IBM Linux on System z and IBM Wave for z/VM

A new wave of Linux innovation

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IBM ATS Tiger Team, IBM Wave for z/VM

The mainframe has changed the world…
…making the extraordinary possible

Industry-changing missions

Breakthrough leaps driven by technology can create possibilities that were never possible before

Reinvention and transformation

Every business must continuously reinvent and transform itself to thrive and create advantage

Growth in secure transactions & data

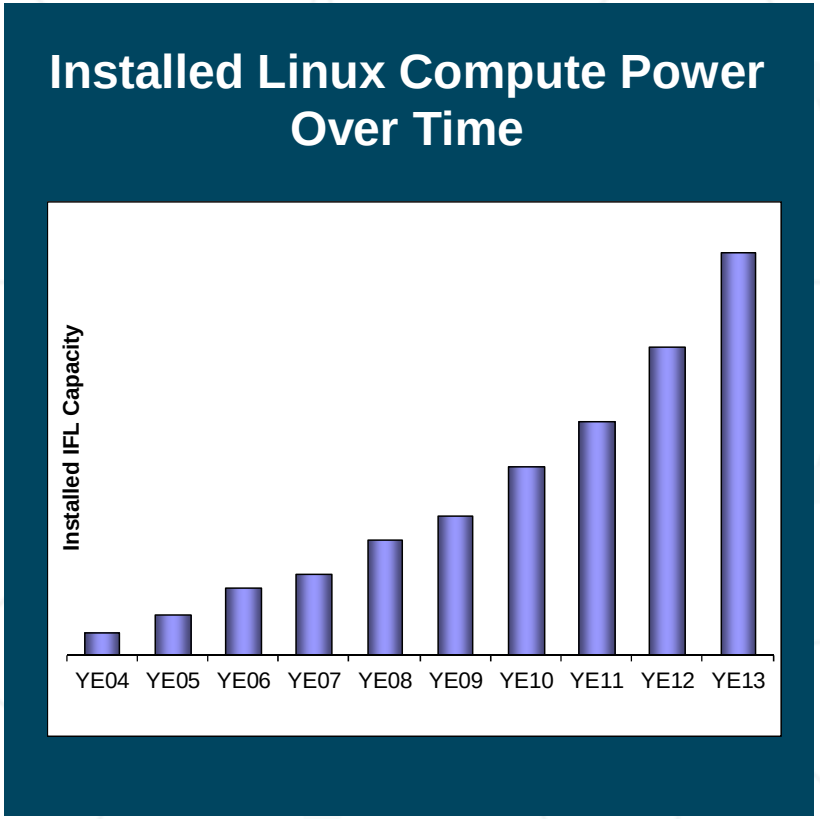
Trust is the foundation for success in an increasingly complex world of cloud, mobile and social

…and it's **just the beginning**

Linux on IBM System z in 4Q2013

*Installed Linux MIPS at 49% CAGR**

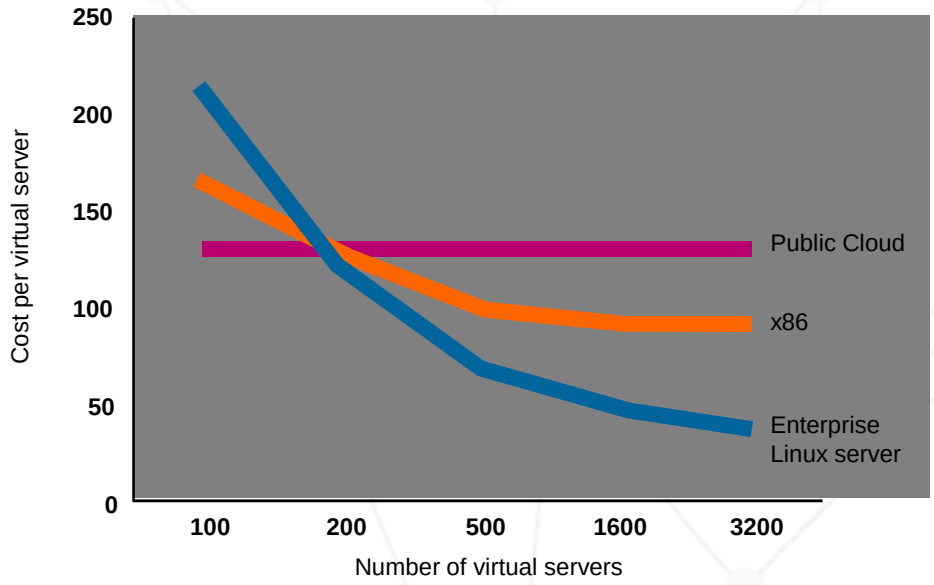
- **26.7%** of Total installed MIPS run Linux as of 4Q13
- Installed IFL MIPS increased **31%** from 4Q12 to 4Q13
- **38%** of System z Customers have IFLs installed as of 4Q13
- **78 of the top 100** System z Customers are running Linux on the mainframe as of 4Q13 **
- **58%** of new FIE/FIC System z Accounts run Linux (FY10-3Q13)
- **34%** of all System z servers have IFLs



