MANAGING PRIVATE CLOUDS

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INTRODUCTION

Cloud computing service models present significant challenges to enterprise IT processes and staff already faced with the increased complexity and management issues of virtualization. The right balance between the cloud user’s control and autonomy is critical to the manageability, scalability, and, ultimately, the success of private cloud environments. Achieving and maintaining that balance— as customer momentum grows and as infrastructures and virtualization technologies rapidly evolve—requires a flexible set of management and automation tools that enable the widest range of self-management activities. These tools must simultaneously provide the policy-based visibility, control, automation, and integration necessary for IT process effectiveness and customer support.

Red Hat® CloudForms has the unique ability to integrate and interoperate with other management agents and processes, enabling highly automated IT service management for private clouds and virtual infrastructures. Service request, incident, release, change, and configuration management activities can be tightly integrated to provide end-to-end automated service management, including:

- Request fulfillment and provisioning
- Continuous service and resource tracking
- Life cycle and change management
- Streamlined incident management
- Real-time synchronization of virtual infrastructure and cloud configurations with configuration management databases (CMDBs)

CloudForms can interoperate simultaneously with multiple integration partners for different activities (e.g., provisioning vs. incident vs. CMDBs) and/or a single integration partner in environments where enterprises have deployed a multiple-function service management solution.
SELF-SERVICE PROVISIONING AND MANAGEMENT

With CloudForms, enterprise IT organizations can use their virtualized infrastructures to offer shared services where end users request, provision, deploy, operate, manage, and decommission their own resources. Using a web-based self-management portal with configurable approval processes, users can securely provision and deploy virtual servers with enterprise configuration standards enforced. Post-provisioning users can operate and manage their resources based on fine-grained access and control policies, including visibility of performance metrics, consumption, chargeback, and compliance along with life cycle management (e.g., reconfiguration, lease extension, retirement, and reporting).

At the infrastructure level, CloudForms provides automatic best-fit resource selection to determine where new self-service virtual machines (VMs) are placed. It also tracks and enforces resource utilization and allocation policies through retirement. CloudForms provisioning tightly integrates with other systems management processes and tools, including configuration management databases, asset management, IP address management (IPAM), and service catalogs.

**CloudForms Provides:**

- A customizable web-based portal for self-service provisioning and management
- Configurable provisioning workflows and approval processes
- Best-fit VM placement based on business rules, quotas, and resource availability
- Automatic VM life cycle tracking and retirement
- Self-service VM operations and reconfiguration
- Resource consumption reports and dashboards
- Integration with internal management services (e.g., CMDB, ITAM, IPAM, and service catalogs)

*Figure 1: CloudForms self-service*
GOVERNING, TRACKING, AND COMPLIANCE

CloudForms enables enterprises to deploy and manage private clouds with the policy-based control, tracking, and management necessary to mitigate the risks associated with shared infrastructures. In addition, CloudForms enables enterprises to achieve the agility and cost savings that elastic, service-based IT cloud computing offers. Key elements of private clouds include: providing service owners with self-service, automated provisioning, and autonomous management of their applications while ensuring that security, availability, and performance meet service-level agreements and enterprise standards.

CloudForms allows IT organizations to safely and securely delegate self-service provisioning, administration, and operations to users while ensuring their preview is limited by role and service ownership. In addition to support for secure delegation, the product ensures that IT organizations responsible for the private cloud infrastructure can enforce compliance with enterprise configuration and security standards. In spite of rapid workload provisioning, movement, and decommissioning, network zone policies and compliance must be tightly controlled and enforced.

CloudForms can also ensure that requests go through appropriate approval processes, are tracked and audited, and that resource allocation, availability and usage are managed in accordance with service level agreements. Cost transparency, chargeback, and quota enforcement enable effective resource management, accurate planning, and forecasting with cost allocation back to the responsible lines of business.

Figure 2: CloudForms provisioning

CloudForms offers:

- Self-service administration and operations, with complete life cycle management, including automated provisioning, console access, tracking, and retirement.
- Automated fulfillment of provisioning requests, with policy-based controls and comprehensive integration with enterprise management systems.
- Web-based request, tracking, and approval as well as support for integration with other systems such as service catalogues and external workflow systems.
- Fine-grained role-based access and delegation based on enterprise directory group memberships, as well as highly-configurable and extensible classifications including ownership, department, workload, geography, and time zone.
- Agentless, policy-based configuration and security standards monitoring, enforcement, and compliance for workloads and private cloud infrastructure elements.
- Workload placement, resource allocation, retirement policy, and quota enforcement based on class of service, workload type, and life cycle stage.
COST ALLOCATION, CHARGEBACK, AND USAGE

With CloudForms, enterprises can create cost transparency and accountability so that business owners and IT administrators can understand the actual cost of the virtual infrastructure required to support business services. In physical datacenters, chargeback was relatively straightforward to implement by associating the cost of the physical hardware with an application or business unit. In the virtual datacenter, chargeback is more complex since it requires detailed information on the utilization of resources in a shared infrastructure.

