# System z Enables Solutions For A Smarter Planet

Handling The Information Explosion

Data Data Everywhere

- **Information is doubling every 18 months**

  ▶ The number of bits in the digital universe is already larger then the number of stars in the universe

  ▶ Structured data growing at 32%

  ▶ Unstructured data growing at 63%

  ▶ Replicated data growing at 49%

- **IDC predicts by 2010, storage of unstructured data will exceed that of structured**
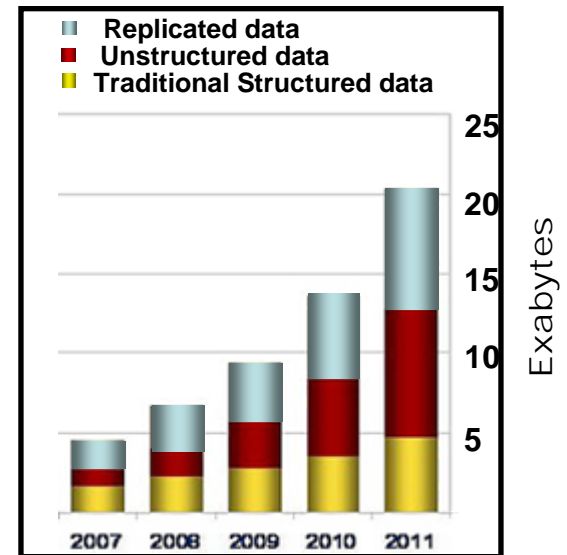
Sources: IDC worldwide enterprise disk in Exabytes from "Changing Enterprise Data Profile", December 2007

Legend:
- Replicated data
- Unstructured data
- Traditional Structured data

Exabytes: 25, 20, 15, 10, 5

Years: 2007, 2008, 2009, 2010, 2011

In This Brutal Economic Environment, Survival Implies A Smarter Approach To Information Management

We are drowning in paper and multiple copies of electronic content. It's costly and slows us down
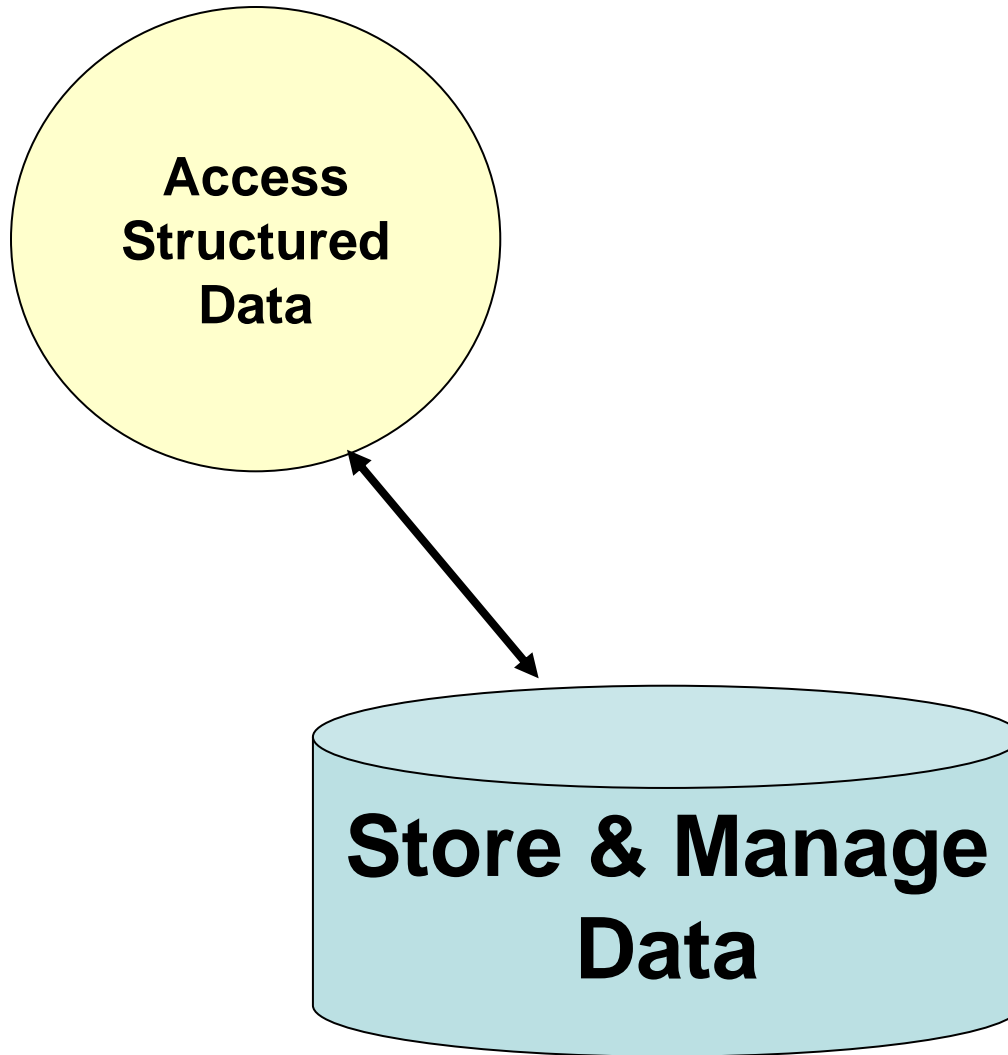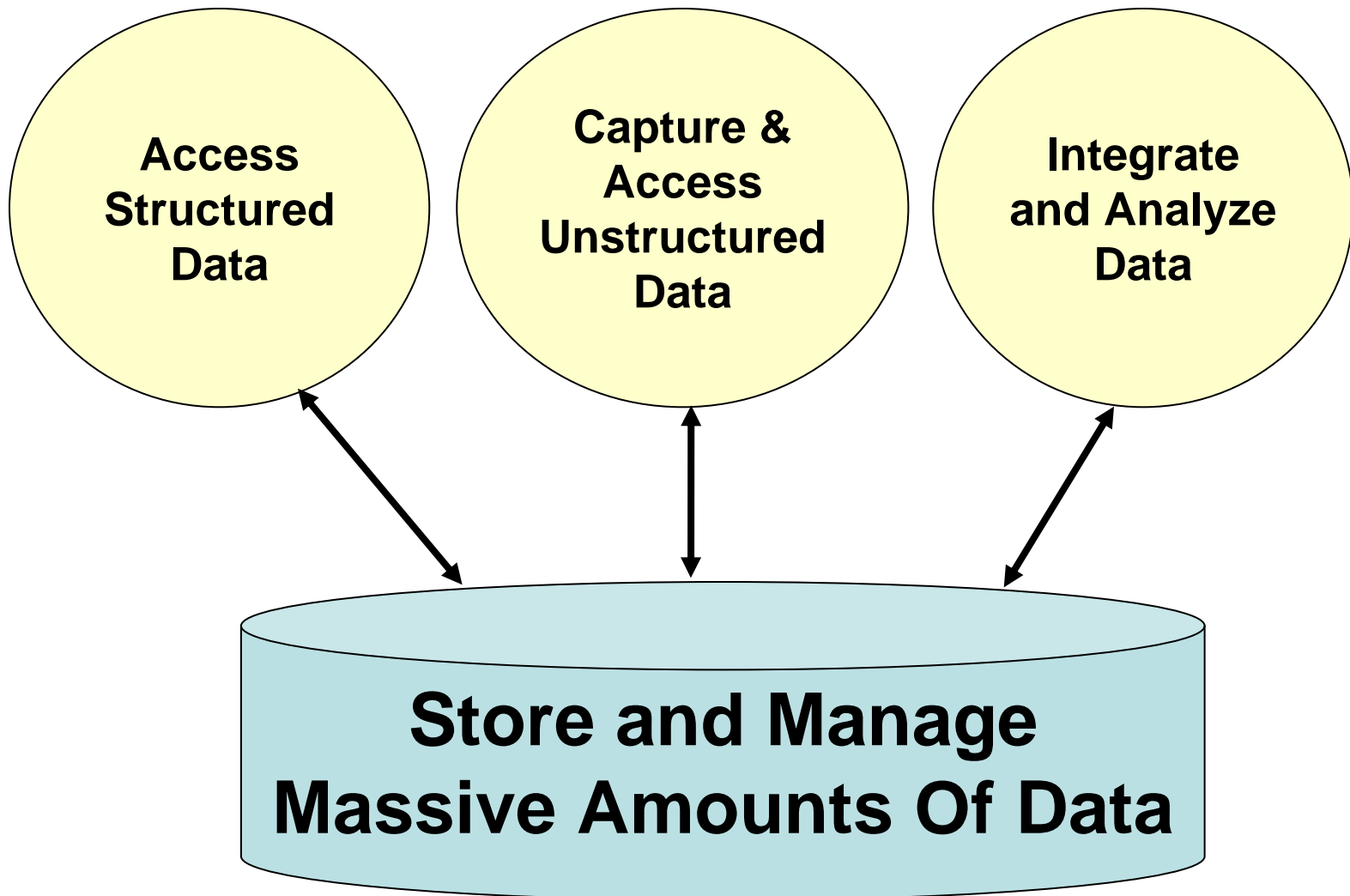
You need a smarter information management strategy

