



**L110483**

## **Lab: Red Hat OpenShift on POWER - Part 1**

Please bring an EMAIL enabled device:

In Part 1, get a Red Hat Developer Account if you don't already have one

In Part 2, get a github account if you don't already have one

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## Session Objectives

- PuTTY Login to Red Hat 7 instance provided on the tear-strip
- Configure for OpenShift "all-in-one" development environment
- Establish no charge Red Hat Developer Account, if you don't already have one
- Install and start Red Hat OpenShift 3.11 for Power
- Browser and login to OpenShift on Power

# Install Doc <https://docs.openshift.com/container-platform/3.11/install/index.html>

The screenshot shows a web browser with several tabs open. The active tab is the OpenShift documentation page for version 3.11. The page has a dark header with the Red Hat OpenShift logo and navigation links. The main content area shows the breadcrumb trail: Documentation / OpenShift Container Platform 3.11 / Installing Clusters / Planning your installation. A dropdown menu is open for the version selection, showing options from 3.0 to 3.11, with 3.11 selected. The left sidebar contains a search bar and a list of navigation links, with 'Planning your installation' highlighted under the 'Installing Clusters' section. The main content area lists various installation topics, including 'Planning', 'Limitations and Considerations for Installations on IBM POWER', 'Considerations', 'Deployment scenarios', 'Single master and node on one system', 'Single master and multiple nodes', 'Multiple masters using native HA', 'Multiple Masters Using Native HA with External Clustered etcd', 'Stand-alone registry', 'Installation types for supported operating systems', 'Required images for system containers', 'systemd service names', 'File path locations', and 'Storage requirements'. A yellow callout bubble points to the version dropdown menu, and another points to the left sidebar.

Be sure to select the right version.

Feel free to use the doc. I used it to build the lab

## General Info

- Some commands in this lab contain continuation characters "\"  
If you know what that is, go forward  
If you are confused by \, ask for help
- We will likely run long in Part 1. Lets try to get the deploy\_cluster playbook (p15, about 32 min) started before break
- An OpenShift cluster is all x86, or all Power; no mixed cluster today
- OpenShift on Power is an rpm install, not atomic, nor CoreOS (at this time)
- Your instance is on 150GB lun, approximately 40GB unused
- You will configure a thinpool for Docker storage in the unused space
- Your host, and a wildcard "route" for your deployments, are already in the lab DNS
- pdf file is on the Windows Desktop, for you to "mouse" commands as needed

# General Config

Lab starts right here

- PuTTY to the IP address of your RHEL7 instance root / abcd1234
- SELINUX enforcing is required
  - # setenforce 1
  - # vi /etc/selinux/config
  - # sestatus

(**at the middle of file**, make it SELINUX=enforcing)  
(verify Current mode, and config file, both show enforcing)
- Your hostname is fully qualified
  - # hostname
  - # hostname -f

## General Config

- firewalld is already set in the Ansible inventory file (hosts). You will retrieve this later.  
[OSEv3:vars]  
os\_firewall\_use\_firewalld=True
- You are starting with RHEL75 minimal image on Power8, will end up at RHEL76 during the process
- Append PATH onto /root/.bashrc  
echo "export PATH=/usr/sbin:/usr/bin:/bin:/sbin:/usr/local/bin" >>/root/.bashrc  
logout and login again
- Generate ssh key  
# ssh-keygen -t rsa -f ~/.ssh/id\_rsa -P ''  
# ssh-copy-id -i ~/.ssh/id\_rsa.pub root@<your\_node\_ip>  
# ssh <your\_node\_ip> date (want date returned, without password prompt)

# General Config

- **At home, but not in this lab**, you'll use subscription-manager to register your Red Hat instance, and also enable repositories like these

For Power8

```
# subscription-manager repos \
--enable="rhel-7-for-power-le-rpms" \
--enable="rhel-7-for-power-le-extras-rpms" \
--enable="rhel-7-for-power-le-optional-rpms" \
--enable="rhel-7-server-ansible-2.6-for-power-le-rpms" \
--enable="rhel-7-server-for-power-le-rhsc1-rpms" \
--enable="rhel-7-for-power-le-ose-3.11-rpms"
```

