Flash Memory

Lowering latency, improving throughput & breakthrough density

1st November 2017

Young Paik, Director of Product Planning

Samsung Semiconductor, Inc.

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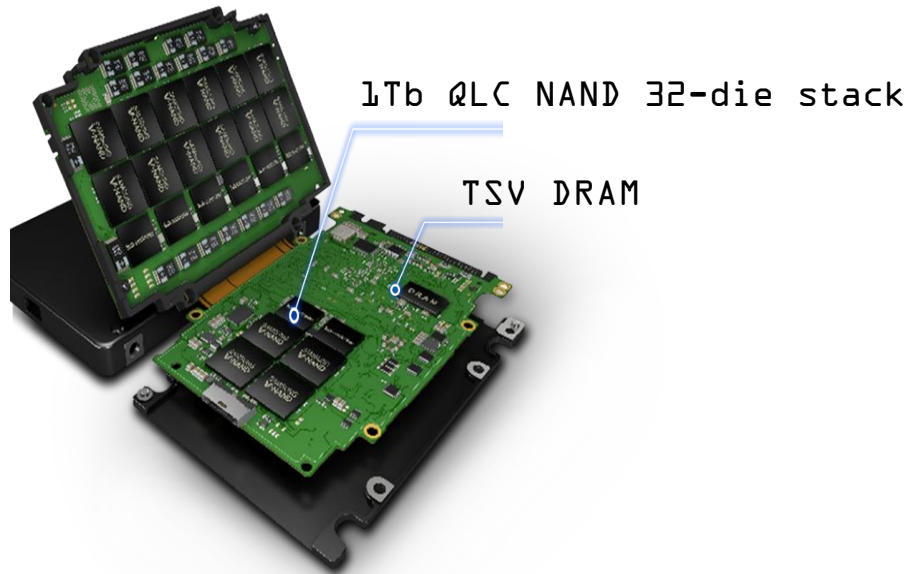
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Agenda

- **High Density NAND**

- **Key Value SSD**

- **Low Latency NAND**

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NAND Delivers High Capacity

Super High density

2.5" 128TB QLC-SSD!

