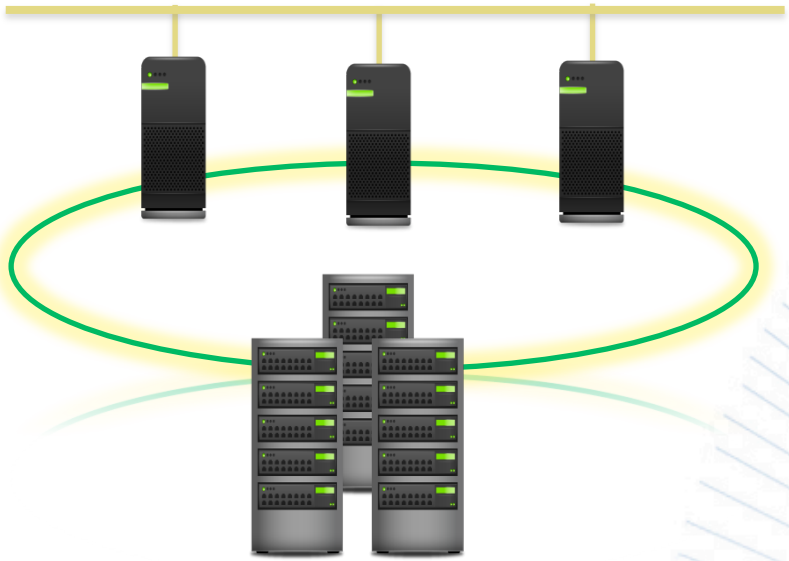
LinkedIn – Pervasive Flash

Before

RISC Servers on SAN
Monolithic SAN Arrays



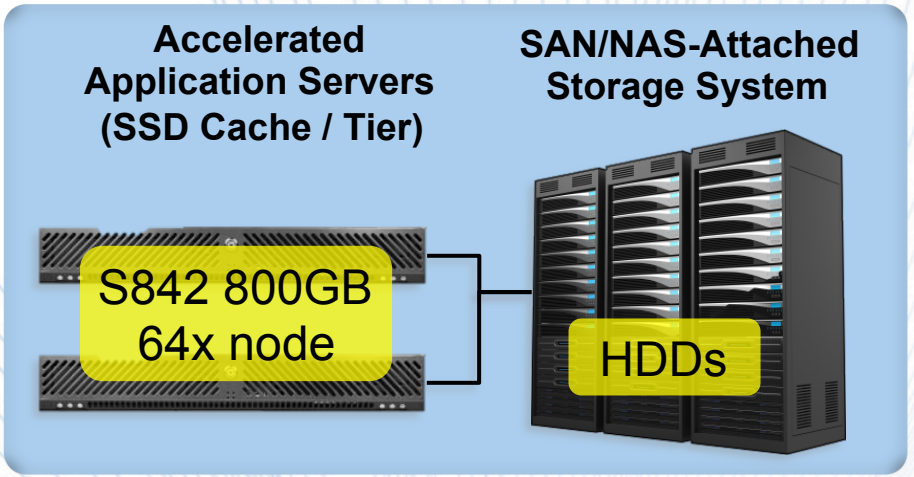
After

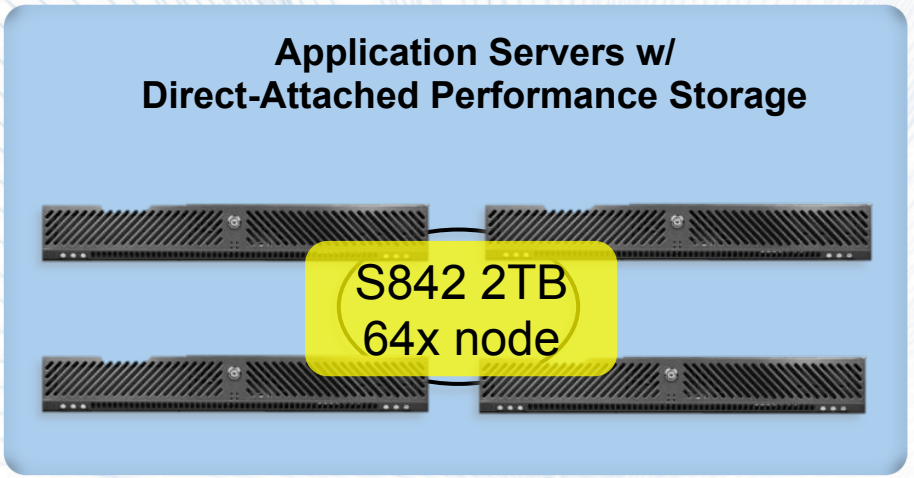
Commodity Hardware
2.2TB PCIe Storage
Near-Pervasive Flash

