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Education

NextGen Infrastructure for Big Data

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Abstract

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NextGen Infrastructure for Big Data

- This session will appeal to Business Planning, Marketing, Technology System Integrators and Data Center Managers seeking to understand the drivers behind the demand for and rise of Big Data.

Abstract

- The internet has spawned an explosion in data growth in the form of data sets, called Big Data, that are so large they are difficult to store, manage and analyze using traditional RDBMS which are tuned for Online Transaction Processing (OLTP) only. Not only is this new data heavily unstructured, voluminous and streams rapidly and difficult to harness but even more importantly, the infrastructure cost of HW and SW required to crunch it using traditional RDBMS, to derive any analytics or business intelligence online (OLAP) from it, is prohibitive.
- To capitalize on the Big Data trend, a new breed of Big Data technologies (such as Hadoop and others) many companies have emerged which are leveraging new parallelized processing, commodity hardware, open source software and tools to capture and analyze these new data sets and provide a price/performance that is 10 times better than existing Database/Data Warehousing/Business Intelligence Systems.

Learning Objectives

- The presentation will illustrate the existing operational challenges businesses face today using RDBMS systems despite using fast access in-memory and solid state storage technologies. It details how IT is harnessing the emergent Big Data to manage massive amounts of data and new techniques such as parallelization and virtualization to solve complex problems in order to empower businesses with knowledgeable decision-making.
- It lays out the rapidly evolving big data technology ecosystem - different big data technologies from Hadoop, Distributed File Systems, emerging NoSQL derivatives for implementation in private and hybrid cloud-based environments, Storage Infrastructure Requirements to Store, Access, Secure, Prepare for analytics and visualization of data while manipulating it rapidly to derive business intelligence online, to run businesses smartly.

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Big Data in IT Industry Roadmap

IT Industry Roadmap

Analytics – BI

Predictive Analytics - Unstructured Data
From Dashboards Visualization to Prediction Engines using Big Data.

Cloudization

On-Premises > Private Clouds > Public Clouds
DC to Cloud-Aware Infrast. & Apps. Cascade migration to SPs/Public Clouds.

Automation

Automatically Maintains Application SLAs
(Self-Configuration, Self-Healing©IMEX, Self-Acctg. Charges etc.)

Virtualization

Pools Resources. Provisions, Optimizes, Monitors
Shuffles Resources to optimize Delivery of various Business Services

Integration/Consolidation

Integrate Physical Infrast./Blades to meet CAPSIMS ®IMEX
Cost, Availability, Performance, Scalability, Inter-operability, Manageability & Security

Standardization

Standard IT Infrastructure- Volume Economics HW/Syst SW
(Servers, Storage, Networking Devices, System Software (OS, MW & Data Mgmt. SW)

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NextGen IT Infrastructure

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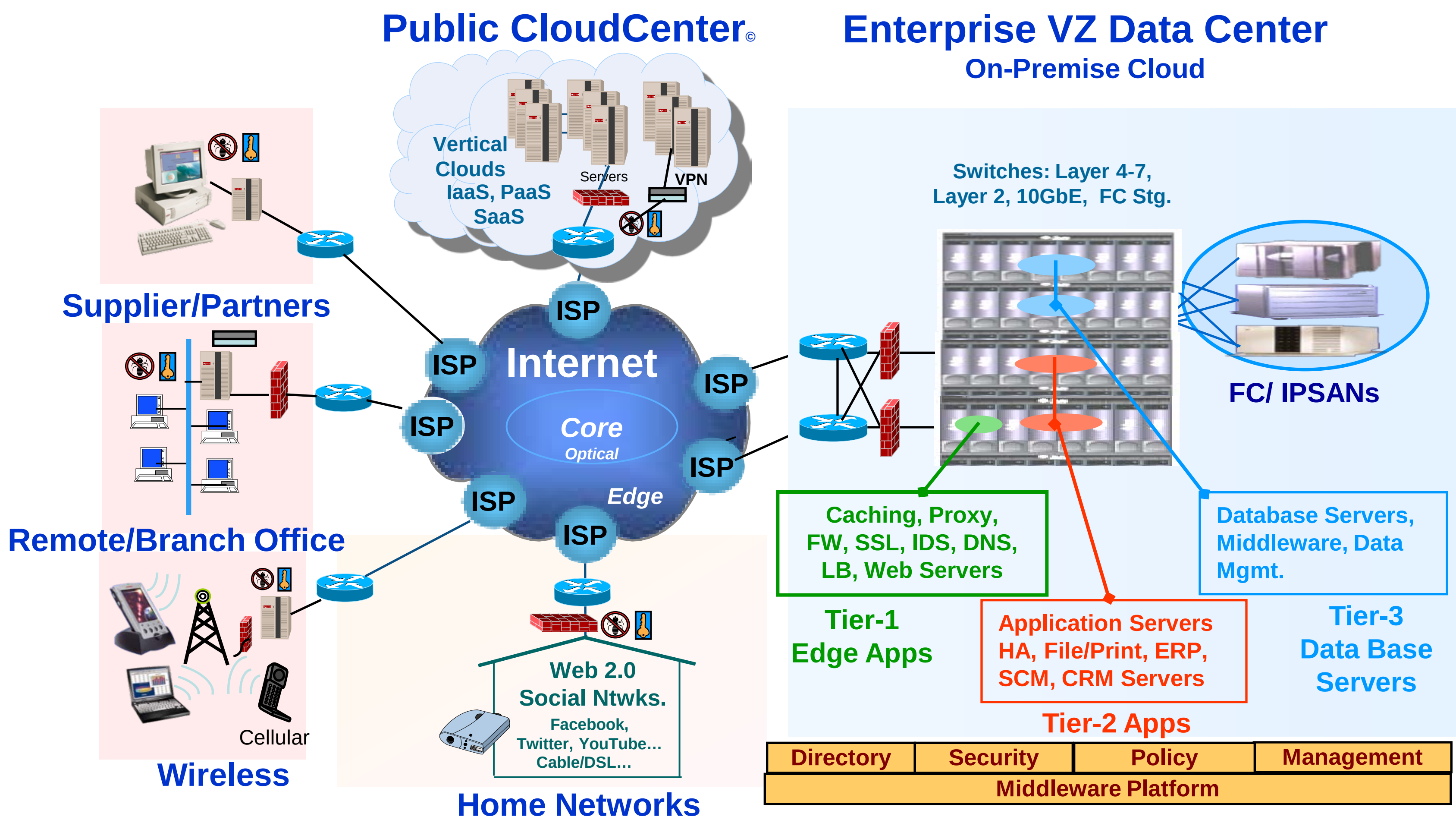

Request for data from a remote client to a Data Center or Cloud crosses a myriad of systems and devices. Key is identifying bottlenecks & improving performance

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Harnessing Big Data for Business Insights

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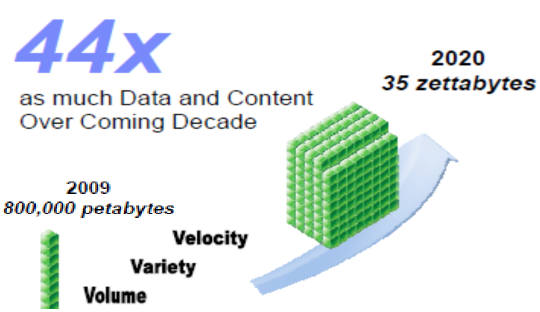
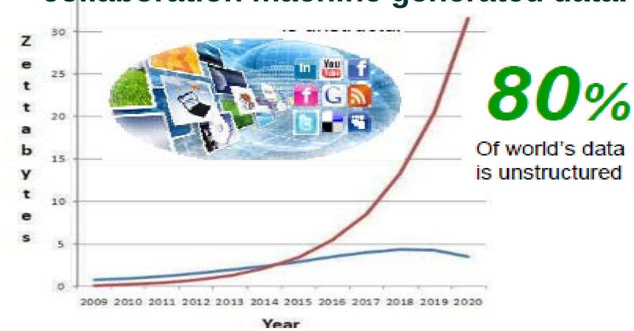
Data Sources → **Big Data Infrastructure** → **Business Insights**

Information is at the center of New Wave of opportunity



Majority of data growth is being driven by unstructured data and billions of large objects

80% of world's data is unstructured driven by rise in Mobility devices, collaboration machine generated data.



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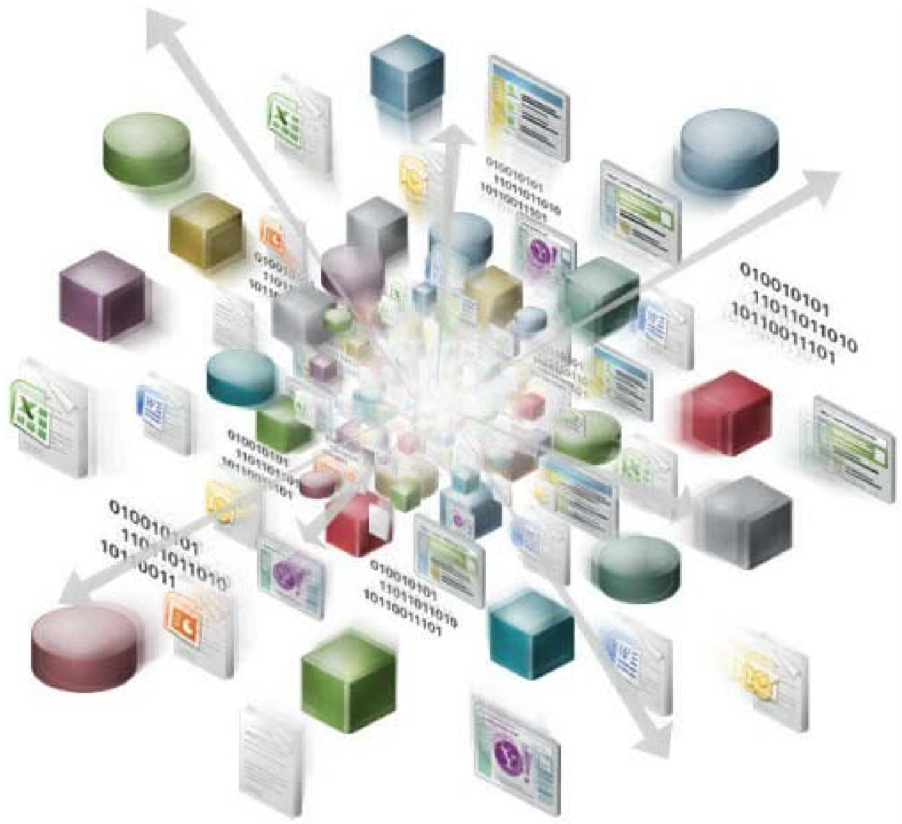
Corporate Need: Business Perf... Optimization



Unstructured Big Data can provide Next Gen Analytics to help businesses make informed, better decision in:

- Product Strategy
- Targeting Sales
- Just-In-Time Supply-Chain Economics
- Business Performance Optimization
- Predictive Analytics & Recommendations
- Country Resources Management

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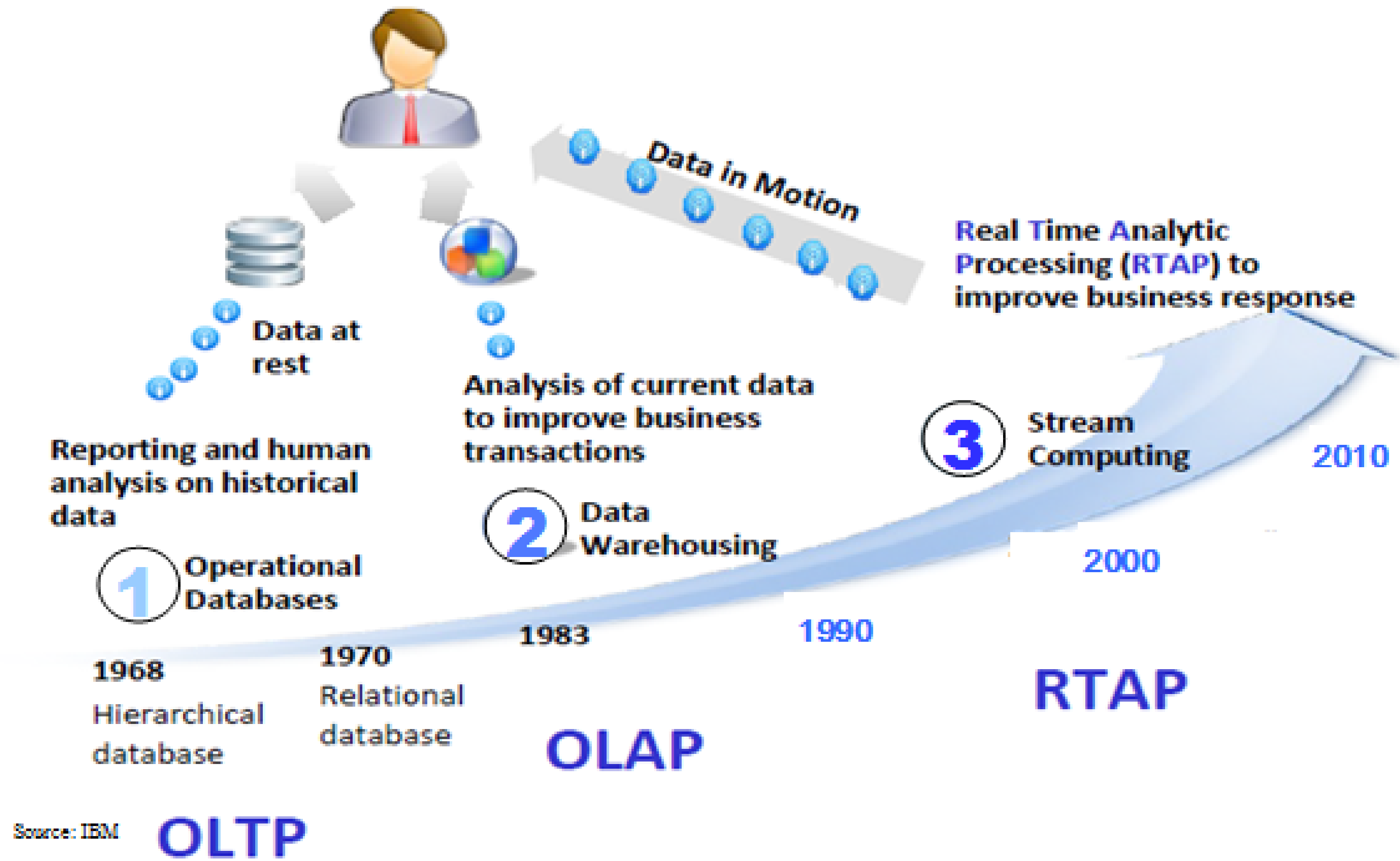
Corporate Need: Real Time Analytics



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Corporate Need: Business Insights

Item	Issue	Solution
Store	**Information Exploding** Volume: Digital Content doubling every 18 months. Velocity: >80% growth driven from unstructured data. Variety: sources of data changing	**A unified information/content storage methodology** that enables users to manage the volume, velocity and variety of information from multiple sources
Manage	**Complexity in "managing" information.** - Need to classify, synchronize, aggregate, integrate, share, transform, profile, move, cleanse, protect, retire	**A solution portfolio of tools and services** to manage all types of information in a hybrid storage environment
Analyze	**Current solutions limited to BI** tools focused on structured and lagging information	Build/buy packaged **Real-Time Predictive Analytical Solutions** for unstructured analytics tools
Collaborate	**Multiple access methods** needed to meet needs of a diverse audience.	**Centralized share, collaborate** and act on insights anytime, anywhere on any device.
Model/ Adapt	Ability to **understand how the information impacts the business**. How to transfer to action.	**Model Information on current operations w/potential strategy impact.** Leverage Tech. to adapt.

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Opportunity: Converting Big Data Deluge into Predictive Analytics & Insights

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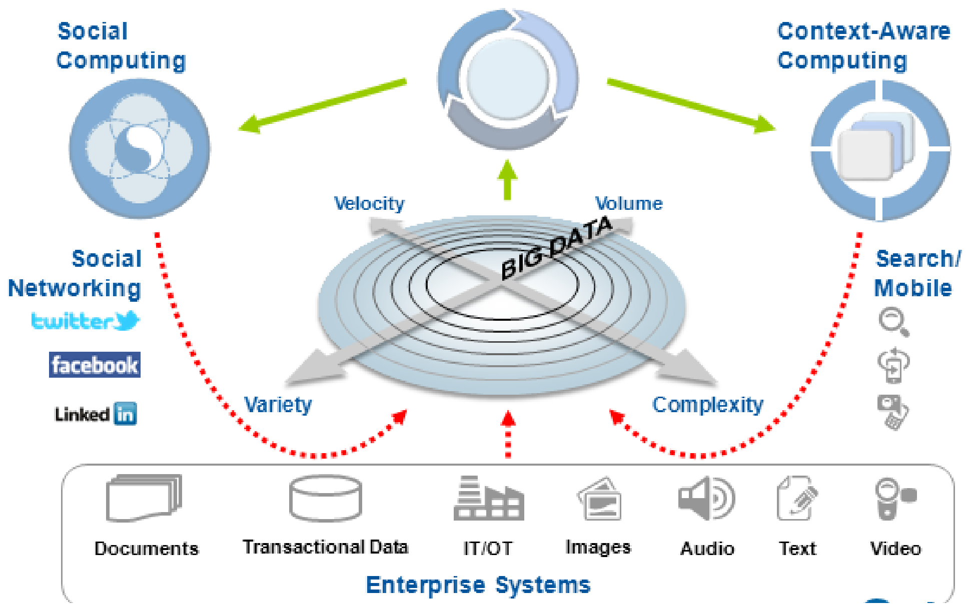
Big Data Predictive Analytics



Personal Location Services Data Generated by	*TB/Year*
Navigation Devices	600
Navigation Apps on Phones	20
Smart Phone Opt-In Tracking	1000
Geo Targeted Ads	20
People Locator (Emergency Calls/Search..)	10
Location based Services (e.g.Games)	5
Other	45
Total (Est.)	1700

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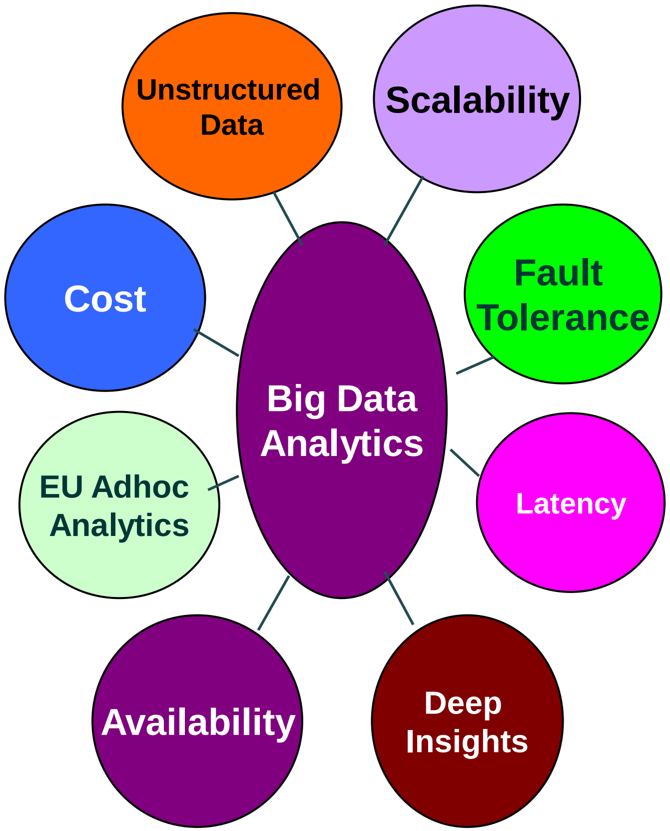
Issues with Existing RDBMS



