Building a Modern Big Data & Advanced Analytics Pipeline

(Ideas for building UDAP)

Tellago

- Emerging technology firm focused on helping enterprises build breakthrough software solutions
- Building software solutions powered by disruptive enterprise software trends

    -Machine learning and data science

    -Cyber-security

    -Enterprise IOT

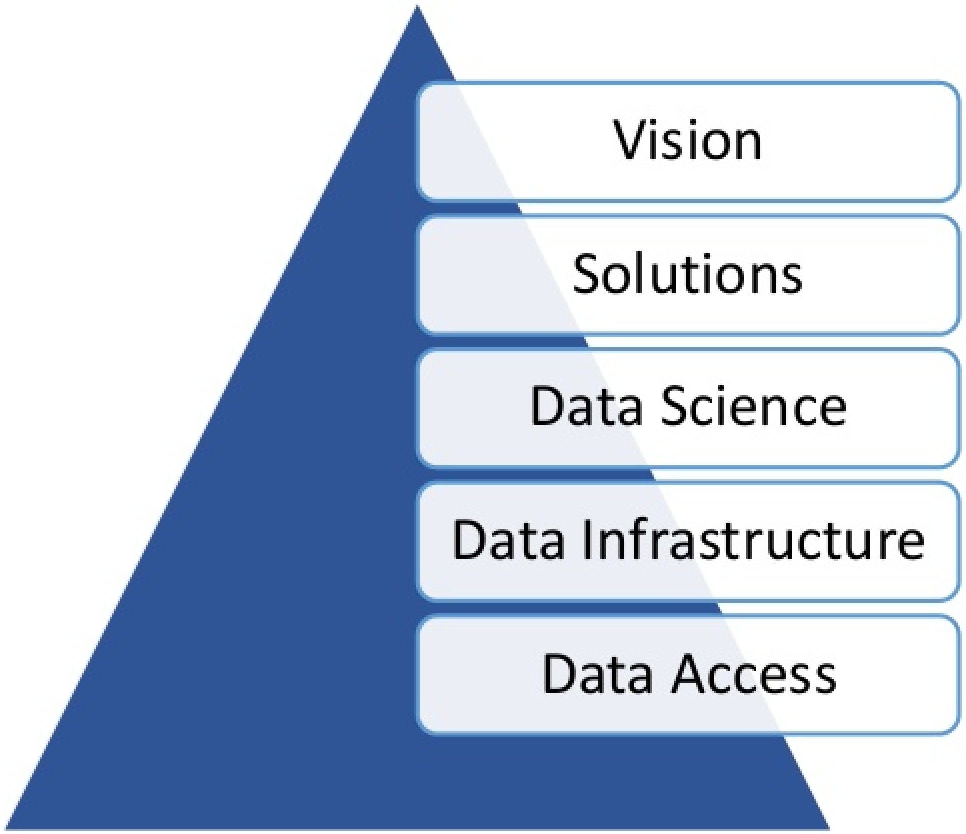
    -Powered by Cloud and Mobile
- Bringing innovation from startups and academic institutions to the enterprise
- Award winning agencies: Inc 500, American Business Awards, International Business Awards

Agenda

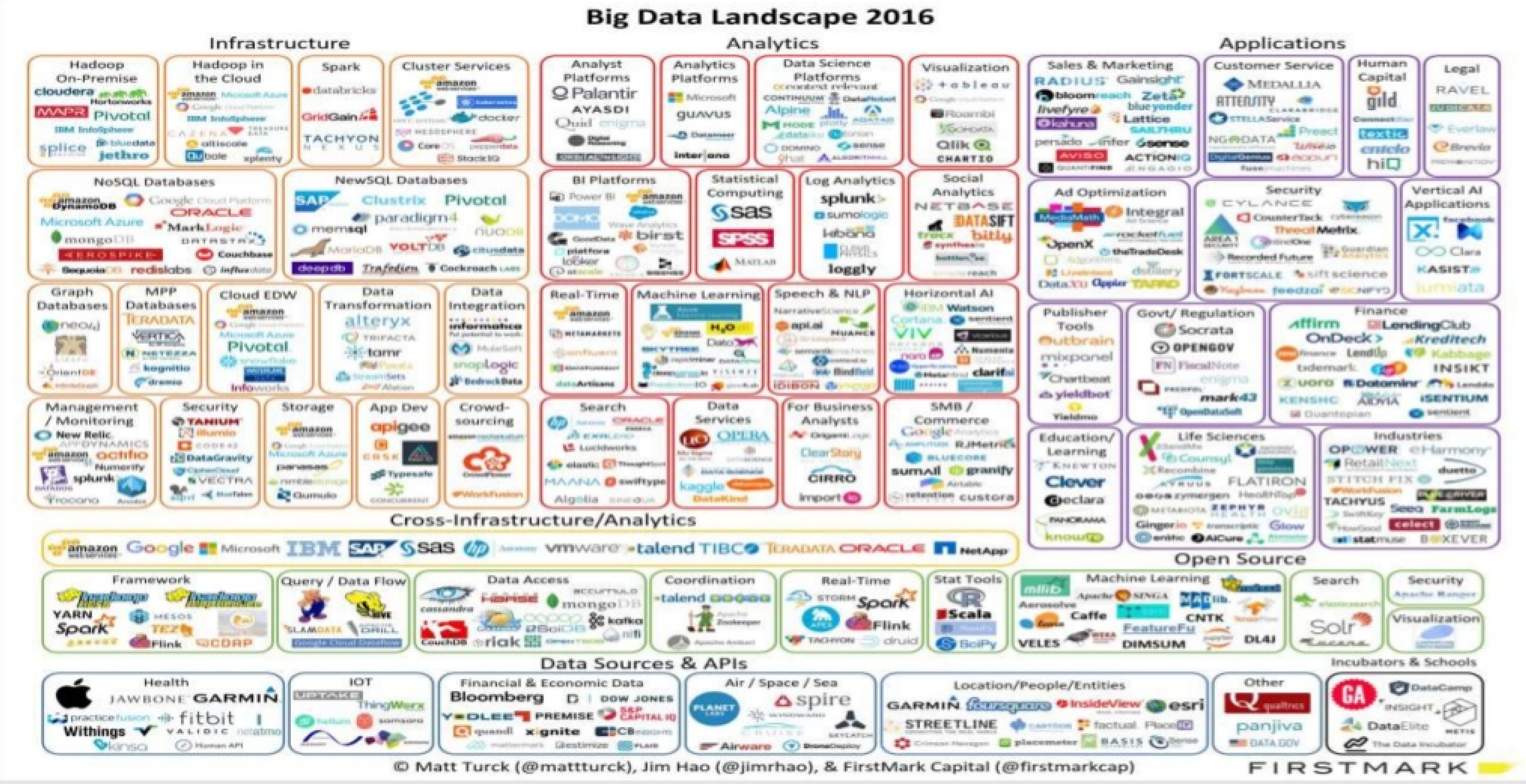
- The principles of big data and advanced analytics pipelines
- Some inspiration
- Capabilities
- Building a big data and advanced analytics pipeline

