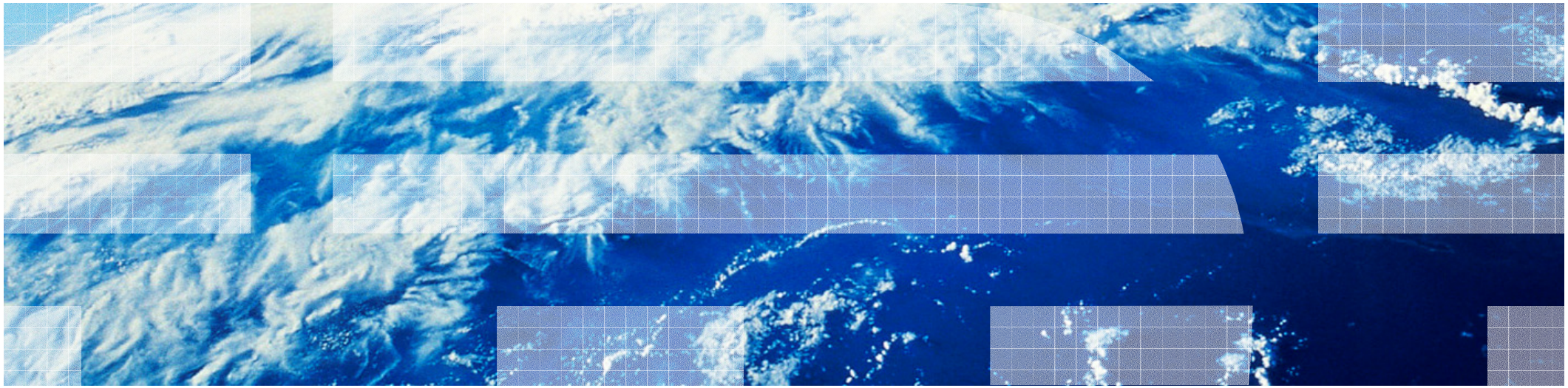
z/VSE and Linux on System z - inseparably more than a decade

Wilhelm Mild, IBM



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Once in the data center...
...not so long ago.

Customer Survey Results

- What platforms are currently installed (System z , distributed)?
  - We found an average of more than 3 *types* of platforms per customer. There are no "VSE customers", only "customers with VSE“
- Are you growing your VSE workload? How and Why ?
  - Yes, Core VSE applications are mostly alive, well, and growing
- Will you move *some* VSE workload to another platform?
  - Customers are both:

    - growing core VSE applications and

    - implementing Replacement Apps on a variety of platforms

UNIX is often the platform of choice for new applications

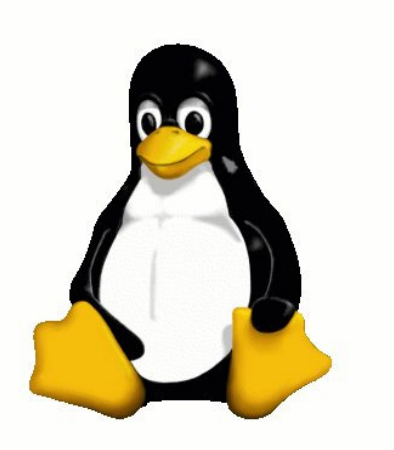
Searching for a UNIX Platform for VSE

Requirements:

- ✓ a UNIX-like extension for VSE/ESA customer
- ✓ cost effective
- ✓ without prerequisites
- ✓ easy to integrate
- ✓ not proprietary

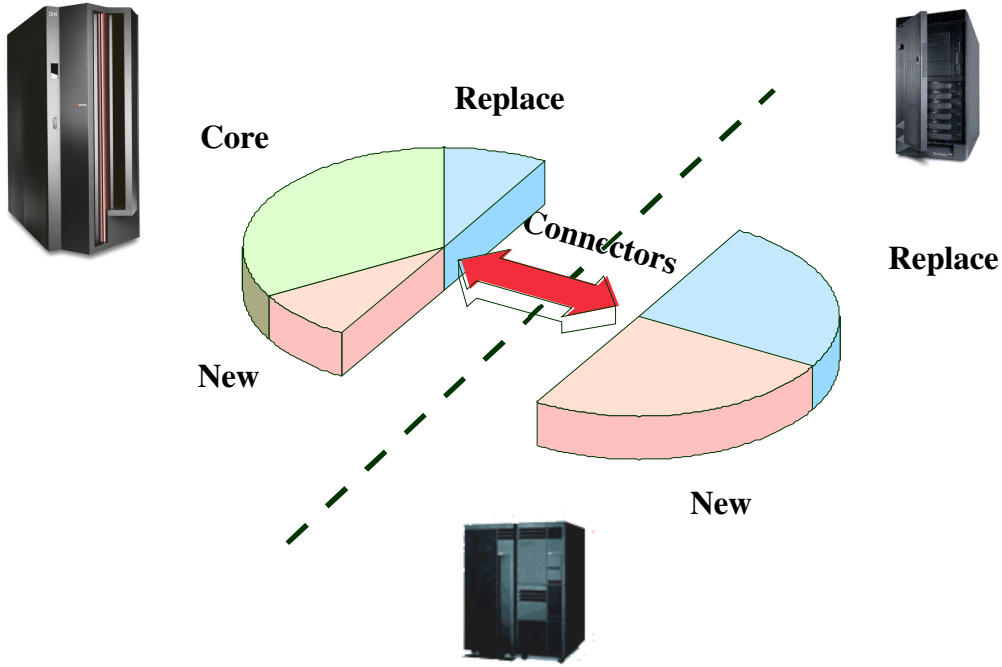
z/VSE – felt young - looking for a good-looking trusted partner

The solution found was Linux for System z



- the UNIX Extension for VSE customers
- born from within the VSE development team

Goal: Integrating z/VSE with hybrid Environments



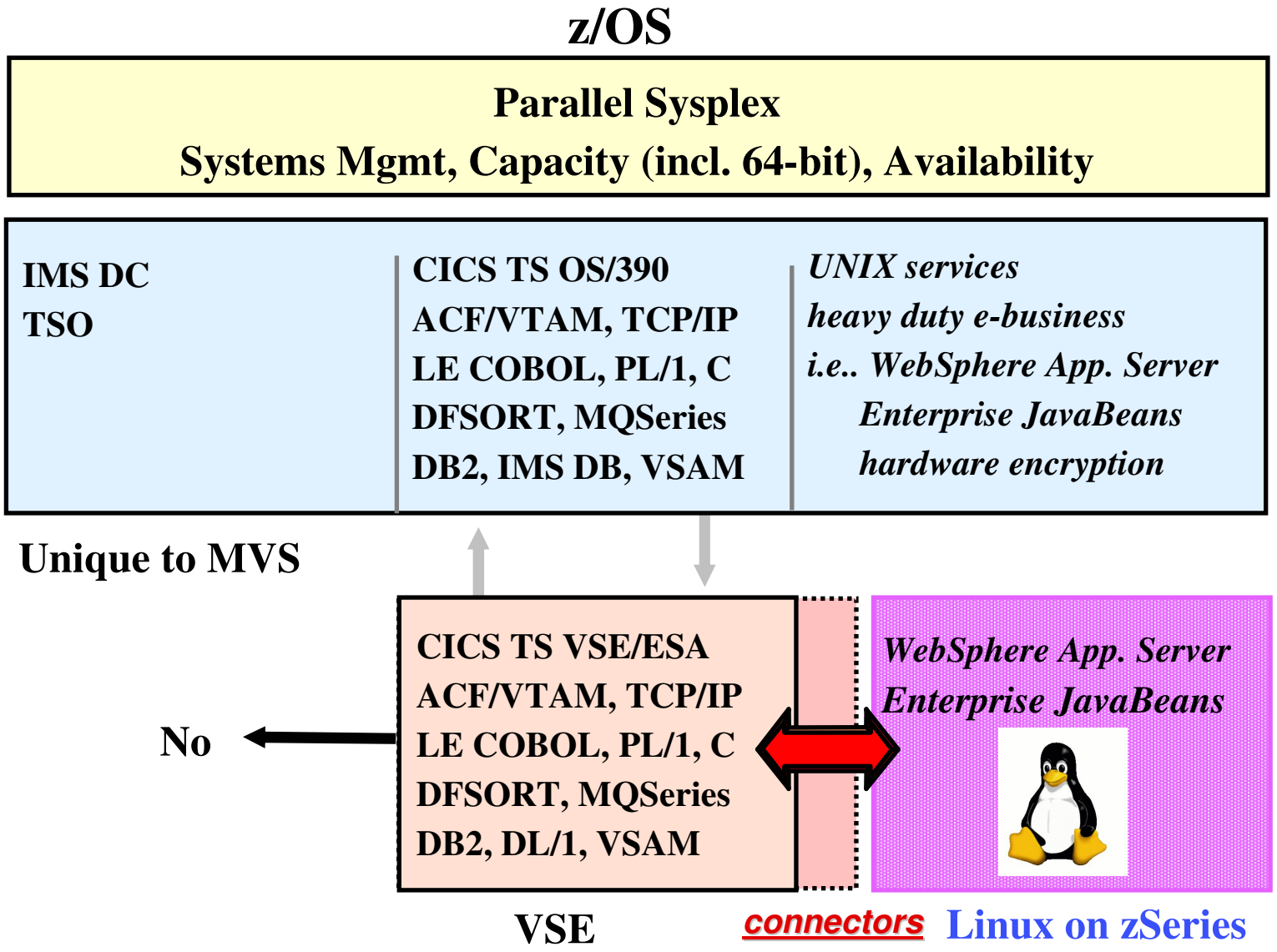
Timeline – 1999

- **January**
  - A splinter group begins work on a Linux on S/390 project in Böblingen, Germany. Their work is neither sanctioned nor budgeted and most likely cannot be found on any official charts.
- **October**
  - Embracing Linux at IBM became Sam Palmisano's bet while he was a senior vice president. "*The Internet has taught us all the importance of moving early, the advantage of being a first-mover*," Palmisano said in an interview. "*We want to be riding that Linux momentum at the front, not trailing it*."
  - First public discussion of IBM's Linux for S/390 port at WAVV by Dr. Strassemeyer in his keynote address with a "secret" preview running on an IBM MP3000
- **December**
  - IBM publishes a collection of patches and additions to the Linux 2.2.13 kernel for System/390 to start a market evaluation, and creates excitement in the developer community.

Linux and Mainframes – Worlds colliding?
The Year 2000 Picture

Linux	Mainframes
ASCII	EBCDIC
VT Terminals	3270 Terminals
Controller-orientiented I/O Paradigm	Abstract I/O Subsystem
Commodity Hardware	High-End Server
'as is'	High Quality
Open Source	Proprietary Source

Extending VSE/ESA with Linux for zSeries

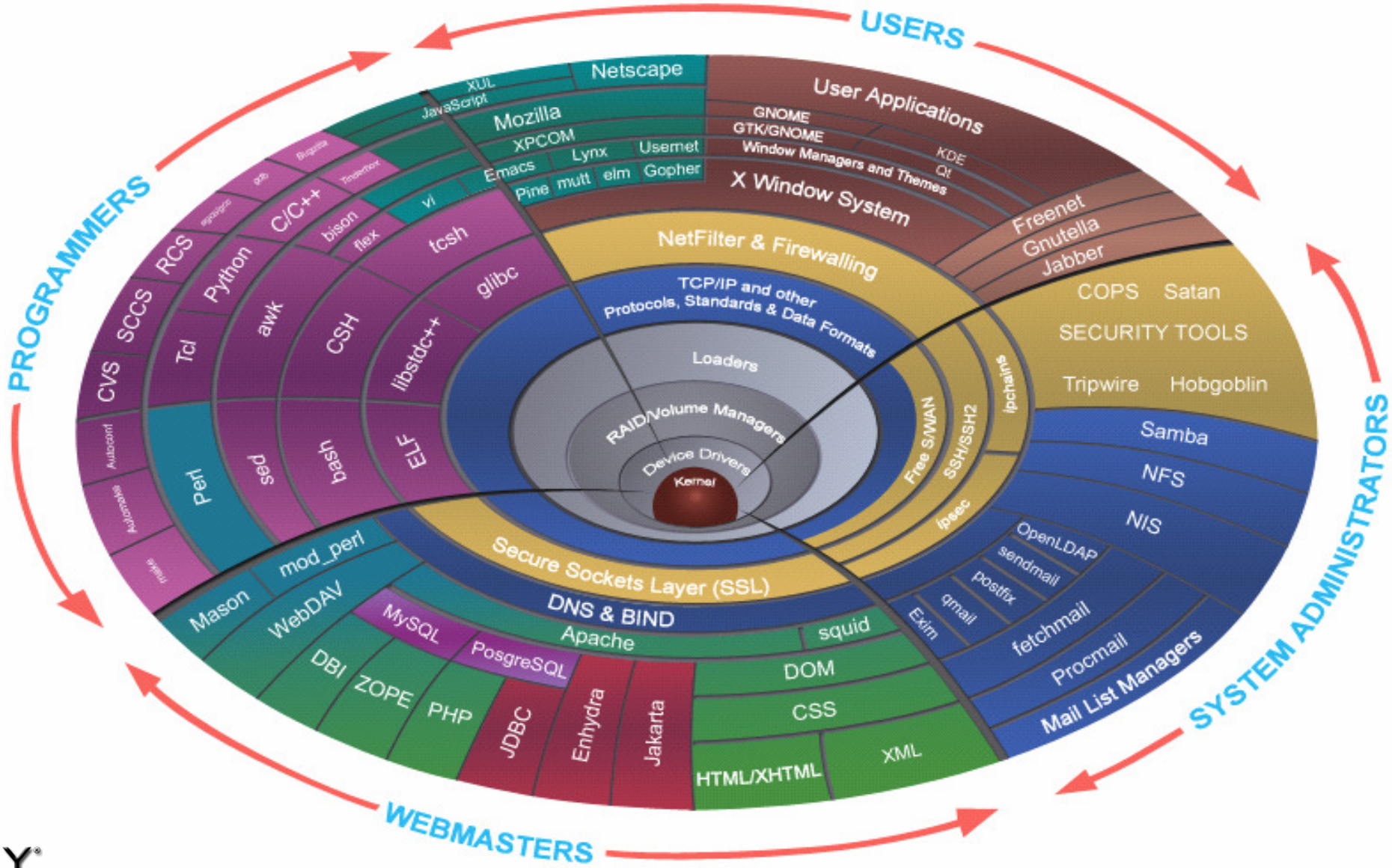


What is Linux on System z?

- „Linux“ actually consists of
  - Linux: the Operating System kernel
  - System Environment, Libraries, Tools, Utilities, Applications: many of them GNU GPL-based
  - Distributions provide lots of application/tools packages

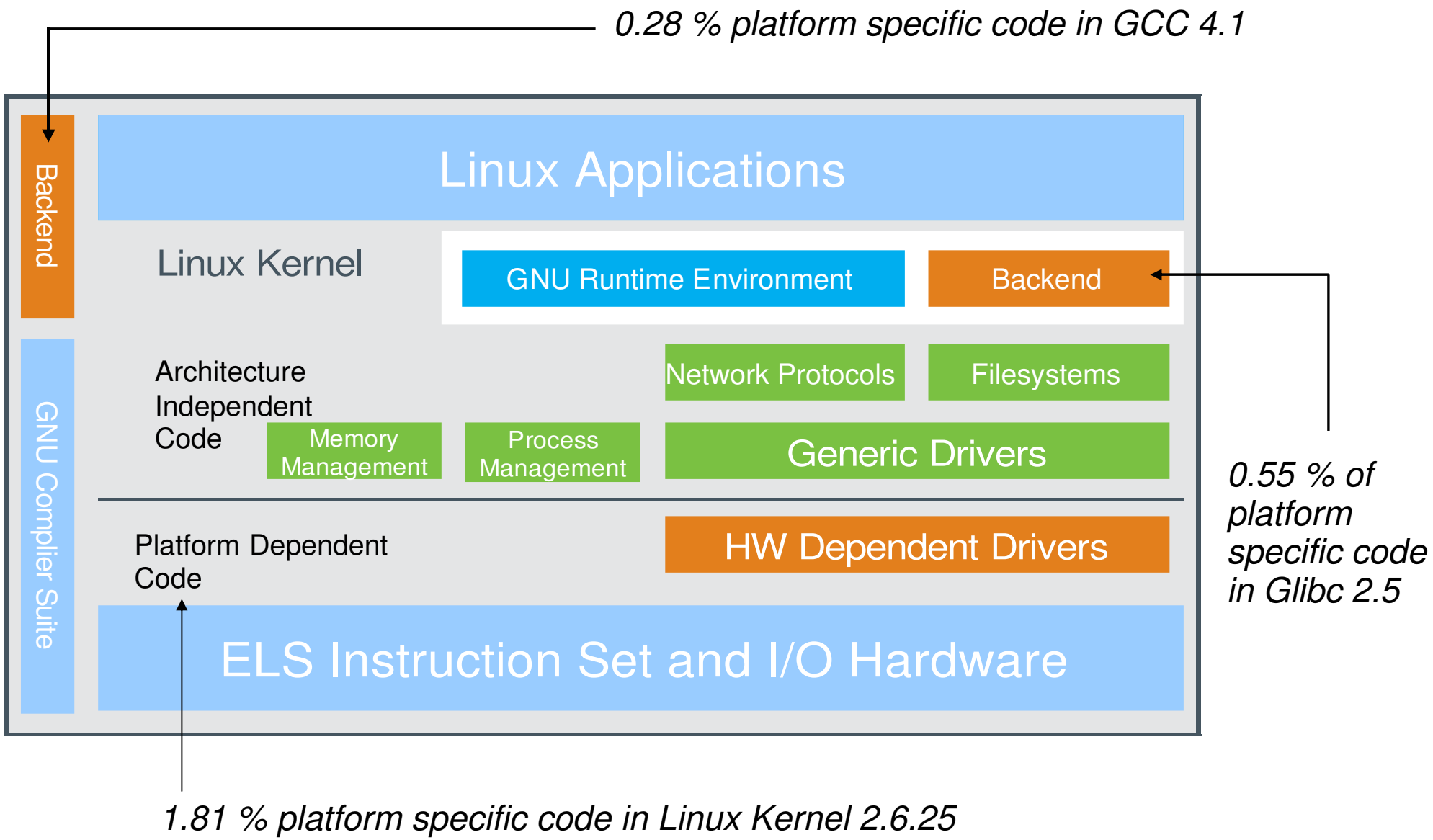
- Linux on System z
  - „Plain original Linux“ – tastes, smells, … like Linux
  - Runs in LPAR and under z/VM
  - Takes advantage of System z platform and System z-specific enhancements
  - Developed and „maintained“ in Böblingen

What is in a Linux distribution?



