MIGRATING HIGH IO WORKLOADS, LIKE ORACLE, TO AZURE

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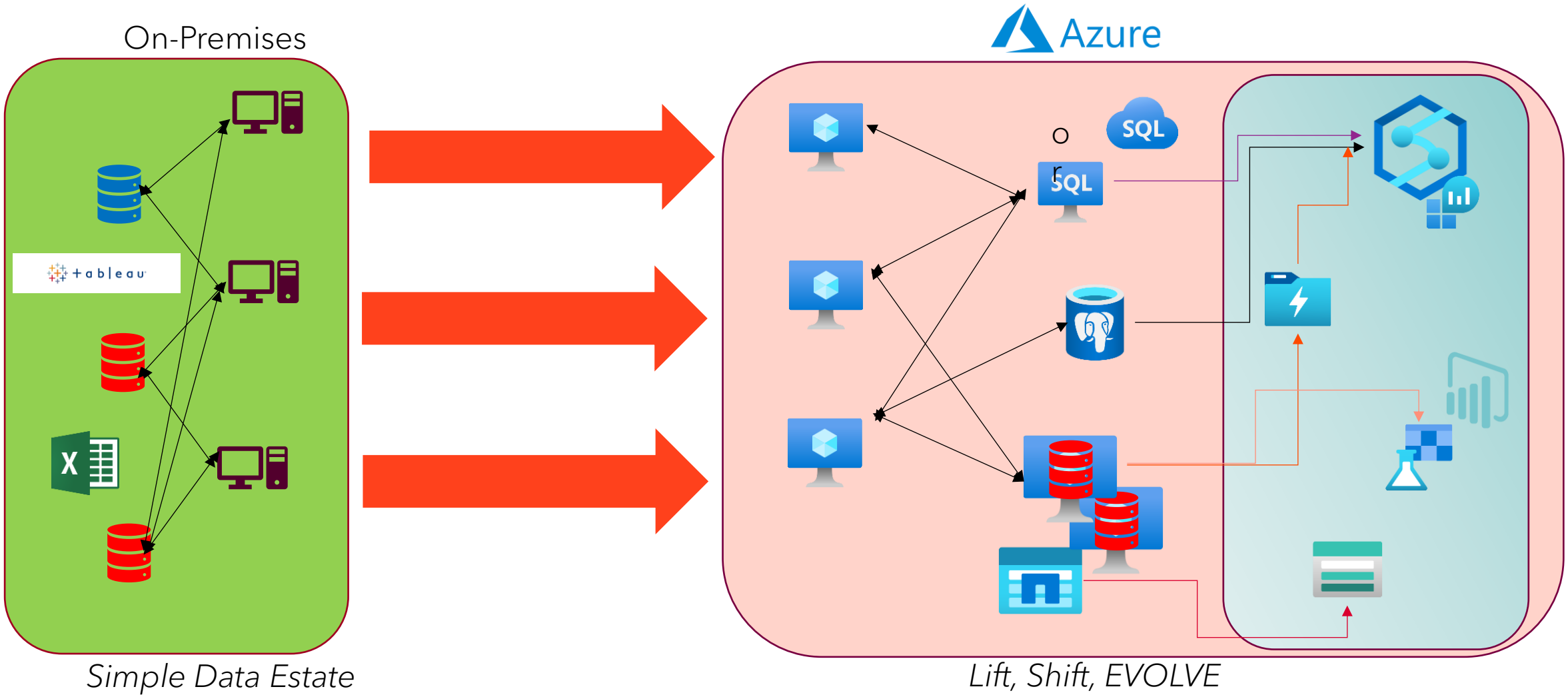
HOW ORACLE ON AZURE IS UNIQUE

Running Oracle on Azure has changed drastically in the last seven years since I began this journey.

- Began as an only Infrastructure as a Service Solution (IaaS)
- Three failed partnership attempts
- Exadata@cloud
- Actual Team that support Oracle on Azure

The Path to the Cloud- Most data estates are tightly coupled on-premises and must moved together

If Oracle doesn't migrate to Azure, then little else can, but once Oracle migrates, then refactoring and new services can be introduced to customer.

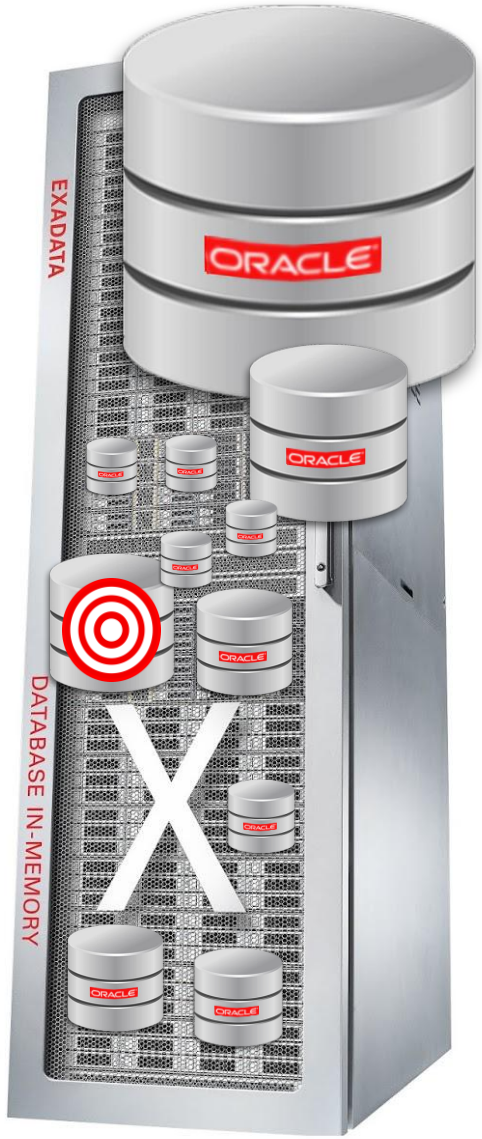


LICENSING ORACLE PRODUCTS IN AZURE CHANGES

Oracle Licensing Limits

- Max 64 vCPU VM compute
- No Multitenant license
- No RAC
- Dataguard is an option
- Advanced features are mostly on Exadata@Azure

WHEN AN EXADATA MIGRATES TO AZURE



- Purchase of Exadata was most likely made due to 1-2 large databases.
- Rest of databases were consolidated to make the most of the investment due to the Exadata features.
- Must discover if customer wants to continue with Exadata.
- If so, then Exadata@Azure, if not, then …

- One Database assessment grants a view into much of the Exadata workloads.

EXADATA IS A FOREIGN CONCEPT IN MICROSOFT?

An Engineered hardware and software solution specifically designed to run Oracle workloads

Consists of database and cell nodes, (servers), fast interconnect, PDU, (power) in a rack configuration.

Proprietary features:

- Offloading, (using cell nodes to perform high IO workloads instead of the primary database nodes.
- Storage indexes, (indexes in memory, along with advanced features.)
- Flash cache and Flash Logging for faster buffer results, elimination of log latency
- HCC, (Hybrid Columnar Compression) for faster scans of compressed data

Can use Oracle RAC or instance caging for single database

Software intelligence installed to know when to use Exadata features to benefit the workload

WHEN IT SHOULD STAY ON EXADATA

High use of RAC scaling, Exadata features such as smart scans, hybrid columnar compression, etc.

Database surpasses what can be accomplished in cloud infrastructure.

