# Printing

We will discuss the following commands in this chapter:

- pr – Convert text files for printing
- lp / lpr – Print files
- a2ps – Format files for printing on a PostScript printer
- lpstat – Show printer status information
- lpq – Show printer queue status
- lprm – Cancel print jobs

# A Brief History of Printing

**Printing in the Dim Times**

- Like computers, printers in the pre-PC era tended to be large, expensive, and centralized.
- The typical computer user of 1980 worked at a terminal connected to a computer some distance away. The printer was located near the computer and was under the watchful eyes of the computer's operators.
- When printers were expensive and centralized, as they often were in the early days of Unix, it was common practice for many users to share a printer.

## Character-Based Printers

- The printer technology of the 80s was very different from today in two respects.
- First, printers of that period were almost always impact printers. Impact printers use a mechanical mechanism that strikes a ribbon against the paper to form character impressions on the page.
- Two of the popular technologies of that time were daisy-wheel printing and dot-matrix printing.
- The second, and more important characteristic of early printers was that printers used a fixed set of characters that were intrinsic to the device.
- For example, a daisy-wheel printer could only print the characters actually molded into the petals of the daisy wheel.

## Graphical Printers

- The development of GUIs led to major changes in printer technology. As computers moved to more picture-based displays, printing moved from character-based to graphical techniques.
- This was facilitated by the advent of the low-cost laser printer which, instead of printing fixed characters, could print tiny dots anywhere in the printable area of the page.
- This made printing proportional fonts (like those used by typesetters), and even photographs and high-quality diagrams, possible.

# Printing with Linux

- Modern Linux systems employ two software suites to perform and manage printing.
- The first, Common Unix Printing System (CUPS) provides print drivers and print-job management, and the second, Ghostscript, a PostScript interpreter, acts as a RIP.
- CUPS manages printers by creating and maintaining print queues
- Unix printing was originally designed to manage a centralized printer shared by multiple users.
- Since printers are slow by nature, compared to the computers that are feeding them, printing systems need a way to schedule multiple print jobs and keep things organized.
- CUPS also has the ability to recognize different types of data (within reason) and can convert files to a printable form.

# Preparing Files for Printing

pr – Convert Text Files for Printing

- pr is used to adjust text to fit on a specific page size, with optional page headers and margins.
- The table summarizes its most commonly used options.
- pr is often used in pipelines as a filter

| Option | Description |
|---|---|
| `+`*`first`*`[:`*`last`*`]` | Output a range of pages starting with *first* and, optionally, ending with *last*. |
| `-`*`columns`* | Organize the content of the page into the number of columns specified by *columns*. |
| `-a` | By default, multicolumn output is listed vertically. By adding the -a (across) option, content is listed horizontally. |
| `-d` | Double-space output. |
| `-D` *"format"* | Format the date displayed in page headers using *format*. See the man page for the `date` command for a description of the format string. |
| `-f` | Use form feeds rather than carriage returns to separate pages. |
| `-h` *"header"* | In the center portion of the page header, use *header* rather than the name of the file being processed. |
| `-l` *length* | Set page length to *length*. The default is 66 (US letter at six lines per inch) |
| `-n` | Number lines. |
| `-o` *offset* | Create a left margin *offset* characters wide. |
| `-w` *width* | Set the page width to *width*. The default is 72. |

- In this example, we will produce a directory listing of /usr/bin and format it into paginated, three-column output using pr:

```
[me@linuxbox ~]$  ls /usr/bin | pr -3 -w 65 | head


2025-02-18 14:00                                        Page 1
[                   apturl              bsd-write
411toppm            ar                  bsh
a2p                 arecord             btcflash
a2ps                arecordmidi         bug-buddy
a2ps-lpr-wrapper    ark                 buildhash
```

# Sending a Print Job to a Printer

- The CUPS printing suite supports two methods of printing historically used on Unix-like systems.
- One method, called Berkeley or LPD (used in the Berkeley Software Distribution version of Unix), uses the lpr program, while the other method, called SysV (from the System V version of Unix), uses the lp program. Both programs do roughly the same thing.

