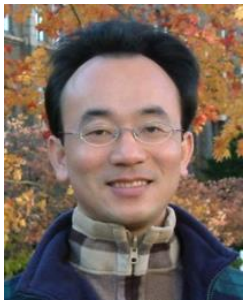
Tamkang University

Data Mining
資料探勘

海量資料分析
(Big Data Analytics)

1032DM09
MI4
Wed, 7,8 (14:10-16:00) (B130)



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http://mail. tku.edu.tw/myday/

2015-05-13

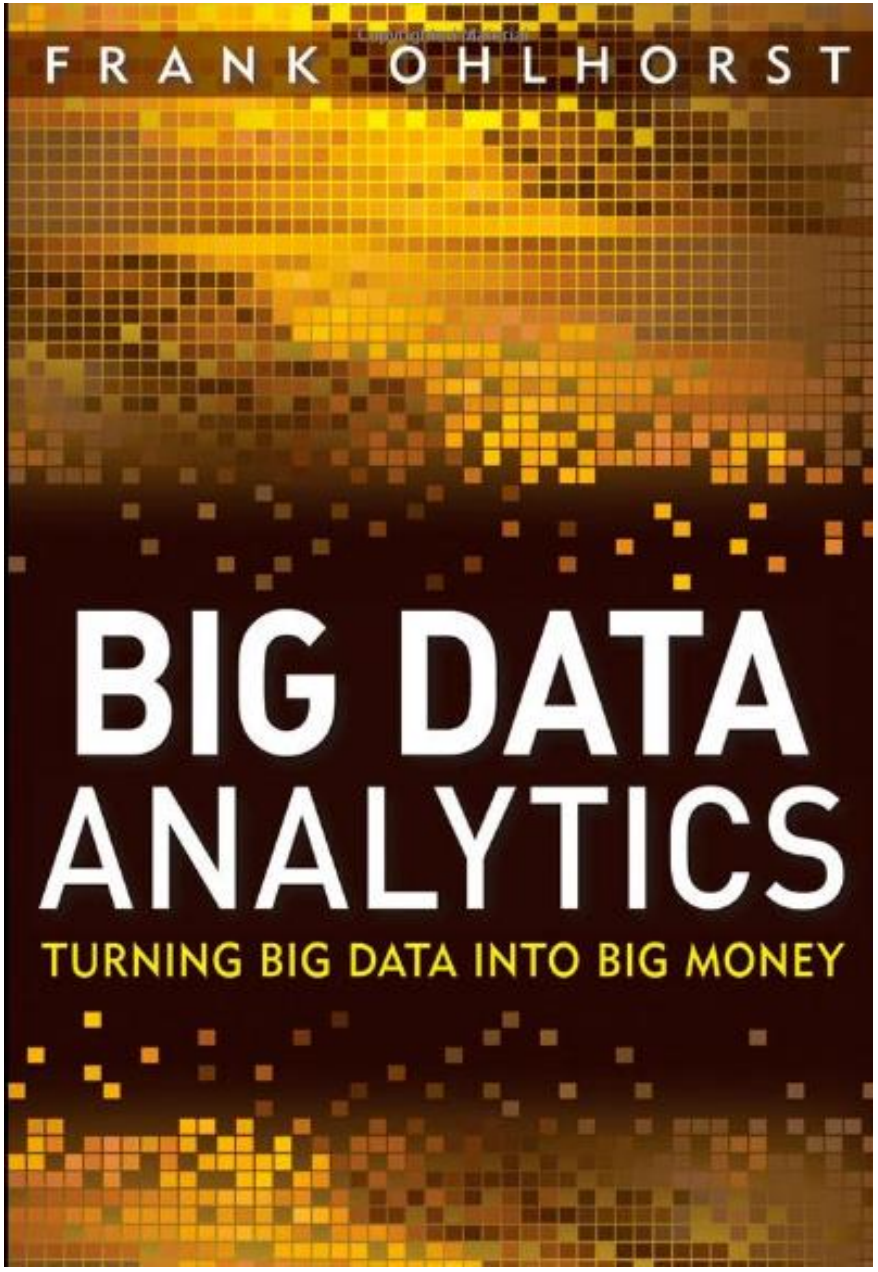
課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2015/02/25	資料探勘導論 (Introduction to Data Mining)
2	2015/03/04	關連分析 (Association Analysis)
3	2015/03/11	分類與預測 (Classification and Prediction)
4	2015/03/18	分群分析 (Cluster Analysis)
5	2015/03/25	個案分析與實作一 (SAS EM 分群分析)： Case Study 1 (Cluster Analysis – K-Means using SAS EM)
6	2015/04/01	教學行政觀摩日 (Off-campus study)
7	2015/04/08	個案分析與實作二 (SAS EM 關連分析)： Case Study 2 (Association Analysis using SAS EM)
8	2015/04/15	個案分析與實作三 (SAS EM 決策樹、模型評估)： Case Study 3 (Decision Tree, Model Evaluation using SAS EM)

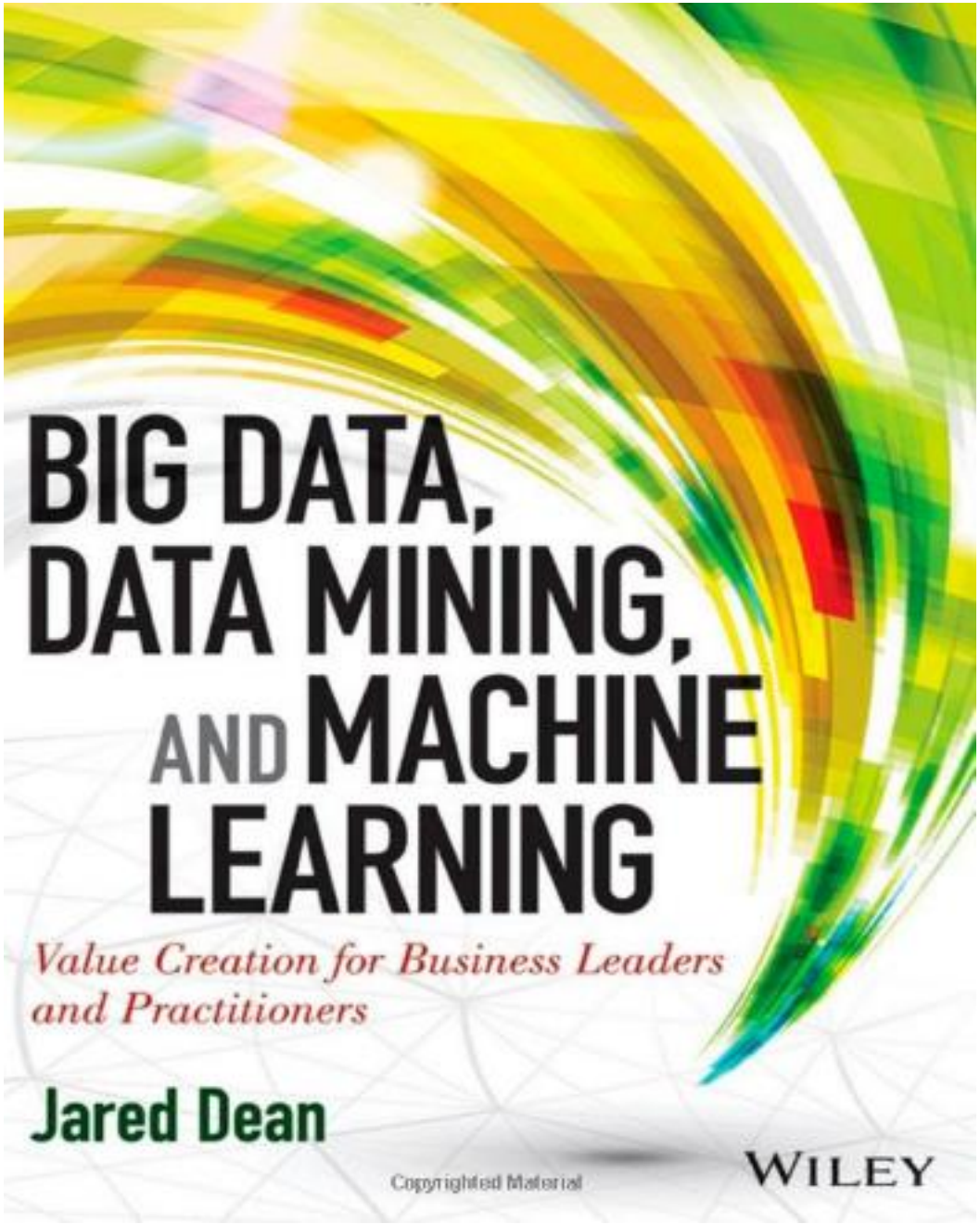
課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
9	2015/04/22	期中報告 (Midterm Project Presentation)
10	2015/04/29	期中考試週 (Midterm Exam)
11	2015/05/06	個案分析與實作四 (SAS EM 迴歸分析、類神經網路)：Case Study 4 (Regression Analysis, Artificial Neural Network using SAS EM)
12	2015/05/13	海量資料分析 (Big Data Analytics)
13	2015/05/20	文字探勘與網頁探勘 (Text and Web Mining)
14	2015/05/27	期末報告 (Final Project Presentation)
15	2015/06/03	畢業考試週 (Final Exam)

