Reducing Administration Costs for Oracle® E-Business Suite Using NetApp Filers

NetApp Best Practices for Shared APPL_TOP, Downtime Reduction, and Cloning by FlexClone™ with Rapid Clone

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TECHNICAL REPORT

Network Appliance, a pioneer and industry leader in data storage technology, helps organizations understand and meet complex technical challenges with advanced storage solutions and global data management strategies.

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Executive Summary

Deploying and maintaining Oracle E-Business Suite in a distributed environment can be very challenging for IT staff. One of the most important tasks in Oracle E-Business Suite lifecycle management is ability to facilitate the process of development, testing, upgrade, and deployment of patches with minimal production downtime. Taking into consideration the multitier architecture for Oracle Applications, it is very difficult to judge whether an upgrade process or patch application will yield the expected results. By using NetApp Snapshot™ and FlexClone technology, the IT staff can test their upgrades or patches using instantly created FlexClone volumes. At any point where they fail, they just destroy the working clone and go back to the point of their last success. This ability to create instant FlexClone volumes and test patches or upgrades without affecting the production environment eliminates the risk and cost of downtime due to user errors or failure of patches.

The advantages of using NetApp filers to deploy Oracle E-Business Suite can be summarized as follows:

- Dramatic improvement in solution availability
- Reduction in operational cost, complexity, and deployment processes
- Typical customer experience of faster database environment
- Seamless scaling possibilities during rapid growth

This paper highlights several cases where seamless integration of NetApp technologies with Oracle E-Business Suite significantly reduces downtime and increases productivity.

1. Oracle E-Business Architecture

Oracle Applications architecture is a framework for multitiered distributed computing. In the Oracle Applications model, the services are distributed among multiple levels or tiers. A service is a process or a group of processes that exercise some business logic and provide a particular functionality. A tier is a grouping of services that can potentially span physical machines. In other words, a tier is a logical grouping of services that is not limited by physical nodes or machines. Thus each tier can consist of one or more nodes, and each node can accommodate more than one tier. For example, a single machine can contain database, application, and desktop tiers. In the same way a database can reside on one of many application servers or on a separate machine by itself.

Figure 1 and Sections 2.1-2.4 provide a brief description of Oracle Applications architecture.

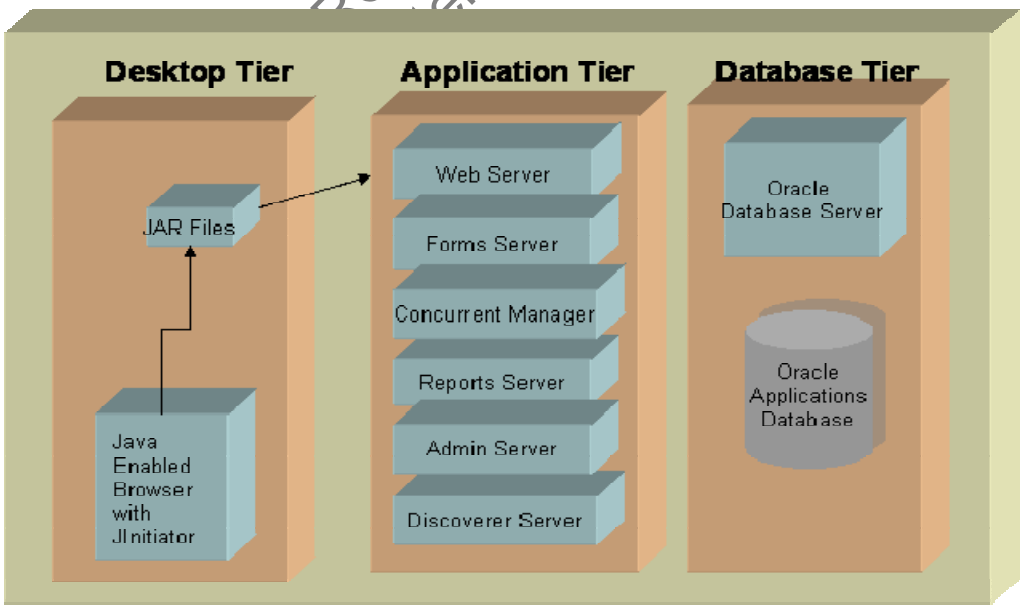

Figure 1) Oracle Applications architecture (3 tiers).
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1.1. The Desktop Tier

This is primarily the client web browser. The interface is provided through HTML for Self-Service applications and a Java™ applet for forms. The desktop client is installed on demand upon first use and is stored locally for future use. The forms client applet is packaged as JAR files and mainly represents the presentation layer of Oracle forms. The JAR files are also downloaded on the desktop during first use. The forms client must run within a Java Virtual Machine (JVM) and is supplied by Oracle JInitiator.