Service Oriented Finance COO

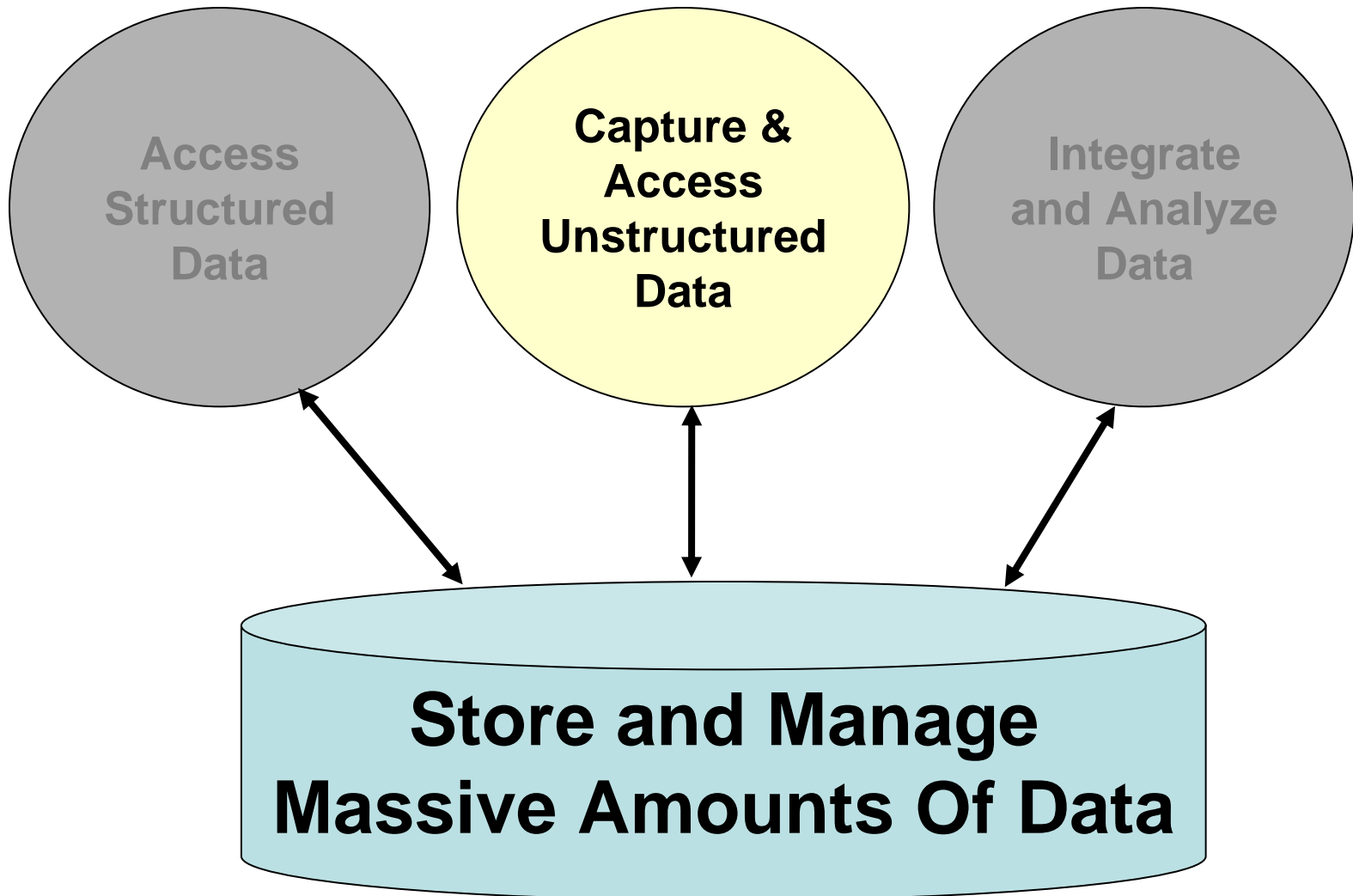**IBM**

Service Oriented Finance Stores Their Structured Data On Operational Systems That Run On System z

Access Structured Data

Store & Manage Data

A Smarter Information Management Strategy

Access Structured Data

Capture & Access Unstructured Data

Integrate and Analyze Data

Store and Manage Massive Amounts Of Data

Content Management Is The First Step

Access Structured Data

Capture & Access Unstructured Data

Integrate and Analyze Data

Store and Manage Massive Amounts Of Data

Content Management Requirements

- Capture unstructured data
- Provide on-line access
- Store and archive massive amounts of data

FileNet Content Manager
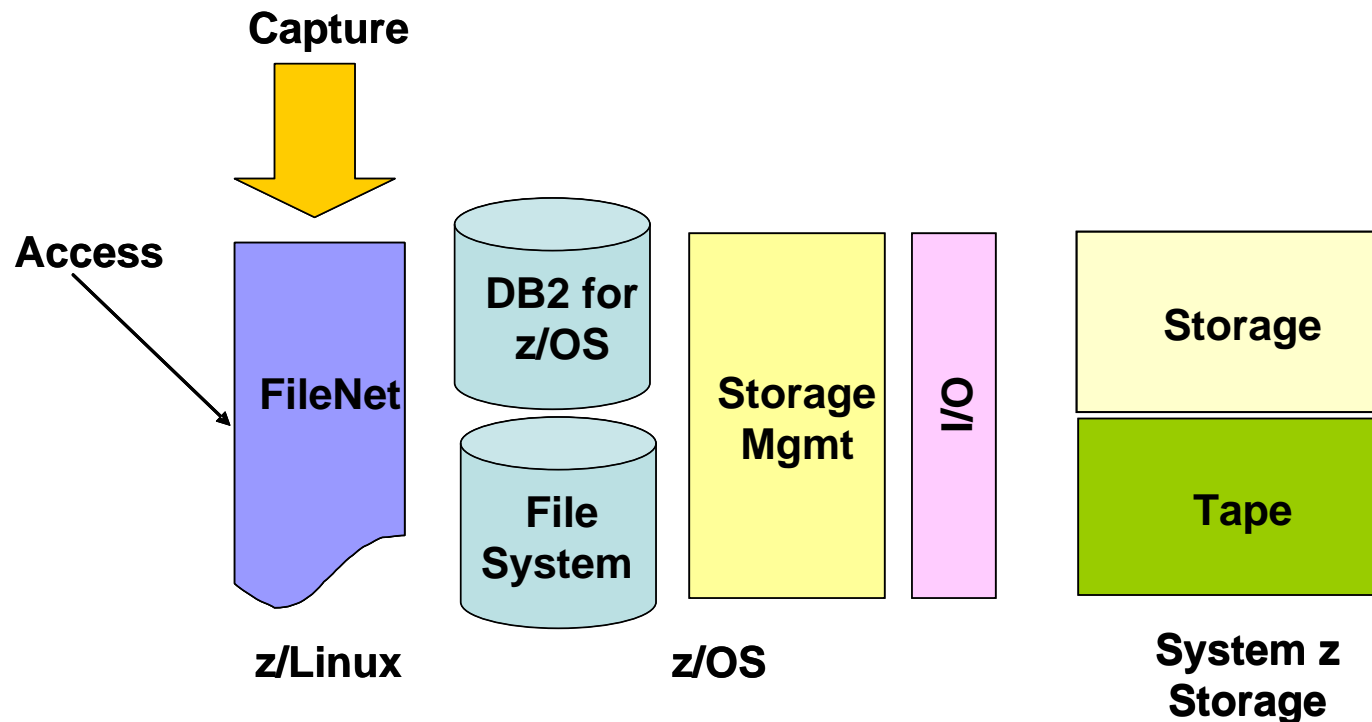
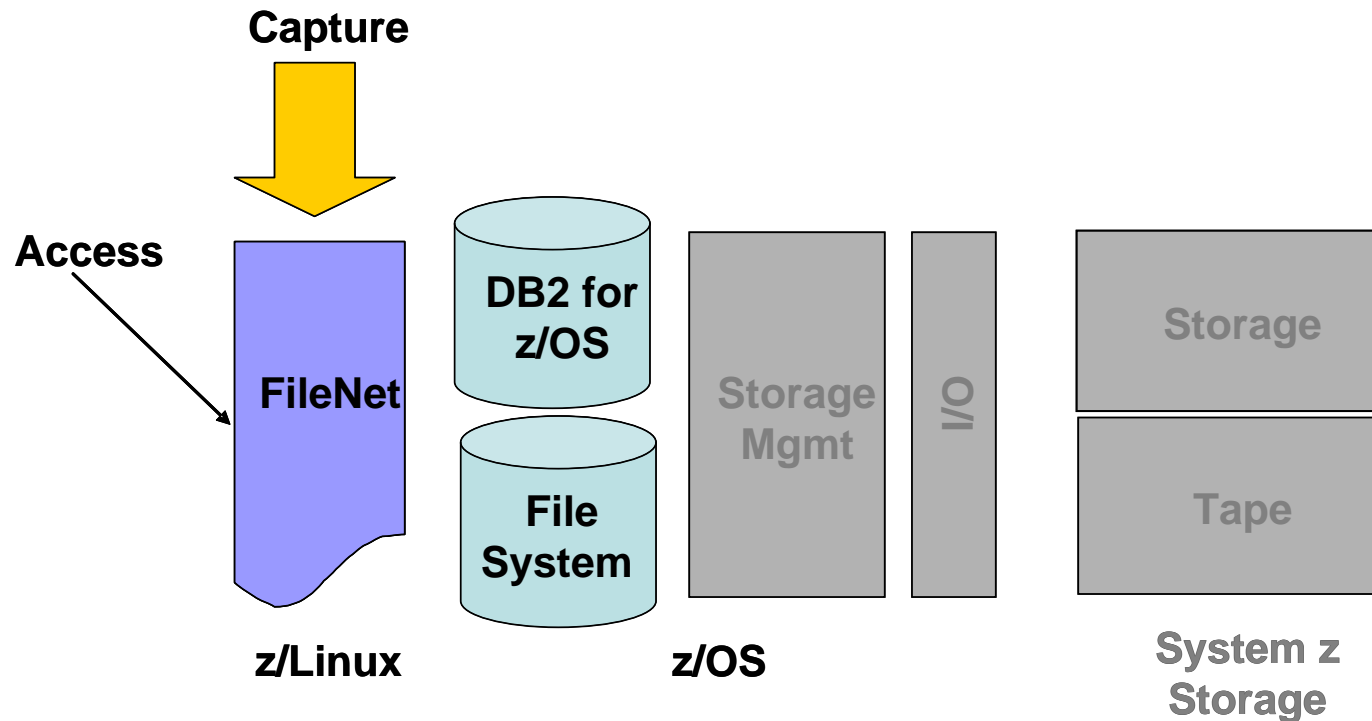**System z**