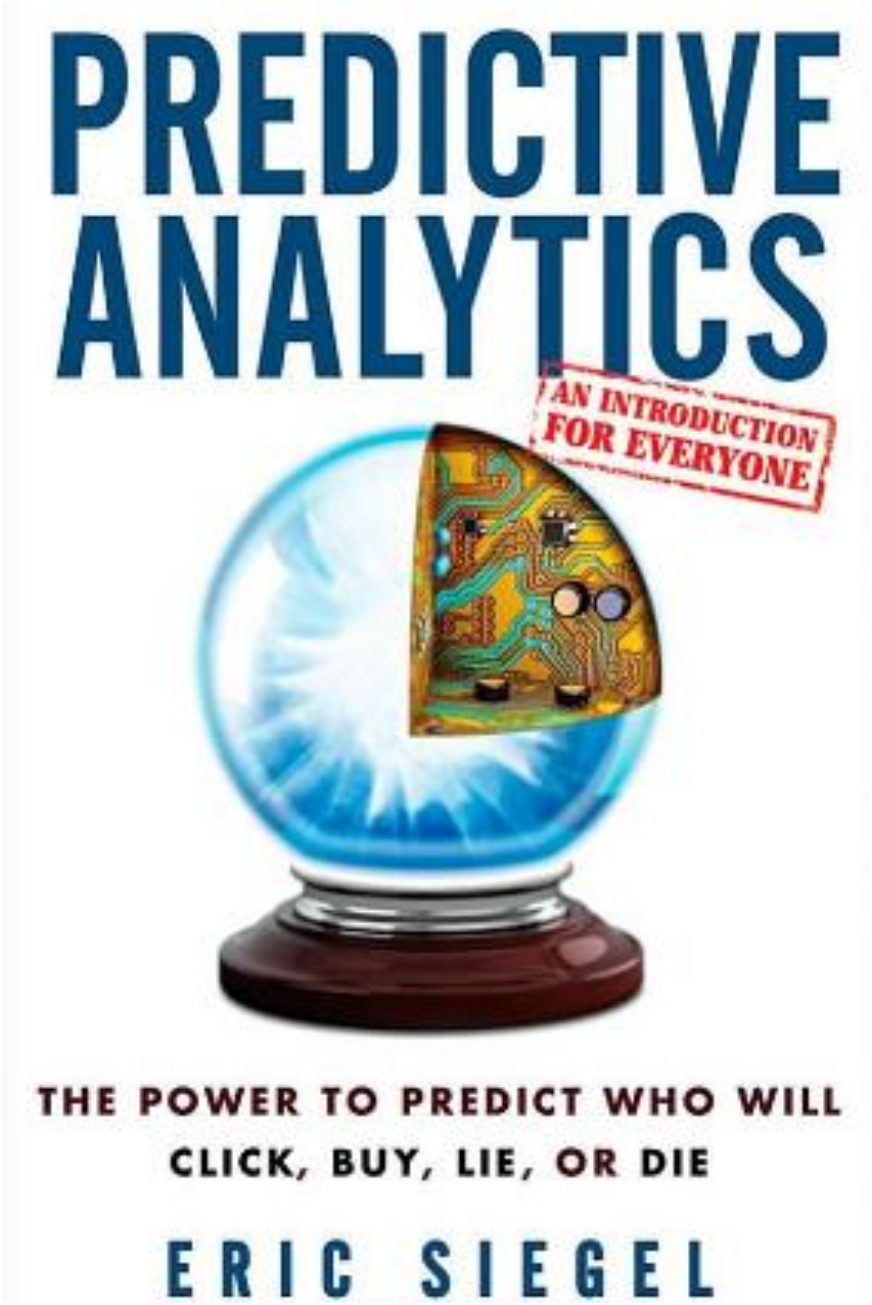
Big Data Analytics



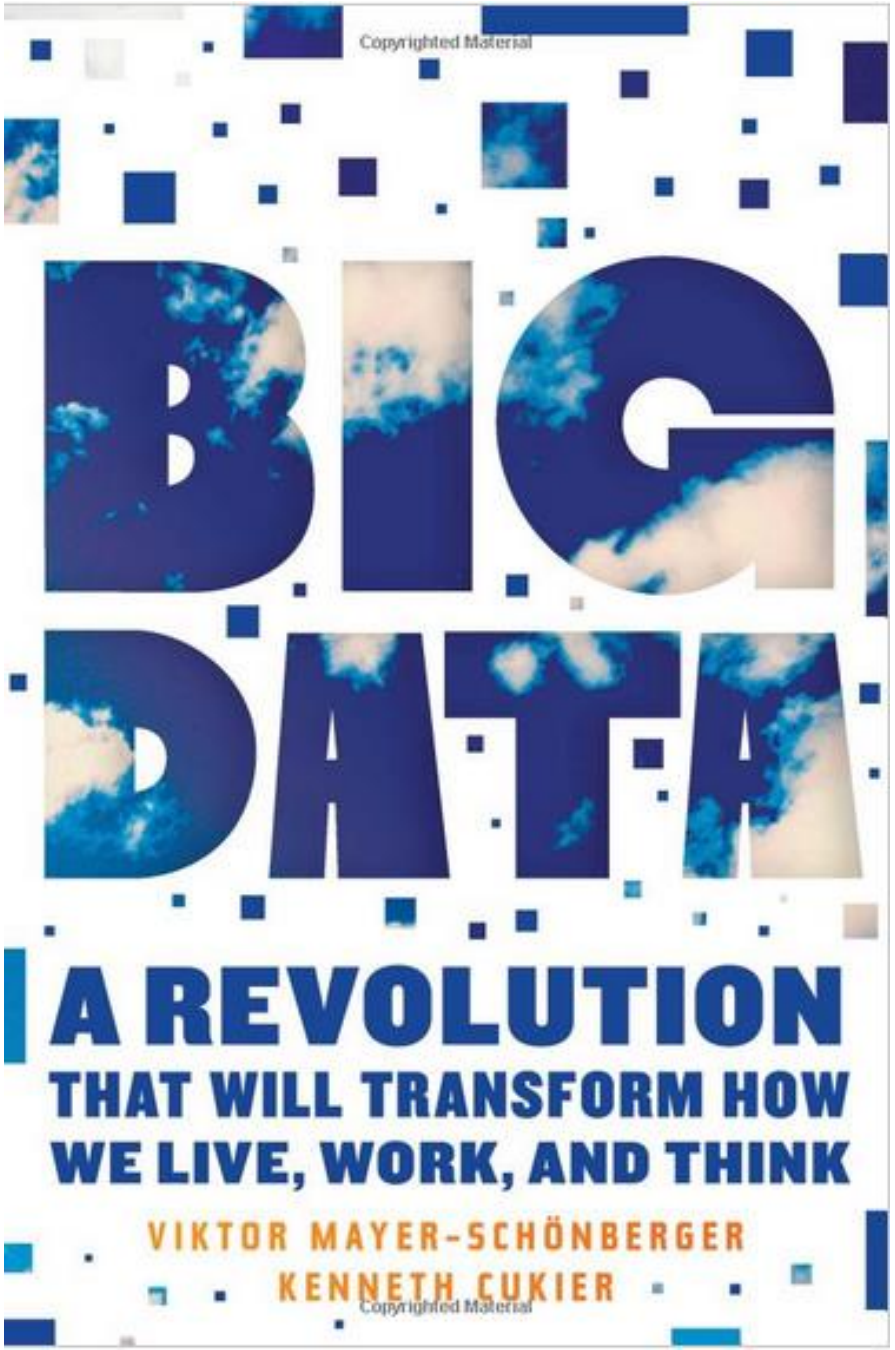
Source: http://www.amazon.com/Big-Data-Analytics-Turning-Money/dp/1118147596



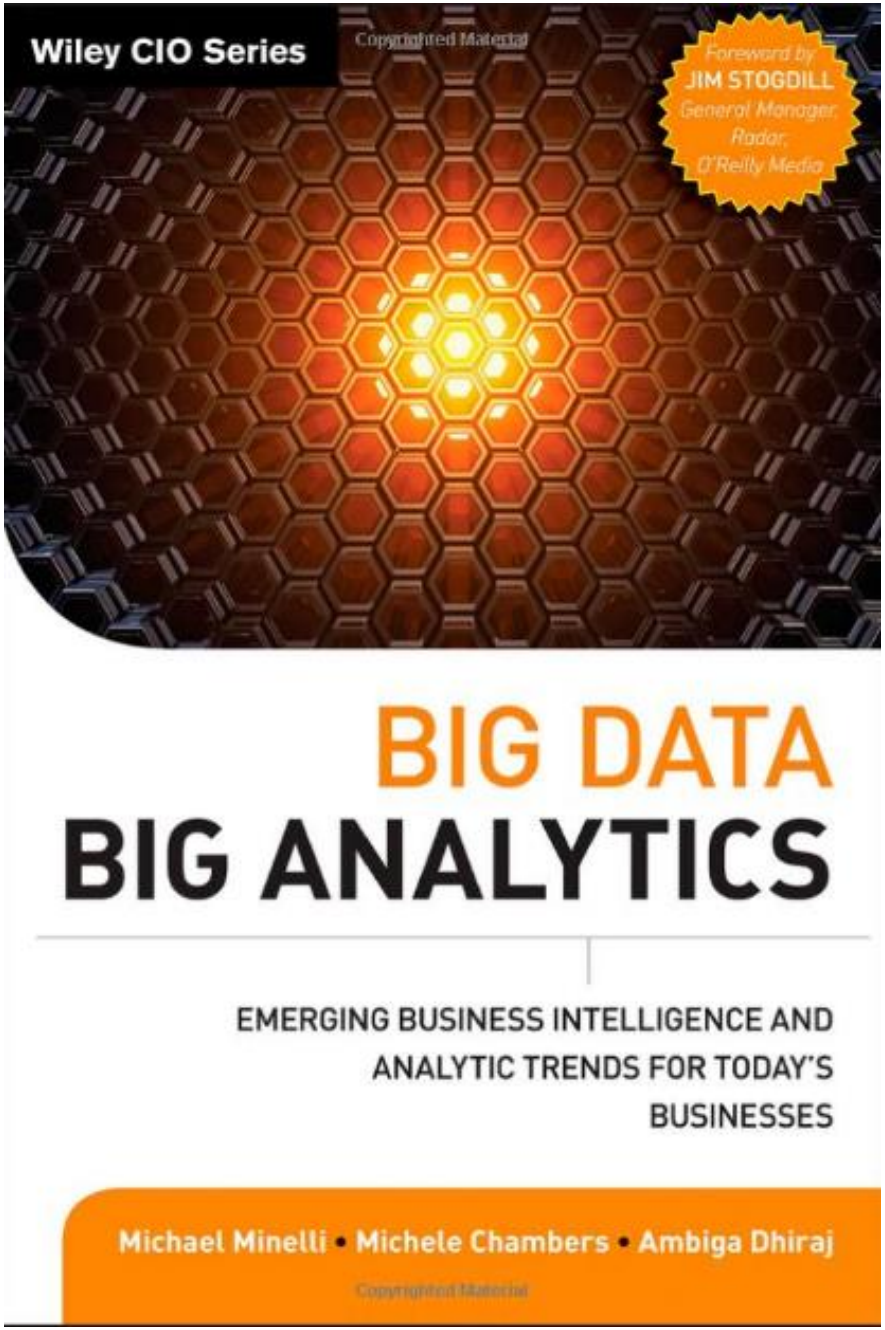
Source: http://www.amazon.com/Data-Mining-Machine-Learning-Practitioners/dp/1118618041



Source: http://www.amazon.com/Predictive-Analytics-Power-Predict-Click/dp/1118356853



Source: http://www.amazon.com/Big-Data-Revolution-Transform-Mayer-Schonberger/dp/B00D81X2YE



Source: http://www.amazon.com/Big-Data-Analytics-Intelligence-Businesses/dp/111814760X

Big Data, Big Analytics:

Emerging Business Intelligence and Analytic Trends for Today's Businesses

Big Data, Prediction vs. Explanation

Source: Agarwal, R., & Dhar, V. (2014). Editorial—Big Data, Data Science, and Analytics: The Opportunity and Challenge for IS Research. Information Systems Research, 25(3), 443-448.

Big Data:

The Management Revolution

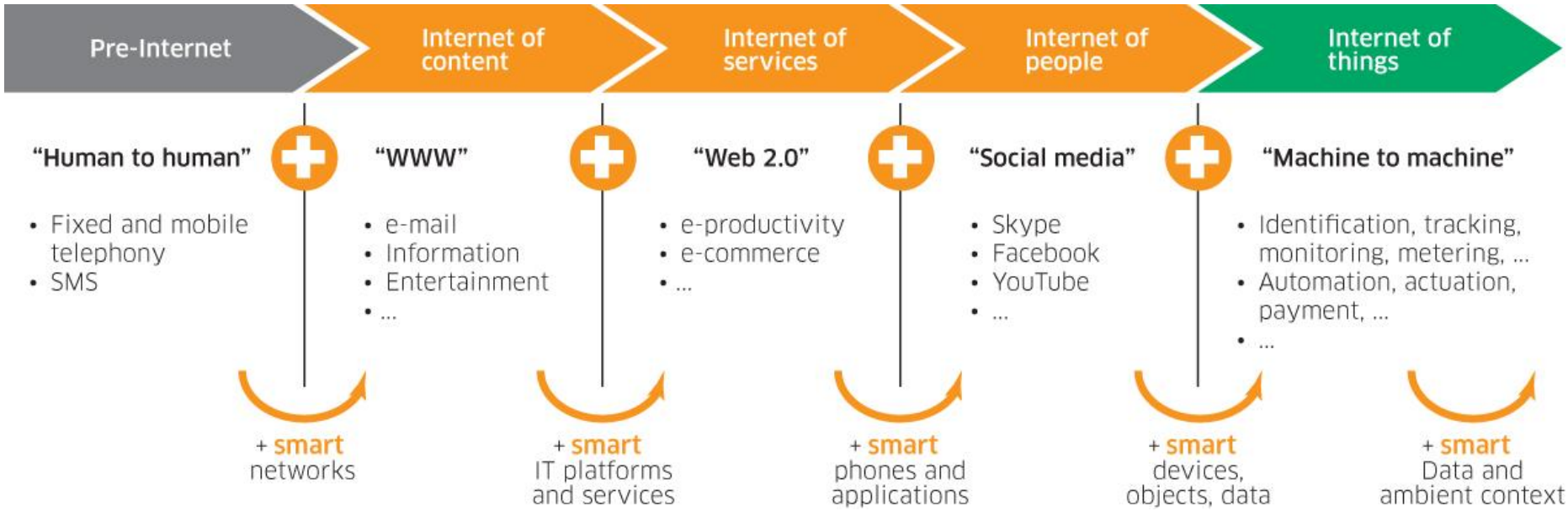
Source: McAfee, A., & Brynjolfsson, E. (2012). Big data: the management revolution.*Harvard business review*.

Source: McAfee, A., & Brynjolfsson, E. (2012). Big data: the management revolution.*Harvard business review*.

