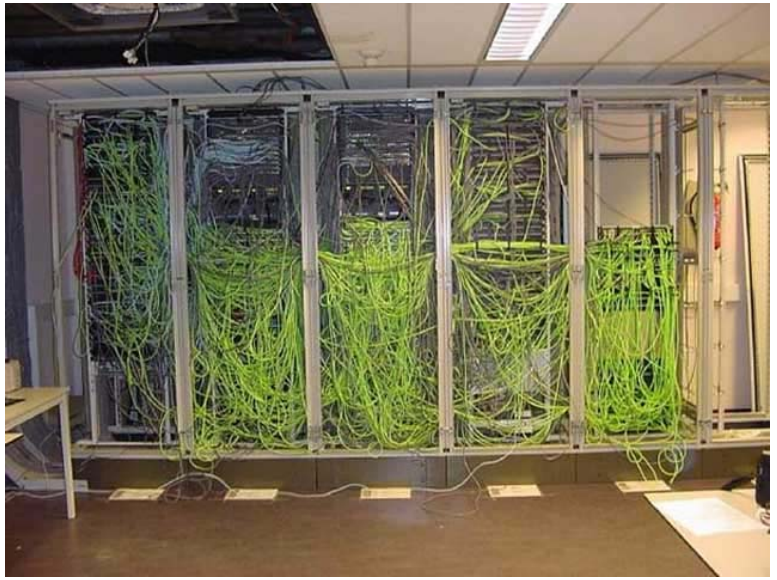
System z – A Smart System For A Smarter Planet

Virtualization And Consolidation For The Enterprise

Server Sprawl Creates Complexity

Complexity drives higher costs

- Software Pricing Per Core
- Network Connections
- Data Synchronization Issues
- Labor



Virtualization and Consolidation reduces these costs

76% of CIOs cited implementing a virtualized computing environment as part of their visionary plans to enhance competitiveness

The Only Question Is…

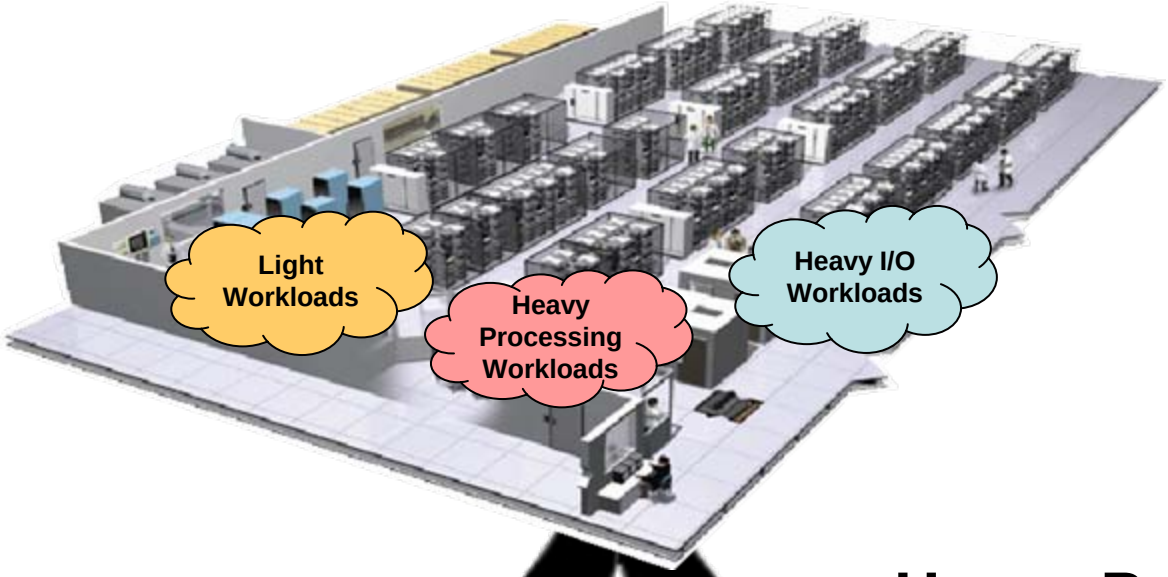
…what's the best strategy to virtualize and consolidate?

Service Oriented Finance CIO

Linux running on System z should be an important part of your strategy.