The principles of an enterprise big data infrastructure

Data Needs


Vision
Solutions
Data Science
Data Infrastructure
Data Access

There are only a few technology choices….


Big Data Landscape 2016
Infrastructure
Analytics
Applications
Hadoop On-Premise
Hadoop in the Cloud
Spark
Cluster Services
Analyst Platforms
Analytics Platforms
Data Science Platforms
Visualization
Sales & Marketing
Customer Service
Human Capital
Legal
NoSQL Databases
NewSQL Databases
BI Platforms
Statistical Computing
Log Analytics
Social Analytics
Ad Optimization
Security
Vertical AI Applications
Graph Databases
MPP Databases
Cloud EDW
Data Transformation
Data Integration
Real-Time
Machine Learning
Speech & NLP
Horizontal AI
Publisher Tools
Govt/ Regulation
Finance
Management / Monitoring
Security
Storage
App Dev
Crowd-sourcing
Search
Data Services
For Business Analysts
SMB / Commerce
Education/ Learning
Life Sciences
Industries
Cross-Infrastructure/Analytics
Open Source
Framework
Query / Data Flow
Data Access
Coordination
Real-Time
Stat Tools
Machine Learning
Search
Security
Visualization
Data Sources & APIs
Incubators & Schools
Health
IOT
Financial & Economic Data
Air / Space / Sea
Location/People/Entities
Other
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Some inspiration….

Netflix

Data Access

Data Fetching: Falcor(https://github.com/Netflix/falcor)

Data Streaming: Apache Kafka (http://kafka.apache.org/)

Federated Job Execution Engine: Genie(https://github.com/Netflix/genie)

Data Infrastructure

Data Lakes: Apache Hadoop (http://hadoop.apache.org/)

Data Compute: Apache Spark

SQL Querying: Presto (https://prestodb.io/)

Data Discovery : Metacat

Data Science

Multidimensional analysis: Druid (http://druid.io/)

Data Visualization: Sting

Machine learning: Scikit-learn(http://scikit-learn.org/stable/)

