# Cloudera:

## Hadoop for the Enterprise

September 2008

# Data Growing Much Faster than Moore's Law

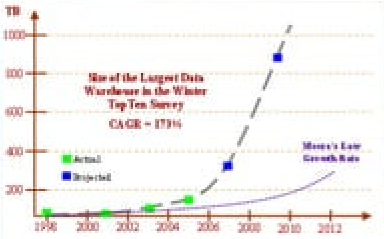
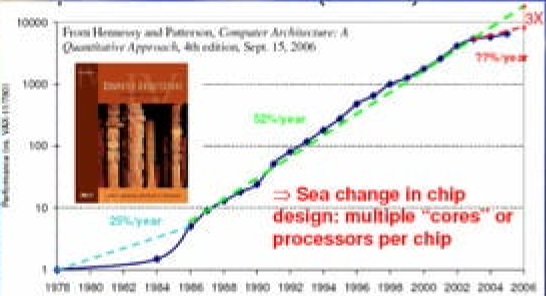


**Figure 1:** Exponential Data Warehouse Growth
(size in terabytes of user data)

Source: Richard Winter, *Why Are Data Warehouses Growing so Fast?*, April 2008

# Uniprocessor Performance



From Hennessy and Patterson, *Computer Architecture: A Quantitative Approach*, 4th edition, Sept. 15, 2006

⇒ Sea change in chip design: multiple "cores" or processors per chip

- VAX : 25%/year 1978 to 1986
- RISC + x86: 52%/year 1986 to 2002
- RISC + x86: ??%/year 2002 to present

# Founding Team

- Mike Olson, CEO
  - CEO Sleepycat
  - Britton Lee, Illustra, Informix, Oracle
  - BA, MS CS, Berkeley
- Amr Awadallah, CTO, VP Engineering
  - Founder Aptivia/VivaSmart
  - 8 years at Yahoo! running BI infrastructure, including Hadoop
  - PhD EE, Stanford
- Christophe Bisciglia, VP Technology
  - Created Google/NSF Hadoop cluster and program
  - BA CS, U Washington
- Jeff Hammerbacher, VP Product
  - Ran world's largest operational BI support system on Hadoop, at Facebook
  - BA Mathematics, Harvard

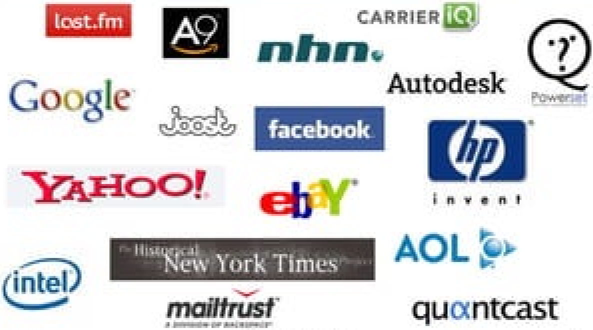
# What Is Hadoop?

- Core engine:
  - Open source implementation of Google's MapReduce and GFS
  - Hundreds or thousands of servers parallelize a data analysis task
- Interfaces built on top of MapReduce
- Storage layer beneath (HDFS)
- Doug Cutting, Mike Cafarella are advisors

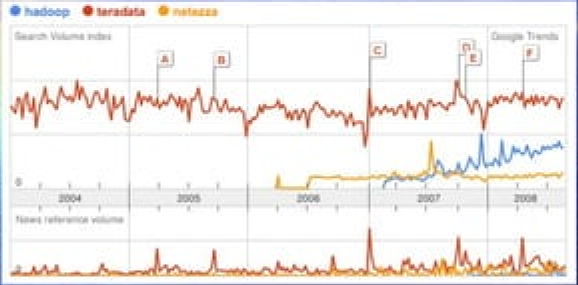
# Hadoop is Open Source

- Hadoop is distributed under the Apache License:
  - Reduces concern about lock-in
  - Low-cost, effective distribution strategy
  - Allows innovation by partners, customers
  - Third-party inspection of source code provides assurances on security, product quality
- Business-friendly license encourages commercial development
  - "Open core" licensing
  - Closed-source components, applications

