



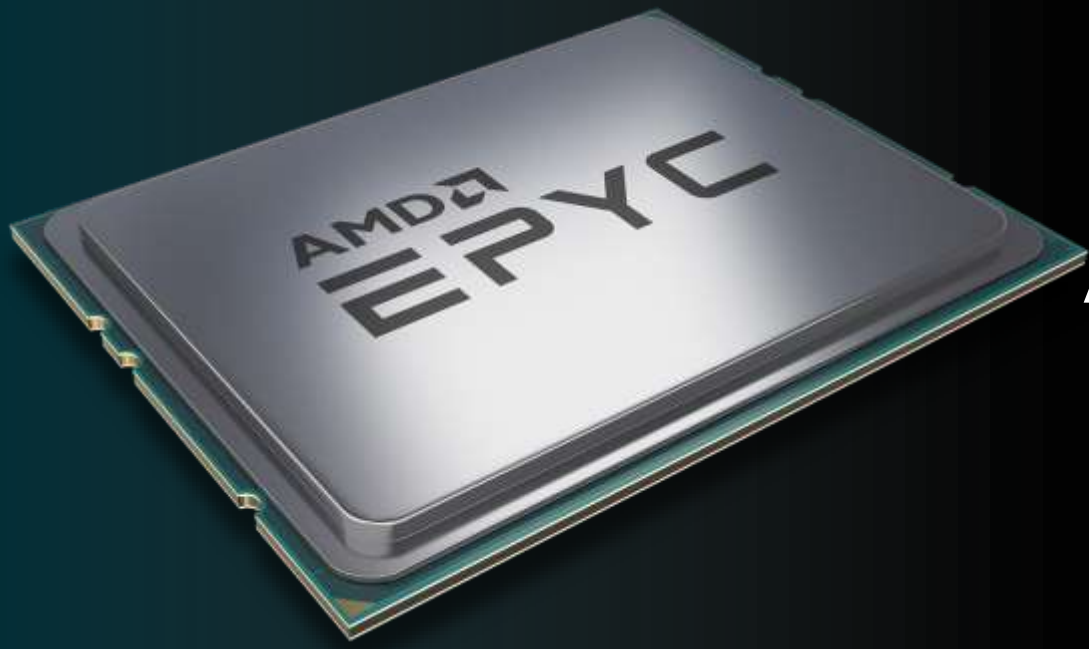
# CLOUDFEST IS EPYC

DANIEL BOUNDS

SR DIRECTOR, AMD DATACENTER SOLUTIONS

MARCH 2018





“For the first time in many  
years,  
AMD could pose a real threat to  
Intel's server supremacy.”  
- Forbes



