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Making Infrastructure-as-a-Service in the Enterprise a Reality

ORACLE

Contents

Executive Overview

Virtualization, cloud computing, massive growth in unstructured data, transaction volumes, and applications and demands for energy efficiency are all driving datacenters to rethink how IT resources should be deployed. Many enterprises are transforming their IT infrastructure from multiple independent datacenters to an Infrastructure-as-a-Service (IaaS) model, in which shared pools of compute and storage are made available to end-users on a self-service basis. While providing significant improvements when implemented properly, this strategy introduces change and complexity at a time when datacenters are already understaffed and overburdened. To aid in this transformation, IT managers need the proper tools to help them provide the array of IT capabilities required throughout the organization without stretching their staff and budget to the limit.

Virtualization plays a key role in enabling the transition to this new paradigm. Placing just two or three virtual environments on an existing server can double or triple the administrative workload for IT staff if not implemented properly. In addition, introducing virtualization technologies adds greater complexity by blurring existing lines of responsibility. Virtual deployments can cross traditional groups of dedicated administrative staff, creating doubt about which group is responsible for managing business services and the underlying infrastructure. Datacenter administrators are caught in the middle with tools that fail to keep pace with technological developments. IT organizations face a breaking point as they attempt to cope with disconnected, single-purpose tools, and labor with the use of scripts and manual processes. Administrators struggle to manage multiple datacenter infrastructure layers and to scale resources in response to rapid change and complexity, resulting in a net loss of productivity as the increased overhead outweighs the efficiency gains provided by the self-service model.

Converged hardware management with Oracle® Enterprise Manager Ops Center 12*c* offers the advanced capabilities to enable IT departments and end-users to take advantage of the many benefits and cost savings of IaaS. Oracle Enterprise Manager Ops Center 12*c* addresses this challenge with a converged approach that integrates hardware management across the infrastructure stack, helping organizations to streamline operations, increase productivity, and reduce system downtime. Based on business-driven policies, unique and comprehensive application-to-disk management capabilities come together within Oracle Enterprise Manager Ops Center 12*c* to further simplify administration, increase efficiency, and break down barriers between management silos.

The Challenges of Managing Complexity

In today's fast moving, highly competitive business environment, enterprises are running increasingly sophisticated and resource-intensive business applications (sometimes referred to in the IT industry as big compute, big data, and big pipe). The combination of comprehensive solutions and powerful IT technologies drives better business performance, helps customers optimize their IT investments, and use IT as a strategic differentiator. Since enterprise datacenters typically use a variety of operating systems and a mixture of server architectures running bare-metal and virtualized environments, datacenter managers frequently struggle with a fragmented management facility consisting of a variety of proprietary and single-purpose tools. These tools tend to be niche products and limited in scope, designed as they are to solve just one piece of a much larger puzzle.

Complicating the issue is the widespread use of virtualization technologies that help increase resource utilization and consolidate hardware resources in the datacenter. Virtualization imposes additional management requirements to handle dynamic resource allocation and often increases the number of systems to provision and support. Virtualization also blurs the lines between IT management responsibilities, making it less clear who handles storage, security, connectivity, and support when the server operating system is no longer tied to a unique hardware resource. The result is a complex, hard-to-manage infrastructure that cannot scale to meet growing demand.

Furthermore, many of today's corporate departments and business units often lack the funding and resources to support their own IT infrastructure. As a result, a new paradigm for corporate IT is growing out of the recent wide-spread enthusiasm for cloud computing, specifically private clouds. IT managers, however, are concerned about the additional system management issues associated with the administration of clouds running mission-critical applications.

Providing Cloud Infrastructure in the Enterprise

Cloud computing offers convenient, on-demand access to a shared pool of computing resources—including networks, servers, storage, applications, and services—that can be rapidly provisioned and released with minimal management effort. Typically, cloud computing is made available in one of three deployment scenarios—Infrastructure-as-a-Service (IaaS) offering physical and virtual systems, including an operating system, hypervisor, raw storage, and networks; Platform-as-a-Service (PaaS) providing the infrastructure plus a solution stack including program language execution environment, database, and Web server; and Software-as-a-Service (SaaS) offering a platform plus applications (Figure 1).