Key Issues with RDBMS Technologies

Handling Mixed Unstructured Data
- RDBMs don't handle non-tabular data
(Notorious for doing a poor job on recursive data structure)

Legacy Archaic Architecture
- RDBMS don't parallelize well to accommodate commodity HW clusters

Speed
- Seek time of physical Storage has not kept pace with network speed improvements

Scale
- Difficult to scale-out RDBMS efficiently – Clustering beyond few servers notoriously hard

Integration
- Data processing tasks need to combine data from non-related sources, over a network

Volume
- Data volumes have grown from 10s GB >100s TB > PBs in recent years. Existing Tabular RDBMS can't handle such large DBs

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Issues with Existing RDBMS

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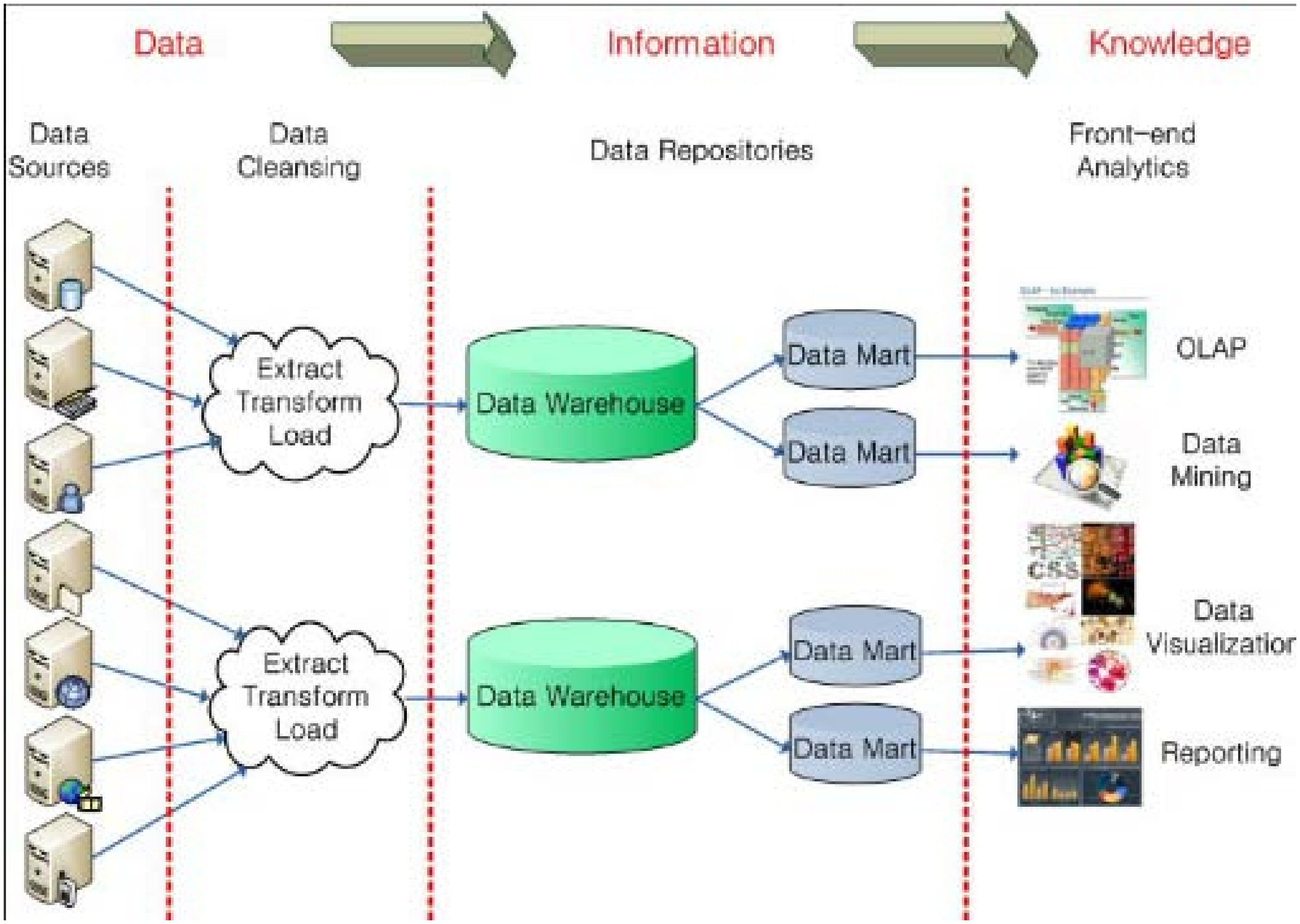
Present RDBMS struggling to Store & Analyze Big Data



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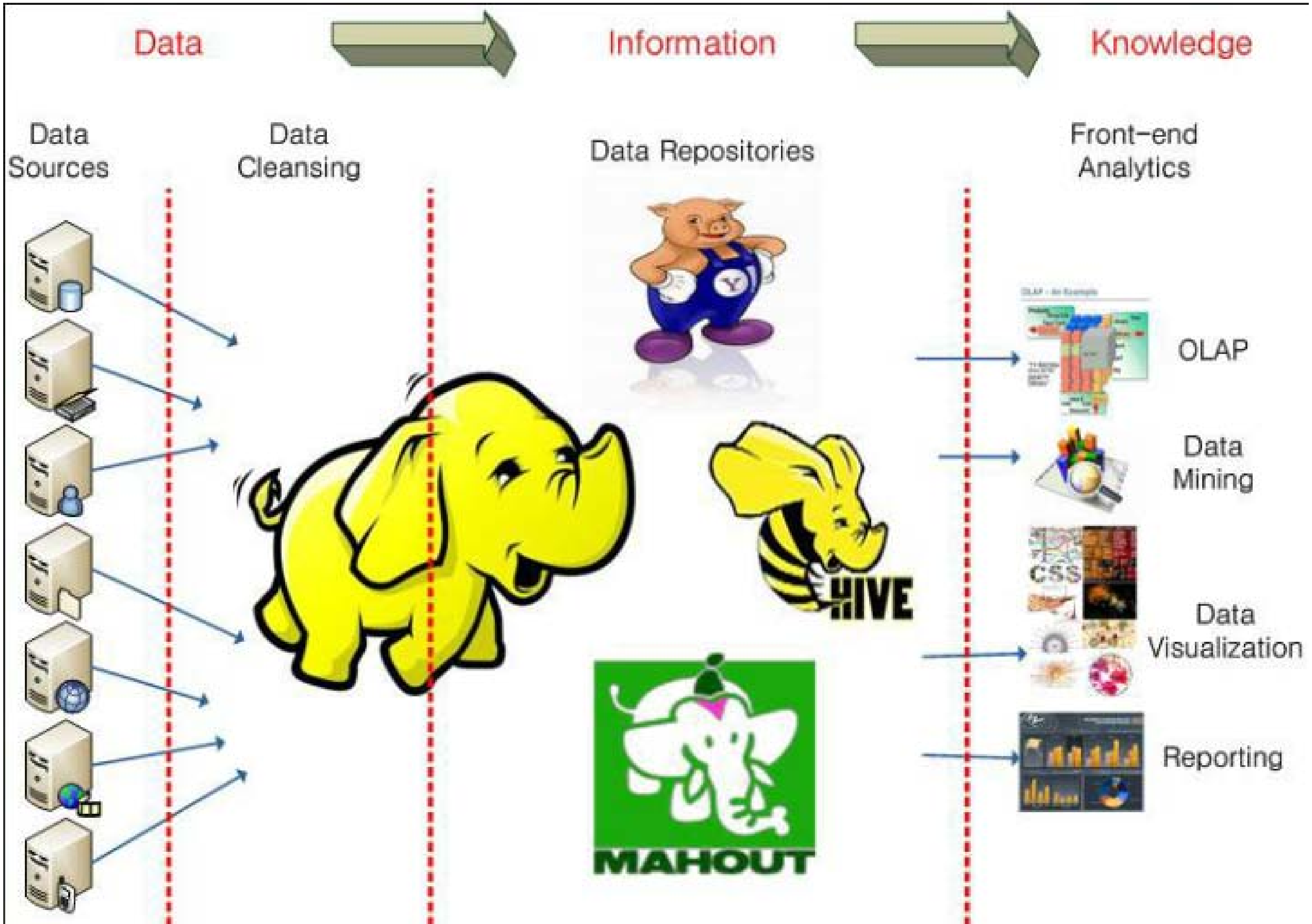
Big Data - Database Solutions



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Big Data – The New Face of DBs

Big Data Paradigm - The New face of DB Systems

- Adopts Schema-Free Architecture
- Can do away with Legacy Relational DB Systems
  - Some data have sparse attributes, do not need relational property
- Key Oriented Queries
  - Some data stored/retrieved mainly by primary key, w/o complex joins
- Trade-off of Consistency, Availability & Partition Tolerance
- Scale Out, not up, - Online Load balancing cluster growth

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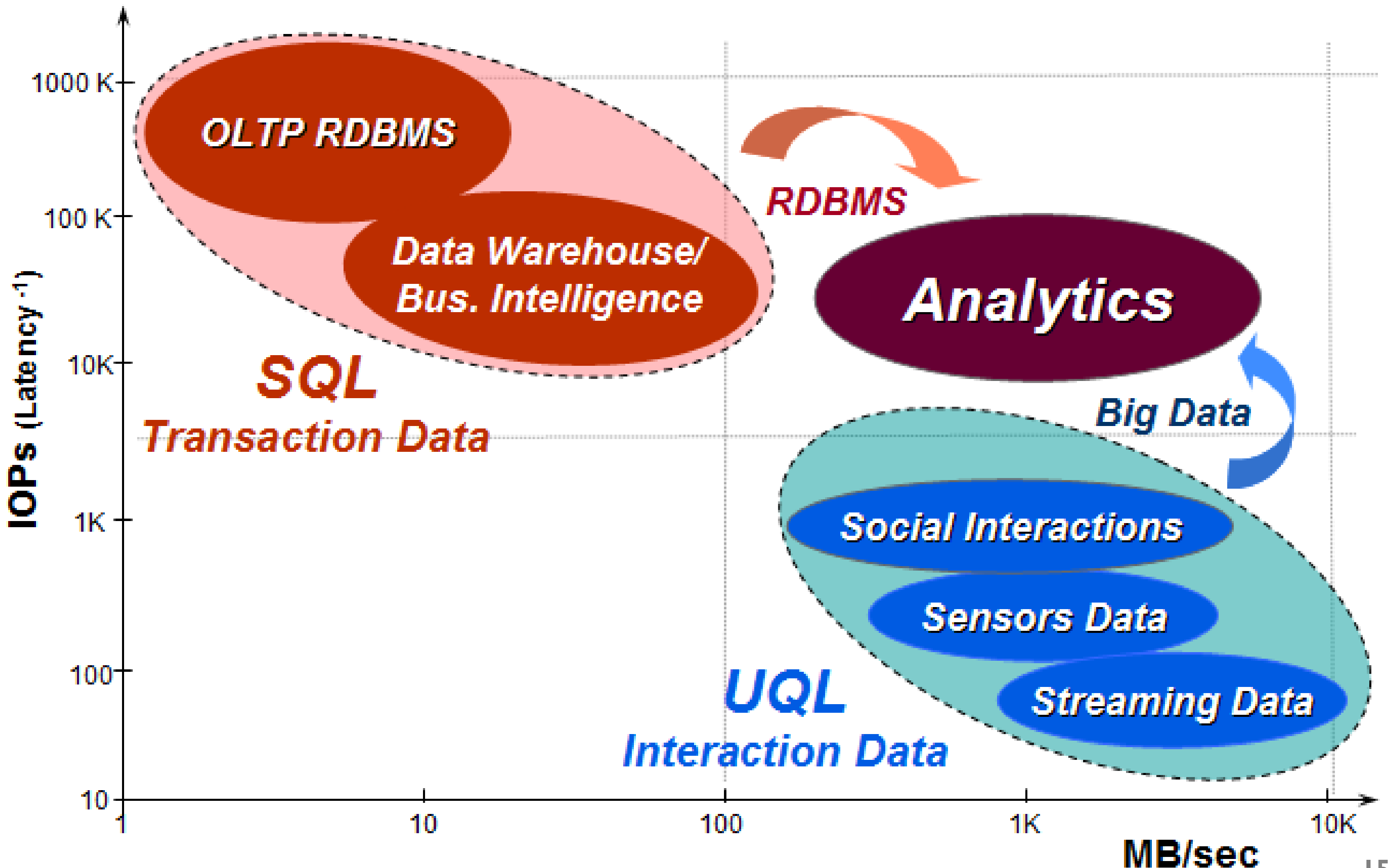
Analytics – The Next Frontier in IT



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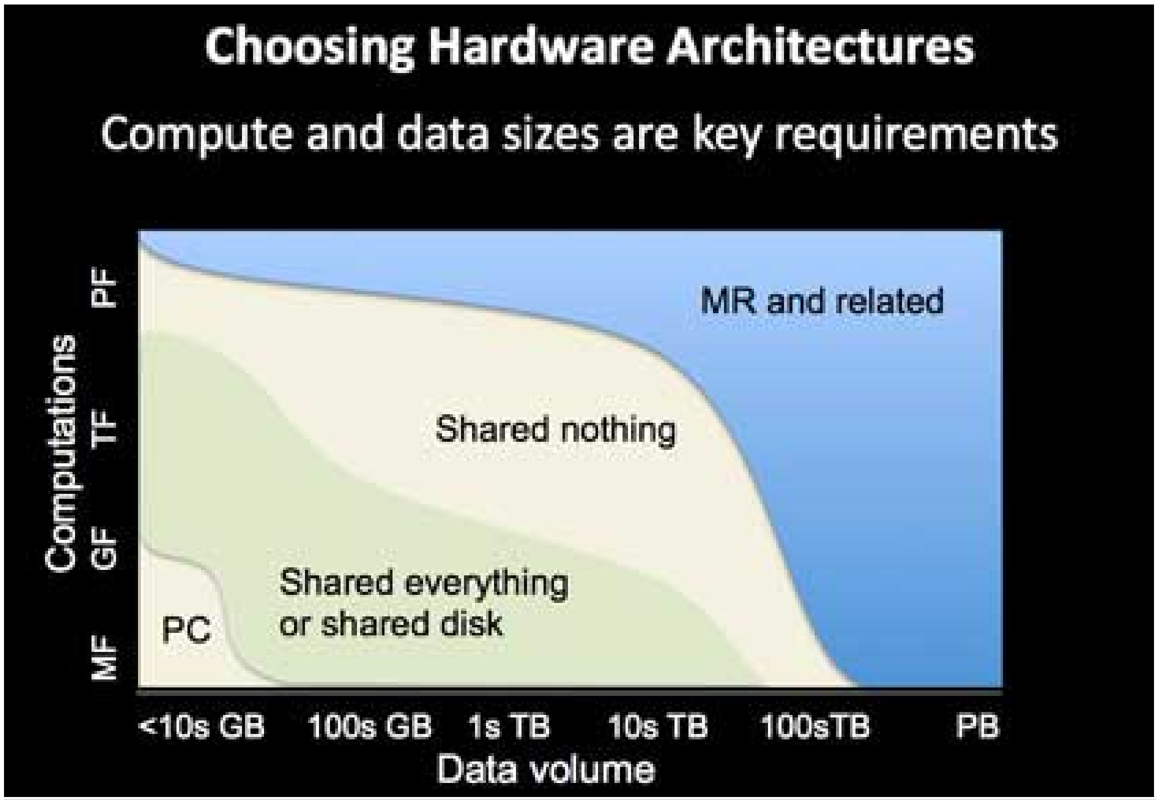
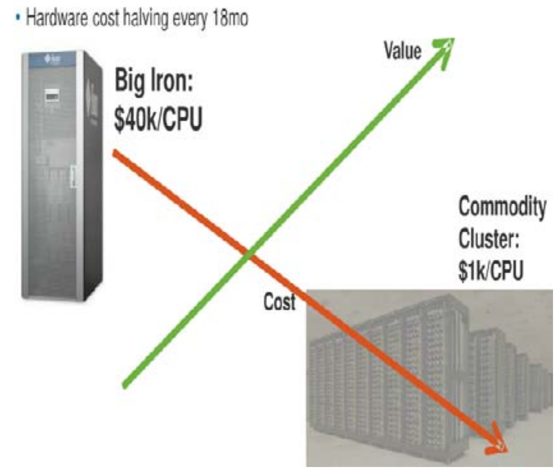
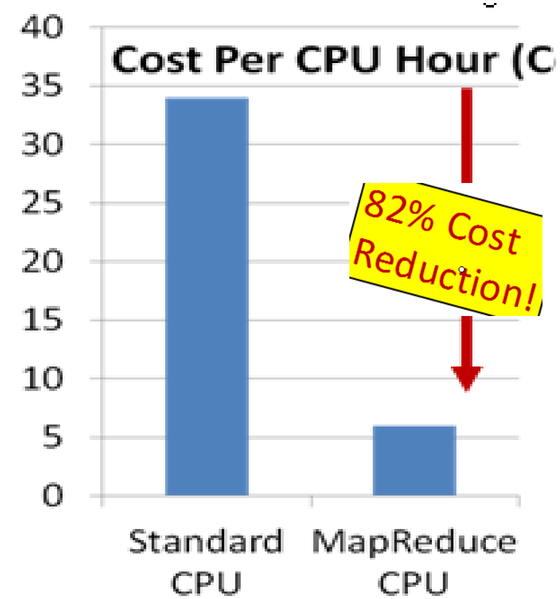
Key Innovations: HW Technologies







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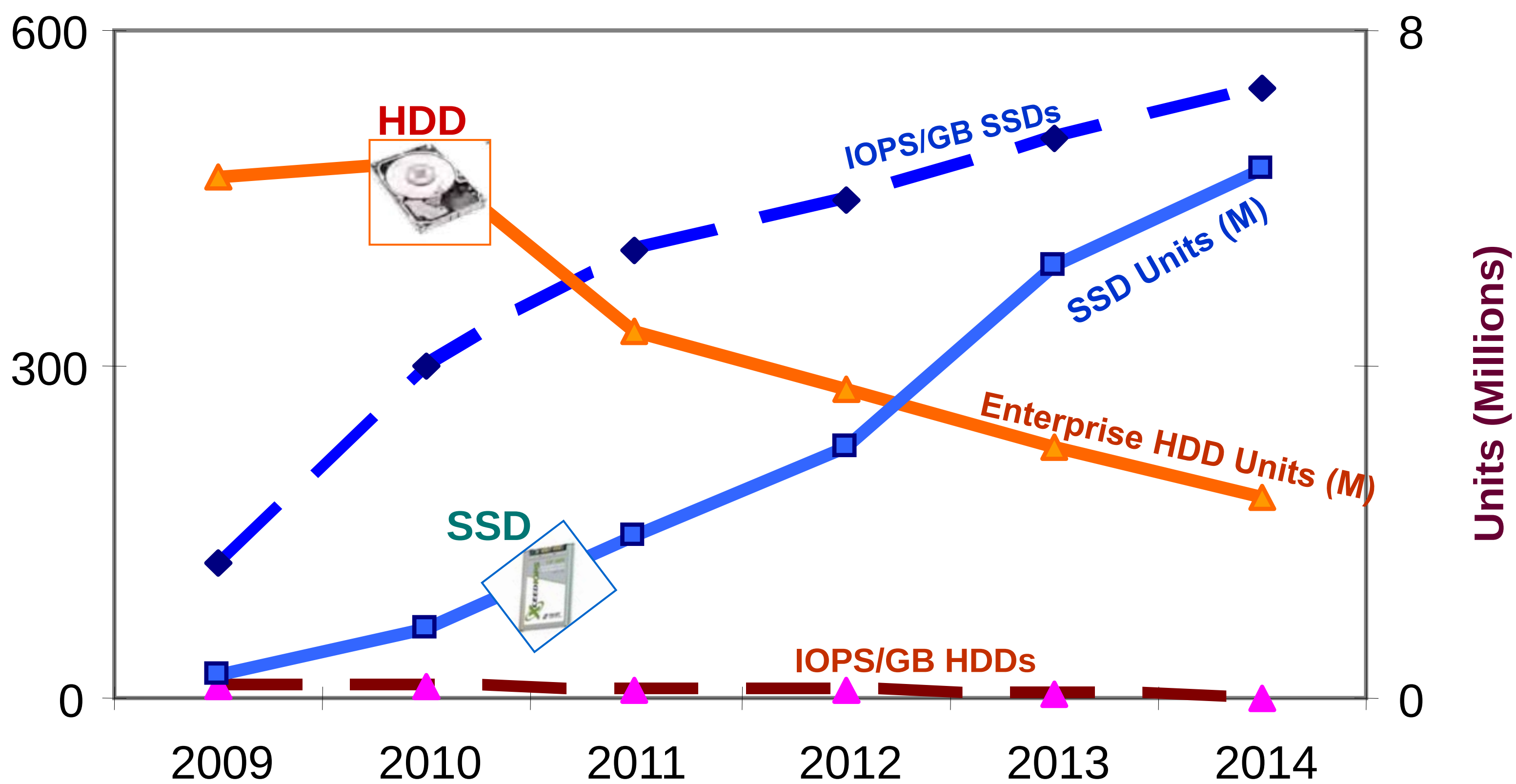
Key Innovations – Solid State Storage

Storage - IOPS/GB & Price Erosion - HDD vs. SSDs



Note: 2U storage rack, • 2.5" HDD max cap = 400GB / 24 HDDs, de-stroked to 20%, • 2.5" SSD max cap = 800GB / 36 SSDs

Key to Database performance are random IOPS. SSDs outshine HDD in IO price/performance – a major reason, besides better space and power, for their explosive growth.

