Unleash the Power of AIX and how to win with AIX in the era of cloud, containers and AI

[PowerVUG]

Petra Buehrer (*Petra.Buehrer@de.ibm.com*)
Offering Manager Power Systems Software
IBM Cognitive Systems

https://www.linkedin.com/in/petrabuehrer/
https://twitter.com/PetraBuehrer

David Spurway (*David.Spurway@uk.ibm.com*)
IBM Power Systems CTO, UK & Ireland
IBM UKI Systems Partner Ecosystem Team

https://www.linkedin.com/in/david-spurway/
https://twitter.com/D_Spurway

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AIX Strategy & Roadmap

Smooth Migration to POWER9

Recent AIX Enhancements

Recent Power Systems Software Enhancements

New Power Systems Enterprise Cloud Editions

AIX Modernization

How AIX can be many times less expensive than the public cloud

- Incl. real life examples such as running Oracle on Power Systems

AIX Strategy

Performance

Open Automation

Availability

Cloud-Ready

Investment Protection

Security

AIX Cognitive

AIX Strategic Themes

Provide a high value platform for core business production workloads

- IBM has a long term commitment to AIX and we are continuing to invest in clients' investment protection, performance, reliability, availability and security, along with technical innovations and modernizations

Exploit open technology

- To align with industry skills, modernize management, and enable cloud use cases

openstack
CHEF
ANSIBLE
puppet

Enable cloud management models and flexible infrastructure choices

- Ranging from highly resilient physical infrastructure to software defined infrastructure
- Spanning private and public clouds - on or off premises

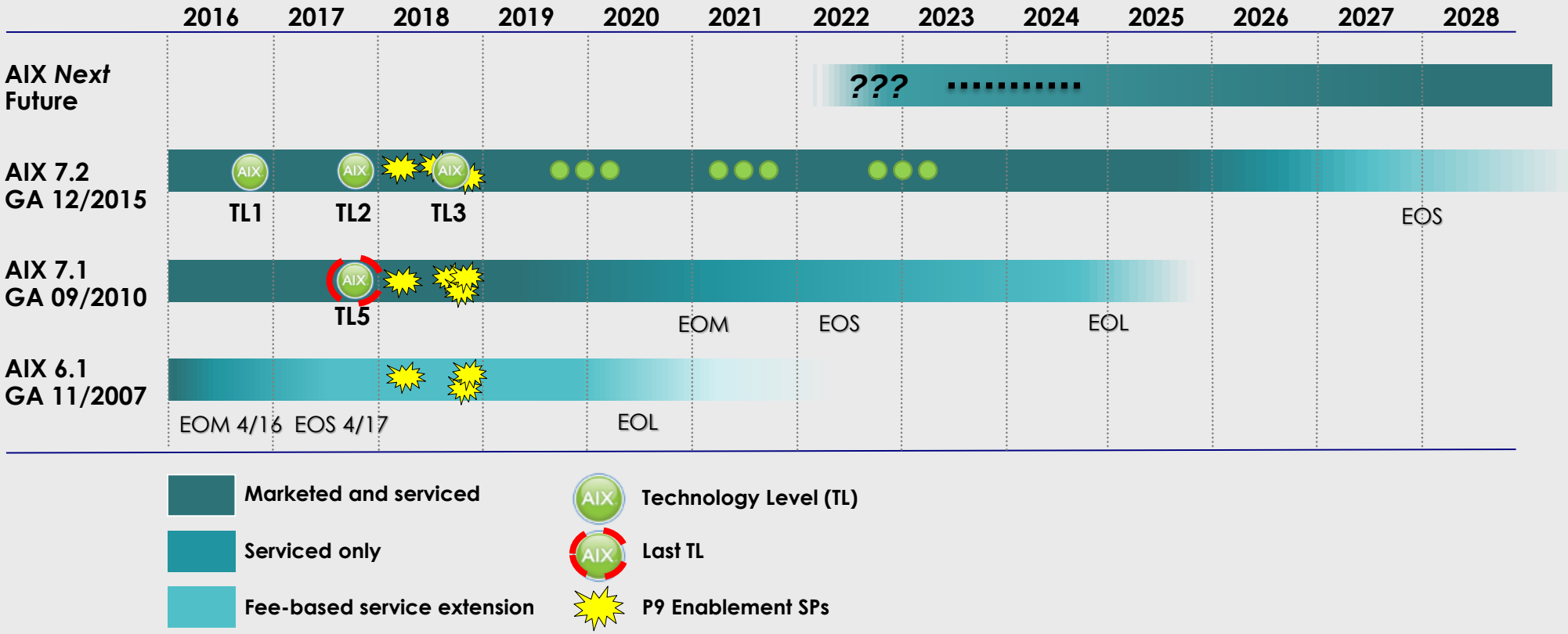
IBM Cloud PowerVC Manager for SDI
IBM Cloud Private
NUTANIX
Skytap
AIX in the IBM Cloud

AIX Cognitive

- Analyze trusted data & find what drives your business leveraging a secure gateway to the Watson Data Platform

Performance | Security | Availability | Investment Protection | AIX Cognitive | Open Automation | Cloud-Ready

AIX Release Roadmap View



All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

AIX Strategy Paper to be published shortly!

& the redhat Acquisition – my 2 Cents

Three Extremes from Social Media

1. *'So IBM finally admits AIX is dead'*
2. *'Now we have IBM's bid to kill off Linux by making it propriety'*
3. *'IBM will clearly merge AIX and RedHat and make a mess of both'*

Our message always was and and will be *'Pick and choose'!*

We have 3 OSes running on Power,

- now we can offer the complete portfolio, which allows for more flexible licensing scenarios for our clients

Red Hat is more than 'just another OS'

- evolved from an open source pioneer to a driving force in hybrid cloud computing

"The merge" would take a 100 years of (legal) wrangling and we can't see that ever happening in out lifetime

AIX Support Matrix

2019 is end of service for POWER5, POWER6, and POWER7 !

Power Platform	AIX 5.3	AIX 6.1	AIX 7.1	AIX 7.2
POWER4				
POWER5				
POWER6				
POWER7				
POWER8				
POWER9				

Support expired
Supported in P6 Mode
Supported in P8 Mode
Not Supported
Supported in P7 Mode
Supported in Native Mode

New Innovation are put in our most current release stream which is AIX 7.2

The last AIX 7.1 TL shipped 4Q2017

AIX 6.1 is in its extended support period (confirmed until April 2020)

AIX 5.3 will finally have its end of life in April 2019

- no possibility to run AIX 5.3 supported beyond that date
- no security fixes will be provided any longer

Smooth Migration to P9 from POWER7 & POWER8

Delivering mobility on every PowerVM server makes migration the obvious choice

- PowerVM (Enterprise Edition) included with all models
  - LPM capability can be deactivated (f. Oracle audits etc.)
- PowerVM Linux Edition remains optional for L models
- PowerVM remains unavailable for LC models

➔ No change to PowerVM on Power8
  - Added by default to server orders in eConfig (deselectable)
  - WFM/EOL for PowerVM Standard Edition aligns with final WFM of Power8 models

LPM can be used to quickly and easily move workloads from P7 / P8 to P9 systems!
- *a **free 60-day activation** can be requested (Feature Code ELPM)*

Live Mobility Considerations (P9 Compatible Mode Architecture)

VMs running AIX levels supporting P9 can be live migrated from P7 or P8 to P9 systems and be run there as is – without workload interruption!

- VMs running on P6 or below must first be migrated to P7 / P8 systems and rebooted before being migrated to P9 systems

AIX 7.2 Enhancements

New Levels of Workload Scalability
- SMT 8 default mode for P9
- 1536 threads in a single VM
- 32 TB RAM in a single VM
- DSO support for P9
- Power 3.0B ISA extensions

New Levels of OS Security
- AIX Secure Boot
- Trusted Install and Update
- Option to restrict AIX kernel trace to only privileged users
- Hardware random number generation

Faster mobility and improved security & compliance by coupling compression and encryption of LPM data

Enhanced Automation & Ressource Management for AIX Live Update
- LPM automation to manage live update operations that require available resources on a different server
- Enhanced CPU management to reduce overall frame required CPU for a live update operation

New I/O features
- PCIe U.2 NVMe SSD
- PCIe4 2-port 100Gb RoCE EN100Gb adapter

MPIO Enhancements
- MPIO enhancements to support disk storage attached through the AIX iSCSI software initiator
- Enhancements for MPIO storage resiliency

JFS2 file space reclaim
- JFS2 file space reclaim for enhanced efficiency with thin provisioned storage solutions

Enhanced support for alt_disk_mksysb installs
- allows customized boot images to be copied during alternate disk maintenance

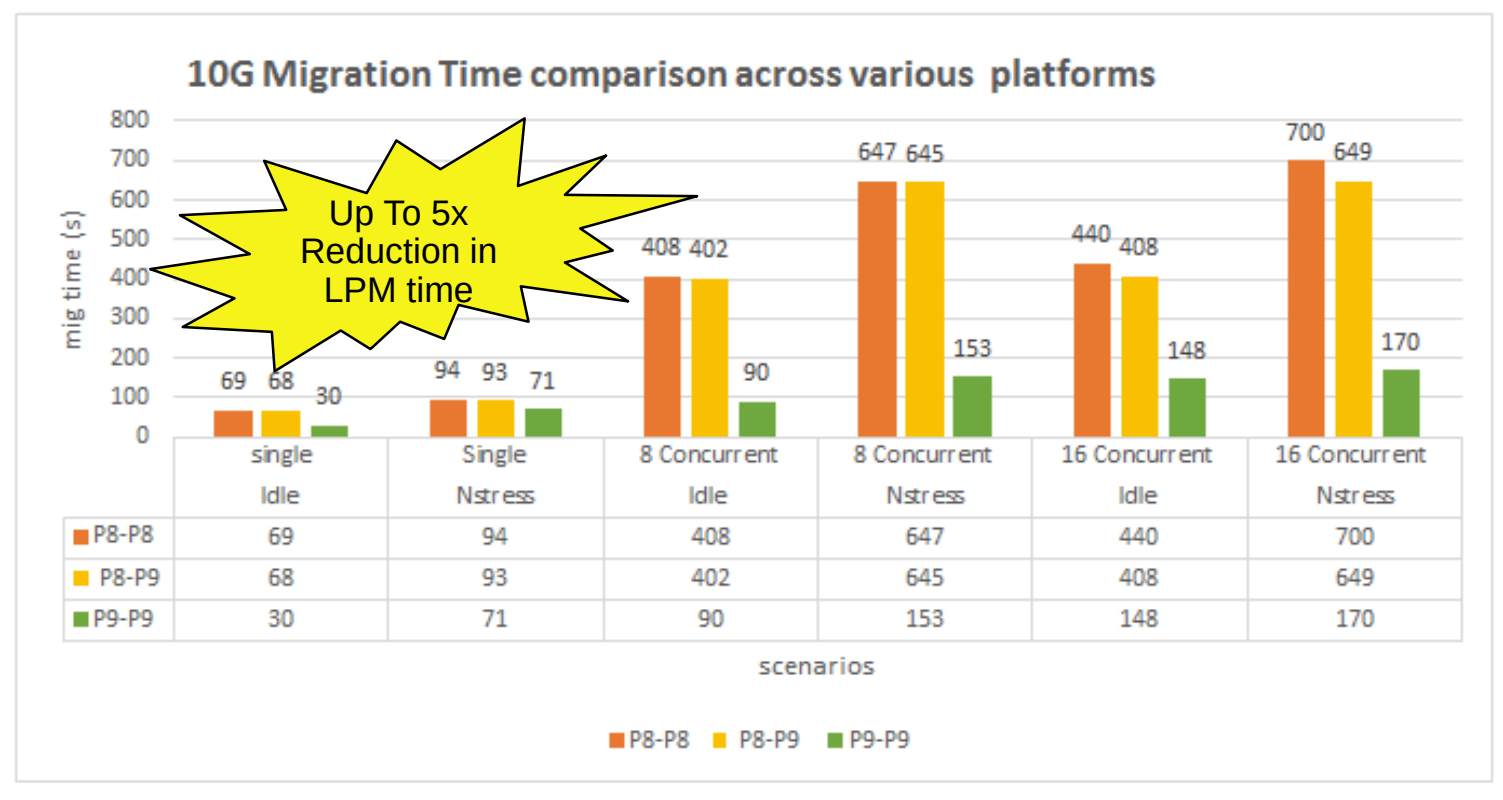
RFA: https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=897/ENUS218-381&infotype=AN&subtype=CA

AIX Toolbox Updates
- New open source tools and solutions for AIX available from the AIX Toolbox for Linux applications, like PostgreSQL, R and Mongoc

LPM Compression & Encryption in P9 Scale-up

Adding LPM encryption in FW920 – the P9 advantages

- Using the on chip accelerators
- Coupling compression & encryption together providing huge performance improvements



AIX Monthly & Capacity on Demand

License more flexibly & scale on demand!

Packages of AIX 7.2 Monthly Subscription Licenses in AAS / eConfig

- Distribute the AIX investment evenly across usage period
  - Based on AIX 7.2
  - Available on small & medium tier
  - 3, 6, 12, & 36 month packs are available
- Using Term Licenses (one time charge)
- incl. License and SWMA

RFA: *https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=872/ENUSAP18-0376&infotype=AN&subtype=CA*

From purchase to active capacity in 10 min - Purchase via the web - deploy instantly - anywhere in your datacenters

- ESS / IBM Marketplace allows the purchase and deployment of eCoD days in minutes
- Pool of resources not tied to any HW in different locations across the country (like pre-paid card)
- Purchase Processor (core - day) or Memory activations (8 GB - day)
- **three new options** under 'My entitled HW‘ in ESS
  1. ‘CoD - Purchase new Elastic days’
  2. 'CoD - Generate new Elastic codes’
  3. 'CoD - View, Download existing codes‘

RFA: https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=an&subtype=ca&appname=gpateam&supplier=877&letternum=ENUSZP18-0601

Power Systems Software Highlights

PowerVM

Every POWER9 based server workload is virtualized, mobile and fully cloud-enabled with PowerVM

Live migration from POWER7, POWER8 to POWER9 based systems with Live Partition Mobility

Mobile workloads are compressed and encrypted for improved security and acceleration

PowerVC

Export / Import capability to share images across data centers /clouds

Integration with Spectrum Scale to support SAN-less Clouds

OpenPower Support: Seamlessly manage AIX, IBM i and cloud native appl. with a single pane of glass

Support for IBM Cloud Private

PowerSC

Simplify Management of Security & Compliance across AIX and LoP

Improved real-time Malware detection

Enhanced compliance automation with support for GDPR

Scalability enhancements incl. REST APIs

Improved Audit support (end-to-end) incl. a new interactive time-line

PowerSC MFA

Enhanced support covering AIX, Linux on Power, and the HMC

Additional factors in addition to RSA SecurID and certificate based smart cards were added - such as TOTP on your phone, Yubikey, Radius protocol, and more

PowerHA

New Back-up to the Cloud Option

New Metrics that allow to track failover times and calculate recovery time

Automated offline backup (SVC only)

Policy-based incremental and full backups

Support for one-site and multisite deployments

VMR HA / VMR DR

VMR provides a simplified VM replication and restart solution

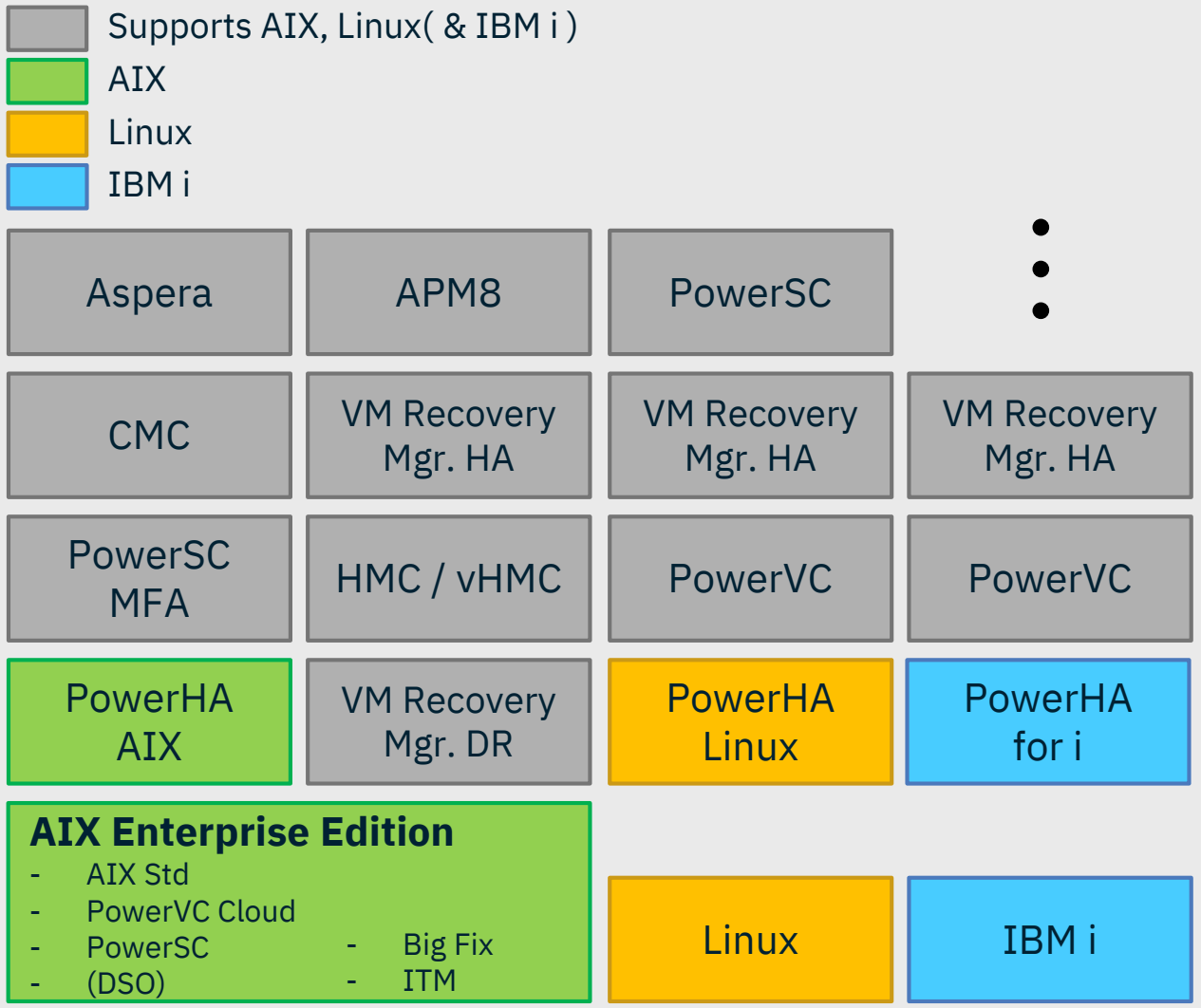
Server, VM, and workload-level HA
OS agnostic

Co-location and anti-colo policy support

Non-discruptive DR rehearsal

Application monitoring agents for DB2, Oracle, and SAP HANA

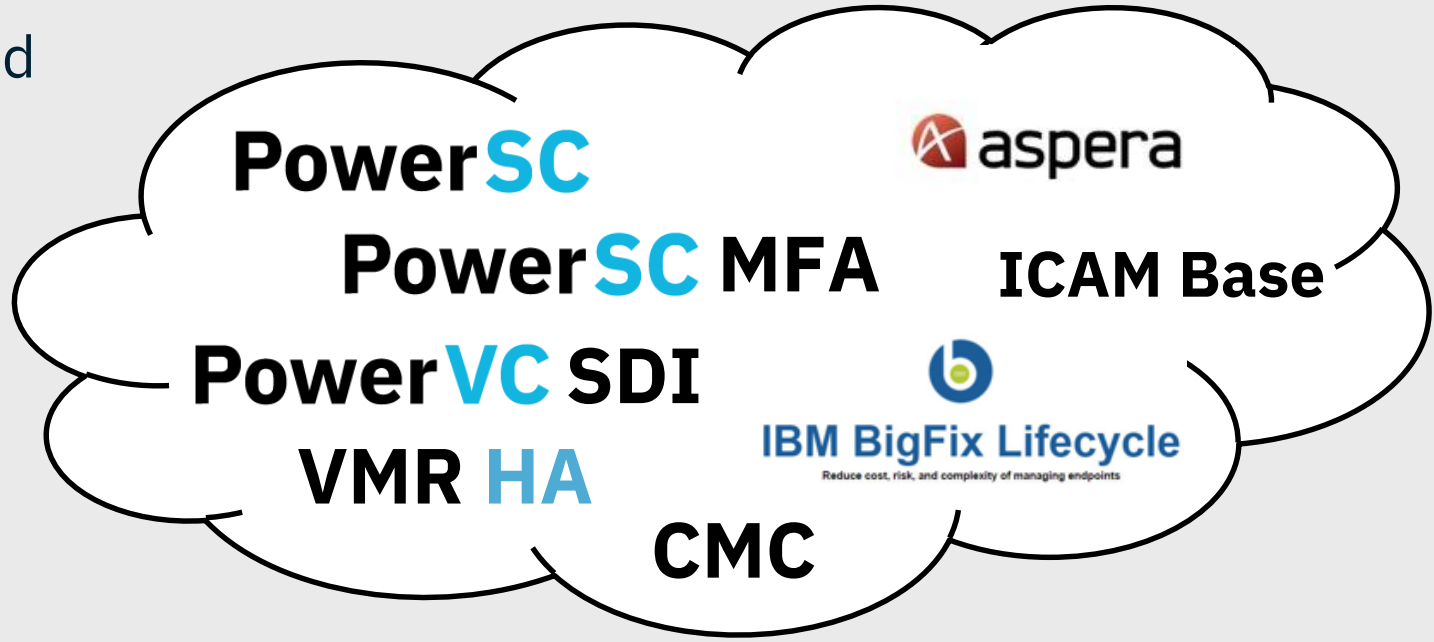
AIX Enterprise Edition



IBM Power Systems Enterprise Cloud Edition

pids: 5765-ECB
5765-CBA

- Bundles key offerings broadly adopted and requested by clients facilitating cloud deployments
  (private, hybrid, multi-clouds)
- Simplified and more cost attractive purchasing model
- Expands client interest for bundle to Linux (/IBM i)
- Allows for more licensing flexibility in terms of the OS



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Rapidly deploy Power Cloud Infrastructures with cost-effective Software Bundles

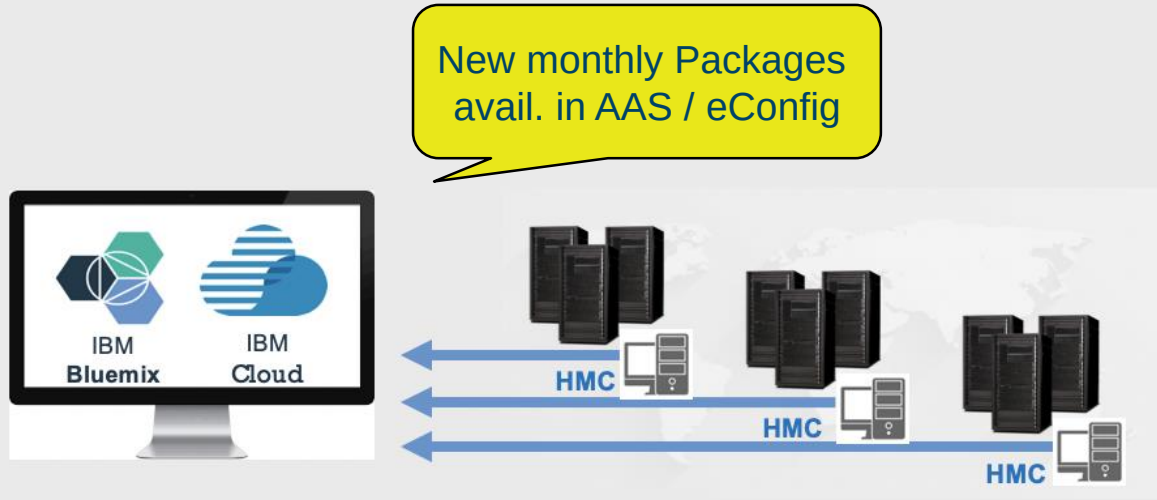
pids: 5765-ECB
5765-CBA

	Power Systems Enterprise Cloud Edition with AIX		AIX Enterprise Edition
Deploy & manage private clouds with simplicity	PowerVC Cloud	***Self service infrastructure provisioning***	PowerVC Cloud
	Spectrum Scale	***Software defined solution for SAN less cloud***	
	Cloud Management Console	***Single pane monitoring of all Power Systems infrastructure***	
	Cloud App Management	***Application aware infrastructure monitoring and analysis***	ITM6
Simplify managing Security & Compliance	PowerSC Std. Ed.	***Security and Compliance management of cloud environments***	PowerSC Std. Ed.
	PowerSC MFA	***Raise the assurance levels with multi-factor authentication***	
	Big Fix Lifecycle	***Discover, secure and manage endpoints on different OSs***	Big Fix Lifecycle
Simplified high availability	VM Recovery Manager HA	***Simplified HA solution for cloud deployments***	
Accelerated file transfer in cloud environments	Aspera	***High Speed file exchange between private and public clouds***	
OS	AIX Linux		AIX Std. Ed.

