

The Cisco Live! logo, featuring the word "CISCO" in a dark blue, sans-serif font, followed by "Live!" in a dark blue, cursive script font.

CISCO *Live!*

The text "Let's go" in a large, dark blue, sans-serif font, positioned to the left of a bright, multi-colored sunburst graphic that radiates from the right side of the image.

Let's go

#CiscoLiveAPJC



The bridge to possible

UCS X-Series: Blurring the Line Between Rack and Blade for Modern Applications

Ravi Mishra

Director, UCS Product Management

@ravmishr

BRKCOM-3618

CISCO *Live!*

#CiscoLiveAPJC



“Reconciliation”- Dustin Koa Art

Cisco Webex App

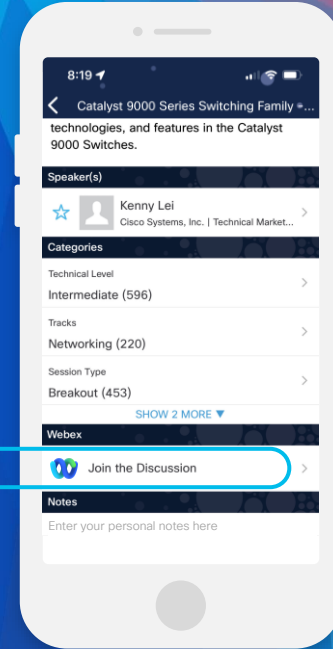
Questions?

Use Cisco Webex App to chat with the speaker after the session

How

- 1 Find this session in the Cisco Live Mobile App
- 2 Click “Join the Discussion”
- 3 Install the Webex App or go directly to the Webex space
- 4 Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until December 22, 2023.



<https://ciscolive.ciscoevents.com/ciscolivebot/#BRKCOM-3618>



~~Agenda~~ Storyline

- Challenges
- Solution
- Deep dive
- Application Examples

The cast



Alex

“The IT Admin”



Mary

“AI Engineer”

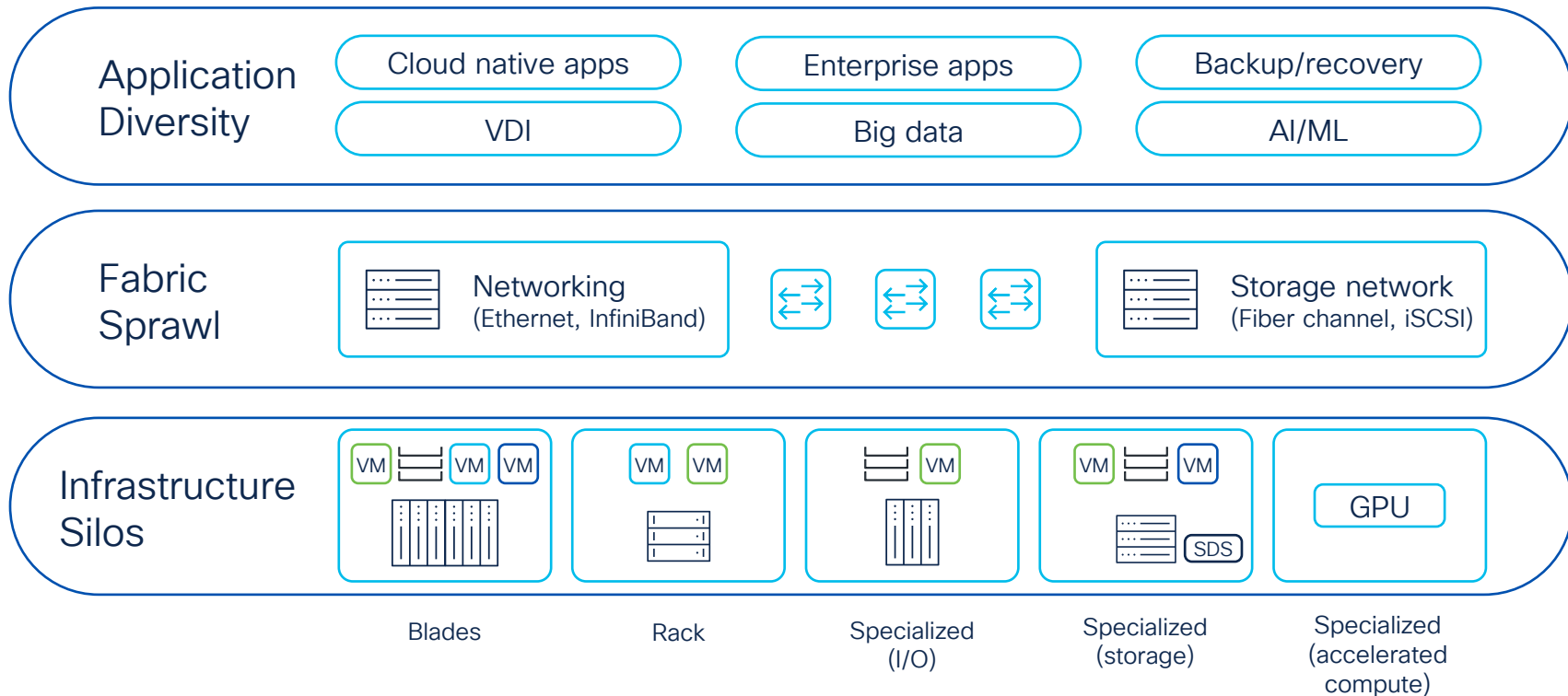


Jim

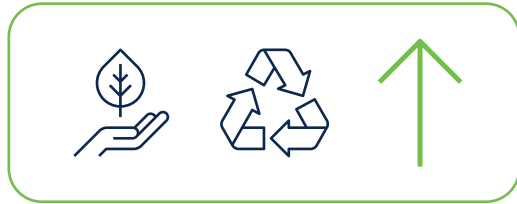
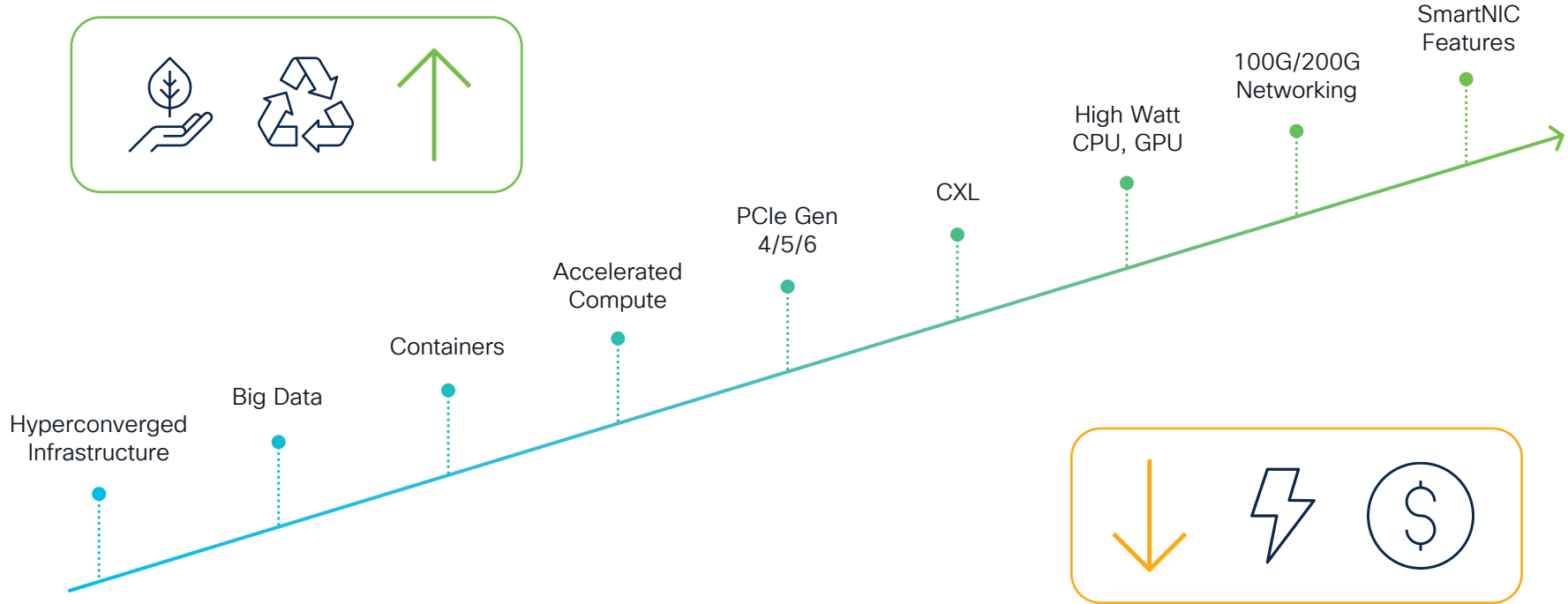
“The CIO”



Architectural Silos Drive complexity



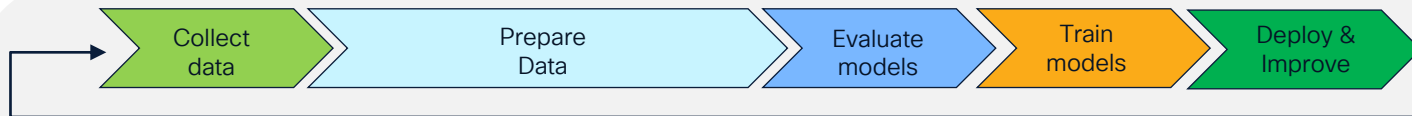
A lot has changed... and continues to change



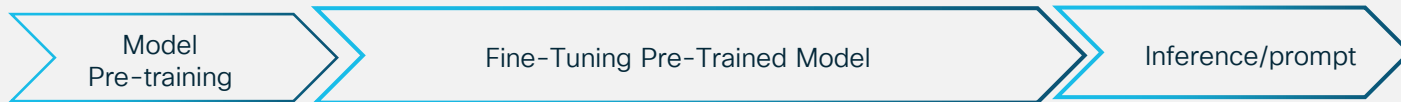


Application needs resources

Typical Machine Learning/AI Pipeline



LLM Pipeline



Challenges



Application growth

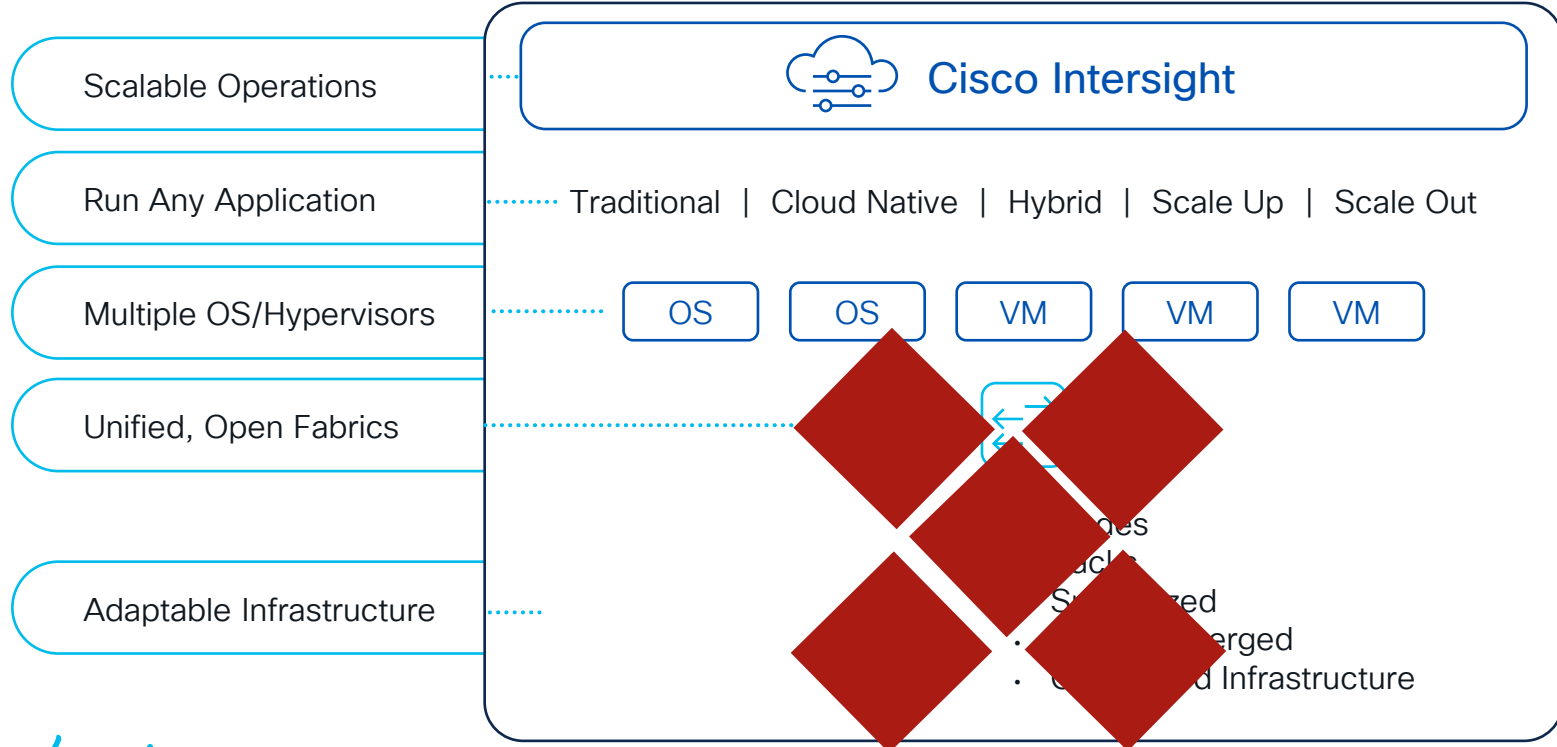


Scalability

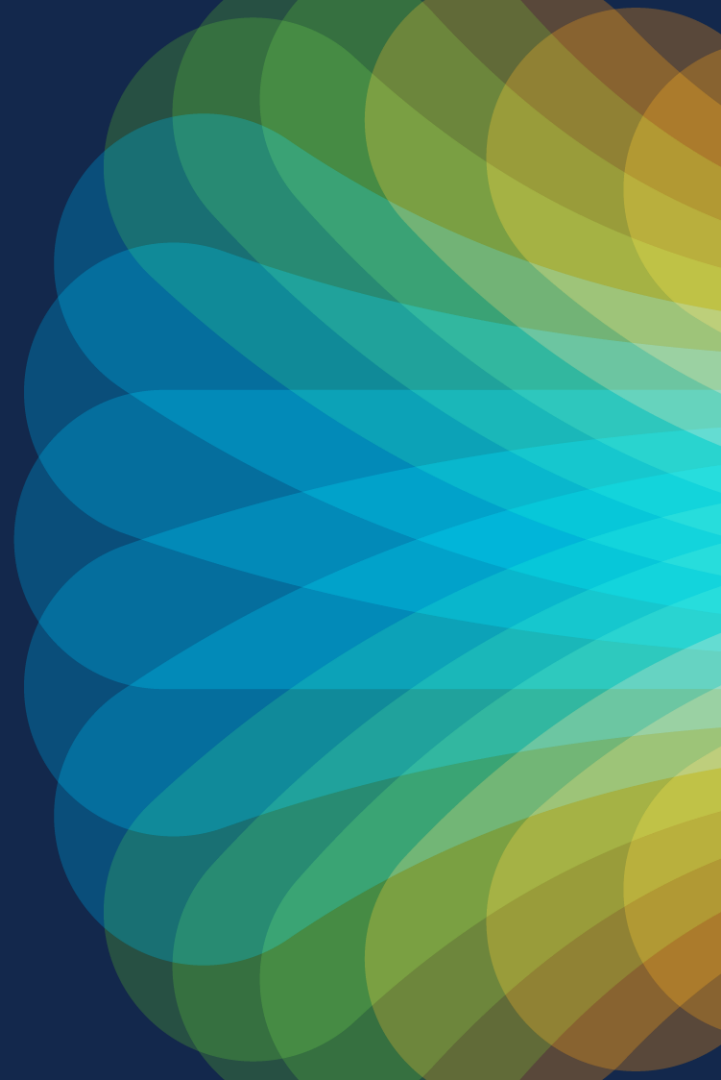


Modern Hybrid Cloud Infrastructure

Simplify to scale, automate, and operate

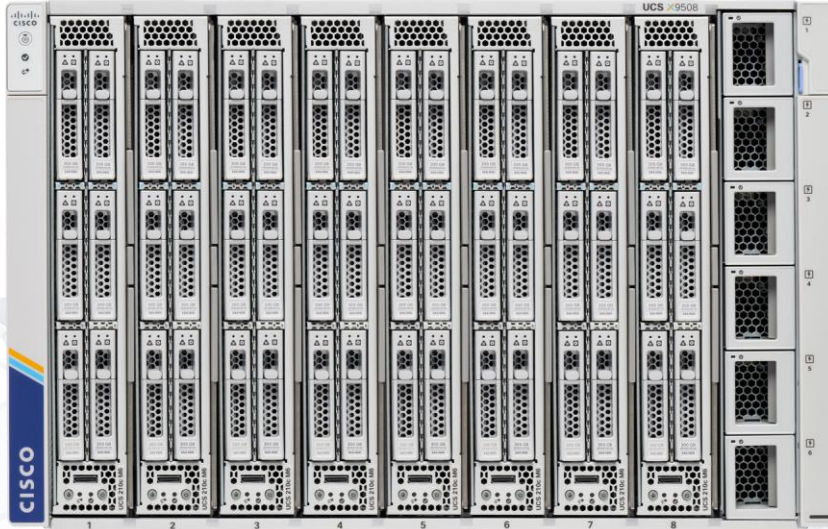


UCS X-Series



Cisco UCS X-Series

Computing for the next decade...



