
Prague
AWS
User Group
Meetup
https://awsug.cz

AWS User Group Meetup

Web pages: awsug.cz, start.awsug.cz, end.awsug.cz

Presentations: https://github.com/awsugcz/awsug.cz/tree/master/static/presentations/

Youtube: https://www.youtube.com/playlist?list=PL0Qk7ytdTD262PgKQ1GgFHX2IdYzhWM1E

Meetup page: https://www.meetup.com/Prague-AWS-Meetup/

Photos: https://photos.app.goo.gl/sE5kAt95ipmJ3ypPA

We want you to speak! https://goo.gl/forms/mFYRDTEL41DCewKP2

Prague AWS User Group

aws

PURESTORAGE®

PURESTORAGE®

aws

Optimizing AWS Storage for Running Mission-critical Applications.

Adam Mazouz

Cloud Solutions Engineer @ Pure Storage

amazouz@purestorage.com

Date 07/09/2022

Speaker Introduction

Adam Mazouz is a Cloud Solutions Engineer at Pure Storage focusing on Pure Cloud Block Store.

He is responsible for testing, documenting, and evangelizing the how and why Pure in the clouds, constantly searching for use cases and integration points.

Currently, designated AWS Community Builder / storage category.

Linkedin: **linkedin.com/in/adammazouz/**

Blog: **blog.purestorage.com/author/adammazouz/**

AWS community builders

aws certified Solutions Architect ASSOCIATE

aws certified Developer ASSOCIATE

aws certified SysOps Administrator ASSOCIATE

aws STORAGE Block SPECIALIZED 2022

aws STORAGE Data Migration SPECIALIZED 2022

Agenda

01 What is a Mission-critical Application?

02 Block Storage On-Premises vs AWS

03 Deep Dive into Elastic Block Store

04 AWS SAN in the Cloud

05 Pure Cloud Block Store

06 DEMO

What is a Mission-critical Application?

What is a Mission-critical Application?

"A mission-critical application is (software, hardware, database, process, application, etc.) that must function continuously in order for a business to be successful. If a mission-critical application experiences even brief downtime, the negative consequences are likely to be financial."

(Source: *Wikipedia*)

Examples of mission-critical systems are:

- Online banking system.
- Railway/aircraft operating.
- Healthcare systems.

Types of Mission-critical Application

Enterprise Applications

SAP ERP, Oracle ERP, Microsoft Exchange, VMware apps on VMC

Relational Databases

MS SQL Server, Oracle DB, SAP HANA

Big Data Analytics

Apache Kafka, Hadoop, Data warehousing

Mission-critical Application Requirements

- Low latency and consistent high IOPS and throughput performance.
- Capacity and performance scalability without workload disruption.
- High Availability, and durability.
- Enterprise-grade features: Data copy management aka Snapshot, Replication, Encryption.

Storage can make or break your application!

Block Storage
On-Premises vs AWS

Before we compare, let's re-cap ...

The Language of Storage

Performance

IOPS, Throughput & Latency

IOPS (input/output operations per second) – is a unit of measure representing the time it takes, in seconds, for a single read or write operation to be completed from beginning to end.

Usually it is defined/tested under two important consideration based on block size (The industry default size for logical data blocks is currently 4 kibibytes (KiB)):

- Ransom Access IOPS
- Sequential Access IOPS

Performance

IOPS, Throughput & Latency

Throughput is the measure of how much data (in MiB/s) you can read/write per second; basically, it measures how many bits you can flip per second. Throughput is generally used to measure transfer performance regarding large sequential files.

```
Throughput = (Number of IOPS) * (size per I/O operation)
```

Example:

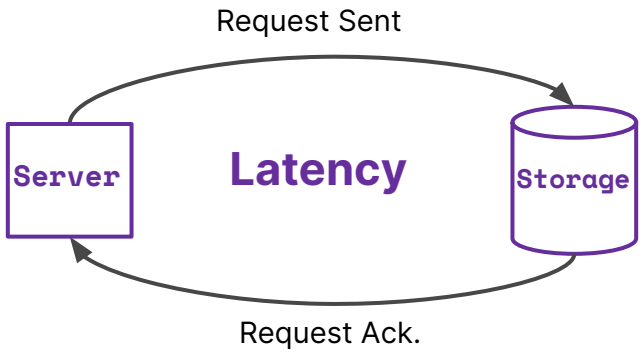
You can calculate throughput in MB/s by multiplying IOPS with block size. So given an IOPS of 3000 and a default block size of 4096 bytes (4KB) you would have:

3,000 * 4KB = 12,000 KB/s = ca. 12 MB/s

Performance

IOPS, Throughput & Latency

Latency is the round-trip time of an I/O operation between sending the I/O request to the storage system and receiving an acknowledgement from it that the I/O read or write operation is complete.



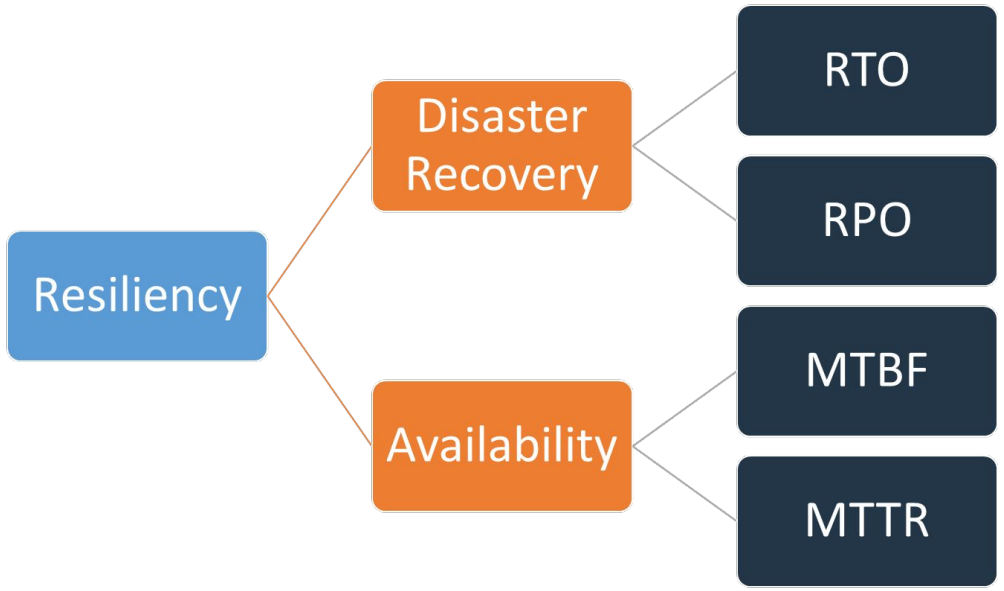
Queue Depth is the number of pending I/O requests from your application to your volume.

