SNIA CMSI | COMPUTE, MEMORY, AND STORAGE

Accelerate Disaggregated Storage to Optimize Data-Intensive Workloads

A SNIA Webcast Panel

Moderated by Tim Lustig, SNIA CMSI/NVIDIA
Panelists: Kfir Wolfson, Pliops and John F. Kim, NVIDIA

Live June 29, 2021 at 10:00 am PDT

Today's Presenters

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SNIA-At-A-Glance

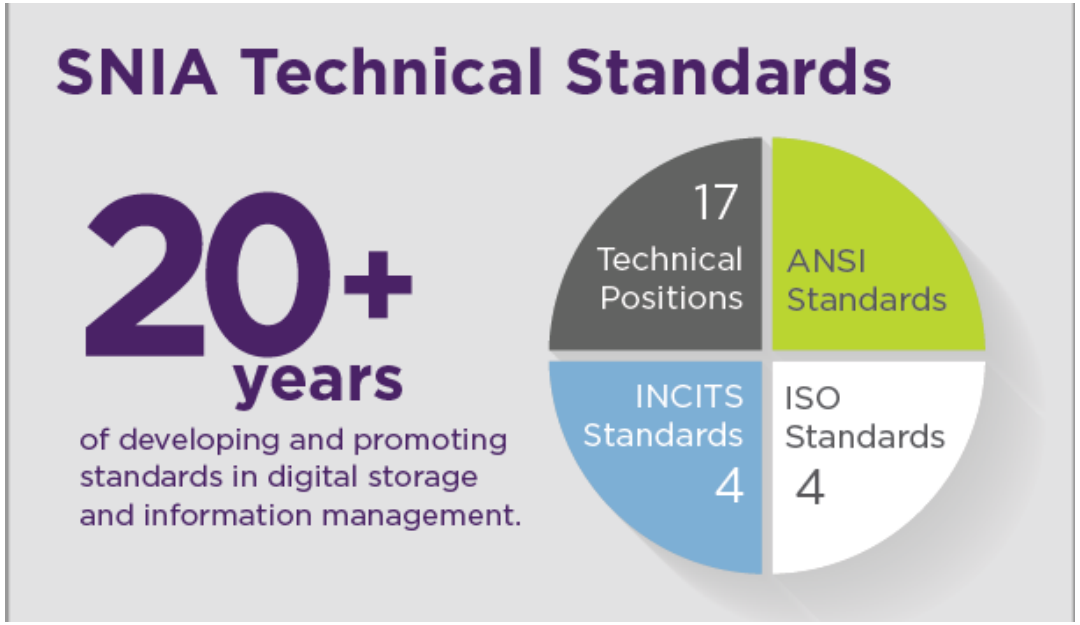
180
industry leading organizations

2,500
active contributing members

50,000
IT end users & storage pros worldwide

What Does SNIA Do?

- SNIA is a non-profit global organization dedicated to developing standards and education programs to advance storage and information technology.



Who is CMSI?

- Part of SNIA, the SNIA Compute, Memory, and Storage Initiative – CMSI - is a community of storage professionals and technical experts who support:
  - The industry drive to combine processing with memory and storage,
  - The creation of new compute architectures and software to analyze and exploit the explosion of data creation over the next decade.
- CMSI's three Special Interest Groups – Computational Storage, Persistent Memory, and Solid State Drives – evangelize and educate on these technologies to the industry

snia.org/cmsi

Agenda

- Background on Disaggregation
- DPU Benefit for Disaggregation
- Modern Storage challenges and requirements
- Roadmap to Disaggregated Architecture
- Today: Storage Data Processor– Block and KV API
- Tomorrow: Full Disaggregation with DPU and Storage Data Processor
- Use Cases
- Key Takeaways

Challenges with Traditional Storage Scale-Out

Local Storage

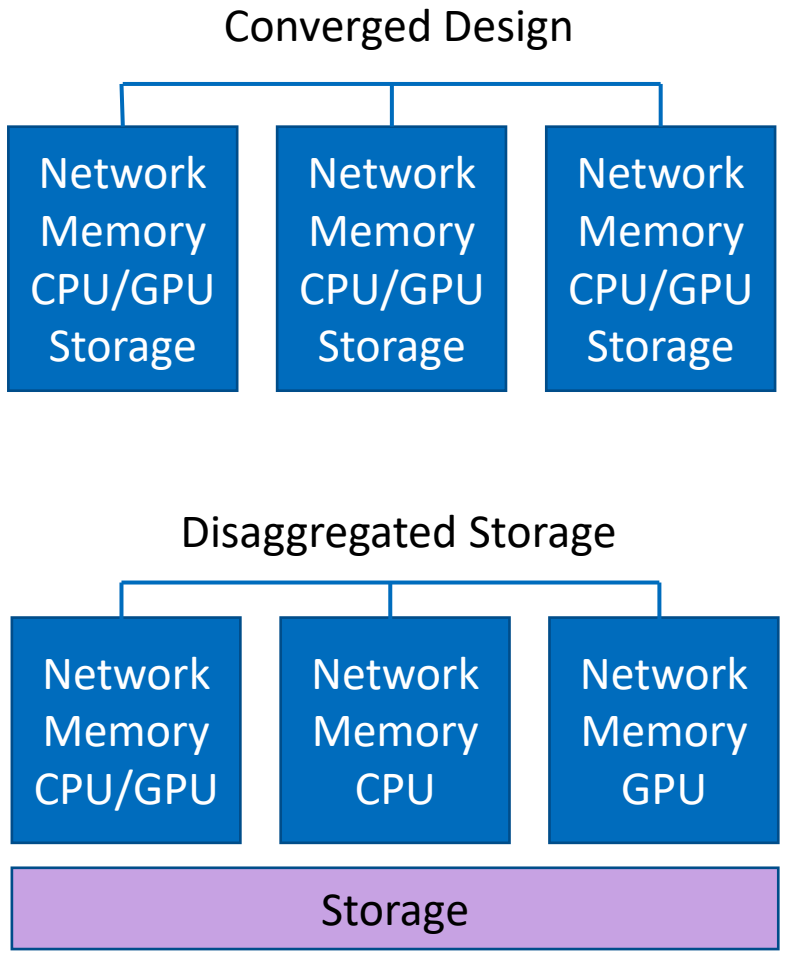
- Easy to buy and set up, but…
- Hard to share, inefficient
- Difficult to protect
- Hard to manage at scale

Traditional SAN/NAS

- Easy to share/protect, but…
- Potentially expensive
- Overworked controllers
- Networking limitations

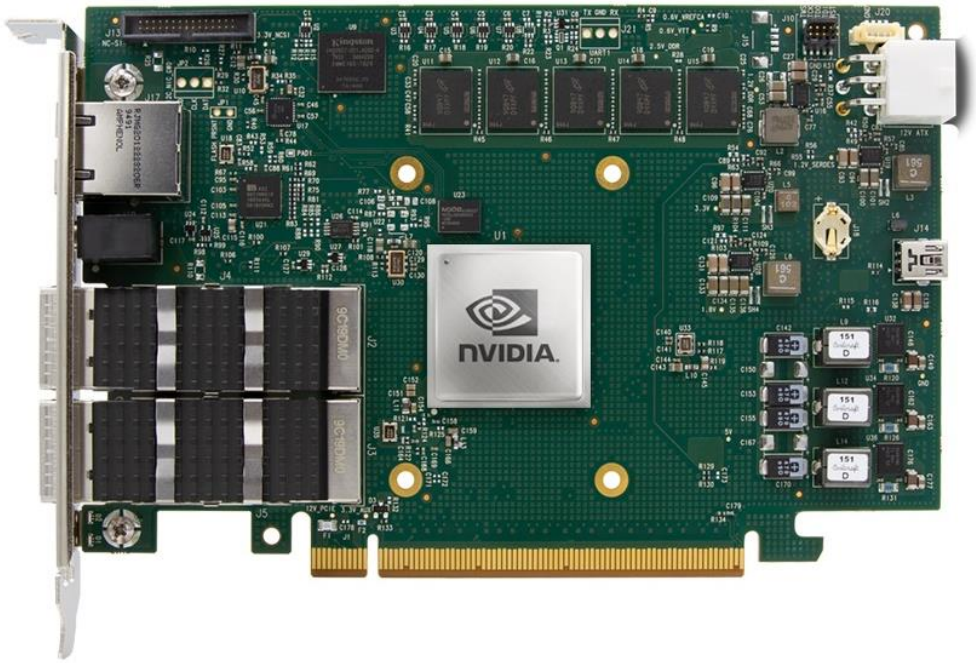
Benefits of Disaggregating Storage

- Disaggregating: Separate the components
  - Typically, separate storage and compute
  - Scale each independently
- Benefits
  - Balanced resources and better performance
  - Separate server admin from cloud infrastructure admin
  - Stronger security isolation



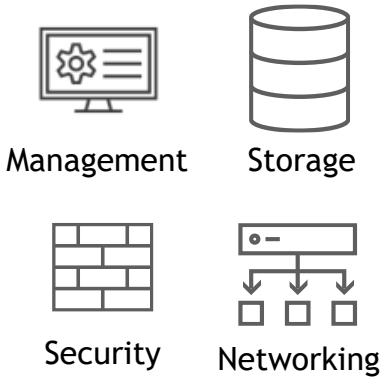
What is a DPU and How Can it Benefit Storage?