O'REILLY®

Platform Agnostic and Platform Specific Code Decomposition



Innovation, Vision and Strategic Direction

"Linux will do for applications, what the Internet did for networks"

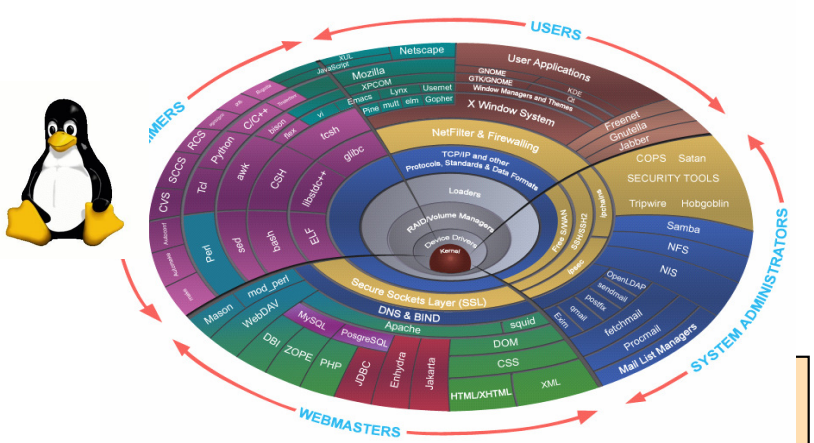
Irving Wladawsky-Berger

z/VSE Strategy:
Modern Solutions leveraging z/VSE, z/VM and Linux on System z

Protect existing VSE investments

Integrate using middleware and VSE connectors

Extend with Linux on IBM System z technology & solutions



Linux on Sytem z

Tivoli Identity Mgmt, TSM, IRMM, Print Serving, DNS, Firewall, etc.

Linux on System z

WebSphere Appl Server, Java, CTG, HOD/HATS, WS MQ, etc.

Linux on System z

DB2 LUW (64-bit)

Connection via HiperSockets

z/VSE Production Environment
+ TCP/IP
+ VTAM
+ CICS TS
+ VSAM
+ COBOL
+ DB2 client
+ LDAP client

z/VSE Test/Dev Environment

z/VM (LDAP server/RACF) | **z/VM or LPAR** | **z/VM or LPAR**

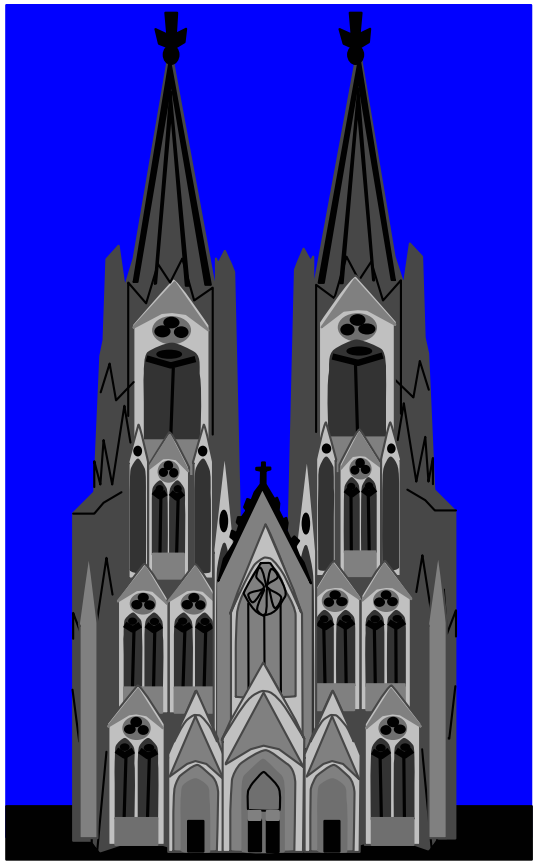
IFL Engine(s) | **CP Engine(s)**

IBM System z

Worlds Colliding – development style ?

- Established development process: Cathedral-Style

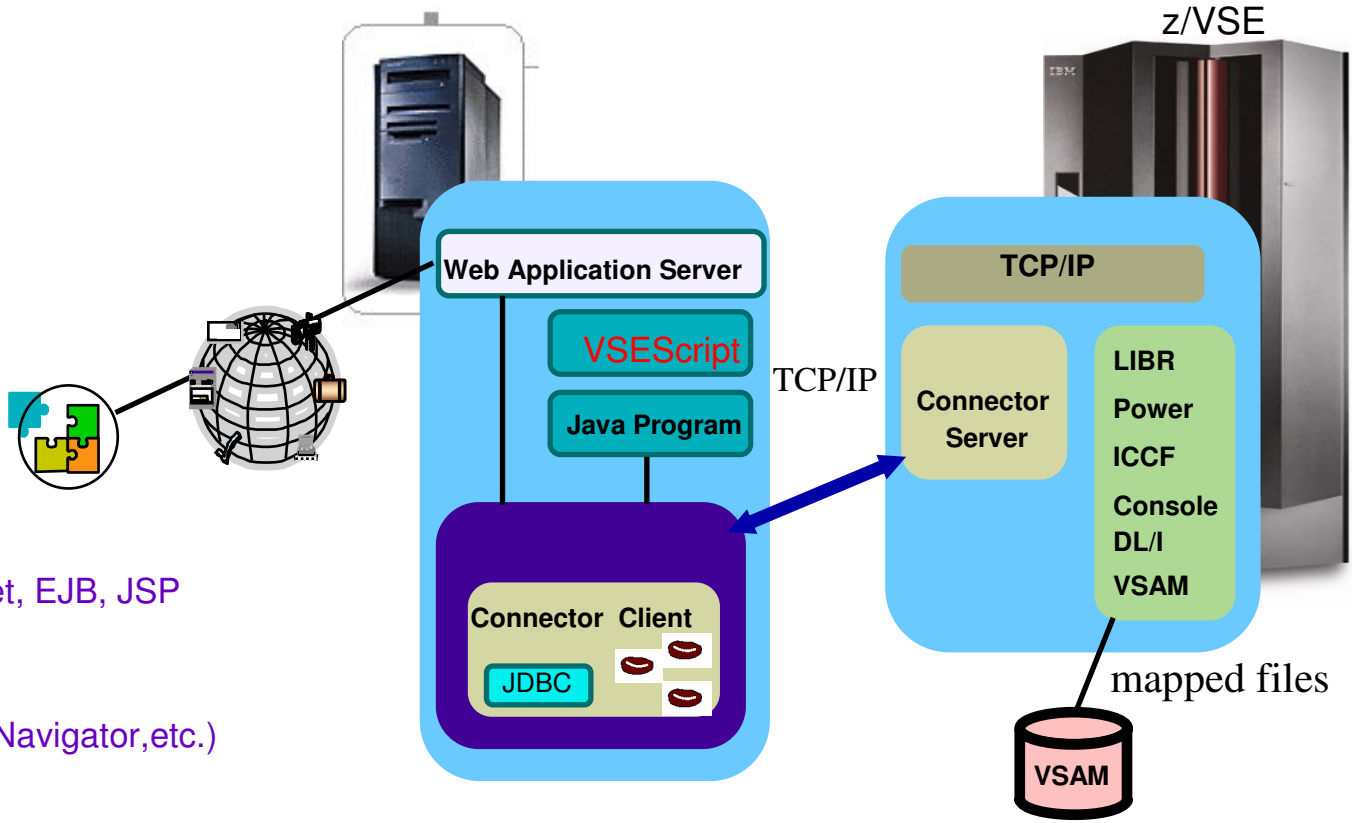
  Well defined scopes and time to deliver



- A different Culture: Bazaar

  Open Source
  flexible (re-) organization
  dynamic processes
  many tasks in parallel
  design by participants
  little control

Real time access to z/VSE resources using the Java–Based Connector and Websphere (WAS)

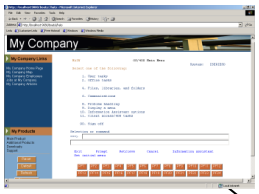


- HTML
- Java applet, servlet, EJB, JSP
- JDBC
- VSEScript
- specialized tools (Navigator,etc.)

- ►real time access to VSE resources from remote systems
- ►new possibilities for leveraging the VSE investment

Development 1: z/VSE access from Java

Leverage VSE resources and data using VSE Connectors on Linux on System z



Linux on System z

WAS

VSE Connector Client (Java)

VSE-supplied VSAM client

(no additional charge)

Connection via HiperSockets

z/VSE Production Environment

+ CICS
+ TCP/IP
+ VSAM
+ COBOL
+ DB2 Client
+ VSAM Redir.

VSAM

z/VSE Test Environment

+ CICS
+ VSAM
+ COBOL

z/VM

LPAR or z/VM

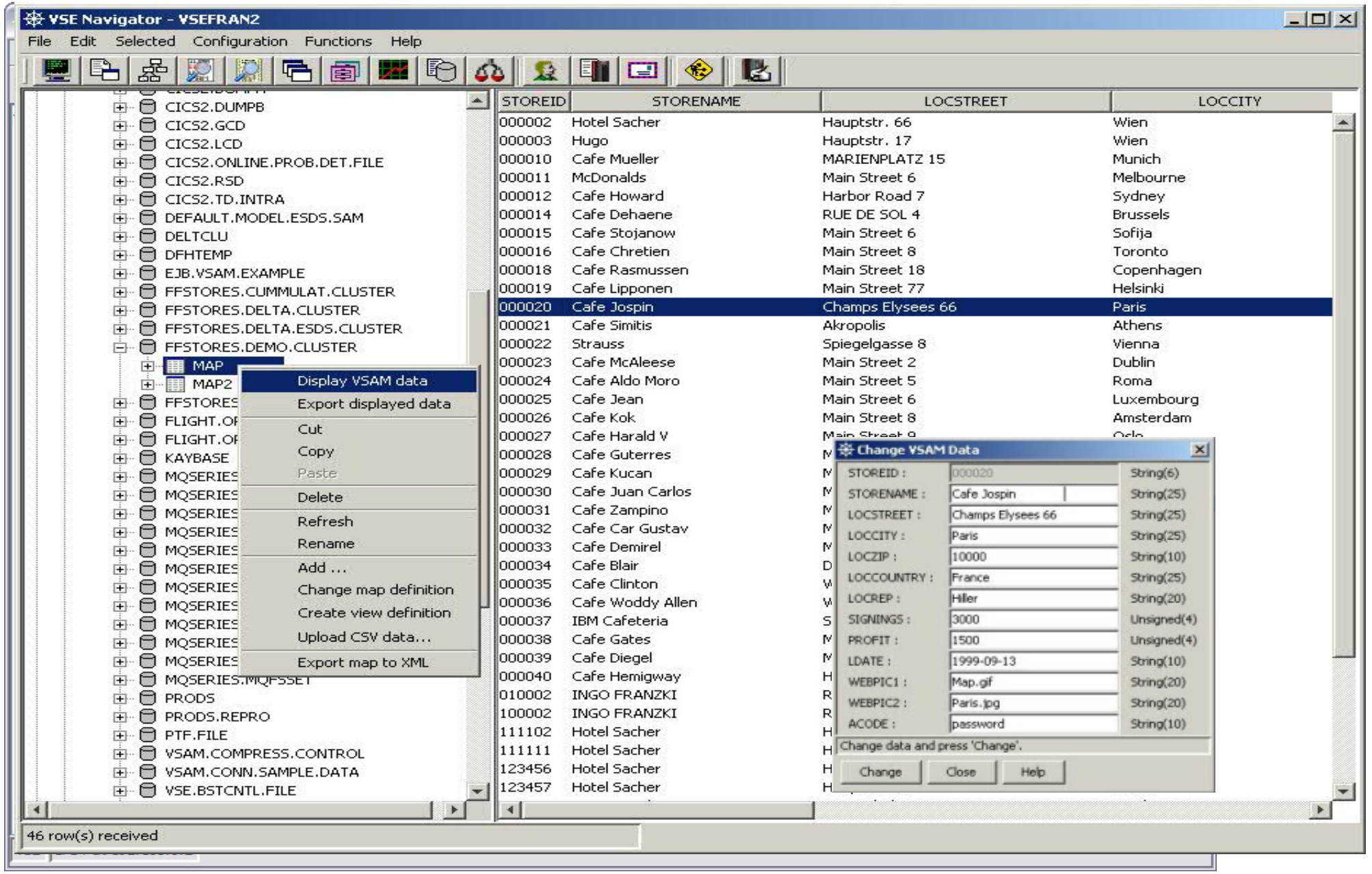
LPAR or z/VM

IFL Engine (s)

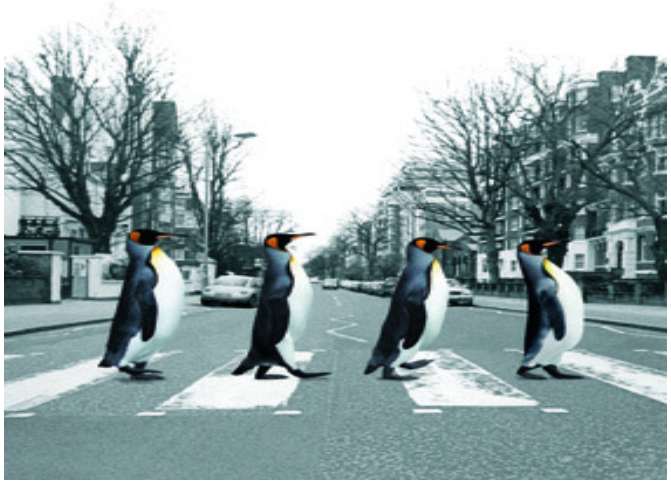
Standard CP Engine (s)

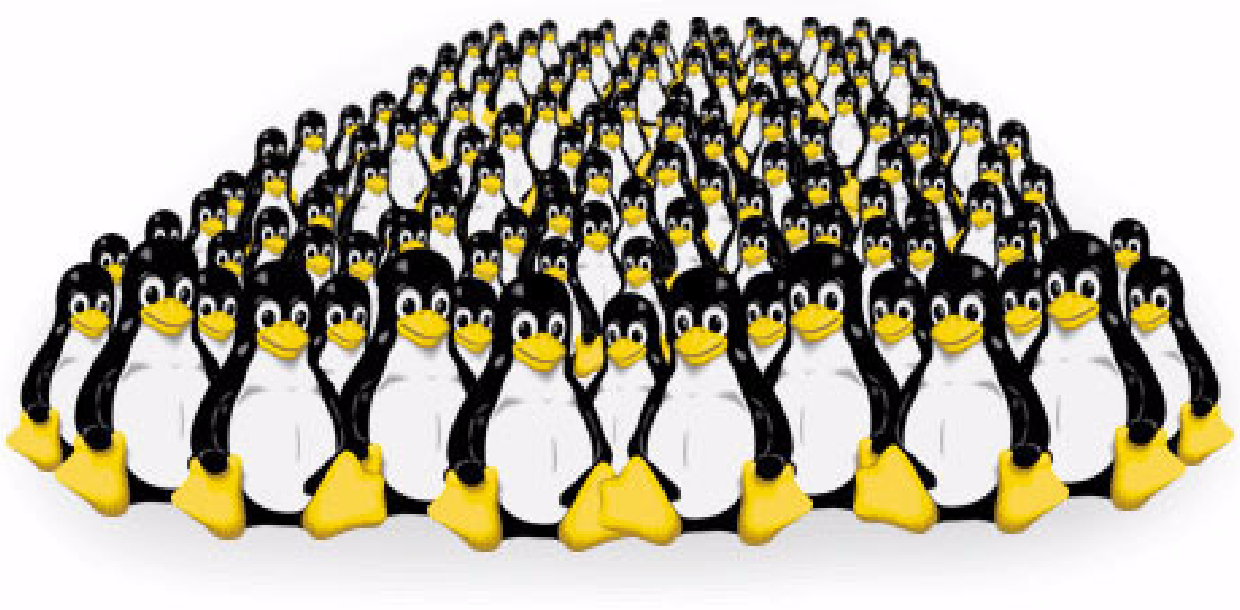
IBM System z

z/VSE Navigator: Graphical interface to z/VSE



Penguins got proud !
…….. And started multiply like Rabbits .