Resiliency

Disaster Recovery and Availability

Availability is calculated using **Mean Time Between Failures (MTBF)** and **Mean Time to Recover (MTTR)**. Also referred to as “nines” 99.99%

$$Availability = \frac{Available\ for\ Use\ Time}{Total\ Time} = \frac{MTBF}{MTBF + MTTR}$$



Source: https://docs.aws.amazon.com/whitepapers/latest/disaster-recovery-workloads-on-aws/disaster-recovery-workloads-on-aws.html

Resiliency

Disaster Recovery and Availability

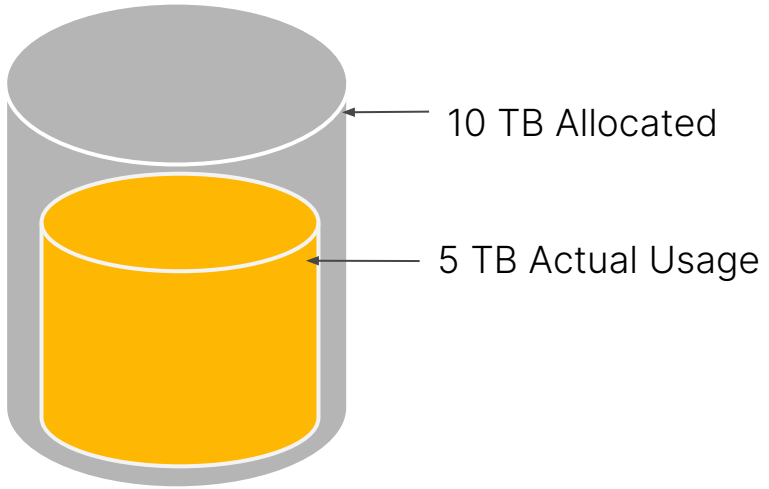
Disaster recovery is the strategy for avoiding loss of data and business continuity, known as the **Recovery Point Objective (RPO)**, and reducing downtime where your workload is not available for use, known as the **Recovery Time Objective (RTO)**.

Source: https://docs.aws.amazon.com/whitepapers/latest/disaster-recovery-workloads-on-aws/disaster-recovery-workloads-on-aws.html

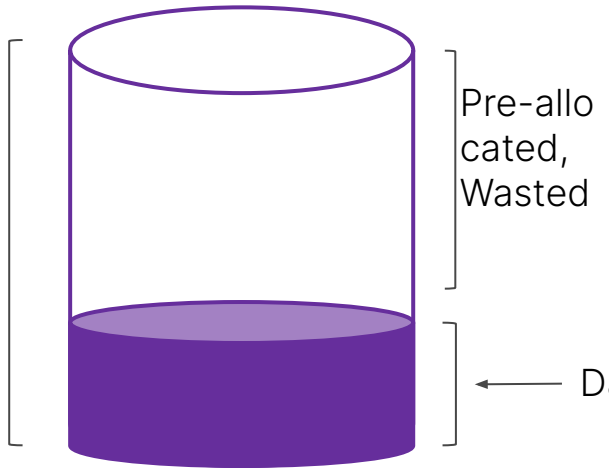
Provisioning

Allocated vs Actual Usage

- Allocated is the storage you pay for, what you provision.
- Actual Usage is the capacity consumed, or sometimes refers to Host-written

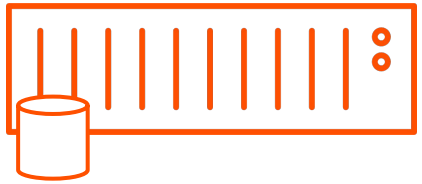


Thick Provisioning

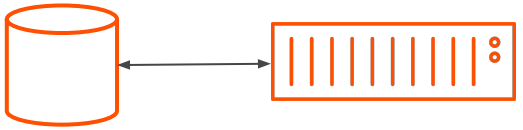


Thin Provisioning

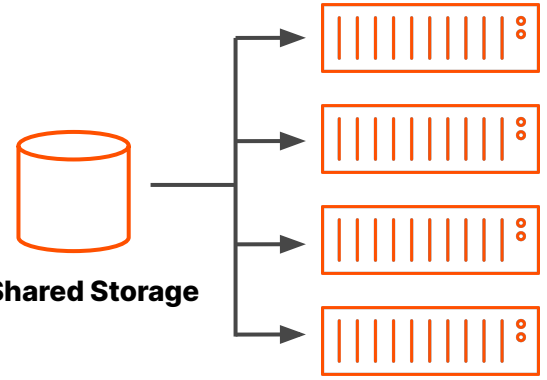
On-Premises vs AWS



Internal (Local) Storage

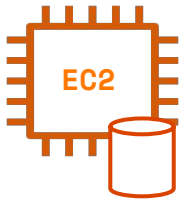


Direct Attached (Dedicated) Storage

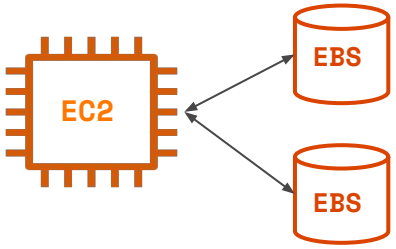


(SAN) Shared Storage

Servers/Clients



Instance Store (ephemeral)



Elastic Block Store (EBS)
Direct Attached

Storage Terms Definition is Different

On-Prem

Resiliency
Highly Reliable Arrays, Built-in Snaps & DR

Efficiency
Thin Provisioning, Deduplication, Compression.

Cost Considerations
Capacity Planning, resources once purchased are fixed

Cloud

Resiliency
High Availability for $, Higher Durability, Globally Replicated

Efficiency
Thick Provisioned Capacity & Performance

Cost Considerations
Ingress/egress charges, Cold vs Warm, performance (IOPS) can be wasted

