Hadoop and data integration with System z

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August 6, 2014
Session 15961

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The Big Picture for Big Data

"The Lack of Information" Problem

1 in 3 Business leaders frequently make decisions based on information they don't trust, or don't have

1 in 2 Business leaders say they don't have access to the information they require to do their jobs

83% Of CIOs cited "Business Intelligence and Analytics" as part of their visionary plans to enhance competitiveness

60% Of CIOs need to do a better job capturing and understanding information rapidly in order to make swift business decisions

"The Surplus of Data" Problem

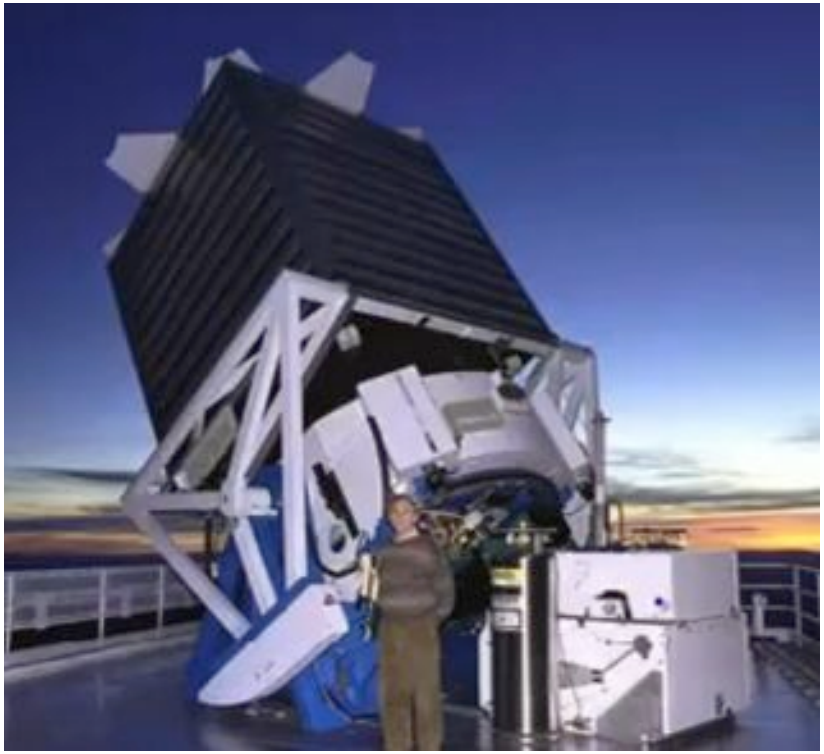
- "The 3 V's" of Big Data
  - **Volume**: More devices, higher resolution, more frequent collection, store everything
  - **Variety**: Incompatible Data Formats
  - **Velocity**: Analytics Fast Enough to be Interactive and Useful

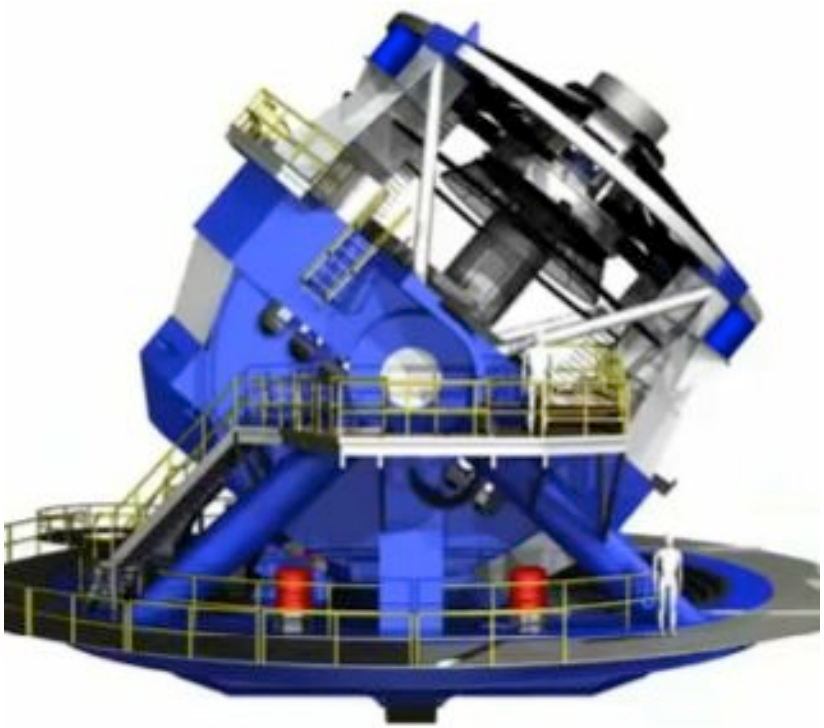
(Doug Laney, Gartner Research)

Big Data: Volume

SDDS telescope, 80 TB in 7 years

LSST telescope, 80 TB in 2 days





Big Market, Big Growth

Big Data: Variety

20% is "Structured"

- Tabular Databases like credit card transactions and Excel spreadsheets
- Web forms

80% is "Unstructured"

- Pictures: Photos, X-rays, ultrasound scans
- Sound: Music (genre etc.), speech
- Videos: computer vision, cell growing cultures, storm movement
- Text: Emails, doctor's notes
- Microsoft Office: Word, PowerPoint, PDF

Big Data: Velocity

- To be relevant, data analytics must be acted upon in a timely fashion
- Results can lead to other questions, and so the solutions should be interactive
- Specific information desired should be searchable

Increasing needs for Detailed Analytics

- Baselining & Experimenting
  - Parkland Hospital analyzed records to find and extend best practices
- Segmentation
  - Dannon uses predictive analytics to adapt to changing tastes in yogurt
- Data Sharing
  - US Gov Fraud Prevention shared data across departments
- Decision-making
  - Lake George ecosystem project uses sensor data to protect $1B in tourism
- New Business Models
  - Social media, location-based services, mobile apps

Big Data Industry Value

US health care
- $300 billion value per year
- ~0.7 percent annual productivity growth

Europe public sector administration
- €250 billion value per year
- ~0.5 percent annual productivity growth

Global personal location data
- $100 billion+ revenue for service providers
- Up to $700 billion value to end users

