



Cloud Service Automation

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Database Monitoring Guide

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Overview

This document provides Cloud Service Automation (CSA) deployment, monitoring, and maintenance guidelines for database administrators. In addition, the document includes best practices, database configuration for optimal performance, and database monitoring based on expected workloads.

You might experience different results than those described here because:

- These guidelines are based on test environments and tests conducted in R&D Performance labs.
- Recommended best practices for database optimizations suggested by vendors (such as VM optimizations recommended by Hypervisor vendors) might not have been followed.
- Tests were conducted with a database installed on a VM.
- SQLserver2012, Oracle 12c, and Postgres 9.1.4 have been tested in the CSA Performance Testing Lab

Workload profiles

Note: See the CSA sizing guide for more information on workload profiles.

Database configuration specifications

The following table lists application server and database server configuration settings that provide optimal performance when paired with specified workload conditions (see the CSA Sizing Guide for additional details on workload profiles used).

Configuration settings for MSSQL

| MSSQL database configuration parameter | Profile A* | Profile B** | Profile C*** |
|--|------------------------------------|-------------------------------------|-------------------------------------|
| TempDB | 4 GB | 8 GB | 8 GB |
| SQLServer Memory | 12 GB | 28 GB | 28 GB |
| Disable parallelism | Yes | Yes | Yes |
| AWE memory manager (SQLserver 2008) | Yes | Yes | Yes |
| Snapshot Isolation | OFF | OFF | OFF |
| optimizer_mode | ALL_ROWS | ALL_ROWS | ALL_ROWS |
| Optimize for Adhoc Workload | Yes | Yes | Yes |
| Database transaction log file size | 50 % of Database File size (50 GB) | 50 % of Database File size (100 GB) | 50 % of Database File size (100 GB) |

*Profile A represents workload with the smaller-load profile of the two profiles outlined in the sizing guide.

**Profile B represents workload with the larger-load profile of the two profiles outlined in the sizing guide.

***Profile C represents workload exercising only Topology designs as outlined in the sizing guide.

Configuration settings for Oracle

| Oracle database configuration parameter | Profile A* | Profile B** | Profile C*** |
|---|------------|-------------|--------------|
| cursor_sharing | EXACT | EXACT | EXACT |
| db_block_size | 8192 | 8192 | 8192 |
| memory_target | 4 GB | 6GB | 6 GB |
| open_cursors | 300 | 300 | 300 |
| optimizer_mode | ALL_ROWS | ALL_ROWS | ALL_ROWS |
| Processes | 300 | 600 | 600 |

Configuration settings for Postgress

| Postgres database configuration parameter | Profile A* |
|---|------------|
| cursor_sharing | EXACT |
| db_block_size | 8192 |
| memory_target | 4 GB |
| open_cursors | 300 |
| optimizer_mode | ALL_ROWS |
| Processes | 300 |

Database maintenance best practices

Using this paper's recommendations as a basis, follow these best practices to deploy CSA:

- Allocate additional capacity for operating-system demands while sizing system resources for CSA database servers.
- Install the database server on a separate server, not the server where CSA is installed.
- Maintain database disk I/O wait times at low values (< 200 ms).
- Run scheduled database jobs on the CSA database schema to ensure optimal performance as the data volume grows. Increases in data volume can negatively impact the SQL execution path.
- Run gather_stats jobs regularly to keep database statistics current.
- Periodically rebuild indexes for tables with high data growth.
- Use the CSA database Purge Tool periodically to physically delete unused auditing subscriptions (and associated data) from the database. Purging will prevent indefinite data growth and save database storage space.
- Actively monitor CPU usage, database memory usage, and database IO latencies.

CSA Purge Tool

This tool is used to delete cancelled, expired, or failed subscriptions and their associated data (requests; request actions; approval processes and notifications; subscription actions; service instances and component actions; resource binding actions; resource subscriptions and actions) from the database.

To run the purge tool, see the section Deleting Service Subscriptions and Audit Data in the *CSA Configuration Guide*.

Database sizing – data growth projection

This section provides high-level, database-server guidelines for CSA data-growth projections. For OO data-growth projections, see OO sizing guidelines.

Two driving factors of disk usage in a CSA database are subscription data volume and complexity of service designs used (number of service components with properties and number of options).

