CRAY AND AMD PAST SUCCESS IN HPC
AMD IN TOP500 LIST 2002 TO 2011

2011 - AMD IN FASTEST MACHINES IN 11 COUNTRIES

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Site</th>
<th>Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>United States of America</td>
<td>Oak Ridge</td>
<td>Cray</td>
</tr>
<tr>
<td>12</td>
<td>Germany</td>
<td>Universitaet Stuttgart</td>
<td>Cray</td>
</tr>
<tr>
<td>19</td>
<td>United Kingdom (Scotland)</td>
<td>Edinburgh</td>
<td>Cray</td>
</tr>
<tr>
<td>31</td>
<td>Korea (South)</td>
<td>KMA</td>
<td>Cray</td>
</tr>
<tr>
<td>34</td>
<td>Switzerland</td>
<td>CSCS</td>
<td>Cray</td>
</tr>
<tr>
<td>41</td>
<td>Canada</td>
<td>Sherbrooke</td>
<td>SGI</td>
</tr>
<tr>
<td>44</td>
<td>Sweden</td>
<td>KTH</td>
<td>Cray</td>
</tr>
<tr>
<td>50</td>
<td>Brazil</td>
<td>INPE</td>
<td>Cray</td>
</tr>
<tr>
<td>61</td>
<td>Taiwan</td>
<td>Taiwan HPC Center</td>
<td>Acer</td>
</tr>
<tr>
<td>78</td>
<td>Austria</td>
<td>Vienna Scientific Center</td>
<td>Megware</td>
</tr>
<tr>
<td>203</td>
<td>Finland</td>
<td>CSC</td>
<td>Cray</td>
</tr>
</tbody>
</table>
“ZEN” A FRESH APPROACH

Designed from the Ground up for Optimal Balance of Performance and Power

- Totally new high-performance core design
- New high-bandwidth, low latency cache system
- Simultaneous multithreading (SMT) for high throughput
- Energy-efficient FinFET design tuned for enterprise applications
8 ZEN CORES PER DIE

Compute
- 8 Zen x86 cores
- 4MB total L2 cache
- 16MB total L3 cache

Memory
- 2 channels ddr4 with ECC
- 2 DIMM per channel
- up to 256GB per channel

Infinity fabric
- Connects die and I/O

Security
- On die security processor
- Memory encryption per VM
ZEN IN MULTI-CHIP ARCHITECTURES

Ryzen 8c Desktop

EPYC 32c HPC server

Threadripper 16c Workstation
RYZEN 2 – 12NM – IMPROVES TOP BOOST CLOCK
Lowering TCO through an Optimal Balance of Compute, Memory, I/O and Security

COMPUTE
- 8 to 32 AMD “Zen” x86 cores (16 to 64 threads)
- 512KB L2 cache per core (16 MB total L2 cache)
- 64MB shared L3 cache (8MB per 4 cores)
- TDP range: 120W-180W

MEMORY
- 8 channel DDR4 with ECC up to 2666 MHz
- RDIMM, LRDIMM, 3DS, NVDIMM
- 2 DIMMs/channel capacity of 2TB/socket

INTEGRATED I/O
- NO CHIPSET
  - 128 lanes PCIe Gen3
  - Used for PCIe, SATA, and Coherent Interconnect
  - Up to 32 SATA or NVMe devices

SECURITY
- Dedicated Security Subsystem
- Hardware Root-of-Trust
- Hardware Memory Encryption
### Feature Consistency and Simplified Product Stack

<table>
<thead>
<tr>
<th>ONE-SOCKET AND TWO-SOCKET</th>
<th>EPYC 32 CORE</th>
<th>EPYC 24 CORE</th>
<th>EPYC 16 CORE</th>
<th>EPYC 8 CORE</th>
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<tbody>
<tr>
<td>7601</td>
<td>$4,200</td>
<td>7451</td>
<td>$2,400</td>
<td>7351P</td>
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<td>7551</td>
<td>$3,400</td>
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<td>$1,850</td>
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<tr>
<td>2TB memory capacity</td>
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<tr>
<td>128 lanes PCIe³</td>
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<td>✓</td>
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<tr>
<td>Turbo boost</td>
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<tr>
<td>SMT</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

AMD pricing based on 1k unit pricing January 2018
EPYC LEADERSHIP TWO-SOCKET

WORLD RECORD BENCHMARKS!

EPYC 7601

More Cores 1

14%

EPYC 7601

SPECfp\textsuperscript{®} _rate2006

33% More Memory Bandwidth 2

SPECrate\textsuperscript{®}2017_fp

2.6x More Memory Capacity 3

EPYC 7601

FABRIC

UP TO 2.6x More Performance / $ 4

Feature and perf/$ comparison to 2 Intel Xeon Platinum 8180.
Perf/$ based on published prices and published SPECfp\_rate2016 scores on spec.org
World record benchmarks based on SPECfp\_rate2006 and SPECrate\_2017_fp scores
on spec.org as of Jan. 18, 2018
See Endnotes

See Endnotes
AMD X86 CORE ROADMAP

“Naples”
- “Zen”

“Rome”
- “Zen 2”

“Milan”
- “Zen 3”

AMD IS BACK TO STAY
“NAPLES” TO “ROME” - WILL BE EPYC TOO

Artistic impression of 14nm to 7nm process shrink
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