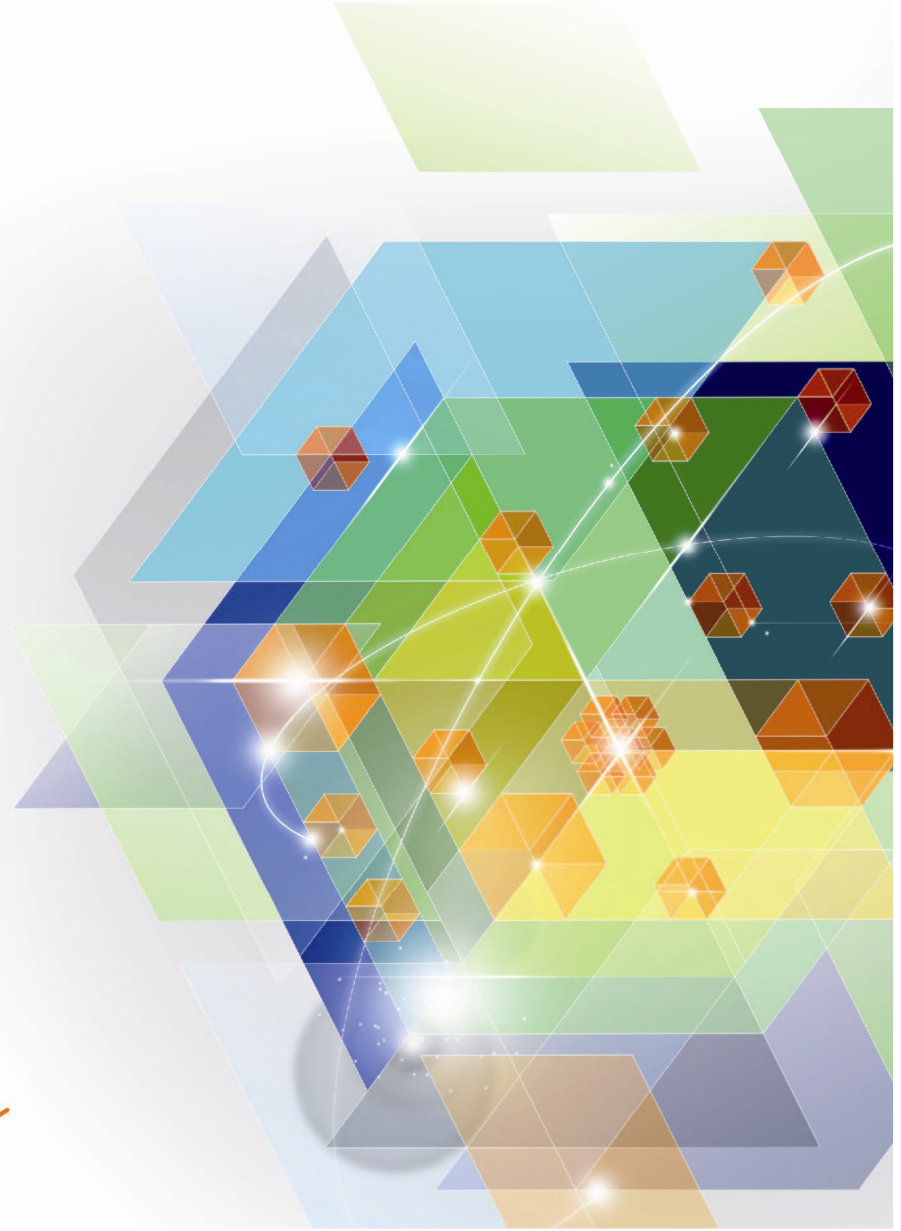
Experience from projects with z/VSE and Linux on System z



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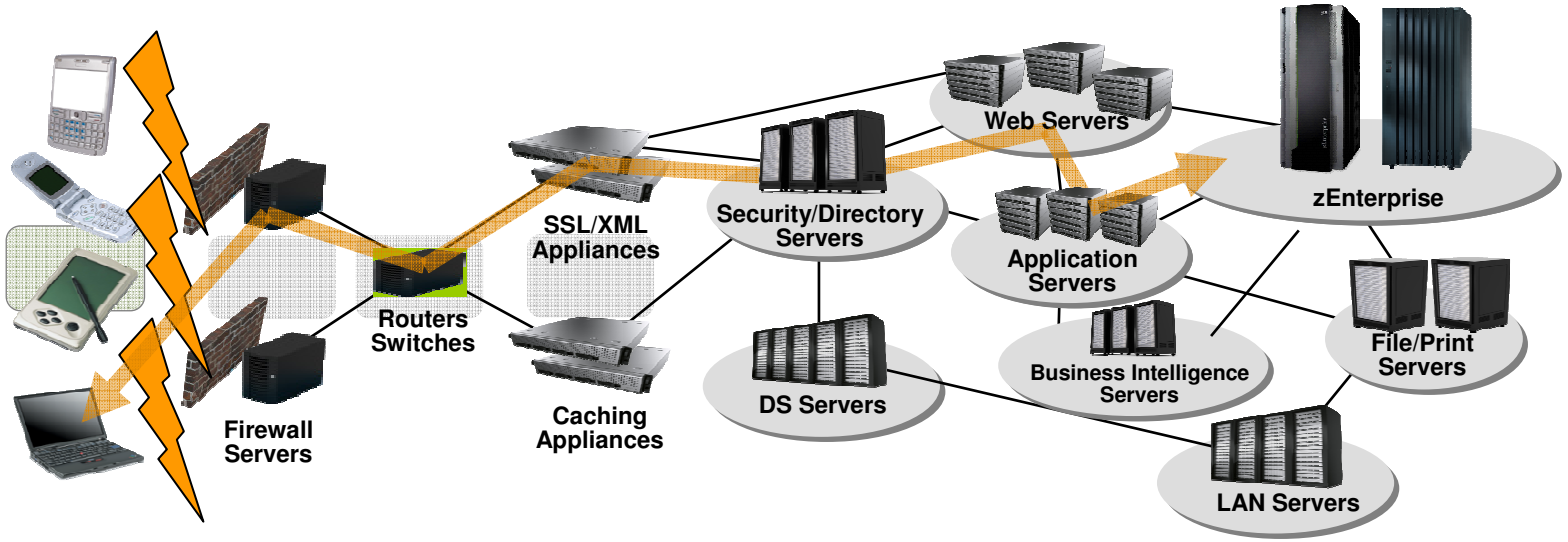
Motivation for change / optimization

- **Server Sprawl Limitations**
- **Platform diversification**
- **Architecture diversification**
- **Operating Systems sprawl**



- How many x86/Unix servers are deployed every month?
- How much data center space is available, or will it become a problem?
- How big is the energy consumption growing?
- How many additional people are required to maintain the constantly growing number of servers?
- How will the software license cost grow, including the virtualization software?
- How can IT availability ensured, what happens in the case of a disaster?

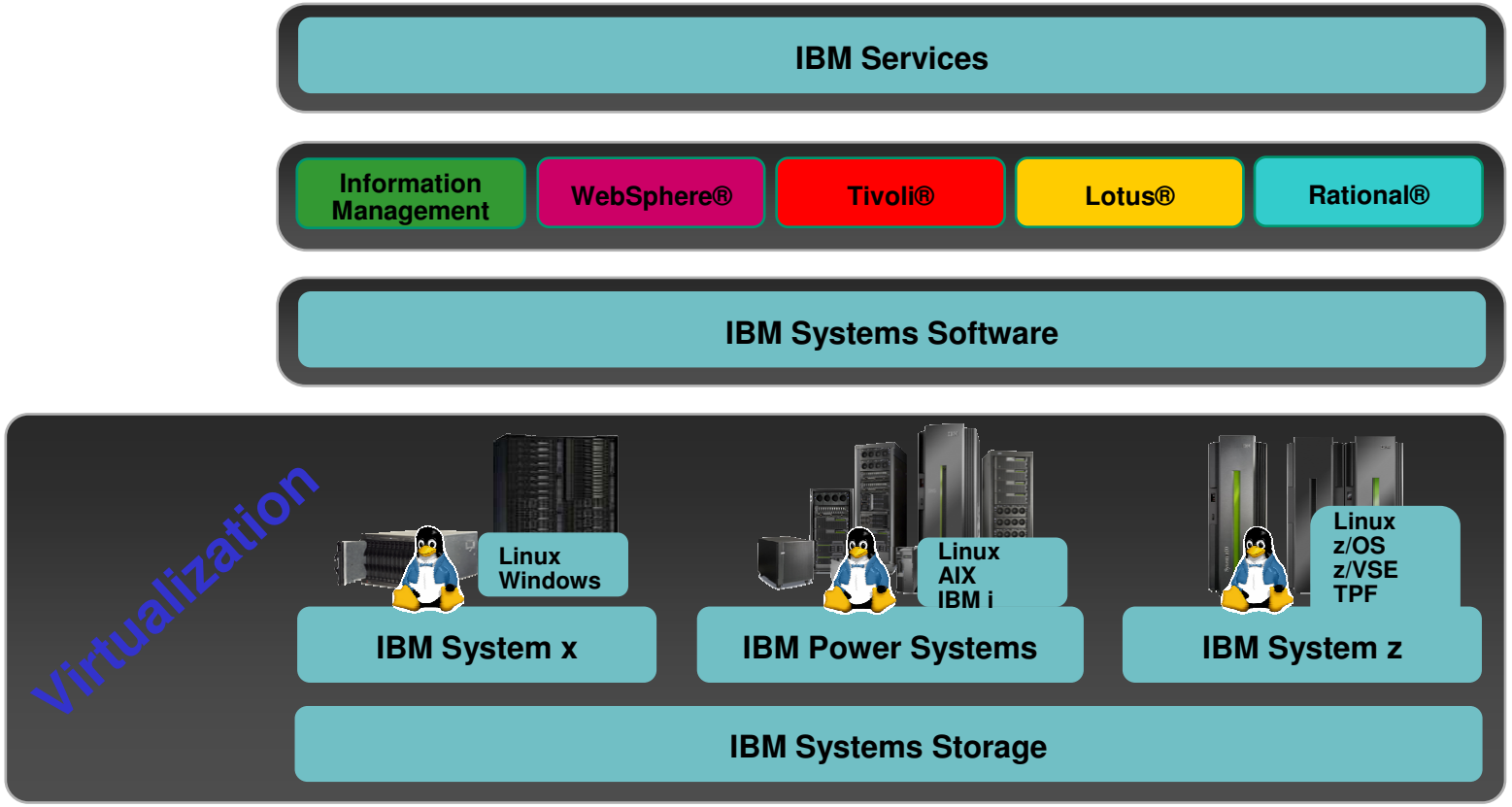
Do you have to re-think your IT server strategy?

IT Requirements

- Manage virtual server sprawl
- Contain licensing costs
- Maximize asset utilization and resource sharing
- Dynamically adjust resources based on workload needs across server, storage and network
- Placement, preference, policy based automation
- A lot of buzz on cloud, where is the best place to start and how?

Virtualization is the Foundation !

