



Innovation for Data and Analytics Trends





WILEY  TIMELY. PRACTICAL. RELIABLE.

The Data Warehouse ETL Toolkit

Practical Techniques
for Extracting,
Cleaning,
Conforming, and
Delivering Data

Ralph Kimball
Joe Caserta



Best Seller
amazon.com

Best Practices and Standards for:

- Collecting and Understanding Requirements
- Planning and Data Design Standards
- Building the Logical Data Map
- Integrating Heterogeneous Data Sources
- Cleaning and Conforming Data
- Data Quality Screens and Their Measurements
- Delivering Dimensions and Facts
- Handling Late Arriving Data
- Metadata Standards and Practices
- Managing, Planning and Leadership
- Implementation and Operations
- Handling Streaming Data



WE PUT YOUR DATA TO WORK

Caserta solves our clients' toughest data and analytics challenges through unrivaled talent and innovation.





Transformative Strategic Consulting



Management
Consulting

Digital
Transformation

Change
Management



Advanced Technical Architecture

A screenshot of a Jupyter Notebook titled "PySpark Sample Notebook". The code in the notebook is as follows:

```
In [5]: import databricks
import databricks.spark as dbutils
import pyspark
from pyspark.sql import SQLContext

In [6]: # Load PySpark
sc = pyspark.SparkContext()
sqlContext = SQLContext(sc)

In [8]: # Examples: Read the description of a Databricks dataset
mydataset = databricks.Dataset('mydataset')
# And read it as a Spark dataframe
df = sqlContext.read_dataFrame(sqlContext, mydataset)

In [9]: # Examples: Get the count of records in the dataframe
df.count()
```



Cloud
Engineering

Data
Engineering

Process
Engineering



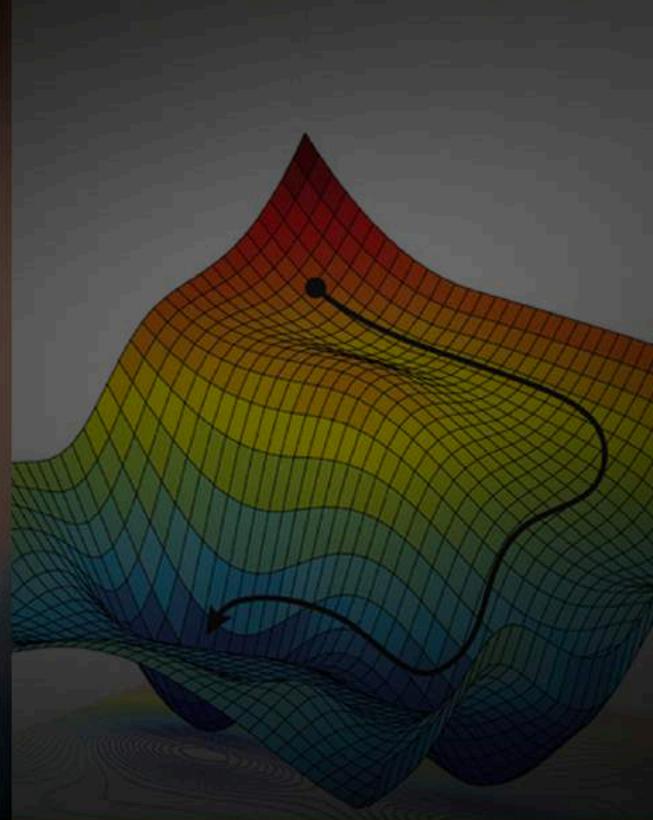
Implement, Build, Deploy



Business Intelligence

Data Intelligence

Artificial Intelligence





Diverse Domain Expertise

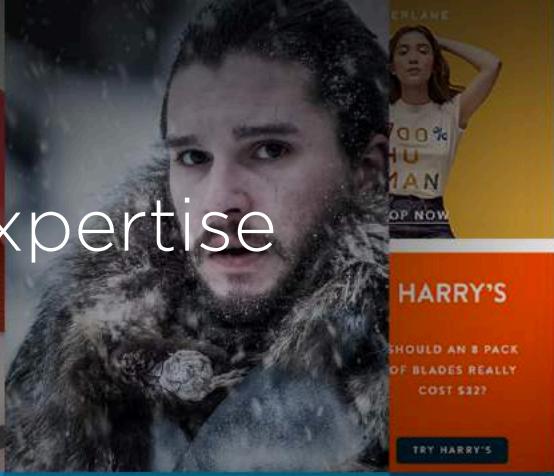
Government



Insurance



Media



Finance



Retail



e-Commerce



Healthcare



Energy



Higher-Ed

Our Clients

Finance, Healthcare
& Insurance

S&P Global



CPP
INVESTMENT
BOARD



MUNICH
HEALTH



NFP
Benefits
Insurance
Wealth Management

Bank of America
Merrill Lynch



AMERICANSECURITIES



EVERCORE
UBS



DE Shaw & Co

Digital Media/AdTech
Education & Services



West Virginia
NETWORK
Enhancing Education through Technology

HBO

SIMUL MEDIA®
people ads want

WorldNow
GROWING LOCAL MEDIA

ALTERRA
MOUNTAIN COMPANY

The
New York
Times

AARP®
Real Possibilities



NEW YORK STATE

CABLEVISION

McKinsey&Company



Metro-North
Railroad



SOULCYCLE
www.soul-cycle.com



Retail/eCommerce
& Manufacturing



COTY

priceline.com
Name Your Own Price™



QVC
QUALITY. VALUE.
CONVENIENCE.



YAMAHA



Saks
Fifth Avenue

PBG
THE PEPSI BOTTLING GROUP



MakerBot

Wegmans

GENERAL MILLS

Our Partners



Google Cloud Platform



Microsoft Azure



Why is Data So Important?



Printing Press
1500s



Penny Post
1840s



Telegraph
1850s



Rural Free Post
1850s



Telephone
1890s



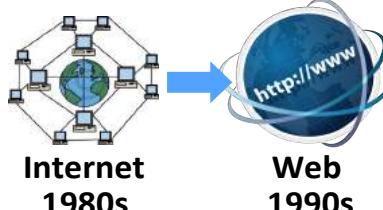
Radio
1900s



TV
1950s



PCs
1970s



Internet
1980s

Web
1990s

Every 60 Seconds



98,000+ Tweets



695,000 Status Updates



11 Million instant messages



698,445 Google Searches



168 million+ emails sent



1,829 TB of data created



217 new mobile web users

**Social Media, Mobile, Big Data, Cloud
2000s**

Chief Data Officer and Chief Digital Officer

Chief Data Officer

- Evangelize a data vision for the organization
- Provide accountability for data
- Innovate ways to use existing data
- Enrich and augment data
- Support & enforce data governance & security
- Monitor and enforce data quality
- Set standards for analytical reporting and generate data insights



Chief Digital Officer

- Digital strategy and Innovation
- Challenge and cannibalize core business
- Digital marketing and customer engagement
- Digital user experience design
- Customer-centric service innovation
- All mobility solutions, data management and analytics
- Sets standards, own data and analytics platform

