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G2M
RESEARCH
Cloud Service Providers: IS Public Cloud, Private Datacenter, or Hybrid Right For You?
Multi-Vendor Webinar
Tuesday Oct 12, 2021

G2M Research Introduction and Ground Rules

Mike Heumann
Managing Partner, G2M Research

Webinar Agenda

9:00-9:05	Ground Rules and Webinar Topic Introduction (G2M Research)
9:06-9:30	Sponsoring Vendor presentations on topic (10 minute each)
9:31-9:36	Panel Discussion Question #1
9:37-9:37	Audience Survey #1
9:38-9:43	Panel Discussion Question #2
9:44-9:44	Audience Survey #2
9:45-9:50	Panel Discussion Question #3
9:51-9:58	Audience Q&A (8 minutes)
9:59-10:00	Wrap-Up

What is a Cloud Service Provider (CSP)?

- Cloud Service Providers (CSPs) provide software-as-a-service (SaaS) offerings to a variety of customers
  - CRM/marketing automation (SFDC, HubSpot, etc.)
  - E-retail/analytics (eBay, SAP, etc.)
  - Content delivery (Akamai, Netflix, Limelight)
  - Email and storage (Dropbox, Box.com, NetApp, Twitter)
- One of their greatest costs is computing, storage, and networking infrastructure
- That is why at one point or another in their evolution, CSPs stand up their own datacenters
  - BUT often mix them with cloud storage resources

Storage for Cloud Service Providers (CSPs)

- CSPs have a variety of challenges when fielding storage for their customers/applications
  - Storage of huge amounts of data (petabytes or more)
  - A peak bandwidth of >1TB/sec for a CSP is not uncommon
  - Millions of concurrent users (multi-tenant ops on steroids!)
  - All spread across multiple datacenters and cloud resources
- Key CSP storage drivers: cloud vs on-prem vs hybrid
  - Ability to rapidly scale # users, bandwidth, and capacity
  - Minimizing CPU utilization
  - Minimizing power footprint
  - Providing predictable end-user performance

Panelists

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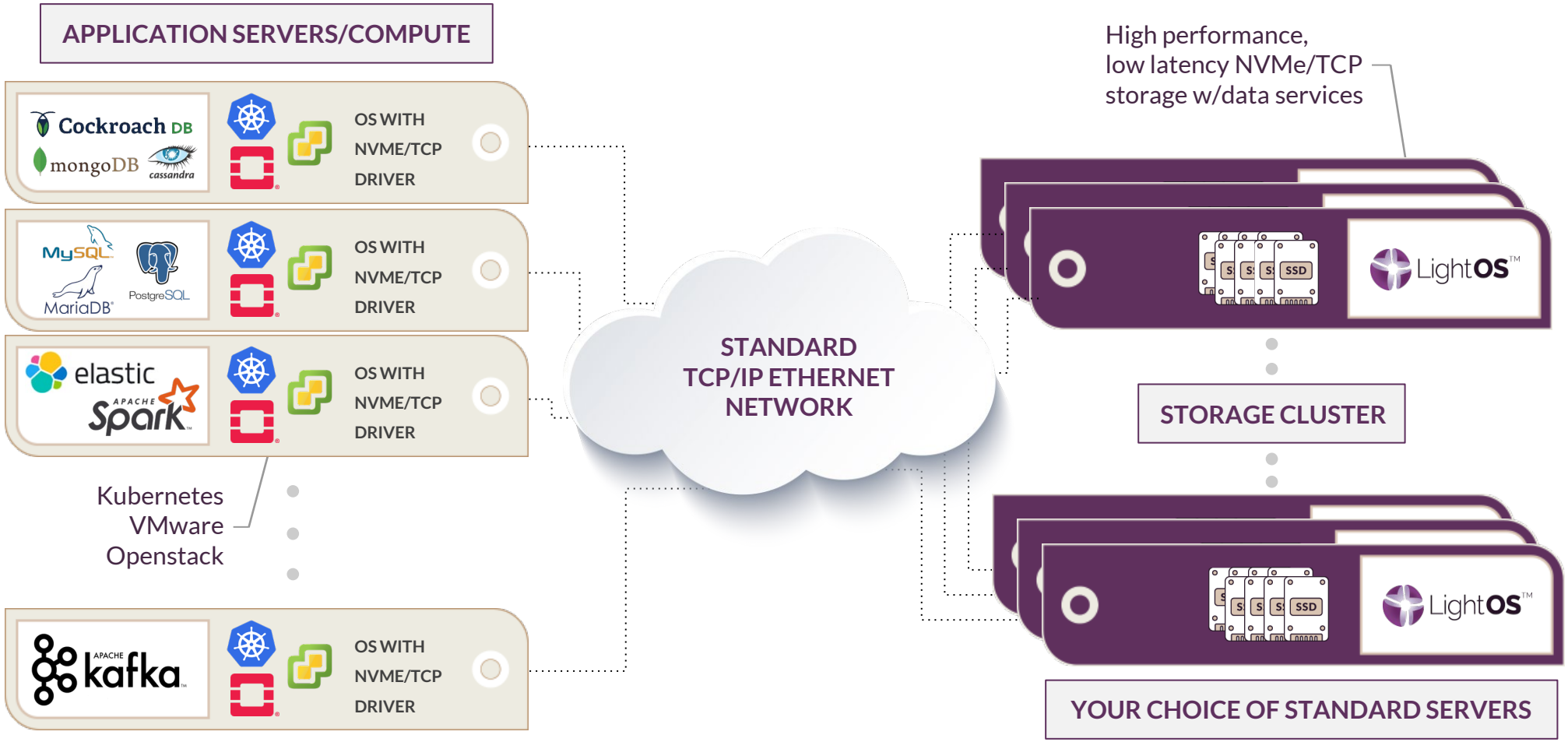
Lightbits LightOS Cloud Storage

