AMD 賦能永續數位校園

AMD 業務協理 何彥明 Albert
AMD 技術經理 張歐佑豪 Simon

AGENDA

- AMD 簡介及價值主張
- 第四代資料中心處理器 EPYC Genoa
- 筆電及桌上型電腦處理器 RYZEN

AMD
together we advance_

[Public]

New Strategic Markets Expand

Long-Term Growth Opportunities

Data Center

$125B

PC

$50B

Gaming

$37B

Embedded

$33B

Communications

$32B

Automotive

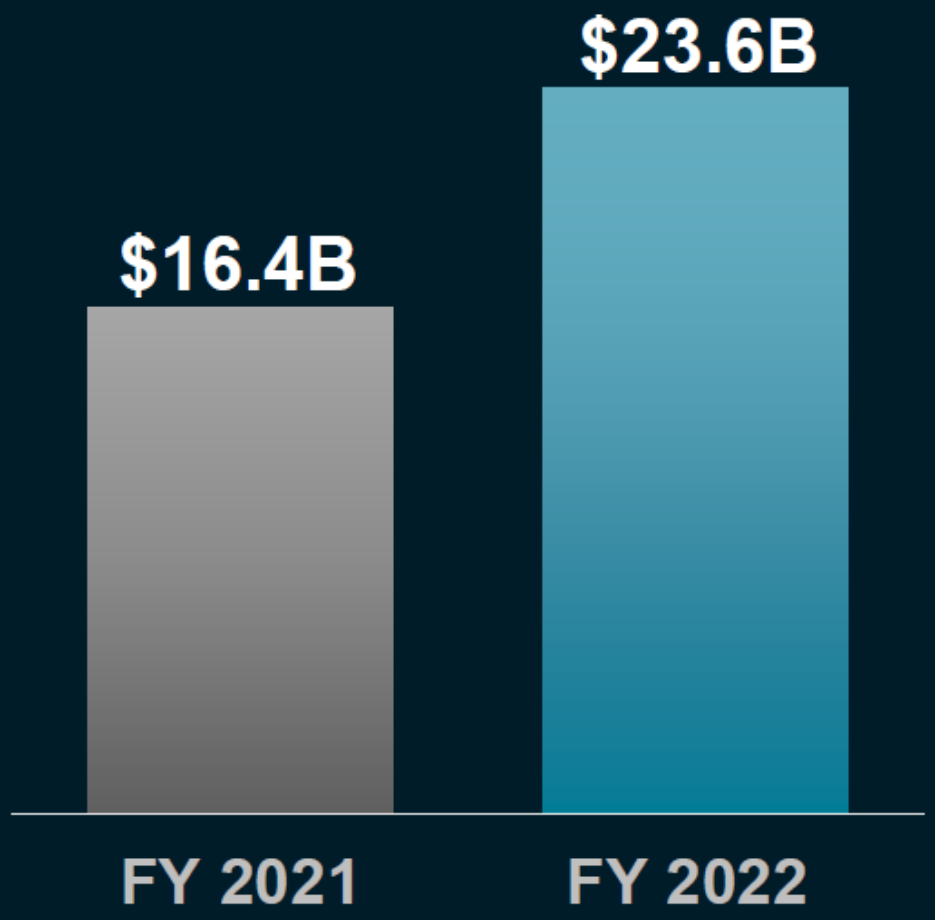
$27B

$300B TAM

Based on AMD Internal data.

REVENUE SUMMARY FY 2022

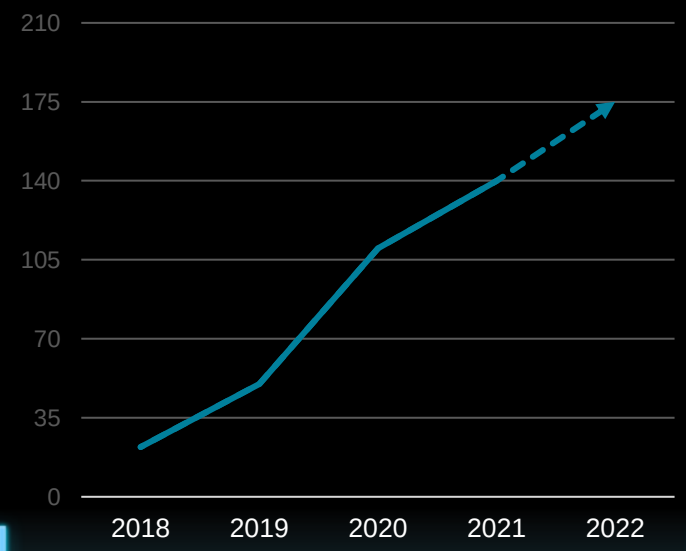
- Revenue of $23.6 billion grew 44% y/y driven by higher Embedded, Data Center and Gaming segment revenue, partially offset by lower Client segment revenue
- Pro forma[1] revenue of $24.1 billion, up 20% compared to $20.1 billion in 2021, on combined AMD and Xilinx company basis



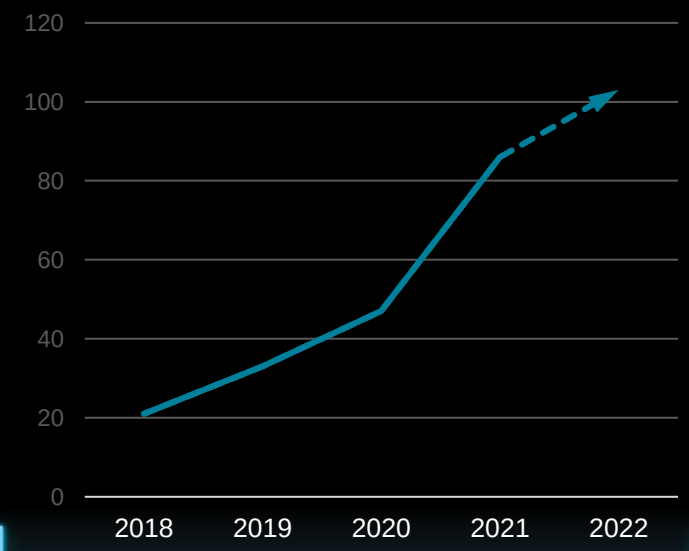
1. See Appendices for Pro-forma revenue reconciliation.

Whatever You're Requesting, AMD Is There

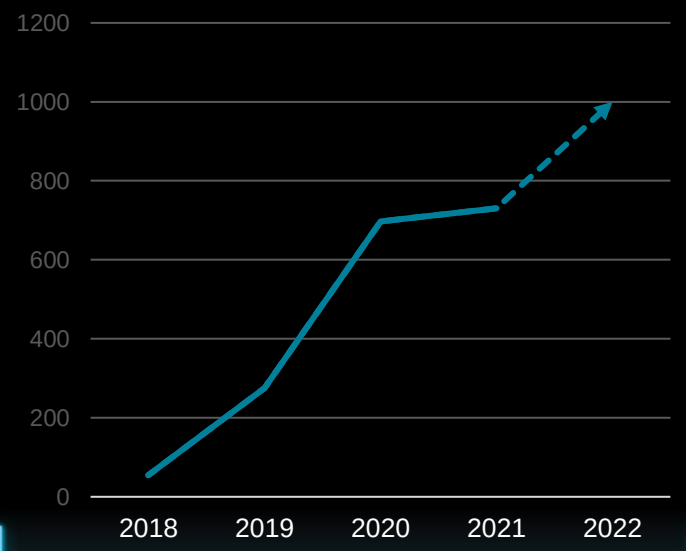
Server Platforms



Commercial Client Platforms



EPYC Public Could Offerings



cisco
DELL Technologies
Hewlett Packard Enterprise
Lenovo
SUPERMICRO

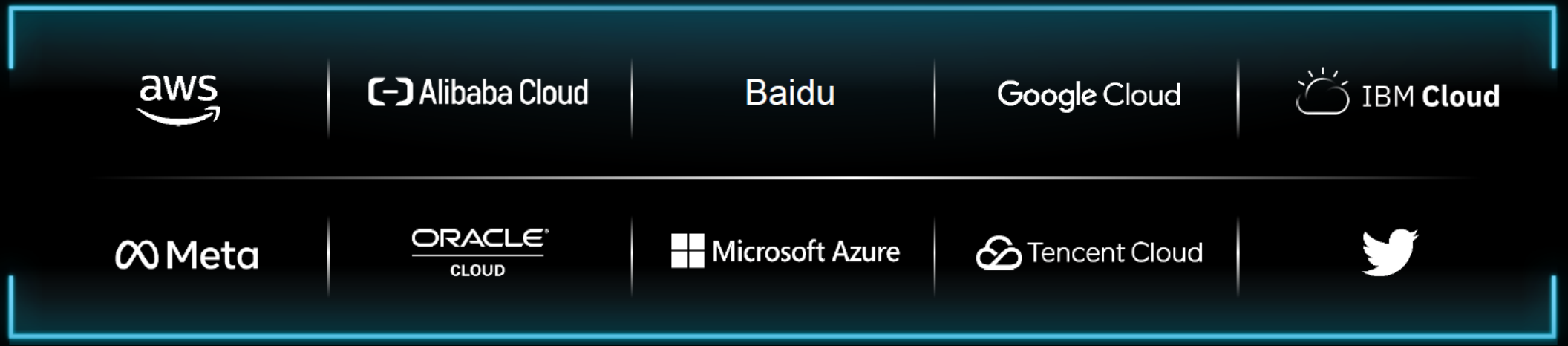
acer
ASUS
FUJITSU
hp
Lenovo
NEC

aws
Alibaba Cloud
Google Cloud
IBM Cloud
Microsoft Azure
ORACLE CLOUD
Tencent Cloud

AMD
together we advance_

WORLD'S LARGER HYPERSCALERS

RUN ON AMD EPYC™ CPUS



AMD EPYC™ PROCESSORS HAVE BEEN DESIGNED INTO DATA CENTERS BY TEN OF

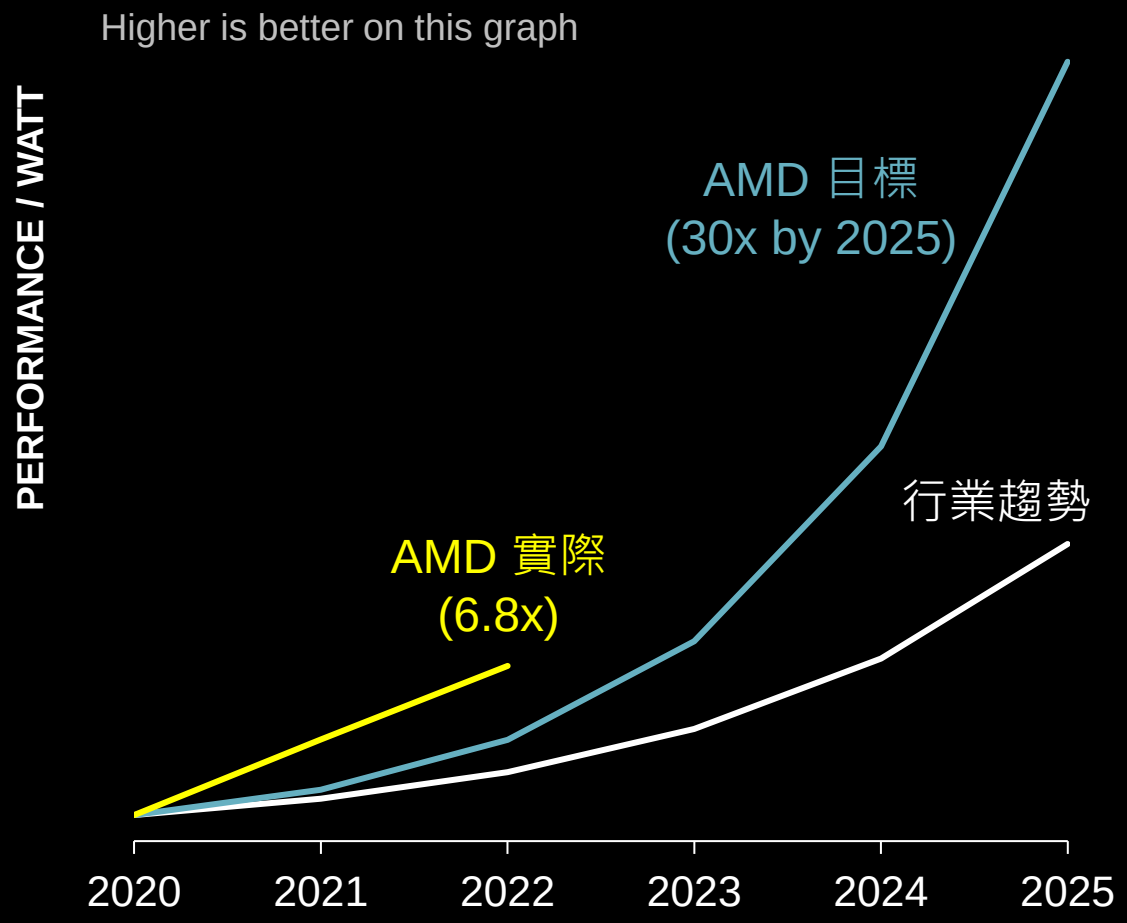
THE WORLD'S LARGEST HYPERSCALE COMPANIES

Use of third-party marks / logos/ products is for informational purposes only and no endorsement of or by AMD is intended or implied. GD-83

AMD

[AMD Official Use Only - General]