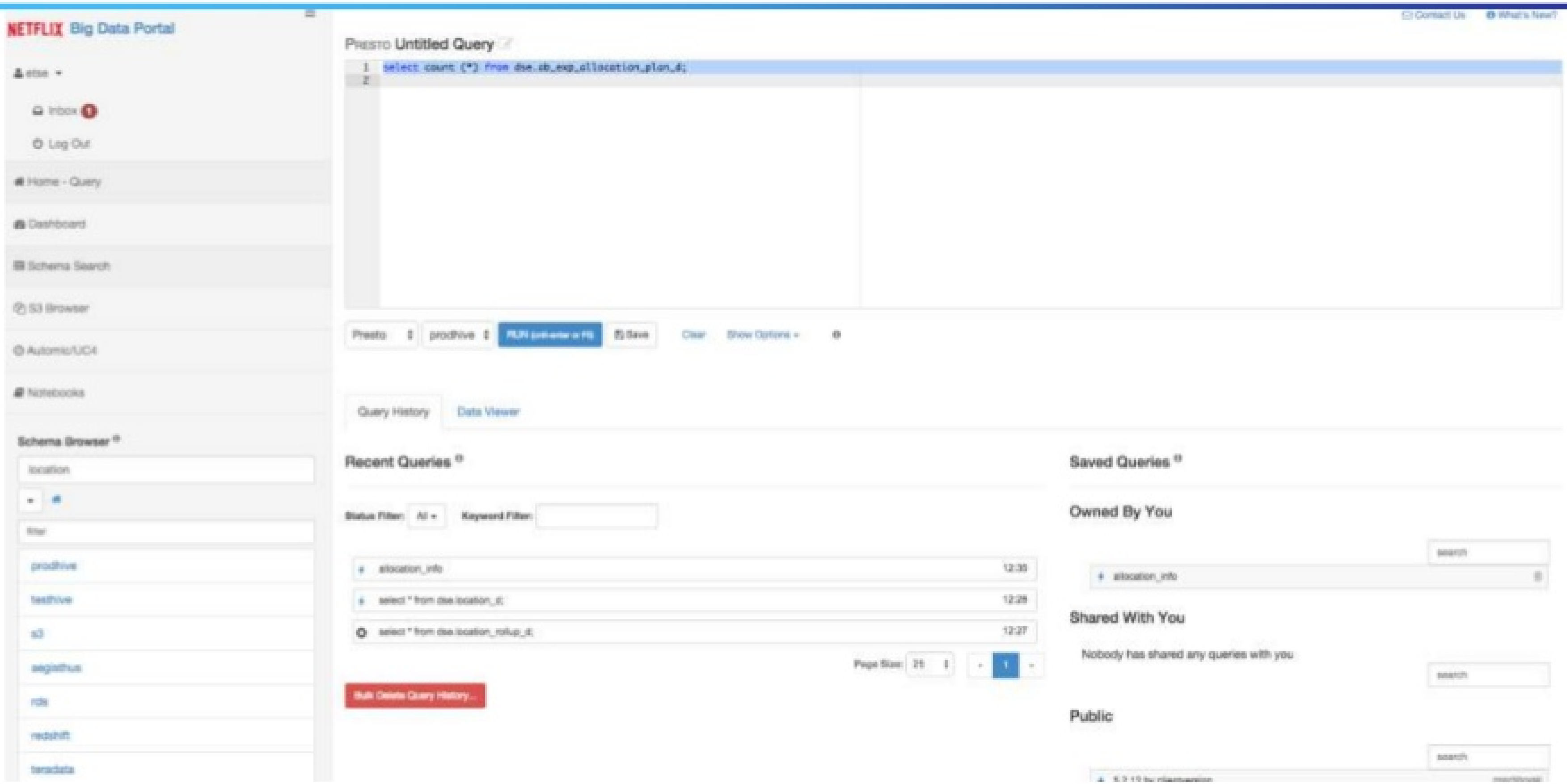
Tools & Solutions

Netflix big data portal

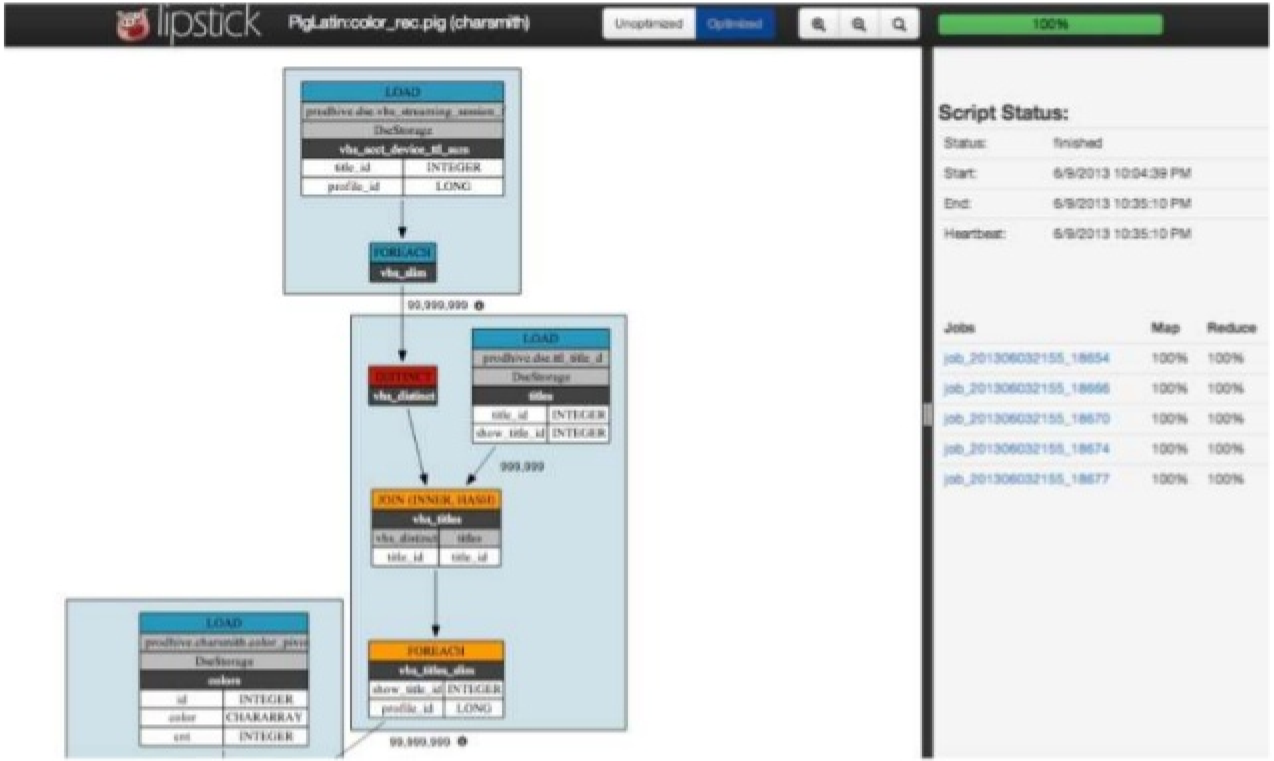
Hadoop Search: Inviso(https://github.com/Netflix/inviso)

Workflow visualization (https://github.com/Netflix/Lipstick)