960+
Cores

~100 TB
Memory

48M
IOPS

1 PB
Storage

2030+

Liquid-cooling

Silicon photonics

Future fabrics ready

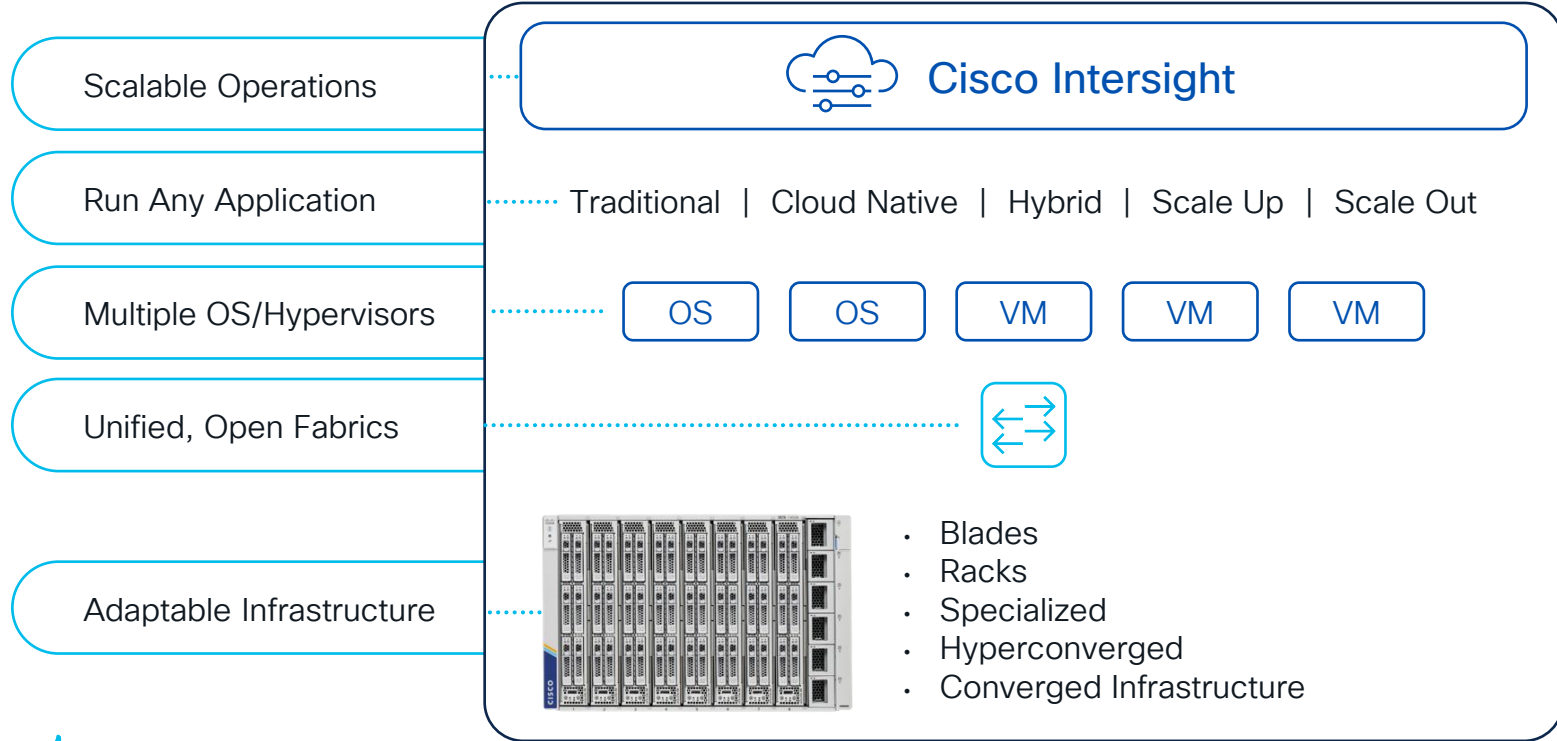
Power-hungry processing

2021



Modern Hybrid Cloud Infrastructure

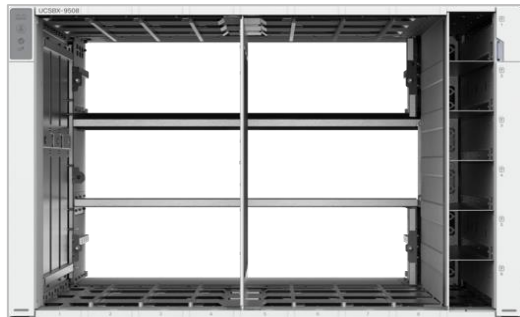
Simplify to scale, automate, and operate



UCS X9508 Modular Chassis

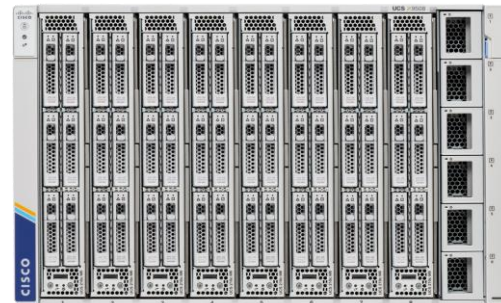
Chassis

7 RU



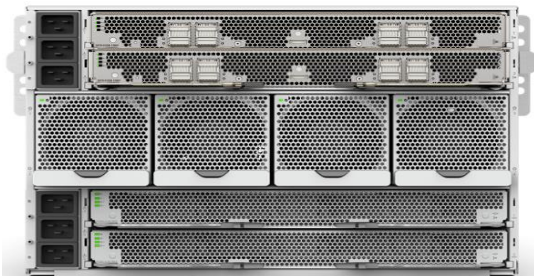
8 Nodes

- Compute Node
- PCIe Node for GPU
- 6x 2800W PSU

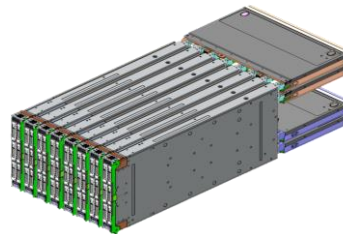


Intelligent Fabric Modules

Flexible X-Fabric



Backplane-less design for fabric flexibility



Power and Cooling Innovation!



Cisco's approach to sustainability

What's running in your data center matters



Energy Star has cited modernizing to higher-performing, consolidated platforms as one of the top ways to reduce total power consumption without sacrificing performance.

Source: Energystar.gov

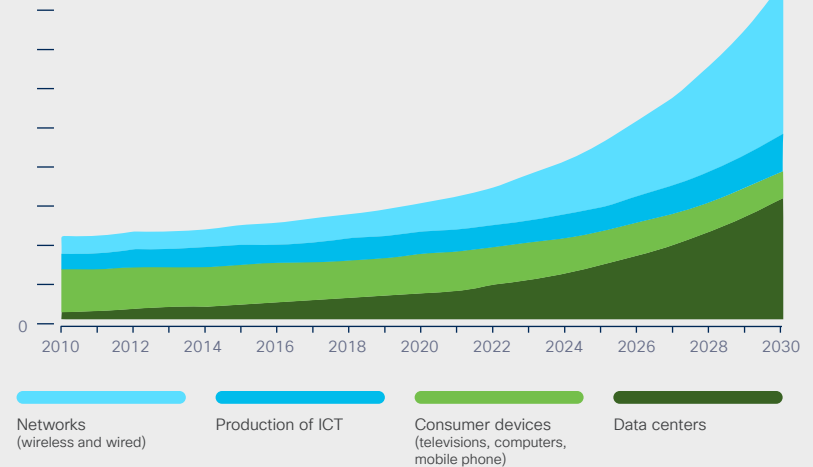
“Between 2010 and 2018, **data center computing grew by 500 percent**, while data center energy use only grew by six percent.”

Energy Forecast

Widely cited forecasts suggest that the total electricity demand of information and communications technology (ICT) will accelerate in the 2020s, and that data centers will take a larger slice.

9,000 terawatt hours (TWh)

20.9% of projected electricity demand



Cisco's approach to sustainability

Efficient data centers are an important sustainability opportunity

Today's data center accounts for **50X the power consumption** of a typical consumer office building.

This is expected to further increase with the adoption of high-performance computing and modern applications.

Source: akcp.com

43%
Cooling and power provision systems

Chillers
Fans and pumps
UPS and transformer losses
Lighting

43%
Servers

Every watt saved on computing results in 1.55 watts saved at the facility level

11%
Storage

3%
Network

The Sustainability Benefits of System Modularity

Material Impact in Rack Mount Servers Lifecycle vs. Compute Nodes



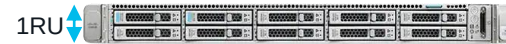
Modular systems use **~40% less** production raw materials:

- Assume a server lifecycle of 36 months
- Assume 3 cycles for 8 servers
- 24 rack servers require 565 kg of raw materials
- 24 compute server nodes require 344 kg of raw materials (infrastructure items unchanged)



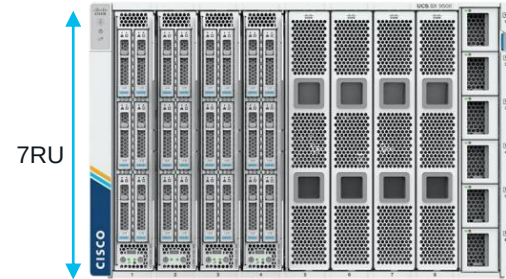
Server disaggregation helps extend lifetime of modular systems

- Compute, storage, GPU, PMEM, accelerators
- Host virtually any workload
- Adapt to evolving application needs
- Better circularity and repairability



Each Server: ~23 Kg*

Total 565 Kg @ 8 servers x 3 lifecycles



Infrastructure: ~ 72 Kg
Each server: ~11 Kg*

Total 344 Kg @ 8 servers x 3 lifecycles

Reduce GHG emissions

Extend lifetime
Reduce raw materials

*Server weight maximums from published technical specs

Impact of Cisco Converged Fabric Design

Conventional Approach

Silos of multiple ethernet and SAN fabrics and adapters

48 LEGACY RACK SERVERS:

- 48 BMC management cables
- 96 DP ethernet cables
- 96 Fabric connect cables
- 384 Optics (4 ethernet, 4 fabric connects)



Massive
complexity
at scale

UCS X-Series

Cisco Unified Fabric and 100G reduces adapter, cabling, network and storage port needs

48 UCS X-SERIES SERVERS:

- 24 Chassis 100G cables
- 48 Chassis optics



Simplified,
optimized, and
automated

88% ↓

reduction in cables
and optics

66% ↓

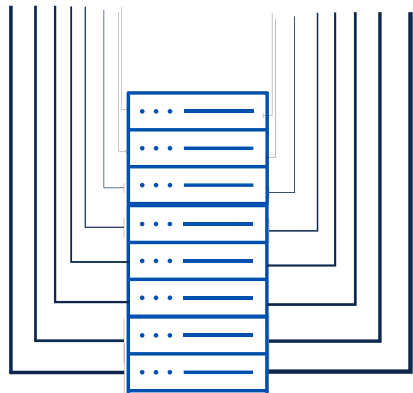
reduction in cost of
cabling components

Impact of Cisco Power Efficiency Design

Powering a chassis v rack servers

Conventional approach

Rack servers requiring Dual PSUs per server for power and redundancy

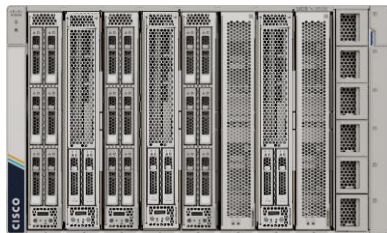


Rack Servers
requiring 2 PSUs and 2
cords per server



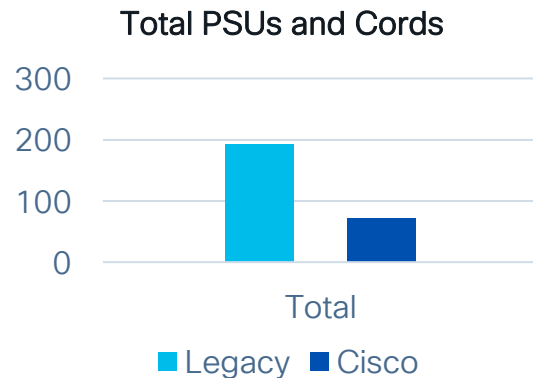
X-Series Power Efficiency

Purpose built for efficient transfer of power, redundancy, and materials reduction



- Efficient 54V Power Distribution
- Reduced Materials with fewer PSUs and cables
- 6 PSUs and 6 cords per chassis

X-Series vs Competitive Rack 48 Server comparison:



**192 PSUs and cords
vs
Only 72 for X-Series**

X-Series 54V Power Distribution

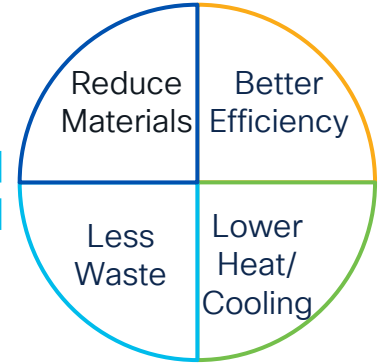
What's the Big Deal?

