



STORAGE INDUSTRY

The Changing Paradigm Leading to Computational Storage

SDC²⁰

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RECAP:

The Storage Evolution



Storage & Its Objectives

Manageability

Ability to configure and re-configure space, backups, memory, and other parameters, as per demands of the data

Scalability

Increasing the capacity to store and process data as per need

Performance

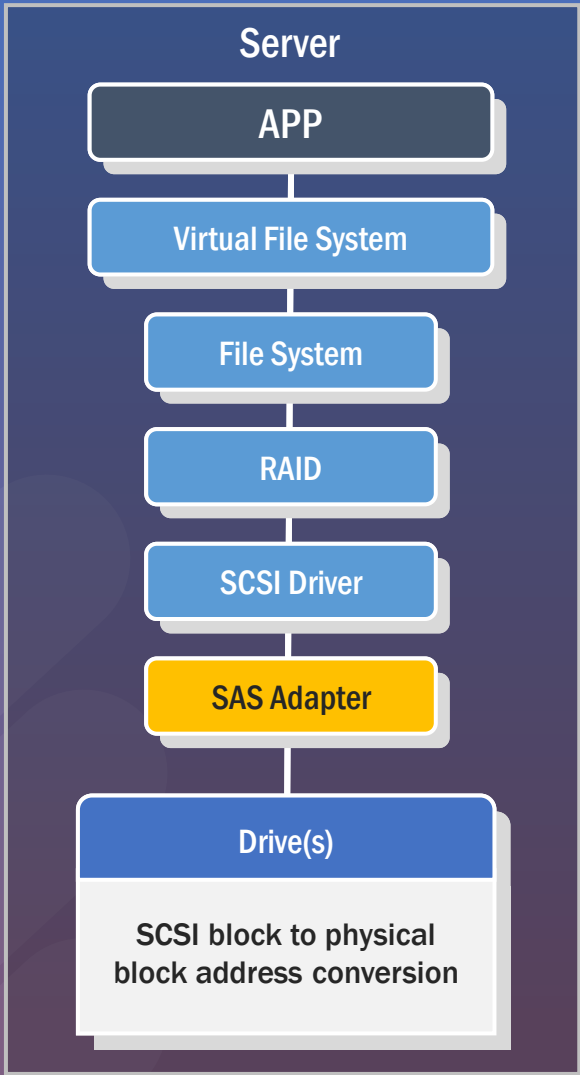
Improving application performance and reducing latency

Availability

Ensuring that business-critical data is always accessible by end users, apps & IT systems even when disruption occurs

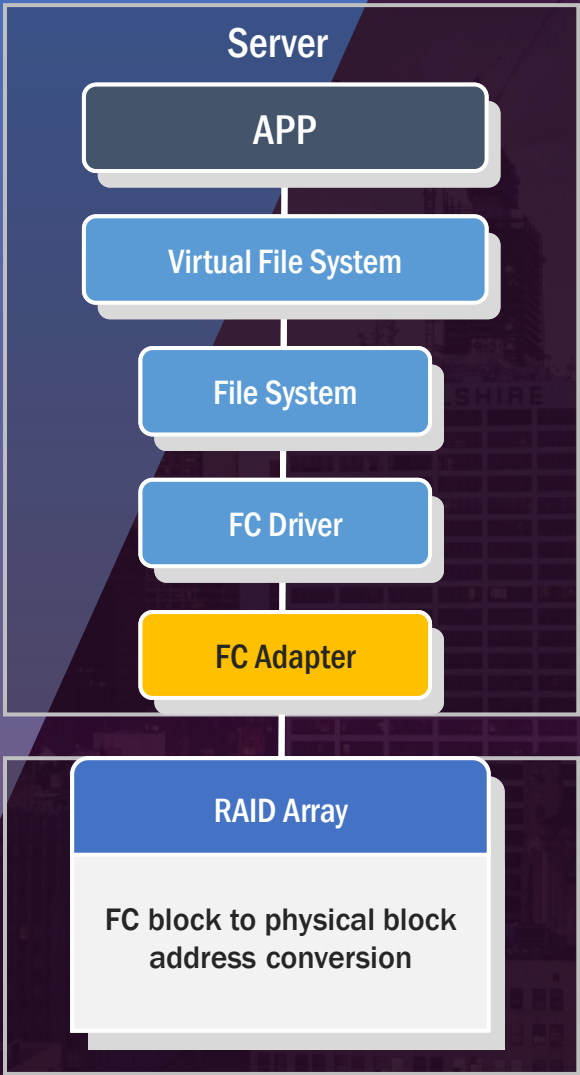
Mitigating the risk of data loss or data theft