IBM Cloud Management Console (HMC capabilities as a Service)

Cloud-based micro-services that can be accessed securely, anytime, anywhere for your complete enterprise

As data centers scale out and up, there's an increasing need for a complete view of the infrastructure!



Inventory Aggregation

- View all Power Systems, HMCs, VMs, etc. across your entire enterprise
- See basic health & state

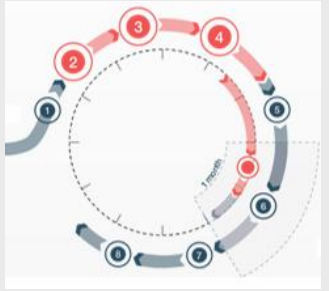
Performance Monitoring

- Aggregated performance views across your Power enterprise
- Energy monitoring
- OS metrics

Log Trends

- Log aggregation
- Telemetry

Patch Planning

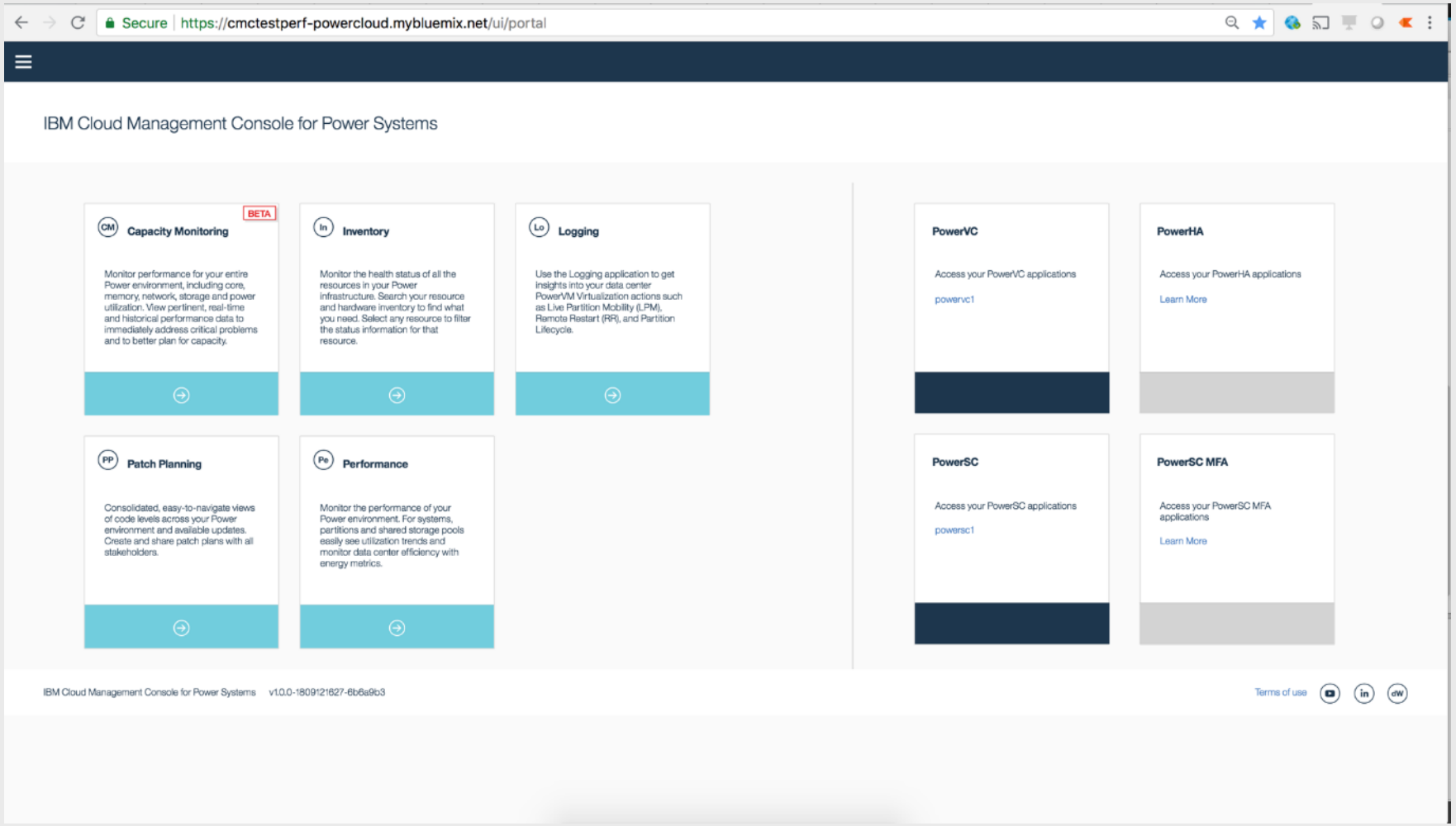


- Patch compliance reports for firmware, HMC, NovaLink, VIOS, and OS
- Scheduled maintenance plan management

Cloud Management for Power Systems – SaaS and On-prem

Central Power System SW UI launch point: Extend CMC to accomodate on-prem Power Systems SW launches

- Improves ease of use of Power Systems software - both on-prem and SaaS - with a single launch point



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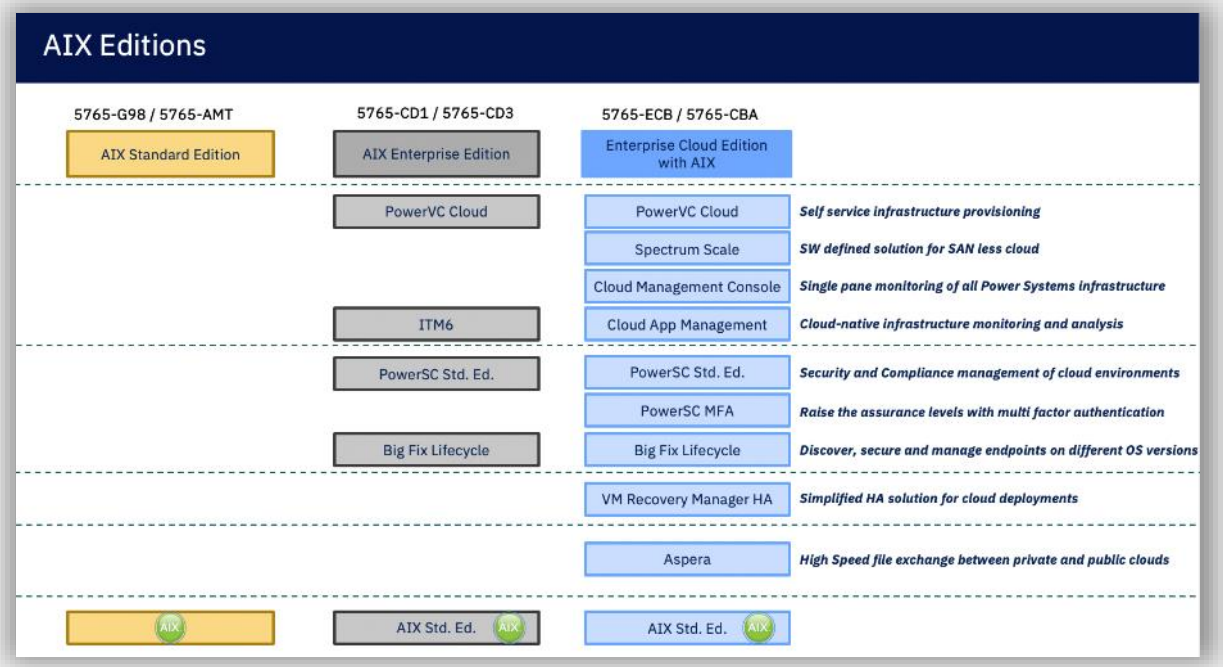
Accelerated file transfer in cloud environments	Aspera	***High Speed file exchange between private and public clouds***	
OS	AIX / Linux / i for Business / AIX 7.2 Std. Ed.		AIX Std. Ed.

AIX Purchasing Options / Considerations



AIX Std. Ed. continues to be marketed as is
- perpetual and in form of AIX Monthly options

AIX EE continues to be marketed as is for now
- set of bundled products won't be changed

AIX Cloud Edition (Enterprise Cloud Edition with AIX)
- A 3rd option how to purchase which might supersede AIX EE at some point in time

All orderable on any (P8/P9*) PowerVM based server!

AIX Modernization

AIX in the Cloud

AIX in the hyperconverged space

AIX & Kubernetes

AIX & Open Source

AIX / Enterprise Systems & AI

AIX Toolbox for Linux Applications & Related Open Source Notes

New Packages of Note

- PostgreSQL, The R language, mongo-c
- Gcc-go 8.1, Json-c 0.13.1, jq
- Krb5 1.16.1, unrar, snappy
- Ganglia, rrdtool, iftop, iperf3, nmap

Security Related Activities

- ~150 CVEs reviewed, ~35 packages updated
- Examples include Samba, httpd, sqlite, subversion libxml2, PHP, python, and Ruby

Current Porting Activities

- MariaDB, Golang 1.12
- nginx, cmake
- Pbzip2, libzip2

Improved Compatibility Between Download Sites

- IBM, Bullfreeware, Perzl
- Enhanced OpenSSL package now available
- Working on improved libiconv compatibility

Automation

- Building blocks available for AIX patching and VIOS update use cases based on NIM, SUMA, and FLRT
- Available for Chef, Ansible, and now Puppet
- Latest materials are available at *https://github.com/aixoss*

http://www-03.ibm.com/systems/power/software/aix/linux/toolbox/alpha.html
http://ibm.biz/aixoss_forum

AIX Tool Box for Linux Applications (Recent Updates)

New Packages Ported

R	json-c	postgresql
bbcp	krb5	rlwrap
blas	kubectl	rrdtool
calico-cni	kubernetes-node	salt
calico-node	lapack	scons
calicoctl	libRmath	sendmail
clamav	libassuan	serf
criwpar	libbson	
cscope	libconfuse	
cyrus-sasl	libdbi	
etcd	libfontenc	
etcdctl	libiconv	
filebeat	libksba	
ganglia	libssh2	
gcc-go	libunistring	
gmp	mkfontscale	
gnupg2	mongo-c-driver	
helm	ncat	
icp-worker	nmap	
iftop	nping	
iperf3	parallel	
jq	pinentry	

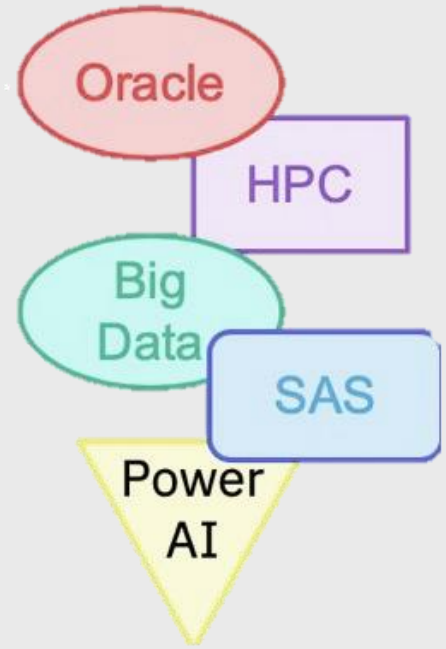
Packages Updated

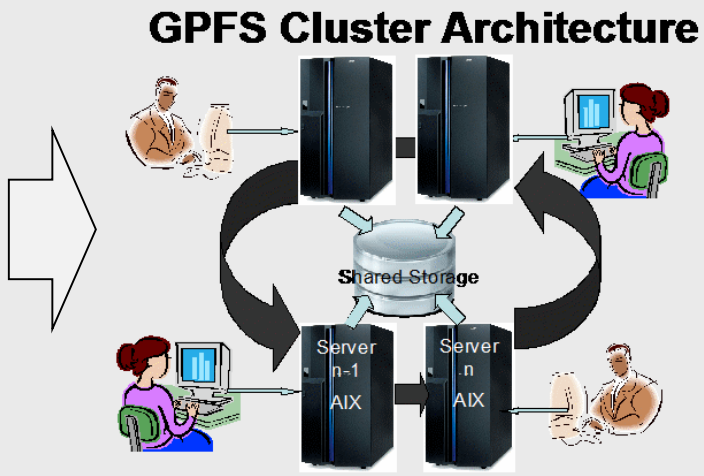
a2ps	findutils	libXcursor	nettle	sudo
ansible	flex	libXft	nspr	sudo_ids
atk	fontconfig	libXrender	nss	tar
automake	freetype2	libart_lgpl	openldap	tcl
bash	gawk	libffi	pango	tcpdump
bind	gcc	libgcrypt	patch	texinfo
binutils	gdb	libgpg-error	pcre	tk
ca-certificates	gettext	libjpeg	perl	vim
cairo	git	libpcap	php	wget
cdda2wav	glib2	libxcb	pkg-config	xz
cdrtools	gnutls	libxml2	pth	zip
coreutils	grep	libxslt	pysqlite	zsh
cups	gtk2	logrotate	python	
curl	gzip	lua	python-pip	
cvs	harfbuzz	lynx	python3	
db	help2man	lzo	rsync	
dbus	hexedit	lzop	ruby	
dejagnu	httpd	make	samba	
diffutils	info	mkisofs	screen	
emacs	intltool	ncftp	sqlite	
expat	lemon	ncurses	squid	
file	less	neon	subversion	

Njmon for modern Performance stats Tooling!

~ 600 stats avail. f. AIX & VIOS

njmon is nmon but saving to JSON format!





njmon for AIX & Linux

Splunk

InfluxDB Grafana

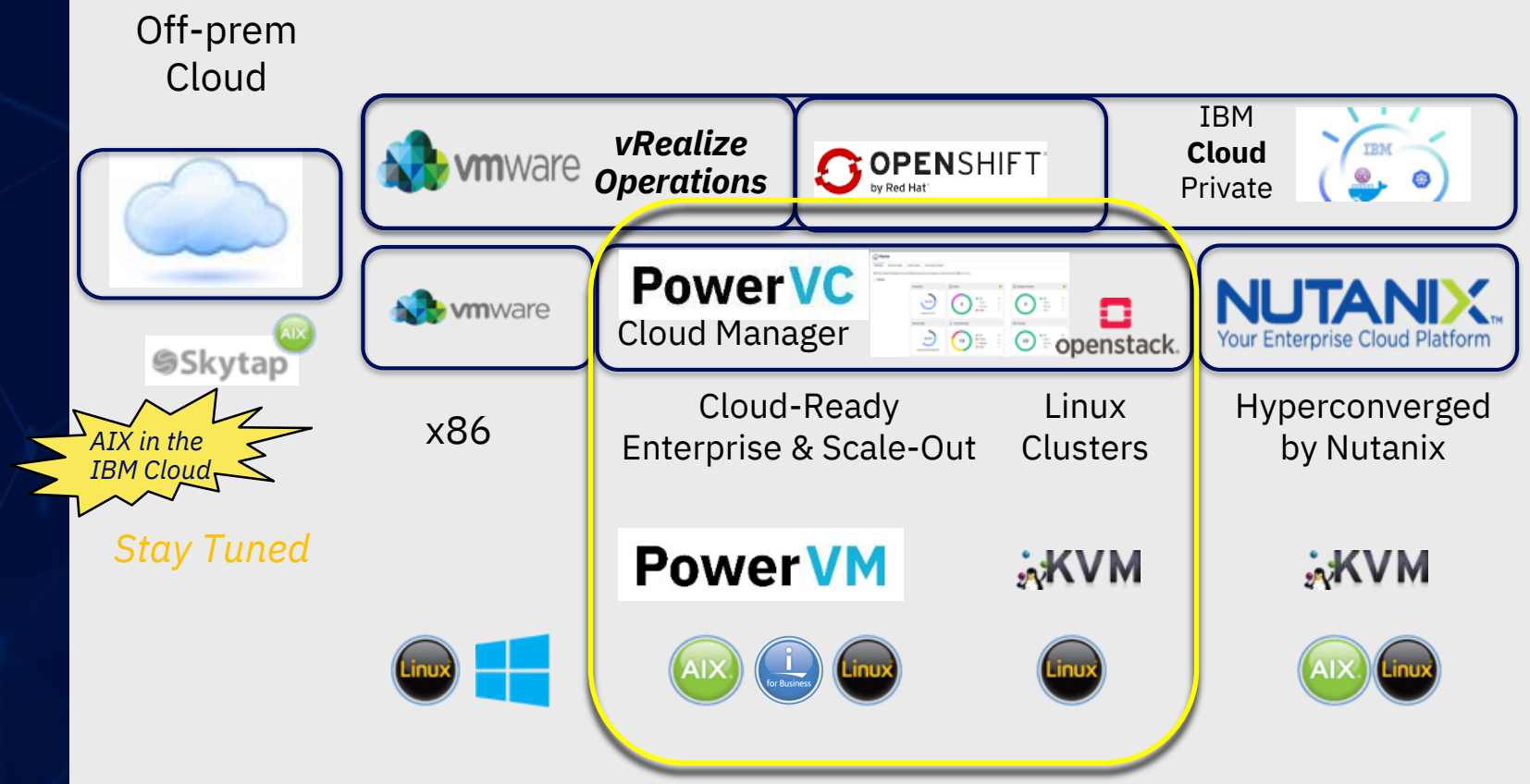
ELK

And others . . .

Cloud Anywhere

- Transform IT Infrastructure to an on premises private cloud
- Extreme simplicity with IBM / Nutanix HCI
- Heterogeneous cloud management
- IBM Cloud Private
- Off-prem cloud options
- Enabled for Multi-cloud

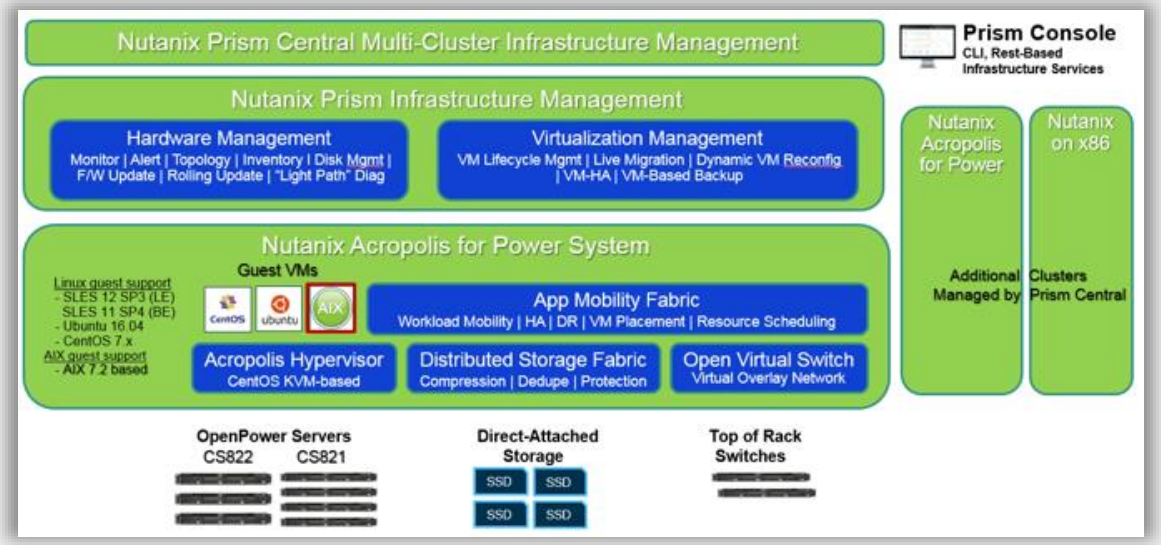
On Premises, Hybrid or Multi-Cloud



Bringing AIX to the IBM Hyperconverged platform

AIX under PRISM - ”Just like other VM Guests”

- Modernizing traditional AIX environments by further simplify datacentre environments
  - manage dozens of applications, some running on Power (Linux or AIX), some on x86 - all through a single pane of glass!



