
MARVELL®
Innovative Chipset Solutions for Accelerating the Data Economy
Nigel Alvares
VP of Marketing, Flash Business Unit

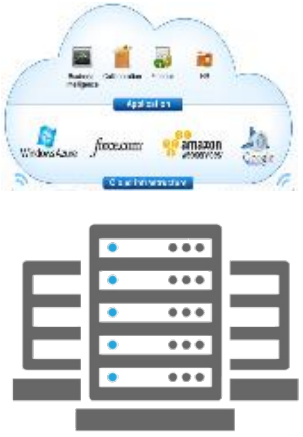
Growing waves of innovation & productivity growth

1st Wave
1983
Personal computing

2nd Wave
1995
Internet era

3rd Wave
2007
Mobile era

4th Wave
2011
Cloud era

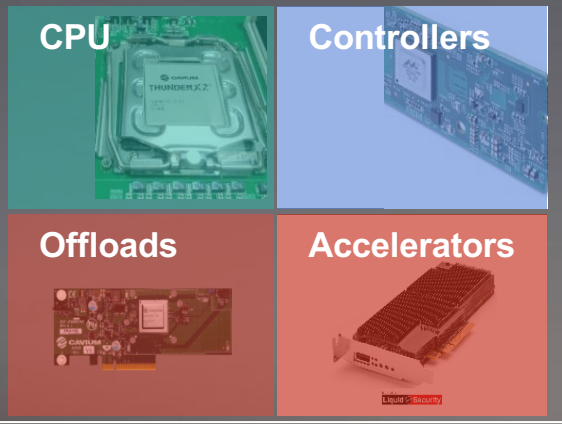


5th Wave
2018
Data era

Infrastructure must transform to proliferate Data era

Unprecedented demand
& growth velocity

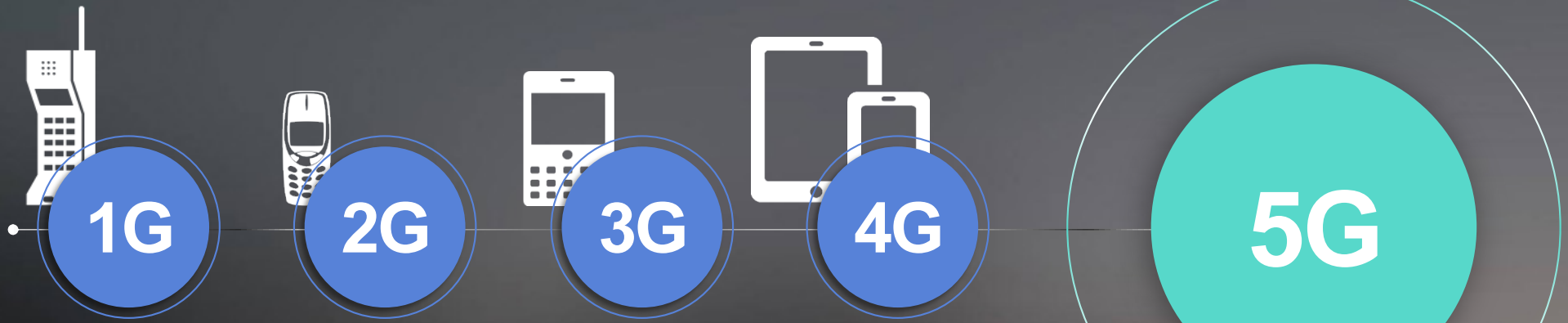
Low latency & data volume is
decentralizing the Cloud



Driving the need for optimized
architectures

5G & Artificial Intelligence will accelerate transformation

What is 5G?