Storage Timeline – From DAS to NAS



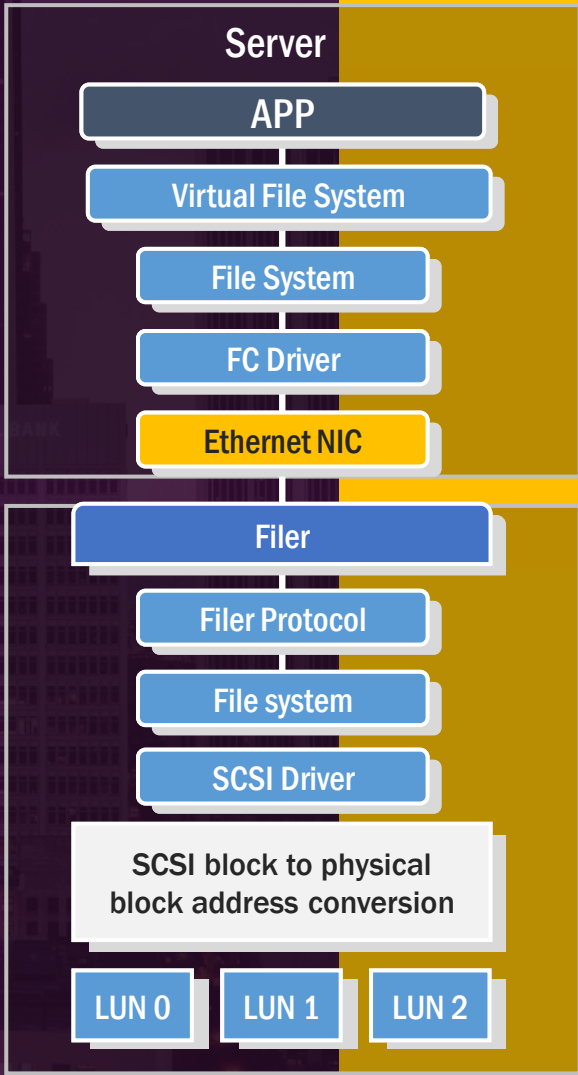
DAS

Does not address any of the objectives



SAN

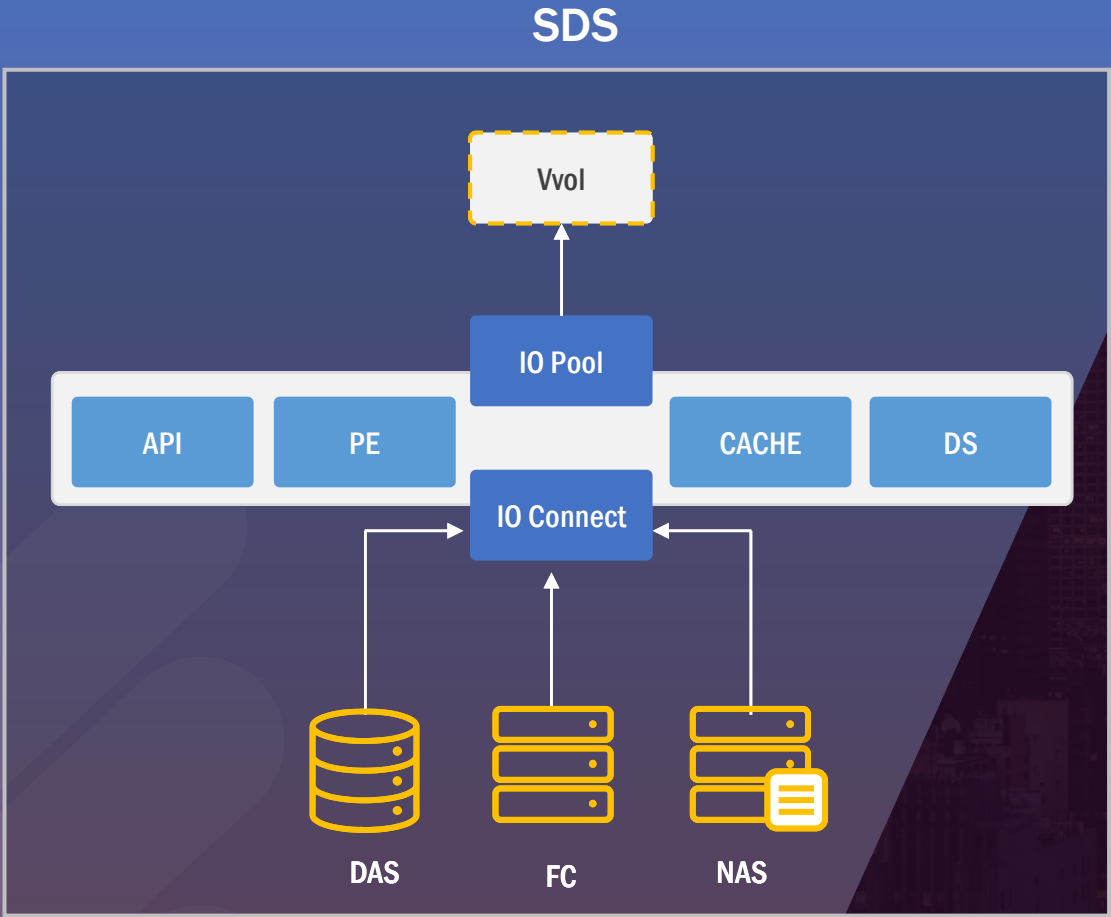
It addresses all 5 aspects, but incurs high costs



