

# KIOXIA



SOFTWARE-ENABLED FLASH™

**G2M**  
RESEARCH

## **Software-Enabled Flash: Large-Scale Data Center Revolution for Flash Storage**

G2M Research Webinar  
Wed March 30, 2022

# Today's Speaker and Moderator



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**G2M**  
RESEARCH



SOFTWARE-ENABLED FLASH™

# Software-Enabled Flash

## Large-Scale Data Center Revolution for Flash Storage

March 2022

 **THE LINUX** FOUNDATION

 **THE LINUX** FOUNDATION

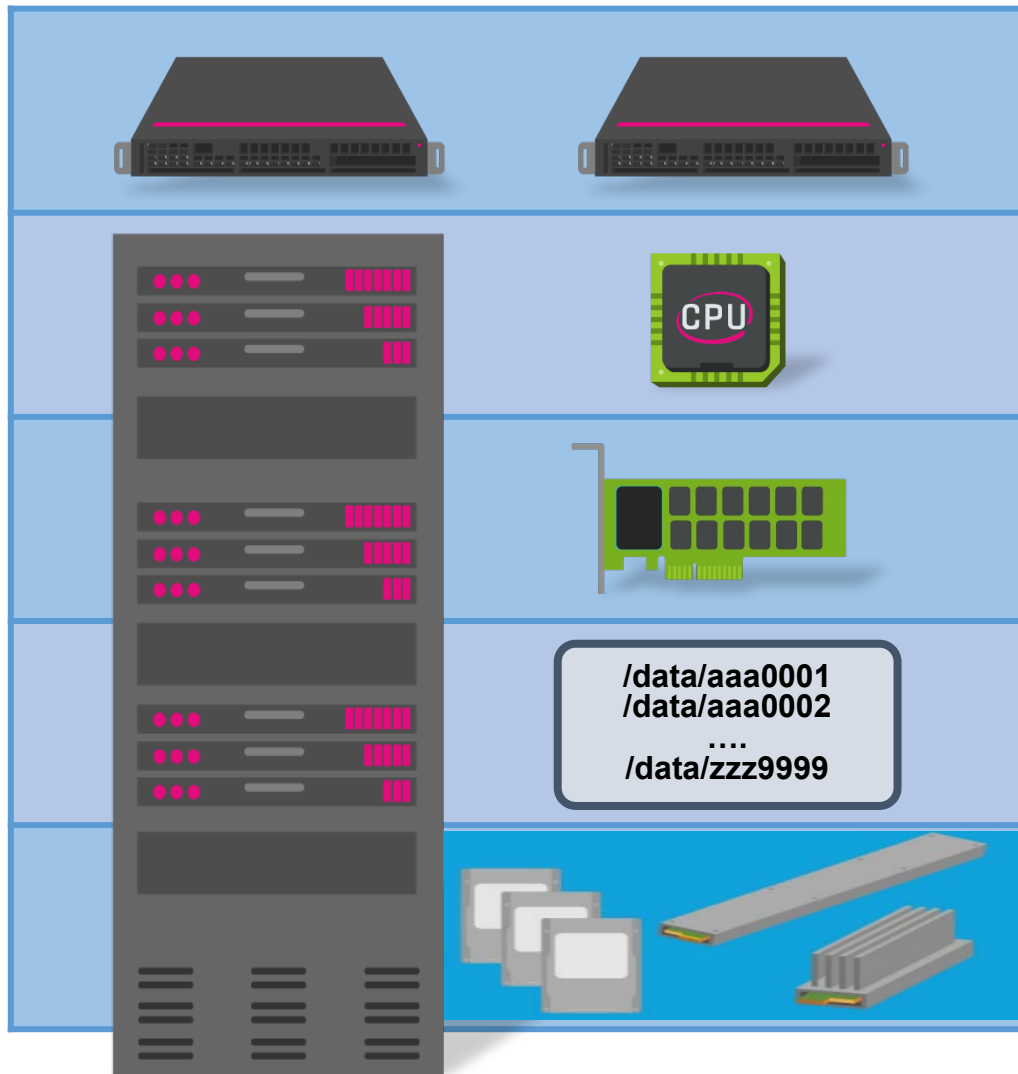


SOFTWARE-ENABLED FLASH™

## AGENDA for Software-Enabled Flash™

- › Pushing the boundaries of flash
- › Making flash software-defined
- › Meeting cloud challenges
- › Why The Linux Foundation
- › How to get more information

# Software-Defined Data Center



Software-Defined Networking

Software-Defined Silicon

Software-Defined Accelerators

Software-Defined Storage

Apply the same idea to flash...