1.2. The Application Tier

The application tier hosts one or more servers that process the business logic and provides communication between the desktop tier and database. The application tier is also commonly known as the middle tier and has the following major components: Web Server, Forms Server, Concurrent Processing Server, Business Intelligence System, Reports Server, Admin Server, and Discover Server. These components usually run as services on the applications tier and may run on one or more nodes. For more details about these components, please refer to *Oracle Applications Concepts*, Part No: B10642-01.

1.3. The Database Tier

The database tier contains the RDBMS Oracle home, along with the Applications database, which stores all the data maintained by Oracle Applications. It also contains Oracle Applications processing code stored inside the Applications database to optimize performance. In essence, the database tier stores the Oracle database files, the Applications database, and executables. The database does not directly communicate with desktop clients but rather works with applications tier services that mediate the communication between the desktop tier and database tier.

1.4. The Oracle Applications File System

Oracle Applications product files, technology stack files, environment files, and common files are held in the file system on the application layer. Typically, the commonly used JAR files are stored on the desktop tier and the database server holds only database files. Oracle Applications stores product files within several top-level directories as described below:

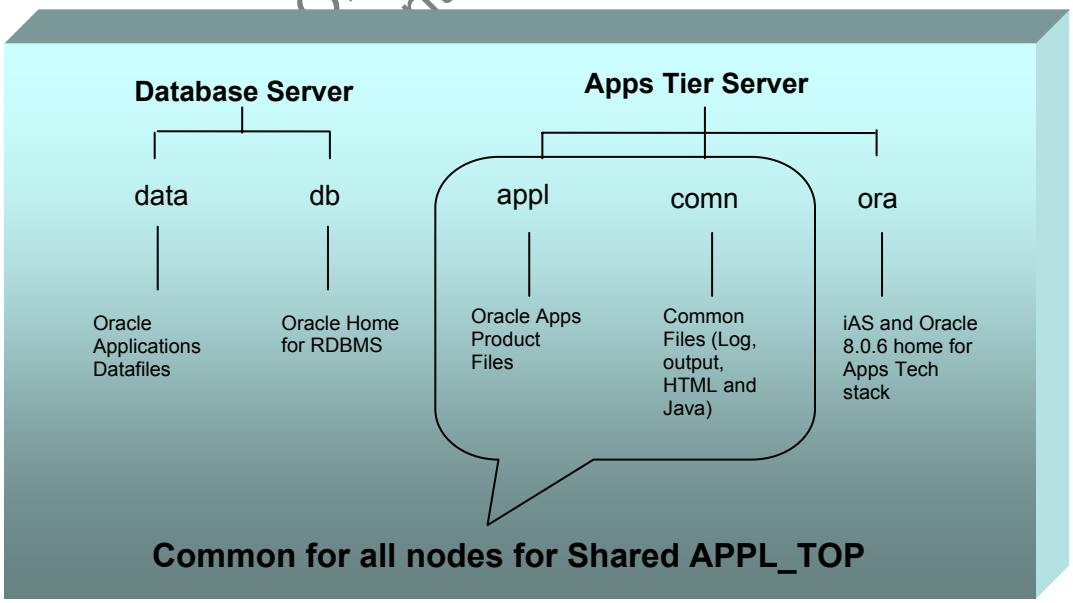

Figure 2) The shared APPL_TOP configuration.

- The `<dbname>data` or `DATA_TOP` directory is located on the database server and contains Oracle Applications datafiles (dbf).
- The `<dbname>db` directory is located on the database server and contains the RDBMS Oracle Home.
- The `<dbname>appl` or `APPL_TOP` directory contains the product directories and files for Oracle Applications. The `APPL_TOP` directory is typically owned by user APPLMGR.
- The `<dbname>ora` directory contains the middle tier techstack, which is the Oracle Home for iAS (HTTP server) and Oracle 8.0.6 stack for Oracle forms.
- The `<dbname>comn` or `COMN_TOP` directory contains directories and files used across products.

As illustrated in Figure 2, the shared `APPL_TOP` directory contains `APPL_TOP` and `COMN_TOP` components of Oracle Applications. However, as of Oracle Applications version 11i9, each node must maintain its own `ORA_TOP` directory. Oracle is currently working on a project to have a shared file system that will have all application tier components including `ORA_TOP` shared.

The following sections discuss NetApp best practices for Oracle Applications in terms of information lifecycle management, patch applications and reversals, and cloning.

2. Oracle Applications Lifecycle

To optimize your Oracle E-Business Suite deployment and maintenance tasks, it is important to understand the Applications lifecycle.