Distribute same power with 80% less current

Reduces heat generation and lower cooling burden

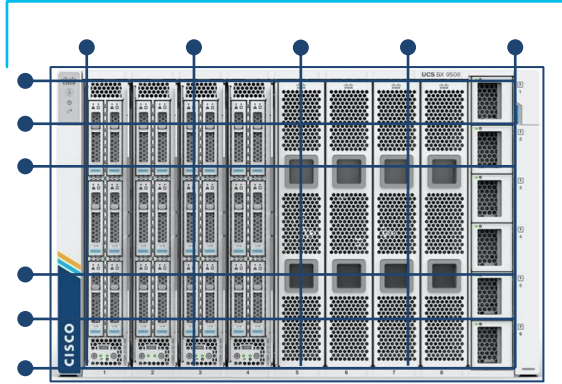
Improves DC-DC conversion efficiency

Less copper required to carry current
Smaller server power distribution components

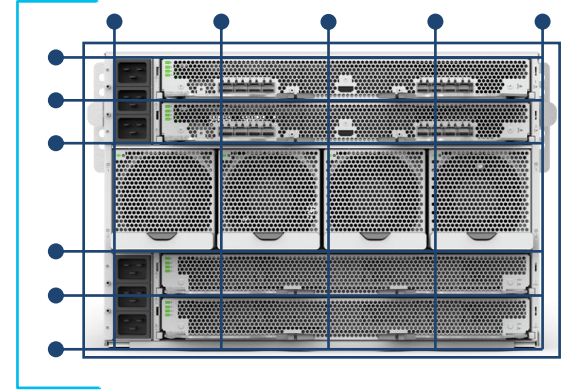


Zoned Based Cooling: Chassis

Vertical
Zones



Horizontal
Zones



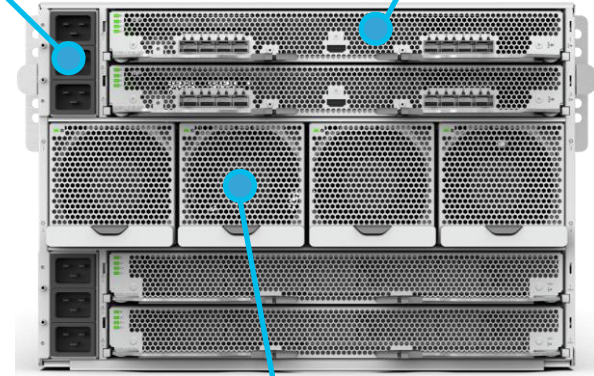
- Vertical and horizontal zones
- Independent fan speed control based on sensors participating in each zone
- Reduces fan power consumption by right-sizing air flow on a per-zone basis, and increases overall power efficiency

System and Module Fan Configuration

- Maximum chassis airflow is approximately 1100 CFM
- Approximately 110 CFM per node, 40 CFM per fabric module and 15 CFM per PSU
- Hot-swappable N+1 redundant
- Large higher voltage system fans provide more airflow at lower speeds, that lowers fan noise and reduces power consumption

1X 40-mm x 56-mm
12Vdc Fan per PSU

3X 40-mm x 56-mm 54Vdc Fans per
IFM/XFM/Blank



4X 100-mm x 90-mm 54Vdc
Fans per Chassis

X-Series Sustainability

X-Series advantages



Modular

Produces roughly 50% lower consumption of raw materials over three generations than rack servers



Energy-efficient

Reduces the number of necessary inverters, power conversions, and by design runs more efficiently lowering total energy consumption



Usage Aware

Uses constant monitoring and cooling algorithms to dynamically adjust power usage for optimal efficiency



Sustainable by design



Sustainable packaging

Offers multipack options to reduce packaging for high-volume orders



Recycled materials

Plastic parts use **post-consumer recycled resin**



Efficient Components

Utilizes efficient components like high-efficiency, Titanium-rated power supplies

Embedding sustainability through the product lifecycle



Supply Chain Sustainability

Cisco works to uphold human rights, promote worker well-being and minimize negative environmental impacts in our supply chain.



Product Takeback and Reuse

Return end-of-use gear for free in a simple, secure, and sustainable way. Certified remanufactured products are available through Cisco Refresh.

Intersight Infrastructure Service simplifies sustainable operations



Power policies

- Global setting for Chassis Power behavior
- Power Restore modes and Power Priority

Power profiling policy

- Node, Blade and Rack server
- Tests and determines actual min and max power draw

Power Allocation (capping) policy

- Chassis level power capping
- Sets the total allocated power budget for the chassis in watts

Power Save Mode

- PSUs can be placed in power saving mode if requested power budget is less than the available power capacity

Dynamic power rebalancing

- Competitive advantage
- Chassis level redistribution of available power between servers and fans

Fan speed control policy

- Global or individual non disruptive server setting
- Controls power usage and airflow noise levels

Power Redundancy policy

- Sets chassis power protection level
- Grid, Redundant, N+1 and N+2 modes

Extended Power Capacity

- Chassis Policy allowing the available power to be increased in Grid mode
- Borrows power from redundant PSUs

BIOS and OS power policy

- Use BIOS tokens to adjust power based on app needs
- OS level power recommendations

Computing Purpose-Built for a Modern, Sustainable Future



Cisco UCS X-Series with 4th Gen Intel® Xeon® Scalable processors

Flexible, sustainable,
easily upgradeable solution

High-performance,
smaller footprint

Powers modern apps
and traditional workloads

Cisco's most energy-
efficient server chassis



Cisco UCS Security

Design to Operations – Protections at Every Level

Cisco's security approach begins in the design stage

The server itself contains:

- Chassis intrusion detection
- Fused security keys
- Immutable, multi-layered hardware roots of trust
- Intel Boot Guard – enhanced trust via Intel PCH

Rigorous supply chain certification, evaluation, auditing ensures authentic, secure componentry

At the system level, UCS builds in:

- Multi-stage secure access and authentication
- Granular role-based policies and authentication
- Multi-factor authentication and encryption
- Cisco InfoSec adherence
- BIOS scrub policies
- Trusted compute pools



Cisco UCS
strategic
approach
to security

With Intersight we increase situational awareness and shorten vulnerability windows through targeted advisories and mitigation automation

UCS X210c M7 2S Compute Node

Key Features

CPU

Up to 2 Intel 4th Gen Xeon CPUs

X-Fabric Mezz

Connect to PCIe Node

In future, to Memory/Drive Nodes

VIC

Up to 2 VICs

100G Cisco mLoM

25G Cisco mLoM

25G Cisco VIC Mezz

Agg NW 200G per node

Memory

Up to 32x DDR5 4800 DIMMs

GPU

Up to 2 x PCIe GPU

+
Up to 2 x NVMe PCIe Drives

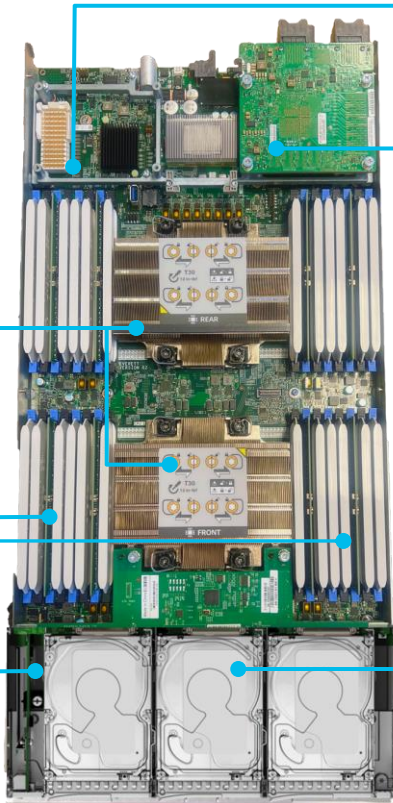
Drives

2 x M.2 SATA HW Raid1/ 2 x M.2 NVMe

Up to 6 x SAS/SATA/NVMe

- RAID Controller for SAS/SATA

- Up to 90TB (15TB x 6) per Blade



UCS X410c M7 4S Compute Node

Key Features

Form Factor

Occupies two slots in chassis

CPU

Up to 4 Intel 4th Gen Xeon CPUs

X-Fabric Mezz

Connect up to 1x PCIe Nodes

In future, 2x PCI node, Memory/Drive Nodes

Memory

Up to 64x DDR5 4800 DIMMs



VIC

200G Aggregate/ 100G per Fabric
100G 5th Gen VIC mLOM

or

25G 5th Gen VIC mLOM
25G 5th Gen VIC Mezz

Drives/GPU

Front Mezz options

1. 6 SAS/SATA with HW RAID
2. 6 NVMe PCIe Gen4 x4
3. 2 NVMe PCIe Gen4 x4, plus 2 PCIe GPUs

Internal

1. 2x M.2 SATA HW RAID1
2. 2x M.2 NVMe

5th Generation UCS Fabric



6536 Fabric Interconnect



9108-100G IFM



VIC 15000 Series

Simplify

- Cloud-operated infrastructure management
- Reduces adapters and cables
- Lowers server and network TCO
- One VIC replaces multiple NICs, HBAs, and Mgmt adapters

Scalable and Resilient

- Converged fabric for modern applications
- Single-fabric for Mgmt, Data, Storage (FC, iSCSI, NFS/SMB, NVMeOF-ROCEv2, NVMeoF/FC, NVMeoF/TCP)
- Flexible Blade/Rack connectivity at 10/25/40/100-Gbps

Future-Ready

- Industry-first End-to-End 100G fabric for blades
- Enables High N/W workloads (BigData, SDS, HCI, CloudNative etc.)
- Single-flow 32G FC and 100G Ethernet
- 14.8 Tbps bandwidth per UCS domain
- 1.6 Tbps bandwidth per X9508 Chassis

Fabric Interconnect– 25G and 100G



	6454	64108	6536
Total Ports	54	108	36
Ethernet only Ports	28x 10/25G, 4x 1/10/25G and 6x 40G	72x 10/25G, 8x 1/10/25G and 12x 40G	32(10*/25/40/100G)
Unified Ports	16x 10/25G Ethernet or 4/8/16G FC	16x 10/25G Ethernet or 4/8/16G FC	4x100G (10*/25/40/100G) Ethernet or 16x 8/16/32G FC with breakout
1G Ports	Port 45-48	Port 89-96	Port 9 and 10
IFM	25G	25G	25G and 100G

Intelligent Fabric Module (IFM) – 25G and 100G



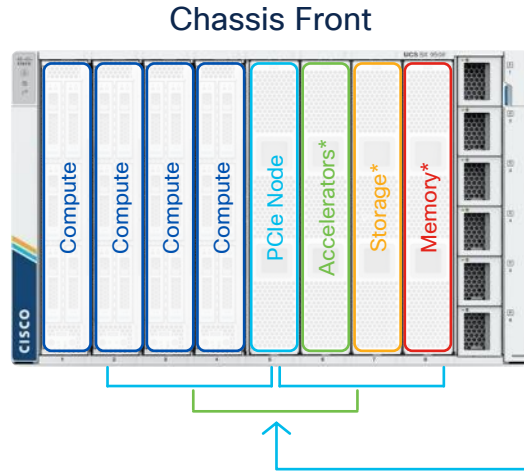
	IFM 9108-25G	IFM 9108-100G
Fabric Interconnect	6454, 64108, 6536	6536
VIC	15231, 14425, +14825	15231, 14425, +14825
Network Interface (NIF) Ports	8 x 25G (port-channel)	8 x 100G (port-channel)
Host Interface (HIF) Ports	32 x 25G	8 x 100G or 32 x 25G
Oversubscription	4 : 1	1 : 1

X-Fabric to Support the Future



UCS X-Fabric Technology

Shape infrastructure resources to applications

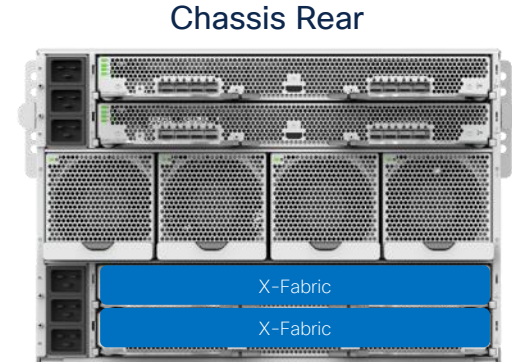


UCS X-Fabric Technology

Internal Fabric interconnects nodes

Industry standard PCIe, CXL Traffic

No backplane or cables = Easily upgrades



* Roadmap items – subject to change

Run modern apps by assembling
modules into systems

Simple policy-based definition
of resources from Intersight

Engineered to accommodate
future technologies

UCS X-Fabric Technology and PCIe Nodes with GPU

PCIe node supports up to:

4x

Intel Data Center
GPU Flex 140

2x

Intel Data Center
GPU Flex 170

2x

Nvidia A16

2x

Nvidia A40

Nvidia L40

4x

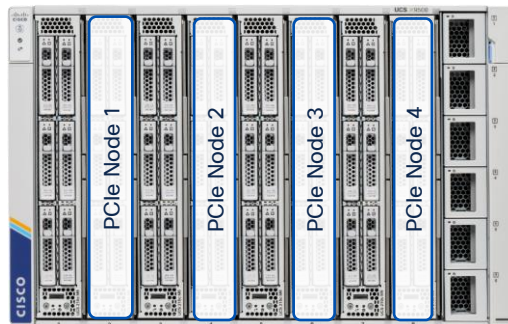
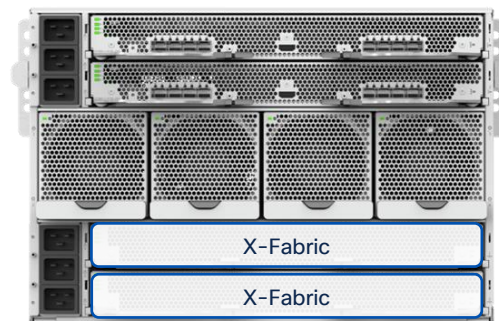
Nvidia T4

Nvidia L4

2x

Nvidia A100

Nvidia H100



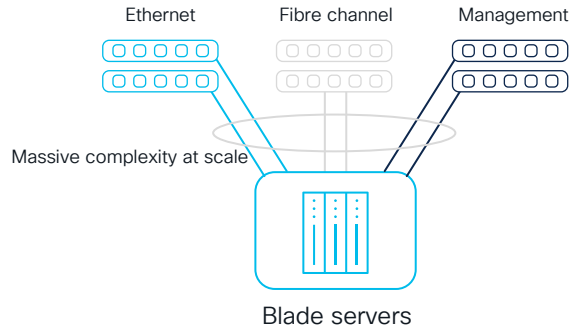
UCS X-Fabric Technology

- ✓ Based on native PCIe Gen. 4
- ✓ Provides GPU acceleration to enterprise application
- ✓ No backplane or cables = Easily upgrades

Industry-leading simplicity

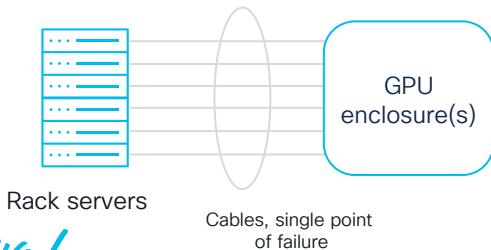
Conventional approaches

- 1 Silos of multiple ethernet and SAN fabrics and adapters



✓ Unified fabric

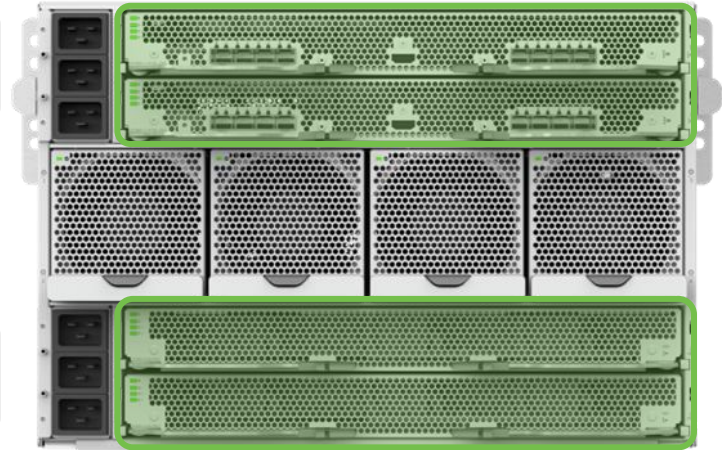
- 2 Complex PCIe connectivity to external accelerators