The Opportunity

# Flash ~~needs to be~~ **Is NOW** Software-Defined

Software-Enabled Flash™ Technology

# Making Flash Software-Defined

Remove HDD-based protocol limitations



Optimize for flash memory's digital nature



Engineered to meet cloud challenges



# Pushing the Boundaries of Flash

The challenge of maximizing the value of every bit



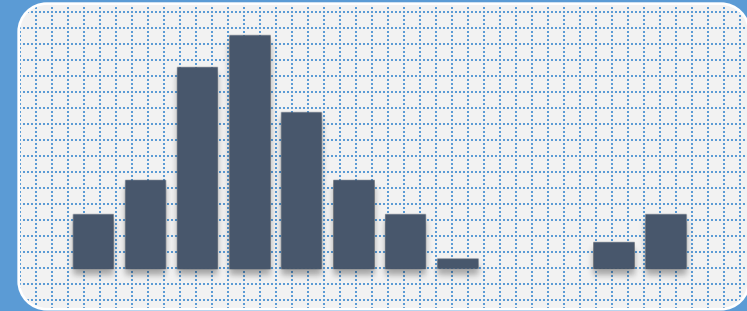
**Fundamentally  
redefines the  
relationship  
between the host  
and solid-state  
storage**

- Brings control of flash to software
- Cloud applications have complete control over storage functionality and behavior
- Solves legacy overhead problems and enables new features
- Maximizes flash flexibility, performance and parallelism...