AIX runs fully virtualized on the Nutanix Acropolis Hypervisor

Workloads and use cases

- AIX workloads on AIX 7.2 TL2 and above
- Custom App consolidation & Dev/ Test
- Selected IBM middleware like IBM WebSphere and Db2
- Integration with IBM Cloud Private

Skytap

Introducing AIX Cloud Instances

Migrate Unchanged

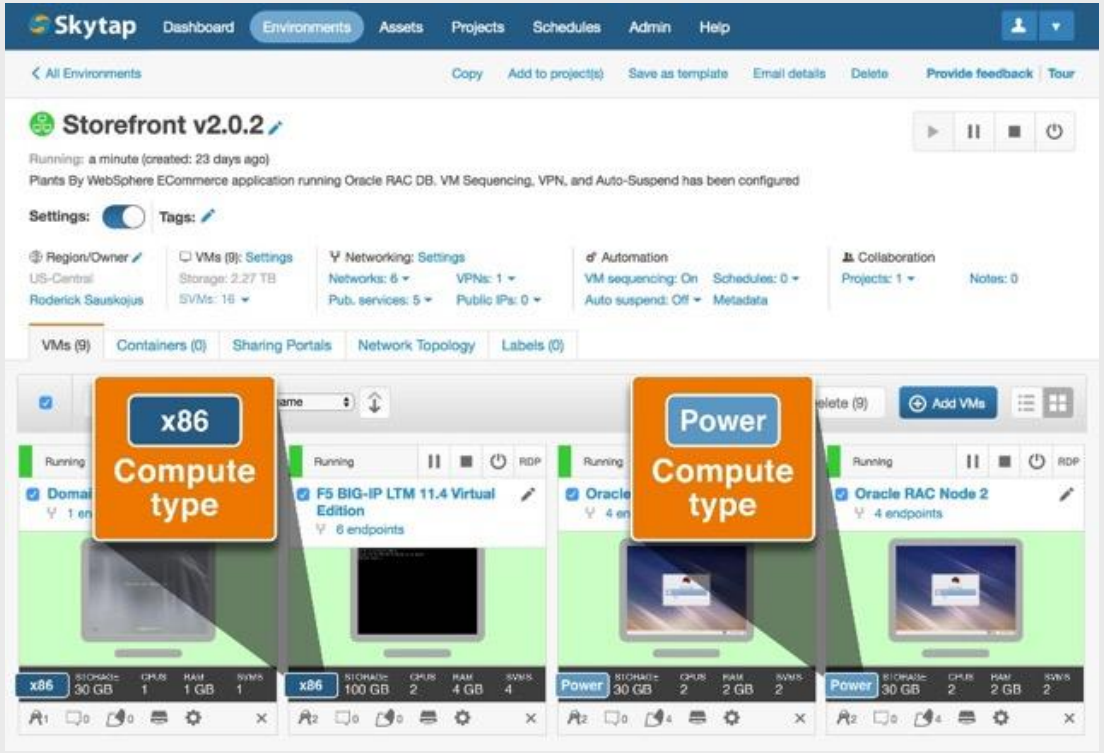
- Migrate AIX and AIX-dependent workloads into the cloud without refactoring

Accelerate Application Delivery

- Reduce development and test times & eliminate environment contention by providing immediate, self-service access to cloneable, cloud environments

Modernize Architecture and Process

- Incorporate cloud-native capabilities and implement modern practices like DevOps and agile development



**AIX running on Power Systems and Linux/Solaris/Windows running on x86 architecture*
https://www.youtube.com/watch?v=c6_tDsyu_10

First in the public Cloud to support blended solutions including x86, AIX workloads and containers

AIX in the IBM Cloud
- IBM Power Systems Virtual Server on IBM Cloud

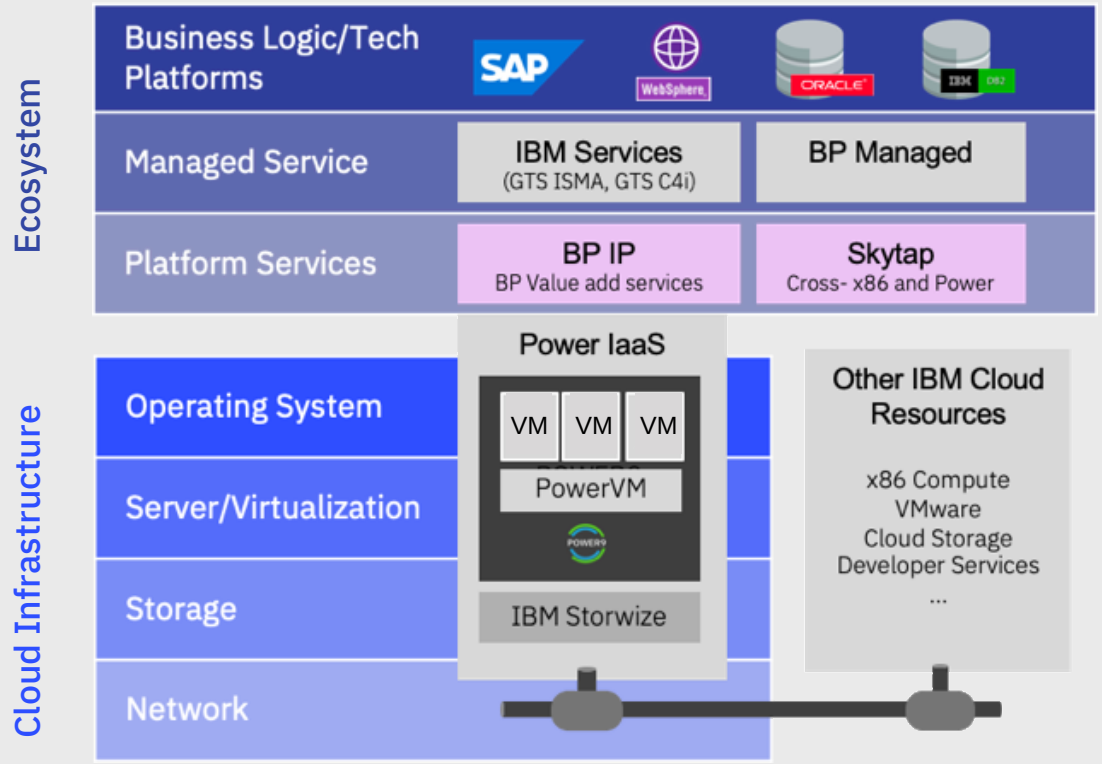
What/How

- AIX and IBM i PowerVM-based VM as-a-Service on IBM Cloud
- IBM manages up to OS deployment and the client self-manages the OS and up
- Cloud consumption-based pricing plans available through IBM Cloud Catalog

Target on-ramps and use cases

- Extend AIX / IBM i workloads to the Cloud
- DB2- and Oracle-based enterprise application (e.g. SAP) running on AIX and IBM i
- Modernize with Cloud Native services

Introducing Power Virtual Server on IBM Cloud



IBM Cloud Private

Modernize existing applications

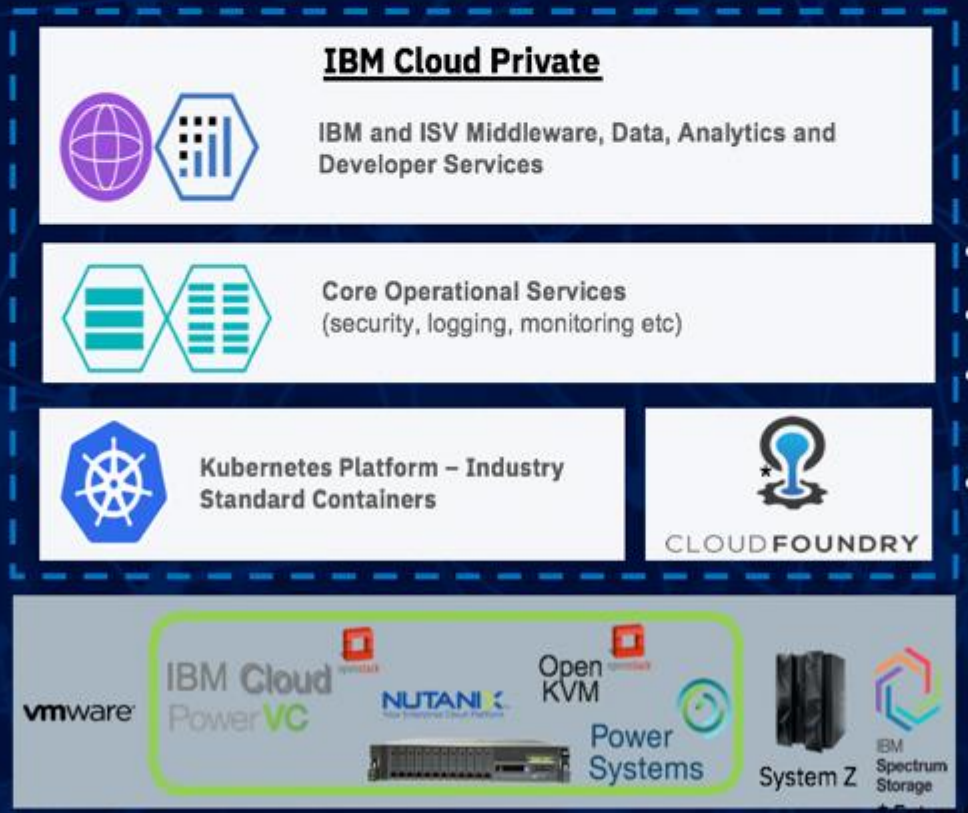
Integrate Hybrid Cloud use cases

Create Cloud Native Applications

Deep Learning

Benefits on POWER

- Faster Insights for Cognitive Applications
- Better Performance at Lower Cost
- Seamless Modernization alongside AIX and IBM i applications



Features

- Enterprise grade services
- Enterprise grade operations
- Open Hardware and Software by design
- Large and Growing Ecosystem of Applications

API access to Existing Workloads & Data

AIX

i for Business

Prevent vendor lock-in!!!

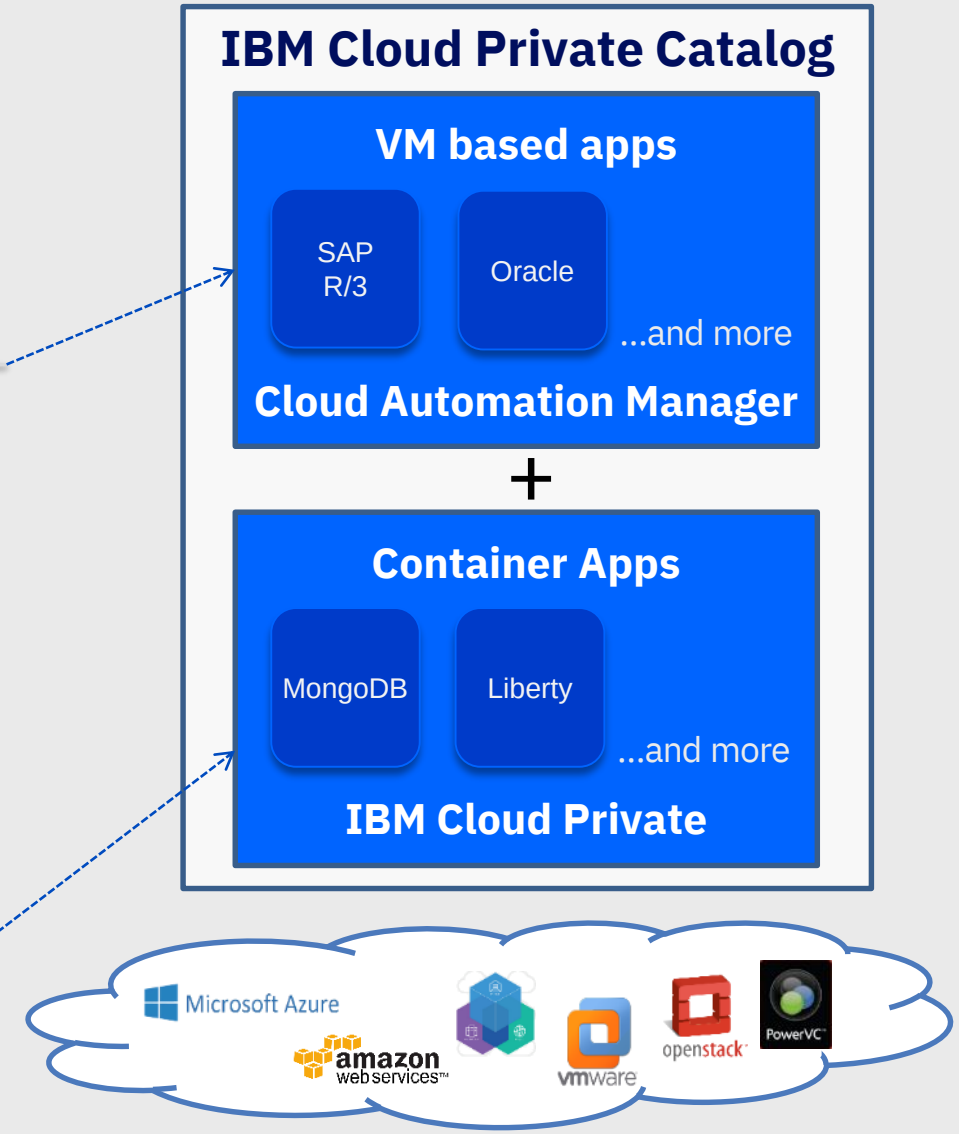
Cloud Enable your Mission Critical Applications
including existing applications running on AIX and IBM i

Traditional Enterprise Apps

WebSphere App Srv
WebSphere MQ
SAP R/3
Oracle
Db2

Container Apps

WebSphere Liberty
MongoDB
Redis
Jenkins



- Deploy existing ***VM-based applications*** in a multi-cloud environment with **Cloud Automation Manager (CAM)**
- Add any **AIX, IBM i, or Linux VM**-based application to the Cloud Private catalog
- Integrate new services with existing mission critical workloads (e.g. DBs), achieving a *single catalog* and **coordinated orchestration**
- Deploy and manage applications with a **common self-service interface,** seamlessly align workloads to most optimized infrastructure
- Manage **integrated clusters** of Power, z/LinuxONE, and Intel servers

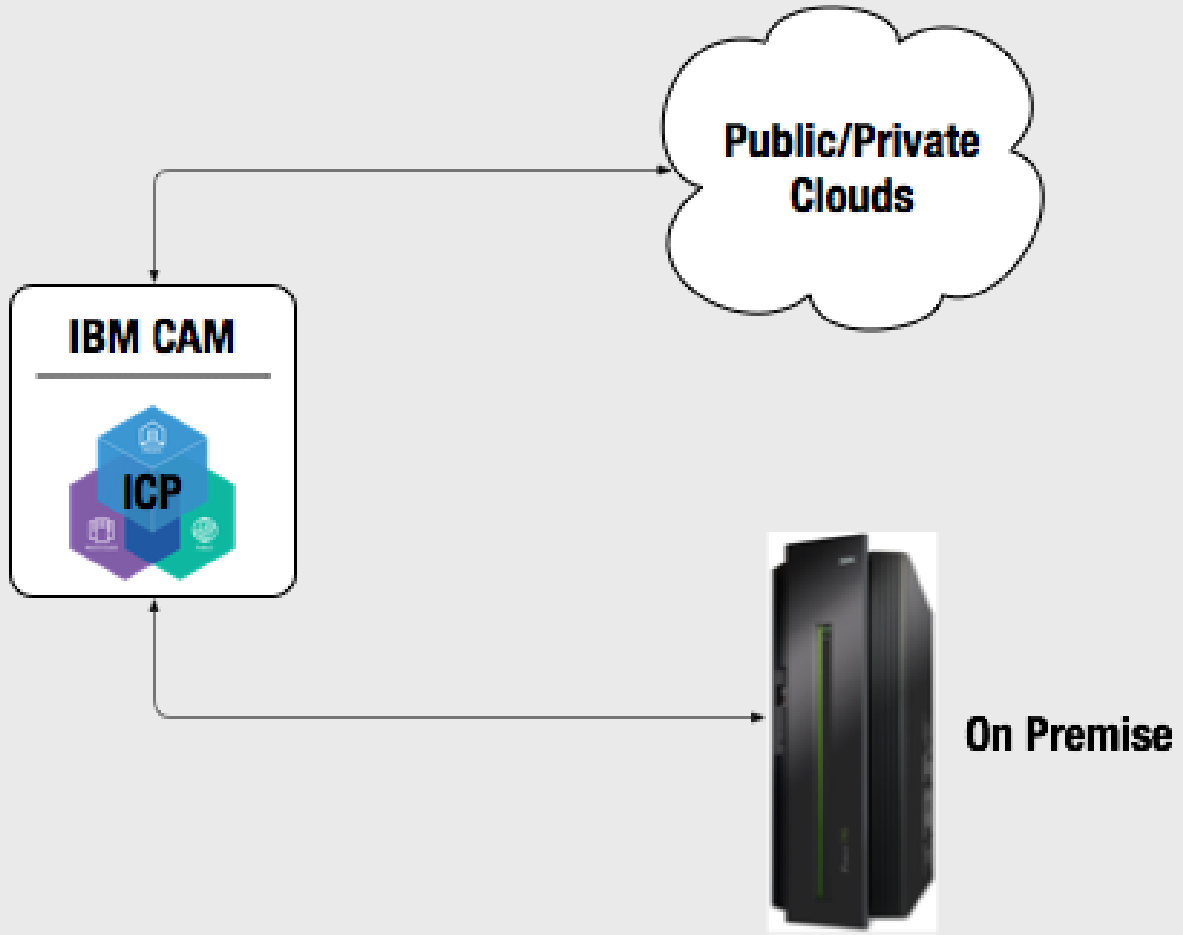
ICP/CAM for Oracle Overview

Provisioning of On/Off Premise:

- Power through PowerVC (OpenStack)
- System z through OpenStack
- Storage through OpenStack
- Oracle VM (x86) through OpenStack

Provisioning of Oracle VM on IBM Cloud (x86) Baremetals (IBM Oracle VM Grid)

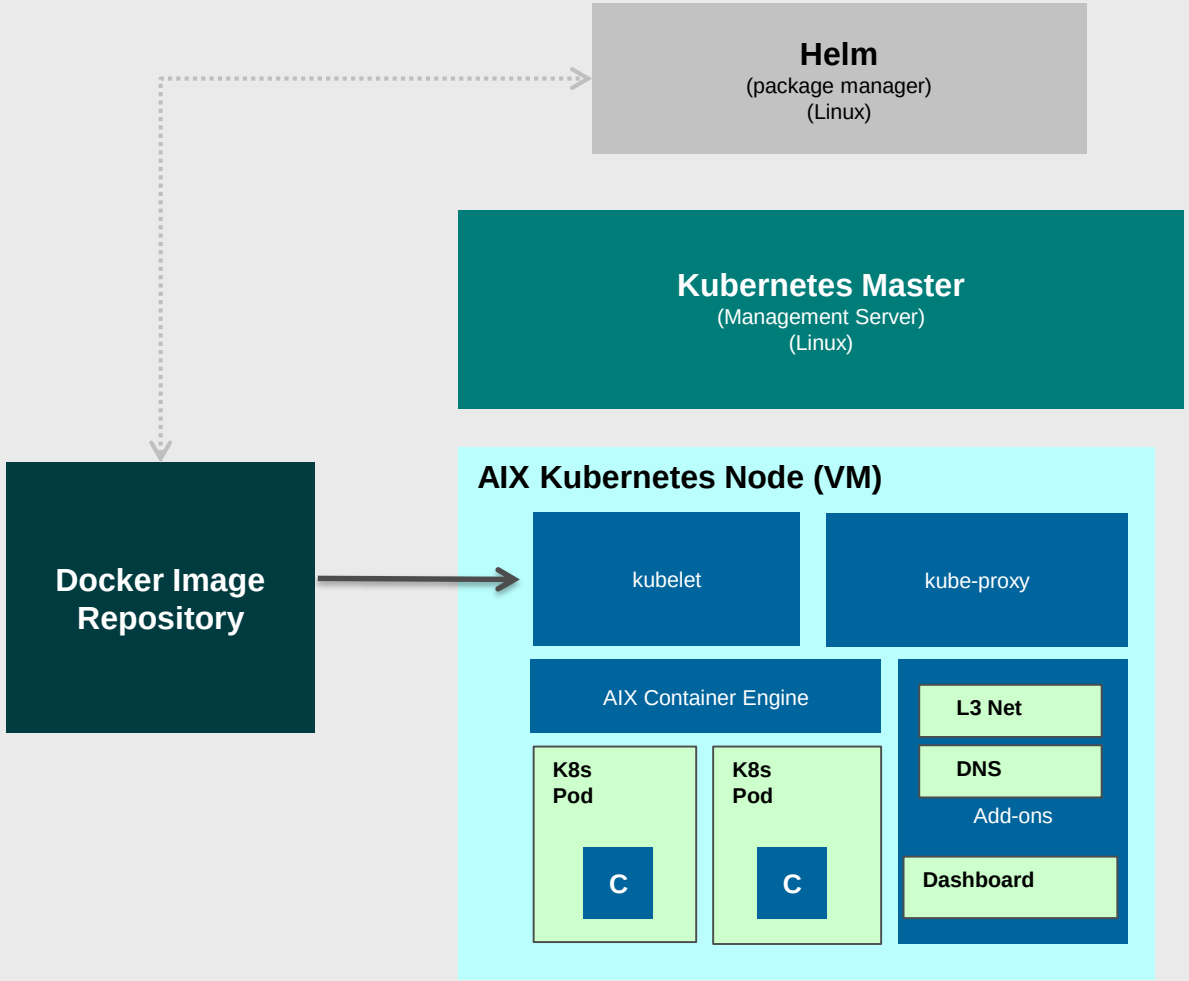
- Chef/Ansible/Puppet deployment of Oracle RDBMS, Fusion Middleware
- Oracle E-Business Suite (ERP)
- Oracle provided Docker, Chef or Oracle VM templates
- AWS, Azure, Oracle Cloud, Google, VMWare
- Anything Terraform supports



AIX Modernization - AIX Node in a Kubernetes Cluster

Compatible with IBM Cloud Private (ICP)

On the AIX Toolbox!



