nuts

The Java Package Manager

http://github.com/thevpc/nuts

Plan

1. Why a package manager
2. `nuts` features
3. Demo

1. Why a Package Manager

- Popularity of a language is proportional to popularity of its PM
  - `Javascript`: `npm`/`npx`/`yarn`
  - `Python`: `pip`, `conda`
  - `Ruby`: `rubygems`
- Newcomer languages already include a PM
  - `golang` package manager (modules)
- `Java` ecosystem already have more that 7M packages deployed

1.1. Java Package Manager?

- `maven`, `gradle`
  - Build tools
  - Manage packaging and dependencies
  - Poor deployment management (`maven` 's `deploy` is a build time stage)
  - Lack of deployment lifecycle (install/uninstall/update)

1.2. Example

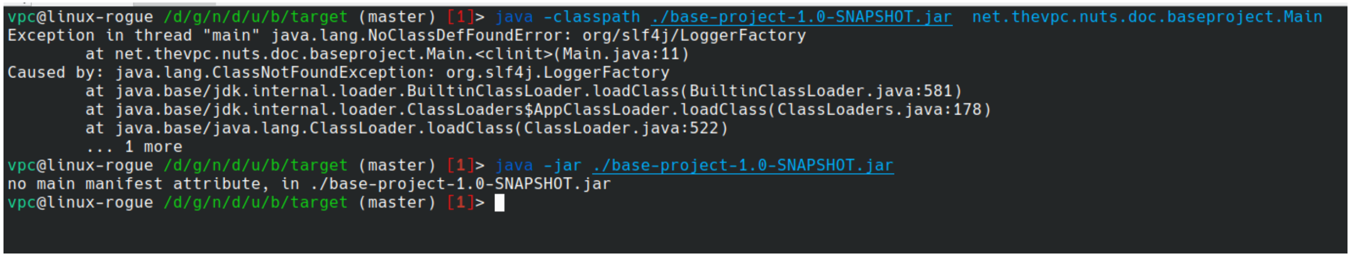
```java
package net.thevpc.nuts.doc.baseproject;

import org.slf4j.Logger;
import org.slf4j.LoggerFactory;

public class Main {
private static final Logger LOG = LoggerFactory.getLogger(Main.class);
    public static void main(String[] args) {
        LOG.debug("A simple app with dependencies. Won't work out of the box!,
unless...");
    }
}
```

1.3. pom.xml

```
<?xml version="1.0" encoding="UTF-8"?><project xmlns="..."><modelVersion>
4.0.0</modelVersion>
<groupId>net.thevpc.nuts.doc</groupId><artifactId>base-project</artifactId>
<version>1.0-SNAPSHOT</version>
<dependencies><dependency>
        <groupId>org.apache.logging.log4j</groupId>
        <artifactId>log4j-api</artifactId><version>2.7</version>
    </dependency>
    <dependency>
        <groupId>org.apache.logging.log4j</groupId>
        <artifactId>log4j-core</artifactId><version>2.7</version>
    </dependency>
    <dependency>
        <groupId>org.apache.logging.log4j</groupId>
        <artifactId>log4j-slf4j-impl</artifactId><version>2.7</version>
    </dependency></dependencies>
</project>
```

1.4. Example

- With a minimal `pom.xml` we cannot execute unless we add the `dependencies` to the classpath
- We also need to adjust the pom.xml to include the main class too!



```
vpc@linux-rogue /d/g/n/d/u/b/target (master) [1]> java -classpath ./base-project-1.0-SNAPSHOT.jar  net.thevpc.nuts.doc.baseproject.Main
Exception in thread "main" java.lang.NoClassDefFoundError: org/slf4j/LoggerFactory
        at net.thevpc.nuts.doc.baseproject.Main.<clinit>(Main.java:11)
Caused by: java.lang.ClassNotFoundException: org.slf4j.LoggerFactory
        at java.base/jdk.internal.loader.BuiltinClassLoader.loadClass(BuiltinClassLoader.java:581)
        at java.base/jdk.internal.loader.ClassLoaders$AppClassLoader.loadClass(ClassLoaders.java:178)
        at java.base/java.lang.ClassLoader.loadClass(ClassLoader.java:522)
        ... 1 more
vpc@linux-rogue /d/g/n/d/u/b/target (master) [1]> java -jar ./base-project-1.0-SNAPSHOT.jar
no main manifest attribute, in ./base-project-1.0-SNAPSHOT.jar
vpc@linux-rogue /d/g/n/d/u/b/target (master) [1]> 
```

1.5. Alternatives for deployment

- System PM / Installers
- Portable Installers
- Custom Deployments
- Build time Processors (Fat Jars)

1.6. System PM / Installers

- `rpm`, `deb`, `dmg`, `msi`
  - Native integration with OS/Env
  - Centralized management
  - Automatable (cmdline)
  - Not portable
  - Multiple deployment packages
  - Problem with installing multiple versions of the same package

1.7. Portable Installers

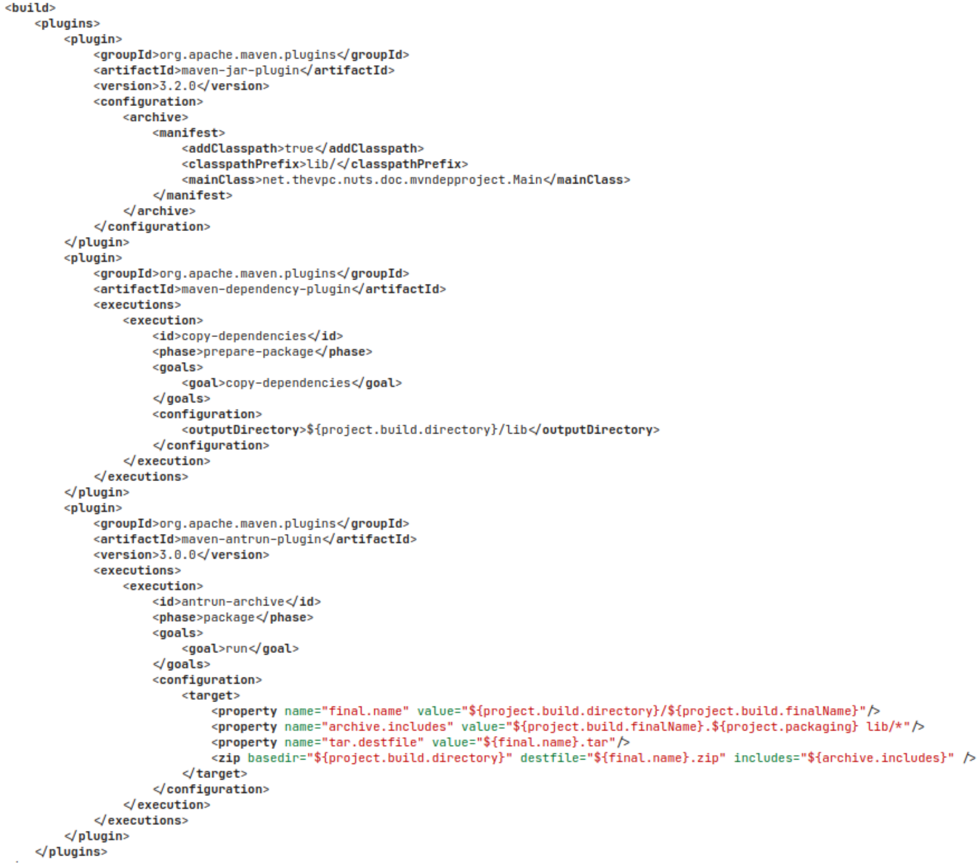
- `InstallAnywhere`, `GetDown`, `IzPack`, BitRock `InstallBuilder`
  - Good integration with OS/Env
  - No centralized management
  - Disk and network overload of dependencies
  - Graphical! not suitable for automation
  - Still Manual

