Create a DNF HTTP repository for custom RPM packages

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Edited version of English class assignment lol

Introduction:

This manual describes how to create a remote DNF HTTP repository on a RHEL 8 or 9 server so that client RHEL computers may connect and install and update custom RPM packages. You don't need to be a pro at DNF or RPM, this manual will guide you through the basics if you have never used the DNF command before.

Materials:

1. The RPM files for software you want to host on the repository.
2. A freshly installed RHEL 8 or 9 server to host the repository. It can be a virtual machine, just make sure it has enough space for the RPM files you plan to host.
3. RHEL 8 or 9 clients

Warning:

- It is recommended to use a fresh installation for the server to host the repository. You'll need to modify the Apache web server config; you'll need to merge or create a new site if you are using an existing web server.
- Installing custom RPM packages may overwrite existing installed software on client computers and change system configuration; make sure you know what you are adding to your repository.
- RPM files usually come in specific releases, check the file name for el8 and el9 for RHEL 8 and RHEL 9 respectively. Separate repositories should be created for RHEL 8 and RHEL 9 clients.

Background Information:

You should know how to remotely access Linux computers, know basic Linux commands (such as navigating with `cd` and `ls`; and viewing and editing files with `vim`), and check system status. Here is some background information to help explain what we'll be setting up:

RPM:

Installed software on RHEL comes in Red Hat Package Manager files (Timoteo, JetStream, & The Fedora Docs team, 2022). Each file contains the binaries for a specific software, the install and removal scripts, and a list of dependences (other software that is required for the current software to work). The RPM command keeps a database of installed packages. It can install software using local RPM files, but it cannot connect to a repository to download files. It can detect if dependencies are met for installing a package, but it cannot

automatically install those dependencies. Instead, higher level commands, like DNF, are used by users to manage software.

DNF:

Dandified YUM is a top-level command on top of RPM used to install software (Timoteo, JetStream, & The Fedora Docs team, 2022). It can connect to repositories to download RPM files. It can automatically get the dependencies needed for packages. It can be used to install, update, and remove packages on a RHEL computer. We'll be setting up a DNF repository which will host RPM files and a database on a website. If a client is configured to use our repository, whenever they install or search for software using DNF they will check our repository to see if it has the most up to date and compatible release of that software. This way our repository can provide custom software not found in other default repositories like Base or Appstream from RHEL and can also provide newer versions of packages.

HTTP:

On our repository we will use the Apache web server to serve the RPM files and database on a website (Zachariah, 2019). Hypertext Transfer Protocol (HTTP) is the internet protocol for accessing websites. Clients will use the DNF command to access our website (but you can even view it in a web browser!).

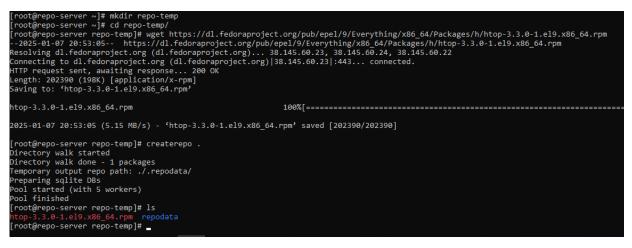## Instructions:

The manual is organized into four major parts:

1. Organizing and creating the repository database on the RHEL server
2. Setting up the web server on the RHEL server
3. Configuring to use the remote repository on a RHEL client
4. Example usage of DNF configuring packages on a RHEL client

1: Organizing and creating the repository database on the RHEL server:

1. On your personal computer, begin by remotely accessing the RHEL server through `ssh` in a terminal app.
2. Transfer all the required .RPM files to a temporary directory, like `/root/repo-temp/`, on the server computer.
   - You can use the `scp` command to transfer files between two computers, such as your personal computer and the RHEL server. You can also use `wget` on the RHEL server to download RPMs from a public repository on the internet.
   - The Extra Packages for Enterprise Linux repository contain software for RHEL maintained by the Fedora Project that is not found in the RHEL official repository (Fedora Project, (n.d.), *EPEL*).
     - For instance, suppose we want to add the htop package to our repository, we could get the htop RPM file on the RHEL server by running `wget`