- Master runs on Linux,
  worker nodes can be AIX or Linux
- Underlying containers are AIX WPARs instead of Docker containers
- AIX images are stored in the Docker repository alongside Linux images and deployed the same way
  - There is no existing “catalog” of AIX images
  - New AIX images are captured from deployed instances similarly to Linux, but not with Docker tools
- Deploy one or more Pods in an AIX VM

Cloud accelerates business transformation

Innovate with the latest technology from any source

Access more types of data, analytics & AI, anywhere

What percentage of enterprise workloads have moved to date?

Improve return on existing investments

Source: McKinsey research

What percentage of enterprise workloads have moved to date?

20%

Source: McKinsey research

Enterprises are reconsidering a pure public cloud strategy

38% of enterprises have moved workloads from the public cloud back to their data centers

More than half (52%) did so because of pricing and cost concerns *

.

* http://www.bmc.com/content/dam/bmc/migration/pdf/Forbes_Avoid_Sticker_Shock_eBook.pdf

The Point

The POWER9 processors are vastly faster than all competitive alternatives

- Fewer cores needed lowers software costs

Virtualisation allows over commitment

- This is one of the main ways how the Cloud Providers make money
- You can keep that benefit with IBM Power Systems

Watch out for how software is licensed

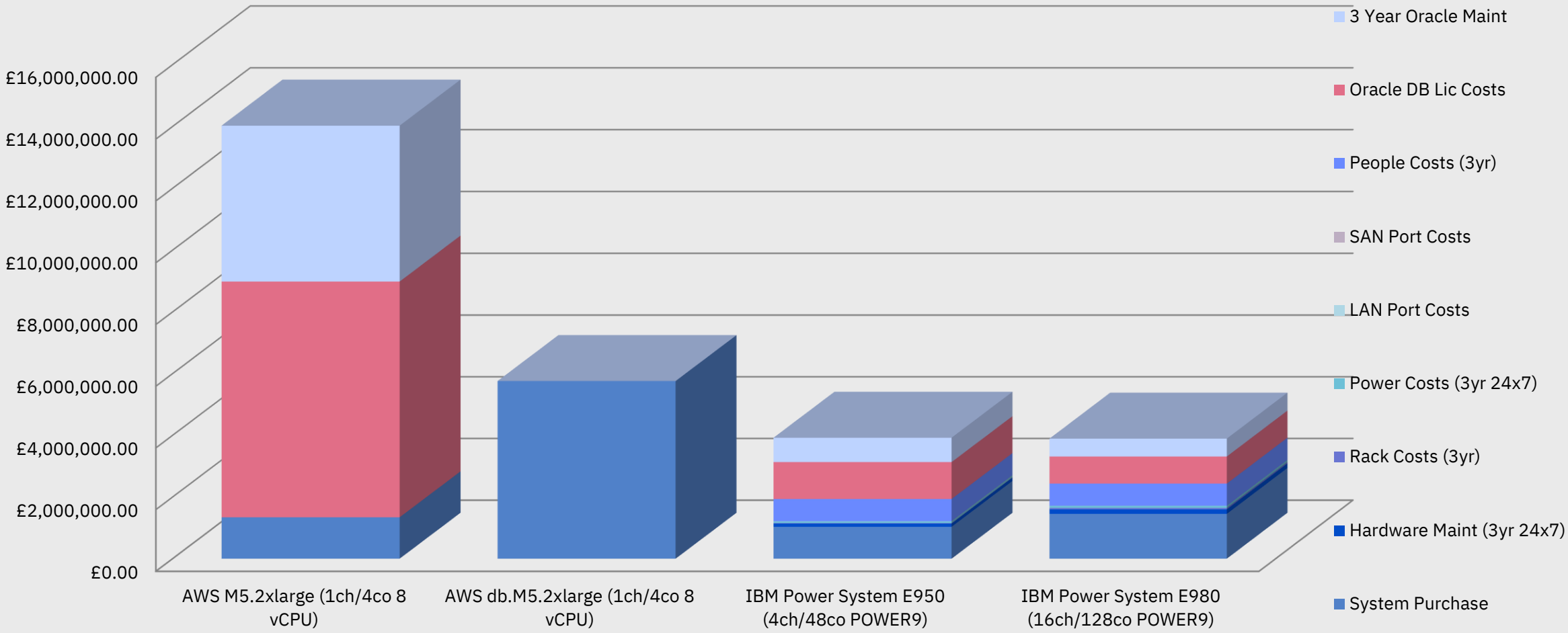
- For AWS & Azure, it can be by the thread, not the core

Software costs can dwarf the hardware spend

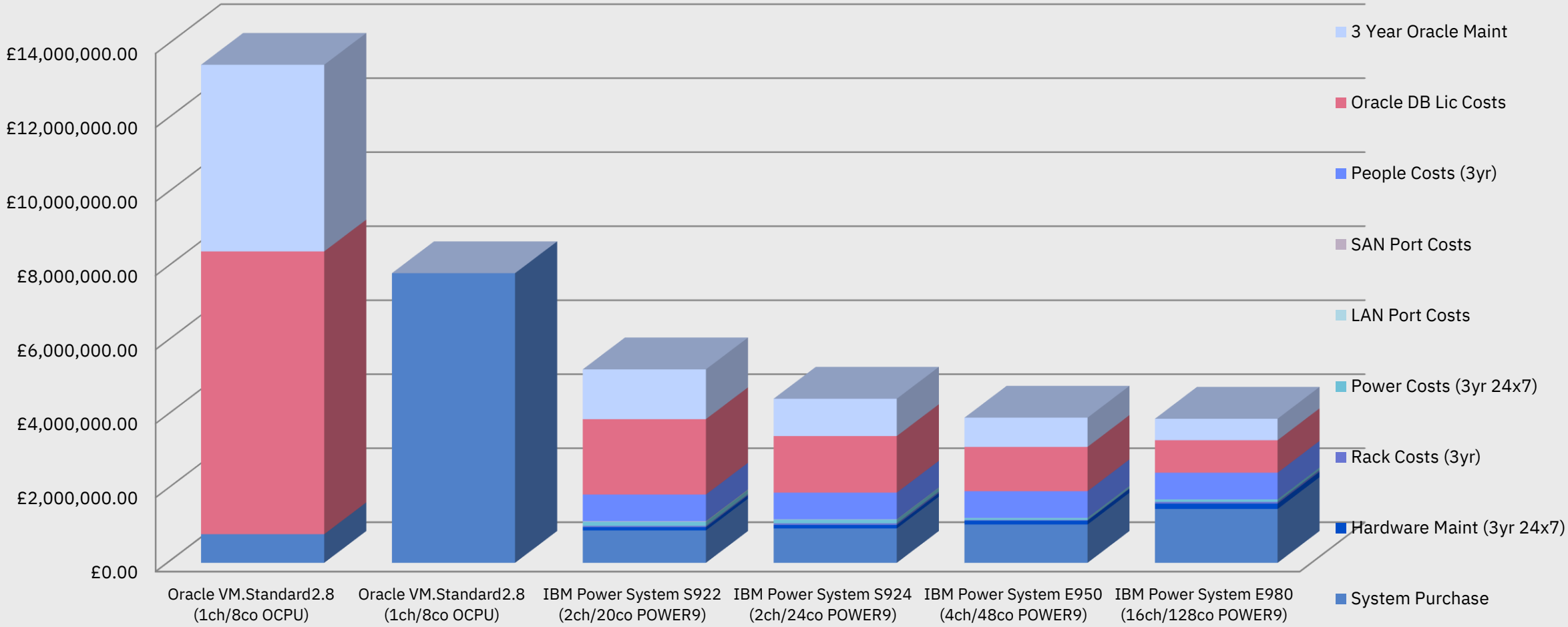
- How long are you staying?

A detailed look at Oracle DB & WAS on AWS vs IBM Power Systems

Oracle DB on AWS is 3.6x more expensive than on IBM Power Systems



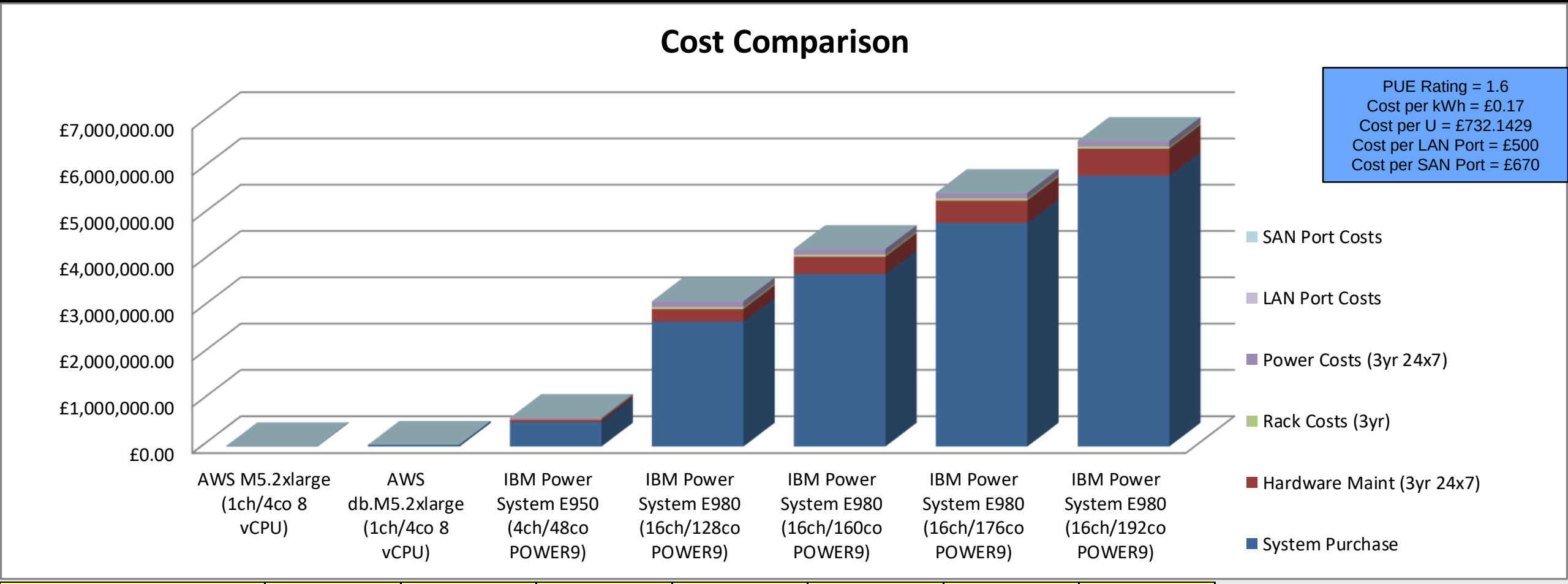
Oracle DB on Oracle Cloud is up to 3.6x more expensive than on IBM Power Systems



Is this real?

Lies ⟷ Truth

Build up case single server

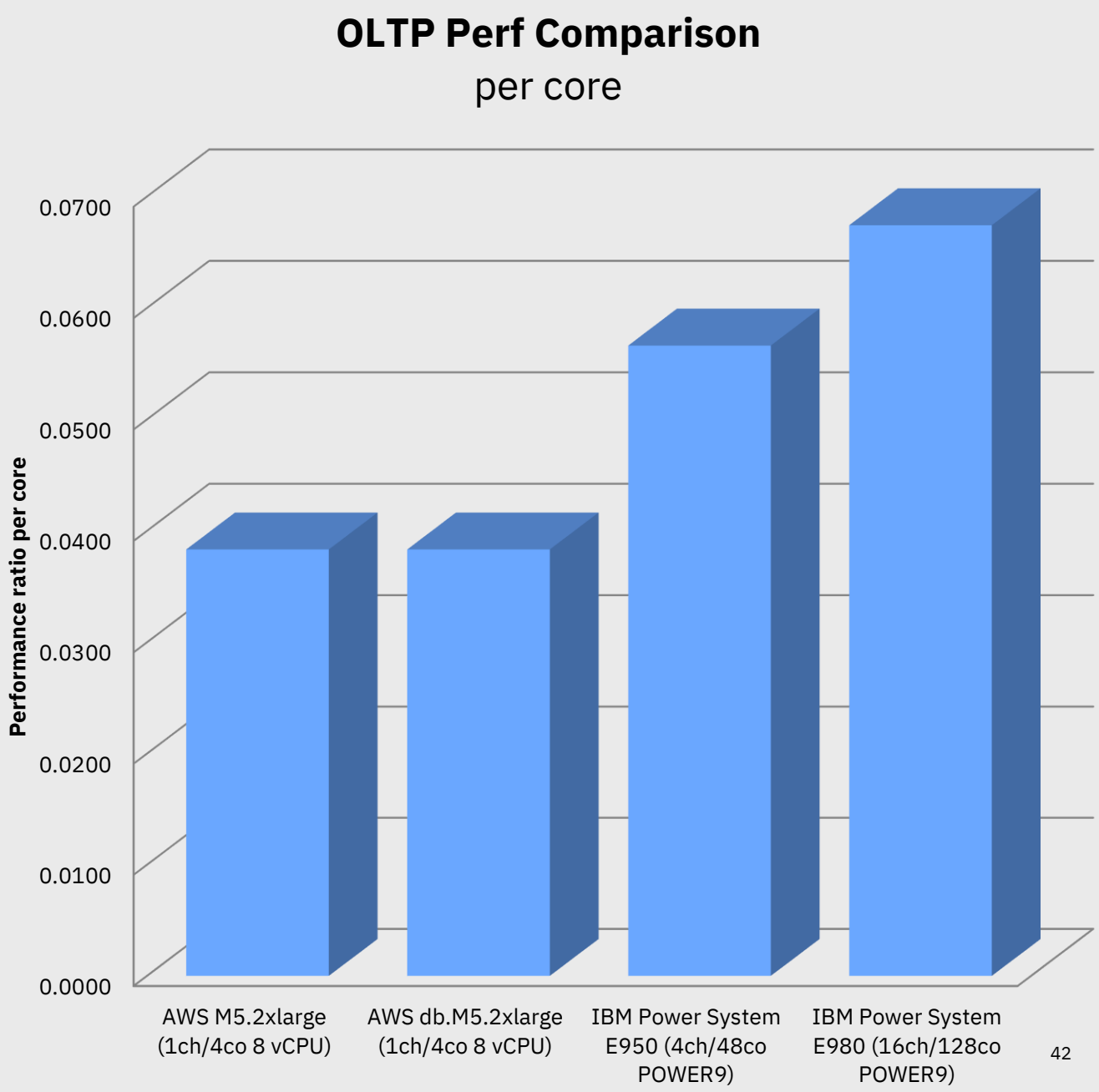


Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Initial Cost of Ownership	**£9,000**	**£39,000**	**£622,000**	**£3,139,000**	**£4,269,000**	**£5,482,000**	**£6,604,000**
Cost Ratio	1 to 1	4.34 to 1	69.12 to 1	348.78 to 1	474.34 to 1	609.12 to 1	733.78 to 1

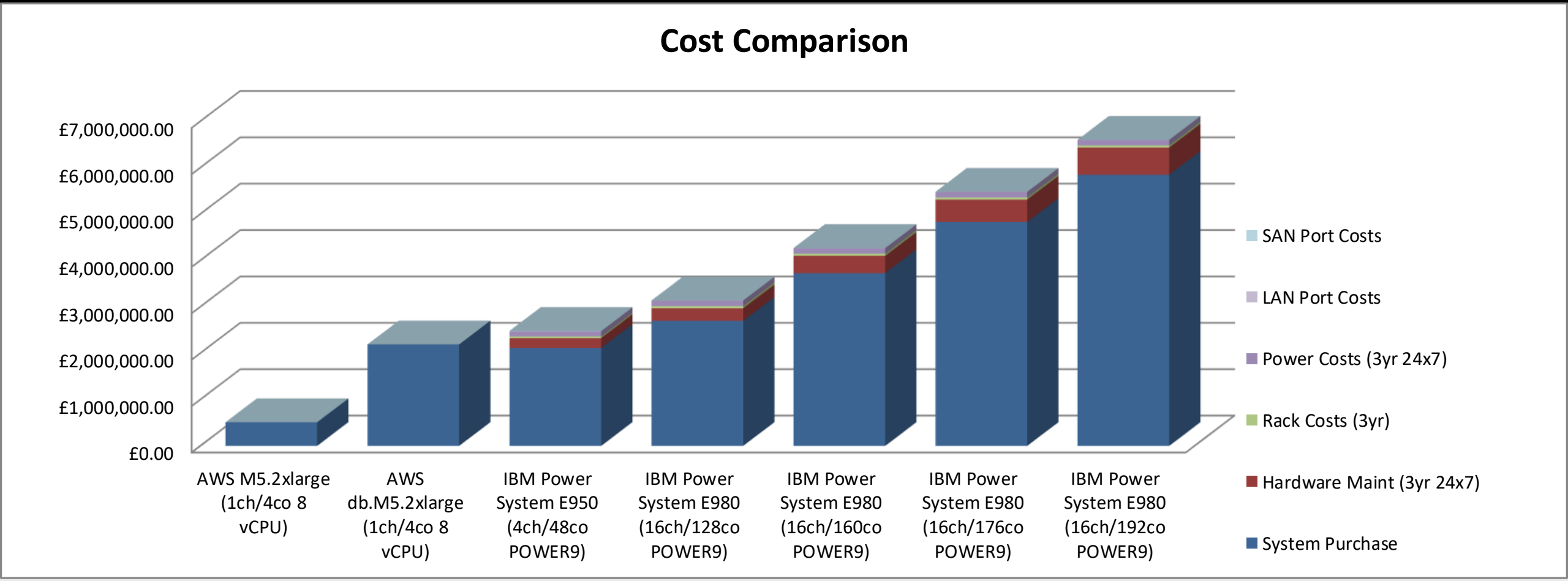
IBM Power Systems are up to 2x faster than AWS

Comparing those apples…

On a per core basis, which is how software is often charged**, IBM Power Systems are between 1.75 and 2x faster than current AWS M5 offerings**.



Build up case benchmark



Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Perf Factor (Benchmark)	56.29	56.29	3.18	1.00	0.83	0.77	0.72
Number of servers	57	57	4	1	1	1	1

Oracle Soft and Hard Partitioning

- https://blog.dbi-services.com/oracle-licensing-revolution/
- “Soft and hard partitioning policy: VMware is still a soft partitioning technology according to Oracle. The distinction between hard and soft partitioning is explained in this Oracle pdf file.”
- **“Meaning than since VMware 5.1 all the physical hosts managed by a vCenter Server instance have to be licensed whatever the Oracle footprint on the virtual servers.”**

- “Basically Oracle proposed them to validate their Oracle/VMware infrastructure and license only the processors that are really used to execute Oracle products with these two conditions:
  - Totally isolating Oracle products in their VMware infrastructure
  - Oracle requires a “certain volume of business” (can be in terms of Oracle Cloud Credit) to validate the customer infrastructure schema”
- What is “Totally isolating Oracle products”?

1. “A dedicated vCenter Server Instance with dedicated physical hosts
2. A dedicated VLAN
3. A Storage isolation through LUN Masking, Zoning or any approved restriction”

How about IBM Power Systems?

- https://www.oracle.com/technetwork/database/virtualizationmatrix-172995.html
- “Oracle software stack is supported on deployments with the IBM Power Systems LPAR hardware partitioning technology, including the micropartition feature.”
- https://www.oracle.com/assets/partitioning-070609.pdf
- “Approved hard partitioning technologies include: …IBM’s LPAR (adds DLPAR with AIX 5.2), IBM’s Micro-Partitions (capped partitions only)”
- “IBM Power VM Live Partition Mobility is not an approved hard partitioning technology. All cores on both the source and destination servers in an environment using IBM Power VM Live Partition Mobility must be licensed.”

- https://www.softwareone.com/en/blog/oracle-licensing-know-the-lingo-to-avoid-confusion
- “When it comes to Oracle licensing, however, an LPAR is a valid hard partition, regardless of whether the LPARs mode is “capped” or “uncapped.” So an “uncapped” LPAR is still a hard partition.”

- Running LPM on Selected Partitions
- “HMC V8R8.4.0 introduces a new partition-level attribute to disable Live Partition Migration (LPM) for that partition. The HMC will block LPM for that partition as long as this attribute is enabled. This feature can be used by ISVs to deal with application licensing issues.”

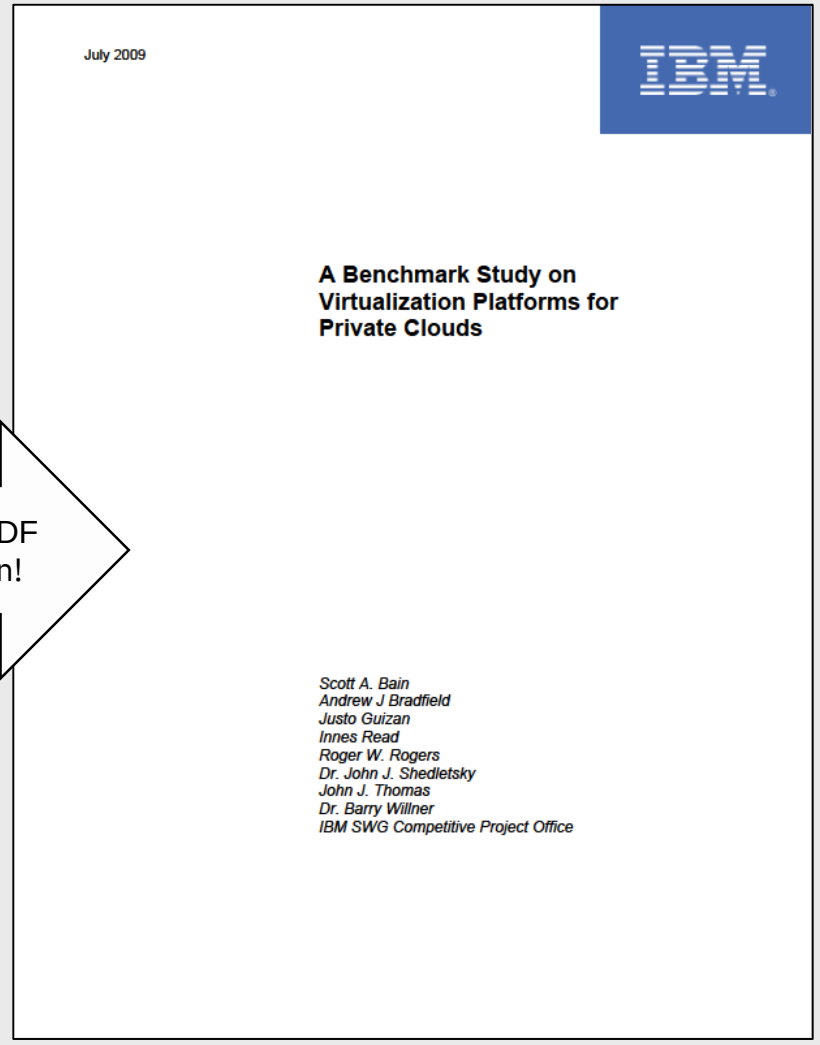
Oracle and IBM

- “Since 1986, IBM and Oracle have held a relationship revolving around business, technology and innovation. From application selection, deployment and implementation to upgrade and maintenance, IBM offers the Oracle consulting services and systems to help you succeed at each stage of your Oracle investment.”
- “The IBM Oracle International Competency Center (ICC) works closely with the IBM Oracle Center (IOC) in Montpellier, France and the IBM Oracle Competency Center in Tokyo, Japan.”
  - IBM Oracle International Competency Center - ibmoracl@us.ibm.com
  - IBM Oracle Center, Montpellier, France – ioc@fr.ibm.com
  - IBM Oracle Competency Center, Tokyo, Japan – ibmoracc@jp.ibm.com

- **“Oracle DB & RAC 12c on IBM AIX : Tips and Considerations”**
  - https://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP102425

Warning – statistical modelling ahead!

