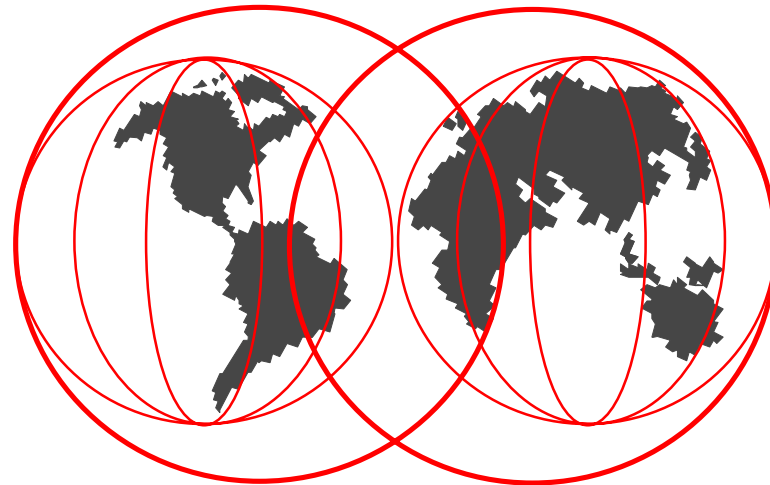


# Implementing an Enterprise Print Server Using VM/ESA and TCP/IP

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# Credits

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- The information contained in this presentation was developed as a result of a residency at the ITSO Poughkeepsie in the summer of 1999 which resulted the IBM Redbook, *TCP/IP Solutions for VM/ESA*, SG24-5459-00
- Special thanks to the following people for their assistance:
  - ▶ Les Geer, Alan Altmark, Romney White, Mary Sue Record - VM Development
  - ▶ Erich Amrehn, Roy Costa, Mike Schwartz - ITSO Poughkeepsie

# Topics

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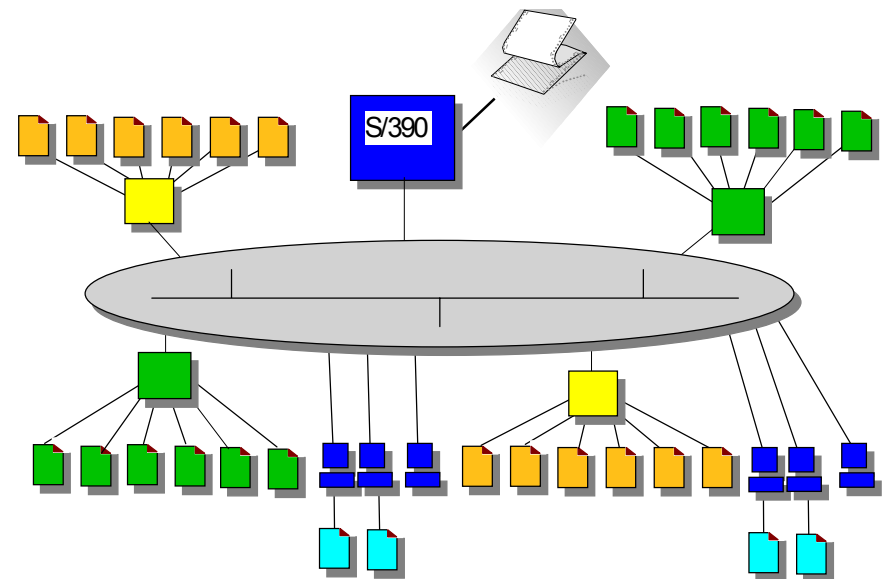


- Print server consolidation
- Concepts
- Configuring Windows
- Configuring TCP/IP for VM/ESA
- Configuring RSCS
- Printing from VM/ESA
- Printing from Windows
- Conclusions and action plan

