CHAPTER 14

Printing with CUPS

14.1 Introduction

The Common Unix Printing System (CUPS) is a modern printing subsystem for Linux and Unix that replaces the hoary old Unix line-printer protocols. It runs on Unix, Linux, Mac OS, and Mac OS X, and it serves clients on nearly any platform, including Windows.

CUPS is thoroughly modern, supporting laser and inkjet printers as well as dot matrix and other legacy printers.

There are two versions of CUPS: the free GPL version, which is the default on most of the major Linux distributions, and a commercial edition. The commercial version comes with support, a larger selection of drivers, and nicer management interfaces.

Printer drivers in CUPS consist of one or more filters specific to a printer, which are packaged in PPD (PostScript Printer Description) files. All printers in CUPS—even non-PostScript printers—need a PPD. The PPDs contain descriptions about the printers, specific printer commands, and filters.

Filters are the heart and soul of CUPS. Filters translate print jobs to formats the printer can understand, such as PDF, HP-PCL, raster, and image files, and they pass in commands for things such as page selection and ordering. PPDs are text files—take a look in /usr/share/cups/model/ to see what they look like. Installed printers have PPDs in /etc/cups/ppd.

Finding Drivers

Included in CUPS are generic PPDs for 9-pin and 24-pin Epson dot matrix printers, Epson Stylus and Color Stylus Photo printers, LaserJet and HP DeskJet printers, and even Dymo label printers. These will work for hundreds of printers, but they do not support all printer functions, such as duplexing, inkjet head-cleaning and alignment, or tray selection.
There are four good sources for printer drivers, if your printer manufacturer does not supply Linux drivers:

- Foomatic, at http://linuxprinting.org
- Gimp-Print, at http://gimp-print.sourceforge.net
- The commercial edition of CUPS, at http://www.easysw.com/cups/
- Windows PostScript drivers

Foomatic is a free printer-driver project that integrates with all the common Linux printing systems (CUPS, LPRng, LPD, GNUlpr, PPR, PDQ, CPS).

Gimp-Print originally started out as a Gimp plug-in, but it has expanded to support all Linux printing. Gimp-Print drivers are very high quality; if there is one for your color printer, it is probably the best choice.

Be sure to check the hardware compatibility list for your Linux distribution, or the printer database on linuxprinting.org, before purchasing a printer.

Gimp-Print and Foomatic are available as packages that you can install on your system, if they are not already included in your distribution. This ensures that you get a complete selection of drivers, plus all the required subsystems that make everything work together correctly. The RPMs are complete; Debian splits them into several smaller packages. Visit the Debian package search page to find them (http://packages.debian.org).

You can use the Windows drivers for PostScript printers on Linux. Look for PPD files in your Windows system directory. Note that only PPDs for real PostScript printers will work. Many printers are only PostScript-compatible; your printer documentation will tell you.

You can test PPDs at http://www.cups.org/testppd.php. This site looks for syntax errors in PPD files. The errors it finds are usually things you can fix, such as a typo or incorrect command.

**Networking Printers**

There are four ways to share printers on a network:

- Share printers that are attached to users’ PCs.
- Build a dedicated Linux printer server.
- Buy network-direct printers, such as the HP JetDirect series.
- Buy hardware printer servers, such as the Linksys EPSX3, that can connect any printer directly to your LAN.

This chapter covers the first two options. The last two are too diverse, and there are too many choices to try to cover here. Here are some things to keep in mind when you’re deciding which one to use:
• Using a Linux box as a printer server gives you maximum flexibility and customization options.
• Network-direct printers, with built-in networking hardware, tend to be expensive and require proprietary network hardware.
• Network-direct printers are usually built for heavy-duty use.
• A hardware printer server lets you network any printers you want.

Using network-direct printers and hardware printer servers means less power consumption and smaller space requirements than using a PC as a dedicated printer server. You must shop carefully for Linux support, though, because some of them come with Windows-only management software. Anything that is managed via a web interface should work fine.

14.2 Installing a Printer on a Standalone Linux PC

Problem
You need to connect a printer to your Linux PC.

Solution
If you have a USB printer, it must be connected and powered up at boot time.
First, make sure that the CUPS daemon is running:

```bash
$ lpstat -t
scheduler is running
...```

If it is not running, it says:

```bash
$ lpstat -t
lpstat: Unable to connect to server: Connection refused```

If that is the case, start it with its `init` script:

```bash
# /etc/init.d/cupsys start```

On Red Hat and Fedora, use:

```bash
# /sbin/service cups restart```

The easiest way to install a new printer is with the CUPS web interface. Type the CUPS URL in any browser:

```
http://localhost:631
```

You’ll need the root password. Click the Printers tab, then click “Add printer,” which opens the Admin menu. There are three values to enter here:

- **Name**: hp6l
- **Location**: room-202
- **Description**: bw-laser
Choose the name carefully—CUPS needs this name, and changing it will cause problems. Your printer name will be used on the next few configuration pages. I’ve entered “hp61” for my Hewlett-Packard LaserJet6L printer. The Location and Description are optional.