IBM focus:
Linux everywhere, global Virtualization and Management



Linux provides common benefits across all IBM platforms

Supported platforms
- x86 to mainframes
- Broadest range of supported virtualization environments
- Can optimize by workload

Scalability
- Ongoing innovation in both scale out and scale up
- Platform support provides flexibility in consolidation

Security
- Policy-based security
- Common criteria certification
- Very rapid time to fix if vulnerabilities are discovered

Linux is Production READY !

Linux drives business critical applications

The growth and expansion of Linux as a mature, cost-effective alternative for business-critical workloads

Linux *continues to enable new ways of doing business*

Edge and Web Infrastructure

- Community Driven
- Internet Enabled
- Worldwide Volunteers

Typical Applications

- E-mail Servers
- Apache
- Lightweight database
- DHCP
- HPC

Application and Data Serving

- Open Industry Driven
- Open elements of IT industry join existing community
- Linux adoption in the enterprise accelerates

- e-Business Applications
- Application Servers
- Mission critical database
- Dynamic Business Models

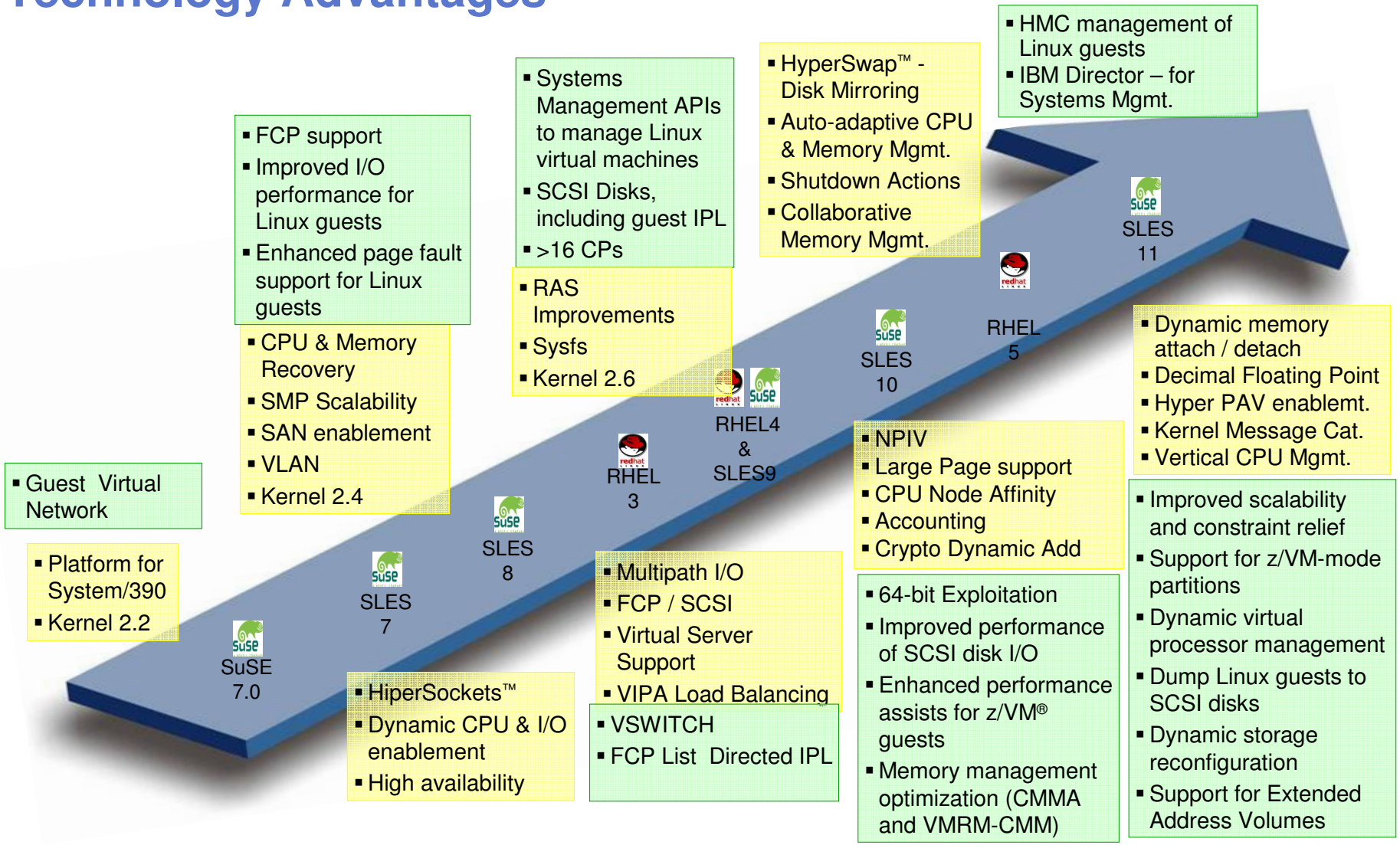
Business-Critical Enterprise Workloads

- Competition Driven
- Accepted as mature, open, lower-cost alternative for hosting DB, BI, ERP, CRM in business-critical environments
- Linux is a permanent presence in the datacenter

- Next-generation workloads
- Virtualization / consolidation
- Cloud and dynamic infrastructure
- New business models

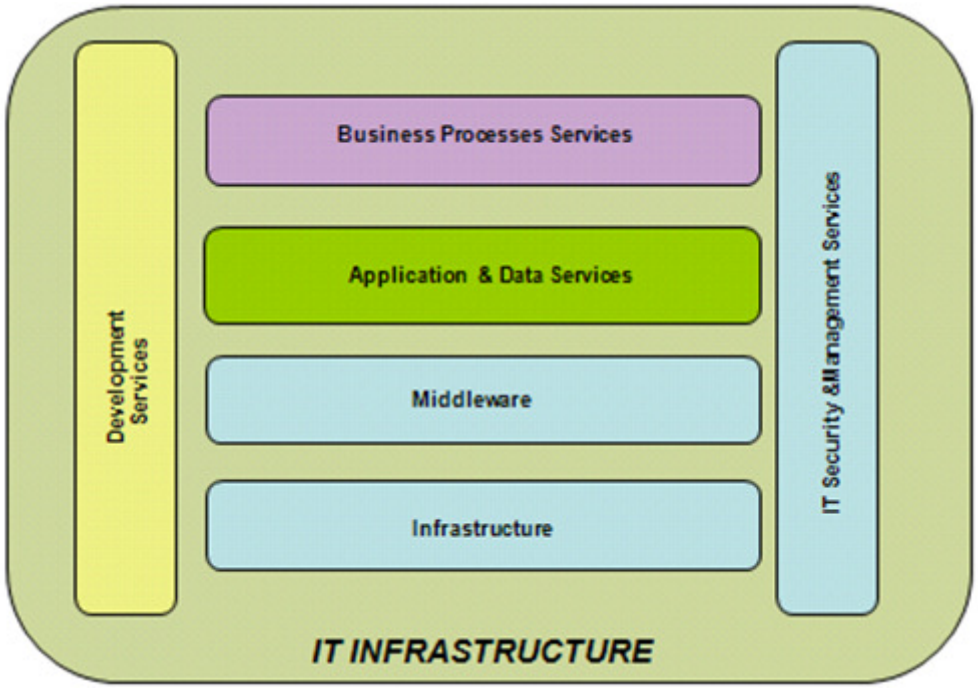
1991 – 2004 | 2005 – 2006 | 2007 – 2011

Unique Linux Extensions to Leverage System z Technology Advantages



Customer projects

- **How to start**
  - Assessment
  - F4P
  - PoC
  - Pilot project



Customer projects

- **Project 1:**

  Standalone servers vs. Large scalable server

- **Project 2:**

  Silos of applications versus a flexible architecture

Project 1: Standalone Servers vs. Large scalable server

- **Standalone Servers – think about infrastructure**
  - Power
    - 10 Distributed server consume double than a zEnterprise z114
  - Cooling
    - zEnterprise 114 doesn't need air conditioning
  - Space
    - Very small foot print for a single Server Rack – vs. halls of servers
  - Maintenance resources and cost !
    - Bigger servers in zEnterprise reduce number of updates
    - Increased compatibility and automation in case of server issues (HA)
  - Software Licenses
    - zEnterprise can run on low number of CPU and high % utilization
  - Network infrastructure and challenges
    - Standalone switches and routers need updates and are expensive
    - z/VM VSWITCH and VLAN can Virtualize entire and isolated networks

Customer 1: Spare parts management, acquisition and wholesale

- **IT infrastructure spread over many sites – geographically dispersed**
  - SW components are different
    - Locations have SW packages and local procedures
  - HW is different in locations and failure cannot always be controlled

- **IT departments need to catch up legal and government decisions**
  - Integration of HW required
  - Increased frustration in controlling

- **New IT infrastructure under investigations - IT expense to be lowered**
  - System z is known and in focus
  - Consolidation in one location – resistance from the field
  - Inflexibility to maintain and control and adopt

Host 76 Linux Servers

...should I use ELS & z/VM Enterprise Virtualization or x86 Virtualization?

What is the price comparison TCA / TCO?

Enterprise Linux Server

Grow inside the box

X86 Virtualization

<<Rack and Stack>> approach:
Add more Servers

Consider System z as just a new server, large scalable

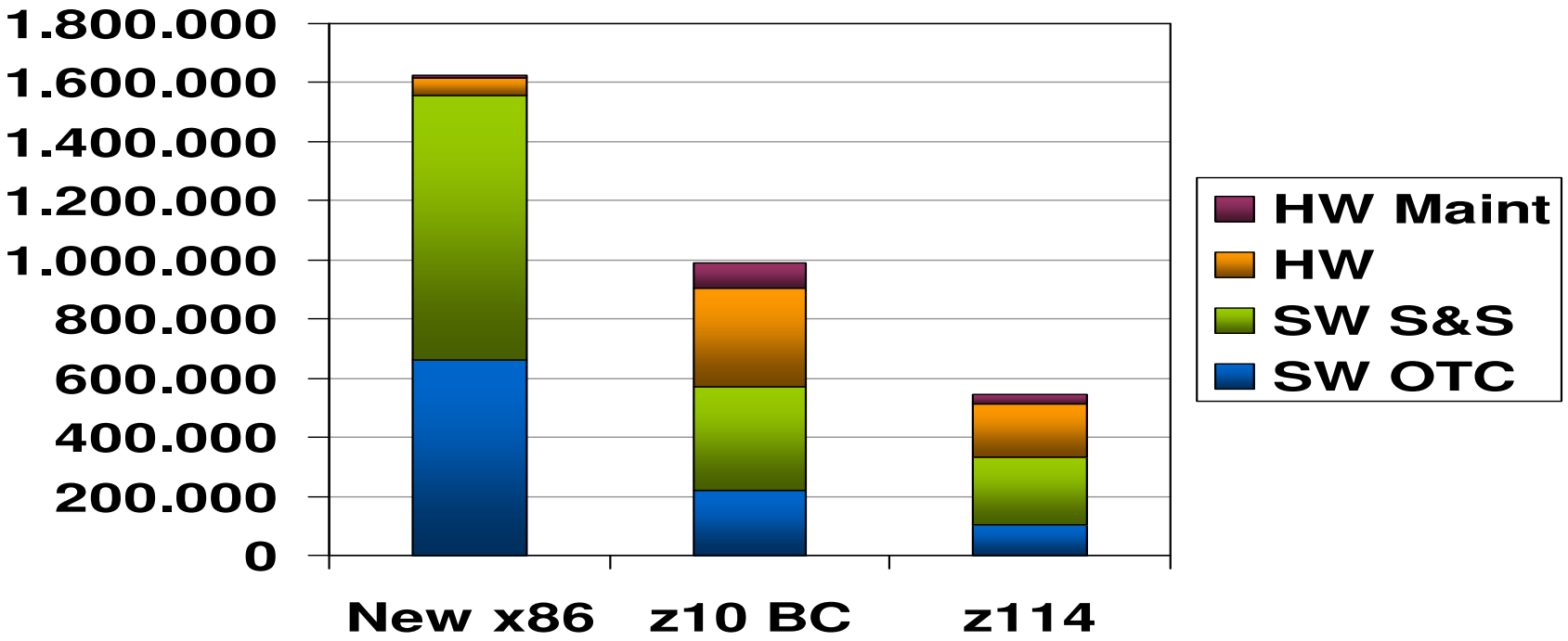
Manage:

