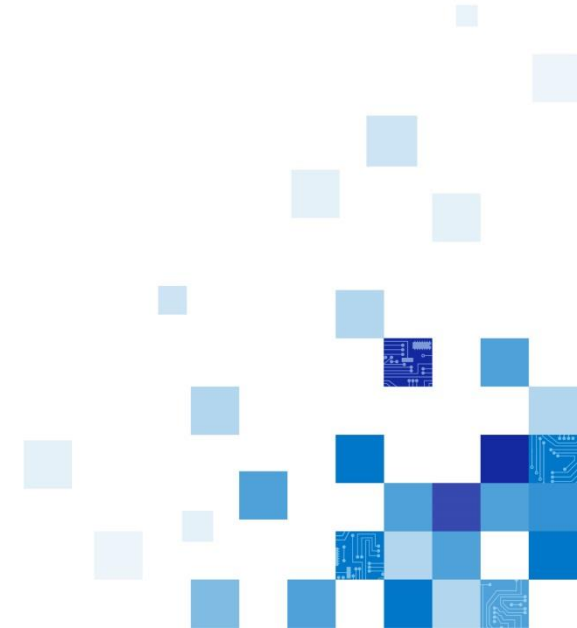


# SSD virtualization technology trend at multi-tenancy application

July 4, 2023 | Samsung Electronics Co., Ltd.

Proprietary



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## **Agenda**

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**1. Industry trend for SSD virtualization: SR-IOV SSD**

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**2. Functionality of SR-IOV SSD**

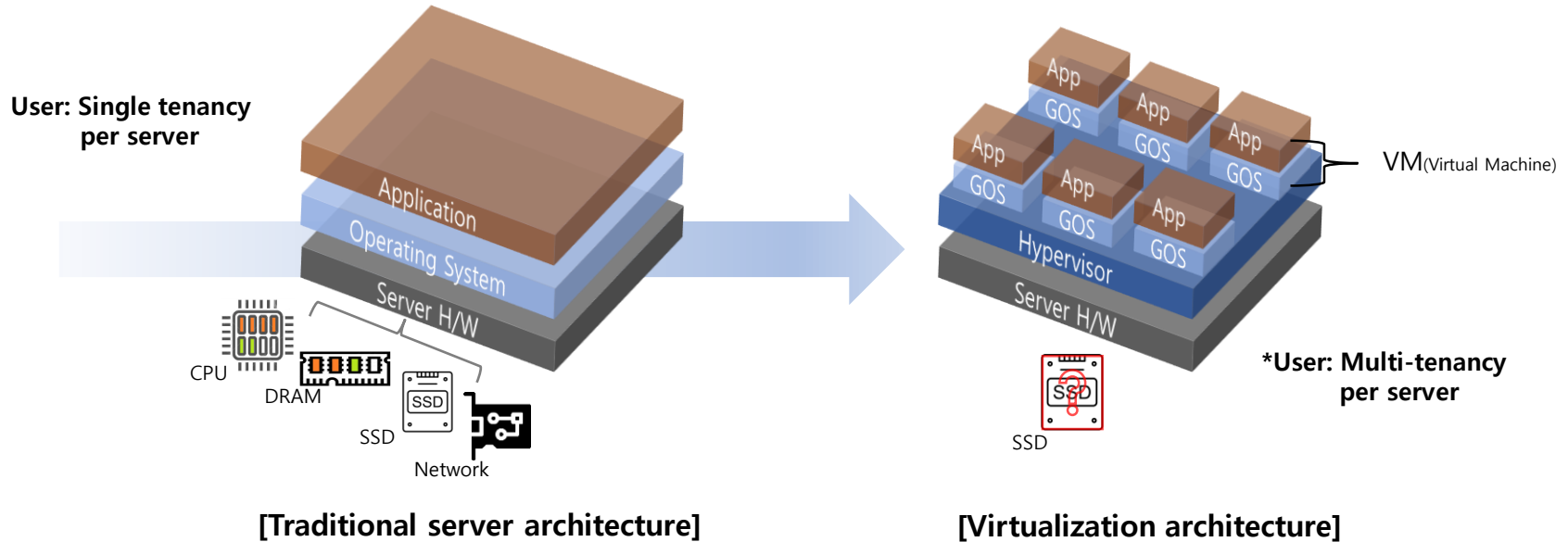
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**3. Future works**

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# Server H/W virtualization at multi-tenancy application

- Server H/W virtualization is widely adapted to datacenter architecture at multi-tenancy application  
→ What is the required **SSD functionality at virtualization architecture?**



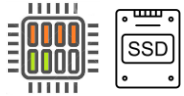
# Industry trend for SSD virtualization

- For higher efficiency of TCO, collaborative technologies between host and SSD are emerged
- SSD capacity and performance requirement per VM are smaller than the provided by SSD

