



NetApp/ Intel

Persistent Memory in New Age Data Center Applications

Flash Memory Summit 2019

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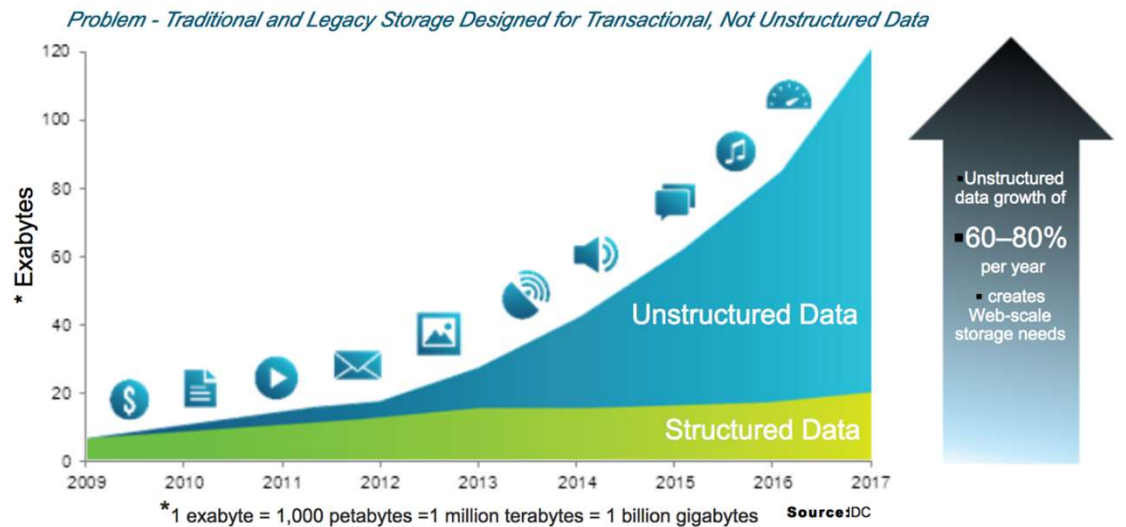
Agenda

- New Data Center
- Current Infrastructure and Challenges
- NetApp MAX Data/ Intel Optane Solution
- Summary

New Age Applications – Trends

- Huge Unstructured Data Growth
- Volume, Velocity & Variety
- Real Time Analytics
- Adoption of In-memory databases and NoSQL

Data Growth



New Age Applications Landscape



New apps are memory hungry, latency sensitive and require huge data set.....

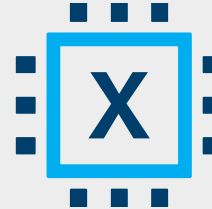
Digital Transformation: The Challenges of In-Memory Processing



DRAM has not kept up with the density and cost efficiencies of other storage technologies