1980s
Analog voice

1990s
Digital/SMS

2000s
Data

2010s
Video streaming

2019+
100X capacity
400X faster
Machine-machine communication

How 5G will disrupt

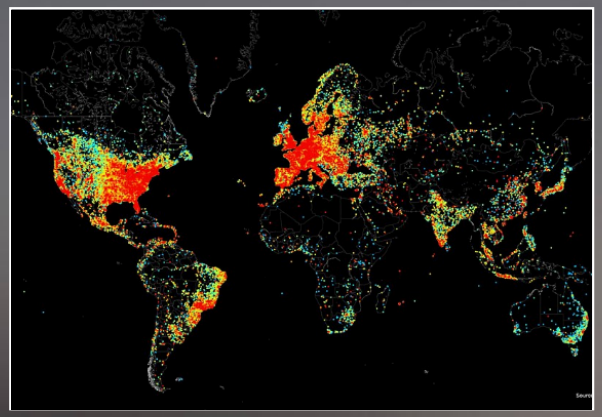
Real-time speed

- 5G <1ms (real time)
- 4G/LTE = 200ms
- Human reaction = 300ms

Ultra-high bandwidth

- 5G = 20Gbps
- Stream 400 8K movies at once
- 4G/LTE = 10-20Mbps

Ubiquitous connectivity



- 5G = 1M devices in 1 square km
- 4G/LTE = 1M devices in 500 square km

5G combined with AI will power the Data era

Factory automation

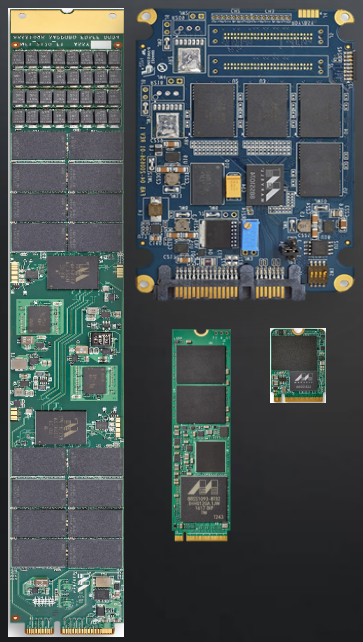
Connected transport & smart vehicles

Industrial IoT & extreme mobile broadband

Immersive experiences

