

Unlocking the Potential of Flash with the Software-Enabled Flash™ API

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Uplifting the world with “memory”

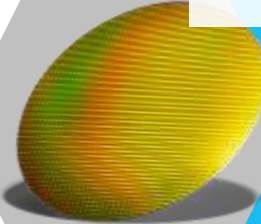
By evolving “memory,” we create uplifting experiences and **change the world.**

The name **KIOXIA** is a combination of the Japanese word *kioku* meaning “memory” and the Greek word *axia* meaning “value” – which forms the foundation of the company’s vision.

Unleashing the potential of “memory” to create new value.

KIOXIA

**Inventor of
flash memory**



**World's largest
flash factory**



**Broadest
line of SSDs**



**Trusted by top 10
server & storage vendors**



**Flash, storage &
software expertise**



**Hyperscale
depends on
flash storage
more than
ever before.**



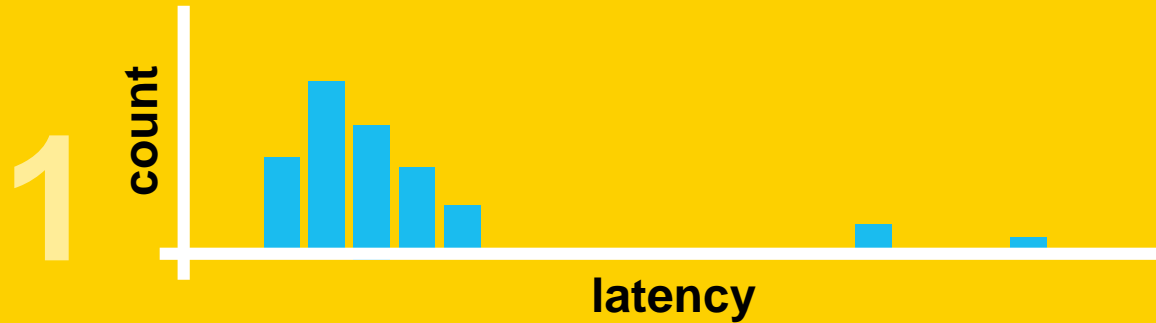
Hyperscale cloud is application-driven (software-defined)

DRIVING
TRANSFORMATION

SDC 2019
Eric Ries, SVP
KIOXIA America

**Hyperscale has
a storage problem.**

Latency



Which is better ?

“It depends...”



Workload Isolation



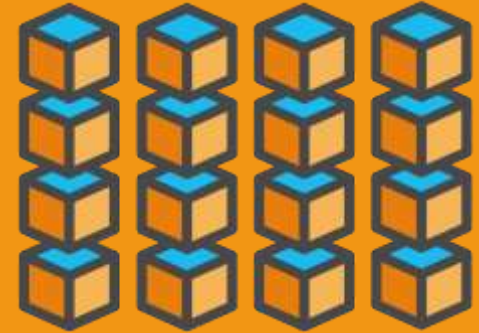
Flexibility



Machine Learning Ingest



KV Store



K8s

Low-Level Control



Data Placement



Garbage Collection



Flash ECC and RAID

...without being tied to a single vendor or technology node

Existing interfaces don't solve Hyperscale problems.

Traditional Drive



- **Generic interface**
- **Lack of control, isolation**
- **Variable performance**

OpenChannel, ZNS



- **Narrowly focused**
- **Must micromanage**
- **Technology-Specific**

It's time for something different...

Software-Enabled Flash™

What is Software-Enabled Flash?

The speed and flexibility of flash

with

The ease of software definability

**Maximize
the potential
of flash.**

All the benefits of flash without traditional overhead.

