

Introduction to Printing from z/OS

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Course Syllabus

- “A fine mess you’ve gotten us into”
 - A very brief history of digital printing
- What’s in a print file
- Where does print come from?
- Why is all this important to me?
- z/OS as a Big Print Server
- The Life of a Print Job
- What a Systems Programmer needs to know
- How do I find out more?

Classes of Print

- Casual printing
 - An email, some pages of a PDF, a web page...
 - To a desktop printer
- Commercial Print
 - Books, magazines, junk mail, catalogs, flyers...
- **Production Print**
 - Business documents, statements, checks, reports...(landfill)
 - Most of the printing we do from z/OS, what we're going to discuss here today

History of Printing from Mainframes

- In the beginning, every computer was a mainframe
 - From the first, it was necessary to show the results of computation
 - Electro-mechanical printers were first made for accounting machines like the IBM 407
 - Impact printers – mechanical or solenoid hammer, inked ribbon and moveable die with character shapes
 - Later printers were also impact printers
 - Dot-matrix print head
 - Connected by coaxial cable using SNA/SCS or serial / parallel ports
 - High-speed impact using print train or chain
 - Channel attached
 - First laser printers
 - From IBM – 3800 continuous-form, 1976
 - From Xerox – 9700 cut-sheet, 1977
 - Required mainframe computers to drive

History of Printing from Mainframes

- Advanced Function Printing
 - Introduced in 1984
 - First architected print file format
 - Can format line data into full-page documents with images, graphics, fonts
 - In 2004 IBM released the AFP standard to an industry consortium, which developed the new color management architecture (afpcolor.org)
 - Used today for most high-speed business transaction printing
- Network-attached printers
 - Connected to workstation (PCs, Unix/Linux)
 - Or later by TCP/IP
 - Low-cost desktop laser printers from Canon, HP, and Apple introduced around 1992
 - Postscript printers such as the Apple Laserwriter often had more powerful processors than the computers that used them
 - Today's high-speed color printers (900 pages per minute and up) still require high bandwidth and multiple processors

What's in a print file?

- Most common on System z:
 - Line data
 - lines of text, usually with 1 or 2 control bytes
 - AFP (alias MO:DCA) (IBM / AFP Consortium)
 - structured fields (binary datastream) with text, graphics, images, fonts and control structures
 - LCDS & Metacode (Xerox)
 - Lines of text with text based (not binary) control commands
 - Metacode is binary controls with text, image and graphics
- Sometimes used on z:
 - Postscript, PDF (Adobe)
 - Graphic data programming language and its descendant
 - PCL (HP)
 - Escape sequences and text

Where does print come from on z?

- Batch jobs
 - Production runs, sometime tens to hundreds of thousands of pages, gigabyte-sized files
- Transaction printing
 - Usually less than a hundred pages
 - From CICS / IMS or other VTAM applications
 - Originally intended for coax-attached printers
 - LU1 (SCS)
 - LU3 (3270)
- From another system
 - z/OS / VM / VSE
 - NJE, with print attributes
 - Windows
 - SMB, IPP or LPR
 - Unix
 - LPR

Where does print come from on z?

- Most formatted print files are created by Document Composition Systems
 - Usually have a document designer
 - Typically runs on Windows for graphical placement of page and document elements
 - Creates some print resources, includes others
 - Fonts, images, graphics
 - And a print formatter or generator program
 - May run on multiple platforms, including z/OS
 - Uses the designer template to read data from a file or database and create a print file
 - May be able to generate multiple print languages
 - Usually additional functions such as indexing or web presentment
 - Exstream Dialog, FIS Custom Statement Formatter, GMC PrintNet, ISIS Papyrus, Group1 DOC1...

Where does print come from on z?

- Still many user-written programs that make print files
 - Application programs, often in COBOL
 - May use print APIs, home-grown generator code, or external formatter
 - Like PPFA for AFP or AFP Toolbox or Xerox JDL compiler
 - WYSIWYG tools like Elixir DesignPro Tools or ISIS Papyrus Designer
- Wide variety of print file transforms
 - Typically from or to AFP, PDF, PostScript, PCL
 - Often part of a print distribution system like VPS or Infoprint Server
- And print we don't print
 - Print is often printed and archived, or just archived
 - Retrieve documents for reprint, customer service, or legal requirements

Why Is All This Important?

