AMD EPYC™ お役に立つサイト情報

EPYC™ 公式ホームページ

https://www.amd.com/ja/products/epyc-server

- EPYC™ 採用事例集 (ケーススタディー) :
  https://www.amd.com/en/case-studies?f%5B0%5D=product_category%3AServer&keyword=&page=0
- EPYC™ テクニカルドキュメント& ホワイトペー
  https://www.amd.com/ja/processors/server-tech-docs/search
- EPYC™ 製品選定 ツール
  https://www.amd.com/ja/processors/epyc-tools
- EPYC™ デモ ビデオ サイト
  https://www.amd.com/en/processors/epyc-demo

3RD GEN AMD EPYC™
パフォーマンス 解説

最高性能 CPU

（ソケットあたり コアあたり 共に）

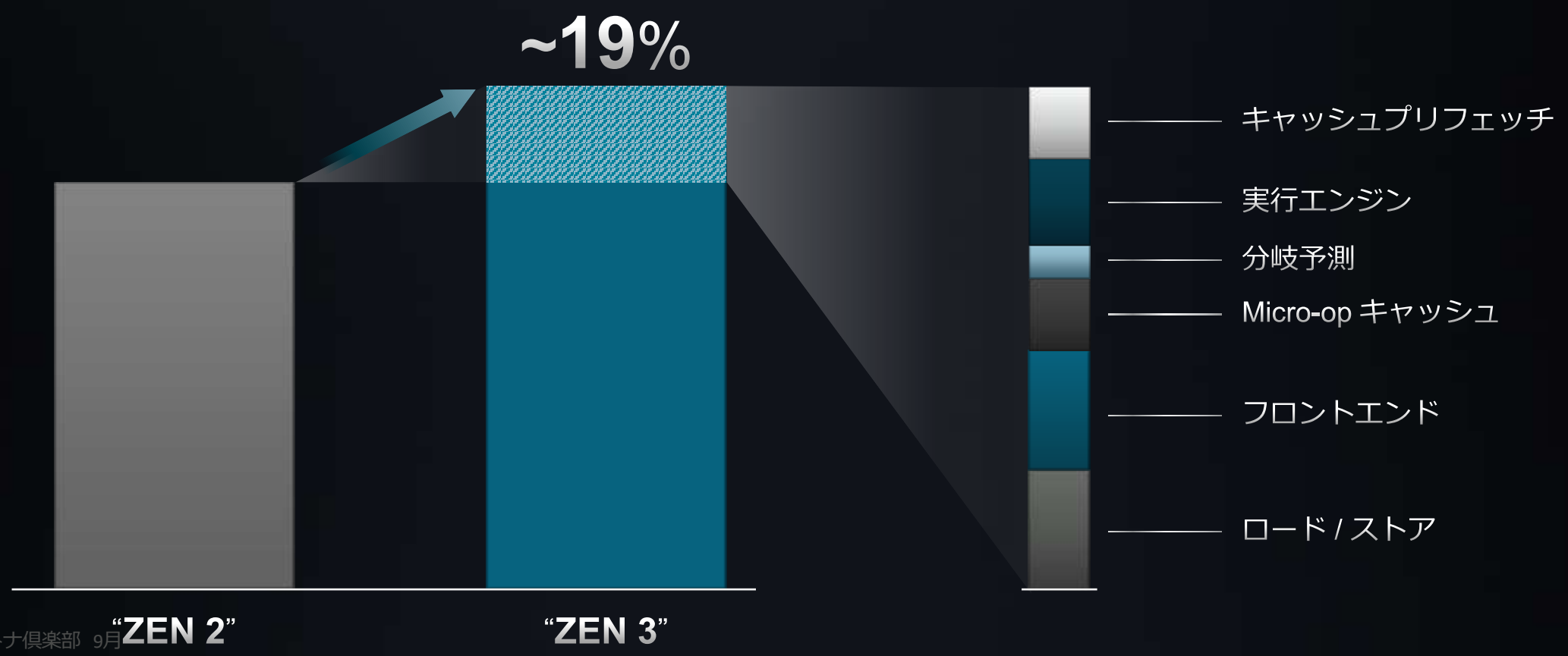
EPYC 7763 Highest CPU and Per Socket performance; EPYC 72F3 Highest Per Core performance. See MLN-016A, MLN-071A, MLN-057A

業界をリードする性能

“ZEN 3” ~19% IPC 強化

28 種類のワークロードからの平均値
(周波数 3.7GHZ 固定, 8 コア)