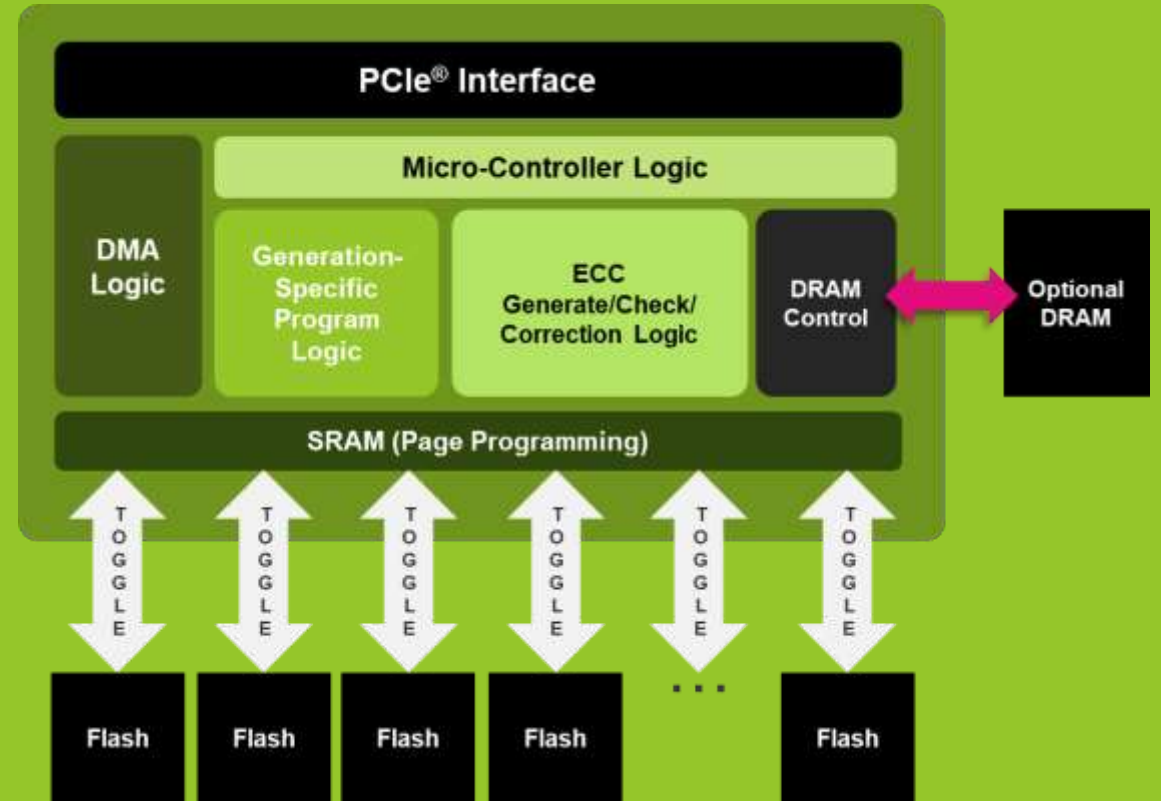
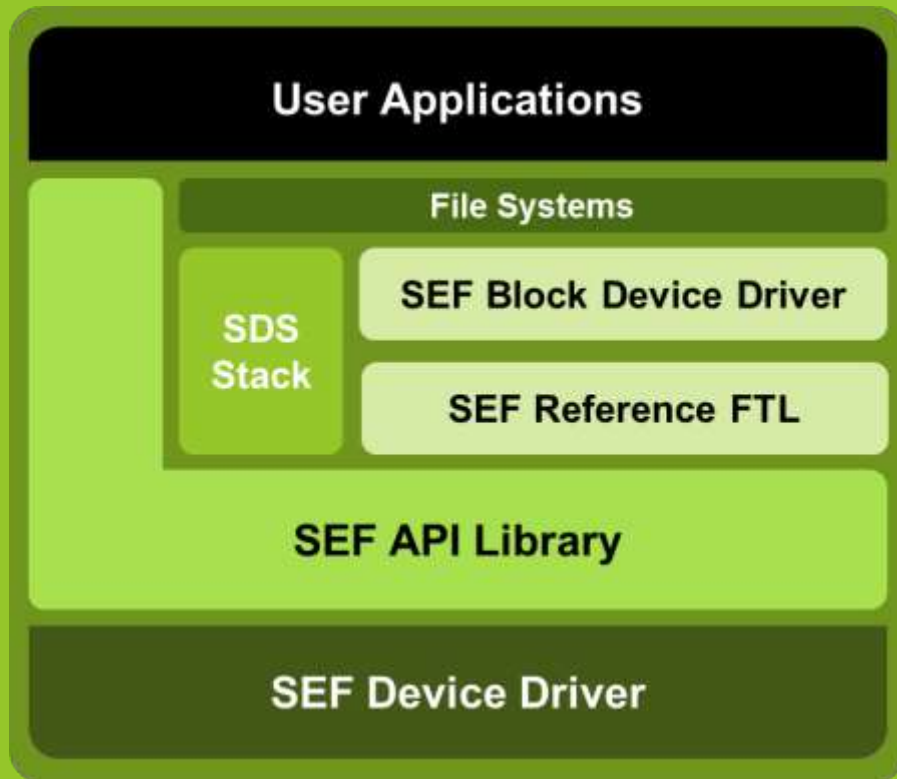
Software-Enabled Flash

