Fold, Spindle, and Mutilate

About Me

- 16 years at University of Wisconsin at River Falls
- Head of macOS/iOS support
- Not the printer guy

About Printers @UWRF

- 54 Konica Minolta copiers, 236 HP LaserJets
- Almost No personal desktop printers
- PaperCut for budgeting/allocation
- Windows Print Servers/AD for printer management
- Jamf for macOS/iOS management

Configuration Profiles

- Limitations in Sierra/High Sierra/Mojave:
  - No local queue name control
  - Add, but not remove
  - Very little access control
  - No settings control

Configuration Profiles

- Limitations in Catalina:
  - No local queue name control
  - Add, but not remove
  - Very little access control
  - No settings control

Configuration Profiles

- Still too clunky to use, except
  - with agentless management
  - or, ironically, on unmanaged devices

lpadmin

- Still the go to tool for printer admin work
- Changes in 10.15
  - raw is dead, unsurprisingly
  - SysV interfaces are dead
  - less fault tolerant

lpadmin

- Still the go to tool for printer admin work
- Changes in 10.15
  - and don’t panic, but…

```
“PPD files and printer drivers are deprecated and
will not be supported in a future version of CUPS.”
```

lpadmin

- Anatomy of an lpadmin command

```
/usr/sbin/lpadmin -p localqueuename
-D "GUI Printer Name"
-L "Physical Location"
-E enable
-v lpd://servername/remotequeuename
-P /path/to/PPD
-o auth-info-required=negotiate
-o whizbangoption=whizzier
```

lpadmin

- but have you noticed -m?

```
/usr/sbin/lpadmin -p localqueuename
-D "GUI Printer Name"
-L "Physical Location"
-E enable
-v lpd://servername/remotequeuename
-m modelname
-o auth-info-required=negotiate
-o whizbangoption=whizzier
```

lpadmin

- lpinfo -m

```
drv:///sample.drv/dymo.ppd Dymo Label Printer
Library/Printers/PPDs/Contents/Resources/EPSON FAX.gz EPSON FAX
drv:///sample.drv/generpcl.ppd Generic PCL Laser Printer
drv:///sample.drv/generic.ppd Generic PostScript Printer
drv:///sample.drv/deskjet.ppd HP DeskJet Series
drv:///sample.drv/laserjet.ppd HP LaserJet Series PCL 4/5
drv:///sample.drv/intelbar.ppd IntelliBar Label Printer, 2.3
drv:///sample.drv/okidata9.ppd Oki 9-Pin Series
drv:///sample.drv/okidat24.ppd Oki 24-Pin Series
raw Raw Queue
drv:///sample.drv/zebra.ppd Zebra ZPL Label Printer
everywhere IPP Everywhere
```

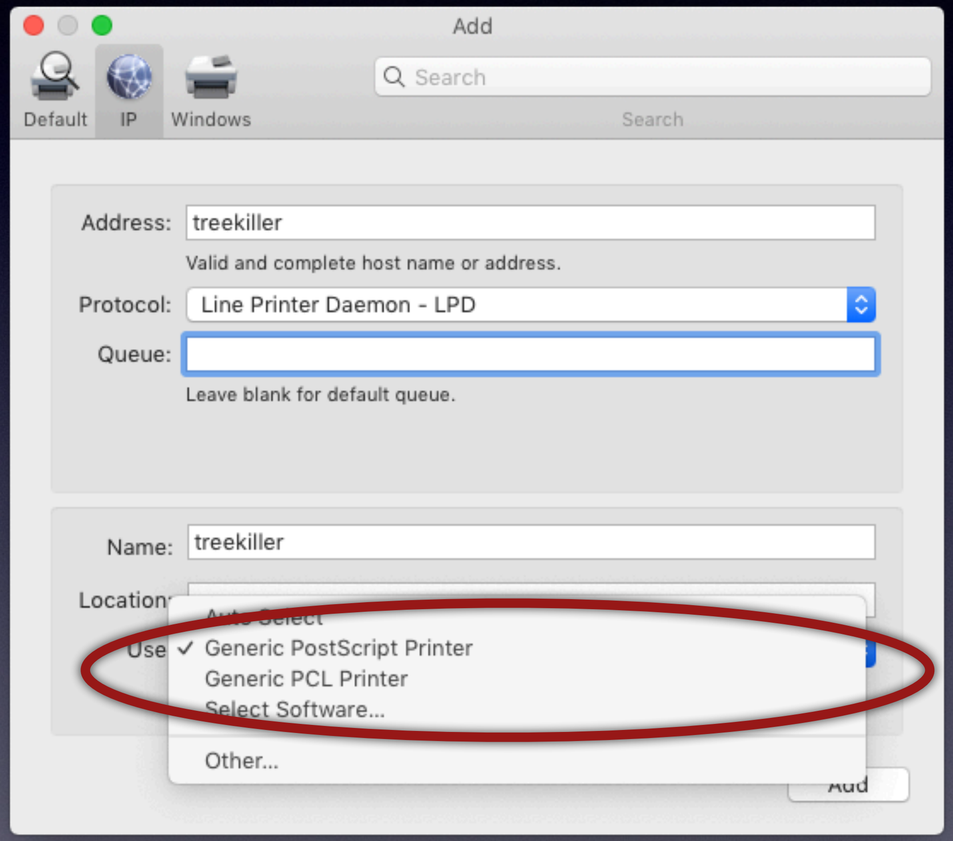
“Generic” Drivers

rsions/A/Resources/Airprint.ppd

“Generic” Drivers

-m everywhere

“Generic” Drivers



“Generic” Drivers

- There are three generic drivers
  - PostScript – colorful
  - PCL – compatible, greyscale, ugly
  - PDF aka AirPrint – compact, talky, the future?

“Generic” Drivers

- Model paths for generic drivers
  - PostScript `-m drv:///sample.drv/generic.ppd`
  - PCL `-m drv:///sample.drv/generpcl.ppd`
  - PDF `-m everywhere`

“Generic” Drivers

- PPD paths for generic drivers
  - PostScript `-P /System/Library/Frameworks/ApplicationServices.framework/Versions/A/Frameworks/PrintCore.framework/Versions/A/Resources/Generic.ppd`
  - PCL `-P /System/Library/Frameworks/ApplicationServices.framework/Versions/A/Frameworks/PrintCore.framework/Versions/A/Resources/GenericPrinter.ppd`
  - PDF `-P /System/Library/Frameworks/ApplicationServices.framework/Versions/A/Frameworks/PrintCore.framework/Versions/A/Resources/Airprint.ppd`

“Generic” Drivers

- If your printers have any capabilities of note, don’t settle for generic drivers.
- When dealing with pooled or multiple output device situations, match the manufacturer and series.