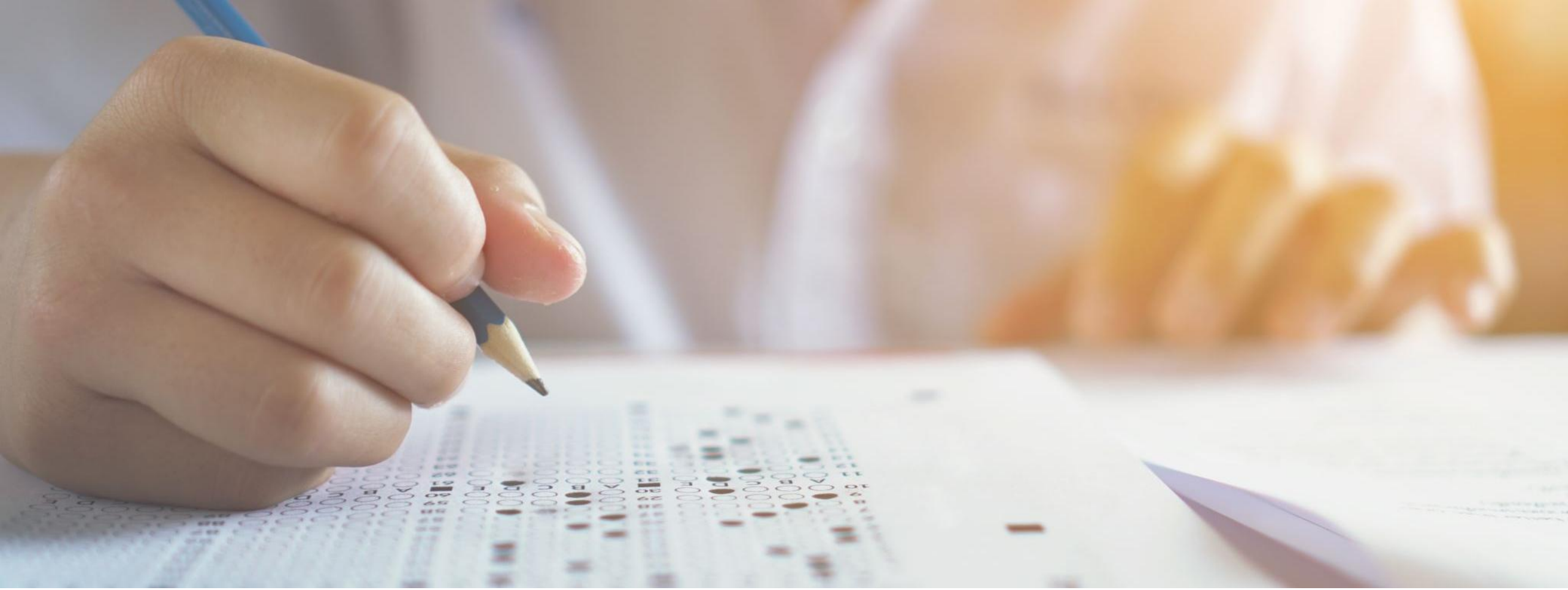
Licensing restrictions

Lacking database resources and would prefer Oracle to manage it but need data close to other sources or applications.

Complex workload without desire to rearchitect

ONCE IN AZURE

- Databases will be broken up to multiple VMs and storage.
- Once workload is assessed, choose correct storage, resizing compute is easy, storage not so much.
- Storage options in Azure such as Azure NetApp Files , Silk , etc. can address much of the Exadata loss.
- Storage indexes aren't replaceable, but missing indexes are.
- No HCC, but traditional compression can help, along with storage compression.
- Partitioning, mviews and other features can make a huge difference.



THE AWR AND A SIZING ASSESSMENT

Above is an Oracle licensing seller as cloud specialists try to lift and shift on-premises Oracle environments into Azure without assessing the workload.

DO IT RIGHT, DON'T DO IT TWICE

Move the Oracle workload, not the server to the cloud.

- The hardware is often quite old or was sized to last years.
- The database workload has grown and/or the workload has changed from the time the hardware was purchased.
- The hardware was incorrectly sized to begin with.

Using it to size the database in the cloud is ripe with failure.

- The Automatic Workload Repository, (AWR) report is the best data to collect to size a workload from Oracle
- AWR is always on in Oracle Enterprise Edition, (SE can use Statspack similarly.)

CAPTURE PEAK WORKLOAD IN THE AWR REPORT, IF POSSIBLE

- For simplicity, we usually request the most recent 3-7 days in a single AWR report

  But ideally, we'd like to see a snapshot of the peak workload

  - SQL*Plus script busiest_awr.sql can assist in finding peak workloads recorded within AWR repository.
  - If you use a peak workload, don't multiply on top of the workload if a small snapshot of time! It will bloat the sizing results!

- AWR reports don't capture all the information we need for sizing (i.e. *database size*, *average daily redo generated*, *expected annual growth rate*) so…

  - SQL*Plus script dbspace.sql can assist in capturing this information from the data dictionary

TIPS

- Ensure customer resources are onboard and understand why a substantial workload is required for an accurate sizing.

- Advisors for SGA and PGA may recommend more memory than allocated.

  Although rare, there are some bugs discovered in the AWR:

  - RAC global report % busy for second node is often less than utilized
  - 19c+ Exadata IOPS is miscalculated in IOSTAT Function Summary, use IOSTAT File Type Summary
  - 10.2.0.3 missing totals and must be calculated for IO, separated by tablespace
  - Statspack, (AWR predecessor requires manual calculations)
  - 12.1 bug will show error at top of AWR report

THE AWR REPORT

- AWR Reports can be between 10-30 pages- Don't get overwhelmed. We only need 12 values. ☺
- Always use a clean worksheet template
- Take care pasting values into worksheet. Can corrupt calculations on second sheet.
- Focus on production workloads.
- Dev and test sizing this way can be wrought with pitfalls, (boiling the ocean).

WORKLOAD REPOSITORY report for

DB Name	DB Id	Unique Name	Role	Edition	Release	RAC	CDB
DB01	423509001	RCP01	PRIMARY	EE	19.0.0.0.0	NO	NO

Instance	Inst Num	Startup Time	User Name	System Data Visible
DB01	1	11-Jul-21 00:09	SYSTEM	YES

Host Name	Platform	CPUs	Cores	Sockets	Memory (GB)
ex06db05.bus01.com	Linux x86 64-bit	56	28	2	754.16

	Snap Id	Snap Time	Sessions	Cursors/Session
Begin Snap:	82951	08-Aug-21 14:00:53	1116	16.0
End Snap:	82953	08-Aug-21 16:00:05	1123	16.0
Elapsed:		119.21 (mins)		
DB Time:		1,531.25 (mins)		

RARELY CHANGE "FUDGE FACTORS"

- These are the numbers that are used to take missing workload data, address averages, additional immediate growth and calculation issues into consideration.
- Leave to the default values unless a specific type of workload, (Exadata, Sparc, etc.) or a peak, then you can decrease these values.

Peak CPU factor	2.00
Est'd RAM factor	2.00
vCPU HT factor	2.00
%Busy CPU threshold	0.75
%Busy CPU multiplier	1.25
IO metrics (IOPS & MB/s) fudge factor	2.00

EXPECTATIONS FOR AN EXADATA WORKLOAD…

Grow the SGA and PGA coming from Exadata, which means more memory than what the workload says it will need.

Grow PGA no matter what if they are upgrading from 12c to 19c or newer.

Times the IO workload by 4.00 to get a solid baseline.

Do a deeper review of the Oracle AWR report to get sizing estimate correct, (covered later in this session)

FILL IN THE TWELVE DATA POINTS TO THE AWR WORKSHEET

AWR detail collected by database instance

DB Name	Instance Name	Host Name	Elapsed Time (mins)	DB Time (mins)	DB CPU (s)	CPUs	Cores	Memory (GB)	%busy CPU	SGA use (MB)	PGA use (MB)	Read Throughput (MB/s)	Write Throughput (MB/s)	Read IOPS	Write IOPS
DBPROD1	dbprod1	host1	360.36	12,092.44	598,197	64	32	32.78	67.90%	15,200	16,384	8,421.00	496.90	3,574.22	200.93
DBPROD2	dbprod2	host2	10,080.34	82,662.54	2,641,050	16	8	377.87	67.60%	128,000	5,898	19.00	4.10	677.20	165.70
DBPROD3	dbprod3	host3	2,200.94	61,276.52	2,599,622	64	32	32.78	52.00%	13,440	4,000	68.28	2.62	4,223.16	184.55
DBRAC	dbrac11	host1	10,139.38	38,675.37	1,883,035	64	32	32.78	38.00%	12,000	3,200	686.81	89.74	250.71	39.60
DBRAC	dbrac12	host2	10,200.54	51,790.93	2,444,168	64	32	32.78	27.00%	7,500	3,200	451.19	24.27	281.83	21.89
DBPROD4	dbprod4	host4	10,079.25	89,952.03	3,955,400	64	32	32.78	16.00%	4,272	2,400	3,399.70	222.54	1,221.39	114.71

1. Copy the first two columns from the AWR sheet to the "Calculated detail by database instance" on the **Calculations** sheet.
2. Copy the third column, (Host Name) from the AWR sheet to the "Aggregated calculations by host" on the **Calculations** sheet.

Please add rows by specifying DB Name, Instance Name, or Host Name as appropriate.
The calculated cells already have formulas to aggregate the AWR information added on the other worksheet appropriately.

