RED HAT PaaS:
BRINGING OPEN CHOICE & APPLICATION PORTABILITY TO THE CLOUD

TAKE FULL ADVANTAGE OF CLOUDS WITH JBOSS ENTERPRISE MIDDLEWARE.
Reduce costs and cycle times, ease development, and increase flexibility without changing the way you build and integrate applications.

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DEMAND OPEN CHOICE IN THE CLOUD

Today's enterprises can realize significant advantages in cost, flexibility, and overall business agility by using cloud computing resources. With access to systems infrastructure and application infrastructure in the cloud, applications use only the resources they need, and organizations pay only for what they use—a model that promises to eliminate waste and shelfware, accelerate the creation of new applications, and maximize ongoing portability and flexibility. For IT, cloud computing represents an important new phase of virtualization that facilitates more efficient business models. But to take advantage of cloud computing, must organizations, as some vendors claim, change their approaches to developing and integrating applications, and even rewrite applications?

With Red Hat PaaS, a Platform-as-a-Service (PaaS) offering based on JBoss Enterprise Middleware and other technologies, these complex approaches will not be necessary. Red Hat PaaS will enable organizations to radically simplify the process of developing, deploying, and managing applications in public and private clouds.

Red Hat PaaS combines cloud-aware tools and optimized runtime services to help organizations maximize the advantages of cloud computing for a wide range of new *and existing applications, without having to rewrite applications or adopt new languages and development tools*. An open environment that ensures maximum flexibility in development and deployment, Red Hat PaaS will bring the proven value of the comprehensive JBoss Enterprise Middleware portfolio to the cloud—*any cloud*—while providing cloud-aware capabilities that help developers and their colleagues take full advantage of their clouds of choice.

Going beyond the rudimentary application container features offered by some PaaS solutions, Red Hat PaaS will deliver a set of integrated runtime services and management capabilities that span the entire application lifecycle. From development to deployment to management, Red Hat PaaS will enable organizations to leverage the benefits of the seasoned and increasingly valuable open source middleware stack into the cloud.

A wide range of services from JBoss Enterprise Middleware will be offered as Red Hat PaaS services, easing the process of making these middleware capabilities available to developers and, in turn, enabling a wide range of applications to run efficiently in the cloud. Red Hat PaaS will also offer open choice for development and deployment. Developers can create applications once using their standard tools, and then deploy to their systems infrastructure environments of choice, whether a private cloud, public cloud, traditional on-premises infrastructure, or a combination, and then move application workloads freely among these options without modification. As a result, developers will be able to streamline development and testing processes, scale deployments in response to business requirements and user demand, and manage applications that are deployed across multiple systems infrastructure environments. With Red Hat PaaS, which will include Red Hat PaaS services and the Red Hat cloud engine, IT organizations can retain and enhance their current development and integration approaches, while deploying applications to achieve the cloud economy and flexibility that drive business agility.

This paper describes the capabilities, direction, and underlying principles of Red Hat's PaaS strategy and is intended to help enterprise IT organizations, ISVs, and anyone who is planning a cloud deployment. Red Hat PaaS components will be delivered in phases so that our customers can take advantage of features and functionality as soon as possible.

REALIZE THE POTENTIAL OF CLOUD COMPUTING

Today many business and IT leaders, along with application developers, are excited by the potential of cloud computing. And the excitement is justified as this new application deployment strategy promises to bring greater flexibility and an optimized cost structure while ensuring that IT organizations can meet SLAs and keep business moving.

Most organizations deploy vastly more compute power and storage than they need. By one estimate, a majority of computing capacity is idle. This situation has arisen not because buyers are wasteful but because application owners are dedicated to delivering applications that meet business needs. 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 on-demand to meet sudden increases in demand based on business changes.

Cloud computing offers a new way to address these basic requirements. With the availability of one or more clouds, enterprises who deploy and manage applications do not need to purchase extra resources "just to be safe." They can instead use only what they need and pay only for what they use, taking advantage of a set of resources shared among the divisions of a single company (*a private cloud*), or shared across many different companies (*a public 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.