CSA 3.2 sizing templates were reused in this guide for data-growth projections because differences in table data growth between CSA 3.2 and CSA 4.50 (or later versions) were negligible. These sizing templates are available on HPE connections and give detailed projections based on the complexity of service designs and volume of subscription data.

High-count tables

The following CSA database tables have high row, read, and write counts:

- CSA_VALUE, CSA_PROPERTY, CSA_ACTION_PROPERTY, CSA_PROCESS_INSTANCE_PROPERTY, CSA_ACTION_INSTANCE_PROPERTY, CSA_PRICING
- CSA_INITIAL_PRICING, CSA_OPTION_PRICING, CSA_RECURRENT_PRICING, CSA_OPTION, CSA_PROPERTY_BINDING, CSA_ACTION, CSA_ARTIFACT
- TOKENSTOREOBJECT (IDM Database)

Use vendor-recommended best practices, including these, for large-data tables:

- Gather table statistics
- Gather index statistics
- Rebuild Indexes with % fragmentation > 30 % to avoid fragmentation

The following table shows estimated required storage for database servers for the workload profiles listed in the sizing guide:

| Estimated Data Growth | Profile A* | Profile B** | Profile C*** |
|-----------------------|------------------------------------|------------------------------------|------------------------------------|
| Oracle | 100 GB (csadb) 1 GB (csa IDMDB) | 240 GB (csadb) 2 GB (csa IDMDB) | 200 GB (csadb) 2 GB (csa IDMDB) |
| MSSQL | 100 GB (csadb) 1 GB (csa IDMDB) | 240 GB (csadb) 2 GB (csa IDMDB) | 200 GB (csadb) 2 GB (csa IDMDB) |
| Postgres | 100 GB (csadb) 1 GB (csa IDMDB) | - | - |

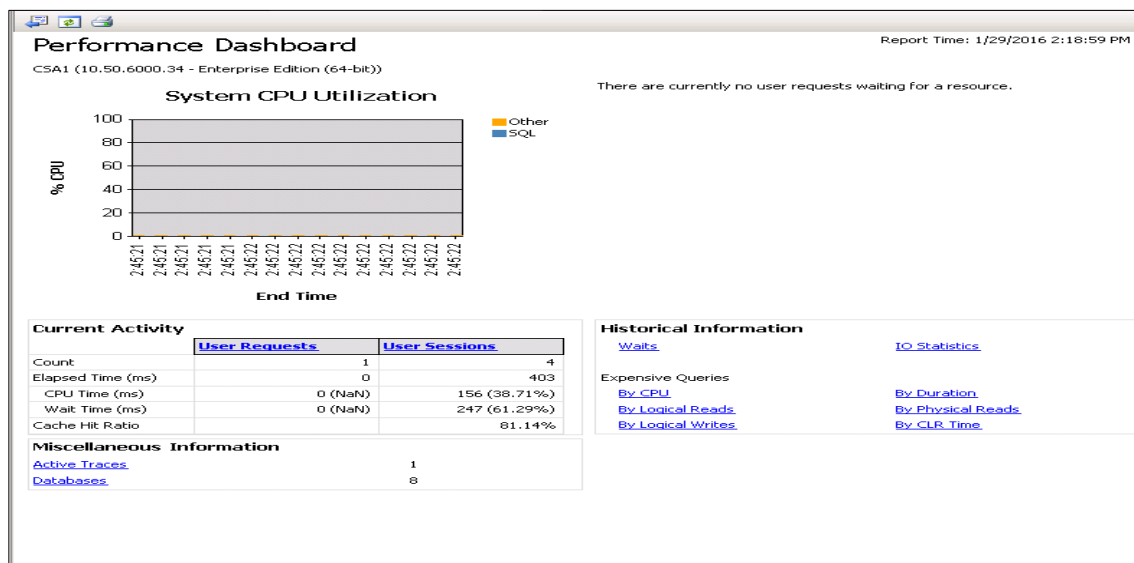
Database monitoring

This section discusses the top critical database server metrics that should be monitored. You can use further monitoring and other metrics to delve further into database issues.

