APACHE GERONIMO

# J2EE Development with Apache Geronimo

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# Agenda

- Lightning Overview & Status Report
- Server Installation & Configuration
- Deployment Tools
- Configuring J2EE Applications for Geronimo
- Q&A

*slides are online for your reference*

# Speaker

- Aaron Mulder
- Geronimo Developer
  - Works on deployment, management, console, kernel, ...
  - Online Geronimo book at http://chariotsolutions.com/geronimo/
- CTO of Chariot Solutions

# Overview & Status

# Overview

- Complete J2EE 1.4 Application Server
- Built on best of breed components (Tomcat/Jetty, OpenEJB, HOWL, etc.)
- Modular architecture (server core plus services grouped into “configurations”)
- Ships with LDAP, Derby DB, sample apps
- Support for Spring, ServiceMix, more...

# Status

- 1.0 released in early January
- J2EE 1.4 Certified, core features ready
- “Draft” of management console
- Initial performance testing complete
- Initial Eclipse, XDoclet support
- Many articles out and books available soon

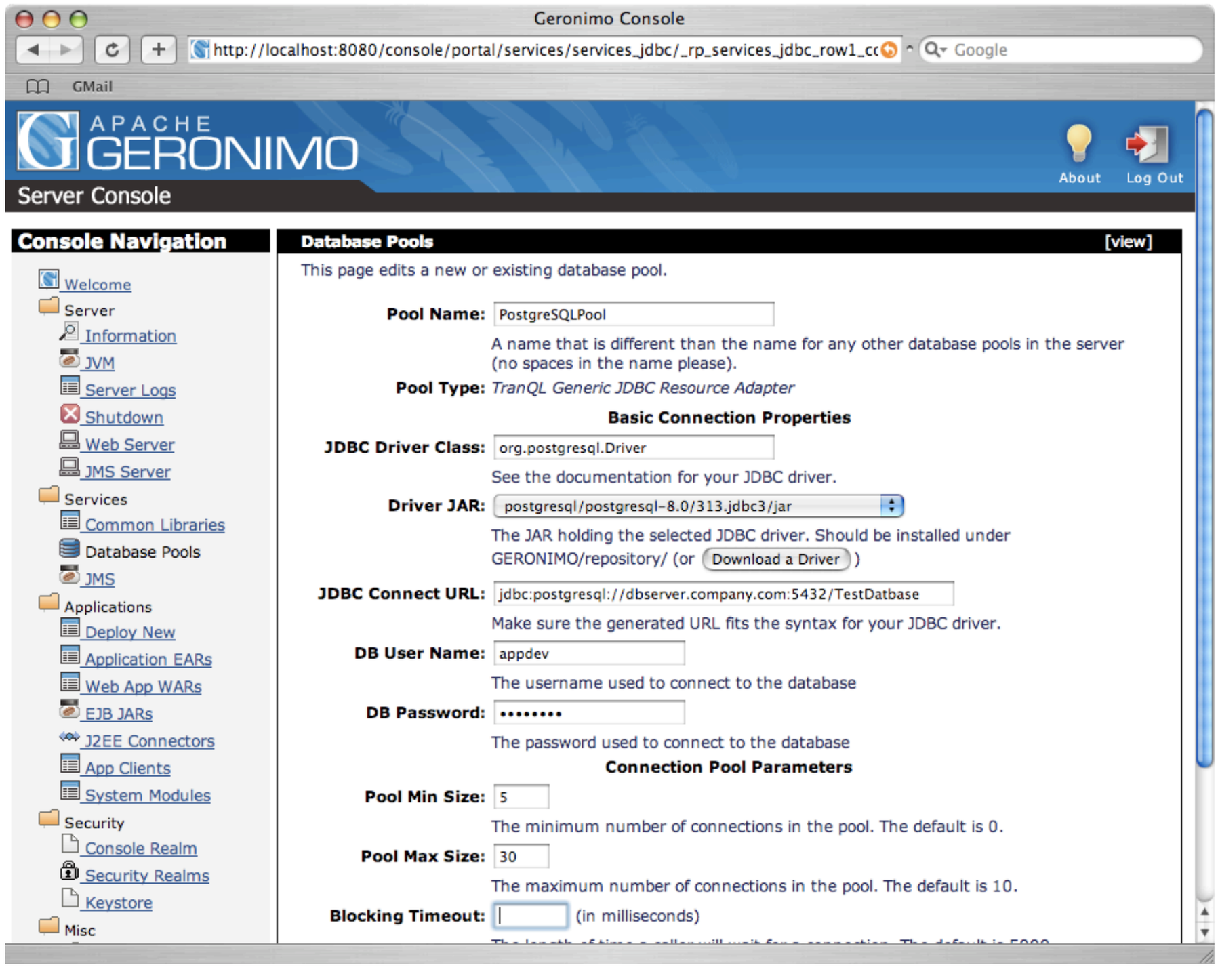
# Advantages

- Open community & open license
- Can build a custom distribution easily
- Web management console
- Fast JMS server included
- Integration with other products
- Multiple support options (free/commercial)

# Management

- Web-based management console included
  - Add/configure network ports
  - Deploy/configure database pools
  - Deploy/configure security realm
- JSR-77 support & easier Management API
  - Statistics still pretty rudimentary

# Management Console



# Performance

- Ships with DayTrader application, which can be used to performance-test Geronimo against other application servers
- Performance is in the right ball park, but does not yet reach commercial app servers
- Currently leak about 1 MB/hour under very heavy load (with a 2GB heap)

# Security

- We're trying to do a good job, but there's still room for improvement
- Authentication required for remote management/deployment
- Some password encryption in place (more places where it's needed)
- Security bugs are high-priority

# 1.0.1 Release

- Planned for early February
- Will include an installer package
- Security fix for Jetty on Windows