- Security
- Deployment
- Development
- Disaster Recovery
- Administration
- Monitoring

1. **Multiple Hypervisor methods**
2. **Common management**
3. **Disaster recovery methods**

Linux on zEnterprise for Consolidation to Reduce Cost

Consolidate 40 Oracle server cores onto 3 Linux cores on z114



The Enterprise Linux Server

A dedicated IBM zEnterprise 114, IBM zEnterprise 196 or System z10 server

System z Solution Edition for Enterprise Linux

Additional capacity on an installed IBM zEnterprise z114, IBM zEnterprise 196 or System z10 server

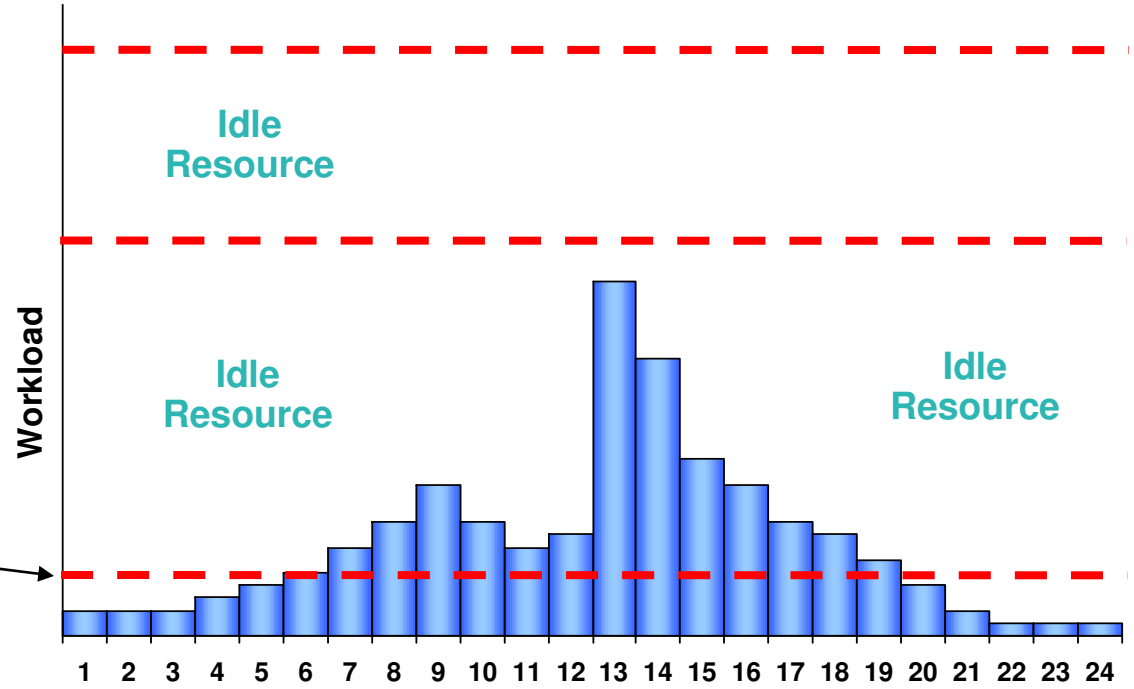
Utilization of Distributed Servers

Provision for expected growth

Provision capacity for peak workload

Server dedicated to one application

Average utilization

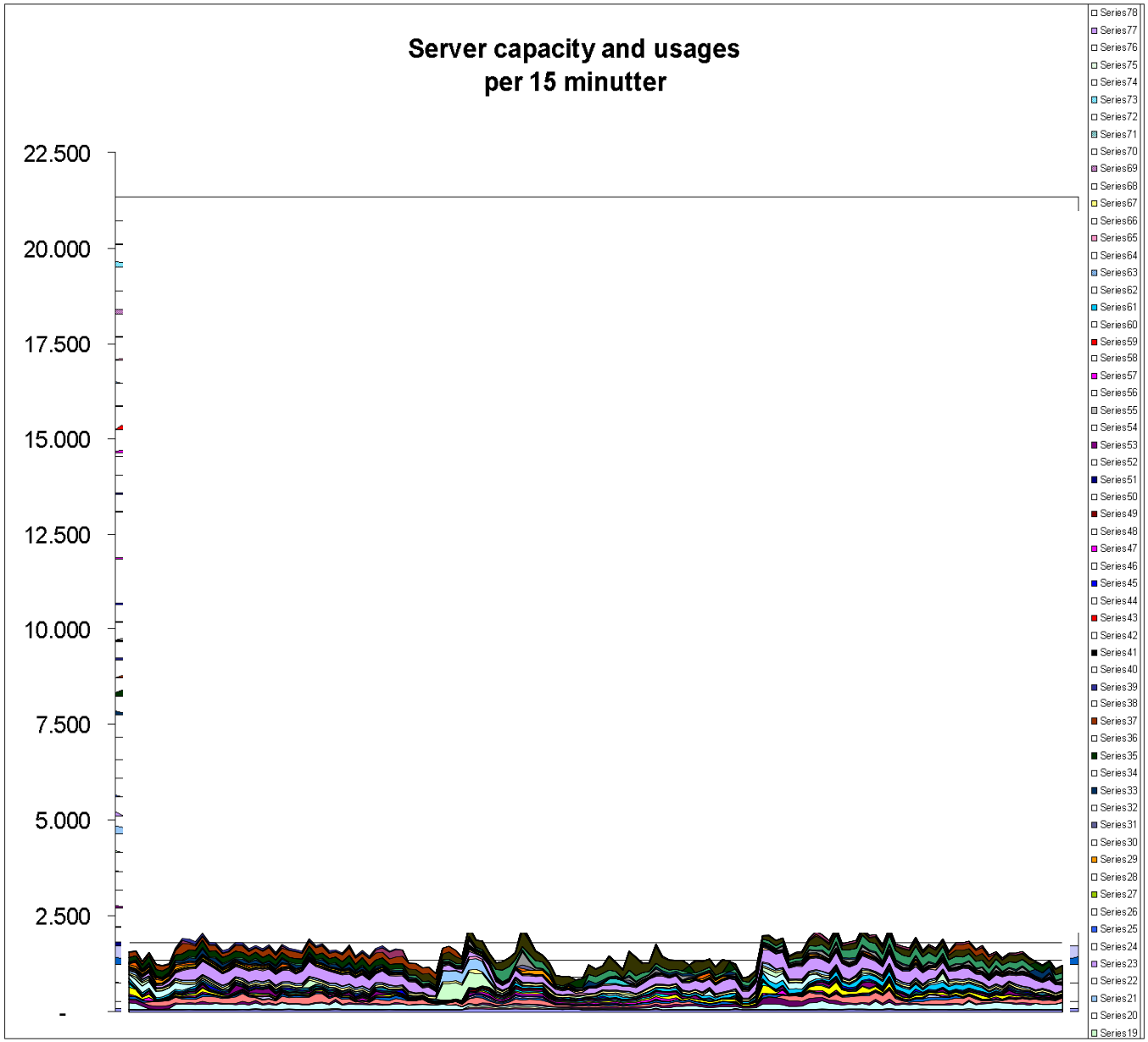


- **Typical utilization of Windows Servers 5 – 10%**
- **Typical utilization of UNIX Servers 10 – 20%**
- **Typical utilization of System z**

Accumulated USED Distributed Server capacity

RPE2

(from Ideas International)



Enterprise Linux Server – Real Customer Configuration




Tangible benefits:

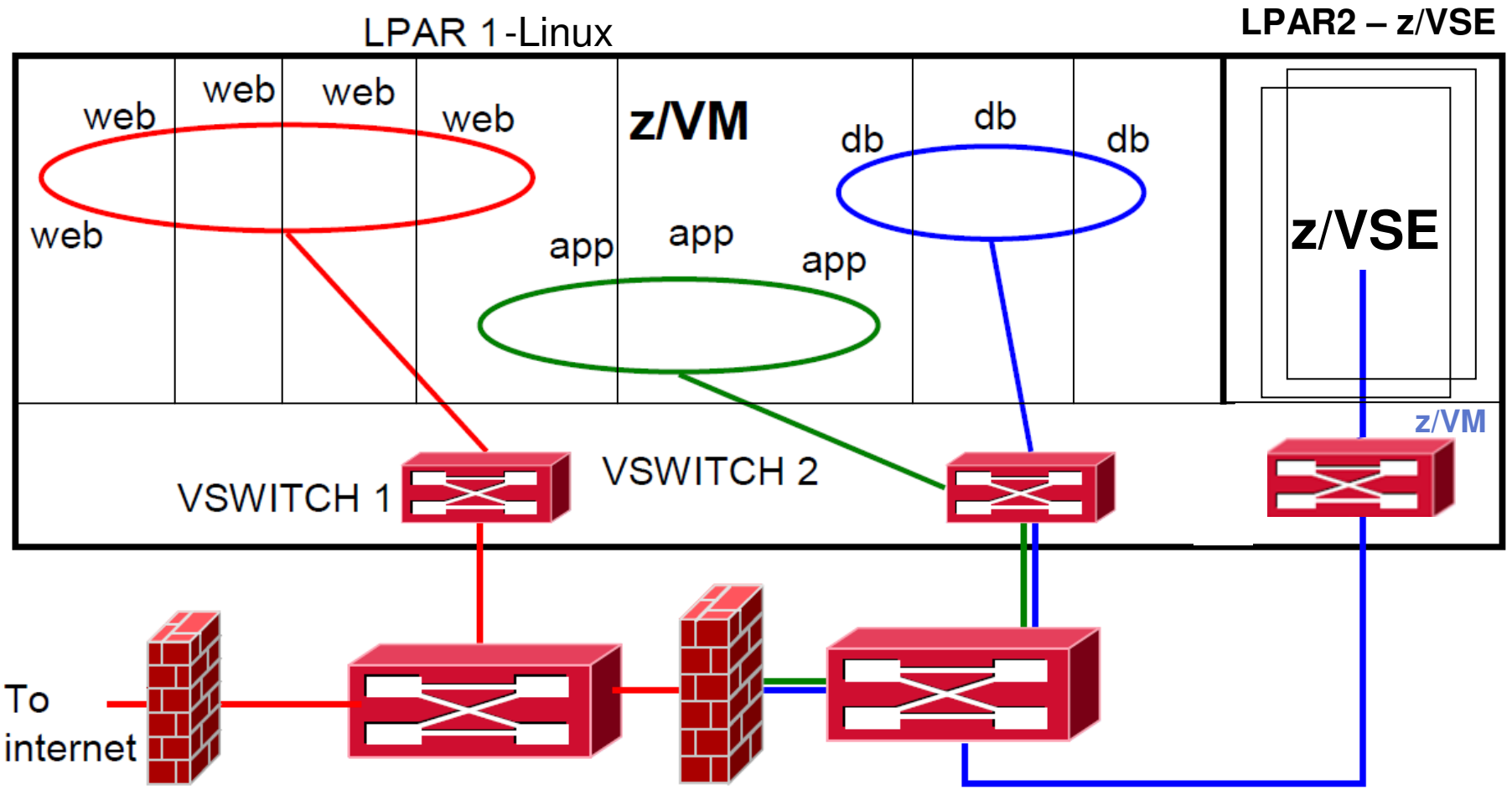
	Existing 4 HP Alpha Server ES45 + HP disks 4x3 CPU Alpha 21264C 9x1 core Oracle license	IBM Bladecenter H 2 HS22 w/2 proc. 4-core IBM Storwize V7000 disks 16x0.5 core Oracle license	IBM Bladecenter H 2 IBM P7 PS700 4-core IBM Storage DS5020 8x1 core Oracle DB license	IBM System z10 ELS 1 IFL IBM Storwize V7000 1 Oracle EE license
1st year	164,234	219,998	242,888	234,040
2nd year	164,234	74,234	74,234	8,248
3rd year	164,234	74,234	74,234	8,248
Total (3 years)	€ 492,701	€ 368,465	€ 391,355	€ 250,537