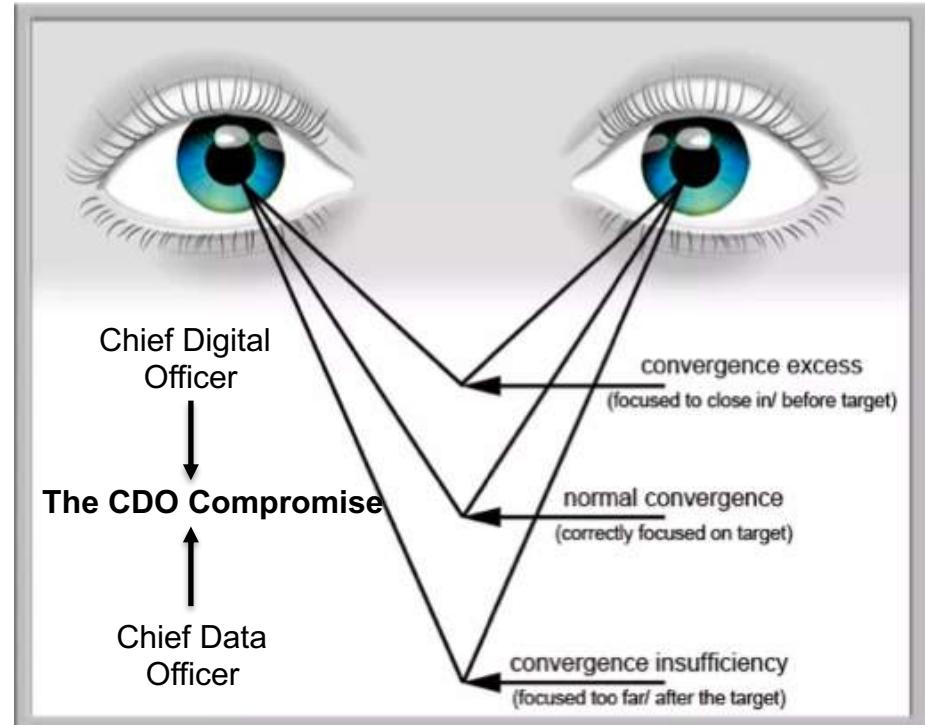
The CDO/CDO Compromise

Digital Focus

- Time to Market
- Company Relevance
- Customer Advocate
- Generate Revenue

Data Focus

- Standards
- Governance
- Stability
- Reusability
- Generate Revenue



140

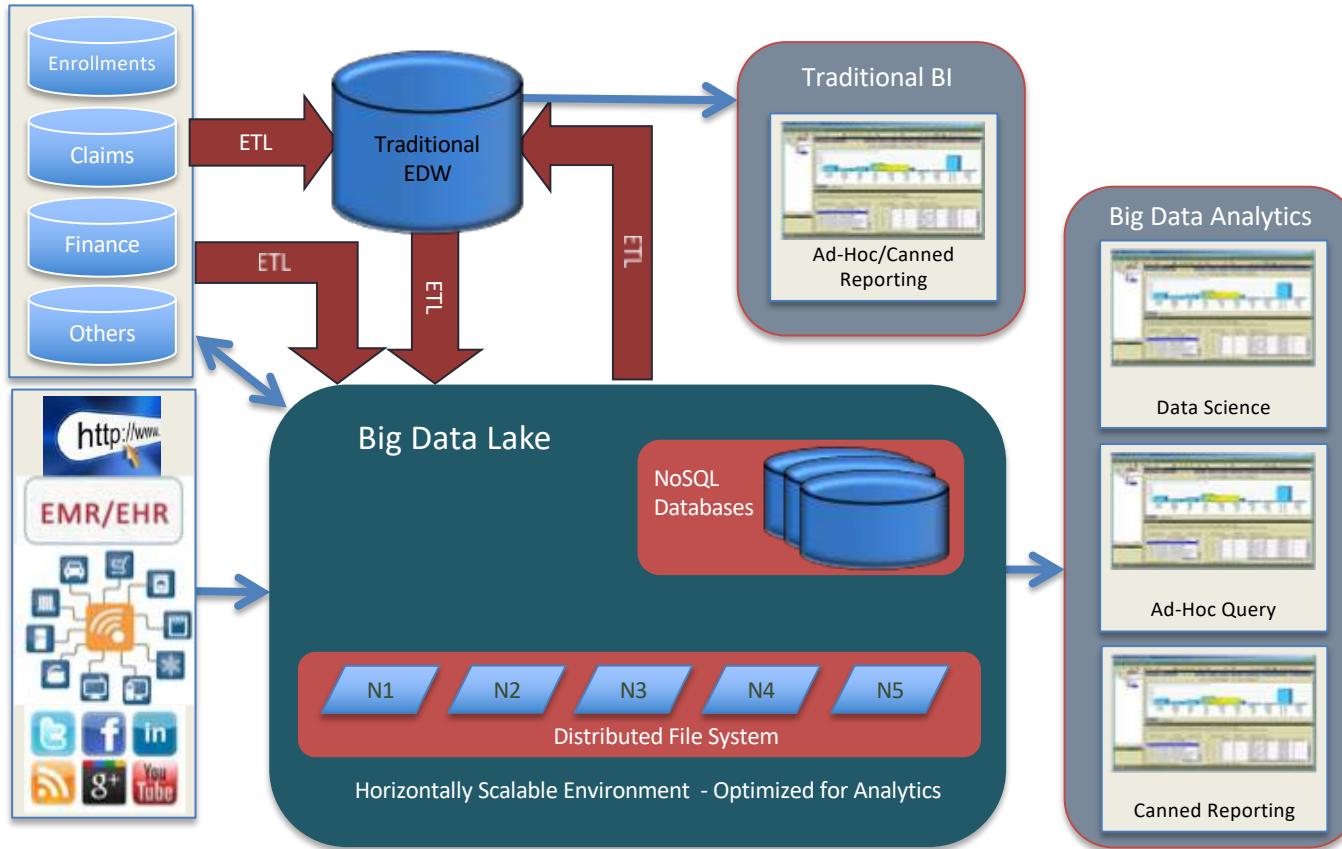


HEART RATE

Innovations may fail, but organizations that don't
innovate will fail



The Evolution of Modern Data Engineering



What is This New Data?

- ❖ Alternative data sets are information about a particular company that is published by sources outside of the company
- ❖ An alternative data set can be compiled from various sources such as sensors, mobile devices, satellites, public records, and the internet.
- ❖ In addition to public websites, companies are collecting and crunching data generated by credit card transactions, images of parking lots, customers reviews, etc.

24 Categories of Alternative Data



Why We Care...

..."because instead of supplying a human trader with tips about breaking news, technology sweeps up data from 300 million websites, 150 million Twitter feeds, as well as analyst presentations and FactSet reports for traders—either humans or algorithms—to analyze. It uses natural-language processing to find keywords like company names, and measures when a story is rising up the media food chain, such as from blogs to newswires, to indicate that it may be important enough to act on."

- John Detrixhe, Future of Finance Reporter, Quartz

Alternative Data Facts

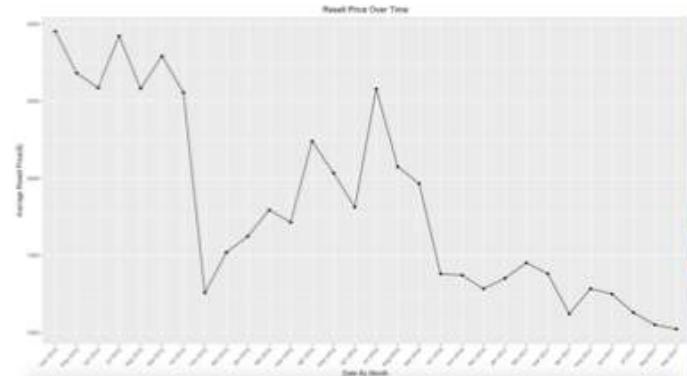
- Analytics can save traditional money managers time by sifting through news and data on their behalf
- Getting as much data as possible into machines running algorithms is becoming common practice
- News and data companies like Bloomberg and Thomson Reuters now include alternative data in their offerings
- About 75% of financial companies already use social media and social-driven news feeds to inform investing decisions

Use Case #1 - Jet Tracking

- ❖ Monitor where portfolio company's private jets are flying and meeting other jets
- ❖ Monitor the change in flying patterns between different companies and/or airports
- ❖ Send alerts to the analysts when something different or unusual is discovered
 - ❖ Cisco flights to Carlsbad, CA, home of semiconductor company Luxtera
 - ❖ Oct 2018 Cisco announced plans to buy Luxtera for \$660 million
 - ❖ Executives from HCA Health, the largest hospital operator in the U.S. tracked flying to Mission HQ in Asheville, NC eight times since May.
 - ❖ August: HCA Health, is buying non-profit company Mission Health for \$1.5B.

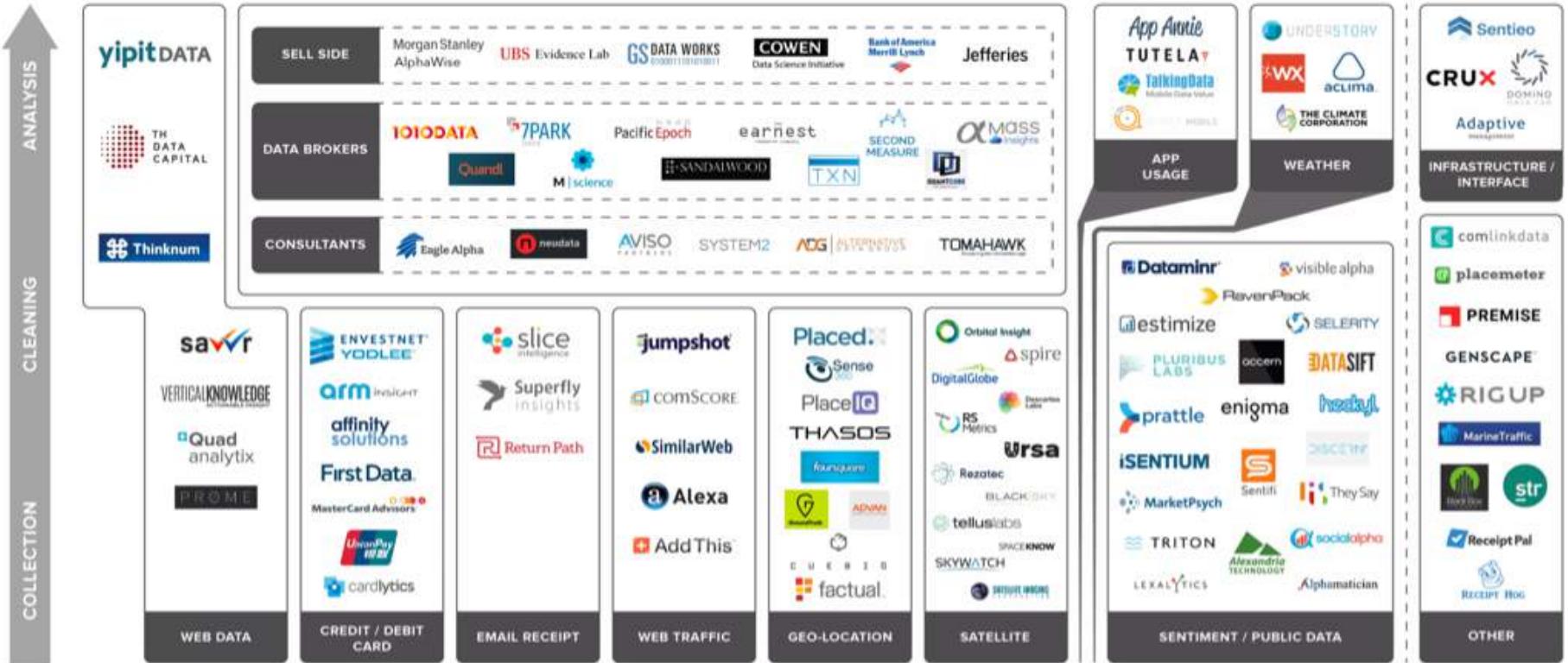
Use Case #2 – Price Scraping

- icosahedron Hidden data in plain sight. Scrape prices of products of portfolio companies to detect trends in pricing and predict sales.
- icosahedron Create web scraper with BeautifulSoup library for Python. Selenium for automated testing
- icosahedron Find retail stores with products of interest. For example, sneakers are sold at Footlocker, Finishline, Adidas Stores, etc
- icosahedron Plot average price of products. Here is a trend of Adidas Yeezy Sneakers
- icosahedron Analyst determines if Yeezy line is leveling off and the value of Yeezy sneakers are depreciating