US retail
- 60+% increase in net margin possible
- 0.5–1.0 percent annual productivity growth

Manufacturing
- Up to 50 percent decrease in product development, assembly costs
- Up to 7 percent reduction in working capital

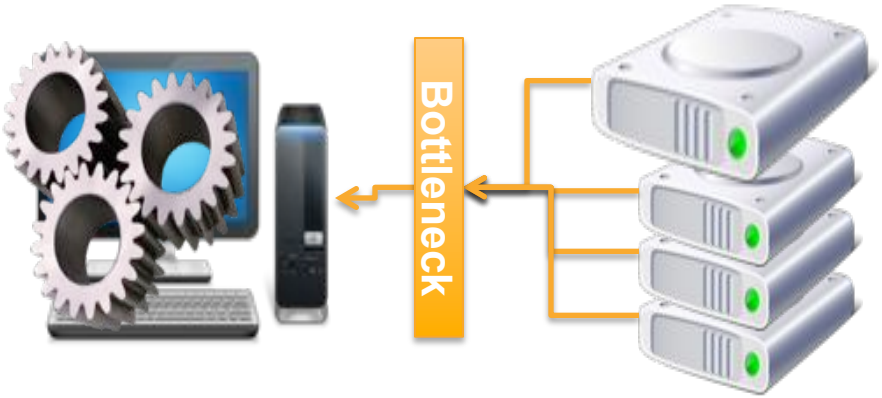
Finance and Insurance
- ~1.5 to 2.5 percent annual productivity growth
- $828 billion industry

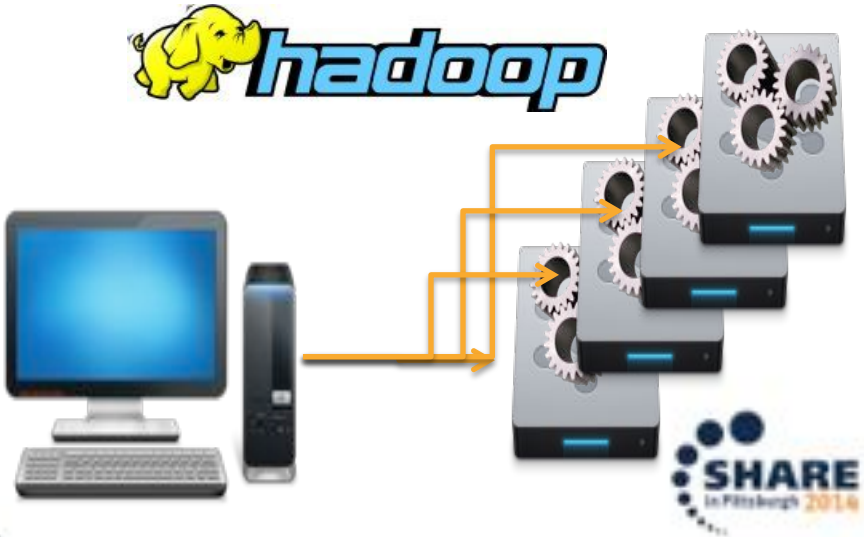
SOURCE: McKinsey Global Institute analysis

What is Hadoop and Why is it a Game Changer?

- Hadoop solves the problem of moving big data
  - Eliminates **interface** traffic jams
  - Eliminates **network** traffic jams
  - New way to move Data
- Hadoop automatically divides the work
  - Hadoop software divides the job across many computers, making them more productive