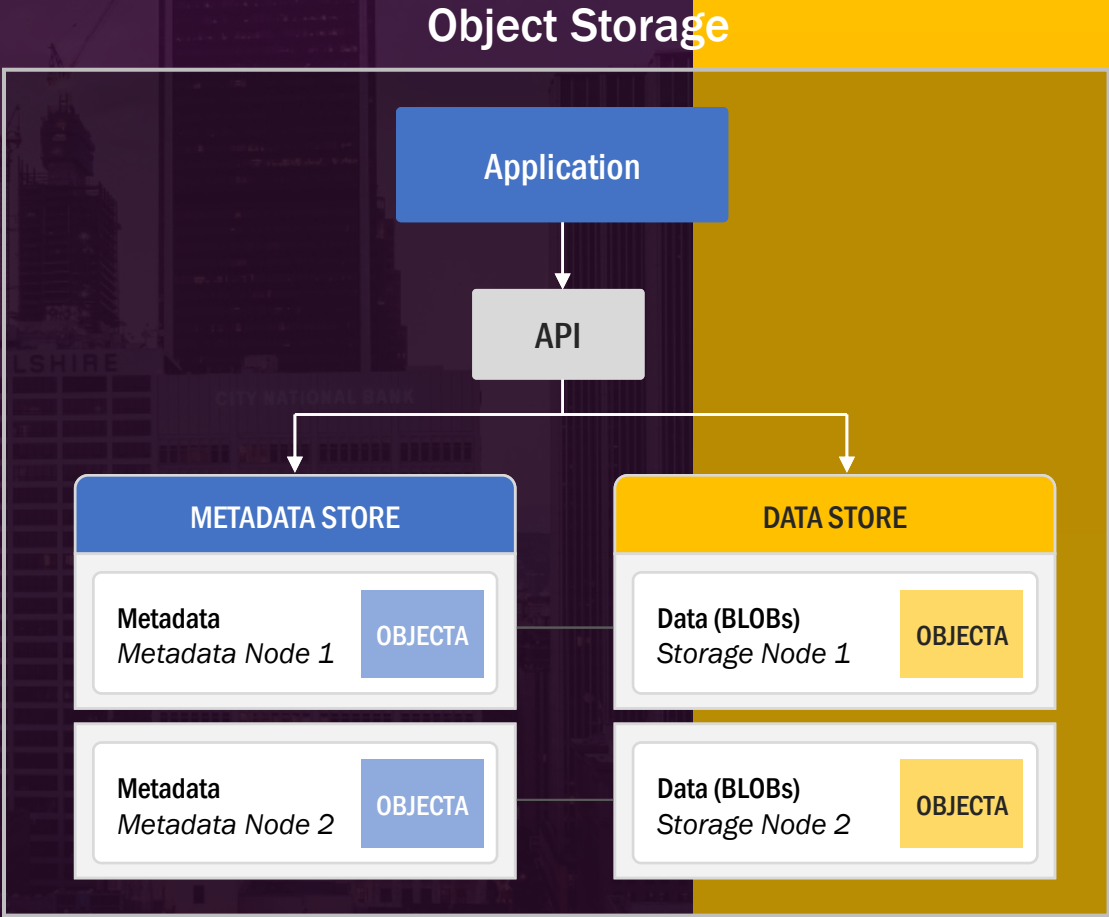
NAS

It addresses all aspects, except performance. Provides cost benefit

Charting the Storage Evolution



Abstract storage resources from the underlying hardware platform for greater flexibility, **efficiency**, and faster scalability