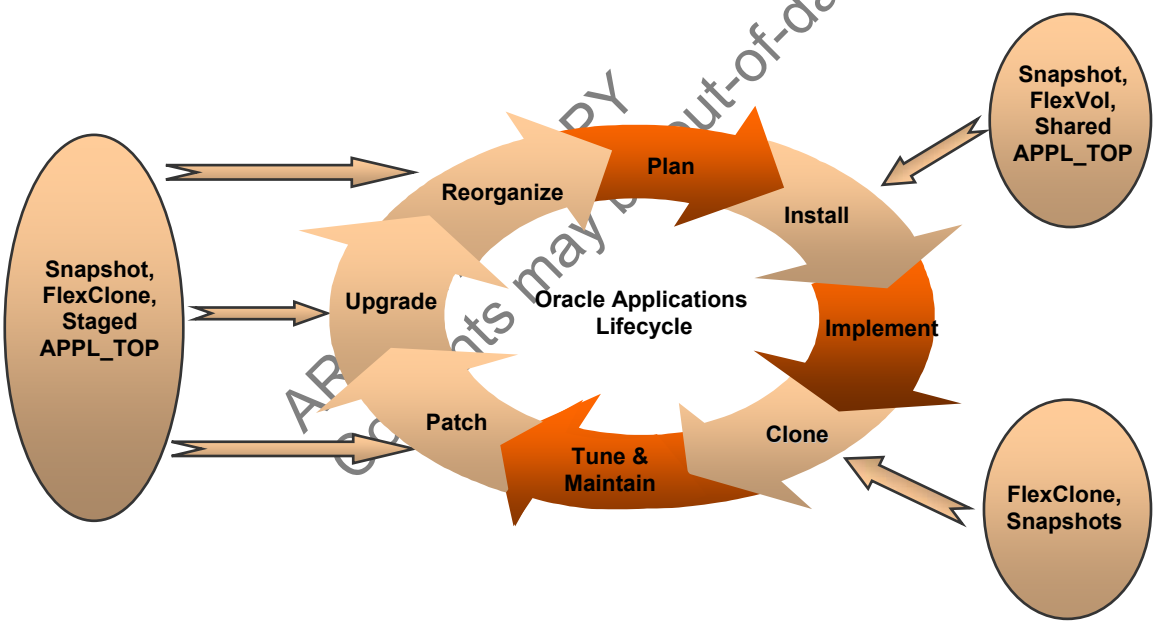

Figure 3) Oracle Applications lifecycle and NetApp solutions.

As indicated in the figure above, the Oracle Application lifecycle model is a circular queue of various phases that are commonly employed in Oracle Applications topology. One or more of these phases belong in one or more of three major categories: development, deployment and maintenance. NetApp offers unique solutions in various phases of this model that can be seamlessly integrated in routine operations of business-critical environments. In this document we will showcase NetApp and Oracle values to reduce administration costs of Oracle E-Business Suite in install, clone, and maintenance (patch, upgrade, and reorganize) phases of the lifecycle. The ultimate result of employing these values will increase productivity, reduce production downtime and maximize return on investment for today's complex and rapidly growing business requirements.

3. Reducing Administration Costs for the Oracle Applications Lifecycle

3.1. Install Phase

Shared APPL_TOP

Prior to Oracle E-Business Suite 11i, a traditional multinode environment required a copy of the Oracle Applications file system on each node. This made maintenance, scalability, and resource management for Oracle Applications extremely complex, redundant, and time consuming. Starting from Oracle E-Business 11i, Oracle allows multiple nodes to share a single APPL_TOP, dramatically simplifying the management of the Oracle Applications file system. In a shared APPL_TOP configuration, the APPL_TOP and COMN_TOP file systems can be installed on a single NetApp storage filer. The shared disk resource can then be shared via various network file protocols across multiple nodes to provide standard application tier services such as forms, web and concurrent processing. A shared APPL_TOP also significantly simplifies the patching or upgrade process since it has to be performed only once and changes made are immediately visible to all the nodes. NetApp Snapshot and SnapRestore® technology also make it very easy to restore the shared APPL_TOP and database to their original state if the patch/upgrade has unforeseen consequences.

In a shared APPL_TOP configuration, the APPL_TOP and COMN_TOP file systems are installed on a shared storage but each node must contain the technology stack (ORA_TOP). Oracle maintains that a shared technology stack is a development project right now and will be supported in the future. At present, all Oracle Applications Rapid Install Platforms except Microsoft® Windows® support a Shared APPL_TOP infrastructure. All nodes sharing the APPL_TOP must be binary compatible. Figure 4 illustrates benefits for shared APPL_TOP configuration.