Clouds also bring opportunities to simplify and fine-tune application deployments above the systems infrastructure layer. Administrators and developers can tailor runtime middleware for the needs of any given application by:

- Selecting and running only the required components
- Sharing resources between and among applications when appropriate
- Eliminating the burden of managing software updates, different versions, and the complex policies of license agreements

Ultimately, clouds will drive an efficient market in which organizations can match their needs to a best-of-breed infrastructure solution. If the cloud meets its SLAs reliably, then it can remove cost, risk, and worry for those who must keep business processes and applications running smoothly.

CLOUD TERMINOLOGY

Cloud services are categorized by the kinds of resources they make available to their clients:

IaaS (Infrastructure-as-a-Service)

Hardware and systems software, including servers, networks, storage, and operating systems, delivered as a service.

PaaS (Platform-as-a-Service)

Software for building, integrating, deploying, and managing applications, delivered as a service.

SaaS (Software-as-a-Service)

An application for end users delivered as a service.

CLOUDS AND APPLICATIONS: REVOLUTION OR EVOLUTION?

Some industry watchers tout cloud computing as the next IT revolution; and its benefits certainly are revolutionary. But revolution implies disruption—a dramatic change in the way we work. Must we endure disruption in our processes, and in our application development processes in particular, in order to take advantage of clouds?

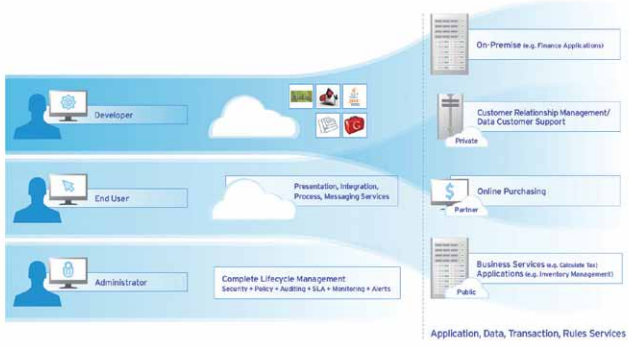
Smart, savvy IT executives and their teams have spent the last decades in a strategic drive to minimize business risk and maximize productivity by:

- Adopting portable tools and languages such as Java
- Insisting that their middleware run on multiple platforms
- Creating platform-independent architectures
- Designing loosely-coupled applications, standard interfaces, and service-oriented architectures
- Taking advantage of virtualization
- Embracing open source software

In short, these IT teams have done everything they can to increase flexibility for their organizations and maintain control over their IT destinies. All of this important work can be leveraged in the cloud, and has prepared organizations, for smooth adoption of cloud deployment. Clouds do not require a revolution in development processes—they are simply the next logical advance in virtualization. IT leaders should therefore be wary of any vendor claims to the contrary.

WHY PaaS?

THREE TYPES OF CAPABILITIES



PaaS is a set of software capabilities and application infrastructure, offered as a service within a public or private cloud. It enables you to manage the complete lifecycle of an application, including development, integration, testing, deployment (and redeployment), monitoring, and management, at a level of abstraction that hides many details of systems infrastructure and application infrastructure from developers and their applications.

A cloud begins with an IaaS (Infrastructure-as-a-Service) that offers virtualized access to systems infrastructure. An important goal of PaaS is to provide access to the resources of the IaaS, enabling administrators to manage the resources available to them. But PaaS also virtualizes access to application infrastructure (runtime middleware services), providing simpler APIs that make it easier for developers to create and deploy applications that meet business requirements without worrying about deployment details or boundaries between machines, networks, or even clouds.

While users of either PaaS or traditional middleware might be deploying applications to an on-premise systems infrastructure, a PaaS solution offers a level of abstraction that dramatically eases *deployment of new and existing applications to the cloud*.

PaaS can scale system resources automatically in response to demand, drawing on the resources of the underlying IaaS and constrained by any policies you have defined. And it can also scale and migrate the application infrastructure (middleware) services as needed behind the scenes, simplifying ongoing application management.

PaaS delivers three types of capabilities:

1. Tools for people who develop, deploy, and manage applications, which enable them to develop and integrate applications, access virtualized resources, and simplify application deployment and redeployment
2. Tools for PaaS administrators that enable them, for example, to federate clouds and on-premises infrastructure to create a super-cloud, manage others' access to these resources, set policies for their uses, and measure and report on usage
3. Deployed application and integration services that make up the runtime application infrastructure, and enable applications to run and work together in the cloud or elsewhere

WHO USES PaaS?

