Nonvolatile Design Challenges and Methodologies

Aaron Olbrich, Senior Fellow

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Flash is Expensive vs HDDs

HP 600GB 6G SAS 15K rpm LFF (3.5-inch) Dual Port 3yr Warranty Hard Drive
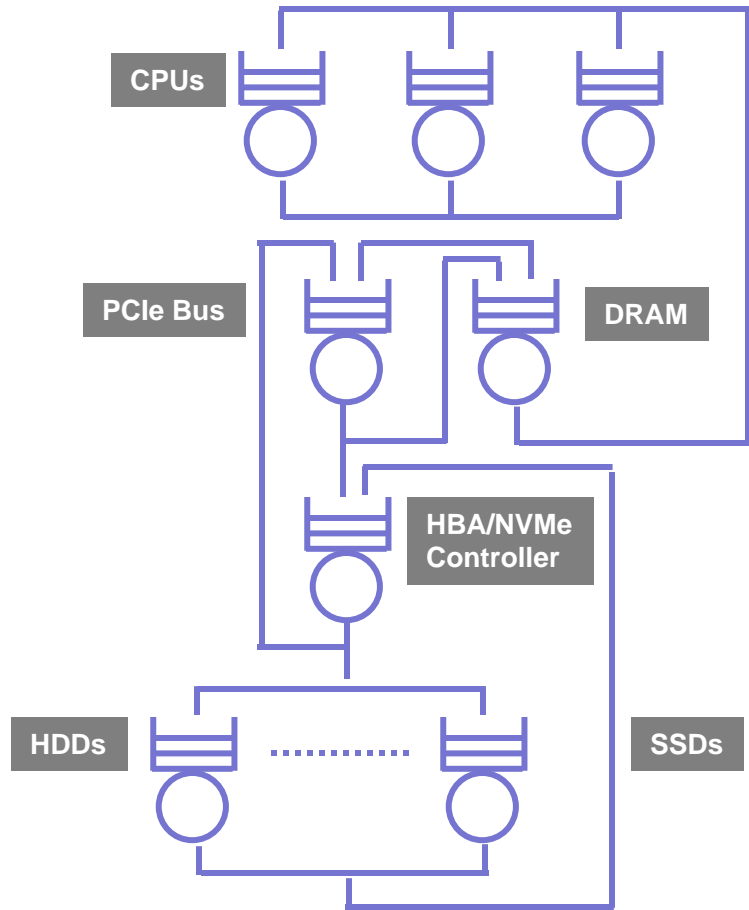
HP Price: $629.00
MFG# 516828-B21

$1.05 per GB

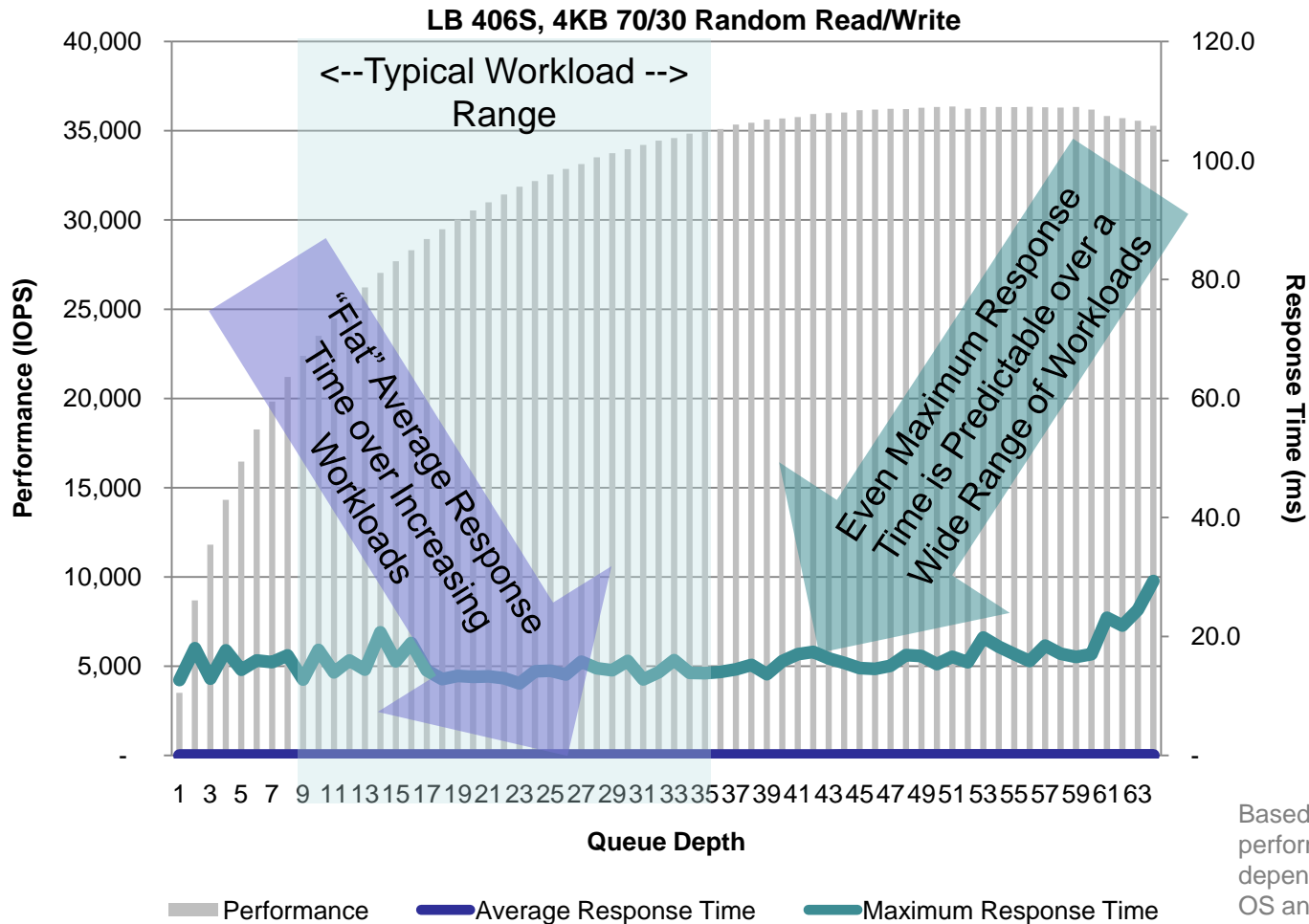**HP 640GB Multi Level Cell PCIe ioDrive Duo for ProLiant Servers**