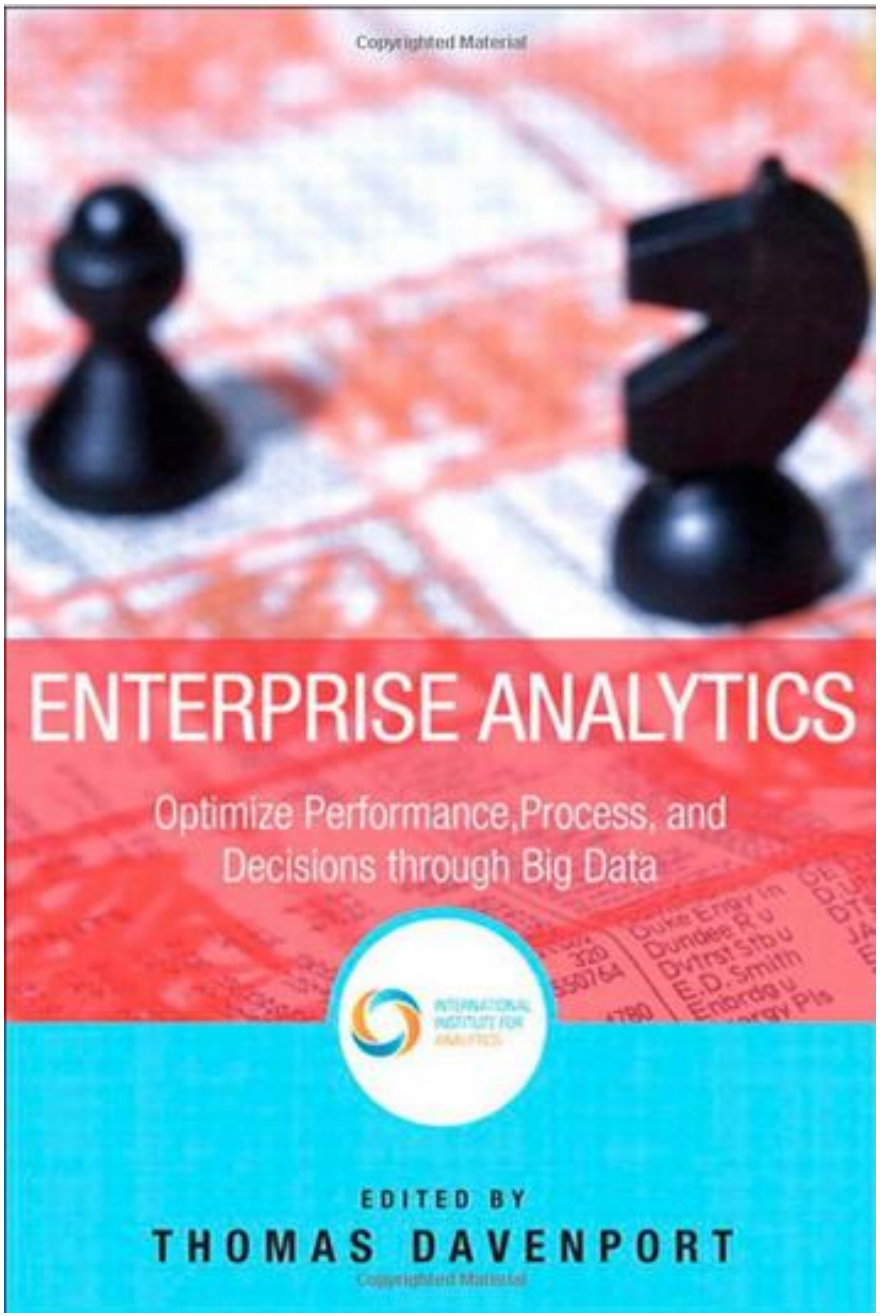
Internet Evolution

Internet of People (IoP): Social Media

Internet of Things (IoT): Machine to Machine



Source: Marc Jadoul (2015), The IoT: The next step in internet evolution, March 11, 2015
http://www2.alcatel-lucent.com/techzine/iot-internet-of-things-next-step-evolution/



Source: http://www.amazon.com/Enterprise-Analytics-Performance-Operations-Management/dp/0133039439

Business Intelligence and Enterprise Analytics

- Predictive analytics
- Data mining
- Business analytics
- Web analytics
- Big-data analytics

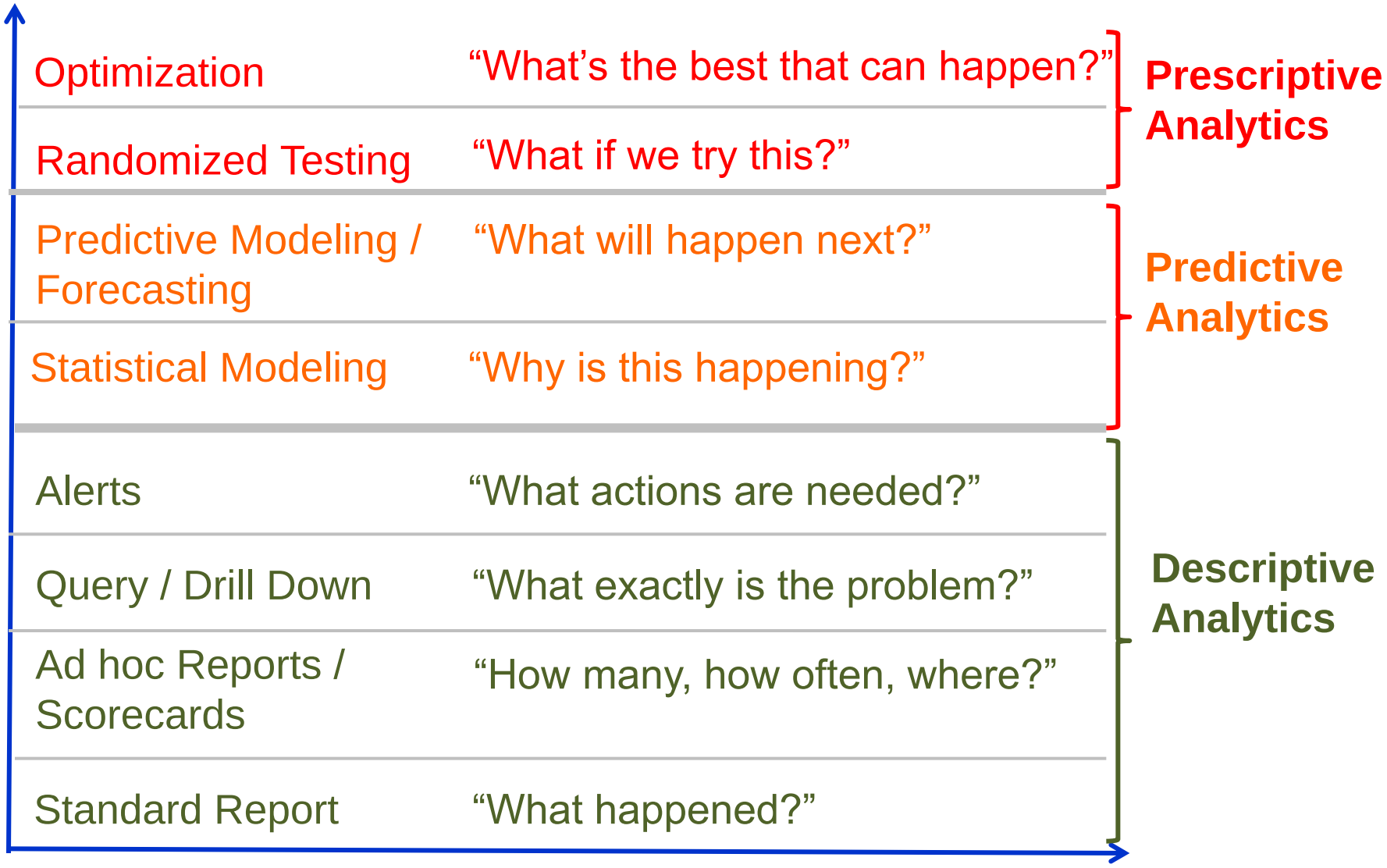
Source: Thomas H. Davenport, "Enterprise Analytics: Optimize Performance, Process, and Decisions Through Big Data", FT Press, 2012

Three Types of Business Analytics

- Prescriptive Analytics
- Predictive Analytics
- Descriptive Analytics

Source: Thomas H. Davenport, "Enterprise Analytics: Optimize Performance, Process, and Decisions Through Big Data", FT Press, 2012

Three Types of Business Analytics



Source: Thomas H. Davenport, "Enterprise Analytics: Optimize Performance, Process, and Decisions Through Big Data", FT Press, 2012

Big-Data Analysis

- **Too Big,**
  too Unstructured,
  too many different source
  to be manageable through traditional databases

Business Intelligence and Analytics: Research Directions

1. Big Data Analytics
   - Data analytics using Hadoop / MapReduce framework
2. Text Analytics
   - From Information Extraction to Question Answering
   - From Sentiment Analysis to Opinion Mining
3. Network Analysis
   - Link mining
   - Community Detection
   - Social Recommendation

Source: Lim, E. P., Chen, H., & Chen, G. (2013). Business Intelligence and Analytics: Research Directions. *ACM Transactions on Management Information Systems (TMIS)*, *3*(4), 17

The Rise of "Big Data"

- "Too Big" means databases or data flows in **petabytes (1,000 terabytes)**
  - Google processes about 24 petabytes of data per day
- "Too unstructured" means that the data isn't easily put into the traditional rows and columns of conventional databases

Source: Thomas H. Davenport, "Enterprise Analytics: Optimize Performance, Process, and Decisions Through Big Data", FT Press, 2012

Examples of Big Data

- Online information
  - Clickstream data from Web and social media content
    - Tweets
    - Blogs
    - Wall postings
- Video data
  - Retail and crime/intelligence environments
  - Rendering of video entertainment
- Voice data
  - call centers and intelligence intervention
- Life sciences
  - Genomic and proteomic data from biological research and medicine

Source: Thomas H. Davenport, "Enterprise Analytics: Optimize Performance, Process, and Decisions Through Big Data", FT Press, 2012

Big Data, Big Analytics:

Emerging Business Intelligence and Analytic Trends for Today's Businesses

- What Big Data is and why it's important
- Industry examples (Financial Services, Healthcare, etc.)
- Big Data and the New School of Marketing
- Fraud, risk, and Big Data
- Big Data technology
- Old versus new approaches
- Open source technology for Big Data analytics
- The Cloud and Big Data

Source: http://www.amazon.com/Big-Data-Analytics-Intelligence-Businesses/dp/111814760X

Big Data, Big Analytics:
Emerging Business Intelligence and Analytic Trends for Today's Businesses

- Predictive analytics
- Crowdsourcing analytics
- Computing platforms, limitations, and emerging technologies
- Consumption of analytics
- Data visualization as a way to take immediate action
- Moving from beyond the tools to analytic applications
- Creating a culture that nurtures decision science talent
- A thorough summary of ethical and privacy issues

Source: http://www.amazon.com/Big-Data-Analytics-Intelligence-Businesses/dp/111814760X

What is BIG Data?