# VM/ESA print server before consolidation



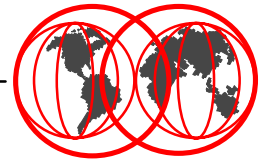
- Multiple network print servers managing network printers
- PC workstations with attached printers
- Individually managed print servers
- Additional printing capacity requires more printers and servers
- High speed printers only available to S/390 applications
- PC to/from S/390 printing requires file transfer



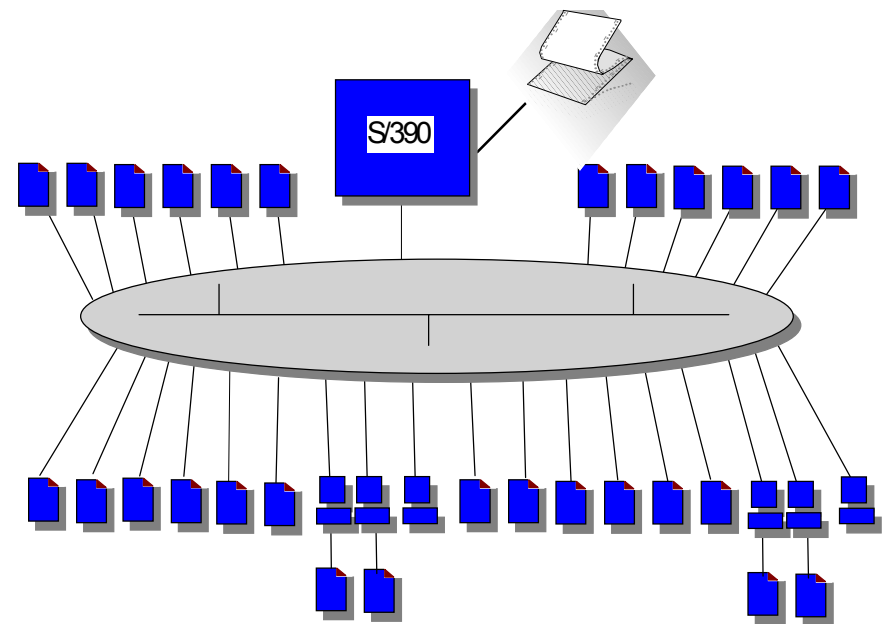
Print server consolidation

ITSO

# VM/ESA print server after consolidation



- Network print servers eliminated
- Queue management function is provided by VM/ESA
- Print queues reside on large, reliable S/390 attached disk
- Any TCP/IP LPR client can print to any printer
- All printers managed centrally



# Enterprise printing for VM/ESA

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- CMS users can print to any IP printer
  - ▶ Printing via domain name or IP address
  - ▶ Postscript printing via the LPR or PPS command
- Host creation of Postscript files using the Document Composition Facility (DCF, aka SCRIPT)
- Workstation users can print to any desired printer using the VM system as the print server
  - ▶ Host attached printers
  - ▶ IP printers
- Single point of management for any and all printers:
  - ▶ Mainframe line printers
  - ▶ High capacity quality printers
  - ▶ LAN printers
  - ▶ Workstation attached printers
- IBM Redbook *TCP/IP Solutions for VM/ESA*, SG24-5459

# Concepts

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- Configuration of both TCP/IP and RSCS required
  - ▶ Use RSCS LPD not TCP/IP LPSERVE function
- LPD serves workstation print requests
  - ▶ Local printers on VM/ESA
  - ▶ Remote printers through RSCS
  - ▶ TCP/IP printers
  - ▶ PSF printers
- VM/ESA print requests
  - ▶ LPR synchronous direct to the LPD which controls the printer
  - ▶ LPR asynchronous through RSCS
  - ▶ PPS asynchronous through RSCS
- TCP/IP printers are not dedicated to VM/ESA
- Dedicated links in RSCS or pool of links



