Advanced Uses of Oracle Enterprise Manager 12c
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Executive Overview

In the modern business environment, many organizations depend on IT to deliver always on systems and mission-critical services. But behind the scenes, IT organizations are coping with more and more complexity than ever before—complexity from growing data volumes, to composite applications, to virtualization and the cloud. Managing all these systems and services 24x7, in a global environment is one monumental challenge and constant battle for IT.

However, help is at hand. Today Oracle Enterprise Manager 12c, Oracle’s flagship enterprise-class management solution, helps IT organizations cut through the complexity and brings order to chaos by managing and monitoring the performance and availability of today’s enterprise applications and their supporting infrastructure from an end-to-end, top-down, end-user perspective in both enterprise private clouds and traditional environments. There are three key aspects of Oracle Enterprise Manager 12c that help accomplish this:

Complete Cloud Lifecycle Solution

Oracle Enterprise Manager 12c contains solutions to manage all phases of the building, managing, and consuming an enterprise cloud. Using Oracle Enterprise Manager 12c you can build and manage a rich catalog of cloud services—whether it is infrastructure as a service, database as a service, or platform as a service, all from a single management console.

Integrated Cloud Stack Management

Secondly, Oracle Enterprise Manager 12c enables integrated management of the entire cloud stack—all the way from application to disk. Oracle Enterprise Manager 12c helps eliminates much of the integration pains and costs that customers would have to otherwise incur by trying to create a cloud environment by integrating multiple point solutions. Any Systems Integrator (SI) would understand this.

Business-Driven Clouds

Lastly, Oracle Enterprise Manager 12c enables creation of application-aware and business-driven clouds that have deep insight into applications, business services and transactions. Applications, whether they are packaged or home grown—power your business. Therefore it is critical that an enterprise cloud platform not only be able to run these applications but also have deep business insight and visibility into your most critical transactions and processes. As
the leading providers of business applications and the middleware that many of your custom applications are built on top of, Oracle offers a cloud solution that is optimized for business services.

With this in mind, Oracle’s approach starts with management capabilities that are built right into applications and infrastructure. Oracle Enterprise Manager 12c provides an integrated and seamless console that gives IT departments better business visibility and comprehensive insight right across the entire cloud stack. This integration enables IT to gain unobstructed views of business transactions and the business-user experience. As a result, IT professionals can focus their efforts where they will have the greatest positive impact on the business.

Along with being able to manage Oracle’s complete software and hardware stack, from applications-to-disk, Oracle Enterprise Manager 12c also offers an extensive array of capabilities that extends its management and monitoring capabilities for heterogeneous environments. For the complete list of available plug-ins and connectors, please visit the Oracle Enterprise Manager 12c Extensibility Exchange.

Objective of Whitepaper

The objective of this whitepaper is to help operational teams, administrators and IT managers comprehend some of the more advanced features of Oracle Enterprise Manager 12c, so you can take full advantage of all the features and capabilities within the software, in order to get the most out of your Oracle investment—rather than just use Oracle Enterprise Manager 12c for basic capabilities, such as monitoring, metrics, thresholds, alerting and so on. While such capabilities are very useful, we need to go beyond monitoring into deep-down management of your applications, databases, middleware and server hosts.

This whitepaper gives you in a nutshell, a number of advanced techniques for setting up and working with Oracle Enterprise Manager 12c. We look at practical use cases from the experience of industry-leading Oracle experts. Tips and recommendations range from architecture for Oracle Enterprise Manager 12c, to setting up Oracle Recovery Manager (RMAN) backups, to creating and managing Oracle Active Data Guard standbys through Oracle Enterprise Manager 12c as well as other advanced capabilities.
Introduction

In the early years of the 21st century, Oracle introduced Oracle Enterprise Manager 10g Grid Control as its flagship Enterprise Management product. Grid Control featured a freshly re-designed interface and architecture, and was primarily intended to assist DBAs with their database management and monitoring tasks.

This was achieved through the streamlining and automation of day-to-day DBA activities such as performance diagnosis and tuning, setting up and scheduling RMAN database backups, and setting up and managing Oracle Active Data Guard. Other capabilities included; cloning and provisioning, configuration management and monitoring of the server, operating system and database management. Grid Control allowed DBAs to schedule and execute scripts at the database or operating system level.

Oracle Enterprise Manager 11g Grid Control Release 1 was launched in April 2010, and built upon the Oracle WebLogic Server foundation, which offered improved performance and memory management. Administrators could manage more than just databases, and they could also manage the entire applications stack; from servers, storage, operating systems, middleware and of course databases—all from within Oracle Enterprise Manager’s centralized management console.

In October 2011, Oracle Enterprise Manager 12c was released with its famous Grid Control moniker renamed to Cloud Control with great customer fanfare. Part of what makes Oracle Enterprise Manager 12c so successful is its ability to manage the entire cloud stack. There are extensive capabilities for managing Oracle Applications such as Oracle Fusion Applications, Siebel, Oracle E-Business Suite, PeopleSoft, and JD Edwards Enterprise One. In addition to applications, Oracle Enterprise Manager 12c has a broad range of solutions for managing Oracle Databases, from performance management and database testing, to database lifecycle management and database as a service.

There are also comprehensive solutions for managing Oracle Fusion Middleware, including Oracle WebLogic Server, Oracle SOA Suite, and Oracle Application Server. Oracle Enterprise Manager 12c can also manage Oracle VM, and Oracle Sun Servers and Storage in the form of close integration with Oracle Enterprise Manager Ops Center 12c.

Oracle Enterprise Manager 12c even goes beyond just managing applications and disks. It goes further to the business layer, and is able to define and manage your business
transactions on services across a service bus, and can be used to set up the entire infrastructure for the cloud—whether the cloud is infrastructure as a service (IaaS), database as a service (DBaaS), schema as a service (Schema-aaS) or middleware as a service (MWaaS)—the latter three forming Oracle’s offering of platform as a service (PaaS).

Oracle Enterprise Manager 12c also enables you to build a private cloud, deliver services in private cloud via its self-service portal, and manage the private cloud, including metering and chargeback. The DBaaS capabilities are based on Oracle Enterprise Manager 12c Database Lifecycle Management (DBLM) Pack and Cloud Management Pack for Oracle Database. We will look at some of these features later on in this white paper.

Besides the Oracle technology stack, Oracle Enterprise Manager 12c is able to monitor and perform configuration management of non-Oracle hardware and software, such as non-Oracle Hosts (for example, HP-UX, IBM AIX, and Windows), non-Oracle virtualization such as VMWare, non-Oracle storage such as EMC and NetApp, as well as firewalls, load balancers, and network devices. This is done via Oracle Enterprise Manager 12c plug-ins written either by Oracle or third-party vendors, such as Blue Medora, Pyhtian, Entuity, NetApp, F5, Dell, Symantec and so on. To see the full list of plug-ins, please visit the Oracle Enterprise Manager 12c Extensibility Exchange. It is also possible for anyone to develop their own plug-in and publish it in this exchange.

