# Management and Monitoring

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# Agenda

- Monitoring
  - JDK tools, System tools, WildFly specifics
- WildFly history and overview
- WildFly 10
  - Architecture, Domain Model,RBAC
- WildFly Swarm
- WildFly 10 Management
  - CLI / Scripting + Java API + HTTP API
  - WebUI
- RHQ, Hawkular
- Openshift



# Monitoring – motivation

You are using WildFly 10, so bright future lies ahead ...

Really?

We will learn how to do some basic investigation and JVM monitoring.



# JDK tools - JAR level investigation

- List files in given jar archive
  - jar
  - unzip
- Disassemble the class file
  - javap



# JDK tools – process

- List of JVMs
  - jps -l [-m -v]
  - JDK specific



# JDK tools – memory

- Memory map
  - jmap
    - Show heap, create heap dump
- Analyze heap dump
  - jhat
    - Parses a java heap dump, launches a webserver to browse the dump



# JDK tools – stack trace and JVM stats

- Java stack traces of threads
  - jstack
    - stack traces of Java threads for a given Java process, core or remote server
    - for investigating thread locking issues
- JVM statistics monitoring
  - jstat



# JDK tools – GUI

## jconsole

- Heap and Non-Heap memory usage, CPU usage, VM summary
- Number of threads and classes, stack trace for each thread
- MBeans details

## VisualVM (jvisualvm before)

- Nicer look & feel, based on NetBeans platform
- Heap and PermGen memory usage, CPU usage, VM summary
- Number of threads and classes, details for each thread, not stack trace
- Lightweight CPU and memory profiling + sampling



# System information

- OS version
- Memory usage
- Disk space
- Processes
- Network – traffic and ports



# WildFly specifics

## JDR - JBoss Diagnostic Reporter

- $WF_HOME/bin/jdr.sh [.bat]
- JBoss specific tool for diagnostic
- add at least one user into ManagementRealm using bin/add-user.sh

## jconsole

- $WF_HOME/bin/jconsole.sh [.bat]
- Jconsole with added WildFly management extension (JBoss Remoting + JSR 160)



# Advanced tools

- your IDE debugger
- your IDE profiler
- JProfiler - http://www.ej-technologies.com/products/jprofiler/overview.html
- Java Decompiler - http://java.decompiler.free.fr/
- TDA - Thread Dump Analyzer - http://java.net/projects/tda/
- MAT - Memory Analyzer - http://www.eclipse.org/mat/

- Wireshark - http://www.wireshark.org/



# WildFly history and overview

- Named JBoss AS before
- Why was AS7 rewritten from scratch?
  - Legacy subsystems
  - Boot time
  - Memory footprint
  - Bad modularity
  - Administration options
  - Not “good enough”



# WildFly history and overview

- Wildfly 8
  - Builds on top of JBoss AS7
  - Small and even #@*%ing faster
  - No legacy stuff
  - Better manageability
  - Multi-node management
  - Simplified configuration
  - Modular



# WildFly history and overview

- Wildfly 9
  - HTTP/2 Support
  - Front End Load Balancer Support
  - Graceful Shutdown
  - WildFly Swarm
- Wildfly 10
  - Java 8+
  - ActiveMQ Artemis
  - JavaScript Support with Hot Reloading



# WildFly 10 Architecture

- **core**
- **extensions** to the core
- **clients** for management interface
  - CLI and web based management console



# Core

- jboss-modules
  - is the first thing started
  - modular and concurrent classloading
  - O(1) dependencies resolution
  - Module sees only its imports
- jboss-msc: modular service container
  - Everything is (interface based) service
  - Services are deployed on demand and in parallel
- Extensible management layer
  - Mediate access to service container
  - Provides configuration model for the AS



# Domain vs. standalone

## Standalone

- Traditional JBoss single JVM server
- Managed individually: 1 configuration file
- No lifecycle management, just shutdown
- Development and embedded solutions

## Domain

- Multi-JVM, multi-server model
- Lifecycle managed by Process Controller (PC)
- Management coordinated by Domain Controller (DC)
- Multiple server instances per host managed by Host Controller (HC)
- HC on master node is DC

