

ORACLE® Windows NT® - Configuration Standards

Introduction

I compiled this document to attempt to come up with some “standard” guidelines for implementing Oracle® on an Intel based server using Microsoft Windows NT® 4 operating system. The information in the document is available in many other sources¹ but, in my experience not as a single consolidated point of reference. This document is not intended to be a “definitive” guide so it would help to view it as a starting point from the reader is encouraged to adopt the contents to their circumstances. Consider your own requirements and refer to other documentation to explore the topics further. *Appendix B* lists some sources, books, discussion lists and Web sites relating to Oracle and NT that I have found useful. Whilst this document attempts to be as Oracle version generic as possible the reader is encouraged to check if feature is applicable to their specific Oracle version(s).

What you might have expected to see but won't:

Oracle backup strategies are not considered to be within the scope of this document. There are also some specific NT operating system configuration changes which can be made to enhance the use of Oracle but these are not discussed in this document.

Acknowledgements:

I'd would like to thank the, too many to name individually, members of the Oracle-L list @ Fatcity.com who provided me with feedback on my initial version of this document. This document is their baby too!

Feedback and Corrections:

I hope this document is if use to you and I have tried to make it as accurate and error free as possible. Feedback, corrections to this document can be sent to me at sean.oneill@organon.ie This document contains links to facilitate navigation to relevant sections.

As I gain more experience I plan to update and improve and maybe even expand this paper. Until then happy DBAing!

- 1: Source documents used in preparing this document.
- Oracle 8i Personal Edition Release 8.1.5 Documentation.
 - Oracle 8 DBA handbook by Kevin Loney, ISBN 0-07-8822406-0
 - RAID and Oracle: Part 1 by David C. Sisk, published in “Oracle Internals” Nov 1999
 - RAID and Oracle: Part 2 by David C. Sisk, published in “Oracle Internals” Jan 2000

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PURPOSE

The primary function of this document is to list the configuration standard guidelines which <company name>, will normally apply to installations of Oracle software on its NT servers. A secondary function of the document is to provide advance information to application vendors of the expected configuration with a view to incorporating these standards during planning phase of projects where the application software requires Oracle. For example, vendor database creation scripts could be modified to adhere to the standards.

A checklist is provided, *Appendix A*, to indicate which standards were applied and also for recording reasons for deviations from the standards.

BACKGROUND

The current server hardware platform standard is Intel based. The current server Operating System is Microsoft NT.

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1 - File name standards

File type	Format	Example for <sid>=LIVE
Configuration parameter file	IFILE_<sid>.ORA	IFILE_LIVE.ORA
Control File	CONTROL'n'_<sid>.CTL	CONTROL1_LIVE.CTL
Data File (Holds data table spaces)	DATA_<var>_<sid>.DBF	DATA_EMP_LIVE.DBF
Index File (Holds Index tablespaces) {see note 1.1}	INDX_<var>_<sid>.IDX	INDX_ACCT_LIVE.IDX
Initialisation Parameter File	INIT<sid>.ORA	INITLIVE.ORA
Redo Log file	REDO'g'm'_<sid>.RDO	REDO1A_LIVE.RDO
Data File (Holds Rollback Segments)	RBS<var>_<sid>.RBS	RBSBIG_LIVE.RBS
Data File (Holds SYSTEM tablespace)	SYSTEM'n'_<sid>.DBF	SYSTEM1_LIVE.DBF
Data File (Holds TEMPORARY tablespace)	TEMP<var>_<sid>.DBF	TEMP1_LIVE.DBF
Data File (Holds application tools in tablespace)	TOOL<var>_<sid>.DBF	TOOL1_LIVE.DBF
Data File (Holds user information)	USER<var>_<sid>.DBF	USER1_LIVE.DBF
SQL PL/SQL script	<i>Filename</i> .SQL	Free space.SQL
Archived Redo Log file {see Note 1.2}	ARC_'seq num''thread num'. ARC	ARC00000025630001.ARC

<sid> = Instance SID {see Note 1.3}

'n' = Number of File starting with 1 and incrementing by one.

<var> = Variable data e.g. brief descriptive information

'g' = Redo group number

'm' = Redo member reference a,b,c etc...

For those using Oracle8i Object Oriented features careful consideration should also be naming standards for objects!

Note 1.1

For databases with large tablespaces containing large tables, consider using same <var> value for corresponding Index files.

