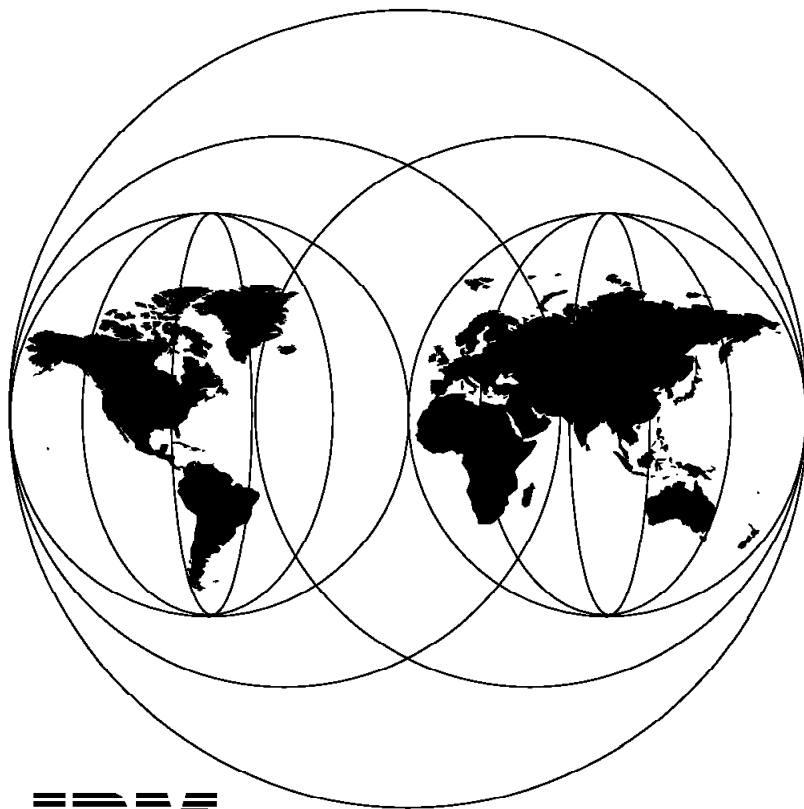


International Technical Support Organization

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Printing with MVS on the IBM PC Server System/390

January 1996



IBM

**International Technical Support Organization
Poughkeepsie Center**



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First Edition (January 1996)

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Abstract

The IBM PC Server/390 system provides an entry-level MVS platform. The hardware (with appropriate PC adapters) can be connected to a wide range of printers, from the largest IBM 3900 to the smallest PC printer. Using these printers with MVS (JES2) can involve a number of considerations, such as hardware, software, and setup, not encountered when using MVS on a mainframe. This document discusses some of these considerations and describes a number of solutions used while writing this document.

(75 pages)

Contents

Abstract	iii
Special Notices	vii
Preface	ix
International Technical Support Organization Publications	x
Acknowledgments	x
Chapter 1. Introduction	1
1.1 Brief IBM PC Server System/390 Review	1
1.2 Printing Discussion Categories	3
1.3 Generating AFP Output	5
1.4 Printing Configuration Controls	5
Chapter 2. Channel-Attached Printers	9
2.1 Channel Device Manager and Setup	9
2.2 Using an IBM 3900 Page Printer	13
2.2.1 Performance and Capacity Planning	15
2.3 Using an IBM 4248 Line Printer	16
2.3.1 Performance and Capacity Planning	17
2.4 Using a Channel-Attached IBM 3820 Printer	17
Chapter 3. LAN-Attached AFP Printers	21
3.1 The IBM 3130 Advanced Function Printer	21
3.1.1 Using an IBM 3130 Printer from PSF	21
3.1.2 Notes About 3130 Usage	26
Chapter 4. Emulated Line-Mode Printers	29
4.1 Lexmark Optra Printers	30
4.2 Basic AWS2821 Use	31
4.3 Advanced AWS2821 Functions	32
Chapter 5. Using PSF/2 for AFP Printing	37
5.1 Our PSF/2 Installation Notes	38
5.2 Selected PSF/2 Configuration Screens	40
Chapter 6. Using Coax-Attached AFP Printers	45
6.1 Channel-Attached SNA 3174 Control Unit	45
6.2 Print Service Adapter	47
Chapter 7. Implementation Notes	49
7.1 HCD Usage with P/390 MVS	49
7.1.1 Step-by-Step HCD	51
7.2 Installing an Overland C490 Tape Drive	53
7.3 AWSTAPE Limitations	55
7.4 Channels and Cables	55
7.5 Standard PAGEDEF and FORMDEF Names	57
7.6 Sharing a PC Printer Under OS/2	58
Chapter 8. Summary and Recommendations	59
8.1 Print Server	60

Appendix A. CM/2 Configuration for APPC	63
Index	77

Special Notices

This publication is intended to help you to understand and implement several methods for attaching printers to an MVS/ESA system operating on a PC Server 500 System/390. The information in this publication is not intended as the specification of any programming interfaces that are provided by any of the products discussed. See the PUBLICATIONS Section of the IBM Programming Announcements for the various products discussed for more information about what publications are considered to be product documentation.

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Preface

The IBM PC Server/390 system provides an entry-level MVS platform. The hardware (with appropriate PC adapters) can be connected to a wide range of printers, from the largest IBM 3900 to the smallest PC printer. Using these printers with MVS (JES2) can involve a number of considerations, such as hardware, software, and setup, not encountered when using MVS on a mainframe. This document discusses some of these considerations and describes a number of solutions used while writing this document.

The reader is assumed to be familiar with MVS and MVS printing (hardware, JES2, PSF) at the level equivalent to an average MVS systems programmer. Various terms, acronyms, and techniques that are commonly understood at the systems programming level are used without further definition or description.

The first chapter describes general PC Server System/390 concepts and various categories of printing and printers that might be used with MVS.

The second chapter describes the use of several channel-attached printers: IBM 3900, IBM 4248, and IBM 3820 units. The installation of the S/370 Channel Emulator/A is discussed in some detail.

Chapter 3 describes, in some detail, the installation of an IBM 3130 printer on a token-ring LAN. MVS, JES2, PSF, and VTAM parameters are listed.

Chapter 4 describes the use of emulated line printers. This area is unique to P/390 systems. The standard AWS2821 device manager is briefly reviewed, and advanced AWS2821 functions oriented to PC laser printers are described.

Chapter 5 is concerned with use of PSF/2 with P/390 MVS. PSF/2 installation is not described in detail, but considerations for using it with P/390 MVS are explored here.

Chapter 6 briefly describes our use of simple coax-attached AFP printers, such as the IBM 3816 unit.

Chapter 7 is not about printing. Rather, it discusses a number of general P/390 MVS points and considerations we encountered while installing the various printers and functions described in the rest of the book. We assume other users may encounter the same problems and concerns, and may find our experiences useful.

Chapter 8 provides a brief summary and a few recommendations for selecting modes of printing for your P/390 MVS system.

Appendix A provides a rather detailed illustration of defining APPC links (as used by PSF/2) in CM/2. This effort is probably quite foreign to typical MVS systems programmers (the assumed audience for this document), and a walkthrough may be helpful.

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Chapter 1. Introduction

Most MVS users are accustomed to having ample resources available for printing. Installations typically have IBM 3900 printers (or something similar) in central locations, and a variety of full-function AFP printers in distributed locations. "Old" line printers are available for those who want them. Most jobs using line-mode output (as from a compiler) are processed by PSF and an AFP printer, providing convenient output formats.

This document describes our experiences installing and using various printers and printer support programs for MVS running on an IBM PC Server System/390. This combination is referenced as P/390 MVS throughout this document. P/390 MVS can offer all the same facilities, provided the same resources are available. However, we expect that this will be the exception, rather than the rule. The large, fast printers are expensive, compared with a P/390 MVS system. We suspect that some P/390 MVS owners will be expected to use PC printers, retired mainframe printers, or newer low-end AFP printers. This will not always be the case, of course. P/390 MVS systems with an NJE connection to a mainframe complex can enjoy the full range of printing resources available in the complex.

We frequently use the term *our MVS* to describe the MVS/ESA 5.1 and 5.2 systems (including additional program products) that we installed. *Our MVS* is not part of the PC Server System/390 product. Customers may order MVS and associated program products through normal IBM marketing channels, and implement whatever MVS configurations are appropriate for their use.

We also use the term *P/390 MVS* to describe our MVS system; this emphasizes that it was installed on an IBM PC Server System/390. There is no unique MVS for the PC Server System/390; it is standard MVS, installed on this processor. (*Our MVS* was, in fact, one of the MVS implementations that are available to members of the S/390 Developers Association for use with an IBM PC Server System/390.¹)

1.1 Brief IBM PC Server System/390 Review

The document *MVS and the IBM PC Server 500 System/390* (IBM order number GG24-2538) describes the PC Server System/390 itself, and the installation and use of MVS with this server. If you are not familiar with the MVS and PC Server System/390 combination, you should obtain this document for a more complete description of this system. This document, number GG24-2538, will be referenced a number of times in this document. The following is a very brief description of the PC Server System/390.

The PC Server System/390 contains two processors: a Pentium processor for the PC Server side, and a S/390 processor (as part of the P/390 adapter card). The processors normally operate in parallel. Each processor has separate memory: the PC Server side has 32MB (ECC, expandable to 256MB), and the P/390 has 32MB (ECC) on the adapter plus 96MB on a daughter card attached to the

¹ Details about the S/390 Developers Association may be obtained by telephoning 1-800-627-8363 or 1-404-835-9900 (USA), 49-7031-16-2809 (Europe), 1-905-316-1408 (Canada).

adapter. (The additional 96MB is an option, but we will assume it is always present when MVS is used.)

The S/390 processor (on the P/390 adapter card) is known as the Microprocessor complex and executes the full S/390 ESA instruction set. When it executes an I/O instruction (such as SSCH), it interrupts the PC Server. OS/2, on the PC Server, has a variety of *device manager* programs (supplied with the P/390 support programs) that emulate various mainframe I/O devices. With appropriate device managers available on the OS/2 side, almost any S/390 program can be executed on the P/390 side. The MVS, VM, or VSE operating systems can be used, with the various subsystems (CICS, DB2, JES, and so forth) usually found with these operating systems.

We cannot say that *all* S/390 programs will operate on the P/390. Exceptions include S/390 extensions such as sysplex, LPAR support, and some of the detailed CE-type diagnostic programs (especially those that attempt to use specialized diagnostic CCWs on the P/390 emulated devices). Poorly designed channel programs, such as those that are self-modifying without using program control interrupts (PCI) for synchronization, may not work correctly. In practice, we find that all normal application programs and all the commonly used subsystems work well.

MVS usage normally requires 3270 displays. CM/2 (under OS/2) currently emulates locally-attached 3270 terminals (such as would be provided by a channel-attached 3174 control unit). MVS "sees" local 3270 displays and uses these for the master console, TSO users, CICS users, and so forth.

S/390 programs, including the operating systems, require no modifications when running on the P/390. They may require configuration or tuning changes, to match the smaller environment provided by the PC Server System/390 functions, but similar adjustments would be needed when moving from a large mainframe to a very small mainframe.

The most important emulated device type is a CKD disk unit. MVS requires CKD disks; it does not support FBA disks. All native PC-type disks are FBA, although the term "FBA" is not normally used with PCs. A device manager emulates IBM 3380 and 3375 disks using standard PC disks; 3390 emulation is expected to be available in the near future. Multiple 3380 disks can be emulated, using PC Server disks. A PC Server System/390 used for MVS would have at least five 2.25GB disks -- enough room to emulate at least nine single-density 3380 volumes, or a mixture of larger 3380 volumes. At the time this was written, it was not possible to connect the PC Server System/390 to mainframe disks.

The standard PC Server System/390 unit has a RAID adapter. The disks controlled by this adapter can be configured in a number of ways. A typical arrangement combines all the physical PC disks into a single RAID array of about 9 GB.² This is then partitioned (by FDISK) into two partitions: a C drive with about 100 MB for OS/2 and various support programs, and a very large D drive. The emulated 3380 volumes are placed on the D drive. A complete emulated 3380 volume is one OS/2 file.

The IBM PC Server 500 includes the following basic connectivity features:

² This assumes that five 2.25GB drives are installed. Some space is lost to the RAID 5 redundant storage controls.

- eight Micro Channel slots
- two parallel printer ports
- two serial ports

A typical Server/390, configured for MVS, might use the eight Micro Channel slots like this:

1. RAID or SCSI adapter (RAID is normal)
2. Second SCSI adapter or second WAC adapter or second S/370 channel adapter
3. SVGA (display) adapter
4. Token-Ring adapter
5. S/370 Channel Emulator/A adapter
6. Wide Area Communications (WAC) adapter
7. P/390 adapter
8. Supplies power to 96MB daughter card for P/390 adapter

The S/370 Channel Emulator/A adapter, shown in this list, is not required, but we expect it will be commonly found with P/390 MVS systems. It is used to connect, via bus and tag channel cables, many standard mainframe I/O devices including printers and tape drives. Likewise, the token-ring adapter shown in the list is not required, but is expected to be commonly installed. (Ethernet can also be used, but the typical environment for P/390 MVS is probably more oriented to token-rings.) The channel emulator, the token-ring adapter, and the parallel printer ports on the basic PC Server are the key connectivity elements for printers.

1.2 Printing Discussion Categories

MVS printed output includes two fundamental types of print streams: line mode and AFP mode. Other types exist, such as PostScript or some SNA-via-VTAM streams, but tend to be for specialized uses. This document does not address these other types of print streams or devices.

Line mode is the original, basic printing mode for S/360. The archetype device was the IBM 1403 printer, some of which are still in use. These devices (and their successors) use print chains (or trains or bands) with fixed-font characters. They normally print lines with up to 132 characters, with ten characters per inch. (Special print chains/trains/bands are available with smaller characters, but these are not considered standard.) Vertical spacing is six lines per inch, with eight lines per inch being a common alternative. Vertical skipping can be controlled by carriage control tapes (older 1403 units) or a forms control buffer (newer units) that does the same thing under software control.

While laser printers now dominate printer sales, impact printers are still needed for certain types of jobs, such as printing multipart forms. A reasonable proportion of MVS “production” printing still uses impact printers, and P/390 MVS support for impact printers may be important.

JES2 controls line printers directly. It builds long chains of CCWs and prints many lines with one I/O operation. (JES3 does the same thing. For a variety of reasons, we do not expect JES3 to be used with P/390 MVS and will not further

reference it in this document.) Basic MVS output, such as the JCL listing at the beginning of a job's printed output, is in line mode, even if the main job output is in AFP mode.

AFP print streams can be more complex than line mode print streams. (Please note that we are using AFP as a collective term for various components of AFP technology such as IPDS, which describes the exact makeup of the print stream.) There are a number of levels of functions that can be included under the heading of AFP. In some cases, applications can generate line-mode output (which is automatically placed in the appropriate page location by AFP page definition controls), and in other cases the application may build a complete page definition (including bit-level graphics). This document does not differentiate among the various functions of AFP.

The archetype AFP printer is the IBM 3800, although there are a large number of other AFP printers available. An AFP printer has considerable intelligence (to interpret complex page definition commands), has a large buffer (to hold at least one page of output while it is being defined), and usually depends on *resources* stored in the host system and downloaded on demand. Resources include font information. An AFP printer, unlike a line printer, may need to chat with its host while printing job output, perhaps to obtain an additional font that is used in the job.

For practical purposes, AFP printing under MVS always uses the PSF product (Print Services Facility) to operate the AFP printers. Printed output from an application is spooled to JES2. If the print class so indicates, JES2 will pass the print stream to PSF for actual printing. PSF drives the printer and handles requests to download fonts, PSEs, page definitions, and so forth. Discussions of AFP printing, in this document, assume you have the current version of PSF installed in your P/390 MVS system.

Line-mode output can be directed to a "normal" AFP printer (driven by PSF). For example, it is common for an MVS job to direct all its output to the same SYSOUT class. Jobs that contain only line-mode output, such as an assembly and linkedit, are printed on AFP printers. Installations with no need for multipart forms may no longer have any true line printers installed. PSF recognizes line-mode data and automatically uses an appropriate PAGEDEF to print it in a reasonable way.

Table 1 (Page 1 of 2). Categories of Printer Attachments for P/390 MVS

	Line Printing	AFP Printing (which includes line printing as a subset)
Channel-attached via S/370 Channel Emulator/A adapter	IBM 1403, IBM 3211, IBM 4248, etc	IBM 3800, IBM 3825, IBM 3827, IBM 3900, etc.
PC printer port, basic	Proprinter; Lexmark 4019, 4029, 4039, Optra, etc.; and many other PC printers	
PC printer port, with PSF/2		Lexmark 4029, 4039, Optra; see PSF/2 documentation for requirements
LAN printer	various products not covered in this study and not tested with the P/390 device managers	IBM 3130, IBM 3160, etc.

<i>Table 1 (Page 2 of 2). Categories of Printer Attachments for P/390 MVS</i>		
3174 coax with the 3174 attached via channel, LAN, or SDLC.	(possible, but we did not use this mode)	IBM 3812, IBM 3816, IBM 3916, IBM 4028-NS1, etc.
SDLC (adapter in PC, 37x5, etc.)		IBM 3820, and others

For the purposes of this document, we have defined a number of categories for P/390 MVS printing. These are shown in the table above. While the table lists only IBM and Lexmark printers, a wide range of other vendors produce printers that might fit in one or more of these categories.

We will discuss all of these categories to some extent, and will cover two in slightly more depth. The two are the “basic” PC printers and PSF/2 printing. These two categories have unique P/390-environment characteristics.

1.3 Generating AFP Output

Simple programs do not usually generate full-function AFP output. Within IBM, the most common generator of AFP output is the BookMaster family of products (based on the older DCF, Document Composition Facility, product), which has very sophisticated print-stream generation functions.

In production customer environments, perhaps the most common AFP printing involves applications that generate simple line mode output (in rigidly defined formats) and AFP FORMDEFs and PAGEDEFs that merge the line data with predefined page graphics. The result might be a utility bill, for example.

While producing this document, we used a number of AFP print streams. Most of these were based on BookMaster output, using, for example, a draft copy of this document.

1.4 Printing Configuration Controls

The following are the three key configuration elements for MVS printing:

1. JES2 parameters
2. VTAM parameters (except for most channel-attached printers)
3. PSF procedures (for AFP printers)

When adding or configuring your printers, you will need to work with these parameters. An MVS owner can decide to place these parameters in a variety of data sets, and finding the operational parameters can sometimes be a challenge.³ You can always determine exactly which libraries are being used, and in what order, by tracing procedures from the Master JCL, the SYSPARM starting number, and the effective COMMNDnn member, but this can be tedious. In our MVS, the key libraries were the following:

1. SYS1.PARMLIB(JES2PARM) for JES2
2. SYS1.VTAMLST for VTAM
3. SYS1.PROCLIB for PSF procedures

³ There can be copies (old, current, correct, incorrect) of these parameters in many libraries. You need to know which ones are actually being used.

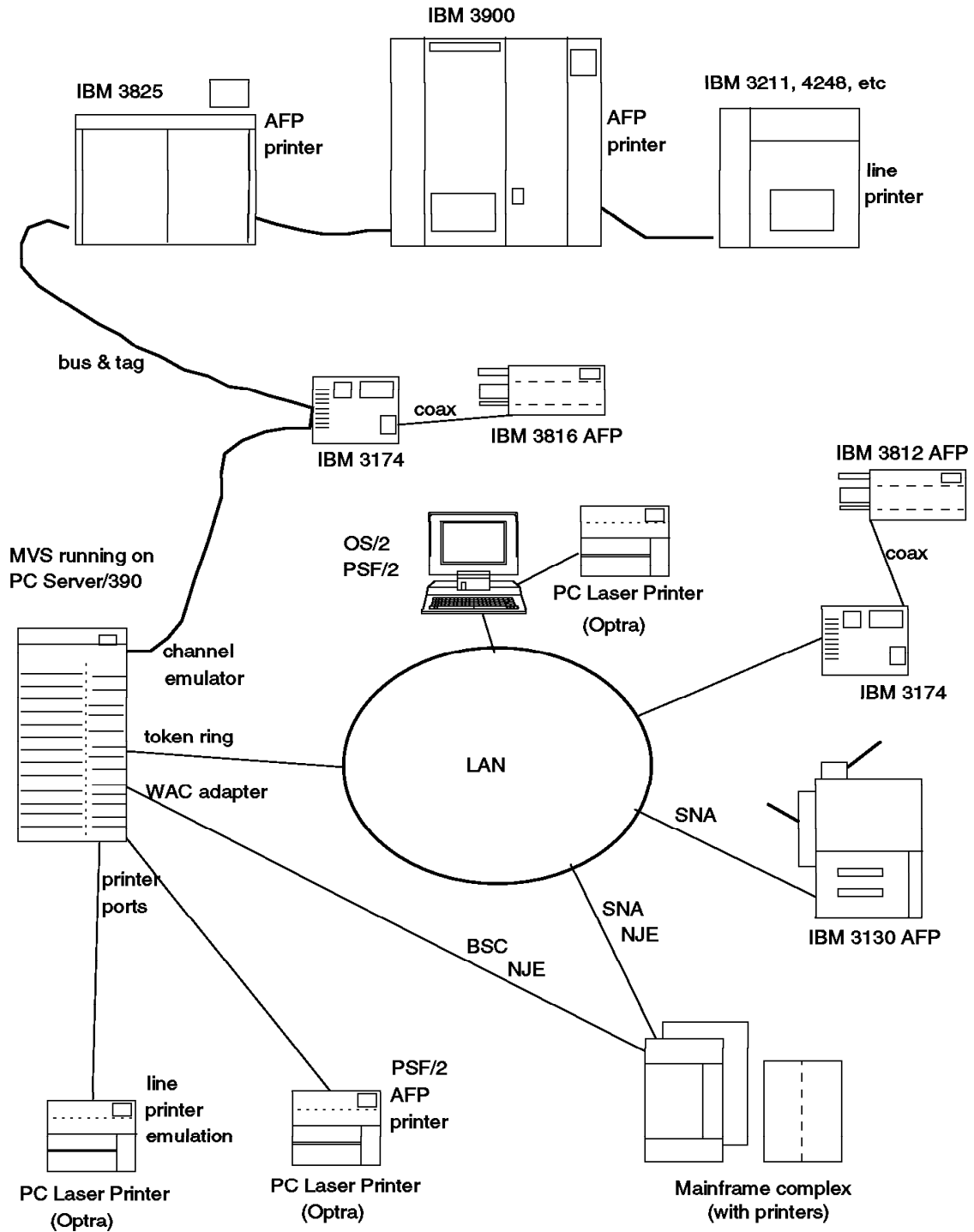


Figure 1. Several Options for Printing from P/390 MVS. There are many ways to print from P/390 MVS. This figure illustrates and suggests a number of possibilities. The figure lists specific printers, such as 3900, 3816, and so forth. The connections are not limited to these specific models, and will generally apply to the printer family represented by the model listed. A token-ring LAN is shown; an ethernet LAN could be used instead (or in addition). (This figure shows four control units connected to a channel emulator. This is to illustrate a style of usage, rather than a specific configuration. A channel emulator adapter can be used with a limited number of control units.)

You may need to add library members for VTAM and PSF. We suggest you add them in the same libraries already in use. (The alternative is to define additional libraries and concatenate these to the existing libraries. We recommend against this when working with printer configurations, because the changes/members are too small to justify the overhead of additional library concatenation.)

JES2PARM is a single member in a library.⁴ If you intend to alter your printer configuration, we suggest you list (on paper) JES2PARM. You will reference it many times.