“ZEN 3” 性能への貢献



See MLN-003

AMD EPYC

最高性能を更に強化

200以上の世界記録を樹立

データベース & 分析
21 リテーショナル
24 ビッグデータ

HCI/SDI/クラウド
12 クラウド と 仮想化
15 整数演算性能

ENTERPRISE
6 ERP ビジネスアプリケーション
46 Java® ベースの性能
20 エネルギー効率

HPC
36 HPC アプリケーション
13 浮動小数点演算性能
12 浮動小数点演算エネルギー効率

AMD EPYC Family of Processors as of 3/15/21, see amd.com/worldrecords

SPEC CPU® 2017 #1 世界記録 –16 の指標全てにおいて

1S SPECspeed®2017 Integer Base (AMD EPYC™ 72F3)	2S SPECspeed®2017 Integer Base (AMD EPYC™ 72F3)	1S SPECrate®2017 Integer Base (AMD EPYC™ 7763)	2S SPECrate®2017 Integer Base (AMD EPYC™ 7763)
1S SPECspeed®2017 Integer Peak (AMD EPYC™ 72F3)	2S SPECspeed®2017 Integer Peak (AMD EPYC™ 72F3)	1S SPECrate®2017 Integer Peak (AMD EPYC™ 7763)	2S SPECrate®2017 Integer Peak (AMD EPYC™ 7763)
1S SPECspeed®2017 Floating-Point Base (AMD EPYC™ 7763)	2S SPECspeed®2017 Floating-Point Base (AMD EPYC™ 7763)	1S SPECrate®2017 Floating-Point Base (AMD EPYC™ 7763)	2S SPECrate®2017 Floating-Point Base (AMD EPYC™ 7763)
1S SPECspeed®2017 Floating-Point Peak (AMD EPYC™ 7763)	2S SPECspeed®2017 Floating-Point Peak (AMD EPYC™ 7763)	1S SPECrate2017 Floating-Point Peak (AMD EPYC™ 7763)	2S SPECrate®2017 Floating-Point Peak (AMD EPYC™ 7763)

HPE X AMD パートナ倶楽部 9月

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AMD EPYC™ CPUs: エネルギー効率のリーダー

#1

SPECpower_ssj® 2008 JAVA® パフォーマンス / ワット

- OVERALL
- 1S/2S OVERALL
- 1U/2U/BLADE
- LINUX®/WINDOWS®

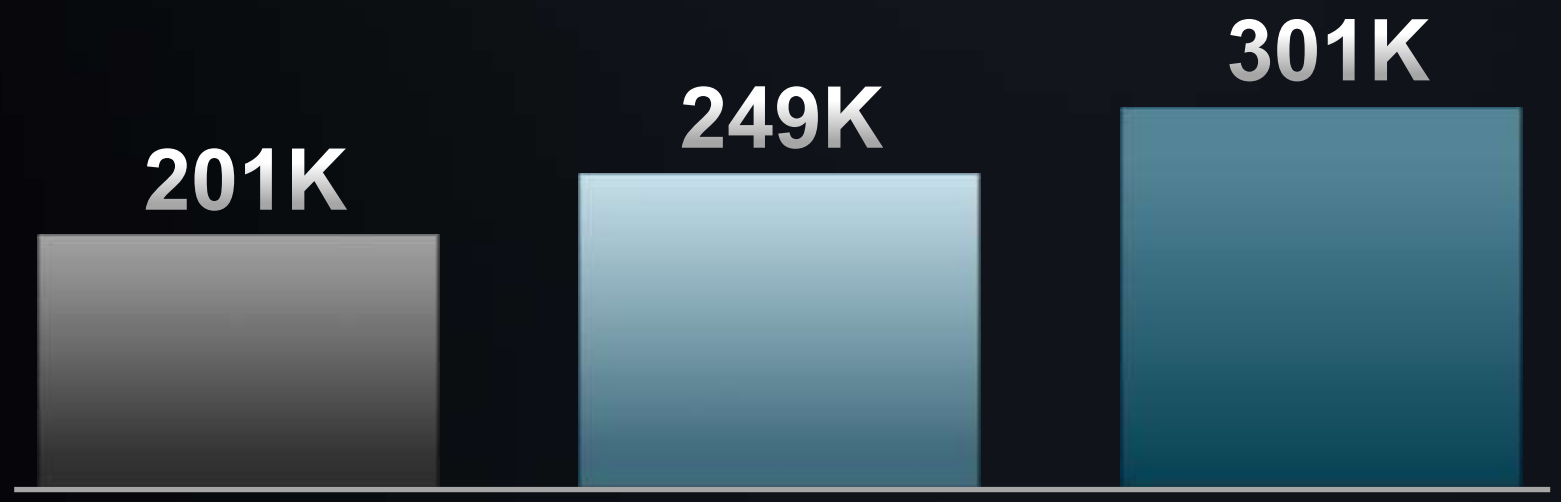
SPEC CPU® 2017 Energy

- 2S SPECspeed® 2017 Integer
- 1S/2S SPECspeed® 2017 Floating Point
- 1S/2S SPECrate® 2017 Integer
- 1S/2S SPECrate® 2017 Floating Point

As of 3/15/21, see amd.com/worldrecords. SPEC®, SPEC CPU®, SPECrate®, SPECspeed® and SPECpower_ssj®, are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org.

エンタープライズ最高性能

ビジネスアプリケーションに最高性能



XEON® PLATINUM 8380	2ND GEN AMD EPYC™ 7H12	3RD GEN AMD EPYC™ 7763
40 コア	64 コア	64 コア

3RD GEN AMD EPYC™

50%

競合製品より高速

2S JAVA仮想化マシン 性能

SPECjbb®2015 MultiJVM critical-jOPS

See MLN-092. SPEC® and SPECjbb® are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org.

HPC最高性能

科学的なブレークスルーを加速

XEON® PLATINUM 8368Q	2ND GEN AMD EPYC™ 7H12	3RD GEN AMD EPYC™ 7763
38 コア	64 コア	64 コア

3RD GEN AMD EPYC™

36%

競合性能より高速

2S 浮動小数点演算性能

SPECrate®2017_fp_base

HPE X AMD パートナ倶楽部 9月

See MLN-086A SPEC® and SPECrate® are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org.