Impact on Flash storage solutions

New SSD protocol interfaces & form factors



New architectures & business models

Optimized platform solutions

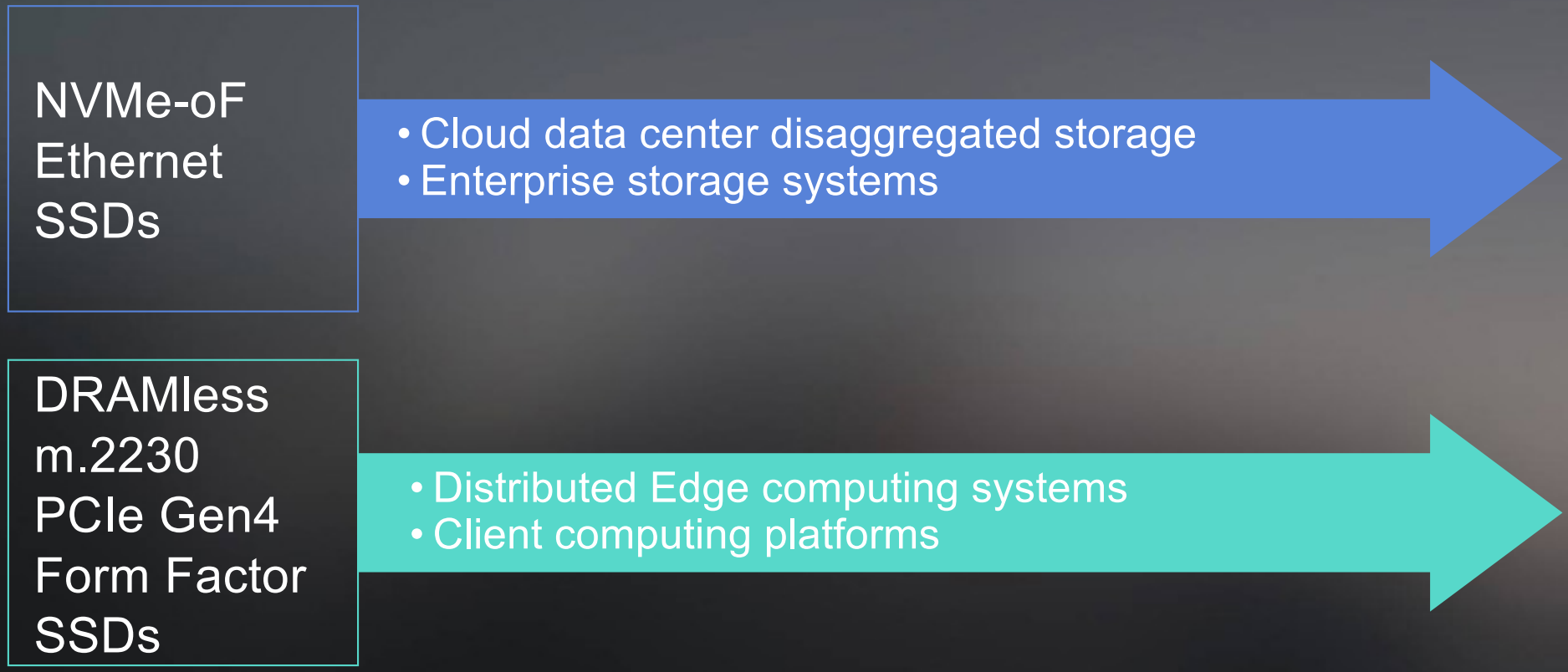
Platform-managed Flash

Key-value Flash

Computational storage

Ethernet Bunch of Flash (EBOF)

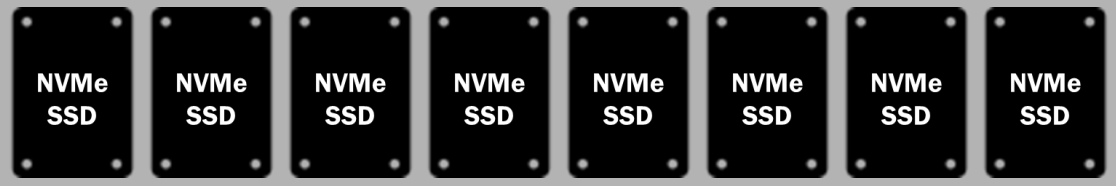
Disruptive Flash solutions for the Data era

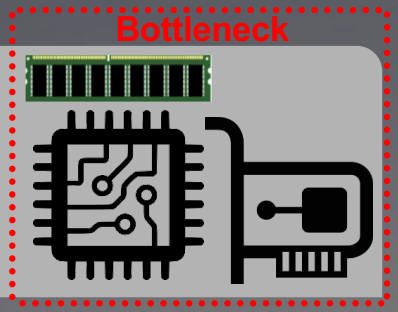


NVMe over Fabric Ethernet SSDs

Disruptive NVMe-oF Ethernet SSD architecture

Today's disaggregated SSD storage (JBOF)

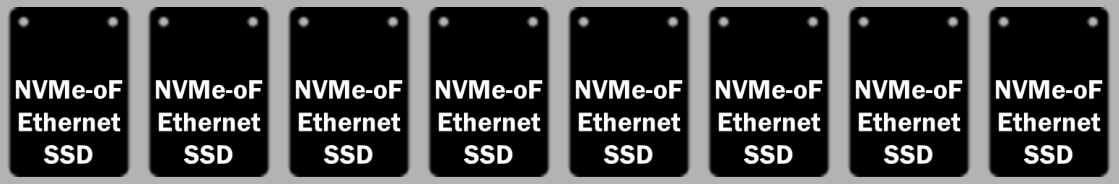




High TCO

Limited performance, high CPU power & high BOM

End-to-end NVMe-oF Ethernet Bunch of Flash (EBOF)