Virtualization with new dimensions

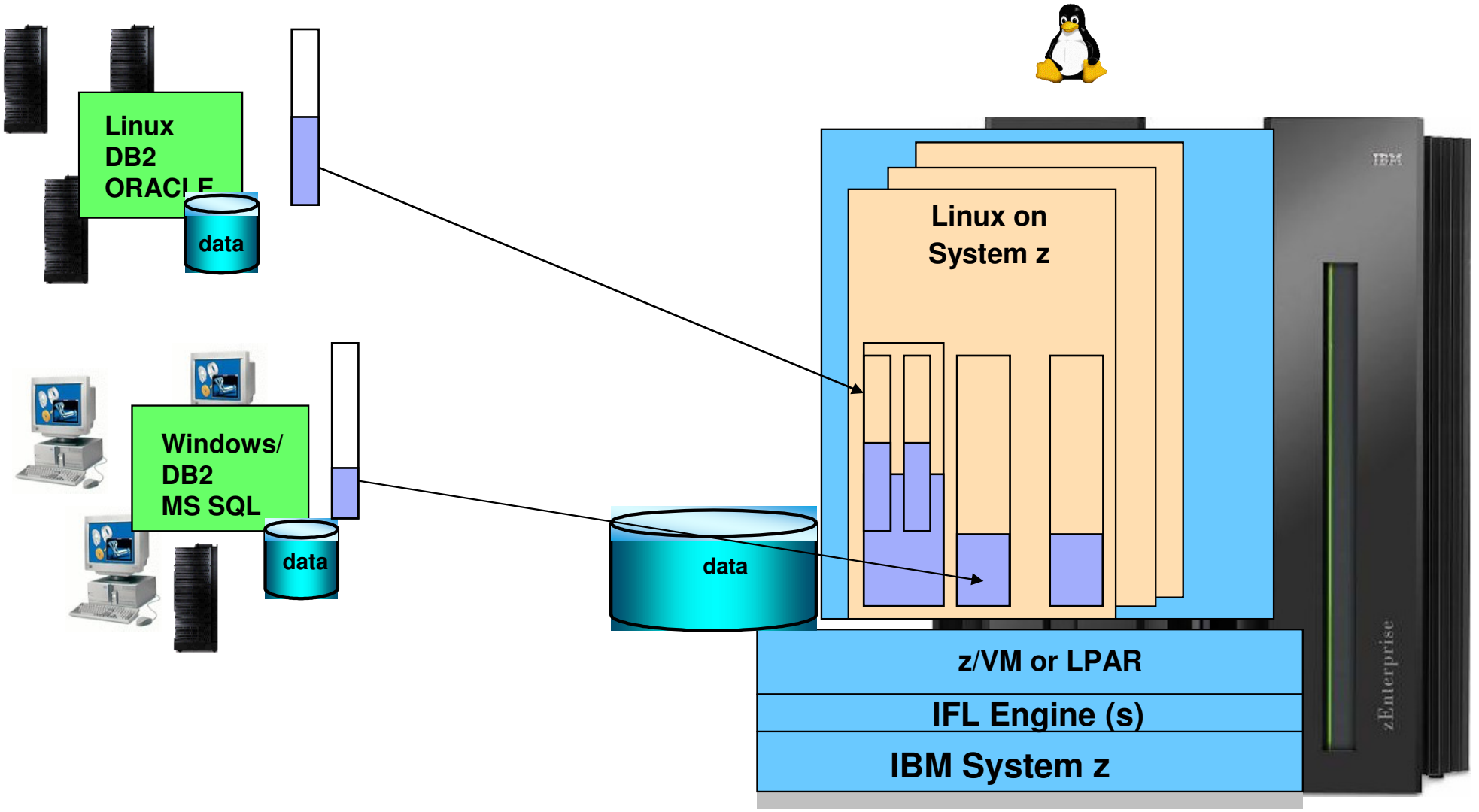
The Economy of a high-end Linux Server

“Green” penguins benefit from the IBM System z platform strengths

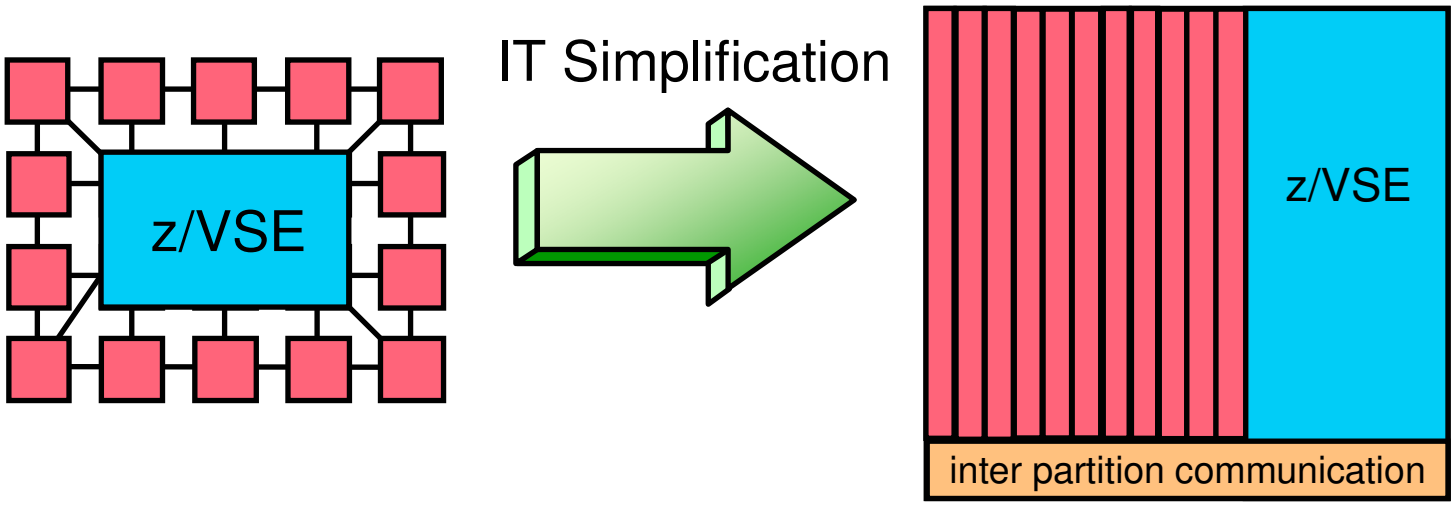
The differences are quantum – many small houses versus a large building.

Linux on System z as workload concentrator

Virtualize, Consolidate, Integrate



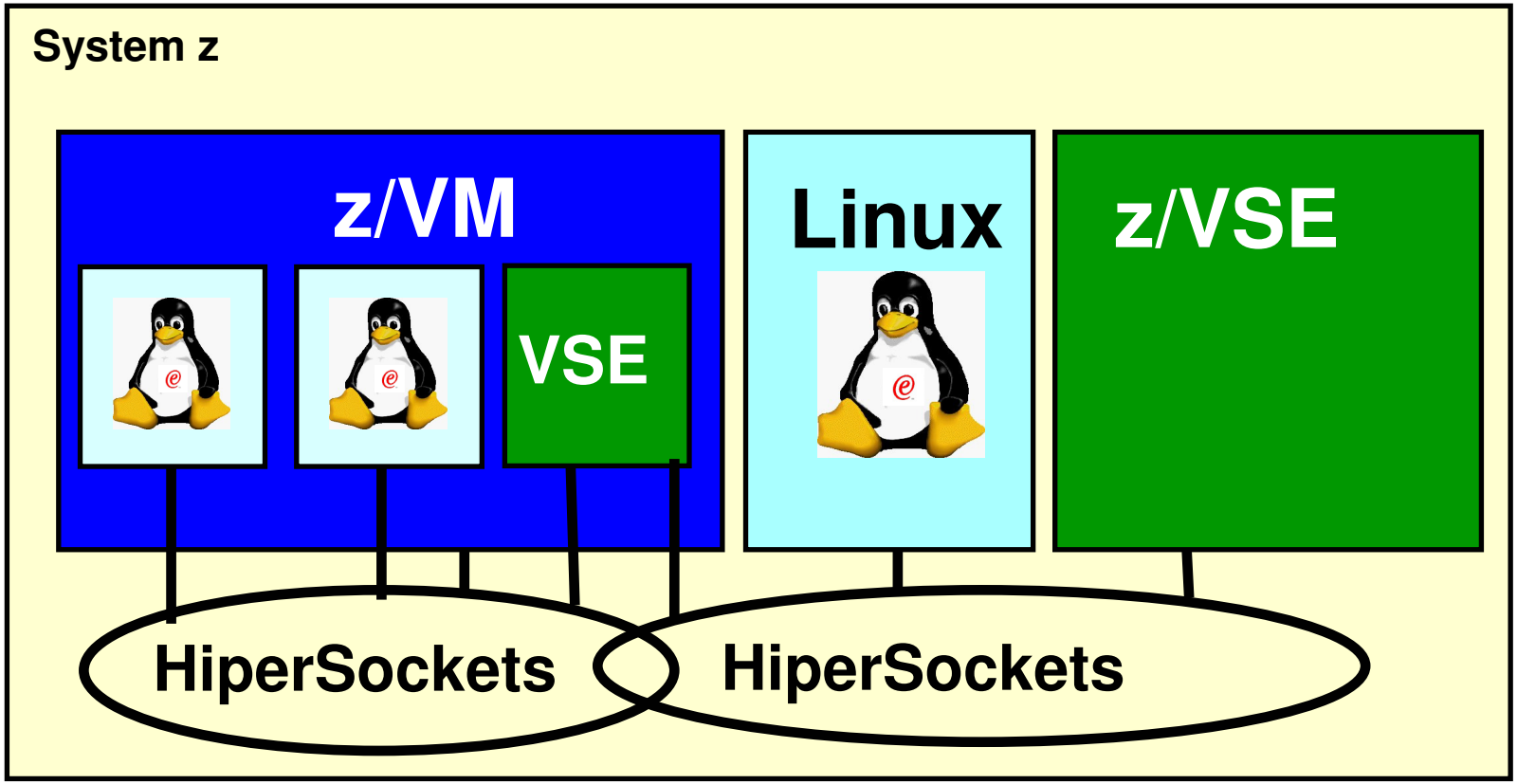
Consolidation of workload Linux on System z



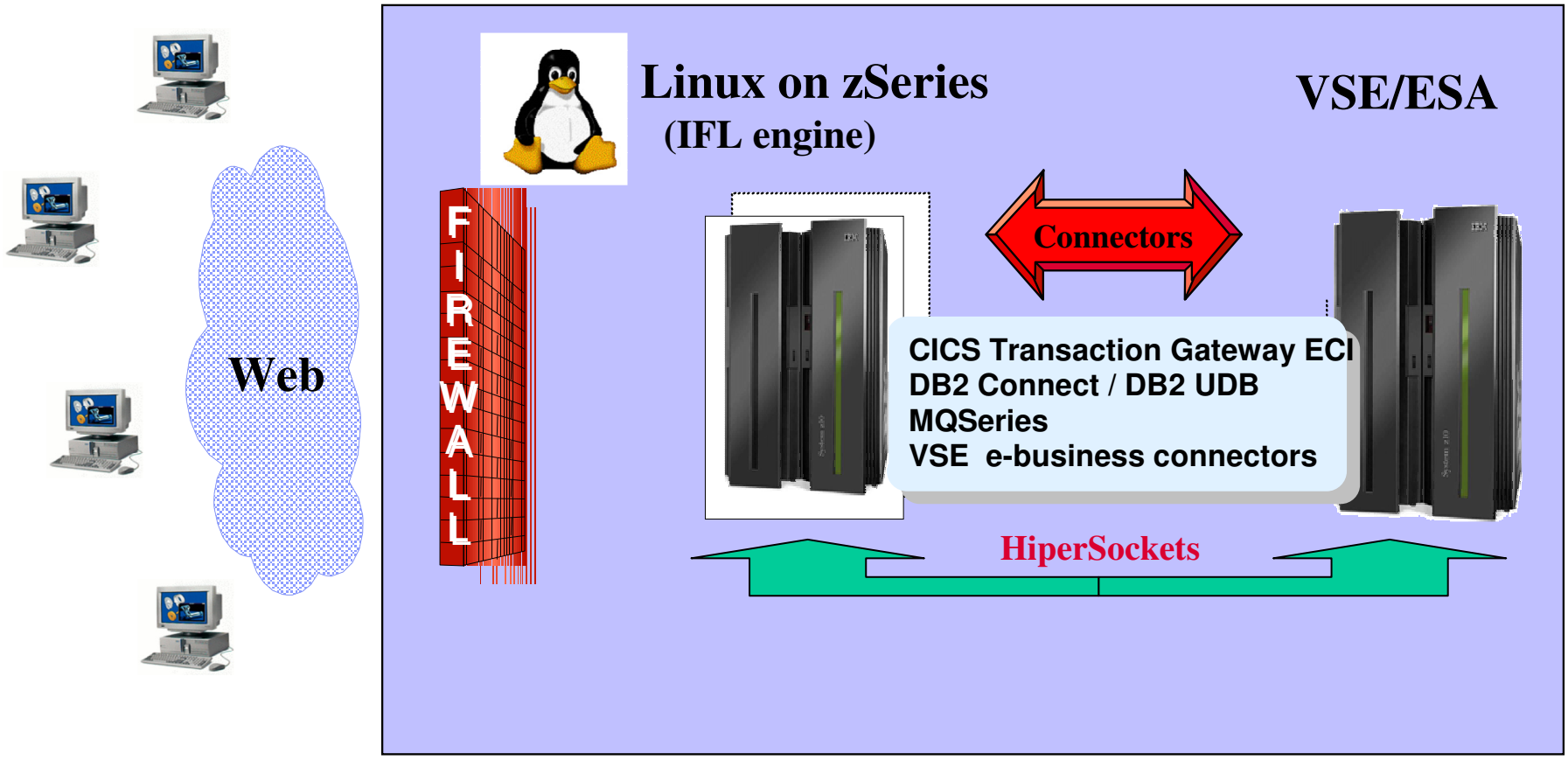
For z/VSE customers, Linux on System z opens new horizons:

- A big variety of standard applications
- The integration of existing applications and data using e-business Connectors
- Modern, scalable new solutions

System z – designs the internal network,
Hipersockets - the Network in the box

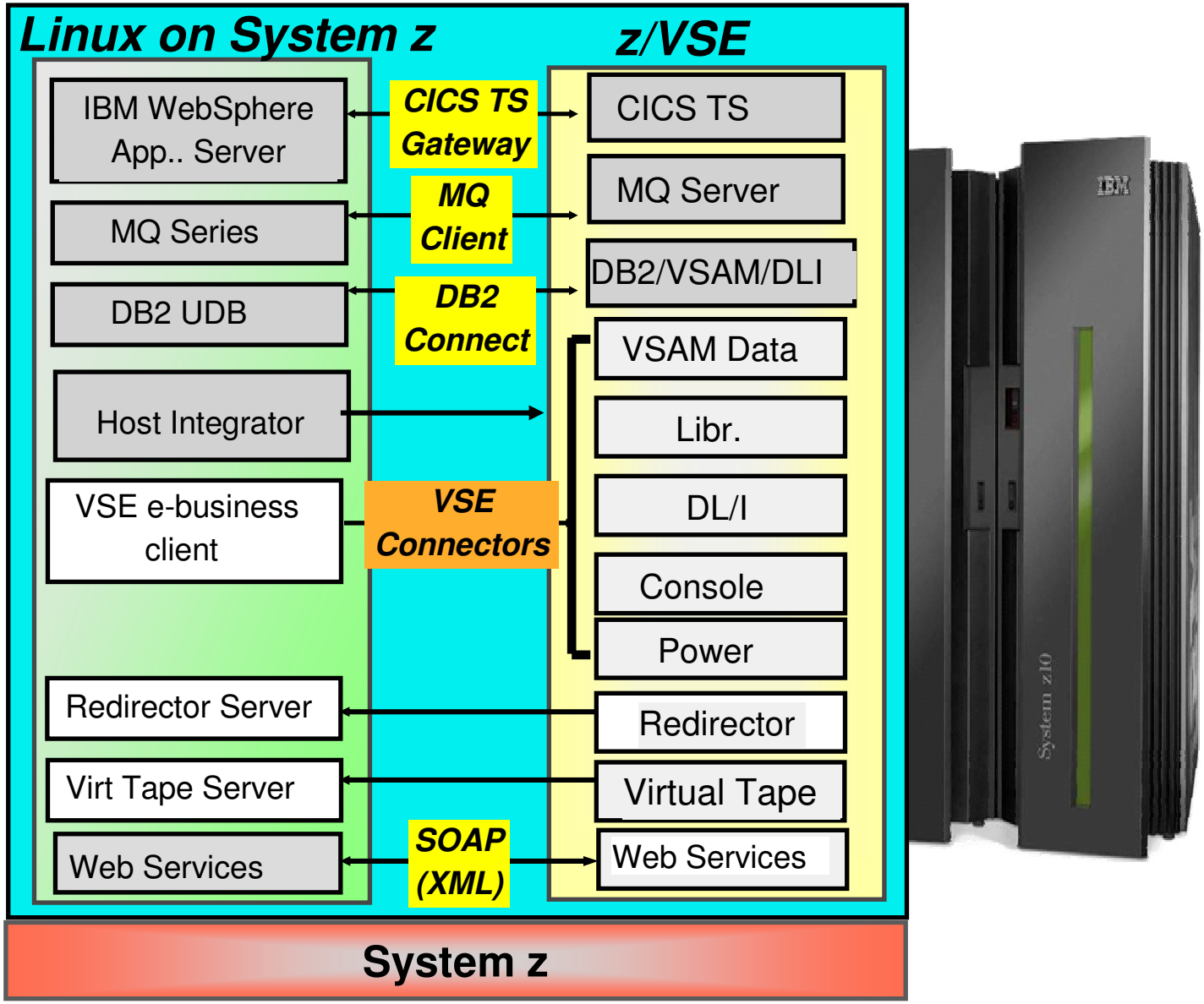


Integration von VSE/ESA mit Linux for zSeries

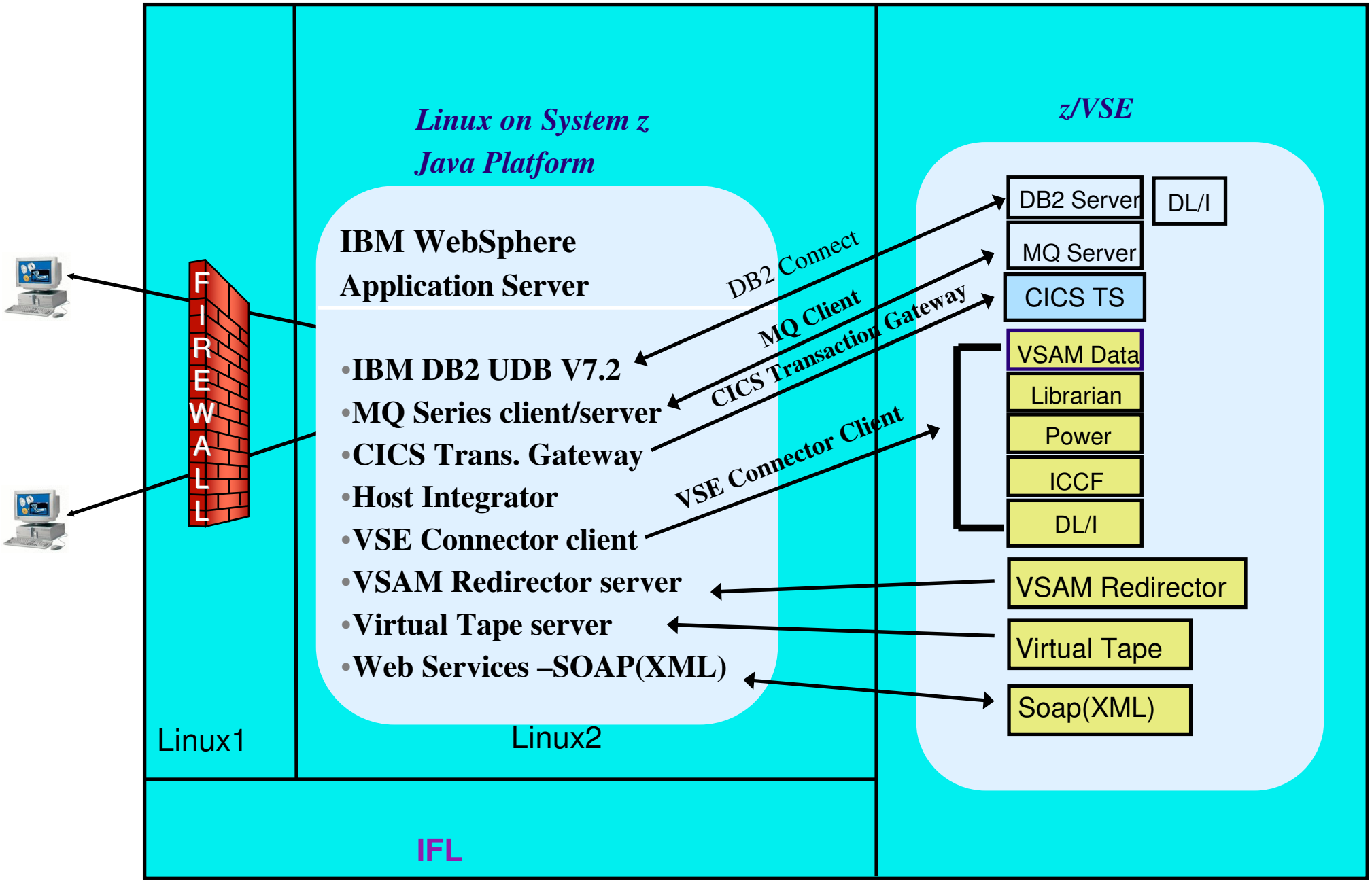


Linux Connector Middleware Relations to z/VSE

- Modern Applications with Linux on System z
- Most modern technologies interact with z/VSE
- Modernized IT infrastructure with heterogeneous workload