Servers represent the main compute resource in IaaS and are often virtual instances within a physical server. Typically they run a standard operating system such as Oracle Solaris, Windows, Oracle Linux, or other Linux variant. IaaS platforms also invariably include a load balancing capability to spread application workloads across a number of server instances or to add a degree of resiliency and availability to applications. A load balancer also can be used to provide a virtual IP network connection to distribute network requests across a number of application instances.

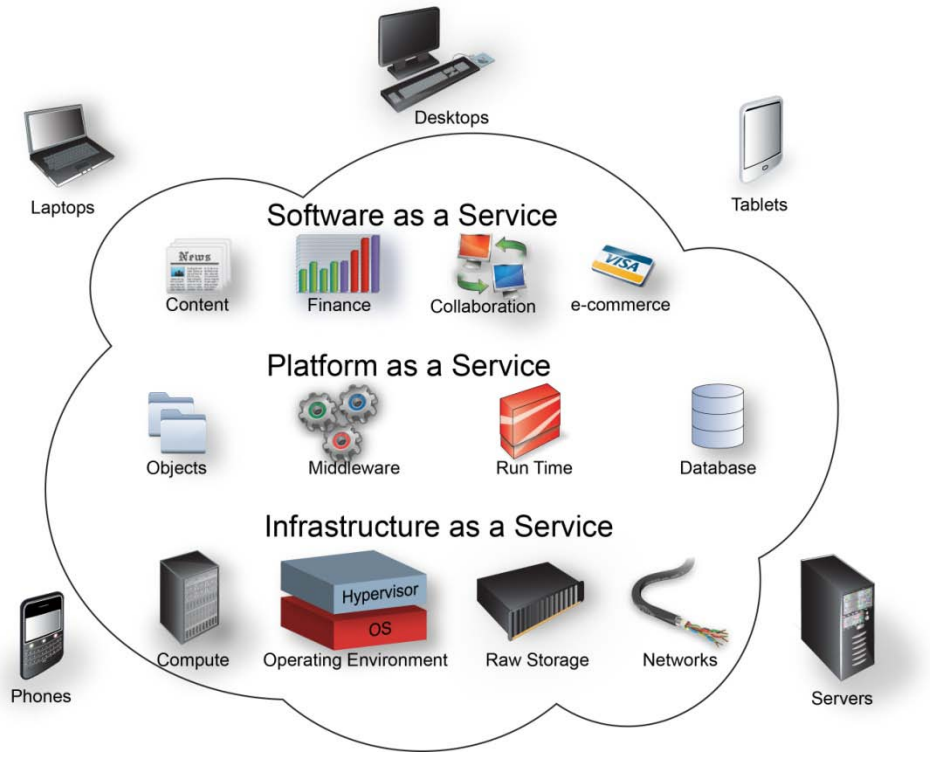

Figure 1. The three deployment methods for cloud computing environments are IaaS, PaaS, and SaaS

The IaaS model is growing in popularity in today's enterprises. Rather than purchasing servers, software, datacenter floor space, and network equipment—as well as having to operate, manage, and maintain them—business units are acquiring only the resources they need, when they need them, from the corporate IT department. The business unit pays for these services on a utility computing basis; the amount of resources consumed (and therefore the cost) reflects the level of activity.

IaaS in the enterprise has a number of distinct benefits. First and foremost is cost savings—both for the client organization as well as the enterprise overall. With IaaS, business units no longer require capital expenditures for hardware and software nor the operational expenses incurred by hiring and maintaining a large IT staff. The unit pays just for the resources used. As a result, a reduction in computing demands translates directly into a reduction in computing expenses. Furthermore, the enterprise reduces expenses by increasing system utilization through the sharing of resources with multiple business units and through the ability to "move" resources around to meet changing demands. The enterprise also reduces its IT management costs through the use of state-of-the-art system management tools—specifically *converged hardware management* tools—that integrate management across the entire infrastructure stack.