Embedded PDF
Click to open!



July 2009

IBM

A Benchmark Study on Virtualization Platforms for Private Clouds

Scott A. Bain
Andrew J Bradfield
Justo Guizan
Innes Read
Roger W. Rogers
Dr. John J. Shedletsky
John J. Thomas
Dr. Barry Willner
IBM SWG Competitive Project Office

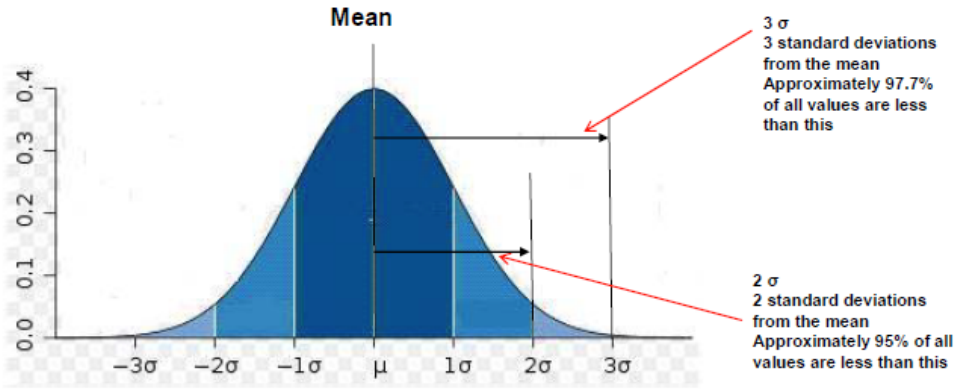
Roger Rogers

Competitive Analyst at IBM IT Economics Studies in Consolidation, Platform Selection, Chargeback, and Security

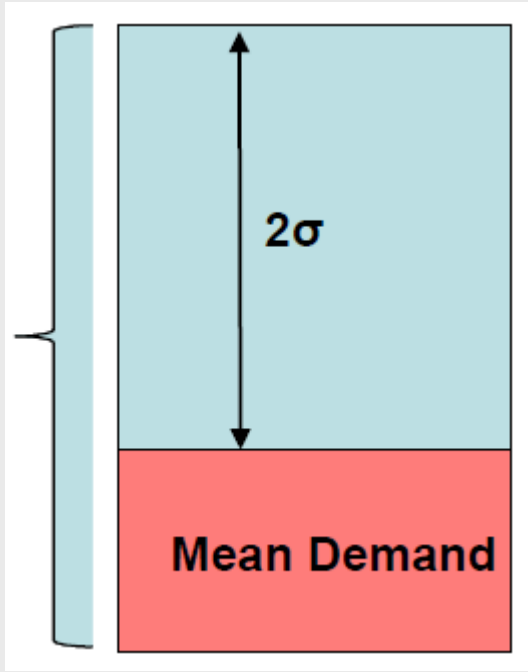
How would you size a server? Cover most peak demands

Statistical Models Can Be Used To Account For Workload Variability

- Assume a server workload with varying demand over time, that can be modeled as a standard normal distribution. Theory tells us 95% of the values are less than 2 standard deviations away.



To meet a 95% SLA, we need a server with a total capacity of (Mean Demand + 2σ)



Adding some Statistical Theory to the model - Sigma

What Is A Typical Value Of Sigma?

IBM Survey Of Workload Variability In 3200 Servers

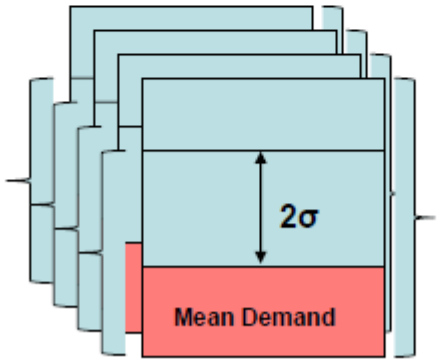
Type Of Workload	Average Utilization	Peak Utilization	Sigma
Infrastructure	6%	35%	2.5 * Mean
Web Server	4%	24%	2.5 * Mean
Application	4%	34%	3.75 * Mean
Database	5%	37%	3.25 * Mean
Terminal	6%	45%	3.25 * Mean
E-Mail	4%	34%	3.75 * Mean

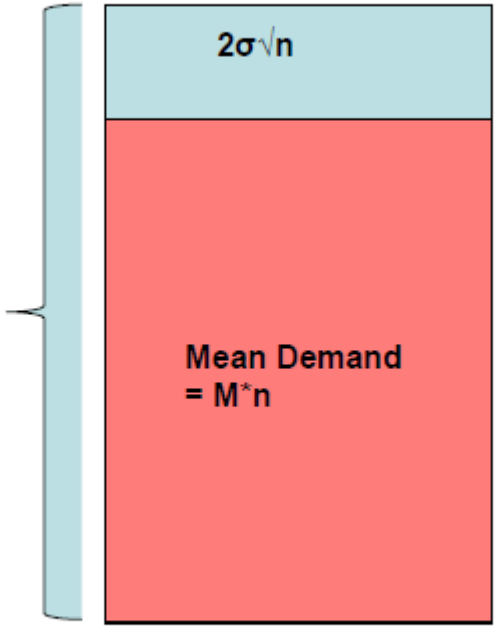
IBM System x™ Servers and VMware Virtual Machine Sizing Guide
Legacy workloads on XEON 2.5-2.8GHz Servers

Adding some Statistical Theory to the model – Central Limit Theorem

Pooling Variability Drives Normalized σ Down By √n

Headroom is reduced by a factor of the square root of n where n is the number of consolidations





The Mean Demand is going up by n, but the headroom is only going up by √n. Normalized by scale this reduced waste by √n.

Efficiently use those resources with Statistical Multiplexing

You could rent a Virtual Server on the Cloud for each instance

Take 8 separate workloads on 8 identical systems

- Average utilisation is 17%
- Peak is 6 times the average

Put all 8 workloads into one system

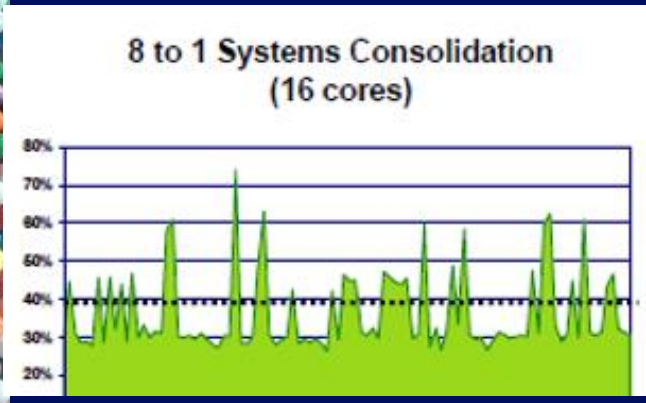
- **Average utilisation is 36%**
- Peak is 2.76 times the average

16 cores deliver the workload of 32,

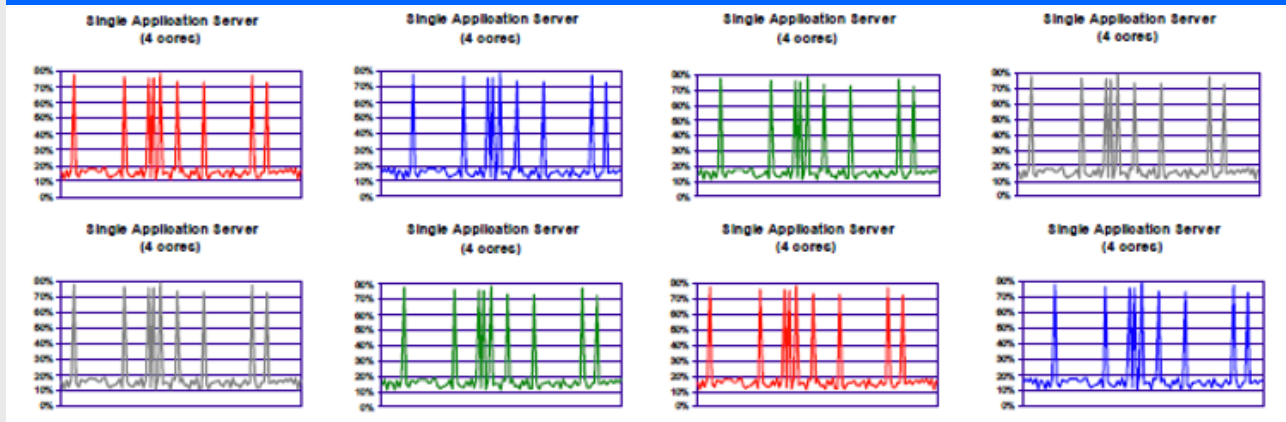
2:1 overcommitment

Tightly packed

Overcommitment



Peaks and troughs at different times



Efficiently use those resources with Statistical Multiplexing

You could rent a Virtual Server on the Cloud for each instance, or you could pack them together in a single server which has been purpose built for the task.

Take 16 separate workloads on 16 identical systems

- Average utilisation is 17%
- Peak is 6 times the average

Put all 16 workloads into one system

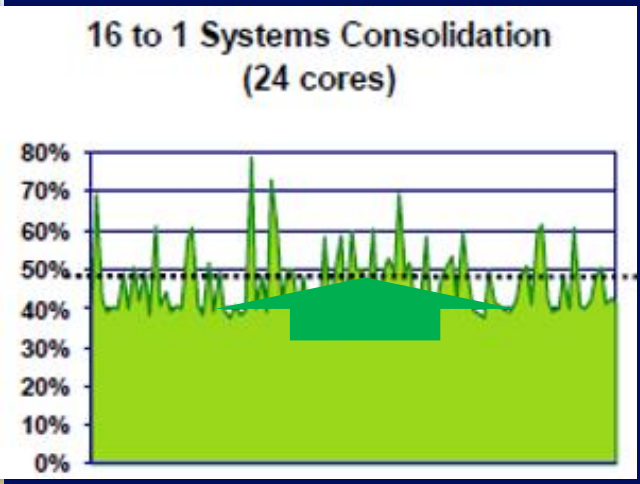
- **Average utilisation is 44%**
- Peak is 2.25 times the average

24 cores deliver the workload of 64,

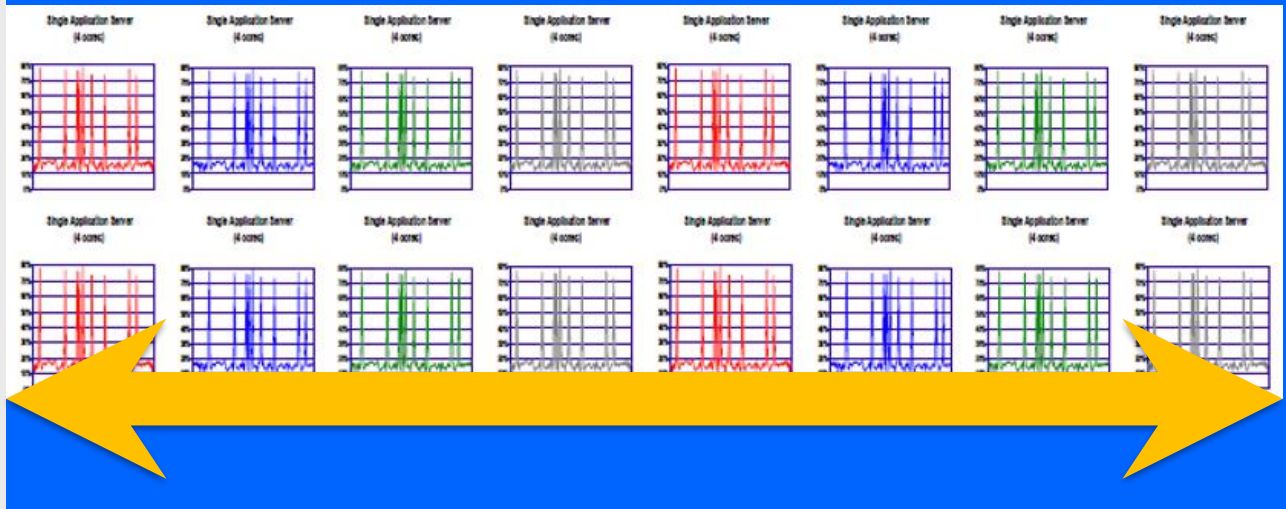
2.65:1 overcommitment

Tightly packed

Overcommitment



Peaks and troughs at different times



Efficiently use those resources with Statistical Multiplexing

You could rent a Virtual Server on the Cloud for each instance, or you could pack them together in a single server which has been purpose built for the task.

Take 64 separate workloads on 64 identical systems

- Average utilisation is 17%
- Peak is 6 times the average

Put all 64 workloads into one system

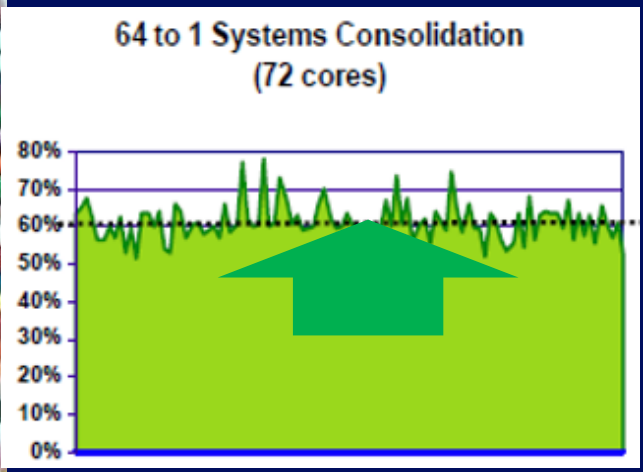
- **Average utilisation is 60%**
- Peak is 1.625 times the average

72 cores deliver the workload of 256,

3.55:1 overcommitment

Tightly packed

Overcommitment



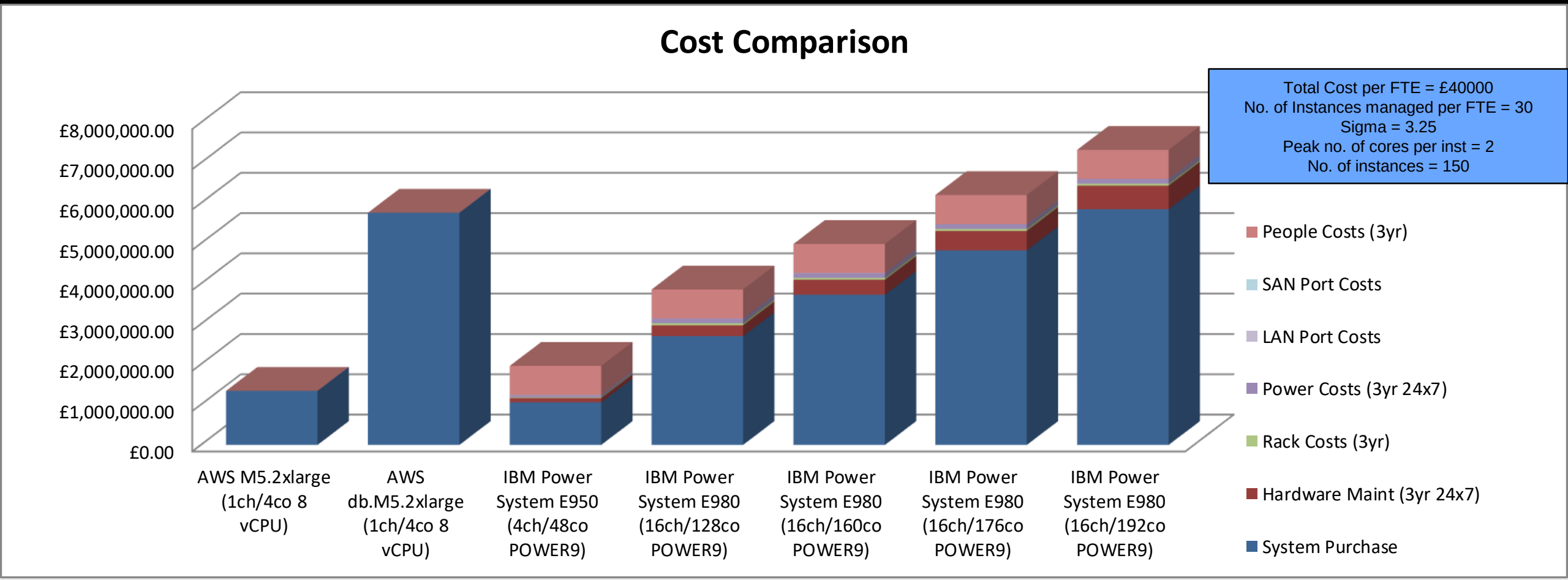
Peaks and troughs at different times

The maths behind this

- $\mathbf{Total\ Cap}\boldsymbol{acity}=\boldsymbol{M}*\boldsymbol{n}+\mathbf{2}*\boldsymbol{Sigma}*\sqrt{\boldsymbol{n}}$ where M is the Mean utilization when running n consolidated workloads.
- $\mathbf{Sigma}=\mathbf{V}*\boldsymbol{M}$ where V is the Variability
- So, $\mathbf{Total\ Cap}\boldsymbol{acity}=\boldsymbol{M}(\boldsymbol{n}+\mathbf{2}\boldsymbol{V}\sqrt{\boldsymbol{n}})$

- Now, if we know the desired Total Capacity (P), we know the Variability (V) and the Mean demand of each workload, we can solve for n
- This gives $[\![\boldsymbol{n}=(\boldsymbol{P}/\boldsymbol{M})+\mathbf{2}\boldsymbol{V}]\!]\mathbf{\hat{}2}\pm\mathbf{2V}\sqrt{((\boldsymbol{P}/\boldsymbol{M})+\boldsymbol{V}\mathbf{\hat{}2}}\ )$
- That means we can model how many workloads will fit into each server
- Which gives us the number of servers for a given number of workloads

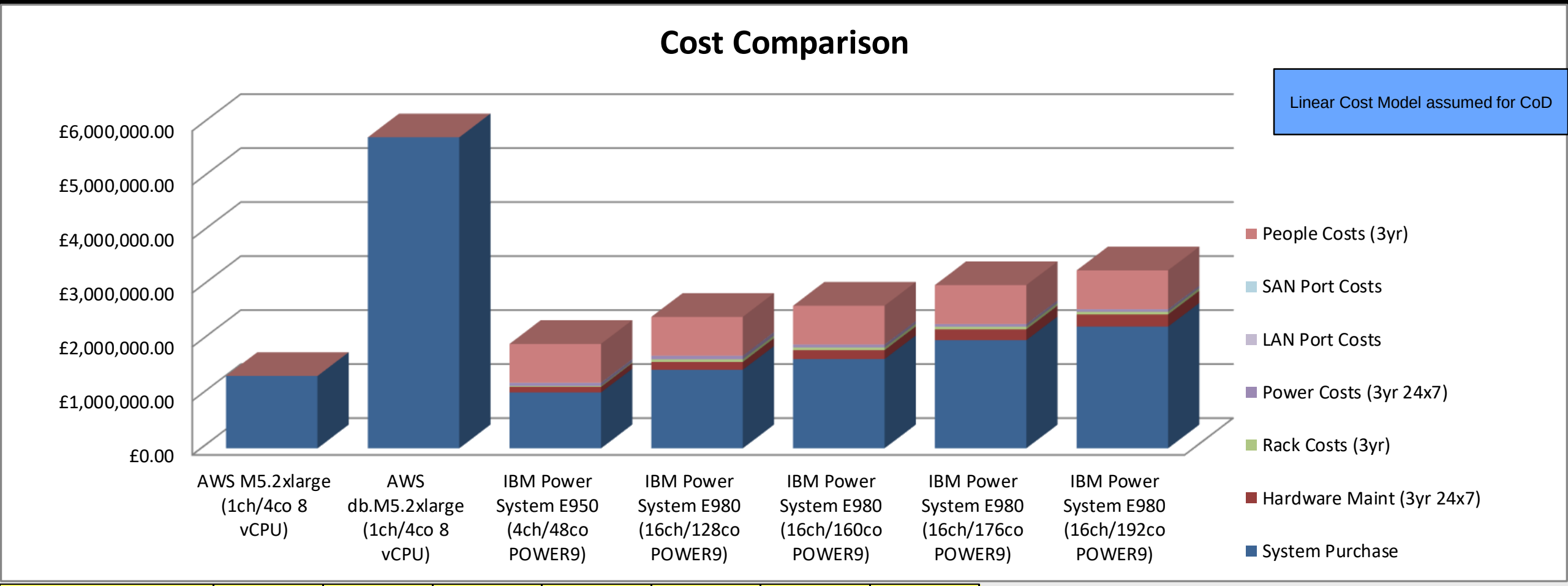
Build up case CLT



Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Difference between Average and Peak (Normalised to Peak)	0.87	0.87	0.43	0.35	0.35	0.35	0.35
Number of servers	150	150	2	1	1	1	1

IBM Power allows larger pools of virtualised resources. Spikes in workloads can be accommodated with fewer resources. Less resources are therefore needed, reducing costs.