There are no *required* changes to JES2PARM that are unique to P/390 MVS. However, there are a few tuning directions you should consider. Disk I/O is more “expensive” for P/390 MVS than for a mainframe. This is due to CKD emulation, and is discussed in some detail in the GG24-2538 document. In particular, random read/write of relatively small blocks has a disproportionate overhead. I/O for demand paging and spool access falls into this category. For tuning, you should consider the following:

- Keep paging as low as possible; lower than on a comparable mainframe. This may mean not starting as many initiators, reducing VTAM definitions to what is actually needed, and so forth. We found that two active initiators, plus TSO users, was reasonable.
- Consider using a SWAP data set; this should reduce the demand paging level somewhat.
- Use large buffers for JES2. This usually means BUFSIZE=3992; this was the default buffersize on our MVS.
- Use track cells for JES2. The default track cell size on our system was TRKCELL=3. We did not experiment with changing this value, but a slightly larger value might be better.
- Use larger buffer sizes for data and work files. Half-track blocking (about 23K bytes for a 3380 device) can be a very efficient size. Of course, this must be balanced with the number of concurrent users and jobs. As a broad generalization, your P/390 MVS is more likely to be limited by disk I/O than by CPU cycles or storage.

There will typically be one PSF procedure for each PSF printer you have installed. Channel-attached printers might share the same PSF procedure; usually VTAM-attached printers will each have its own procedure (because it contains an LU name). They tend to be very similar, possibly with different FORMDEFs for default output, or different VTAM parameters.

VTAM is more complex. There are many members in the SYS1.VTAMLST library.⁵ Not all of them are used in any given system, and there is no easy way to determine which ones relate to printers. Member ATCCON00 (or ATCCONxx if the name is overridden by a startup operation) contains a *list* of the members that are automatically started when VTAM is started. You can scan this list, looking for member names related to printer models (such as SL3816, for example), but this is not a reliable indicator. You can examine each active member (using ISPF to browse members in SYS1.VTAMLST) and examine

⁴ The JES2 parameters can have a member name different than JES2PARM, but JES2PARM is the generic name for the effective member.

⁵ It is possible to use another name for the VTAM parameter library, but this is rarely done.

comments and parameters. The MVS operator can start and stop additional SYS1.VTAMLST members, so the ATCCON00 list is not necessarily an exact list of what VTAM elements are in use.

In addition to these controls, channel-attached printers require MVS UCBs. This is discussed in 7.1, "HCD Usage with P/390 MVS" on page 49.

This document lists a number of SYS1.VTAMLST members related to printing, but does not discuss VTAM in any depth. We recommend the redbook *Connectivity on a PC Server System/390 with MVS* (IBM order number SG24-4624) for more detailed VTAM information.

Chapter 2. Channel-Attached Printers

In the P/390 MVS environment, any channel-attached devices are connected through the S/370 Channel Emulator/A adapter. By channel-attached we mean connected through a parallel bus-and-tag channel, as commonly used by mainframe devices. A maximum of two of these adapters can be installed in a PC Server System/390.

The S/370 Channel Emulator/A adapter connects to a Micro Channel on one side and provides a large cable with bus and tag connectors on the other side. It creates the *host* end of a channel connection. Several mainframe-type control units can be attached via this cable. An IBM 3800 printer or an IBM 3480 tape drive/control unit are examples of control units that can be attached through this emulator. The adapter can be configured to operate in DCI or streaming mode, at speeds of up to 4.5 MB/second. To a control unit, it appears as just another host channel, and can be mixed with channels from mainframes when connecting to control units with more than one channel interface.

This adapter cannot be used to connect a PC Server System/390 to mainframe DASD. This limitation is due to very critical timing requirements in fetching CCWs and data in the midst of DASD I/O operations. We are not aware of any other major restrictions on the use of the adapter. It does have some performance limitations which could be important when used with small I/O blocks or time-critical devices.

The S/370 Channel Emulator/A adapter works best when large blocks of data are used. Large is a relative word, of course, but in this case it means blocks much larger than 80 or 132 bytes. Normal AFP printing uses relatively large blocks, and the channel adapter works very well with AFP printers and typical jobs. Multiple IBM 3800 or 3900 type printers can be driven at full speed through a single channel adapter. This is discussed later in this chapter.

Line printers use small block sizes, although the long CCW chains of JES2 are an intermediate case. The channel adapter is not as efficient with these blocks and some care may be needed if multiple high-speed line printers are attached to P/390 MVS. A few informal measurements are described later in the chapter.

The P/390 device manager that runs the channel emulator is AWSC370. For any serious use of the channel emulator, *be certain your copy of AWSC370.EXE has a date later than October 27, 1995*. A number of problems have been fixed in later versions of the module.

2.1 Channel Device Manager and Setup

Installation of the channel adapter and the relevant P/390 device manager is described in GG24-2538, referenced earlier. We will briefly review the same material in this section. Configuration parameters appear in three places: CONFIG.SYS, the IPL.CMD command file, and the P/390 configuration panel.

The S/370 Channel Emulator/A adapter can be installed in any slot of the PC Server System/390. Installation is roughly the same as any other Microchannel adapter.

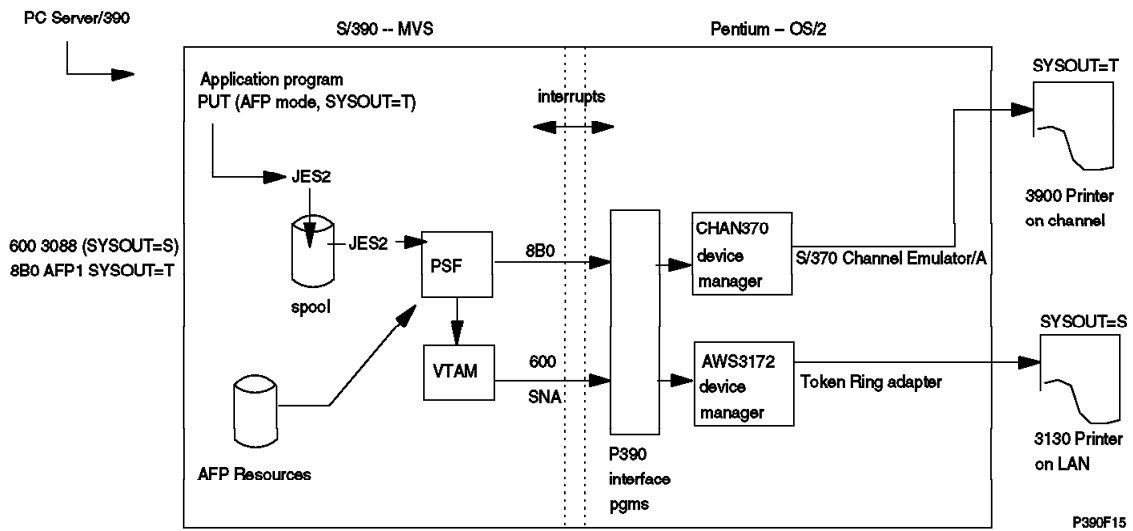


Figure 2. Channel and LAN AFP Printers. This illustration provides an overview of the logical flow of AFP output from an application to AFP printers. Two different methods of connecting printers are shown. This flow would also apply to line-mode output directed to AFP printers.

We have seen a few problems when configuring a channel adapter after installing it. You should autoconfigure⁶ your system after installing a channel adapter. Key steps are the following:

1. If a reference diskette was included with your channel adapter, set it aside. You should not use it.
2. Before installing the channel adapter, boot the reference diskette⁷ for your PC Server System/390. Use the Copy Option Diskette menu selection to copy the P/390 Reference and Diagnostic diskette to your reference diskette. (You probably already did this when you first set up your system.)

A revised set of configuration files for the channel adapter are included with the P/390 support diskettes.

3. Install the channel emulator adapter.
4. Boot your system from your reference diskette. It should note that a new adapter has been added, and offer to autoconfigure the system. Run autoconfiguration at that point.
5. The system will reboot (from the reference diskette). Select the Set Configuration option, and then the View Configuration option. Check the upper righthand corner of the display for a “* Conflict” message. If this message does not appear, your channel adapter probably was accepted correctly, although you should scan the configuration display for possible error messages.
6. If the “* Conflict” message appears, try to autoconfigure again.

⁶ This is a standard process, well known to anyone who has installed IBM PS/2 systems.

⁷ The RAID models require the use of a reference diskette. The non-RAID models have the reference diskette programs stored in a special area on the hard disk. If you have a non-RAID version, use the hard disk reference programs in the steps described here.

7. If, after the system reboots again, the conflict message still appears in the View Configuration display, do the following (turning power off before removing or adding adapters, of course):

- Remove the channel adapter.
- Autoconfigure. Verify that the View Configuration display shows no errors.
- Add the channel adapter.
- Immediately boot the reference diskette and permit it to automatically autoconfigure your system.

The essential point is to use autoconfigure immediately after adding the channel adapter. The reference diskette will detect the new adapter and immediately offer to autoconfigure. Use this option. (We do not know why this procedure is sometimes needed, but it has been used with several systems.)

If you are ordering a new S/370 Channel Emulator/A adapter, be certain to order the special cable it uses. This cable has a large D shell connector (62 pins) on one end and splits into bus and tag connectors on the other end. This is an unusual cable that cannot be obtained other than by ordering it with, or for, the channel emulator adapter.⁸

For use with P/390 MVS, two lines must be included in the OS/2 CONFIG.SYS file. Installing the P/390 support programs will place these two lines (among others) in CONFIG.SYS, but they may be commented out. If so, edit CONFIG.SYS and remove the REM keywords from these two lines. The lines are similar to the following:

```
DEVICE=D:\P390\chan370.sys tbuf=2040 pollcount=10000  
RUN=d:\P390\chan370.exe
```

The RUN statement will cause a driver program for the channel emulator to be started every time OS/2 is booted, regardless of whether the P/390 subsystem is used.

You should check the IPL.CMD file, in the P390 directory on the OS/2 system. This file is executed to IPL an operating system on the P/390 adapter. It is a complex command file, which starts all the device managers, among other functions. In this file you will find a statement similar to the following:

```
DMSTART AWSC370.EXE N /D4
```

The "N" operand indicates that no OS/2 window should be opened while executing this command. The other potential operands are these:

```
DMSTART AWSC370.EXE N /[s]Dn /[s]S /[s]B /Wttttt /Z
```

where "s" is the PS/2 slot number of the channel emulator card (in case there is more than one). The default is to apply the option to all channel emulator adapters in the system. "S" means the channel emulator should be operated in selector mode, and "B" means it should be operated in block multiplexor mode. The default is block multiplexor mode. The "D" operand sets data streaming mode; D3 specifies 3 MB/sec and D4 specifies 4.5 MB/sec. If no "D" operand is used, the channel is operated in DCI (DC Interlock) mode, which tends to be slower. The "ttttt" operand sets the channel timeout value, in seconds, and

⁸ We believe it is now included as part of the base order for the emulator adapter, but you might want to confirm this.

defaults to 10 seconds. The "Z" operand activates a special trace output (not recommend as the default setting).

To use the channel emulator, it must be specified as the device manager associated with a S/390 device. This is done in the P/390 configuration panel. At the time this was written, the channel emulator is device manager "L," and a typical configuration line would look like the following⁹:

```
Addr  Device                               Mgr  FN/P
-----
> 580 > 3480                               > L   >
```

In this example, when MVS addresses unit 580, the P/390 support programs direct the channel I/O operations to the channel emulator adapter. The adapter will then connect to control unit 80 on the channel. The device manager code for the channel emulator does not use the device type (3480 in this example) specified in the configurator. It is there for documentation.

The "L" under "Mgr" in this example is the current ID of the channel emulator manager. The P/390 configuration panel lists all these numbers. You will see this list as you define a new configuration device.

The following are two special considerations for using this adapter with P/390 MVS:

1. It cannot be used with control unit and device address "00"; that is, it can not be used with addresses 100, 200, 300, and so forth.
2. Control unit and device addresses are related to real hardware addresses, unless they are remapped. This is unlike all P/390 emulated devices, where the emulated S/390 control unit and device addresses are completely arbitrary.

The FN/P field can contain operands to remap device addresses. For example, a printer at address 3A0 (in the P/390 MVS system) might be sent to control unit address C8 (in the printer control unit). Parameters in the FN/P field can remap these addresses. See page 99 in GG24-2538 for details.

A single channel adapter can emulate connections with multiple S/390 channel addresses. However it must not have conflicting control unit addresses. For example, you could have two 3825 printers attached to one channel adapter, one with S/390 address 3A8 and the other at 7C0. The channel addresses, 3 and 7 in this example, have no practical effects. However, you could not have two devices at 3A0 and 7A0, for example, because both would respond to control unit address A0. In a S/390 hardware sense, the channel function provided by the S/370 Channel Emulator/A has no channel address. The control units and devices connected through it do have real control unit and device addresses, and these cannot conflict with each other.

You can use the C370MAP command (working from an OS/2 command line) to display the devices currently recognized by the channel emulation device

⁹ The single letters assigned to a device manager in the P390 Configurator are subject to change. They are sequential indicators used with the list of device managers known to the configurator. The full name of the selected device manager is stored in your DEVMAP (the file holding your configuration), so that the correct device managers are always associated with the devices in your configuration. If the list of known device managers changes, the sequential letter assigned to each device manager may change, but the correct, current letter will always be displayed by the Configurator. In this document, we consistently use device L as the channel emulator.

manager. The C370MAP.EXE program is part of the P390 support programs, and should be in the P390 directory.

2.2 Using an IBM 3900 Page Printer

The IBM 3900 page printer is attached and configured the same as an IBM 3800, 3825, 3827, or similar channel-attached page printers, and the comments here should apply to any of these devices. IBM 3820 channel-attached printers are connected the same way (for the hardware connection), but are configured differently to JES2 (and VTAM). The following comments do not apply to 3820 printers.

Attaching a 3900 printer requires configuration parameters in the following areas:

1. The normal channel emulator controls, as described above, in CONFIG.SYS, the IPL.CMD file, and in the P/390 configurator panel.
2. MVS must contain a UCB for an AFP1 printer. This is added with the MVS HCD function. See 7.1, "HCD Usage with P/390 MVS" on page 49 for HCD usage notes.
3. The JES2 procedure must contain an entry for the printer and SYSOUT classes associated with the printer, as well as an FSS entry for the printer. An example is shown below.
4. A PSF procedure must exist for the printer. An example is shown below.
5. AFP resources, *fonts* and a basic set of PAGEDEFs, must exist in an MVS library. As a minimum, the core interchange fonts and the PAGEDEFs and FORMDEFs that are provided with PSF should be present. If PSF is already installed in your system, these will be available.

The MVS UCB definition for a 3900 printer is:

```
UNIT=AFP1,MODEL=0
```

With MVS/ESA Version 5, this definition would be entered through the HCD facility. If this AFP1 unit is defined at address 8B0, the corresponding P/390 configuration entry would be

```
Addr Device                               Mgr   FN/P
-----
> 8B0 > 3900                             > L   >
```

We used these JES2 parameters, for a 3900 printer defined as PRT3 and with channel address 8B0:

```
PRT(3) FSS=FSS3900,MODE=FSS,PRMODE=(LINE,PAGE),UNIT=8B0,
        SETUP=NOHALT,
        CLASS=ST,SEP,DRAIN,MARK,TRKCELL=YES,CKPTPAGE=50
FSS(FSS3900) PROC=APSWPROA,HASPFSSM=HASPFSSM
OUTCLASS(S) OUTDISP=WRITE,OUTPUT=PRINT,TRKCELL=YES
OUTCLASS(T) OUTDISP=WRITE,OUTPUT=PRINT,TRKCELL=YES
```

In our system, the JES2PARM member is in SYS1.PARMLIB; it might be in a different location in your system.

We used this PSF procedure. It is a standard procedure and uses the data sets (SYS1.FONTLIBB, SYS1.PSEGLIB, and so forth) that are usually used for PSF.

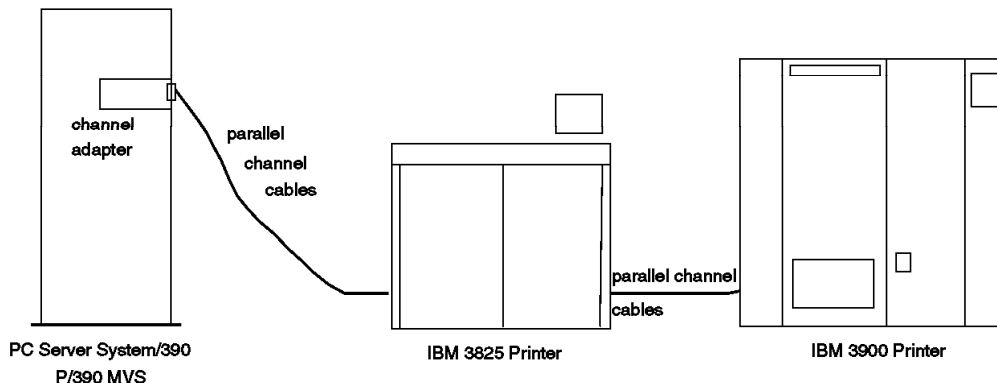


Figure 3. Two Channel-Attached AFP Printers. This figure illustrates the cable connections of channel-attached printers. Line printers, AFP printers, and other channel-connected devices could be configured in this manner.

When PSF is installed, this procedure is automatically added to SYS1.PROCLIB. We modified it to use PRT3 instead of PRT1. (The procedure in your SYS1.PROCLIB will have more comments than are listed here. We removed some comments in order to have a more compact listing.)

```
//APSWPROA PROC
//*****
//*   PSF WRITER PROCEDURE FOR 3900 PRINTER
//*****
//STEP01   EXEC PGM=APSPPIEP,REGION=4096K
//JOBHDR   OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//JOBTLR   OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//DSHDR    OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//MSGDS    OUTPUT PAGEDEF=A06462,FORMDEF=A10110
//FONT01   DD DSN=SYS1.FONTLIBB,DISP=SHR
//PSEG01   DD DSN=SYS1.PSEGLIB,DISP=SHR
//OLAY01   DD DSN=SYS1.OVERLIB,DISP=SHR
//PDEF01   DD DSN=SYS1.PDEFLIB,DISP=SHR
//FDEF01   DD DSN=SYS1.FDEFLIB,DISP=SHR
//PRT3     CNTL
//PRT3     PRINTDEV FONTDD=*.FONT01, /* LIBRARY FOR FONTS      */
//         OVLYDD=*.OLAY01,         /* LIBRARY FOR OVERLAYS */
//         PSEGDD=*.PSEG01,         /* LIBRARY FOR PSEGS    */
//         PDEFDD=*.PDEF01,         /* LIBRARY FOR PAGEDEFS */
//         FDEFDD=*.FDEF01,         /* LIBRARY FOR FORMDEFS */
//         JOBHDR=*.JOBHDR,         /* JOB SEPARATOR PAGE   */
//         JOBTRLR=*.JOBTLR,        /* JOB TRAILER PAGE     */
//         DSHDR=*.DSHDR,           /* DATA SET HEADER PAGE */
//         MESSAGE=*.MSGDS,         /* MESSAGE DATASET OUTPUT */
//         BUFNO=5,
//         PAGEDEF=V06483,          /* DEFAULT PAGEDEF      */
//         FORMDEF=A10110,          /* DEFAULT FORMDEF      */
//         CHARS=(GT12,GB12,ST12,CR12)
//         PIMSG=YES,
//         DATAK=UNBLOCK,          /* UNBLOCK ANY DATA CHECKS */
//         TRACE=NO
//PRT3     ENDCNTL
```

While your data set names may differ, this is a fairly standard PSF procedure for a 3900. It produces simplex output in landscape orientation with GT12 characters.

Printer control is with normal JES2 commands, such as \$SPRT3 to start the printer, \$PPRT3 to stop it, and so forth.

If you have an appropriate UCB in MVS, and have modified the PSF procedure as required, you could dynamically define the printer to JES2, using the following commands:

```
$ADD FSS(FSS3900),PROC=APSWPROA
$ADD PRT3,MODE=FSS,FSS=FSS3900,Q=ST,UNIT=8B0
```

Such dynamic definitions disappear when JES2 is stopped, but can be useful for initial testing.

2.2.1 Performance and Capacity Planning

There has been considerable interest in using P/390 MVS as a print server. Typically this means that P/390 MVS is connected to one or more production MVS systems (via NJE), and drives several AFP printers. Capacity concerns include:

- The NJE connection. If this is a LAN connection, output for several fast AFP printers should represent only a small percentage of LAN capacity, especially if a 16 Mb/s token-ring is considered. An exception may occur if the data consists mostly of bit images.
- The channel connection to fast AFP printers. The S/370 Channel Emulator/A adapter was designed for this purpose, and should not be a limitation in any reasonable configuration.
- JES processing. JES2 must spool data from the NJE connections, and later unspool it to PSF for printing. JES2 is very efficient at this, and should require little CPU time for it. Disk I/O, through the AWSCKD device manager, may be more of a concern. This can be addressed by using track cells and large buffer sizes.
- PSF processing. PSF processor utilization can vary over a wide range, depending on the services requested. For normal commercial printing, it should not be a bottleneck.

Our very informal measurements, using CPU utilization reported by RMF, and using a text file already in the JES2 spool area, were these:

	MVS CPU	OS/2 CPU
Single 3900-001, full speed	18-22%	15-20%

These were informal measurements, made by noting RMF data while printing. The 390 CPU numbers include VTAM, one local TSO user observing RMF numbers, RMF, and the background rumblings of an otherwise idle MVS. The data was a technical report, listed in duplex with 4-up reduction.¹⁰ The OS/2 CPU usage was taken from the OS/2 Pulse display, which is a very crude indicator. These percentages are for steady-state printing. CPU utilization (MVS and OS/2)

¹⁰ PSF needed to build the 4-up pages (four normal text pages, reduced to fit on one printed page) before sending it to the printer. This presented a fairly significant work load for PSF, demanding more CPU time than would be needed for more routine printing.

was much higher when copying the large print file (with IEBGENER) and when starting the PSF print (while PSF was manipulating resources, and so forth).

2.3 Using an IBM 4248 Line Printer

An IBM 4248 is a high-speed line printer, printing up to 2000 lines per minute. Attaching a 4248 printer requires configuration parameters in the following areas:

1. The normal channel emulator controls, as described above, in CONFIG.SYS, the IPL.CMD file, and in the P/390 configurator panel. The device type (second field in a configuration panel line) is not used, and you can enter "4248" for documentation purposes.
2. MVS must contain a UCB for the 4248 printer. This can be added with the MVS HCD function.
3. The JES2 procedure must contain an entry for the printer and SYSOUT classes associated with the printer. An example is shown below.
4. A library of forms control and character (chain/train) definitions must exist. This is provided by MVS.

The following discussion assumes we have a 4248 printer that we want to use as device address 831. The printer itself has jumpers installed to recognize control unit address 31. (Address 831 is arbitrary, and happened to be the normal address (on a mainframe) of the printer we used.)

The MVS definition (used to build a UCB) was:

```
UNIT=4248 (defined for address 831)
```

Note that the MVS UCB for the 4248 (specified through HCD definitions) should specify the correct device type. In particular, a device generated as a 1403 will not operate a 4248 (or 3262-5) correctly. Do not attempt to use the three common line printer definitions (1403, 3211, and 4248) interchangeably. The corresponding P/390 configuration was:

```
Addr Device                               Mgr  FN/P
-----
> 831 > 4248                               > L  >
```

The JES2 parameters, for a 4248 printer defined as PRT1 and with channel address 831, were:

```
PRT(1) UNIT=831,TRKCELL=YES,CLASS=A,UCS=P11
OUTCLASS(A) OUTDISP=WRITE,OUTPUT=PRINT,TRKCELL=YES
```

It is important to specify a UCS parameter (and to specify the correct one). If UCS is not specified or is incorrect, the printer will have data checks (indicated by DCK error messages on the MVS console). You can use the command \$DU PRT1 (from the MVS Master Console) to display the characteristics of PRT1, and \$T PRT1 to change various parameters. The UCS (and FCB) you specify must exist in SYS1.IMAGELIB. With the data we were printing, we did not need to load an FCB.