High performance, scalable NVMe/TCP Storage Service

Sagi Grimberg, CTO

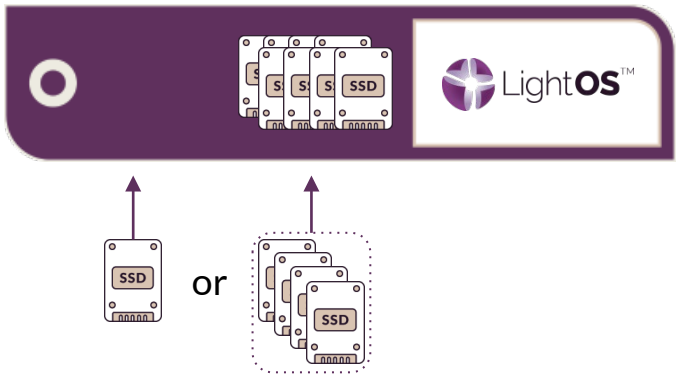
High Performance Software Defined Storage

Standard servers, NICs and SSDs for IaaS and PaaS



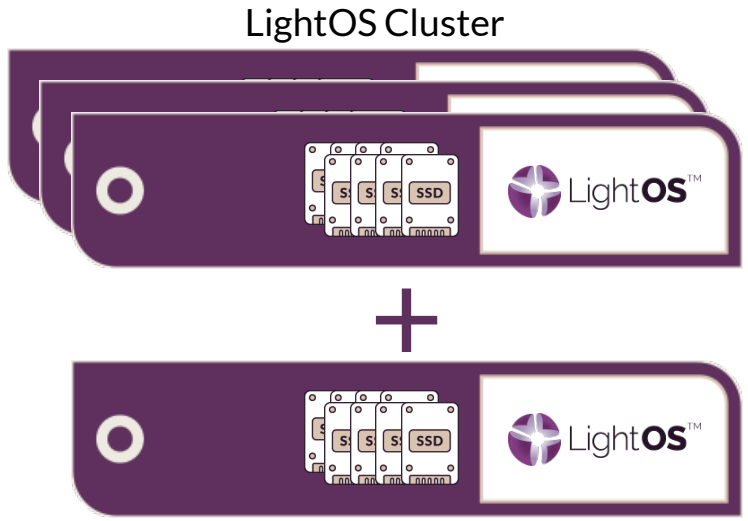
IaaS Flexibility: Independently Scale Storage

Scale up, or out, or both



Per Storage Server

- Start partially populated, add additional NVMe drives at any time
- Add 1 or many at once with no disruption in service



