



redhat.®

# PACKAGING TOMCAT FOR LINUX DISTRIBUTIONS

**COTY SUTHERLAND**

Senior Software Engineer, Red Hat

# AGENDA

- WHO AM I?
- WHY USE DISTRIBUTIONS?
- DISTRIBUTION OVERVIEW
- APACHE TOMCAT
- THE FEDORA DISTRIBUTION
- THE UBUNTU DISTRIBUTION
- SNAPS: UNIVERSAL LINUX PACKAGES
- DISCUSSION/QUESTIONS
- THANKS!

# WHO AM I?

## A QUICK ABOUT ME

- Coty Sutherland
- Red Hatter for ~5.5 years
- Supported Tomcat, httpd, and JBoss EAP for ~3 years
- Previously Worked in Red Hat Business Intelligence
- Open Source user/contributor since 2006
- Fedora tomcat and tomcat-native package co-maintainer since 2015
- ASF Tomcat committer since late 2016
- One interesting fact about me: I am a Native American from the Waccamaw Siouan Tribe of North Carolina :)
- A recent interesting project: <https://github.com/csutherl/tomcat-maven-wrapper>

# WHY USE DISTRIBUTIONS?

## PROS

- Easy and reliable way to install, configure, and update/remove packages
- Potential for automation using system tools
- Standardized installation
- Standardized method to start and stop daemons
- Easily utilize other libraries on the system, such as log4j
- System stability provided by targeted bug and security fixes

# WHY USE DISTRIBUTIONS?

## CONS

- Bugs in wrapper components or service scripts that are distribution specific
- Difficult for developers
- Added complexity to configure (compared to the ASF distribution)
- Requires some administration skills specific to the distribution

# DISTRIBUTION OVERVIEW

## APACHE TOMCAT, FEDORA, UBUNTU, SNAPS

All Tomcat distributions (excluding ASF Tomcat) follow the same basic recipe to create their packages:

- 1 Download the source package provided by the ASF distribution (or the binary, in some cases)
- 2 Build Tomcat and any extras needed
- 3 Add OS specific things, such as service scripts and wrappers to run Tomcat
- 4 Distribute the resulting package via their package manager (e.g. yum)

# APACHE TOMCAT

- Apache Tomcat distributes a self-contained archive
- Apache Tomcat provides extra things in their archive distributions:
  - The API documentation (docs webapp)
  - Embedded Tomcat JARs
  - Logging adapters for log4j 1.x (removed in Tomcat 8.5+ due to EOL of log4j 1)

# THE FEDORA DISTRIBUTION

## TOMCAT RPM PACKAGING

### FEDORA 25

- What is an RPM package?
- Packaging breakdown, what's with all the sub-packages?
- Directory layout
- update-alternatives for API JARs
- Installing and configuring Tomcat
- Starting and stopping Tomcat
- Updating and removing Tomcat
- Contributing



# WHAT IS AN RPM PACKAGE?

- The RPM format is the software packaging format used by Red Hat flavors of Linux. Everything you need to know about an RPM is in its specfile
- A specfile is a plain text file that contains information about the package, instructions for the package builder (rpmbuild) to build and structure the package, and instructions for the package manager to carry out upon install/uninstall/update (if needed)
- The tomcat spec for Fedora Rawhide is [here](#). Let's take a look...
  - Note that the tomcat spec is very complex compared to others. If you want to see a simpler spec file, then take a look at the link [here](#) for Fedora's guide to building an RPM package