- Fixes to hot deployment of server configs, deployment of unpacked EAR containing unpacked WAR
- More as necessary

# 1.1 Release

- Maven 2 support?
- Management improvements (console, more statistics providers, etc.)
- Still more modular configurations (easier to remove EJB container, etc.)
- Performance & tooling improvements
- Complete web clustering

# 2.0 Release

- Targeting J2EE 1.5 (J2SE 1.5, EJB3, Web 2.5, annotations, generics, etc.)
- Significant improvements to application security infrastructure
- Portal server integration
- Robust clustering
- New, portable CORBA implementation

# Installation & Configuration

# Installation

- .ZIP & .TAR.GZ distributions available now
- ZIP/TAR: Download and unzip either the Jetty or the Tomcat distribution
  - Edit ports, etc. in `var/config/config.xml`
- Installer: run `java -jar geronimo-installer.jar` and make your selections accordingly

# Start & Stop

- Start: run `java -jar bin/server.jar`
  - command-line options:
    - `--long` (simpler startup output)
    - `--quiet` (no progress bar)
    - `-v` or `-vv` (more log output to console)
- Stop: `Ctrl-C` or `java -jar bin/shutdown.jar`

# Startup Sequence

```
Booting Geronimo Kernel (in Java 1.4.2_09)...
Starting Geronimo Application Server
[**************] 100%  18s Startup complete

  Listening on Ports:
    1099 0.0.0.0 RMI Naming
    1527 0.0.0.0 Derby Connector
    4201 0.0.0.0 ActiveIO Connector EJB
    4242 0.0.0.0 Remote Login Listener
    8080 0.0.0.0 Jetty Connector HTTP
    8443 0.0.0.0 Jetty Connector HTTPS
   61616 0.0.0.0 ActiveMQ Message Broker Connector

  Started Application Modules:
    EAR: org/apache/geronimo/Console/Jetty
    WAR: org/apache/geronimo/applications/Welcome/Jetty

  Web Applications:
    http://server-hostname:8080/
    http://server-hostname:8080/console
    http://server-hostname:8080/console-standard

Geronimo Application Server started
```

# Configuration (easy)

- Start server and point browser to http://localhost:8080/console/
- Use the screens there to edit network ports, add database connection pools, etc.
- May need to restart the server to apply certain changes
- Can't use if original network ports conflict

