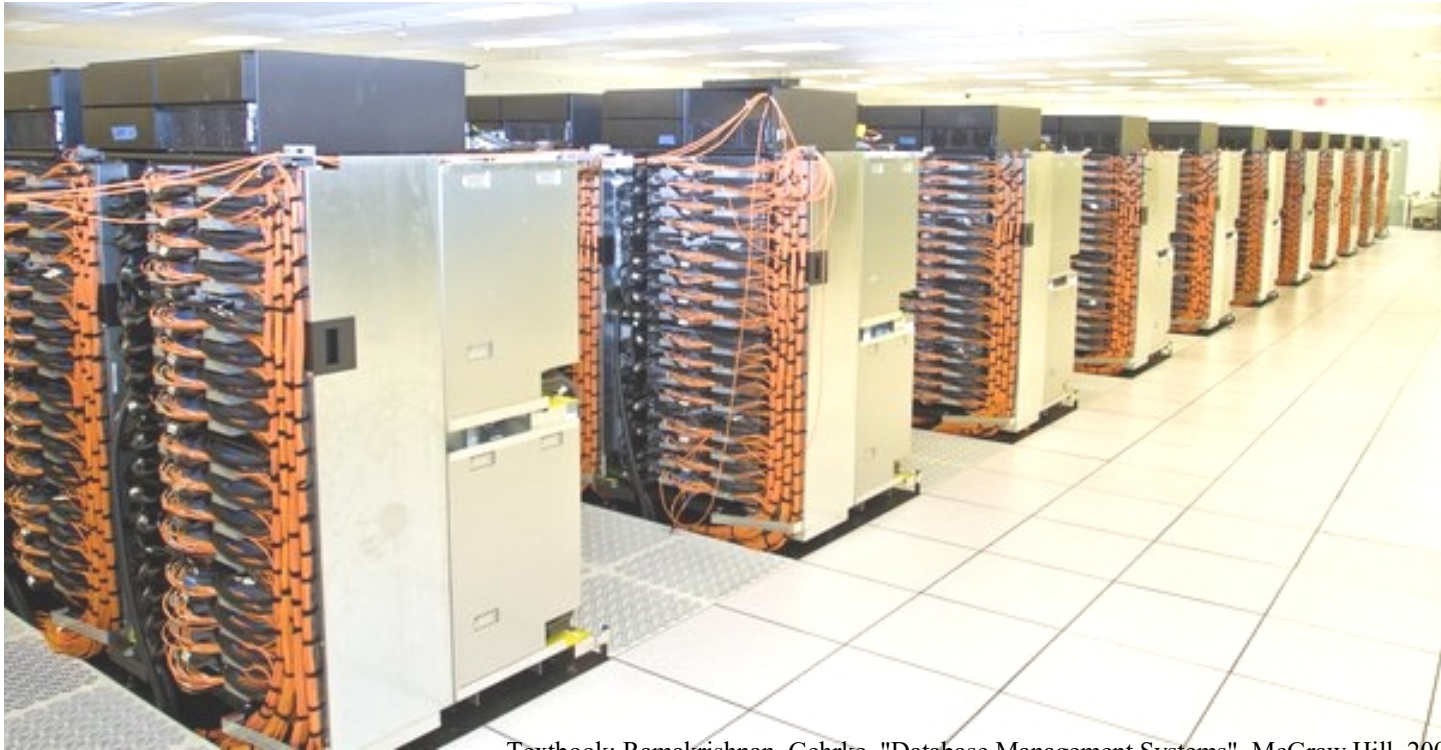


Databases

Cap. 12. Introduction to DB Administration and Security



Textbook: Ramakrishnan, Gehrke, "Database Management Systems", McGraw Hill, 2003

2017 UPT

Conf.Dr. Dan Pescaru

Oracle Database Management

1. Command line: SQL DDL + Oracle specific
 1. E.g. ALTER DATABASE. ALTER USER, ALTER SESSION
2. Using ORACLE Enterprise Manager
 - Database tuning
 - Modify database parameters as shared pool, buffer cache, PGA (Program global area), SGA (System global area)