# THIS IS EPYC

## POWER

*Industry-Leading Core Count<sup>1</sup>*

*Industry-Leading Memory Capacity<sup>2</sup>*

*Industry-Leading Memory Bandwidth<sup>2</sup>*

*Industry-Leading I/O Capacity<sup>3</sup>*

## OPTIMIZE

*Industry's First No-Compromise 1-Socket*

*Unrestrained Product Stack*

*Balanced System Design*

## SECURE

*Secure Root of Trust*

*Real-time Memory Encryption*

*VM Encryption and Isolation*

## A NEW STANDARD FOR SCALE AND ECONOMICS

**32** 24, 16, 8  
cores per socket

Wide range of cores  
without sacrificing features



**128** PCIe® Gen 3 lanes  
in a single CPU

Largest I/O  
capacity<sup>3</sup>



**8** Memory channels  
per CPU

Industry leading memory  
bandwidth<sup>2</sup>



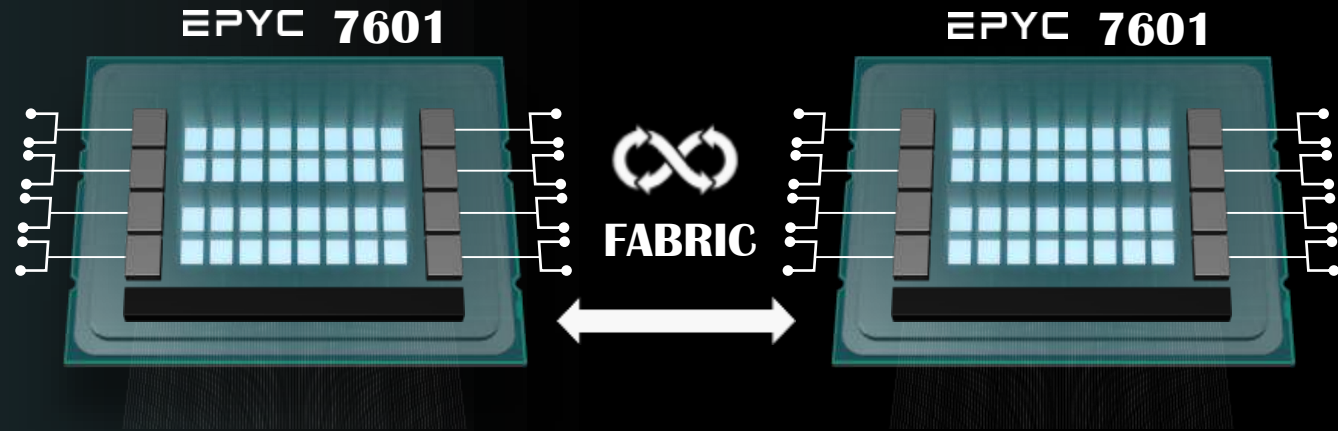
**2TB** RAM per  
socket

Richest  
memory density



MODEL	CORES/ THREADS	BASE/ BOOST FREQ.	MEMORY SPEED	MEMORY CAPACITY	I/O	SMT and Turbo Boost	HW Encrypted Security
EPYC™ 7601	32/64	2.2 / 3.2 GHz	↑	↑	↑	↑	↑
EPYC™ 7551	32/64	2.0 / 3.0 GHz					
EPYC™ 7501	32/64	2.0 / 3.0 GHz					
EPYC™ 7451	24/48	2.3 / 3.2 GHz	8 Channels DDR4-2666	2TB	128 Lanes PCIe®	Yes	Yes
EPYC™ 7401	24/48	2.0 / 3.0 GHz					
EPYC™ 7351	16/32	2.4 / 2.9 GHz	↓	↓	↓	↓	↓
EPYC™ 7301	16/32	2.2 / 2.7 GHz					
EPYC™ 7281	16/32	2.1 / 2.7 GHz					
EPYC™ 7251	8/16	2.1 / 2.9 GHz					

# LEADERSHIP TWO SOCKET



UP TO 

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**33%**  
GREATER MEMORY  
BANDWIDTH <sup>1</sup>

UP TO 

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**160%**  
GREATER MEMORY  
CAPACITY <sup>1</sup>