## Pain points at DC

### Multi-tenancy application

(E.g. VM instance)



- ✓ Large number of VMs per server,  
→ "Higher efficiency of server TCO"
- ✓ Higher capacity & performance at  
a single SSD

◇ **Pain point:** Capacity and performance partition  
at SSD-level

## DC industry trend

\*NIC: Network Interface Card

\*DPU: Data Processing Unit

### Hypervisor w/ SR-IOV +SR-IOV NIC support

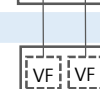
AS-WAS

General SSD  
- Low capacity: 512GB, 1TB, 2TB



CPU/DPU

Host



\*VF: Virtual Function

### Hypervisor w/ SR-IOV +SR-IOV NIC support +SR-IOV SSD support

TO-BE

### SR-IOV SSD

- High capacity: 4TB, 8TB, 16TB  
- Guarantee performance limit  
per VF

# Usage model at VM instance service

- **Competitiveness at VM service: Smaller scalability of performance and capacity at local storage**
- **Minimum SSD capacity from suppliers are more higher in aligned with NAND density increase**

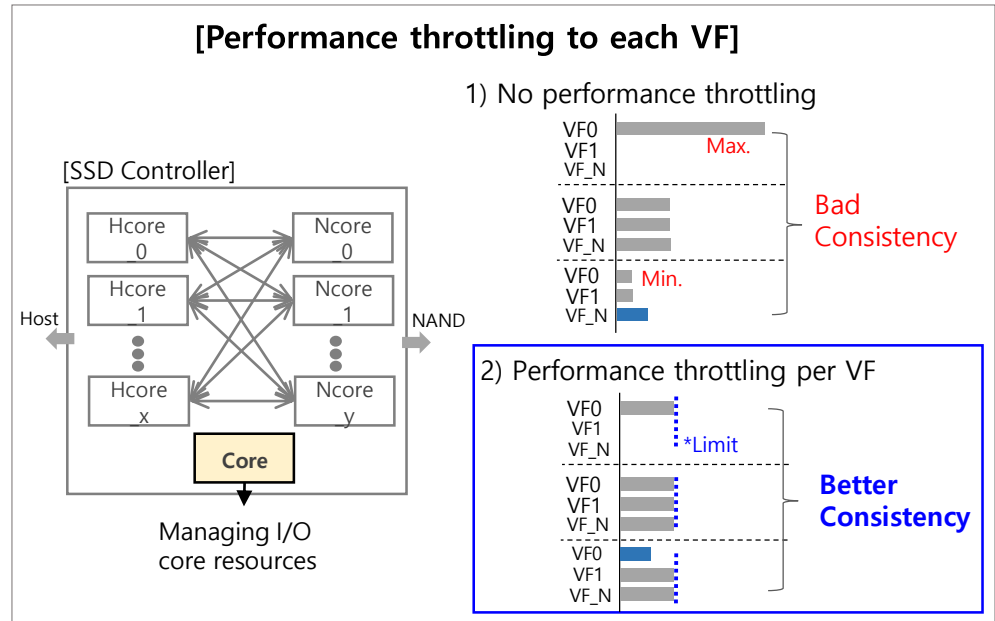
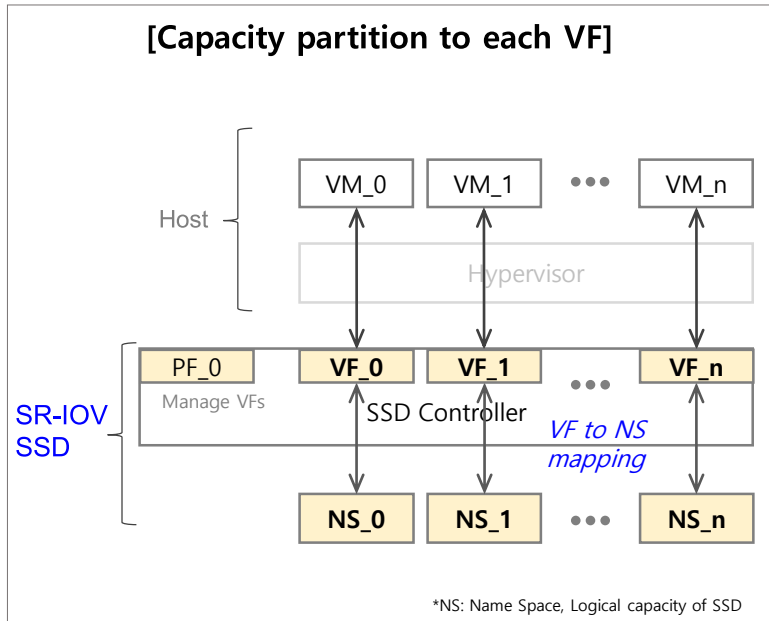
[Example: General-purpose VM instance]