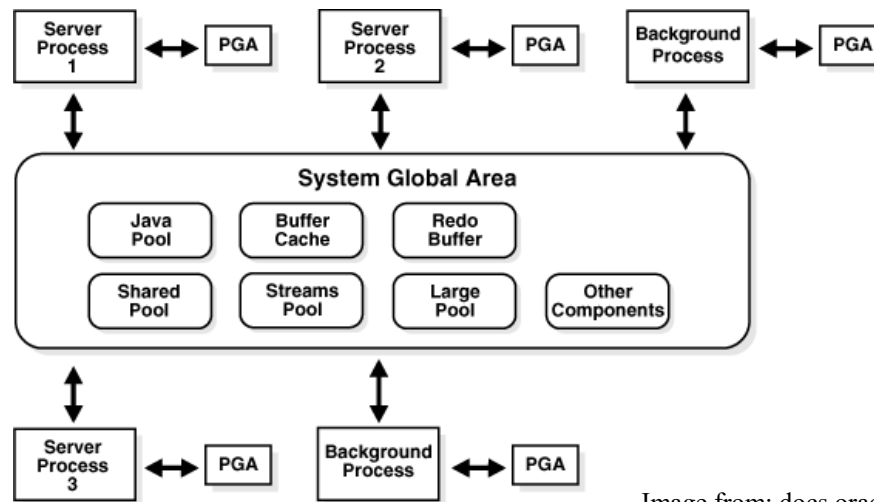


Image from: docs.oracle.com

Oracle Memory Management

1. The main components of the shared pool are
 - the library cache - stores the executable (parsed or compiled) form of recently referenced SQL and PL/SQL code
 - the dictionary cache - stores data referenced from the data dictionary
 - the result cache - stores the results of queries and PL/SQL function results
2. Program Global Area (PGA) is a private memory region containing data and control information for a server process
 - E.g. the run-time area of a cursor. Each time a cursor is executed, a new run-time area is created for that cursor in the PGA memory region of the server process executing that cursor
3. The System Global Area (SGA) components are the following: Database Buffer Cache, Redo Log Buffer, Shared Pool, Large Pool, Java Pool, Streams Pool

Oracle Database Management

Oracle Database Memory Management Modes

Memory Management Mode	For	You Set	Oracle Database Automatically Tunes
Automatic memory management	SGA and PGA	<ul style="list-style-type: none">• Total memory target size for the Oracle instance• (Optional) Maximum memory size for the Oracle instance	<ul style="list-style-type: none">• Total SGA size• SGA component sizes• Instance PGA size• Individual PGA sizes
Automatic shared memory management (Automatic memory management disabled)	SGA	<ul style="list-style-type: none">• SGA target size• (Optional) SGA maximum size	SGA component sizes
Manual shared memory management (Automatic memory management and automatic shared memory management disabled)	SGA	<ul style="list-style-type: none">• Shared pool size• Buffer cache size• Java pool size• Large pool size	-
Automatic PGA memory management	PGA	Instance PGA target size	Individual PGA sizes
Manual PGA memory management (not recommended)	PGA	Maximum work area size for each type of SQL operator	-

Info from: docs.oracle.com

Oracle Enterprise Manager

Edit Database : DB9 - SYS@DB9

General Memory Recovery Resource Monitors Undo

SGA

Shared Pool : 48 MB Advice...

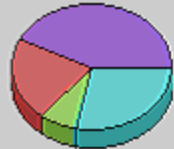
Buffer Cache : 24 MB Advice...

Large Pool: 8 MB

Java Pool : 32 MB

Total SGA: 112.932 MB

SGA Max Size: 129.069 MB




PGA

Aggregate PGA Target: 24 MB Advice...