Note 1.2

Determined by INIT<sid>.ORA parameter LOG_ARCHIVE_FORMAT which should be defined as follows to meet name standard:

Log_archive_format = ARC%S%T.ARC

where

%S = Log sequence number, left-zero-padded

%T = Thread number, left-zero-padded

Note 1.3

Consideration to using <sid> as part of file name will require file renames if cloning your database.

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2 - Control Files

Database to be configured to use 3 control files.

Each control file to be on separate spindle.

See also

Section 1: *File name standards.*

Section 5: *File separation.*

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3 - RAID

Hardware RAID is preferred over software RAID.

RAID adapter write cache set to "write through" (physically writing the information on disk before acknowledging the write to the operating system).

File Type	Acceptable RAID (best first)	Comments
Redo Logs	None RAID 0 (single disk array) RAID 1 RAID 5	Always Mirror at Oracle-level
Data and Index	RAID 10 RAID 1 RAID 5 RAID 0	For high write capacity. Moderate write capacity. Moderate write, heavy read. Best write performance but no fault tolerance!
SYSTEM TS	RAID 10 RAID 1 RAID 5 RAID 0	
RBS	RAID 10 RAID 1 RAID 5 RAID 0	
TEMP	RAID 10 RAID 1 RAID 5 RAID 0	If little loss of functionality due to loss of TEMP and can be easily relocated then consider RAID 0
Archive Logs	RAID 5 RAID 10	For high change activity.
Control Files	Non-specific	Always mirror at Oracle-level
Oracle Software and Configuration Files	RAID 1	

RAID Level	Description	Minimum No. of physical disks required
0	Disk striping	2
1	Disk mirroring	2
5	Disk striping with parity	3
10 (0+1)	Mirrored stripe sets	4

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4 – Optimal Flexible Architecture (OFA)

Use of OFA is related to RAID levels in use, refer to section 3 this document on *RAID*, and also file separation, refer to section 5 this document on *File Separation*.

This section deviates from OFA as outlined in Oracle8i documentation in that the SID is still contained in the database file name, refer to section 1 of this document on *File Name Standards*. This section identifies the preferred directory structure. For sample spread of database files across 7 separate physical disks refer to Section 5 of this document on *File Separation*. Executables for Oracle are held on separate physical drive from database files, C: in the example below.

If more than 7 separate disks/spindles are available then consideration might be given to having Oracle software on separate disk other than NT operating system and virtual memory files. This can be a useful configuration where a system needs to be rebuilt after a disaster.

```
C:\ORACLE    {ORACLE_BASE which ideally should not be changed once defined}
             \ORA81      {ORACLE_HOME1}    ! Contains Oracle executables
```

```
E:\ORADBA
```

```
    \<sid>
        \adump      ! Audit files
        \arch       ! Archived redo log files
        \bdump      ! Background process trace files
                   [background_dump_dest]
        \cdump      ! Core dump files? Not configurable with NT?
        \create     ! Database creation files
        \exp        ! Database export files
        \pfile      ! Initialization parameter file
        \scripts    ! SQL scripts for <sid> [may include subdirectories]
        \udump      ! User SQL trace files
                   [user_dump_dest]
```

```
X:\ORADATA    ! Contains data files
```

```
    \<sid>
```

where X: = logical name of drives available for use (ideally separate physical disks).

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5 - File separation

Separation of files to balance disk I/O and reduce contention is primarily influenced by whether database is read intensive (DSS) or transaction oriented (OLTP). Files may also be separated in support of recovery strategy.

The primary aim is to separate objects by object type and activity type by placing tablespaces associated with specific objects in separate physical data files and separating these physical files subject to quantities of disks available, desired RAID levels and recovery considerations. A review of the expected usage levels of the various tablespaces should also be taken into account when deciding which files to separate across disks.

Below is a list of some typical tablespaces found in databases and their recommended separations.

Tablespace	Description of objects for use in tablespace	Keep separated from
SYSTEM	Data dictionary	All other tablespaces
DATA	Standard-operation tables	SYSTEM, DATA_2
DATA_2	Static tables used during standard operations	SYSTEM, DATA
INDEXES	Indexes for the standard-operation tables	From tables used by indexes
INDEXES_2	Indexes for the static tables	From tables used by indexes
TOOLS	RDBMS tools tables	TOOLS_I
TOOLS_I	Indexes for heavily used RDBMS tools tables	TOOLS
RBS	Standard-operation rollback segments	DATA, INDEXES and TEMP
RBSBIG	Speciality rollback segments used for data loads	DATA, INDEXES and TEMP
TEMP	Standard-operation temporary segments	SYSTEM
TEMP_USER	Temporary segments created by a specific user	SYSTEM
USERS	User objects, in development databases	All other tablespaces
USERS_I	User indexes, in testing databases	All other tablespaces

In addition to above where applicable each distinct object type should be stored in its own tablespace to minimise the impact objects have on each other. Typically these can include:

- SNAPS For snapshot tables and indexes.
- PARTITIONS
- TEMP_WORK For use during large data loads.