Calculated detail by database instance

DB Name	Instance Name	%DB Time of Elapsed Time	%DB CPU of server capacity	Total ORA (GB)	Total IOPS	Total Throughput (MB/s)	Est'd Azure vCPUs
DBPROD1	dbprod1	3355.655%	43.229%	31	3,775.15	8,917.90	25.17
DBPROD2	dbprod2	820.037%	27.292%	131	842.90	23.10	6.15
DBPROD3	dbprod3	2784.107%	30.759%	17	4,407.71	70.90	20.88
DBRAC	dbrac11	381.437%	4.836%	15	290.31	776.55	2.86
DBRAC	dbrac12	507.727%	6.240%	10	303.72	475.46	3.81
DBPROD4	dbprod4	892.448%	10.220%	7	1,336.10	3,622.24	6.69
		8741.412%	122.575%	210	10,955.89	13,886.15	65.56

Aggregated calculations by host

Host Name		%DB Time of Elapsed Time	%DB CPU of server capacity	Total ORA (GB)	Total IOPS	Total Throughput (MB/	Est'd Azure vCPUs
host1		489.861%	6.236%	58.42	13294.20	10014.53	1.22
host2		664.648%	10.443%	153.94	2300.62	538.05	1.66
host3		2784.107%	30.759%	17.03	4407.71	70.90	20.88
host1		489.861%	6.236%	58.42	13294.20	10014.53	1.22
host2		664.648%	10.443%	153.94	2300.62	538.05	1.66
host4		892.448%	10.220%	6.52	1336.10	3622.24	6.69
Total		5985.572%		448.28	36933.45	24798.30	33.35

Aggregated calculations by database

DB Name	%DB Time of Elapsed Time	Total vRAM (GiB) consumed only by Oracle	Est'd Azure vRAM for server	Total IOPS	Total Throughput (MB/s)	Est'd Azure IOPS for peak load	Est'd Azure Throughput (MB/s) for peak load	Est'd Azure vCPUs for avg load	Est'd Azure vCPUs for peak load	DB Size in TB	Bkup Info
DBPROD1	3355.655%	31	46	3,775.15	8,917.90	7,550.30	17,835.80	26	39		
DBPROD2	820.037%	131	196	842.90	23.10	1,685.80	46.20	7	11		
DBPROD3	2784.107%	17	26	4,407.71	70.90	8,815.42	141.80	21	32		
DBRAC	444.772%	25	38	594.03	1,252.01	1,188.06	2,504.02	7	11		
DBPROD4	892.448%	7	10	1,336.10	3,622.24	2,672.20	7,244.48	7	11		

FINAL STEPS

- Paste each UNIQUE DB Name into the "Aggregated Calculations by Database"
- Rest of calculations will fill in for Azure sizing
- Manually add the size of the database and the backup storage required.

ASSESSMENT TIPS

- We're not aiming for EXACT- remember, you're finding the "bucket" they fit into with their workload.
- Be careful not to confuse different DBCPU values and IO data.
- Take your time filling out the AWR worksheet. If you take the time to fill this out correctly, all the rest of the data will populate.
- Always size from the values for peak, (in RED) but also make intelligent decisions of where you can consolidate, working with the customer to identify opportunities.
- Add notes about versioning, SLAS for uptime, etc. in the notes section on the worksheet.
- Try not to change the fudge factors unless necessary.

success with these engineered systems.

Compute, Storage and Architecture

UNDERSTAND IAAS VM SERIES

- A and B-series won't work for Oracle workloads and are highly avoided.
- D-series can work for some, but consider matching SKU series to production, but with lesser resources
- L and H-series are outliers for database workloads.
- Identify workload needs
- D-series is for general use
- E-series and M-series are the most common VMs in the database industry

  E-series for average production databases

  M-series for VLDB, but use the newest v3 of the series.

https://azure.microsoft.com/en-us/pricing/details/virtual-machines/series/

VIRTUAL MACHINES FOR ORACLE DATABASES

Type	vCPUs	vRAM	Max throughput (MBps) for SCSI storage	Max IP egress rate (Mbps) for NFS, iSCSI storage
Dds_v5	2-64	8-256	125-2000	1000-30000
Eds_v5	2-104	16-672	125-4000	1000-12500
Mbs_v3	16-176	128-1636	1000-6000	1000-6250
Msv3	416-832	5696-15200	4000-8000	4000-8000
Eads_v6	2-96	8-672	125-4320	12500-4800
Ebds_v5	2-112	16-672	125-10000	1000-12500

**Not mentioning the Lsv2/3 series storage optimized VM series*

https://azure.microsoft.com/en-us/pricing/details/virtual-machines/series

CONSTRAINED VCPU VMS

Name	vCPU	Specs
Standard_E4-2ds_v5	2	Same as E4ds_v5
Standard_E8-4ds_v5	4	Same as E8ds_v5
Standard_E8-2ds_v5	2	Same as E8ds_v5
Standard_E16-8ds_v5	8	Same as E16ds_v5
Standard_E16-4ds_v5	4	Same as E16ds_v5
Standard_E32-16ds_v5	16	Same as E32ds_v5
Standard_E32-8ds_v5	8	Same as E32ds_v5
Standard_E64-32ds_v5	32	Same as E64ds_v5
Standard_E4-2ds_v5	2	Same as E4ds_v5
Standard_E8-4ds_v5	4	Same as E8ds_v5
Standard_E8-2ds_v5	2	Same as E8ds_v5
Standard_E16-8ds_v5	8	Same as E16ds_v5
Standard_E16-4ds_v5	4	Same as E16ds_v5
Standard_E32-16ds_v5	16	Same as E32ds_v5

https://docs.microsoft.com/en-us/azure/virtual-machines/windows/constrained-vcpu

MOST IMPORTANT THING TO REMEMBER

Need to change a VM?

- No problem.

Need to change storage?

- Could be a problem, definitely a LOT of work.

STORAGE IS SEPARATE AND IMPORTANT

- Ensure you know the IO workload for your database going to the cloud- DO NOT GUESS!
- Understand both the MBPs and the IOPS, (Requests) for the database.
- Note that network attached IO is measured in Mbps, not MBps… ☺
- Oracle has demonstrated, on average, much higher demands for IO than MSSQL, MySQL or PostgreSQL.

- *Separate storage offers us the opportunity to create the right combination for success in IaaS.*

DATABASE SAVVY STORAGE

	Protocol	Max Throughput (MBps)	Min Latency (ms)	Pricing	Notes
Premium SSD/PV2	SCSI	900/device, 2000/VM cumulatively	0.7 w/ host-caching, 2 w/o host-caching	$	Snapshot capable, bursting capable, LRS/ZRS redundancy
UltraDisk	SCSI	2000/device, 2000/VM cumulatively	1	$$$	Limited Use with PV2, LRS redundancy
Azure Files premium	NFS v4.1	100 + (0.1 * GiB-provisioned)	1	$$	No snapshots, LRS/ZRS redundancy
Azure NetApp Files	NFS v3.0 NFS v4.1	4500	0.25	$$$	Snapshot capable, LRS/GRS redundancy
SILK	iSCSI	11000	0.5	$$	Snapshot capable, thin cloning, LRS/ZRS redundancy
ANF AVGs	iSCSI/NFS	11000	0.27	$$	No snapshots, LRS/ZRS redundancy

STORAGE CONSIDERATIONS

What is the storage to be used for?

Data- OLTP, DSS,OLAP, Exadata?

Logging

Backup

Ensure that backups and data refresh requirements are calculated into the IO demands for the database.

IO THROTTLING

- Why does it happen?
  - No, you can't have all the resources for yourself.
- What all can be involved?
  - It's not just the database.
- How to identify it?
  - What do to when it is identified?

Just because you have a big VM, doesn't mean you have high throughput!

Size	vCPU	Memory: GiB	Temp storage (SSD) GiB	Max data disks	Max cached and temp storage throughput: IOPS/MBps (cache size in GiB)
Standard_M8ms	8	218.75	256	8	10000/100 (793)
Standard_M16ms	16	437.5	512	16	20000/200 (1587)
Standard_M32ts	32	192	1024	32	40000/400 (3174)

https://docs.microsoft.com/en-us/azure/virtual-machines/sizes-memory?toc=/azure/virtual-machines/linux/toc.json&bc=/azure/virtual-machines/linux/breadcrumb/toc.json

HOST CACHING VS. BURSTING

Name	Capacity (GiB)	IOPS per disk	Max burstable IOPS	Throughput per disk (MB/s)	Max burstable throughput per disk (MB/s)	Cache limit per disk (GiB)
P1	4	120	3,500	25	170	4
P2	8	120	3,500	25	170	8
P3	16	120	3,500	25	170	16
P4	32	120	3,500	25	170	32
P6	64	240	3,500	50	170	64
P10	128	500	3,500	100	170	128
P15	256	1,100	3,500	125	170	256
P20	512	2,300	3,500	150	170	512
P30	1,024	5,000	30000	200	1000	750 MBPs/1,024
P40	2,048	7,500	30000	250	1000	750 MBPs/2,048
P50	4,096	7,500	30000	250	1000	750 MBPs/4,095
P60	8,192	16,000	30000	500	1000	750 MBPs/4,095
P70	16,384	18,000	30000	750	1000	750 MBPs/4,095
P80	32,727	20,000	30000	900	1000	750 MBPs/4,095

Source: Managed disks pricing

BRING IN ADDITIONAL SOLUTION

- High IOPS-
  - MBPs: Azure NetApp Files
  - Higher IO throughput: Consider Silk, Flashgrid Storage, Pure Storage, Lightbits or even a PaaS service like Tessell.
  - Consider disk striping of smaller disks and parallel processing at the database level.
- Backups, batch loading and other challenges:
  - Offload backups with secondary backup solutions.
  - Refactor batch processing with other services, (Azure Data Factory, Azure Analysis Services, Databricks, etc.)

