

Tearing open
packages

What is a package?

A package is an archive of files and directories.

The archive contains information about location, kind, owner, group, and mode of each file and directory.

The archive contains information about **location**, **kind**, **owner**, **group**, and **mode** of each file and directory.

A package may also
optionally run some scripts.

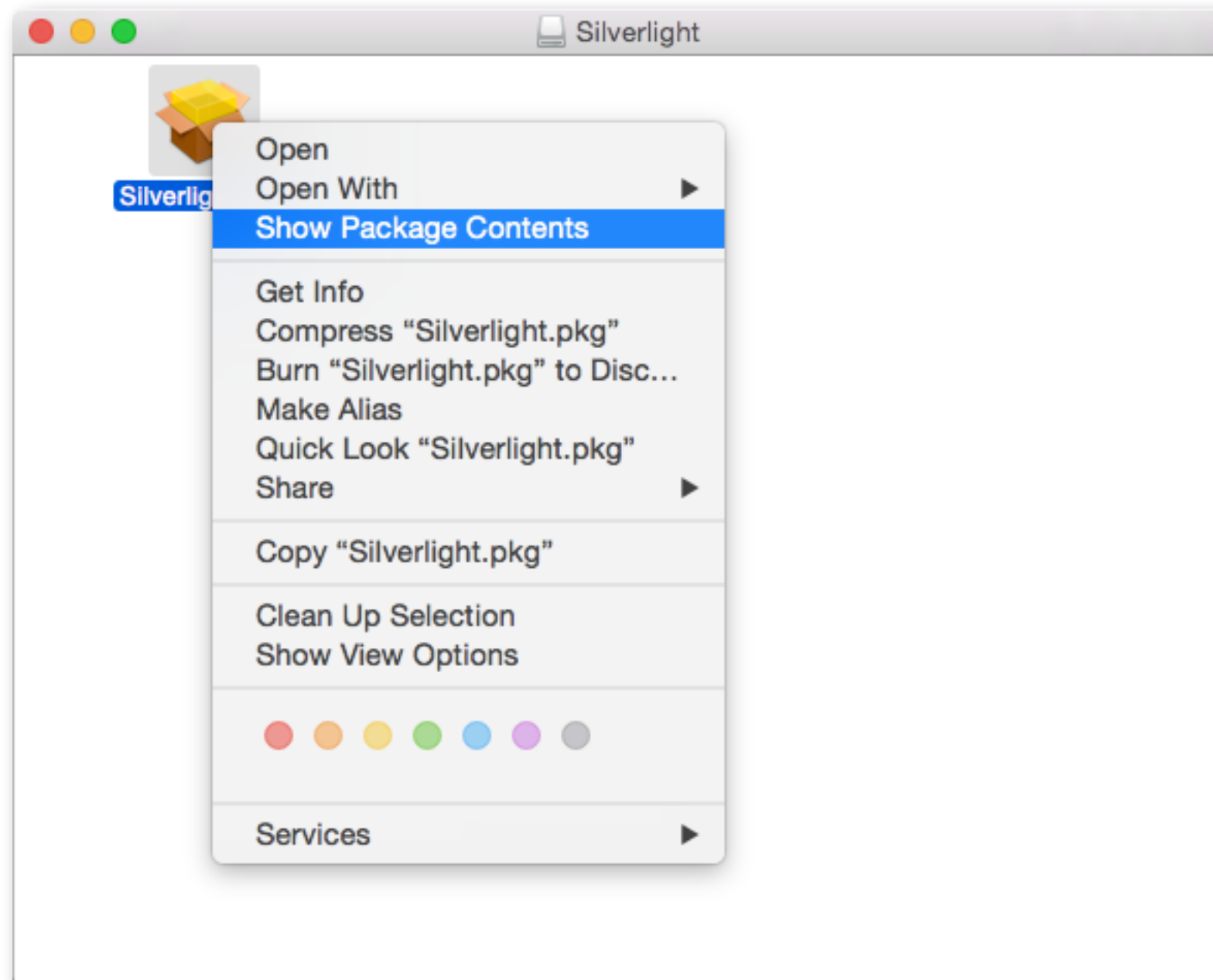
A package **may** also
optionally run some scripts.

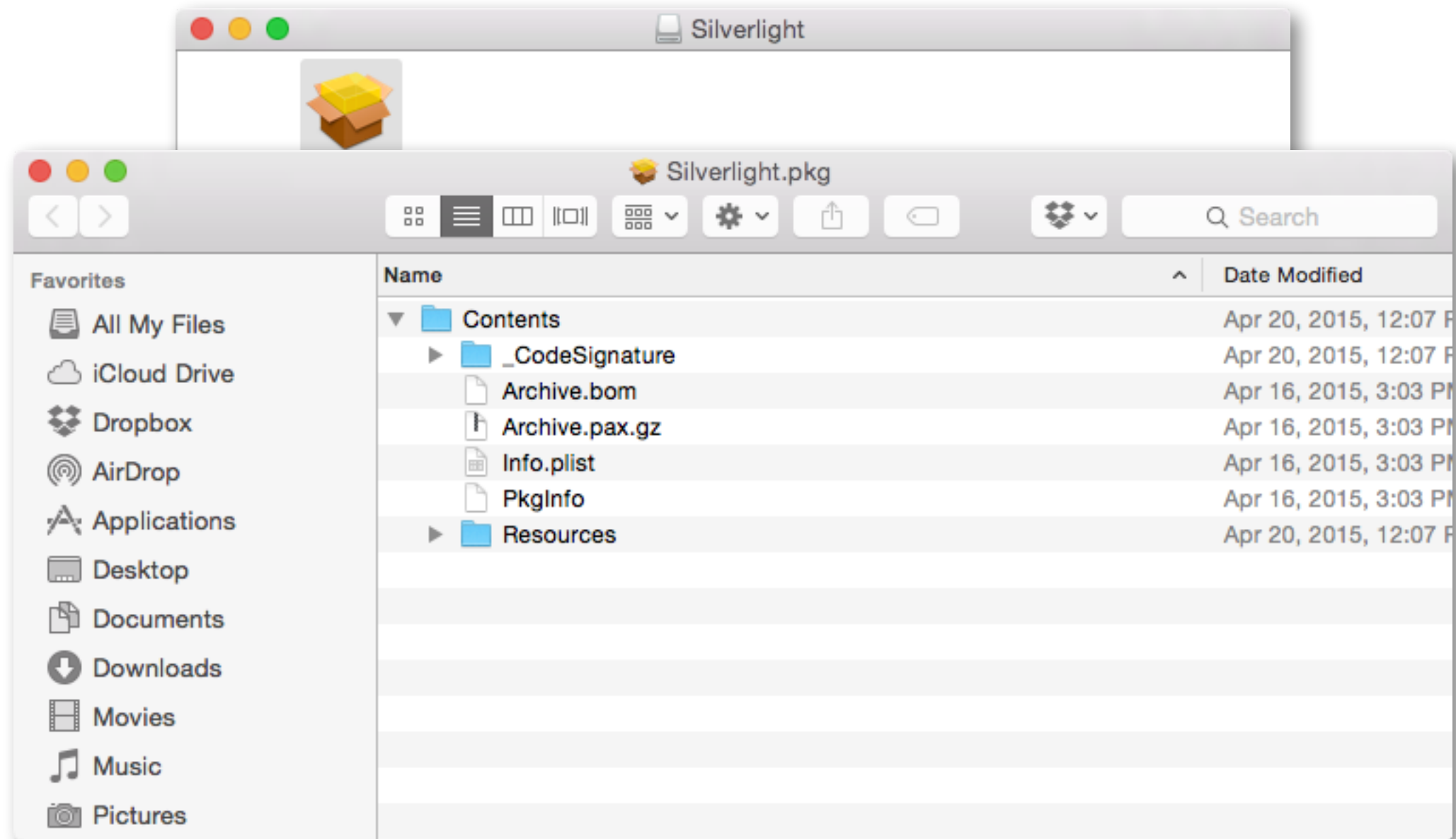
Package Types

- Bundle
- Flat

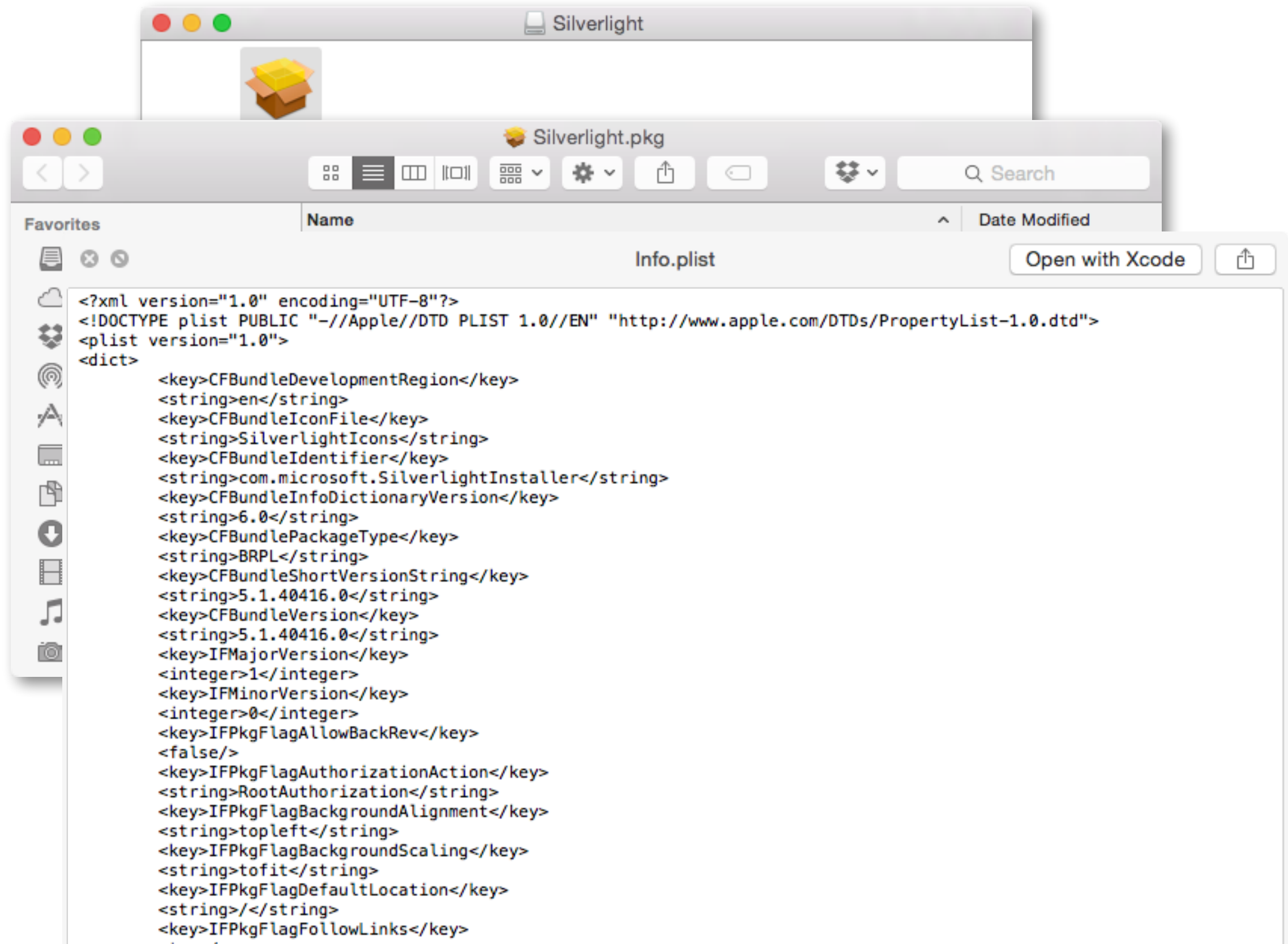
Bundle packages

- Like other OS X bundles (apps, preference panes, etc): a special type of directory





Info.plist: package metadata



```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
  <key>CFBundleDevelopmentRegion</key>
  <string>en</string>
  <key>CFBundleIconFile</key>
  <string>SilverlightIcons</string>
  <key>CFBundleIdentifier</key>
  <string>com.microsoft.SilverlightInstaller</string>
  <key>CFBundleInfoDictionaryVersion</key>
  <string>6.0</string>
  <key>CFBundlePackageType</key>
  <string>BRPL</string>
  <key>CFBundleShortVersionString</key>
  <string>5.1.40416.0</string>
  <key>CFBundleVersion</key>
  <string>5.1.40416.0</string>
  <key>IFMajorVersion</key>
  <integer>1</integer>
  <key>IFMinorVersion</key>
  <integer>0</integer>
  <key>IFPkgFlagAllowBackRev</key>
  <false/>
  <key>IFPkgFlagAuthorizationAction</key>
  <string>RootAuthorization</string>
  <key>IFPkgFlagBackgroundAlignment</key>
  <string>topleft</string>
  <key>IFPkgFlagBackgroundScaling</key>
  <string>tofit</string>
  <key>IFPkgFlagDefaultLocation</key>
  <string>/</string>
  <key>IFPkgFlagFollowLinks</key>
  <true/>
  <key>IFPkgFlagInstallFat</key>
  <false/>
  <key>IFPkgFlagInstalledSize</key>
  <integer>99420</integer>
  <key>IFPkgFlagIsRequired</key>
  <false/>
  <key>IFPkgFlagOverwritePermissions</key>
  <false/>
  <key>IFPkgFlagRelocatable</key>
  <false/>
  <key>IFPkgFlagRestartAction</key>
  <string>None</string>
```



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<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/DTDs/PropertyList-1.0.dtd">
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  <key>CFBundleDevelopmentRegion</key>
  <string>en</string>
  <key>CFBundleIconFile</key>
  <string>SilverlightIcons</string>
  <key>CFBundleIdentifier</key>
  <string>com.microsoft.SilverlightInstaller</string>
  <key>CFBundleInfoDictionaryVersion</key>
  <string>6.0</string>
  <key>CFBundlePackageType</key>
  <string>RRPL</string>
  <key>CFBundleShortVersionString</key>
  <string>5.1.40416.0</string>
  <key>CFBundleVersion</key>
  <string>5.1.40416.0</string>
  <key>IFMajorVersion</key>
  <integer>1</integer>
  <key>IFMinorVersion</key>
  <integer>0</integer>
  <key>IFPkgFlagAllowBackRev</key>
  <false/>
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  <string>RootAuthorization</string>
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  <key>CFBundleIconFile</key>
  <string>SilverlightIcons</string>
  <key>CFBundleIdentifier</key>
  <string>com.microsoft.SilverlightInstaller</string>
  <key>CFBundleInfoDictionaryVersion</key>
  <string>6.0</string>
  <key>CFBundlePackageType</key>
  <string>BRPL</string>
  <key>CFBundleShortVersionString</key>
  <string>5.1.40416.0</string>
  <key>CFBundleVersion</key>
  <string>5.1.40416.0</string>
  <key>irmajorversion</key>
  <integer>1</integer>
  <key>IFMinorVersion</key>
  <integer>0</integer>
  <key>IFPkgFlagAllowBackRev</key>
  <false/>
  <key>IFPkgFlagAuthorizationAction</key>
  <string>RootAuthorization</string>
  <key>IFPkgFlagBackgroundAlignment</key>
  <string>topleft</string>
  <key>IFPkgFlagBackgroundScaling</key>
  <string>tofit</string>
  <key>IFPkgFlagDefaultLocation</key>
  <string>/</string>
  <key>IFPkgFlagFollowLinks</key>
  <true/>
  <key>IFPkgFlagInstallFat</key>
  <false/>
  <key>IFPkgFlagInstalledSize</key>
  <integer>99420</integer>
  <key>IFPkgFlagIsRequired</key>
  <false/>
  <key>IFPkgFlagOverwritePermissions</key>
  <false/>
  <key>IFPkgFlagRelocatable</key>
  <false/>
  <key>IFPkgFlagRestartAction</key>
  <string>None</string>
```

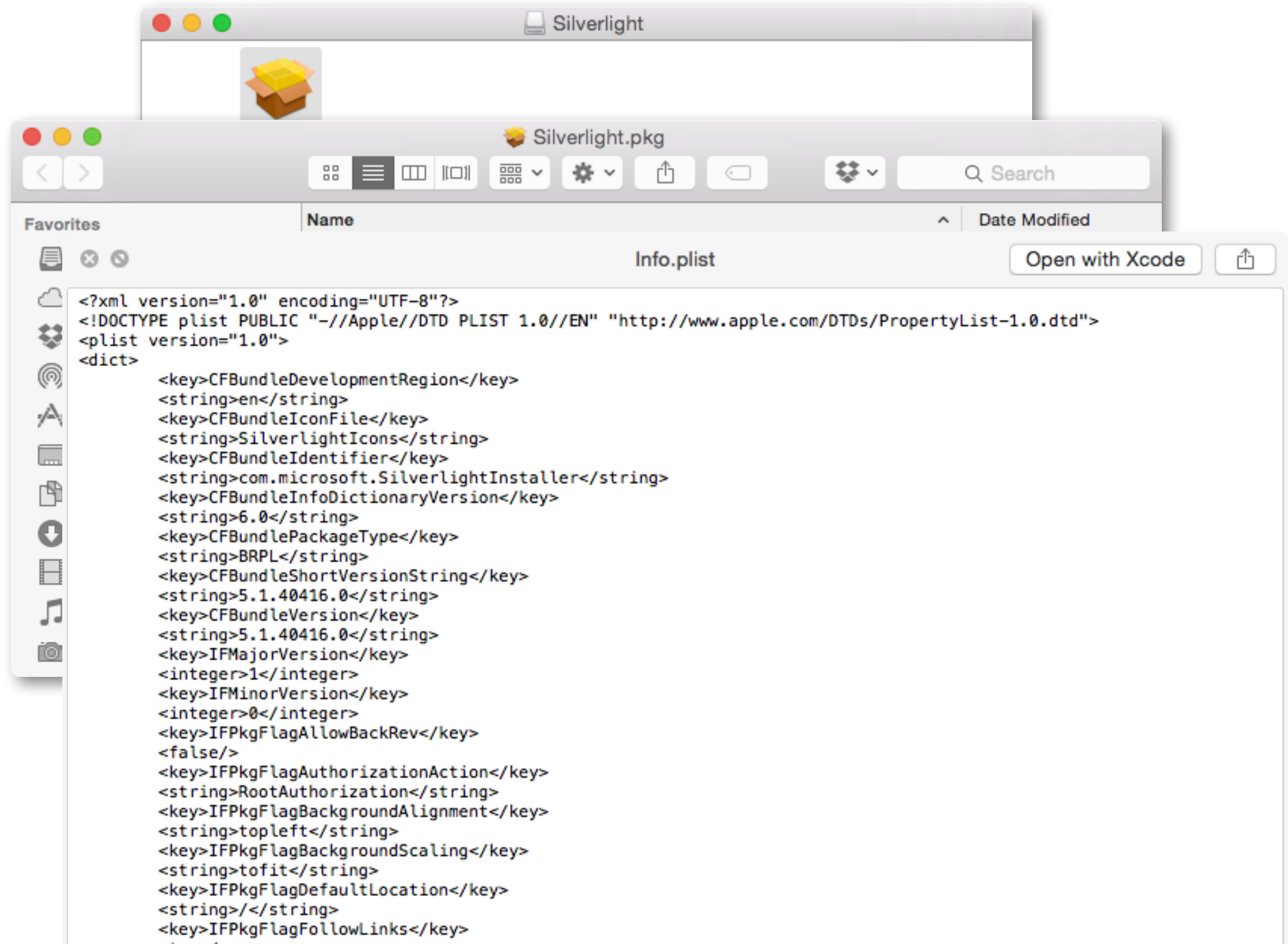