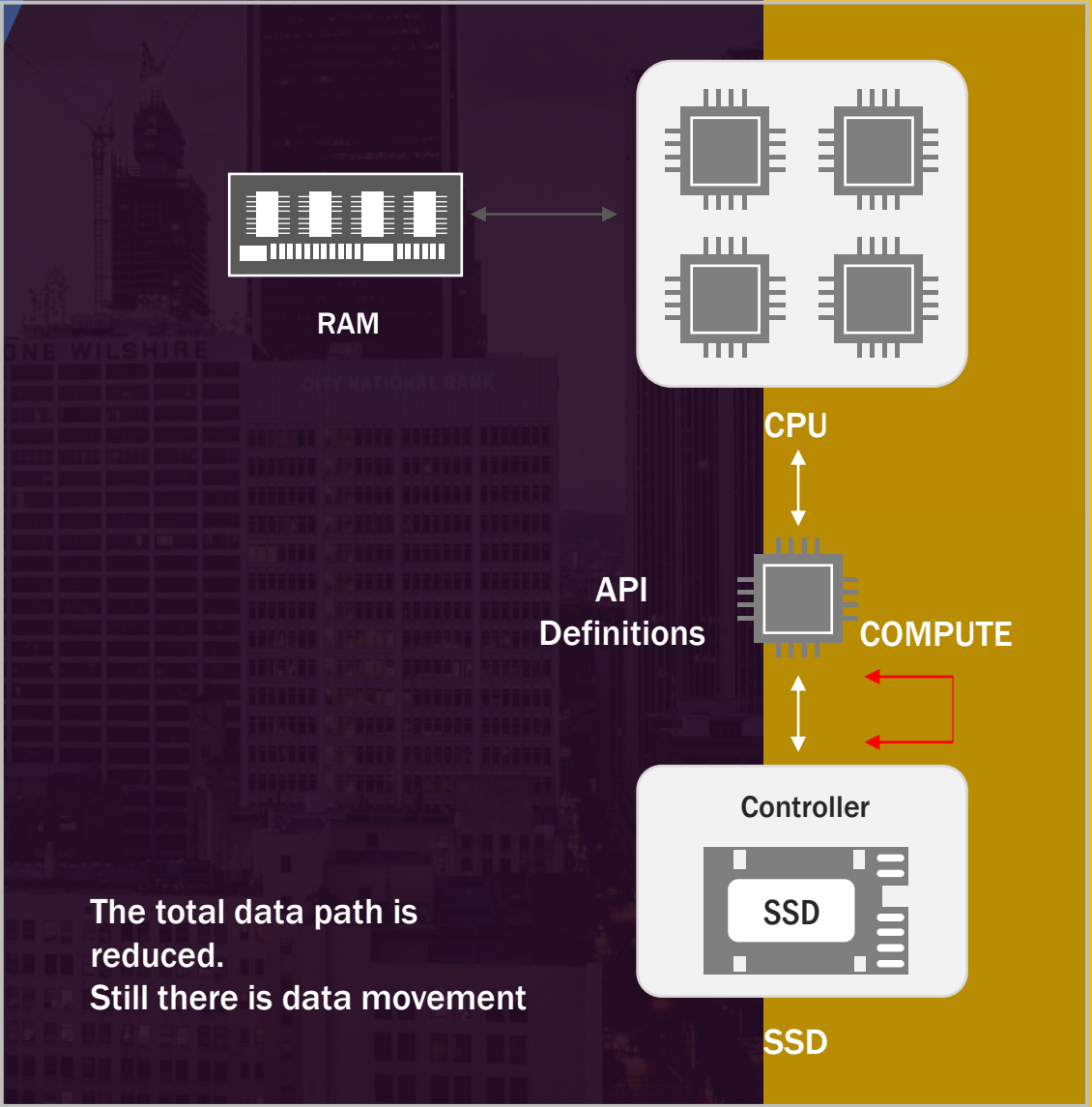
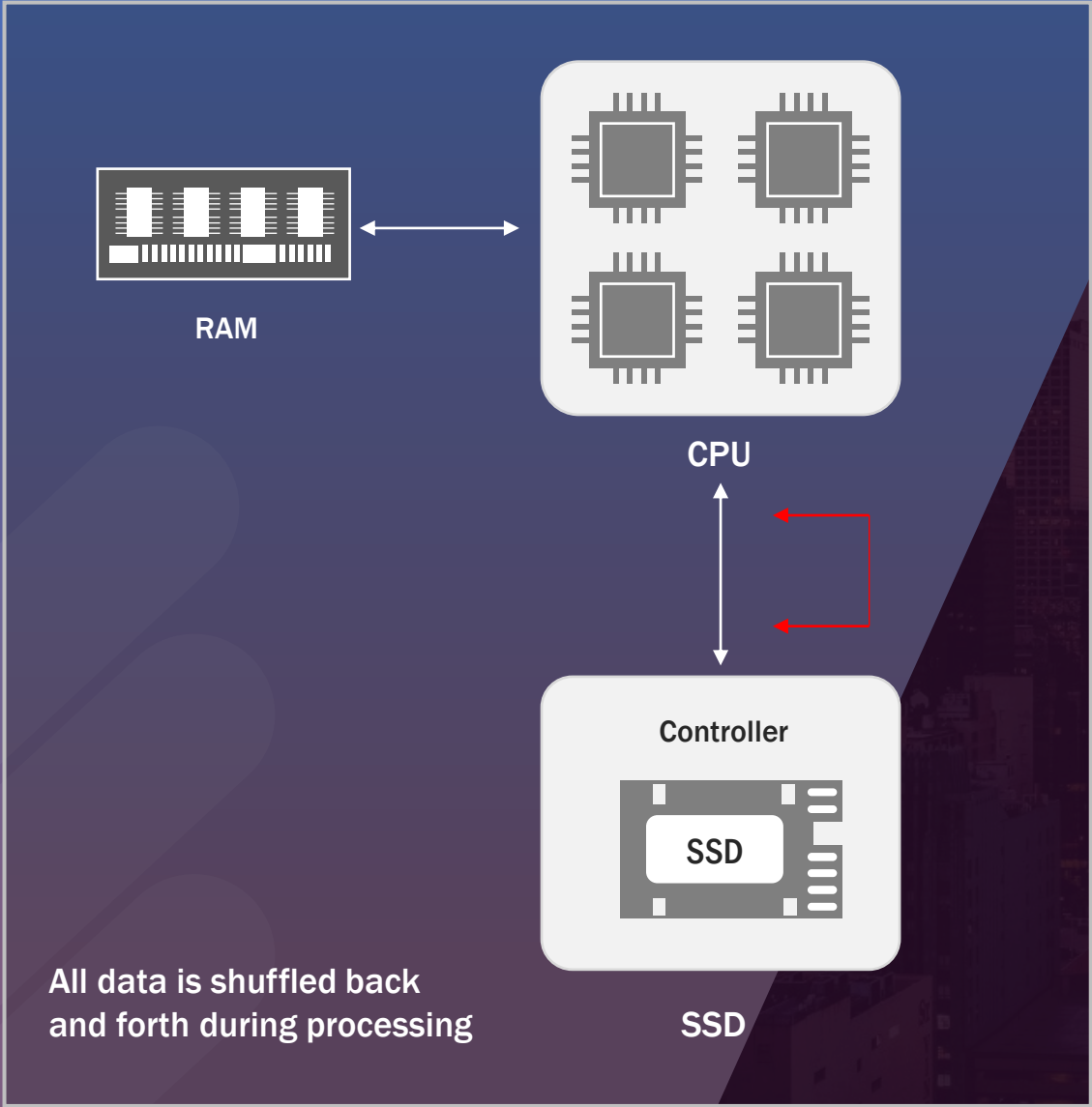