# PACKAGING BREAKDOWN

## WHAT'S WITH ALL THE TOMCAT SUB-PACKAGES?

- Tomcat is broken up into sub-packages to allow users to install the minimum number of packages required to run the daemon; additional packages may be installed as needed
- Here is a list including a short description of all of the Tomcat RPMs that are available in fc25 (ignoring ones that are not sub-packages of Tomcat):

```
$ dnf search tomcat | grep ^tomcat | egrep -v '(taglibs|tomcatjss|tomcat-native)'  
tomcat.noarch : Apache Servlet/JSP Engine, RI for Servlet 3.1/JSP 2.3 API  
tomcat-lib.noarch : Libraries needed to run the Tomcat Web container  
tomcat-docs-webapp.noarch : The docs web application for Apache Tomcat  
tomcat-jsp-2.3-api.noarch : Apache Tomcat JSP API implementation classes  
tomcat-javadoc.noarch : Javadoc generated documentation for Apache Tomcat  
tomcat-jsvc.noarch : Apache jsvc wrapper for Apache Tomcat as separate service  
tomcat-servlet-3.1-api.noarch : Apache Tomcat Servlet API implementation classes  
tomcat-webapps.noarch : The ROOT and examples web applications for Apache Tomcat  
tomcat-admin-webapps.noarch : The host-manager and manager web applications for  
tomcat-el-3.0-api.noarch : Expression Language v3.0 API
```

# DIRECTORY LAYOUT

## WHERE DO ALL THE THINGS GO?

- The Tomcat RPMs follow a standard called the Filesystem Hierarchy Standard (FHS) which determines where things go. Examples of the FHS include installing executables in /usr/bin, global configuration files in /etc, and things of that nature
- Using FHS makes all packages installed via RPM easy for admins to manager by putting everything in the same structure
- For Tomcat, /usr/share/tomcat is \$CATALINA\_HOME and includes symlinks to the FHS standard locations for other things

```
$ ll /usr/share/tomcat
total 4
drwxr-xr-x. 2 root root 4096 Mar  2 07:29 bin
lrwxrwxrwx. 1 root tomcat 11 Feb 16 15:49 conf -> /etc/tomcat
lrwxrwxrwx. 1 root tomcat 22 Feb 16 15:49 lib -> /usr/share/java/tomcat
lrwxrwxrwx. 1 root tomcat 15 Feb 16 15:49 logs -> /var/log/tomcat
lrwxrwxrwx. 1 root tomcat 22 Feb 16 15:49 temp -> /var/cache/tomcat/temp
lrwxrwxrwx. 1 root tomcat 23 Feb 16 15:49 webapps -> /var/lib/tomcat/webapps
lrwxrwxrwx. 1 root tomcat 22 Feb 16 15:49 work -> /var/cache/tomcat/work
```

# UPDATE-ALTERNATIVES FOR API JARS

**\* THIS IS A RELIC AND I'M NOT SURE IT'S EVEN USED ANYMORE...**

- Back to the API sub-packages...
- The concept of alternatives on Red Hat Linux systems is pretty easy to grasp. Basically it creates a link that's easily configurable to the reference binary/library installed on the system
- Example: Tomcat provides the reference implementation for the Servlet API on Red Hat flavors of Linux. Each time it is installed or updated the alternatives link is updated to reflect that
- Here is what the servlet link looks like. It points references for `/etc/alternatives/servlet` to the correct JAR location:

```
$ ls -l /etc/alternatives/servlet
lrwxrwxrwx. 1 root root 42 Apr 26 13:39 /etc/alternatives/servlet -> /usr/share/java/tomcat-servlet
```

# INSTALLING AND CONFIGURING TOMCAT

- To install Tomcat on a Red Hat Linux machine use the Yellowdog Updater, Modified (or simply 'yum') package manager. All you need is the name of the package to be installed (e.g. tomcat), and you can install it such as:

```
$ yum install tomcat
```

- The 'tomcat' parent package needs a few other packages (dependencies), which are automatically installed: 'tomcat-lib', 'tomcat-el-2.2-api', 'tomcat-jsp-2.2-api', and 'tomcat-servlet-3.0-api'
- This is a minimal installation, which means no webapps are included. If you need the admin webapps (for example), execute the following to install them:

```
$ yum install tomcat-admin-webapps
```

