



RED HAT: UNLOCKING THE VALUE OF THE CLOUD

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RED HAT'S APPROACH TO THE CLOUD IS BETTER

Build better clouds with Red Hat

1. The most comprehensive solutions for clouds – both private and public.
2. Consistent enterprise-class environments bridge the physical and virtual world, inside the data center and public clouds.
3. Strategic flexibility without lock-in.
4. Better infrastructure, designed specifically for multi-tenant clouds.
5. Industry-leading ecosystem makes cloud usable, accessible, and safe.



BRINGING THE INDUSTRY TOGETHER WITH COMPREHENSIVE CLOUD SOLUTIONS

Enterprises

- The most comprehensive, flexible, reliable, and secure infrastructure for private clouds.
- IaaS and PaaS.
- Run the same certified application in a private or a public cloud.
- Certified Ecosystem makes the cloud safe and trustworthy and innovative business models make it simple.

Cloud Providers

- Comprehensive products to help create public IaaS and PaaS clouds.
- Consistency with the enterprise environment, allowing thousands of Linux/LAMP, Java/JBoss applications to run in the public cloud.
- The only virtualization designed for clouds drives costs down, security and service levels up.
- Resell the industry's fastest growing products—Red Hat Enterprise Linux and JBoss—by the hour, month or year
- Certified Cloud Provider program drives customers confidence in your cloud.



ISVs & Developers

- The easiest on-ramp to the cloud for developers and ISVs.
- Write once, sell everywhere. Consistent environments and seamless migration: data center to cloud.
- Eliminating the barriers to cloud development.

Resellers and Systems Integrators

- Respond to today's demand for cloud with real solutions.
- Cloud Foundations provides everything needed to sell, build, and manage clouds.



A CONSISTENT, COMPREHENSIVE ENVIRONMENT: INSIDE THE DATACENTER AND IN THE CLOUD

**Only Red Hat
provides consistent
environments
between the
datacenter and in the
cloud**

Consistent environments

Run enterprise-class applications in the data center or in the cloud

Both Enterprise-Class environments and Light Frameworks

Red Hat Enterprise Linux and JBoss make the cloud usable for enterprise-class applications. Fast application development in LAMP, Ruby and Spring.

No other vendor gives you both.

Opens the Cloud to More Applications



RED HAT MAKES CLOUD AN EVOLUTION, NOT A REVOLUTION

**Red Hat's unique
business and
technology model
unlocks the most
strategic flexibility
for IT**

Red Hat makes moving to the cloud a simple, gradual approach

Avoid getting locked in to one vendor's monolithic stack

Manage your diverse IT assets as one cloud

- Microsoft Windows or Red Hat Enterprise Linux
- LAMP, Java, or .Net
- Red Hat Enterprise Virtualization, VMWare ESX, or Microsoft Hyper-V
- IaaS or PaaS
- On-premise or public clouds

Committed to openness and interoperability at all levels of both the current and future cloud computing stacks



RED HAT DELIVERS BETTER CLOUD INFRASTRUCTURE

Red Hat's unique approach to technology unlocks the value of the cloud for enterprises and governments worldwide

Only x86 virtualization designed for multi-tenancy with advanced security features

Red Hat Enterprise Virtualization is the right virtualization architecture built directly into the Linux kernel

The best development model using open source

Guarantee minimum resources for better Quality of Service

Centralized management of all virtual machines



TRUST THE CLOUD WITH RED HAT'S INDUSTRY-LEADING CERTIFIED CLOUD ECOSYSTEM

Red Hat's ecosystem of thousands of certified hardware vendors, ISVs, and cloud providers means reliable and safe deployment

Confidently run your certified application
On any type of certified server capacity

- physical
- virtual
- or in a certified public cloud

At any time, based on the needs of your business

With the confidence that it has been tested, certified, and is supported for enterprise-class production use.



RED HAT'S CLOUD ARCHITECTURE



WHAT DOES A CLOUD PROVIDE?

A Cloud provides an abstraction layer to manage scale and complexity

- Self service
- Abstracted, elastic resources
- Location-independent storage & services
- Users, Groups
- Accounting
- API's, Drivers, Tools
- Federation



Cloud:

Resource abstraction,
Second Abstraction maps cloud to virtual resources



Virtualization:

Hardware abstraction,
First Abstraction maps virtual to physical resources



Bare metal:

Full access,
No Abstraction



**PHASE 1:
CONSOLIDATE
VIRTUALIZE
YOUR
SERVERS**

Virtualize your physical hardware to achieve higher utilization, consolidation, and flexibility.

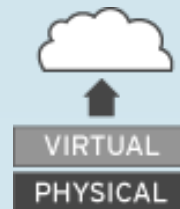
Virtualization increases the utilization of physical servers and provides a foundation for cloud computing.



**PHASE 2: AUTOMATE
BUILD A
PRIVATE
CLOUD**

As you expand your use of virtualization, build a private cloud to manage the scale and complexity.

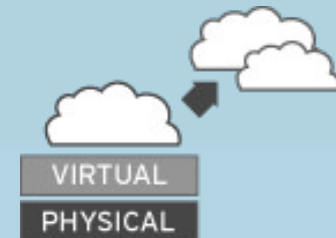
A private cloud abstracts multiple instances of virtual resources into elastic pools of computation with self-provisioning and scalable services.



**PHASE 3: UTILITY
ADD A
PUBLIC
CLOUD**

As you expand your use of cloud computing, add public cloud providers delivered as a utility to increase capacity and lower costs.

Red Hat's cloud architecture lets you manage and integrate various virtualization systems and public cloud providers together. This allows you to leverage public cloud computing as a utility.



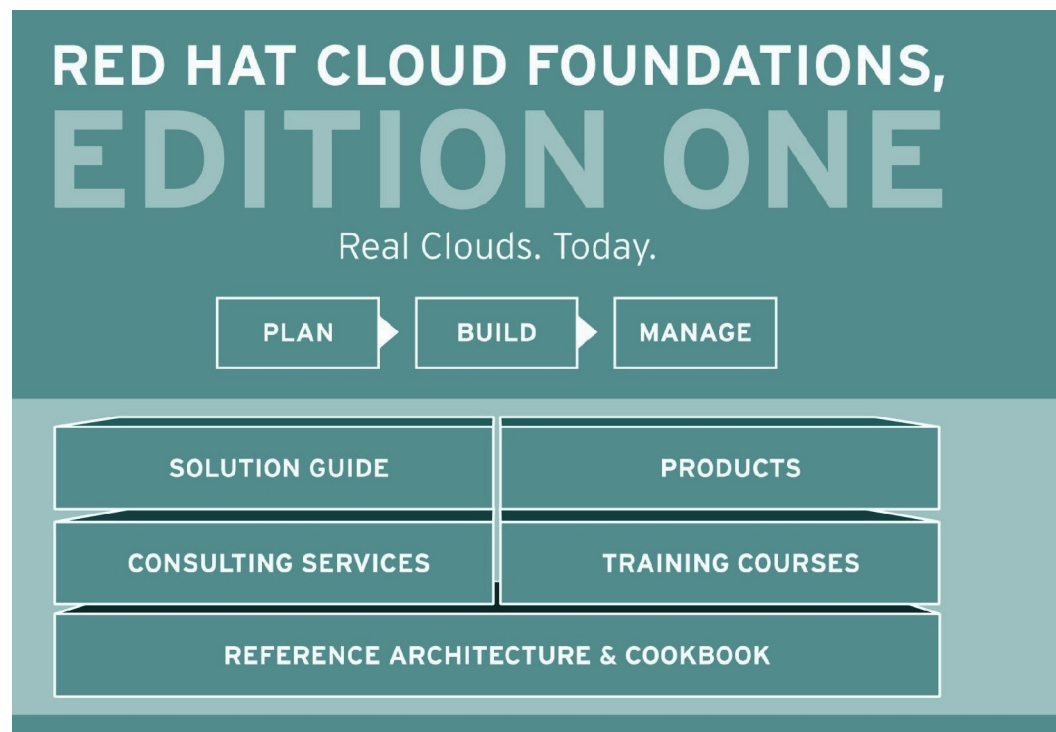
EVERYTHING NEEDED TO PLAN, BUILD, AND MANAGE A CLOUD. TODAY.