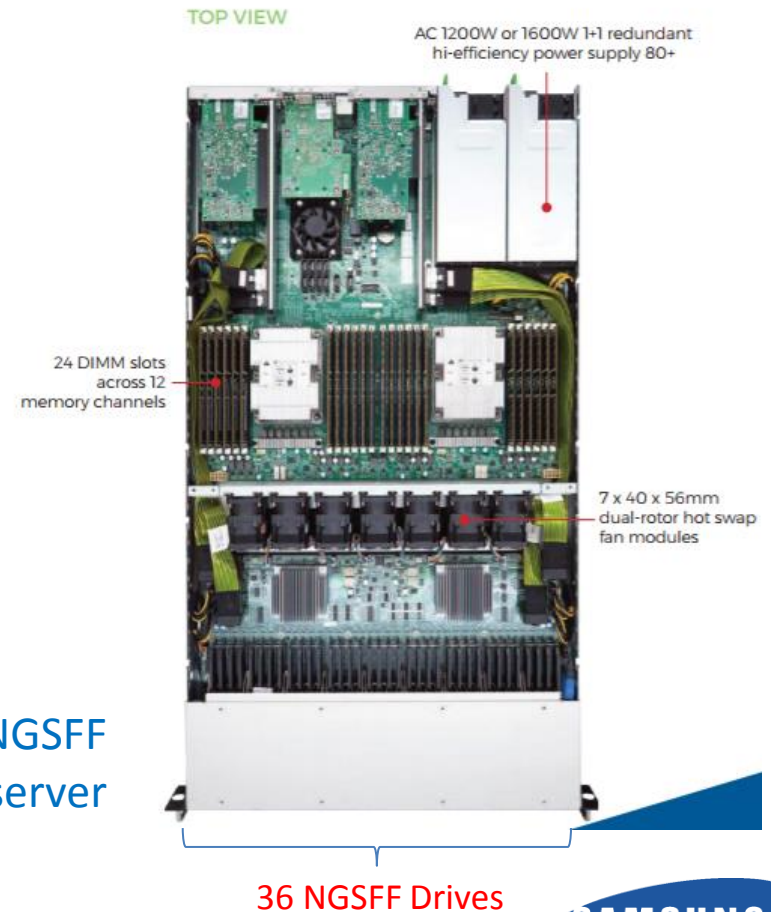1Tb QLC NAND 32-die stack

TSV DRAM

Mission Peak reference design puts 36 NGSFF
SSDs in the front of a standard 1U server

Density + Performance

NGSFF: 36 x 16TB = 576 TB in 1U

NGSFF: 16TB

TOP VIEW

AC 1200W or 1600W 1+1 redundant
hi-efficiency power supply 80+

24 DIMM slots
across 12
memory channels

7 x 40 x 56mm
dual-rotor hot swap
fan modules

36 NGSFF Drives
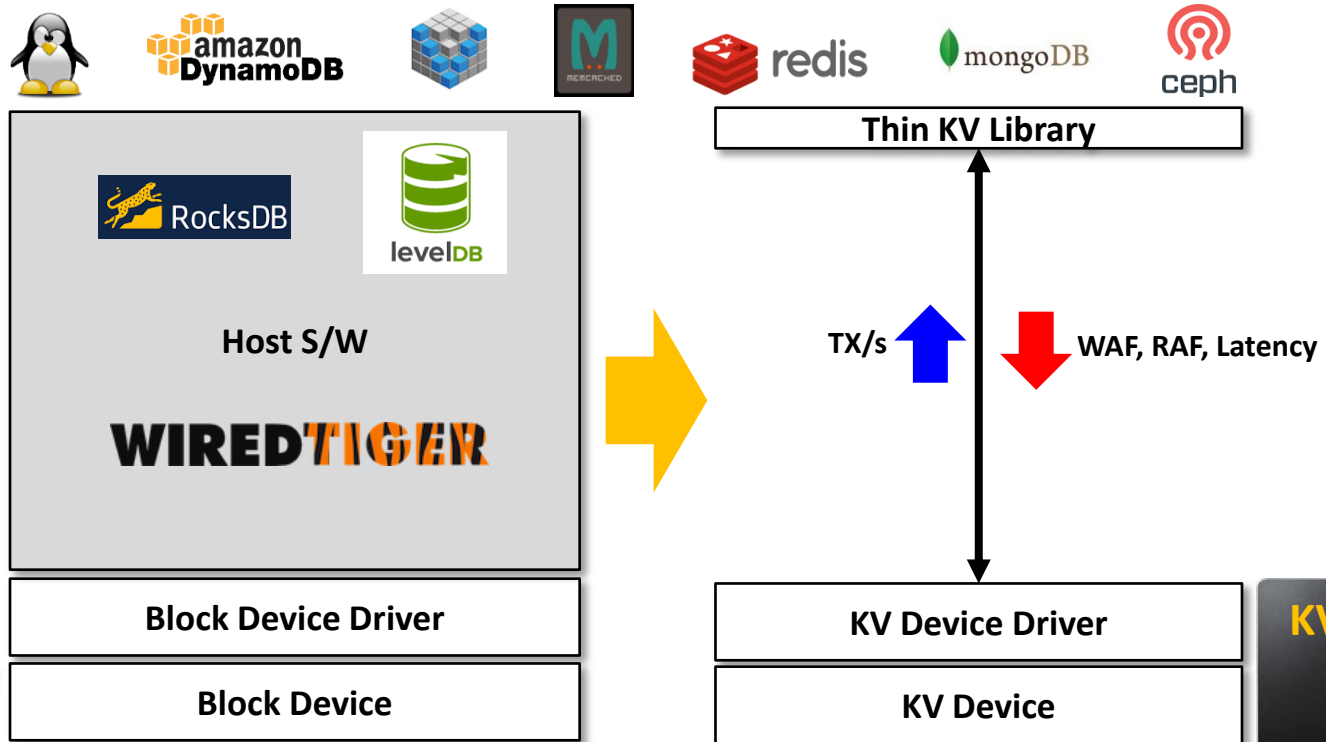
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Key Value SSD