```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
  <key>CFBundleDevelopmentRegion</key>
  <string>en</string>
  <key>CFBundleIconFile</key>
  <string>SilverlightIcons</string>
  <key>CFBundleIdentifier</key>
  <string>com.microsoft.SilverlightInstaller</string>
  <key>CFBundleInfoDictionaryVersion</key>
  <string>6.0</string>
  <key>CFBundlePackageType</key>
  <string>BRPL</string>
  <key>CFBundleShortVersionString</key>
  <string>5.1.40416.0</string>
  <key>CFBundleVersion</key>
  <string>5.1.40416.0</string>
  <key>IFMajorVersion</key>
  <integer>1</integer>
  <key>IFMinorVersion</key>
  <integer>0</integer>
  <key>IFPkgFlagAllowBackRev</key>
  <false/>
  <key>IFPkgFlagAuthorizationAction</key>
  <string>RootAuthorization</string>
  <key>IFPkgFlagBackgroundAlignment</key>
  <string>topleft</string>
  <key>IFPkgFlagBackgroundScaling</key>
  <string>tofit</string>
  <key>IFPkgFlagDefaultLocation</key>
  <string>/</string>
  <key>IFPkgFlagFollowLinks</key>
  <true/>
  <key>IFPkgFlagInstallFat</key>
  <false/>
  <key>IFPkgFlagInstalledSize</key>
  <integer>99420</integer>
  <key>IFPkgFlagIsRequired</key>
  <false/>
  <key>IFPkgFlagOverwritePermissions</key>
  <false/>
  <key>IFPkgFlagRelocatable</key>
  <false/>
  <key>IFPkgFlagRestartAction</key>
  <string>None</string>
```

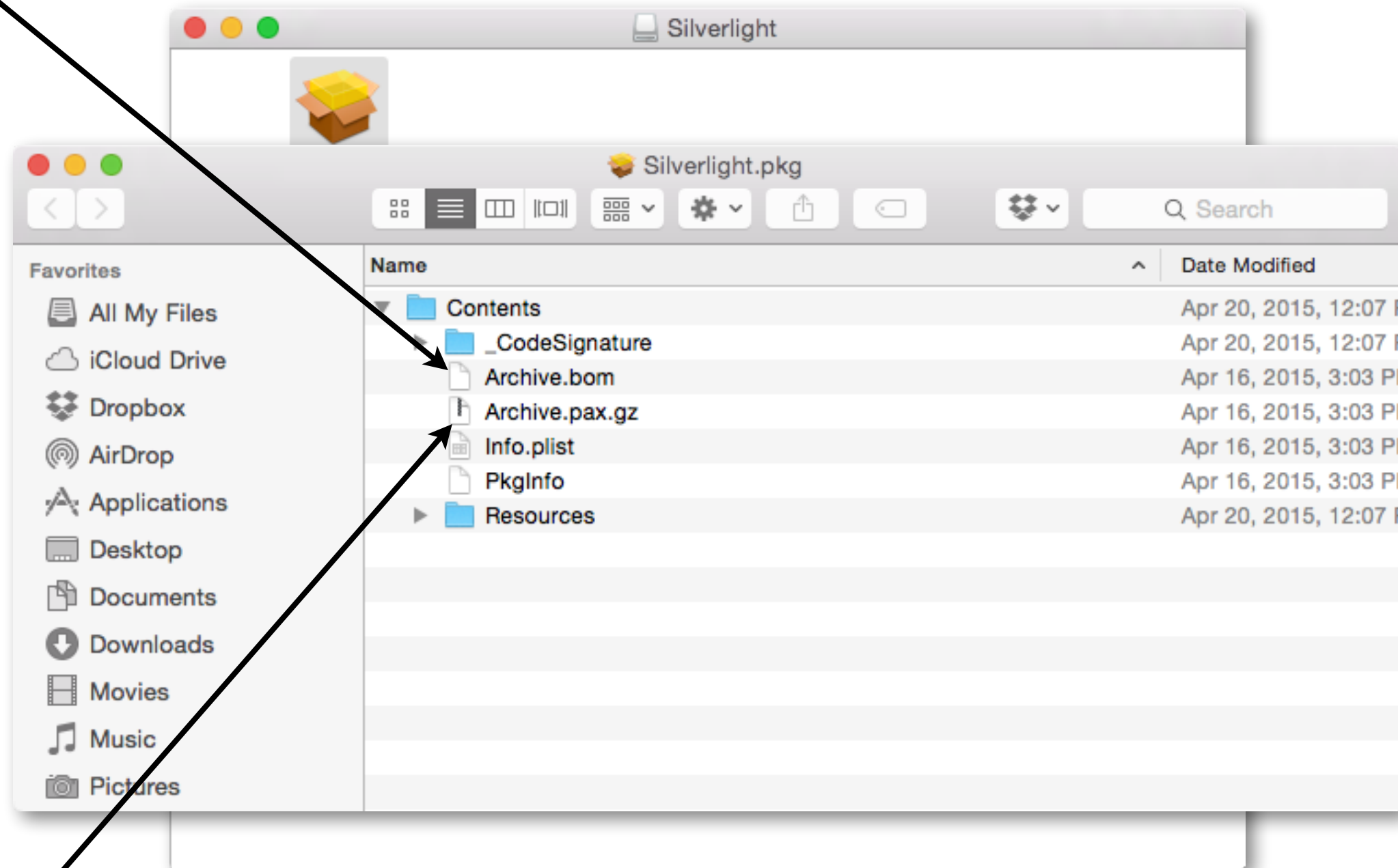


```
<key>CFBundleShortVersionString</key>
<string>5.1.40416.0</string>
<key>CFBundleVersion</key>
<string>5.1.40416.0</string>
<key>IFMajorVersion</key>
<integer>1</integer>
<key>IFMinorVersion</key>
<integer>0</integer>
<key>IFPkgFlagAllowBackRev</key>
<false/>
<key>IFPkgFlagAuthorizationAction</key>
<string>RootAuthorization</string>
<key>IFPkgFlagBackgroundAlignment</key>
<string>topleft</string>
<key>IFPkgFlagBackgroundScaling</key>
<string>tofit</string>
<key>IFPkgFlagDefaultLocation</key>
<string>/</string>
<key>IFPkgFlagFollowLinks</key>
<true/>
<key>IFPkgFlagInstallFat</key>
<false/>
<key>IFPkgFlagInstalledSize</key>
<integer>99420</integer>
<key>IFPkgFlagIsRequired</key>
<false/>
<key>IFPkgFlagOverwritePermissions</key>
<false/>
<key>IFPkgFlagRelocatable</key>
<false/>
<key>IFPkgFlagRestartAction</key>
<string>None</string>
<key>IFPkgFlagRootVolumeOnly</key>
<true/>
<key>IFPkgFlagUpdateInstalledLanguages</key>
<false/>
<key>IFPkgFormatVersion</key>
<real>0.10000000149011612</real>
<key>IFPkgPathMappings</key>
<dict>
  <key>./Contents/Resources/RestartPrompt.app</key>
  <string>{pkmk-token-14}</string>
  <key>./Contents/Resources/Silverlight Preferences.app</key>
  <string>{pkmk-token-18}</string>
  <key>./Contents/Resources/UpdatePrompt.app</key>
  <string>{pkmk-token-22}</string>
  <key>./Library/Application Support/Microsoft/Silverlight/OutOfBrowser/SLLauncher.app</key>
  <string>{pkmk-token-2}</string>
```

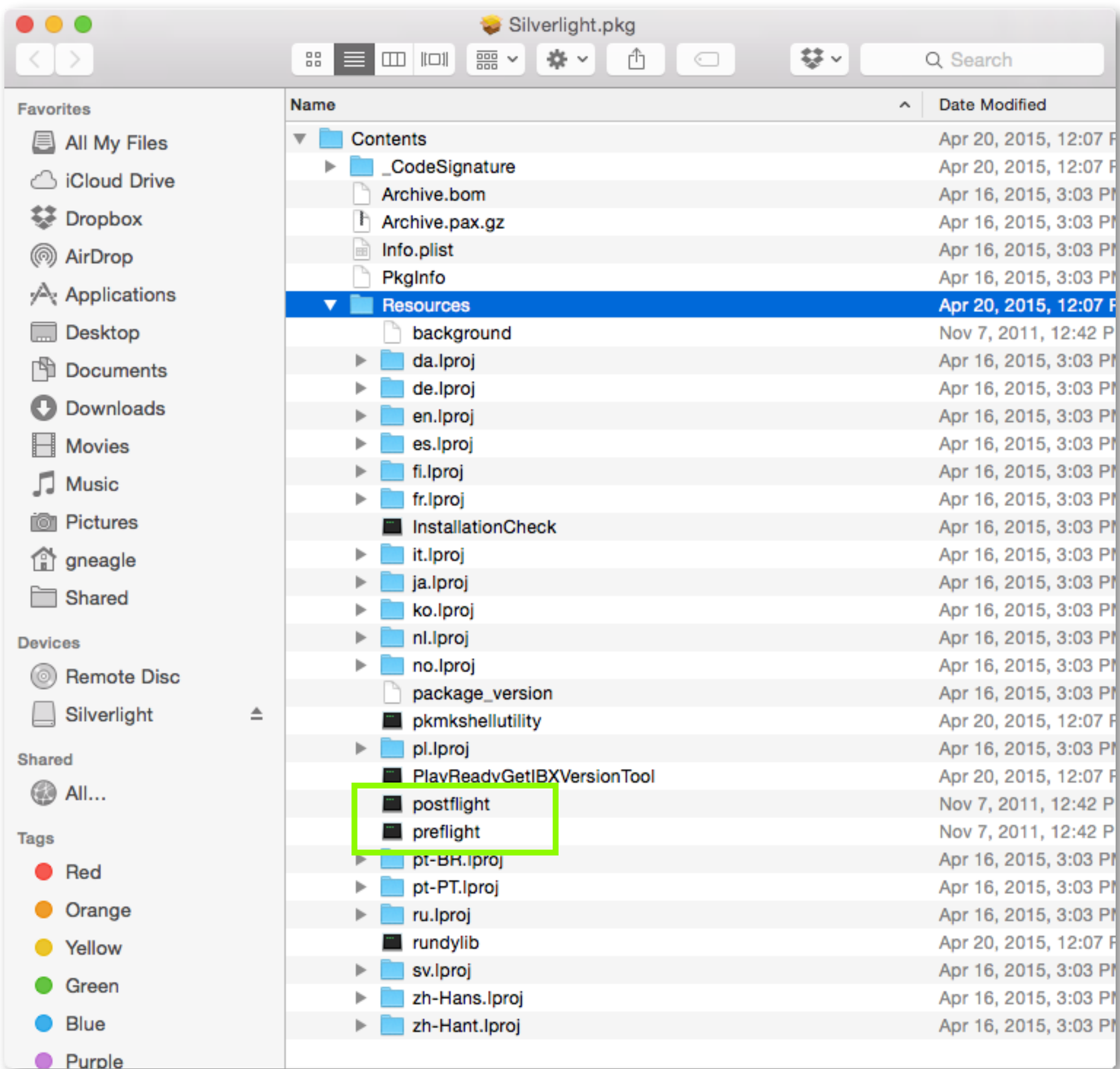
Info.plist: package metadata



Archive.bom: list of filesystem items and metadata



Archive.pax.gz: compressed archive of files

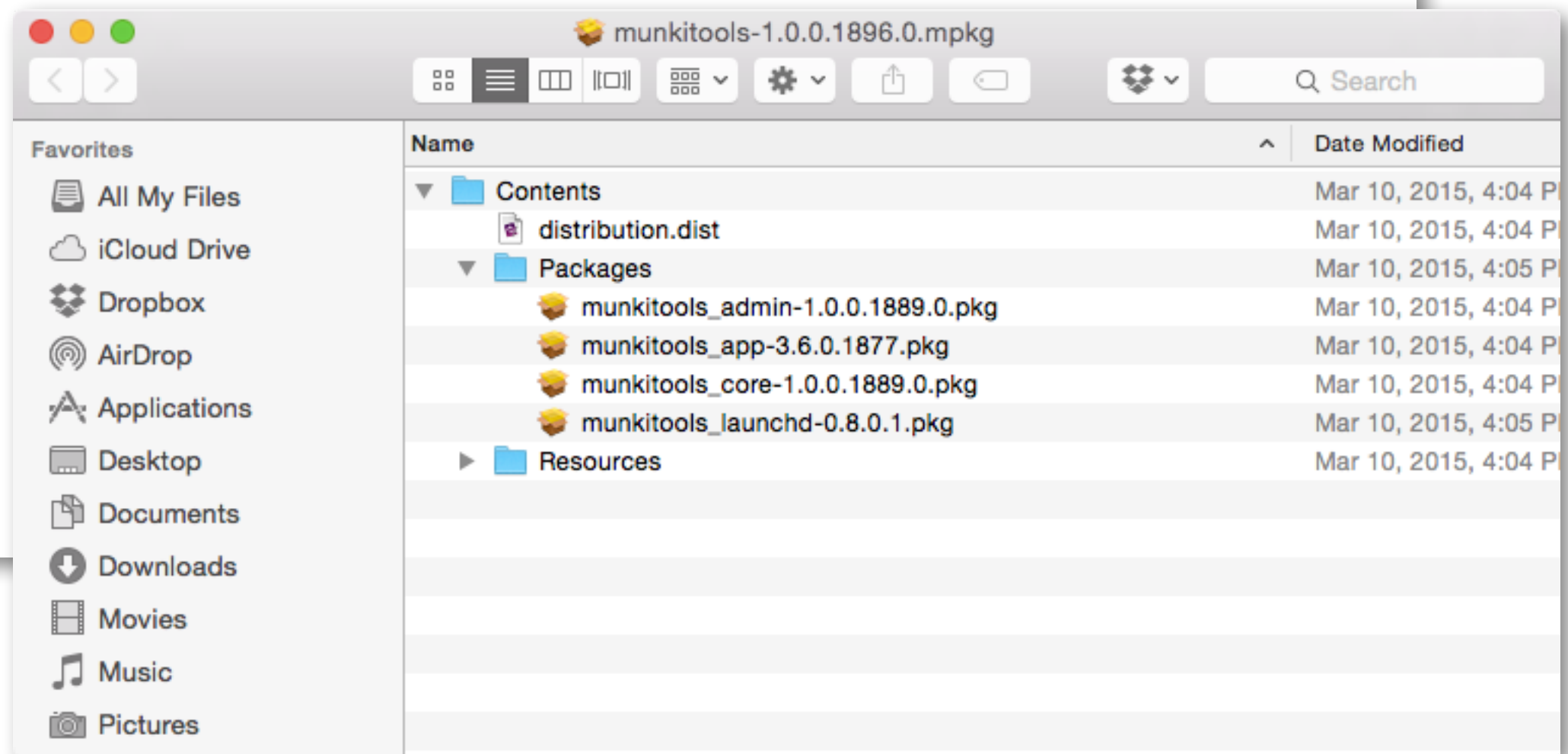
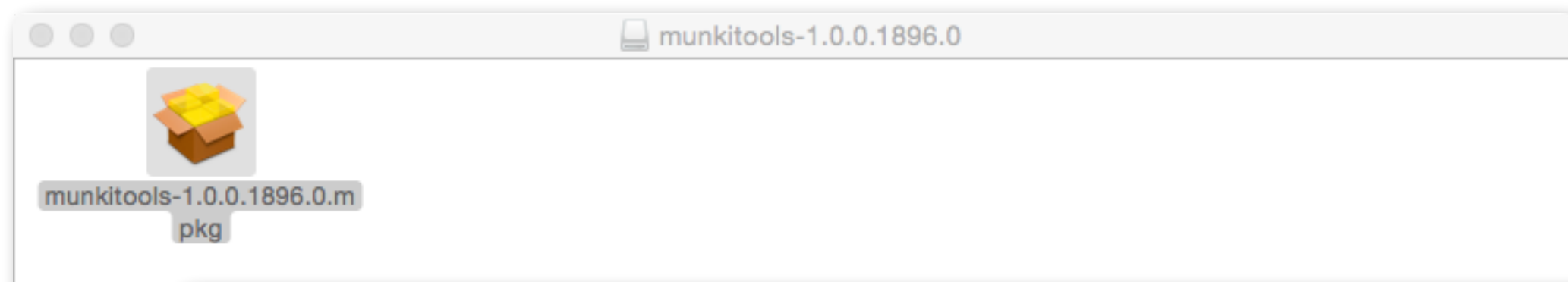


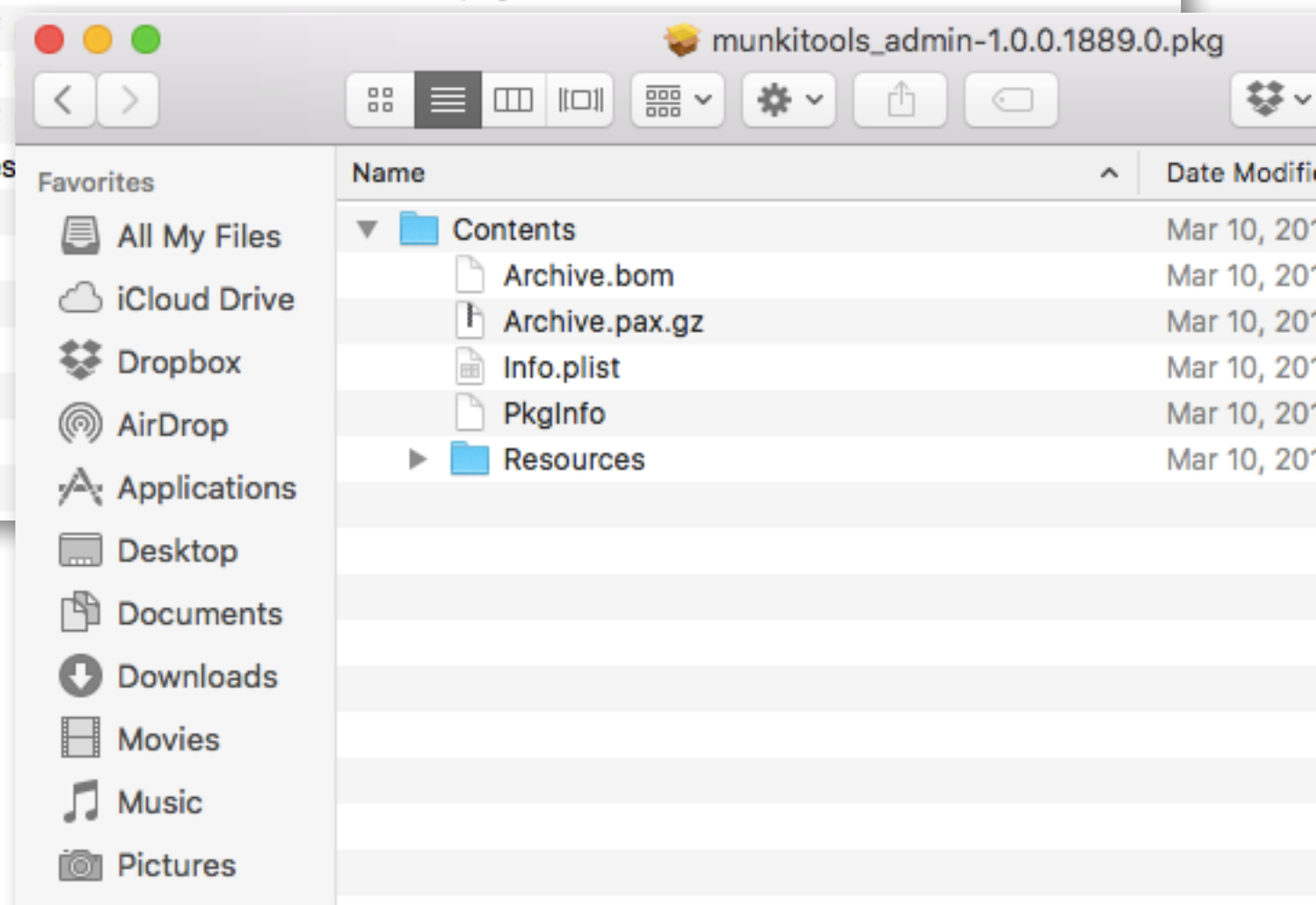
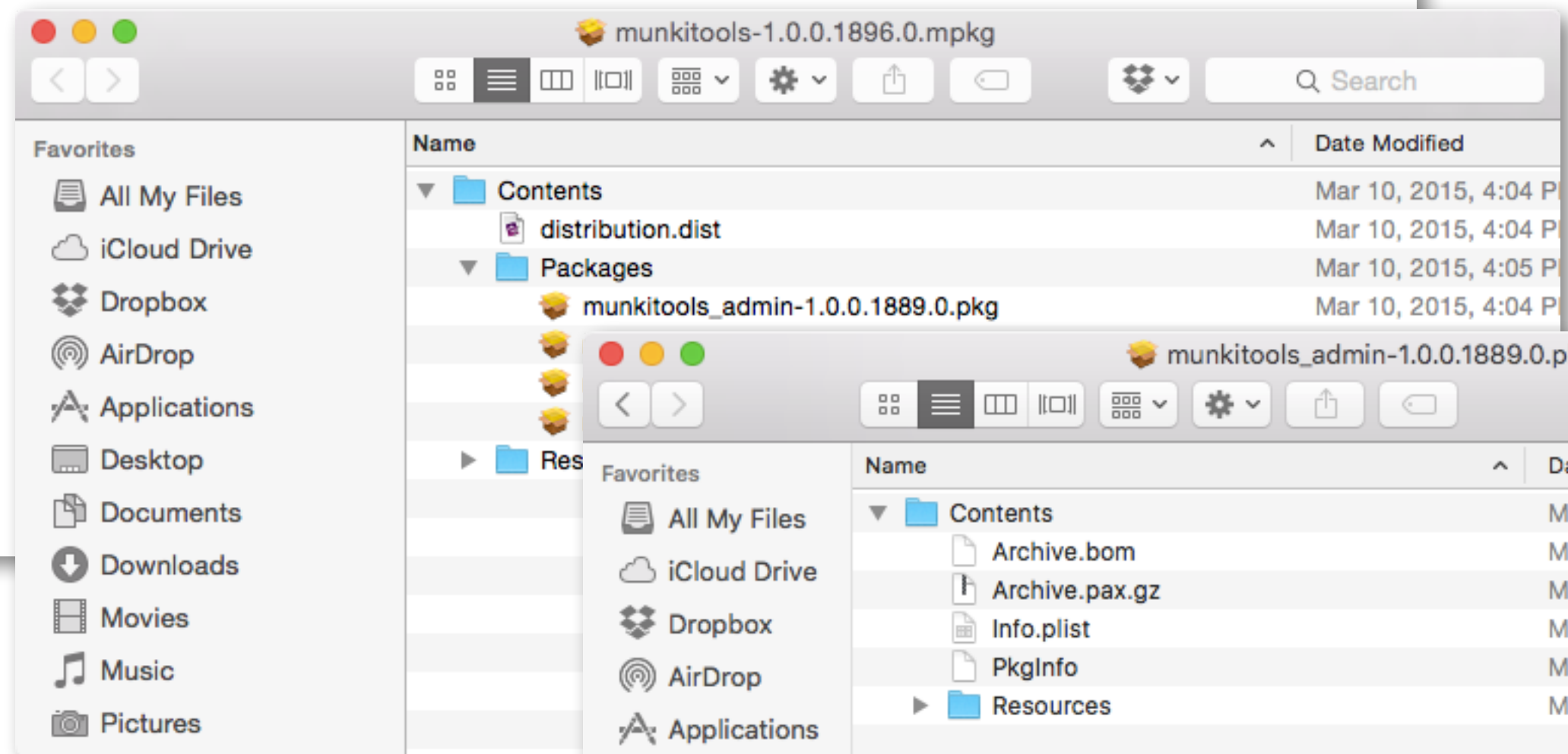
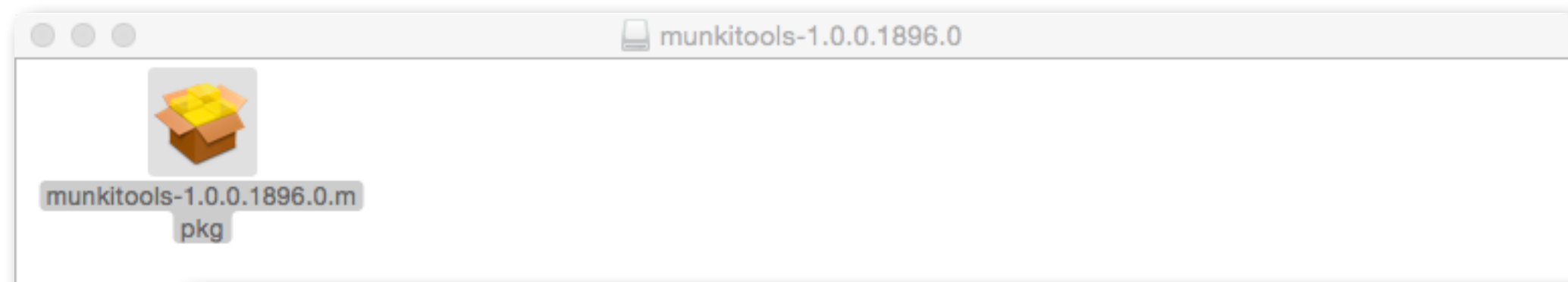
Bundle pkg scripts

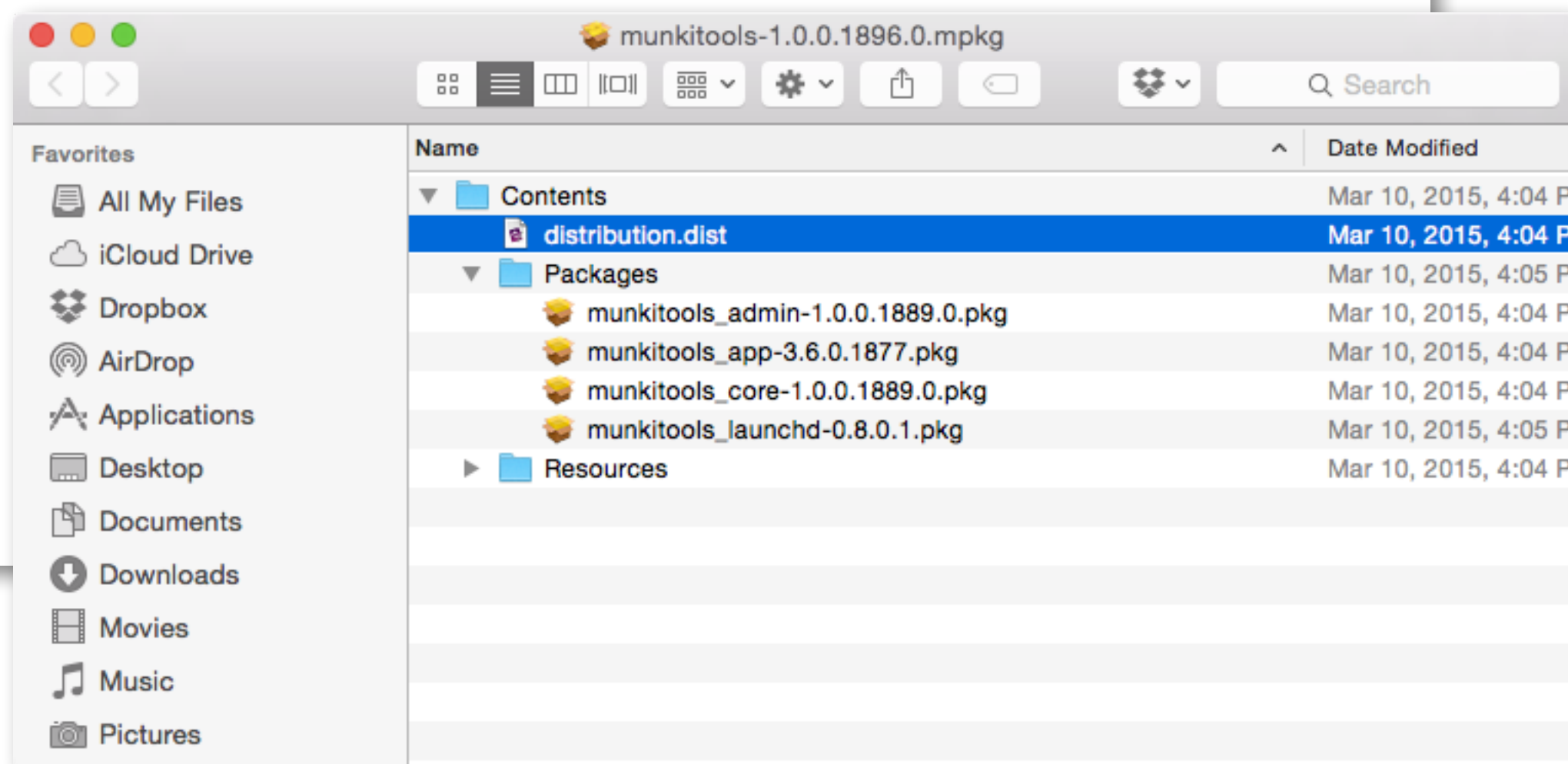
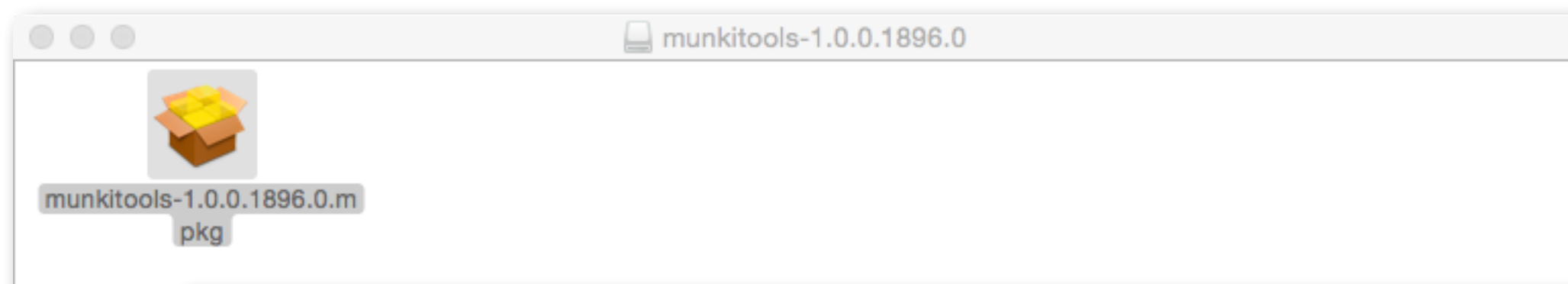
- preflight
- preinstall
- preupgrade
- postupgrade
- postinstall
- postflight

Bundle metapackage
and distribution pkgs