Without Hadoop



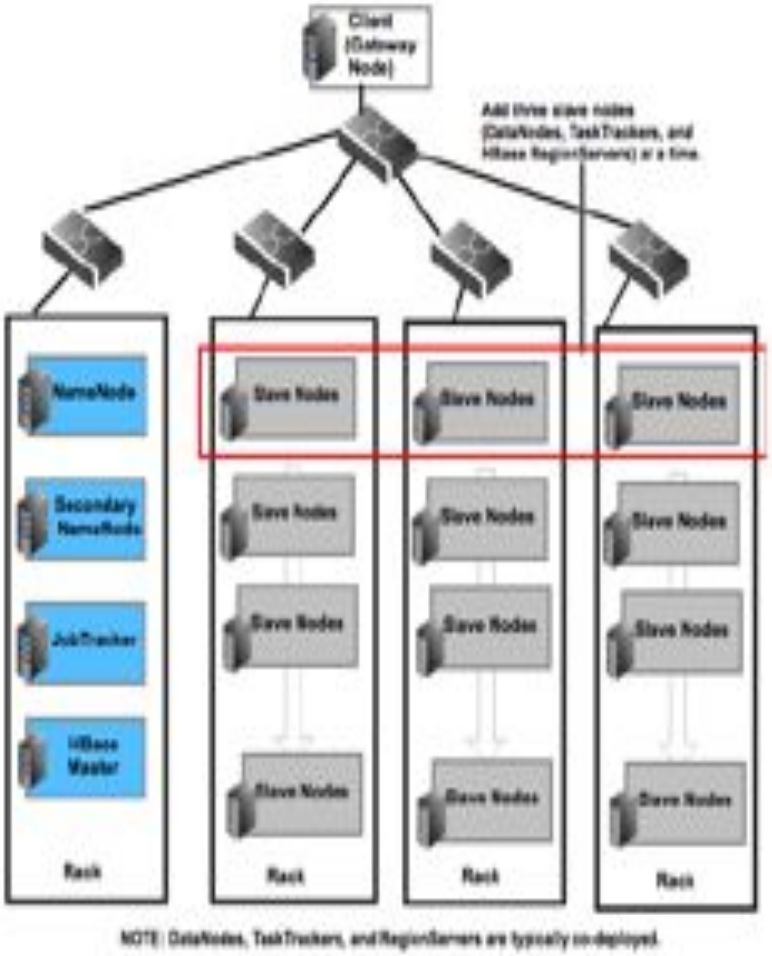


Hadoop Family & Ecosystem

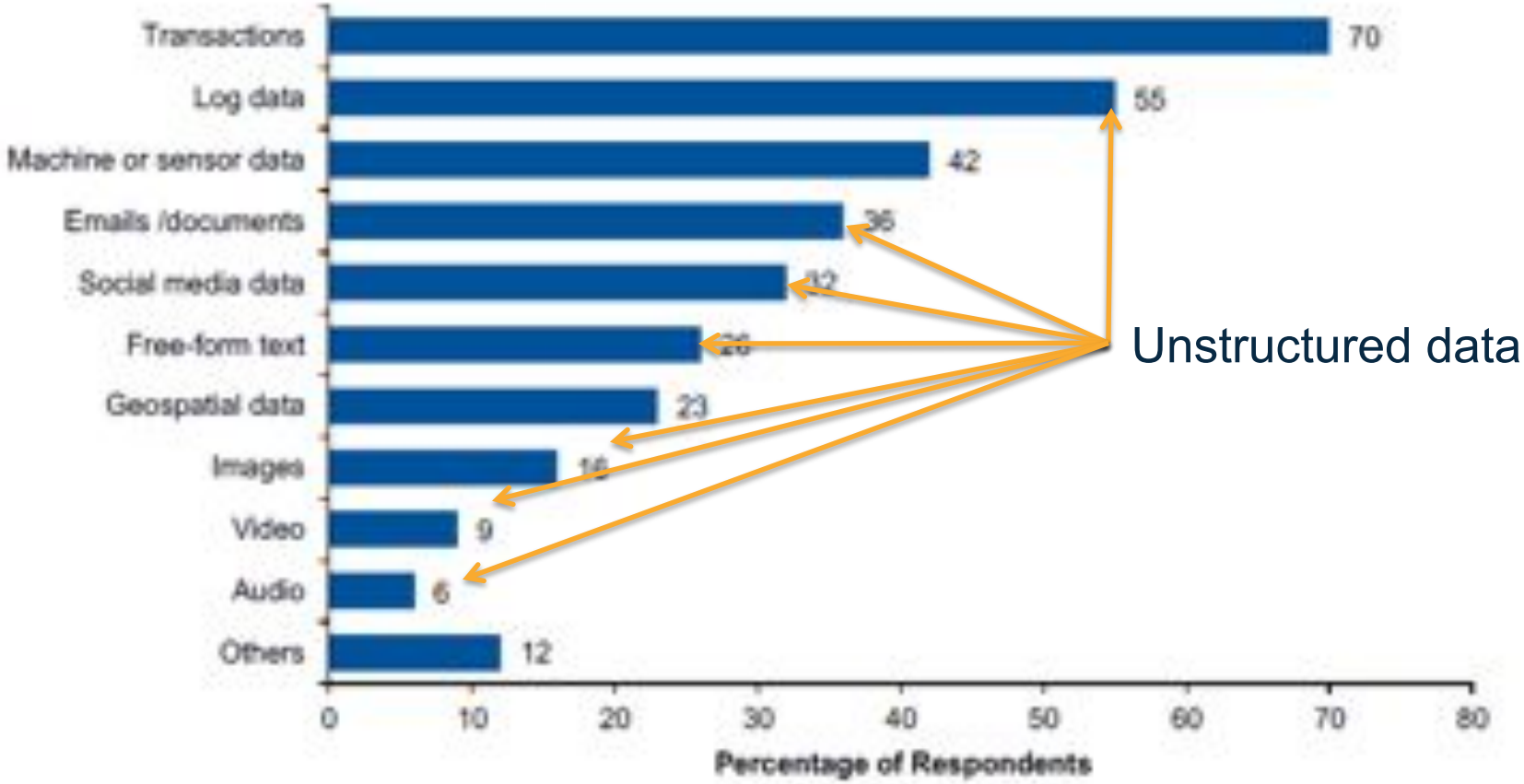
- Hadoop solves the problem of moving big data
  - Eliminates **interface** traffic jams of getting data from a large disk
  - Eliminates **network** traffic jams of getting data from many disks
- Hadoop divides and moves the work instead
  - Hadoop divides the job across many servers and sends the work to them
- Apache Hadoop is an open-source platform
- Hadoop includes
  - **HDFS**—File-based, unstructured, massive
  - **MapReduce**—Distributes processing and aggregates results (queries or data loading)
  - **Yarn**— …?
  - **Pig**—Programming language
  - **Hive**—Structure with SQL-like queries
  - **Hbase**—Big table, with limits
  - **Flume**—Import streaming logs
  - **Sqoop**—Import from RDBMS

Typical Hadoop Cluster

- NameNode—Master, directs slave DataNodes, tracks file block storage, overall health
- Secondary NameNode—Backup
- JobTracker—Assigns nodes to jobs, handles task failures
- Slave Nodes
  - DataNode—IO and backup
  - TaskTracker—Manages tasks on slave; talks with JobTracker
- 3X data blocks!



Today's Big Data Initiatives: Transactions, Logs, Machine Data



N =465 (multiple responses allowed)

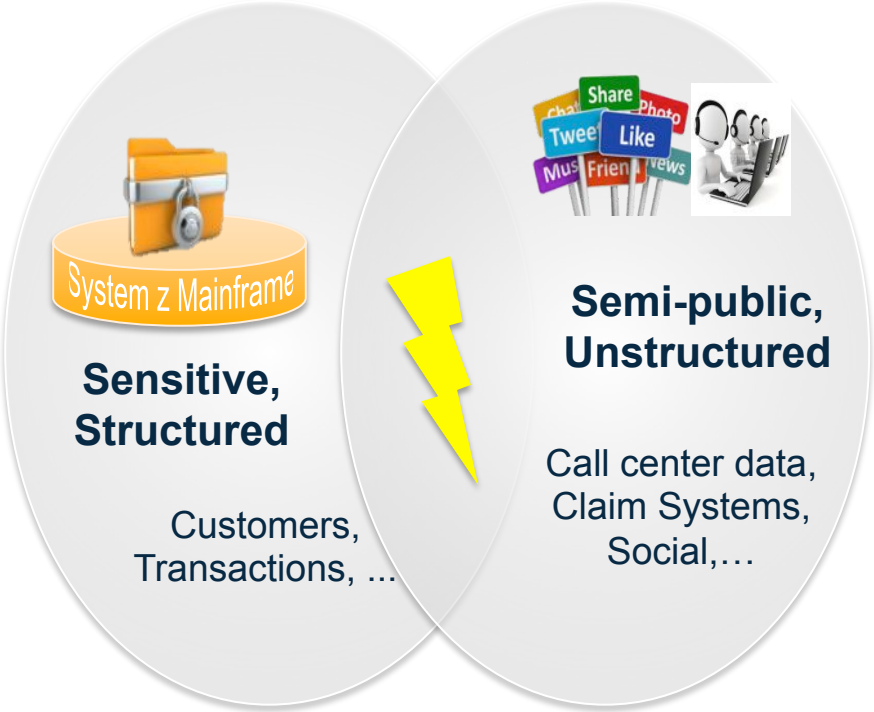
Source: Gartner (September 2013)