HP Price: $14,999.00
MFG# 600-282-B21

$23.44 per GB

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New Bottlenecks Exposed → at the System Level

Need to Guarantee QoS with Predictable Max Response Time

LB 406S, 4KB 70/30 Random Read/Write

<--Typical Workload -->
Range

"Flat" Average Response Time over Increasing Workloads

Even Maximum Response Time is Predictable over a Wide Range of Workloads
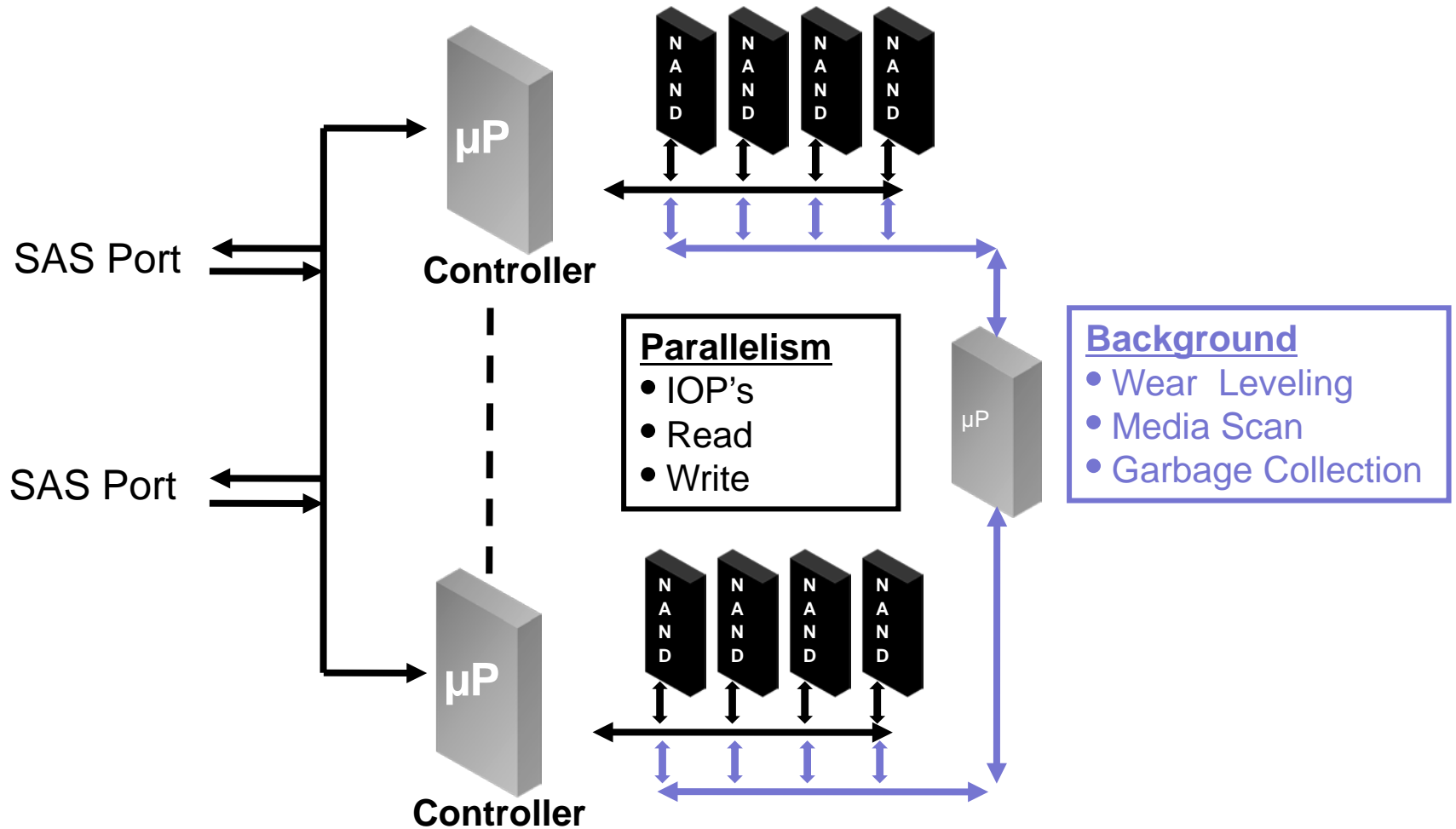
Performance (IOPS)