```
<?xml version="1.0" encoding="utf-8"?>
<installer-script minSpecVersion="1.000000" authoringTool="com.apple.PackageMaker"
authoringToolVersion="3.0.4" authoringToolBuild="179">
  <title>Munki - Managed software installation for OS X</title>
  <options customize="allow" allow-external-scripts="no"/>
  <domains enable_anywhere="true"/>
  <choices-outline>
    <line choice="core"/>
    <line choice="admin"/>
    <line choice="app"/>
    <line choice="launchd"/>
  </choices-outline>
  <choice id="core" title="Munki core tools" description="Core command-line tools used by
munki.">
    <pkg-ref id="com.googlecode.munki.core"/>
  </choice>
  <choice id="admin" title="Munki admin tools" description="Command-line munki admin
tools.">
    <pkg-ref id="com.googlecode.munki.admin"/>
  </choice>
  <choice id="app" title="Managed Software Update" description="Managed Software Update
application.">
    <pkg-ref id="com.googlecode.munki.app"/>
  </choice>
  <choice id="launchd" title="Munki launchd agents" description="Munki launch daemons and
launch agents.">
    <pkg-ref id="com.googlecode.munki.launchd"/>
  </choice>

  <pkg-ref id="com.googlecode.munki.core" installKBytes="588" version="1.0.0.1889.0"
auth="Root">file: /Contents/Packages/munkitools_core-1.0.0.1889.0.pkg</pkg-ref>
```

```
</choice>
  <choice id="app" title="Managed Software Update" description="Managed Software Update
application.">
    <pkg-ref id="com.googlecode.munki.app"/>
  </choice>
  <choice id="launchd" title="Munki launchd agents" description="Munki launch daemons and
launch agents.">
    <pkg-ref id="com.googlecode.munki.launchd"/>
  </choice>

  <pkg-ref id="com.googlecode.munki.core" installKBytes="588" version="1.0.0.1889.0"
auth="Root">file:../Contents/Packages/munkitools_core-1.0.0.1889.0.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.admin" installKBytes="132" version="1.0.0.1889.0"
auth="Root">file:../Contents/Packages/munkitools_admin-1.0.0.1889.0.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.app" installKBytes="1520" version="3.6.0.1877"
auth="Root">file:../Contents/Packages/munkitools_app-3.6.0.1877.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.launchd" installKBytes="32" version="1.0.0.1889.0"
auth="Root" onConclusion="RequireRestart">file:../Contents/Packages/
munkitools_launchd-0.8.0.1.pkg</pkg-ref>

</installer-script>
```

```
</choice>
  <choice id="app" title="Managed Software Update" description="Managed Software Update
application.">
    <pkg-ref id="com.googlecode.munki.app"/>
  </choice>
  <choice id="launchd" title="Munki launchd agents" description="Munki launch daemons and
launch agents.">
    <pkg-ref id="com.googlecode.munki.launchd"/>
  </choice>

  <pkg-ref id="com.googlecode.munki.core" installKBytes="588" version="1.0.0.1889.0"
auth="Root">file:./Contents/Packages/munkitools_core-1.0.0.1889.0.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.admin" installKBytes="132" version="1.0.0.1889.0"
auth="Root">file:./Contents/Packages/munkitools_admin-1.0.0.1889.0.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.app" installKBytes="1520" version="3.6.0.1877"
auth="Root">file:./Contents/Packages/munkitools_app-3.6.0.1877.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.launchd" installKBytes="32" version="1.0.0.1889.0"
auth="Root" onConclusion="RequireRestart">file:./Contents/Packages/
munkitools_launchd-0.8.0.1.pkg</pkg-ref>

</installer-script>
```

```
</choice>
  <choice id="app" title="Managed Software Update" description="Managed Software Update
application.">
    <pkg-ref id="com.googlecode.munki.app"/>
  </choice>
  <choice id="launchd" title="Munki launchd agents" description="Munki launch daemons and
launch agents.">
    <pkg-ref id="com.googlecode.munki.launchd"/>
  </choice>

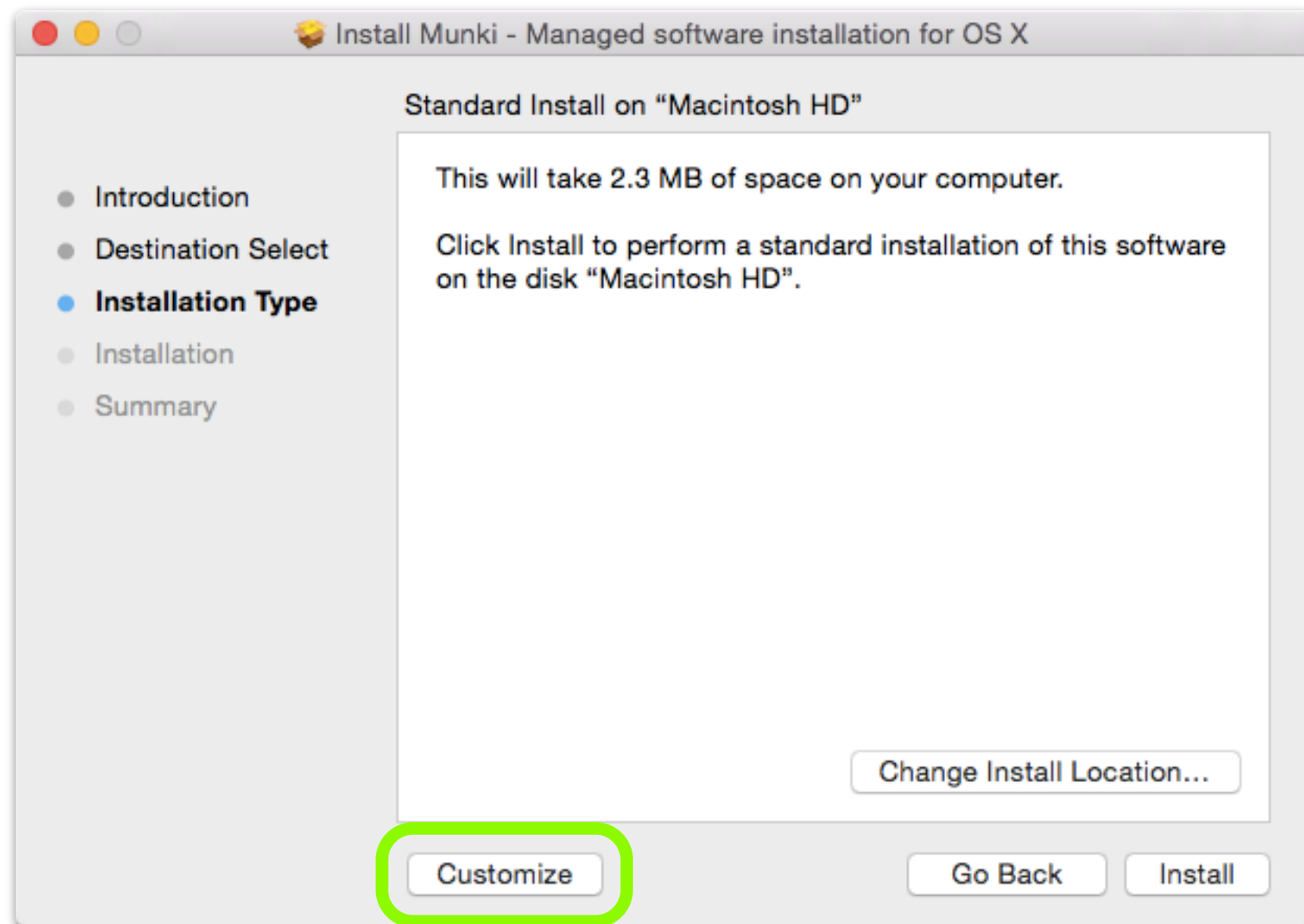
  <pkg-ref id="com.googlecode.munki.core" installKBytes="588" version="1.0.0.1889.0"
auth="Root">file:./Contents/Packages/munkitools_core-1.0.0.1889.0.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.admin" installKBytes="132" version="1.0.0.1889.0"
auth="Root">file:./Contents/Packages/munkitools_admin-1.0.0.1889.0.pkg</pkg-ref>
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auth="Root">file:./Contents/Packages/munkitools_app-3.6.0.1877.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.launchd" installKBytes="32" version="1.0.0.1889.0"
auth="Root" onConclusion="RequireRestart">file:./Contents/Packages/
munkitools_launchd-0.8.0.1.pkg</pkg-ref>

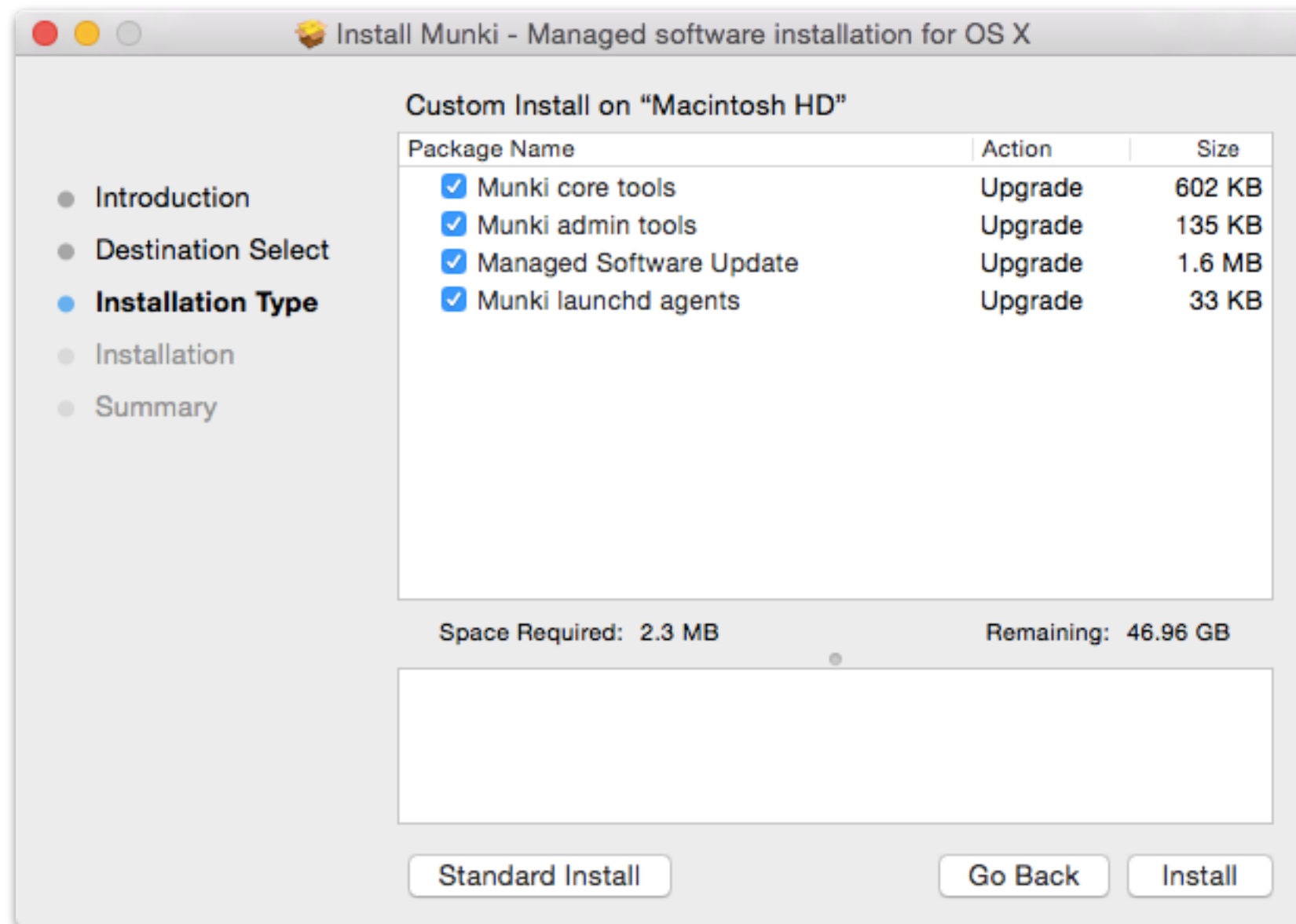
</installer-script>
```

```
</choice>
  <choice id="app" title="Managed Software Update" description="Managed Software Update
application.">
    <pkg-ref id="com.googlecode.munki.app"/>
  </choice>
  <choice id="launchd" title="Munki launchd agents" description="Munki launch daemons and
launch agents.">
    <pkg-ref id="com.googlecode.munki.launchd"/>
  </choice>

  <pkg-ref id="com.googlecode.munki.core" installKBytes="588" version="1.0.0.1889.0"
auth="Root">file:./Contents/Packages/munkitools_core-1.0.0.1889.0.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.admin" installKBytes="132" version="1.0.0.1889.0"
auth="Root">file:./Contents/Packages/munkitools_admin-1.0.0.1889.0.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.app" installKBytes="1520" version="3.6.0.1877"
auth="Root">file:./Contents/Packages/munkitools_app-3.6.0.1877.pkg</pkg-ref>
  <pkg-ref id="com.googlecode.munki.launchd" installKBytes="32" version="1.0.0.1889.0"
auth="Root" onConclusion="RequireRestart">file:./Contents/Packages/
munkitools_launchd-0.8.0.1.pkg</pkg-ref>