PaaS is used by:

- **IT organizations supporting businesses, government organizations, and nonprofits** can use PaaS to help reduce IT infrastructure costs and simplify application development, deployment, and management on an ongoing basis. These organizations will build private clouds, purchase time in public clouds, and perhaps make use of a combination of private clouds, public clouds, and traditional on-premises systems infrastructure and middleware in order to optimize their costs and flexibility.
- **Cloud service providers** may offer PaaS (for example a PaaS solution obtained from a vendor such as Red Hat) as a service to their customers.
- **ISVs and SaaS providers** will use PaaS solutions to build, deploy, and manage applications that are made available to users in SaaS mode.

EVALUATING PaaS SOLUTIONS

Not everything called a PaaS offers the same, or even similar, capabilities. PaaS offerings form a spectrum. At one end of the spectrum, they are highly specialized environments that enable extensions to SaaS software and offer components and frameworks for solving very specific classes of business problems. Other PaaS solutions are purpose-built to solve a specific type of business problem, providing productivity tools that enable developers to build one type of application with high levels of productivity.

At the other end of the spectrum are PaaS solutions, based on general-purpose middleware, that are intended for development, deployment, and management of myriad applications that address a wide range of business challenges. Red Hat PaaS, based on JBoss Enterprise Middleware, is an example of this type of PaaS solution.

TYPES OF PaaS SOLUTIONS

SaaS with extensions	Customize and extend the capabilities of a SaaS application
Purpose-built PaaS	A framework that simplifies the development of a specific class of applications
PaaS tied to a single application paradigm	Provides general capabilities, but supports only one programming model or development/deployment environment
PaaS tied to a single cloud	May provide general capabilities, but can be used only in the context of a single public cloud or a single type of private cloud infrastructure
Middleware hosted in the cloud	Eases distribution of middleware across the organization, but adds no other value
General-purpose PaaS	Comprehensive, open, and flexible solution that simplifies the process of developing, deploying, integrating, and managing applications in public and private clouds.

The more specialized PaaS solutions (the first two items in the table) may be successful in addressing their specific problem domains; and organizations needing those capabilities should not assume they must employ only one PaaS offering. In fact, the typical large organization may have multiple special-purpose PaaS services in use, just as it may have multiple SaaS applications in use that require customizations or extensions.

A general-purpose PaaS solution, such as Red Hat PaaS, serves a different need. It helps organizations realize cloud advantages quickly *for the bulk of their applications, new and existing*. Organizations choose this type of PaaS in the same way that they choose middleware as their standard architectures.

Organizations seeking a general-purpose PaaS should carefully evaluate whether a given solution provides *sufficiently comprehensive capabilities and sufficient flexibility and openness* to meet their present and future requirements. Some PaaS solutions claim to be general-purpose PaaS offerings for developing a wide range of applications. But to take advantage of these cloud-based platforms, their providers ask them to abandon their development tools, learn new languages and APIs (many of them proprietary), commit to one platform (a proprietary platform at that), and give up on the idea of application portability. Of course, given the needs of today's enterprise IT organization, this will not happen, and it should not happen. Fortunately, there is no need to do this.

A comprehensive, flexible, and open PaaS is one that:

- **Supports existing applications, development paradigms, programming models, and languages, as well as new ones.** An open, general-purpose platform will enable application developers to keep using the tools and programming models they are using today, supporting languages such as JEE, POJO, Spring, Seam, GWT, Groovy, PHP, Ruby, and others, and will not force developers to use new proprietary languages or only one model.
- **Protects organizations' investments** by supporting deployment of existing applications to the cloud of choice. Companies cannot afford to throw away all their applications and start over.
- **Enables developers to write an application once and deploy it anywhere**—to any cloud or to on-premises systems infrastructure—in one step. Applications should be portable. There should be no need to tailor the application to a given cloud environment.
- **Bridges multiple deployment environments** with a common set of tools and services, including on-premises deployments, public clouds, and private clouds. Today's IT organizations need to be able to take advantage of multiple clouds for different purposes at different times. And they should not have to use a different tool set for each type of cloud deployment.
- **Facilitates the development and integration of a broad range of applications**, including capabilities that enable integration with run-the-business applications, address integration with value chain partners and external services, support complex multi-tier and composite applications, and enable integration across deployment environments. In short, organizations should be able to perform all of the types of integration that they do today, and perhaps find that some of them are easier to execute.