# Hadoop Users

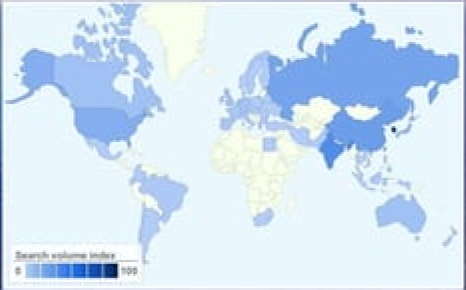


# Momentum: Google Trends



Netezza: $127M in FY08, $79M in FY07
Teradata: $830M in 1H08, $1.7B in FY07
04/21/17

# Worldwide Phenomenon



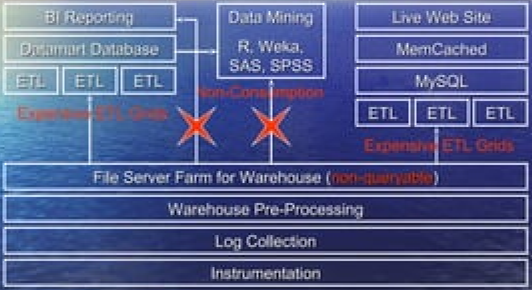
Source: Google Insights world map for searches on "hadoop", Sept 2008.

04/21/17

# Why is Hadoop Successful?

- **Brings computation closer to data allowing both IO and compute scalability.**
- **Map-Reduce** forces developers to **think in a parallel way**
- Operates on **unstructured data**, and **structured data** (HBASE, HIVE)
- **Prescriptive development**, grows with you without needing to re-architect
- **Procedural language** offers power

# Current Systems Isolate Users from the Event Level Raw Data



BI Reporting

Datamart Database

ETL ETL ETL

Expensive ETL Grids

Data Mining

R, Weka, SAS, SPSS

Non-Consumption

Live Web Site

MemCached

MySQL

ETL ETL ETL

Expensive ETL Grids

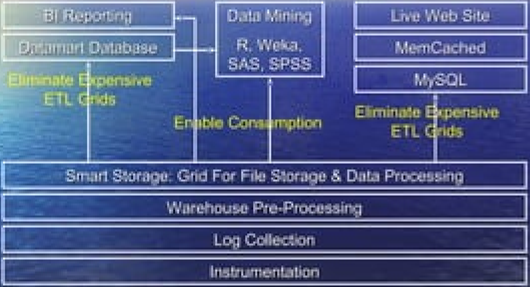
File Server Farm for Warehouse (non-queryable)

Warehouse Pre-Processing

Log Collection

Instrumentation

# Solution: "Smart" Storage Service



BI Reporting

Datamart Database

Data Mining

R, Weka, SAS, SPSS

Live Web Site

MemCached

MySQL

Eliminate Expensive ETL Grids

Enable Consumption

Eliminate Expensive ETL Grids

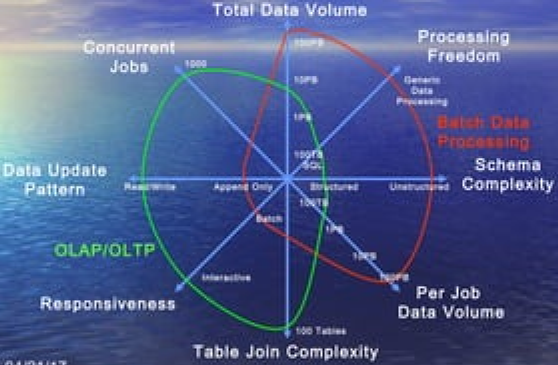
Smart Storage: Grid For File Storage & Data Processing

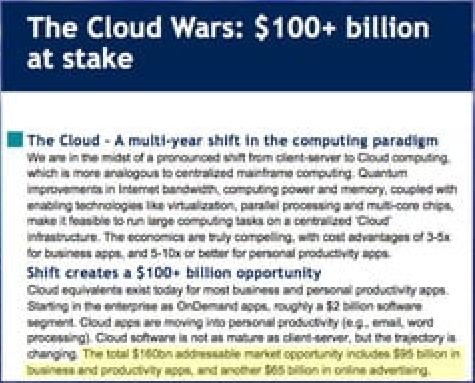
Warehouse Pre-Processing

Log Collection

Instrumentation

# BDP versus OLAP/OLTP





# The Cloud Wars: $100+ billion at stake

- **The Cloud – A multi-year shift in the computing paradigm**

We are in the midst of a pronounced shift from client-server to Cloud computing, which is more analogous to centralized mainframe computing. Quantum improvements in Internet bandwidth, computing power and memory, coupled with enabling technologies like virtualization, parallel processing and multi-core chips, make it feasible to run large computing tasks on a centralized 'Cloud' infrastructure. The economics are truly compelling, with cost advantages of 3-5x for business apps, and 5-10x or better for personal productivity apps.

