All Things SQL

In the Microsoft Cloud

David Klee

HERAFLUX
T E C H N O L O G I E S ®

1

About David Klee

MVP Microsoft® Most Valuable Professional

vmware vEXPERT

 @kleegeek
 davidklee.net
 heraflux.com
 davidaklee

Specialties / Focus Areas / Passions:

- Virtualization & Cloud
- Performance Tuning
- Business Continuity
- Infrastructure Architecture
- Health & Efficiency
- Capacity Management

HERAFLUX
T E C H N O L O G I E S ®
Founder & Technical Exorcist

HERAFLUX
TECHNOLOGIES®

2

3

4

SQL Server

- Traditionally boxed product
- DMBS platform – and more
  - Relational database engine
  - Integration services
  - Reporting services
  - Analysis services
- Relational database launched on MS Azure in 2010

HERAFLUX
TECHNOLOGIES®

5

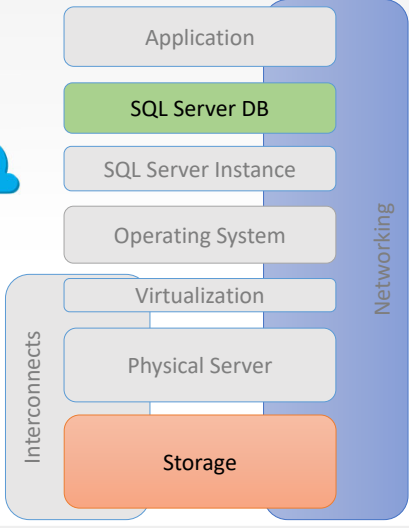## Cloud Database Choices

IaaS?

AaaS?

DBaaS?

QaaS?

PaaS?

ZaaS?

HERAFLUX
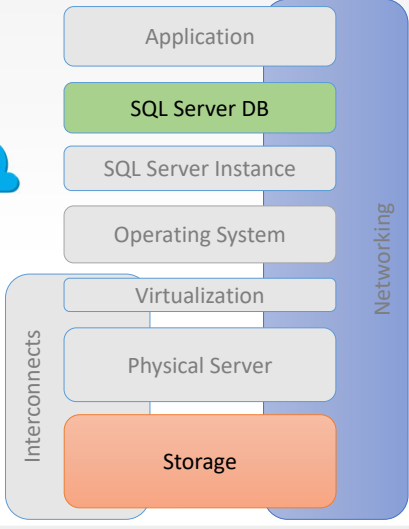TECHNOLOGIES®

6

DBaaS – Azure SQL Database

- Just a database…
- Fully compatible SQL Server 2019
- Use cases
  - Small application
  - Quick development
  - Smaller databases
  - POCs / Pilots
  - DevOps
  - Many single-tenant DBs

7

DBaaS – Azure SQL Database

- Pros
  - No instance to manage
  - No OS to manage
  - Straightforward HA + DR options
- Cons
  - Single database
  - No cross-database calls
  - No SQL Agent
    - Use Azure Runbooks (PowerShell)
  - Code adjustments?
  - Migration strategy

8

Azure SQL Database Tiers

- General Purpose
  - 500-20k IOPs
  - 2-10ms latency
- Hyperscale
  - 500-204K IOPs
  - 1-10ms latency
  - Up to 4 replicas
- Business Critical
  - 500-204K IOPs
  - Read scale-out
  - Greater availability

- Up to 80 vCores
- Select max data size
- DTU model (legacy)
  - Standard
  - Premium
  - DTU != vCore

9

Azure SQL Database

- "Serverless" option
  - New!
  - Charged for storage but not compute during 'auto-pause'
- Max 16 vCores
- Max 1.5TB DB