Deep Dive into Elastic Block Store

Tuning and Optimizing

Considerations When Selecting your Volume

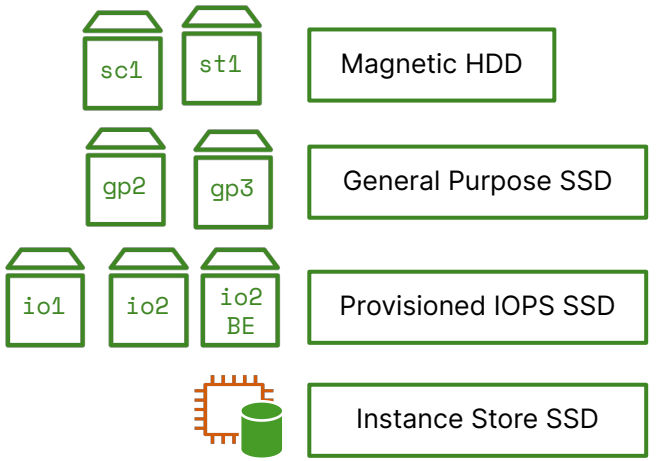
Trade-offs

Amazon Elastic Block Store

Performance and Capabilities

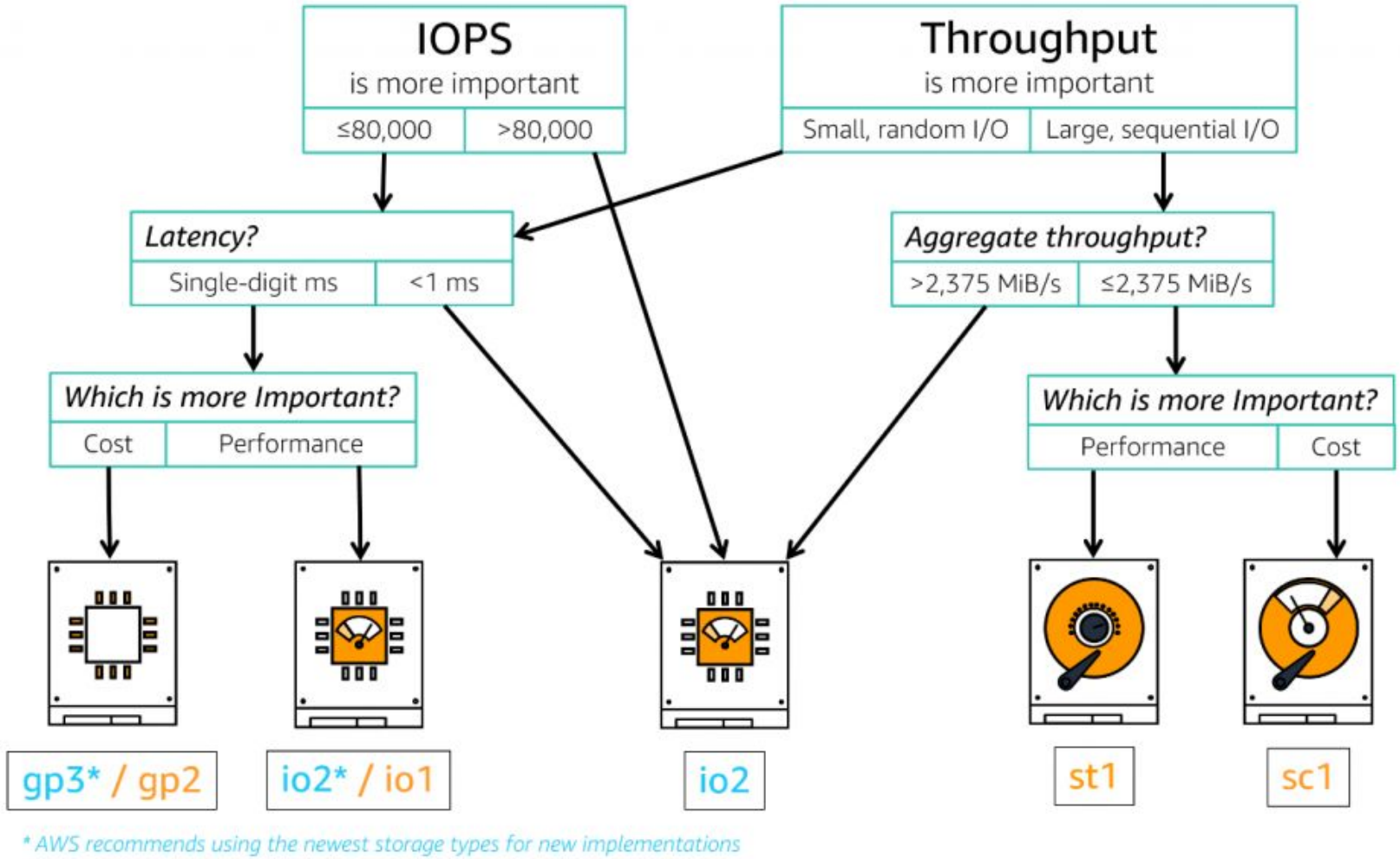
- Capacity vs. Throughput
- Capacity vs. IOPS
- Performance vs Latency
- Multi-Attach: Shared Volumes
- Snapshot capabilities

SSD or HDD-Based



Best Practices

Always use the newest storage type



Best Practices

RAID (Redundant Array of Independent Disks)

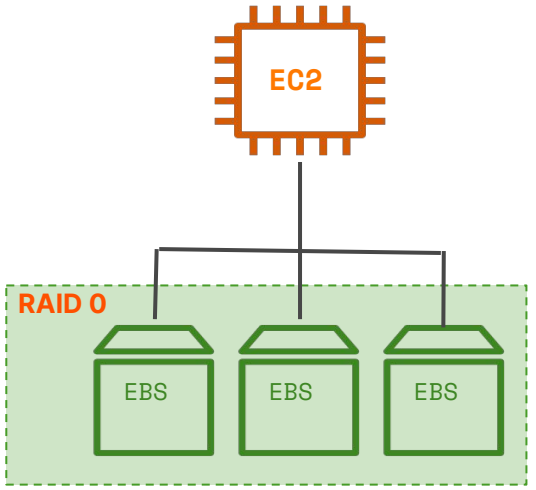
When to RAID?

- Storage requirement > 16 TiB
- Throughput requirement > 1000 MiB/s
- IOPS requirement > 64,000 @ 16K

Avoid RAID for redundancy

- EBS data is already replicated
- RAID 1 splits available EBS bandwidth
- RAID 5/6 loses 20% to 30% of usable capacity to parity

Creating a RAID 0 array allows you to achieve a higher level of performance for a file system than you can provision on a single EBS volume. Use RAID 0 when I/O performance is of the utmost importance. With RAID 0, I/O is distributed across the volumes in a stripe.

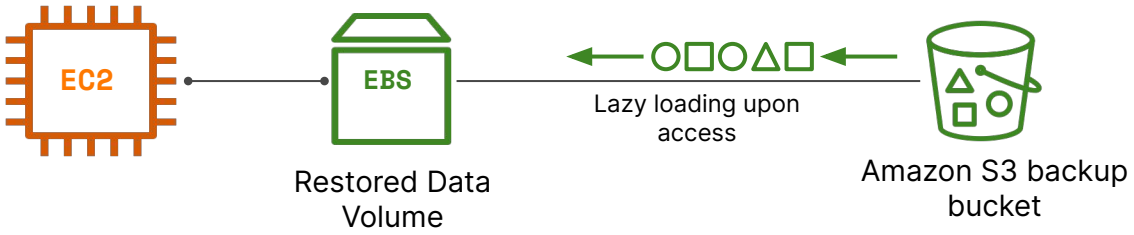


Best Practices

Snapshot Restore

Behind the scenes:

After a volume is created from a snapshot, there is no need to wait for all the data to transfer from S3 to your EBS volume before your attached instance can start accessing the volume. EBS Snapshots implement **lazy loading**, so that you can begin using them right away.



Best Practices

Snapshot Restore

This leads to performance penalty, and in order to address the IO latency, there are two options:

Force initialization: use dd command on Linux to read all blocks before getting the volume into production.

Fast Snapshot Restore (FSR): enable FSR capability for low latency access to data restored from snapshots. This feature costs an additional hourly charge. However, EBS volumes restored from FSR-enabled snapshots instantly receive their full performance.