# Configuration (hard)

- Most configuration is controlled by `config.xml` in `var/config`
  - controls which configurations to load
  - lets you override settings on any server component (identified by config name + component name + attribute name)
- Can also deploy additional services by hand

# config.xml

```
<attributes
   xmlns="http://geronimo.apache.org/xml/ns/attributes">

    <configuration name="geronimo/rmi-naming/1.0/car">
        <gbean name="RMIRegistry">
            <attribute name="port">1099</attribute>
        </gbean>
        <gbean name="NamingProperties">
            <attribute name="namingProviderUrl">
               rmi://0.0.0.0:1099
            </attribute>
        </gbean>
    </configuration>
    ...
</attributes>
```

# Logging

- Uses Log4J
- Config file at `var/log/server-log4j.properties`
- Server log at `var/log/geronimo.log`
- Console log level defaults to INFO (reduce with -v or -vv on startup)
- Can search server log and web access logs in the console (though not as fast as grep)

# Database Pools

- Pretty straightforward to add via the console
- Can deploy by hand as well, by writing a connector deployment plan and running the deploy tool (more on this later)
- Options include pool size, SQLException sorter class, etc.
- Can also deploy within an application

# JMS Resources

- The standard Geronimo configuration starts an ActiveMQ server
- Adding connection factories in the console is straightforward (destinations coming...)
- Can deploy by hand as well, by writing a connector deployment plan and running the deploy tool (more on this later)
- Can also deploy within an application

# Security Realms

- Based on JAAS LoginModules
- Default realm based on properties files in `var/security` (used for console login, etc.)
- Can also add auditing, lockout on repeated attempts, etc. with additional LoginModules
- Can configure in the console or by deploying a custom configuration

# JAAS LoginModules

- A realm normally uses one LoginModule, but may include several
- Extra features like auditing are added by using multiple LoginModules for the realm
- When mapping security later, you'll need to know what classes the LoginModules use to represent the Principals (users/groups)

# Realm Example

## SQLSecurityRealm

1. SQL Login Module → Required
2. Lockout Login Module → Required
3. Auditing Login Module → Optional

# Included Login Modules

- Properties File
- Kerberos
- LDAP
- SQL
- Auditing
- Lockout on repeated failure

# Deployment Overview & Tools

# Deployment Overview

- For apps: need an archive or directory with a J2EE deployment descriptor, and typically a Geronimo deployment plan
- For services (custom configurations): just need a Geronimo deployment plan
- Use the deploy tool or the hot deploy directory to deploy the app or service

# Deployment Plan

- aka “server-specific deployment descriptor”
- Geronimo plans are based on XML Schemas (normally one per module type)
- Schemas can be found in `schemas/`
- Always have a `configId` (a unique ID for the module) and optional `parentId` and `include's` (used to set up class loaders)

# Typical Plan

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app
    xmlns="http://geronimo.apache.org/xml/ns/j2ee/web-1.0"
    configId="geronimo/jmxdebug/1.0/car"
    parentId="geronimo/j2ee-server/1.0/car">

    <dependency>
        <uri>
      commons-collections/commons-collections/3.1/jar
        </uri>
    </dependency>

    <context-root>/debug-tool</context-root>
    <context-priority-classloader>
        false
    </context-priority-classloader>
</web-app>
```

# Digression:Namespaces

- Several part of the plan (typically the ones reused across many plan types) come from different namespaces
- You can write your files all in the owning plan's namespace, and Geronimo will be fine with that (but XML editors may not)
- You can use the correct namespaces and Geronimo will be fine with that too

# Strictly Correct Plan

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app
    xmlns="http://geronimo.apache.org/xml/ns/j2ee/web-1.0"
    xmlns:dep=
       "http://geronimo.apache.org/xml/ns/deployment-1.0"
    configId="geronimo/jmxdebug/1.0/car"
    parentId="geronimo/j2ee-server/1.0/car">

    <dep:dependency>
        <dep:uri>
      commons-collections/commons-collections/3.1/jar
        </dep:uri>
    </dep:dependency>

    <context-root>/debug-tool</context-root>
    ...
```

