# 10.4.1 Common Unix Print System (CUPS) Operation

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Common Unix Print System (CUPS) Operation 0:00-1:21

No matter what operating system you're using, probably one of the most important services it offers is the ability to send print jobs to a printer. If you don't believe me, just go and unplug your office printer for about an hour and observe what happens.

Okay, don't really do that, because your coworkers will probably inflict bodily harm upon you if you do. The point is that printing is vital to most users. And because of this, you need to be very familiar with how Linux printing works.

The most common Linux printing system in use today is the Common Unix Printing System, or we just call it CUPS. CUPS was designed from the ground up to make Linux printing as easy as possible-- whether you're printing to just a locally-attached printer, like through a USB or parallel port connection, or whether you're printing to a remote network printer.

The CUPS service is provided by the cupsd daemon. One of the cool things that cupsd can do is announce the availabilities of all the printers that it services out on the local network segment.

This is cool because CUPS client systems can actually listen for these announcements, and that allows an individual user somewhere on the network to select the printer that he or she wants to print to, without having any networking knowledge. They just see the printer, they select it, and they send the print job. They don't have to set it up.

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CUPS Components 1:22-2:11

The CUPS daemon provides network printing using the Internet Printing Protocol, or IPP, which runs on IP port 631. The CUPS system itself is composed of several different parts.

The first one is the CUPS scheduler, which is really just a web server, and its job is to handle these IPP printing requests that come in over the network from CUPS clients. In addition to processing print jobs, the CUPS scheduler also functions as a web server, which is what it is. It provides CUPS documentation, and it also provides a web-based CUPS administration tool.

The next component that you need to be familiar with are the CUPS filters. In order to understand what a CUPS filter is, you need to be familiar with the concept of a page description language, or PDL.

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PDLs 2:12-5:25

A PDL is used by most modern printers to define print jobs. Here's the key thing that you need to understand: in a Linux system, almost all applications running on Linux will generate print jobs using Adobe's PostScript PDL, or PS. This configuration works great if you have a PostScript-compatible printer.

However, not all printers include PostScript support because of the fact that if the printer does, then the printer manufacturer has to pay a licensing fee to Adobe, which increases the price of the unit, which is the reason why I don't actually own a PostScript compatible printer.

As result, most printer manufacturers actually define their own PDLs. For example, Hewlett-Packard printers use the Printer Control Language, or PCL, which is a form of a PDL. Other manufacturers, like Epson, use the ESC/P PDL.

Well, why do we care? Because if your printer isn't PostScript compatible-- and there is a high probability that your printer is not PostScript compatible-- then what you have to do is use a CUPS filter to convert print jobs from the default PostScript PDL that's used by most Linux applications into the appropriate PDL of the printer to which they're being sent.

That's what a CUPS filter does. These filters are stored in the /usr/lib/cups/filter directory on your Linux system. Basically, this allows the Adobe print jobs that are being generated by the applications on your system to work with just about any printer that you purchase on the market.

The next component that you need to be familiar with are the CUPS backends. Backends are responsible for providing an interface between the CUPS scheduler up here and the actual printer hardware.

Your CUPS backends are located in /usr/lib/cups/backends. Because there are different types of printer interfaces that are used to connect printers to the system, we need a different backend for each one. CUPS provides backends for printer interfaces such as parallel, serial, USB, and so on.

The important thing to remember is that every time the cupsd daemon starts, it queries each backend installed on the system, and each backend responds to the daemon reporting whether or not it's got a printer connected to it. If a printer is connected, they report information about that printer, such as its make and its model. And by doing this, the CUPS daemon has the information that it needs to send print jobs to that printer.

The next CUPS component that you need to be familiar with are the PPD files. That stands for PostScript Printer Description. PPDs are used by the cupsd daemon to determine what the capabilities are for a particular printer that's connected to a printer interface on the system.

For example, can it print in color? Can it print duplex? Printing on both sides of the paper, and so on. These PPD files are stored in the /etc/cups/ppd directory.

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## CUPS Administration Interface 5:26-6:31

The last CUPS component that you need to be familiar with is the web-based administration utility. Remember we said earlier that the CUPS scheduler provides the web-based administrative interface. This administration utility can be used to set up printers, it can be used to manage print jobs on those printers, and so on.

To access the CUPS web-based administration utility on your system, open up a web browser and then navigate to the URL you see here: http:// followed by the server's IP address, or its DNS name, :631. Remember that the scheduler uses the IPP protocol, which uses port 631 by default.

If you're accessing the CUPS administration interface from the same system where the CUPS daemon is running, then it should have no problem. In fact, you could just use local host instead of the server IP address.

But if you're trying to access the web-based administration utility from a different system over the network, then you need to make sure that port 631 is open in the host-based firewall. Otherwise, remote hosts aren't going to be able to connect to the scheduler and access the administration interface.

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## CUPS Printing 6:32-8:21

Now that you're familiar with all the different components that are required for CUPS printing to work, let's talk about how they work together when a print job is submitted. First, an application running down here on the client system generates a print job and it sends it to the cupsd daemon on the server.

Because the printer might be busy or the cupsd daemon might be receiving multiple jobs at the same time, instead of sending the print job directly to the printer, what cupsd will do is actually save that print job to a directory called the spooling directory on the hard disk drive. Basically, it queues it up so that when the printer is available, the next job would be processed, and when that job is done, the next job would be processed, and so on.

By default, this print queue is /var/spool/cups. This is where the print jobs are saved, waiting for the printer to be available. When the printer is ready and it's time for the print job to actually be printed, the cupsd daemon is going to send the print job to the appropriate filter--that we talked about earlier-- so that that print job can be converted to the appropriate PDL for the printer down here.

Once that's done, the converted print job is sent from the filter to the backend, which, remember, is just the interface that the printer is connected to. The backend will then forward the job onto whatever printer is connected to that interface.

After sending the print job to the printer, the backend will notify the cupsd daemon that the print job was sent, and so cupsd will then find the print job in the queue over here and delete it. Because it's already been sent to the printer, we don't need it saved on the hard drive anymore.

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## Summary 8:22-8:30

That's it for this lesson. In this lesson we introduced you to printing on Linux using the CUPS daemon. We reviewed how CUPS works, and we also listed the various components that are used by the CUPS daemon to send print jobs to a printer.

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