Content Management Requirements
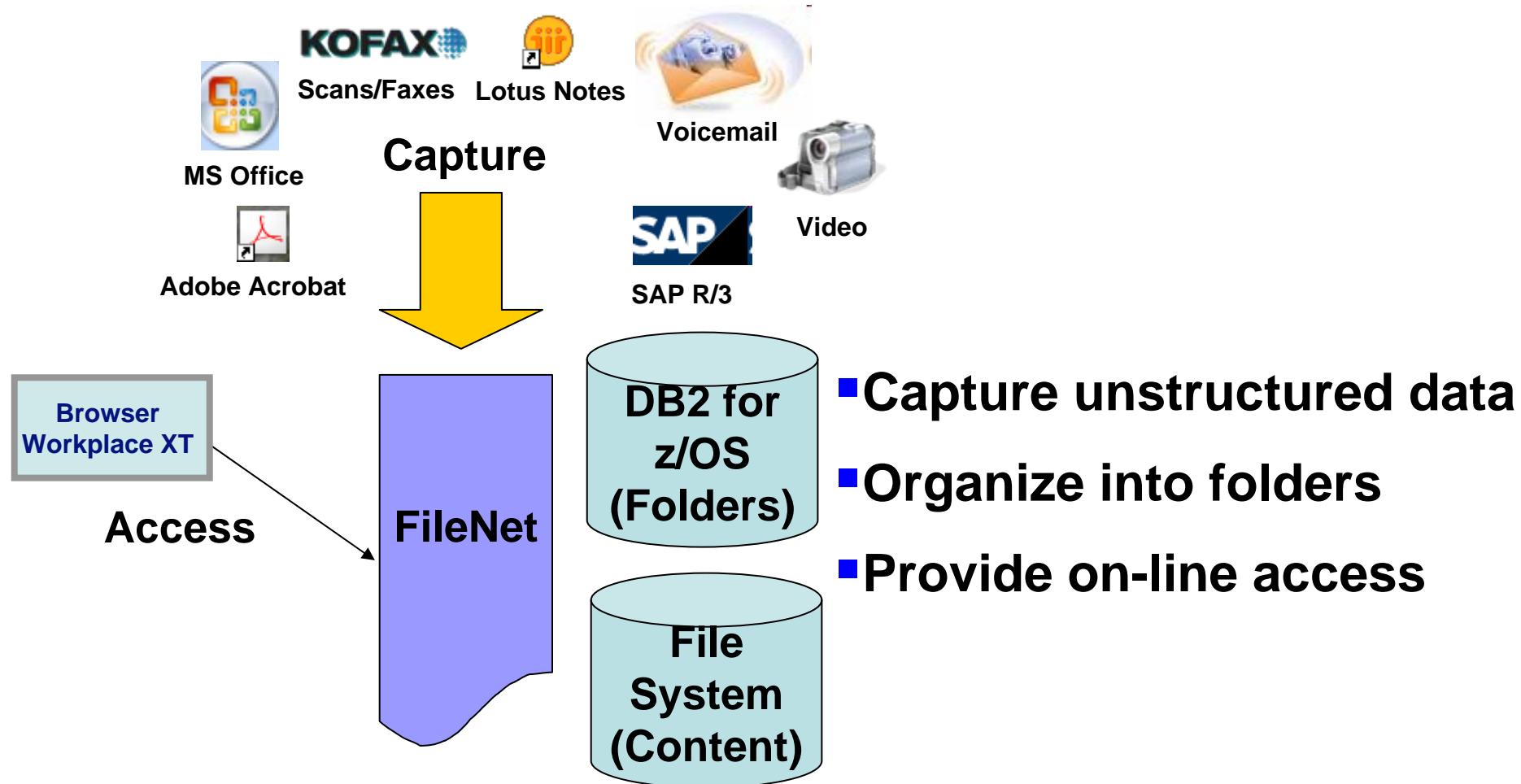
- Capture unstructured data
- Provide on-line access
- Store and archive massive amounts of data

FileNet Content Manager

System z

FileNet Content Manager Captures A Variety Of Content Classes And Provides Web Access

KOFAX

Scans/Faxes   **Lotus Notes**

Voicemail

MS Office

Capture

Video

Adobe Acrobat

SAP R/3

Browser Workplace XT

DB2 for z/OS (Folders)

■**Capture unstructured data**

Access

FileNet

■**Organize into folders**

■**Provide on-line access**

File System (Content)

Mortgage Document Handling At Service Oriented Finance Is Currently Paper Based

To comply with regulations we need a better way to manage our mortgage documents

Risk
Theft Cost
Auditors

Mortgage Business VP

Service Oriented Finance CIO

FileNet Content Manager Can Help Service Oriented Finance Go Paperless

Case Management Paradigm

- "Folder" collects all the documents for each mortgage:
  - ► Credit Reports
  - ► Proof of Identity (Driver's License)
  - ► Email
  - ► Change of Address eForm
  - ► Picture and Video of house
  - ► Appraisal, Inspection Report
  - ► Federal Tax Return

- Role-based security

- Library Services (Check-In/Check-Out)
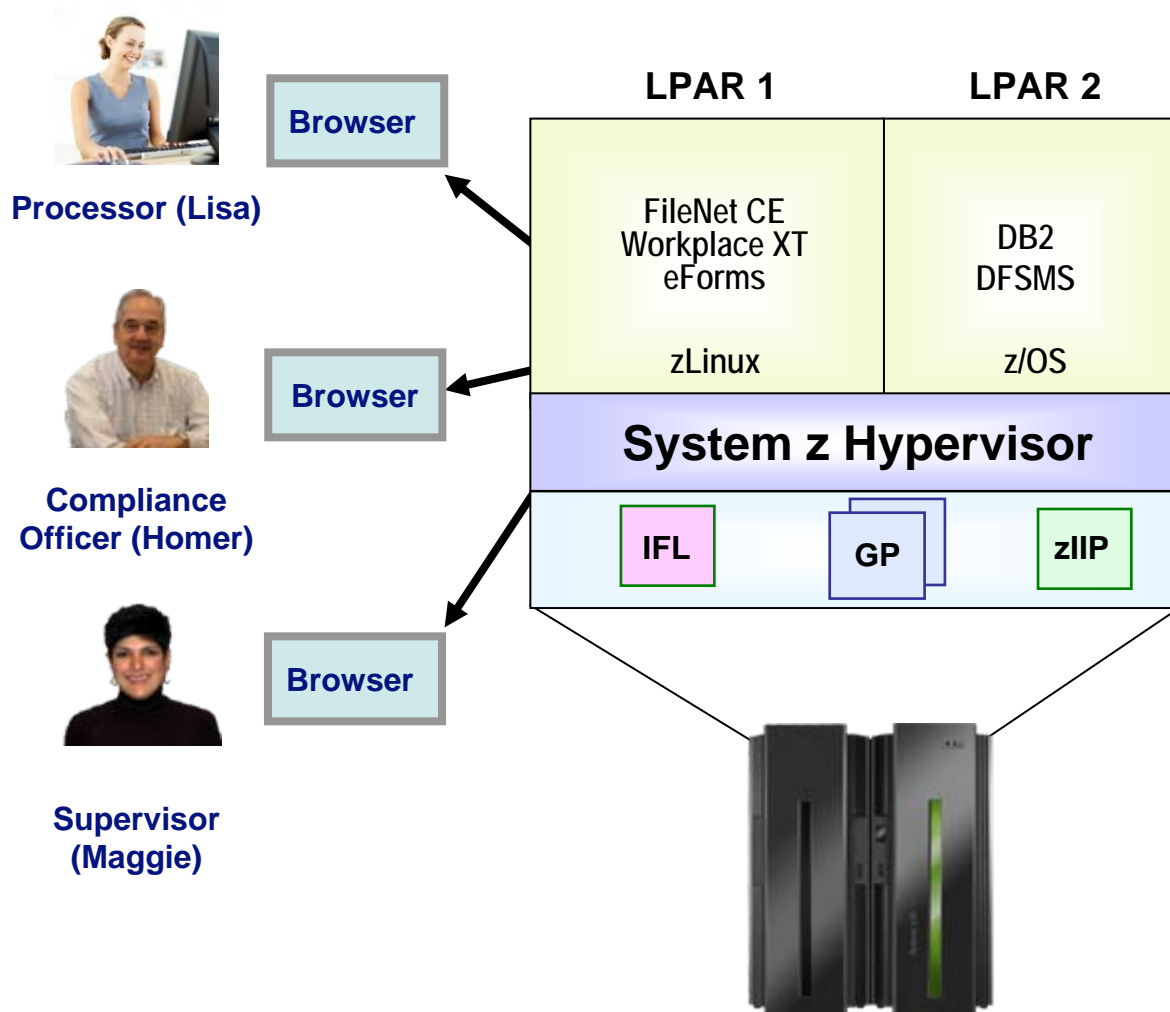 - ► Versioning and Tracking for compliance

Mortgage documents can be accessed on-line using a case management approach.