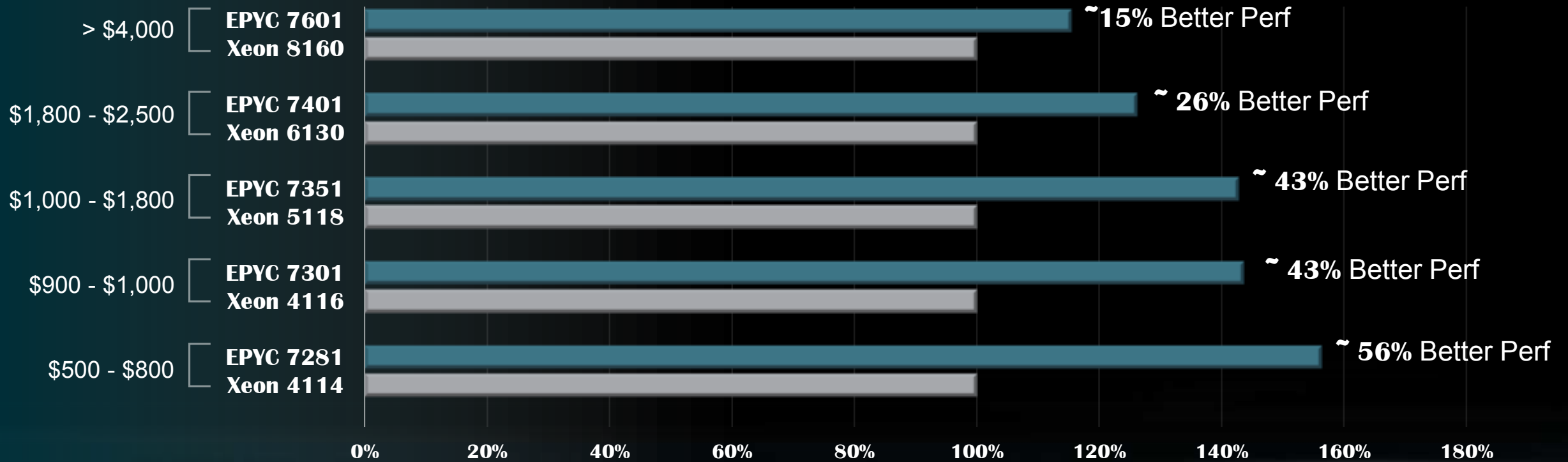
UP TO 

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**33%**  
GREATER CPU I/O  
DENSITY <sup>3</sup>

# GAME CHANGING PERFORMANCE

## 2 EPYC™ vs. 2 XEON™ SKYLAKE





## AMD EPYC 7301

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# of Cores	16
Boost Freq	2.7 GHz
L3 Cache	64 MB
Mem Channels	8
Max Mem	2 TB
Max Mem Speed GHz	2666
I/O	128 PCIe Lanes
List Price	\$825

**MORE**

**MORE**

**MORE**

**MORE**

**MORE**

**MORE**

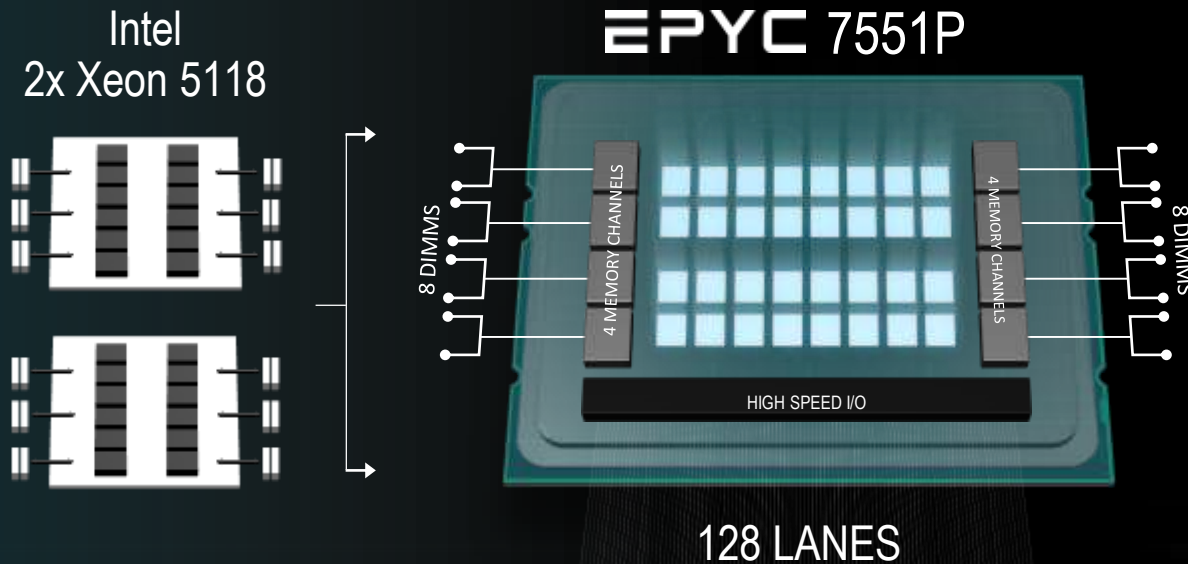
**LESS**

## Intel Xeon 4116

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# of Cores	12
Boost Freq	3.0 GHz
L3 Cache	16.5 MB
Mem Channels	6
Max Mem	768 GB
Max Mem Speed GHz	2400
I/O	48 PCIe Lanes
List Price	\$1,002

