SESSION 9 – PRINTER MANAGEMENT

Course Writer: Dr. Ed. Danso Ansong, Dept of Computer Sc.
Contact Information: edansong@ug.edu.gh

UNIVERSITY OF GHANA
College of Education
School of Continuing and Distance Education

- This session will introduce students to printer and printing services.

The key topics to be covered in the session are as follows:

- Printing Terminology
- Printing Concepts
- Print Server requirements
- Printer configuration and
- Print requirements

- Refer to the following reading material which is available on Sakai

RECOMMENDED TEXT

- Unix And Linux System Administration Handbook, 5th [Chapter 12], Essential of Systems Administration 3rd Edition

Chapter Objectives

At the end of the session, the student will be able to:

- Understand printing terminology and concepts
- Understand print server requirements
- Perform print configurations

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Printing

- Printers
  - Managing printing can be quickly summarized in the words of Calvin (of Calvin and Hobbes):

EWWWWWW, YUCK, GROSS!

Printing

- Printing Overview (in a perfect world)
  - User creates file, wants to print it.
  - User calls system utility (lp, lpr, print) to print out the file.
  - The utility sends the print job to a print spooler.
  - The print spooler sends the job to the printer.
- Things rarely work this easily!

Printing

- Printers
  - Local Vs Remote vs Network printers
    - A local printer is one which is connected to “this” system.
      - Most local printers are connected to a serial port (RS/232, USB, or Firewire) or a parallel port.
      - The local system needs to know the capabilities of the printer, and which port the printer is connected to.
      - If this system is a print spooler it also has to know what other systems/users are allowed to send jobs to the printer.
    - A remote printer is a printer connected to “some other” system.
      - The local system needs to know what system the printer is on, how to send the print job to the other system, and the name of the remote printer.

Printing

- Printers
  - A network printer is a printer connected to the network, but not necessarily associated with any system.
    - Network printers include their own spooler, so all systems on the network could print directly to the printer.
      - This can cause interesting problems.
      - Usually have to load vendor drivers on every system.
      - New manufacturers often get this part wrong!

Printing

- Printer Setup (BSD)
  - All printing processes are controlled by the lpd daemon, and the lpr program.
    - Lpr accepts input to be printed and places it in a spool directory.
      - Lpr selects where to store the print job, based on the name of the printer the user wants to send the job to. The print spool area is in **/var/spool**
      - Lpr creates two files in the spool directory for each job. These files are named cfXXX and dfXXX where xxx is the print job number.
      - The control file (**cfXXX)** contains reference and handling information for this print job.

Printing

- Printer Setup (BSD)
  - The data file (dfXXX) contains the information to be printed.
  - Once lpr places files in the spool directory, it notifies lpd that it needs to wake up and print the job.
  - Lpd “finds” the entry in the spool directory and looks up the printer in the **/etc/printcap** database.
    - » The **/etc/printcap** file contains an entry for each printer the system has access to.
    - » The printcap file specifies the printer capabilities, which machine is the print spooler for the printer, the names/locations of any filters to be used for this printer, and line discipline information for this printer.

Printing

- Printer Setup (BSD)
  - If printcap says the printer is local, lpd checks to see if a daemon is running for that printer (or starts a daemon if none is present).
  - Once lpd knows the printer capabilities, and that this machine is the spooler, lpd creates a series of pipes between the spool file and the printer device driver.
    - » If a filter program is specified for this printer, lpd places connections to this filter between the print spool area and the printer.
  - The (filtered) data is sent to the printer by the device driver.

Printing

- Printer Setup (BSD)
  - If printcap says the printer is a network printer, or a remote printer,
    - » lpd opens a connection to the remote machine's lpd, and transfers the data and control files to the remote machine.
    - » lpd then deletes the local copies of these files.

Printing

```
lj254-grayscale:\
        :sh:\
        :ml=0:\
        :mx=0:\
        :sd=/var/spool/lpd/lj254-grayscale:\
        :af=/var/spool/lpd/lj254-grayscale/lj254-grayscale.acct:\
        :lp=|/usr/share/printconf/util/jetdirectprint:\
        :lpd_bounce=true:\
        :if=/usr/share/printconf/util/mf_wrapper:
 lj254-color:\
        :sh:\
        :ml=0:\
        :mx=0:\
        :sd=/var/spool/lpd/lj254-color:\
        :af=/var/spool/lpd/lj254-color/lj254-color.acct:\
        :lp=|/usr/share/printconf/util/jetdirectprint:\
        :lpd_bounce=true:\
        :if=/usr/share/printconf/util/mf_wrapper:
```

Printing

- Printer and Print Job Management (BSD)
  - The **lpq** command allows the users to view a list of entries in the print queue. **lpq -P name** views the entries for printer referred to as **name.**
  - The **lprm** command allows a user to remove (their own) jobs from the print queue.
  - The **lpc** command allows the administrator to manage the lpr/lpd environment.
    - NOTE: lpc has the distinction of winning the "**flakiest program of the year**" award five times in 15 years! Lpc has not been improved (thereby getting it off the honors list), instead other programs have been released which are even flakier!