# Required documentation



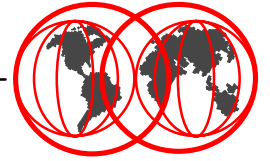
| Title   | Source   |
|---|--|
| VM RSCS Planning and Installation, SH24-5219-03                               | <a href="http://www.vm.ibm.com/pubs/pdf/">http://www.vm.ibm.com/pubs/pdf/</a><br>Hardcopy also available                                     |
| VM RSCS Operation and Use, SH24-5220-03                                       | <a href="http://www.vm.ibm.com/pubs/pdf/">http://www.vm.ibm.com/pubs/pdf/</a><br>Softcopy ONLY   |
| VM RSCS Exit Customization, SH24-5222-03                                      | <a href="http://www.vm.ibm.com/pubs/pdf/">http://www.vm.ibm.com/pubs/pdf/</a><br>Softcopy ONLY   |
| VM RSCS Program Directory, Gl10-4655-02                                       | <a href="http://www.vm.ibm.com/pubs/pdf/">http://www.vm.ibm.com/pubs/pdf/</a><br>Hardcopy also available                                     |
| PCL5e/PostScript Technical Reference,<br>S544-5344-03                         | <a href="http://www.printers.ibm.com/R5PSC.NSF/Web/nprefm/">http://www.printers.ibm.com/R5PSC.NSF/Web/nprefm/</a><br>Hardcopy also available |
| PostScript Language Reference, by Adobe Systems,<br>Inc. ISBN 0-201-37922-8   | Adobe Systems, Inc.<br>May be available in some book stores  |
| Technical Reference Bundle, by Hewlett-Packard,<br>Inc. part number 5021-0377 | Hewlett-Packard, Inc.  |

A short reference to PCL Commands, Basic Page Formatting, and Font Selection is available on the Hewlett-Packard Web site at:

<http://www.interactive.hp.com/cgi-bin/cspt/ljxxxx/dyndocwrap.pl?lid=general&fid=bpl02705>

# Configuring Windows to receive print from VM/ESA

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- Windows 95/98 does not include an LPD
- Windows NT 4 LPD "TCP/IP Print Server" less than robust
  - ▶ If used, printer queues must be renamed to conform to LPD rules
- 3rd party LPD server recommended, many available
  - ▶ We used NIPrint from Network Instruments, Inc. during residency
  - ▶ Maps selected installed printers to a printer name for use with LPR