**Shift creates a $100+ billion opportunity**

Cloud equivalents exist today for most business and personal productivity apps. Starting in the enterprise as OnDemand apps, roughly a $2 billion software segment. Cloud apps are moving into personal productivity (e.g., email, word processing). Cloud software is not as mature as client-server, but the trajectory is changing. The total $160bn addressable market opportunity includes $95 billion in business and productivity apps, and another $65 billion in online advertising.

Source: Merrill Lynch Industry Overview, May 7, 2008

04/21/17

# Cloudera Differentiators

- **Enabling Hadoop as an elastic platform with statistical multiplexing over many customers**
- **Multi-Tenant Support:** Concurrency, Priority, Namespace Isolation, Performance Isolation.
- **Monitoring, Reliability, and Availability**
- **Resilience and Fast Recovery**: A **non-sexy problem** that is **critical to enterprises**, no time to restart ETL job from scratch, otherwise misses SLA.
- **IDE** to easily **debug, deploy, and tune.**
- Integration with **data mining and analysis** functionality (R, Weka, SAS, SPSS)
- **Connector certification**: another non-sexy problem that is ignored by community, make sure system is compatible with other enterprise systems.

# Cloudera:

## Hadoop for the Enterprise

September 2008

# Data Growing Much Faster than Moore's Law

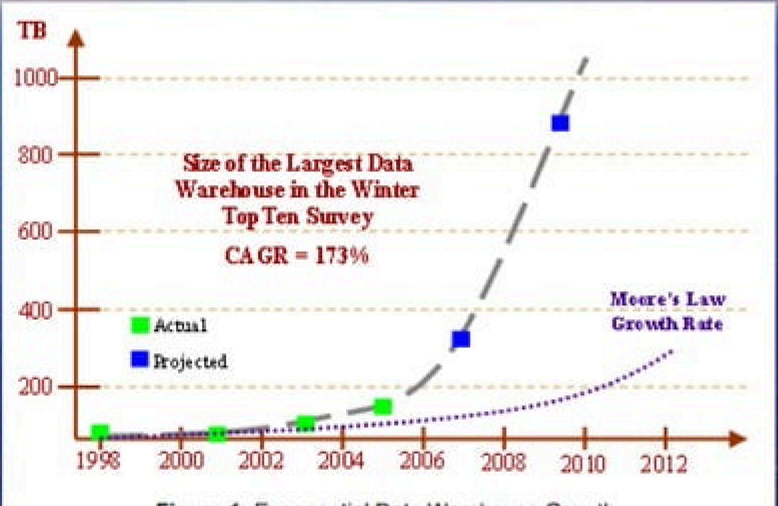
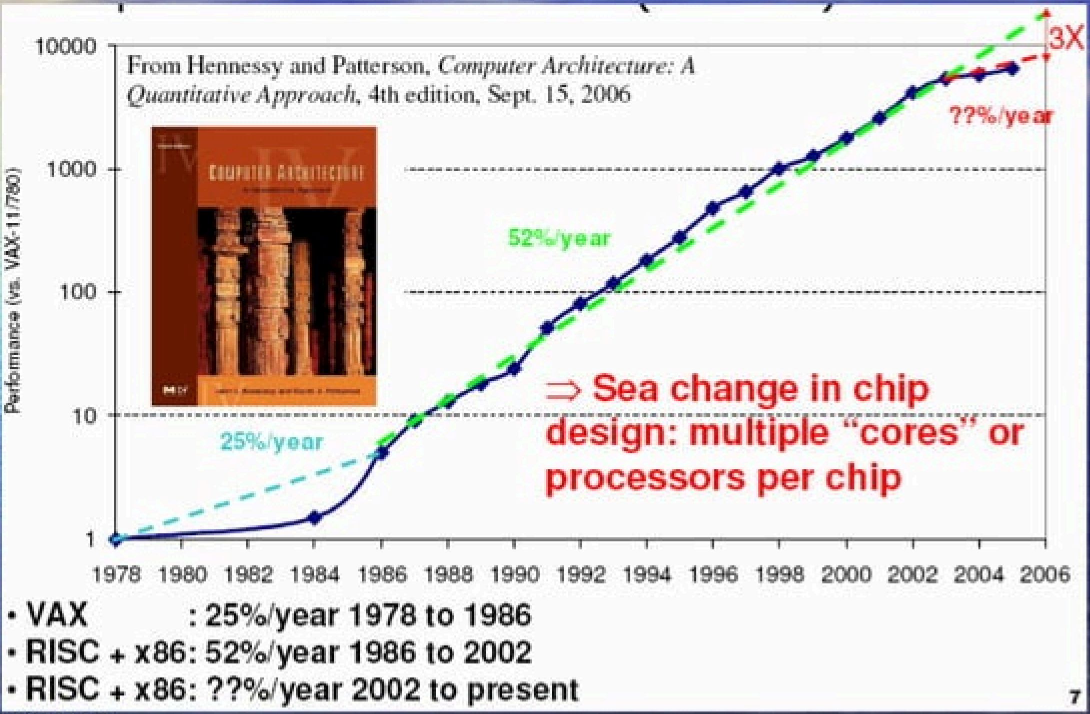


