

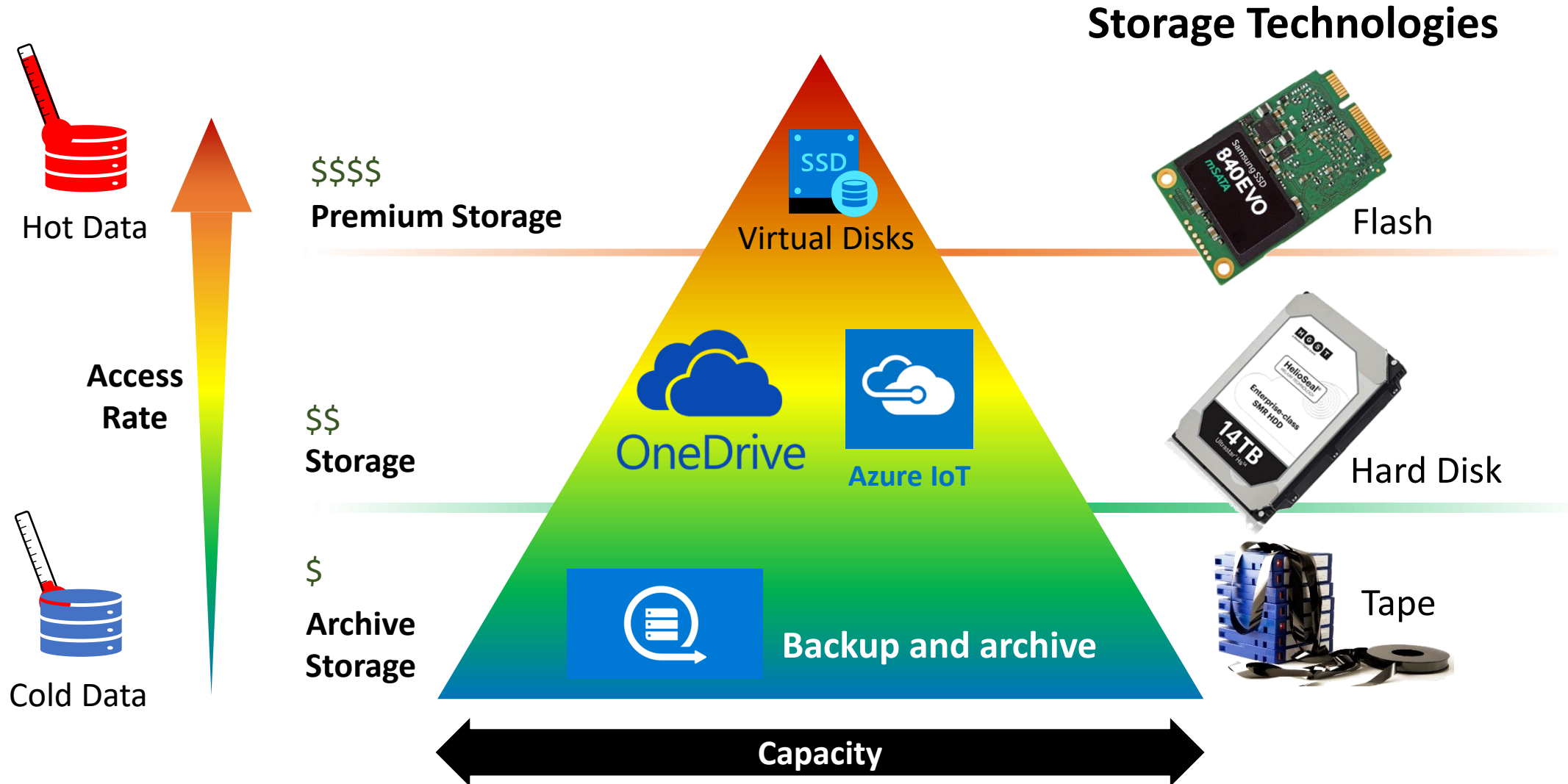
Could Cloud Storage Be Disrupted in the Next Decade?