> `https://dl.fedoraproject.org/pub/epel/9/Everything/x86_64/Package`
> `s/h/htop-3.3.0-1.el9.x86_64.rpm`.
- Be sure to check the dependencies for each RPM you get. If they aren't in the official RHEL repositories, you'll need to download them and include them in your repo. You can check the official website for each RPM you download or use RPM aggregation tools.
3. Install the `createrepo` command with `dnf install createrepo` (Red Hat, 2024).

```
[root@repo-server ~]# mkdir repo-temp
[root@repo-server ~]# cd repo-temp/
[root@repo-server repo-temp]# wget https://dl.fedoraproject.org/pub/epel/9/Everything/x86_64/Packages/h/htop-3.3.0-1.el9.x86_64.rpm
--2025-01-07 20:53:05--  https://dl.fedoraproject.org/pub/epel/9/Everything/x86_64/Packages/h/htop-3.3.0-1.el9.x86_64.rpm
Resolving dl.fedoraproject.org (dl.fedoraproject.org)... 38.145.60.23, 38.145.60.24, 38.145.60.22
Connecting to dl.fedoraproject.org (dl.fedoraproject.org)|38.145.60.23|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 202390 (198K) [application/x-rpm]
Saving to: 'htop-3.3.0-1.el9.x86_64.rpm'

htop-3.3.0-1.el9.x86_64.rpm                      100%[===================================================================>
2025-01-07 20:53:05 (5.15 MB/s) - 'htop-3.3.0-1.el9.x86_64.rpm' saved [202390/202390]

[root@repo-server repo-temp]# createrepo .
Directory walk started
Directory walk done - 1 packages
Temporary output repo path: ./.repodata/
Preparing sqlite DBs
Pool started (with 5 workers)
Pool finished
[root@repo-server repo-temp]# ls
htop-3.3.0-1.el9.x86_64.rpm  repodata
[root@repo-server repo-temp]#
```

Example of creating temp directory, downloading htop package, and creating local repository. The repodata directory contains the database of the repository.

4. DNF uses the `createrepo` command to scan a directory containing RPM files and create a database for a new DNF repository (Red Hat, 2024). Clients use this database to interact with a remote repository. We will use this command in the directory where we stored our RPM files on our RHEL server to create a new repository database.
   a) Run `createrepo your_temp_directory/` in the directory where you are storing your RPM files on the RHEL server.
      o For example: `createrepo /root/repo-temp/`
   b) If you need to update a repository directory, such as for adding new packages or replacing current runs, run `createrepo` with the `–update` flag.
      o For example: `createrepo –update /var/www/html/repo/`. This command will let you in-place update the repository when you finish setting it up after following this manual.
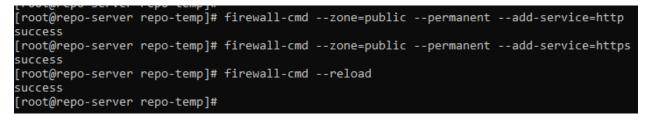
2: Setting up the web server on the RHEL server

1. Install the Apache web server, if not already done so, by running `dnf install httpd` (Zachariah, 2019).

```
[root@repo-server ~]# systemctl enable httpd
Created symlink /etc/systemd/system/multi-user.target.wants/httpd.service → /usr/lib/systemd/system/httpd.service
[root@repo-server ~]# systemctl start httpd
[root@repo-server ~]# systemctl status httpd
● httpd.service - The Apache HTTP Server
     Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
     Active: active (running) since Tue 2025-01-07 20:49:32 EST; 3s ago
       Docs: man:httpd.service(8)
   Main PID: 30371 (httpd)
     Status: "Started, listening on: port 443, port 80"
      Tasks: 178 (limit: 12307)
     Memory: 36.2M
        CPU: 107ms
     CGroup: /system.slice/httpd.service
             ├─30371 /usr/sbin/httpd -DFOREGROUND
             ├─30372 /usr/sbin/httpd -DFOREGROUND
             ├─30373 /usr/sbin/httpd -DFOREGROUND
             ├─30374 /usr/sbin/httpd -DFOREGROUND
             ├─30375 /usr/sbin/httpd -DFOREGROUND
             └─30376 /usr/sbin/httpd -DFOREGROUND

Jan 07 20:49:32 repo-server.doggett.tech systemd[1]: Starting The Apache HTTP Server...
Jan 07 20:49:32 repo-server.doggett.tech systemd[1]: Started The Apache HTTP Server.
Jan 07 20:49:32 repo-server.doggett.tech httpd[30371]: Server configured, listening on: port 443, port 80
[root@repo-server ~]#
```

Example of enabling and setting up the Apache web server.