</installer-script>
```





Review

Examine the contents of the ExifTool-10.03 package and answer these questions:

- What is the package id?
(Hint: look for CFBundleIdentifier)
- What are the names of any scripts included in the package?

Examine the contents of the ExifTool-10.03 package and answer these questions:

- What is the package id?
(Hint: look for CFBundleIdentifier)
- Answer: com.philharvey.image-exiftool

Examine the contents of the ExifTool-10.03 package and answer these questions:

- What are the names of any scripts included in the package?
- Answer:
preflight

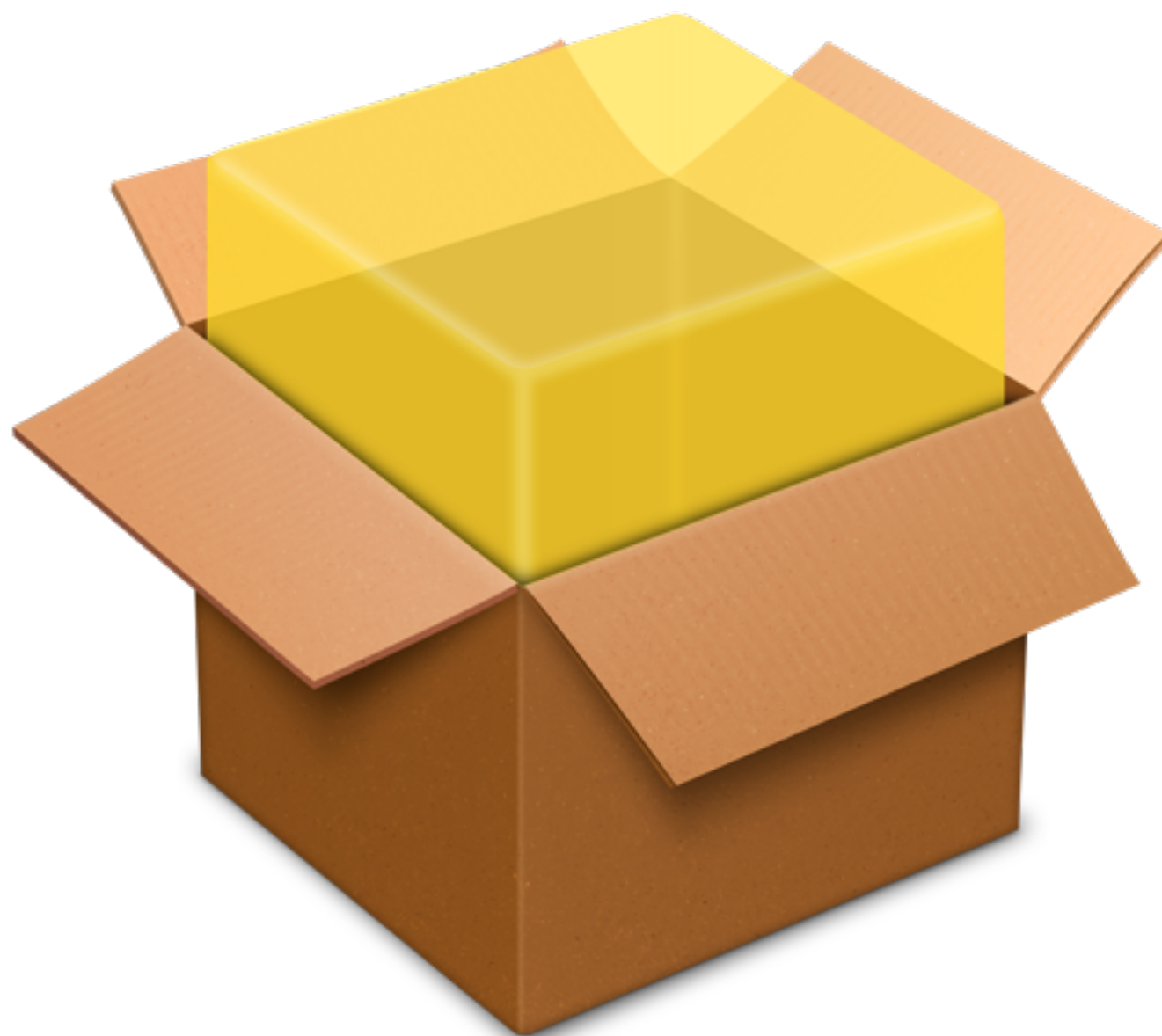
Flat packages

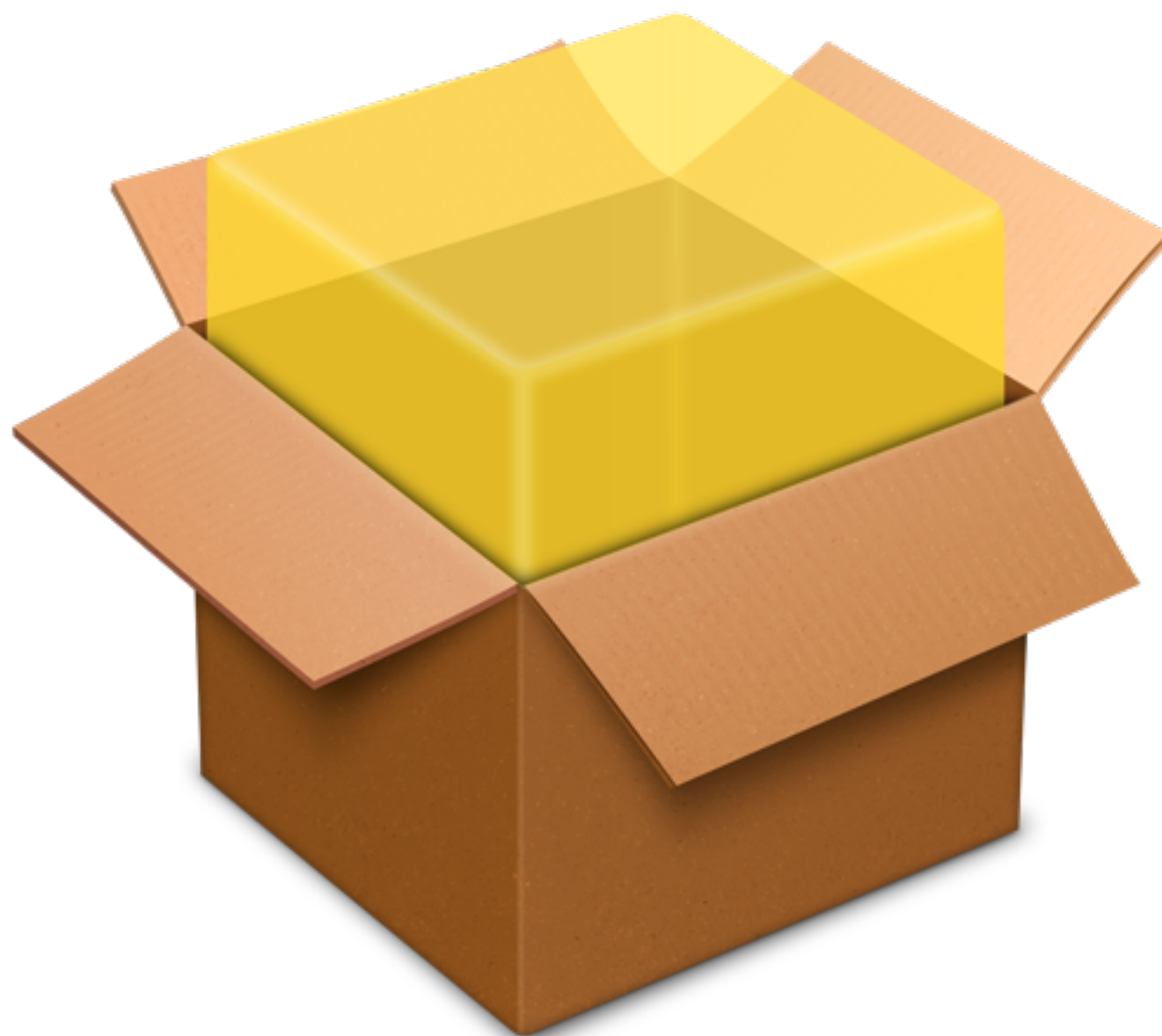
Flat packages

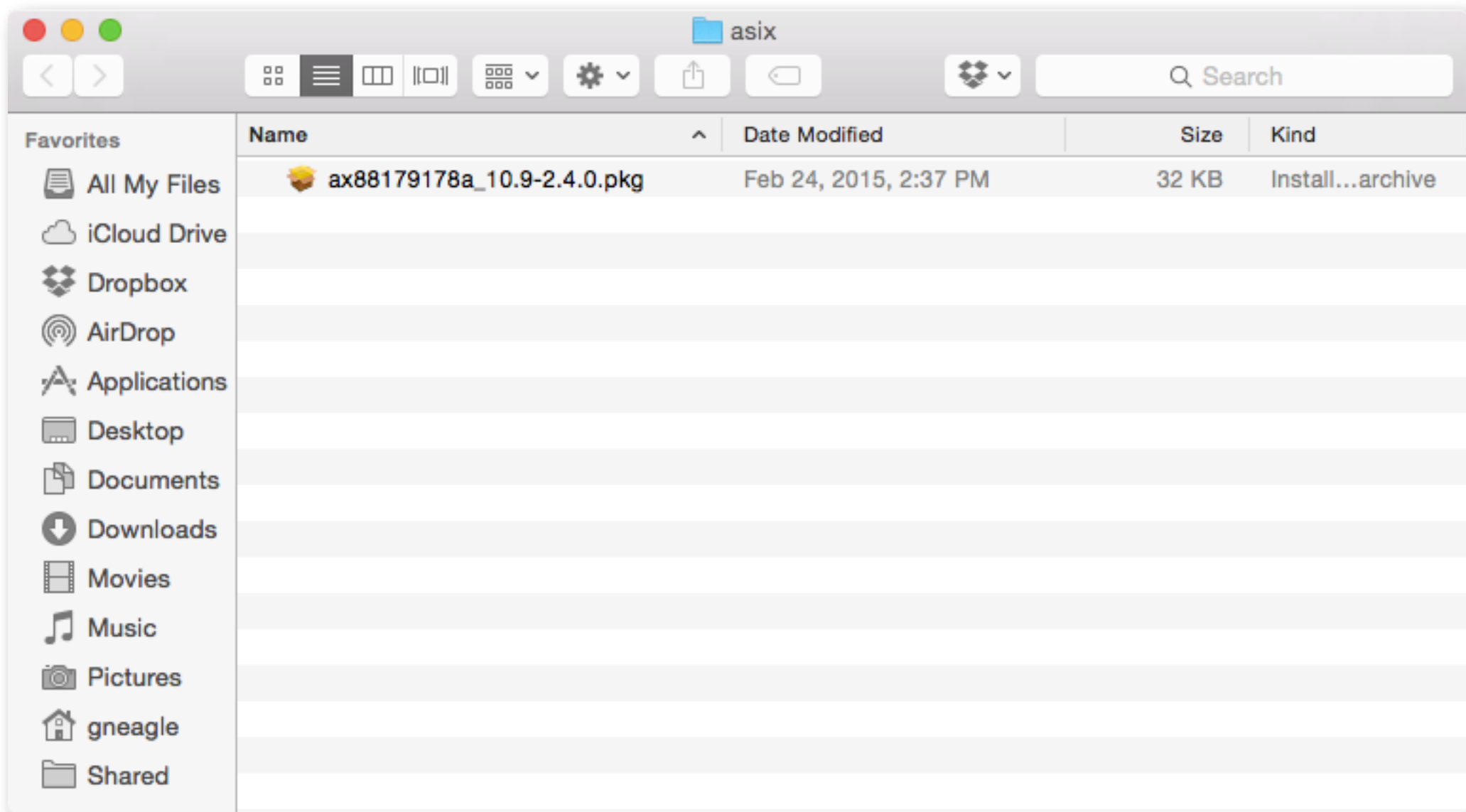
- Introduced in Mac OS X 10.5 Leopard
- "Flat" because they are a single file

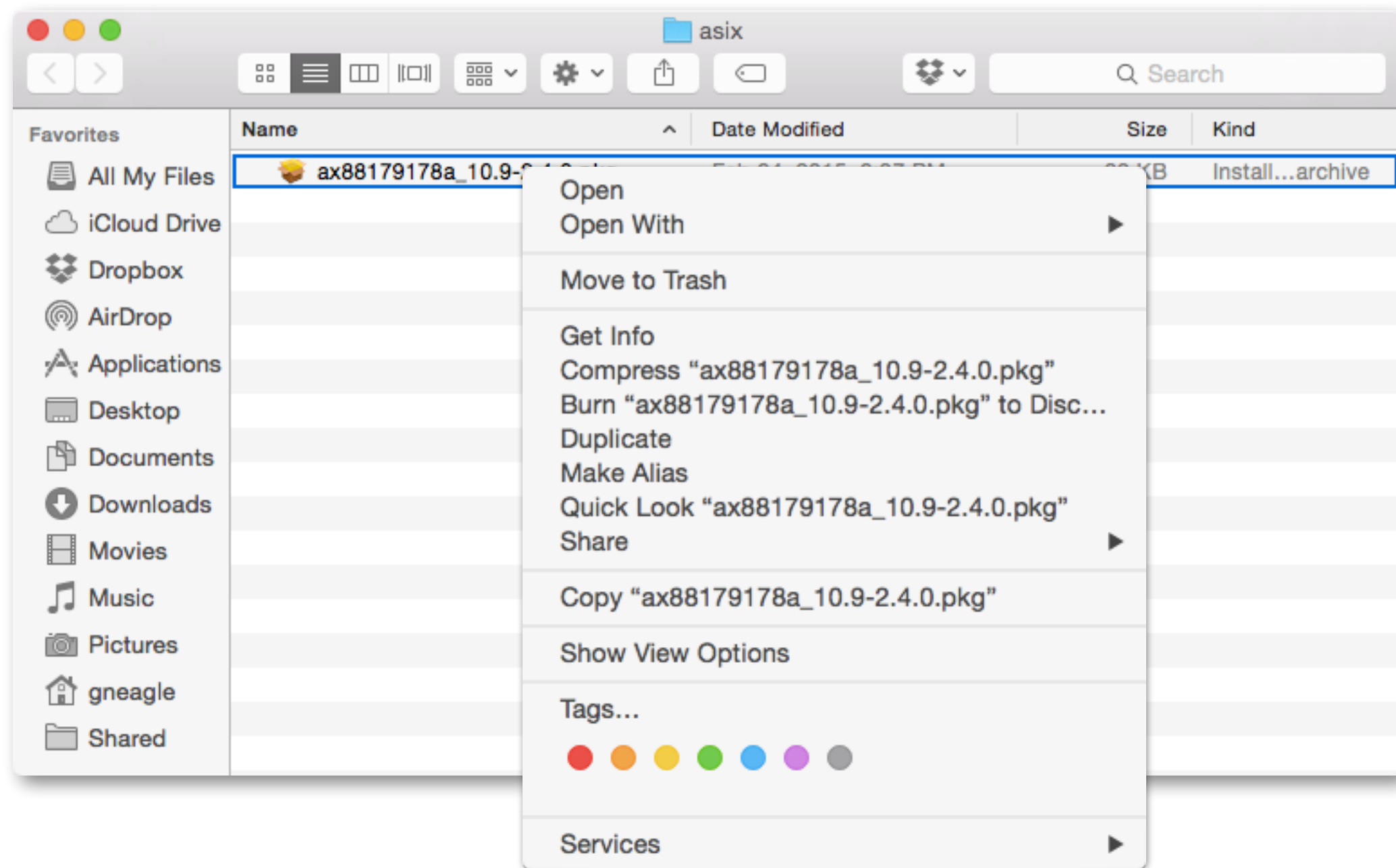
Flat packages

- Component pkgs
- Distribution pkgs



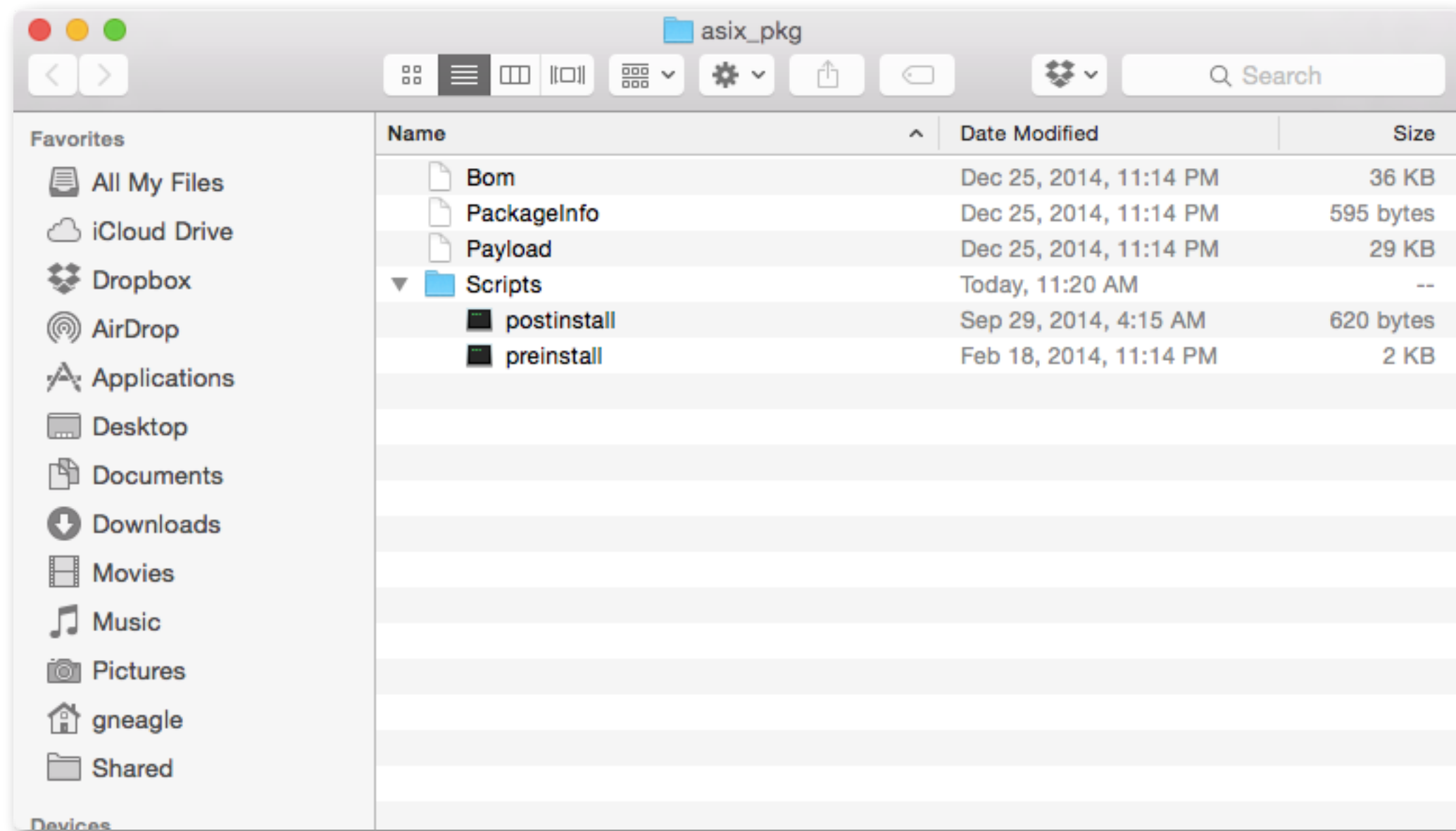


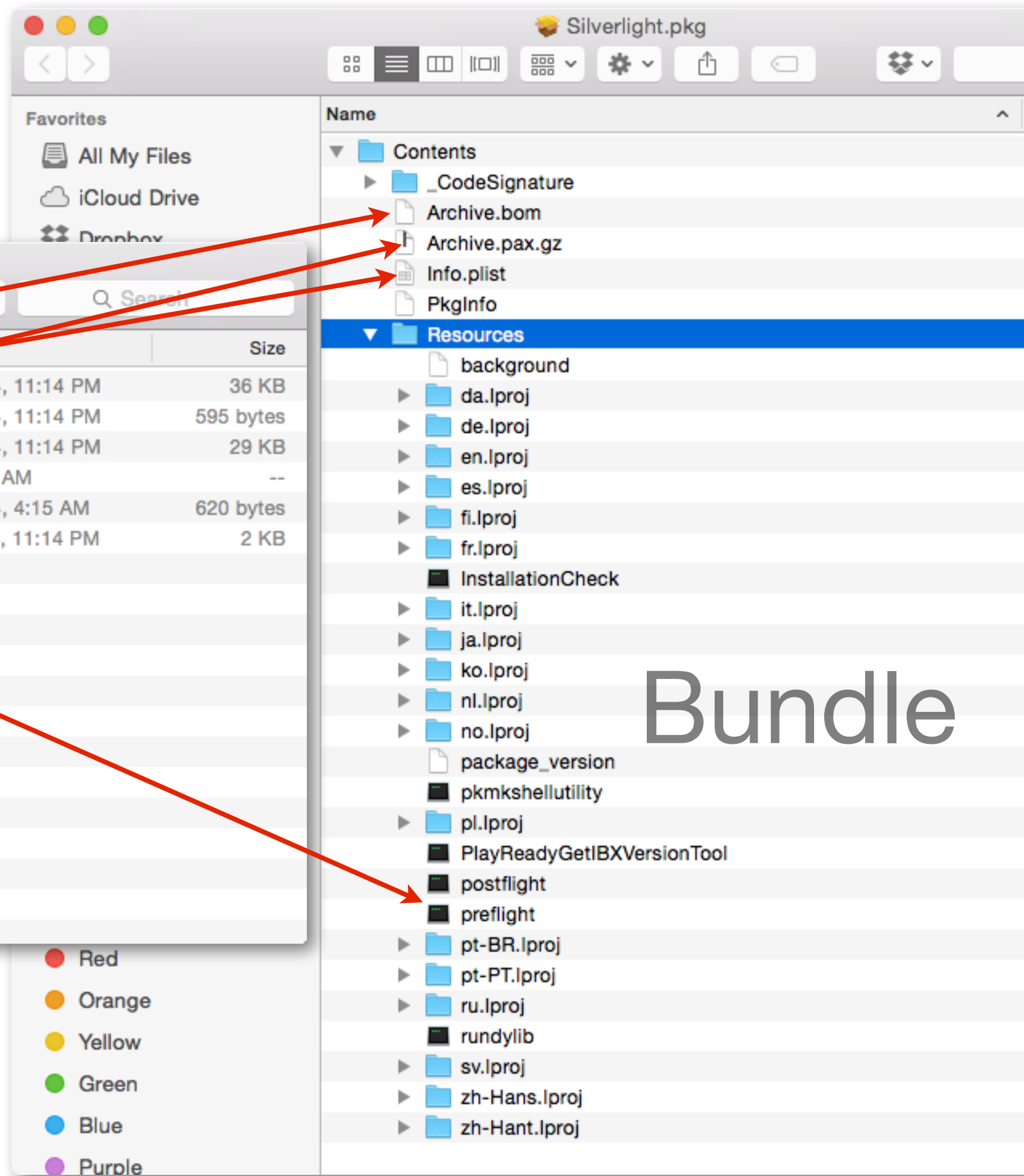
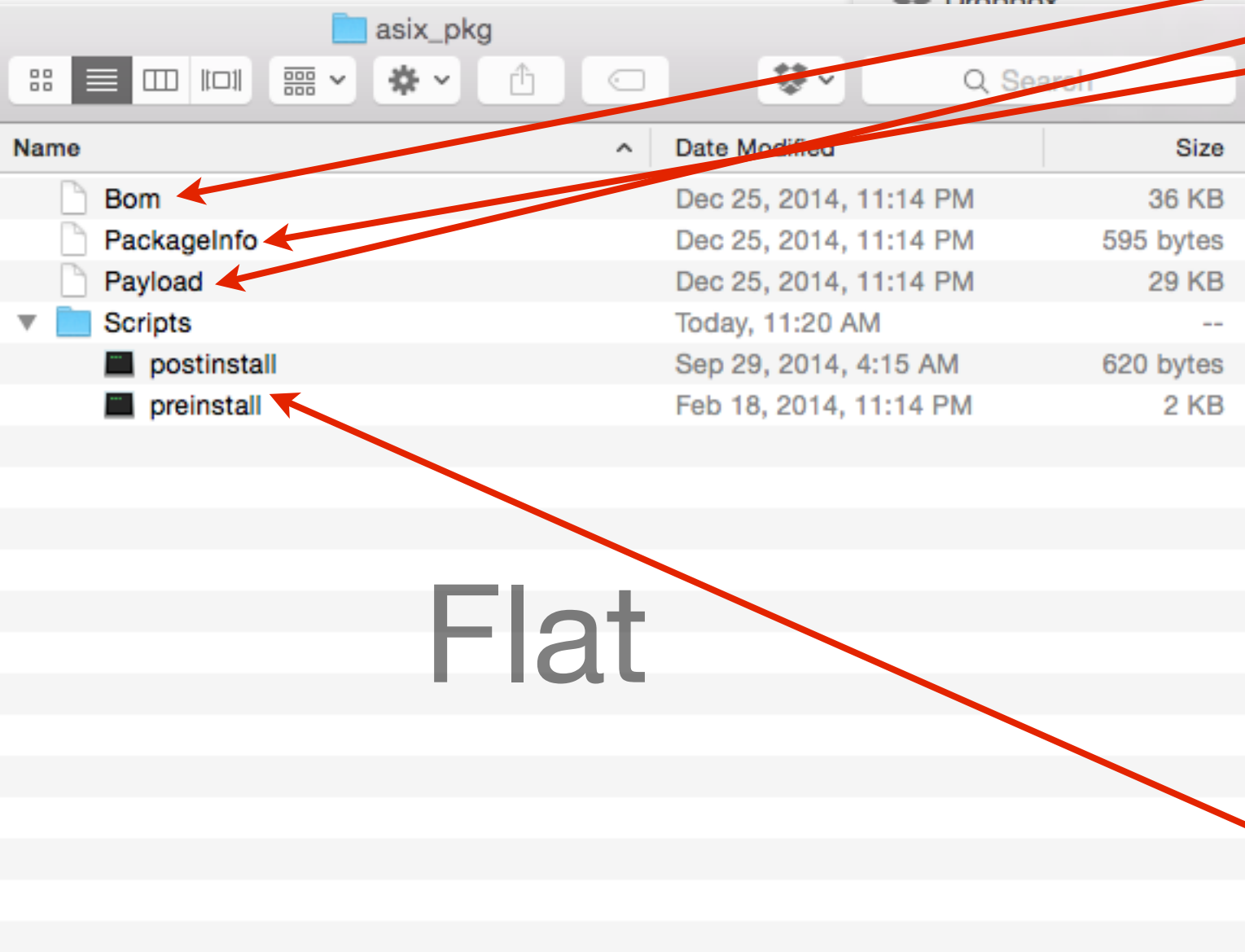