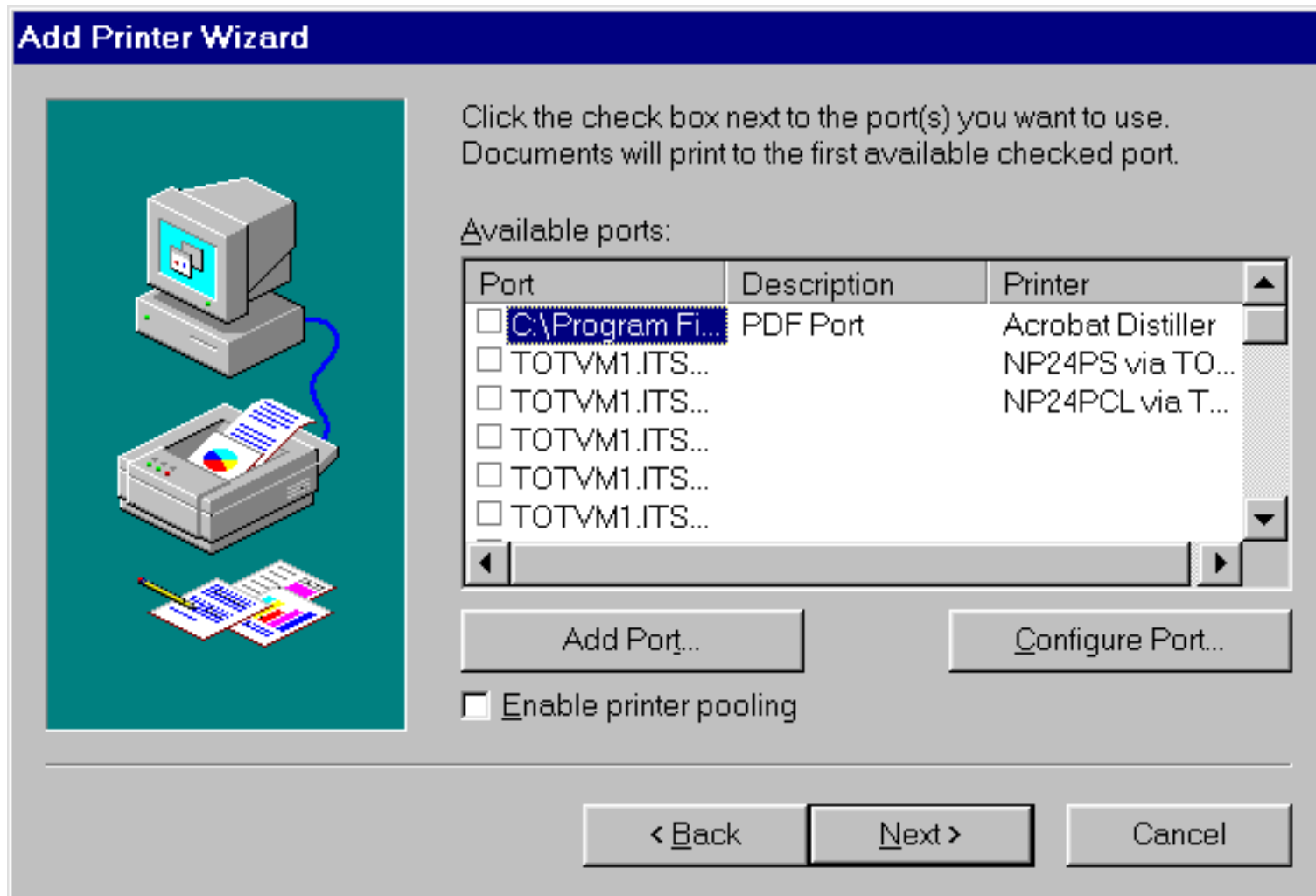
# Configuring Windows NT 4 as a print client

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- Windows NT 4 includes a LPR port monitor
- Provides for seamless Windows NT network printing
- Port monitor configured using the Add Printer Wizard
- LPR command also provided in Windows NT 4

# Configuring Windows NT 4 as a print client ...



- Using the Add Printer Wizard on the port selection menu, click "Add Port...", then select "LPR Port" and click "New Port..."

# Configuring Windows NT 4 as a print client ...



**Add LPR compatible printer**

Name or address of server providing lpd:

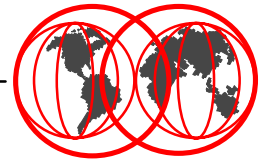
Name of printer or print queue on that server:

OK  
Cancel  
Help

- Enter the name or address of the VM/ESA system providing the LPD server and the printer queue name as defined in LPDXMANY CONFIG

# Configuring Windows 95/98 as a print client

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- The IBM LPR Remote Printing Client utility provides a TCP/IP print monitor port driver for seamless Windows 95/98 network printing
- This package also includes a command line LPR, RFC 1179, executable program for printing jobs directly from DOS
- Available ***at no charge*** from the IBM Printing Systems web site for use with IBM Network Printers and IBM InfoPrint printers
- ACITS LPR Remote Printing Windows 95/98 and NT 4.0 available from the University of Texas at Austin for non-IBM printers for a charge
- Other 3rd party LPR port monitors or clients available

# Configuring TCP/IP for VM/ESA

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- Changes required to PROFILE TCPIP on TCPMAINT's 198
  - ▶ Comment out LPSERVE in the AUTOLOG section

```
 ; LPSERVE      PASSWORD      ; LP Server
```
  - ▶ Comment out LPSERVE and add RSCS in the PORT section

```
 ; 515      TCP LPSERVE      ; LP Server
515      TCP RSCS      ; LP Server
```
- Install the latest RSU to get any fixes for LPR
- Install the PTF for APAR PQ29745 to correct a problem with the LPR command not uppercasing the FORM, PREFIX and SUFFIX data