**Fundamentally
redefines the
relationship
between host
and solid-state
storage**

- **Media-based, host-managed, API interfaced**
- **Applications have complete control over flash behavior**
- **Open-source API and SDK**
- **Maximizes flash flexibility, performance, and parallelism...**

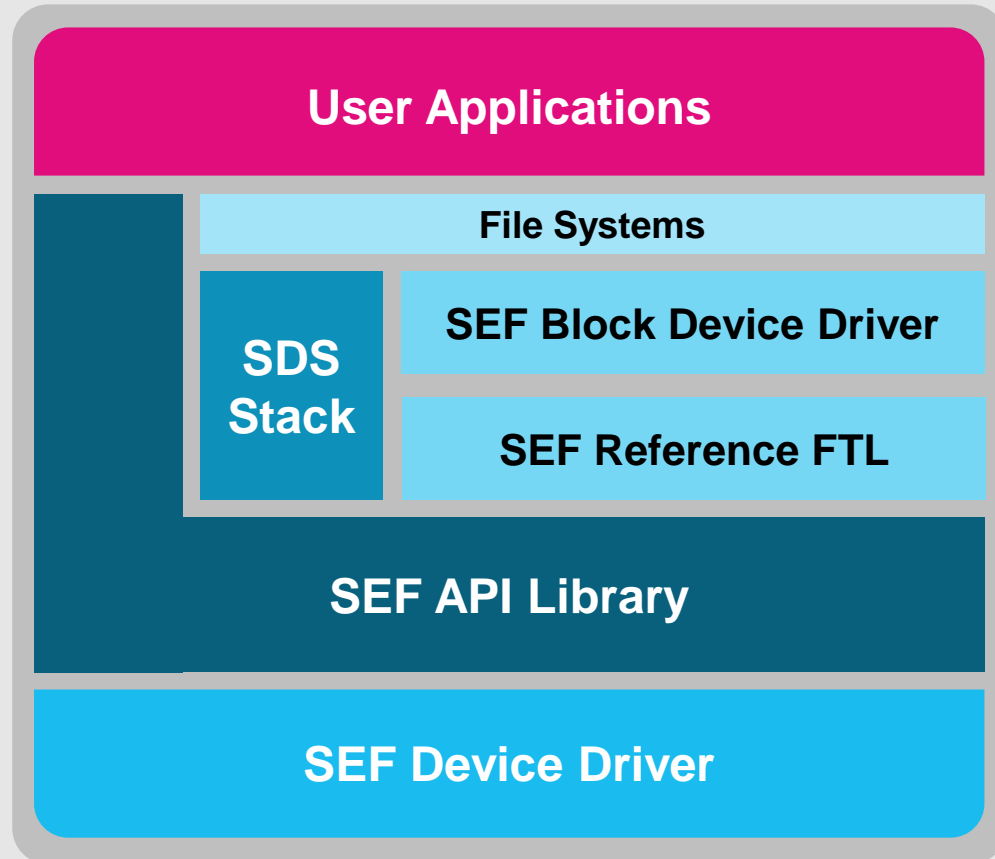
**In other words,
it maximizes flash value.**

Purpose-Built Software and Hardware



PCIe is a registered trademark of PCI-SIG.