- **Native key value commands for accessing objects**
  - Software and hardware garbage collection handled by controller
  - Consistent performance

LBA=100

"SSI-Photo"

Block SSD

Key-Value SSD

KV SSD

15x

RocksDB

PERFORMANCE
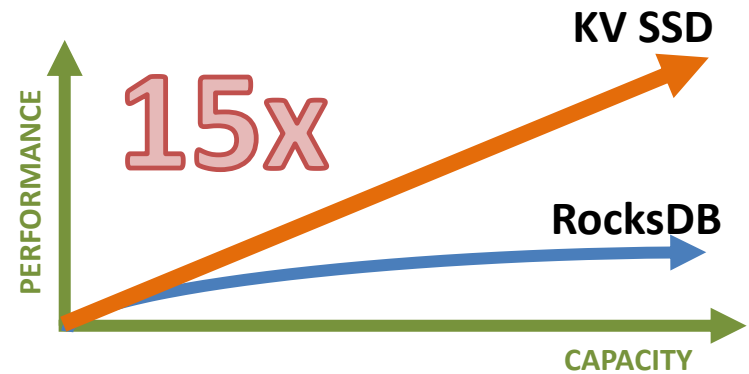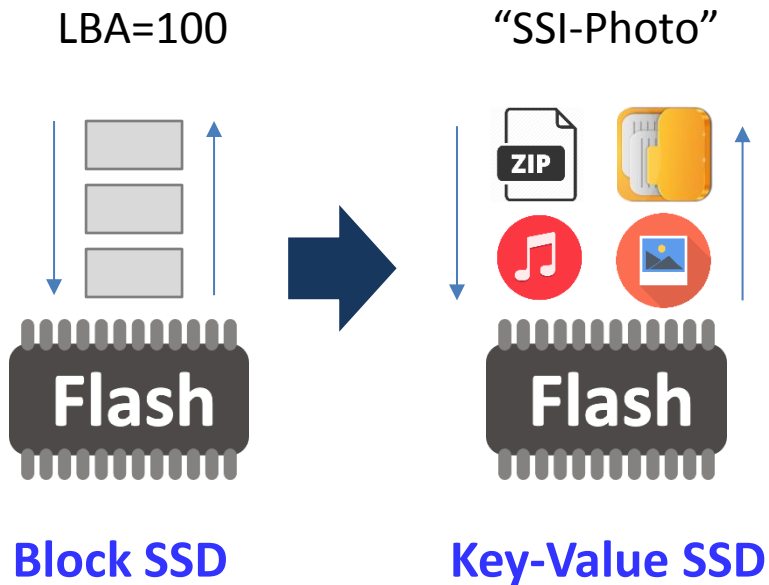
CAPACITY

Performance & Capacity Scaling

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Key Idea – Simplify Coding

Key Value Store is everywhere!

Traditional KV Store

Host S/W — RocksDB, levelDB, WIREDTIGER
Block Device Driver
Block Device

KV Stacks

Thin KV Library
TX/s ↑   WAF, RAF, Latency ↓
KV Device Driver
KV Device

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X-IO Axellio Edge Computing System, Scaling In

Designed for high throughput and low latency
   2u form factor with 2x Server motherboards
   Up to 88x cores
   Up to 2TB RAM
   72x NVMe SSDs (PM1725a)
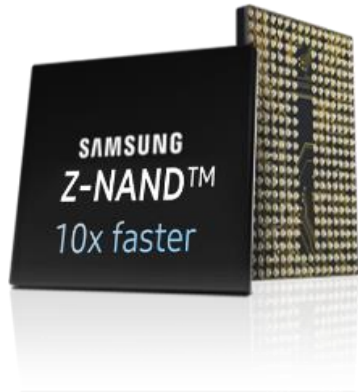   **Up to 1PB with 16TB SSDs**

Use Cases
- Edge/Event/Stream Processing
- Hyper-Scale Cluster Consolidation
- High Throughput/Low Latency applications

New Records!