IBM

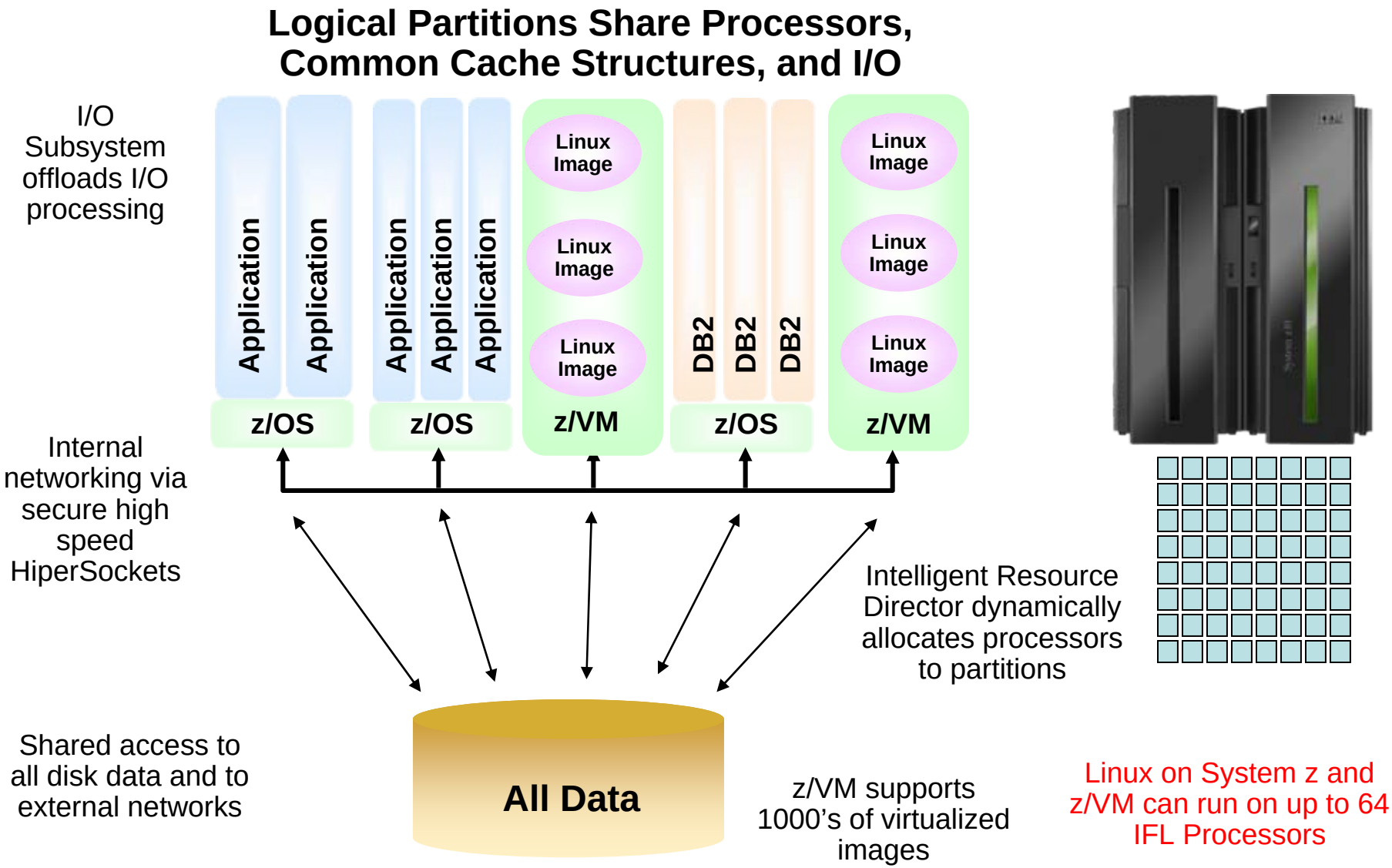
Fit For Purpose Consolidation Strategy



Light Processing

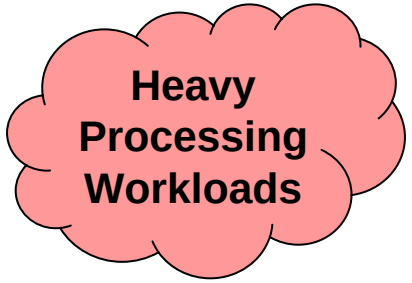
Heavy Processing
Heavy I/O
Quality of Service

System z Is Designed For Large Scale Virtualization And Consolidation

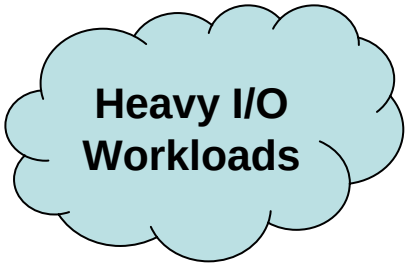


Different Workload Characteristics

- Light processing
- Low I/O bandwidth
- Low quality of service requirements



- Heavy processing intensity



- Heavy processing
- Heavy I/O
- High quality of service requirements

System z is fit for purpose to virtualize these workloads and achieve the lowest cost

Enterprise Linux Server – New Lower Price!

The Enterprise Linux Server is a *new* footprint System z10 machine configured to run Linux-only workloads

- System z10 frame (EC or BC)
- IFL specialty processors
  - 2 to 10 for z10 BC machine
  - 6 to 64 for z10 EC machine
- 16 GB of memory per IFL
- Configured with 4-Port FICON cards and 4-Port OSA cards
- z/VM: base operating system and all features
- Hardware and software maintenance for three or five years

Note: Participation and pricing may vary by country

System z Solution Edition For Enterprise Linux – Also Great Pricing!

The System z Solution Edition for Enterprise Linux delivers a similar solution stack that users can add to an *existing* z10

- IFL specialty processors
- 16 GB of memory per IFL
- Clients can optionally add more memory or I/O connectivity (OSA and FICON cards)
- z/VM: base operating system and all features
- Hardware and software maintenance for three or five years

Add to Existing z10

Add an incremental LPAR to run Linux on z/VM

Incremental pricing for Solution Edition for Enterprise Linux is similar to the pricing characteristics of the Enterprise Linux Server

Note: Participation and pricing may vary by country

Compare Options For Deploying Heavy Processing Workloads

Which platform provides the lowest TCA over 3 years?

34 Heavy Processing Workloads

IBM WebSphere Application Server ND
ITCAM

Online banking workloads, each driving **745** transactions per second

272 cores

Deploy with z/VM

64 cores

Requirements

Buy **34** HP DL380 G6 8-core Nehalem servers

TCA: $6.73M

Consolidate on **1** z10 EC Enterprise Linux Server

TCA: $6.38M

Why Linux On System z Achieves Lowest TCA For Heavy Processing Workloads

- Larger scale of shared processor pools (64 cores vs. 8 cores)
- Statistical benefit of sharing a larger pool of processors
- Software priced per core
- Cost benefit of Enterprise Linux Server Solution Edition pricing

Compare Options For Deploying Light Workloads With Heavy I/O Requirements

Which platform provides the lowest TCA over 3 years?