Our initial P/390 MVS system had only one printer defined, PRT1. It had no unit associated with it, and did not specify a UCS parameter. It was possible to dynamically define the printer, assuming that the correct UCB exists and the device was online. We used the following JES2 commands:

```

$T PRT1,UNIT=831
$T PRT1,UCS=P11      Our printer had a P11 print band
$T PRT1,Q=S          We had SYSOUT=S data to print
$DU PRT1              Verify options
$SPRT1               Start printer
. . .
$SPRT1               Respond to setup request

```

2.3.1 Performance and Capacity Planning

Our very informal measurements, using CPU utilization reported by RMF, and using a single line-mode file already in the JES2 spool area, were these:

	MCS CPU	OS/2 CPU
Single 4248, high speed	trivial	30-40%

The printer appeared to run at rated speed. Our concern was with the S/370 Channel Emulator/A adapter, which was not designed for the short blocks normally encountered with line printers. Normal MVS monitoring tools, such as RMF, do not provide an accurate picture of channel capacity in this case. Part of the overhead of channel emulation appears as OS/2 CPU usage¹¹ As mentioned before, our measurements were crude, based on observation of RMF and the OS/2 pulse window.

Our finding was that P/390 MVS can drive a 4248 at rated speed, although it presented a significant load for OS/2.¹² All normal program controls, such as FCB loading, operated normally.

2.4 Using a Channel-Attached IBM 3820 Printer

Although it is an older printer, there are still many IBM 3820 printers still in use. It is a full-function AFP printer, and could be useful for AFP printing with P/390 MVS. The 3820 printer is unusual because, even for the channel-attached version, it uses SNA communications. Since it is a channel device, there must be an MVS UCB for it. It is specified (via HCD) as a 3791L device. If the MVS address for the 3791L is 090, the P390 definition would be:

```

Addr Device                      Mgr  FN/P
-----
> 090 > 3791                      > L  >

```

For our project, we temporarily defined the 3820 printer to JES2 (because we simply wanted to try it and then remove it). We used the following commands to add the printer to JES2. You could add the same operands to JES2PARAM for a permanent definition.

```

$ADD FSS(FSS3820),PROC=PSF3820
$ADD PRT9,MODE=FSS,FSS=FSS3820,QUEUE=6,UCS=GT12

```

¹¹ The more important channel constraints involve time-dependent CCW processing (on the OS/2 side), and we could not measure the capacity-related aspects of this processing.

¹² This load is partly related to JES2 CCW chains. JES2 chains 50 (default) write CCWs in a single I/O operation, with one CCW per line of printed output. For a 4248 in high-speed mode, this is 33 CCWs/second. The AWSC370.EXE device manager (running under OS/2) must analyze the CCW chains from MVS (JES2), and modify them for use by the channel emulator adapter. It must also manage data movement from S/390 memory to OS/2 memory, where the channel emulator adapter can access it.

We adopted one of the standard PSF procedures to use with the 3820. It is listed here, without the many comments that were present in the original procedure:

```
//PSF3820 PROC
//STEP01 EXEC PGM=APSPPIEP,REGION=1750K
//JOBHDR OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//JOBTLR OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//DSHDR OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//MSGDS OUTPUT PAGEDEF=A06462,FORMDEF=A10110,CHARS=GT15
//FONT01 DD DSN=SYS1.FONTLIBB,DISP=SHR
//PSEG01 DD DSN=SYS1.PSEGLIB,DISP=SHR
//OLAY01 DD DSN=SYS1.OVERLIB,DISP=SHR
//PDEF01 DD DSN=SYS1.PDEFLIB,DISP=SHR
//FDEF01 DD DSN=SYS1.FDEFLIB,DISP=SHR
//PRT9 CNTL
//PRT9 PRINTDEV FONTDD=*.FONT01, /* FONT LIBRARY DD */
// OVLDD=*.OLAY01, /* OVERLAY LIBRARY DD */
// PSEGDD=*.PSEG01, /* SEGMENT LIBRARY DD */
// PDEFDD=*.PDEF01, /* PAGEDEF LIBRARY DD */
// FDEFDD=*.FDEF01, /* FORMDEF LIBRARY DD */
// JOBHDR=*.JOBHDR, /* JOB HEADER SEPARATOR */
// JOBTRLR=*.JOBTLR, /* JOB TRAILER SEPARATOR */
// DSHDR=*.DSHDR, /* DATA SET HEADER */
// MESSAGE=*.MSGDS, /* MESSAGE DATA SET OUTPUT */
// PAGEDEF=V06483, /* DEVICE PAGEDEF DEFAULT */
// FORMDEF=A10110, /* DEVICE FORMDEF DEFAULT @H3C*/
// CHARS=(GT12, /* DEVICE */
// GT10,GT15,GT18), /* DEFAULT FONT SET */
// PMSG=YES, /* ACCUMULATE DATA SET */
// DATAK=UNBLOCK, /* REPORT ALL DATA-CHECK @H7A*/
// TRACE=NO, /* CREATE INTERNAL TRACE @H3C*/
// FAILURE=WCONNECT, /* PSF ACTION ON PRINTER */
// TIMEOUT=REDRIVE, /* PSF ACTION ON TIMEOUT */
// DISCINTV=1800, /*DISCONNECT INTERVAL IN */
// APPLID=P390PSF1, /*VTAM APPLICATION PGM */
// MGMTMODE=IMMED, /*PRINTER MANAGEMENT MODE */
// LUNAME=LU3820 /* VTAM LOGICAL UNIT NAME */
//PRT9 ENDCNTL
```

The corresponding VTAM definitions, placed in SYS1.VTAMLST(LOC3820) were:

```
LOC3820 VBUILD TYPE=LOCAL
PU3820 PU CUADDR=080,MAXBFRTU=13
LU3820 LU LOCADDR=1,MODETAB=MIBM3820,DLOGMOD=IBM3820C
```

The 3820 needed a new mode table. We created this member in SYS1.VTAMLST(MIBM3820). We then assembled and linked it with the JCL shown in 3.1, "The IBM 3130 Advanced Function Printer" on page 21.

```
MIBM3820 MODETAB MODETAB FOR A CHANNEL-ATTACHED 3820
IBM3820C MODEENT LOGMODE=IBM3820C, +
      FMPROF=X'13', +
      TSPROF=X'07', +
      PRIPROT=X'B0', +
      SECPRROT=X'B0', +
      COMPROT=X'DOB1', +
      RUSIZES=X'85C7', +
      PSNDPAC=X'03', +
      SRCVPAC=X'03', +
      SSNDPAC=X'00', +
```

```
PSERVIC=X'0602000000000000002000'  
MODEEND  
END
```

Chapter 3. LAN-Attached AFP Printers

Current models of medium-speed AFP printers are often attached through LANs. A LAN can easily drive the printer at full speed, and LAN attachment permits the printer to be remote from the processor and easily relocated to any location on the LAN. In general, the LAN attached AFP printers are displacing the coax-attached AFP printers (such as the IBM 3812) that have been widely used for years.

3.1 The IBM 3130 Advanced Function Printer

The IBM 3130 printer is especially well suited for use with P/390 MVS. It is a new product and may be unfamiliar to many readers. Included here are a few paragraphs describing the 3130 printer.

The 3130 Advanced Function Printer is a 30 impression-per-minute printer intended to be shared by multiple users connected to host systems and local area networks (LANs). It provides a higher-function alternative to the IBM 3930 Page Printer when configured with multiple input trays and output stackers. The 3130 also features a duty cycle of up to 200,000 impressions per month and a high-speed RISC processor that can print complex applications at rated speeds. The 3130 supports multiple attachments, multiple printer data streams, and multiple paper sizes. It can be used with AS/400, S/390, RISC System/6000 LANs, and PS/2 and PC LANs.

The 3130 supports the IPDS data stream (which is the standard AFP data stream) and has options to support PCL5e and PostScript Level 2 data streams. Data-stream sensing and switching are supported.

Three models are available: 3130-01S (standard), 3130-02S (higher input capacity, 2750 sheets of paper), and 3130-02D (duplex, with 2500 sheet input capacity). A variety of attachment protocols can be specified, including SNA, and TCP/IP.

We used a model 3130-02D (duplex printing) with a token-ring SNA protocol. Document *3130 and 3935 Advanced Function Printer Attachment Configuration Handbook (S544-3977)* is the primary reference for installing this printer.

3.1.1 Using an IBM 3130 Printer from PSF

The 3130 printer can be driven directly from MVS PSF, or from PSF/2 on a remote workstation. PSF/2 is discussed in a later chapter. The following discussion is for direct control of a 3130 printer from MVS PSF.

Attaching a LAN AFP printer requires configuration parameters in these areas:

1. LAPS must contain a suitable definition for the LAN adapter and protocol.
2. MVS must contain a UCB for a 3088 CTC connection, which is used for a connection to a 3172 LAN control unit. For P/390 MVS, the AWS3172 device manager is used to emulate a 3172.
3. The emulated 3172 must be defined in the P/390 configuration table.

4. The (emulated) 3172 must be defined to VTAM.
5. VTAM must have a suitable mode table for the AFP printer.
6. VTAM needs an application definition for PSF.
7. The 3130's configuration must be customized, using the keys and menus available on the 3130 printer.
8. The JES2 procedure must contain an entry for the printer and SYSOUT classes associated with the printer, as well as an FSS entry for the printer. An example is shown below.
9. A PSF procedure must exist for the printer. An example is shown below.
10. AFP resources, *fonts* and a basic set of PAGEDEFs, must exist in an MVS library. As a minimum, the core interchange fonts and the PAGEDEFs and FORMDEFs that are provided with PSF should be present. If PSF is already installed in your system, these will be available.

We needed to define an SNA APPC link between PSF/VTAM and the 3130 printer. This involved the AWS3172 device manager and LAPS customization. Your LAPS configuration is probably correct already, but you might review both the README.AWS documentation file and the following:

- LAPS configuration is usually started from an OS/2 command window, with the command IBMCOM\LAPS.
- Select **CONFIGURE**.
- Select **CONFIGURE LAN TRANSPORTS**, and **CONTINUE**.
- In the lower window (Current Configuration), you should see something like:

```

IBM Token-Ring Network Adapter
  0 - IBM IEEE 802.2
  0 - IBM OS/2 NETBIOS

```

- (The NETBIOS protocol is not needed for the 3130 printer, but is probably needed by other device managers or OS/2 programs).
- Select "IBM Token-Ring Network Adapter" with the mouse, and then select the **EDIT** function.
- This will provide a panel for a number of token-ring parameters. One of these is the **NETWORK ADAPTER ADDRESS**. We entered a locally-administered address for our adapter here; we used 400005003902. We did not alter any other parameters in this panel.
- There are no CM/2 parameters involved.

The MVS definition for a 3172 (used through HCD) is:

```
UNIT=3088 (defined for address E20)
```

The address is arbitrary. We used E20 because a 3088 was already generated at this address in our system. The corresponding P/390 configuration to associate this unit with the AWS3172 device manager is:

```

Addr Device                               Mgr   FN/P
-----
> E20 > 3088                             > 9   >

```

We added these definitions to JES2PARMS, assigning PRT4 for the printer:

```

PRT(4) FSS=FSS4,MODE=FSS,PRMODE=(LINE,PAGE),SETUP=NOHALT,
        CLASS=ST,SEP,DRAIN,MARK,TRKCELL=YES,CKPTPAGE=50
FSS(FSS4) PROC=PSF3130,HASPFSSM=HASPFSSM
OUTCLASS(R) OUTDISP=WRITE,OUTPUT=PRINT,TRKCELL=YES

```

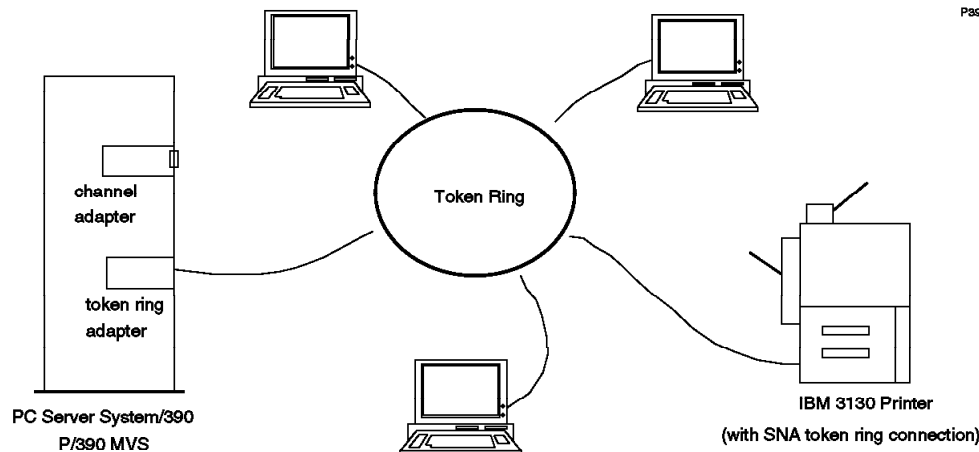


Figure 4. LAN-Attached IBM 3130 Printer. This illustrates the physical connection of a LAN SNA printer. A token-ring is shown, but the same principle would apply to Ethernet LANs.

We used the following PSF procedure (which we placed in SYS1.PROCLIB). This was a minor modification of the APSWPROS procedure, which is automatically placed in SYS1.PROCLIB when PSF is installed. We changed the PRT number, the APPLID, and the LUNAME. (Some comment lines were removed from the following listing, to make it more compact.)

```
//PSF3130 PROC
//*****
//* PSF WRITER PROCEDURE FOR 3130 PRINTER
//*****
//STEP01 EXEC PGM=APSPPIEP,REGION=1750K
//JOBHDR OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//JOBTLR OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//DSHDR OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//MSGDS OUTPUT PAGEDEF=A06462,FORMDEF=A10110,CHARS=GT15
//FONT01 DD DSN=SYS1.FONTLIBB,DISP=SHR
//PSEG01 DD DSN=SYS1.PSEGLIB,DISP=SHR
//OLAY01 DD DSN=SYS1.OVERLIB,DISP=SHR
//PDEF01 DD DSN=SYS1.PDEFLIB,DISP=SHR
//FDEF01 DD DSN=SYS1.FDEFLIB,DISP=SHR
//PRT4 CNTL
//PRT4 PRINTDEV FONTDD=*.FONT01, /* LIBRARY FOR FONTS */
// OVLydd=*.OLAY01, /* LIBRARY FOR OVERLAYS */
// PSEGDD=*.PSEG01, /* LIBRARY FOR PSEGS */
// PDEFDD=*.PDEF01, /* LIBRARY FOR PAGEDEFS */
// FDEFDD=*.FDEF01, /* LIBRARY FOR FORMDEFS */
// JOBHDR=*.JOBHDR, /* JOB SEPARATOR PAGE */
// JOBTRLR=*.JOBTLR, /* JOB TRAILER PAGE */
// DSHDR=*.DSHDR, /* DATA SET HEADER PAGE */
// MESSAGE=*.MSGDS, /* MESSAGE DATASET OUTPUT */
// PAGEDEF=V06483, /* DEFAULT PAGEDEF */
// FORMDEF=A10110, /* DEFAULT FORMDEF */
// CHARS=(GT12,GT10,GT15,GT18)
// PIMSG=(YES,0)
// DATAck=UNBLOCK, /* SHOW DATA CHECKS */
// TRACE=NO,
// FAILURE=WCONNECT, /* ACTION ON FAILURE */
// TIMEOUT=REDRIVE, /* ACTION ON TIMEOUT */
// DISCINTV=1800, /* DISCONNECT IN SECONDS */
// APPLID=SCGAFP14, /* --- match VTAM */
```

```

//      MGMTMODE=IMMED,      /* PRINTER MANAGEMENT MODE */
//      LUNAME=SCT5000A      /* <-- match VTAM          */
//PRT4  ENDCNTL

```

We needed to define the 3172 to VTAM, and then define a major node for the 3130 printer. This is done by adding (with ISPF edit) members in SYS1.VTAMLST. The member names are arbitrary, but are used in several places after they are defined. We used SYS1.VTAMLST(SLSW3172) to define the 3172 to VTAM:

```

SL3172MN VBUILD TYPE=XCA
SL3172PU PORT CUADDR=E20,      <- MVS address          X
              DELAY=0,          X
              ADAPNO=0,        <- only one token-ring adapter X
              MEDIUM=RING,     <- token-ring            X
              SAPADDR=4,       <- to match SAP 4 in 3130    X
              TIMER=60
*
GRP2172 GROUP DIAL=YES,DYNPU=YES,ANSWER=ON,ISTATUS=ACTIVE,CALL=INOUT
SLL2  LINE          <- no parameters required
SLP2  PU            <- no parameters required
SLL3  LINE          <- no parameters required
SLP3  PU            <- no parameters required

```

We used SYS1.VTAMLST(SLSW3130) to define a major name for the 3130 printer.

```

* SWITCHED MAJOR NODE DEFINITION FOR A TOKEN-RING ATTACHED 3130
  VBUILD TYPE=SWNET,MAXGRP=1,MAXNO=1
SL3130PU PU ADDR=02,          <- not meaningful          X
              IDBLK=071,      <- fixed for 3130 printer      X
              IDNUM=F5000,     <- match parameter set in 3130  X
              VPACING=0,       X
              MAXPATH=1,       X
              PUTYPE=2,        X
              DWACT=YES,       X
              SSCPFM=USSSCS,   X
              MAXDATA=1033,    X
              MODETAB=MIBM3935, <- name of mode table module X
              DLOGMOD=IBM3935  <- name of specific mode entry
PTH3130 PATH DIALNO=0004400050000001, <- see next paragraphs    X
              GRPNM=SLGRP2,GID=5,PID=1 <- match 3172 main entry
SCT5000A LU  LOCADDR=1        <- denotes a dependent LU

```

The DIALNO parameter consists of a two-digit placeholder ("00"), a two-digit SAP number for the printer ("04"), and the LAN adapter address of the printer ("400050000001," a locally-administered token-ring address we set in the 3130 printer.) Note that the SCT5000A LUname is arbitrary, but must match the LUname specified at the printer.

If the printer connection is to be started automatically, you should add the member names (SLSW3130 and SLSW3172, in our example) to the list in SYS1.VTAMLST(ATCCON00). If you do not do this, the connection can be started manually (from the MVS Master Console) with the commands VARY NET,ACT,ID=SLSW3172 and VARY NET,ACT,ID=SLSW3130.

You need a VTAM definition for the PSF application. We created SYS1.VTAMLST(PSFAPP) with the following lines:

```
* VTAM APPLICATION DEFINITION for PSF APPLICATION
PSFAPP  VBUILD TYPE=APPL
SCGAFP14 APPL  AUTH=ACQ,EAS=1,SONSCIP=YES
```

You should also add this member name to the list in SYS1.VTAMLST(ATCCON00). The SCGAFP14 name is arbitrary, but must match the name specified at the printer.

You must provide a VTAM mode table. The exact contents of a mode table are arcane, and we will not attempt to describe their meanings. We suggest you use the one shown below.¹³ A mode table must be assembled and linked into SYS1.VTAMLIB before it can be used. Listed here is the JCL to assemble and link a mode table. We suggest you place the source for the mode table in a member in SYS1.VTAMLST, and assemble it from there. We found the original JCL in IPO1.INSTLIB(VTMASM). We created the mode table parameters, based on several examples from various products.

```
//P390D  JOB  1,P390,REGION=6000K,MSGLEVEL=(1,1),MSGCLASS=X
//*  PROCEDURE TO ASSEMBLE A MODETAB
//ASMBLE  PROC M=
//ASM     EXEC PGM=ASMA90,PARM=' OBJECT,NODECK,RENT', REGION=256K
//STEPLIB DD DSN=SYS1.LINKLIB,DISP=SHR
//SYSLIB  DD DSN=SYS1.MACLIB,DISP=SHR
//        DD DSN=SYS1.SISTMAC1,DISP=SHR
//*       DD DSN=SYS1.AMODGEN,DISP=SHR
//SYSUT1  DD UNIT=SYSALLDA,SPACE=(1700,(600,100))
//SYSUT2  DD UNIT=SYSALLDA,SPACE=(1700,(600,100))
//SYSUT3  DD UNIT=SYSALLDA,SPACE=(1700,(600,100))
//SYSPRINT DD SYSOUT=*
//SYSIN   DD DSN=SYS1.VTAMLST(&M),DISP=SHR
//SYSPUNCH DD DUMMY,SYSOUT=B
//SYSLIN  DD DSN=&OBJSET,DISP=(NEW,PASS),
//          UNIT=SYSALLDA,SPACE=(80,(200,50))
//*  LINK-EDIT OBJECT TO VTAMLIB
//LKED    EXEC PGM=IEWL,PARM=' XREF,LET,LIST,NCAL,',
//          COND=(8,LE,ASM),REGION=256K
//SYSLIN  DD DSN=&OBJSET,DISP=(OLD,DELETE)
//SYSLMOD DD DSN=SYS1.VTAMLIB(&M),DISP=SHR
//SYSUT1  DD UNIT=SYSALLDA,SPACE=(1024,(50,20))
//SYSPRINT DD SYSOUT=*
//ASMBLE  PEND
//*
//MBM3935 EXEC ASMBLE,M=MIBM3935
/*
```

(listing of mode table we placed in SYS1.VTAMLST(IBM3935))

```
MOD3935  MODETAB          MODETAB FOR A TOKEN-RING ATTACHED 3130
IBM3935  MODEENT LOGMODE=IBM3935,                                X
          FMPROF=X'13',                                          X
          TSPROF=X'07',                                          X
          PRIPROT=X' B0',                                         X
          SECPROT=X' B0',                                         X
          COMPROT=X' DOB1',                                       X
          RUSIZES=X'8787',                                        X
          PSNDPAC=X'03',                                          X
```

¹³ The formal documentation of VTAM-related devices usually lists a mode table suitable for the device.

```

SRCVPAC=X'03',
SSNDPAC=X'00',
PSERVIC=X'060200000000000000002000'
MODEEND
END

```

We configured the 3130 printer as follows. (We configuring the printer, using the menus available in its display window. This takes some practice. If you can find someone who has done it before, we suggest you ask this person for assistance.)

```

Installed:                Yes
XID number:               71F5000
Remote network name:     SYSLAB
SNA Intervention Timer:  99
Local LU name:           SCT5000A      <-- match VTAM
Remote LU name:         SCGAFP14      <-- match VTAM
Mode name:
Remote address:         400005003901   <-- match LAPS
Local network name:     SYSLAB
Control point name:     SCGAFP14      <-- match VTAM
Alternate address:      400050000001   <-- match VTAM
Ring speed:             16
SSCP ID:                 050000001523
Local LU address:       1
Call type:              Call

```

3.1.2 Notes About 3130 Usage

The PSF procedure listed above is for 240 dpi characters. A 3130 printer can be set up (using the menu functions on the printer) for either 240 or 300 dpi. In a normal MVS installation, fonts for 240 dpi are in SYS1.FONTLIBB.¹⁴ A separate library, usually SYS1.FONT300, must be used for 300 dpi fonts. Simply change the FONT01 DD statement to point to SYS1.FONT300. You can also concatenate SYS1.FONTBB and SYS1.FONT300, although the correct one must be first in the concatenation.