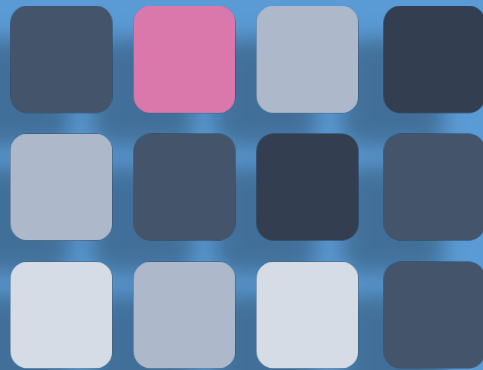
- **in other words, flash's value.**



**Tenant Isolation**



**Latency Control**

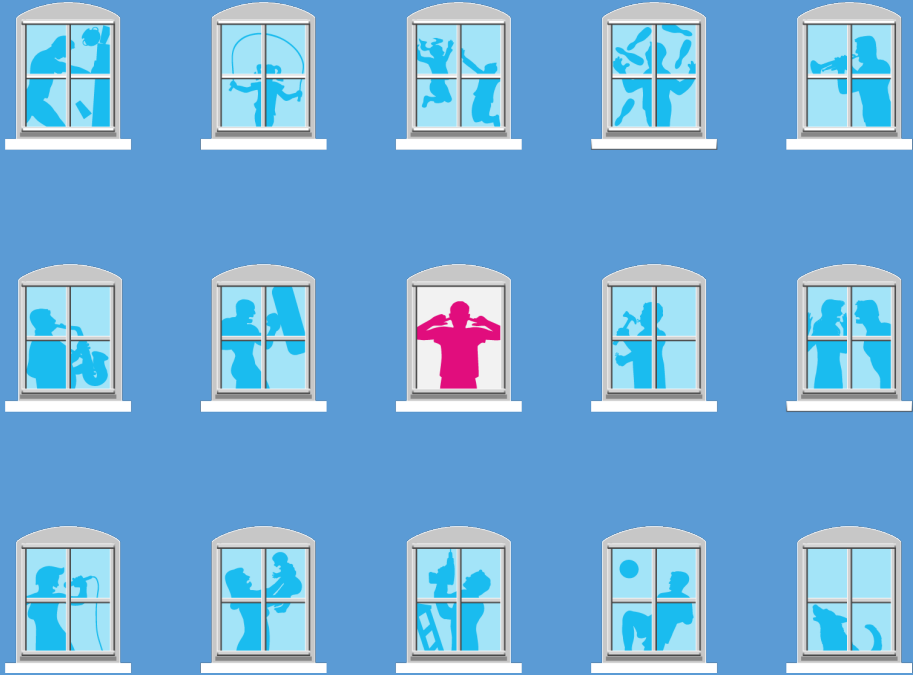


**Data Placement**



**Flash Migration**

# TENANT ISOLATION



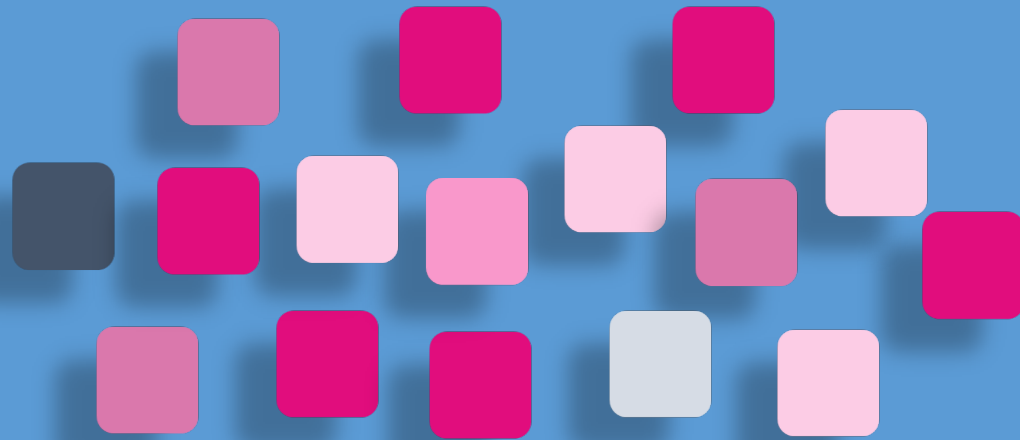
## CHALLENGE

- Noisy neighbor problem

## PUSHING BOUNDARIES

- Prevent one customer's workload from impacting another's workloads
- Deliver predictable Quality of Service