Scalable Architecture Tips

Before we talk about advanced uses, we need to consider some best practices regarding setting up a production Oracle Enterprise Manager environment. As a real-life example, let us look at the first Oracle Enterprise Manager production site in the world, which was a large telecommunications company in Australia.

The company’s corporate database team was involved in this major project, in close association with Oracle Support consultants (from ACS—Oracle Advanced Customer Services) in Sydney and Melbourne who guided the client in on-site beta testing as well as the first production implementation of Oracle Enterprise Manager Grid Control Release 1, and subsequently upgrading to Release 2. The objective of the project was to set up a centralized Oracle Enterprise Manager site at the company headquarters in Melbourne.

Normally, when a DBA team or their management decides to implement Oracle Enterprise Manager, they use a test or development server to install the product, on UNIX, Linux, or Windows. In this scenario all Oracle Enterprise Manager components are installed on a single server. This includes the repository database, Oracle Management Service (OMS), and the Oracle Enterprise Manager agent.
However, while fine for proof of concept purposes, this is the wrong approach for production use. The main working component engine of Oracle Enterprise Manager is the Oracle Management Service (OMS). This is a J2EE application previously deployed on Oracle Application Server, and now on Oracle WebLogic Server. As a result, only limited scalability would be achieved if all Oracle Enterprise Manager components were placed on a single server. Doing this limits use to one Java Machine process with its inherent limits of memory and processor speed. If this process was under heavy load, it would reach its limits quickly and the process would slow down, not respond, or even reboot—however this would happen less frequently in the case of Oracle WebLogic due to its better memory management capabilities.

In production scenarios, it is generally not recommended to place all the Oracle Enterprise Manager components on a single server, and these components should also not be shared with a production or test databases on the same server. Oracle Enterprise Manager should preferably be allocated its own server, or its own set of servers as per a well architected and documented solution.

As time tested Oracle best practice suggests, spend quality time to plan and prepare any Oracle Enterprise Manager installation meant for production, as a professional project, since it is a management solution for the enterprise—and should not be treated as a minor database tool to be implemented on a single workstation.

The sizing of the Enterprise Manager servers is still an area that many administrators ignore, and as a result the central Enterprise Manager site could experience scalability/performance issues. The technical white paper "Enterprise Manager 12c Cloud Control Sizing Guidelines" can be referred to as a starting point for site sizing. This document covers basic Oracle Enterprise Manager sizing.

For more Oracle Enterprise Manager Best Practices, please visit the Oracle Technology Network site on Oracle Enterprise Manager 12c Framework and Infrastructure.

Scalability and Performance

With the release of Oracle Enterprise Manager Grid Control 10g, Oracle altered the internal architecture and changed it to the N-tier model. Oracle Enterprise Manager was now divided into three components—the Repository database, the Oracle Management Service (OMS), and the Oracle Enterprise Manager agent. The OMS which was the main engine, ran on the application server as a Java Machine component, and therefore became inherently scalable.

The reason that makes this possible is that Oracle Enterprise Manager is not tied to one single PC or one single server. It runs as a Java Machine application on the application server tier. Multiple Oracle Enterprise Manager applications can be placed on the application server running on numerous servers, and these can all be directed to the same Oracle Enterprise Manager repository. The following diagram illustrates a typical Oracle Enterprise Manager architecture for large sites.
Oracle Enterprise Manager Architecture for Large Deployments.

We should note at this point that the internal firewalls illustrated in the diagram are not necessary and may or may not be present, depending on the internal network security policies in force in each large site. However, externally facing firewalls are normally present.

In the case of Oracle Enterprise Manager being heavily used for the advanced tasks described in this white paper, performance scale-out could be more of a necessity on the management service level rather than the database level. In such scenarios, the Java Machine is where the bulk of the Oracle Enterprise Manager work is performed; and scalability would be desirable on the management services. On the other hand, housekeeping jobs in the Oracle Enterprise Manager repository are also a heavy burden, so scale-out on the database side using the Oracle Real Application Clusters (RAC) option may be required as well.
Load Balancing Oracle Enterprise Manager

In the case of a large Oracle Enterprise Manager setup; an example of a large scale Cloud Control deployment would involve thousands of targets across multiple servers and tiers. For this architecture, three or more load balanced management servers should be included. We could use for this purpose as an example; a hardware load balancer—like F5 Networks’ BIG-IP Application Switch Load Balancer.

Setting up the Load Balancer in the appropriate way and balancing requests from management servers is further discussed in the white paper Oracle Enterprise Manager 12c Cloud Control: Configuring OMS High Availability with F5 BIG-IP Local Traffic Manager.

This architecture, using hardware load balancers and multiple management servers, has proven to be extremely powerful. The concept sits well with Oracle’s Grid/Cloud vision of enabling groups of hardware and software targets to be pooled and provisioned, on demand, to meet the needs of business. At its core, Cloud Control is the underlying management technology that makes it possible to manage, with ease, hundreds or even thousands of Grid/Cloud targets and/or services within any given environment.

Oracle Maximum Availability Architecture for Oracle Enterprise Manager 12c

What is Oracle’s Maximum Availability Architecture recommendation (MAA) for Oracle Enterprise Manager 12c? As a best practice, an Oracle Real Application Clusters (RAC) database should be used for hosting the Oracle Enterprise Manager 12c repository for High Availability (HA) purposes. Multiple load balancers can be used to act as a primary and standby, with the latter load balancer taking over if the primary is down. Multiple management services when used also fulfill HA requirements by continuing to work if any one or more management services are down. This is illustrated in the above diagram.

For Disaster Recovery (DR) purposes, as should be done for any production system, the entire Cloud Control setup should be duplicated at a remote location far enough not to be disturbed by a disaster at the primary site. Oracle Active Data Guard can be used for the purpose of a standby database for the repository, and the standby itself can be either a single instance database or a RAC database depending on the database used at the primary site. Likewise, the load balancers and the management servers should be set up in a similar configuration to production at the standby site.

Shared Storage is another important best practice when more than one management service is used. If the Cloud Control agents upload to a shared directory, then all management services can process files that have been uploaded by any agent. The EMCTL command is used to configure the shared directory from each management service. Shared storage can also be used for the Software Library of Cloud Control that is used in provisioning.

From Enterprise Manager 12c Release 3 onwards (released in July 2013), OMS Disaster Recovery uses standard Fusion Middleware procedures for disaster recovery. The new disaster recovery solution requires that all primary OMSs are installed on replicated storage which is automatically kept in sync across primary and standby sites by underlying storage
technology. Doing this simplifies the management of the disaster recovery site, because standby OMSs are no longer required to be manually updated following operations such as OMS patch applications, plug-in updates, or upgrades.

For further information on these MAA concepts and techniques for Cloud Control, you can refer to Part VII: Configuring Oracle Enterprise Manager for High Availability included in the Oracle Enterprise Manager Cloud Control Administrator’s Guide 12c Release 3 (12.1.0.3) from Oracle’s documentation library. You can also refer to the detailed technical white paper “Enterprise Manager Cloud Control 12c Disaster Recovery with Storage Replication”.