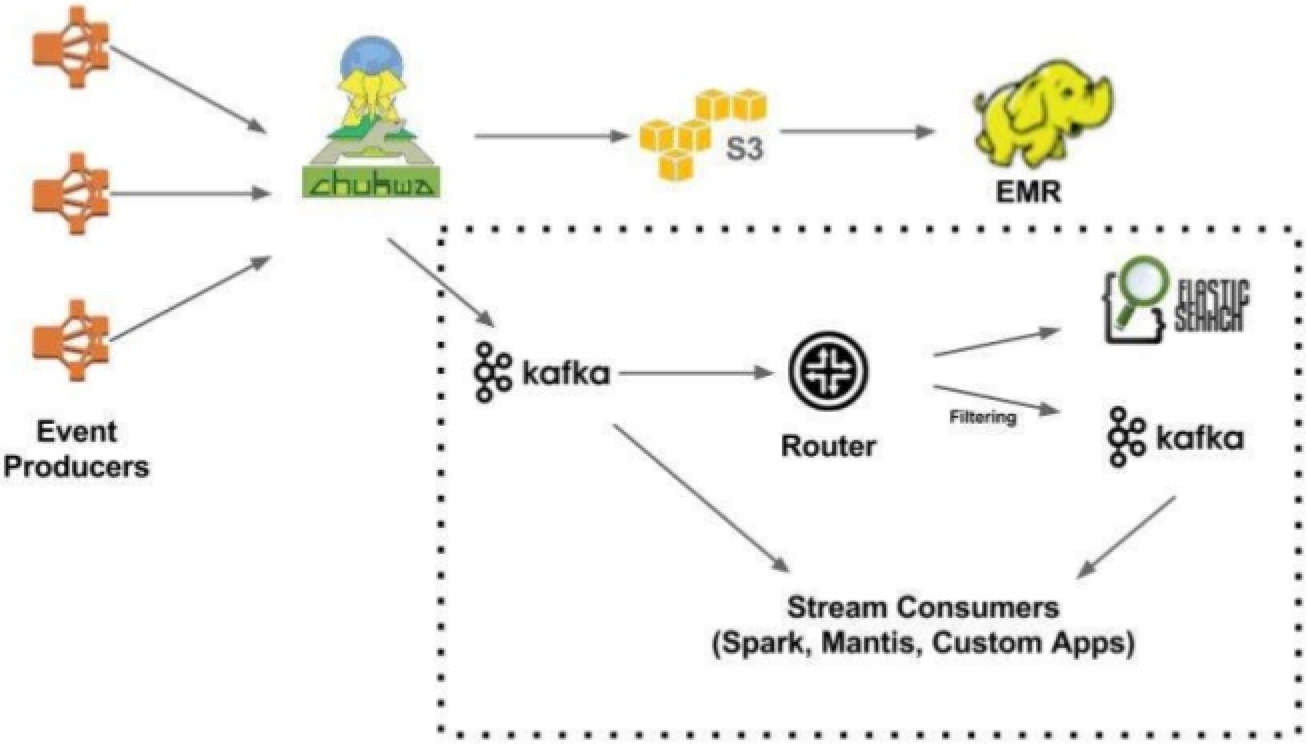
Netflix Big Data Portal



Netflix Lipstick



Netflix Data Pipeline



Spotify

Data Access

Data Fetching: GraphQL(https://facebook.github.io/react/blog/2015/05/01/graphql-introduction.html)

Data Streaming: Apache Kafka (http://kafka.apache.org/)

Data Infrastructure

Data Lakes: Apache Hadoop (http://hadoop.apache.org/)

Data Compute: Apache Spark

SQL Aggregation: Apache Crunch(https://crunch.apache.org/)

Fast Data Access: Apache Cassandra(http://cassandra.apache.org/)

Workflow Manager :Luigi(https://github.com/spotify/luigi)

Data Transformation: Apache Falcon(http://hortonworks.com/hadoop/falcon/)

Data Science

Data Visualization: Sting

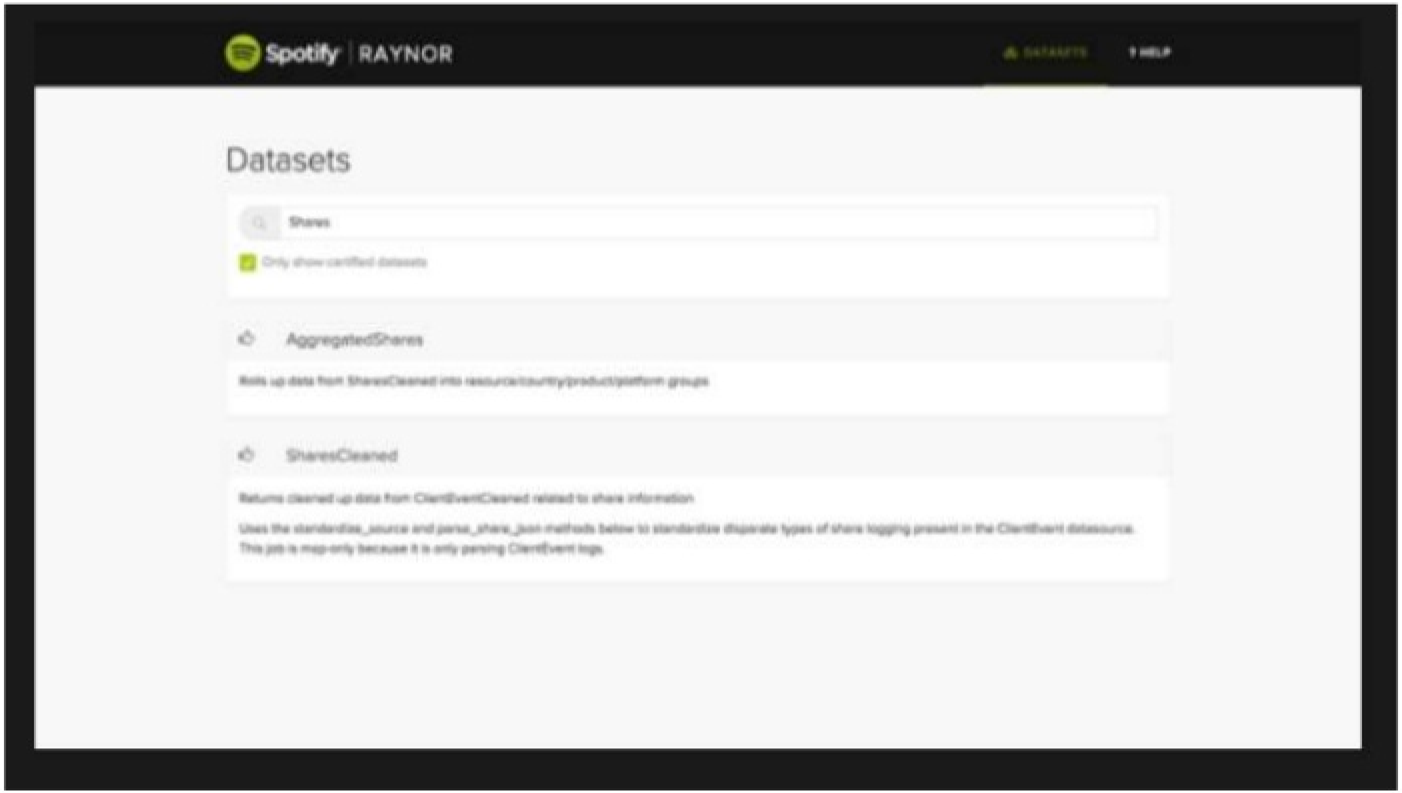
Machine learning: Spark MLib(http://scikit-learn.org/stable/)

Data Discovery: Raynor

Tools & Solutions

Hadoop Search: Inviso(https://github.com/Netflix/inviso)

Raynor



Spotify
RAYNOR
Datasets
Shares
AggregatedShares
Rolls up data from SharesCleaned into resource/country/product/platform groups
SharesCleaned
Returns cleaned up data from ClientEventCleaned related to share information
Uses the standardize_source and parse_share_json methods below to standardize disparate types of share logging present in the ClientEvent datasource.
This job is map-only because it is only parsing ClientEvent logs.