Prices based on actual European market prices (Euro). Local pricing and conditions will vary!

Intangible benefits:

- **Improved security – no information leak during data copy between servers**
- **Improved availability – no network routers or switches**
- **Highest reliability and centralized systems management**

Multi-zone Network VSWITCH (red zone physical isolation)

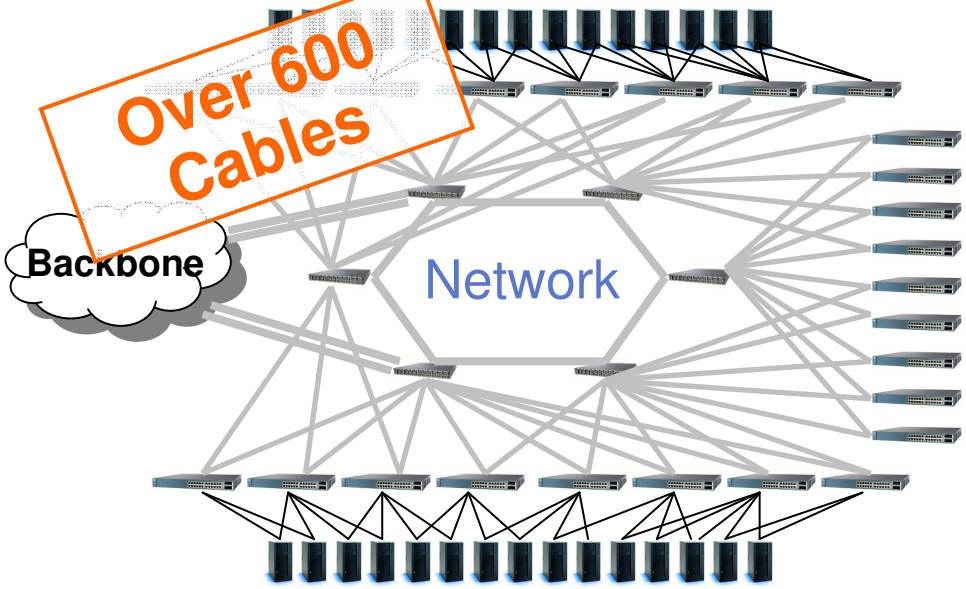


With 2 VSWITCHes, 3 VLANs, and a multi-domain firewall

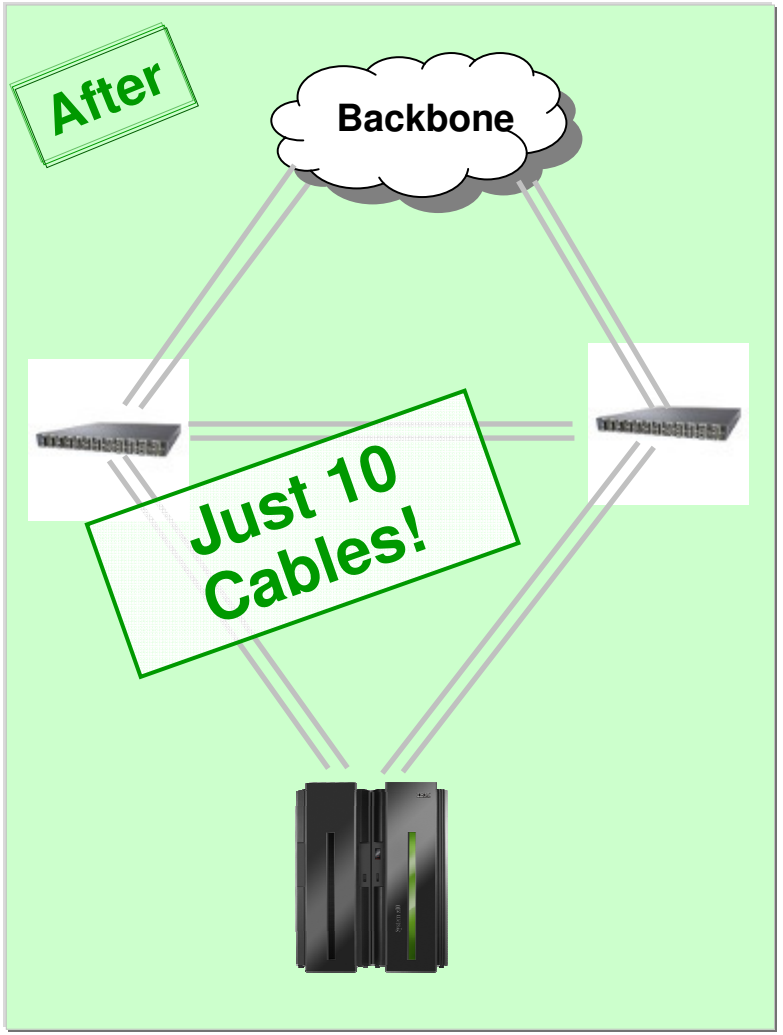
Company Consolidated 292 Servers to a z10

Before

3560E-24TD	8
3560E-24TD	17
3560E-12D	6
50 Ft UTP Cable	584
10GB Eth Fiber Cable	60



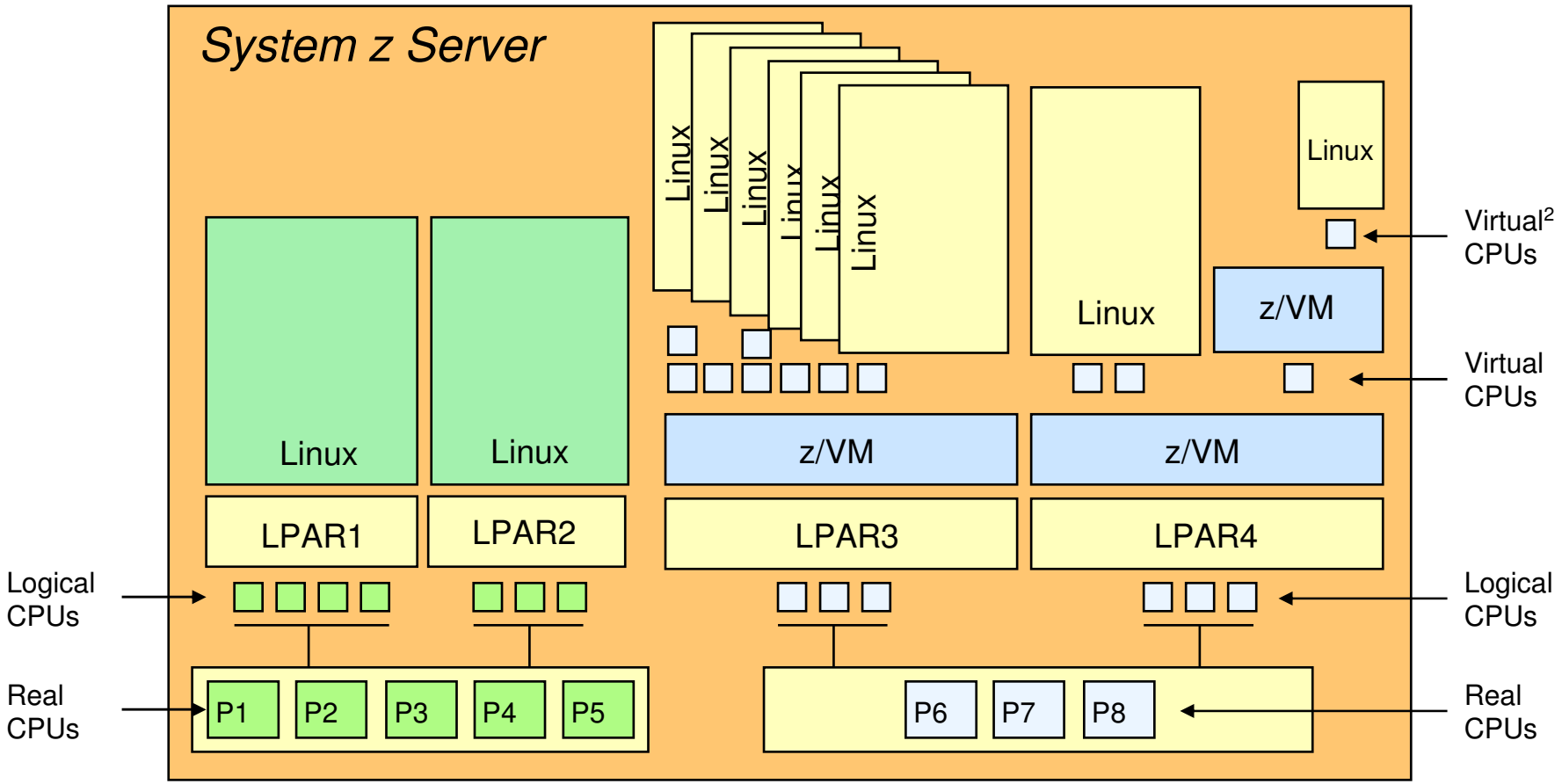
The diagram only shows **30** of **292** servers



Data is based on real client opportunity and on internal standardized costing tools and methodologies.
Client results will vary by types of workloads, technology level of consolidated servers, utilization factor, and other implementation requirements. Savings will vary by client.

System z Virtualization

Note: There are typically dozens or hundreds of Linux servers in a z/VM LPAR.