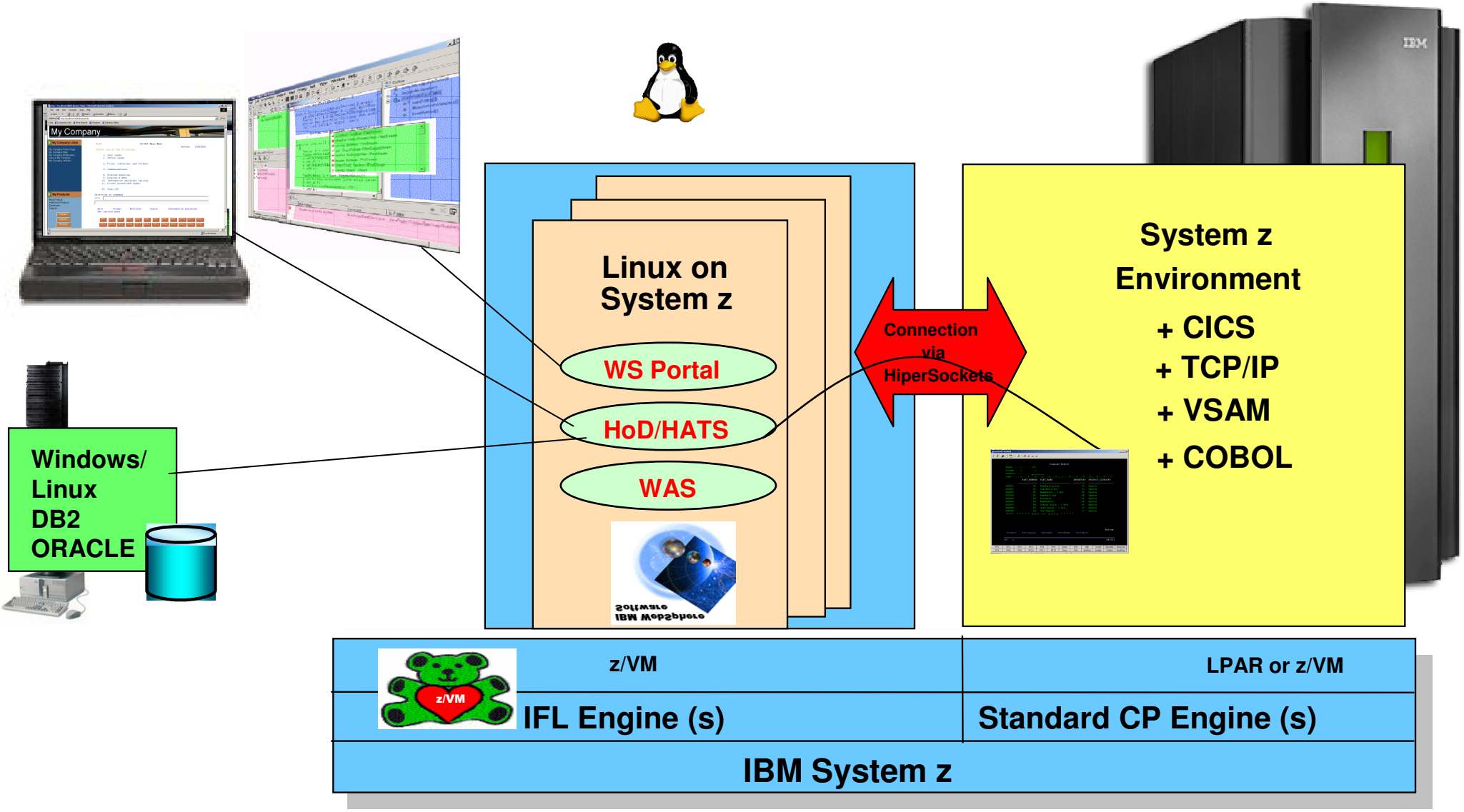


Connectors to z/VSE

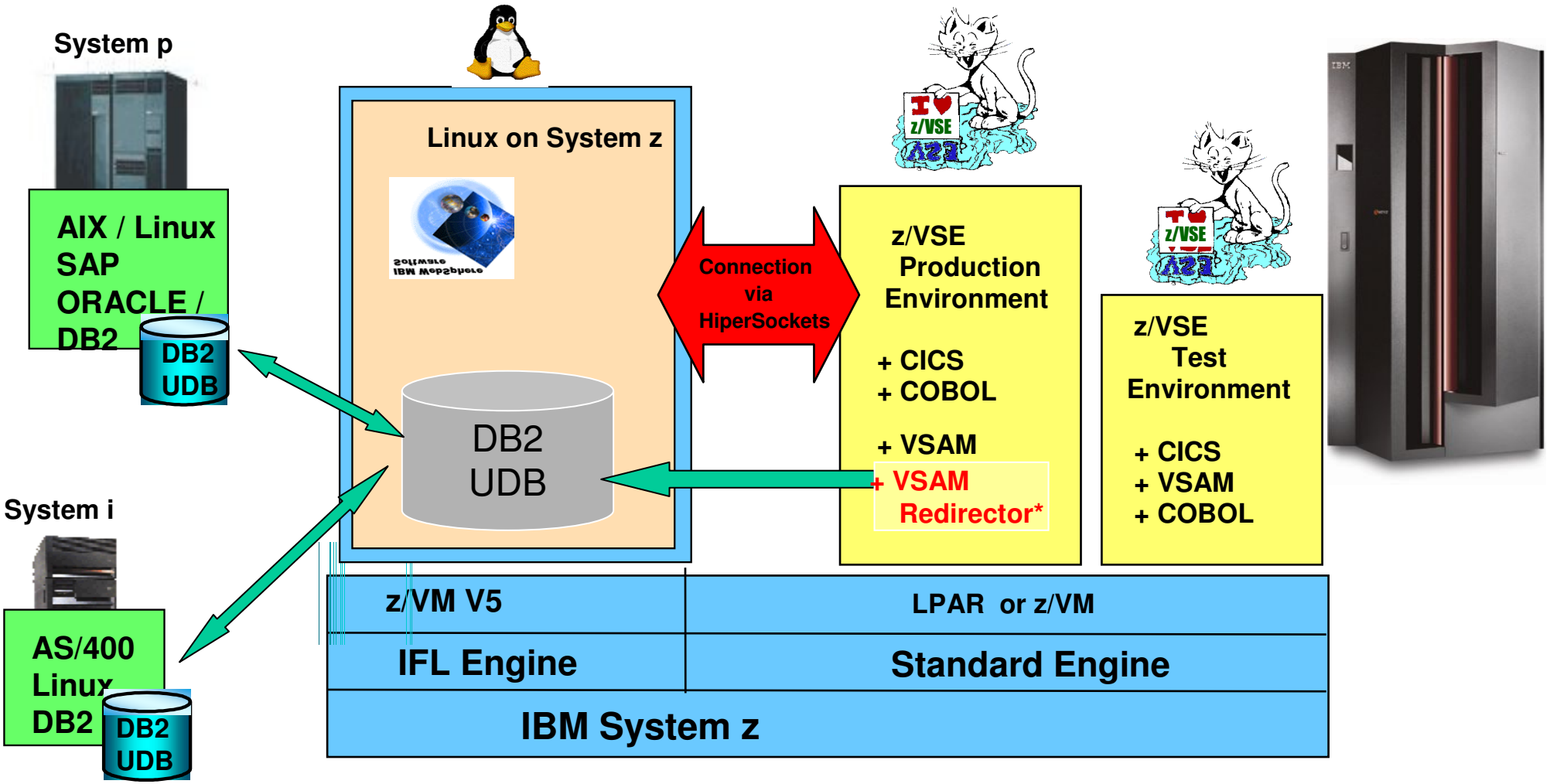


Linux on System z as Enterprise Access point

Web enable, improve interface, simplify, extend existing applications

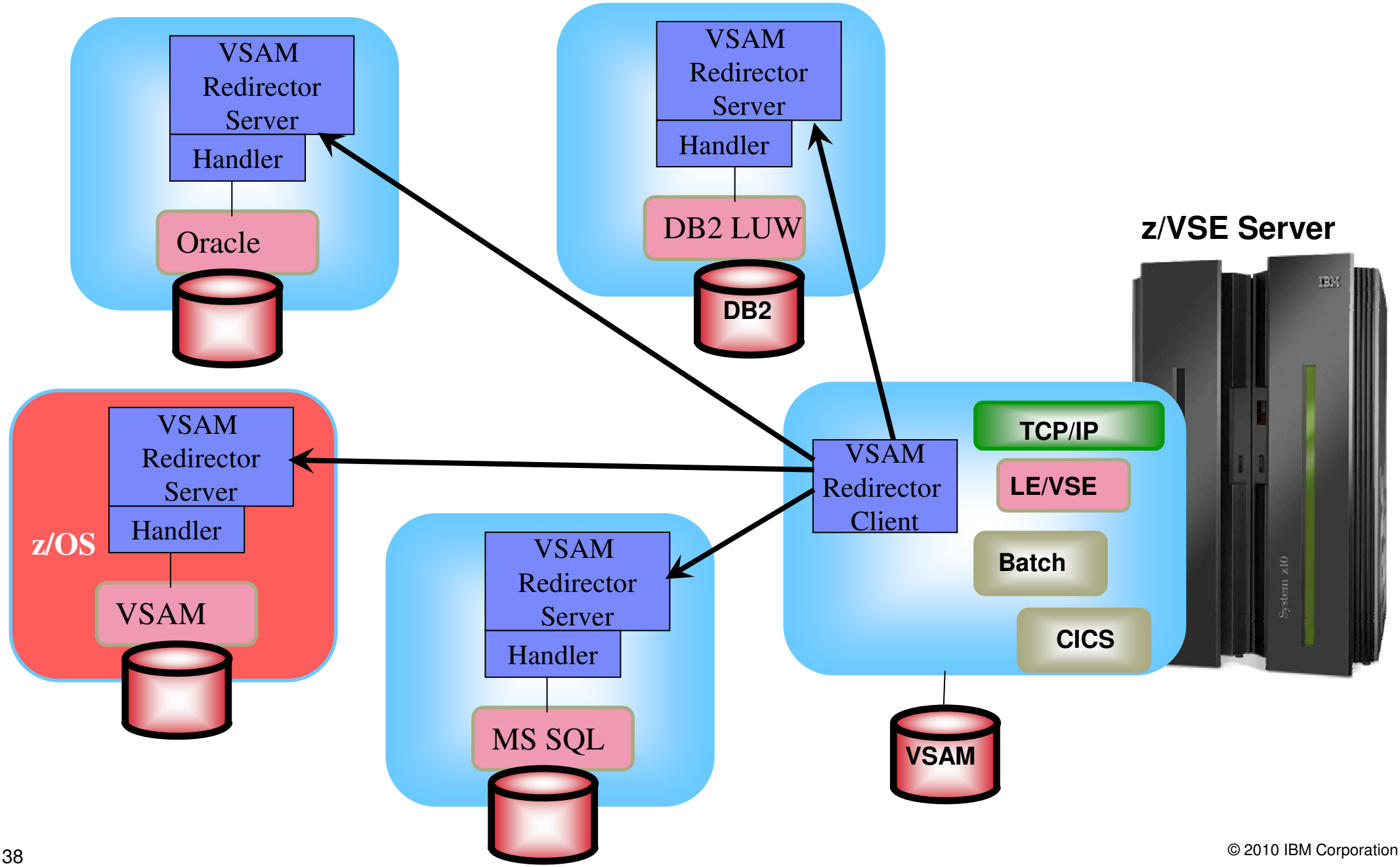


Transparent access of VSAM Programs to DB2 UDB on Linux on System z



(*) VSAM Redirector – Common data store solution – with DB2 on Linux on zSeries Solutions without changes to VSAM programs

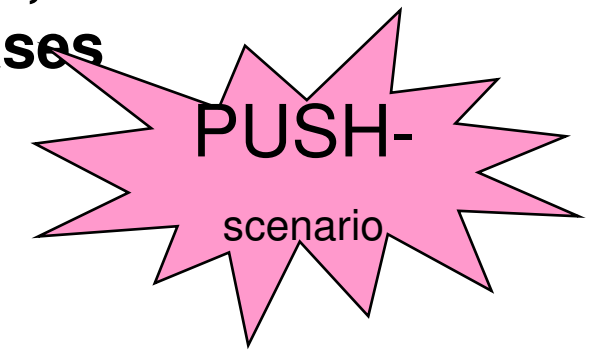
VSE/VSAM applications, access remote relational databases

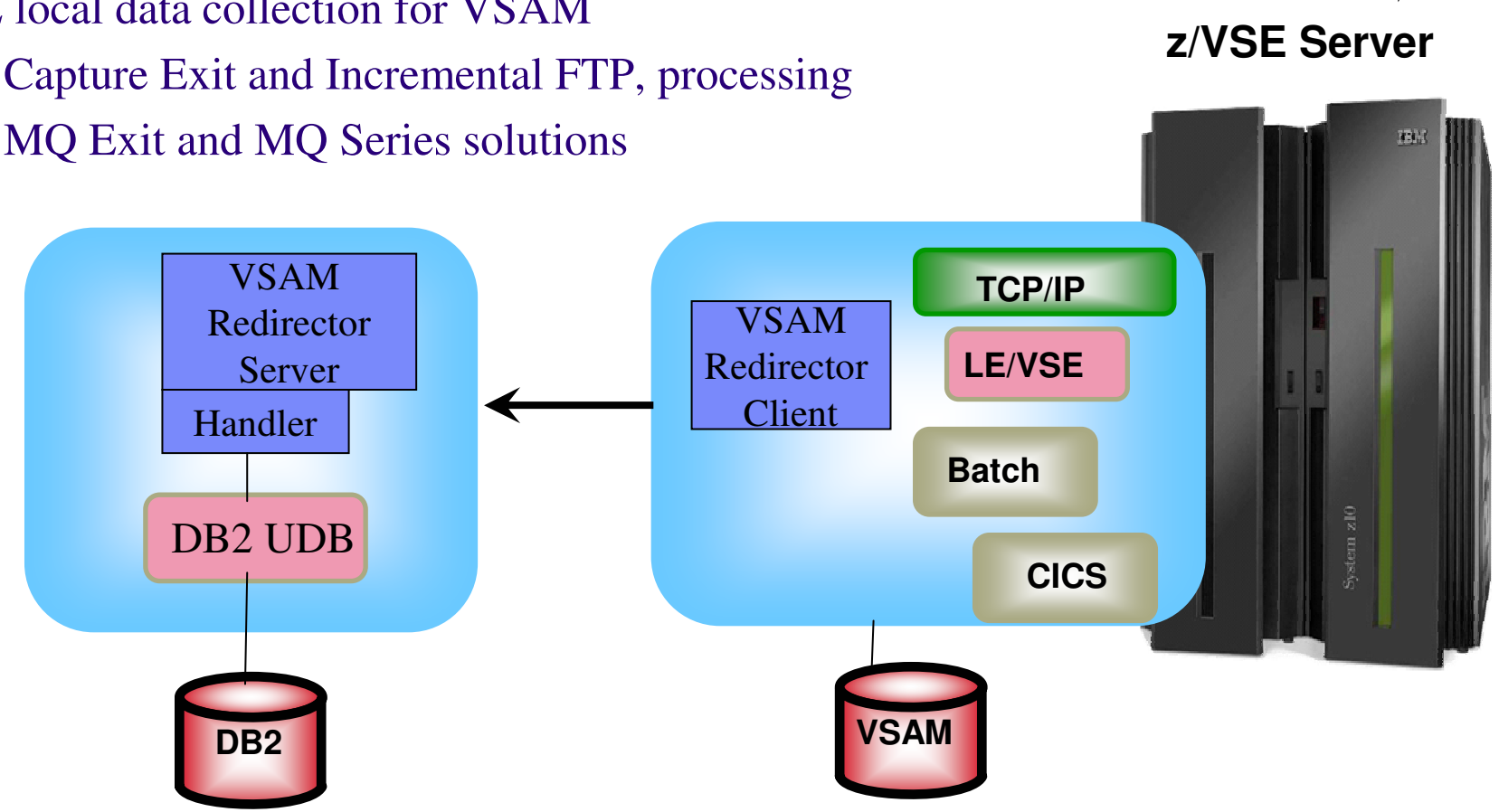


PUSH scenario: VSE/VSAM applications, access remote relational databases

(1) Real time access VSAM to relational databases
   a) synchronization (two phase commit of VSAM and DB2)
   b) Real time access to DB2 (no VSAM access anymore)