- Data Processing Unit
  - SmartNIC + programmable cores
  - Computer in front of the computer
- Offloads infrastructure tasks
  - Networking, security, remote management
  - Frees server CPU to run applications
  - May run storage software on cores
  - Can reduce cost of storage servers
- Additional security isolation
- Example: AWS Nitro

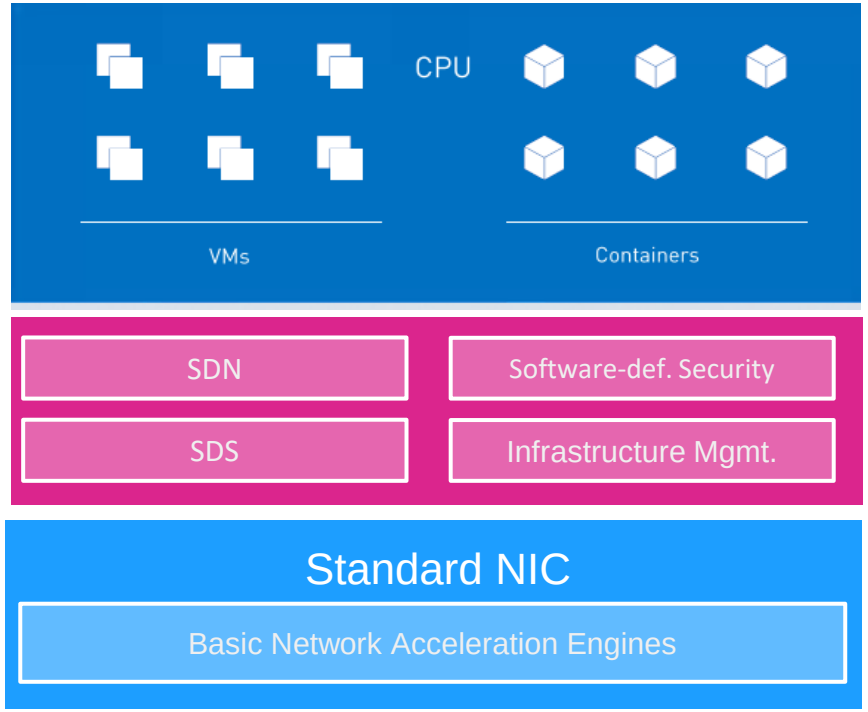


NVIDIA BlueField-2, one example of a DPU

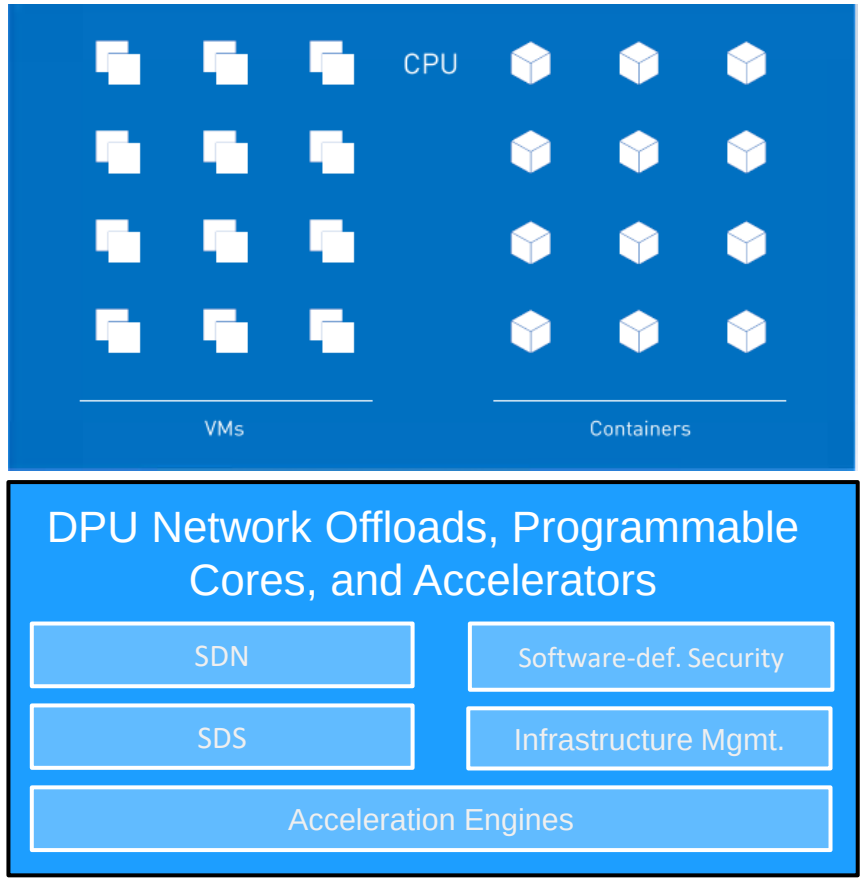
Illustrating DPU Benefits



Hardware Appliances



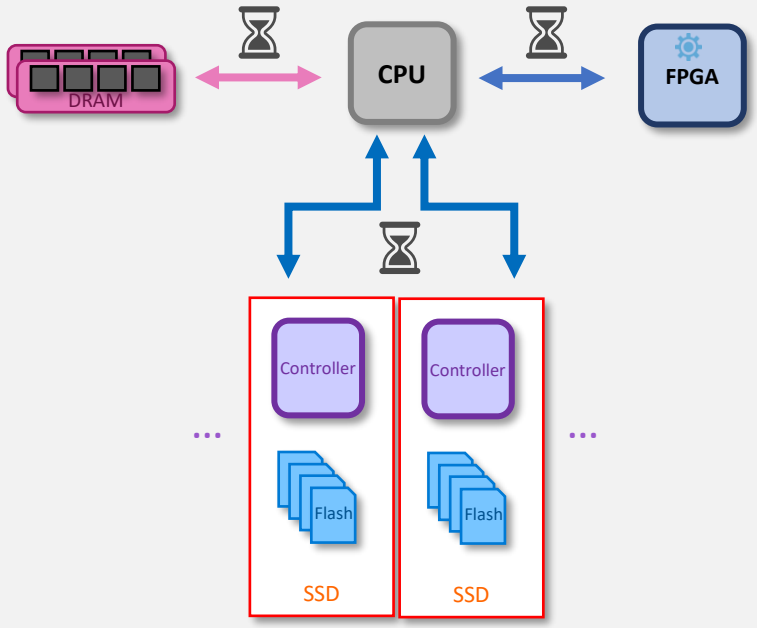
Software Defined Infrastructure on CPU



Software Defined, Hardware-Accelerated Infrastructure on DPU

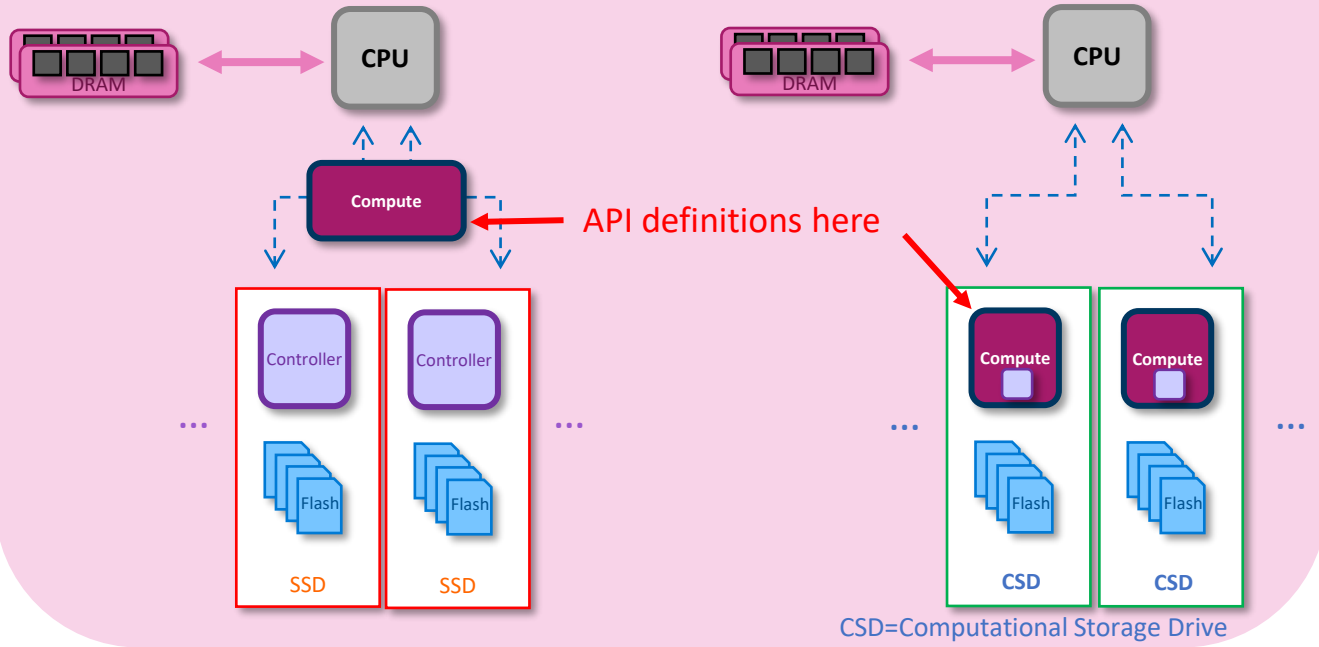
Computational Storage Architecture

Current Compute / Storage Architecture



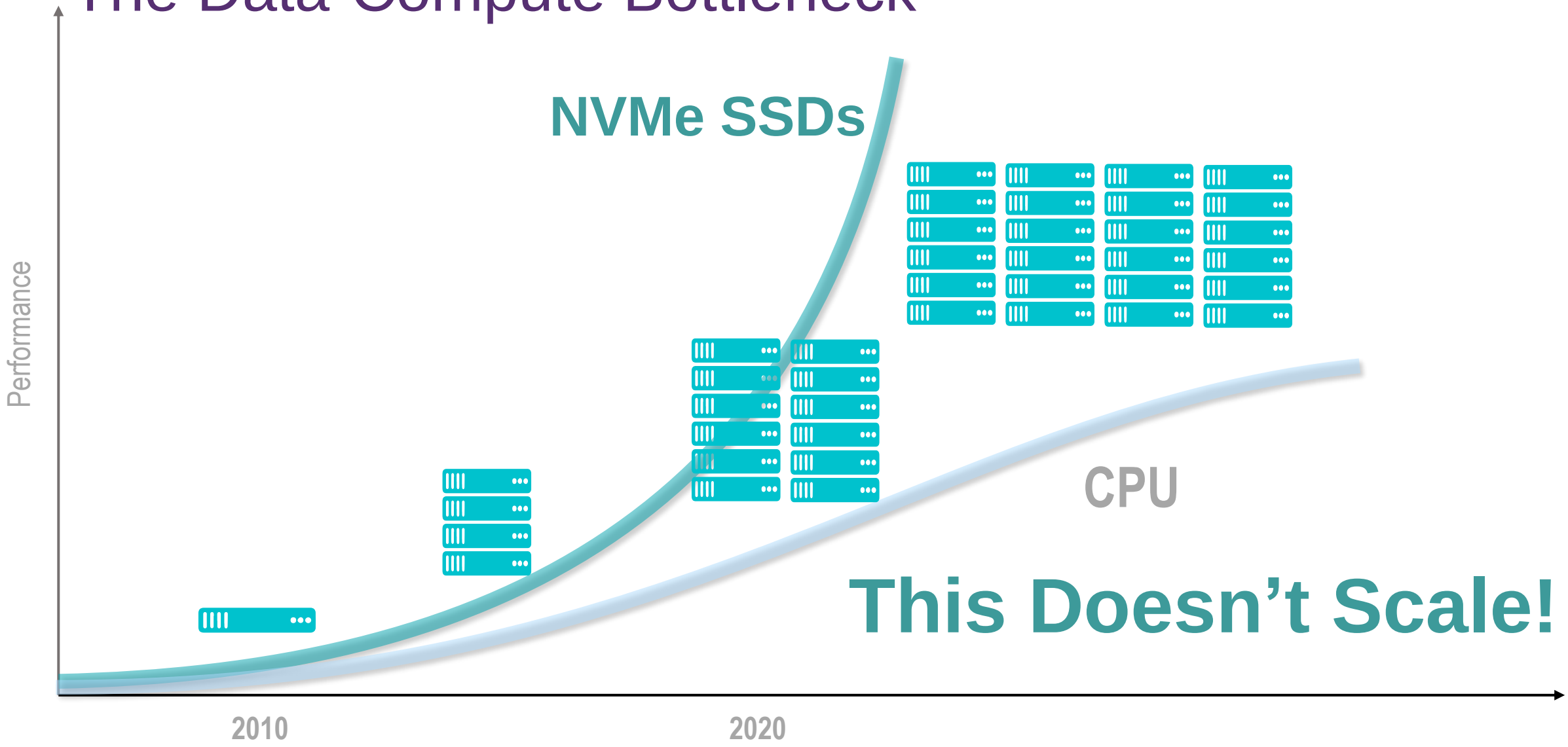