Volume

Large amount of data

Velocity

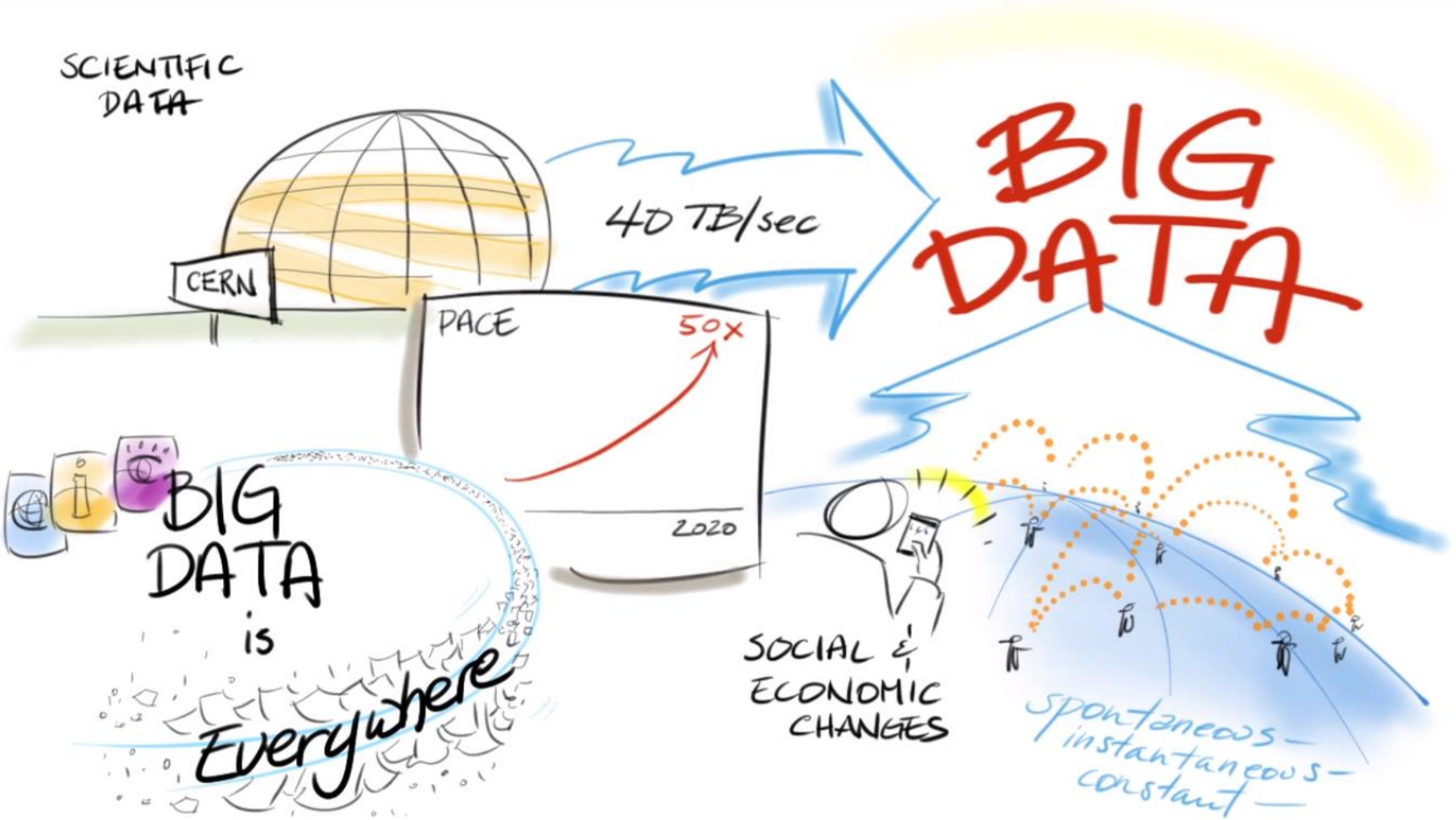
Needs to be analyzed **quickly**

Variety

Different types of structured and unstructured data

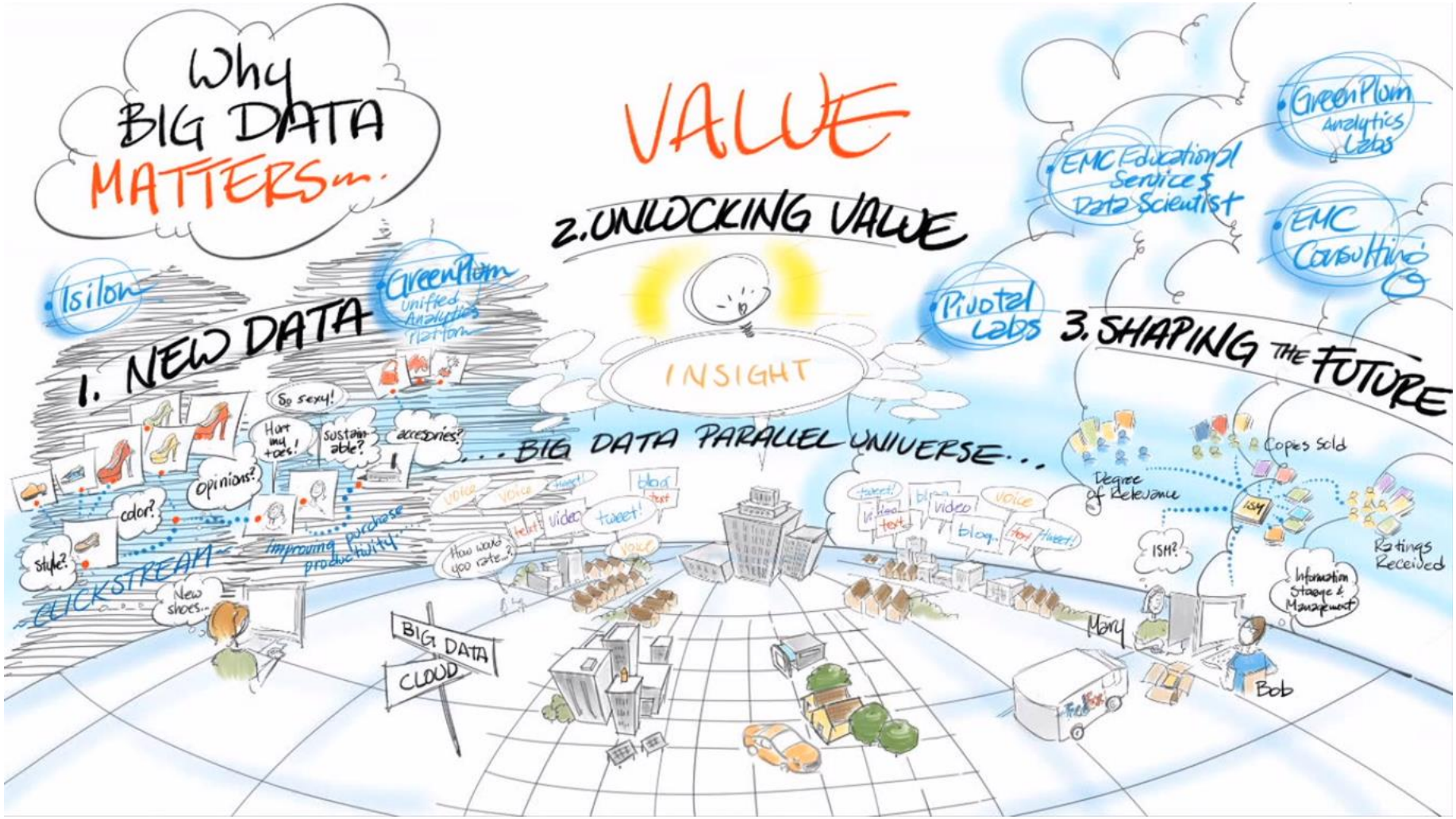
Source: http://visual.ly/what-big-data

Big Ideas: How Big is Big Data?



Source: http://www.youtube.com/watch?v=eEpxN0htRKI

Big Ideas: Why Big Data Matters



Source: http://www.youtube.com/watch?v=eEpxN0htRKI

Key questions enterprises are asking about Big Data

- How to store and protect big data?
- How to backup and restore big data?
- How to organize and catalog the data that you have backed up?
- How to keep costs low while ensuring that all the critical data is available when you need it?

Source: http://visual.ly/what-big-data

Volumes of Data

- Facebook
  - **30 billion pieces of content** were added to Facebook this past month by 600 million plus users
- Youtube
  - **More than 2 billion videos** were watch on YouTube yesterday
- Twitter
  - **32 billion searches** were performed last month on Twitter

Source: http://visual.ly/what-big-data

Source of Big Data

(1) public data

(2) private data

(3) data exhaust

- Information-seeking behavior, people's needs, desires, or intentions

(4) community data

- Customer reviews on products, voting buttons, Tweeters feeds

(5) self-quantification data

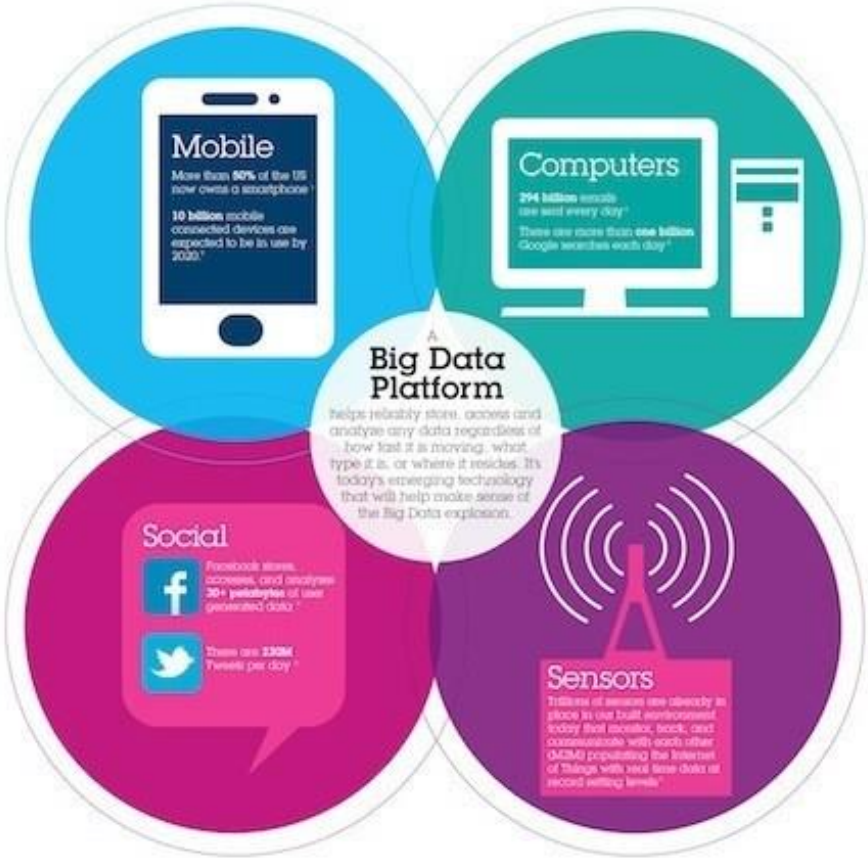
- Quantifying personal actions and behaviors, wristbands

Source: George, G., Haas, M. R., & Pentland, A. (2014). Big data and management. Academy of Management Journal, 57(2), 321-326

Big Data:

Making the World go Round

Big Data is growing and moving fast from a variety of sources; are you keeping up?



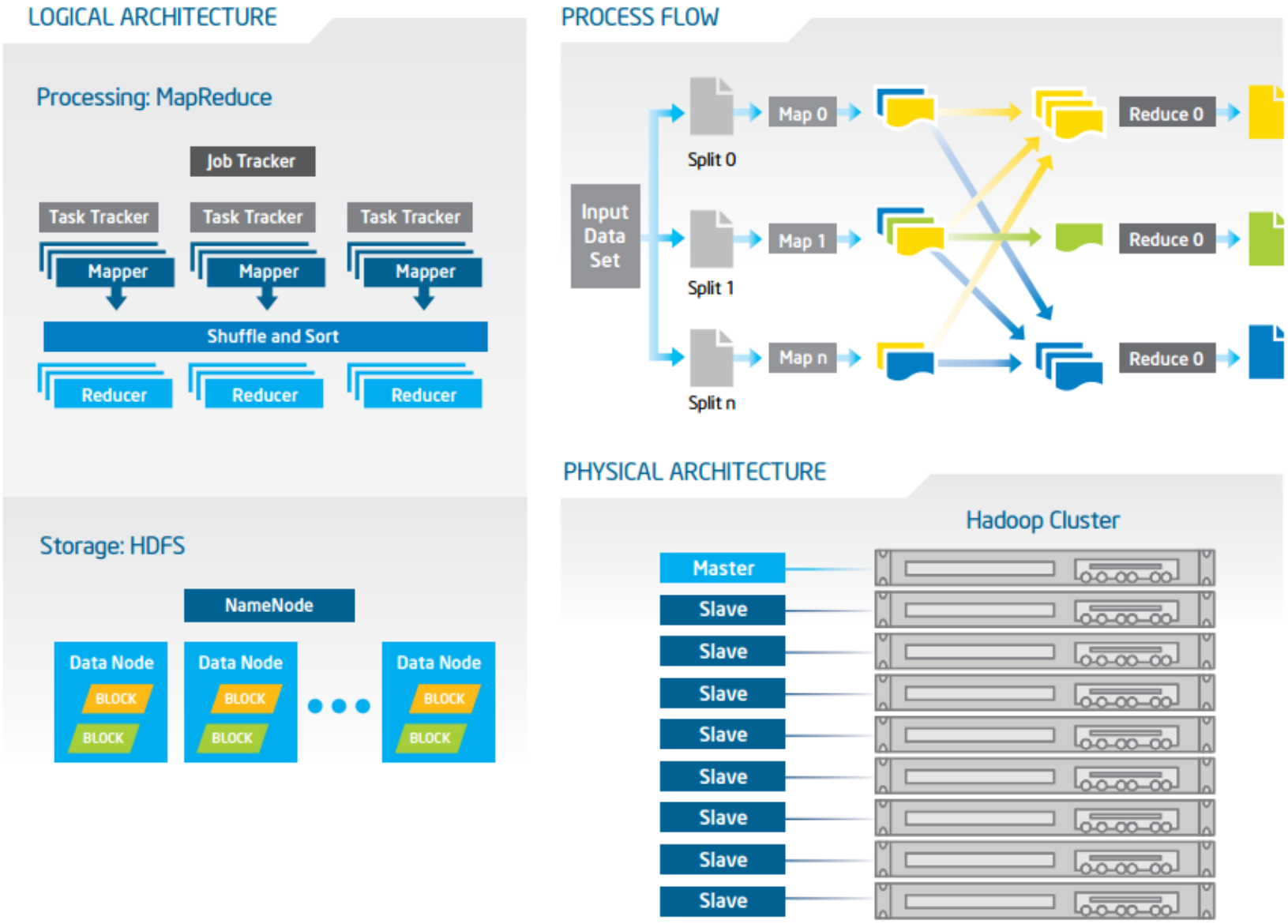
Information gathered by IBM:

1. Clarkin Sharma Consulting - US Mobile Data Market Update Q3 2012
2. 2011 Economist
3. IBM - Managing the Big Flood of Big Data in Digital Marketing
4. Google - How Google Search Works
5. Wikibon - Taming Big Data
6. IBM - Managing the Big Flood of Big Data in Digital Marketing
7. IBM

IBM

Source: http://www.business2community.com/big-data/big-data-big-insights-for-social-media-with-ibm-0501158