Andromachi Chatzieftheriou, Ioan Stefanovici, Dushyanth Narayanan

Benn Thomsen, Antony Rowstron

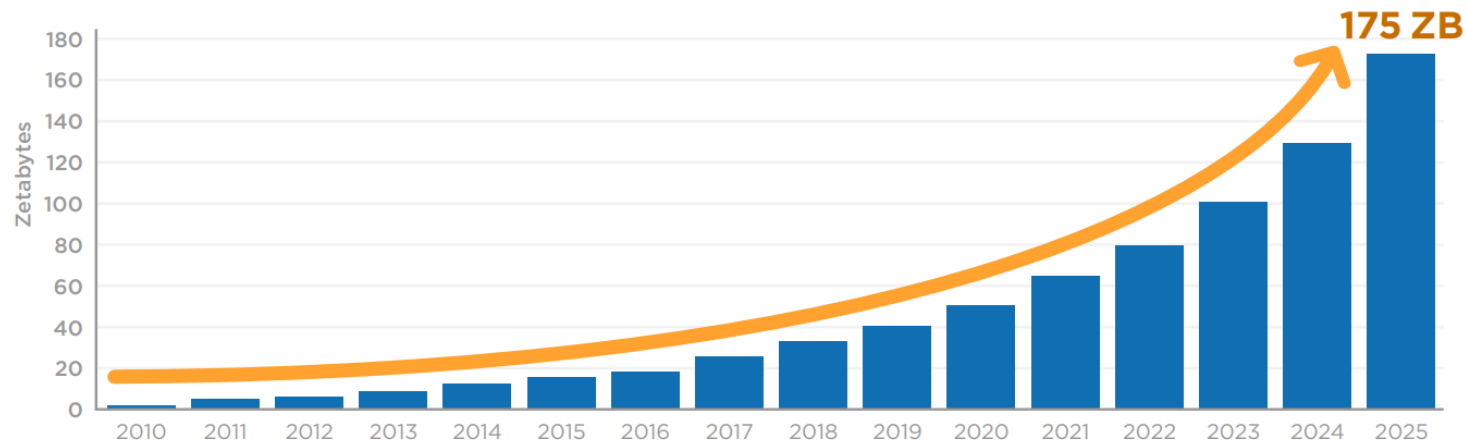
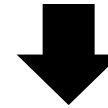
Microsoft Research

Cloud Storage Landscape: Yesterday + Today



Exponential Growth

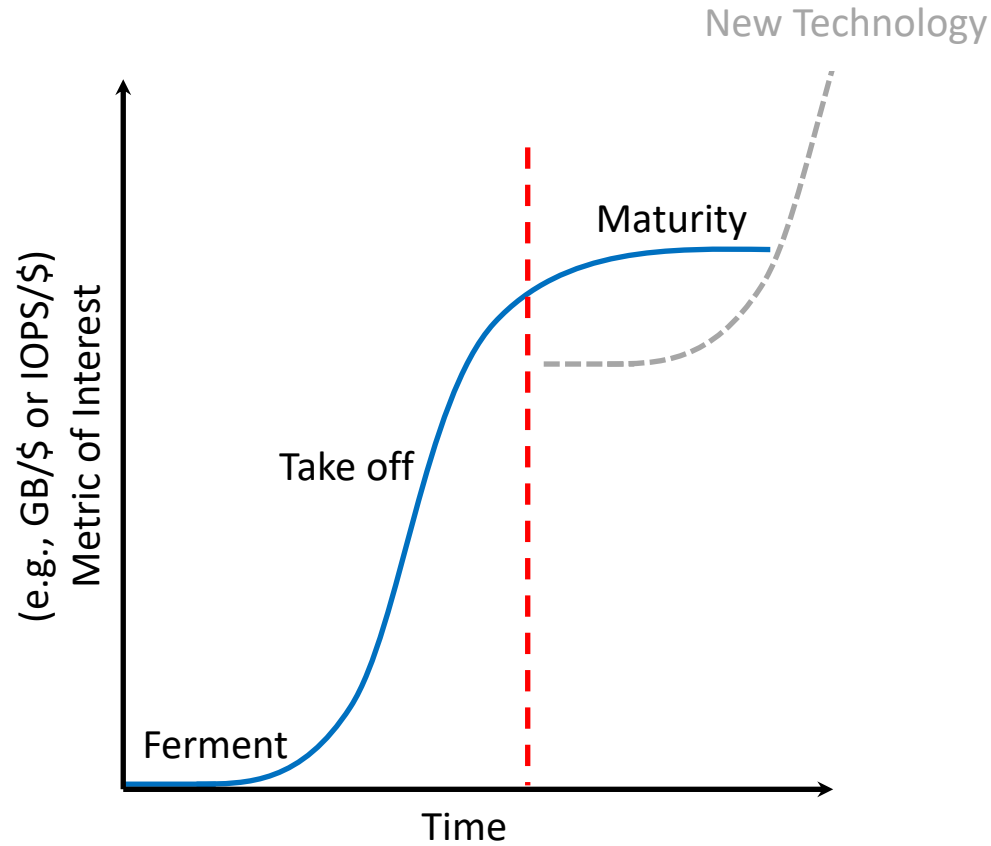
- Storage demand continues to increase at a staggering pace!