# THE POWER OF ONE SOCKET



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**11**  
%  
GREATER  
PERFORMANCE<sup>4</sup>

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UP TO

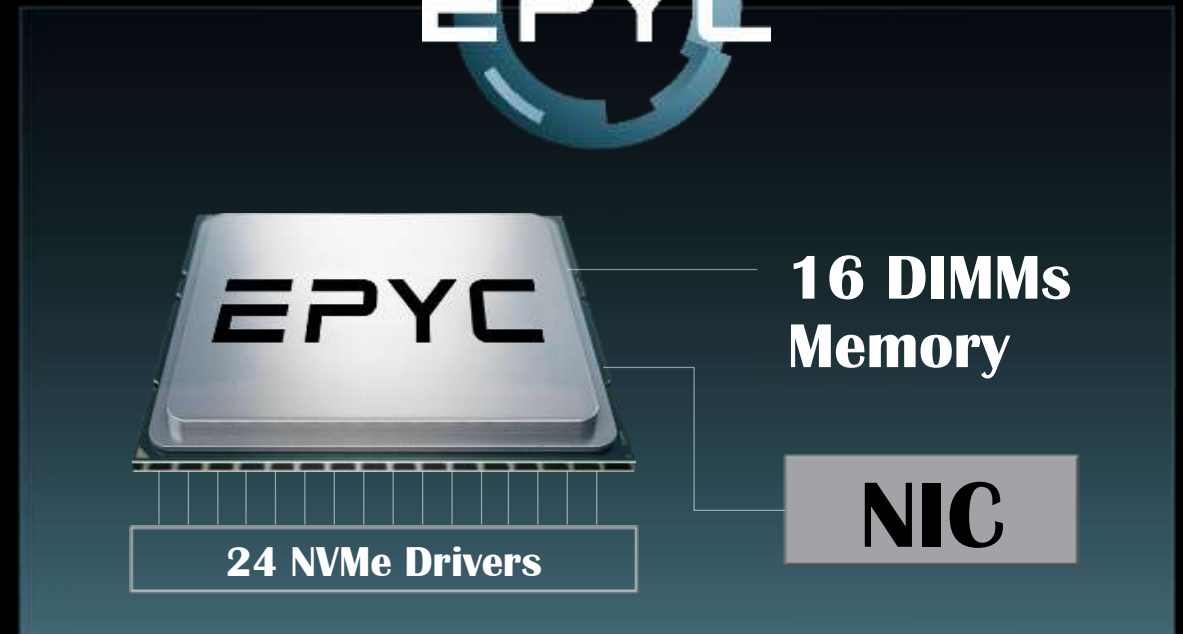
**20%**  
LOWER POWER  
DRAW<sup>5</sup>

