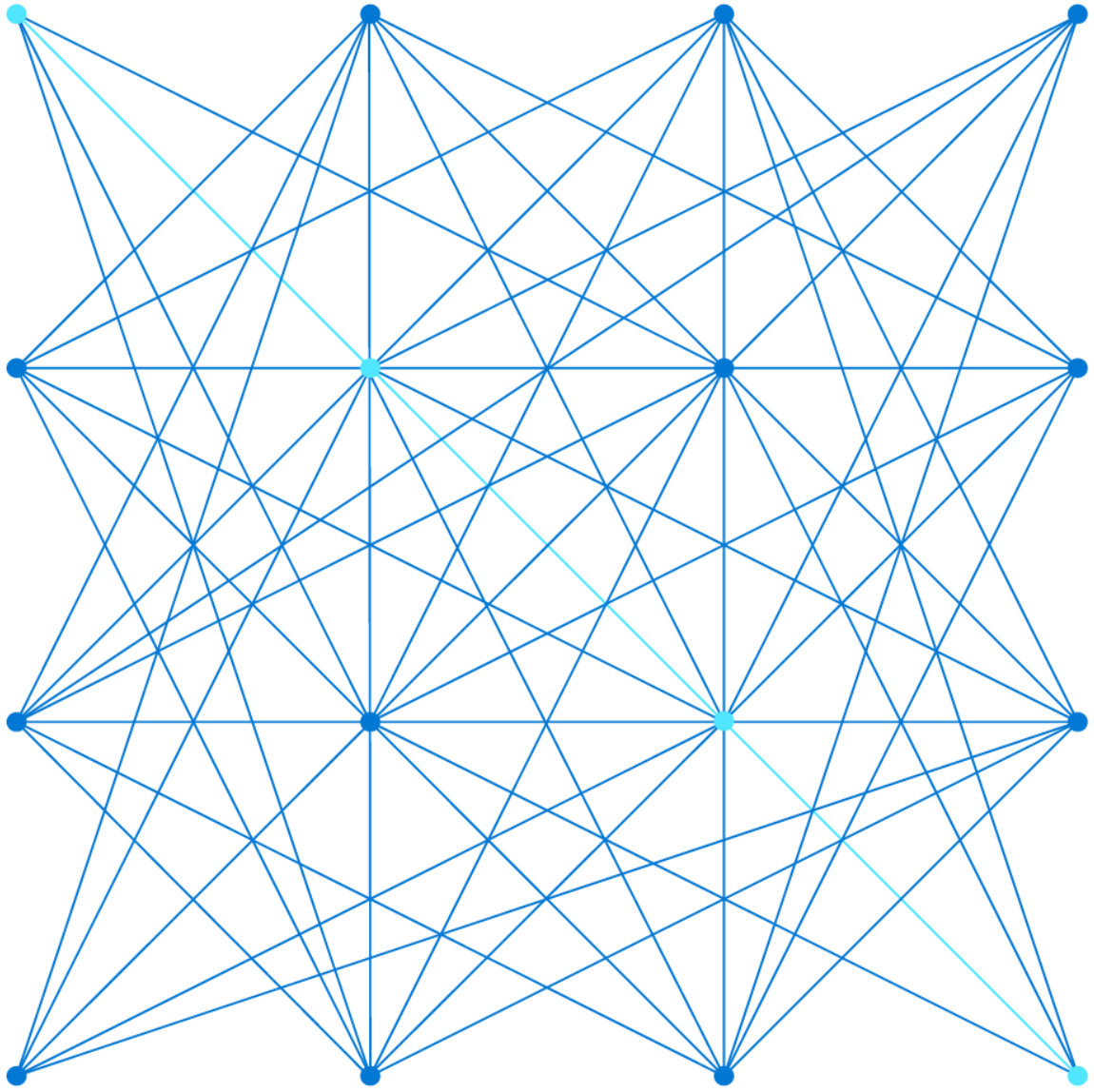
Microsoft Azure

Windows Server and SQL Server workloads on Azure IaaS

Bogdan Grozoiu & Joke Feije
Cloud Solution Architects

15th of November 2023



Contents

Windows Server workloads

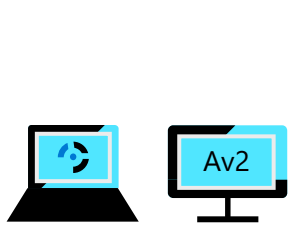
- Azure core compute and storage options
- Latest offerings
- File sharing

SQL Server workloads

- Azure core compute and storage options
- Latest offerings
- Benchmarking
- BCDR considerations

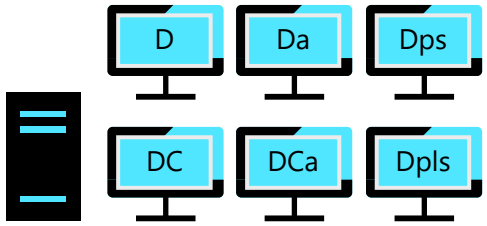
Azure core Compute options for Windows Server workloads

Azure Virtual Machines for every workload type

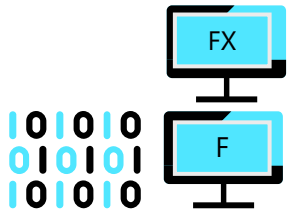


Entry level

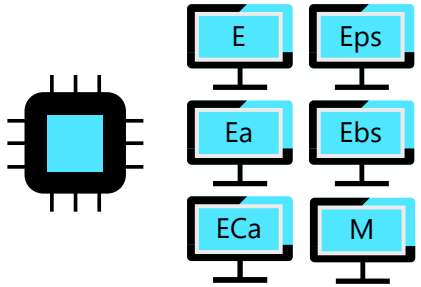
Burstable



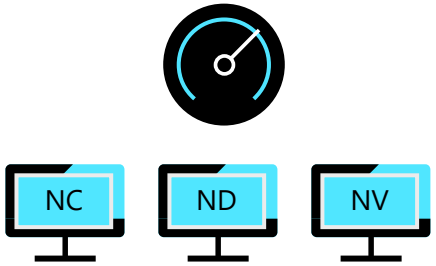
General Purpose and Confidential Computing



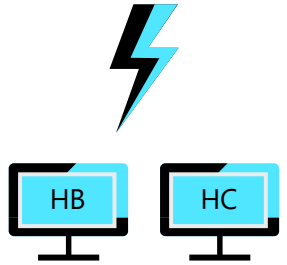
Compute intensive



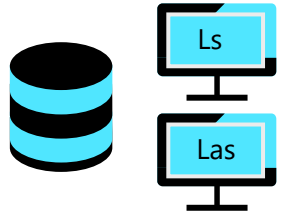
Memory optimized and Confidential Computing



GPU accelerated



High Performance Computing



Storage optimized

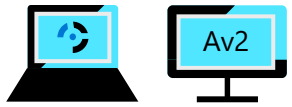
AMD

intel

AMPERE

NVIDIA

Azure VMs for general-purpose workloads



Entry level

- Development and testing
- Low traffic web servers
- Proof-of-concepts
- Code repositories

Burstable

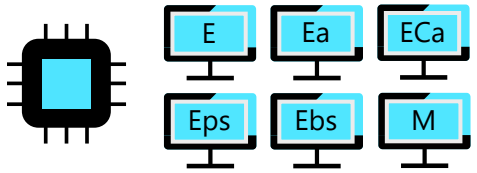
- Workloads not needing full CPU performance continuously
- Development build environments
- Proof-of-concepts

General Purpose

- Low-to-medium traffic web servers
- Application servers
- Small-to-medium databases
- Desktop virtualization solutions
- Enterprise-grade applications

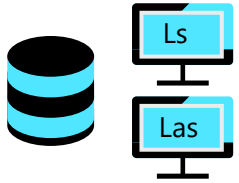
AMD AMPERE intel

Azure VMs for memory/storage intensive workloads



Memory optimized

- Relational database servers
- Medium-to-large caches
- In-memory analytics
- OLTP systems



Storage optimized

- Big data applications
- SQL and NoSQL databases
- Enterprise search engines
- Data warehousing solutions
- Distributed file systems

AMD

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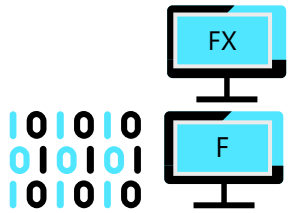
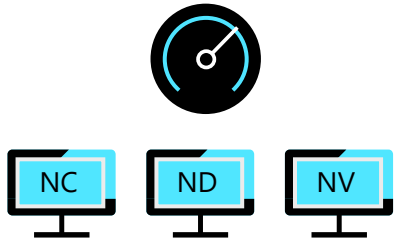
intel

Azure VMs for compute intensive and HPC workloads



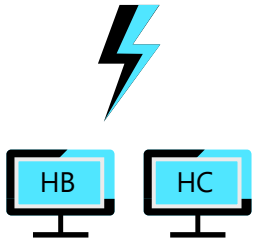
Compute intensive

- Computationally intensive workloads
- Electronic Design Automation (FX)
- Video encoding and rendering
- Gaming



GPU accelerated

- Compute intensive, graphic-intensive workloads
- Video editing
- Remote visualization, streaming, encoding, gaming
- ML, training and inference scenarios for deep learning



High Performance Computing

- Workloads requiring dense computation and memory bandwidth
- Finite element analysis
- Computational chemistry
- Molecular dynamics
- Fluid dynamics
- Reservoir simulations

AMD intel NVIDIA

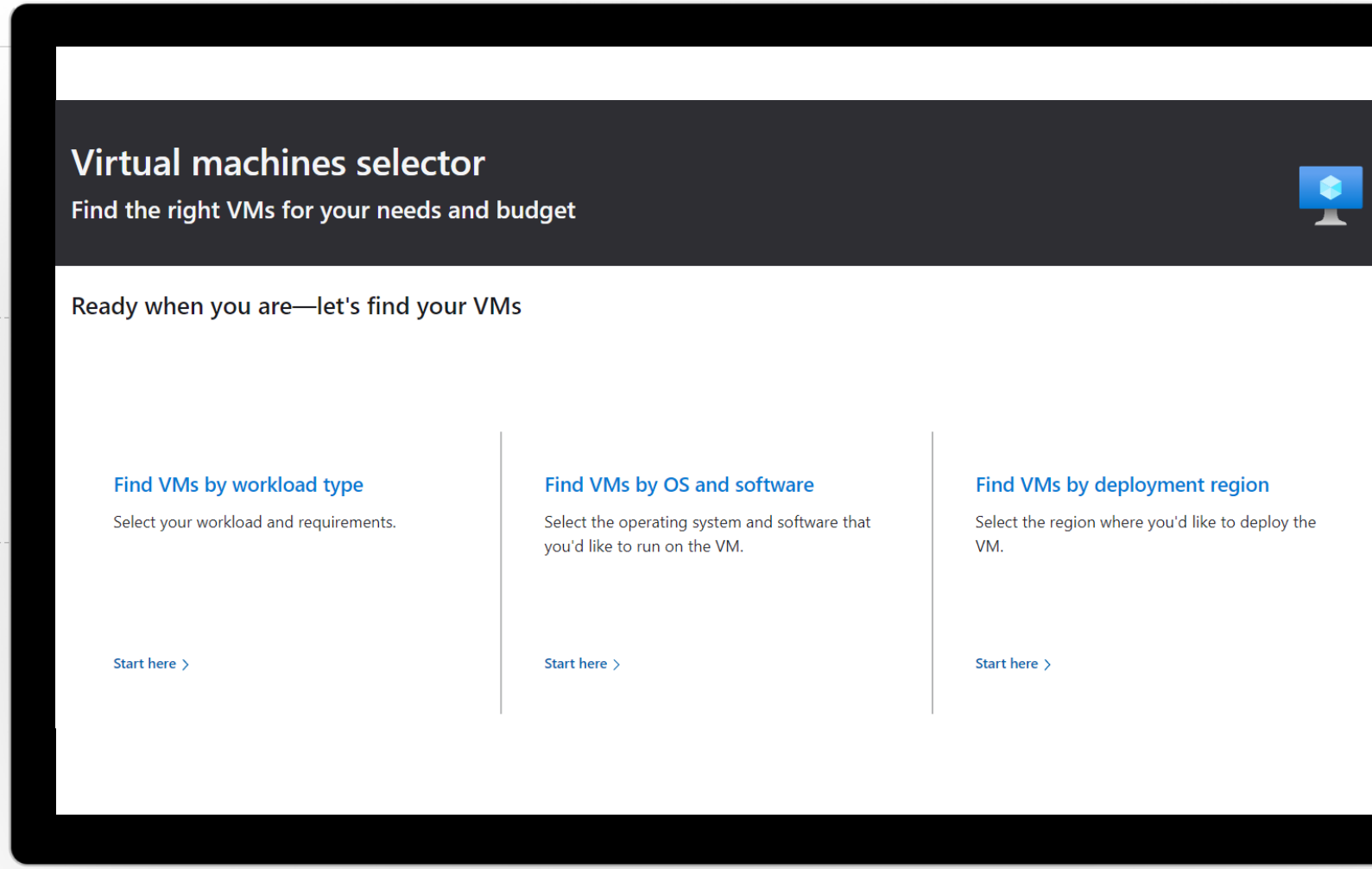
GA

Virtual Machines Selector

Quickly find the Azure VMs and Disk Storage options that meet your requirements

Selection based on workload type, OS, and Region

Integration with the pricing calculator



aka.ms/vm-selector

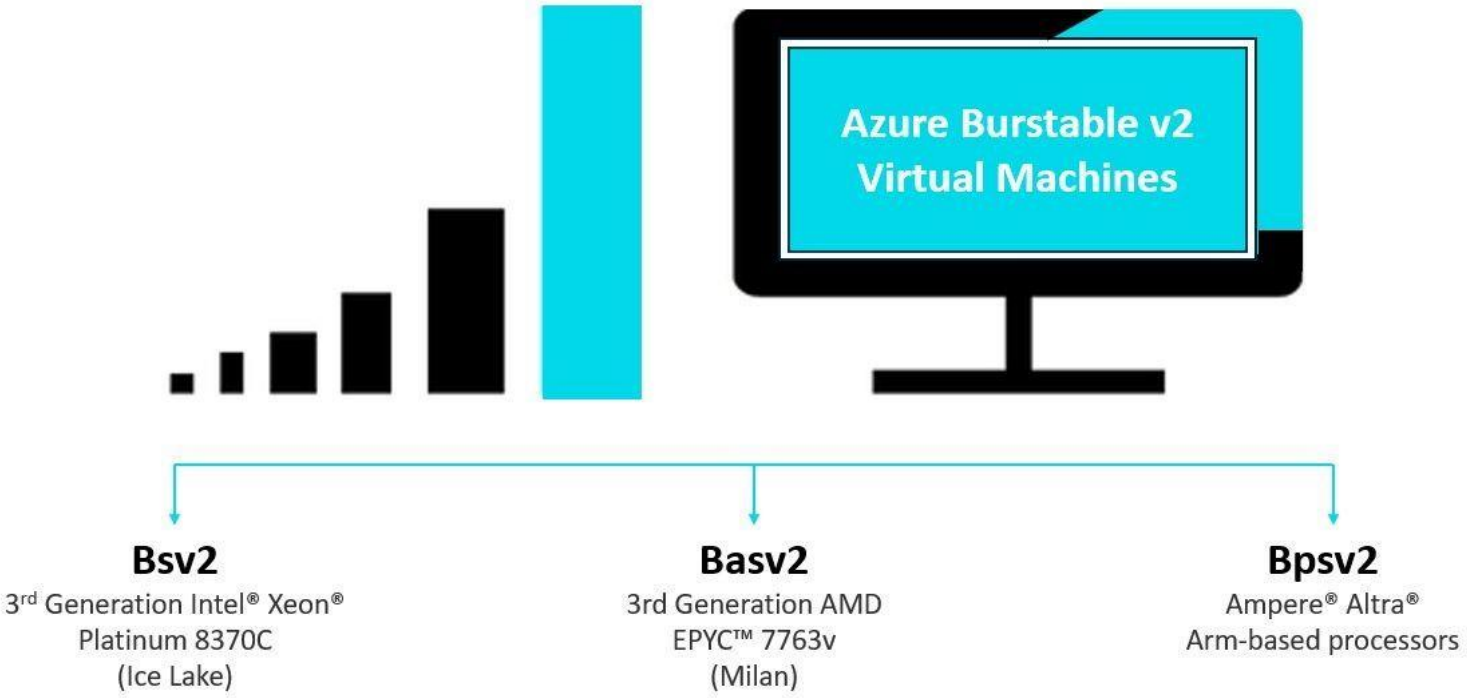
Latest Azure Virtual Machines

Availability: GA

New Burstable General purpose VM sizes

Designed for non intensive workloads in a cost effective way

Bsv2 - Basv2 - Bpsv2 – Sizes



- Support all remote disk types such as Standard SSD, Standard HDD, Premium SSD and Ultra Disk storage
- Take advantage of Spot Virtual Machines, Reserved Instances and Saving Plan