AZURE NETAPP FILES

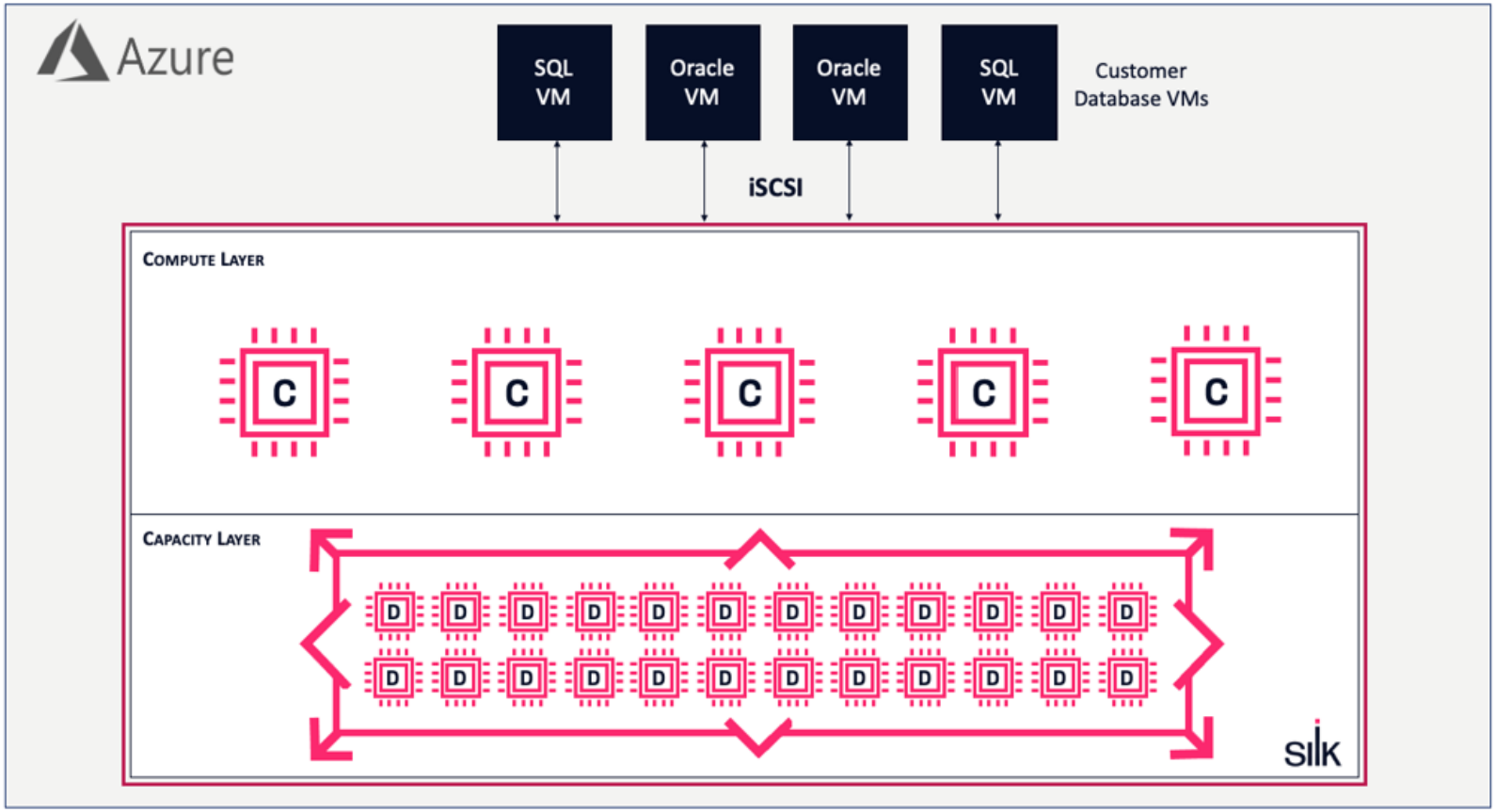
- Fully Managed, PaaS, Microsoft Azure Storage Service
- All Flash Baremetal Storage
- Only dependent on Nic, not VM.
- *Available in Standard, Premium, (common) and Ultra, (optimal)
- ANF is native to Azure

	Azure Files	Premium Files	Azure NetApp Files	Premium Disk
Performance	1K IOPs	100K IOPs	**320K IOPs**	20K IOPs
Capacity Pool	5TB	100TB	**500TB**	32TB
AD Integration	Azure AD	N/A	**Bring Your Own AD *I* Azure AD**	N/A
Protocol	SMB	SMB	**NFS & SMB**	Disk
Data Protection		LRS Only	**Snapshots Back Up Tools**	Snapshots

FAQs About Azure NetApp Files | Microsoft Docs

*Be aware of pricing with scaling to meet IO

Silk Platform Architecture



A Silk data pod, deployed in a single zone, RG

Silk Platform components

C **Compute:**
2 - 8 c.nodes

D **Capacity:**
1 m.node =
24 d.nodes

SILK PERFORMANCE

Why Silk on Azure ?

Metric	Azure + Silk	Azure Ultra SSD	Gain vs. Ultra SSD	Azure Premium SSD	Gain vs. Premium SSD
Read IOPS	1m+	160K	6.3x	20K	50x
Read BW	15 GB/s	2 GB/s	7.5x	0.9 GB/s	15x
Write IOPs	800K	160K	5x	20K	40x
Write BW	8.5 GB/s	2 GB/s	4x	0.9 GB/s	9x

All performance numbers achieved at 1.5ms consistent latency or lower, with data services enabled

- Designed for mixed workloads – OLTP & BI
- Elastically scale performance up and down
- Patented algorithms for high parallelism
- Automatic tuning for optimal CX
- Shared performance for all applications

Metric	Azure + Silk	Azure High End	Gain vs. High End	Azure Native	Gain vs. Native
Read IOPS	1.5m+	160K	10x	20K	75x
Read BW	26 GB/s	4 GB/s	6.5x	0.9 GB/s	28x
Write IOPS	1.1M+	160K	6.3x	20K	55x
Write BW	13 GB/s	2 GB/s	6.5x	0.9 GB/s	14.4x

All performance numbers achieved at 1.5ms consistent latency or lower, with data services enabled