Computational Storage Architecture

Move Compute Closer to Storage

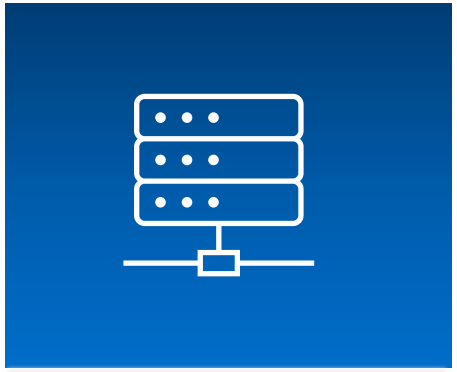


Source: [SNIA Computational Storage Architecture and Programming Model]

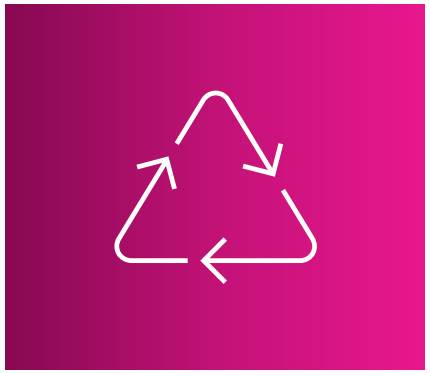
The Data-Compute Bottleneck



Challenges with Broad SSD Adoption

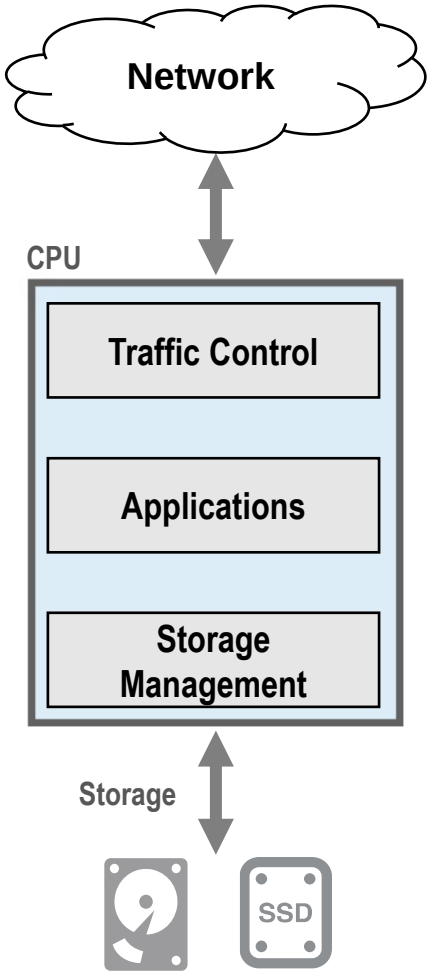


Imbalanced Server Architectures



Amplified Data

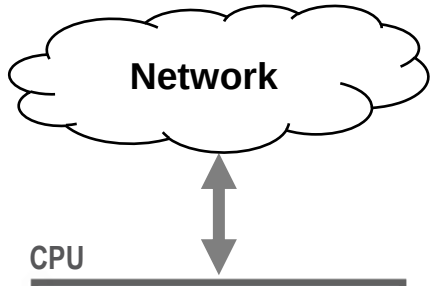
Inefficient System Reliability

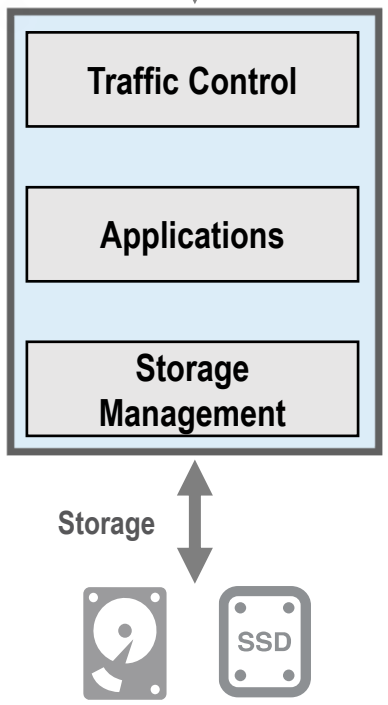


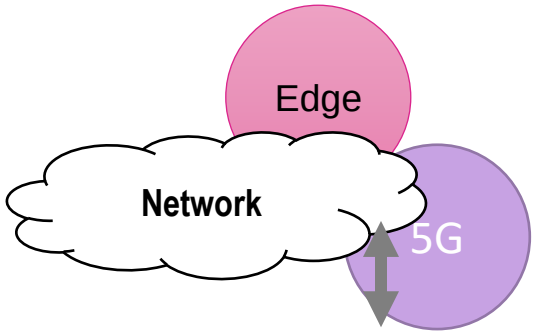
Yesterday's
COMPUTE CENTRIC

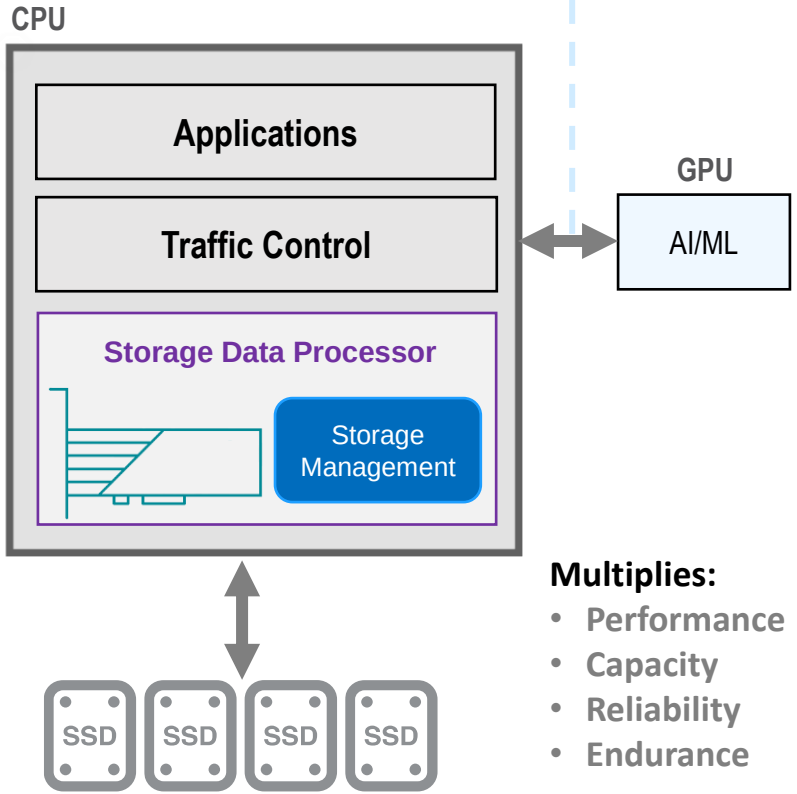
Today's
COMPUTE / DATA HYBRID

Tomorrow's
DATA CENTRIC









Multiplies:

- Performance
- Capacity
- Reliability
- Endurance

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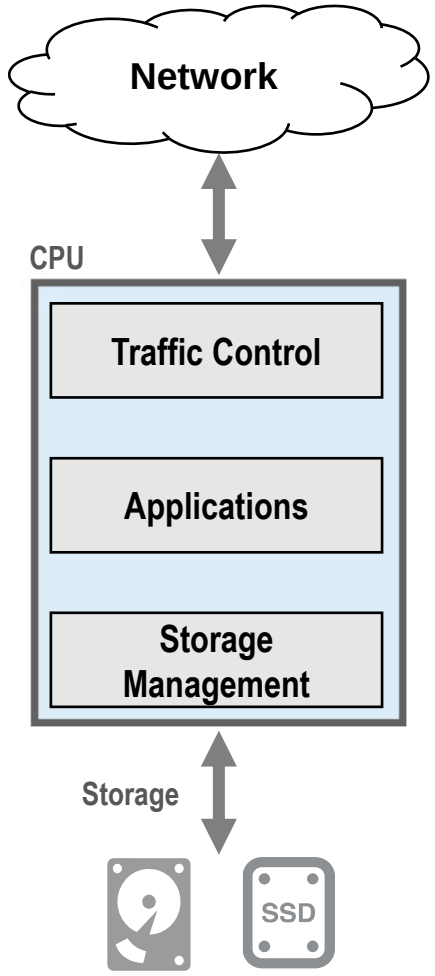