LinkedIn

Data Access

Data Streaming: Apache Kafka (http://kafka.apache.org/)

Data Fetching: GraphQL(https://facebook.github.io/react/blog/2015/05/01/graphql-introduction.html)

Data Infrastructure

Data Lakes: Apache Hadoop (http://hadoop.apache.org/)

Data Compute: Apache Spark(http://www.project-voldemort.com/voldemort/)

Fast Data Access: Voldemort(http://cassandra.apache.org/)

Stream Analytics : Apache Samza(http://samza.apache.org/)

Real Time Search : Zoie (http://javasoze.github.io/zoie/)

Data Science

Multidimensional analysis: Druid (http://druid.io/)

Data Visualization: Sting

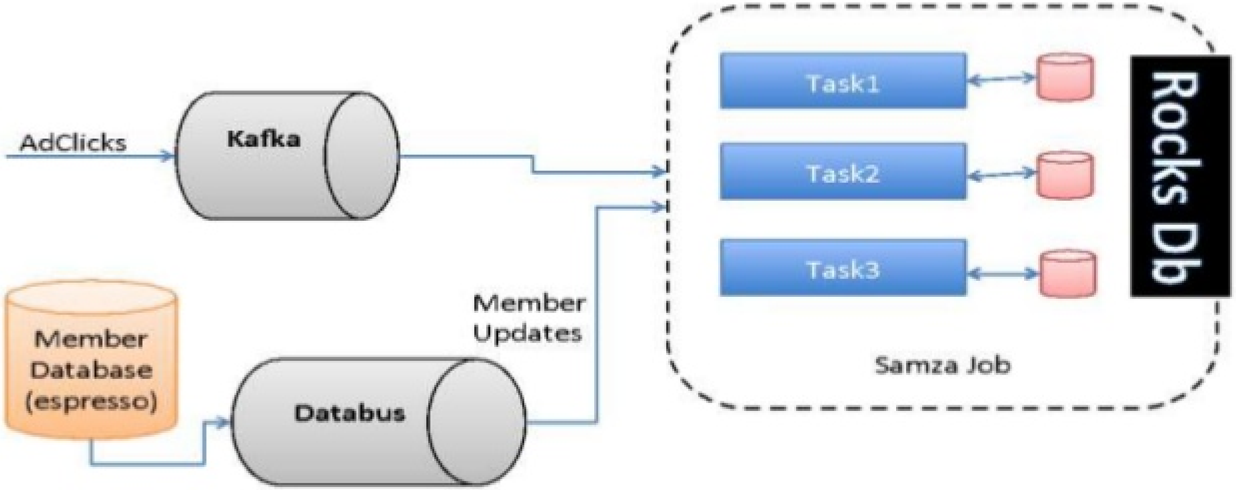
Machine learning: Scikit-learn(http://scikit-learn.org/stable/)

Data Discovery: Raynor

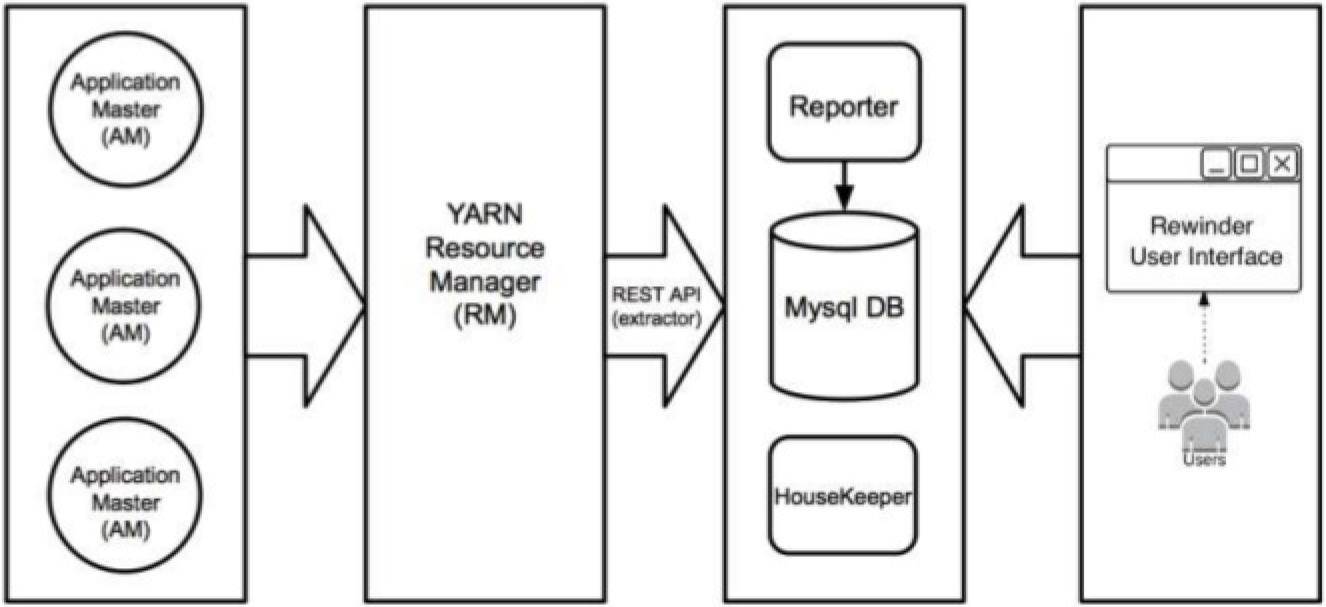
Tools & Solutions

Hadoop Search: Inviso(https://github.com/Netflix/inviso)

LinkedIn Stream Data Processing



LinkedIn Rewinder



Goldman Sachs

Data Access

Data Fetching: GraphQL(https://facebook.github.io/react/blog/2015/05/01/graphql-introduction.html)

Data Streaming: Apache Kafka (http://kafka.apache.org/)

Data Infrastructure

Data Lakes: Apache Hadoop/HBase (http://hadoop.apache.org/)

Data Compute: Apache Spark

Data Transformation: Apache Pig(http://hortonworks.com/hadoop/falcon/)

Stream Analytics: Apache Storm (http://storm.apache.org/)

Data Science

Multidimensional analysis: Druid (http://druid.io/)