# INSTALLING AND CONFIGURING TOMCAT, CONTINUED

- Configuring Tomcat is done the same as the ASF distribution with the addition of two files, `/etc/sysconfig/tomcat` and `/etc/tomcat/tomcat.conf`. These files are optional, but they give you similar capabilities as `setenv`. For example, you can enable the `SECURITY_MANAGER` in either of these
- Generally `tomcat.conf` is used as the main configuration with `/etc/sysconfig/tomcat` allowing you to override things set in `tomcat.conf` on a per-service level (for multi-instance installs). Instructions for how to setup a multi-instance install are in the configuration file's comments

# STARTING AND STOPPING THE TOMCAT SERVICE

- Using the system provided scripts make it very easy to start, stop, and check the status of the Tomcat daemon. They make it very easy for users to enable Tomcat to start on boot too!
- Examples on next slide
- A note about Fedora tomcat's logging (excluding EPEL 6)...
  - After moving from sysV to the systemd service unit method stdout/stderr no longer log to catalina.out. The events that recently logged to catalina.out now log to the system's journal. If users need to see stdout/stderr logging, check the journal (`journalctl -u tomcat`)

```
$ sudo systemctl start tomcat
$ sudo systemctl stop tomcat
$ sudo systemctl status tomcat
• tomcat.service - Apache Tomcat Web Application Container
  Loaded: loaded (/usr/lib/systemd/system/tomcat.service; disabled; vendor preset: disabled)
  Active: inactive (dead)
```

```
Apr 26 14:00:48 localhost.localdomain systemd[1]: Started Apache Tomcat Web Application Container.
Apr 26 14:00:51 localhost.localdomain systemd[1]: Stopping Apache Tomcat Web Application Container...
Apr 26 14:00:51 localhost.localdomain server[24961]: 26-Apr-2017 14:00:51.419 INFO [Thread-3] org.apache.c
Apr 26 14:00:51 localhost.localdomain server[24961]: 26-Apr-2017 14:00:51.474 INFO [Thread-3] org.apache.c
Apr 26 14:00:51 localhost.localdomain server[24961]: 26-Apr-2017 14:00:51.525 INFO [Thread-3] org.apache.c
Apr 26 14:00:51 localhost.localdomain server[24961]: 26-Apr-2017 14:00:51.528 INFO [Thread-3] org.apache.c
Apr 26 14:00:51 localhost.localdomain server[24961]: 26-Apr-2017 14:00:51.579 INFO [Thread-3] org.apache.c
Apr 26 14:00:51 localhost.localdomain server[24961]: 26-Apr-2017 14:00:51.630 INFO [Thread-3] org.apache.c
Apr 26 14:00:51 localhost.localdomain server[24961]: 26-Apr-2017 14:00:51.630 INFO [Thread-3] org.apache.c
Apr 26 14:00:51 localhost.localdomain systemd[1]: Stopped Apache Tomcat Web Application Container.
```



# UPDATING AND REMOVING TOMCAT

- Both updating and removing Tomcat are very simple. The syntax for updating a package on Fedora is shown below along with how to remove a package
- Note that when updating the tomcat parent package all sub-packages are updated, but because of how the dependencies are configured removing it requires the '\*' to get all the sub-packages

```
$ sudo yum update tomcat  
$ sudo yum remove tomcat-*
```

- Updating with the package manager is one of the big benefits of using an OS' package over the ASF distribution. When you run the update command it basically installs everything again leaving the configuration files in place so you do not need to configure the service again

# CONTRIBUTING

## A QUICK NOTE

- Generally pretty quiet as far as new bugs
- I update around once a month, depending on ASF tomcat and tomcat-native releases. The links below are for the package pages of tomcat and tomcat-native. If you're interested in contributing or learning more about the packages, please take a look:
  - <https://apps.fedoraproject.org/packages/tomcat/overview/>
  - <https://apps.fedoraproject.org/packages/tomcat-native/overview/>