クラウド最高性能

ハイパースケールに最高の計算密度

XEON® PLATINUM 8368Q	2ND GEN AMD EPYC™ 7H12	3RD GEN AMD EPYC™ 7763
38 コア	64 コア	64 コア

3RD GEN AMD EPYC™

47%

競合製品より高速

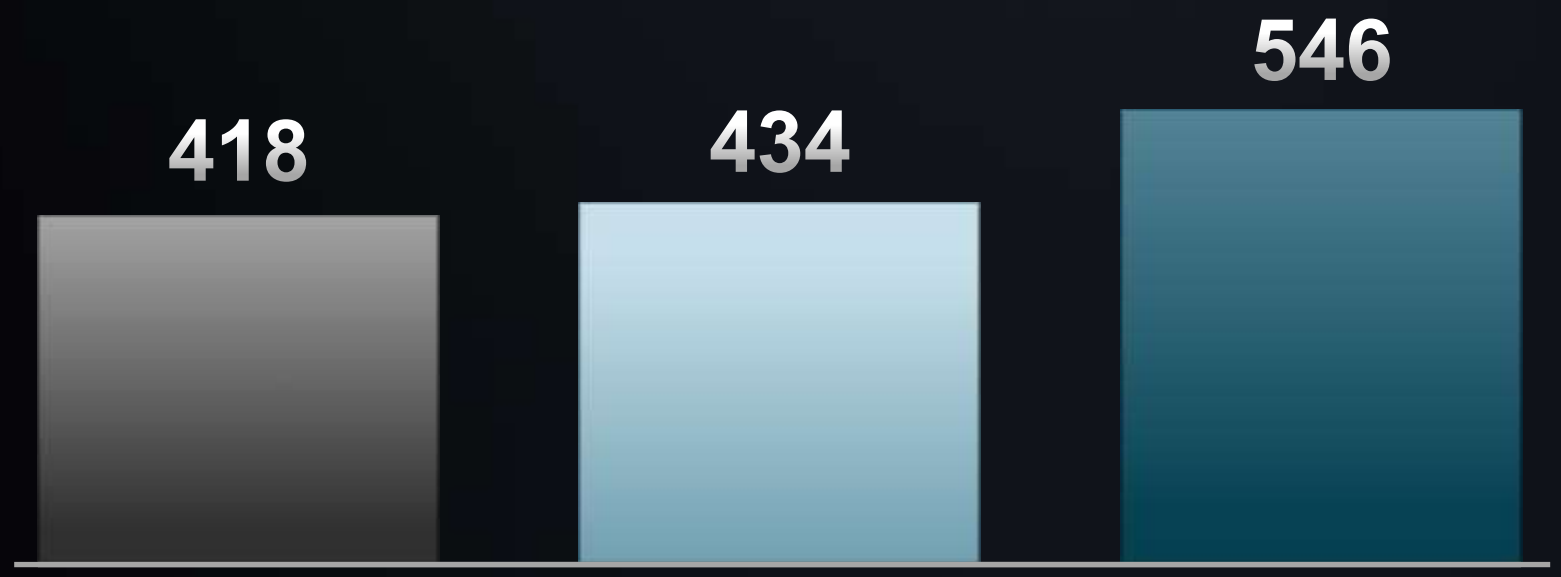
2S 整数演算性能

SPECrate®2017_int_base

MLN-089, ROM-787 SPEC® and SPECrate® are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org.

最高性能を更に強化

コアあたりの性能も抜群



XEON® PLATINUM 8358	2ND GEN AMD EPYC™ 7532	3RD GEN AMD EPYC™ 75F3
32 コア	32 コア	32 コア

3RD GEN AMD EPYC™

31%

競合製品より高速

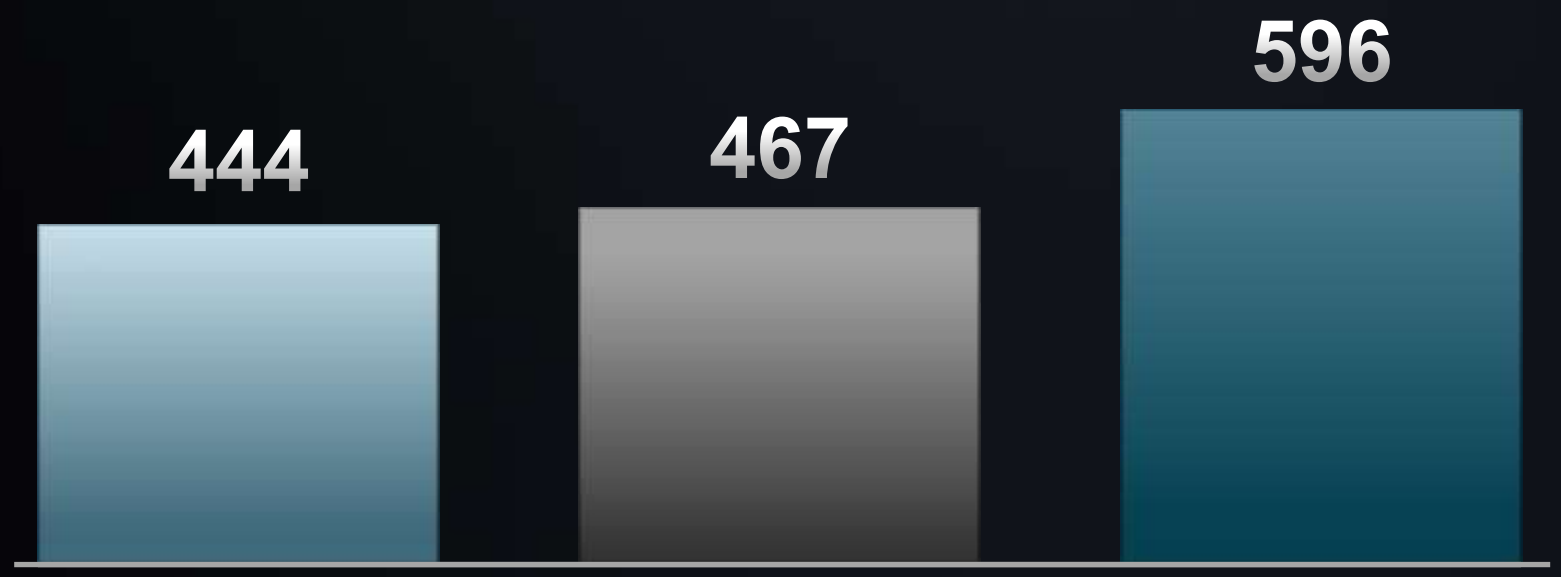
2S FLOATING POINT PERFORMANCE

SPECrate®2017_fp_base

See MLN-093. SPEC® and SPECrate® are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org.