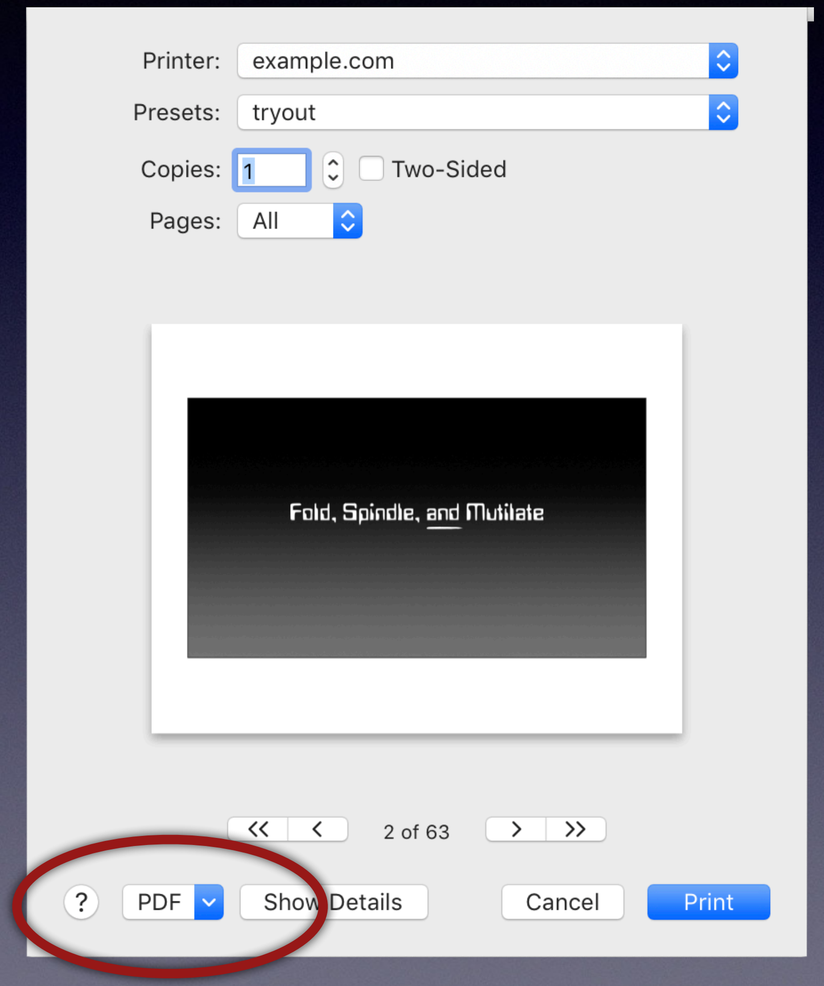
Printer Presets

- Can apply to one printer or all.
- Stored as property list files, often binary.
- Usually in `~/Library/Preferences/com.apple.print.custompresets.forprinter.queuename.plist`

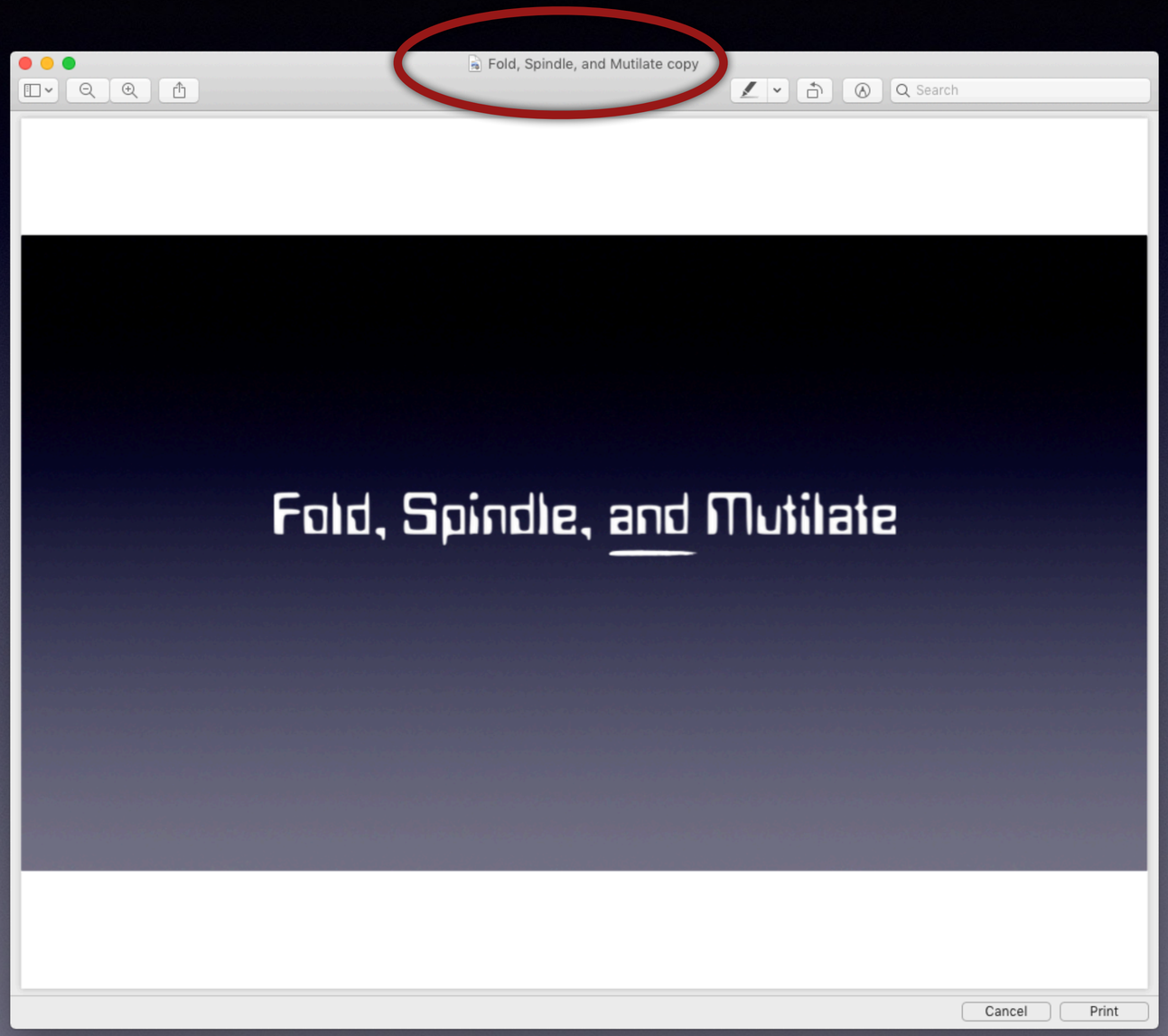
Printer Presets

- Before queueing, print jobs carry presets with them as separate files, along with additional information about the job.
- Queued print job have the presets encoded into them