The Oracle Maximum Availability Architecture Website is also an excellent reference site for MAA best practices, case studies and documentation. The MAA best practices for Oracle Enterprise Manager 12c are located here.

Cloud Management

One of the advanced uses of Oracle Enterprise Manager 12c is being able to manage multiple phases of the cloud lifecycle—such as the planning, set up, build, deployment, monitoring, metering/chargeback, and optimization of the cloud.

With its comprehensive management capabilities for clouds, Oracle Enterprise Manager 12c enables rapid deployment and end-to-end monitoring of infrastructure as a service (IaaS), platform as a service (PaaS)—including database as a service (DBaaS), schema as a service (Schema-aaS), and middleware as a service (MWaaS). The following is an overview of Oracle Enterprise Manager 12c’s features in this regard.

Planning

First, Oracle Enterprise Manager 12c assists in the planning for the cloud via the Consolidation Planner. Existing source server can be selected, and actual resource usage data from these servers can be collected over a planned number of days, weeks, or months, using the collection abilities of Oracle Enterprise Manager 12c’s agents. The resource usage information can then be used to map the source servers to either existing or planned, physical or virtual destination servers.
The Consolidation Planner allows you to create consolidation projects and scenarios that are useful for planning purposes. Both physical to physical (P2P) and physical to virtual (P2V) cases are possible, along with multiple scenarios leading to the final recommendations and confidence level generated by the planner based on the mathematical calculations it has performed.

Exadata Database Machines can be used as the destination servers, and in Enterprise Manager 12c Release 3 (released in July 2013), the consolidation planner tool has been extended to support Oracle Exalogic Elastic Cloud. This allows customers to create plans and scenarios to consolidate their Java workloads on Oracle Exalogic servers.

Set Up

After the planning is completed, the actual set up of the cloud infrastructure can be performed via Oracle Enterprise Manager 12c self-service portal. This involves the creation of Oracle VM zones for IaaS clouds, or PaaS Infrastructure zones for DBaaS, Schema-aaS or MWaaS clouds. Quotas can easily be assigned to self-service users, and chargeback set up for various aspects of the cloud—such as resource usage, or feature usage by self-service users and projects. In Release 3 onwards, the chargeback capability supports the new Oracle Database 12c multitenant option and has been extended to support custom metrics, enabling better accountability and resource planning.

Service Templates are created by the cloud administrator as the vehicles for the actual creation of the cloud instance, building on the provisioning capabilities of Oracle Database Lifecycle Management Pack or Oracle WebLogic Server Management Pack.
Deployment

Once the cloud infrastructure has been set up, the self-service application (SSA) users can then log in to the self-service portal page in Oracle Enterprise Manager 12c, and select the appropriate type of cloud service(s) required—whether it’s IaaS, DBaaS, Schema-aaaS or MWaaS. They can then make a request for the self-service provisioning of their required VM template or assembly, or database, or schema, or middleware service or java applications, depending on the quotas that have been granted to them.

Management

The cloud administrators can easily manage the entire cloud infrastructure using Oracle Enterprise Manager 12c, including deep-down management of Oracle VM Servers, Oracle Databases, and Oracle WebLogic Server just to name a few. The components can be monitored with warnings or critical alerts, and the performance managed accordingly. In addition, the underlying Oracle targets and components can be patched with the latest up-to-date releases from My Oracle Support. Administrator can even perform all the necessary configuration management tasks and track changes for compliance purposes.

For more in-depth details on these cloud topics, you can read the following white papers: Delivering Database as a Service using Oracle Enterprise Manager 12c and Oracle Enterprise Manager 12c: Complete, Integrated and Business-Driven Cloud Management.

Oracle Enterprise Manager Cloud Control 12c RMAN Tips

Installing and configuring Oracle Enterprise Manager is covered in many books and even in the detailed Oracle installation manuals and README files, but what about the real use of Oracle Enterprise Manager? How is it going to help the DBAs in their routine and daily activities? So a key question for many is; what is the practical use of Oracle Enterprise Manager in the real world?

Almost all DBAs would know that Oracle has a powerful tool to backup and recover Oracle Databases. This tool is Oracle Recovery Manager, or better known as RMAN. Today’s DBA can make a very smart choice—he or she can set up and schedule RMAN backups via the modern approach in Oracle Enterprise Manager 12c, or choose instead the older, more time-consuming, manual method of Unix shell scripting and cron jobs.

RMAN Backups: Scripting vs. Oracle Enterprise Manager 12c

Let’s take a look at the traditional approach which consists of a number of manual steps. First, RMAN backup scripts need to be written, changed for each new system, and then tested, with changes made to the schedule in crontab. The estimates supplied by the DBA implementation team range from 3 to 4 hours to perform these steps, including customizing the backup script and testing out the backup script for each installation. This would have to be done on every new server that is provisioned in the organization. Compressing this time frame is possible, but a rush job could potentially introduce human error. Not wanting to tie up precious DBAs
resources, IT management finally decides on an average time component of 3 hours per server, to allow sufficient time to the DBA team.

However, even 3 hours adds up to a lot—if there are a number of RMAN deployments happening on projects every week in a large sized company. DBAs are quite valuable and their time is precious to the business.

Besides these factors, management must also consider the maintenance cost aspect of the UNIX shell scripts. DBAs familiar with UNIX scripting need to be hired and retained, or if Perl has been used as the scripting language, than Perl-literate resources are required. Other sites may use other scripting languages, and since there are no scripting standards in place, scripts may be written in totally different ways to do the same job. There may be little or no comments in the code, and little or no documentation.

After the initial author of the scripts has moved on to bigger and better things in his/her career, other new DBAs inherit the scripts. These newcomers spend a lot of time first understanding the code and logic of the scripts, and when they feel confident, they try their own enhancements or code fixes. The scripts start to grow exponentially with every new DBA that comes on, as more and more maintenance work gets done, until finally these initially simple scripts start to resemble a multi-headed monster. Sounds familiar?

The very aim of Oracle Enterprise Manager 12c is to eliminate such issues. With Oracle Enterprise Manager 12c, DBAs don’t need to know the detailed complexity of each customized backup script. Cloud Control provides a step-by-step wizard to help guide administrators through the backup process as illustrated in the following screen shot.
Scheduling Different Kinds of Backup in the Oracle Enterprise Manager 12c Wizard.

The Backup Settings can easily be changed, including the parallelism, whether the backup set needs to be compressed or an image copy is to be taken, the tape settings and the media management settings, the compression algorithm, and the backup policy—what type of retention policy is to be used, whether a block change tracking file is to be used, if the control file and server parameter file is to be backed up automatically, and so on.

All these aspects and nuances of RMAN backup technology are displayed and it makes it a lot easier even for the novice DBA to understand the new aspects of RMAN and utilize the benefits of the new technology, such as block change tracking for example which was first introduced in Oracle Database 10g. The latest technological advances in RMAN would be available in the Oracle Enterprise Manager wizards depending on the version of the database target. If manual backup scripts were used, the chances are they would remain the same after a database upgrade and not be changed to use the new technology. Therefore, the benefits of using Oracle Enterprise Manager are clearly seen.