# DATA PLACEMENT



## CHALLENGE

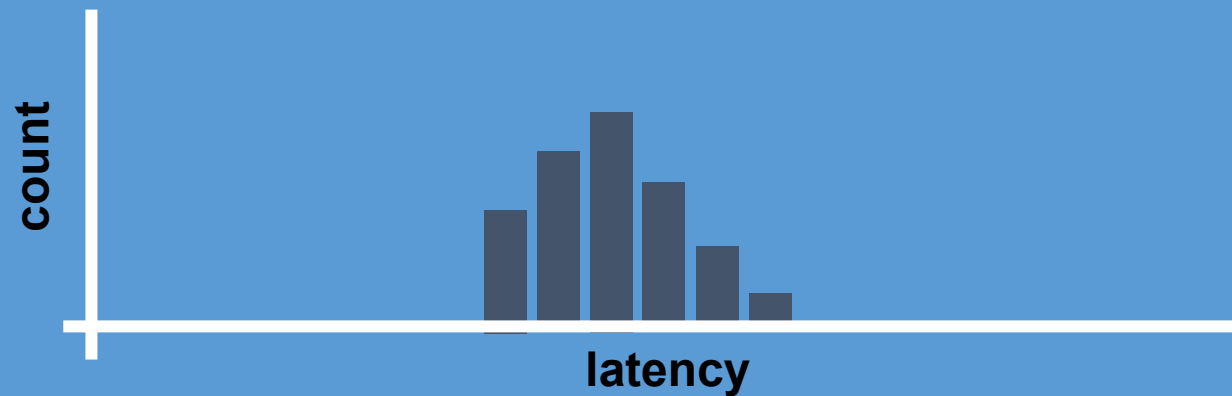
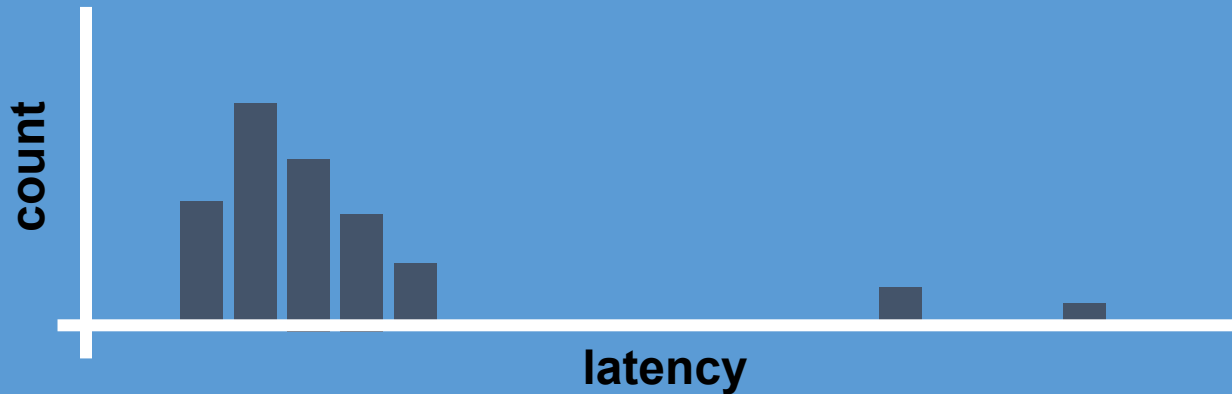
- Ensure data with each tenant or workload doesn't impact neighbors

## PUSHING BOUNDARIES

- Define HW isolation of flash from a single flash die to many die as needed
- Control security, access, performance and latency using QoS domains under host control

# LATENCY CONTROL

Which is better ?



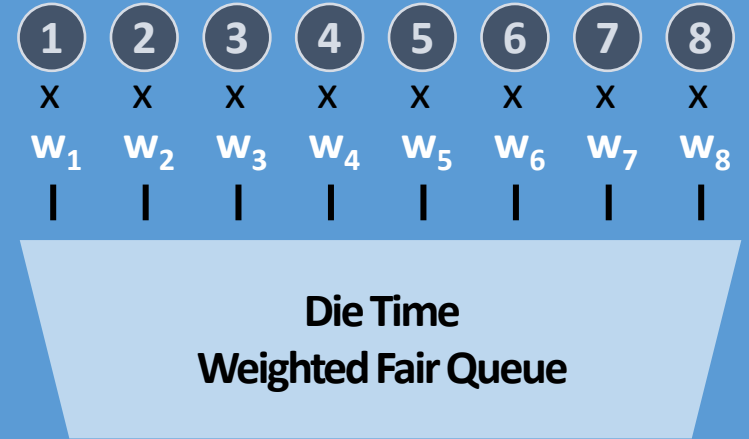
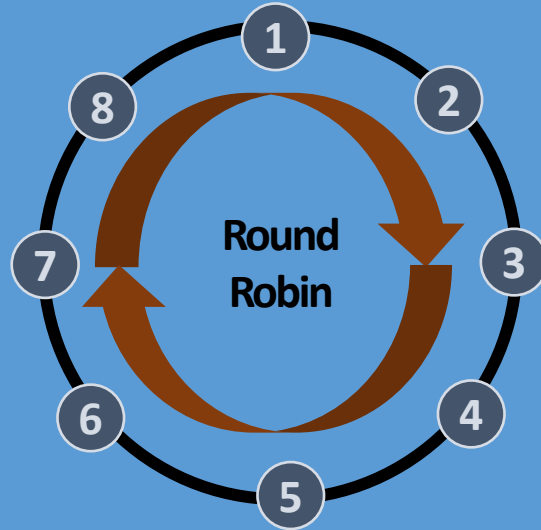
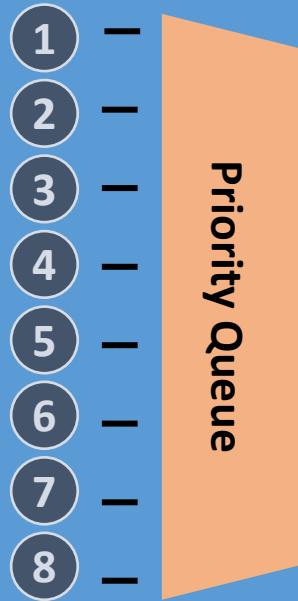
## CHALLENGE