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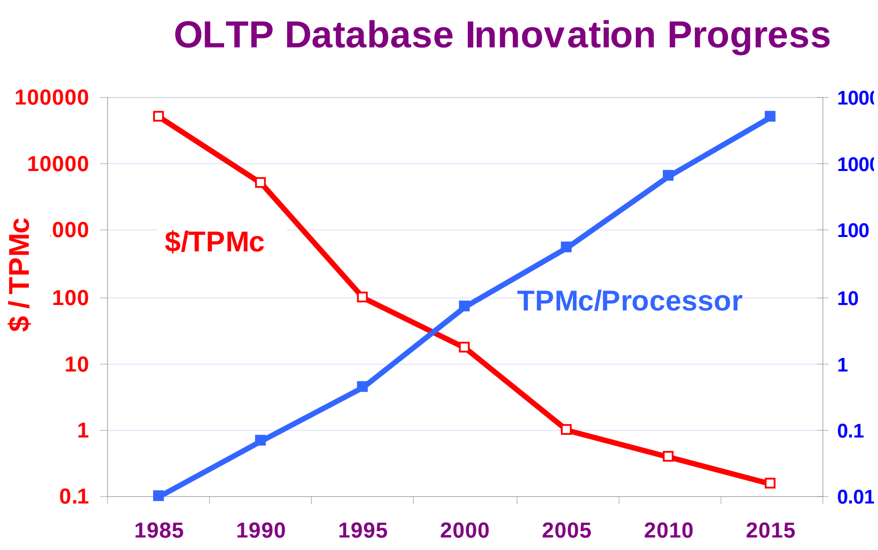
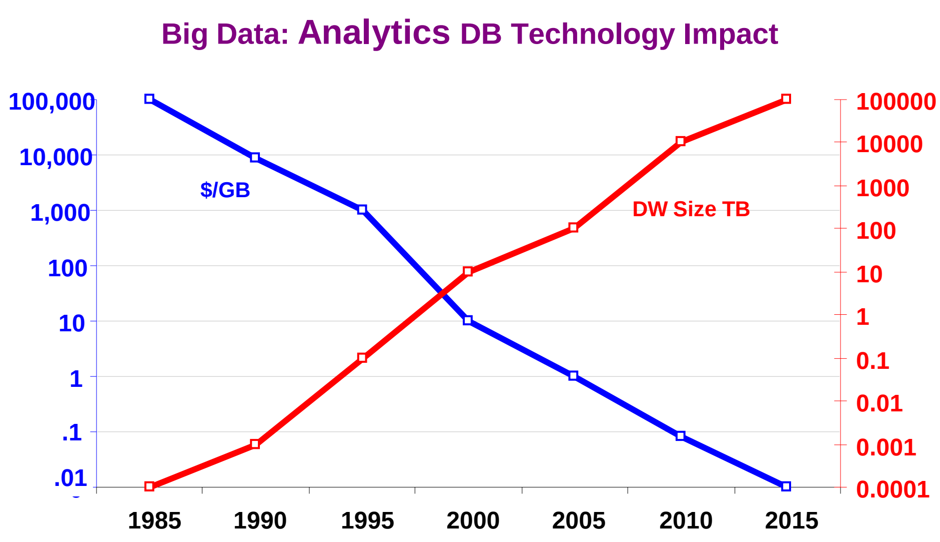
Innovations – DB SW Technologies

Tech Innovation	1985	1990	1995	2000	2005	2010	2015
OLTP Transactions DB SW	Rows Locking	Optimizer	Parallel Query	Clustering	XML	Grid	Open Source / Hadoop
OLAP- Analytics DB SW	Indexing	Partitioning	Columnar	Materialized View	Bit Mapped Index	In-Memory	Query Binding
Hardware	32 bit	SMP	NUMA	64 bit	Multi-core/ Blades	Flash	MPP
Big Data					Multi-core	Columnar In-Memory	MPP Visualization





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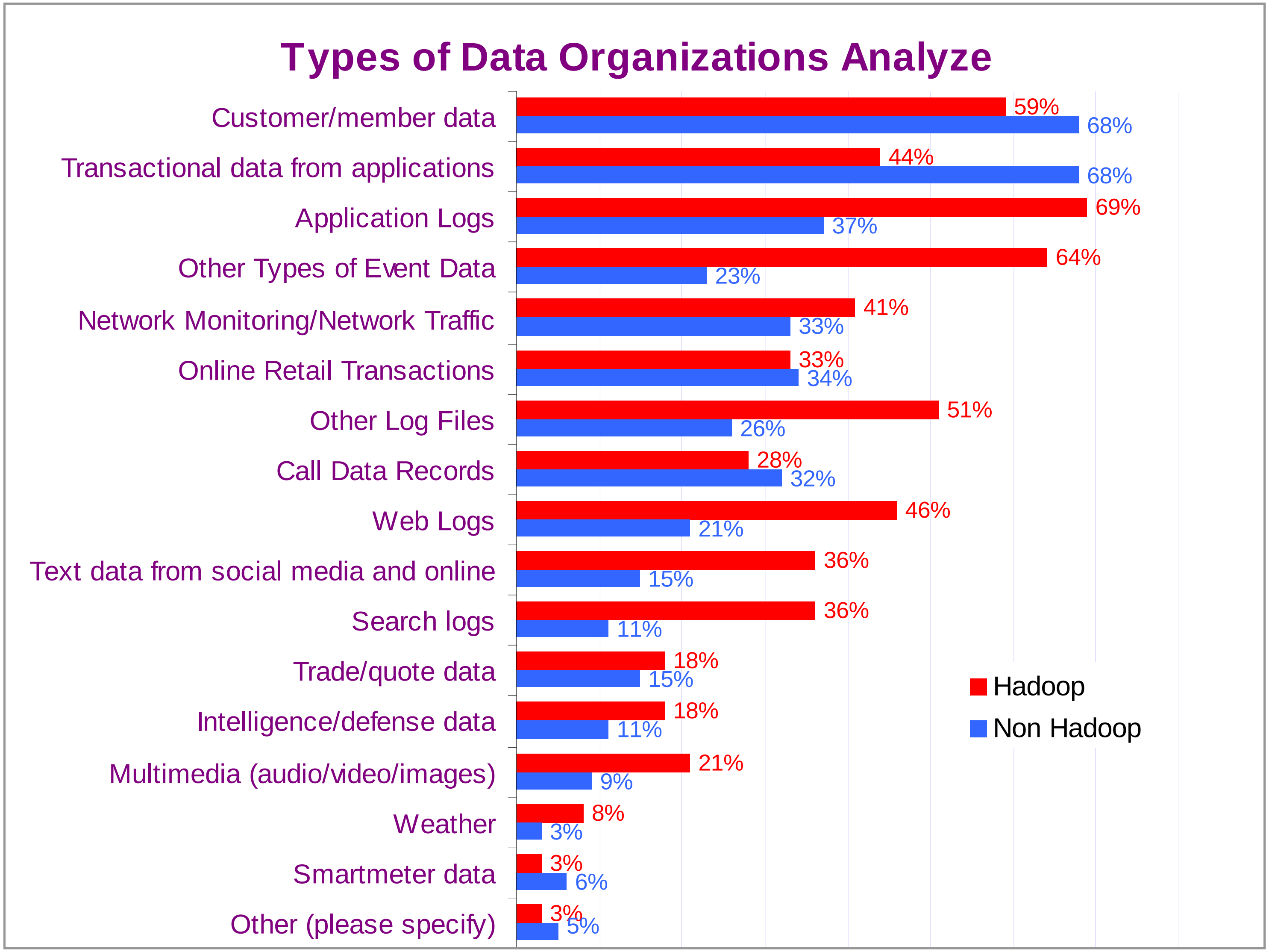
Big Data - Key Requirements



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Big Data – Architectural Goals

Meet Requirements of V3

Volume — Optimize capital investments based on 6 Petabytes of information

Velocity — Analyze 100k records/second to address customer satisfaction in real time

Variety — Analyze telemetry, fuel consumption, schedule and weather patterns to optimize shipping logistics.

Big Data Platform

Meet Enterprise Criterion

Failure Tolerance — High availability architecture to support hardware or application failure.

Scale Economically — Runs on scalable hardware with the ability to dynamically add additional nodes.

Security & Privacy — Security protection for granular data access control.

Analyze Data in Native Format

- Text
- Image & Video
- Acoustic
- Statistics
- Geospatial
- Mathematical
- Financial
- Times Series
- Predictive

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Big Data - Market Requirements

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Unified system: Pre-integrated for Ease of Installation and Management

- Platform – **Large Scale Indexing** Pre-integrated using Hadoop Foundation,
- Integrated Text Analytics - **Address Unstructured Data**
- **Usability** - User Friendly Admin Console including HDFS Explorer, Query Languages
- **Enterprise Class Features** – Provisioning, Storage, Scheduler, Advance Security
- Supports **search-centric, document-based XML data model**
  - store documents within a transactional repository.
- **Schema-Free**:
  - No advance knowledge of the document structure (its "schema") needed
  - Index words and values from each of the loaded documents together with its document structure.
- **Standard commodity hardware** leveraged

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Big Data – Market Requirements

Architectural

- **Shared-nothing clustered DB architecture**
  - programmable and extensible application servers.
- Support **massive scalability** to petabytes of source data
- Support **open-source XQuery- and XSLT-driven architecture**
- Simple to Deploy, Develop and Manage (**UI & Restful Interface**)
- Support **extreme mixed workloads** - a wide variety of data types including arbitrarily hierarchical data structures, images, waveforms, data logs etc.
- Support **thousands of geographically dispersed on--line users and programs** executing variety of requests from ad hoc queries to strategic analysis
- **Loading data before declaring or discovering its structure**
- **Load data in batch and streaming fashion**
- **Integrate data from multiple sources** during load process at very high rates **Spread I/O and data across instances**
- Provide consistent **performance with linear cost**
- Leverage **Open Source SW** Lo Costs, Multiple Sources, Hadoop Foundation Tools
- Connectivity with Oracle DB, Teradata Warehouse, JDBC Connectivity,

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Big Data - Market Requirements

Real Time Analytics Execution

- Execute **"streaming" analytic queries in real time** on incoming load data
- **Updating data in place** at full load speeds
- Scheduling and execution of **complex multi-hundred node workflows**
- Join a **billion row dimension table to a trillion row fact table** without pre-clustering the dimension table with the fact table

Performance

- Analyze data, at very high rates >GB/sec
- **Predictable Sub-ms response time** for highly constrained standard SQL queries

Availability

- Ability to **configure without any single point of failure**
- **Auto-Failover Extreme High Availability**
  - Automated failover and process continuation without operational interruption when processing nodes fail

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Big Data – Product Metrics Choices

Big Data - Product Metrics		
	Data Set Size	PB
		TB
		GB
	Data Structure	Transaction
		Machine
		Unstructured
		Other
	Access/Use	Transaction
		Search
		Analytics
	Parallel Processing	Appliance
		Cluster < 1K
		Cluster > 1K
	Memory	In-Memory
		Flash
	DB Technique	Columnar
		Zero Sharing
		No SQL
	Data Cataloging SW	Text
		Image
		Audio
		Video

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Advantage: Big Data Products

Characteristic	Legacy Paradigm	Big Data Paradigm
Structure	•Transactional/Corporate	•Unstructured/Derivative/Internet
Mode	•Data Collection	•Data Analysis
Focus	•Find Answers	•Find Questions
Facility	•Reportive / What Happened?	•Analytic / Why did it Happen? Predictive / What will Happen Next?
Opportunity	•Very Small Growth	•Massive Growth
Players	•Legacy Players	•Agile Start Ups, well funded
Impact	•Analyze Existing Businesses	•Create New Businesses

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Advantage: Big Data Products

Characteristic	Traditional RDBMS	Big Data/MapReduce
Data Size	•GB	•PB
Access	•Interactive	•Batch/Near Real-Time
Latency	•Low	•High
Data Updates	•Read & Write Many Times	•Write Once Read Many Times
Schema/Structure	•Static Schema	•Dynamic Schema
Language	•SQL	•UQL/Procedural (Java,C++..)
Integrity	•High	•Not 100%
Works Well for	•Process Intensive Jobs	•Data Intensive Jobs
Works Well w Data Size	•Gigabytes	•Petabytes
Data/Processing Interactions	•Low Latency/High BW – precursor to success. Ntwk. BW can be a bottleneck causing nodes to be idle	•Sends Code to Data, instead of Sending Data to other Nodes (Requiring Lower BW in Cluster)
Fault Tolerance	•Coordinating Processes with Node Failures – a challenge	•Fault Tolerant for HW/SW Failures
Access	•Interactive	•Batch/Near Real-time
Scaling	•Non-linear	•Linear
Pgm-Distribution of Jobs	•Difficult	•Simple & Effective

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Big Data Ecosystem

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Generation

Data Class Types

Data Types
- Structured (Relational)
- Unstructured (Adhoc)

Data Class
- Human
- Machine

Data Velocity
- Batch
- Streaming

Operational IT

Store Access Prepare

Data Mgmt & Storage
- Store
- Secure
- Access
- Network

Engines
- Hadoop/MapReduce
- Apache Tools
- Cloudera/IBM/EMC …
- Visualization …

Prepare Data For Analytics
- ETlL / Data Integration
- Workflow Scheduler
- System Tools

Analytics

Analyze Visualize

Data Analytics
- Algorithmics
- Automation
- In Real Time

Business Analytics
- Visualization
- Interoperate with SQL- RDBMS
- BI/EDW

Usage

Analyze Business

Business Analysis
- Decision Support
- Just In Time Business Model

Business Use
- Market Penetration Enhancements
- Cash Flow/ROI

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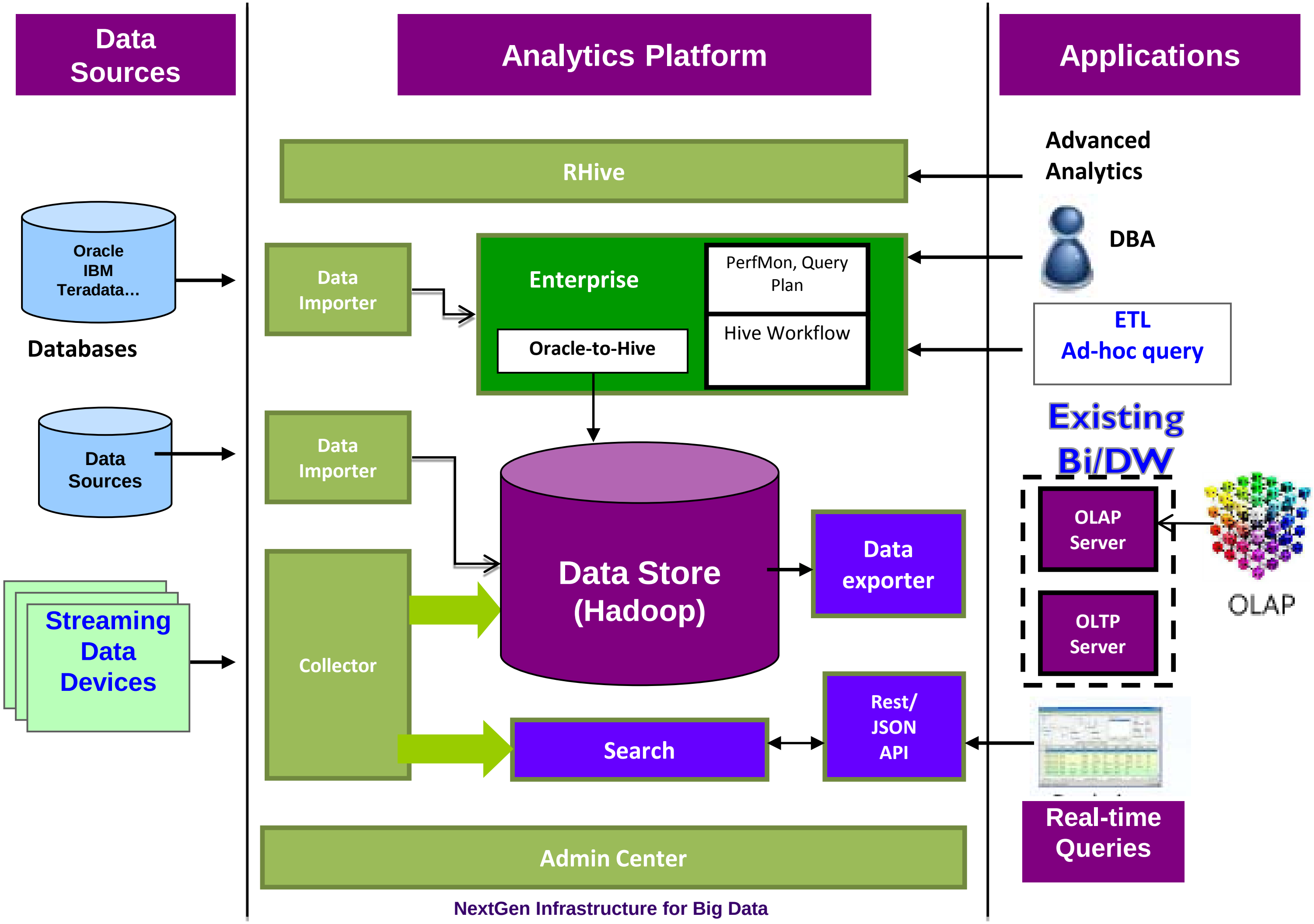
Big Data Stack