Big Data with Hadoop Architecture

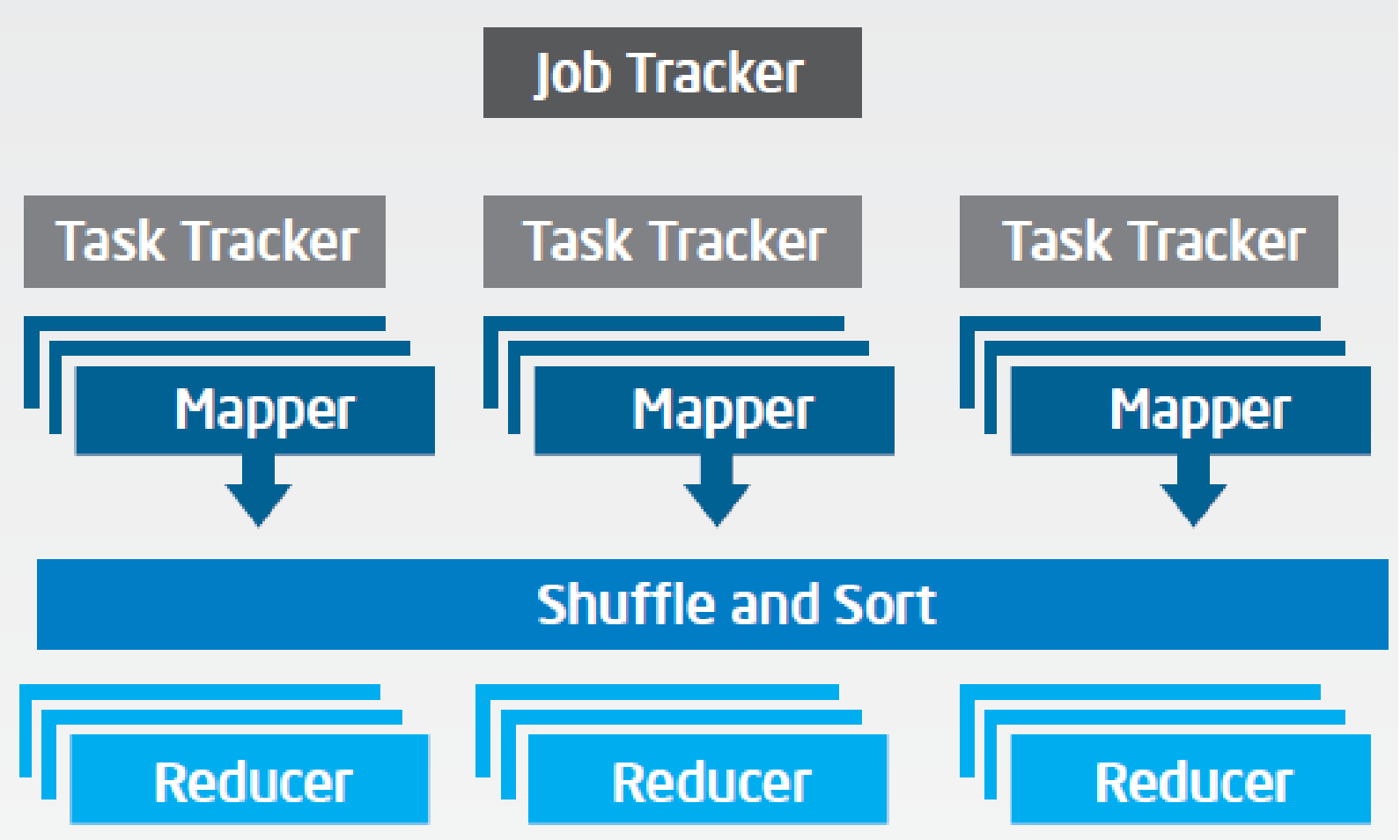


Source: https://software.intel.com/sites/default/files/article/402274/etl-big-data-with-hadoop.pdf

Big Data with Hadoop Architecture

Logical Architecture

Processing: MapReduce

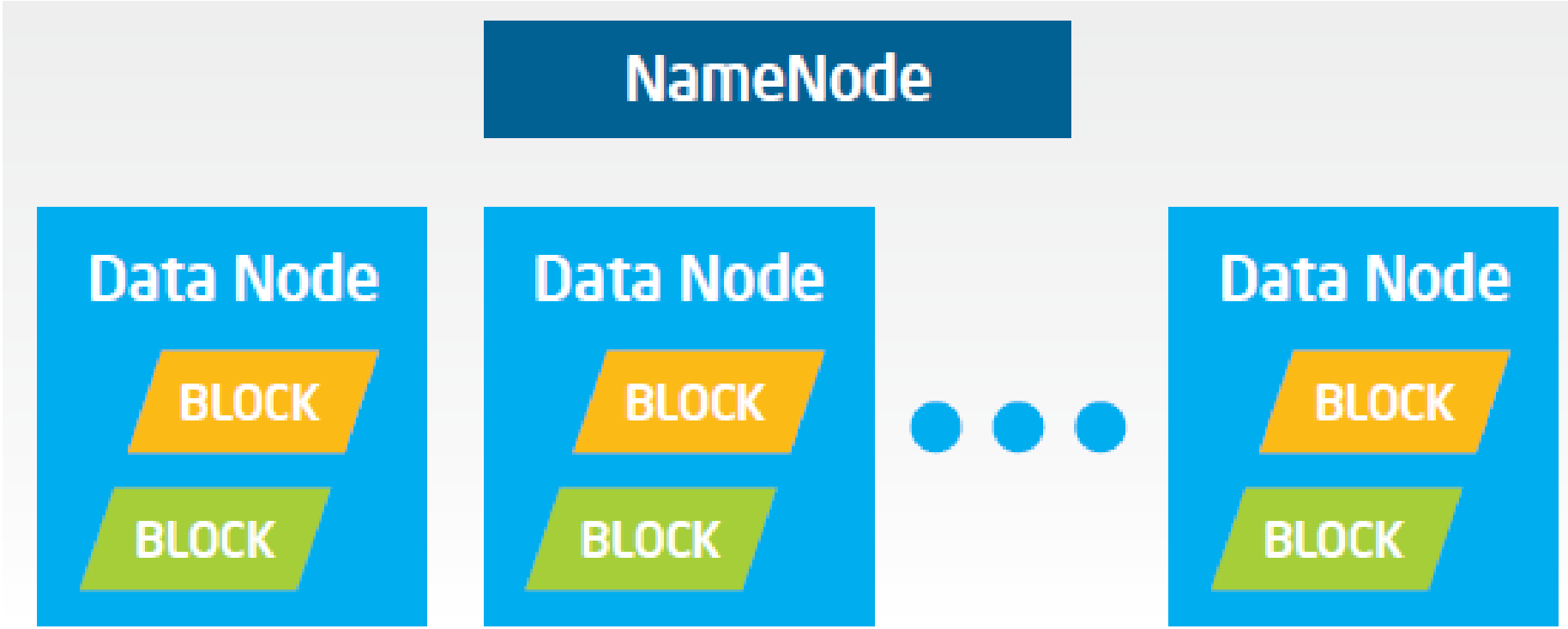


Source: https://software.intel.com/sites/default/files/article/402274/etl-big-data-with-hadoop.pdf

Big Data with Hadoop Architecture

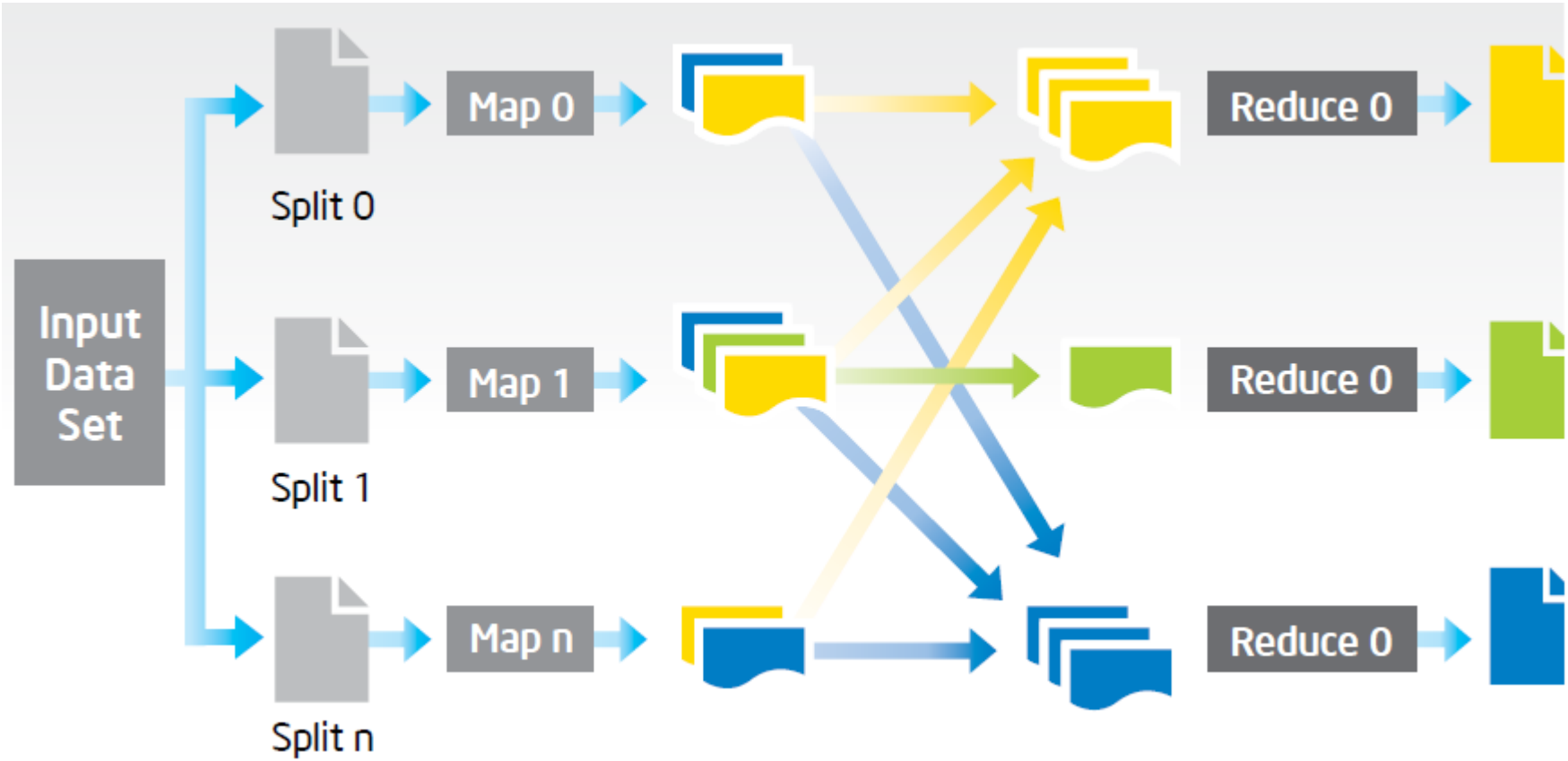
Logical Architecture

Storage: HDFS



Source: https://software.intel.com/sites/default/files/article/402274/etl-big-data-with-hadoop.pdf

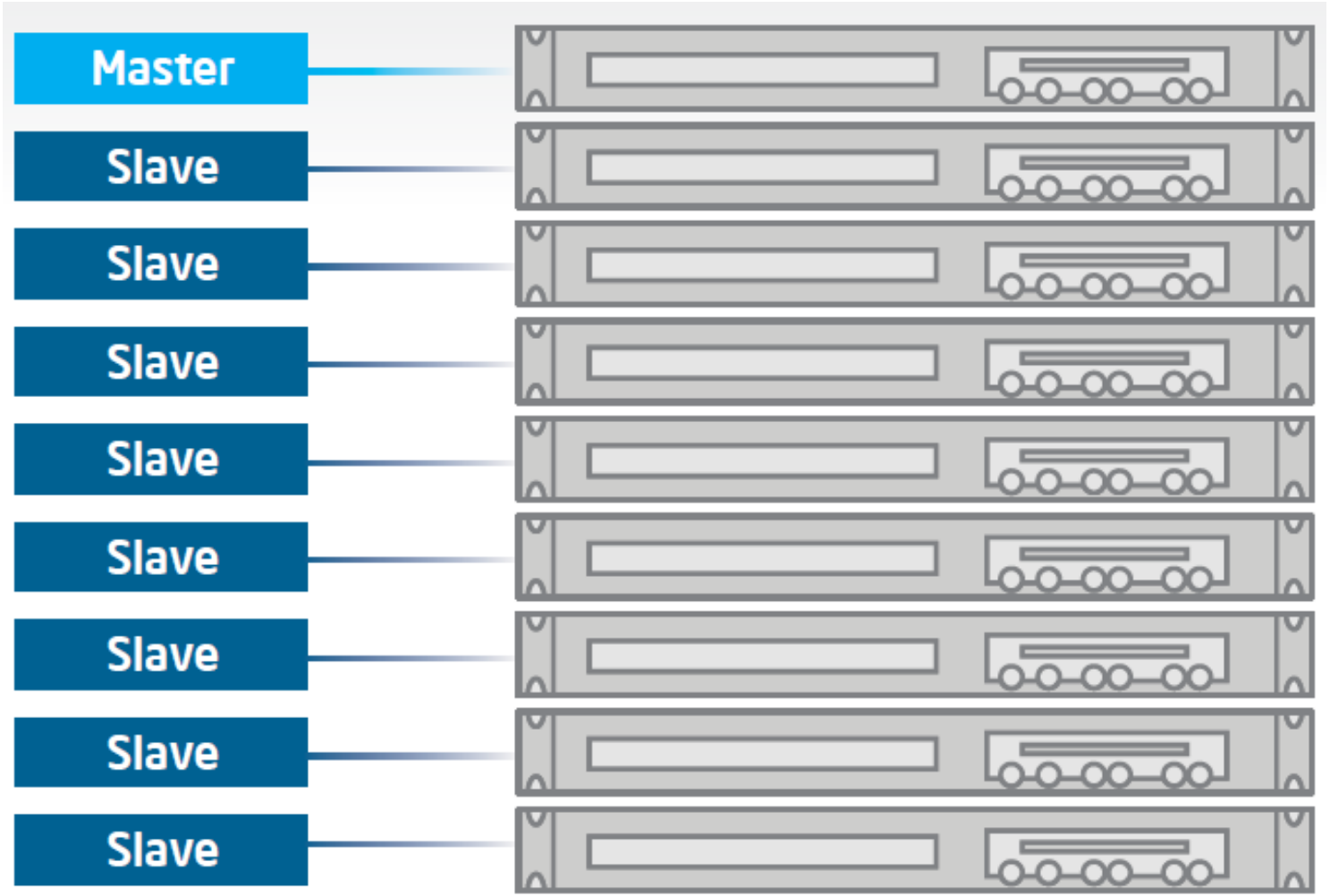
Big Data with Hadoop Architecture
Process Flow