加速資料中心的永續發展



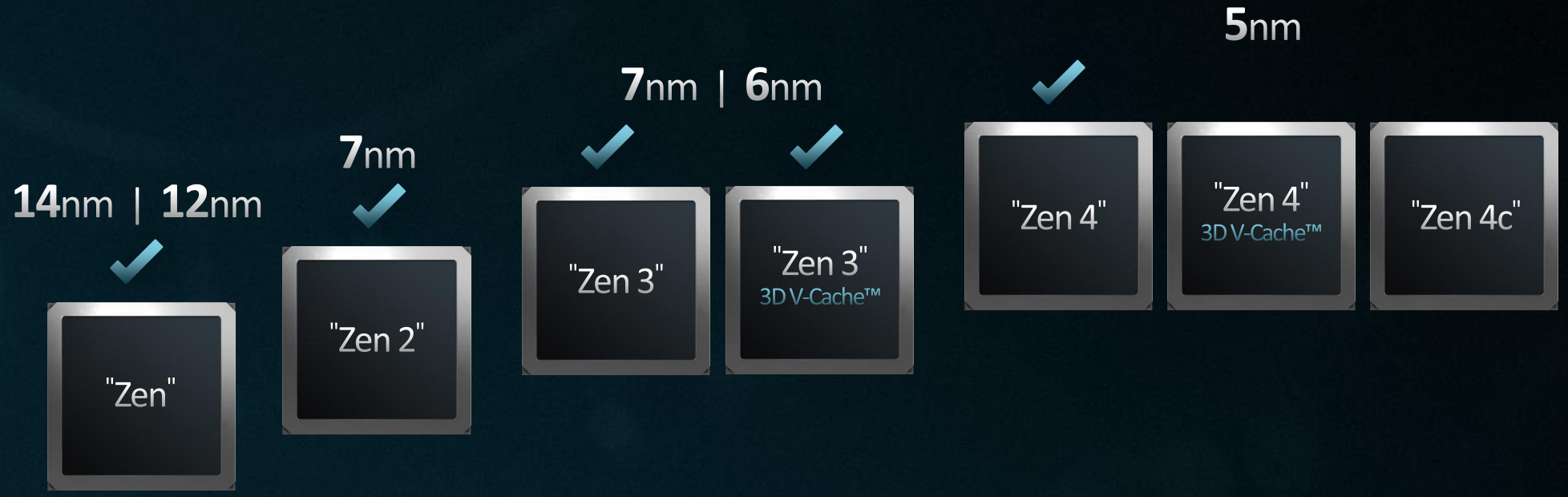
30x25 目標：在 2025 年之前，加速資料中心運算節點的能源效率將在2020年的基礎上**提升30倍**。

要在2025年達成提升 30 倍的目標，意謂著AMD加速運算節點完成單次運算的能源要比 2020 年降低97%。為了實現這一目標，AMD運算節點能源效率的提升速度必須比2015至2020年期間整個產業的提升速度快2.5倍。

這計畫正順利進行，透過使用搭載一個AMD第3代EPYC CPU與四個AMD Instinct MI250x GPU的加速運算節點，在2020年的基準水平上將能源效率**已經提升6.79倍**。

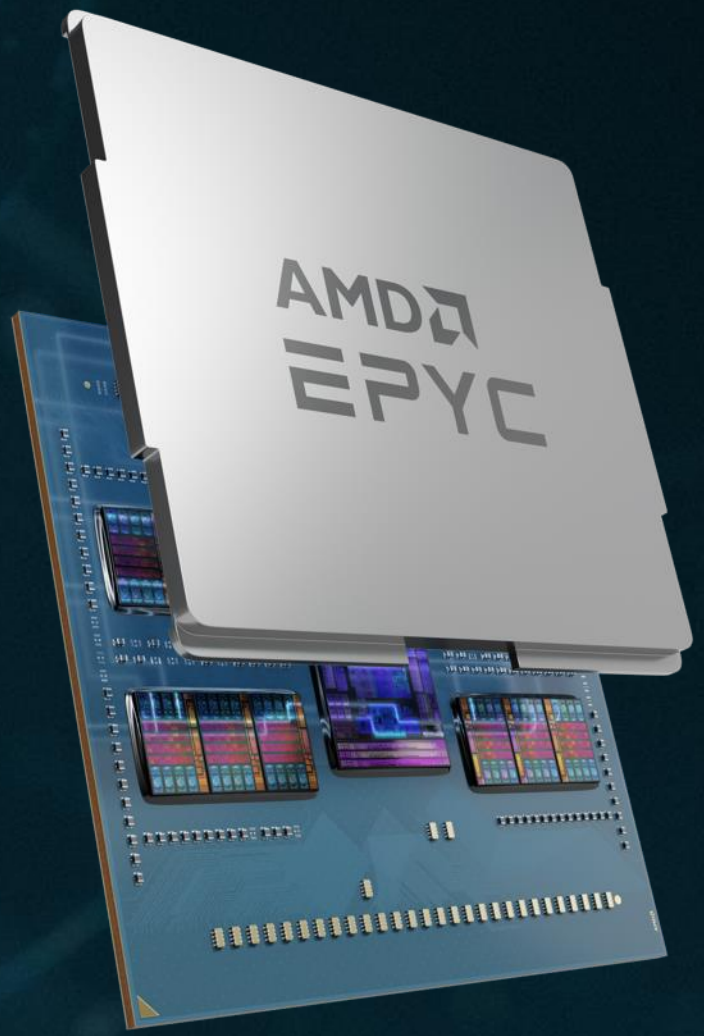
AMD
together we advance_

Delivering as Promised



All roadmaps are subject to change.

AMD
together we advance_



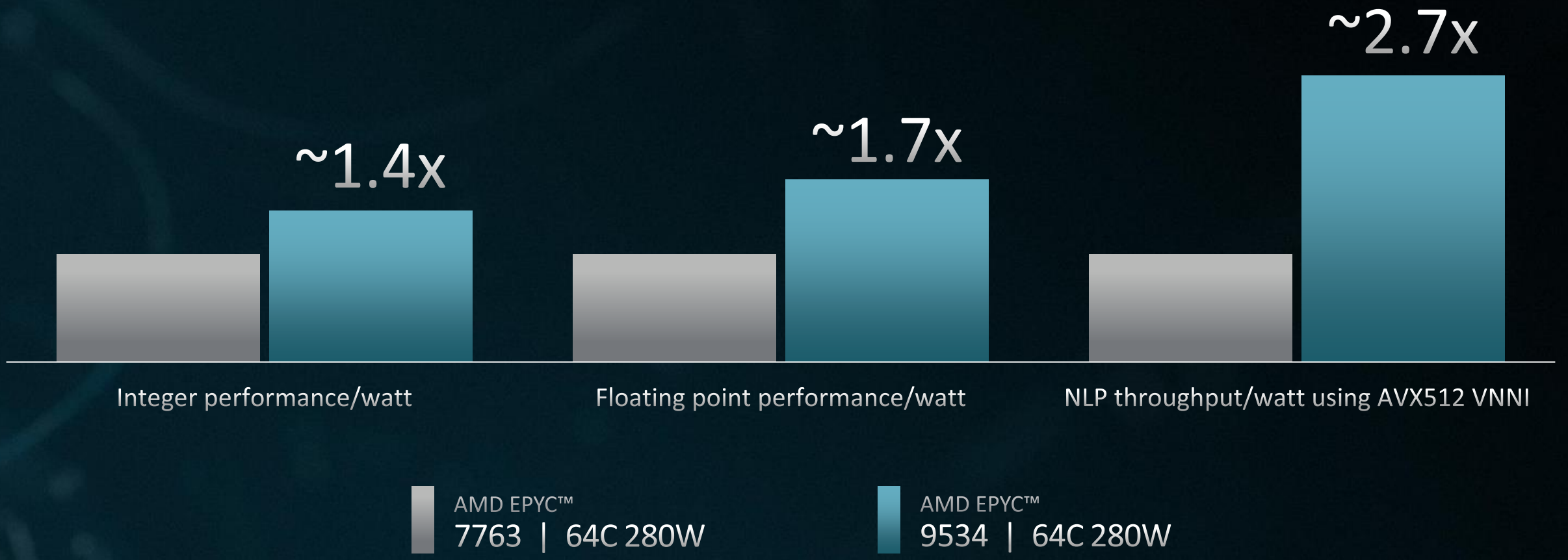
4TH GEN AMD EPYC™ CPUs

Engineering leadership

Leadership efficiency, unmatched enterprise value

Full Solutions Ecosystem

推動性能和效率的疊代突破

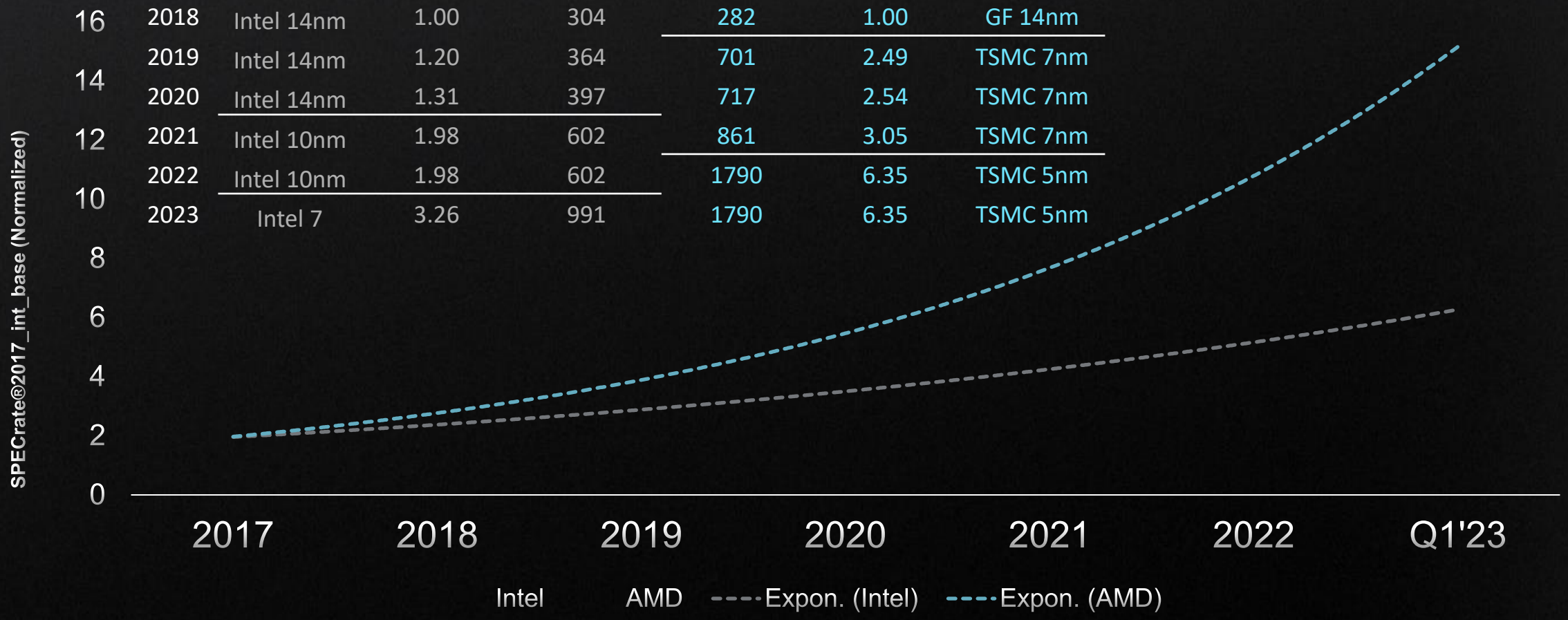


Endnote: SP5-068

[Public]

提升資料中心效能

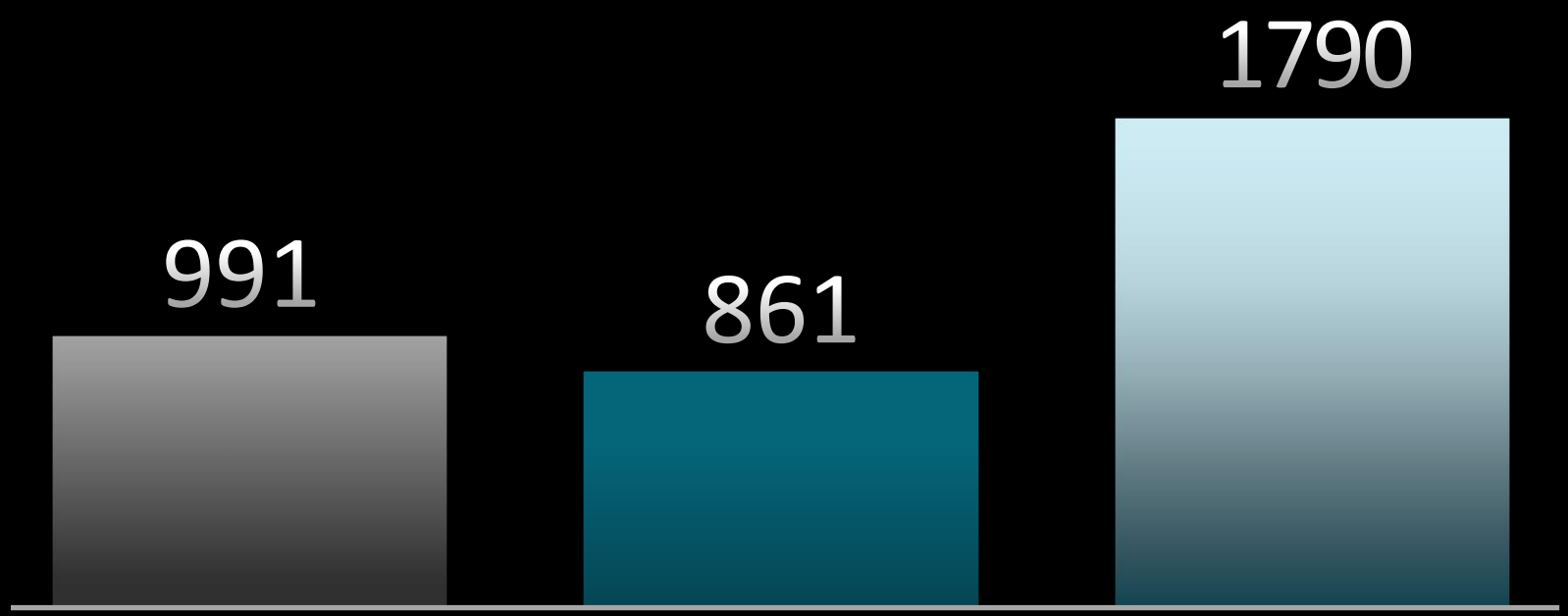
Year	Intel 製程	Intel 效能提升倍數	Intel 最高效能分數	AMD 最高效能分數	AMD 效能提升倍數	AMD 製程
2018	Intel 14nm	1.00	304	282	1.00	GF 14nm
2019	Intel 14nm	1.20	364	701	2.49	TSMC 7nm
2020	Intel 14nm	1.31	397	717	2.54	TSMC 7nm
2021	Intel 10nm	1.98	602	861	3.05	TSMC 7nm
2022	Intel 10nm	1.98	602	1790	6.35	TSMC 5nm
2023	Intel 7	3.26	991	1790	6.35	TSMC 5nm



As of 1/11/2023. See Endnotes SP5-021B.