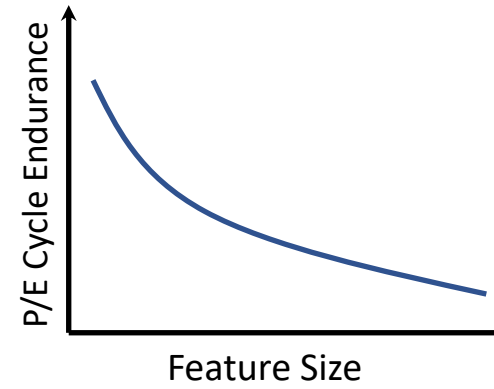
Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, Nov 2018

- Cost is paramount in the cloud
- Exponential demand requires exponential drops in cost (\$/GB)

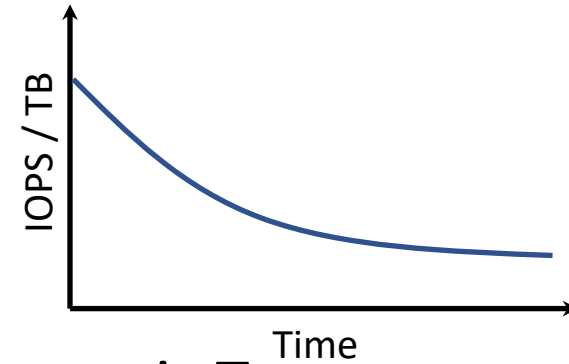
The S-Curve