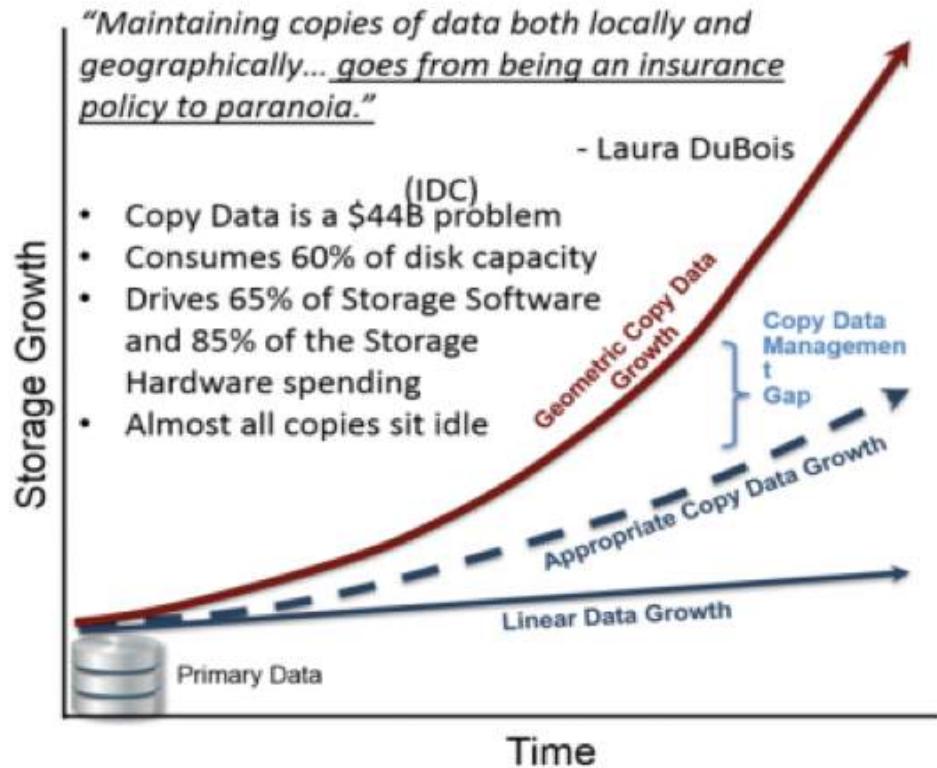
Alternative Data Providers

Source: alternatedata.org



Today's IT Challenge: Drowning in a Deluge of Copy Data

Result: Increased cost and complexity and no additional business value



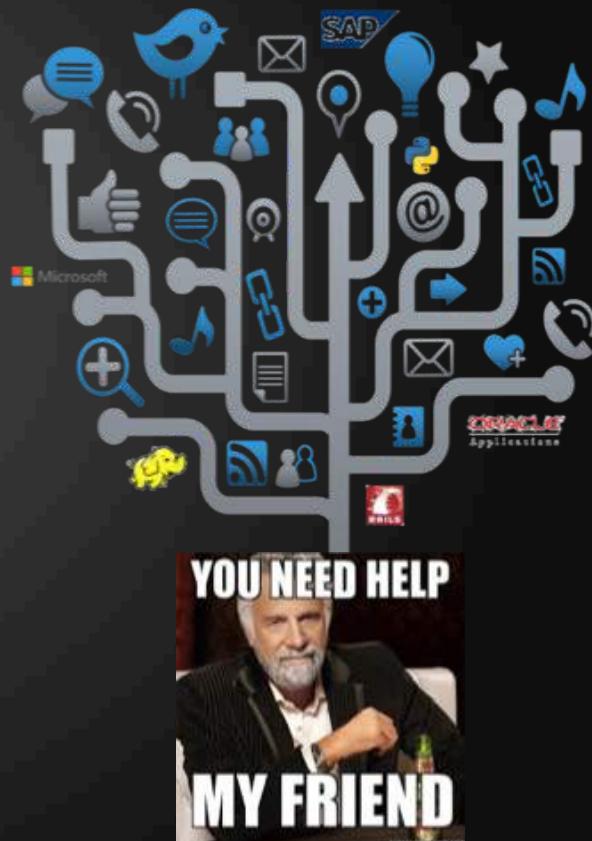
	Big Data workload (Analytics)	?
	Compliance workload (Archive)	1
	Resilient workload (Mirror)	1
	Non production workload (Test/Dev or DevOps)	6
	Resilient workload (Disk Backup)	23
	Recovery workload (Tape Backup)	23
	Primary Data Growth	~35%

50+

The Data Sprawl Issue

- There is one application for every 5-10 employees generating copies of the same files leading to massive amounts of duplicate idle data strewn all across the enterprise.
 - Michael Vizard, ITBusinessEdge.com
- Employees spend 35% of their work time searching for information... finding what they seek 50% of the time or less.
 - "The High Cost of Not Finding Information," IDC

The screenshot shows a news article from The Wall Street Journal. The headline reads "Big Companies Rein In Data Sprawl". The sub-headline states "Whole Foods, GE and others merge disparate data sets to cut costs, learn about customers". The author is Steven Norton, and the date is Oct. 21, 2013, 10:46 p.m. ET. There are 11 comments. The article discusses how companies are merging disparate data sets to extract cost savings and insights about customers. It mentions Whole Foods Market Inc. planning to build a new retail management system and other big companies like Wal-Mart Stores Inc. and General Mills Inc. also pursuing related initiatives. The article includes a sidebar for Zurich Insurance with the text "WATCH OUR RISK PROFILING VIDEO" and "ZURICH". At the bottom, there are links for "THE WALL STREET JOURNAL.", "DIGITAL + PRINT", "\$12 FOR 12 WEEKS", and "SUBSCRIBE NOW".

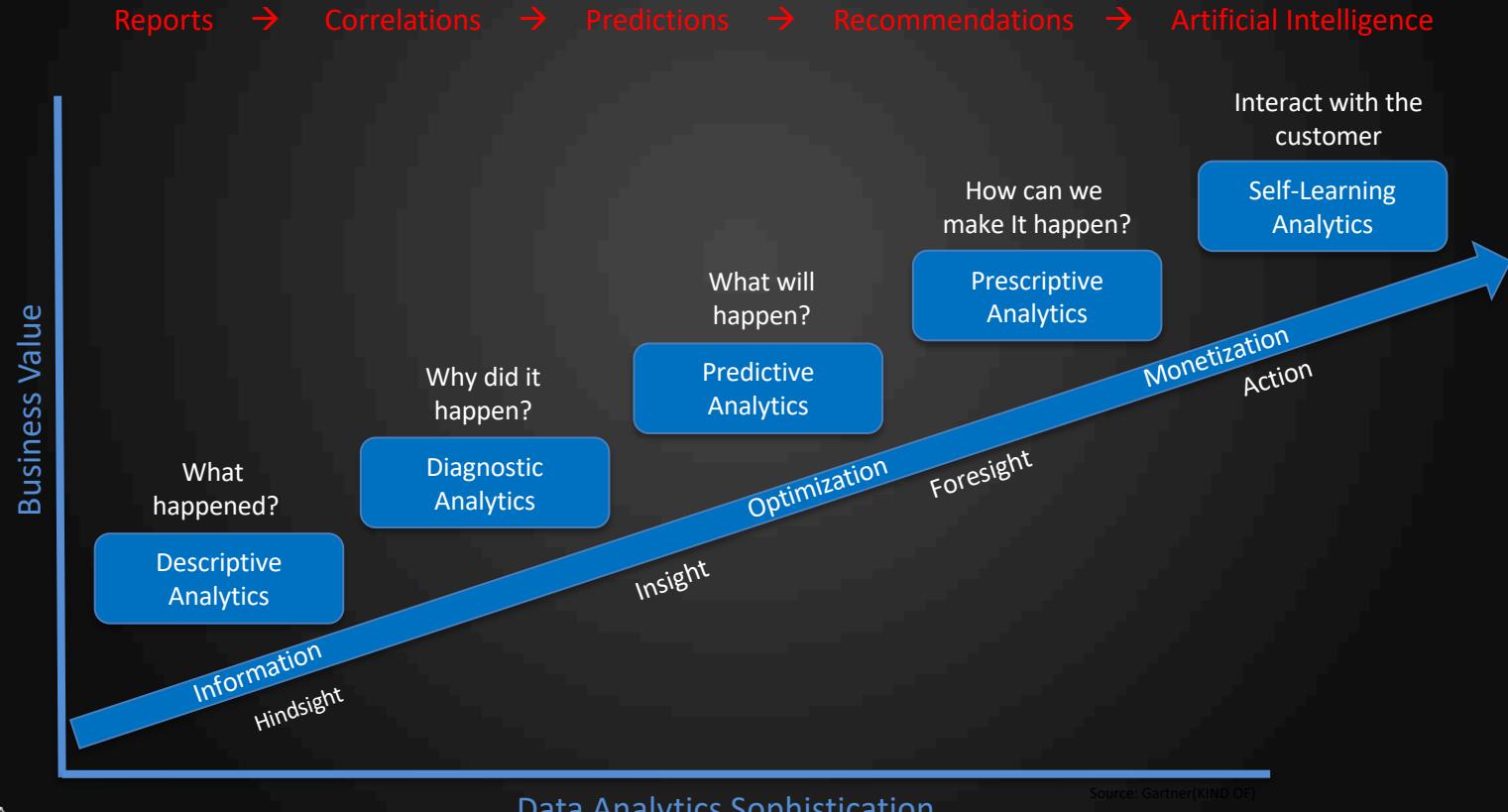


Dealing with the explosion of data sources and data types is an organizational priority.

The **need to simplify information** is driving significant change in organizations: **43 percent** of all organizations currently are making changes to how they design and deploy information and another **37 percent** are planning to make changes.



Evolution of Data Analytics



4 steps of the Industrial Revolution

- ❖ **18th Century:** Introduction of Water and Steam powered mechanical manufacturing facilities
- ❖ **19th Century:** Introduction of electric powered mass production. First assembly lines in 1870
- ❖ **1970s:** Introduction of electronics and IT to advance automation of manufacturing; for programmable controller 1969
- ❖ **Today:** Introduction of AI based Cyber-Physical systems

How We've Built Data Warehouses

Design – Top Down, Bottom Up

Customer Interviews and requirements gathering
Data Profiling

Create Data Models

Facts and Dimensions

Extract Transform Load (ETL)

Copy data from sources to data warehouse

Data Governance

Stewardship, business rules, data quality

Put a BI Tool on Top

Design semantic layer

Develop reports



Cracks in the DW Armor - Onboarding New Data

Business: “I need to analyze some new data”

- ✓ IT collects requirements
- ✓ Creates normalized and/or dimensional data models
- ✓ Profiles and conforms and the data
- ✓ Sophisticated ETL programs and quality standards
- ✓ Loads it into data models
- ✓ Builds a BI semantic layer
- ✓ Creates dashboards and reports

IT: “**You'll have your data in 3-6 months to see if it has value!**

- Onboarding new data is difficult!
- Rigid Structures and Data Governance
- Disconnected/removed from business



The New Conversation

- Do we need a Data Warehouse at all?
- If we do, does it need to be relational?
- Should we leverage NoSQL, the Cloud?
- Which platform and language are we going to code in?
- Which bleeding edge Apache Project should we put in production!



The Paradigm Shift

BIG DATA IS NOT THE PROBLEM
IT'S THE CHANGE AGENT.