**The only difference between domain and standalone is in how severs are managed, not in the capabilities**

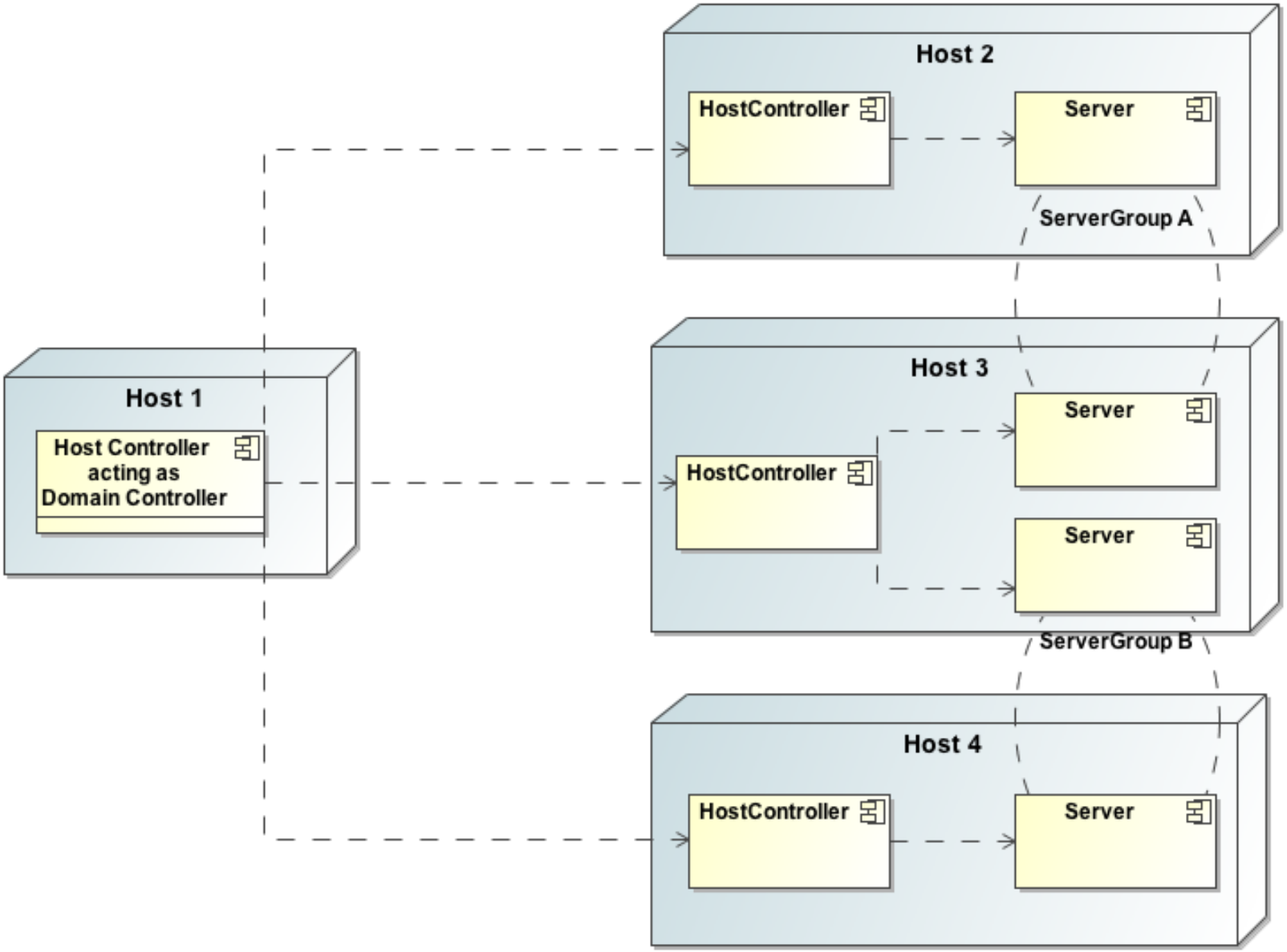


# Domain model: key goals

- manage multiple servers via a single control point
  - configure a cluster, start/stop nodes in a cluster, deploy an application to all nodes in the domain,...
- end user configuration centralized in a few files
- schema files for all configurations
- everything in the configuration is exposed via management API