**Figure 1:** Exponential Data Warehouse Growth
(size in terabytes of user data)

Source: Richard Winter, *Why Are Data Warehouses Growing so Fast?*, April 2008

# Uniprocessor Performance



From Hennessy and Patterson, *Computer Architecture: A Quantitative Approach*, 4th edition, Sept. 15, 2006

⇒ Sea change in chip design: multiple "cores" or processors per chip

- VAX : 25%/year 1978 to 1986
- RISC + x86: 52%/year 1986 to 2002
- RISC + x86: ??%/year 2002 to present

7

# Founding Team

- Mike Olson, CEO
  - CEO Sleepycat
  - Britton Lee, Illustra, Informix, Oracle
  - BA, MS CS, Berkeley
- Amr Awadallah, CTO, VP Engineering
  - Founder Aptivia/VivaSmart
  - 8 years at Yahoo! running BI infrastructure, including Hadoop
  - PhD EE, Stanford
- Christophe Bisciglia, VP Technology
  - Created Google/NSF Hadoop cluster and program
  - BA CS, U Washington
- Jeff Hammerbacher, VP Product
  - Ran world's largest operational BI support system on Hadoop, at Facebook
  - BA Mathematics, Harvard

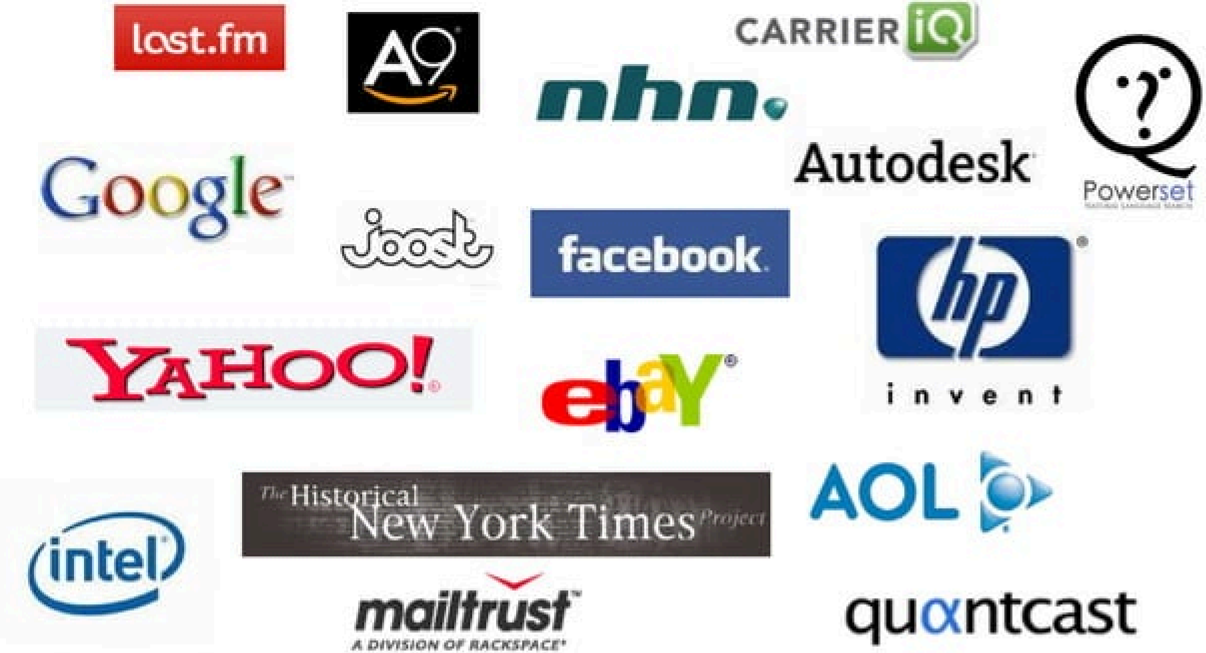
# What Is Hadoop?