最高性能を更に強化

コアあたりの性能も抜群



2ND GEN AMD EPYC™	XEON® PLATINUM	3RD GEN AMD EPYC™
7532	8358	75F3
32 コア	32 コア	32 コア

3RD GEN AMD EPYC™

28%

競合製品より高速

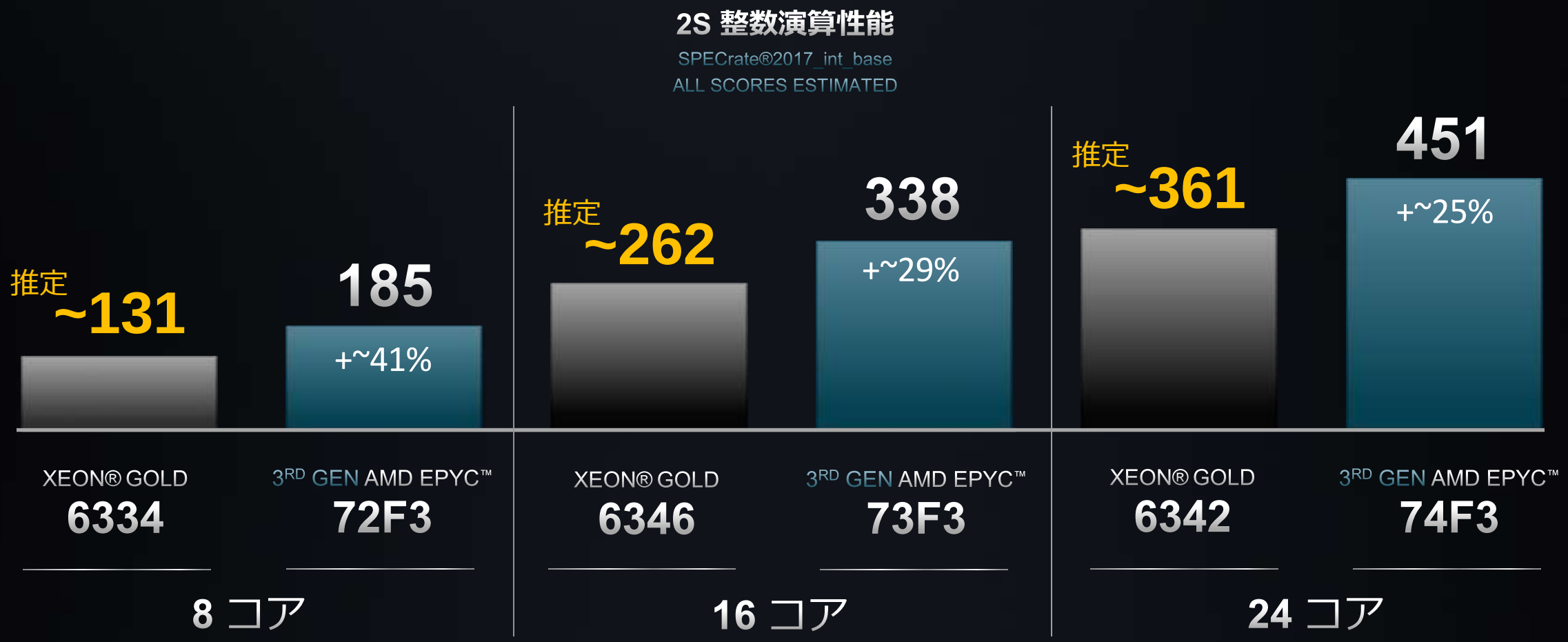
2S INTEGER PERFORMANCE

SPECrate®2017_int_base

See MLN-090A. SPEC® and SPECrate® are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org.

最高性能を更に強化

コアあたりの性能も抜群 @ 同じコア数での比較



Results may vary. All subject to change based on publications. See MLN-095, 096, 097. SPEC® and SPECrate® are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org.

最高性能を更に強化

価格性能比も抜群

2S 整数演算性能 （価格性能比)

SPECrate®2017_int_base

ALL SCORES ESTIMATED (EXCEPT 8358 VS 7543)

Results may vary. All subject to change based on publications. See ROM-792, MLN-098, 099, 100. SPEC® and SPECrate® are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org.

