RED HAT CLOUD
A ROAD MAP TO GOVERNMENT CLOUD COMPUTING BASED ON OPENNESS, PORTABILITY, AND CHOICE

In a remarkably short time, cloud computing has emerged as an important evolution in the way that organizations and individuals consume and operate computing. This evolution represents a compelling business model for public sector agencies seeking to reduce siloed IT and find ways to deliver reliable and user-centric services quickly, despite resource constraints. But how?

With access to systems and middleware infrastructure in the cloud, the onerous task of application development and deployment is streamlined. Applications use only the resources they need, and organizations pay only for what they use—an agile model that promises to provide economies of scale, accelerate the creation of new applications, and maximize ongoing portability and flexibility. **With a cloud computing approach, government spends less time managing complex IT and more time investing in the mission.**

These business-facing benefits are exciting in themselves, but couple these with the rush of recent government initiatives—including the Federal CIO's Cloud-First policy—and government agencies are finding themselves increasingly under pressure to plan for a migration to the cloud.

This whitepaper aims to make sense of cloud computing for government audiences that haven't been deeply involved in the details of its rapid evolution. It lays out the capabilities and characteristics of a cloud computing infrastructure and how this can be achieved using existing IT investments, without vendor lock-in. It discusses how these features translate into significant potential for government agencies. It also describes how open choice and application portability in the cloud and the relationships between technology providers are critical to building a cloud that government agencies can take advantage of.

THE USER-DRIVEN CAPABILITIES OF THE CLOUD

So how does the cloud deliver on its much-talked-about ability to solve the complexities of government IT and provide business value? To answer this question we need to step back a little.

The cloud is not an abstract, but rather a set of capabilities that address individual customer challenges. Whereas most technology innovations are vendor or consortium-driven, **the cloud is the first user-driven innovation of its kind. And this innovation was enabled by open source software.**

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Adherence to these principles continues to ensure that the true value of the cloud — that of an open platform that allows developers and enterprises to own and manage their delivery directly to end users, without vendor lock-in or huge investments in proprietary hardware — is maintained. This user-driven open model is essential to innovation, standardization, and, ultimately, choice.

The following cloud capabilities, developed thanks to an open IT architecture, will likely become the norm over time in mature, production cloud implementations:

Resource abstraction and pooling – Pooled computing resources (storage, processing, memory, networking, and virtual machines) serve multiple consumers using a multi-tenant model with physical and virtual resources dynamically assigned and reassigned depending on demand.

Network-centric – Whether implemented within a single organization or at a public cloud provider, cloud computing is network-centric. Services are made available over the network and accessed through standard mechanisms, typically lightweight web protocols.

Simple, fast provisioning of resources – One of the ways that cloud computing makes an IT infrastructure more agile is by enabling new resources to be brought online quickly. This may include, over time, a degree of self-service—meaning that a user can provision computing capabilities, such as server capacity and storage, as-needed without having to interact with a human.

Rapidly and elastically provisioned resources – In a cloud environment, resources can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and scale back based on pre-set policies and the demands of an application. This avoids unused servers sitting idle after the task they were initially purchased for ends.

Utility pricing – Cloud computing is often associated with utility pricing, or pay-per-use. Today, this is something that is largely specific to public cloud providers.

REALIZING THE POTENTIAL OF THE GOVERNMENT CLOUD

So how do these individual cloud capabilities address the very specific challenges of government IT and its agency-centric, siloed, bare-metal environments?

Let's consider the typical characteristics of traditional government IT:

- Low asset utilization
- A fragmented demand for resources
- Duplicative systems and stove-piped environments that are inflexible and difficult to manage
- Long procurement lead times leading to reduced agility

This situation occurs because IT departments and application owners are required to deliver applications that meet the needs of the mission. And to do this well, they must ensure sufficient capacity for each application while maintaining control over its deployment and operation. Concurrently, they find it **difficult to increase capacity as needed to meet sudden increases in mission demand.**

In traditional IT, this application lifecycle management process also involves **lengthy procurement and deployment cycles** of the bare-metal hardware and software assets needed to support it — a slow and sprawling process that has increasingly compromised agency agility and responsiveness to business needs.

Add to this the complexity of stove piping because of a lack of consolidated IT spending under agency CIOs. This gives rise to a **duplication of effort, increased capital spending, lack of standardization, and information inefficiencies across government.** These inefficiencies negatively impact the government's ability to meet the demands of the mission and the expectations of citizens.

ADDRESSING THE INEFFICIENCIES OF GOVERNMENT IT

Cloud computing has the potential to play a major part in addressing these inefficiencies and improving government service delivery by delivering highly reliable, innovative services quickly, despite resource constraints.

