



# **Session 5540**

## **Linux Printing**

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25 July 2001

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# How do I print in Linux for System/390?



- Linux does not yet have any drivers for channel-attached printers
- You could always write one
  - Linux is Open Source
  - Simply write the device driver and drop it into the kernel; how hard can that be?
- However, it's easier to just tell Linux you have a remote printer and let something else drive it

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# Printing in Linux



- Direct-connected printers often connect to `/dev/lpX` via a device driver
  - In the PC world, typically a parallel port
  - The port is usually not used raw but exported to applications via the `lpr/lpd` facility
- Two different methods of remote printing
  - `lpr/lpd` within Unix world
  - Samba within Windows world

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# Traditional Unix Printing



- lpd is a service daemon
  - Runs on TCP port 515
  - Accepts print jobs from the network
- lpr is the client
  - Accepts print jobs from user
  - Submits them to lpd on the network
  - Controlled by /etc/printcap
- RFC 1179; not all implementations really follow RFC

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# Unix Printing



- PostScript printers are generally assumed
  - In the absence of other information, spooled print data is assumed by Linux to be PostScript
- /etc/printcap controls lpd as well as lpr
- /etc/hosts.lpd defines host access to a particular machine's print subsystem
  - hosts.equiv works too, but is more dangerous

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# lpd on the mainframe



- VM/ESA's TCP/IP contains LPSERVE, which acts as an lp daemon
  - This is the older interface and probably shouldn't be used if you can use RSCS instead
- RSCS allows you to define an LPD-type-link
  - Preferred way of using lp under VM/ESA or z/VM
- Z/OS Network Print Facility can speak LPD too
  - JES or VTAM can access LPD functionality

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# S/390 Examples



- I'm going to use z/VM or VM/ESA for my examples
  - If you're running Linux, it's likely you have some version of VM in the picture
  - I'm more familiar with it than with z/OS
  - All of this should work exactly the same if you can get lpd running under z/OS and pointed at your Linux LPAR

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# Configuring /etc/printcap



- /etc/printcap contains queue name, spool file locations, and input and output filters
- A simple network printer entry might be

```
lp:\  
:rm=printer.barfoo.cx:\  
:rp=lp:\  
:sd=/var/spool/lp:\  
:lf=/var/spool/lp/lp-errs:
```

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# Scenario I: Printing from Linux



- With the `/etc/printcap` from the last slide, our default printer (“lp”) became the PostScript printer named `printer.barfoo.cx`
- To print on it, we just do

`lpr filename`

which is the same as

`lpr -Plp filename`

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## Scenario II: VM/ESA, S/390 printer



- We have a printer controlled by our System/390, which is running VM/ESA
- We have a Linux guest under VM/ESA that wishes to print to that printer
- We will set up lpd on the VM/ESA side to accept jobs from our Linux guest and print them on its locally-attached printer

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# Linux preparation



- VM/ESA's TCP/IP stack is at `vm.barfoo.cx`
- We will call the printer "lp" under Linux
- `/etc/printcap:`

```
lp:\  
:rm=vm.barfoo.cx:\  
:rp=SYSTEM:\  
:sd=/var/spool/lp:\  
:lf=/var/spool/lp/lp-errs:
```

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# VM/ESA Preparation



- Use RSCS LPD-type-link, not TCP/IP LPSERVE
- Add FILEDEFS to GLOBAL LOADLIB in PROFILE GCS
- The RSCS documentation explains this pretty thoroughly
- Add your appropriate LINKDEFINES and their corresponding PARMs to RSCS CONFIG
- Then START your links

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# Network-attached printers



- The mainframe side of things can speak lpr in addition to lpd, so mainframe users can act as print clients
- So we can configure lpr-type links to point at any host and printer that can do lpr/lpd printing
- And we can use this, plus Linux, to print to printers otherwise unsupported in a mainframe environment
- Linux simply presents all the printers it knows about as PostScript devices

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# Printing to non-PS printers



- Linux distributions come with a great utility called “ghostscript”
- Ghostscript translates PostScript into other printer definition languages
- This is where we use the input and output filter fields in `/etc/printcap`
  - Use the `:if=` directive to run ghostscript to change its input to something the printer understands

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# Ghostscript Print Devices



- All kinds of stuff is supported
  - LaserJet models
  - Common laser and inkjet printers
  - Several fax resolutions
  - Dot-matrix printers (Proprinter, Imagewriter)
  - JPEG/PDF/raster graphic formats