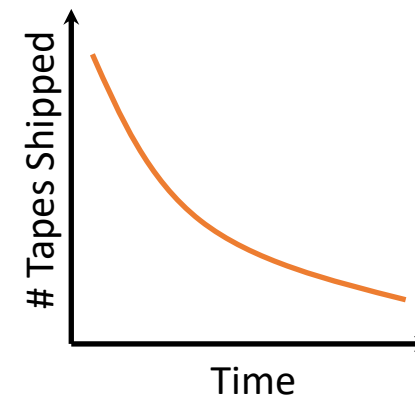
- **Flash**



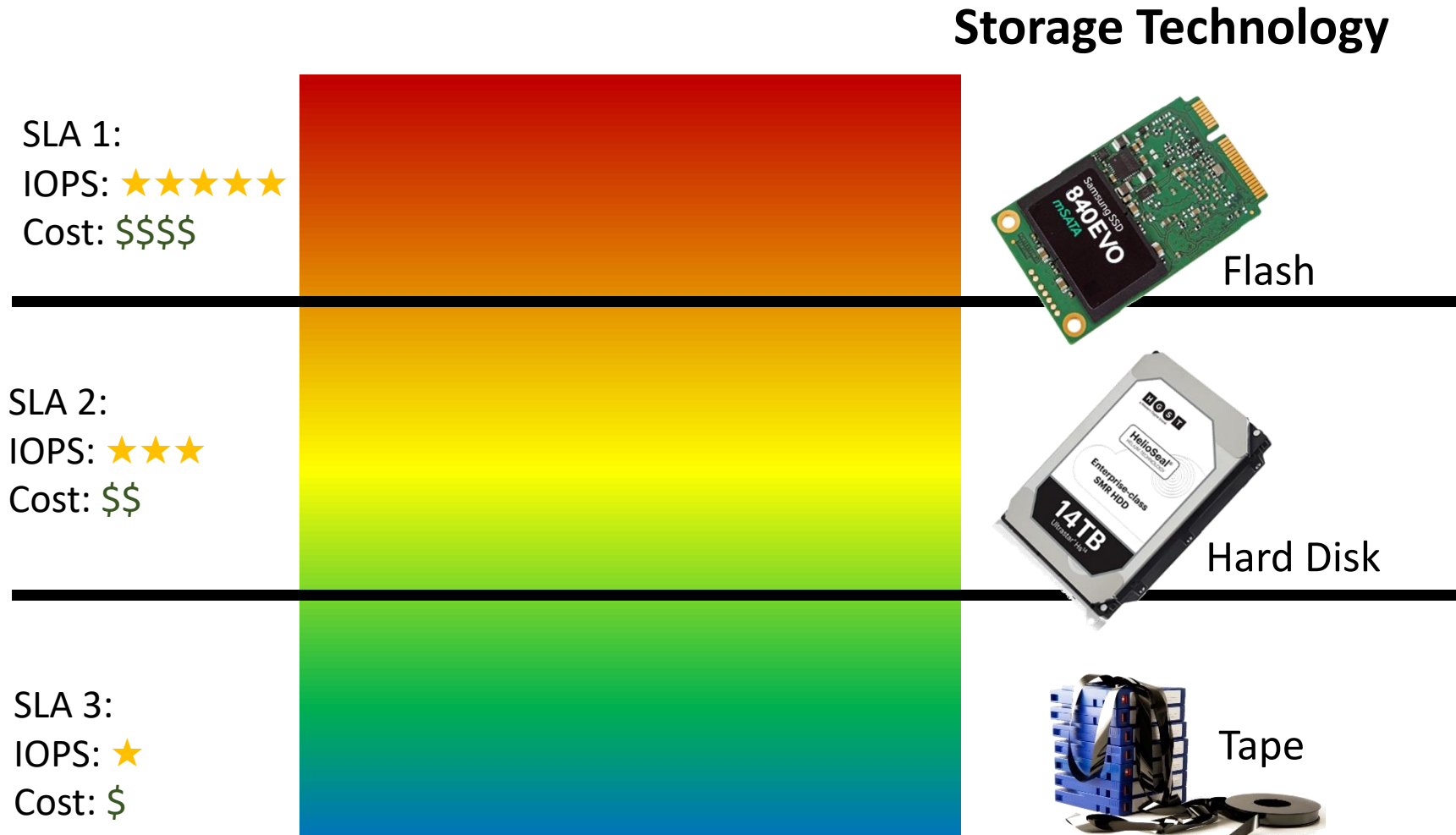
- **Hard Disk Drives**



- **Magnetic Tape**



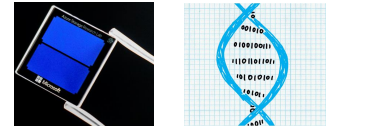
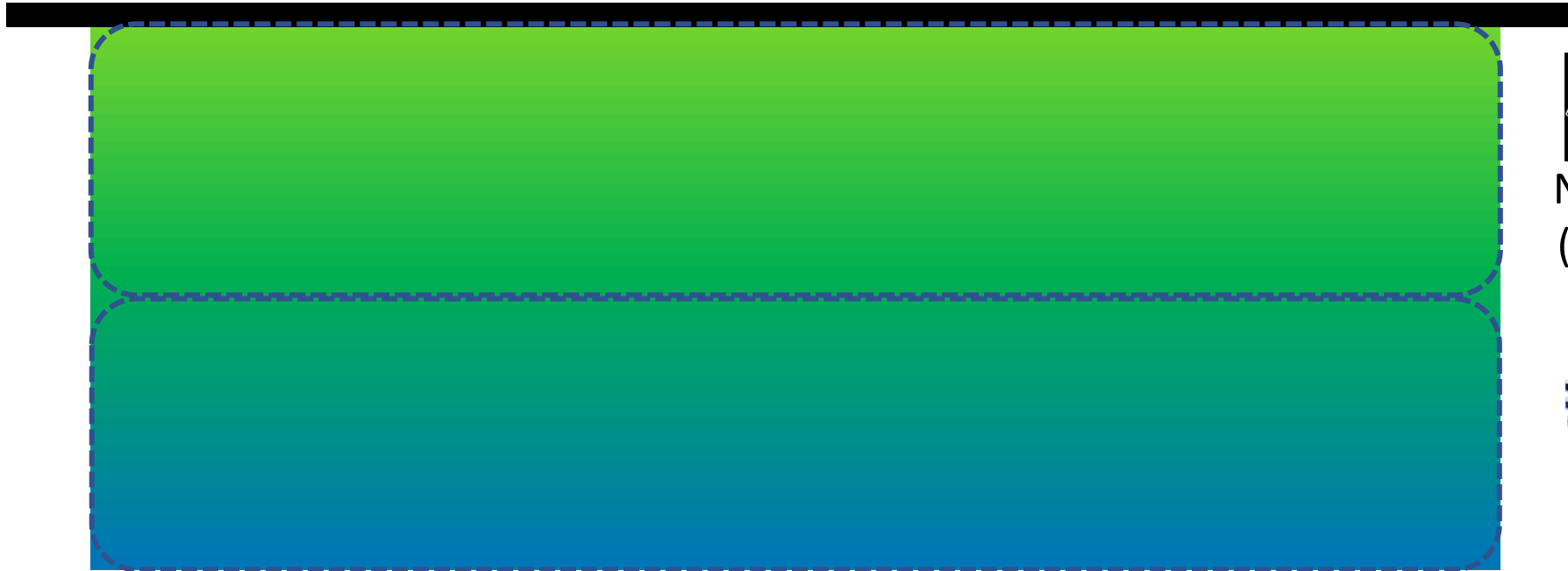
Tier Virtualization



