

# Main Man

*Cheaper Than Your Grandpa's Mainframes*

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Everyone with a data center has at least one common goal: making or saving money for the company. They're trying to lower total cost of ownership (TCO), increase business agility and simplify the complexity. One obvious way to do this is with server virtualization; that is, consolidating workloads running on several servers onto one generally more powerful server. Once you agree that server virtualization is a great solution, you start wondering which workloads to consolidate and what virtualization infrastructure to use.

Often, those who accept server virtualization as a solution start the virtualization process by selecting a hypervisor and then the work of consolidating workloads running on physical servers onto virtual machines created by the hypervisor. *Don't take this approach.* Rather, start with an analysis of your data center workloads to determine which are good candidates for consolidating.

Eventually, you'll have to select virtualization software to create your virtualization environment. Most of the options are x86-based. Yet, another choice—consolidating workloads onto mainframes<sup>1</sup>—is often overlooked, but now is becoming more popular. Often, you'll find it can be the most cost-effective approach to server virtualization because mainframes aren't as expensive as they previously were, and they've gotten much more powerful over the years. In addition, they require a fraction of the floor space and power that comparable-capacity x86 servers need. And you get the benefits of a mainframe such as increased hardware reliability, extreme I/O throughput, and less downtime. Those benefits just come with mainframes and you won't automatically get them from server virtualization on x86 servers or any other architectures.

To use Linux on a mainframe as a server virtualization technology, make sure the workloads that you'll consolidate run on Linux or at least can be ported to Linux.

Two flavors of commercial Linux distributions run on mainframes: SUSE Linux Enterprise Server for System z from Novell and Red Hat Enterprise Linux for System z from Red Hat. You choose which to use, but know that Novell has an 80+ percent market share.

## > Virtualization with Linux on the Mainframe: How It Works

Mainframes are about 40 years old. And as you probably know, several years ago mainframes were being written off as expensive, dated computers that were capable of running only large business applications. Not anymore.

<sup>1</sup> Herein, the word "mainframe" is synonymous with IBM S/390, IBM zSeries (z990, z890, z900, z800) and IBM System z9 and z10 servers.

Mainframes have evolved rapidly during the past few years with Linux and innovation from IBM. But, innovation has maintained the benefits of mainframes that have always made them desirable:

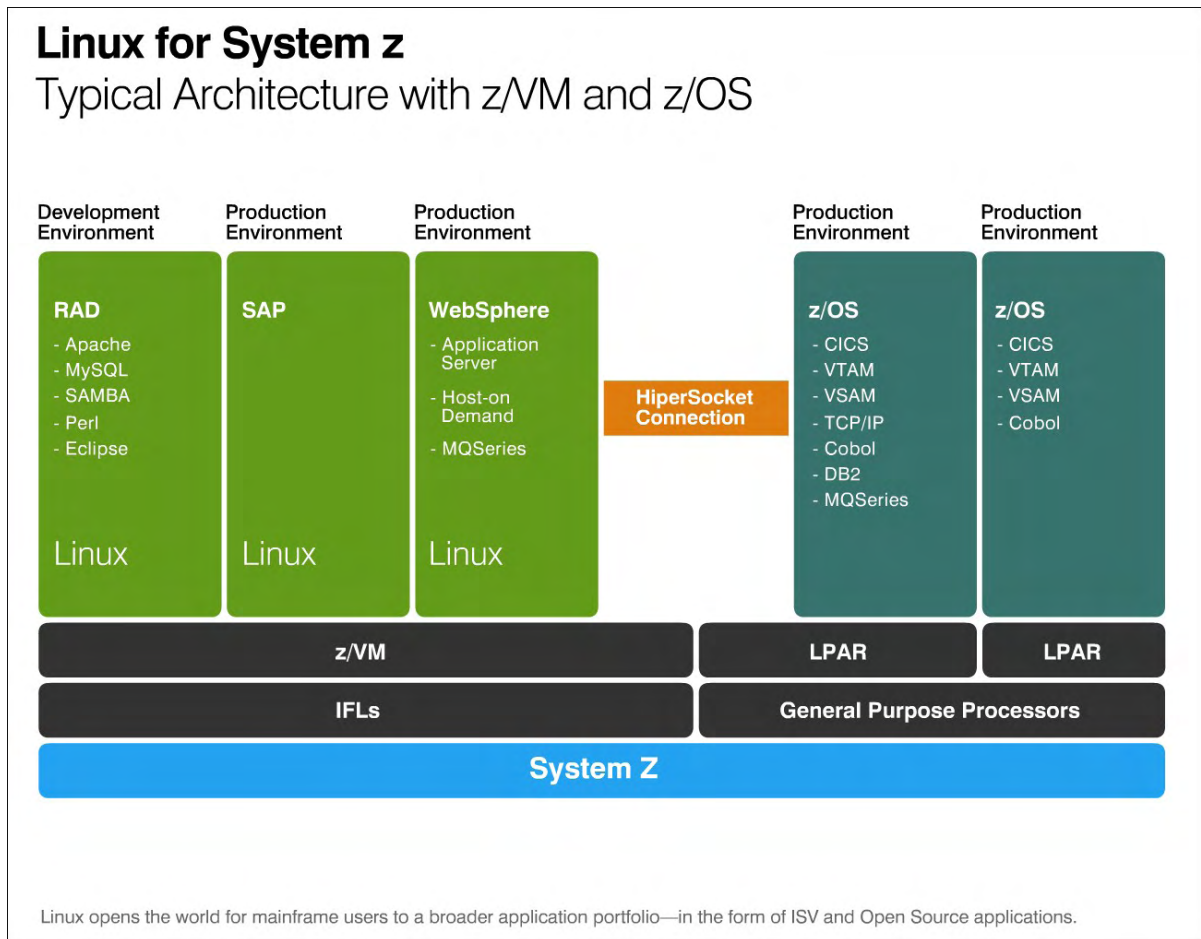
- high utilization rates: 80–95 percent over a 24-hour period
- ability to run mixed workloads without user intervention
- efficient use of floor space and power
- virtually zero downtime

Today, mainframes are faster, smaller, and far less expensive than their ancestors. Take for example, the IBM System z10 Business Class server.<sup>2</sup> The z10 BC gives you usable capacity equivalent to 232 x86-based servers, while using 83 percent less floor space, and up to 93 percent less energy. The cost per millions of instructions executed per second (MIPS) is one way that IBM compares the cost of mainframes. Today, the cost per MIPS for the System z10 is a very small fraction of the cost per MIPS for mainframes sold in 1980. This means that you get significantly more speed and capacity for your dollar than with older mainframes. You can get an IBM z10 BC for around \$100,000, and it gives you significant capacity with its new 3.7GHz quad-core processors. Plus, you get all the benefits of newer, more innovative technologies. Not bad at all when compared to the specs and pricing of your grandpa's mainframes.

Creating virtual machines to run Linux workloads on the mainframe begins with z/VM, IBM's mainframe hypervisor operating system. z/VM runs in a logical partition (LPAR). When it creates Linux virtual machines, it shares CPUs, memory and network resources among the Linux virtual machines. It also manages Linux virtual machines. Linux virtual machines created using z/VM are run using standard mainframe processors, also known as Cps, or an Integrated Facility for Linux (IFL). An IFL is a specialty engine that IBM created to make running Linux-based software more economical. For example, when you buy software, say an expensive app such as an Oracle database, Cps and IFLs are treated as a single processor, so the app can be used relatively inexpensively by all the workloads running in the Linux virtual machines. (See Figure 1.) More on that later.

To use Linux under z/VM, you'll need to buy enough CPU and memory capacity, and a Linux for mainframe subscription from Novell or Red Hat. With the use of z/VM functionality, you can begin creating Linux virtual machines in minutes and hours compared to days or weeks for distributed hardware. Today, there are more than 4,000 IFLs installed and more than 1,300 customers running Linux on the mainframe.