Transaction Data = Mainframe Computers

- Mainframes run the global core operations of
  - 92 of top 100 banks
  - 21 of top 25 insurance
  - 23 of top 25 retailers
- Process 60% of **all** transactions
- Mainframe computers are the place for essential enterprise data
  - Highly reliable
  - Highly secure
- IBM's Academic Initiative
  - 1000 higher education institutions
  - In 67 nations
  - Impacting 59,000 students
- However, mainframe data uses proprietary databases which must be translated to talk to formats familiar in "Big Data"

The ROI Behind the Hype

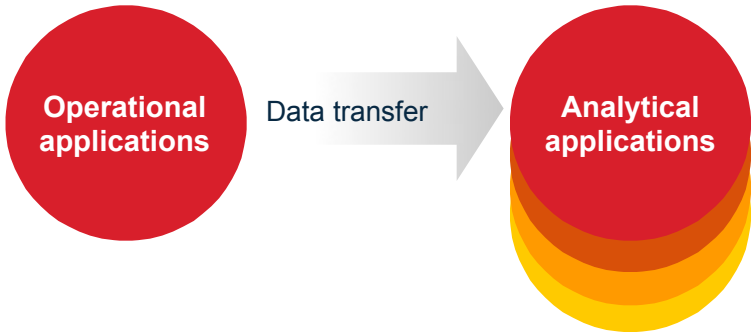
The most relevant insights come from enriching **your** primary enterprise data



Bring Analytics to the Data rather than the Data to the Analytics

Extract, Transform and Load (ETL)

1TB ETL per day, Initial copy plus three derivatives costs > $8 million over 4 years



Multiple copies of data

Transaction and analytics isolation

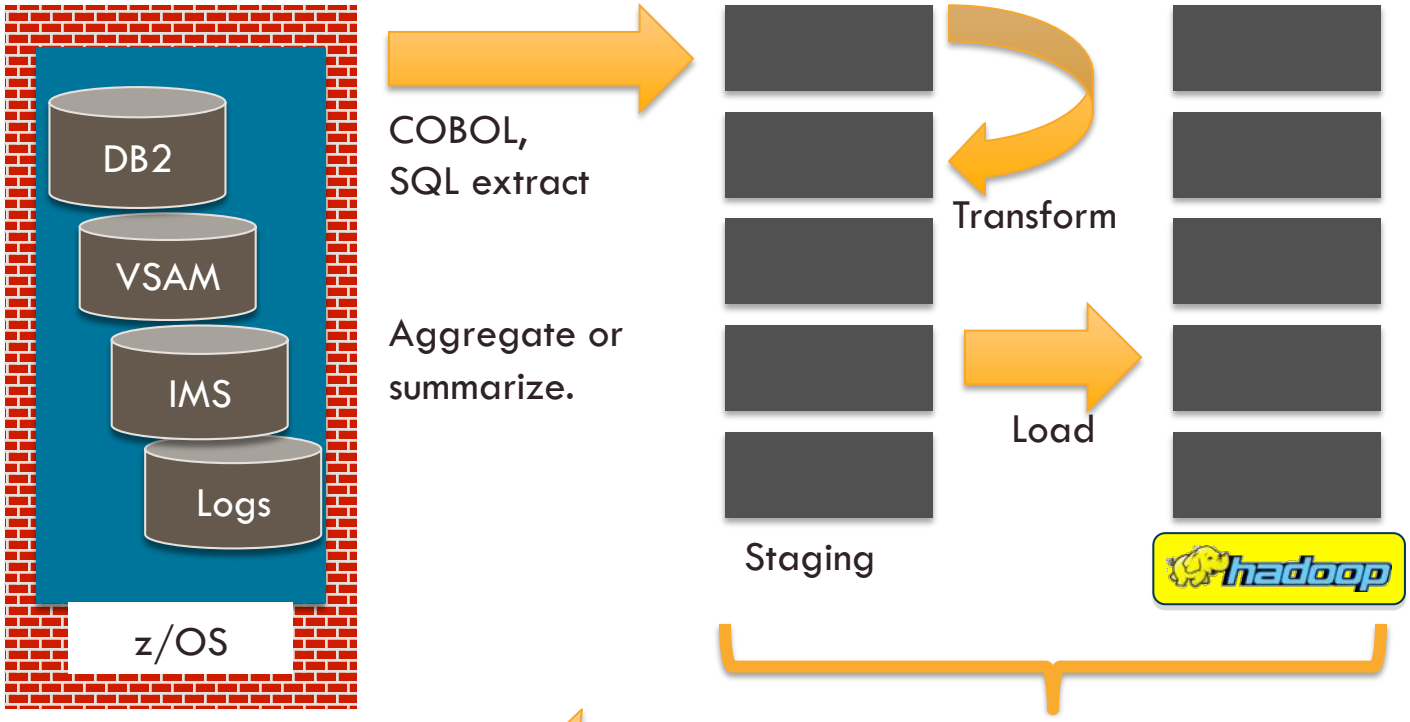
Significant compute power

Source: CPO internal study. Assume dist. send and load is same cost as receive and load.. Also, assume 2 switches and 2 T3 WAN connections.

Before we even start with a workload evaluation, we need the answer to one important question: "Where's the data located?"