**lpr – Print Files (Berkeley Style)**

- The lpr program can be used to send files to the printer. It may also be used in pipelines, as it accepts standard input. For example, to print the results of our previous multicolumn directory listing, we could do this:

```
[me@linuxbox ~]$ ls /usr/bin | pr -3 | lpr
```

- The report would be sent to the system's default printer. To send the file to a different printer, the -P option can be used like this:

```
lpr -P printer_name
```

- Here, printer_name is the name of the desired printer. To see a list of printers known to the system, use this:

```
[me@linuxbox ~]$ lpstat -a
```

- The table describes the common options for lpr.

| Option | Description |
|---|---|
| `-# number` | Set number of copies to *number*. |
| `-p` | Print each page with a shaded header with the date, time, job name, and page number. This so-called "pretty print" option can be used when printing text files. |
| `-P printer` | Specify the name of the printer used for output. If no printer is specified, the system's default printer is used. |
| `-r` | Delete files after printing. This would be useful for programs that produce temporary printer-output files. |

# `lp` – Print Files (System V Style)

- Like `lpr`, `lp` accepts either files or standard input for printing. It differs from `lpr` in that it supports a different (and slightly more sophisticated) option set.
- The table describes the common options.

| Option | Description |
|---|---|
| `-d` *`printer`* | Set the destination (printer) to *printer*. If no d option is specified, the system default printer is used. |
| `-n` *`number`* | Set the number of copies to *number*. |
| `-o landscape` | Set output to landscape orientation. |
| `-o fitplot` | Scale the file to fit the page. This is useful when printing images, such as JPEG files. |
| `-o scaling=`*`number`* | Scale file to *number*. The value of 100 fills the page. Values less than 100 are reduced, while values greater than 100 cause the file to be printed across multiple pages. |
| `-o cpi=`*`number`* | Set the output characters per inch to *number*. The default is 10. |
| `-o lpi=`*`number`* | Set the output lines per inch to *number*. The default is 6. |
| `-o page-bottom=`*`points`*<br>`-o page-left=`*`points`*<br>`-o page-right=`*`points`* | Set the page margins. Values are expressed in *points*, a unit of typographic measurement. There are 72 points to an inch. |
| `-o page-top=`*`points`* | |
| `-P` *`pages`* | Specify the list of pages. *pages* may be expressed as a comma-separated list and/or a range, for example, `1,3,5,7-10` |

- We’ll produce our directory listing again, this time printing 12 CPI and 8 LPI with a left margin of one half inch. Note that we have to adjust the pr options to account for the new page size:

```
[me@linuxbox ~]$ ls /usr/bin | pr -4 -w 90 -l 88 | lp -o page-left=36
-o cpi=12 -o lpi=8
```

- This pipeline produces a four-column listing using smaller type than the default. The increased number of characters per inch allows us to fit more columns on the page.

