

Business white paper

Move beyond IAAS with HP CloudSystem Enterprise



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Introduction

IT organizations around the globe are in search of technological solutions to address increasingly complex business challenges. Many of these challenges have emanated from the demands for instant gratification from highly mobile, interactive, and always-connected consumers and citizens. Organizations are transforming their traditional IT models into an optimal blend of private and public cloud services along with traditional IT to achieve greater organizational agility, flexibility, and cost efficiency.

HP CloudSystem Enterprise is HP's answer for organizations in search of a complete, open, and integrated solution to support this hybrid IT delivery strategy. Based on proven, market-leading HP Converged Infrastructure and HP Cloud Service Automation, HP CloudSystem Enterprise integrates servers, storage, networking, security, and management to automate the infrastructure-to-application lifecycle across all (IaaS, PaaS, and SaaS) service models for hybrid service delivery.

The intent of this white paper is to discuss the architecture of HP CloudSystem Enterprise and how its key components work together.

Key advantages of HP CloudSystem Enterprise

HP CloudSystem Enterprise has a number of advantages resulting from its architecture and design. Here are a few of the key advantages customers tell us are the most important to them:

- Deployment of complex, multi-tier applications and infrastructure
- Business-oriented self-service portal with a service catalog
- End-to-end lifecycle management for services
- Unified management for both cloud and traditional IT
- HP Cloud Maps, handy accelerators to incorporate popular applications and services
- Flexible, scalable, open architecture

Take a closer look at why these features are so valuable in a cloud computing environment.

Faster time to value, more consistent performance with advanced application and infrastructure deployment

A significant advantage of HP CloudSystem Enterprise over other cloud solutions is complex, multi-tier application deployment. Most commercial cloud offerings begin and end with infrastructure provisioning—creating pools of virtual resources such as virtual machines (VMs), virtual storage, and perhaps some virtual networking, but leaving you on your own to turn those resources into full-fledged services.

HP CloudSystem

Choosing the right cloud solution for your organization's needs

There is no one-size-fits-all cloud solution. We offer a complete portfolio of HP CloudSystem solutions to address complex needs, with an upgrade path for growth and expansion:

- HP CloudSystem Matrix is an on-premises cloud solution that provides infrastructure as a service (IaaS) for IT organizations.
- HP CloudSystem Enterprise is for organizations looking to deploy a full range of service models (IaaS, PaaS, and SaaS), including advanced application-to-infrastructure lifecycle management.
- HP CloudSystem Service Provider addresses the requirements of service providers to provide a public cloud IaaS and SaaS, including aggregation and management of those services.

HP CloudSystem Enterprise, on the other hand, makes the most of the cloud by adding the ability to completely provision and deploy applications such as SAP or Oracle. Provisioning includes everything associated with an application: not only servers and storage but also middleware, while configuring infrastructure such as load firewalls, and more. Moreover, the system not only provisions and initially deploys applications, but it can also manage those applications throughout their life, as well as upgrade and patch them when required. Advanced application deployment takes advantage of an internal library of some 4,000 proven workflows, helping to reduce the time to define a service and ensure the final application's consistency and reliability in operation.

Greater efficiency and user satisfaction with a self-service portal

CloudSystem Enterprise equips knowledge workers and business users with a self-service portal that lets them view service descriptions and select services from a catalog, much like checking out a video from a kiosk. Whether it's a single virtual machine, a banking application, or even a full application stack, the user can select the service and launch it immediately without needing to work with the IT department or know if the underlying resources are from traditional IT, a private cloud, or even a public service provider such as Amazon or Microsoft®.

For end users, this self-service portal means greater agility for responding to business challenges and greater on-the-job satisfaction, as their applications can be deployed in minutes rather than six to nine months. For the IT department, it means less staff involvement in setting up applications, less IT administration time, and more satisfied end users who will be less likely to resort to "shadow IT" in the form of services outside the organization.