Comprehensive product family
Detailed reference architecture
and cookbook implementation
guides

Expert services to plan, build and
manage.

Training classes for knowledge
transfer and development

**June, 2010: Cloud
Foundations, Edition One:
Private Infrastructure-as-a-
Service Cloud.**

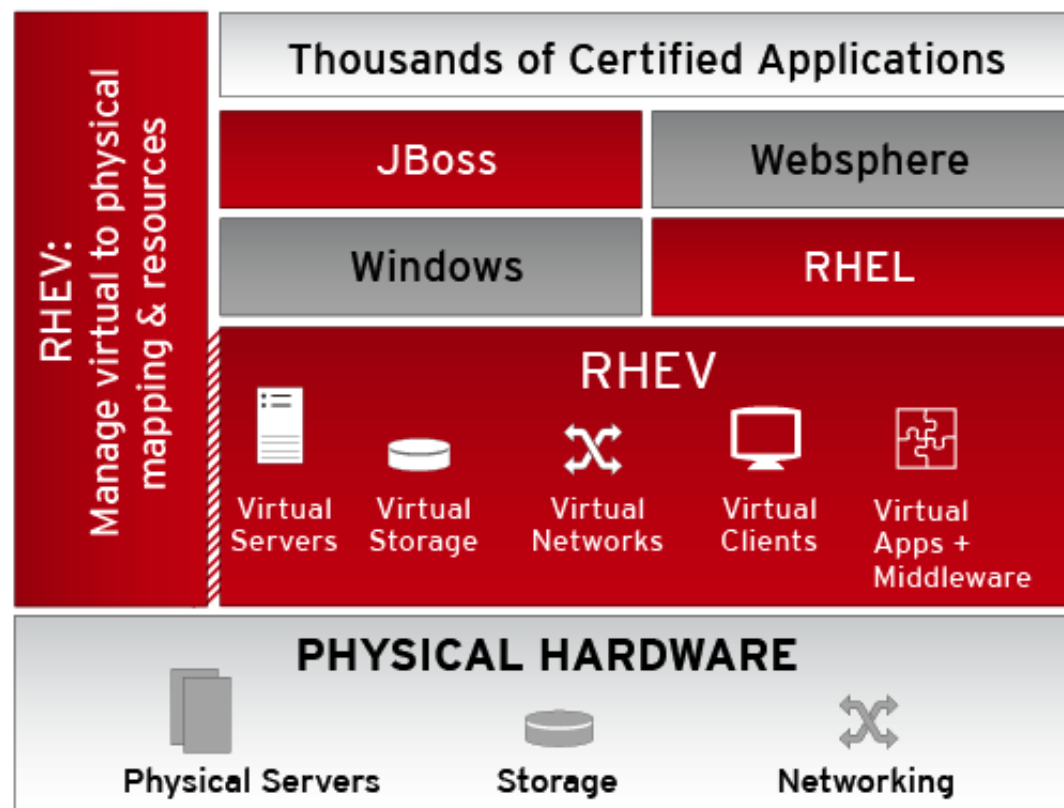


START WITH VIRTUALIZATION

The Only x86 Virtualization Designed Specifically for Cloud Environments

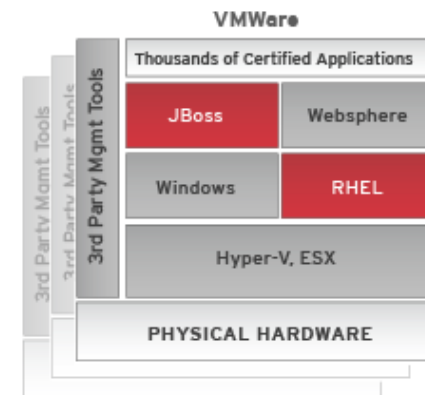
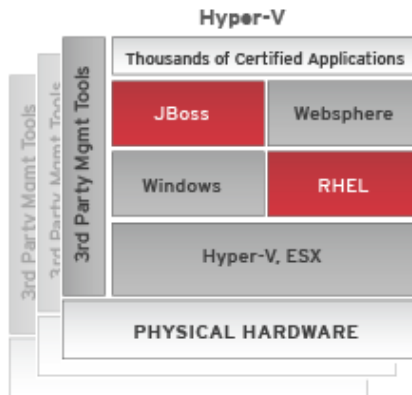
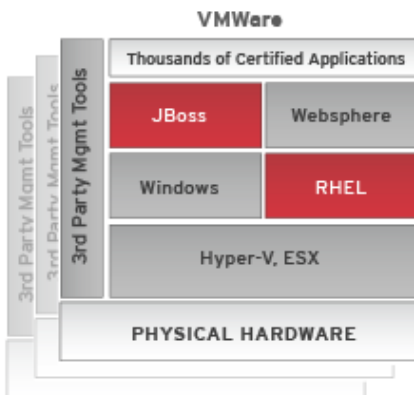
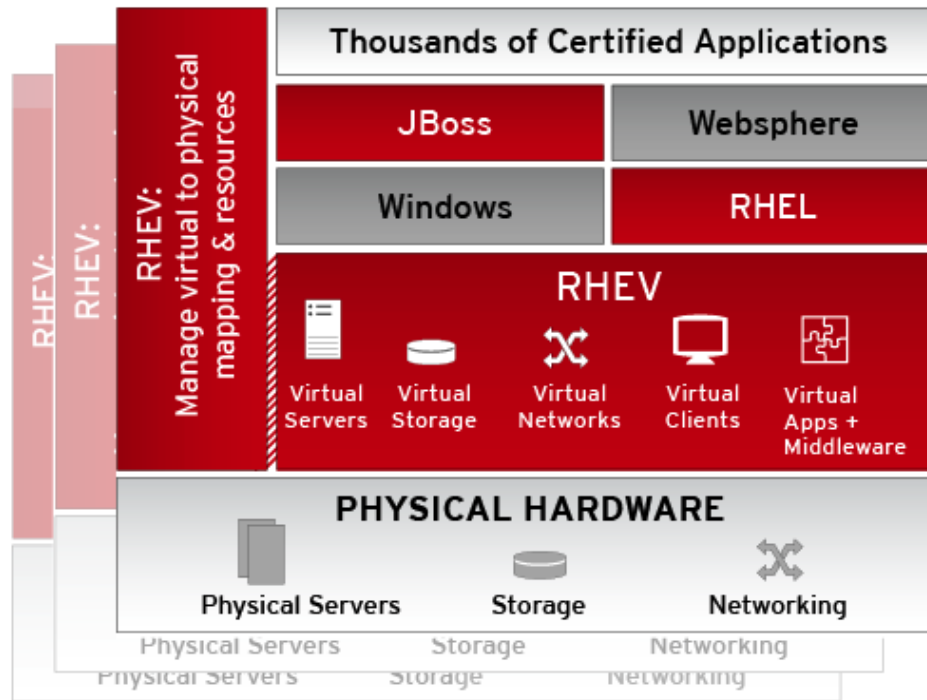
- Quality of service (QoS) protection
- Granular, policy-based security in the kernel
- Industry-leading reliability, availability, scalability (RAS)
- Exceptional performance