# Another Option: a2ps

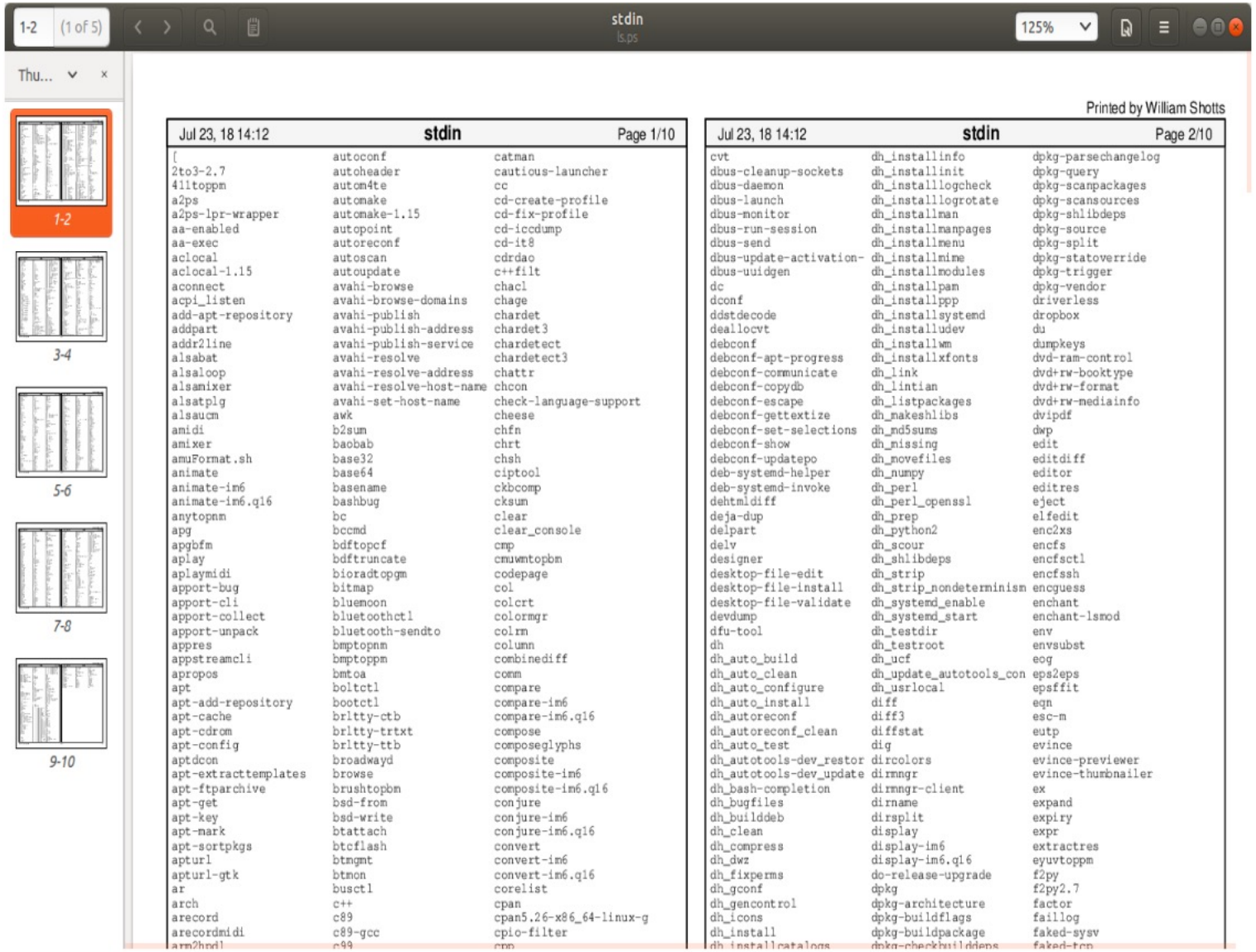
- The a2ps program (available in most repositories) is interesting. As we can surmise from its name, it's a format conversion program, but it also much more.
- Its name originally meant "ASCII to PostScript" and it was used to prepare text files for printing on PostScript printers. Over the years, however, the capabilities of the program have grown, and now its name means "Anything to PostScript."
- While its name suggests a format- conversion program, it is actually a printing program. It sends its default output to the system's default printer rather than standard output.
- The program's default behavior is that of a "pretty printer," meaning that it improves the appearance of output.
- We use the program to create a PostScript file on our desktop.

```
[me@linuxbox ~]$ ls /usr/bin | pr -3 -t | a2ps -o ~/Desktop/ls.ps -L
66
[stdin (plain): 11 pages on 6 sheets]
[Total: 11 pages on 6 sheets] saved into the file `/home/me/Desktop/
ls.ps'
```

- Here we filter the stream with pr, using the -t option (omit headers and footers), and then with a2ps, specifying an output file (-o option) and 66 lines per page (-L option) to match the output pagination of pr.
- If we view the resulting file with a suitable file viewer, we will see the output in the Figure.

# Viewing a2ps output

- As we can see, the default output layout is “two up” format. This causes the contents of two pages to be printed on each sheet of paper. a2ps applies nice page headers and footers, too.



