POWER up your Linux!

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Today's session: POWER up your Linux!

Will cover:

- Overview of using Linux on Power systems for techies*
- Why might this be of interest?
- What do I need to consider?
- Where do I start?

Follow on sessions

- More in depth sessions focused at those with a specific background
- Focus on certain areas of interest

* techies = with Power and x86 background
Agenda

By the end of the hour:

- Why would I run Linux on Power?
- Linux = ?
- Power = ?
- How can I run it?
- How to install it?
- What might I use it for?
- Other things you should know
- Where to go for more information?
First, a couple of questions

- Who are you?
- Which describes you best?
- What's your favourite Linux OS for business use?
Why run Linux on Power?
Why Linux on Power?

“I know Power...”
All the benefits of running on Power systems plus...

- Price equivalent to AIX or lower
- Access to emerging workloads available only on Linux
- Easy use of Open Source solutions e.g. Apache, Ganglia...

“I know Linux...”
All the benefits of running of Linux plus...

- Better scale out performance at lower cost than x86
- Ability to scale up
- Better reliability and resiliency than x86
- Linux is Linux

IBM Innovation & Focus
IBM Power Systems built on open innovation

Embraces open stack of software for easy development and implementation

Creates a pipeline of ecosystem innovation

Accelerates applications on a purpose-built infrastructure

Leverage industry innovation
IBM has a history of industry-leading collaboration on open technology
IBM is heavily invested in the success of Linux

- 100% of our systems
- 400+ software products
- 500 patents donated
- 600+ developers
Big Data / Hadoop

- POWER8 S824 will deliver 2x the performance of the best published x86 system for Big Data / Hadoop
- POWER8 exploits additional cores, more threads, larger caches, memory bandwidth, I/O bandwidth
- Terasort is a popular benchmark to measure the performance of a Hadoop solution

Derive insights 67% faster with Cognos Business Intelligence (Cognos v10.2) running on Linux on POWER8 versus Linux on Intel Ivy Bridge-EP

Utilize Predictive Analytics to get the answers before your competitors

67% faster is based on IBM Internal Testing of sample analytic workloads; current as of March 28, 2014. Performance improvement figures are cumulative of all queries in the workload. Individual results will vary depending on individual workloads, configurations and conditions.

IBM Analytics Stack: IBM Power System S824; 24 cores / 192 threads, POWER8; 3.5GHz, 512 GB memory, RHEL 6.5, InfoSphere BigInsights 2.1.2

Competitive stack: HP DL380p; 24 cores / 48 threads; Intel E5-2697 v2; 2.7 GHz; 384 GB; DB2 10.1 and Cognos v 10.2

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Lower cloud infrastructure costs

Thirty-four 2-socket Power S822L servers do the job of 100 2-socket x86 (HP DL380) servers running equal virtualised capacity

58% lower total HW TCO

vs.

Ivy Bridge w/ VMware

66% Less Systems & Cores

Lower SW License Fees
Reduced Management Costs
Reduced Floor Space

Power S822L
- TCA/TCO is for 34 servers, 816 cores
- 3x better virtualized throughput vs. an HP 2 socket Ivy Bridge
- 2S, 24 cores each
- POWER8, 3.0GHz
- PowerVM

HP DL 380 G8
- TCA/TCO is for 100 servers, 2400 cores
- 100 HP servers needed for ~ equal virtualized throughput of 34 Power S822L
- 2S, 24 cores each
- Ivy Bridge, 2.7GHz
- VMware vSphere Ent


This is an IBM sizing designed to replicate a typical IBM customer workload used in the marketplace. The results are calculated and not an actual customer environment. IBM's internal workload studies are not benchmark applications, nor are they based on any benchmark standard. As such, customer applications, differences in the stack deployed, and other systems variations or conditions may produce different results and may vary based on actual configuration, applications, specific queries and other variables in a production environment. Prices, where applicable, are based on published US list prices for both IBM and competitor.
## Power systems have better RAS features

<table>
<thead>
<tr>
<th>RAS Feature</th>
<th>POWER7</th>
<th>x86</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application/Partition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move running workload partitions to another server</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Partition Availability priority</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Failure Data Capture</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Memory Keys ensure secure hardware separation of memory</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Processor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dedicated Service Element processor</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Processor Instruction Retry</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Alternate Processor Recovery</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Predictive ProcessorDeallocation</td>
<td>Yes</td>
<td>No (1)</td>
</tr>
<tr>
<td>Dynamic Processor Sparing</td>
<td>Yes</td>
<td>No (1)</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chipkill™ - Redundant Memory Capabilities</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Chipkill™ - Survives Double Memory Failures with x8 DRAMS</td>
<td>Yes (2)</td>
<td>No</td>
</tr>
<tr>
<td><strong>I/O</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended Error Handling – PCI bus, PCI bridge, GX+ bus adapter</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>VIOS - Dynamic adapter failover</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