Source: https://software.intel.com/sites/default/files/article/402274/etl-big-data-with-hadoop.pdf

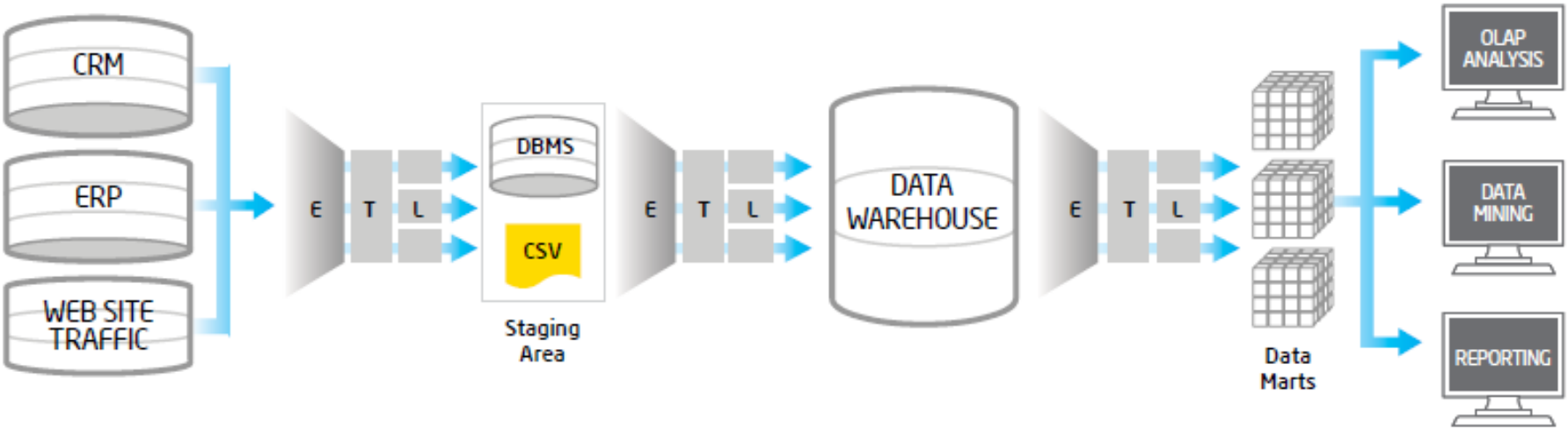
Big Data with Hadoop Architecture

Hadoop Cluster



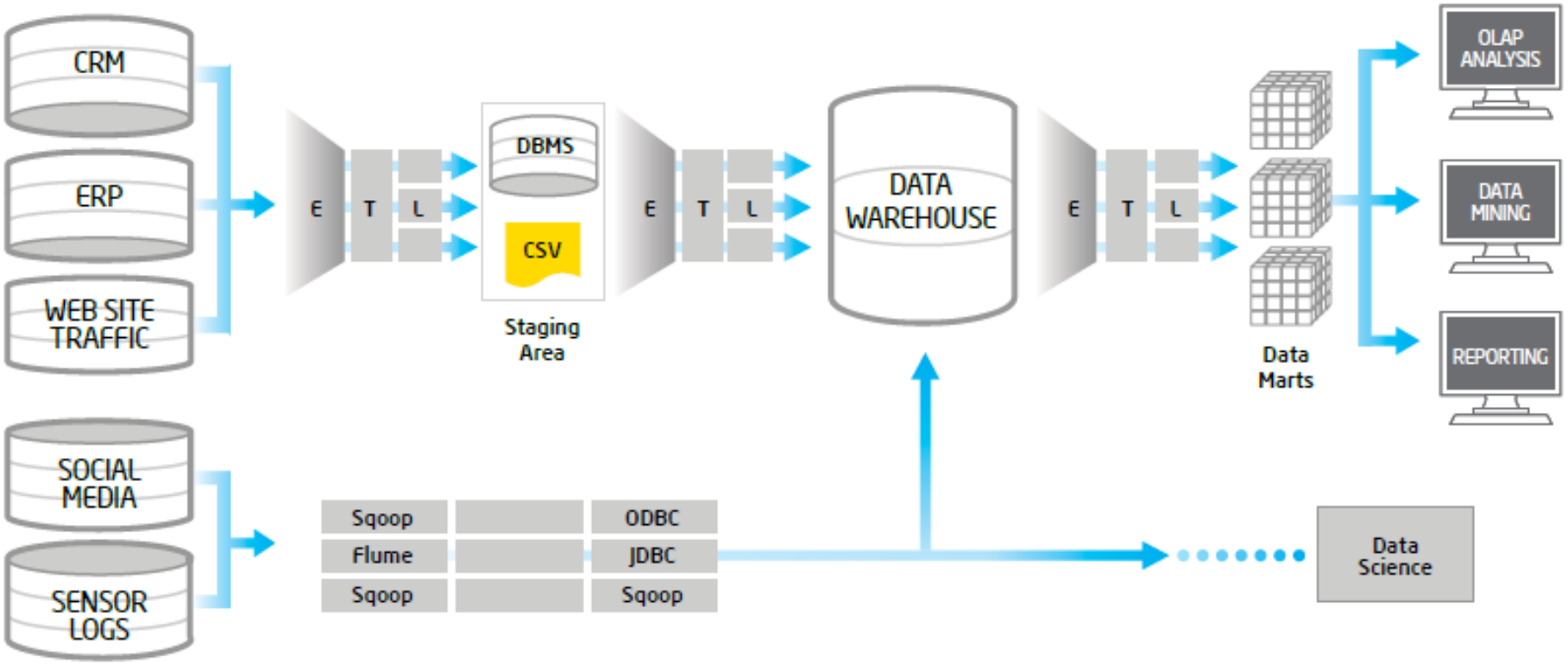
Source: https://software.intel.com/sites/default/files/article/402274/etl-big-data-with-hadoop.pdf

Traditional ETL Architecture



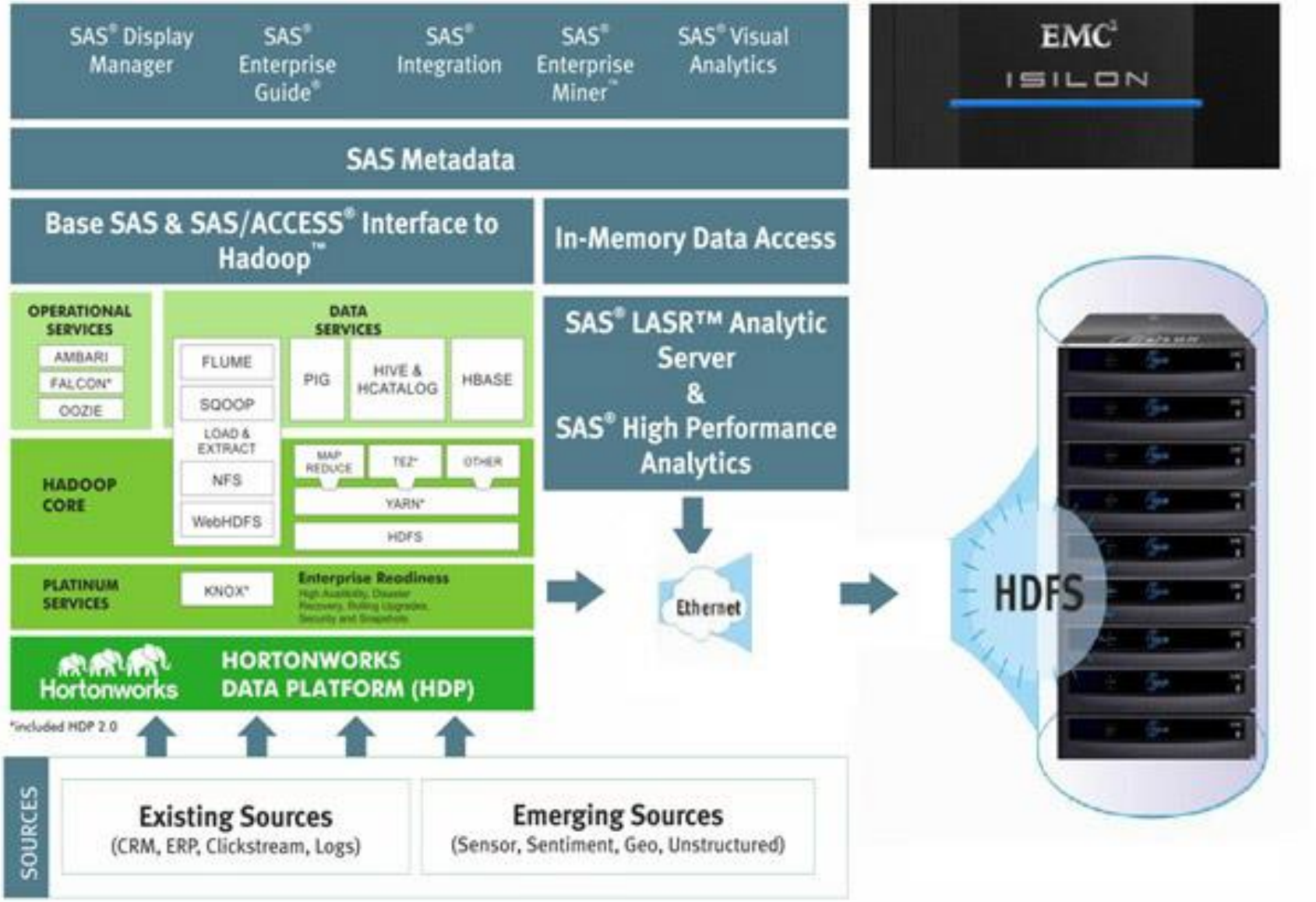
Source: https://software.intel.com/sites/default/files/article/402274/etl-big-data-with-hadoop.pdf

Offload ETL with Hadoop (Big Data Architecture)



Source: https://software.intel.com/sites/default/files/article/402274/etl-big-data-with-hadoop.pdf