Cloud Performance Leadership

Most Threads per Rack for Hyperscale Deployments



4th Gen AMD EPYC™ CPU

~1.8x

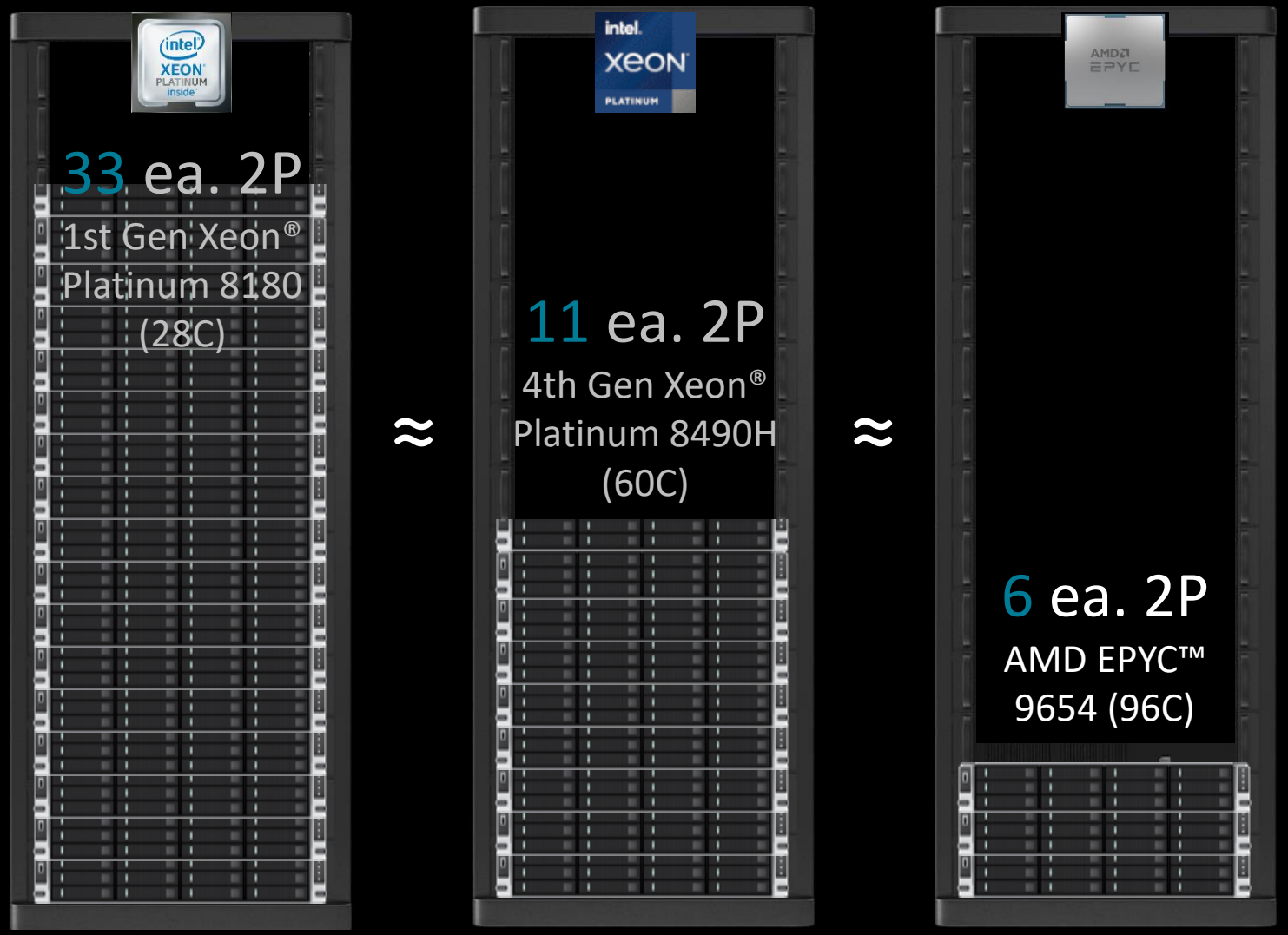
Performance
vs. Competition

2P Integer Throughput

SPECrate®2017_int_base

Results May Vary. See Endnotes SP5-013B

使用更少的雙路伺服器推進更新



Servers needed >10,000 total SPECrate®2017_int_base score

是時候升級舊的 28C 第一代 Xeon® Platinum 8180 ("Skylake-SP") 伺服器了嗎?

對於比較的性能*:

- 購買基於 11x 60C 2P 第 4 代 Xeon® Platinum 8490H 的伺服器

或者

- 僅購買 6x 基於 96C 第 4 代 AMD EPYC™ 9654P 的雙路伺服器

額外的潛在好處:

- 降低 Opex 電源/冷卻和管理成本
- 極大化機房的空間效率

*2P SPECrate®2017_int_base scores on published scores at SPEC.org to meet 10,000 total base score at the rack level found as of 11/10/22. See SP5-041A.

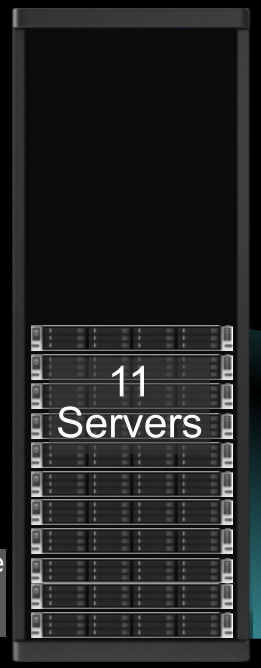
AMD
together we advance_

[Public]

更少的伺服器，更少的功耗，導致碳排放的降低

10,000 分整數運算效能 (SPECrate® 2017_int_base)
頂級型號比較

2P INTEL® Platinum 8490H



Integer score 991 per server

1320 Cores

~174k kWh per year

EPYC Savings
(Estimated)

- 13% up to 更少核心數
- 45% up to 更少伺服器及處理器
- 45% up to 更少每年功耗
- ~43 英畝美國森林每年相當碳封存[2]

2P AMD EPYC™ 9654

Integer score 1790 per server

1152 Cores

~95k kWh per year

AMD EPYC 同時提供

- 46% up to 年度OPEX降低[1]
- 54% up to 三年TCO降低[1]

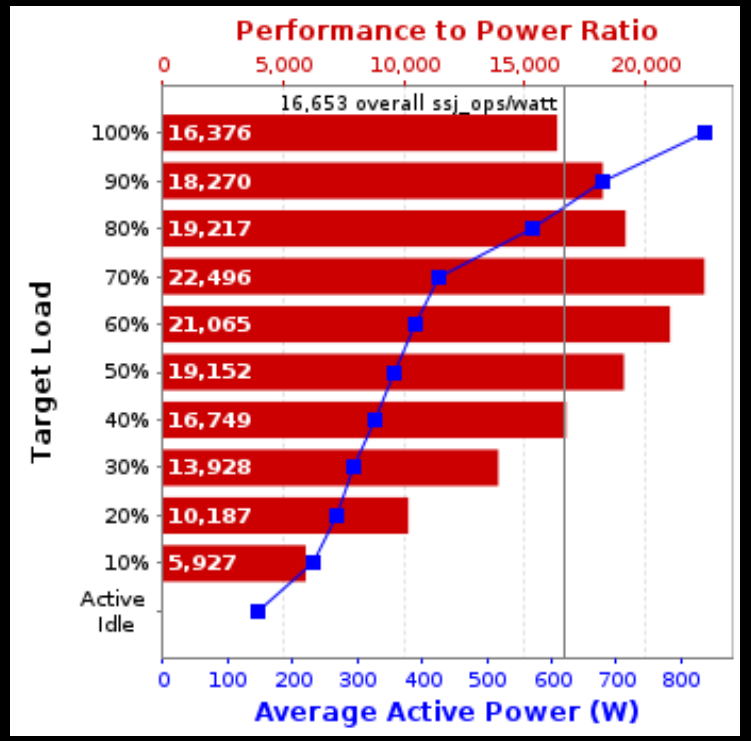
SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

Analysis based on the AMD EPYC™ Bare Metal Server & Greenhouse Gas Emission TCO Estimation Tool - version 6.80.
AMD processor pricing based on 1KU price as of Jan 2023. Intel® Xeon® Scalable CPU data and pricing from https://ark.intel.com as of Jan 2023. All pricing is in USD.
[1] TCO time frame of 3-year and includes estimated costs for real estate, admin and power with power @ $0.16/kWh with 8kW / rack and a PUE of 1.7. Software cost as well as networking and storage power external to the server are not included in this analysis. [2] Values are for USA.

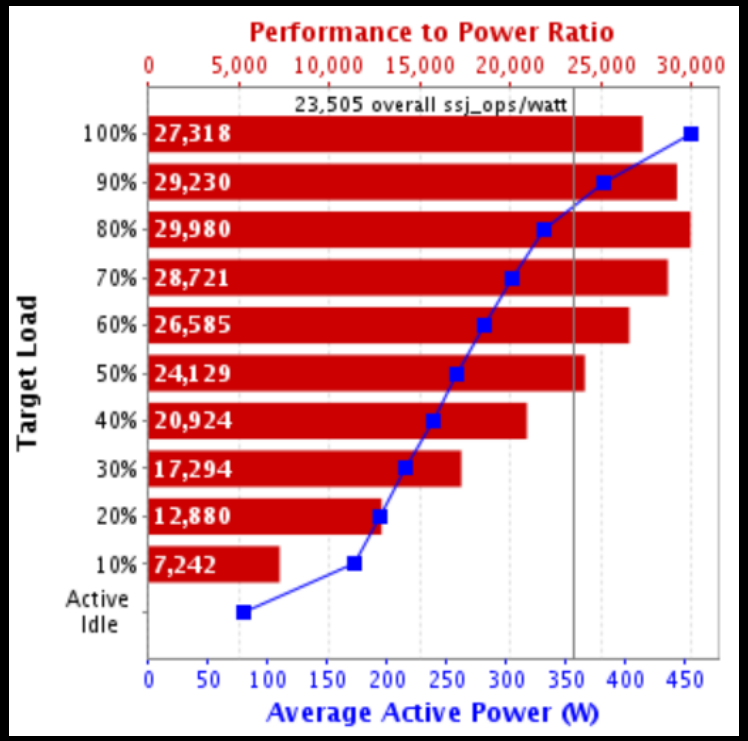
See endnote SP5TCO-032

[Public]

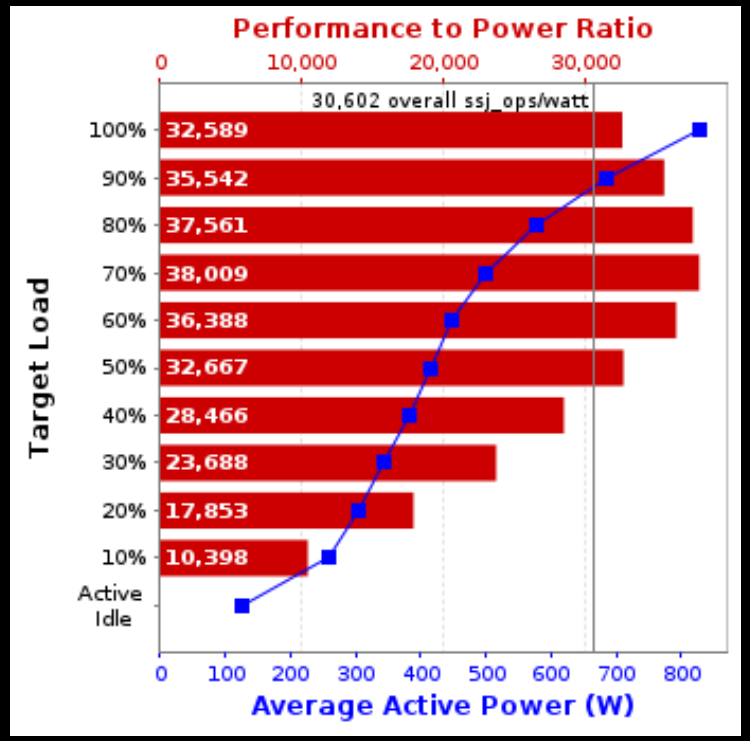
3rd and 4th Gen EPYC™ CPUs Lead in Performance/Server Watt