Build up case SubCap



Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Active cores	600	600	94	69	71	73	74
Number of servers	150	150	2	1	1	1	1

Larger IBM Power Systems can still be right sized and dynamically upgraded to control initial purchase costs and software license requirements

The AWS version of a vCPU

- AWS Compute Blog
- Disabling Intel Hyper-Threading Technology on Amazon Linux
- …
- Exploring HT Technology on Amazon Linux
- Look at the configuration on an Amazon Linux instance. I ran the examples below on an m4.2xlarge, which has eight vCPUs. Note that each vCPU is a thread of an Intel Xeon core. Therefore, the m4.2xlarge has four cores, each of which run two threads, resulting in eight vCPUs.

https://aws.amazon.com/blogs/compute/disabling-intel-hyper-threading-technology-on-amazon-linux/

Oracle BYOL in AWS & Azure

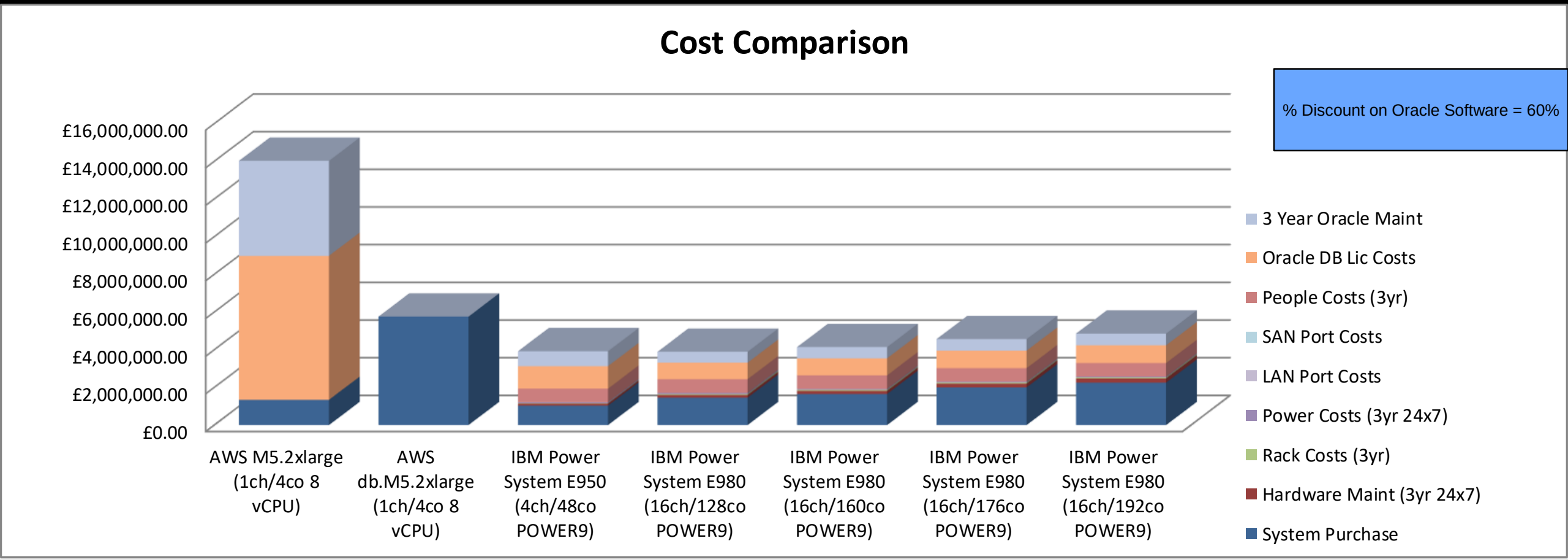
Licensing Oracle Software in the Cloud Computing Environment
For the purposes of licensing Oracle programs in an Authorized Cloud Environment, customers are required to count as follows:

- Amazon EC2 and RDS - **count two vCPUs as equivalent to one Oracle Processor license if hyper-threading is enabled**, and one vCPU as equivalent to one Oracle Processor license if hyper-threading is not enabled.
- Microsoft Azure – **count two vCPUs as equivalent to one Oracle Processor license if hyperthreading is enabled**, and one vCPU as equivalent to one Oracle Processor license if hyperthreading is not enabled.

When counting Oracle Processor license requirements in Authorized Cloud Environments, the Oracle Processor Core Factor Table is not applicable.

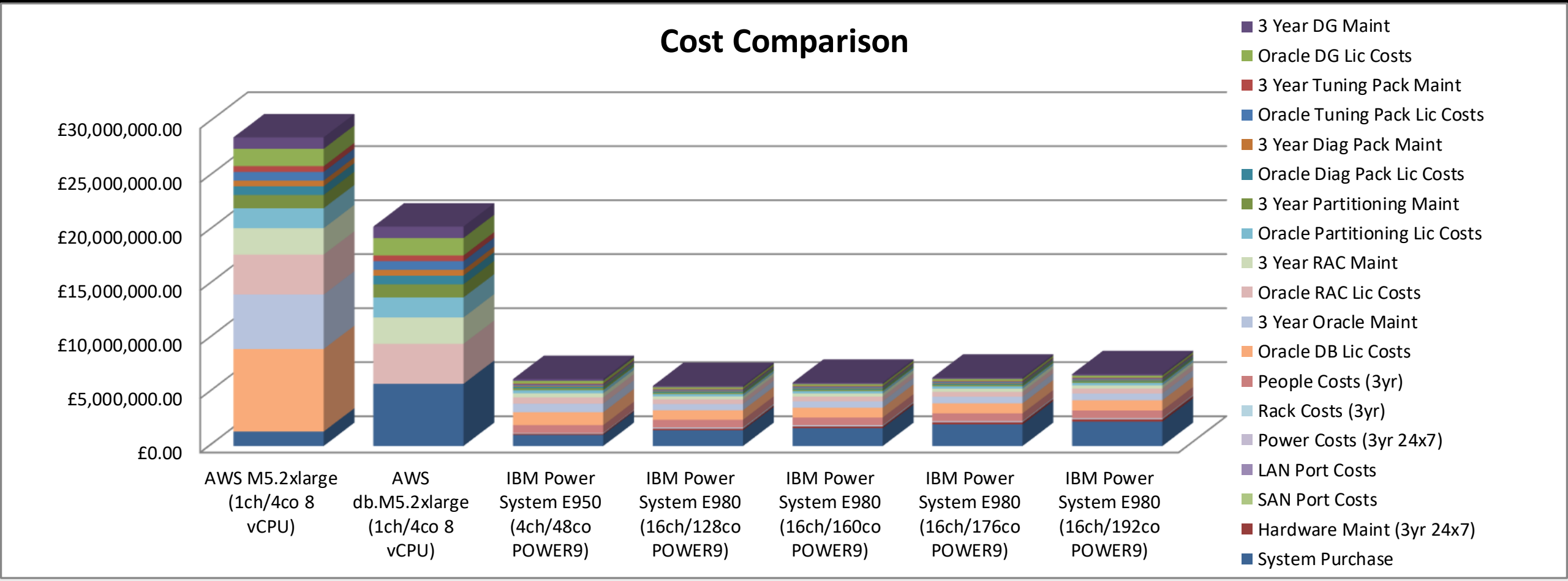
http://www.oracle.com/us/corporate/pricing/cloud-licensing-070579.pdf

Build up case oracle DB



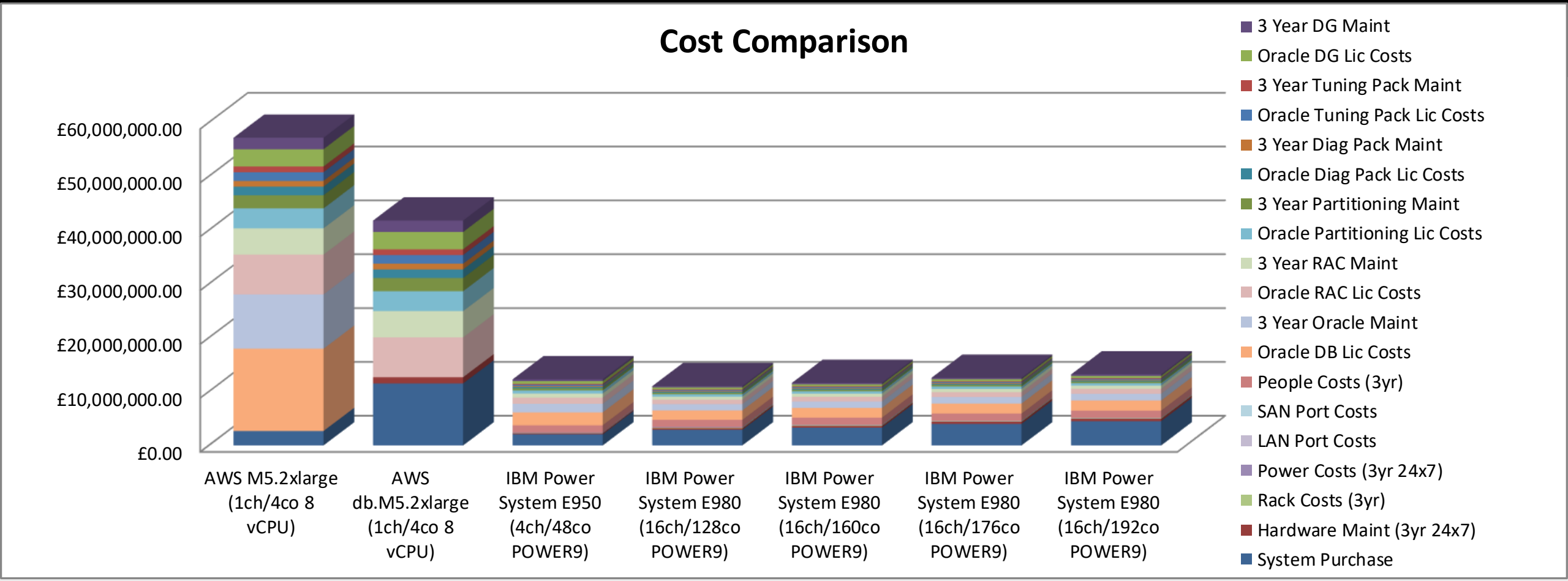
Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Oracle Licenses Needed	600	600	94	69	71	73	74
Number of servers	150	150	2	1	1	1	1

Build up case RAC Stack



Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Oracle Software Costs	£27,245,000	£14,559,000	£4,276,000	£3,139,000	£3,228,000	£3,320,000	£3,367,000
Hardware Costs	£1,342,000	£5,760,000	£1,139,000	£1,600,000	£1,819,000	£2,203,000	£2,480,000

Build up case RAC N+1



Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Server for "+1" in "n+1"	150	150	2	1	1	1	1
Resulting Servers needed	300	300	4	2	2	2	2

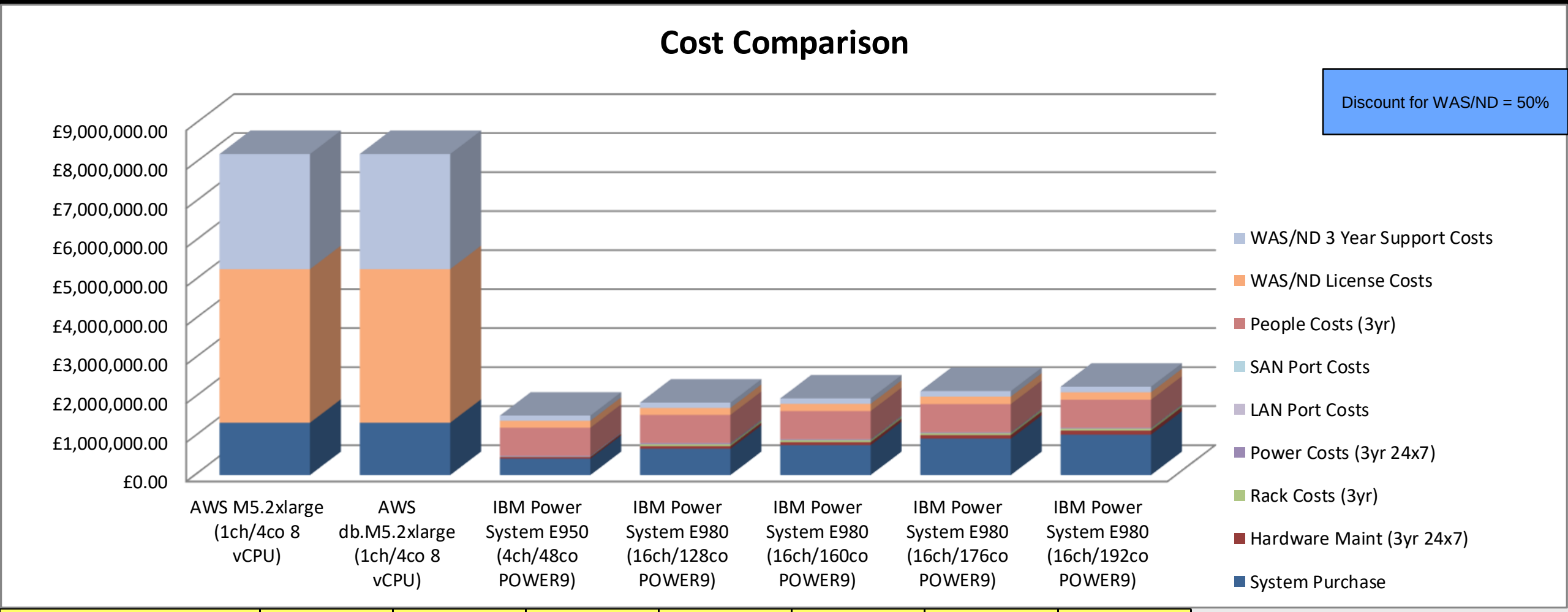
IBM Eligible Public Cloud BYOSL policy

- IBM authorizes you to deploy your eligible IBM software on an eligible public cloud Infrastructure as a Service (IaaS) provided by IBM or a third party subject to the conditions below…
- This policy allows you to deploy and execute on an EPC any IBM software licensed to you directly or through an authorized IBM reseller under IBM license terms, subject to the use authorizations and restrictions stated in the applicable governing license agreements and transaction documents for such software including the IBM International Passport Advantage (IPAA) and IBM International Program License Agreement (IPLA) and the License Information documents applicable to the software.

Provider	Offering	PVUs per vCPU or Core	For more details go to:
Amazon	EC2 Instances & Dedicated Instances	70 PVU per vCPU	aws.amazon.com/ec2/instance-types

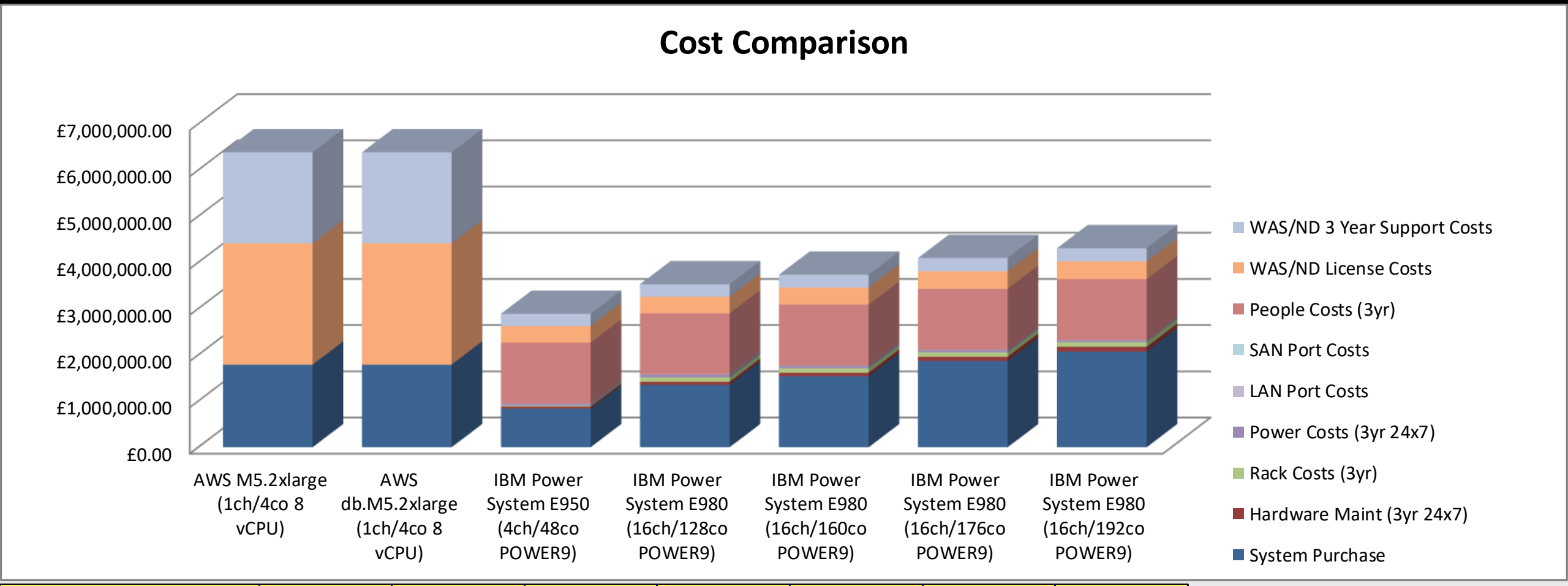
https://www-01.ibm.com/software/passportadvantage/eligible_public_cloud_BYOSL_policy.html

Build up case WAS



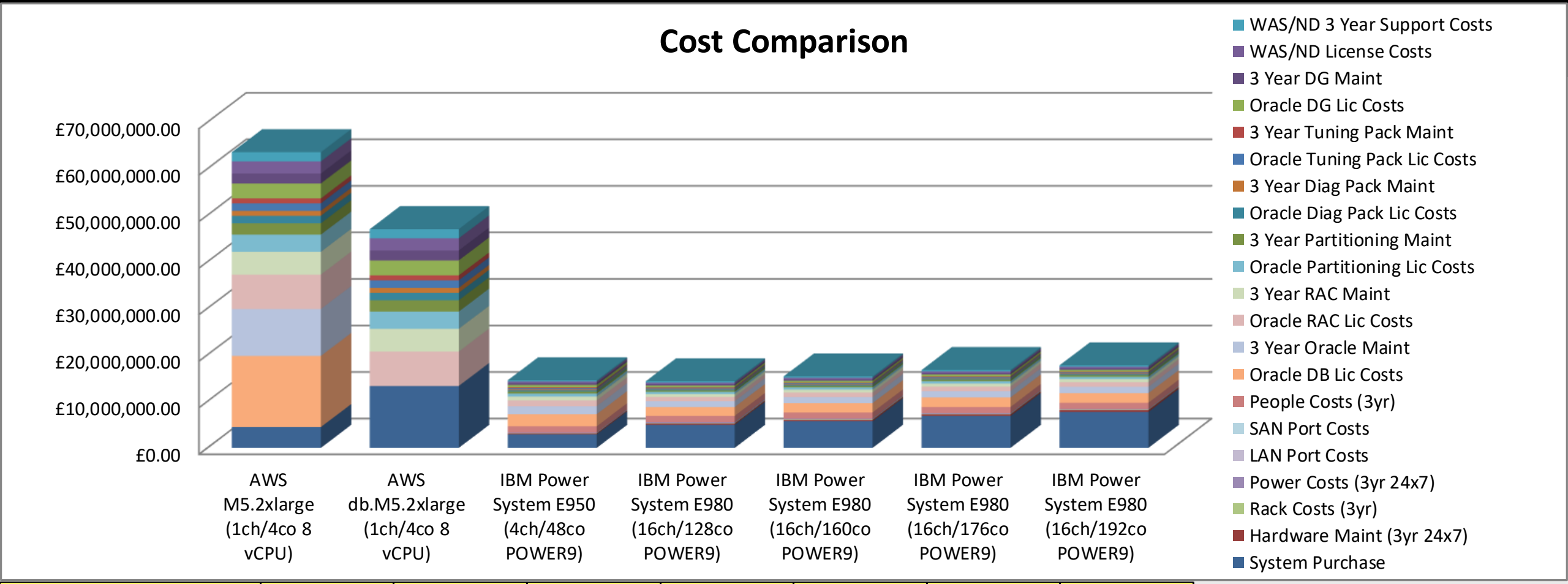
Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Total PVU	84000	84000	3800	3840	3960	4080	4080
Number of servers	150	150	1	1	1	1	1

Build up case WAS N+1



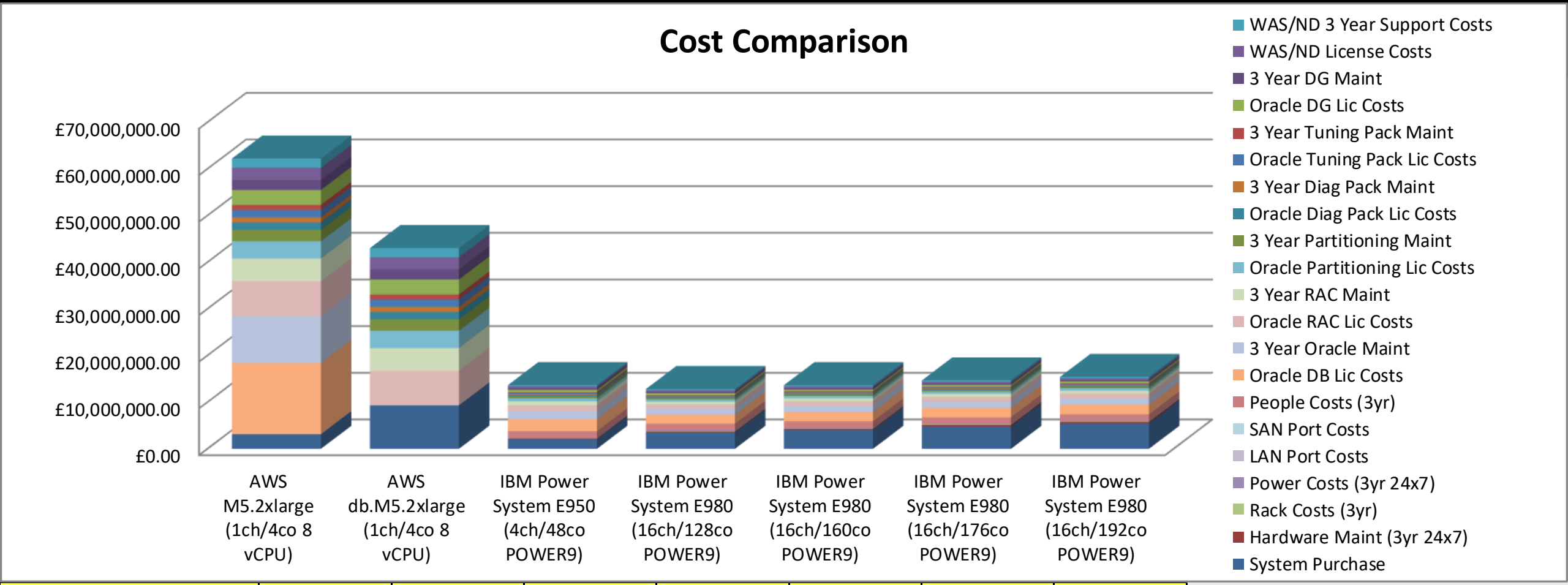
Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Server for "+1" in "n+1"	50	50	1	1	1	1	1
Resulting Servers needed	200	200	3	2	2	2	2