Availability: PREVIEW

New Intel memory-optimized VM sizes

Designed for data intensive workloads to process more data on fewer vCPUs

Ebsv5/Ebdsv5 – Sizes

- Up to 10 GBps and 400K IOPS
- Ebsv5-series VMs feature Intel® Hyper-Threading Technology
- Ideal for memory-intensive enterprise applications and applications that benefit from high remote storage performance but with no local SSD storage
- Supported only on Generation 2 VMs
- Initially available in the US East, Canada Central more regions to be added soon

Largest Ebsv5 sizes:

- E96bsv5
- E112ibsv5

Intel® Xeon® Platinum 8370C (Ice Lake)

[Public Preview Access Form]

Azure Boost VM family

Availability: Preview

Azure Boost VMs in preview can achieve **up to 200 Gbps networking throughput**, marking a significant improvement with a doubling in performance over other existing Azure VMs.

Achieve an industry leading **remote storage throughput** and **IOPS** performance of **10 GBps** and **400K IOPS** using NVMe-enabled Premium SSD v2 or Ultra Disk options.

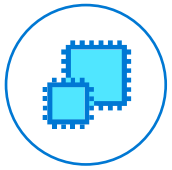
Isolated architecture inherently improves **security** by running storage and networking processes separately on Azure Boost's **purpose-built hardware** instead of running on the host server.

Reduced downtime needed to complete updates to Azure host infrastructure. Azure Boost's introduction means that Azure infrastructure updates can be deployed much faster by loading directly onto the Azure Boost hardware with minimal impact to customer running VMs on the host servers.

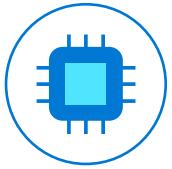
Public Preview Access Form

Availability: GA

New storage optimized Lasv3 and Lsv3 VM series



Lasv3 VMs run on **AMD** 3rd Generation EPYC™ 7763v (Milan) processors.



Lsv3 VMs run on **Intel** 3rd Generation Xeon® Platinum 8370C (Ice Lake) processors.

Our tests of a data processing and analytics workloads demonstrated **up to 2x higher performance** of Lsv3/Lasv3 versus Lsv2 VMs.

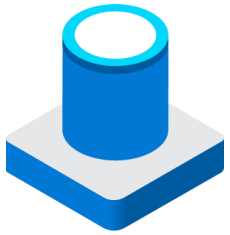
Networking and remote storage throughput/IOPS will be increased up to 290% versus Lsv2.

Local storage (incl. NVME) is considered ephemeral, so use cases that can tolerate data loss and/or systems architected with redundancy / backup / replications will benefit from the L-series VMs performance.

Azure Storage options For Windows Server workloads

Microsoft Azure

Storage recommendations for Windows Server workloads



Windows Server

Azure Disk Storage

Block storage for wide range of workloads

Shared disks for clustering

Azure Files

Recommended for file share migrations from Windows File Server SMB shares

Hybrid file shares /w Azure Files Sync

Azure NetApp Files

Recommended for file share migrations requiring <2ms latency

Built-in backup support with Azure Backup

Built-in backup support through ANF

Azure Disk Storage for *every* Windows Server workload

• Recommended for production workloads •

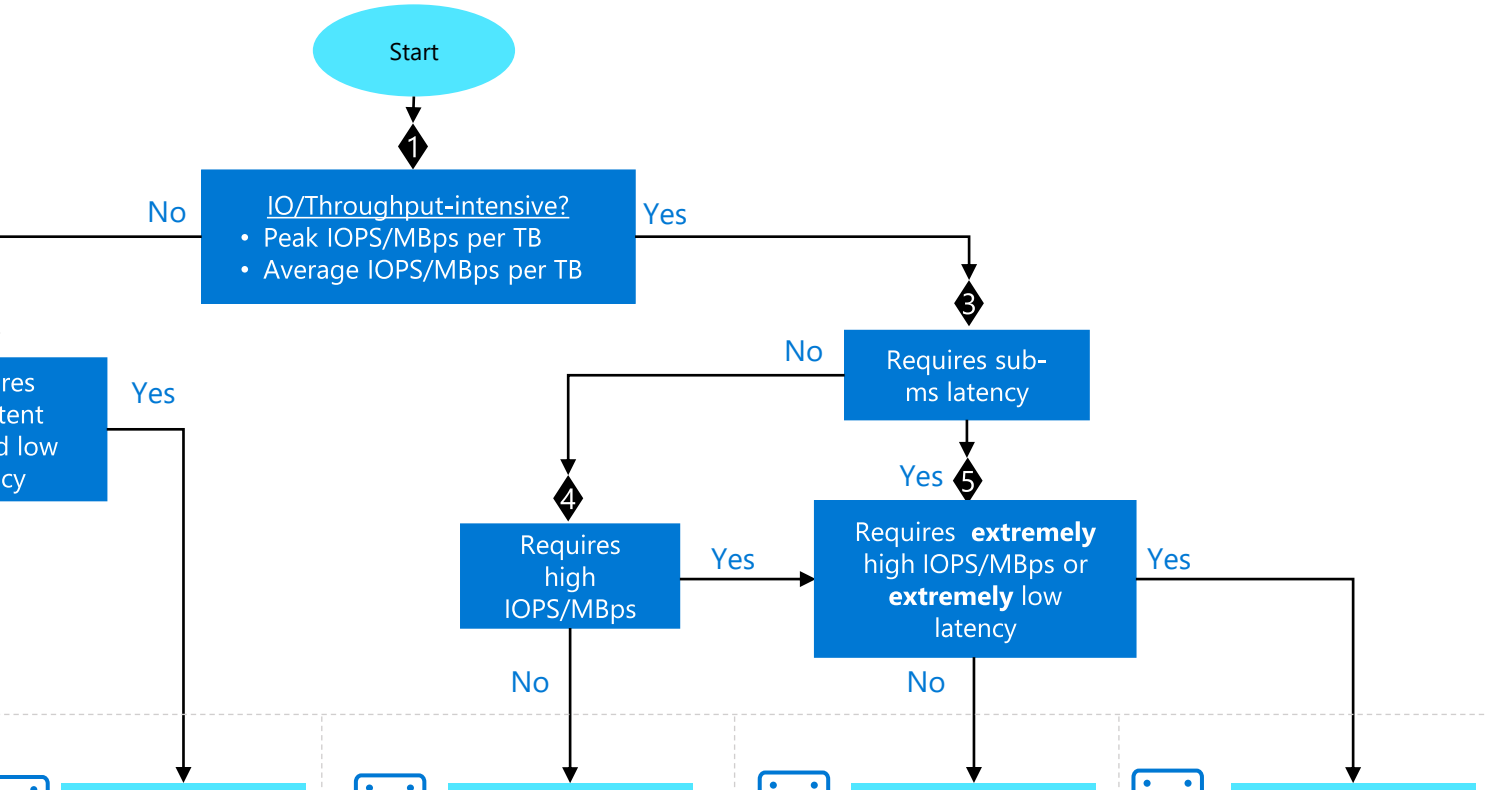
	Azure Disk – Optimized for Virtual Machines					Azure Elastic SAN (Preview)	
	Standard HDD	Standard SSD	Premium SSD	Premium SSD v2	Ultra Disk	Elastic SAN	
	Low-cost storage	Consistent performance	High performance	Sub-millisecond latency	Low sub-millisecond latency	Cost efficiency at scale	
Workloads	Backups, low end file server, test and dev	Big Data, entry-level apps, small DBs, Web Servers	IO-intensive, database, production workloads, container volumes	SAP HANA, SAN, Tier-1 workloads	SAP HANA, SAN, Tier-1 workloads	Tier 1 and 2 workloads, Databases, VDI hosted on any Compute options (VM, Containers, AVS*)	
Single disk max value						**Volume**	**SAN**
Size	32 TiB	32 TiB	32 TiB	64 TiB	64 TiB	64 TiB	1 PiB
IOPS	2,000	6,000	20,000 (**burst to 30,000**)	80,000	160,000	64,000	2,000,000
Throughput	500 MB/s	750 MB/s	900 MB/s (**burst to 1,000 MB/s**)	1,200 MB/s	4,000 MB/s	1,000 MB/s	32,000 MB/s
Provisioning model	Performance scales with capacity	Performance scales with capacity	Performance scales with capacity	Flexible scaling at 1GiB granularity	Flexible performance scaling	Per GiB provisioning granularity	Flexible model at TiB granularity

Disk storage for Windows Server based workload migrations

Choose Azure Disk Storage for your application performance needs

Primary Considerations:

- Latency
- IOPS
- Throughput



Disk Types	Standard HDD	Standard SSD	Premium SSD	Premium SSDv2	Ultra Disk
Disk Characteristics	Most cost-efficient storage on HDD	Entry level SSD with lowest GB cost on Cloud	Great balance for cost and performance	Best price performance on Azure	Fastest Disks and most flexible cost model
Disk Sizes	Per IOPS, capacity & throughput requirements.				

Industry-only support for Windows-based clustering with shared disks on Azure Disk Storage

Enables fast failover and high availability for clustered databases, parallel file systems and container volumes

Unique capabilities

Supports Windows-based scenarios

- SQL Server FCI (Failover Cluster Instance)
- Scale-out File Server (SoFS)
- SAP ASCS/SCS (SAP Central Services)
- Remote Desktop Server
- User Profile Disk RDS

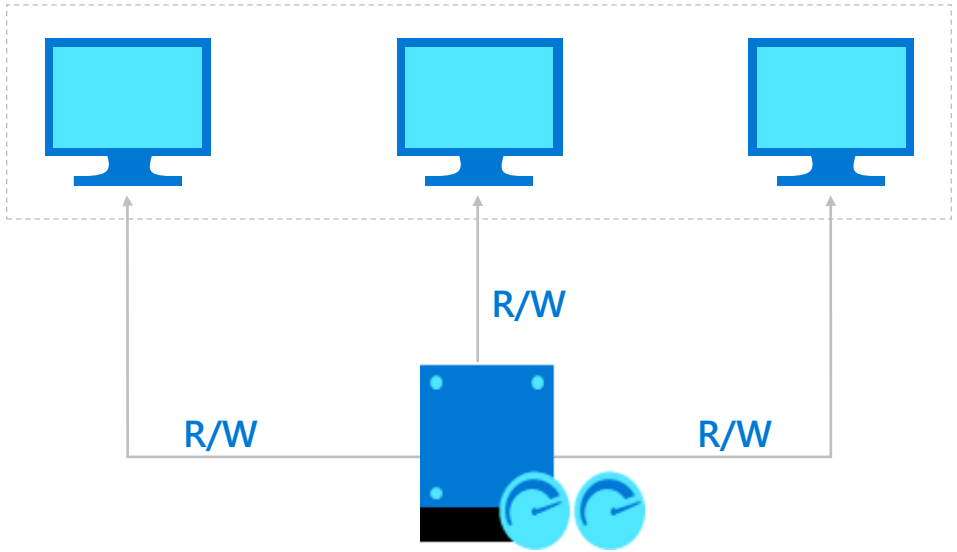
Support for SCSI Persistent Reservations (PR) for:

- Multi-Read + Multi-Write scenarios

Ability to change disk properties after disk creation*

*All VMs need to be unmounted

Documentation: aka.ms/azureshareddiskdocs



Supported on Premium SSD, Premium SSD v2 and Ultra Disks

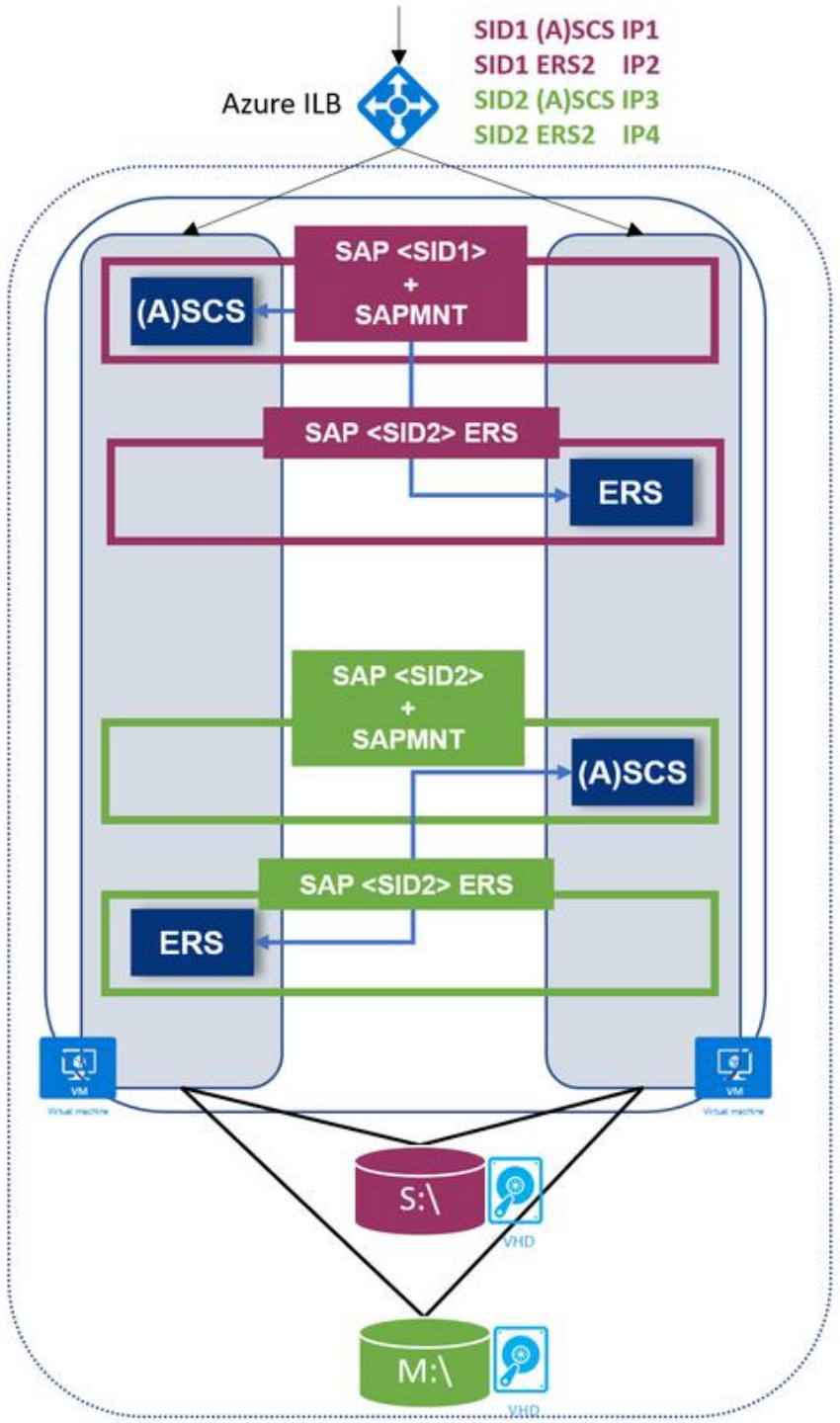
For single-write/multi-read scenarios, Ultra Disks offer ability to scale out horizontal – Enabling customers to provision additional read IOPS for secondary nodes

Watch this deep dive video to learn more about Azure shared disks

Azure Availability Set + PPG

Legend:

Azure shared disks



S:\usr\sap\<SID1>\SYS\...
S:\usr\sap\<SID1>\ASCS<Nr>\...