```
% pkgutil --expand ax88179178a_10.9-2.4.0.pkg /tmp/asix_pkg  
% open /tmp/asix_pkg
```

Flat component package





- Red
- Orange
- Yellow
- Green
- Blue
- Purple

```
% cat /tmp/asix_pkg/PackageInfo
```

```
<pkg-info format-version="2"
identifier="com.asix.pkg.ax88179-178a-10.9" version="2.4.0"
install-location="/Library/Extensions" auth="root"
postinstall-action="restart">
  <payload installKBytes="104" numberOfFiles="11"/>
  <scripts>
    <preinstall file="./preinstall"/>
    <postinstall file="./postinstall"/>
  </scripts>
  <bundle id="com.asix.driver.ax88179-178a"
CFBundleIdentifier="com.asix.driver.ax88179-178a" path="./
AX88179_178A.kext" CFBundleVersion="1.4.0"/>
  <bundle-version>
    <bundle id="com.asix.driver.ax88179-178a"/>
  </bundle-version>
</pkg-info>
```



```
% cat /tmp/asix_pkg/PackageInfo
```

```
<pkg-info format-version="2"  
  identifier="com.asix.pkg.ax88179-178a-10.9" version="2.4.0"  
  install-location="/Library/Extensions" auth="root"  
  postinstall-action="restart">  
    <payload installKBytes="104" numberOfFiles="11"/>  
    <scripts>  
      <preinstall file="./preinstall"/>  
      <postinstall file="./postinstall"/>  
    </scripts>  
    <bundle id="com.asix.driver.ax88179-178a"  
CFBundleIdentifier="com.asix.driver.ax88179-178a" path="./  
AX88179_178A.kext" CFBundleVersion="1.4.0"/>  
    <bundle-version>  
      <bundle id="com.asix.driver.ax88179-178a"/>  
    </bundle-version>  
</pkg-info>
```

```
% cat /tmp/asix_pkg/PackageInfo
```

```
<pkg-info format-version="2"  
identifier="com.asix.pkg.ax88179-178a-10.9" version="2.4.0"  
install-location="/Library/Extensions" auth="root"  
postinstall-action="restart">  
  <payload installKBytes="104" numberOfFiles="11"/>  
  <scripts>  
    <preinstall file="./preinstall"/>  
    <postinstall file="./postinstall"/>  
  </scripts>  
  <bundle id="com.asix.driver.ax88179-178a"  
CFBundleIdentifier="com.asix.driver.ax88179-178a" path="./  
AX88179_178A.kext" CFBundleVersion="1.4.0"/>  
  <bundle-version>  
    <bundle id="com.asix.driver.ax88179-178a"/>  
  </bundle-version>  
</pkg-info>
```

```
% cat /tmp/asix_pkg/PackageInfo
```

```
<pkg-info format-version="2"  
  identifier="com.asix.pkg.ax88179-178a-10.9" version="2.4.0"  
  install-location="/Library/Extensions" auth="root"  
  postinstall-action="restart">  
    <payload installKBytes="104" numberOfFiles="11"/>  
    <scripts>  
      <preinstall file="./preinstall"/>  
      <postinstall file="./postinstall"/>  
    </scripts>  
    <bundle id="com.asix.driver.ax88179-178a"  
CFBundleIdentifier="com.asix.driver.ax88179-178a" path="./  
AX88179_178A.kext" CFBundleVersion="1.4.0"/>  
    <bundle-version>  
      <bundle id="com.asix.driver.ax88179-178a"/>  
    </bundle-version>  
</pkg-info>
```

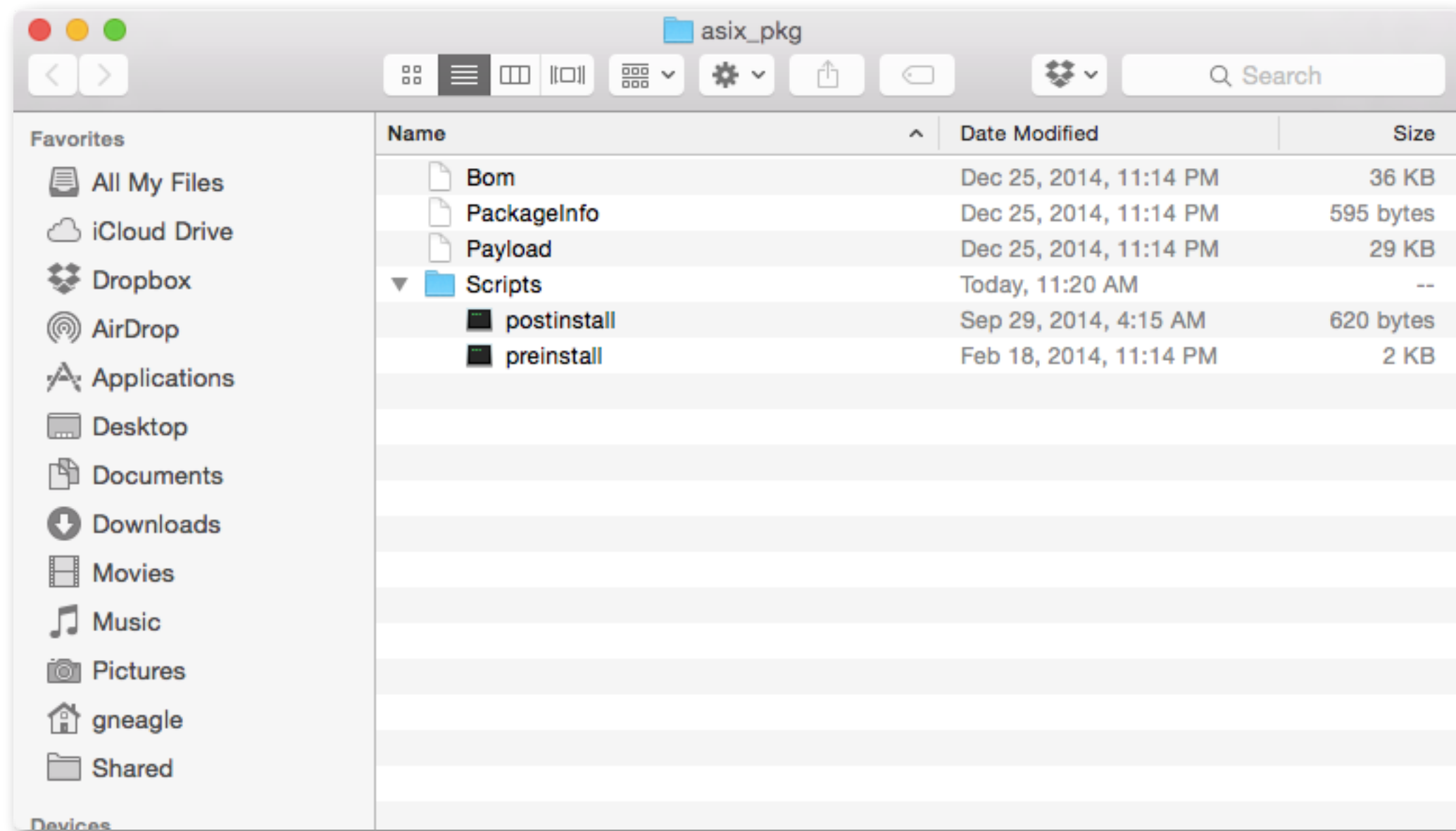
```
% cat /tmp/asix_pkg/PackageInfo
```

```
<pkg-info format-version="2"  
identifier="com.asix.pkg.ax88179-178a-10.9" version="2.4.0"  
install-location="/Library/Extensions" auth="root"  
postinstall-action="restart">  
  <payload installKBytes="104" numberOfFiles="11"/>  
  <scripts>  
    <preinstall file="./preinstall"/>  
    <postinstall file="./postinstall"/>  
  </scripts>  
  <bundle id="com.asix.driver.ax88179-178a"  
CFBundleIdentifier="com.asix.driver.ax88179-178a" path="./  
AX88179_178A.kext" CFBundleVersion="1.4.0"/>  
  <bundle-version>  
    <bundle id="com.asix.driver.ax88179-178a"/>  
  </bundle-version>  
</pkg-info>
```