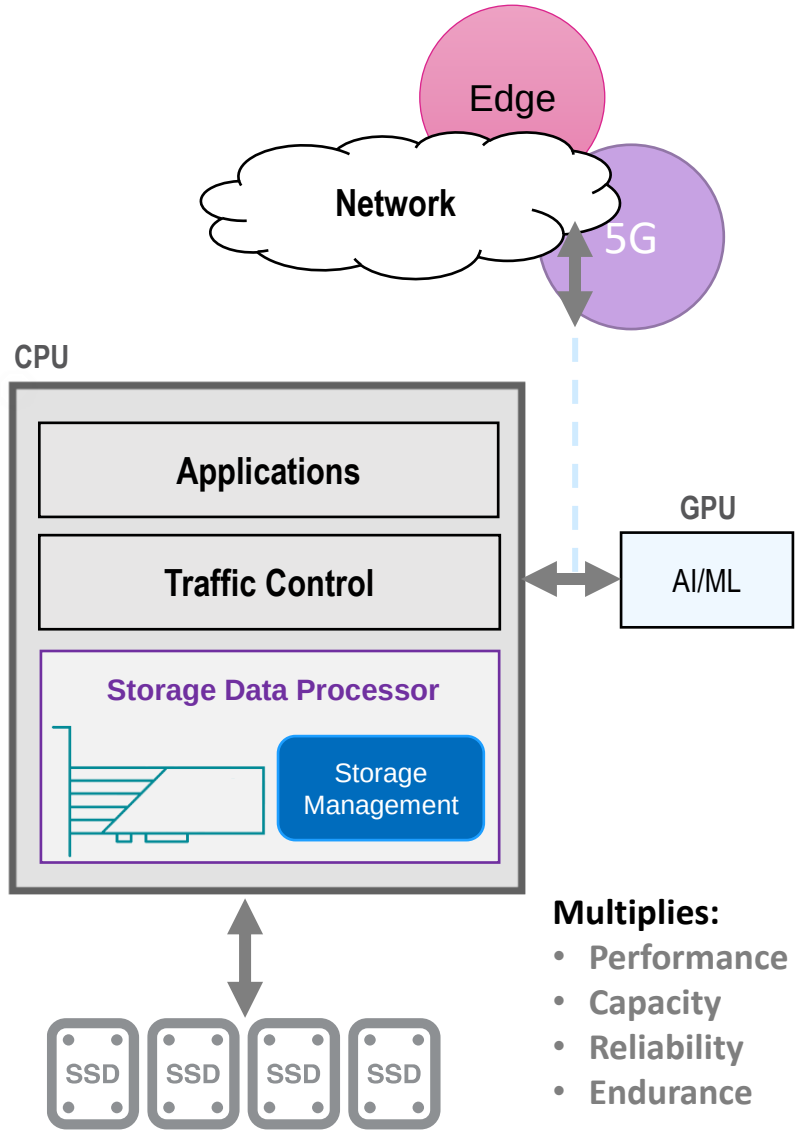

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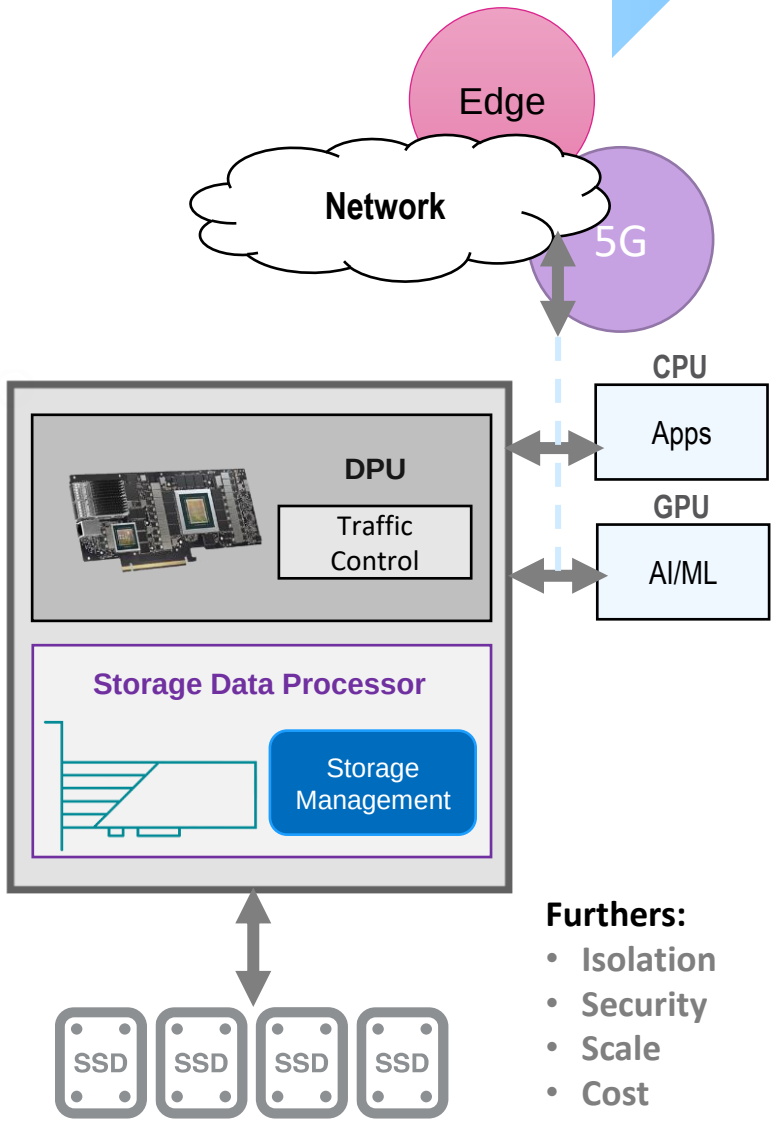
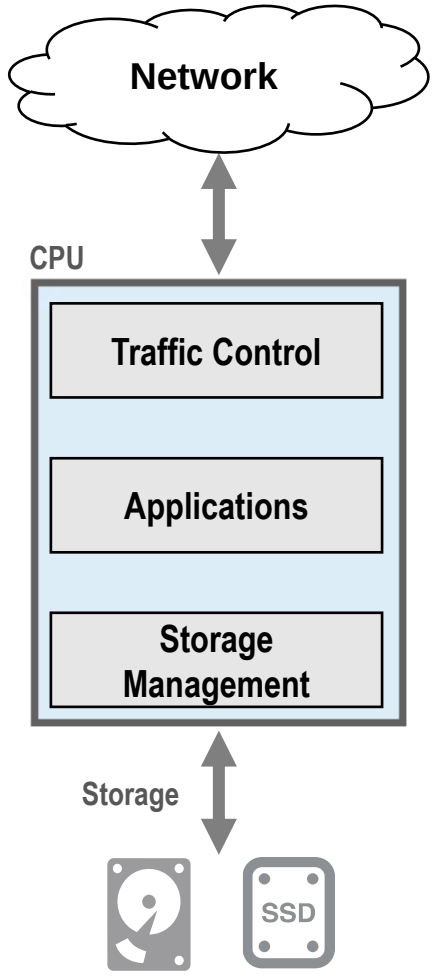


Furthers:
- Isolation
- Security
- Scale
- Cost

Yesterday's
COMPUTE CENTRIC



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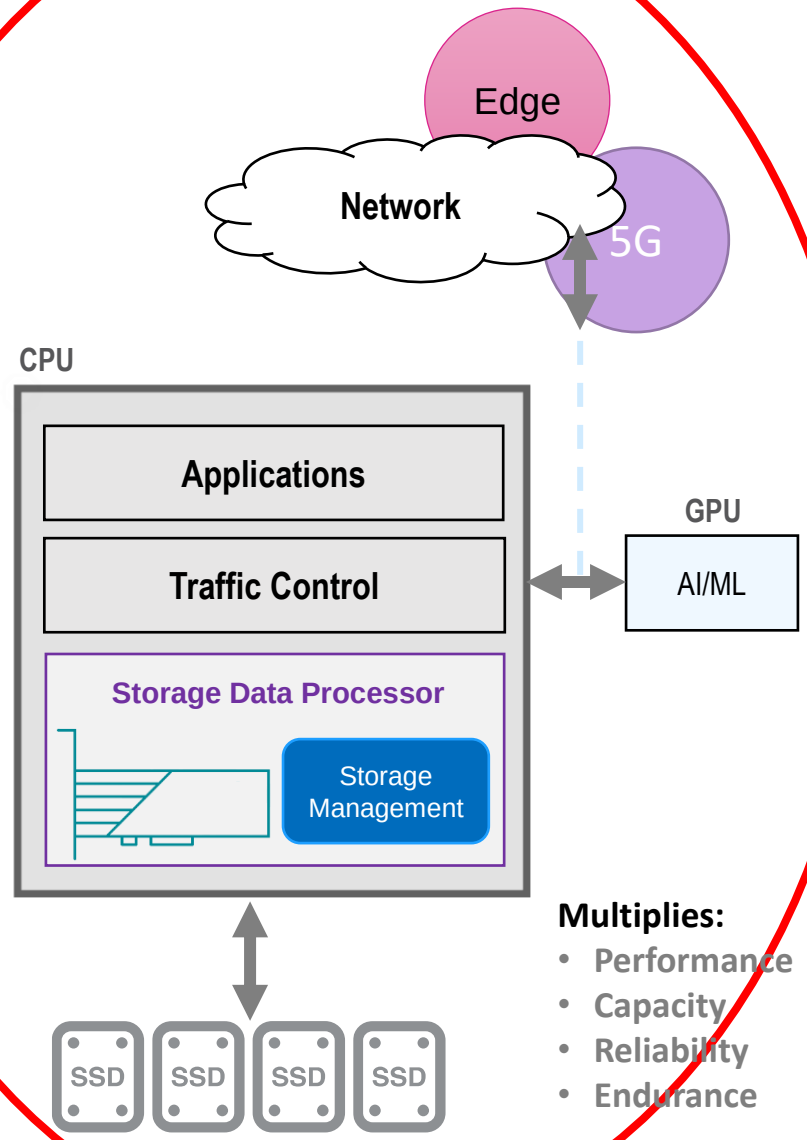
COMPUTE / DATA HYBRID



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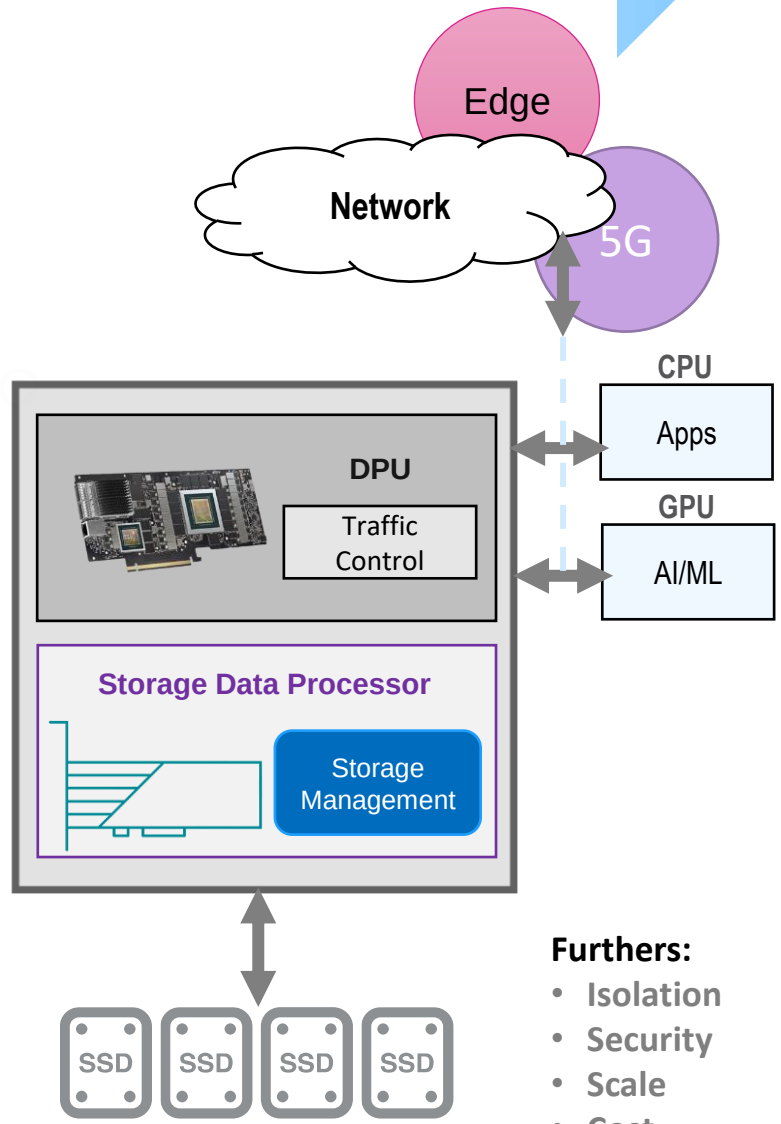
Tomorrow's
DATA CENTRIC