✓ X-Fabric + PCIe nodes

Cisco solution

UCS X-Series

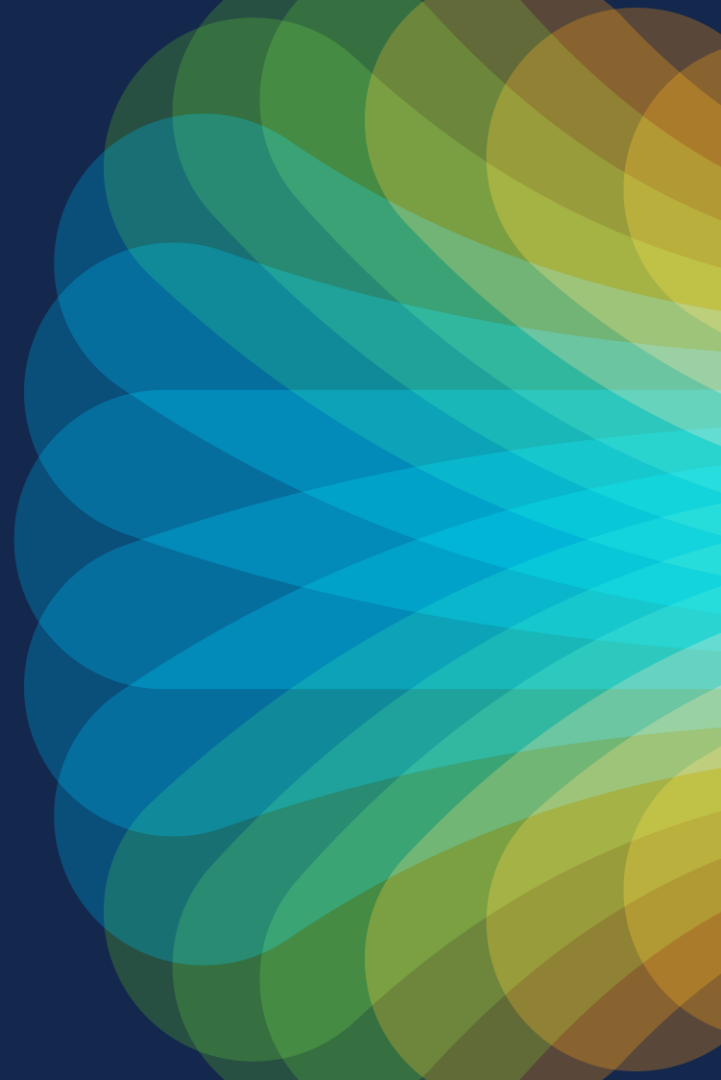


no cables

Demo

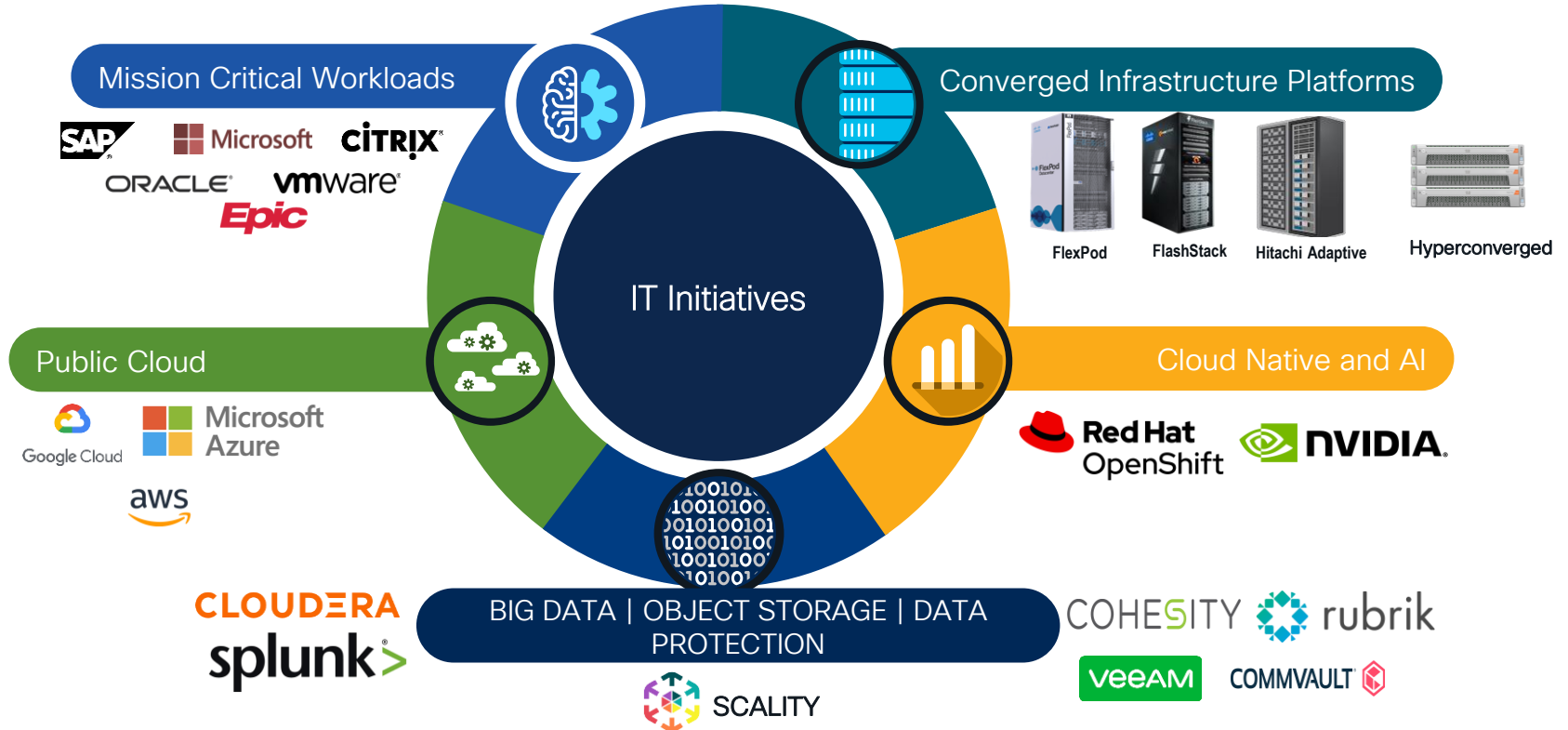
VDI to accelerated VDI in
under 7 minutes!

[Youtube Video Link](#)



Return of the workloads

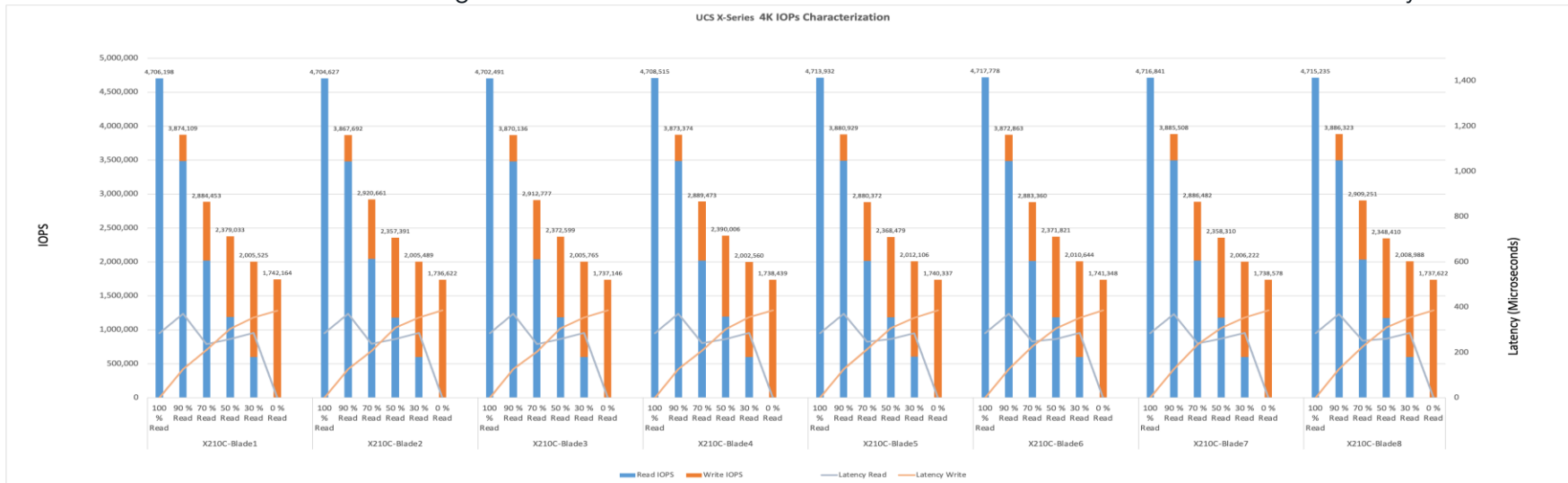
Cisco Data Center Solutions Portfolio



Consistent raw storage performance

Performance Summary - Chassis level performance across individual blades

- 8 X210c Nodes each with 6 intel P5600 NVMe Drives
- FIO Mix of Reads / Writes - 4K 100 % Reads to 100% Writes
- Sustained and reproducible performance for longer duration (4- 8 hours)
- Near identical performance from 1 Blade to 8 Blades - Power, Cooling and Efficiency
- Total 48 million Read IOPs in a single Chassis - Each Blade ~4.8 million with less than 400 micro-Seconds latency



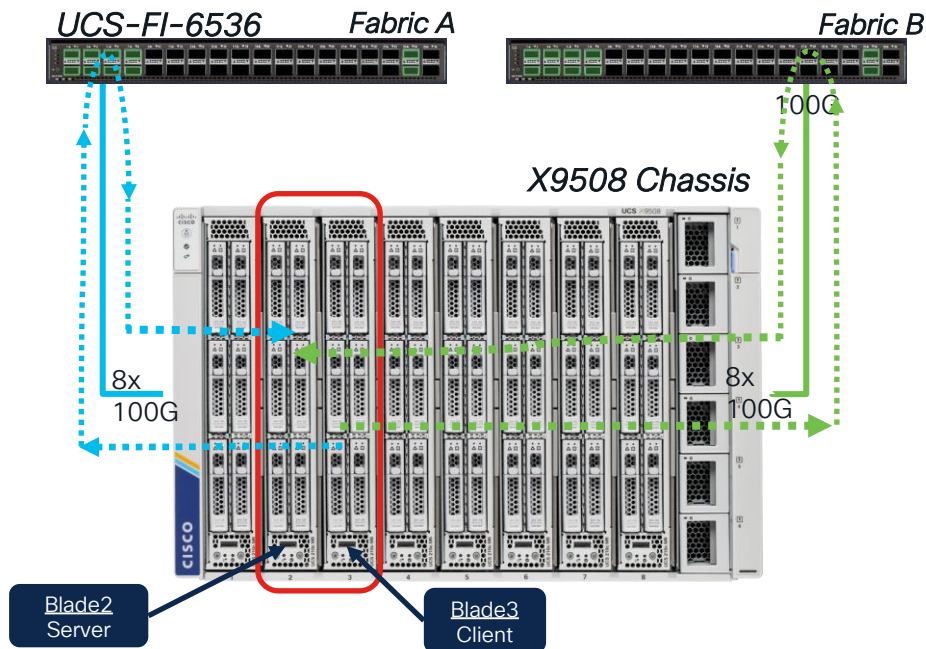
[Cisco UCS X210c M6 Compute Node Disk I/O Characterization White Paper](#)

TCP End to End 100G : VIC 15230 performance

iPERF Traffic :

Fabric A : Blade3 vnic1 (client) -> Blade2 vnic1 (Server)

Fabric B : Blade3 vnic2 (client) -> Blade2 vnic2 (Server)



iPerf results

```
[root@blade2 ~]# taskset -c 16-24 iperf -s -B 10.0.11.41
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)

[ 1] local 10.0.11.41 port 5001 connected with 10.0.11.42 port 55864
[ 2] local 10.0.11.41 port 5001 connected with 10.0.11.42 port 55870
[ 3] local 10.0.11.41 port 5001 connected with 10.0.11.42 port 55868
[ 4] local 10.0.11.41 port 5001 connected with 10.0.11.42 port 55866
```

```
Disable this terminal from "MultiExec" mode

[ 4] 21.00-24.00 sec 5.75 GBytes 16.5 Gbits/sec
[ 3] 21.00-24.00 sec 11.5 GBytes 33.0 Gbits/sec
[ 2] 21.00-24.00 sec 11.5 GBytes 33.0 Gbits/sec
[ 1] 21.00-24.00 sec 5.76 GBytes 16.5 Gbits/sec
[SUM] 21.00-24.00 sec 34.5 GBytes 98.9 Gbits/sec

[ 4] 24.00-27.00 sec 5.76 GBytes 16.5 Gbits/sec
[ 3] 24.00-27.00 sec 11.5 GBytes 33.0 Gbits/sec
[ 2] 24.00-27.00 sec 11.5 GBytes 33.0 Gbits/sec
[ 1] 24.00-27.00 sec 5.76 GBytes 16.5 Gbits/sec
[SUM] 24.00-27.00 sec 34.5 GBytes 98.9 Gbits/sec
```

~100Gbps Fabric A

```
Disable this terminal from "MultiExec" mode

[root@blade2 ~]# taskset -c 32-40 iperf -s -B 10.0.21.41
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)

[ 1] local 10.0.21.41 port 5001 connected with 10.0.21.42 port 36552
[ 2] local 10.0.21.41 port 5001 connected with 10.0.21.42 port 36548
[ 3] local 10.0.21.41 port 5001 connected with 10.0.21.42 port 36550
[ 4] local 10.0.21.41 port 5001 connected with 10.0.21.42 port 36558
```

```
Disable this terminal from "MultiExec" mode

[ 2] 6.00-9.00 sec 7.64 GBytes 21.9 Gbits/sec
[ 1] 6.00-9.00 sec 9.95 GBytes 28.5 Gbits/sec
[ 4] 6.00-9.00 sec 7.65 GBytes 21.9 Gbits/sec
[ 3] 6.00-9.00 sec 8.49 GBytes 24.3 Gbits/sec
[SUM] 6.00-9.00 sec 33.7 GBytes 96.6 Gbits/sec

[ 2] 9.00-12.00 sec 8.70 GBytes 24.9 Gbits/sec
[ 1] 9.00-12.00 sec 8.72 GBytes 25.0 Gbits/sec
[ 4] 9.00-12.00 sec 8.71 GBytes 24.9 Gbits/sec
[ 3] 9.00-12.00 sec 8.39 GBytes 24.0 Gbits/sec
[SUM] 9.00-12.00 sec 34.5 GBytes 98.9 Gbits/sec
```

