HEPiX TechWatch WG: Server

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Global server market revenue up substantially
- $23.37 billion in Q3 2018 with 3.16 million servers shipped
- Primarily due to hyperscale cloud provider purchases
- May grow to $100 billion/year industry

Revenue outpacing units sold
- Increased cost of components including CPU, GPUs/FPGAs, memory and solid state storage

Total server shipments per quarter now almost double what they were for an entire year ~20 years ago (1997)
- Vast majority of revenue from x86 servers
- Other server platforms only sold $1.6 billion in Q3 2018: ~6.8%

New ARM Neoverse server CPU platform hopes to change the downward trend for non-x86 servers
ODMs (Original Design Manufacturers) combined have a larger server sales revenue than any single tier one vendor.

These servers are often purchased by hyperscale cloud providers.

Some examples ODMs include Foxconn, Quanta, and Inventec.

Approximately one in four servers shipped now going to hyperscale cloud providers.

Dell, HPE and Lenovo, respectively, leading tier one server vendors in terms of sales revenue.

AMD-based server shipments still a small portion of the total market.

However was 0% prior to EPYC Naples’ release.

AMD anticipates capturing additional server market share after the 2019 release of EPYC Rome CPUs.

Hyperscale cloud providers currently most heavily driving AMD server sales.
Server Market - Environment and Cooling

Data centers used ~3% of the world’s total electricity output in 2017
Estimated to jump to ~20% by 2025

US DoE recommending EPEAT environmental certification for servers
"Electronic Product Environmental Assessment Tool"
https://greenelectronicscouncil.org/epeat/epeat-overview/
Both Dell and HP participating in the program, among others
Rates products on 51 environmental criteria, including recycled content, toxin reduction, energy efficiency, etc.

Traditionally, there’s been reluctance and little need for data centers to adopt liquid cooling technologies, although they’re considerably more efficient than air-based cooling
Impediments for adoption including cost and increased maintenance complexity
However, expect to see more demand for both rear-door heat-exchange and direct liquid cooling in 2019
High demand for co-processors (GPU, FPGAs, etc.) increasing the power density of servers
Increasing use of “hyperconverged infrastructure” - combining separate network, compute and storage elements into a single higher-density systems
Cooling

- Common density 10-12 kW/rack max to 12-20 kW/rack
- Today a 42U rack full of 2S nodes (80 server) can draw 40 kW
- Full air cooling is not enough
Liquid Cooling Landscape

Close Coupled Cooling
- In-Row, In-Rack, Rear Door Exchangers
- Air is still the only mean to cool board/chip
- Limited by existing chip maximum temps
- Requires additional fans

DLC (Cold Plates)
- Positive Pressure, Negative Pressure

Immersion Cooling
- Single Phase, Two-Phase

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Cold Plates
- Individual Heatsinks
- Board-Specific
- Individual Chip Fluid-cooling

Immersion
- Specialty fluids ($$$)
- Can require separate cooling coil
- Orientation sensitive
Open 19

- Aims at support data center design, open, economical and customizable
- Similar to Facebook OCP Open Compute Project that is more address to major internet companies
- Open19 focused on optimizing data center of any size including small edge platforms, unlike OCP
- Define a common, open standard server form factor, using rack, cages and pre-defined network and power
Open 19

- Standard 19” 4-post rack, Brick cage
- Brick (B), Double Wide Brick (DWB), Double High Brick (DHB), Double High & Wide Brick (DHWB)
- Power shelf: 12v distribution, OTS power modules with any AC or DC inputs
- Optional Battery Backup Unit (BBU)
- Networking switch (ToR)
- Snap-on power cables – up to 400w per brick, linear growth with size
- Snap-on data cables – up to 100G per brick, linear growth with size
Open Computing Project

- Server compute node designs included one for Intel processors and one for AMD processors. In 2013, Calxeda contributed a design with ARM processors.
- Several subprojects:
  - HPC: heterogeneous computing networking and fabric platform for multi-node processor
  - Networking: Network hardware and software
  - Rack and Tower: rack standards, integrating the DC infrastructure
  - Open System Firmware: OS Hw platform initialization
  - Data Center Facility: maximizes mechanical performance and thermal and electrical efficiency
References

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