Let's review some of the capabilities IBM'S FileNet P8 Platform provides
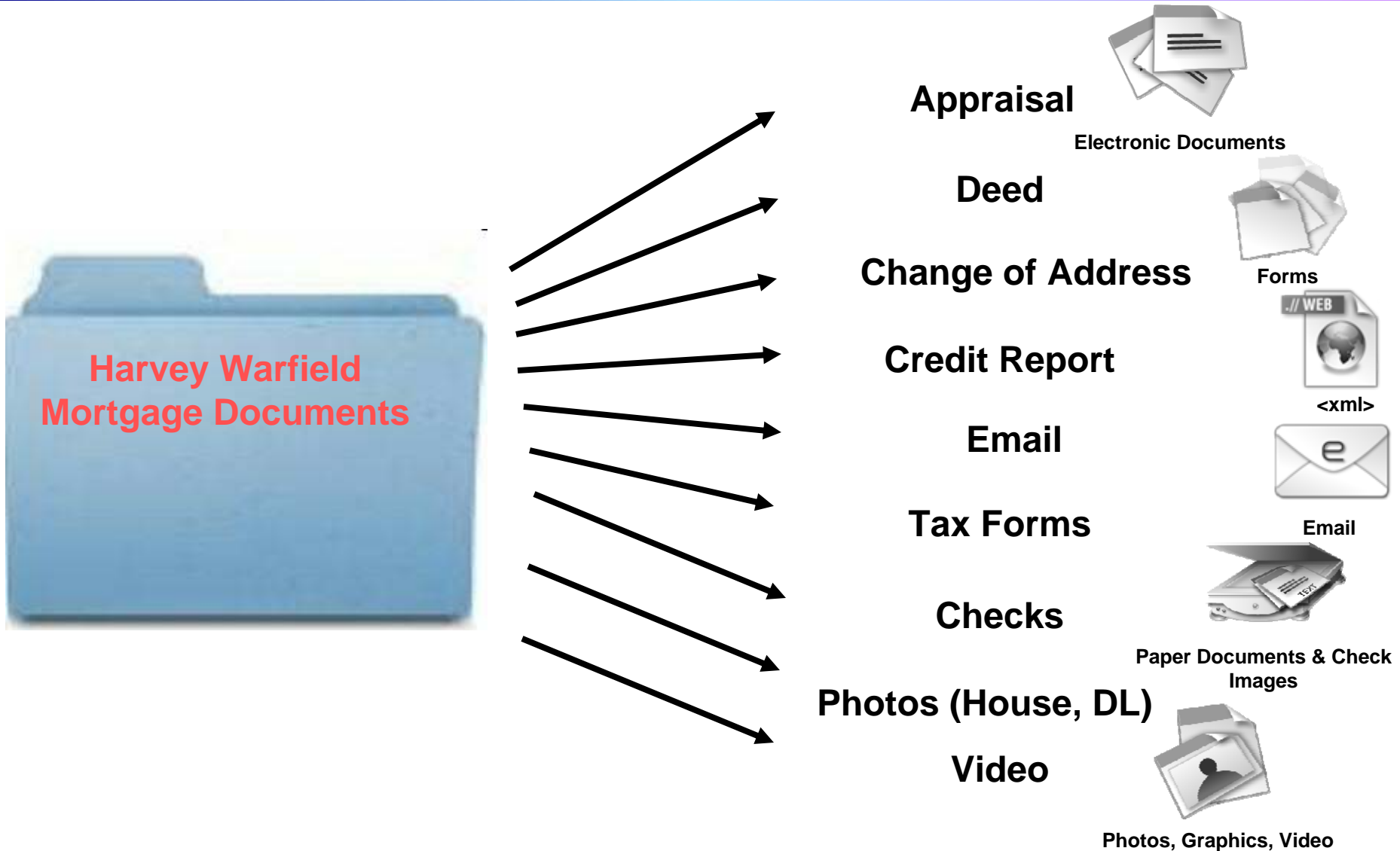
IBM

FileNet Enterprise Content Management Solution For Mortgage Document Handling

Processor (Lisa) — Browser

Compliance Officer (Homer) — Browser

Supervisor (Maggie) — Browser

LPAR 1
FileNet CE
Workplace XT
eForms

zLinux

LPAR 2
DB2
DFSMS

z/OS

System z Hypervisor

IFL   GP   zIIP

DEMO: IBM FileNet Workplace XT, eForms And IBM FileNet Content Engine

Harvey Warfield Mortgage Documents

Appraisal

Deed

Change of Address

Credit Report

Email

Tax Forms

Checks

Photos (House, DL)

Video

Electronic Documents

Forms

<xml>

Email

Paper Documents & Check Images

Photos, Graphics, Video

Why Deploy FileNet On System z?

- Take advantage of System z storage management capabilities

  - ► Capability to store massive amounts of data

  - ► Virtualized storage is included

  - ► Hierarchical storage management is included

  - ► Dedicated I/O subsystem offloads I/O

- Lower cost as an incremental workload

- Linux for System z quality of service

  - ► Reliability and serviceability

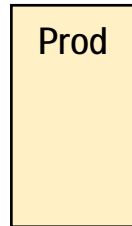# Case Study: Deploy FileNet Content Manager On System z With Disaster Recovery (1000 Users)

Existing Mainframe

Existing z10:
2 GP 1,720 MIPS
DB2 and utilities
With 20Tb storage

Existing Disaster Recovery Site

Existing:
1 GP processor for hot disaster switch-over
1 "dark" DR processor
With 20Tb storage
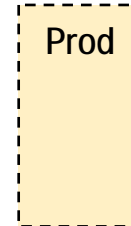
Add LPAR for FileNet Content Manager w 3.8 TB Storage

Prod

2,184 MIPS additional workload on z/OS and 920 MIPS on zLinux

Incremental:
2 GP   1,310 MIPS (60%) DB2 & Utilities
1 zIIP   874 MIPS (40%) DB2
1 IFL   920 MIPS FileNet Content Manager
Add 10 GB memory

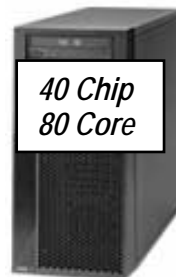## And add Disaster Recovery w 3.8 TB Storage

Prod

Capacity Backup:
2 GP
1 zIIP
1 IFL

3 year cost of acquisition $5.8M

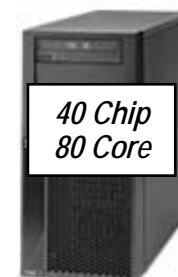## Or add HP Integrity Superdome sx2k 9140N Server w 3.8 TB storage

Prod

40 Chip 80 Core

Documentum & Oracle

272,902* Performance Units

And add Disaster Recovery w 3.8 TB storage

Prod

40 Chip 80 Core

HP DR solution is used in software and hardware

3 year cost of acquisition $12.05M

*Performance Units required = (2,184+920) MIPS x 87 = 270,048

Content Management Requirements

- Capture unstructured data
- Provide on-line access

FileNet Content Manager

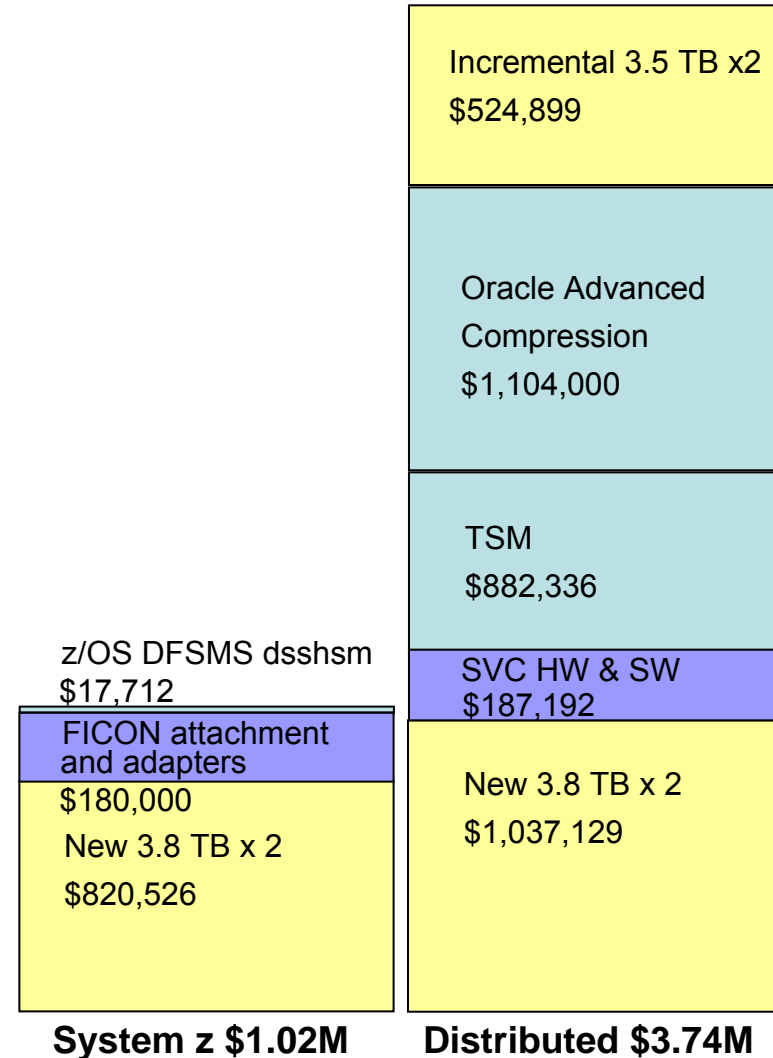- Store and archive massive amounts of data