Data stored in DRAM is volatile and doesn't persist across server reboots



Critical applications cannot make use of in-memory technologies

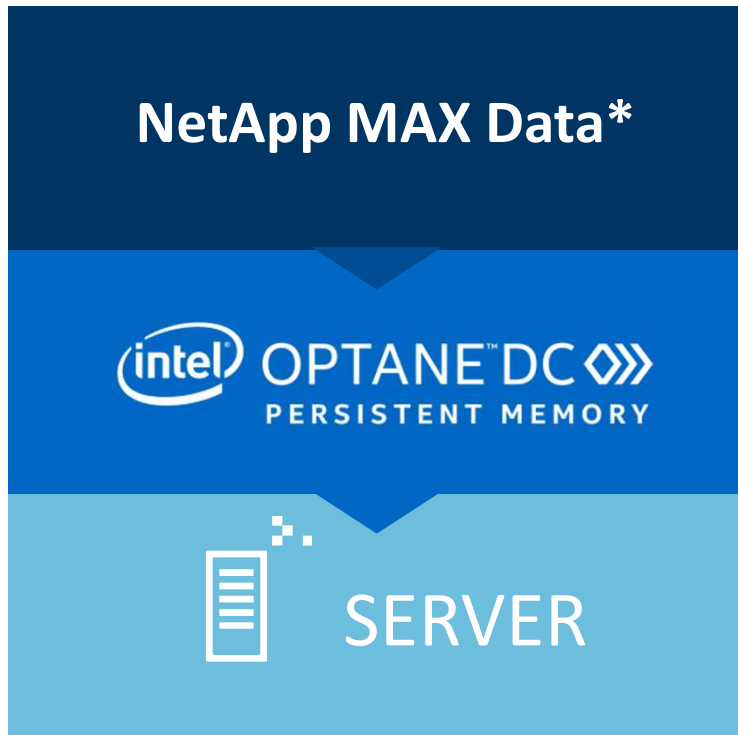


In-memory data isn't automatically protected against data loss



NetApp MAX Data/ Intel Optane Memory

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Intel and NetApp are bringing high-speed, cost-effective in-memory **performance to critical applications**



NetApp is the only storage provider that **offers memory performance in an enterprise-class solution**

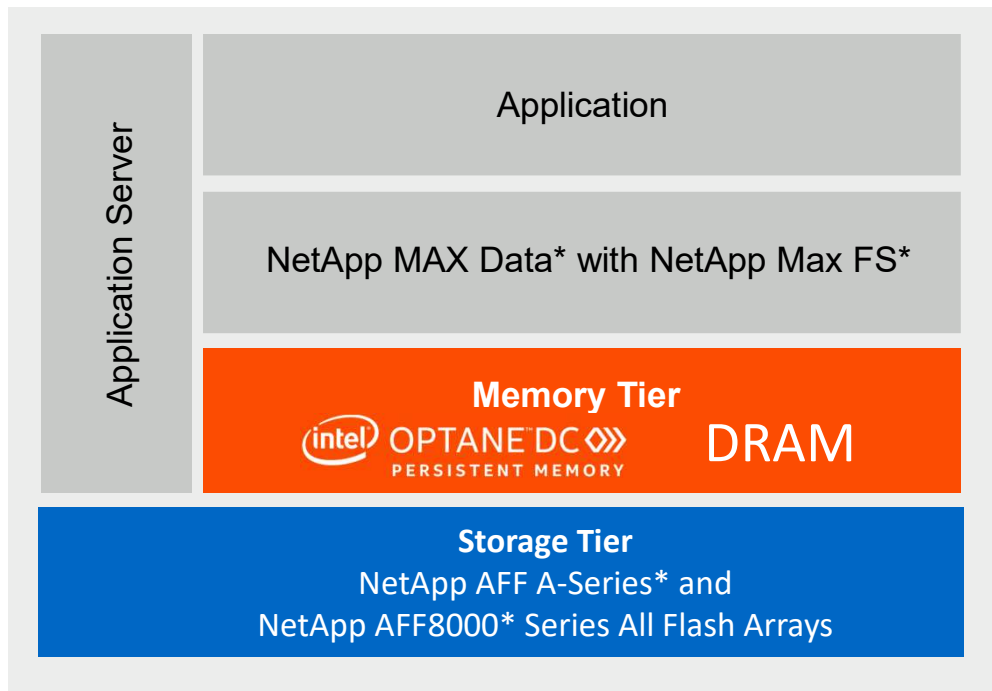


No need to wait for costly application rewrites—use your applications with persistent memory today (App Direct Mode)