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## COMPETITOR



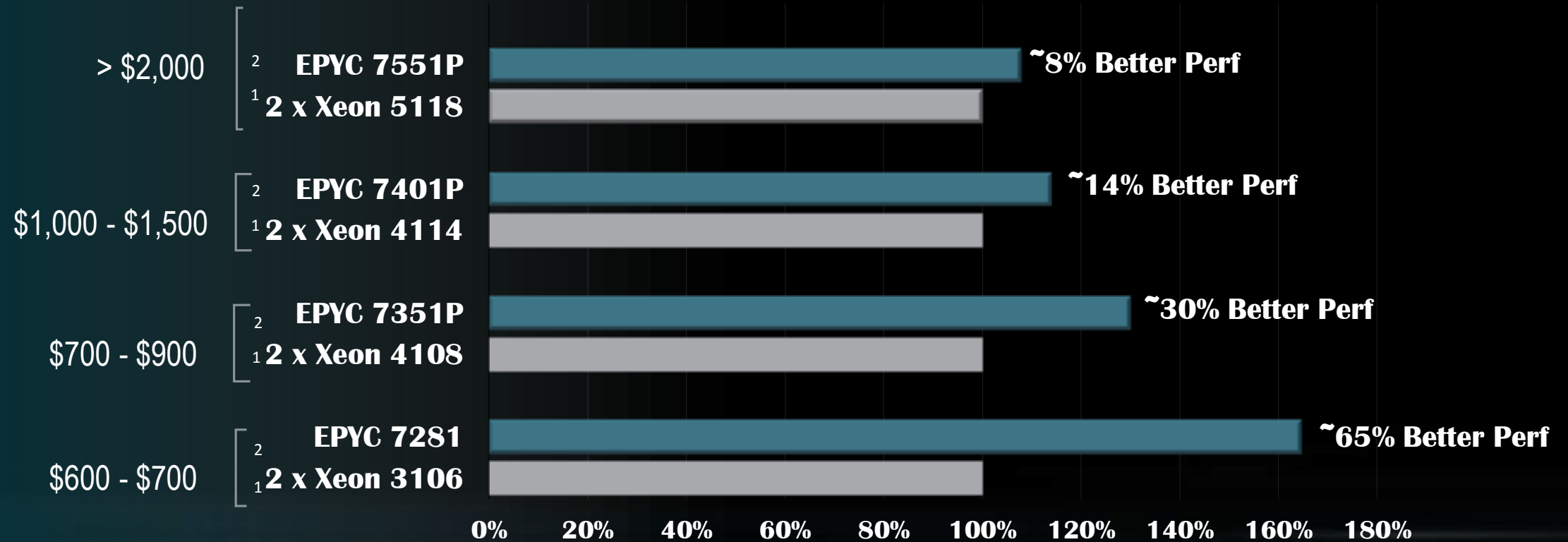
**2P COMPETITIVE SYSTEMS**  
**= 4.1-7.1M IOPS**