1.8. Custom Deployers

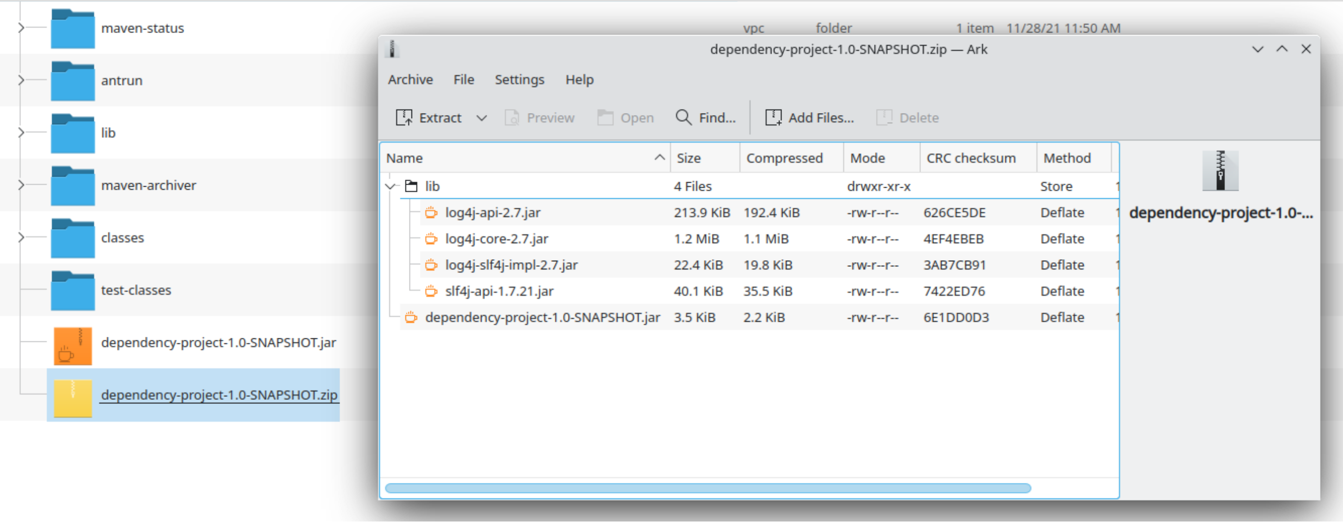
- Custom (tomcat, netbeans) with multiple formats (tarball, zip)
  - Manual
  - No centralized management
  - Difficult to automate
  - Lack of integration with environment
  - Disk and network overload of dependencies

1.9. Fat Packages: maven-dependency-plugin

- `maven-dependency-plugin`
  - Maven plugin
  - Jars included in the "lib" folder
  - Still need to bundle the jar and the lib folder (zip with `maven-antrun-plugin`)



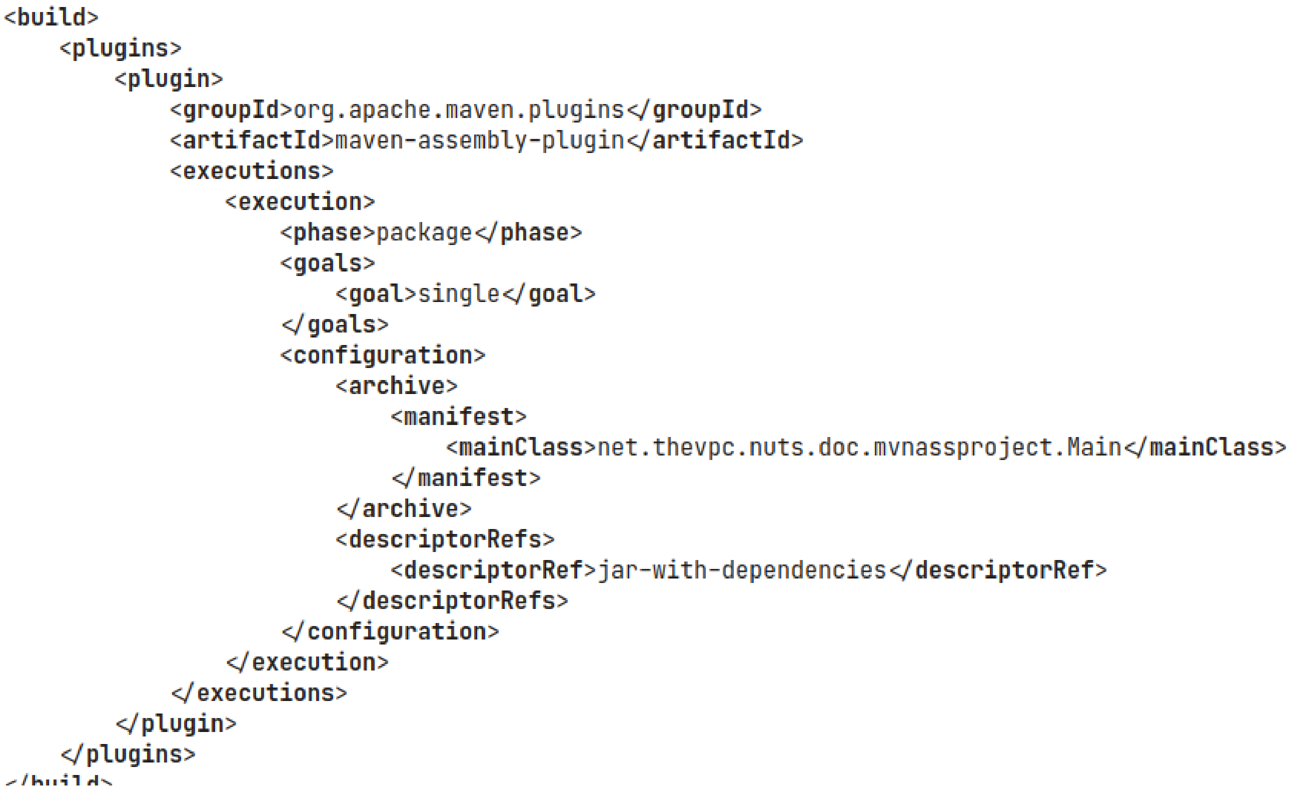
```
<build>
    <plugins>
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-jar-plugin</artifactId>
            <version>3.2.0</version>
            <configuration>
                <archive>
                    <manifest>
                        <addClasspath>true</addClasspath>
                        <classpathPrefix>lib/</classpathPrefix>
                        <mainClass>net.thevpc.nuts.doc.mvndepproject.Main</mainClass>
                    </manifest>
                </archive>
            </configuration>
        </plugin>
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-dependency-plugin</artifactId>
            <executions>
                <execution>
                    <id>copy-dependencies</id>
                    <phase>prepare-package</phase>
                    <goals>
                        <goal>copy-dependencies</goal>
                    </goals>
                    <configuration>
                        <outputDirectory>${project.build.directory}/lib</outputDirectory>
                    </configuration>
                </execution>
            </executions>
        </plugin>
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-antrun-plugin</artifactId>
            <version>3.0.0</version>
            <executions>
                <execution>
                    <id>antrun-archive</id>
                    <phase>package</phase>
                    <goals>
                        <goal>run</goal>
                    </goals>
                    <configuration>
                        <target>
                            <property name="final.name" value="${project.build.directory}/${project.build.finalName}"/>
                            <property name="archive.includes" value="${project.build.finalName}.${project.packaging} lib/*"/>
                            <property name="tar.destfile" value="${final.name}.tar"/>
                            <zip basedir="${project.build.directory}" destfile="${final.name}.zip" includes="${archive.includes}" />
                        </target>
                    </configuration>
                </execution>
            </executions>
        </plugin>
    </plugins>
```