# Domain model






# Domain model - terms

- **server** - one AS instance
- **server group** - set of server instances that will be managed and configured as one
- **cluster** - server group with group communication services configured
- **module** - classloading space, grouping of classes in some jar(s)s
- **subsystem** - block of configuration, has its own namespace, basically some grouping of services
- **profile** - set of subsystems



# Role Based Access Control (RBAC)

- Different users have different sets of permissions to read and update parts of the management tree
- Replaces the simple permission scheme used in JBoss AS 7, when authenticated user have all permissions

- **Role** - named set of permissions ( read, modify management resource
- Mapping users and groups to roles
- https://docs.jboss.org/author/display/WFLY10/RBAC



# RBAC roles

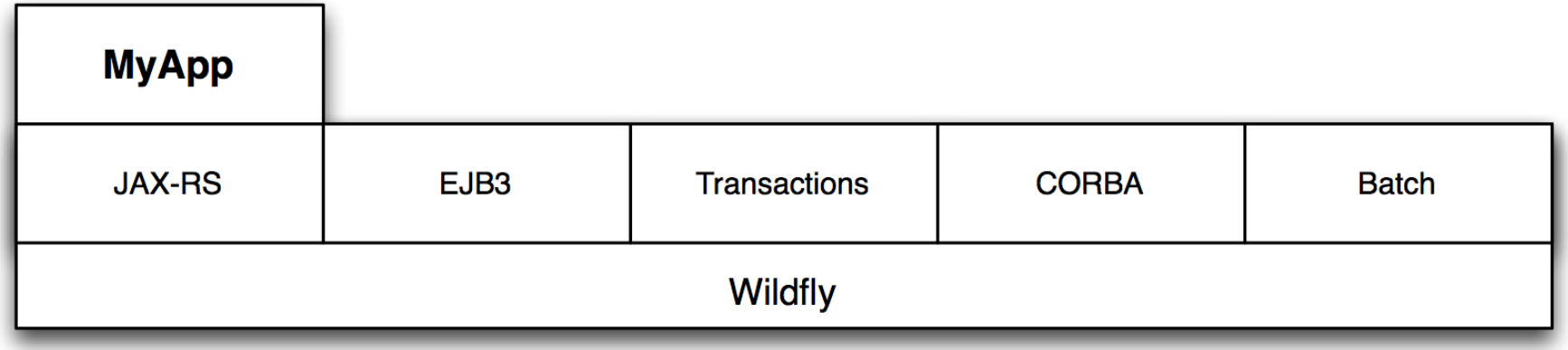
- Not given permissions for "security sensitive" items:
  - **Monitor** – read only
  - **Operator** – Monitor + modify runtime state
  - **Maintainer** – Operator + modify persistent config.
  - **Deployer** – Operator + modify "application resources"

- Given permissions for "security sensitive" items:
  - **SuperUser** – all permissions ( == JBoss AS 7 admin)
  - **Administrator** – all permissions except cannot read or write resources related to the administrative audit logging system
  - **Auditor** – can read anything. Can only modify the resources related to the administrative audit logging system.

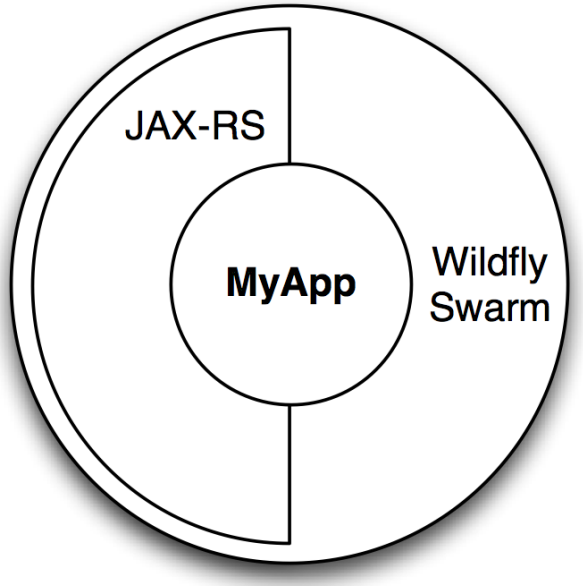


# WildFly Swarm

- Monolithic App server
  - Traditional model – more functionality than needed




- WildFly Swarm Uberjar
  - Just enough app server
  - Smaller usage of resources
  - Microservices