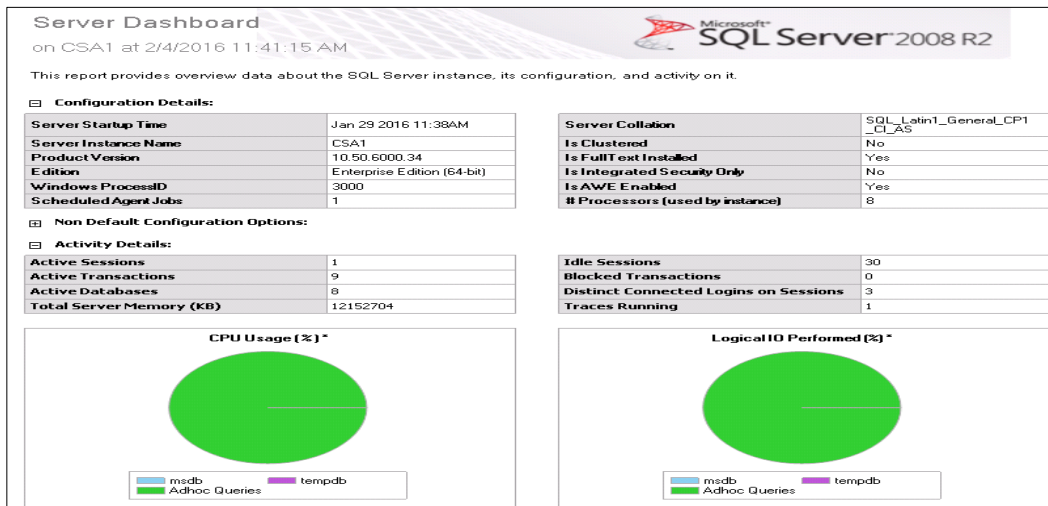
MSSQL

CPU Usage

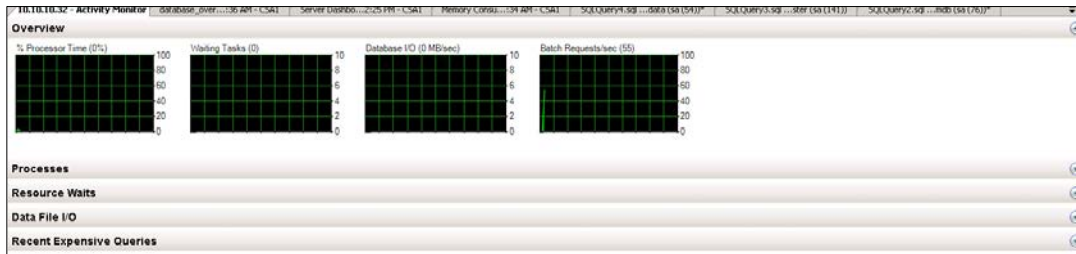
SQL server Performance Dashboard



Reports -> Standard Reports -> Server Dashboard

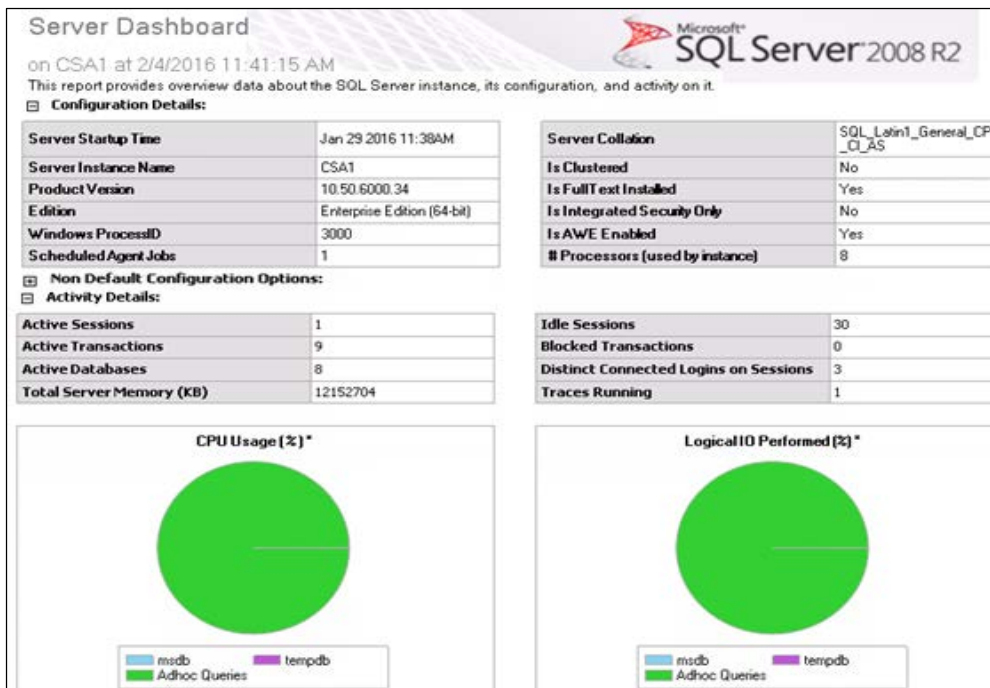


Activity Monitor



SQL Server Memory usage

Reports > Standard Reports > Server Dashboard > Total Server Memory



Disk Latencies

SQLserver performance dashboard -> IO Statistics Report

Historical IO Report Report Time: 2/4/2016 11:40:02 AM

The following table shows the number of IOs performed for each database since it was brought online (normally server startup) and how this compares to the total IO across all online databases.

| Database Name | % Reads | Reads | Read Wait Time (ms) | Avg Read Wait (ms) | % Writes | Writes | Write Wait Time (ms) | Avg Write Wait (ms) | % Total IO |
|--------------------|-------------|--------------|---------------------|--------------------|-------------|----------------|----------------------|---------------------|-------------|
| csadb_data | 94.64% | 55515 | 6199087 | 111.7 | 99.66% | 1146294 | 40193498 | 35.1 | 99.41% |
| idmdb | 0.83% | 489 | 6724 | 13.8 | 0.14% | 1610 | 42035 | 26.1 | 0.17% |
| master | 0.10% | 61 | 454 | 7.4 | 0.00% | 30 | 2 | 0.1 | 0.01% |
| model | 0.11% | 65 | 146 | 2.2 | 0.00% | 10 | 309 | 30.9 | 0.01% |
| msdb | 0.42% | 249 | 2254 | 9.1 | 0.01% | 114 | 1349 | 11.8 | 0.03% |
| ReportServer | 0.13% | 75 | 586 | 7.8 | 0.00% | 6 | 30 | 5.0 | 0.01% |
| ReportServerTempDB | 0.05% | 31 | 130 | 4.2 | 0.00% | 7 | 8 | 1.1 | 0.00% |
| tempdb | 3.70% | 2173 | 9783 | 4.5 | 0.19% | 2180 | 28464 | 13.1 | 0.36% |
| Grand Total | 100% | 58658 | 6219164 | 106.0 | 100% | 1150251 | 40265695 | 35.0 | 100% |

This table shows the top 20 objects within each database responsible for the most physical IO during the recent past. The DMV from which this data is collected may age out entries under memory pressure.

- csadb_data
- idmdb
- master
- model
- msdb