- Core engine:
  - Open source implementation of Google's MapReduce and GFS
  - Hundreds or thousands of servers parallelize a data analysis task
- Interfaces built on top of MapReduce
- Storage layer beneath (HDFS)
- Doug Cutting, Mike Cafarella are advisors

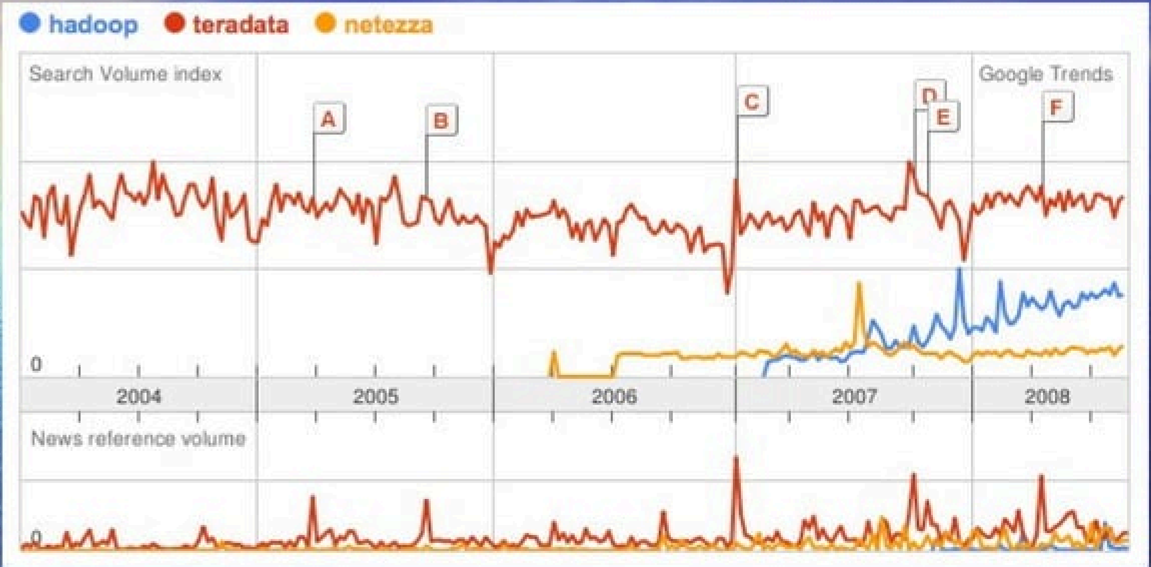
# Hadoop is Open Source

- Hadoop is distributed under the Apache License:
  - Reduces concern about lock-in
  - Low-cost, effective distribution strategy
  - Allows innovation by partners, customers
  - Third-party inspection of source code provides assurances on security, product quality
- Business-friendly license encourages commercial development
  - "Open core" licensing
  - Closed-source components, applications

