

Cheryl Watson's 2010 z/OS 101 Primer

The z/OS 101 Primer

At the 2008 SHARE conference held in Orlando, I gave a lunchtime presentation called *The Tips Your Mentor Forgot to Mention*. It was for the zNextGen project, which was created to help those people who are new to mainframes or new to performance. The response to the project was incredible. One teacher even brought several students from his class in Georgia to the conference JUST to attend the zNextGen sessions.

Because of the project's success, and because several of our readers responded so favorably to my advice for new techies, I decided to include a new section in our Tuning Letters called "z/OS 101". Each z/OS 101 article addresses a topic that should be useful to those new to mainframes, especially in the performance, capacity planning, data center reporting, and charge back areas. They're also good as a review of the basics. If you'd like some special topic addressed, please let me know.

This particular document is a compilation of the 2010 z/OS 101 articles written so far and is offered to the public via our website. Please use it and copy it as you see fit, provided that you use the entire document if you distribute it, always credit us as the source, and make no attempt to resell it. The most recent compilation, as well as the 2009 compilation can always be found at www.watsonwalker.com/articles.html.

So, hats off to our next generation of z/OS techies, and welcome to the exciting world of performance!



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z/OS 101

With the introduction of the zEnterprise, z/OS-only programmers and analysts are being thrust into the world of non-Z software and hardware. Although most installations run Unix of some sort, the Unix systems are often maintained by other staff. But we're all going to need to understand terms like POWER, blades, AIX, and others, so this section is for those who haven't dealt with non-z platforms.

IBM Non-Z Hardware

System i

This is the term used for the midrange IBM processors, previously known as AS/400, eServer iSeries, and System/38 (S/38). It was officially merged with the System p to become the IBM Power Systems line. We're including it because it's still used in several references. The software for the System i processors was IBM i, which was previously called OS/400 and i5/OS. [Note - software is described in a later section.]

System p

The System p servers were originally the RS/6000 machines that were the RISC/Unix-based servers. These were renamed first to eServer pSeries, then eServer p5, and then System p5 before merging with the System i to become the IBM Power Systems line. We're including it because it's still used in several references. System p could run either AIX or Linux.

System x

The System x servers are the PC-based servers from IBM. System x is also referred to as an x86 server, which can run Windows, Linux, VMware, and Solaris Unix. They're important to z/OS people because an IBM statement of direction indicates that the new zBX (zEnterprise BladeCenter Extension) will support Linux running System x blades by mid-2011. System x is available in towers, rack-mounted, and blades.

IBM Power Systems

Power Systems merged the System i and System p lines into a single line of processors in 2008. The POWER6 processor models (520, 550, 560, 570, 575, and 595) have been the primary systems since 2008. In February 2010, IBM introduced the POWER7 (710, 720, 730, 740, 750, 755, 770, 780, and 795). Any of the Power Systems can run four types of operating systems: AIX, Linux for Power, z86 Linux, or IBM i. The primary Web site for Power Systems is <http://www-03.ibm.com/systems/power/>. The Power Hypervisor (PowerVM) is similar to PR/SM and z/VM because it is firmware that supports multiple virtual guest operating systems.

Here's the February 8, 2010 press release for the POWER7 family - <http://www-03.ibm.com/press/us/en/pressrelease/29315.wss>. Photos of the POWER7 family are seen in Figure 1.

Figure 1 - - IBM POWER7 Family



We'll cover only the POWER7 in this discussion, because it's at the heart of the zEnterprise zBX. The POWER7 can have up to 32 chips with 4, 6, or 8 cores per chip. Think of a core as a z/OS CP. The cores run at between 3.0 and 4.25 GHz, and can execute instructions out-of-order in order to improve performance. Each core has a level 1 (L1) memory cache of 64KB, an L2 cache of 256KB, and an L3 cache of between 4MB and 32MB. The POWER7 also comes in the form of blade servers (see next paragraph).

Blade Server or Blade

You can think of a blade server as a compressed computer. One small piece of hardware contains the processors, memory, and disk storage. A blade is designed to fit into a BladeCenter that can contain several blades. For example, the BladeCenter PS701 is a POWER7 blade that contains eight cores and runs at 3.0 GHz. The BladeCenter PS700 has 4 cores, and the PS702 has 16 cores. The PS701 is the blade used in the zBX model 002, and comes with eight 64-bit 3.0 GHz cores, with between 16GB and 128GB of memory, and up to a 600GB hard drive. It is 9.65" (245 mm) x 1.14" (29 mm) x 17.55" (445 mm) in size. Figure 2 shows a the PS702, PS701, and PS700 blades (from left to right).

We're only going to discuss the POWER-based blade servers, but others exist for Intel and AMD processor-based blade servers and Cell/B.E. processor-based blade servers.