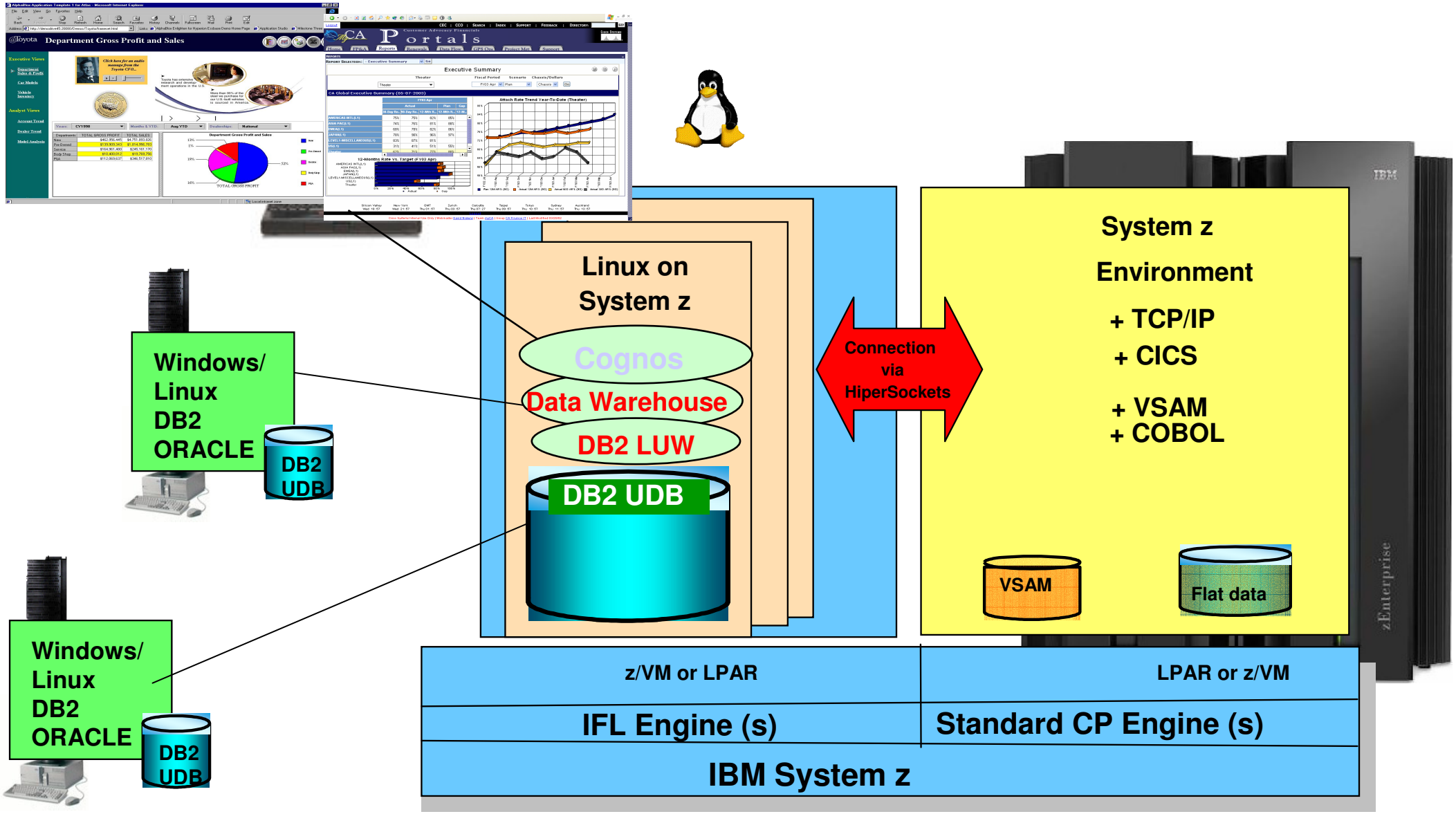
(2) VSE local data collection for VSAM
   a) Capture Exit and Incremental FTP, processing
   b) MQ Exit and MQ Series solutions





Solution: Linux on System z as data hub

Consolidate, Integrate, Evaluate, Decide, Base for Business Intelligence (BI)



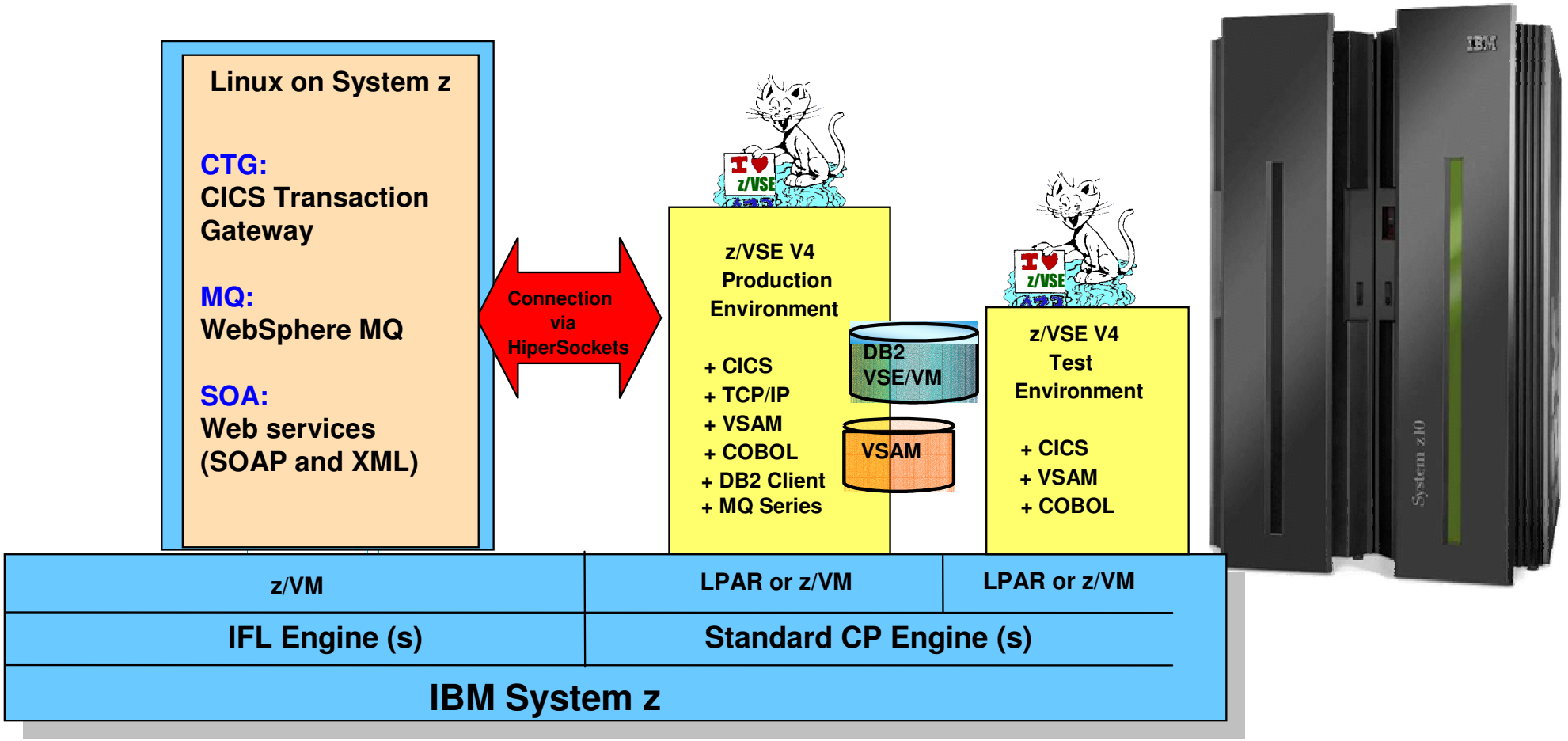
Szenario 3: Integration of z/VSE Applications

Leverage VSE application logic using SOA or CTG

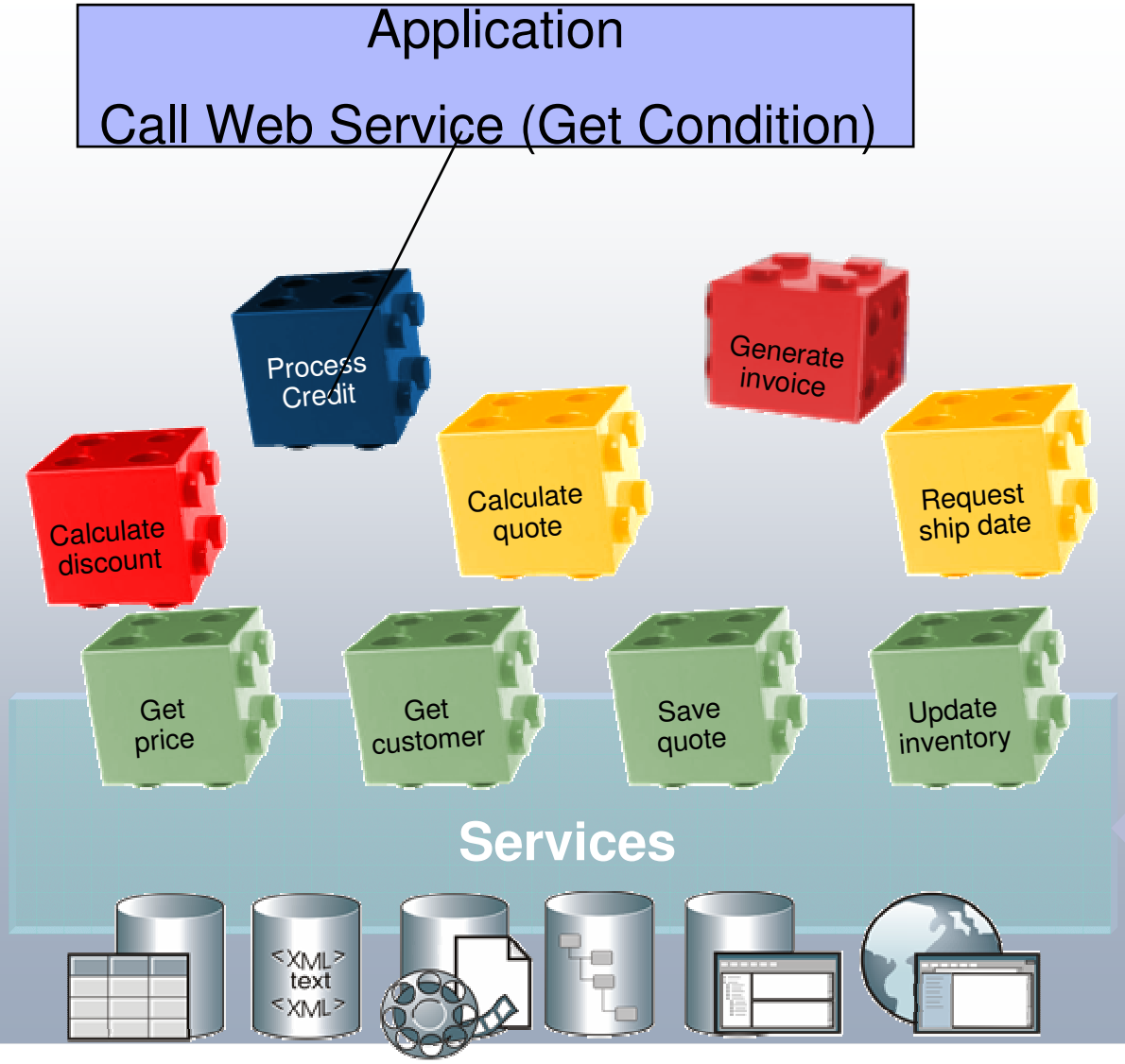
CTG: Access to CICS applications

SOA: Standard Integration of CICS applications

MQ: Asynchronous data distribution



SOA evolution - Integrating Logic across platforms



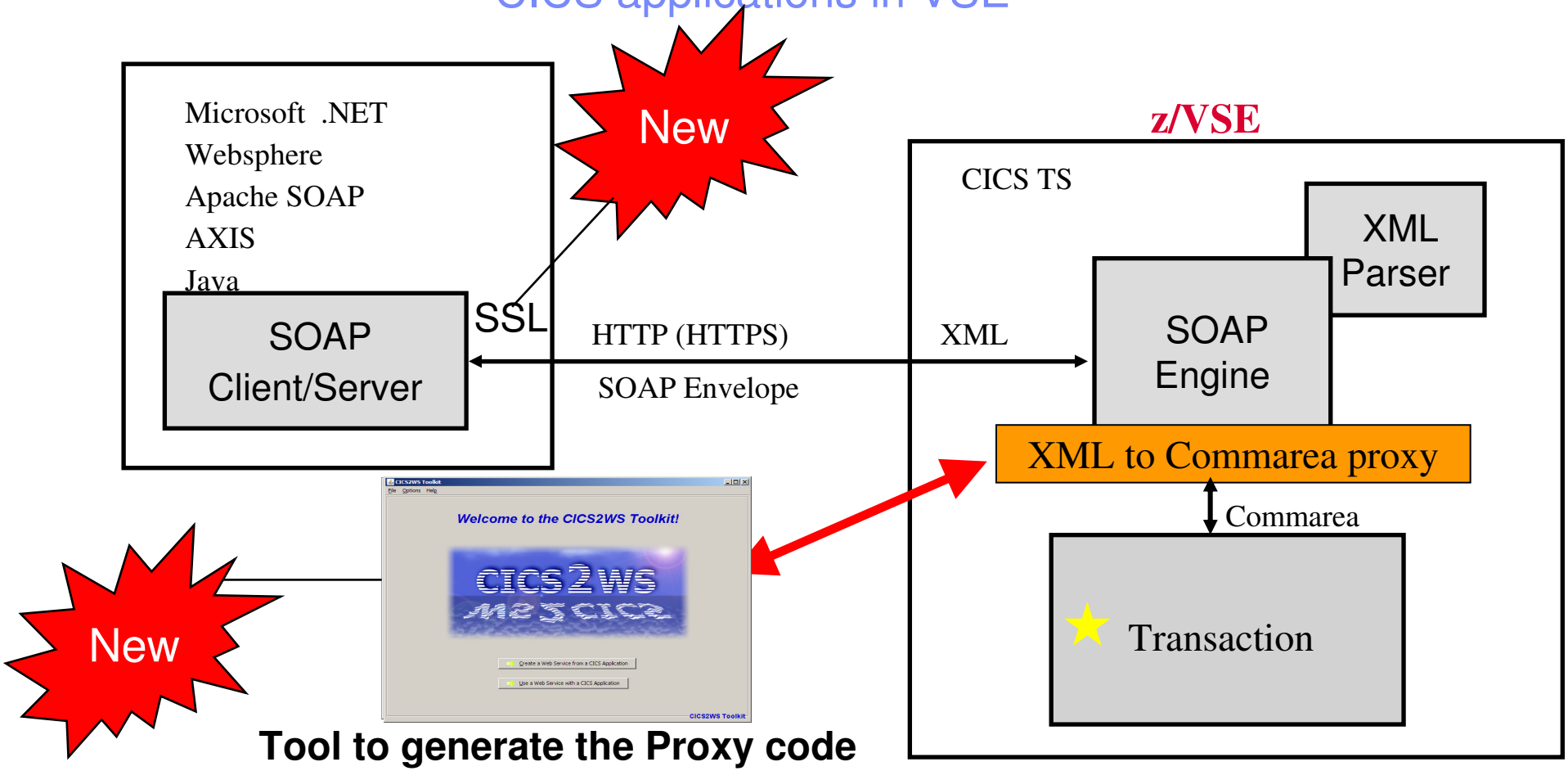
Information as a service makes information more accessible, consistent, and flexible

Publishing consistent, reusable services for information that make it easier for processes to get the information they need from across a heterogeneous landscape of application and data.

- Select data from sources
- Run Business logic
- Transform data to target

Web Services with z/VSE

SOA and XML data interchange with CICS applications in VSE



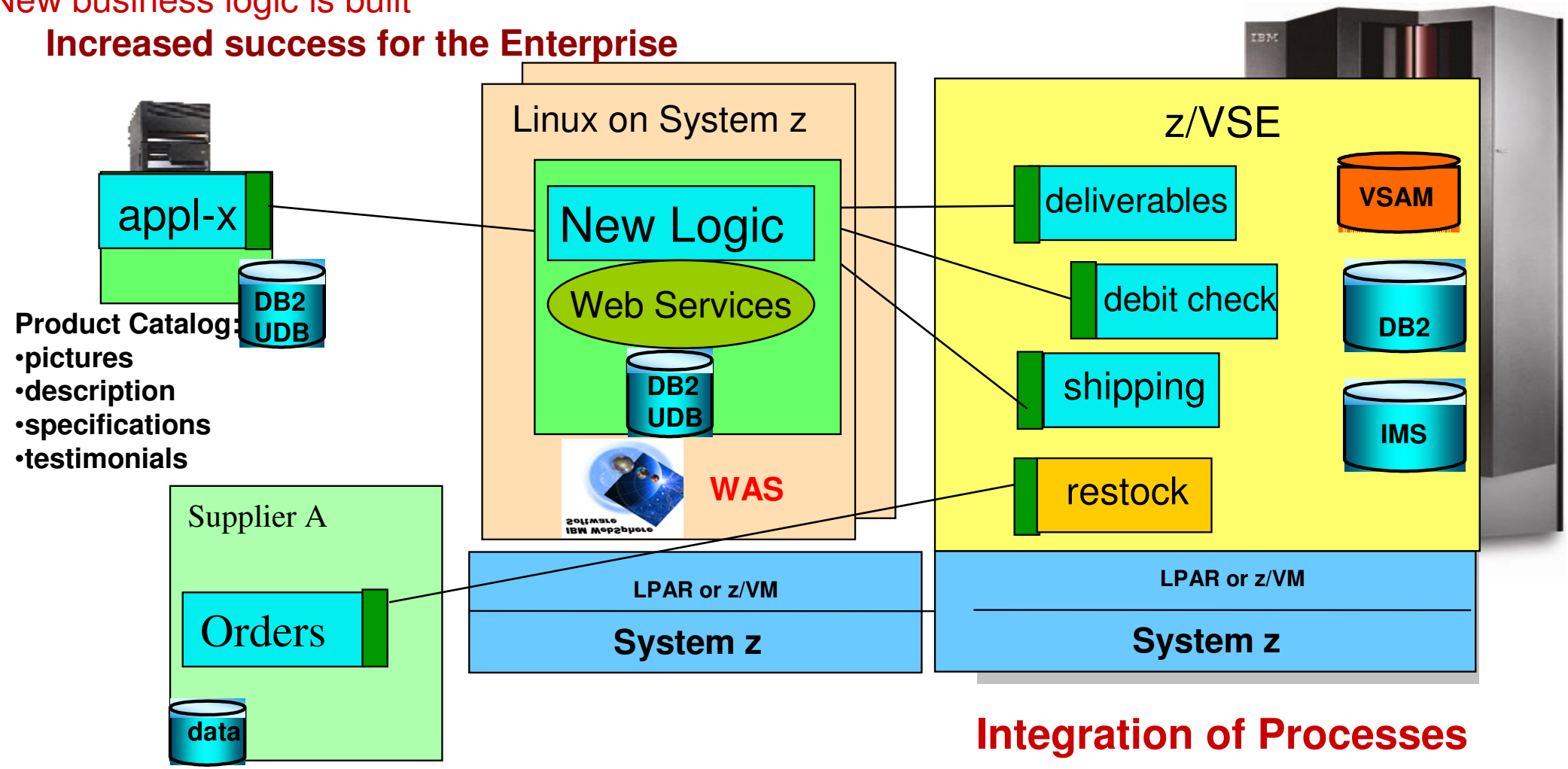
Tool to generate the Proxy code

- Existing VSE Transactions as Web Service
- Existing Transactions can call a remote Web Service

SOA – the way to new applications and processes

- Applications look the same for all users
- Core applications can be enhanced with an interface
  (independent of their language, COBOL, ASM, PL/I)
- New business logic is built