OLD WAY:

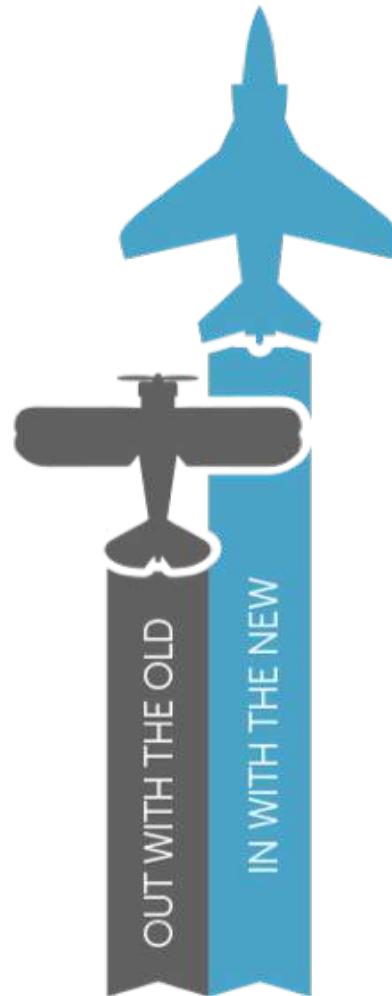
- Structure → Ingest → Analyze
- Fixed Capacity
- Monolithic

NEW WAY:

- Ingest → Analyze → Structure
- Dynamic Capacity
- Ecosystem

RECIPE:

- ✓ Cloud
- ✓ Data Lake
- ✓ Polyglot Data Ecosystem



The Promise of the Data Lake

Technology:

- Scalable distributed storage → HDFS, S3, GCS
- Pluggable fit-for-purpose processing → Spark

Functional Capabilities:

- Remove barriers from data ingestion and analysis
- Storage and processing for all data
- Tunable Governance

Governing Big Data

- Before Data Governance
 - Users trying to produce reports from raw source data
 - No Data Conformance
 - No Master Data Management
 - No Data Quality processes
 - No Trust: Two analysts were almost guaranteed to come up with two different sets
- Before Big Data Governance
 - We can put “anything” in the Data Lake
 - We can analyze anything
 - We’re scientists, we don’t need IT, we make the rules
 - Rule #1: Dumping data into a Data Lake with no repeatable process, procedure, or governance will create a mess
 - Rule #2: Information harvested from an ungoverned systems will take us back to the old days: **No Trust = Not Actionable**



THE DATA SWAMP: CHOOSE YOUR OWN ADVENTURE



Data Governance for Big Data

Organization	<ul style="list-style-type: none">• Add Big Data to overall framework and assign responsibility• Add data scientists to the Stewardship program• Assign stewards to new data sets (twitter, call center logs, etc.)
Metadata	<ul style="list-style-type: none">• Larger scale• New datatypes• Integrate with Hive Metastore,, home grown tables
Privacy/Security	<ul style="list-style-type: none">• Data detection and masking on unstructured data upon ingest
Data Quality and Monitoring	<ul style="list-style-type: none">• Data Quality and Monitoring (probably home grown, drools)• Quality checks not only SQL: machine learning, artificial intelligence• Acting on large dataset quality checks may require distribution
Business Process Integration	<ul style="list-style-type: none">• Near-zero latency, DevOps, Core component of business operations
Master Data Management	<ul style="list-style-type: none">• Graph databases are more flexible than relational• Lower latency service required• Distributed data quality and matching algorithms
Information Lifecycle Management (ILM)	<ul style="list-style-type: none">• Secure and mask multiple data types (not just tabular)• Deletes are more uncommon (unless there is regulatory requirement)• Take advantage of compression and archiving (like AWS Glacier)

The Corporate Data Pyramid

Usage Pattern

Arbitrary/Ad-hoc Queries
and Reporting

Munging, Blending
Machine Learning

Organize, Define,
Complete

Ingest Raw
Data

Data Governance

Fully Governed (trusted)

Data Quality and Monitoring
Metadata, ILM , Security
Data Catalog
Data Integration

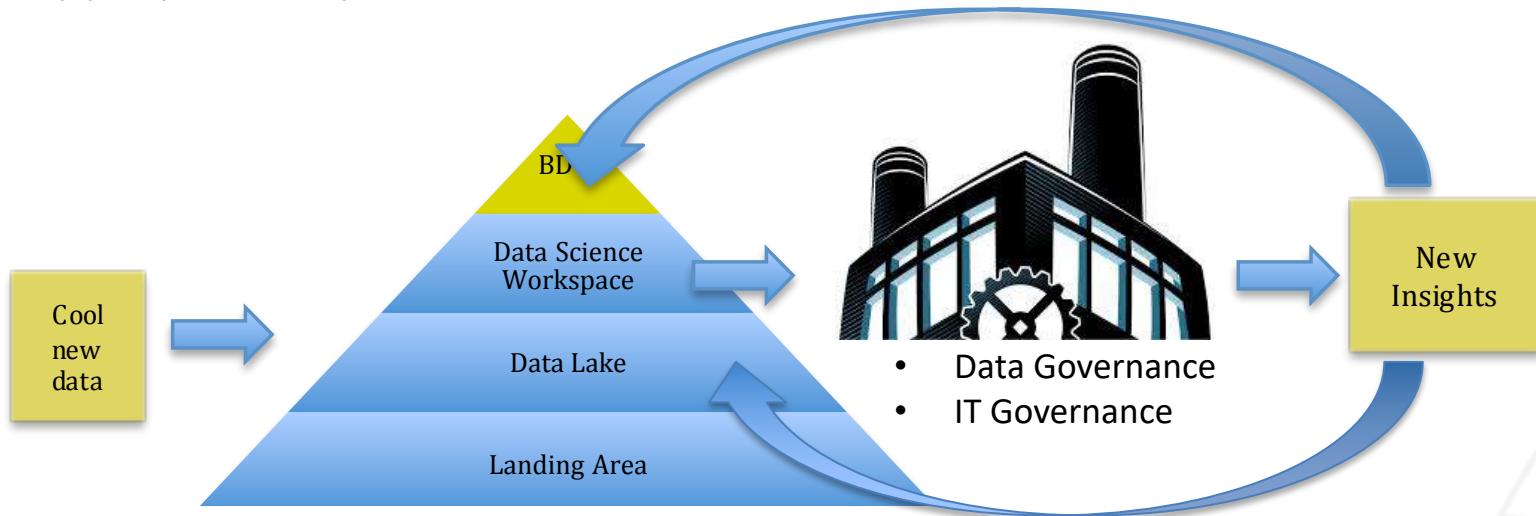
Metadata, ILM,
Security

Data Lake - Integrated Datasets

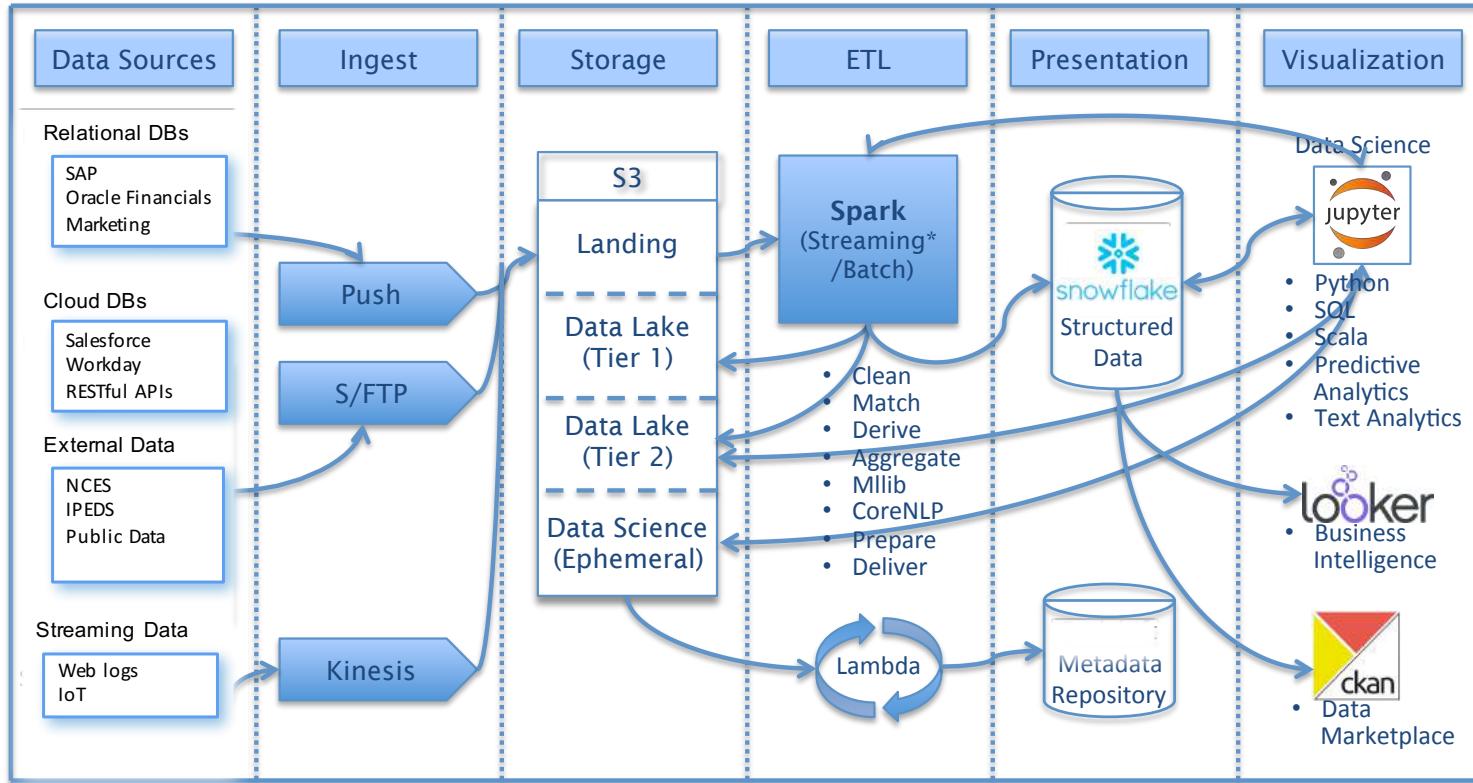
Ingestion Area - Source Data in “Full Fidelity”

The Data Refinery

- The feedback loop between Data Science and Data Warehouse is critical
- Successful work products of science must **Graduate** into the appropriate layers of the Data Lake