* Based on YE 2003 to YE2013
**Top 100 is based on total installed compute power

Redefining the Efficiency & Economics of IT

Delivering superior service at lower cost than legacy x86 or Public Cloud vendors



Nationwide

Saved **$46 million** through consolidation

Cut datacenter costs by **70%**

Algar Telecom

CRN TECH INNOVATOR AWARDS 2013

zEnterprise wins CRN's **Tech Innovators Award for Cloud** Solution

Increasing investment in Linux & Cloud solutions on zEnterprise

IBM Wave for z/VM
Manage virtual machines with drag and drop simplicity

Enterprise Linux Server
The power of Enterprise Linux made easy

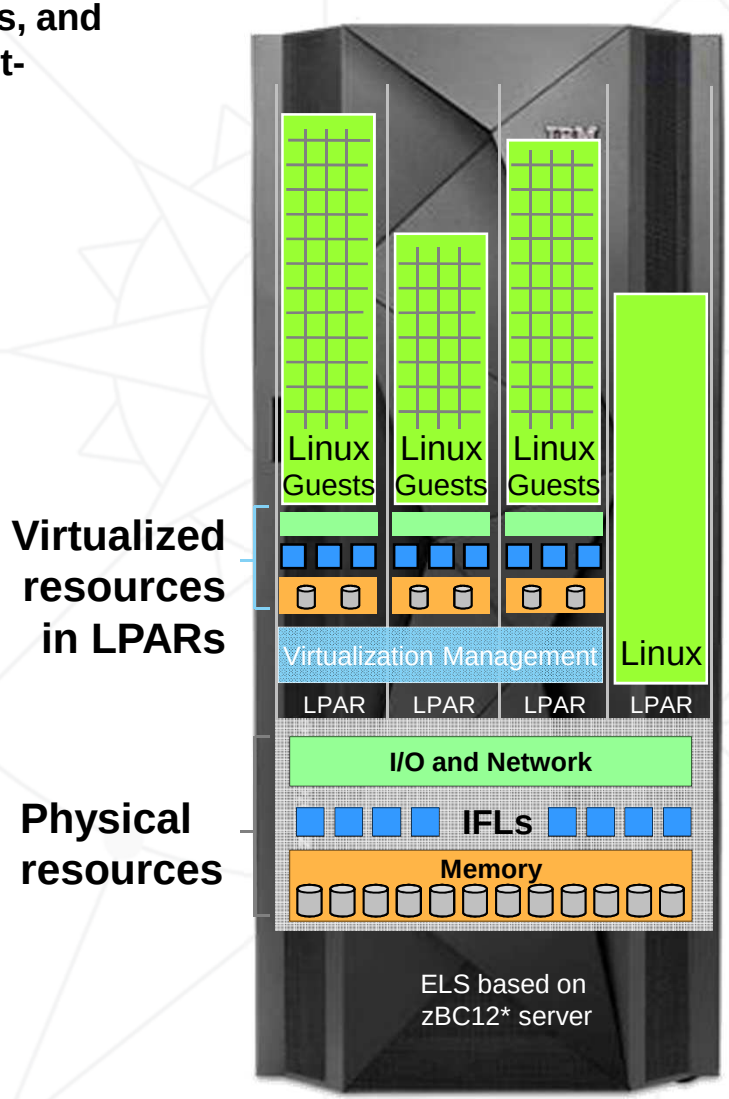
Cloud Management Suite
Move cloud services to System z with standardized, open orchestration

IBM Enterprise Linux Server

Unlock new systems of engagement, analytic capabilities, and the economics of cloud with open technologies, in a cost-effective, scalable, reliable, secure, and simple solution.