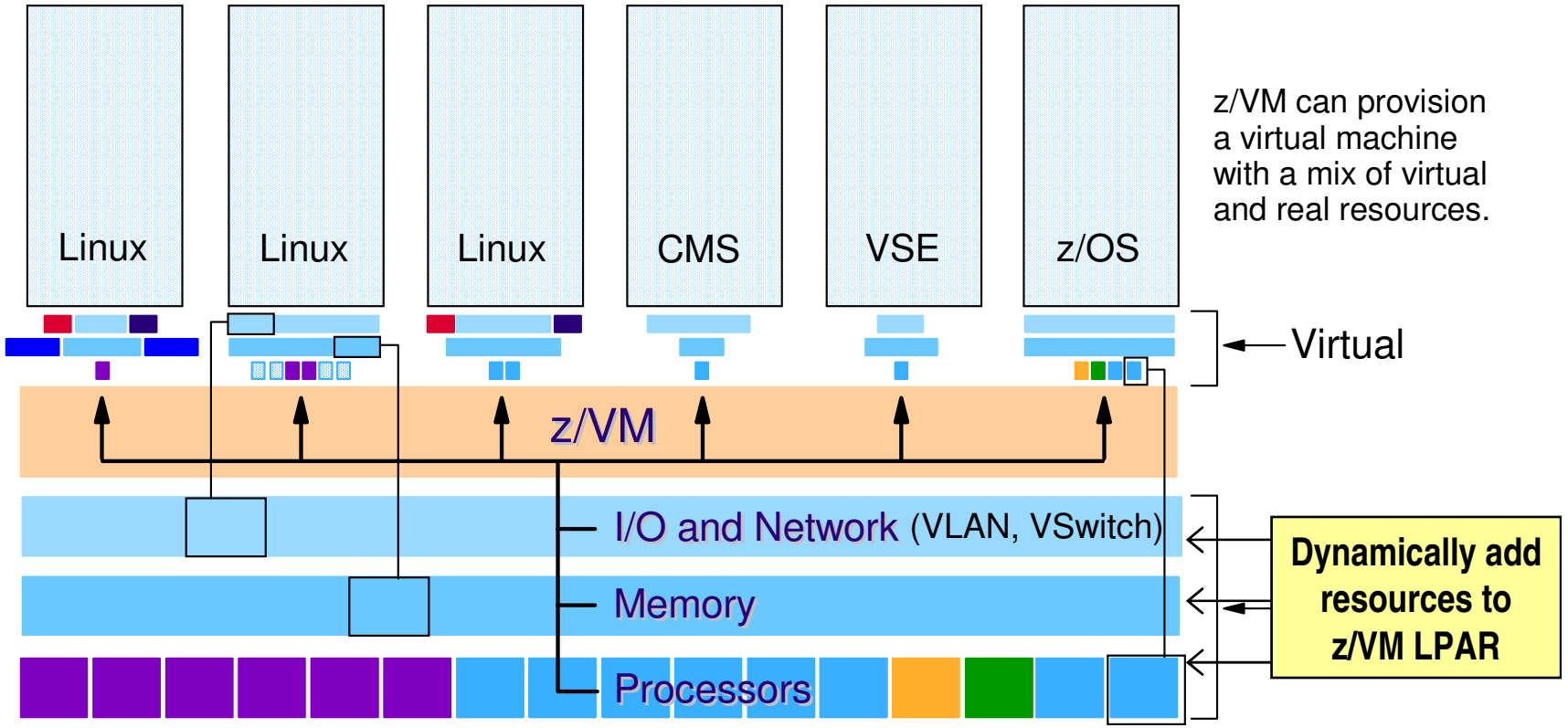
P1 – P8 are Integrated Facility for Linux (IFL) Processors

Implement Virtualization on System z: LPAR and z/VM, when to use what

- **z/VM Virtualization**
  - **Vertical virtualization** - Grow workloads without linearly growing number of virtual guests
    - one guest can be increased by allocating more resources (CPUs, memory)
  - **Horizontal virtualization** – isolation between servers
    - isolation of guests in a network
    - Redundancy for application high availability
  - **Dynamically** add, remove and shift physical resources to optimize business results
- **LPAR Virtualization**
  - High Isolation with fixed resources
  - Direct attached I/O devices for max bandwidth

Virtualization in System z and zEnterprise
z/VM Technology: Share everything

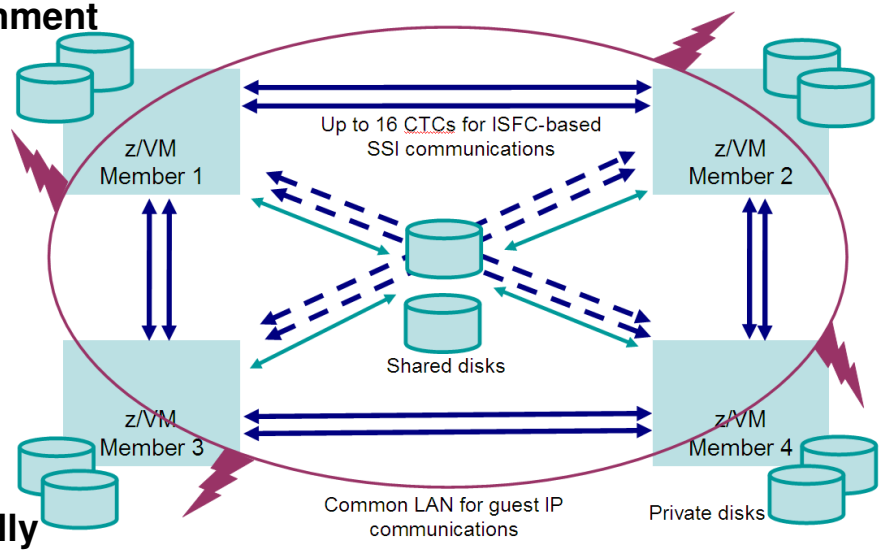
- z/VM simulates the existence of a dedicated real machine, including processor functions, storage, and input/output resources.
- z/VM includes network Virtualization, high availability and integrated security between VMs
- It supports uniquely, over commitment on all levels.



Linux on z/VM is the industry's most advanced virtual solution

z/VM V6.2 - *Single System Image, Live Guest Relocation*

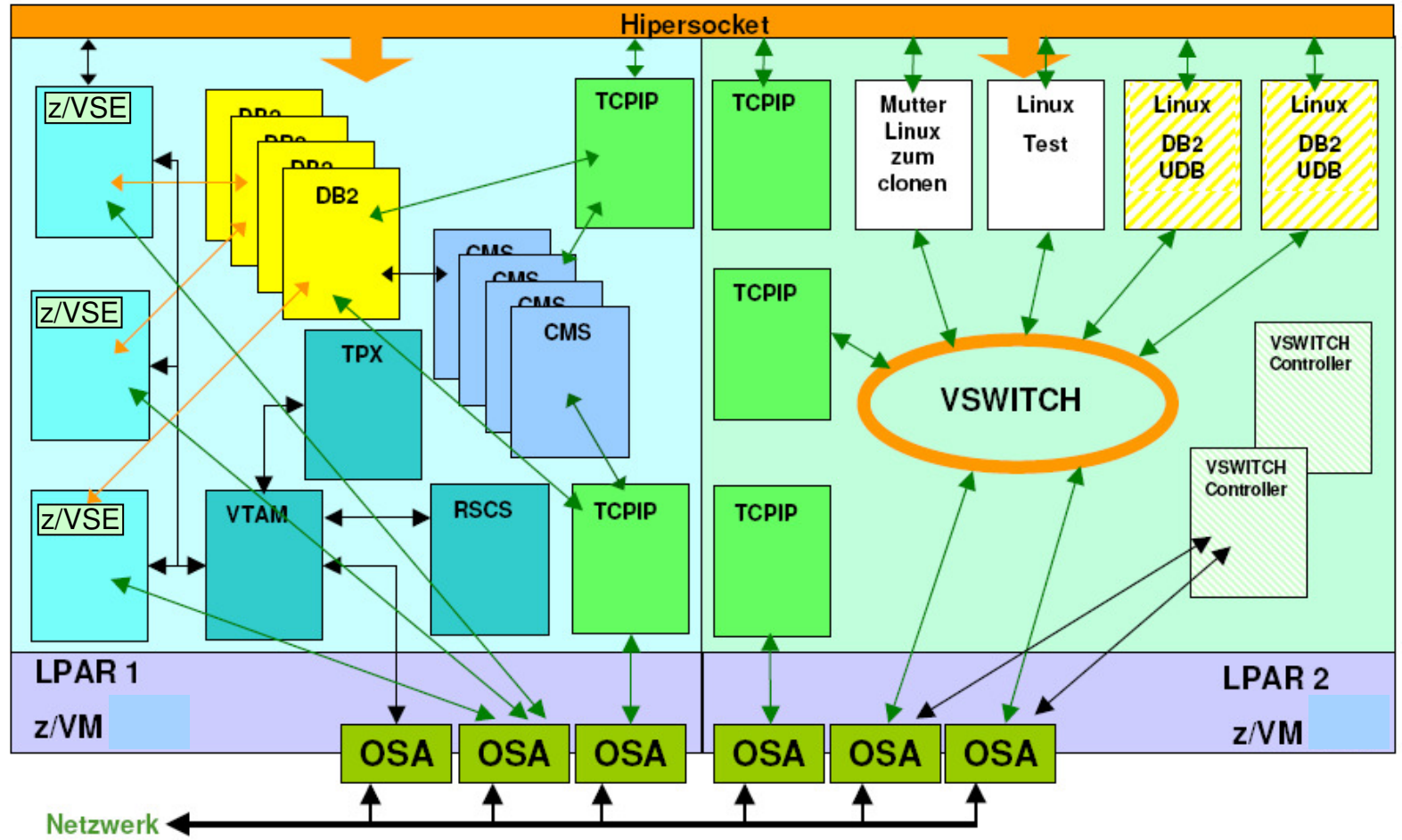
- **Single System Image (SSI) - connect up to four z/VM systems as members of a cluster**
- **Provides a set of shared resources for member systems and their hosted virtual machines**
  - Directory, minidisks, spool files, virtual switch MAC addresses
- **Cluster members can be run on the same or different z10, z196, or z114 servers**
- Simplifies systems management **of a multi-z/VM environment**
  - Single user directory
  - Cluster management from any member
    - Apply maintenance to all members in the cluster from one location
    - Issue commands from one member to operate on another
  - Built-in cross-member capabilities
  - Resource coordination and protection of network and disks



- **Live Guest Relocation (LGR) – Dynamically**
- **move Linux guests from one z/VM member to another**
- **Reduce planned outages; enhance workload management**
  - Non-disruptively move work to available system resources **and** non-disruptively move system resources to work
  - When combined with Capacity Upgrade on Demand, Capacity Backup on Demand, and Dynamic Memory Upgrade, you will get the best of both worlds