# Configuring RSCS

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- Install the latest RSU to get any fixes for LPR and LPD
  - ▶ Must be at RSU 9803 or higher
- Install PTF UV60455 for APAR VM62277 to correct several problems in LPR printing discovered during the residency
- Change RSCS's PROFILE GCS on P684096K's 401  
GLOBAL LOADLIB RSCS RSCSEXIT



# RSCSDNS Server

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- RSCSDNS provide an interface to the domain name server for use by LPR links in RSCS
- Should be pre-defined if installing VM/ESA 2.4.0
- If running VM/ESA 2.3.0 or earlier, RSCSDNS userid must be defined and a PROFILE EXEC created

```
/* RSCSDNS PROFILE EXEC */
'ACCESS 403 B' /* access GETHOSTC MODULE */
'ACCESS 592 C' /* access TCPMAINT disk */
'GLOBAL LOADLIB SCEERUN' /* LE runtime library */
'GETHOSTC' /* invoke DNS interface */
```



- RSCSDNS userid definition

```
USER RSCSDNS XXXXXXXX 8M 16M G
  IPL CMS PARM AUTOOCR
  MACHINE ESA
  OPTION SVMSTAT LANG AMENG
  XAUTOLOG GCS
  CONSOLE 001F 3215 T OPERATOR
  SPOOL 000C 2540 READER A
  SPOOL 000D 2540 PUNCH A
  SPOOL 000E 1403 A
  LINK P684096K 0403 0403 RR
  LINK MAINT 0190 0190 RR
  LINK MAINT 019E 019E RR
  LINK TCPMAINT 0592 0592 RR
  MDISK 0191 3390 2798 001 240RES MR
```

# Setting up LPD in RSCS

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- Add to RSCS's PROFILE GCS on P684096K's 401  
`FILEDEF LPD DISK LPDXMANY CONFIG`
- Define LPD-type links in RSCS CONFIG (same disk)  
`LINKDEFINE LPD1 TYPE LPD`  
`LINKDEFINE LPD2 TYPE LPD`  
`PARAM LPD1 EXIT=LPDXMANY EP='C=LPDXMANY' TIMEOUT=300`  
`PARAM LPD2 EXIT=LPDXMANY EP='C=LPDXMANY' TIMEOUT=300`
- Multiple LPD links should be defined so that workstation users can always connect
- Increase timeout to allow for network response time problems
- Add to RSCS's PROFILE GCS after 'RSCS INIT' to start LPDs  
`START LPD1`  
`START LPD2`

# Setting up LPD in RSCS ...

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- Copy LPDXMANY CONFSAMP from P684096K's 406 to 401 as LPDXMANY CONFIG
- This file can be quite confusing to set up, check the Redbook for more information
- Define a DEFAULT entry for the most common configuration of printer in your installation
- Define additional entries for every other printer OR pool of printers in your installation, i.e. every print queue

# Setting up LPR in RSCS

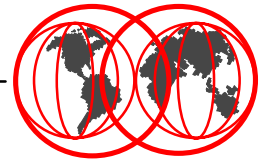
---



- Add to RSCS's PROFILE GCS on P684096K's 401  
`FILEDEF LPR DISK LPR CONFIG`  
`FILEDEF LPRP DISK LPRP CONFIG`  
`FILEDEF LPRXFORM DISK LPRXFORM CONFIG`
- Define the LPRXFORM exit in RSCS CONFIG (same disk)  
`EXIT 0 ON LPRXFM00`  
`EXIT 1 ON LPRXFM01`
- Create an LPRXFORM CONFIG (same disk)