10

SQL Database Migrations

- Cannot backup DB and restore into
- Recreate schema / SSIS
- BACPAC import / export
    - DACPAC = schema for upgrades
    - BACPAC = schema and data for import / export
- Azure Database Migration Service
    - https://azure.microsoft.com/en-us/services/database-migration/
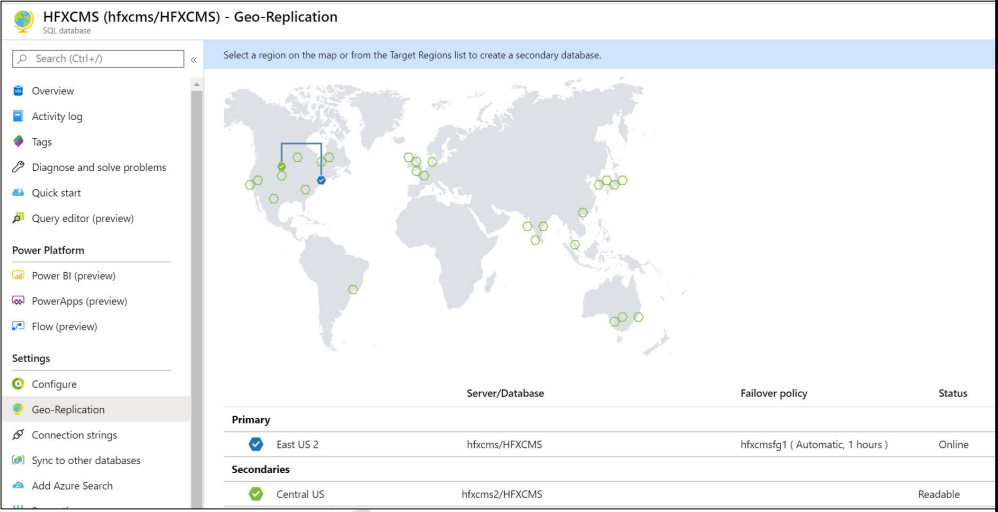
11

SQL Database Disaster Recovery

- Trivial!

HFXCMS (hfxcms/HFXCMS) - Geo-Replication
SQL database

Select a region on the map or from the Target Regions list to create a secondary database.

- Overview
- Activity log
- Tags
- Diagnose and solve problems
- Quick start
- Query editor (preview)

Power Platform
- Power BI (preview)
- PowerApps (preview)
- Flow (preview)

Settings
- Configure
- Geo-Replication
- Connection strings
- Sync to other databases
- Add Azure Search

	Server/Database	Failover policy	Status
Primary			
East US 2	hfxcms/HFXCMS	hfxcmsfg1 (Automatic, 1 hours)	Online
Secondaries			
Central US	hfxcms2/HFXCMS		Readable

12

Deploy a SQL Database

- https://portal.azure.com/#create/Microsoft.SQLDatabase

13

Demo: Azure SQL Database

14

Instance-aaS – SQL Managed Instance

- SQL Server instance without operating system
- Almost a full SQL Server
- Multiple databases
- Features not available in DB
  - XEvents
  - Service Broker
  - CDC
  - Transactional Replication
  - SQL Agent
  - DB Mail

  - Query Store
  - Cross-DB Queries
  - Linked Servers
  - CLR Assemblies

| Application |
| SQL Server DB |
| SQL Server Instance |
| Operating System |
| Virtualization |
| Physical Server |
| Storage |

HERAFLUX
TECHNOLOGIES®

15

SQL Managed Instance

- Service Tiers
- General Purpose
  - HA via Azure Blob & Service Fabric
- Business Critical
  - Is an Availability Group underneath
  - R-O replica for read-only workloads accessible

| Application |
| SQL Server DB |
| SQL Server Instance |
| Operating System |
| Virtualization |
| Physical Server |
| Storage |

HERAFLUX
TECHNOLOGIES®

16

SQL Managed Instance

- Pros
  - (Almost) full SQL Server instance
  - Full DB restore from Azure Blob
  - SQL Agent
  - HA + DR options?
  - Faster possible migration time
- Cons
  - Less flexibility
  - External dependencies won't work
  - HA + DR options? Backups?

17

SQL Managed Instance Migrations

- Can backup DB and restore into via Azure Blob
- Recreate schema / SSIS
- BACPAC import / export
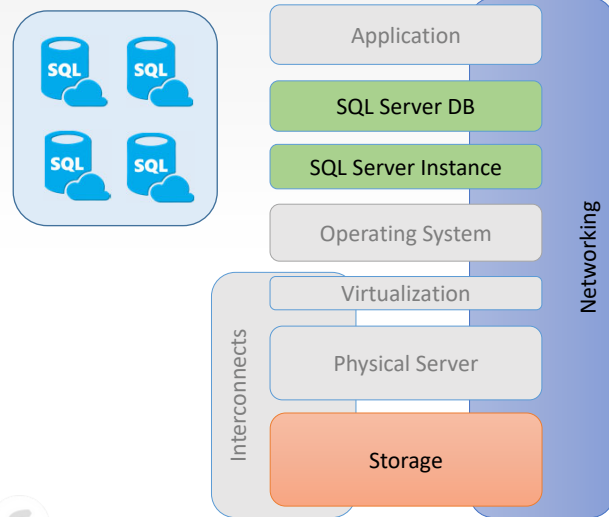 - DACPAC = schema for upgrades
  - BACPAC = schema and data for import / export
- Azure Database Migration Service
  - https://azure.microsoft.com/en-us/services/database-migration/