RED HAT ENTERPRISE VIRTUALIZATION

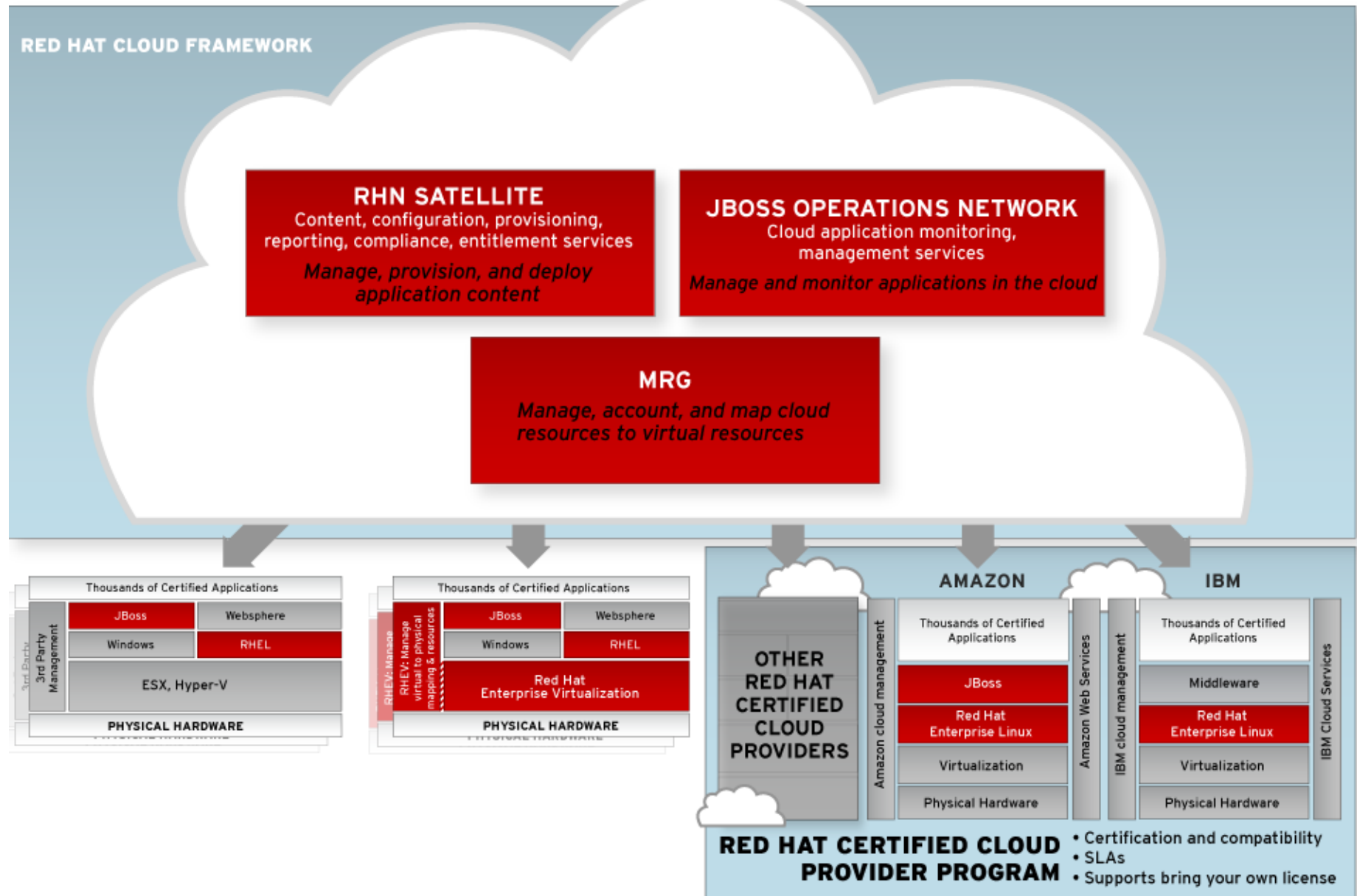


GROW YOUR VIRTUALIZATION DEPLOYMENT

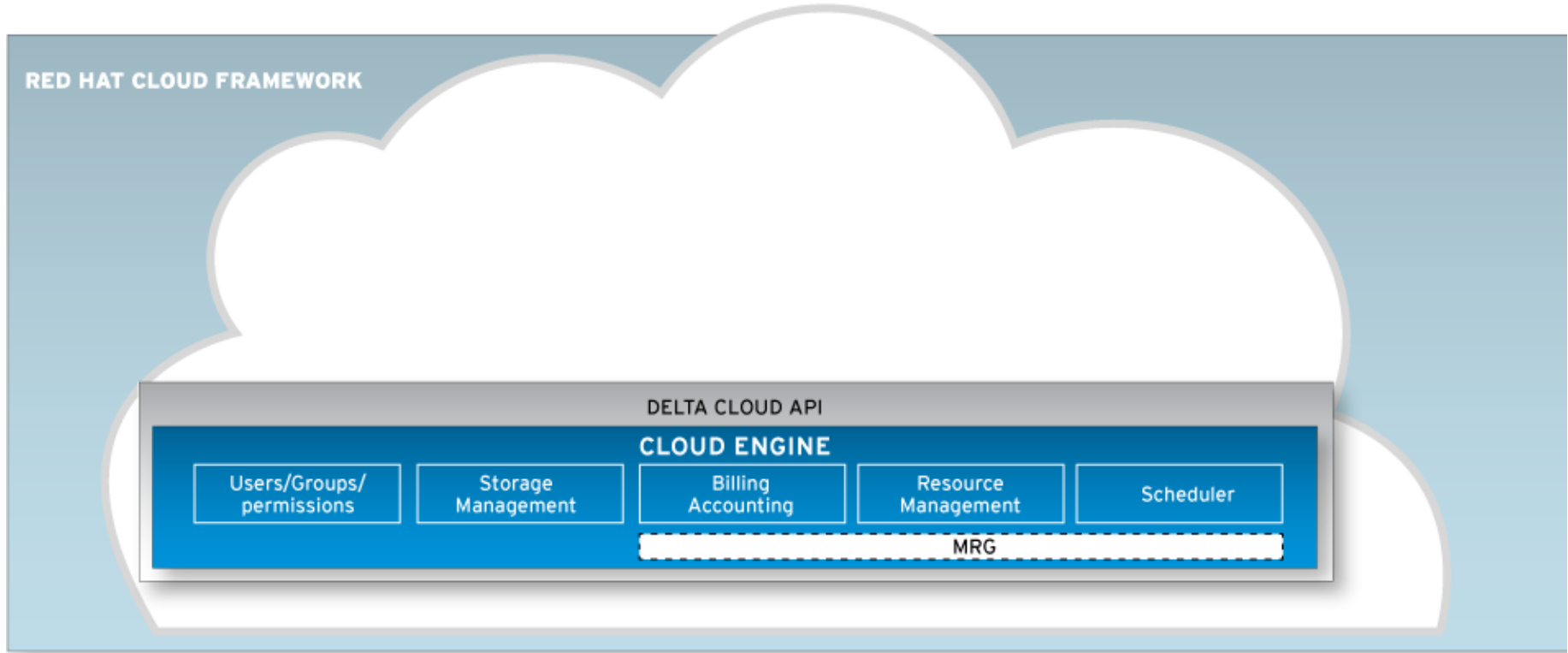
RED HAT ENTERPRISE VIRTUALIZATION



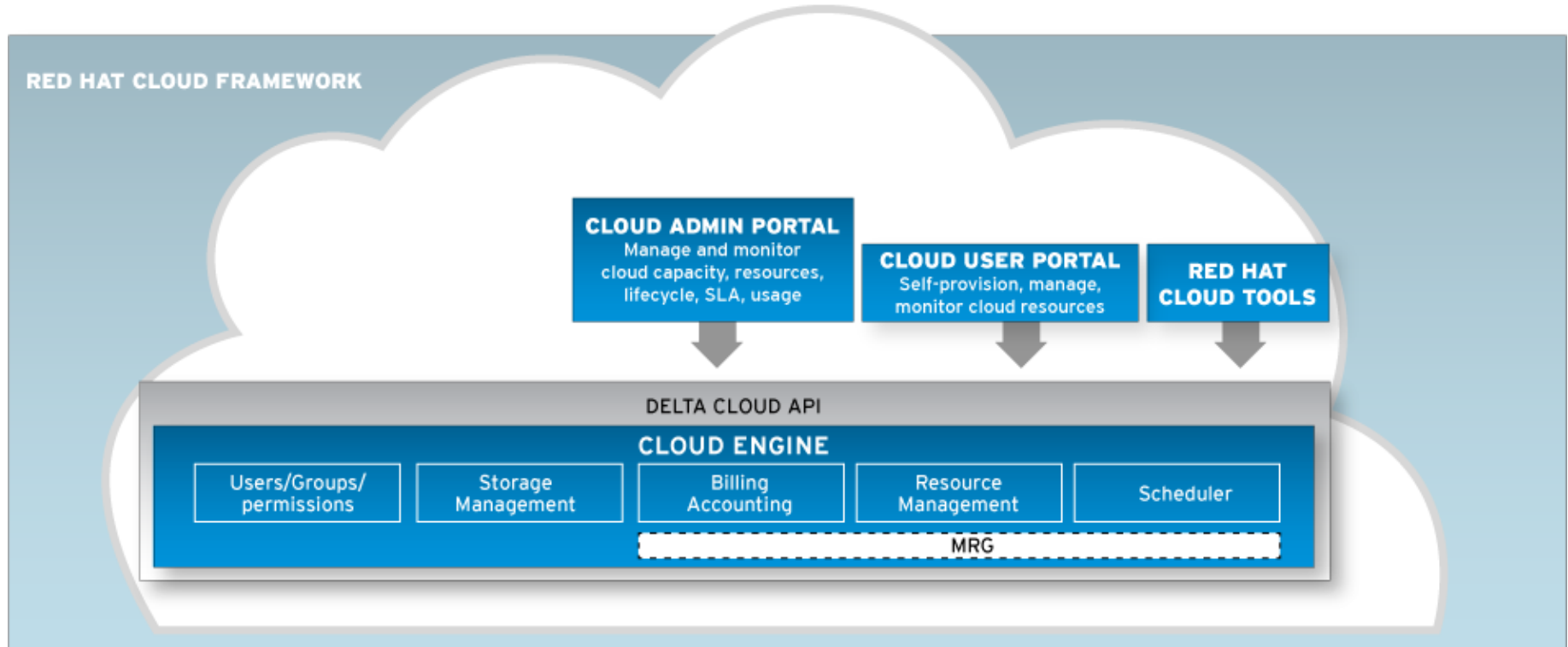
BUILD A PRIVATE CLOUD



ROADMAP TO GREATER AGILITY