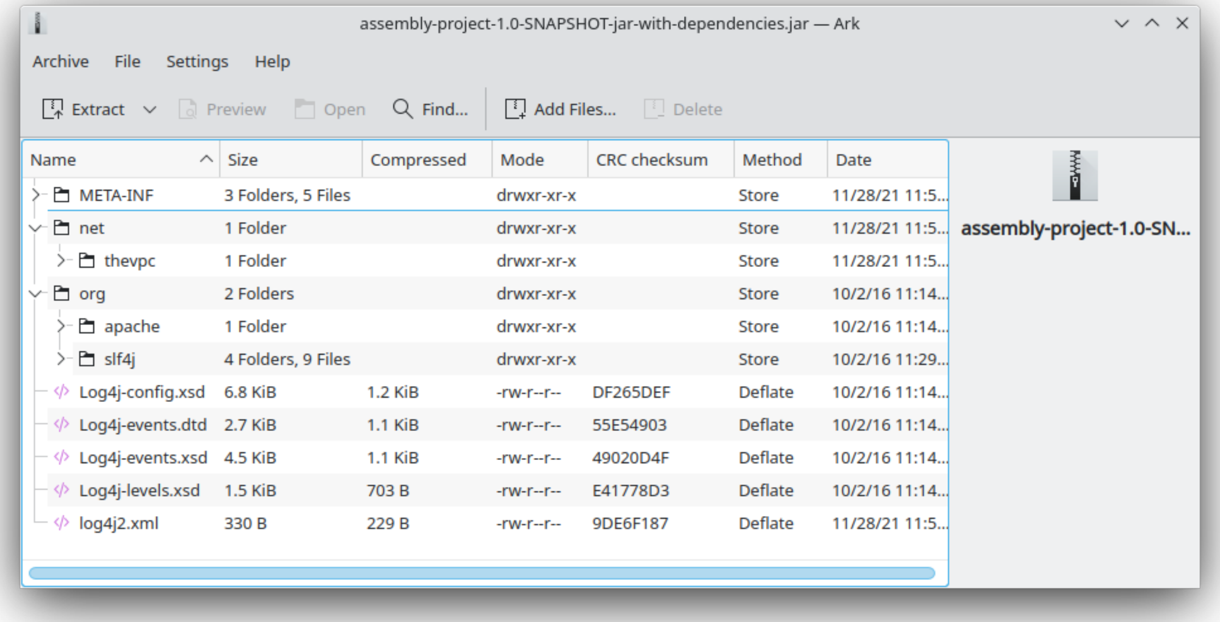
Name	Size	Compressed	Mode	CRC checksum	Method
lib	4 Files		drwxr-xr-x		Store
log4j-api-2.7.jar	213.9 KiB	192.4 KiB	-rw-r--r--	626CE5DE	Deflate
log4j-core-2.7.jar	1.2 MiB	1.1 MiB	-rw-r--r--	4EF4EBEB	Deflate
log4j-slf4j-impl-2.7.jar	22.4 KiB	19.8 KiB	-rw-r--r--	3AB7CB91	Deflate
slf4j-api-1.7.21.jar	40.1 KiB	35.5 KiB	-rw-r--r--	7422ED76	Deflate
dependency-project-1.0-SNAPSHOT.jar	3.5 KiB	2.2 KiB	-rw-r--r--	6E1DD0D3	Deflate

1.10. Fat Jars : Uber Jar

- `maven-assembly-plugin`
  - Jars deflated into the same jar
  - Can rewrite classes/resources
- `maven-shade-plugin`
  - Jars deflated into thesame jar
  - Rewrites classes/resources
  - Simpler than `maven-assembly-plugin`