エンタープライズにおける計算リソースの優位性

SAP® 販売・流通 における性能の優位性

XEON® PLATINUM 8380	2ND GEN AMD EPYC™ 7H12	3RD GEN AMD EPYC™ 7763
40 コア	64 コア	64 コア

3RD GEN AMD EPYC™

56%

競合製品より高速

SAP® SALES AND DISTRIBUTION 2-TIER

NUMBER OF BENCHMARK USERS

See MLN-101

IT インフラでの優位性

VMmark® 3.1 より多くの仮想マシンを提供可能

XEON® PLATINUM 8380	2ND GEN AMD EPYC™ 7H12	3RD GEN AMD EPYC™ 7763
40 コア	64 コア	64 コア

3RD GEN AMD EPYC™

52%
競合製品より高速

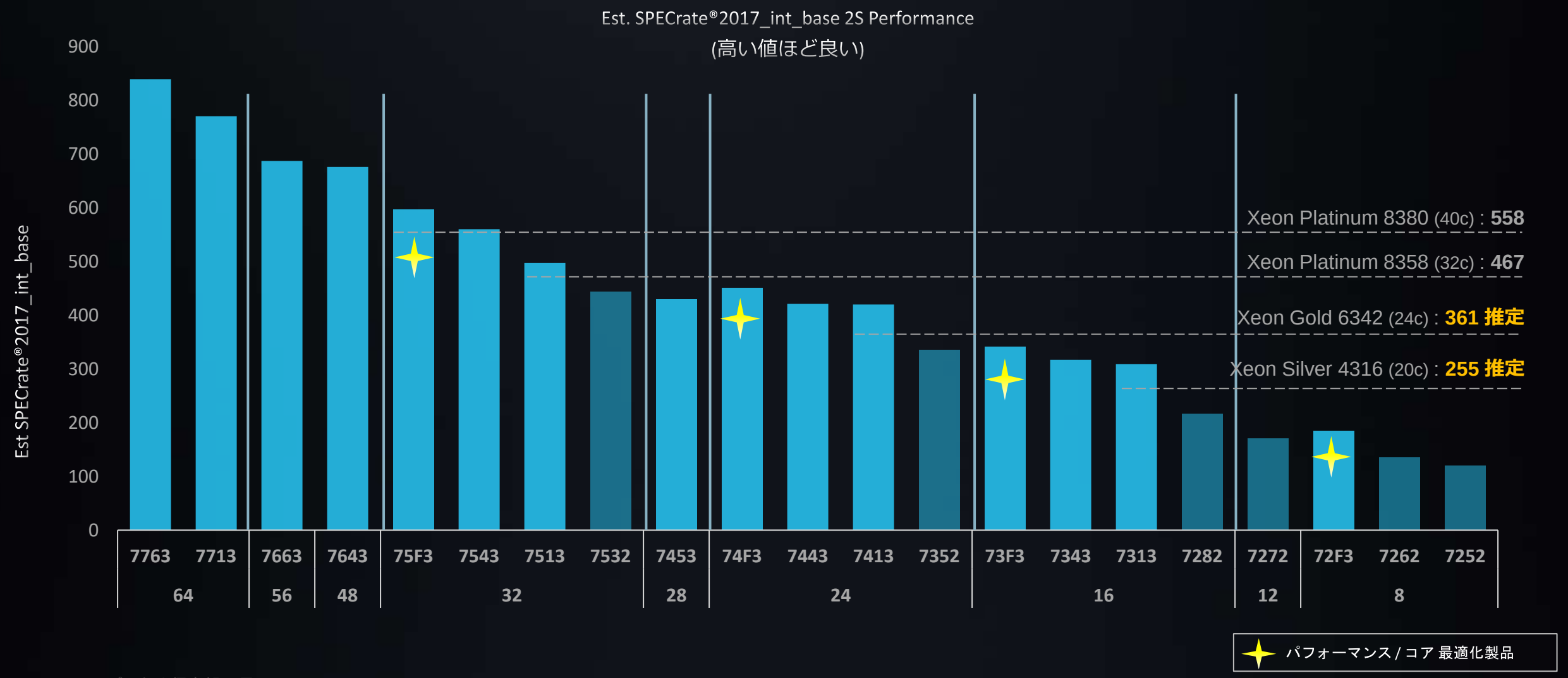
71%
より多くの VMs (タイル) を提供

VMmark® 3.1 matched pair
PERFORMANCE @ TILES

See MLN-102

AMD EPYC™ プロセッサー ファミリー

性能一覧



2X 3RD GEN AMD EPYC™ CPU URLS: 7252 7262 72F3 7272 7282 7313 7343 73F3 7352 7413 7443 74F3 7453 7532 7513 7543 75F3 7643 7663 7713 7763. 2X 2ND GEN EPYC URLS: 7532,7352, 7282, 7272, 7262, 7252. BEST PERFORMING 2X INTEL XEON PLATINUM AND GOLD PROCESSORS PUBLISHED AT WWW.SPEC.ORG OR AMD ESTIMATED AS OF 05/12/21. INTEL XEON URLS: 2X XEON PLATINUM 6258R, PLATINUM 8358; SPEC® AND SPECrate® ARE REGISTERED TRADEMARKS OF THE STANDARD PERFORMANCE EVALUATION CORPORATION. SEE WWW.SPEC.ORG FOR MORE INFORMATION.

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ENDNOTES

EPYC-22: For a complete list of world records see http://amd.com/worldrecords.

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MLN-003: Based on AMD internal testing as of 02/1/2021, average performance improvement at ISO-frequency on an AMD EPYC™ 72F3 (8C/8T, 3.7GHz) compared to an AMD EPYC™ 7F32 (8C/8T, 3.7GHz), per-core, single thread, using a select set of workloads including SPECrate®2017_int_base,SPECrate®2017_fp_base, and representative server workloads. SPEC® and SPECrate® are registered trademarks of Standard Performance Evaluation Corporation. Learn more at spec.org.