Specialization at Scale

- E.g.: cold storage

SLA 3:
IOPS: ★
Cost: \$



New Technology
(e.g. Silica, DNA)



Tape

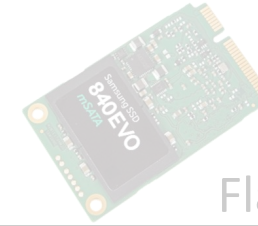
Specialization at Scale

Storage Technology

SLA 1:

IOPS: ★★★★★

Cost: \$\$\$\$



Flash



Future
Technology!

SLA 4:

IOPS: ★★★★★

Cost: \$\$\$

NEW!

SLA 2:

IOPS: ★★★

Cost: \$\$



Hard Disk

SLA 3:

IOPS: ★

Cost: \$



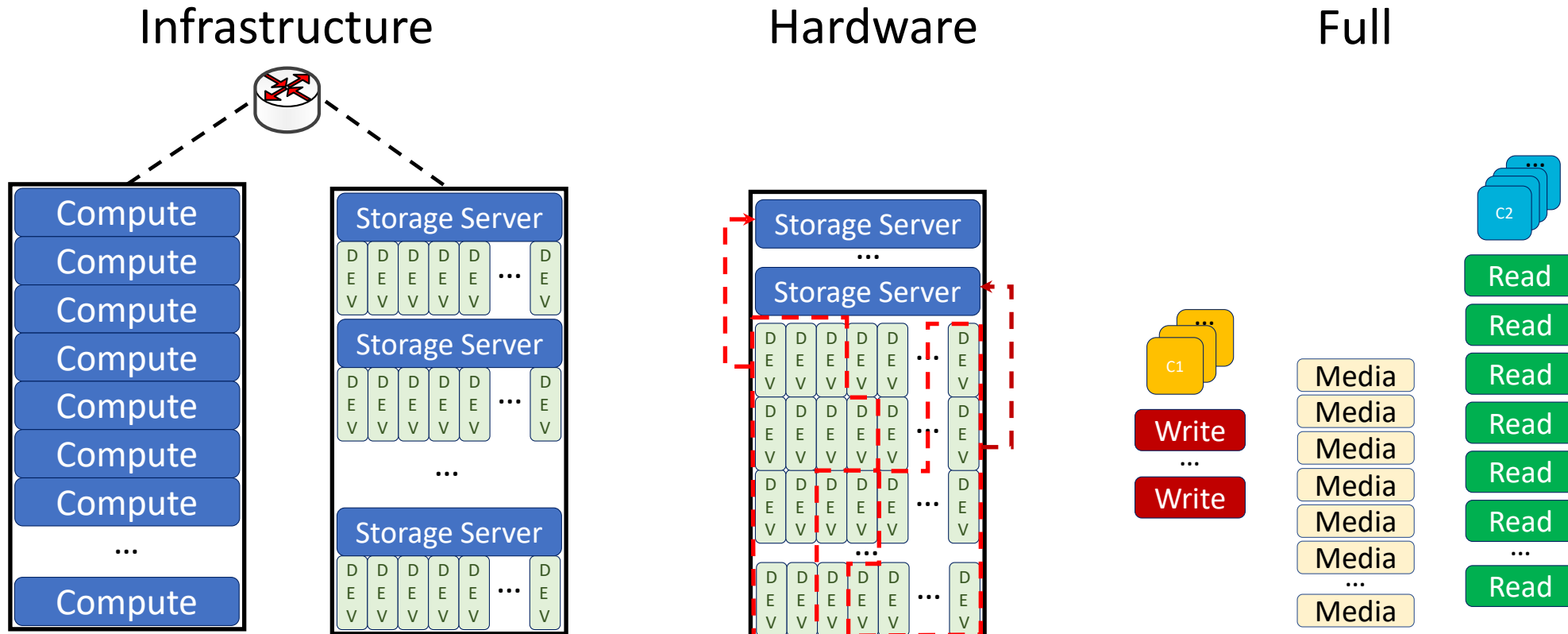
New Technology
(e.g. Silica, DNA)