~100Gbps Fabric B

CISCO *Live!*

```
Chassis-Blade2 vHBA1 <-- HBA1 Storage (100% read)
Chassis-Blade2 vHBA1 <-- HBA5 Storage (100% read)
```



```
[root@ora5g-node1 ~]# cat /sys/class/fc_host/host3/speed
100 Gbit

[root@ora5g-node1 ~]# fio --filename=/dev/mapper/5g_vol1:/dev/mapper/5g_vol2 --direct=1 --rw=rw
--ioengine=libaio --bs=512k --rwmixread=100 --iodepth=8 --numjobs=8 --runtime=120 --group_reporting
--name=seqreadwrite --seqreadwrite: (g=0): rw=rw, bs=(R) 512KiB-512KiB, ioengine=libaio, iodepth=8

fio-3.19
Starting 8 processes
Jobs: 8 (f=16): [R(8)] [11.6%][r=3141MiB/s] [r=6281 IOPS][eta 01m:47s]
```

~32G FC
Fabric A

```
[root@ora5g-node1 ~]# cat /sys/class/fc_host/host7/speed
100 Gbit

[root@ora5g-node1 ~]# fio --filename=/dev/mapper/5g_vol9:/dev/mapper/5g_vol10 --direct=1 --rw=
rw --ioengine=libaio --bs=512k --rwmixread=100 --iodepth=8 --numjobs=8 --runtime=120 --group_r
eporting --name=seqreadwrite
seqreadwrite: (g=0): rw=rw, bs=(R) 512KiB-512KiB, ~32G FC Fabric B
                    512KiB-512KiB, ioengi
ne=libaio, iodepth=8
...
fio-3.19
Starting 8 processes
Jobs: 8 (f=16): [R(8)] [12.4%][r=3142MiB/s][r=6284 IOPS][eta 01m.46s]
```

~32G FC
Fabric B

```
FlexPod-A800:~>
FlexPod-A800:~> qos statistics performance show
Policy Group IOPS Throughput Latency Is Adaptive? Is Shared?
-----
-total- 108565 6342.20MB/s 4.00ms - -
User-Best-Effort 101469 6342.12MB/s 5.00ms - -
System-Work 7096 74.24KB/s 38.00ms - -
-total- 101496 6341.45MB/s 5.00ms - -
User-Best-Effort 101455 6341.44MB/s 5.00ms false true
System-Work 41 15.06KB/s 1.00ms false true
-total- 101503 6342.33MB/s 5.00ms - -
User-Best-Effort 101465 6342.31MB/s 5.01ms false true
System-Work 38 19.30KB/s 105.00ms false true
```

Total 64G across Fabric A & B

CISCO *Live!*

Chassis Blade2 <-- 4x 32G FC storage target (100% read)



```
[root@ora5g-node1 ~]# fio --filename=/dev/mapper/5g_vol1:/dev/mapper/5g_vol2:/dev/mapper/5g_vol3:/dev/mapper/5g_vol4:/dev/mapper/5g_vol5:/dev/mapper/5g_vol6:/dev/mapper/5g_vol7:/dev/mapper/5g_vol8 --direct=1 --rw=rw --ioengine=libaio --bs=512k --rwmixread=100 --iodepth=32 --numjobs=64 --runtime=30 --group_reporting --name=seqreadwrite
seqreadwrite: (g=0): rw=rw, bs=(R) 512KiB-512KiB, (W) 512KiB-512KiB, (T) 512KiB-512KiB, ioengine=libaio, iodepth=32
...
fio-3.19
Starting 64 processes
Jobs: 64 (f=512): [R(64)][64.5% [r=11.1GiB/s] r=22.7k IOPS][eta 00m:11s]
```

```
FlexPod-A800:> q s p s
(qos statistics performance show)
Policy Group IOPS Throughput Latency Is Adaptive? Is Shared?
-----
-total- 183591 11479.40MB/s 4.9ms - -
User-Best-Effort 183529 11479.38MB/s 4.9ms - -
System-Work 62 22.08KB/s 4.60ms - -
-total- 183511 11474.38MB/s 4.60ms - -
User-Best-Effort 183489 11474.38MB/s 4.60ms false true
System-Work 22 0.00KB/s 4.00ms false true
-total- 183569 11478.01MB/s 5.09ms - -
User-Best-Effort 183529 11478.00MB/s 5.09ms false true
System-Work 40 5.34KB/s 200.00ms false true
```

CISCO *Live!*

Chassis-Blade2 vNIC1 <-- 100G NIC on Storage (100% read)



```

root@orag-node1:~# fio -name=test1 --filename=/fiovol/data1:/fiovol/data2:/fiovol/data3:/fiovol/data4:/fiovol/
data5:/fiovol/data22:/fiovol/data23:/fiovol/data24:/fiovol/data31:/fiovol/data32:/fiovol/data33:/fiovol/data34:/fiovol/
1:/fiovol/data42:/fiovol/data43:/fiovol/data44 --rw=read --direct=1 --ioengine=libaio --bs=512k --numjobs=16 --iodepth=
300 --time-based --group-reporting
test1: (g=0): rw=read, bs=(R) 512KiB-512KiB, (W) 512KiB-512KiB, (T) 512KiB-512KiB, ioengine=libaio, iodepth=64
...
fio-3.19
Starting 16 processes
fio 16 (f=255) [R(16)] [100.0%] [r=11.36GiB/s|r=23.2k IOPS|eta 00m:00s]
test1: (group=0, jobs=16): err=0 pid=82192 Fri Apr 22 13:52:52 2022
read: IOPS=23.3k, BW=11.46GiB/s (12.26GB/s) (3408616/300028msc)
slat (usec): min=26, max=5329, avg=56.33, stdev=25.11
clat (usec): min=1957, max=531941, avg=43399.16, stdev=9451.20
lat (usec): min=1997, max=531997, avg=43999.59, stdev=9450.83
clat percentiles (msec):
  1.00th=[ 25], 5.00th=[ 28], 10.00th=[ 31], 20.00th=[ 38],
  30.00th=[ 41], 40.00th=[ 44], 50.00th=[ 46], 60.00th=[ 47],
  70.00th=[ 49], 80.00th=[ 51], 90.00th=[ 53], 95.00th=[ 56],
  99.00th=[ 61], 99.50th=[ 66], 99.90th=[ 103], 99.95th=[ 131],
  99.99th=[ 205]
bw ( MiB/s): min=5977, max=12232, per=100.00%, avg=11646.89, stdev=19.82, samples=9584
iops ( iops): min=200, max=2445, avg=23293.77, stdev=30.65, samples=9584
lat ( msec): min= 0.01%, 4.001%, 10.001%, 20.006%, 50.78%, 43.4%
lat (msec): 100=21.39%, 250=0.10%, 500=0.01%, 750=0.01%
cpu
  usr=0.22%, sys=8.45%, ctx=6244500, majf=0, minf=0
IO depths
  1=0.1%, 2=0.1%, 4=0.1%, 8=0.1%, 16=0.1%, 32=0.1%
submit rate
  complete=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%
issued rwts: total=6980099,0,0,0 short=0,0,0,0 dropped=0
latency
  target=0, window=0, percentile=100.00%, d=0.04
Run starting group 0 (all jobs):
READ: bw=11.46GiB/s (12.26GB/s), 11.46GiB/s-11.46GiB/s (12.26GB/s-12.26GB/s), io=3408616 (366060), run=300028-300028msc

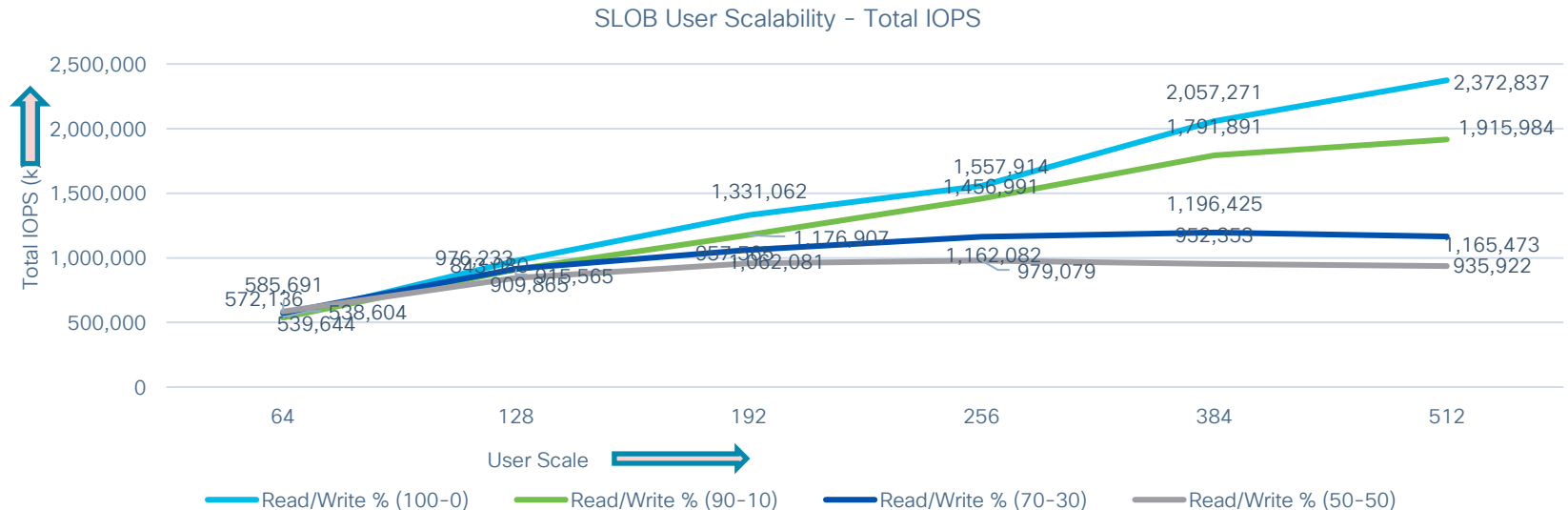
```

tcpdump-8800: cluster: 4/22/2022 13:50:07																
cpu	cpu	total		fchoce	total	total data	data	data	cluster	cluster		disk	disk	pkts	pkts	
avg	busy	ops	nfs-ops	clifs-ops	ops	recv	sent	busy	recv	sent	busy	recv	write	recv	sent	
18K	43K	187117	187117	0	0	38.1M	11.4G	97%	37.7M	11.4G	0%	338K	336K	478M	1.71M	238653
18K	42K	186775	186775	0	0	38.4M	11.5G	98%	38.1M	11.5G	0%	285K	286K	481M	3.91K	236859
18K	43K	187603	187603	0	0	39.0M	11.5G	98%	38.1M	11.5G	0%	285K	285K	480M	2.3K	24584
18K	43K	186820	186820	0	0	38.0M	11.4G	97%	37.8M	11.4G	0%	266K	266K	609M	1.18M	231085
18K	43K	186775	186775	0	0	38.5M	11.5G	98%	38.2M	11.5G	0%	301K	301K	643M	1.73K	237274
18K	43K	186634	186634	0	0	38.4M	11.4G	97%	38.1M	11.4G	0%	251K	251K	613M	1.46M	239374
18K	43K	185568	185568	0	0	37.7M	11.4G	97%	37.4M	11.4G	0%	278K	278K	616M	3.91M	226770
18K	43K	187085	187085	0	0	38.3M	11.4G	97%	38.0M	11.4G	0%	307K	307K	582M	23.9K	235274
18K	43K	186116	186116	0	0	38.4M	11.4G	98%	38.2M	11.4G	0%	269K	269K	577M	1.17M	239758
18K	43K	186856	186856	0	0	38.1M	11.4G	98%	37.8M	11.4G	0%	270K	270K	579M	29.9K	234293
18K	43K	186380	186380	0	0	38.5M	11.4G	97%	38.2M	11.4G	0%	281K	281K	590M	646K	238783
18K	43K	186480	186480	0	0	38.6M	11.4G	97%	38.3M	11.4G	0%	309K	309K	577M	2.25M	241873
18K	43K	185636	185636	0	0	38.2M	11.4G	97%	37.9M	11.4G	0%	284K	282K	568M	23.9K	235542
18K	43K	185936	185936	0	0	37.6M	11.3G	97%	37.3M	11.3G	0%	280K	282K	594M	1.18M	225957
18K	43K	187402	187402	0	0	38.3M	11.5G	98%	38.0M	11.5G	0%	268K	268K	587M	29.9K	234891

Speeds and Feeds – Oracle SLOB performance

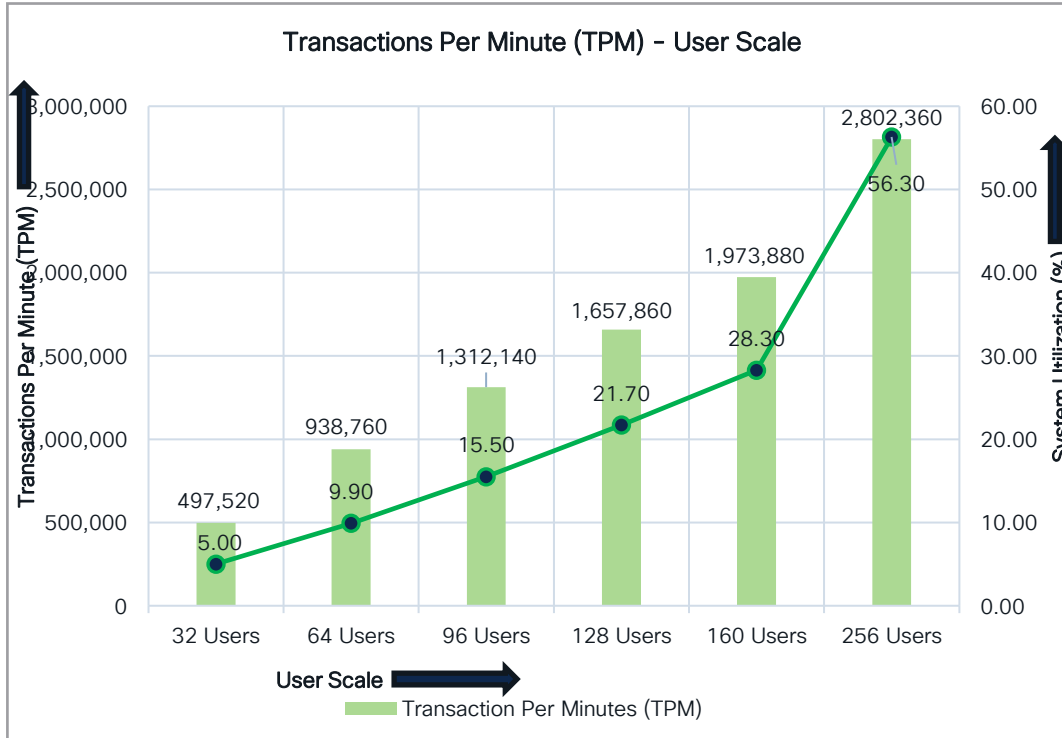
Performance Summary

- SLOB – Silly Little Oracle Benchmark
 - SLOB is an Oracle I/O workload generation tool kit
 - Tests physical random single-block reads (db file sequential read), single block writes (DBWR flushing capacity) and REDO logging I/O capacity
- Near linear User Scale with a mix of Database 8K Reads and Updates at 100 %, 70% and 50% Reads/Updates
- 6 x 2.9 TB NVMe Disks as single "DATA" Disk Group
- 2 TB Schema, 16 GB SGA



Database Performance Test

Swingbench – Users and TPM Scale



Oracle AWR Latency Sample

✓ Workload

- Tool Used – Swingbench
- Oracle Database – 5 TB
- OLTP Workload – SOE
- User Scale – 32 to 256
- Each Test Run for 24 Hours