MLN-016A: Results as of 04/14/2021 using SPECrate®2017_int_base. The AMD EPYC 7763 scored 839, http://www.spec.org/cpu2017/results/res2021q1/cpu2017-20210219-24936.html which is higher than all other 2P scores published on the SPEC® website. SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-057A: Based on SPECrate®2017_int_base on 04/14/2021, a server powered by two 8c AMD EPYC 72F3 CPU has scored 185, http://www.spec.org/cpu2017/results/res2021q2/cpu2017-20210329-25427.html with a per core score of 11.5 which is a higher per core integer base performance score than any currently posted in any SPEC.org publication. SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-071A: Based on SPECrate®2017_int_base on 04/14/2021, a server powered by one 64c AMD EPYC 7763 CPUs has a score of 424, http://www.spec.org/cpu2017/results/res2021q1/cpu2017-20210219-24941.html which is higher than any currently posted SPEC score/chip (socket). SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-077: SPECrate®2017_int_base comparison based on highest system results published at spec.org as of 4/14/2021.2x AMD EPYC 7763 (64C) scores 839, https://www.spec.org/cpu2017/results/res2021q1/cpu2017-20210219-24936.txt versus 2x Intel Xeon E5-2699A v4 (22C) SPECrate®2017_int_base score of 199 http://spec.org/cpu2017/results/res2018q1/cpu2017-20180109-02607.html for 4.2x the performance. It would then take five 2x EPYC 7763 CPU-based servers to meet/exceed the performance of 20x 2x Intel Xeon E5-2699A v4 CPU-based servers. SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-078: SPECrate®2017_int_base comparison based on highest system results published at spec.org as of 4/14/2021 : 2x AMD EPYC 7763 (64C) scores 839, https://www.spec.org/cpu2017/results/res2021q1/cpu2017-20210219-24936.txt versus 2x AMD EPYC 7601 (32C) SPECrate®2017_int_base score of 304 http://spec.org/cpu2017/results/res2019q2/cpu2017-20190411-11817.html for 2.76x the performance. It would take eight 2x EPYC 7763 CPU-based servers to meet/exceed the performance of 20x 2x AMD EPYC 7601 CPU-based servers. SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-086A: SPECrate®2017_fp_base comparison based on best performing systems published at www.spec.org as of 04/28/2021. Configurations: 2x AMD EPYC 7763 (651 SPECrate®2017_fp_base, http://spec.org/cpu2017/results/res2021q1/cpu2017-20210219-24944.html) versus 2x Intel Xeon Platinum 8368Q (477 SPECrate®2017_fp_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210330-25511.html) for ~36.5% more performance. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-088: SPECrate®2017_int_base comparison based on highest system results published at spec.org as 4/14/2021, 2x AMD EPYC 7763 (64C) scores 839, http://spec.org/cpu2017/results/res2021q1/cpu2017-20210219-24936.html versus 2x Intel Xeon Platinum 8380 (40C) SPECrate®2017_int_base score of 558 http://spec.org/cpu2017/results/res2021q2/cpu2017-20210330-25513.html for 1.5x the performance. It would take only ten 2x EPYC 7763 CPU-based servers to meet/exceed the performance of 15x 2x Intel Xeon Platinum 8380 CPU-based servers. SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

ENDNOTES (CONT'D)

MLN-089: Based on SPECrate®2017_int_base as of 4/14/2021, 2x AMD EPYC™ 7763 ($7890 1Ku) scored 839 (0.106 score/$) https://spec.org/cpu2017/results/res2021q1/cpu2017-20210219-24936.html which has 47% higher throughput and 25% better performance/$ than the top "Ice Lake" score is 2x Intel® Xeon® Platinum 8368Q ($6743 1Ku) that scored 570 (0.085 score/$) https://spec.org/cpu2017/results/res2021q2/cpu2017-20210330-25512.html. AMD 1Ku pricing and Intel 1Ku pricing from ark.intel.com as of 4/14/2021. SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-090A: SPECrate®2017_int_base comparison based on best performing systems published at www.spec.org as of 04/28/2021. Configurations: 2x AMD EPYC 75F3 (596 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210409-25541.html) versus 2x Intel Xeon Platinum 8358 (467 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210329-25456.html) for ~27.6% more performance. 2x AMD EPYC 7532 (444 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2020q3/cpu2017-20200622-23002.html). SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-092: SPECjbb® 2015-MultiJVM Critical comparison based on best performing systems published at www.spec.org as of 4/28/2021, 2x AMD EPYC™ 7763 scored 301,297 SPECjbb® 2015-MultiJVM Critical-jOPS (359,067 max-jOPS, https://spec.org/jbb2015/results/res2021q1/jbb2015-20210224-00612.html) which has 50% higher critical server-side Java® operations than the top "Ice Lake" 2x Intel® Xeon® Platinum 8380 that scored 201,334 critical-jOPS (258,368 max-jOPS, https://spec.org/jbb2015/results/res2021q2/jbb2015-20210324-00635.html). 2x AMD EPYC 7H12 scored 248,942 critical-jOPS (315,663 max-jOPS, http://spec.org/jbb2015/results/res2020q2/jbb2015-20200423-00550.html). SPEC® and SPECjbb® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-093: SPECrate®2017_fp_base comparison based on best performing systems published at www.spec.org as of 04/28/2021. Configurations: 2x AMD EPYC 75F3 (546 SPECrate®2017_fp_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210409-25543.html) versus 2x Intel Xeon Platinum 8358 (418 SPECrate®2017_fp_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210329-25455.html) for ~30.6% more performance. 2x AMD EPYC 7532 (434 SPECrate®2017_fp_base, http://spec.org/cpu2017/results/res2020q3/cpu2017-20200622-23004.html). SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-095: SPECrate®2017_int_base comparison based on best performing systems published at www.spec.org and AMD estimates as of 04/28/2021. Configurations: 2x AMD EPYC 72F3 (185 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210329-25427.html) versus 2x Intel Xeon Gold 6334 (est ~131 SPECrate®2017_int_base, AMD cores*frequency model using published Intel specifications at ark.intel.com) for ~39% more performance. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-096: SPECrate®2017_int_base comparison based on best performing systems published at www.spec.org and AMD estimates as of 04/28/2021. Configurations: 2x AMD EPYC 73F3 (338 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210412-25561.html) versus 2x Intel Xeon Gold 6346 (est ~262 SPECrate®2017_int_base, AMD cores*frequency model using published Intel specifications at ark.intel.com) for ~29% more performance. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information..