Increased success for the Enterprise

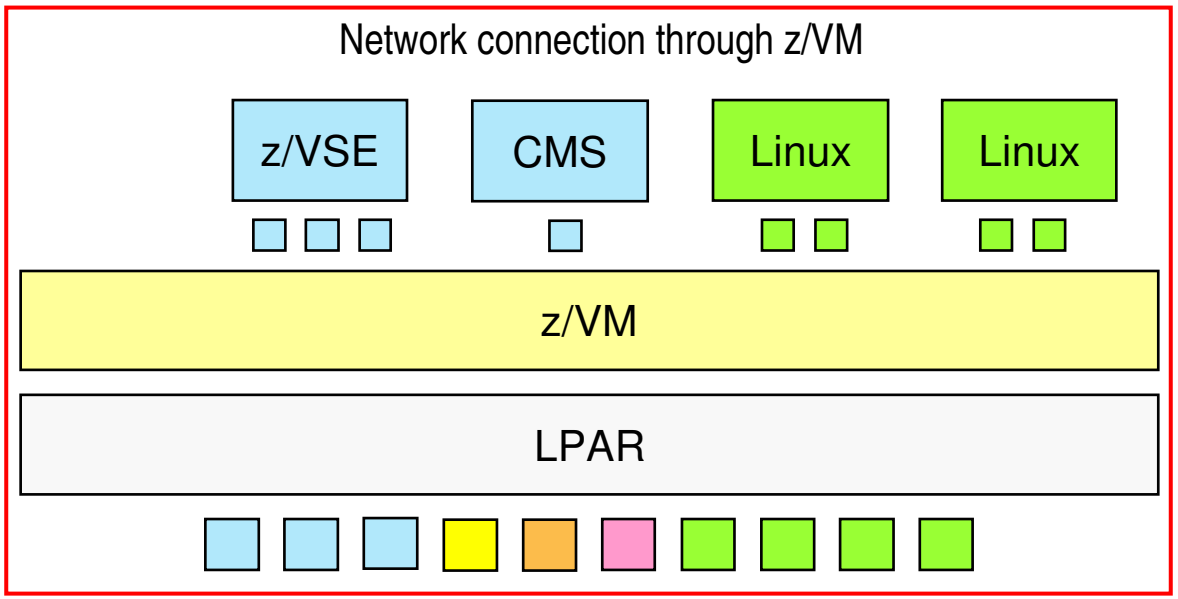


Integration of Processes

Virtualization evolution
z/VM-Mode LPAR and possibilities (z/VM 5.4 and newer)

Allows z/VM users to configure all CPU types in one System z LPAR

- Offers added flexibility for mainframe workloads
  - **Add *IFLs* to an existing standard-engine z/VM LPAR to host Linux workloads**
  - **Add *CPs* to an existing IFL z/VM LPAR to host z/VSE, or traditional CMS workloads**
  - **Run integrated Linux and z/VSE solutions in the same LPAR**
- No change to software licensing
  - **Software continues to be licensed according to CPU type**



z/VSE 4.3: Linux Fast Path in a z/VM-Mode LPAR

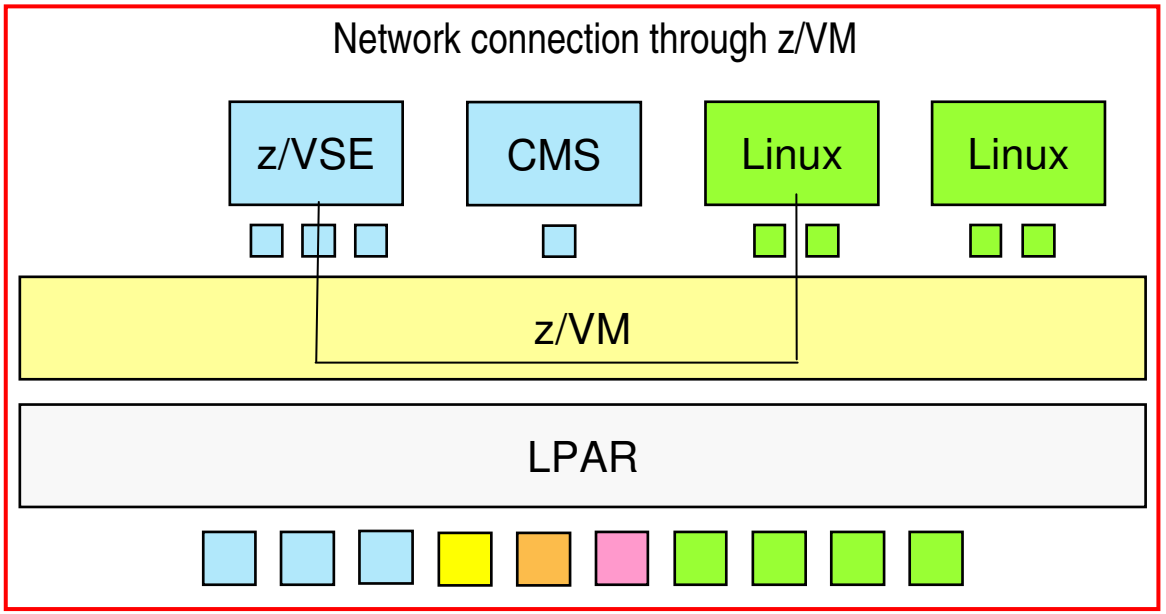
- Linux Fast Path (LFP) is a new function within z/VSE 4.3 (GA 4Q 2010)
- It enables for a short access path with Linux on System z

Prerequisites:

- IBM System z10 or newer
- Environment in a *z/VM-mode LPAR*
- z/VM 5.4 or z/VM 6.1

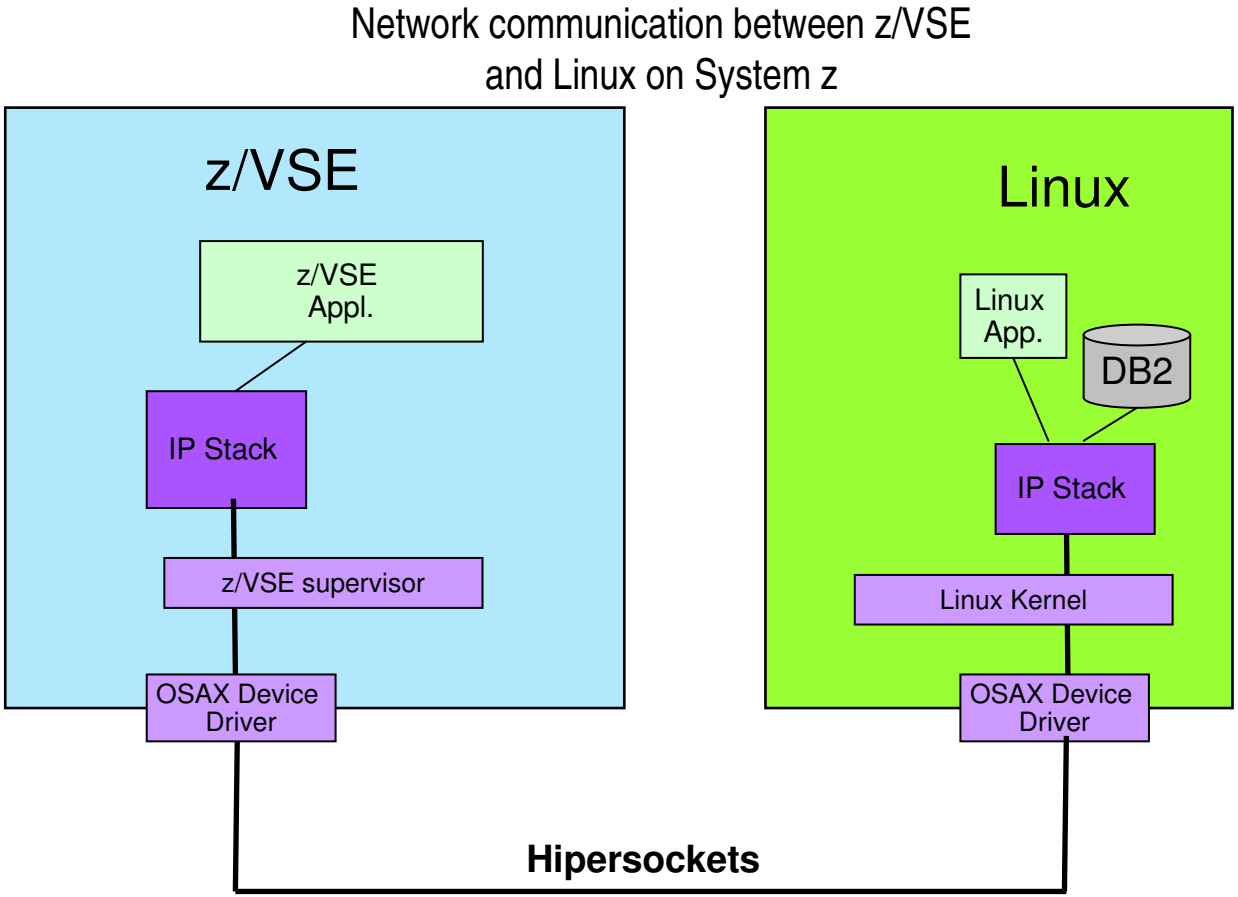
Scope:

- Reduce path length for z/VSE to Linux on System z communication
- Application transparent: fast path for z/VSE socket applications to Linux on System z



z/VSE and Linux on System z communication

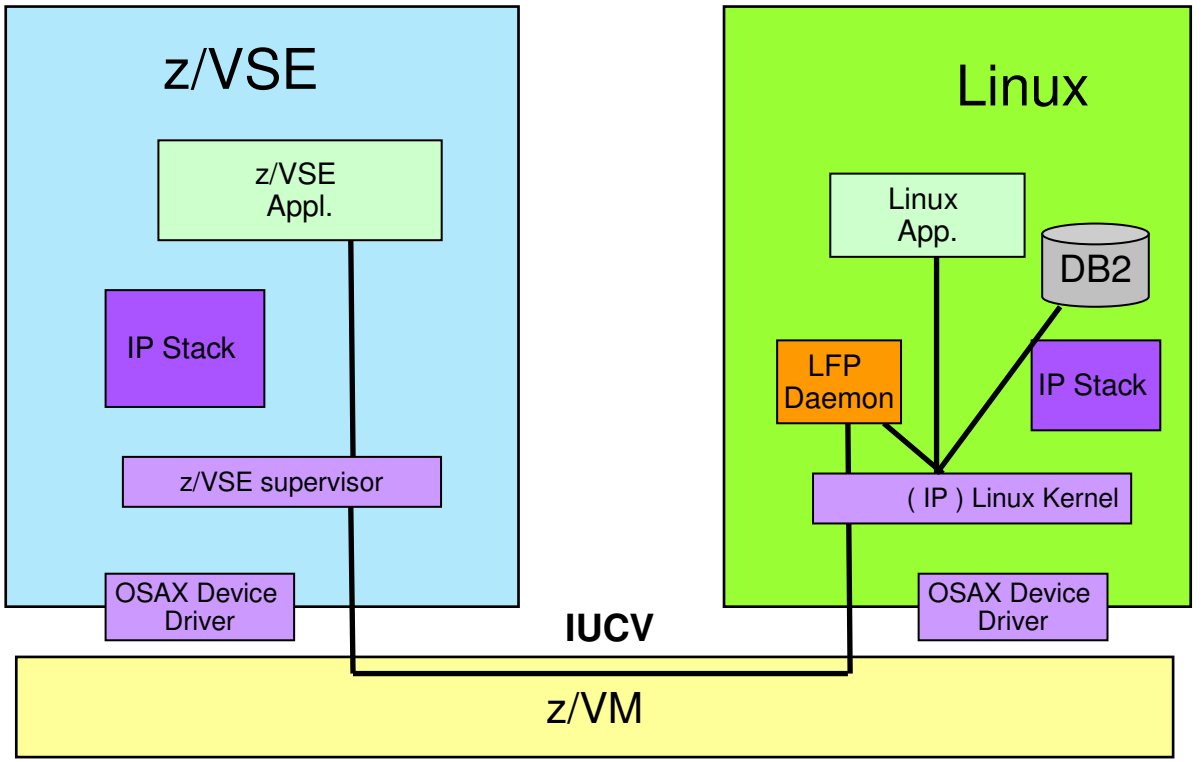
- The figure shows components for a **normal IP network** access to Linux on System z
  - The overhead is the two stacks path length



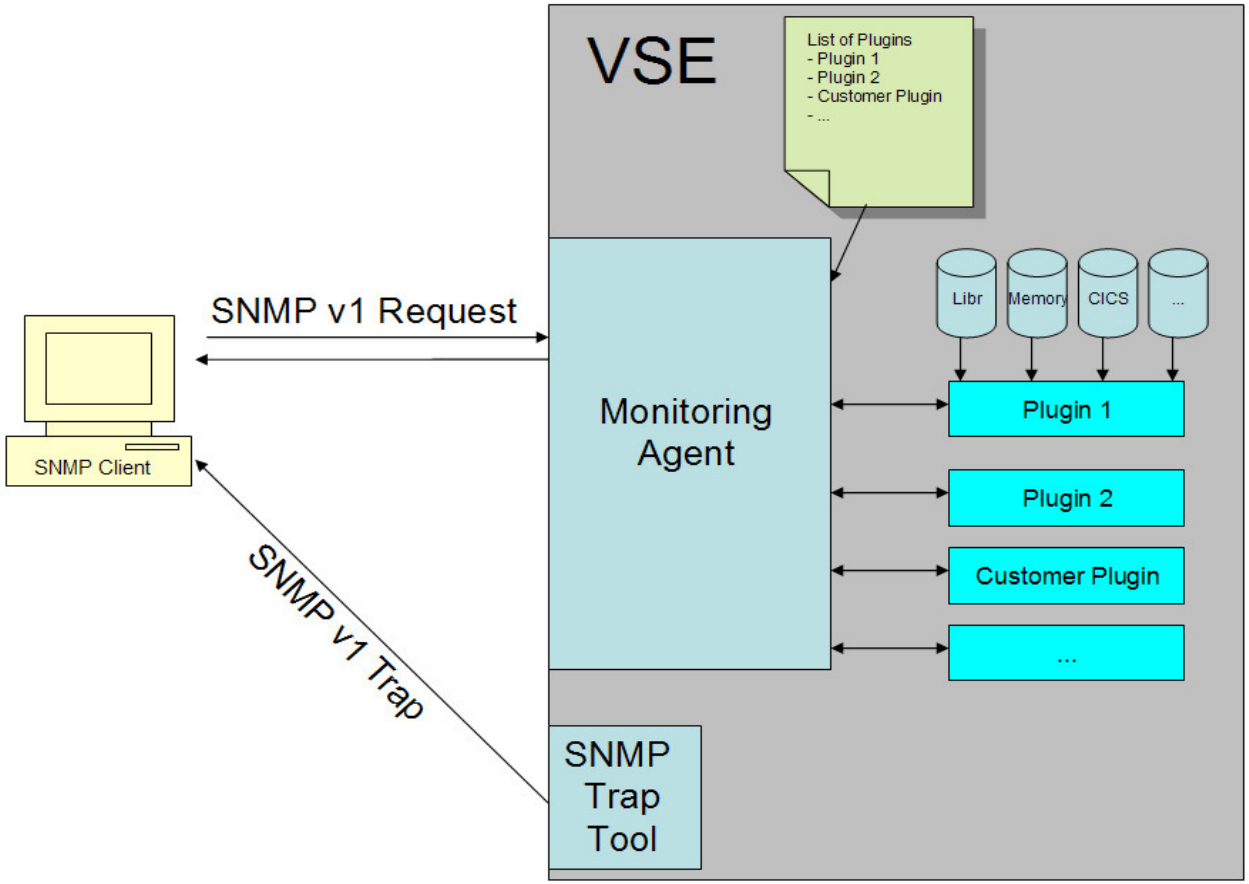
z/VM-Mode LPAR and Linux Fast Path communication from z/VSE

- LFP is a new function within z/VSE 4.3 (GA 4Q 2010)
- It enables for a **short access path** with Linux on System z
  - Reduces the IP stack path length and uses the Linux IP only
  - Transparent to socket applications