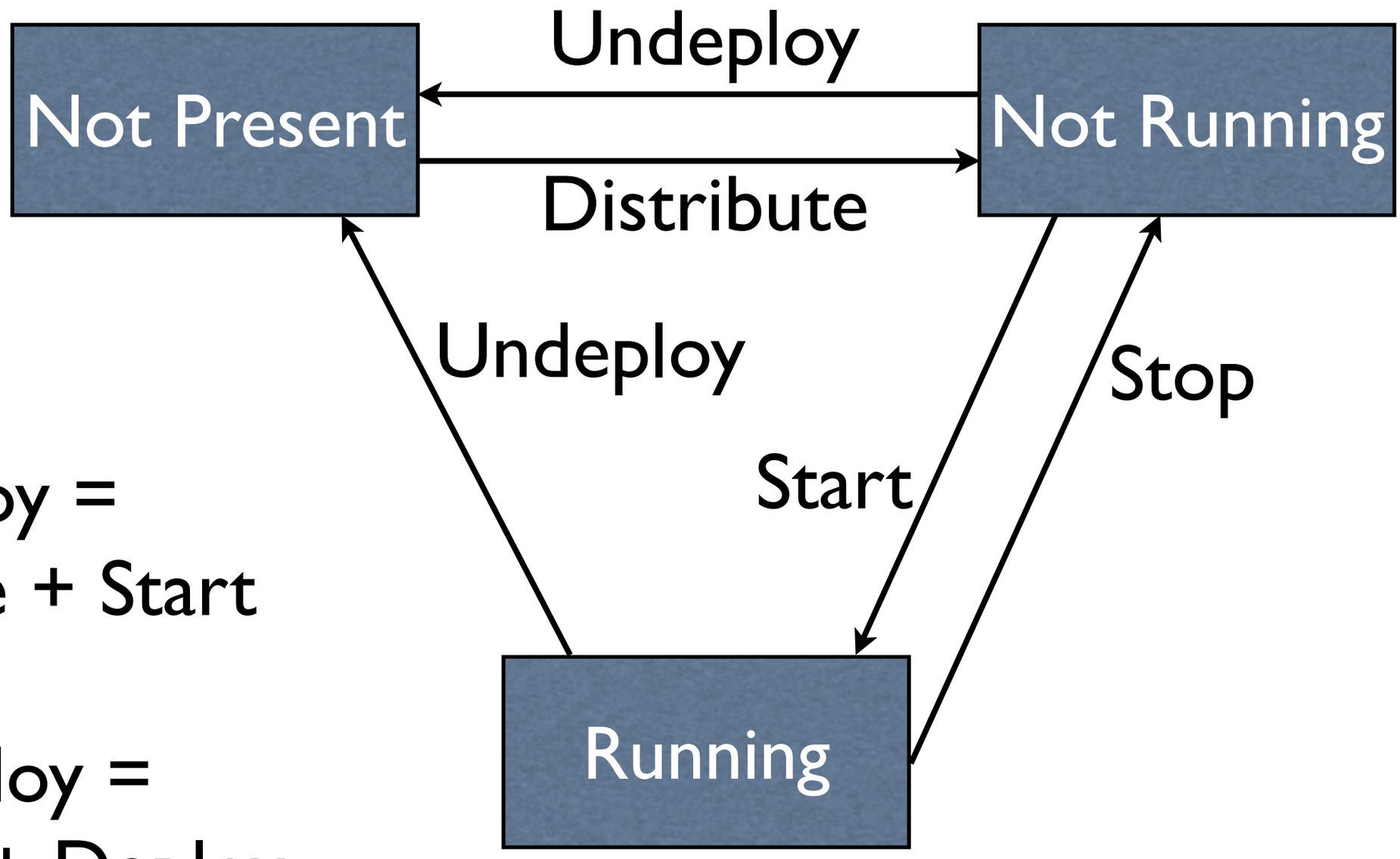
# Deploy Tool

- Communicates with a running server
- Run with `java -jar bin/deployer.jar [options] command [command-options]`
- Commands include `login`, `help`, `deploy`, `undeploy`, `redeploy`, `list-modules`, etc.
- Normally prompted for a username and password ("system" and "manager" unless you selected something different)