The ETL Problem, Clabby Analytics

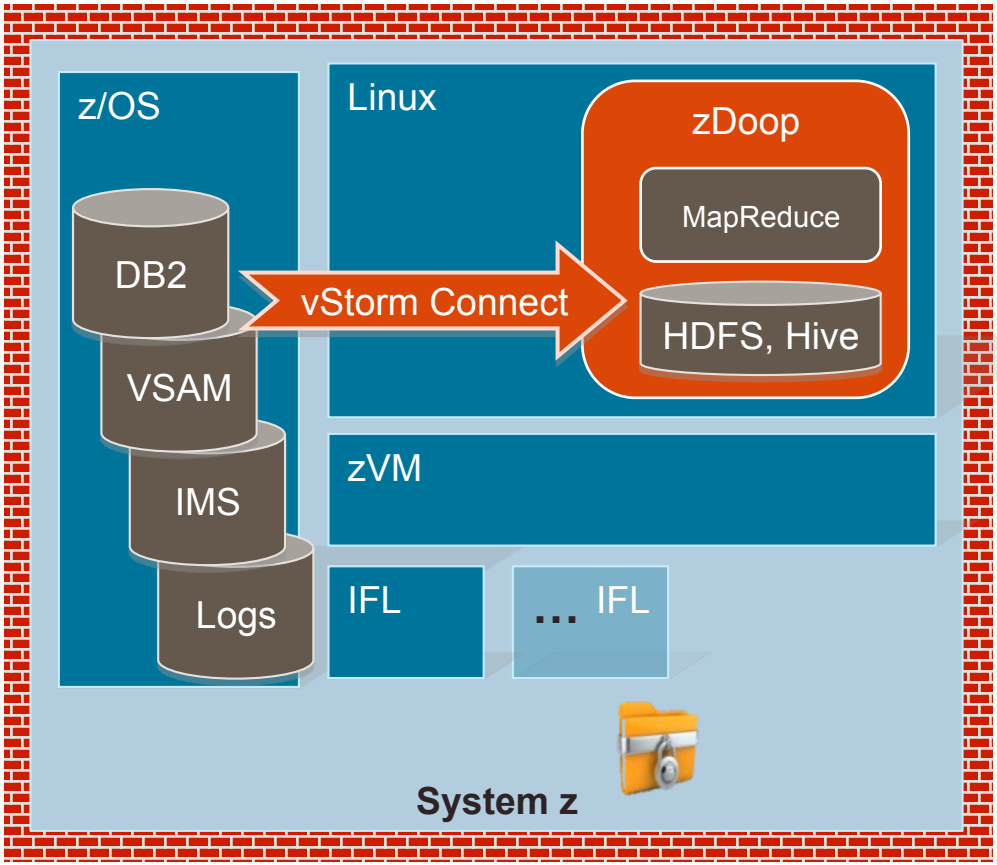
The Dilemma: Ease of Access vs. Governance



Security? Governance? Agility? TCO?

Costly Services Engagements

vStorm Enterprise (vStorm Connect + zDoop)

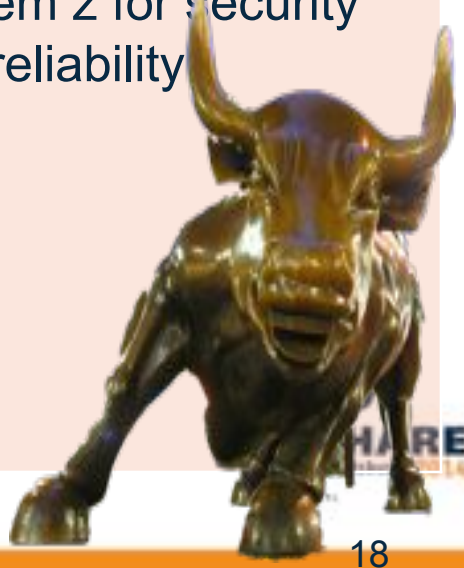


- **Secure**
  - Data never leaves the box
  - Hardware encrypt streaming
  - RACF
- **Easy to use**
  - Graphical interface
  - No programming required
  - Wide variety of data sources
  - Automatic conversions
  - Native data collector
  - Does not load z/OS engines
  - No DASD for staging
- **Templates for agile deployment**
  - New nodes on demand
  - Cloud deployment platform
- **Mainframe efficiencies**

Financial Services Use Case

Problem	Solution	Benefits

• High cost of searchable archive on mainframe
  • $350K+ storage costs (for 40TB)
  • MIPS charges for operation
• $1.6M+ development costs due to many file types, including VSAM
• 2000+ man-days effort and project delay
	• Move data to Hadoop for analytics and archive
	• Shift from z/OS to IBM Linux (processors) on z to reduce MIPS
	• Use IBM SSD storage
	• Use IBM private cloud softlayer
	• Tap talent pool of Hadoop ecosystem
		• Reduction in storage costs
		• Dev costs almost eliminated
		• Quick benefits and ROI
		• New analytics options for unstructured data
		• Retains data on System z for security and reliability



Health Care Use Case

Problem	Solution	Benefits
• Relapses in cardiac patients • "One size fits all" treatment • $1M+ Medicare re-admission penalties • Sensitive patient data on Mainframe • No efficient way to offload/integrate	• Identify risk factors by analyzing patient data* • Create algorithms to predict outcomes	• 31% reduction in re-admissions • $1.2M savings in penalties • No manual intervention • No increase in staffing • 1100% ROI on $100K

* Mainframe database requires special skills to access without Veristorm

Public Sector Use Case

Problem	Solution	Benefits
• Mismanaged assets led to neighborhood, publicity, law & order issues • Post-2008 austerity measures reduced budget • Asset data was Mainframe based – no efficient offload and integration mechanism	• "Crowd source problem" reporting – cell phone photo, social media, GPS data • Integrate social media reports with asset / governance data on Mainframe, achieving regulation conformity	• Software cost of $400K compares to $2M consulting engagement • Better maintained neighborhoods yield $5.6M in higher taxes first year

* System z IMS database requires special skills to access without vStorm

Retail Use Case

Problem	Solution	Benefits
• Streams of user data not correlated • e.g. store purchases, website usage patterns, credit card usage, historical customer data • Historical customer data Mainframe based – no efficient, secure integration	• Secure integration of historical customer data, card usage, store purchases, website logs • Customer scores based on the various data streams • High scoring customers offered coupons, special deals on website	• 19% increase in online sales during slowdown • Over 50% conversion rate of website browsing customers • Elimination of data silos – analytics cover all data with no more reliance on multiple reports / formats

North Carolina Agricultural and Technical State University

- NC A&T State University
- Located in Greensboro, NC, enrollment approx. 10,500.
- One of the 100+ Historically Black Colleges and Universities
- Established in 1891 as a Land Grant College
- Still produces more African American engineers than any school in the world
- I am in the Computer Systems Technology Dept. in the School of Technology