Per Storage Cluster

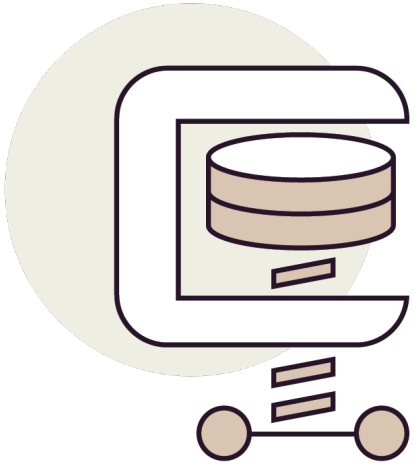
- Start with at least 3 storage servers
- Add additional server to the cluster at any time, online, without disruption
- Cluster dynamically (re)balances capacity and load

NVMe-oF with Data Services

Local flash like performance, array-like features

NVMe/TCP virtual block devices:

- Thin provisioning
- Inline compression
- SSD level RAID and HA policies per volume
- Redirect-On-Write Snapshots and Clones
- Online Volume resize
- Premium performance and Consistent low latency



LightOS™

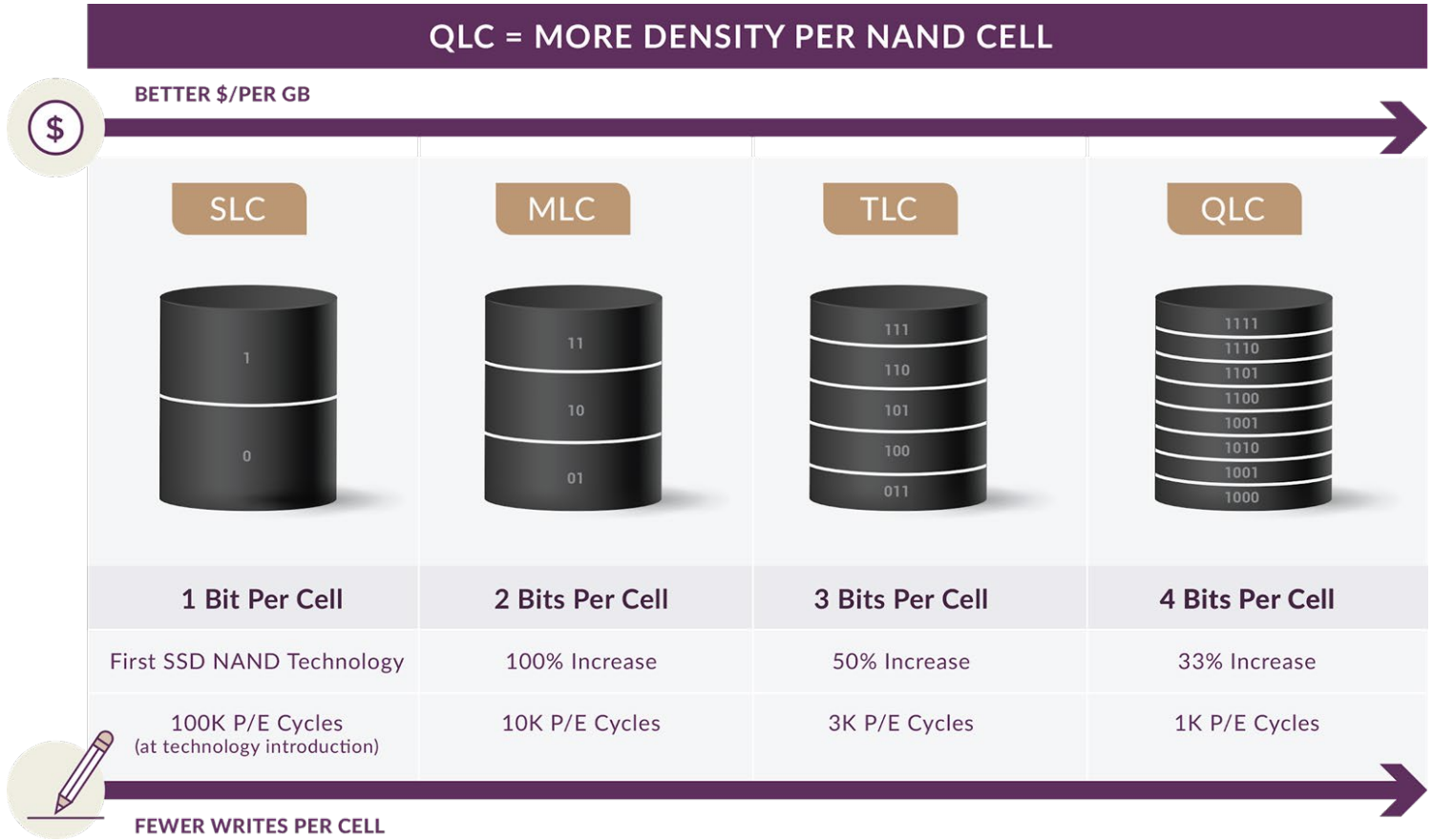
LightOS™

LightOS enables QLC Flash:

- **Up to 20 times endurance ***
- Aggregates writes for higher performance
- Allows for high capacity and high density at low cost while preserving high performance

* with 4:1 compression and LightOS Flash management

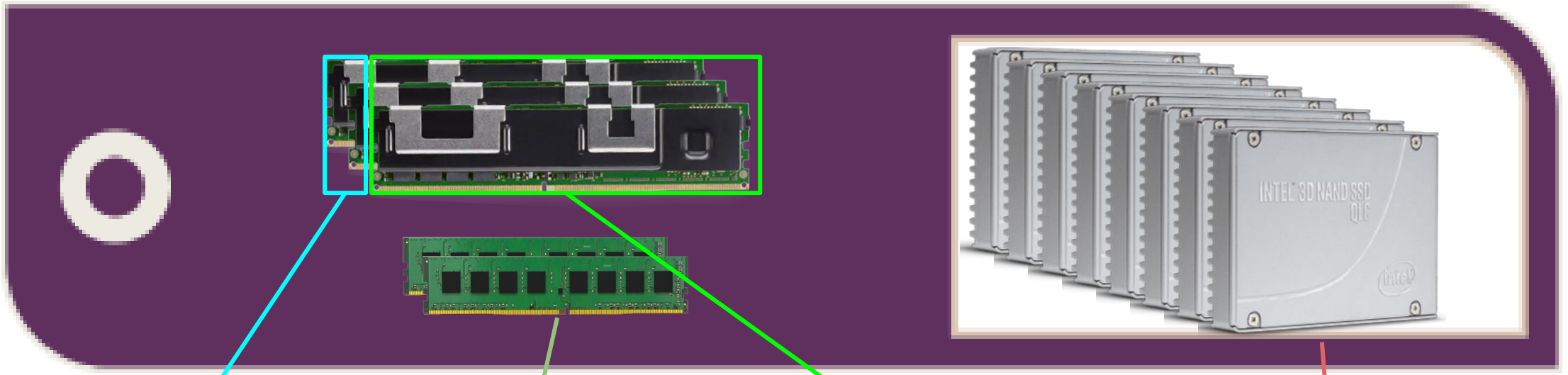
Reduce TCO



Optane and QLC

Make optimal use of each memory component

Storage Server with LightOS



Write Buffer
- Persistent memory (but not more!)
- Small size (few GBs)
- Designed to persist stage data on its way to flash

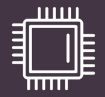
System Memory
- Small size (few dozens of GBs)
- Boot and handle system operation and data-path

MD Store:
- Granular log-structured MD store
- Vast majority of system memory (up TBs)
- Cheap volatile memory replacement

Primary Storage:
- Low cost QLC Flash
- High raw density (hundreds of TBs)
- RAID protected flash pool

LightOS for the Cloud

Storage Solution For Each Cloud Use-Case



Private Cloud

- Software Defined
- Simple to Manage
- High Performance
- Rich Data-Services
- Lower TCO with QLC

CSP

- High-Availability
- Easily to Scale
- Multi-tenant Aware
- QoS
- Kubernetes, VMware, Openstack

Edge Cloud

- Fail-in-Place
- Flexible Deployments
- Standard OSs
- Standard Networks
- Standard SSDs

Public Cloud

- Stay Tuned...