Low TCO

Simple native scalable performance with extremely lower power consumption

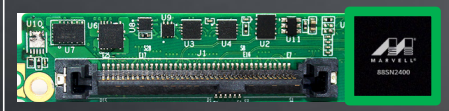
>65%* TCO savings excluding SSDs

*Toshiba & Marvell TCO analysis

NVMe-oF Ethernet SSD & EBOF architecture update #1

Industry's 1st 2.5" in-form factor NVMe-oF Ethernet SSD

2018
Flash Memory Summit



Industry's 1st NVMe-oF SSD Converter Controller

Dual-ported 25GE to PCIe Gen3x4

<1.5W operating power

up to random 700kIOPs

13mm x 13mm package

Toshiba Memory, Aupera & Marvell demo >14M IOPS EBOF

2019
Flash Memory Summit

Industry's 1st 2.5" In-Form Factor NVMe-oF Ethernet SSD

Embeds Marvell's NVMe-oF SSD Converter Controller

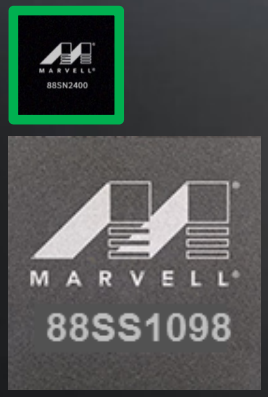
Toshiba Memory, Aupera & Marvell demo >15.5M IOPS EBOF

Live at Toshiba Memory FMS booth #307
Live at Marvell FMS booth #511

NVMe-oF Ethernet SSD & EBOF architecture update #2

Industry's 1st 2.5" NVMe-oF Ethernet SSD controller

2018
Flash Memory Summit



Industry's 1st NVMe-oF SSD Converter Controller

Dual-ported 25GE to PCIe Gen3x4

<1.5W operating power

13mm x 13mm package

88SS1098 Data Center PCIe Gen3x4 SSD controller

Up to 700 kIOPS

17mm x 17mm package

2-chip SSD solution

2019
Flash Memory Summit

Industry's 1st Native NVMe-oF Ethernet SSD Controller

Dual-ported 25GE to eight 800MT/s NAND channels

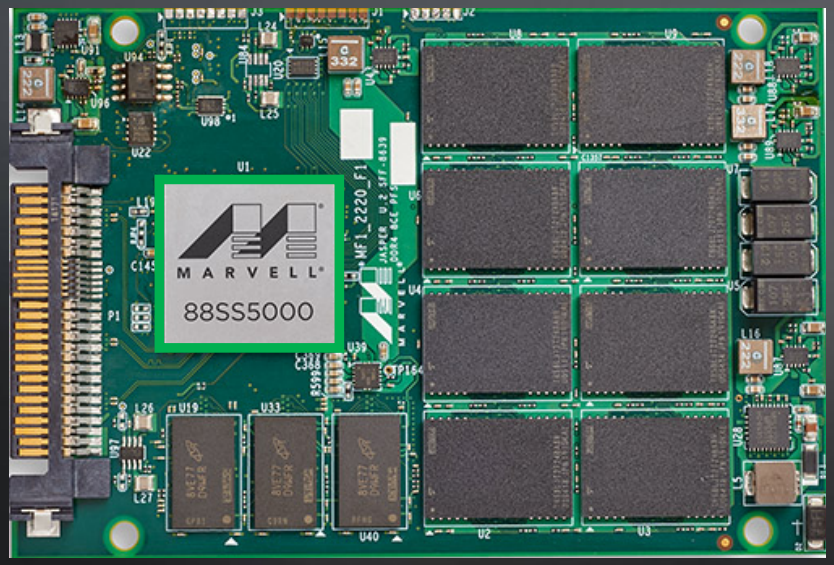
<5W operating power

Up to random 700kIOPs

21mm x 21mm package

Single chip SSD solution

Enabling in-form factor 2.5” NVMe-oF Ethernet SSDs



- Dual-ported 25GE Ethernet
- SFF-8639 / 9639 connector with Ethernet pinout
- Up to 8TB capacity
- Up to random 700kIOPs
- **Live at Marvell FMS booth #511**