# Setting up LPR in RSCS ...

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## ● LPRXFORM CONFIG (partial)

```
FORM=HP890C
HOSTNAME=TOT48.ITSO.IBM.COM
PRINTER=HP890C
SEP=YES
PREFIX=1B45
PREFIX=1B28733050
PREFIX=1B2873313248
PREFIX=FF04
PREFIX=1B45
SUFFIX=1B45
*
FORM=NPPS
FORMSUB=P+ASCII
SEP=YES
PREFIX=252150532D41646F62650D0A
PREFIX=7374617475736469637420626567696E2066616C7365207365746475706C
PREFIX=65786D6F646520322073657470617065727472617920656E640D0A
PREFIX=FF04
PREFIX=252150532D41646F62650D0A
PREFIX=7374617475736469637420626567696E2074727565207365746475706C65
PREFIX=786D6F646520332073657470617065727472617920656E640D0A
```

# Setting up LPR in RSCS ...



## ● LPRXFORM CONFIG (partial)

```
FORM=NP
SEP=YES
PREFIX=252150532D41646F62650D0A
PREFIX=7374617475736469637420626567696E2066616C7365207365746475706C
PREFIX=65786D6F646520322073657470617065727472617920656E640D0A
PREFIX=FF04
PREFIX=252150532D41646F62650D0A
PREFIX=7374617475736469637420626567696E2074727565207365746475706C65
PREFIX=786D6F646520332073657470617065727472617920656E640D0A
*
FORM=STANDARD
SEP=YES
PREFIX=252150532D41646F62650D0A
PREFIX=7374617475736469637420626567696E2066616C7365207365746475706C
PREFIX=65786D6F646520322073657470617065727472617920656E640D0A
PREFIX=FF04
PREFIX=252150532D41646F62650D0A
PREFIX=7374617475736469637420626567696E2074727565207365746475706C65
PREFIX=786D6F646520332073657470617065727472617920656E640D0A
```

# Setting up LPR in RSCS ...

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- Define the LPR-type links in RSCS CONFIG (same disk)
- Definition for a pool of IBM Network Printer 24s

```
LINKDEFINE NP24PSA TYPE LPR FORM * AST
LINKDEFINE NP24PSB TYPE LPR FORM * AST
LINKDEFINE NP24PSC TYPE LPR FORM * AST
PARAM NP24PSA EXIT=LPRXPSE ITO=0 US=Y SYS=Y EP='S=Y EH=N
        C=LPRP' HOST=9.12.2.5 PR=PASS
PARAM NP24PSB EXIT=LPRXPSE ITO=0 US=Y SYS=Y EP='S=Y EH=N
        C=LPRP' HOST=9.12.2.6 PR=PASS
PARAM NP24PSC EXIT=LPRXPSE ITO=0 US=Y SYS=Y EP='S=Y EH=N
        C=LPRP' HOST=9.12.2.8 PR=PASS
ROUTE GROUP NP24PS TO LINK NP24PSA NP24PSB NP24PSC
```



# Setting up LPR in RSCS



- Generic printers are mapped to real printers via LPRXFORM
- Generic PostScript printer definitions

```
LINKDEFINE LPRP1 TYPE LPR FORM * AST
...
LINKDEFINE LPRP8 TYPE LPR FORM * AST
PARAM LPRP1 EXIT=LPRXPSE ITO=0 US=Y SYS=Y EP='S=Y EH=N C=LPRP'
...
PARAM LPRP8 EXIT=LPRXPSE ITO=0 US=Y SYS=Y EP='S=Y EH=N C=LPRP'
ROUTE GROUP LPRP TO LINK LPRP1 ... LPRP8
```

- Generic non-PostScript printer definitions

```
LINKDEFINE LPR1 TYPE LPR FORM * AST
...
LINKDEFINE LPR8 TYPE LPR FORM * AST
PARAM LPR1 EXIT=LPRXONE ITO=0 US=Y SYS=Y EP='S=Y FF=N C=LPR'
...
PARAM LPR8 EXIT=LPRXONE ITO=0 US=Y SYS=Y EP='S=Y FF=N C=LPR'
ROUTE GROUP LPR TO LINK LPR1 ... LPR8
```