120 Heavy I/O Workloads

IBM WebSphere Application Server ND
DB2 ESE
ITCAM

Online banking workloads, each driving **22** transactions per second, with 1 MB I/O load/transaction

88 cores

Deploy with VMware

Deploy with z/VM

28 cores

Requirements

Buy **11** 8-core Nehalem servers

TCA: $5.74M

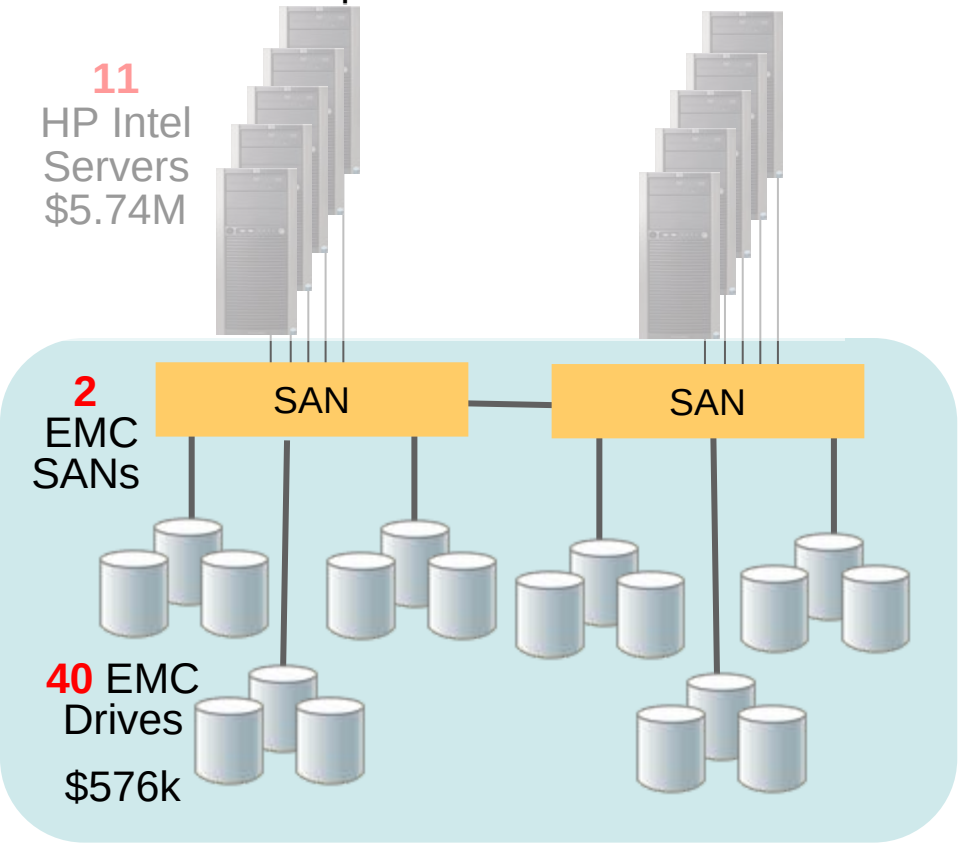
Consolidate on **1** z10 EC Enterprise Linux Server

TCA: $5.15M

Add Storage To Complete The Picture For Heavy I/O Workloads

Storage Solution with SAN

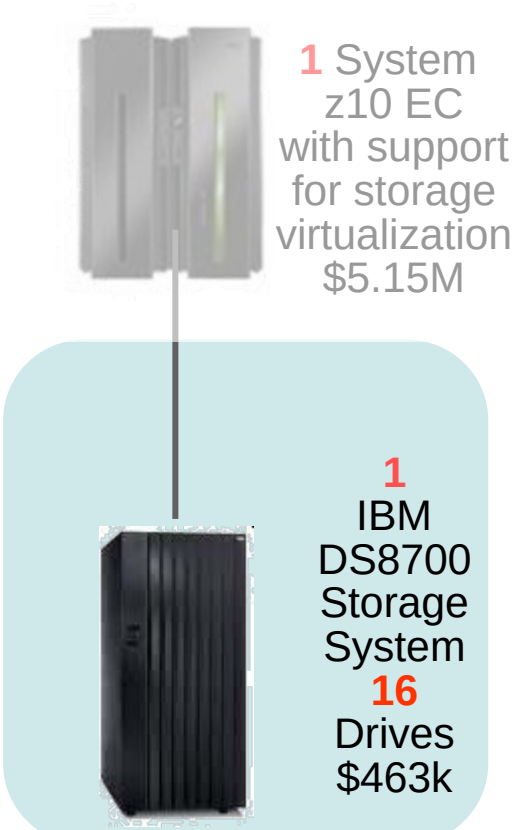
- **$576K** 3 year TCA
- Less flexible
- More complex