18

SQL Managed Instance Limitations

- DB engine + Agent only
  - No SSRS, SSAS
  - SSIS possible, but needs ADF
- Agent limitations
  - Not all job types exist
- Manual backups are COPY_ONLY
- 4 vCore minimum, 80 vCore max
- Storage
  - Up to 8TB 'fast' storage for GP
  - Up to 4TB for 'super fast' storage in BC

19

SQL Managed Instance Limitations

- 100 DBs max
- No PolyBase
- No access to server level functionality
  - *Is this really a bad thing?*
- App vendor support?
- Can backup INTO but not RESTORE FROM
  - SQL version always higher than boxed

20

Demo: SQL Managed Instance

HERAFLUX
TECHNOLOGIES®

21
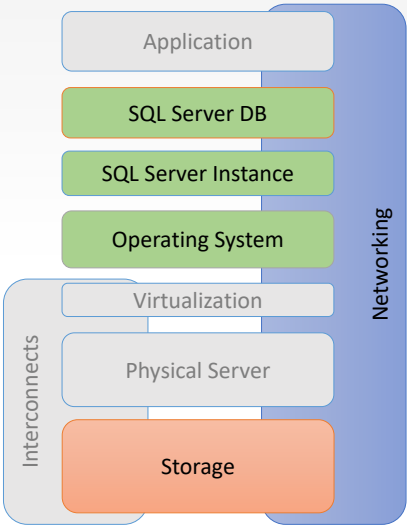
VM + SQL Server (IaaS)

- Pros
  - Full flexibility
  - Maximum customization
  - Fastest possible migration time
- Cons
  - You patch Windows
  - You patch SQL Server
  - You manage HA
  - You manage DR
  - You manage backups

| Application |
| SQL Server DB |
| SQL Server Instance |
| Operating System |
| Virtualization |
| Physical Server |
| Storage |

Networking

Interconnects

HERAFLUX
TECHNOLOGIES®

22

Choices

- What platform works best for you?
  - DBaaS
  - Instance-aaS
  - VMaaS
  - On-prem?

- DBAs work with Infra Admins
- Selection of platform depends on DB requirements
- Once you pick the platform…
- *Then you pick the SCALE*

HERAFLUX
TECHNOLOGIES®

23

Scale

(Img src: https://auto.ndtv.com/lamborghini-cars/aventador-s)   (Img src: https://www.toyota.com/sienna)

HERAFLUX
TECHNOLOGIES®

24

"Right-Sizing"

- Cloud claims: "pay f[...]
- **Not true** for most clo[...]
- Reality: "pay by allo[...]
- Allocate what you[...]

You pay whether you use it or not…

Virtual Machines

REGION: West US
OPERATING SYSTEM: Windows
TYPE: SQL Server
TIER: Standard
LICENSE: SQL Enterprise

INSTANCE: D13 v2: 8 Cores(s), 56 GB RAM, 400 GB Temporary storage, $4.134/hour

[...]ption

[...]2% on pay as you go prices with 1 year or 3 year reserved options. Learn more about Reserved VM Instances pricing.

○ Pay a[...]ou go
○ 1 year reserved (~7% savings)
○ 3 year reserved (~11% savings)

Save up to 40% with Windows Server Licenses you already own. Learn more about Azure Hybrid Benefit to save compute costs.