Software



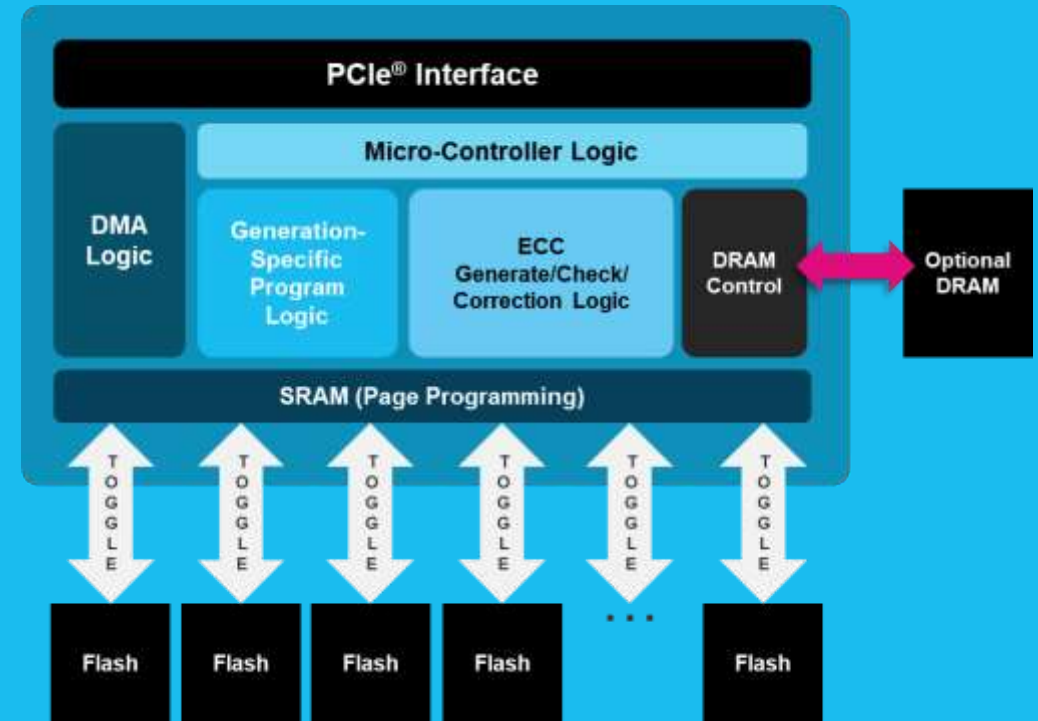
Open sourced API and libraries providing application-focused functionality.

- **Data placement**
- **Workload / tenant isolation**
- **Latency control / Error Handling**
- **Buffer management**

Hardware

Purpose-built, media-centric flash controllers focused on Hyperscale application requirements.

- Flexible DRAM configurations
- Host CPU offload
- Flash generation and vendor abstraction
- Advanced die time scheduling



PCIe is a registered trademark of PCI-SIG.

Software-Enabled Flash™ is...

DIFFERENT

Abstraction is a key feature of the Software-Enabled Flash API



Hardware Abstraction

- Flash Generations {3rd, 4th, 5th, ...8th, etc.}
- Flash Types {MLC/TLC/QLC}
- Flash Interface {Toggle/ONFI}
- Flash Vendors {KIOXIA, ... }