In addition, client organizations can readily take advantage of IaaS since the resources are similar to what they have traditionally deployed in their own datacenters. This means existing skill sets around server, database, and application administration can all be retained and reused. IaaS provides a degree of portability between the IT department and the client organization's own existing infrastructure as deployment takes place on standard platforms such as Oracle Solaris and Oracle Linux. The isolation of resources at the virtual server level also means the client department has control over their operations, including the storage of data and specific encryption and security measures.

System management tools have been available for many years to help administrators automate some of the processes related to monitoring and managing the infrastructure. In fact, the issue is not a lack of tools—but too many tools that are disconnected and difficult to learn. The duplication, confusion, and errors that result from the lack of an integrated solution often contribute to unplanned downtime.

Oracle Enterprise Manager 12*c* is a leading solution for transforming traditional IT environments to enterprise clouds. With advanced virtualization management, complete application-to-disk management, intelligent configuration management, and more, Oracle Enterprise Manager Ops Center 12*c* helps IT managers reduce complexity as well as streamline and simplify infrastructure management. It provides IT leaders total cloud control, enabling 12 times higher operational agility for cloud, mission-critical applications, and traditional IT environments, helping IT managers in the following ways:

- **Accelerate Mission Critical Cloud Deployment.** Oracle Enterprise Manager Ops Center 12*c* delivers comprehensive cloud lifecycle management across Oracle hardware, Oracle Linux, and Oracle Solaris. Features include central management of all virtualization technologies, self-service management of cloud lifecycle, and dynamic resource scheduling. It is the industry's first and only solution for managing virtualized pools of x86 and SPARC servers through a uniform interface.
- **Unleash the Power of Oracle Solaris 11.** Oracle Enterprise Manager Ops Center 12*c* helps accelerate the delivery of robust, scalable, and secure platforms for mission-critical enterprise and ISV applications across multiple servers. It adds support for Solaris Image Packaging System, Automated Installer, and Alternate Boot Environments. It also enhances I/O manageability in Oracle Solaris environments with improved manageability of iSCSI, fiber channel interfaces, and network and storage technologies.
- **Simplify Oracle Engineered Systems Management.** Oracle Enterprise Manager Ops Center 12*c* includes management support for Oracle SPARC SuperCluster and enhances the management of Oracle Exadata Database Machine and Oracle Exalogic Elastic Cloud—enabling administrators to go from bare-metal to the cloud in minutes, while maintaining control and maximizing the productivity of these highly performant systems.
- **Proactive Cloud Support.** Enhancements in My Oracle Support allow cloud administrators to benefit from Automatic Service Requests (ASR), proactive patch recommendations, and health checks, integrated with Oracle Enterprise Manager's comprehensive automated patch planner and end-of-life advisor for all of the application technology deployed within Oracle clouds.

Furthermore, Oracle demonstrates its commitment to delivering top value with the Oracle Ops Center Everywhere Program. Oracle server, storage, networking hardware, Oracle Linux, Oracle Solaris, and Oracle VM users can now receive access to Oracle Enterprise Manager Ops Center though their Oracle Premium Support agreements, at no additional cost.

Converged Hardware Management

By transforming IT infrastructure into a business-centric provider of services that business units can access from anywhere, Oracle Enterprise Manager Ops Center 12*c* helps users build a more agile, efficient, and innovative enterprise. It introduces unique capabilities to help users create, manage, and support enterprise clouds delivered in an IaaS model. Oracle users with SPARC or x86 systems, Oracle Solaris or Oracle Linux operating systems, Oracle ZFS Storage Appliances, Oracle switches, and Oracle virtualization technologies can accelerate cloud adoption faster and at lower cost than any alternative in the market (Figure 2).