2P 56C Xeon® Platinum 8480+
½ the 100% throughput – higher idle



2P 64C EPYC™ 7763
Higher ssj_ops/W - every target level of CPU utilization



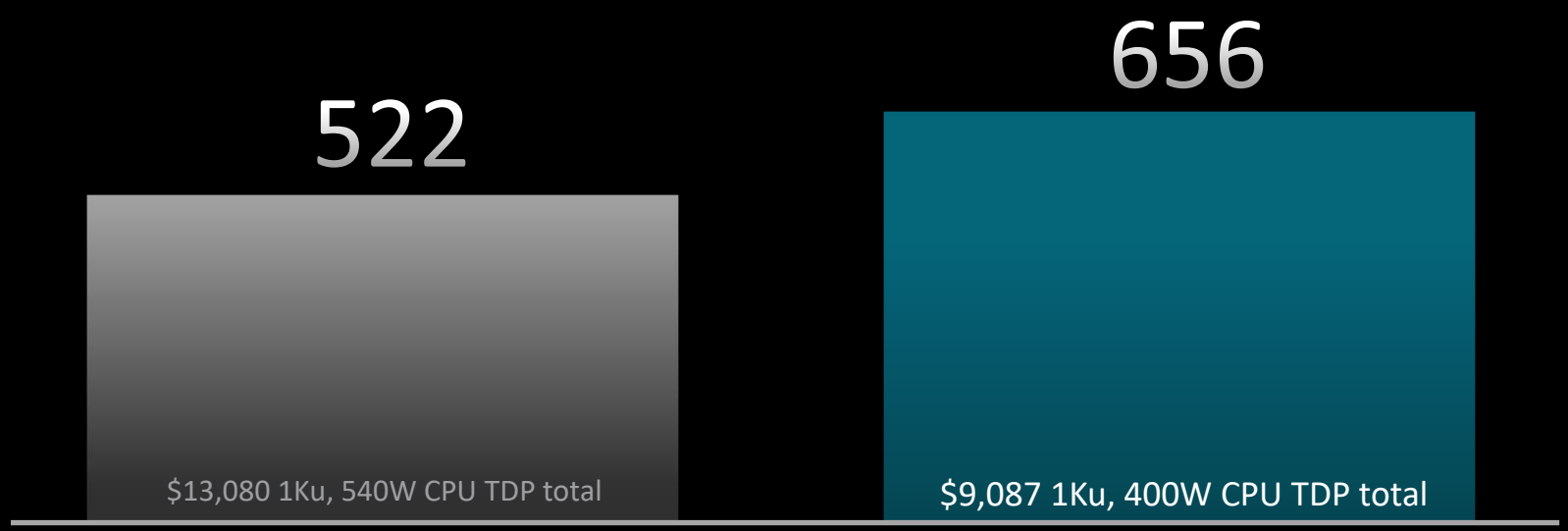
2P 96C EPYC 9654
Overall highest ssj_ops/W – efficient use of W @ target levels

As of 1/11/2023. See Endnotes SP5-011C.

AMD
together we advance_

沒有任何妥協, 單路解決方案領導地位

1P 64C AMD EPYC™ vs. 2P 32C Xeon® 8454H 整數運算效能



4th Gen Xeon® Platinum
2x 8454H

64 Total Cores

4th Gen EPYC™
1x 9554P

64 Total Cores

4th Gen AMD EPYC™ CPU

26% 更多效能

26% 更少功耗

更低 CPU 成本

vs. Competition

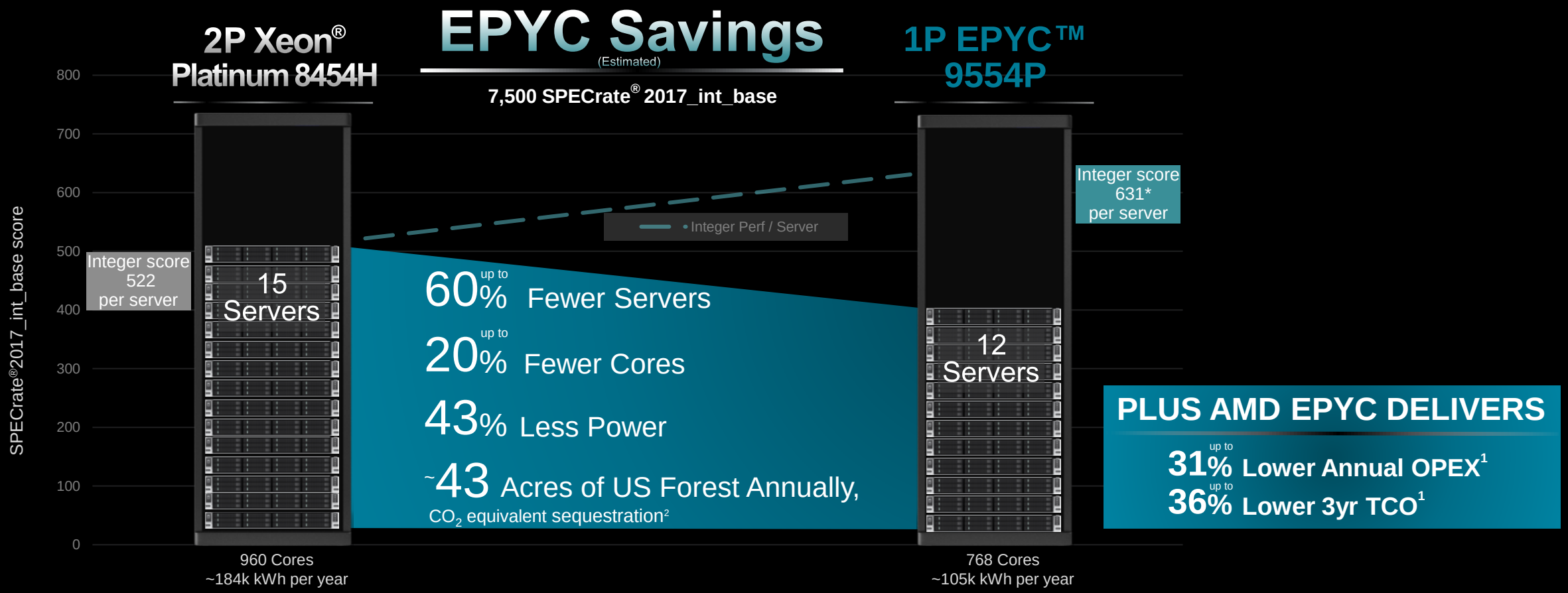
1P EPYC™ vs. 2P Xeon® CPUs
Integer Throughput
SPECrate®2017_int_base

Results May Vary. See Endnotes SP5-069A.

[Public]

Fewer Servers, Less Power, Leading to Lower Emissions

1P 64C 4th Gen EPYC™ vs. 2P 32C 4th Gen Xeon® CPU-server solution



See endnote SP5TCO-029

SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

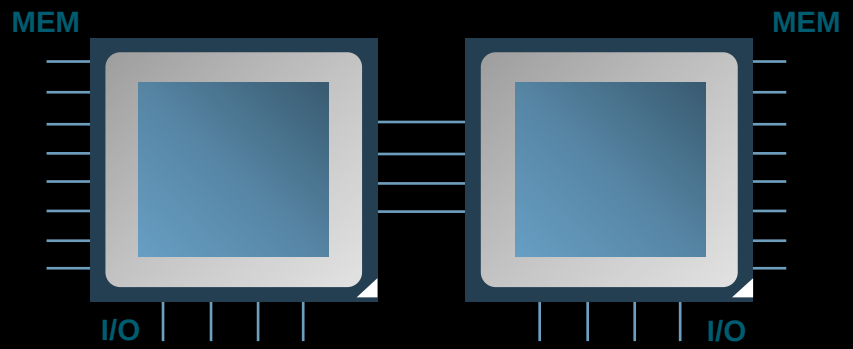
Analysis based on the AMD EPYC™ Bare Metal Server & Greenhouse Gas Emission TCO Estimation Tool - version 6.80.
AMD processor pricing based on 1KU price as of Jan 2023. Intel® Xeon® Scalable CPU data and pricing from https://ark.intel.com as of Jan 2023. All pricing is in USD.
[1] TCO time frame of 3-year and includes estimated costs for real estate, admin and power with power @ $0.16/kWh with 8kW / rack and a PUE of 1.7. Software cost as well as networking and storage power external to the server are not included in this analysis. [2] Values are for USA.

AMD
together we advance_

[AMD Official Use Only - General]

換一個思考方向的時候到了

達成效率而且不需要妥協

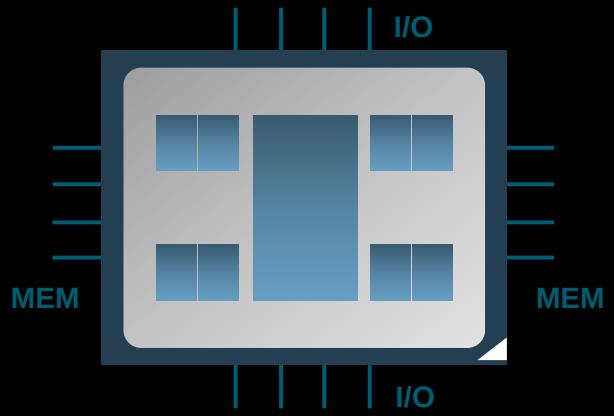


為何人們要買雙路伺服器?

- 運算效力需求
- IO或記憶體需求
- 一直以來都這樣買，為何需要改變?
- 雙路伺服器提供冗餘的錯誤認知

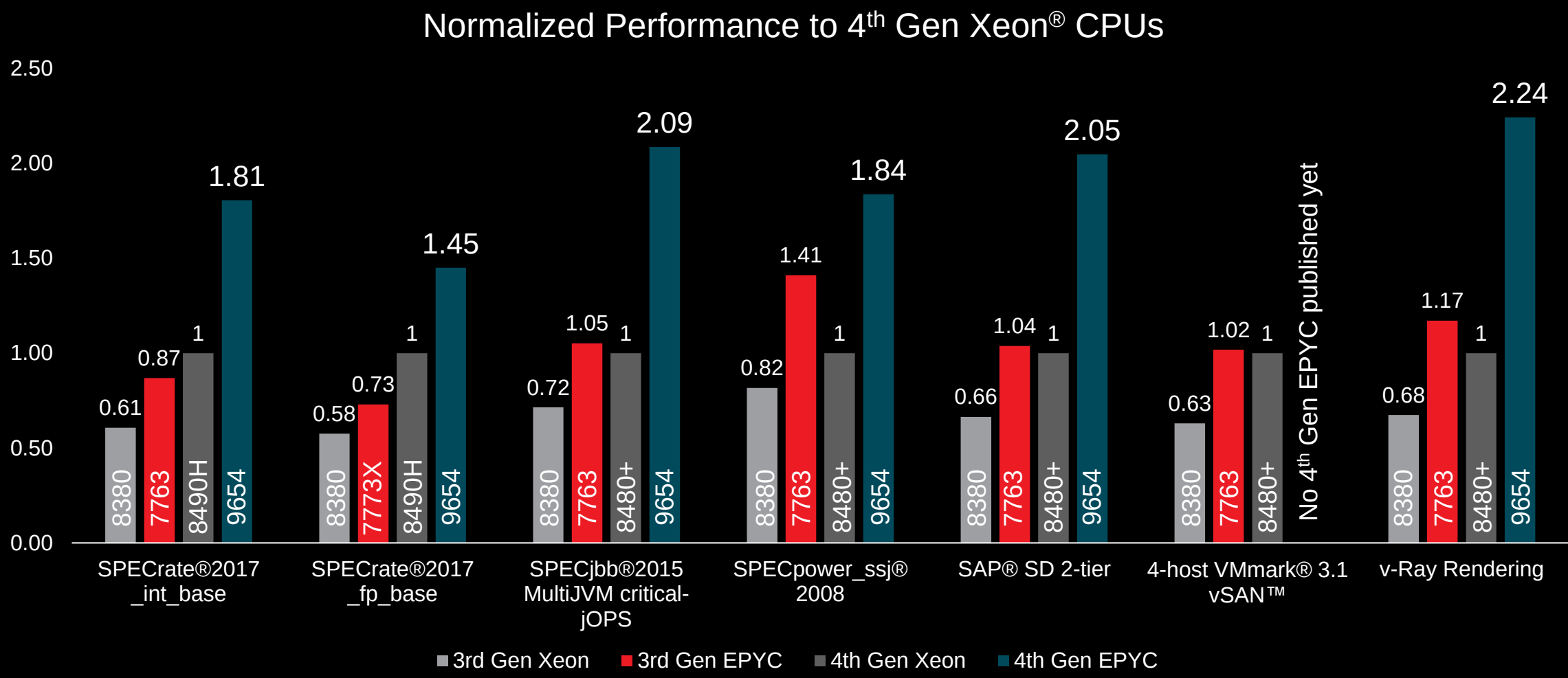
AMD EPYC™ 處理器 改變你對單路伺服器的觀念:

- 一顆CPU就能提供雙路的效能和功能*
- 能源效益
- 減少跨CPU時產生的記憶體延遲
- 結構成本效益
- 運算效率



[Public]