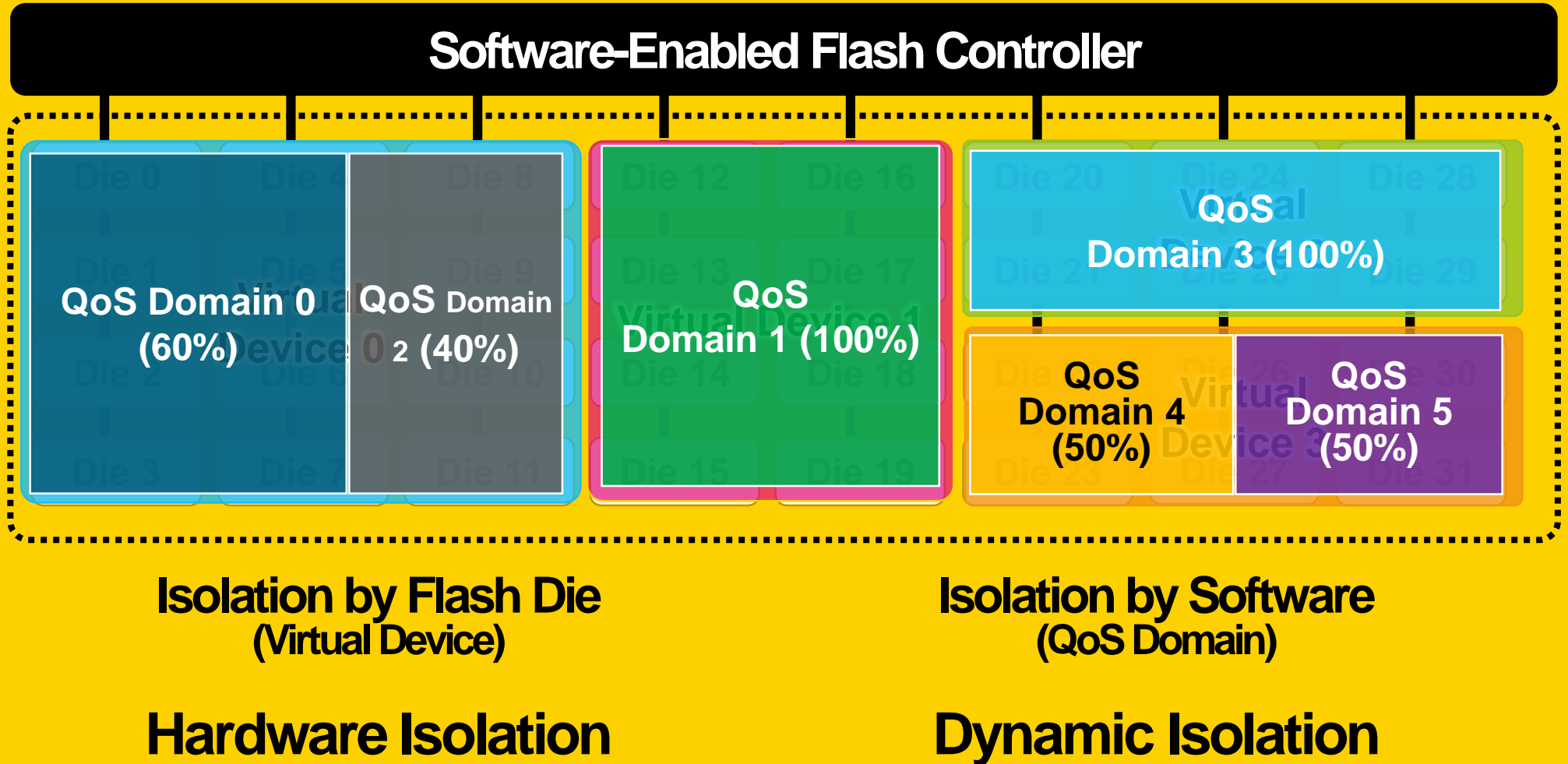


Software Abstraction

- Isolation {HW:die and SW:zone}
- Queuing {latency controls}
- Offload {Host efficiency}