Merging Hadoop innovations into Nextgen DBMS



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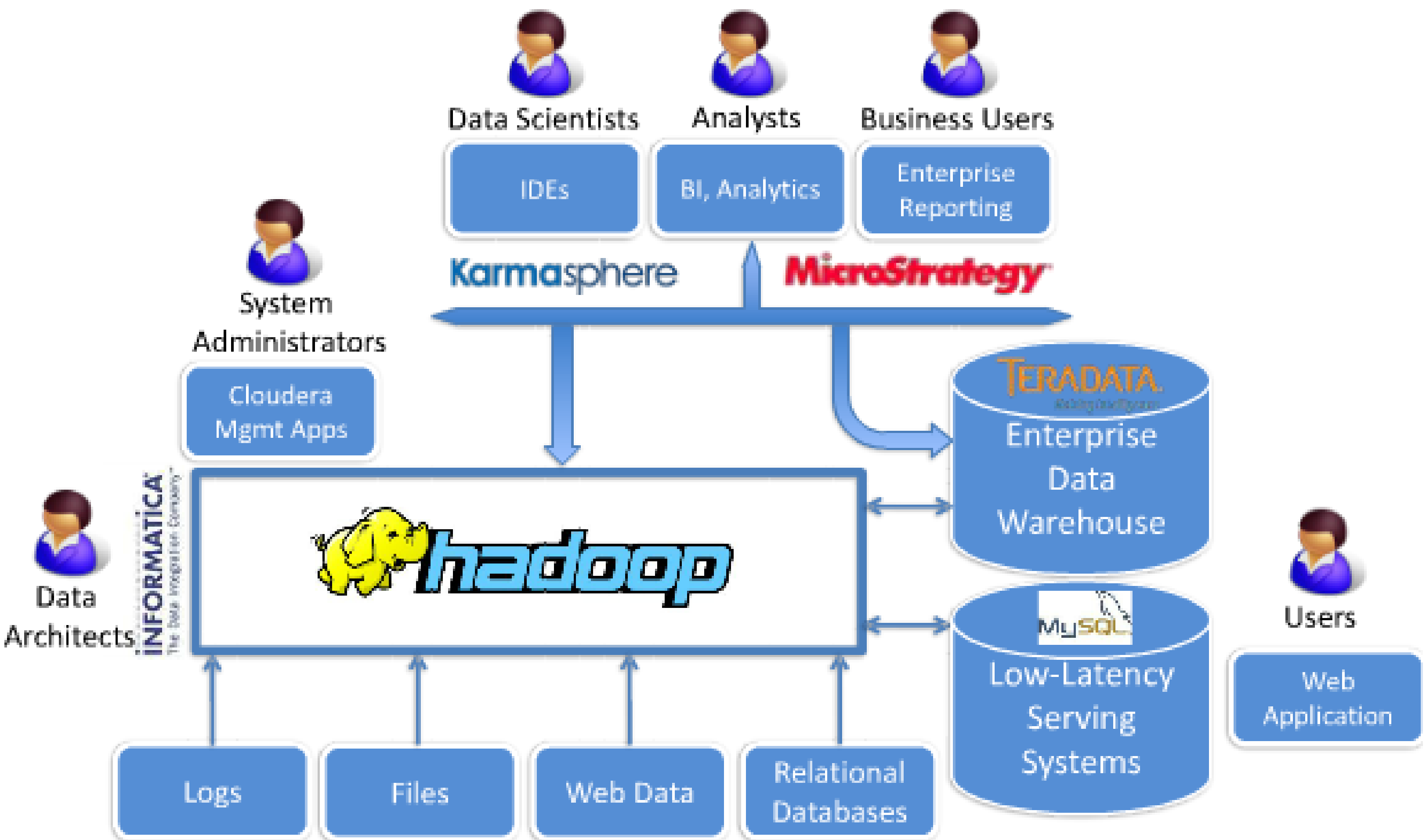
Hadoop's Fit in Enterprise Stack



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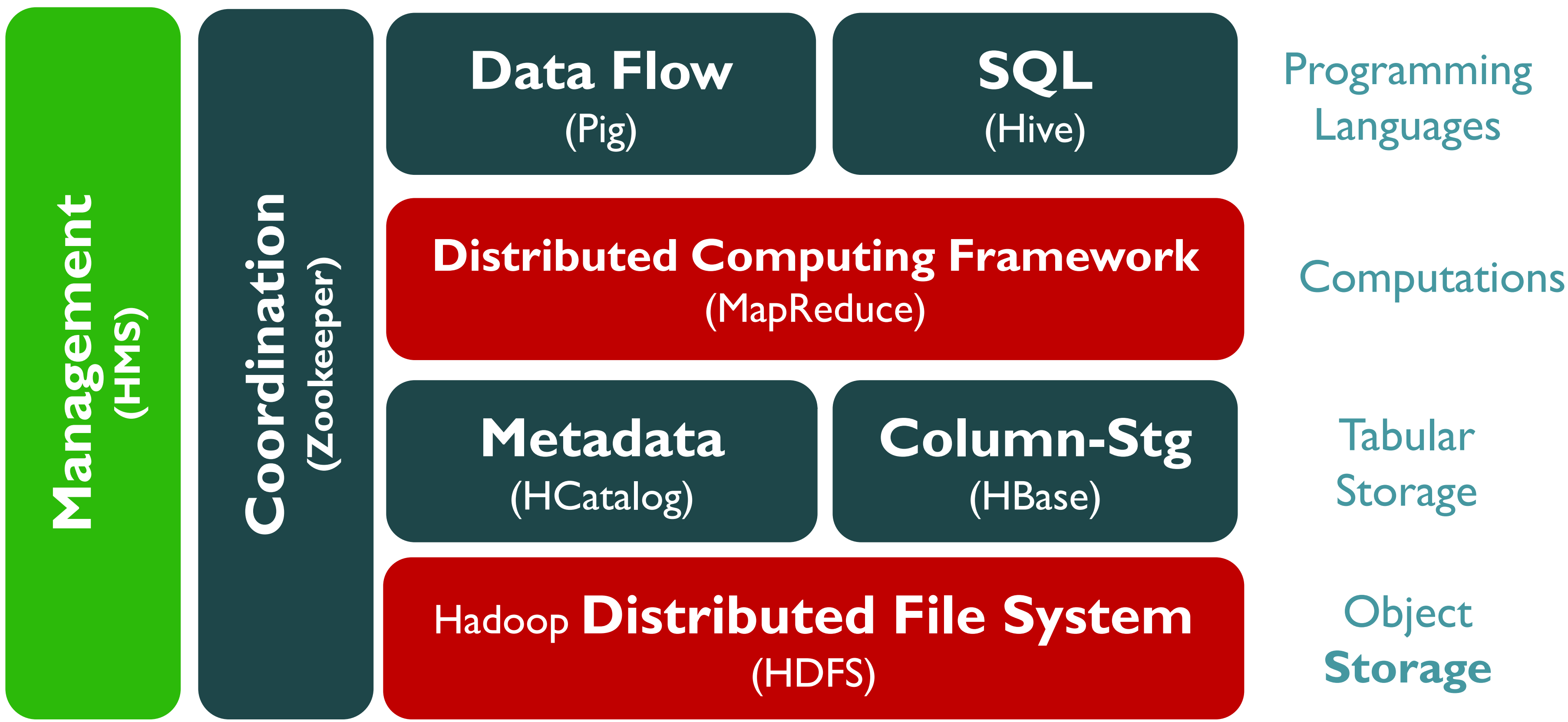
Big Data - Hadoop Architecture



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Big Data Connectors to EDW/BI

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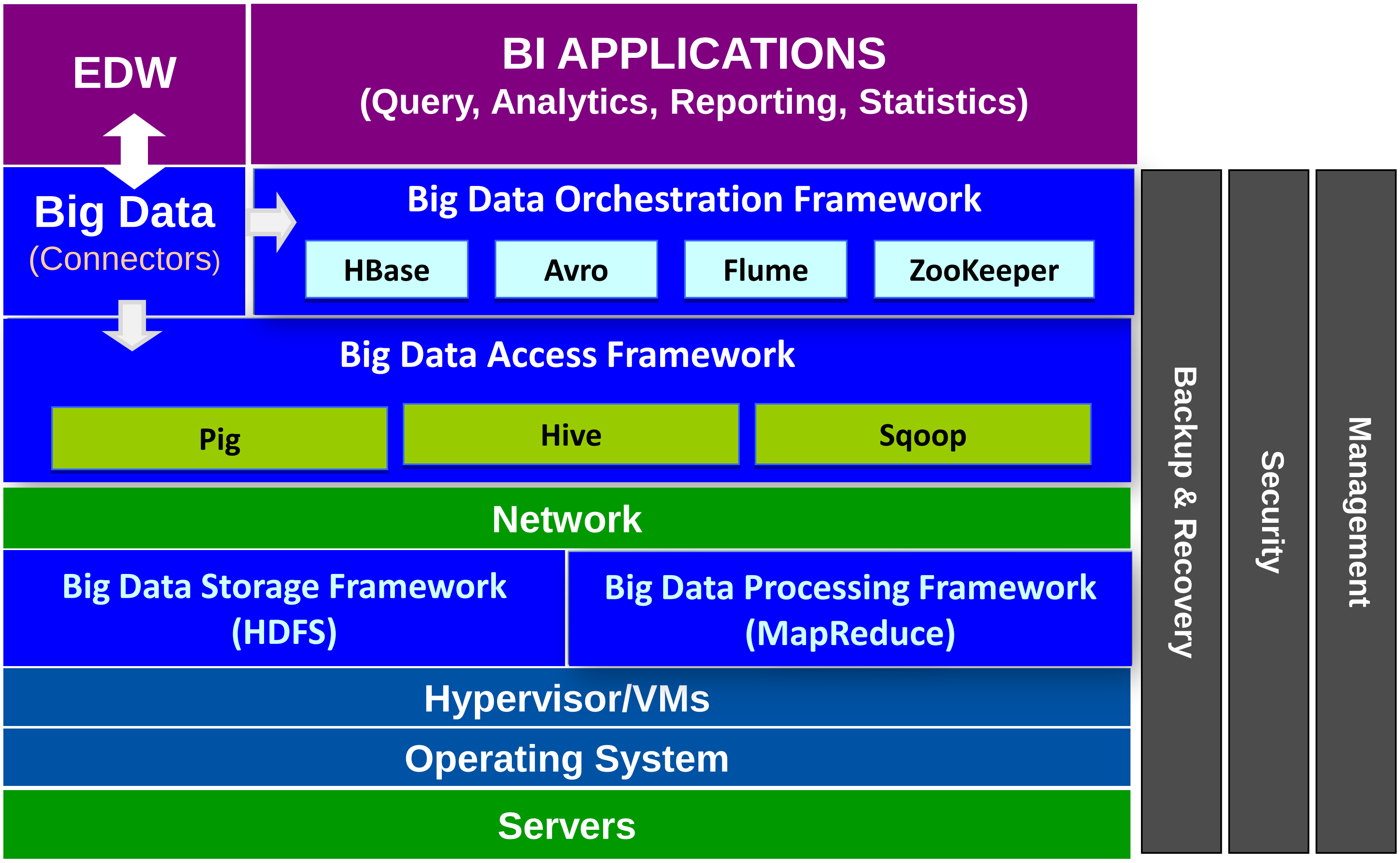
BI Framework - Interoperable with Enterprise Data Warehousing



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Big Data Infrastructure – Map Reduce

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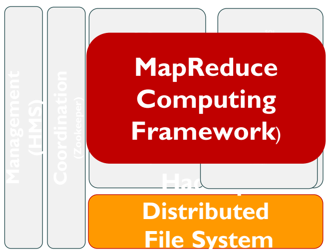
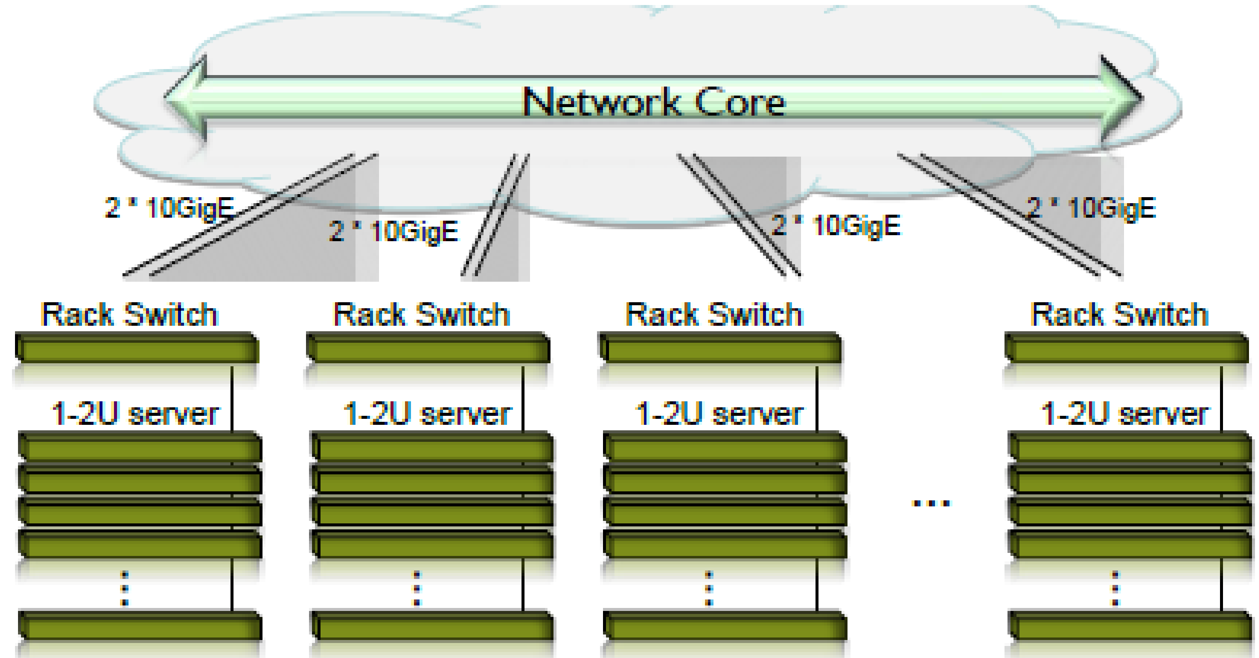
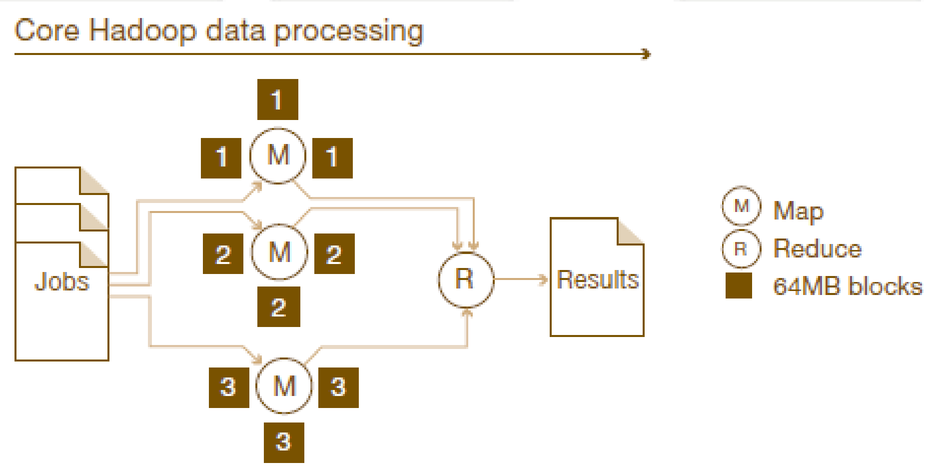


- 20-40 nodes / rack
- 16 Cores
- 48G RAM
- 6-12 * 2TB disk
- 1-2 GigE to node



Map Reduce

- A Distributed Computing Model
- Typical Pipeline: Input>**Map**>Shuffle/Sort>**Reduce**>Output
- Easy to Use , Developer writes few functions, Moves compute to Data
- Schedules work on HDFS node with data
- Scans through data, reducing seeks
- Automatic Reliability and re-execution on failure



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Big Data Infrastructure – HDFS

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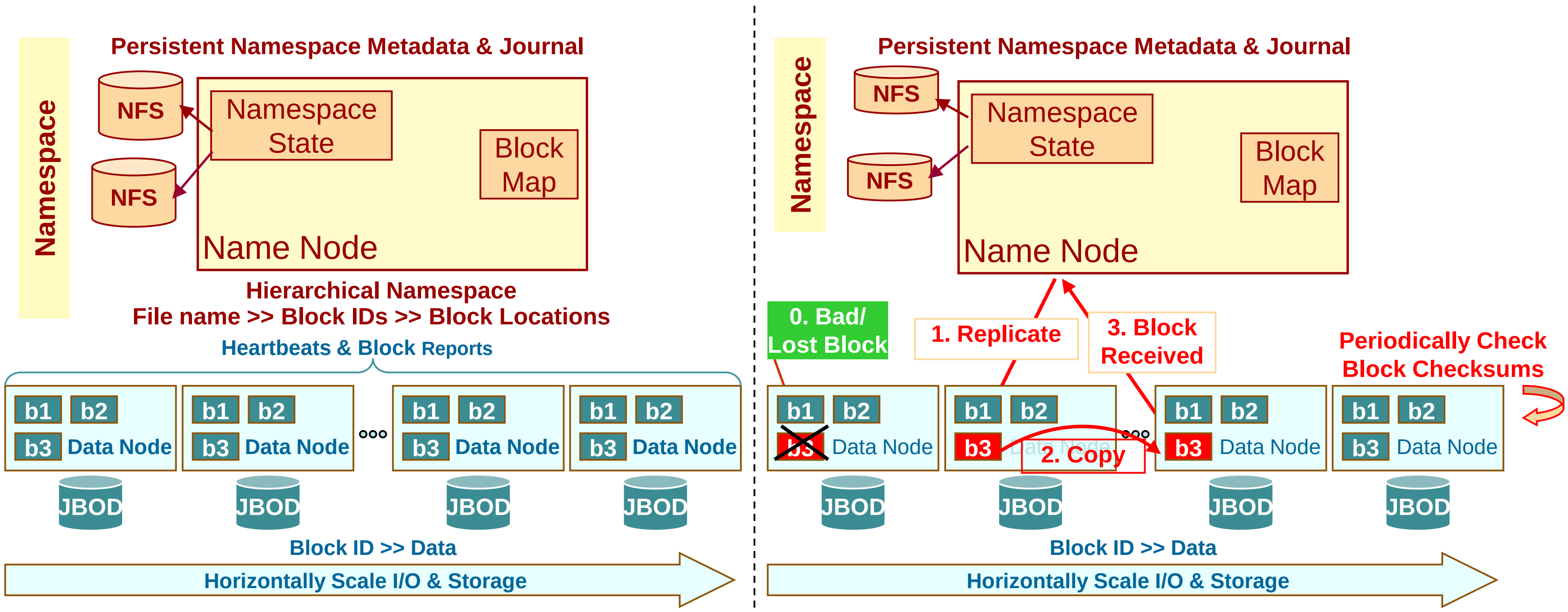
HDFS Architecture