System z
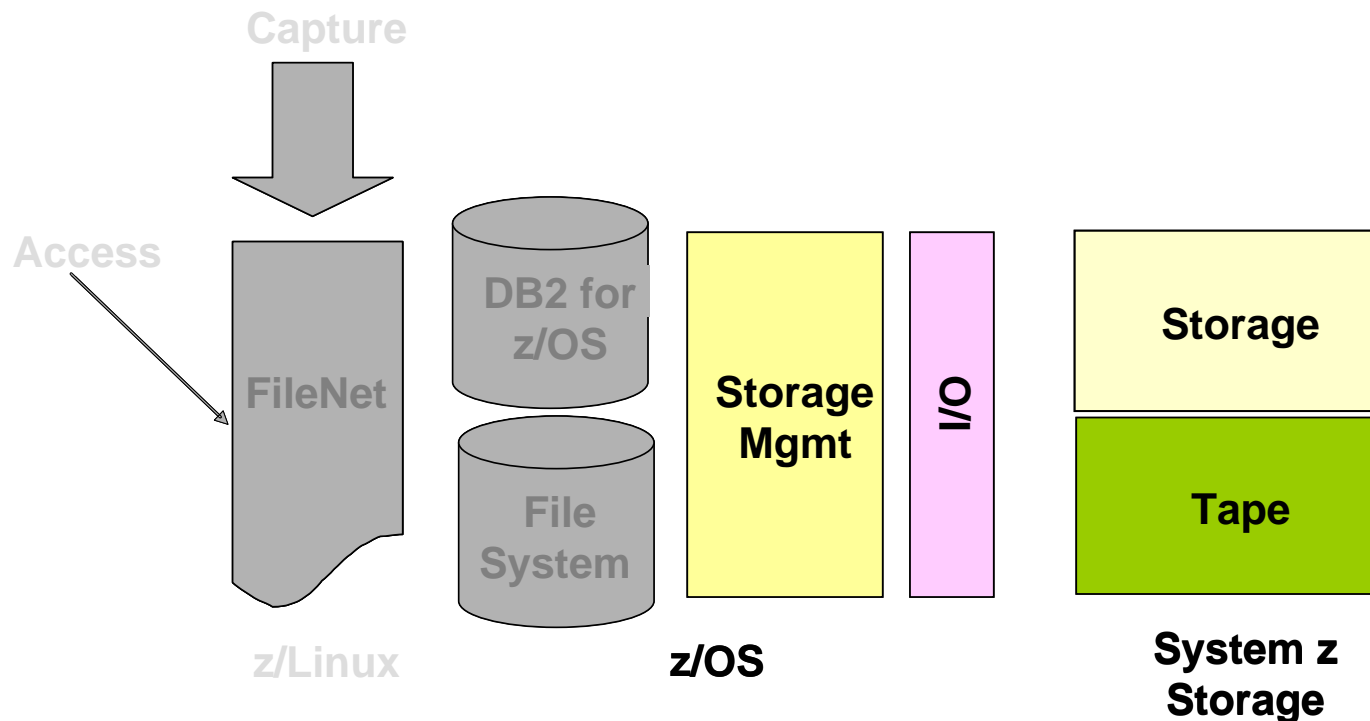
System z Storage Management Is Cost Efficient And Best Of Breed

- Virtualized and System managed storage functionality is built-in to z/OS

- Unique I/O subsystem providing data sharing, I/O virtualization and offloading

- Scalable, energy-efficient and tiered architecture for massive data storage and archival

System Managed Storage (DFSMS)
Dedicated I/O Subsystem

| TS7700	DS8000

Tapes

Disks
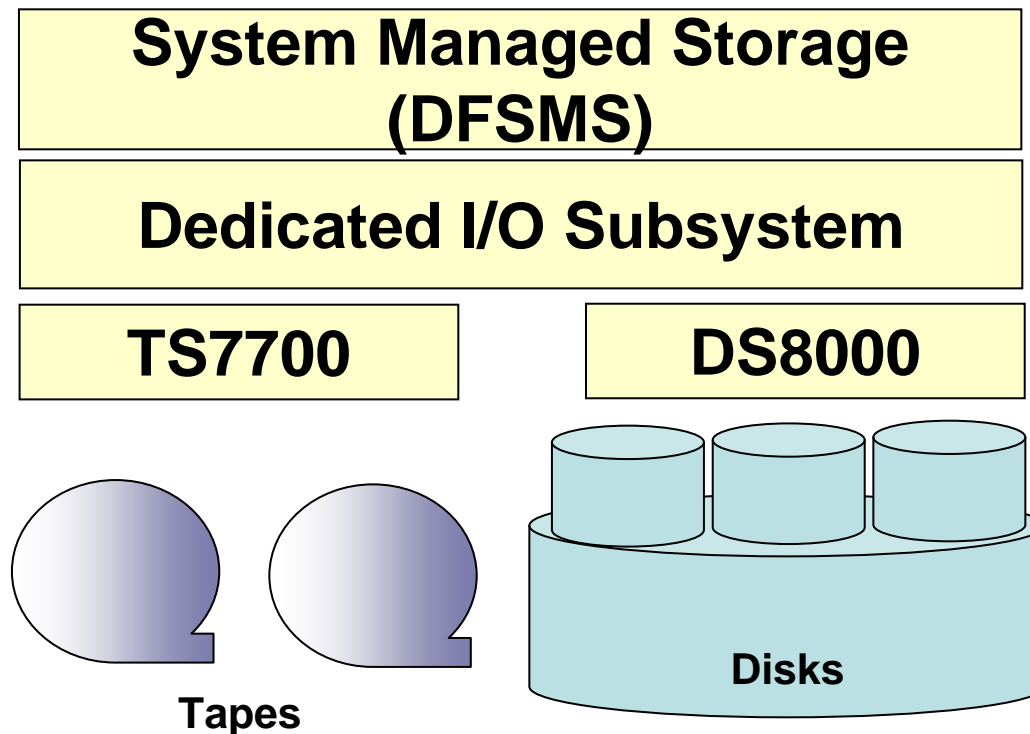
System z Storage Is 73% Cheaper Than Distributed For A New 10TB Database

- For new storage capacity, 3.8TB x 2 (Primary+Secondary), DS8100 costs less than HPXP2400

- Storage Management (HSM) and Virtualization (Data Sharing)
  - ▶ System z – DFSMS and FICON attachment and adapters
  - ▶ Distributed – San Volume Controller (SVC) and Tivoli Storage Management (TSM)

- Data Compression (10TB Storage)
  - ▶ System z – No incremental storage required, since DB2 uses built-in hardware compression, which supports up to 62%
  - ▶ Distributed – Incremental 3.5TB x 2 capacity since Oracle Advanced compression supports up to 27%

Incremental 3.5 TB x2
$524,899

Oracle Advanced Compression
$1,104,000

TSM
$882,336

SVC HW & SW
$187,192

New 3.8 TB x 2
$1,037,129

z/OS DFSMS dsshsm
$17,712

FICON attachment and adapters
$180,000

New 3.8 TB x 2
$820,526

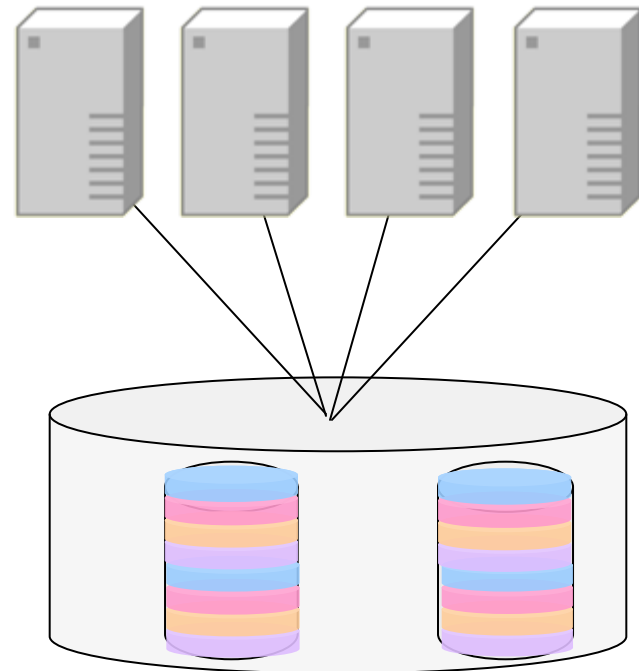**System z $1.02M**   **Distributed $3.74M**