M:\usr\sap\<SID2>\SYS\...
M:\usr\sap\<SID2>\ASCS<Nr>\...

Create a managed disk

Basics | Encryption | Networking | **Advanced** | Tags | Review + create

Add additional configurations for your managed disk

Shared disk

Allow this disk to be attached to two or more virtual machines, depending on storage type and disk size. When shared disk is enabled host caching is unavailable. Learn more about shared disks

Enable shared disk: (•) Yes ( ) No

Max shares: 2

On-demand bursting

Allow this disk to burst beyond original provisioned target up to 30,000 IOPS and 1,000 Mbps. Learn more

Enable on-demand bursting: [ ]

On-demand disk bursting is not supported with Shared disk. Learn more

Data access authentication mode

Allow Data Access with Azure Active Directory Authentication for disk upload/export. Learn more

Enable data access authentication mode: [ ]

Azure Files – Tiers for Windows workloads

Easily Managed
No managing OS or hardware

Secure
Encryption in transit and at rest. AD DS, Entra DS and **Entra Kerberos** integration. Private endpoints to lock down network access.

Cross Platform
SMB, NFS access for Windows, Linux, and Mac as well as REST API.

Hybrid
Access directly from on prem or via Azure File Sync with on-prem caching.

Standard: Recommended for General purpose
10s of ms latency, 10K IOPS, 300 MBps $0.06/GB Used

Premium: Recommended for Performance Sensitive
Low Latency, 100K IOPS, 10 GBps $0.16/GB Provisioned

General Purpose & Hybrid Access
- Departmental file shares
- Hybrid shares with sync
- Home/user directories such as AVD
- Scratch folders
- Logs Store
- Config Files

DevOps & Backups
- Backups
- Dev/test
- Libraries
- CI/CD Pipeline
- Build Shares
- Tool Shares

Enterprise Apps
- Databases(SQL/MySQL)
- CRM
- LOB Applications
- Web content
- Containers
- Dev cloud platform

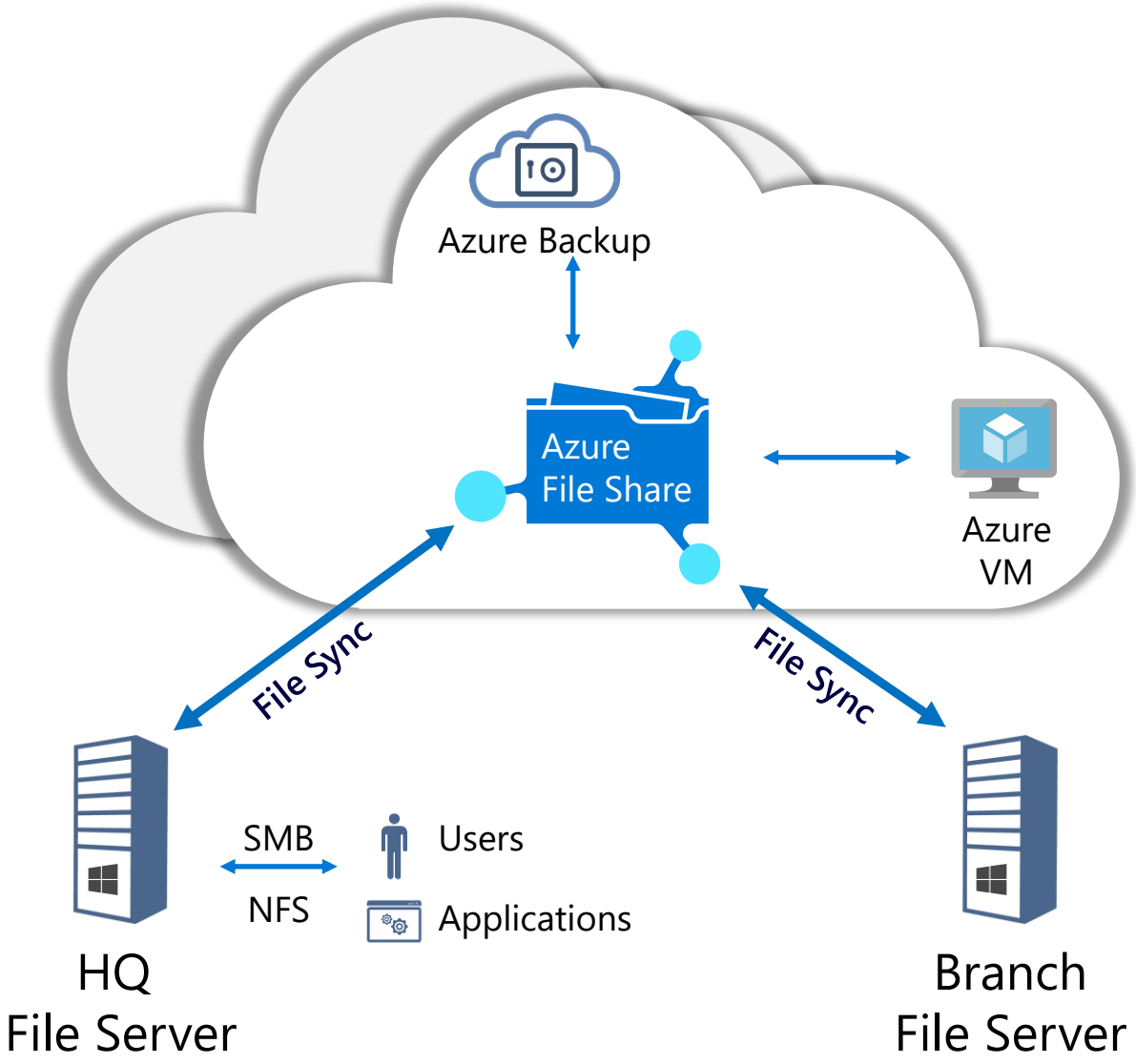
Performance sensitive
- Shared cache
- Media/analytics
- High variable/batch
- Content repositories

Learn more about Azure Files

Hybrid Shares

via Azure File Sync

- Zero Downtime Migration
- Cloud Tiering
- Cloud Access
- Multi-Site Sync
- Cloud Backup



Learn more about Azure File Sync

File Sharing on Azure NetApp Files

On-Premises

Azure

Windows Server 2019
Edge Instance (VM)

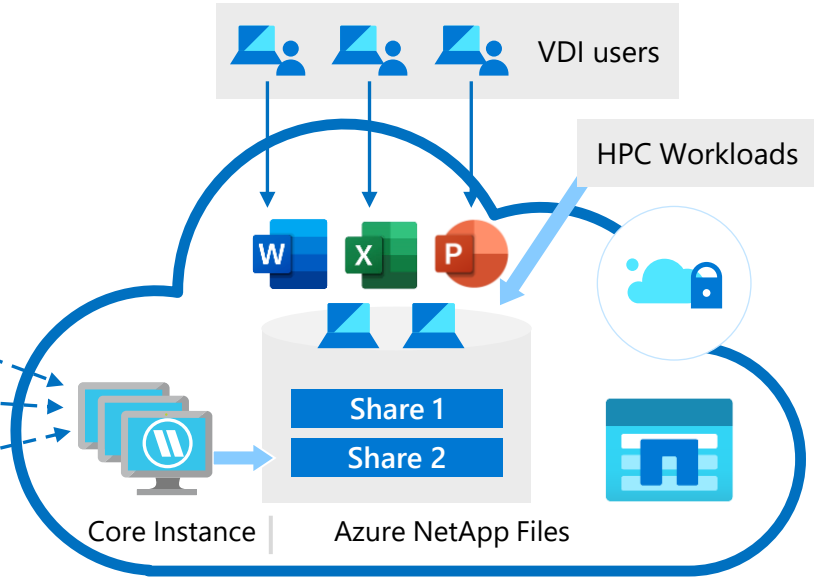
Windows Server 2019
Edge Instance (VM)

Windows Server 2019
Edge Instance (VM)

- ExpressRoute
- Site-to-Site VPN
- Public Internet (SSL)

Direct "In Cloud" Data Access:

- VDI users access data directly on Azure NetApp Files
- HCP workloads can interact directly with Azure NetApp Files



- Managed Storage Platform: **Azure NetApp Files**
- Cloud Storage Platform: **Microsoft Azure**
- File Server Interface : **SMB**
- High Availability: **Scale-out/Load Distribution**
- Compliance: **Cloud Compliance**
- Backup: **Azure NetApp Files Snapshots**

Globally Distributed Enterprise File Sharing with Azure NetApp Files and NetApp Global Files Cache: learn more

SQL Server workloads

Run high-performance SQL Server workloads on Azure

Find the best Azure VM and Disk Storage configuration for your workloads in three steps

1

Determine the requirements of your database workload

Evaluate the nature of your workload to determine the ideal configuration for SQL Server on Azure VMs.

IOPS, throughput, latency and storage size requirements are key decision factors.

You should understand your regional support and high availability requirements.

2

Select your **VMs** to match compute and I/O throughput needs

Choose from a wide variety of virtual machines. For SQL Server production workloads, depending on performance requirements, Ebs, Es, Eas, Ds, Das and Ms series Virtual Machines are **compatible** with Premium SSD, Premium SSD v2 and/or Ultra Disk Storage.

Ebs VM series delivers the best price-performance for SQL Server workloads.

3

Select your **disks** based on storage requirements (I/O throughput)

Azure managed disks currently offers five disk types. Ultra Disk, Premium SSD v2 and Premium sold-state drives (SSD), offer the highest performance.

Ensure the VM series and disk type you select are **compatible** and meet your workload requirements.

Get right-sized Azure VM compute and storage SKU recommendation: https://aka.ms/ads-sql-sku-recommend

SQL Server on Virtual Machines

Best price-performance VM series for OLTP and DW workloads that have a need for high I/O throughput

Up to 120,000 IOPS / 4,000 MB/s;
64 vCPUs, 512 GiB Memory

Ebs VM series

Large SQL Server databases that require high VM-to-Disk Storage IOPS and throughput.

Es and Eas VM series

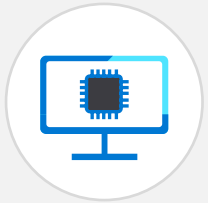
Large relational databases for online transaction processing and business intelligence apps.

Suitable for most **enterprise** OLTP and DW production workloads

Up to 80,000 IOPS / 2,600 MB/s
104 vCPUs
672 GiBs Memory*

Mission critical OLTP/DW workloads requiring a high vCPU and very large memory (highest mem-to-core ratio)

Up to 80,000 IOPS / 2,000 MB/s; 416 vCPUs, 12 TiB Memory



Ms VM series

Large in-memory business critical workloads requiring massive parallel computer power.

Ds and Das VM series

Small to mid-sized SQL Server databases for online transaction processing and analytics.

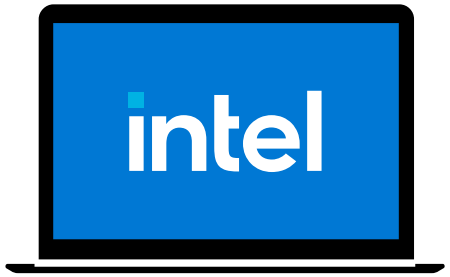
General purpose VM series for **small to mid-sized** OLTP or DW workloads (suitable for **Dev/Test**)

Up to 80,000 IOPS / 2,600 MB/s; 96 vCPUs, 384 GiB Memory

*The isolated instance part of the Ev5 VM-series can deliver up to 4,000 MB/s and 120K IOPS

VM series optimized for data-intensive workloads

Up to 6X increase in remote storage performance compared to Ev4 VMs. Ideal for large databases and data analytics applications.