<sup>2</sup> [www.ibm.com/press/us/en/pressrelease/25584.wss](http://www.ibm.com/press/us/en/pressrelease/25584.wss)



Linux on mainframe distributions aren't much different than their x86-based counterparts. Differences involve the implementation of features that take advantage of mainframe hardware and mainframe operating systems such as z/VM. These features aren't generally visible to application developers so they don't need much, if any, training to be productive.

With Linux on mainframe distributions you can generally run the same applications that run on Linux on x86-based architectures. Of course, this requires software vendors to support the architecture, which not all do. If your vendor says that they have a version of their product for Linux, make sure that they have one for Linux on System z.

Novell makes it easy for you to try out SUSE Linux Enterprise Server for System z, even the new release 11, on a mainframe for free. Just [download SUSE Linux Enterprise Server Starter System for System z](#) and install it in less than 90 minutes. If you don't have the z/VM operating system running on your mainframe, you can get a free eval from [IBM](#). The Starter System doesn't require much experience with Linux and it gives you the chance to do proof of concept evaluations for free.

#### > Reasons to Consider Linux on the Mainframe for Server Virtualization

TCO for using Linux on mainframes includes the costs of:

- servers
- software licenses
- floor space
- power
- system management tools
- system administrators
- network hardware (and administrators)
- backup and restores
- downtime
- and so on.

Following are several reasons why Linux on the mainframe is an excellent way to meet your data center challenges and reduce costs.

#### > Owning a Mainframe Isn't Costly

As stated earlier, mainframes used to be expensive. But not anymore when compared with old prices, the power you get and how you can use them to save money, time and space in your data center.

You can also save on Linux on the mainframe subscriptions from Novell. In 2008, Novell created a pricing promotion for SUSE Linux Enterprise Server for System z that gives you a three-year subscription for the price of two years and a five-year subscription for the price of three; that alone saves you thousands of dollars on subscription fees.

Then in late 2008, Novell and IBM created new pricing for the new System z10 Business Class mainframe to make it more economical for you to use the mainframe. This amounts to about a 40 percent discount on SUSE Linux Enterprise Server for System z subscriptions for the System z10 Business Class servers. IBM also dropped its prices for IFLs by more than 50 percent. These pricing promotions make server virtualization on System z servers even more attractive when compared to server virtualization on x86-based servers because it can be much more cost effective on a mainframe.

For example, Nationwide Insurance, a Novell customer, uses SUSE Linux Enterprise Server for System z and has improved server utilization by 70 percent, projected savings of \$15 million over a three-year period. They've reduced floor space and power usage by 80 percent by migrating workloads to the mainframe.

Another Novell customer, First National Bank of Omaha, consolidated 40 Sun Solaris servers to five virtual SUSE Linux Enterprise Server for System z servers; reduced administrative costs by nearly 70 percent and software licensing costs by more than 90 percent, and realized a \$1.8 million savings the first year. Novell has many customer success stories similar to these for customers that have moved combinations of Linux, UNIX and Windows workloads to Linux on the mainframe running in a z/VM virtualization environment.

#### > **Save a Load of Money on Software Licensing**

Many large ISVs such as Oracle, have per-processor licensing models for at least some of their software applications. This means you're charged for the software based on the number of processors on the server on which the software runs. For example, Oracle Database, Enterprise Edition is US\$47,500 per processor. Generally, you pay that price regardless of the architecture.

Linux virtual machines share the cost of a single processor license. Remember, CPs and IFLs count as a single processor engine with respect to software licensing; that is, one IFL equals one core. Not only do you get a break on software licensing, but the capacity in a System z10 Business Class machine is many times that of an x86 server.

#### > **Many Applications are Available on Linux on the Mainframe**

Many of the 2,500+ applications that run on Linux on x86 are available on Linux on the mainframe. In fact, you can run more than 1,600 certified applications on SUSE Linux Enterprise Server for System z. More than 400 ISVs have

certified applications running on Linux on the mainframe, including more than 280 IBM middleware applications. These applications range from data-intensive, high-I/O applications to CPU-intensive applications, including applications from BEA, CA, IBM, Oracle, SAP and Veritas. You can also run many of the important open source applications such as Apache, MySQL and SAMBA on Linux on the mainframe.