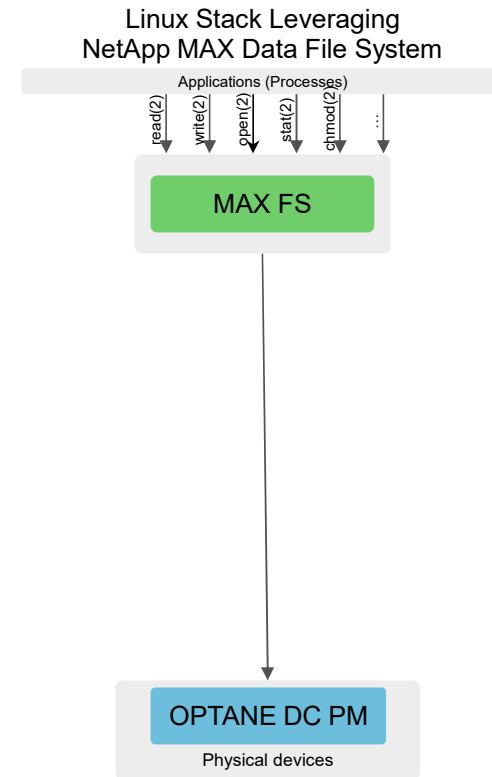
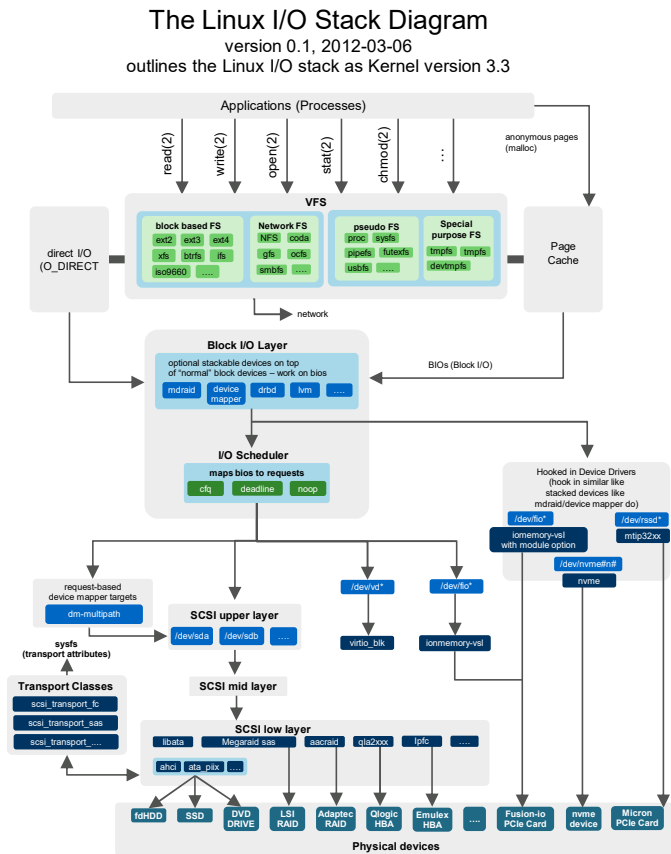
NetApp ONTAP*, combined with NetApp MAX Data* and Intel® Optane™ DC persistent memory, **enables enterprise data resiliency**