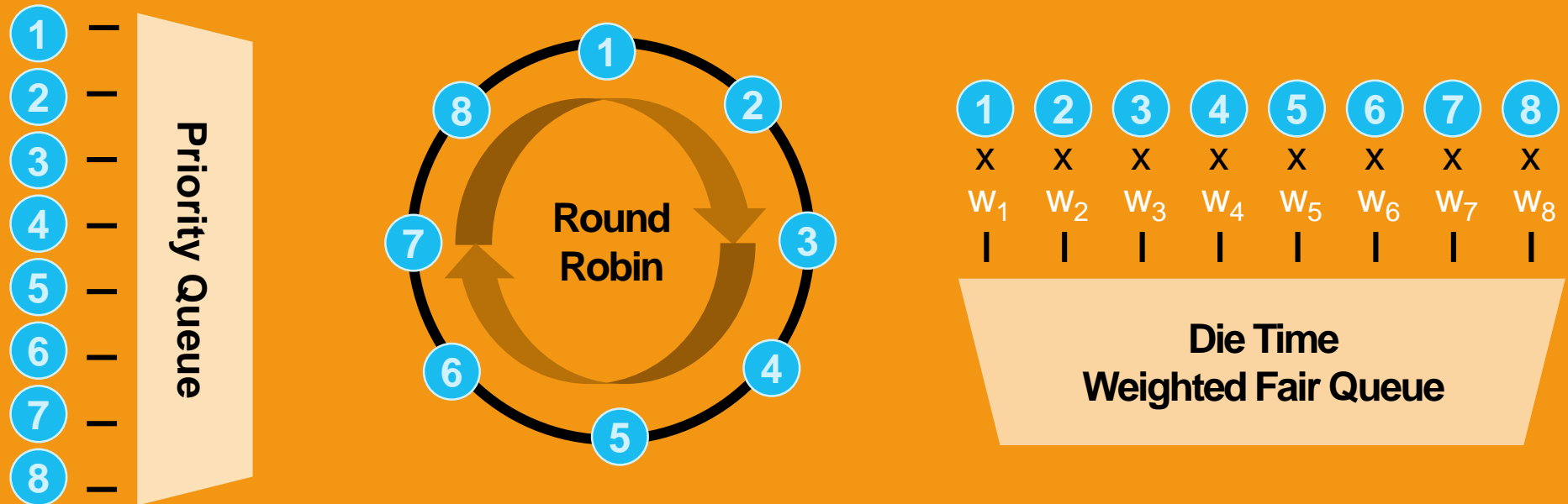
Goal: To make flash **fast** and **easy to use** and customize

Flexibility to define both hardware and software regions to isolate Tenants, Workloads, and Streams



Queueing

Application control over queueing and die scheduling to manage and deliver latency outcomes



The host is in full control and can override defaults on queues and weights for individual commands

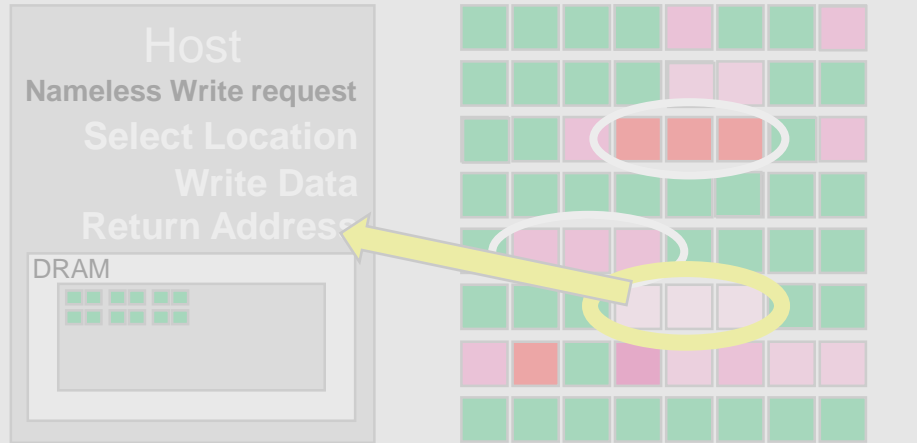
Look for our technical session at 11:20 AM:

“Unlocking the New Performance and QoS Capabilities of the Software-Enabled Flash™ API”

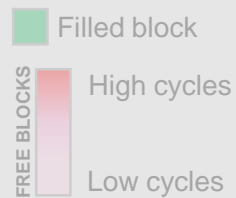
Offload

Host Offload frees host from low-level flash management

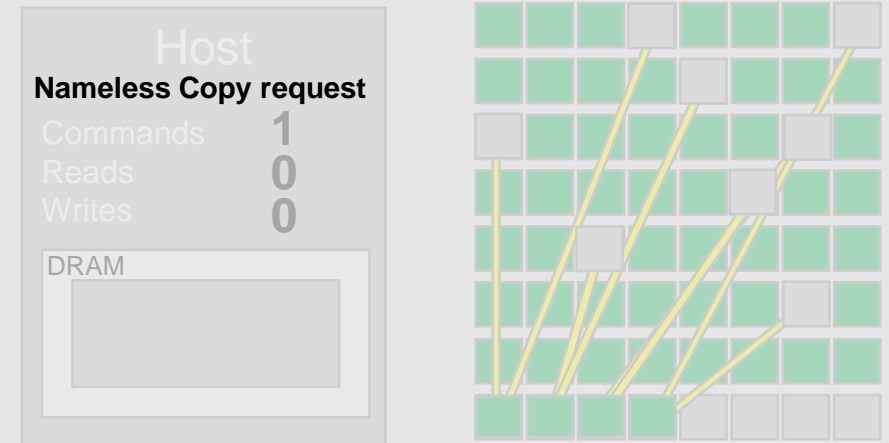
Nameless Write Operation



- Frees host from managing flash health and endurance.
- Device chooses the best physical location.
- Returns physical flash address for *direct access*.