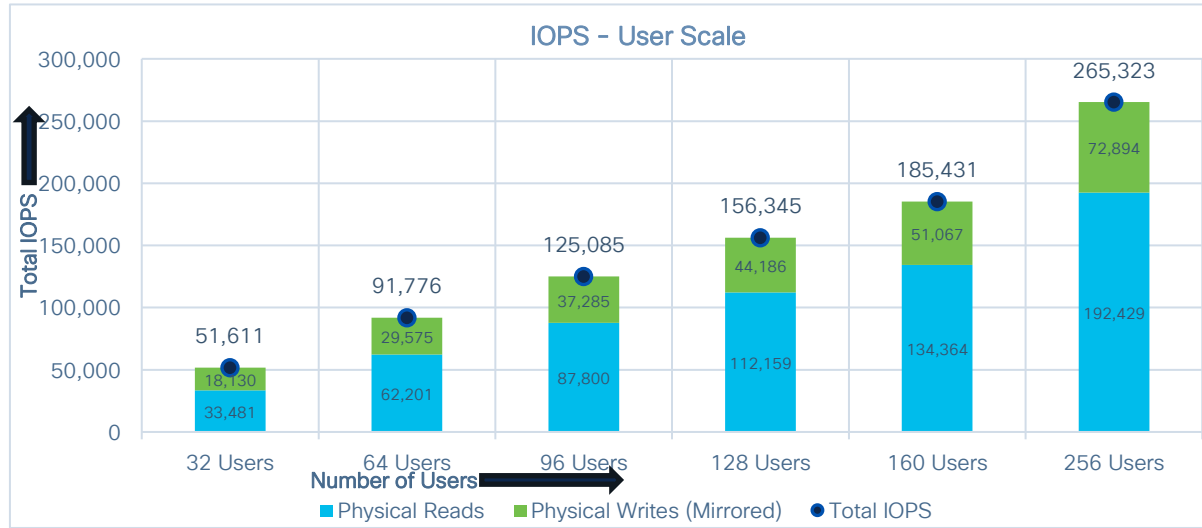
✓ Observation

- Linear Scalability TPM
- Latency under 0.4 milliseconds

[Youtube Video Link](#)

Database Performance Test

Swingbench – Users and IOPs Scale



iostat 300 user test output – Even IOPs on all drives

Device	r/s	w/s	rMB/s	wMB/s	rrqm/s	wrqm/s	%rrqm	%wrqm	r_await	w_await	aq-sz	rareq-sz	wareq-sz	svctm	%util
nvme3n1	32136.53	33370.60	251.10	264.75	0.00	6.60	0.00	0.02	0.12	0.06	0.32	8.00	8.12	0.02	99.83
nvme4n1	32165.57	33612.77	251.32	264.22	0.03	6.60	0.00	0.02	0.12	0.06	0.30	8.00	8.05	0.02	99.83
nvme0n1	32272.23	32910.87	252.15	265.11	0.07	5.80	0.00	0.02	0.12	0.07	0.39	8.00	8.25	0.02	99.87
nvme2n1	32158.27	33337.97	251.27	263.98	0.00	5.83	0.00	0.02	0.12	0.06	0.33	8.00	8.11	0.02	99.78
nvme1n1	32235.40	33527.93	251.86	265.31	0.00	5.47	0.00	0.02	0.12	0.07	0.37	8.00	8.10	0.02	99.79
nvme5n1	32179.27	33424.87	251.40	263.69	0.03	5.50	0.00	0.02	0.12	0.07	0.40	8.00	8.08	0.02	99.86

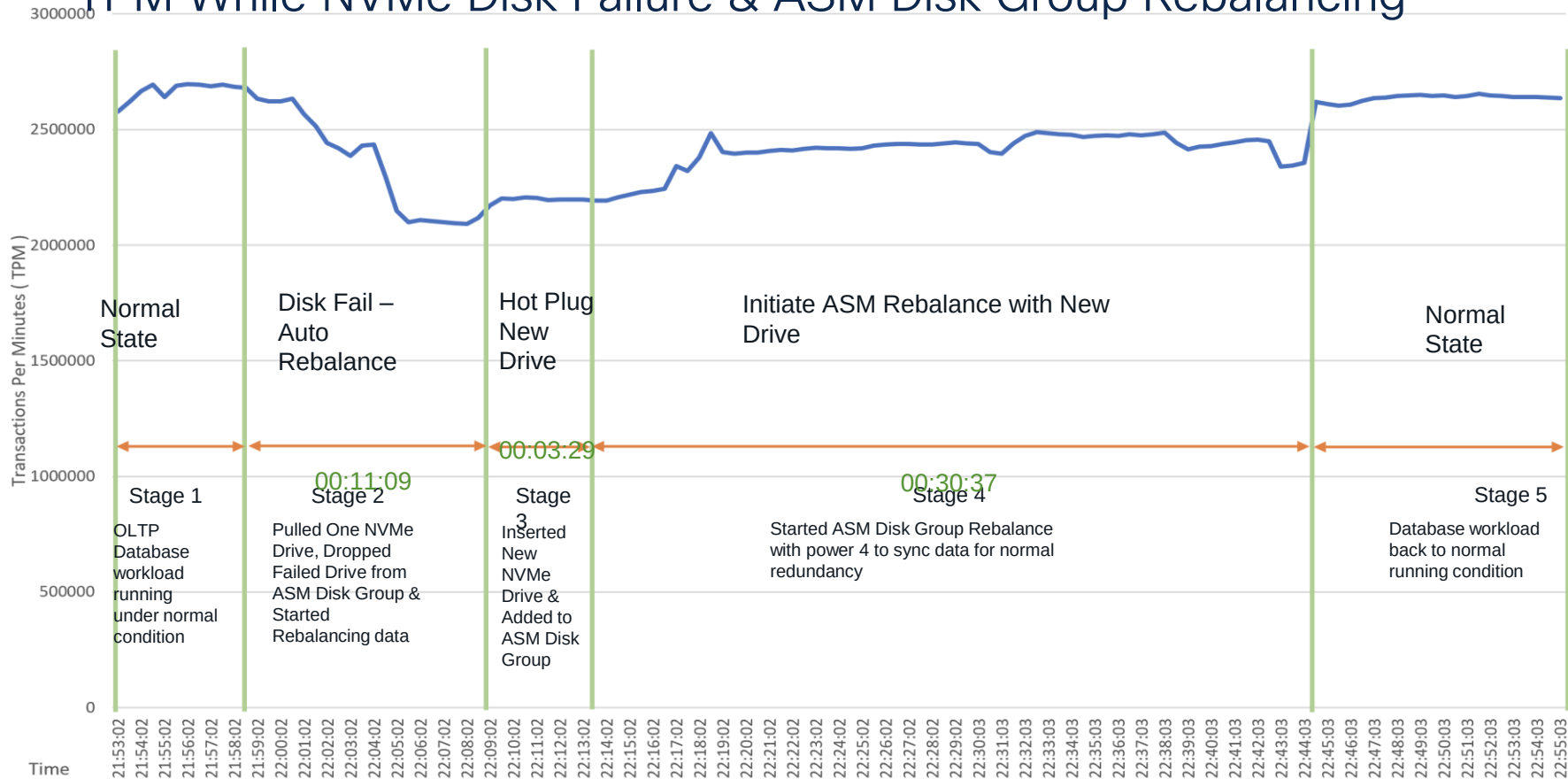
✓ Workload

- Tool Used – Swingbench
- Oracle Database – 5 TB
- OLTP Workload – SOE
- User Scale – 32 to 256
- Sustainable Test results over 24 hours
- IOSTAT sample for 300 Users

✓ Observation

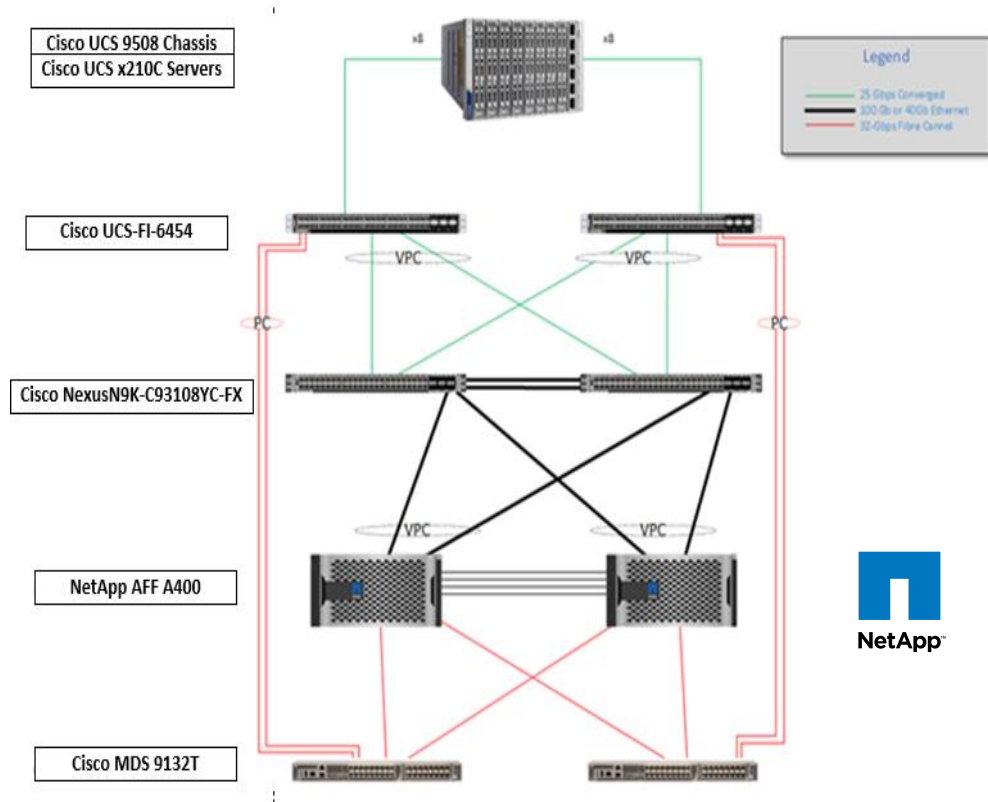
- Linear Scalability IOPs by adding Users
- 50k to 265k IOPs
- Latency under 300 Microseconds
- IO evenly distributed across all NVMe drives

TPM While NVMe Disk Failure & ASM Disk Group Rebalancing

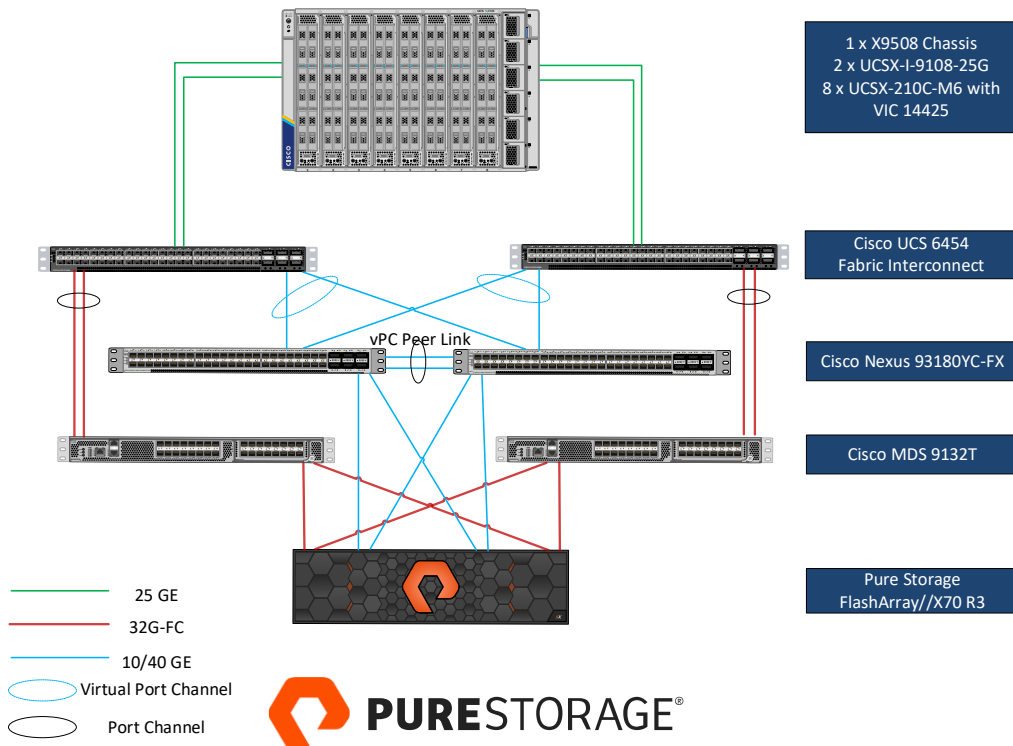


Cisco UCS X-Series for VDI

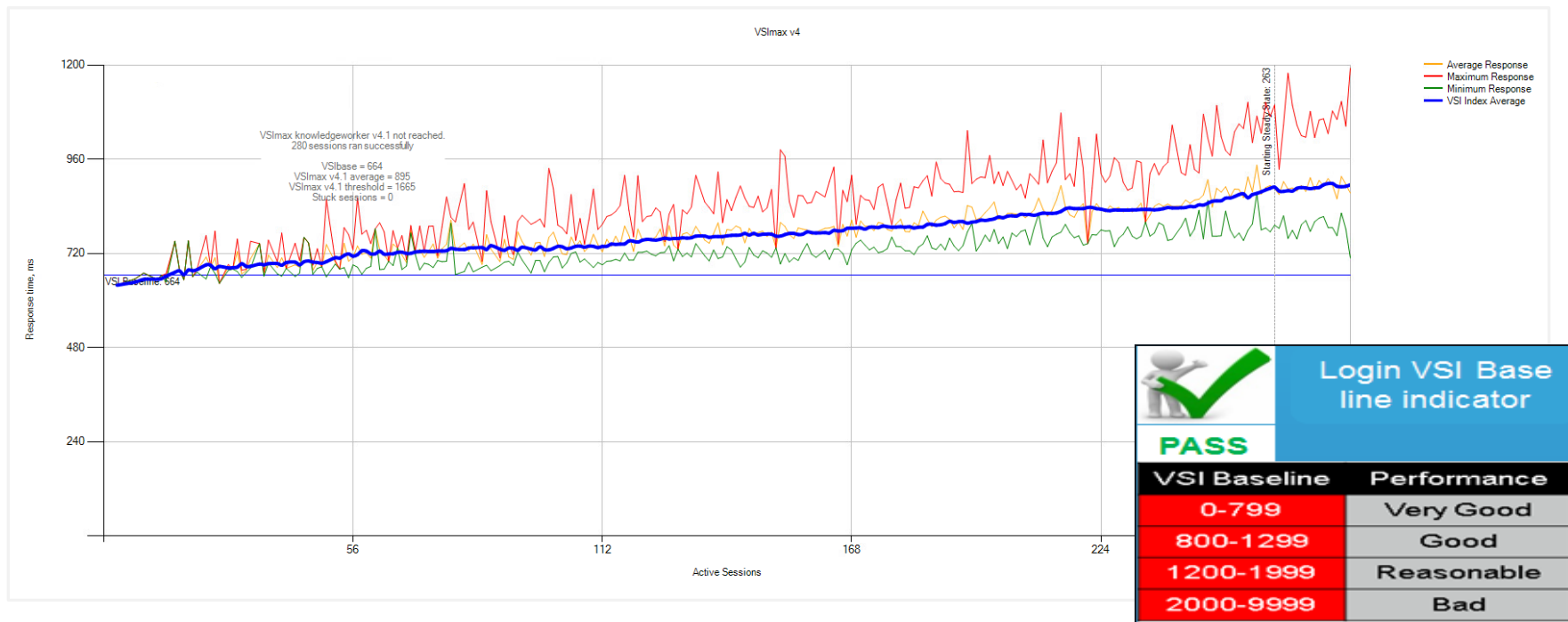
X-Series/Intersight VDI Cisco validated design



X-Series/Intersight VDI Cisco validated design



VDI performance results (Windows 10)



VDI performance results (Windows 10)

Summary Settings VSImax v4 VSImax v4 Detailed VSImax v4 Detailed Weighted VSImax v4 Scatter UMEM IO CPU ZLC ZHC NFP NFO NSLD AppSta

280-02

Successfully completed Login VSI test with **280 knowledgeworker** sessions. VSImax (system saturation) was not reached. All Login VSI users completed the test.