And for Power9

```
# subscription-manager repos \
--enable="rhel-7-for-power-9-rpms" \
--enable="rhel-7-for-power-9-extras-rpms" \
--enable="rhel-7-fpr-power-9-optional-rpms" \
--enable="rhel-7-server-ansible-2.6-for-power-9-rpms" \
--enable="rhel-7-server-for-power-9-rhsc1-rpms" \
--enable="rhel-7-for-power-9-ose-3.11-rpms"
```



# General Config

— **For this lab**, we have the code needed already on the lab network. Bring over a new yum repo file for it.

```
# cd /etc/yum.repos.d
# mv RH75LE.repo RH75LE.repo.save
# wget http://10.31.193.224/RH7LE/311/OSE.repo
# yum clean all
# rm -rf /var/cache/yum
# yum repolist enabled
...
repo id                repo name                status
Advance_Toolchain      Advance Toolchain        844
Extras                 rhel-7-for-power-le-extras-rpms 481
IBM_Power_SDK_Tools    IBM Power SDK Tools      17
IBM_Power_Tools        IBM_Power_Tools          17
OSE                    rhel-7-for-power-le-ose-3.11-rpms 367
Optional               rhel-7-for-power-le-optional-rpms 13,775
ansible-26             rhel-7-server-ansible-2.6-for-power-le-rpms 15
rhsc1                  rhel-7-server-for-power-le-rhsc1-rpms 2,260
rpms                   rhel-7-for-power-le-rpms 16,971
repolist: 34,747
```



# General Config

- Install the following base packages:

```
# yum install wget git net-tools bind-utils yum-utils \
iptables-services bridge-utils bash-completion kexec-tools sos psacct
# yum update
# reboot
```

PuTTY login again...

```
# yum install openshift-ansible
# reboot
```

PuTTY login again, and

```
# yum install docker-1.13.1
```

Verify Docker level

```
# rpm -V docker-1.13.1
# docker version
```

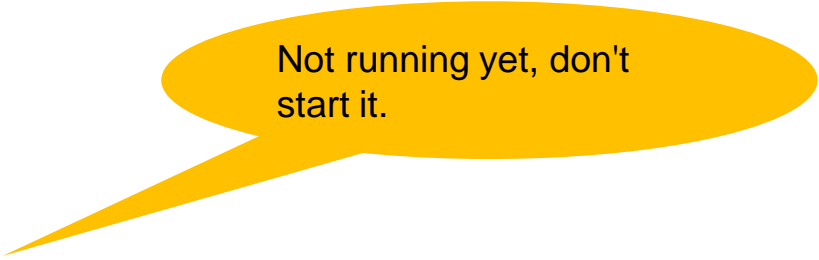
Client:

Version: 1.13.1

API version: 1.26

Package version:

Cannot connect to the Docker daemon at unix:///var/run/docker.sock. Is the docker daemon running?



Not running yet, don't start it.

# Configuring thinpool storage for Docker

- You may struggle a bit with the command `/usr/bin/docker-storage-setup` and the config file `/etc/sysconfig/docker-storage-setup`. Do the following instead:

- We will add the thinpool into the unused space of your `root_vg` physical volume

```
# lvcreate --wipesignatures y -n thinpool root_vg -L 19G
# lvcreate --wipesignatures y -n thinpoolmeta root_vg -L 300M
# lvconvert -y --zero n -c 512K --thinpool root_vg/thinpool --poolmetadata root_vg/thinpoolmeta
```

```
# lvs
```

LV	VG	Attr	LSize	Pool	Origin	Data%	Meta%	Move	Log	Cpy%	Sync	Convert
root	root_vg	-wi-ao----	100.70g									
swap	root_vg	-wi-a-----	8.00g									
thinpool	root_vg	twi-a-t---	19.00g			0.00	5.35					

```
# vi /etc/lvm/profile/docker-thinpool.profile
activation {
    thin_pool_autoextend_threshold=80
    thin_pool_autoextend_percent=20
}
```