Company	Instance	Local storage		Scalability per CPU Core
		Min.	Max.	
A	Dxads v5	75GB	3,600GB	75GB
B	M5a	75GB	3,600GB	75GB
C/D		Networked storage only		
E	IT3	3,720GB	14,800GB	3,720GB

Core was estimated to 2 vCPU  
GB means GiB

# Functionality: SR-IOV SSD

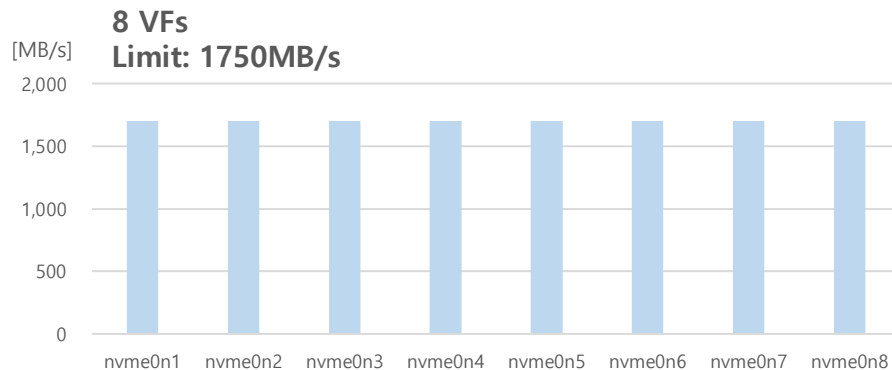
- SR-IOV SSD: 1) Capacity partition to each VM, 2) Performance throttling per VF
- Acceptable performance and consistency have strong dependency on application usage



# Test result: SR-IOV SSD

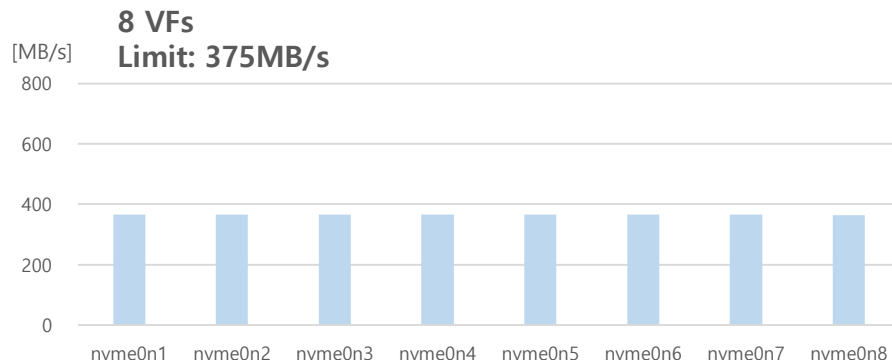
## ■ Sequential Read, 128KB

VF	Performance
nvme0n1	1,701
nvme0n2	1,701
nvme0n3	1,701
nvme0n4	1,701
nvme0n5	1,701
nvme0n6	1,701
nvme0n7	1,701
nvme0n8	1,701



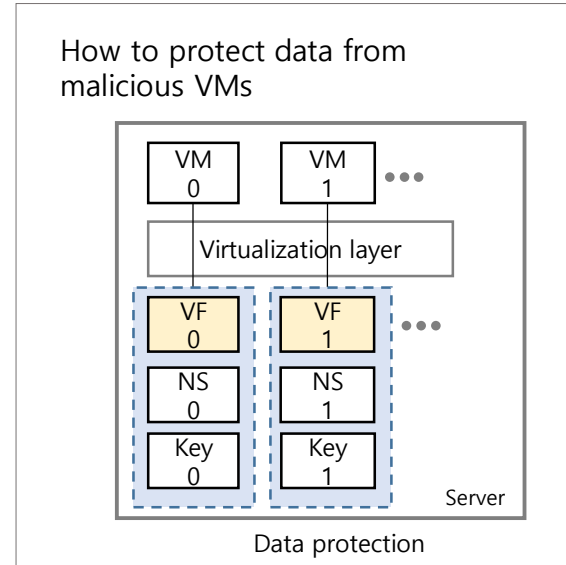
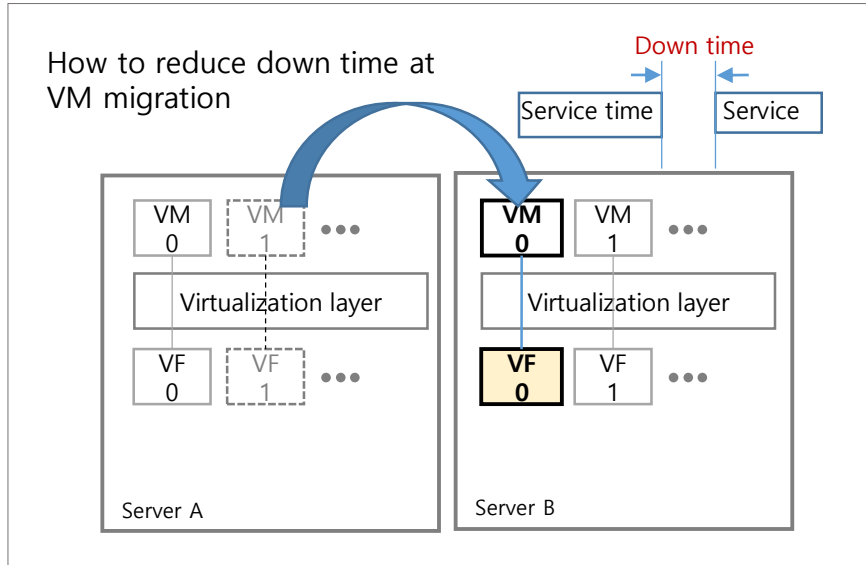
## ■ Sequential Write, 128KB