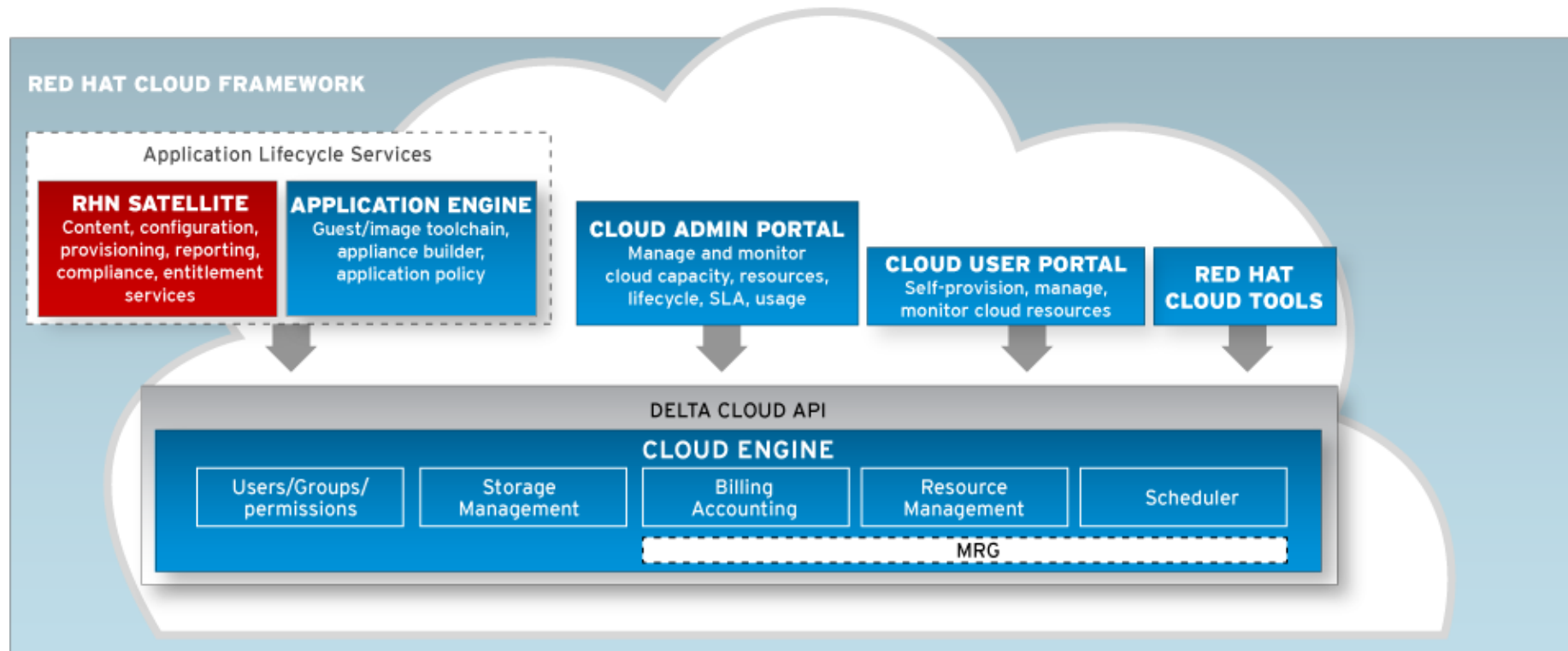


ROADMAP TO GREATER AGILITY



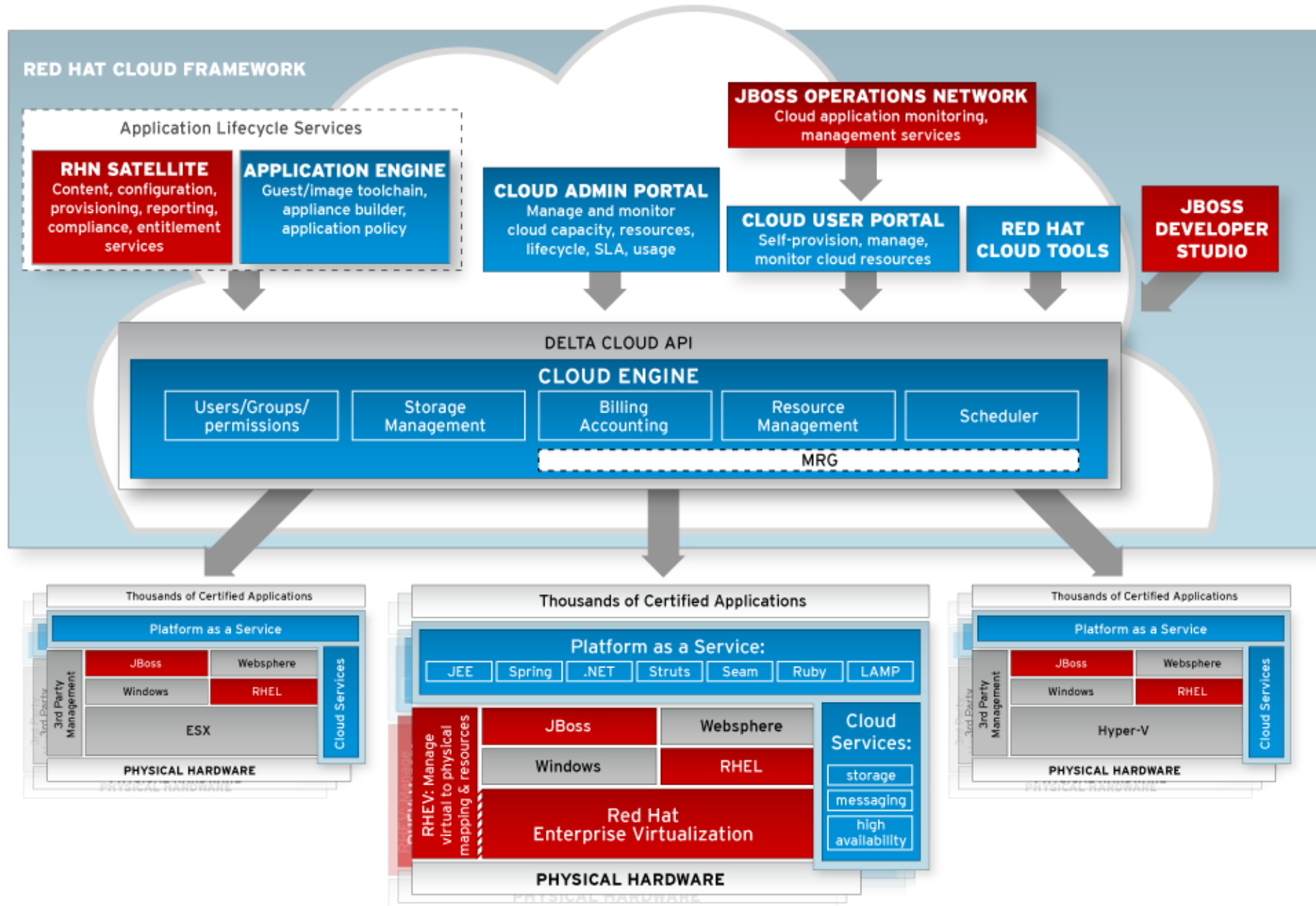
PHASE 2: AUTOMATE

ROADMAP TO GREATER AGILITY

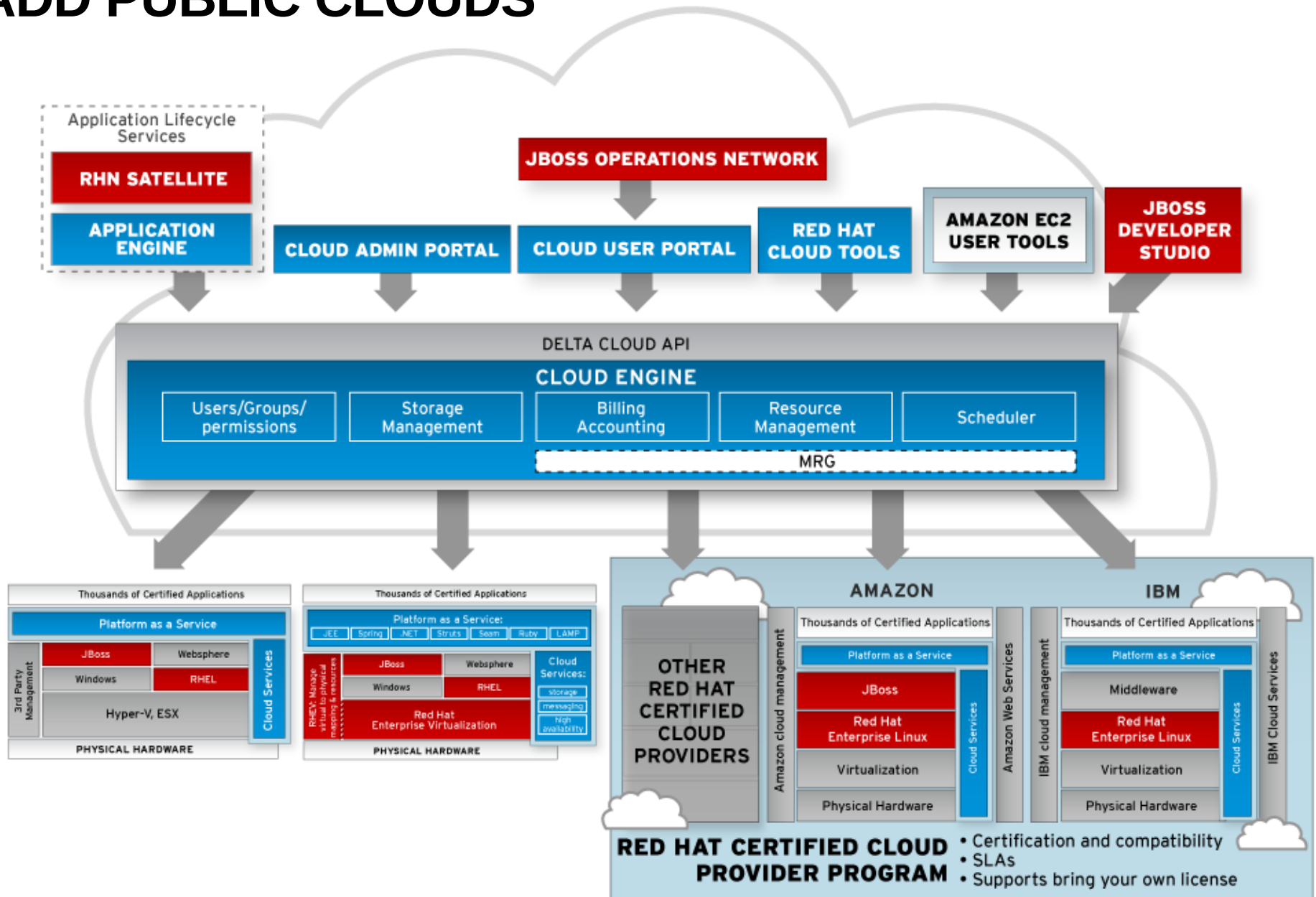


PHASE 2: AUTOMATE

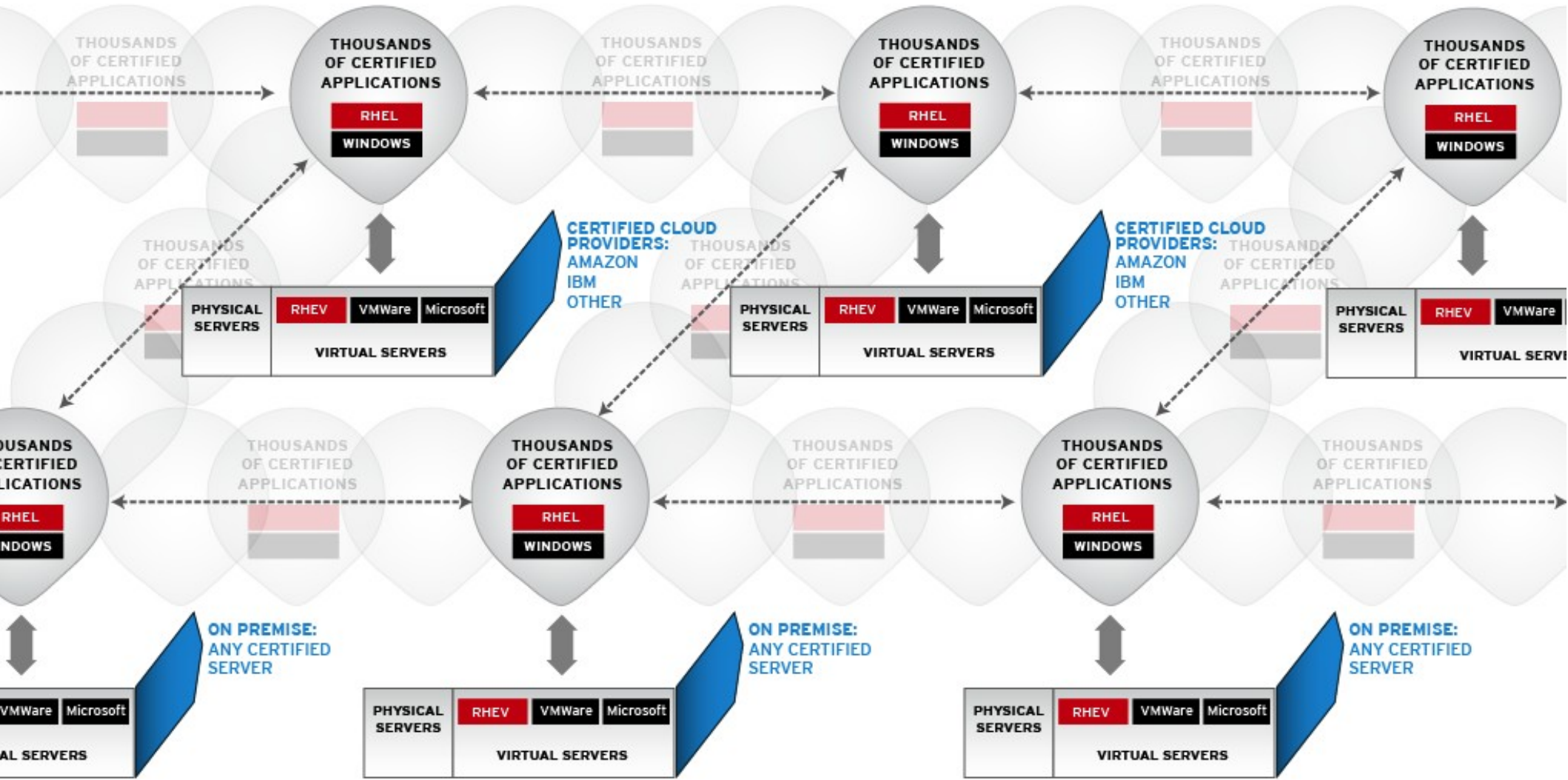
ROADMAP TO GREATER AGILITY



ADD PUBLIC CLOUDS



LEADING THE INDUSTRY WITH A UNIQUE AND EXTENSIVE CERTIFIED CLOUD ECOSYSTEM



LEADING THE INDUSTRY WITH A UNIQUE AND EXTENSIVE CERTIFIED CLOUD ECOSYSTEM

Red Hat Certified Cloud Provider

RHEL and JBoss certified applications are compatible with a certified Cloud.

The vendors have done extensive testing and passed rigorous certification criteria.

A support network has been established to provide reliable, seamless enterprise support across vendors.

Security and other image updates are easily available.

Buy RHEL and JBoss by the hour.