# Remote Deployment

- Deploy tool can manage and deploy to a remote server
- Need to be able to access the RMI port (1099) and an HTTP(S) port (8080)
- Must have the remote-deploy web application deployed on the server (it is)
- use `--host` and `--port` (or perhaps `--uri`)

# Module Lifecycle




Deploy =
Distribute + Start

Redeploy =
Undeploy + Deploy

# Sample Commands

- `java -jar bin/deployer.jar ...`
  - `login`
  - `deploy [archive] [plan]`
  - `undeploy configId`
  - `redeploy [archive] [plan] [configId]`
  - `stop/start configId`
  - `list-modules`

# Config IDs

- When you deploy, you'll get output like:

```
Deployed geronimo/webconsole-jetty/1.0/car
```

- That is the Config ID for the module, used to start, stop, undeploy, redeploy it
- It is set by the `configId` in the deployment plan, or the JAR name otherwise

# In context...

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app
    xmlns="http://geronimo.apache.org/xml/ns/j2ee/web-1.0"
    configId="geronimo/webconsole-jetty/1.0/car"
    parentId="geronimo/j2ee-server/1.0/car">
...
```

---

```
> java -jar bin/deployer.jar deploy console.war
Deployed geronimo/webconsole-jetty/1.0/car
```

---

```
> java -jar bin/deployer.jar stop
                        geronimo/webconsole-jetty/1.0/car
```

---

```
> java -jar bin/deployer.jar list-modules
Found 33 modules
  geronimo/webconsole-jetty/1.0/car
  ...
```

# Parent IDs

- The optional `parentId` attribute controls the ClassLoader structure and startup order
- Can additionally specify `import` elements in the body of the deployment plan
- For startup order, can also just deploy a DB pool or JMS resource as part of an EAR
- Typical value is `geronimo/j2ee-server/1.0/car`

# Hot Deploy Directory

- `geronimo/deploy/`
- Copy files to this directory to deploy, update to redeploy, delete to undeploy
- On startup, recognizes new deployments, but will not undeploy or redeploy
- Should use either command-line deployer or hot deployer for any given module

# Maven Plugin

- Deployment plugin for Maven 1.x can start & stop server, deploy/undeploy/redeploy applications, etc.
- Can be included in build scripts and won't return until application is running (for subsequent testing, etc.)
- Maven 2 & Ant plugins in 1.1 or 2.0

# Eclipse Plugin

- Work with Eclipse WTP
- Can create Geronimo apps, including XDoclet-based EJBs, etc.
- Can run an embedded Geronimo server
- Can deploy to Geronimo
- Not quite in a “finished” state, but working

# Debugging

- In IDEA, create a new debugging configuration and select "Remote"
- IDEA gives you a bunch of command-line parameters; start Geronimo with those
  `java -Xdebug -Xnoagent... -jar bin/server.jar`
- Then remote connection works perfectly
- Eclipse can run and debug Geronimo locally

# Common Deployment Plan Features

# Plans, revisited

- Generally hold things like:
  - Security mapping
  - Database/JMS/EJB/Web Service reference mapping
  - Component-specific configuration (EJB CMP, RA config settings, etc.)
- Required if any of that mapping is necessary

# Common Elements

- <dependency> lists a JAR that should be added to the module's class loader
  - The JAR must be in geronimo/repository
    - The "uri" is in the repository format of *groupId/artifactId/version/type*, like the standard `geronimo/j2ee-server/1.0/car`
- <gbean> lists custom services to be loaded when this module is loaded

# Common Elements...

- <security> holds security mapping (which users/groups are in which J2EE roles)
- <ejb-ref>, <ejb-local-ref>, <resource-ref>, <resource-env-ref>  hold more mapping
  - Doesn't use JNDI, uses a combination of the app name and component name
- <service-ref> resolves Web Services clients

# 3rd Party JAR Example

