Past, Present, and the Bleak Future

STORAGE
Looking back 10 Years

• SAS was in its hey-day, FC drives ruled, and the SAS protocol was the answer to all evils
• Datasets fit into scale-up architectures
• NFS was starting to die
Looking back 5 Years

• JBOD became cool, and physical disaggregation was the name of the game

• Hadoop and other data-lakes were still in their ‘puddle’ phase with a few outliers leading the charge

• RAID failed us and EC was in it’s infancy
State of Storage Today

• Software integration into the device is the trend, FTL, Rebuild Assist, ISE etc.
  o Hyper-scalers are bucking the trend, wanting dumber endpoints and the CPU to do all the work
• Erasure Coding grows up and goes 3-D
• SMART was dumbed down so DHM is to be our salvation, but T10/13 are too slow
• Arial density is reaching a maximum
We Hit up Against the Laws of Physics

Source: Bit-player.org plus additions
The Optimists Opinion, All based on SMR
Bulk Tier, What is Coming to Help?

• TPI, BPT and total inch$^2$ games to squeeze bits in
• He, SMR, TDMR, HAMR, BPM and other esoteric technologies are all adding cost
• RV becomes the biggest issue
• ATI and the need to keep committed data safe after a write
• Noise became a real problem
  o [https://www.youtube.com/watch?v=tDacjrSCEq4](https://www.youtube.com/watch?v=tDacjrSCEq4)
Hot Tier

- # junctions per sq mm
- Thermals & die stacking already an issue
- Disaggregation via NVMe-F vs. more lanes on the CPU complex
  - Other methods for making the CPU a loaner..
    - Intel: Rack Scale Architecture, Inspur: Scorpio, OCP: OpenRackV3..
A Junction now is the diameter of 50 electrons
Cold Tier

• Tape has legs, but suffers badly in the efficient DC environment
  o RIP LTO, OpenStandards we will miss you, hello Neodymium
• BluRay is up and coming fast
  o New densities make it attractive, better throughput, great random reads
  o TTFB vs. cost and longevity, BluRay cannot be ignored
• Cold Flash has a niche play (checkpointing for instance) and could see a revival into many applications
The Envelope

• Thermal and RH implications as we push for higher efficiency in the DC

• Cloud-Scale economics for the rest of us
  o Fractional pennies per GB for cold data
  o Need for auditability and secure sharing of datasets

• Higher density is the enemy
  o Air flow impedance causes a log-growth in power overhead
  o DC floor costs are dropping drastically
    ▪ Early POD designs did not include the infra components
Storage History and Future

• Call to action:
  o Do not let the Hyperscale accounts dominate the conversation, open up workload profiles and use-cases to the device manufacturers
  o Start classification and data value assessments, put the data into a tiered storage architecture to reduce long-term costs, and deliver usable performance on demand
  o Look for value-added software to come from startups who got sick of the status quo and went out on their own
    ▪ get an in before they are bought up.
Thank You