Furthers:
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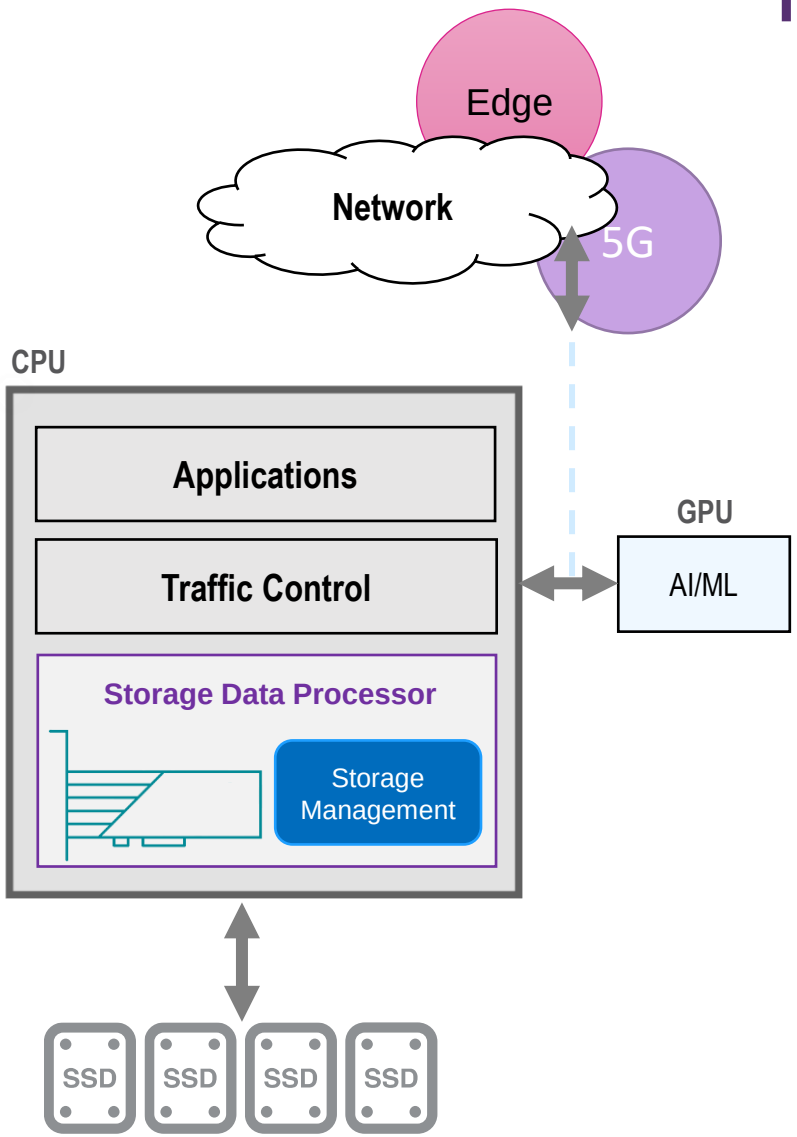
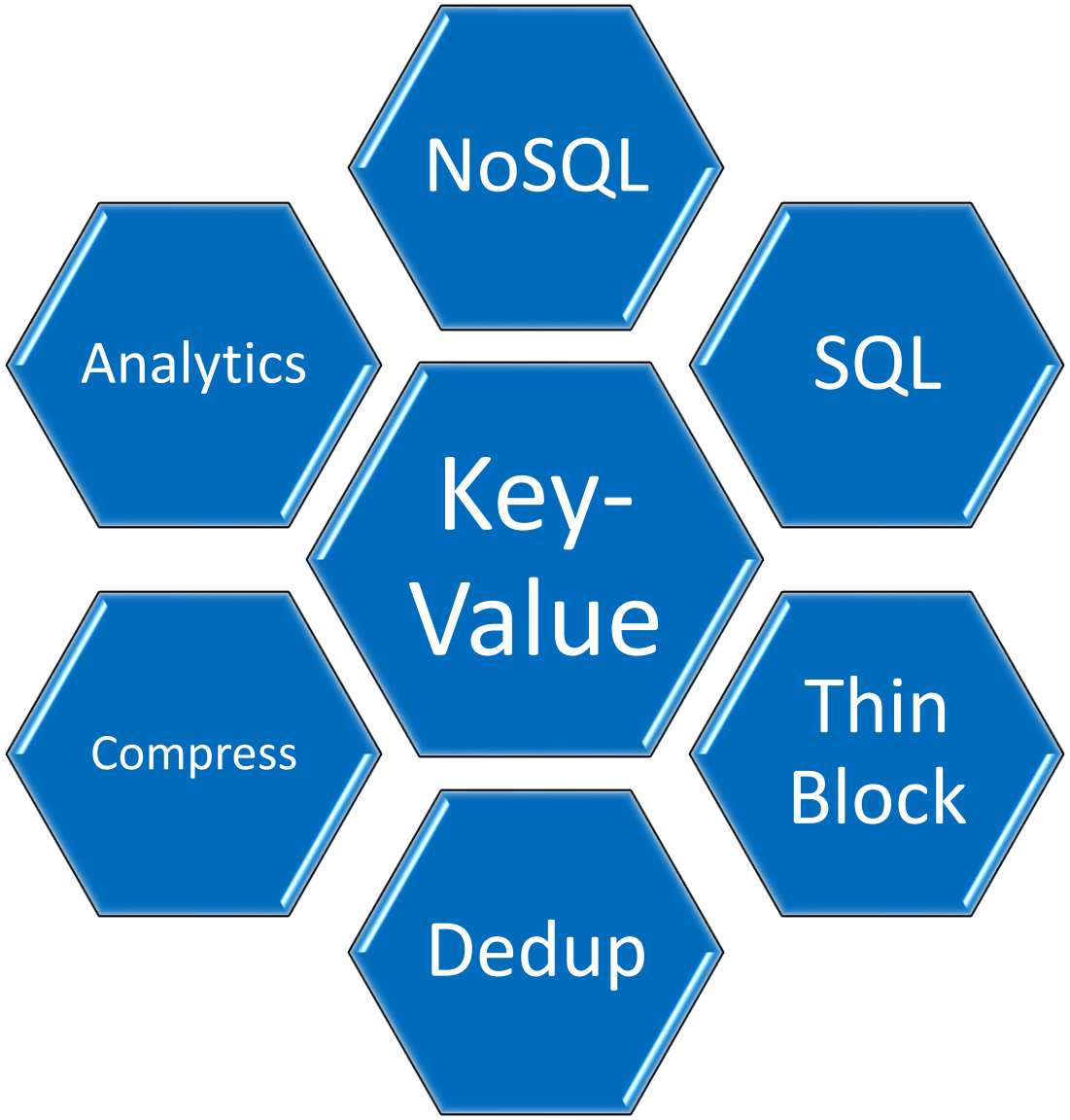
Today's SDP benefits

Today's
COMPUTE / DATA CENTRIC

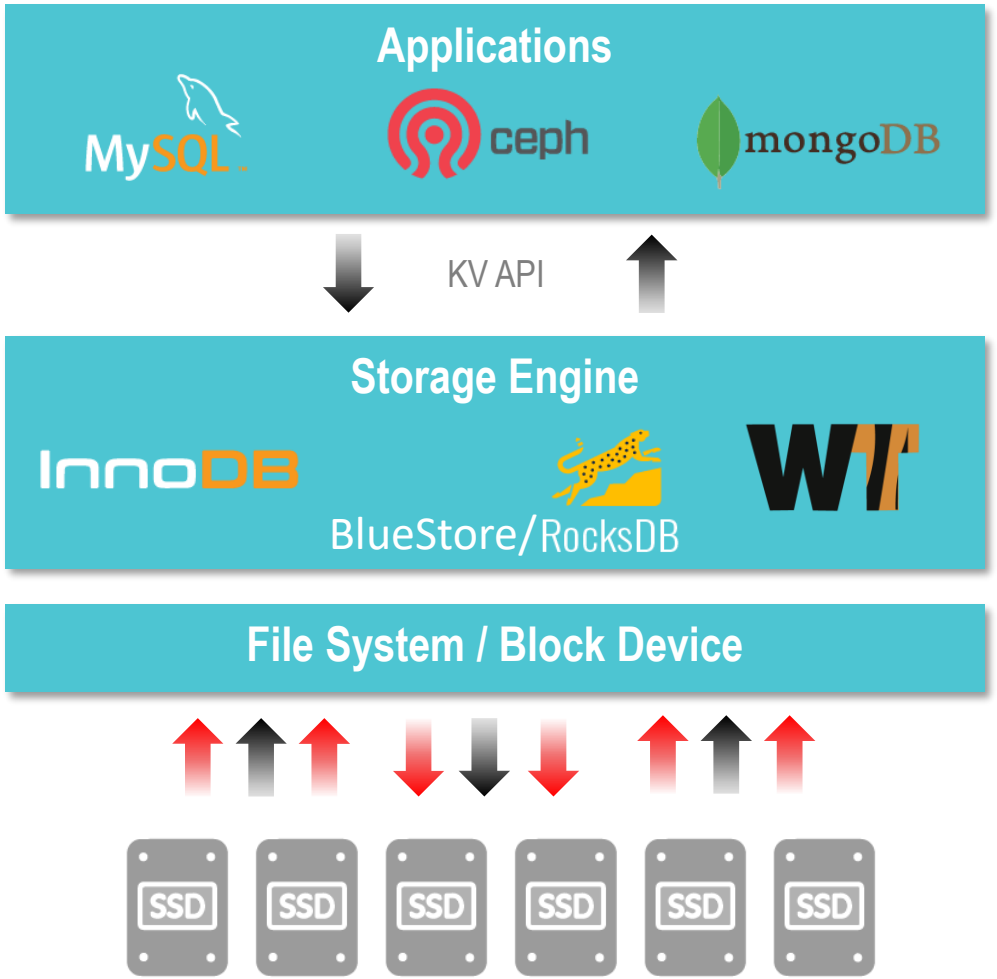


Performance	2x-15x, 40x
Capacity	Up to 6x
Reliability	RAID5 2x > RAID 0
Endurance	TLC, QLC, ZNS

Why KV API?