Best Practices

Choosing The Right EC2 Instance Type for your workloads

- Each EC2 type has different EBS network bandwidth.
- vCPU numbers.
- Enable EBS–optimized. Which provides dedicated bandwidth and capacity for EBS.
  - At Launch. Note: Some instances can support maximum performance for 30 minutes at least once every 24 hours.
  - Existing instance. Note: If the instance is running, you must stop it first

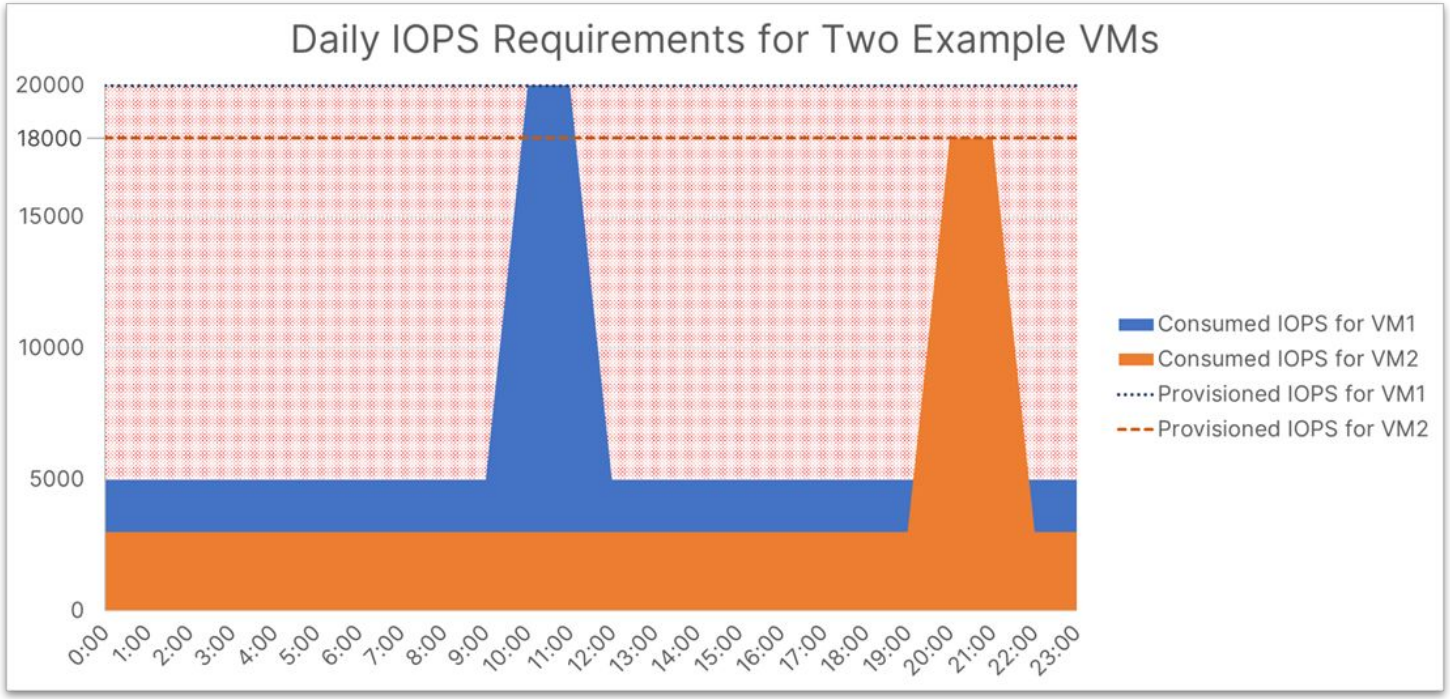
Best Practices

Mixing different EBS volumes types for same EC2

Example volume layout for SQL server:

- **C:** Boot on General Purpose SSD (gp3)
- **D:** Data files on PIOPS (single or striped)
- **E:** Log file on st1 or PIOPS
- **F:** Backups on st1, sc1, or S3
- **Z:** Tempdb on instance storage