# Setting up LPR in RSCS ...

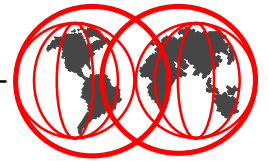


- EXECs in Redbook to transform EBCDIC to ASCII HEX
- PCL prefix and suffix strings defined in LPRXFORM

```
FORM=HP890C
HOSTNAME=TOT48.ITSO.IBM.COM
PRINTER=HP890C
SEP=YES
PREFIX=1B45
PREFIX=1B28733050
PREFIX=1B2873313248
PREFIX=FF04
PREFIX=1B45
SUFFIX=1B45
```

| Hex value    | ASCII value          | Description         |
|--------------|----------------------|---------------------|
| 1B45         | <sup>esc</sup> E     | Reset               |
| 1B28733050   | <sup>esc</sup> (s0P  | Monospace font      |
| 1B2873313248 | <sup>esc</sup> (s12H | Pitch 12 CPI        |
| FF04         |                      | Separator placement |

# Setting up LPR in RSCS ...



## ● PostScript prefix and suffix strings defined in LPRXFORM

```
FORM=NPPS
FORMSUB=P+ASCII
SEP=YES
PREFIX=252150532D41646F62650D0A
PREFIX=7374617475736469637420626567696E2066616C7365207365746475706C
PREFIX=65786D6F646520322073657470617065727472617920656E640D0A
PREFIX=FF04
PREFIX=252150532D41646F62650D0A
PREFIX=7374617475736469637420626567696E2074727565207365746475706C65
PREFIX=786D6F646520332073657470617065727472617920656E640D0A
```

| Hex value  | ASCII value   | Description              |
|--|---|--------------------------|
| 252150532D41646F62650D0A   | %!PS-Adobe <sup>CRLF</sup>  | PostScript header        |
| 7374617475736469637420626567696E2066616C7365207365746475706C65786D6F646520302073657470617065727472617920656E640D0A | statusdict begin false<br>setduplexmode 0<br>setpapertray end <sup>CRLF</sup> | Paper tray 0, duplex off |
| 7374617475736469637420626567696E2074727565207365746475706C65786D6F646520312073657470617065727472617920656E640D0A   | statusdict begin true<br>setduplexmode 1<br>setpapertray end <sup>CRLF</sup>  | Paper tray 1, duplex on  |
| FF04   |   | Separator placement      |

# Printing from VM/ESA

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- LPRSET, LPR and PPS commands utilized
- LPRSET used to set defaults for LPR

```
lprset (perm asynch rscs np24ps,totvm1
Ready; T=0.03/0.04 11:32:10
lprset (query
Printer and host values have not been defined
Server is defined as: RSCS (Default)
Printer is connected on link: NP24PS
Printer is connected on node: TOTVM1
LPR mode: ASYNCHRONOUS
Ready; T=0.03/0.03 11:32:12
```

# Printing to a PostScript printer

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- **Printing an EBCDIC file to our Network Printer pool**

```
PPS filename filetype (PRINTER NP24PS FORM NP
PPS filename filetype (PRINTER NP24PS
LPR filename filetype (RSCS NP24PS,TOTVM1 FORM NP
LPR filename filetype (RSCS NP24PS,TOTVM1
LPR filename filetype
```

- **Printing a PostScript file to our Network Printer pool**

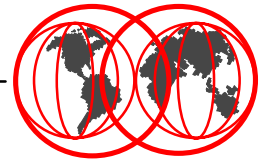
```
PPS filename filetype (PRINTER NP24PS FORM NPPS
LPR filename filetype (RSCS ASCII,NP24PS FORM NPPS
LPR filename filetype (RSCS NP24PS,TOTVM1 FORM NPPS
LPR filename filetype (FORM NPPS
```