Enterprise Systems Program, School of Technology at NC A&T:

- Mission: To support education, research, and business development in the System z space
- NCAT System z Environment:
  - Since 2010
  - Z9, 18 GPs, no IFLs, 128GB storage, 4 TB DASD (online)
  - 44 TB DS8300 (offline)
  - 2 LPARs (using 1)
  - z/VM is the base OS, all other OSes are guests of z/VM
  - Plan in the works with our business partners to acquire a BC12
  - Using GPs as IFLs (special no-MIPS deal with IBM)
  - Allocate GPs to the LPAR
  - VM 5.4
  - SUSE 11, Debian, RHEL
  - DB2, LAMP, SPSS for System z, Cognos, zDoop and more

System z as a Private Cloud

- Students & faculty need to rapidly deploy, clone, and turn down servers
  - Helps manage the student (user) learning process
- First university to adopt CSL Wave
- Adding rapid deployment of Hadoop clusters
- Early adopter of vStorm Enterprise
- On-demand scaling by simply adding IFLs
- No additional power or space
- Use existing skills, processes, security (RACF/LDAP), management tools

Research Support

- Several researchers at A&T have a focus on analytics
- Areas of Focus
  - Sentiment Analysis (opinion analysis)
  - Health Informatics (fraud detection, Medicare/Medicaid)
  - Predictive Analytics (student outcomes, product viability, etc.)
- Faculty have expressed interest in Hadoop
  - Need to manage larger data sets
  - Collecting unstructured/non-relational data
  - Want to pool data without pre-determined query in mind
  - Interactive/discovery and query

Education

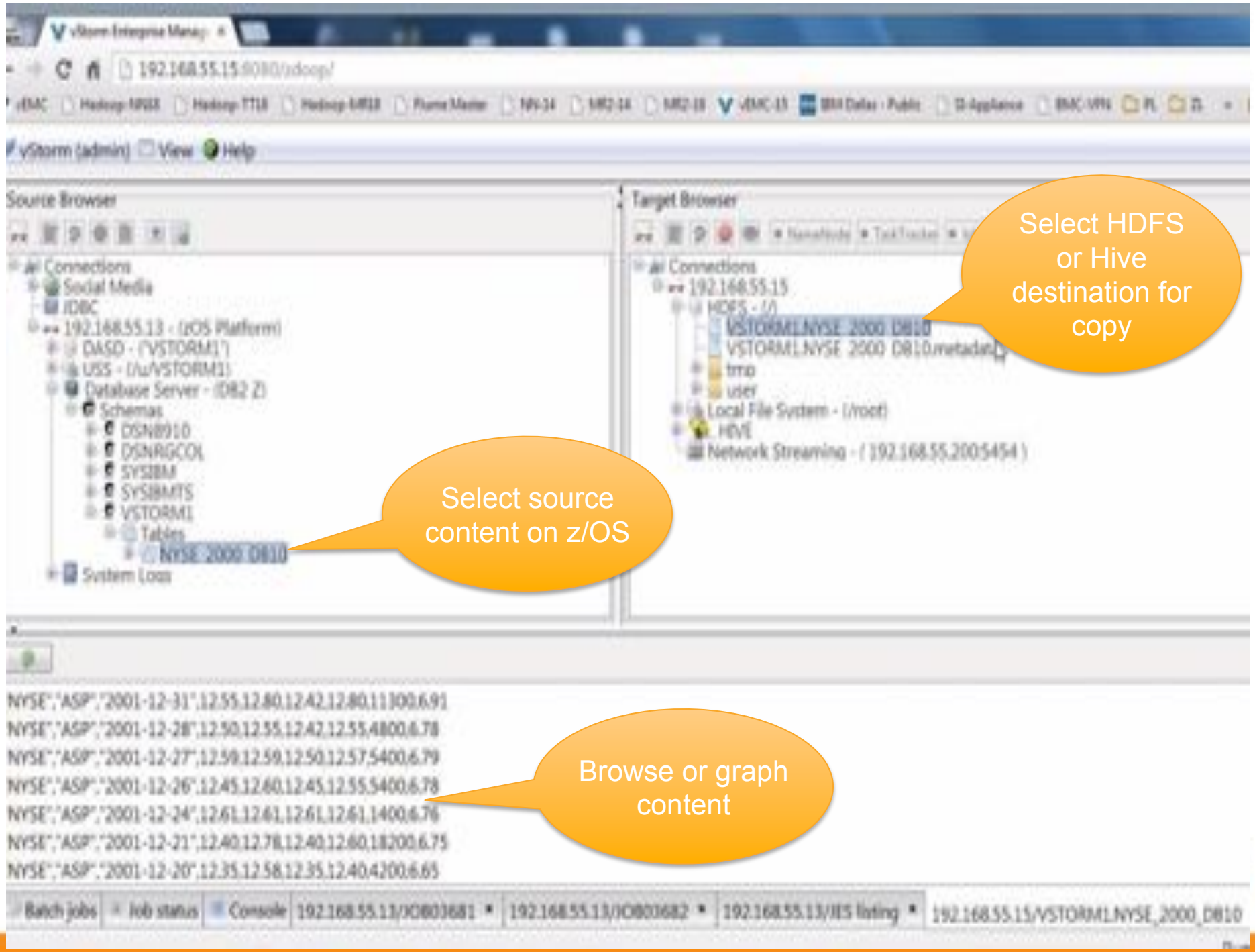
- 4 undergraduate courses: intro, intermediate, advanced mainframe operations and z/VM
- 2 graduate courses (mainframe operations, z/VM)
- Proposed graduate certificate of enterprise systems (under review)
- High school outreach programs in enterprise systems
- 1 semester zVM class (CPCMS, Install Linux as a guest, getting Linux running, using VM as a deployment tool for Linux)
- VM will be increasingly important; key to preparing students for careers in Big Data

Student Example

- Over 70 students placed in enterprise systems positions
- Heavy focus on IBM's *Master the Mainframe* contest
- Two students participants in IBM's 50th Anniversary of the Mainframe
  - Dontrell Harris, a keynote speaker, capacity planning specialist at Met Life
  - Jenna Shae Banks, a judge for the first *Master the Mainframe* world championship
  - Placements at IBM, Met Life, USAA, BB&T, Fidelity, Wells Fargo, Bank of America, First Citizen's Bank, John Deere, State Farm and others