RED HAT PaaS

With Red Hat PaaS, you will be able to take full advantage of clouds while continuing to use your preferred development tools and approaches. There will be no need to adopt new development tools or be locked into the offerings of a single cloud provider. Simply treat your preferred cloud as a new deployment option—a virtual set of resources that can be called upon as needed.

Users will be able to use Red Hat PaaS to set up their own internal PaaS (private cloud) service or to leverage the powerful capabilities of JBoss Enterprise Middleware on public clouds such as Amazon EC2. Red Hat PaaS will help users to:

- Reduce the complexity, time, and cost associated with developing, deploying, and running applications
- Take advantage of on-demand resource allocation (elastic scaling) in order to meet business demands in the most cost-effective way, scaling resources up and down easily and quickly
- Use one tool to gain visibility into the entire array of systems and application infrastructure available, including public clouds, private clouds, and on-premise systems infrastructure
- Fit your systems infrastructure and application infrastructure to the task at hand—use only what you need, pay only for what you use, and optimize the cost of operating your applications throughout their lifecycles
- Deliver solutions faster by eliminating infrastructure setup time during development, testing, and production phases

- Eliminate many time-consuming tasks associated with system and application management, including applying updates and upgrades, as well as managing different versions of hardware, operating systems, and middleware components, and ensuring compatibility among them

WHY RED HAT PaaS?

Red Hat PaaS will deliver on many of the benefits you have come to expect from Red Hat, including openness and the proven capabilities of JBoss Enterprise Middleware. While many other PaaS offerings introduce a new proprietary application development environment and a rudimentary set of tools, Red Hat offers much more, including:

- Open choice in development languages and tools
- Open choice for deployment
- A comprehensive set of middleware services
- Enterprise-ready open source solutions
- Complete application lifecycle management

RED HAT PaaS

OPEN CHOICE DEVELOPMENT

- **Keep your current development process.** Developers can use their current preferred programming models and APIs for PaaS deployments, so organizations can leverage existing skill sets. Red Hat PaaS will support JEE, POJO, Spring, Seam, Struts, GWT, and multi-language (e.g. Groovy, and Ruby).
- **Optimize resource use during development and testing.** When you take advantage of the cloud for development and testing of your application, you avoid the cost of acquiring and configuring infrastructure. Use only what you need, pay for only what you use, and scale the environment to suit production requirements when you are ready.

- **Run existing applications in the cloud.** Any applications developed using Java standards will run in the cloud with no modification. *There is no need to rewrite applications.*
- **Integrate applications** across cloud and on-premise deployments using a full suite of integration capabilities.

OPEN CHOICE DEPLOYMENT

- **Leverage the cloud while protecting your application investment.** Red Hat PaaS will protect your application investment, enabling you to deploy new and existing applications to public and private clouds, to on-premise systems infrastructures, and to hybrid (cloud and on-premise) deployments. *You can also redeploy easily among these environments.*
- **Choose among a range of public and private cloud deployments.** Images for Red Hat PaaS components will be 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, based on Windows Hyper-V, and more.
- **Eliminate maintenance headaches and incompatibility worries.** There is no longer a need to manage versions of hardware, operating systems, and middleware—or the relationship between them. Leave these worries and the time-consuming update processes to your PaaS provider.
- **Avoid deployment lock-in.** As a consumer of cloud services, Red Hat's Open Choice approach enables you to choose the cloud provider with the most appealing offer at any given point in time, and instantly redeploy on a different cloud. Your workloads can run wherever you want them to run so there is no need, from a technical standpoint, to be locked into a single cloud vendor.
- **Redeploy quickly** in response to changing business requirements, requisitioning additional systems infrastructure, and application infrastructure components.
- **Use one set of deployment tools** across diverse, on-premises, public cloud, and private cloud deployments.