The RMAN Backup Settings that can be set are visible in the screenshot below.
RMAN backup settings in Oracle Enterprise Manager 12c.

For those that absolutely need to run their UNIX shell scripts or other type of scripts for that matter, Oracle Enterprise Manager 12c allows for that too. The tool provides capabilities to run customized scripts using the Oracle Enterprise Manager 12c Job System. DBAs can specify which scripts to run and then schedule them in the Job System. Oracle Enterprise Manager
12c provides status tracking and notifications for backup success or failure.

Oracle Enterprise Manager 12c Job System can be used for automating customized scripts.

In this way, Oracle Enterprise Manager 12c can be used for setting up and scheduling RMAN backups without hand-written or borrowed scripts, and without the use of Cron.

Security Concerns

Security teams often voice their concerns when they are informed about a central management site being setup in their company. They fear that database administrators will be able to access any databases which are not in their domain. However, this fear is unfounded—just the fact that Oracle Enterprise Manager 12c is a central site doesn’t mean everything is accessible to everyone.

Oracle Enterprise Manager 12c imposes full security via the creation of target groups whose rights can be assigned to different Cloud Control administrators. So, when disparate database teams login to the Cloud Control console, they have access only to their own target groups in which the databases, listeners, hosts and application servers managed by that particular team have been placed. The access to the targets can also be controlled—full management rights or only view access.

For example, if the accounting department DBA team is responsible for the production PRD1FIN database and its listener, they would be assigned their own target group and a new administrator login to Cloud Control.
When any of the DBAs from this team would log onto the console, the PRD1FIN database and associated targets would be available to them, but not any of the targets handled by other DBA teams.

Managing Oracle Secure Backup

Oracle Secure Backup is an integrated secure tape backup management system from Oracle. It is a welcome alternative to third-party tape backup solutions that are highly priced and are not tightly integrated with Oracle.

Oracle Secure Backup protects not only Oracle Database 9i, 10g, 11g, and 12c, but also the entire environment including heterogeneous application file systems (from OSB 10.2 onwards). It is the fastest backup for Oracle Databases, at least 25-40% faster than other products.

Most importantly, Oracle Secure Backup is the only media management software that is fully integrated with Oracle Enterprise Manager 12c, which can now manage tape backup administrative tasks such as managing volumes (tapes) and tape devices.

Oracle Secure Backup can perform offline backups of 3rd party databases as part of a file system backup operation. Or, the 3rd party databases can perform an online backup using their own backup utilities to disk, and Oracle Secure Backup can backup their backup files.

The other advantage is that Oracle Secure Backup encrypts data before it leaves the database. The database engine handles the encryption; the data never leaves the database in unencrypted format. The encryption keys are transparently managed by the database.

There is also an Express version of Oracle Secure Backup available, and this is bundled with the Oracle Database. Oracle Secure Backup Express is free with the database for protecting one server with one attached tape drive. There is no encryption possible with Oracle Secure Backup Express version. The licensing information is available here.

Backup Strategies Using Oracle Enterprise Manager 12c

Executing a full database backup every night is fine for small or medium sized databases, and no one complains about the small amount of disk space the backup requires or why the backup executes in a very short time.

However, when the database size is more than say 200 GB, it is time to rethink your backup strategy. In most of the real world database scenarios, having a proper and validated backup strategy is very important—even for small databases. And regular testing of your RMAN backup of all your databases is one of the DBA’s mandatory responsibilities.

Consider a larger database with 500 GB in total of database files. Obviously, it will not be appropriate to take a full database backup each day. You can adopt a better backup strategy by taking a full database backup once a week on a Sunday and then an incremental database backup Monday through Saturday.
This will enable you to recover the database to any point in time during the previous week by first restoring Sunday's full database backup and then applying the appropriate incremental backups. The different backup types for this kind of strategy can be easily set up using Oracle Enterprise Manager 12c, and scheduled using Oracle Enterprise Manager 12c Job Scheduler. After the jobs execute overnight, their output is visible by drilling down into the job logs from the console, and if any of the backup jobs fail, a notification can be sent to any of the DBAs on roster duty.

The whole database, or individual tablespaces or data files, and/or archive logs can be backed up via the backup screens in Oracle Enterprise Manager 12c. An Oracle suggested backup strategy is also available, which is based on creating an image copy of the database which is then rolled forward using incrementally updated backups that are taken on the succeeding days. It is then possible to switch to this updated image copy of the database at any time without incurring any restore time lags—there is no need to restore the backup files to the database location. Such techniques are useful in the case of very large databases that would take a long time to restore.

These advanced techniques of RMAN like incrementally—updated image copies, and also the new features in Oracle Database 10g and 11g, such as compressed backups and encrypted backups, are easily available via Oracle Enterprise Manager 12c's console. Even less-experienced DBAs can easily exploit the modern features of the database using Oracle Enterprise Manager 12c, and feel confident in doing so.

“Thanks to Oracle, we are saving US$49,000 each year, and reducing backup times by five hours. We have also become much more proactive, in terms of troubleshooting.”

Edward A. Woolls, IT Operations Manager, Foschini Group

Integrated System Management and Support

Automating Patching with My Oracle Support

Oracle Database Lifecycle Management Pack encompasses configuration management, provisioning, patch automation, and change management. In short, configuration management enables you to capture and centralize information about all the hardware and software resources, enables historical change tracking, and also includes security compliance plus configuration rules and violations.

Provisioning and patch automation allows deployment of Oracle software, applications and patches. You can provision the entire software stack, including the OS, middleware, and the database. You can patch the OS and the database. This allows DBAs to automate the task of configuring, patching and provisioning Oracle software across multiple IT environments.

Beginning with Bundle Patch 1 (released in February 2012), Enterprise Manager can also patch your WebLogic Server (WLS) environments. From Enterprise Manager Release 3
(released in July 2013) onwards, administrators can now apply Oracle WebLogic Server patches to several WebLogic Domains in a single operation. In addition, administrators can identify whether middleware targets have missing properties or unsupported configurations, and provide recommendations on resolving the issues found.

Note that WLS provisioning and patching requires the separate license of the WebLogic Server Management Pack Enterprise Edition (EE).

By automating the configuration management, patching and deployment processes, Oracle not only helps reduce deployment time, but helps eliminate redundant often errors-prone manual tasks that DBAs face, day in, day out. And with the tight integration of Oracle Enterprise Manager 12c and My Oracle Support, it now gives DBAs and system administrators a powerful and comprehensive management tool that bridges the gap between IT management and customer support—all from within Oracle Enterprise Manager Cloud Control 12c’s centralized console.

