TNE30019/TNE80014 – Unix for Telecommunications

Printing Basics – Windows and Unix

Dr. Jason But

Swinburne University

Outline

Printing

- Printing has always been difficult
- Unix always had different approach to printing than Windows

Modern printing concepts: Modularisation

- Software prints to generic printer interface
- Printer drivers convert to printer-specific format
- OS sends final document to printer

Print Servers

- Jobs need to be queued – even for local printer
- Print **spooler** queues jobs and sends them to printer
- Printer services jobs one at a time

Windows Network Printing

Printing APIs

- **GUI API** allows programs to display to screen
- **GDI API** allows programs to draw to special – virtual – device that implements Graphics Device Interface (GDI)
- Open XML Paper Specification (OpenXPS or XPS) is page description language and document format

Windows Printing Paths

- GDI printing path in pre-Vista Windows until Windows 8
- XPS printing path since Windows Vista

Windows GDI Printing

1. Application calls GDI
2. GDI call printer driver to get printer specific information
3. GDI renders print job in Enhanced Metafile (EMF) or Page Description Language (PDL) and sends it to local spooler
4. Local spooler hands document to printer driver or forwards it to remote spooler, which hands document to printer driver
5. Driver renders document in printer specific format
6. Driver sends document to printer via USB, network, ...

Windows XPS Printing

1. Application sends XPS to local spooler
2. Local spooler hands document to printer driver or forwards it to remote spooler, which hands document to printer driver
3. Driver renders document in printer specific format
4. Driver sends document to printer via USB, network, ...

Printer Drivers

- Postscript printers require PostScript[a] format
- HP LaserJet printers (non-PostScript) require PCL[b] format
- Other formats specific to printer brand and model

[a] `http://www.adobe.com/products/postscript`
[b] `http://www.hp.com` – Printer Command Language (PCL)

Windows Printing Summary

What gets sent over the network?

- Send EMF/PDL to remote PC to convert to printer format and print
- Send XPS format to remote PC to print

Pros/cons of network printing under Windows

- Printer drivers installed everywhere
- But this allows WYSIWYG printing
- Higher bandwidth requirements with GDI

Unix Network Printing (Traditional)

Unix only talks to PostScript printers

- Applications must print **to** PostScript document
- Send document to spooler – Line Printer Daemon (LPD)
- LPD sends document to local printer or remote LPD, which sends document to printer

Most documents are not PostScript

- Use Ghostscript (`http://www.ghostscript.com`)
- FreeBSD port: `/usr/ports/print/ghostscript6`
- Something-to-PostScript converter
- PostScript rasteriser (vector to pixels)
- Can send to printer directly (multiple types)
- Commonly used as backend by other applications

Unix Network Printing (Modern)

Common Unix Printing System (CUPS)

- CUPS[a] implements print server using Internet Printing Protocol (IPP) Protocol
- Clients send jobs to CUPS server over network
- Modular and extensible system
- FreeBSD port: `/usr/ports/print/cups`

[a] `http://www.cups.org`

CUPS Server

- Manages access restrictions
- Manages queue of print jobs
- Converts/renders print jobs into printer format
- Uses OS to send rendered document to printer
- Applications need only generate **any** format CUPS can print

Unix Network Printing

Pros/cons of Unix network printing

- No common application user interface to printer
- But CUPS enabled applications provide common interface and also allow controlling printer options
- Don't need printer driver on clients (but need PPD files)
- No real WYSIWYG printing
- (High bandwidth requirements with traditional approach)