On the next page, define the “Device for <printername>.” This means the physical connection: parallel port, USB, SCSI, serial port, or network. Select your deviceURI from the drop-down menu. In this example, that is “Parallel port #1 Hewlett-Packard HP LaserJet6L.”

On the “Model/Driver for <printername>” menu, scroll to the model number of your printer, and select a driver from the list.

Now it should say “Printer <printername> has been added successfully.” Click on the printer name to go to the printer’s control page, and print a test page. Your CUPS page should look like Figure 14-1.

![Figure 14-1. CUPS page](image)

**Discussion**

If you prefer the command line, this long command does the same thing as the above example:

```bash
# lpadmin -p hp6L -L room-202 -D bw-laser -E -v parallel:/dev/lp0 \
-m HP-LaserJet_6-hpijs.ppd
```
Here are some definitions:

```
lpadmin -p
  Set the printer name.

-L
  Set the printer location.

-D
  Describe the printer.

-E
  Enable the printer and make it ready to receive jobs.

-v
  Set the device URI.

-m
  Specify which driver (PPD file) to use. Note that the filepath is hardcoded into
  CUPS; if you try to use a filepath like /usr/share/cups/model/laserjet.ppd, it will
  fail, saying “lpadmin: add-printer (set model) failed: server-error-internal-error.”
  Just use the PPD name, and make sure the PPD file you want is in /usr/share/
  cups/model/.
```

If you have Gimp-Print and Foomatic installed (if you don’t you probably should)
you’ll find additional PPDs in /usr/share/cups/model/gimp-print and /usr/share/cups/
model/foomatic. They are compressed:

```
HP-LaserJet_6-hpijs.ppd.gz
```

You’ll need to uncompress the file and move it to the /usr/share/cups/model directory:

```
# gunzip HP-LaserJet_6-hpijs.ppd.gz && mv HP-LaserJet_6-hpijs.ppd /usr/share/cups/model/
```

It is not necessary to uncompress and move PPD files when you install printers using
the CUPS web interface.

**Generic drivers**

These are the generic drivers that come with the free version of CUPS:

```
$ ls /usr/share/cups/model
  epson24.ppd  laserjet.ppd  pxlcolor.ppd  stphoto.ppd  deskjet.ppd  epson9.ppd
  okidata24.ppd  pxlmono.ppd  stphoto2.ppd  deskjet2.ppd  okidata9.ppd  stcolor.ppd
  dymo.ppd  pcl-6.ppd  stcolor2.ppd
```

If you can’t find a driver specific to your printer, one of these should work. (You
did check your distribution’s hardware compatibility list, or the database on
linuxprinting.org, before purchasing the printer, right?)

**See Also**

- This chapter’s “Introduction,” for more information on printer drivers
14.3 Serving Linux Clients

Problem

You want to share the printers attached to your Linux PCs with other Linux clients on your LAN.

Solution

First, make sure CUPS is installed on all the computers with attached printers. These PCs must have static IP addresses and you’ll need name resolution in place and working (/etc/hosts or a local DNS server).

Next, on the PCs with printers attached, edit /etc/cupsd.conf. This sample cupsd.conf shows how to make the printers accessible to the local subnet. You can use this as it’s shown, using your own network values:

```
LogLevel info
Port 631
<Location />
Order Deny,Allow
Deny From All
Allow From 127.0.0.1
Allow From 192.168.1.*
</Location>
BrowseAddress 192.168.1.255
```

Add this entry to restrict administrative access to the server only and not allow it from client machines:

```
<Location /admin>
AuthType Basic
AuthClass System
Order Deny,Allow
Deny From All
Allow From 127.0.0.1
</Location>
```

Restart cupsd after editing cupsd.conf:

```
#/etc/init.d/cupsys restart
```

On Red Hat and Fedora, use:

```
#/sbin/service cups restart
```

Print a test page. If you get the infamous “client-error-not-found” message, stop and restart the printer from the CUPS web interface.

CUPS printers will now automatically broadcast themselves on the network. Make sure that TCP port 631 is not blocked on either the server or the client machines.
Open the CUPS web interface (http://localhost:631) on any of the Linux client PCs, and all CUPS printers should automatically appear on the Printers page. You can now print a test page and print from applications.

**Discussion**

If there is a sample cupsd.conf on your system, don’t let its size scare you. Chances are you’ll never need most of the directives; just hang on to it as a reference, and create your own cupsd.conf from scratch.