CloudForms has been designed specifically for the virtual datacenter. It constantly monitors the actual consumption of server, storage, and network resources and organizes the data by enterprise-specific classifications.

Outside of formal chargeback programs, IT organizations implementing virtualization often find themselves fighting the perception that “VMs are free.” Management has no way of tracking the costs of specific applications. And as the virtual infrastructure grows, it is difficult to assess the reasons for growth. Even organizations that don’t want to implement a formal chargeback program are challenged to understand who is using what part of the virtual infrastructure and which users are driving the growth of the infrastructure.

In a virtualized infrastructure, fine-grained resource utilization and tracking is important to demonstrate the value of the resources being provided to users. Whether formal chargeback or simple showback is being used, it is beneficial to understand who is using the shared resources and the associated costs.
VM LIFE CYCLE MANAGEMENT

Virtualization enables rapid provisioning of new systems through the use of templates, cloning, and automated provisioning as well as rapid virtualization of existing systems through physical-to-virtual (P2V) utilities. This rapid proliferation introduces many new management challenges for IT organizations and, if left unchecked, can impact cost, availability, and security. There is a common misconception that VM resources are free. Uncontrolled VM proliferation can cause VM sprawl and dramatically impact resource consumption and costs, which wastes storage, consumes server capacity and network bandwidth, and incurs additional software license expenses. There are also additional risks and challenges associated with managing, securing, and patching VMs, dealing with offline VMs, and ensuring compliance across the virtual infrastructure.

CloudForms provides the ability to manage VMs across their life cycle from provisioning or conversion (P2V/V2V) through operations and eventually to VM retirement. Managing and tracking VMs from discovery and creation through retirement is essential to avoiding VM sprawl and keeping the virtual environment well-managed and optimized. CloudForms automatically discovers, assesses, classifies, monitors, and tracks VMs in any state—powered on, off, or suspended—without installing any agents. The product maintains comprehensive visibility of VM configuration, virtual hardware, performance, event, utilization, allocation, and event information together with relationship and dependency mapping.

Figure 4: CloudForms Lifecycle management
CONTINUED:

- Resource monitoring and optimization, with performance monitoring, identification of over-allocated resources and current and future bottlenecks, automatic VM aging and retirement, snapshot management, and resource policy enforcement with best-fit placement for new VMs

- Usage, chargeback and cost allocation, including detailed usage tracking by configurable classifications with support for multiple rates tables, fixed cost, allocation, and usage-based chargeback and cost allocation

- Advanced capacity planning and placement, including resource availability, policies, business classifications across time periods, optimal planning, and VM placement

**RESOURCE MANAGEMENT, OPTIMIZATION, AND CAPACITY PLANNING**

Virtualized IT infrastructures present major challenges to capacity planning, resource utilization, and optimization. These shared infrastructures introduce significant complexity to resource management and capacity planning.

Measuring utilization in a virtual infrastructure is impossible with traditional management tools and requires new technologies and approaches. Significant management complexity is introduced by the layer of abstraction that accompanies clusters and resource pools, and that hosts cloud visibility. Complexity is also introduced by the fluidity created by new capabilities such as resource reservations, DRS, and high availability.

While resource utilization data in a virtual infrastructure can be obtained using new, virtual-aware techniques, this data alone is insufficient to manage, optimize, and plan the virtual infrastructure. This quantitative capacity and utilization data by itself lacks the qualitative information necessary to answer complex questions like:

- What is driving server utilization higher? What changes were responsible for the increase in demand or decrease in capacity? Were VMs added? Did hardware change?

- Why is SAN utilization dramatically increasing? Which users or groups are responsible for the increase? What is on the SAN and who owns it?

- How many more VMs can the infrastructure support? How many VMs are being retired? How many are underutilizing their resource reservations? How many VMs are overallocated on vCPUs, memory, or storage?

- Why are some VMs performing well and others poorly when they were all derived from the same source? What’s different? When did something change?