```
% cat /tmp/asix_pkg/PackageInfo
```

```
<pkg-info format-version="2"  
identifier="com.asix.pkg.ax88179-178a-10.9" version="2.4.0"  
install-location="/Library/Extensions" auth="root"  
postinstall-action="restart">  
  <payload installKBytes="104" numberOfFiles="11"/>  
  <scripts>  
    <preinstall file="./preinstall"/>  
    <postinstall file="./postinstall"/>  
  </scripts>  
  <bundle id="com.asix.driver.ax88179-178a"  
CFBundleIdentifier="com.asix.driver.ax88179-178a" path="./  
AX88179_178A.kext" CFBundleVersion="1.4.0"/>  
  <bundle-version>  
    <bundle id="com.asix.driver.ax88179-178a"/>  
  </bundle-version>  
</pkg-info>
```

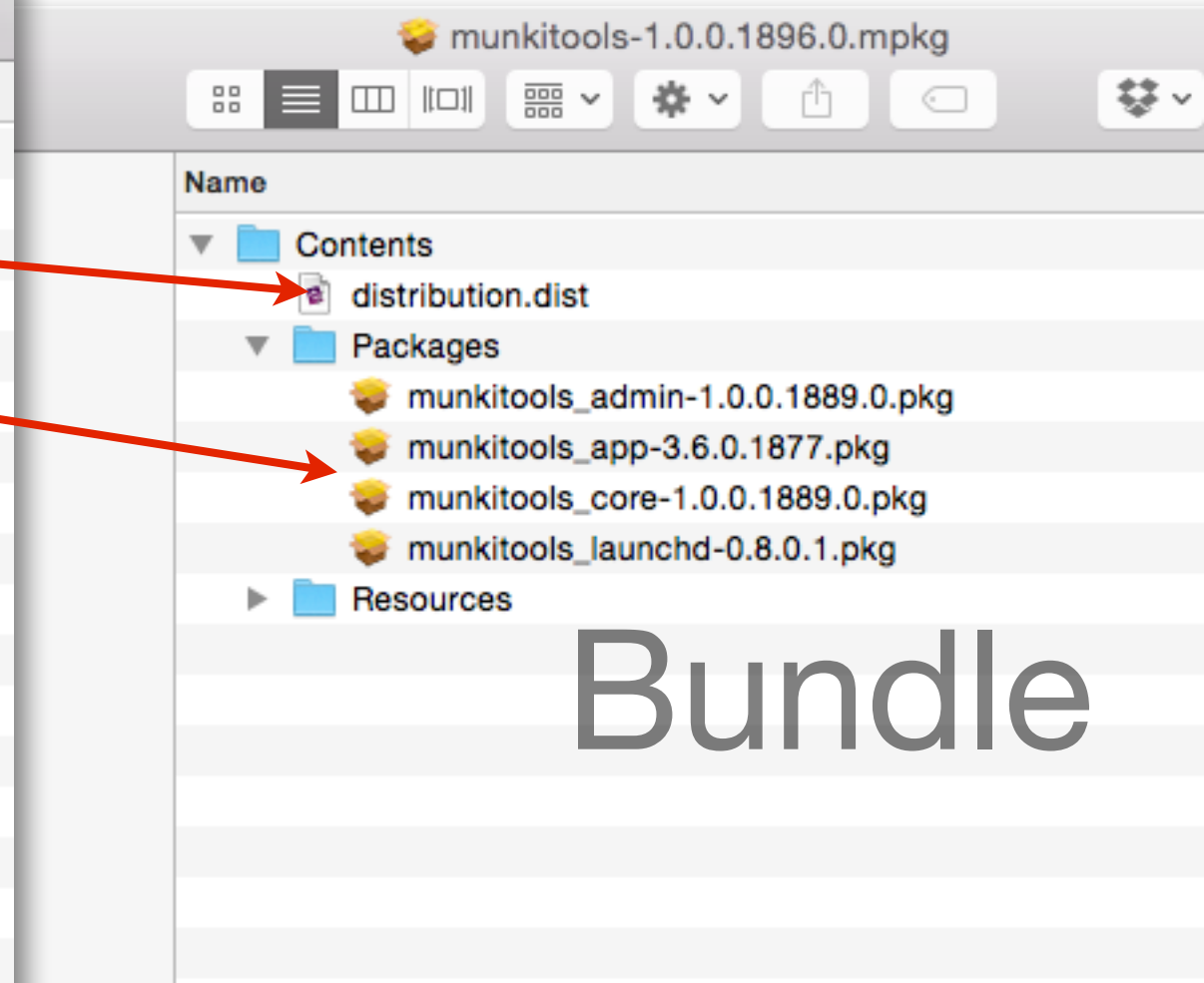
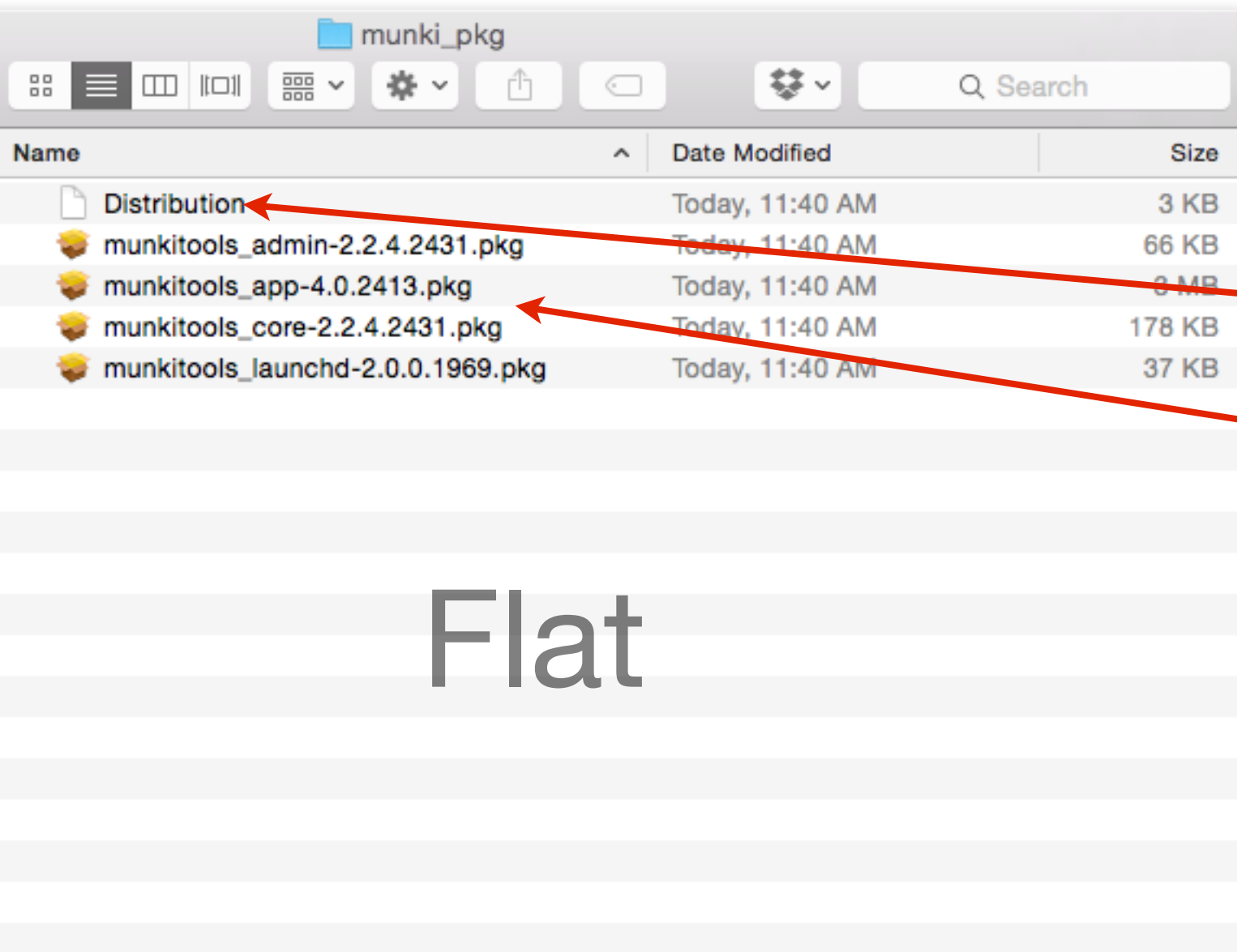
Flat component package



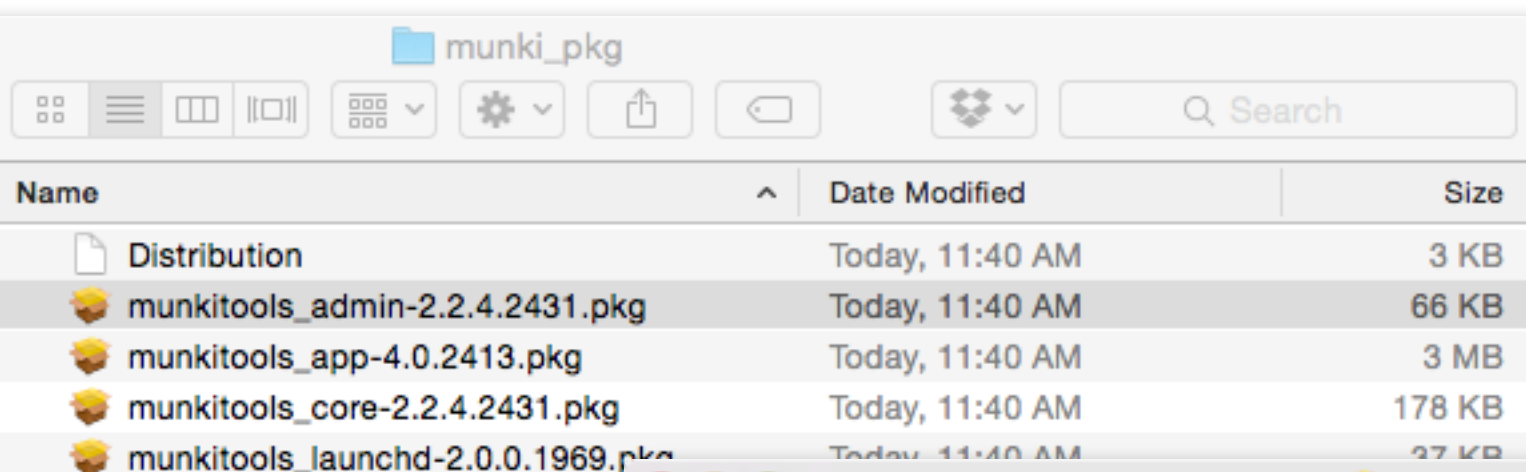
Flat pkg scripts

- ~~• preflight~~
- preinstall
- ~~• preupgrade~~
- ~~• postupgrade~~
- postinstall
- ~~• postflight~~

Distribution packages

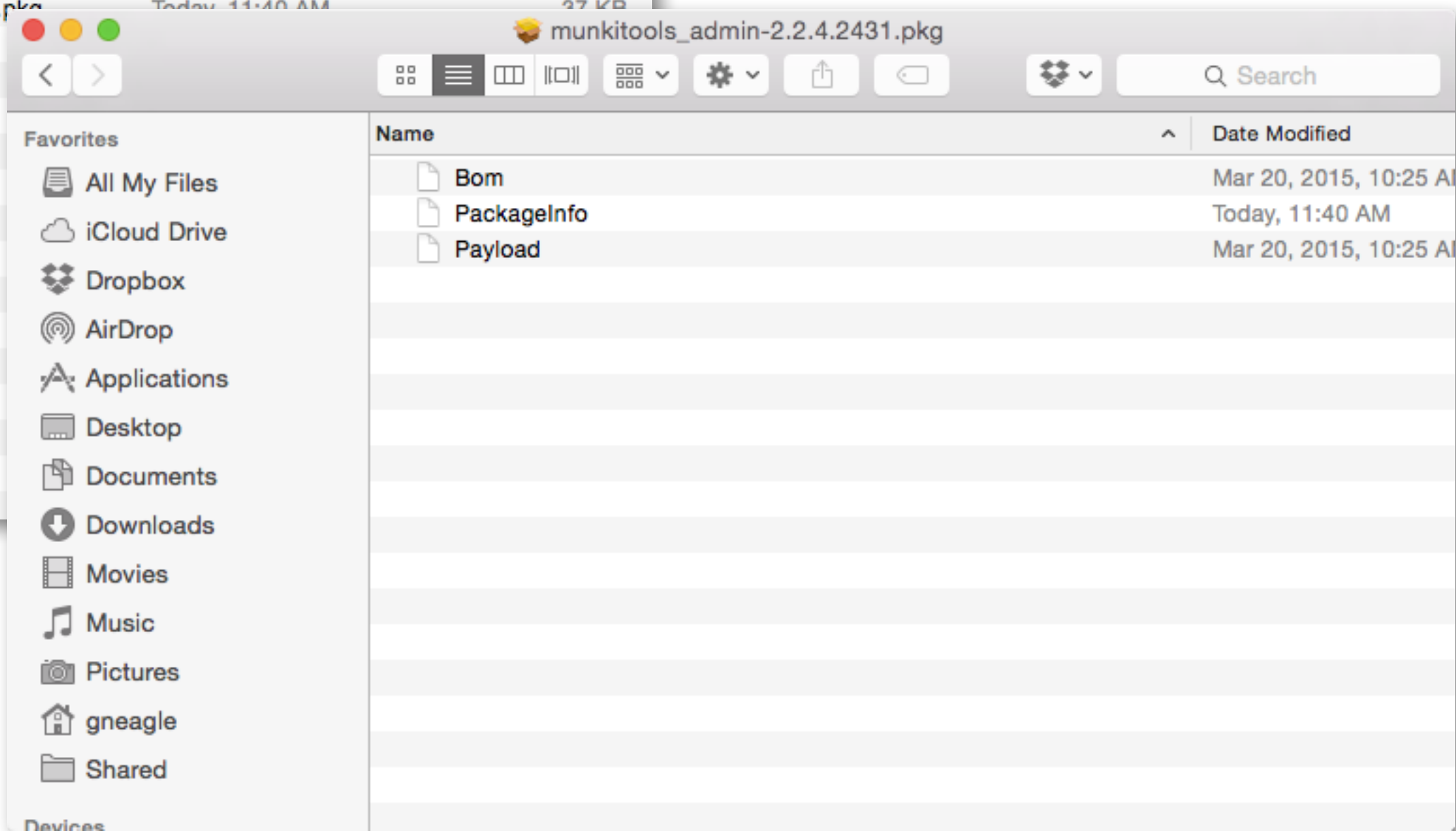


Distribution packages



A screenshot of a macOS Finder window titled "munki_pkg". The window shows a list of files with columns for Name, Date Modified, and Size. The files are:

Name	Date Modified	Size
Distribution	Today, 11:40 AM	3 KB
munkitools_admin-2.2.4.2431.pkg	Today, 11:40 AM	66 KB
munkitools_app-4.0.2413.pkg	Today, 11:40 AM	3 MB
munkitools_core-2.2.4.2431.pkg	Today, 11:40 AM	178 KB
munkitools_launchd-2.0.0.1969.pkg	Today, 11:40 AM	27 KB



A screenshot of a macOS Finder window titled "munkitools_admin-2.2.4.2431.pkg". The window shows the contents of the package, which are:

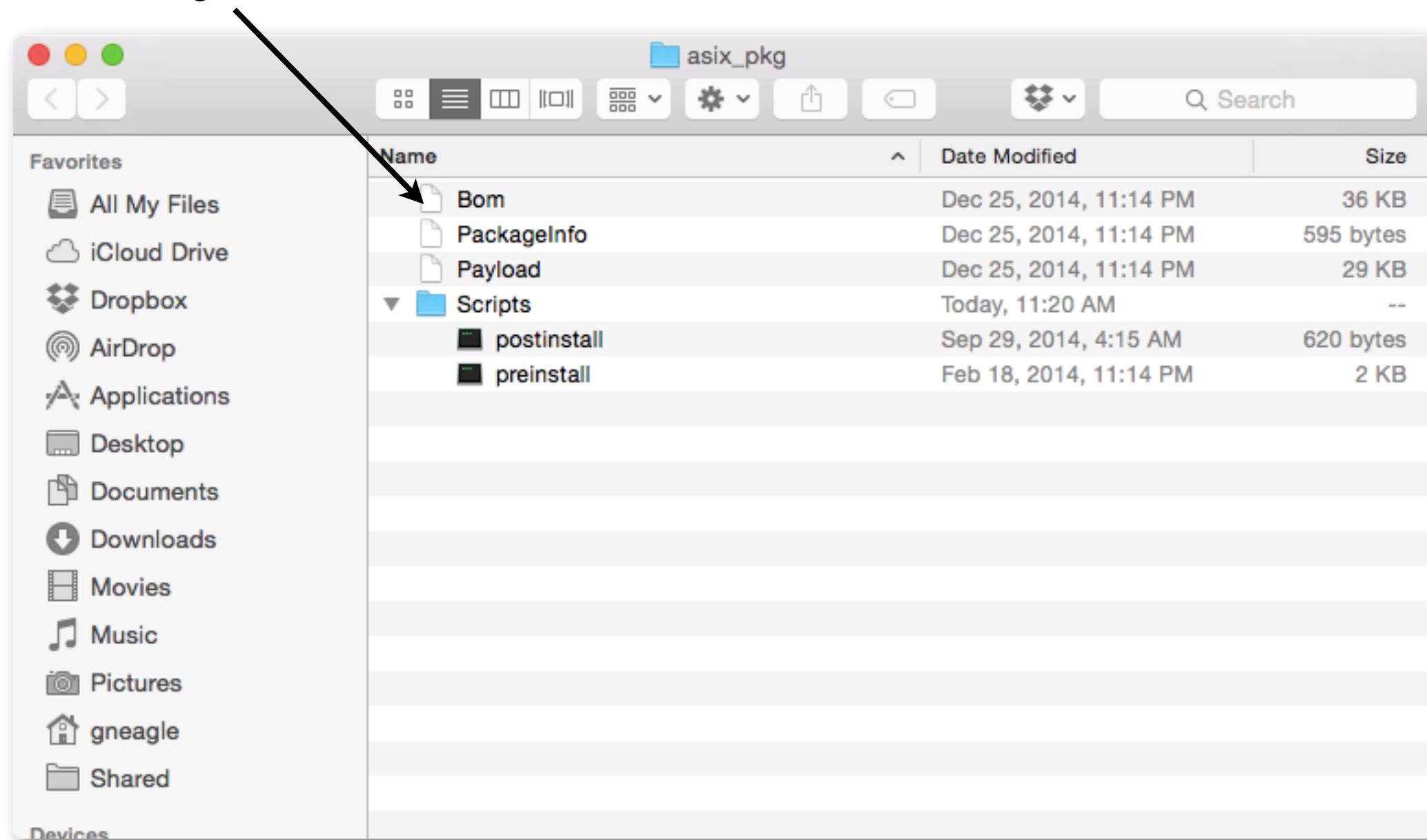
Name	Date Modified
Bom	Mar 20, 2015, 10:25 AM
PackageInfo	Today, 11:40 AM
Payload	Mar 20, 2015, 10:25 AM

The left sidebar of the window shows a list of Favorites and Devices:

- Favorites
 - All My Files
 - iCloud Drive
 - Dropbox
 - AirDrop
 - Applications
 - Desktop
 - Documents
 - Downloads
 - Movies
 - Music
 - Pictures
 - gneagle
 - Shared
- Devices

Examining a pkg archive

Bom/Archive.bom:
list of filesystem items and metadata



lsbom

The archive contains information about **location**, **kind**, **owner**, **group**, and **mode** of each file and directory.

```
% lsbom /tmp/asix_pkg/Bom
```

```
. 40700 501/0
./AX88179_178A.kext 40755 501/20
./AX88179_178A.kext/Contents 40755 501/20
./AX88179_178A.kext/Contents/Info.plist 100644 501/20 4286 2081773764
./AX88179_178A.kext/Contents/MacOS 40755 501/20
./AX88179_178A.kext/Contents/MacOS/AX88179_178A 100755 501/20 88624
3319426119
./AX88179_178A.kext/Contents/Resources 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings
100644 501/20 152 221771084
./AX88179_178A.kext/Contents/_CodeSignature 40755 501/20
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources 100644
501/20 780 4075065949
```

```
% lsbom /tmp/asix_pkg/Bom
```

```
. 40700 501/0
./AX88179_178A.kext 40755 501/20
./AX88179_178A.kext/Contents 40755 501/20
./AX88179_178A.kext/Contents/Info.plist 100644 501/20 4286 2081773764
./AX88179_178A.kext/Contents/MacOS 40755 501/20
./AX88179_178A.kext/Contents/MacOS/AX88179_178A 100755 501/20 88624
3319426119
./AX88179_178A.kext/Contents/Resources 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings
100644 501/20 152 221771084
./AX88179_178A.kext/Contents/_CodeSignature 40755 501/20
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources 100644
501/20 780 4075065949
```

```
% lsbom /tmp/asix_pkg/Bom
```

```
. 40700 501/0
./AX88179_178A.kext 40755 501/20
./AX88179_178A.kext/Contents 40755 501/20
./AX88179_178A.kext/Contents/Info.plist 100644 501/20 4286 2081773764
./AX88179_178A.kext/Contents/MacOS 40755 501/20
./AX88179_178A.kext/Contents/MacOS/AX88179_178A 100755 501/20 88624
3319426119
./AX88179_178A.kext/Contents/Resources 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings
100644 501/20 152 221771084
./AX88179_178A.kext/Contents/_CodeSignature 40755 501/20
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources 100644
501/20 780 4075065949
```



```
% lsbom /tmp/asix_pkg/Bom
```

```
. 40700 501/0
./AX88179_178A.kext 40755 501/20
./AX88179_178A.kext/Contents 40755 501/20
./AX88179_178A.kext/Contents/Info.plist 100644 501/20 4286 2081773764
./AX88179_178A.kext/Contents/MacOS 40755 501/20
./AX88179_178A.kext/Contents/MacOS/AX88179_178A 100755 501/20 88624
3319426119
./AX88179_178A.kext/Contents/Resources 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings
100644 501/20 152 221771084
./AX88179_178A.kext/Contents/_CodeSignature 40755 501/20
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources 100644
501/20 780 4075065949
```

```
% lsbom /tmp/asix_pkg/Bom
```

```
. 40700 501/0
./AX88179_178A.kext 40755 501/20
./AX88179_178A.kext/Contents 40755 501/20
./AX88179_178A.kext/Contents/Info.plist 100644 501/20 4286 2081773764
./AX88179_178A.kext/Contents/MacOS 40755 501/20
./AX88179_178A.kext/Contents/MacOS/AX88179_178A 100755 501/20 88624
3319426119
./AX88179_178A.kext/Contents/Resources 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings
100644 501/20 152 221771084
./AX88179_178A.kext/Contents/_CodeSignature 40755 501/20
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources 100644
501/20 780 4075065949
```

```
% lsbom /tmp/asix_pkg/Bom
```

```
. 40700 501/0
```

```
./AX88179_178A.kext 40755 501/20
```

```
./AX88179_178A.kext/Contents 40755 501/20
```

```
./AX88179_178A.kext/Contents/Info.plist 100644 501/20 4286 2081773764
```

```
./AX88179_178A.kext/Contents/MacOS 40755 501/20
```

```
./AX88179_178A.kext/Contents/MacOS/AX88179_178A 100755 501/20 88624  
3319426119
```

```
./AX88179_178A.kext/Contents/Resources 40755 501/20
```

```
./AX88179_178A.kext/Contents/Resources/en.lproj 40755 501/20
```

```
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings  
100644 501/20 152 221771084
```

```
./AX88179_178A.kext/Contents/_CodeSignature 40755 501/20
```

```
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources 100644  
501/20 780 4075065949
```

```
% lsbom /tmp/asix_pkg/Bom
```

```
. 40700 501/0
./AX88179_178A.kext 40755 501/20
./AX88179_178A.kext/Contents 40755 501/20
./AX88179_178A.kext/Contents/Info.plist 100644 501/20 4286 2081773764
./AX88179_178A.kext/Contents/MacOS 40755 501/20
./AX88179_178A.kext/Contents/MacOS/AX88179_178A 100755 501/20 88624
3319426119
./AX88179_178A.kext/Contents/Resources 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings
100644 501/20 152 221771084
./AX88179_178A.kext/Contents/_CodeSignature 40755 501/20
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources 100644
501/20 780 4075065949
```

```
% cat /tmp/asix_pkg/PackageInfo
```

```
<pkg-info format-version="2"
identifier="com.asix.pkg.ax88179-178a-10.9" version="2.4.0"
install-location="/Library/Extensions" auth="root" postinstall-
action="restart">
  <payload installKBytes="104" numberOfFiles="11"/>
  <scripts>
    <preinstall file="./preinstall"/>
    <postinstall file="./postinstall"/>
  </scripts>
  <bundle id="com.asix.driver.ax88179-178a"
CFBundleIdentifier="com.asix.driver.ax88179-178a" path="./
AX88179_178A.kext" CFBundleVersion="1.4.0"/>
  <bundle-version>
    <bundle id="com.asix.driver.ax88179-178a"/>
  </bundle-version>
</pkg-info>
```

```
% ls -al /Library/Extensions/AX88179_178A.kext
```

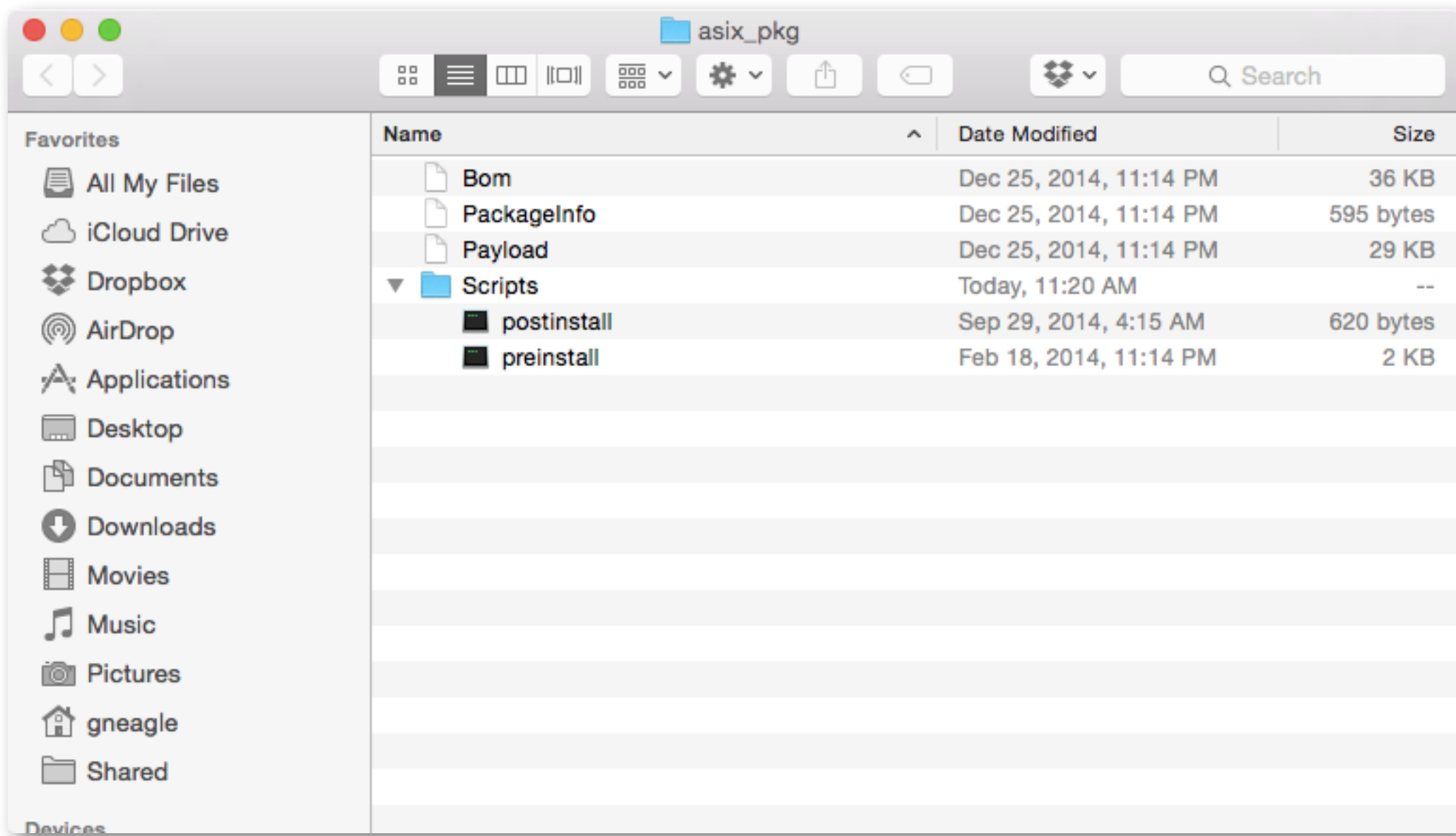
```
total 0
```

drwxr-xr-x	3	root	wheel	102	Dec	25	21:55	.
drwxr-xr-x	16	root	wheel	544	Jun	22	11:37	..
drwxr-xr-x	6	root	wheel	204	Dec	25	21:55	Contents

```
% lsbom /tmp/asix_pkg/Bom
```

```
. 40700 501/0
./AX88179_178A.kext 40755 501/20
./AX88179_178A.kext/Contents 40755 501/20
./AX88179_178A.kext/Contents/Info.plist 100644 501/20 4286 2081773764
./AX88179_178A.kext/Contents/MacOS 40755 501/20
./AX88179_178A.kext/Contents/MacOS/AX88179_178A 100755 501/20 88624
3319426119
./AX88179_178A.kext/Contents/Resources 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj 40755 501/20
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings
100644 501/20 152 221771084
./AX88179_178A.kext/Contents/_CodeSignature 40755 501/20
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources 100644
501/20 780 4075065949
```

A package **may** also
optionally run some scripts.