Built up case Combined



Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Mixed/Separate?	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed
Total Servers Needed	500	500	8	3	3	3	2

Conclude case



Server	AWS M5.2xlarge	AWS db.M5.2xlarge	IBM Power System E950	IBM Power System E980	IBM Power System E980	IBM Power System E980	IBM Power System E980
Discount	30%	30%	30%	30%	30%	30%	30%
Cost Ratio	4.4 to 1	3.07 to 1	1.06 to 1	1 to 1	1.07 to 1	1.15 to 1	1.31 to 1

A detailed look at Oracle DB & WAS on Azure vs IBM Power Systems

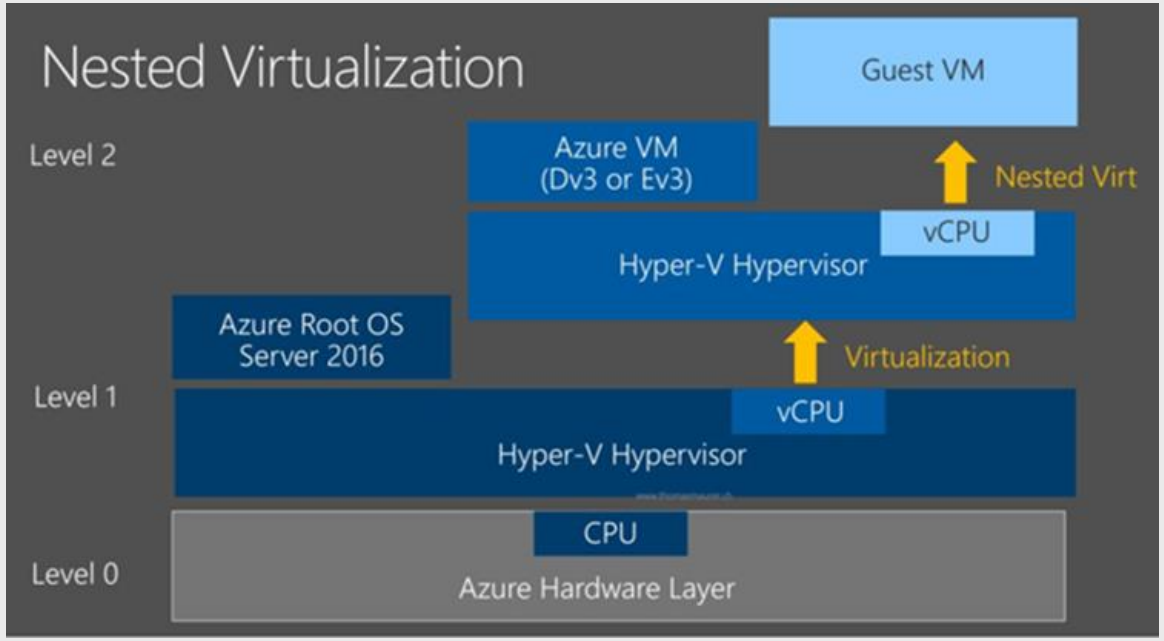
vCPUs in Azure

Introducing the new Dv3 Sizes

- “We are excited to announce the general availability of our new Dv3 VM sizes.”
- “These new sizes introduce Hyper-Threading Technology running on the Intel® Broadwell E5-2673 v4 2.3GHz processor, and the Intel® Haswell 2.4 GHz E5-2673 v3. The shift from physical cores to virtual CPU’s (vCPU) is a key architectural change that enables us to unlock the full potential of the latest processors to support even larger VM sizes.”

https://azure.microsoft.com/en-us/blog/introducing-the-new-dv3-and-ev3-vm-sizes/

Nested Virtualization in Azure

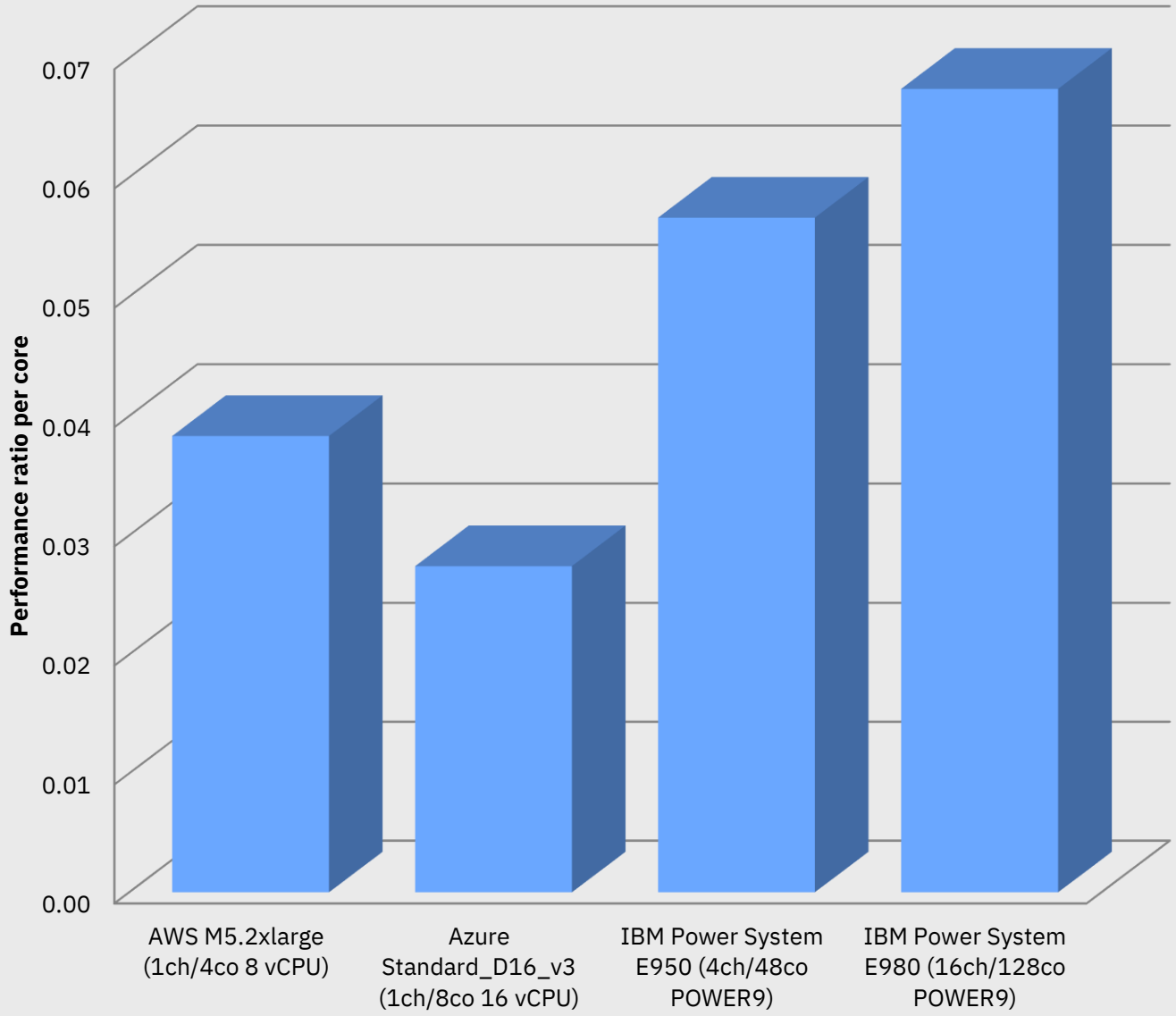


https://azure.microsoft.com/en-us/blog/nested-virtualization-in-azure/

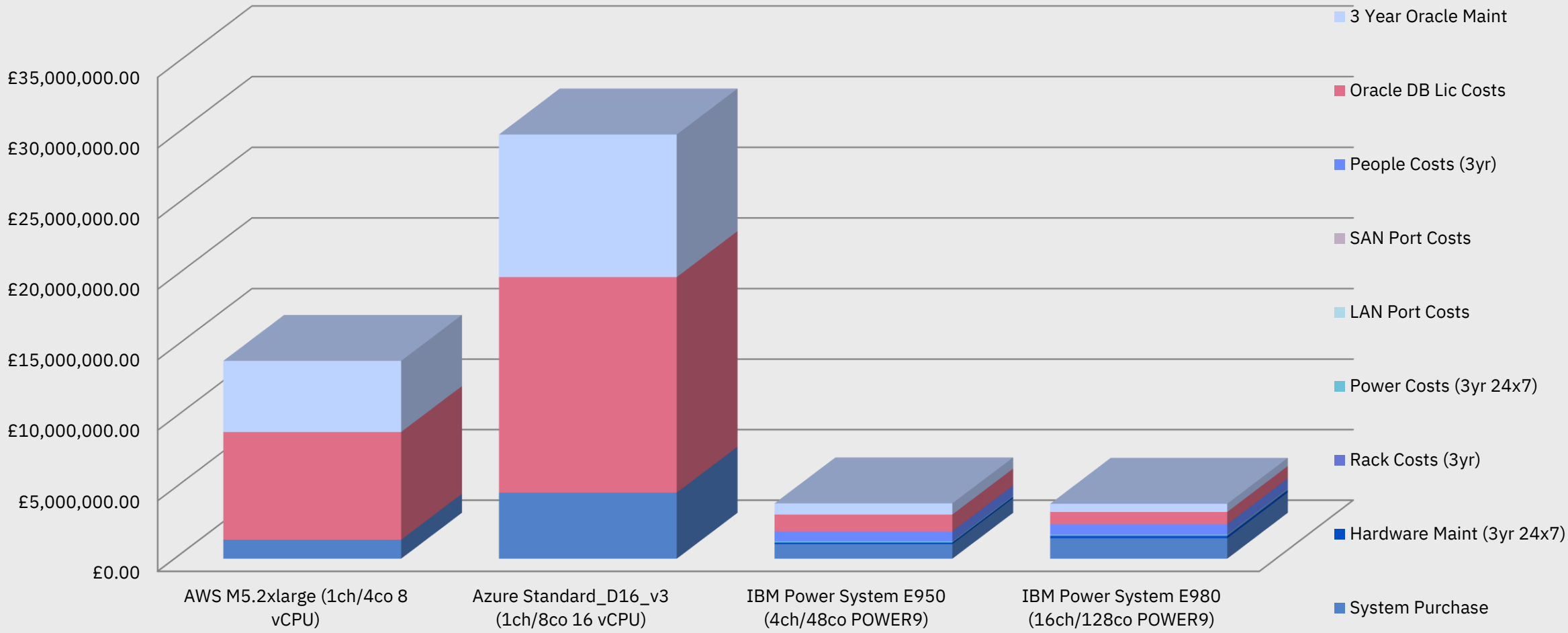
IBM Power Systems are up to 2.45x faster than Azure

Comparing those apples…

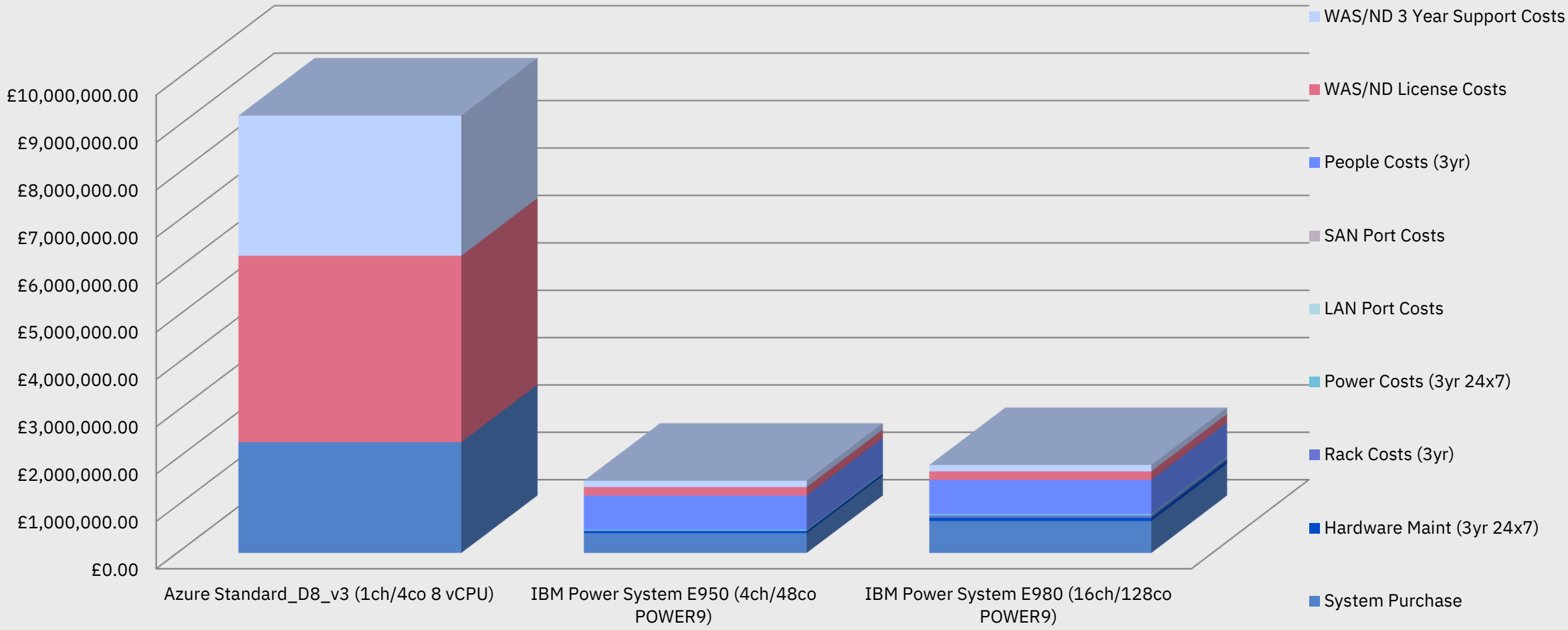
On a per core basis, which is how software is often charged**, IBM Power Systems are 2.45x faster than the v3 offerings from Azure**



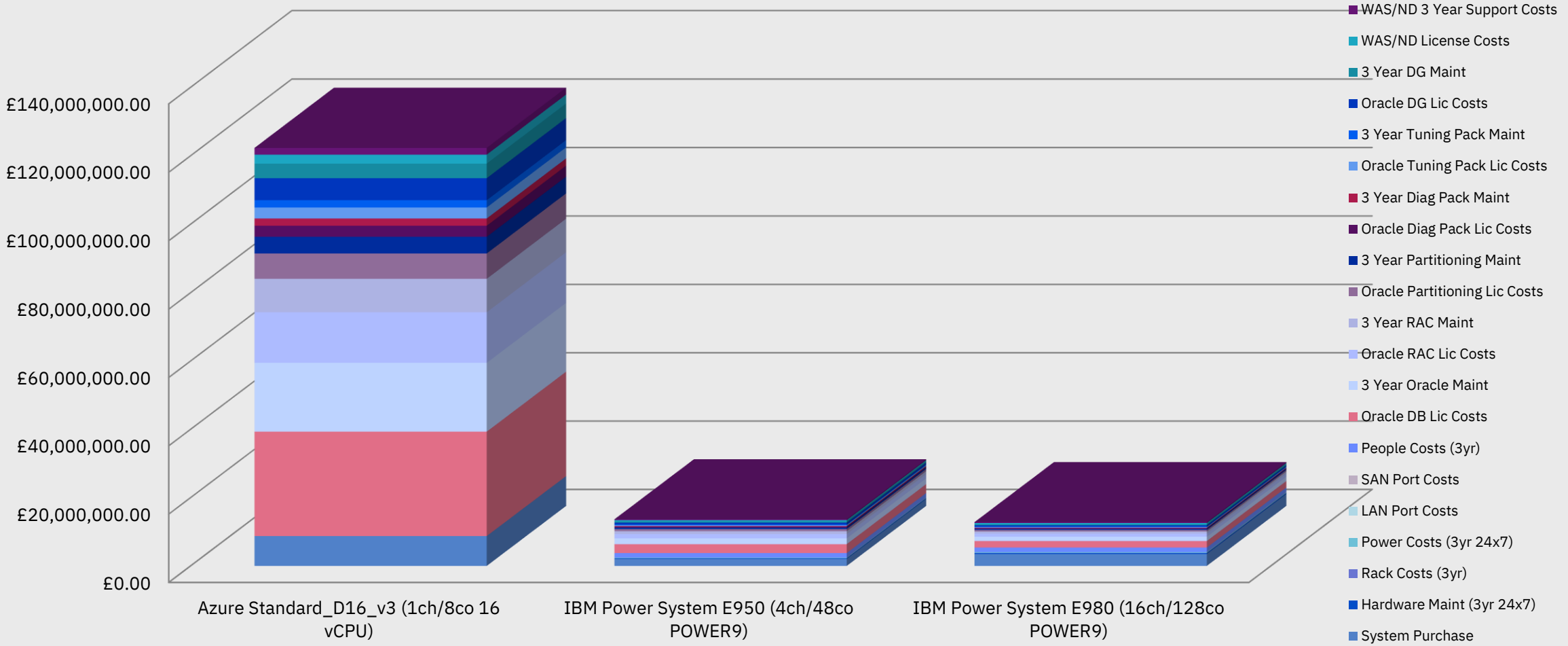
Oracle DB on Azure is over 5.4x more expensive than on IBM Power Systems



WAS/ND on Azure is over 6x more expensive than on IBM Power Systems



Combine together and discount the hardware, IBM Power Systems are 9.6x cheaper than Azure

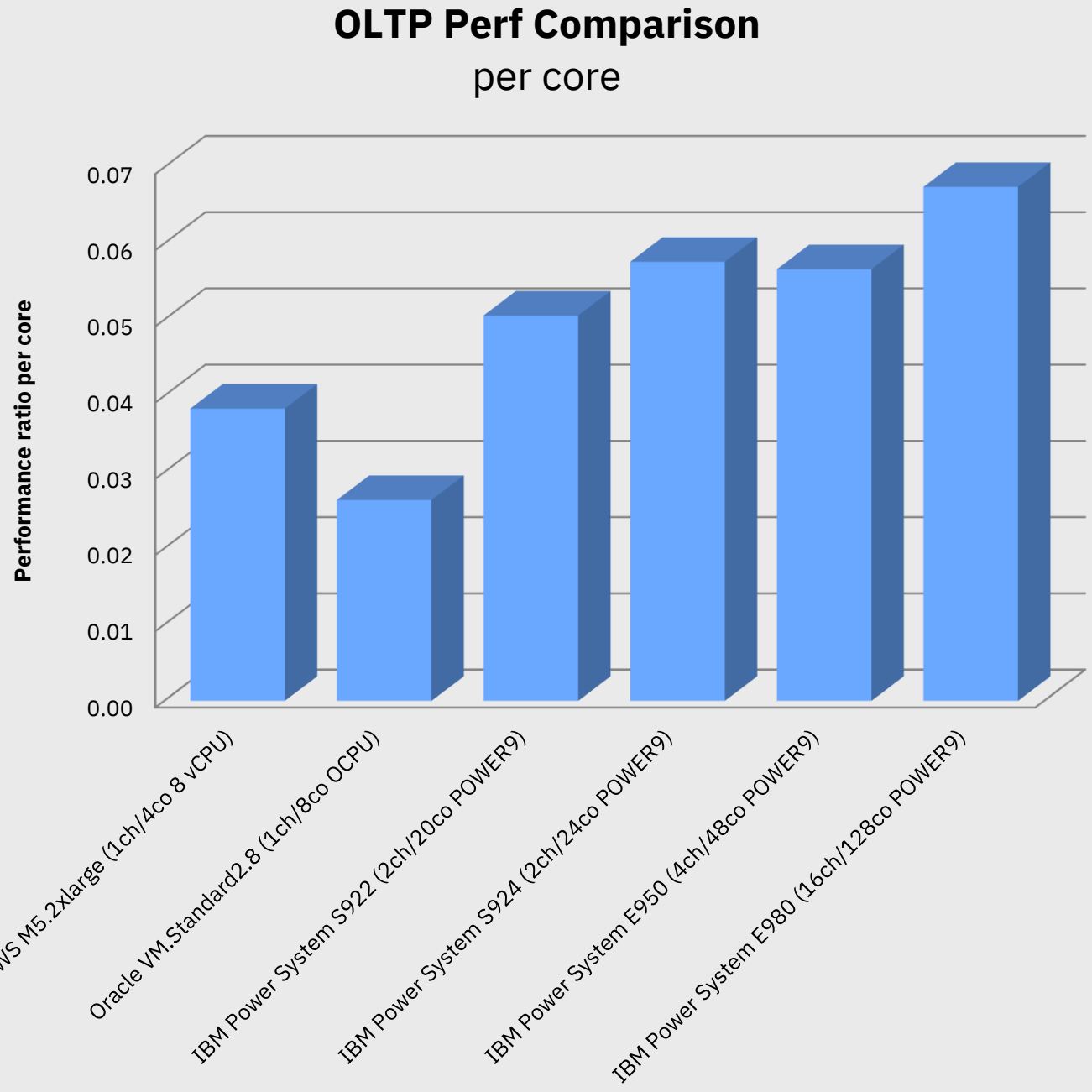


A detailed look at Oracle DB & WAS on Oracle Cloud vs IBM Power Systems

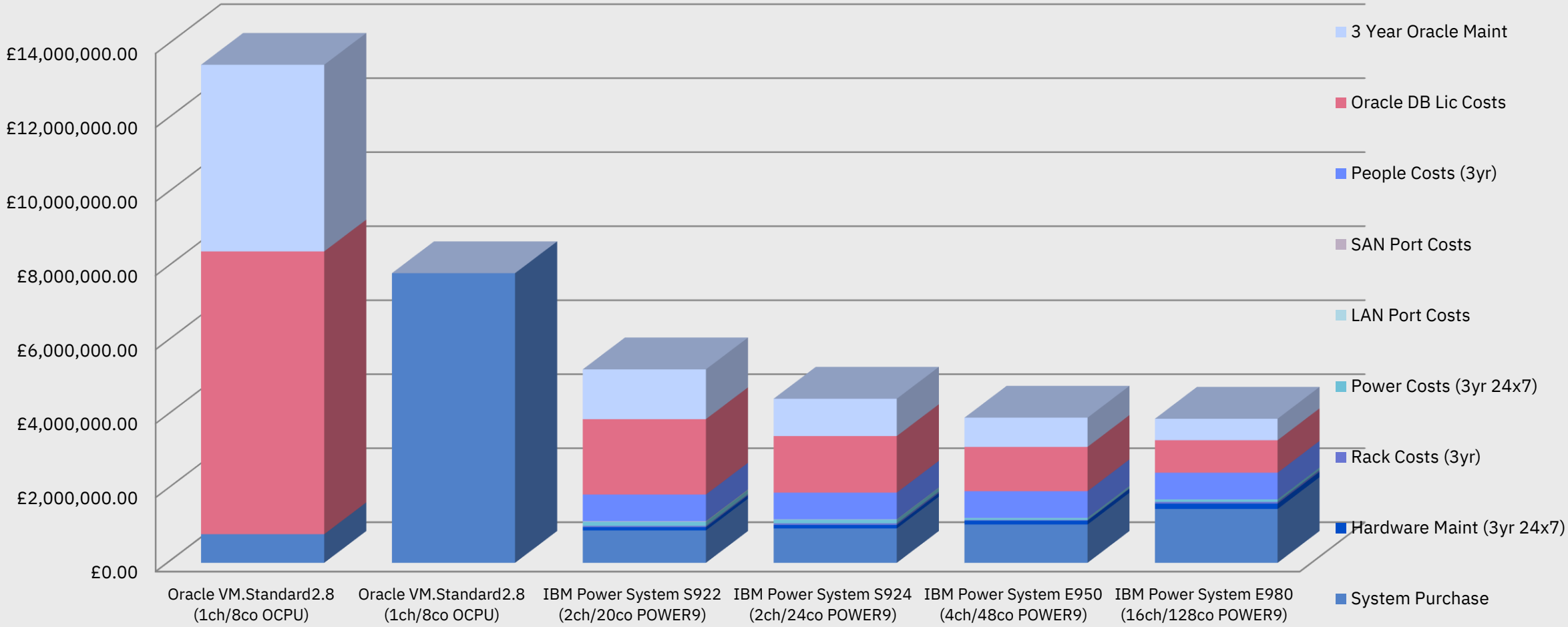
IBM Power Systems are up to 2.55x faster than Oracle Cloud