With the Enterprise Linux Server you can:

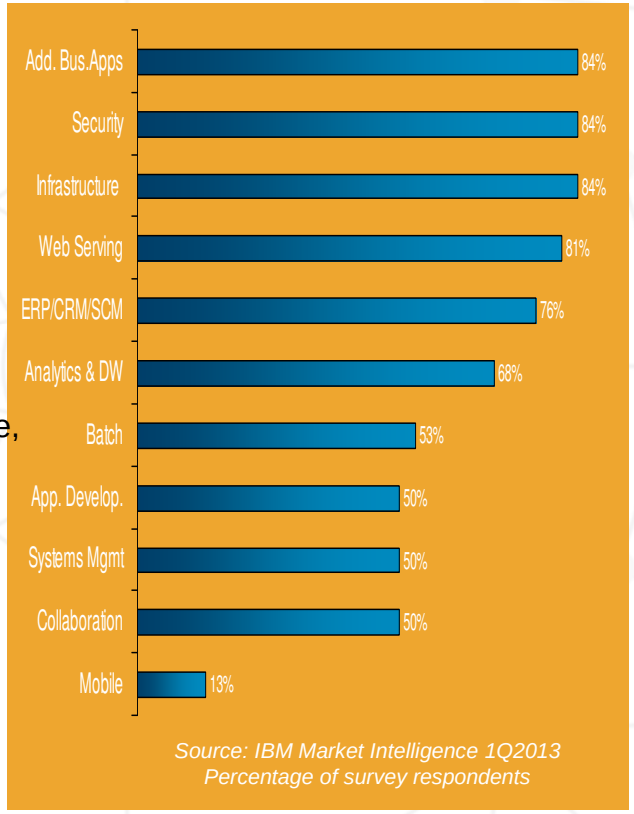
Deploy up to 40 virtual servers per core	
As low as $1.^{20}$/day per virtual server[1]	Up to 520 virtual servers in a single ELS footprint
Save up to 50% on TCO over 5 years[2]	Secure isolation of logical partitions with highest level of security certification
Support for Red Hat, SUSE and OpenStack® Cloud	More than 3,000 ISV applications supported
CRN Most Innovative Cloud Solution Winner – zBC12 Linux Journal Winner, Best Server Linux Vendor- IBM	



[1] IBM calculations of zEnterprise limits across maximum zBC12 configuration. Results may vary. 3-Year cost for hardware, hardware maintenance, and z/VM. Does not include IBM Wave for z/VM
[2] Based on preliminary measurements and projections comparing Oracle DB on x86 2 chip 8 core 2.13GHz blades vs. zBC12 and ELS solution edition pricing. Subject to change and results may vary based on numerous factors.

Recommended Workloads for Linux on System z

- **Data services**: DB2, Cognos, SPSS, InfoSphere™, Informix, Oracle Database, Builders WebFOCUS, …
- **Business applications**: WebSphere Application Server, WebSphere Process Server, WebSphere Commerce, SAP apps, Oracle apps, Java™, …
- **Mobile application hosting**: WebSphere Portal, IBM Worklight®, …
- **Security & Infrastructure services**: WebSphere MQSeries®, WebSphere Message Broker, WebSphere Enterprise Service Bus, DB2 Connect™, …
- **Email & collaboration**: Lotus Domino®, Lotus Collaboration: Sametime, Connections, Quickr™, Forms, …
- **Business Process Management**: Business Process Manager, WebSphere Business Monitor, FileNet® Business Process Manager, WebSphere Operational Decision Management, …
- **Enterprise Content Management**: FileNet Content Manager, Content Manager, Content Manager On Demand
- **Development & test**: e.g. of WebSphere/Java applications – Rational® Asset Manager, Build Forge®, ClearCase®, Quality Manager, UrbanCode



- **Industry Solutions**: Intelligent Operations Center for Smarter Cities®, Smarter Infrastructure for Social Services - Curam on zEnterprise, Enterprise Asset Management (Maximo®) for Government, Smarter Analytics™ Anti-Fraud Infrastructure for zEnterprise, zEnterprise Smarter Analytics for Retail

➔ **All workloads managed in a Cloud**: Tivoli® Provisioning Manager (TPM), Tivoli System Automation Manager (TSAM), SmartCloud Provisioning (SCP), IBM-Wave, xCat, …