Reduced provisioning time with end-to-end advanced lifecycle management

HP CloudSystem Enterprise performs advanced lifecycle management, from provisioning a cloud service to its retirement. It's all automatic: when a user orders from the service catalog, the system provisions the necessary resources—such as virtual and physical servers, storage, networking, and security—and brings them up to date with the latest patches. The software launches the service and monitors it while in use. And when the service is no longer needed, it shuts down, decommissions the resources, and returns them to the resource pool. Even if your HP CloudSystem Enterprise solution incorporates non-HP hardware and software, you get the same management of the service throughout its life.

Unified control and reduced complexity with a single management environment

While many cloud offerings manage only the public and private cloud, CloudSystem Enterprise allows you to use a single view of all services available—whether they are from on-premises clouds, public clouds, or traditional IT. You can manage multiple vendor platforms, hypervisors, operating systems, databases, middleware, and applications. Employing a single management platform unifies and simplifies the control of cloud and traditional IT resources, reducing the need for IT staff involvement.

As further evidence of the control and management of the cloud, CloudSystem Enterprise can provide a link to other business processes by exchanging data with HP business software such as HP IT Service Manager or Business Service Manager. Linking to other software and systems enhances the value of the hybrid cloud solution and increases return on investment.

Contrast HP CloudSystem Enterprise's end-to-end lifecycle management with the usual time-consuming process for standing up and managing services. IDC data shows CloudSystem can reduce provisioning time alone by 80 percent¹ or more, saving weeks to months over the approaches used in most environments. Services provisioning can now be reduced from months to minutes.

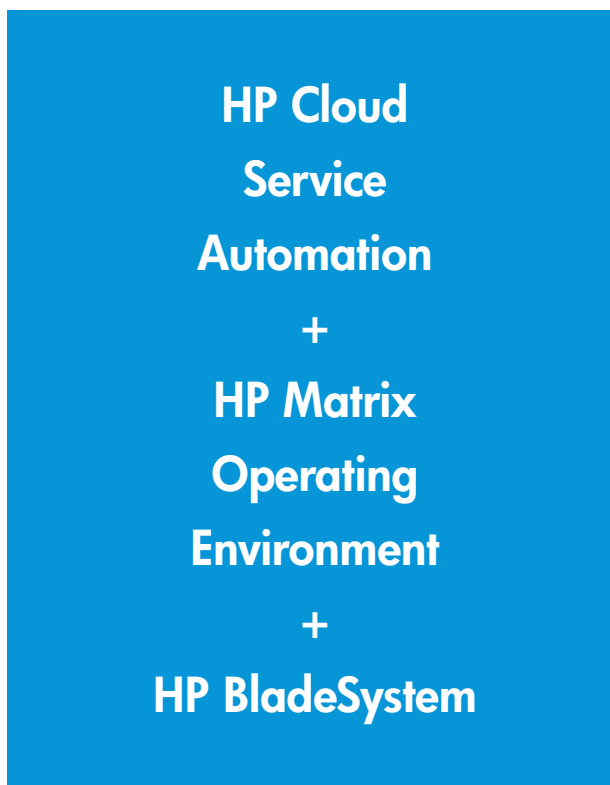
¹ IDC white paper, sponsored by HP: "The Business Value of HP Business Service Automation (BSA) Solutions," June 2010

Faster implementation of popular applications with HP Cloud Maps

Cloud Maps provide service designers with tools and best practices that enable them to quickly and easily create service catalogs for a variety of popular application environments from major vendors, including Oracle, SAP, and Microsoft. Cloud Maps make it easier to configure and deploy an application-specific cloud environment and can take weeks off the time needed to develop a catalog of CloudSystem services. Cloud Maps are a clear example of the benefit gained by choosing a fully integrated HP CloudSystem offering instead of building your own. You can realize reduced staff time, faster deployment, and virtually “out-of-the-box” integration with major enterprise applications.

Figure 1

HP CloudSystem Enterprise is comprised of HP BladeSystem hardware, the Matrix Operating Environment, and HP Cloud Service Automation software.