If you use the printer in 300 dpi mode, PSF will adjust PSEGs from 240 dpi (which is the normal form for PSEGs), but you might want to verify the results. For best results, you should have PSEGs generated at the correct dpi density.

The 3130 printer has an operator display that uses a system of menus to perform various operator functions and to configure the printer. Some of the menus are complex, and you may not want to permit routine users to change menu options.

Communications failures (such as taking down VTAM) can cause the 3130 to close its LAN adapter interface. This can be restarted through the menu controls, or you can turn the printer power off and back on again to reset it. It takes several minutes to restart, but this is an alternative to having users work with the printer menu functions. *Please note that the 3130 documentation specifically recommends against power-off/power-on as a means of restarting communications*, although we observe that this method is frequently used.

¹⁴ SYS1.FONTLIB contains unique 3800 fonts. If you do not have a 3800 printer, you do not need SYS1.FONTLIB and can delete it.

One of the setup options in the printer menu (for SNA connections) is the selection of CALL or LISTEN mode. This determines whether the printer should attempt to make the initial contact with VTAM (CALL) or whether it should wait for VTAM to contact the printer (LISTEN). Either option may be used, but we found that CALL appeared to be a better choice.

Chapter 4. Emulated Line-Mode Printers

Emulating mainframe line-mode printing using small PC printers is not as simple as it may first appear. Problems include the following:

- Some programs do not provide any carriage control functions. That is, they assume they are starting at the top of the page, and depend on line-to-line spacing to correctly format their output. If a PC printer used for this output has a different number of lines per page, the output will not be formatted correctly.
- For a given character size and line spacing, PC laser printers have a different number of lines per page than mainframe line printers. This is due to the unusable page margin on small laser printers.
- PC printers usually “wrap around” print lines that are too long, printing the overflow on the next line. Mainframe line printers (and the JES support programs) usually discard the excess.
- Typical PC printers have no equivalent to carriage control tapes or forms control buffers. These functions need to be emulated by counting print lines per page, and this can be quite difficult due to wrap-around printing or spacing adjustments (made by direct printer commands) that are unknown to the line-counting code.
- Different sized forms can be mounted on line printers, and this usually cannot be done on small PC laser printers. This problem is compounded when mainframe line output is sent to AFP printers with different FORMDEFs. The same paper (letter size) in an AFP printer receiving line mode output can be printed as:
 1. Simplex portrait mode output (in various font sizes, line lengths, and line spacings).
 2. Simplex landscape mode output (in various font sizes, line lengths, and line spacings).
 3. Duplex portrait mode output (in various font sizes, line lengths, and line spacings).
 4. Duplex landscape mode output (in various font sizes, line lengths, and line spacings).

The two duplex modes listed do not correspond to modes of a line printer, but they are desirable output modes in line format. AFP printers used in line mode usually offer a duplex option.

- Standard ASA and machine printer control characters have no meaning for PC printers, and their actions must be emulated.
- Different printer trains/chains and translation buffers can be used with line printers, effectively creating different code pages.
- Different PC printers may have different control codes, meaning that the program used to emulate a mainframe line printer must provide a way to specify the proper PC printer control strings for various functions.

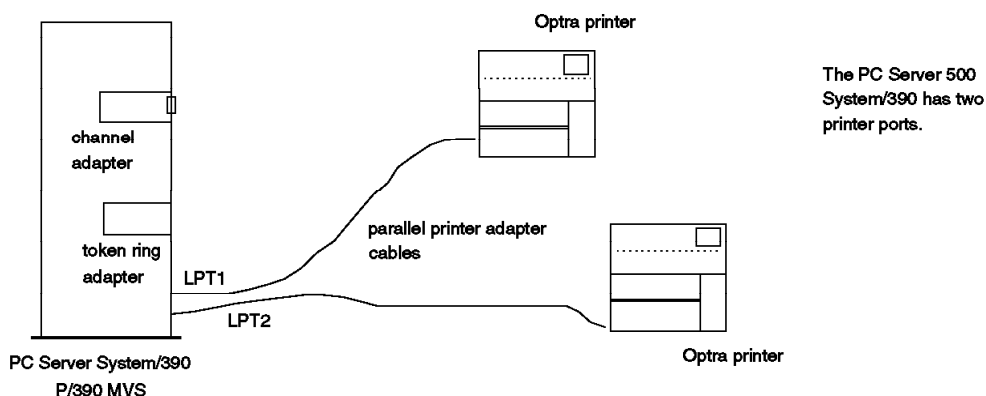


Figure 5. Printers for Line-Mode Emulation. PC printers, used for emulating mainframe line printers, are connected to the Server's printer ports, as normal PC printers. The PC Server/390 has two parallel printer ports. Lexmark Optra printers are shown, but the configuration applies to most PC printers.

Line printers can be *emulated* for P/390 operating systems by the AWS2821 device manager.¹⁵ AWS2821 has a number of potential operating modes, including:

1. Direct output to an OS/2 file. New output is appended to the end of the file. The file grows until an action is taken under OS/2 to edit or delete it.
2. Print directly to an OS/2 printer. A variety of printers can be used, and this chapter details some of the potential configurations.
3. Print through the OS/2 spooler. This is similar to directly controlling a printer, but with some additional considerations.

The AWS2821 device manager, like all P/390 device managers, is driven by CCWs from MVS. JES2 thinks it is driving a real line printer, and generates whatever CCWs are necessary for driving that model of printer. The AWS2821 program inspects each CCW, and emulates the function required. Logical printer control, such as controlling lines per page and issuing channel skips, is done by JES2 or the MVS application program. The net result is a series of CCWs for data writes and control functions. AWS2821 attempts to interpret the CCWs and issue whatever PC printer commands are needed to accomplish the required operation.

MVS works in EBCDIC; PC printers work in ASCII. AWS2821 always needs to convert EBCDIC to ASCII. The AWS2821 device manager uses the default code pages set for the P/390 configuration for conversion.

4.1 Lexmark Optra Printers

We used a Lexmark Optra model L printer for direct PC attachment. This model is rated at 12 pages/minute (600 dpi printing) or 8 pages/minute (1200 dpi printing). Our unit had a duplex printing attachment, for printing on both sides of the paper. It used a standard PC parallel interface to connect to the PC Server. This printer has basic PC printing functions, plus PCL 5 emulation and PostScript

¹⁵ The IBM 2821 unit was a control unit for 1403 printers and 2540 card readers/punches as part of the original S/360 systems.

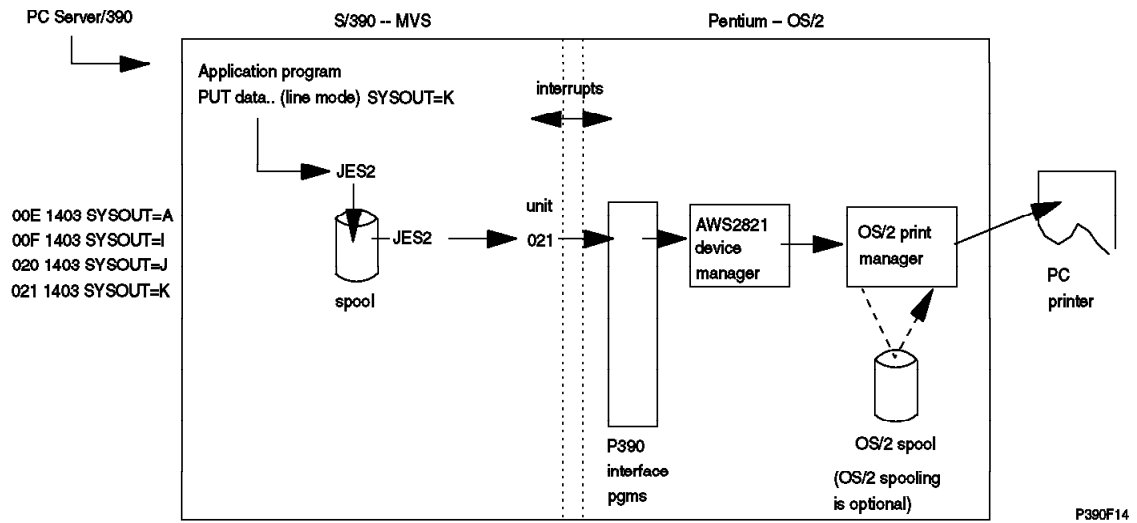


Figure 6. Emulated Line Printer. This illustration provides an overview of the logical flow of line-mode output from an application to a PC printer.

Level 2 emulation. It has automatic data stream detection that switches to the appropriate control language mode.

The descriptions in this section (and in the section on PSF/2) assume the use of this printer. We expect that most of the discussion and examples will apply to a wide range of PC printers, although minor variations may be present in various other printers.

We did not install the toolkit or MarkVision programs that came with the printer.

4.2 Basic AWS2821 Use

The AWS2821 device manager can direct output to a PC printer or to a PC file. There are many uses for file output, but they are not within the scope of this document and are ignored here. The GG24-2538 document and the DOC files with the P/390 diskettes contain more information about this option. This chapter discusses the use of AWS2821 to provide output on a PC printer.

Using the P/390 configuration program, we defined device 00E, assigned it to the AWS2821 device manager, and told the device manager to direct output to LPT1 on the OS/2 system.

Addr	Device	Mgr	FN/P
> 00E	> 1403	> 6	> LPT1

(AWS2821 is device manager “6” in the current P/390 support programs.) Our MVS had a 1403 printer defined as address 00E. Our JES2 had PRT1 defined for SYSOUT=A output, but no unit assigned to it. To temporarily connect the MVS and JES2 definitions, use:

```

$DU,PRT1          to verify state and queue name(s)
$T PRT1,UNIT=00E  to assign device 00E to $PRT1
$$ PRT1          start printer
- -
$$ PRT1          to respond to setup message before first job

```

To permanently connect JES2 PRT1 to device 00E, edit JES2PARM and add a UNIT definition to the PRT1 parameters.

Using this setup, application output directed to SYSOUT=A was sent to the Optra printer. It printed (in portrait orientation) with 10-pitch characters, 60 lines per page. This character size provided lines with 80 characters; any lines longer than this were truncated (and *not* wrapped around to the next print line). We had the printer set for duplex printing, but this was ignored.¹⁶ This is the most basic printing mode of the AWS2821 device manager.

Note that IBM 1403 printers used paper carriage control tapes to manage forms skipping. AWS2821 has no way to emulate this, and carriage control skips (other than channel 1, which is interpreted to be top-of-page) are ignored. If used with MVS printer definitions that support FCBs (a 3211 printer, for example), the FCB functions are not emulated by the original AWS2821 modules.

By default, JES2 prints 61 lines per page. Our printer (in the very basic mode described here) printed 60 lines per page. The result was a lot of output pages with one line (being the 61st line before a page eject). AWS2821 interpreted the page in the JES2 output and passed it to the Optra printer. You can change the JES2 default number of lines per page by changing a statement like this in JES2PARM:

```
PRINTDEF CCWNUM=50,DBLBUFR=YES,FCB=6,LINECT=61
```

AWS2821 is intended to print 132-character lines, by default, using a smaller character set. It produces control characters suitable for IBM 4019 printers. These control characters did not function with our Optra printer, and the 10-pitch characters were produced.

4.3 Advanced AWS2821 Functions

A new release of AWS2821 is expected in early 1996, and this has more features than described in GG24-2538 and other documents associated with the original P/390 MVS announcement. The new version may be named AWSLPT instead of AWS2821; at the time this was written, the name change was uncertain. We will use the AWS2821 name here. *The description here is based on early versions of the code, and the final program may differ in some details.*

The new features of AWS2821 include the use of a control file. You must create this file yourself; the P390 configuration program cannot do it automatically. To use the new functions, include the name of the control file in the configurator line defining the emulated printer:

```

Addr Device                               Mgr   FN/P
-----
> 00E > 1403                             > 6   > /C=D:\P390\PRT.00E

```

¹⁶ This printer can be set for PCL5 or PC as its native printer control language. We tried both, with the same results. We normally used PCL5 as the control language setting for the printer.

In our examples, we assume that Manager 6 is AWS2821.¹⁷ The “/C=” characters are required. The remainder must be a fully qualified OS/2 file name; we suggest using a meaningful name, such as shown in the example.

The control file is a simple OS/2 ASCII file, created with any of the basic OS/2 editors. The control file will contain several lines in any order; the basic control lines are as follows:

```
// Comment lines begin with two slashes
PC= xx xx xx xx xx xx xx xx xx
EOJ=nn,oo,' sssssssssssssss'
FILTER=Y          (or N)
LL=132           (or some other length)
EOJPC= xx xx xx xx xx
FILE=C:\OUTLST.TXT
```

You are unlikely to have all of these control lines in any given instance of a printer control file. The meanings of the parameters are:

- **PC** provides a string of printer control characters (entered in hex) that are sent to the PC printer every time a printer output file is opened. You must provide this string, although we provide some examples for common Lexmark and HP printers. AWS2821 does not interpret or verify these codes. The maximum length of the line is 255 characters. All control files will normally have this parameter line.
- **EOJ**, if present, checks line nn (after a skip to channel 1), at offset oo in the line, and attempts to match string ssss. If a match is found, then this page is the ending page of a job. After the next skip to channel 1, AWS2821 will close the printer file. (If more printed output arrives from the P/390, a new printer file is opened.) The nn and oo parameters start with 1; a page begins with line 1 and column 1.
- **FILTER**, which defaults to Y, indicates that AWS2821 should, after all code page translation is completed, remove any ESC characters in the output before sending it to the printer.
- **LL**, which defaults to 132, sets a truncation length for print lines.
- **EOJPC**, if present, defines printer control characters which should be sent to the printer before closing the printer file. These characters might restore the printer to its normal characteristics. (We found that OS/2 does this, so this function may not be needed.)
- **FILE** provides the name of an OS/2 file for output, instead of sending output to the printer. You can specify an output file name in the configurator line instead. You can also specify a printer name, such as LPT1 or LPT2, as the file name; this would be useful if you have more than one PC printer.

With proper setup, AWS2821 plus a control file can be a powerful combination. The ability to send control characters to the PC printer, before printing any output, is the key to the advanced functions. If your PC printer supports the necessary functions, you can send controls to rotate the output (to landscape

¹⁷ As mentioned before, the manager numbers are not fixed. They are simply the sequential number of a particular manager in a list of managers. Your configuration file (on disk) contains the name of the appropriate manager, which would be AWS2821 in the example here. If the list of known device managers changes, the relative number of a particular manager may change. If you install a future set of P390 updates, AWS2821 might be manager C, for example. Your configuration file would still be valid, because it remembers the name of the manager, not its number.

mode), select a smaller character set (to hold 61 lines of 132 characters, for example), and print on both sides of the paper (duplex).

The EOJ string is not required, but can be helpful. You would normally set it to a string contained in the JES2 trailer page. If you do not specify an EOJ (or if your string is not found in the output), AWS2821 closes the PC printer after approximately 10 seconds of no new print data. Since OS/2 is normally spooling output, it may¹⁸ not start printing AWS2821 output until the file is closed. If you specify an EOJ string (and the string is found in the output file), AWS2821 will close the printer file at the end of that page, thus releasing it for OS/2 printing immediately. AWS2821 will then open another printer file for the next output job.

We used this control file for our Optra printer:

```
// control file for Lexmark Optra with duplexer
PC=1b 45 1b 26 6c 31 53 1b 26 6c 31 45 1b 26 6c 38 44 1b 28 73 31 33 56
EOJ=31,01,'**END**'
LL=132
```

This control file causes the Optra to rotate to landscape mode, print 8 lines/inch, with 12 characters/inch. This produces 60 lines/page, with a 120-character line filling the page. Duplex printing is enabled.

A brief analysis of this control string may be helpful. Remember that each control character is entered in hexadecimal in the control file. Your printer documentation may list control characters in hex, decimal (for eventual use as a single-byte binary number), or ASCII. You must make the conversion. The control string in the last example is used as follows:

1b 45	This sequence resets the printer
1b 26 6c 31 53	This enables the duplex option
1b 26 6c 38 44	This sets 8 lines per inch
1b 28 73 31 34 56	This sets 14 characters per inch

Our printer selected 12 characters/inch, instead of the 14 we requested. It automatically selects the best fit of resources available to resources requested.¹⁹ Allowing for a .25 inch left and right margin, a line (on letter-size paper, printed in landscape mode) can contain 126 characters. Lines longer than this will be truncated. By default, a Courier font was used.

You may need to do a little experimentation to find the best controls for your printer. Many PC printers offer a wide range of control sequences, with overlapping definitions between various controls.

You can define multiple printers (1403, 3211, and so forth) to MVS and JES2. You can assign a different SYSOUT class for each one. You can define a different AWS2821 control file for each emulated printer. You might, for example, define the following:

- 1403 address 00E - SYSOUT A - control file D:\P390\PRT.00E - with controls to produce landscape, duplexed, 64 line, 132 character pages.
- 1403 address 020 - SYSOUT C - control file D:\P390\PRT.020 - with controls to produce portrait, simplex, 12-pitch characters (about 96 characters/line), with 66 lines per page.

¹⁸ You can control this using standard OS/2 controls.

¹⁹ The printers can be set to use many different fonts and sizes. The example here is merely a starting point.

- 1403 address 021 - SYSOUT D - control file D:\P390\PRT.021 - with controls to produce landscape, simplex, tiny characters, with as many lines per page as possible (for printing dumps).
- And so forth.

If you have only one PC printer, how can you have multiple emulated printers? OS/2 can spool multiple print streams and schedule their printing as the printer becomes available! This means double spooling: JES2 spooling followed by OS/2 spooling. Within reason, this should work well. If this bothers you, you can start only one JES2 printer (emulated printer, of course) at a time and disable OS/2 spooling, or buy two PC printers (there are two parallel ports on the PC Server), or use multiple LAN printers for output, or some combination of these options.

Any changes to your DEVMAP file (that is, changes made through the P390 configurator) are generally not available until you stop the P390 subsystem and then restart it. For example, if you add a control file name to a printer, or change the control file name, you must restart the P390 (and re-IPL MVS) to effect the changes.

However, you can change the contents of a printer control file while the P390 and MVS are running. For example, you might change the **PC=** control characters. To activate the changed file, do the following:

1. Stop using the printers associated with the AWS2821 device manager. You might use the \$P PRTS command, for example. Be certain there is no printer activity before continuing. You do not need to vary the printers offline.

2. In an OS/2 window, switch to the P390 directory and issue the command:

```
AWSSTAT AWS2821
```

This will stop the AWS2821 device manager.

3. From the same OS/2 window, enter the command:

```
AWSSTART AWS2821.EXE N
```

This will restart the device manager, and cause it to re-read the control file. It will not read a different control file; it will re-read the control file that was specified in your DEVMAP when you last started the P390 subsystem. (You must enter the .EXE portion of the AWS2821 name.) Enter the command:

```
AWSSTAT /L
```

to verify that AWS2821 is in the list of operational device managers.

4. From the MVS console, start the printers again.

The new version of AWS2821 will also process additional CCWs intended for printers later than the 1403. These are primarily for forms control. The new AWS2821 versions will accept functions that set the FCB (as in a 3211 or 4248 printer), and will simulate carriage control skips by line counting and blank lines to the PC printer. There is no way to emulate the paper carriage control tape used with 1403 printers. There are no external controls (in the P/390 configurator setup, for example) for the FCB function. You must generate an FCB, using the documented MVS functions, and specify this FCB in your JCL for the output data set. JES2 will send the FCB to the 3211, where AWS2821 will read and interpret it.

As a reminder, MVS has several standard FCBs supplied in SYS1.IMAGELIB. In particular, FCB2STD1 (48 lines), FCB26 (64 lines) and FCBSTD2 (66 lines) are included. FCB26 is commonly used as a default FCB. The naming convention for FCBs is:

- Names beginning with FCB2 are for 3211 printers.
- Names beginning with FCB4 are for 4248, 3262-5, and 6262-14 printers. (FCBs for 3211s can also be used with these printers.)
- In general, all FCB names should begin with either FCB2 or FCB4.

While preparing this document, we did not have time to work with the FCB functions, and have no experience in using them with P/390 MVS.

Chapter 5. Using PSF/2 for AFP Printing

PSF/2, which runs under OS/2, works in conjunction with PSF running under MVS, VM, or VSE.²⁰ PSF/2 offers a number of services, including:

- It can accept data from PSF, using an SNA link, and drive printers attached to the OS/2 system. This can offload some of the overhead of driving printers.
- It can drive AFP printers, attached in a variety of ways. These can be channel attached, LAN attached, or coax attached.
- It can also emulate AFP printers, using typical PC laser printers. That is, PSF/2 contains logic to interpret an IPDS data stream and produce the required output on a variety of PC laser printers. With minor exceptions, full-function AFP is possible this way, including proper handling of PAGEDEFs, FORMDEFs, PSEGs, and so forth.
- In one mode of operation (DPF), it accepts data from the host and spools it on the OS/2 system (using its own spool file) and later prints from this spooled data. In this mode, the printer operator works with PSF/2 commands, where he can stop, start, space the printer, select jobs to be printed, and so forth. In this mode (DPF), PSF/2 maintains or caches selected AFP resources (such as fonts) to further offload the host.
- In another mode (PSF Direct), it acts as remote printer for host PSF. This mode still offers AFP printing on simple PC laser printers, but there is no local spooling, resource holding, or extensive operator interaction.

We installed PSF/2 primarily to use PSF Direct mode to produce AFP output on our Lexmark Optra laser printer attached to one of the parallel ports on our PC Server/390. We were particularly interested on having PSF/2 operate on the OS/2 side of our PC Server/390, while MVS ran on the P/390 side. (This worked fine.) While we were at it, we also connected a 3130 printer (token- ring), and a 3816 printer (PSA attached, mentioned later in 6.2, "Print Service Adapter" on page 47).

We were interested in the use of a PC laser printer as a low-volume, low-cost AFP printer suitable for many P/390 MVS users. By "low volume" we mean something up to a thousand pages per day, although the average might be considerably less than this. Our printer is capable of more, but the mechanics of handling several thousand pages per day (loading paper in relatively small trays, replacing the toner cartridge every week or so, and so forth) indicate that another class of printer might be better for medium volume printing.

The use of a PC laser printer for low volume P/390 MVS printing is attractive. The same printer can be used for OS/2 printing. The print quality is good (our Optra is superb). Costs are low. Printer handling (loading, clearing) can be done by anyone. If AFP printing is not required, the same printer can be managed in a variety of ways -- as described in Chapter 4, "Emulated Line-Mode Printers" on page 29.

²⁰ PSF/2 can also work independently, printing files from OS/2, although it would seldom be installed solely for this purpose.