- **PostScript file created by DCF (Script), uploaded from a workstation, or created by a utility program**

- **It is NOT possible to print an ASCII (including PCL) file using the PostScript printer exit (LPRXPSE)**

# Printing to a non-PostScript printer

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- Can print non-Postscript ASCII (including PCL) and EBCDIC through LPRXONE exit
- Use LPR command (not PPS)
- To print an EBCDIC file on our HP890C  
`LPR filename filetype (FORM HP890C`
- To print an ASCII (including PCL) file on our HP890C  
`LPR filename filetype (FORM HP890C RSCS ASCII, LPR`

# i-data Print Subsystem for VM

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- Product of i-data international
- ida PSS transforms AFP into PCL and PostScript
  - ▶ Dynamic scaling to 300 pel
- Runs as a GCS service machine support PSF syntax
- Binary files (formatted PCL or PostScript) can be printed transparently
- Direct interface to TCP/IP printers
  - ▶ Program available for "batch" conversion, a utility to convert AFP or EBCDIC "line" data into PostScript or PCL

# Printing from Windows

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- Printing to a network printer
  - ▶ Just select a printer you defined on a TCP/IP port and print to it
  - ▶ Print output will be routed to VM/ESA through TCP/IP
  - ▶ Print output will be routed from VM/ESA by RSCS through TCP/IP to the selected printer
  
- Printing to a host printer
  - ▶ For non-AFP printers, the host printer should be defined in LPDXMANY CONFIG with the TRAN option to translate the file to EBCDIC
  - ▶ For AFP printers use the IBM AFP printer driver for Windows and define the printer in LPDXMANY CONFIG as a PSF printer



# Conclusions and Action Plan

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## ● Conclusions

- ▶ It is possible to set up a VM/ESA system as an Enterprise Print Server using RSCS and TCP/IP.
- ▶ The more printer types you have, the more complex it becomes!

## ● Action Plan

- ▶ Improved support of PCL printers required including separator page, host PCL file generation, etc. (LPRXPCL ?)
- ▶ PostScript exit (LPRXPSE) support of ASCII and PCL print
- ▶ Single, dynamic configuration file for printer information for both RSCS and CMS users
- ▶ Document AFP support (workstation print on host AFP printers)
- ▶ LPQ support in LPDXMANY exit

# Sources of Information on the Internet

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- VM/ESA <http://www.ibm.com/s390/vm/>
  - VM/ESA TCP/IP <http://www.ibm.com/s390/vm/related/tcpip/>
  - VM/ESA RSCS <http://www.ibm.com/s390/vm/related/rscs/>
  - S/390 Server Consolidation on the web  
<http://www.ibm.com/s390/sc/>
    - ▶ ITG Management Brief *Business Value of Consolidation* GF22-5034  
<http://www.ibm.com/s390/sc/consult.html>
  - IBM Printing Systems - LPR Client  
<http://www.ibm.com/printers/>
    - ▶ Select "Support", then "Fixes, printer drivers and updates", then "Network Printers Utilities and Microcode" then follow the instructions under "IBM LPR Remote Printing Client Version 2.30 for Windows 95"
  - IBM Printing Systems - AFP Printer Drivers for Windows
    - ▶ Select "Support", then "Fixes, printer drivers and updates", then "IBM AFP printer drivers for Windows" and follow the instructions
  - *TCP/IP Solutions for VM/ESA Redbook* SG24-5459  
<http://www.ibm.com/redbooks/>
-

# Sources of Information on the Internet ...

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- ACITS LPR Remote Printing for Windows 95/98 and NT 4.0  
<http://www.utexas.edu/academic/otl/software/lpr/>
- NIPrint from Network Instruments, Inc.  
<http://www.netinst.com/>
- ida PSS from i-data international  
<http://www.i-data.com/>



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<http://ibm.com/vm/devpages/jelliott/>