Other files for separation consideration are:

File type	Keep separated from
Online Redo Logs	Ideally all other DB files. Less optimally from SYSTEM, RBS or very active DATA or INDEX tablespaces. If running DB in ARCHIVELOG mode then also from each other across multiple disks to avoid LGWR-ARCH contention.
Archived Redo Log Files	SYSTEM, RBS or very active DATA or INDEX tablespaces, Online Redo Log files.
Control files (have 3 copies)	Other copies of control file.
Oracle software	Database files.

Below is a suggested arrangement for a compromise of 7 disks (reduced from ideal of 22 disk solution and does not allow for use of RAID).

Disk	Contents
1	Oracle software
2	SYSTEM, TOOLS, INDEXES_2 tablespaces, Control file 1
3	RBS, RBSBIG tablespaces, Control file 2
4	DATA tablespace, Control file 3, Oracle Mirrored Online Redo logs 1, 2, and 3
5	INDEXES, TEMP, TEMP_USER, DATA_2 tablespaces
6	Online Redo logs 1, 2, and 3
7	Application software, Archived redo logs

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6 – Instances/Databases

Depending on Good Manufacturing Practice and other regulatory guidelines/requirements it may be necessary to set-up 3 databases as follows:

Preferred

SID name	Database Use
LIVE	Live production database {Use of PROD instead of LIVE is also quite common in practice}
TEST	For testing new functionality etc.
VAL	For validation

Ideally each database would be on separate server if budget allows!

Using single server to host a number of databases has implications for memory and disk usage, refer to section 11 - *Capacity Planning - SGA, Tablespaces*. There are also implications for separation of data files for each database, refer to section 5 - *File Separation*.

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7 - Redo Logs

The quantity and size of Redo Logs to be determined initially by application requirements and tuned as needed.

Redo logs must always be mirrored at Oracle level with a minimum of 2 members per group and members of each group on different disks.

Redo logs should typically be switching every 30 minutes.

Example configuration for 2 groups of two files.

Disk 1	Disk 2	
LOG1A.RDO	LOG1B.RDO	{Group 1, 2 members A and B}
LOG2B.RDO	LOG2A.RDO	{Group 2, 2 members A and B}

See also:

Section 1 - *File name standards*

Section 3 - *RAID*

Section 5 - *File separation*

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8 – Redo Log Archiving

Unless there is a particular reason for not doing so, each database is to be set-up with Archive Logging enabled.

Use of LOG_ARCHIVE_DUPLEX_DEST parameter may also be considered for duplexing archived redo logs.

With Oracle8i it is possible to define up to 5 archive destinations and these can be remote.

See also:

Section 1 - *File name standards*

Section 5 - *File separation*

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9 - File system

NTFS is the preferred operating file system for use because of its file level security, fault tolerance features and also it's capability to handle larger file sizes.

See also:

Section 10 – *Block Size*.

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10 - Block size

Default OS block size for Intel NT is dependant on the file system and volume size. See table below for specific values.

NTFS Volume Size (Mb)	Cluster Size (Bytes)
Up to 511	512
512 - 1023	1024
1024 - 2047	2048
2048 and up	4096

Default Oracle Block size for NT platform is 2,048 bytes = 2Kb.

If application is Decision Support System (DSS) oriented with many long running queries a larger Oracle block size than default may need to be defined using DB_BLOCK_SIZE parameter in INIT<sid>.ORA file.

If application is OnLine Transaction Processing (OLTP) oriented with large number of small transactions an 8Kb Oracle block size is typically preferred over the default value.

Prior to Oracle 7.3 the block size limited the number of extents tables can have. See table below.

Block Size	Max number of Extents
2Kb	121
4Kb	255
8Kb	504
16Kb	1032
32Kb	2070

From Oracle 7.3 on it is possible to specify the storage parameter **maxextents unlimited** which allows you to have as many extents as your operating system will support.