Audited Results – Record setting STAC-M3 results

Join X-IO during the Innovation Roundup
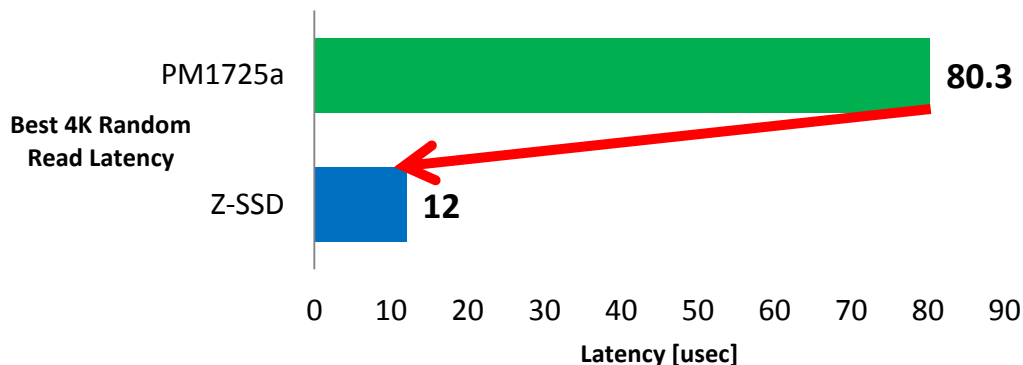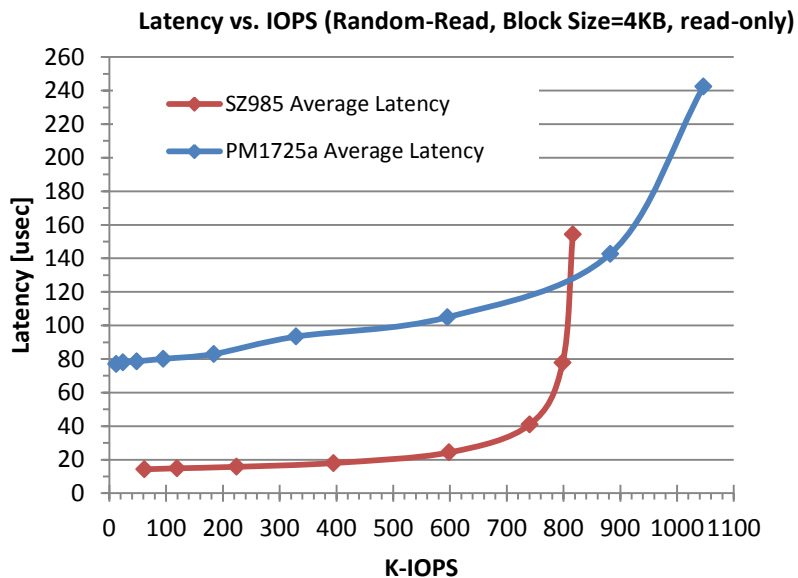shortly following this presentation

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NAND Delivers Low Latency

	PM1725a	Z-SSD
Form factor	HHHL	HHHL
PCIe Lanes	Gen3 x8	Gen3 x4
Seq. Read BW (MB/sec)	6,400	3,200
Seq. Write BW (MB/sec)	3,000	3,200
4K Random Read (KIOPS)	1,080	750
4K Random Write (KIOPS)	170	170
Endurance (DWPD)	5 for 5 years	30 for 5 years