SinfoniaRx reaps the benefits of the Enterprise Linux Server

Infrastructure Benefits

- **One weekend** to conduct migration. Simple and Easy!
- Data load times reduced by **1/3**
- Complete business rule running processes reduced by **60%**
- Batch update process reduced **94%**

Operational Benefits

- Batch processes run during normal business hours **without disrupting operations**
- High performing IT infrastructure to support future growth
- Processing higher volumes of data without the need for extra staff

Customer and Patient Benefits

- Ability to **engage the patient**
- **163,622** medication changes and **$65,618,855** in savings passed on to patients
- Nominated for the **Pinnacle Award** by Express Scripts Inc. for scaling capabilities to meet customer demands

Fueling global growth with the IBM Enterprise Linux Server

Growing Mobility

- Consolidated aging x86 infrastructure onto two z196 based Enterprise Linux Servers.
- Developed **24/7 cloud infrastructure** for core and mobile banking.
- Avoided **$1.5 million** in annual electricity cost and 207 tons of C02.
- Achieved **600% growth** in mobile banking.

Zero Downtime

- Consolidated aging x86 and Sun servers onto z114 based Enterprise Linux Server
- Developed **24/7 Linux based infrastructure** for inventory management, email, and analytics.
- Avoided **£2 million** per day cost of downtime.
- Leveraged Cognos analytics to deliver **real-time** dashboard of key metrics.

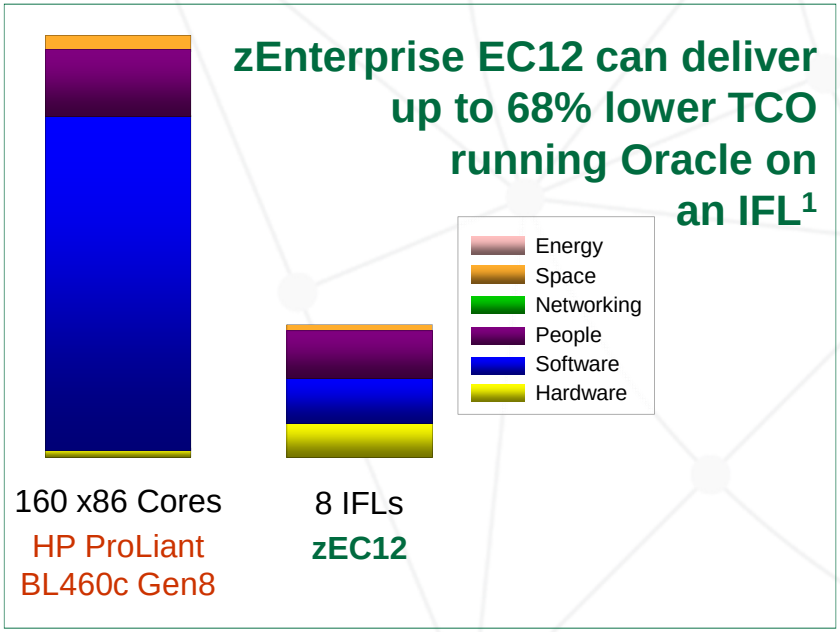
Secure IT for CSPs

- Capability for **industry leading SLAs**
- Scalable economics for **higher margins at scale.**
- **Secure infrastructure** foundation for sensitive and private data.
- Enable **lower labor and administrative costs** through extensive use of virtualization.

The Economics of Consolidation with System z

Large-scale server consolidation to Linux on System z

- *Allows hundreds of workloads to be deployed over fewer cores in a single system*
- *Massive reductions in software license, energy and facilities costs*



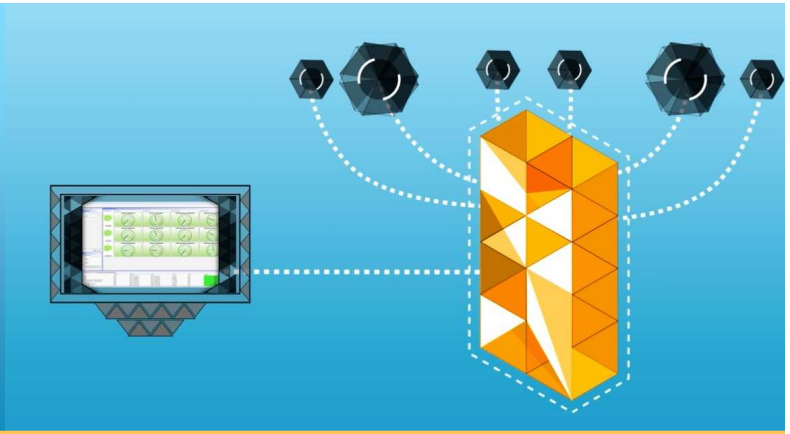
- **Simplified IT infrastructure inside a single server**
- **Up to 100% utilization**
- **Tight workload integration**
- **Highly scalable, flexible and secure**
- **Business continuance that help avoid downtime**
- **'Green' values**
- **Pay less as you run more**