UNDENIABLE 4TH GEN EPYC™ CPU LEADERSHIP

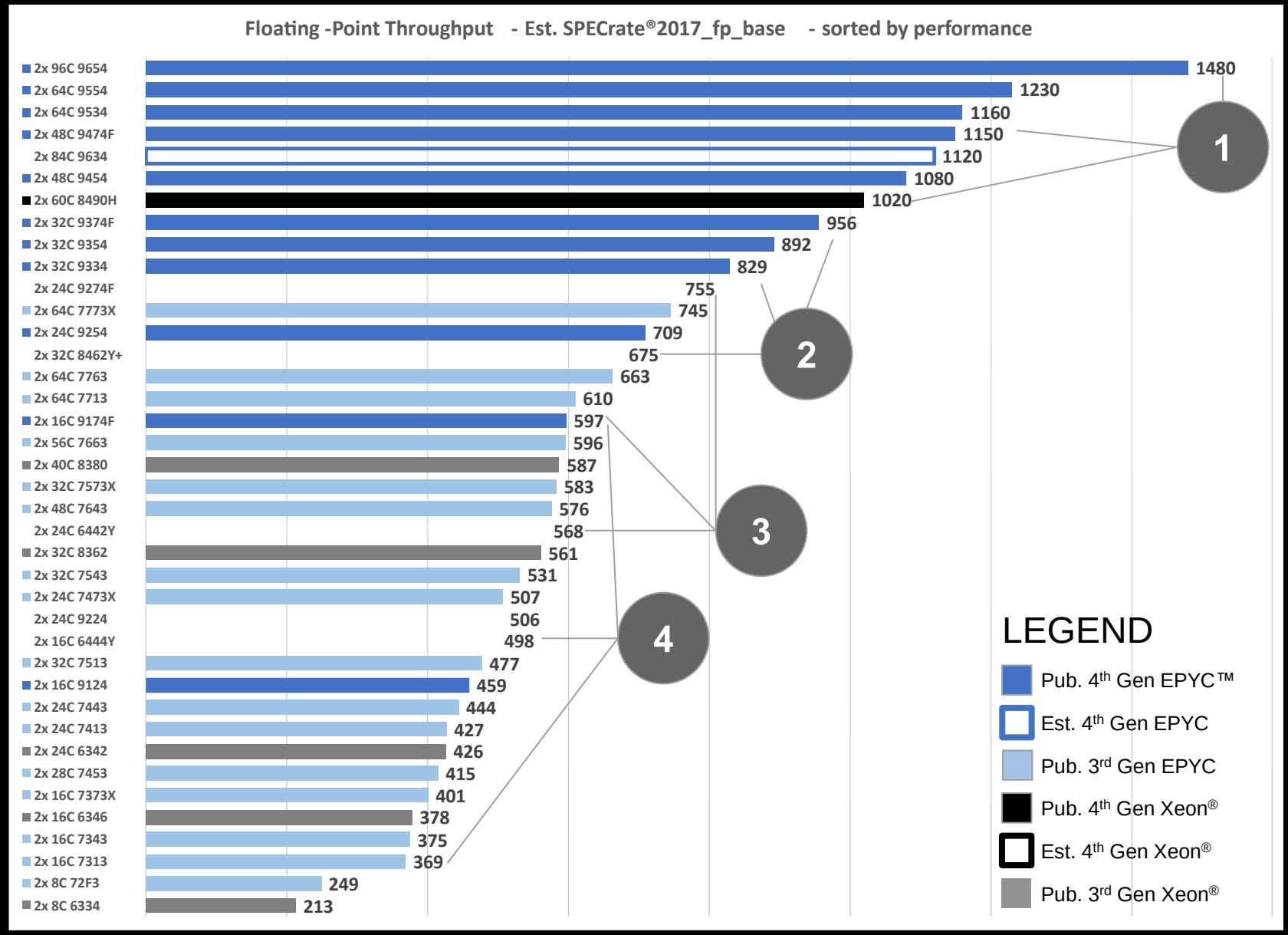


As of 1/11/2023. See Endnotes MLN-129A, SP5-009D, SP5-011C, SP5-013B, SP5-038B, SP5-056A, SP5-100, SP5-104.

AMD
together we advance_

[Public]

By Model Floating-Point Throughput Performance Comparisons



1. Top 60C Xeon 8490H = 1020
   - Top EPYC 9654 leads by 45%
   - 48C EPYC 9474F beats it by 13%
   - All >=48C EPYC CPUs all >1000

2. Top 32C Xeon 8462Y = 675 est.
   - EPYC 9374F leads by ~42%
   - EPYC 9334 has exceptional perf/CPU$ & PPW

3. Top 24C Xeon 6442Y = 568 est.
   - EPYC 9274F exceeds by ~33%
   - 16C EPYC 9174F edges

4. Top 16C Xeon 6444Y = 498 est.
   - EPYC 9174F leads by ~20%
   - EPYC 7313 competitive choice for perf/CPU$ & PPW

As of 1/11/2023. See Endnotes SP5-009D, SP5-024C, SP5-025B, SP5-026A, SP5-027B. See slide 56 for source information.

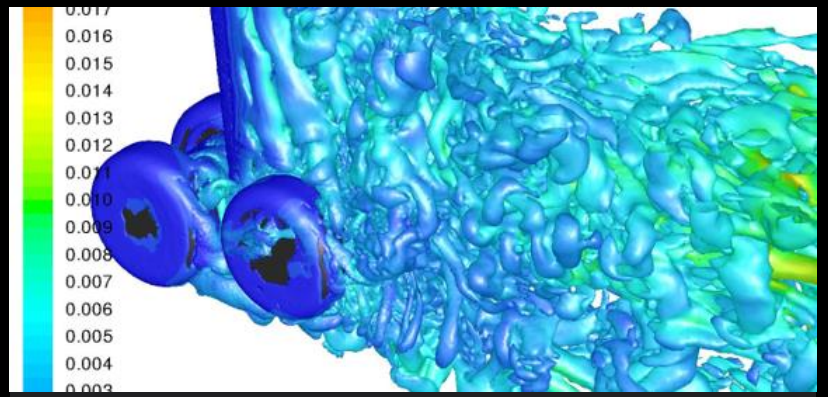
AMD
together we advance_

HPC Per-Core Performance Leadership

Faster Time to Discovery at Equal Core Counts

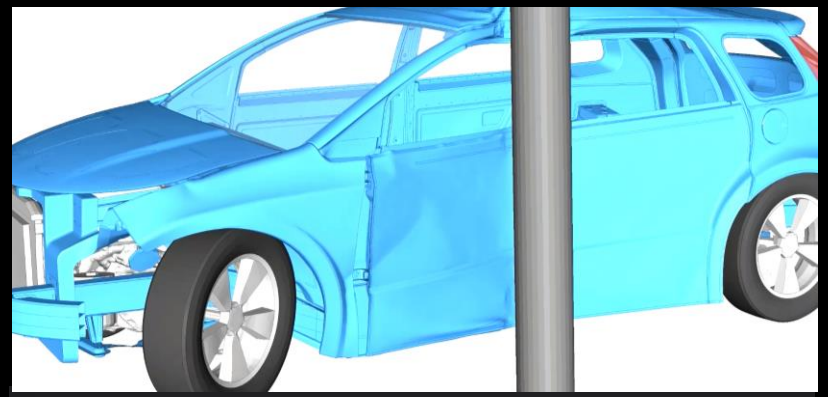
Weather Forecasting

~2x WRF®
-CONUS 2.5km



Computational Fluid Dynamics

~1.7x Ansys Fluent®
- 2022 R2 Test Cases



Finite Element Analysis - Explicit

~1.7x Altair Radioss™
- Neon test case

2P AMD EPYC™ 9374F (32C) vs. 2P Xeon® Platinum 8362 (32C)

Results may vary. As of 11/10/2022, see endnotes SP5-033, -035A, -037.

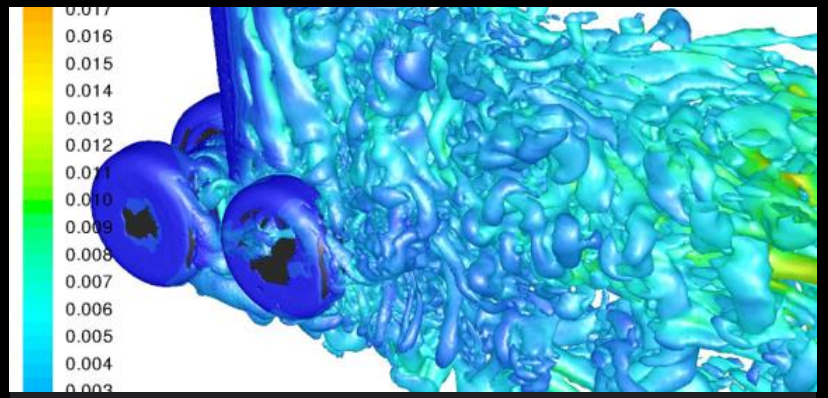
AMD
together we advance_

HPC Throughput Performance Leadership

Faster Time to Solution With High Core Counts and Memory Bandwidth

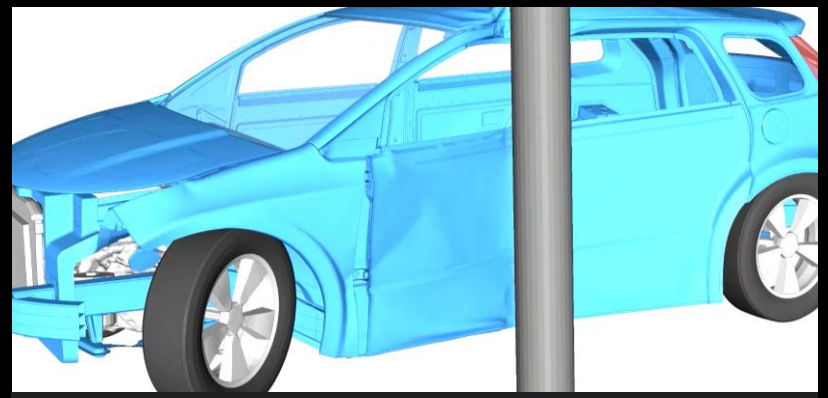
Weather Forecasting

~2.5x WRF®
-CONUS 2.5km



Computational Fluid Dynamics

~2.5x Ansys Fluent®
- 2022 R2 Test Cases



Finite Element Analysis - Explicit

~2.6x Altair Radioss™
- Neon test case

2P AMD EPYC™ 9654 (96C) vs. 2P Xeon® Platinum 8380 (40C)

Results may vary. As of 11/10/2022 See endnotes SP5-032, -034A, -036.

AMD
together we advance_

Enabling Complete Software Ecosystem

GD-83: Use of third-party marks / logos/ products is for informational purposes only and no endorsement of or by AMD is intended or implied.

[Public]

為何 AMD 能贏得份額?

執行 | 信任 | 差異化 | 產品藍圖

AMD 提供...

...這可以幫助客戶

效能，效能，效能	每瓦特效能	單路伺服器策略
▪ 減少開發時程 ▪ 讓決策更快 ▪ 更大的伺服器集縮 ▪ 最大化軟體授權投資	▪ 減少電力消耗 ▪ 降低資料中心碳足跡 ▪ 最大化每虛擬機，每使用者，每機櫃效能	▪ 提高非CPU受限型工作負載的電源效率 ▪ 降低伺服器成本 ▪ 最佳資源使用效率

降低持有成本 / 加速價值實現

AVAILABLE IN SYSTEMS Q2 2022

AMD RYZEN™ PRO 6000 SERIES

ZEN3+

"ZEN 3+" CORE

Incredible Performance-per-Watt in x86 Mobile Processors

AMD RDNA 2

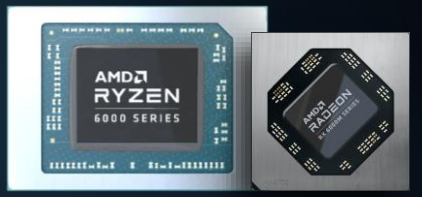
AMD RDNA™ 2 GRAPHICS

A Massive Leap in Performance For Notebook Graphics

6nm

TECHNOLOGY

Higher Processor Performance With Greater Power Efficiency



CONNECTED PLATFORM

LPDDR5/DDR5, PCIE®4.0, USB4, WiFi 6E

[Public]

HOW DOES THE RYZEN™ 5 PRO STACK UP?

COMPARING SPECS AND FEATURES TO 12TH GEN CORE I5

MODEL	AMD Ryzen™ 5 PRO 6650U	Intel Core i5-1250P Intel Core i5-1240P Intel Core i5-1245U Intel Core i5-1235U
PERFORMANCE CORES	6	P Series: 4 U Series: 2
PROCESS	6NM	10NM (Intel 7)
MAX BOOST (up to)	4.5 GHz	4.40 GHz
CACHE	19 MB	12 MB
BASE TDP	15-28W	P Series: 28W U Series: 15W

AMD COMPETITIVE ADVANTAGE	
TECHNOLOGY ✓	Most advanced x86 technology enables leadership battery life
PERFORMANCE ✓	More high-performance cores for faster multitasking, applications
SIMPLICITY ✓	Single, scalable part spans 15W – 28W. Reduces complexity of evaluation and ordering.

See endnotes GD-150, GD-203.

AMD

HOW DOES THE RYZEN™ 7 PRO STACK UP?

COMPARING SPECS AND FEATURES TO 12TH GEN CORE I7

MODEL	AMD Ryzen™ 7 PRO 6850U	Intel Core i7-1280P Intel Core i7-1270P Intel Core i7-1265U Intel Core i7-1260P Intel Core i7-1260U Intel Core i7-1255U Intel Core i7-1250U
PERFORMANCE CORES	8	P Series: 6 U Series: 8
PROCESS	6NM	10NM (Intel 7)
MAX BOOST (up to)	4.7 GHz	4.8 GHz
CACHE	20 MB	12 MB
BASE TDP	15-28W	P Series: 28W U Series: 15W

AMD COMPETITIVE ADVANTAGE	
TECHNOLOGY ✓	Most advanced x86 technology enables leadership battery life
PERFORMANCE ✓	More high-performance cores for faster multitasking applications
SIMPLICITY ✓	Single, scalable part spans 15W – 28 W. Reduces complexity of evaluation and ordering.