# THE UBUNTU DISTRIBUTION

## TOMCAT DEB PACKAGING

### UBUNTU 16.04 (XENIAL)

- What is a DEB package?
- Packaging breakdown, what's with all the sub-packages?
- Directory layout
- Compared Fedora
- Installing and configuring Tomcat
- Starting and stopping Tomcat
- Updating and removing Tomcat
- Contributing

# WHAT IS A DEB PACKAGE?

- The deb format is the software packaging format that the Debian distribution and its derivatives (including Ubuntu) use. These packages are archives which contain three files, debian-binary, control.tar.gz, and data.tar.gz. Two of them are effectively meta-data, while the third contains the installable artifacts
- If you want to inspect any of the .deb packages, you can download them with apt-get and use dpkg to list its contents:

```
$ apt-get download tomcat8
Get:1 http://us.archive.ubuntu.com/ubuntu xenial-updates/main amd64 tomcat8 all 8.0.32-1ubuntu1.
Fetched 42.2 kB in 0s (103 kB/s)
$ dpkg -c tomcat8_8.0.32-1ubuntu1.3_all.deb
drwxr-xr-x root/root          0 2017-01-18 09:30 ./
drwxr-xr-x root/root          0 2017-01-18 09:30 ./usr/
drwxr-xr-x root/root          0 2017-01-18 09:30 ./usr/share/
drwxr-xr-x root/root          0 2017-01-18 09:30 ./usr/share/tomcat8-root/
drwxr-xr-x root/root          0 2017-01-18 09:30 ./usr/share/tomcat8-root/default_root/
....
```

# PACKAGING BREAKDOWN

## WHAT'S WITH ALL THE TOMCAT SUB-PACKAGES?

- Ubuntu follows the same idea that minimalism is good, so it also includes some tomcat sub-packages that can be installed as needed
- Here is a list of the Ubuntu sub-packages for tomcat:

```
$ apt list | grep tomcat8
libtomcat8-java/xenial-updates,xenial-updates,xenial-security,xenial-security,now 8.0.32-1ubuntu
tomcat8/xenial-updates,xenial-updates,xenial-security,xenial-security,now 8.0.32-1ubuntu1.3 all
tomcat8-admin/xenial-updates,xenial-updates,xenial-security,xenial-security,now 8.0.32-1ubuntu1.
tomcat8-common/xenial-updates,xenial-updates,xenial-security,xenial-security,now 8.0.32-1ubuntu1
tomcat8-docs/xenial-updates,xenial-updates,xenial-security,xenial-security,now 8.0.32-1ubuntu1.3
tomcat8-examples/xenial-updates,xenial-updates,xenial-security,xenial-security,now 8.0.32-1ubunt
tomcat8-user/xenial-updates,xenial-updates,xenial-security,xenial-security 8.0.32-1ubuntu1.3 all
```

# DIRECTORY LAYOUT

## WHERE DO ALL THE THINGS GO?

- Debian follows the FHS also, <https://wiki.debian.org/FilesystemHierarchyStandard>
- \$CATALINA\_HOME in Debian's tomcat8 package is /var/lib/tomcat8 and you can see the links to other FHS-compliant directories:

```
$ ls -l /var/lib/tomcat8
total 16
drwxr-xr-x  4 root    root    4096 Apr 27 12:42 ./
drwxr-xr-x 66 root    root    4096 Apr 27 12:42 ../
lrwxrwxrwx  1 root    root         12 Jan 18 09:30 conf -> /etc/tomcat8/
drwxr-xr-x  2 tomcat8 tomcat8 4096 Jan 18 09:30 lib/
lrwxrwxrwx  1 root    root         17 Jan 18 09:30 logs -> ../../log/tomcat8/
drwxrwxr-x  3 tomcat8 tomcat8 4096 Apr 27 12:42 webapps/
lrwxrwxrwx  1 root    root         19 Jan 18 09:30 work -> ../../cache/tomcat8/
```