Storage Stack Inefficiencies



Data Amplification

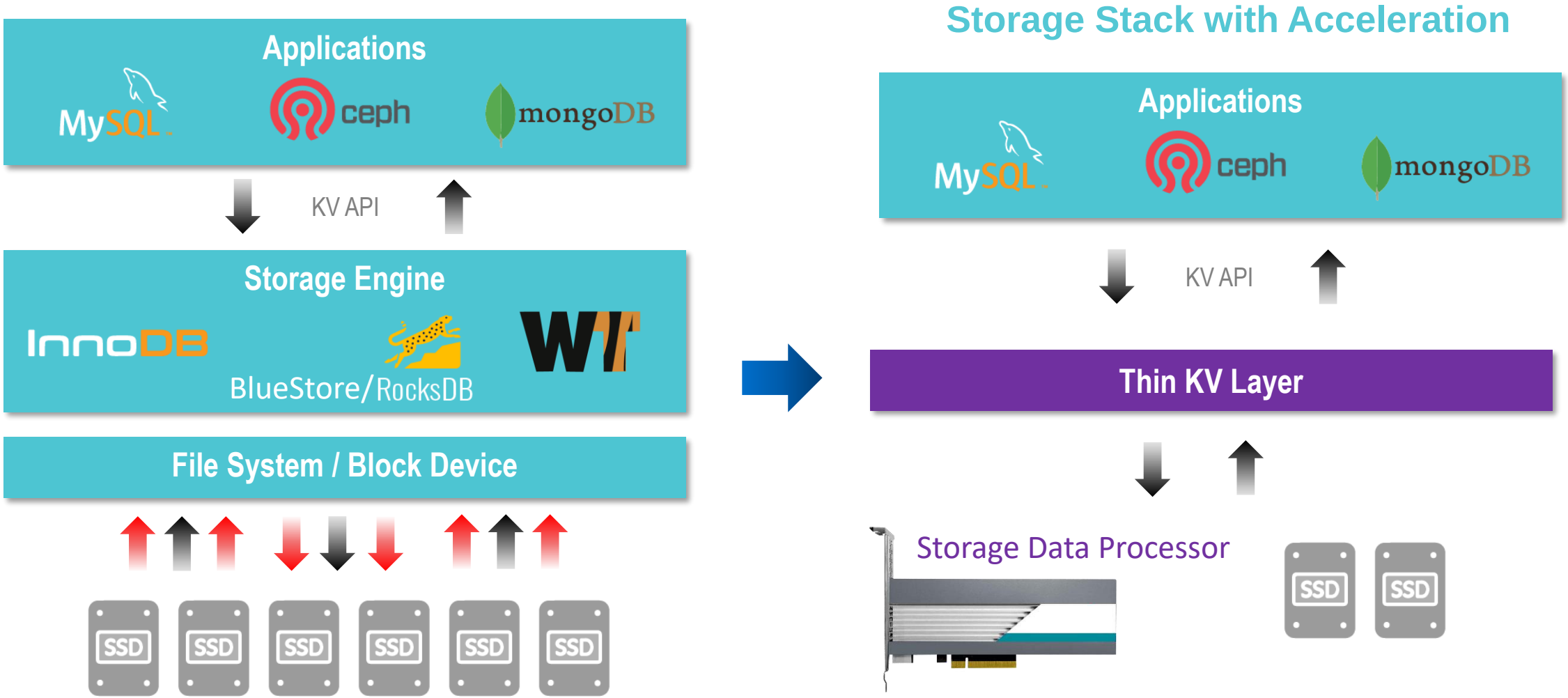
- Write – up to 40x
- Read – up to 100x
- Space – 2x-6x

High CPU Consumption

- 30% - 80%

Unstable Performance

Storage Data Processor Architecture



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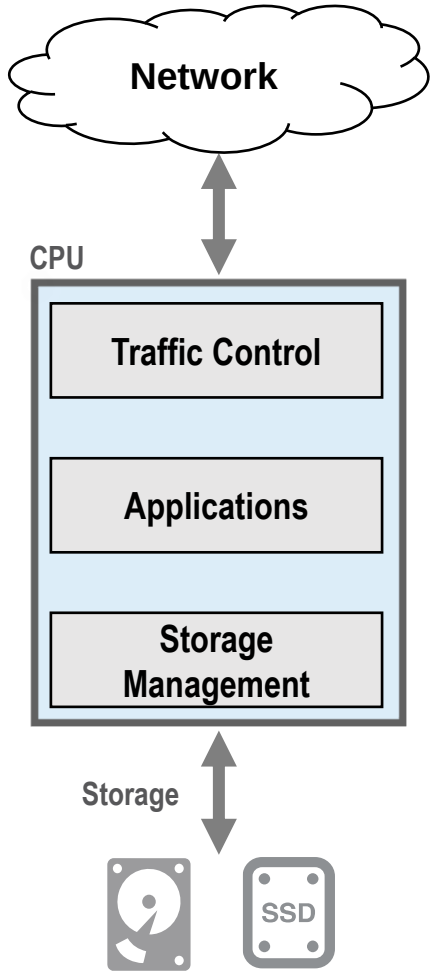

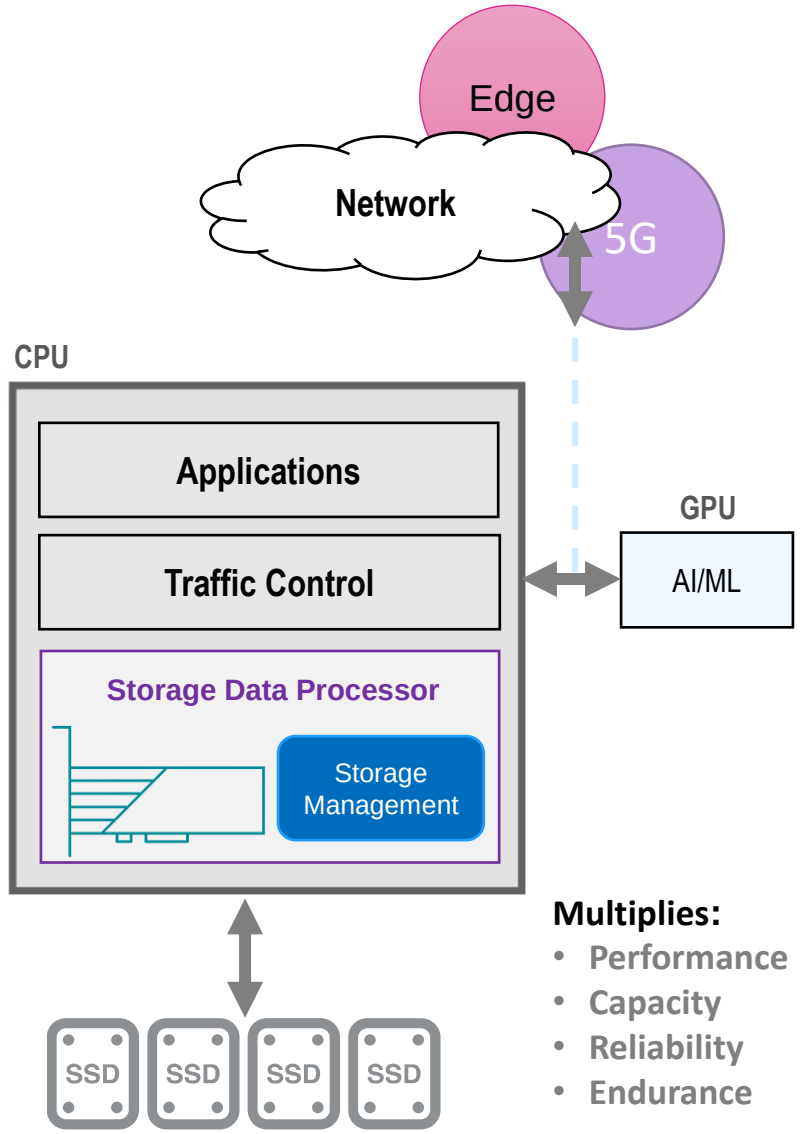

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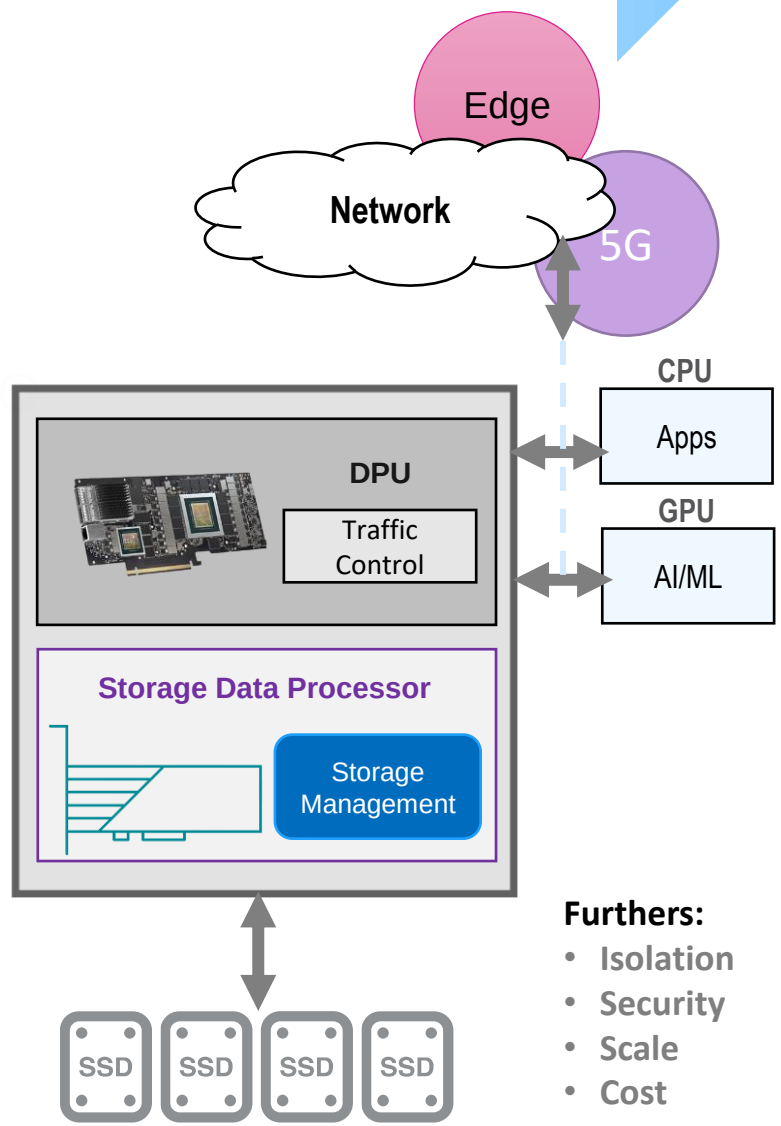