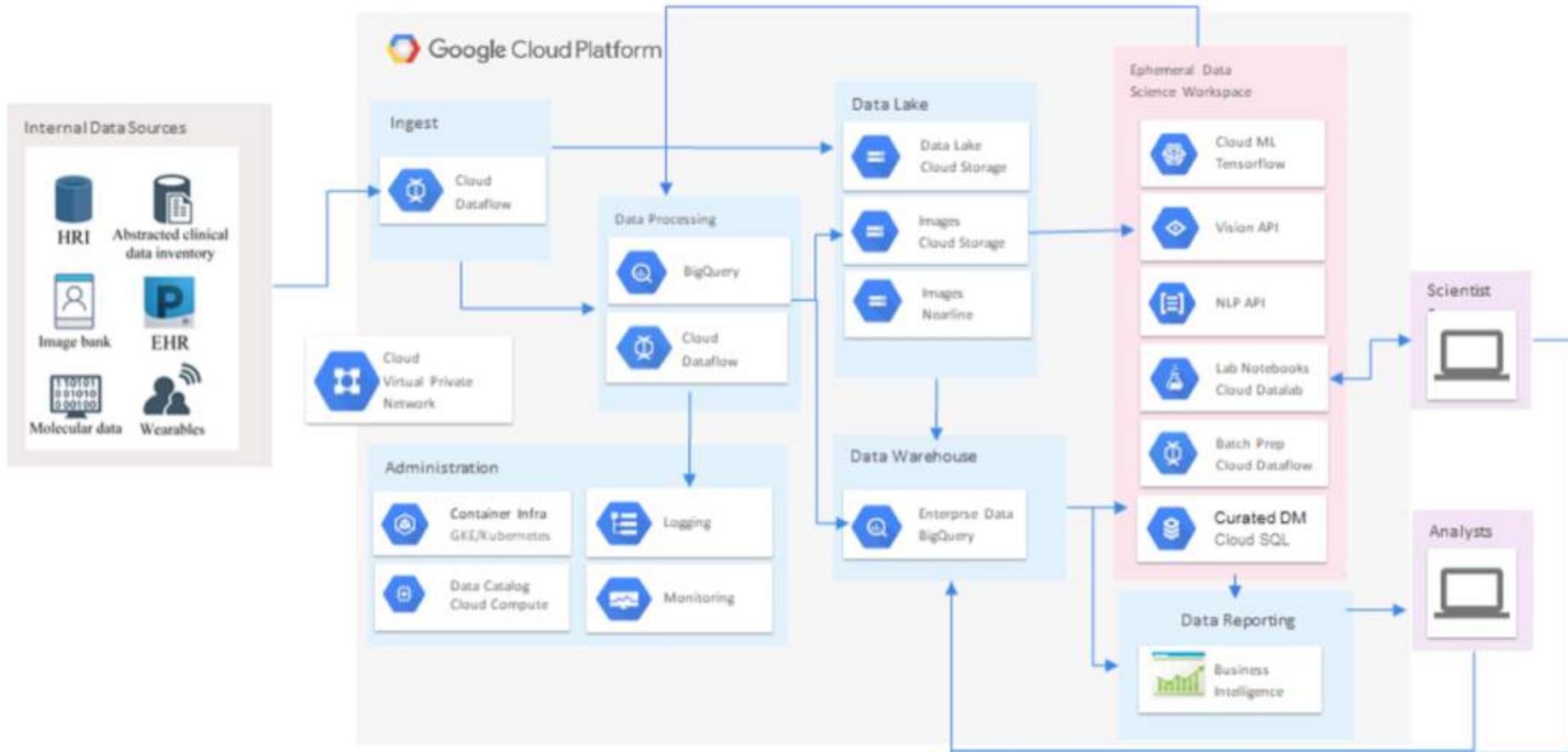
Data Ecosystem Reference Architecture (AWS)



The Data Ecosystem on the Cloud

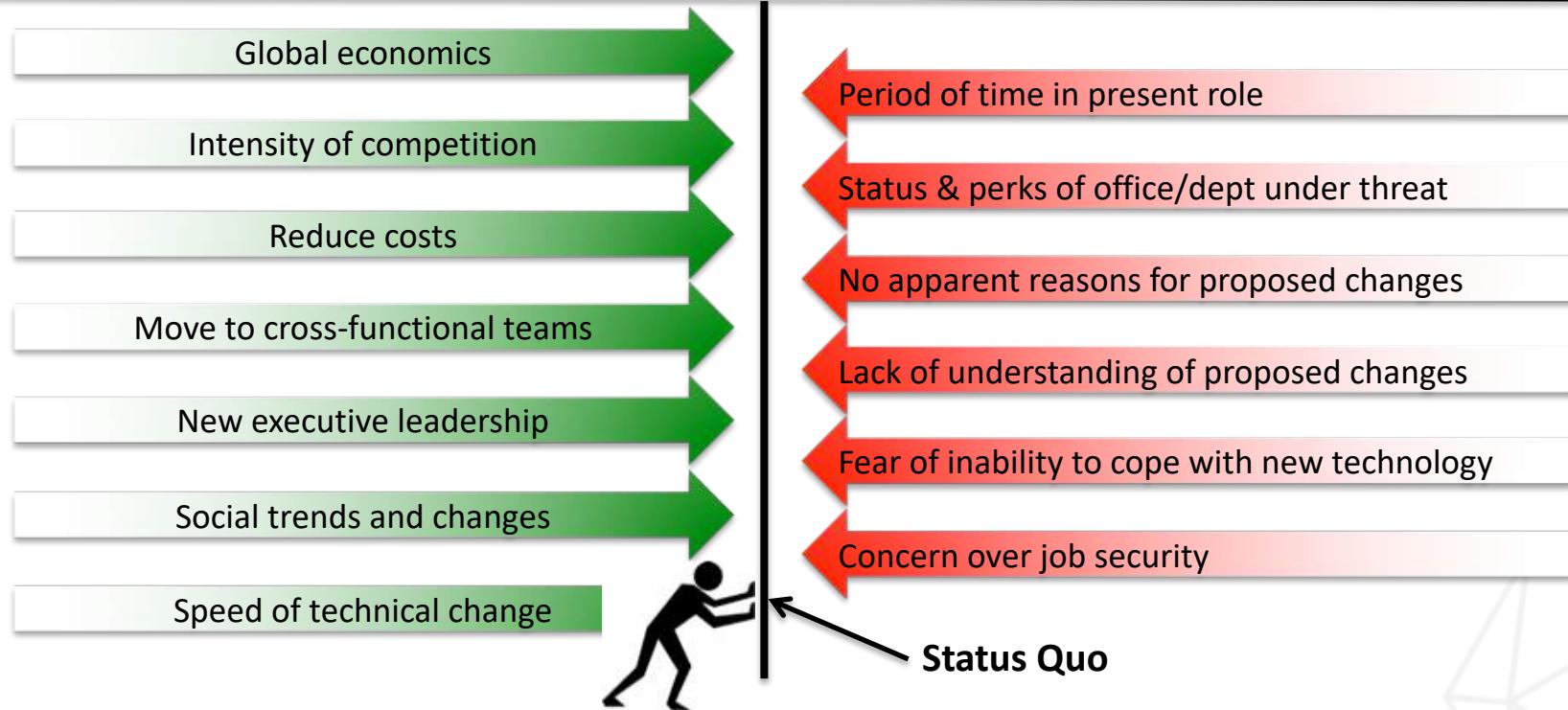
Cloud Component	AWS	Google	Microsoft
Scalable distributed storage	S3	GCS	Azure Storage
Pluggable fit-for-purpose processing	EMR	DataProc	HDInsight
Compute Services	EC2	GCE	VMs
Consistent extensible framework	Spark	Spark	Spark
Dimensional MPP Data Warehouse	Redshift/ Snowflake	BigQuery	Azure SQL Data Warehouse
Data Streaming	Kinesis	PubSub	Azure Stream
Common Interface	Jupyter	DataLab	Azure Notebook
Machine Learning	SageMaker	TensorFlow	ML Studio

Data Ecosystem Reference Architecture (GCP)

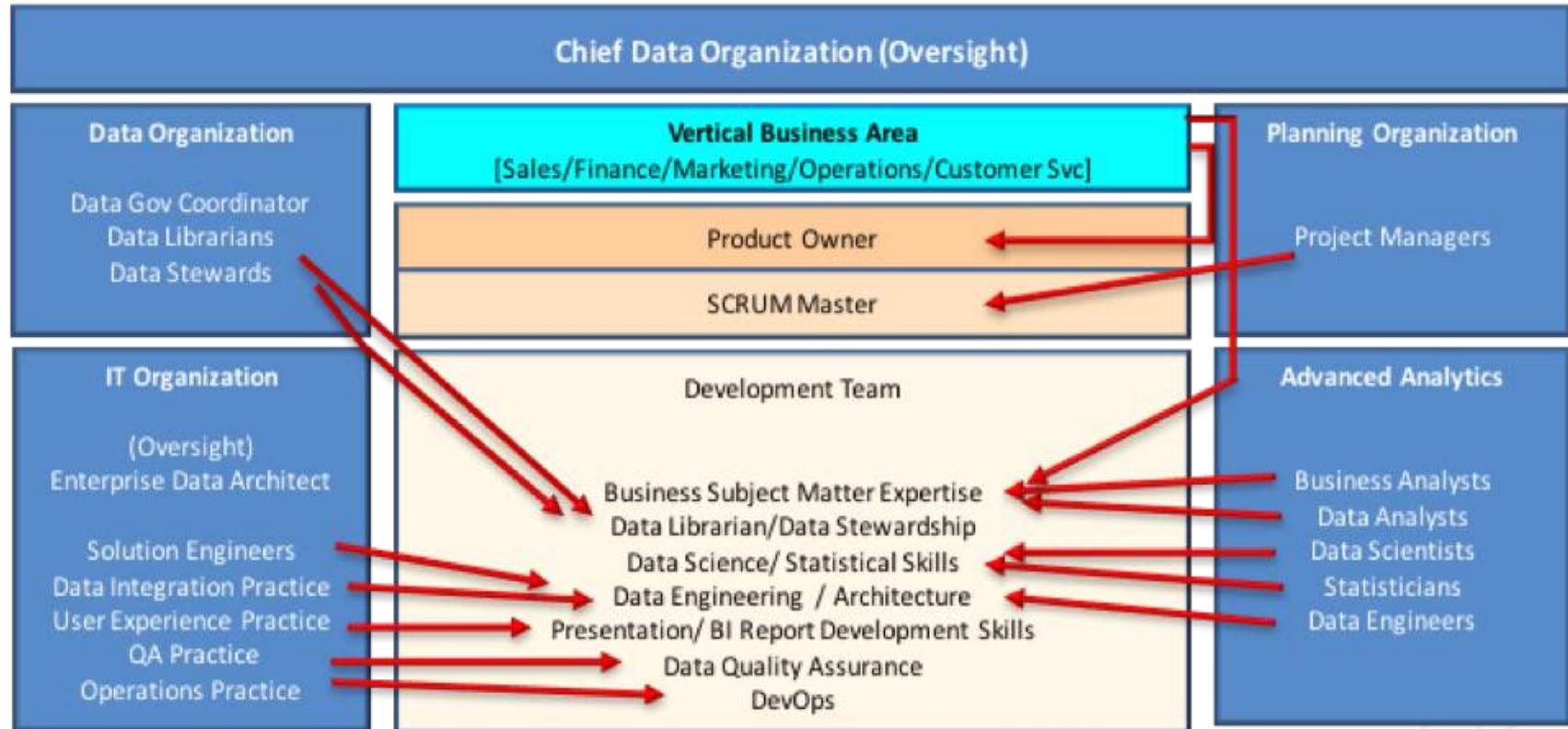


Moving the Status Quo – Change Management

Forces for Change Forces Resisting Change



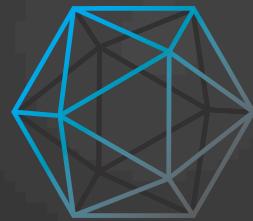
It takes a Village!