1 Virtual machines × 730 Hours = $3,017.82 Per month

HERAFLUX
TECHNOLOGIES

25

Resource Allocation

- What do you need?
- CPU
- RAM
- Storage space
- Storage SPEED

- More flexibility as approach VM
- **YOU** have to define this, not a sysadmin
- Do you have a resource consumption baseline?
- Low-granularity averages ARE NOT ACCURATE
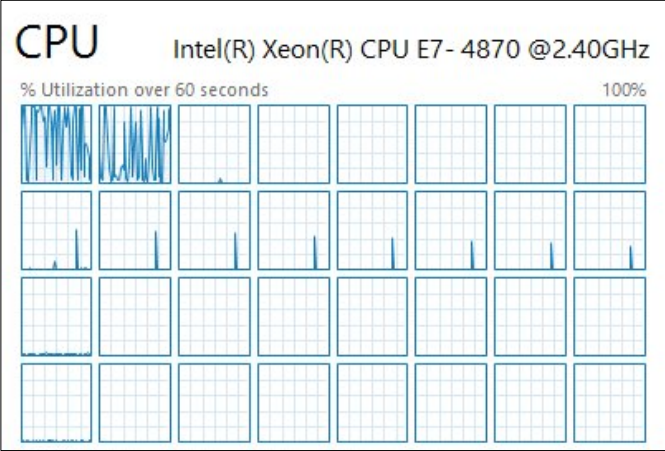
HERAFLUX
TECHNOLOGIES

26

CPU Performance

- "I have 32 CPUs!"
- "It's still slow!"
- 6% CPU consumption average?

CPU   Intel(R) Xeon(R) CPU E7- 4870 @2.40GHz

% Utilization over 60 seconds   100%

HERAFLUX
TECHNOLOGIES®

27

Windows Perfmon

- Collect raw data first
- Perfmon how-to guide
  - Download at hfxte.ch/perfmon
- 30-second interval
- Export to CSV (relog)
- Review trends
- Or use other third-party tools