NVMe-oF Ethernet SSD & EBOF architecture update #3

Industry's 1st Storage Aware Flow Engine (SAFE) Ethernet switches

2018
Flash Memory Summit

Prestera® CX 84xx
1.8Tb/s Ethernet Switch Family
10GE, 25GE & 100GE
Multiple configurations & packages

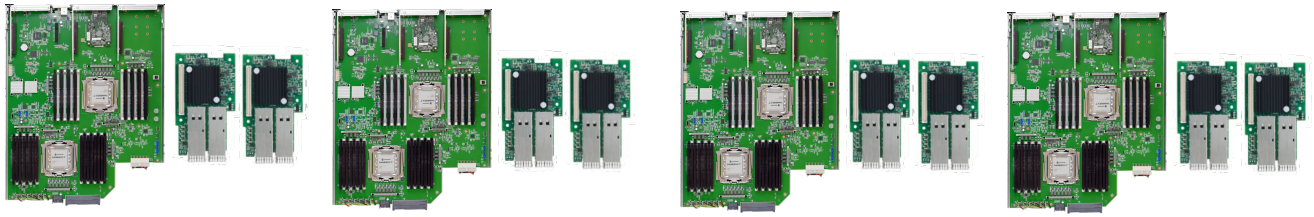
2019
Open Compute Summit

Prestera® CX 85xx
2Tb/s to 12.8 Tb/s Ethernet Switch Family
25GE, 50GE, 100GE & 400GE
Multiple configurations & packages

Industry's 1st Switches supporting Storage Aware Flow Engine (SAFE) IP

End-to-end NVMe-oF EBOF chipset architecture solution

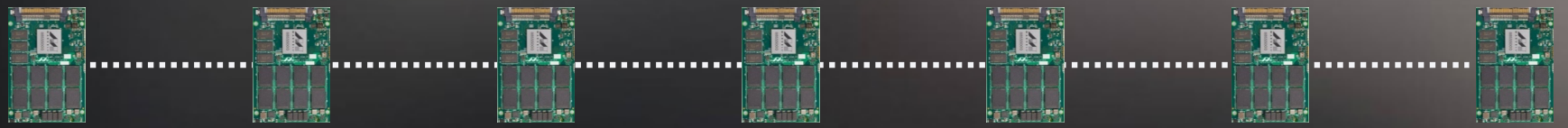
ThunderX2® ARM Servers
& FastLinQ® NVMe-oF NICs



Ethernet Bunch of Flash (EBOF)
with redundancy

MARVELL PRESTERA CX85xx

MARVELL PRESTERA CX85xx



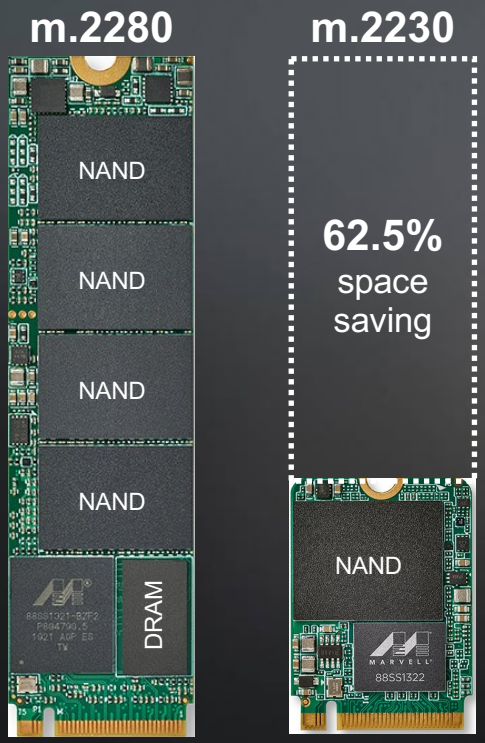
Ethernet SSD #1 | Ethernet SSD #5 | Ethernet SSD #9 | Ethernet SSD #13 | Ethernet SSD #17 | Ethernet SSD #21 | Ethernet SSD #24