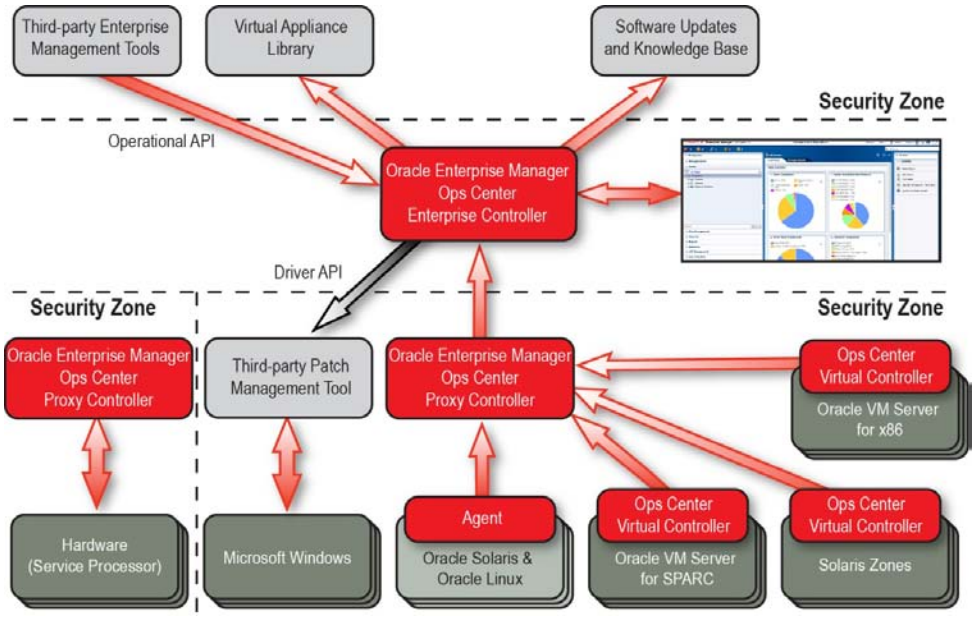

Figure 2. Oracle Enterprise Manager Ops Center 12*c* offers a comprehensive solution for IaaS platform management

Some of the key capabilities and benefits offered by Oracle Enterprise Manager Ops Center 12*c* are listed here and illustrated in Figure 3:

- Manage all Oracle systems technologies from a single panel, with no extra license charges.
- Deploy and manage IaaS powered by Oracle systems faster than alternative solutions.
- Receive proactive support information and recommendations, manage service requests and apply patches, which are capabilities not offered by other management solutions.
- Eliminate third party tools and save complexity and cost. Oracle Enterprise Manager Ops Center 12*c* can do the job of multiple tools to manage Oracle systems including discovery, inventory, monitoring, patching, configuration management, server provisioning, host management, storage management, virtualization management, network management, and cloud infrastructure management.
- Provide total cloud control across applications, middleware, databases, and hardware through built-in integration with Oracle Enterprise Manager 12*c*.

Figure 3. The major benefits of Oracle Enterprise Manager Ops Center 12*c*

Automate Workflow

A major challenge in most datacenters is managing the ongoing tasks of configuring, updating, and maintaining the infrastructure. Not only are these activities time consuming and resource intensive, they are also prone to errors, delaying resource deployment, or worse, incapacitating active systems. Oracle Enterprise Manager Ops Center 12*c* does the heavy lifting so IT staff can focus on other tasks.

- **Automation.** To assist with setting up a cloud environment, Oracle Enterprise Manager Ops Center 12*c* offers automatic policy-based setup and allocation of shared and pooled system resources. Now cloud administrators can define rules, privileges, and policies to govern how full-stack resources are consumed, how workloads are balanced, and how resources are reclaimed and redeployed. The software automates new system deployment in a single step, from hardware configuration and firmware updates, to operating system and virtual machine (VM) provisioning, reducing the number of administrative tasks and enabling the infrastructure to scale without growing in complexity.

