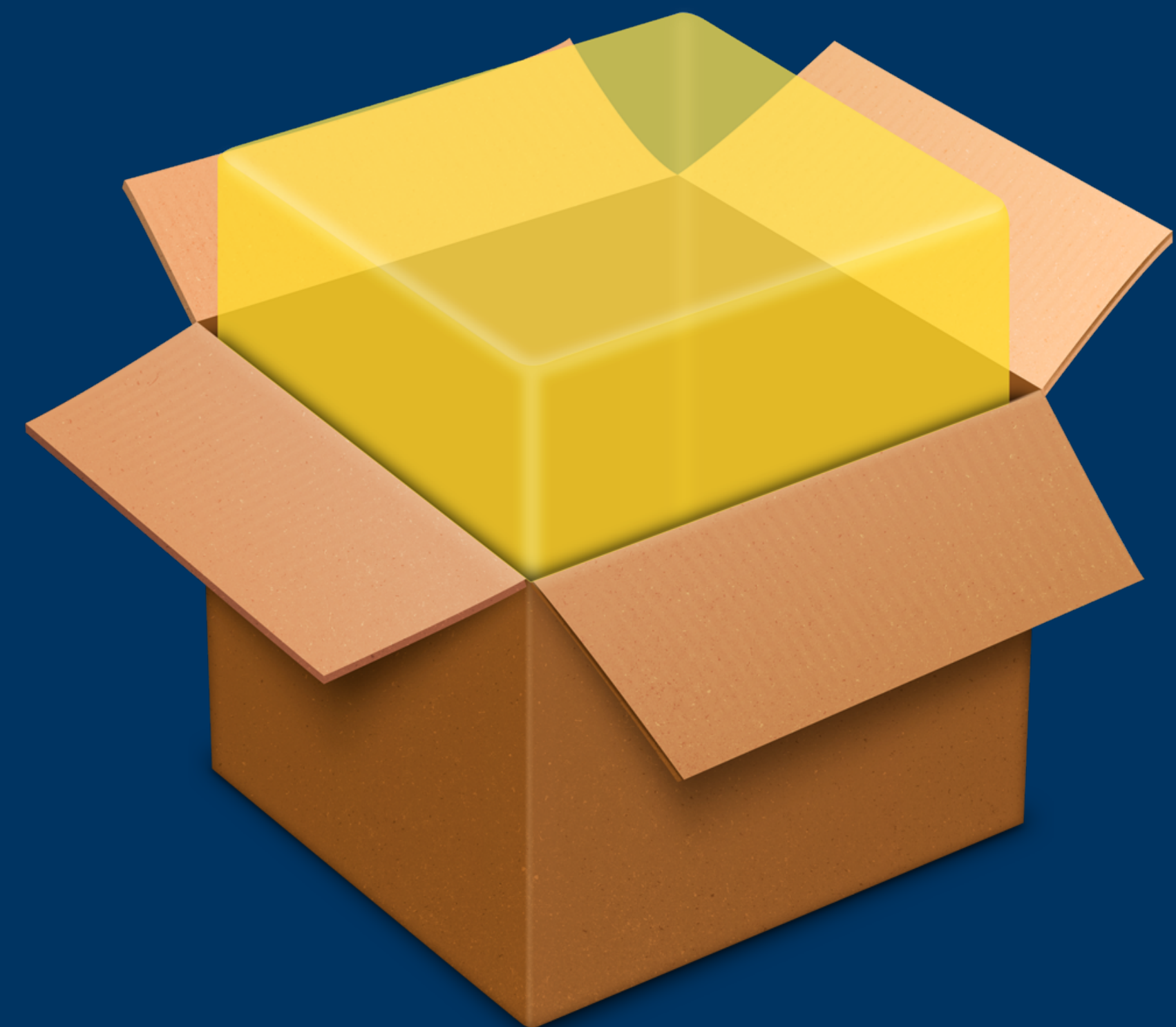


# Advanced Packaging

MacSysAdmin 2025

Duncan McCracken



# About Me

**MacSysAdmin #14  
(for me)**

- Originally from Australia
- About 30 years in this industry
- The last 5 were with Jamf
- The previous 10 years were at Mondada
- Taking a bit of a break
- Live in Mexico

# About Me

**MacSysAdmin #14  
(for me)**

- Originally from Australia
- About 30 years in this industry
- The last 4 years 360 days were with Jamf
- The previous 10 years were at Mondada
- Taking a bit of a break
- Live in Mexico







# MacSysAdmin

15 years ago





# MacSysAdmin

**15 years ago**

- 55 mins. No more. No less.
- Don't expect any questions.
- Lots of live demos.
- I did 2 talks.
- Packaging (good for live demos).
- A now defunct large scale storage solution (less good for live demos).
- Time to re-visit packaging.



# Last Year

<https://docs.macsysadmin.se/2024/>

**macOS application  
packaging 101**



# Why?

**Not necessarily to do, but to know.**



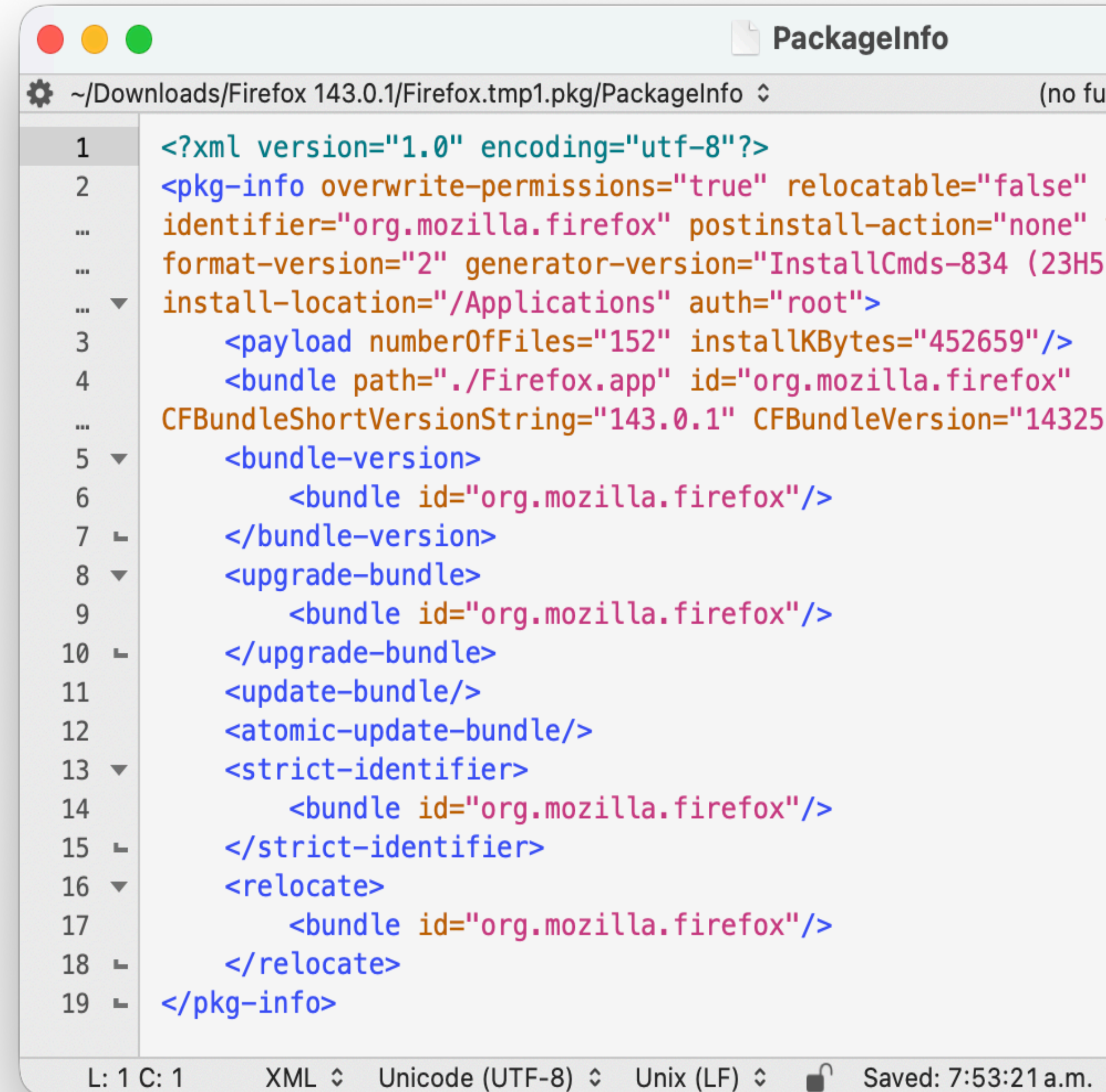
# Component Package



# PackageInfo

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion



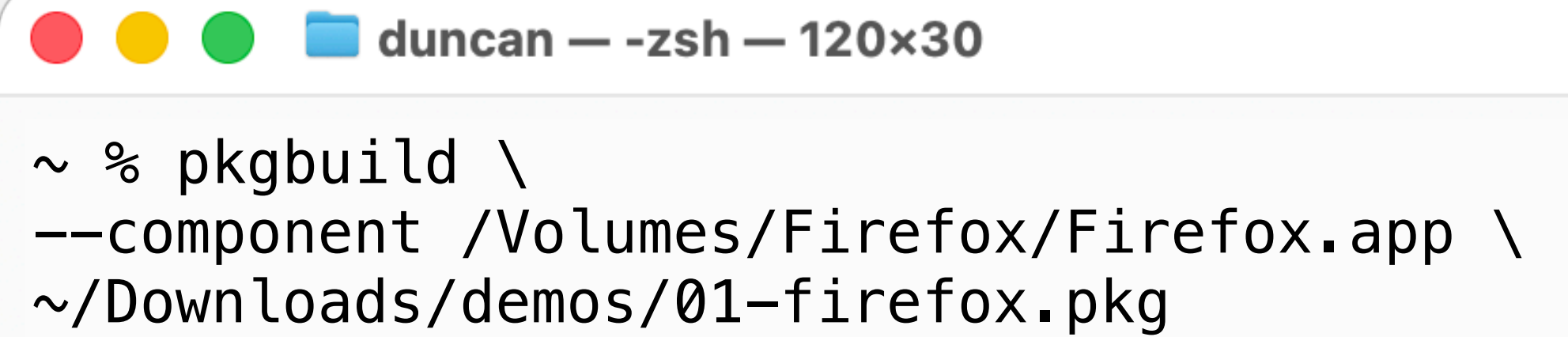
```
1 <?xml version="1.0" encoding="utf-8"?>
2 <pkg-info overwrite-permissions="true" relocatable="false"
3   identifier="org.mozilla.firefox" postinstall-action="none"
4   format-version="2" generator-version="InstallCmds-834 (23H5
5   install-location="/Applications" auth="root">
6     <payload numberOfFiles="152" installKBytes="452659"/>
7     <bundle path="./Firefox.app" id="org.mozilla.firefox"
8     CFBundleShortVersionString="143.0.1" CFBundleVersion="14325
9     <bundle-version>
10       <bundle id="org.mozilla.firefox"/>
11     </bundle-version>
12     <upgrade-bundle>
13       <bundle id="org.mozilla.firefox"/>
14     </upgrade-bundle>
15     <update-bundle/>
16     <atomic-update-bundle/>
17     <strict-identifier>
18       <bundle id="org.mozilla.firefox"/>
19     </strict-identifier>
20     <relocate>
21       <bundle id="org.mozilla.firefox"/>
22     </relocate>
23   </pkg-info>
```



# Component

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion

A terminal window with a title bar containing three colored circles (red, yellow, green) and a folder icon, followed by the text "duncan — -zsh — 120x30". The terminal content shows a command being executed: "~ % pkgbuild \", followed by "--component /Volumes/Firefox/Firefox.app \" on the next line, and "~/Downloads/demos/01-firefox.pkg" on the third line.

```
duncan — -zsh — 120x30
~ % pkgbuild \
--component /Volumes/Firefox/Firefox.app \
~/Downloads/demos/01-firefox.pkg
```



# Component

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- **install-location**
- auth
- minimumSystemVersion

```
duncan — -zsh — 120x30

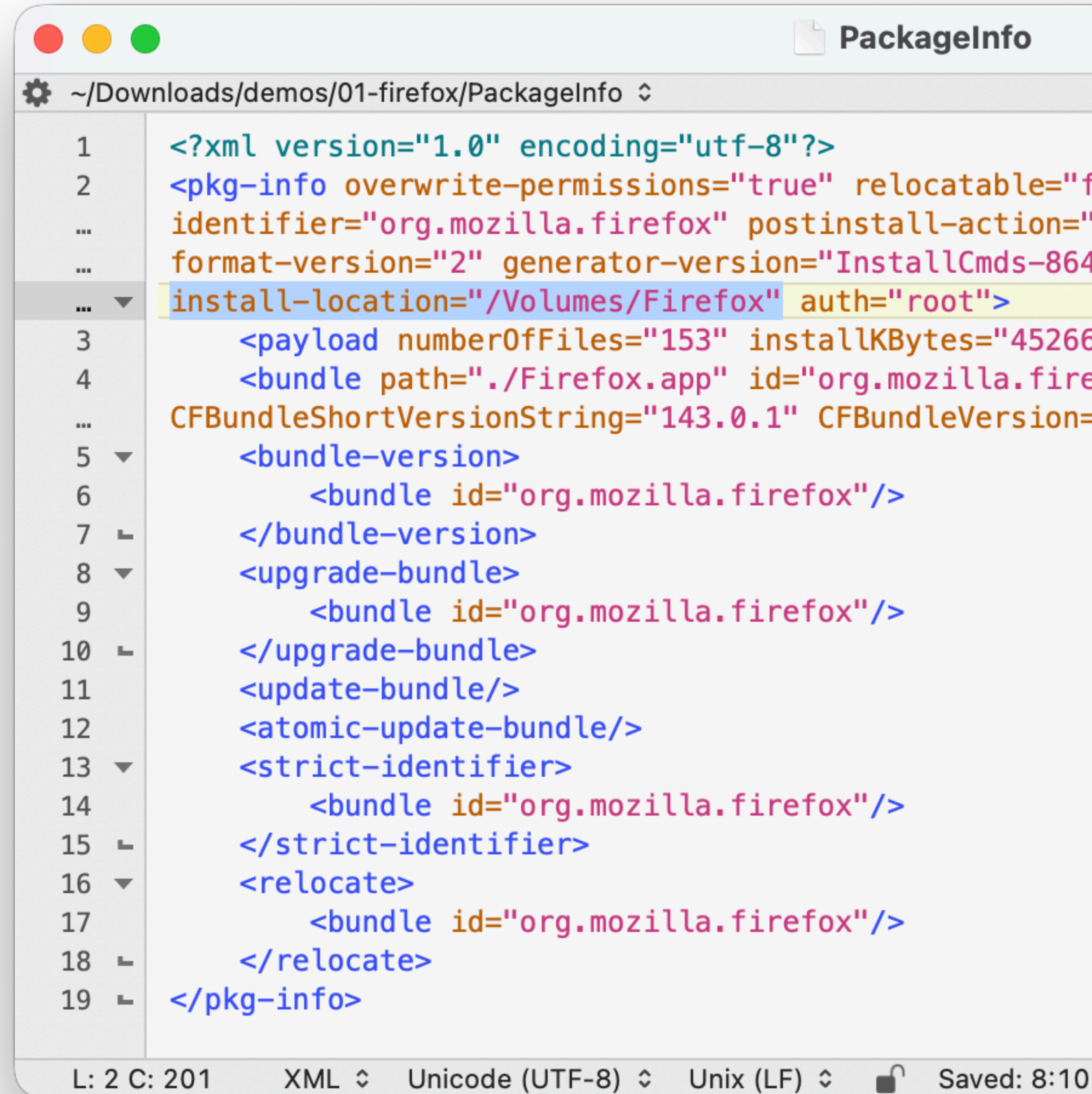
~ % pkgbuild \
--component /Volumes/Firefox/Firefox.app \
~/Downloads/demos/01-firefox.pkg
pkgbuild: Adding component at /Volumes/Firefox/
Firefox.app
pkgbuild: Inferred install-location of /Volumes/
Firefox
pkgbuild: Wrote package to ~/Downloads/demos/01-
firefox.pkg
~ %
```



# Component

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- **install-location** ❌
- auth
- minimumSystemVersion



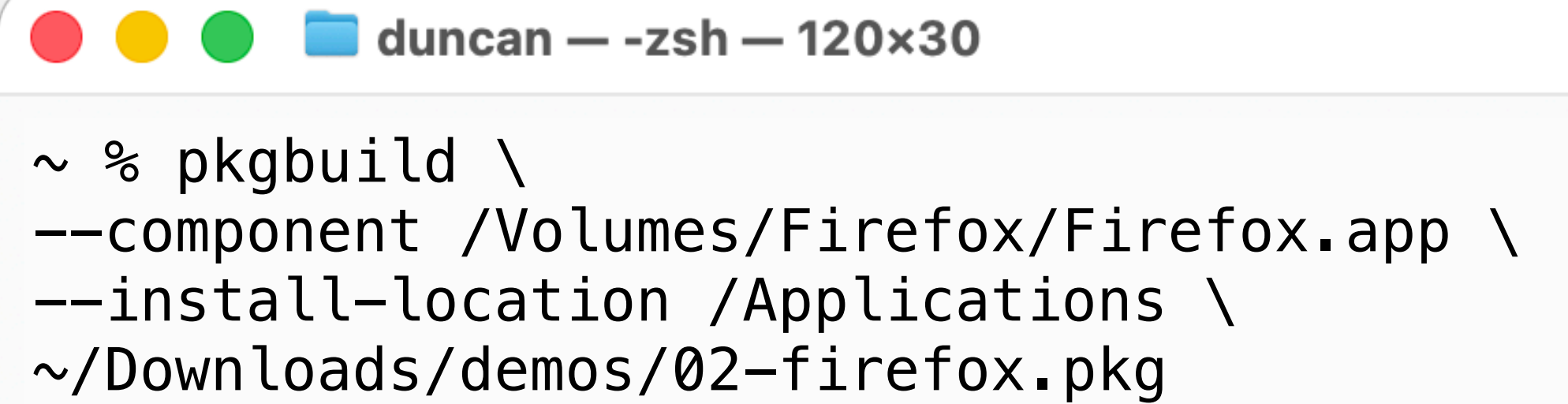
```
<?xml version="1.0" encoding="utf-8"?>
<pkg-info overwrite-permissions="true" relocatable="true"
identifier="org.mozilla.firefox" postinstall-action="f
format-version="2" generator-version="InstallCmds-864
install-location="/Volumes/Firefox" auth="root">
  <payload numberOfFile="153" installKBytes="45266
  <bundle path="./Firefox.app" id="org.mozilla.fire
CFBundleShortVersionString="143.0.1" CFBundleVersion=
  <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>
  <relocate>
    <bundle id="org.mozilla.firefox"/>
  </relocate>
</pkg-info>
```



# Install Location

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- **install-location**
- auth
- minimumSystemVersion

A terminal window with a title bar containing three colored circles (red, yellow, green) and a folder icon, followed by the text "duncan — -zsh — 120x30". The terminal content shows a command being executed: "~ % pkgbuild \", followed by two lines of arguments: "--component /Volumes/Firefox/Firefox.app \" and "--install-location /Applications \", and finally the filename "~/Downloads/demos/02-firefox.pkg".

```
duncan — -zsh — 120x30
~ % pkgbuild \
--component /Volumes/Firefox/Firefox.app \
--install-location /Applications \
~/Downloads/demos/02-firefox.pkg
```