Customer Architecture and implementation

EDV-Umgebung



Customer projects

- **Project 1:**

  Standalone servers vs. Large scalable server

- **Project 2:**

  Silos of applications versus a flexible architecture

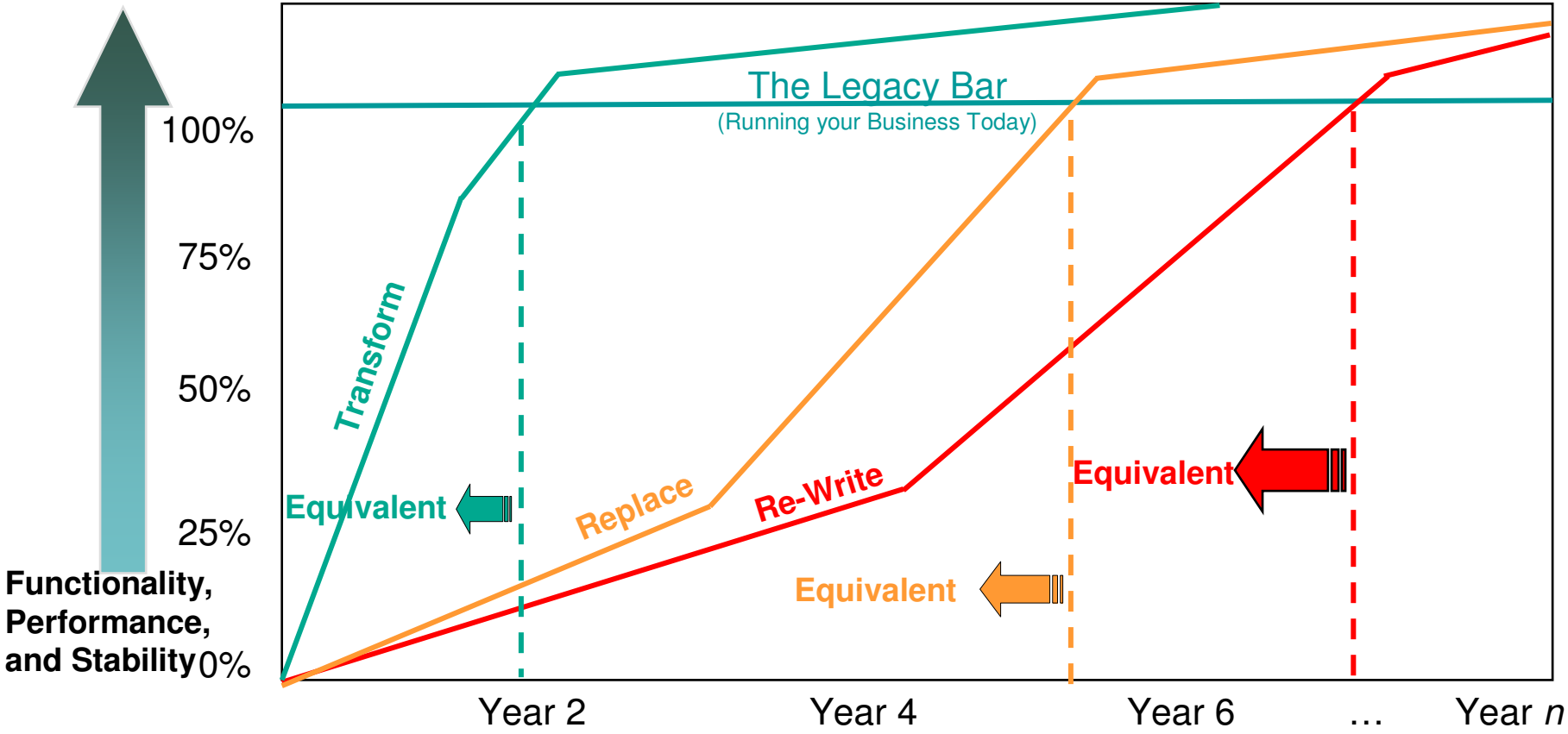
Customer 2: Global Magazine/books distribution company

- **Business decisions were made without IT involvements**
  - SW components aquired without IT compliance check
    - API's, In-house knowledge, DBs, platform experience
    - Mindset of inflexible IT – outsourcing of servers and partial solutions
- **IT departments needed to catch up with appl maintenance**
  - Integration of new acquirements difficult
  - Increased frustration in IT staff
  - Recovery structures not avaiable
- **New CIO – changed mindset because of IT expense**
  - Outsourcing, multiple platforms, incompatible APIs
  - Inflexibility to adopt and expand

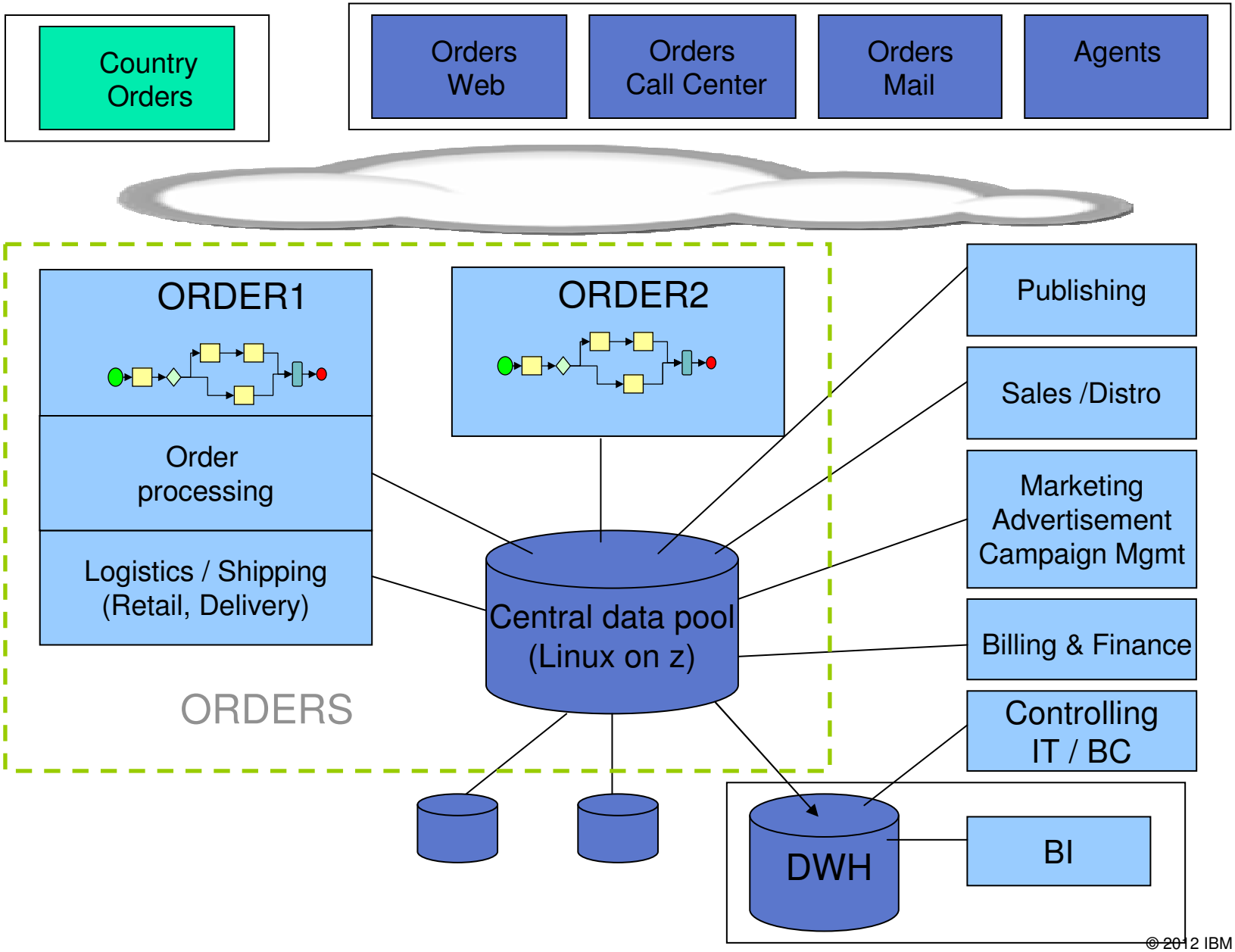
Application Transformation Time Table

Source: ATERAS

- **Many legacy applications are valuable and reliable assets, but their aging code base is seen sometimes as an inhibitor to business growth and process change**
- **Many Customers are considering to: Transform / Replace / Re-Write**

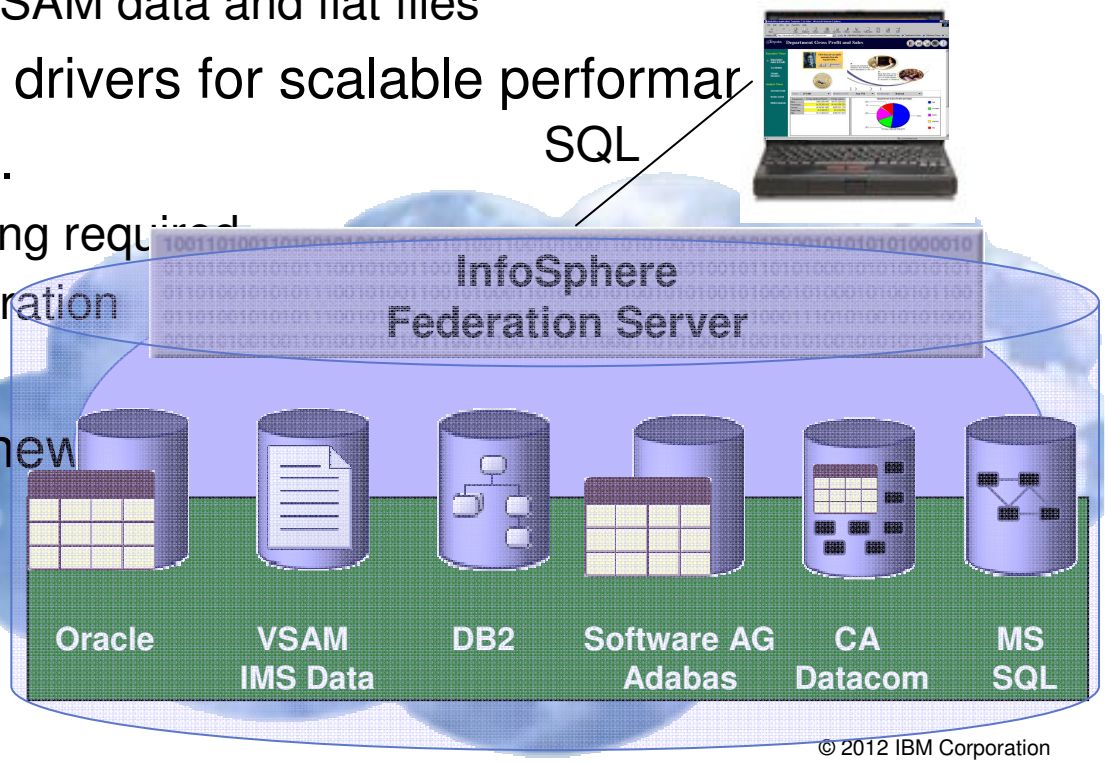


Proposed Architecture Overview Diagram (AOD)



InfoSphere Federation Server on Linux on System z

- **Integrating at the data layer – Federation of data**
  - Read from and write to federated mainframe data sources using SQL
  - Standards-based access via JDBC, ODBC, or Call Level Interface
    - Including for mainframe VSAM data and flat files
  - Multithreaded with native drivers for scalable performar
  - Metadata-driven means...
    - No mainframe programming requ
    - Fast installation & configuration
    - Ease of maintenance
  - Works with existing and new
    - Mainframe infrastructure
    - Application infrastructure
    - Toolsets



What means Production in your enterprise

- **High Reliable IT environment**
- **High Availability IT environment**
- **High Scalability of IT environment**
- **Stability and RAS together**

Linux on System z platform selection

- **Business Requirements**
  - Faster time to market
  - Faster decisions
- **Technical Requirements**
  - more flexibility to adopt new solutions
  - faster response to clients requests
- **Selection of possible solutions based on cost**
  - TCO Price
  - TCA Price
- **In-house skill**

Define IT Standards in your Enterprise !

