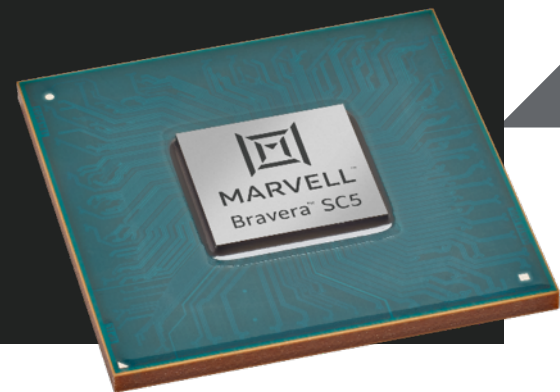




# Introducing Marvell Bravera™ SC5 SSD Controllers

## Enabling PCIe 5.0 Cloud Flash Storage

May 2021



# Overview

Company founded

**1995**

FY21 revenue

**\$3.0B\***

Employees

**6,000+**

Patents worldwide

**10,000+**

Located in **Santa Clara, CA**

R&D centers in **US, Israel, India, Germany, China**

\*Excludes Inphi CY2020 revenues (\$0.68B)



# Data infrastructure leadership

## Compute

### Data Processor Units (DPUs)



### Security Solutions



## Networking

### High-speed Electro-Optics PAM4 DSPs, Coherent DSPs, TIAs and Drivers



### Ethernet PHYs



### Ethernet switches



### Silicon photonics



### Ethernet NICs



### Automotive ethernet

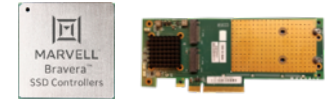


## Storage

### HDD controllers and pre-amps



### Flash SSD controllers and NVMe accelerators



### Fibre Channel HBAs



## Custom ASICs

# Marvell Bravera™

## Essential Data Center Storage Done Right

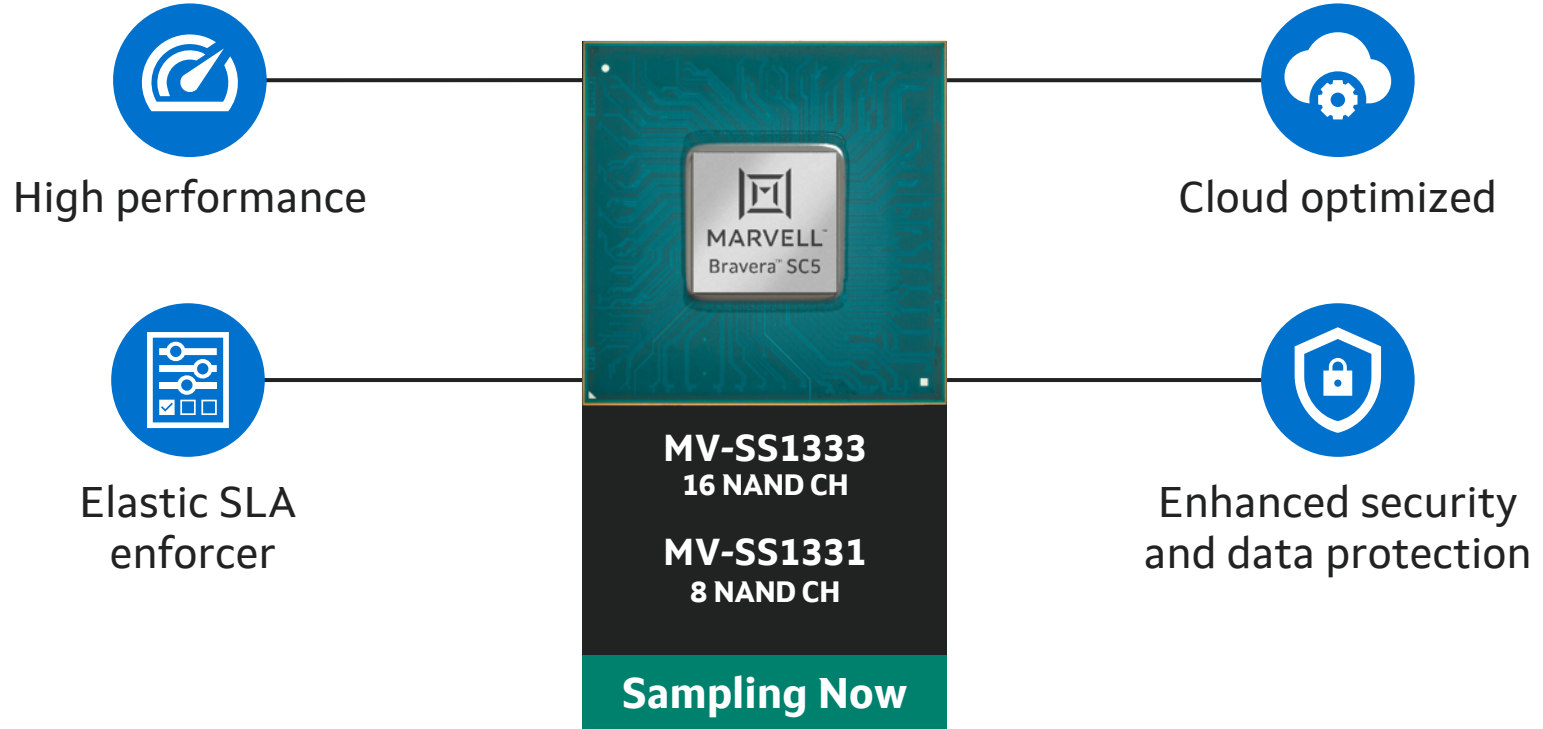


### Complete Solution and Ecosystem Enablement

- Silicon (Merchant and Custom)
- Firmware
- Reference Design
- NAND Qualifications
- CPU interop validated

**A Brave New Era In Cloud Semiconductor Storage Solutions**

# Bravera SC5 - World's 1st PCIe 5.0 SSD Controller



# Bravera SC5 SSD Controller - launch quotes

In developing the Bravera SSD controller line, Marvell worked closely with leading hyperscale cloud providers such as Microsoft Azure to ensure fleet compatibility and data center SSD standardization across the open hardware landscape.