# Hadoop Users

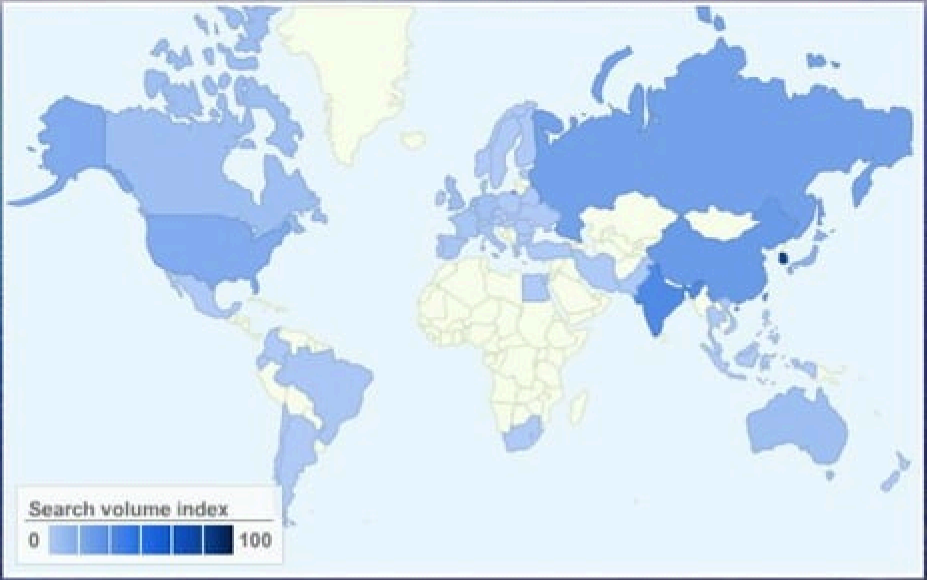


# Momentum: Google Trends



Netezza: $127M in FY08, $79M in FY07
Teradata: $830M in 1H08, $1.7B in FY07

# Worldwide Phenomenon

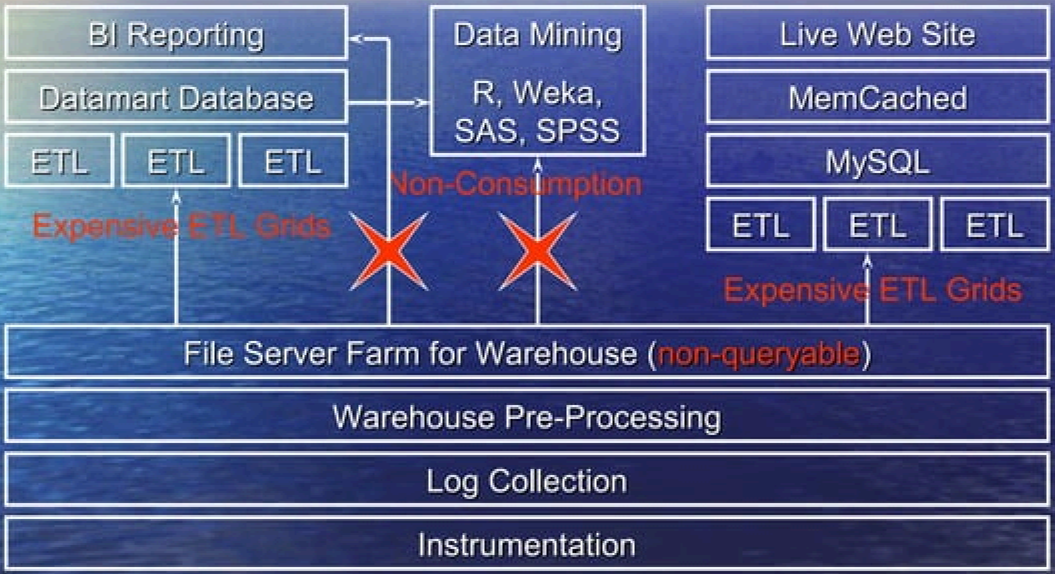


Source: Google Insights world map for searches on "hadoop", Sept 2008.