Comparing those apples…

On a per core basis, which is how software is often charged**, IBM Power Systems are up to 2.55x faster than the Oracle VMs**



Oracle DB on Oracle Cloud is up to 3.6x more expensive than on IBM Power Systems



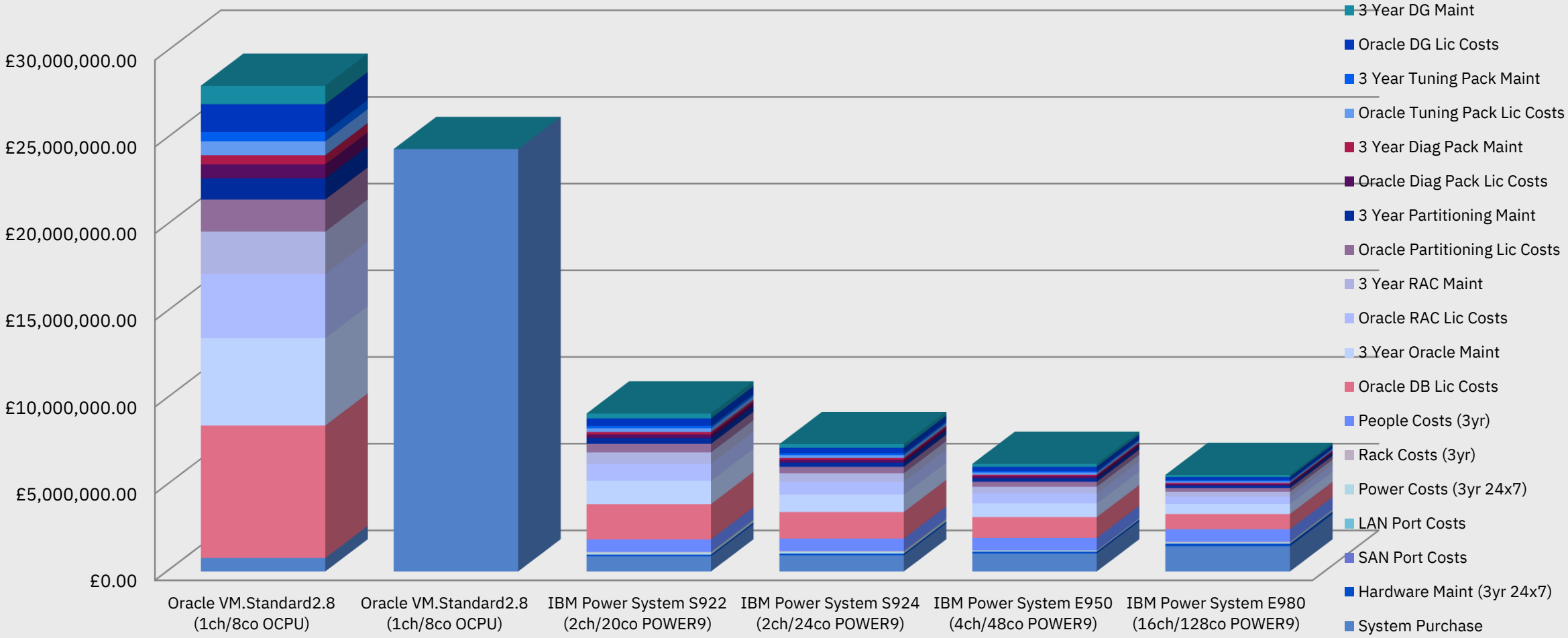
Oracle Cloud Database Offerings

Product	Pay As You Go (OCPU Per Hour)	Monthly Flex (OCPU Per Hour)
Standard Package	$0.4032	$0.2688

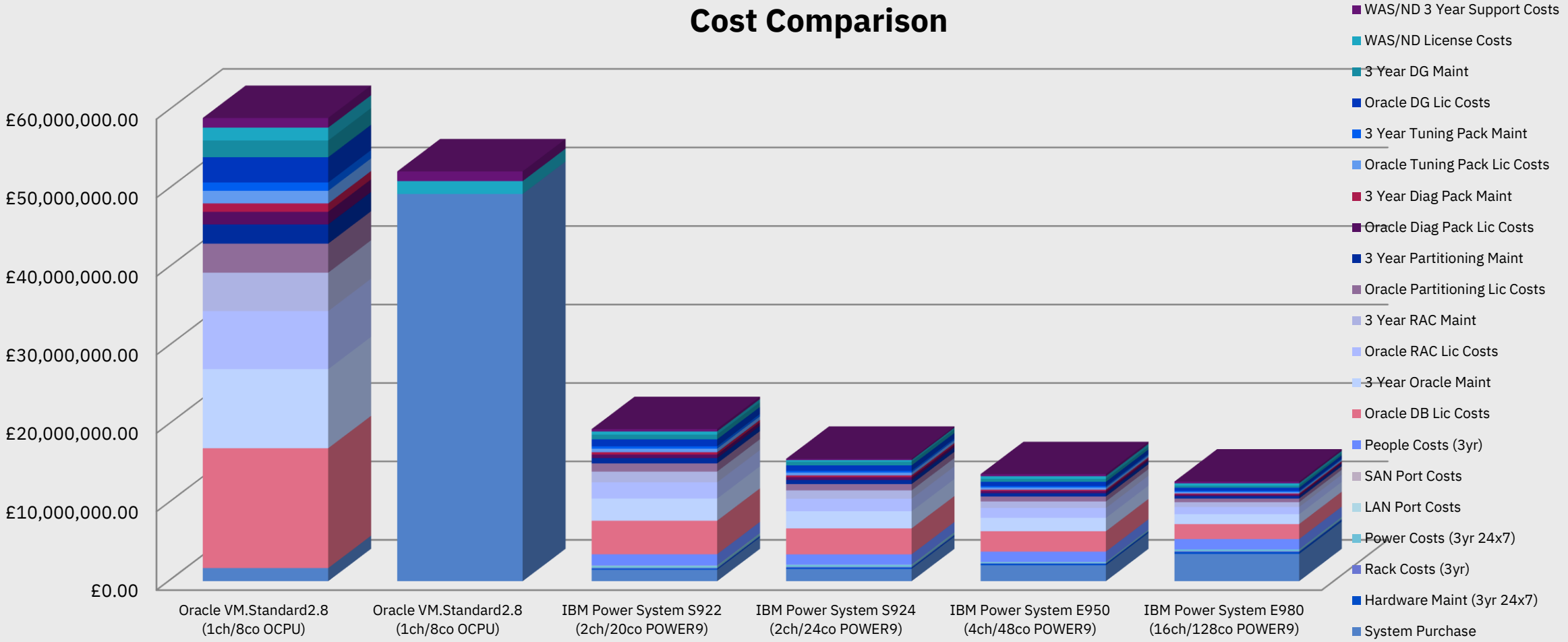
https://cloud.oracle.com/en_US/database/pricing

- All packages include Oracle Database Transparent Data Encryption.
- Standard package includes the Oracle Database Standard Edition 2.
- Enterprise package includes the Oracle Database Enterprise Edition, Data Masking and Subsetting Pack, Diagnostics and Tuning Packs, and Real Application Testing.
- High Performance extends the Enterprise package with the following options: Multitenant, Partitioning, Advanced Compression, Advanced Security, Label Security, Database Vault, OLAP, Advanced Analytics, Spatial & Graph, Database Lifecycle Management Pack and Cloud Management Pack for Oracle Database.
- Extreme Performance package extends the High Performance package with the following options: RAC (Real Application Clusters), In-Memory Database, Active Data Guard.

Oracle RAC on Oracle Cloud is up to 5x more expensive than on IBM Power Systems



Combine WAS with Oracle RAC, IBM Power Systems are over 4x cheaper than Oracle Cloud



Proven Reliable

Industry Leading Reliability

– IBM Power Systems ranked the most reliable for the 10th straight year[1]

Investment Protection

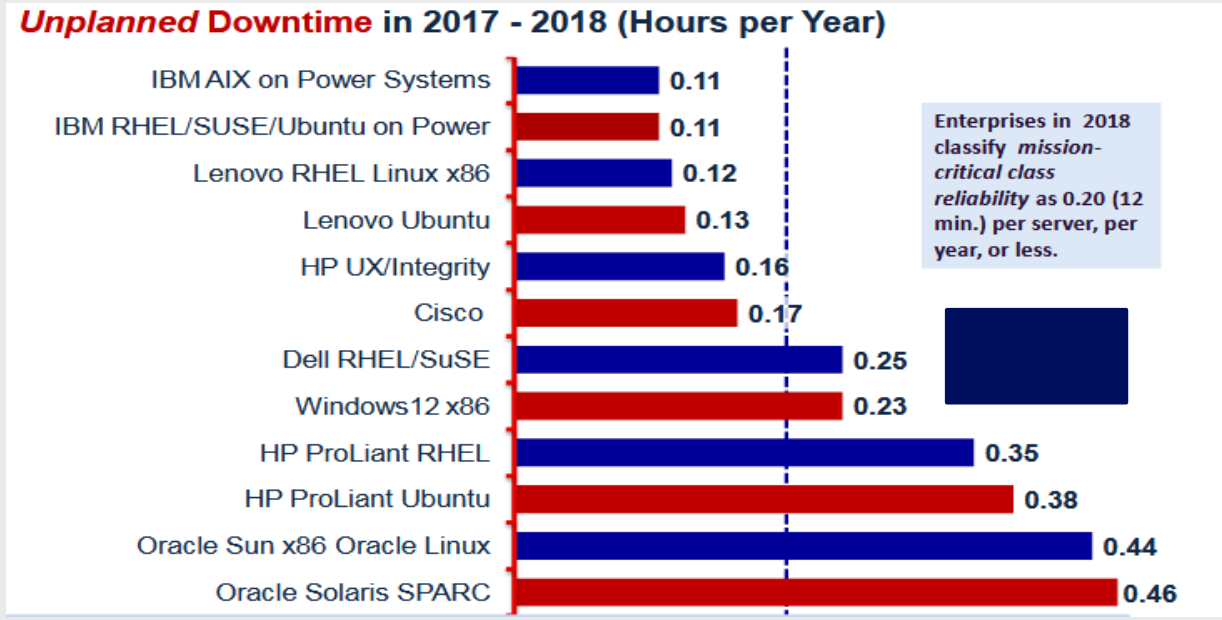
– Committed 10+ year roadmap for both IBM i and AIX

Industry Leadership in Enterprise Servers

– IBM Power Systems was #1 in combined 8 socket large system, standard rack optimized and tower servers during 2017 with an aggregate revenue share of 34.4% [2]

Ranked Number 1 in every major reliability category by ITIC

"IBM POWER8-based processor systems and the latest POWER9 servers provide several key feature/function advantages that advance reliability and enable customers to lower Total Cost of Ownership (TCO) and achieve near-immediate ROI."



Delivered with Security

End-to-End Security

– Security built-in at all layers: processor, firmware, OS, hypervisor

Secured Cloud

– PowerVM is the only hypervisor amongst its major competitors with no reported vulnerabilities

Security In Motion

– Protect data in motion with secured Live Partition Mobility (LPM)

The Point – moving to the cloud? IBM Power Systems can save money over Public Clouds

How long are you staying?

The POWER9 processors are much faster than all competitive alternatives

Fewer, faster cores leads to lower software costs

Virtualisation allows over commitment

This is one of the main ways Cloud Providers make money

You can keep that benefit with IBM Power Systems

Watch out for how software is licensed

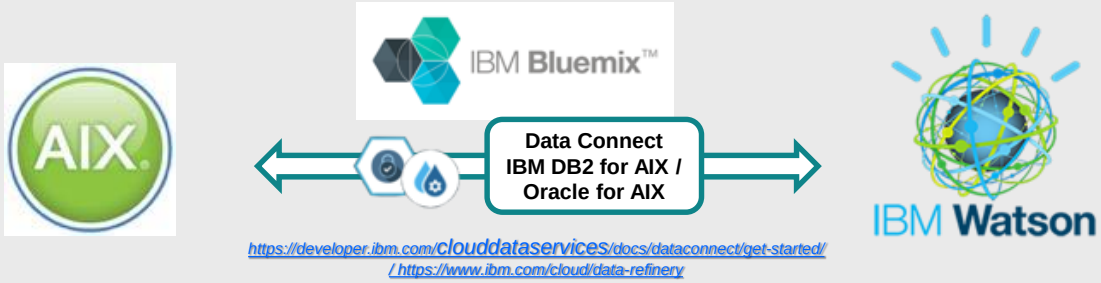
For AWS & Azure, it can be by the thread, not the core

Software costs can dwarf the hardware spend

‘AIX Cognitive’ – Leverage the Impact of Data!

Watson Analytics & IBM Cloud Data Connect / Data Refinery

Analyze trusted data & find what drives your business leveraging a secure gateway!



Enable AI/Cognitive capabilities for data residing in Enterprise systems – on-prem

- objective: lots of data residing on enterprise systems, that clients want to get insight from

AIX and AI – Open Source Packages available

All the changes for the ML packages have been upstreamed and are available in their latest release!

Python machine learning packages on AIX!

–Python ML packages like numpy, pandas, scipy, scikit-learn, scikit-image, matplotlib … can be installed on AIX using pip

–Jupyter notebook to develop ML models and flask server to deploy those models, can also be installed on AIX using pip

- These packages work with latest python available from AIX toolbox (python-2.7.15-3 or later, python3-3.7.1 or later)

–To support these packages required libraries like libblas, liblpack also made available on AIX toolbox

Installing and configuring machine learning tools on AIX: https://developer.ibm.com/tutorials/machine-learning-with-python-on-aix/

Reference Links

AIX & Power Systems SW Resources

AIX Website
- https://www.ibm.com/it-infrastructure/power/os/aix

AIX Release Overviews
- http://ibm.biz/IBM_AIX721_overview
- http://ibm.biz/AIX_2017_TL_Releases

Power Systems Software Website
- https://www.ibm.com/it-infrastructure/power/software
- https://yourlearning.w3bmix.ibm.com/#activity/LDE-LTU66712

PowerVM Website
- https://www.ibm.com/de-en/marketplace/ibm-powervm

PowerVC Website
- https://www.ibm.com/de-en/marketplace/powervc

PowerSC Website
- https://www.ibm.com/de-en/marketplace/powersc

PowerHA Website
- https://www.ibm.com/de-en/marketplace/powerha

AIX Systems Magazine Articles

Who said AIX is Dead!?
- http://ibmsystemsmag.com/power/businessstrategy/executiveperspective/who-said-aix-is-dead/

AIX is at the Center of Cloud Initiatives and AI
- http://ibmsystemsmag.com/power/businessstrategy/competitiveadvantage/aix-is-at-the-center/

New Enterprise Cloud Edition

Cloud Bundle RFA

- *http://www-01.ibm.com/common/ssi/ShowDoc.wss?docURL=/common/ssi/rep_ca/6/897/ENUS218-006/index.html&lang=en&request_locale=en*

Cloud Bundle Website / Marketplace

- https://www.ibm.com/us-en/marketplace/power-enterprise-cloud-edition

Cloud Bundle Announcement Blog

- https://www.ibm.com/blogs/systems/deploy-and-manage-cloud-environments-with-new-software-bundles-on-ibm-power-systems/

Cloud Bundle Datasheet

- https://public.dhe.ibm.com/common/ssi/ecm/0e/en/0eff0b38-c382-4d87-89e3-e4d6a319af92usen/0eff0b38-c382-4d87-89e3-e4d6a319af92_32019832USEN.pdf

Non-Power References

ICAM

- *https://www.ibm.com/us-en/marketplace/app-management*

BifFix Lifecycle

- *https://www.ibm.com/us-en/marketplace/bigfix-lifecycle*

Aspera Endpoint

- *https://www.ibm.com/us-en/marketplace/aspera-point-to-point-client*

ICSS Resources

IBM Cloud for Skytap Solutions (ICSS)

IBM Website
- https://www.ibm.com/cloud/skytap

Skytap Website
- https://www.skytap.com/partners/ibm-cloud-skytap-solutions/

Datasheet
- https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=KUD12403USEN

Short youtube video: ICSS Overview & Demo (general)
- https://www.youtube.com/watch?v=boUvlFVAFkY

Short youtube video: AIX in the Cloud
- https://www.youtube.com/watch?v=c6_tDsyu_10

Cloud Reference Links

CMC Website
- https://www-03.ibm.com/systems/power/software/cloud-management-console/

Announcement Blog
- http://ibmsystemsmag.com/aix/trends/ibm-announcements/mfa/

CMC Datasheet
- https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=POD03130USEN&

CMC Security Whitepaper
- https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=POW03204USEN

Short youtube Video:
- https://youtu.be/vpbhahnUDbs

Capacity on Demand
- https://www-03.ibm.com/systems/power/hardware/cod/

CoD Knowledge Center
- https://www.ibm.com/support/knowledgecenter/en/POWER8/p8ha2/codofferings.htm

Elastic CoD on IBM Marketplace
- https://www.ibm.com/us-en/marketplace/elastic-capacity-on-demand

ESS -> my entitled HW
- https://www-304.ibm.com/servers/eserver/ess/ProtectedServlet.wss

Nutanix Resources

Announcement Blog
– https://www.ibm.com/blogs/systems/simplify-aix-environment-hyperconverged-infrastructure

Think! 2018 Presentation
– https://www.ibm.com/events/think/watch/replay/113885402/

IBM Hyperconverged Systems Marketplace page
– https://www.ibm.com/us-en/marketplace/hyperconverged-systems=

Updated IBM Hyperconverged Systems Datasheet
– https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=POD03132USEN&

AIX on Nutanix Solution Brief
– https://ibm.biz/BdZAuJ

AIX Binary Compatibility Statement
– https://ibm.biz/BdZAuV

IBM Hyperconverged Client Center POC Support Request:
– http://ibm.biz/BMC_Nutanix

CSSC Sales Support Request
https://ibm.biz/BdFfcV or cssc@us.ibm.com

IBM Cloud Private Resources

Learn more

- ✓ ICP Product page: http://ibm.biz/IBMCloudPrivate
- ✓ ICP on Power DeveloperWorks page: http://ibm.biz/ICP-Power-TechnicalCommunity
- ✓ Linux on Power Development portal: https://developer.ibm.com/linuxonpower
- ✓ ICP Technical Community: http://ibm.biz/ICP-TechnicalCommunity
- ✓ ICP Knowledge Center: http://ibm.biz/ICP-KnowledgeCenter
- ✓ Introduction to ICP (video): https://www.youtube.com/watch?v=UL_jXJoRPdY
- ✓ ICP Overview (video): https://www.youtube.com/watch?v=yzXA3qhfaq0
- ✓ ICP on IBM Power (video): https://www.youtube.com/watch?v=73LpA1Cmqcc

See it in action

- ✓ Try ICP Community Edition for free: http://ibm.biz/ICP-SignUp
- ✓ YouTube ICP tutorials play list: http://ibm.biz/ICP-YouTubeTutorials

Get help

- ✓ Join the #ibm-cloud-private public Slack channel: http://ibm.biz/ICP-Slack
- ✓ ICP on Stack Overflow: https://stackoverflow.com/questions/tagged/ibm-cloud-private

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