- ❑ 300% increase in IOPS
- ❑ 200% reduction in latency
- ❑ Significant savings in space, power and SW licenses

Server-Centric Performance Storage

verizon terremark





Ping An - Microsoft Exchange

Before

Latency 100ms

After

Latency 2ms

- 120,000 mailboxes, 56 servers, replicated to SAN (DAGs)
- Average load time for 10MB attachment from 3 minutes to 5 s

Imperial PFS VMware VDI

Before

View Servers

Domain Controller

VDI Cluster

(& Personas)

15-18 Virtual Desktops per hour

10-15 linked clones recomposed per hour

100 Hosts for 1000 VMs

After

View Servers

Domain Controller

VDI Cluster

(& Personas)

500 Linked clones in 61 minutes

500 recomposed in 58 minutes

3 Hosts for 1000 VMs

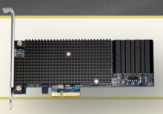
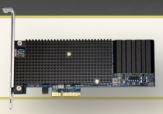
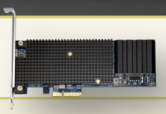
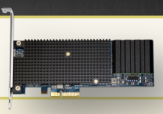
HGST
a Western Digital company

BACKUP

Product Lineup Flash Max II

Product Category	Standard	Performance	Capacity
Flash Type	MLC	MLC	MLC
Capacity (GB)	550, 1100	1100, 2200	4800
Read Bandwidth (64KB random)	1.6GB/s	2.7GB/s	2.6GB/s
Write Bandwidth (64KB sequential)	550MB/s	1GB/s	900MB/s
Random Read IOPS (512)	630,000	1,130,000	850,000
Random Read IOPS (4KB)	175,000	340,000	270,000
Sustained Random Write IOPS (4KB)	50,000	110,000	45,000
Sustained 25% write, 75% read IOPS (4KB)	110,000	220,000	120,000
Read Latency (4KB random)	76us	76us	78us
Write Latency (512B sequential)	16us	18us	18us
Maximum permissible amount of flash writes covered by warranty	10PB	16PB	33PB

Product Lineup STEC 1120 and 1122

Product Category				
Flash Type	SLC	MLC	MLC	MLC
Capacity (GB)	200G(40)	400G(80)	800G(1TB)	1.6TB (2TB)
Read Bandwidth (64KB random)	1.5GB/s	1.4GB/s	1.4GB/s	1.4GB/s
Write Bandwidth (64KB sequential)	1.1GB/s	600GB/s	1.1GB/s	1.1GB/s
Max 100% Read IOPS	145,000	145,000	155,000	155,000
Sustained Random Read IOPS (8KB)	100,000	85,000	85,000	85,000
Sustained Random Write IOPS (8KB)	50,000	35,000	54,000	54,000
Max 100% Write IOPS	150,000	165,000	165,000	165,000
Latency (512KB)	18us	23us	23us	23us
Cell Care Reliability / Endurance	Yes	Yes	Yes	Yes
Maximum permissible amount of flash writes covered by warranty	55PB	33PB	66PB	90PB