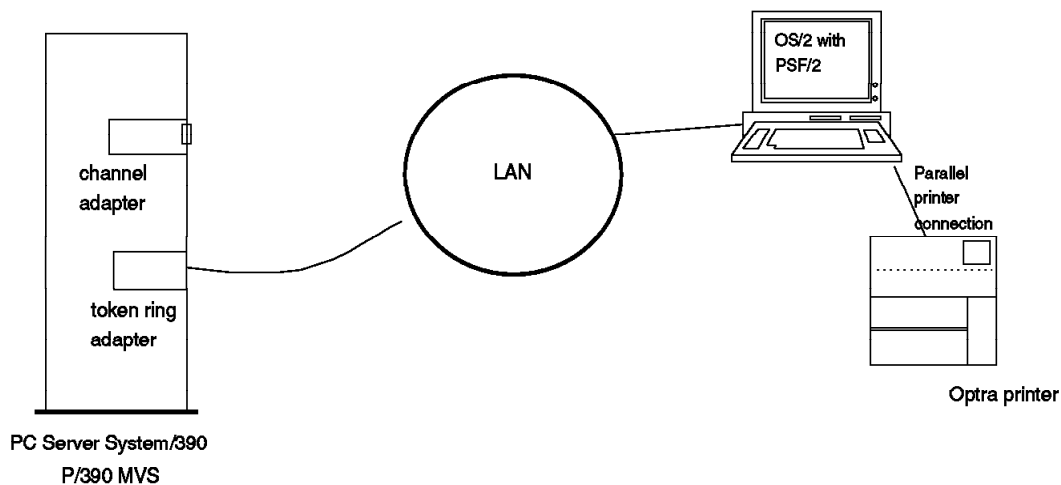


Figure 7. Normal PSF/2 Configuration. PSF/2 runs in a PC, normally separate from a host MVS system.

Typical PC printers do not understand AFP protocols and formats. Software or hardware is required to convert AFP functions (meaning an IPDS data stream) to data and commands that can be handled by PC printers. (A few printers are available that handle both normal PC protocols and IPDS protocols. We did not have one of these and this class of printer is not addressed here.) PSF/2, working with host PSF, does this. The PSF/2 Version 2.00 product number is 5622-551. PSF/2 requires DB2/2 as a prerequisite. We used the DATABASE 2 OS/2 Single-User version. Be certain you have the latest OS/2 version. PSF/2 required about 45 MB disk space on the OS/2 system, and DB2/2 required about 11 MB. The use of DB2 is completely transparent to the customer. No customization or setup is required (other than adding three startup commands to OS/2).

5.1 Our PSF/2 Installation Notes

We will not describe PSF/2 or DB2/2 installation here. Both are normally installed from CD-ROMs, and the installation process is about the same as any other OS/2 product. PSF/2 includes good documentation, covering installation, customization, and operation. It has many examples for working with a large variety of printers and communications methods. PSF/2 normally communicates with PSF through an APPC SNA link. In our case, this means a link through the AWS3172 device manager and through CM/2.

PSF/2 is normally operates on a separate system from the MVS host. In our P/390 MVS environment, we wanted to use it on the same PC Server that had the P/390 adapter running MVS. We needed to simulate the SNA link between PSF in MVS and PSF/2.²¹ We were able to do this by having both AWS3172 (handling VTAM output) and CM/2 (handling PSF/2 input, and sometimes PSF/2 output to a printer) use the same token-ring adapter in the PC Server/390. The

²¹ An alternative is to run PSF/2 in another PC, connected via LAN SNA to the P/390 MVS system. This is normal PSF/2 usage and is discussed in other documents, such as *Distributed AFP Printing from a Host System* (redbook GG24-4493), and is not covered here.

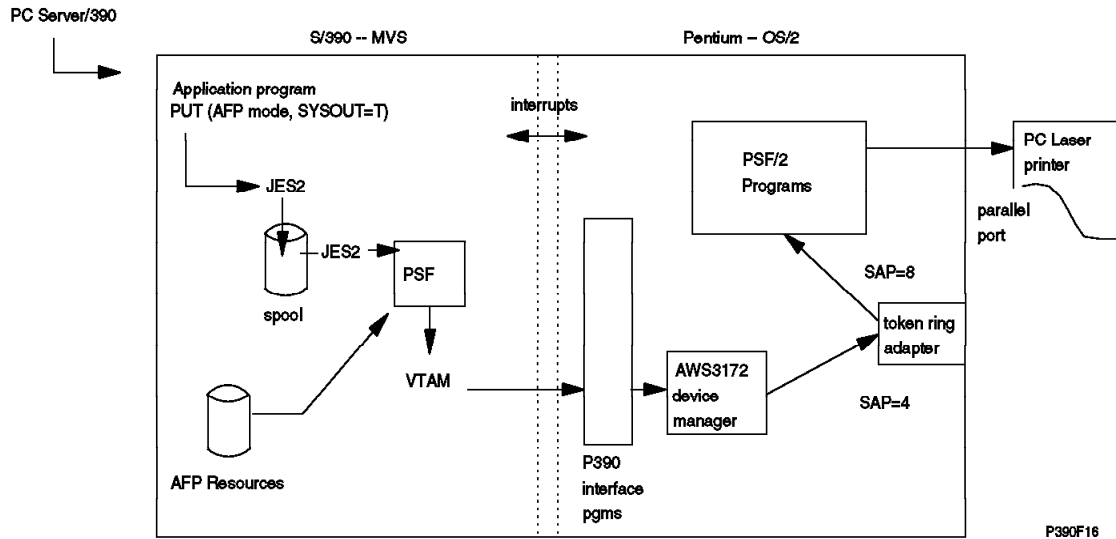


Figure 8. AFP Printing Through Local Server. This illustrates the use of two separate SNA functions (CM/2 and AWS3172) working through the same token-ring adapter. An APPC is used between the two programs.

key to making this work is to assign different token-ring SAP addresses to the two users (AWS3172 and CM/2).

An screen-by-screen view of the CM/2 customization we used to communicate between PSF/2 and AWS3172, via the same token-ring adapter, and to communicate between PSF/2 and a 3130 printer on the same token-ring is shown in Appendix A, "CM/2 Configuration for APPC" on page 63. A more extensive discussion of SAP addressing, or CM/2 customization, is beyond this document.

In one configuration with PSF/2 operating in the same PC Server as P/390 MVS, we had no external devices attached to our token-ring adapter. PSF/2 was using the token-ring to communicate with MVS PSF (via CM/2, AWS3172, and VTAM), but these were all in the same physical box. This operation is shown in Figure 8. If we disconnected the token-ring cable, or unplugged it from a MAU, the communication system failed. It appears that the token-ring adapter must be in an operational environment before two internal applications can communicate through it. We found that we could remove the token-ring cable, at the Server end, replace it with a token-ring loop plug, and again have an operational system.²² The loop plug is IBM part number 6165899, and is normally used when running token-ring adapter diagnostic programs.

We did note one potential problem when installing PSF/2. Both P/390 support programs and PSF/2 contain OS/2 device drivers for the channel emulator adapter. No error messages appear during OS/2 startup if both drivers are present. However, P/390 MVS (and probably PSF/2) do not work correctly if both drivers are present. **After installing PSF/2, check CONFIG.SYS to determine if it installed a device driver for the channel emulator.** You probably want to remove it. This driver is usually named PSF2\BIN\CHAN370.SYS. The channel emulator cannot be shared between OS/2 programs (such as PSF/2) and P/390 programs.

²² We also tried removing the token-ring adapter completely, but this did not work.

We will not list all the JES2, VTAM, and PSF parameters used to drive printers through PSF/2. They are very similar to the listings shown in 3.1.1, "Using an IBM 3130 Printer from PSF" on page 21. Different JES2 printer names (PRT1, PRT2, PRT3, and so forth) must be used for each printer. A different PSF procedure would be used for each printer. The LU names and APPLID names would differ. For driving PSF/2, we used APPLID=P390PSF1 and APPLID=P390PSF2 in two PSF procedures. The corresponding VTAM definitions were:

```
PSFAPPL2 VBUILD TYPE=APPL
P390PSF1 APPL AUTH=ACQ,EAS=1,SONSCIP=YES
P390PSF2 APPL AUTH=ACQ,EAS=1,SONSCIP=YES
```

We used LUNAME=PSF39021 and LUNAME=PSF39022 in the PSF procedures. The corresponding VTAM definitions were:

```
                VBUILD TYPE=SWNET,MAXGRP=1,MAXNO=1
P3902          PU  ADDR=02,IDBLK=05D,IDNUM=23902,MAXPATH=1,C
                VPACING=0,PUTYPE=2,SSCPFM=USSSCS,MAXDATA=1033,C
                MODETAB=MODDPFN,DLOGMOD=MODDPFC2
TERM390       LU  LOCADDR=2,MODETAB=ISTINCLM,DLOGMOD=SNX32702
PSF39021      LU  LOCADDR=0
PSF39022      LU  LOCADDR=0
```

The PSF/2 documentation contains extensive descriptions of the PSF and VTAM parameters needed to install and use PSF/2.

5.2 Selected PSF/2 Configuration Screens

As stated before, we will not describe the installation of PSF/2. The product documentation does this very well, and there is no need to repeat it. In this section we include a few of the screens used to configure PSF/2, to provide a indication of the general appearance and style of the PSF/2 screens.

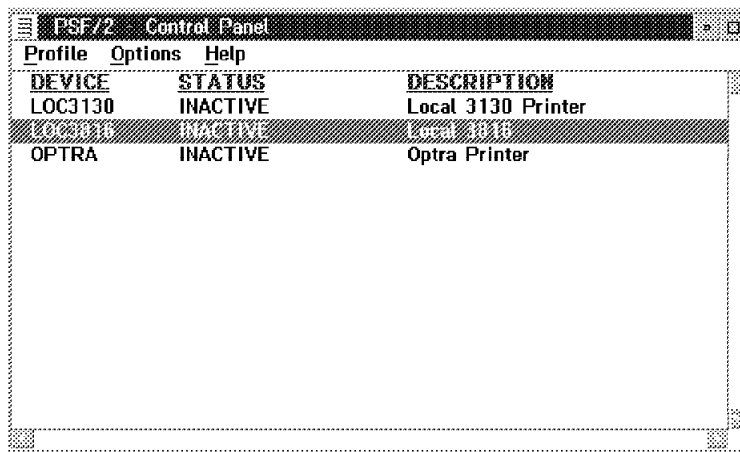


Figure 9. PSF/2 Control Panel. To reach this screen, click on PSF/2 **Control Panel** in the PSF/2 icon. To create a new printing device, click on **Profile**, and then **New**. This will produce the following screen.

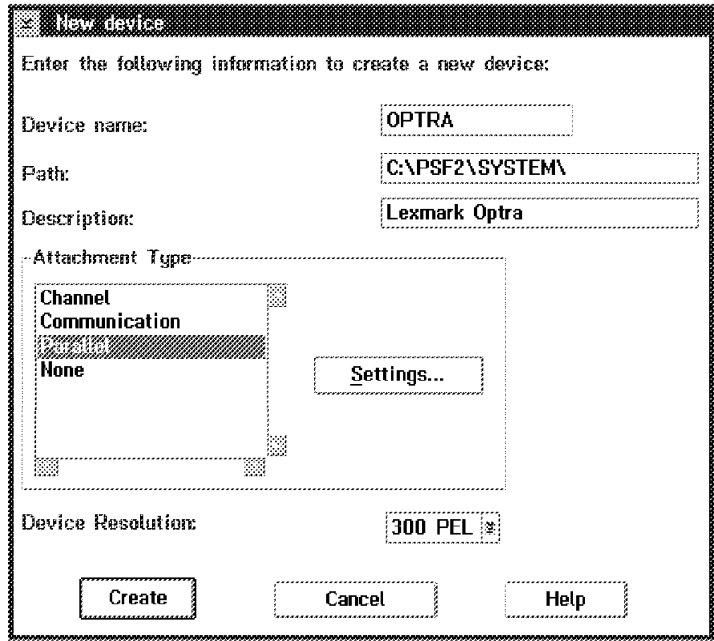


Figure 10. New Device. For a printer attached to the PC parallel port (such as our Optra printer), click on **Parallel** and then **Settings**.

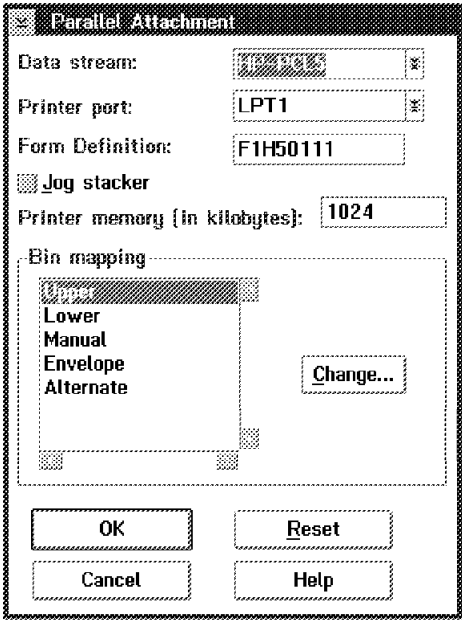
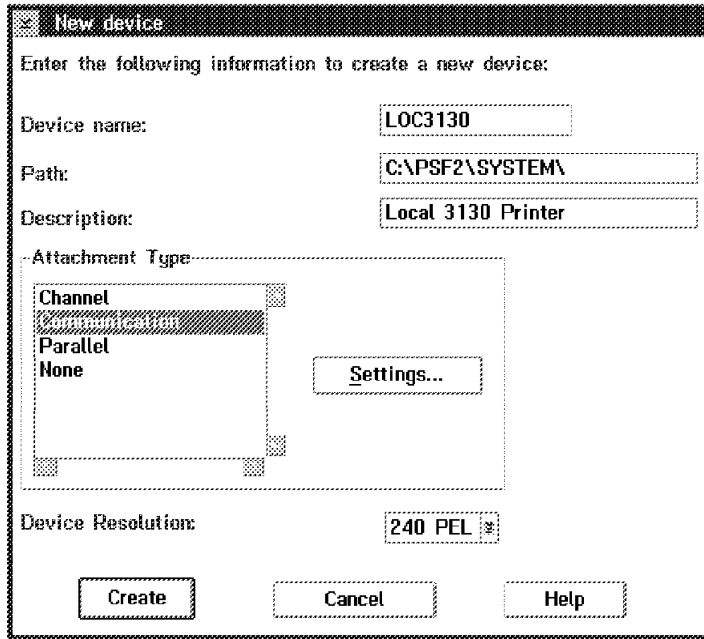


Figure 11. Parallel Attachment. In the settings panel, specify the proper port (LPT1), native printer control language (HP-PCL5), and a default form definition.

The following few screen images illustrate the definition of an IBM 3130 LAN-attached printer to PSF/2. A LAN-attached 3130 printer can be controlled directly by MVS PSF (via VTAM), or controlled through PSF/2. This chapter also discusses direct MVS PSF control of a 3130. The following screens illustrate defining a 3130 to PSF/2, if you wish to operate it through PSF/2.



New device

Enter the following information to create a new device:

Device name: LOC3130

Path: C:\PSF2\SYSTEM\

Description: Local 3130 Printer

Attachment Type:

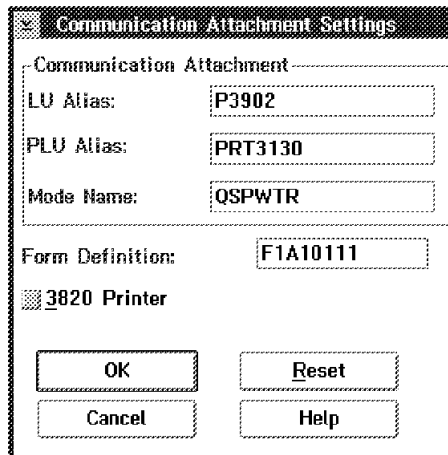
- Channel
- Parallel
- None

Settings...

Device Resolution: 240 PEL

Create Cancel Help

Figure 12. New Device. Create a new printer attached through a **Communications** path.



Communication Attachment Settings

Communication Attachment:

LU Alias: P3902

PLU Alias: PRT3130

Mode Name: QSPWTR

Form Definition: F1A10111

3820 Printer

OK Reset

Cancel Help

Figure 13. Communications Attachment Settings. The LU is the PU name defined in CM/2. The PLU is the partner LU name, which must also match the partner LU name defined in CM/2.

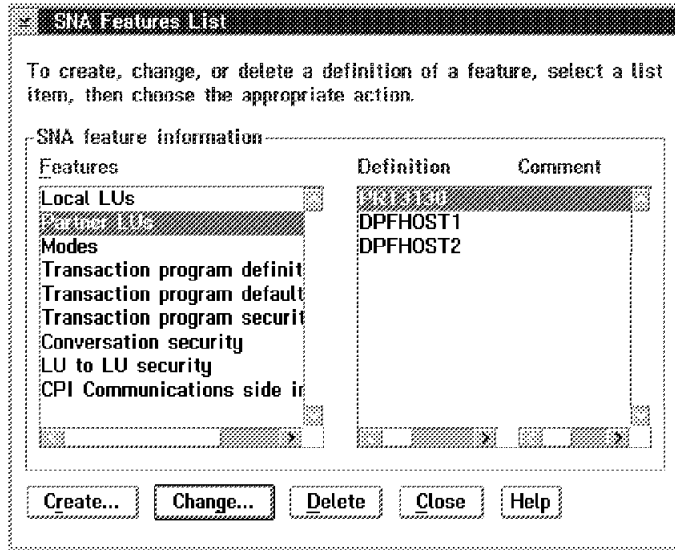


Figure 14. SNA Features List. This is a screen from CM/2, showing the matching names.

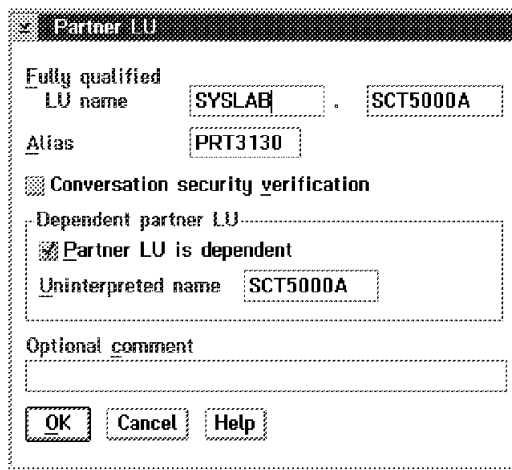


Figure 15. Partner LU. This is another screen from CM/2, showing the matching partner name.

The IBM 3130 printer must be customized to match its host system. This is done using the operator panel on the 3130 itself. Here are the key variables set in our 3130, when we used it with PSF/2.

```

Installed:                Yes
XID number:               71F5000
Remote network name:      SYSLAB
SNA Intervention Timer:   99
Local LU name:            SCT5000A
Remote LU name:           SLPS86
Mode name:                QSPWTR
Remote address:           400008555086
Local network name:       SYSLAB
Control point name:       SCGAFP14
Alternate address:        400050000001
Ring speed:               16
SSCP ID:                  050000001523
Local LU address:         1
Call type:                 Call

```

The following table indicates where matching parameters should be found. The specific parameters we used are indicated in parenthesis. Most of our parameters are arbitrary names, but are used consistently throughout this document.

<i>Table 2. Matching Parameters</i>		
3130 Customization	PSF/2 Parameters	CM/2 and LAPS
Remote network name (SYSLAB)		Network ID
Local LU name (SCT5000A)		Connection to Peer Node; Partner LUs; LU name
Remote LU name (P3902)		APPC APIs through TR; Local node name
Mode name (QSPWTR)	Device options; communication attachment settings; mode name	
Remote address (400005003902)		LAPS network adapter address
Local network name (SYSLAB)		Connection to Peer; Node, Partner LUs; Network ID
Control point name (SCGAFP14)		Connection to Peer Node; Partner node name
Alternate address (400050000001)		Connection to Peer Node; LAN destination address
	Device Options; Communications; Attachment Settings; PLU Alias (PRT3130)	Connection to Peer Node; Partner LUs; Alias ID

Chapter 6. Using Coax-Attached AFP Printers

IBM 3174 control units can be attached (via coax) to a variety of small AFP printers, including IBM 3812, 3816, 3916, and so forth. These printers are of interest because (a) there are many of them installed in larger customers, (b) some are being replaced by faster LAN-attached printers, and (c) you (a P/390 MVS owner) may inherit some of the older units. If this is the case, be certain to also acquire the 3174 control unit needed to drive the printers.

The 3174 control units are normally used to attach various 3270-family terminals, and a few of the coax positions might be used for printers. The 3174 control units can be connected to the P/390 MVS host via:

- Channel attachment, using the S/370 Channel Emulator/A adapter in the PC Server System/390. There are two versions: SNA and non-SNA. We describe the SNA version here, because it is the only one supporting full-function AFP printing through an attached 38xx-type printer.
- LAN connection, using an SNA gateway function.
- SDLC modem connection for remote 3174 units. A variety of models and sizes are available for remote units. For practical purposes, you will need synchronous modems (not normal PC modems) and a leased line for connection.

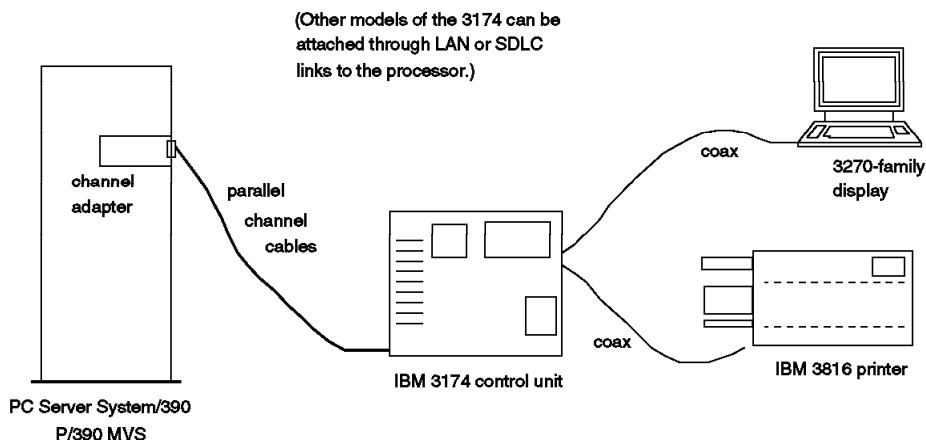
In principle, the channel-attached 3174 should be the lowest-overhead unit. In practice, with P/390 MVS, the LAN-connected 3174 may at least equal the performance of the channel-attached unit. The reason is that the S/370 Channel Emulator/A adapter does not provide its best performance for small I/O blocks, and 3174 I/O tends toward smaller blocks. The differences are probably not significant unless a system is heavily loaded; we do not have any experimental measurements for this situation.