Furthers:
- Isolation
- Security
- Scale
- Cost

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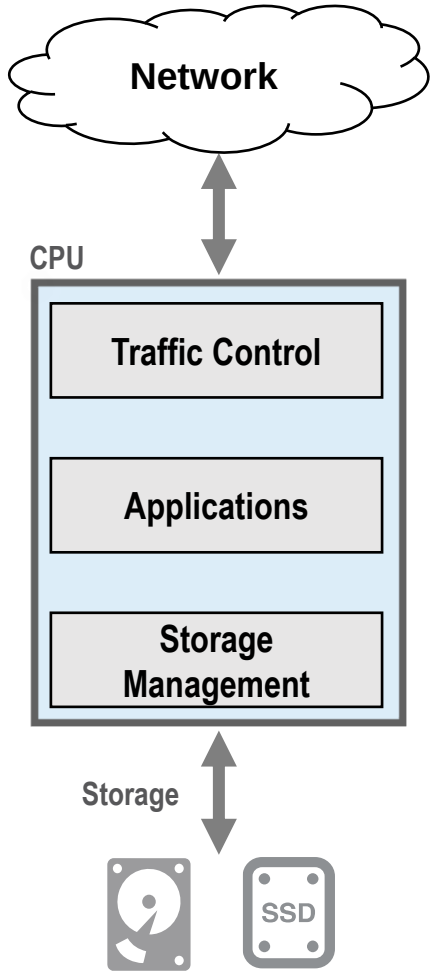

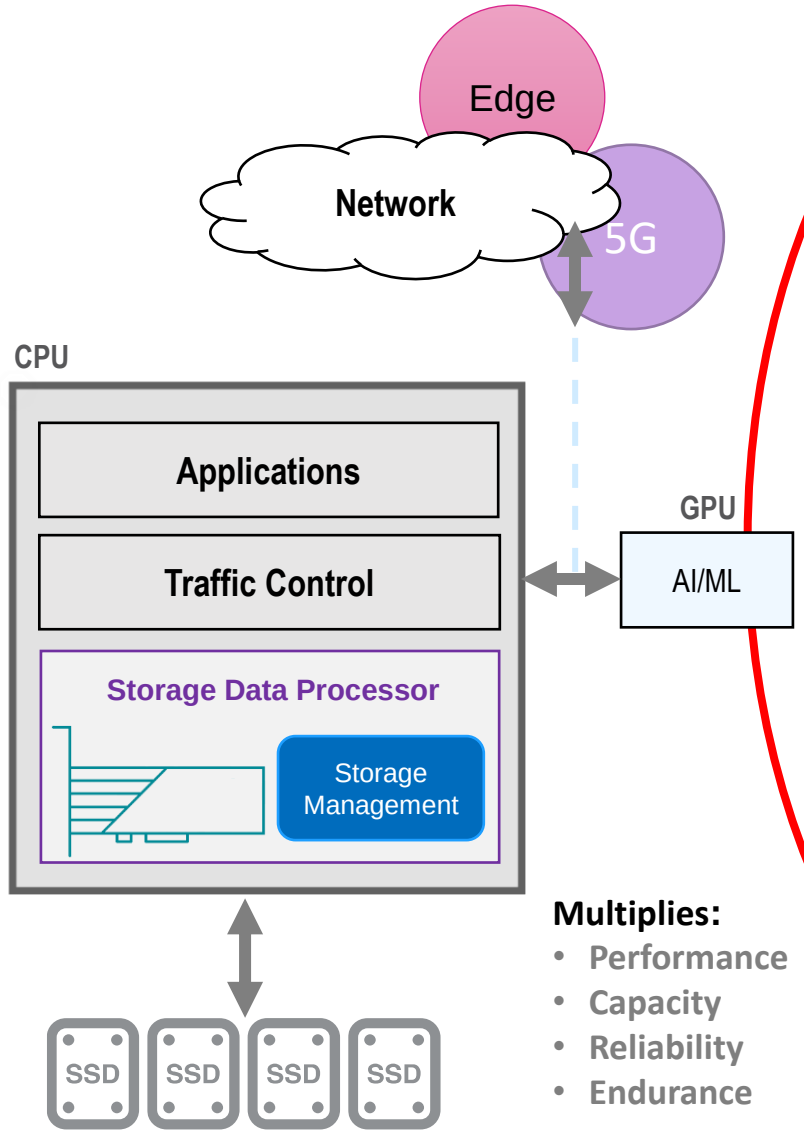

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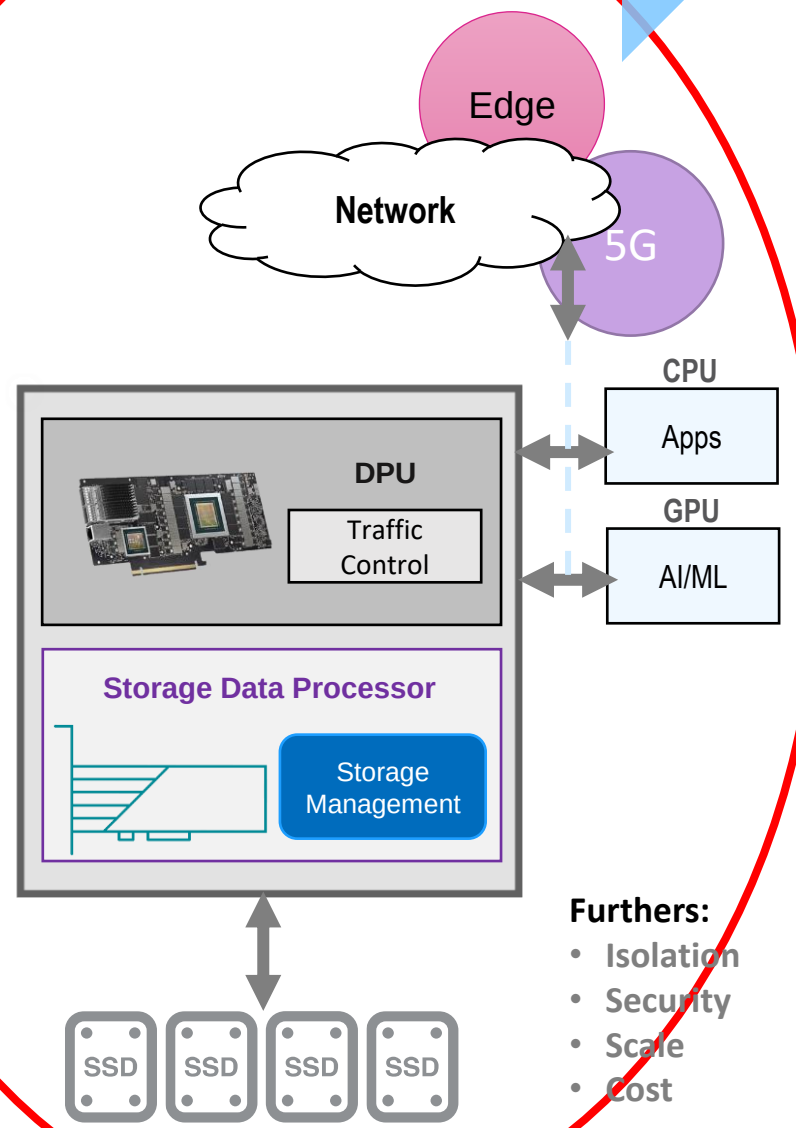
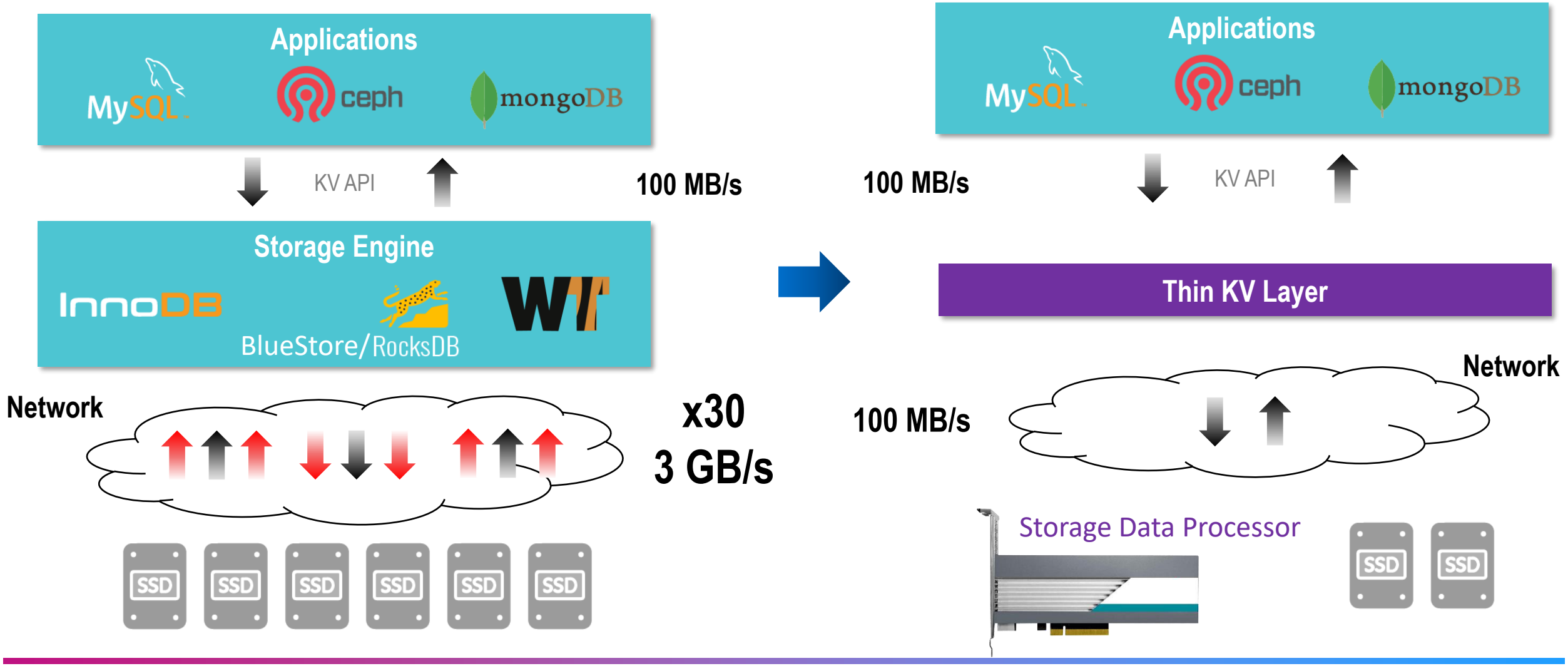