Actively Maintaining High Availability



HDFS

- Immutable File System – Read, Write, Sync/Flush – No random writes
- Storage Server used for Computation – Move Computation to Data
- Fault Tolerant & Easy Management – Built In Redundancy, Tolerates Disk & Node Failure, Auto-Managing addition/removal of nodes, One operator/8K nodes
- Not a SAN but high bandwidth network access to data via Ethernet
- Used typically to Solve problems not feasible with traditional systems: Large Storage Capacity >100PB raw, Large IO/computational BW >4K node/cluster, scale by adding commodity HW, Cost ~$1.5/GB incl. MR cluster

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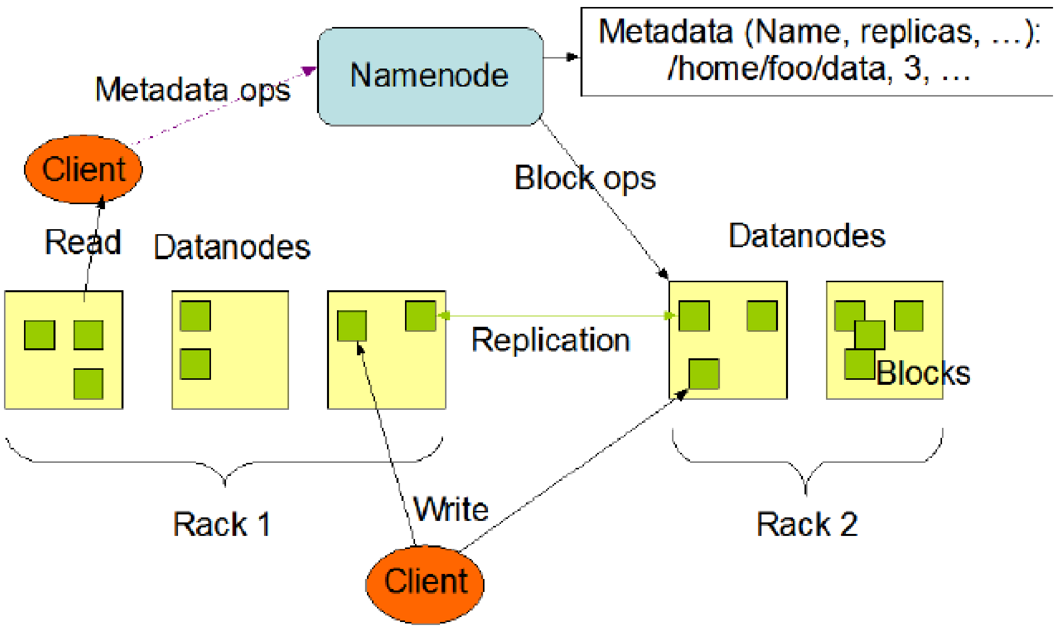
Hadoop Distributed File System

HDFS Architecture



HDFS Characteristics

- **Based on Google GFS** (Google File System)
- **Redundant Storage** for massive amounts of data
- **Data is distributed across all nodes** at load time – efficient MapReduce processing
- **Runs on commodity hardware** – assumes high failure rate for components
- **Works well with lots of large files**
- **Built around Write once** – Read many times"
- **Large Streaming Reads** – Not random access
- **High Throughtput** more important than low latency

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Hadoop Architecture - Overview

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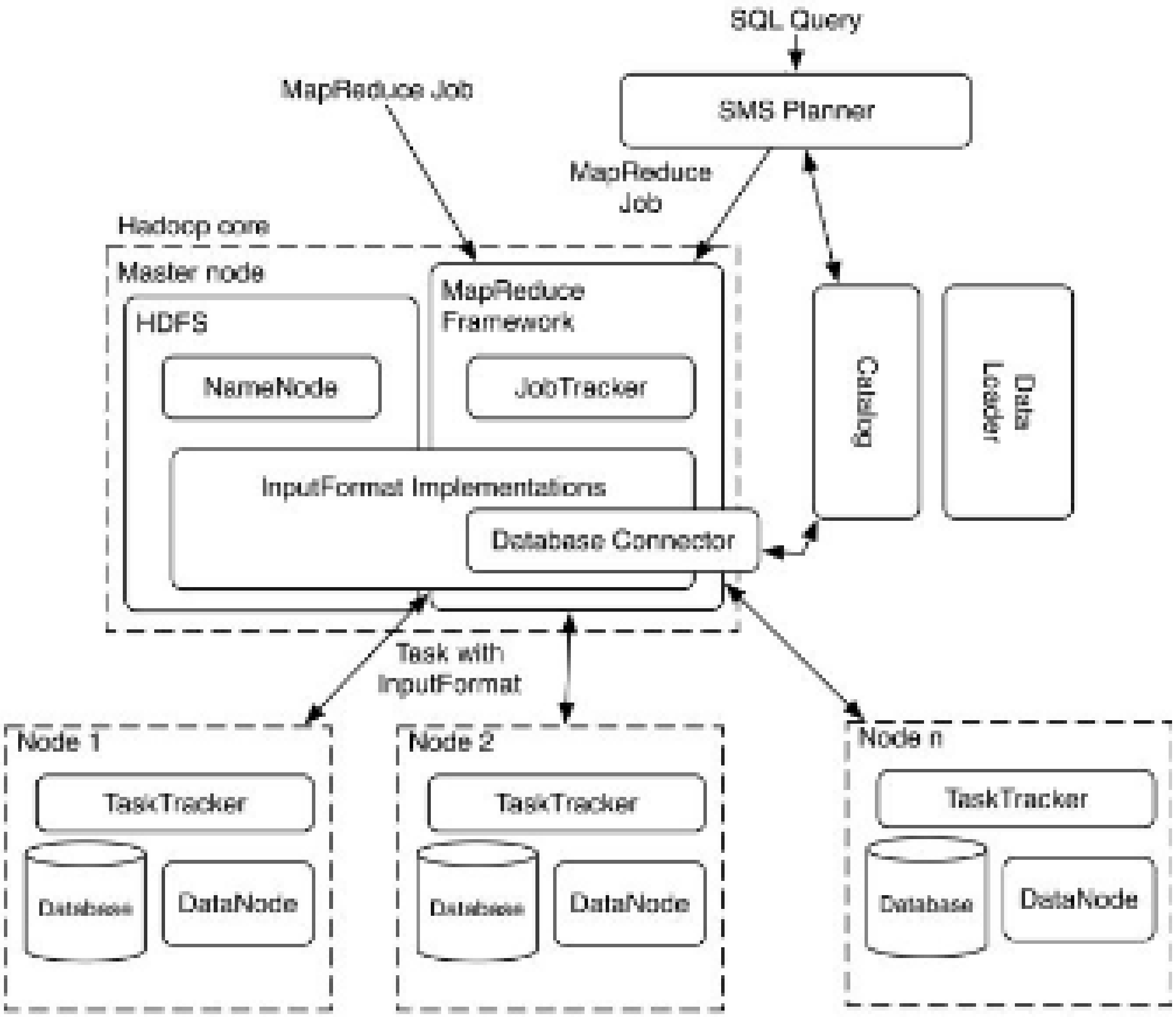
Hadoop Data Processing Architecture



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Key Technologies Required for Big Data

Key Technologies Required for Big Data

- **Cloud Infrastructure**
- **Virtualization**
- **Networking**
- **Storage**
  - In-Memory Data Base (Solid State Memory)
  - Tiered Storage Software (Performance Enhancement)
  - Deduplication (Cost Reduction)
  - Data Protection (Back Up, Archive & Recovery)

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Cloud Infrastructure for Big Data

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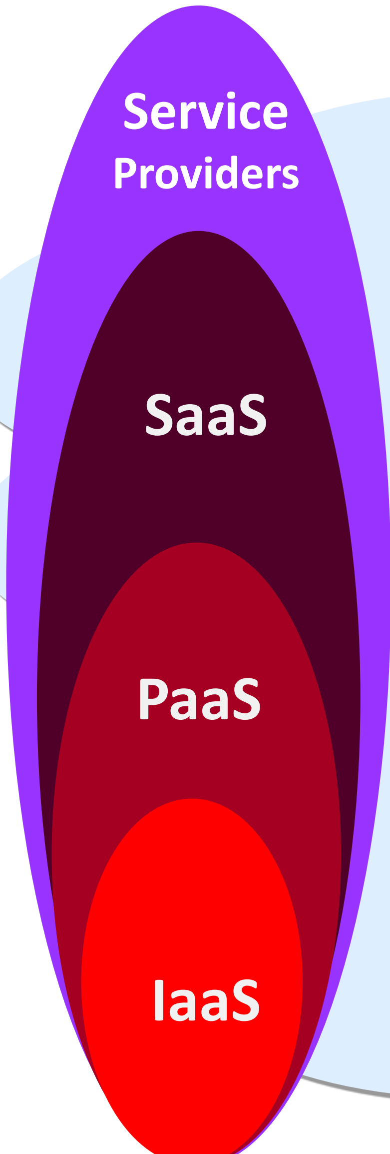


Cloud Services Providers
Public – Mutitenancy,OnDemand
Private - On Premises, Enterprise
Hybrid – Interoperable P2P

Examples
Public - BT, Telstra, T-Systems France Telecom
Private –
Hybrid – IBM/Cloudburst,

Software-as-a-Service
- Servers, Network, Storage
- Management, Reporting

Examples
eMail - Yahoo!,Google…
Collaboration - Facebook,Twitter …
Bus.Apps - SalesForce, GoogleApps, Intuit…

Platform Tools & Services
- Deploy developed platforms ready for Application SW on Cloud Aware Infrastructure

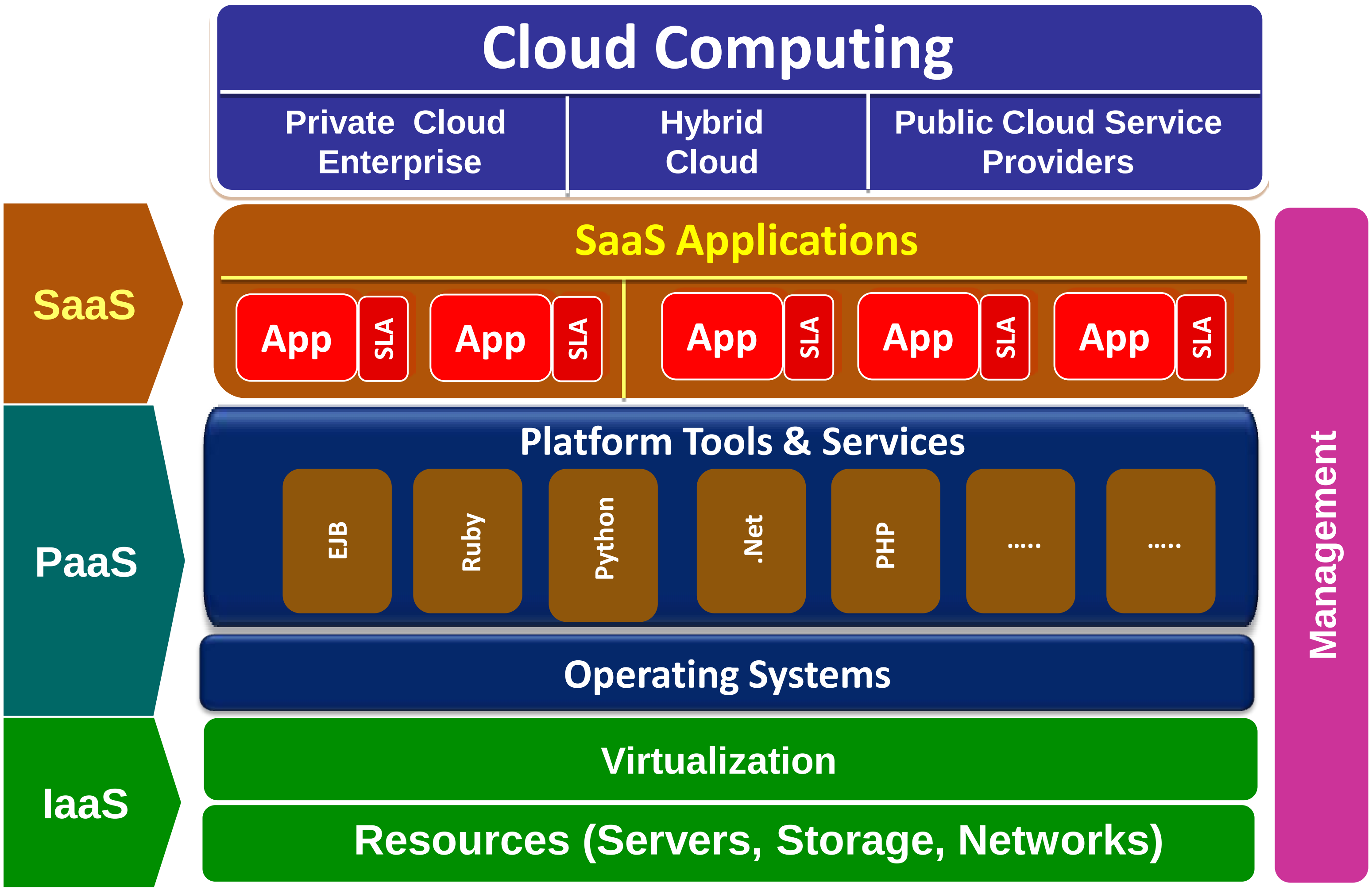
Examples
Amazon EC2
Force.com
Navitaire

Infrastructure HW & Services
- Servers, Network, Storage
- Management, Reporting

Examples
Amazon S3
Nirvanix

Source: © IMEX Research – Big Data Industry Report ©2011-12

Cloud Infrastructure for Big Data



Application's SLA dictates the Resources Required to meet specific requirements of Availability, Performance, Cost, Security, Manageability etc.

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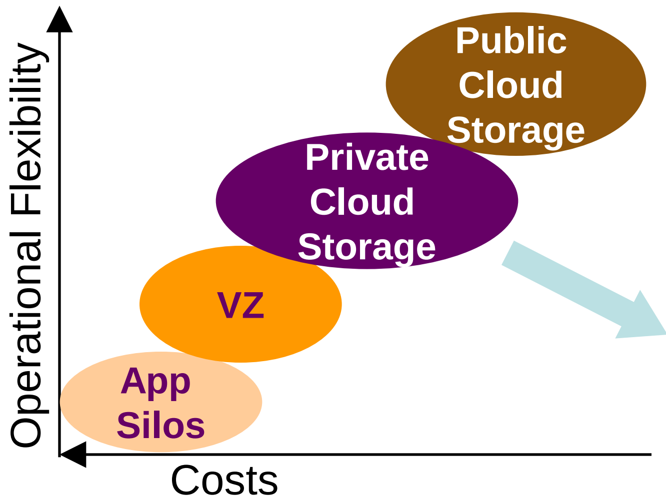
Private Cloud Requirements for Big Data



Service Catalog

- Choose pre-defined IT Services/user/dept.
- Define SLA to efficiently meet services

Private Cloud Storage

Self-Service

- Access Resources on demand to speed deployment and delivery
- Scale Resource Up/down
- to optimize their usage,
- Release when not needed

Service Analytics

- Monitor & Analyze Usage for Charge back
- Interactively auto-tune performance

Availability with SLA requirements

Automation

- Automated Provisioning
- Moving Data & Processes Seamlessly
- Allocation, Self Tuning of Resources to meet Workload Requirements

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Virtualization: Workloads Consolidation

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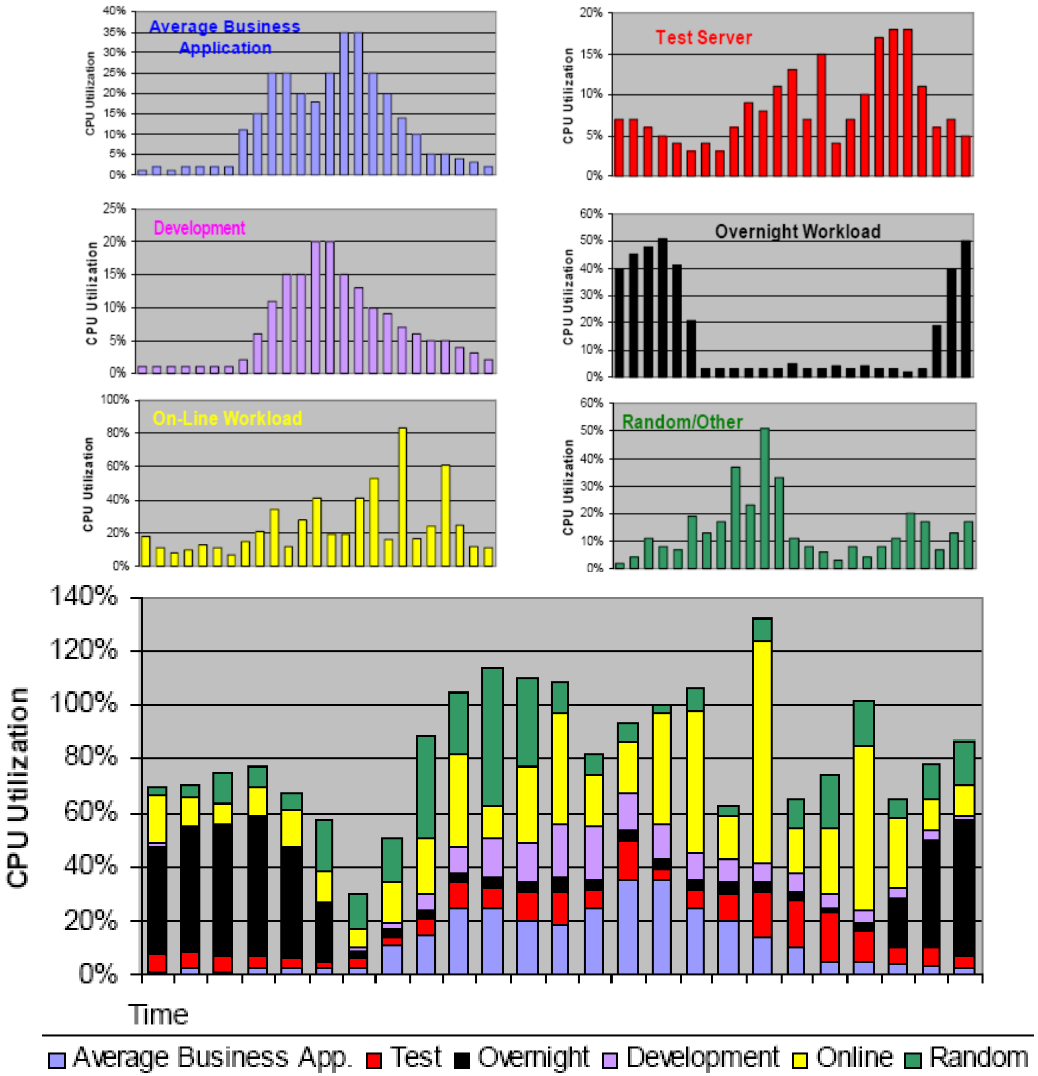

Source: Dan Olds & IMEX Research 2009

- A single server 1.5x larger than standard 2-way server will handle consolidated load of 6 servers.
- VZ manages the workloads + important apps get the compute resources they need automatically w/o operator intervention.
- Physical consolidation of 15-20:1 is easily possible
- Reasonable goal for VZ x86 servers – 40-50% utilization on large systems (>4way), rising as dual/quad core processors becomes available
- Savings result in Real Estate, Power & Cooling, High Availability, Hardware, Management