Big Data Initiative

- Challenge & opportunity
  - Saw the potential for zVM application for Hadoop; most people focused on x86
  - Hot topic for research; important to students
  - Provide easy & controlled access to mainframe data
  - Enable the developer community to take advantage of the enterprise primary data in a model they understand
  - Familiar environment: Linux, Java, SQL & the hot technology: Hadoop
- Getting buy-in for z
  - Most don't know z at all
  - Dean, Chair, Chancellor, Provost: Needed to be sold; not IT people
  - Simplify!


vStorm (admin)
View
Help
Source Browser
Connections
Social Media
JDBC
192.168.55.13 - (zOS Platform)
DASD - ('VSTORM1')
USS - (/u/VSTORM1)
Database Server - (DB2 Z)
Schemas
DSN8910
DSNRGCOL
SYSIBM
SYSIBMTS
VSTORM1
Tables
NYSE_2000_D810
System Logs
Target Browser
Connections
192.168.55.15
HDFS - (/)
VSTORM1.NYSE_2000_D810
VSTORM1.NYSE_2000_D810.metadata
tmp
user
Local File System - (/root)
HIVE
Network Streaming - (192.168.55.2005454)
Select HDFS or Hive destination for copy
Select source content on z/OS
Browse or graph content
Batch jobs
Job status
Console
192.168.55.13/IO803681
192.168.55.13/IO803682
192.168.55.13/IES listing
192.168.55.15/VSTORM1.NYSE_2000_D810

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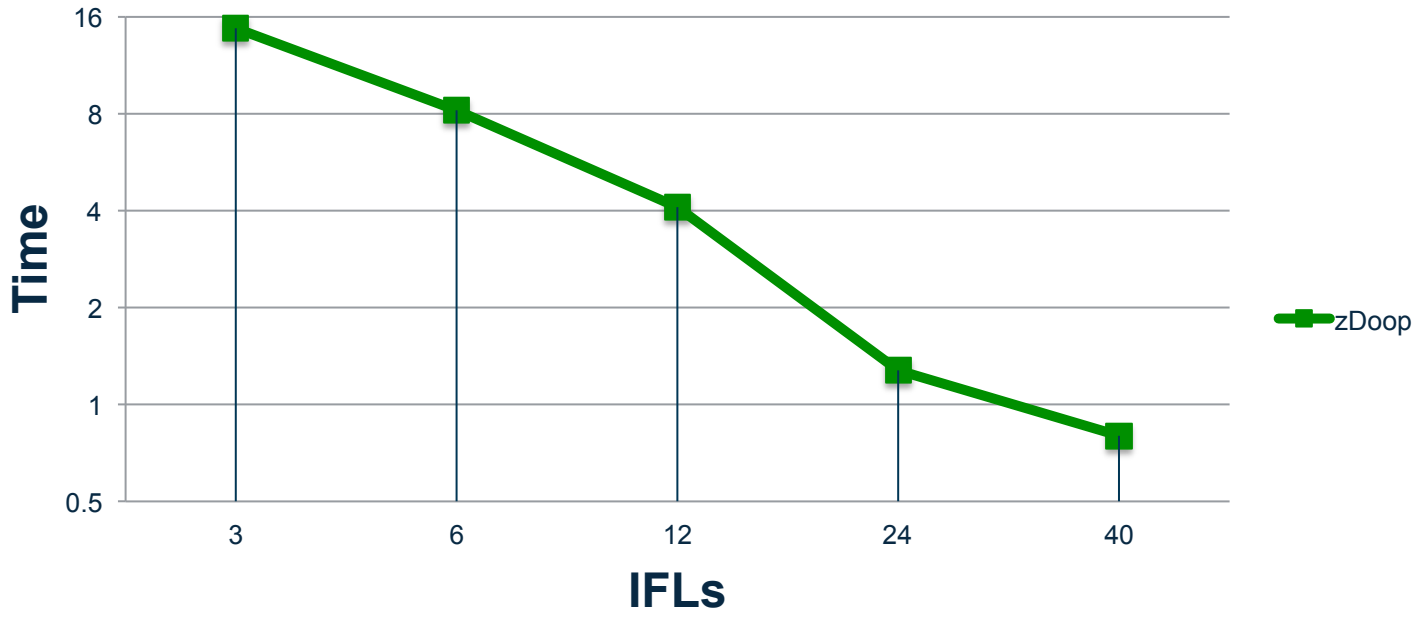
Agility and efficiency comes from the end-to-end manageability:
2 Billion records transferred to Hadoop and analyzed in 2 hours with 2 IFLs

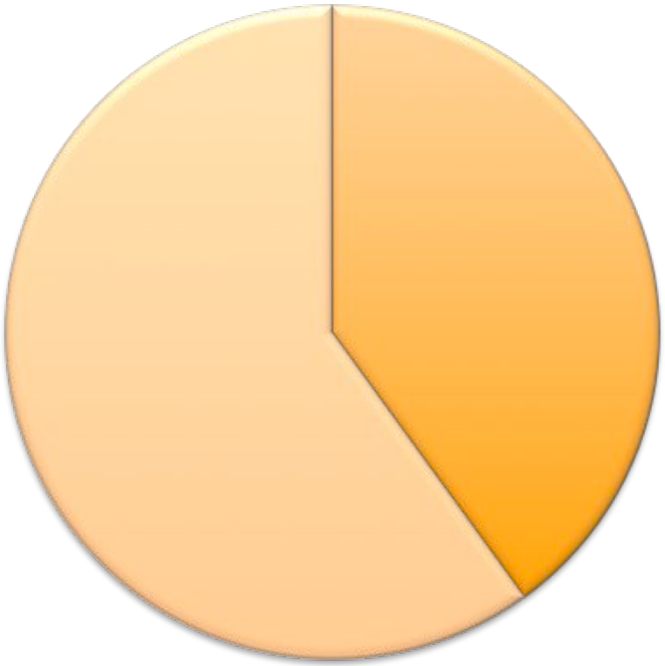
Instant, near-linear scaling by adding IFLs