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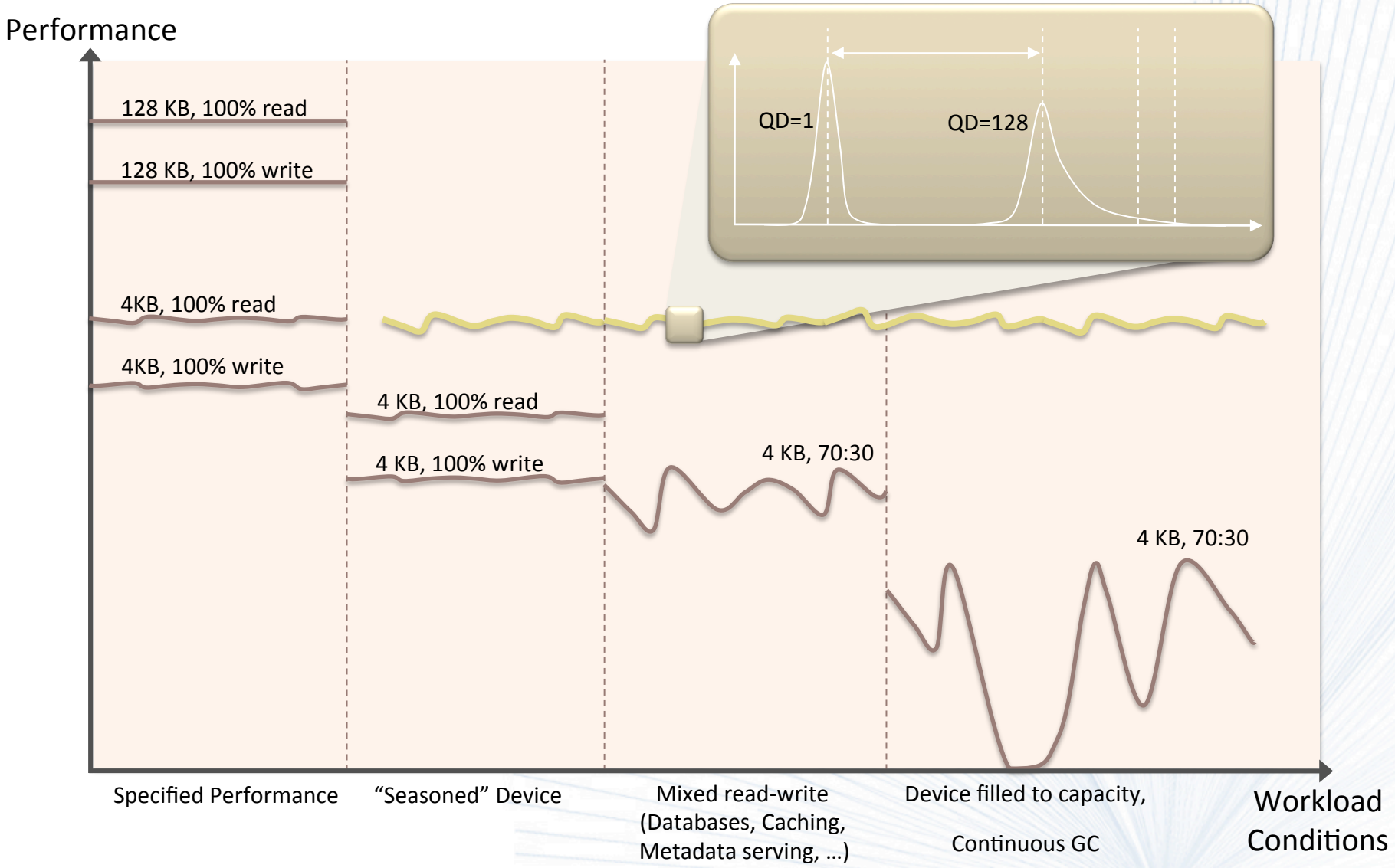
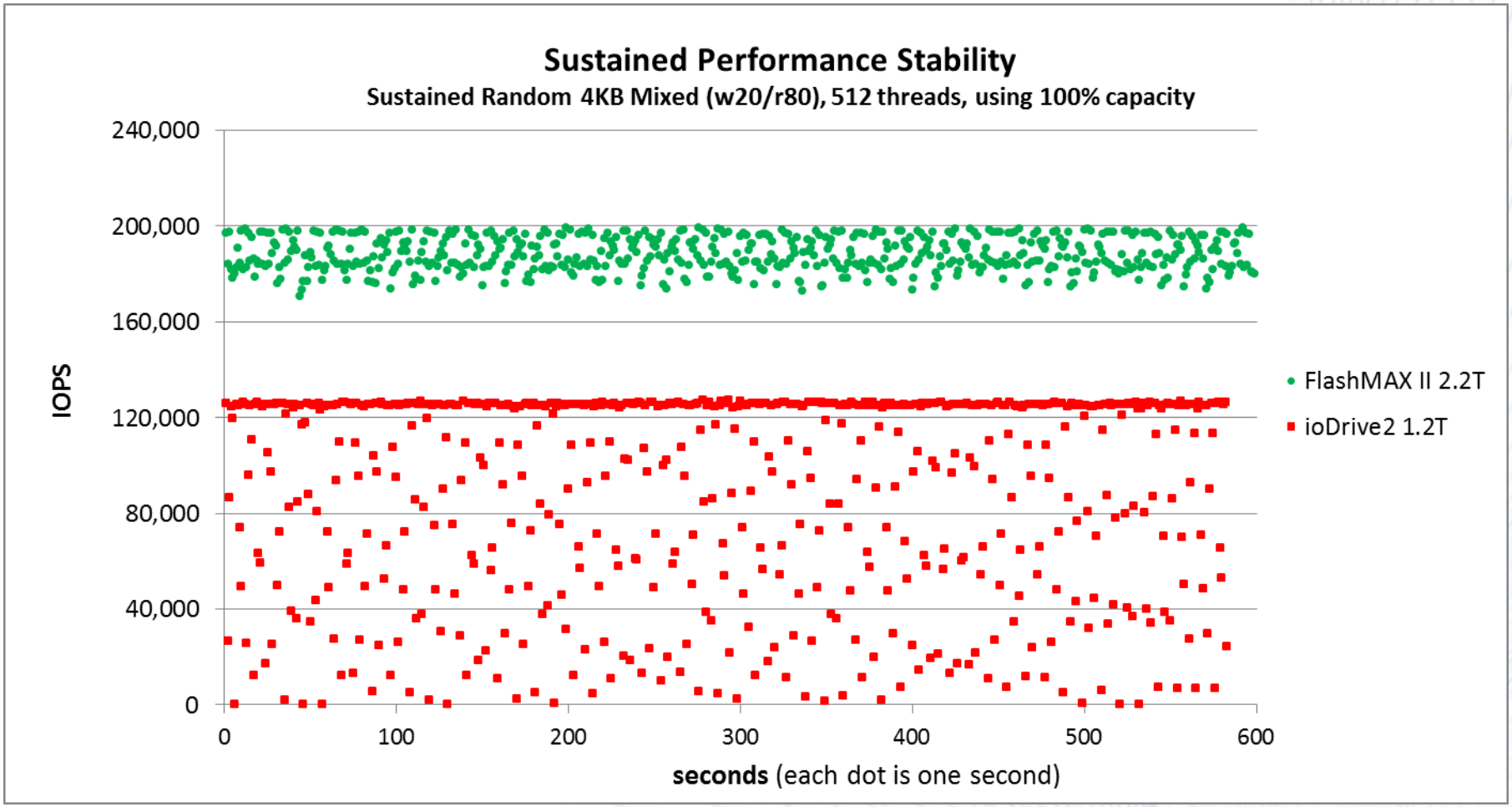
Reality of High Performance SSDs Normal flash cards slow down : we don't Going from IOPS to IO-QoS