With the new IBM System z10 server and its new quad-core processors, 70 percent more capacity and three times the available memory of the largest System z9 server, you can run CPU-intensive workloads that you couldn't run with any degree of efficiency on mainframes before. This greatly broadens the scope of applications that are good fits for the mainframe.

#### > **Get the Benefits of the Mainframe**

You get considerable benefits when you virtualize servers onto a mainframe. We've already listed some, but others include:

- **Increased security.** When you move workloads from front-end servers that were accessing databases on a mainframe onto that mainframe, security increases because you're not using an external network.
- **Increased communication.** When workloads are running on a mainframe, the mainframe HiperSocket<sup>3</sup> technology permits interaction among operating systems running in LPARs at internal memory speeds. This is especially useful when you have front-end applications running in Linux virtual machines under z/VM while accessing data in a database such as DB2 running on z/OS in another LPAR on the same mainframe.
- **Disaster recovery.** Disaster recovery is generally seen as a huge and expensive problem. But mainframe ease of disaster recovery is inherited by Linux on the mainframe with no additional set up or cost. That gives you virtualization on the mainframe with a huge advantage over virtualization on x86 servers. For example, you pay well over \$2,000 per processor for VMware vCenter Site Recovery Manager, which requires you to install VMware vCenter Server (formerly VirtualCenter). VMware vCenter Server costs between \$6,044 and \$8,180 depending on the support purchased. If you're virtualizing a two-processor x86 server running VMware virtualization software, you'd spend well over \$10,000 to get disaster recovery with one year, 12x5 support. But you won't pay extra for high-quality mainframe disaster recovery.

<sup>3</sup> HiperSocket is an IBM technology for high-speed communications between partitions such as LPARs. It can provide in-memory TCP/IP connections between and among LPARs running various operating systems such as Linux on the mainframe.

> **Summary**

Linux on the mainframe used for server virtualization is growing rapidly. You should seriously consider the mainframe as a server virtualization platform when you're thinking about consolidating Linux, UNIX and/or Windows workloads to reduce costs and increase business agility. It's also a good platform if you're migrating from UNIX to Linux. You don't always have to migrate a RISC/UNIX workload to an x86 server running Linux. You can migrate the RISC/UNIX workloads to Linux on the mainframe and keep the positive features of RISC/UNIX, such as security.

To determine whether or not Linux on the mainframe is a good choice for your server virtualization project, take a look at how well the workloads you're considering consolidating fit the mainframe. The best fitting applications are those that leverage the classic strengths of System z servers: high availability, high-I/O bandwidth capacity, etc. Example workloads you might already be running include Oracle and SAP. Other applications that are good fits include DB2, Informix, WebSphere Application Server and Apache.

The breadth of good-fit apps has increased to include those with serious computational needs with the advent of the IBM System z10 server. But question some

workloads for the mainframe, such as apps that haven't yet been ported to Linux, apps such as geological mapping animation rendering that are optimized for throughput, and apps that are too internally sensitive to try and migrate due to political issues.

As part of your quest to virtualize your servers, use IBM's vRACE tool (Rehosting Applications from Competitive Environments) to evaluate your workloads and see if they're a fit for Linux on the mainframe. The vRACE tool utilizes a set of 10 workload categories, ranked according to how well they fit the mainframe. A vRACE evaluation tells you the cost savings you can expect to get by consolidating workloads onto Linux on the mainframe versus other server virtualization technologies such as VMware. It's a sophisticated tool that will give you a much-needed hand in helping you decide what server virtualization technology is right for your data center so you can make even more money for your company. Customers wishing to understand RACE and/or vRACE and/or wish to participate in a vRACE Workshop (an engagement with the vRACE tool) can contact Montgomery Bauman at IBM ([mbauman@us.ibm.com](mailto:mbauman@us.ibm.com)). **N**