1 = Capability built in but typically supported
2 = Chipkill™ On Systems with DRAM sparing
Which Linux?
Red Hat support on POWER

- **Red Hat Enterprise Linux 7**
  - Public beta available for existing RHEL customers
  - Expected full support for POWER8 (native mode) and POWER 7/7+ at operating system GA

- **Red Hat Enterprise Linux 6**
  - POWER8 supported with U5 (P7-compatibility mode)
  - Full support of POWER6 and POWER7 (native mode)
  - Last update: U5 GA December 2013

- **Fedora**
  - Fedora 16 was first release to re-launch POWER
  - Fedora 20 has POWER8 support
  - Fedora remains primary community for major innovation/collaboration

- **Supported add-ons**
  - JBoss
  - High Performance Network Add-on

- Built from the same source as x86
- Delivered on the same schedule as x86
- Supported at the same time as x86
SUSE support on POWER

- SUSE Linux Enterprise Server 11
  - POWER8 supported with SP3 (P7-compatibility mode)
  - POWER7+ encryption, RNG accelerators supported with SP3
  - Full support of POWER7 (native mode)
  - Earliest supported release: SLES 11 base
  - Last update: SP3 GA July 2013

- SUSE Linux Enterprise Server 10*
  - POWER7 supported with SP3 (P6-compatibility mode)
  - Full support of POWER6 (native mode)
  - Last update: SP4 GA April 2011

- openSUSE
  - openSUSE 12.2 re-launched for IBM POWER
  - openSUSE 13.2 includes POWER8 support (native mode)

- Supported add-ons
  - SUSE Linux Enterprise High Availability Extension (included in base Power license)

* Not supported on POWER7+ and POWER8 systems
Canonical support on POWER

- **Ubuntu 14.04**
  - POWER8 enabled (native mode)
  - No official support for POWER7+ and older systems
  - No support for 32-bit applications. 64-bit only.
  - Supported in KVM only at this time

- **Supported add-ons**
  - JuJu Charms
  - MaaS (Metal as a Service)
  - Landscape

- **Debian**
  - Community enablement in process

- Built from the same source as x86
- Delivered on the same schedule as x86
- Supported at the same time as x86
Power has Linux “release parity” with x86

See for more details:
- Red Hat lifecycle information - https://access.redhat.com/support/policy/updates/errata/
- SUSE lifecycle information – http://support.novell.com/lifecycle/
- Ubuntu lifecycle information - https://wiki.ubuntu.com/Releases
Which Power boxes?
POWER7+ based systems

PowerLinux™ 7R2
- 2-socket, 2U
- POWER7+ processor
- Up to 16 cores
- 512 GB memory
- Linux only

PowerLinux™ 7R4
- 4-socket, 5U
- Up to 32 POWER7+ cores
- 1 TB memory
- Hot-swap PCI adapters
- Linux only

Power 795
- Power 770
- Power 780

Power Enterprise IFLs

Customers value enterprise class features, robustness

PureFlex

Customers value integrated infrastructure

Customers value initial cost of acquisition

1, 2 and 4-socket

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New Power Systems scale-out portfolio

- **Power Systems S812L**
  - 1-socket, 2U
  - Linux Only

- **Power Systems S822L**
  - 2-socket, 2U
  - Linux Only

- **Power Systems S822**
  - 2-socket, 2U
  - All Operating Systems

- **Power Systems S814**
  - 1-socket, 4U
  - All Operating Systems

- **Power Systems S824**
  - 2-socket, 4U
  - All Operating Systems

- **Power Systems S824L**
  - 2-socket, 4U
  - Linux Only
  - Statement Of Direction (SOD)
POWER8 Linux 2S 2U Scale Out System

- Form Factor: 2U
- Sockets: 2S
- Dual Sockets
  - Cores: 20 (2 x 10) or 24 (2 x 12)
  - Memory: Up to 1 TB / 16 DIMMs
  - Slots: 9 PCIe G3 LP (Hotplug)
- Ethernet: Quad 1 Gbt / (x8 slot)
- Media: DVD
- Internal Storage
  - Up to 12 SFF Bays
  - Up to 8 SFF Bays & Up to 6 1.8” SSD Bays with Easy Tier
- Hypervisor: PowerVM or PowerKVM
OK, I want to have a go – where do I start?
Things you will need...