2. Enable the Apache web server with `systemctl enable httpd` (Zachariah, 2019).
3. Start the Apache web server with `systemctl start httpd` (Zachariah, 2019).
4. Verify the Apache web server is running with `systemctl status httpd` (Zachariah, 2019).

```
[root@repo-server repo-temp]# firewall-cmd --zone=public --permanent --add-service=http
success
[root@repo-server repo-temp]# firewall-cmd --zone=public --permanent --add-service=https
success
[root@repo-server repo-temp]# firewall-cmd --reload
success
[root@repo-server repo-temp]#
```

Example of configuring firewalld to allow HTTP and HTTPS traffic.

5. Configure the RHEL firewall to allow ports 80 (http) and 443 (https) (Zachariah, 2019). Run:
    a. `firewall-cmd --zone=public --permanent --add-service=http`
    b. `firewall-cmd --zone=public --permanent --add-service=https`
    c. `firewall-cmd –reload`

```
[root@repo-server repo]# cd ..
[root@repo-server ~]# mv repo/ /var/www/html/repo
[root@repo-server ~]# cd /var/www/html/
[root@repo-server html]# ls
repo
[root@repo-server html]# setfacl -R -m u:apache:rwx repo/
[root@repo-server html]# chcon -Rt httpd_sys_content_t repo/
[root@repo-server html]# ls -lZ
total 0
drwxrwxr-x+ 3 root root unconfined_u:object_r:httpd_sys_content_t:s0 57 Jan  7 21:11 repo
[root@repo-server html]# cd repo/
[root@repo-server repo]# ls -lZ
total 204
-rw-rwxr--+ 1 root root unconfined_u:object_r:httpd_sys_content_t:s0 202390 Jan 15  2024 htop-3.3.0-1.el9.x86_64.rpm
drwxrwxr-x+ 2 root root unconfined_u:object_r:httpd_sys_content_t:s0   4096 Jan  7 21:11 repodata
```

Example of moving the temporary repo directory to /var/www/html and updating SELinux. Note use the httpd user for setfacl command in RHEL (I used AlmaLinux to create this manual).

6. Move your temporary repository directory into /var/www/html. Ex: `mv /root/repo-temp/ /var/www/html/repo` (Zachariah, 2019).

7. Update the SELinux permissions on the repo directory (Zachariah, 2019). Run the following commands:
   a. `cd /var/www/html`
   b. `setfacl -R -m u:httpd:rwx repo-directory, ex: setfacl -R -m u:httpd:rwx repo/`
   c. `chcon -Rt httpd_sys_content_t repo-directory, ex: chcon -Rt httpd_sys_content_t repo/`

The example website you should see when accessing your remote repository.

8. Check that you can access the repository on your web browser by going to the IP or hostname of the server and going to the correct repository directory you set up. Note the connection will be insecure, use HTTP or ignore HTTPS warnings.

3: Configuring to use the remote repository on a RHEL client:

```
[root@repo-client ~]# dnf config-manager --add-repo http://repo-server.doggett.tech/repo/
Adding repo from: http://repo-server.doggett.tech/repo/
[root@repo-client ~]# cd /etc/yum.repos.d/
[root@repo-client yum.repos.d]# ls
almalinux-appstream.repo  almalinux-crb.repo      almalinux-highavailability.repo  almalinux-plus.repo          almalinux-rt.repo          almalinux-sap.repo
almalinux-baseos.repo     almalinux-extras.repo   almalinux-nfv.repo               almalinux-resilientstorage.repo  almalinux-saphana.repo  repo-server.doggett.tech_repo_.repo
[root@repo-client yum.repos.d]# cat repo-server.doggett.tech_repo_.repo
[repo-server.doggett.tech_repo_]
name=created by dnf config-manager from http://repo-server.doggett.tech/repo/
baseurl=http://repo-server.doggett.tech/repo/
enabled=1
[root@repo-client yum.repos.d]# dnf repolist
repo id                                                                repo name
appstream                                                              AlmaLinux 9 - AppStream
baseos                                                                 AlmaLinux 9 - BaseOS
extras                                                                 AlmaLinux 9 - Extras
repo-server.doggett.tech_repo_                                         created by dnf config-manager from http://repo-server.doggett.tech/repo/
[root@repo-client yum.repos.d]#
```
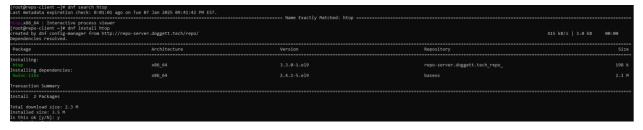
Example of adding and checking remote repository.