Enabling optimal disaggregated data center flash storage

DRAMless m.2230 Form Factor PCIe Gen4 SSDs

MARVELL®

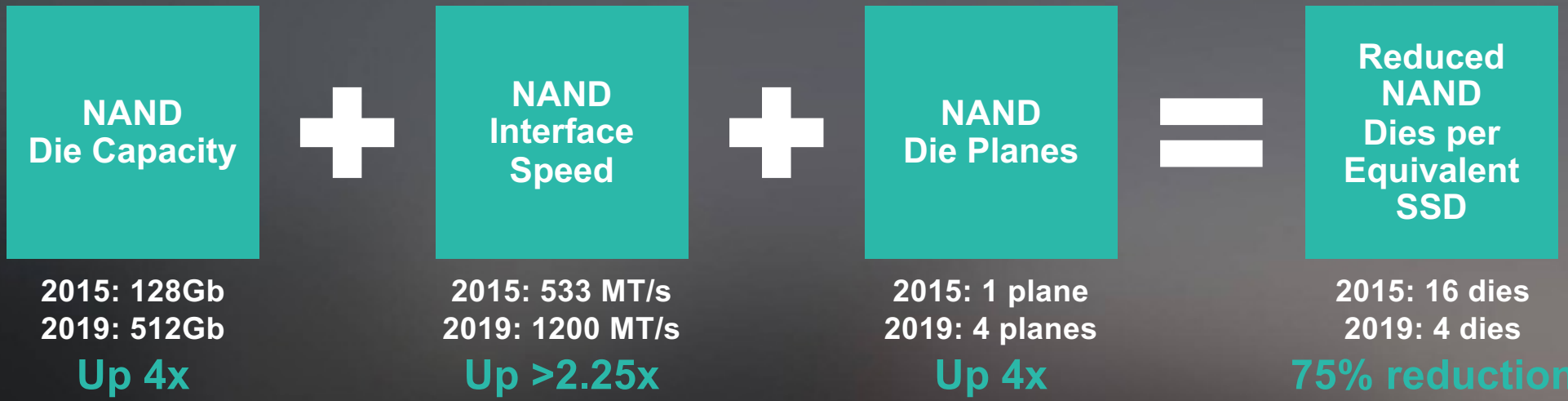
Why m.2230 form factor for edge & client computing SSDs?



- **62.5% space savings**
- **Lowers power by >30%* with DRAM eliminated**
- Capacities up to 1TB** on a single side
- Comparable high sequential & random performance*

* Controller & NAND configuration dependent
** Assumes 1Tb ODP 1200MT/s NAND Package

How? Capitalizing on three NAND component trends



Mainstream <1TB SSDs will no longer require larger & higher-power 8 channel SSD controllers

Introducing the industry's 1st 12nm PCIe Gen4 NVMe DRAMless 4CH SSD controllers

- PCIe Gen4x4 & PCIe Gen4x2
- Four 1200MT/s NAND channels
- Less than 2W* of dissipated power
- Up to 3.9GB/s sequential performance
- Up to 500kIOPS of random performance
- Ultra small 8mm x 11mm package

* Actual power may vary on multiple parameters including temperature, SSD configuration & workload usage

Summary

- 5G & AI will proliferate Data era & require new Flash solutions
- EBOF is optimal flash storage disaggregation architecture
- Ethernet SSDs are here today: Toshiba Memory & Marvell demo
- m.2230 DRAMless SSDs optimal for for edge & client computing
- Industry's 1st 12nm PCIe Gen4 DRAMless controllers available now

Visit Marvell FMS booth #511 for latest EBOF & Flash innovations
Visit Toshiba Memory booth #307 for industry's 1st 2.5" NVMe-oF Ethernet SSD

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