**EPYC™ 7601**  
**= 9.1M IOPS**

# RIGHT-SIZE WITHOUT COMPROMISE

## 1 EPYC™ Vs. 2 XEON™ SKYLAKE



5532194

RECORDS BREACHED PER DAY

4%

PERCENT OF DATA  
BREACHES WHERE  
ENCRYPTION WAS USED





# HARDWARE BASED SECURITY

## SME / SEV

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FULL  
MEMORY ENCRYPTION

SECURE  
MULTI-TENANCY

NO  
APPLICATION IMPACT

TAKING DATA ENCRYPTION TO THE NEXT LEVEL

# INDUSTRY STANDARDS: SEAMLESS INTEROPERABILITY

Simplifying Deployment and Removing Vendor Lock-in



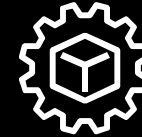
**x86 ISA**



**MANAGEMENT**



**OPERATING SYSTEM**



**APPLICATION**



**POWER**



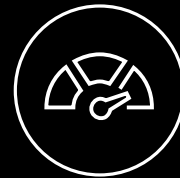
CLOUD, HYPERSCALE AND HIGHLY  
AUTOMATED VIRTUALIZATION



DATA ANALYTICS



VIRTUALIZED BACK  
OFFICE AND VDI



HIGH PERFORMANCE  
COMPUTING



SW-DEFINED STORAGE

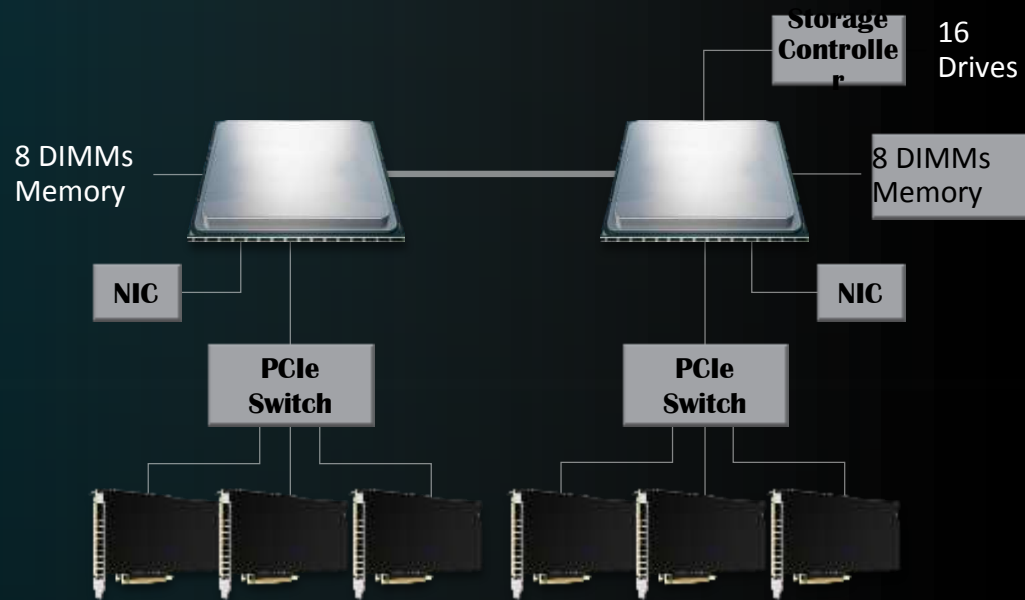


MACHINE LEARNING



# A SIMPLIFIED MACHINE INTELLIGENCE ARCHITECTURE

## COMPETITOR

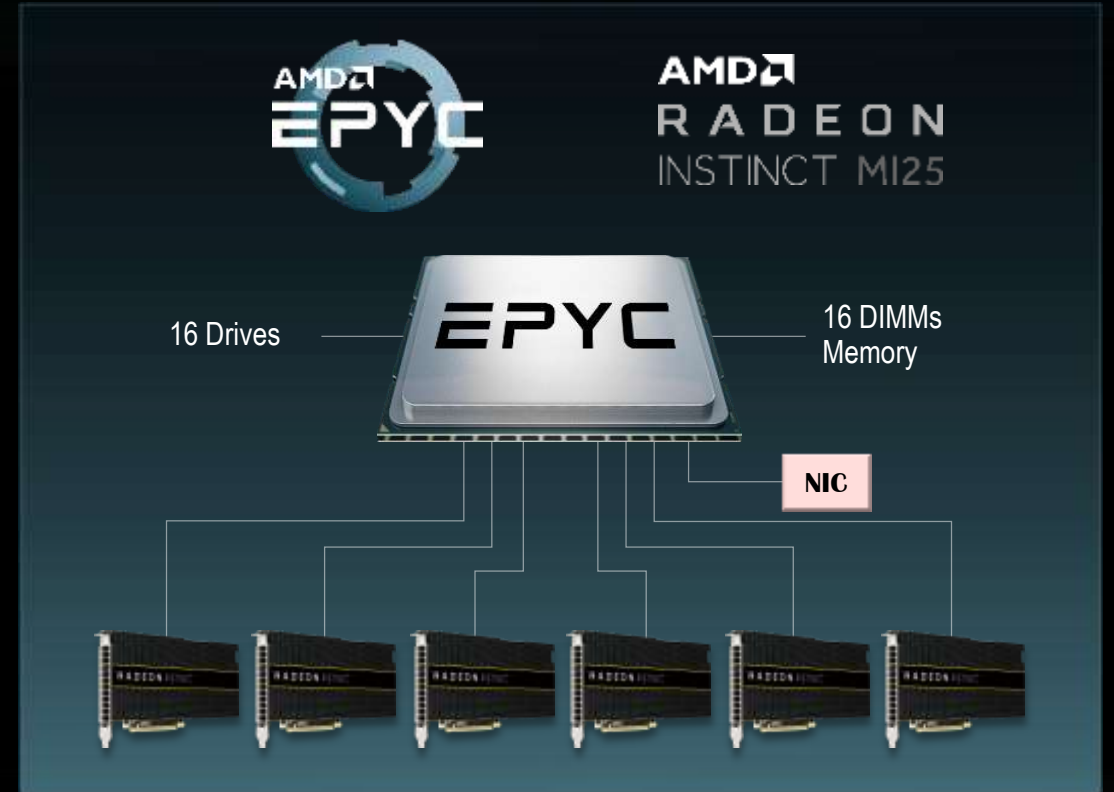


Flexible Configurations

Open Ecosystem

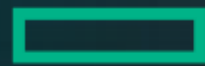
Optimized Platforms

Helps Lower TCO



Optimized Platforms

Helps Lower TCO



Hewlett Packard  
Enterprise

DELL EMC



中科曙光  
SUGON

Lenovo™

英業達  
Inventec

H3C

TYAN

GIGABYTE™

ASUS®

wistron®



*THIS IS*  **EPYC**

COME SEE US AT THE AMD BOOTH

**AMD** 

# FOOTNOTES

## Slide 3 and 4

1. AMD EPYC™ processor includes up to 32 CPU cores versus the Xeon SP Platinum 8180 processor with 28 cores.
2. AMD EPYC™ processor supports up to 21.3 GB/s per channel with DDR4-2667 x 8 channels (total 170.7 GB/s), versus the Xeon SP Platinum 8180 processor at 21.3 GB/s with max DDR4-2667 x 6 channels (total 127.8 GB/s).