Virtualization: TCO Savings

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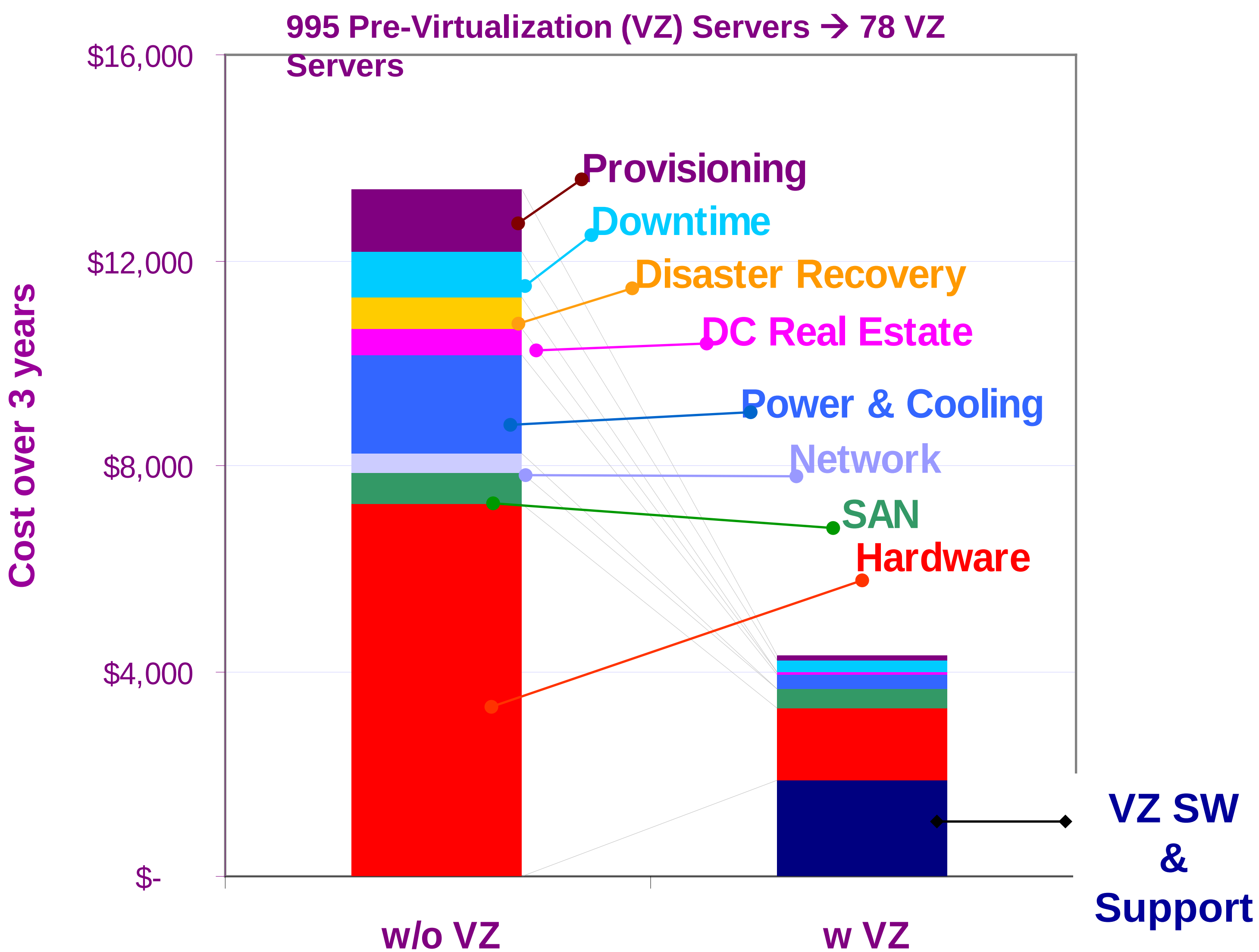


For TCO Analysis, EM: imex@ imexresearch.com (408) 268-0800

Source: © IMEX Research – Big Data Industry Report ©2011-12

Storage Infrastructure for Big Data

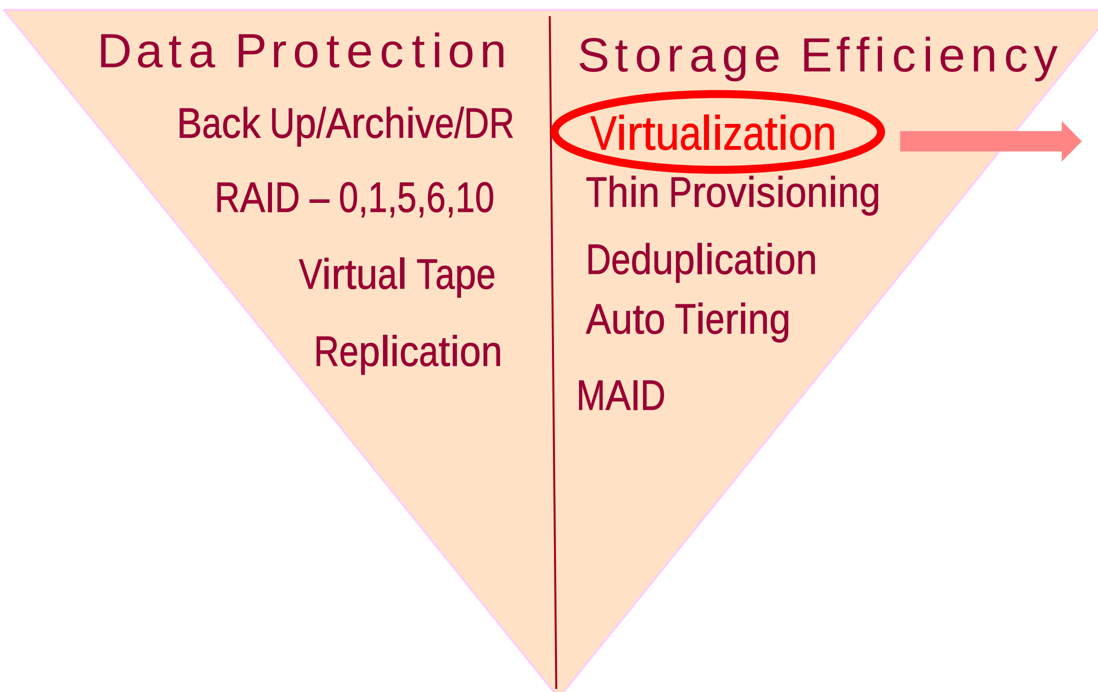
Education SNIA

Storage Efficiency	**Virtualization** ▪ Mapping P > V, VM Management **Performance** ▪ In-Memory DB, Auto-Tiering-SSD/HDD **Costs Reduction** ▪ Thin Provisioning ▪ Deduplication **Availability** RAID/Auto recover HA, Snapshots, CDP, Cloning, DRS **Security** Encryption/DLP

Service Efficiency	**Storage -as-a Service**
	▪ Service Catalogs by Workloads etc.
	▪ Policy Infrastructure
	  • Service Level Attributes
	  • Service Measurements
	▪ Performance Analytics
	  • IOPS/Response Time, Bandwidth
	▪ Automation
	  • Unified SAN/NAS Protocols
	  • Auto learning Workload Forensics
	  • Provisioning to Match Workloads
	  • Assured Auto recovery

Source: © IMEX Research – Big Data Industry Report ©2011-12

Storage Architecture - Impact from VZ



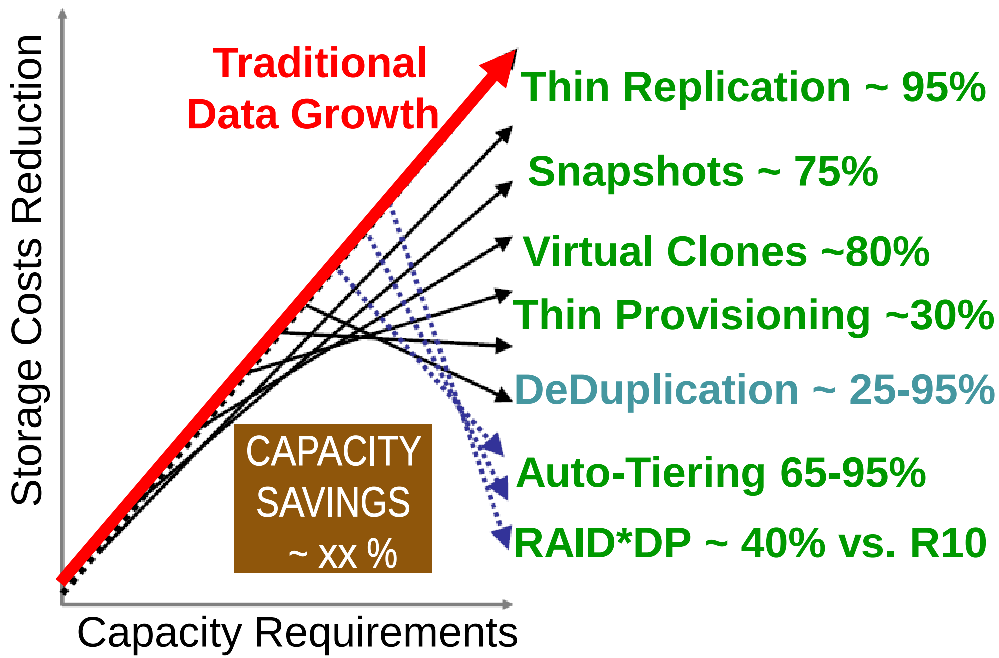
Virtualization (VZ) requires Shared Storage for
- VMotion
- Storage VMotion
- HA/DRS
- Fault Tolerance

Additional Capacity Consumed for
- VZ snapshots,
- VM Kernel etc.

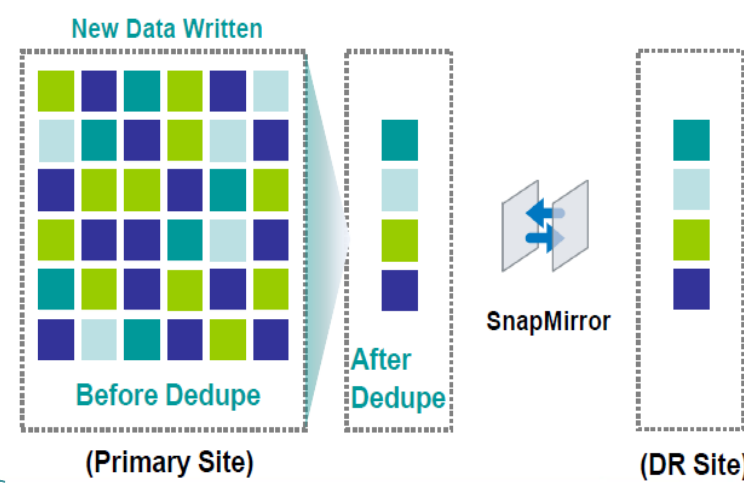
Source: IMEX Research SSD Industry Report ©2011

Storage – Issues & Solutions

Technologies Reducing Storage Costs



- Replicates only the deduplicated blocks
- Only unique data is replicated to the DR site



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Storage Architecture Impacting Big Data

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Data Protection

Back Up/Archive/DR

RAID – 0,1,5,6,10

Virtual Tape

Replication

Storage Efficiency

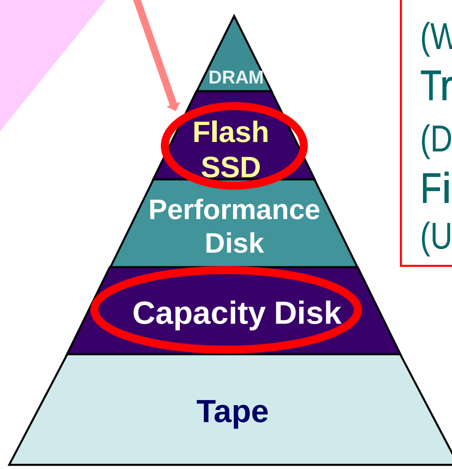
Storage Virtualization

Thin Provisioning

Deduplication

Auto-Tiering

MAID



Auto-Tiering System using Flash SSDs

Data Class
(Tiers 0,1,2,3)
Storage Media Type
(Flash/Disk/Tape)
Policy Engines
(Workload Mgmt.)
Transparent Migration
(Data Placement)
File Virtualization
(Uninterrupted App.Opns.in Migration)

Source: IMEX Research SSD Industry Report ©2011

Source: © IMEX Research – Big Data Industry Report ©2011-12

Data Storage: Hierarchical Usage

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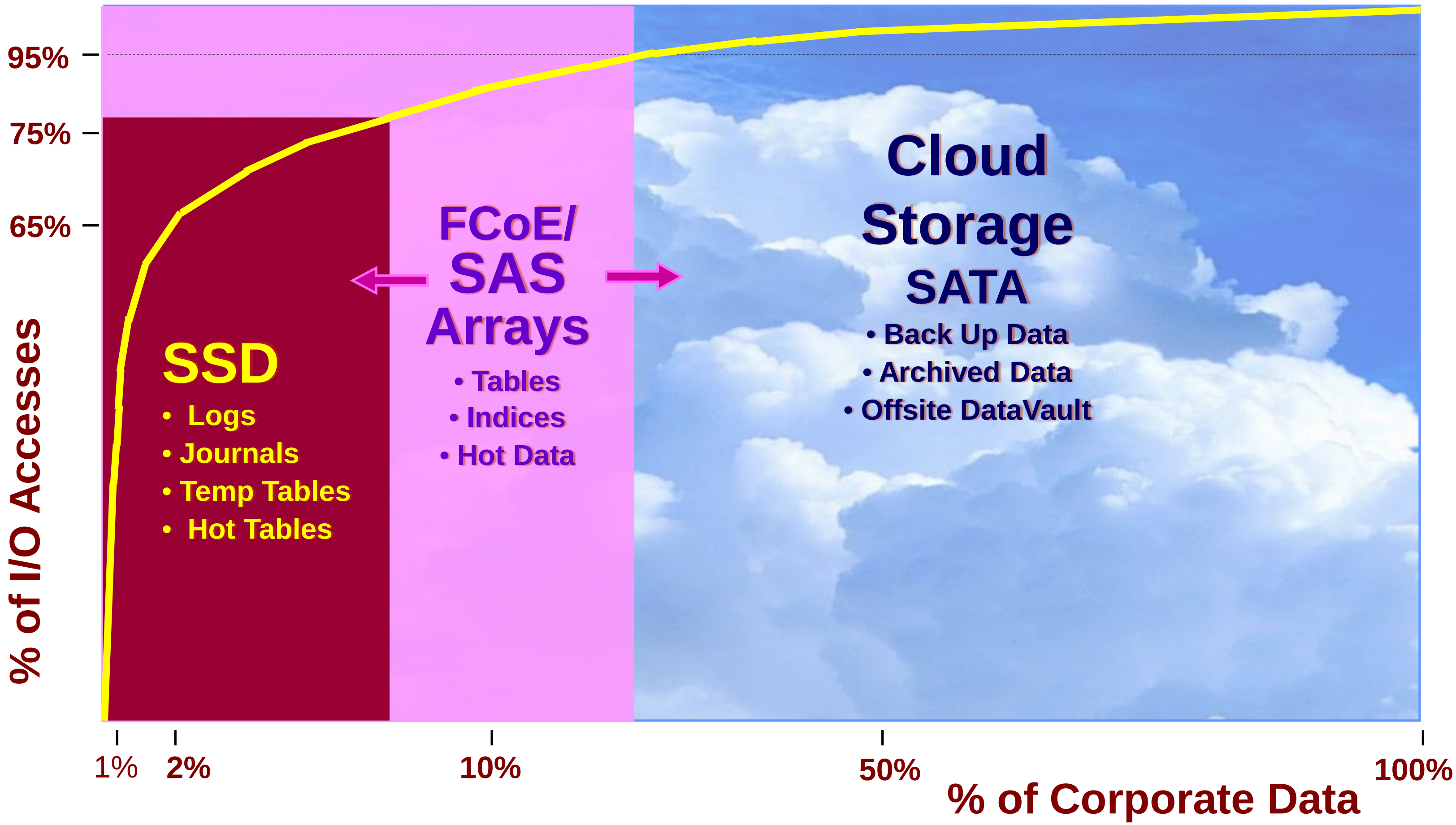
I/O Access Frequency vs. Percent of Corporate Data



Source:: IMEX Research - Cloud Infrastructure Report ©2009-12
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SSD Storage: Filling Price/Perf.Gaps