# COMPARED TO FEDORA

- Some similarities between Ubuntu and Fedora:
  - Both are Linux systems and follow the FHS
  - Both system's distributions are easily manageable by using the system's package manager (yum for Fedora and apt for Debian/Ubuntu)
- One notable difference is despite the shared method of starting and stopping the service, Ubuntu still uses the sysV implementation instead of a systemd service unit for tomcat, so it hasn't yet migrated completely to systemd (at least not in Xenial)

# INSTALLING AND CONFIGURING TOMCAT

- Installing the tomcat package on Ubuntu is just as easy as Fedora's installation process:

```
$ apt install tomcat8
```

- And installing sub-packages works the same way:

```
$ apt install tomcat8-admin
```

- Configuring Tomcat in Ubuntu is similar to how you would do it with the ASF distribution. All of the scripts are in the bin directory, here:  
`/usr/share/tomcat8/bin/`



# STARTING AND STOPPING THE TOMCAT SERVICE

- This syntax is the same as Fedora's:

```
$ systemctl start tomcat8
$ systemctl stop tomcat8
$ systemctl status tomcat8
• tomcat8.service - LSB: Start Tomcat.
  Loaded: loaded (/etc/init.d/tomcat8; bad; vendor preset: enabled)
  Active: inactive (dead)
  Docs: man:systemd-sysv-generator(8)

Apr 27 13:38:11 localhost.localdomain systemd[1]: Starting LSB: Start Tomcat....
Apr 27 13:38:11 localhost.localdomain tomcat8[4162]: * Starting Tomcat servlet engine tomcat8
Apr 27 13:38:16 localhost.localdomain tomcat8[4162]: ...done.
Apr 27 13:38:16 localhost.localdomain systemd[1]: Started LSB: Start Tomcat..
Apr 27 13:38:26 localhost.localdomain systemd[1]: Stopping LSB: Start Tomcat....
Apr 27 13:38:26 localhost.localdomain tomcat8[4215]: * Stopping Tomcat servlet engine tomcat8
Apr 27 13:38:26 localhost.localdomain tomcat8[4215]: ...done.
Apr 27 13:38:26 localhost.localdomain systemd[1]: Stopped LSB: Start Tomcat..
```

# UPDATING AND REMOVING TOMCAT

- This is the same as Fedora also:

```
$ sudo apt update tomcat8  
$ sudo apt remove tomcat8-*
```

# CONTRIBUTING

## A VERY QUICK NOTE...

- I'm not a maintainer of the Ubuntu tomcat package; if more information is required it is recommended to reach out directly to the Ubuntu maintainers, located on the package information page for tomcat8:
  - <http://packages.ubuntu.com/zesty/tomcat8>

# SNAPS: UNIVERSAL LINUX PACKAGES

## A BRIEF OVERVIEW

- Snaps are packages for Linux that deliver software in a single binary package which runs in an isolated manner on the system perfectly and securely in any environment (cloud, desktop, etc). They are advertised to be easier to create and maintain than traditional Linux packages, such as RPMs
- I've included snaps in this presentation since it's rather new (at least to Fedora) and I've gotten a few inquiries about it on Freenode. Does anyone here use the tomcat snap package at the moment?
- [snapcraft.io](https://snapcraft.io) is the official site for the technology. There's also some good information about snaps on the Ubuntu blog, <https://insights.ubuntu.com/2016/06/14/universal-snap-packages-launch-on-multiple-linux-distros/>
- More information is available from the package creator's, Michael Hall, blog here: <http://mhall119.com/2017/03/war-on-snaps/>

# SNAPS, CONT'D.

## INSTALLING A SNAP

- This is pretty easy since snaps are managed by the snap package manager. Here is a quick example of how to install a snap on Fedora. Instructions are also [here](#)

```
# Install snapd
$ sudo dnf install snapd
# And configure the daemon to run
$ sudo systemctl enable --now snapd.socket
# Install the tomcat-sample snap
$ sudo snap install tomcat-sample
tomcat-sample 0.1 from 'mhall1119' installed
```

