CSE 265: System and Network Administration

- Printing and print services
  - Printing policies and architecture
  - Printing terms
  - Types of printers
  - LPD, LPRng, CUPS
  - Adding a printer
  - Common printing software
Print services

• People depend on print services
  − for contracts
  − for proofreading
  − for quizzes
  − for reading long material that is less pleasant to read on-screen

• Print is a utility
  − It should *always* work
Where should printers be located?

- Some want a printer on their own computer
  - Very convenient, extremely expensive
- Some want to be able to print to any printer, no matter where it is
  - Flexible, able to borrow specialty printers as needed
- Finance people want to centralize everything
  - A single high-speed printer, single high-quality printer, and one color printer per building
- Others want to charge every expense
  - Regardless of how much is out there, those who use it, pay for it
Real world

• People need to be able to print to any printer they have permission to use

• Centralized printing services can save money
  – Ten people who might otherwise buy slow, low-quality personal printers for $250, without support contracts, can buy a single high-quality, fast shared printer with long-term maintenance
    • Plus the sysadmin only has to support one printer driver/printer rather than 10
Print architecture

• How centralized will printing be?
  – How many people will share a printer for general printing?
  – Who qualifies for a personal printer?
  – How will they be networked?
    • Networked printers require a central print-spool
      – Also provides access control
  – How will they be maintained?
  – How will they be paid for?
Print architecture (cont.)

- Who orders supplies and resupplies the printers?
  • Are the printers re-supplied when they are out (and users complain), or does someone visit them regularly?

- What kinds of printing technologies will be supported?
  • Postscript/PCL
  • Duplex printing
  • LPD over IP/NT's SMB/AppleTalk/USB or parallel, etc.

- How will the printers be named?
  • You don't want people printing to the wrong building or wrong country (!) by mistake
Print abuse

• How to handle printer abuse?
  – Use per-page chargeback scheme
  – Give people or departments a certain amount of “free” printing
  – Announce top-10 page generators
Print system architecture

- Peer-to-peer
  - All hosts spool jobs directly to the destination printer
  - Simplest, but all clients must know current printer IP/name
  - Cannot route around broken printers
  - Limited by printer spool memory

- Central funnel
  - Hosts send print jobs to a central server which distributes
  - Can convert formats
  - Can collect per-page billing
  - Can intelligently select printers
  - Single place for printer drivers
Printing terms

- spooler
- PDL
- bitmap
- RIP
- filters
- PostScript
Printing terms

- **spooler**
  - Daemon that receives print jobs, stores, prioritizes, and sends them sequentially to be printed

- **PDL**
  - Page Description Language, usually device and resolution independent
  - PostScript, PCL, PDF

- **bitmap**
  - JPEG, TIFF, GIF

- **RIP**
  - Raster image processor
  - Accepts PDL input, generates bitmap appropriate for a particular device

- **filters**
  - Modify print jobs on their way to a printer

- **PostScript**
  - Most common PDL – also a full programming language
Types of printers

- Classified by connection interface and type of data they understand
- Serial and parallel printers
  - USB faster and the default today for personal printers
- Network printers
  - Contain network interfaces
  - Accept jobs via one or more printing protocols
    - including via LPD, CIFS, IPP, HP JetDirect
- PostScript is well-supported under Linux/UNIX
  - Non-postscript printers require special software to convert to unique PDL (vendor supplied, or ghostscript)
LPD, LPRng, CUPS
Print Server Packages

- LPD is the old standard
  - Not found on current distributions

- LPRng
  - Designed for backwards compatibility with Berkeley and System V printing systems
  - Was common (default for Red Hat 7.3), but is now often replaced by...

- CUPS – Common UNIX Printing System
  - Standard on modern distributions (our focus)
client utility: lpr

- Invoked to submit a print job
  - typically use `-P printer` to choose which printer, default printer used when none is selected

  ```bash
  % lpr -Phowler-lw -#2 thesis.ps
  ```

- All apps use it (even things like enscript and Acrobat)

- Checks `/etc/printcap` for info about printer

- Under LPD it creates two files in `/var/spool/lpd/printername`
  - One is a control file with handling info (like username)
  - Second is data file

- Then tells lpd about file
lpq and lprm

- **lpq -P** *printer*
  - Examines the queue of jobs waiting to be printed on the particular printer
  - Shows the job id as well as owner, filename, size

- **lprm** *jobid*
  - Deletes one or more jobs, erasing the stored data files
  - Can delete with job id, or by username
  - Typically must be on machine where job was generated and must be same user (or root)

- Both work across a network (most of the time)
lpc/lpadmin: make admin changes

• Can be used to
   Enable or disable queuing for a printer
   Enable or disable printing on a printer
   Remove all jobs from a printer queue
   Move a job to the top of a printer's queue
   Start, stop, or restart the lpd daemon
   Get printer status information

• lpadmin much more powerful
Filters

• Filters are typically shell scripts that run on spooled data before sending to the printer

• Can
  – Fix various non-printing sequences
  – Write out accounting records
  – Convert to printer-supported PDL
  – Add banner pages
CUPS

- Common UNIX Printing System
  - Latest rewrite of the printing system
- Also supports secure printing (SSL, etc.)
- Implements IPP: Internet Printing Protocol (HTTP-based)
- Supports load-balancing across a class of printers
- Supports automatic network configuration
- Standard in most Linux distributions
Adding a printer in CUPS

- From command line:
  - `lpadmin -p fezmo -E -v socket://192.168.0.12 -m laserjet.ppd`
  - `lpadmin -p groucho -E -v parallel:/dev/lp0 -m pxlcolor.ppd`
- From browser: [http://localhost:631/admin](http://localhost:631/admin)
- From Red Hat/Fedora
  - Command line: `system-config-printer`
  - GUI: System->Administration->Printing
CUPS Administration

- Provides a Web-based interface for administration
HP Web Interface, Protocols
Other common printing software

- ghostscript
  - Free PostScript interpreter to view PS files onscreen
  - Also used to drive raster devices (cheap printers) by rendering the PS in the format needed
  - Powers front-ends like gv, ggv, KGhostView

- mpage
  - Re-formats text or PostScript to have multiple logical pages per physical page

- enscript
  - Similar to mpage, also has nice page headers
Viewing print files

• Ghostscript
  – Front-ends like gv, ggv, KghostView
• Acrobat reader
• evince
• xpdf
• display (ImageMagick)
Resources

  - Successor to linux-printing.org
- http://www.cups.org/
  - And if CUPS is installed, http://localhost:631/
- http://www.lprng.com/