Data Visualization: Sting

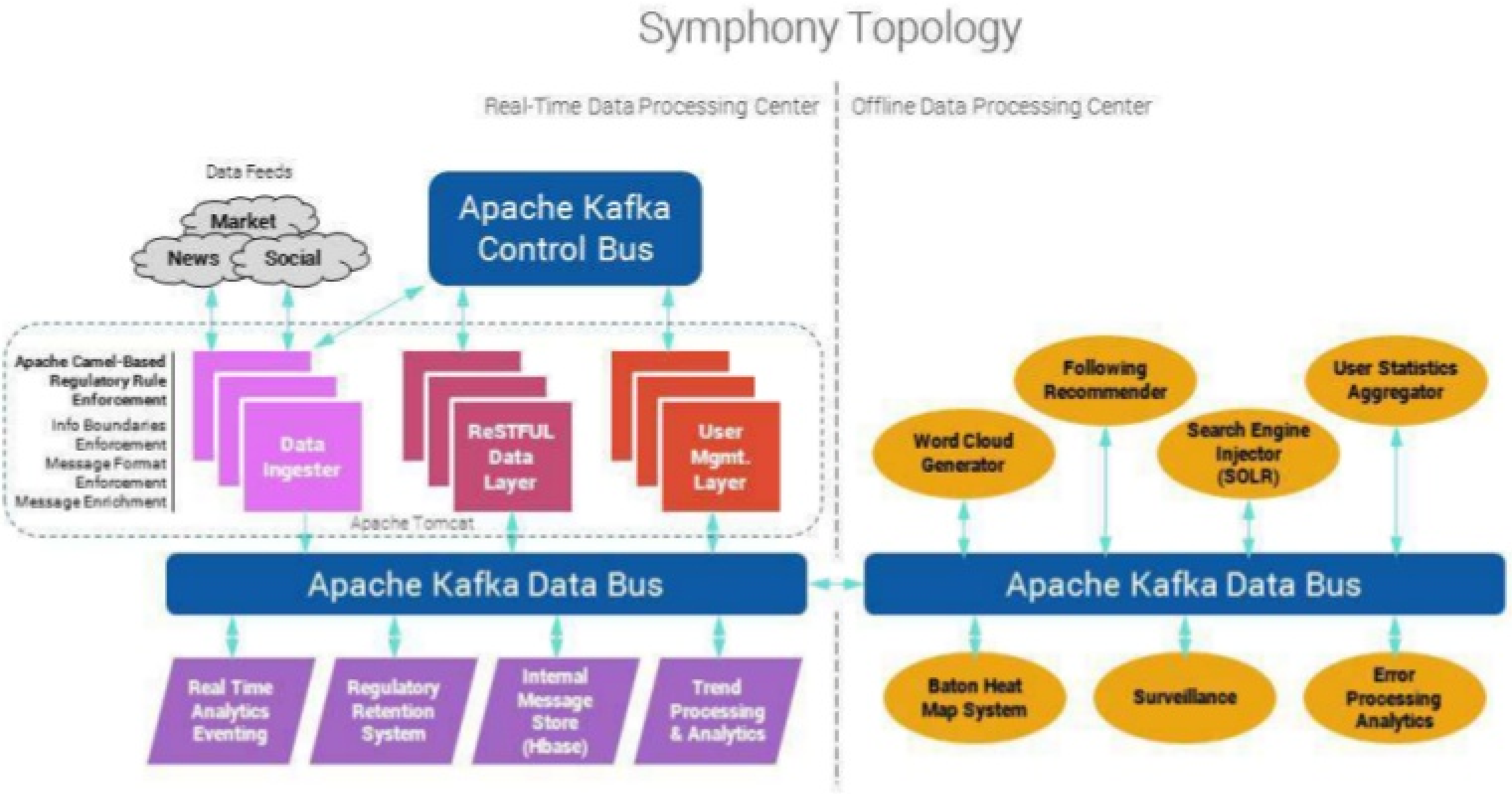
Machine learning: Spark MLib(http://scikit-learn.org/stable/)

Data Discovery: Custom data catalog

Tools & Solutions

Secure data exchange: Symphony (http://www.goldmansachs.com/what-we-do/engineering/see-our-work/inside-symphony.html)

Goldman Sachs Data Exchange Architecture



Capabilities of a big data pipeline

Data Access….

Goals

- Provide the foundation for data collection and data ingestion methods at an enterprise scale
- Support different data collection models in a consistent architecture
- Incorporate and remove data sources without impacting the overall infrastructure

Foundational Capabilities

- On-demand data access
- Batch data access
- Stream data access
- Data transformation

On-Demand Data Access

Best Practices

- Enable standard data access protocols for line of business systems
- Empower client applications with data querying capabilities
- Provide data access infrastructure building blocks such as caching across business data sources

Interesting Technologies

- GraphQL(https://facebook.github.io/react/blog/2015/05/01/graphql-introduction.html)
- Odata(http://odata.org)
- Falcor (http://netflix.github.io/falcor/)

Batch Data Access

Best Practices

- Enable agile ETL models
- Support federated job processing

Interesting Technologies

- Genie(https://github.com/Netflix/genie)
- Luigi(https://github.com/spotify/luigi)
- Apache Pig(https://pig.apache.org/)

Stream Data Access

Best Practices

- Enable streaming data from line of business systems
- Provide the infrastructure to incorporate new data sources such as sensors, web streams etc
- Provide a consistent model for data integration between line of business systems

Interesting Technologies

- Apache Kafka(http://kafka.apache.org/)
- RabbitMQ(https://www.rabbitmq.com/)
- ZeroMQ(http://zeromq.org/)
- Many others....

Data Virtualization

Best Practices

- Enable federated aggregation of disparate data sources
- Focus on small data sources
- Enable standard protocols to access the federated data sources

Interesting Technologies

- Denodo(http://www.denodo.com/en)
- JBoss Data Virtualization(http://www.jboss.org/products/datavirt/overview/)

Data Infrastructure….

