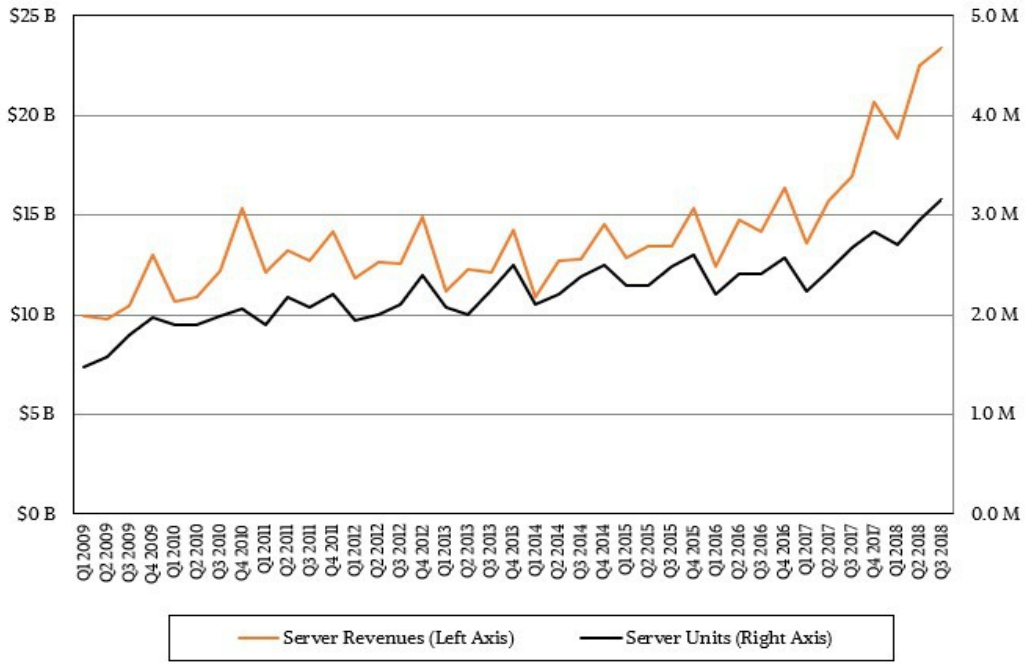
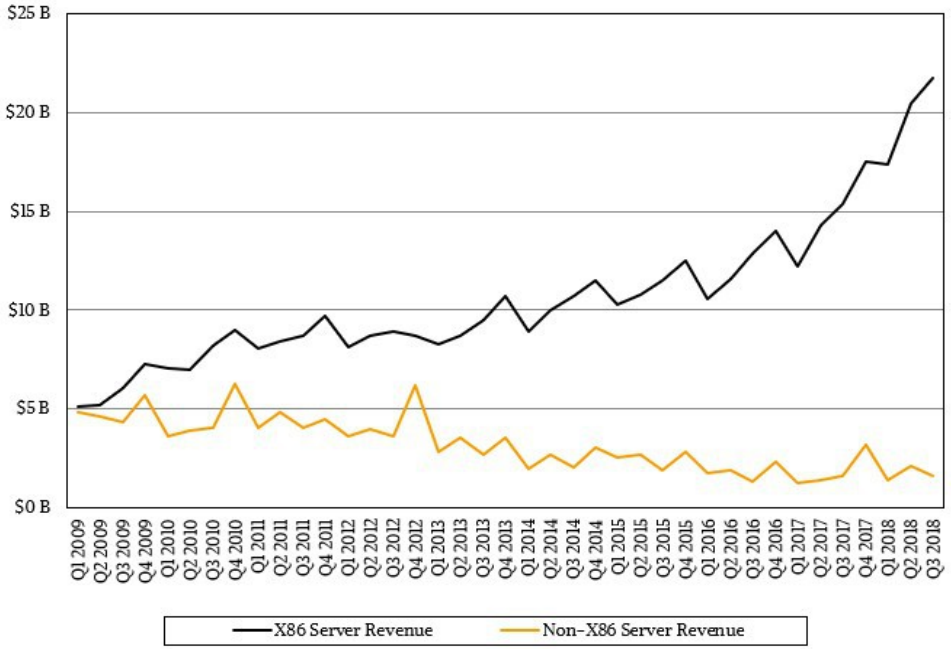
Server Market