We're carving about 20GB here. On a separate disk, in another vg, we might use percentages, like  
-l 95%VG  
-l 1%VG

Edit up the file:  
`docker-thinpool.profile`

# Configuring thinpool storage for Docker

```
# vi /etc/docker/daemon.json
{
  "insecure-registries": [
    "172.30.0.0/16"
  ]
}
```

Also edit up the file:  
daemon.json

Also, add content to  
/etc/sysconfig/docker-  
storage. Make it look like  
this, all one line

```
# vi /etc/sysconfig/docker-storage
DOCKER_STORAGE_OPTIONS="--storage-driver overlay2 --storage-opt dm.fs=xfs --storage-opt
dm.thinpooldev=/dev/mapper/root_vg-thinpool --storage-opt dm.use_deferred_removal=true --storage-opt
dm.use_deferred_deletion=true"
```

```
# systemctl daemon-reload
# systemctl enable docker
# systemctl start docker
# systemctl is-active docker
# systemctl status docker
```

## Retrieve all-in-one Inventory file (hosts)

```
# cd /etc/ansible
# mv hosts hosts.default
# wget -O hosts http://10.31.193.224/RH7LE/311/hosts.save
```



dash big Oh, not zero

In the hosts file, you will fill in oreg fields with your Red Hat Developer account and password (leave off the arrowheads). Don't have RH Developer account? Create one next page

```
# vi hosts
...
oreg_auth_user=<your-red-hat-developer-login>
oreg_auth_password=<your-red-hat-developer-passwd>
```

# Red Hat Developer Subscription (free)

<https://developers.redhat.com/blog/2016/03/31/no-cost-rhel-developer-subscription-now-available/>

Everything you need to grow your career.

With your free Red Hat Developer program membership, unlock our library of cheat sheets and ebooks on next-generation application development.


SIGN UP



1) Hit SIGN UP

2) Fill in form and hit CREATE

3) AFTER you create the account, you **MUST** login, edit profile, and fill in mandatory first name, last name.



### Create a Red Hat account

Sign up and use this Red Hat account to access all of Red Hat's applications, communities, support, and more.

\* Required fields

Choose your username (Red Hat Login ID) \*

You can use this username (also known as your Red Hat Login ID) to log in to other Red Hat sites. It **cannot be changed once created** and it must be at least five characters.

Email address \*

Job role \*

Choose a password \*

Your password must be at least 8 characters long. A strong password combines lowercase letters, uppercase letters, numbers, and symbols.

☐ I have read and agree to all the terms and conditions below (check all boxes).

☐ \* I have read and agree to the [Enterprise Agreement](#).

☐ \* I have read and agree to the [Developer Program Terms & Conditions](#).

☒ I would like to receive the Red Hat Developer Program newsletter.

CREATE MY ACCOUNT

## prerequisites ansible playbook

With your developer login and password in /etc/ansible/hosts, run prereq ansible playbook

```
# time ansible-playbook -i /etc/ansible/hosts /usr/share/ansible/openshift-ansible/playbooks/prerequisites.yml  
\ | tee ~/preq.txt 2>&1
```

...

...

```
PLAY RECAP *****  
localhost                : ok=91    changed=19    unreachable=0    failed=0
```

```
INSTALLER STATUS *****  
Initialization   : Complete (0:01:14)
```

# deploy\_cluster ansible playbook

```
# time ansible-playbook -i /etc/ansible/hosts /usr/share/ansible/openshift-ansible/playbooks/deploy_cluster.yml \
| tee ~/deploy.txt 2>&1
```

...