Investment protection from an open, scalable architecture

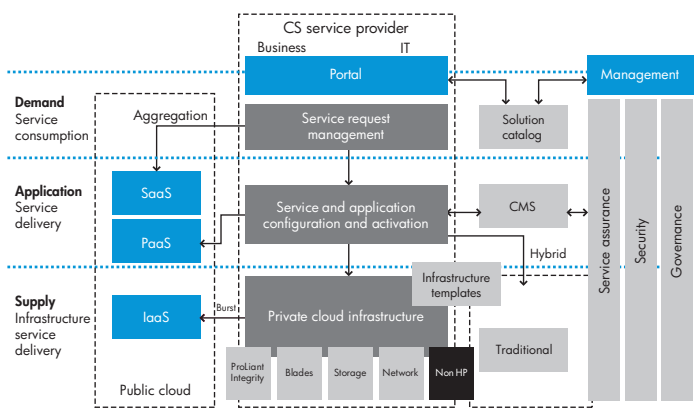
The open, scalable architecture of HP CloudSystem Enterprise supports heterogeneous environments and offers advanced workload optimization and metering for those environments. You can employ multiple virtualization products, multiple servers, different varieties of storage, and a number of operating systems. CloudSystem Enterprise supports leading hypervisors, including VMware vSphere and Microsoft Hyper-V™, and can burst to public clouds from service providers.

With CloudSystem Enterprise you can start small and grow tall, integrating with existing HP or multivendor infrastructure and adding new hardware and software as needed. The ability to incorporate heterogeneous environments and many hypervisors provides investment protection for your existing physical and virtual assets.

What is “converged infrastructure”

HP Converged Infrastructure is an integration of servers, storage, networking, security, power, cooling, and facilities into shared pools of interoperable resources—all managed through a common management platform. This infrastructure model accelerates the provisioning of IT services and applications and provides a blueprint for the data center of the future. The result is the ability to deliver any workload, anywhere, anytime to achieve better business results.

Figure 2
 HP CloudSystem Enterprise employs a three-layer architecture consisting of supply, application, and demand layers.



HP CloudSystem Enterprise architecture

HP CloudSystem Enterprise takes advantage of a powerful set of hardware and software technologies to deliver a full range of models for infrastructure, platform, and software as a service (IaaS, PaaS, and SaaS). It is based on a converged infrastructure to allow this system to combine and unify control across private, public, and hybrid clouds, and to add advanced infrastructure-to-application lifecycle management.

HP CloudSystem Enterprise begins with a converged infrastructure based on a shared services model, including pools of compute, storage, and network resources that form the ideal foundation for this cloud solution within both HP and non-HP environments. The solution employs the Matrix Operating Environment to manage and control these resources.

HP CloudSystem Enterprise also includes HP Cloud Service Automation software, which provides a complete cloud management solution for all services, both cloud-based and traditional IT. This software also automatically provisions applications and integrates lifecycle monitoring and management for those applications. HP Cloud Service Automation provides the ability to manage cloud services regardless of the infrastructure they are deployed on; and also includes service assurance and control, ensuring complete cloud lifecycle management.

HP CloudSystem Enterprise employs a three-layer architecture with supply, delivery, and demand layers, and it includes both a core offering and a number of extensions. The core of CloudSystem Enterprise is built on the modular HP BladeSystem architecture, including the highly automated Matrix Operating Environment (Matrix OE).

The delivery and demand layers are primarily made up of HP Cloud Service Automation software, while the supply layer is enhanced for HP Converged Infrastructure but can also incorporate your existing non-HP infrastructure. The supply layer provides for service delivery of infrastructure elements such as compute, network, storage, and other resources both physical and virtual. Above the supply layer is the delivery layer, where Cloud Service Automation software enables and manages the delivery of application services. Cloud Service Automation also provides the portal services for the demand layer, where end users can request services.