- ReportServer
- ReportServerTempDB
- tempdb

Blocking Transactions

Reports -> Standard Reports -> All Blocking Transactions Report

All Blocking Transactions

[csadb_data]

on CSA1 at 2/4/2016 11:44:10 AM

This report identifies transactions within the Database that are blocking other transactions and provides details about them.

All Blocking Transactions

The description of transactions which are blocking other transactions.

Currently, there are no blocking transactions for [csadb_data] database.

Log File usage

SQLserver Performance Dashboard -> Databases report

Allocate sufficient initial Log file size to adequately limit the log-file dynamic growth.

Databases Overview Report Time: 2/4/2016 11:46:11 AM

| Database ID | Database Name | Compat Level | Param Level | Auto Create Stats | Auto Update Stats | Recovery Model | Data File Size (MB) | Log File Size (MB) | % Log Used |
|-------------|--------------------|--------------|-------------|-------------------|-------------------|----------------|---------------------|--------------------|------------|
| 1 | master | 100 | SIMPLE | Enabled | Enabled | SIMPLE | 4 | 0.99 | 41 |
| 2 | tempdb | 100 | SIMPLE | Enabled | Enabled | SIMPLE | 8,192 | 4,395.13 | 0 |
| 3 | model | 100 | SIMPLE | Enabled | Enabled | FULL | 2 | 0.49 | 84 |
| 4 | msdb | 100 | SIMPLE | Enabled | Enabled | SIMPLE | 47 | 46.49 | 7 |
| 5 | ReportServer | 100 | SIMPLE | Enabled | Enabled | FULL | 4 | 6.74 | 13 |
| 6 | ReportServerTempDB | 100 | SIMPLE | Enabled | Enabled | SIMPLE | 2 | 0.74 | 58 |
| 7 | idmdb | 100 | SIMPLE | Enabled | Enabled | SIMPLE | 2,000 | 3,999.99 | 4 |
| 8 | csadb_data | 100 | SIMPLE | Enabled | Enabled | SIMPLE | 235,795 | 124,999.99 | 4 |

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Oracle

Use the Oracle AWR report to analyze the critical monitoring metrics in this section, and Oracle Enterprise manager to display live graphical monitoring of the Oracle database.