![Figure 5: CloudForms planning](image-url)
CloudForms provides IT administrators and managers with advanced capacity planning and sophisticated resource management capabilities, including trending and alerting. By combining extensive configuration and change information – and operational event data with utilization and performance statistics – the product uniquely addresses both the quantitative and qualitative management requirements needed by enterprises to get the most out of their infrastructure investment with the lowest management costs.

**REPORTING, ANALYTICS, AND VISUALIZATION**

CloudForms provides a rich set of reports that include timelines and charts ready to be viewed as soon as your virtual infrastructure and VMs have been discovered. The product’s out-of-the-box reports include detailed information on your virtual infrastructure. Configuration management reports allow you to see hardware, application, network, service, user account, operating system, and snapshot information across your VMs, hosts, vCenters, clusters, resource pools, and storage locations.

In addition, migration readiness reports allow you to see information specifically related to items required to migrate VMs from one host to another. Operations reports look at free space on registered and unregistered VMs to see power states for VMs, and to see which offline VMs have snapshots or have never been analyzed.

Customizable, role-based views ensure that users only see the information that is appropriate for their roles and access privileges in reporting and visualization. Fine-grained, automatic, policy-based classification makes certain that as the environment changes in real-time, the access rights and views are always correct.

*Figure 6: CloudForms analytics*
REPORTING CATEGORIES AND USES

All reports can be scheduled to occur once or on a periodic basis so that you can see data for a certain point of time. Once a report is created, it can be exported to standard formats such as PDF, CSV, or TXT for further analysis. CloudForms also allows you to view and subscribe to RSS feeds about your virtual infrastructure such as life cycle events, discovered VMs, VM formats, and VM power events. Available report categories include:

- **Configuration management reports** allow you to view hardware, application, network, service, user account, operating system, and snapshot information for VMs, hosts, management systems, clusters, resource pools, and storage locations.
- **Migration readiness reports** allow you to see information specifically related to requirements for VM migration.
- **Operations reports** provide the ability to look at free space on registered and unregistered VMs and their power states. See which offline VMs have snapshots or have never been analyzed.
- **Use VM sprawl reports** identify VM atrophy, power status, and disk usage and waste.
- **Relationship reports** show VM, folder, and cluster relationships.
- **Event reports** allow you to see operations and configuration management events.

Using CloudForms, you can view and customize reports to be used and viewed in multiple formats. In addition to the provided reports, you can also create your own reports customized precisely to your environment by editing one of the current reports or using the report builder functionality to create one with your own set of specifications, using information stored in the virtual management database. The reports are role-based to guarantee that only information that is appropriate for a user’s role and access privileges is shown to the user.

Finally, the information collected in reports can be used with CloudForms policies to control and automate operations in your virtual infrastructure.
ANALYTICS
CloudForms provides organizations with rich insight into their virtual infrastructure configurations, capacity, and usage. Automated summarization of key capacity data along with utilization trend analysis allows users to quickly identify current and future bottlenecks in the environment. Using CloudForms categorization capabilities enables users to get a precise understanding of the allocation and usage of the virtual environment. Correlating usage information and configuration events provides a unique and extremely efficient approach to understanding how configuration changes are impacting the global virtual infrastructure.

VISUALIZATION
CloudForms provides powerful visualization capabilities and a rich, graphical experience. CloudForms supports mashups of information such as VM discovery, security, policy, and usage information combined with external sources of information such as RSS feeds. This provides role-based views with a high degree of customization.

CloudForms’ virtual timeline supports a user-friendly, time-based presentation of infrastructure events, including configuration events and discovery, operations events such as start and stop, and policy events. This view of events enables administrators, operators, and users to see events in a temporal context showing what was happening to a particular VM or a cluster during a specific interval.

Virtual thumbnails create an intuitive visual representation of information associated with the virtual infrastructure and virtual machines, including status, life cycle stage, and level of policy compliance.
CONCLUSION

Cloud computing service models present significant challenges to enterprise IT processes and staff already faced with the increased complexity and management issues of virtualization. The right balance between the cloud user’s control and autonomy is critical to the success of private cloud environments. Achieving and maintaining that balance requires a flexible set of management and automation tools that enable the widest range of self-management activities. Red Hat CloudForms has the unique ability to integrate and interoperate with other management agents and processes, enabling highly automated IT service management for private clouds and virtual infrastructures.
ABOUT RED HAT

Red Hat is the world’s leading provider of open source solutions, using a community-powered approach to provide reliable and high-performing cloud, virtualization, storage, Linux, and middleware technologies. Red Hat also offers award-winning support, training, and consulting services. Red Hat is an S&P company with more than 70 offices spanning the globe, empowering its customers’ businesses.

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