[1] Distributed server comparison is based on IBM cost modeling of Linux on zEnterprise 196 vs. alternative distributed servers. Given there are multiple factors in this analysis such as utilization rates, application type, local pricing, etc., savings may vary by user.

IBM Wave for z/VM

NEW

Empowered Virtualization Management



Intelligent Visualization

- *Shorten the learning curve needed to manage complex environments*
- *Organize and simplify management of z/VM and virtual Linux servers*
- *View servers and storage utilization graphically; understand the status of system resources with Intelligent icons*
- *Reduce unnecessary steps using highly customizable views*
- *Graphical or tabular displays with layered drill down*

Simplified Monitoring

- *Monitor the status of z/VM systems through an innovative interface*
- *Monitor performance of CPU, paging devices, spool disks and more;*
- *Use agentless discovery to detect an accurate view of your environment*
- *Use advanced filters, tagging, layout and layer selection to make monitoring and management more meaningful*
- *Complements IBM OMEGAMON® XE used for in-depth performance monitoring*

Unified Management

- Manage your system from a single point of control
- Assign and delegate administrative access with role based assignments
- Provision, clone, and activate virtual resources . Define and control virtual network and storage devices
- Perform management tasks such as live guest relocation
- Annotate resources for additional policy based management
- Execute complex scripts with a single mouse click

IBM Wave Architecture

Client

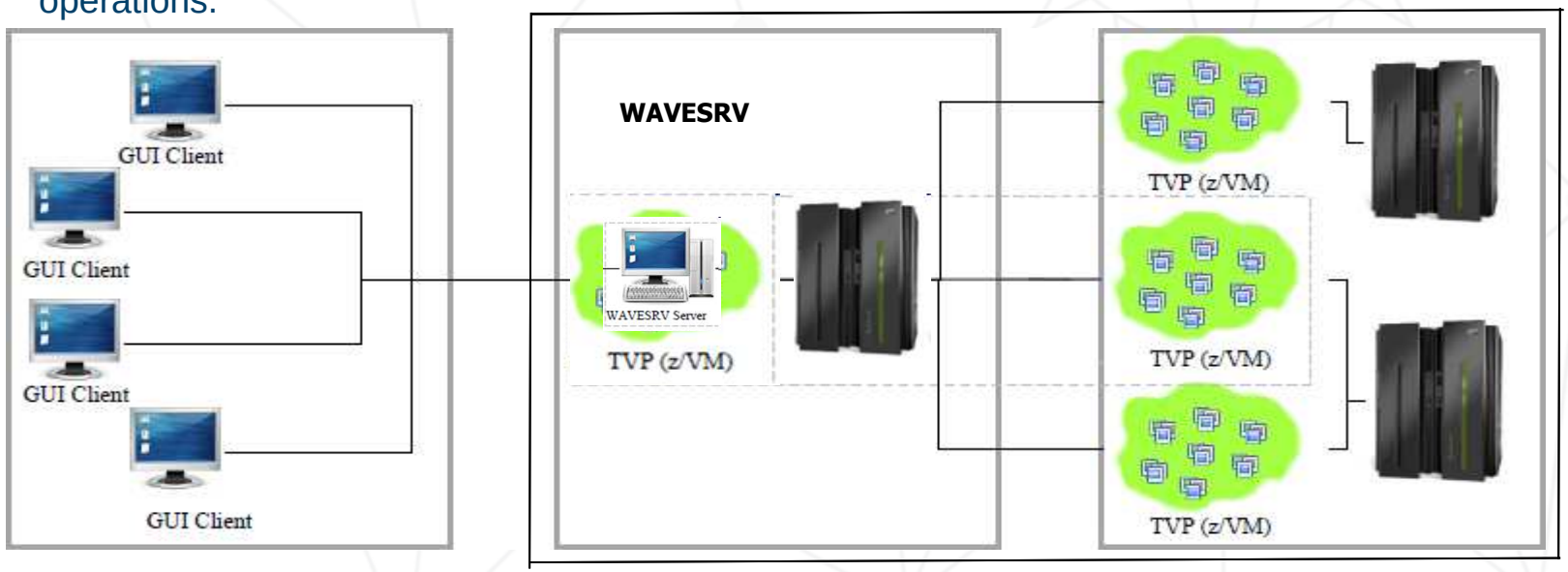
The Client can run on any platform supporting Java ™ (Microsoft® Windows®). It provides a graphic interpretation of the knowledgebase and allows the user to interact with the TVP using Point-and-Click and Drag-and-Drop operations.