All of the directives in cupsd.conf are listed and defined in the CUPS Software Administrators Manual, at http://localhost:631/documentation.html.

**LogLevel info**

There are 10 levels of logging. info is the default; it logs errors and printer activity in /var/log/cups/error_log.

**Port 631**

This is reserved for IPP (Internet Printing Protocol).

```xml
<Location />
</Location>
```

The Location directive specifies access control and authentication options. Note the positioning of the slashes—make sure you get them right, or things won’t work.

**Order Deny,Allow**

- Deny From All
- Allow From 127.0.0.1
- Allow From 192.168.1.*

Your standard “deny all, allow as needed” scheme, limiting inbound connections to the local machine and the local subnet.

**See Also**


### 14.4 Sharing a Printer Without Using Name Resolution

**Problem**

You haven’t bothered to create /hosts files, or set up a local DNS server on your LAN, because you have no need for name resolution. The PCs on your LAN sit comfortably behind a NAT firewall, for sharing an Internet connection, and that’s all they need. So how do you share a printer?
Solution

Give your printer server a static IP address. Add a ServerName directive to /etc/cupsd.conf on the server, using its own IP address:

    ServerName 192.168.1.5

Restart cupsd. On Debian, use:

    # /etc/init.d/cups sys restart

On Red Hat and Fedora, use:

    # /sbin/service cups restart

There is nothing to do on the client PCs, except wait a few seconds for CUPS to broadcast the printer. If you get the infamous “client-error-not-found” message, stop and restart the printer.

Discussion

By default, CUPS uses the hostname as the ServerName. If you are not using any kind of name resolution, your client PCs will not see any CUPS printers. Specifying the IP address as the ServerName fixes that. A side effect is that you may not be able to print a test page from the server; instead, you’ll get the screen shown in Figure 14-2.

However, you’ll still be able to print from applications on the server. Client PCs won’t notice anything odd.

If you don’t need to set up a network filesystem such as NFS or Samba, or use DNS; it’s perfectly okay, even if the other geeks laugh at you. A primary rule of security is “don’t run what you don’t need.”

See Also

14.5 Serving Windows Clients Without Samba

Problem
You would like to connect your Windows clients to a Linux printer server, but you really don’t want to set up Samba just to share printers.

Solution
CUPS can handle the job without Samba. You need your Windows installation CD or printer driver disk, and Windows clients need to have Internet Printing Services installed. This is the same as IPP (Internet Printing Protocol) on Linux.


Windows ME supplies the Internet Printing Services software in the Add-on folder on the installation CD.

On Windows NT, go to Control Panel ➝ Network ➝ Services tab ➝ Add Microsoft TCP/IP Printing.

On Windows2000/XP, install TCP/IP Print Services from Network and Dial-up Connections ➝ Advanced Menu ➝ Optional Networking Components ➝ Other Network File and Print Services.

Next, fire up the Add Printer wizard. Select Network Printer, then add the printer URI. This consists of the IP address or server name, port number, and /printers/<printername>. Be sure to use the exact name you gave the printer, like this:

http://192.168.1.5:631/printers/hp6L

There isn’t a /printers directory anywhere; that’s just a convention used by CUPS.

When Windows first connects to the CUPS server, it will install its own local printer drivers and print its own test page, rather than the CUPS test page. So you may need a Windows CD or the driver installation disk.

Discussion
If you have name resolution working on your LAN, you can use the server name instead of the IP address:

http://windbag:631/printers/hp6L

See Also
- This chapter’s “Introduction,” for more information on printer drivers
14.6 Sharing Printers on a Mixed LAN with Samba

**Problem**
Your LAN has both Linux and Windows printers, and you want all of them to be accessible by both Linux and Windows clients.

**Solution**
You’ll need both Samba and CUPS to make this work. See Recipe 23.22 and Recipe 23.23.

**See Also**
- The Official Samba-3 Howto and Reference Guide (http://samba.org)

14.7 Building a Dedicated CUPS Printer Server

**Problem**
Sharing printers connected to PCs works fine, but it places an extra load on the PCs, and the PCs must be running for printers to be accessible. And sometimes it means running all over to fix things. You want to set up a dedicated printer server, for easier centralized printer management.

**Solution**
A plain-vanilla Pentium-class PC with several attached printers makes a dandy CUPS printer server. There are two good ways to install multiple printers to a single PC:

- Use additional parallel-PCI cards, for connecting parallel-port printers.
- Add USB hubs for connecting more USB printers.

Set up a minimal Linux installation, with CUPS. Install all the Foomatic and Gimp-Print packages and drivers. (These are available both as RPMs and in Debian repositories.)