Ebsv5 and Ebdsv5 – Series

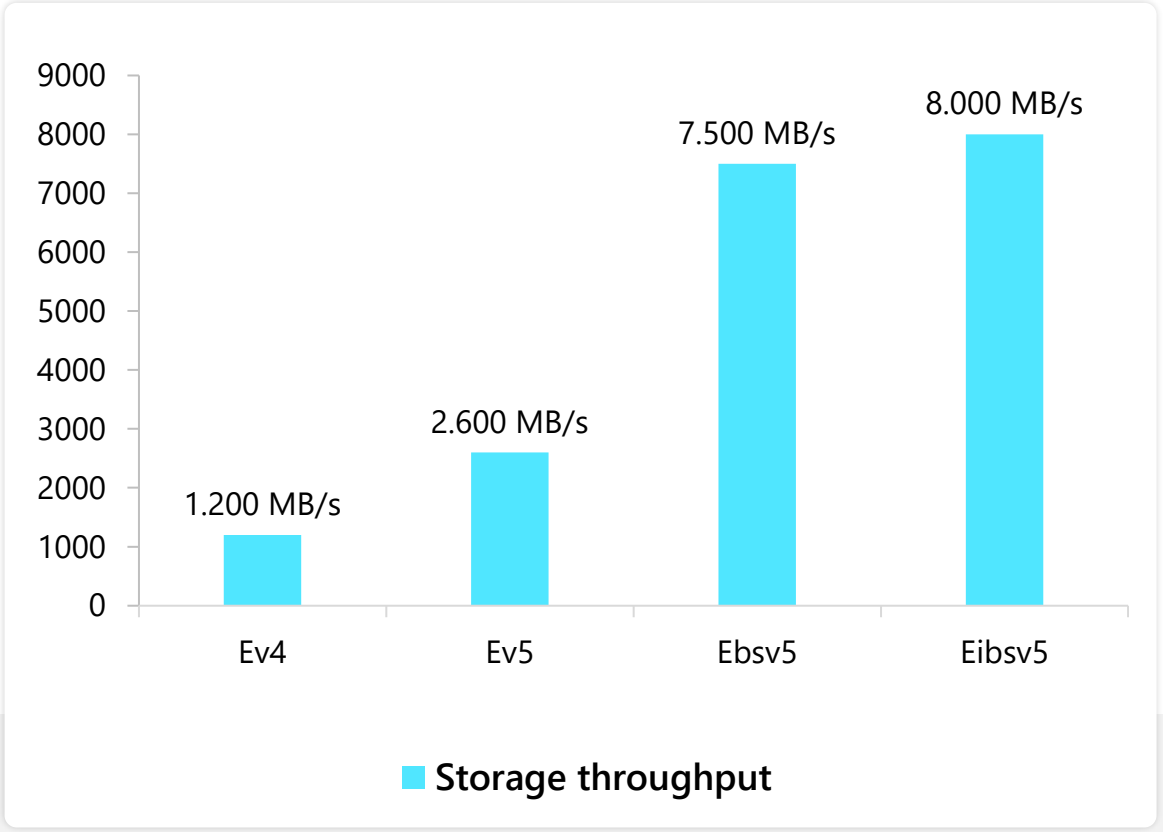
Memory intensive workloads requiring higher storage performance

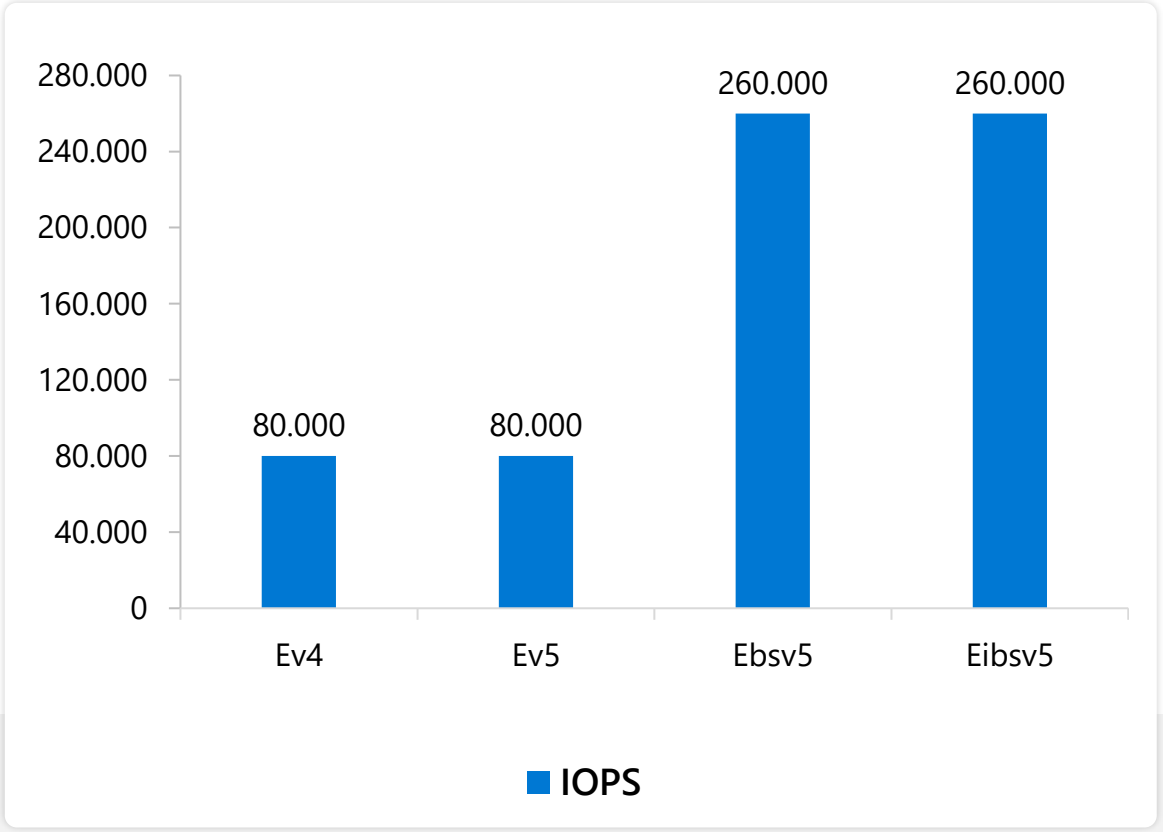
Up to 260,000 IOPS and 8,000 MB/s* of remote disk storage throughput.

From 2 to 112i vCPUs featuring 3rd Generation Intel® Xeon® Platinum 8370C (Ice Lake)

*only available for new E96bs & E112ibs v5 sizes in preview

Increased VM-to-disk max storage throughput and IOPS comparison

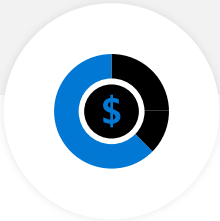




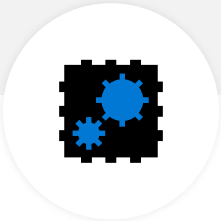
Ebsv5 offers 3x more storage throughput and IOPS than Ev5 VMs and 6x more than Ev4 VMs

Ebsv5 Virtual Machines

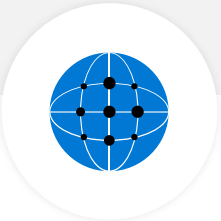
Ebsv5 series specifications with Premium SSD and Ultra Disks



Improved I/O to core ratio offers cost savings for existing constrained core customers.



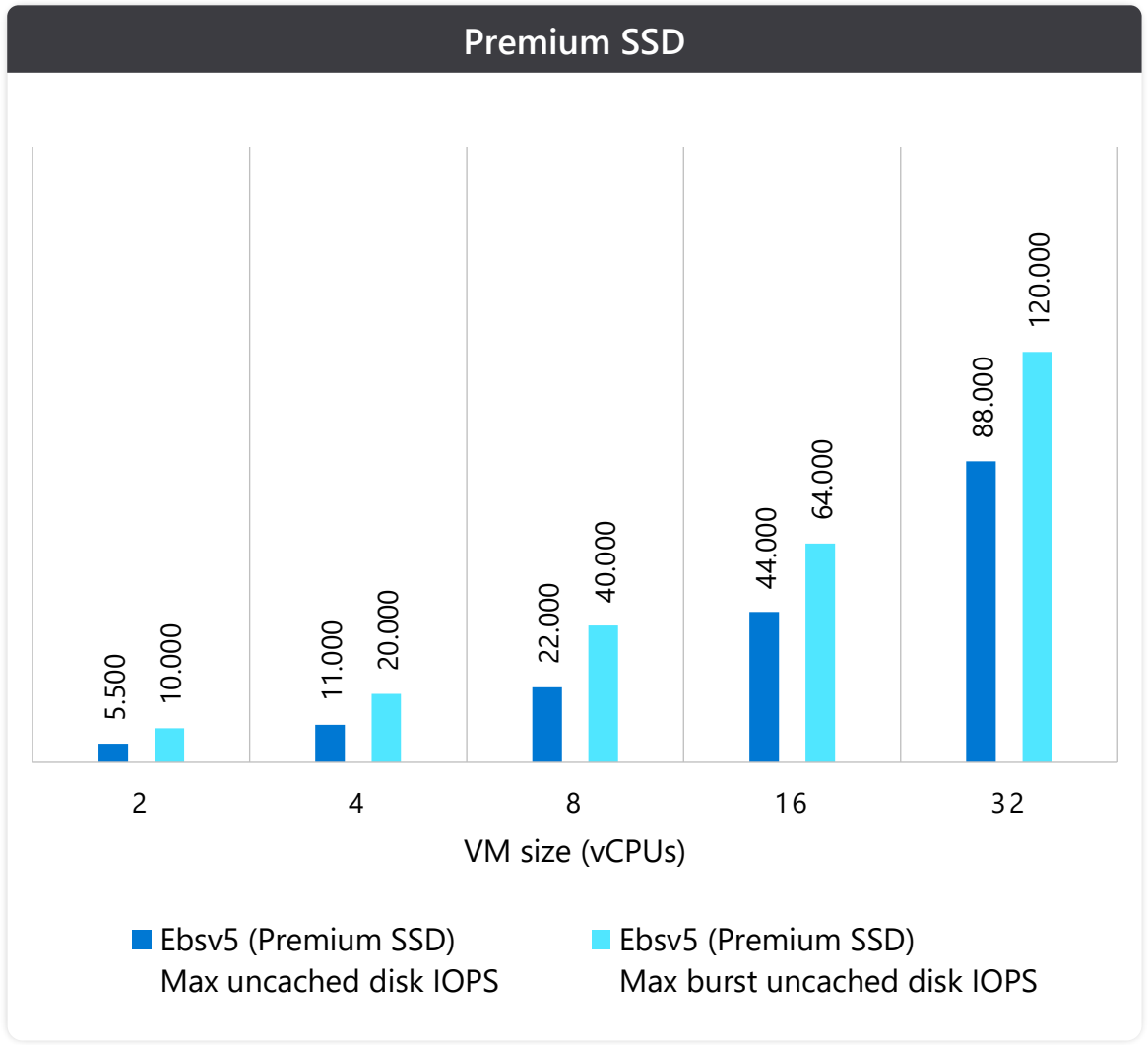
From 2 to 112 vCPUs and Up to 672 GiB of RAM

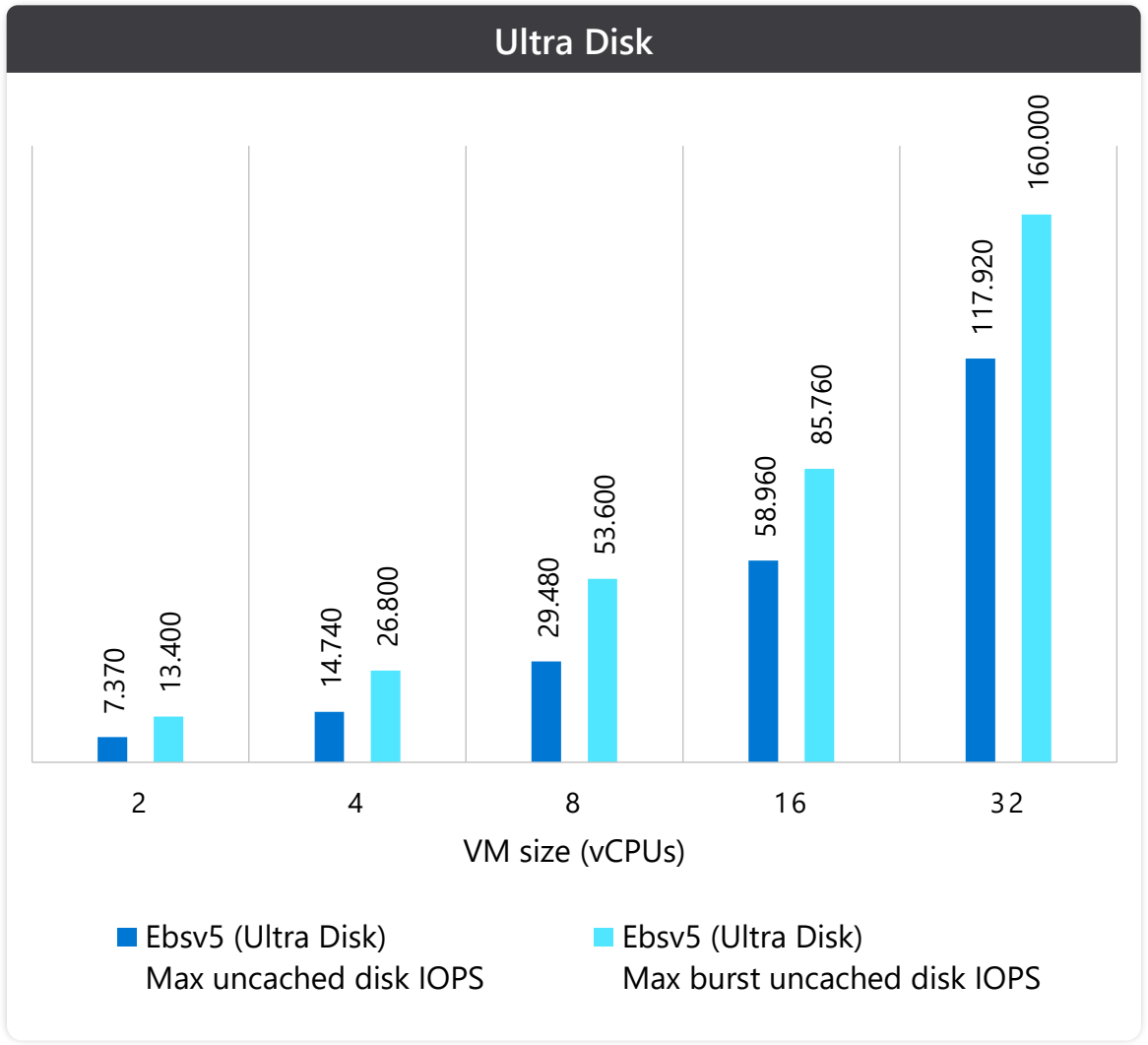


Generally Available: Sizes E2-64vCPU
Public Preview: Sizes E96 and 112i

VM size (vCPU)	**Ev5 (Premium SSD)** Expected uncached disk IOPS/throughput (MBps)	**Ebsv5 (Premium SSD)** Expected uncached disk IOPS/ throughput (MBps)
8	12,800/290	22,000/625
16	25,600/600	44,000/1,250
32	**51,200/865**	**88,000/2,500**
48	76,800/1,315	120,000/4,000
64	80,000/1,735	120,000/4,000
96	80,000/2,600	260,000/7,500

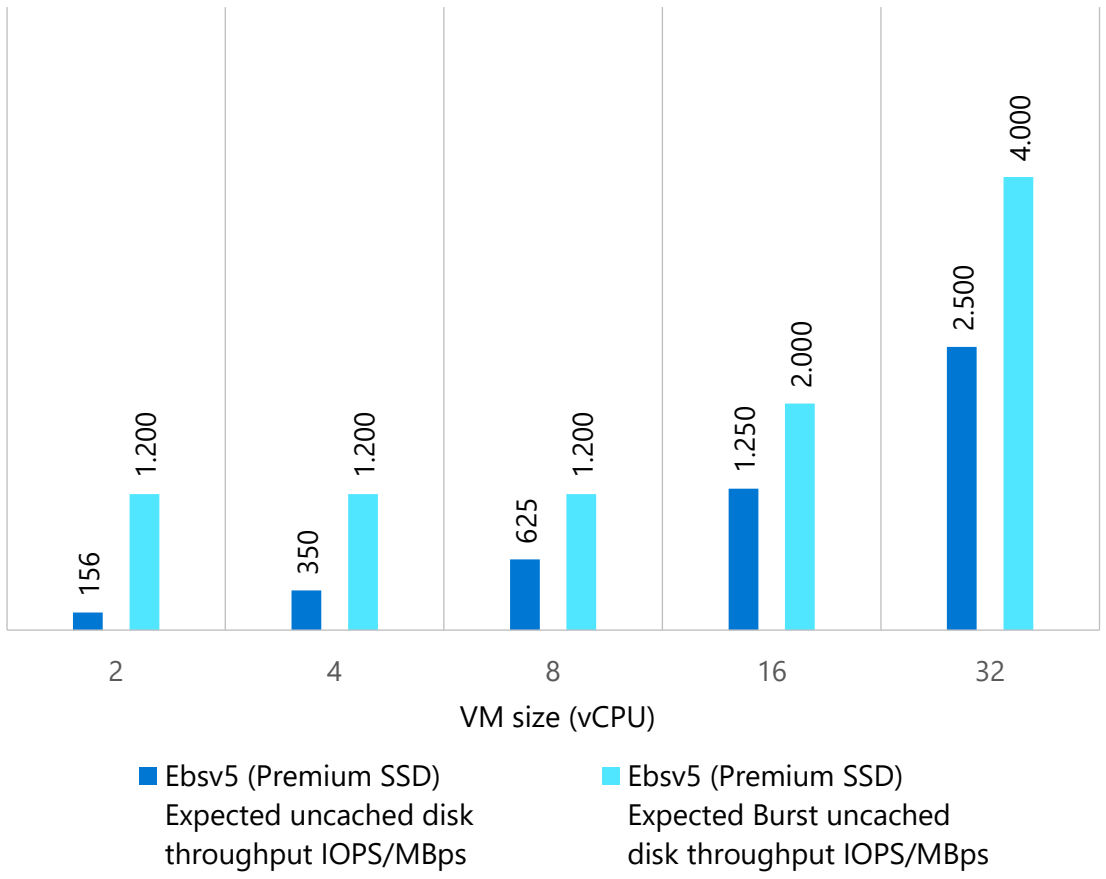
Ebsv5-series burst capabilities (IOPS)



