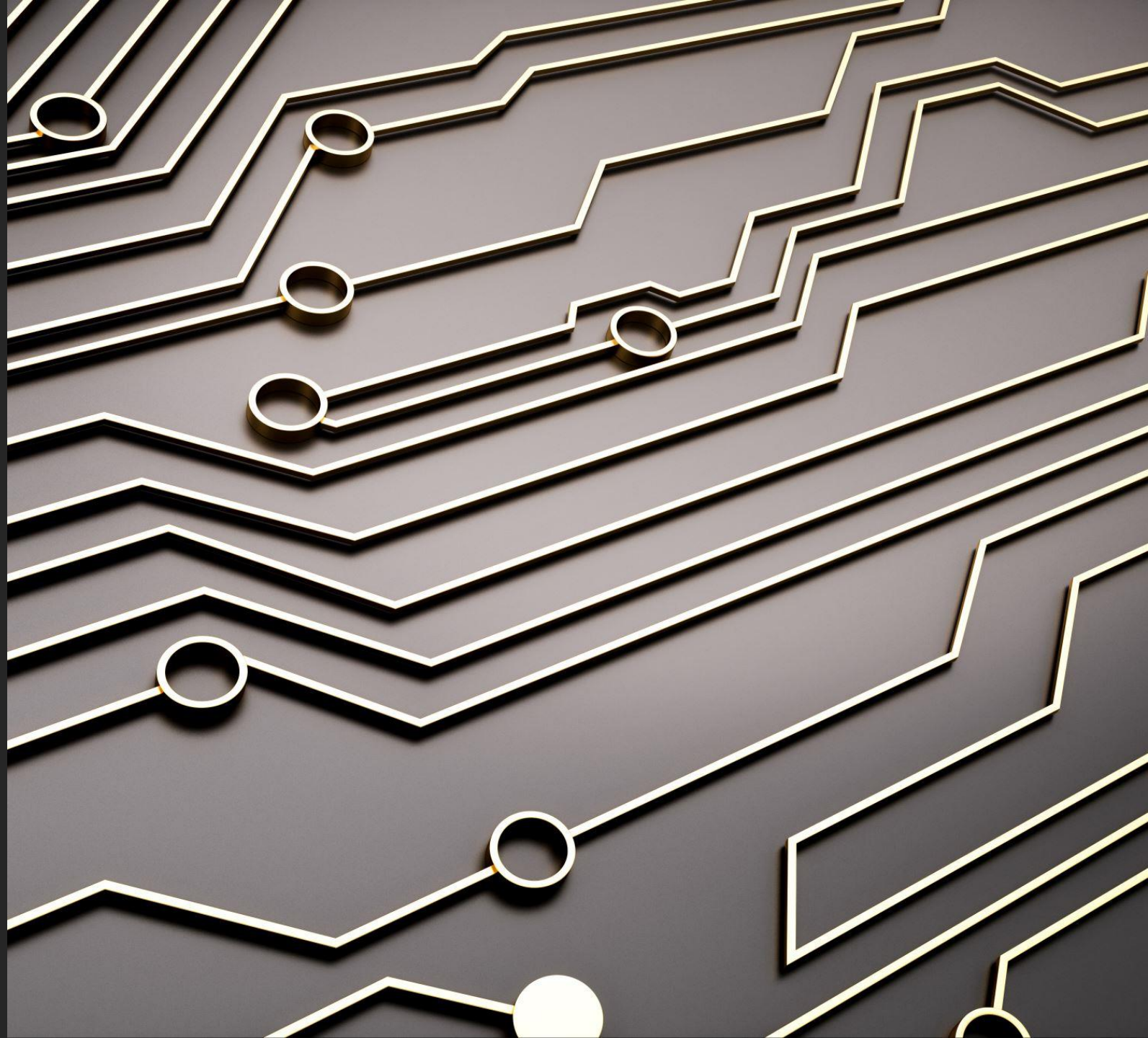# FUTURE HDD INTERFACES

JASON ADRIAN
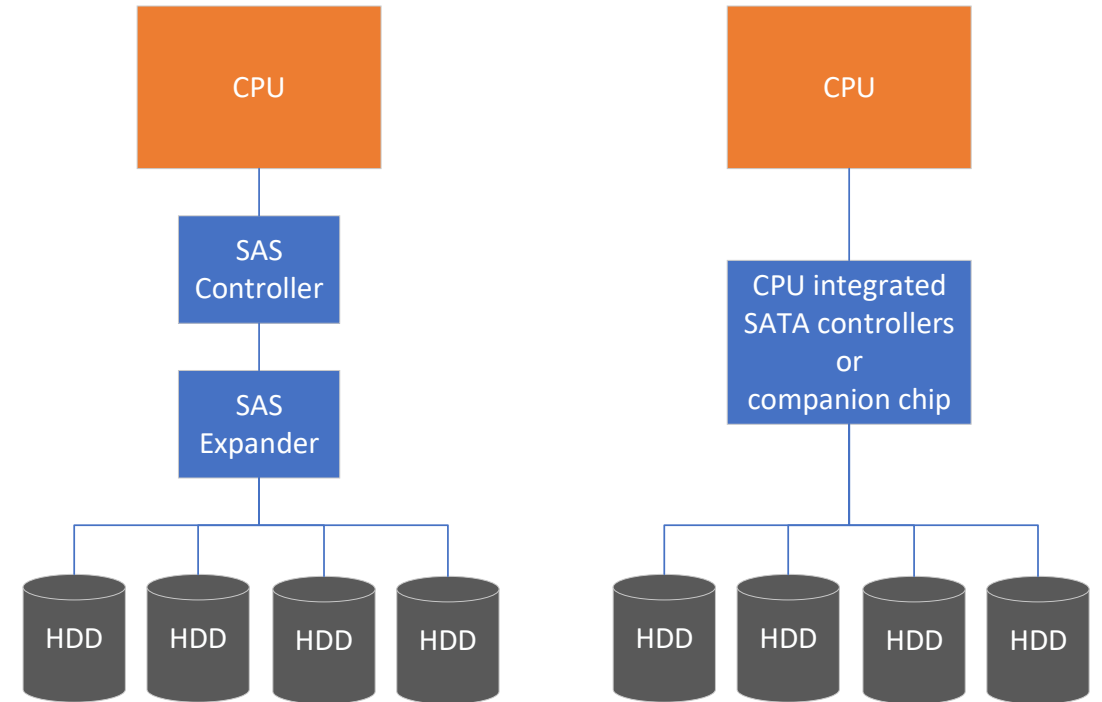
STORAGE HARDWARE ARCHITECT
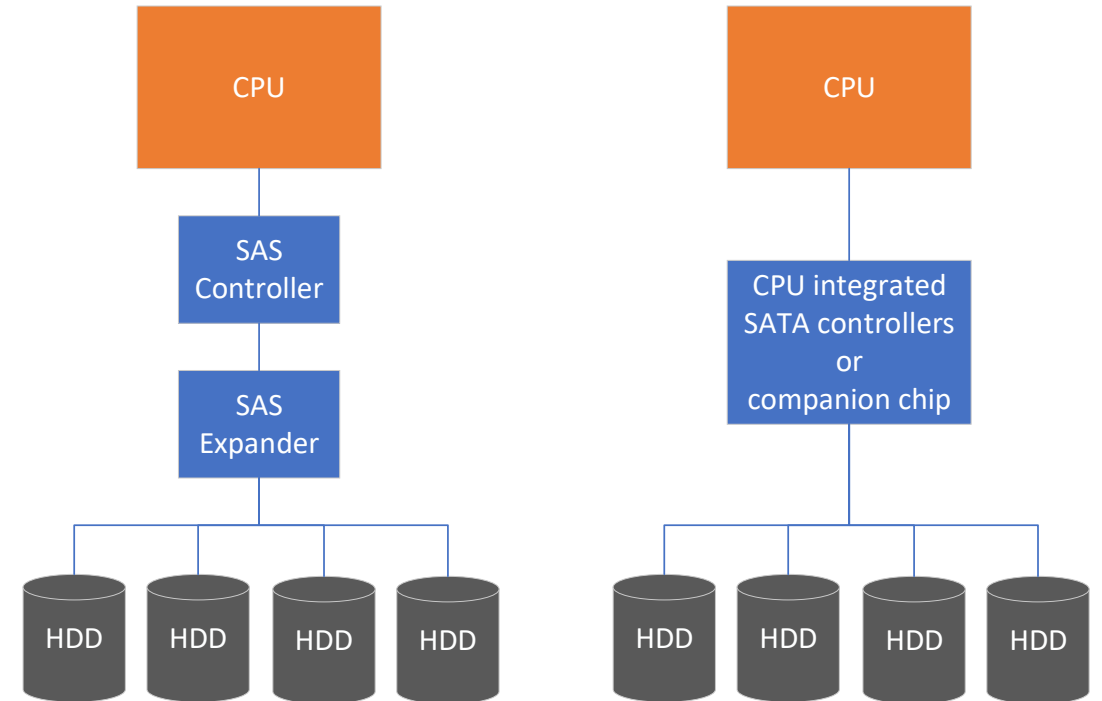
MICROSOFT AZURE

Microsoft Azure

SAS AND SATA

- SAS and SATA are mature interfaces and have served us well for well over a decade

- SATA is the lowest cost

- SAS has mature device topology, hot plug capabilities, and signal integrity

SO WHY CHANGE?