Infinite scalability, faster retrieval, and lower cost

02

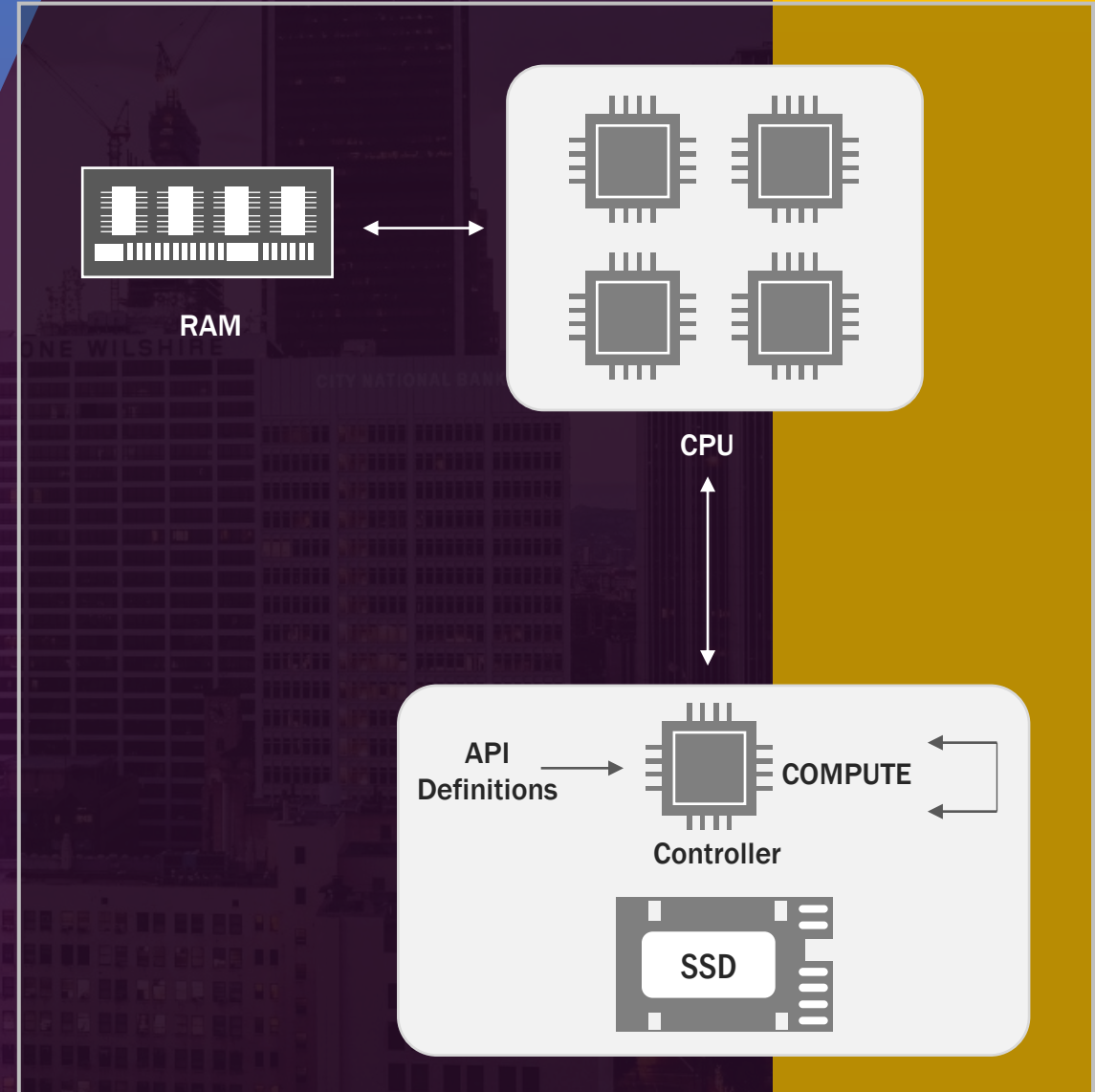
Tracing the Journey of
Computational Storage