The Problem with Provisioned IOPS

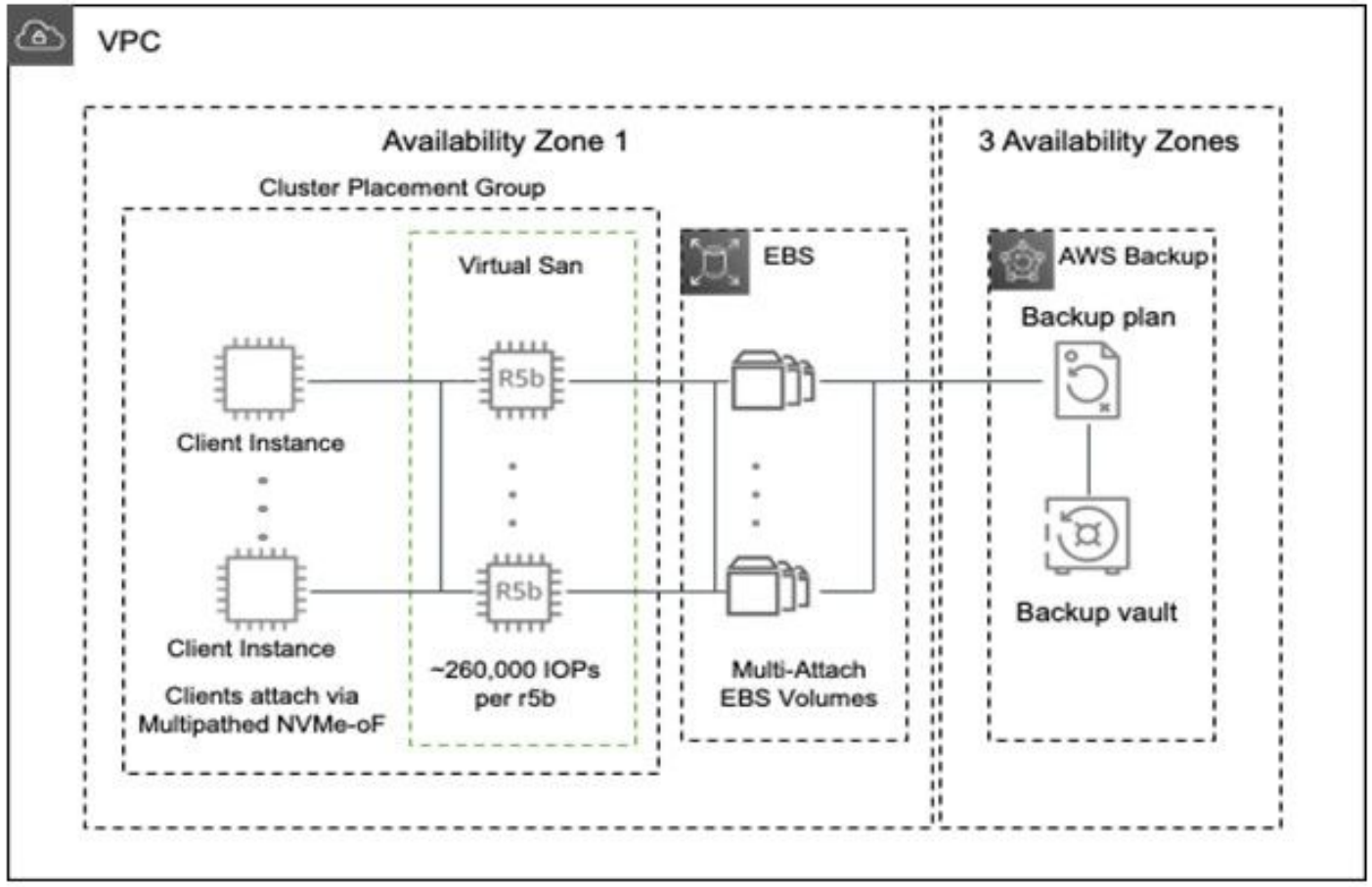


AWS SAN in the Cloud

AWS Virtual Storage Array VSA

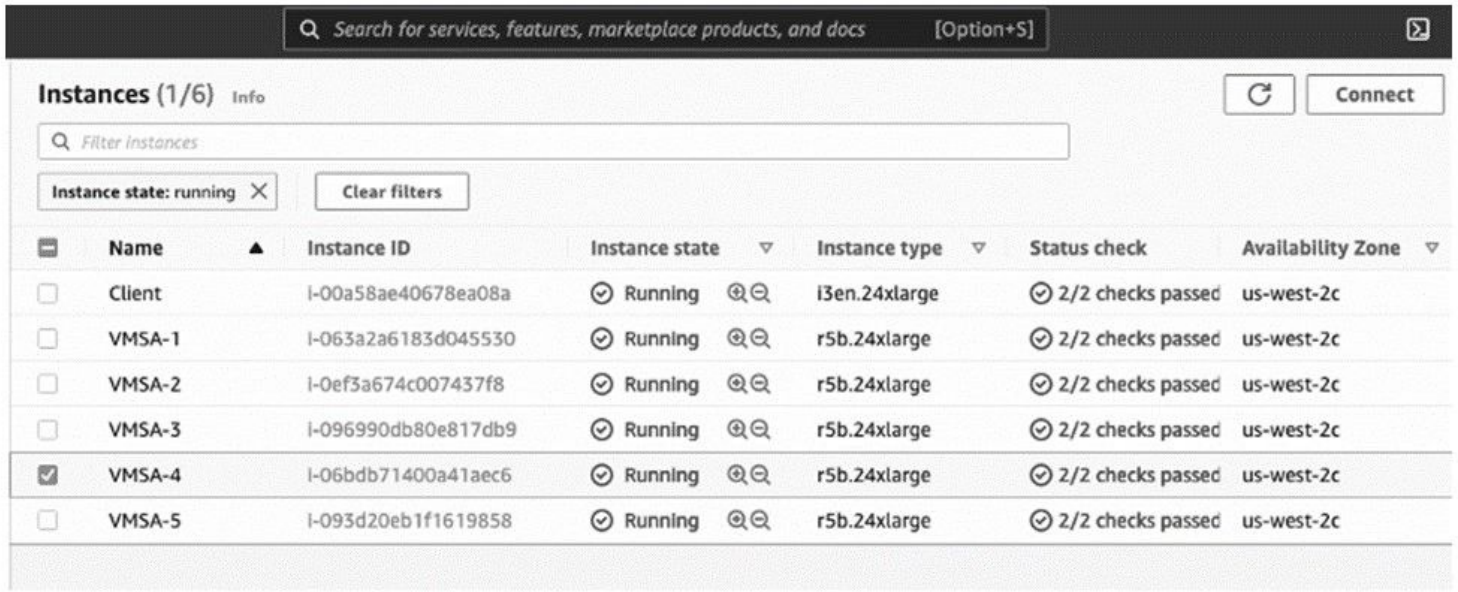
Take away from the blog announcement

- It is PoC, not GA yet.
- Two proposed models:
  - **r5b** front-end controllers backed by io2 Block Express.
  - **i3en.24** frontend controllers with local NVMe instance store.



AWS Virtual Storage Array VSA

- you can get more out of your storage—either from a performance perspective or to share.
- Scaling out both performance and capacity on demand.
- Integration with EBS Snapshots and Backup services.



Pure Cloud Block Store

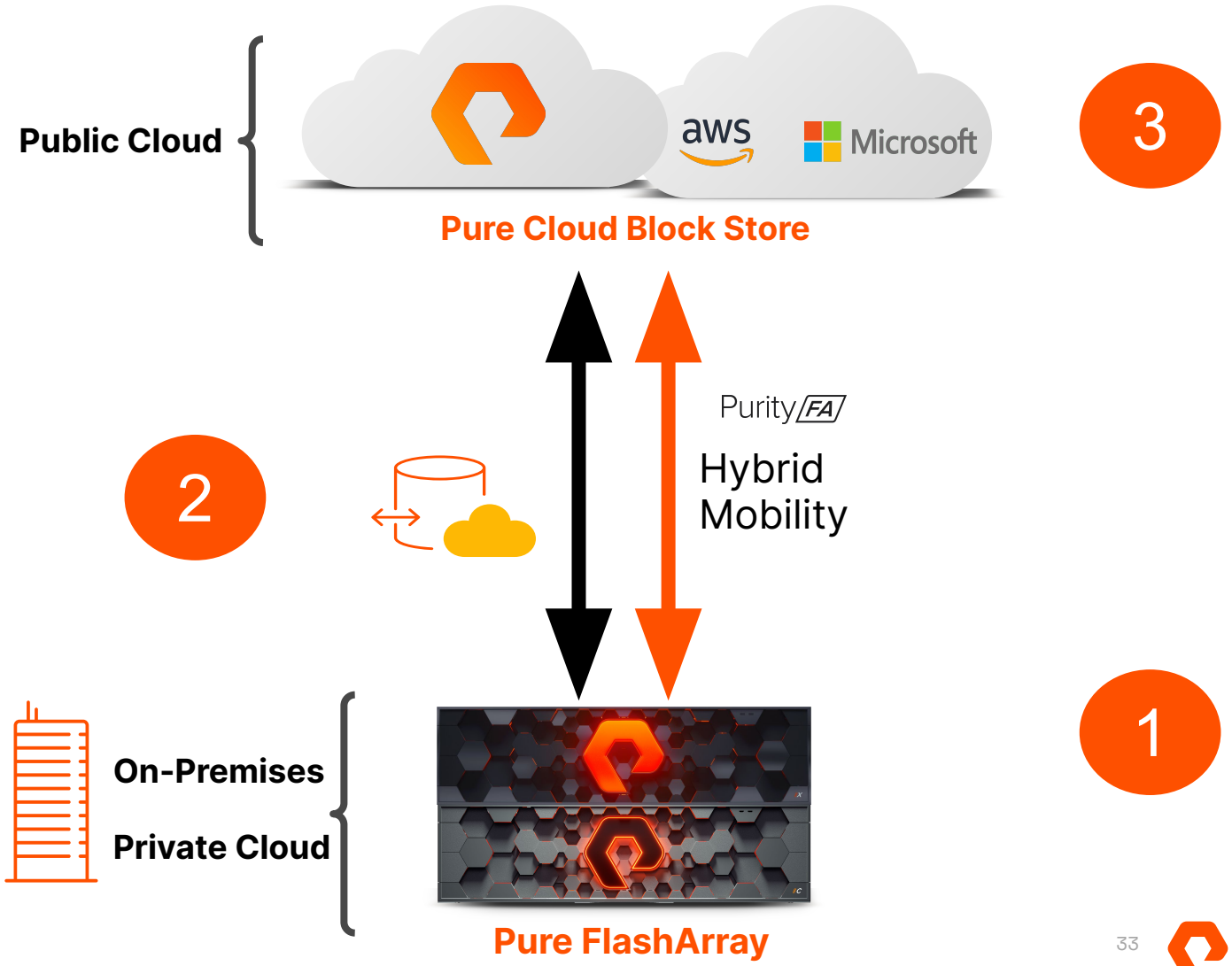
What is Pure Cloud Block Store?