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# Non-PostScript printers



- You can do this all manually by directly giving Ghostscript command-line parameters
  - Set :if= to something like
    - `gs -dNOPAUSE -slaserjet -sOutputFile=- -r300`
- Or you can just use `apsfilter` (or `magicfilter`), which figures it out for you and creates the appropriate `printcap` entries on your behalf

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# Ghostscript and afilter



- With afilter, it gets really easy: you say, “I have a LaserJet 4 on /dev/lp0”, and it builds the appropriate /etc/printcap entries for you
- Ghostscript and afilter both work on S/390—but ghostscript is slow on pre-G5 machines
- If possible, offload your ghostscript filtering to someplace (like x86) where cycles are cheap

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# Scenario III: z/VM to network-attached HP LaserJet



- Set up z/VM lpd links as before
- Set up z/VM lpr links pointing to Linux guest
  - LINKDEFINES in RSCS CONFIG
  - HOST parameter in LPRXFORM CONFIG
  - PRINTER defines Linux print queue: let's call it pcl
- As far as z/VM knows, it's simply printing on printer "pcl" on the Linux machine

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# Linux setup for LaserJet



- Printer is named `ljet.printers.barfoo.cx`
- It is a LaserJet 5 that can do 600 dpi
- We will print to the “raw” queue
- `/etc/printcap` needs an entry like

```
pcl:\  
:rm=ljet.printers.barfoo.cx:\  
:rp=raw:\  
:if=/var/lib/apsfilter/bin/ljet-5-letter-auto-mono-600:
```

- `apsfilter` will set up `printcap` for us

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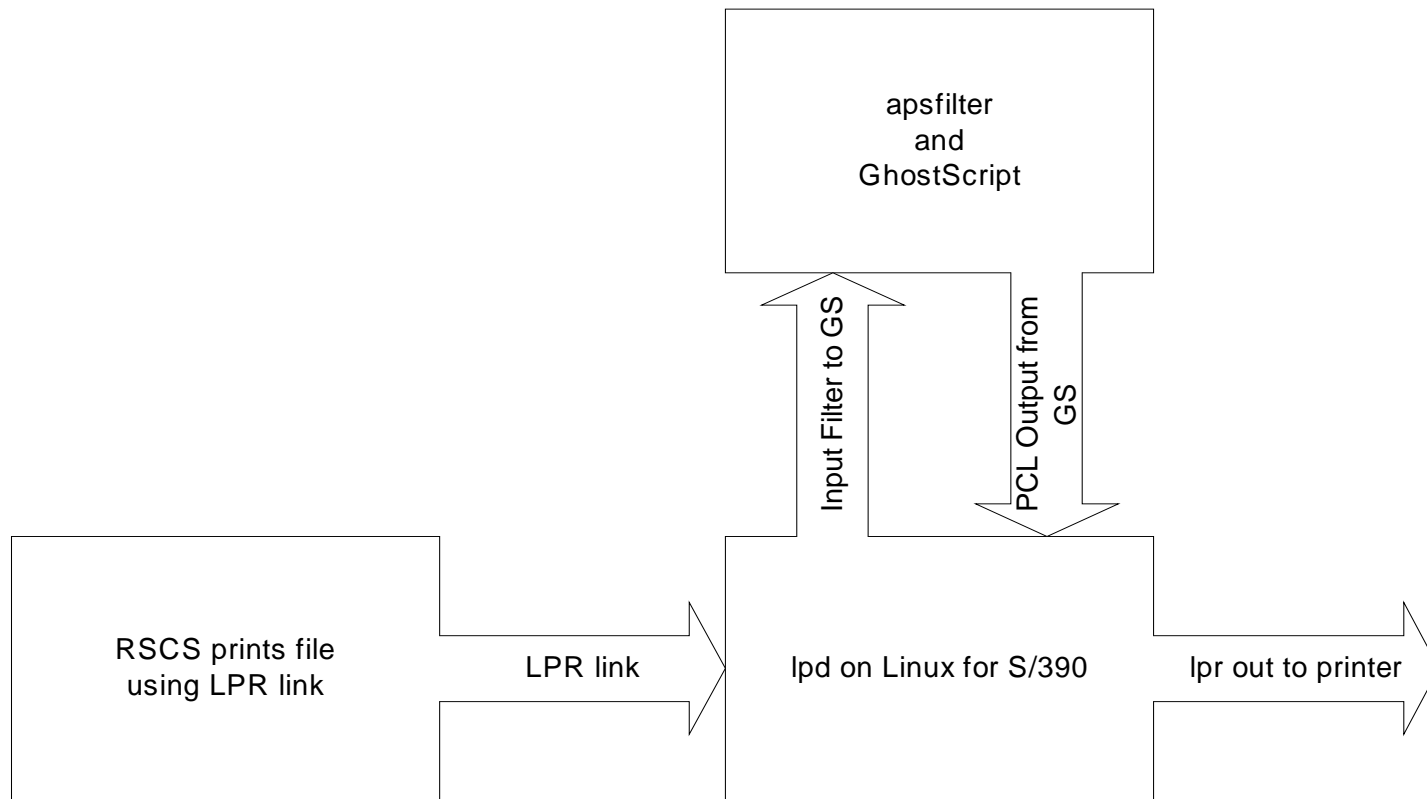
# Putting it all together