Total $6.34M

Storage Solution with System z

- **$463K** 3 year TCA (**20%** Cost Reduction)
- Agile
- Easier to manage



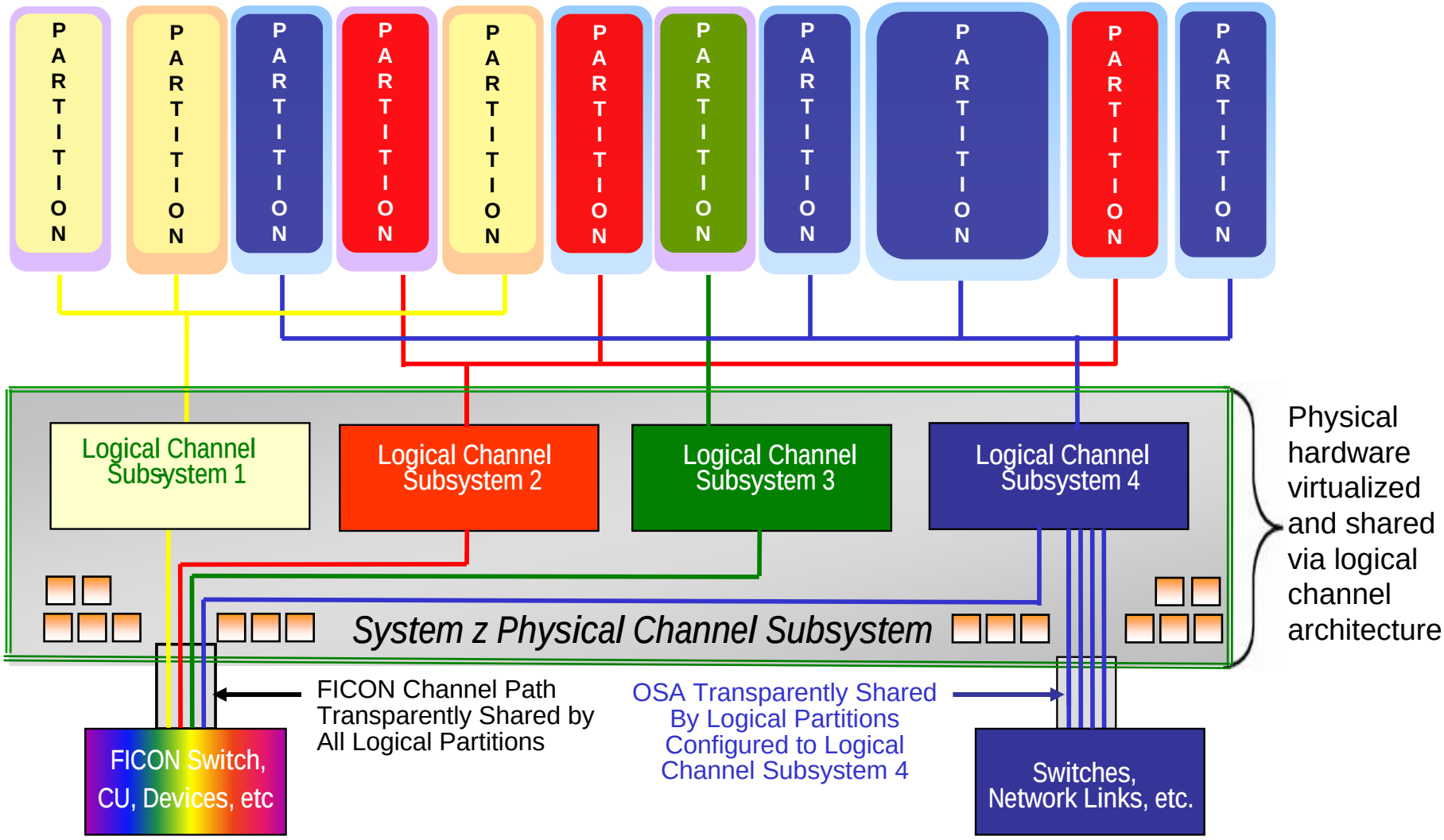
Total $5.63M

Note: Assume 20 GB storage per workload

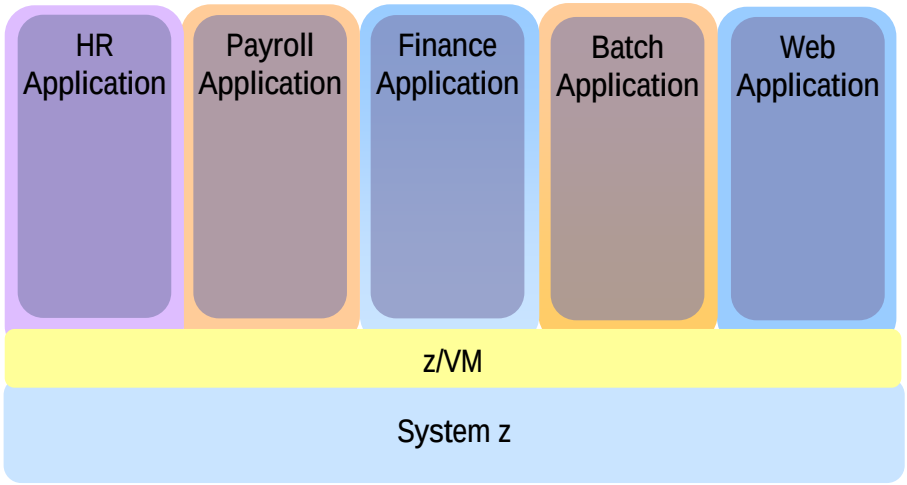
Why Linux On System z Achieves Lowest TCA For Heavy I/O Workloads