# WildFly Swarm

- Fraction
  - well-defined collection of capabilities to add, (in most cases maps directly to WF subsystem)
- Uberjar
  - A self-contained,

    executable Java archive
- Requires JDK 8+
- Maven
- http://wildfly-swarm.io

```
<dependency>
  <groupId>org.wildfly.swarm</groupId>
  <artifactId>jaxrs</artifactId>
</dependency>
```

```
<plugin>
  <groupId>org.wildfly.swarm</groupId>
  <artifactId>wildfly-swarm-plugin</artifactId>
  <executions>
    <execution>
      <goals>
        <goal>package</goal>
      </goals>
    </execution>
  </executions>
</plugin>
```

```
java -jar MyApp-swarm.jar
```



# Management

- The problem: management model too large and complex
- The requirements for the API:
  - Simple, powerful, stable
  - As few compile time and runtime dependencies as possible
  - Backward compatibility

- WF uses de-typed management API and a small library:

  jboss-dmr.jar



# DMR – dynamic model representation

- https://github.com/jbossas/jboss-dmr
- https://docs.jboss.org/author/display/WFLY10/Detyped+management+and+the+jboss-dmr+library
- All management operations operate with/on DMR
- Compatibility is stressed
- Convertible from/to JSON

- Wildfly Model Reference Documentation:
  - https://wildscribe.github.io/index.html



# Java API

- Native management interface uses an open protocol based on the JBoss Remoting library
- The management protocol is an open protocol, so a completely custom client could be developed without using prepared libraries (e.g. using Python or some other language)

- Maven artifact org.wildfly.core:wildfly-controller-client

- https://docs.jboss.org/author/display/WFLY10/The+native+management+API



# Java API

```
ModelControllerClient client = ModelControllerClient.Factory.
        create(InetAddress.getByName("localhost"), 9999);

ModelNode op = new ModelNode();
op.get("operation").set("read-resource");
op.get("recursive").set(true);
op.get("include-runtime").set(true);
op.get("recursive-depth").set(10);

ModelNode returnVal = client.execute(op);
System.out.println(returnVal.get("result").toString());
client.close();
```



# HTTP API

- http://localhost:9990/management
- Sometimes called REST API
- HTTP request in JSON like format
- The default operation is read-resource
- add user into ManagementRealm using bin/add-user.sh

- https://docs.jboss.org/author/display/WFLY10/The+HTTP+management+API
- https://community.jboss.org/wiki/HTTPJSON-likeAPI



# CLI

- Command line management tool for the WF server
- Command bin/jboss-cli.sh or bin/jboss-cli.bat
- Interactive mode
- Non-interactive mode
- Batch mode
- GUI mode
- Operations based on model



# CLI

```
$ ./bin/jboss-cli.sh --connect controller=IP_ADDRESS
[standalone@IP_ADDRESS:9999 /] /system-property=foo:add(value=bar)
[standalone@IP_ADDRESS:9999 /] /system-property=foo:read-resource
{
    "outcome" => "success",
    "result" => {"value" => "bar"}
}
[standalone@IP_ADDRESS:9999 /] /system-property=foo:remove
{"outcome" => "success"}
```

```
[domain@IP_ADDRESS:9999 /] /system-property=foo:add(value=bar)
[domain@IP_ADDRESS:9999 /] /system-property=foo:read-resource
[domain@IP_ADDRESS:9999 /] /system-property=foo:remove
```

```
[domain@IP_ADDRESS:9999 /] /host=master/system-property=foo:add(value=bar)
[domain@IP_ADDRESS:9999 /] /host=master/system-property=foo:read-resource
[domain@IP_ADDRESS:9999 /] /host=master/system-property=foo:remove
```

```
[domain@IP_ADDRESS:9999 /] /host=master/server-config=server-one/system-property=foo:add(value=bar)
[domain@IP_ADDRESS:9999 /] /host=master/server-config=server-one/system-property=foo:read-resource
[domain@IP_ADDRESS:9999 /] /host=master/server-config=server-one/system-property=foo:remove
```