# Install Location

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- **install-location**
- auth
- minimumSystemVersion

```
duncan — -zsh — 120x30

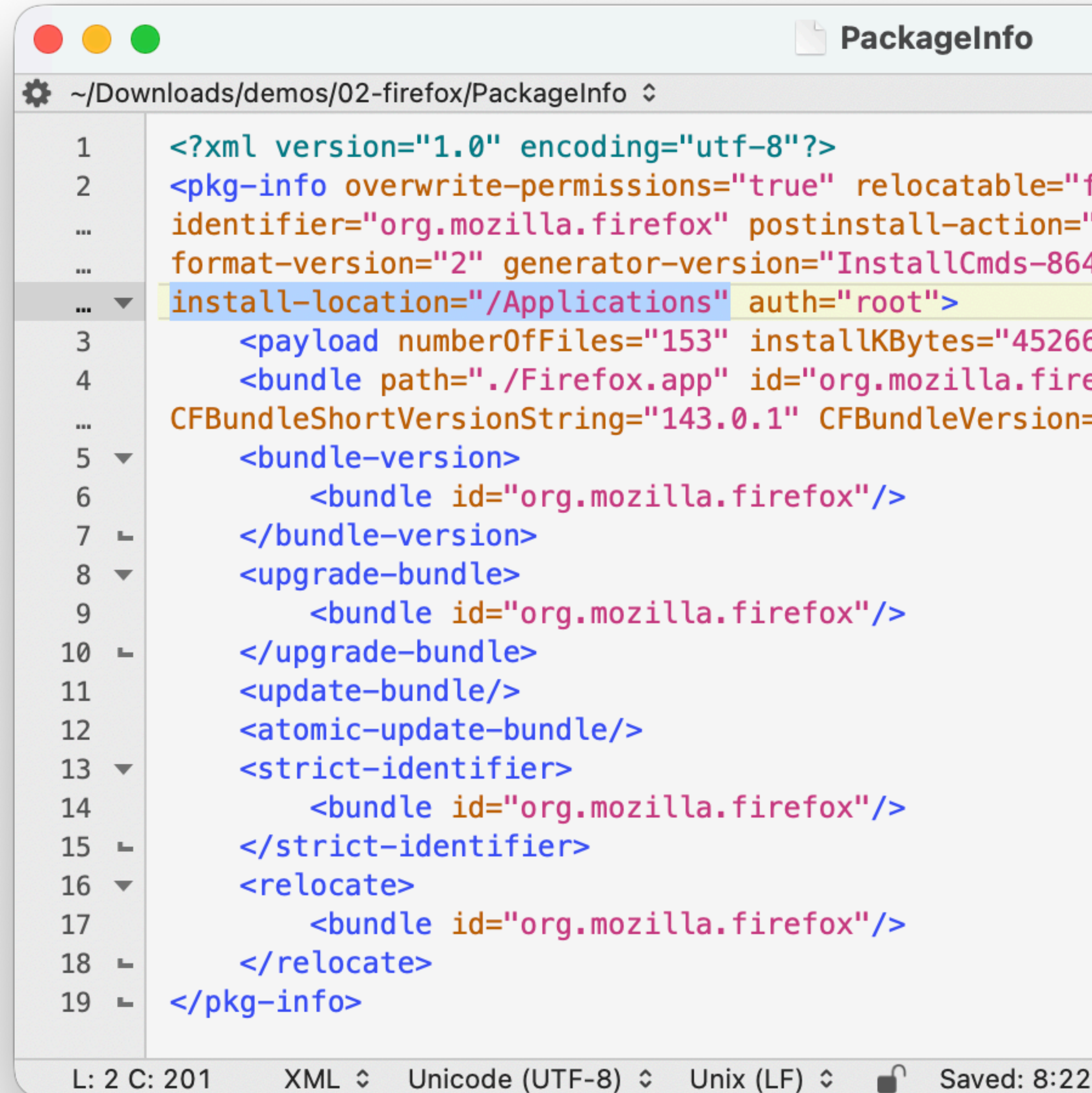
~ % pkgbuild \
--component /Volumes/Firefox/Firefox.app \
--install-location /Applications \
~/Downloads/demos/02-firefox.pkg
pkgbuild: Adding component at /Volumes/Firefox/
Firefox.app
pkgbuild: Wrote package to ~/Downloads/demos/02-
firefox.pkg
~ %
```



# Install Location

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- **install-location** ✓
- auth
- minimumSystemVersion



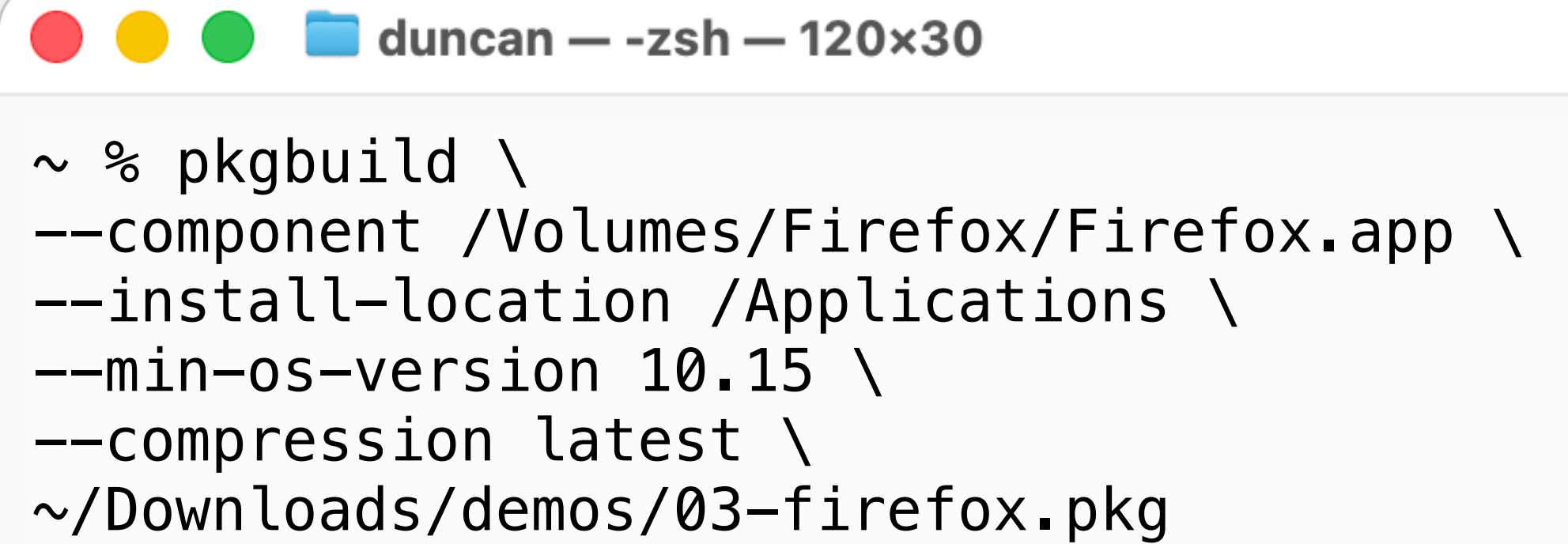
```
1 <?xml version="1.0" encoding="utf-8"?>
2 <pkg-info overwrite-permissions="true" relocatable="true"
... identifier="org.mozilla.firefox" postinstall-action="
... format-version="2" generator-version="InstallCmds-864
... install-location="/Applications" auth="root">
3     <payload numberOfFiles="153" installKBytes="45266"
4     <bundle path="./Firefox.app" id="org.mozilla.firefox"
... CFBundleShortVersionString="143.0.1" CFBundleVersion="
5     <bundle-version>
6         <bundle id="org.mozilla.firefox"/>
7     </bundle-version>
8     <upgrade-bundle>
9         <bundle id="org.mozilla.firefox"/>
10    </upgrade-bundle>
11    <update-bundle/>
12    <atomic-update-bundle/>
13    <strict-identifier>
14        <bundle id="org.mozilla.firefox"/>
15    </strict-identifier>
16    <relocate>
17        <bundle id="org.mozilla.firefox"/>
18    </relocate>
19 </pkg-info>
```



# Min OS Version

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- **minimumSystemVersion**

A terminal window with a title bar containing three colored circles (red, yellow, green) and a folder icon, followed by the text "duncan — -zsh — 120x30". The terminal content shows a series of command-line arguments for the pkgbuild command, including component path, install location, minimum OS version, and compression settings.

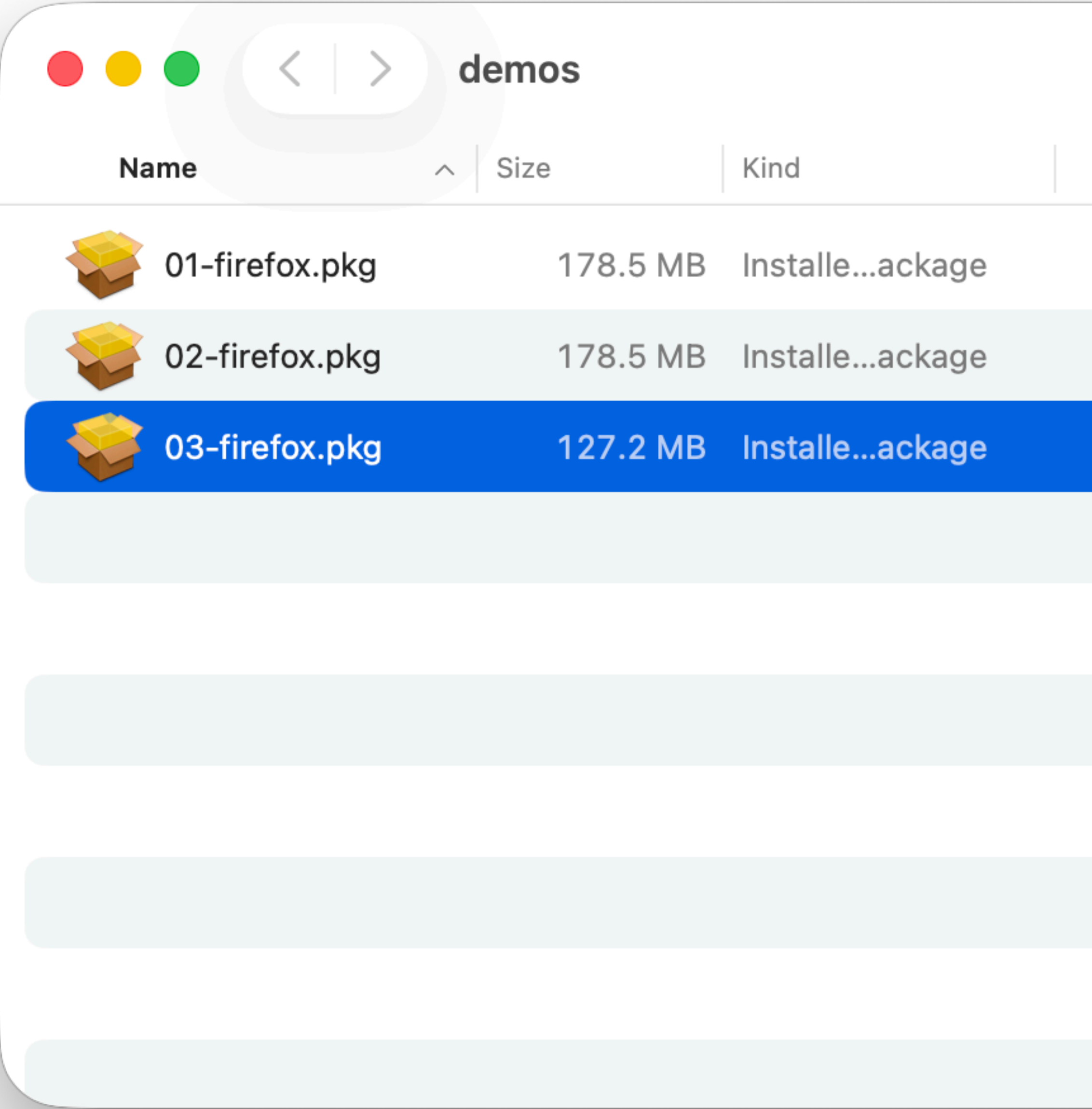
```
~ % pkgbuild \  
--component /Volumes/Firefox/Firefox.app \  
--install-location /Applications \  
--min-os-version 10.15 \  
--compression latest \  
~/Downloads/demos/03-firefox.pkg
```






# Min OS Version

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- **minimumSystemVersion**



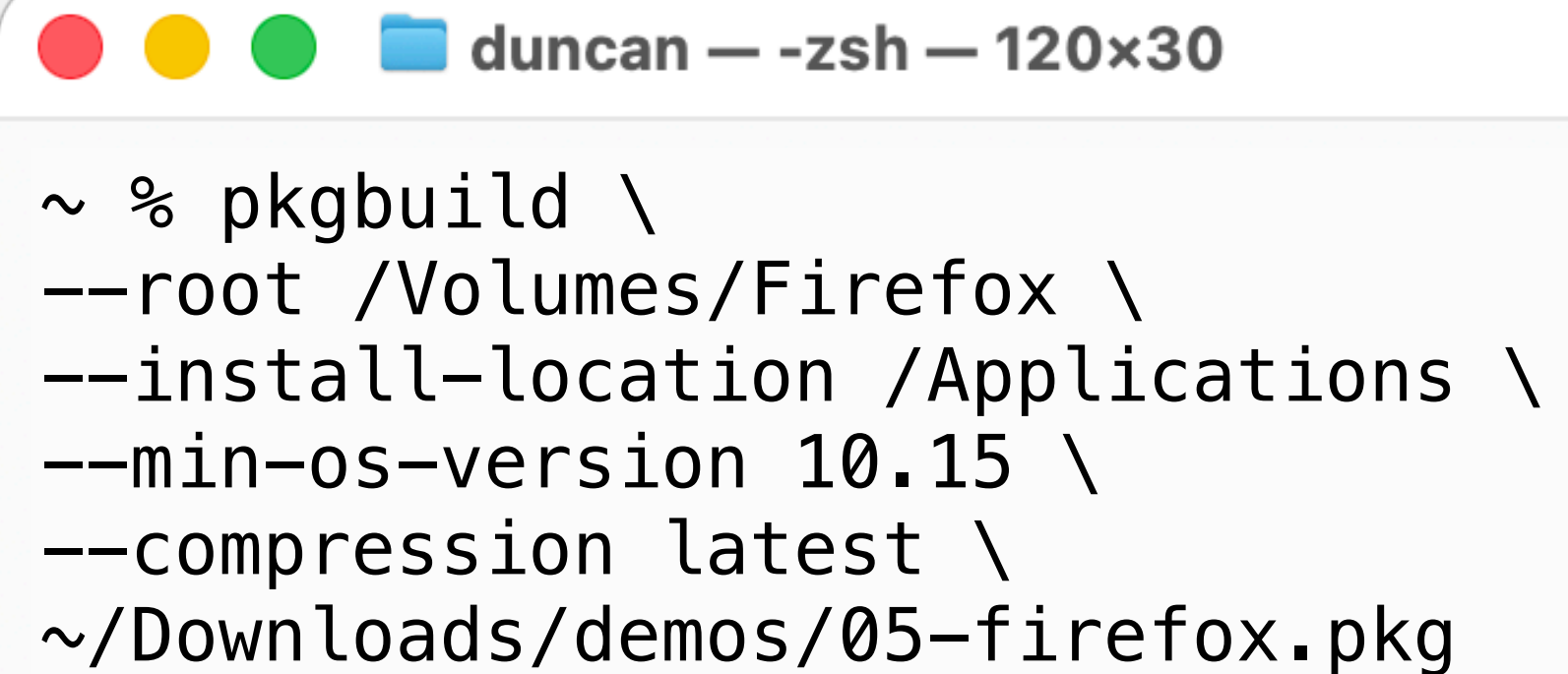
demos			
Name	Size	Kind	
 01-firefox.pkg	178.5 MB	Installe...ackage	
 02-firefox.pkg	178.5 MB	Installe...ackage	
 03-firefox.pkg	127.2 MB	Installe...ackage	



# Root

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion



```
~ % pkgbuild \  
--root /Volumes/Firefox \  
--install-location /Applications \  
--min-os-version 10.15 \  
--compression latest \  
~/Downloads/demos/05-firefox.pkg
```



# Root

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion

duncan — -zsh — 120x30

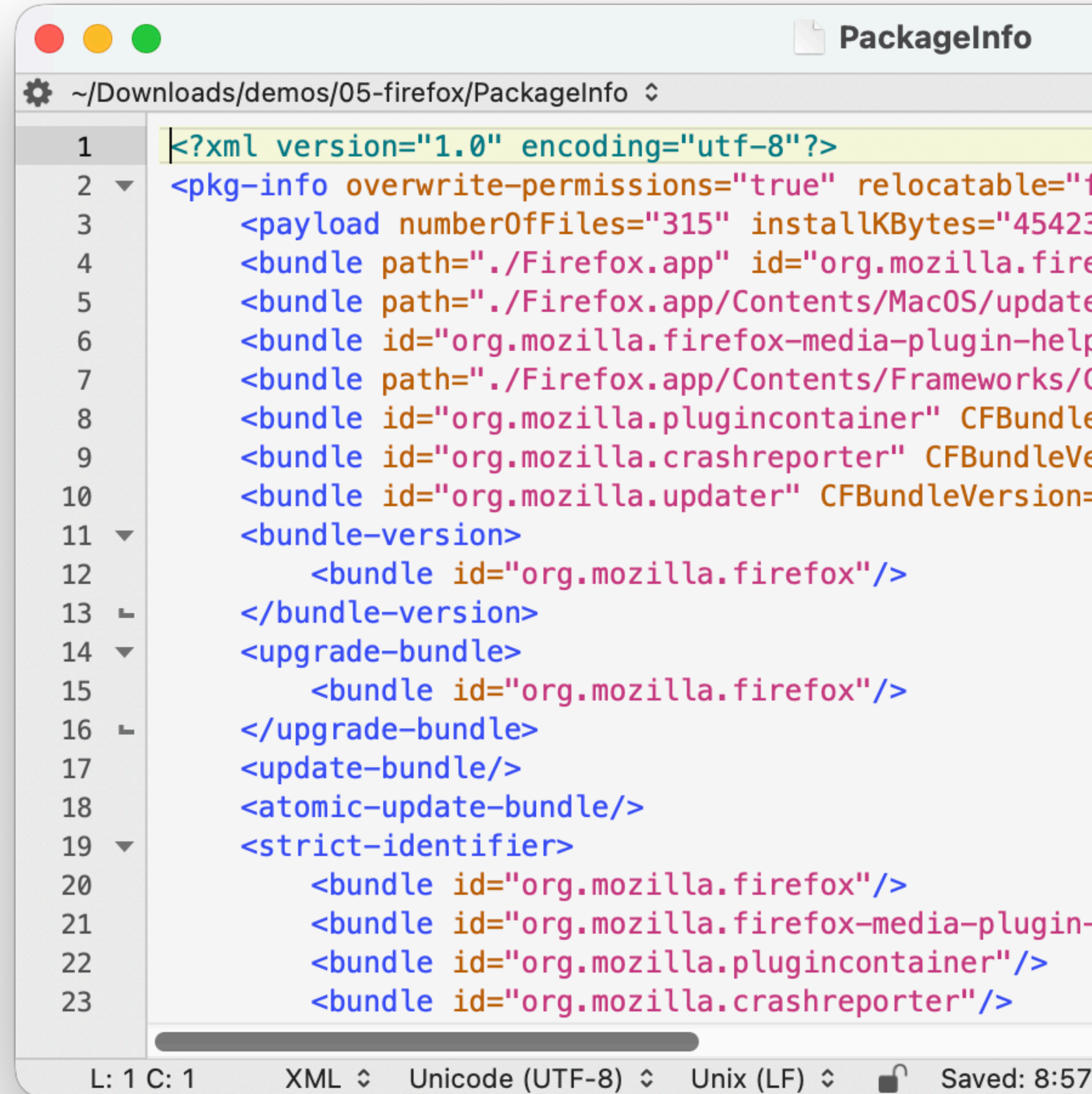
```
~ % pkgbuild \  
--root /Volumes/Firefox \  
--install-location /Applications \  
--min-os-version 10.15 \  
--compression latest \  
~/Downloads/demos/05-firefox.pkg  
pkgbuild: Inferring bundle components from  
contents of /Volumes/Firefox  
pkgbuild: Adding component at Firefox.app  
pkgbuild: Adding component at Firefox.app/  
Contents/MacOS/updater.app/Contents/Frameworks/  
UpdateSettings.framework  
pkgbuild: Adding component at Firefox.app/  
Contents/MacOS/media-plugin-helper.app  
pkgbuild: Adding component at Firefox.app/  
Contents/Frameworks/ChannelPrefs.framework  
pkgbuild: Adding component at Firefox.app/  
Contents/MacOS/plugin-container.app  
pkgbuild: Adding component at Firefox.app/  
Contents/MacOS/crashreporter.app  
pkgbuild: Adding component at Firefox.app/  
Contents/MacOS/updater.app  
pkgbuild: Wrote package to /Users/duncan/
```