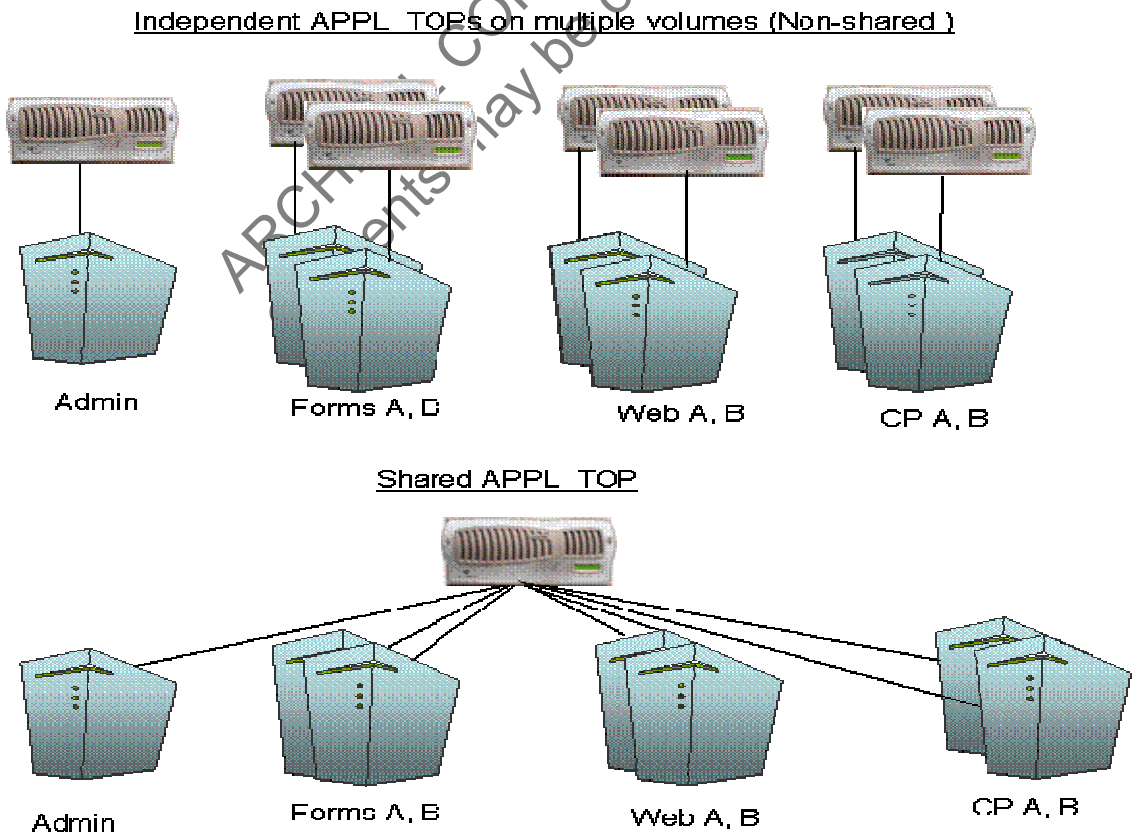

Figure 4) Shared APPL_TOP benefits.

Major benefits of using a shared APPL_TOP are the following:

- Administration tasks need to be performed only once and from any node.
- The cost of patching and upgrades is reduced. Application patches/upgrades need to be performed only once and can be performed from any node.
- Overall disk requirements are reduced.
- It is easier to add additional nodes in existing configurations.
- Complexity is reduced.

The following is a limitation of a shared APPL_TOP configuration:

- There is a single file system point of failure. However, this can be overcome by effective disaster recovery planning and configuration.

To effectively address the shared APPL_TOP single point of failure, Network Appliance provides robust solutions for components that are most prone to failure. For E-Business Suite deployments requiring the greatest levels of data availability, Network Appliance™ clustered failover delivers full redundancy with no single points of failure. A cluster consists of two appliances in an active-active configuration. Both appliances actively serve data during normal operation. Both are connected to the same networks (or SANs) and the same disk arrays. In normal operation, each system is responsible for data service from a subset of disk volumes. Should one system fail, the other assumes its identity and takes over its workload. In most circumstances failover occurs automatically. However, failover can also be initiated manually for administrative purposes, allowing one system to be taken offline for maintenance or hardware upgrade while maintaining continuous data service and further reducing planned downtime.

The following values make Oracle E-Business Suite on NetApp storage a winning combination:

- **Zero downtime**: Increase storage capacity without any interruption to ongoing data service. Disk shelves can be added and configured without taking the system offline.

- **Disaster recovery**: Hardware redundancy is provided for those components that are most prone to failure. For example, NetApp storage appliances feature redundant, hot-pluggable fans and power supplies in both system cabinets and disk shelves. Important parameters such as temperature, fan speed, voltage, power, and disk channel function are constantly monitored to ensure correct operation and protect systems from failure.