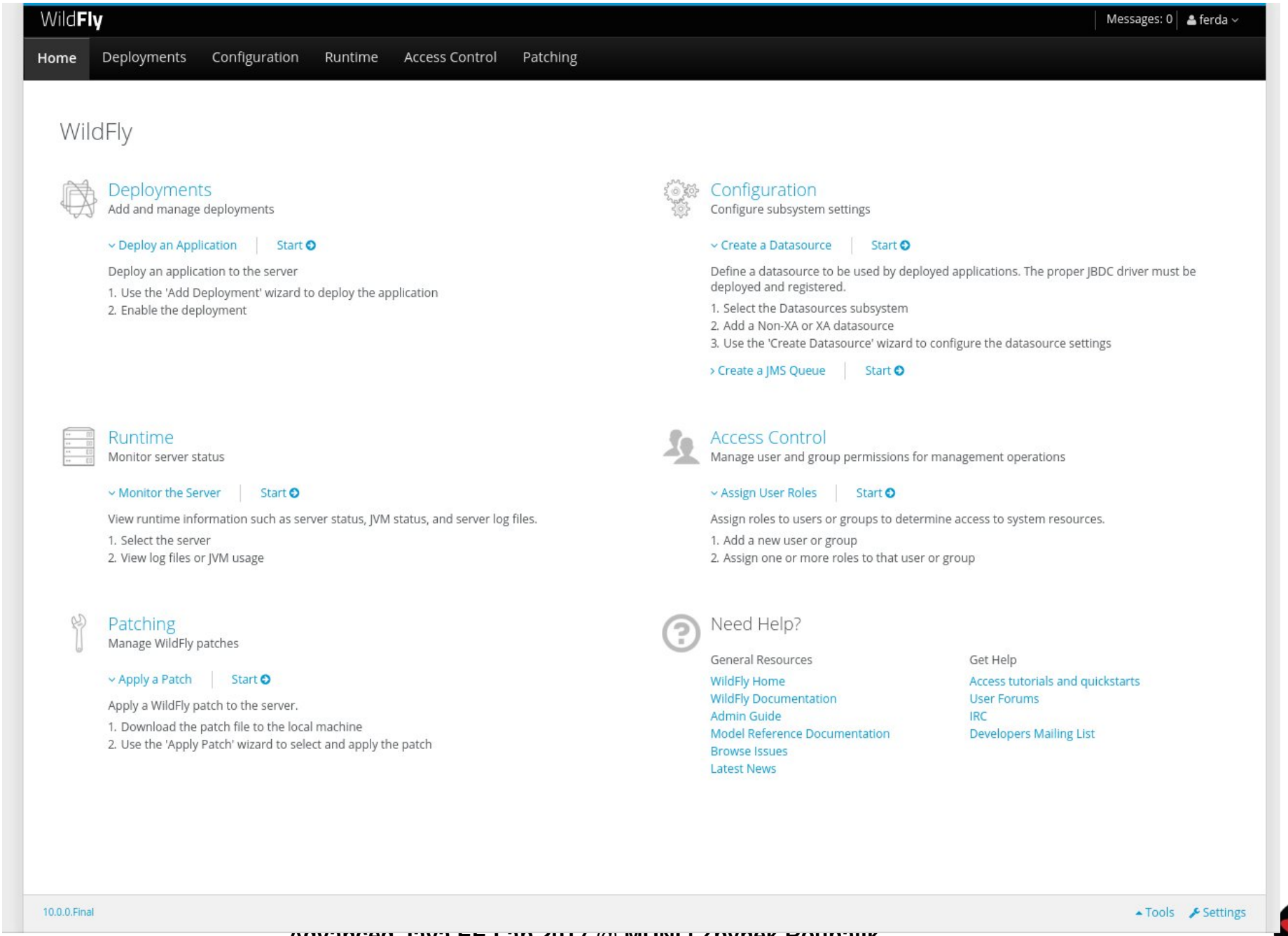


# CLI

- https://community.jboss.org/wiki/CommandLineInterface
- https://community.jboss.org/wiki/GenericTypeCLICommands
- https://community.jboss.org/wiki/CLICompoundValueFormat
- https://community.jboss.org/wiki/CLINon-interactiveMode
- https://community.jboss.org/wiki/CLIBatchMode
- https://docs.jboss.org/author/display/WFLY10/CLI+Recipes