Lessons Learned from the Field

- icosahedron Data is becoming 80% exploration and 20% production. A lot of effort will be thrown away. This is normal. Embrace it.
- icosahedron Because it is mostly exploration, things WILL change and change OFTEN. Architect for rapid change.
- icosahedron Business rules usually get complicated and evolve, your ETL processes must be dynamic and metadata driven.
- icosahedron Deliver the smallest release you can and deliver, often; keep everyone focused on what is currently important. No amount of pre-development meetings will deliver as much knowledge as having your users starting to use the data. Be Agile!

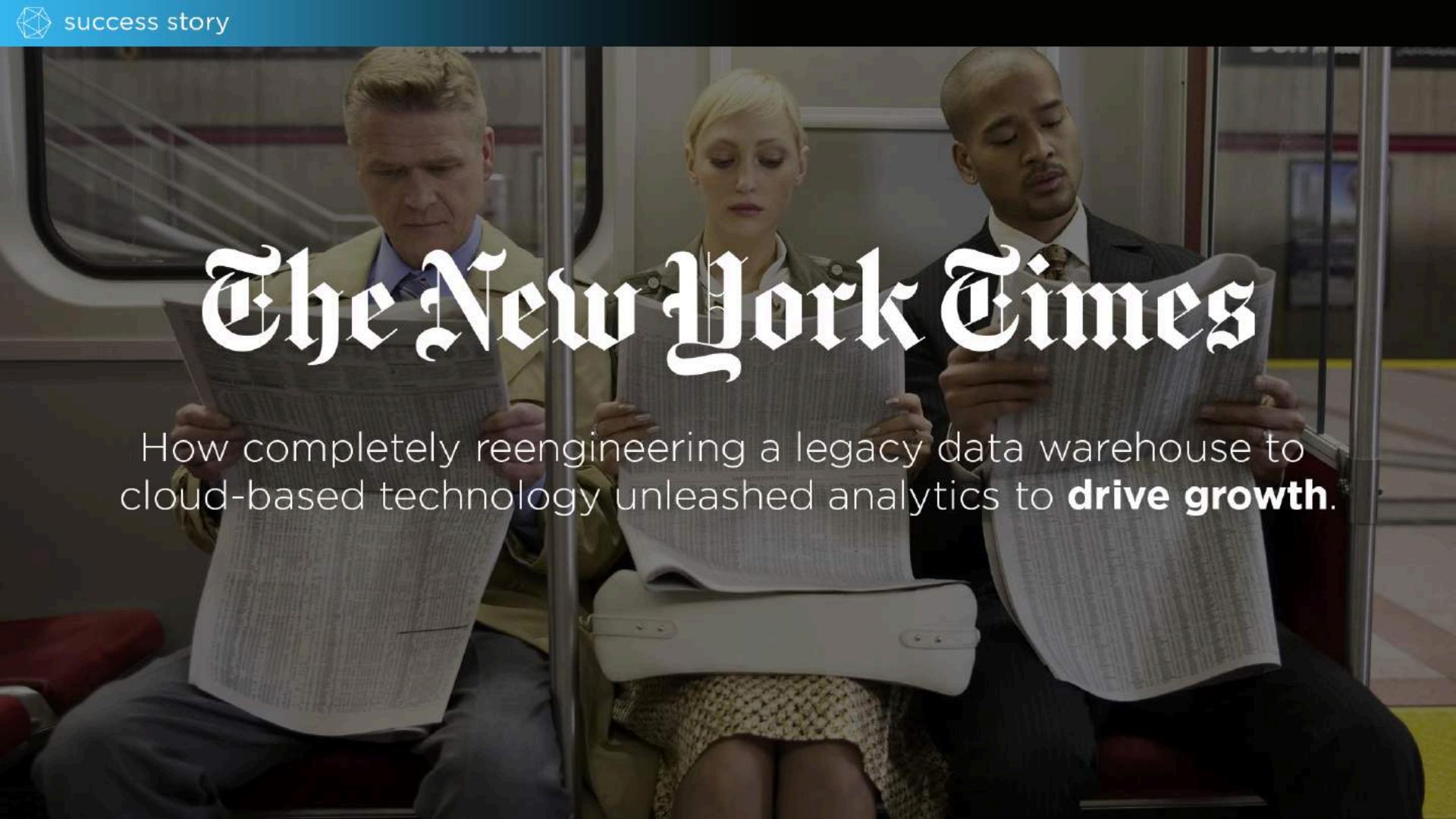
Joe Caserta
President, Caserta
joe@caserta.com
 @joe_caserta



caserta

Practical Use Cases

The New York Times



How completely reengineering a legacy data warehouse to cloud-based technology unleashed analytics to **drive growth.**



The New York Times

CHALLENGE

The New York Times was on a tight deadline to migrate all systems from legacy on-premises data ecosystems to the cloud. The team tasked with the daunting project was lacking the necessary resources and expertise to get the job done right and on time.

SOLUTION

Caserta's expert consultants interfaced with the team at the NYT. We completely reimaged a cloud architecture that leverages 100% cloud-based systems. Caserta reskilled the team at the NYT to ensure a smooth transition.





The New York Times

BUSINESS OUTCOME

Caserta successfully helped The New York Times reengineer all legacy systems to the cloud by the mandated tight deadline.

Total cost of ownership for analytics was reduced. Reports to stakeholders are now delivered faster and easier. This new architecture empowers the business with speed-of-thought analysis in order to gain new insights and fuel growth.



The New York Times

- ❖ This is not a model, this is the Director, Analytic Systems shutting down the servers in the data center for good!
- ❖ Entire Data Ecosystem re-engineered and replaced with Google Cloud Platform components
- ❖ The Data Center shutdown was an interdisciplinary concerted effort across the entire enterprise
- ❖ Primary reasons were to eliminate efforts towards:
 - ❖ Infrastructure engineering
 - ❖ Permits
 - ❖ Power systems
 - ❖ Generators
 - ❖ Conduit and cabling
 - ❖ Lighting protection
 - ❖ HVAC
 - ❖ Fire suppression
 - ❖ Managed Services
 - ❖ Real Estate



“Caserta was able to integrate with our processes, project management and build out the architecture that Caserta developed. Caserta spent a lot of time making sure that the hand off between their team and ours was successful when the project was over.”

Matt Digan
Executive Director of Data Engineering
The New York Times





How architecting an analytics-driven marketing strategy helped to **boost retention** and to **acquire new members**.



CHALLENGE

AARP was struggling to collect and analyze the large amounts of data available to them on member profile, transaction, and behavior information that would give them insight into member behavior. The organization does not have in-house technical teams capable of building the necessary analytics infrastructure.

SOLUTION

AARP partnered with Caserta to architect and build a cloud-based data lake that combines data collected from all available channels and fed to an analytics platform.





BUSINESS OUTCOME

The new unified data lake enabled business stakeholders to gain a high-resolution look into member behavior. The new data analytics platform allows unrestrained data analysis, which enables the business to create more personalized experiences and boost member retention.

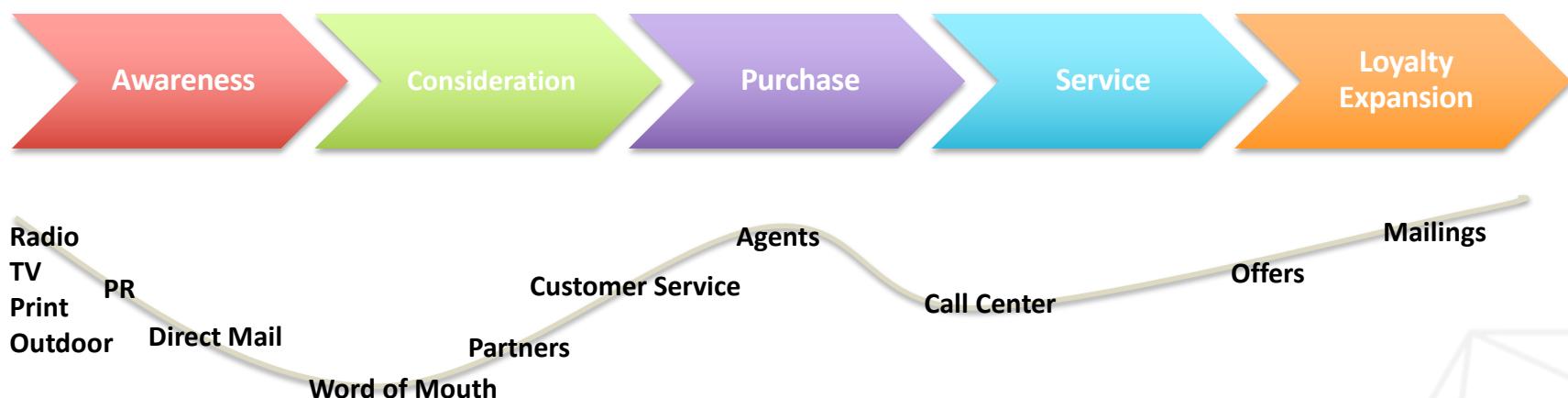
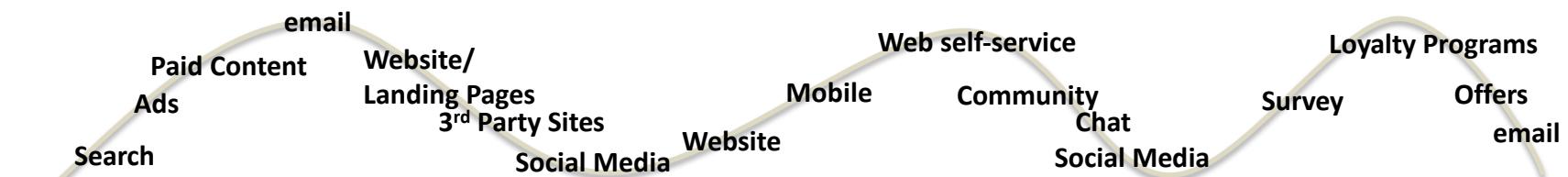
The new analytics platform is helping AARP on their goal to reaching 50M members by 2020.