Red Hat Premier Certified Cloud Provider

All the advantages of a Certified Cloud Provider, plus:

- Unique Cloud Access feature allows easy transfer of Red Hat subscriptions between in-house servers and public clouds.
- Confidence that the Cloud is built on the most scalable, secure virtualization infrastructure available, designed specifically for multi-tenant environments.



BEST PRACTICES: WHICH WORKLOADS TO START

Good candidates

Non-critical (dev/test)

Uneven load

Lower data requirements (less data, less security/regulation)

Computationally intensive

Challenging candidates

Apps with complex security, privacy, regulation issues

Extremely performance-sensitive

Data intensive

Legacy

Just as Red Hat Enterprise Linux today powers the most demanding mission-critical applications, so Clouds will in the future.



PRODUCTS

A blue-tinted landscape photograph showing rolling hills and fields under a cloudy sky. The word "PRODUCTS" is overlaid in white text on the left side of the image.

RED HAT ENTERPRISE VIRTUALIZATION (RHEV)

High performance, feature-rich virtualization management platform

Key benefits

Highly scalable

Secure and reliable

Support for Windows and Linux virtual machines

High availability

Live Migration

Dynamic workload management

Leverage RHEL hardware and software ecosystem

Cloud highlights

Proven security and reliability of RHEL

Includes features to maximize density and efficiency

- Thin provisioning
- CPU overcommit
- Memory overcommit
- Templating
- Dynamic resource management

Large ecosystem of certified hardware and software

The world's largest cloud providers build their clouds on RHEV



RED HAT ENTERPRISE MRG

High performance distributed computing platform

Key benefits

Reliable, high performance AMQP messaging

Realtime Linux for deterministic performance

Grid for HPC and utility computing workloads

Integrated capabilities for best performance, features, management

Cloud highlights

MRG Messaging provides inter-node communication and data distribution in the cloud

MRG Messaging provides scalable infrastructure for cloud eventing, management, and monitoring

MRG Grid provides HPC scheduling across clouds

MRG Grid provides resource management, scheduling, accounting for cloud engine



RED HAT ENTERPRISE LINUX (RHEL)

**Scalable, high performance
operating environment**

Key benefits

Multi-architecture support
with broad hardware support

Integrated virtualization

Integrated high availability

Leading OEM and ISV Support

World-class enterprise support

Flexible systems management

Cloud highlights

Cloud infrastructure foundation

Core virtualization management
infrastructure

Guest operating environments
with ISV ecosystem support

Leading guest operating system
for leading cloud providers



RED HAT NETWORK SATELLITE

Highly scalable lifecycle management of Red Hat Enterprise Linux systems

Key benefits

Scale logically, locally and globally with your IT infrastructure

Scheduled provisioning, installation and update

Templatable, flexible provisioning and configuration

Deep and broad APIs to integrate with existing infrastructure management applications

Cloud highlights

Satellite APIs provide rich mechanism to integrate cloud content management processes

Satellite provides multi-tenant capabilities to divide and organize large groups of systems, both physical and virtual

Satellite templates allow groups of systems to remain compliant, consistent and secure

Satellite provides reports to track inventory and content compliance



JBoss Operations Network

Integrated JBoss management

Key benefits

Application lifecycle management

Availability and performance management

Single integrated console to provide visibility for entire JBoss stack

Positioned for use across dev, test, infrastructure, and production teams and environments

Positioned today to address both admin and ops use cases for application managers

Cloud highlights

JON provides operational visibility and control of JBoss middleware in the cloud

JON provides ability to deploy applications (current), application containers (soon) essential for building out JBoss deployments in the cloud

JON provides monitoring of applications in the cloud

JON provides flexibility to extend JBoss management to 3rd party vendor products.



JBoss Enterprise Middleware

Comprehensive Java Middleware portfolio

Key benefits

Process management

Service integration and high-speed messaging (SOA-P)

Data integration (EDS)

User interaction services (EPP)

Systems management and monitoring (JBoss Operations Network)

Integrated development tooling (JBoss Developer Studio)

Cloud highlights

Cloud-ready runtimes from lightweight to enterprise-scale

Open Choice allows you to choose development frameworks that meet your needs, and preserve your investment in applications and skills

Broad portfolio to cover use cases from front-end UI to integration & data services

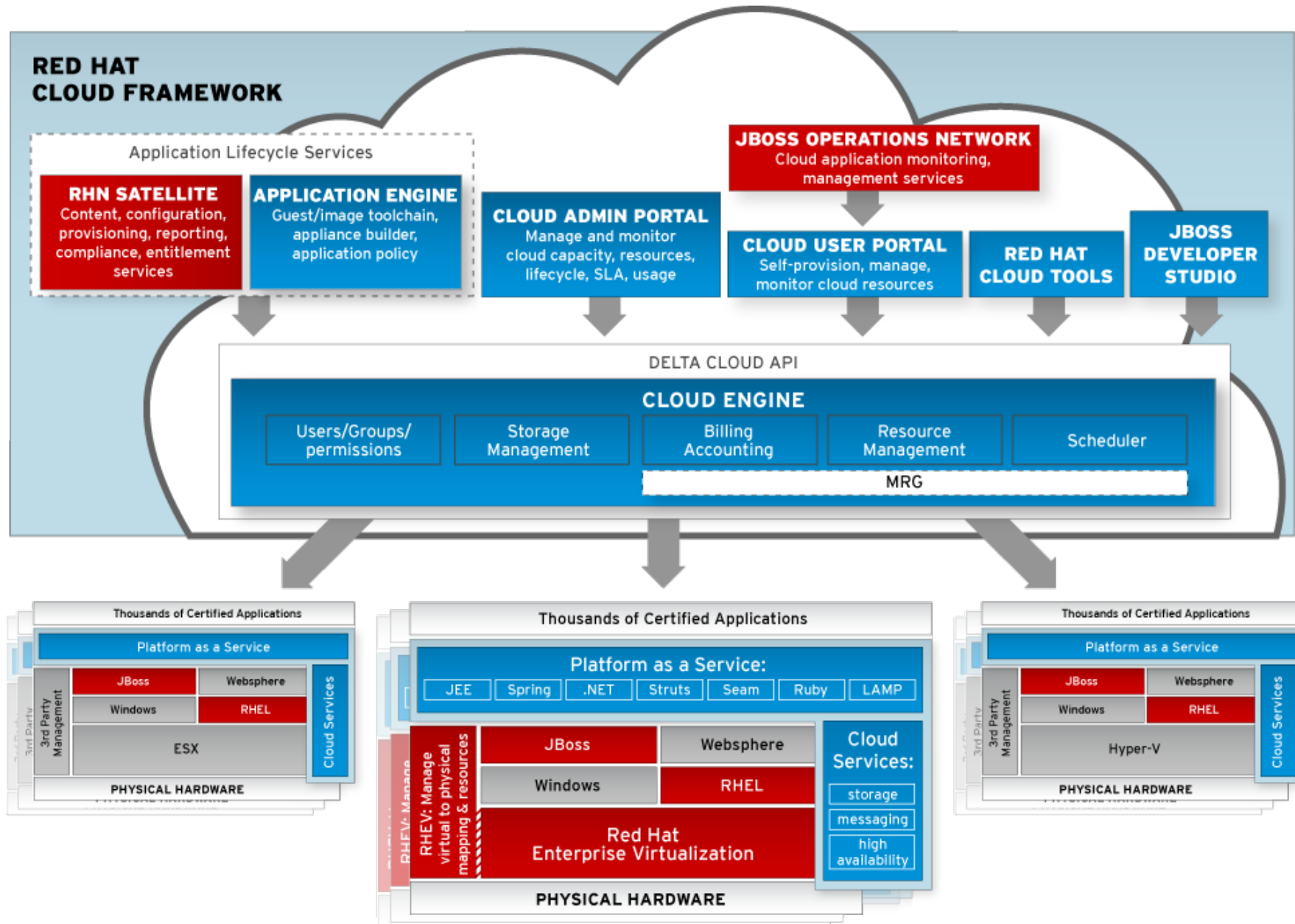
Tools for appliance creation, configuration, and deployment in house, or to the cloud