6.1 Channel-Attached SNA 3174 Control Unit

A channel-attached SNA 3174 control unit is easy to set up. The channel connection to the S/370 Channel Emulator/A is straightforward, as outlined in Chapter 2, "Channel-Attached Printers" on page 9. In our discussion, we assume the 3174 control unit has S/390 base address 080. Setup involves the following:

1. The P/390 configuration panel, to define a channel connected device
2. MVS UCBs (defined using HCD)
3. The JES2 parameters
4. A PSF procedure
5. A SYS1.VTAMLST member
6. Another mode table for VTAM

An SNA 3174, channel attached, is defined to MVS (HCD) as a 3791L control unit. The P/390 configuration definitions would appear like this:



P890F10

Figure 16. Coax-attached AFP Printer

Addr	Device	Mgr	FN/P
>	>	>	>
080	3791	L	

The JES2 definitions we used were:

```
PRT(7) FSS=FSS3812,MODE=FSS,PRMODE=(LINE,PAGE),
CLASS=J,SPE,DRAIN,MARK,TRKCELL=YES,CKPTPAGE=50
FSS(FSS7) PROC=PSF3812,HASPFSSM=HASPFSSM
OUTCLASS(7) OUTDISP=WRITE,OUTPUT=PRINT,TRKCELL=YES
```

We added SYS1.PROCLIB(PSF3812) as follows:

```
//PSF3812 PROC
//STEP01 EXEC PGM=APSPPIEP,REGION=1750K
//JOBHDR OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//JOBTLR OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//DSHDR OUTPUT PAGEDEF=V06483,FORMDEF=A10110,CHARS=GT15
//MSGDS OUTPUT PAGEDEF=A06462,FORMDEF=A10110,CHARS=GT15
//FONT01 DD DSN=SYS1.FONTLIBB,DISP=SHR
//PSEG01 DD DSN=SYS1.PSEGLIB,DISP=SHR
//OLAY01 DD DSN=SYS1.OVERLIB,DISP=SHR
//PDEF01 DD DSN=SYS1.PDEFLIB,DISP=SHR
//FDEF01 DD DSN=SYS1.FDEFLIB,DISP=SHR
//PRT7 CNTL
//PRT7 PRINTDEV FONTDD=*.FONT01, /* FONT LIBRARY DD */
// OVLDD=*.OLAY01, /* OVERLAY LIBRARY DD */
// PSEGDD=*.PSEG01, /* SEGMENT LIBRARY DD */
// PDEFDD=*.PDEF01, /* PAGEDEF LIBRARY DD */
// FDEFDD=*.FDEF01, /* FORMDEF LIBRARY DD */
// JOBHDR=*.JOBHDR, /* JOB HEADER SEPARATOR */
// JOBTLR=*.JOBTLR, /* JOB TRAILER SEPARATOR */
// DSHDR=*.DSHDR, /* DATA SET HEADER */
// MESSAGE=*.MSGDS, /* MESSAGE DATA SET OUTPUT */
// PAGEDEF=V06483, /* DEVICE PAGEDEF DEFAULT */
// FORMDEF=A10110, /* DEVICE FORMDEF DEFAULT @H3C*/
// CHARS=(GT12, /* DEVICE */
// GT10,GT15,GT18), /* DEFAULT FONT SET */
// PIMSG=YES, /* ACCUMULATE DATA SET */
// DATAACK=UNBLOCK, /* REPORT ALL DATA-CHECK @H7A*/
```

```

//          TRACE=NO,                /* CREATE INTERNAL TRACE   @H3C*/
//          FAILURE=WCONNECT,        /* PSF ACTION ON PRINTER   */
//          TIMEOUT=REDRIVE,         /* PSF ACTION ON TIMEOUT   */
//          DISCINTV=1800,           /*DISCONNECT INTERVAL IN   */
//          APPLID=P390PSF1,         /*VTAM APPLICATION PGM     */
//          MGMTMODE=IMMED,          /*PRINTER MANAGEMENT MODE  */
//          LUNAME=SNA08003          /* VTAM LOGICAL UNIT NAME  */
//PRT7          ENDCNTL

```

We added SYS1.VTAMLST(SNA080) containing:

```

SNA080  VBUILD TYPE=LOCAL
SNA080PU PU CUADDR=080,MAXBFRTU=20,PUTYPE=2,ISTATUS=ACTIVE
SNA08002 LU LOCADDR=2,MODETAB=ISTINCLM,... (for 3270 displays)
SNA08003 LU LOCADDR=3,MODETAB=MIBM3812,DLOGMOD=IBM3812C
SNA08004 LU LOCADDR=4,MODETAB=ISTINCLM,... (for 3270 displays)
SNA08005 LU LOCADDR=5,MODETAB=ISTINCLM,... (for 3270 displays)
SNA08006 LU LOCADDR=6,MODETAB=ISTINCLM,.. (for 3270 displays)

```

Note that the coax ports on the SNA 3174 are numbered beginning with number two. The printer port in this definition corresponds to the second coax connector in the control unit.

We then added a mode table for the 3812 printer, and installed it using the JCL shown in 3.1, "The IBM 3130 Advanced Function Printer" on page 21. The mode table source was placed in SYS1.VTAMLST(MIBM3812):

```

MIBM3812 MODETAB
IBM3812C MODEENT LOGMODE=IBM3812C,                +
          FMPROF=X'03',                            +
          TSPROF=X'03',                            +
          PRIPROT=X' B1',                          +
          SECPROT=X' B0',                          +
          COMPROT=X'7080',                          +
          RUSIZES=X'85C7',                          +
          PSNDPAC=X'02',                            +
          SRCVPAC=X'02',                            +
          SSNDPAC=X'00',                            +
          PSERVIC=X'014000010000000001000000'
          MODEEND
          END

```

6.2 Print Service Adapter

There is another way to connect coax-attached printers to your P/390 MVS system. This uses a Micro Channel Print Service Adapter, often called a PSA.²³ These adapters are not widely used, and are available only as RPQ features for IBM 3816 and similar printers.

The adapter looks very much like a 3270 adapter. It is a Micro Channel adapter with a single coax connector for output. For operation, a coax cable (RG-62 coax, the same cable used for 3270 displays) is connected to the adapter and a 3816-type printer. Only one printer can be attached. The adapter is supported by PSF/2; we know of no other support for it.

²³ The development name of the adapter was "Genie," and it is still often referenced as the "Genie card."

In our case, we installed the PSA in the PC Server/390 where we had MVS (on the P/390 side) and PSF/2 (on the OS/2 side) installed. We connected it to an IBM 3816 printer. Our PSF/2 installation was briefly described in the previous chapter. No changes to MVS, JES2, or MVS PSF were needed. Only minor setup changes, using the standard PSF/2 screens, were needed to enable and use the PSA and attached 3816 for full-function AFP printing.

We will not describe the PSF/2 configuration process in detail. It is fairly intuitive once PSF/2 is installed. PSF/2 recognizes the presence of the PSA and makes it available for use.

Chapter 7. Implementation Notes

While working with the printers described in this document, we needed to configure or alter other hardware and software in our system. Several of the areas involved were not familiar to the author, and might not be familiar to some readers. This chapter briefly covers a few of these areas.

7.1 HCD Usage with P/390 MVS

While working with the printer configurations described in this document, we needed to add devices (1403s, 3211s, AFP printers) to our MVS system. Older releases of MVS changed their I/O configurations through SYSGENs, IOGENs, MVSCPs, and IOCDs. With MVS Version 5, configurations are changed with the HCD function. HCD, which is an application that runs under ISPF, produces IODF files. An IODF file contains, among other things, the information needed to build MVS UCBs. HCD can also produce IOCDs files, but these are not used with the PC Server System/390. A full description of HCD and IODFs is beyond this document. The following is a very brief review of pertinent points.

- There are two types of IODF data sets: a *production* IODF and a *work* IODF. You can have many production IODF data sets; one of these will be the *active* IODF that was used for your current IPL.
- Only a production IODF can be used by MVS at IPL time.
- An IODF can contain multiple system configurations. This is useful in a large sysplex mainframe environment, but not useful in a P/390 MVS environment. The IODF supplied with the MVS CD-ROM contains one configuration named CBIPO.
- You can display a production IODF (using option 1 on the main HCD menu), but you cannot alter it. You can only alter work IODF data sets.
- If you only have a production IODF (such as SYS1.IODF00 on the MVS CD-ROM), and you need to modify it, you must do the following:
 1. Create a work IODF from the production IODF.
 2. Alter it as needed, using HCD functions.
 3. Create a new production IODF from the work IODF.
 4. IPL using the new production IODF. (There is also an option to dynamically switch to the new IODF, but we had mixed success doing this.)
- After a few cycles of IODF updates, you will have a number of old production IODF data sets. You can delete these, using another HCD option. The key point is that you cannot change a production IODF, and must create a new production IODF for every change.
- You can write a new production IODF over an existing production IODF, even the *active* IODF. Overwriting the only usable production IODF may not be a good idea, however, since (if your new IODF is unusable for some reason) you may not be able to IPL again.

The normal way to create a work IODF from a production IODF (in order to modify that production IODF) is to use option 1 of the main HCD menu to view the production IODF. If you then try to alter the production IODF, HCD will offer

to create a work IODF for you and ask for a name for the work copy. You should use the standard naming convention: if your production IODF (that you are viewing with HCD option 1) is SYS1.IODFnn, you should name the work IODF created from it SYS1.IODFnn.WORK.²⁴ *Place all IODF data sets on the same volume.*

Once a production IODF is produced, it can be used. Here are some of the key points about using an IODF:

- An IPL parameter is the starting point. The IPL parameter 012201 is used with our particular system.²⁵ This value is entered in the appropriate field of the P/390 environment configuration panel (which is obtained by pressing PF4 while in the main menu of the P/390 configuration program). Do not confuse the *IPL address* (sometimes called the *IPL volume address* or *SYSRES address*) with the *IPL parameter*. The IPL address is the channel address of a disk drive that contains the IPL program. The IPL parameter is a data string that is placed in registers before starting the IPL process.

Our IPL parameter tells the MVS IPL program to search the disk volume at address 0122 for SYSn.IPLPARM or SYS1.PARMLIB.²⁶ Our system used SYS1.PARMLIB, on the volume at address 122.

- SYS1.PARMLIB (or SYSn.IPLPARM) is a PDS. Once found, the IPL program opens member LOADnn, where nn is the fifth and sixth digits of the IPL parameter (and is 01 in the system we used and are describing here.)
- In our case, SYS1.PARMLIB(LOAD01) (on the 3380 volume at address 0122) contains a line like this:

```
IODF      01 SYS1      CBIPO      00
```

IODF starts in column 1. The 01 begins in column 10, the SYS1 begins in column 13, and the CBIPO begins in column 22. These fields are sensitive to particular columns. Two of these fields are used to specify the name of the production IODF data set to be used during MVS operation. This data set must be on the same volume as the SYS1.PARMLIB dataset (or the SYSn.IPLPARM data set, if it is used instead of SYS1.PARMLIB).

In our example, the data set name will be SYS1.IODF01. The SYS1 portion of the name is taken from the field beginning in column 13 of the IODF statement. The IODF portion of the name is fixed. The 01 portion of the name is from column 10 of the IODF statement. A given IODF data set can contain multiple MVS definitions. In our example, the definition CBIPO (from column 22) is used for the MVS being started. The 00 parameter in the IODF statement is the number of an EDT table in the IODF definition.²⁷

²⁴ You might select a new nn value such that it will match the new production IODF you intend to create. Most systems programmers tend to keep the same nn value as the production IODF they started from. This is common, but not logical, because the work IODF (after you change it) will not match the production IODF with the same nn. For example, if you start with production SYS1.IODF05 and try to modify it, HCD will ask you to for a name for a new work IODF. It would be logical to select SYS1.IODF06.WORK. You would then modify SYS1.IODF06.WORK to add new printers (for example), and then create a new production IODF. You could name this SYS1.IODF06.

²⁵ Again, our MVS system was the Developers Association P/390 MVS distributed on CD-ROM. The smaller preconfigured MVS system, also offered by IBM for P/390 MVS customers, has similar characteristics.

²⁶ The system will search first for SYSn.IPLPARM (where n is 0 to 9) on the volume indicated by the IPL parameter, then it will search for SYS1.PARMLIB on this volume, then it will search for SYS1.PARMLIB on the IPL volume. It expects to find member LOADxx in the first of these data sets it finds.

²⁷ The EDT is the eligible device table used to resolve esoteric JCL device names.

You can verify your currently active IODF name with the MVS command D IOS,CONFIG(ALL). This will produce (on the MVS console) a response like this:

```
ACTIVE IODF DATASET = SYS1.IODF00
CONFIGURATION ID = CBIP0   EDT = 00
HARDWARE SYSTEM AREA DATA COULD NOT BE OBTAINED
```

If you need to change your MVS configuration you should proceed in a way that provides a fallback if your new IODF is not usable. That is, you want to leave your old, working IODF intact and usable. There are a number of ways to do this. We created SYS1.IODF02 for our new IODF and added member LOAD02 to the SYS1.PARMLIB data set. (Remember to keep all your IODF data sets on the same volume.)

Our initial MVS contained SYS1.PARMLIB(LOAD01):

```
IODF      01 SYS1      CBIP0      00
NUCLEUS   1
SYSCAT    SCPVM5113CMVSV5.MASTER.CATALOG
*SYSPARM  00
```

We created member SYS1.PARMLIB(LOAD02) like this:

```
IODF      02 SYS1      CBIP0      00
NUCLEUS   1
SYSCAT    SCPVM5113CMVSV5.MASTER.CATALOG
*SYSPARM  00
```

The new member is exactly the same as the original member except for the two digits (column 10 in the IODF statement) used as the suffix for the IODF data set name. The new member will use SYS1.IODF02 as the production IODF. By changing the IPL parameter from 012201 to 012202 we can IPL with our new IODF. If this fails for some reason, we can IPL with parameter 012201 and use the original IODF.

7.1.1 Step-by-Step HCD

A step-by-step walkthrough using HCD to alter an MVS device definition may be helpful. This example was provided by Gordon Chamberlain of Interprocess Systems, Inc. (where we purchased our tape drives). The specific situation involves the first release of the Developer's Association MVS CD-ROM. In this case, HCD does not appear as an ISPF menu item, and the production IODF supplied on the CD-ROM is not at the level required by the version of HCD supplied on the CD-ROM. Gordon notes:

If you have a SCSI-attached 3480 tape drive which has the IDRC feature and you are unable to read or write 3480 tapes to process compacted or compressed data (IDRC), one probable cause is that the I/O definition for your MVS system does not specify that the COMPACT feature is enabled for the tape unit at the address you are using (typically address 560).

To correct your I/O definition file (SYS1.IODFxx), use the following steps:

1. Under ISPF, select option 6 (Command).
2. On the command line, enter: CBDCHCD (don't ask why?!) (This will invoke the HCD facility; if HCD appears on your primary ISPF menu, you can invoke it from that menu)
3. Ensure that the IODF file name is set to 'SYS1.IODF00'. Select option 6 (maintain IODF files).

4. Select option 6 (upgrade IODF files)
5. Specify 1 (to create a new work IODF). Specify the new IODF name as 'SYS1.IODF01.WORK' and specify the Volume as SCPMV5.

The successful conversion is complete when you see a message such as: "Back-level IODF upgraded". (Editor's note: these first five steps are needed only if HCD informs you that your IODF is down-level.)
6. Use PF3 until you return to the main HCD menu.
7. Ensure that the new IODF name is specified: SYS1.IODF01.WORK²⁸
Select option 1 (Define, Modify, etc.).
8. Select option 5 (I/O devices).
9. On the next panel, page down to device address 560, place a slash (/) in the prefix area and press ENTER. (Editor's note: device 560 is a 3480 tape drive; the object here is to add a feature to the definition of this drive.)
10. Select option 2 (Change).
11. The next panel gives you the option to specify or revise several fields. Just press ENTER to continue.
12. On the next panel, place a slash (/) in the prefix area to select the CBIPO OS and press ENTER.
13. Select option 1 (Connect, Change)
14. On the next panel (Define Device Parameters / Features), change the setting for the COMPACT feature from NO to YES.
15. On the next panel (Assign/Unassign Device to Esoteric), note that a new generic will be shown (3480X). This is what you should specify in your JCL (UNIT=3480X) to specifically select a 3480 drive which has IDRC enabled. You could also set the option for the other generics shown for this device (CART, CTAPE, TAPE) to NO. Press ENTER twice to activate.
16. Press PF3 until you return to the main HCD menu.
17. Select option 2 (Activate).
18. Select option 1 (Build new IODF). Set the work IODF name to 'SYS1.IODF01.WORK'. Set the production name to 'SYS1.IODF01'. Set the volume serial to SCPMV5. Select option 1 to use the work IODF in use at present. Press ENTER.
19. At the next panel (Specify or Revise), just press ENTER. Success is near when you see the message: "Production IODF SYS1.IODF01 created".
20. Press ENTER.
21. Press PF3 until you exit HCD and return to the main ISPF menu.

Now you must change the MVS parameter controls so that the IPL process will pick up the new IODF file. Complete the following steps:

²⁸ If SYS1.IODF01.WORK does not yet exist, specify SYS1.IODF01. When you start to modify it, HCD will offer to create a new work data set for you. At this time specify the name SYS1.IODF01.WORK. There is no requirement to create a work data set with the same base name as a production IODF, but most users do so.

22. From the main ISPF menu select option 2 (Edit).
23. Set the data set name to 'SYS1.PARMLIB'
24. On the command line enter S LOAD01.
25. On the command line of the new (empty) edit member, enter COPY LOAD00.
26. Change the IODF parameter in column 10 from 00 to 01.
27. Save the new LOAD01 member, exit completely and shutdown MVS.
The last step in this process is to change the P390 setting for the System Load PARM.
28. From the P390 folder, invoke the P390 Configurator
29. On the Update System Environment screen (F4), change the load parameter from 012200 to 012201.
30. Exit the P390 Configurator and save the new settings (F6).

When you IPL MVS, the new IODF file will be activated and you can use UNIT=3480X to direct tape mount requests to device 560 (which now has the COMPACT feature enabled).

There are many ways to do this IO change under MVS (almost as many as there are MVS system programmers). One advantage of this approach is that if you have trouble with your new IODF file, you can change your IPL load parameter back to 012200 and revert to your previous IODF file.

7.2 Installing an Overland C490 Tape Drive

We attached an Overland model C490 tape drive to our PC Server System/390 while working on this project.²⁹ The Overland T490 is the same as the C490, except it is configured for rack mounting. When connecting this drive (or a similar one) you should remember the following:

1. The cable between the PC Server System/390 SCSI (or RAID) adapter and the tape drive is unique to IBM SCSI adapters. It has a Centronics SCSI connector at the tape end, and a small connector (mini-Centronic) with 68 connectors for the computer end of the cable. The cable is IBM part number 32G4143; other suppliers may have similar cables, but it is not as commonly available as other types of PC cables.
2. The SCSI address of the tape drive is set by firmware in the unit. There are no switches for setting a SCSI address. Do not depend on the default SCSI address for the drive that is described by the vendor's documentation. Verify an unused SCSI address in your server (by using the Configure SCSI devices option in the Reference diskette programs), and set the tape drive SCSI address to this value. The tape drive documentation contains instructions for doing this; the Overland models C480 and C490 use parameter address 50 to

²⁹ There are a number of other drives that have been used at various locations, including (for 3480/3490 cartridge tapes) Overland Data models C480, C490, and Fujitsu models M2481, M2483, M2485; for 3420 (round tape) compatibility Overland Data models 5212, 5612, TR995, Qualstar models 1260S, 3404S, 3414S, 3418S, M4 Data model 9914. We purchased our tape drives through Interprocess Systems, Inc., 11660 Alpharetta Highway Suite 455, Roswell, Georgia 30076; telephone 770-410-1700, fax 770-410-1773. While the drives are available from several sources, this company is familiar with the PC Server System/390 and can supply the correct cables and setup tips.

set the SCSI address. We did not change any other firmware parameters in the drive.

3. If you connect an external device (such as the tape drive) to the RAID adapter in the PC Server System/390, you cannot connect the second shelf of disk drives to the same RAID adapter. If you already have disks in the first and second shelf, connected to the standard RAID adapter, you will need a new IBM SCSI adapter (or another RAID adapter) to use with the external tape drive.
4. Edit CONFIG.SYS on your server. You probably need two lines something like this in the P/390 section of CONFIG.SYS:

```
DEVICE=D:\P390\SCSI3420.SYS 00,00
DEVICE=D:\P390\SCSI3480.SYS 04,00
```

The GG24-2538 document (pages 91-92) explains this setup in some detail. The key is that the 00,00 for one of these lines should be changed to the SCSI address of the external tape drive. In the example here, the external drive has SCSI address 04 and is used as a 3480 drive. The internal 4mm tape drive has SCSI address 00 and is used as a 3420 drive in this example.

The second "00" parameter in each DEVICE statement denotes this is the first SCSI adapter in the system. If you have more than one SCSI adapter, this number will be different if the tape drive is attached to the second SCSI adapter. In this case, OS/2 will assign a device driver adapter number for the second adapter. Unfortunately, we cannot predict what this number will be; it depends on the order of BASEDEV and DEVICE statements in your CONFIG.SYS. The number is usually 01, but not always. If you have this situation, edit IPL.CMD (in the P390 directory), find the following statement:

```
call dmstart "awsDEV.exe n /cu=SCSI3420 /dd=SCSI3480"
```

and change it to:

```
call dmstart "awsDEV.exe n /cu=SCSI3420 /dd=SCSI3480 /T"
```

When you next IPL MVS, this will display the OS/2 device manager number for the SCSI adapters, and you can note the correct number for use in your DEVICE parameter.

The external tape drive should be turned on before booting OS/2 *and when IPLing MVS*. The P/390 device manager routines (SCSI3480 or SCSI3420) check for the presence of the unit, and it must be ready when these device managers start. After IPL, we found we could turn the external tape drive off (to reduce the noise level), and later turn it on before submitting a tape job.

You can have only one SCSI3480 device (and only one SCSI3420 device) defined in the P/390 subsystem. If you have a strong requirement for more than one SCSI3480 device, telephone the P/390 development group at 1-800-633-7437 or 1-914-435-5280 (both are U.S. telephone numbers) for special assistance.

We have used our drive for restoring 3380 backup tapes to emulated 3380 drives, and for reading various program product tapes.

If you attach a second (external) SCSI tape drive to your RAID adapter³⁰, do not use the same address (usually address 0) as the first tape drive. Even though

³⁰ The standard 4mm drive is already attached to the adapter

the external tape drive is on a second SCSI channel of the RAID adapter, there may be a conflict in resolving the address.

7.3 AWSTAPE Limitations

The AWSTAPE device manager is used to emulate tape drives, using OS/2 files for tape storage. "Tapes" (which are OS/2 files) can be mounted on these simulated drives using the AWSMOUNT command. This process is explained at some length in GG24-2538, starting on page 61.

There is a restriction for the AWSTAPE device manager (the version current at the time this document was written) that limits it to a maximum of 16 emulated drives. The *unit* address of each emulated drive must be unique. The channel and control unit portions of the address are ignored. For example, if you have an emulated drive at address 581, you could not also have an emulated drive at address 461. The "1" portion of the addresses conflict.

This addressing limitation for AWSTAPE may be removed in a future release.

7.4 Channels and Cables

With mainframes, the IBM Customer Engineers or a dedicated operations staff installed the cables between the processors and I/O devices. You (the owner of a P/390 MVS system) may find yourself installing channel cables to the S/370 Channel Emulator/A adapter.

The cable associated with the channel adapter has a large D shell connector on one end and splits into bus and tag connectors on the other end. If you need to connect additional bus and tag cables to reach a control unit, remember that these cables are not symmetrical. The connectors, on both bus and tag cables, are color coded. One end is solid dark gray (almost black); the other end has a light gray band. *The end with the light gray band must be the end away from the processor.* If several control units are connected in a string, all the channel cables must retain this rule.

A channel-connected control unit has a set (bus and tag) of input connectors and output connectors. The output connectors are used to connect another control unit on the channel. The last (or only) control unit must have *terminators* in the output connectors. (If you have access to a mainframe operation, they can supply extra sets of channel terminators.) Be certain to use *channel* terminators, not *control unit* terminators. They look very much the same and have the same connectors. There are several versions of acceptable channel terminators, with different IBM part numbers. We used part numbers 2282675 (bus) and 2282676 (tag).

Before using any bus and tag cables *check the connectors for bent pins/fingers.* The connectors on these cables are very sturdy, but the contacts do occasionally become damaged. Diagnosing this condition, from software indications, can be very frustrating. Check the connectors before using them!