With the availability of cloud, government organizations who deploy and manage applications do not need to purchase extra resources that sit idle when not in use. They can instead use only what they need and pay only for what they use, taking advantage of a set of resources shared among individual agencies (a private cloud), or shared across many (a community cloud). The ability to right-size systems infrastructure for the task at hand—not only on initial application deployment but as an automatic, elastic-scaling process throughout the useful life of the application—can drive dramatic savings in the cost of development, operations, and systems administration.

Cloud computing streamlines the entire application lifecycle. The many onerous tasks associated with purchasing, installing, and configuring systems infrastructure and application infrastructure become instead a simple point-and-click administrative process. And those resources can be released again just as easily.

In addition, the ongoing process of updating and upgrading systems, middleware, and applications can be centralized in the cloud, thereby eliminating distribution challenges, dramatically reducing overhead costs, freeing resources, and reducing disruption for users.

YET, QUESTIONS REMAIN

Despite the many benefits of cloud computing, as espoused by federal leaders and a rapidly evolving and persuasive marketplace, government decision-makers and IT departments have many questions:

- Can we leverage our existing infrastructure and technology investments in the cloud?

- Must we endure disruption in our IT processes in order to take advantage of cloud technology?

- How much risk are we assuming by adopting cloud services?

- How can we ensure the technical choices we make now are future-proof?

- Must we, as some vendors claim, change our approaches to developing and integrating applications—even rewrite applications?

BUILDING A GOVERNMENT CLOUD—THE RIGHT WAY

Many of the concerns outlined above are driven by the fact that, until now, government IT teams have done everything they can to increase flexibility for their agencies and still maintain control of their IT destinies. All of this important work can be leveraged in the cloud. In fact, it has actually prepared agencies for a smooth adoption of cloud deployment. Clouds don't require a revolution in development processes or the relinquishment of technology investments and legacy know-how—they are simply the next logical advance in IT infrastructure.

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Imagine being able to take advantage of IT-as-a-service that:

- Lets you leverage and extend your existing infrastructure.

- Is portable across hybrid environments—giving you the flexibility and openness to meet present and future requirements without abandoning your development know-how.

- Allows you to manage image and application compliance throughout the complete lifecycle.

- Lets you define, create, and manage secure images—once—and apply to many systems

- Offers a level of abstraction that dramatically eases deployment of new and existing applications to the cloud.

- Lets you manage your infrastructure and applications as one entity—not separate silos.

- Includes a robust security framework that ensures that IT is under control, even in the cloud.

There are a variety of cloud services in the market that offer a number of these capabilities. However, the greatest value comes from enabling government agencies to build and deploy clouds that have all of them. Red Hat® cloud solutions provide exactly this.

Built on the open source architecture that government agencies have come to trust, Red Hat delivers the world's leading solutions for private clouds, hybrid clouds, and public clouds: CloudForms helps your organization build and manage your own cloud (Infrastructure-as-a-Service or IaaS). The revolutionary OpenShift Platform-as-a-Service (or PaaS) enables developers to manage the complete lifecycle of an application at a level of abstraction that hides many of the systems and applications infrastructure from developers and their applications.

By using an open source cloud deployment, government users can take full advantage of clouds that provide them with the agility and choice they need to manage what they really care about—applications, not just virtual machines.

IT'S ABOUT PORTABILITY, STANDARDIZATION, AND CHOICE

Red Hat cloud solutions are unique. Unlike other approaches, Red Hat delivers choice to government customers. Choice of platform, choice of virtualization, choice of cloud provider. Choice that only the open source leader can deliver.

The IT industry has spent the last 10 to 15 years moving off of closed, proprietary stacks of hardware and software towards relatively open, standardized, commodity gear. In doing so, it has benefited not only from the reduced up-front costs but also from competitive cost-savings. You can compare solutions from giant IT manufacturers and probably get a better price than if you were to sole-source that hardware purchase. Open platforms also give a better chance of incorporating new innovations, since users don't have to wait for their one-and-only vendor to catch up.

In these early days of the virtualization and cloud market, there are many software and hardware vendors that want to sell you a 'cloud-in-a-box.' This monolithic piece of hardware holds all your infrastructure inside: networking, compute, storage, operating systems, databases, and so on. They are expensive up front, but the gamble is that by removing or reducing the cost of tying all these pieces together yourself, it's less expensive in the long-run.

In fact, this couldn't be further from the truth.

Cloud computing is about elasticity and flexibility. It's about moving away from encumbering capital invest-ments and towards operating expenses, which are more agile. A big black box with all your hardware and software in it is the opposite of that. A single vendor in control of your entire virtualization layer is the opposite of that. Government agencies can get much more out of their infrastructure and staff by deploying an open cloud strategy that encourages standardization across their physical, virtual, and cloud-deployed systems, rather than consolidating their spend with a single vendor.