Goals

- Store heterogeneous business data at scale
- Provide consistent models to aggregate and compose data sources from different data sources
- Manage and curate business data sources
- Discover and consume data available in your organization

Foundational Capabilities

- Data lakes
- Data quality
- Data discovery
- Data transformation

Data Lakes

Best Practices

- Focus on complementing and expanding our data warehouse capabilities
- Optimize the data lake to incorporate heterogeneous data sources
- Support multiple data ingestion models
- Consider a hybrid cloud strategy (pilot vs. production)

Interesting Technologies

- Hadoop(http://hadoop.apache.org/)
- Hive(https://hive.apache.org/)
- Hbase(https://hbase.apache.org/)
- Spark(http://spark.apache.org/)
- Greenplum(http://greenplum.org/)
- Many others….

Data Quality

Best Practices

- Avoid traditional data quality methodologies
- Leverage machine learning to streamline data quality rules
- Leverage modern data quality platforms
- Crowsourced vs. centralized data quality models

Interesting Technologies

- Trifacta(http://trifacta.com)
- Tamr(http://tamr.com)
- Alation(https://alation.com/)
- Paxata(http://www.paxata.com/)

Data Discovery

Best Practices

- Master management solutions don't work with modern data sources
- Promote crow-sourced vs. centralized data publishing
- Focus on user experience
- Consider build vs. buy options

Interesting Technologies

- Tamr(http://tamr.com)
- Custom solutions…
- Spotify Raynor
- Netflix big data portal

Data Transformations

Best Practices

- Enable programmable ETLs
- Support data transformations for both batch and real time data sources
- Agility over robustness

Interesting Technologies

- Apache Pig(https://pig.apache.org/)
- Streamsets(https://streamsets.com/)
- Apache Spark (http://spark.apache.org/)

Data Science….

Goals

- Discover insights of business data sources
- Integrate machine learning capabilities as part of the enterprise data pipeline
- Provide the foundation for predictive analytic capabilities across the enterprise
- Enable programmatic execution of machine learning models

Foundational Capabilities

- Data visualization & self-service BI
- Predictive analytics
- Stream analytics
- Proactive analytics

Data Visualization and Self-Service BI

Best Practices

- Access business data sources from mainstream data visualization tools like Excel , Tableau, QlickView, Datameer, etc.
- Publish data visualizations so that they can be discovered by other information workers
- Embed visualization as part of existing line of business solutions

Interesting Technologies

- Tableau(http://www.tableau.com/)
- PowerBI(https://powerbi.microsoft.com/en-us/)
- Datameer(http://www.datameer.com/)
- QlikView(http://www.qlik.com/)
- Visualization libraries
- ....

Predictive Analytics

Best Practices

- Implement the tools and frameworks to author machine learning models using business data sources
- Expose predictive models via programmable APIs
- Provide the infrastructure to test, train and evaluate machine learning models

Interesting Technologies

- Spark Mlib(http://spark.apache.org/docs/latest/mllib-guide.html)
- Scikit-Learn(http://scikit-learn.org/)
- Dato(https://dato.com/)
- H2o.ai(http://www.h2o.ai/)
- ....

Stream Analytics

Best Practices

- Aggregate data real time from diverse data sources
- Model static queries over dynamic streams of data
- Create simulations and replays of real data streams

Interesting Technologies

- Apache Storm(http://storm.apache.org/)
- Spark Streaming (http://spark.apache.org/streaming/)
- Apache Samza(http://samza.apache.org/)
- ....

Proactive Analytics

Best Practices

- Automate actions based on the output of predictive models
- Use programmatic models to script proactive analytics business rules
- Continuously test and validate proactive rules

Interesting Technologies

- Spark Mlib(http://spark.apache.org/docs/latest/mllib-guide.html)
- Scikit-Learn(http://scikit-learn.org/)

Solutions….

Enterprise Data Solutions

- Leverage a consistent data pipeline as part of all solutions
- Empower different teams to contribute to different aspects of the big data pipeline
- Keep track of key metrics about the big data pipeline such as time to deliver solutions, data volume over time, data quality metrics, etc

Some Examples

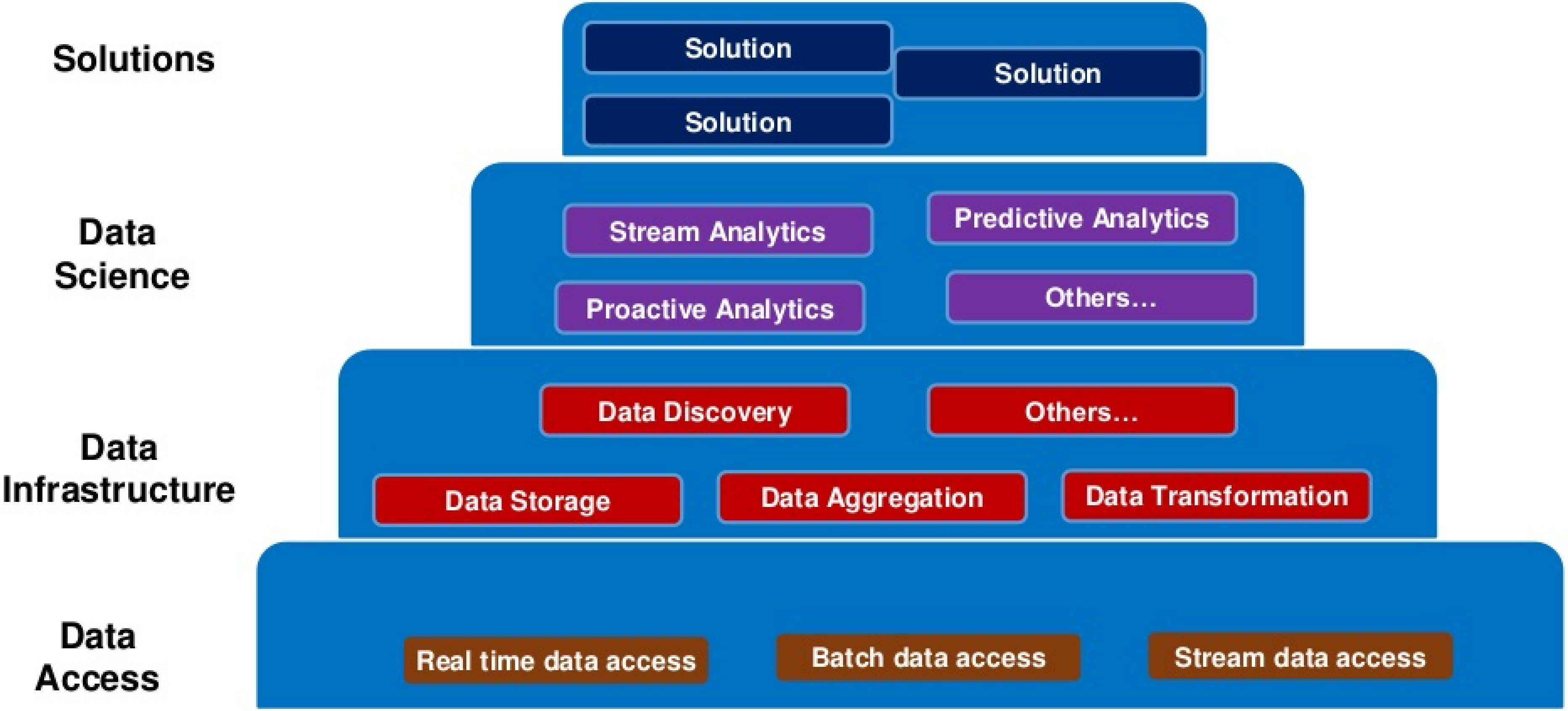
- Data discovery
- Data quality
- Data testing tools
- ...