...

```
PLAY RECAP *****
localhost                : ok=729  changed=325  unreachable=0    failed=0
```

```
INSTALLER STATUS *****
```

```
Initialization           : Complete (0:00:37)
Health Check             : Complete (0:01:21)
Node Bootstrap Preparation : Complete (0:05:21)
etcd Install             : Complete (0:01:36)
Master Install           : Complete (0:09:21)
Master Additional Install : Complete (0:01:54)
Node Join                : Complete (0:00:45)
Hosted Install           : Complete (0:02:00)
Cluster Monitoring Operator : Complete (0:03:02)
Web Console Install      : Complete (0:01:25)
Console Install          : Complete (0:01:01)
metrics-server Install   : Complete (0:00:04)
Service Catalog Install  : Complete (0:06:52)
```

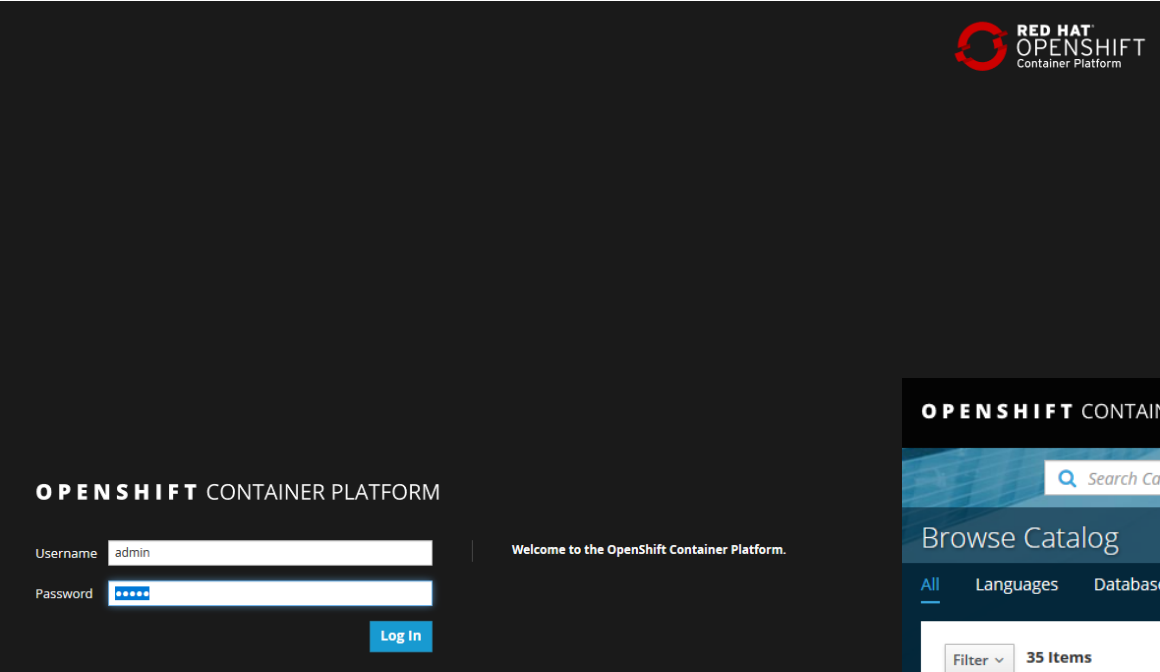
```
real    32m15.141s
user    26m58.294s
sys      2m23.482s
```