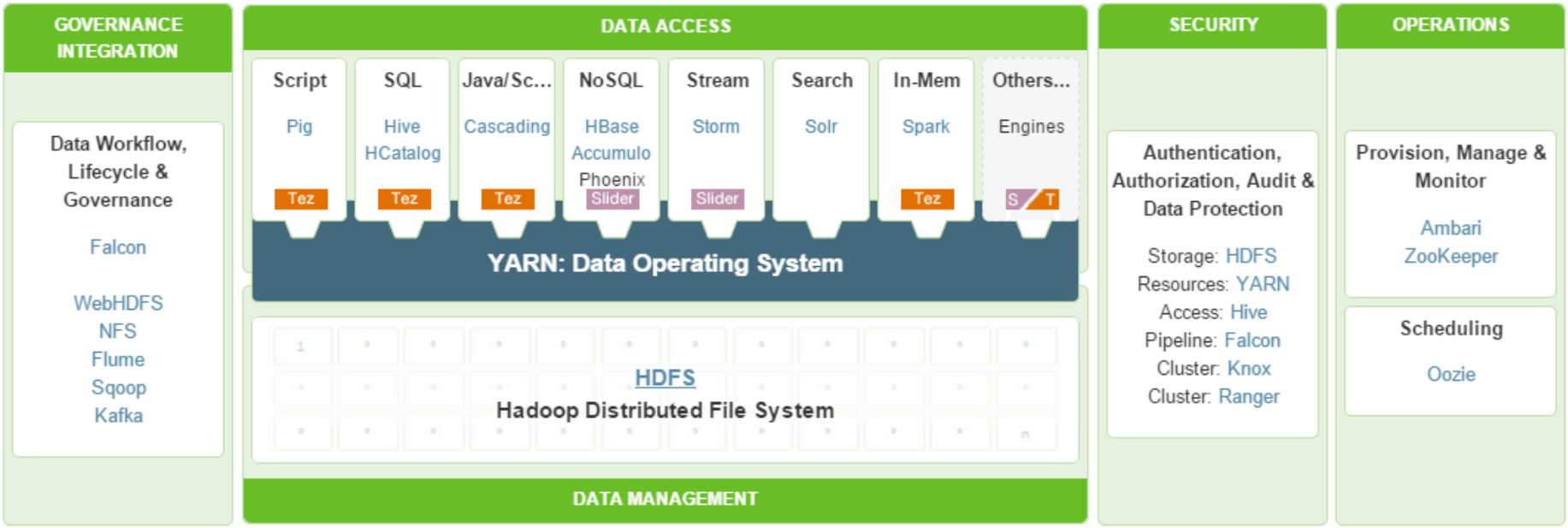
Big Data Solution



Source: http://www.newera-technologies.com/big-data-solution.html

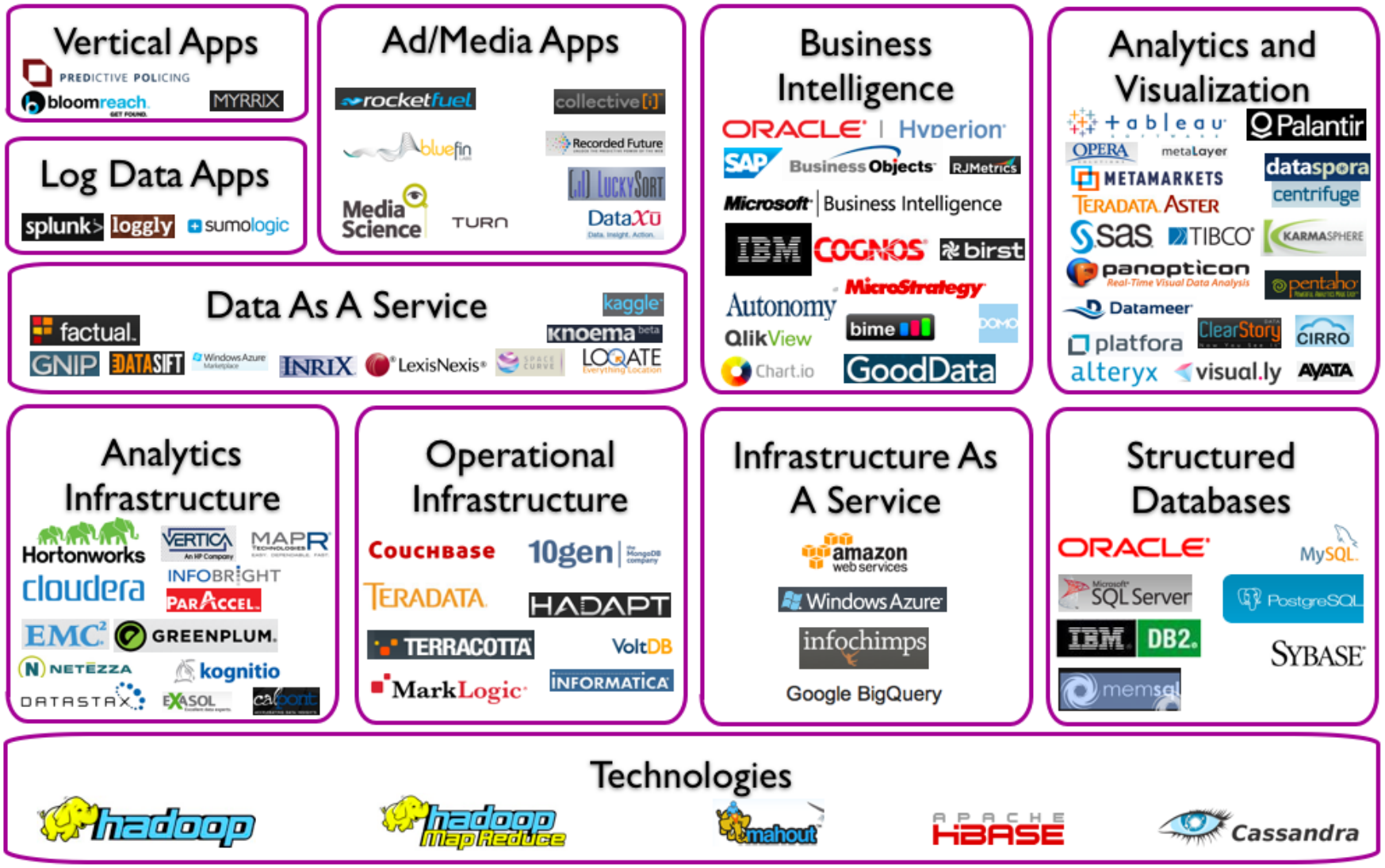
HDP

A Complete Enterprise Hadoop Data Platform



Source: http://hortonworks.com/hdp/

Big Data Landscape

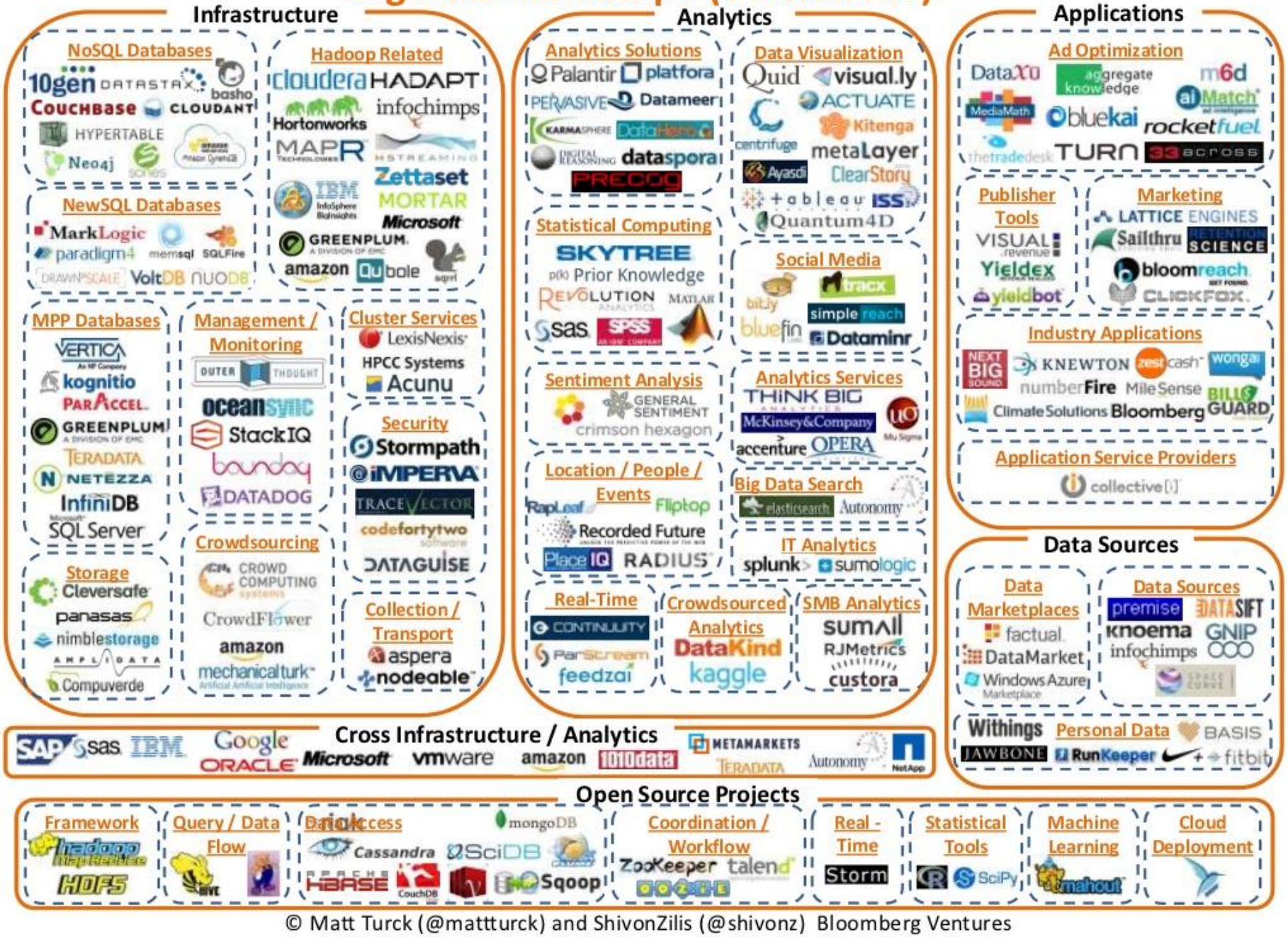


dave@vcdave.com

blogs.forbes.com/davefeinleib

Source: http://www.forbes.com/sites/davefeinleib/2012/06/19/the-big-data-landscape/

Big Data Landscape (Version 2.0)

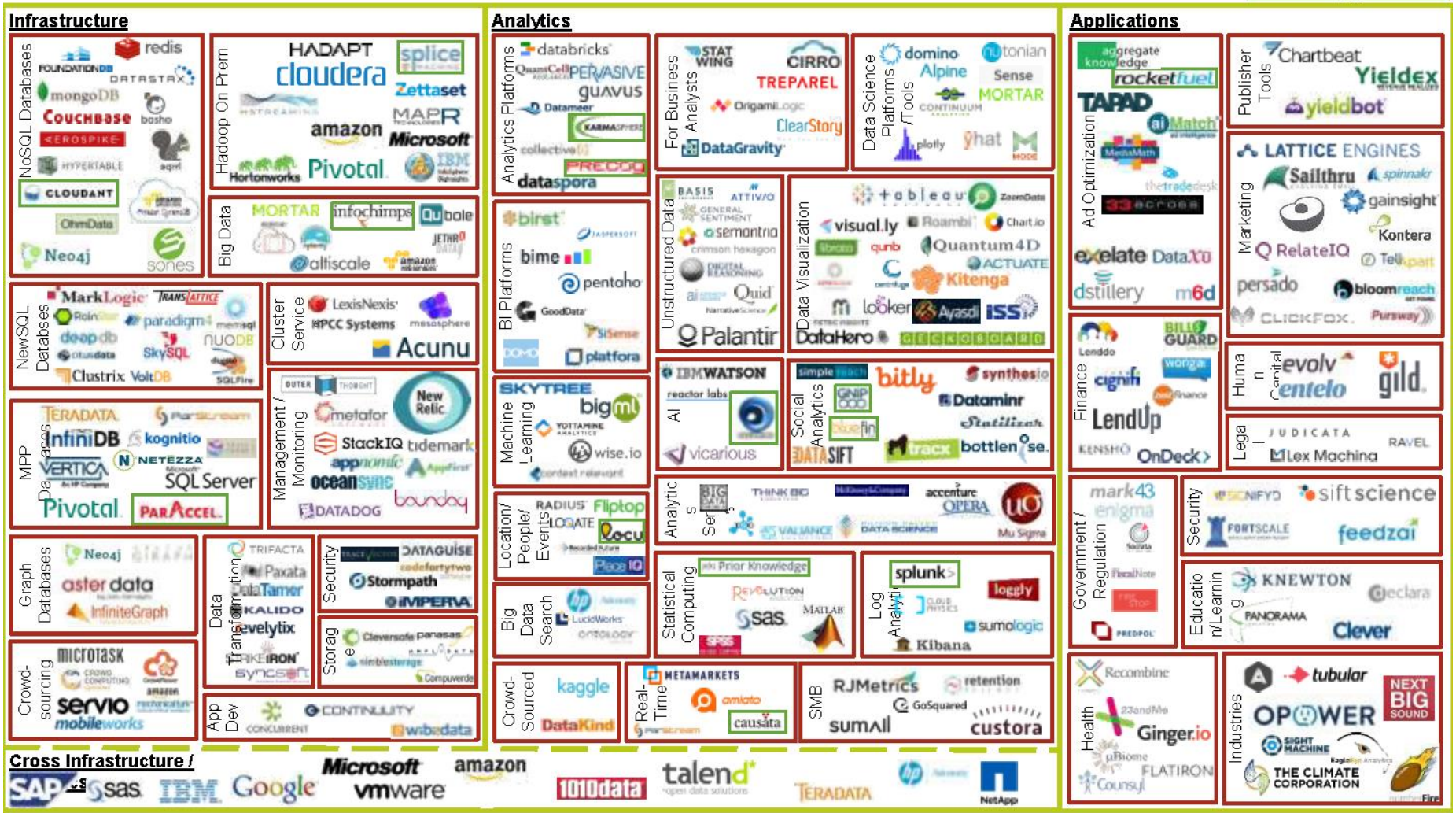


© Matt Turck (@mattturck) and ShivonZilis (@shivonz) Bloomberg Ventures

Source: http://mattturck.com/2012/10/15/a-chart-of-the-big-data-ecosystem-take-2/