# Root

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion



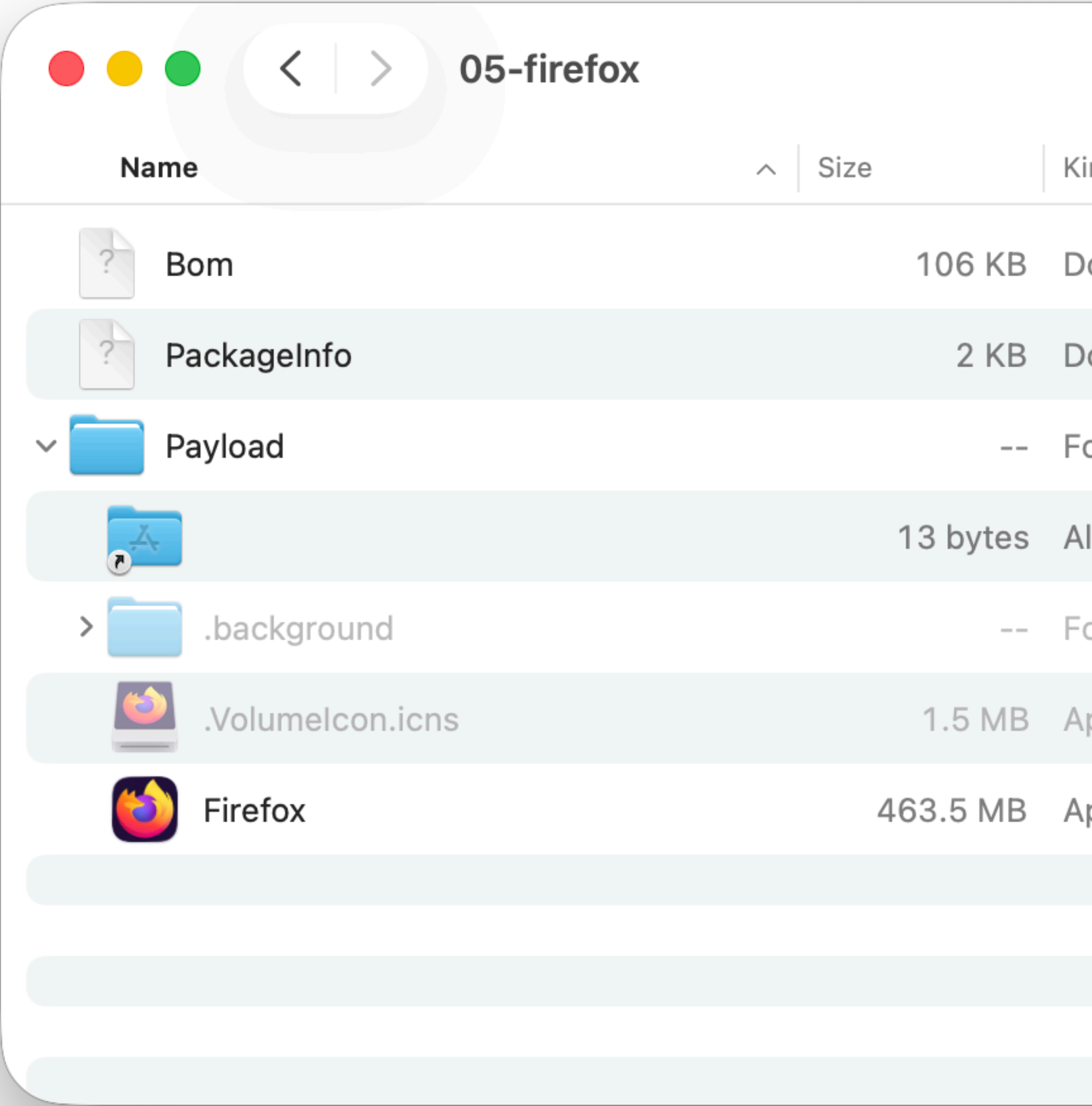
```
<?xml version="1.0" encoding="utf-8"?>
<pkg-info overwrite-permissions="true" relocatable="true">
  <payload numberOffiles="315" installKBytes="45423">
    <bundle path="./Firefox.app" id="org.mozilla.firefox">
      <bundle path="./Firefox.app/Contents/MacOS/update" id="org.mozilla.firefox">
        <bundle id="org.mozilla.firefox-media-plugin-help" id="org.mozilla.firefox-media-plugin-help">
          <bundle path="./Firefox.app/Contents/Frameworks/Contents" id="org.mozilla.firefox-media-plugin-help">
            <bundle id="org.mozilla.plugincontainer" CFBundleVersion="1.0.0">
              <bundle id="org.mozilla.crashreporter" CFBundleVersion="1.0.0">
                <bundle id="org.mozilla.updater" CFBundleVersion="1.0.0">
                  <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"/>
            <bundle id="org.mozilla.firefox-media-plugin-help"/>
            <bundle id="org.mozilla.plugincontainer"/>
            <bundle id="org.mozilla.crashreporter"/>
          </strict-identifier>
        </bundle>
      </bundle>
    </payload>
  </pkg-info>
</pre>
```



# Root

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion

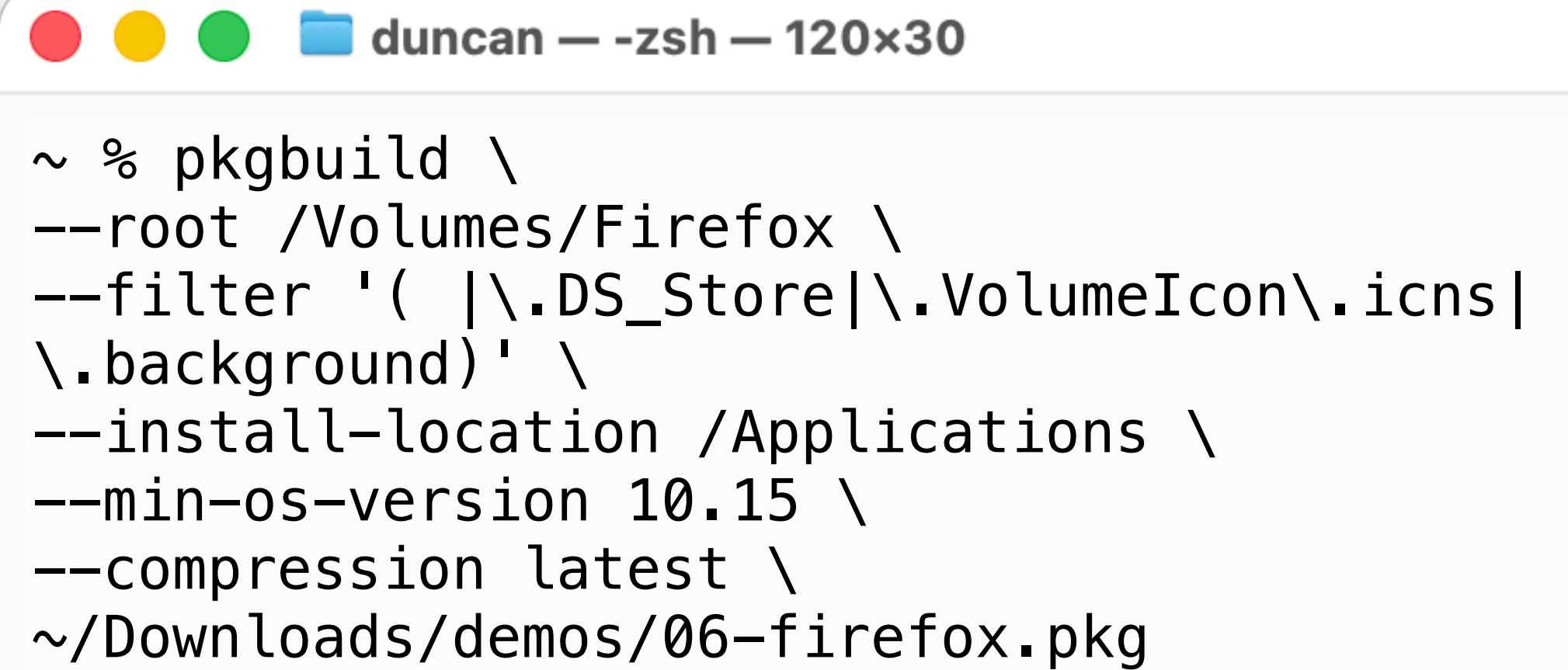




# Filter

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion

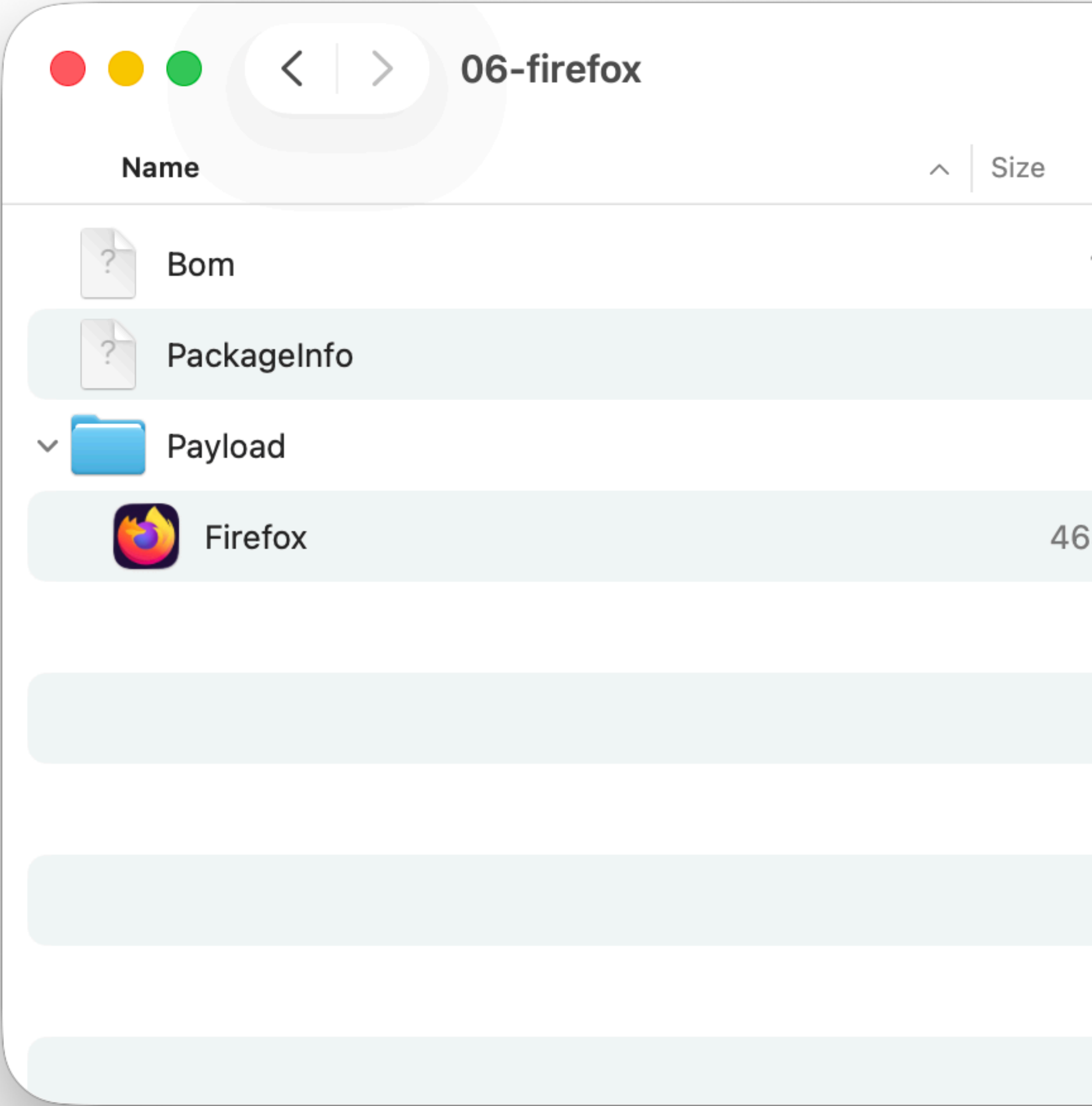
A terminal window titled "duncan — -zsh — 120x30" with standard macOS window controls (red, yellow, green buttons). The terminal displays a series of command-line arguments for the pkgbuild utility, including root path, filter rules for DS\_Store and VolumeIcon files, installation location, minimum OS version, and compression settings, followed by the path to the package file.

```
~ % pkgbuild \  
--root /Volumes/Firefox \  
--filter '( |\|.DS_Store|\|.VolumeIcon\|.icns|  
\.background)' \  
--install-location /Applications \  
--min-os-version 10.15 \  
--compression latest \  
~/Downloads/demos/06-firefox.pkg
```

# Filter

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion





# Identifier & Version

## <pkg-info>

- overwrite-permissions
- relocatable
- **identifier**
- postinstall-action
- **version**
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion

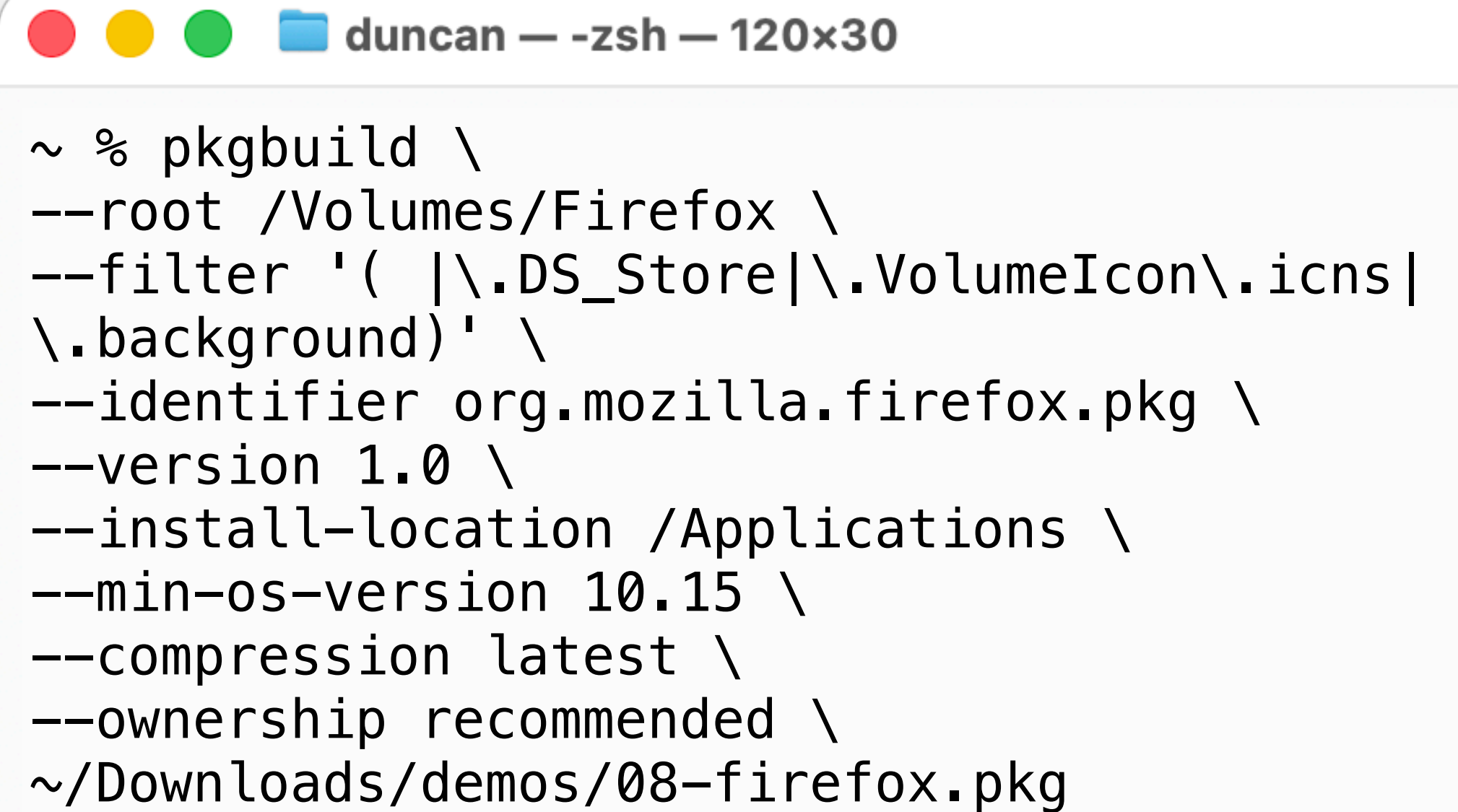
```
duncan — -zsh — 120x30

~ % pkgbuild \
--root /Volumes/Firefox \
--filter '( |\|.DS_Store|\|.VolumeIcon\|.icns|
\|.background)' \
--identifier org.mozilla.firefox.pkg \
--version 1.0 \
--install-location /Applications \
--min-os-version 10.15 \
--compression latest \
~/Downloads/demos/07-firefox.pkg
```

# Ownership

## <pkg-info>

- overwrite-permissions
- relocatable
- identifier
- postinstall-action
- version
- format-version
- generator-version
- install-location
- auth
- minimumSystemVersion

A terminal window with a title bar containing three colored circles (red, yellow, green) and a folder icon, followed by the text "duncan — -zsh — 120x30". The terminal content shows a series of backslashes and pkgbuild flags: ~ % pkgbuild \ --root /Volumes/Firefox \ --filter '( |\|.DS\_Store|\|.VolumeIcon\|.icns| \|.background)' \ --identifier org.mozilla.firefox.pkg \ --version 1.0 \ --install-location /Applications \ --min-os-version 10.15 \ --compression latest \ --ownership recommended \ ~/Downloads/demos/08-firefox.pkg.