- Designed for mixed workloads – OLTP & BI
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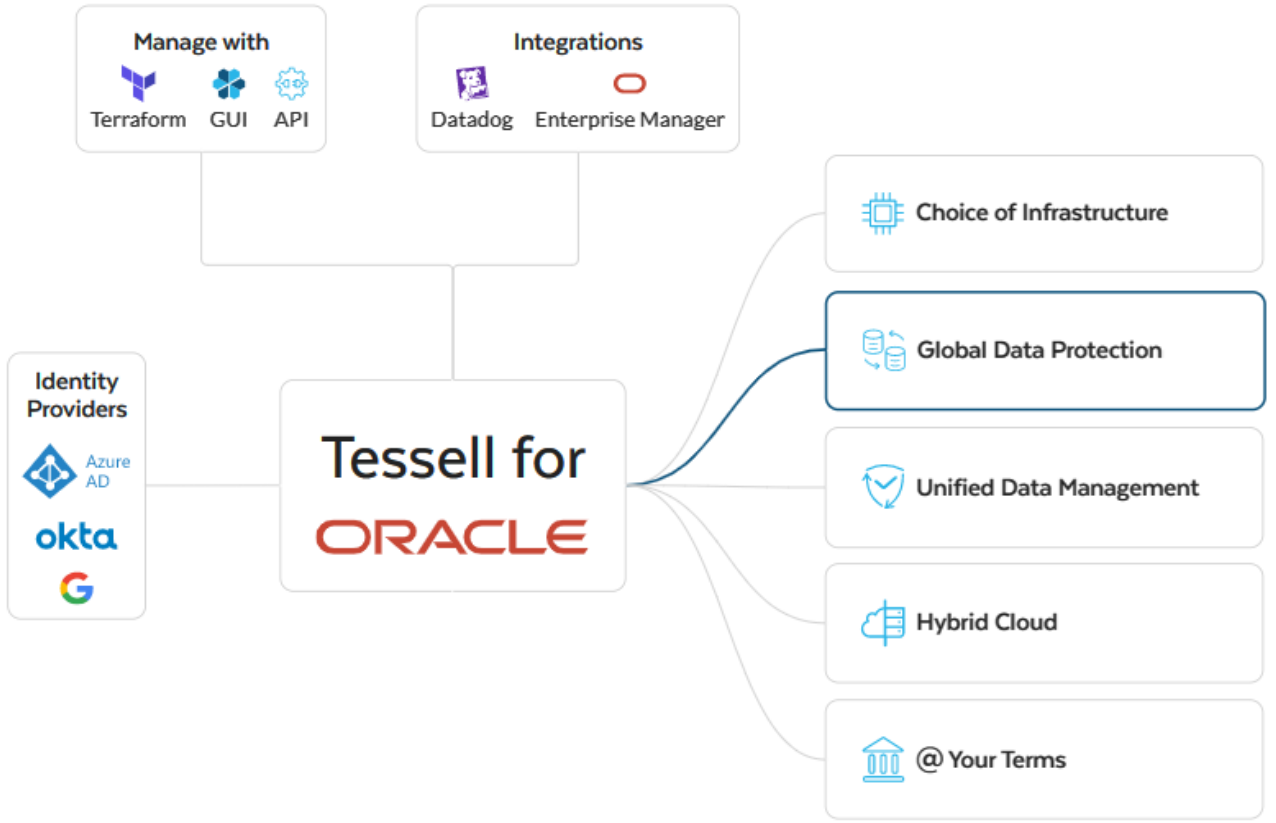
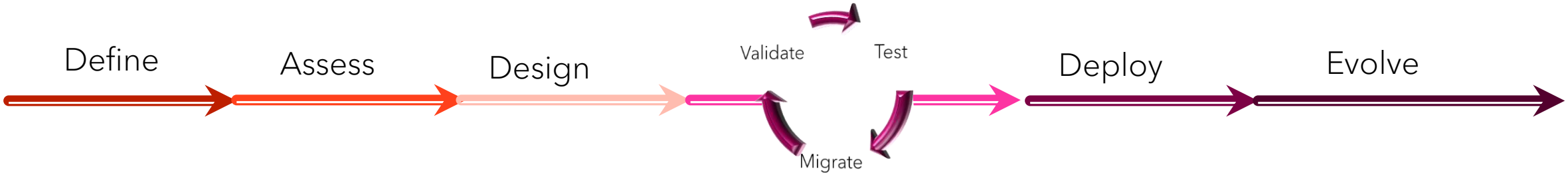
TESSELL- RDS FOR AZURE!

- Ability to deploy PaaS for Azure IaaS
- Supports Oracle, SQL Server, PostgreSQI
- Patches OS and Database and full HA/DF
- Volume Snapshots, Clones, Snapshot conversion to RMAN
- Data masking, encryption
- Ability to integrate management tools lik OEM, Splunk, Perf Insights, etc.



Migration Strategy

AN ORACLE ON AZURE MIGRATION



- Stay on Oracle
- Strong data estate strategy.

- Identify targets
- Assess Workload using AWR.

- Design architecture
- Plan on migration path.

- Preform POC.
- Test HA and DR
- Test Migration process and Improve.

- Check Customer Readiness
- Verify recommended practices.
- Lifecycle Support

- Optimize Existing IaaS Opportunities
- Introduce Azure services to do more with Oracle data.

BENCHMARK TOOLS

HammerDB for SQL Server and MySQL, (not for Oracle)

SLOB and FIO for Oracle, Oracle Swingbench less often.

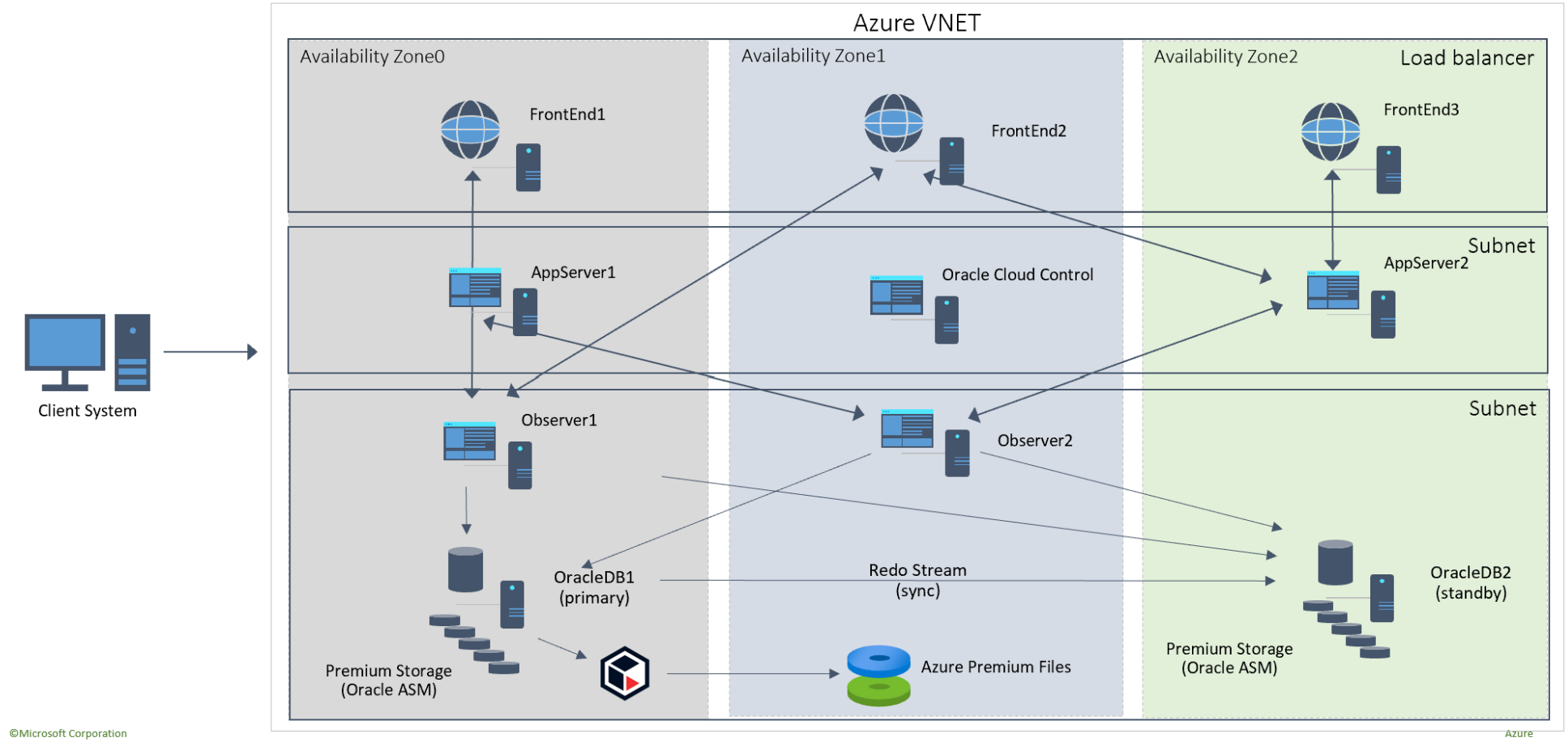
Understand the limitations of these benchmarks and that they are not the customer's workloads, so often won't guarantee anything around the performance the customer will receive.

Many times, these exercises are a waste of time, especially when attempting to compare one cloud to another cloud.

Especially poor when specialists from one cloud vendor attempt to perform benchmarks on another cloud or database product they are unfamiliar with.