If you have a channel emulator installed, with nothing connected to the bus and tag cables (or with the cable not connected to the adapter), *do not define the adapter in the your P390 configurator.* If your configurator defines any device connected to the CHAN370 device manager, you should have the bus and tag

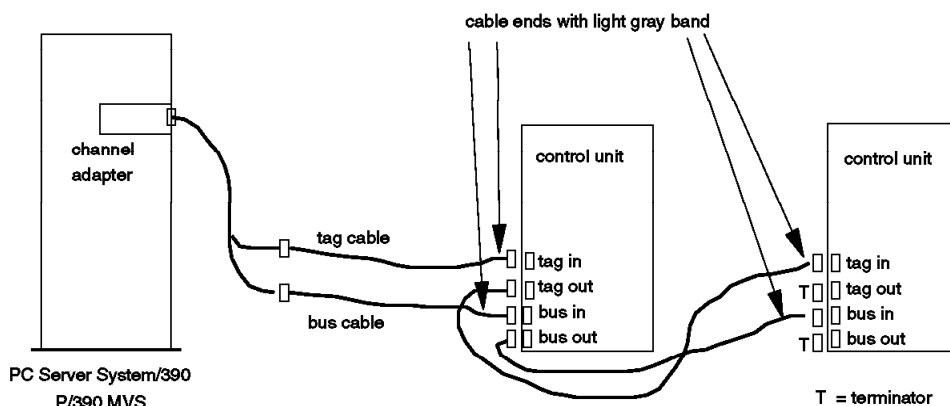


Figure 17. Parallel Channel Cables

cables connected to the adapter and properly terminated (whether or not it is connected to external control units). If you have CHAN370 devices defined, and the channel adapter is unterminated, you may experience long timeouts (system activity indicator turns pink) when a S/390 operating system is IPLing. (These recommendations differ from those given in the GG24-2538 document, and reflect more experience with the system.)

The S/370 Channel Emulator/A adapter was designed for a limit of two to four control units. (This is not well documented elsewhere.) It has been used with more than this (with more than two 3174 control units, for example), but you should be aware of the design limit. A maximum of two channel adapters can be used in a PC Server System/390. Also, the channel adapter may limit cable lengths (for the bus and tag cables) to shorter limits than that of a mainframe. The systems described in various redbooks (including this one) used relatively short cables (under 10 meters). We believe the recommend maximum cable lengths for the emulator adapter are about 65 meters. This length *includes* any cables downstream of the specific control unit you may be attempting to use. Some devices, such as 3803 control units, have much shorter maximum cable lengths.

Even if the emulator cables are long enough to connect directly to your control unit, we strongly suggest you use short sections of standard bus and tag cables as jumpers between the emulator cable and the control unit. With careful placement, you can remove most mechanical strain from the emulator cable, and the standard cables have the proper screws for a secure connection to the control unit.

The S/370 Channel Emulator/A adapter is not always reset when the OS/2 system is booted. In rare cases, it may be necessary to cycle system power off and back on to reset it. We have seen this only in diagnostic situations with multiple control units connected to multiple channel adapters. If you make hardware or software changes to the channel emulator and experience problems, you may want to cycle system power once.

7.5 Standard PAGEDEF and FORMDEF Names

The PSF procedures listed in this document contain specific FORMDEF and PAGEDEF names. A number of standard PAGEDEFs and FORMDEFs are supplied with the PSF product, and are normally found in SYS1.PDEFLIB and SYS1.FDEFLIB. If you have not worked closely with PSF before, you may find the names confusing.

The name of a FORMDEF or PAGEDEF is the same as the library member name. However, the leading P1 (for PAGEDEFs) or F1 (for FORMDEFs) is dropped when using the name in JCL statements. For example, the statement:

```
//          PAGEDEF=V06683,          /* DEFAULT PAGEDEF          */
```

in one of the PSF procedures refers to member P1V06683 in the PAGEDEF library.

Several factors are encoded in a standard³¹ PAGEDEF name:

- The first two characters are P1.
- The next character can denote paper size (in inches)
 - A - 8.5 x 11.0 (U.S. letter size)
 - B - 8.5 x 14.0 (U.S. legal size)
 - C - 8.27 x 11.69
 - D - 10.12 x 14.33
 - E - 7.17 x 10.12
 - F - 7.5 x 10.5
 - G - 7.25 x 10.5
 - H - 7.00 x 10.5
 - V - 8.27 x 11.0
 - W - multiple-up printing
- The next three characters are the number of lines per page.
- The next character (usually “6” or “8”) is the number of lines per inch.
- The last character is orientation:
 - 0 is no rotation (portrait format)
 - 1 is 90 degree rotation
 - 2 is 180 degree rotation
 - 3 is 270 degree rotation (landscape format)

Thus V06683 defines a page with 66 lines/page, 8 lines/inch, printed in landscape mode. Note that it is the printed format that is defined, not necessarily the physical page size (which might be larger).

A standard FORMDEF name includes:

- The first two characters are F1.
- The next four characters indicate a paper size and coordinate of the logical starting point on the page. Many FORMDEFs you are likely to use have A101 for these characters.

³¹ Except for the leading P1, these standards are not enforced. Locally written PAGEDEFs and FORMDEFs can select any names.

- The next character is a bin number for printers having more than one source of blank paper.
- The last character denotes simplex printing (0), duplex printing (1), or tumble duplex (2). Duplex means printing on both sides of the paper. Tumble duplex prints on both sides, but with reversed top and bottom senses on alternate pages.

7.6 Sharing a PC Printer Under OS/2

Throughout this project, we had a single PC printer (the Lexmark Optra) connected to the first parallel printer port on our server. We had a variety of functions attempting to use the printer, including:

- OS/2 PRINT commands, going through the OS/2 print spooling function.
- Simple OS/2 COPY commands, going to LPT1 (not through the OS/2 spooling functions).
- PSF/2 Direct output, going directly to LPT1 (not through the OS/2 spooling or PSF/2 spooling functions).
- PSF/2 DPF output, going through the PSF/2 spooling function, and then to LPT1.
- Output from the AWS2821 device manager, going directly to LPT1.
- Output from the AWS2821 device manager, going through the OS/2 spooling function.

We found that OS/2 provides reasonable protection against two printing functions using the printer at the same time (and thus mixing their output). In some cases, the printer is seen as *not ready* by a printing function, if it is already in use by another function. PSF/2 has user-specified time intervals for retrying the printer, and for releasing it if there is no more output.

Once printed output is in the OS/2 system (via the AWS2821 device manager), you can use OS/2 products with it. For example, you could send it to LPTn, which you have set up as an automatic fax transmitter. By coordinating the SYSOUT class, JES2 definitions, AWS2821 parameters, and an OS/2 fax program, you could have any output to that SYSOUT class automatically sent by fax. (The fax program can scan the output for the fax telephone number.)

Chapter 8. Summary and Recommendations

No single printer or printing environment can fit all MVS systems. A large MVS environment fills many roles: production (with many different applications), development, test, and so forth. The large MVS system(s)³² usually have multiple printers, local and remote, handling a variety of needs. P/390 MVS, being a much smaller MVS, is likely to have a more restricted set of roles. For example, a given system may be only for development, or only for production of a specific application or set of applications. In these cases, it may be possible to narrow printing requirements to a small number of cases.

A development system is oriented to compiler listings and similar output. This is line-mode data. However, most MVS programmers would not be satisfied by a simple line printer. They usually prefer using PSF to handle line mode data. This can, for example, print a compiler listing on cut-sheet (as opposed to continuous forms), letter size paper, in landscape mode, duplexed, with a font size that produces 132-character lines, with 60 (or 61 or 66) lines per page.

By default, most compilers (and link editors, and utilities) assume their printed output should be formatted for the continuous-form wide paper that was standard years ago. PSF can transparently change this output to the letter-sized duplexed form mentioned above, producing more human-oriented results with no changes to the compilers and utility programs. This use of PSF/AFP is common in most MVS installations, and is probably the preferred printing method for developers.

As a general statement, there is little interest in simple line printers -- except for the special case of multiple-part forms, or the trivial case of little or no printing at all. For P/390 MVS, this means little interest in channel-attached line printers or emulated line printers using ASW2821 in its most basic mode.

The first major decision point for P/390 MVS printing is PSF. Do you need it? Factors may be:

- You need it because you have AFP printers.
- You need it because you have AFP print streams, with PSEs, FORMDEFs, PAGEDEFs, fonts, and all various elements of IPDS data streams.
- You prefer it because it makes normal line-mode output look better.
- If you must drive AFP printers, your only choice is to drive them directly from MVS PSF (via channel or LAN connections), or to drive them remotely through PSF/2.
- If you must print AFP (IPDS) print streams, you must have PSF but you have a choice of printers. You can use AFP printers, or you can use PSF/2 with PC laser printers.
- If you simply prefer PSF output, without having real IPDS print streams, you have a choice of using PSF or using the enhanced AWS2821 functions.

For P/390 MVS, the AWS2821 device manager offers functions that are not available on mainframe MVS. It can write JES2 output to an OS/2 file, with automatic EBCDIC-ASCII translation. Once in OS/2, there are many avenues for

³² A large MVS environment is assumed to involve multiple systems or LPARs.

processing the data, but these are not the subject of this document and are not discussed here. By using more advanced functions of AWS2821, results similar to those of line-mode with PSF can be obtained without PSF. That is, line output (formatted for 132-character lines, 60-66 lines per page) can be printed on letter-size paper and even duplexed (if the PC printer supports this). This is discussed in 4.3, "Advanced AWS2821 Functions" on page 32.

We expect the more sophisticated uses of AWS2821 will meet the needs of many development-oriented P/390 MVS owners, especially if only a modest amount of printing is required. (If a project requires developing specific AFP data streams, this would be an obvious exception.) Using ASW2821 with a good PC printer (such as the Optra we used) is a very inexpensive method of providing acceptable MVS printing. Of course, it cannot handle true AFP printing, using multiple fonts, PSEGs, PAGEDEFS, FORMDEFS, and so forth.

In a different category, for a routine production environment that needs moderate AFP printing, we recommend the IBM 3130 or 3160 printers. These are production-strength units, built to different standards than PC-oriented printers. They are real AFP printers, and should handle the entire AFP functionality without limitations. The price (in the \$20,000 range for duplex 3130 units) is commensurate with other P/390 MVS costs. The connection we used, SNA over a token-ring LAN, worked well and is suitable for general use. Multiple printers can be used, distributed as needed in various LAN locations.

For heavier AFP printing, any of the many channel-attached AFP printers can be used. We offer no specific recommendations, and there are no unique P/390 MVS considerations involved.

P/390 MVS can drive multiple IBM 3900 printers, but in this case we might say that printing *is* the application. The system is a print server for other MVS systems. There are two specific considerations for this case, as follows:

- By using P/390 MVS, the customer retains MVS compatibility with the rest of his installation. Operators manage NJE and JES commands on P/390 MVS just like any other MVS system, making training and integration very easy.
- MVS, even for the P/390 processor, is expensive. P/390 VSE or VM could drive the same printers, and cost less. However, this would mean mixed operating systems (VSE or VM, and MVS) in an installation and other costs (training, integration, support) must be considered.

We recommend coax-attached AFP printers (IBM 3812, 3816, etc.) only where these printers (and the necessary IBM 3174 control unit or PSA adapter) are already available, waiting to be used. For new installations, they have been supplanted by LAN-attached printers.

8.1 Print Server

We have seen considerable interest in using the PC Server System/390 as a print server, driving several high-volume AFP printers such as IBM 3900 units. We did not configure or try such a system, but offer the following comments for someone considering a print server:

- VSE might be a better operating system for an AFP print server than MVS. The operating system (with required components) is less expensive and less complex to manage.

- VSE POWER can communicate with MVS NJE, as a means of routinely sending jobs to the print server.
 - A variety of communications links and protocols can be used.
- A 3480-compatible tape drive can be added to the server, permitting offline (from mainframe hosts) printing.
- We estimate that three 3900-001 printers (or an equivalent load) can be driven with normal AFP print loads.

Appendix A. CM/2 Configuration for APPC

In the following example, we create an APPC connection to MVS and define two LUs (and their partner LUs). This permits us to drive two printers, in parallel, from MVS PSF through PSF/2. On the PSF/2 end, these printers can be directly driven by MVS PSF (PSF Direct mode) or managed through PSF/2 spooling and controls (DPF mode). The CM/2 definitions are the same for either mode. On the MVS side, two JES2 FSS printers are defined, with appropriate output classes. Typical definitions are shown in Chapter 5, "Using PSF/2 for AFP Printing" on page 37.

After the CM/2 screen illustrations, we show several of the PSF/2 screens that might be used to configure the PSF/2 printers. With this setup, we used the following printers (but not more than two at one time, since we defined only two APPC links):

1. Opra printer, driven by PSF/2 to emulate an AFP printer.
2. IBM 3816 printer, attached through the PSA adapter.
3. IBM 3130 printer, driven through its own token-ring APPC link from PSF/2 to the 3130. (Setup for this is not shown in detail).

A PSF-to-PSF/2 link is an APPC link. On the PSF (MVS) side, normal VTAM definitions are used. The VTAM-to-LAN connection is through the AWS3172 device manager, and no additional definitions are needed there. PSF/2, whether on the OS/2 side of the PC Server/390 or on a separate PC system, needs the proper CM/2 parameters to establish the APPC link. This appendix steps through a typical CM/2 customization for this environment. The following comments assume that PSF/2 is being installed on the same PC Server/390 that is running MVS.

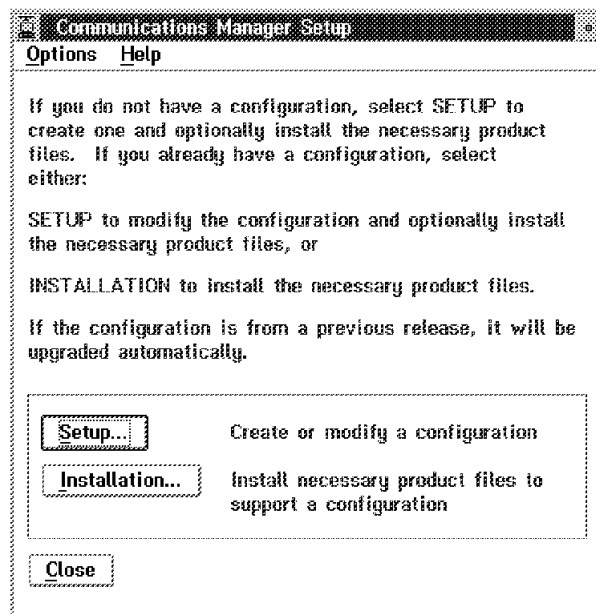


Figure 18. Initial CM/2 Customization Screen. This screen is obtained by clicking on **CM/2 Setup**. On this screen, click **Setup**

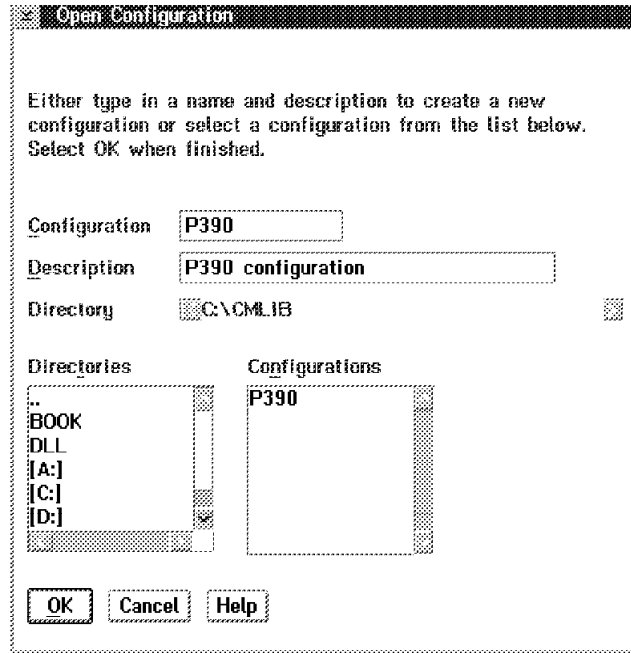


Figure 19. Open Configuration Screen. When you first installed your OS/2 and CM/2 for use with P/390 MVS, you defined a configuration for your 3270 emulation sessions. You probably named this configuration "P390." Enter the same name in this panel, in order to modify your existing CM/2 configuration. (If you are working with CM/2 on a separate PC, you probably want to modify the existing CM/2 configuration, if there is one. For a new CM/2 installation, select a new configuration name.)

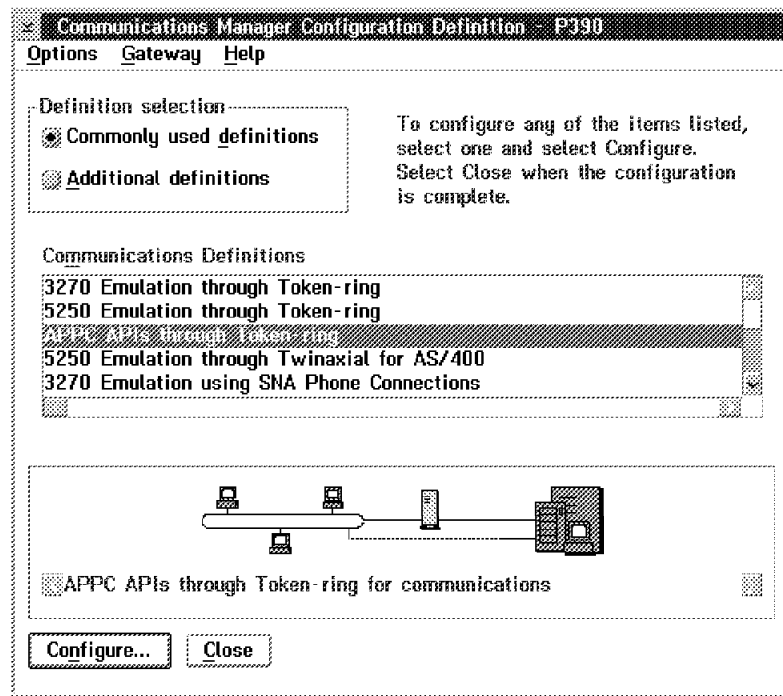


Figure 20. Communications Manager Configuration Definition - P390. The "P390" in the title of this screen is the name of the CM/2 configuration you are modifying or building. Select **Commonly used definitions** and **APPC APIs through Token-Ring** (assuming you are using a token-ring).

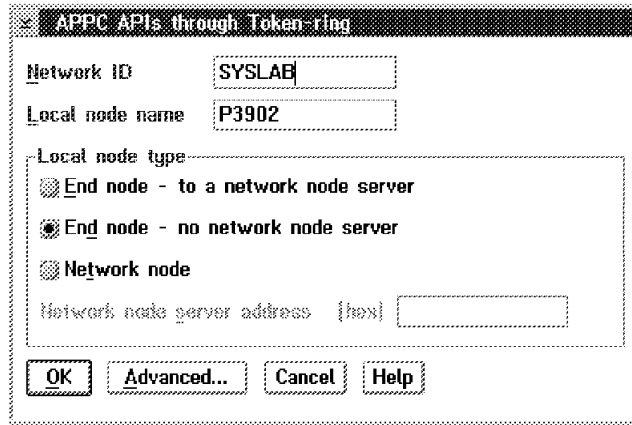


Figure 21. APPC APIs through Token-ring. The Network ID can be any arbitrary name, but it must match VTAM. The Local node name is the PU name of your CM/2. It must match the PU name you specified in VTAM for the link to PSF/2. Select **End node - no network node server** and then click on **Advanced**.

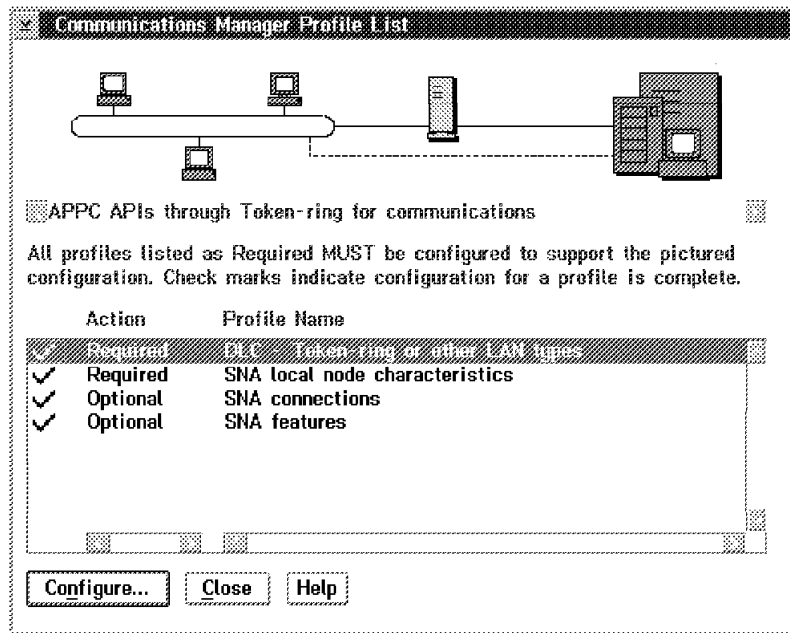


Figure 22. Communications Manager Profile List. This is an important screen. In the next several steps you will select each of the Required and Optional actions. First, select **DLC - Token-ring or other LAN types** and then click on **Configure**.

Token Ring or Other LAN Types DLC Adapter Parameters

Adapter

Free unused links

Send alert for beaconing

Maximum activation attempts (1 - 99)

Maximum link stations (1 - 255)

Maximum I-field size (265 - 16393)

Percent of incoming calls (%) (0 - 100)

Link establishment retransmission count (1 - 127)

Retransmission threshold (1 - 127)

Local sap (hex) (04 - 9C)

C&SM LAN ID

Connection network name (optional) .

Figure 23. Token-Ring or Other LAN Types DLC Adapter Parameters. Since this CM/2 connection is operating on the same physical token-ring adapter as VTAM (where VTAM is operating via the ASW3172 device manager), they cannot both share the same SAP number. The default SAP is 04, and this is left for VTAM. (A 3130 printer also uses SAP 4, and cannot be changed. If a 3130 is being driven from VTAM (not via PSF/2), then VTAM must have SAP 4.) We selected Local SAP 08 for CM/2. The number is arbitrary, but must be a multiple of 04.) If you intend to drive an IBM 3130 printer from PSF/2, the Maximum I-field size should be set large enough; the value shown (3884) is sufficient. Click on OK.

Communications Manager Profile List

APPC APIs through Token-ring for communications

All profiles listed as Required MUST be configured to support the pictured configuration. Check marks indicate configuration for a profile is complete.

Action	Profile Name
<input checked="" type="checkbox"/> Required	DLC - Token-ring or other LAN types
<input checked="" type="checkbox"/> Required	SNA local node characteristics
<input checked="" type="checkbox"/> Optional	SNA connections
<input checked="" type="checkbox"/> Optional	SNA features

Figure 24. Communications Manager Profile List.. The preceding screen returns to this selection screen. Now select SNA local node characteristics and click on Configure.

Figure 25. Local Node Characteristics. Enter the same Network ID and Local node name (PU) you already selected. The Local node ID is the XID. If you are not familiar with this area of SNA, we suggest you enter the values shown (05D and 23902). Click on **Options**.

Figure 26. Local Node Options. Enter the PU name you selected for this CM/2 as Local node alias name. Another name could be assigned, but we suggest you avoid this unless you are familiar with the SNA effects involved. Select **Activate Attach Manager at start up**, and click on **OK**.