ENDNOTES (CONT'D)

MLN-097: SPECrate®2017_int_base comparison based on best performing systems published at www.spec.org and AMD estimates as of 04/28/2021. Configurations: 2x AMD EPYC 74F3 (451 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210412-25565.html) versus 2x Intel Xeon Gold 6342 (est ~361 SPECrate®2017_int_base, AMD cores*frequency model using published Intel specifications at ark.intel.com) for ~25% more performance. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

MLN-098: SPECrate®2017_int_base comparison based on best performing systems published at www.spec.org as of 05/12/2021. Configurations: 2x AMD EPYC 7543 (560 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210426-25663.html, $3761) versus 2x Intel Xeon Platinum 8358 (467 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210329-25456.html, $3950) for ~16.7% more performance at ~1.20x the score per CPU $. AMD 1Ku pricing and Intel ARK.intel.com pricing as of 4/1/21. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. Pricing subject to change.

MLN-099: SPECrate®2017_int_base comparison based on best performing systems published at www.spec.org and AMD estimates as of 04/28/2021. Configurations: 2x AMD EPYC 7443 (421 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210413-25629.html, $2010) versus 2x Intel Xeon Gold 6342 (361 SPECrate®2017_int_base, AMD estimated using published Intel specification at ark.intel.com, $2529) for ~16.6% more performance at ~1.48x the score per CPU $. AMD 1Ku pricing and Intel ARK.intel.com pricing as of 4/1/21. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. Pricing subject to change.

MLN-100: SPECrate®2017_int_base comparison based on best performing systems published at www.spec.org and AMD estimates as of 04/28/2021. Configurations: 2x AMD EPYC 7313 (309 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q2/cpu2017-20210329-25434.html, $1083) versus 2x Intel Xeon Gold 6326 (241 SPECrate®2017_int_base, AMD estimated using published Intel specifications at ark.intel.com, $1300) for ~28.2% more performance at ~1.54x the score per CPU $. AMD 1Ku pricing and Intel ARK.intel.com pricing as of 4/1/21. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. Pricing subject to change.

MLN-101: SAP® SD 2-tier comparison based on best performing systems published at www.sap.com/benchmarks as of 5/5/2021, 2x AMD EPYC™ 7763 scored 75,000 benchmark users (https://www.sap.com/dmc/benchmark/2021/Cert21021.pdf) which supports 56% more benchmark users than the top "Ice Lake" 3rd Gen 2x Intel® Xeon® Platinum 8380 that scored 48,000 benchmark users (https://www.sap.com/dmc/benchmark/2021/Cert21026.pdf). 2x AMD EPYC 7H12 scored 69,499 benchmark users, https://www.sap.com/dmc/benchmark/2020/Cert20023.pdf). SAP and SAP logo are the trademarks or registered trademarks of SAP SE (or an SAP affiliate company) in Germany and in several other countries.

ENDNOTES (CONT'D)

MLN-102: VMmark® 3.1 matched pair comparison based on best performing systems published at https://www.vmware.com/products/vmmark/results3x.html as of 5/5/2021, 2x AMD EPYC™ 7763 scored 21.58 @ 24 tiles (https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/vmmark/2021-05-04-Lenovo-ThinkSystem-SR665.pdf) which performs 52% better than the top "Ice Lake" 2x Intel® Xeon® Platinum 8380 that scored 14.19 @ 14 tiles (https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/vmmark/2021-04-20-Fujitsu-PRIMERGY-RX2540M6.pdf). 2x AMD EPYC 7H12 scored 18.23 @ 19 tiles, https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/vmmark/2020-11-17-Lenovo-ThinkSystem-SR665.pdf). VMmark is a registered trademark of VMware in the US or other countries.

MLN-103: SPECrate®2017_int_base comparison based on best performing systems published at www.spec.org as of 4/28/2021. Configuration: 2X AMD EPYC 7763 (128C total, 560W TDP total, $15,780 CPU 1Ku total cost, 839 score, http://spec.org/cpu2017/results/res2021q1/cpu2017-20210219-24936.html) versus 4X Intel Xeon Platinum 8380H (112C total, 1000W TDP total, $40,036 CPU 1Ku total cost, 814 score, http://spec.org/cpu2017/results/res2021q1/cpu2017-20210128-24857.html). AMD 1Ku pricing and Intel ARK.intel.com specifications and pricing as of 4/1/21. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. Pricing subject to change.

MLN-104: SPECrate®2017_int_base comparison based on AMD estimates as of 5/12/2021. Configuration: 1X AMD EPYC 7543P (32C total, 225W TDP total, $2,730 CPU 1Ku total cost, 271 score, https://www.spec.org/cpu2017/results/res2021q2/cpu2017-20210402-25537.html) versus 2X Intel Xeon Gold 6346 (32C total, 410W TDP total, $4,600 CPU 1Ku total cost, 262 AMD estimated using published Intel specification on ark.intel.com). AMD 1Ku pricing and Intel ARK.intel.com specifications and pricing as of 4/1/21. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. Pricing subject to change.

ENDNOTES (CONT'D)

MLNTCO-003: 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. This estimate compares the selected AMD EPYC™ and Intel® Xeon® CPU based server solutions required to deliver ~10,000 units of integer performance based on the published scores for 3rd Gen Intel Xeon Scalable ("Ice Lake") and AMD 7003 CPU based servers. This analysis is based on Bare Metal Server TCO v1.3 - Master.xlsm. This estimation reflects a 3 year time frame.