[Public]

LEADING BATTERY LIFE WITH AMD RYZEN™ PROCESSORS

- TOP-RANKED OVERALL BATTERY LIFE IN INDUSTRY-STANDARD BENCHMARK
- LONGER BATTERY LIFE THAN THE COMPETITION FOR MICROSOFT TEAMS.
- UP TO AN AMAZING 29-HOUR BATTERY LIFE FOR VIDEO PLAYBACK

Up to

26 HRS

AMD Ryzen™ 7 6800U ranked #1 and #2 on MobileMark 2018

Up to

+45%

Better Teams battery life AMD Ryzen™ 7 PRO 6850U vs Intel Core i7-1260P

Up to

29 HRS

Video playback battery life with the AMD Ryzen™ 7 6800U in the HP Elitebook 865 G9

See endnotes RMP-32, RMP-33, RMP-39

AMD

AMD-BASED CHROMEBOOKS FOR EDUCATION MARKET

ENTRY → IMMERSIVE LEARNING

HP Chromebook c645 14”
AMD Athlon 3000 Series

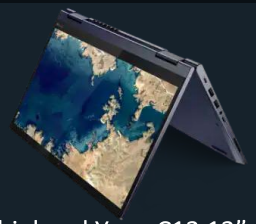
HP Chromebook 14 c645”
AMD Ryzen 3000 Series

HP Chromebook 14 c645”
AMD Ryzen 5000 Series

Chromebook Spin 514 14”
AMD Athlon 3000 Series

Chromebook Spin 514 14” **AMD**
AMD Ryzen 3000 Series

Chromebook Spin 514 14” **AMD**
AMD Ryzen 5000 Series



Thinkpad Yoga C13 13”
AMD Athlon 3000 Series

Thinkpad Yoga C13 13”
AMD **Ryzen 3000 Series**

Chromebook 15” Flip CM5
AMD Ryzen 3000 Series

COMING SOON
RYZEN™ and Athlon
7020C SERIES

AMD
together we advance_data centers

[Public]

AMD EPYC™-BASED SERVER PLATFORMS

PERFORMANCE, FLEXIBILITY, SCALABILITY, SECURITY AND OUTSTANDING BUSINESS VALUE

	DELL Technologies	Hewlett Packard Enterprise	Lenovo	SUPERMICRO	CISCO
APPLIANCES	R6515 (1U1P) R7525 (2U2P) R7515 (2U1P) C6525 R6525 (1U2P) XE8545	DL325 (1U1P) DL385 (2U2P) DL345 (2U1P) Apollo 2000/6500 DL365 (1U2P) HPE Cray EX	SR635 (1U1P) SR655 (2U1P) SR645 (1U2P) SR665 (2U2P)	Ultra TwinPro WIO FatTwin CloudDC SuperBlade BigTwin Mainstream	UCS C125 UCS C245 UCS C225 CUCS 4200
APPLIANCES	VxRail™ *(VMware®)* XC Series *(Nutanix™)* Microsoft® Azure Stack HCI AX	Nimble dHCI ProLiant® DX *(Nutanix)* SimpliVity™	ThinkAgile HX *(Nutanix)* ThinkAgile VX *(VMware®)*		FlashStack™ with PureStorage®* FlexPod® With NetAPP®* *Note: Converged Solutions
SOLUTIONS	VMware® ReadyNodes™ Dell EMC Ready Architectures for VDI *(Citrix & Horizon)*	VMware® ReadyNodes Azure Stack HCI VDI Solutions *(Citrix & Horizon)*	ThinkAgile HX Certified Node ThinkAgile VX Certified Node VMware® ReadyNodes VDI Solutions *(Citrix & Horizon)*	VMware® ReadyNodes Reference Architecture for: ▪ VDI – Horizon ▪ Red Hat® Ceph ▪ Weka.IO ▪ OpenStack® ▪ Kubernetes® / OpenShift®	

Note: Solutions include 2nd and 3rd Generation AMD EPYC CPUs. Use of third-party marks / logos/ products is for informational purposes only and no endorsement of or by AMD is intended or implied. GD-83

AMD

HPE 2023 Portfolio

with AMD EPYC™ Second, Third, and Fourth Generation Processors

Enterprise

DL325 Gen11

4th Gen EPYC™

DL365 Gen11

4th Gen EPYC™

DL365 Gen10 Plus

2nd Gen* & 3rd Gen EPYC™

DL385 Gen11

4th Gen EPYC™

DL345 Gen11

4th Gen EPYC™

DL345 Gen10 Plus

2nd Gen* & 3rd Gen EPYC™

SimpliVity 325

2nd Gen* & 3rd Gen EPYC™

DL385 Gen10 Plus v2

3rd Gen EPYC™

DL325 Gen10 Plus v2

3rd Gen EPYC™

Apollo/Cray

Apollo 2000 Gen10 Plus

2nd Gen & 3rd Gen EPYC™

Apollo 6500 Gen10 Plus

2nd Gen, 3rd Gen EPYC ™

& MI100

Cray XD 2000 Gen11

4th Gen EPYC™

Cray XD 6500 Gen11

4th Gen EPYC™

Supercomputing

HPE EX

2nd Gen, 3rd Gen EPYC ™

& MI200

Apollo 9000

2nd Gen & 3rd Gen EPYC™

ClusterStor E1000

2nd Gen & 3rd Gen EPYC™

Storage

HPE Alletra 6000

2nd Gen EPYC™

DX385 Gen10 Plus

2nd Gen EPYC™

DX325 Gen10

2nd Gen EPYC™

AMD

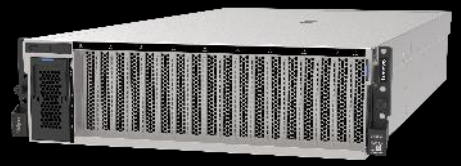
* Partial 2nd Gen EPYC™ Support

Lenovo releases new ThinkSystem V3 Servers

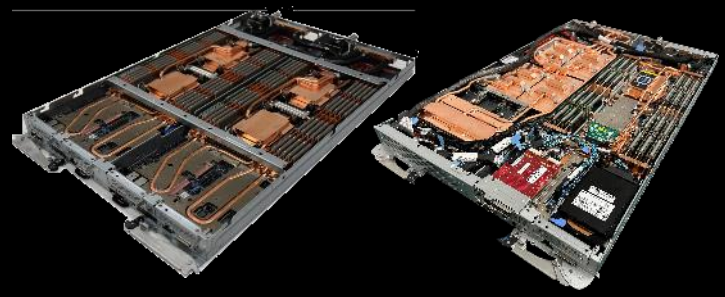
Powered by 4th Generation AMD EPYC™ processors

- SR635 V3
- SR645 V3

- SR655 V3
- SR665 V3



- SR675 V3



- SD665 V3
- SD665-N V3

New System Mgt | **Enhanced Security** | **Delivered as a Service** | **Built for AI** | **Environmentally Friendly**

Accelerated Compute

- **World records for SPEC ACCEL Peak and Base**
- **Up to 86% increase** in performance

Compute with Confidence

- **Most reliable x86 platforms** for the 8th year*

Industry-leading performance

- Lenovo and AMD have amassed over **101 World Benchmarking Records, more than 2x Lenovo's competition**

Supercomputing leadership

- Helping customers solve **humanities greatest challenges** with Supercomputers

7 new ThinkSystem V3 Servers

- **Workloads of any size**, for SMBs to Hyperscalers

A proven portfolio that delivers performance when and where you need it most!

Lenovo 2022 Lenovo. All rights reserved.

Content provided by Lenovo and not independently verified by AMD.

Endnotes

GD-183: AMD Infinity Guard features vary by EPYC™ Processor generations. Infinity Guard security features must be enabled by server OEMs and/or Cloud Service Providers to operate. Check with your OEM or provider to confirm support of these features. Learn more about Infinity Guard at https://www.amd.com/en/technologies/infinity-guard.

EPYC-018: Max boost for AMD EPYC processors is the maximum frequency achievable by any single core on the processor under normal operating conditions for server systems.

EPYC-028B: SPECpower_ssj® 2008, SPECrate®2017_int_energy_base, and SPECrate®2017_fp_energy_base based on results published on SPEC's website as of 11/10/22. VMmark® server power-performance (PPKW) based results published at https://www.vmware.com/products/vmmark/results3x.1.html?sort=score. The first 74 ranked SPECpower_ssj®2008 publications with the highest overall efficiency overall ssj_ops/W results were all powered by AMD EPYC processors. For SPECrate®2017 Integer (Energy Base), AMD EPYC CPUs power the first 4 of 5 SPECrate®2017_int_energy_base performance/system W scores. For SPECrate®2017 Floating Point (Energy Base), AMD EPYC CPUs power the first 8 of 9 SPECrate®2017_fp_energy_base performance/system W scores. For VMmark® server power-performance (PPKW), have the top two results for 2- and 4-socket matched pair results outperforming all other socket results. See https://www.amd.com/en/claims/epyc3x#faq-EPYC-028B for the full list. More information about SPEC® is available at http://www.spec.org. SPEC, SPECrate, and SPECpower are registered trademarks of the Standard Performance Evaluation Corporation. VMmark is a registered trademark of VMware in the US or other countries.

EPYC-038: Based on AMD internal testing as of 09/19/2022, geomean performance improvement at the same fixed-frequency on a 4th Gen AMD EPYC™ 9554 CPU compared to a 3rd Gen AMD EPYC™ 7763 CPU using a select set of workloads (33) including est. SPECrate®2017_int_base, est. SPECrate®2017_fp_base, and representative server workloads.

SP5-009C: SPECrate®2017_fp_base based on published scores from www.spec.org as of 11/10/2022. Configurations: 2P AMD EPYC 9654 (1480 SPECrate®2017_fp_base, 192 total cores, www.spec.org/cpu2017/results/res2022q4/cpu2017-20221024-32605.html) is 2.52x the performance of published 2P Intel Xeon Platinum 8380 (587 SPECrate®2017_fp_base, 160 total cores, www.spec.org/cpu2017/results/res2022q4/cpu2017-20221010-32542.html).Published 2P AMD EPYC 7763 (663 SPECrate®2017_fp_base, 128 Total Cores, http://spec.org/cpu2017/results/res2021q4/cpu2017-20211121-30146.html) is shown at 1.13x for reference. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

SP5-010B: SPECrate®2017_int_base based on published scores from www.spec.org as of 11/10/2022. Configurations: 2P AMD EPYC 9654 (1790 SPECrate®2017_int_base, 192 total cores, www.spec.org/cpu2017/results/res2022q4/cpu2017-20221024-32607.html) is 2.97x the performance of published 2P Intel Xeon Platinum 8380 (602 SPECrate®2017_int_base, 80 total cores, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210521-26364.html). Published 2P AMD EPYC 7763 (861 SPECrate®2017_int_base, 128 total cores, http://spec.org/cpu2017/results/res2021q4/cpu2017-20211121-30148.html) is shown at 1.43x for reference. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. NOTE: Red text only needs to be included with charts that show the 7763.

SP5-012B: SPECjbb® 2015-MultiJVM Max based on published scores from www.spec.org as of 11/10/2022. Configurations: 2P AMD EPYC 9654 (815459 SPECjbb®2015 MultiJVM max-jOPS, 356204 SPECjbb®2015 MultiJVM critical-jOPS, 192 Total Cores, http://www.spec.org/jbb2015/results/res2022q4/jbb2015-20221019-00861.html) is 2.85x the performance of published 2P Intel Xeon Platinum 8380 (286125 SPECjbb®2015 MultiJVM max-jOPS, 152057 SPECjbb®2015 MultiJVM critical-jOPS, 80 Total Cores, http://www.spec.org/jbb2015/results/res2021q4/jbb2015-20211006-00706.html). 2P AMD EPYC 7763 (420774 SPECjbb®2015 MultiJVM max-jOPS, 165211 SPECjbb®2015 MultiJVM critical-jOPS, 128 total cores, http://www.spec.org/jbb2015/results/res2021q3/jbb2015-20210701-00692.html) shown at 1.47x for reference. SPEC® and SPECjbb® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. NOTE: Red text only needs to be included with charts that show the 7763.

SP5-022: Neural Magic measured results on AMD reference systems as of 9/29/2022. Configurations:2P EPYC 9654 "Titanite" vs. 2P EPYC 7763 "DaytonaX" running on Ubuntu 22.04 LTS, Python 3.9.13, pip==22.12/deepsparse==1.0.2. BERT-Large Streaming Throughput items/sec (seq=384, batch 1, 48 streams, INT8 + sparse) using SQuAD v1.1 dataset; ResNet50 Batched Throughput items/sec (batch 256, single-stream, INT8 sparse) using ImageNet dataset; YOLOv5s Streaming Throughput ([image 3, 640, 640], batch 1, multi-stream, per-stream latency <=33ms) using COCO dataset. Testing not independently verified by AMD.