Current PGA Allocated: 9070 KB

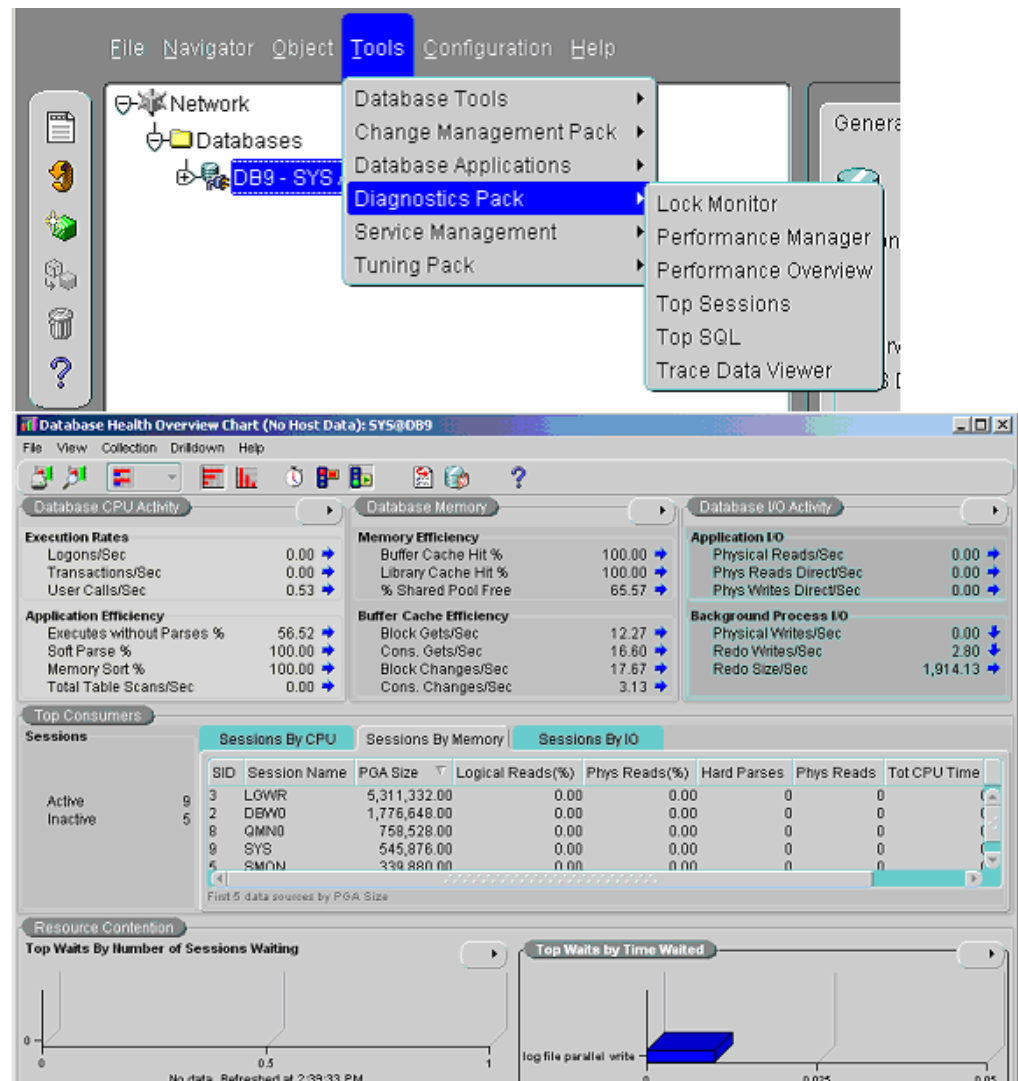
Maximum PGA Allocated (since startup): 19143 KB

Cache Hit Percentage: 100%

 The sum of PGA and SGA should be less than the total system memory minus memory required by the OS and other applications.