- **Simplicity:** NetApp storage appliances adhere to the philosophy that simpler is better. A typical system can be installed and operational in less than 15 minutes.

- **High availability and return on investment:** Network Appliance storage solutions offer the availability, manageability, performance, and scalability to get the job done while keeping costs under control. A recent study by Mercer suggests that the TCO of Network Appliance storage is up to 67% lower than that of competitive storage platforms for database applications.

The common scenarios regarding a shared APPL_TOP configuration in an enterprise environment consist of

- A new installation of shared APPL_TOP
- Migrating a nonshared APPL_TOP to shared APPL_TOP configuration
- Merging existing shared APPL_TOPs to create a single shared APPL_TOP configuration
- Adding or removing nodes from an existing shared APPL_TOP configuration

It is always a NetApp best practice to take a Snapshot copy of an existing working set before performing any of the above tasks. Then the changes can be made with the confidence that you can always fall back to the original working environment if things do not go as planned. Please refer to document 233428.1 on Oracle metalink for detailed step-by-step instructions if you have to perform these tasks.

3.2. Cloning Phase

Oracle Application Tier or Database Tier Cloning

Cloning creates an identical copy of an existing Oracle Applications system. Reasons and advantages of cloning Oracle Applications system(s) are the following:

- Creating a copy of the production system for testing updates
- Migrating an existing system to new hardware
- Creating a stage area to reduce patching downtime
- Custom development
- Data reporting or preserving month-end or year-end instances
- Testing migration/upgrade or data fix before doing it on production
- Business continuity: all activities or testing done on a clones, freeing up production system for business use
- Reduced downtime for production systems
- Changing configuration of Applications either by adding or removing tiers

For E-Business Suite middle tier and database cloning, the first step involves a physical copy of one or more volumes, which can take several hours. This is then followed by running one or more additional configuration scripts that perform services such as reconfiguration, rebuilding database, and recompiling. As mentioned in earlier topics, Network Appliance provides FlexClone volumes, which provide an instant copy of an existing volume from a Snapshot copy of an existing volume. Most commonly encountered cloning scenarios for the Oracle E-Business environment are illustrated below, followed by a list of simple tasks to create a database or application tier clones.

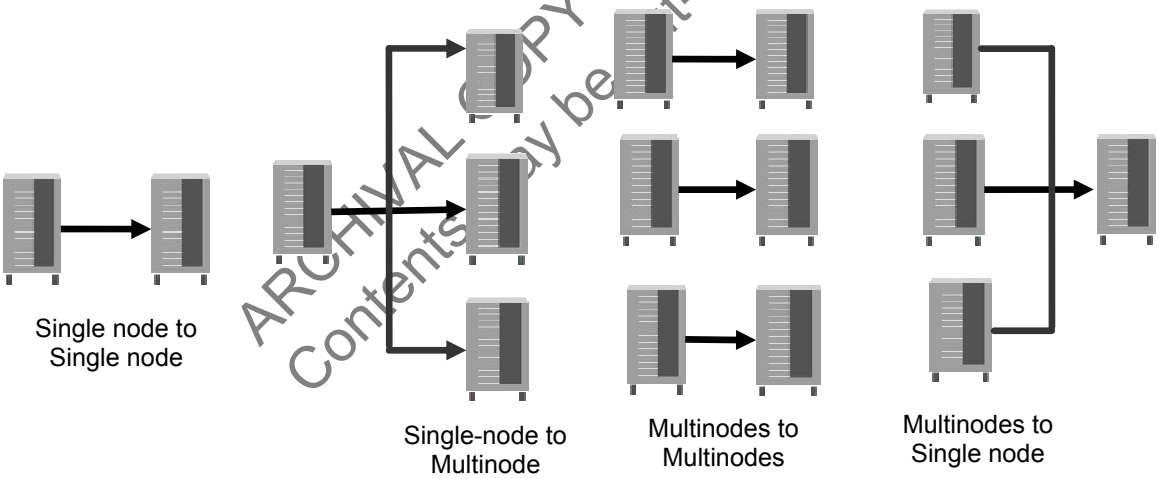

Figure 5) Common cloning scenarios.

3.2.1. Cloning a Database Tier or Application Tier

All Oracle database or application tier and cloning tasks are described in detail in Document 230672.1 on Oracle metalink. Here are the brief steps required in cloning of a database tier or application tier.

1. **Verify the rapid clone prerequisites**. Perform precloning tasks for database or application tier cloning as described in Section 1 of Document 230672.1.
2. **Complete clone preparation steps**. Prepare the source system database tier for cloning as described in Step 1 of Section 2 of Document 230672.1
3. **Clone the database tier or application tier**. Create instant writeable FlexClone volumes of database RDBMS_HOME and data volumes. This step replaces the most time-consuming task of cloning, which is the component copy part explained in Step 2 of Section 2 of Document 230672.1.