Unlock New Insight and Reduce Cost

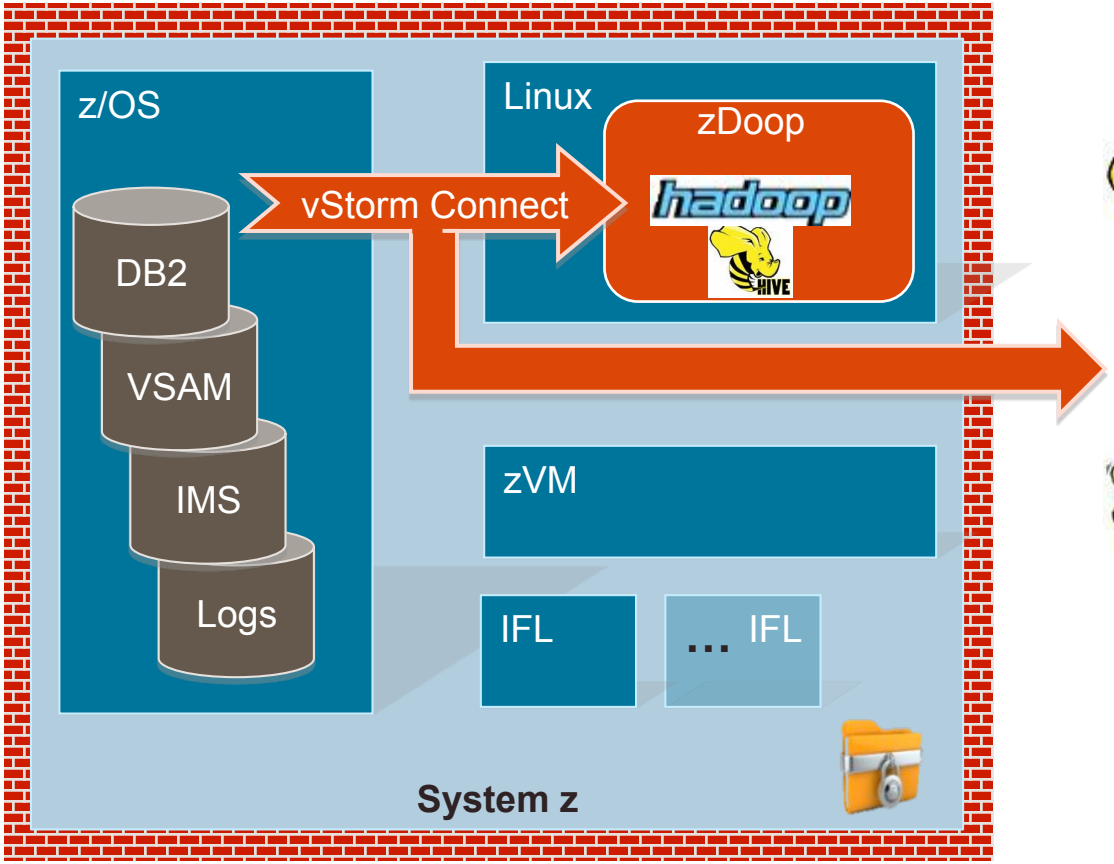
- Do More
  - Analyze large amount of information in minutes
  - Offload batch processes to IFLs to meet batch window requirement
- Reduce Cost
  - Take advantage of IFLs price point to derive more insight
- Application extensibility achieved through newly available skillset

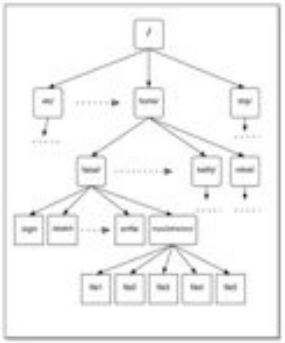
System z Workloads



Batch Real-time

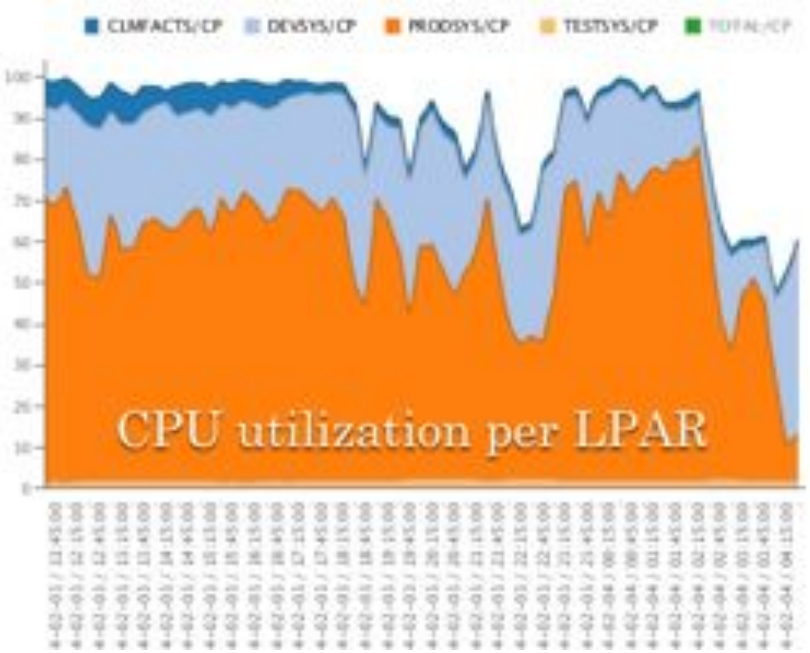
vStorm Enterprise – Mainframe data to Mainstream





Get Started

- Free trial, 2 hour install
  - vStorm Enterprise
  - vStorm Performance Manager
- Rapid end-to-end processing of customer and transaction data
  - SMF/RMF performance data
  - Detecting fraud
  - Enhancing insurance policy enforcement
  - Reducing healthcare costs
  - Improving claims response time



Any Questions?

- Mike Combs
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- Cameron Seay, Ph.D.
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- Reports:
  - The Elephant on z (IBM)
  - Bringing Hadoop to the Mainframe (Gigaom)
  - www.veristorm.com

- https://share.confex.com/share/123/webprogrameval/Session15961.html

- Visit us at booth #622

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