Endnotes

SP5-085: SPECrate®2017_fp_base comparison based on published scores from www.spec.org as of 11/10/2022. Comparison of published 2P AMD EPYC 9654 (1480 SPECrate®2017_fp_base, 800 Total TDP W, 192 Total Cores, $23610 Total CPU $, http://spec.org/cpu2017/results/res2022q4/cpu2017-20221024-32605.html) is 5.36x the performance of published 2P Intel Xeon Platinum 8180 (276 SPECrate®2017_fp_base, 410 Total TDP W, 56 Total Cores, $20018 Total CPU $, http://spec.org/cpu2017/results/res2019q2/cpu2017-20190506-13573.html) [at 2.75x the performance/W] [at 4.54x the performance/CPU$]. Published 2P Intel Xeon Platinum 8380 (587 SPECrate®2017_fp_base, 540 Total TDP W, 80 Total Cores, $18718 Total CPU $, http://spec.org/cpu2017/results/res2022q4/cpu2017-20221010-32542.html) is shown for reference. AMD 1Ku pricing and Intel ARK.intel.com specifications and pricing as of 11/10/22. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

SP5TCO-009K: As of 11/10/2022 based on AMD Internal analysis using the AMD EPYC™ Bare Metal Server & Greenhouse Gas Emission TCO Estimation Tool - version 6.35 estimating the cost and quantity of 2P AMD EPYC™ 9654 powered servers versus 2P Intel® Xeon® 8380 based server solutions required to deliver 8500 units of integer performance. Environmental impact estimates made leveraging this data, using the Country / Region specific electricity factors from the '2020 Grid Electricity Emissions Factors v1.4 – September 2020', and the United States Environmental Protection Agency 'Greenhouse Gas Equivalencies Calculator'. This scenario contains many assumptions and estimates and, while based on AMD internal research and best approximations, should be considered an example for information purposes only, and not used as a basis for decision making over actual testing. The analysis includes both hardware and virtualization software components. For additional details, see https://www.amd.com/en/claims/epyc3x#faq-SP5TCO-009K.

DISCLAIMER AND ATTRIBUTION

The information contained herein is for informational purposes only and is subject to change without notice. While every precaution has been taken in the preparation of this document, it may contain technical inaccuracies, omissions and typographical errors, and AMD is under no obligation to update or otherwise correct this information. Advanced Micro Devices, Inc. makes no representations or warranties with respect to the accuracy or completeness of the contents of this document, and assumes no liability of any kind, including the implied warranties of noninfringement, merchantability or fitness for particular purposes, with respect to the operation or use of AMD hardware, software or other products described herein. No license, including implied or arising by estoppel, to any intellectual property rights is granted by this document. Terms and limitations applicable to the purchase or use of AMD's products are as set forth in a signed agreement between the parties or in AMD's Standard Terms and Conditions of Sale.

Timelines, roadmaps, and/or product release dates shown in these slides are plans only and subject to change. "Rome", "Milan", "Genoa", "Zen", "Zen2", "Zen3", and "Zen4" are codenames for AMD architectures, and are not product names.

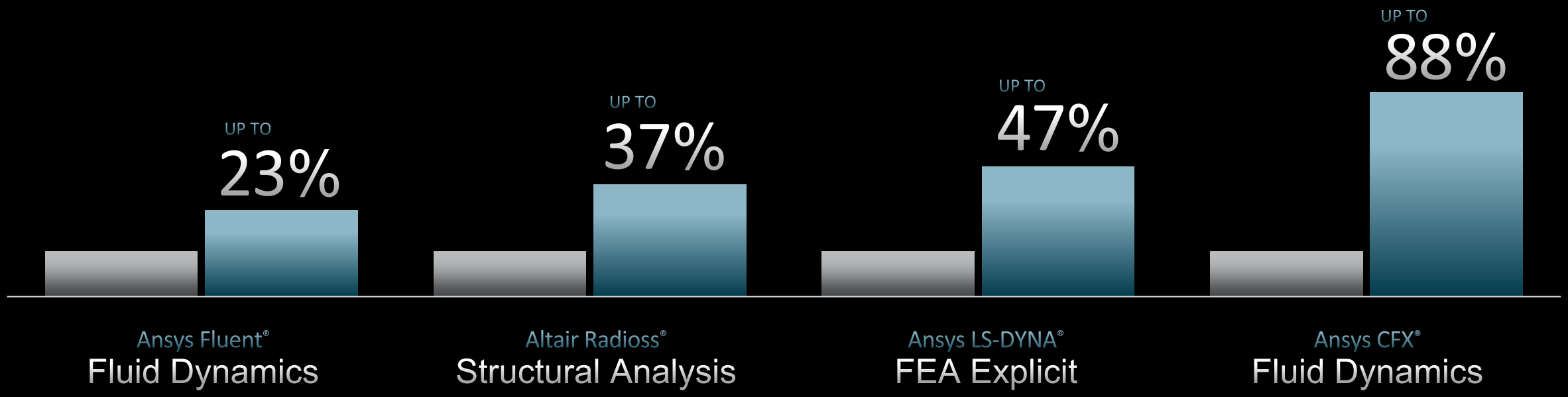
©2022 Advanced Micro Devices, Inc. All rights reserved. AMD, the AMD Arrow logo, AMD EPYC, Infinity Fabric, and combinations thereof are trademarks of Advanced Micro Devices, Inc. Other product names used in this publication are for identification purposes only and may be trademarks of their respective companies. Microsoft SQL Server is a trademark of Microsoft Corporation in the US or other jurisdictions, PCIe - PCIe is a registered trademark of PCI-SIG Corporation, Oracle is a registered mark of Oracle and/or its affiliates, Radioss is a trademark of Altair Engineering, Inc. SPEC®, SPECrate®, and SPECpower® are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org. More information about SPEC® is available at http://www.spec.org. VMmark is a registered trademark of VMware in the US or other countries.

[Public]

3RD GEN AMD EPYC™ CPU WITH AMD 3D V-CACHE™

THE LEADER FOR TECHNICAL COMPUTING WORKLOADS

AVERAGE PER-CORE PERFORMANCE UPLIFT



1-node, 2x AMD EPYC 7#73X vs same core count 3rd Gen Xeon Platinum. Results may vary. RESULTS MAY VARY. SEE ENDNOTES: MLNX-010A, -014, -017, -019

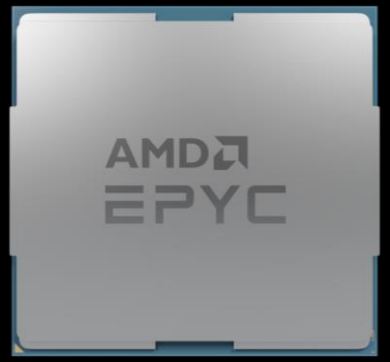
AMD

AMD EPYC

THE BEST GETS EVEN BETTER

300+ 世界紀錄 *且持續增加中*

商用軟體
8 ERM/SCM Business
48 Enterprise server-side Java®
18 Enterprise Energy Efficiency
4 FinTech



大數據 / 數據分析
16 Business Intelligence
6 Structured Database Management
2 Unstructured Analytics Database
9 AI Platform/Text & Media Analytics

雲 / 超融合 / 軟體定義基礎架構
23 Cloud and Virtualization
15 Integer Performance/General Purpose
8 Integer/General-Purpose Energy Efficiency
3 VM Energy Efficiency

高性能運算 / 工程 / 技術
73 Massively Parallel applications
37 Modeling & Simulation
16 Floating Point Compute Intensive apps
12 HPC Energy Efficiency

專業渲染
5 Rendering

數位服務
1 Social Networking BI

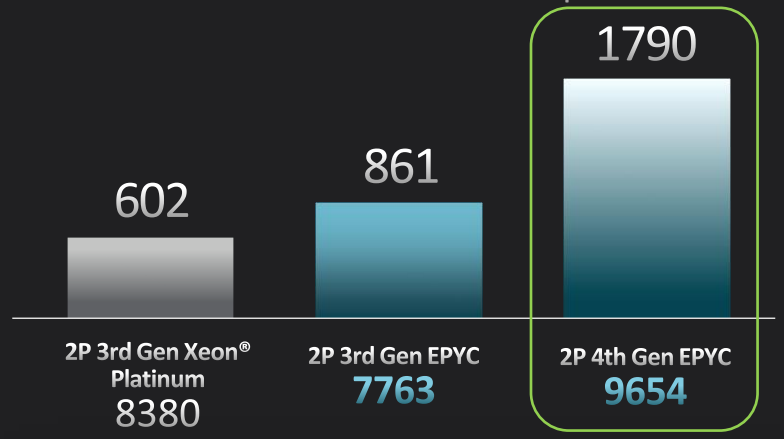
AMD EPYC™ Family of Processors as of 11/10/22, see amd.com/worldrecords for the full list

AMD
together we advance_

Advancing AMD EPYC™ CPU Leadership

Cloud

~3x Performance vs. Competition



Integer Throughput

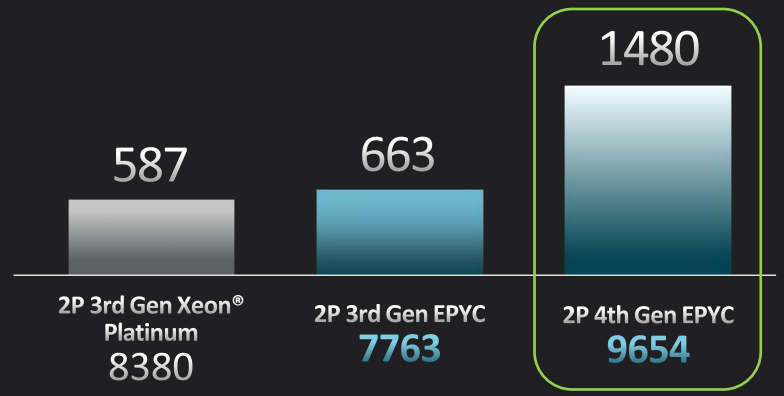
Cloud Service Providers

IaaS/PaaS | Search | Social | SaaS

SPECrate®2017_int_base

HPC

2.5x Performance vs. Competition



Floating-Point Throughput

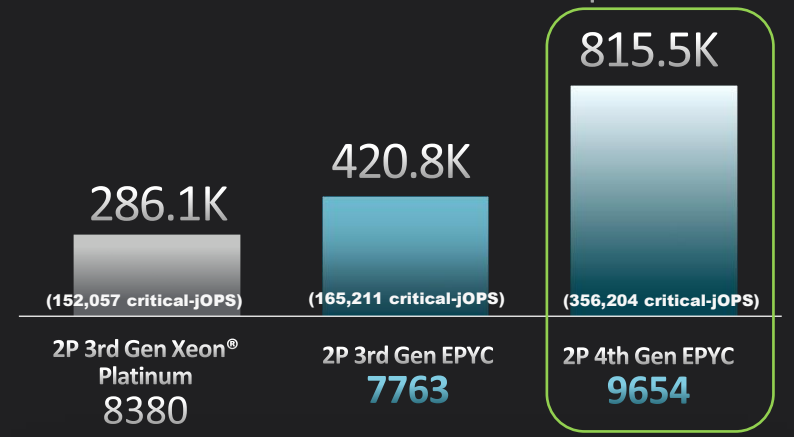
High Performance Computing

Design & Simulation | Research & Academia | Machine Learning | Super Computing

SPECrate®2017_fp_base

Enterprise

2.8x Performance vs. Competition



Server-Side Java® Max Throughput

Enterprise IT

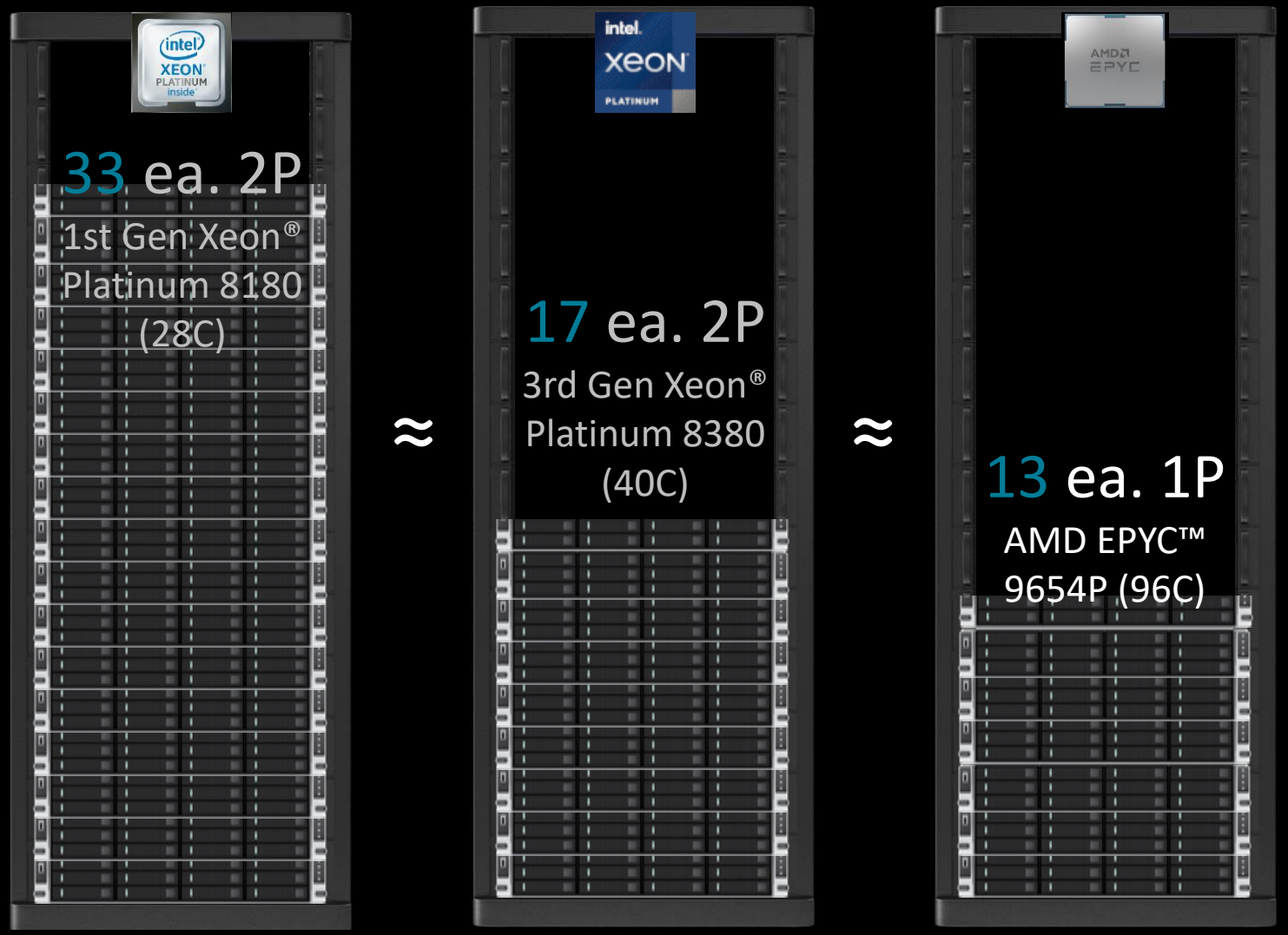
Virtualization | SDS/HCI | Hadoop | NoSQL

SPECjbb®2015 MultiJVM max-jOPS (critical-jOPS)

Results May Vary. See Endnotes SP5-009C, SP5-010B, SP5-012B.