CUSTOMER JOURNEY

Digital Touchpoints



Physical Touchpoints

Modern Attribution Modeling

What Works?

Isolated

Analyze effectiveness of single touch point type



100%

Rules-Based

Assess correlations between interactions based on domain expertise



Statistically Driven

Detect interactions based full customer journey, determine success path with data-driven model



How do we know?

- Dimensional data warehouse
- Ignores bulk of customer journey
- Undervalues other interactions and influencers

- Subjective
- Assigns arbitrary value to each interaction
- Lacks analytics rigor to determine weights

- ✓ Looks at full behavior patterns
- ✓ Consider all touch points
- ✓ Can apply different models for best results
- ✓ Use data to find correlations between touch points (winning combinations)

VÄRDE



How harmoniously integrating many data sources into a single cloud data warehouse delivers **high-value investment insights that fuel growth.**



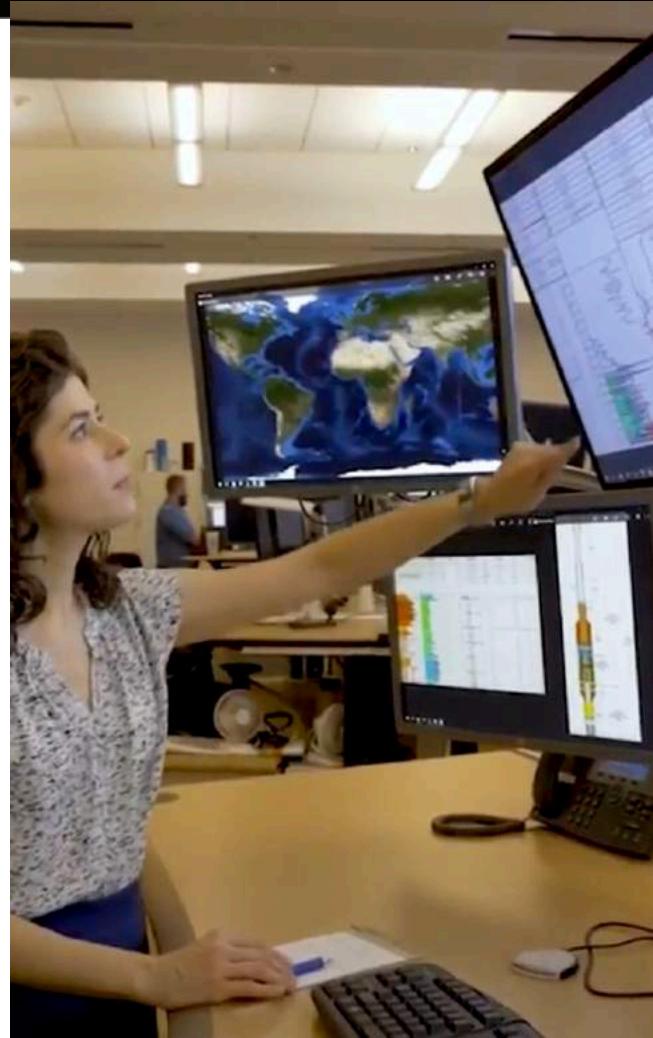
VÄRDE

CHALLENGE

As alternative sources of data come in many types and formats, data was challenging to analyze in a unified view. Värde's analysts were struggling to gain a complete picture of the data. New sources could not be added, as each additional source of data would need to be manually added and cleansed, thus stifling scalability.

SOLUTION

Caserta helped Värde go from an onsite platform that was architected for individualized reporting to a cloud-based data warehouse solution that is both extensible and flexible to support the internal and external demands of the business.





VÄRDE

BUSINESS OUTCOME

Värde's new cost-effective cloud-based unified data warehouse enabled analysts to get a better picture of data and make better investing decisions and fuel growth.

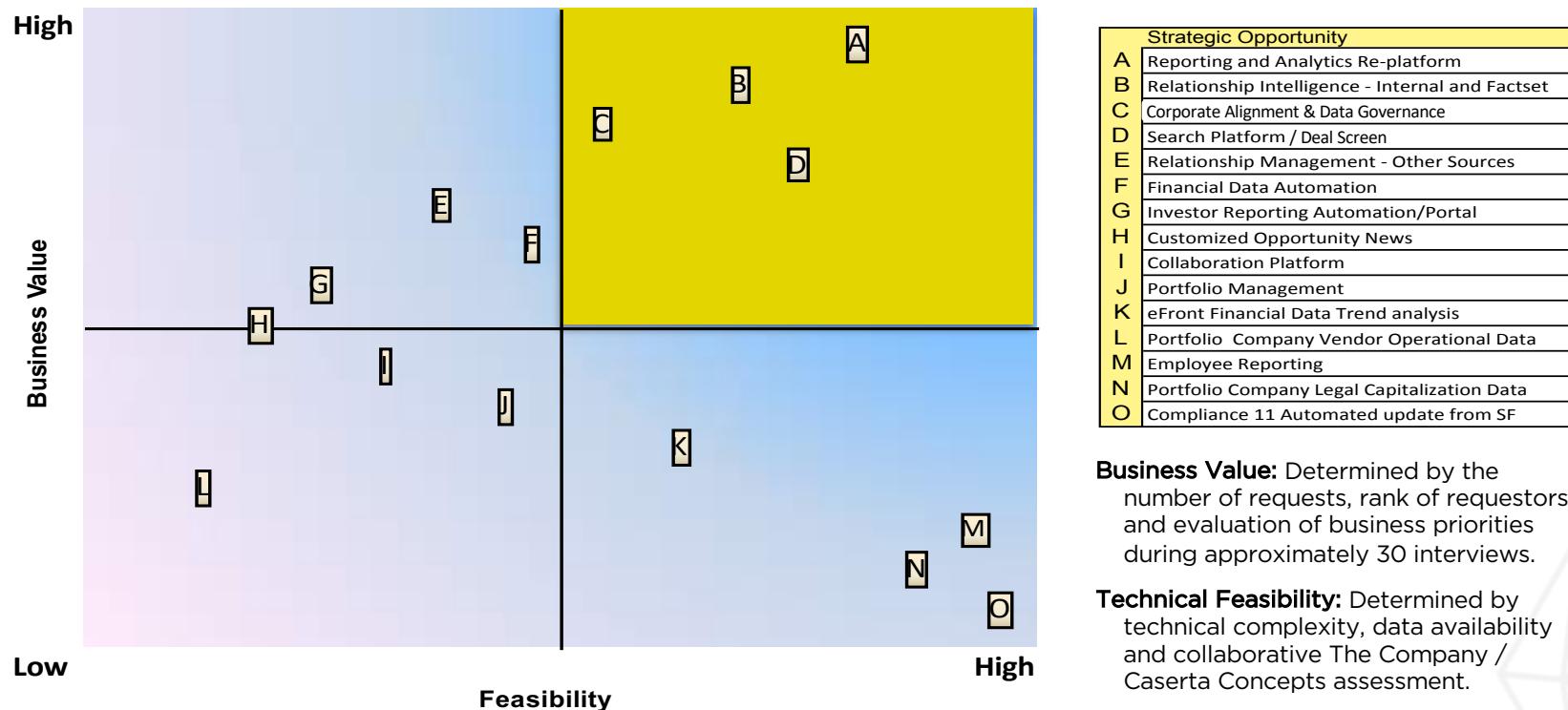
The architecture of the data warehouse enabled the integration of new and evolving data sources to address current needs and provides a foundation platform for future growth.





Proven Methods & Techniques - Feasibility Matrix

The feasibility matrix illustrates relative business value versus technical feasibility of each strategic opportunity identified. The upper right quadrant represents areas with the highest business value and highest technical feasibility.





Sample Analytics Platform Roadmap

P1 – P4 includes:

- Business requirements
- Data Catalog
- Business Intelligence
- Data Integration
 - Source-to-Stage
 - Stage-to-Lake
 - Lake-to-Warehouse
- Full production roll-out of all components

Jan 2018

Recommendation for conceptual design and technologies for:
- Cloud Analytics Platform
- Analytics Platform
- Data Laboratory
- Data Pipeline
- Data Catalog

P1 May 2018

Cloud-based Analytics Platform & Data Warehouse
Re-engineer Solution Architecture for Ad-hoc reporting regarding:

- Analytics
- Reporting
- ODS (as needed)

Build Data Science Laboratory

Collect requirements for Data Science Laboratory POC

Alation Data Catalog Installed and configured

P2 Aug 2018

Fully Functional Solutions:
Security Master
Reference Master
Salesforce

Implement Data Laboratory POC
Hydrate Data Lake with Alternative Data

- Bloomberg
- Eagle Alpha

P3 Oct 2018

Fully Functional Solutions:
Middle Office
Treasury DB

Source System and Data Gap Analysis
Mortgage DB
Real Estate

P4 2018+

Fully Functional Productionalized Solution

Plan refactoring of Source-to-Stage data Feeds to read new sources as needed

Plan On-Prem Sunset strategy including migration of all data integration, reporting and dashboards to new Data Platform



Media & Entertainment





Media & Entertainment

CHALLENGE

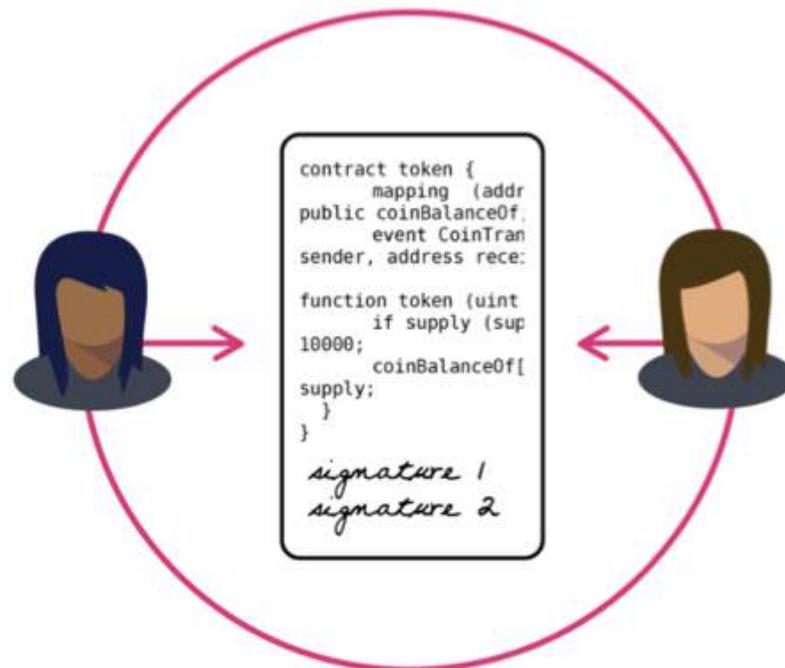
- Content is the heart of everything
- Sales Team looks at rights and availability
- The 7 Factors of a Deal Point....
- Jaguar is the source for creating all contracts
- Jaguar feeds the Rights Data Mart
- Embarking on a project to move Rights Data Mart to Snowflake

SOLUTION

Caserta helped design and architect a cloud-based solution that combines Blockchain and Artificial Intelligence to modernize the Rights Management ecosystem.