“We would like to congratulate Marvell on being first to market with its new Bravera SC5 SSD controller. Marvell’s latest SSD controller enables OCP compliance, power efficiency, performance, and features which are critical to Microsoft Azure’s demanding requirements.”

**Pablo Ziporovich**  
**GM Azure Memory & Storage Center of Excellence**



“There are many data center technology challenges. These include the need for PCIe 5.0 for performance scaling, E1.S for density and serviceability and OCP data center NVMe SSD support for product features. Marvell’s Bravera SC5 SSD controller family supports technology that enables next generation hyperscale SSD use cases.”

**Ross Stenfort**  
**Hardware System Engineer, Storage**



# Bravera SC5 SSD Controller - launch partners

## Cloud

facebook



## NAND

KIOXIA



## Ecosystem

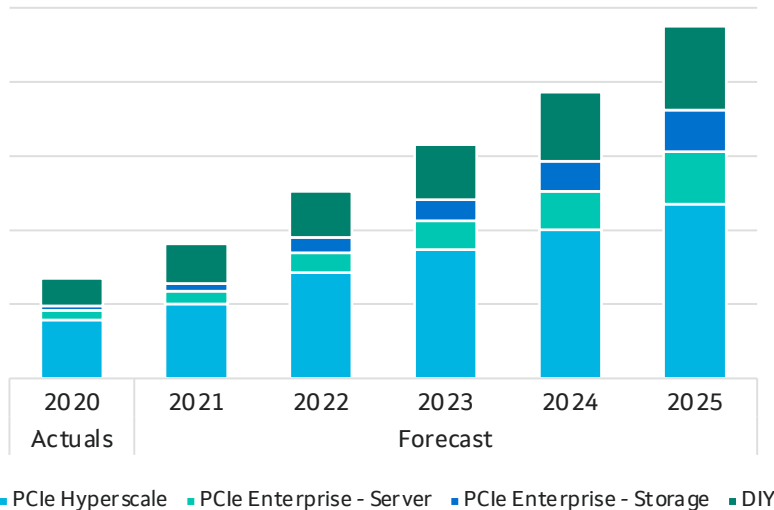


intel

RENESAS

# Bravera SC5 for Next-Gen Cloud Flash Solutions

## Data Centers PCIe Flash Storage Capacity: 30% CAGR



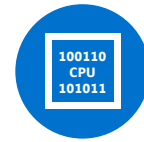
Source: Trend Focus

## Diverging Data Center Requirements



### Storage Server

- High capacity
- Bandwidth Intensive
- SEF, ZNS
- QLC Support
- Advanced Encryption
- Dual Port
- U.2 → E3, E1.L



### Compute Server

- High IOPS
- Ultra Low Latency
- OCP SSD, Open Channel
- I/O Isolation and QoS
- PF/VF Enabled
- NVMe 1.4b features
- M.2 → E1.S