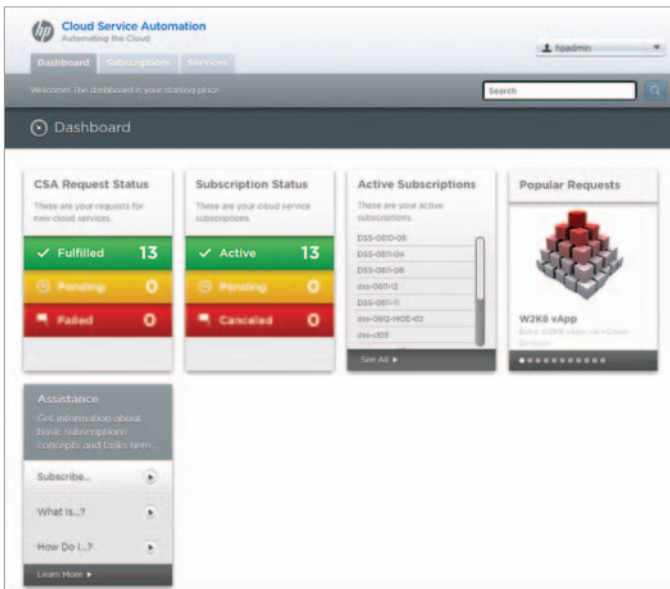
Supply layer—infrastructure

The supply (infrastructure) layer consists of the modular HP BladeSystem architecture with HP ProLiant and Integrity server blades, and includes HP Matrix Operating Environment that enables rapidly provisioning complex infrastructure services and adjusting them to meet changing business demands. The supply layer can also include non-HP hardware.

- **HP BladeSystem**
 A common modular infrastructure constructed for any workload from client to cloud
- **HP Matrix Operating Environment (Matrix OE)**
 A common platform for advanced infrastructure lifecycle management and for drag-and-drop provisioning of a complex multi-tier infrastructure in minutes
- **HP ProLiant G7 servers**
 Servers with high performance, excellent availability, fast remote management, and low requirements for power and cooling
- **HP Integrity servers**
 Scale-up blade servers with an operating system (HP-UX 11i v3) for demanding mission-critical workloads
- **HP Virtual Connect**
 A common, virtualized network fabric that connects servers to networking and storage while simplifying and increasing flexibility from the data center to the network edge
- **HP 3PAR Storage, F-Class, and T-Class**
 Thin-provisioned storage optimized for hybrid clouds and with multi-tenancy capability
- **HP EVA, XP**
 Traditional architecture storage arrays that bridge to conventional storage technology
- **HP TippingPoint, vController + vFW**
 Security solutions for physical and virtual clouds, providing security and attack protection for the entire data center, including the hypervisor
- **HP Networking (12500, 5800, 5100 switches)**
 High-performance, flexible, core-to-edge networking fabrics

Figure 3

Users have a convenient, easy-to-use dashboard, a list of current subscriptions, and a service catalog for browsing.



Delivery and demand layers—Cloud Service Automation

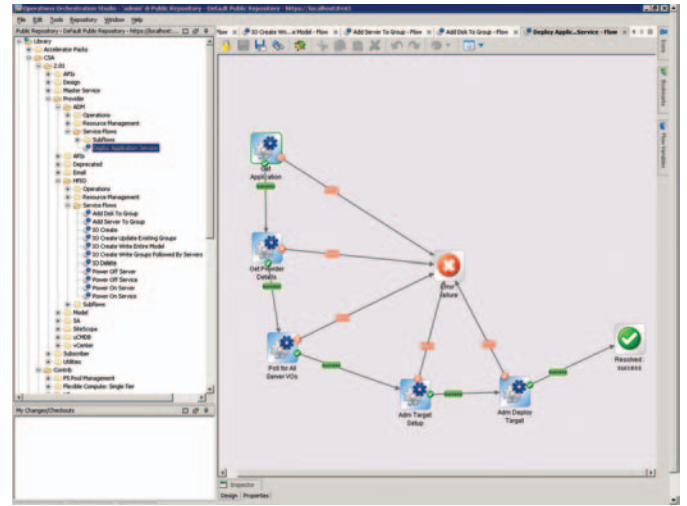
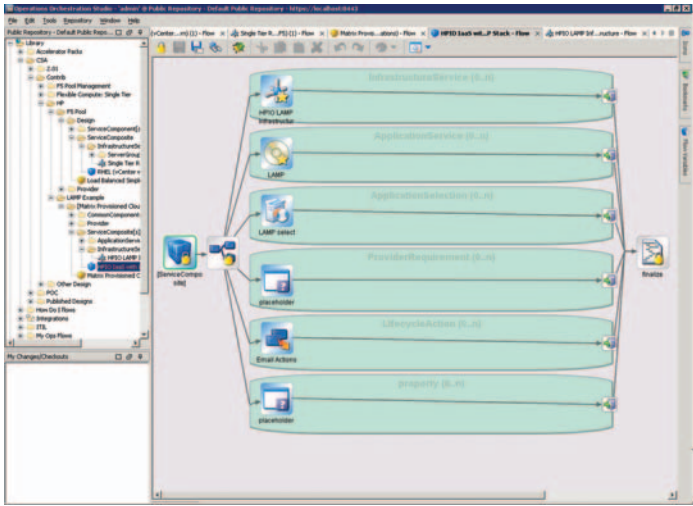
HP Cloud Service Automation is comprehensive software to automate and manage heterogeneous, hybrid cloud implementations for enterprise clients. In HP CloudSystem Enterprise, Cloud Service Automation provides advanced end-to-end lifecycle automation for the cloud, from infrastructure through to application. Key elements of the HP Cloud Service Automation architecture and the delivery and demand layers include the following:

- **Self-service business portal**
Easy-to-use self-service screen with a single view of all available services, written in business language
- **Service catalog**
A comprehensive catalog of all services
- **Cloud Controller**
Performs the core functions of HP Cloud Service Automation by providing cloud lifecycle management, allocation management, a service catalog, and cloud automation workflow
- **Server Automation (SA)**
Provides lifecycle management for enterprise servers and applications from discovery to provisioning, patching to configuration management, and script execution to compliance assurance; in HP CloudSystem Enterprise, SA automates key tasks associated with managing physical and virtual servers across disparate IT teams and systems

- **Application Deployment Management (ADM)**
Automates the deployment of applications across the lifecycle; together with Database and Middleware Automation (DMA) it automates the deployment of an entire application stack that includes database servers and application servers
- **Database and Middleware Automation (DMA)**
Provides best practices for provisioning and configuration, patching, upgrading, and management related to databases and application servers; DMA complements Cloud Maps
- **HP Operations Orchestration (OO)**
Automates processes such as incident resolution, change orchestration, and maintenance tasks; it visually composes a service definition, using a library of design elements assembled to describe infrastructure, applications, and external integrations
- **HP SiteScope**
Provides agentless monitoring of an infrastructure platform and an application's key performance indicators, such as CPU, disk, and memory usage
- **HP Universal Configuration Management Database (UCMDB)**
Employed by Cloud Service Automation as a configuration management system to store configuration information; this database provides advanced configuration management that models configuration items (CIs) for the service architecture that has been built, allowing CIs to be shared with other applications.

These components of HP Cloud Service Automation are each highly capable individually. But their real value comes when they are integrated together in HP CloudSystem Enterprise. In the next section, we'll see how some of these software components operate in conjunction with other parts of CloudSystem Enterprise, whether in an HP-only or a heterogeneous multivendor deployment.

Figure 4
Solution designers have graphical representations to construct and stand up services.



How it works: the self-service portal

HP CloudSystem Enterprise puts applications in the hands of business users in minutes. All it takes is for a business user (a “subscriber”) to visit the self-service business portal in the demand layer. This portal has a user interface with easy-to-understand graphics, and it includes lists of services and their descriptions written in everyday business language.

When the subscriber chooses a service and submits a request, the service is automatically provisioned by HP CloudSystem and becomes available to the user within minutes.

When the requested service is no longer required or the subscription has expired, the services are automatically decommissioned and the resources are returned to the resource pool. This process is virtually seamless.

How it works: service design

Services are designed by IT before they can be delivered through the service catalog. There are key roles within the service design process.

Service designer/architect

Before a service such as a banking application or a marketing survey appears in the catalog, the service must be designed—including all the elements needed to run the application. These elements might include a database, middleware, a Web tier to serve the application, and perhaps more complex elements.

To effectively design a service, the various elements, infrastructure, and application components are first combined using the graphical Cloud Service Automation interface. Next, all the service elements are linked together in a logical order to form a specific service blueprint that will be packaged as a complete cloud service offering and placed in the service catalog. End users can then browse the catalog and subscribe to the service offering.

In HP CloudSystem Enterprise, the solution designer has access to over 4,000 prewritten templates for infrastructure and applications, speeding service development and substantially reducing the need to write new code for any particular design.