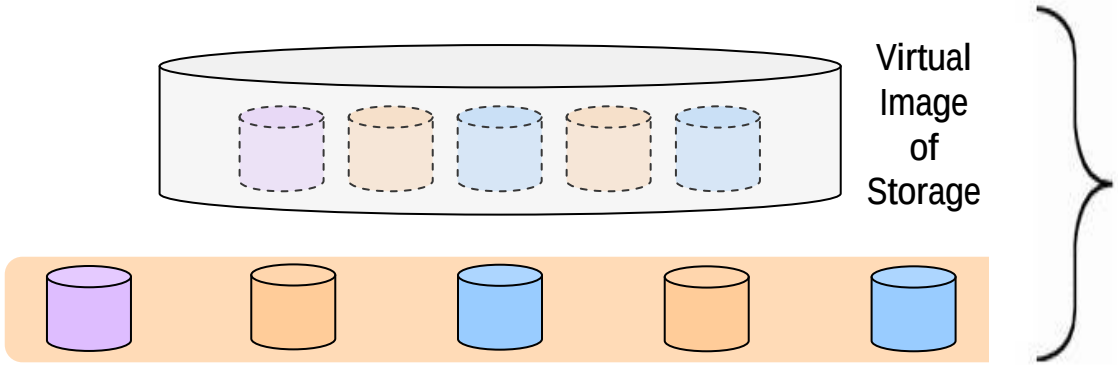
- Dedicated I/O Subsystem offloads I/O processing
- Greater I/O bandwidth
- Virtualization of I/O processing resources
- Built-in storage virtualization and switching

Physical I/O Adapters And Channels Are Virtualized And Shared By The Consolidated Workloads



Storage Virtualization And Consolidation



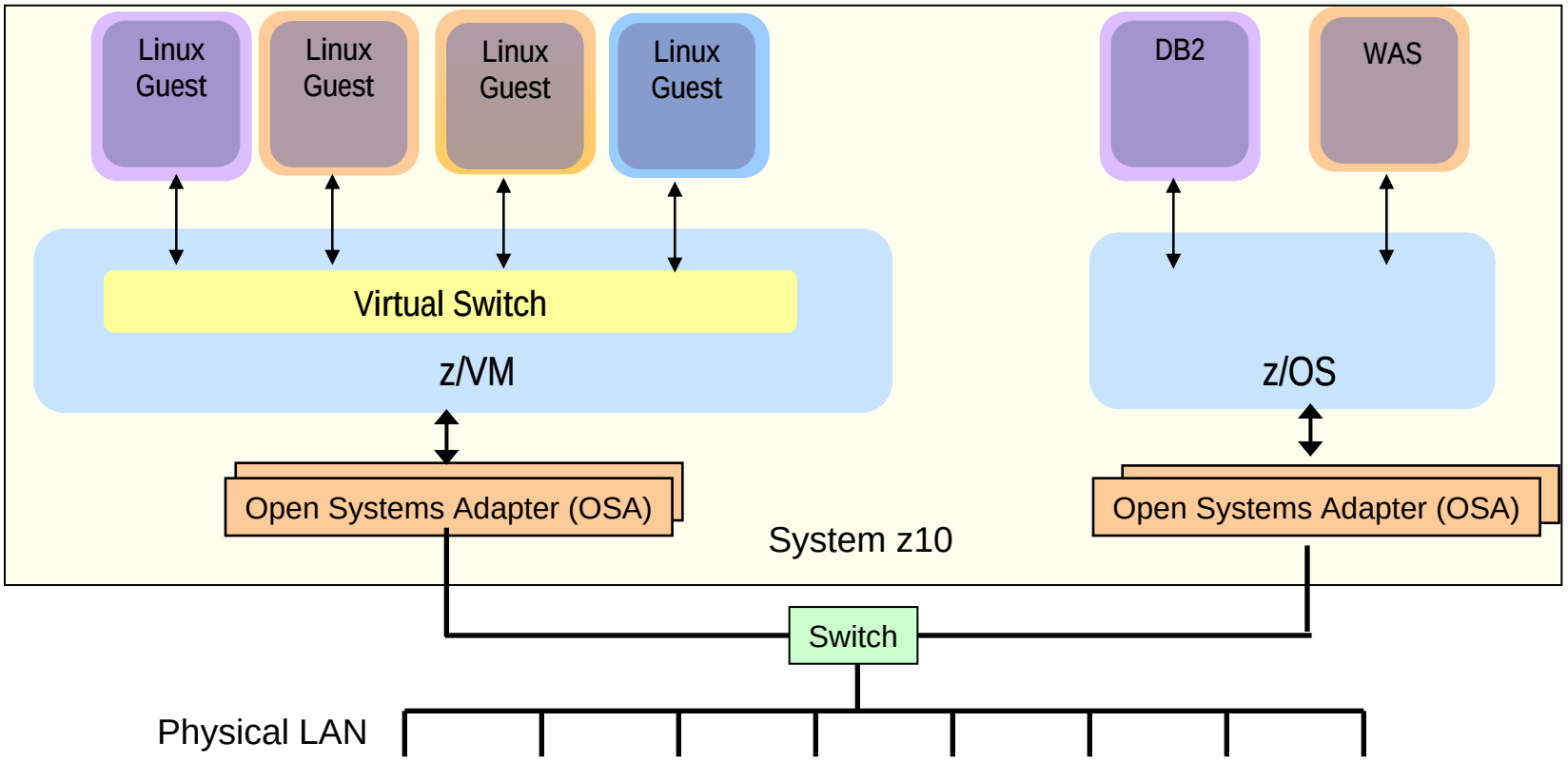


- Physical storage is virtualized and shared via built-in function in DS8000 storage controller