Virtualization Simplifies Management And Storage Cost Through Higher Utilization

- Individual disks over-provisioned

- Difficult to use stranded storage

- New storage added only when required

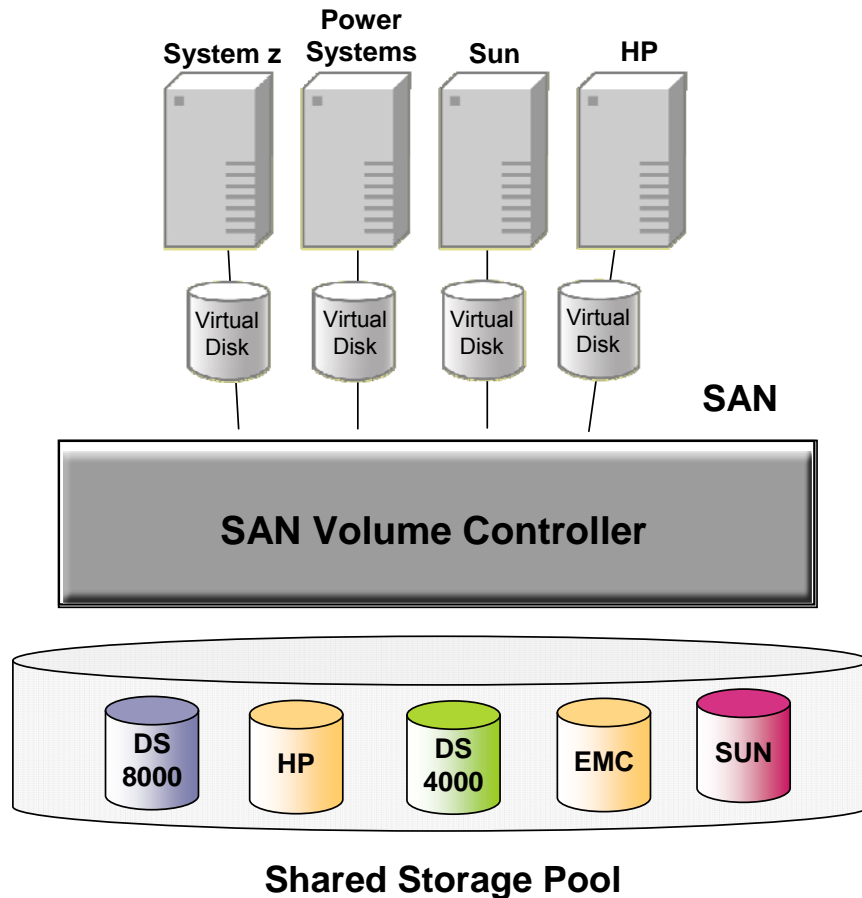- Minimize stranded storage
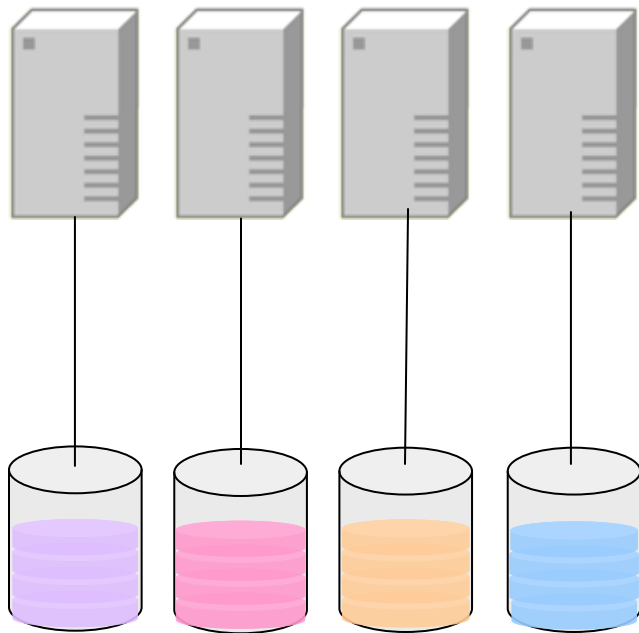
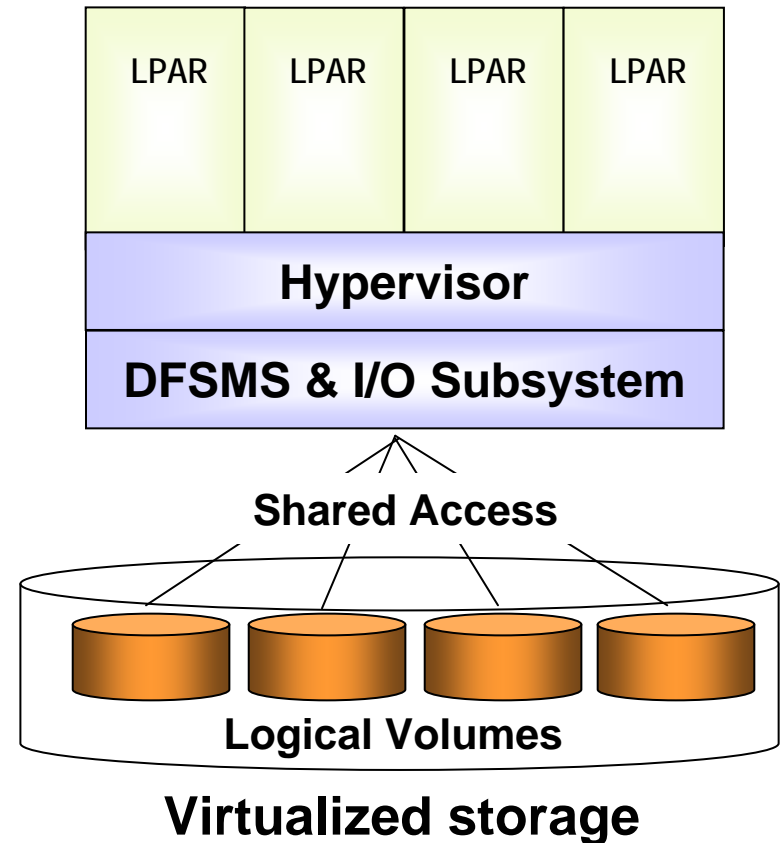Direct-Attached Storage

Shared Storage

In this example, storage virtualization uses half the hardware!

You Need Additional Software For Shared Storage In Distributed, But It Is Included With System z

Distributed

System z

Power Systems

Sun

HP

Virtual Disk

Virtual Disk

Virtual Disk

Virtual Disk

SAN

SAN Volume Controller

DS 8000

HP

DS 4000

EMC

SUN

Shared Storage Pool

System z

LPAR

LPAR

LPAR

LPAR

Hypervisor

DFSMS & I/O Subsystem

Shared Access

Logical Volumes

Virtualized storage

Storage Management Is Built Into z/OS Via Data Facility Storage Management Subsystem (DFSMS)

dfp – automates management of datasets, catalogs, objects and z/OS UNIX files and logical volumes

dss – copy, backup and automatic space management

DFSMS

**hsm** – manages movement of data in storage hierarchy

rmm – manage removable data (tape libraries)

tvs – concurrent update of shared VSAM data

System Managed Storage Simplifies Management And Reduces Labor Costs

- Separate application, data and storage media

- Group physical volumes in storage pools

- Assign data sets/applications to pools based on policies

- z/OS automates data set allocation, retrieval and mounting

- Advanced Hierarchical Storage Management monitors data usage and automatically migrates data from high to low-cost media
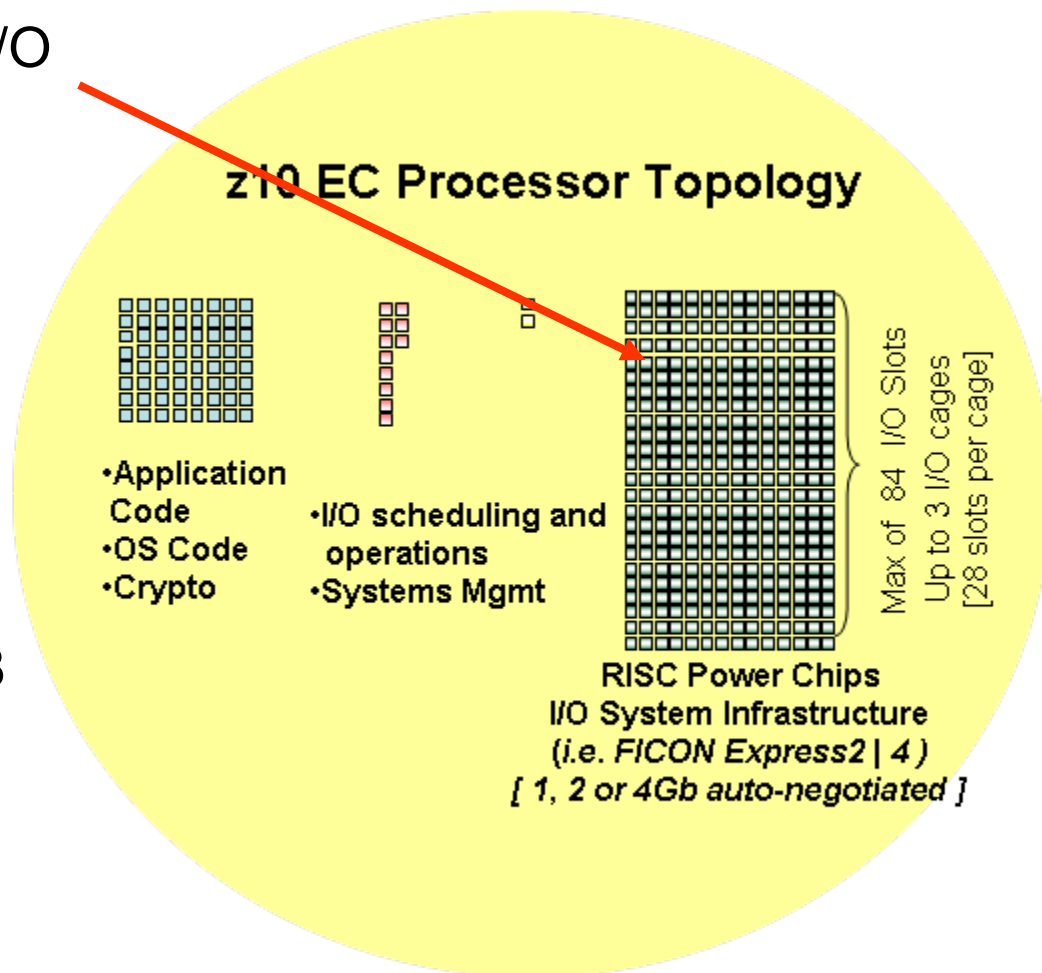
Hierarchical Storage Management (HSM) Autonomically Migrates Data For Archival