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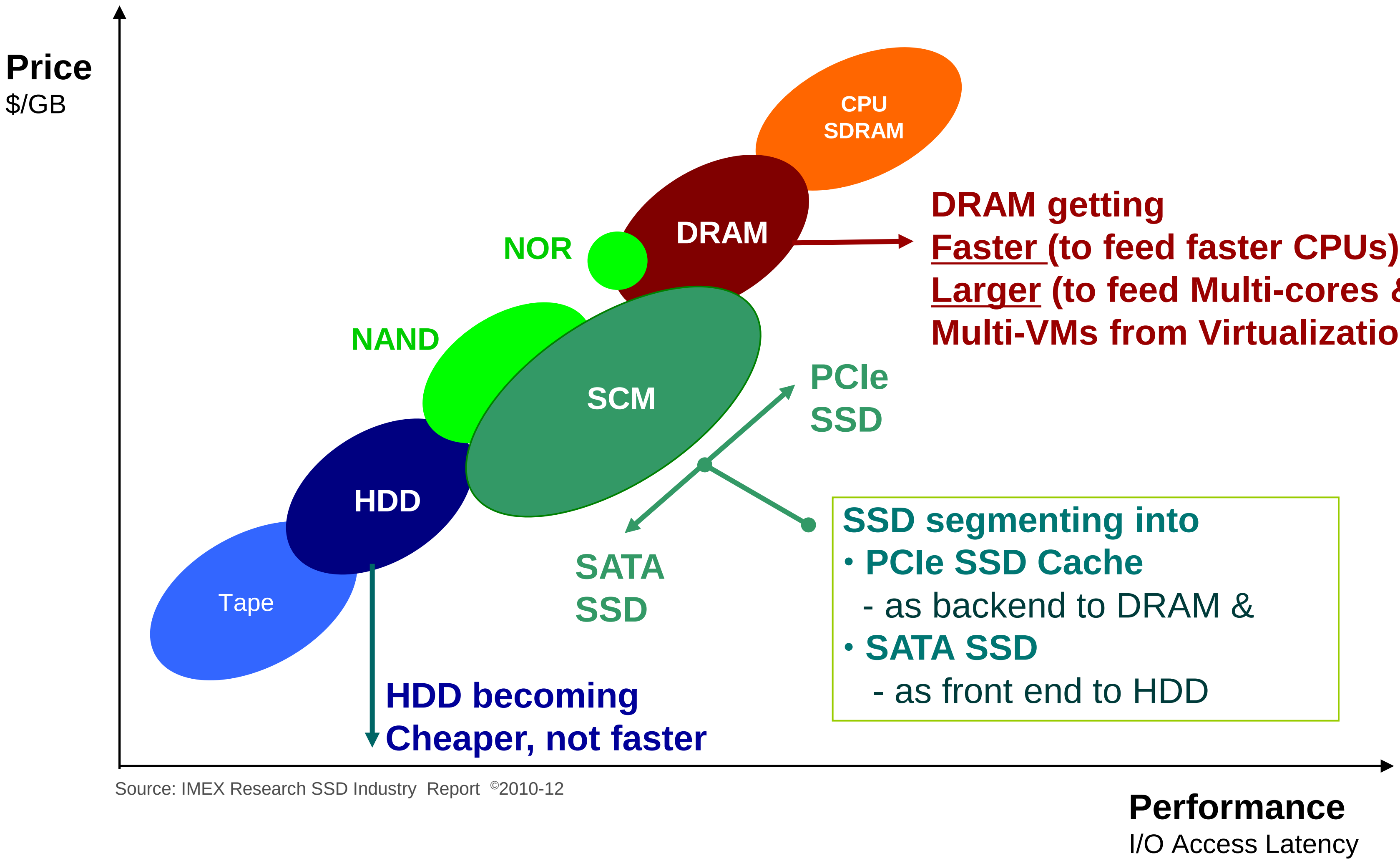
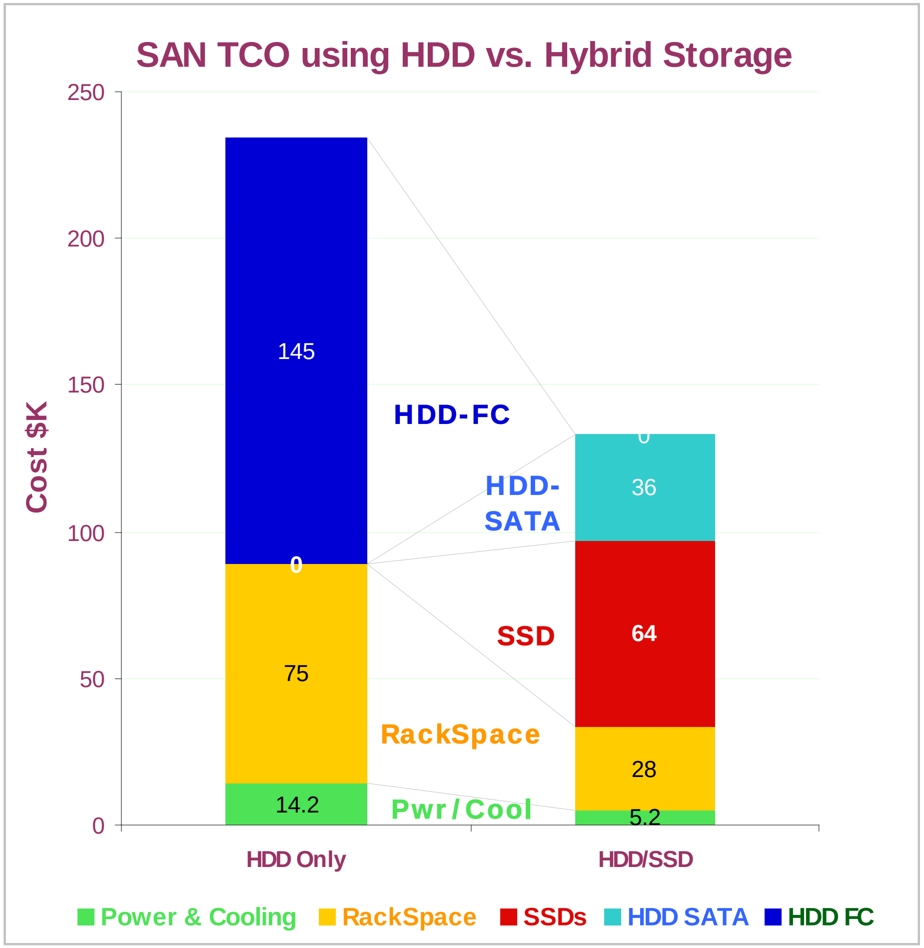
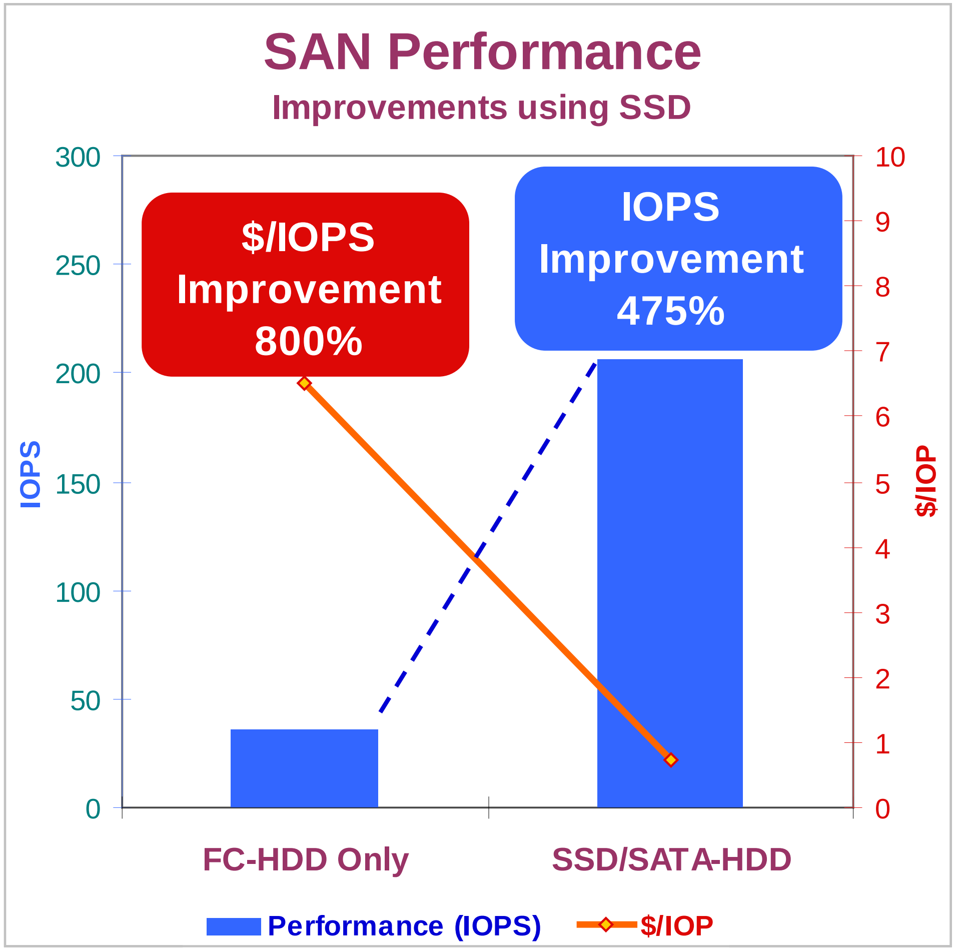


SSD segmenting into
- **PCIe SSD Cache**
  - as backend to DRAM &
- **SATA SSD**
  - as front end to HDD

Source: IMEX Research SSD Industry Report ©2010-12

SSD Storage - Performance & TCO





Source: IMEX Research SSD Industry Report ©2011

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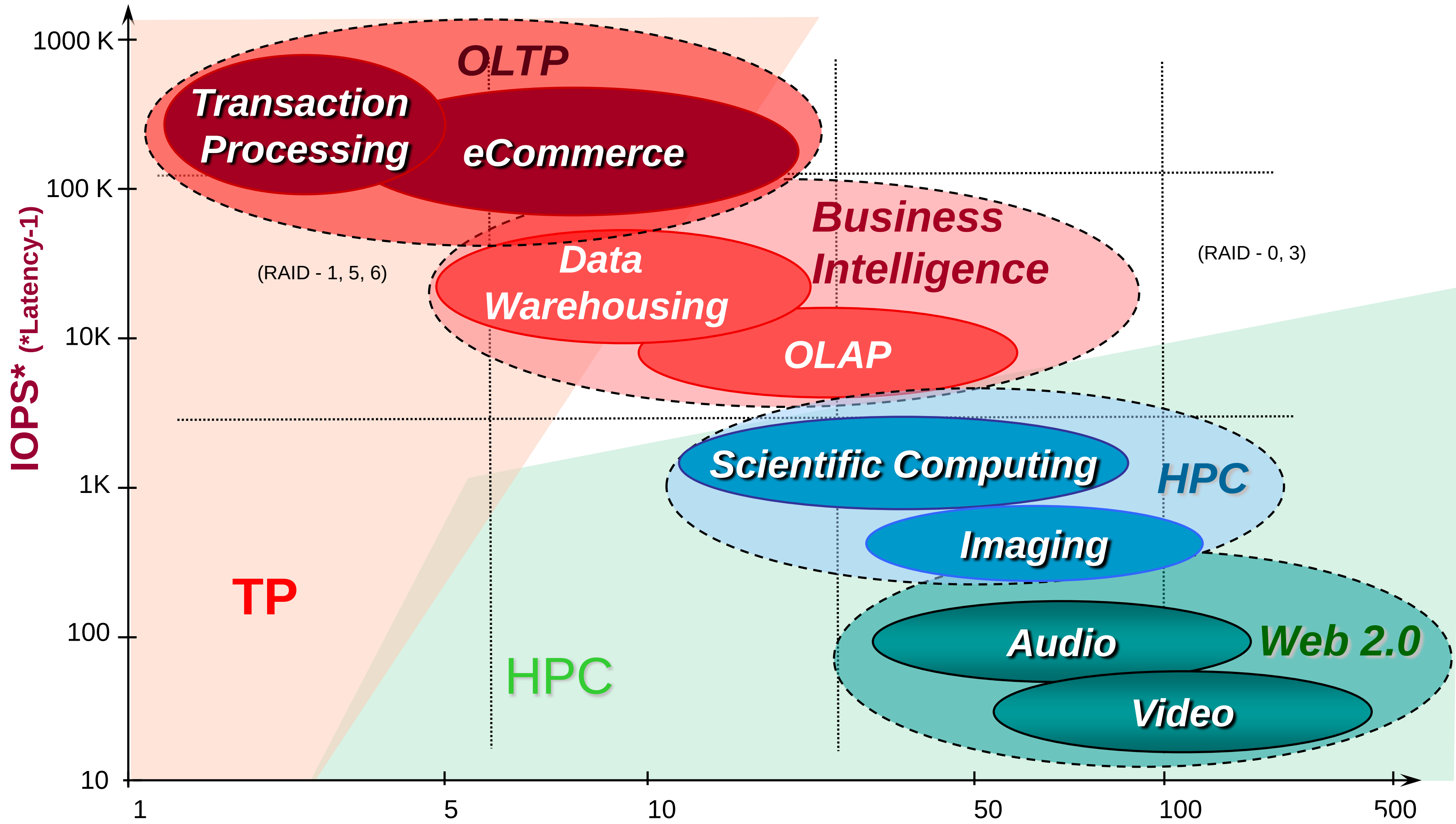
Workloads Characterization



*IOPS for a required response time (ms)
*=(#Channels*Latency-1)

Source:: IMEX Research - Cloud Infrastructure Report ©2009-12
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Workloads Characterization

Storage performance, management and costs are big issues in running Databases

- **Data Warehousing Workloads are I/O intensive**
  - Predominantly read based with low hit ratios on buffer pools
  - High concurrent sequential and random read levels
    - ✓ Sequential Reads requires high level of I/O Bandwidth (MB/sec)
    - ✓ Random Reads require high IOPS)
  - Write rates driven by life cycle management and sort operations
- **OLTP Workloads are strongly random I/O intensive**
  - Random I/O is more dominant
    - ✓ Read/write ratios of 80/20 are most common but can be 50/50
    - ✓ Can be difficult to build out test systems with sufficient I/O characteristics
- **Batch Workloads are more write intensive**
  - Sequential Writes requires high level of I/O Bandwidth (MB/sec)
- **Backup & Recovery times are critical for these workloads**
  - Backup operations drive high level of sequential IO
  - Recovery operation drives high levels of random I/O

Source: IMEX Research SSD Industry Report ©2011
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Best Practices – Storage in Big Data Apps

Goals & Implementation

- Establish **Goals for SLAs** (Performance/Cost/Availability), BC/DR (RPO/RTO) & Compliance
- **Increase Performance for DB, OLTP and OLAP Apps**:
  - Random I/O > 20x , Sequential I/O Bandwidth > 5x
  - Remove Stale data from Production Resources to improve performance
- Use **Partitioning Software to Classify Data**
  - By Frequency of Access (Recent Usage) and
  - Capacity (by percent of total Data) using general guidelines as:
  - Hyperactive (1%), Active (5%), Less Active (20%), Historical (74%)

Implementation

- **Optimize Tiering** by Classifying Hot & Cold Data
  - Improve Query Performance by reducing number of I/Os
  - Reduce number of Disks Needed by 25-50% using advance compression software achieving 2-4x compression
- **Match Data Classification vs.Tiered Devices** accordingly
  - Flash, High Perf Disk, Low Cost Capacity Disk, Online Lowest Cost Archival Disk/Tape
- **Balance Cost vs. Performance** of Flash
  - More Data in Flash > Higher Cache Hit Ratio > Improved Data Performance
- **Create and Auto-Manage Tiering** (Monitoring, Migrations, Placements) without manual intervention

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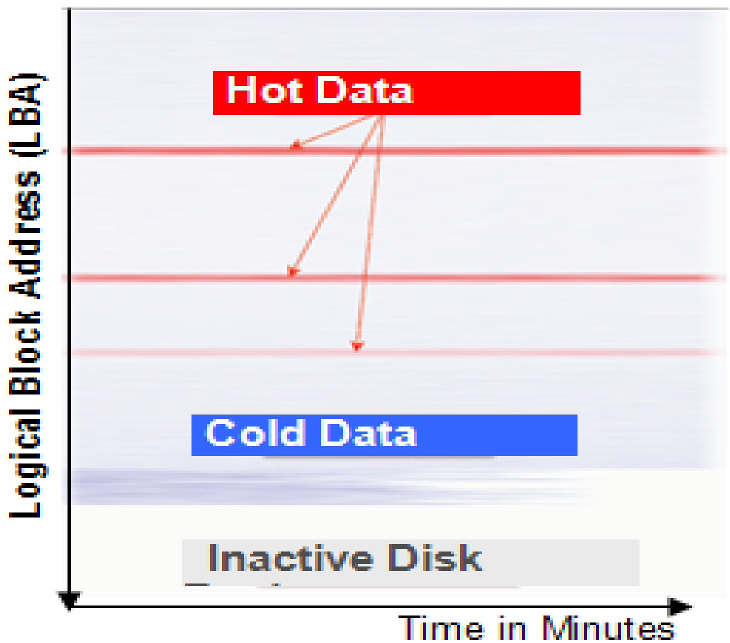
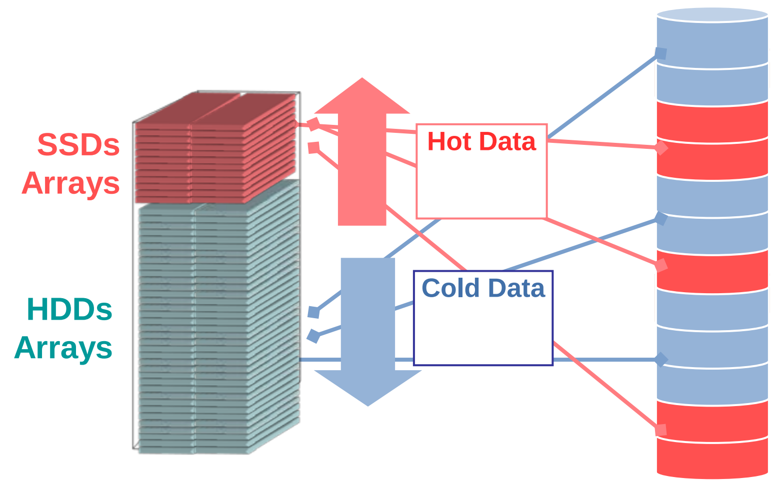
Best Practices: I/O Forensics in Storage-Tiering



Storage-Tiered Virtualization

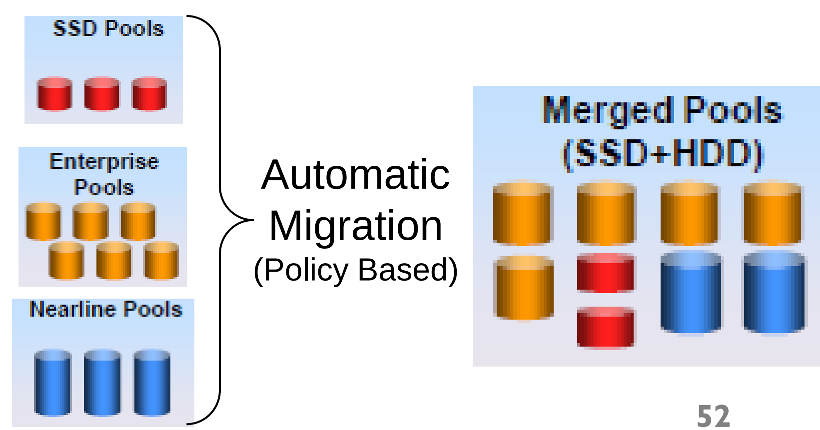
Storage-Tiering at LBA/Sub-LUN Level

Physical Storage | Logical Volume



LBA Monitoring and Tiered Placement

- Every workload has unique I/O access signature
- Historical performance data for a LUN can identify performance skews & hot data regions by LBAs



Source: IBM & IMEX Research SSD Industry Report 2011 ©IMEX 2010-12

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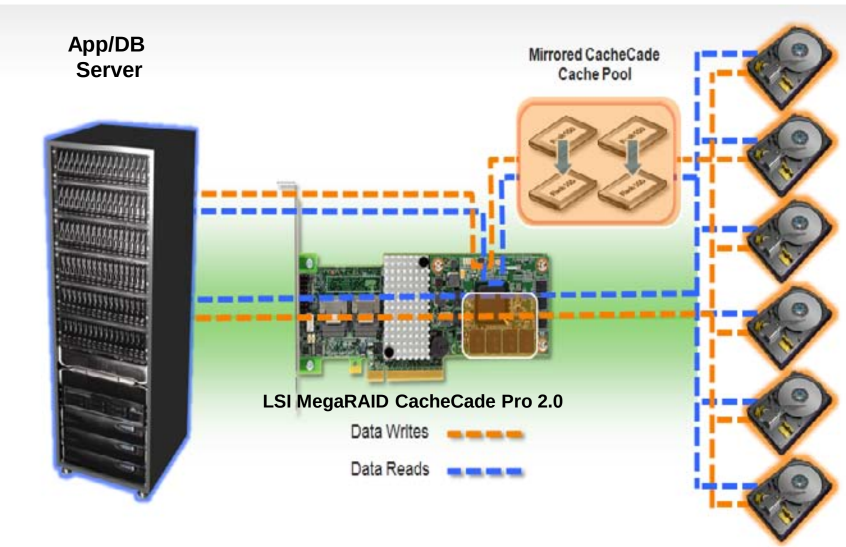
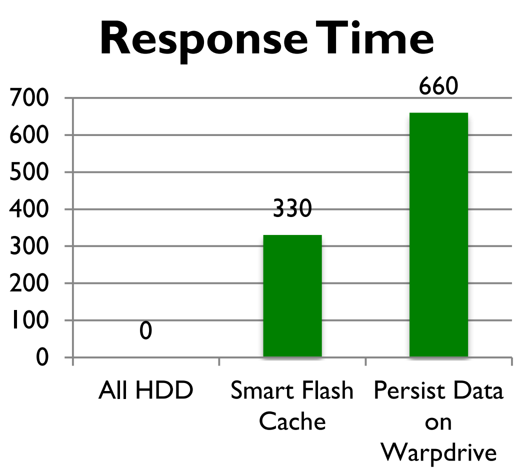
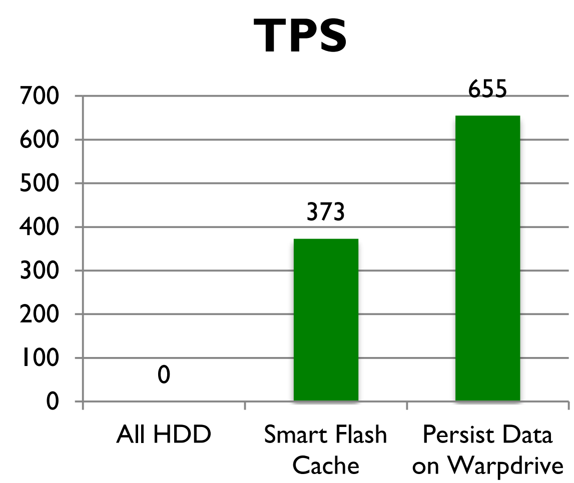
Best Practices: Cached Storage