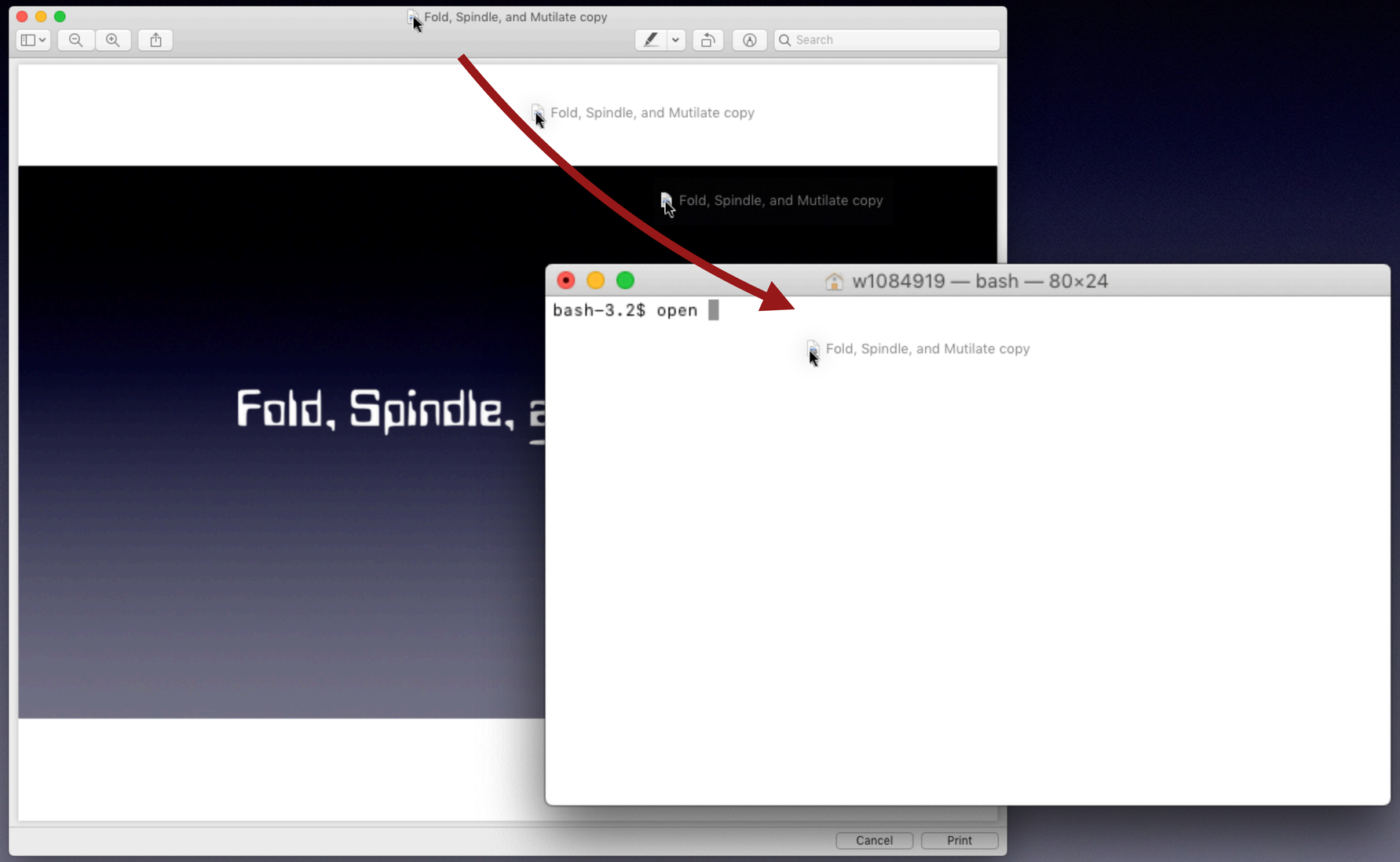
Printer Presets



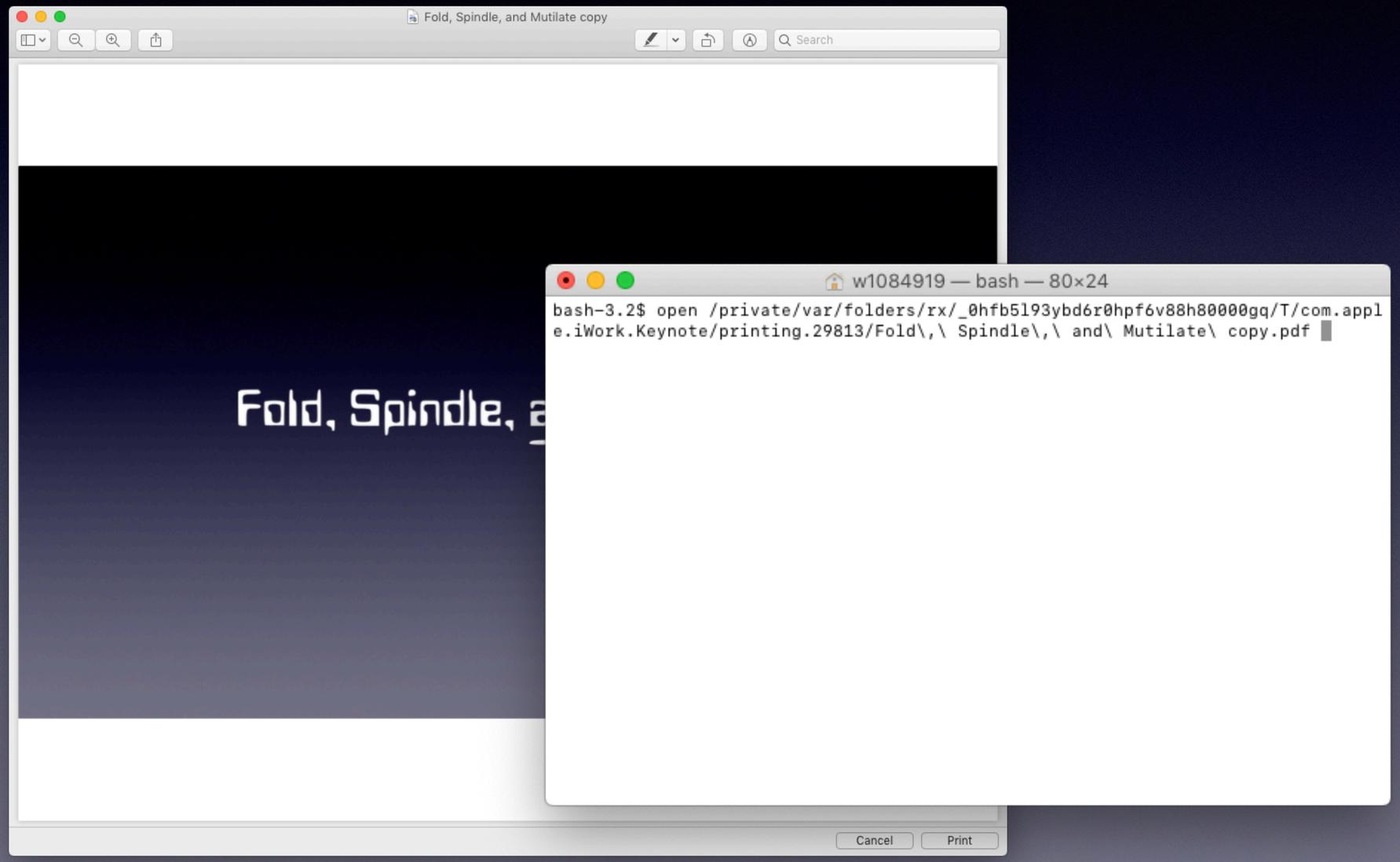
Printer Presets



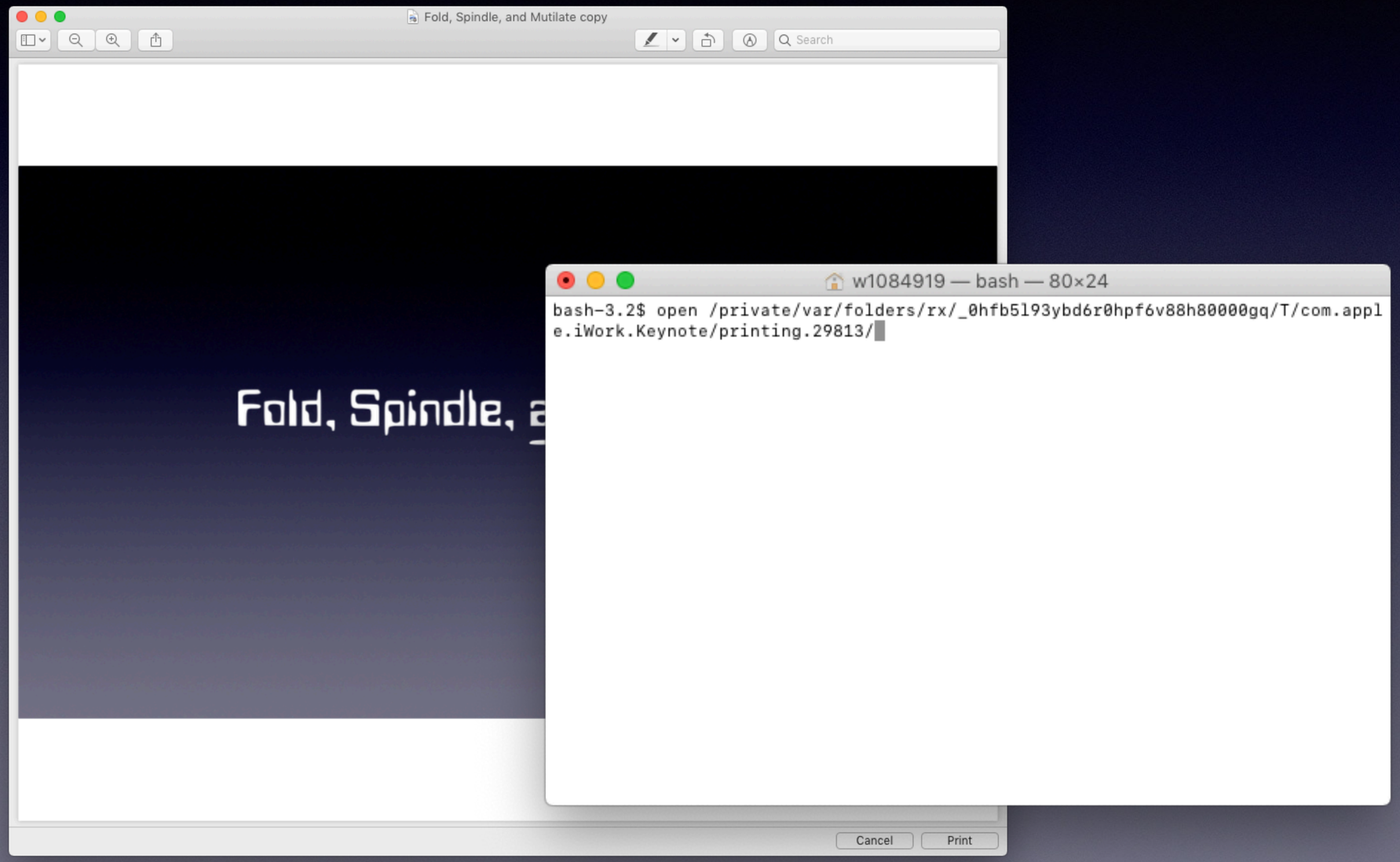
Printer Presets



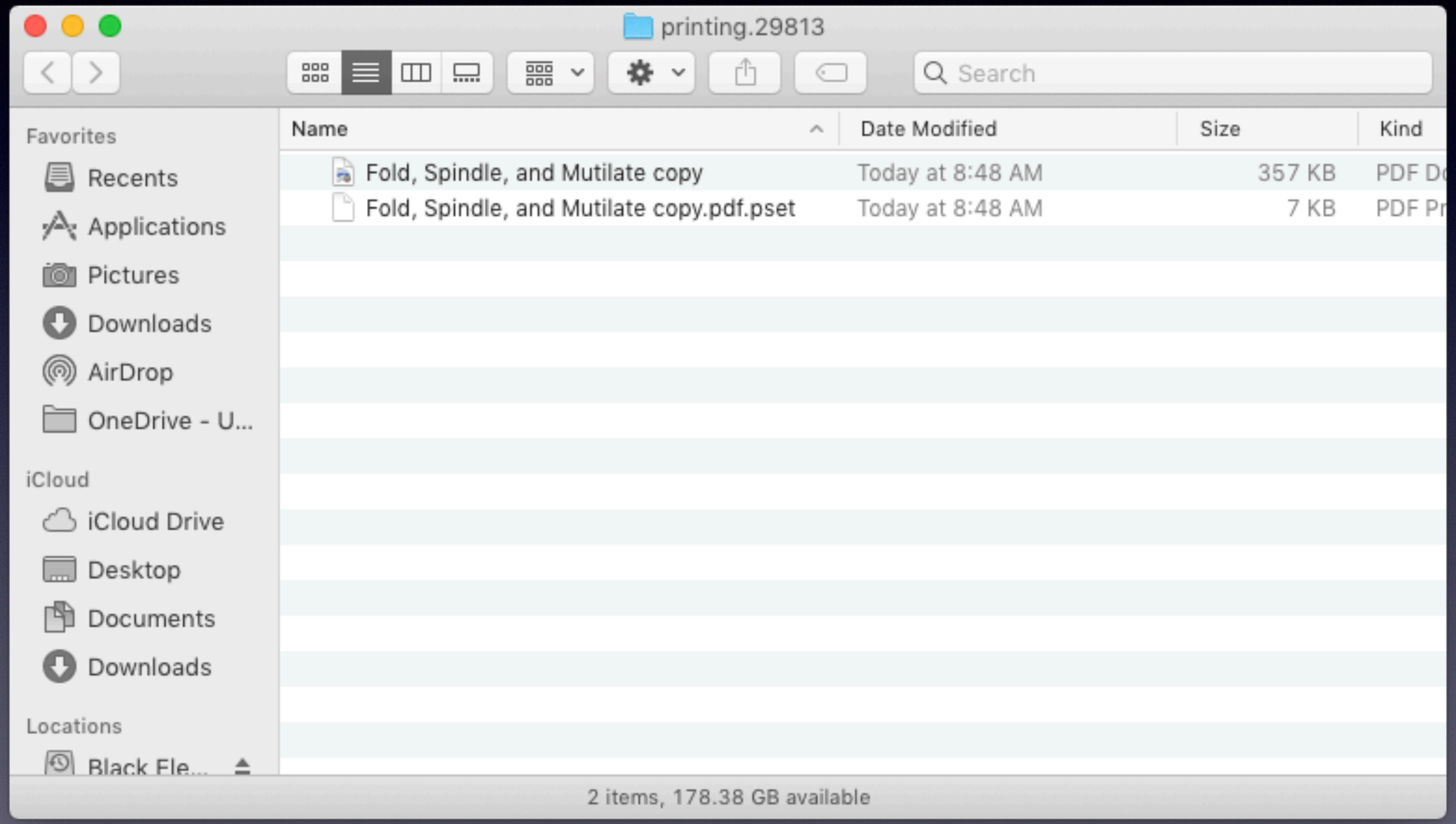
Printer Presets



Printer Presets



Printer Presets



Printer Presets

Fold, Spindle, and Mutilate copy.pdf.pset — Edited


```xml
<?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>AP_ColorMatchingMode</key>
        <string>AP_ApplicationColorMatching</string>
        <key>AP_D_InputSlot</key>
        <string></string>
        <key>BookletBinding</key>
        <false/>
        <key>BookletType</key>
        <integer>0</integer>
        <key>DestinationPrinterID</key>
        <string>example</string>
        <key>HPJobName</key>
        <string>Default</string>
        <key>HPUserName</key>
        <string>System User Name</string>