CLOUD ROADMAP

The image features a monochromatic blue color scheme. The background is a vast, dense field of clouds, viewed from an elevated perspective, creating a textured, undulating landscape. The clouds are more prominent in the foreground and middle ground, while the background shows a flatter expanse of clouds meeting a dark, clear sky. The text 'CLOUD ROADMAP' is positioned in the upper left quadrant, rendered in a clean, white, sans-serif font.

CLOUD ROADMAP ARCHITECTURE REVIEW



CLOUD ENGINE

Maps cloud resources to various virtualization and public cloud resources

Key benefits

Users, Groups, Permissions

Storage Management

Resource Management

Billing, Accounting

Scheduling



APPLICATION ENGINE

Provides tools for building images and application appliance for the cloud

Key benefits

Makes creating, updating, deploying applications easy

Builds and deploys to multiple virtualization and cloud targets

Groups applications and services as bundles (e.g. 5 app servers with 1 database)

Provides intuitive Web-based interface

Integrates with RHN Satellite and other content sources



API that abstracts the differences between clouds

Key benefits

Provides an API that standardizes the capabilities of clouds

Enables heterogeneous cloud and virtualization deployments—just provide a Deltacloud driver for each cloud you want to manage

Enables compatibility with 3rd party cloud tools

Simplifies cloud service and application writing for ISV's and SaaS providers



CLOUD SERVICE: STORAGE

Cloud-aware table storage services for

- **Archival data: User-data and guest-images and snapshots compatible with Amazon S3, for any (internal & external) cloud deployment**
- **Operational data: Elastic block storage API's compatible with Amazon EBS**

Key benefits

S3 compatible APIs

EBS compatible APIs

Tabled storage on RHEL/RHEV

Daemon based storage on non RHEL/RHEV cloud

Meta data daemons and repository to managing the storage domains.



CLOUD SERVICE: INTER-NODE MESSAGING

Cloud-aware messaging to facilitate instance-to-instance and instance-to-external communication compatible with Amazon SQS, for any (internal & external) cloud deployment

Key benefits

Amazon SQS compatible REST API on MRG Messaging

Cloud ready ACL/authentication to manage secured domains

Additional API bindings available for AMQP from MRG Messaging



CLOUD SERVICE: NODE & INSTANCE AVAILABILITY

REST API's that allow applications and administrators to inspect instances and know the active state and configuration.

Key benefits

REST API for instance state (up/ down, uptime)

REST API to enumerate instances & configuration

Can be scripted to/ used internal and external to cloud

Provides the basis for Cloud HA service



CLOUD SERVICE: HIGH AVAILABILITY

Actively maintain and manage application availability when run in a cloud.

Key benefits

Failure detection and restart of applications in a cloud

Notifications of application failures and restarts

Configuration and dependency updates manage application failures

'Think of it as cluster suite for the cloud'



RED HAT PLATFORM AS A SERVICE (PaaS)

DEVELOPMENT APPLICATION PORTABILITY & APPLIANCE ASSEMBLY

Deploy directly from IDE to cloud, or package existing workloads for portability between in-house and cloud deployment targets

Cloud-Services Packager aids in the development of portable application appliances for any target deployment environment



DEPLOYMENT CONFIGURE- TO-ORDER RUNTIME SERVICES

Red Hat PaaS Foundation Services: Deploy apps to the right set of pre-configured and run-ready services on the cloud

JBoss modular services, deployed as ready-built runtime appliances available for assembly under new or existing workloads in the cloud



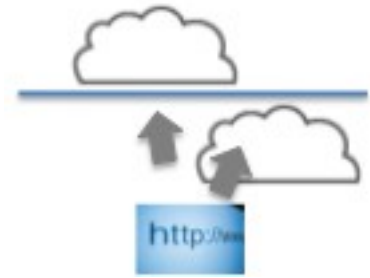
MANAGEMENT LAYERED MANAGEMENT FOR SYSTEM CONTROL

Cloud-ready appliances pre-configured for client management, wired to cloud-specific elastic load balancing & provisioning

Manage instances, groups, clusters and connections with cloud-based management services to achieve scalable, layered management



RED HAT PaaS - DEVELOPMENT



- JBoss Developer Studio Cloud-Deploy Extensions
 - Allows developers to deploy to on-premise and external cloud environments from the IDE
 - Applications made portable for deployment to any, or many targets
 - Can be configured for on-premise or hosted clouds
- Cloud Engine – Create your own cloud appliances
 - Bundle configuration, application artifacts, and other metadata into a single, deployable package
 - Streamline application lifecycle with versionable images
 - Use alone, or as Part of Red Hat Appliance Builder



RED HAT PaaS - DEPLOYMENT



- Red Hat PaaS Foundation Services
 - Modular middleware services, ready to run in on-premise or on hosted cloud environments
 - N-Tier service profiles to accommodate sophisticated topologies
 - Most complete middleware reference architecture



- Fit-to-task middleware services are assembled on deploy
 - Red Hat Cloud Engine Application Extension assemble the right components to host the load
 - Working toward greater service granularity, and intelligent service assembly, defined by the needs of the workload



RED HAT PaaS - MANAGEMENT



- Ready-to-manage service profiles
 - Pre-deployed JBoss-ON agents make post-deploy management a breeze
 - Standards-based interfaces for cloud-resident monitoring & management
- Elastic scaleout
 - Pre-configured load balancer
 - Tested with popular resident high availability technologies
- Security management
- Layer management from the instance to the group, or cluster
 - Tame management complexity
 - Manage on-premise, on-cloud, or across boundaries
- Monitoring



KEY OPEN SOURCE PROJECTS

Key Open Source Projects Include

Deltacloud <http://deltacloud.org>

Condor <http://www.cs.wisc.edu/condor/>

Project Hail <http://hail.wiki.kernel.org/>

Apache Qpid <http://qpid.apache.org/>

StormGrind <http://www.jboss.org/stormgrind.html>

Additional Project Information

Red Hat Cloud Computing Forum <http://www.redhat.com/cloudcomputingforum/>