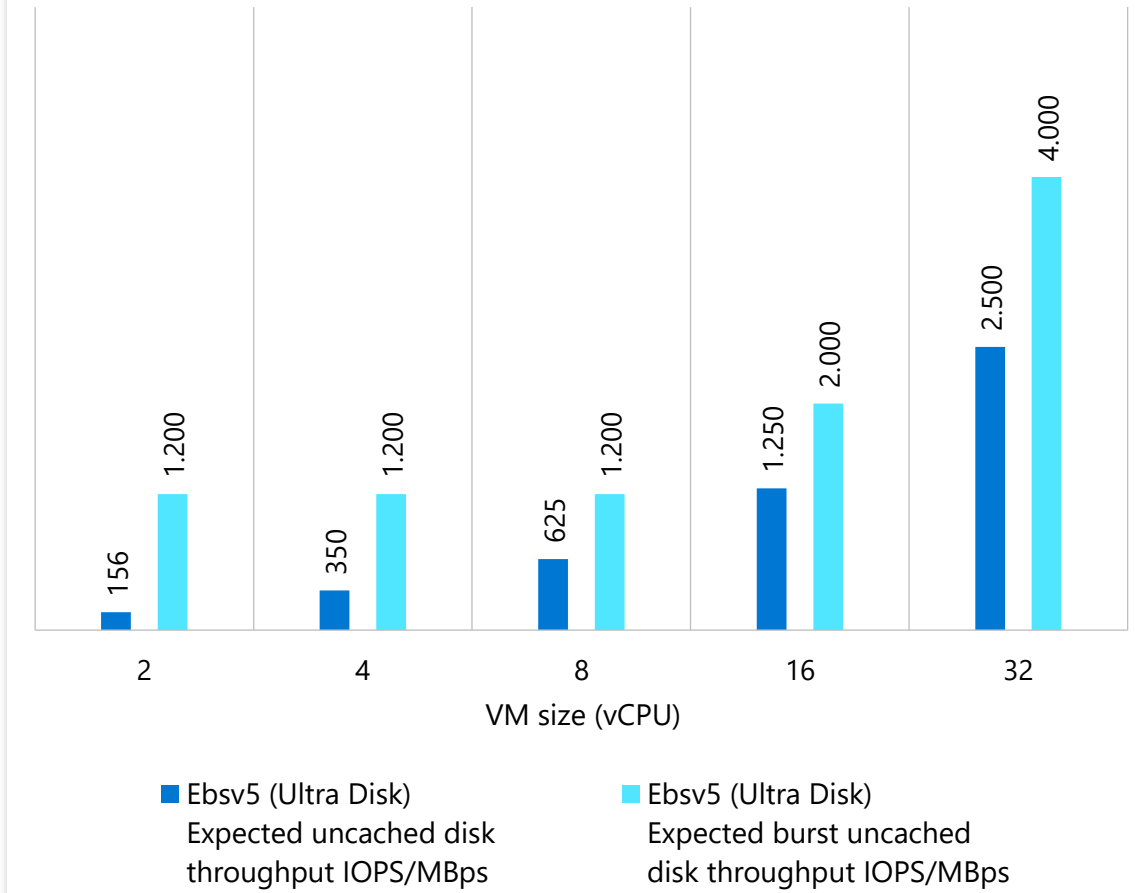


Ebsv5-series burst capabilities (Throughput)

Premium SSD



Ultra Disk



New Ebsv5 VMs with better price-performance

Factors	E64s_v4	E48s_v5	E16bs_v5
Throughput Requirement 1200MBps	1,200MBps	1,315MBps	1,250MBps
Monthly Compute Cost (West US 2)	$2,943.36	$2,207.52	$870.16
vCPU savings	N/A	16 vCPUs	48 vCPUs
Savings in compute cost vs. Ev4		25%	70%

Azure Storage options For SQL Server

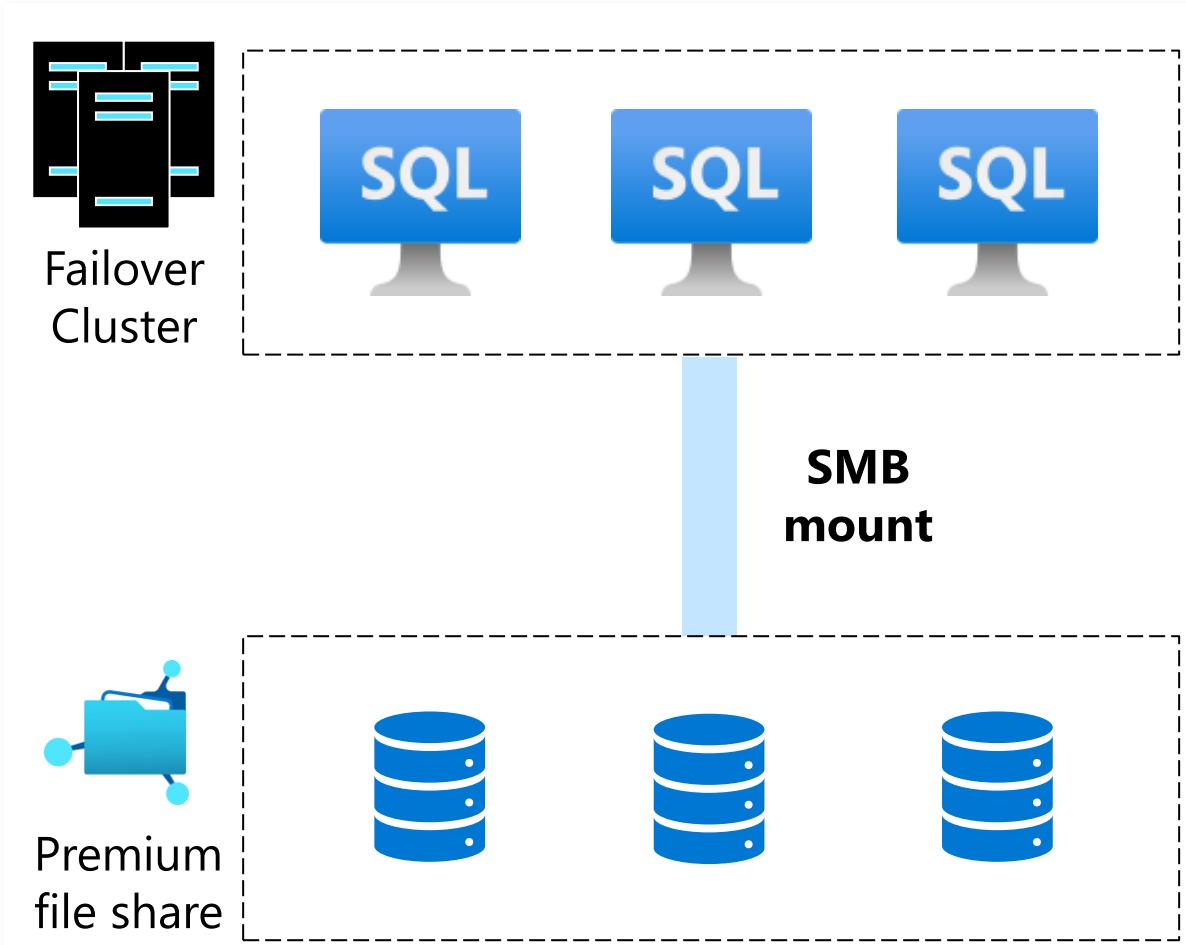
Microsoft Azure

Azure Disk Storage for *every* SQL Server workload

• Recommended for production workloads •

	Azure Disk – Optimized for Virtual Machines					Azure Elastic SAN (Preview)	
	Standard HDD	Standard SSD	Premium SSD	Premium SSD v2	Ultra Disk	Elastic SAN	
	Low-cost storage	Consistent performance	High performance	Sub-millisecond latency	Low sub-millisecond latency	Cost efficiency at scale	
Workloads	Backups, low end file server, test and dev	Big Data, entry-level apps, small DBs, Web Servers	IO-intensive, database, production workloads, container volumes	SAP HANA, SAN, Tier-1 workloads	SAP HANA, SAN, Tier-1 workloads	Tier 1 and 2 workloads, Databases, VDI hosted on any Compute options (VM, Containers, AVS*)	
Single disk max value						**Volume**	**SAN**
Size	32 TiB	32 TiB	32 TiB	64 TiB	64 TiB	64 TiB	1 PiB
IOPS	2,000	6,000	20,000 (**burst to 30,000**)	80,000	160,000	64,000	2,000,000
Throughput	500 MB/s	750 MB/s	900 MB/s (**burst to 1,000 MB/s**)	1,200 MB/s	4,000 MB/s	1,000 MB/s	32,000 MB/s
Provisioning model	Performance scales with capacity	Performance scales with capacity	Performance scales with capacity	Flexible scaling at 1GiB granularity	Flexible performance scaling	Per GiB provisioning granularity	Flexible model at TiB granularity

SQL FCI with premium file shares



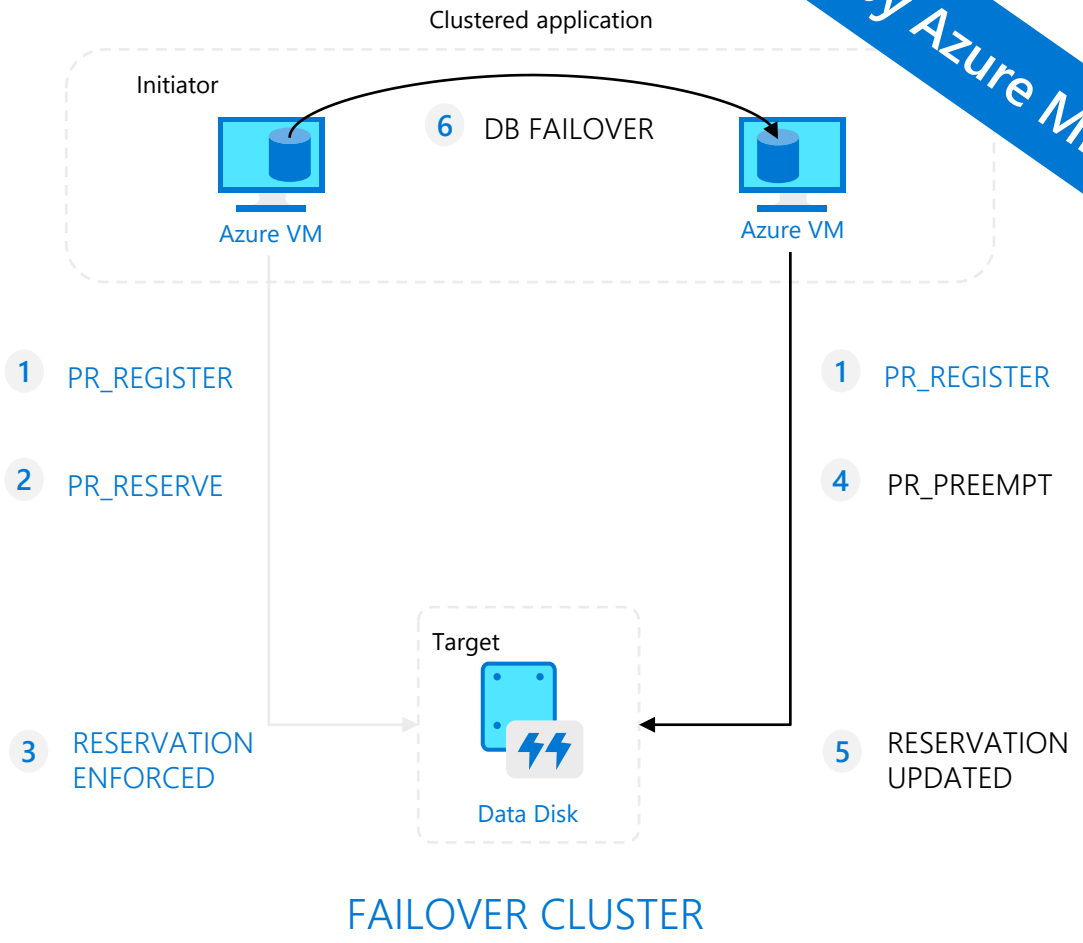
Key Benefits

- Fully managed storage with simple provisioning and management
- Scale up & down with zero downtime
  - Resize capacity and increase IOPS in seconds
  - Built-in bursting allows IOPS to triple for up to one hour
- Share storage & IOPS across many SQL servers.
- Zonal Redundancy
- Ideal for **low to mid range performance** requirements and larger databases
- Well suited when data capacity is growing fast, leading to regular resizing or variable IOPS needs
- Documentation: aka.ms/PfsSqlFci

SQL Server Failover Cluster Instance on Azure Shared Disk

Now supported by Azure Migrate

- Preferred storage for SQL Server FCI implementations
- Enables lift and shift of on-premises deployments
- Built for Windows Server/SQL Server 2008+
- Leverages Windows Server Failover Cluster (WSFC) for cluster management/disk arbitration
- Supports Premium SSD, Premium SSD v2 or Ultra Disk
- Supports disk/cloud/fileshare witness
- Supports disk striping via Windows Server Storage Spaces for performance
- Supports Availability Sets
- Supports zonal redundancy in select regions



[Step-by-step tutorial to configure SQL Server FCI with Azure Shared Disk]

Azure NetApp Files for Windows Servers and SQL Workload

	RECOMMENDED for File Shares	RECOMMENDED for Database and High-Performance File Shares		
	Standard	**Premium**	**Ultra**	
	Throughput comparable to mainstream HDD	*Throughput comparable to mainstream SSD*	*Throughput comparable to high end Flash Arrays*	
Throughput	16MiB / s per 1TiB	64MiB / s per 1TiB	128MiB / s per 1TiB	*Up to 4,500MiB / s per volume*
IOPS (4K I/O size)	4,000 per 1TiB	16,000 per 1TiB	32,000 per 1TiB	*Up to 375,000 IOPS per volume*
Price	$ 0.15 per GiB / month	$ 0.30 per GiB / month	$ 0.40 per GiB / month	