Integration with My Oracle Support

A task that DBAs have to perform all the time is patching. Many find patching a mundane and repetitive task that has to be done. Oracle Enterprise Manager 12c helps alleviate the pain with its ability to connect to My Oracle Support (formerly Oracle Metalink) from within Cloud Control. DBAs can now effectively analyze and download patches they need, apply them in a test environment, promoted them to a staging area, and then deploy them into production. Once deployed, Oracle Enterprise Manager 12c verifies that the patches were applied correctly. Also, with Oracle Real Application Clusters (RAC), certain patches can be applied in a rolling fashion to each node in the cluster to eliminate downtime. With Oracle Enterprise Linux, the ability to download and apply operating system patches is totally automated from beginning to end requiring no intervention at the console.
Integration of Oracle Enterprise Manager 12c and My Oracle Support

Let's take a look at the benefits of the Oracle Enterprise Manager 12c and My Oracle Support integration:

**INTERGRATED SYSTEM MANAGEMENT AND SUPPORT—SUMMARY**

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>BENEFITS</th>
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| Analyze  | The integration of Oracle Enterprise Manager 12c and My Oracle Support gives administrators, the ability to leverage proactive support advisories, recommendations, and analysis of their systems in order to streamline the support process and improve overall customer experience.  
*Highlights:*  
- One centralized management console with My Oracle Support connection  
- Proactive patch advisories and recommendations  
- Best practices for system health checks and diagnostic tools  
- Service request processing and management  
- Get answers, tips and techniques using Oracle's vetted and secure peer-to-peer support community  
- Comprehensive knowledge articles from Oracle  
- Pre-flight dependency analysis |
| Patch    | Patching systems on mass scale using automation helps boost operational efficiencies and saves administrator's time and effort  
*Highlights:*  
- Full patch automation for Oracle software and hardware reduces error-prone manual tasks  
- Downloads for Critical Patch Updates, one-off patches and patch set  
- Zero downtime patching for RAC  
- Automatic download and lights-out patching for Oracle Enterprise Linux  
- Streamlined conflicts and merge patch process |
| Test     | Thorough end-to-end testing prior to deployment not only helps ensure service quality but also ensures your |

![Patches & Updates](image_url)
applications and underlying infrastructure are configured and optimized for performance

**Highlights:**
- Test infrastructure and system changes using real production workloads
- Proper test data management, enables secure, production-scale testing
- Test and predict the impact of patches on performance before production deployments helps mitigate risks

**Provision**
System Administrators can save time and effort by staging changes and patches prior to production by using Enterprise Manager’s out-of-box “gold” configuration management best practices and policies. This helps lower deployment costs while maintaining standards, service quality and consistency.

**Highlights:**
- **Deploy databases faster** across test and production and ultimately to the cloud
- Drive IT efficiencies with out-of-box “gold” configuration standards
- Reduce patch management efforts by using standardized deployment processes
- Integrated patch management and deployment automation helps lower operational risks

**Reporting**
Meet regulatory compliance requirements through Oracle Enterprise Manager 12c’s comprehensive dashboard and reporting capabilities

**Highlights:**
- Automated compliance management, and streamlined configuration management enforces compliance with corporate and security standards
- Comprehensive performance analysis and reporting maximizes resource utilization
- Rich compliance reporting dashboards and out-of-the-box policy frameworks for popular industry and regulatory requirements accelerate IT compliance and drives down costs

“Spinning up a database, a process that used to take **two to three weeks**, now takes us **only 19 minutes**, something like a **1,000% improvement** in deployment time. Accelerating deployment to this degree has brought us much closer to the customer service levels our business goals demand.”

—Surren Partabh, Chief Technology Officer, BT Operate

**Read the case study**

### Best Practices Using Deployment Procedures

Many companies restrict Internet access to production servers for security reasons. In such cases, Oracle Enterprise Manager Cloud Control site will not have a direct (or even proxy) Internet connection to the My Oracle Support site.

Conveniently, Oracle allows you to perform offline updates to overcome this restriction. The official reference on how to achieve this is provided in **“Patching Software Deployments”** in the Oracle Enterprise Manager Lifecycle Management Administrator's Guide 12c Release 3 (12.1.0.3). The section for Online and Offline patching is here.

For the actual patching, we recommend the extremely powerful Deployment Procedures functionality in Oracle Enterprise Manager 12c that allows you access to a number of advanced features including multiple patch application, patch flow customization, sudo, and also pluggable authentication modules (PAM) support.

These deployment procedures are based on best practices and Oracle experience over the years. Examples of the multiple out-of-the box deployment procedures that Oracle Enterprise Manager 12c provides are seen in the following screen shot:
Out-of-the box Deployment Procedures in Oracle Enterprise Manager 12c
As an example, the deployment procedure “Patch Oracle Database” performs the following actions in order:

<table>
<thead>
<tr>
<th>ORACLE DATABASE PATCHING PROCEDURES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Upgrade the Oracle OPatch utility, which is the actual database-level mechanism for patching Oracle Databases. This upgrade of OPatch is optional but is always recommended.</td>
<td>8. Apply any applicable SQL script in the case of a patch set or a CPU.</td>
</tr>
<tr>
<td>2. Stage the selected patch in a staging location.</td>
<td>9. Apply a post-SQL script.</td>
</tr>
<tr>
<td>3. Initiate a blackout for the database in Oracle Enterprise Manager 12c—since this downtime has been planned in advance, no alerts should be raised when the database is brought down.</td>
<td>10. Shut down the database.</td>
</tr>
<tr>
<td>4. Shut down the database.</td>
<td>11. Restart the database.</td>
</tr>
<tr>
<td>5. Apply the database patch.</td>
<td>12. Apply additional SQL scripts as required.</td>
</tr>
<tr>
<td>6. Execute any applicable root script.</td>
<td>13. Stop the Oracle Enterprise Manager 12c blackout for the database so that Enterprise Manager can begin raising alerts again.</td>
</tr>
<tr>
<td>7. Restart the database in the upgrade or migrate mode.</td>
<td>14. Refresh the host configuration collection.</td>
</tr>
</tbody>
</table>

These steps can be seen in the following screen shot:
“Patch Oracle Database” Deployment Procedure in Oracle Enterprise Manager 12c
You can use “Create Like” to create a similar procedure, and then suitably modify the steps, even adding your own steps, or creating a totally new User Defined Deployment Procedure (UDDM) which you can define to patch or provision even non-Oracle software.

Oracle Database Change management, another feature of Oracle Database Lifecycle Management Pack, allows the capture and comparison of metadata (dictionary) definitions, which in real life keep changing across application releases. This includes schema objects, users, and privileges.

You can track changes in a single database or compare multiple databases; you can reverse-engineer the database and schema definitions, capture and version baselines, compare databases and schemas or baselines, and propagate schema changes to multiple databases using synchronization. You can also compare data.

You can learn about most of these features of Oracle Database Lifecycle Management Pack from this Oracle Technology Network page, and also from the author’s book, Managing Data Center Chaos using Enterprise Manager Cloud Control 12c which goes through these features in detail.

Configuring Oracle Active Data Guard using Oracle Enterprise Manager 12c

One other interesting possibility is Oracle Data Guard (Active or Normal) using Oracle Enterprise Manager 12c. It is possible to easily set up, manage and monitor standby databases for any primary database using Oracle Enterprise Manager 12c.