# SNAPS, CONT'D. 2

## START/STOP/STATUS A SNAP PACKAGE'S SERVICE

- This is pretty much the same as a normal service which uses systemctl, however there's one difference: the service name is prefixed by "snap." and includes some auto-generated things defined in the snap's configuration. Also note that the service is started when you install the snap for tomcat:

```
$ systemctl start snap.tomcat-sample.tomcat.service
$ systemctl status snap.tomcat-sample.tomcat.service
• snap.tomcat-sample.tomcat.service - Service for snap application tomcat-sample.tomcat
  Loaded: loaded (/etc/systemd/system/snap.tomcat-sample.tomcat.service; enabled; vendor preset
  Active: active (running) since Thu 2017-04-27 15:13:27 EDT; 14s ago
Main PID: 14384 (java)
  Tasks: 53 (limit: 512)
  CGroup: /system.slice/snap.tomcat-sample.tomcat.service
          └─14384 /var/lib/snapd/snap/tomcat-sample/1/usr/lib/jvm/default-java/jre/bin/java -Dj

Apr 27 15:13:28 localhost.localdomain snap[14384]: 27-Apr-2017 15:13:28.571 INFO [localhost-star
Apr 27 15:13:28 localhost.localdomain snap[14384]: 27-Apr-2017 15:13:28.571 INFO [localhost-star
Apr 27 15:13:28 localhost.localdomain snap[14384]: 27-Apr-2017 15:13:28.581 INFO [localhost-star
Apr 27 15:13:28 localhost.localdomain snap[14384]: 27-Apr-2017 15:13:28.581 INFO [localhost-star
Apr 27 15:13:28 localhost.localdomain snap[14384]: 27-Apr-2017 15:13:28.592 INFO [localhost-star
Apr 27 15:13:28 localhost.localdomain snap[14384]: 27-Apr-2017 15:13:28.592 INFO [localhost-star
Apr 27 15:13:28 localhost.localdomain snap[14384]: 27-Apr-2017 15:13:28.601 INFO [localhost-star
Apr 27 15:13:28 localhost.localdomain snap[14384]: 27-Apr-2017 15:13:28.603 INFO [main] org.apac
Apr 27 15:13:28 localhost.localdomain snap[14384]: 27-Apr-2017 15:13:28.608 INFO [main] org.apac
```

# DISCUSSION

## QUESTIONS?

- I'd like to know how distribution maintainers can better provide Tomcat to users
- What questions are left unanswered after this presentation?
- Does anyone use any other distributions (maybe docker?) that you would like to see covered in a future talk?
- What are some problems caused by the packaged distribution (not tomcat bugs) that you're facing today?
- Reasons for/against using Tomcat from an OS distribution rather than the ASF distribution?

# USER QUESTIONS FROM FREENODE

## #TOMCAT

**Q:** Looking at the `/usr/lib/systemd/system` directory, what is the difference between `tomcat.service` and `tomcat@.service`?

**A:** `tomcat@` is for named services and is generally only used if you have multiple instances of tomcat on a machine

**Q:** Can someone explain what the file `/etc/logrotate.d/tomcat` does?

**A:** That file is a configuration file for the logrotate daemon which configures it to rotate `catalina.out`. Unfortunately, this is a bug ([rhbz#1370261](#)) because `catalina.out` isn't used after moving to systemd, so you can safely remove it (unless you're using `jsvc` which DOES log to `catalina.out`).



# RPM BUILD/INSTALL DEMO

- Building an RPM with rpmbuild
- Installing the newly created RPMs (localinstall)
  - Would anyone like to see how to create a local repository and install from there?
- Enabling the Security Manager via configuration
- Starting, checking status, and stopping the service
- Removing the package(s)



redhat.®

THANK YOU!

## COTY SUTHERLAND



[linkedin.com/in/cotysutherland](https://www.linkedin.com/in/cotysutherland)



[github.com/csutherl](https://github.com/csutherl)



[twitter.com/cotysutherland](https://twitter.com/cotysutherland)