

# CSE 265: System and Network Administration

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



# Print services

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- 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?

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- 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



# Real world

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- 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 architecture

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- 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?

# Print architecture (cont.)

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- 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

# Print system architecture

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## - 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

# Printing terms

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



# Printing terms

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- 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

# Types of printers

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- 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)

# LPD, LPRng, CUPS

## Print Server Packages

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- 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

# client utility: lpr

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- Invoked to submit a print job
  - typically use *-Pprinter* 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

# lpq and lprm

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## - 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

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- 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

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- 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

# CUPS

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- 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



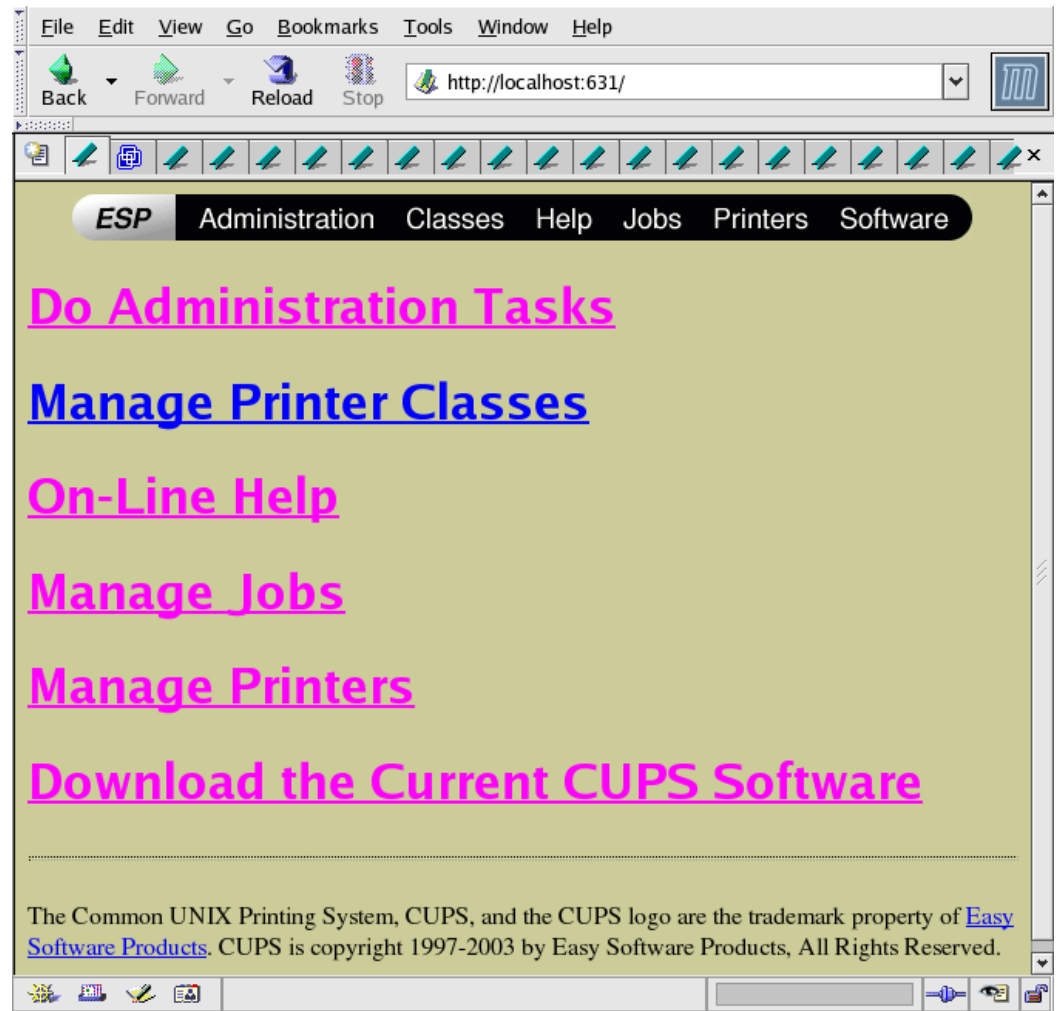
# Adding a printer in CUPS

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- 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

# CUPS Administration

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



# HP Web Interface, Protocols

The image displays two screenshots of the HP LaserJet 2200 web interface, accessed via a browser at <http://hp.local.cse.lehigh.edu/>.

**Left Screenshot: Device Information**

- hp / 192.168.0.250
- HP LaserJet 2200
- Home Networking
- Device Info Select Language
- Other Links: [Help](#), [Support](#), [HP Home](#)
- Device: HP LaserJet 2200
- Page Count: 37334
- Control Panel: READY
- Host Name: hp
- System Up Time: 47days,19:47:26
- System Contact: Brian Davison - davison(at)cse.lehigh.edu
- System Location: PL251
- HP JetDirect: J4169A
- Firmware Version: L.21.11
- IP Address: 192.168.0.250
- Hardware Address: 0001E64075D5
- Admin Password: <Set>
- Refresh

**Right Screenshot: Other Settings**

- hp / 192.168.0.250
- HP LaserJet 2200
- Home Networking
- Configuration: Network Settings, Select Language, Support Info, Other Settings
- Security: Admin Password, Access Control
- Diagnostics: Network Statistics, Protocol Info, Test Page, Refresh Rate
- Other Links: [Help](#), [Support](#), [HP Home](#)
- Enabled Features:
  - SLP Config
  - 9100 Printing
  - LPD Printing
  - Telnet Config
  - FTP Printing
  - IPP Printing
- DNS Server: 192.168.0.1
- Syslog Facility: LPR
- Dynamic Raw Port Setting:
  - Dynamic Raw Port 1: [ ]
  - Dynamic Raw Port 2: [ ]
- Apply Cancel

# Other common printing-related software

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- 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)

# Viewing print files

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

# Resources

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