The standby databases can be Active Data Guard or normal Data Guard databases, the difference being that the Active Data Guard standby is open for reporting all the time, as opposed to normal Data Guard standby which is not open for reporting when applying redo information. Many companies therefore prefer Active Data Guard to be able to use their standby systems for reporting, reducing the production workload and also move their database backup to the standby.

The advanced web interface provided by Oracle for creating and managing Active Data Guard configurations, is an easy to use tool and provides common functionality for many Active Data Guard applications. This is seen in the screenshot below.
DBAs can also easily use Oracle Enterprise Manager 12c for day-to-day monitoring and management of Active Data Guard configurations. They can also easily perform Switchovers or Failovers to the standby database, in case of planned or unplanned downtime, and they can do all this from the Cloud Control console.

Cloud Control supplies a common, standard interface to set up and manage Oracle Data Guard for Oracle Database 9i, 10g and 11g databases. Advanced features of Oracle Data Guard in different database releases are visible corresponding to the release, and automatically offered to the DBA, thus reducing the learning curve.

Oracle Enterprise Manager 12c can therefore be very useful in implementing Oracle Data Guard for various Oracle Database releases. Active Data Guard is available in Oracle Database 11g onwards in the Enterprise Edition.

For detailed information on the set up and management of Oracle Data Guard using Oracle Enterprise Manager 12c, please see the technical articles by the Author.

Virtual Server Monitoring and Management Capabilities

Oracle Enterprise Manager 12c can monitor and manage Oracle Virtual Servers. If Oracle Virtual Machine (VM) is the virtual engine used to virtualize your IT environment, then Oracle Enterprise Manager 12c can be deployed to manage the virtualized environments. You can monitor the availability as well as performance of the virtual machines, manage their configuration, set up a software library of Oracle VM templates, provision new virtual machines from this library, perform live migration of a guest machine to a different server so that maintenance activities can be performed, and patch these machines. Oracle Enterprise Manager 12c is integrated with OVM and Oracle Virtual Assembly Builder (OVAB). Release 3 of Enterprise Manager now supports OVM 3.2.3.
Further, by using Oracle Enterprise Manager Ops Center 12c, you can manage the full lifecycle of virtual guests that use the Oracle Sun Virtualization technology (such as Solaris Containers and LDOMs (Oracle VM for Sparc). This includes hot and cold migration, Guest Provisioning, Guest creation and deletion, virtual resource Pools (resource management) and also Storage and Network Management.

Oracle Enterprise Manager 12c therefore provides a very effective solution for managing the entire lifecycle of Oracle Sun physical and virtual systems—Oracle Enterprise Manager 12c and Ops Center together are therefore a very powerful and effective systems management solution to manage Oracle’s Sun infrastructure.

Managing Heterogeneous Environments Using Oracle Enterprise Manager 12c

Today, you’ll find more and more IT organizations using multiple software vendors’ solutions across their data centers. This provides additional challenges to system administrators and DBAs.

Monitoring and managing all of these various components and infrastructure pieces is difficult at best, especially when each vendor provides their own management tools. Keeping track of which vendor’s technology is impacting application performance or services is a never ending battle. This can be a very silo’d approach.

With Oracle Enterprise Manager 12c, IT operational teams have the ability to manage and monitor non-Oracle technologies including; hosts, OS, databases, middleware and applications. Using Oracle Enterprise Manager 12c’s open and extensible framework to extend Cloud Control beyond Oracle software, is a huge benefit to administrators, who now can manage and monitor heterogeneous technologies in their data center from one console.

Let’s take a quick look at the benefits of Oracle Enterprise Manager 12c to the Unix system administrator for Unix host monitoring, the company auditors and regulators for compliance, and also IT management for managing ‘service level agreements’.

UNIX Host Monitoring for System Administrators

Oracle Enterprise Manager 12c captures host performance metrics in the repository and these details can be accessed from Cloud Control by selecting the Host target and selecting Monitoring CPU/Memory/Disk Details. This displays a graphical view of the Host performance metrics as can be seen in the screenshot below. It is possible to display host performance data for the last 31 days by selecting the appropriate option from the drop-down box. CPU utilization metrics and the top Host processes (ordered by CPU) are seen in this screenshot.
Oracle Enterprise Manager 12c CPU Performance Metrics for Host Targets

It is possible to switch to the other performance details for the host by simply selecting the link from the Oracle Enterprise Manager 12c menu for the host as shown below. Memory utilization, disk i/o utilization, and even specific program resource utilization can be examined in detail.
Monitoring options for Host Targets

The technical white paper "Strategies for Scalable, Smarter Monitoring using Oracle Enterprise Manager Cloud Control 12c" covers the basics around monitoring setup, and helps on the ground work along with useful tips and best practices. You can refer to it for more detail on monitoring.
Real-Time Configuration Change Control and Compliance for Auditors

Oracle Enterprise Manager 12c captures configuration metrics for many components such as host servers and can compare them to one another, thus enabling system administrator to pinpoint configuration drift in their environments. This also includes real-time configuration monitoring, which provides continuous detection, validation and reporting associated with any authorized and unauthorized configuration change across applications-to-disk. This kind of change control is in accordance with regulatory and industry standards like Sarbanes-Oxley, PCI and ITIL, which is being implemented today by many organizations.

The Compliance Library, seen below in the next screenshot, shows the out-of-the-box frameworks such as the PCI DSS framework. The PCI DSS standard is the worldwide Payment Card Industry Data Security Standard from the PCI Security Standards Council.

Compliance Frameworks in Compliance Library including PCI DSS

Oracle Enterprise Manager 12c allows you to create custom compliance frameworks, compliance standards and compliance rules in addition to the predefined compliance standards and compliance rules pertaining to the different frameworks that are displayed. There are hundreds of out of the box compliance rules as can be seen in the screenshot below.
Compliance Rules in the Oracle Enterprise Manager 12c Compliance Library

The Compliance Dashboard offers a view at a glance, of how the company systems are complying with best practices, security policies, storage policies, and other user defined policies. This would be quite useful to company auditors and regulators.
Oracle Enterprise Manager 12c Compliance Dashboard

Service Level Management for IT Managers

In the case of IT Managers, they would be interested in how Oracle Enterprise Manager 12c can help them achieve an overall end-to-end, corporate view of its infrastructure system, such as the availability of the systems, the database versions in use, Oracle licensing aspects, and the different hardware systems out there in the organization. They would like to see the dashboards that display the performance of the application system components as a whole, including the databases, listeners, application server instances, hosts, and other components that make up the application in total. If any of these components were to stagger and fail, the entire application system would be adversely affected.

IT Managers are interested in the proper use or wastage of expensive storage space, and they would also appreciate the automation of jobs without scripts, removing much of the dependence on UNIX shell scripts and cron jobs. This allows their DBAs to focus on high business value projects and tasks, like capacity planning and service quality improvements.

They would be interested to see if the security compliance requirements and the service level agreements (SLAs) for the various systems in the company are being achieved—just as the managers of Oracle’s next generation data center in Austin Texas do. All the mentioned aspects are in Oracle Enterprise Manager 12c.