# Web console


WildFly
Messages: 0
ferda
Home
Deployments
Configuration
Runtime
Access Control
Patching
WildFly
Deployments
Add and manage deployments
Deploy an Application
Start
Deploy an application to the server
1. Use the 'Add Deployment' wizard to deploy the application
2. Enable the deployment
Configuration
Configure subsystem settings
Create a Datasource
Start
Define a datasource to be used by deployed applications. The proper JBDC driver must be deployed and registered.
1. Select the Datasources subsystem
2. Add a Non-XA or XA datasource
3. Use the 'Create Datasource' wizard to configure the datasource settings
Create a JMS Queue
Start
Runtime
Monitor server status
Monitor the Server
Start
View runtime information such as server status, JVM status, and server log files.
1. Select the server
2. View log files or JVM usage
Access Control
Manage user and group permissions for management operations
Assign User Roles
Start
Assign roles to users or groups to determine access to system resources.
1. Add a new user or group
2. Assign one or more roles to that user or group
Patching
Manage WildFly patches
Apply a Patch
Start
Apply a WildFly patch to the server.
1. Download the patch file to the local machine
2. Use the 'Apply Patch' wizard to select and apply the patch
Need Help?
General Resources
WildFly Home
WildFly Documentation
Admin Guide
Model Reference Documentation
Browse Issues
Latest News
Get Help
Access tutorials and quickstarts
User Forums
IRC
Developers Mailing List
10.0.0.Final
Tools
Settings