Steps to create a clone for application tier

- Create a snapshot of Apps volume(s) from the filer prompt as shown below:

```
Filer1> snap create u03 oraAppsbackup
```

  Where u03 is Apps volume (APPL_TOP, COMN_TOP and ORA_TOP) and oraAppsbackup is snapshot.

- Create a FlexClone volume based on snapshot as shown below:

```
Filer1> vol clone create Appsdataclone1 -b u03 oraAppsbackup
```

  Where Appsdataclone1 is the newly created FlexClone volume based on oraAppsbackup snapshot. If there are multiple volumes, create clones of all additional volumes.

- Mount newly created volume(s) on a new host.

Steps to create a clone for database tier

- Put database in hot backup mode
- Create a snapshot of database volume(s) from the filer prompt as shown below.

```
Filer1> snap create u02 oradatabackup
```

  Where u02 is database datafiles volume and oradatatbackup is snapshot.

```
Filer1> snap create u01 orahomebackup
```

  Where u01 is RDBMS home volume and orahomebackup is snapshot.

- Take database out of hot backup mode.
- Create a FlexClone volume based on snapshot as shown under.

```
Filer1> vol clone create dbdataclone1 -b u02 oradatabackup
```

  Where dbdataclone1 is newly created FlexClone volume based on oradatabackup snapshot.

```
Filer1> vol clone create dbhomeclone1 -b u01 orahomebackup
```

  Where dbhomeclone1 is newly created FlexClone volume based on orahomebackup snapshot.

- Mount the newly created volumes on the new host.
- Recreate control files as mentioned in Appendix B of metalink document. Please make to sure rename your cloned database instance
- Startup new cloned instance.

4. **Perform configuration tasks**. Configure the target systems according to step 3 in Section 3 of Document 230672.1.
5. **Complete post clone tasks**. Finish the postcloning tasks according to Section 4 of Document 230672.1.

3.2.2.Advanced Cloning Scenarios

The most common cloning scenarios encountered in any Oracle Applications deployment are:

1. Cloning a single-node system to a multinode system
2. Cloning a multinode system to a multinode system with same number of nodes
   (**Note:** The database server node must be cloned first.)

3. Adding a new node to an existing system
4. Cloning a Shared APPL_TOP system
5. Reducing number of nodes from existing configuration
6. Cloning a RAC database system
7. Refreshing an existing configuration to synchronize with latest changes

For more details, please refer to Section 4 of Document 230672.1 on Oracle metalink. In most of these cloning scenarios, you can significantly reduce cloning time by avoiding the time-consuming copy part with an instantly created FlexClone volume.

3.3. Maintenance Phase (Patch, Upgrade, and Reorganize)

Oracle Apps Maintenance and Upgrade

Using NetApp FlexClone volumes, the critical system downtime can be significantly reduced during the Oracle Application upgrade process. Starting with Data ONTAP™ 7G, NetApp filer administrators have access to a powerful new feature that allows them to instantly create clones of a flexible volume. A FlexClone volume is a writeable point-in-time image of a FlexVol™ volume. They take only a few seconds to create and are created without interrupting access to the parent FlexVol volume. FlexClone volumes are also very space efficient by leveraging the Data ONTAP architecture's ability to store only data that changes between the parent and clone volumes.

FlexClone volumes are an excellent proposition for any development, testing, or upgrade situation where IT staff needs to make substantive changes to the production environment. The cost and risk of a mistake/failure are too high to do it on the production volume. Ideally there could be an instant writable copy of the production environment available at minimal cost in terms of resources, storage, and service interruptions. By using FlexClone volumes, the IT staff gets just that. They can try out their upgrades or testing using instantly created FlexClone volumes. At any point that they make solid progress, they clone their working FlexClone volume to lock in the successes. At any point where they get stuck, they just destroy the working clone and go back to the point of their last success. At the end of the patch application or upgrade process, they can split off the clone to replace their current production volumes. The following section describes NetApp best practices for minimizing downtime during critical updates.

3.3.1. Best Practices for Downtime Reduction

Production downtime for patching/upgrades can be significantly reduced via staged APPL_TOP use, patch merging, keeping up-to-date, and leveraging enterprise-wide resources with distributed AD.