SAMSUNG Z-NAND™
10x faster

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SZ985 : Samsung Z-SSD

- ## High performance @ consistent low latency

Latency vs. IOPS (Random-Read, Block Size=4KB, read-only)

Legend:
- SZ985 Average Latency
- PM1725a Average Latency

Axis: Latency [usec] vs K-IOPS

Best 4K Random Read Latency

- PM1725a: 80.3
- Z-SSD: 12

Axis: Latency [usec]

fio --rw=randread --bs=4k --direct=1 --iodepth=[1-8] --ioengine=libaio --refill_buffers --scramble_buffers=1 --numjobs=[1-16] --file_service_type=random --norandommap

fio --rw=randread --bs=4k --direct=1 --iodepth=1 –numjobs=1 --ioengine=libaio --norandommap

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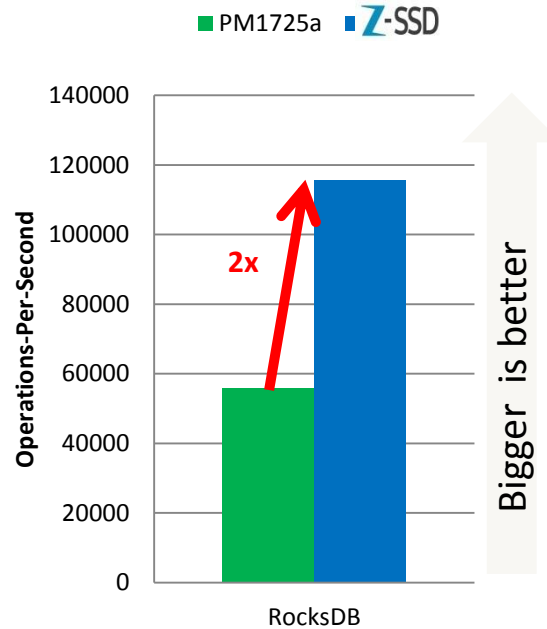# NoSQL Database

Used for:

- **High speed, simple transactions**
- **Fraud prevention**

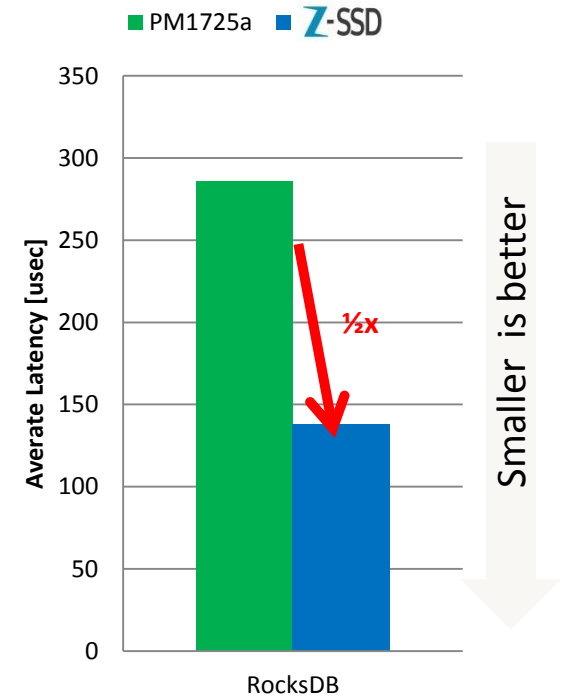**RocksDB is a key-value store that can act as a back end for other databases such as MongoDB, Redis and MySQL.**

Benchmark characteristics:

- Read while writing
- 800 byte objects

RocksDB Throughput

■ PM1725a ■ Z-SSD

(Operations-Per-Second chart: PM1725a ≈ 56000, Z-SSD ≈ 115000, **2x**)

Bigger is better

RocksDB Average Latency

■ PM1725a ■ Z-SSD

(Averate Latency [usec] chart: PM1725a ≈ 285, Z-SSD ≈ 138, **½x**)

Smaller is better

db_bench read-while-writing workload

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Thank You
young.paik@samsung.com