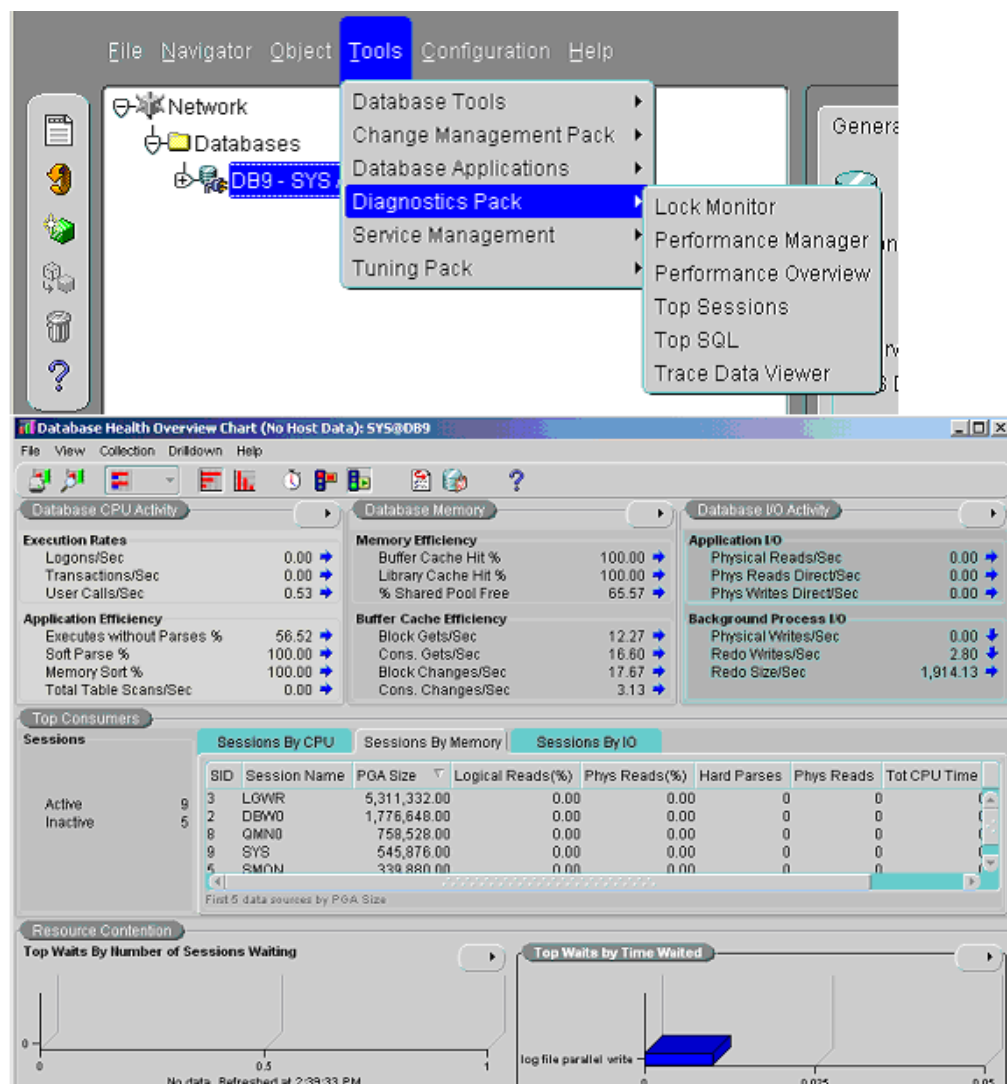
Oracle Performance Assessment

1. Diagnostic Pack / Performance Overview from Enterprise Manager



Oracle Performance Assessment

1. Diagnostic Pack / Performance Overview from Enterprise Manager



DB Bottlenecks

1. Performance of most systems (at least before they are tuned) usually limited by performance of one or a few components: these are called bottlenecks
2. E.g. 80% of the code may take up 20% of time and 20% of code takes up 80% of time
3. Bottlenecks may be in hardware (e.g. disks are very busy, CPU is idle), or in software
4. Removing one bottleneck often exposes another
5. De-bottlenecking consists of repeatedly finding bottlenecks, and removing them
 - This is a heuristic

Identifying Bottlenecks

1. Transactions request a sequence of services
 - e.g. CPU, Disk I/O, locks
2. With concurrent transactions, transactions may have to wait for a requested service while other transactions are being served
3. Can model database as a queueing system with a queue for each service
 - transactions repeatedly do the following:
request a service, wait in queue for the service,
and get serviced

Performance Benchmarks

1. Suites of tasks used to quantify the performance of software systems
2. Important in comparing database systems, especially as systems become more standards compliant
3. Commonly used performance measures:
 - **Throughput** (transactions per second, or tps)
 - **Response time** (delay from submission of transaction to return of result)
 - **Availability** or mean time to failure

Performance Benchmarks

1. Suites of tasks used to characterize performance
 - single task not enough for complex systems
2. Beware when computing average throughput of different transaction types
 - E.g., suppose a system runs transaction type A at 99 tps and transaction type B at 1 tps
 - Given an equal mixture of types A and B, throughput is not $(99+1)/2 = 50$ tps
 - Running one transaction of each type takes time $1+.01$ seconds, giving a throughput of 1.98 tps
 - To compute average throughput, use harmonic mean:

$$\frac{n}{1/t_1 + 1/t_2 + \dots + 1/t_n}$$

- Interference (e.g. lock contention) makes even this incorrect if different transaction types run concurrently

DB Security – Oracle network encryption

1. Encrypts all communication with the database
 - AES
 - RSA RC4 (40-, 56-, 128-, 256-bit keys)
 - DES (40-, 56-bit) and 3DES (2- and 3-key)
2. Data integrity with checksums
 - MD5, SHA-1
 - Automatically detects modifications, replays, missing packets

DB Security – Authentication systems

1. Kerberos

- Ease of deployment makes this a popular choice

2. PKI

- Large companies are working on full scale deployments
- Strong interest among researchers
- Some systems supports SSL accelerators

3. Radius

- Database integrates with RADIUS (Remote Authentication Dial In User Service) protocol

DB Security – Data audit

1. Audit & monitor database activity

2. Interest on:

- logon failures
- privilege usage
- data access
- object access
- other DB activities

3. Contents based data access monitoring