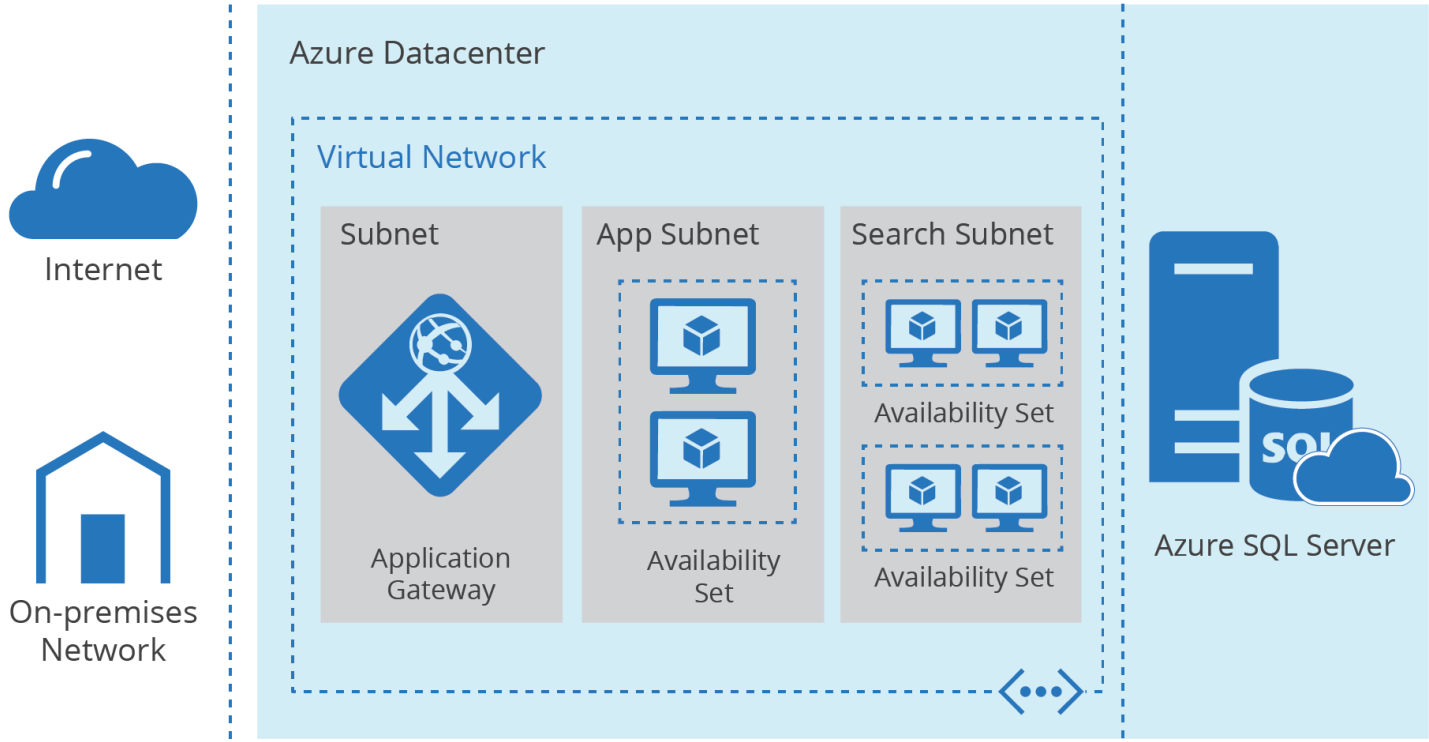
DISASTER RESILIENCY OPTIONS

- Oracle DataGuard or Active DataGuard with FSFO, TAF, and FarSync options for *active/passive redundancy*
- Oracle GoldenGate with one-way replication for *active/passive redundancy* or multi-master replication for *active/active redundancy*
- Azure Site Recovery is an option for application and middleware tiers!
  - only suitable for VMs with less than 54 MBps (soon 100 MBps) throughput



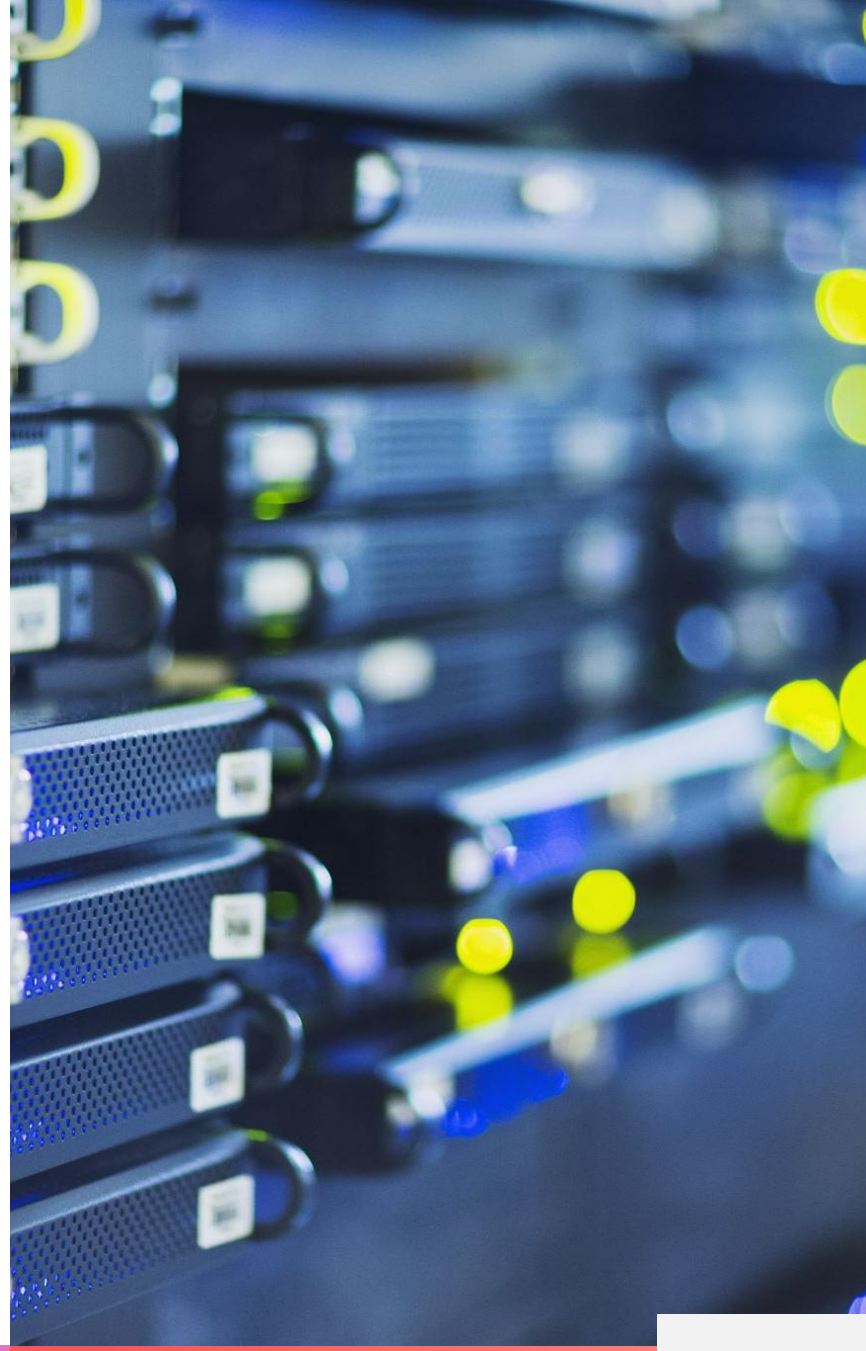
HIGH AVAILABILITY ZONES

AVAILABILITY SETS AND PROXIMITY PLACEMENT GROUPS



DON'T TRY TO USE AZURE SITE RECOVERY FOR ORACLE DATABASES

- Azure Site Recovery (ASR) has limits around how much churn, (block changes) it can handle, both per second and per VM total.
- Oracle bypasses this on almost all workloads.
- If you are using ASR for high IO workloads, please see the following: Deployment Planner for Hyper-V disaster recovery with Azure Site Recovery - Azure Site Recovery | Microsoft Docs
- And ASR Limits: Support matrix for VMware/physical disaster recovery in Azure Site Recovery. - Azure Site Recovery | Microsoft Docs (not just VMWare)
-



BACKUPS AND RECOVERY

- RMAN (Recovery Manager) is IO intensive- this can be used for smaller databases, (under 1TB) with Blob storage up to premium files.
- Azure Backup can be used for Oracle compatible volume snapshots for larger databases.
- Many storage vendors have volume snapshots that are Oracle compatible, (ANF, SILK)

- Ensure customers test backup and recovery early in the POC.

PERFORM POC

Choose valid database and application example to perform test with.

Create a list of goals to accomplish as part of POC

Do NOT choose the whale in the pond of ANY environment, data center, Exadata, etc.

Decide what performance is satisfactory for initial migration, must be addressed in XX number of days and can be addressed longer term.

When an issue arises as part of the POC, don't assume- gather data and identify the real issue.