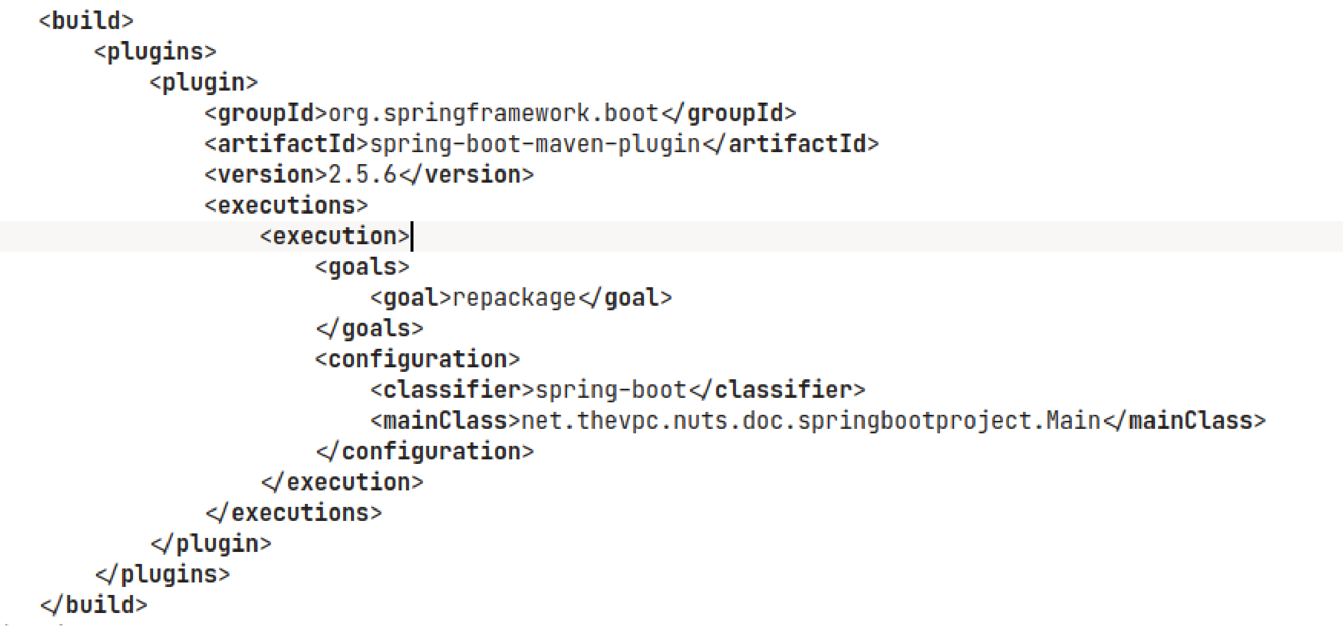
```xml
<build>
    <plugins>
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-assembly-plugin</artifactId>
            <executions>
                <execution>
                    <phase>package</phase>
                    <goals>
                        <goal>single</goal>
                    </goals>
                    <configuration>
                        <archive>
                            <manifest>
                                <mainClass>net.thevpc.nuts.doc.mvnassproject.Main</mainClass>
                            </manifest>
                        </archive>
                        <descriptorRefs>
                            <descriptorRef>jar-with-dependencies</descriptorRef>
                        </descriptorRefs>
                    </configuration>
                </execution>
            </executions>
        </plugin>
    </plugins>
</build>
```


assembly-project-1.0-SNAPSHOT-jar-with-dependencies.jar — Ark
Archive
File
Settings
Help
Extract
Preview
Open
Find...
Add Files...
Delete
assembly-project-1.0-SN...

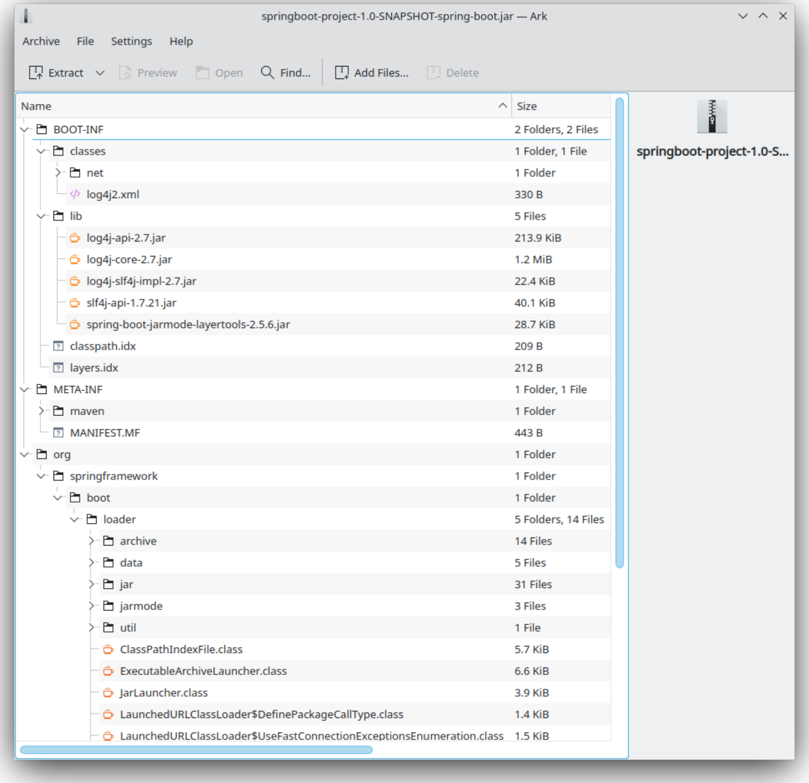
Name	Size	Compressed	Mode	CRC checksum	Method	Date
META-INF	3 Folders, 5 Files		drwxr-xr-x		Store	11/28/21 11:5...
net	1 Folder		drwxr-xr-x		Store	11/28/21 11:5...
thevpc	1 Folder		drwxr-xr-x		Store	11/28/21 11:5...
org	2 Folders		drwxr-xr-x		Store	10/2/16 11:14...
apache	1 Folder		drwxr-xr-x		Store	10/2/16 11:14...
slf4j	4 Folders, 9 Files		drwxr-xr-x		Store	10/2/16 11:29...
Log4j-config.xsd	6.8 KiB	1.2 KiB	-rw-r--r--	DF265DEF	Deflate	10/2/16 11:14...
Log4j-events.dtd	2.7 KiB	1.1 KiB	-rw-r--r--	55E54903	Deflate	10/2/16 11:14...
Log4j-events.xsd	4.5 KiB	1.1 KiB	-rw-r--r--	49020D4F	Deflate	10/2/16 11:14...
Log4j-levels.xsd	1.5 KiB	703 B	-rw-r--r--	E41778D3	Deflate	10/2/16 11:14...
log4j2.xml	330 B	229 B	-rw-r--r--	9DE6F187	Deflate	11/28/21 11:5...

1.11. Fat Jars : Jar Jar

- `onejar-maven-plugin`
    - Rewrites jar to include dependencies as jars!
    - Adds bootstrap classes
    - Changes classloader
- `spring-boot-maven-plugin`
    - Rewrites jar to include dependencies as jars!
    - Adds bootstrap classes
    - Changes classloader



```
<build>
    <plugins>
        <plugin>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-maven-plugin</artifactId>
            <version>2.5.6</version>
            <executions>
                <execution>
                    <goals>
                        <goal>repackage</goal>
                    </goals>
                    <configuration>
                        <classifier>spring-boot</classifier>
                        <mainClass>net.thevpc.nuts.doc.springbootproject.Main</mainClass>
                    </configuration>
                </execution>
            </executions>
        </plugin>
    </plugins>
</build>
```


springboot-project-1.0-SNAPSHOT-spring-boot.jar — Ark
Archive
File
Settings
Help
Extract
Preview
Open
Find...
Add Files...
Delete
springboot-project-1.0-S...