Test result review

280 sessions were configured to be launched in **2880** seconds.

In total **0** sessions failed during the test:

- 0** sessions was/were not successfully launched
- 0** launched sessions failed to become active
- 280** sessions were active during the test
- 0** sessions got stuck during the test (before VSImax threshold)

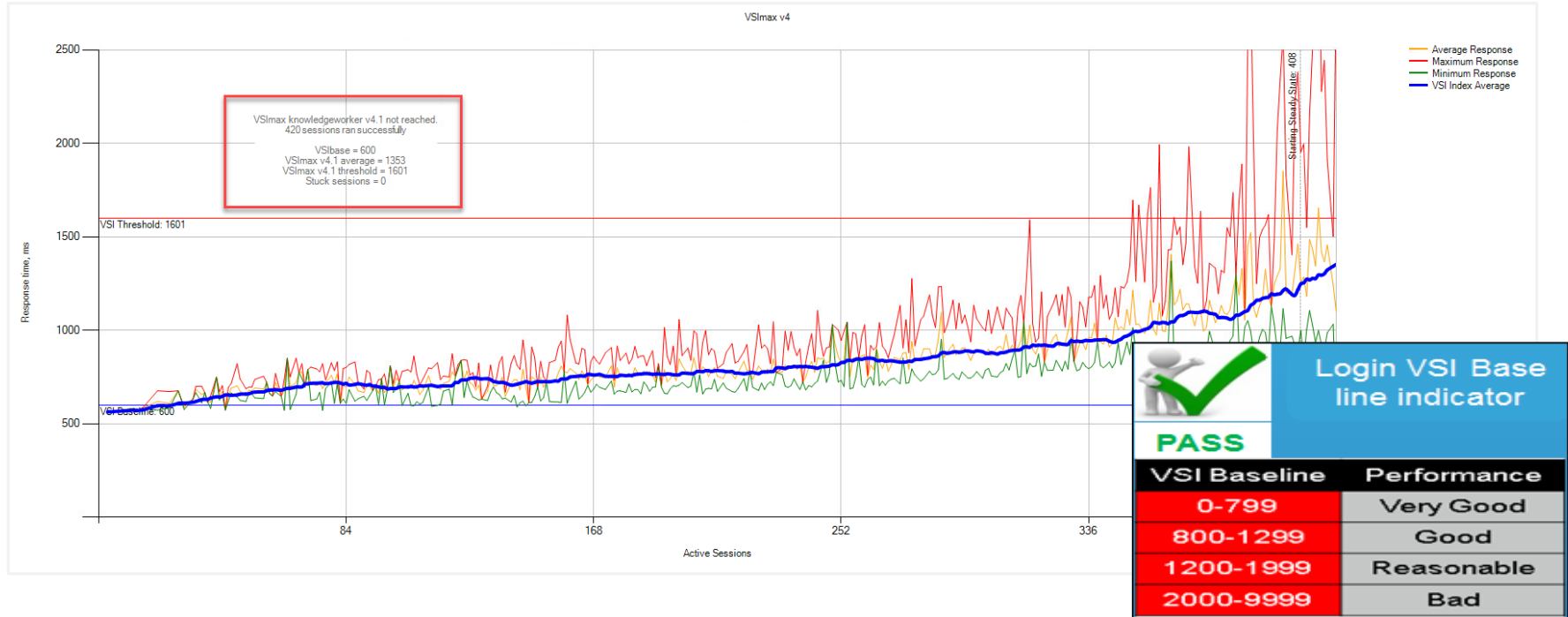
With **280** sessions the maximum capacity VSImax (v4.1) **knowledgeworker** was not reached with a Login VSI baseline performance score of **664**

Login VSI index average score is **791** lower than threshold. It might be possible to launch more sessions in this configuration.

Baseline performance of **664** is: **Very good**

	Login VSI Base line indicator
PASS	
VSI Baseline	Performance
0-799	Very Good
800-1299	Good
1200-1999	Reasonable
2000-9999	Bad

VDI performance results (Windows Server 2019 RDS)



VDI performance results (Windows Server 2019 RDS)

Summary Settings VSImax v4 VSImax v4 Detailed VSImax v4 Detailed Weighted VSImax v4 Scatter UMEM IO CPU ZLC ZHC NFP NFO NSLD AppStart Log

RDS-420-03

Successfully completed Login VSI test with **420 knowledgeworker** sessions. VSImax (system saturation) was not reached. All Login VSI users completed the test.

Test result review

420 sessions were configured to be launched in **2880** seconds.

In total **0** sessions failed during the test:

- **0** sessions was/were not successfully launched
- **0** launched sessions failed to become active
- **420** sessions were active during the test
- **0** sessions got stuck during the test (before VSImax threshold)

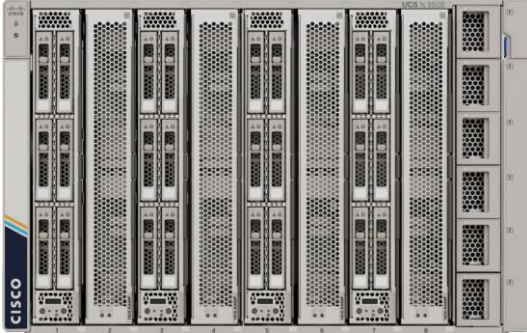
With **420** sessions the maximum capacity VSImax (v4.1) **knowledgeworker** was not reached with a Login VSI baseline performance score of **600**

Login VSI index average score is **500** lower than threshold. It might be possible to launch more sessions in this configuration.

Baseline performance of **600** is: **Very good**

 Login VSI Base line indicator	
PASS	
VSI Baseline	Performance
0-799	Very Good
800-1299	Good
1200-1999	Reasonable
2000-9999	Bad

Why X-Series for VDI



Add nodes to meet VDI growth

Add GPU – expand app options

- GPU node offers wider array of GPUs to meet specific application requirements, enables higher utilization of GPU resources
- Can grow into a Converged Infrastructure with NetApp or Pure Storage driving up to 2,500 user, fully detailed in Cisco Validated Designs
- Supports Citrix and VMware Horizon deployments running side by side from one chassis
- Cloud based Intersight enables management from compute node processors up thru external storage for complete management

Cisco UCS X- Series for AI/ML

AI is accelerating and exposing new challenges

AI changes everything

AI MOMENTUM

Increased data collection
and computing power

Advancements in
AI frameworks and tooling

Generative
AI revolution

IT CHALLENGES

New operational silos

Unfamiliar and fragmented
applications stacks

Ethics, privacy and
compliance

Complex infrastructure
patterns

Data volume,
velocity and variety

Shortage of
technical expertise

High entry cost and
lock-in issues

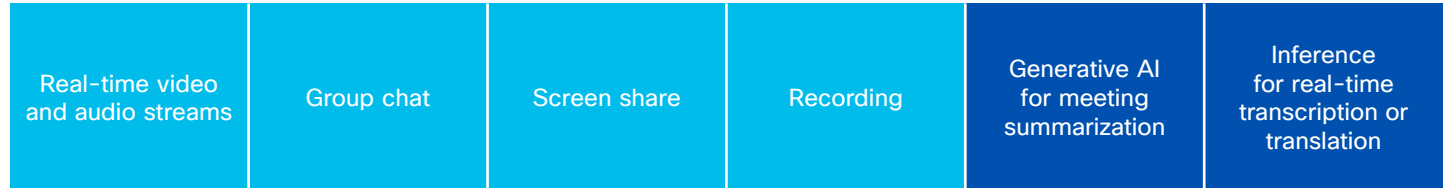
Disorienting AI hype

Organizations need flexible AI acceleration

AI changes everything

1

Flexible acceleration for AI-enabled apps



Example: AI-enabled Video Conferencing App

General Purpose Compute (CPU)

AI Acceleration (GPU)

2

Flexible acceleration for diverse AI workloads



It's time to simplify infrastructure and operations for AI

Our approach

Mainstream AI infrastructure

Reduce complexity of AI infrastructure at core and edge with cloud-based operations that delivers global visibility, consistency and control

Operationalize and Automate for AI

Deploy with validated solutions to save time and reduce risk, use playbooks to automate deployment of common AI models from the cloud

Future-proof and secure AI platforms

Keep AI infrastructure running and protected with proactive, automated resiliency and security capabilities.

Simplify and Automate AI Infrastructure



Integrated, validated
solutions on
proven platforms

Simplify and Automate AI Infrastructure

Curated automation
playbooks to
get started

1

Cisco Validated Designs for Simplified AI Infrastructure

EXPANDED
ROADMAP



NVIDIA AI
Enterprise



Red Hat
OpenShift AI



GPT-in-a-box
on Nutanix
Hyperconverged

CLUSTERA

Gen-AI with
Cloudera
Data Platform



2

Deployment-ready playbooks for common AI models

NEW!

Large Language Models
(GPT3, BERT, T5)

Computer Vision Models
(ResNet, EfficientNet, YOLO)

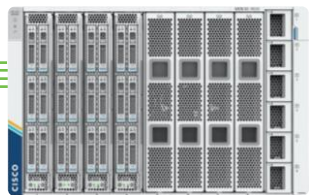
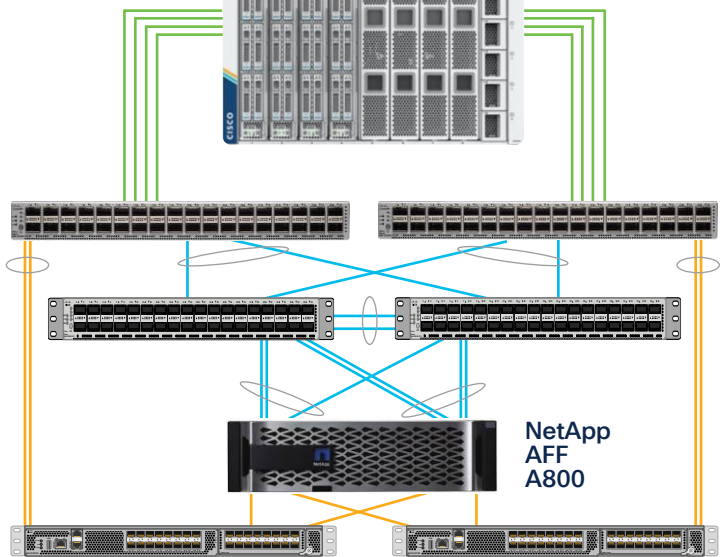
Generative Models
(GANs, VAEs)



Cisco UCS X- Series with FlexPod and FlashStack

Converged Infrastructure with X-Series

 FlexPod



iSCSI

FC

NFS

[Youtube Video Link](#)

Cisco UCSX-9508 Chassis

Cisco UCSX 9108-100G

Cisco UCS X210c M6 with
Cisco UCS VIC 15231

Cisco UCS 6536
Fabric Interconnect

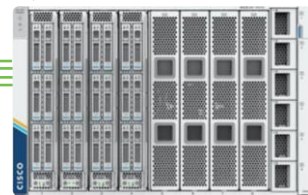
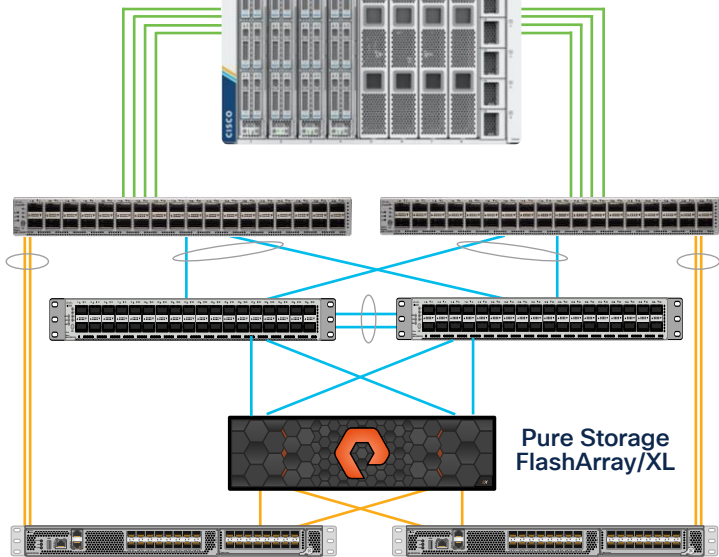
Cisco Nexus 9336C-FX2

— 100 GE

— 100 GE

— 32Gbps FC

 FlashStack



iSCSI

FC

[Youtube Video Link](#)

CISCO *Live!*

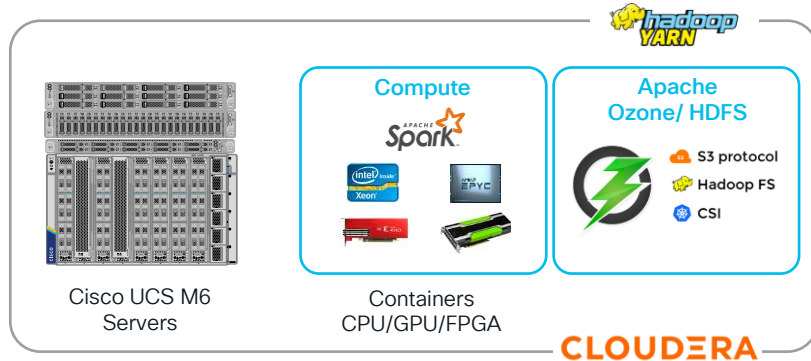
Cisco Data Intelligence Platform

Journey to Hybrid Cloud

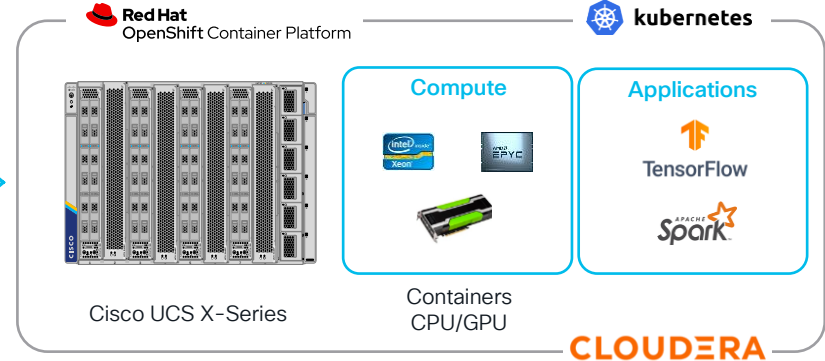
Cisco Data Intelligence Platform

Cloudera Private Cloud on Cisco UCS M6

CDP Private Cloud Base



CDP Private Cloud Data Services



Data intensive workloads

Fully supported



World record performance

- TPCx-HS (20 plus)
- Proven linear scaling
- Only to publish 300 TB test

Compute intensive workloads

Cisco Intersight management

- Manage from the cloud
- Single pane of glass management

Scaling

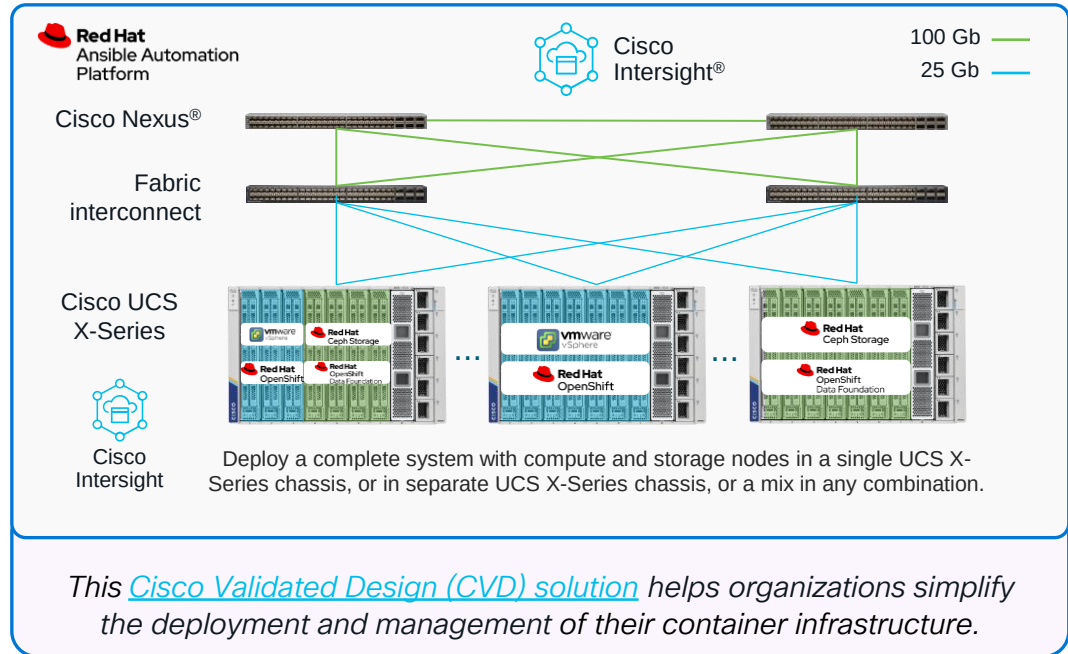
- Independently scale storage and compute
- Data tiering