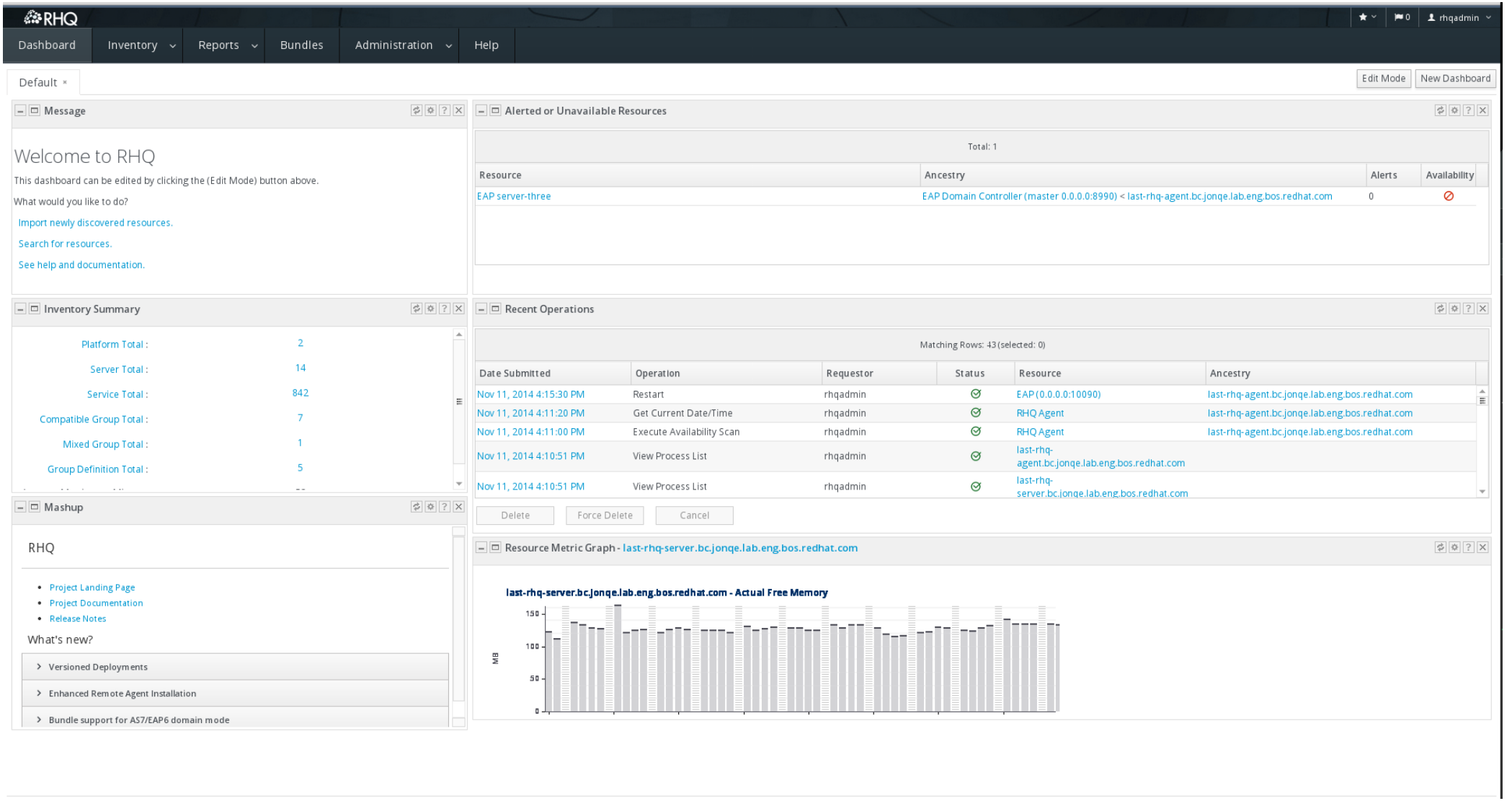
# RHQ

- RHQ is an enterprise management solution for JBoss middleware projects, Tomcat, Apache Web Server, etc.
- Server-side and agent-side (extendable via plugins)
- Features
  - Inventory – tracking resources (autodiscovery)
  - Configuration – audited, rollback
  - Monitoring – collection of statistics
  - Alerts – to provide notifications of user defined conditions
  - Operations – ability to execute actions against managed resources in the inventory

