Monitoring SQL Databases

Three important parameters should be monitor

1. DTU Usage
2. CPU Usage
3. IO Usage

DTU usage:

DTU stands for Database Transaction Unit. DTUs give you a way to compare database performance across the service tiers offered by Azure. DTUs roughly measure performance as a combination of CPU, Memory, Reads, and Writes. When provisioning compute for elastic pools, the acronym eDTU may be used to refer to DTUs that are part of an elastic pool.

Effects

Running at consistently high DTU usage, especially near 100% usage will be detrimental to the performance of your database and should be addressed ASAP. Specific issues may include:

- Longer query times
- Rejected transactions due to timeouts

Fixes

diagnosing high DTU usage is to figure out which resource is contributing to your high usage by querying the sys.dm_db_resource_stats table.

```
SELECT * FROM sys.dm_db_resource_stats ORDER BY end_time DESC;
```

important parameter to observe here

avg_cpu_precent
avg_data_io_precent
avg_log_write_precent
avg_memory_usage_precent

Refer:

https://docs.microsoft.com/en-us/sql/relational-databases/system-dynamic-management-views/sys-dm-db-resource-stats-azure-sql-database?view=azuresqldb-current

CPU usage

CPU usage is a term used to describe how much the processor is working. A computer's CPU usage can vary depending on the types of tasks that are being performed by the processor. CPU usage can be monitored to see how much of the processor's capacity is in use.

When looking at high CPU usage on a database, the culprit is very likely to be one of the following:

- Too many queries running
- Too many queries compiling
- Queries running sub-optimally

Root Cause:

Might increase Resources (last option)

IO Usage:

What is IO Process:

input/output (defined as KB/s) is just the throughput or speed of data transfer between the hard disk and the RAM. On a server, a disk I/O describes every process that involves writing to or reading from a storage device which on a shared web hosting server will be the hard disk drive, or HDD

SELECT end_time, avg_data_io_percent, avg_log_write_percent FROM sys.dm_db_resource_stats ORDER BY end_time DESC;

Root Cause:

No	Problem	Recommendation
1	Hard disk specifications with low RPM speed or slow interface technology	Upgrade the hard disk on your server or split the application load between separate hard disks.
2	No bandwidth available on the hard disk	Upgrade the hard disk on your server or split the application load between separate hard disks.
3	Write caching is disabled	Enable write caching on the disk.

Type of purchase model:

1. vCore
2. DTU

Compare the DTU-based service tiers

Choosing a service tier depends primarily on business continuity, storage, and performance requirements.

	Basic	Standard	Premium
Target workload	Development and production	Development and production	Development and production
Uptime SLA	99.99%	99.99%	99.99%
Maximum backup retention	7 days	35 days	35 days
CPU	Low	Low, Medium, High	Medium, High
IO throughput (approximate)	1-5 IOPS per DTU	1-5 IOPS per DTU	25 IOPS per DTU
IO latency (approximate)	5 ms (read), 10 ms (write)	5 ms (read), 10 ms (write)	2 ms (read/write)
Columnstore indexing	N/A	S3 and above	Supported
In-memory OLTP	N/A	N/A	Supported

Refer: https://docs.microsoft.com/en-us/azure/sql-database/sql-database-service-tiers-dtu

Database tier:

Standard service tier

Compute size	S0	S1	S2	S3
Max DTUs	10	20	50	100
Included storage (GB)	250	250	250	250
Max storage choices (GB)	250	250	250	250, 500, 750, 1024
Max in-memory OLTP storage (GB)	N/A	N/A	N/A	N/A
Max concurrent workers (requests)	60	90	120	200
Max concurrent sessions	600	900	1200	2400

Standard service tier (continued)

Compute size	S4	S6	S7	S9	S12
Max DTUs	200	400	800	1600	3000
Included storage (GB)	250	250	250	250	250
Max storage choices (GB)	250, 500, 750, 1024	250, 500, 750, 1024	250, 500, 750, 1024	250, 500, 750, 1024	250, 500, 750, 1024
Max in-memory OLTP storage (GB)	N/A	N/A	N/A	N/A	N/A
Max concurrent workers (requests)	400	800	1600	3200	6000
Max concurrent sessions	4800	9600	19200	30000	30000

Premium service tier

Compute size	P1	P2	P4	P6	P11	P15
Max DTUs	125	250	500	1000	1750	4000
Included storage (GB)	500	500	500	500	4096*	4096*
Max storage choices (GB)	500, 750, 1024	500, 750, 1024	500, 750, 1024	500, 750, 1024	4096*	4096*
Max in-memory OLTP storage (GB)	1	2	4	8	14	32
Max concurrent workers (requests)	200	400	800	1600	2400	6400
Max concurrent sessions	30000	30000	30000	30000	30000	30000

Recommended Approach

> **Important**
>
> The Standard S0, S1 and S2 tiers provide less than one vCore (CPU). For CPU-intensive workloads, a service tier of S3 or greater is recommended.
>
> Regarding data storage, the Standard S0 and S1 service tiers are placed on Standard Page Blobs. Standard Page Blobs use hard disk drive (HDD)-based storage media and are best suited for development, testing, and other infrequently accessed workloads that are less sensitive to performance variability.

Upgrade Considerations:

1. Max concurrent sessions
2. Max concurrent requests
3. CPU Usage
4. IO usage
5. DTU Usage

Refer:

https://docs.microsoft.com/en-us/azure/sql-database/sql-database-dtu-resource-limits-single-databases

Pricing Details:

Standard

	DTUS	INCLUDED STORAGE	MAX STORAGE	PRICE FOR DTUS AND INCLUDED STORAGE [1]
S0	10	250 GB	250 GB	$0.0202/hour
S1	20	250 GB	250 GB	$0.0404/hour
S2	50	250 GB	250 GB	$0.1009/hour
S3	100	250 GB	1 TB	$0.2017/hour
S4	200	250 GB	1 TB	$0.4033/hour
S6	400	250 GB	1 TB	$0.8066/hour
S7	800	250 GB	1 TB	$1.6130/hour
S9	1,600	250 GB	1 TB	$3.2260/hour
S12	3,000	250 GB	1 TB	$6.0488/hour

[1]An additional cost applies for extra storage that is provisioned above the amount of storage included. Please see the FAQ for details on how this cost is computed.

Pricing include:

1. SQL Instance cost and DB
2. Extra Data Storage
3. Inbound Data transfer (Free)
4. Outbound Data transfer (5Gb free)

Monitoring and Alerts:

Signal name	Signal type	Monitor service
CPU percent	Metric	Platform
Memory percent	Metric	Platform
IO percent	Metric	Platform
Storage percent	Metric	Platform
Storage used	Metric	Platform
Storage limit	Metric	Platform
Server Log storage percent	Metric	Platform
Server Log storage used	Metric	Platform
Server Log storage limit	Metric	Platform
Active Connections	Metric	Platform
Failed Connections	Metric	Platform
Backup Storage used	Metric	Platform
Network Out	Metric	Platform
Network In	Metric	Platform
Replica Lag	Metric	Platform
Max Lag Across Replicas	Metric	Platform
All Administrative operations	Activity Log	Administrative
List query text of a query (Microsoft.DBforPostgreSQL/servers)	Activity Log	Administrative
Create/Update PostgreSQL Server (Microsoft.DBforPostgreSQL/servers)	Activity Log	Administrative
Delete PostgreSQL Server (Microsoft.DBforPostgreSQL/servers)	Activity Log	Administrative

please refer the above pics by default azure provide metrics list.

Refer:

https://www.bluematador.com/docs/troubleshooting/azure-sql-dtu-usage