HERAFLUX
TECHNOLOGIES®

28

Perfmon to SQL

PowerShell Loader for Perfmon Files into SQL Server

https://github.com/heraflux/BLGtoSQL

29

CPU by Core - Five Minute Mon-Fri Baseline

30

8-Core CPU Percentile Baseline (15 min)
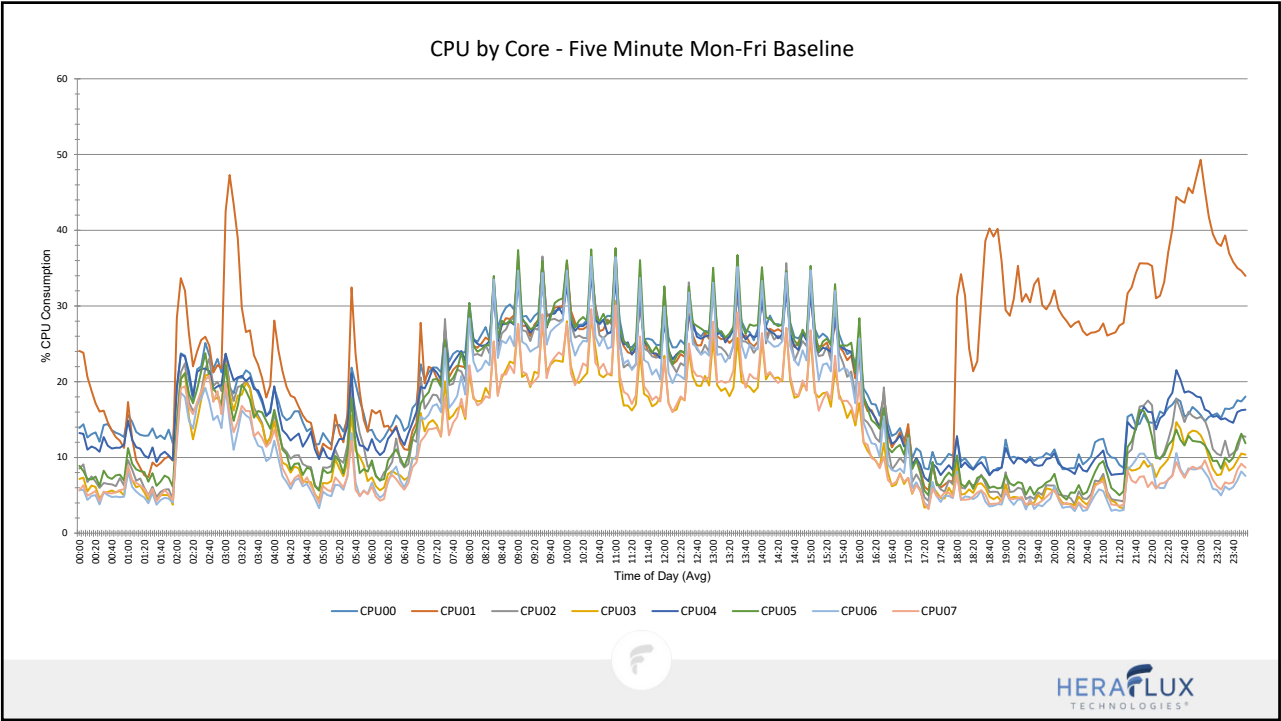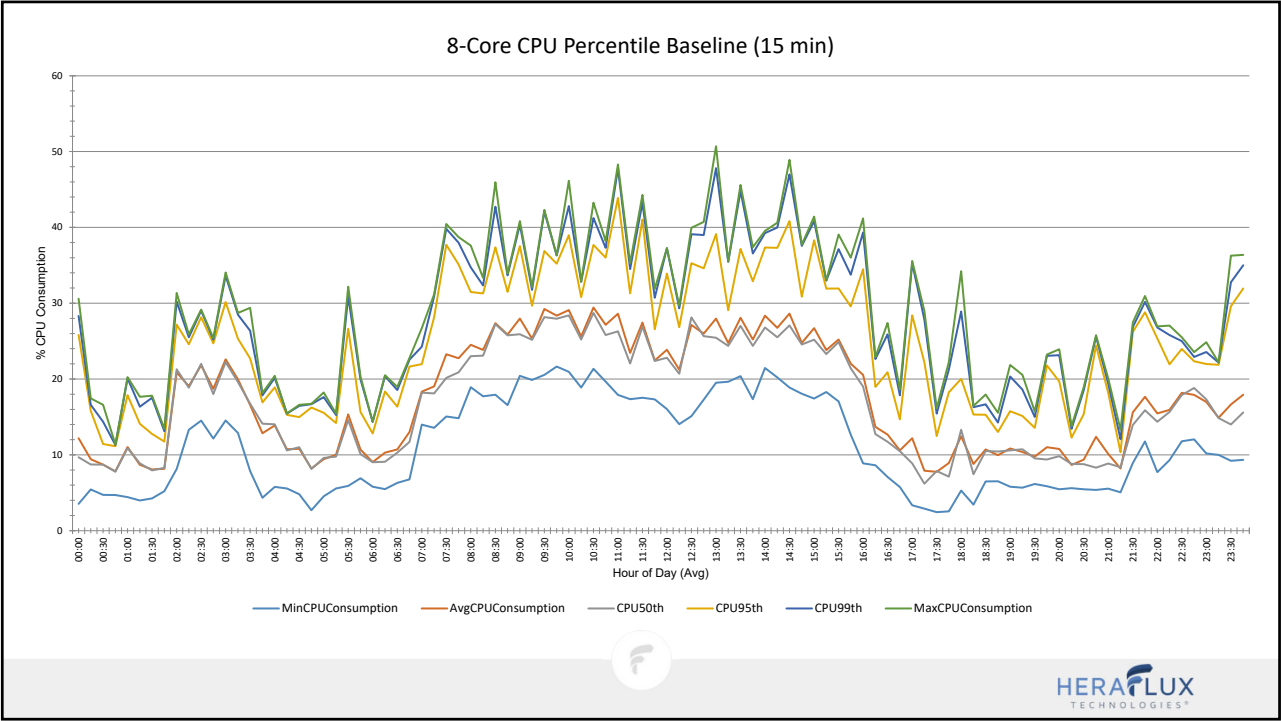
31

Right-Sizing CPU Example

- Server had 8 vCPUs
- Business hours Mon-Fri or 24x7?
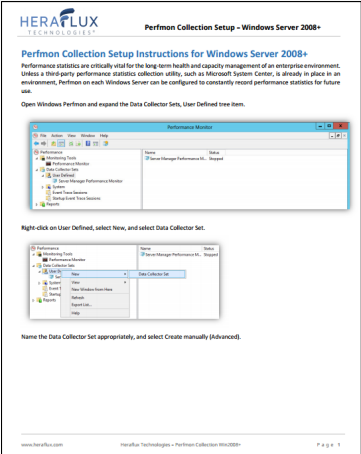- Used no more than 50% at absolute max
- Used no more than 40% at 95th percentile
- Aggressive = 4 vCPUs
- Conservative = 6 vCPUs
- 2 vCPUs not paying for!
- 25% price reduction - immediately