Finally, browser into your cluster  
<https://your.ip.addr:8443> admin / admin

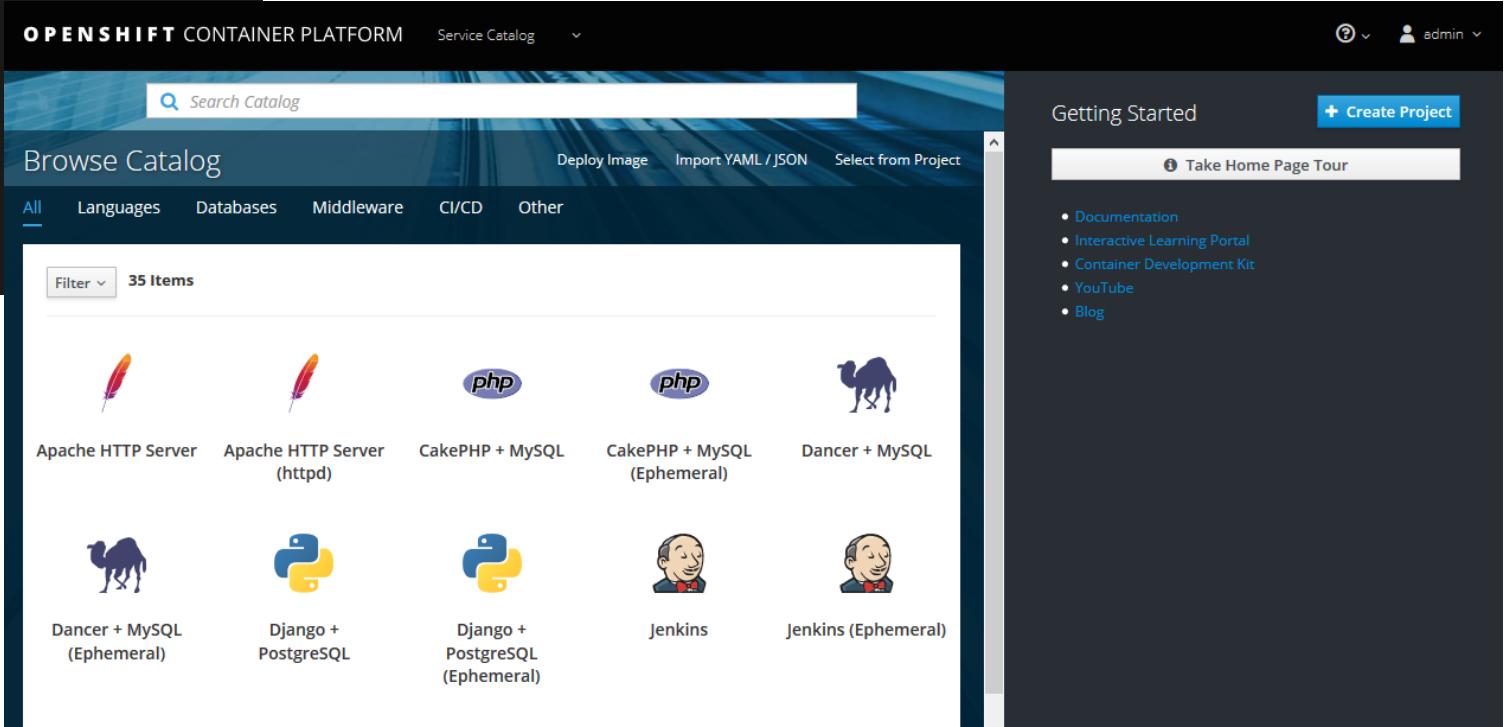


# OCP login

<https://your.ip.addr:8443> admin / admin

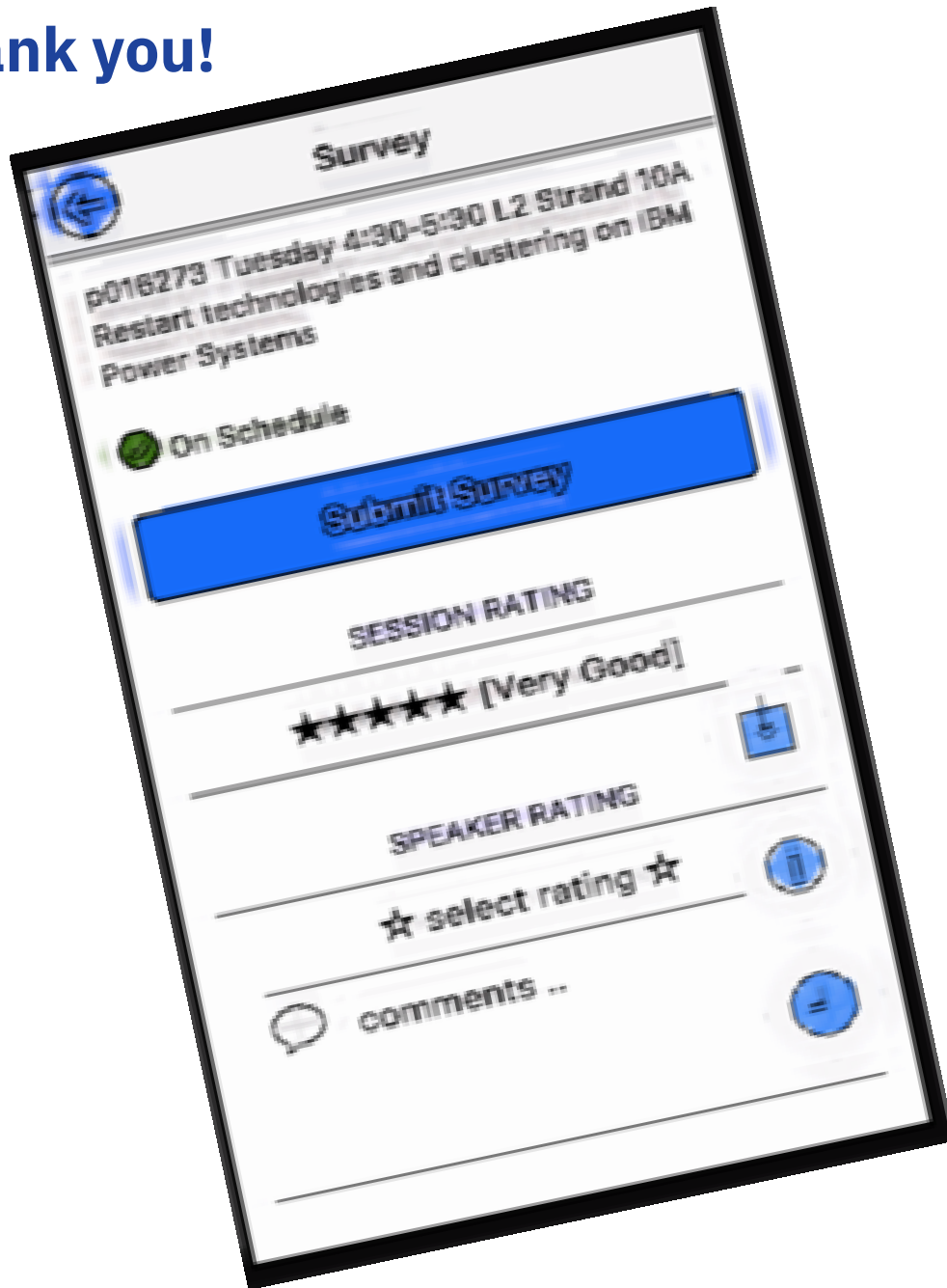


You might have to attempt login a few times



End of Part 1!

Thank you!



L110483 OpenShift on Power Part 1  
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**Please complete the Session  
Evaluation!**

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## Try out OpenShift 4

- <https://try.openshift.com>
- Cloud based instance, surely x86 based
- Likely a valuable and different exercise than what we are doing in this lab
- You might be wondering, why Power? See next 4 slides