```
% cat /tmp/asix_pkg/Scripts/postinstall
```

```
#!/bin/sh
```

```
#filename:autopack.sh
```

```
if [ -d /System/Library/Extensions/IONetworkingFamily.kext/  
Contents/PlugIns/AX88179_178A.kext ]; then  
sudo chown -R root:wheel /System/Library/Extensions/  
IONetworkingFamily.kext/Contents/PlugIns/AX88179_178A.kext  
sudo chmod 755 /System/Library/Extensions/IONetworkingFamily.kext/  
Contents/PlugIns/AX88179_178A.kext/Contents/MacOS/AX88179_178A  
fi
```

```
if [ -d /Library/Extensions/AX88179_178A.kext ]; then  
sudo chown -R root:wheel /Library/Extensions/AX88179_178A.kext  
sudo chmod 755 /Library/Extensions/AX88179_178A.kext/Contents/  
MacOS/AX88179_178A  
fi
```

```
sudo touch /System/Library/Extensions
```

```
% cat /tmp/asix_pkg/Scripts/postinstall
```

```
#!/bin/sh
```

```
#filename:autopack.sh
```

```
if [ -d /System/Library/Extensions/IONetworkingFamily.kext/  
Contents/PlugIns/AX88179_178A.kext ]; then  
sudo chown -R root:wheel /System/Library/Extensions/  
IONetworkingFamily.kext/Contents/PlugIns/AX88179_178A.kext  
sudo chmod 755 /System/Library/Extensions/IONetworkingFamily.kext/  
Contents/PlugIns/AX88179_178A.kext/Contents/MacOS/AX88179_178A  
fi
```

```
if [ -d /Library/Extensions/AX88179_178A.kext ]; then  
sudo chown -R root:wheel /Library/Extensions/AX88179_178A.kext  
sudo chmod 755 /Library/Extensions/AX88179_178A.kext/Contents/  
MacOS/AX88179_178A  
fi
```

```
sudo touch /System/Library/Extensions
```

The archive contains information about location, kind, owner, group, and mode of each file and directory.

Info alternatives

```
% pkgutil --payload-files /Users/Shared/asix/ax88179178a_10.9-2.4.0.pkg
```

```
.
```

```
./AX88179_178A.kext
```

```
./AX88179_178A.kext/Contents
```

```
./AX88179_178A.kext/Contents/_CodeSignature
```

```
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources
```

```
./AX88179_178A.kext/Contents/Info.plist
```

```
./AX88179_178A.kext/Contents/MacOS
```

```
./AX88179_178A.kext/Contents/MacOS/AX88179_178A
```

```
./AX88179_178A.kext/Contents/Resources
```

```
./AX88179_178A.kext/Contents/Resources/en.lproj
```

```
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings
```

```
% pkgutil --bom /Users/Shared/asix/ax88179178a_10.9-2.4.0.pkg
```

```
/tmp/ax88179178a_10.9-2.4.0.pkg.boms.VFjBtZ/Bom
```

```
% lsbom /tmp/ax88179178a_10.9-2.4.0.pkg.boms.VFjBtZ/Bom
```

```
. 40700 501/0
```

```
./AX88179_178A.kext 40755 501/20
```

```
./AX88179_178A.kext/Contents 40755 501/20
```

```
./AX88179_178A.kext/Contents/Info.plist 100644 501/20 4286 2081773764
```

```
./AX88179_178A.kext/Contents/MacOS 40755 501/20
```

```
./AX88179_178A.kext/Contents/MacOS/AX88179_178A 100755 501/20 88624 3
```

```
./AX88179_178A.kext/Contents/Resources 40755 501/20
```

```
./AX88179_178A.kext/Contents/Resources/en.lproj 40755 501/20
```

```
./AX88179_178A.kext/Contents/Resources/en.lproj/InfoPlist.strings 100644 501/20
```

```
./AX88179_178A.kext/Contents/_CodeSignature 40755 501/20
```

```
./AX88179_178A.kext/Contents/_CodeSignature/CodeResources 100644 501/20
```

Flat package review

Examine the contents of the Adobe Reader package and answer these questions:

- What are the component packages inside the distribution package?
- Which component packages include scripts?
- What are the install-locations for the component packages?

Examine the contents of the Adobe Reader package and answer these questions:

- What are the component packages inside the distribution package?
(Hint: you'll need to expand the flat pkg)

```
% pkgutil --expand ax88179178a_10.9-2.4.0.pkg /tmp/asix_pkg  
% open /tmp/asix_pkg
```

Examine the contents of the Adobe Reader package and answer these questions:

- What are the component packages inside the distribution package?
(Hint: you'll need to expand the flat pkg)

- Answer:

```
% cd /Volumes/AdbeRdr11010_en_US/
```

```
% pkgutil --expand Adobe\ Reader\ XI\ Installer.pkg /tmp/AdobeReader_pkg
```

```
% ls /tmp/AdobeReader_pkg
```

```
Distribution      Resources          application.pkg    browserPlugin.pkg  
support.pkg
```

Examine the contents of the Adobe Reader package and answer these questions:

- Which component packages include scripts?

- Answer:

```
% ls /tmp/AdobeReader_pkg/application.pkg
```

```
Bom          PackageInfo Payload      Scripts
```

```
% ls /tmp/AdobeReader_pkg/browserPlugin.pkg
```

```
Bom          PackageInfo Payload      Scripts
```

```
% ls /tmp/AdobeReader_pkg/support.pkg
```

```
Bom          PackageInfo Payload
```

Examine the contents of the Adobe Reader package and answer these questions:

- What are the install-locations for the component packages?
- Answer includes:

```
% cat /tmp/AdobeReader_pkg/support.pkg/PackageInfo

<pkg-info format-version="2"
identifier="com.adobe.acrobat.reader.
11010.reader.appsupport.pkg.en_US" version="11.0.10"
install-location="/Library/Application Support"
auth="root">...
```
- Other pkg install-locations:
 - application.pkg install-location="/Applications"
 - browserPlugin.pkg install-location="/Library/Internet Plug-Ins"

Apple packaging tools

pkgutil

Query and manipulate Mac OS X Installer packages and receipts.

pkgutil

Receipt database commands:

--pkgs

--pkg-info

--files

--file-info

--forget

pkgutil --pkgs

```
% pkgutil --pkgs  
adobe.adobeShockwavePlayer.shockwave11.pkg  
adobe.adobeShockwavePlayer.shockwave12.pkg  
com.adobe.pkg.AIR  
com.adobe.pkg.FlashPlayer  
com.alias.pkg.AliasUninstaller1.0  
com.alinofsoftware.alinoftimer  
com.amazon.Kindle  
com.apple.pkg.AdditionalEssentials  
com.apple.pkg.AdditionalSpeechVoices  
com.apple.pkg.AirPortUtility  
com.apple.pkg.Aperture_AppStore  
com.apple.pkg.AppleConfigurator  
com.apple.pkg.AsianLanguagesSupport  
com.apple.pkg.BaseSystemBinaries  
com.apple.pkg.BaseSystemResources
```

pkgutil --pkgs

```
% pkgutil --pkgs | grep -i flash  
com.adobe.pkg.FlashPlayer  
com.googlecode.munki.disableflash10autoupdate
```

pkgutil --pkg-info

```
% pkgutil --pkg-info com.googlecode.munki.disableflash10autoupdate  
package-id: com.googlecode.munki.disableflash10autoupdate  
version: 1.0  
volume: /  
location:  
install-time: 1375297642
```

```
% date -r 1375297642  
Wed Jul 31 12:07:22 PDT 2013
```

pkgutil --files

```
% pkgutil --files com.googlecode.munki.disableflash10autoupdate  
Library  
Library/Application Support  
Library/Application Support/Macromedia  
Library/Application Support/Macromedia/mms.cfg
```

pkgutil --file-info

```
% pkgutil --file-info /Library/Application\ Support/Macromedia/mms.cfg  
volume: /  
path: /Library/Application Support/Macromedia/mms.cfg  
  
pkgid: com.googlecode.munki.disableflash10autoupdate  
pkg-version: 1.0  
install-time: 1375297642  
uid: 0  
gid: 80  
mode: 664
```

pkgutil --forget

```
% pkgutil --forget com.adobe.pkg.FlashPlayer
```


pkgutil

Flat package commands:

--expand

--flatten

--bom

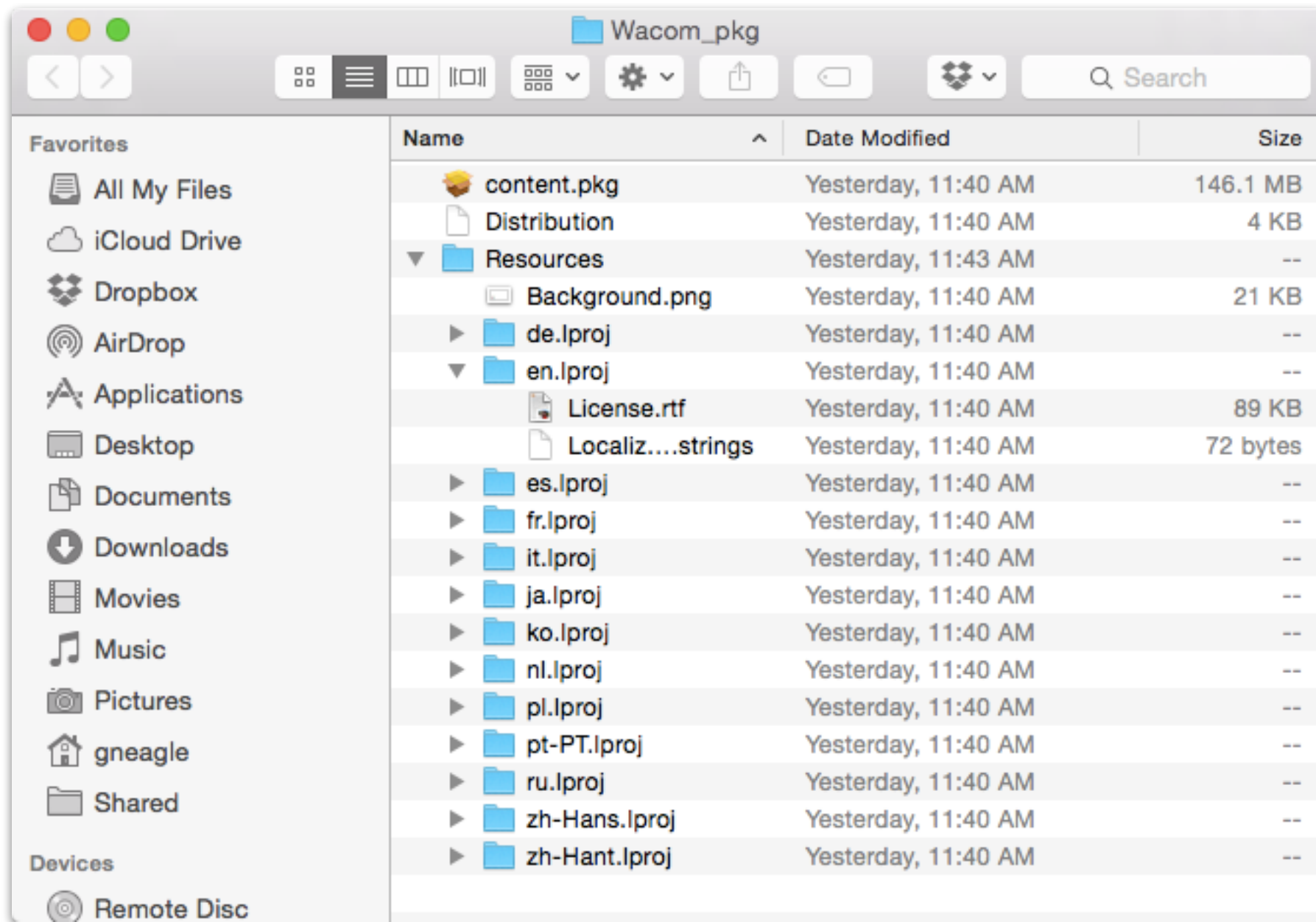
--payload-files

--check-signature

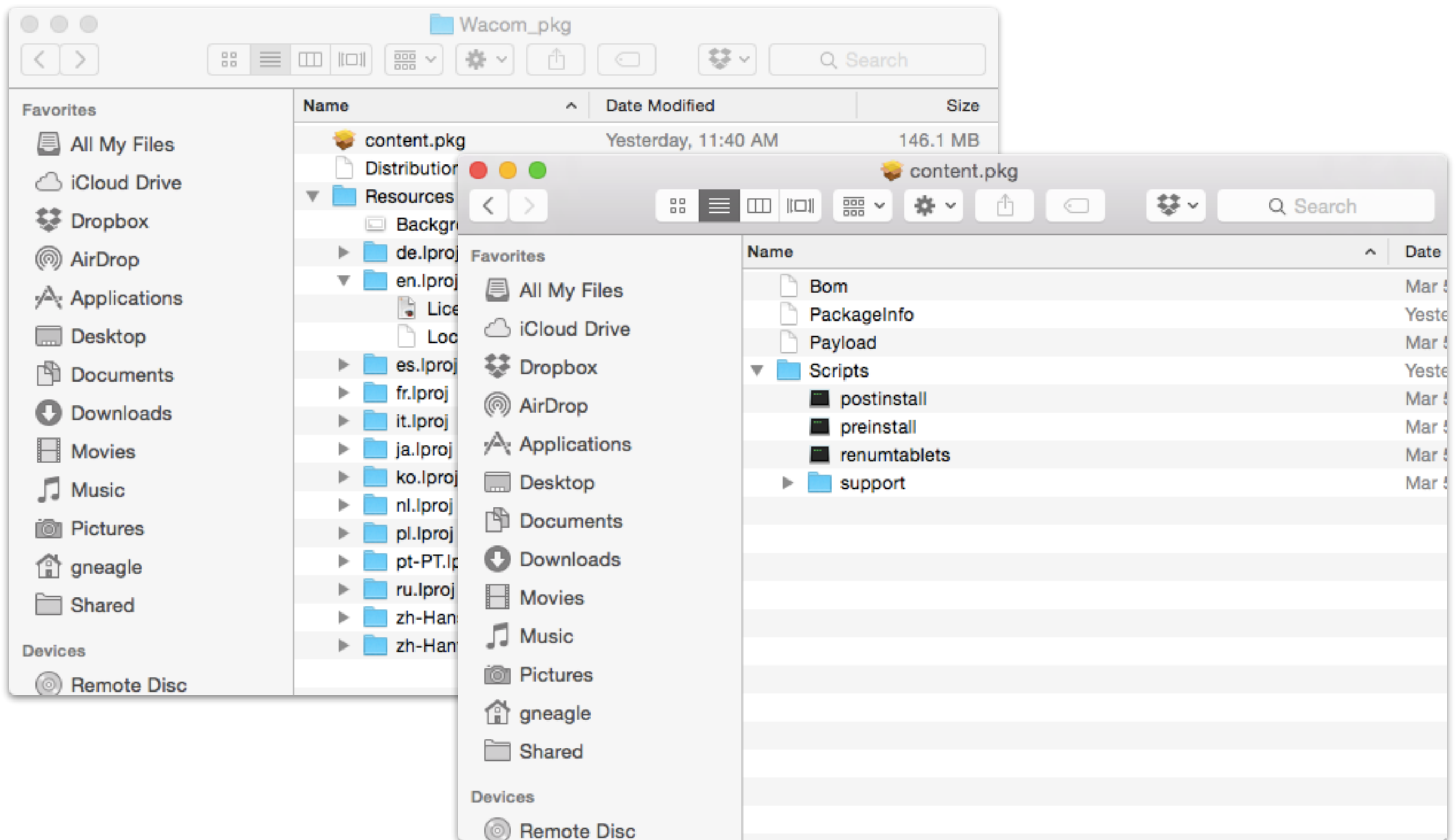
pkgutil --expand

```
% pkgutil --expand Install\ Wacom\ Tablet.pkg /tmp/Wacom_pkg
```

pkgutil --expand



pkgutil --expand



pkgutil --flatten

```
% pkgutil --flatten /tmp/Wacom_pkg ~/Desktop/CustomWacom.pkg
```

pkgutil --bom

```
% pkgutil --bom Install\ Wacom\ Tablet.pkg
/tmp/Install Wacom Tablet.pkg.boms.ye2sPU/content.pkg/Bom

% lsbom "/tmp/Install Wacom Tablet.pkg.boms.ye2sPU/content.pkg/Bom"
. 407550/0
./Applications 407750/0
./Applications/Wacom Tablet.localized 40775 0/0
./Applications/Wacom Tablet.localized/.localized 40775 0/0
./Applications/Wacom Tablet.localized/.localized/de.strings 100664 0/0 72 2630072004
./Applications/Wacom Tablet.localized/.localized/en.strings 100664 0/0 70 2525589374
./Applications/Wacom Tablet.localized/.localized/es.strings 100664 0/0 72 3567506170
./Applications/Wacom Tablet.localized/.localized/fr.strings 100664 0/0 74 3315303271
./Applications/Wacom Tablet.localized/.localized/it.strings 100664 0/0 76 3843434223
./Applications/Wacom Tablet.localized/.localized/ja.strings 100664 0/0 64 3782196401
./Applications/Wacom Tablet.localized/.localized/ko.strings 100664 0/0 58 981171454
./Applications/Wacom Tablet.localized/.localized/nl.strings 100664 0/0 70 3200743802
./Applications/Wacom Tablet.localized/.localized/pl.strings 100664 0/0 70 2340425475
./Applications/Wacom Tablet.localized/.localized/pt.strings 100664 0/0 82 1558099759
./Applications/Wacom Tablet.localized/.localized/ru.strings 100664 0/0 72 3166065194
./Applications/Wacom Tablet.localized/.localized/zh_CN.strings 100664 0/0 64 3933362247
./Applications/Wacom Tablet.localized/.localized/zh_TW.strings 100664 0/0 64 3696104737
./Applications/Wacom Tablet.localized/Wacom Desktop Center.app 40775 0/0
```

pkgutil --payload-files

```
% pkgutil --payload-files /Install\ Wacom\ Tablet.pkg
```

```
.
```

```
./Applications
```

```
./Applications/Wacom Tablet.localized
```

```
./Applications/Wacom Tablet.localized/.localized
```

```
./Applications/Wacom Tablet.localized/.localized/de.strings
```

```
./Applications/Wacom Tablet.localized/.localized/en.strings
```

```
./Applications/Wacom Tablet.localized/.localized/es.strings
```

```
./Applications/Wacom Tablet.localized/.localized/fr.strings
```

```
./Applications/Wacom Tablet.localized/.localized/it.strings
```

```
./Applications/Wacom Tablet.localized/.localized/ja.strings
```

```
./Applications/Wacom Tablet.localized/.localized/ko.strings
```

```
./Applications/Wacom Tablet.localized/.localized/nl.strings
```

```
./Applications/Wacom Tablet.localized/.localized/pl.strings
```

```
./Applications/Wacom Tablet.localized/.localized/pt.strings
```

```
./Applications/Wacom Tablet.localized/.localized/ru.strings
```

```
./Applications/Wacom Tablet.localized/.localized/zh_CN.strings
```

```
./Applications/Wacom Tablet.localized/.localized/zh_TW.strings
```

```
./Applications/Wacom Tablet.localized/aft.tar
```

```
./Applications/Wacom Tablet.localized/Wacom Desktop Center.app
```

pkgutil --check-signature

```
% pkgutil --check-signature Install\ Wacom\ Tablet.pkg
```

```
Package "Install Wacom Tablet.pkg":
```

```
Status: signed by a certificate trusted by Mac OS X
```

```
Certificate Chain:
```

```
1. Developer ID Installer: Wacom Technology Corp.
```

```
SHA1 fingerprint: 62 F5 E7 EC B3 21 8F B7 CE 63 70 4B E7 B9 8A 0B 3B 03 0D 8D
```

```
-----
```

```
2. Developer ID Certification Authority
```

```
SHA1 fingerprint: 3B 16 6C 3B 7D C4 B7 51 C9 FE 2A FA B9 13 56 41 E3 88 E1 86
```