- a2ps has a lot of options. The table provides a summary

| Option | Description |
|---|---|
| `--center-title=`*`text`* | Set center page title to *text*. |
| `--columns=`*`number`* | Arrange pages into *number* columns. The default is 2. |
| `--footer=`*`text`* | Set page footer to *text*. |
| `--guess` | Report the types of files given as arguments. Since `a2ps` tries to convert and format all types of data, this option can be useful for predicting what `a2ps` will do when given a particular file. |
| `--left-footer=`*`text`* | Set the left-page footer to *text*. |
| `--left-title=`*`text`* | Set the left-page title to *text*. |
| `--line-numbers=`*`interval`* | Number lines of output every *interval* lines. |
| `--list=defaults` | Display default settings. |
| `--pages=`*`range`* | Print pages in range. |
| `--right-footer=`*`text`* | Set the right-page footer to *text*. |
| `--right-title=`*`text`* | Set the right-page title to *text*. |
| `--rows=`*`number`* | Arrange pages into *number* rows. The default is 1. |
| `-B` | No page headers. |
| `-b` *`text`* | Set the page header to *text*. |
| `-f` *`size`* | Use *size* point font. |
| `-l` *`number`* | Set characters per line to *number*. This and the `-L` option (see next entry) can be used to make files paginated with other programs, such as `pr`, fit correctly on the page. |
| `-L` *`number`* | Set lines per page to *number*. |
| `-M` *`name`* | Use media *name*. For example, `A4`. |
| `-n` *`number`* | Output *number* copies of each page. |
| `-o` *`file`* | Send output to *file*. If *file* is specified as `-`, use standard output. |
| `-P` *`printer`* | Use *printer*. If a printer is not specified, the system default printer is used. |
| `-R` | Portrait orientation. |
| `-r` | Landscape orientation. |
| `-T` *`number`* | Set tab stops to every *number* characters. |
| `-u` *`text`* | Underlay (watermark) pages with *text*. |

# Monitoring and Controlling Print Jobs

- As Unix printing systems are designed to handle multiple print jobs from multiple users, CUPS is designed to do the same.
- Each printer is given a print queue, where jobs are parked until they can be spooled to the printer.
- CUPS supplies several command line programs that are used to manage printer status and print queues.
- Like the lpr and lp programs, these management programs are modeled after the corresponding programs from the Berkeley and System V printing systems.

# `lpstat` – Display Print System Status

- The lpstat program is useful for determining the names and availability of printers on the system. For example, if we had a system with both a physical printer (named “printer”) and a PDF virtual printer (named “PDF”), we could check their status like this:

```
[me@linuxbox ~]$ lpstat -a
PDF accepting requests since Mon 08 Dec 2024 03:05:59 PM EST
printer accepting requests since Tue 24 Feb 2025 08:43:22 AM EST
```

- Further, we could determine a more detailed description of the print system configuration this way:

```
[me@linuxbox ~]$ lpstat -s
system default destination: printer
device for PDF: cups-pdf:/
device for printer: ipp://print-server:631/printers/printer
```

- In this example, we see that “printer” is the system’s default printer and that it is a net- work printer using Internet Printing Protocol (ipp://) attached to a system named “print- server”.

# Common `lpstat` Options

| Option | Description |
|---|---|
| `-a [printer...]` | Display the state of the printer queue for *printer*. Note that this is the status of the printer queue's ability to accept jobs, not the status of the physical printers. If no printers are specified, all print queues are shown. |
| `-d` | Display the name of the system's default printer. |
| `-p [printer...]` | Display the status of the specified *printer*. If no printers are specified, all printers are shown. |
| `-r` | Display the status of the print server. |
| `-s` | Display a status summary. |
| `-t` | Display a complete status report. |

# `lpq` – Display Printer Queue Status

- To see the status of a printer queue, the lpq program is used. This allows us to view the status of the queue and the print jobs it contains. Here is an example of an empty queue for a system default printer named “printer”:

```
[me@linuxbox ~]$ lpq
printer is ready
no entries
```

- If we do not specify a printer (using the -P option), the system’s default printer is shown.
- If we send a job to the printer and then look at the queue, we will see it listed.

```
[me@linuxbox ~]$ ls *.txt | pr -3 | lp
request id is printer-603 (1 file(s))
[me@linuxbox ~]$ lpq
printer is ready and printing
Rank    Owner   Job     File(s)                         Total Size
active  me      603     (stdin)                         1024 bytes
```

# `lprm / cancel` – Cancel Print Jobs

- CUPS supplies two programs used to terminate print jobs and remove them from the print queue. One is Berkeley style (lprm) and the other is System V (cancel).
- They differ slightly in the options they support, but do basically the same thing. Using our earlier print job as an example, we could stop the job and remove it this way:

```
[me@linuxbox ~]$ cancel 603
[me@linuxbox ~]$ lpq
printer is ready
no entries
```

- Each command has options for removing all the jobs belonging to a particular user, particular printer, and multiple job numbers.