The WAVESRV

This server (virtual or physical) hosts the application database and Background Task Scheduler. One BTS server can manage many targets.

The TVP

The Target Virtualization Platform (TVP) represents the hypervisor which hosts the virtual guests that are managed. The BTS and the GUI Clients utilize the TVP API to query and perform changes to the TVP and hosted virtual guests.



IBM Wave for z/VM Tested Productivity Savings*

IBM Wave is designed to help automate and improve the productivity of many administrative tasks. Tests were run on a zEnterprise processor both with and without the IBM Wave interface**.

Tasks	Manual Times in seconds	With IBM Wave Times in seconds	Reduction in time
Clone a Guest Linux Server	576	29	95%
Activate/deactivate a guest	65	10	85%
Add a virtual switch	88	20	77%
Execute scripts for a guest	96	18	81%
Monitor z/VM	30	13	58%
Live guest migration	95	13	87%

*These are sample task timings conducted by the IBM Competitive Project Office. Manual test times assumed a base knowledge of z/VM and assume no additional scripting. Individual test results may vary.
**Tests used a zEnterprise 196.model 2817-H10 running z/VM 6.3 with 6 cores shared by LPARS in the test. Each z/VM has 128G of memory.

IBM Wave Systems Management Task Example:

"Live Guest Relocation"

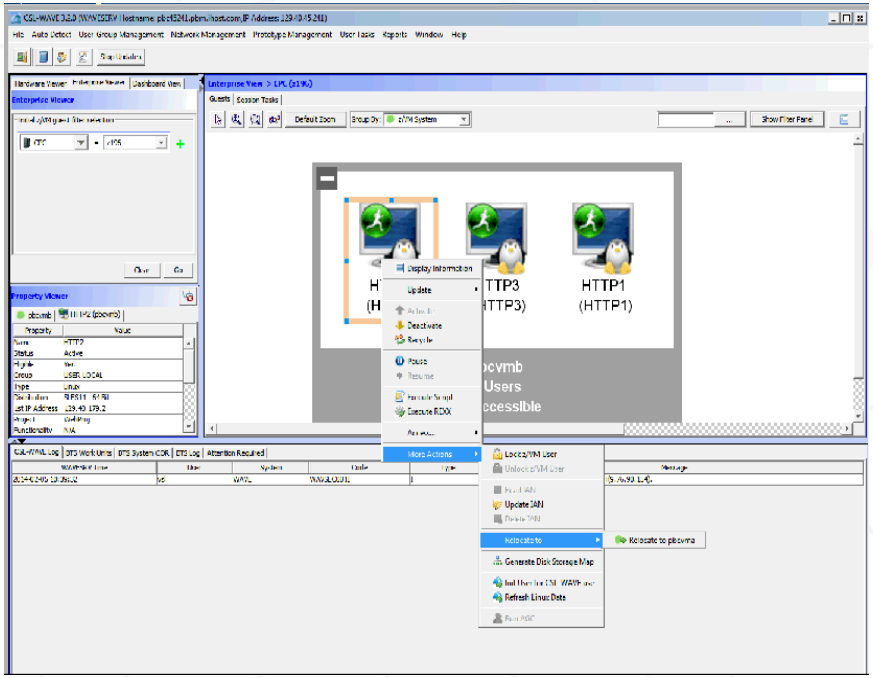
Without IBM Wave

- Using manual control program commands

With IBM Wave

•Using the GUI's Drag-and-Drop techniques
•Or Execute via menu selection

Task	Task Steps
Log into both z/VM instances	Login PBCVMA Login PBCVMB
Find out which instance has the running guest	q HTTP2 in PBCVMA q HTTP2 in PBCVMB
Verify the guest can be moved	vmrelo test HTTP2 to PBCVMB
Move the guest	vmrelo move HTTP2 to PBCVMB
Log out of both z/VM instances	Logoff PBCVMA Logoff PBCVMB