1. On your personal computer remotely access the RHEL client through `ssh` in a terminal app. You will need to complete this section of instructions for all clients you wish to connect to your RHEL server.
2. Use the dnf config-manager sub-command to add your remote repository to the list of remote repositories a client connects to when using DNF (Red Hat, (n.d.), *Managing custom software repositories*).
   a) Run the following command to add your repository to the client's DNF repository list: `dnf config-manager --add-repo http://REPOSITORY_IP_OR_HOSTNAME/REPO_DIRECTORY/`
      o For example: `dnf config-manager --add-repo http://repo-server.doggett.tech/repo/`
3. Verify the repo was added (Zachariah, 2019).
   a) Run `dnf repolist` to see all repositories installed
   b) Check the `/etc/yum.repos.d/` directory for the IP address or hostname of your RHEL server. There should be a .repo file there with a matching IP or hostname. You can check with the command `ls /etc/yumd.repos.d/`.

4. Open the .repo file for your remote repository on the client in the directory `/etc/yum.repos.d/` with a text editor such as `vim` (Reselman, 2022, *What's inside an RPM .repo file?*).
   a) Change the name inside the `[brackets]` to a short human readable name of the repo.
   b) change the `name=` line to a long human readable name of the repo.
   c) In this manual we don't set up GPG keys, so we need to disable them in the client config. For more advanced setups you may want to enable some of this functionality. To disable GPG keys, add the following lines to the file:
      i. Add `repo_gpgcheck=0`
      ii. Add `gpgcheck=0`
   d) See Red Hat Developer for more options in the .repo file (Reselman, 2022, *What's inside an RPM .repo file?*).

```
[repo-server.doggett.tech_repo_]
name=created by dnf config-manager from http://repo-server.doggett.tech/repo/
baseurl=http://repo-server.doggett.tech/repo/
enabled=1
repo_gpgcheck=0
gpgcheck=0
```

Example config of .repo file.

4: Example usage of DNF configuring packages on a RHEL client:

```
[root@repo-client ~]# dnf search htop
Last metadata expiration check: 0:01:01 ago on Tue 07 Jan 2025 09:41:42 PM EST.
======================================================== Name Exactly Matched: htop ========================================================
htop.x86_64 : Interactive process viewer
[root@repo-client ~]# dnf install htop
created by dnf config-manager from http://repo-server.doggett.tech/repo/                                      415 kB/s | 3.0 kB    00:00
Dependencies resolved.
============================================================================================================================================
 Package                       Architecture              Version                      Repository                              Size
============================================================================================================================================
Installing:
 htop                          x86_64                    3.3.0-1.el9                  repo-server.doggett.tech_repo_          198 k
Installing dependencies:
 hwloc-libs                    x86_64                    2.4.1-5.el9                  baseos                                  2.1 M

Transaction Summary
============================================================================================================================================
Install  2 Packages

Total download size: 2.3 M
Installed size: 3.5 M
Is this ok [y/N]: y
```

Example of searching and installing for htop, a process monitoring tool for Linux.

Below are some common DNF commands you can run on RHEL clients to manage the packages they have installed (Timoteo, JetStream, & The Fedora Docs team, 2022).

- Search for packages with `dnf search SEARCH_TERM`.
  - For example: `dnf search htop`
- Install packages with `dnf install PACKAGE_NAME`.
  - For example: `dnf install htop`
- Remove packages with `dnf remove PACKAGE_NAME`.
  - For example: `dnf remove htop`
- Check for package updates with `dnf check-update`.
- Update packages with `dnf update`
- See more example usage of the `dnf` command from the Fedora Documentation (Timoteo, JetStream, & The Fedora Docs team, 2022).

DNF automatically searches for the highest available and supported (depending on what software is currently installed, there may be held back dependencies) RPM packages (Reselman, 2022, *How does RPM package discovery work?*). If your custom repository has unique packages or newer versions of packages compared to other repositories, clients will download packages from it when they install new software or update.

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