- The things we print
 - Internal reports
 - Your users need them to manage the business
 - Production print
 - Prints and mails the bills that your customers pay so your paycheck won't bounce!
- "Mission critical" print: bills, invoices, checks, legal documents needed to keep the business operating
 - Produced to deadlines: missing a schedule costs \$\$\$
 - High cost of mailing
 - Web presentment for some customers
 - Mail cost reduction for others
 - Postal sortation, Weight calculations
- Profit centered printing
 - Sell white space on customer documents for advertisements

z/OS As A Big Print Server

- Printer Drivers for AFP (IPDS)
 - High-volume
 - Production print
 - Automated recovery
 - Mission-critical print requires guaranteed printing of each page and no duplicates (how many copies of that check do you want?)
 - Connected channel (ESCON or Fibre) or, mostly, TCP/IP
 - Common print server software
 - IBM PSF, Océ SPS, LRS VPS/IPDS
- Non-AFP printing connected over TCP/IP or coax
 - IBM Infoprint Server
 - LRS VPS
 - MacKinney JES Queue for Printers
 - CA Spool

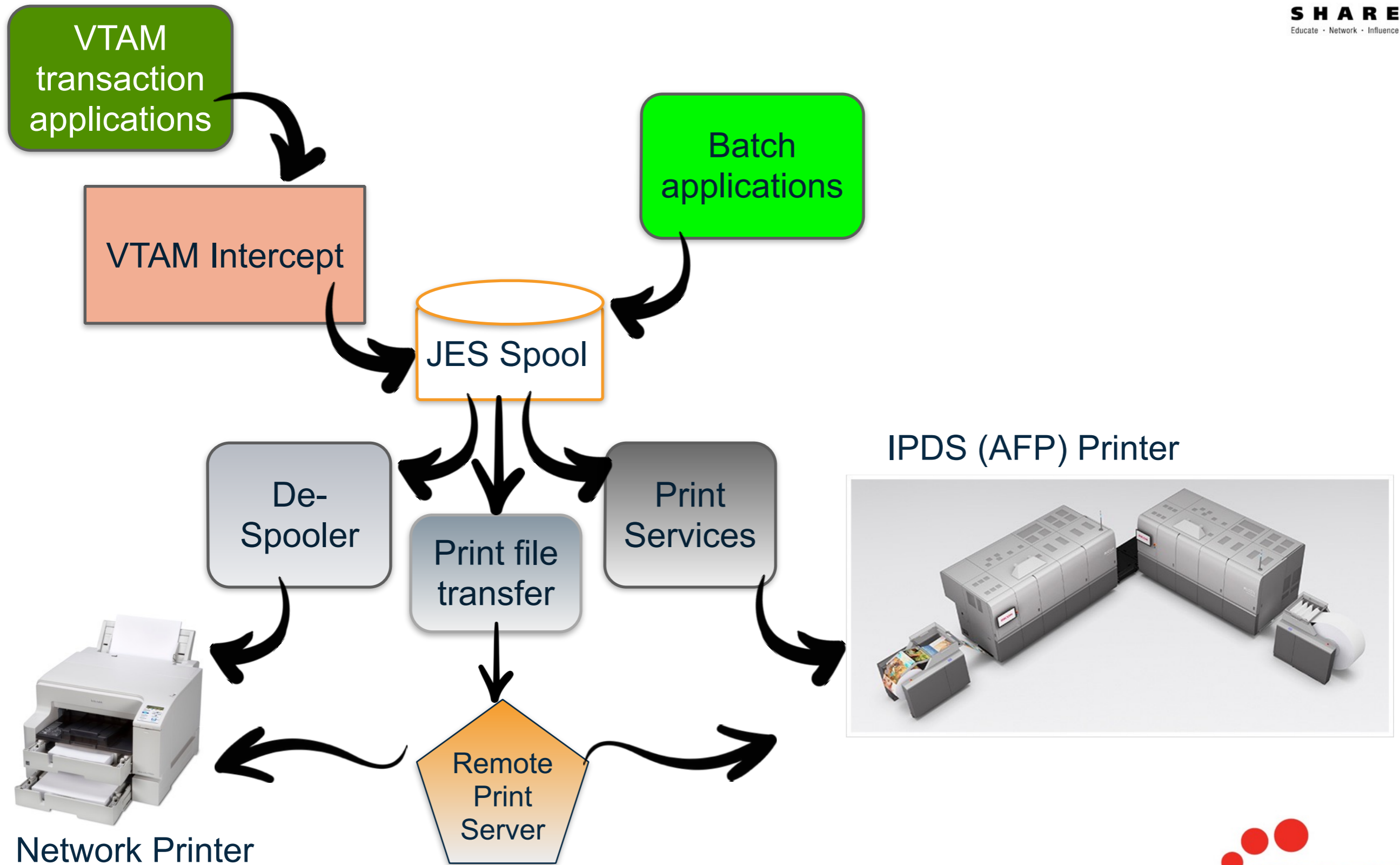
The Life of a Print Job

- Most production transaction print is created on System z
 - Even if it isn't printed there
 - In most cases, print is sent to the JES spool from
 - Batch jobs
 - VTAM virtual printer
 - From another system
- JES schedules the job to print
 - Based on work selection
 - Sends it to a print driver
 - Process SYSOUT (PSO) writer or older channel-attached printers
- After the file is printed:
 - Normally, if there are no print errors, the job is purged
 - Print servers usually re-queue failed jobs

The Life of a Print Job

- JES functional subsystem
 - Intelligent print driver such as PSF or SPS
 - Converts and manages output and printers
 - Print file transfer programs from JES to remote server
 - Download for z/OS, AFP Download Plus, PRISMAproduction Host ROUTER
- Print file is taken from the spool by a de-spooler
 - For printers not managed by JES
 - Email, ftp server...
 - Usually use JES SAPI (SYSOUT API) to select jobs
 - VPS, Infoprint Server
 - Remote print servers
 - Ricoh, LRS, Oce, Pitney-Bowes and others have print servers that run on workstation platforms