```
File at geronimo/repository/postgresql/jars/
                                postgresql-8.0-313.jdbc3.jar
```

```
<dependency>
  <uri>postgresql/postgresql-8.0/313.jdbc3/jar</uri>
</dependency>
```

```
<dependency>
  <groupId>postgresql</groupId>
  <type>jar</type>
  <artifactId>postgresql-8.0</artifactId>
  <version>313.jdbc3</version>
<dependency>
```

# Component Mapping

- Need a name to identify the reference we're resolving, then one of a:
  - link (short name identifying the target, in same application or top-level in server)
  - "target-name" (long name uniquely identifying the target anywhere in server)
  - group of elements containing all the components of the target-name

# Component Example

```
<resource-ref>
  <ref-name>jdbc/MyDatabase</ref-name>
  <resource-link>PostgreSQLPool</resource-link>
</resource-ref>
```

```
<resource-ref>
  <ref-name>jdbc/MyDatabase</ref-name>
  <target-name>geronimo.server:J2EEApplication=null,
J2EEServer=geronimo,JCAResource=PostgreSQLPoolConfigID,
j2eeType=JCAManagedConnectionFactory,name=PostgreSQLPool
  </target-name>
</resource-ref>
```

```
<resource-ref>
  <ref-name>jdbc/MyDatabase</ref-name>
  <module>PostgreSQLPoolConfigID</module>
  <type>JCAManagedConnectionFactory</type>
  <name>PostgreSQLPool</name>
</resource-ref>
```

# Security Mapping

- Security settings declared at the application level (EAR) apply to all included modules
- Map principals (by principal class and name) to J2EE Roles
- Indicate a default principal to use when the user does not authenticate
- Indicate a principal to use whenever a run-as role applies

# Security Example

```
<security>
  <default-principal>
    <principal name="nobody"
class="org.apache.geronimo.security.realm.providers.Geroni
moUserPrincipal" />
  </default-principal>
  <role-mappings>
    <role role-name="Administrators">
      <principal name="Admins"
class="org.apache.geronimo.security.realm.providers.Geroni
moGroupPrincipal" />
      <principal name="Aaron"
class="org.apache.geronimo.security.realm.providers.Geroni
moUserPrincipal" />
    </role>
  </role-mappings>
</security>
```

# J2EE Module Deployment

# Web Applications

- Plan in WAR at `WEB-INF/geronimo-web.xml`
- Web settings for context path, classloader configuration (parent-first vs. WAR-first), security realm used to validate logins
- Container-specific virtual host settings
- Otherwise pretty standard (dependencies, resource/EJB/service references, security...)

# Web App Plan

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app
    xmlns="http://geronimo.apache.org/xml/ns/j2ee/web-1.0"
    configId="MyWebAppName"
    parentId="geronimo/j2ee-server/1.0/car">
    <dependency ...>
    <context-root>/debug-tool</context-root>
    <context-priority-classloader>
        false
    </context-priority-classloader>
    <container-config ...>
    <ejb-ref ...> <service-ref ...> <resource-ref ...>
    <security-realm-name>SQLRealm</security-realm-name>
    <security ...>
    <gbean ...>
</web-app>
```

# EJB JARs

- Plan in JAR at `META-INF/openejb-jar.xml`
- EJB settings for CMP/CMR, JNDI/CORBA/ Web Service settings for remote clients, MDB configuration
- Otherwise pretty standard (dependencies, resource/EJB/Web Service references, security, gbeans, etc.)