        <key>HPwmTextMessage</key>
        <string>Draft</string>
        <key>NameServerEnable</key>
        <string>True</string>
        <key>PaperInfoIsSuggested</key>
        <true/>
        <key>com.apple.print.DocumentTicket.PMSpoolFormat</key>
        <string>application/pdf</string>
        <key>com.apple.print.JobInfo.PMApplicationName</key>
        <string>Keynote</string>
        <key>com.apple.print.JobInfo.PMJobName</key>
        <string>Fold, Spindle, and Mutilate copy</string>
        <key>com.apple.print.JobInfo.PMJobOwner</key>
```

Printer Presets

Fold, Spindle, and Mutilate copy.pdf.pset — Edited

```
<?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>AP_ColorMatchingMode</key>
        <string>AP_ApplicationColorMatching</string
        <key>AP_D_InputSlot</key>
        <string></string>
        <key>BookletBinding</key>
        <false/>
        <key>BookletType</key>
        <integer>0</integer>
        <key>DestinationPrinterID</key>
        <string>example</string>
        <key>HPJobName</key>
        <string>Default</string>
        <key>HPUserName</key>
        <string>System User Name</string>
        <key>HPwmTextMessage</key>
        <string>Draft</string>
        <key>NameServerEnable</key>
        <string>True</string>
        <key>PaperInfoIsSuggested</key>
        <true/>
        <key>com.apple.print.DocumentTicket.PMSpool
        <string>application/pdf</string>
        <key>com.apple.print.JobInfo.PMApplicationN
        <string>Keynote</string>
        <key>com.apple.print.JobInfo.PMJobName</key
        <string>Fold, Spindle, and Mutilate copy</s
        <key>com.apple.print.JobInfo.PMJobOwner</ke
```

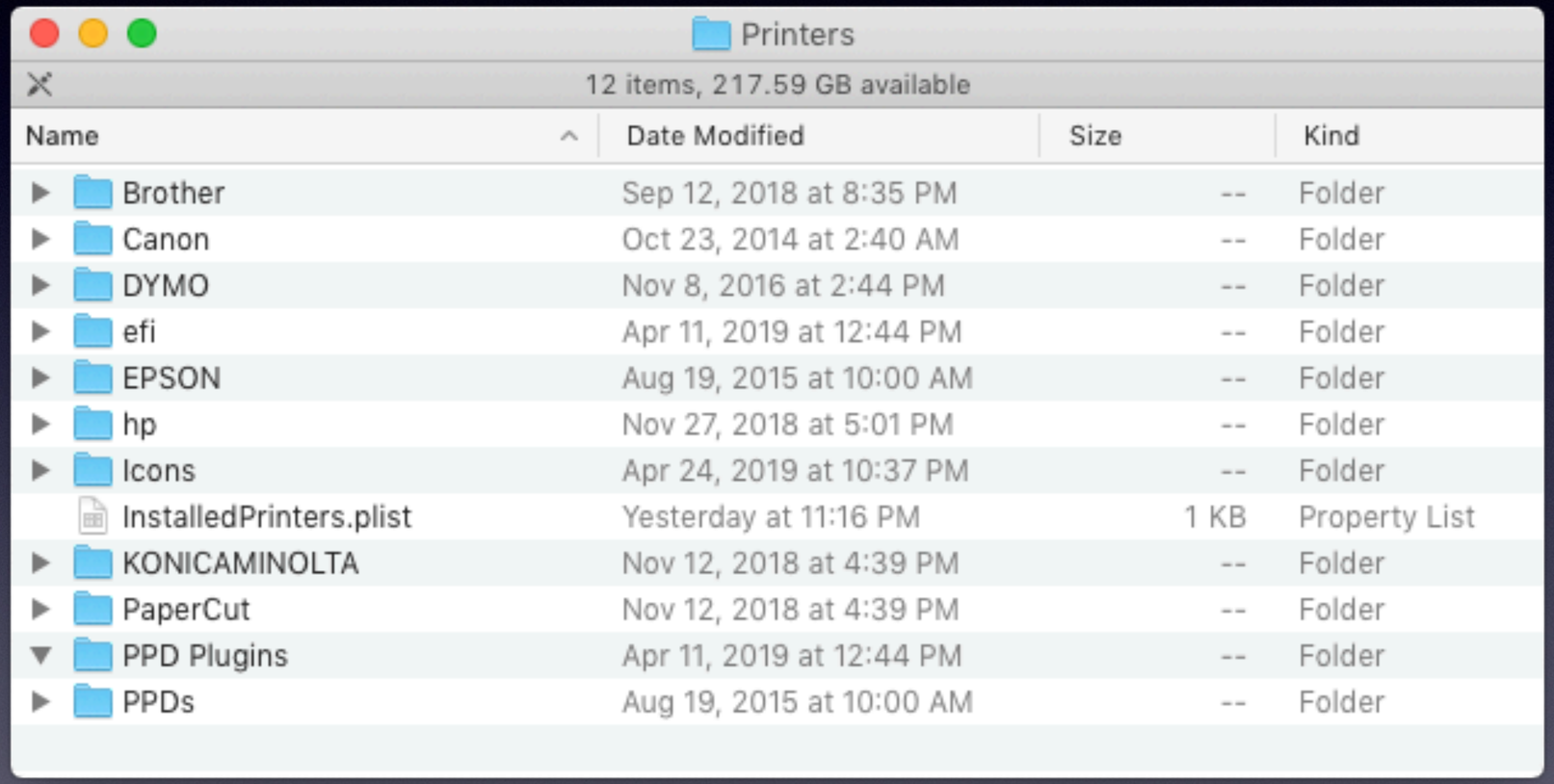
com.apple.print.custompresets.forprinter.example.plist