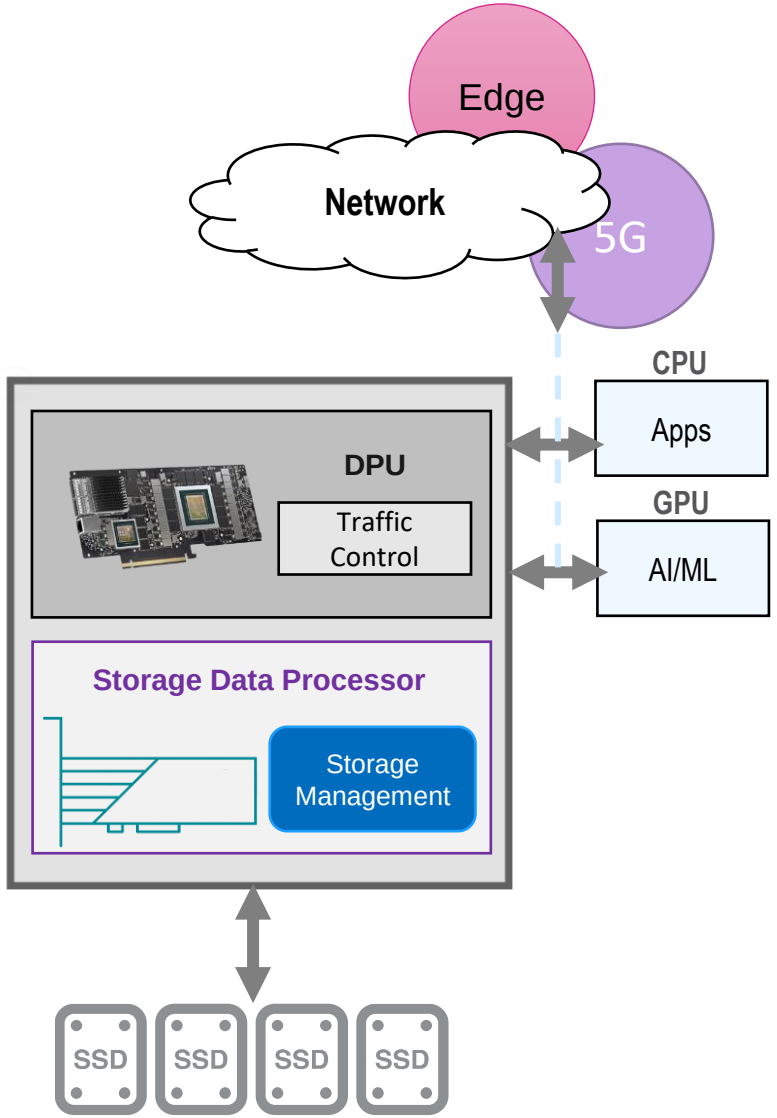
Furthers:
- Isolation
- Security
- Scale
- Cost

High Performance Disaggregation with KV



Tomorrow's
DATA CENTRIC

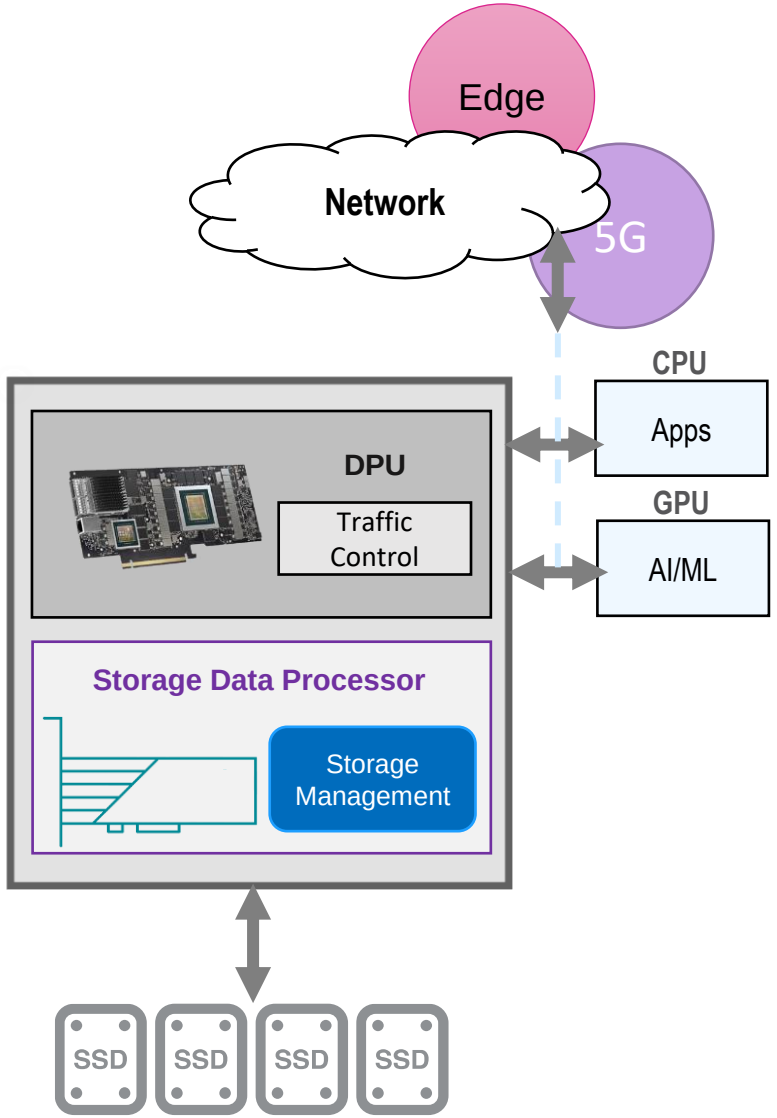
Tomorrow's disaggregated benefits



- **Isolation**
- **Security**
- **Scale**
- **Cost**

Tomorrow's
DATA CENTRIC

Tomorrow's disaggregated benefits



- Isolation
- Performance
- Security
- Capacity
- Scale
- Reliability
- Cost
- Endurance

Use Cases for SDP + DPU

Distributed SDS

- i.e. Ceph or shared filesystem
- Replace BlueStore engine
- Efficiency, scale, security

Used in cloud, HPC

Databases

- i.e. MongoDB, MySQL, MariaDB
- Replace RocksDB/InnoDB
- Speed, endurance, cost

Used in cloud, web, analytics

Use Cases for SDP + DPU, continued…

Data Analysis

- Large volumes of data
- Distributed queries
  - Efficiency, endurance
  - Improve isolation, security

Future

- CS does queries
- Fast object storage on flash

Key Takeaways

- CPU Power has not kept up with storage performance/capacity
  - Traditional storage architecture hits limits
  - Need to disaggregate tasks
- New solutions: Storage Data Processor and Data Processing Unit
  - Offload storage processing to dedicated hardware—SDP
  - Offload networking, security and telemetry to dedicated hardware—DPU
- Improves efficiency, scale, isolation, cost
  - In future can increase capacity, endurance, performance
- Recommendation: Evaluate SDP and DPU for storage disaggregation

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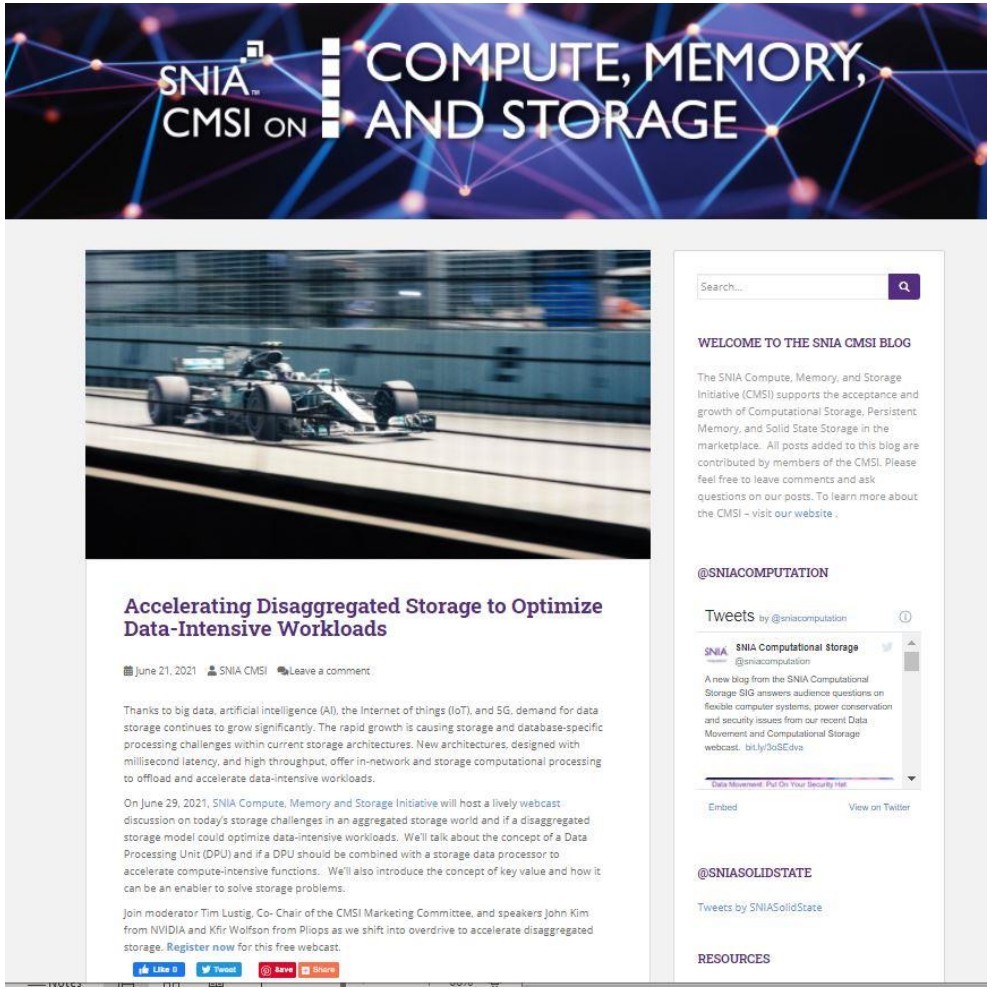
- A Q&A from this webcast will be posted to the SNIA Compute, Memory, and Storage Blog



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- Joining SNIA and the Compute, Memory, and Storage Initiative
  - https://www.snia.org/member_com/join-SNIA

Questions & Answers