**Bravera SC5 Supports All These Features**



# Unprecedented Performance

2x more than PCIe 4.0  
SSD Controllers

**14GB/s**  
Sequential  
read

**2M+**  
**IOPS**  
Random  
read

**< 6 $\mu$ s**  
Ultra-low  
deterministic  
latency  
(30%\* Improvement)

**40%\***  
Improved  
power-performance  
efficiency

\*Over Previous Generation Marvell SSD Controllers

# 1<sup>st</sup> SSD Controller with Elastic SLA Enforcer



**Multi Physical Function Support**  
Enables easy virtualization  
without host software changes



**Hardware Queue Management**  
Easy performance prioritization  
with latency regulation



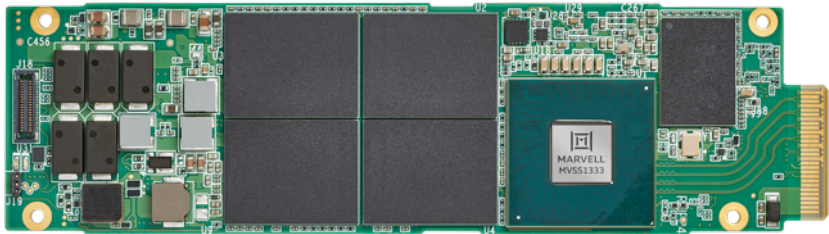
**Granular Hardware Arbiter**  
Enables rate measurement and  
metering for multi-tenant  
environments

**Minimizes cloud server CPU utilization | Improves user experience**

# Bravera SC5 - Cloud Data Center Optimized

**Enables world's first  
16CH E1.S**

2x performance over existing 8CH solutions




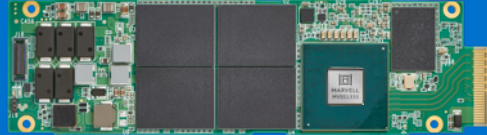
**Package 45% smaller than competition**  
MV-SS1333 with 16 NAND CH: 20x20mm

**First SSD controller to enable  
multiple usage models**

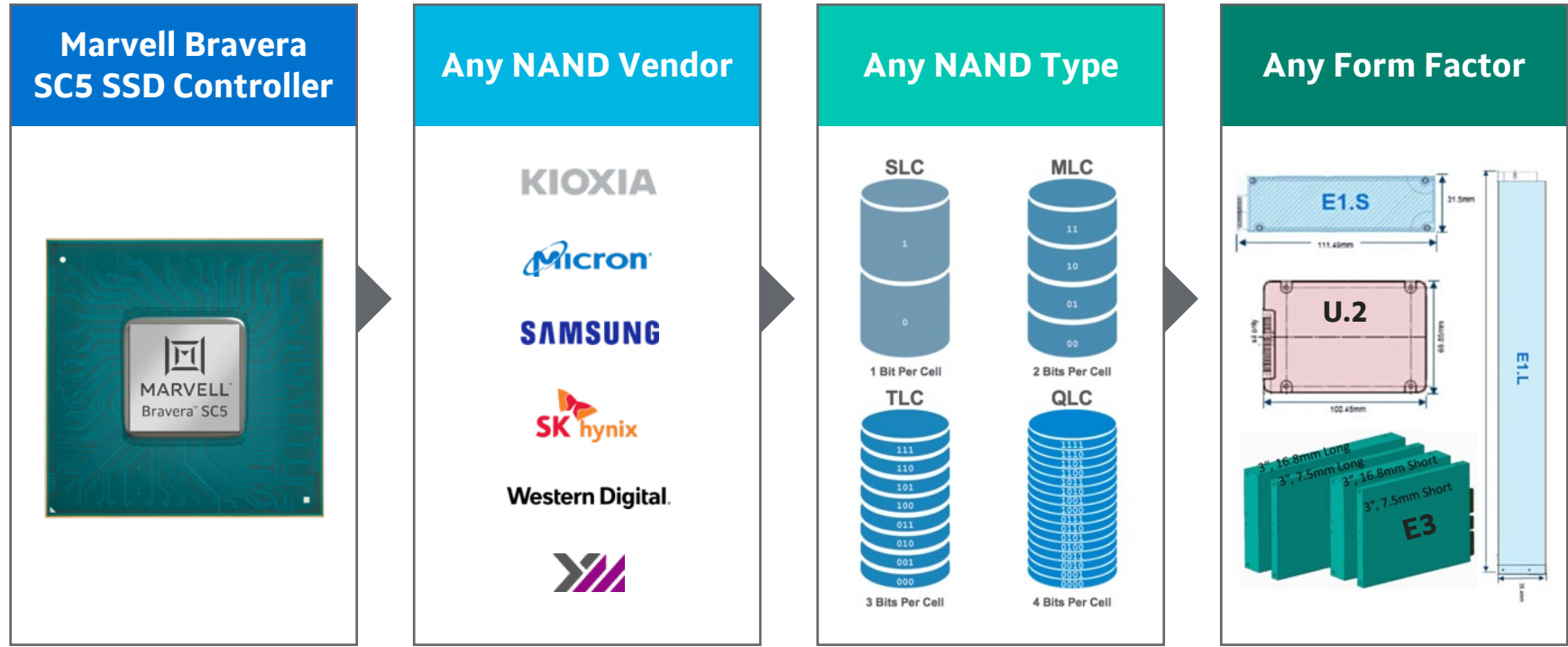
OCP	Open Compute Project
SEF	Software Enabled Flash
ZNS	Zoned Names Space
OC	Open Channel
NVMe	Dual Port