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Clint Stalker

Director of Business Development

www.netlist.com

NETLIST

Company | Technology | Supply

Enterprise Solid State Drives (SSDs) and Server Memory Modules

20+ Years of Memory Expertise

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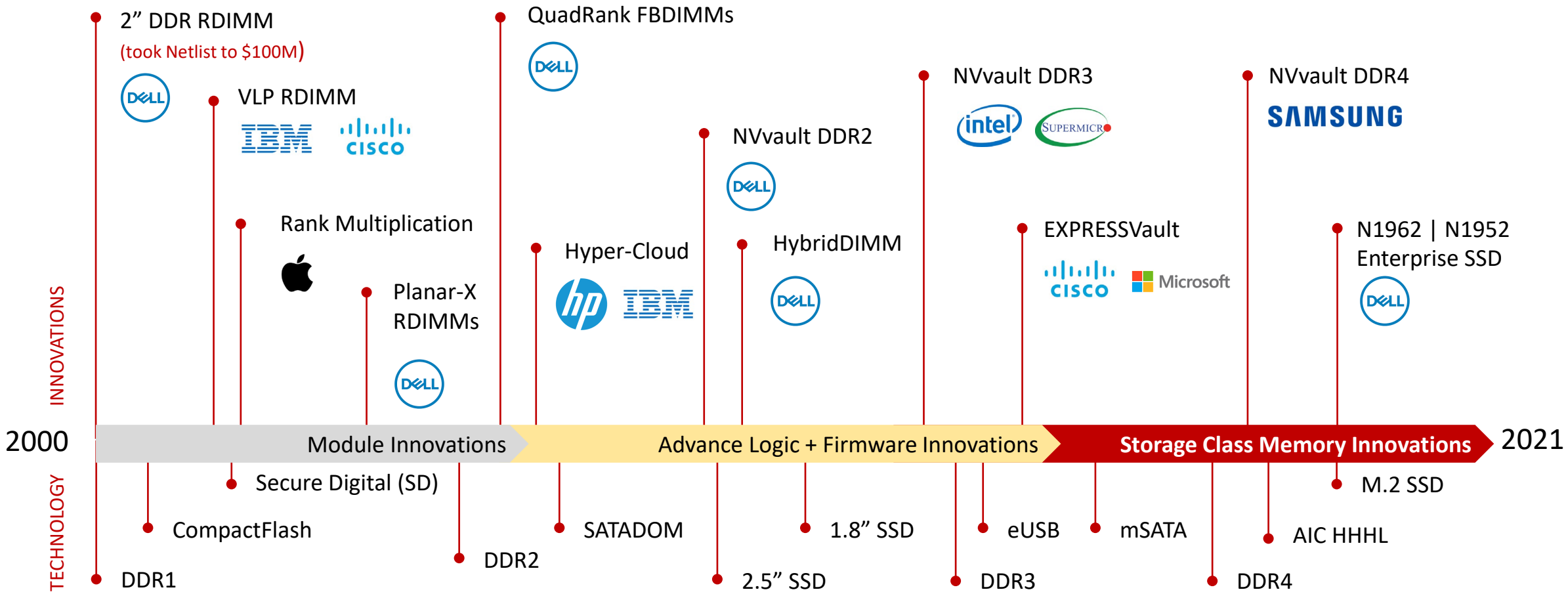

Why Storage Latency Matters for Cloud Service Providers

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- Latency is response time or wait time—how long it takes to complete a request:
  - The amount of time to perform a stock trade, load Fortnite (likely on a SQL server), complete your Amazon purchase…
- NVMe is the leading storage technology to enable top performance
- Customers are migrating to NVMe SSDs for faster processing and bandwidth
- Their customers cannot wait:
  - Gaming service providers need 800G servers for their clients
  - Video-streaming services are migrating to 400G servers to MSPs
  - CDN systems are going all flash arrays for payment processing
  - Self-driving cars!