- **Discovery capabilities.** Oracle Enterprise Manager Ops Center 12*c* features enhanced discovery capabilities to identify all the elements of an IT environment, as well as capacity-planning tools to advise IT staff on how to integrate the environment into a shared infrastructure. The software also helps administrators determine what types of services they want to offer—Infrastructure-as-a-Service, with basic computing, memory, and storage capabilities, or higher-level offerings such as Platform-as-a-Service.
- **Templates.** Template-based provisioning, used in conjunction with Ops Center server deployment plans, speeds development and maintenance of cloud service provisioning. Oracle publishes full-stack templates for all Oracle products. Partners can build additional templates as needed to streamline management and control of third-party hardware and software resources.
- **Physical and virtual management.** Oracle Enterprise Manager Ops Center 12*c* manages virtualized and bare metal environments equally. IT can use the same management infrastructure across both environments, and clients can leverage virtualization capabilities to meet business requirements.
- **Automated updates.** The software automatically downloads—with embedded installation instructions—and installs BIOS, service processor, RAID controller, and disk drive firmware. Oracle Enterprise Manager Ops Center 12*c* automates the process of acquiring required installation software, gathering intelligence on how to perform installations, and creating the environment necessary for successful installation. For example, when installing disk drive firmware, Oracle Enterprise Manager Ops Center 12*c* boots the server from a network distributed mini-root, automatically updates and installs the drive firmware, and reboots the server.

Manage Infrastructure from Application-to-disk

Traditional management tools are geared to manage just one or two facets of the datacenter environment, such as server instances or storage systems. Oracle Enterprise Manager 12*c* helps IT staff understand and manage every architectural layer—from bare metal to operating systems and applications. It provides a centralized interface for physical and virtual machine lifecycle management, from power-on to decommissioning. In addition, it offers IT admins a unique insight into the user experience, business transactions, and business services, helping admins quickly detect changes in system health and troubleshoot issues across the entire environment.

Oracle Enterprise Manager Ops Center 12*c* enables IT administrators to manage cloud resources as business services rather than just a collection of technical components. It offers the capability to manage IT from a business perspective due to the deep application awareness gained from the integration with a centralized role-based console called Oracle Enterprise Manager Cloud Control. Cloud Control is designed to support a lifecycle view of private and hybrid cloud management that spans infrastructure, database, middleware, and applications environments. Using Cloud Control, cloud administrators can access a wide range of integrated management capabilities including discovery, consolidation, capacity planning, self service, testing, monitoring, metering, and chargeback.

APIs allow users to develop customized self-service portals. These portals can connect to the broader Oracle Enterprise Manager 12*c* framework capable of spanning physical and virtual infrastructures, public cloud services, as well as database, middleware, and application environments.

Increase System Utilization

Many datacenter systems are configured to handle peak demand, leaving them underutilized the rest of the time. Virtualization enables greater resource optimization, more flexibility, better scaling, and increased security and isolation. Oracle Enterprise Manager Ops Center 12*c* enables the effective use of virtualization with comprehensive management across three key Oracle virtualization technologies: Dynamic Domains in Oracle's SPARC Enterprise M-Series servers, Oracle Solaris Zones, and Oracle VM Server. These three technologies provide different methods for virtualizing system environments—but with Oracle Enterprise Manager Ops Center 12*c*, they can all be managed with a single tool.

Oracle Enterprise Manager Ops Center 12*c* provides complete lifecycle management across all of these virtualization technologies. Administrators can create, configure, and delete domains, zones, and virtual machines as needed, as well as monitor and manage virtual machine resources—all in same pane of glass (Figure 4). Management capabilities for domains, zones, and virtual machines include dynamically reconfiguring CPU, storage, and I/O resources for each virtual machine, or moving virtual machines from one system to another.