Oracle itself uses Oracle Enterprise Manager 12c to manage its entire data center, meeting the service level agreements to the various departments throughout Oracle. The following screenshot shows a monitored service that has been defined in Oracle Enterprise Manager 12c.
Oracle Enterprise Manager 12c Service Level View.

The topology of the service can be seen in the next screenshot.
Oracle Enterprise Manager 12c's Topology Viewer with Drill-Down Diagnostic Capabilities.

In a complex system, such a map would be useful to find out the interdependencies. You can search for individual components and you can also change the annotations that appear on the topology view, such as the status, metrics (with names or values), and incidents.
Root Cause Analysis: Manual vs. Automation

Component targets that are up or those that have critical incidents, such as the listener in the preceding screenshot, are pinpointed easily and quickly thanks to the help of Oracle Enterprise Manager 12c's Topology Viewer. This points out an interesting use case and argument for using Oracle Enterprise Manager 12c's automation capabilities vs. manual intervention.

The root cause of the database system having a critical incident is traced to the host and then to the listener, this is known as Root Cause Analysis (RCA); Oracle Enterprise Manager 12c goes through all the components in the system one by one until it finds the root cause.

If the same tasks were to be done manually in a complex multi-component system, every component would have to be checked manually and this is where the automation power of Oracle Enterprise Manager 12c is most useful. For example, consider an application system with a number of databases, listeners, hosts, and application servers. If the system was reported as non-functional, the administrators would have to go through it and manually check every host, every database, every listener, and every application server to pinpoint the problem. This could take hours or even days.

Suppose they were using Oracle Enterprise Manager 12c, all the administrator would have to do is to view the topology of the application system, and they would immediately know where the problem was thanks to the help of the Root Cause Analysis being performed visually in Cloud Control. The incident is resolved in minutes without impacting the database service and or business users.

In Release 3, for target down scenarios, Enterprise Manager automatically analyzes the various target down events and the targets' relationship to each other to determine which events are root cause and which events are symptoms. This will then allow administrators to meet service level agreement (SLA) goals by helping them to repair the issues a lot faster.

Oracle Exadata Management

Oracle Enterprise Manager 12c can be used for monitoring and managing Oracle Exadata Database Machine. Discovery is done with greater ease, and the entire Oracle Exadata system can be monitored (both the hardware and software). SLAs can be set up for Oracle Exadata systems. The management of a number of Oracle Exadata components is possible via Oracle Enterprise Manager Cloud Control console, including, but not limited to, Oracle RAC databases and storage servers.
Partitioned Oracle Exadata racks can be monitored and managed by Oracle Enterprise Manager 12c using the Exadata plugin. SPARC SuperClusters and multi-rack Oracle Exadata Machines can now be discovered and managed from Oracle Enterprise Manager Release 3 onwards. Pre-created I/O Resource Plans are also available in Release 3 for Exadata.

Deeper hardware monitoring of Oracle Exadata can be achieved—if required—via Oracle Enterprise Manager Ops Center 12c. This goes down to the Field Replacement Unit (FRU) level of all the components with the serial numbers and part numbers, and also the energy information, such as the electricity usage levels, and trends, temperature, firmware levels, and updates of hardware components among others.
The Auto Service Requests (ASR) phone-home capabilities (for My Oracle Support purposes) can also be achieved via Oracle Enterprise Manager Ops Center 12c. An Internet connection would be required for the ASR facility, since it would notify Oracle Support in case of any hardware failure in any component in Oracle Exadata, allowing Oracle Support to dispatch an engineer along with the Field Replacement Unit (FRU). This is provided you have Oracle Premier Support for Oracle Exadata. The ASR Manager (or Oracle Enterprise Manager Ops Center 12c, if it is used, since it has ASR capabilities) is placed on a server that has a direct Internet connection, or via a proxy with a username and password.

Managing Oracle Database 12c and Beyond

Oracle Enterprise Manager 12c has been able to monitor and manage Oracle Database 12c as soon as it was released; including new management support for Oracle Multitenant, a new Oracle Database 12c Enterprise Edition option. This new option embraces a multitenant architecture that lets you have many “sub databases” inside a single “super database.”

The sub databases are referred to as “pluggable databases”—abbreviated as PDB, since you can plug and unplug them from the “super database” also known as a “multitenant container database”—abbreviated as CDB. For a complete understand and background on the multitenant container and pluggable database architecture, please refer to this whitepaper; Oracle Multitenant.

The Oracle Enterprise Manager agent can now discover both these types of CDB and PDBs. RMAN backups via Oracle Enterprise Manager can backup the whole database, or the CDB root, or the PDB—either with a full or incremental backup. The Standby database wizard in Oracle Enterprise Manager is also CDB and PDB aware, and allows you to create a standby database from the CDB only if all the PDBs are open. Oracle Enterprise Manager also allows you to create Data Redaction policies for Oracle Database 12c’s new Data Redaction feature, which camouflages data on the fly when being displayed. The Database Resource Manager is now CDB aware and allows you to create CDB Resource plans. This will control resources to pluggable databases inside the CDB.

New Deployment procedures are now available in Oracle Enterprise Manager to provision PDBs from a baseline or seed pluggable database. It can also provision from unplugged PDBs, or by cloning an existing pluggable database. You can also migrate existing non-CDB databases as pluggable databases using Oracle Enterprise Manager, or unplug and drop a pluggable database altogether.
Provision Pluggable Databases via Oracle Enterprise Manager 12c.

Regarding self-service of the database cloud, the “Schema as a Service” cloud capability is already present in the Cloud plug-in “Oracle Enterprise Manager for Oracle Cloud (SSA) 12.1.0.5”. The “Chargeback and Consolidation Planner Plug-in 12.1.0.4” release provides support for Oracle Multitenant. This enables the chargeback administrator to add a multitenant container database (CDB) to a Chargeback plan, and assign each pluggable database (PDB) individually to a cost center.

On the Active Session History (ASH) Analytics page (via Performance > ASH Analytics from the Database target menu in Oracle Enterprise Manager), you can select either the CDB or any of the PDBs. This is also the case on the SQL Monitoring page (via Performance > SQL Monitoring menu option).

Oracle Database 12c has an excellent feature known as Information Lifecycle Management (ILM) which is now fully automated in moving data between different storage, depending on data age and access. The Heat Map and Automatic Data Optimization (ADO) features of Oracle Database 12c can be used to implement your ILM strategy, along with Partitioning, Advanced Compression, and Hybrid Columnar Compression.
EMCLI With Scripting

Oracle Enterprise Manager 12c Release 3 also introduces the Enterprise Manager Command Line Interface (EMCLI) With Scripting Option, which was a popular request from many Administrators. This is in addition to the previously available Standard EMCLI.

The scripting support in the new option is Jython-based. With this capability, you can now build complex scripts and automate operational activities. Script mode is very useful when performing tasks in bulk mode, or if you need to complete many tasks at once.

The programming model is object-oriented and supports encapsulation, loops, functions, exception and error handling, besides other features. In essence, EMCLI can now benefit from all the powerful features of the Jython programming language.