NetApp MAX Data* and Intel® Optane™ DC Persistent Memory

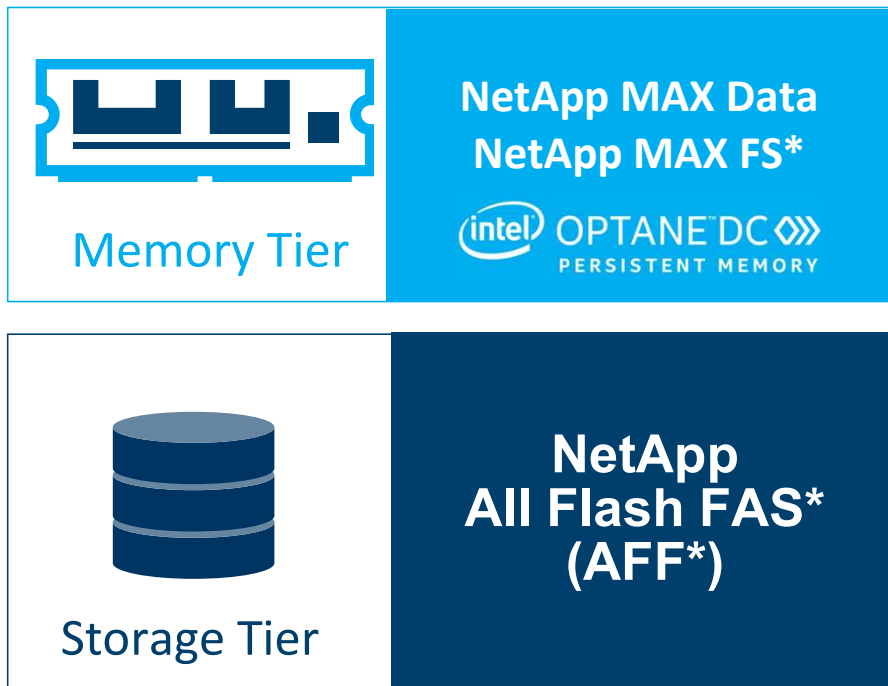


- **NetApp MAX Data** runs on servers equipped with 2nd Generation Intel® Xeon® Scalable processors and Intel Optane DC persistent memory
- **NetApp MAX File System* (FS)** uses high-capacity, low-latency persistent memory as a storage medium
- **Applications write data to NetApp MAX FS** just as they would any other file system
- Your applications **don't require any changes (App Direct Mode)**

NetApp MAX Data File System Simplifies the IO Stack



NetApp MAX Data* Storage Architecture



- Application data is written to Intel® Optane™ DC persistent memory through NetApp MAX FS
- NetApp MAX FS moves infrequently accessed data down to the storage tier
- Data moves from the storage tier to persistent memory when it is requested by an application

NetApp MAX Data* Enables Data Protection

While data can be stored in Intel® Optane™ DC persistent memory on individual servers, how do you protect your data?



NetApp MAX Data enables data protection with minimal performance impact, provides enterprise-grade data management for persistent memory, and extends the data-management capabilities of NetApp ONTAP* to the memory tier

NetApp MAX Recovery* mirrors data stored in persistent memory to enable last-transaction safety

Target Workloads

- Latency-sensitive applications
- Database
 - Relational: Oracle, MySQL, DB2 etc
 - NoSQL: MongoDB, Cassandra etc
- Real-time applications



Use cases

- Financial trading – Faster trading, higher revenue opportunity
- Fraud detection: Protect losses due to fraud
- Cyber threat detection: Prevent security breach
- Manufacturing, supply chain: Time to insights
- E-commerce: faster transaction, higher e-commerce sale
- AdTech, online games, web scale application: faster user personalization/ experience, higher click through
- IoT aggregator/ AI: faster processing of huge data set