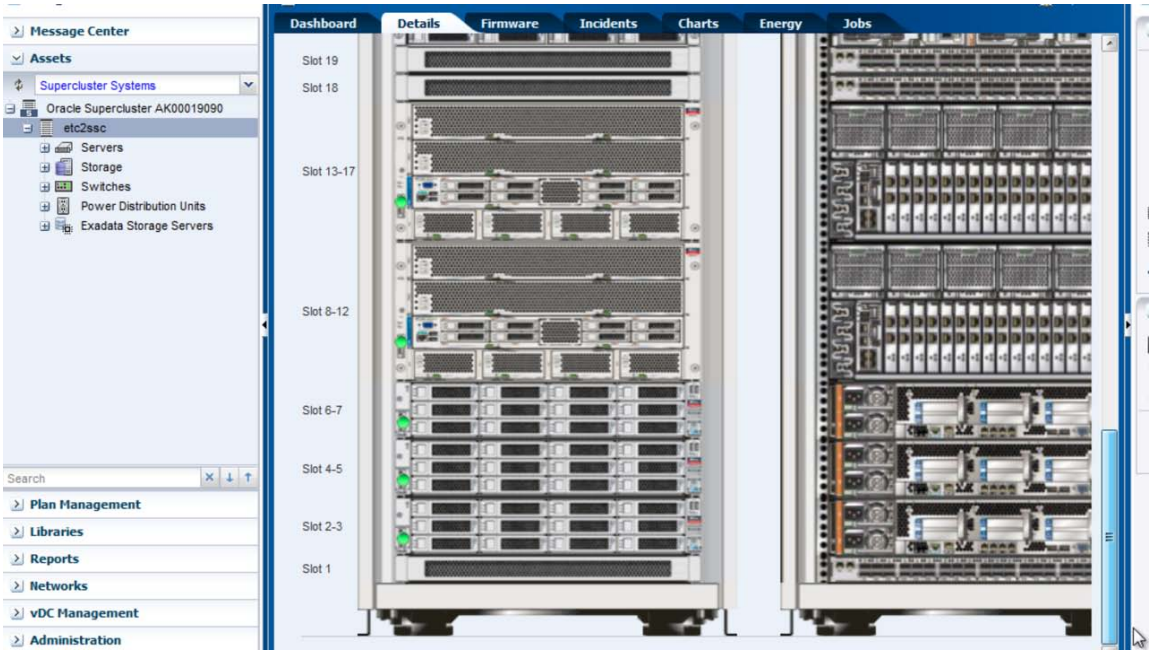

Figure 4. Oracle Enterprise Manager Ops Center 12*c* User Interface

In addition, Oracle Enterprise Manager Ops Center 12*c* automatically pools and dynamically allocates resources to workloads as needed using policy-based elasticity depending on a range of business and other factors including schedule, utilization level, load, number of VMs, energy usage, and more. With Oracle Enterprise Manager Ops Center 12*c*, IT staff can ensure they are maximizing resource utilization with simple and efficient virtualization management.

Oracle Enterprise Manager Ops Center 12*c* allows datacenter staff to observe and take action against energy misuse, and supports viewing energy consumption in terms of real dollars. It correlates energy usage to CPU, temperature, and fan information, and data can be aggregated by rack, business owner, or any other logical group. For Oracle's SPARC processor-based servers, Oracle Enterprise Manager Ops Center 12*c* can change the energy policy on the service process or between performance mode and elastic mode, enabling the datacenter to optimize its investment without spending excessively on electricity.

Enhanced Operating System Performance Awareness

IT administrators must have visibility into all areas of a system to optimize performance and ensure service-level agreements (SLAs) are met. In Oracle Enterprise Manager Ops Center 12*c*, application-to-disk fault management and comprehensive monitoring combine in a single console, making it possible to understand how hardware, virtualization, and operating system performance affect production services. With these tools, application administrators gain insight into the hardware infrastructure, and system administrators gain visibility into the applications that run on systems. As a result, IT staff can speed incident resolution and coordinate more effectively to improve application performance. Oracle Enterprise Manager Ops Center 12*c* tracks, reports, and manages resource utilization and performance, including the scaling up and down of resources based on predefined policies for such metrics as end user and application health, performance, availability monitoring, and related business impact SLAs.