Other Interesting Capabilities

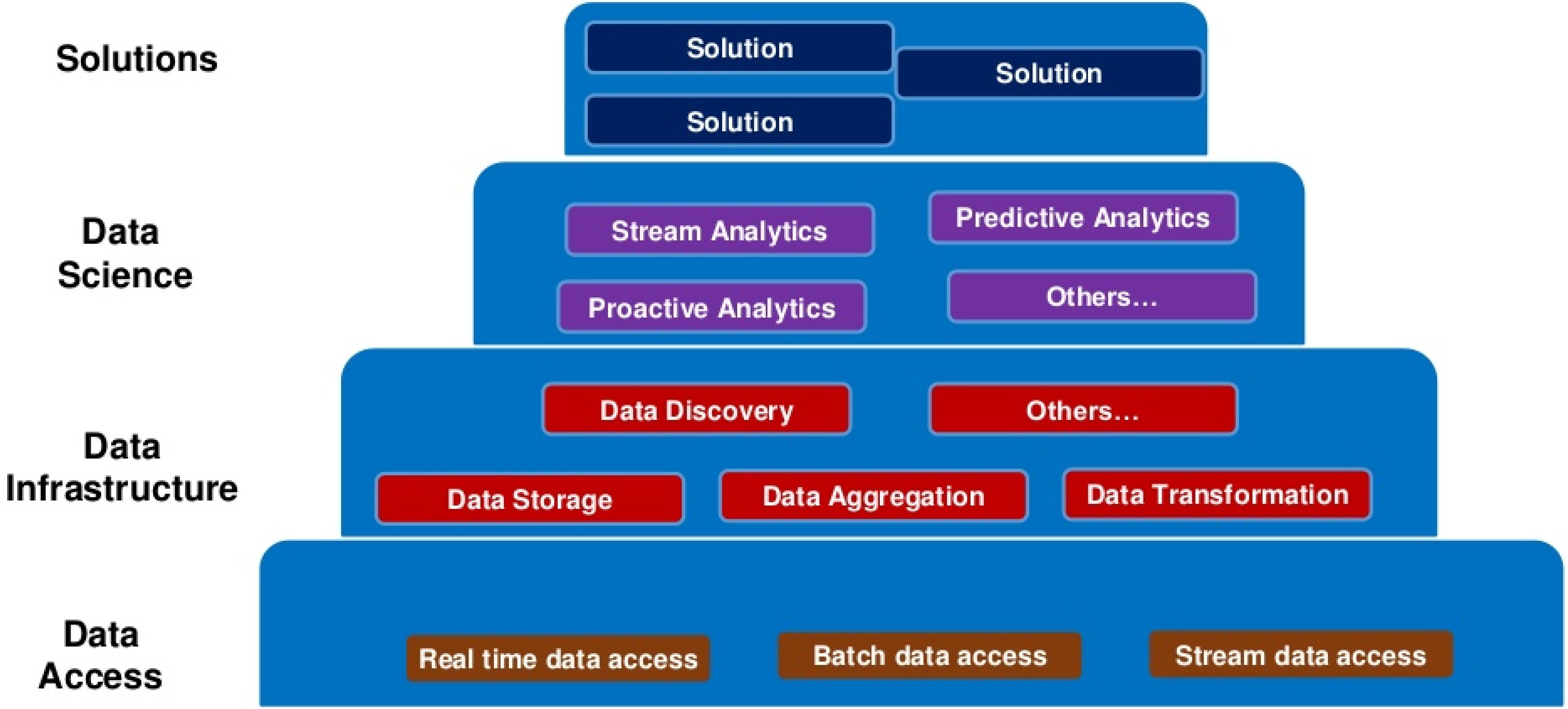
- Mobile analytics
- Embedded analytics capabilities (ex: Salesforce Wave, Workday)
- Aggregation with external sources
- Video & image analytics
- Deep learning
- ....

Building a big data and advanced analytics pipeline

Infrastructure-Driven



Domain-Driven



Infrastructure-Drives vs. Domain-Driven Approaches

Infrastructure-Driven

- Lead by the architecture team
- Military discipline
- Commitment from business stakeholders

Domain-Driven

- Federated data teams
- Rapid releases
- Pervasive communications

Some General Rules

- Establish a vision across all levels of the data pipeline
- You can't buy everything…Is likely you will build custom data infrastructure building blocks
- Deliver infrastructure and functional capabilities incrementally
- Establish a data innovation group responsible for piloting infrastructure capabilities ahead of production schedules
- Encourage adoption even in early stages
- Iterate

Summary

- Big data and advanced analytics pipelines are based on 4 fundamental elements: data access, data infrastructure, data science, data solutions….
- A lot of inspiration can be learned from the big data solutions built by lead internet vendors
- Establish a common vision and mission
- Start small….iterate….

Thanks

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