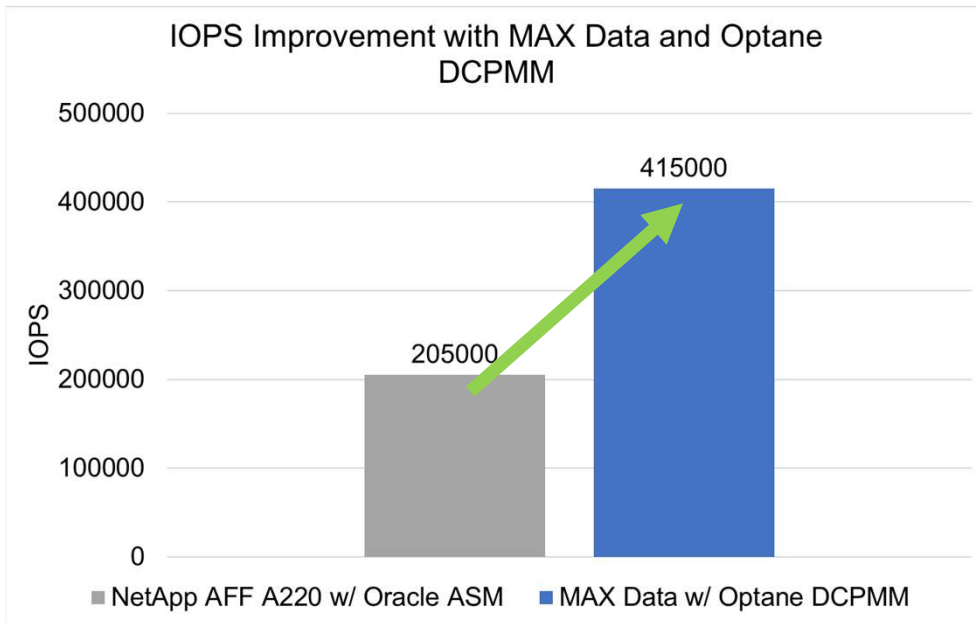


NetApp MAX Data/ Intel Optane Memory Performance/ Benchmark

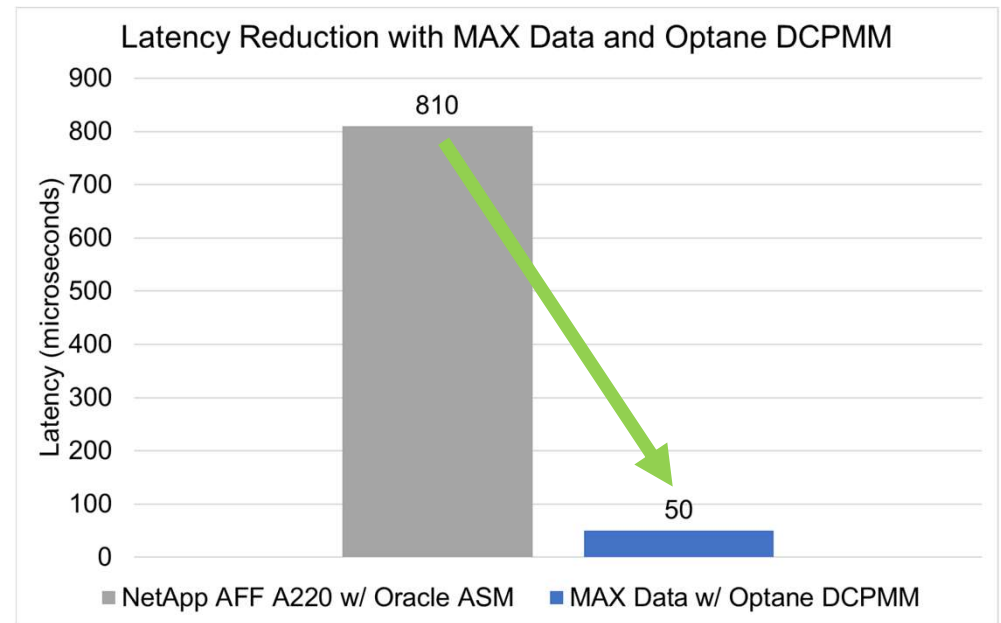
NetApp MAX Data Oracle Performance – A220

MAX Data and Intel Optane DCPMM

2X increase in IOPS



16X reduction in latency



NetApp MAX Data, MAXimum performance

- Oracle SLOB run 2.8x faster on the same hardware using MAX Data
- Efficient utilization of CPU

80%/20% Read/Update SLOB Benchmark			
	EXT4	MAX Data	Difference
Latency (us)	823	169	487%
IO Read (MB)	551	1343	244%
IO Write (MB)	64	277	433%
Read IOPS	70,500	171,900	244%
Write IOPS	7,509	35,522	473%
SQL/sec	1304	3686	283%
Transactions	236	710	301%

Oracle SLOB running directly on A800



█ User time
█ System time
█ CPU wait

Oracle SLOB running on MAX Data



NetApp MAX Data / Intel Optane Memory Value Proposition

- Lower TCO
 - Reduced DRAM footprint/server count,
 - Do more with less: increased VM density, more transactions per second
- Faster application response time for ultra-low latency applications
- Simplify the life for end customers **with application plug n play**

Summary

- Opportunity to bring convergence of memory and storage
 - Achieve best of both worlds
- Persistent memory brings the new paradigm
- NetApp MAX Data: an enabler for persistent memory
 - Application plug and play is critical for faster adoption of PM
 - Software stack to deliver enterprise grade features



Thank You/ Questions

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