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/DTDs/PropertyList-1.0.dt
<plist version="1.0">
<dict>
        <key>com.apple.print.lastPresetPref</key>
        <string>Default Settings</string>
        <key>com.apple.print.lastPresetPrefType</key>
        <integer>1</integer>
        <key>com.apple.print.lastUsedSettingsPref</key>
        <dict>
                <key>com.apple.print.preset.id</key>
                <string>com.apple.print.lastUsedSettingsPref</string>
                <key>com.apple.print.preset.settings</key>
                <dict>
                        <key>AP_D_InputSlot</key>
                        <string></string>
                        <key>BookletBinding</key>
                        <false/>
                        <key>BookletType</key>
                        <integer>0</integer>
                        <key>HPJobName</key>
                        <string>Default</string>
                        <key>HPUserName</key>
                        <string>System User Name</string>
                        <key>HPwmTextMessage</key>
                        <string>Draft</string>
                        <key>NameServerEnable</key>
                        <string>True</string>
                        <key>PaperInfoIsSuggested</key>
                        <true/>
                        <key>com.apple.print.JobInfo.PMOutputType</key>
```

Driver File Structure

- `/Library/Printers/`
- `/etc/cups/`

Driver File Structure



Driver File Structure

- PPDs
- Icons
- Filters & PDEs

PPDs

- PostScript Printer Description
- PostScript language, mostly…
- Can be a “driver” on its own, but usually bundled with icons, PDEs, filters, etc.
- Usually prepared by CUPS from a gzipped source in `/Library/Printers/PPDs/`

1 of 1

Printer: NH-0304-BW-01

Presets: Default Settings

Copies: 1 Two-Sided

Pages: All
Selection
From: 2 to: 2

Printer Features

Feature Sets: Watermarks

Watermark

Pages: All Pages

Text: Draft

Font: Helvetica Bold

Size: 48

Angle: 45°

Style: Medium Outline

Intensity: Medium

? PDF Hide Details Cancel Print

PPDs

- Preferences are stored as printer presets
- Not code signed
- ASCII text, 255 character line length limit
- `cupstestppd` for a linter

PPDs

```
*PPD-Adobe: "4.3"
*%%%% PPD file for LaserJet Series PCL 4/5 with CUPS.
*%%%% Created by the CUPS PPD Compiler CUPS v2.2.9.
*% Copyright 2007-2014 by Apple Inc.
*% Copyright 1997-2007 by Easy Software Products.
*%
*% These coded instructions, statements, and computer programs are the
*% property of Apple Inc. and are protected by Federal copyright
*% law.  Distribution and use rights are outlined in the file "LICENSE.txt"
*% which should have been included with this file.  If this file is
*% file is missing or damaged, see the license at "http://www.cups.org/".
*FormatVersion: "4.3"
*FileVersion: "2.1"
*LanguageVersion: English
*LanguageEncoding: ISOLatin1
*PCFileName: "laserjet.ppd"
*Product: "(LaserJet Series PCL 4/5)"
*Manufacturer: "HP"
*ModelName: "HP LaserJet Series PCL 4/5"
*ShortNickName: "HP LaserJet Series PCL 4/5"
*NickName: "HP LaserJet Series PCL 4/5"
*PSVersion: "(3010.000) 0"
*LanguageLevel: "3"
*ColorDevice: False
```

PPDs

```
*PPD-Adobe: "4.3"
*%%%% PPD file for LaserJet Series PCL 4/5 with CUPS.
*%%%% Created by the CUPS PPD Compiler CUPS v2.2.9.
*% Copyright 2007-2014 by Apple Inc.
*% Copyright 1997-2007 by Easy Software Products.
*%
*% These coded instructions, statements, and computer programs are the
*% property of Apple Inc. and are protected by Federal copyright
*% law.  Distribution and use rights are outlined in the file "LICENSE.txt"
*% which should have been included with this file.  If this file is
*% file is missing or damaged, see the license at "http://www.cups.org/".
*FormatVersion: "4.3"
*FileVersion: "2.1"
*LanguageVersion: English
*LanguageEncoding: ISOLatin1
*PCFileName: "laserjet.ppd"
*Product: "(LaserJet Series PCL 4/5)"
*Manufacturer: "HP"
*ModelName: "HP LaserJet Series PCL 4/5"
*ShortNickName: "HP LaserJet Series PCL 4/5"
*NickName: "HP LaserJet Series PCL 4/5"
*PSVersion: "(3010.000) 0"
*LanguageLevel: "3"
*ColorDevice: False
```

PPDs