- Different workloads demand different latency profiles

## PUSHING BOUNDARIES

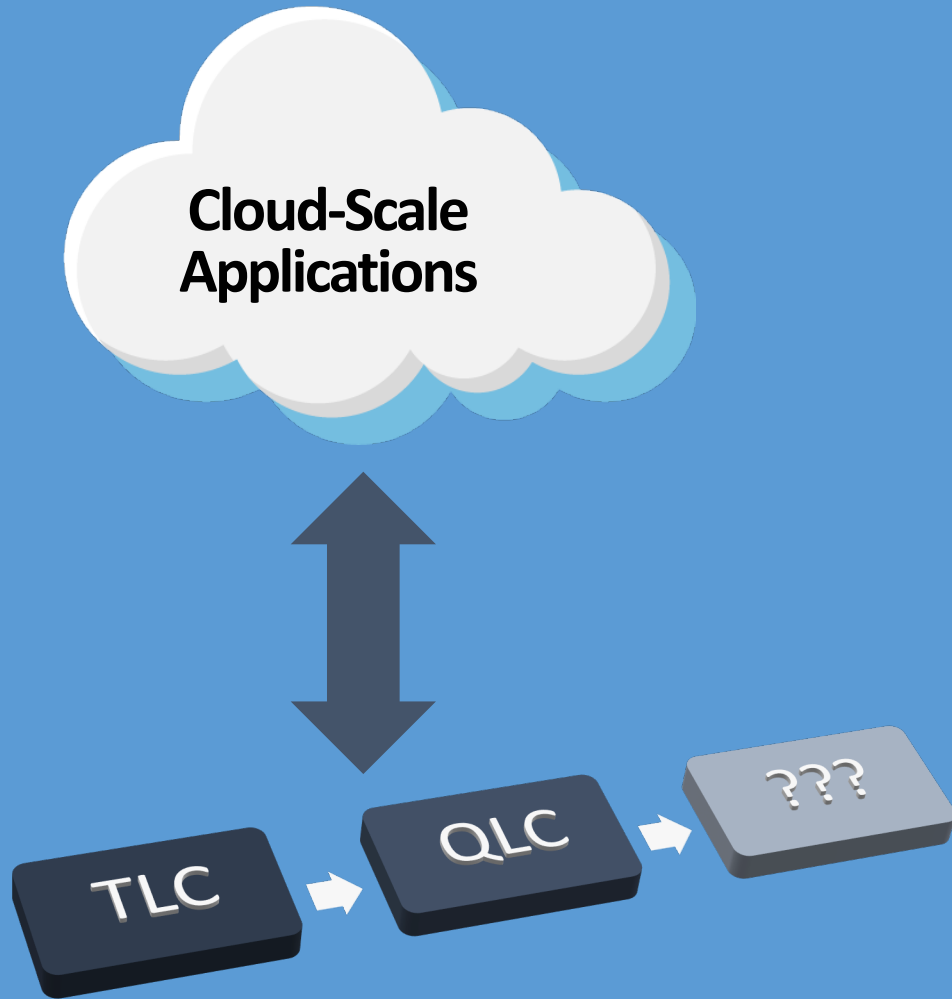
- Deliver optimal I/O latency to each application

# QUEUEING CONTROL



Multiple, software-controlled queueing modes  
Controllable on a per-application or even per-I/O basis

# FLASH MIGRATION



## CHALLENGE

- Achieve optimal results without tying to a single flash drive or technology

## PUSHING BOUNDARIES

- Improve TCO by deploying new flash memory advances
- Speed time to market for new applications

- What is the biggest problem in your datacenter when deploying flash storage at scale (select one)?