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11 - Capacity Planning - SGA, Tablespaces

It is expected that the vendor supplying an application using an Oracle Database will provide some capacity planning worksheet(s) to facilitate:

- Memory sizing. SGA. Remember there may be requirement to have 3 instances.
- Disk space & physical disk quantities. Considerations to include level of fault tolerance required (RAID), file separation (refer to section 5), compliance to OFA (refer to section 4), initial data load volume and projected data take on.
- Server processor requirements dependant on transaction volumes and concurrent usage.

In the event where vendor has little to no experience with capacity sizing as well as above some general capacity guidelines to consider include:

- Number of concurrent users - Now? - In "x" years time?
- Database size - Now? - In "x" years time?
- Database availability requirements, e.g. 24 X 7, 10 hours a day

Also check if you hardware vendor has any capacity sizing utilities which may be of use in subsequent hardware sizing.

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12 - Application Maintenance Procedures

Where possible vendor to supply documentation specifying procedures for:

- Application specific tuning/configuration
- Data archiving. Archiving data from database. (Not to be confused with Archive Logging of transactions)
- Any other relevant procedures

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13 – Other miscellaneous considerations

This section lists some additional “topics” you may wish to consider further by exploring relevant sections of documentation, in particular the Windows NT Getting Started documentation.

- Default values for INIT.ORA parameters
- Default NLS settings
- Database limits (max file sizes, number of files etc.)
- Using Oracle Parallel Server has implications for file naming standards, refer to Section 1 this document on – File Name Standards)

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APPENDIX A

Deviation Form

Section 1 - File name standards

Deviation Description	Reason for Deviation

Section 2 - Control Files

Deviation Description	Reason for Deviation

Section 3 - RAID

Deviation Description	Reason for Deviation

Section 4 - Optimal Flexible Architecture (OFA)

Deviation Description	Reason for Deviation

Section 5 - File separation

Deviation Description	Reason for Deviation

Section 6 - Instances/Databases

Deviation Description	Reason for Deviation

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Section 7 - Redo Logs

Deviation Description	Reason for Deviation

Section 8 - Redo Log Archiving

Deviation Description	Reason for Deviation

Section 9 - File system

Deviation Description	Reason for Deviation

Section 10 - Block size

Deviation Description	Reason for Deviation

Section 11 - Capacity Planning - SGA, Tablespaces

Deviation Description	Reason for Deviation

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APPENDIX B

Useful sources of Information For Oracle and Win NT

BOOKS

- Oracle NT Handbook* by Anand Adkoli and Rama Velpuri Osborne/McGraw-Hill ISBN 0-07-211917-9
- Oracle8 and Windows NT Black Book* by Mike Curtis and Jacqueline King Coriolis ISBN 1-57610-248-3
- Teach Yourself Oracle8i on Windows NT in 24 Hours* by Meghraj Thakkar SAMS ISBN 0-672-31578-5
- Windows NT Shell Scripting* by Tim Hill Macmillan Technical Publishing ISBN 1-57870-047-7

WEB Sites

- <http://www.ipass.net/~davesisk/oont.htm> Dave Sisks Oracle on NT page
- <http://www.oramag.com> Free Subscription to Oracle Magazine
- <http://www.auerbach-publications.com/io.htm> Web page for "Oracle Internals"
- <http://technet.oracle.com/> Oracles Technet Web Page (Free subscription)
- <http://metalink.oracle.com/> MetaLinks login page
- <http://www.orafaq.com/faq2.htm> Oracle FAQ site
- <http://www.orapub.com> Good source of papers for Oracle and Win NT
- <http://www.oracle-users.com/> Good source of papers for Oracle and Win NT
- <http://web.singnet.com.sg/~petermag/oracle.html> Loads of links to Oracle related sites

Discussion Lists/Boards

List Name	Join request	To
ORACLE-L@fatcity.com	SUB ORACLE-L <your name>	ListGuru@fatcity.com
oracledba-digest@quick.co.uk	Blank message	'oracledba-digest-subscribe@quickdoc.co.uk'
	SUBSCRIBE ORACLE-L	LISTSERV@LISTS.SUNYSB.EDU

There are also lots of discussion lists for Oracle and related topics available by looking around in www.e-groups.com

- <http://www.voug.org> Open subscription to Virginia Oracle User Group discussion list
- <http://www.revealnet.com/> Free subscription with DBA Web Board