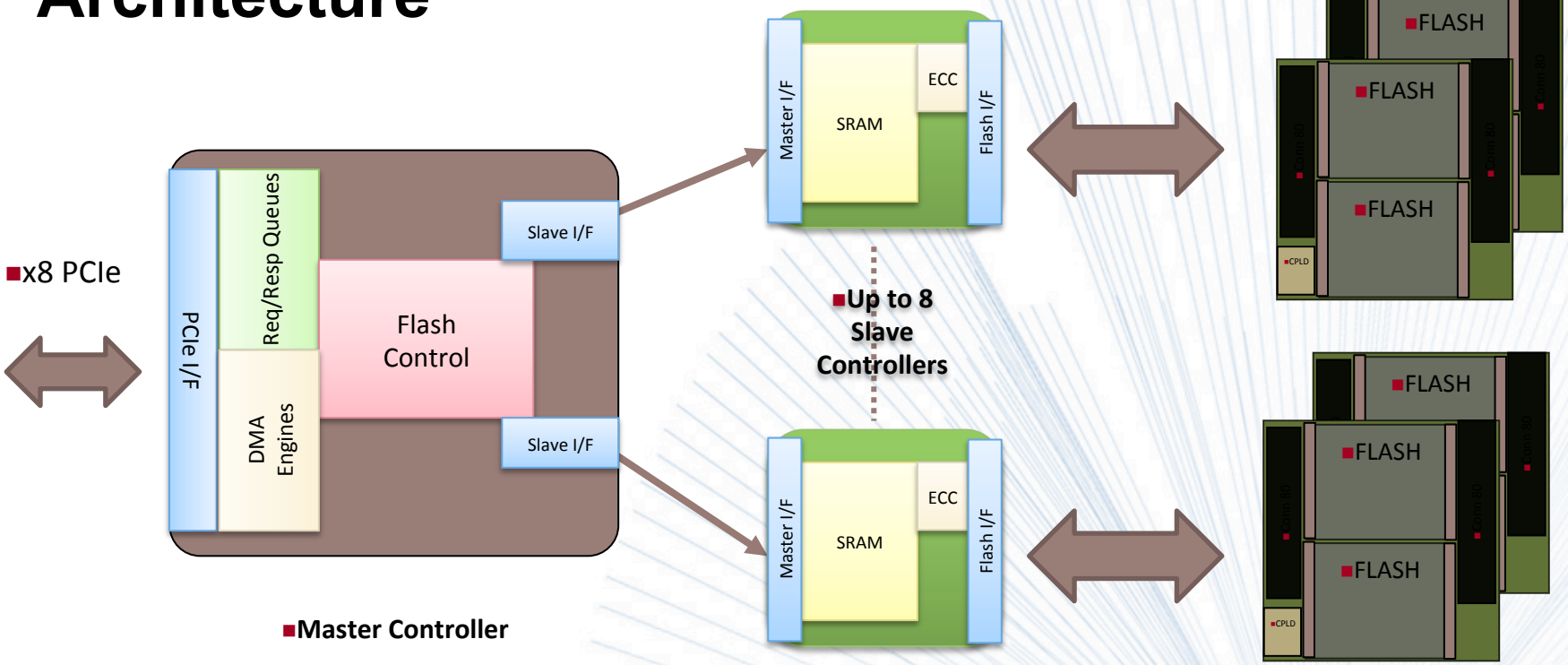


FlashMAX II vs. ioDrive2



- Stable performance with no freezes under the most demanding workloads

FlashMAX Hardware Architecture



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Virident | HGST
Customer Use Cases

Virident Flash Platform – Comparison with Alternatives

Metric	VIRIDENT	HW RAID of SSDs	Native PCIe Flash	Network Flash Appliances	Layered Flash Software
Sample Vendor		LSI	FUSION-IO	Violin MEMORY	ScaleIO
(Legacy) Application Performance	✓✓ Application-optimized flash management	✓ Bandwidth	✓ Latency, app metrics	✗ Network latency	✗ Targets heterogeneity, scale, integration
Flash Sharing and Availability	✓✓ Server-side flash clustering, integrated with FTL	✗ No support	✓ ION targets appliance level functionality	✓ No server-side support	✓ Functionally complete, but not performant
Support for Flash-aware Applications	✓✓ FlashMAX APIs – server and cluster	✗ No support	✓ ioMemory SDK targets server-level APIs	✗ No support	✗ No support