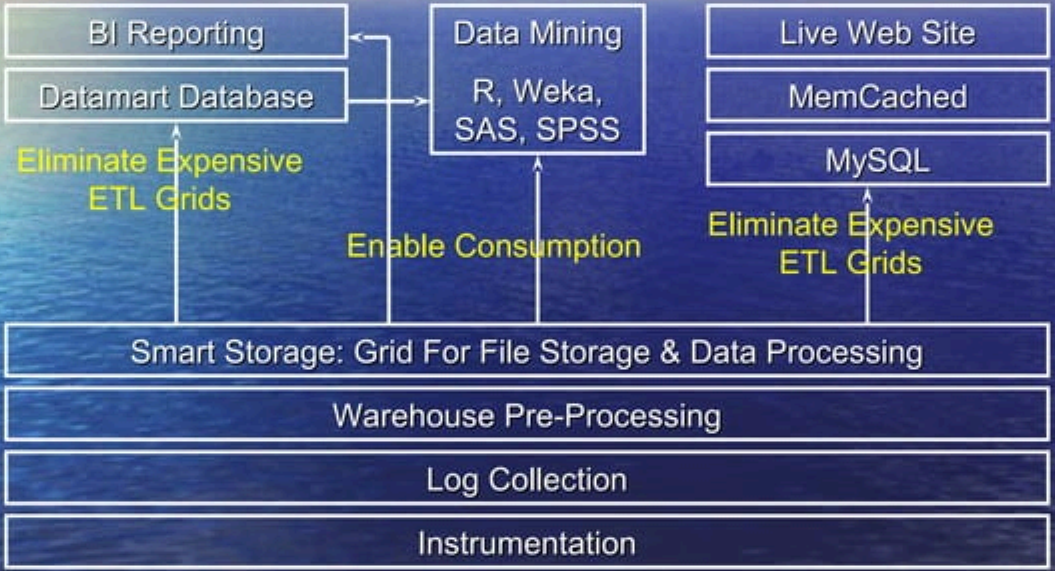
# Why is Hadoop Successful?

- Brings **computation closer to data allowing both IO and compute scalability.**
- **Map-Reduce** forces developers to **think in a parallel way**
- Operates on **unstructured data**, and **structured data** (HBASE, HIVE)
- **Prescriptive development**, grows with you without needing to re-architect
- **Procedural language** offers power

# Current Systems Isolate Users from the Event Level Raw Data



# Solution: "Smart" Storage Service



BI Reporting

Datamart Database

Data Mining

R, Weka, SAS, SPSS

Live Web Site

MemCached

MySQL

Eliminate Expensive ETL Grids

Enable Consumption

Eliminate Expensive ETL Grids

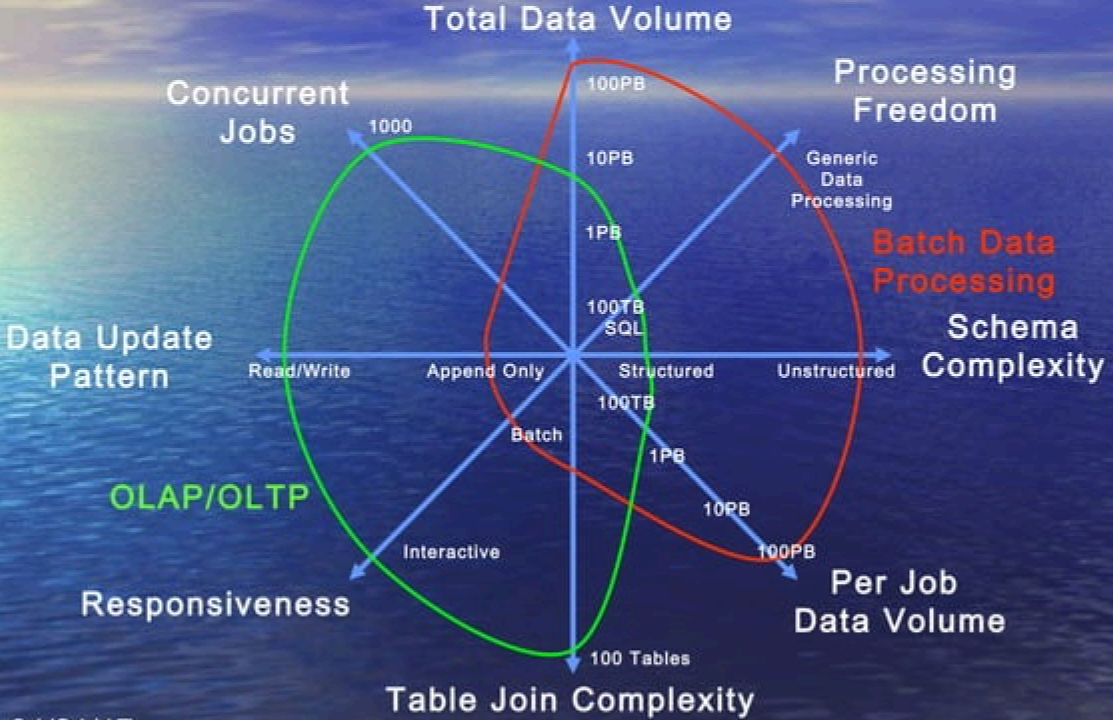
Smart Storage: Grid For File Storage & Data Processing