- **Do you have an enterprise catalog for IT standards**
  - Standards for new Platform acquisition to avoid diversification
  - Application portfolio based on a list of platforms
  - Databases based on knowledge and platforms

- **Do you integrate Business requirements with IT goals**
  - Globalization of the company
  - Effective and fast reaction to market trends

- **Are the IT divisions having a supported common direction and goal**
  - Departmental goals
  - Business goals and local (internal) achievements

Project Life Cycle to Production

- **Assessment of workload for Linux on System z**
  - Does the workload run today on standalone servers
  - A Virtualized environment on System z is different than distributed
  - Workload Assessment is not unique for Linux on z – it is required for server changes

- **Architecture of solution**
  - Consider Business Requirements
  - Consider functional Requirements
  - Consider Non-functional Requirements

- **Proof of Concept / Technology (PoC / PoT)**
  - Define a production like setup for PoT
  - Define needed skills – internal and external
  - Define the exact scope of PoT
  - Define **production like workload** for PoT
  - Consider Network Connectivity
  - Consider Remote Systems involved
  - Define Monitoring capabilities for correct evaluation of workload behavior

- **Move to production**
  - Consider fine tuning transition period

Before starting: Get the right groups involved - upfront

- Hardware
- Network
- Architects
- Administrators
- Storage
- Security (including network security)

➢ A wrong start - to just try something – can be a big inhibitor in the project

➢ Decide Responsibilities for Linux on z

Definition of Hardware Requirements

- **Hardware sizing upfront**
  - Based on workload assessment
  - Consider the dynamics growth

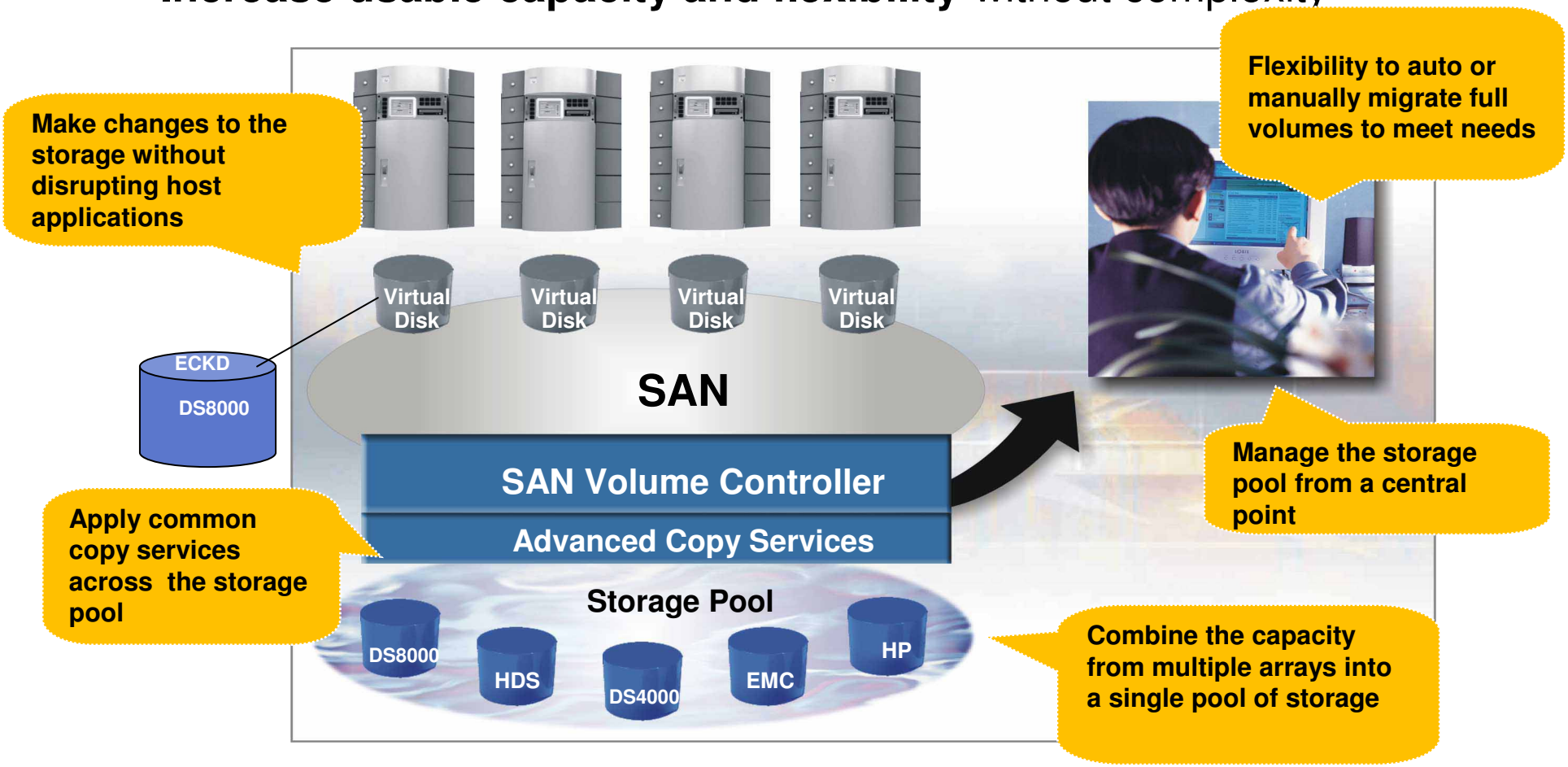
- **Recommendation:**
  - Separate Production LPAR(s) from Dev / Test
    - Even separated LPARs can share Resources on System z
  - Consider temporary increase of capacity and memory during PoC
    - These Resources have tobe defined upfront to be enabled and disabled non-disruptive
  - Main memory size should not be used based on distributed systems

Disk Storage Selection

- What kind of Disk / DASD devices will be used
- Directly attached (FICON or ESCON)
- SCSI over FCP
-
- Recommendations:
  - Linux can be used on ECKD or FCP disks
  - SCSI over FCP gives better performance for big data / database access
    - might lead to additional adapters on the mainframe side
    - Adapters can be used for FICON or FCP, but not both at the same time
  - Make sure that your storage hardware is certified/compatible with z/VM & Linux on System z

Virtualize Storage to Increase Utilization

- **Virtualize existing storage with IBM SAN Volume Controller**
  - **Increase usable capacity and flexibility** without complexity



Network Alternatives

- **Define the Architecture for dynamic network infrastructure**
  - Shared OSA network for smaller installations
  - Hipersockets for LPAR communications
  - VLAN and VSWITCH for isolated networks inside System z

  - Consider DR and HA environments
  - Consider dynamic environments and Cloning

- **Recommendation:**
  - Hipersockets is very fast but more static connection
  - VSwitch in z/VM allows more flexible setup and port aggregation
  - VSwitch reduces network cables and external router point of failures

Proof of Concept (PoC)

- The PoC is a proof of the desired solution on the System z server
- **Define the exact scope of the PoC**
  - Plan the scenario and expected outcome
  - Define expected Results
  - For comparison use comparable environments
  - Define needed skills – internal and external
  - Define involved data
  - Define Monitoring capabilities for correct evaluation of workload behavior
- **Execute PoC with all specialists and in time**

Platform shift is often easier than thought

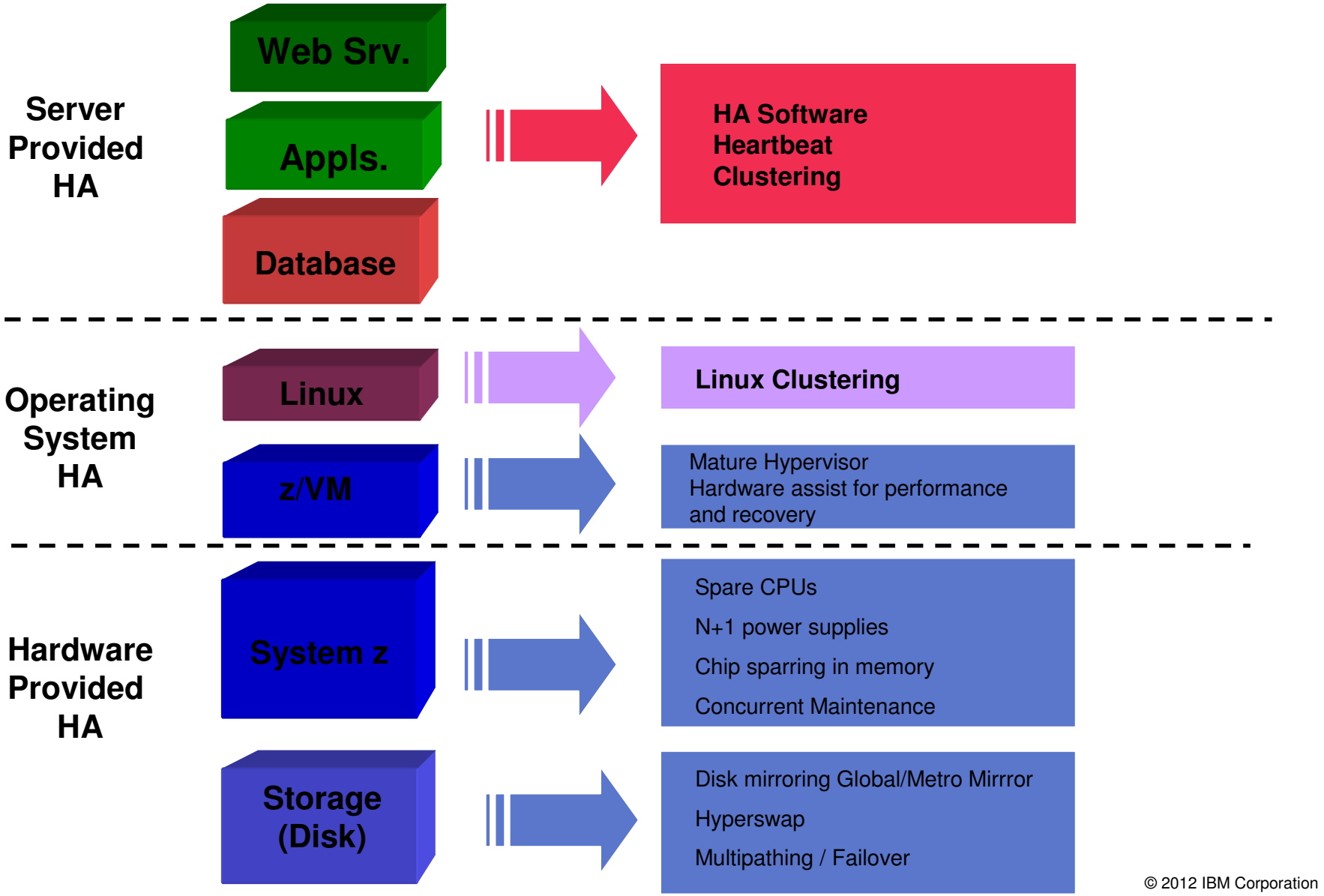
- Application migrations are easy
  - WAS to WAS
  - Oracle to Oracle
  - Domino to Domino
- Start small
  - Start to move workload to Linux step by step
  - Observe the scalability of virtualization and over-commitment
- Use the PoC to learn the new server technology
  - Virtualization in System z –> over-commitments
  - Behavior of main memory virtualization
  - Network and DASD virtualization