Name	Size
BOOT-INF	2 Folders, 2 Files
classes	1 Folder, 1 File
net	1 Folder
log4j2.xml	330 B
lib	5 Files
log4j-api-2.7.jar	213.9 KiB
log4j-core-2.7.jar	1.2 MiB
log4j-slf4j-impl-2.7.jar	22.4 KiB
slf4j-api-1.7.21.jar	40.1 KiB
spring-boot-jarmode-layertools-2.5.6.jar	28.7 KiB
classpath.idx	209 B
layers.idx	212 B
META-INF	1 Folder, 1 File
maven	1 Folder
MANIFEST.MF	443 B
org	1 Folder
springframework	1 Folder
boot	1 Folder
loader	5 Folders, 14 Files
archive	14 Files
data	5 Files
jar	31 Files
jarmode	3 Files
util	1 File
ClassPathIndexFile.class	5.7 KiB
ExecutableArchiveLauncher.class	6.6 KiB
JarLauncher.class	3.9 KiB
LaunchedURLClassLoader$DefinePackageCallType.class	1.4 KiB
LaunchedURLClassLoader$UseFastConnectionExceptionsEnumeration.class	1.5 KiB

1.12. So...

- All alternatives are poor and/or ugly
- `pom.xml` polluted with +16-20 lines of code
- ~~Why do we need a package manager for `Java`~~
- Why don’t we already have a package manager for `Java`!

2. nuts Package Manager for Java

Main Idea:

- Open Source
- Simple but extensible Package Manager for Java
- Good Integration with Java ecosystem and popular build/deploy/devops tools
- Little to no Intrusion and Backward compatibility to support existing apps and repos
- Solid enough to support multiple platforms

2.1. nuts: A Package Manager for Java

Is:

- Centralized package manager for Java Apps and Libs (not only)
  - `install`, `uninstall`, `update` `search` and `exec` for packages
  - Optimized dependency resolution solver
  - Cache for dependencies across installed apps
- Automation/devops friendly commandline tool
- Developed in java
- Portable across OSes, Architectures, Desktop Environments
- Libre and Open Source

2.2. nuts: A Package Manager for Java

Is Not:

- a replacement for `maven`, `gradle` or any build tool
- a plugin for `maven`, `gradle` or any build tool
- a replacement for `spring` framework or any other framework
- a replacement for `IzPack` or `InstallAnywhere` (but can do pretty much of it)
- a replacement for `ansible` or `chef` (but is conceptually driven by automation)
- a mere download tool

2.3. nuts: Unique features

- Solid integration with environments
  - Uses OS’s File System Layouts (XDG for Linux, …)
  - Supports cmdline and gui apps (installs scripts, icons, menus, …)
  - Download/Caches/Installs only relevant dependencies (according to arch …)
- Integrates seamlessly with `maven`
  - No required modification of the build process
  - No special `maven`/`gradle` plugin needed
  - Does not alter/rewrite the package

2.4. nuts: Unique features

- Solves at runtime what `maven`/`gradle` solve at build time
  - Supports `maven` and `gradle` dependency resolution algorithms, scopes, …
- Supports out of the box
  - `maven` 's repos (including central, spring, google, …)
  - Apache repos
  - Powerful toolbox with `props`, `xml`, `json`, `yaml`, `table`, `tree`, … output formats
  - Bundles a `bash`/`GNU binutils` compatible (still incomplete) but enhanced java implementations
- Is statically built and has (almost) no dependencies

2.5. 'nuts'... really?

- N etwork U pdatable T hings S ervices
- The `nuts` (fool) companion for the `maven` (sage)

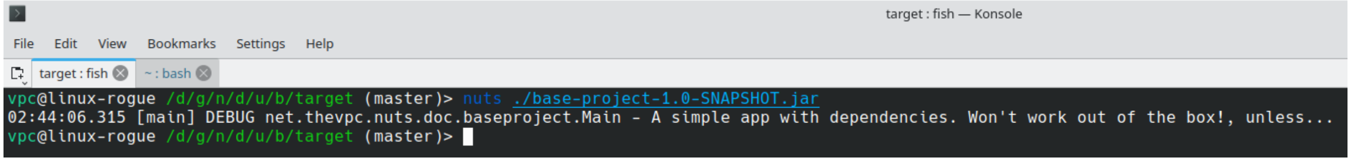
2.6. nuts stability

- Tested:
  - over 140 regression tests with 3500+ lines of test-code in the repository.
  - `opensuse`, `ubuntu`, `docker`, `windows7`, `windows10`
  - `sh`, `bash`, `csh`, `zsh`, `fish`

3. Demonstration

3.1. Run the app

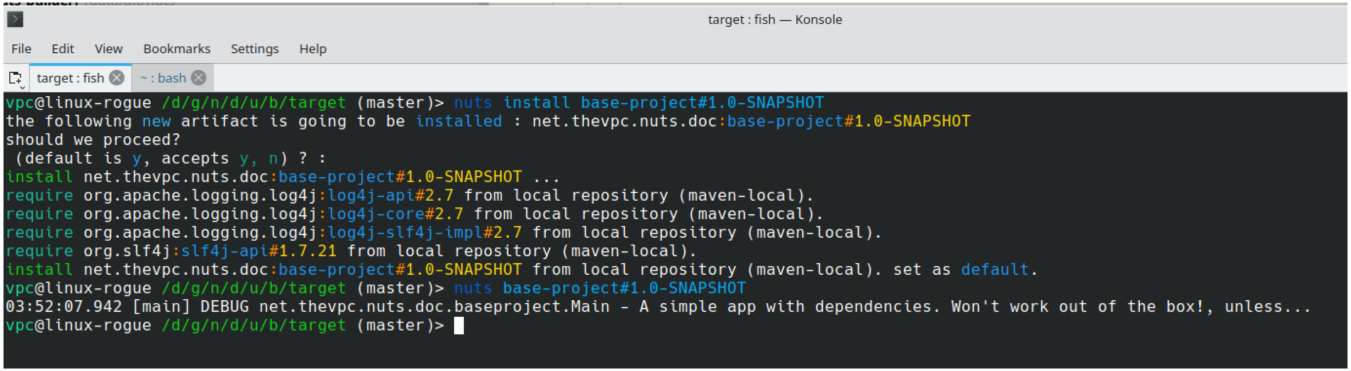
- We can just run the app, with no modification



```
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts ./base-project-1.0-SNAPSHOT.jar
02:44:06.315 [main] DEBUG net.thevpc.nuts.doc.baseproject.Main - A simple app with dependencies. Won't work out of the box!, unless...
vpc@linux-rogue /d/g/n/d/u/b/target (master)>
```