- Latency affects the bandwidth as more IoT devices become connected
  - The goal is to avoid the app, transaction, movie, etc. from stalling
- Latency can be the most important metric for a performance sensitive application or database environment (per SNIA)

Private Cloud… Public Cloud… Hybrid Cloud… Multicloud… And SSDs

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- SSDs with consistent and predictable performance is critical
  - High QoS (4 9s or 5 9s)
  - No latency spikes—predictability and consistency are necessities
- Information needs to be located close to the edge—with the cloud/datacenter behind it
- Data needs to be stored closer to the customers so your data packets do not have to enter the cloud where congestion is high
- Local points of presence (POPs) are key
- The focus should be localization of data processing

N1962 NVMe Gen4 U.2 SSD

Latest Generation of Enterprise/Datacenter Solid State Drives

Best-in-class Performance

Up to 16TB

On-Hand Inventory vs. Competitor 16 Weeks Lead-Times

Unrivaled 9DWPD (Drive Writes per Day)

Extremely Short Lead-Times (~ 4 weeks)

On-Hand Inventory, Readily Available for Most SKUs

Top Performing Gen4 NVMe SSD

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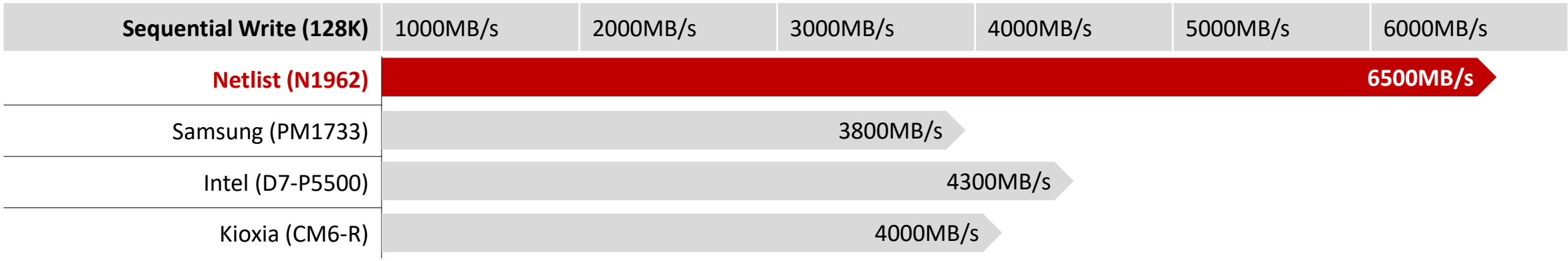
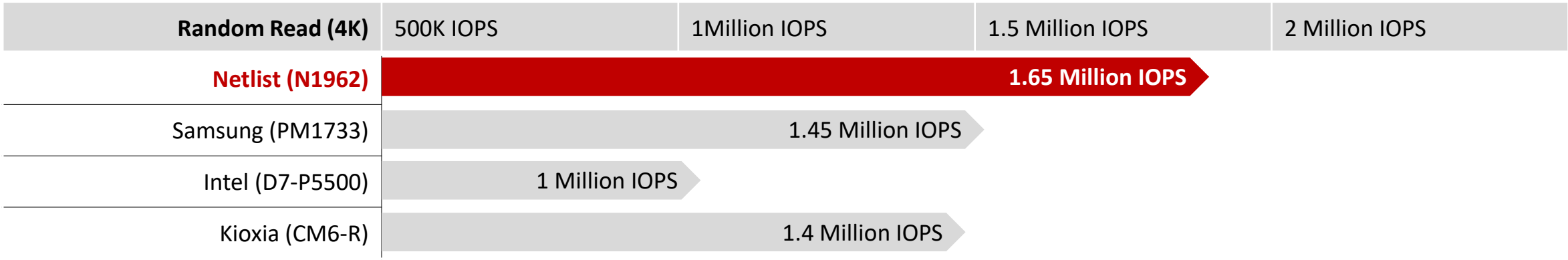