The Cloud Service Automation graphical user interface (GUI) provides a flow diagram showing how the various elements will be laid down. The architect might take a prewritten template from HP Cloud Service Automation, combine that with the application template for Oracle Database, and add the WebSphere middleware stack. The solution might also be combined with a Webapp applet and other applets for a banking application.

Once the service is built and tested, the solution designer gives the service a name—for example, “Banking Application XYZ”—and a description that will appear in the service catalog. The solution designer can specify options for different levels (for instance, a “gold” service with a high-availability tier for production use, or a “bronze” level with minimum monitoring that signifies a service for test and development), as well as various support levels. The final step is to save that entire service definition and publish it in the service catalog.

Infrastructure service templates

The infrastructure service designer is the tool where infrastructure service templates are created that incorporate the physical and virtual resources—including HP servers, storage, networking, applications, and security. The infrastructure service templates are also where other resources, such as a customer’s existing computing assets and virtualization, are linked into CloudSystem.

The infrastructure architect uses the infrastructure service designer tool to define what infrastructure will be needed to support a particular service: what kind of server will be used for the database, what type of server for the Web tier, what security will be needed, and more. These infrastructure elements are set up as infrastructure design templates in the Matrix Operating Environment. Server, storage, and networking administrators manage the infrastructure. These administrators maintain control over their own environment while making resource pools available for use by the infrastructure template.

Server, storage, and networking administrators interact with the infrastructure elements through the Matrix Operating Environment. Depending on policy, an infrastructure design template can include bursting to external resources such as a public cloud. Moreover, infrastructure can be provided as a service (IaaS) to other parts of the enterprise.

Application architects define application templates and policies that will be needed to support the composite application architecture for the service offering.

Enterprise IT departments are usually characterized by a number of different types of administration roles. In some organizations, one person may perform several different roles, while in another organization there may be strict division of labor. HP CloudSystem Enterprise allows for that division of labor while also making it easy for one person to perform several different tasks simply by clicking a mouse from one portal to another via the easy-to-use graphical user interface.

How it works: service delivery

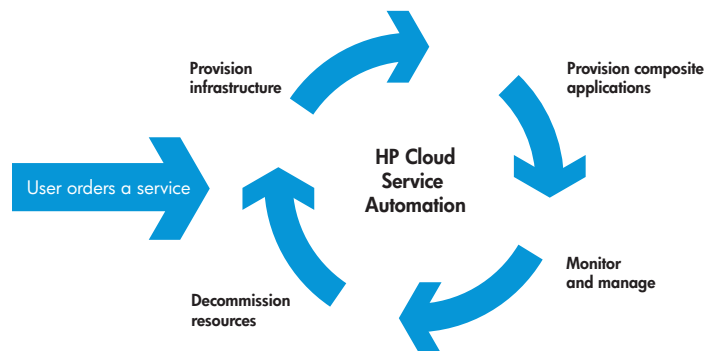
When a subscriber chooses an offering from the service catalog, the self-service business portal indicates the request has been submitted. Depending on how the system is set up, approval can be automatic or an administrator can do a manual approval. Upon approval, the system automatically begins to install and provision the infrastructure.

Automatic initialization and resource reservation

Before provisioning the infrastructure, HP CloudSystem Enterprise goes through an initialization phase, checking the resource pool and reserving the necessary resources. Only after confirming that resources are available does the system actually begin provisioning. This process ensures that in the event of an error, those resources are not locked and remain available for use by other services.

Figure 5

Provisioning, monitoring, and release of services are all automatic.



Automatic provisioning

The system first reaches out to the infrastructure layer and pulls in that portion of the service definition. Then the system automatically begins provisioning, installing databases, middleware, and applications according to the order and dependencies specified by the solution architect. When CloudSystem Enterprise installs a large component such as a database, the system also configures that database, automatically applying patches and whatever else is needed to bring it to the required compliance level. Finally the system might lay down the various Web applications, as defined in the architecture.

All these steps are performed automatically—a process that virtually eliminates manual configuration errors. After all the components have been configured, the system automatically deploys and launches monitoring tools such as SiteScope, as defined by the service definition. CloudSystem Enterprise can monitor performance or other parameters specified by the solution architect.