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

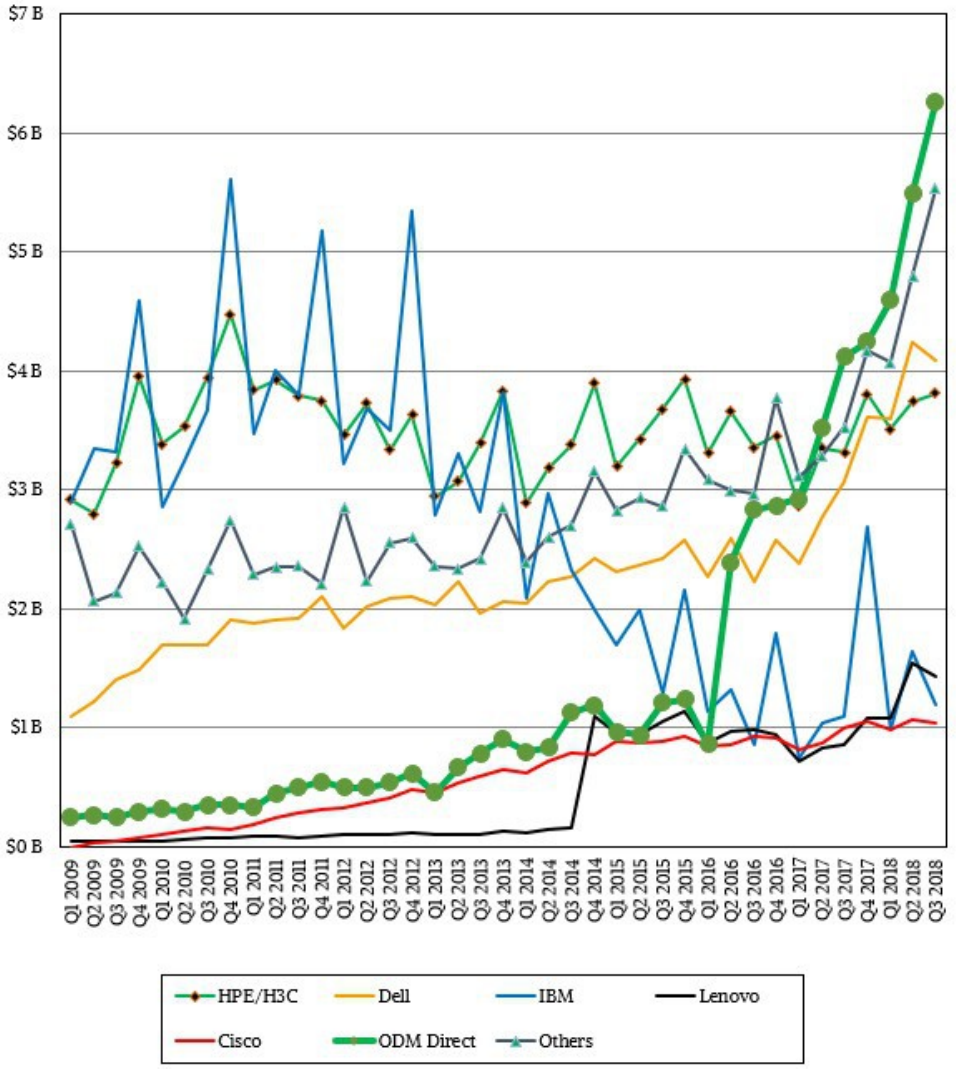
Revenue outpacing units sold
- Increased cost of components including CPU, GPUs/FPGAs, memory and solid state storage

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

Server Market (Cont.)



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

In Q4 2018, AMD-based server shipments rose to ~5% of the total market share

- Was 0% prior to EPYC Naples' release

- AMD anticipates capturing another 5% of the market in 2019 after the release of the EPYC Rome CPU

- Hyperscale cloud providers currently most heavily driving AMD server sales

Server Market – Environment and Cooling

Datacenters used ~3% of the world's total electricty 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 enviromental criteria, including recycled content, toxin reduction, energy efficiency, etc.

Traditionally, there's been reluctance and little need for datacenters 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

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