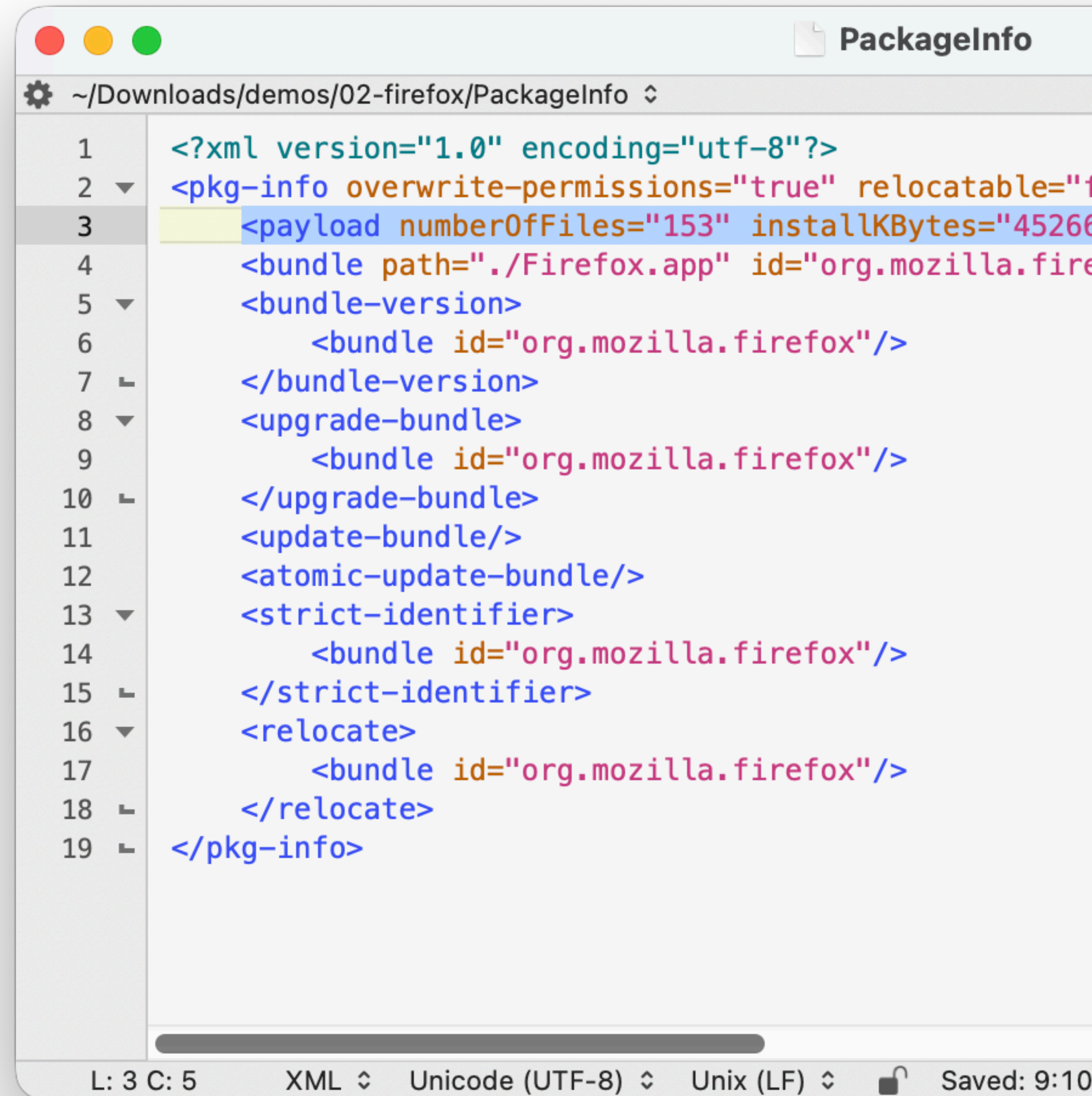
```
duncan — -zsh — 120x30
~ % pkgbuild \
--root /Volumes/Firefox \
--filter '( |\|.DS_Store|\|.VolumeIcon\|.icns|
|.background)' \
--identifier org.mozilla.firefox.pkg \
--version 1.0 \
--install-location /Applications \
--min-os-version 10.15 \
--compression latest \
--ownership recommended \
~/Downloads/demos/08-firefox.pkg
```



# PackageInfo

## <payload>

- numberOfFiles
- installKBytes



The screenshot shows a code editor window titled "PackageInfo" with a file path of "~/Downloads/demos/02-firefox/PackageInfo". The XML content is as follows:

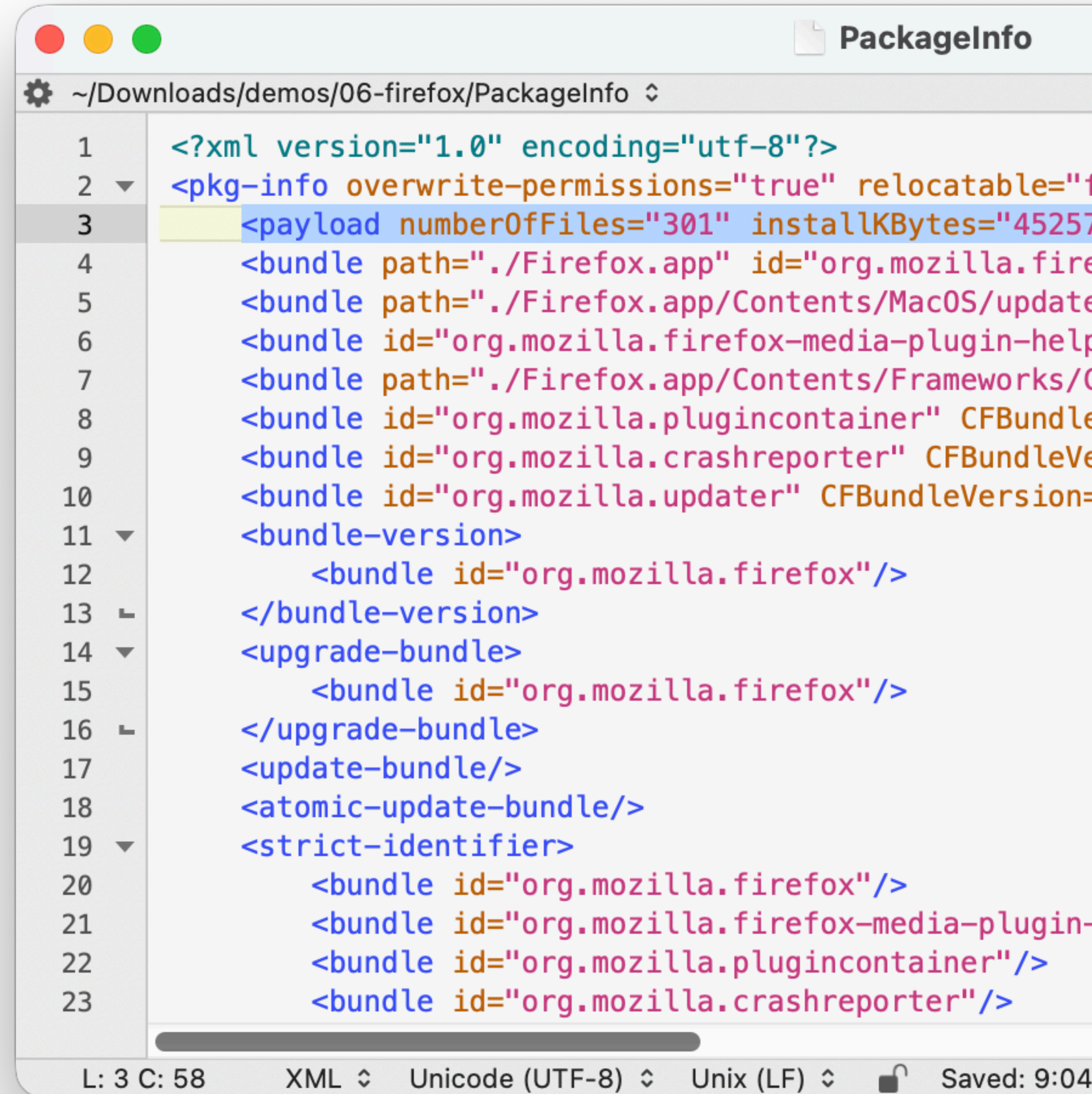
```
1 <?xml version="1.0" encoding="utf-8"?>
2 <pkg-info overwrite-permissions="true" relocatable="true">
3   <payload numberOfFiles="153" installKBytes="45266">
4     <bundle path="./Firefox.app" id="org.mozilla.firefox">
5       <bundle-version>
6         <bundle id="org.mozilla.firefox"/>
7       </bundle-version>
8     <upgrade-bundle>
9       <bundle id="org.mozilla.firefox"/>
10    </upgrade-bundle>
11    <update-bundle/>
12    <atomic-update-bundle/>
13    <strict-identifier>
14      <bundle id="org.mozilla.firefox"/>
15    </strict-identifier>
16    <relocate>
17      <bundle id="org.mozilla.firefox"/>
18    </relocate>
19  </payload>
</pkg-info>
```

The status bar at the bottom indicates the cursor is at line 3, column 5, the file is encoded in XML using Unicode (UTF-8) with Unix (LF) line endings, and it was last saved at 9:10.

# PackageInfo

## <payload>

- numberOfFiles
- installKBytes



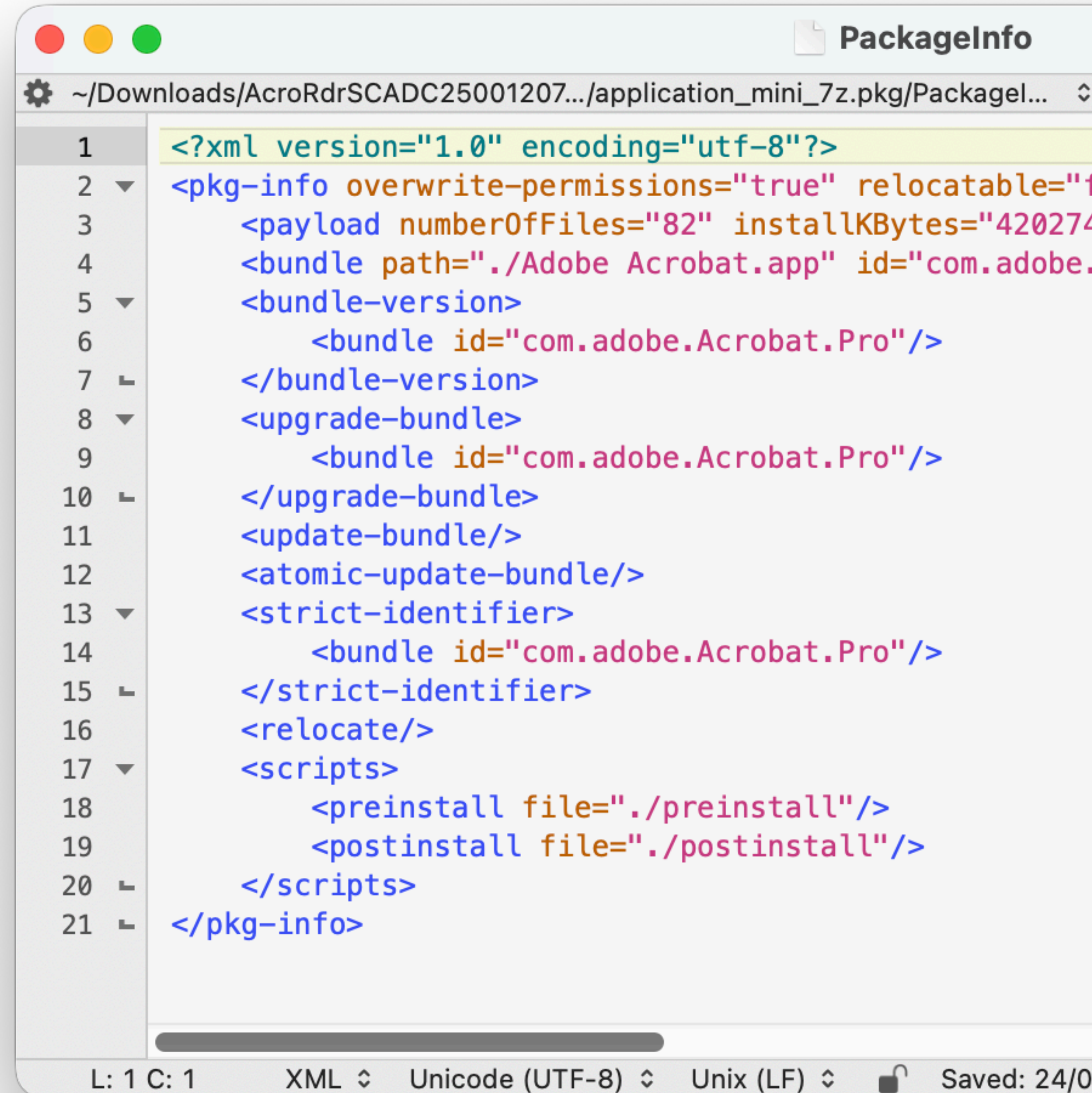
```
<?xml version="1.0" encoding="utf-8"?>
<pkg-info overwrite-permissions="true" relocatable="true" />
<payload numberOfFiles="301" installKBytes="45257" />
<bundle path="./Firefox.app" id="org.mozilla.firefox" />
<bundle path="./Firefox.app/Contents/MacOS/update" id="org.mozilla.firefox" />
<bundle id="org.mozilla.firefox-media-plugin-help" />
<bundle path="./Firefox.app/Contents/Frameworks/Content Advisor" id="org.mozilla.firefox-media-plugin-help" />
<bundle id="org.mozilla.plugincontainer" CFBundleVersion="1.0" />
<bundle id="org.mozilla.crashreporter" CFBundleVersion="1.0" />
<bundle id="org.mozilla.updater" CFBundleVersion="1.0" />
<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" />
  <bundle id="org.mozilla.firefox-media-plugin-help" />
  <bundle id="org.mozilla.plugincontainer" />
  <bundle id="org.mozilla.crashreporter" />
</strict-identifier>
</pkg-info>
```



# PackageInfo

## <scripts>

- <preinstall file="...">
- <postinstall file="...">
- component-id="..."

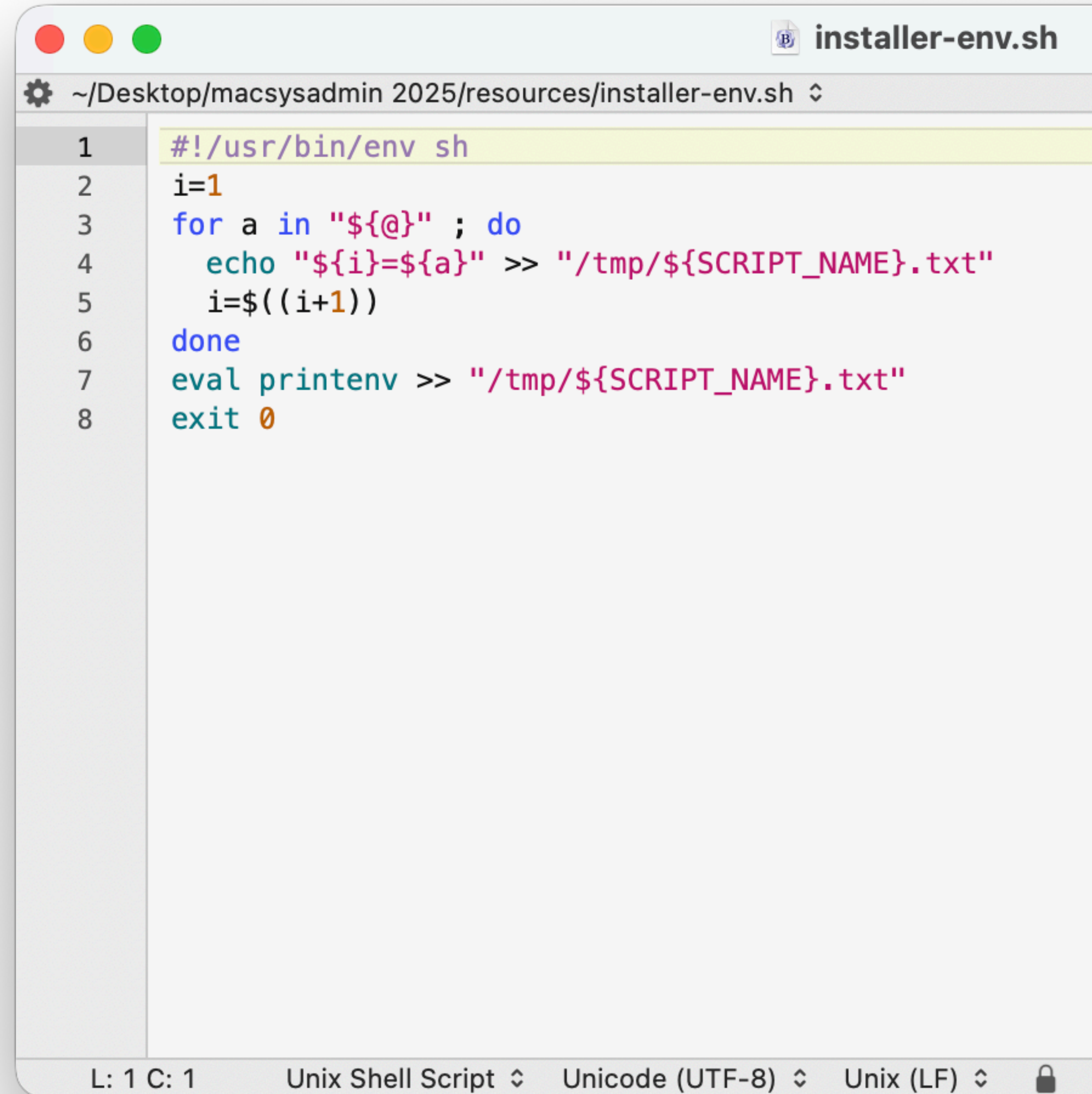


```
<?xml version="1.0" encoding="utf-8"?>
<pkg-info overwrite-permissions="true" relocatable="true">
  <payload numberOfFile="82" installKBytes="420274">
    <bundle path="./Adobe Acrobat.app" id="com.adobe.Acrobat.Pro">
      <bundle-version>
        <bundle id="com.adobe.Acrobat.Pro"/>
      </bundle-version>
      <upgrade-bundle>
        <bundle id="com.adobe.Acrobat.Pro"/>
      </upgrade-bundle>
      <update-bundle/>
      <atomic-update-bundle/>
      <strict-identifier>
        <bundle id="com.adobe.Acrobat.Pro"/>
      </strict-identifier>
      <relocate/>
      <scripts>
        <preinstall file="./preinstall"/>
        <postinstall file="./postinstall"/>
      </scripts>
    </bundle>
  </payload>
</pkg-info>
```

# PackageInfo

## <scripts>

- **printenv**
- GUI
- CLI
- MDM
- App Store



```
#!/usr/bin/env sh
i=1
for a in "${@}" ; do
    echo "${i}=${a}" >> "/tmp/${SCRIPT_NAME}.txt"
    i=$((i+1))
done
eval printenv >> "/tmp/${SCRIPT_NAME}.txt"
exit 0
```

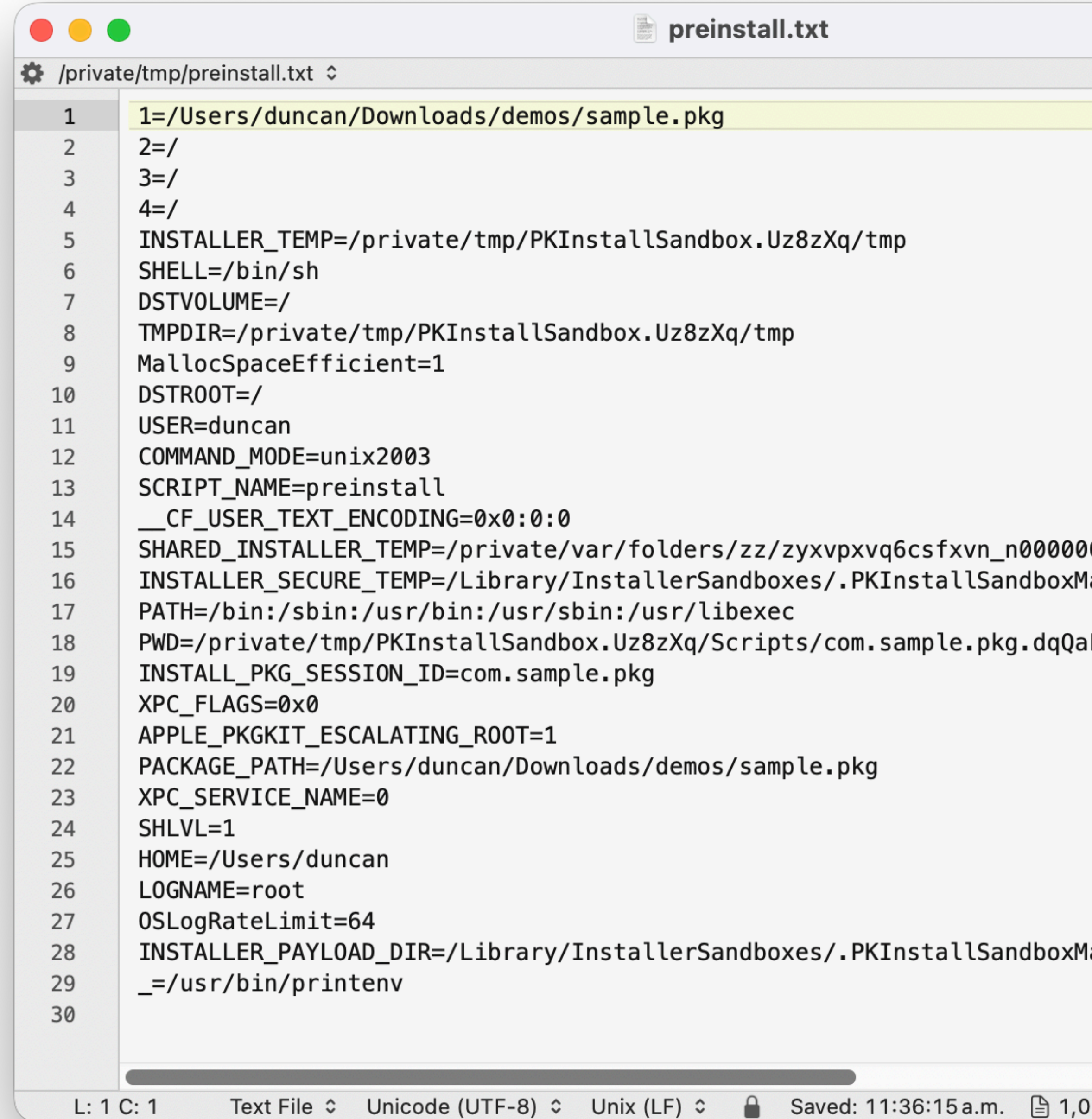
L: 1 C: 1    Unix Shell Script    Unicode (UTF-8)    Unix (LF)



# PackageInfo

## <scripts>

- **printenv**
- GUI
- CLI
- MDM
- App Store



The screenshot shows a macOS text editor window with the title bar 'preinstall.txt'. The window displays a list of environment variables and installation parameters, numbered 1 through 30. The first line is highlighted in yellow. The status bar at the bottom indicates the file is a Text File in UTF-8 encoding with Unix line endings, and it was saved at 11:36:15 a.m.