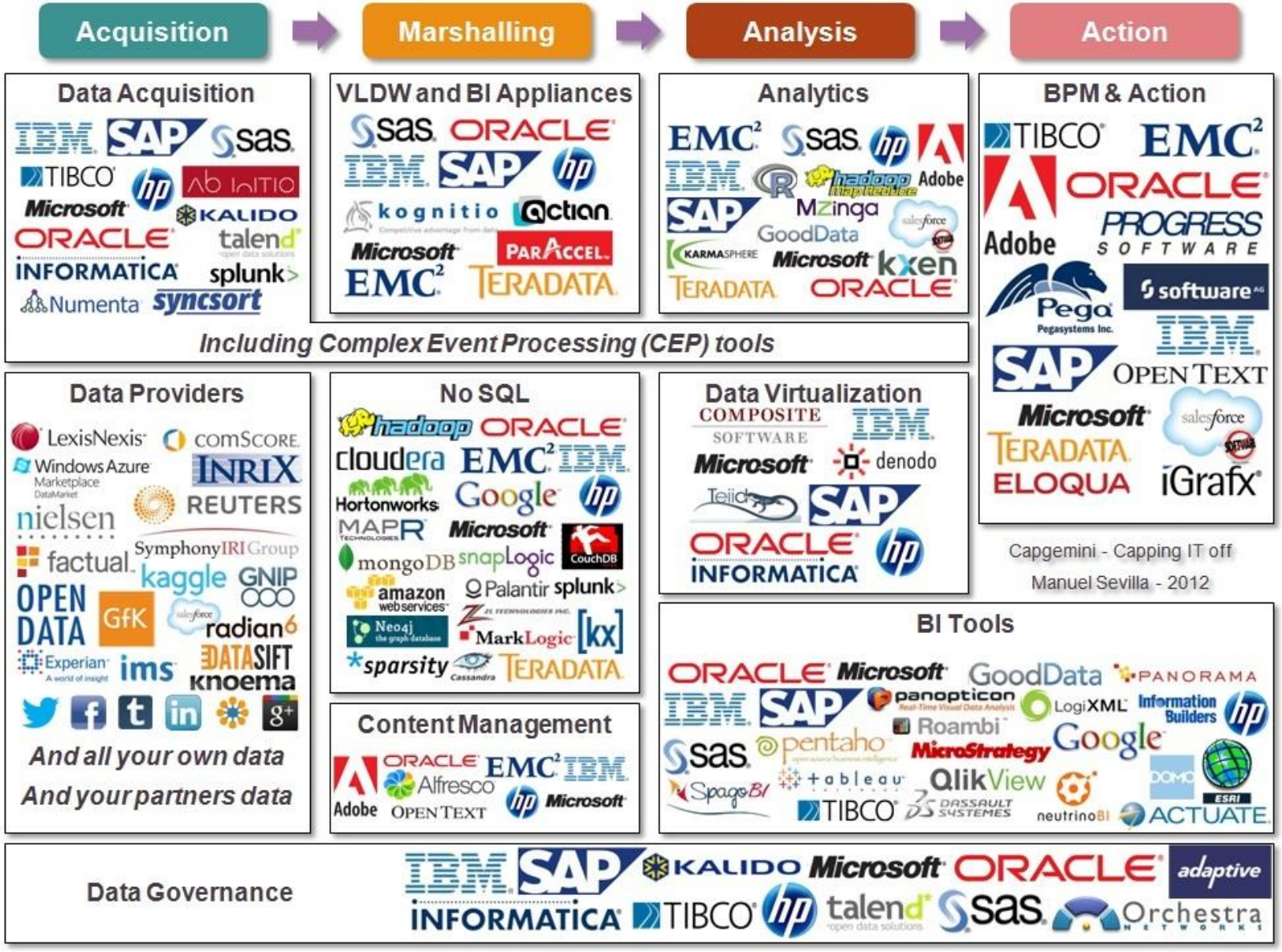
BIG DATA LANDSCAPE, VERSION 3.0

Exited: Acquisition or IPO



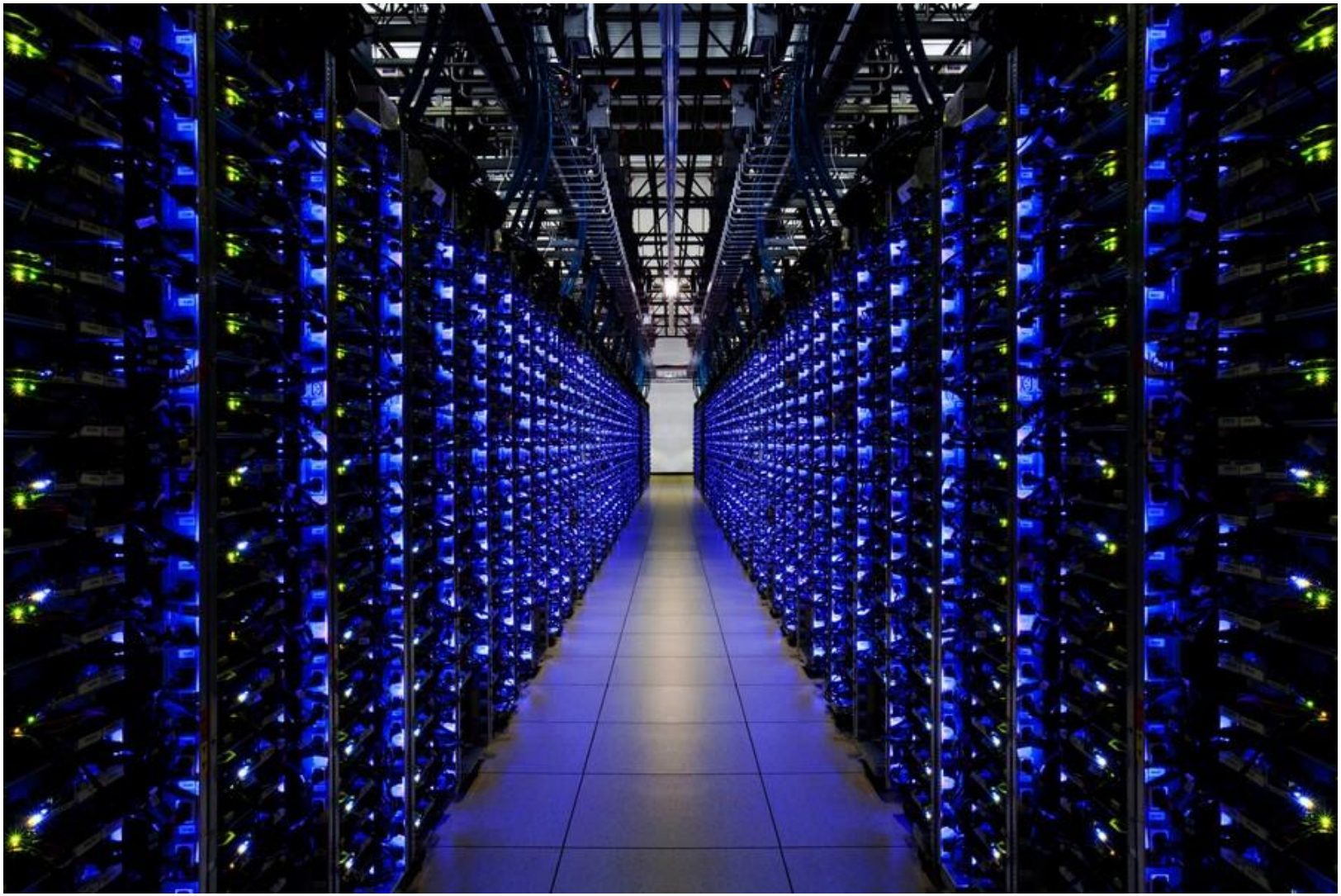
Source: http://www.slideshare.net/mjft01/big-data-landscape-matt-turck-may-2014

Big Data Vendors and Technologies



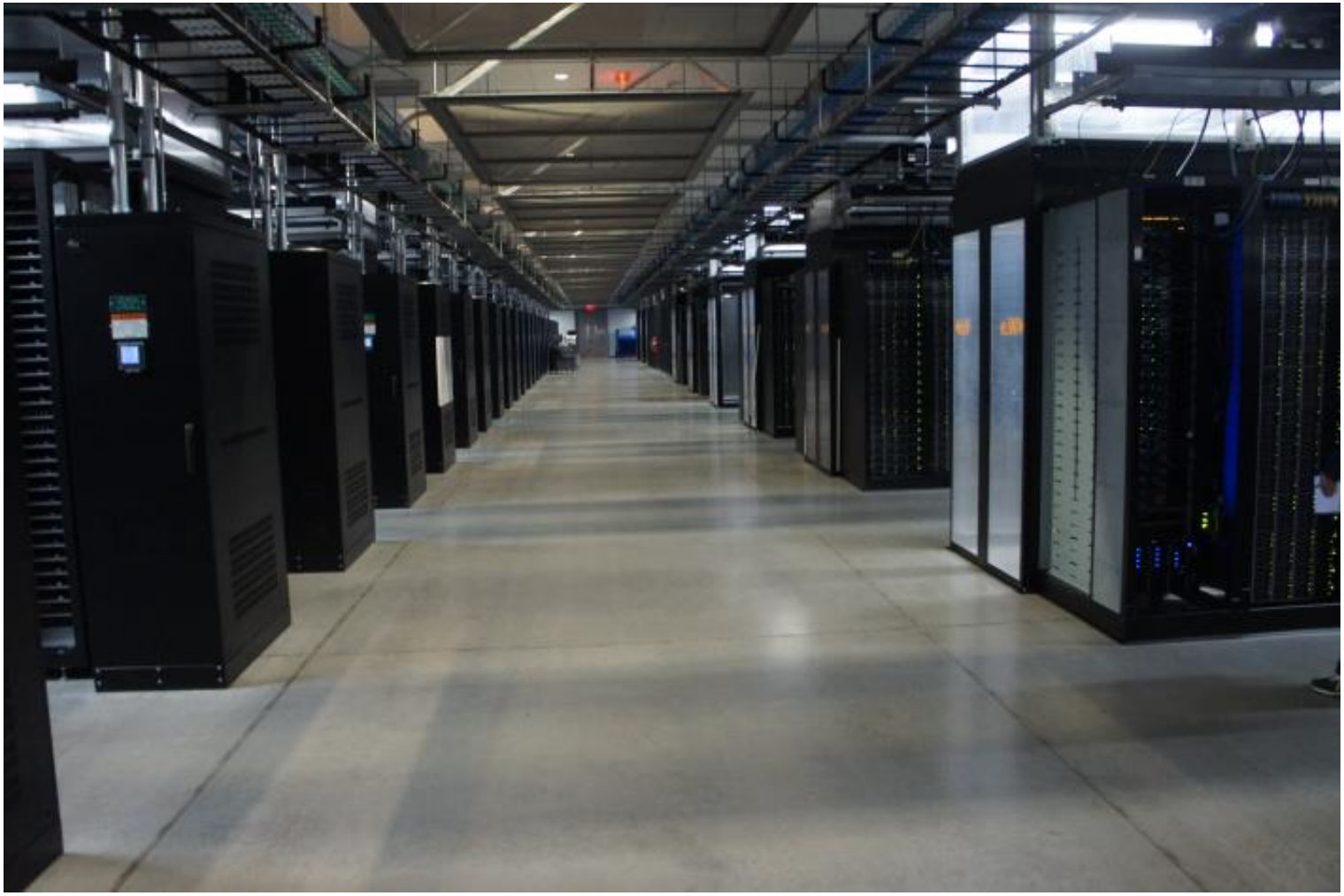
Source: http://www.capgemini.com/blog/capping-it-off/2012/09/big-data-vendors-and-technologies-the-list

Processing Big Data
Google



Source: http://whatsthebigdata.files.wordpress.com/2013/03/google_datacenter.jpg

Processing Big Data, Facebook



http://gigaom.com/2012/08/17/a-rare-look-inside-facebooks-oregon-data-center-photos-video/

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- Thomas H. Davenport, Enterprise Analytics: Optimize Performance, Process, and Decisions Through Big Data, FT Press, 2012
- Michael Minelli, Michele Chambers, Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley, 2013
- Viktor Mayer-Schonberger, Kenneth Cukier, Big Data: A Revolution That Will Transform How We Live, Work, and Think, Eamon Dolan/Houghton Mifflin Harcourt, 2013
- Jared Dean, Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners, Wiley, 2014