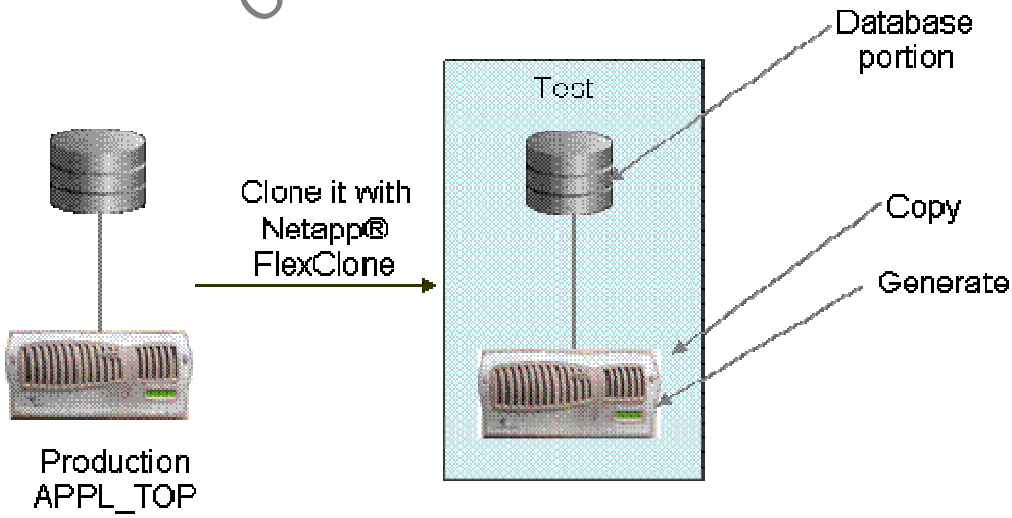

Figure 6) Patching staged APPL_TOP (database and APPL_TOP).

A staged application system represents an exact copy of the production system, including all APPL_TOPs as well as a copy of the production database. As described in Section 4.3, NetApp FlexClone technology provides an instant writable copy of an existing FlexVol of an APPL_TOP or database. For database volumes, you must put the database in hot backup mode before creating FlexClone volumes. Patches can then be applied to the cloned system, while the production system remains up. As illustrated in Figure 6, the staged system is patched the same way as any Oracle Application system using the AutoPatch utility. While patches are being applied, care must be taken that no patches are accidentally being applied to the production system.

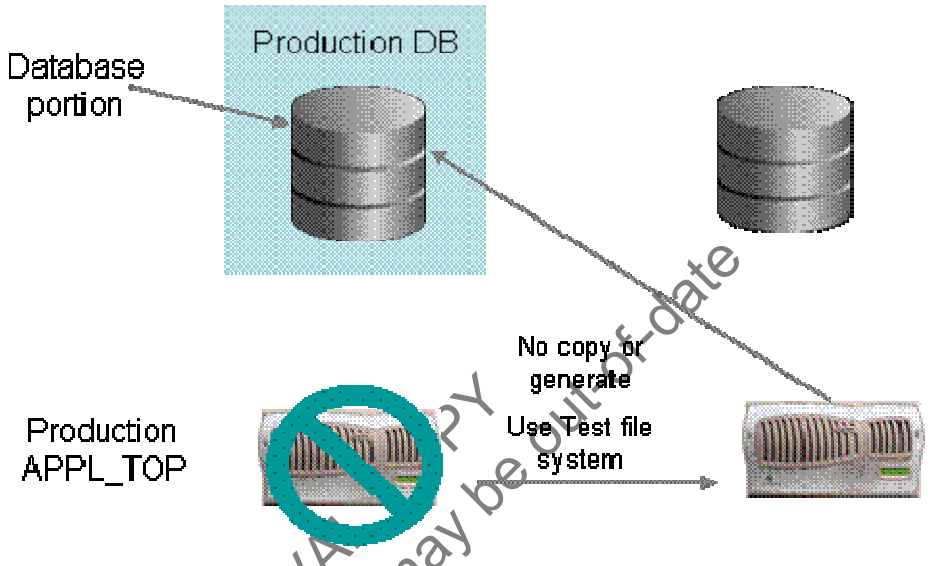

Figure 7) Patching production database with updated APPL_TOP.

When all the patches have been applied successfully to the test systems, the reduced downtime for the production system can begin. The staged APPL_TOP is then used to run updates on the production database as well as synchronizing the production APPL_TOP. The production database update involves disabling all the services on the production system. Then run AutoPatch using the database driver of the patch that needs to be applied. Make sure that database name prompted by AutoPatch is correct. If multiple patches are applied to the staged system, the database update must be run in the same order. It is also highly recommended to consider merging patches to further reduce downtime.

The next step is to synchronize the production APPL_TOP with the staged APPL_TOP. To minimize downtime, this step can be performed while the production database is being updated. The synchronization steps vary based on existing topology such as multiple APPL_TOPs or shared APPL_TOP, multiple COMN_TOPs vs. shared COMN_TOP, etc. In addition, certain configuration files, environment files and log directories are APPL_TOP specific and must be handled appropriately. As one of the postproduction patching steps, you must update each APPL_TOP's patch history appropriately by using the adphmigr.pl utility. Please refer to Document 233428.1 on Oracle metalink for more details about staged APPL_TOP and patching best practices.