Enterprise-grade storage built for on-prem, public cloud, private cloud, your cloud.

Best in Class Performance

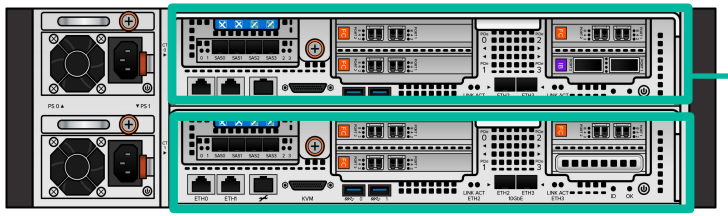
Hybrid Mobility and Protection

Consistent workload experience

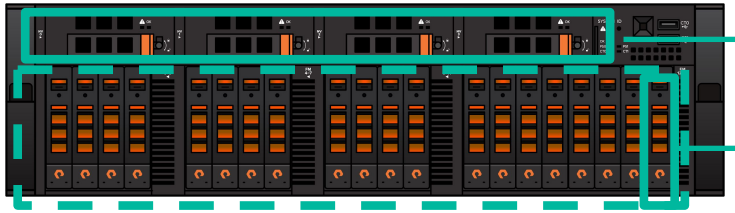


How we built it? The Architecture

Built-in performance & reliability

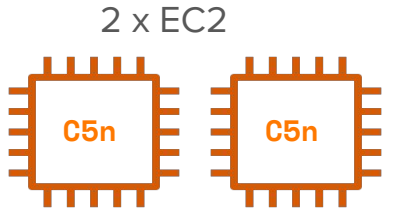


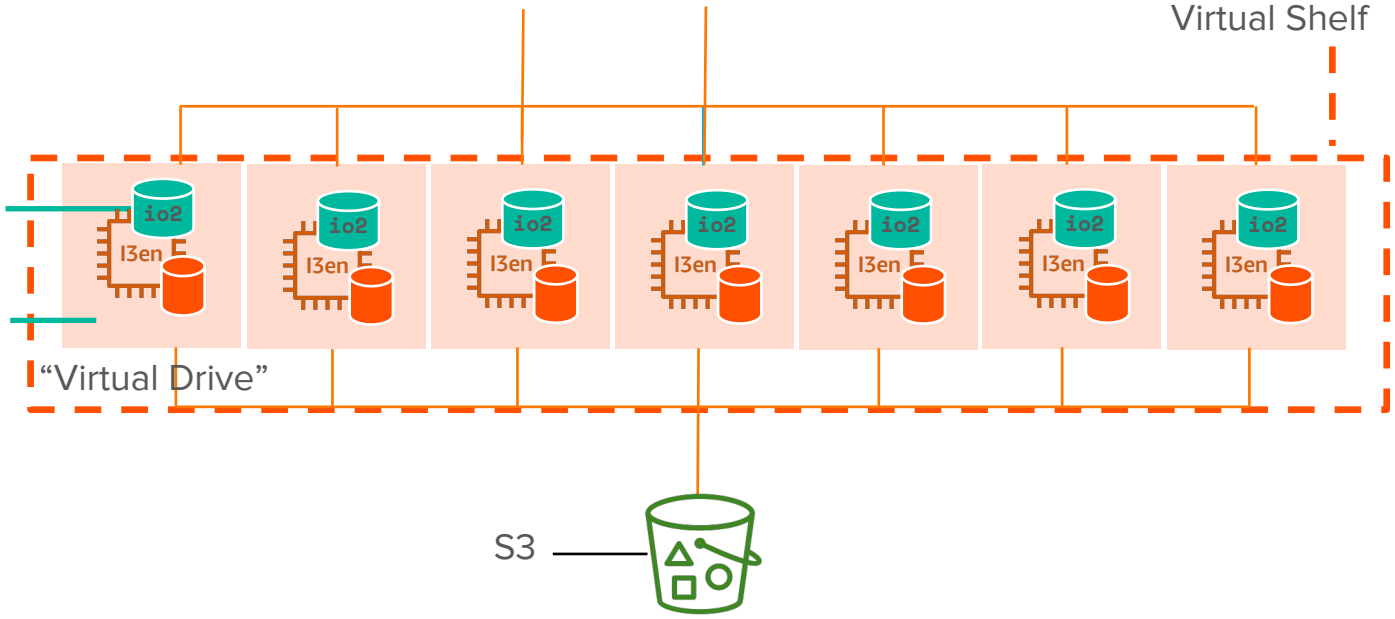
2 x Controllers



NVRAMS

Flash Module



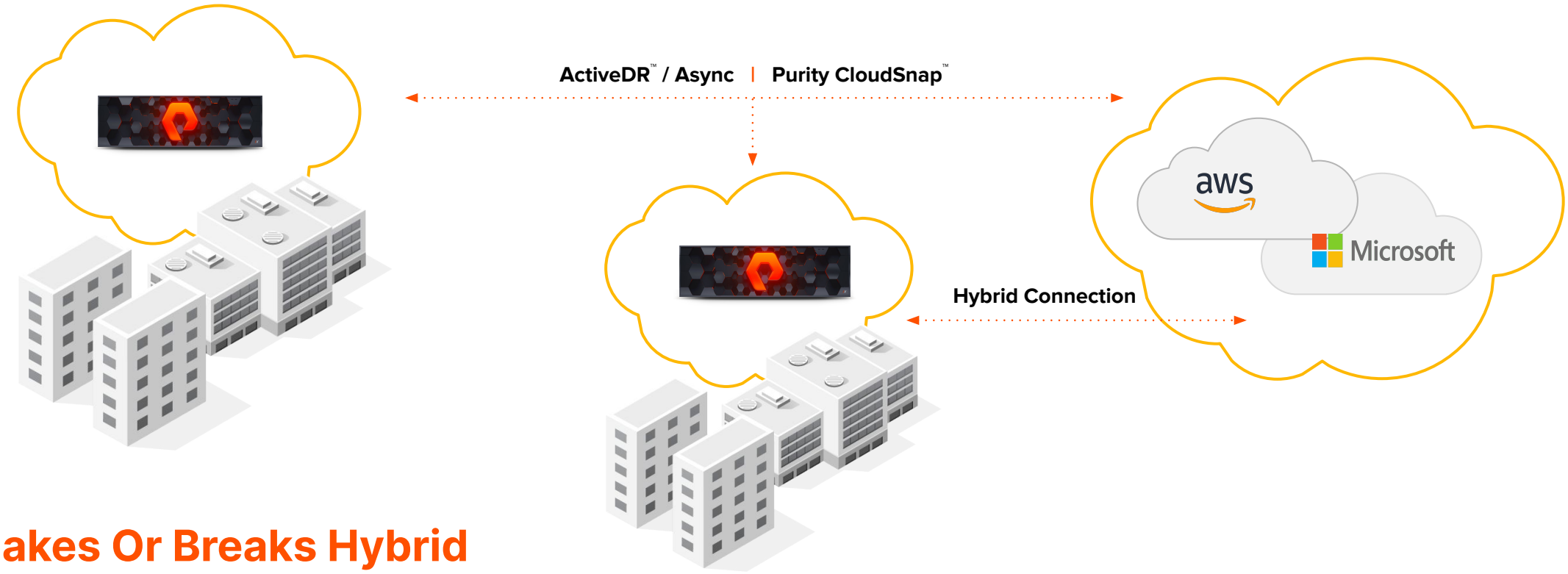


Pure Enables a Unified Hybrid Cloud