Benefits	IBM Wave for z/VM Capabilities
✓ Gain efficiencies in virtualization management ✓ Work with a current, accurate and complete view of your managed z/VM environment	▪ IBM Wave provides a high level view of performance, storage usage, networks at a glance with built-in reporting ▪ IBM Wave enables automation of management tasks and can incorporate scripts. ▪ By providing an up to date, accurate view of the IT environment through its "agent-less discovery" organizations can plan, change and optimize their virtualized resources accurately
✓ Simplify administrative, operations and systems functions ✓ Enable improved self service to reduce costs	▪ Tasks that would otherwise take hours and require significant z/VM knowledge such as Live Guest Relocation, Server Cloning and Storage provisioning can be performed quickly and easily ▪ Make common management tasks accessible to more user roles
✓ Respond quickly to changing business needs ✓ Reduce errors with appropriate delegation	▪ Easily delegate administrative capabilities to the appropriate users ▪ Enforce segregation policies at the individual administrator as well as the group level ▪ Set scope and permissions to match business requirements

Benefits	IBM Wave for z/VM Capabilities
✓ Improve service levels ✓ Easily respond to changing requirements. ✓ Reduce time spent on administrative efforts	▪ Offers easy, convenient access to performance and management information –at a glance ▪ Helps you quickly and easily administer and provision resources like servers, storage, user accounts. ▪ Tag resources with meaningful notes to help enforce installation defined rules.
✓ Easily manage virtualized environments ✓ Simplify and accelerate your journey to cloud	▪ Lets you provision new servers and easily clone Linux virtual servers and other resources ▪ Scripts allow customization of a golden master. ▪ Support early virtualization steps needed to get to a private cloud.
✓ Create audit trails of IBM Wave users' activities	▪ List tasks and status requested by the users with respect to their scope. ▪ Log each operation that changes the system including logon and logoff to provide an audit trail. The logs may be then routed to a centralized logging mechanism for further filtering or processing.
✓ Simplify your administration ✓ Extend the reach of your existing IT staff	▪ IBM Wave automates a sequence of VM commands, reducing steps needed to complete common administrative and management tasks—and improve consistency. ▪ IBM Wave helps your team manage additional servers even if you do not have a deep expert skills bench available.

Where IBM Wave Fits in the Cloud Blueprint

Integrate	Automate	Orchestrate
Virtualization *Infrastructure & Virtualization Management*	**Entry Level Cloud** *Standardization & Automation*	**Advanced Cloud** *Service Lifecycle Management*
Differentiation	*Standardization*	*Service Management*
▪ Rapid deployment of Linux virtual servers for less than $1 a day ▪ Industry leading "gold standard" security for tenant isolation ▪ Elastic scaling achieved by dynamically adjustable capacity at sustained performance ▪ Simplified and empowered virtualization management with IBM Wave – **z/VM** – **IBM Wave** – **Linux on IBM System z**	▪ Automated provisioning and de-provisioning ▪ Pool standardized virtualized building blocks ▪ Plug-and-play capacity across hardware generations ▪ Capture and catalog virtual images in the data center ▪ Automated methods for faster delivery of services with higher levels of control – **xCAT** – **SmartCloud Entry***	▪ Integrated virtualization management with IT service delivery processes ▪ Self-service provisioning ▪ Automated service lifecycle management including dynamic instantiation of cloud services ▪ Pay for use ▪ Optimize IT resources to reinvent business processes – **Cloud Ready for Linux on System z** – **SmartCloud Provisioning*** – **SmartCloud Orchestrator*** • *System z support currently in development*

Summary- Overall Benefit of IBM Wave for z/VM:

- Simplify the administrative and management of virtualized servers all from a single dashboard
- Reduce the time it takes to perform complex virtualization management tasks
- Extend the reach of existing skills to manage even the most complex tasks
- Improve the quality and consistency of operations with a current and accurate view of your system

- Reduce risk of errors by delegating management scope to the appropriate teams
- Accelerate virtualization steps like virtual server cloning and provisioning to make the transformation to cloud easier

Questions?