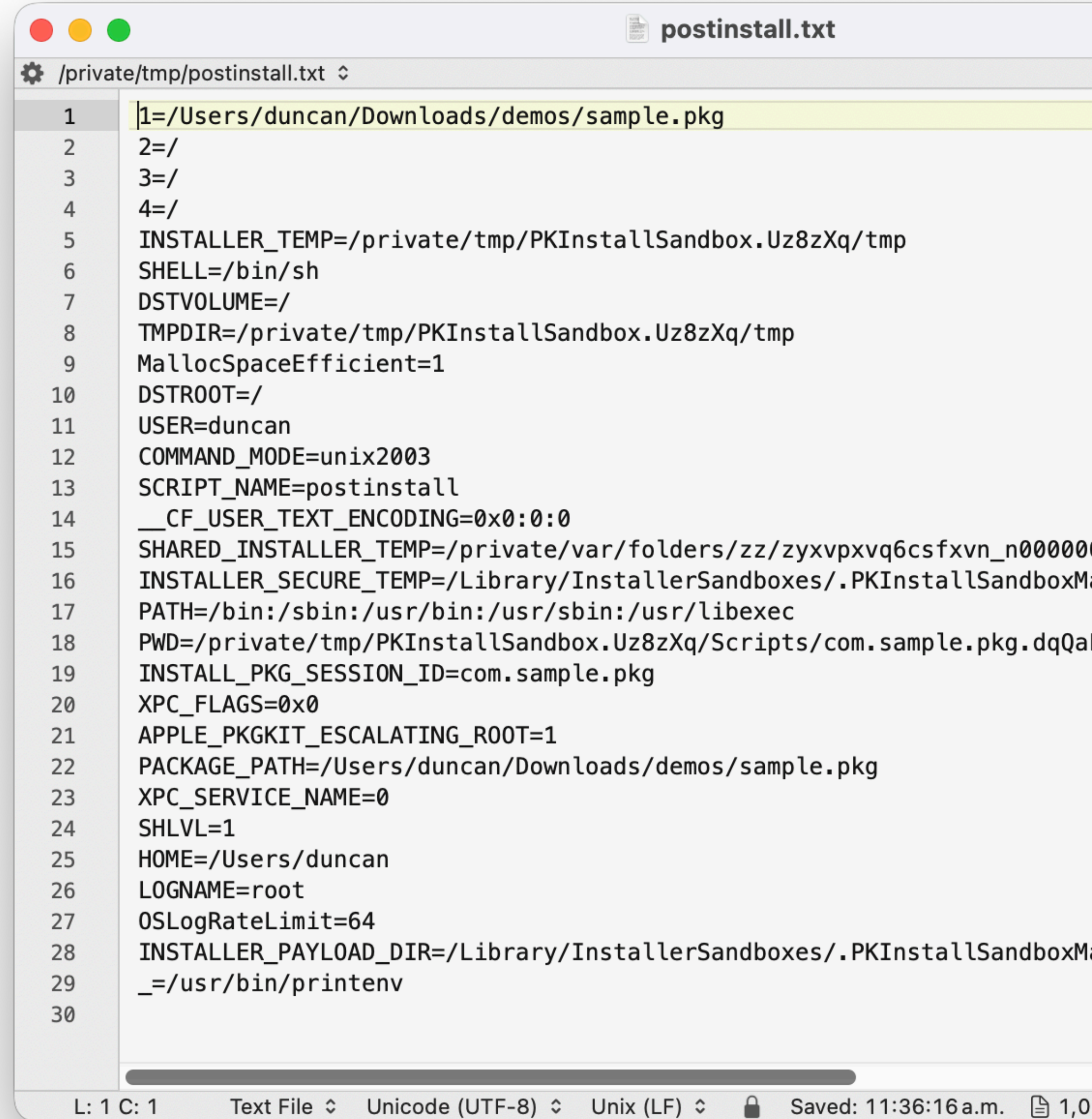
```
1 1=/Users/duncan/Downloads/demos/sample.pkg
2 2=/
3 3=/
4 4=/
5 INSTALLER_TEMP=/private/tmp/PKInstallSandbox.Uz8zXq/tmp
6 SHELL=/bin/sh
7 DSTVOLUME=/
8 TMPDIR=/private/tmp/PKInstallSandbox.Uz8zXq/tmp
9 MallocSpaceEfficient=1
10 DSTR00T=/
11 USER=duncan
12 COMMAND_MODE=unix2003
13 SCRIPT_NAME=preinstall
14 __CF_USER_TEXT_ENCODING=0x0:0:0
15 SHARED_INSTALLER_TEMP=/private/var/folders/zz/zyxvpxvq6csfxvn_n000000
16 INSTALLER_SECURE_TEMP=/Library/InstallerSandboxes/.PKInstallSandboxM
17 PATH=/bin:/sbin:/usr/bin:/usr/sbin:/usr/libexec
18 PWD=/private/tmp/PKInstallSandbox.Uz8zXq/Scripts/com.sample.pkg.dqQa
19 INSTALL_PKG_SESSION_ID=com.sample.pkg
20 XPC_FLAGS=0x0
21 APPLE_PKGKIT_ESCALATING_R00T=1
22 PACKAGE_PATH=/Users/duncan/Downloads/demos/sample.pkg
23 XPC_SERVICE_NAME=0
24 SHLVL=1
25 HOME=/Users/duncan
26 LOGNAME=root
27 OSLogRateLimit=64
28 INSTALLER_PAYLOAD_DIR=/Library/InstallerSandboxes/.PKInstallSandboxM
29 _=/usr/bin/printenv
30
```



# PackageInfo

## <scripts>

- printenv
- **GUI**
- CLI
- MDM
- App Store



The screenshot shows a macOS text editor window titled "postinstall.txt". The file path in the title bar is "/private/tmp/postinstall.txt". The editor displays a list of 30 lines of text, with line numbers on the left. Line 1 is highlighted in yellow. The text in the editor is as follows:

```
1 1=/Users/duncan/Downloads/demos/sample.pkg
2 2=/
3 3=/
4 4=/
5 INSTALLER_TEMP=/private/tmp/PKInstallSandbox.Uz8zXq/tmp
6 SHELL=/bin/sh
7 DSTVOLUME=/
8 TMPDIR=/private/tmp/PKInstallSandbox.Uz8zXq/tmp
9 MallocSpaceEfficient=1
10 DSTR00T=/
11 USER=duncan
12 COMMAND_MODE=unix2003
13 SCRIPT_NAME=postinstall
14 __CF_USER_TEXT_ENCODING=0x0:0:0
15 SHARED_INSTALLER_TEMP=/private/var/folders/zz/zyxvpxvq6csfxvn_n000000
16 INSTALLER_SECURE_TEMP=/Library/InstallerSandboxes/.PKInstallSandboxM
17 PATH=/bin:/sbin:/usr/bin:/usr/sbin:/usr/libexec
18 PWD=/private/tmp/PKInstallSandbox.Uz8zXq/Scripts/com.sample.pkg.dqQa
19 INSTALL_PKG_SESSION_ID=com.sample.pkg
20 XPC_FLAGS=0x0
21 APPLE_PKGKIT_ESCALATING_R00T=1
22 PACKAGE_PATH=/Users/duncan/Downloads/demos/sample.pkg
23 XPC_SERVICE_NAME=0
24 SHLVL=1
25 HOME=/Users/duncan
26 LOGNAME=root
27 OSLogRateLimit=64
28 INSTALLER_PAYLOAD_DIR=/Library/InstallerSandboxes/.PKInstallSandboxM
29 _=/usr/bin/printenv
30
```

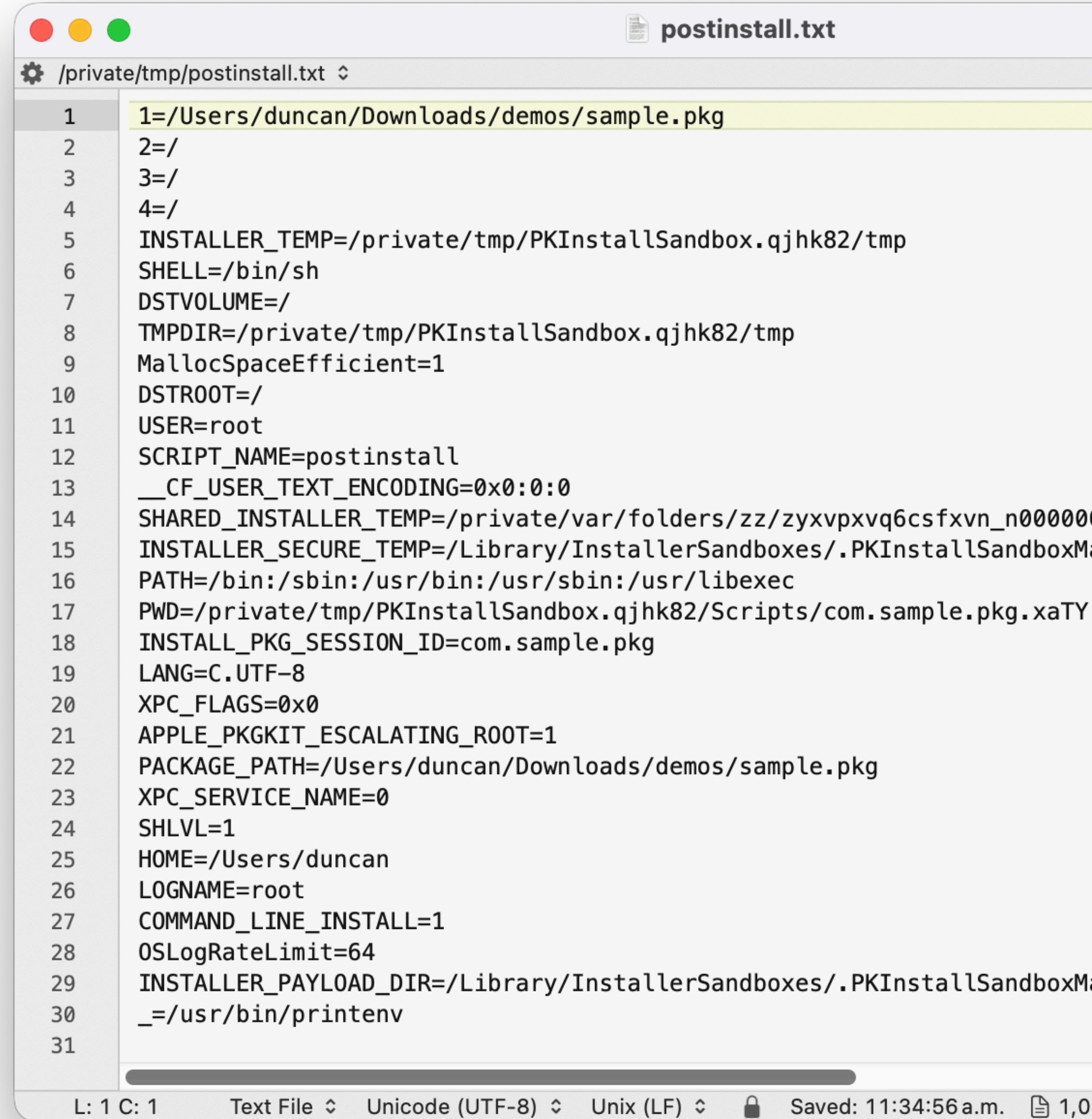
The status bar at the bottom of the window shows "L: 1 C: 1", "Text File", "Unicode (UTF-8)", "Unix (LF)", a lock icon, "Saved: 11:36:16 a.m.", and a document icon with "1,0".



# PackageInfo

## <scripts>

- printenv
- GUI
- **CLI**
- MDM
- App Store



The screenshot shows a macOS text editor window titled 'postinstall.txt'. The file path in the title bar is '/private/tmp/postinstall.txt'. The editor displays a list of 31 lines of text, with line numbers on the left. The first line is highlighted in yellow. The text is as follows:

```
1 1=/Users/duncan/Downloads/demos/sample.pkg
2 2=/
3 3=/
4 4=/
5 INSTALLER_TEMP=/private/tmp/PKInstallSandbox.qjhg82/tmp
6 SHELL=/bin/sh
7 DSTVOLUME=/
8 TMPDIR=/private/tmp/PKInstallSandbox.qjhg82/tmp
9 MallocSpaceEfficient=1
10 DSTR00T=/
11 USER=root
12 SCRIPT_NAME=postinstall
13 __CF_USER_TEXT_ENCODING=0x0:0:0
14 SHARED_INSTALLER_TEMP=/private/var/folders/zz/zyxvpxvq6csfxvn_n000000
15 INSTALLER_SECURE_TEMP=/Library/InstallerSandboxes/.PKInstallSandboxM
16 PATH=/bin:/sbin:/usr/bin:/usr/sbin:/usr/libexec
17 PWD=/private/tmp/PKInstallSandbox.qjhg82/Scripts/com.sample.pkg.xaTY
18 INSTALL_PKG_SESSION_ID=com.sample.pkg
19 LANG=C.UTF-8
20 XPC_FLAGS=0x0
21 APPLE_PKGKIT_ESCALATING_R00T=1
22 PACKAGE_PATH=/Users/duncan/Downloads/demos/sample.pkg
23 XPC_SERVICE_NAME=0
24 SHLVL=1
25 HOME=/Users/duncan
26 LOGNAME=root
27 COMMAND_LINE_INSTALL=1
28 OSLogRateLimit=64
29 INSTALLER_PAYLOAD_DIR=/Library/InstallerSandboxes/.PKInstallSandboxM
30 _=/usr/bin/printenv
31
```

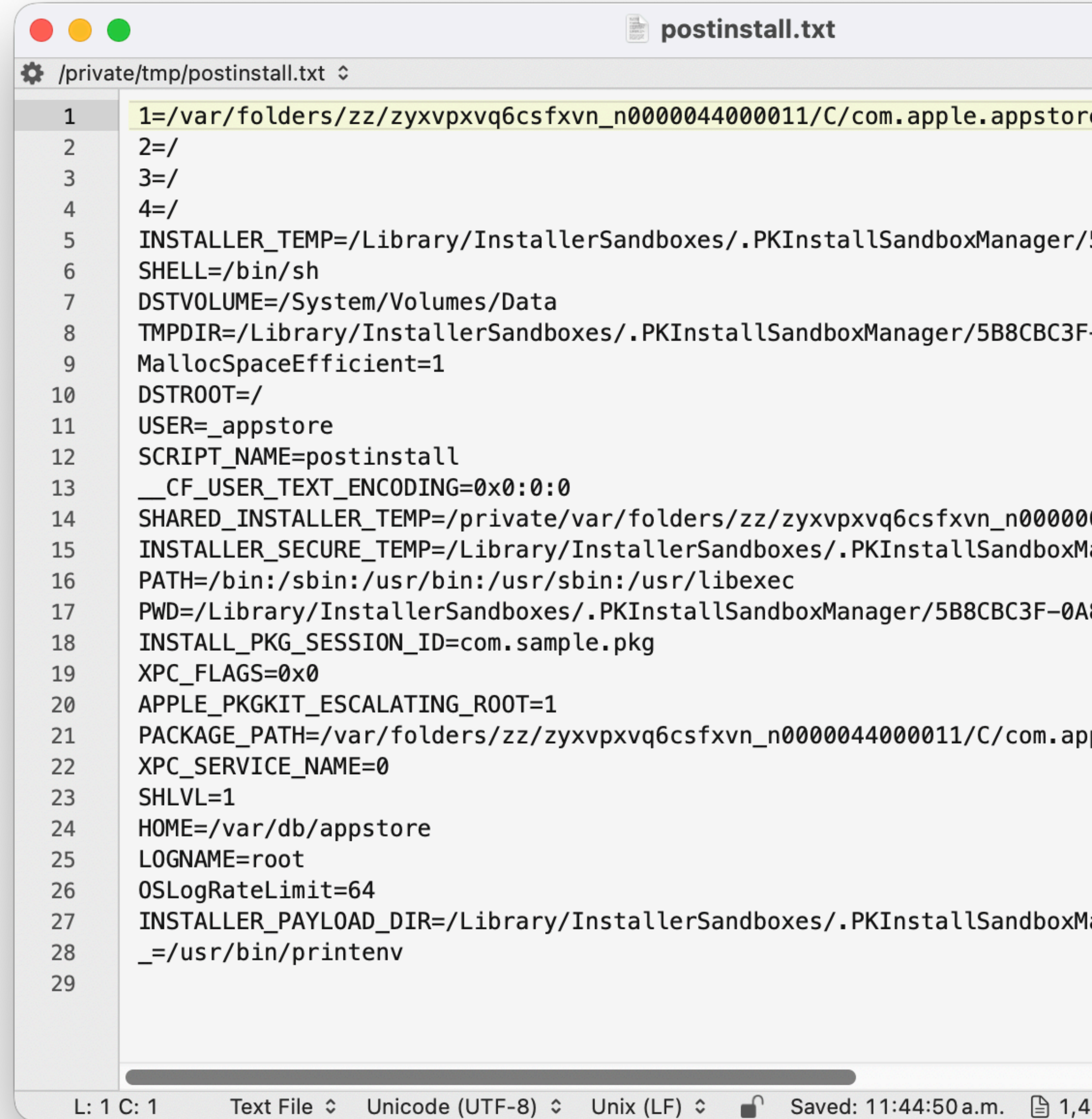
The status bar at the bottom of the window shows: 'L: 1 C: 1', 'Text File', 'Unicode (UTF-8)', 'Unix (LF)', a lock icon, 'Saved: 11:34:56 a.m.', and a document icon with '1,0'.



# PackageInfo

## <scripts>

- printenv
- GUI
- CLI
- **MDM**
- App Store



A screenshot of a macOS text editor window titled "postinstall.txt". The window shows a script with 29 lines of text. The first line is highlighted in yellow. The script sets various environment variables and performs actions like setting the shell, volume, temporary directory, and user. The status bar at the bottom indicates the file is a text file in UTF-8 encoding with Unix line endings, saved at 11:44:50 a.m.