Test backups, high availability scenarios and disaster recovery as part of POC.

TEST, TEST, RINSE AND REPEAT

Use metrics and performance data collected from onpremises environment to compare to cloud performance.

Test thoroughly and again, don't assume what culprits are the cause of a performance or failure- identify!

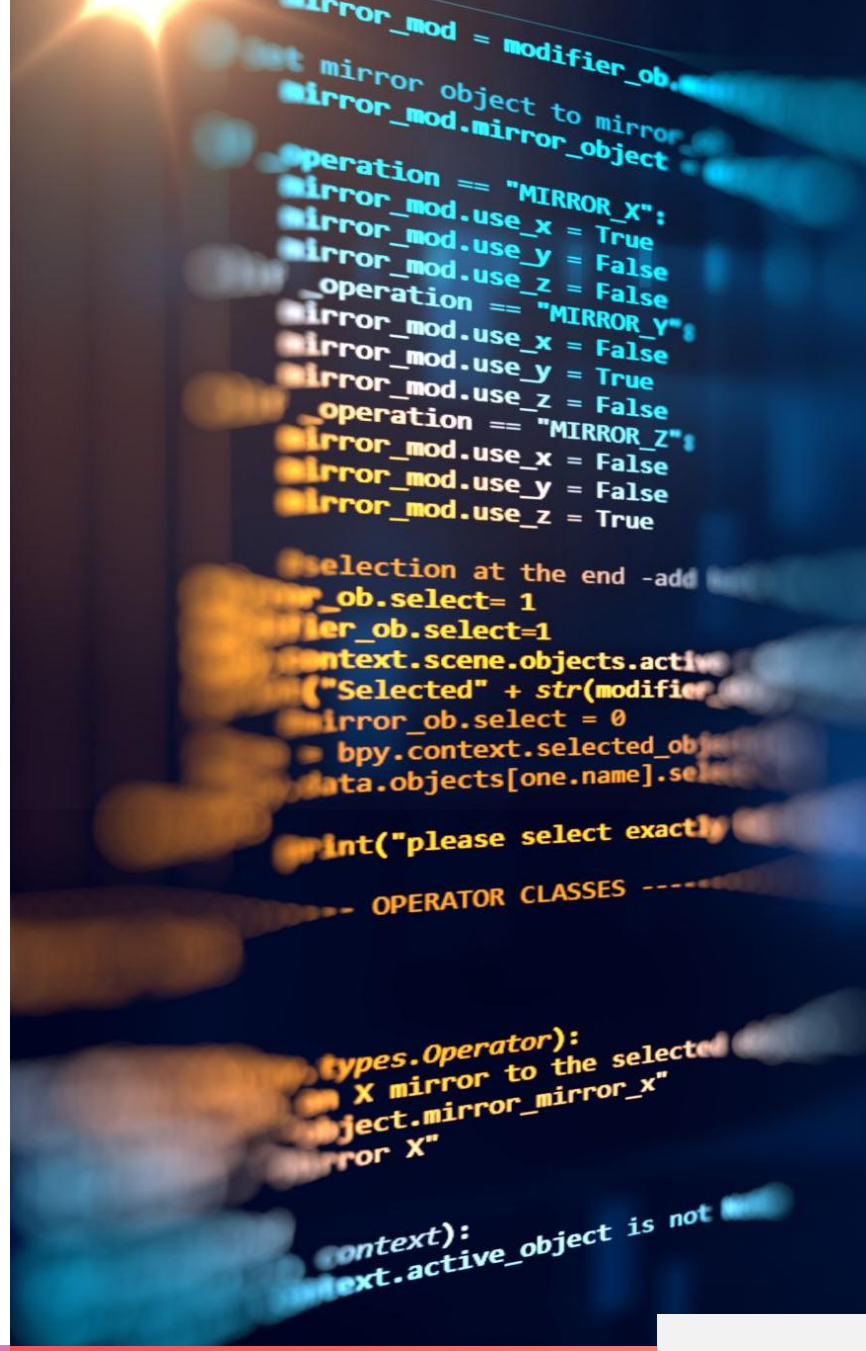
Test and collect logs, data results, test times.

DMVs, Query Store and Profiler in SQL Server and AWR, Active Session history, (ASH), Traces for Oracle are your friends.

Use the right tool for the job- Network traces for identified slowness on network.

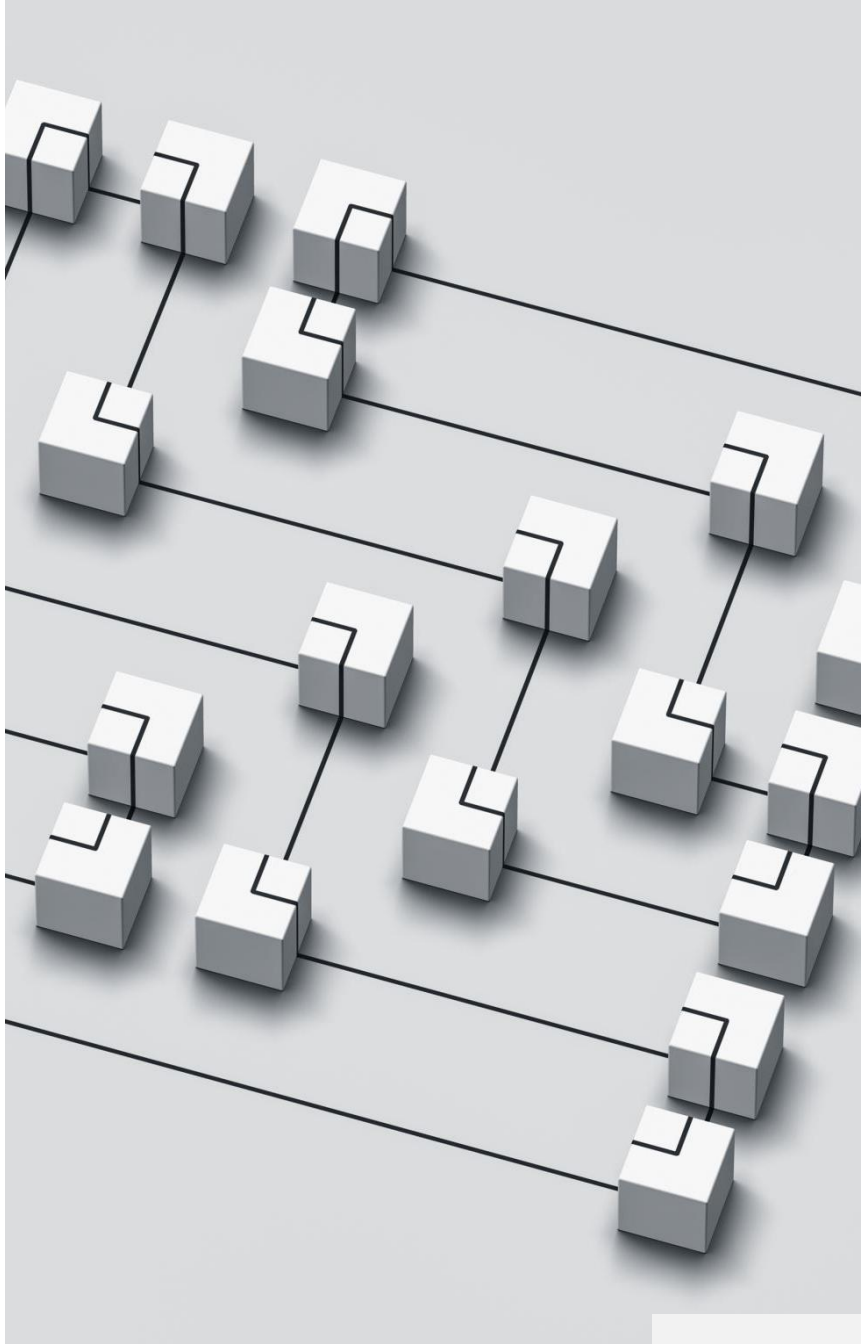
SIMPLIFY THE SHIFT TO THE CLOUD

- Migrate your tools that you already use to monitor and manage the database on-prem into the cloud whenever possible.
  - Implement Oracle Enterprise Manager, (Cloud Control) to ensure DBAs and SQL Developer to have same interface used on-premises.
  - Or consider Redgate SQL Monitor, Solarwinds SQL Sentry, Dynatrace, Idera Uptime Infrastructure Monitor, etc.
  - If it isn't working on-premises, don't migrate it over to the cloud environment.



VERIFY, THEN SWITCHOVER

- Don’t assume, verify every application and functionality.
- Assign someone accountable over each facet of environment.
- Have performance and functionality, along with architecture diagrams prepared.
- Users should be assigned to test as soon as switchover is performed, and all tiers are verified as running.