Evolution of Computational Storage

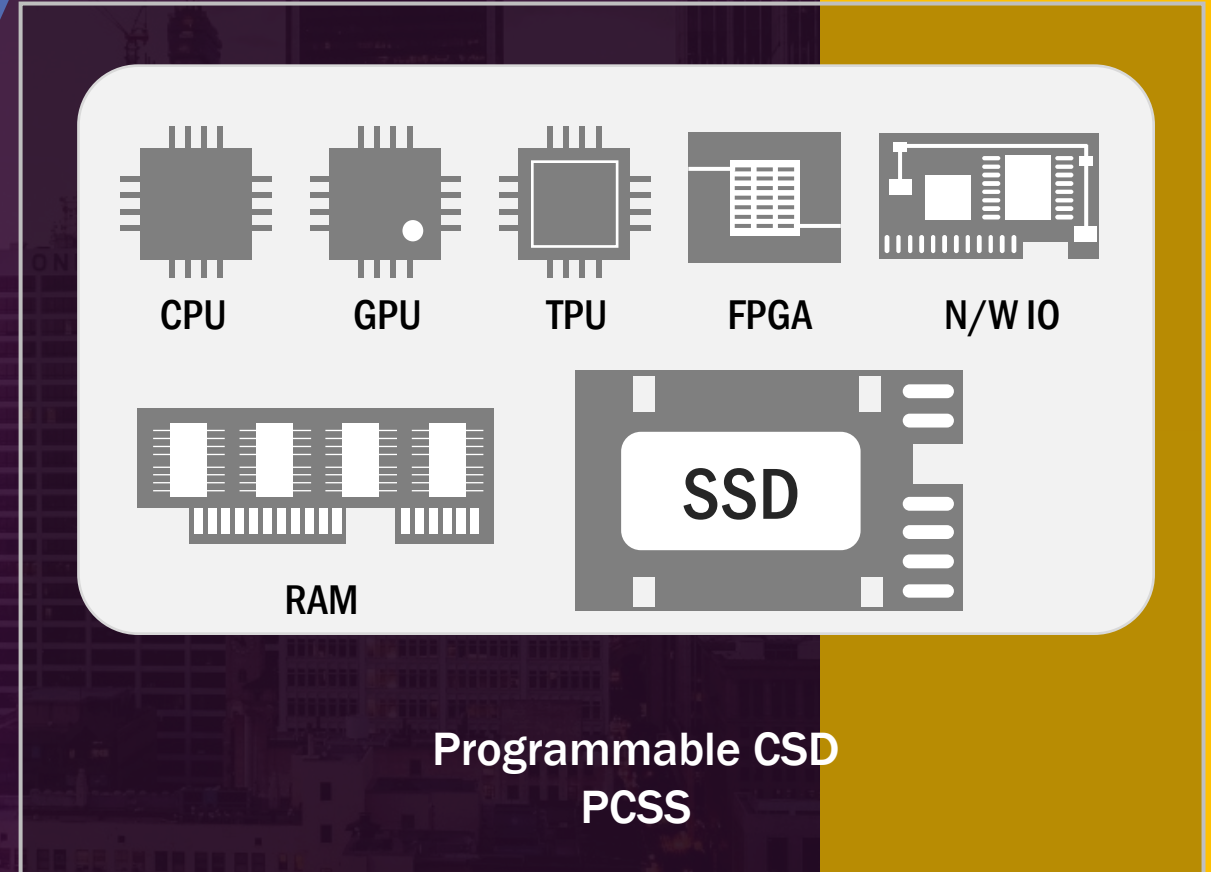
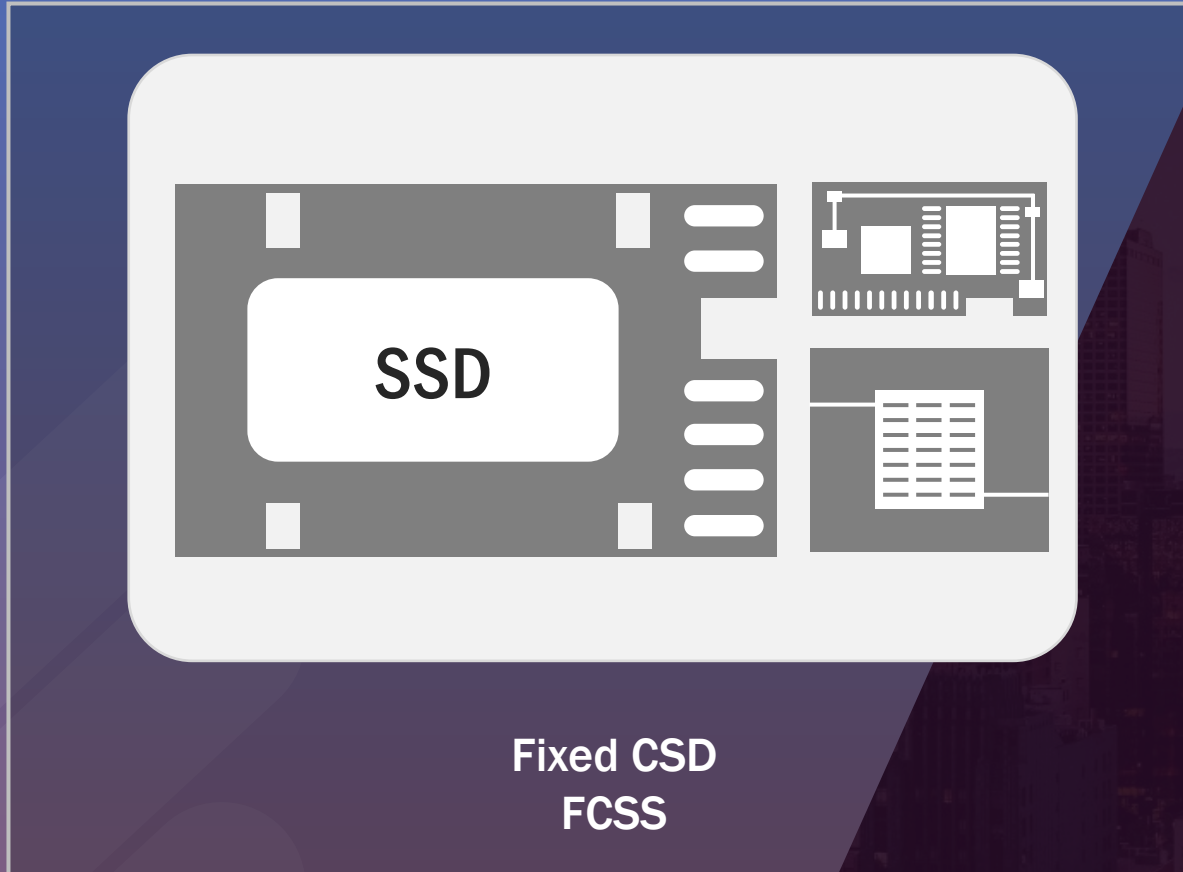


An Architecture providing Computational Storage Services, when coupled with storage, provides these benefits:

- Improves application/infrastructure efficiency by coupling compute resources directly with storage
- Enables parallel computation
- Reduces I/O traffic
- Alleviates other constraints on existing compute, memory, storage, and I/O
- Small power footprint: typically ~ 20 Watts



Types of Computational Storage





03

The
Business Angle

What's in it for the Developers & Engineers?

Data is the new oil; moving it to where it's needed is the main hurdle!

Movement of data from SSDs to a server or a processor for insights leads to challenges like:

- Latency
- Heavy consumption of bandwidth and power
- Increased security and privacy concerns

How does Computational Storage fit in here?

Computational storage takes processing to where data is stored, resulting in:

- Faster responses & reduced latency
- Data-centric processing
- Improved security and privacy
- Optimized power and bandwidth consumptions

What's in it for Organizations and Businesses?

- IDC points out that nearly 30% of the world's data will need real-time processing by 2025.
- This means: Enterprises need to have infrastructure that supports near-instant data processing, which will enable them to offer superior customer experience & grow.

How does Computational Storage fit in here?