Printing

- Printer and Print Job Management (BSD)
  - lpc allows the administrator to:
    - **enable** or **disable** queuing for a printer.
    - enable (**start**) or disable (**stop**) printing on a printer. The **abort** command is a harsh version of stop (current job is not completed).
    - Declare the printer **down** or **up** (these commands affect both spooling and printing).
    - Remove all jobs from a printers queue (**clean**).
    - Move a job to the top of the printers queue (**topq**).
    - Manipulate lpd (**restart**).
    - Get printer status information (**status**).

Printing

- System V Printing Overview
  - User wants to print file and invokes the lp utility.
  - lp takes the input and places in the appropriate spool directory.
  - lpsched determines when and where the file should be printed.
  - lpsched launches a filter to format the output and send it to the printer.
  - So far it looks just like lpr, right?
    - The similarities end here!

Printing

- Printer Setup (System V)
  - All of the print commands are different between BSD and System V! To name a few:
    - To print a file, use **lp -d printer** instead of lpr -P printer
    - To remove a print job, use **cancel** instead of lprm
    - To obtain print job status, use **lpstat** instead of lpq
  - In order to remain consistently inconsistent, Sun created lpr, lpc, and lpq programs under Solaris. These programs are actually wrapper programs which call the appropriate System V commands and pass the data off to the lp system.

Printing

- Printer Setup (System V)
  - System V printer software defines destinations and classes of printers.
    - A destination is (usually) a particular printer.
      - » A destination could also be a plain file that you want to append text to.
      - » Because lp uses exclusive locks on the printer “device” , this capability allows several users to append text to a file without concurrent access problems.
    - A class of printers is a group of destinations.
      - » If you had two printers in a room, you could set them up as a class, and lp would print jobs to both printers (the first free printer gets the next job).

Printing

- System V Printing
  - **lp** is the user-level print command.
  - lp (sometimes) copies (and sometimes links) the data to the spool directory files (**/var/spool/lp/request/dest**).
  - Spool files are labeled xxxn where xxx varies depending on the OS. **n** is the print job number.
  - lpsched takes the files in the spool directories and sends them to the appropriate device.

Printing

- Printer and Print Job Management (System V)
  - System V UNIX uses the **lpadmin** command to setup and administer printers.
  - lpadmin is used to add/remove, start/stop, enable/disable printers much like lpc did in the BSD model.
    - Most System V systems want lpsched stopped before lpadmin commands will work.
    - As usual, Solaris had to be different. Solaris wants lpsched running before lpadmin commands will work.

Printing

- Printer Setup (System V)
  - lpadmin comes complete with a bag full of options:
    - **-d dest (make this the default printer)**
    - **-x dest (remove printer dest)**
    - **-p printer (tells lpadmin which printer to work with)**
    - **-v device (append output for *printer* to *file*)**
    - **-i interface (interface program for printer)**
    - **-c class (add printer to class)**
    - **-r class (remove class)**
    - **-h (printer is hardwired)**
    - **-l (printer is login terminal)**
    - **-e dest (copy interface for printer to dest)**
    - **-m model (copy model for printer to dest)**

Printing

- Printer and Print Job Management (System V)
  - Once you add a printer with lpadmin, you have to tell the system to **accept** requests, and **enable** printing for that printer.
  - Solaris also requires you to set the type of input that can be sent to a printer (any, simple, postscript, ...).
    - This information is used to allow or deny printing based on the value of the magic number for the data file.
    - Programs like Mentor that define their own file types cause problems with this model.
    - You have to write a filter program to convert the “odd” files into a known/allowed file type in order to print them!