Performant	Simple to Manage	Secure and compliant
SMB 3.1, SMB 2.1, NFS v4.1 and NFS v3	Provision bare-metal-based volumes in minutes	FIPS-140-2 data encryption at rest
SMB 3.1 multichannel w/ receive-side-scaling (RSS)	Instantaneous snapshots & restore	RBAC, AD authentication, and export policies for network-based ACLs
High availability: 99.99% SLA	Cross region volume replication	HIPAA, FedRamp High/Commercial, FedRamp High US Gov, SOC, IRAP, ISO (27001, 27017, 27018,27701), IL4/IL5 US Gov, HITRUST, PCI DSS
	Built-in backup to object storage through ANF	

Azure NetApp Files SMB Performance: learn more here | Deploy SQL on Azure NetApp Files: learn more here

SQL Server on IaaS Benchmarking

SQL Transaction Processing and Analytic Performance Price-Performance Testing v1.0

Microsoft SQL Server Evaluation: Azure vs. Amazon Web Services

Cloud	AWS	Azure
Database	SQL Server 2019 Enterprise on Windows Server 2019 Datacenter	SQL Server 2019 Enterprise on Windows Server 2022 Datacenter
Build*	Microsoft SQL Server 2019 (RTM-CU12) (KB5004524) - 15.0.4153.1 (X64) Jul 19 2021 15:37:34 Enterprise Edition: Core-based Licensing (64-bit) Windows Server 2019 Datacenter 10.0 <X64> (Build 17763) (Hypervisor)	Microsoft SQL Server 2019 (RTM-CU15) (KB5008996) - 15.0.4198.2 (X64) Jan 12 2022 22:30:08 Enterprise Edition: Core-based Licensing (64-bit) Windows Server 2022 Datacenter 10.0 <X64> (Build 20348) (Hypervisor)
Region	Oregon	North Central US
Instance Type	r5b.8xlarge	E32bds_v5
vCPU	32	32
RAM (GiB)	256	256
Storage Configuration	5x 2TB gp3 (14,733iops 420MB/s) data 1x 1TB gp3 (10,000iops 200MB/s) log 1x 0.5TB gp3 (3000iops 200MB/s) root	16x P30 1TB (5,000iops 200MB/s) data (read-only cache); 2x P30 1TB (5,000iops 200MB/s) log (no cache)
Total IOPS	86,667	90,000

Source: GigaOm 2022

Benchmarks

- **Gigaom Transactional Field Test** – Derived from TPC Benchmark™ E (TPC-E), simulates brokerage with central database. Data model consists of 33 tables, 27 of which have 50 foreign key constraints. Database scaled to 1 million customers.
- **Gigaom Analytical Field Test** – Informed by the TPC Benchmark™ H (TPC-H) spec validation queries

Test setup

- **Gigaom Transactional Field Test** – SQL VM E32bds_v5 vs AWS EC2 r5b.8xlarge. 3 test runs, min 2 hrs each, avg tps from the last 30 min of the test runs
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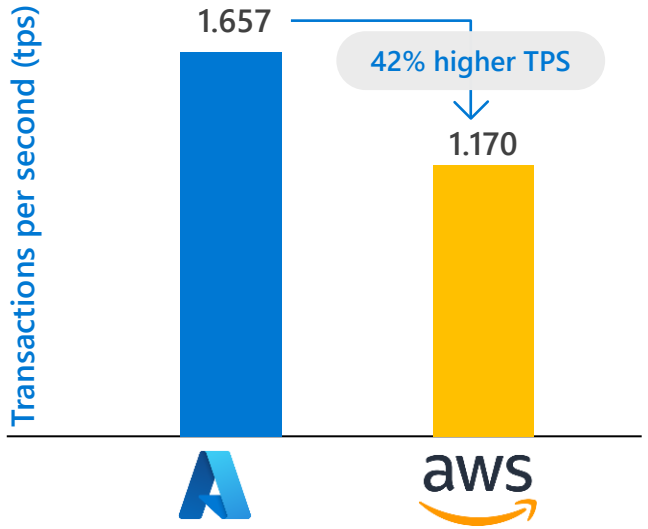
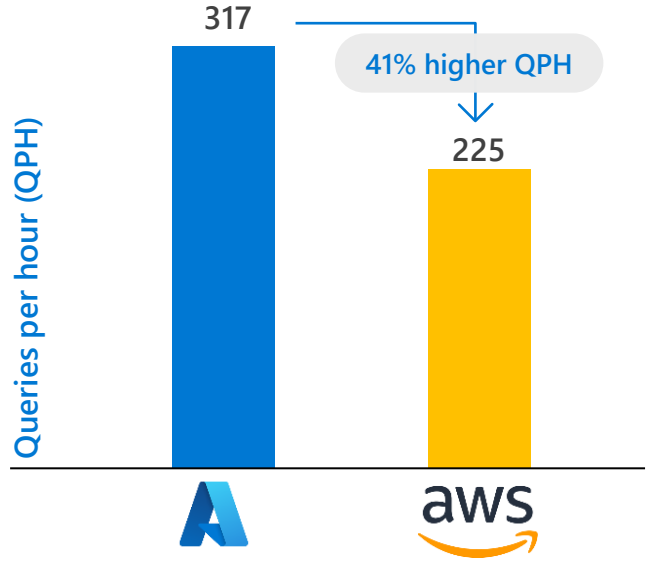
SQL Server on Azure Virtual Machines meets your mission-critical requirements up to 42% faster than AWS EC2

SQL Server on Azure VM vs SQL Server on AWS EC2
GigaOm Transactional Field Test
Azure E32bds_v5 vs AWS EC2 r5b.8xlarge
April 2022



Database performance comparison. Higher is better.

SQL Server on Azure VM vs SQL Server on AWS EC2
GigaOm Analytics Field Test
Azure E32bds_v5 vs AWS EC2 r5b.8xlarge
April 2022



Database performance comparison. Higher is better.

Read the full report from GigaOm

Source: GigaOm

Price-performance claims based on data from a study commissioned by Microsoft and conducted by GigaOm in April 2022. The study compared price performance between SQL Server 2019 Enterprise edition on Windows Server 2022 in Azure E32bds_v5 instance type with P30 Premium SSD disks and SQL Server 2019 Enterprise Edition on Windows Server 2022 in Amazon Web Services Elastic Cloud Compute instance type r5b.8xlarge with General Purpose (gp3) volumes. Benchmark data is taken from two tests:

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The GigaOm Analytics Field test derived from the TPC-H Benchmark. The field test does not implement the full TPC-H benchmark and as such is not comparable to any published TPC_H benchmarks.

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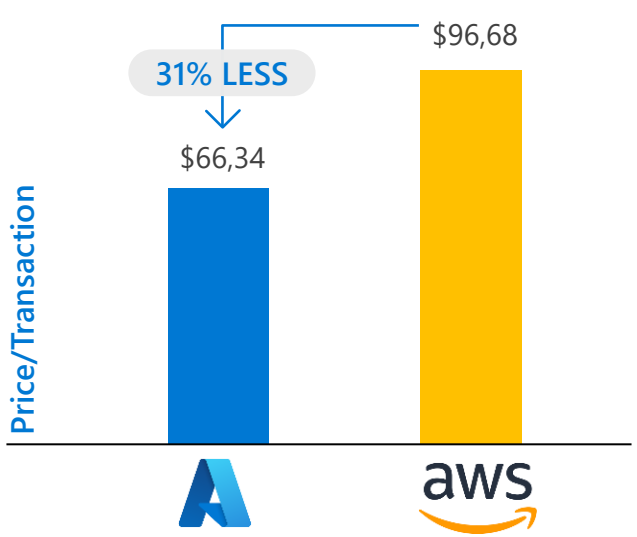
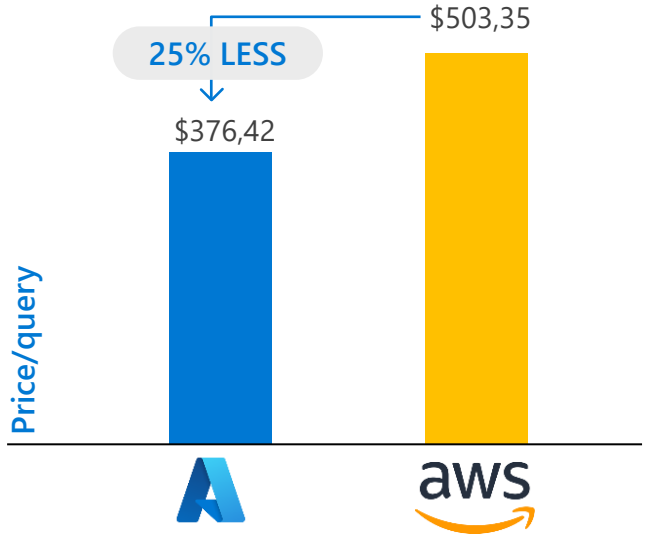
SQL Server on Azure Virtual Machines meets your mission-critical requirements – Costing up to 31% less than AWS EC2

SQL Server on Azure VM vs SQL Server on AWS EC2
GigaOm Transactional Field Test
Azure E32bds_v5 vs AWS EC2 r5b.8xlarge
April 2022



Price performance comparison. Lower is better.
Includes Azure Hybrid Benefit + 3-yr commitment

SQL Server on Azure VM vs SQL Server on AWS EC2
GigaOm Analytics Field Test
Azure E32bds_v5 vs AWS EC2 r5b.8xlarge
April 2022



Price performance comparison. Lower is better.
Includes Azure Hybrid Benefit + 3-yr commitment

Read the full report from GigaOm

Source: GigaOm

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SQL Transaction Processing and Analytic Performance Price-Performance Testing v1.0

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Cloud	AWS	Azure
Database	SQL Server 2019 Enterprise on Windows Server 2019 Datacenter	SQL Server 2019 Enterprise on Windows Server 2022 Datacenter
Build*	Microsoft SQL Server 2019 (RTM-CU12) (KB5004524) - 15.0.4153.1 (X64) Jul 19 2021 15:37:34 Enterprise Edition: Core-based Licensing (64-bit) Windows Server 2019 to Windows Server 2022 Datacenter 10.0 <X64> (Build 17763) (Hypervisor)	Microsoft SQL Server 2019 (RTM-CU18) (KB5017593) - 15.0.4261.1 (X64) Sep 28 2022 Enterprise Edition: Core-based Licensing (64-bit) Windows Server 2022 Datacenter 10.0 <X64> (Build 20348) (Hypervisor)
Region	Oregon	East US
Instance Type	r5b.8xlarge	E32bds_v5
vCPU	32	32
RAM (GiB)	256	256
Storage Configuration	5x 2TB gp3 (14,733iops 420MB/s) data 1x 1TB gp3 (10,000iops 200MB/s) log 1x 0.5TB gp3 (3000iops 200MB/s) root	Premium SSD v2 2x 1TB (60,000 iops 1,200 MB/s) data + 1X 1TB (10,000 iops 120 MB/s) log
Total IOPS	86,667	130,000
Source: GigaOm 2023		

Benchmarks

- **GIGAOM TRANSACTIONAL FIELD TEST** – derived from TPC Benchmark™ E (TPC-E), simulates brokerage with central database. Data model consists of 33 tables, 27 of which have 50 foreign key constraints. Database scaled to 1 million customers.
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Test setup

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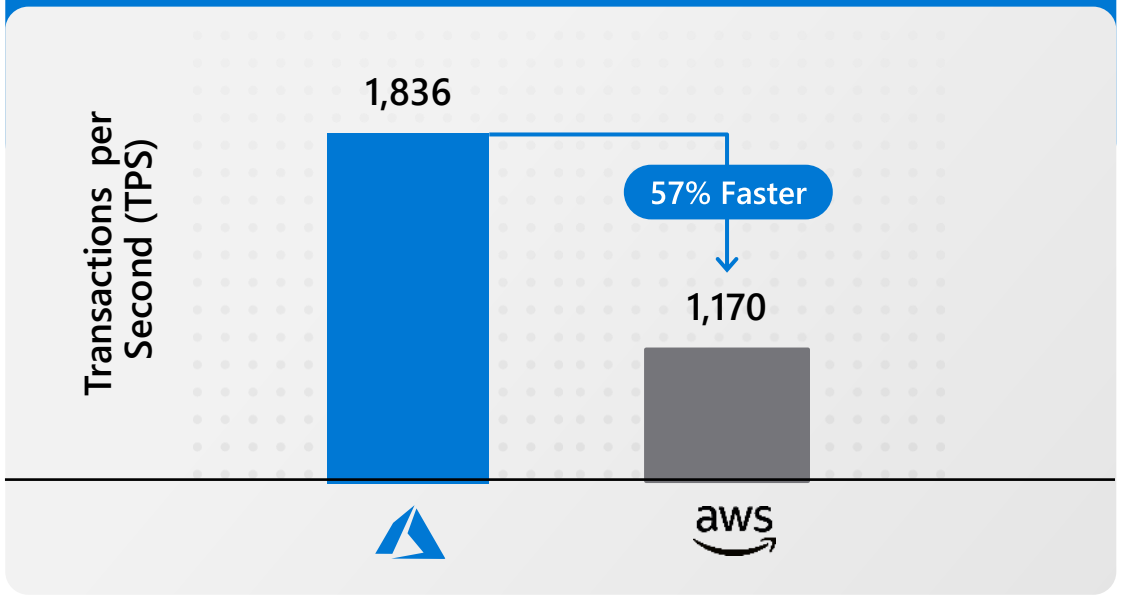
- **GIGAOM ANALYTICAL FIELD TEST** - SQL VM E32bds_v5 vs AWS EC2 r5b.8xlarge. 3 test runs, captured best result overall

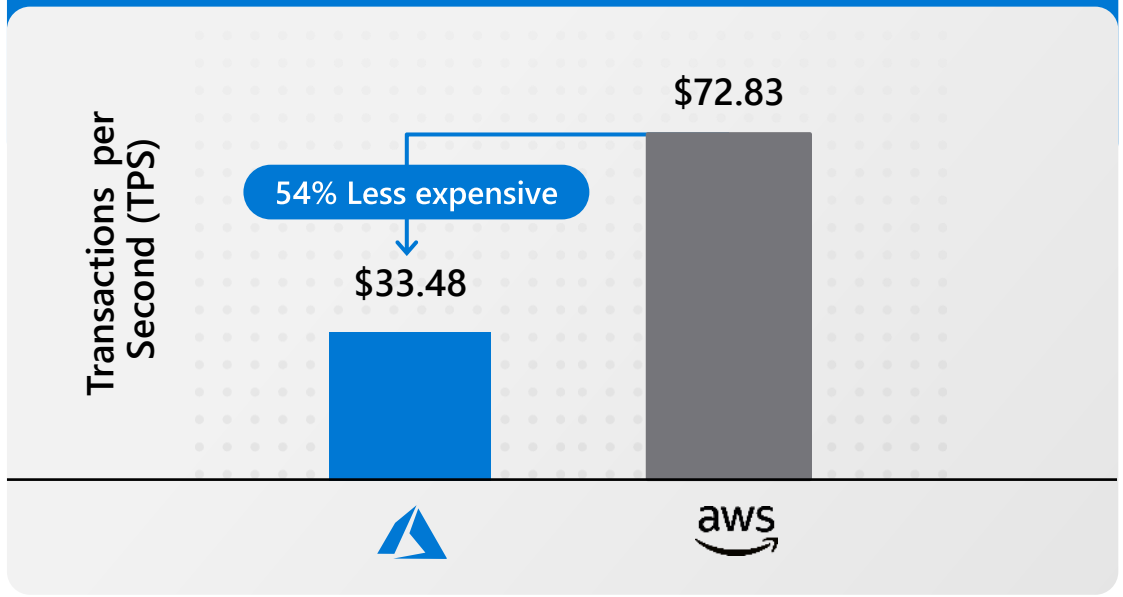
SQL Server on Azure Virtual Machines meets your mission-critical requirements up to 57% faster than AWS EC2

Transactions Per Second: Azure Premium SSD v2 Managed Disks vs. AWS EBS General Purpose SSD (gp3). Higher is better.