Why Blockchain

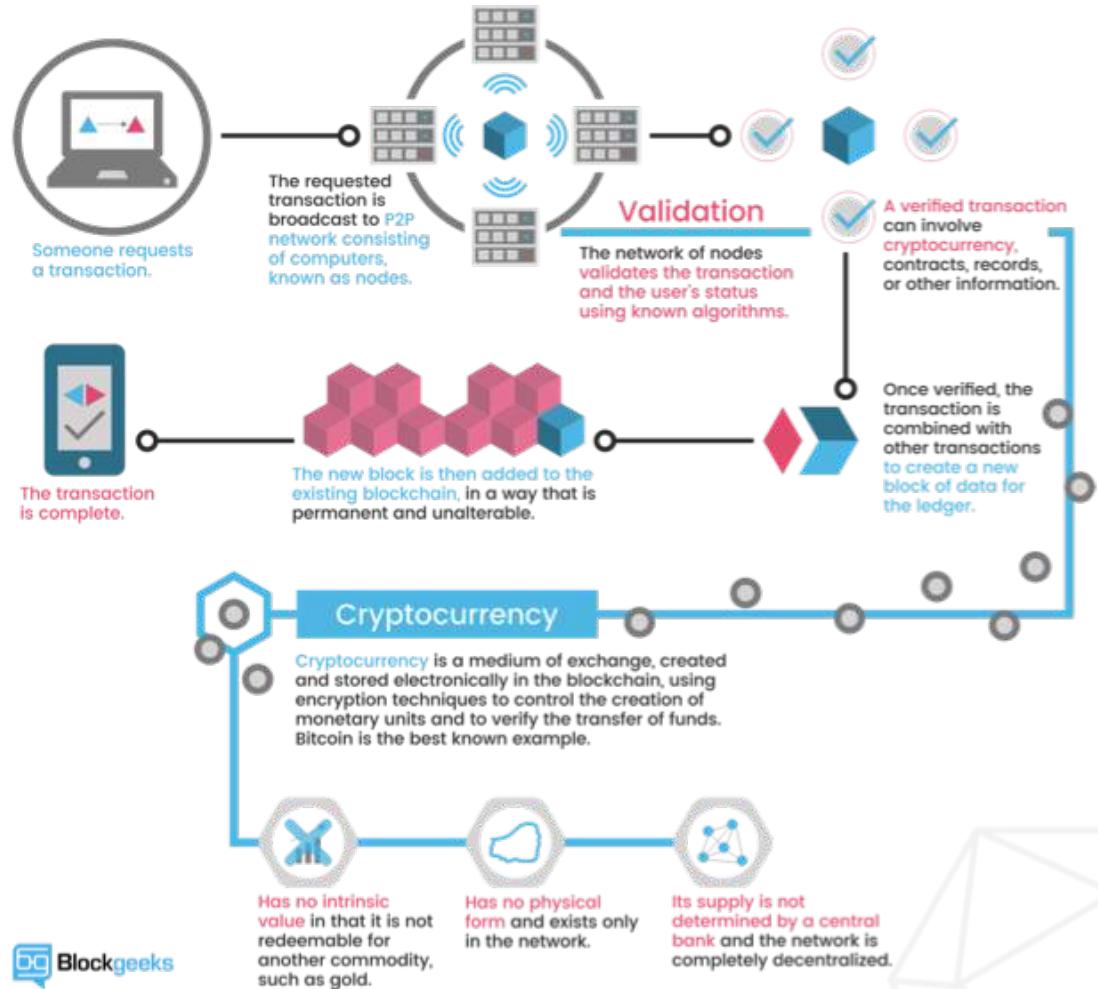


Blockchain is a Distributed Database

- Information held on a blockchain exists as a shared – and continually reconciled – database.
- The blockchain database isn't stored in any single location, meaning the records it keeps are truly public and easily verifiable.
- No centralized version of this information exists for a hacker to corrupt.
- Hosted by millions of computers simultaneously, its data is accessible to anyone on the internet.
- ‘Miners’ collect all of the transactions made during a set period into a list, called a block. It’s the miners’ job to confirm those transactions, and write them into a general ledger.

How it Works

- A self-auditing ecosystem. The network reconciles every transaction that happens in ten-second intervals.
- Each group of these transactions is referred to as a “block”.
- Every Node connected to the blockchain network uses a client that performs the task of validating and relaying transactions.
- Each Node has an incentive for participating in the network.
- In fact, each Node is competing to win Bitcoins or Ether (or other exchangeable value tokens) by solving computational puzzles.



Smart Contracts

- Distributed ledgers enable the coding of simple contracts that will execute when specified conditions are met.
- Ethereum is an open source blockchain project that was built specifically to realize this possibility.
- Ether is the incentive ensuring that developers write quality applications (wasteful code costs more)
- Every few seconds a new block is added to the blockchain with the latest transactions processed by the network and the computer that generated this block will be awarded 5 ether. Due to the nature of the algorithm for block generation, this process (generating a proof of work) is guaranteed to be random and rewards are given in proportion to the computational power of each machine.

Coding a Smart Contract

Etherium accounts:

- external: like wallet addresses.
- Internal: contract addresses (a class with a bunch of methods)

OpCode. Lowest level code

Python and Node.js have libraries

- Solidity - programming language
Like javascript
- Serpent - python based.
Not used as much
- Web3 - distributed apps on Etherium
- “Gas” is the internal pricing for running a transaction or contract

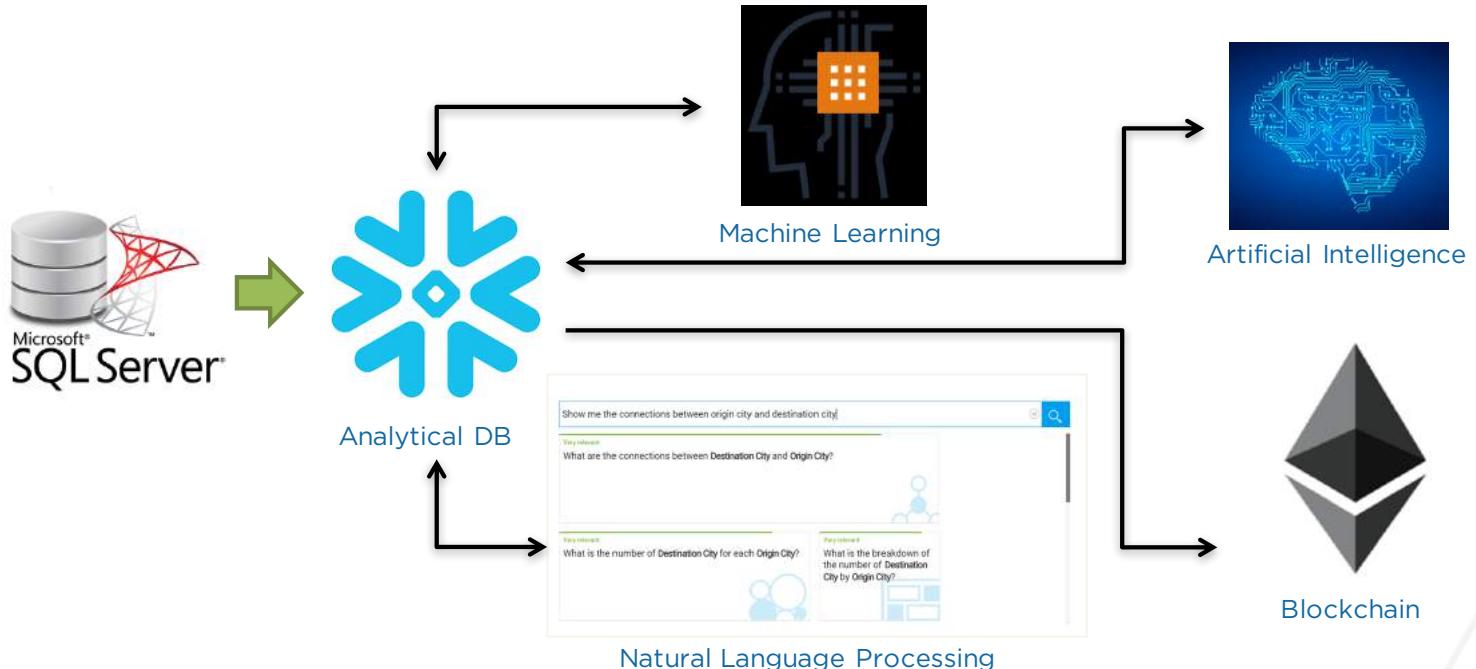
The screenshot shows a Solidity IDE interface with the following details:

- Code Editor:** Untitled.sol file containing the following Solidity code:

```
// HelloWorld.sol
contract HelloWorld {
    function displayMessage() constant returns (string) {
        return "Hello World, from a smart contract!";
    }
}
```
- Compiler Status:** Solidity version: 0.4.9+commit.364da425.Emscripten.clang
Change to: 0.4.9+commit.364da425
Auto Compile is selected.
- Contract Details:** Untitled:HelloWorld
Bytecode: 6060604052341561000c57fe5b5b61017f8061001c6000396000f30060606040526000357c0
Interface: [{"constant":true,"inputs":[],"name":"displayMessage","outputs":[{"name":"","type":"string"}],"p...}
Web3 deploy:
var untitled:helloworldContract = web3.eth.contract([{"constant":true,"input...
Metadata location: bzz://be4c596546c4fb25b8884ea54a73a17a51d4954af21475c3e58b9ef84afdf69
- Compiler Warning:** Untitled:3:1: Warning: Source file does not specify required compiler version! Consider adding pragma solidity "0.4.9".
contract HelloWorld {
 Spanning multiple lines.

BLOCKHEAD Architecture

Use Case: Rights Management for the Entertainment Industry



Data is Food for the Future



Imagine the Possibilities



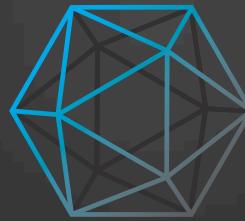
Forge Ahead – Change the World

**Life is like riding a bicycle, to
keep your balance, you must
keep moving.**

- Albert Einstein

Thank You / Q&A

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