3. AMD EPYC™ processor offers 128 lanes PCIe3 across the entire stack vs 96 lanes for Intel Xeon SP.

## Slide 6

1. AMD EPYC™ 7601 processor offers up to 33% greater memory bandwidth than the Intel Xeon Platinum 8180. A single AMD EPYC™ 7601 processor offers up to 2TB/processor (x 2 = 4TB), versus a single Xeon Platinum 8180 processor at 768Gb/processor (x 2 = 1.54TB). A 2P AMD EPYC™ 7601 processor offers up to [2.6X the / 160% greater] memory capacity than a 2P Intel Xeon Platinum 8180-based system. NAP-44
2. AMD EPYC™ offers up to [2.6X the / 1.6X better] I/O density in a single socket configuration than an Intel® Xeon® SP Series Processor.
3. AMD EPYC™ offers up to 33% greater CPU I/O density in a dual socket configuration than the Intel Xeon Platinum 8180. AMD EPYC™ processor offers up to 128 available PCI Express high speed I/O lanes in a dual socket configuration, versus the Xeon Platinum 8180 processor at 96 available high speed lanes in a dual socket configuration. NAP-56

## Slide 9

1. Based on estimated SPECint®\_rate\_base2006 scores. In AMD internal testing using AMD's "Ethanol" reference system with Ubuntu 16.04, GCC-02 v6.1, 256GB 2Rx5 PC4-2667 (running at 2400), 1 x 500GB SSD, the 1P EPYC 7551P system scored 697; versus 2P Xeon Gold 5118-based Intel S2600WFT system with Ubuntu 16.04, GCC-02 v6.1, 392GB DDR4 2r2400, 2 x 500Gb SSD score of 629. SPEC and SPECint are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-39.
2. A single EPYC 7551P TDP is 180w, versus 2P Xeon Gold 5118 at 105w each plus a 15w C 621 chipset. NAP-41.