- SAS seems like an obvious winner, but:
  - Drives often cost slightly more
  - Requires SAS controller
  - Requires SAS expander for more than 8 or 16 (sometimes 24) direct attached HDDs
- Technologies like dual actuator are easier to manage with SAS and its native LUN semantics
- Dual actuator with SATA is more challenging, and will start pushing against the 6gb PHY limitations in future generations
- Do we really need SAS controllers and expanders? Why not use PCIe like we do for NVMe SSDs?

CPU

SAS
Controller

SAS
Expander

HDD HDD HDD HDD

CPU

CPU integrated
SATA controllers
or
companion chip

HDD HDD HDD HDD

NVME HDDS

- If HDDs move to NVMe, SW infrastructure can manage SSD and HDD platforms in a similar manner

- Can eliminate SAS controller ASICs

- Can directly connect to host CPU for low to moderate HDD counts

- Utilize PCIe switches instead of SAS expanders

  - This is a trade of protocol switches, not an improvement

- NVMe name spaces are conducive to technologies like dual actuator
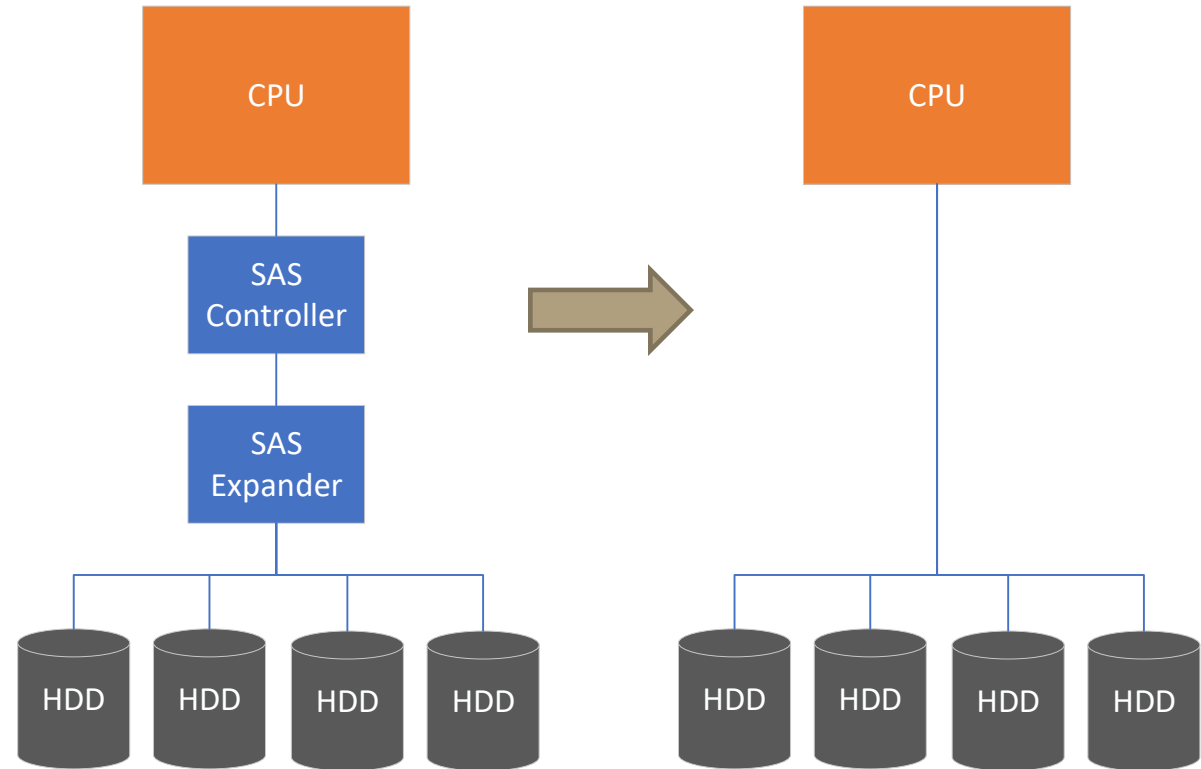
NVME HDDS – HOW TO MAKE THIS SUCCESSFUL?

- NVMe HDDs need only a single PCIe lane

- Could support 2 x1 lanes for those requiring dual porting

- PCIe Gen 3 would have a reasonable trace length for system designers. Gen 4/5 likely not required for many years.

- Host CPU complex's need to support x1 PCIe bifurcation to enable a larger direct HDD attach count

- Need to prove out surprise removal and PCIe enumeration for HDDs. This should be able to leverage much of the work from NVMe HDD design in efforts

CPU

HDD HDD HDD HDD