Here are some low-cost, high-return practices for downtime reduction:

- Take Snapshot copies for updated volumes after a successful patch application. This allows you to roll back to the previous working set if the next patch or upgrade fails.
- Use AD Merge Patch to consolidate all patches into merged patches. This eliminates a lot of redundant patching steps as well as duplicate linking, generating database actions, etc.
- Avoid "Compiling APPS schema" and "Maintain MRC" until all the patches have been applied.
- Apply patches on the test system first as described earlier. If the patch applies to the test system successfully, then you are sure that the same application of the patch is unlikely to create new

issues on production systems. NetApp FlexClone technology allows you to create FlexVol volumes in a matter of seconds, saving significant time in duplicate copies.
Relink and regenerate all executable, forms, reports, libraries, and Java archives on the test system. You can then copy these files to production, saving a lot of time.
AutoPatch can use parallel worker threads for all database and file system tasks. Choose the appropriate number of worker threads based on machine resources, load, and type of tasks. You can also distribute the processing load to other nodes by using distributed AD. Please refer to the "Distributed AD" section on Oracle metalink for more details.
Proper rollback segment and temporary segment sizing can make some upgrade scripts run up to an order of magnitude faster. For example, setting larger rollback segments' batch commit size value to high allows faster data processing.

4. Conclusion

NetApp storage appliances are the ideal platform for Oracle E-Business storage needs. NetApp storage offers great performance, scalability, and availability, along with a host of software features that enhance data protection and availability, and reduce downtime and total cost of ownership. For Oracle E-Business lifecycle tasks such as patching and upgrades, NetApp makes the process substantially faster, simpler and safer to perform.

This paper highlighted several scenarios of how the partnership between NetApp and Oracle delivers unique value to our joint customer base. NetApp best practices for Oracle E-Business Suite environment are summarized below:

- For multinode architecture, use shared APPL_TOP configuration whenever possible.
- For Oracle Applications patching, upgrades, or maintenance, use staged APPL_TOP along with NetApp Snapshot copies and FlexClone volumes.
- Use FlexClone volumes along with Rapid Clone to clone database or middle tiers.
- In addition, FlexClone volumes offer the following unique advantages in Oracle E-Business environment.

Task	NetApp FlexClone Benefit
Application testing	▪ Make necessary changes to infrastructure without worrying about production system. ▪ Avoid making untested changes on production systems to reduce downtime. ▪ Less risk, less stress and higher confidence when applying changes to production after testing on FlexClone volumes.
System deployment	▪ Maintain a template environment and use FlexClone volumes to build and deploy identical environments. ▪ Clone creation is faster, simpler, and available as needed for reliable and predictable testing.
IT operations	▪ Maintain multiple copies of production systems saving disk space. ▪ Instantly refresh clones to create a working set that is as close to live production system as practical.

5. APPENDIX

5.1. Additional References

- **http://www.netapp.com/tech_library/3310.html**

  "Streamlining Oracle E-Business Suite Operations and Migration with NetApp Storage Appliances"

- **http://www.netapp.com/tech_library/3300.htnl**

  "Cloning Oracle E-Business Suite Using SnapMirror®"

- **http://www.netapp.com/tech_library/ftp/3347.pdf**

  "A Thorough Introduction to FlexClone Volumes"

- **http://metalink.oracle.com/**

  Doc ID: 230672.1 "Cloning Oracle Applications"
  Doc ID: 242480.1 "Using Staged Application to Reduce Downtime"
  Doc ID: 233428.1 "Sharing an APPL_TOP in Oracle Applications 11i"
  Doc ID B13586-01 "Oracle Applications Maintenance Utilities rel 11i Reference Manual"

5.2. Flexible Volume Cloning Syntax

Syntax:

Create a Clone

```
vol clone create <vol-name> [-s none | File | volume] –b <parent-flexvol>
[parent_snaphot]
```

Status of Clone Volume

```
vol status <vol-name>
```

Clone Split

```
vol clone split [start|stop|status|estimate] <vol-name>
```

Examples:

```
vol clone create myclone -b flexvol1

vol status myclone

vol clone split start myclone
```


6. Acknowledgments

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7. Disclaimer

Each environment has its own specific set of requirements, and no guarantees can be given that the results presented in this report will work as expected on other platforms. This paper should assist in the research and troubleshooting that may be required in a particular case and serve as a checklist of items to be aware of. Please forward any errors, omissions, differences, new discoveries, and comments about this paper to tusharp@netapp.com.