Where should printers be located?

- Some want a printer on their own desk
  - Very convenient but 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 (most cost-effective)
- Others want to charge every expense
  - Regardless of how much is out there, those who use it, pay for it

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

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 $50-150, 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 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

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 provide access control
  - Can collect per-page billing
  - Can intelligently select printers
  - Single place for printer drivers

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?
    - Network printers can benefit from a central print-spool
  - How will they be maintained?
  - How will they be paid for?

Printing terms

- spooler
- PDL
- bitmap
- RIP
- filters
- PostScript

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/PDF
  - Duplex printing
  - Laser vs. InkJet
  - LPD over IP vs. SMB, 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

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 ages ago (default for Red Hat 7.3), but is now replaced by...
- CUPS – Common UNIX Printing System
  - Standard on modern distributions (our focus)
  - Now owned and maintained by Apple

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, PNG
- 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

client utility: lpr

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

  % lpr -Phowler-lw -#2 thesis.ps
- 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 the print daemon about file

Types of printers

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

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 a printer-supported PDL
  - Add banner pages

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)

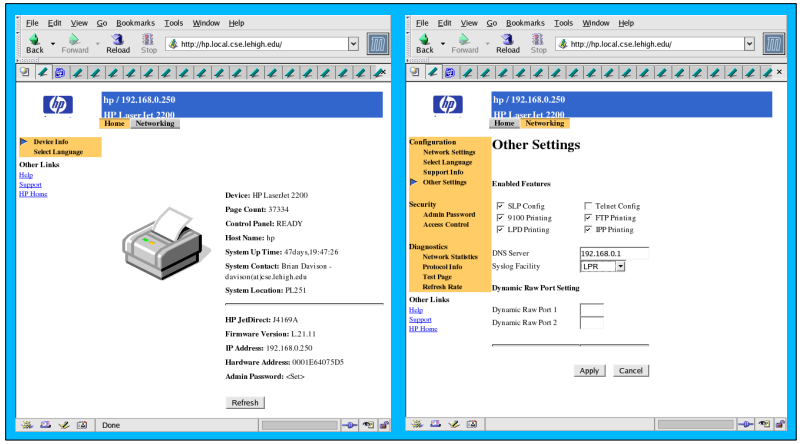
CUPS

- 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

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

HP Web Interface, Protocols



Adding a printer in CUPS

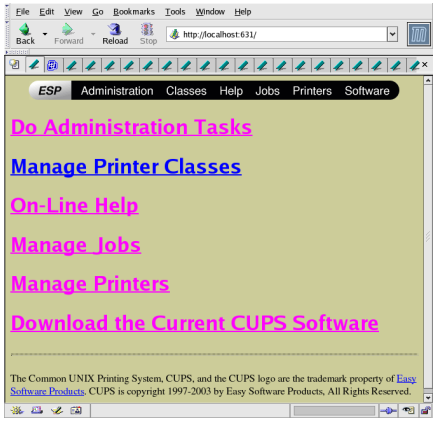
- From command line:
  - lpadmin -p fezmo -E -v socket://192.168.0.12 -m laserjet.ppd
  - lpadmin -p groucho -E -v parallel:/dev/lp0 -m pxlcolor.ppd
- From browser: http://localhost:631/admin
  - Even works on Macs!
- From Red Hat/CentOS
  - Command line: system-config-printer
  - GUI: System->Administration->Printing

Other common printing-related 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 postscript-viewing front-ends
- enscript (and the older mpage)
  - Re-formats text or PostScript to have multiple logical pages per physical page
  - Also has nice page headers, many options (installed on sunlab machines)

CUPS Administration

- Provides a Web-based interface for administration
  - http://localhost:631/



Viewing print files

- Acrobat reader (acroread)
- evince
- display (ImageMagick)
- Ghostscript
  - Front-ends like gv, ggv, KghostView

Resources

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