A COMPREHENSIVE SET OF MIDDLEWARE SERVICES

With Red Hat PaaS, organizations will be able to take advantage of a comprehensive middleware reference architecture and a comprehensive set of middleware services. While some PaaS offerings provide simple containers for basic web applications, Red Hat PaaS will bring the full power of the JBoss Enterprise Middleware portfolio to the cloud. This portfolio will include messaging services, transaction services, data services, and a broad range of integration services, among others. With Red Hat PaaS, developers can work with proven enterprise-class middleware as they create a broad range of applications, from simple web applications to complex transactional and composite applications.

ENTERPRISE-READY OPEN SOURCE SOLUTIONS

Unlike other PaaS solutions, many of which are proprietary, Red Hat PaaS will be delivered as open source software that represents the combined efforts of a vast open community and Red Hat software experts. Open source projects draw on the best thinking of a large number of professionals with varying business challenges and perspectives. JBoss Enterprise Middleware, in turn, draws on these projects to create products that are tested, proven, and ready for enterprise production environments.

Like the JBoss Enterprise Middleware platforms on which it is based, Red Hat PaaS will be thoroughly tested, hardened, and productized through a process that anticipates enterprise challenges and it will be backed by Red Hat's expert technical support.

COMPLETE APPLICATION LIFECYCLE MANAGEMENT

Red Hat PaaS will provide all the tools necessary for streamlined management of the entire application lifecycle, wherever applications are deployed. Using a single PaaS environment, you will be able to:

- **Develop and integrate applications.** Ease management and maintenance of your developer tool environment by making JBoss Developer Studio and other application and integration services available in the cloud. Provision PaaS capabilities using a full set of access controls. Shorten development, testing, and maintenance cycles with easy infrastructure setup and tailored productivity tools.
- **Deploy and redeploy applications.** View all the systems infrastructures available to you—public cloud, private cloud, and on-premise systems—in a single tool, selecting your deployment strategy from a full range of options. Unifying your entire application infrastructure (local and virtual) makes it easier to port applications and scale resources as needed.
- **Monitor and manage applications.** Monitor all your application instances through a single tool set, regardless of where they are running. Observe demand patterns, add resources, change configurations, and take full advantage of the elastic scaling capabilities of one or more of your IaaS services to optimize the resources available to your application while minimizing cost.

INSIDE RED HAT PaaS

Red Hat PaaS will consist of two major sets of capabilities: Red Hat PaaS services and Red Hat cloud engine.

RED HAT PaaS SERVICES

Red Hat PaaS services are powerful application and integration runtime services whose APIs are used by application developers when they build applications. Each service can be run and scaled independently from the container, allowing developers and administrators to customize the application runtime environment for a given application and its workload. RESTful APIs make these services easy for developers to understand and use.

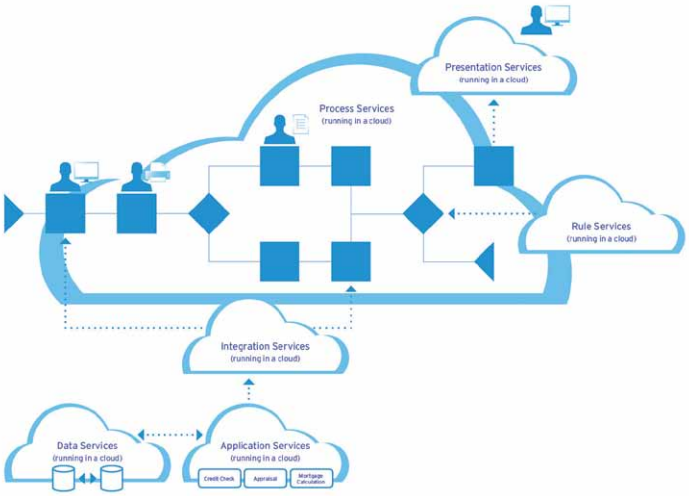
Currently, core infrastructure services that are provided by cloud vendors are limited to messaging and storage (persistence). While these types are sufficient for the most basic applications and proof-of-concept projects, a broader range of services will be necessary for enterprise-grade applications and workloads. These will include the types of services described below, which have formed the core of enterprise middleware solutions for the past four decades. Cloud does not change the requirements for these services. In fact, cloud makes it even more imperative that people developing and deploying applications have access to these discrete services. JBoss Enterprise Middleware is the perfect point of departure for providing these services in Red Hat PaaS in a modular and dynamic fashion. As Red Hat announced in 2009, the Open Choice strategy, built around the re-architected JBoss Enterprise Application Server (EAP), allows for deployment profiles that support a targeted set of discrete or related services. Red Hat PaaS services, then, represent a straightforward next step in the evolution of middleware deployment.