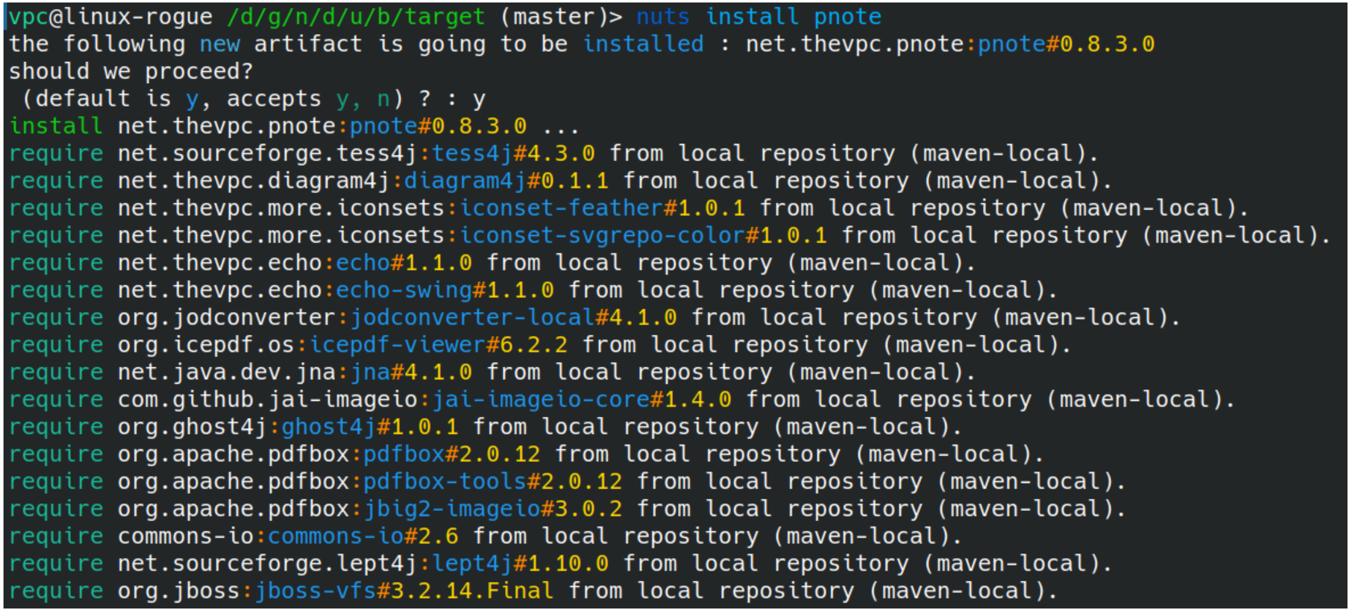
3.2. Demonstration : Install Application

- Or we can install the app (and its `required` dependencies)

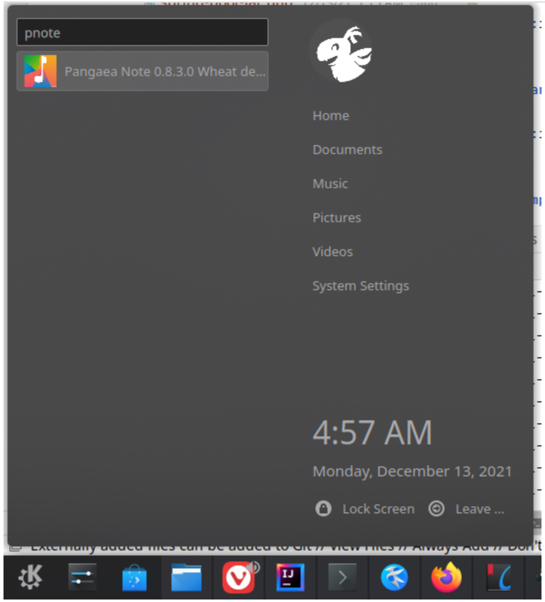


```
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts install base-project#1.0-SNAPSHOT
the following new artifact is going to be installed : net.thevpc.nuts.doc:base-project#1.0-SNAPSHOT
should we proceed?
 (default is y, accepts y, n) ? :
install net.thevpc.nuts.doc:base-project#1.0-SNAPSHOT ...
require org.apache.logging.log4j:log4j-api#2.7 from local repository (maven-local).
require org.apache.logging.log4j:log4j-core#2.7 from local repository (maven-local).
require org.apache.logging.log4j:log4j-slf4j-impl#2.7 from local repository (maven-local).
require org.slf4j:slf4j-api#1.7.21 from local repository (maven-local).
install net.thevpc.nuts.doc:base-project#1.0-SNAPSHOT from local repository (maven-local). set as default.
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts base-project#1.0-SNAPSHOT
03:52:07.942 [main] DEBUG net.thevpc.nuts.doc.baseproject.Main - A simple app with dependencies. Won't work out of the box!, unless...
vpc@linux-rogue /d/g/n/d/u/b/target (master)>
```

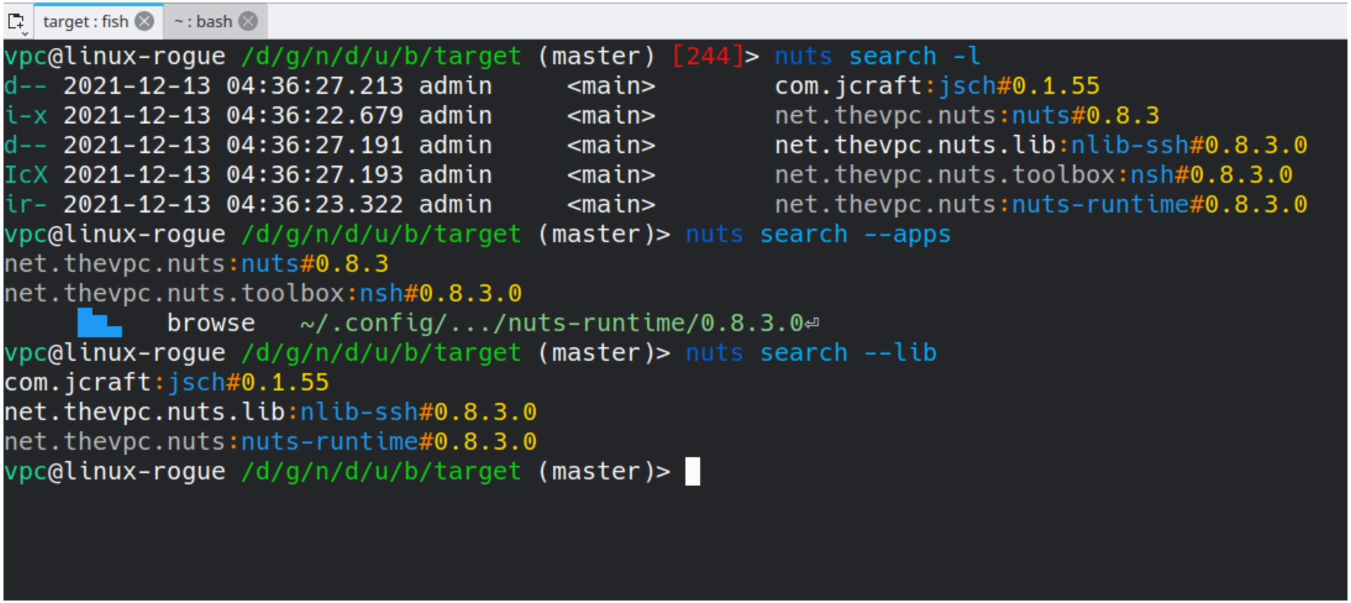
3.3. Install Gui App



```
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts install pnote
the following new artifact is going to be installed : net.thevpc.pnote:pnote#0.8.3.0
should we proceed?
 (default is y, accepts y, n) ? : y
install net.thevpc.pnote:pnote#0.8.3.0 ...
require net.sourceforge.tess4j:tess4j#4.3.0 from local repository (maven-local).
require net.thevpc.diagram4j:diagram4j#0.1.1 from local repository (maven-local).
require net.thevpc.more.iconsets:iconset-feather#1.0.1 from local repository (maven-local).
require net.thevpc.more.iconsets:iconset-svgrepo-color#1.0.1 from local repository (maven-local).
require net.thevpc.echo:echo#1.1.0 from local repository (maven-local).
require net.thevpc.echo:echo-swing#1.1.0 from local repository (maven-local).
require org.jodconverter:jodconverter-local#4.1.0 from local repository (maven-local).
require org.icepdf.os:icepdf-viewer#6.2.2 from local repository (maven-local).
require net.java.dev.jna:jna#4.1.0 from local repository (maven-local).
require com.github.jai-imageio:jai-imageio-core#1.4.0 from local repository (maven-local).
require org.ghost4j:ghost4j#1.0.1 from local repository (maven-local).
require org.apache.pdfbox:pdfbox#2.0.12 from local repository (maven-local).
require org.apache.pdfbox:pdfbox-tools#2.0.12 from local repository (maven-local).
require org.apache.pdfbox:jbig2-imageio#3.0.2 from local repository (maven-local).
require commons-io:commons-io#2.6 from local repository (maven-local).
require net.sourceforge.lept4j:lept4j#1.10.0 from local repository (maven-local).
require org.jboss:jboss-vfs#3.2.14.Final from local repository (maven-local).
```