THE BENEFITS OF AN OPEN CHOICE CLOUD ENVIRONMENT

By bringing open choice and standardization to the cloud — both for deployment and development — Red Hat delivers portable, comprehensive and managed clouds that deliver the following benefits:

PORTABILITY ACROSS HYBRID ENVIRONMENTS – LETS YOU KEEP YOUR OPTIONS OPEN

Maintaining portability across technology stacks and deployment options delivers the greatest value with minimal risk for the organization and ensures your technology investment is future-proof.

Red Hat's approach to open choice cloud computing delivers this. Red Hat provides:

- **An open, standardized, and agile operating system** – Fundamentally, it's the operating system's layer of abstraction that determines whether a given application can run on one type of hardware or many. With Red Hat Enterprise Linux®, these APIs are open source and based on open standards that run across a broad swath of computer architectures. This brings in a large community of developers and users and eliminates the possibility of being locked into any single vendor's API.

- **The ideal platform for building Linux or Windows-based clouds** – Red Hat Enterprise Virtualization is fully compatible with Red Hat Enterprise Linux (applications certified to run on Enterprise Linux on physical machines are also certified when run on virtual machines), and is the ideal platform on which to build an internal or private cloud. Red Hat Enterprise Virtualization can host both Red Hat Enterprise Linux and Microsoft Windows virtual machines.

- **Infrastructure-as-a-service that delivers portability across multiple environments** – Red Hat CloudForms integrates with existing products and technologies, including physical servers and virtual-ization platforms from other vendors. This provides the easiest on-ramp to an on-premise cloud. It also allows you migrate to multiple public or community cloud providers, including those running a software stack from a different vendor. In addition, CloudForms also allows you to manage the lifecycle of your applications across disparate cloud providers. In short, CloudForms lets you manage both the container and content of your applications.

- **A consistent development and deployment platform for use across multiple clouds** – With OpenShift, Red Hat delivers a consistent development and deployment platform across on-premise and cloud envi-ronments. Developers can take full advantage of clouds while continuing to use their preferred devel-opment tools and approaches. There is no need to adopt new development tools or be locked into the offerings of a single cloud provider. Users can use OpenShift to set up their own internal PaaS service or leverage the powerful capabilities of JBoss® Enterprise Middleware on public clouds such as Amazon EC2.

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MANAGE IMAGE AND APPLICATION COMPLIANCE THROUGHOUT COMPLETE LIFECYCLE

Maintaining compliance with federal security and other policies requires both content management and runtime management within running instances. Compliance can't be a one-shot thing only checked when 'golden images' are first created. Continuous compliance is the only way to minimize the drift that causes applications to deviate from established IT security and other policies and creates risk to the agency as a result.

The Red Hat IaaS solution, CloudForms, provides automated control over applications while they are running, meaning that administrators can be highly confident that their infrastructure is under control at all times and not just at the instant a new image starts up.

DEFINE, CREATE, AND MANAGE SECURE IMAGES – ONCE

Red Hat delivers a comprehensive set of development and deployment tools to flexibly manage applications at the image level and ensure an in-control cloud.

With Red Hat CloudForms, developers can write an application once and deploy it anywhere—to a cloud or to on-premises systems infrastructure—in one step.

With CloudForms, users can import images created elsewhere and store them in its repository. Images can be built in whatever formats are needed for their deployment destination in one standard open operating environment that can be quickly replicated for scalability across physical servers, a variety of virtualization platforms, and a choice of public or community clouds.

A ROBUST SECURITY FRAMEWORK WITH SELF-SERVICE

Security is a top-of-mind concern for government IT considering any cloud deployments, and is more important than ever in the context of the cloud. Even in a private cloud, different groups are sharing the same physical and virtual resources. Red Hat CloudForms provides a comprehensive set of security features to mitigate the potential risk of operating a multi-tenant environment. Policies around utilization, access, quality of service, cost, and geography ensure that IT is under control—even though an administrator doesn't need to have a hand in every tactical decision.

AVOID VENDOR LOCK-IN WITH PORTABLE CLOUD SERVICES

IaaS cloud services provides organizations with the technologies needed to implement commonly used application features—and avoid the need to reinvent such capabilities. Red Hat cloud services are also one of the mechanisms that maintain portability across multiple clouds because they can be mapped to and run on top of the offerings of different public cloud providers—avoiding vendor lock-in.

CLOUD RESOURCE POOLING AND REPORTING—BREAKING DOWN SILOS

As mentioned earlier, pooled computing resources serve multiple consumers using a multi-tenant model, with physical and virtual resources dynamically assigned and reassigned depending on demand. The abstraction of systems into resources is a fundamental aspect of clouds. Examples of resources include storage, processing, memory, and network bandwidth. Resource pooling is a big part of why a private cloud is different from virtualization; it's the additional level of abstraction that can take you from managing systems (even if virtualized) to a set of logical resources that cut across silos of capacity.