LFP connection through z/VM in a z/VM LPAR

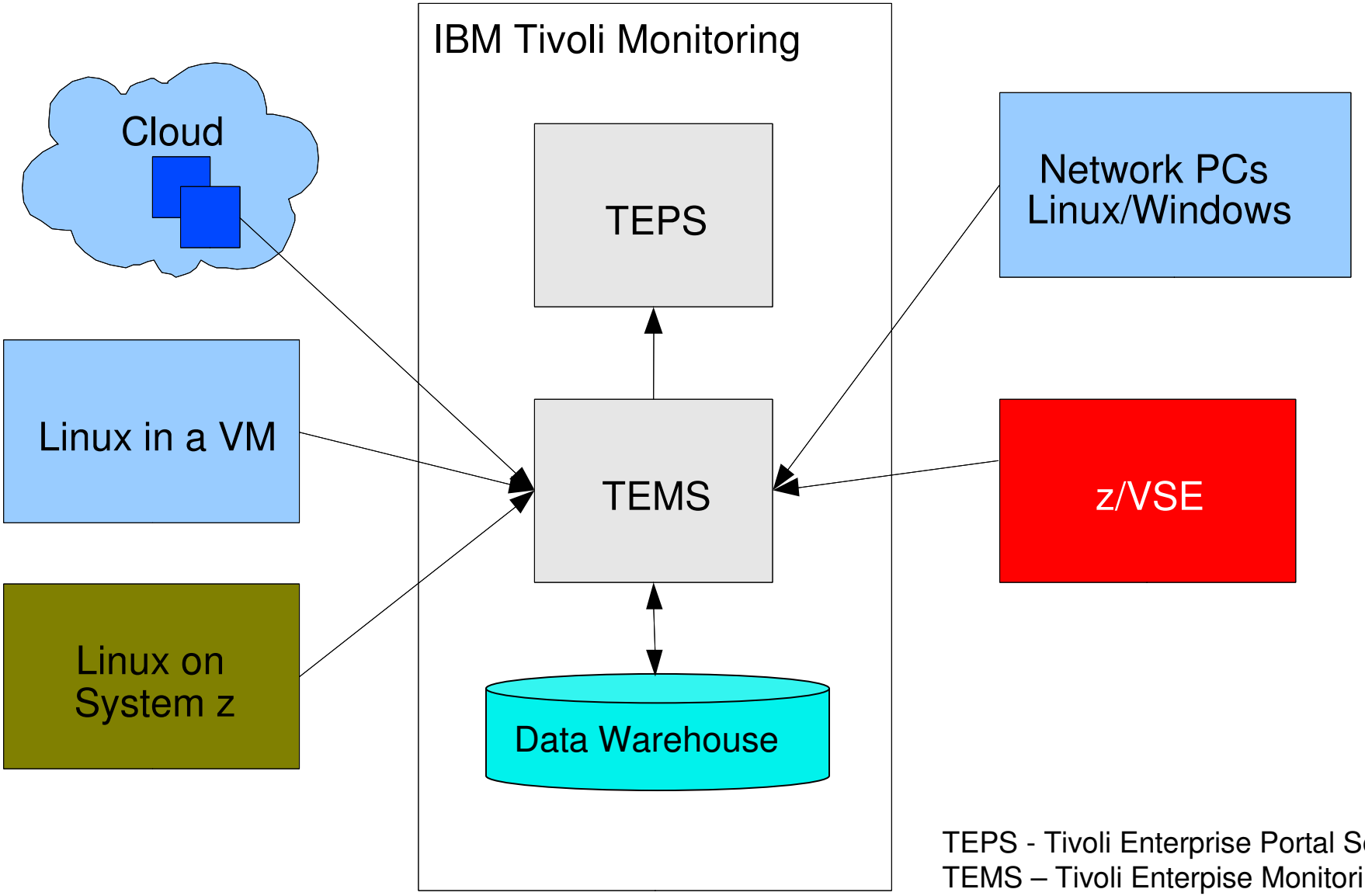


z/VSE 4.3 Monitoring enhancement



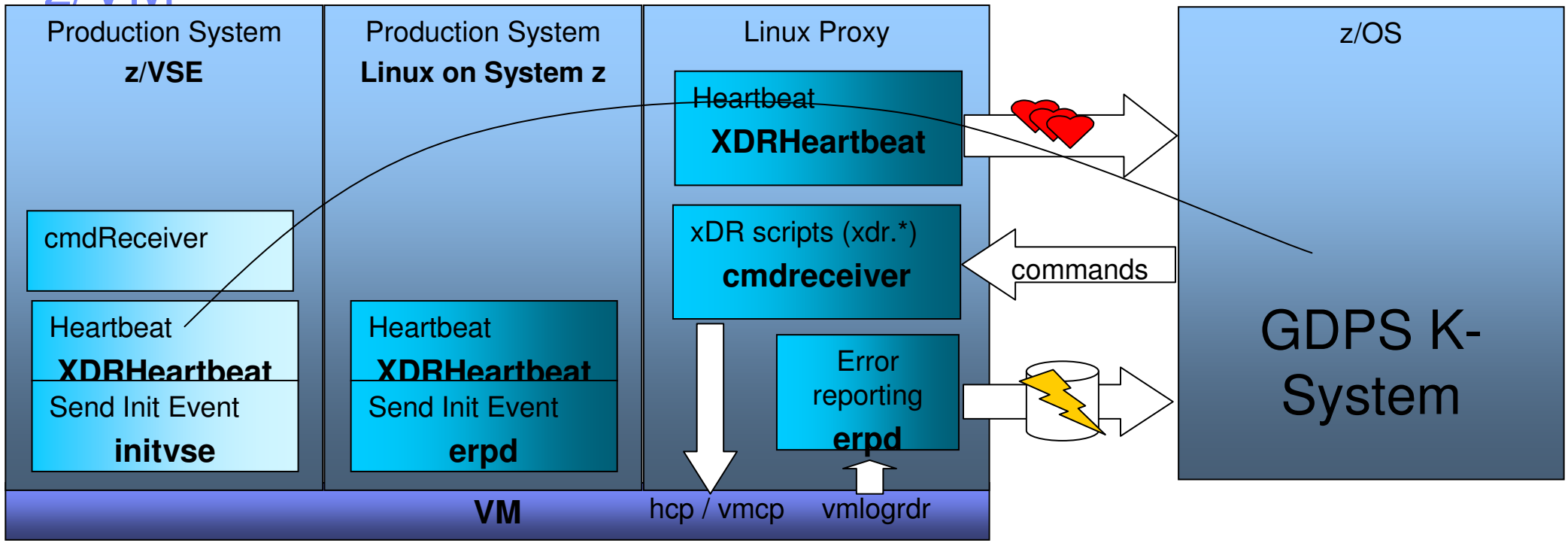
- Monitoring Agent based on SNMP V1
  - Real time monitoring
    - retrieve z/VSE specific system and performance data
  - Event driven monitoring using SNMP Trap tool
    - Helps to automate processes in z/VSE with SNMP traps

Monitoring Facility (coming soon for z/VSE)



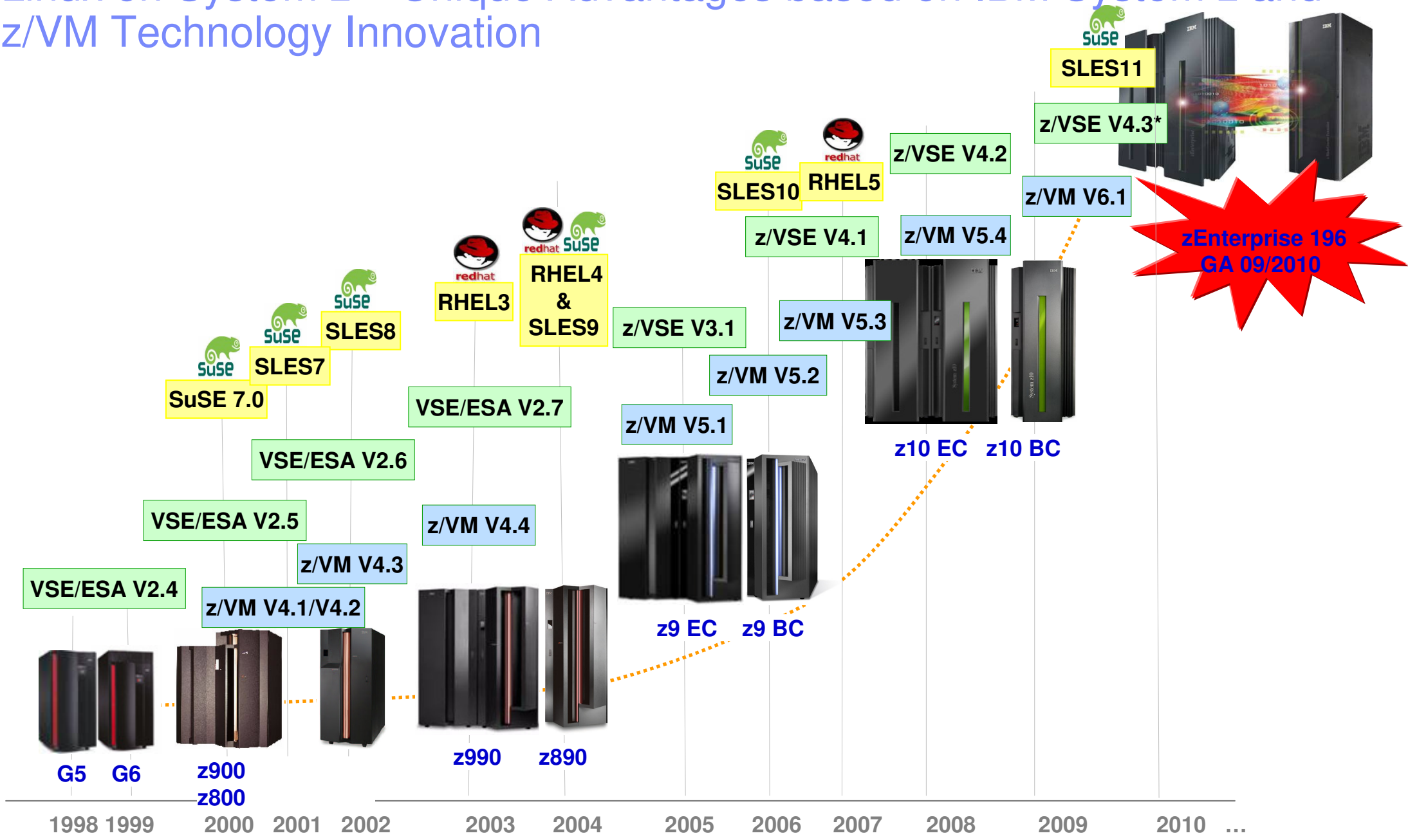
TEPS - Tivoli Enterprise Portal Server
TEMS – Tivoli Enterpise Monitoring Server

Coming soon: xDR Support for z/VSE as active guest under z/VM



- z/VSE as active guest under z/VM and Linux Proxy
  - z/VSE is active for GDPS
  - HyperSwap of disks via z/VM
  - re-ipl triggered by XDRHeartbeat in z/VSE
  - communication with GDPS via z/VSE and Linux Proxy
  - cmdreceiver (init, shutdown, switch heartbeat to K2)

Linux on System z – Unique Advantages based on IBM System z and z/VM Technology Innovation



IBM System z: Transforming our Clients' Datacenters

Moved to System z from Lintel to deliver the availability and security their clients demand of their e-Procure-to-Pay SAAS, while supporting the strong growth the company is experiencing

Casas Bahia centralized operations on System z to support rapid growth and reduce IT costs

Nationwide
On Your Side

Consolidated Windows-based systems to Linux on z to achieve substantial cost efficiencies

Satyam has positioned the mainframe as a platform to reach the SMB audience in growth markets with hosted web business services

Entering provider space for cloud services for universities, schools systems and other public entities

HOPLON infotainment

Their massive-multi-player game and virtual world application middleware runs on System z10. (www.taikodom.com)

Customer Example: Wessels & Müller AG (Car parts wholesale)

IBM Case Study

Wessels+Müller AG: New opportunities with z/VSE, DB2 UDB and Linux on the IBM System z9

Overview

■ *The task at hand*
To modernize existing warehouse management systems in order for

■ *The benefits*
Installing DB2 UDB for Linux on system z achieves maximum flexibility, the best data serving, the highest ever availability of applications and the dynamic rearrangement of resources. The simplified infrastructure reduces operating costs.

The company
Wessels+Müller AG supplies its customers with original parts from brand name manufacturers. In doing so, it ensures punctual deliveries and a service that makes it possible for

wide delivery capacity and, last but not least, the know-how, skills and the friendliness of our employees."

Advancement thanks to the flexibility of the new solution
The company's main focus is on maximum flexibility in order to shape ongoing operations optimally at all times. The idea is not only to obtain the highest performance during peak demand, rather, above all, to benefit from reduced operating costs during the quieter times. Once the previously installed IBM zSeries® z890 had already reached about 80 percent capacity just handling daily operations, Wessels+Müller decided to opt for migration in order to have more capacity available in the future.

The IBM System z9® platform primarily functions as a pure data serving environment. By using highly scalable services, Wessels+Müller is able to consolidate and manage very large data volumes on one system. The flexible platform offers

became easier and easier to administrate."

In close cooperation between Wessels+Müller, the IBM business partner Becom and IBM, migration to the z9 Business Class (BC) IBM System took place in just one weekend.

After migration, the applications as well as the databases (DB2/VM) were noticeably faster, which not only resulted in accelerated processing, but also optimal handling of the data load, even during transaction-intense phases. The team even installed Linux on a separate Linux processor (IFL) and z/VM® V5.2 and also installed the DB2® Universal Database™ (UDB). The first applications have been in production at Wessels+Müller since May 2007. All data and applications are gradually being migrated to the UDB.

With the additional options, Wessels+Müller is able to maintain its competitive edge and to further build on it. The improved service is not only available to the company's 1,950 employees, but also to customers and partners. As an application and data server, the z/VSE functions as the company-wide information and ordering system on the Internet.

Under z/VM V5.2, five z/VSE systems operate in a logical partition (LPAR). In a second LPAR, which is assigned to a dedicated Linux processor, numerous Linux guests are installed under z/VM, which, in turn, serves as the carrier system for DB2 UDB.

Time is money

Wessels+Müller currently relies on z/VSE V3.1.2, but is preparing to upgrade to z/VSE V4.1. With the help of tools, pre-testing is being performed to see which additional options will be offered with the new functions such as workload pricing. In the second quarter of 2008, the 64-bit version of the operating system will be ready for use at Wessels+Müller.

Technical Data

IBM System z9® Business Class (BC), IFL-z/VSE™ V3.1.2, z/VM® V5.2, DB2® Universal Database™ (UDB), LPAR

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ibm.com/ch

The IBM website address is:
ibm.com

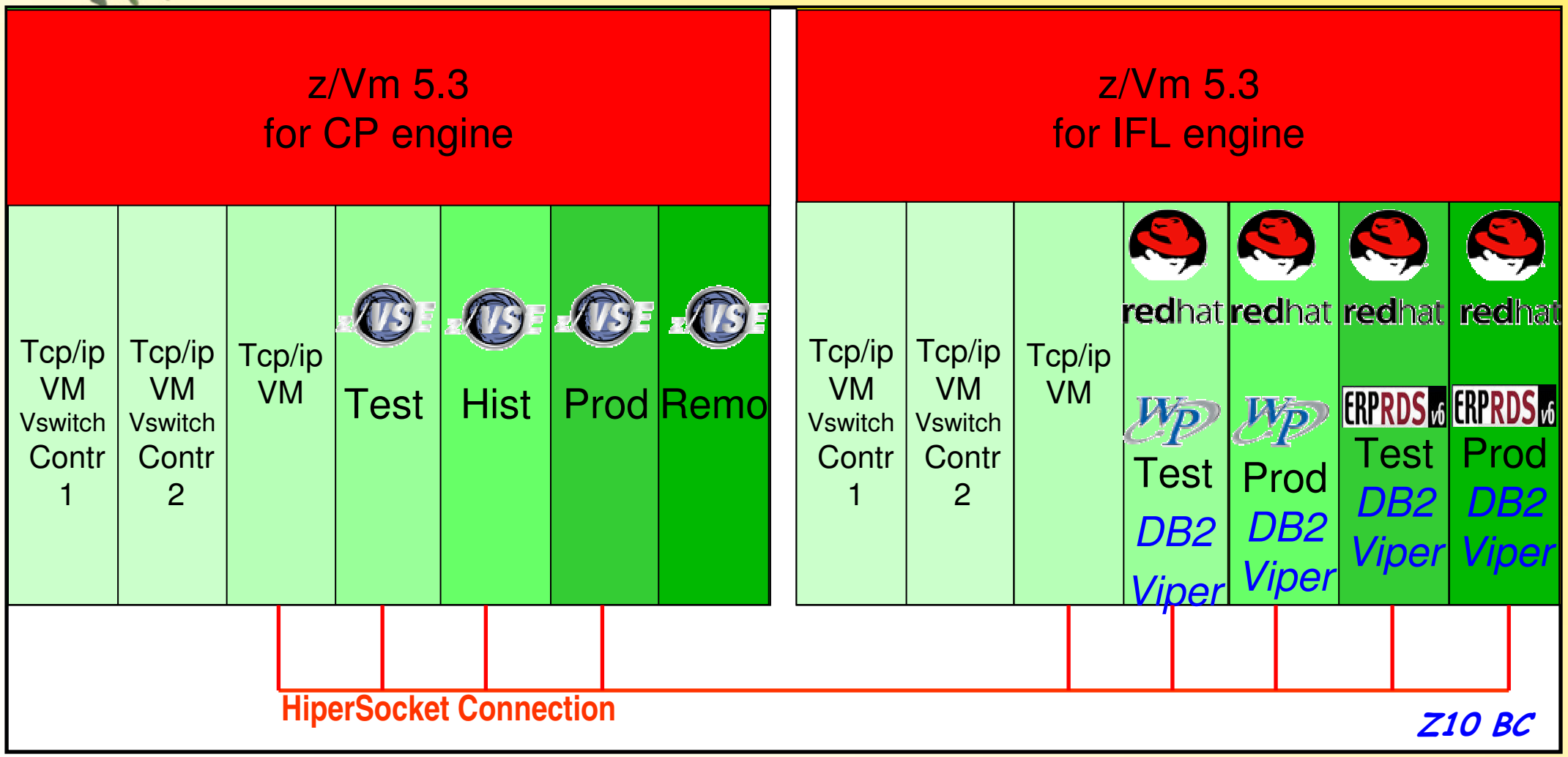
Printed in Germany.

z/VSE and Linux on System z

- About 3 Mill. Txs / day
- CICS TS app.
- Access DB2 LUW on Linux
- Response Time avg: 0.2-0.4 sec

Source: IBM Form GK12-4361-00

Internal Connections



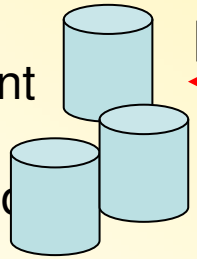
The Leading Producer of Premium Olive Oil sold directly to Consumers

the Leading Producer of Premium Olive Oil sold directly to consumers

Email from batch or cics

AFP / PSF via ipaddress

300 files every day transferred to different operating systems (Zlinux, linux, microso



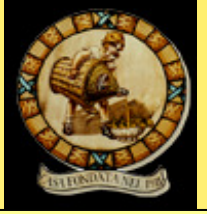
FTP

Production Environment

TCP/IP

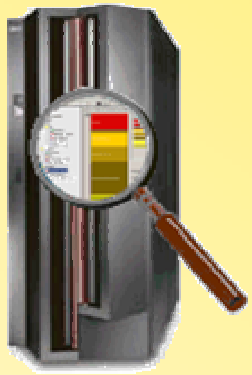
Virtual Tape

CICS TS web SOA via hipersocket



redhat **version 5** z/Linux Java Application running on Tomcat

VSE Navigator



Z/Vse Health checker

Db2 udb z/linux applications

Vsam redirector Server via hipersocket to z/linux DB2 and via vswitch Osa QDIO to Sql Server