Response Time (ms)

Queue Depth

Performance — Average Response Time — Maximum Response Time

Based on internal testing; performance may be lower depending upon host device, OS and application.

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Parallel Architecture Required to Do More Work

Parallelism
- IOP's
- Read
- Write

Background
- Wear Leveling
- Media Scan
- Garbage Collection

SAS Port

SAS Port

µP

Controller

µP

Controller

NAND

µP

Power Becomes a Critical Issue

Current versus Time to Program (Tprog)
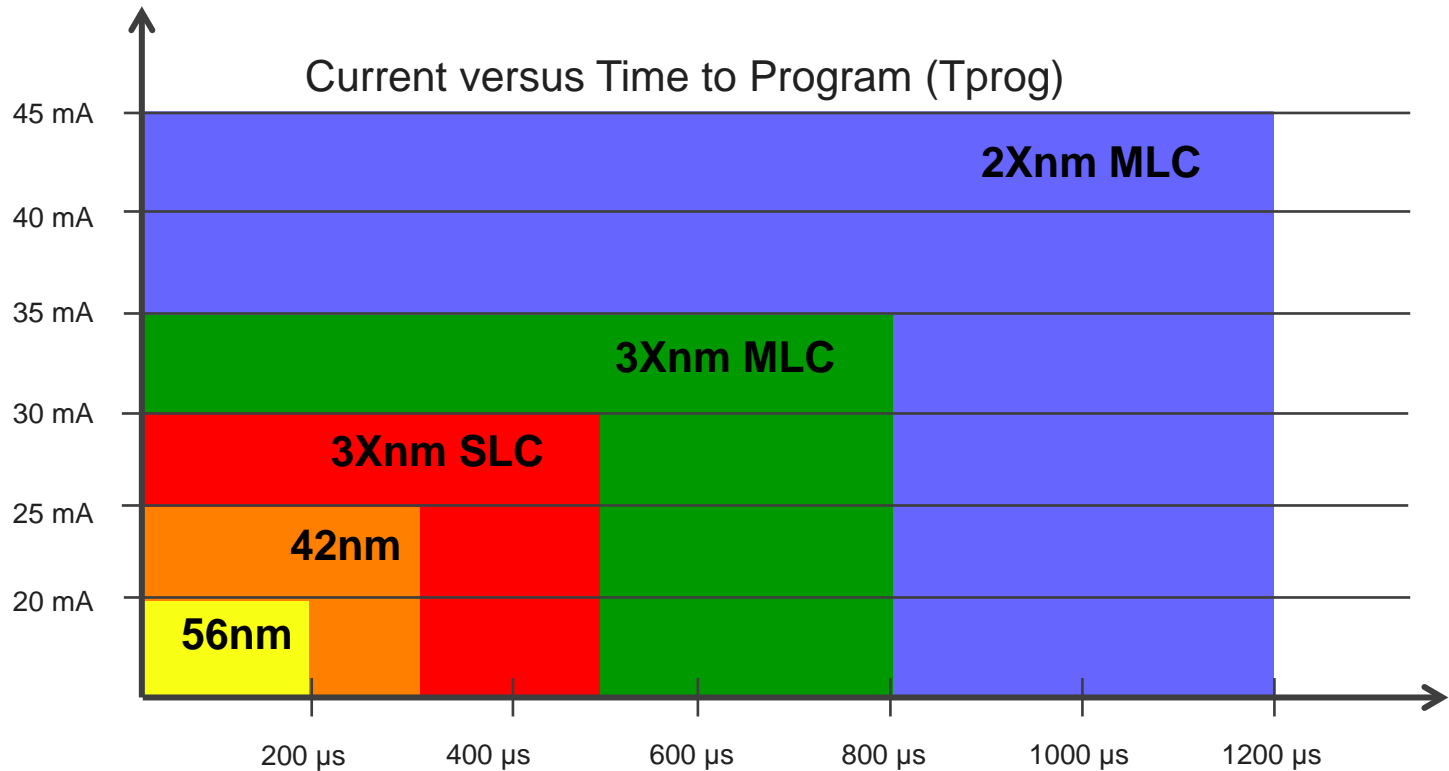
Increasing power of NAND driving up system supply needs

Summary – Design Challenges

- More SSDs drives up CPU utilization

- Parallelism enables more work (and drives up power needs)

- Power budgets are significant design factor

- Maintaining quality of service (QoS) essential during peak workloads

ANY QUESTIONS?

Thank you!

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