SQL Server on Azure Virtual Machines meets your mission-critical requirements – costing up to 54% less than AWS EC2

Price-Performance Transactions per Second: Windows 2022 Azure VMs vs. AWS Windows Server 2019 VMs with Azure Hybrid Benefit and a 3-year commitment. Lower is better.



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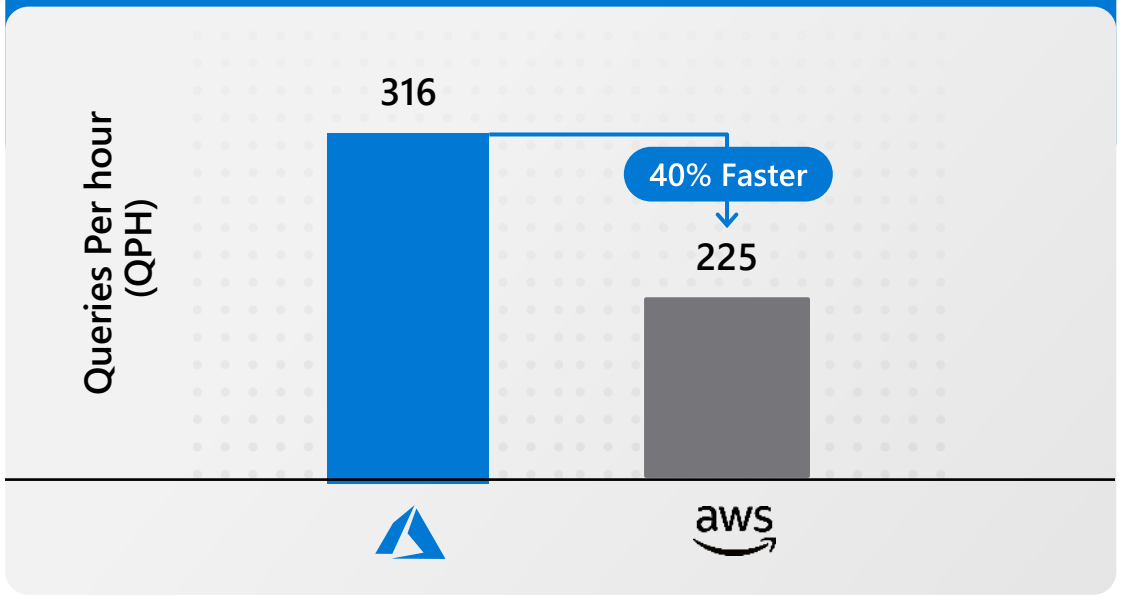
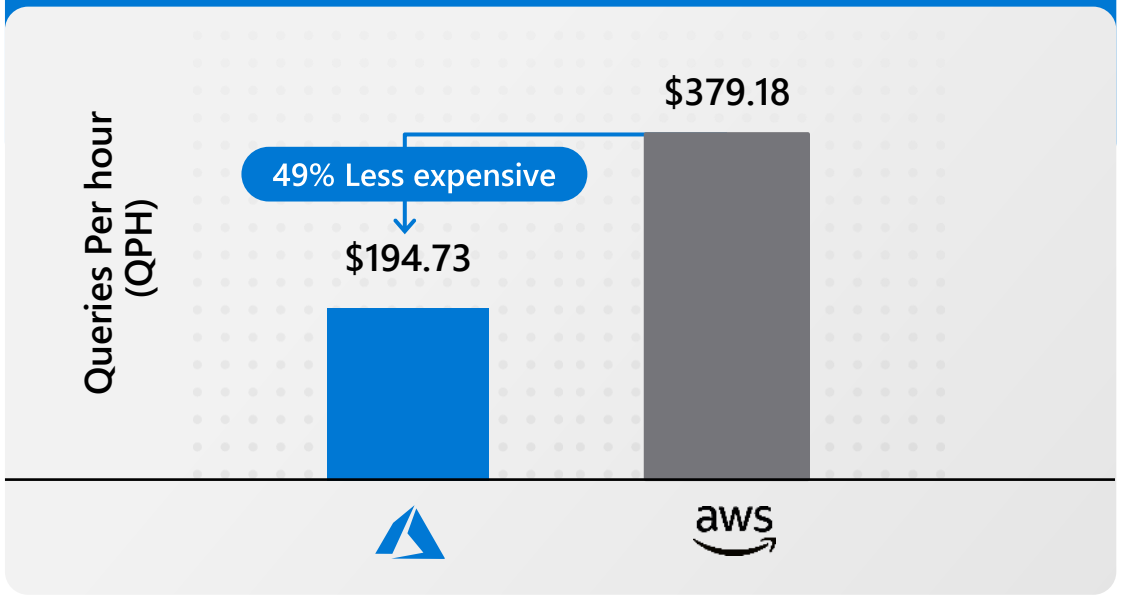
SQL Server on Azure Virtual Machines meets your mission-critical requirements up to 40% faster than AWS EC2

Queries per Hour: Azure Premium SSD v2 Managed Disks vs. AWS EBS General Purposes SSD (gp3). Higher is better.



SQL Server on Azure Virtual Machines meets your mission-critical requirements – costing up to 49% less than AWS EC2

Price-Performance, Queries per Hour: Windows 2022 Azure VMs vs. AWS Windows Server 2019 VMs with Azure Hybrid Benefit and a 3-year commitment. Lower is better.



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BCDR Considerations

Backup SQL Server databases running in Azure VM

App-consistent backups are generated using managed disk snapshots and/or stream-based backups based on the RPO/RTO

ALL databases

(including SQL Server)

Use Azure VM backup solution to generate Application-consistent snapshot backups.

(Auto) coordination with VSS to quiesce all VSS-aware apps (databases)

Database specific pre/post-scripts **to be written by the user** to freeze and thaw the application.

Use specially devised end-to-end backup solution for better RPO and RTO (recommended for production workloads)

High fidelity stream-based backups: Full / copy-only Full / differential / incremental / log backups are streamed using VDI stream for SQL and 'backint' for HANA.

Self service restores with 15 mins RPO: Trigger point-in-time restores, without having to manually apply a chain of logs over differential and full backups.

Database level protection: Granular control with database level backup/restores with an option to automatically protect all the **existing and incoming** DBs in a server.

Long-term retention in standard or archive tier: Retain backups for 10 years+ with recovery points getting pruned automatically by the **built-in lifecycle management**, while maintaining dependencies amongst backups.

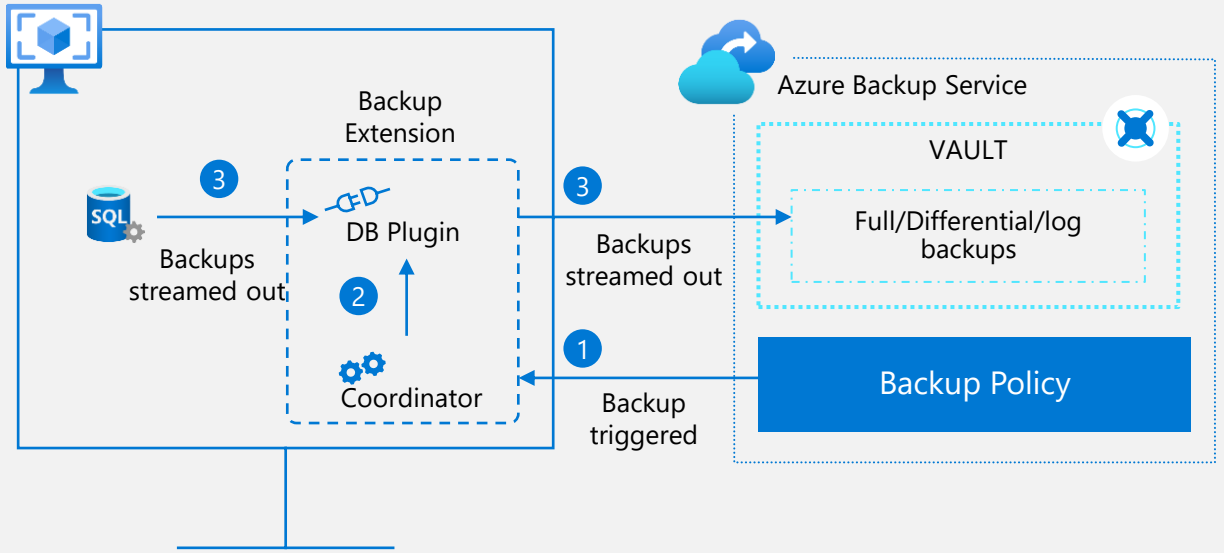
Restore anywhere: Restore as **.bak** files to a network share to port the backup data across Azure subscriptions or regions and even to an on-prem server.

Backup Databases in Azure VM | Stream-based

Backups are streamed out from the database engine and written to the Azure Backup managed storage.

	SQL Server
Supported DB and OS versions	• SQL Server 2008 and above • Windows Server 2008 R2 and above
Supported deployment	• Standalone Azure VMs, • SQL Always on availability group • SQL FCI – To be added soon
***Performance**	200 MBps
Key call outs	• All recovery models • SQL native compression • TDE encrypted DBs backup • In-built checksum used • SQL sys-admin permission required for backups

**The actual speed depends on the underlying disk(s) and VM throughput along with the number of backups running at a time.*



- The backup extension gets temporary access to write to specific blobs. In this way, even in a compromised environment, existing backups can't be tampered with or deleted by the guest.
- Stream-based db backup solution should not be used along with any other backup solution to prevent lsn breaks. However, Azure VM backup can be used along with them

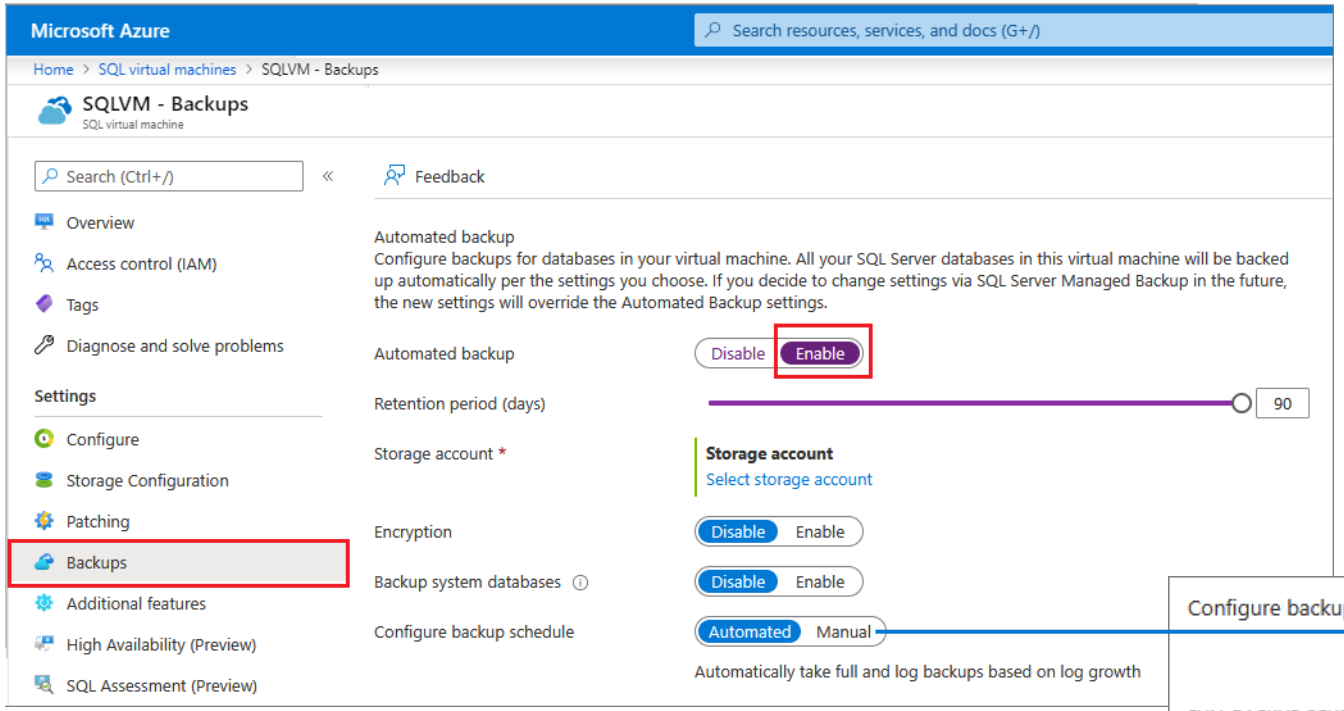
SQL VM backup- Demo Video

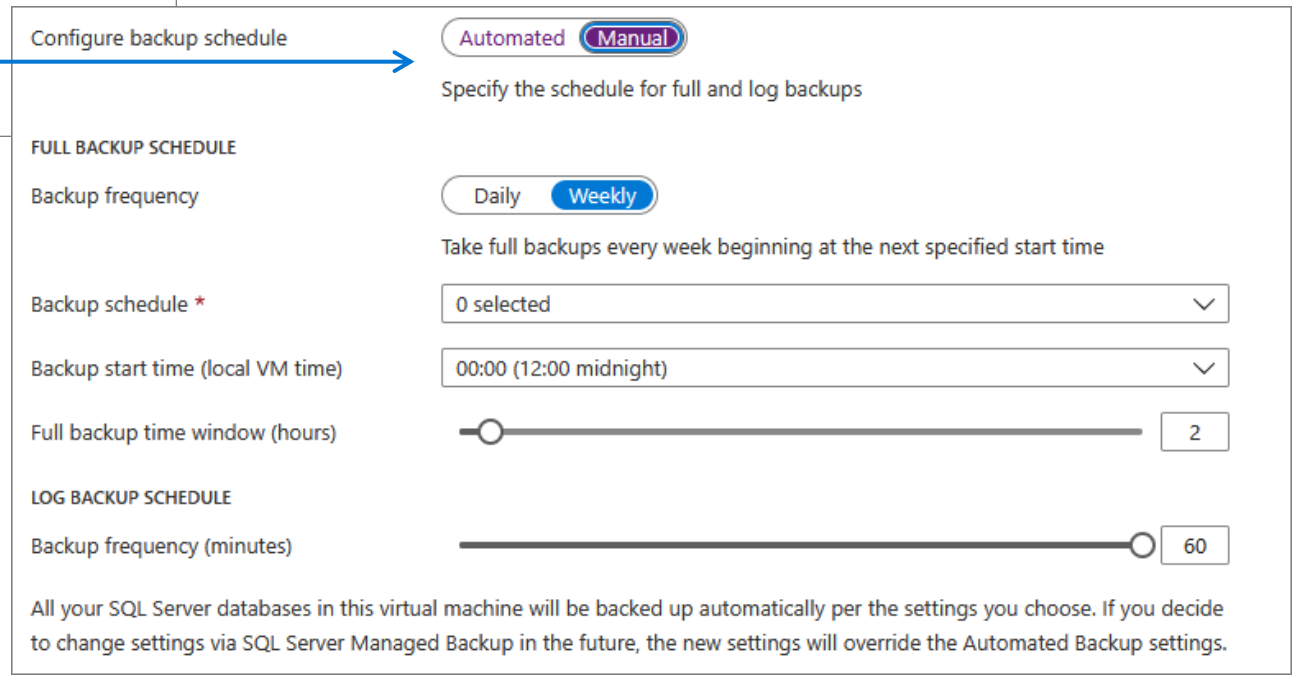
Backup options for SQL Server in Azure VMs

While Azure Backup is an enterprise-class backup solution that comes at a 'backup' management price, there are other backup solutions in Azure as well. It is recommended that you compare the capabilities amongst them and pick the one that meets your requirements the best.