Here are the business benefits:

- **Reduced physical footprint**
 - Increased deployment density
 - Not restrictive to datacenter-only deployments
- **Lower cost and increased efficiency**
 - Reduced energy footprint
- **Greater flexibility for application development & deployment**
 - Cloud-based, Edge nodes, IoT
- **Improved data posture**
 - Security
 - De-duplication & compression

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Use Cases

Why Is Computational Storage So Hot?

PULL FACTORS

Computational storage brings processing closer to the data. This helps many ML or analytics applications, with huge potential for IoT, ML & Edge computing

Running applications inside storage devices improves performance while decreasing energy consumption

Keeps data pipes unclogged by allowing ingestion of all generated data and processing of only what is truly necessary

Use Case #1 - CEPH



PCSS Application

- OSDs are replaced by CSDs
- Ceph Object Storage Daemons are now running in CSDs



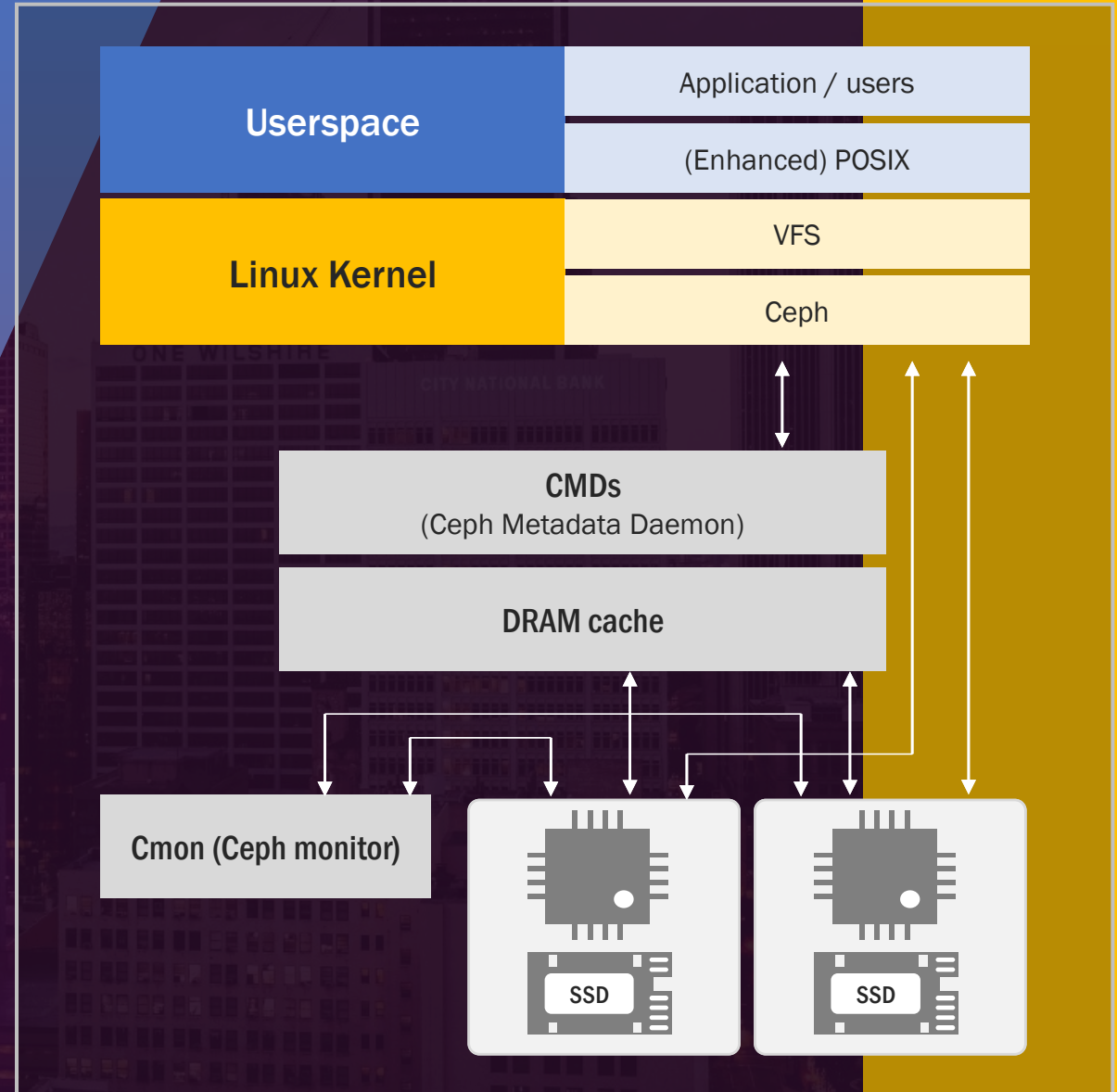
Advantages

- Better isolation
- Faster access to applications
- Better control over resource utilization



Industry Adoption

- Telecommunication
- Storage



Use Case #2 - Real-time Image Processing



Advantages

- Increased accuracy
- Greater speed
- Advanced color shade processing technology