Post Migration and Optimization

REMEMBER TOP SQL BY ELAPSED TIME?

SQL ordered by Elapsed Time (Global)

- Captured SQL account for 68.7% of Total DB Time (s): 4,140,773
- Captured PL/SQL account for 9.7% of Total DB Time (s): 4,140,773

	Total								Per Execution						
SQL Id	Elapsed (s)	CPU (s)	IOWait (s)	Gets	Reads	Rows	Cluster (s)	Execs	Elapsed (s)	CPU (s)	IOWait (s)	Gets	Reads	Rows	Cluster (s)
2bfqds9ybrfbt	520,291.70	461,620.81	3,411.08	3,072,779,693	164	16	15,118.17	11,015	47.23	41.91	0.31	278,963.20	0.01	0.00	1.37
4m2ks9ca4r38q	237,212.65	8,686.14	114.64	2,458,200,402	1,656	402,088	16,017.78	402,092	0.59	0.02	0.00	6,113.53	0.00	1.00	0.04
7qhcw6rqpm3mq	228,319.79	3,875.61	77.28	420,079,911	373	159,243	14,184.80	241,263	0.95	0.02	0.00	1,741.17	0.00	0.66	0.06
71v9ncuzxtu5x	108,506.75	68,743.79	2,483.47	6,317,174,672	42	112	5,149.03	56	1,937.62	1,227.57	44.35	112,806,690.57	0.75	2.00	91.95
a1u3rdpgp8j95	107,223.23	68,680.50	2,124.38	6,317,200,693	796	56	5,149.36	56	1,914.70	1,226.44	37.94	112,807,155.23	14.21	1.00	91.95
3f0raf35651h7	103,839.76	95,840.15	2,528.43	107,387,344	6,125,983	2,663,576,810	17.38	1	103,839.76	95,840.15	2,528.43	107,387,344.00	6,125,983.00	2,663,576,810.00	17.38
2mhr20c7syvc6	81,605.40	80,459.07	1,267.36	9,578,900	8,591,351	2,470,473,990	2.40	1	81,605.40	80,459.07	1,267.36	9,578,900.00	8,591,351.00	2,470,473,990.00	2.40
f7w22df179049	49,812.48	33,761.05	16,148.44	913,279,786	107,144,210	1,496,558,134	91.42	1	49,812.48	33,761.05	16,148.44	913,279,786.00	107,144,210.00	1,496,558,134.00	91.42
avn8wdx9akdtv	48,490.41	45,576.81	608.04	585,201,067	7,287,041	3,325,464,756	47.28	1	48,490.41	45,576.81	608.04	585,201,067.00	7,287,041.00	3,325,464,756.00	47.28
25q01dg3wdhfm	47,929.38	37,260.12	4,962.82	17,515,694	32,260,178	0	7.57	1	47,929.38	37,260.12	4,962.82	17,515,694.00	32,260,178.00	0.00	7.57

START HERE FOR ORACLE COMPARISONS

- Observe overall workload and verify that it's the same.
- Identify if there are outliers or if there is overall degradation.
- Identify if it's degradation in one resource area, (CPU, IO, memory or network)
- Compare the per execution time for the same SQL IDs and see how they've changed from onpremises vs. in the cloud.
- Use an awrsqrpt.sql, (SQL ID specific AWR report) to gather plan and execution timings to see if there is a change. Compare to the on-premises versions and consider pulling reports for top SQL before the migration time. The exact process can be done from the Query store and DMV data in SQL Server migrations.

USE SQL PLAN MANAGEMENT

Uses the DBMS_SPM package

No longer has access to the Exadata parameter AUTO_SPM_EVOLVE_TASK (set to OFF if ON or AUTO for Exadata)

Will provide plan enhancements for any database and take the cloud environments best options

Set to AUTO_LIMIT and let Oracle decide the best value. No_LIMIT can cause too heavy IO usage in a cloud environment.

Review all recommendations and accept manually to ensure best performance enhancements happen.

MODERNIZATION IS THE FUTURE

- Power BI is a swiss army knife for Oracle users in Azure:
  - OBIEE and other older BI tools can be replaced with it. Great opportunities to also replace tableau and Cognos connected to Oracle.
  - Hyperion and Essbase are heavy Excel users- engage them with Power BI, a natural fit and evolve to analytics, AI and ML.
  - This also gives them an opportunity to take advantage of Microsoft Fabric or Databricks with valuable Oracle data.
- New projects with a focus on PostgreSQL PaaS from schemas inside large Oracle databases, allowing for easier learning curve for developers.
- Then propose PostgreSQL with PaaS for smaller Oracle databases.
- Heavier data warehouse loads to Azure data lakes or Synapse, but keep in mind, considerable PL/SQL rework will be required.
- New projects , (greenfield) that may lean on Azure PaaS solutions unless an Exadata@Azure solution is available.

THANK YOU!

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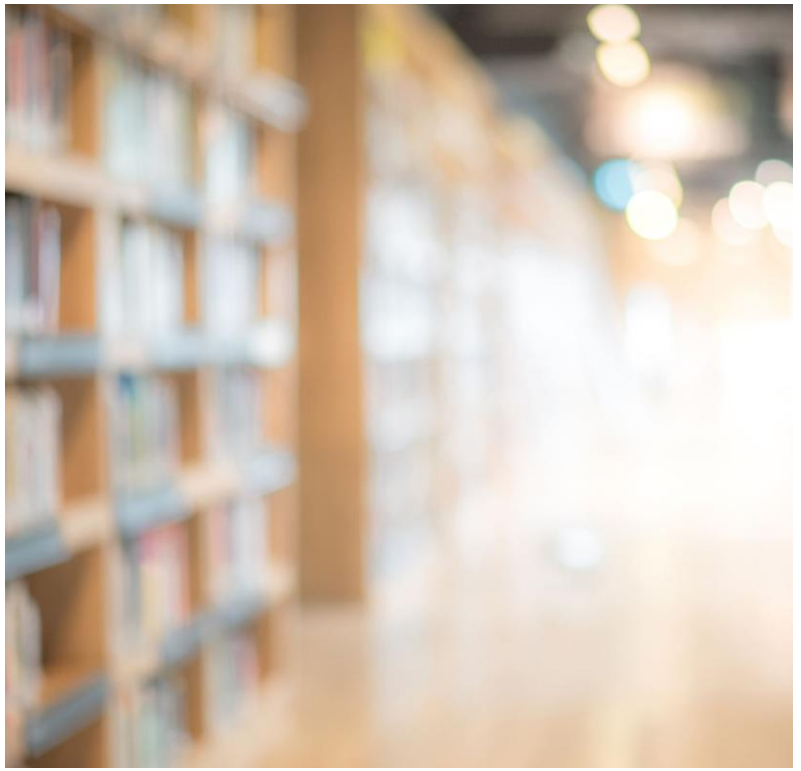
https://linkedin.com/in/kellyngorman

AZURE IAAS REFERENCES

- Oracle on Azure- DBAKEVLAR: Oracle on Azure (dbakevlar.com)
- Oracle on Azure: Oracle solutions on Microsoft Azure - Azure Virtual Machines | Microsoft Docs
- Understanding AZ and AS: Availability options for Azure Virtual Machines - Azure Virtual Machines | Microsoft Docs
- Virtual Machine and Disk Performance: Virtual machine and disk performance - Azure Virtual Machines | Microsoft Docs
- Azure Premium Storage: Azure Premium Storage: Design for high performance - Azure Virtual Machines | Microsoft Docs
- Azure Network Performance for IaaS: Optimize VM network throughput | Microsoft Docs
- Infrastructure Automation: Use infrastructure automation tools - Azure Virtual Machines | Microsoft Docs



ORACLE SPECIFIC REFERENCE READS

- Azure IO Performance for the RDBMS DBA- Part I (dbakevlar.com)
- Why a One-Week Report for AWR Sizing in Azure (dbakevlar.com)
- Prepping an Oracle Database for a Cloud Migration (dbakevlar.com)
- Oracle Storage Snapshots with Azure Backup - Microsoft Tech Community
- Backup Scenarios for Oracle on Azure IaaS - Microsoft Tech Community
- Estimate Tool for Sizing Oracle Workloads to Azure IaaS VMs - Microsoft Tech Community
- Prepping an Oracle Database for a Cloud Migration (dbakevlar.com)
- Script to create a simple Oracle VM configuration: GitHub - tigormanmsft/oravm: Azure CLI (bash) script to fully automate the creation of an Azure VM to run Oracle database