On-Premises in Your Data Center

Co-Location / Hosted Connected to Public Cloud

Within the Public Cloud

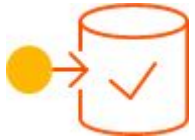


Data Makes Or Breaks Hybrid

Use Cases

Migrate To / From Cloud

Migrate data to cloud and back fast and efficiently.



Disaster Recovery to Cloud

Leverage cloud as a reliable disaster recovery target using async or continuous replication

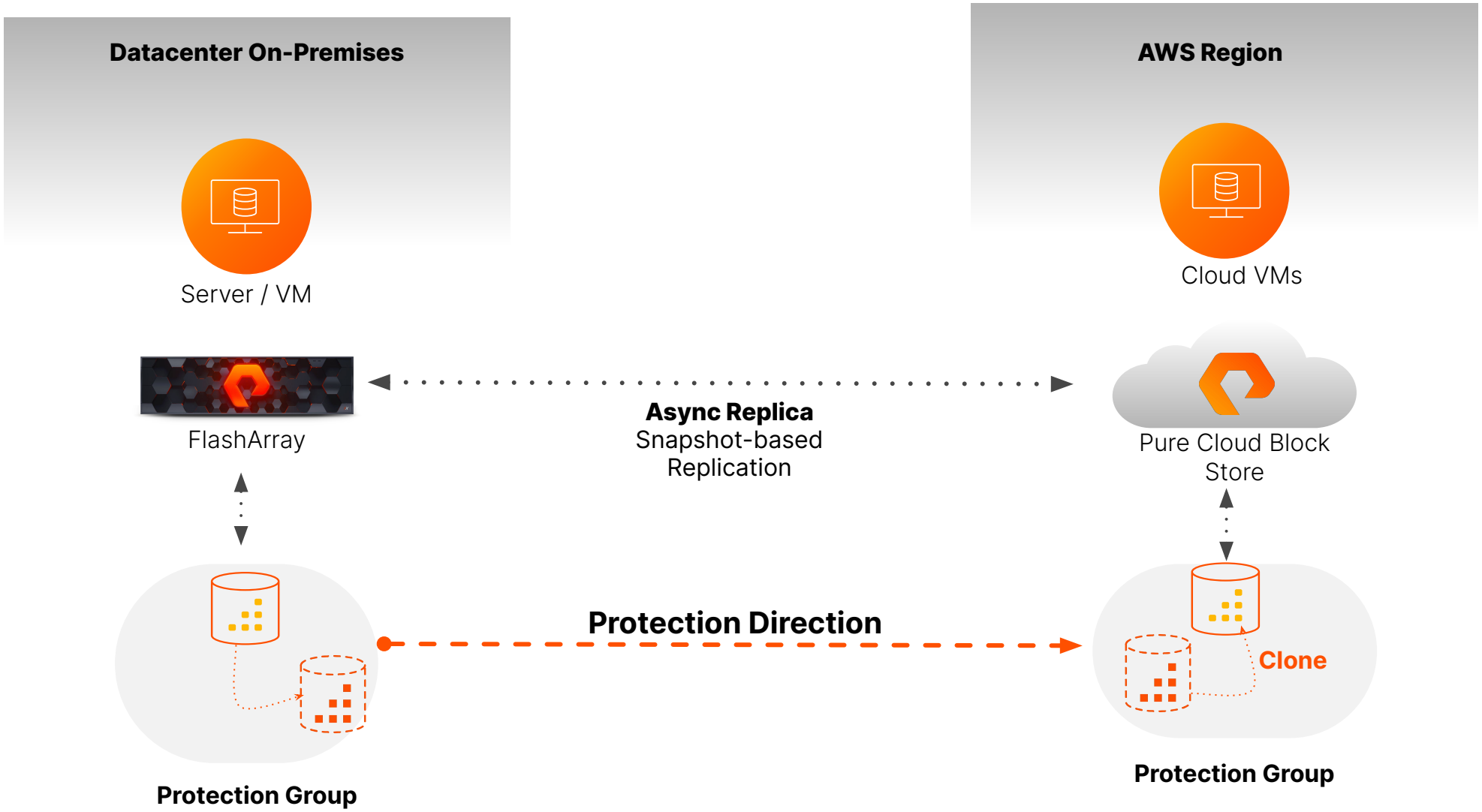
DevTest in the Cloud

Pure Cloud Block Store snapshots and clones enable efficient DevTest environments on-demand