Industry Adoption

- Healthcare
- Insurance
- Automotive
- Agriculture



Moving RAW
image data is
expensive



FCSS can be
coupled with
camera



FCSS would be
leveraged to
vectorize



Vector data can be
stored and shared
for further
processing

Use Case #3 - CDNs



Content Delivery Network

- Edge nodes are replaced by PCSS
- PCSS hosts OPES applications



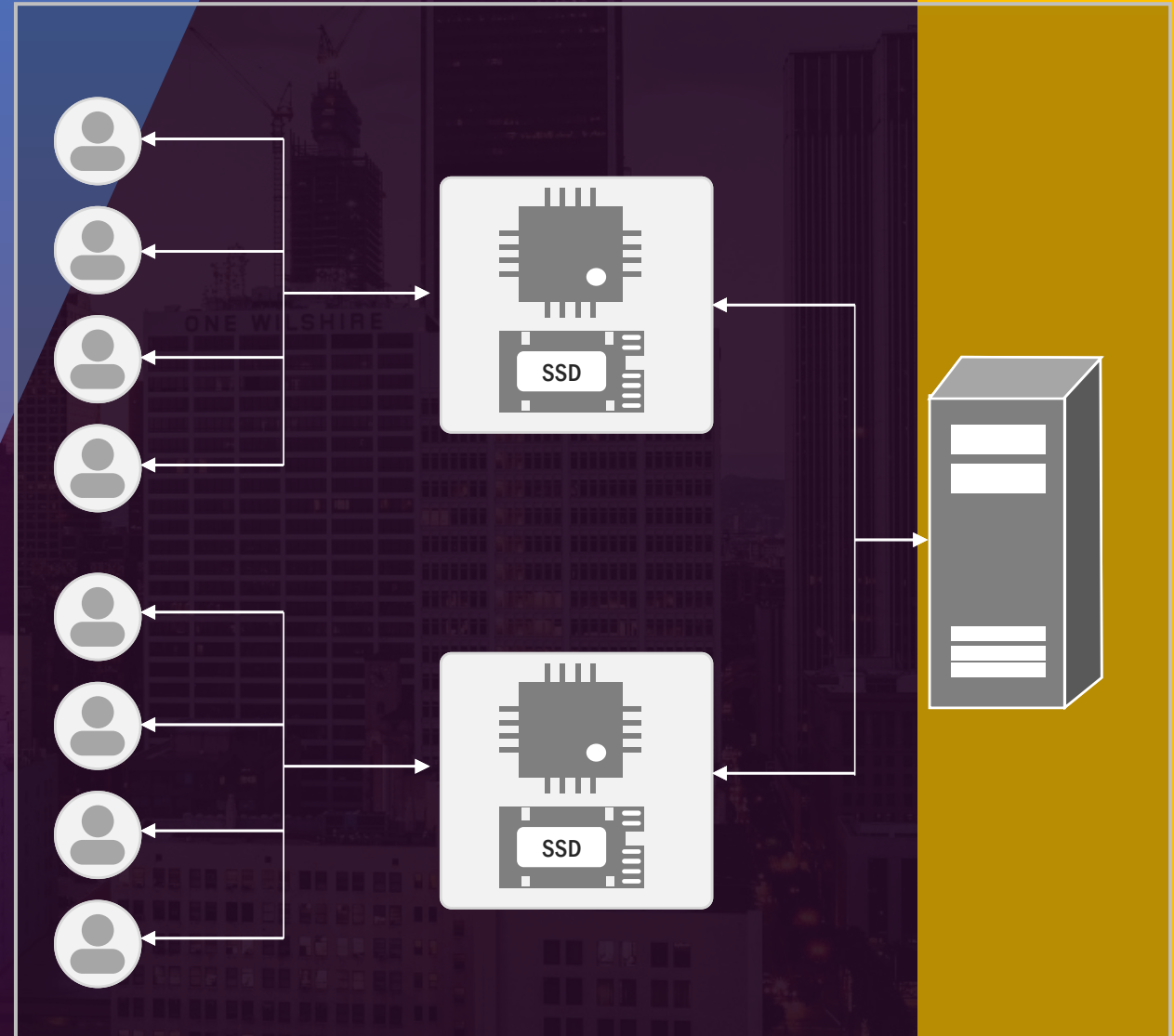
Advantages

- Better performance at an affordable cost
- Using predictive analytics (AI/ML) enables smart content delivery, real-time routing decisions, intelligent content management



Industry Adoption

- 5G at the Edge (Telecom)
- Media & Entertainment
- Healthcare



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Conclusion

Computational Storage is the next best thing to NVMe.

IoT, ML, Edge Computing are fuelling Computational Storage growth due to its benefits like:

- Faster responses & reduced latency
- Data-centric processing
- Improved security and privacy
- Optimized power and bandwidth consumption

Emerging needs of compute and storage will drive businesses towards Computational Storage, which is here to stay!

CSDs are helpful for scaled-out solutions

SNIA's working committee on CSD & standards is accelerating its adoption in real-life use cases

- **Product and Software Engineering**
- **Digital Services**
- **Cloud and Security Services**
- **Sustaining and Support Services**
- **DevOps and UI/UX Services**
- **IoT, AI, and ML Platform Solutions**

- **Storage Expertise SSD/Flash**
- **Cloud Storage**
- **Software Defined Storage**
- **HCI**
- **Data Protection**
- **Data Deduplication**

- **Storage Accelerators**
- **Windows CBT**
- **iSCSI Test Suite**
- **Office 365 Backup Solution**
- **Generic Cloud Solution**
- **Emulators**



<https://journalofbigdata.springeropen.com/articles/10.1186/s40537-019-0265-5>



<https://www.computerweekly.com/feature/Computational-storage-What-is-it-and-what-are-its-key-use-cases#:~:text=%E2%80%9CUse%20cases%20include%20computational%20edge,research%20vice%2Dpresident%20at%20Gartner.>



<https://www.computerweekly.com/feature/Computational-storage-What-is-it-and-what-are-its-key-use-cases>



<https://searchstorage.techtarget.com/feature/Computational-storage-terminology-explained>



<https://blocksandfiles.com/2019/06/14/computational-storage-market-research/>

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Questions?