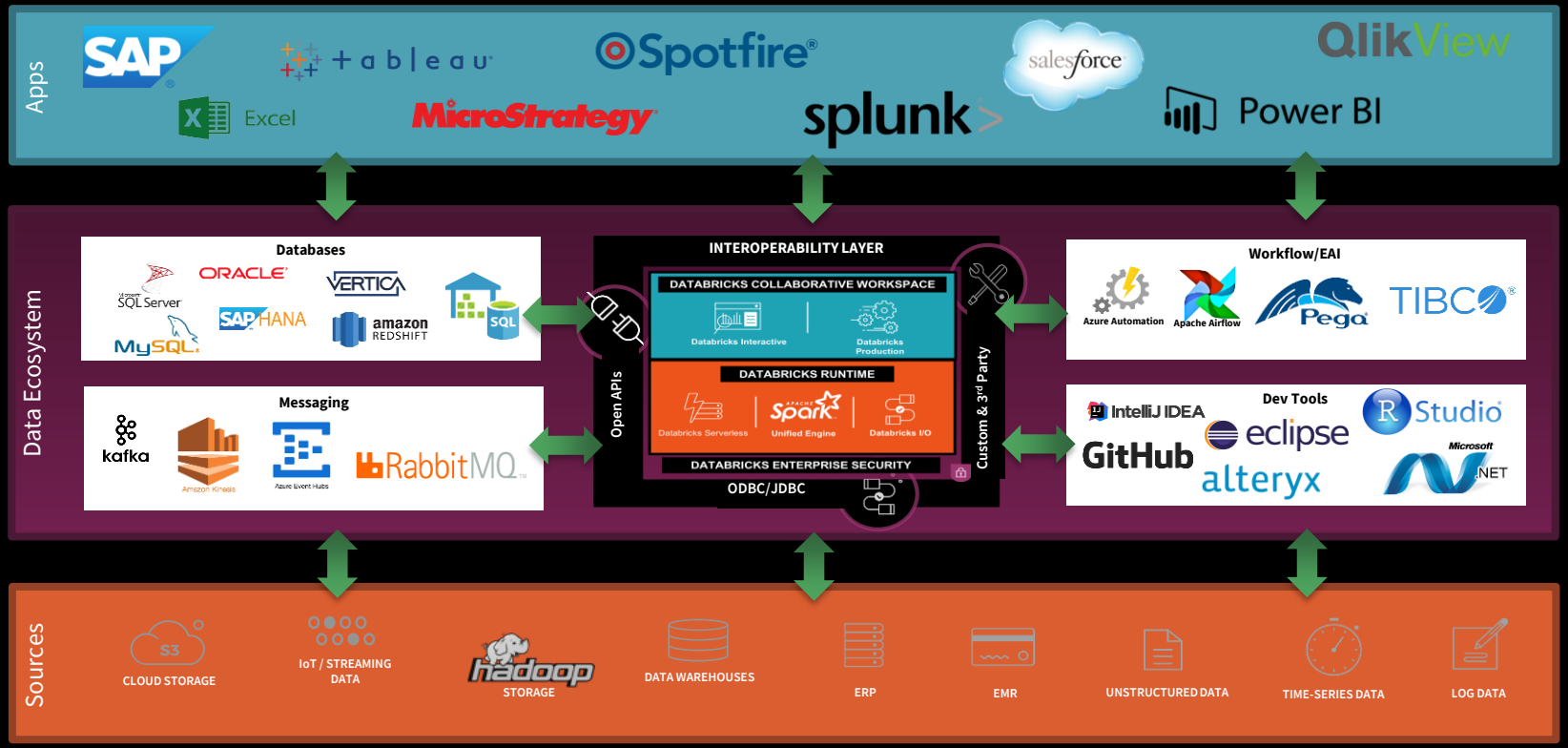
Databricks 101 Architecture



Databricks Ecosystem Reference Architecture



Thank you ! Questions?

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Main Links

https://azure.microsoft.com/en-us/services/databricks/
https://spark.apache.org/
https://databricks.com/
https://databricks.com/spark/about
http://lambda-architecture.net/
http://spark.apache.org/powered-by.html
https://www.businesswire.com/news/home/20190131005243/en/Databricks-Named-Visionary-Consecutive-Year-Gartner-Magic

Databricks Community Edition

https://databricks.com/product/faq/community-edition

Free version of the cloud based platform

Hosted on Amazon Web Services

Uses a micro-cluster of one driver with 6 GB of memory

Contains training resources

Great way to get started learning about Apache Spark

Blogs

https://www.desertislesql.com/ - Ginger Grant

https://databricks.com/blog
https://databricks.com/blog/category/engineering
https://databricks.com/blog/category/company
https://curatedsql.com/?s=spark

Videos

https://databricks.com/resources/type/videos
https://www.youtube.com/user/TheApacheSpark/feed
https://www.youtube.com/channel/UC3q8O3Bh2Le8Rj1-Q-_UUbA
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https://www.youtube.com/watch?v=TJcEP6AX02U
https://databricks.com/sparkaisummit/north-america/sessions
https://databricks.com/session/jaws-data-warehouse-with-spark-sql
https://databricks.com/azure-databricks-demo
https://databricks.com/resources/type/customer-stories

Projects and Papers

https://cs.stanford.edu/~matei/

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https://spark.apache.org/research.html

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Training and Certification

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https://www.edureka.co/blog/spark-tutorial/
https://github.com/midomsft/DatabricksHOL
http://spark.apache.org/docs/latest/building-spark.html
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https://www.coursera.org/specializations/scala
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Other projects

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https://www.microsoft.com/en-us/research/project/dryadlinq/

https://github.com/Microsoft/SmartHotel360-Backend

https://eng.uber.com/uber-big-data-platform/

https://github.com/Microsoft/Mobius

Dayton Gray Sort Record - 2014

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https://spark.apache.org/news/spark-wins-daytona-gray-sort-100tb-benchmark.html

http://sortbenchmark.org/

http://sortbenchmark.org/ApacheSpark2014.pdf

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https://docs.microsoft.com/en-us/azure/architecture/reference-architectures/data/stream-processing-databricks

https://databricks.com/glossary/what-are-continuous-applications

https://docs.microsoft.com/en-us/azure/stream-analytics/stream-analytics-window-functions

https://docs.databricks.com/spark/latest/structured-streaming/index.html

https://databricks.com/blog/2016/07/28/continuous-applications-evolving-streaming-in-apache-spark-2-0.html

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https://databricks.com/blog/2018/05/03/benchmarking-apache-spark-on-a-single-node-machine.html

http://datastrophic.io/core-concepts-architecture-and-internals-of-apache-spark/

https://lenadroid.github.io/posts/connecting-spark-and-eventhubs.html

https://docs.microsoft.com/en-us/azure/machine-learning/team-data-science-process/spark-data-exploration-modeling

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https://docs.microsoft.com/en-us/azure/machine-learning/team-data-science-process/spark-overview

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https://azure.microsoft.com/en-us/blog/azure-databricks-industry-leading-analytics-platform-powered-by-apache-spark/

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https://github.com/giulianorapoz/DatabricksStreamingPowerBI

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https://databricks.com/blog/2016/05/23/apache-spark-as-a-compiler-joining-a-billion-rows-per-second-on-a-laptop.html