Other System z Benefits For Virtualization

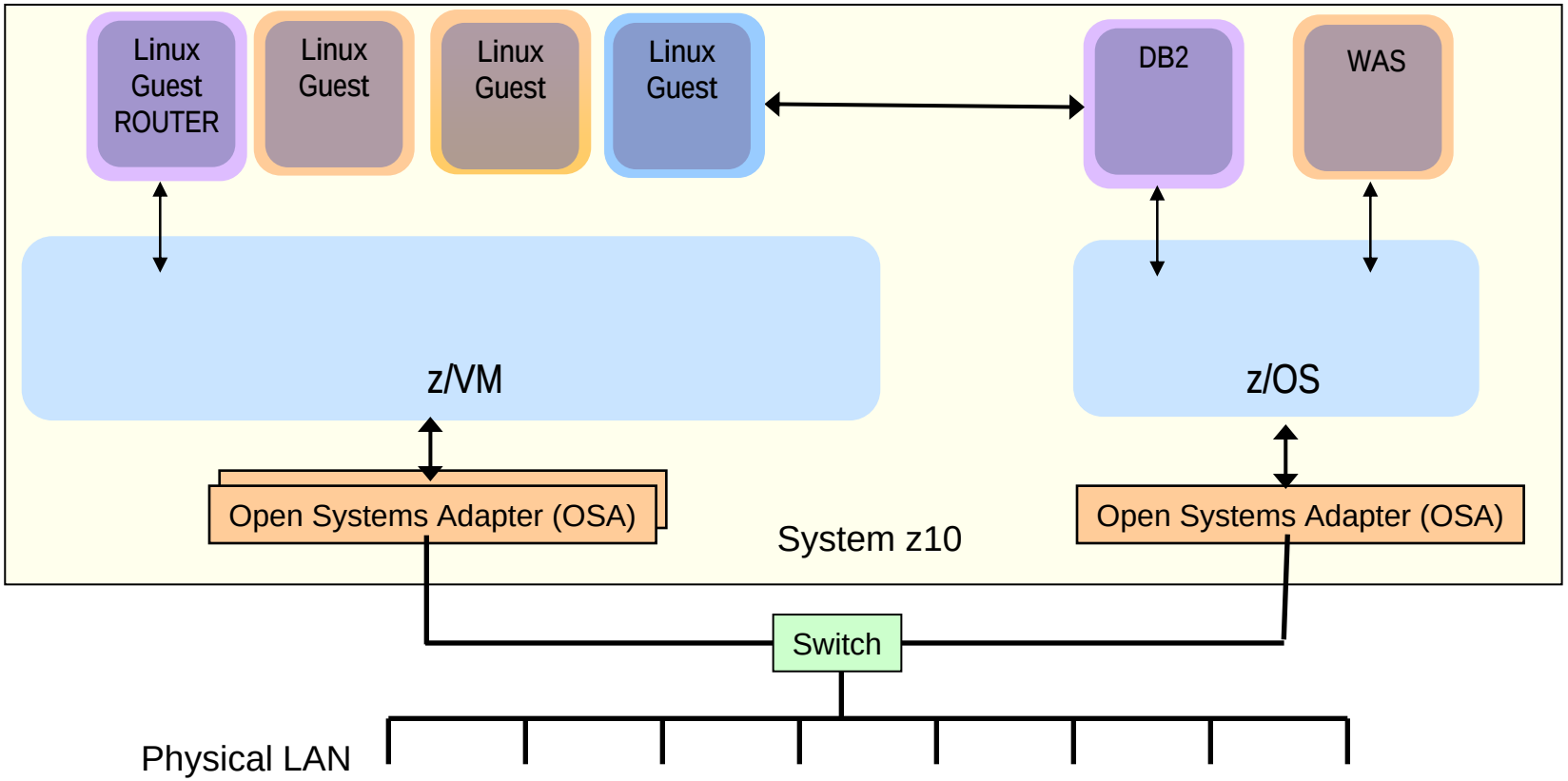
- Network Simplification
- Co-location with existing System z data source
- Security
- Quality of Service