Run the following command from the sqlplus prompt to execute the Oracle-supplied script and generate the AWR report:

```
@$ORACLE_HOME\rdbms\admin\awrrpt.sql
```

CPU Use

AWR report -> Instance CPU usage

| Host CPU (CPUs: 24 Cores: 12 Sockets: 2) | | | | | |
|--|------------------|-------|---------|------|-------|
| Load Average Begin | Load Average End | %User | %System | %WIO | %Idle |
| 1.97 | 1.66 | 6.9 | 0.3 | 0.0 | 92.7 |

| Instance CPU | | |
|--------------|-----------|---|
| %Total CPU | %Busy CPU | %DB time waiting for CPU (Resource Manager) |
| 7.2 | 98.4 | 0.0 |

Database Memory usage (SGA)

AWR -> Memory Statistics -> SGA usage

| Memory Statistics | | |
|------------------------------|----------|----------|
| | Begin | End |
| Host Mem (MB): | 64,454.9 | 64,454.9 |
| SGA use (MB): | 7,872.0 | 7,872.0 |
| PGA use (MB): | 261.8 | 251.9 |
| % Host Mem used for SGA+PGA: | 12.62 | 12.60 |

AWR > SGA Target Advisory for the optimal SGA recommended by Oracle based on the workload. Choose a SGA target size from the following table that results in minimum Estimated Physical Reads:

| SGA Target Advisory | | | |
|---------------------|-----------------|-----------------|--------------------|
| SGA Target Size (M) | SGA Size Factor | Est DB Time (s) | Est Physical Reads |
| 1,968 | 0.25 | 221,614,120 | 617,509,289,159 |
| 2,952 | 0.38 | 80,003,131 | 202,693,019,102 |
| 3,936 | 0.50 | 19,326,019 | 24,950,049,652 |
| 4,920 | 0.63 | 11,224,423 | 1,217,900,031 |
| 5,904 | 0.75 | 11,107,941 | 877,735,645 |
| 6,888 | 0.88 | 11,097,956 | 863,236,835 |
| 7,872 | 1.00 | 11,093,519 | 857,917,745 |
| 8,856 | 1.13 | 11,091,300 | 853,971,323 |
| 9,840 | 1.25 | 11,089,082 | 848,738,025 |
| 10,824 | 1.38 | 11,086,863 | 844,191,061 |
| 11,808 | 1.50 | 11,085,754 | 838,786,179 |
| 12,792 | 1.63 | 11,081,316 | 826,003,205 |
| 13,776 | 1.75 | 11,080,207 | 826,003,205 |
| 14,760 | 1.88 | 11,079,097 | 826,003,205 |
| 15,744 | 2.00 | 11,079,097 | 826,003,205 |

Disk Latencies (IO bottlenecks)

AWR -> Top Timed Foreground events -> Look for Database File type waits

| Top 5 Timed Foreground Events | | | | | |
|-------------------------------|------------|---------|---------------|-----------|------------|
| Event | Waits | Time(s) | Avg wait (ms) | % DB time | Wait Class |
| DB CPU | | 22,660 | | 63.38 | |
| direct path read | 122,403 | 32 | 0 | 0.09 | User I/O |
| SQL*Net message to client | 30,711,443 | 31 | 0 | 0.09 | Network |
| db file sequential read | 13,285 | 27 | 2 | 0.08 | User I/O |
| SQL*Net more data from client | 366,665 | 6 | 0 | 0.02 | Network |

Postgres

Use the open source tool pgstatspack available from <http://pgfoundry.org/projects/pgstatspack> to monitor Postgres. This tool gives an overview of the top SQL-related statistics (CPU, memory, disk usage, and other statistics that are also reported in the Oracle AWR report).

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