- |  |     |
|--|-----|
| 1. “Noisy Neighbors”   | 7%  |
| 2. Different quality of service/service level agreement requirements across apps | 7%  |
| 3. Migrating from one flash media to another                                     | 29% |
| 4. Managing data placement across flash devices                                  | 36% |
| 5. Other issues  | 21% |
| 6. None of the above   | 0%  |



# Meeting Cloud Challenges

Pushing flash boundaries in a cloud environment

# Software-Enabled Flash™

## A Software-Defined Flash API Sheds the legacy HDD paradigm

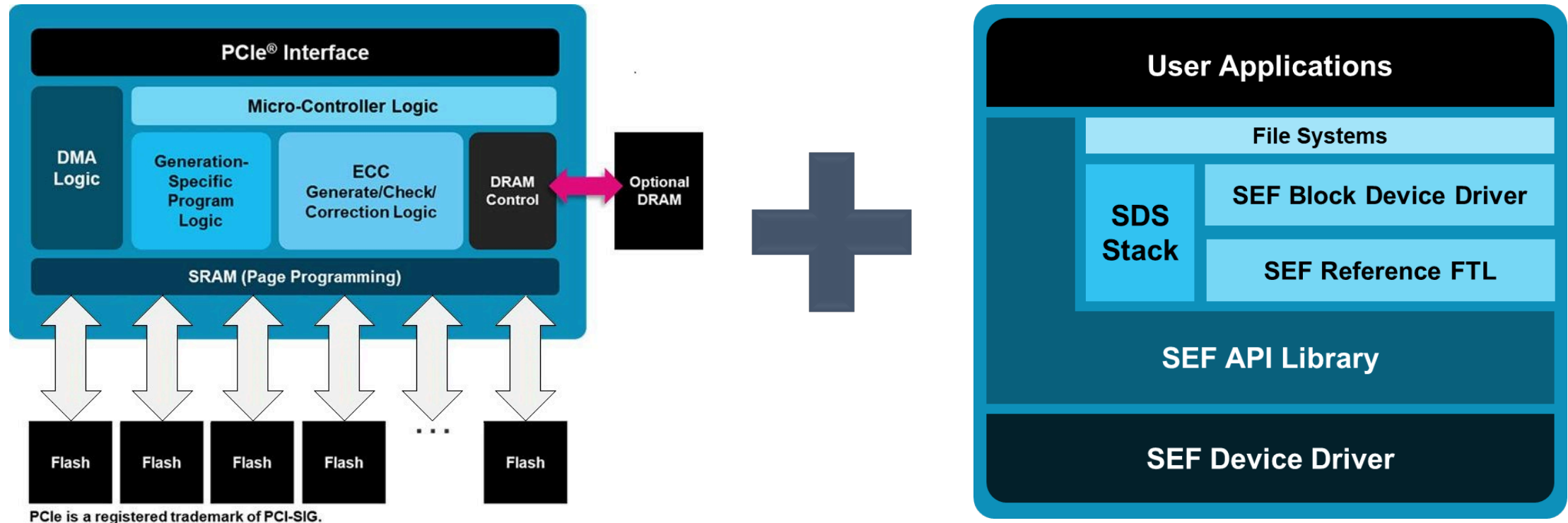


Flash can behave in a much more predictable and uniform manner with:

- Data placement and Workload Isolation
- Latency control with advanced queuing
- Multi-protocol capabilities

**A powerful way forward for flash**

# Optimized Hardware + Open Source Software



The hardware focuses on media management and host offload functionality...