When the service is fully deployed and operational, the subscriber receives a notification on the portal, and also typically by email, that the request has been fulfilled. The requested services are now available to the user. The entire process of deploying a service might take a few minutes or a few hours, depending on the complexity of the service definition. This is dramatically faster than the typical three to six months most enterprises require to stand up a new service.

End-to-end lifecycle management and automatic fault remediation

HP CloudSystem Enterprise provides full lifecycle management that addresses the complete lifecycle of the service, including full control and management while in use, from subscription all the way to retirement and returning resources to the pool. Even if your HP CloudSystem Enterprise solution incorporates non-HP hardware and software, you get the same management of the service throughout its life.

HP CloudSystem Enterprise includes comprehensive agentless software that monitors the availability and performance of distributed IT infrastructures and applications remotely. It continually monitors IT components, an essential part of lifecycle management, and also provides automatic fault remediation. It allows you to gain real-time information such as troubleshooting tickets that automatically log an issue if an alarm is triggered. In this way, it helps you to stay apprised of problems and solve bottlenecks before they become critical. Here's a detailed example of how it works:

- Assume that a service employing 20 CPUs is performing its tasks normally when one of those CPUs fails. This is not a severe error, and the end user might notice only a slight degradation in performance. Depending on the rules or remediation actions defined, the system automatically tries to restart the virtual machine. If that fails, HP CloudSystem Enterprise generates an alert and trouble ticket in the UCMDB, indicating that the system is running with one less CPU than it should.

- In more severe instances, the administrator might need to intervene manually, and perform root cause analysis and troubleshooting. The administrator might decide to move the virtual machine to a different hypervisor or even swap out the physical server. The monitoring tools in HP CloudSystem Enterprise allow administrators to keep a close eye on the underlying computing environment and take timely corrective action, often without a hiccup in the service itself.

Automatic decommissioning

Depending on its design, the service may have a time limit, or the subscriber may need to return to the self-service portal and unsubscribe. In either case, CloudSystem Enterprise then executes provisioning in reverse, first disabling monitors so no error messages will be created. HP CloudSystem Enterprise uninstalls the applications and releases the hardware resources back to the pool, so they are available for the next request that comes in. If desired, the solution architect can allow users to archive the configuration when done, or to suspend and resume it. The process typically takes only a few minutes.

Summing up

Whether you are architecting a cloud solution in an all-HP or a multivendor hardware/software environment, HP CloudSystem Enterprise solution offers a significant number of advantages over other would-be cloud offerings:

- It is a complete cloud solution, with comprehensive cloud management software for automated provisioning, governance, monitoring, deployment, and security.
- It is an open solution that offers heterogeneous support, allowing you to use HP products or a combination of HP and third-party products. So you avoid lock-in to any single vendor.
- It is an integrated cloud solution that offers rapid infrastructure and application provisioning and complete management of complex, multi-tier applications, integrated with the underlying servers, storage, and networking.

In short, HP CloudSystem Enterprise is a complete, integrated system to build and manage services across private, public, and hybrid cloud environments. It combines the strength of HP Converged Infrastructure with the established leadership of HP Cloud Service Automation software, creating a solution that delivers unified security, governance, and compliance across applications as well as physical and virtual infrastructure. It's the one cloud-based and traditional IT solution that provides the necessary agility to accelerate time to value and lower costs while building an enterprise that can quickly and decisively respond to business needs. Agility allows enterprise organizations to meet changing customer/citizen demands, and to accelerate time-to-market and time-to-service initiatives. In an age of immediate expectations, organizations need to have the ability to respond quickly and effectively to changing business and public needs.

HP CloudSystem Enterprise gives you tools you need to create an IT environment that serves customers, employees, partners, and citizens with whatever they want and need, at any point in time and through any channel. It uses technology to integrate and automate the value chain. It adapts easily and innovates rapidly. It manages risk and environmental responsibilities.

In today's transparent world, business/government and technology are one in the same. Technology is fully embedded in the enterprise to accelerate time to value. It is where enterprises and IT innovate together to deliver value instantly to customers and citizens—at all the points that matter.

Resources

For more about HP CloudSystem, visit hp.com/go/cloudsystem

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