CloudForms lets you create these pools of resources, greatly simplifying IT management.

LEVERAGE AND EXTEND EXISTING INFRASTRUCTURE AND APPLICATION INVESTMENTS

Red Hat makes moving to the cloud a simple, gradual approach that introduces freedom of choice and interoperability that no other provider can offer.

By leveraging and extending existing infrastructure investments, computing environments, and operational processes, cloud adoption can be evolved at a pace that makes sense for the needs of a government organization. Building a cloud in this way also reduces risk because it doesn't require wholesale adoption of new technologies and changes to applications all at once. Red Hat solutions are more comprehensive than the competition, but that doesn't mean you have to buy everything from us. For example, CloudForms supports virtualization platforms from Microsoft and VMware in addition to Red Hat Enterprise Virtualization.

Red Hat cloud solutions also protect your investment in applications and human resources. Because you can deploy existing applications to the cloud, there is no need to throw away all your agency's applications and start over. An open, general-purpose platform also allows you to keep using the tools and programming models that you use today, without the need to use new proprietary languages or only one model.

OpenShift also ensures interoperability across your IT infrastructure—images for Red Hat PaaS components are available through a variety of public and private clouds, including private clouds based on Red Hat Enterprise Linux, Red Hat Enterprise Virtualization, and VMware ESX, as well as on public clouds, including Amazon EC2, those based on Windows Hyper-V, and more.

THE RED HAT GOVERNMENT CLOUD ADVANTAGE

Government IT has worked long and hard to implement standards and governance processes that maximize application portability. They have also adopted open solutions that ease maintenance and reduce vendor lock-in, while creating flexible application architectures that enhance mission agility. At the same time, these agencies are looking to realize the value of cloud computing and quickly adapt to change, in a cost-effective, secure, and flexible manner.

Only with Red Hat can agencies move forward from this strong foundation, optimize the resources their applications consume, shorten delivery cycles, and reduce costs without disrupting development.

It's no secret that the open source development model drives innovation, faster. As the leading open source solutions provider in the world, Red Hat brings innovation to the cloud and helps agencies build not only a better cloud, but a more open one.

Using the Red Hat IaaS solution—CloudForms—and the Red Hat PaaS solution—OpenShift—agencies can achieve interoperability with their technology investments, optimize the resources their applications consume, shorten cycles, and reduce costs—without disrupting development.

In fact, Red Hat allows government organizations to focus in what they care about most—the applications that are critical to their mission and the lifecycle of those applications. And they can do this, confident in the knowledge that the foundation that their clouds are built on reduces risk by being flexible, portable, and well-managed.

THE INDUSTRY'S FIRST CLOUD VENDOR CERTIFICATION PROGRAM

To deliver on this promise, Red Hat has established the industry's first cloud certification program—the Red Hat Certified Cloud Provider Program. A Red Hat Certified Cloud Provider offers a trusted destination for Red Hat customers, ISVs, and partners to use Red Hat technologies in public clouds. It meets rigorous testing and certification requirements to ensure the delivery of a safe, scalable, supported, and consistent environment for enterprise cloud deployments.

EXTEND YOUR TRUSTED RED HAT SERVICE AND SUPPORT

Red Hat also extends the concept of flexibility to qualified enterprise customers who can migrate their current subscriptions as they journey to the cloud. This gives customers the ability to make use of Red Hat support, relationships, and technology on certified clouds, while maintaining a consistent level of service and support across all certified deployment infrastructures with consistent and predictable pricing.

Red Hat provides everything you need to evolve your IT infrastructure and applications into the future. From individual technology components to complete solutions and services, Red Hat has led the industry into the world of the cloud. And with the richest ecosystem anywhere, from a range of Certified Public Cloud Providers, hardware vendors, ISVs, and PaaS middleware vendors, Red Hat is the cloud platform that delivers you the widest range of choices.

WHY RED HAT CLOUD?

Cloud computing is one of the most important shifts in information technology to occur in decades. Red Hat is proud to be a leader in delivering the infrastructure necessary for reliable, agile, and cost-effective cloud computing in the public sector.

Whether you're just exploring your options or you're ready to start building today, only the leader in open source can bring the agility, interoperability, and portability your agency requires to the cloud.

Contact Red Hat today to learn how your agency can:

- Leverage your existing infrastructure investments.
- Add to the cloud when your needs and budget allow.
- Evolve your policies at your own pace.
- Maintain portability, manageability, and interoperability across your infrastructure.

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