System z Features Enable Network Simplification – z/VM Virtual Switch



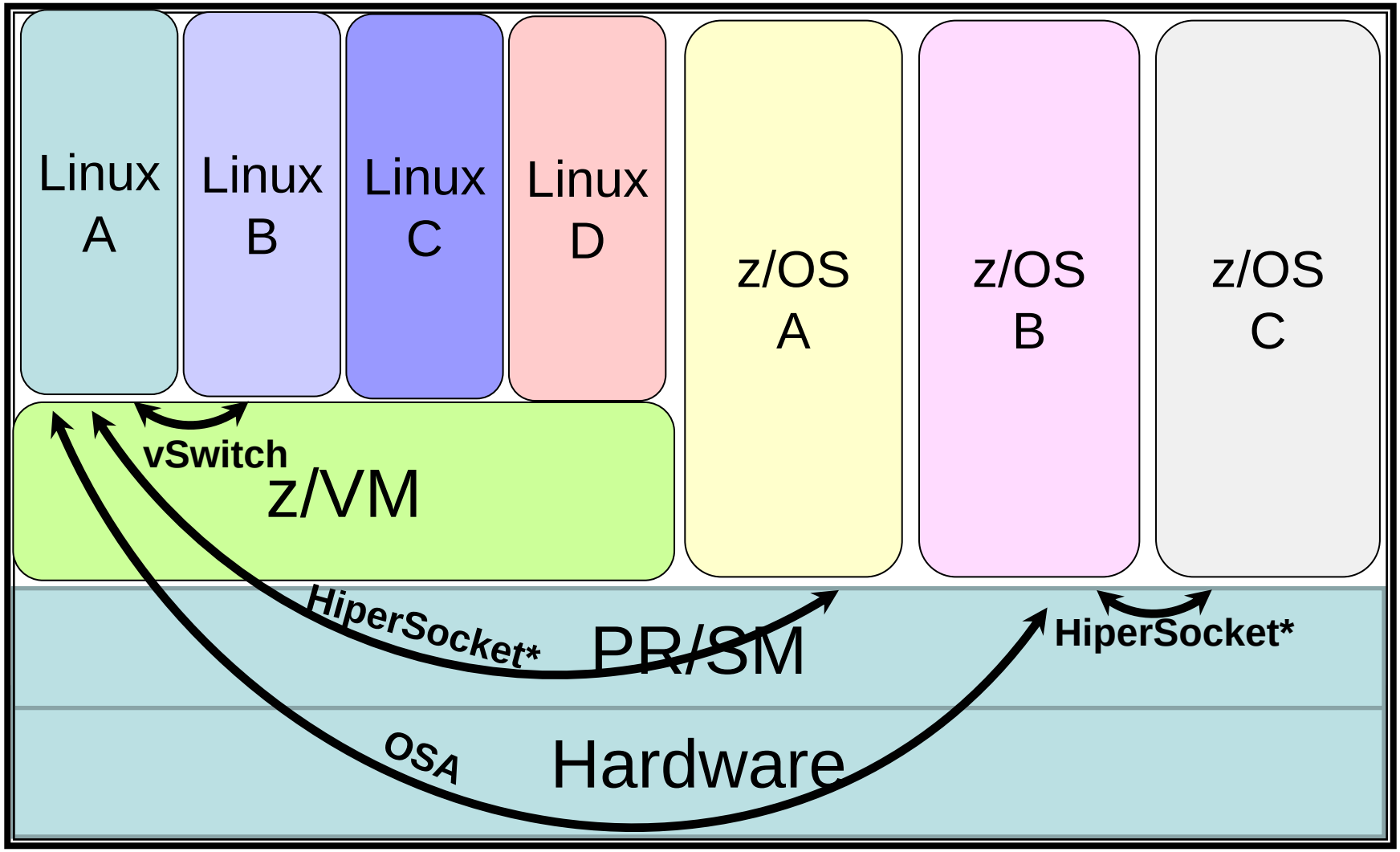
- Linux guests can talk to each other via zVM virtual switch – memory speed
- Linux guests can talk to outside world via z/VM virtual switch connected to shared OSA adapter
- Attach up to 8 physical OSA ports - redundancy, balancing
- Dynamically add new physical OSA to support Linux workload growth

System z Features Enable Network Simplification – HiperSockets



- Linux guests can talk to z/OS applications
- **Secure** IP communication at memory speed
- Close integration of data-intensive applications with database
- Reduces network management and physical assets

Network Simplification Options



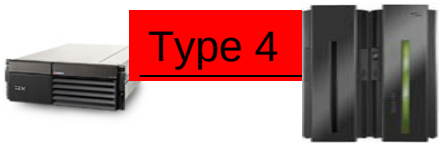
*HiperSockets recommended for LPAR to LPAR communications when high bandwidth and low latency are required – take advantage of memory speed

On-line Banking Benchmark Demonstrates Performance Advantages Of Co-location

① Separate Machines

4 CPUs (98% busy) | 4 CPUs (10%)

WAS 7 Linux | DB2 9.1 Linux on System z



System p | System z

320 tps

② Separate LPARs

4 CPUs (98% busy) | 4 CPUs (14% busy)

WAS 7 Linux on System z | DB2 9.1 Linux on System z

System z

410 tps

③ Same LPAR

8 CPUs (93%)

WAS 7 DB2 9.1 Linux on System z

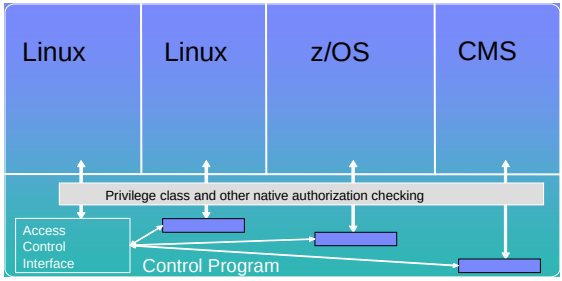
System z

550 tps

34% more throughput with co-located workload

z/VM Security For Virtualization

- Operates without interference/harm from guest virtual machines
- Virtual machines cannot circumvent system security features
- Protects virtual machines from each other
- Ensures that a user only has access to resources specifically permitted
- Tracks who is accessing all system resources
- LPAR certified Common Criteria EAL5
- z/VM certified at Common Criteria EAL4+
- HiperSockets for highly secure internal networking
- Access to System z Crypto features
  - CPACF, CryptoExpress3