```
*ModelName: "HP LaserJet Series PCL 4/5"
*ShortNickName: "HP LaserJet Series PCL 4/5"
*NickName: "HP LaserJet Series PCL 4/5"
*PSVersion: "(3010.000) 0"
*LanguageLevel: "3"
*ColorDevice: False
*DefaultColorSpace: Gray
*FileSystem: False
*Throughput: "8"
*LandscapeOrientation: Plus90
*TTRasterizer: Type42
*% Driver-defined attributes...
*1284DeviceID: "MFG:HP;MDL:HP LaserJet;CMD:PCL;"
*cupsBackSide: "Normal"
*cupsVersion: 2.2
*cupsModelNumber: 0
*cupsManualCopies: False
*cupsFilter: "application/vnd.cups-raster 50 rastertohp"
*cupsLanguages: "en ar ca cs da de el es fi fr he hr hu id  ms no pl pt ¬
*UIConstraints: *Duplex *Option1 False
*UIConstraints: *Option1 False *Duplex
*UIConstraints: *PageSize A3 *InputSlot Envelope
*UIConstraints: *InputSlot Envelope *PageSize A3
*UIConstraints: *PageSize A4 *InputSlot Envelope
```

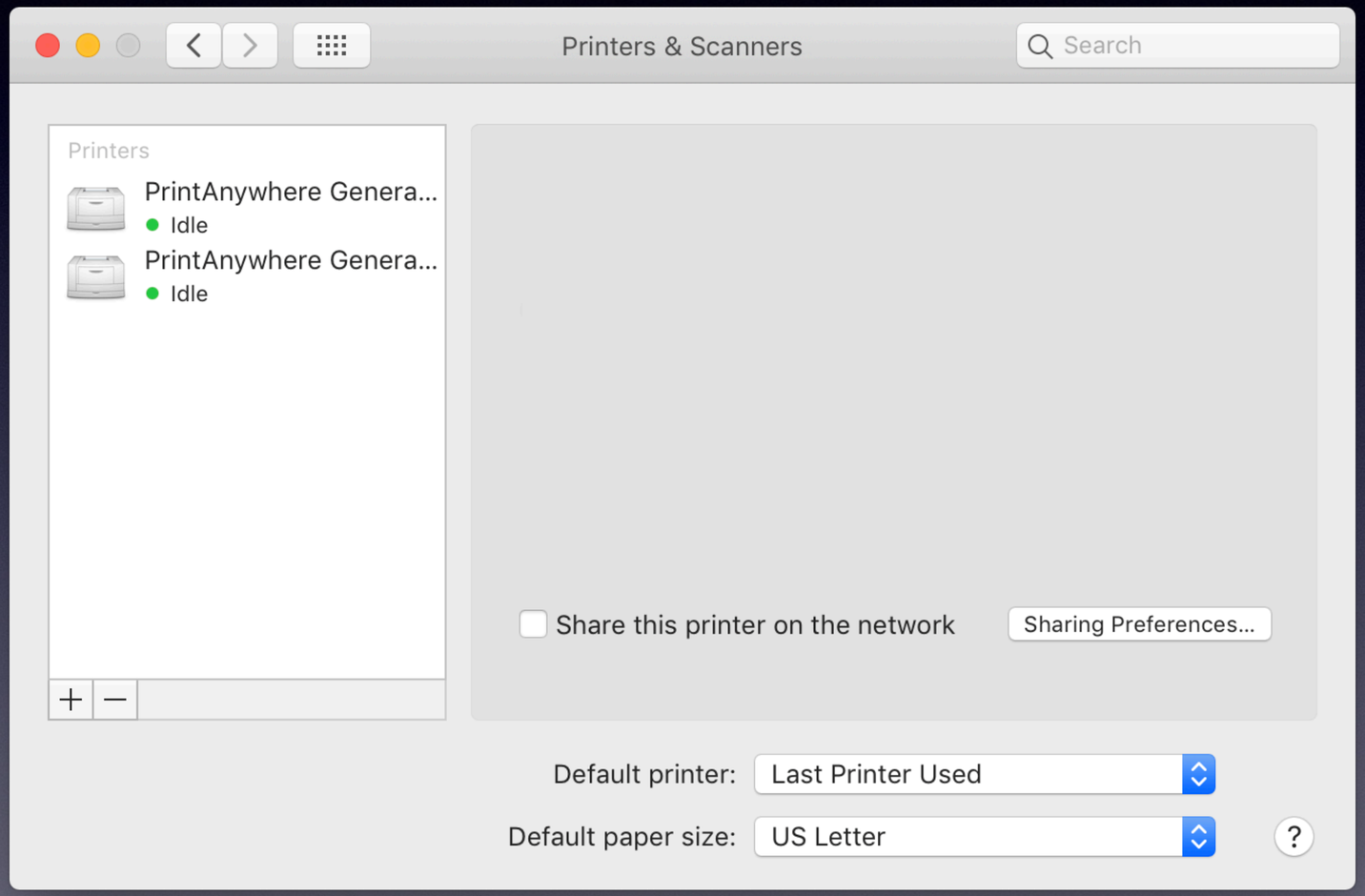
PPDs

```
*UIConstraints: *Duplex *Option1 False
*UIConstraints: *Option1 False *Duplex
*UIConstraints: *PageSize A3 *InputSlot Envelope
*UIConstraints: *InputSlot Envelope *PageSize A3
*UIConstraints: *PageSize A4 *InputSlot Envelope
*UIConstraints: *InputSlot Envelope *PageSize A4
*UIConstraints: *PageSize A5 *InputSlot Envelope
*UIConstraints: *InputSlot Envelope *PageSize A5
*UIConstraints: *PageSize B5 *InputSlot Envelope
*UIConstraints: *InputSlot Envelope *PageSize B5
*UIConstraints: *PageSize Executive *InputSlot Envelope
*UIConstraints: *InputSlot Envelope *PageSize Executive
*UIConstraints: *PageSize Legal *InputSlot Envelope
*UIConstraints: *InputSlot Envelope *PageSize Legal
*UIConstraints: *PageSize Letter *InputSlot Envelope
*UIConstraints: *InputSlot Envelope *PageSize Letter
*UIConstraints: *PageSize Tabloid *InputSlot Envelope
*UIConstraints: *InputSlot Envelope *PageSize Tabloid
*OpenUI *PageSize/Media Size: PickOne
*OrderDependency: 10 AnySetup *PageSize
*DefaultPageSize: Letter
*PageSize Letter/US Letter: "<</PageSize[612 792]/ImagingBBox null>>setpagedevic
*PageSize Legal/US Legal: "<</PageSize[612 1008]/ImagingBBox null>>setpagedevice
*PageSize Executive/Executive: "<</PageSize[522 756]/ImagingBBox null>>setpagede
```

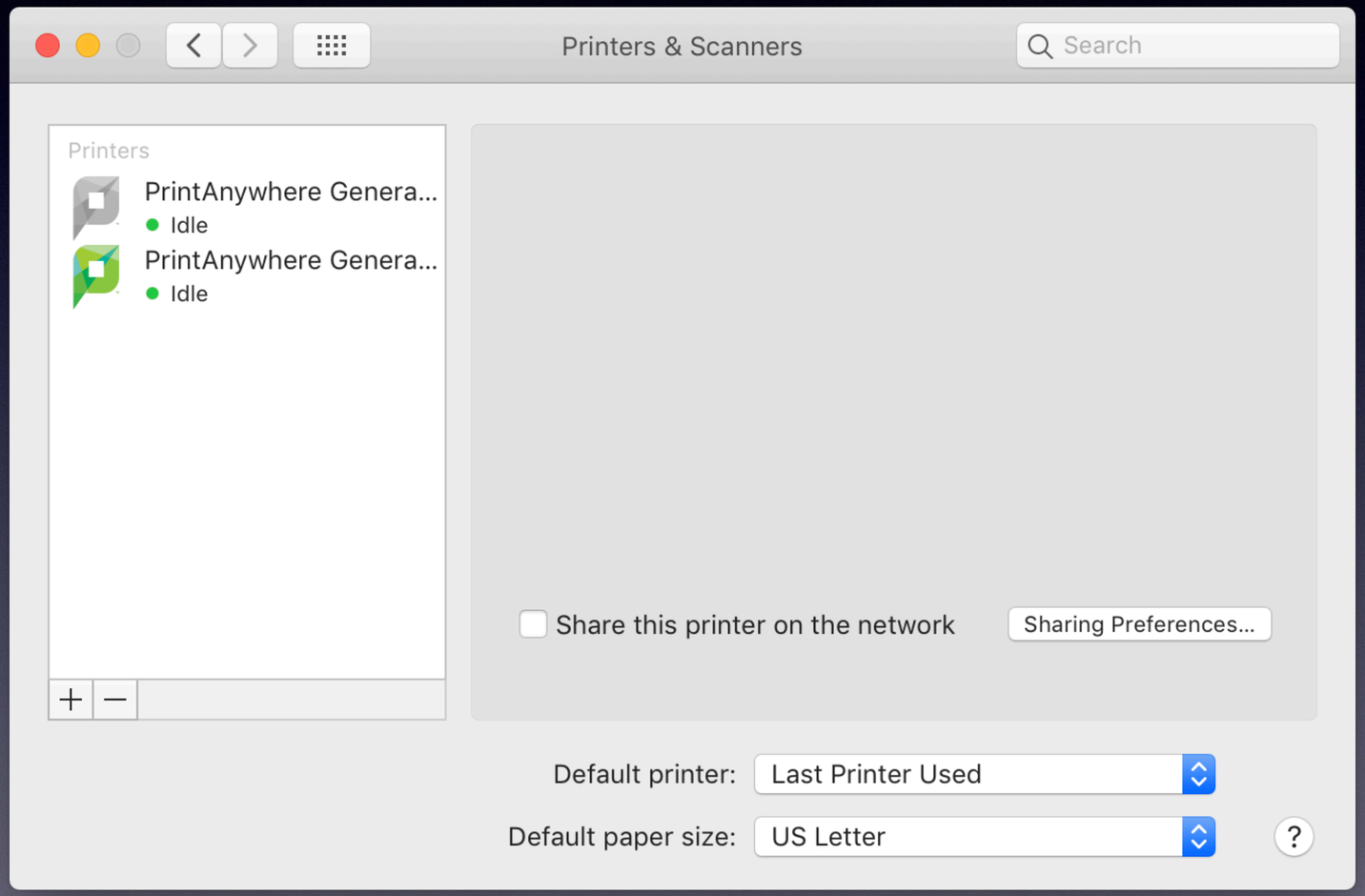
Icons

- Those fun, graphical thingies
- ICNS format for printer list
- Called with `APPrinterIconPath`
- Usually in `/Library/Printers/Manufacturer/Icons/`

Icons


Printers & Scanners
Search
Printers
PrintAnywhere Genera...
Idle
PrintAnywhere Genera...
Idle
Share this printer on the network
Sharing Preferences...
Default printer:
Last Printer Used
Default paper size:
US Letter

Icons


Printers & Scanners
Search
Printers
PrintAnywhere Genera...
Idle
PrintAnywhere Genera...
Idle
Share this printer on the network
Sharing Preferences...
Default printer:
Last Printer Used
Default paper size:
US Letter

Discovery

- Network segregation
- Private list
- DNS-SD (Airprint & IPP everywhere)
- Directory Services

Discovery

Network Segregation

- Printers are only one a selected number of subnets or VLANs
- Works if you already got it, substantial setup required.
- Coarse access control

Discovery

Network Segregation

Add UWRF Network Printers OLD VERSION

AppleScript | tell current application | <No selected element>