- A POWER based system to run on
- An OS to run
  - Might already have a site favourite / strategy?
  - If not:
    - Get a 60 day trial version of RHEL or SLES, or try Ubuntu (POWER8 only)
    - Download one of the community supported versions at no cost e.g. Fedora / OpenSUSE / Debian (links to ppc download sites)
  - Check the flavour / version you choose works with
    - the Power system you are using (look at the release notes)
    - the application stack you are planning to use
- To decide how to set up your system (quite a few options)
  - To virtualise or not to virtualise?
  - HMC availability?
  - Volume of virtual machines / partitions required: a one off or 100s
Installation / hosting options

- **Bare metal / native install**
  - If no graphics adapter installed, then use RS232 interface (see gotcha)
  - Doesn't take advantage of flexibility and high utilisation of virtualisation

- **Using Integrated Virtualisation Management (IVM)**
  - No need for HMC
  - Access mgmt partition via browser to work with partitions + virtual infrastructure

- **Using an HMC and PowerVM**
  - Needs an HMC
  - Business as usual for larger Power servers.

- **Using PowerKVM**
  - No need for HMC
  - Only on POWER8 Linux only servers

Larger installations
PowerVM: virtualisation without limits

- New monitoring views help simplify performance and capacity management
- Support for latest POWER8 servers and capabilities
- SRIOV NIC support for enhanced network virtualisation
PowerKVM: open virtualisation for scale-out servers

- Kernel-Based Virtual Machine (KVM) virtualisation targets new Linux workloads
- Provides simplicity and familiarity for VMware and KVM Intel Linux admins
- Enables cloud providers to integrate Linux on Power into OpenStack environments
- Managed by PowerVC or open source tools such as Kimchi
- Exploits POWER8 micro-threading for performance efficiency
Installation / hosting options - revisit

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Larger installations
How to install?

Flowchart can be found online [here](#)
Blue writing = links on online version
Other symbols = Videos / Quickstart guides

To be updated when PowerKVM ships
Installation of a Linux operating system
Either natively or into a partition / virtual machine

- DVD
- Network
- IBM Installation toolkit
  - “hides” distribution front end, automated install, includes IBM service and productivity tools
  - installation natively or on a pre-configured LPAR
  - minimal options, optionally select server type e.g. LAMP
- To make life easier:
  - Use VNC installation mode for headless nodes
    - **boot: linux vnc**
    - Needs network connection and assumes DHCP available, otherwise specify network settings also
  - Automated installation using config file available on network
    - Kickstart for Redhat
    - AutoYAST for SUSE
Linux is Linux
(but there are some differences related to the architecture)

• Partitioning:
  – additional PreP partition which holds bootloader
  – MBR is present, but only holds partition table

• System firmware
  – System Management Services (SMS)
  – Press 1 at boot time to enter, x to exit
  – Config boot order, bootp network boot, ...

• Bootloader: yaboot (compared to grub / lilo)

• No PXE boot, network boot uses BOOTP protocol (grub2 future direction)

• Package names: ppc / ppc64

• Additional value-add packages: e.g. lprutils, Powerpc-utils, ppc64-utils, servicelog
Potential gotcha

- Beware of the RS232 serial interface – dig out those old cables!
  - For native / IVM installations with no graphics adapter, first part of install requires input of information via serial port
  - Need adapter from Power machine (port marked S1, looks like ethernet / RJ45 socket) to RS232 serial port
  - Need laptop with a serial port (!) or a RS232 to USB adapter
  - A female to female adapter to attach your adapters together
  - A terminal emulator on your laptop e.g. Teraterm (Windows) or minicom (Linux)
  - See Nigel’s AIXpert related blog for more details

<table>
<thead>
<tr>
<th>Machine State</th>
<th>Port function</th>
<th>Serial port attribute</th>
<th>Default setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powered off</td>
<td>Service processor text interface</td>
<td>Line speed</td>
<td>19200</td>
</tr>
<tr>
<td>Powered on</td>
<td>System console for 1st partition</td>
<td>Word Length (bits)</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parity</td>
<td>No</td>
</tr>
<tr>
<td>HMC Managed</td>
<td>Disabled</td>
<td>Stop Bits</td>
<td>1</td>
</tr>
</tbody>
</table>
OK, I've got it installed, now what do I do with it?
Starting off