Nameless Copy Operation



- Garbage Collection
- Wear Leveling
- Compaction



Without using PCIe, host memory, or CPU cycles.

value

Business Value from API-based Low-level Control



Time to market

Quick transition to newest flash generations



Resource allocation

Focus development where it matters most



Maximize your flash

Adapt and change flash as workloads change

Software-Enabled Flash technology maximizes flash value

Software-Enabled Flash™ is...

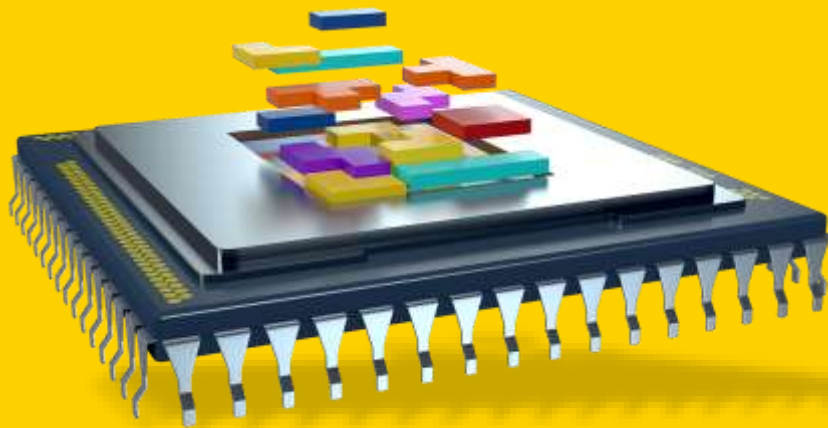
ADAPTABLE

An Open Standard for Vendors and Users

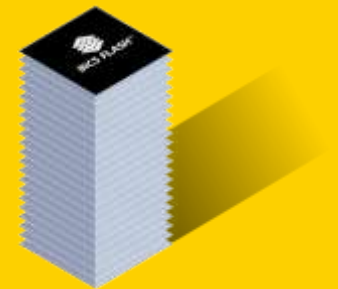


<https://github.com/KioxiaAmerica/SoftwareEnabledFlash>

Hardware Design Flexibility Enabled by Software Abstraction



Flash Architecture	<ul style="list-style-type: none">✓ MLC✓ TLC✓ QLC
Flash Interfaces	<ul style="list-style-type: none">✓ Toggle✓ ONFI
DRAM	<ul style="list-style-type: none">✓ Device-Side DRAM✓ Host-Side DRAM (UWB)✓ Hybrid
Controller	<ul style="list-style-type: none">✓ Channels per Die✓ CPU Architecture✓ Acceleration Blocks



Software-Enabled Flash technology fundamentally redefines the relationship between host and solid-state storage.



Purpose-built hardware for managing flash media under host control



Industry standards and protocols



Open-source, flash-native API



Combines full host control with ease of use

Getting Involved at SDC 2020



Unlocking the New Performance and QoS Capabilities of the Software-Enabled Flash™ API

Tuesday, September 22 at 11:20 am PDT

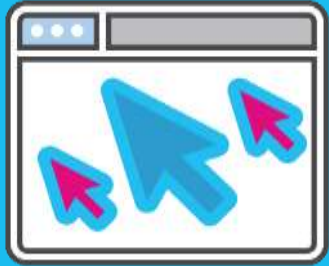


**Building the Software-Enabled Flash™ Community
Birds of a Feather**

Wednesday, September 23 at 3:00 pm PDT

For More Information

1



Website

www.softwareenabledflash.com

2



White Paper

Available on the website

3



API

<https://github.com/kioxiaamerica>

KIOXIA