High Cost $$$

Low Cost $

DFSMShsm

Fast Access

Slow Access
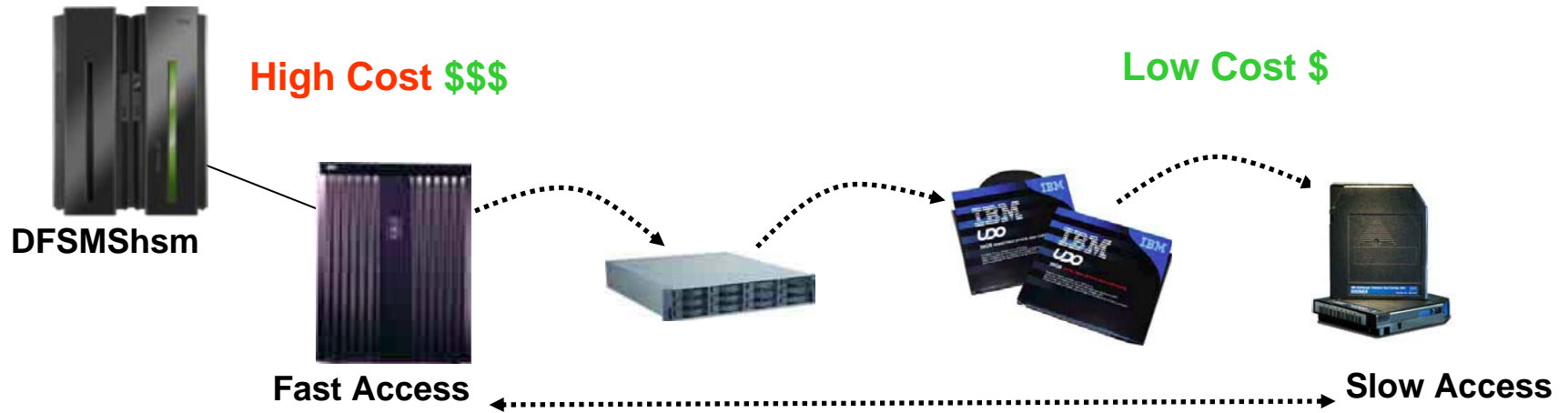
- References to data typically diminish over time

- Hierarchical storage management moves older data to slower devices

- DFSMShsm provides automated hierarchical storage management for System z and Tivoli Storage Manager for Space Management is required for HSM in distributed environment

# System z Has Dedicated I/O Subsystem To Enhance Access Performance

- Up to 336 RISC CPUs handle I/O

- Offload I/O operations to dedicated System Assist Processors, saving CPU

- Specialty zIIP processors for data mirroring

- Policy goals drive I/O priority (defined through DFSMS)

- Maximum I/O Bandwidth of 288 GB/sec

  ▶ HP Superdome maximum bandwidth is 173 GB/sec and 122 GB/sec sustained

z10 EC Processor Topology

- Application Code
- OS Code
- Crypto

- I/O scheduling and operations
- Systems Mgmt

Max of 84 I/O Slots
Up to 3 I/O cages
[28 slots per cage]

RISC Power Chips
I/O System Infrastructure
(i.e. FICON Express2 | 4)
[1, 2 or 4Gb auto-negotiated]

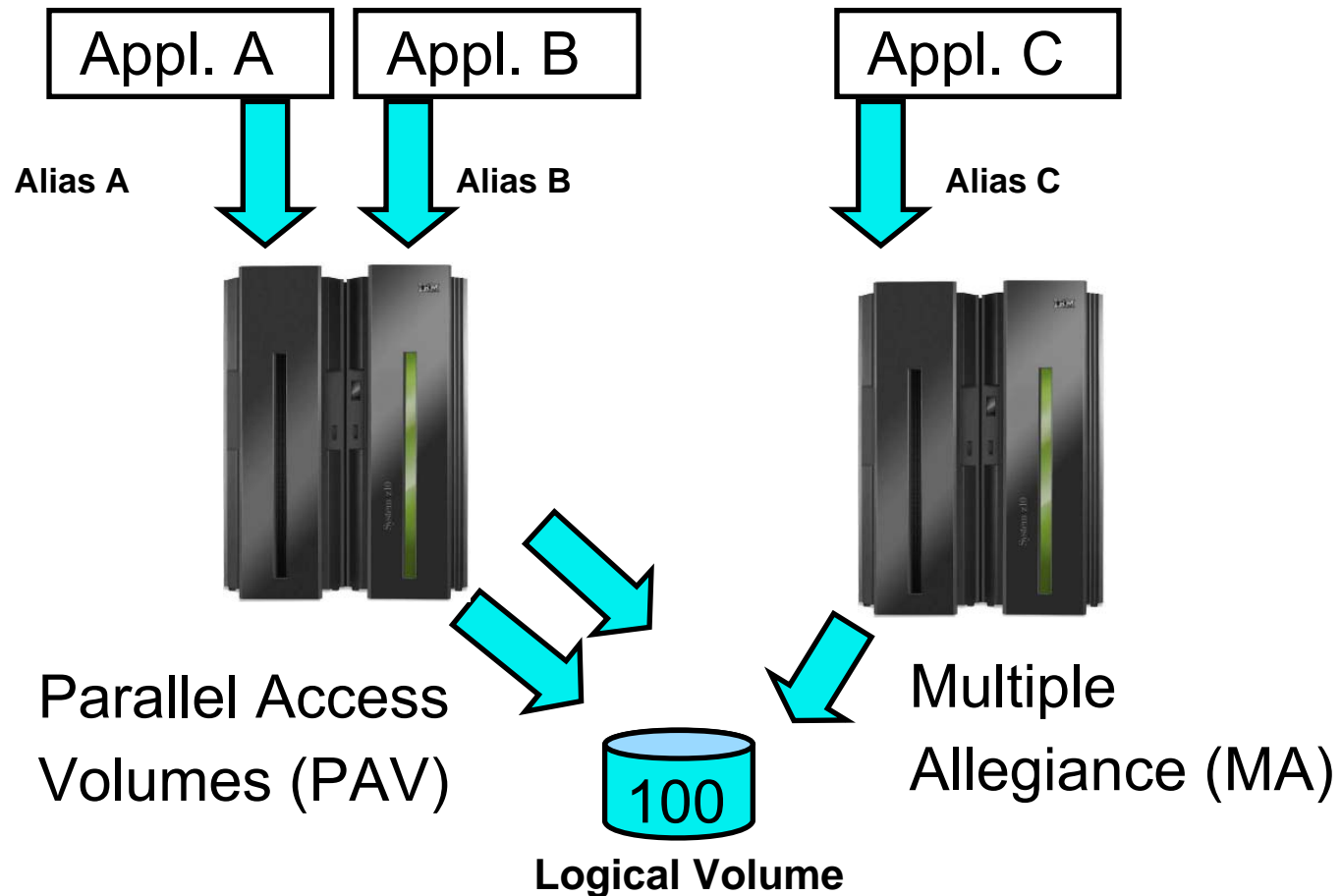**You don't get this with a distributed server**

Virtualization Of I/O Enables Redundant I/O Paths

- **I/O Virtualization provided by Logical Channel Subsystem**
  - ▶ Up to 4 Logical Channel Subsystems, each with 256 channel paths and supporting up to 15 logical partitions (LPARs)
- **Virtualization enables optimal Physical I/O path to be used**
  - ▶ Dynamic path selection
  - ▶ Load balances I/O traffic
- **Transparent Failover**
  - ▶ Recover I/O operations in progress and switch to alternate path
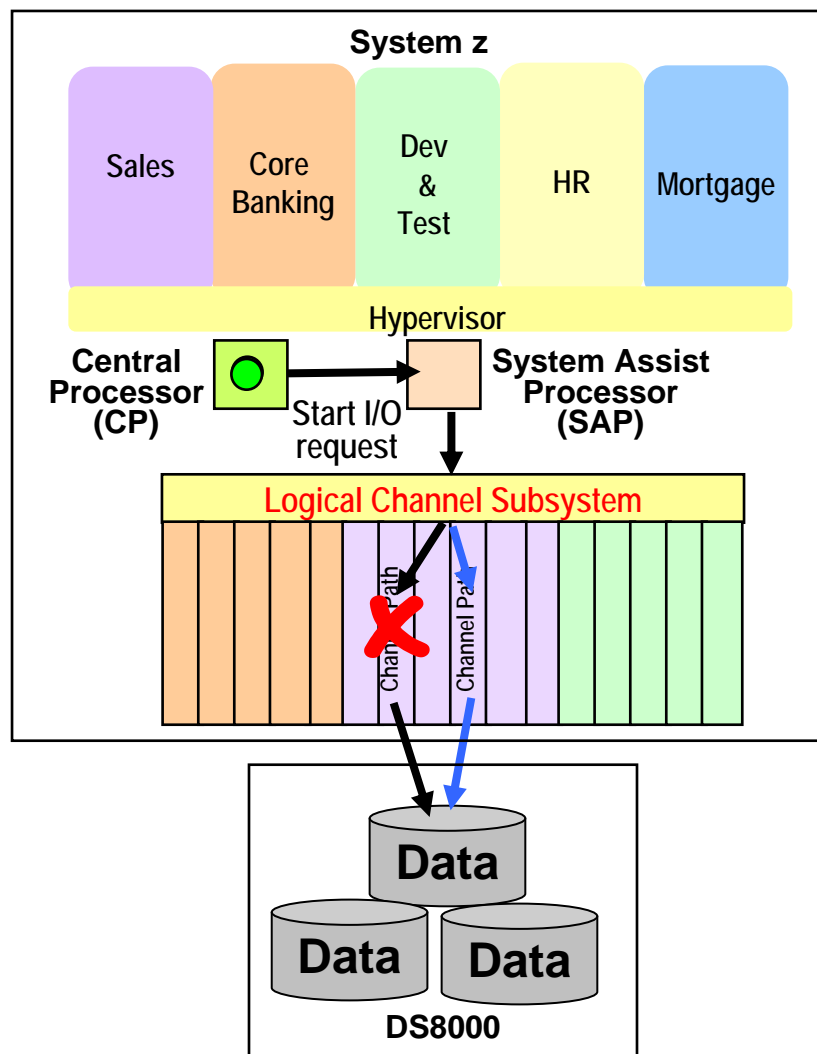
System z provides uniform I/O access across the channel paths – better than HP Superdome's non-uniform I/O access across drawers