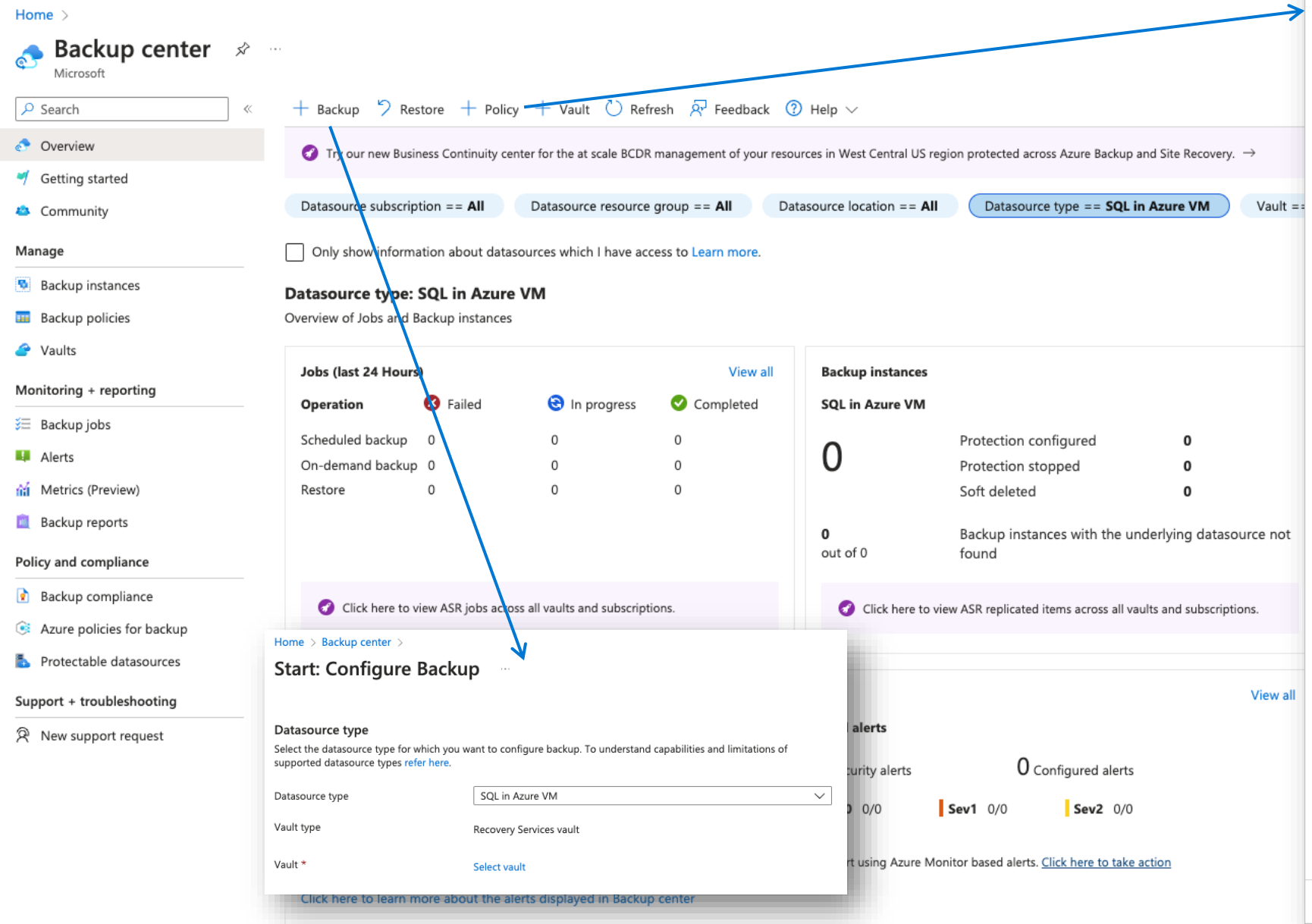
Capability	Automated Backup (Managed Backup)	Azure Backup	Manual Backup (inc. Backup to URL)
DB and OS versions supported	SQL Server 2014 and above	SQL Versions: All Win version: 2008 (64 bit), 12, 16, 19	All (inc. SQL on-prem)
Max DB Size	12 TB	• 6TB-8TB for stream-based backups • ~50TB for snapshots	No Limit (12.8 TB for Backup to url)
Max Retention	30 days	10 years+ (with Archive tier support)	No Limit (with archive tier)
Availability Group Awareness	No	Yes	Configurable
RPO	5 min	15 min	No Limit
Pricing	Storage fee only	Backup management fee + Storage consumed	Storage fee only
(out of the box) Central management and monitoring	No	Yes	No
Available interface/tools	Azure Portal, ARM, PS, CLI	Azure Portal, PS	T-SQL, SSMS
Granularity (backup and restore)	SQL Server instance level	• SQL database level • Backup can also be configured at server level with option to Restore individual DBs.	SQL database level

Automated Backup → Storage Account (SQL VM Setting)





Azure Backup → Backup Vault (Azure Backup Center Configuration)



Backup policy

Policy name *

Backup schedule

Frequency * Time * Timezone *

Daily | 11:00 AM | (UTC) Coordinated Universal Time

Instant Restore

Retain instant recovery snapshot(s) for

2 Day(s)

Retention range

Retention of daily backup point.

At For

11:00 AM 180 Day(s)

Retention of weekly backup point.

On * At For

Sunday 11:00 AM 12 Week(s)

Retention of monthly backup point.

Week Based | Day Based

On * Day * At For

First Sunday 11:00 AM 60 Month(s)

Retention of yearly backup point.

Week Based | Day Based

In * On * Day * At For

January First Sunday 11:00 AM 10 Year(s)

Azure Backup service creates a separate resource group to store the instant recovery points of managed virtual machines. T
naming format of resource group created by Azure Backup service is AzureBackupRG_{Geo}_{n}. It is optional to customize t
per your requirement. Learn More

Azure Backup Resource Group (Optional)

Enter the name n Suffix (Optional)

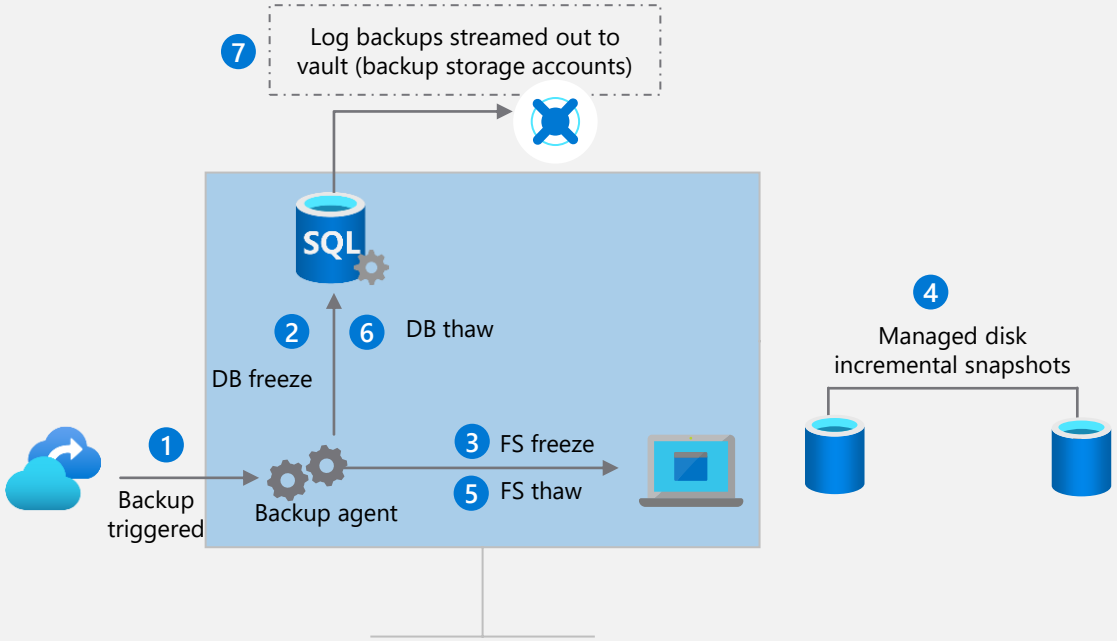
OK

PREVIEW

Backup Databases running in Azure VM | Snapshot-based

Large databases are effectively backed up using a combination of app-consistent, managed-disk incremental snapshots along with the log backups

- Recommended for large databases (6-8 TB+) to make backup a low performance impacting activity and improve backup and restore speeds.
- Snapshots happen in a matter of seconds and since they are incremental in nature, they ensure cost efficiency.
- Snapshots provide instant restore where disks could be created immediately from snapshots stored in the customer's subscription and then attached to the target VM.
- Log backups (streamed every 15 mins) are applied on top of these restored snapshots.



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Extend your BCDR strategy with our trusted partner ecosystem

Backup data/apps to Azure as an offsite

Eliminate storage/**tapes** on-premises

Backup securely to Azure with online and offline mechanisms

Store cost-effectively in Azure Storage

Store data on durable and secure Azure Blob Storage for $1/TB

Scale to PBs of data, when you need it

Optimize for cost and RTO with **Hot, Cool, Cold or Archive** tiers

Save up to 40% on long-term retention with Reserved Capacity pricing

Use Azure as a cost-effective DR site

Restore data & apps to Azure (Failover) during DR

Orchestrate DR Drills without provisioning infrastructure

Clone on-premises production environments for test/dev scenarios

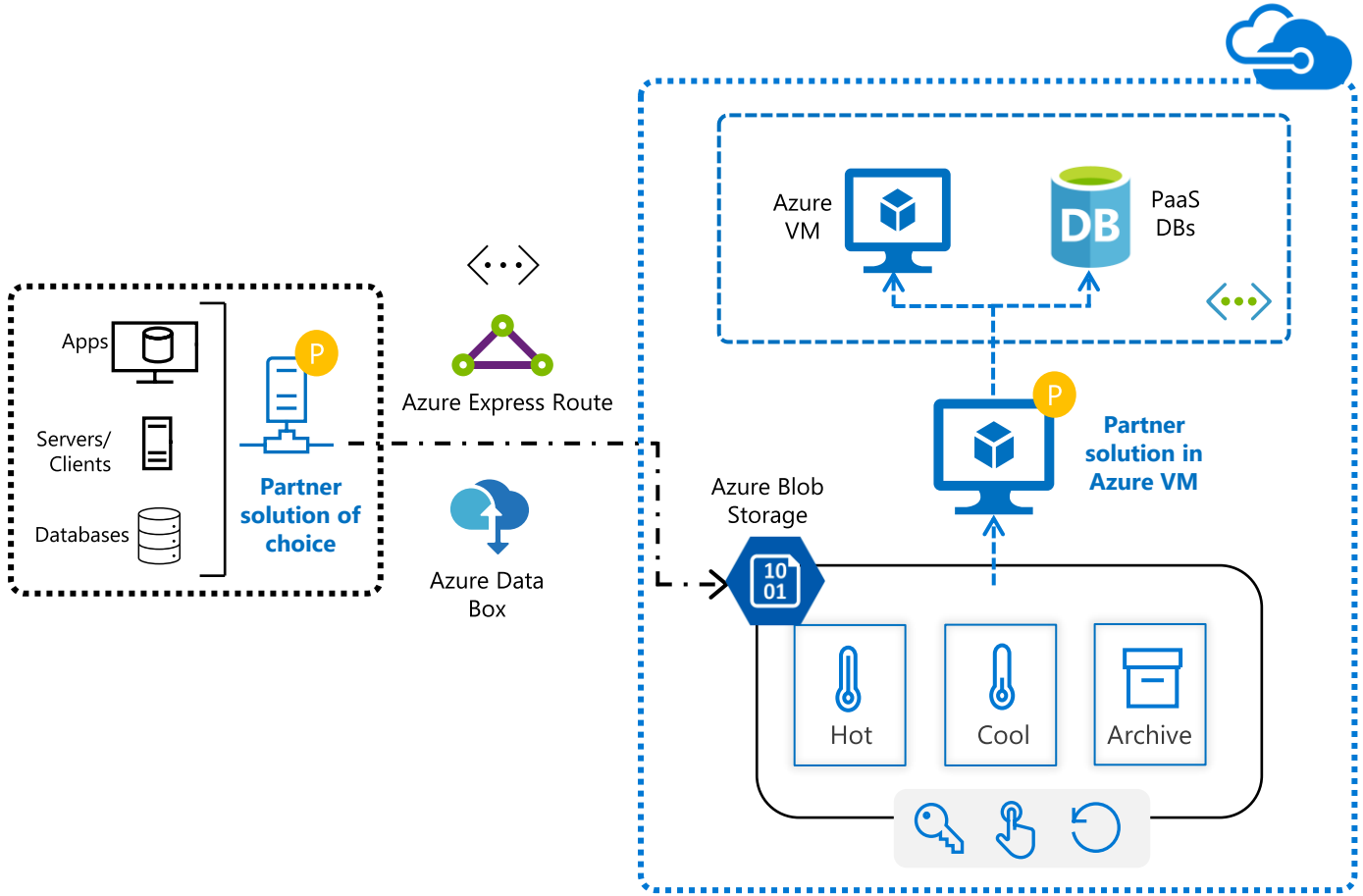
Migrate and protect in Azure

Migrate data & apps to **Azure VMs or as PaaS** resources

Use the same solutions in Azure to protect migrated resources

Stay compliant

90+ built-in compliance offerings across industries



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Resources

Azure Disk Storage homepage:	Azure Disk Storage
Azure Disk Storage documentation:	Introduction to Azure managed disks (Shared disks, zone-redundant storage, disk bursting)
Azure Elastic SAN homepage:	Azure Elastic SAN (preview)
Azure Elastic SAN documentation:	What is Azure Elastic SAN? (preview)
SQL Server on VM with Premium SSD v2 disks GigaOm Report:	GigaOM Price Performance Report
Azure Disk deep dive videos:	Azure Disk Storage
Azure Files homepage:	Azure Files
Azure Files documentation:	Azure Files documentation
Azure NetApp Files homepage:	Azure NetApp Files
Azure NetApp Files documentation:	Azure NetApp Files documentation Azure NetApp Files solution architectures
Azure Backup homepage:	Azure Backup
Azure Backup documentation:	Azure Backup service documentation
SQL Migration Guidance:	SQL Migration Guidance documentation
Windows Server Migration Guidance:	Windows Server Migration Guidance documentation
Best practices for SQL Server on Azure VMs:	Checklist: Best practices for SQL Server on Azure VMs

Microsoft Azure

Thank you.