This analysis compares a 2P AMD EPYC EPYC_7763 powered server with a best SPECrate®2017_int_base score of 839 (https://spec.org/cpu2017/results/res2021q1/cpu2017-20210219-24936.html) compared to a 2P Intel Xeon Platinum_8380 based server with a best SPECrate®2017_int_base score of 558 (https://spec.org/cpu2017/results/res2021q2/cpu2017-20210330-25513.html) as of 4/8/2021

Both AMD EPYC and Intel based servers use the same cost for the following elements of the analysis: server chassis size of 2RU at a cost of $2500 per chassis; internal storage $380; physical servers managed per admin: 30; fully burdened cost per admin $110500; server rack size of 42; space allowance per rack of 27 sq feet; monthly cost of data center space $20 per sq foot; cost per kW for power $0.12; power drop per rack of 12kW; and a PUE (power usage effectiveness) of 2.0.

The EPYC powered solution estimates are: 12 total 2P EPYC 7763 powered servers at a hardware only acquisition cost of $23,908 per server, which includes total system memory of 1024GB, which is 8GB of memory / core and a total system memory cost of $5248; internal storage cost of $380. The total estimated AMD EPYC hardware acquisition cost for this solution is $286,896. Each server draws ~680 kWhr per month. For the 3 years of this EPYC powered solution analysis the: total solution power cost is ~$70503 which includes the PUE factor; the total admin cost is ~$132600, and the total real estate cost is ~$19440. The total 3 TCO estimate for the AMD solution is ~$509,439.

The Intel based solution requires 18 total 2P Xeon Platinum 8380 powered servers at a hardware only acquisition cost of $24326 per server, which includes total system memory of 1024GB, which is 12.8GB of memory / core and a total system memory cost of $5248; internal storage cost of $380. The total estimated Intel hardware acquisition cost for this solution is $437,868. Each server draws ~741 kWhr per month. For the 3 years of this Intel based solution analysis the: total solution power cost is ~$115239 which includes the PUE factor; the total admin cost is ~$198900, and the total real estate cost is ~$38880. The total 3 TCO estimate for the Intel solution is ~$790,887.

Delivering 10000 of estimated SPECrate®2017_int_base performance produces the following estimated results: the AMD EPYC solution requires 33% fewer servers [1-(AMD server count / Intel server count)]; 50% less space [1-(AMD rack count / Intel rack count)]; 39% less power [1-(AMD power cost / Intel power cost)]; costing 34% less ([1-(AMD hardware acquisition cost/Intel hardware acquisition cost)], providing a 36% lower 3 year TCO [1-(AMD TCO / Intel TCO)]. AMD processor pricing based on 1KU price as of April 1, 2021. Intel® Xeon® Scalable processor data and pricing from https://ark.intel.com as of April 6, 2021. All pricing is in USD.

ENDNOTES (CONT'D)

ROM-787: A server powered by two AMD EPYC 7H12 CPUs has a SPECint® score of 717, https://spec.org/cpu2017/results/res2020q2/cpu2017-20200525-22554.pdf. 70% higher than score for a Intel Gold 6258R 2P server of 397, https://spec.org/cpu2017/results/res2020q3/cpu2017-20200915-23981.pdf, for SPECrate®2017_int_base as of 02/20/2021. SPEC®, SPECrate®, SPECint® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

ROM-788: A server powered by two AMD EPYC 7H12 CPUs has a SPECfp® score of 543, https://spec.org/cpu2017/results/res2020q3/cpu2017-20200707-23397.pdf. 70% higher than score for a Intel Gold 6258R 2P server of 309, https://spec.org/cpu2017/results/res2020q3/cpu2017-20200915-23979.pdf, for SPECrate®2017_fp_base as of 02/20/2021. 543 / 309 = 1.76 = 1.76x The Performance or 76% More Performance of the 6258R. SPEC®, SPECrate®, SPECfp® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

ROM-789: A server powered by two AMD EPYC 7532 CPUs has a score of 434, https://spec.org/cpu2017/results/res2020q3/cpu2017-20200622-23004.pdf. 40% higher than score for an Intel Gold 6258R 2P server of 309, https://spec.org/cpu2017/results/res2020q3/cpu2017-20200915-23979.pdf, for SPECrate®2017_int_base as of 02/20/2021. SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

ROM-790: A server powered by two AMD EPYC 7532 CPUs has a score of 444, https://spec.org/cpu2017/results/res2020q3/cpu2017-20200622-23002.pdf. 12% higher than score for an Intel Gold 6258R 2P server of 397, https://spec.org/cpu2017/results/res2020q3/cpu2017-20200915-23981.pdf, for SPECrate®2017_int_base as of 02/20/2021. SPEC®, SPECrate® and SPEC CPU® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information.

ROM-792: SPECrate®2017_int_base comparison based on best performing systems published at www.spec.org and AMD estimates as of 04/28/2021. Configurations: 2x AMD EPYC 7252 (120 SPECrate®2017_int_base, http://spec.org/cpu2017/results/res2021q1/cpu2017-20210104-24738.html, $348) versus 2x Intel Xeon Silver 4309Y (124 SPECrate®2017_int_base, AMD estimated using published Intel specifications at ark.intel.com, $501) for ~-3.2% more performance at ~1.39x the score per CPU $. AMD 1Ku pricing and Intel ARK.intel.com pricing as of 4/1/21. SPEC®, SPEC CPU®, and SPECrate® are registered trademarks of the Standard Performance Evaluation Corporation. See www.spec.org for more information. Pricing subject to change.