# CMP Settings

- DB syntax mapping & DDL generation
- Table/column mappings
- Resolving unknown primary keys
- Automatic PK generation
- Prefetch groups
- Query tuning

# CMR Settings

- Maps one-to-one and one-to-many relationships using foreign keys
- Maps many-to-many relationships using a join table
- Can set prefetch group to use when a CMR field is accessed, including multiple levels at once

# EJB Plan

```
<?xml version="1.0" encoding="UTF-8"?>
<openejb-jar
    xmlns="http://www.openejb.org/xml/ns/openejb-jar-2.0"
    configId="MyEJBJarName"
    parentId="geronimo/j2ee-server/1.0/car">
    <dependency ...>
    <!-- some CMP settings here -->
    <enterprise-beans>
      <session ...>
      <entity ...>
      <message-driven ...>
    </enterprise-beans>
    <relationships ...>
    <security ...>
    <gbean ...>
</web-app>
```

# J2EE Connectors

- Plan in RAR at `META-INF/geronimo-ra.xml`
- Configures instances of the resource adapter, connection factory instances, and admin objects
  - Database: connections to multiple DBs, with same or different drivers
  - JMS: connection factories & destinations

# Inbound Connectors

- Configure the thread pool (WorkManager) and connectivity to the messaging server
- Configure destinations that can be accessed individually or mapped to MDBs
- Supports any connector, JMS or otherwise
- Ships with ActiveMQ resource adapter for JMS connections and destinations

# Outbound Connectors

- Support connection pools (single pool, subpools per user, etc.)
  - Configurable timeout for a caller to wait for a connection
  - Configurable timeout to reclaim connections in the pool
- Ships with TranQL adapter for JDBC pools

# Connector Strategies

- Normally deployed as a top-level module (a server-wide JDBC pool, etc.)
  - This is how the console does it
- Can also package it within an EAR, so the DB pool or JMS resources are deployed and undeployed with the application
  - Still visible to other applications though

# Connector Plan

```
<?xml version="1.0" encoding="UTF-8"?>
<connector xmlns="http://geronimo.apache.org/xml/ns/j2ee/
connector-1.0"
    configId="MyConnectorName"
    parentId="geronimo/j2ee-server/1.0/car">

    <dependency ...>
    <resourceadapter>
      <resourceadapter-instance ...>
      <outbound-resourceadapter>
        <connection-definition>
          <connectiondefinition-instance ...>
        </connection-definition>
      </outbound-resourceadapter>
    </resourceadapter>
    <adminobject ...>
    <gbean ...>
</web-app>
```

# Application EARs

- Plan in EAR at `META-INF/geronimo-application.xml`
- Can point to a module's Geronimo deployment plan inside the EAR but outside the module JAR, or can just put the whole module deployment plan in here
- Can specify dependencies and security settings for all the modules in one shot

# Sample EAR Contents

```
my-app.ear/
   my-web.war
   my-ejbs.jar
   tranql-connector-1.1.rar
some-3rd-party-library.jar
plans/
   web.xml
   ejb-jar.xml
   geronimo-web.xml
   geronimo-ejb-jar.xml
   dbpool-definition.xml
```

# EAR Plan

```
<?xml version="1.0" encoding="UTF-8"?>
<application xmlns="http://geronimo.apache.org/xml/ns/
j2ee/application-1.0"
    configId="MyApplicationName"
    parentId="geronimo/j2ee-server/1.0/car">
    <dependency ...>
    <module>
      <connector>tranql-connector-1.1.rar</connector>
      <alt-dd>plans/dbpool-definition.xml</alt-dd>
    </module>
    ...
    <security ...>
    <gbean ...>
</web-app>
```

# Clients

- Supports J2EE application clients, with a client container (same machine as server)
  - Uses a client deployment plan
  - Can access remote EJBs and kind of supports connectors
- Supports normal "J2SE" clients, using a JAAS login and Subject.doAs

# Summary

# Closing Thoughts

- A complete J2EE server
- Configuration and DB/JMS/Security setup through the web console
- Deployment tool and hot deploy directory
- Deployment plans for J2EE modules
- Can pack resources & services in an EAR

# In the "Advanced" talk:

- Building custom Geronimo distributions
- The management API
- CORBA in and out of Geronimo
- Writing and deploying GBeans (custom services for Geronimo)
- Using Derby, Spring, ServiceMix, Pluto, UDDI, & Apache LDAP within Geronimo

# Q&A

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Slides at http://chariotsolutions.com/geronimo/