Plan for NON-functional requirements / enhancements

- High Availability (HA) requirements over entire architecture
  - HW HA
  - Virtual Server HA
  - Linux HA
  - Network HA
  - Web Application infrastructure HA (WAS)
  - Database / Data pools HA

- Disaster Recovery (DR) Versus HA scenarios
  - Recovery Time Objectives (RTO) – time from failure to DR production
  - Recovery Point Objective (RPO) – toleration of data loss (min)

Components of HA with Linux for System z



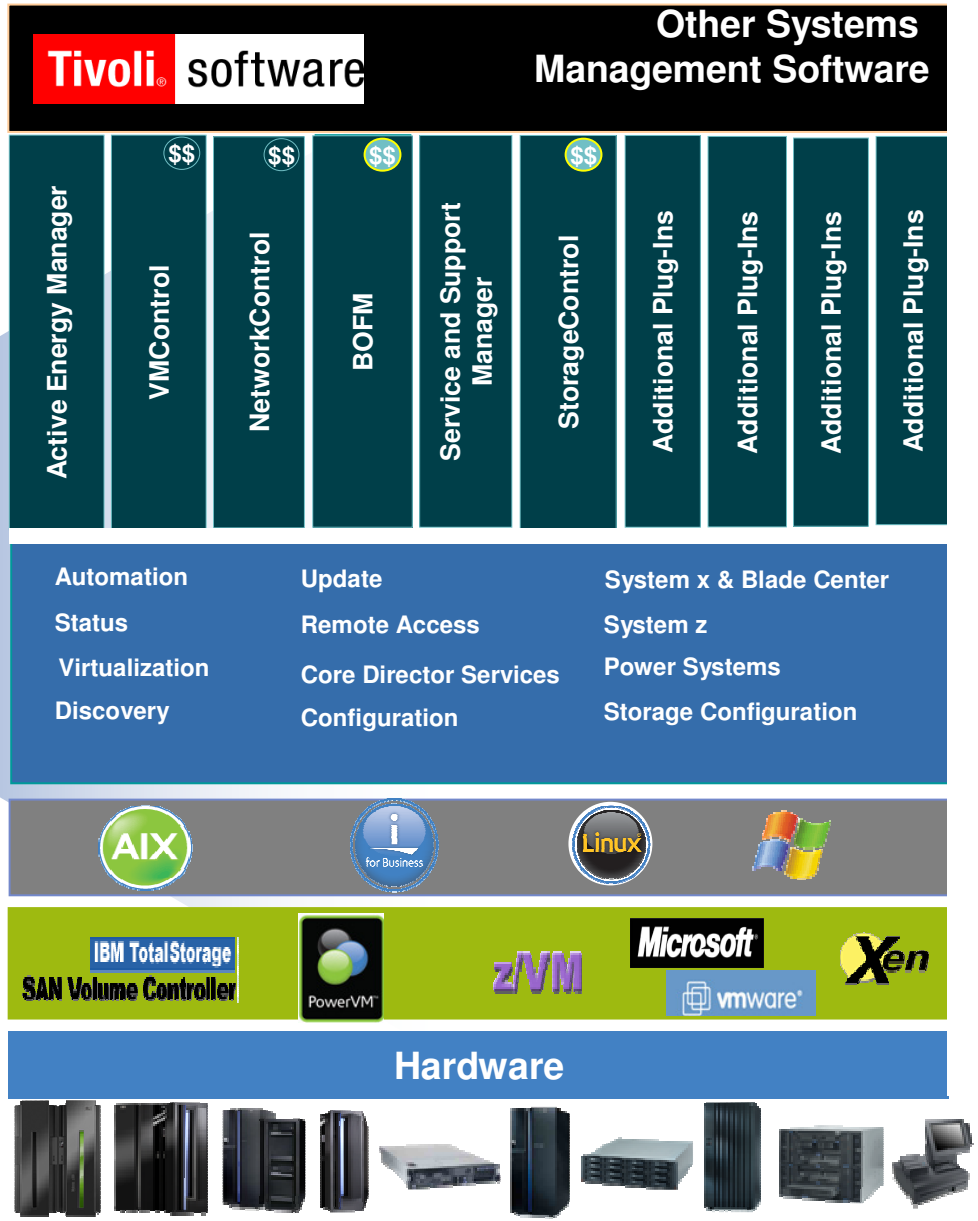
Move to production

- Consider fine tuning period
  - Adjustments may needed for the first productive period
  - Establish monitoring features to control productive behavior
  - Ask for help in early state of uncertainty

- Don’t start in highest workload period if possible
  - Start production in a time with lower workload to verify the setup
  - All levels should be measured to be able to act and to fine tune the solution

- Linux is production ready and a good planned solution positions the enterprise for dynamic growth and makes it ready for the future.

Easy Management, IBM Systems Director



Enterprise Service Management

Advanced Managers & Priced Plug-Ins

Base Systems Director Managers & Hardware Platform Managers

Resource Management

Managed virtual and physical environments

IBM and non-IBM hardware

What is IBM Systems Director VMControl?

VMControl encompasses virtual server lifecycle management, image management and resource pool management as an extension to IBM Systems Director.

IBM System x

Power Systems

System z

VMControl features:

- Discover virtual resources
- Display inventory and topology
- Monitor virtual resource health
- Relocate virtual resources
- Create and manage virtual servers
- Deploy and manage workloads
- Provision and manage virtual images
- Manage virtual resource pools

Using VMControl as an extension of IBM Systems Director it is possible to combine physical and virtual management in one management tool

IBM zEnterprise

The integration of System z and distributed technologies into a revolutionary combination

IBM zManager (URM)

- Unified Resource manager, unifies resources, extending System z qualities of service across the infrastructure
- Install, Monitor, Manage, Optimize, Diagnose & Service

IBM zEnterprise

- The industry's fastest and most scalable enterprise server
- Ideally suited for large scale data and transaction serving and mission critical enterprise applications

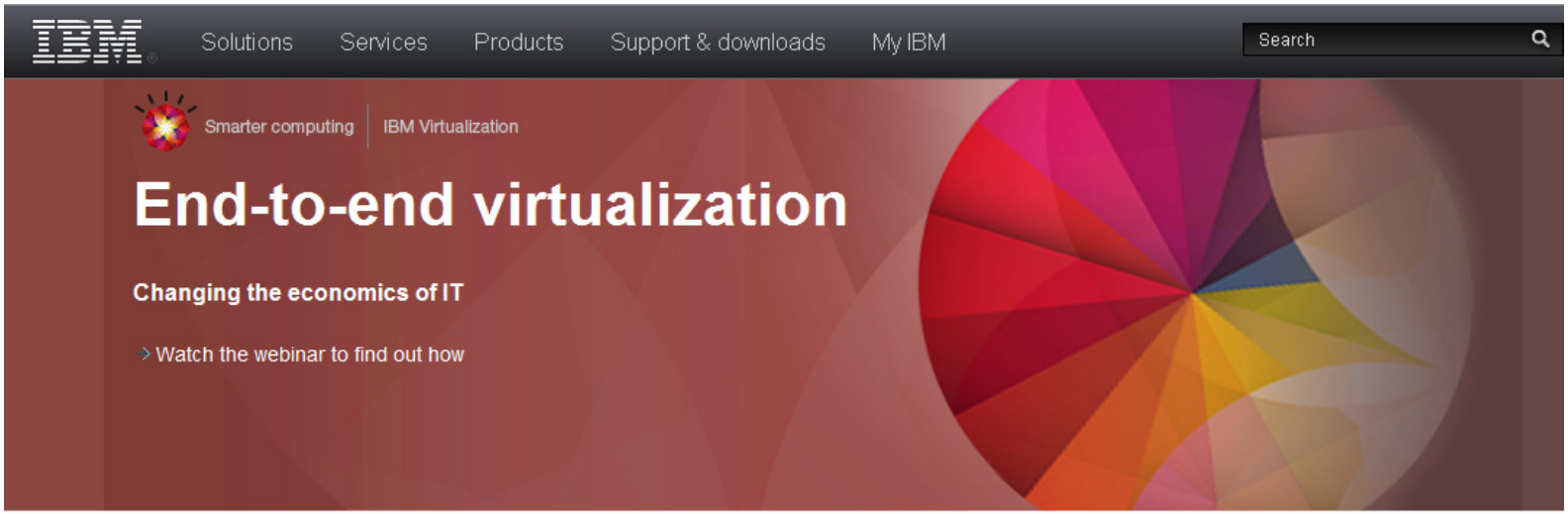
IBM zBX BladeCenter Extension

Application Server Blades

- Runs applications unchanged and supports what you know. Logical device integration between System z and distributed resources

Optimizers

- Workload specific accelerators to deliver significant performance and/or lower cost per transaction



Improve service levels. Keep costs low. Enhance flexibility. Simplify management.

You ask a lot of your IT infrastructure

The reality is that you need an IT infrastructure designed for data, tuned to the task and managed in the cloud. If your IT staff spends all of their time managing IT, they won't be working with you to drive innovation. You need your infrastructure to help you in the marketplace, to help you innovate, to help you be more competitive, to help you succeed.

Today, success demands agility. You need to adjust to changes in your business, from your customers, and in the world. IBM offers a range of virtualization solutions designed to help your business be more agile:

- Server consolidation and storage consolidation solutions with a choice of virtualization technologies to improve efficiency and reduce ongoing costs – do more with less
- Virtualization management solutions to make it easier for your IT staff to support the key business priorities
- Data center automation solutions to reduce management costs and make execution of key tasks more consistent
- Optimized cloud delivery solutions so that applications can quickly respond to the demands of the business

Contact IBM

Email IBM

Call IBM: **1-866-883-8901**
Priority code: **101KV05W**

IDC white paper

End-to-end virtualization: A holistic approach for a dynamic environment

Read the paper ›

Virtualization spotlight

Cloud Solutions (00:04:11)
Explore how IBM solutions can help you transition to cloud.

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More information on zEnterprise

- **IBM zEnterprise landing page:**
  http://www.ibm.com/systems/z/hardware/zenterprise/index.html
- **IBM zEnterprise 114 (z114):**
  http://www.ibm.com/systems/z/hardware/zenterprise/z114.html
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  http://www.ibm.com/services/us/gts/zenterprise/index.html
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  http://www.redbooks.ibm.com/portals/systemz

Questions?

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धन्यवाद
Hindi

多謝
Traditional Chinese

ขอบคุณ
Thai

Спасибо
Russian

Bedankt
Nederlands

Thank You
English

شكرا
Arabic

Merci
French

Obrigado
Brazilian Portuguese

Gracias!
Spanish

多谢
Simplified Chinese

Danke
German

நன்றி
Tamil

ありがとうございました
Japanese

감사합니다