Independent Lab Performance Testing Results Against Competitive Products

#1 in SQL Server

80% Reduced Latency over Samsung PM1735

#1 in Sysbench

32% Reduced Latency over Kioxia CM6

#1 in VDBench

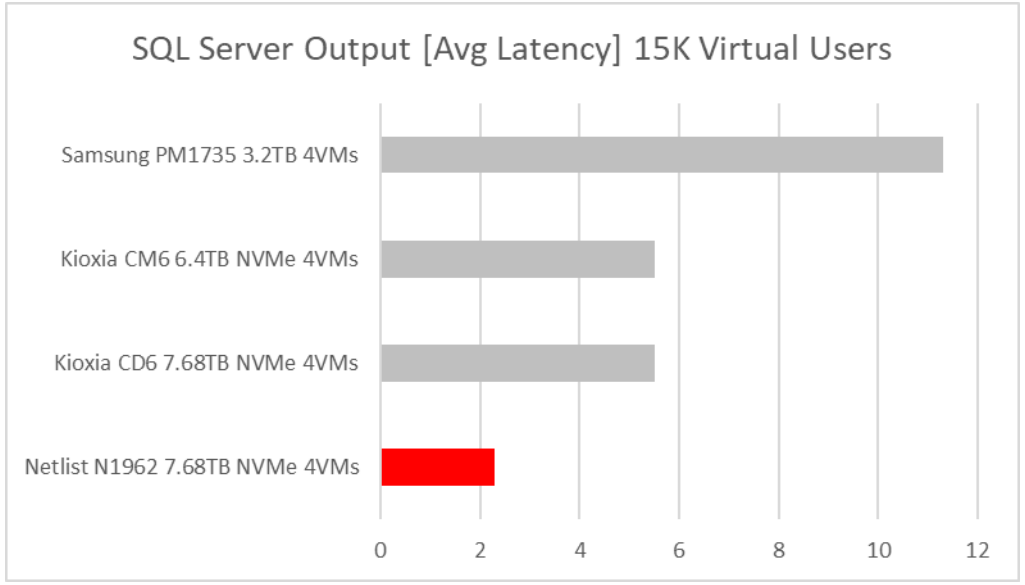
40% Higher Random 4K Reads over Samsung PM1735

Top Overall Performance

Compared to Samsung PM1735, Kioxia CM6, Kioxia CD6

N1962 Latency Highlight (Lower Is Better)

- **In actual application-level testing, the N1962 performed significantly better than the Samsung and Kioxia drives**
  - **Samsung's latency was nearly 5x higher**
- **In the synthetic testing, Netlist's drive was first or second in every test**
  - **Samsung's latency was nearly 50% higher in several Sysbench tests**



Netlist Storage Products – Meeting Customer Needs in SSD, Flash and DRAM

Solid State Drives

Enterprise Class, Datacenter, Hyperscaler

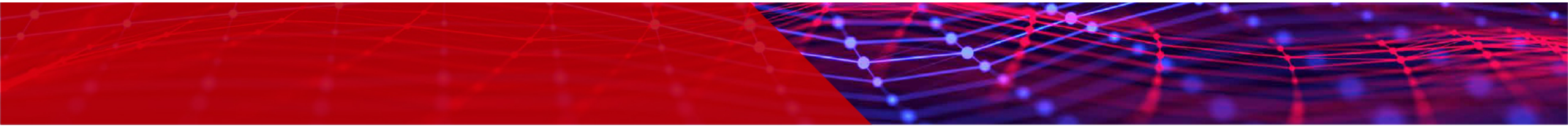
Embedded Flash Devices

CF, SD, eUSB, M.2

DRAM Modules

DDR5, DDR4, DDR3, Legacy modules

Thank you



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Panel Questions and Audience Surveys

Panel Question #1

What are the top three drivers for choosing whether to put your primary storage in the cloud, on-premises, or in a hybrid model?

- Clint Stalker - Netlist
- Sagi Grimberg – Lightbits Labs

Audience Survey Question #1

What do you see as the greatest tradeoff between on-premises storage, cloud storage, and a hybrid model (pick one answer):

- Overall Cost: 13%
- Cost Predictability: 25%
- Performance: 21%
- Performance Predictability: 13%
- Security/Data Privacy: 17%
- Other Concerns: 0%
- No concerns/no opinion: 13%

Panel Question #2

Many hyperscalers now offer cloud-based instances of technologies such as NVMe®, NVMe-oF™, and clustered file systems. How can you best integrate these capabilities in a hybrid storage model?

- Sagi Grimberg – Lightbits Labs
- Clint Stalker - Netlist

Audience Survey Question #2

What are the biggest impacts of maintaining an on-premises datacenter as a cloud services provider (check all that apply):

- CapEx costs: 45%
- Staffing costs and expertise: 36%
- Security concerns: 27%
- Coordinating datasets across multiple datacenters: 32%
- Don’t know/no opinion: 27%

Panel Question #3

How can storage datasets be effectively managed in mixed environments?

- Sagi Grimberg – Lightbits Labs
- Clint Stalker - Netlist

Audience Q&A

G2M COMMUNICATIONS

Effective Marketing & Communications with Quantifiable Results