Printing

```
#!/bin/csh -f
lpsystem -t bsd -y "OIT print server" print.helios.nd.edu
lpsystem -t s5 -y "CSE print server”  babbage.cse.nd.edu
lpadmin -p lp -s print.helios.nd.edu\!cse326
lpadmin -p lw384 -s print.helios.nd.edu\!cse384
lpadmin -p lj323 -s print.helios.nd.edu\!cse323
lpadmin -p eng_lab6 -s print.helios.nd.edu
lpadmin -p eng_lab7 -s print.helios.nd.edu
lpadmin -p eng_color1 -s print.helios.nd.edu

foreach printer (lp eng_lab6 eng_lab7 eng_color1 lj323 lw384 )
    lpadmin -p $printer -T unknown -I simple,postscript
    enable $printer
    accept $printer
end
lpadmin -d lp
```

Printing

- Printer and Print Job Management (System V)
  - System V printing software is a suite of programs to accomplish what BSD does with 3 programs:
    - **cance**l - remove a print job
    - **accept/reject** - tell system to accept/reject spooling jobs for printer.
    - **enable/disable** - tell the system to allow/reject printing on this printer. Job is still spooled, just not printed.
    - **lpmove** - move job to another printer.
    - **lpstat** - get status of print job(s)

Printing

lpstat comes with a bag full of options:

-a [list]	Reports which print destinations are accepting request
-c [list]	Report status of all classes and their members.
-d	Report status of the system default destination.
-f [list] [-l]	Verify [list] the forms recognized by LP print service.
-o [list]	Report status of output requests.
-p [list] [-D] [-l]	Report status of printers [description] [capabilities].
-P	Report paper types.
-r	Report the status of the LP request scheduler.
-R	Report the position of each job in the print queue.
-s	Report a status summary.
-S [list] [-l]	Verify the character sets / print wheels.
-t	Report all status information.
-u [login-ID-list]	Report status of output requests for users.
-v [list]	Report printer names and devices.

Printing

- Printing Problems and Solutions
  - The two basic print problems are:
    - No Output:
      - **Check the obvious:**
        - **Is the printer on?**
        - **Does the printer have paper, ribbon, toner?**
        - **Is the printer paper jammed?**
        - **Will other jobs print?**
      - **Check the lp user database.**
      - **Determine if the print spooler can talk to the printer.**
      - **Check the printer log files for clues.**

Printing

- Printing Problems and Solutions
  - Incorrect Output:
    - Check the printcap file (or lpadmin) to see if the printer type is correct.
    - Make sure the line discipline matches the printer settings.
    - Look at the filter files and see that they do what you think they are doing.
    - Check the data file for odd character sequences.

Printing

- Printing Problems and Solutions
  - Many times printing problems are due to software failures. These failures fall into two general categories:
    - System software failure.
      - lpd/lpsched has crashed/burned.
        - » Use the appropriate commands to stop the lp system, then restart the lp system and see if the problem disappears.
        - » If stop/restart does not work, try removing the first entry in the queue to see if lpd/lpsched work. If so, the problem is in the data file.

Printing

- Printing Problems and Solutions
  - Data file problems.
    - Look for odd character sequences in the file.
    - Try printing the file to another printer (same model if possible).
    - Check filter program operation.
    - Check job types allowed on the printer.

Printing

- Windows
  - Windows also knows about local and remote printers.
    - Local printers are almost always connected to a parallel port.
    - Local printers are added with the Printer Control Panel (Add Printer Wizard).
    - You will probably need the OS media to install print drivers.
    - Remote printers are handled similarly to the UNIX remote printers, but they require more setup:
      - Use the Add Printer Wizard
      - Add a printer port (defines remote spooler type)
      - Add the printer like it was a local printer.
      - If print server is a UNIX host, FIX the setup!

Printing

- Windows
  - Windows/DOS wants to send printer control codes to the printer. These codes are part of the language the printer uses to speak to the PC.
    - Unix does not like these control codes!
  - On NT/Win2k systems (Win 95/98 have no TCP print driver):
    - Go to the Document Defaults for the printer.
    - Select the Advanced options.
    - Select the Postscript Options.
    - Set the system so that it does NOT send control codes.
    - Set the system so that it does NOT send control-D after each print job.

Summary

- Configuring and managing printers should be easy.
  - Unfortunately, printer setup and management is not as easy as it should be.
  - The lack of standards makes this task a problem for system administrators.
  - Homogeneous printing is the simplest case.
  - Heterogeneous printing is the most problematic.
- System administrators should understand how to:
  - Configure print services under Windows, BSD and System V.
  - Troubleshoot printing problems.
  - Configure filters and advanced printing options.

- Unix And Linux System Administration Handbook, 5th Edition By Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin. Released September 2017. Publisher(s): Addison-Wesley Professional. ISBN: 9780134278308
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