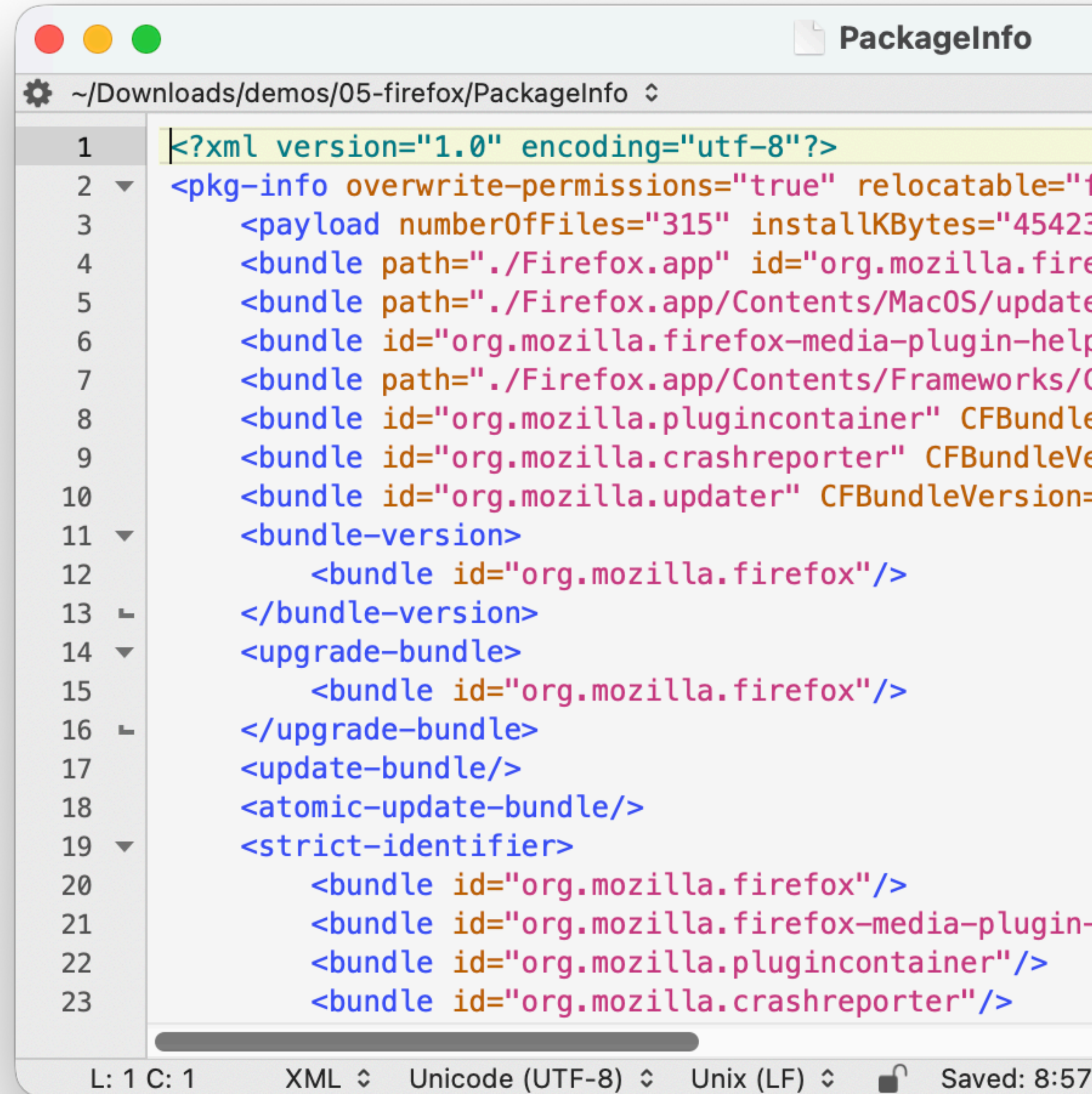
```
1 1=/var/folders/zz/zyxvpxvq6csfxvn_n0000044000011/C/com.apple.appstore
2 2=/
3 3=/
4 4=/
5 INSTALLER_TEMP=/Library/InstallerSandboxes/.PKInstallSandboxManager/
6 SHELL=/bin/sh
7 DSTVOLUME=/System/Volumes/Data
8 TMPDIR=/Library/InstallerSandboxes/.PKInstallSandboxManager/5B8CBC3F-
9 MallocSpaceEfficient=1
10 DSTR00T=/
11 USER=_appstore
12 SCRIPT_NAME=postinstall
13 __CF_USER_TEXT_ENCODING=0x0:0:0
14 SHARED_INSTALLER_TEMP=/private/var/folders/zz/zyxvpxvq6csfxvn_n00000
15 INSTALLER_SECURE_TEMP=/Library/InstallerSandboxes/.PKInstallSandboxM
16 PATH=/bin:/sbin:/usr/bin:/usr/sbin:/usr/libexec
17 PWD=/Library/InstallerSandboxes/.PKInstallSandboxManager/5B8CBC3F-0A
18 INSTALL_PKG_SESSION_ID=com.sample.pkg
19 XPC_FLAGS=0x0
20 APPLE_PKGKIT_ESCALATING_R00T=1
21 PACKAGE_PATH=/var/folders/zz/zyxvpxvq6csfxvn_n0000044000011/C/com.ap
22 XPC_SERVICE_NAME=0
23 SHLVL=1
24 HOME=/var/db/appstore
25 LOGNAME=root
26 OSLogRateLimit=64
27 INSTALLER_PAYLOAD_DIR=/Library/InstallerSandboxes/.PKInstallSandboxM
28 _=/usr/bin/printenv
29
```



# PackageInfo

## <bundle>

- path
- id
- CFBundleShortVersionString
- CFBundleVersion
- SourceVersion



```
<?xml version="1.0" encoding="utf-8"?>
<pkg-info overwrite-permissions="true" relocatable="1"
  <payload numberOffFiles="315" installKBytes="45423"
    <bundle path="./Firefox.app" id="org.mozilla.firefox" CFBundleShortVersionString="1.0" CFBundleVersion="1.0" SourceVersion="1.0"
      <bundle path="./Firefox.app/Contents/MacOS/update" id="org.mozilla.firefox-media-plugin-help" CFBundleShortVersionString="1.0" CFBundleVersion="1.0" SourceVersion="1.0"
        <bundle id="org.mozilla.firefox-media-plugin-help" CFBundleShortVersionString="1.0" CFBundleVersion="1.0" SourceVersion="1.0"
          <bundle path="./Firefox.app/Contents/Frameworks/CrashReporter.framework" id="org.mozilla.plugincontainer" CFBundleShortVersionString="1.0" CFBundleVersion="1.0" SourceVersion="1.0"
            <bundle id="org.mozilla.plugincontainer" CFBundleShortVersionString="1.0" CFBundleVersion="1.0" SourceVersion="1.0"
              <bundle id="org.mozilla.crashreporter" CFBundleShortVersionString="1.0" CFBundleVersion="1.0" SourceVersion="1.0"
                <bundle id="org.mozilla.updater" CFBundleShortVersionString="1.0" CFBundleVersion="1.0" SourceVersion="1.0"
                  <bundle-version>
                    <bundle id="org.mozilla.firefox"/>
                  </bundle-version>
                </bundle-version>
              <upgrade-bundle>
                <bundle id="org.mozilla.firefox"/>
              </upgrade-bundle>
            <update-bundle/>
          <atomic-update-bundle/>
        <strict-identifier>
          <bundle id="org.mozilla.firefox"/>
          <bundle id="org.mozilla.firefox-media-plugin-help"/>
          <bundle id="org.mozilla.plugincontainer"/>
          <bundle id="org.mozilla.crashreporter"/>
        </strict-identifier>
      </bundle>
    </bundle>
  </payload>
</pkg-info>
```

# PackageInfo

**<bundle id="...">**

- <bundle-version>
- <upgrade-bundle>
- <update-bundle>
- <atomic-update-bundle>
- <strict-identifier>
- <relocate>

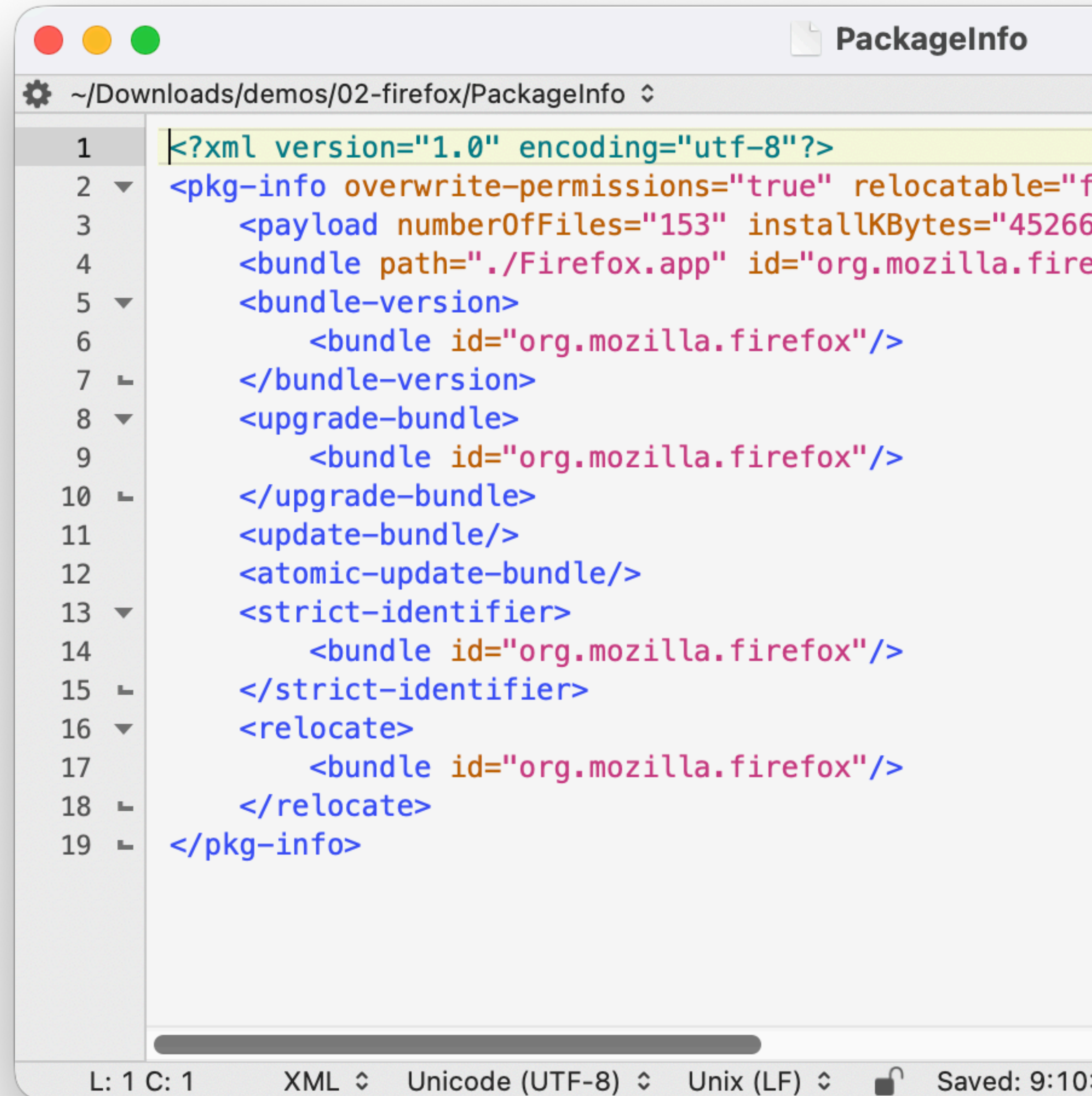
```
<?xml version="1.0" encoding="utf-8"?>
<pkg-info overwrite-permissions="true" relocatable="true">
  <payload numberOfFiles="153" installKBytes="45266">
    <bundle path="./Firefox.app" id="org.mozilla.firefox">
      <bundle-version>
        <bundle id="org.mozilla.firefox"/>
      </bundle-version>
      <upgrade-bundle>
        <bundle id="org.mozilla.firefox"/>
      </upgrade-bundle>
      <update-bundle/>
      <atomic-update-bundle/>
      <strict-identifier>
        <bundle id="org.mozilla.firefox"/>
      </strict-identifier>
      <relocate>
        <bundle id="org.mozilla.firefox"/>
      </relocate>
    </bundle>
  </payload>
</pkg-info>
```



# PackageInfo

**<bundle id="...">**

- **<bundle-version>**
- **<upgrade-bundle>**
- **<update-bundle>**
- **<atomic-update-bundle>**
- **<strict-identifier>**
- **<relocate>**

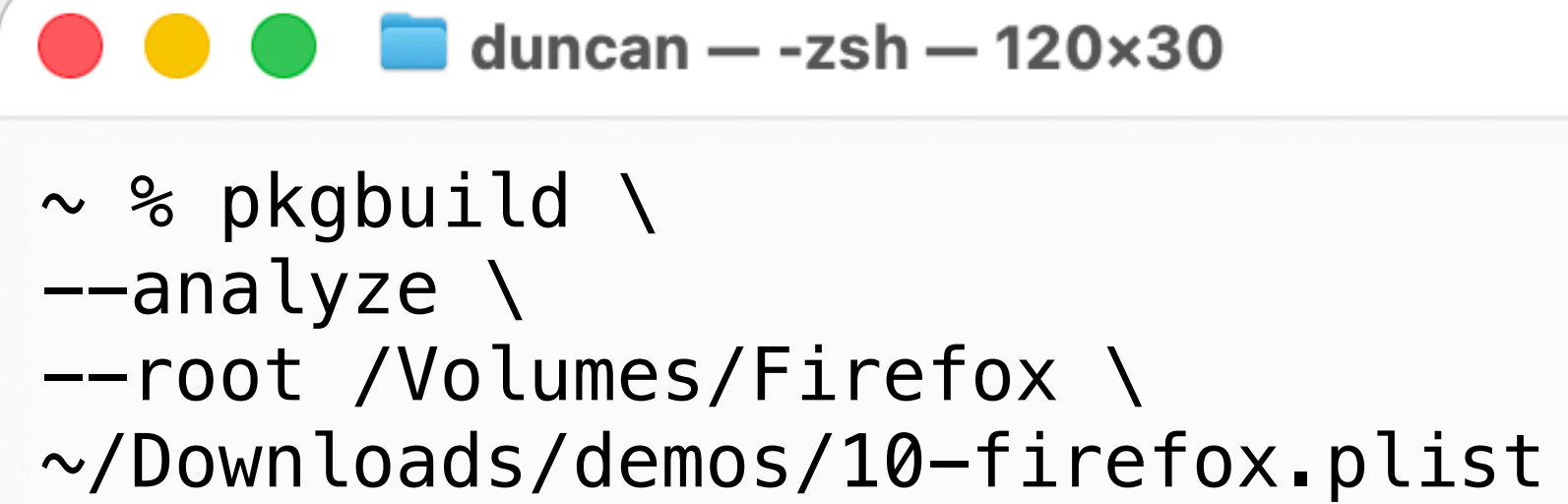


```
<?xml version="1.0" encoding="utf-8"?>
<pkg-info overwrite-permissions="true" relocatable="true">
  <payload numberOfFiles="153" installKBytes="45266">
    <bundle path="./Firefox.app" id="org.mozilla.firefox">
      <bundle-version>
        <bundle id="org.mozilla.firefox"/>
      </bundle-version>
      <upgrade-bundle>
        <bundle id="org.mozilla.firefox"/>
      </upgrade-bundle>
      <update-bundle/>
      <atomic-update-bundle/>
      <strict-identifier>
        <bundle id="org.mozilla.firefox"/>
      </strict-identifier>
      <relocate>
        <bundle id="org.mozilla.firefox"/>
      </relocate>
    </bundle>
  </payload>
</pkg-info>
```

# Analyse

## component.plist

- RootRelativeBundlePath
- BundleIsRelocatable
- BundleIsVersionChecked
- BundleHasStrictIdentifier
- BundleOverwriteAction
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



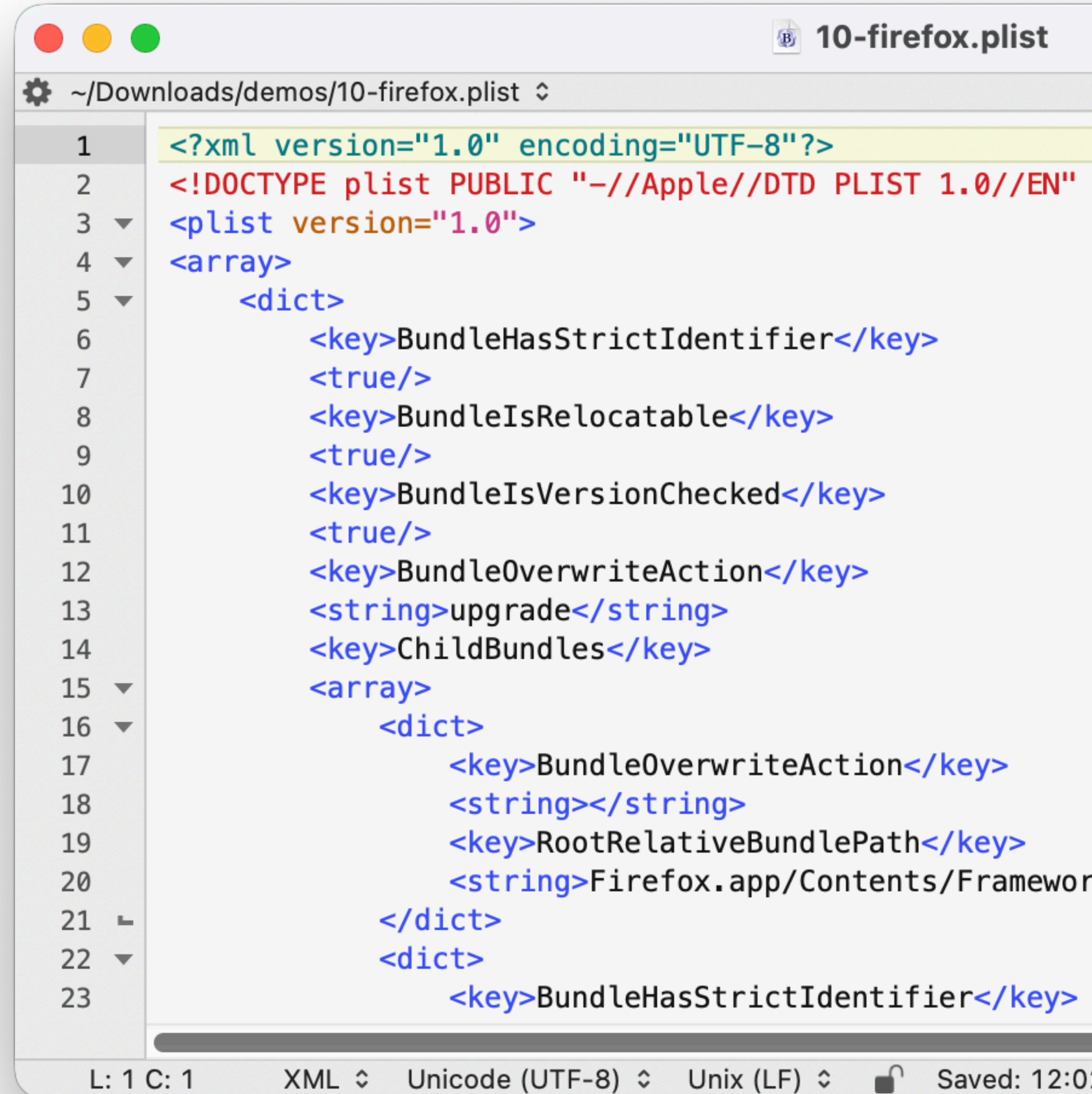
A terminal window with a title bar containing three colored circles (red, yellow, green) and a folder icon, followed by the text "duncan — -zsh — 120x30". The terminal content shows a command being executed: "~ % pkgbuild \", followed by "--analyze \" on the next line, "--root /Volumes/Firefox \" on the third line, and "~/Downloads/demos/10-firefox.plist" on the fourth line.

```
duncan — -zsh — 120x30
~ % pkgbuild \
--analyze \
--root /Volumes/Firefox \
~/Downloads/demos/10-firefox.plist
```