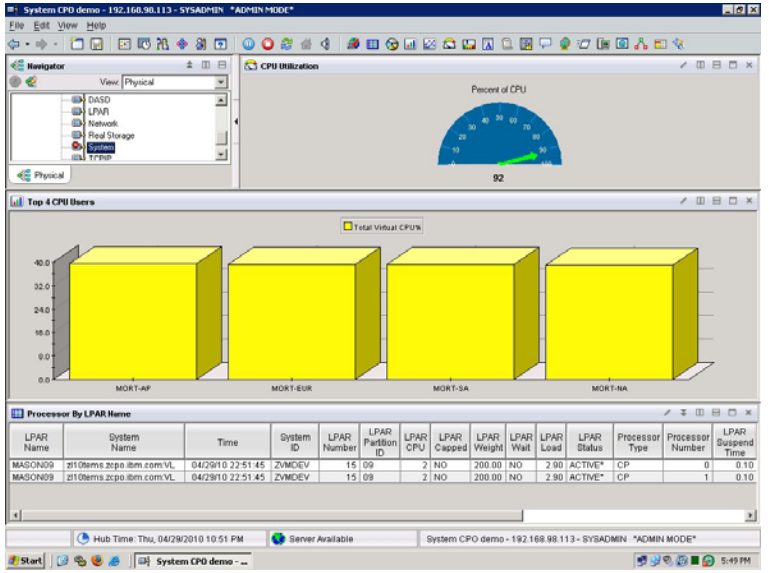


Linux On System z Workloads Inherit System z Qualities Of Service

- Reliability, availability, serviceability characteristics of System z
- Site failover for disaster recovery
- Capacity on demand upgrades
- Add physical processors to Linux environment without disruption

DEMO: Dynamically Add New Processor To z/VM LPAR To Handle Increased Risk Analysis Workload

1. SOF has in-house Risk Analysis program running on Linux on System z
2. Increased workload to all 4 Linux guests is causing z/VM LPAR utilization of 90%+
3. SOF determines this is a long term trend - additional physical capacity needed
4. New capacity made available to LPAR as new Logical CPU, available for work
   - Without disruption in service



VMware can't recognize and take advantage of additional physical processors without bringing down and rebooting the system

Note: Assumes available processors on installed books

DEMO: How Does Hardware Repair And Upgrade Work?

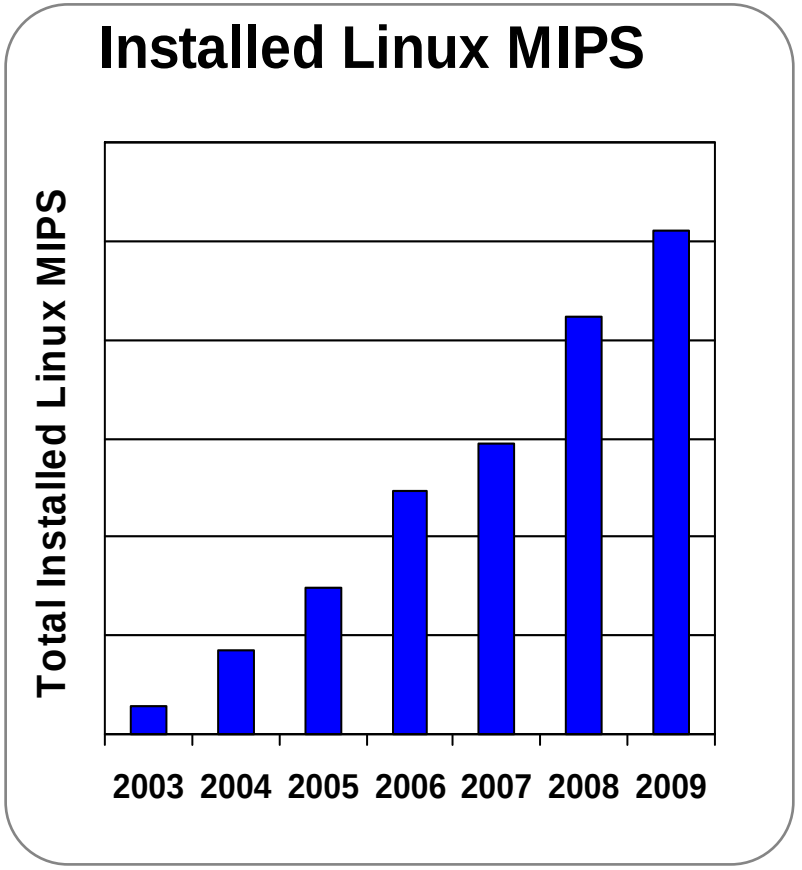
- Perform a memory upgrade while the system continues to run
- Service engineer dispatched automatically through “phone home”
- Parts already ordered through IBM global parts replacement program
- The book is removed while the system is operational
- Memory cards can be added easily similar to servicing a PC
- Even the service tray is included

Types of Replacements:

1. In z10 EC, add a single book for processors, memory, and I/O Connections
2. Remove and replace a book
3. Allocate physical resources on other books

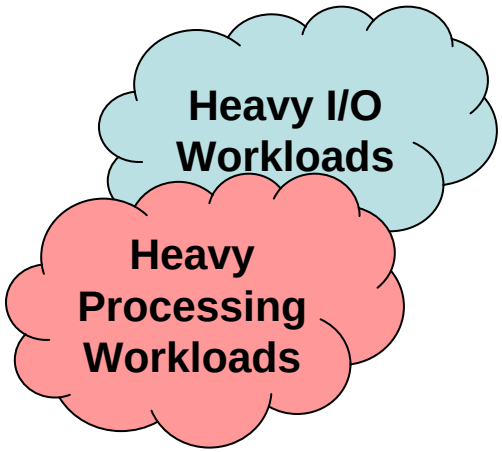
Client Adoption Drives Linux Success
*Installed Linux MIPS At 43% CAGR**

- The momentum continues:
  - **Shipped IFL engine volumes increased 35% from YE07 to YE09**
  - **Shipped IFL MIPS increased 65% from YE07 to YE09**
- Linux is 16% of the System z customer install base (MIPS)
- 70% of the top 100 System z clients are running Linux on the mainframe
- >3,100 applications available for Linux on System z



* Based on YE 2004 to YE 2009

Summary



System z is fit for purpose to consolidate heavy processing and heavy I/O workloads.

IBM