Application	Improvement over Cached vs.HDD only
Oracle OLTP Benchmarks	681%
SQL Server OLTP Benchmark	1251%
Neoload (Web Server Simulation	533%
SysBench (MySQL OLTP Server)	150%





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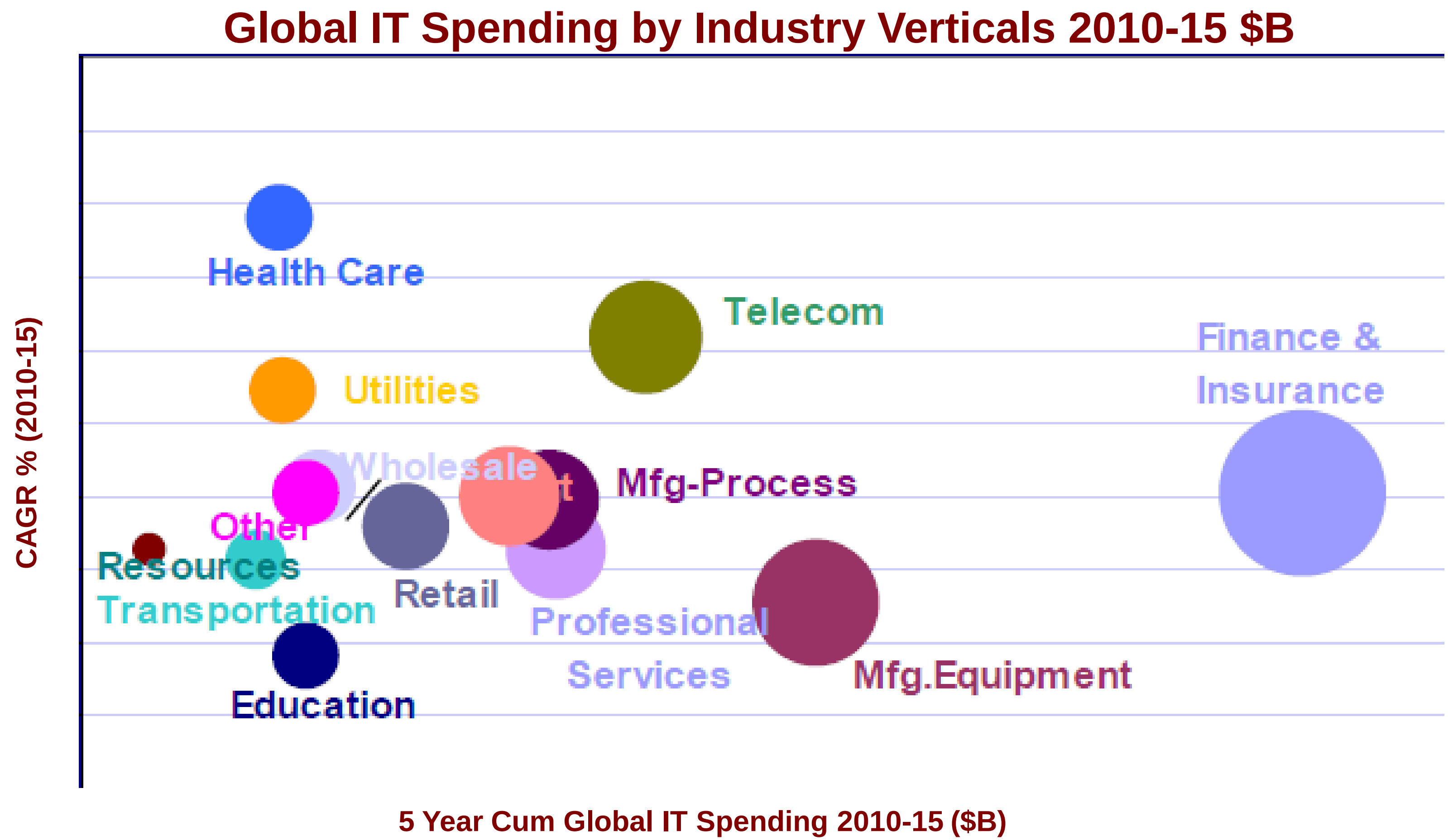
Big Data Targets: Analytics

Key Industries Benefitting from Big Data Analytics



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Big Data Targets – Storage Infrastructure

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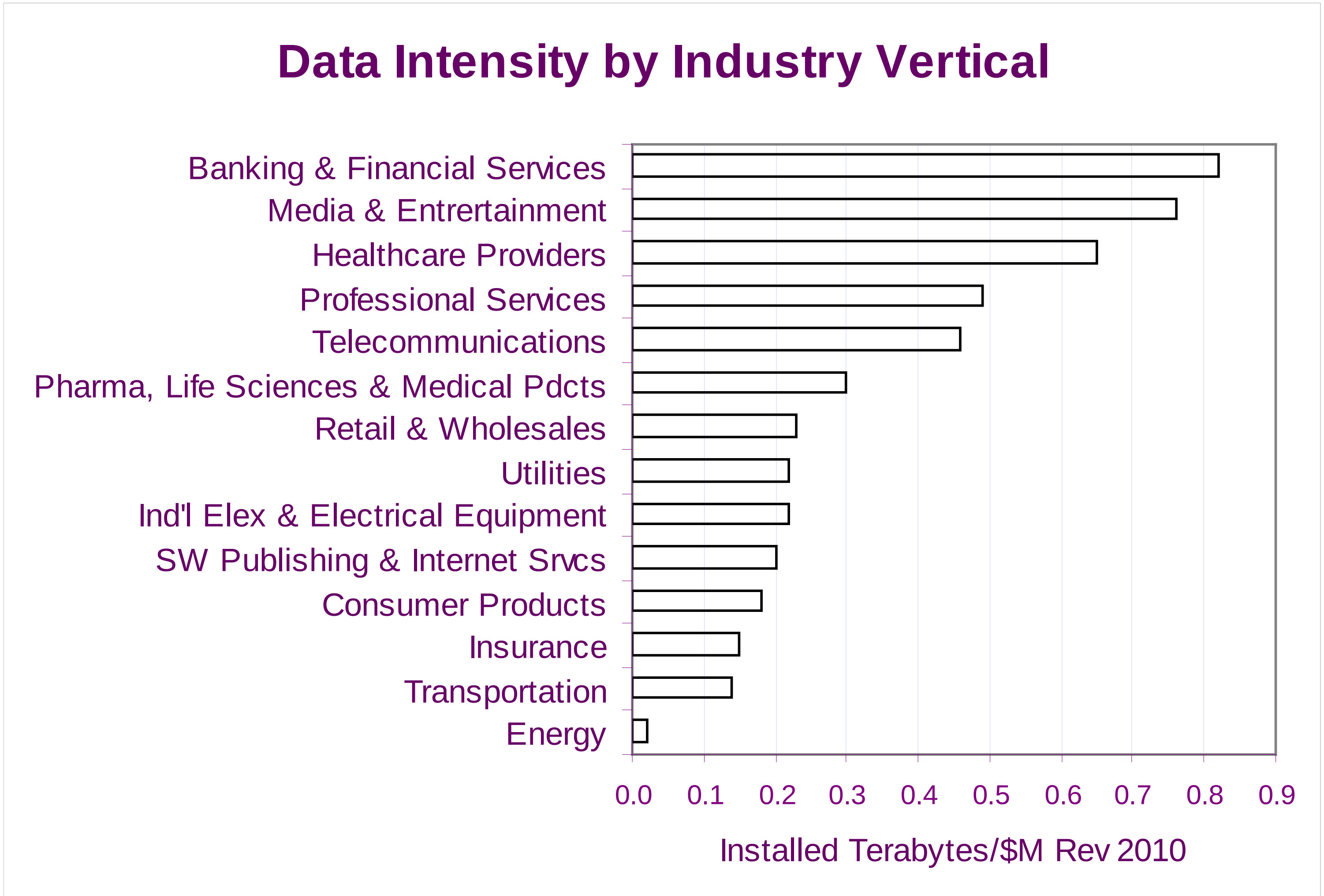
Value Potential of Using Big Data by Data Intensive Verticals



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Big Data Targets: Storage Infrastructure

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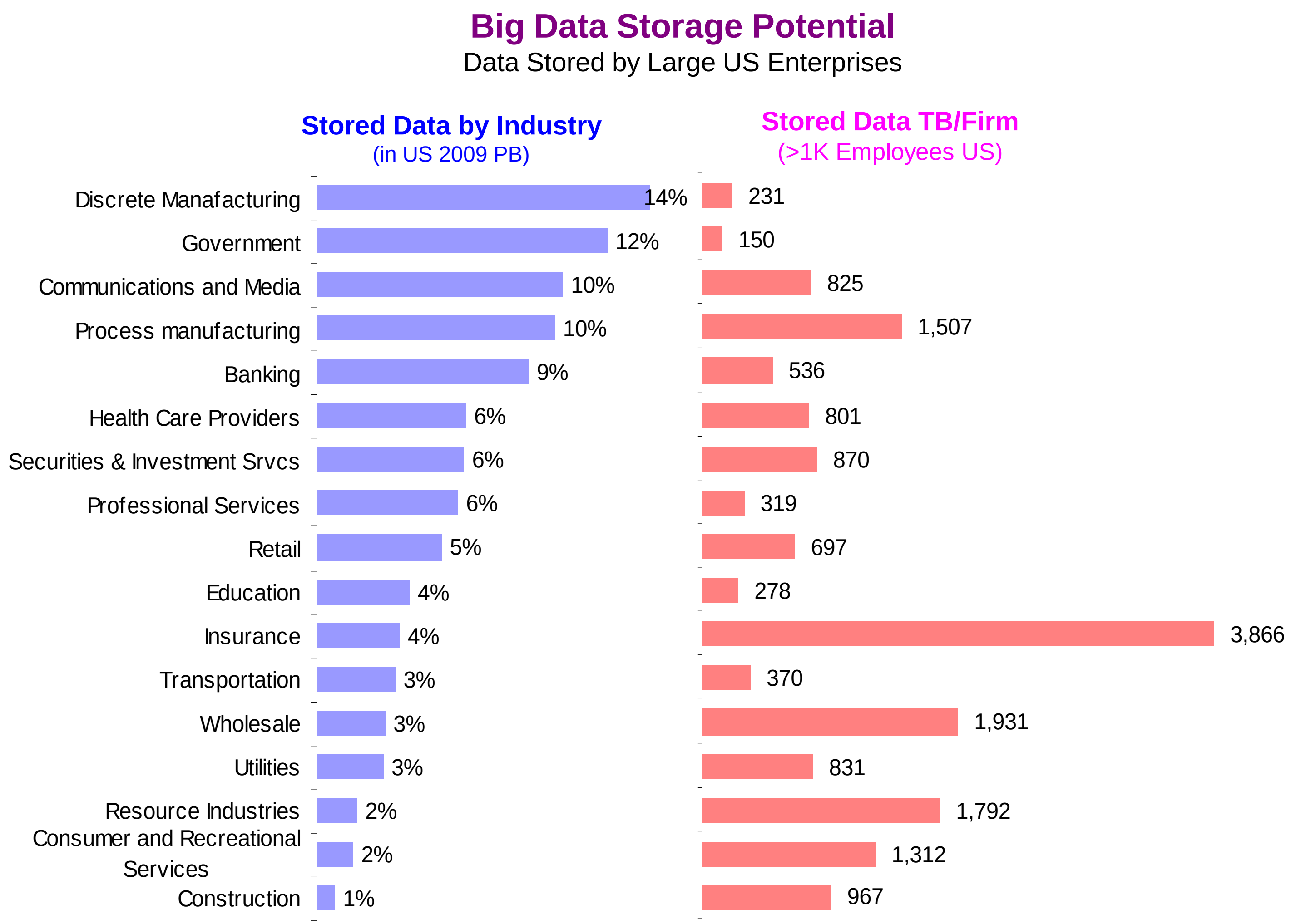
Data Stored by Large US Enterprises



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Big Data Targets: Savings w Open Source

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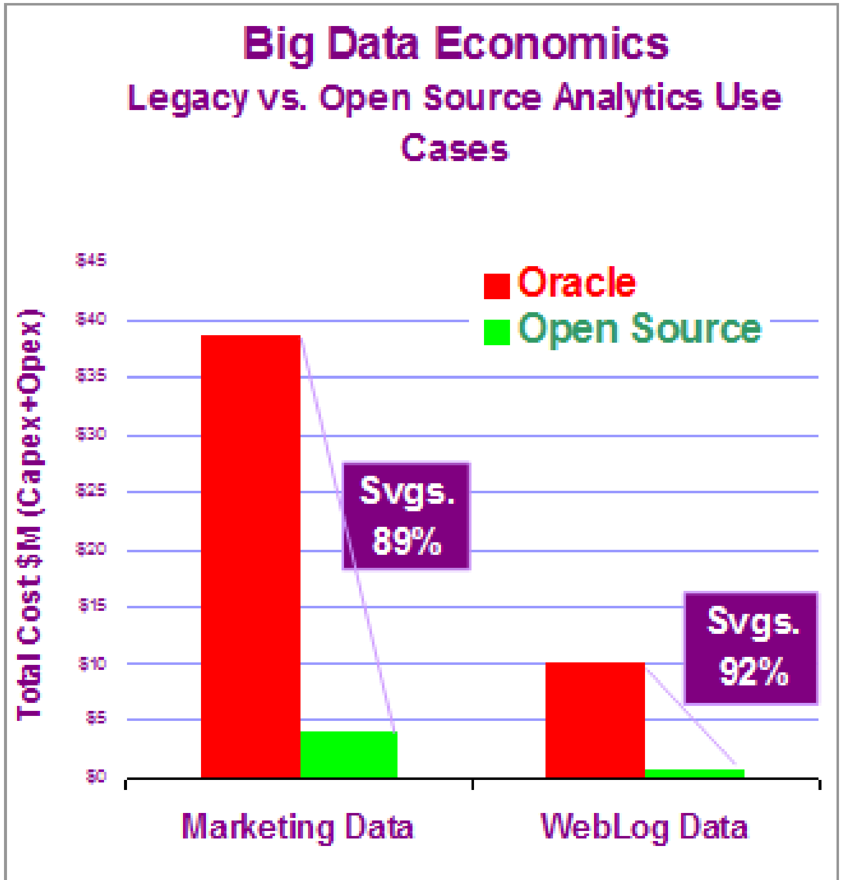
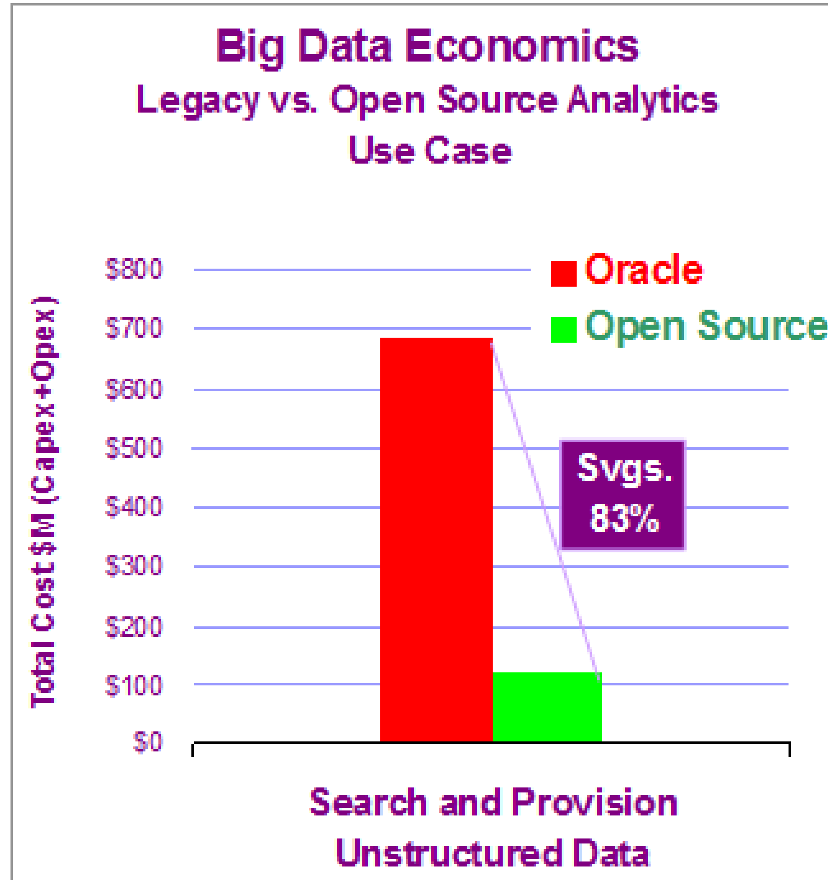
Legacy BI vs. Open Source Big Data Analytics





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Rise of Big Data Adoption

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2006

Yahoo!

Internet Archive

2007

Powerset

last.fm

2008

Google, ablegrape, ImageShack, Cascading, IBM, facebook, ENORMO, A9, krugle, rackspace HOSTING, Lookery, The New York Times, Joost, Zvents, Information Sciences Institute, News Corporation, Cornell University Computing and Information Science, Visible Measures, LOTAME, NetSeer, parc, veoh

2009

AOL, amazon web services, deepdyve, cooliris, eyealike, TEXTMAP, PSG College of Technology, iterend, tailsweep, hulu, RapLeaf, USCMS, Ning, quantcast, cloudera, pressflip, detikSearch, WorldLingo, Systems@ETH Zürich, VK SOLUTIONS, TARRAGONA, HOSTING HABITAT, HOLA, Terrier, adknowledge, stampede

2010

SAMSUNG, rubicon, BERKELEY LAB, VISIBLE TECHNOLOGIES, APOLLO GROUP, ADSDAQ, rackspace HOSTING, RapLeaf, wordnik, comScore, trulia, Accela COMMUNICATIONS, Forward3D, LinkedIn, Microsoft, Infochimps, Pharm2Phork, ADMELD, gumgum, Pronux, The Datagraph Blog, NETFLIX, mobileanalytics.tv, markt24.de, twitter, media6degrees, BEEBLER, SLC Security, ebay

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Key Takeaways

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- **Big Data creating paradigm shift in IT Industry**
  - Leverage the opportunity to optimize your computing infrastructure with Big Data Infrastructure after making a due diligence in selection of vendors/products, industry testing and interoperability.
  - Apply best storage technologies listed in this presentation and elsewhere
- **Optimize Big Data Analytics for Query Response Time vs. # of Users**
  - Improving Query Response time for a given number of users (IOPs) or Serving more users (IOPS) for a given query response time
- **Select Automated Storage Management Software**
  - **Data Forensics and Tiered Placement**
  - Every workload has unique I/O access signature
  - Historical performance data for a LUN can identify performance skews & hot data regions by LBAs.Non-disruptively migrate hot data using auto-tiering Software
- **Optimize Infrastructure to meet needs of Applications/SLA**
  - **Performance Economics/Benefits**
  - Typically 4-8% of data becomes a candidate and when migrated for higher performance tiering can provide response time reduction of ~65% at peak loads. Many industry Verticals and Applications will benefit using Big Data

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Q&A / Feedback

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Many thanks to the following individuals for their contributions to this tutorial.
Source: IMEX Research

Joseph White
Anil Vasudeva

Send any questions or comments on this presentation to SNIA: tracktutorials@snia.org