# Analyse component.plist

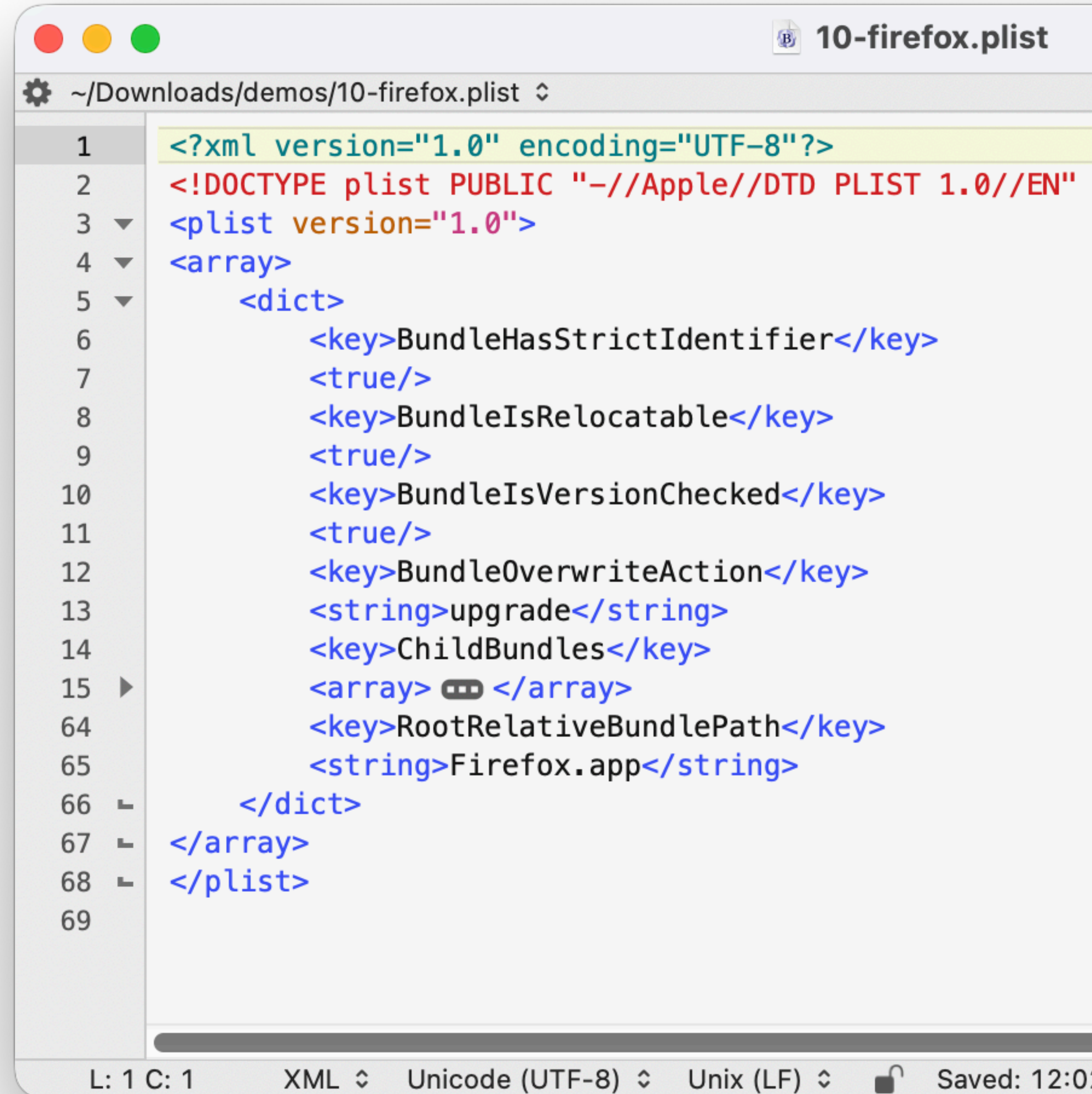
- RootRelativeBundlePath
- BundleIsRelocatable
- BundleIsVersionChecked
- BundleHasStrictIdentifier
- BundleOverwriteAction
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



```
1  <?xml version="1.0" encoding="UTF-8"?>
2  <!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN"
3  <plist version="1.0">
4  <array>
5    <dict>
6      <key>BundleHasStrictIdentifier</key>
7      <true/>
8      <key>BundleIsRelocatable</key>
9      <true/>
10     <key>BundleIsVersionChecked</key>
11     <true/>
12     <key>BundleOverwriteAction</key>
13     <string>upgrade</string>
14     <key>ChildBundles</key>
15     <array>
16       <dict>
17         <key>BundleOverwriteAction</key>
18         <string></string>
19         <key>RootRelativeBundlePath</key>
20         <string>Firefox.app/Contents/Frameworks
21       </dict>
22     <dict>
23       <key>BundleHasStrictIdentifier</key>
```

# Analyse component.plist

- RootRelativeBundlePath
- BundleIsRelocatable
- BundleIsVersionChecked
- BundleHasStrictIdentifier
- BundleOverwriteAction
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



```
1  <?xml version="1.0" encoding="UTF-8"?>
2  <!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN"
3  <plist version="1.0">
4  <array>
5  <dict>
6      <key>BundleHasStrictIdentifier</key>
7      <true/>
8      <key>BundleIsRelocatable</key>
9      <true/>
10     <key>BundleIsVersionChecked</key>
11     <true/>
12     <key>BundleOverwriteAction</key>
13     <string>upgrade</string>
14     <key>ChildBundles</key>
15     <array> </array>
64     <key>RootRelativeBundlePath</key>
65     <string>Firefox.app</string>
66 </dict>
67 </array>
68 </plist>
69
```

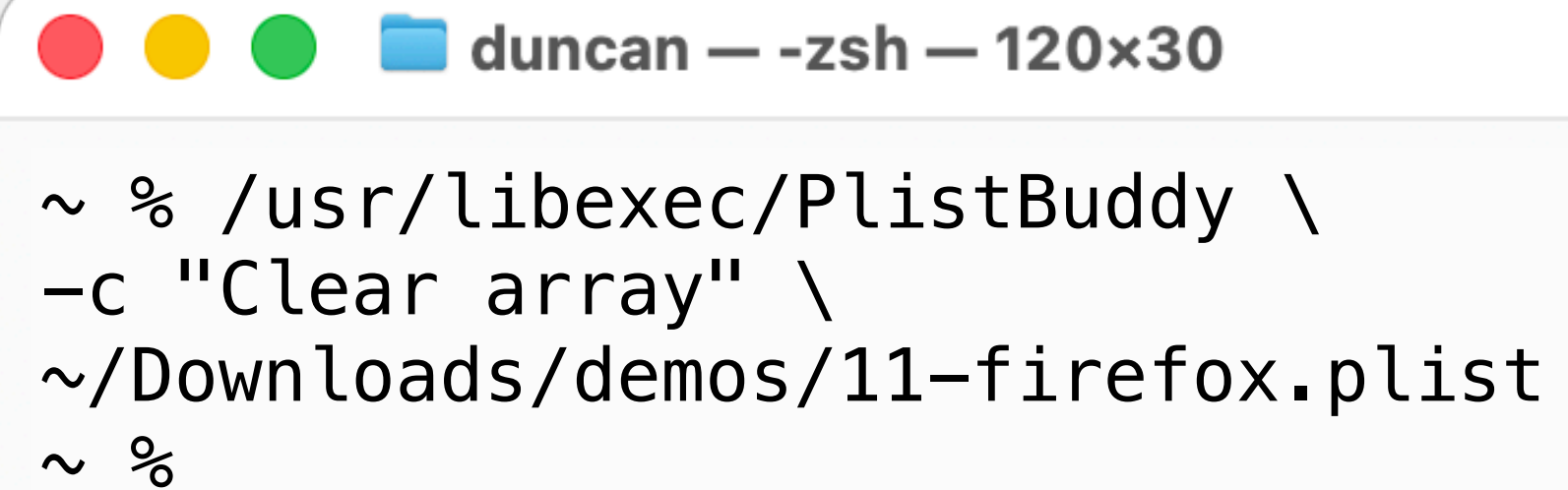
L: 1 C: 1 XML Unicode (UTF-8) Unix (LF) Saved: 12:00



# PlistBuddy

## component.plist

- RootRelativeBundlePath
- BundleIsRelocatable
- BundleIsVersionChecked
- BundleHasStrictIdentifier
- BundleOverwriteAction
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles




A terminal window titled "duncan — -zsh — 120x30" showing a command to clear an array in a plist file. The command is: `/usr/libexec/PlistBuddy -c "Clear array" ~/Downloads/demos/11-firefox.plist`. The prompt is `~ %`.

```
~ % /usr/libexec/PlistBuddy \  
-c "Clear array" \  
~/Downloads/demos/11-firefox.plist  
~ %
```

# PlistBuddy

## component.plist

- RootRelativeBundlePath
- BundleIsRelocatable
- BundleIsVersionChecked
- BundleHasStrictIdentifier
- BundleOverwriteAction
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN"
3 <plist version="1.0">
4 <array/>
5 </plist>
6
```

L: 1 C: 1 XML Unicode (UTF-8) Unix (LF) Saved: 12:10



# PlistBuddy

## component.plist

- **RootRelativeBundlePath**
- BundleIsRelocatable
- BundleIsVersionChecked
- BundleHasStrictIdentifier
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles

```
duncan — -zsh — 120x30

~ % /usr/libexec/PlistBuddy \
-c "Add : dict" \
~/Downloads/demos/11-firefox.plist
~ %
~ % /usr/libexec/PlistBuddy \
-c "Add :0:RootRelativeBundlePath string './
Firefox.app'" \
~/Downloads/demos/11-firefox.plist
~ %
~ % /usr/libexec/PlistBuddy \
-c "Add :0:BundleOverwriteAction string
'upgrade'" \
~/Downloads/demos/11-firefox.plist
~ %
```

# PlistBuddy

## component.plist

- **RootRelativeBundlePath**
- BundleIsRelocatable
- BundleIsVersionChecked
- BundleHasStrictIdentifier
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles

A screenshot of a text editor window titled "11-firefox.plist". The window shows the XML content of a plist file. The text is color-coded: XML tags are blue, strings are green, and comments are red. The content is as follows:

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <!--DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN"
3 <plist version="1.0">
4 <array>
5 <dict>
6 <key>BundleOverwriteAction</key>
7 <string>upgrade</string>
8 <key>RootRelativeBundlePath</key>
9 <string>./Firefox.app</string>
10 </dict>
11 </array>
12 </plist>
13
```

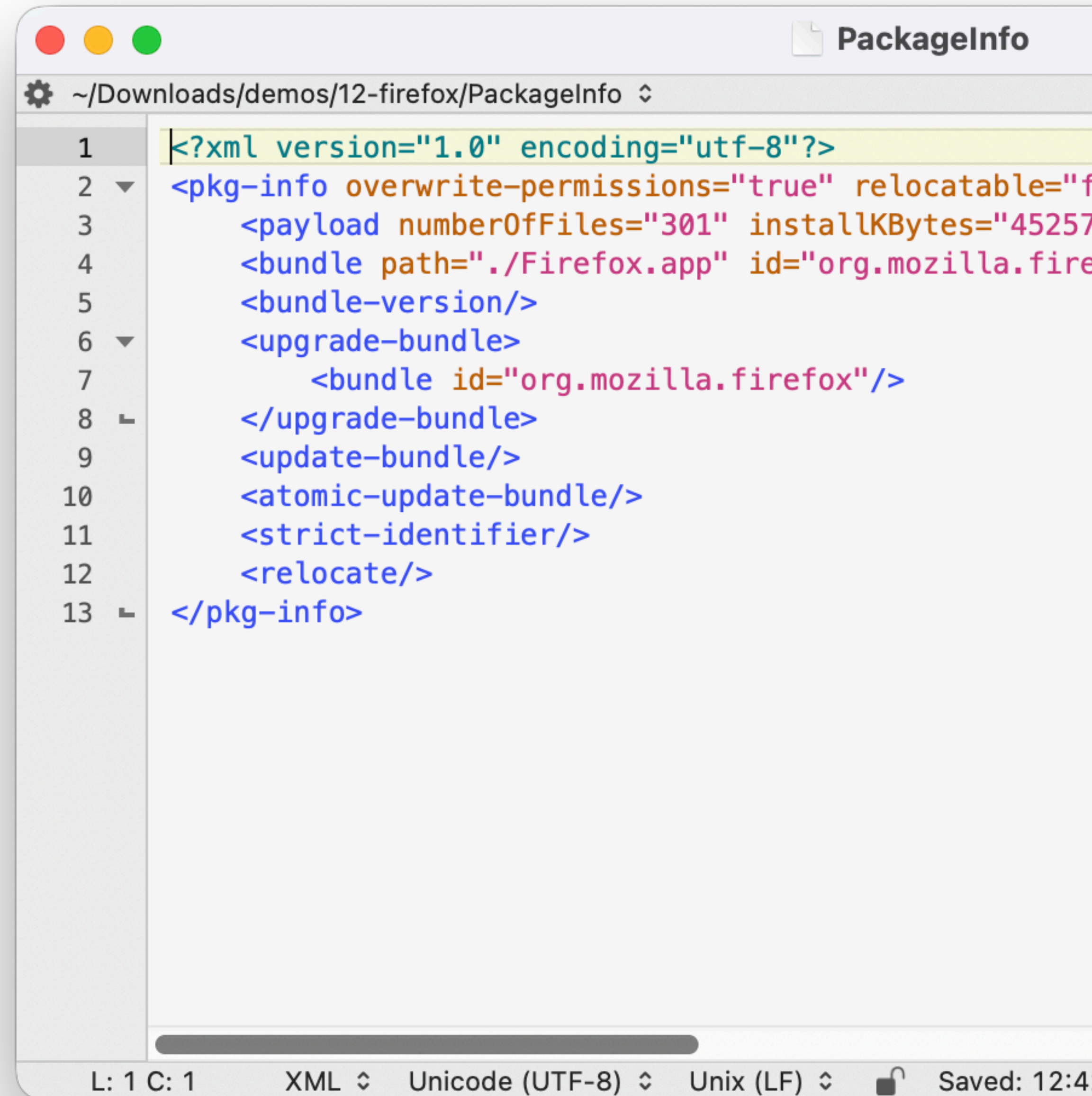
The editor has a status bar at the bottom showing "L: 1 C: 1", "XML", "Unicode (UTF-8)", "Unix (LF)", and "Saved: 12:1".



# PlistBuddy

## component.plist

- **RootRelativeBundlePath**
- BundleIsRelocatable
- BundleIsVersionChecked
- BundleHasStrictIdentifier
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



```
<?xml version="1.0" encoding="utf-8"?>
<pkg-info overwrite-permissions="true" relocatable="f
  <payload numberOfFiles="301" installKBytes="45257
  <bundle path="./Firefox.app" id="org.mozilla.fire
  <bundle-version/>
  <upgrade-bundle
    <bundle id="org.mozilla.firefox"/>
  </upgrade-bundle
  <update-bundle/>
  <atomic-update-bundle/>
  <strict-identifier/>
  <relocate/>
</pkg-info>
```

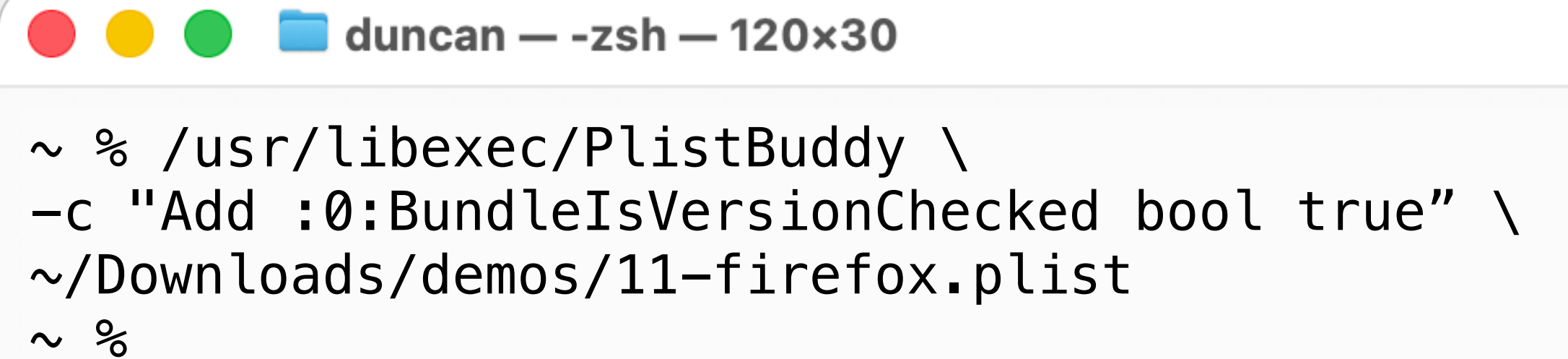
relocate	strict-identifier	bundle-version	location	none	older	equal	newer
0	0	0	default	install	downgrade	re-install	upgrade
0	0	1	default	install	dont-install	re-install	upgrade
0	1	0	default	install	downgrade	re-install	upgrade
0	1	1	default	install	dont-install	re-install	upgrade
1	0	0	default	install	downgrade	re-install	upgrade
1	0	1	default	install	dont-install	re-install	upgrade
1	1	0	default	install	downgrade	re-install	upgrade
1	1	1	default	install	dont-install	re-install	upgrade
0	0	0	conflict	-	replace-conflict	replace-conflict	replace-conflict
0	0	1	conflict	-	dont-install	replace-conflict	replace-conflict
0	1	0	conflict	-	localized-install	localized-install	localized-install
0	1	1	conflict	-	localized-install	localized-install	localized-install
1	0	0	conflict	-	replace-conflict	replace-conflict	replace-conflict
1	0	1	conflict	-	dont-install	replace-conflict	replace-conflict
1	1	0	conflict	-	localized-install	localized-install	localized-install
1	1	1	conflict	-	localized-install	localized-install	localized-install
0	0	0	custom	-	ignore-custom/install-default	ignore-custom/install-default	ignore-custom/install-default
0	0	1	custom	-	ignore-custom/install-default	ignore-custom/install-default	ignore-custom/install-default
0	1	0	custom	-	ignore-custom/install-default	ignore-custom/install-default	ignore-custom/install-default
0	1	1	custom	-	ignore-custom/install-default	ignore-custom/install-default	ignore-custom/install-default
1	0	0	custom	-	downgrade-custom	re-install-custom	upgrade-custom
1	0	1	custom	-	dont-install	re-install-custom	upgrade-custom
1	1	0	custom	-	downgrade-custom	re-install-custom	upgrade-custom
1	1	1	custom	-	dont-install	re-install-custom	upgrade-custom
0	0	0	conflict/custom	-	replace-conflict	replace-conflict	replace-conflict
0	0	1	conflict/custom	-	dont-install	replace-conflict	replace-conflict
0	1	0	conflict/custom	-	localized-install	localized-install	localized-install
0	1	1	conflict/custom	-	localized-install	localized-install	localized-install
1	0	0	conflict/custom	-	replace-conflict	replace-conflict	replace-conflict
1	0	1	conflict/custom	-	dont-install	replace-conflict	replace-conflict
1	1	0	conflict/custom	-	localized-install	localized-install	localized-install
1	1	1	conflict/custom	-	dont-install	re-install-localized(custom)	upgrade-localized(custom)



# PlistBuddy

## component.plist

- **RootRelativeBundlePath**
- BundleIsRelocatable
- **BundleIsVersionChecked**
- BundleHasStrictIdentifier
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



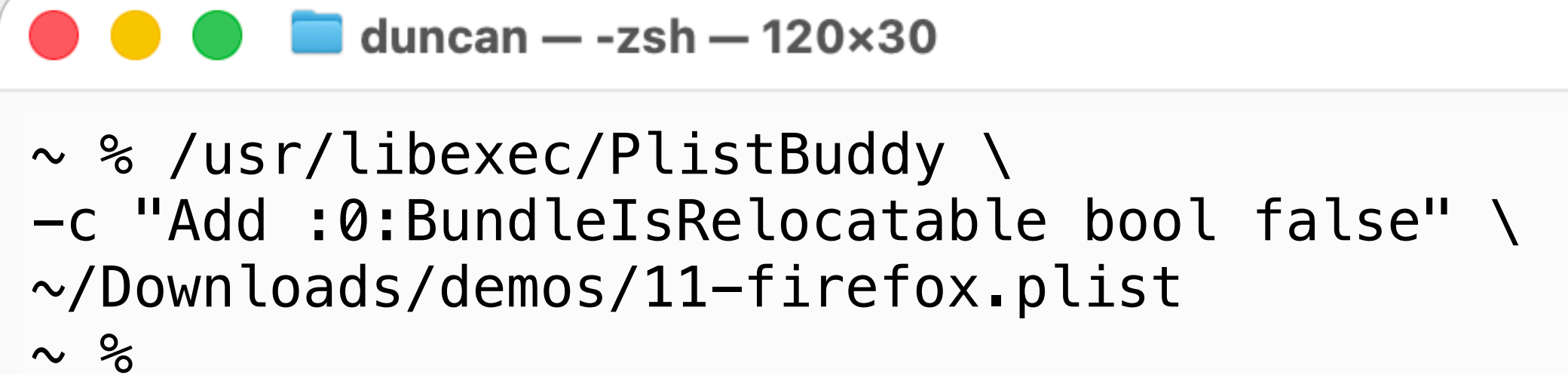
A terminal window titled "duncan — -zsh — 120x30" showing a command to add a new entry to a plist file. The command is: `/usr/libexec/PlistBuddy -c "Add :0:BundleIsVersionChecked bool true" ~/Downloads/demos/11-firefox.plist`. The prompt is `~ %`.

```
~ % /usr/libexec/PlistBuddy \  
-c "Add :0:BundleIsVersionChecked bool true" \  
~/Downloads/demos/11-firefox.plist  
~ %
```

# PlistBuddy

## component.plist

- **RootRelativeBundlePath**
- **BundlesRelocatable**
- BundleVersionChecked
- BundleHasStrictIdentifier
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



A terminal window titled "duncan — -zsh — 120x30" showing a command to add a new entry to a plist file. The command is: `/usr/libexec/PlistBuddy -c "Add :0:BundleIsRelocatable bool false" ~/Downloads/demos/11-firefox.plist`. The prompt is `~ %`.