System z Disk I/O Operations Are Executed In Parallel Reducing Bottlenecks

Appl. A   Appl. B   Appl. C

Alias A   **Alias B**   **Alias C**

Parallel Access
Volumes (PAV)

Multiple
Allegiance (MA)

100

Logical Volume

PAV supports parallel access of logical volumes within the same system and MA supports I/O parallelism across different systems

Solid State Disk (SSD) Drives Are Here To Revolutionize Storage

- Semiconductor
  - ▶ Electronically erasable medium
  - ▶ Random access
  - ▶ No mechanical read/write interface
- Response times is around 0.8 milliseconds in contrast to 6 milliseconds for a typical 15,000 RPM (revolutions per minute) enterprise fiber channel hard disk drive (HDD)
  - ▶ 5-10x improvement in throughput & queries
  - ▶ SSD drives can sustain I/O rates of many ten's of thousands of I/O's per second while traditional spinning disk can handle hundreds of I/O operations per second
  - ▶ Reduce the "batch window"
- 75% reduction in number of disks switching from HDD to SSD
- Cost reductions due to no moving parts like spinning disks
  - ▶ 75% reduction in space
  - ▶ 80+% reduction in power and cooling
  - ▶ Reduce RAM requirements
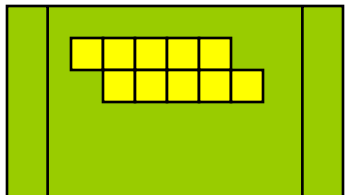 - ▶ Reducing peak MIPS saves $3K/MIPS/year
- Avoidance of application changes

SimpleTech
SOLID STATE DRIVE

DFSMS Policy Based Storage Management Automatically Controls Which New Datasets Gets Allocated On HDD Versus SSD

OLTP Application

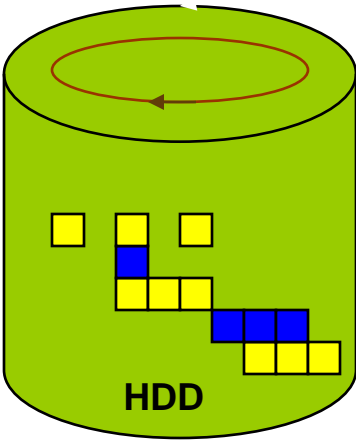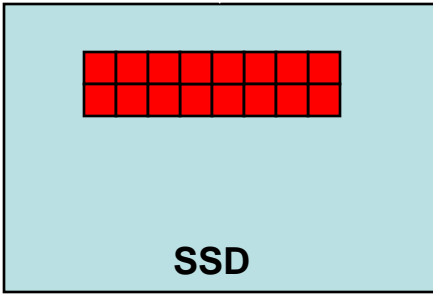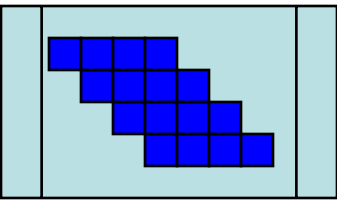z/OS SMS Policy for new datasets

Batch Application

HDD

SSD

HDD – Hard Disk Drive
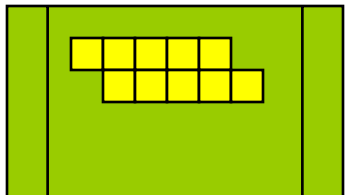**SSD – Solid State Drive**

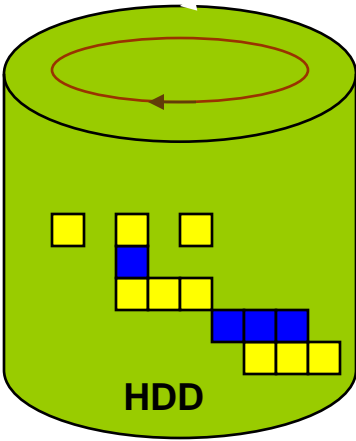# DFSMS Policy Based Storage Management Automatically Controls Which New Datasets Gets Allocated On HDD Versus SSD
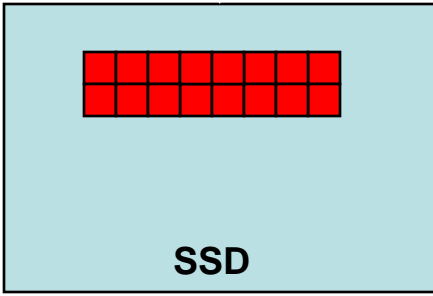
OLTP Application

z/OS SMS Policy for new datasets

Batch Application

HDD

SSD
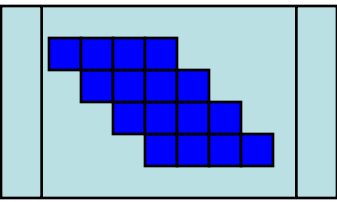
HDD – Hard Disk Drive
SSD – Solid State Drive

IBM DS8000 Provides High Capacity, Secure, And Resilient Storage To Store And Process Growing Data Volumes

- 1.1 Terabyte (TB) to over 1000 Terabyte on a single system with max 1024 disk drives
- DS8000 supports tiered storage with intermix of disk drives
  - ▶ 146GB (SSD), 450 GB (FC HDD, 15K rpm),1TB (SATA, 7200 rpm)
- 4 Gbps fiber channel adapters each transmitting 154,000 Input/Output operations (IOPs) per second for a total of up to 4.9 million IOPs
- Equipped with up to 256 GB of cache with Intelligent Write Caching and Adaptive Multistream Pre-fetching
- Powered by dual 4-way Power5+ processors
  - ▶ Supports two virtual storage subsystems
- Stripe data across multiple RAID arrays
  - ▶ Minimize disk "hot spots"
- Mirroring for business resilience
  - ▶ Synchronous copies up to 300 km apart
 - ▶ Asynchronous copies over virtually unlimited distances

IBM DS8000 Supports Unique Features For Improved Scale And Capacity On System z

- **HyperPav** supports an on-demand I/O model, where base addresses for physical I/O resources are dynamically assigned per I/O operation to logical aliases from a pool based on workload requirements

- **Modified Indirect Data Address Word (MIDAW)** reduces channel traffic by allowing same command to read/write multiple discontiguous storage locations. **z High Performance FICON (zHPF)** doubles I/O bandwidth by shrinking channel program sizes, replacing multiple channel command words (CCW) with a single task control word (TCW)

- Simplifies disk management with reduced number of volumes by using **"Extended Address Volume"** feature of z/OS, which allows up to 223 GB per volume

- Disk availability is increased as migration to larger volumes is done online without disrupting operations with **"Dynamic Volume Expansion"**

- Administrator work for system load balancing is reduced as "**Storage Pool Striping"** feature puts data fragments on different disks automatically

TS7700 Provides A Virtual Tape Solution Supporting A Tiered Storage Hierarchy Of Disk And Tape

Virtual Volumes and Drives
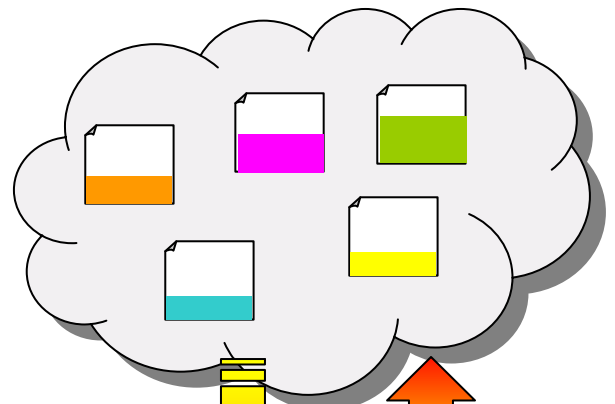
Tape Volume Cache
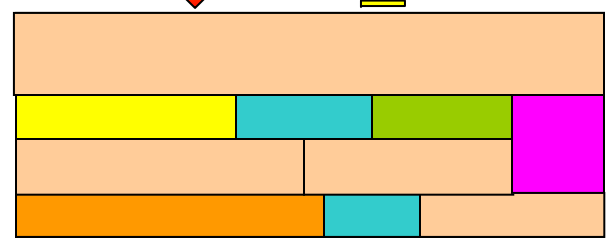
TS3500 Tape Library

- Provides transparent access to virtual tape volumes or drives

- Better performance with up to 70TB Disk Cache and integrated hierarchical storage management

- Scalable and Automated Tape solution supporting 16 tape drives and can archive up to 11 PB with Ultrium 4 cartridges

Philippine Airlines Selects IBM System Storage To Support Exponential Growth

- As PAL prepared to launch new routes to both domestic and international destinations, it realized it needed to upgrade its current information infrastructure

- PAL required better performance and superior throughput of the storage systems to run more efficiently. PAL also required an off-site fallback storage for business continuity and disaster recovery

- PAL replaced three different multi-vendor disk systems with an IBM storage solution consisting of the IBM System Storage Turbo DS8300

- In 2008, PAL celebrated the 25th anniversary of the Philippine Airlines Commitment to Excellence to Reservations Systems on IBM System z

New Intelligence Is The Next Step For A Smarter Information Strategy