HA Cloud / Cloud

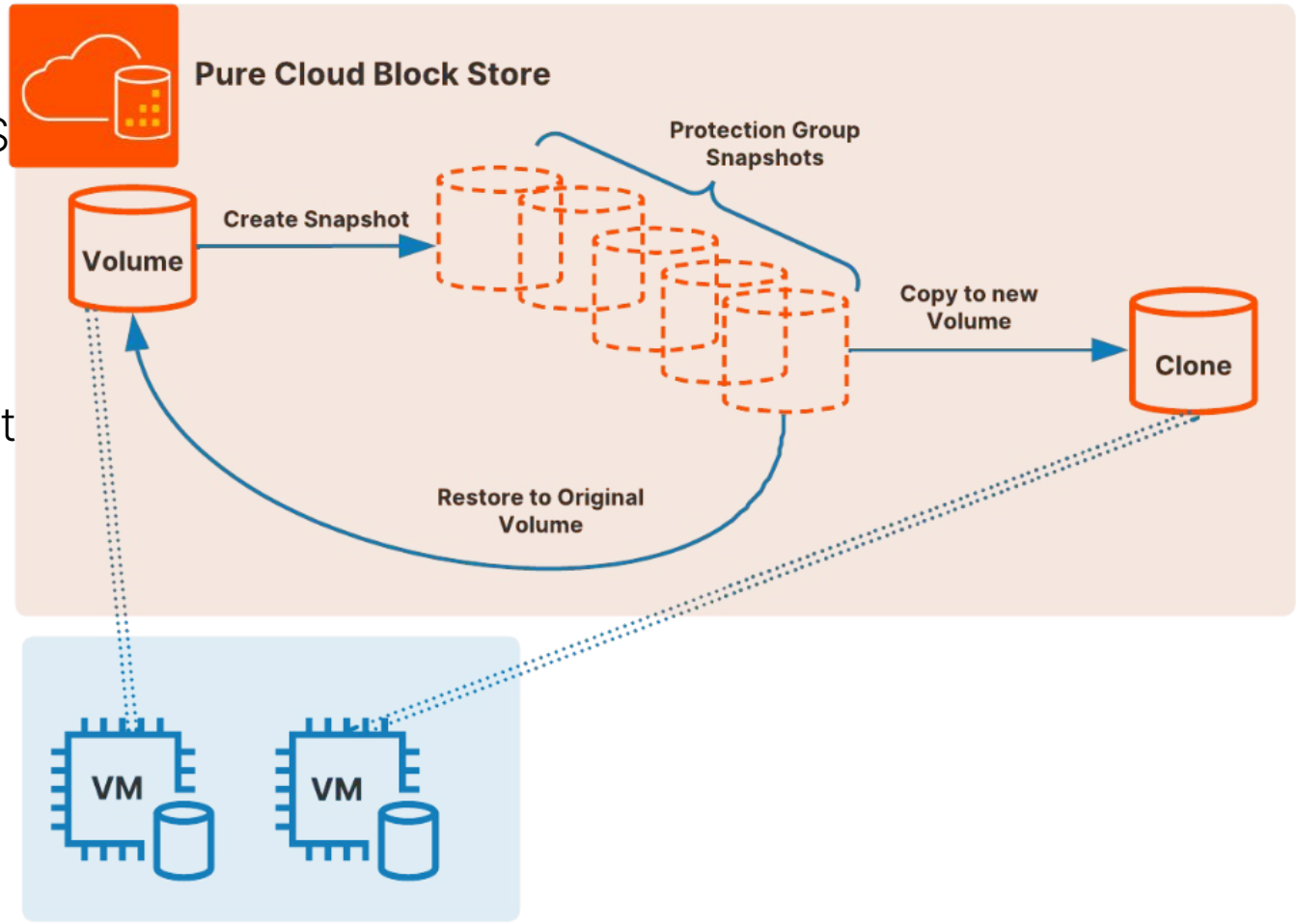
Maintain business continuity by leveraging cloud high-availability zones.

Use Case: Migration to/from Cloud

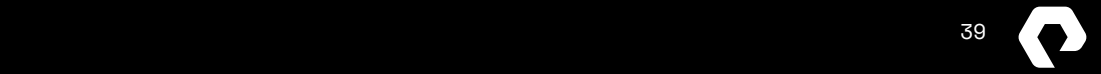


Use Case: DevTest in the Cloud

- Snapshots and Clones are costly in AWS or non-existent.
- On CBS you can create thousands of volume snapshots and clones are almost zero cost.
- Only changed data that is unique consumes capacity.



$DEMO

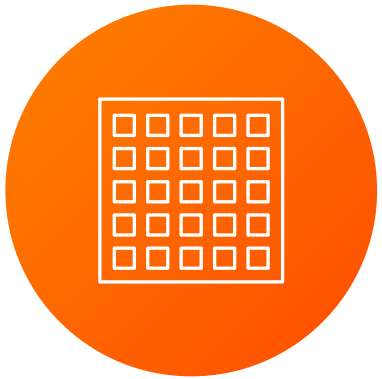


Build Cloud Storage; Join Pure

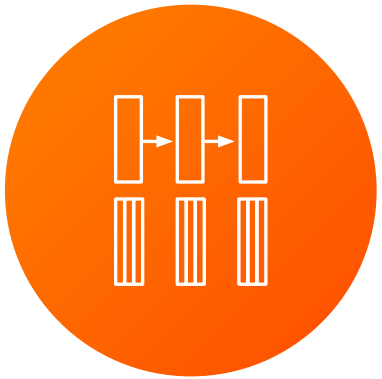
- Apply now on career page
- Learn more and watch the light-board video series

What is it like to Work with CBS? Life of CBS Engineer

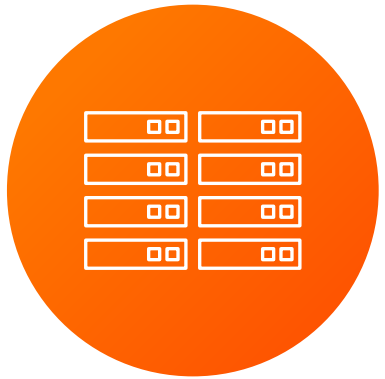
Development Main focus area / Tech Stack



CBS Platform



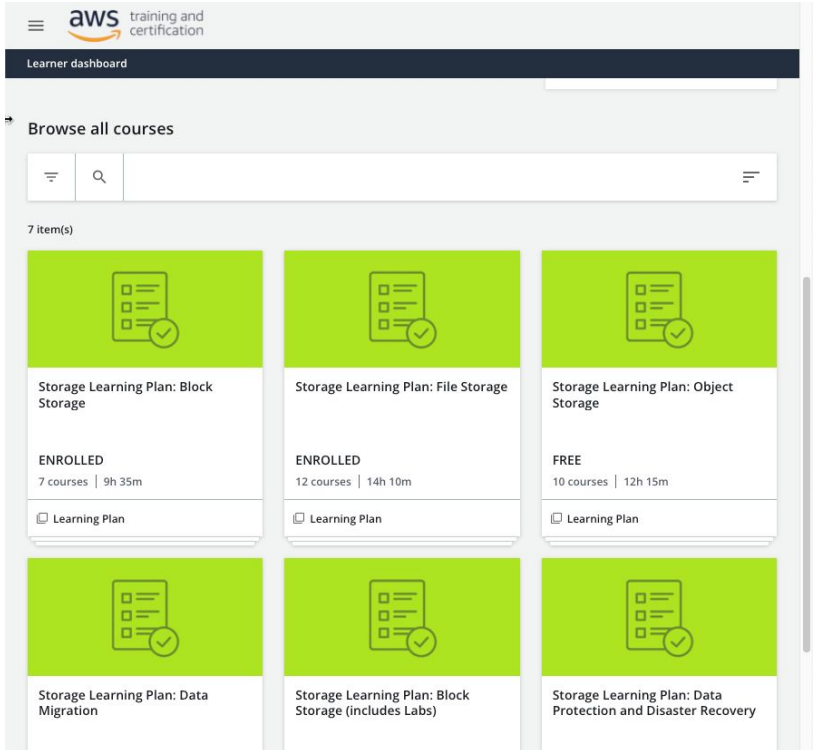
CBS I/O Path



CBS Automation

Learn all things about AWS Storage and Earn Badges

- **Learn at AWS Skillbuilder → https://explore.skillbuilder.aws/**



- **Earn Badges on Credly**

QUIZ!

Thank you...

https://ef.awsug.cz