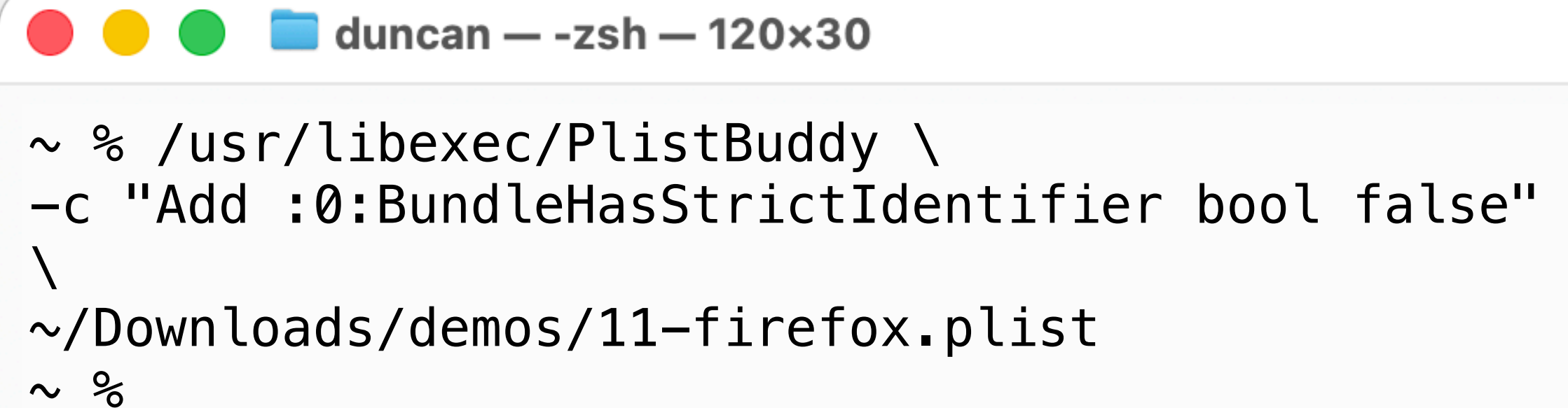
```
~ % /usr/libexec/PlistBuddy \  
-c "Add :0:BundleIsRelocatable bool false" \  
~/Downloads/demos/11-firefox.plist  
~ %
```



# PlistBuddy

## component.plist

- **RootRelativeBundlePath**
- BundleIsRelocatable
- BundleIsVersionChecked
- **BundleHasStrictIdentifier**
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles

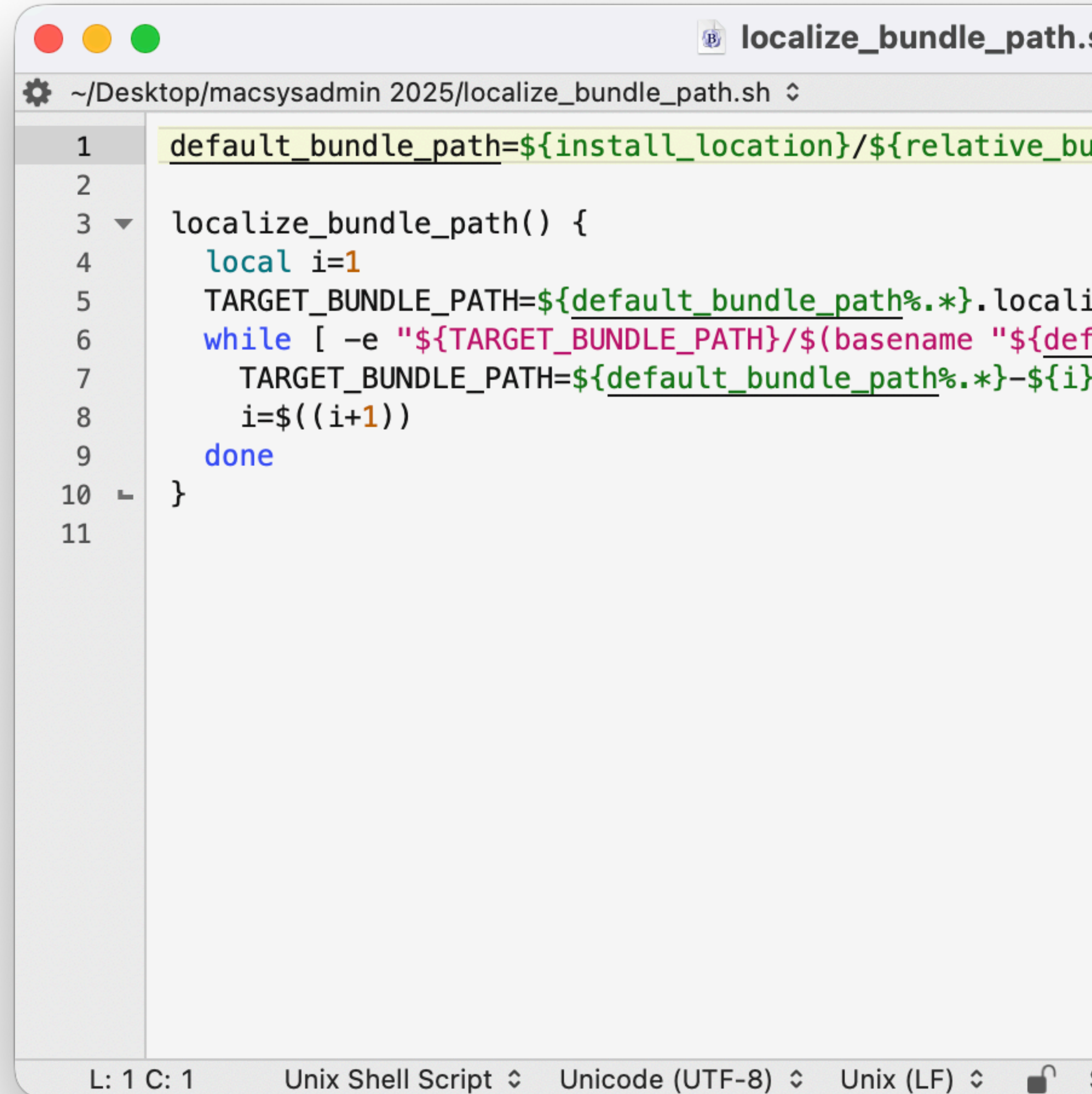
A terminal window with a title bar showing three colored window control buttons (red, yellow, green) and a folder icon. The title bar text is "duncan — -zsh — 120x30". The terminal content shows a command being executed: "~ % /usr/libexec/PlistBuddy \", followed by "-c \"Add :0:BundleHasStrictIdentifier bool false\"", then a backslash on the next line, then "~/Downloads/demos/11-firefox.plist", and finally "~ %" on the last line.

```
duncan — -zsh — 120x30
~ % /usr/libexec/PlistBuddy \
-c "Add :0:BundleHasStrictIdentifier bool false"
\
~/Downloads/demos/11-firefox.plist
~ %
```

# Localized Install

## Bundle id conflict

- **RootRelativeBundlePath**
- BundleIsRelocatable
- BundleIsVersionChecked
- **BundleHasStrictIdentifier**
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



```
1  default_bundle_path=${install_location}/${relative_bu
2
3  localize_bundle_path() {
4      local i=1
5      TARGET_BUNDLE_PATH=${default_bundle_path%.*}.locali
6      while [ -e "${TARGET_BUNDLE_PATH}/${basename "${def
7          TARGET_BUNDLE_PATH=${default_bundle_path%.*}-${i}
8          i=$((i+1))
9      done
10 }
11
```

The screenshot shows a macOS text editor window titled "localize\_bundle\_path.sh". The window displays a shell script with line numbers 1 through 11. The script defines a function `localize_bundle_path()` that takes a default bundle path and iteratively appends a suffix to find a unique path. The script is written in a Unix Shell Script language, using variables and control structures like `while` and `local`. The status bar at the bottom indicates the file is at line 1, column 1, and is a Unix Shell Script in UTF-8 encoding with Unix line endings.



localize\_bundle\_path.sh

Evaluation (28 days left)

~/Desktop/macsysadmin 2025/localize\_bundle\_path.sh (no function selected)

1

2

3

4

5

6

7

8

9

10

11

```
default_bundle_path=${install_location}/${relative_bundle_path}

localize_bundle_path() {
    local i=1
    TARGET_BUNDLE_PATH=${default_bundle_path%.*}.localized
    while [ -e "${TARGET_BUNDLE_PATH}/${basename "${default_bundle_path}"}" ] ; do
        TARGET_BUNDLE_PATH=${default_bundle_path%.*}-${i}.localized
        i=$((i+1))
    done
}
```

L: 1 C: 1

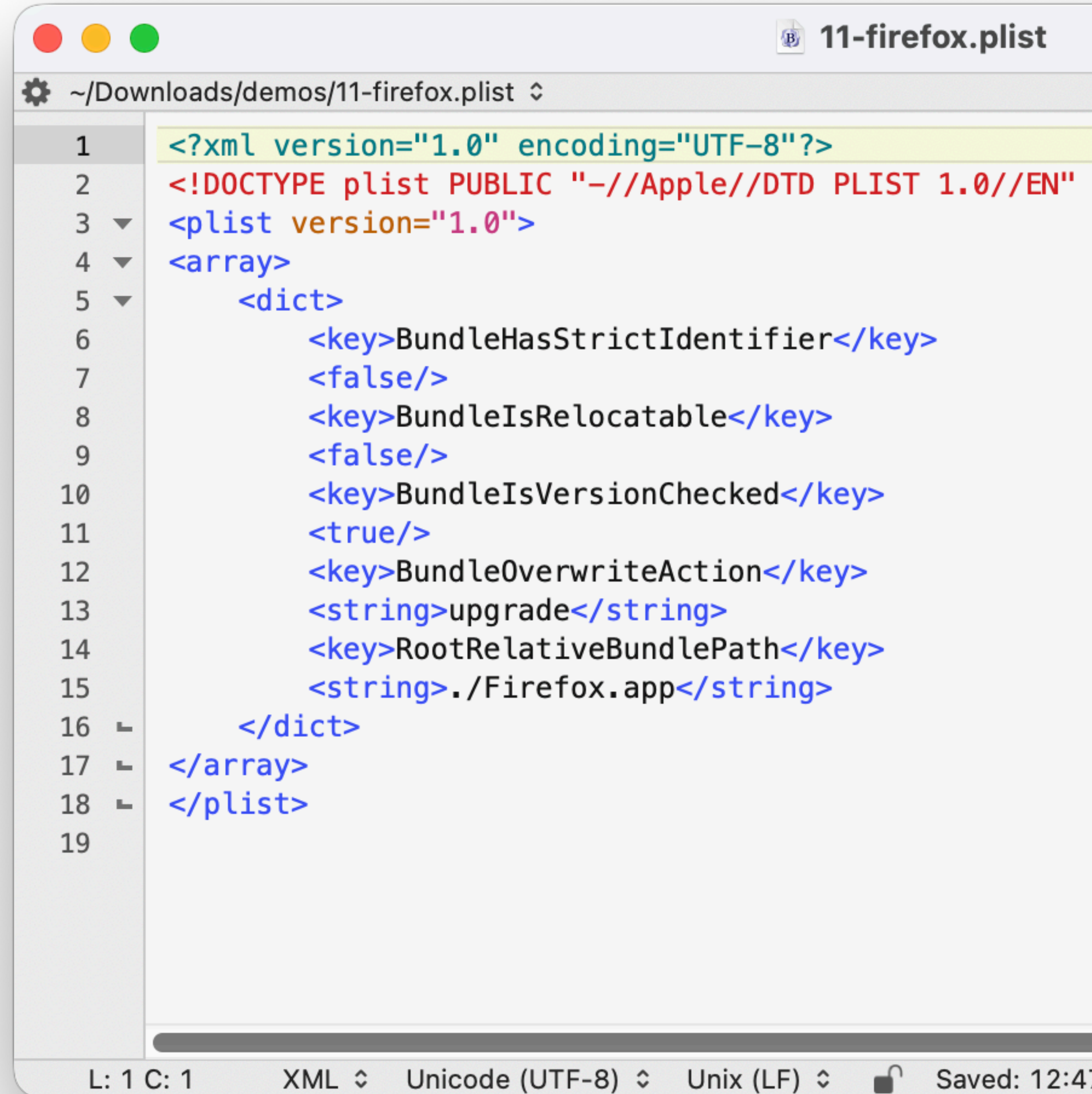
Unix Shell Script Unicode (UTF-8) Unix (LF)

Saved: 12:23:36 p.m. 328 / 24 / 11 4

# PlistBuddy

## component.plist

- **RootRelativeBundlePath**
- **BundlesRelocatable**
- **BundlesVersionChecked**
- **BundleHasStrictIdentifier**
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN"
<plist version="1.0">
<array>
  <dict>
    <key>BundleHasStrictIdentifier</key>
    <false/>
    <key>BundleIsRelocatable</key>
    <false/>
    <key>BundleIsVersionChecked</key>
    <true/>
    <key>BundleOverwriteAction</key>
    <string>upgrade</string>
    <key>RootRelativeBundlePath</key>
    <string>./Firefox.app</string>
  </dict>
</array>
</plist>
```



# PlistBuddy

## component.plist

- **RootRelativeBundlePath**
- **BundleIsRelocatable**
- **BundleIsVersionChecked**
- **BundleHasStrictIdentifier**
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles

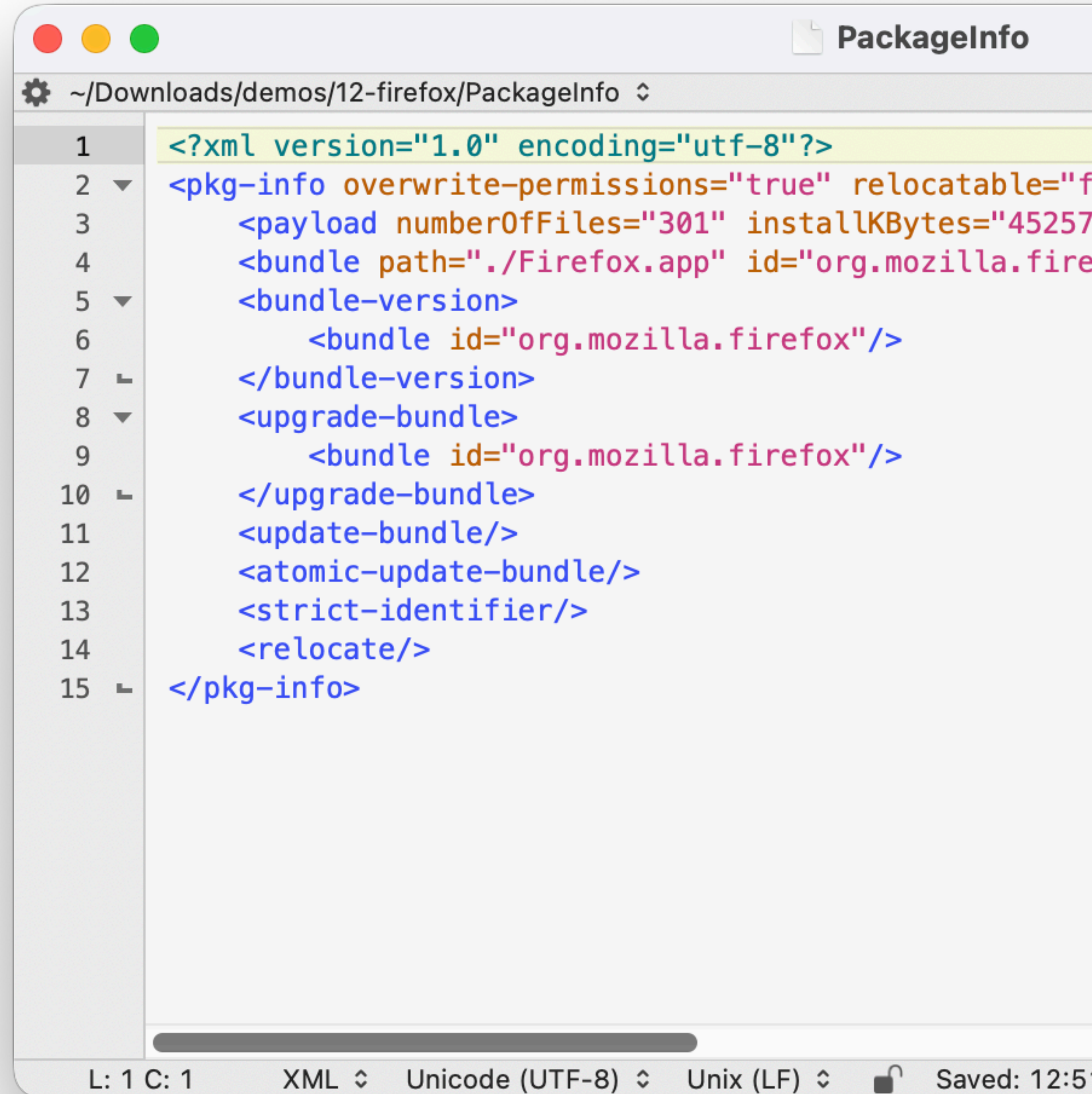
```
duncan — -zsh — 120x30

~ % pkgbuild \
--root /Volumes/Firefox \
--filter '( |\|.DS_Store|\|.VolumeIcon|.icns|
|.background)' \
--component-plist ~/Downloads/demos/11-
firefox.plist \
--install-location /Applications \
--min-os-version 10.15 \
--compression latest \
--ownership recommended \
~/Downloads/demos/12-firefox.pkg
```

# PlistBuddy

## component.plist

- **RootRelativeBundlePath**
- **BundlesRelocatable**
- **BundlesVersionChecked**
- **BundleHasStrictIdentifier**
- **BundleOverwriteAction**
- BundlePreInstallScriptPath
- BundlePostInstallScriptPath
- BundleInstallScriptTimeout
- ChildBundles



```
1 <?xml version="1.0" encoding="utf-8"?>
2 <pkg-info overwrite-permissions="true" relocatable="true">
3     <payload numberOfFiles="301" installKBytes="45257">
4     <bundle path="./Firefox.app" id="org.mozilla.firefox">
5     <bundle-version>
6         <bundle id="org.mozilla.firefox"/>
7     </bundle-version>
8     <upgrade-bundle>
9         <bundle id="org.mozilla.firefox"/>
10    </upgrade-bundle>
11    <update-bundle/>
12    <atomic-update-bundle/>
13    <strict-identifier/>
14    <relocate/>
15 </pkg-info>
```

L: 1 C: 1 XML Unicode (UTF-8) Unix (LF) Saved: 12:5



# Extended Attributes

## Removal\*

- com.apple.macl
- com.apple.quarantine
- com.apple.provenance

• • • duncan — -zsh — 120x30

```
~ % xattr \  
-d "com.apple.macl" \  
/tmp/Firefox.app  
~ %
```

# Reference

**~ % man pkgbuild**



# Distribution Package

# Reference

**~ % man productbuild**



Questions?

¡Muchas Gracias!