One problem with datacenter monitoring solutions is that they can generate an inordinate amount of meaningless events and false alarms that can obscure real issues. To address such problems, datacenter managers must invest in tools to automatically preprocess this data before administrators can evaluate it. Oracle Enterprise Manager Ops Center 12*c* monitors a massive number of operating system attributes, eliminating the need for additional tools by selecting the performance attributes that are most likely to indicate a real problem on the system. Both system-level and process-level activities are monitored, linked to business services, and displayed in easy-to-understand graphs and tables. With this information, datacenter staff can set site-specific, smart thresholds on logical groups of systems or individual systems.

Automate Service Requests

Once a problem is detected in a business-critical system, every minute until the problem is resolved is costly. Oracle Enterprise Manager Ops Center 12*c* provides deep connections to My Oracle Support systems and processes to enable automatic problem detection, analysis, automated service requests, and access to the Oracle knowledge base and community for optimal problem resolution.

Oracle Engineered Systems for IaaS

Oracle's engineered systems are pre-integrated, purpose-built servers designed to reduce the cost and complexity of IT infrastructures while increasing productivity and performance. The systems are designed to enable faster time to production by implementing pre-engineered and pre-assembled hardware and software bundles. The single-vendor stack simplifies and reduces the costs associated with purchasing, deploying, and supporting IT environments. Only Oracle has the breadth of resources to innovate and optimize at every layer of the stack, simplifying system operations, reducing costs, and accelerating business innovation.

Oracle Enterprise Manager Ops Center 12*c* offers enhanced application-to-disk management capabilities for Oracle Exadata, Oracle Exalogic, and Oracle SPARC SuperCluster systems. Among these capabilities are application discovery and modeling, monitoring and analysis of configuration compliance, and managed resource utilization, helping to provide reduced costs and improved performance. Application Replay, a component that enables extensive testing of the entire stack, helps to ensure that application performance and availability are not negatively impacted by infrastructure changes and enables real workload testing to improve quality.

Oracle Enterprise Manager Ops Center 12*c* also enhances the value of Oracle's engineered systems by providing a comprehensive solution for managing Oracle hardware infrastructure. It aids in unifying the management of servers, storage, and network fabric, including simplified management of virtual infrastructure for easy application consolidation. It enables instant network and storage provisioning and automated updates of all firmware and software components. In addition, a direct connection to the Oracle knowledge-base speeds problem resolution.

The Power of Converged Hardware Management

Enterprises are struggling to develop comprehensive cloud management strategies that push the limits of today's capabilities. Oracle has raised the bar by including mission-critical database, middleware, and application self-service provisioning and dynamic scaling in corporate cloud management environments. Oracle offers a comprehensive cloud lifecycle approach—especially for those organizations that deploy Oracle engineered systems or a complete Oracle technology stack—and Oracle offers the resources needed to plan, implement, operate, and manage clouds to derive business value from increasingly complex application deployments.

By allowing IT managers to quickly plan, set up, deploy, manage, and support complex application environments, Oracle Enterprise Manager Ops Center 12*c* delivers a unique foundation for a truly self-service IT organization. This enables business users to satisfy whatever IT needs they have immediately, on demand, improving the overall quality of the user experience. By ensuring the entire cloud lifecycle is controlled efficiently and cost-effectively, Oracle Enterprise Manager Ops Center 12*c* helps maximize return on investment.

For More Information

Information on the products and technologies discussed in this paper can be found at the following locations.

TABLE 1. SOURCES FOR ADDITIONAL INFORMATION

TOPIC	URL
Oracle Enterprise Manager 12*c* home page with links to multiple resources	oracle.com/enterprisemanager
Oracle Technology Network page on hardware and virtualization management	oracle.com/technetwork/oem/host-server-mgmt/index.html

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