ERPRDS v6

Microsoft Sqlserver

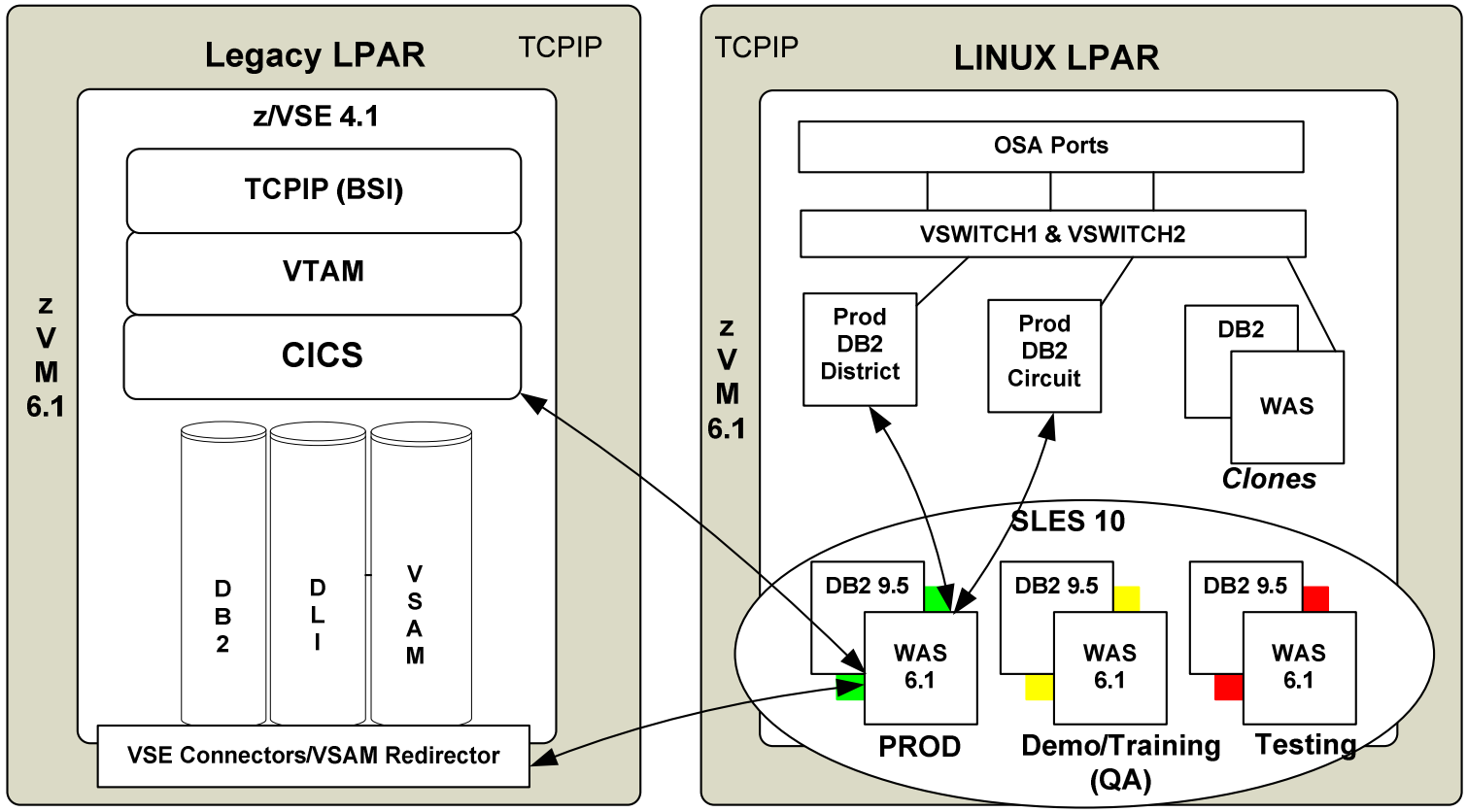
TCP/IP only for telnet applications

Every day 240,000 cics transactions from 400 telnet connections

Olio Carli

The Leading Producer of Premium Olive Oil sold directly to Consumers

Supreme Court of Virginia 10/2010



- 1 + 1 z10 BC L02
- 2 + 2 CPs
- 5 + 5 IFLs
- 112 + 112 GB memory
- 2 + 2 z/VM V6.1 LPARs
- 8 + 4 z/VSE V4.1 guests
- 73 + 24 SLES 10 SP2 guests
- WAS V6.1, DB2 V8.2, DB2 V9

- **z10 BC L02 for Court System (internal)**
  - Serves 325 courts, 5.000+ users, 4.2 million new cases in 2009
  - Integrating z/VSE, DB2/UDB and WebSphere applications
  - eMagistrate* system serves 125 locations, 2.800 trans per day

  2007 ComputerWorld Honors Program Laureate
- **z10 BC L02 for Internet**
  - eCommerce application integrating z/VSE and WebSphere appls

60

IBM zEnterprise

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

IBM zManager

- 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

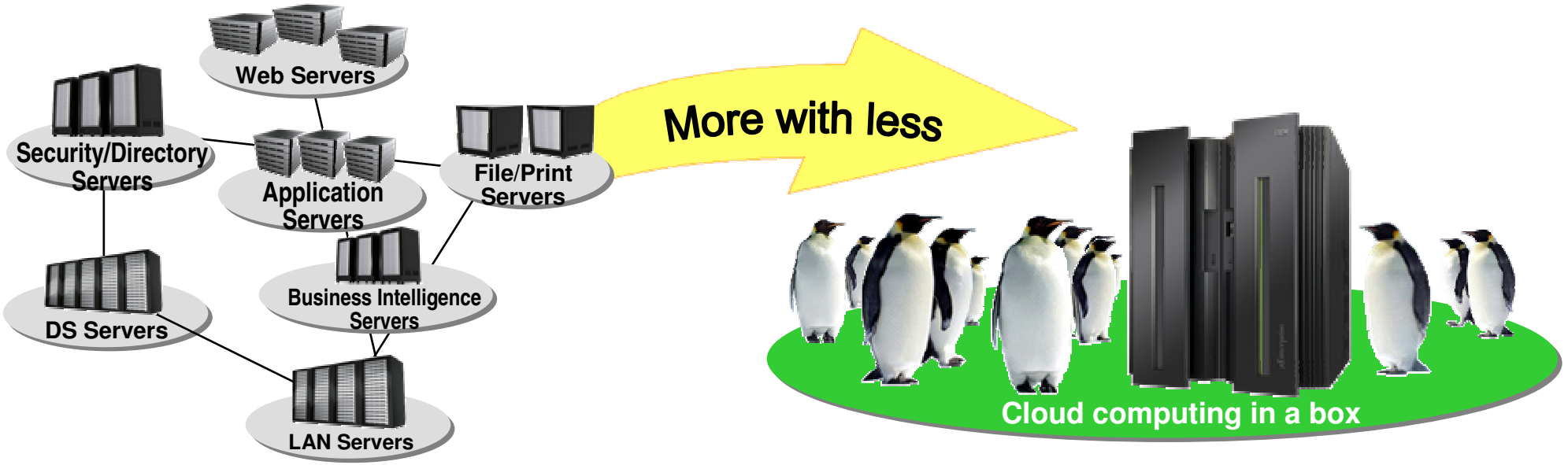
Application Server Blades

- 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

Most Efficient Platform for Large Scale Data Center Simplification and Consolidation



Islands of computing

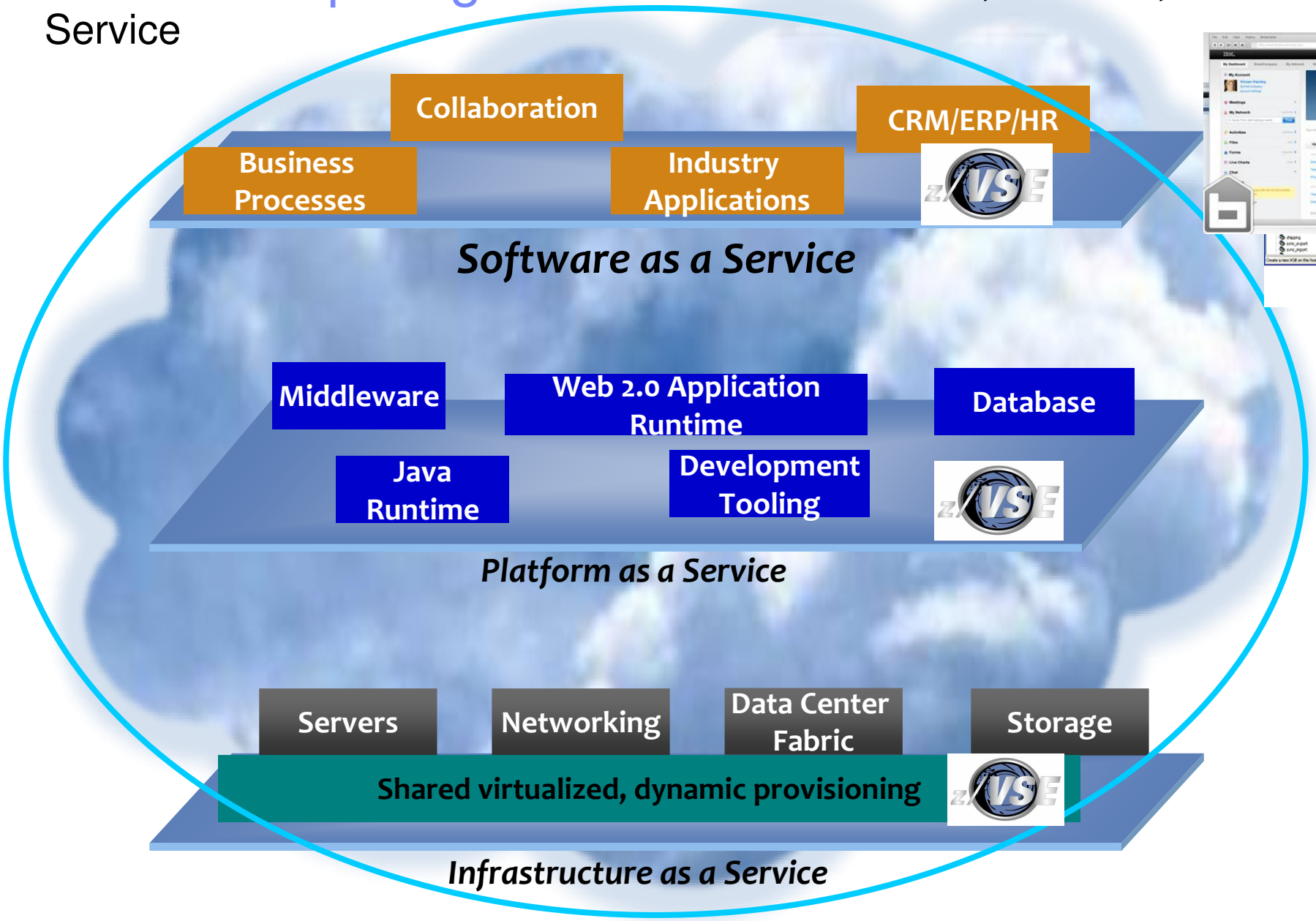
- Silo managed islands
- Minimal resource sharing
- Less dynamic

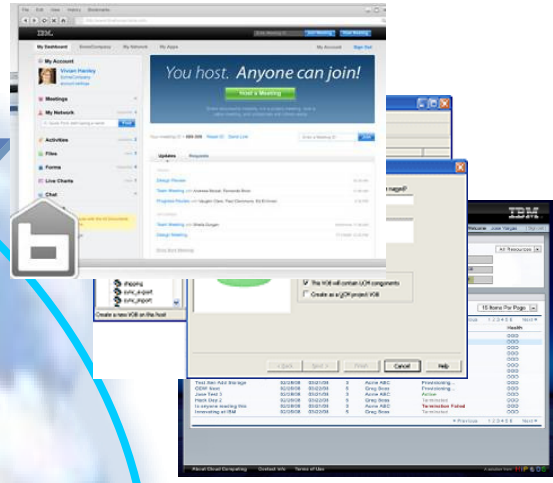
Linux on IBM zEnterprise™ 196 (z196)

- Single server simplicity
- Industry leading virtualization
- Advanced resource sharing and dynamic allocation

Save money, reduce complexity, improve service

Cloud Computing with z/VSE– Software, Platform, Infrastructure as a Service





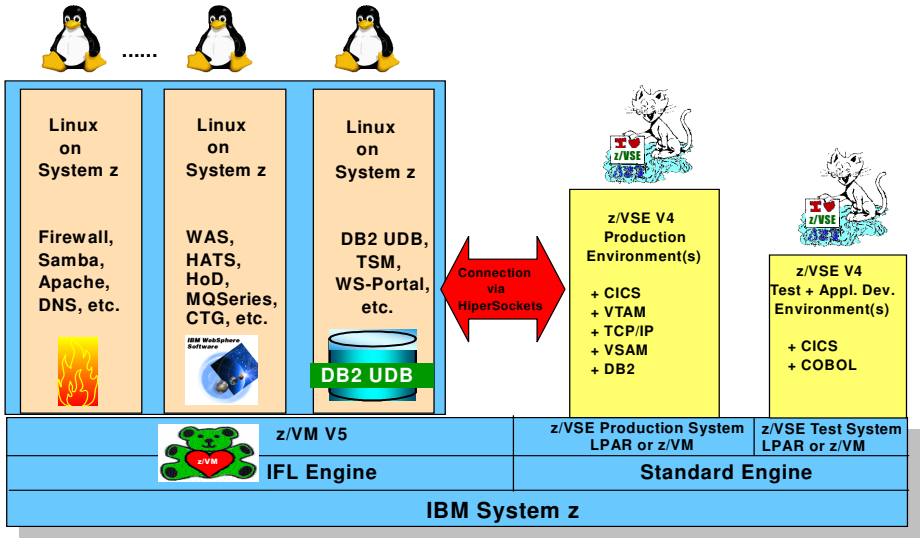
Manage your enterprise from one machine, the only server manager you need!

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

Manage:

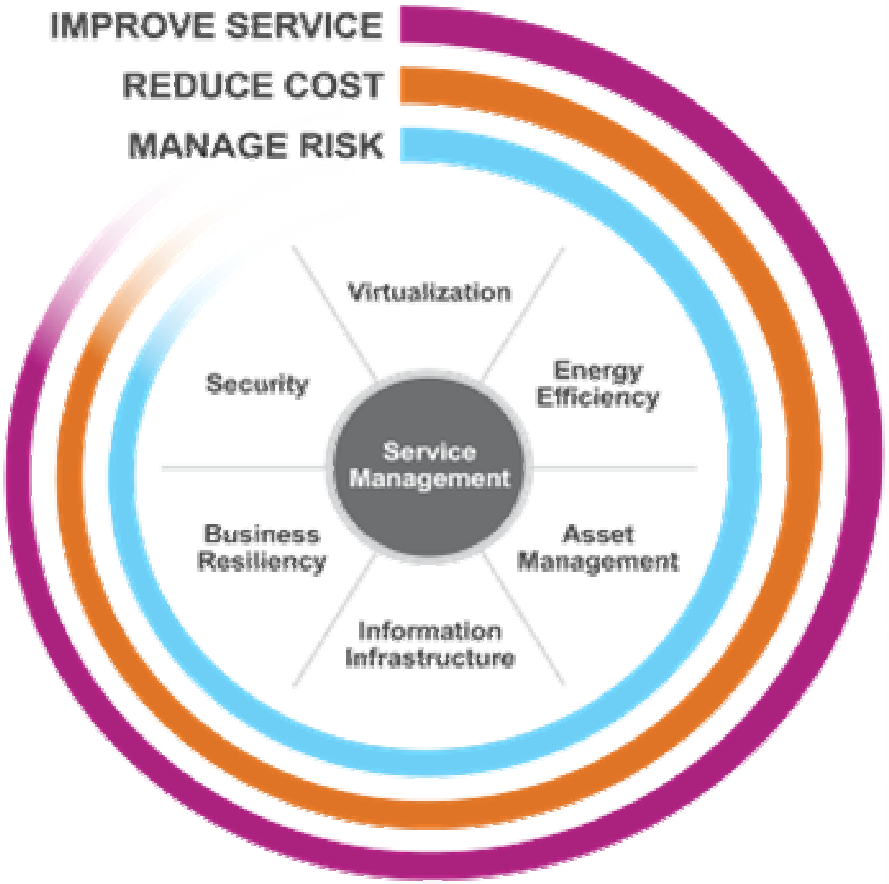
- Security
- Deployment
- Development
- Disaster Recovery
- Administration
- Monitoring

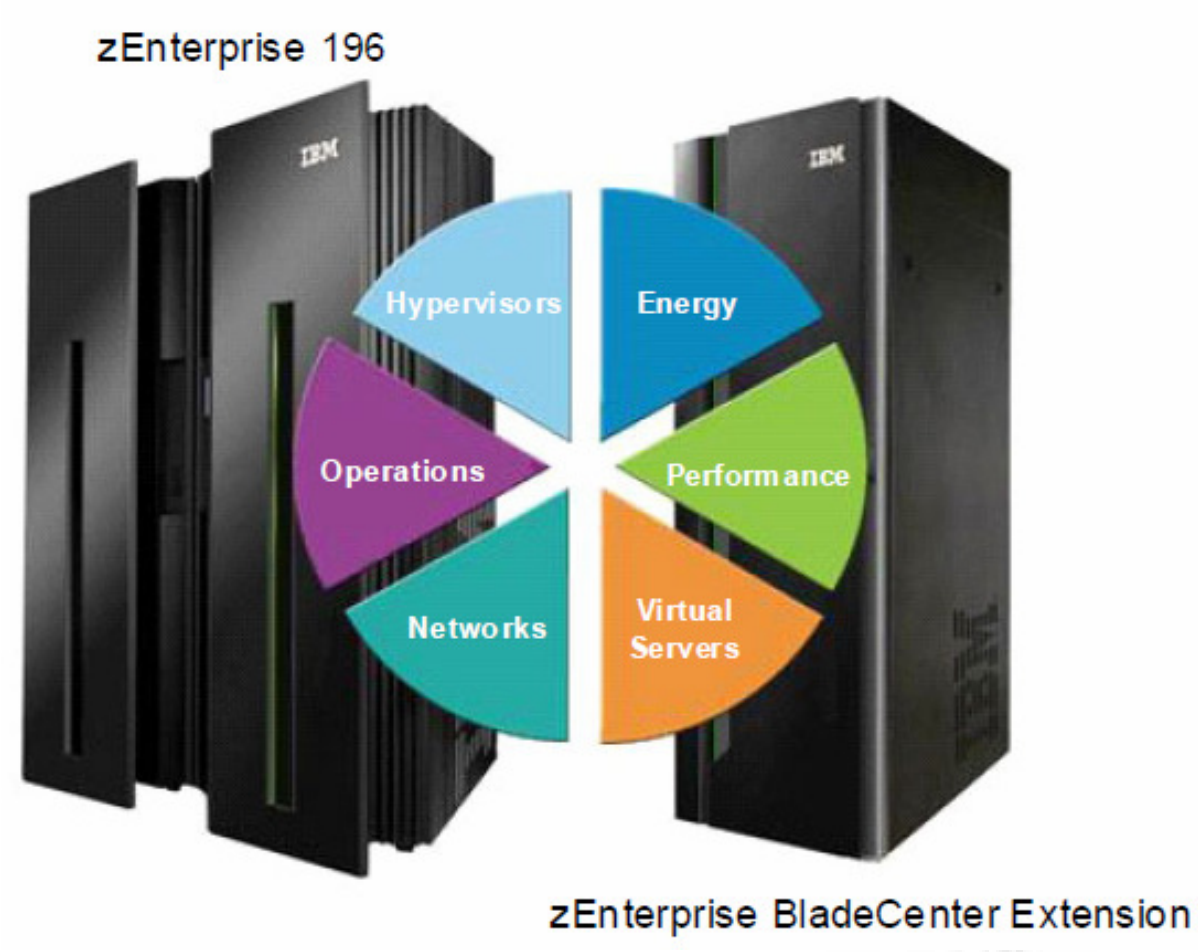
More than a decade of most successful pair
z/VSE and Linux on System z
enables and supports customer growth
with IBM System z, IBM System Storage, and IBM Middleware



- **z/VSE V4**
  - Protect core IT investments through PIE
  - Robust, secure enterprise server
  - Cost-effective solutions
  - Interoperability with network / servers
  - Highly improved price / performance
- **z/VM V5**
  - Highly flexible, industrial strength
  - Advanced virtualization
  - Multiple z/VSE and Linux images
  - Designed to exploit System z9
- **Linux on System z**
  - Large portfolio of new applications
  - Platform for IBM middleware
  - Infrastructure Simplification
  - Massive scalability / consolidation

The Future runs on System z, the largest scalable server





… System z delivers extreme business value by helping to reduce cost, manage risk, and improve service.

More than a decade
Linux on System z and z/VSE