- CMS user prints PostScript file using RSCS (PPD EXEC); let RSCS handle carriage control
  - Continuous forms get tricky in page-oriented world
- RSCS uses LPR link to Linux lpd with “pcl” queue
- lpd consults /etc/printcap and runs its input filter, which hands file to apsfiler, which invokes ghostscript
- Ghostscript sends PCL back to Linux lpd
- PCL is sent over network to printer’s “raw” queue

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# Putting it all together



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# But what about Windows?



- So far, we have neglected a whole class of printing solutions
- Plenty of Windows machines whose users would like to print to big network-attached printers
- Plenty of machines out there with Windows-shared printers

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# Samba



- Samba provides SMB (Server Message Block) networking (Windows Networking)
- Open Source
- Has been built on all sorts of systems
- Standard with Linux distributions
- Controlled from `/etc/smb.conf`

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# Adding printers in Samba



- Add a [printers] section in smb.conf
  - path = /var/spool/public
  - printable = yes
- Add to [global] in smb.conf
  - printing = bsd
  - printcap name = /etc/printcap
  - load printers = yes
- All printers in /etc/printcap will appear

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# Samba



- If we did that and started Samba, then...
- With *no further modification* Windows clients could print to our mainframe-attached printer in Scenario II
- With *no further modification* Windows clients could use our LaserJet as a PostScript printer in Scenario III
- Samba is also used for file sharing: see Rick Troth's Session 5547, Monday at 1:30

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# Printing to Windows Printers



- You can use the “smbprint” script as an input filter in /etc/printcap
  - It lurks in /usr/share/doc/packages/samba/examples/printing/smbprint on SuSE—make it an executable in \$PATH
- Recent apsfilters will let you simply set up a Windows remote printer
  - It’s probably integrated into your system configuration tool as well; it certainly is for SuSE

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# Samba 2.2



- Samba 2.2 contains direct support for NT printing via MS-RPC rather than the LAN Manager printing interface
- Upload/download drivers on demand
- NT ACLs on printers
- Details are in the Samba 2.2 HOWTO
  - I haven't implemented this myself, yet

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# Scenario IV: z/VM to Windows



- We want to let our CMS users print to Windows-managed, shared printers
- This is exactly the same as Scenario III
  - Except that we define a remote Samba printer to our Linux guest
  - Then we point our LPR link at the Linux queue that represents the Samba printer

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# Capabilities



- We can now implement a lot of the capabilities of something like Macro 4 for free
- By using a Linux machine as our printing hub, we can print from any platform to nearly any printer
- Linux is Linux
  - Our Linux printing hub could be Linux/390 in a virtual machine
  - Or it could be a standalone x86 box

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# Capabilities



- Moving beyond paper
  - With Ghostscript and a2ps acting as translators, we can “print” all kinds of things:
    - Faxes
    - PDF file output
    - Various formats of graphical file output
- And if you’re really ambitious, netatalk will let you network AppleTalk printers into the mix too

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# Conclusion



- The combination of Linux, lpr/lpd, ghostscript, and apsfiler make a tremendously powerful printing solution
- With apsfiler and integrated system tools (like YaST or Linuxconf) setup is made pretty easy
- And on top of all that, it's all free and Open Source!

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