AMD
together we advance_

使用更少的單路伺服器推進更新



Servers needed >10,000 total SPECrate®2017_int_base score

是時候升級舊的 28C 第一代 Xeon® Platinum 8180 ("Skylake-SP") 伺服器了嗎?

對於比較的性能*:

- 購買基於 17x 40C 2P 第 3 代 Xeon® Platinum 8380 的伺服器

或者

- 僅購買 13x 基於 96C 第 4 代 AMD EPYC™ 9654P 的單路伺服器

額外的潛在好處:

- 降低 Opex 電源/冷卻和管理成本
- 極大化機房的空間效率

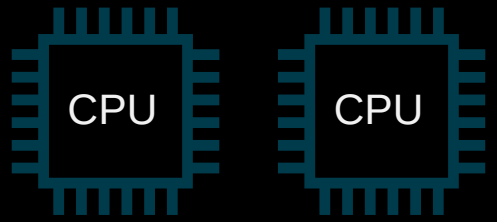
*1P/2P SPECrate®2017_int_base scores on published scores at SPEC.org to meet 10,000 total base score at the rack level found as of 11/10/22. See endnote SP5-090.

AMD
together we advance_

[AMD Official Use Only - General]

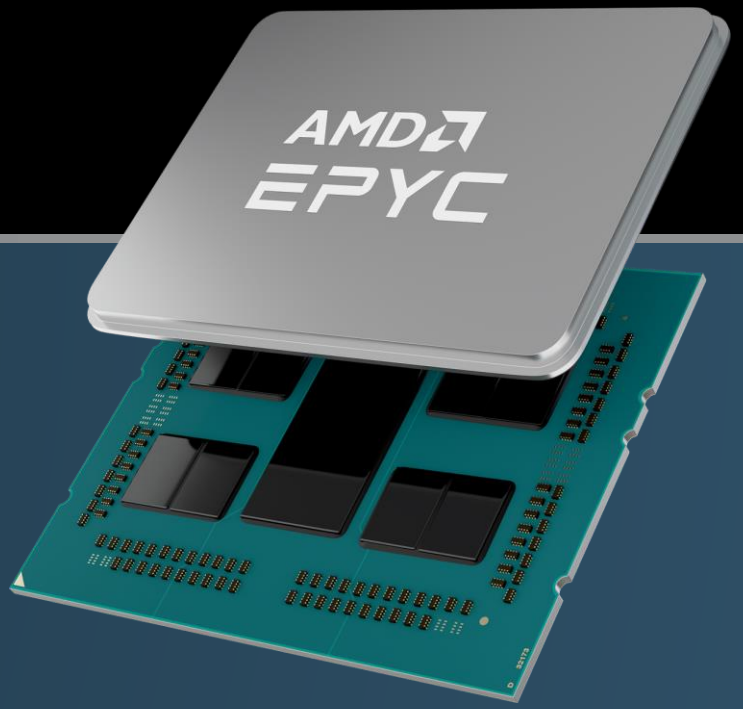
與時俱進的思路

不須妥協就能達到的**能效**



客戶採買雙路伺服器的理由

- 運算需求
- IO 或記憶體需求
- 一直以來都是這樣買，為何要改變?
- 雙路伺服器提供冗餘功能的錯誤認知



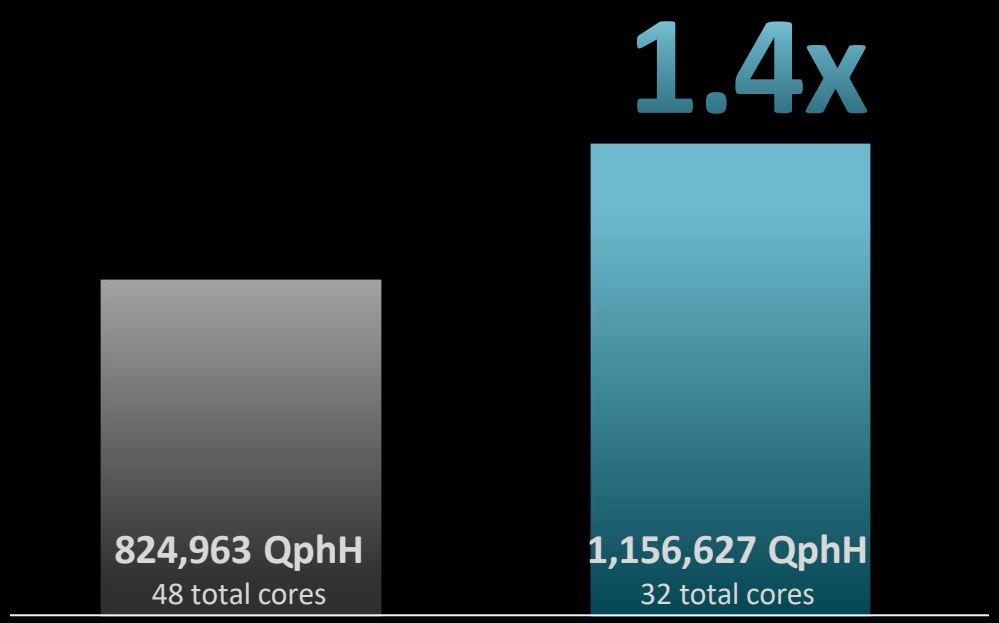
AMD EPYC™ 處理器: 改變你對單路伺服器的觀念

- 一顆CPU就能提供雙路的效能和功能*
- 能源效益
- 減少跨CPU時產生的記憶體延遲
- 架構成本效益
- 運算效率

* Performance comparison is dependent on the servers and applications being compared

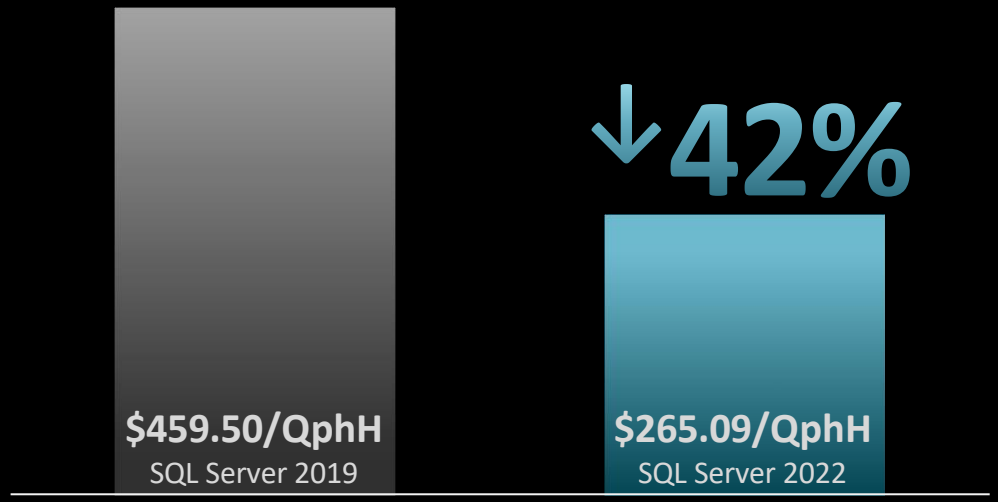
加速商業洞悉

DECISION SUPPORT TPC BENCHMARK™ H @ 1000GB SF
WITH **SQL SERVER® 2022**
(higher is better)



降低每次詢問成本42%

PRICE/TPC BENCHMARK™ H @ 1000GB SF
WITH **SQL SERVER® 2022**
(lower is better)

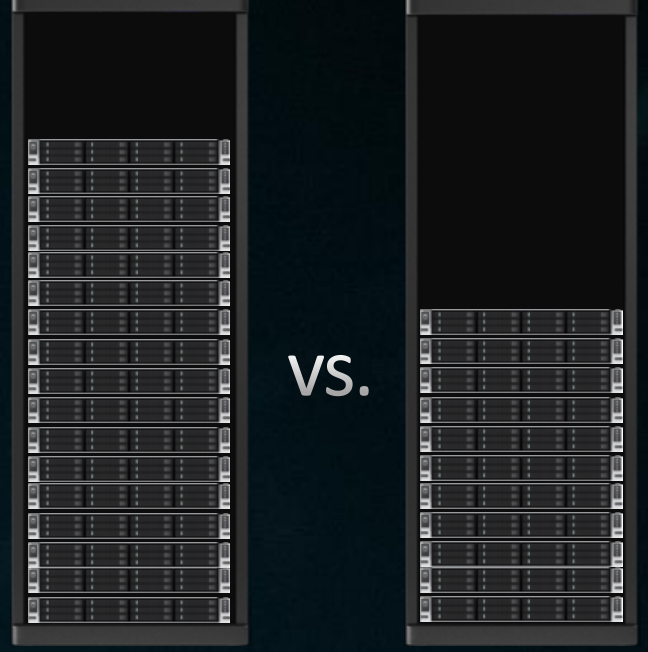


As of 11/10/2022, see endnote: SP5-089.

AMD
together we advance_

17 servers

2P Intel® Platinum 8490H



2040 Cores
~245k kWh per year

vs.

2112 Cores
~175k kWh per year

11 servers

2P AMD EPYC™ 9654

4th Gen AMD EPYC 擴大基礎設施整合效益

2000 VMs @ 1 CPU core and 8GB memory per VM

Up to **35%** 更少伺服器

Up to **29%** 更少功耗[1]

Up to **46%** CAPEX 節省[2]

Up to **21%** 降低第一年每VM成本[2]

Analysis based on the AMD EPYC™ Server Virtualization & Greenhouse Gas Emission TCO Estimation Tool - version 12.00.
AMD processor pricing based on 1KU price as of Jan 2023. Intel® Xeon® Scalable CPU data and pricing from https://ark.intel.com as of Jan 2023. All pricing is in USD. 1) Annually 2) TCO time frame of 3-year and includes estimated costs for real estate, admin and power with power @ $0.16/kWh with 8kW / rack and a PUE of 1.7. Software cost as well as networking and storage power external to the server are not included in this analysis. [2] Values are for USA.

See Endnote SP5TCO-036

AMD EPYC™ cpu-powered CLOUD SOLUTIONS by workload

		GENERAL PURPOSE ENTERPRISE IT APPLICATIONS	HPC VMS COMPUTE INTENSIVE APPLICATIONS	CONFIDENTIAL VMS SECURITY SENSITIVE APPLICATIONS
aws	**Up to 10% lower cost vs comparable x86 EC2 instances***	◢ M6a - General Purpose 3rd Gen EPYC™ ◢ M5a/M5ad - General Purpose ◢ R5a/R5ad - Memory Optimized ◢ T3a - Burstable General Purpose	◢ Hpc6a - HPC Optimized on 3rd Gen EPYC™ ◢ C6a - Compute Optimized on 3rd Gen EPYC™ ◢ C5a/C5ad - Compute-optimized ◢ G4ad - CPU+GPU optimized	
Microsoft Azure	**ACU Score Leadership HPC Confidential VM**	◢ Dasv5 - General Purpose on 3rd Gen EPYC™ ◢ Easv5 - Memory Optimized on 3rd Gen EPYC™ ◢ Dav4 - General Purpose ◢ Eav4 - Memory Optimized ◢ Lsv2 - Storage-optimized	◢ Nvv4 - Remote Workstation / Desktop ◢ HBv2 - HPC Optimized ◢ HBv3 - HPC Optimized on 3rd Gen EPYC™ (New)	◢ DCasv5 General Purpose CVM ◢ ECasv5 Memory Optimized CVM
Google Cloud	**Up to 13% cost savings vs N1 instances Confidential VM****	◢ N2D-standard - General purpose ◢ N2D-highmem - Memory Optimized ◢ N2D-highcpu - HPC Optimized ◢ T2D - Tau VMs on 3rd Gen EPYC™	◢ N2D-highcpu - Compute Optimized ◢ C2D - HPC Optimized on 3rd Gen EPYC™	◢ N2D Confidential VMs ◢ N2D, C2D, GKE Confidential VMs on 3rd Gen EPYC™ (Coming Soon)
ORACLE CLOUD	**Excellent per/$ and sizing flexibility**	◢ Standard E2 - General Purpose ◢ Standard E3 - General Purpose with Flex Sizing ◢ Standard E4 - Flex Sizing on 3rd Gen EPYC™ (New)		

*https://aws.amazon.com/ec2/amd/
**https://cloud.google.com/blog/products/compute/announcing-the-n2d-vm-family-based-on-amd

AMD
together we advance_