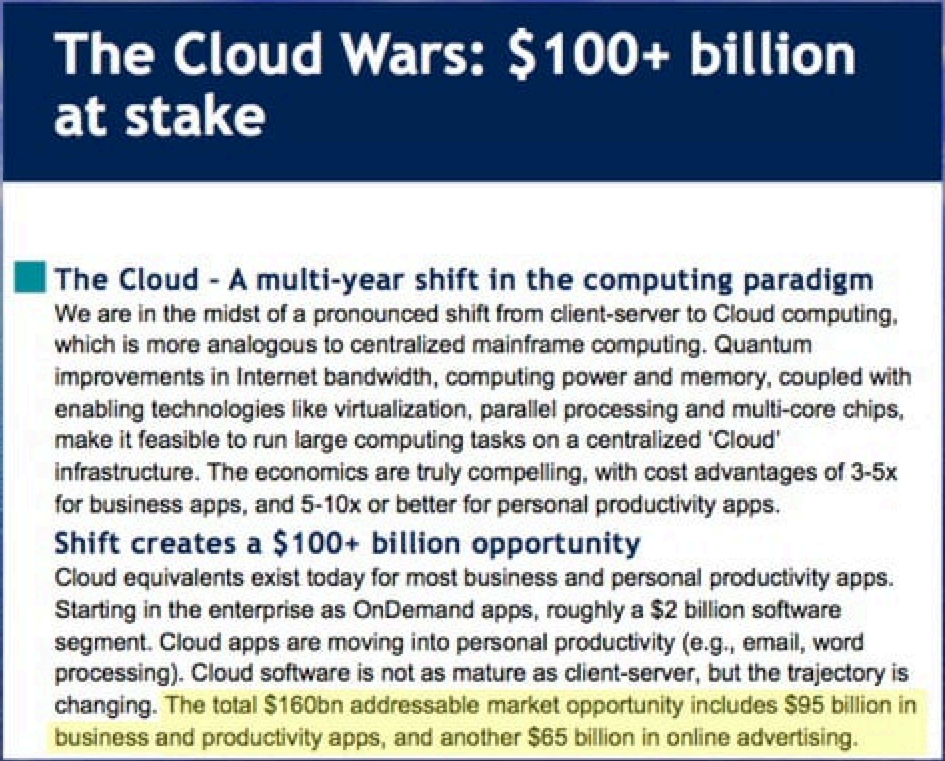
Warehouse Pre-Processing

Log Collection

Instrumentation

# BDP versus OLAP/OLTP





# The Cloud Wars: $100+ billion at stake

## 🟦 The Cloud - A multi-year shift in the computing paradigm

We are in the midst of a pronounced shift from client-server to Cloud computing, which is more analogous to centralized mainframe computing. Quantum improvements in Internet bandwidth, computing power and memory, coupled with enabling technologies like virtualization, parallel processing and multi-core chips, make it feasible to run large computing tasks on a centralized 'Cloud' infrastructure. The economics are truly compelling, with cost advantages of 3-5x for business apps, and 5-10x or better for personal productivity apps.

## Shift creates a $100+ billion opportunity

Cloud equivalents exist today for most business and personal productivity apps. Starting in the enterprise as OnDemand apps, roughly a $2 billion software segment. Cloud apps are moving into personal productivity (e.g., email, word processing). Cloud software is not as mature as client-server, but the trajectory is changing. The total $160bn addressable market opportunity includes $95 billion in business and productivity apps, and another $65 billion in online advertising.

Source:
Merrill Lynch
Industry
Overview,
May 7, 2008

# Cloudera Differentiators

- **Enabling Hadoop as an elastic platform with statistical multiplexing over many customers**
- **Multi-Tenant Support:** Concurrency, Priority, Namespace Isolation, Performance Isolation.
- **Monitoring, Reliability, and Availability**
- **Resilience and Fast Recovery**: A **non-sexy problem** that is **critical to enterprises**, no time to restart ETL job from scratch, otherwise misses SLA.
- **IDE** to easily **debug, deploy, and tune.**
- Integration with **data mining and analysis** functionality (R, Weka, SAS, SPSS)
- **Connector certification**: another non-sexy problem that is ignored by community, make sure system is compatible with other enterprise systems.