...allowing software to orchestrate and manage protocols, latencies and data placement

# Software-Enabled Flash™ API and SDK

- **Accelerate development**
  - **Faster application time-to-market**
  - **Base for new development**
- **Options for virtualized and containerized applications**
- **Deploys the full power and capabilities of flash hardware**

**SDK enables developers to evaluate and test Software-Enabled Flash™ without writing a single line of code**

# Why The Linux Foundation

Enabling the eco-system and community

# Benefits of The Linux Foundation



**Neutral Home  
for Code &  
Collaboration**



**Ecosystem Curation  
and Community  
Building**
































































































**Support Programs  
to Ensure Enterprise  
Adoption**



**Insights & Tools  
to Drive Project  
Success**

# Behind some of the most critical projects in the world

<b>Security</b>	       
<b>Networking</b>	       
<b>Cloud</b>	      
<b>Automotive</b>	  
<b>Blockchain</b>	     
<b>Edge/IoT</b>	       
<b>Web</b>	       
<b>AI</b>	        
<b>Film</b>	      
<b>CI/CD</b>	        
<b>Energy</b>	       
<b>Hardware</b>	    
<b>Standards</b>	      

# Building large ecosystems with collective resources

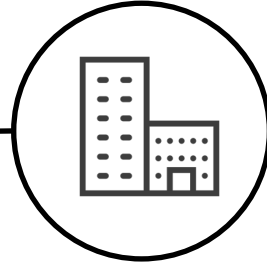
**2000+**

Members From  
41 Countries



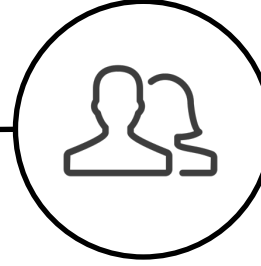
**100%**

of Fortune 100  
Tech & Telecom



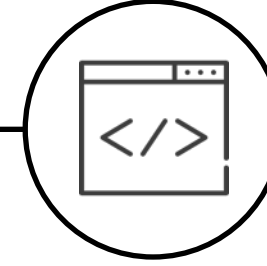
**242,960+**

Developers  
Contributing Code



**400+**

Critical Open  
Source Projects



**\$54.1B**

Shared  
Value



The Linux Foundation is a critical part  
of modern technology

**+**  
**31.2M**  
Lines of Code  
Added Weekly

**-**  
**20M**  
Lines of Code  
Removed Weekly

**</>**  
**236,040**  
Contributing  
Developers

**19,442**  
Contributing  
Companies

**12,290**  
Repositories

**-**  
**10.4M**  
Commits

**1.1M**  
Pull Requests

**735,760**  
Builds Monitored

**815,110**  
Logged Issues

**4.6B**  
Container  
Downloads

**5.1M**  
Chat  
Messages Sent

**4.4M**  
Email  
Messages Sent

**10,334**  
Scanned  
Repositories

**236,499**  
Vulnerabilities  
Detected

**21,597**  
Recommended  
Fixes

**13,802**  
Vulnerabilities  
Fixed

**31,496**  
CLA  
Contributors

**26,998**  
Community  
Meetings



# Governance Model for Software-Enabled Flash



- Do you have any projects where software-enabled flash could provide value underway or in planning (select one)?
  1. We are currently deploying flash storage for a project where SEF would definitely be of value 7%
  2. We are planning a flash project where SEF would definitely be of value 13%
  3. We are planning a flash project where SEF could have some value 13%
  4. We do not have any projects where SEF could have significant value 7%
  5. No opinion 60%

# Summary and More...

Pushing flash boundaries in a cloud environment

# Software-Enabled Flash™

**A force  
multiplier  
in data  
center  
economics**

- ✓ Isolated tenant environments
- ✓ Deliver tiered service levels
- ✓ Better flash economics (TCO)
- ✓ Faster time to market (TTM)
- ✓ Open Source ecosystem

Join, contribute, lead



# The Project is Live

**Membership is open**

**Join the project  
contribute to the future of  
flash becoming  
“Software-Defined”**



<https://softwareenabledflash.org>



# Audience Q&A

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Effective **Marketing & Communications** with  
Quantifiable Results