**Re-purpose same HW | Streamline data center operations**

# E1.S replacing M.2 in the Cloud

Comparison	M.2	E1.S
Dimensions	 22mm x 110mm	 31.5mm x 111.5mm
Max NAND Channels	8CH	16CH
Max performance	Limited by Power/Thermals	Not Limited
PCIe Connector	Gen5 SI Issues	No SI Issues
Hot Plug	No	Yes
Max SSD Power	7W	Up to 25W
Heatsink Support	No	Yes

# Enabling Cloud DIY SSD with ultimate flexibility



## Security

FIPS Compliant Root  
of Trust with AES-256

Multi Key Revocation  
+ TCG Opal



NANDEdge™  
LDPC Error Correction

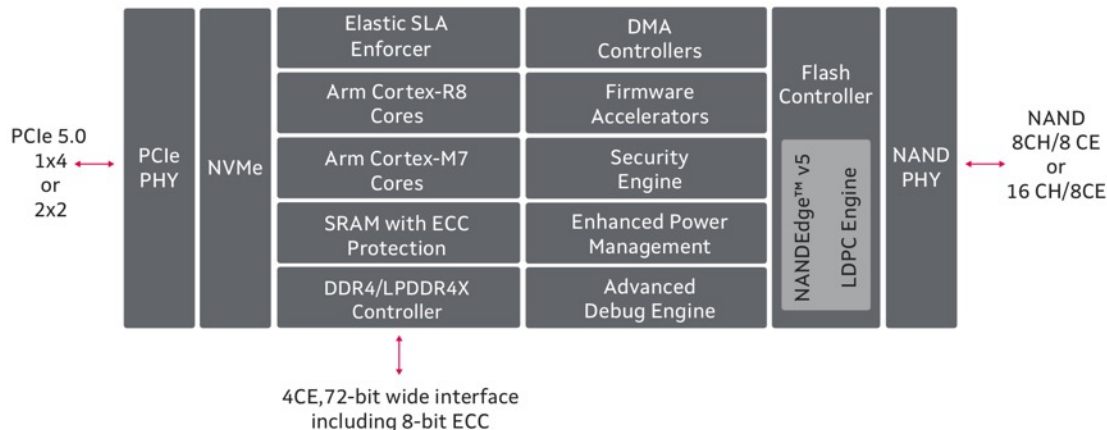
End-to-End  
Datapath Protection

## Data protection

**Built for ultimate reliability**

# Bravera™ SC5

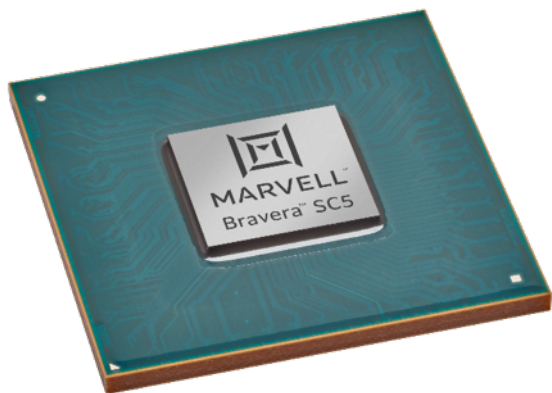
## Enabling Disruptive Cloud SSDs



<b>Part Numbers</b>	MV-SS1331 with 8 NAND CH MV-SS1333 with 16 NAND CH
<b>PCIe I/F</b>	Gen 5x4 with dual-port
<b>NAND I/F</b>	1600MT/s
<b>DRAM I/F</b>	DDR4 at 3200MHz LPDDR4x at 4266MHz
<b>NVMe</b>	v1.4b
<b>Functions</b>	32VF and 16PF
<b>128KB Seq. Read</b>	14 GB/s
<b>128KB Seq. Write</b>	9 GB/s
<b>4K Rand. Read</b>	2M IOPS
<b>4K Rand. Write</b>	1M IOPS
<b>Controller Latency</b>	< 6us
<b>Power</b>	MV-SS1331 8.7W max MV-SS1333 9.8W max
<b>Package</b>	20x20mm

**Evaluation Boards and SDK available now**

# Bravera™ SC5 SSD Controller Industry Firsts



PCI  
EXPRESS

1<sup>st</sup> PCIe 5.0 & NVMe 1.4b SSD Controller

EDSFF

1<sup>st</sup> 16Ch E1.S Form Factor Enabler

OCP  
SEF  
ZNS

1<sup>st</sup> with Flexible Usage Models

Elastic  
SLA

1<sup>st</sup> with Elastic SLA Enforcer





Thank You



Essential technology, done right™