Figure 2 – IBM POWER7 Blades



BladeCenter

Before BladeCenters, you had racks and rack-mounted servers. Each rack was called a 1U to indicate the size, where 1U indicates a space that is 19" (48 cm) wide and 1.75" (4.45cm) high. Some servers might be 2U in size, but each server was independent. That is, each had their own power cord and network connection. The back of the racks could become a maze of cables. Most racks cannot exceed 42U in height.

A BladeCenter, in IBM terms, replaces those rack-mounted models. It reduces the complexity, energy, and cost because it manages the power, cooling, and networking. It can contain one or more blade servers, and it can contain multiple types of blade servers, such as an AIX POWER6 blade, a Linux POWER7 blade, and a Windows System x blade. The advantages of BladeCenters are many, starting with the reduction in floor space, the reduction in energy, the reduction in cables and connections, and the ability to provide redundancy for every portion of a server, including the UPS (Uninterrupted Power Supply). As an example of the cost reductions, the home page of the IBM BladeCenter had a story about Europe Airpost who consolidated 70 HP servers to 8 BladeCenter HS22 blade servers reducing the cost of ownership 60% in two months. The home page is at <http://www-03.ibm.com/systems/bladecenter/>.

The BladeCenter chassis can come in several sizes: Model S (7U high, 6 bays)), Model H (9U, 14 bays), Model E (7U, 14 bays), T (8U, 8 bays), HT (12U, 12 bays).

Although this presentation is a couple of years old, I think it does a good job of explaining the benefits of a BladeCenter - <http://www.authorstream.com/Presentation/RobClare-8888-why-haven-moved-ibm-bladecenter-blade-system-others-misc-ppt-powerpoint/>. (I really like the array of cables on slide 17.)

zBX - zEnterprise BladeCenter Extension

This is the newest BladeCenter to be announced and is part of the July 22, 2010, zEnterprise announcement. zBX has two models - Model 002 that will be available in November 2010 and Model 001 that will be available in December 2010. The zBX has direct connections to a z196 to improve performance for applications that communicate between AIX, Linux, and z/OS. The Model 002 can support POWER7 blades.

IBM Non-Z Software

Although you're most familiar with z/OS, there are several other operating systems supported by IBM. Here are a few you should know:

AIX - Advanced Interactive eXecutive

This is IBM's proprietary Unix operating system created in 1986. The most current release is AIX V6.1, but V7.1 is announced for a September availability. AIX can run on a variety of hardware, including the POWER and PowerPC systems, and PS/2 PCs.

IBM i - Operating System for Power Systems

The latest release is i7.1. IBM i used to be called OS/400, then i5/OS. This is the operating system for IBM's midrange computers.

Linux

Linux is an open-source Unix operating system that was developed in 1991 and is still being expanded. (Unix itself dates from 1969.) The Linux popularity has grown steadily because of the open source concept and its expandability to hardware ranging from cell phones to System z. Linux can run on System x (x86) machines.

zLinux - Linux on System z

This is an open source version of Linux that is designed to run on IBM specialty engines (Integrated Facility for Linux - IFL) and was developed in 1999. Most installations run zLinux under z/VM. There are two zLinux distributions that are now supported: Red Hat Linux and Novell SUSE Linux.

z/VM

This is IBM's virtualization system. It can run in a dedicated or shared LPAR and can run one or more guest server operating systems including z/OS and zLinux. This is usually used to run z/OS development systems or many production zLinux systems. z/VM used to be called VM/CMS (VM/Conversational Monitor System) or VM/ESA (Enterprise System Architecture). Older versions were VM/SP, VM/XA, and VM/HPO. CMS can also be run on z/VM as an end-user operating system platform.

More New Terms

There are a couple of other terms used in zEnterprise that might be somewhat new to z/OS-only programmers - appliance, accelerator, and hypervisor.

Appliance

In a Unix/Linux world, the term appliance indicates a specialized hardware and firmware solution. Some IBM WebSphere DataPower SOA appliances are described at (<http://www-01.ibm.com/software/integration/datapower/>). These are purpose-built network devices to simplify Web services deployments. Another common set of appliances are the XML appliances originally developed by DataPower (which was bought by IBM in 2005). The XML appliances are network devices that can perform XML processing.

Accelerators

IBM provides a host of accelerators to improve the speed of results to the user. An accelerator is an integrated offering (hardware and/or software) that can reduce either the implementation or performance of an application. The most recent accelerator is the IBM DB2 Optimizer that was announced on July 22, and improves the response time of business analytic queries. IBM also has several accelerators for WebSphere Portal, a PCI Cryptographic Accelerator, and several others.

Hypervisors

Hypervisors are firmware in other platforms and are similar to PR/SM on z/OS in their ability to support multiple virtual operating systems on one machine. This allows AIX LPARs on Power systems. ■

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