Re-Architecting Cloud Storage with Intel® 3D XPoint™ Technology and Intel® 3D NAND SSDs

Jack Zhang yuan.zhang@intel.com, Cloud & Enterprise Storage Architect
Agenda

• Memory Storage Hierarchy
• Analysis of Next generation storage Intel® 3D XPoint™ technology / Intel® Optane™ technology + 3D NAND SSDs
• Use case studies
• Summary
Memory Storage Hierarchy

- CPU
- DDR
- Intel® 3D XPoint™ technology
- Intel® Optane™ SSD
- TLC/QLC 3D NAND SSD
- Hard Disk Drives

*Other names and brands may be claimed as the property of others.
Next generation storage on Intel® Optane™ Technology + Intel® QLC 3D NAND SSDs

Intel® Optane™ Technology based on Intel® 3D XPoint™ Memory Media:
>Excellent performance: BW/IOPS, QoS/latency, consistency

Intel® QLC 3D NAND SSD
>Low system cost

\[
\text{Performance} + \text{Storage density} + \text{Performance/}\$ + \text{TCO} = \text{Intel® QLC 3D NAND Technology}
\]
Storage innovations
@compute and storage

Storage node

Journal/metadata/Logs

1:40 on GB

Intel® SSD P4800X

Data

Intel® DC P4510 TLC
Intel® D5-P4320 QLC

Compute node

Local/Temp storage

Intel® SSD P4800X

Cache

Write buffer

Intel® SSD P4800X

SDS/Distributed storage systems
TCO Equation on total storage cost

\[ \text{Optane\_free\_GB} = \text{Storage\_In\_TB} \times 1024 \times (\text{price\_diff}\%) / n \]

Where:

- Price\_diff is $/GB delta between QLC vs TLC in percentage
- \( n \) = Number of times Intel® Optane™ SSDs more than TLC in $/GB
System Configuration Trend

Storage Node (Yesterday)
- TLC 4/8TB
- TLC 4/8TB
- TLC 4/8TB
- TLC 4/8TB
- TLC 4/8TB
- TLC 4/8TB

Transition to

Storage Node (Today)
- Intel® P4800X (750GB)
- P4510 8TB
- P4510 8TB
- P4510 8TB
- P4510 8TB
- P4510 8TB
- P4320/6 9TB or 16 TB

Storage efficiency
Quality of service
IOPS and Throughput
Consistency
5x Client Node
- Intel® Xeon® CPU E5-2699 v4 @ 2.20GHz
- BIOS: 00.01.0013; ME: .00.04.294; BMC: 1.43.91f76955
- 128GB Memory
- X710 40Gb NIC
- 1x 800G SSD for OS
- Intel® Optane™ QLC Config
- 1x Intel® DC P4800X 750G SSD for DB&WAL
- 4x 8.0TB Intel® SSD D5-P4320 as data drive

5x Storage Node
- Intel® Xeon® Gold 6142 CPU @ 2.60GHz
- BIOS: 00.01.0013; ME: .00.04.294; BMC: 1.43.91f76955
- 256GB Memory
- X710 40Gb NIC
- 1x 800G SSD for OS
- Intel® Optane™ QLC Config only:
  - 1x Intel® DC P4800X 750G SSD for DB&WAL
  - 4x 8.0TB Intel® SSD D5-P4320 as data drive
- TLC Config only:
  - 4x 8.0TB Intel® SSD DC P4510 for DB, WAL & Data
- Ubuntu® 16.04, Linux® Kernel 4.4, Ceph version 12.2.2
- 4 OSD instances each P4320 SSD
- Replica =2

Performance results are based on testing as of July 2018 and may not reflect the publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.
Architect for High capacity all flash “Ruler” SSDs

Compute node
Intel® SSD DC P4800X

Compute node
Intel® SSD DC P4800X

Compute node
Intel® SSD DC P4800X

Compute node
Intel® SSD DC P4800X

NVMeOF*

RSSD JOB System
Shared storage
High capacity
Intel® 3D NAND

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Summary and Next STEPS

Re-Architect Cloud Storage with Intel® 3D XPoint™ technology and Intel® 3D NAND SSDs:
• Storage performance and storage density
• TCO on total storage cost

Next Steps:
• Design management/buffer layer with Intel® Optane™ technology, reduce backend write amplifier, Garbage Collection, etc
• Design software hybrid storage solutions with Intel® Optane™ technology + Intel® 3D QLC NAND SSDs
• Ecosystem, OEMs readiness for Intel® Optane™ SSDs + QLC systems
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