The methods of downloading and deploying the standard EMCLI client or the Advanced EMCLI Client, and of using EMCLI in either the Standard, Interactive or Script modes (the latter two being Jython-based) are described in detail in the Oracle Enterprise Manager Command Line Interface Manual.

Change Activity Planner

Release 3 of Oracle Enterprise Manager 12c leverages its existing capabilities of configuration management, compliance management, and automation, and introduces the Change Activity Planner (CAP) to manage long running change processes.

The Change Activity Planner provides the ability to plan, execute, and track change activities in real time. It covers the typical datacenter activities that are spread over a long period of time, across multiple people and multiple targets and target types. Change Activity Plans enable you to track the progress of long running change processes such as patches, security compliance rollout operations, upgrades, and consolidation.

The overview of the Change Activity Planner can be seen here in the Oracle Enterprise Manager Lifecycle Management Administrator's Guide. A learning video is also available.

At-source Data Masking, Integrated Data Subsetting and Masking

Oracle Enterprise Manager 12c Release 3 considerably enhances the previously available Enterprise Manager capabilities of data masking (whereby confidential data in production databases is obfuscated for use in test or development databases), and data subsetting (the ability of Enterprise Manager to create smaller test or development datasets from larger production databases).

Now, to comply more strictly with PCI DSS requirements, sensitive data is desensitized and de-identified right at the source before it leaves the production database. The Data Masking capability reads production data and writes out the masked data as a Data Pump file. This is known as inline data masking.

In the case of Integrated Data Subsetting and Masking, it is now possible to subset production data and mask the sensitive data in the subset in one step, using on-the-fly masking. As the
subsetted data is read from the production database, the Data Masking capability masks the sensitive data before it is written to the Data Pump file.

At-source Data Masking and the integration of Data Subsetting and Masking are common-sense and logical enhancements to Enterprise Manager that combine to make test system provisioning even more secure and compliant to industry standards. These capabilities are possible for Oracle Database 11g or higher releases.

Inline Masking and Subsetting is further described here in the Oracle Database Testing Guide 12c Release 1 (12.1).

Consolidated Database Replay
Database Replay is a major feature of the Real Application Testing (RAT) option. It allows production database workloads to be captured and replayed on test systems with production workload characteristics such as timing, transaction dependency, think time, etc., fully maintained. This can identify application scalability and concurrency problems, and so can be used for server and OS consolidation. Individual workloads can be captured and replayed in parallel.

Consolidated Database Replay, introduced in May 2012, means that workloads captured on different databases can be replayed concurrently in a single target database (11.2.0.2 and above). This allows schema consolidation. In Enterprise Manager Cloud Control 12c, there is a “Create Concurrent Capture Wizard Workflow” and “Create Concurrent Replay Task Page” to assist in the complete process. MOS Doc ID 1453789.1 provides more details on the required patches, and how to use this functionality and associated best practices.

With the release of Oracle Database 12c, Consolidated Database Replay now includes Pluggable Databases so you can also do CDB consolidation. Multiple workload captures can be replayed against PDBs by remapping capture connections to services. This is possible via the Database API in Oracle Database 12c using the DBMS_WORKLOAD_REPLAY package.

The API in Oracle Database 12c now also supports capacity planning by scaling up the workload replay. The three possibilities for the scaling up are:

- Time-shifting: Align workload peaks (of workloads captured from different applications) for maximum concurrency for the purpose of stress testing.
- Workload folding: Split single capture into multiple time-based pieces and replay them concurrently, for scale-up testing.
- Schema Remapping: Schema remapping is performed by adding the captured workload multiples times into a replay schedule and remapping the users to different schemas. Duplicating and replaying the workload in each schema concurrently allows you to identify possible host bottlenecks when deploying multiple instances of an application.

More information on Consolidated Replay can be found here in the Oracle Database Testing Guide. Workload Scale-up is described here.
Conclusion

Based on the backbone of the industry-leading Oracle Database Enterprise Edition and Oracle WebLogic Server, Oracle Enterprise Manager 12c is a very powerful and comprehensive solution, capable of managing your entire data center from end-to-end with a business-driven application management approach. And the sky is truly the limit for future versions of the fantabulous Oracle Enterprise Manager product.

Oracle Enterprise Manager 12c Release 3 also includes enhancements to the system dashboard, the security console, administrator entitlements, incident manager, metric extensions and the Oracle Enterprise Manager auditing framework, and this improves overall efficiency.

In the whitepaper, we discussed how DBAs can benefit from Oracle Enterprise Manager 12c, by using the solution to automate many of the practical database tasks in their daily routines.

We looked at how database backups, and the creation of standby databases can be streamlined, and how entire database systems and their underlying infrastructure can be automatically patched and provisioning with the newly integrated Oracle Enterprise Manager 12c and My Oracle Support (MOS).

These are nitty-gritty tasks but they combine to take up a lot of DBA’s time and effort. Not only by using Oracle Enterprise Manager 12c’s automation and its manage many as one approach, DBAs now can devote their efforts to higher value tasks like improving service quality and system availability and become true strategic advisors to the business.

The benefits of Oracle Enterprise Manager 12c to system administrators, compliance officer, and even IT executives are well defined and quantifiable, with Oracle Enterprise Manager 12c delivering superior return on investment and business value.

The Oracle Enterprise Manager Extensibility Exchange now offers a catalog of numerous Enterprise Manager Extensions, such as Plug-Ins and Management Connectors. And as we see the number of Oracle Enterprise Manager 12c management packs, management connectors and plug-ins steadily grow with capabilities—for all its ambition to be the enterprise management system of choice, it truly can be said that Oracle Enterprise Manager 12c has progressed well on that path.

For more in-depth technical information and resources, please visit Oracle Enterprise Manager 12c on the Oracle Technology Network at http://www.oracle.com/technetwork/oem/grid-control/overview/index.html where you can download demos, whitepapers, webcasts and more!
About the Author

**Porus Homi Havewala** works as a Senior Manager (Enterprise Technology) at Oracle Corporation Singapore. He was awarded the Oracle ACE Director title by Oracle HQ in 2008, and after joining Oracle became an Oracle Employee ACE. He has extensive experience in Oracle technology since 1994 in Australia, including as a Senior Production DBA, Principal Database Consultant, Database Architect, E-Business Technical DBA, Development DBA, and Database Designer Modeler (using Oracle Designer). He has also worked in Oracle India in the ACS (Advanced Customer Services) department and is an enthusiast for Oracle technology, especially Oracle Enterprise Manager, on which he has conducted seminars for large enterprises around the world and implemented this powerful enterprise tool. In the early 2000s, Porus was the Technical team leader with the first production Grid Control project in the world, a large telecommunications company in Australia. He has authored two books on Enterprise Manager including the latest *[Managing Data Center Chaos using Enterprise Manager Cloud Control 12c](http://enterprise-manager.blogspot.com/)*. He has published numerous technical articles and white papers on Enterprise Manager on OTN, and created one of the first blogs dedicated to Enterprise Manager [http://enterprise-manager.blogspot.com/](http://enterprise-manager.blogspot.com/) (with Oracle Press Credentials).