[Youtube Video Link](#)

UCS X-Series with Red Hat OpenShift and OpenShift Data Foundation

Cisco UCS X-Series CVD with Red Hat OpenShift Container Platform and Red Hat OpenShift Data Foundation

- Pre-designed, integrated, and validated architecture of Cisco UCS® X-Series with Red Hat OCP and ODF is deployed and configured using Red Hat Ansible Automation Platform.
- Consolidates cloud-native applications and their persistent block, file, or object storage onto a single platform.
- Validated architecture could be replicated to deploy additional Cisco UCS X-Series chassis containing only compute nodes, or storage nodes, or a mix of both.



FIO performance block



Very promising results



No UCS, vSphere, OCP or Ceph tuning



Just best practice with 4 OSD/NVMe

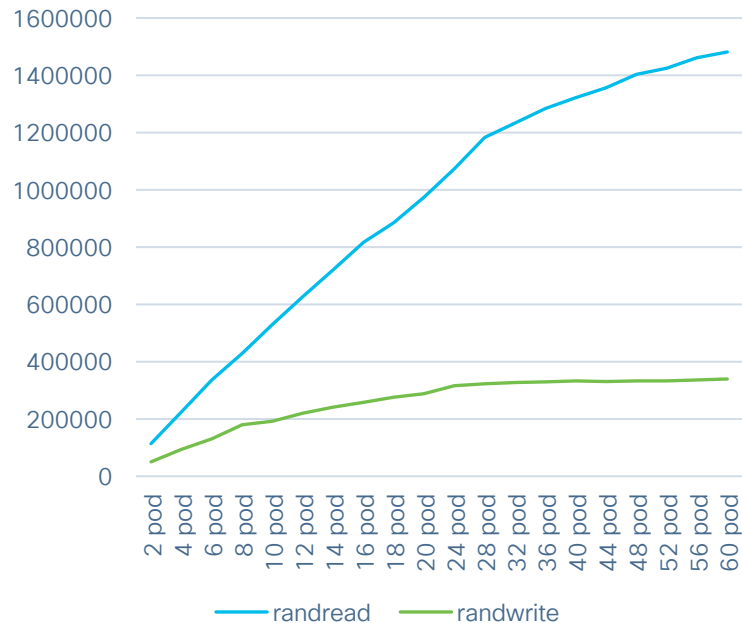


Tool to be used: Fiooadgen



Large block (4M) reached 11 GBps

Random IOPS 4K



Why X-Series for Red Hat OpenShift



Complete solution in just 7RU with all the power you need



Easily to deploy and manage through Cisco Intersight and Ansible



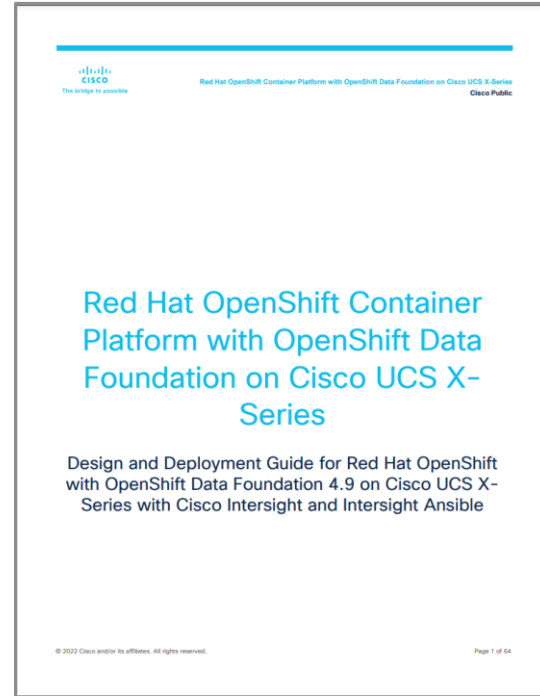
Simple expansion by adding more X-Series or rack server, either OCP or ODF



Connect to hybrid cloud with Intersight Solutions and Red Hat



Solution available as CVD and on GitHub





Consolidate Rack Workloads



AI/ML



Accelerated VDI

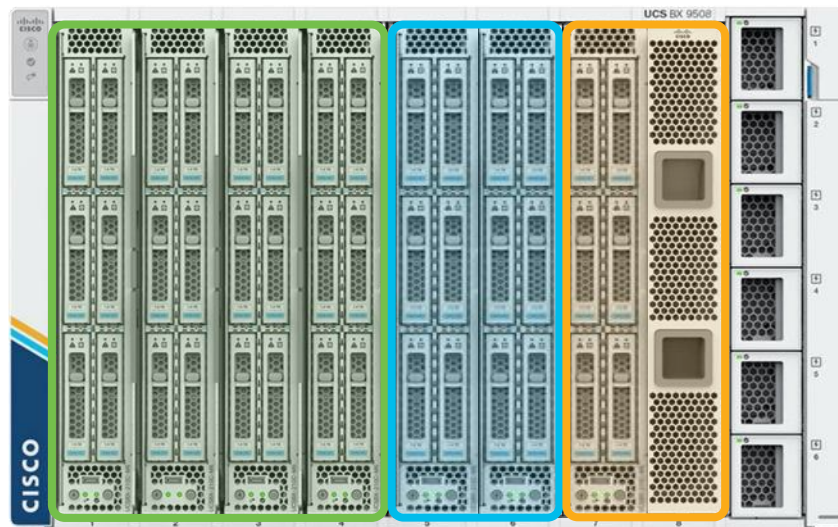


Big Data, SDS, Containers



Traditional Blade Workloads

UCS X-Series with X-Fabric



Up to 960

Cores
per Chassis
(M6 or M7)

24

GPUs
per Chassis



200G

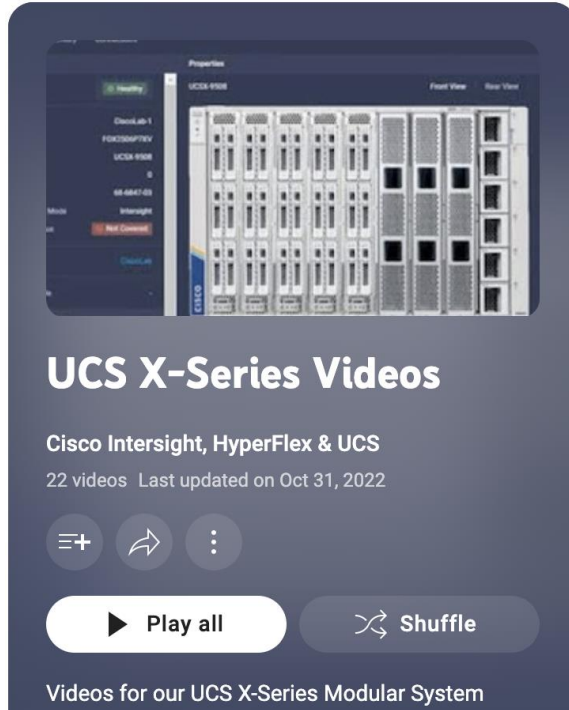
Bandwidth to
compute node

1 PB

of storage



Link of YouTube Videos



The image shows a YouTube video player interface. At the top, there's a video thumbnail showing a rack of UCS X-Series modular system units. Below the thumbnail, the title "UCS X-Series Videos" is displayed in a large, bold, white font. Underneath the title, it says "Cisco Intersight, HyperFlex & UCS" and "22 videos Last updated on Oct 31, 2022". There are three icons for video controls: a list icon, a share icon, and a more options icon. Below these icons are two buttons: "Play all" and "Shuffle". At the bottom, it says "Videos for our UCS X-Series Modular System".

UCS X-Series Videos

Cisco Intersight, HyperFlex & UCS
22 videos Last updated on Oct 31, 2022

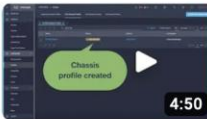
Play all Shuffle

Videos for our UCS X-Series Modular System

bit.ly/ucs-x

- 

3 **VDI to accelerated VDI in under 7 minutes!**
Cisco Intersight, HyperFlex & UCS • 198 views • 3 months ago
- 

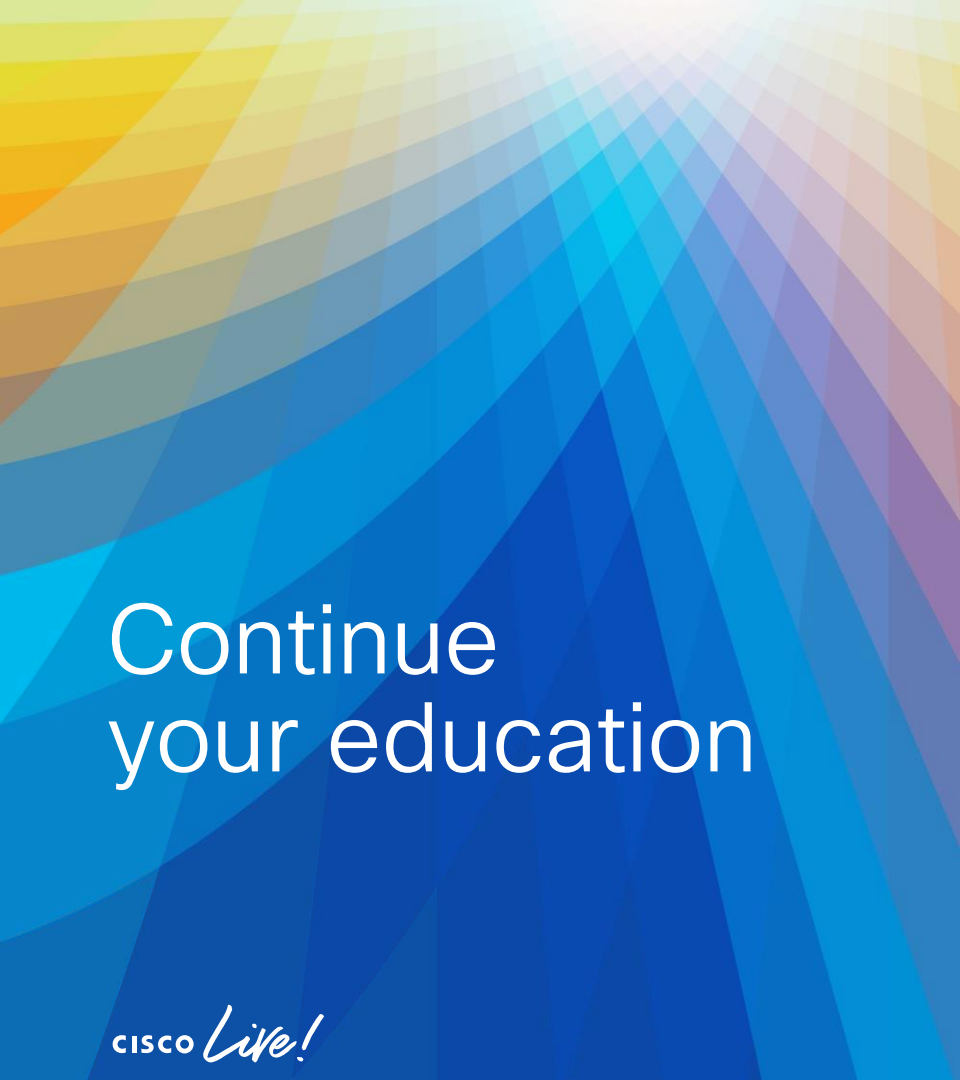
4 **X-Series Automation with Intersight and Ansible**
Cisco Intersight, HyperFlex & UCS • 160 views • 2 months ago
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5 **Deploy Red Hat OpenShift OCP on UCS-X Series Modular System compute nodes**
Cisco Intersight, HyperFlex & UCS • 114 views • 2 months ago
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6 **Oracle on UCS X-Series with local NVMe storage**
Cisco Intersight, HyperFlex & UCS • 74 views • 2 months ago

X-Series white papers

- [Cisco UCS X-Series Quick Start Guide](#)
- [Cisco UCS X210c M6 Compute Node Disk I/O Characterization](#)
- [Deploy Cisco UCS X210c Compute Node with Cisco Intersight Management Mode for VDI](#)
- [FlashStack with Cisco UCS X-Series and Cisco Intersight](#)
- [FlexPod Datacenter with Cisco UCS X-Series and Cisco Intersight](#)
- [Power SAP HANA with the Cisco UCS X-Series Certified by SAP](#)
- [Deploy SAP HANA Scale-Up Appliance with UCS X-Series](#)
- [Cisco UCS and Intel SGX with Fortanix Confidential Computing Manager](#)
- [Deploy a High-Performance Standalone Oracle Database Solution: Oracle 19c on Cisco UCS X-Series](#)
- [FlexPod Datacenter with Citrix VDI and VMware vSphere 7 for up to 2500 Seats](#)
- [FlexPod XCS Solution with Cisco Intersight Platform Tech Preview](#)
- [Red Hat OpenShift Container Platform with OpenShift Data Foundation on Cisco UCS X-Series](#)
- [Cisco UCS X-Series Servers with Intel Optane Persistent Memory for Virtual Desktop Infrastructure White Paper](#)
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The background is a vibrant, abstract graphic. On the left, there are overlapping, wavy shapes in shades of red, orange, and yellow, resembling a stylized cloud or a series of overlapping circles. On the right, a bright white light source emits a series of colorful rays in shades of blue, green, and yellow, creating a sunburst effect. The overall color palette is a rainbow spectrum.

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