```
set printserver to button returned of (display dialog "What type of network printer would you like to add?" buttons {"Office", "Lab"} default button 1)
set printserver to (run script (printserver & " of  {office:\"139.225.51.\", lab:\"139.225.159.\"}"))

if (do shell script "route -n get default") does not contain "139.225." then
	error "Not on the UWRF campus network. Check connection."
end if

set printlist to (do shell script "echo '' > ~/.printhosts.txt; for ((i=1;i<256;i++)); do host '' & printserver & "$i | grep -v NXDOMAIN | cut -d' ' -f5 >>
		~/.printhosts.txt; done; sort ~/.printhosts.txt")

set printchoice to choose from list (paragraphs of printlist) with prompt "Choose one or more printers:" with multiple selections allowed without empty
		selection allowed

if printchoice is false then
	error "User cancelled."
end if

repeat with i in printchoice
	set printqueue to i
	set printname to do shell script "echo " & quoted form of printqueue & " | tr -cd [:alnum:]-"
	do shell script "lpadmin -p " & printname & " -D '" & printqueue & "' -E -v  'lpd://" & printqueue & "' -o printer-is-shared=false -P /System/Library/
		Frameworks/ApplicationServices.framework/Versions/Current/Frameworks/PrintCore.framework/Resources/Generic.ppd"
end repeat

tell application "System Preferences"
	open ((path to system preferences) as string) & "PrintandScan.prefpane"
	activate
end tell
```

Discovery
Private list

- You, or a management architecture, keeps a list of printers and who gets them.
- Easy, iterative setup.
- Good access control.
- Headache to maintain, scales very poorly.

Discovery

- Managing printers one by one for multiple departments quickly gets unworkable

- Letting users find printers gives them a sense of control and you back some sanity.

Discovery

DNS-SD

- Domain Name Service - Service Discovery
- Technology behind AirPrint and IPP Everywhere
- Easy to implement
- Limited access control, scales poorly

Discovery

DNS-SD

- `lpinfo -v`
- `ippfind`

Discovery

Directory Service

- ActiveDirectory and OpenDirectory
- Substantial work to implement
- Lets the users find the printers they want
- Very good access control, scales well

Directory Services

- Most will let you discover the printer but, at least for Macs, not the driver.
- Depends on the computer being bound to the directory… unless

Directory Services
SMButil

- Can query SMB servers, including Windows print servers, for available resources.
- Kerberos savvy, or use a service account
- Output is reasonably easy to parse

smbclient

- smbutil view //printserver.example.com

```
Share                                   Type    Comments
-------------------------------
mcs-0111-bw-01                          Printer HP LaserJet MFP M426fdn
hh-0140-color-01                        Printer Ricoh MP C2003
uc-0170-color-02                        Printer HP Color LaserJet CP4525
hat-b003-label-01                       Printer Dymo LabelWriter Twin
csh-0151-bw-01                          Printer HP LaserJet 1320
C$                                      Disk    Default share
kfa-0308-color-01                       Printer HP Color LaserJet 4700
par135-bw-01                            Printer HP LaserJet M402dne
print$                                  Disk    Printer Drivers
mcm110-bw-01                            Printer HP LaserJet M402dn
rdi-0120-color-01                       Printer HP Color LaserJet CP4525
jhn-0119-bw-01                          Printer HP LaserJet P4015
IPC$                                    Pipe    Remote IPC

13 shares listed
```

lpinfo

```
lpinfo --product “$model_string” --language English -m;
```

lpinfo

```
mx00000% lpinfo --product "HP Officejet Pro L7700 series" --
language English -m;

Library/Printers/PPDs/Contents/Resources/HP Officejet Pro
L7700.ppd.gz HP Officejet Pro L7700 series

Library/Printers/PPDs/Contents/Resources/HP Officejet Pro
L7700 Series Fax.ppd.gz HP Officejet Pro L7700 series. Fax

everywhere IPP Everywhere
```

snmpwalk

```
snmpwalk -Os -c public -v 1 someprinter.example.com
```

Printer Passwords

```
security add-internet-password -a "printpw" -D "Network
Password" -s “labprintserver.example.com” -r "smb " -l
“Display Name of Printer” -A -w ‘haxorP@ssw0rd'
```