Then all you need to do is install the printers and configure CUPS. See the first four recipes in this chapter for how to install printers, and information on sharing with both Windows and Linux clients without needing to use Samba.

**Discussion**
A centralized printer server has a lot of advantages: all the printers are in one place, supplies can be stored close by, and users are not bothered by other people wanting...
to use their printers. And if you use Linux and CUPS for a print server, you don’t need to set up Samba to share printers with Windows clients.

See Also

- *PC Hardware in a Nutshell*, by Robert Bruce Thompson and Barbara Fritchman Thompson (O’Reilly). This is a great hardware guide, even though it is Windows-centric, and their companion web site ([http://www.ttgnet.com](http://www.ttgnet.com)) includes a lot of useful updates to the book.

### 14.8 Distributed Printing with Classes

**Problem**

You have a user group that generates a lot of high-volume printing, and you need an easy way to give users a group of printers to use, without having to hassle with individual print queues.

**Solution**

Use classes to create, in effect, a single printer queue containing several printers. From the Admin page of the CUPS web interface, click “Add Class.” Select printers for the class from your installed printers. Users can now send print jobs to the class, instead of to an individual printer, and the first available printers will take them. You can add or remove printers from this menu, and even create subclasses.

You can also do this from the command line. Create a class and populate it with printers this way:

```
# lp-admin -p printer1 -p printer2 -p printer3 -c art-dept
```

To add another printer to this class, use:

```
# lp-admin -p printer4 -c art-dept
```

Remove a printer with the `-r` option:

```
# lp-admin -p printer4 -r art-dept
```

To delete the entire class, use:

```
# lp-admin -x art-dept
```

**Discussion**

Obviously, you don’t want to group geographically dispersed printers into the same class—they should be in the same room. It will get confusing enough, as users won’t know which printers have their print jobs. The advantage is that if a printer gets
jammed or otherwise becomes unavailable, jobs will still be printed without user intervention. It’s also great for high-volume printing, as idle printers will automatically take over from busy ones.

See Also

- The “Printer Classes” section in the CUPS Software Administrators Manual (http://localhost:631/documentation.html)

14.9 Restricting Users from Printers and Classes

Problem

You have some printers you would like to restrict to selected users. You don’t want people printing pictures of their kids on the design group’s fancy graphics printer, for example.

Solution

Use the `lpadmin` command:

```
# lpadmin -p hp6L -u allow:carla,jenn,dancer
```

This changes `/etc/cups/printers.conf`:

```
<DefaultPrinter hp6L>
Info
Location
DeviceURI parallel:/dev/lp0
State Idle
Accepting Yes
JobSheets none none
QuotaPeriod 0
PageLimit 0
KLimit 0
AllowUser carla
AllowUser jenn
AllowUser dancer
</Printer>
```

You can also restrict classes:

```
# lpadmin -p art-dept -u allow:carla,jenn,dancer
```

This modifies `/etc/cups/classes.conf`.

You can also deny users:

```
# lpadmin -p hp6L -u deny:daryl,larry,otherlarry
```
Discussion

Don’t try to edit classes.conf or printers.conf directly, because your changes will be lost. Use lpadmin.

See Also

• The “Managing Printers” section in the CUPS Software Administrators Manual (http://localhost:631/documentation.html)

14.10 Troubleshooting

Problem

Printing, especially network printing, is probably the most difficult and troublesome aspect of system administration. What tools are there for diagnosing and fixing problems?

Solution

Your first stop is /var/log/cups/error_log. The default log level in cupsd.conf is LogLevel info. This logs errors and ordinary activity. If LogLevel info does not generate enough detail, the highest levels are debug and debug2.

Trying a different printer driver cures a large number of printing problems.

If test pages won’t print, try printing other documents. A test page not printing indicates a problem somewhere, but if you can get your work done, you can probably live without the test page.

For network printing, make sure you have connectivity. Ping both IP addresses and hostnames. Try connecting manually to Samba shares. Try printing from the machine to which the printer is attached.

Run the ppd file for the printer through the PPD checker at http://www.cups.org/testppd.php to test for syntax errors.

If you can’t decipher for yourself where the problem is, you can post log output and the steps you’ve tried in help forums. Here is a listing of the more useful ones:

http://printing.kde.org
  Specific to printing in KDE, but still a thorough resource for many aspects of printing with CUPS

http://gimp-print.sourceforge.net/p_Mailing_Lists.php3
  Help for Gimp-Print drivers

http://www.linuxprinting.org/forums.cgi
  Help forums for HP, Epson, Alps, and many more printers

http://www.cups.org/newsgroups.php
  CUPS newsgroups
As always, search the archives before posting your query. There is nothing new under the sun.

**See Also**