VF	Performance
nvme0n1	365
nvme0n2	365
nvme0n3	365
nvme0n4	365
nvme0n5	365
nvme0n6	365
nvme0n7	365
nvme0n8	364



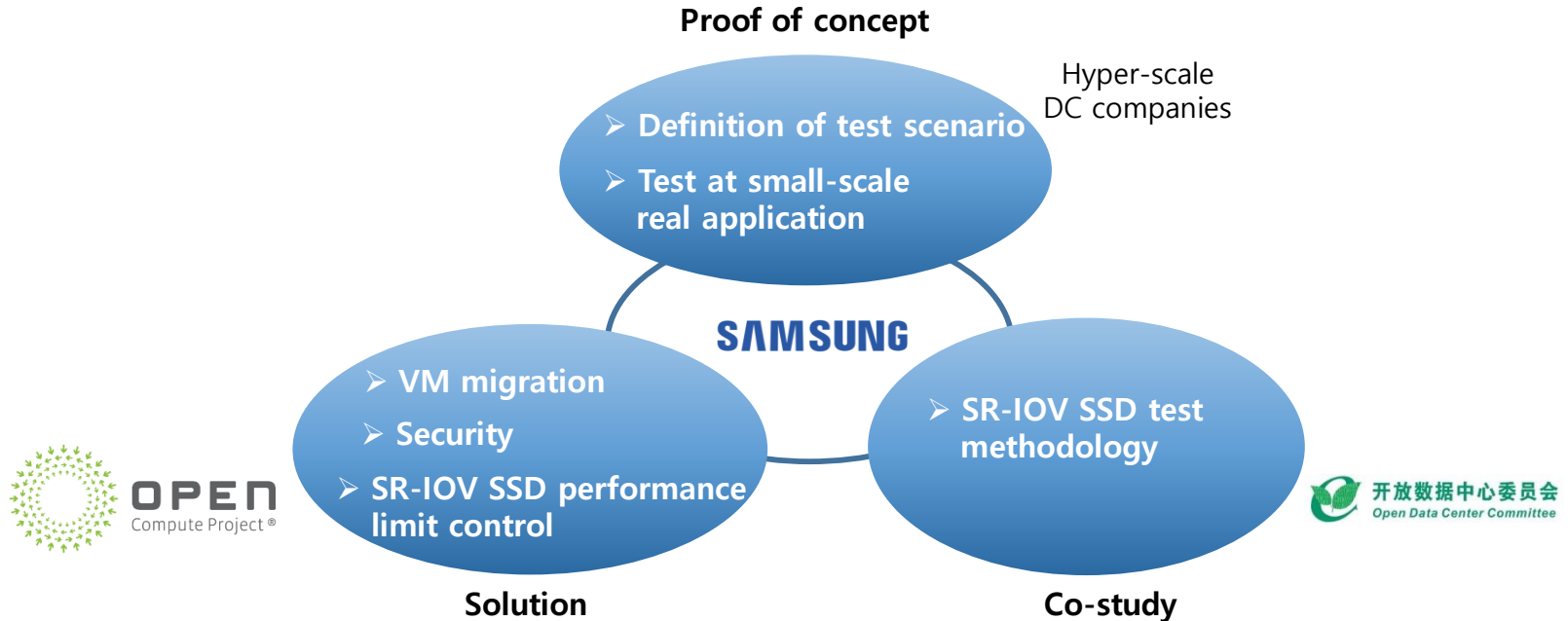
# Future works at SSD virtualization technology

- VM migration with minimum down time of service
- Data protection from malicious VMs





# Contribution to SR-IOV SSD Eco-build



**END**