# IBM Cloud Paks and Red Hat OpenShift on Power Systems

Working 4Q  
plan for Power

## IBM Cloud Pak for Applications

Build, deploy and run applications

IBM containerized software



Operational services

ICP 4.1



Container platform

RH OpenShift 3.11



Working plan  
for Power

## IBM Cloud Pak for Data

Collect, organize, and analyze data

IBM containerized software



Operational services



Container platform

RH OpenShift 4.x



Working 4Q  
plan for Power

## IBM Cloud Pak for Integration

Integrate applications, data, cloud services, and APIs

IBM containerized software



Operational services

ICP 4.1



Container platform

RH OpenShift 3.11



Working 4Q  
plan for Power

## IBM Cloud Pak for Automation

Transform business processes, decisions, and content

IBM containerized software



Operational services



Container platform

RH OpenShift 4.x



Available in  
3Q for Power

## IBM Cloud Pak for Multicloud Management

Multicloud visibility, governance, and automation

IBM containerized software



Operational services

ICP 4.1



Container platform

RH OpenShift 3.11



**Runs on choice of IBM Power Systems Infrastructure-as-a-Service (IaaS)**

**PowerVC  
PowerVM**



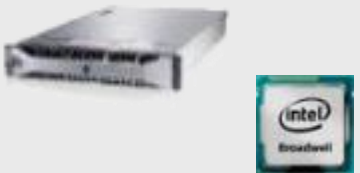


**Bare-metal**



# Why Power for Containers?

## Modernization: WAS Liberty and Db2

<div>Acme Air</div> <div></div> <div>Open source Docker containers</div> <div>WebSphere Application Server Liberty Profile</div>	IBM Power S822LC for BD (20-core, 512GB)	HP DL380 (24-core, 512GB)
	<div></div>	<div></div>
Server price -3-year warranty	\$18,080	\$26,711
System Cost -Server + WAS Liberty ND Annual Subscription @ \$4,606 per core (3yrs)	\$110,200	\$137,255
Total Throughput (tps)	48,780	33,420
Number of containers	120	76
\$/container	\$919/container	\$1,805/container

1.96X better

## Improved Container Density at Lower Solution Price

1.45X

Throughput per Server

1.57X

Containers per Server

1.96X  
Price-Performance


WebSphere Application Server V9 Liberty on IBM Power S822LC for BD with open source Docker delivers 1.57X more containers and 1.96X *better price-performance* than Intel Xeon E5-2650 v4 Broadwell

\*Results are based on IBM internal testing of single system and OS image running with Acme Air work load (<https://github.com/acmeair>) on a private network with a dedicated JMeter driver machine and dedicated MongoDB server machine: One MongoDB instance per 8 WAS containers. Each WAS container was bound to a full core to run with 20 users and a 25ms think time between transactions. The number of containers were increased for each system until average throughput dropped below 400 transactions/second or latency exceeded 25ms. Tests were run on November 29th, 2016. Individual results will vary depending on individual workloads, configurations and conditions. IBM Power System S822LC for Big Data: 20 cores / 160 threads, POWER8; 2.92GHz, kernel 4.4.0-12-generic, CPU frequency governor of performance, and hardware prefetch disabled. HP ProLiant DL380, 24 cores / 48 threads; Intel E5-2650 v4; 2.2 GHz; CPU frequency governor of performance, and hardware prefetch disabled. Both configurations ran Ubuntu 16.04, had 512 GB memory, included 1TB SATA 7.2K rpm HDD, 10 Gb 4-port, 1 x 16Gbps FCA; WebSphere Application Server V9.0 Liberty profile; Java options: -Xmx512m -Xms512m -Xgthreads8 -Xnoclassgc -Xnoclassgc -Xconcurrentlevel0 -Xdisableexplicitgc; Open source Docker Version: 1.12.0 / API: 1.24 / Go: 1.6.3; Docker storage driver: overlay2 and aufs had similar results. Pricing is based on: S822LC for Big Data <http://www-03.ibm.com/systems/power/hardware/linux-lc.html> and HP DL380 <https://h22174.www2.hp.com/SimplifiedConfig/Index> on December 7th, 2016. Pricing for WebSphere Application Server based on 20% discount from Passport Advantage pricing on: [https://www-01.ibm.com/software/passportadvantage/pao\\_customer.html](https://www-01.ibm.com/software/passportadvantage/pao_customer.html) on December 7th, 2016



# Reduce operating costs with Power L922 Server running IBM Cloud Private

*1.66X price-performance per rack unit over tested Intel Xeon SP Gold 6130 servers (Skylake)*