```
-----
```

```
3. Apple Root CA
```

```
SHA1 fingerprint: 61 1E 5B 66 2C 59 3A 08 FF 58 D1 4A E2 24 52 D1 98 DF 6C 60
```


pkgutil review

pkgutil review tasks

- How many packages are installed on your machine?
- What pkgs are responsible for the current contents of these files?
 - /Applications/Chess.app/Contents/MacOS/Chess
 - /Applications/Safari.app/Contents/MacOS/Safari
- What files do the XProtectPlistConfigData packages manage?

pkgutil review tasks

- How many packages are installed on your machine?

Hint: List installed packages, use a UNIX pipe and `wc -l`

pkgutil review tasks

- How many packages are installed on your machine?

One solution:

```
% pkgutil --pkgs | wc -l
```

pkgutil review tasks

- What pkgs are responsible for the current contents of these files?
 - /Applications/Chess.app/Contents/MacOS/Chess
 - /Applications/Safari.app/Contents/MacOS/Safari

One solution:

```
% pkgutil --file-info /Applications/Chess.app/Contents/MacOS/  
Chess
```

pkgutil review tasks

- What files do the XProtectPlistConfigData packages manage?
- Hint: grep might be useful here

pkgutil review tasks

- One solution:

```
% pkgutil --pkgs | grep XProtect
com.apple.pkg.XProtectPlistConfigData.14U4030
com.apple.pkg.XProtectPlistConfigData.14U4033
com.apple.pkg.XProtectPlistConfigData.12U4038
<etc>
% pkgutil --files com.apple.pkg.XProtectPlistConfigData.14U4030
System
System/Library
System/Library/CoreServices
System/Library/CoreServices/XProtect.bundle
System/Library/CoreServices/XProtect.bundle/Contents
System/Library/CoreServices/XProtect.bundle/Contents/Info.plist
System/Library/CoreServices/XProtect.bundle/Contents/Resources
System/Library/CoreServices/XProtect.bundle/Contents/Resources/XProtect.meta.plist
System/Library/CoreServices/XProtect.bundle/Contents/Resources/XProtect.plist
System/Library/CoreServices/XProtect.bundle/Contents/_CodeSignature
System/Library/CoreServices/XProtect.bundle/Contents/_CodeSignature/CodeDirectory
System/Library/CoreServices/XProtect.bundle/Contents/_CodeSignature/CodeRequirements
System/Library/CoreServices/XProtect.bundle/Contents/_CodeSignature/CodeResources
System/Library/CoreServices/XProtect.bundle/Contents/_CodeSignature/CodeSignature
System/Library/CoreServices/XProtect.bundle/Contents/version.plist
```

pkgbuild

Build an OS X Installer component package
from on-disk files

pkgbuild

We're going to build a simple package to bypass the OS X Registration / Setup Assistant that launches on first boot.

Two files need to be placed:

- `/private/var/db/.AppleSetupDone`
- `/Library/Receipts/.SetupRegComplete`

pkgbuild

```
# need some working space
```

```
% cd ~/Desktop
```

pkgbuild

```
# make a root directory for our files  
% mkdir NoSetupAsst
```

pkgbuild

```
# create needed subdirectories
```

```
% mkdir -p NoSetupAsst/private/var/db
```

```
% mkdir -p NoSetupAsst/Library/Receipts
```

pkgbuild

```
# create our two files in the correct subdirectories  
% touch NoSetupAsst/private/var/db/.AppleSetupDone  
% touch NoSetupAsst/Library/Receipts/.SetupRegComplete
```

pkgbuild

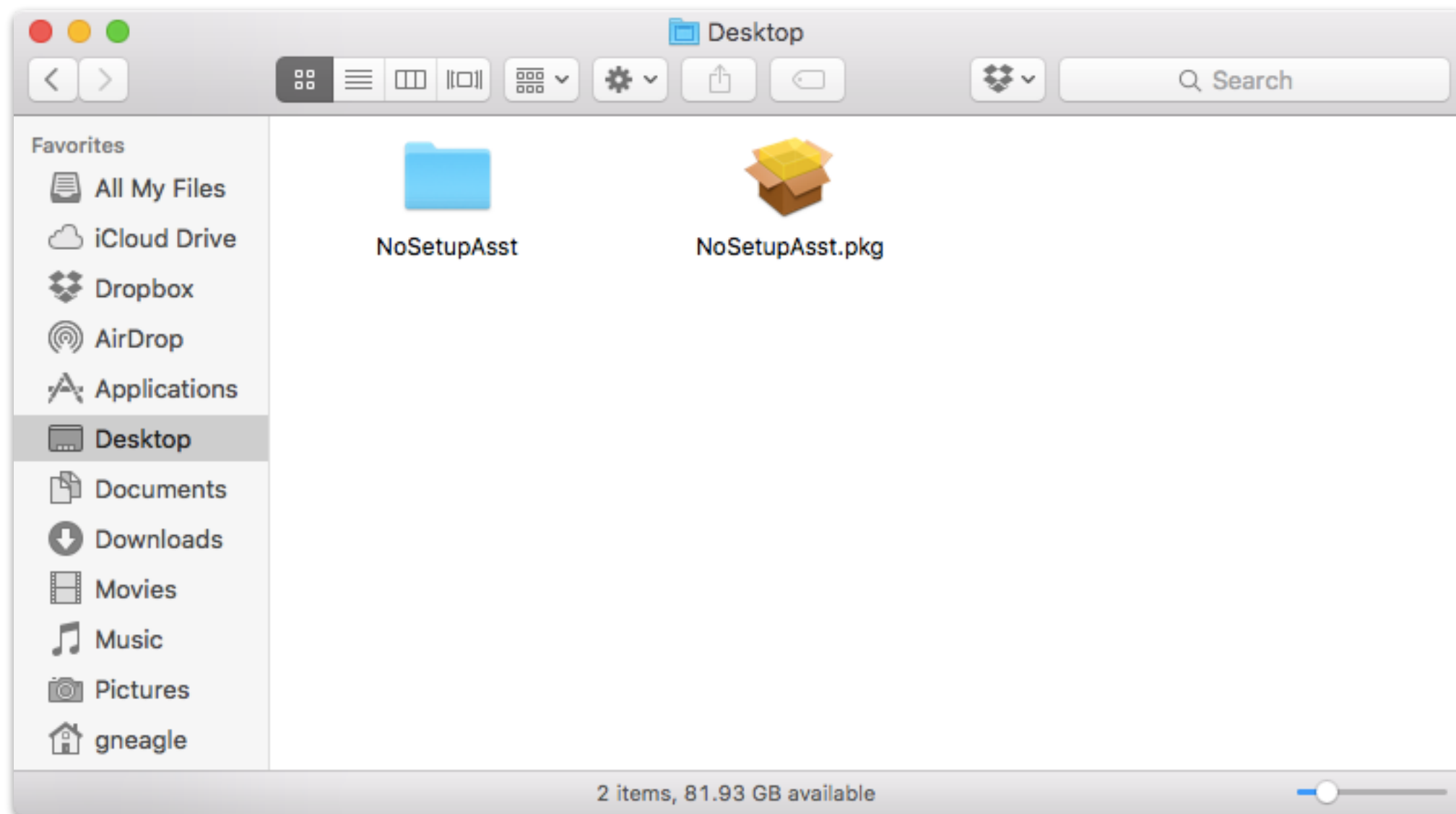
```
# build the pkg
```

```
% pkgbuild --root NoSetupAsst \  
            --identifier com.mycompany.pkg.NoSetupAsst \  
            --version 1.0 \  
            NoSetupAsst.pkg
```

```
pkgbuild: Inferring bundle components from contents of fakeroot
```

```
pkgbuild: Wrote package to NoSetupAsst.pkg
```

pkgbuild



Let's check our work...

```
% pkgutil --payload-files NoSetupAsst.pkg  
.  
./Library  
./Library/Receipts  
./Library/Receipts/.SetupRegComplete  
./private  
./private/var  
./private/var/db  
./private/var/db/.AppleSetupDone
```


Or fancier...

```
% lsbom `pkgutil --bom NoSetupAsst.pkg`  
. 40775 0/0  
./Library 40775 0/0  
./Library/Receipts 40775 0/0  
./Library/Receipts/.SetupRegComplete 100664 0/0 0 4294967295  
./private 40775 0/0  
./private/var 40775 0/0  
./private/var/db 40775 0/0  
./private/var/db/.AppleSetupDone 100664 0/0 0 4294967295
```

pkgbuild

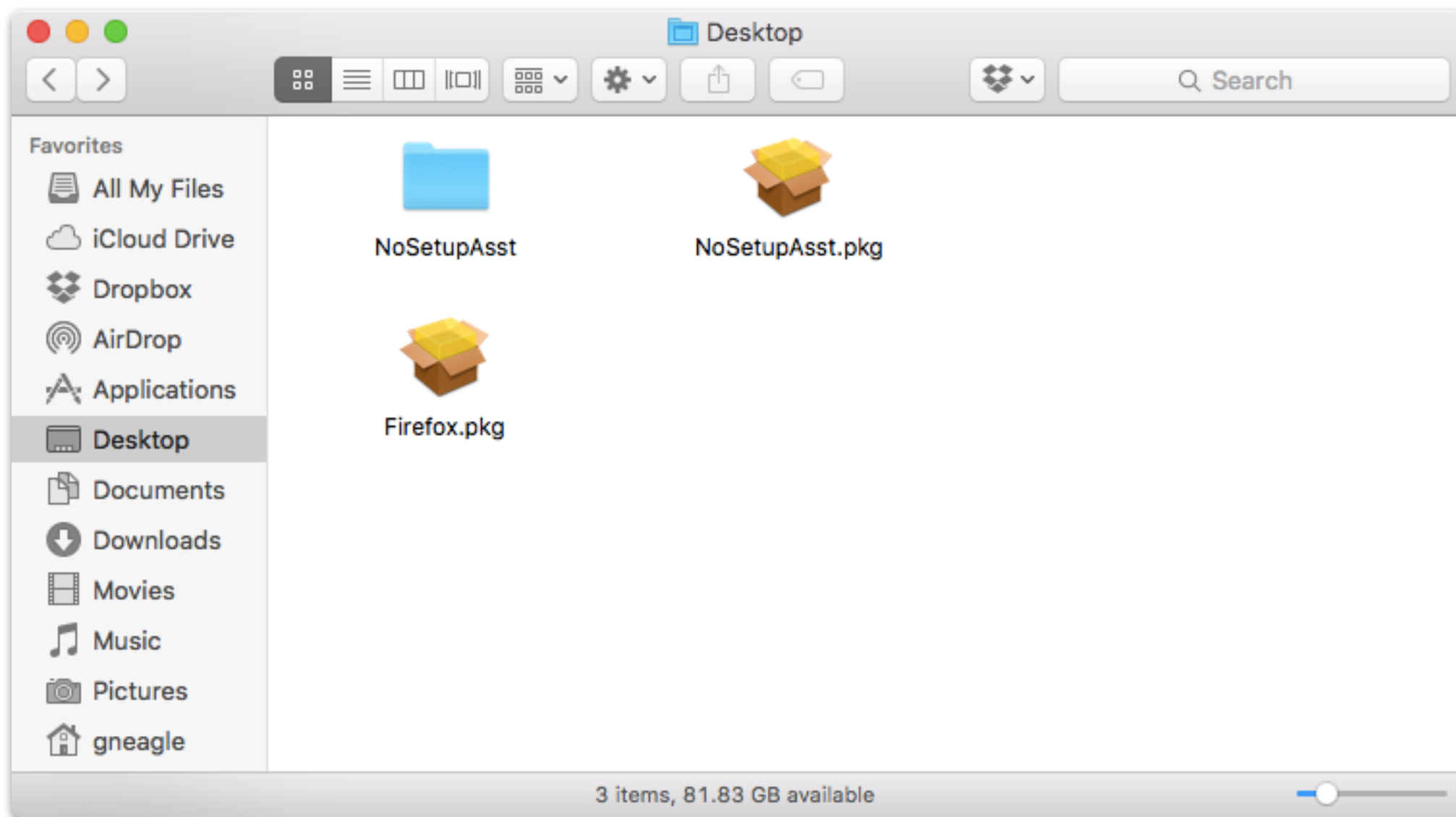
Package from application



pkgbuild

```
% pkgbuild --component /Volumes/Firefox/Firefox.app \  
            --install-location /Applications \  
            Firefox.pkg  
pkgbuild: Adding component at /Volumes/Firefox/Firefox.app  
pkgbuild: Wrote package to Firefox.pkg
```

pkgbuild



Let's check our work...

```
% pkgutil --payload-files Firefox.pkg
```

```
.  
./Firefox.app  
./Firefox.app/Contents  
./Firefox.app/Contents/_CodeSignature  
./Firefox.app/Contents/_CodeSignature/CodeResources  
./Firefox.app/Contents/_CodeSignature/._CodeResources  
./Firefox.app/Contents/._CodeSignature  
./Firefox.app/Contents/Info.plist  
./Firefox.app/Contents/._Info.plist  
./Firefox.app/Contents/MacOS  
./Firefox.app/Contents/MacOS/crashreporter.app  
./Firefox.app/Contents/MacOS/crashreporter.app/Contents  
./Firefox.app/Contents/MacOS/crashreporter.app/Contents/_CodeSignature  
./Firefox.app/Contents/MacOS/crashreporter.app/Contents/_CodeSignature/CodeResources  
./Firefox.app/Contents/MacOS/crashreporter.app/Contents/_CodeSignature/._CodeResources  
./Firefox.app/Contents/MacOS/crashreporter.app/Contents/._CodeSignature  
./Firefox.app/Contents/MacOS/crashreporter.app/Contents/Info.plist  
./Firefox.app/Contents/MacOS/crashreporter.app/Contents/._Info.plist  
./Firefox.app/Contents/MacOS/crashreporter.app/Contents/MacOS  
./Firefox.app/Contents/MacOS/crashreporter.app/Contents/MacOS/crashreporter
```

Let's check our work...

```
% pkgutil --expand Firefox.pkg Firefox_pkg
% cat Firefox_pkg/PackageInfo
<?xml version="1.0" encoding="utf-8" standalone="no"?>
<pkg-info overwrite-permissions="true" relocatable="false"
identifier="org.mozilla.firefox" postinstall-action="none"
version="42.0.0" format-version="2" generator-version="InstallCmds-554
(15B42)" install-location="/Applications" auth="root">
  <payload numberOfFiles="146" installKBytes="180912"/>
  <bundle path="./Firefox.app" id="org.mozilla.firefox"
CFBundleShortVersionString="42.0" CFBundleVersion="4215.10.29"/>
    <bundle-version>
      <bundle id="org.mozilla.firefox"/>
    </bundle-version>
    <upgrade-bundle>
      <bundle id="org.mozilla.firefox"/>
    </upgrade-bundle>
    <update-bundle/>
    <atomic-update-bundle/>
    <strict-identifier>
      <bundle id="org.mozilla.firefox"/>
    </strict-identifier>
```

Let's check our work...

```
% pkgutil --expand Firefox.pkg Firefox_pkg
% cat Firefox_pkg/PackageInfo
<?xml version="1.0" encoding="utf-8" standalone="no"?>
<pkg-info overwrite-permissions="true" relocatable="false"
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version="42.0.0" format-version="2" generator-version="InstallCmds-554
(15B42)" install-location="/Applications" auth="root">
  <payload numberOfFiles="146" installKBytes="180912"/>
  <bundle path="./Firefox.app" id="org.mozilla.firefox"
CFBundleShortVersionString="42.0" CFBundleVersion="4215.10.29"/>
  <bundle-version>
    <bundle id="org.mozilla.firefox"/>
  </bundle-version>
  <upgrade-bundle>
    <bundle id="org.mozilla.firefox"/>
  </upgrade-bundle>
  <update-bundle/>
  <atomic-update-bundle/>
  <strict-identifier>
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  </strict-identifier>
```

Let's check our work...

```
% pkgutil --expand Firefox.pkg Firefox_pkg
% cat Firefox_pkg/PackageInfo
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version="42.0.0" format-version="2" generator-version="InstallCmds-554
(15B42)" install-location="/Applications" auth="root">
  <payload numberOfFiles="146" installKBytes="180912"/>
  <bundle path="./Firefox.app" id="org.mozilla.firefox"
CFBundleShortVersionString="42.0" CFBundleVersion="4215.10.29"/>
  <bundle-version>
    <bundle id="org.mozilla.firefox"/>
  </bundle-version>
  <upgrade-bundle>
    <bundle id="org.mozilla.firefox"/>
  </upgrade-bundle>
  <update-bundle/>
  <atomic-update-bundle/>
  <strict-identifier>
    <bundle id="org.mozilla.firefox"/>
  </strict-identifier>
```


A word about owner,
group and mode

The archive contains
information about location,
kind, owner, group, and
mode of each file and
directory.

--ownership (recommended | preserve | preserve-other)

--ownership recommended

- Default
- `pkgbuild` applies Apple's recommended owner and group to files in the payload
- Generally, this is `root:wheel`

`--ownership preserve`

- `pkgbuild` uses the owner and group from the actual on-disk source files
- It's *your* responsibility to set these before building the package

`--ownership preserve-other`

- `pkgbuild` will apply the recommended UID and GID to those files that are owned by the user running `pkgbuild`, but leave other files unchanged.

But what about
mode?

- Mode (read/write/execute) is always copied from on-disk files.
- It's *your* responsibility to set these to the right values *before* building the package
- If package fixes user, group or mode in a postinstall script, it is doing it wrong.

pkgbuild review

pkgbuild review task

- Build a package that installs some application that is normally distributed via “drag-n-drop” disk image.

pkgbuild review task

- Build a package that installs some application that is normally distributed via “drag-n-drop” disk image.
- One solution:

```
% pkgbuild --component /Applications/Skype.app ~/Desktop/Skype.pkg
```

productbuild

Build a product archive for the OS X Installer
or the Mac App Store

(Builds “distribution”-style packages)

productbuild

Convert a component pkg to a distribution pkg:

```
% mkdir ComponentPkgs  
% productbuild --package Firefox.pkg ComponentPkgs/Firefox.pkg  
productbuild: Wrote product to ComponentPkgs/Firefox.pkg
```

productbuild

Check our work:

```
% pkgutil --expand ComponentPkgs/Firefox.pkg ComponentPkgs/Firefox_pkg  
% ls -1 ComponentPkgs/Firefox_pkg
```

Distribution

Firefox.pkg

productbuild

Create a distribution pkg from multiple component pkgs

```
productbuild --package Firefox.pkg \  
             --package NoSetupAsst.pkg \  
             ComponentPkgs/Combo.pkg
```

productbuild

Check our work!

```
% pkgutil --expand ComponentPkgs/Combo.pkg ComponentPkgs/Combo_pkg
% ls -1 ComponentPkgs/Combo_pkg
Distribution
Firefox.pkg
NoSetupAsst.pkg
```


productbuild review

- Using **pkgbuild** and **productbuild**, build a distribution pkg that installs both Firefox and Google Chrome (or any two apps of your choice)

- Using **pkgbuild** and **productbuild**, build a distribution pkg that installs both Firefox and Google Chrome (or any two apps of your choice)
- A solution:

```
% pkgbuild --component /Volumes/Firefox/Firefox.app --install-location /Applications Firefox.pkg  
pkgbuild: Adding component at /Volumes/Firefox/Firefox.app  
pkgbuild: Wrote package to Firefox.pkg
```

```
% pkgbuild --component /Volumes/Google\ Chrome/Google\ Chrome.app \  
--install-location /Applications GoogleChrome.pkg  
pkgbuild: Adding component at /Volumes/Google Chrome/Google Chrome.app  
pkgbuild: Wrote package to GoogleChrome.pkg
```

```
% productbuild --package Firefox.pkg --package GoogleChrome.pkg FreeBrowsers.pkg  
productbuild: Wrote product to FreeBrowsers.pkg
```

Philosophy

Repackaging
considered harmful

Why repackage?

- Vendor doesn't supply a deployable package

• Want to customize or configure what is installed

Why **not** repackage?

- Vendor may won't support your installs
- It's tedious and difficult to do right
- It's easy to do wrong
- It's hard to test and replicate

Repackaging alternatives

- Install additional pkgs
- Edit vendor packages
- Post-install scripting
- AutoPkg

Common repackaging pitfalls

- “Snapshotting”:
 - Can miss important changes
 - Can include irrelevant changes
 - Hard to ensure actions of package scripts are replicated

Common repackaging pitfalls

- Can break updates unless you also repackage those

Why repackage?

- Vendor doesn't supply a deployable package

• Want to customize or configure what is installed

Why repackaging?

- Vendor doesn't supply a deployable package:
 - Not a supported pkg format
 - InstallEase, InstallAnywhere, InstallerVISE, etc
 - Installation application
- Won't install "silently" (requires human interaction)
- Won't install when there is no GUI user

Why package?

- Internal files, tools, configurations, apps that need to be deployed

If you must (re)package?

- Repeatable
- Testable
- Documented

- TheLuggage
<https://github.com/unixorn/luggage/>
- AutoPkg
<https://autopkg.github.io/autopkg/>
- MunkiPkg
<https://github.com/munki/munki-pkg/>

- Scripts that use pkgbuild/
productbuild
- Put these in Git (or other
version control)