## Slide 7

Estimates based on SPECrate® 2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 196 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 2 x AMD EPYC 7601 SOC’s (\$4200 each at AMD 1ku pricing), 512GB memory (16 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Supermicro SYS-1029U-TRTP server scored 169.8 in tests conducted in AMD labs configured with 2 x Xeon 8160 CPU’s (\$4702 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to Extreme performance setting. SPEC and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-57

Estimates based on SPECrate® 2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 149 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 2 x AMD EPYC 7401 SOC’s (\$1850 each at AMD 1ku pricing), 512GB memory (16 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Supermicro SYS-1029U-TRTP server scored 118.1 in tests conducted in AMD labs configured with 2 x Xeon 6130 CPU’s (\$1894 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to Extreme performance setting. SPEC and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-58

Estimates based on SPECrate® 2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 123 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 2 x AMD EPYC 7351 SOC’s (\$1100 each at AMD 1ku pricing), 512GB memory (16 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Supermicro SYS-1029U-TRTP server scored 86.2 in tests conducted in AMD labs configured with 2 x Xeon 5118 CPU’s (\$1273 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz running at 2400), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to Extreme performance setting. SPEC and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-59

Estimates based on SPECrate® 2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 113 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 2 x AMD EPYC 7351 SOC’s (\$825 each at AMD 1ku pricing), 512GB memory (16 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Supermicro SYS-1029U-TRTP server scored 78.7 in tests conducted in AMD labs configured with 2 x Xeon 4116 CPU’s (\$1002 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz running at 2400), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to Extreme performance setting. SPEC and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-60

Estimates based on SPECrate® 2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 106 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 2 x AMD EPYC 7351 SOC’s (\$650 each at AMD 1ku pricing), 512GB memory (16 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Intel R2224WFTZS server scored 67.6 in tests conducted in AMD labs configured with 2 x Xeon 4114 CPU’s (\$694 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz running at 2400), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to default settings. SPEC and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-61

## Slide 11

Estimates based on SPECrate®2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 93 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 1 x AMD EPYC 7551P SOC (\$2100 each at AMD 1ku pricing), 256GB memory (8 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Supermicro SYS-1029U-TRTP server scored 97 in tests conducted in AMD labs configured with 2 x Xeon 5120 CPU’s (2 x \$1555 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz running at 2400), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to Extreme performance setting. See [www.spec.org](http://www.spec.org). NAP-66

Estimates based on SPECrate® 2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 93 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 1 x AMD EPYC 7551P SOC (\$2100 each at AMD 1ku pricing), 256GB memory (8 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Supermicro SYS-1029U-TRTP server scored 86.2 in tests conducted in AMD labs configured with 2 x Xeon 5118 CPU’s (2 x \$1273 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz running at 2400), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to Extreme performance setting. SPEC and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-62

Estimates based on SPECrate® 2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 77 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 1 x AMD EPYC 7401P SOC (\$1075 each at AMD 1ku pricing), 256GB memory (8 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Intel R2224WFTZS server scored 67.6 in tests conducted in AMD labs configured with 2 x Xeon 4114 CPU’s (2 x \$694 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz running at 2400), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to default settings. SPEC and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-63

Estimates based on SPECrate® 2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 62 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 1 x AMD EPYC 7351P SOC (\$750 each at AMD 1ku pricing), 256GB memory (8 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Intel R2224WFTZS server scored 47.7 in tests conducted in AMD labs configured with 2 x Xeon 4108 CPU’s (2 x \$417 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz running at 2400), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to default settings. SPEC and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-64

Estimates based on SPECrate® 2017\_int\_base using the GCC-02 v7.2 compiler. AMD-based system scored 54 in tests conducted in AMD labs using an “Ethanol” reference platform configured with 1 x AMD EPYC 7281 SOC (\$650 each at AMD 1ku pricing), 256GB memory (8 x 32GB 2R DDR4 2666MHz), Ubuntu 17.04, BIOS 1002E. Intel-based Intel R2224WFTZS server scored 32.8 in tests conducted in AMD labs configured with 2 x Xeon 3106 CPU’s (2 x \$306 each per ark.intel.com), 768GB memory (24 x 32GB 2R DDR4 2666MHz running at 2133MHz), SLES 12 SP3 4.4.92-6.18-default kernel, BIOS set to default settings. SPEC and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. See [www.spec.org](http://www.spec.org). NAP-65