IBM Cloud Private 	IBM Power L922 (16-core, 256GB, 2 VMs)	Intel Xeon SP based 2-socket server (32-core, 256GB, 2 VMs)
<b>Server price</b> <sup>2,3,4</sup> -3-year warranty	<b>\$25,932</b>	<b>\$29,100</b>
<b>Solution Cost</b> <sup>5</sup> -Server + RHEL OS + Virtualization + ICP Cloud Native VPC Annual Subscription @ \$250 per core per month x 36 months	<b>\$180,049</b> (\$25,932 + \$10,117 + \$144,000)	<b>\$321,019</b> (\$29,100 + \$3,919 + \$288,000)
<b>Acme Air workload</b> <sup>1</sup> Total Transactions per Second - With 2 VM's	<b>36,566 tps</b>	<b>39,312 tps</b>
<b>TPS/K\$</b>	<b>203.1 tps/K\$</b>	<b>122.5 tps/K\$</b>

**1.86X**  
per core  
performance

**43%**  
Lower solution  
costs

**1.66X**  
Better Price-performance

- Based on IBM internal testing of a VM image running the Acme Air workload (<https://github.com/acmeair>) with containers bound to a socket including a MongoDB microservice. Results valid as of 3/17/18. and conducted under laboratory condition with speculative execution controls to mitigate user-to-kernel and user-to-user side-channel attacks on both systems, individual result can vary based on workload size, use of storage subsystems & other conditions.
- IBM Power L922 (2x8-core/3.4 GHz/256 GB memory) 2 x 600GB SATA 7.2K rpm LFF HDD, 10 Gb two-port, 1 x 16gbps FCA, EDB Postgres Advanced Server 10, RHEL 7.4 with PowerVM (2partitions@8-cores each),
- Competitive stack: 2-socket Intel Xeon Skylake Gold 6130 (2x20-core/2.1 GHz/256 GB memory), 2 x 600GB SATA 7.2K rpm LFF HDD, 1 Gb two-port, 1 x 16gbps FCA , RHEL 7.4, KVM (2 VMs@16-cores each)
- Pricing is based on Power L922 <http://www-03.ibm.com/systems/power/hardware/linux-lc.html>, Typical industry standard x86 pricing <https://www.synnecorp.com/us/govsolv/pricing/>
- IBM software pricing for ICP Cloud Native VPC Monthly Subscription .

# Power LC922 Server: Improved Price-Performance for Clients

*Better Performance and Lower Cost running YCSB with MongoDB than tested Intel Xeon SP servers*

Power LC922

**472,927 Ops/sec**

4 VMs @ 118,232 ops/sec



Intel Xeon SP Gold 6150

**322,738 Ops/sec**

3 VMs @ 107,579 ops/sec

Intel Xeon SP

Gold 6150 server:

**\$30,587**



**28%**

LOWER  
Price<sup>2,3,4</sup>

Power LC922

**\$21,878**



**Power LC922 Delivers**

**2X**

**Price-performance**

1. Based on IBM internal testing of MongoDB 3.6.2 using YCSB workload, Results valid as of 4/11/18 and conducted under laboratory condition with speculative execution controls to mitigate user-to-kernel and user-to-user side-channel attacks on both systems, individual results can vary based on workload size, use of storage subsystems & other conditions.

2. IBM Power LC922 (2x22-core/2.6 GHz/256 GB memory) using 2 x internal HDD, 10 GbE two-port, 1 x 16gbps FCA running 4VM's of Mongo 3.6 and RHEL 7.5 LE for Power9, running 4 VM's Mongo 3.6 and RHEL 7.5

3. Competitive stack: 2-socket Intel Xeon SP (Skylake) Gold 6150 (2x18-core/2.7 GHz/256 GB memory) using 2 x 300GB SATA 15K rpm HDD, 10 GbE two-port, 1 x 16gbps FCA , running 3 VM's Mongo 3.6 and RHEL 7.5

4. Pricing is based on Power LC922 <http://www-03.ibm.com/systems/power/hardware/linux-lc.html> and publicly available x86 pricing.

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Mono

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IBM Plex  
Serif

A hybrid of the third kind (combining the best of Plex, *Bodoni*, and **Janson** into a contemporary serif). Replaces Cambria, Garamond, Lucida Bright, Times New Roman, etc.

**IBM Plex is freely available as TrueType and OpenType at: <https://github.com/IBM/plex/releases> and looks consistently good across Windows, Linux and Mac**