- https://rhq-project.github.io/rhq/



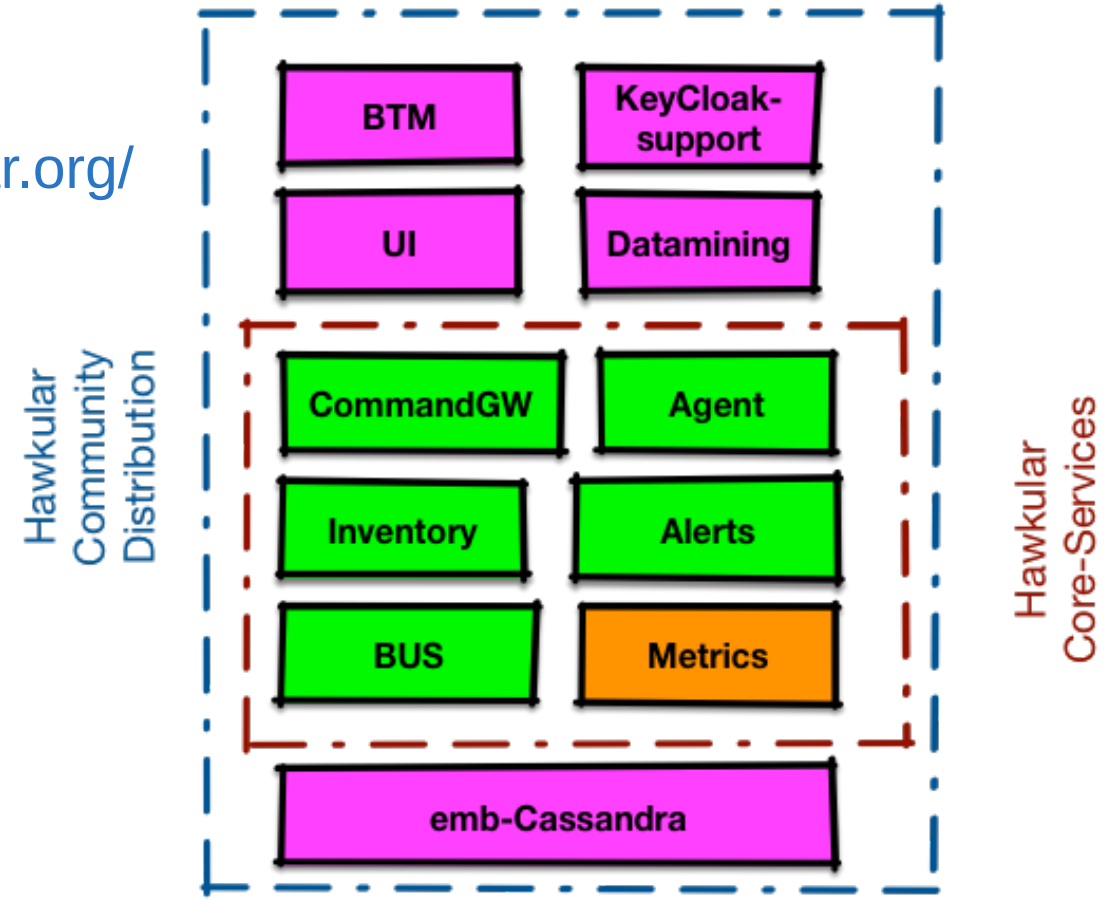
# RHQ


RHQ
rhqadmin
Dashboard
Inventory
Reports
Bundles
Administration
Help
Default
Edit Mode
New Dashboard
Message
Welcome to RHQ
This dashboard can be edited by clicking the (Edit Mode) button above.
What would you like to do?
Import newly discovered resources.
Search for resources.
See help and documentation.
Alerted or Unavailable Resources
Total: 1
Resource
Ancestry
Alerts
Availability
EAP server-three
EAP Domain Controller (master 0.0.0.0:8990) < last-rhq-agent.bc.jonqe.lab.eng.bos.redhat.com
0
Inventory Summary
Platform Total : 2
Server Total : 14
Service Total : 842
Compatible Group Total : 7
Mixed Group Total : 1
Group Definition Total : 5
Recent Operations
Matching Rows: 43 (selected: 0)
Date Submitted
Operation
Requestor
Status
Resource
Ancestry
Nov 11, 2014 4:15:30 PM
Restart
rhqadmin
EAP (0.0.0.0:10090)
last-rhq-agent.bc.jonqe.lab.eng.bos.redhat.com
Nov 11, 2014 4:11:20 PM
Get Current Date/Time
rhqadmin
RHQ Agent
last-rhq-agent.bc.jonqe.lab.eng.bos.redhat.com
Nov 11, 2014 4:11:00 PM
Execute Availability Scan
rhqadmin
RHQ Agent
last-rhq-agent.bc.jonqe.lab.eng.bos.redhat.com
Nov 11, 2014 4:10:51 PM
View Process List
rhqadmin
last-rhq-agent.bc.jonqe.lab.eng.bos.redhat.com
Nov 11, 2014 4:10:51 PM
View Process List
rhqadmin
last-rhq-server.bc.jonqe.lab.eng.bos.redhat.com
Delete
Force Delete
Cancel
Mashup
RHQ
Project Landing Page
Project Documentation
Release Notes
What's new?
Versioned Deployments
Enhanced Remote Agent Installation
Bundle support for AS7/EAP6 domain mode
Resource Metric Graph - last-rhq-server.bc.jonqe.lab.eng.bos.redhat.com
last-rhq-server.bc.jonqe.lab.eng.bos.redhat.com - Actual Free Memory
MB
150
100
50
0



# Hawkular

- Successor of RHQ
  - Set of independent services sharing information over a communication bus
- http://www.hawkular.org/






# Openshift

- Container
- Docker
- Kubernetes
- UI Demo

- https://www.openshift.com/



Thank you for your attention.

Questions?