Tape

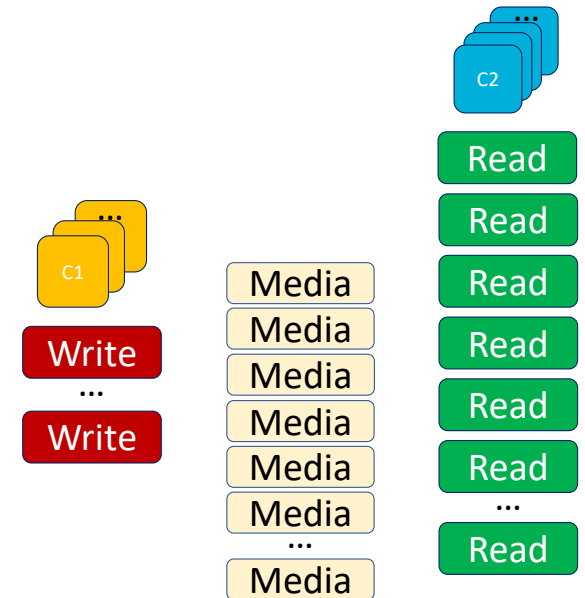
Cloud-First Storage Design

- Maximizing component utilization + flexibility is crucial!
- Disaggregation



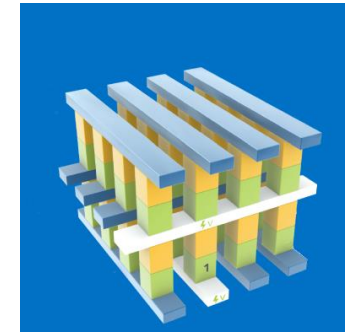
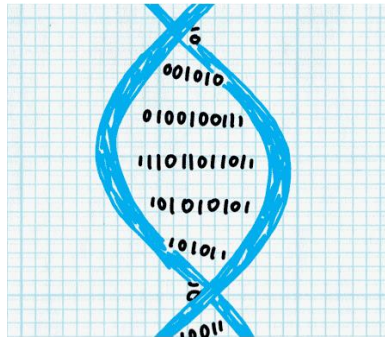
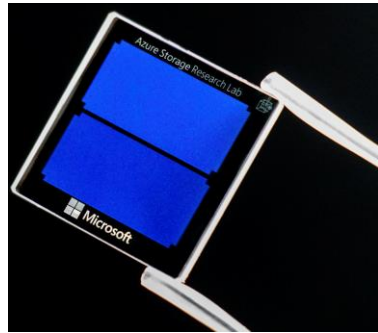
Cloud-First Storage Design

- Full Disaggregation
- Embrace form factor freedom!
 - Cloud-first technologies don't need to emulate
 - Hardware deployment is rack-level
- HW/SW co-design for e-2-e tail latency
 - Providers have little insight into workloads
- Needed compute can ride hardware trends
- Sustainability (please read paper!)



What's Next?

- Today: cloud storage is poised for disruption
- Tomorrow?



Something completely new!

Parting Thoughts

- Design for a single domain: cloud
 - Avoid “drop-in-replacement” emulation
 - Remove compromises + embrace form factor freedom!
- Hardware/software co-design from the materials up!
 - Crucial to providing sustainable exponential growth in the cloud
- Multi-disciplinary teams are **key**
 - Challenge the conventional “division of labour”
- Join us!

Thank you!

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