System configuration:
- yast2 = smitty on SLES / OpenSUSE
  - GUI / TUI
- equivalent for RedHat / Fedora found via system-config-* commands
  - e.g. system-config-network, system-config-services …

Service and productivity tools (link):
- Hardware diagnostic aids and productivity tools (yum repository)
- IBM Software Development Kit
  - a free, Eclipse-based integrated development environment
  - Advance Toolchain
  - Classic Linux performance analysis tools, including OProfile and Valgrind
- nmon (of course!)
This is starting to look pretty good! What else should I know?
What might you use it for?

IBM Software Group apps

156 applications supported and increasing!

Big Data, Data services, Business application middleware, Infrastructure services, Development and test, Mobile, Social, Enterprise Content Management, High Availability, Security

For more details see: IBM Software Product Compatibility Reports

link

Independent Software Vendor (ISV) apps

1000s of applications available for Linux on Power systems

Open source “killer apps”

(aka things that are much easier to do / possible on Linux compared to AIX)

IBM Global Solutions Directory
Useful snippets

70 PVU rating for all Power cores running Linux

PowerKVM just announced

You don't need to buy a server – switch on some dark cores!

- Power IFL
  - 4 x CUoD core activations
  - 32 GB CUoD memory activations
  - 4 x PowerVM for PowerLinux license entitlement
  - Scales in increments of 4 cores

Available on Power 770, 780 & 795
Recent Redbooks

**IBM Power Systems S812L and S822L Technical Overview and Introduction**

- Outstanding performance based on POWER8 processor technology
- 2U scale-out rack-mount Linux server
- Improved RAS features

Alexandre Bross Caldasen
Valcarne Haag
Marc-Olivier Callo
Cesar de los Mocel
Monica Sanchez

[Link](ibm.com/redbooks)

**Performance Optimization and Tuning Techniques for IBM Processors, including IBM POWER8**

- Learn optimization strategies for the new IBM POWER8 processor
- Apply strategies to IBM POWER7 and IBM POWER6 processors
- Optimize code performance in POWER environments

Brian Hall
Aruna Ramakrishnan
Briangel Andrade
Walter dos Santos Marques
Robert Donald
Paul Viegas
Michael R. Weroner
Alex Markev
Philipp Seiler
Bret DeMaestri
Sarah Simon
Daniel Sakkas
Adriano Zaffari

[Link](ibm.com/redbooks)

[Link to search for “Linux” on the Power Systems Redbooks site](ibm.com/redbooks)
Key points:

- Only on scale out 1-2 socket Linux only servers
- Not nested in LPAR, sits on hardware
- No HMC / IVM / VIOS
- Embraces opensource clouds and other virtualisation SW through standard interfaces like oVirt (VDSM) and OpenStack
KVM on Power Management Architecture
Enabling integration into an x86 world

Linux Host

KVM

Open Power Abstraction Layer (OPAL)
Power Platform

Linux Userspace

Qemu
Libvirt
API & virsh CLI
Console Shell

VM1 RHEL
VM2 SLES
VM3 Fedora

KVM

Standard interfaces

Browser Or Client

Openstack controller

CLI

Xcat
Chef
Puppet
Custom scripts

CLI / IPMI

Note: oVirt has been enabled in version 3.4 for Linux on Power.
Where to go for more information?
Learn more about Linux on Power Systems

**Power Systems Linux web site**

www.ibm.com/systems/power/software/linux/

**The PowerLinux Community**

www.ibm.com/developerworks/group/tpl/

**AIXpert blog** tinyurl.com/AIXpert

@ibmpowerlinux  plus.google.com/communities/100156952249293416679

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In summary....

- There are many benefits to running Linux on Power whether you are coming from a Power background or an x86 background.
  - For scale out workloads the default answer should not be Linux on x86. Linux on Power has comparable TCA, better TCO, better performance and reliability.
  - In an existing Power environment Linux can be better suited for emerging / open source workloads.
- Have a go!
  - Download a version of Linux and try it out on your existing hardware.
  - IBMers / partners – try it out on the IBM Power Development Cloud
  - Customers - don't have hardware but have a focus workload? Get us involved in a proof of concept
  - Unsure about your Linux strategy? Get us involved to look more closely at your existing workloads and their suitability for moving.
Thanks for your time!

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