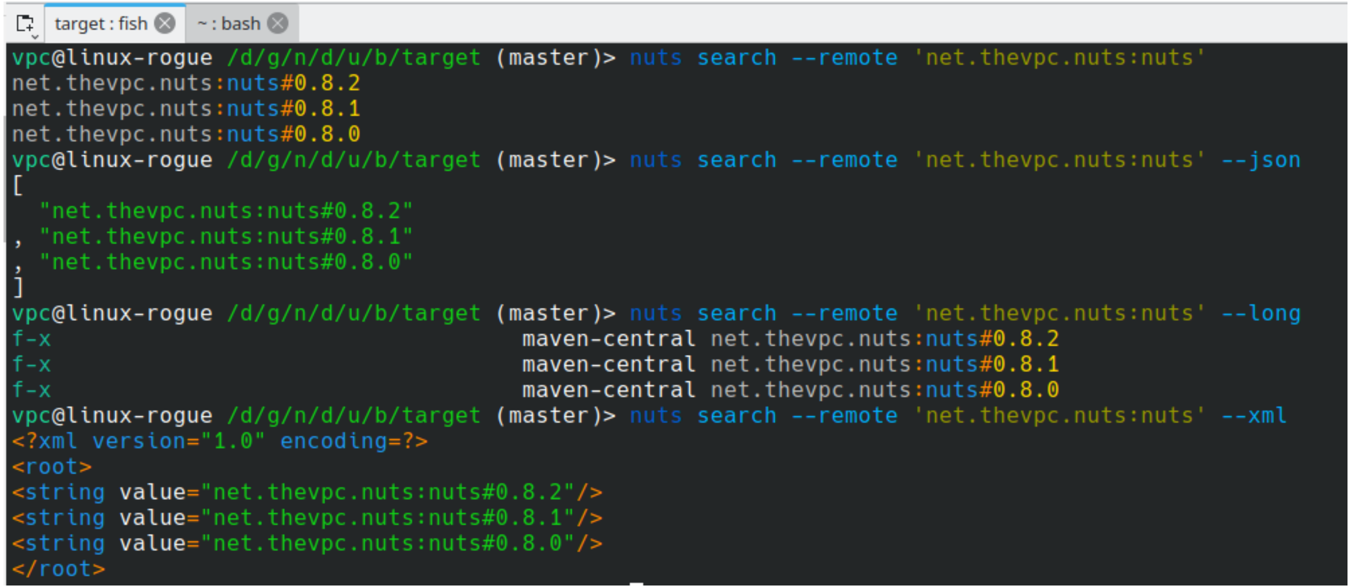

pnote
Pangaea Note 0.8.3.0 Wheat de...
Home
Documents
Music
Pictures
Videos
System Settings
4:57 AM
Monday, December 13, 2021
Lock Screen
Leave ...

3.4. Search for available applications



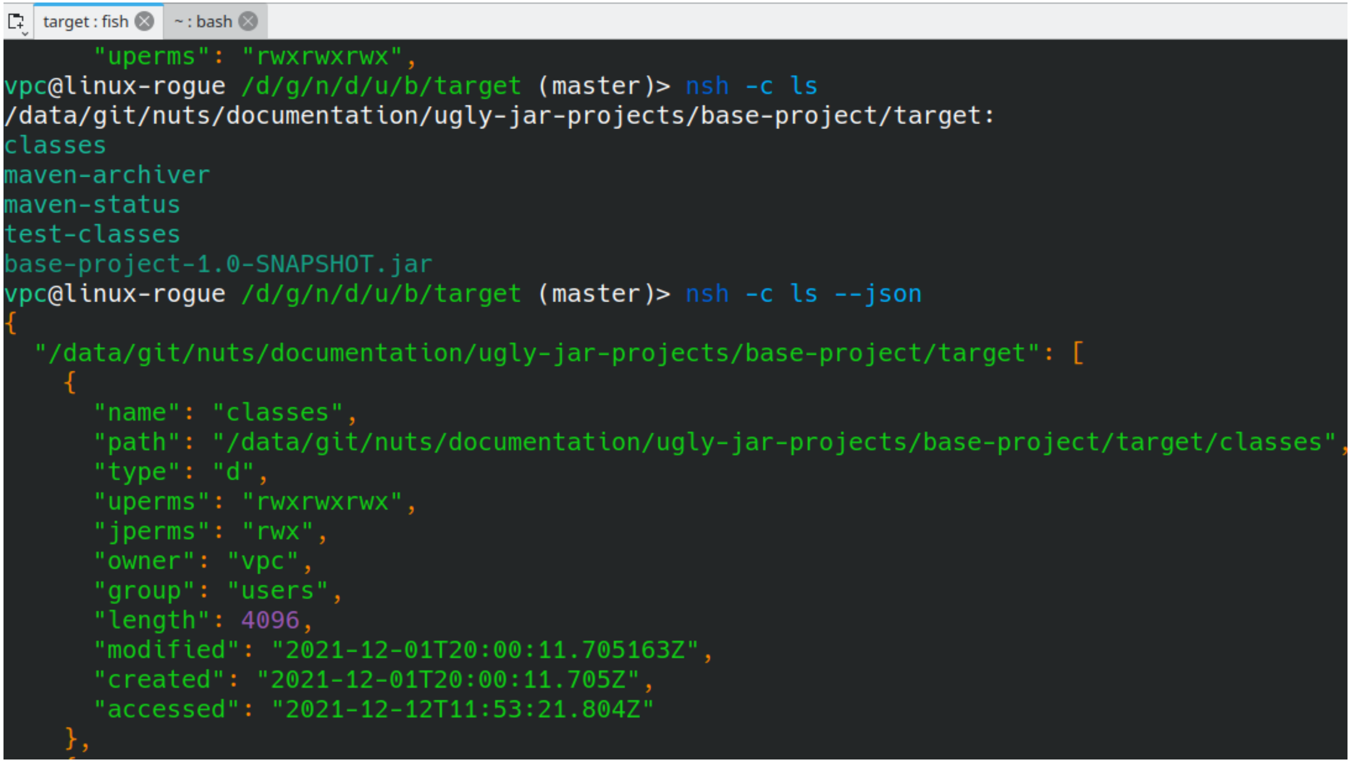
```
vpc@linux-rogue /d/g/n/d/u/b/target (master) [244]> nuts search -l
d-- 2021-12-13 04:36:27.213 admin     <main>        com.jcraft:jsch#0.1.55
i-x 2021-12-13 04:36:22.679 admin     <main>        net.thevpc.nuts:nuts#0.8.3
d-- 2021-12-13 04:36:27.191 admin     <main>        net.thevpc.nuts.lib:nlib-ssh#0.8.3.0
IcX 2021-12-13 04:36:27.193 admin     <main>        net.thevpc.nuts.toolbox:nsh#0.8.3.0
ir- 2021-12-13 04:36:23.322 admin     <main>        net.thevpc.nuts:nuts-runtime#0.8.3.0
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search --apps
net.thevpc.nuts:nuts#0.8.3
net.thevpc.nuts.toolbox:nsh#0.8.3.0
           browse   ~/.config/.../nuts-runtime/0.8.3.0⏎
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search --lib
com.jcraft:jsch#0.1.55
net.thevpc.nuts.lib:nlib-ssh#0.8.3.0
net.thevpc.nuts:nuts-runtime#0.8.3.0
vpc@linux-rogue /d/g/n/d/u/b/target (master)> 
```