DS12_V2 Standard	DS13_V2 Standard
4 vCPUs	8 vCPUs
28 GB	56 GB
16 Data disks	32 Data disks
12800 Max IOPS	25600 Max IOPS
56 GB Local SSD	112 GB Local SSD
Premium disk support	Premium disk support
Load balancing	Load balancing
1,2,3 Zones	1,2,3 Zones
485.09 USD/MONTH (ESTIMATED)	872.71 USD/MONTH (ESTIMATED)

32

CPU Requirements

- Less choices in cloud
- Some services allow CPU count selection
- Other services have more abstract scale
  - Azure SQL DB DTU

33

RAM Right-Sizing

- Memory means Buffer Pool
- Buffer Pool is just that - I/O Buffer
- Assumption – RAM is faster than storage
- Working data in RAM, or flush to disk
- Low RAM = High I/O consumption?
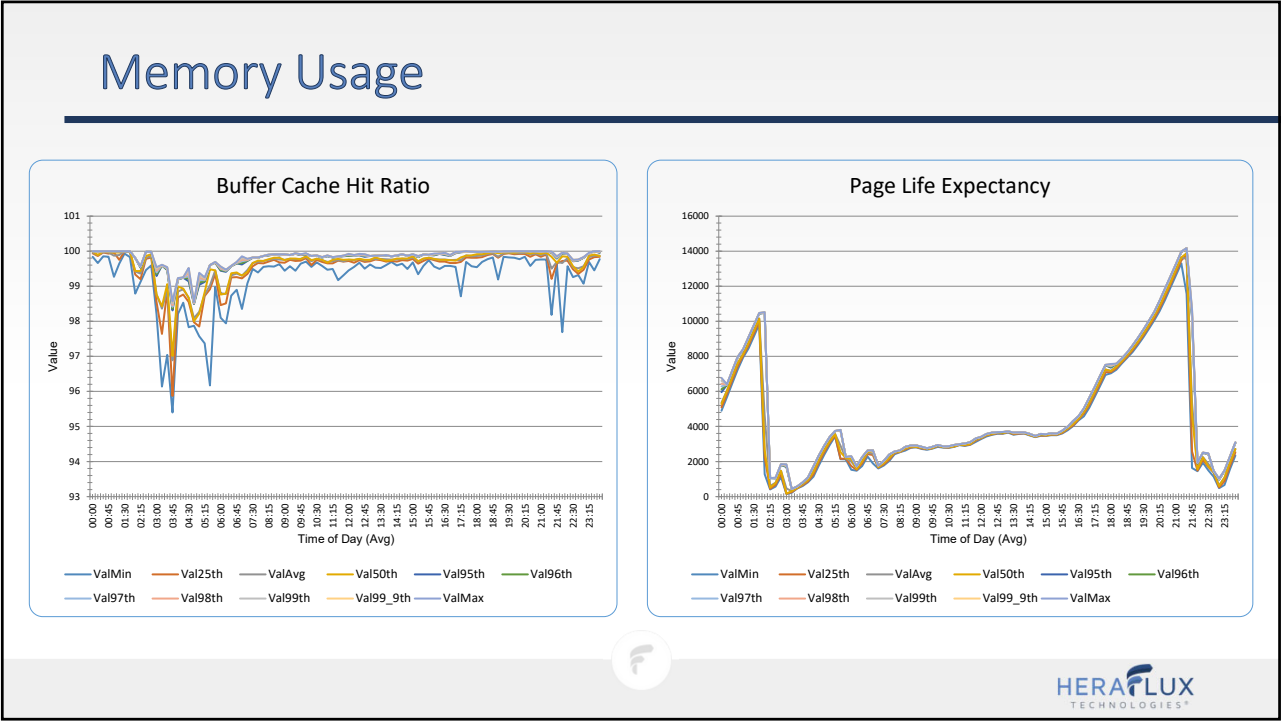- High RAM = Low I/O consumption?
- Premium SSD storage is quite fast
- What is your memory consumption?

34

Memory Usage

Buffer Cache Hit Ratio

Page Life Expectancy

35

Storage IOPs / Latency are Critical

- Low latency = SSD (Premium storage)
- IOPs critical
- IOPs x NTFS block size = Throughput (MB/s)
- Cloud-provisioned storage has IOPs limits
- Some have throughput limits too
- VM limits
- What are you consuming today?