Getting the Print to the Printer



What A Systems Programmer Needs To Know

- JES
 - How it works
 - How output is scheduled and managed
 - Operator commands
 - How to configure it
 - How to manage it
 - What it **doesn't** do
 - Format print
 - Drive most modern printers
 - JES only knows how to talk to channel-attached and NJE printers
 - Doesn't directly speak to TCP/IP-attached printers
 - Knows little or nothing about AFP/IPDS, Xerox, PostScript™/PDF/PCL

What A Systems Programmer Needs To Know



- Something about your printers
 - Basic print formatting education
 - Enough to know the basics of what you use
 - Printer characteristics
 - » How they connect
 - » What Page Description Languages they speak
 - » How to administer them
 - AFP (MO:DCA)
 - Xerox LCDS/metacode
 - PCL/postscript/PDF remote printing

What a Systems Programmer needs to know

- Communications
 - Most modern printers driven over TCP/IP
 - Older remote printers are SNA
 - Your shop probably plans to migrate to TCP/IP
- Your print software: configuration and management
 - Resource libraries
 - Online management tools
 - Console / SDSF or equivalent
 - Infoprint central, VMCF
 - Printer web page
- Extra credit
 - Many companies expect the systems programmer to also manage resources or even do print formatting
 - Learn your company's printing strategy and direction
 - Know where you fit
 - Defend yourself

When It Doesn't Print, Who Are They Gonna Call?



- Print operations
- Help desk
- Who will help the help desk?
 - You...

How Do I Find Out More?

- Product manuals
 - People put a lot of time and effort into producing good manuals—use them!
AFP Consortium: <http://afpcinc.org/afp-publications/>
 - IBM Pubs: http://www-01.ibm.com/support/knowledgecenter/#!/SSLTBW_2.1.0/com.ibm.zos.v2r1.aps/aps.htm?cp=SSLTBW_2.1.0%2F20
- Vendor support
 - Most hardware and software vendors have extensive support organizations
- Online forums
 - MVS main
 - afp-l mailing list <https://www.listserv.uga.edu/cgi-bin/wa?A0=AFP-L>
- Share
 - For z-based print software
- Xplor
 - For printing technology: <http://xplor.org>
 - Print operations management

As Mulder observed, “We are not alone...”

Questions?



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