3.5. Integration And Formats



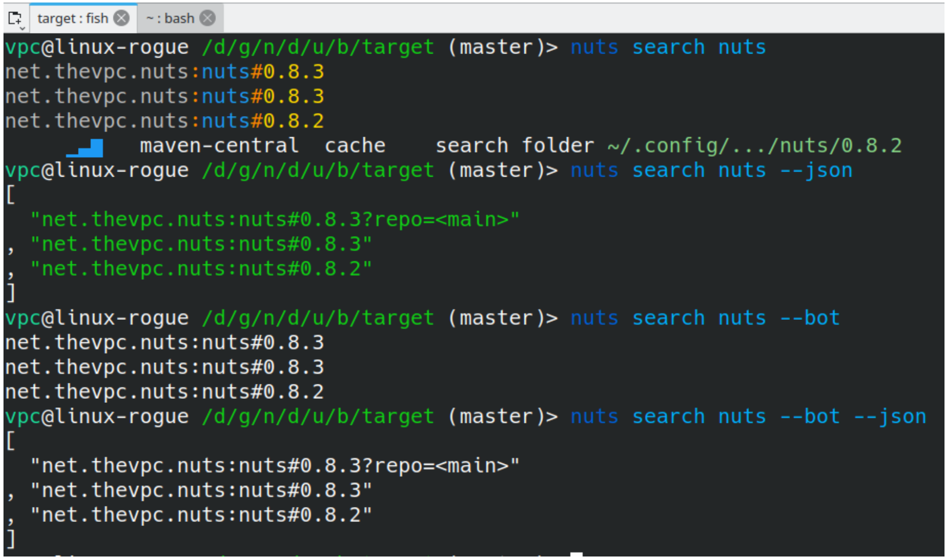
```
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search --remote 'net.thevpc.nuts:nuts'
net.thevpc.nuts:nuts#0.8.2
net.thevpc.nuts:nuts#0.8.1
net.thevpc.nuts:nuts#0.8.0
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search --remote 'net.thevpc.nuts:nuts' --json
[
  "net.thevpc.nuts:nuts#0.8.2"
, "net.thevpc.nuts:nuts#0.8.1"
, "net.thevpc.nuts:nuts#0.8.0"
]
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search --remote 'net.thevpc.nuts:nuts' --long
f-x                                    maven-central net.thevpc.nuts:nuts#0.8.2
f-x                                    maven-central net.thevpc.nuts:nuts#0.8.1
f-x                                    maven-central net.thevpc.nuts:nuts#0.8.0
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search --remote 'net.thevpc.nuts:nuts' --xml
<?xml version="1.0" encoding=?>
<root>
<string value="net.thevpc.nuts:nuts#0.8.2"/>
<string value="net.thevpc.nuts:nuts#0.8.1"/>
<string value="net.thevpc.nuts:nuts#0.8.0"/>
</root>
```

3.6. Companions



```
      "uperms": "rwxrwxrwx",
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nsh -c ls
/data/git/nuts/documentation/ugly-jar-projects/base-project/target:
classes
maven-archiver
maven-status
test-classes
base-project-1.0-SNAPSHOT.jar
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nsh -c ls --json
{
  "/data/git/nuts/documentation/ugly-jar-projects/base-project/target": [
    {
      "name": "classes",
      "path": "/data/git/nuts/documentation/ugly-jar-projects/base-project/target/classes",
      "type": "d",
      "uperms": "rwxrwxrwx",
      "jperms": "rwx",
      "owner": "vpc",
      "group": "users",
      "length": 4096,
      "modified": "2021-12-01T20:00:11.705163Z",
      "created": "2021-12-01T20:00:11.705Z",
      "accessed": "2021-12-12T11:53:21.804Z"
    },
```

3.7. Bot Mot



```
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search nuts
net.thevpc.nuts:nuts#0.8.3
net.thevpc.nuts:nuts#0.8.3
net.thevpc.nuts:nuts#0.8.2
     ▁▃    maven-central  cache    search folder ~/.config/.../nuts/0.8.2
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search nuts --json
[
  "net.thevpc.nuts:nuts#0.8.3?repo=<main>"
, "net.thevpc.nuts:nuts#0.8.3"
, "net.thevpc.nuts:nuts#0.8.2"
]
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search nuts --bot
net.thevpc.nuts:nuts#0.8.3
net.thevpc.nuts:nuts#0.8.3
net.thevpc.nuts:nuts#0.8.2
vpc@linux-rogue /d/g/n/d/u/b/target (master)> nuts search nuts --bot --json
[
  "net.thevpc.nuts:nuts#0.8.3?repo=<main>"
, "net.thevpc.nuts:nuts#0.8.3"
, "net.thevpc.nuts:nuts#0.8.2"
]
```