APPLICATION PLATFORM SERVICES

Container services are the basic PaaS application services, supporting many different component models (e.g. JMX, POJO, OSGi), programming APIs (e.g. Java Enterprise Edition, Spring Framework, Seam, Struts, Google Web Toolkit), and languages (e.g. Java, PHP, Groovy, Ruby). Other application services will include:

- **Messaging services** to provide high-speed, reliable transport for application and service integration and interoperability

- **Transaction services** that deliver robust, reliable, two-phase commit transaction processing for enterprise applications
- **Cloud-aware clustering services** to deliver highly available PaaS services and applications to enterprise users and cloud service providers
- **Storage services**, enabling access to diverse types of storage ranging from unstructured storage to highly structured or specialized databases
- **Data services**, including a data abstraction layer for in-memory storage of data
- **Web services**, including a complete web services stack for integrating with web services interfaces



BUSINESS & INTEGRATION SERVICES

Red Hat PaaS integration services will make integration capabilities from JBoss Enterprise Middleware available as PaaS services. These might include, for example:

- **Integration services building on fast, reliable messaging services** including mediation services that provide end-to-end connection among end points and APIs, offering translation, data federation, and registry services
- **Presentation and user interaction services**, to aid in the development of role-based and productive web-based user experiences
- **Rules services**, including a high-speed rules engine and business rules management service
- **Business process services**, including modeling, workflow, and orchestration of flow and monitoring

RED HAT CLOUD ENGINE

Red Hat cloud engine is a set of management and provisioning services—accessible through developer or administrator tools such as JBoss Developer Studio, JBoss Operations Network, or a browser interface—that will enable developers and administrators to create and manage their IaaS and PaaS resources, so they can

work in a highly productive, streamlined fashion with the systems infrastructure and application infrastructure available to them. These services enable them to manage the organization's cloud resources and environment, control Red Hat PaaS access, stand up applications, redeploy from one systems infrastructure to another very easily, scale an application's systems infrastructure and middleware up or down to respond to business needs and runtime conditions, and monitor and manage applications, wherever they are running.

CONCLUSION

While cloud computing has the potential to deliver dramatic benefits, it does *not* force a revolution in the ways application developers conceive, develop, and integrate business applications. Despite the claims of some vendors that cloud computing demands substantial redevelopment, in fact the benefits of cloud computing are readily available today to organizations that wish to *redeploy* existing applications while continuing to develop and integrate new applications using Java standards.

Architects and developers should think of cloud computing as simply the next stage in the evolution of resource virtualization, one that can dramatically simplify the application lifecycle, and not constrain them to a single programming model or a single cloud environment.

Red Hat PaaS will offer developer and administrator capabilities and runtime services that bring open choice to the cloud for both development and deployment, ease application portability, streamline development, integration, and deployment, and enable federation of clouds and on-premises infrastructure with a virtualized view of both application infrastructure and systems infrastructure. Red Hat PaaS will provide PaaS access to the powerful and proven capabilities of JBoss Enterprise Middleware.

Many IT organizations have worked long and hard to implement standards that maximize application portability, to adopt open solutions that ease maintenance and reduce vendor lock-in, and to create flexible application architectures that enhance business agility. With Red Hat PaaS, organizations can move forward from this strong foundation, optimize the resources their applications consume, shorten cycles, and reduce costs, without disrupting development.

FOR MORE INFORMATION

To learn more about Red Hat PaaS and other Red Hat resources to support your cloud strategies and development goals, please contact your Red Hat representative or visit **www.jboss.com/paas**.

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