DS12_V2 Standard ⭐	DS13_V2 Standard ⭐
4 vCPUs	8 vCPUs
28 GB	56 GB
16 Data disks	32 Data disks
12800 Max IOPS	25600 Max IOPS
56 GB Local SSD	112 GB Local SSD
Premium disk support	Premium disk support
Load balancing	Load balancing
1,2,3 Zones	1,2,3 Zones
485.09 USD/MONTH (ESTIMATED)	**872.71** USD/MONTH (ESTIMATED)

36

Storage IO Operations Per Sec (IOPs)

Physical Disk Read IOPs

Physical Disk Write IOPs

37

Limits

- Single drives have IOPs / throughput limits
- Scaling up speed is costly if you don't need the *space*
- *DBaaS / Instance-aaS*
  - *Less choice*
- *VMs*
  - *Windows Storage Spaces*
  - *Bundle multiple smaller disks together for faster performance and lower costs*

DISK SIZE:

P4: 32 GiB, 120 IOPS, 25 MB/sec, $5.280/month

P4: 32 GiB, 120 IOPS, 25 MB/sec, $5.280/month
P6: 64 GiB, 240 IOPS, 50 MB/sec, $10.207/month
P10: 128 GiB, 500 IOPS, 100 MB/sec, $19.710/month
P15: 256 GiB, 1100 IOPS, 125 MB/sec, $38.012/month
P20: 512 GiB, 2300 IOPS, 150 MB/sec, $73.220/month
P30: 1024 GiB, 5000 IOPS, 200 MB/sec, $135.170/month
P40: 2048 GiB, 7500 IOPS, 250 MB/sec, $259.046/month
P50: 4096 GiB, 7500 IOPS, 250 MB/sec, $495.566/month

38

Not Just SQL Server

- Azure Database for:
  - PostgreSQL
  - MySQL / MariaDB
- Cosmos DB
- Data Lake
- Data Factories

HERA**F**LUX
TECHNOLOGIES®

39

Recap

- You must determine resource allocations
- Saving your company $$ makes you a hero
- Many platform choices
  - DBaaS / Instance-aaS / VMaaS
- With SQL Server - pay by allocation, not consumption
- So allocate just what you need!
- Leave just enough headroom
- Scale as needed

HERA**F**LUX
TECHNOLOGIES®

40

Questions?

HERA**FLUX**
TECHNOLOGIES®

41

Global Azure Day 2020 - Omaha

#GLOBALAZURE

Mark Your Calendar

The **Global Azure Day 2020 – Omaha** will take place on **April 24, 2020** at **Kiewit University**.

Free full-day event hosted by community members for community.

Event is open to IT professionals, architects, developers, administrators and anyone who is interested in Azure.

Registration is now open - https://globalazureday.omahaaug.com/

If you are interested in sponsoring/volunteering, please reach out the organizers in-person, on slack channel or email at info@omahaaug.com

42
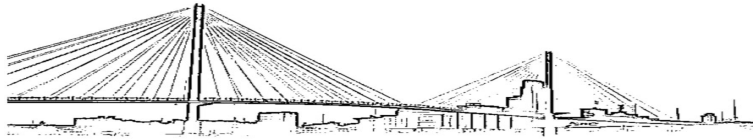
Omaha Azure User Group Meeting - March 2020

The **next meeting** will take place on **March 25, 2020**

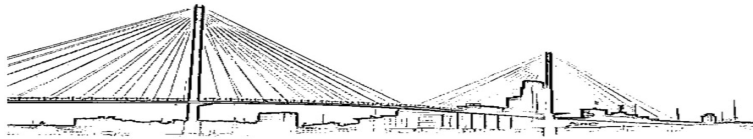Topic – "**Methodology and Framework for an Enterprise AI foundation on Azure**"

Intended For: **Anyone and everyone interested in AI and want to know what it really is and how to get started.**

Speaker: **Sudhir Gajre**

Sponsor: **Farm Credit Services of America**

More details - https://omahaaug.com/omaha-azure-user-group-meeting-march-2020/

43

Omaha Azure User Group

https://omahaaug.com/

https://www.meetup.com/Omaha-Azure-User-Group-Meetup/

omahaaug.slack.com

@omahaaug

info@omahaaug.com

44

If you are interested in speaking at one of our meetings, please reach out to organizers in one of the following ways:

- Submit the session details at - https://omahaaug.com/speakers/
- On slack channel
- Email at info@omahaaug.com
- In-person

45

Thanks for attending!

HERAFLUX
TECHNOLOGIES®

46