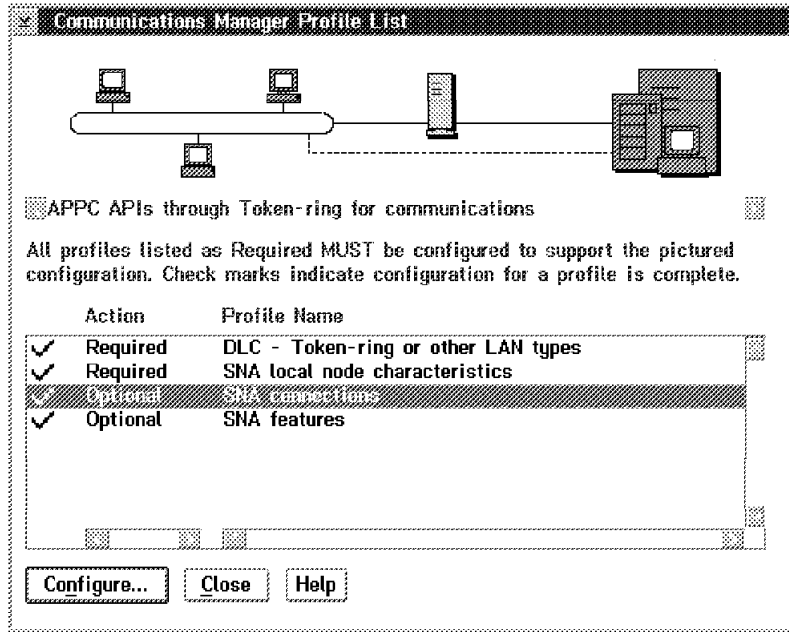


Figure 27. Communications Manager Profile List. Select the third element in the action list, and click on Configure.

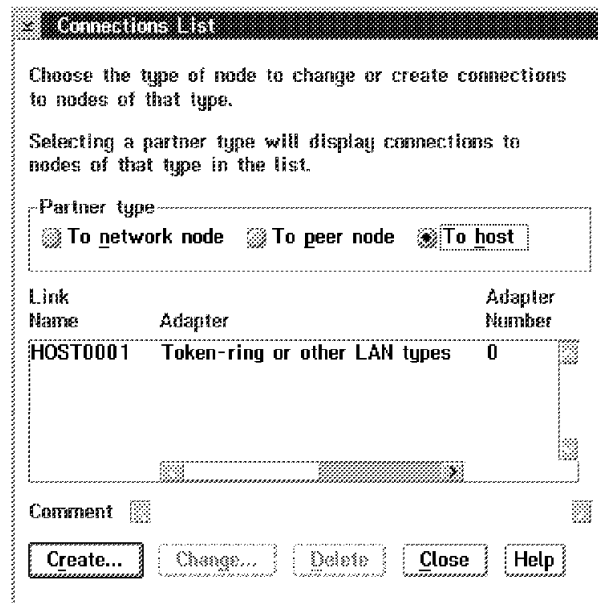


Figure 28. Connection List. Select To host. The other fields should already be complete. Click on Create. (If you are redefining an exist APPC link, and the connection list already exists, click on Change instead.)

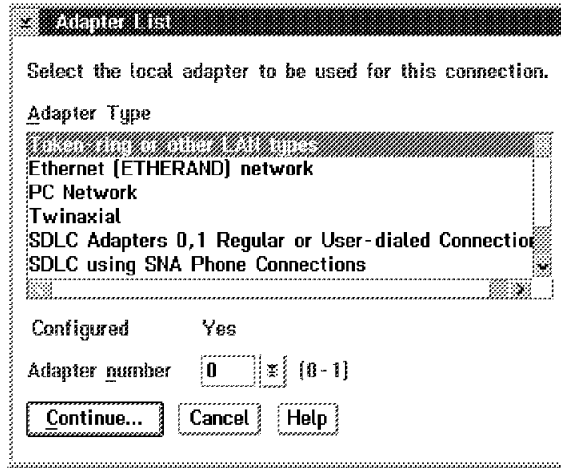


Figure 29. Adapter List. Select the appropriate adapter in the list shown. We used **Token-ring of other LAN types**. The adapter number is "0" for the first (or only) LAN adapter. Click on **Continue**.

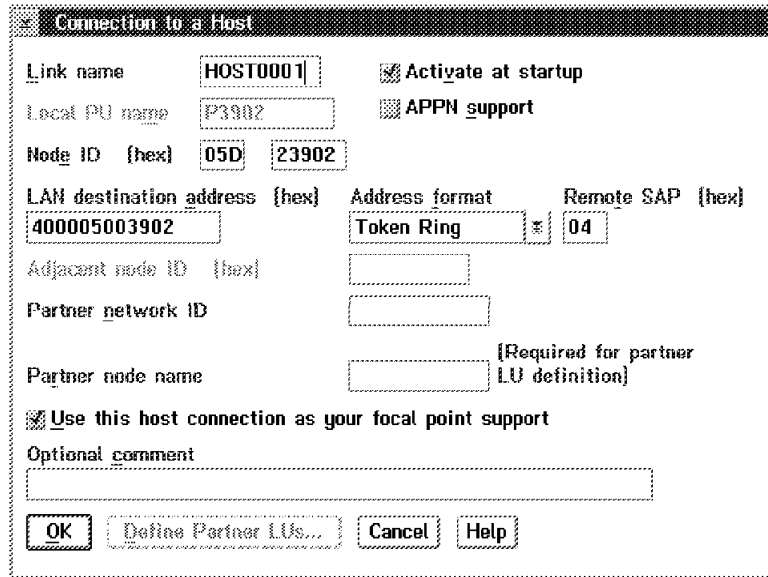


Figure 30. Connection to a Host. The LAN destination address is the token-ring address for VTAM (via AWS3172). Set the Remote SAP address for VTAM. We used "04" (the default) as the SAP address for the (emulated) 3172 interface to VTAM. If you are working with CM/2 on the same PC Server/390 that is running MVS same token-ring adapter (and adapter address) can be used for both AWS3172 and CM/2. The address can be a universal address or locally-administered address. We used the locally-administered address shown. Click on **OK**.

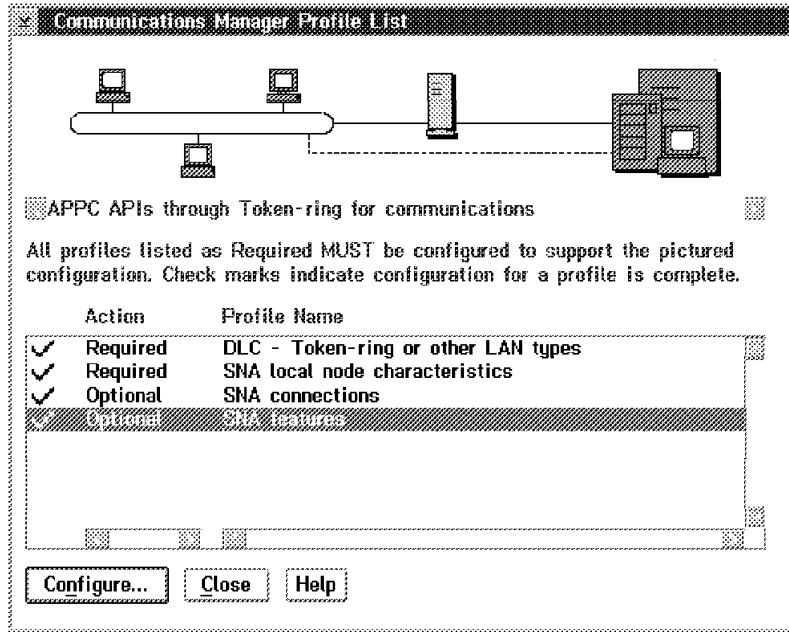


Figure 31. Communications Manager Profile List. Finally, select the last action item and click on **Configure**.

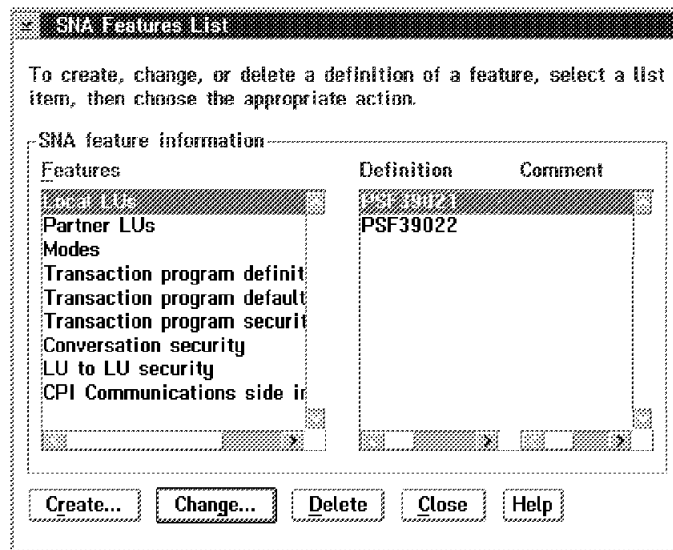
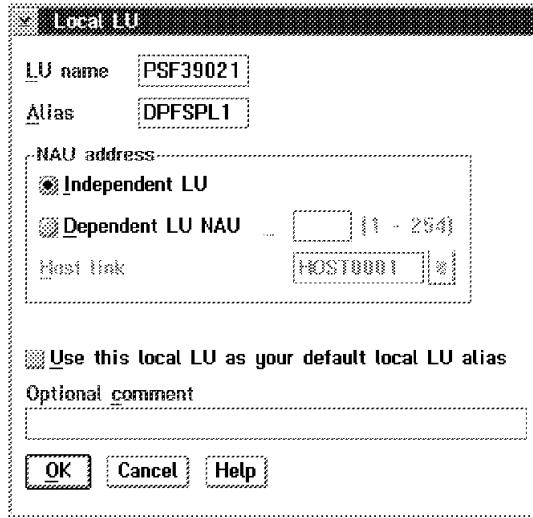


Figure 32. SNA Features List. This screen will be used several times. First create **Local LU** for printers used from MVS. We used the names shown, PSF39021 and PSF39022. Click on **Create** to create the LU; thereafter you can click on **Change** to alter it.



Local LU

LU name: PSF39021

Alias: DFFSPL1

NAU address:

- Independent LU
- Dependent LU NAU: [] (1 - 254)

Host link: HOST0001

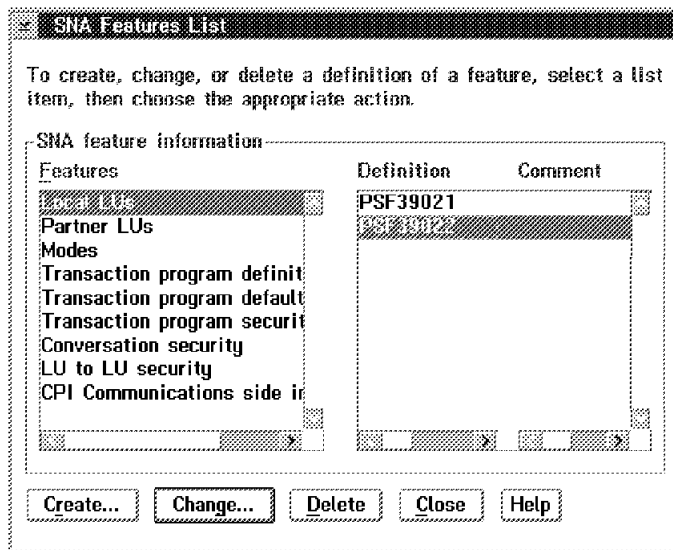
Use this local LU as your default local LU alias

Optional comment:

[]

OK Cancel Help

Figure 33. Local LU. Define a Local LU. The Alias name matches a PSF/2 screen, shown later. We used independent LUs, although dependent LUs could be used. Click on OK.



SNA Features List

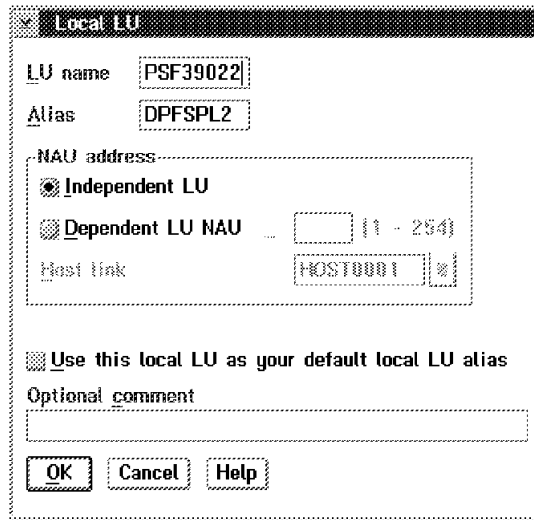
To create, change, or delete a definition of a feature, select a list item, then choose the appropriate action.

SNA feature information:

Features	Definition	Comment
PSF39021	PSF39021	
Partner LUs		
Modes		
Transaction program definit		
Transaction program default		
Transaction program securit		
Conversation security		
LU to LU security		
CPI Communications side ir		

Create... Change... Delete Close Help

Figure 34. SNA Features List. Define a second local LU (for another printer) if needed.



Local LU

LU name: PSF39022

Alias: DPFSP2

NAU address:

- Independent LU
- Dependent LU NAU: [] (1 - 254)

Host link: HOST0001

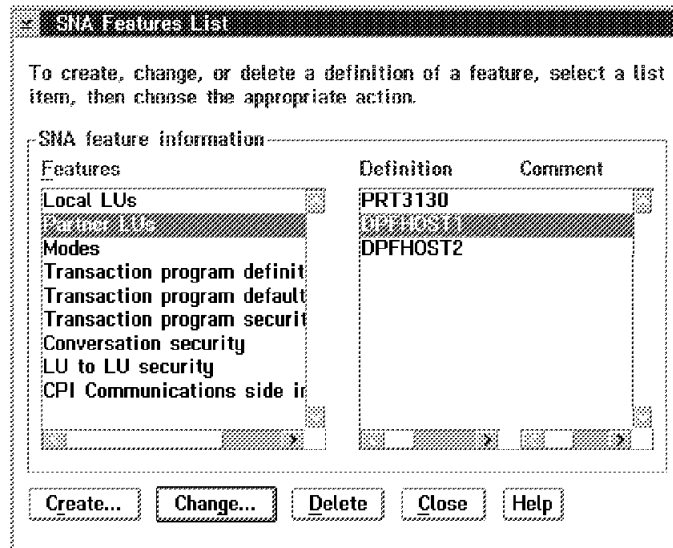
Use this local LU as your default local LU alias

Optional comment:

[]

OK Cancel Help

Figure 35. Local LU. This follows the pattern of the first printer LU.



SNA Features List

To create, change, or delete a definition of a feature, select a list item, then choose the appropriate action.

SNA feature information:

Features	Definition	Comment
Local LUs	PRT3130	
Modes	DPFHOST1	
	DPFHOST2	
Transaction program definit		
Transaction program default		
Transaction program securit		
Conversation security		
LU to LU security		
CPI Communications side in		

Create... Change... Delete Close Help

Figure 36. SNA Features List. Now identify Partner LUs, to match the MVS side. These will match the two local printer LUs we just defined. We used partner names "DPFHOST1" and "DPFHOST2." Click on **Create**. (In the screen shown here, the two LUs were previously created.)

Partner LU

Fully qualified LU name: SYSLAB . P390PSF1

Alias: DPFHOST1

Conversation security verification

Dependent partner LU:

Partner LU is dependent

Uninterpreted name: DPFHOST1

Optional comment

OK Cancel Help

Figure 37. Partner LU. The Fully qualified LU name is the network name we previously selected and the LU name we are defining. With CM/2 1.11, the partner LU should be dependent, and the **Uninterpreted name** the same as the alias name. Click on **OK**, and then create the other partner LU.

Partner LU

Fully qualified LU name: SYSLAB . P390PSF2

Alias: DPFHOST2

Conversation security verification

Dependent partner LU:

Partner LU is dependent

Uninterpreted name: DPFHOST2

Optional comment

OK Cancel Help

Figure 38. Partner LU. This is the second partner LU.

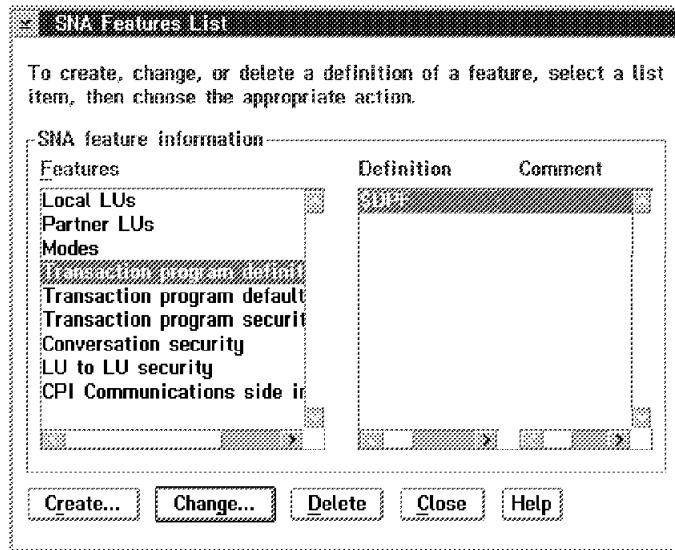


Figure 39. SNA Features List. Now define the transaction program name for the APPC sessions. Click on "Create"

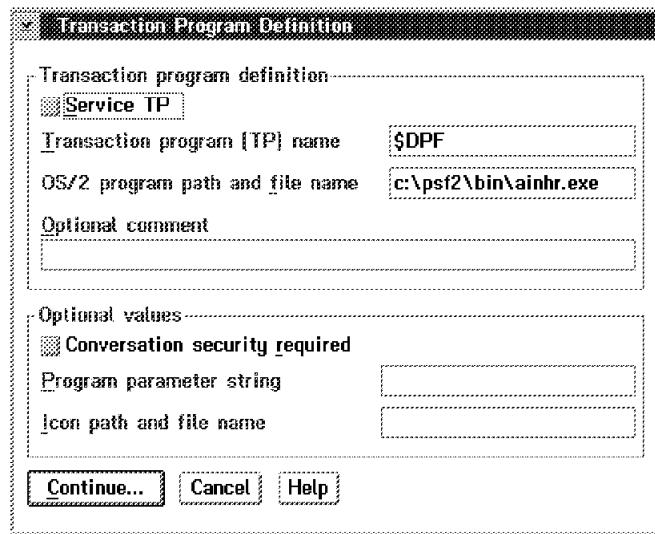


Figure 40. Transaction Program Definition. Use \$DPF as the Transaction program (TP) name. Click on **Continue**.

This is the end of the CM/2 definitions. You should exit from CM/2 and enter PSF/2 setup. The following screens illustrate the definition of printers to match the above APPC definitions. Not all PSF/2 screens are shown.

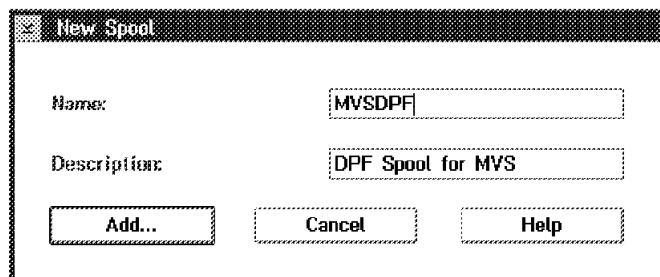


Figure 41. New Spool. Add a logical printer, using an arbitrary name.

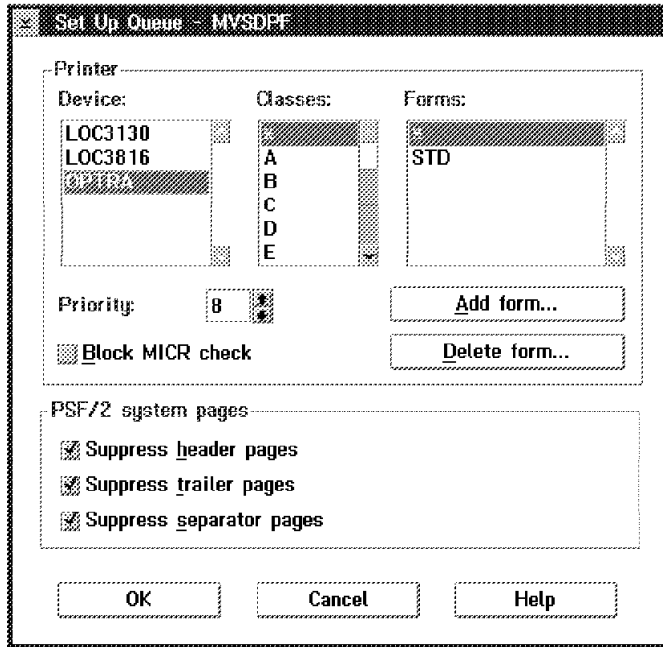


Figure 42. Set Up Queue (logical name). In prior setup (not shown), the printers listed were defined to PSF/2. Here we select a physical printer, our Lexmark Optra, and permit it to be used for all print classes and forms.

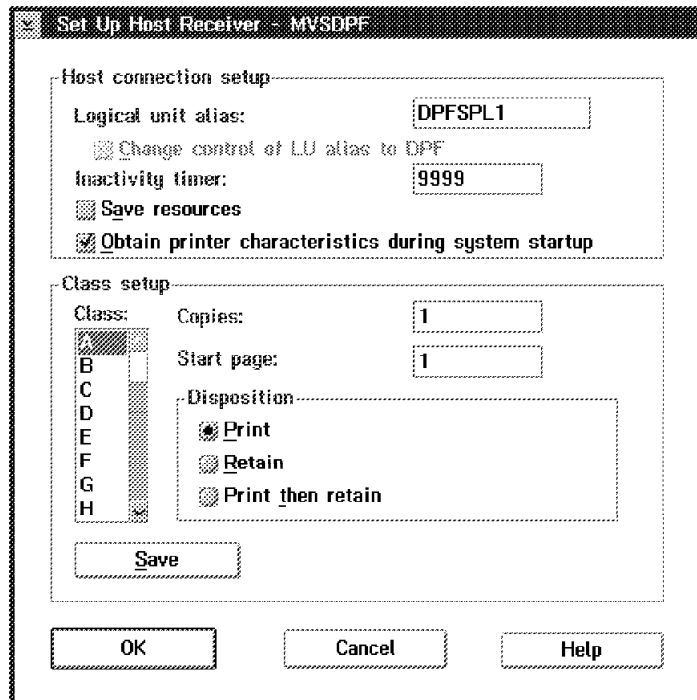


Figure 43. Set Up Host Receiver. Here we define, to PSF/2, a connection to VTAM. The alias name must match that defined in CM/2.

Change

Name: MVSDIR

Description: PSF/MVS Direct

Host connection

LU Alias: DPFSP2

Change control of LU alias to PSF Direct

Inactivity Timer: 9999

Device Busy Timer: 9999

Device:

LOC3130

OPTRA

OK Reset

Cancel Help

Figure 44. Change. Here we use a second connection to VTAM, via CM/2, to drive a 3816 printer connected to PSF/2.

Index

Numerics

1403 emulated printers 29
1403 printers 3
3130 customization, for PSF/2 43
3130 printer customization 26
3130 printer, introduction 21
3130 printer, use 21
3174 control unit 45
3174, SNA, use 45
3211 emulated printers 29
3270 terminals, for MVS 2
3480-type tape drive 53
3800 printer 4
3820 printer, use 17
3900 printer, capacity planning 15
3900 printer, use 13
4248 printer, capacity planning 17
4248 printer, use 16

A

AFP mode printing 4
APPC definition 63
assembly of mode table 25
autoconfiguration, server 10
AWS2821 device manager 29
AWS2821, advanced functions 32
AWS2821, basic use 31
AWS3172, for APPC 63
AWSC370 device manager 9
AWSTAPE, limitations 55

B

buffer size, JES2 7
bus and tag cables 55

C

C370MAP utility program 12
cables, bus and tag 55
carriage control, function 29
Channel cables, installation 55
channel emulator adapter 9
channel emulator adapter, conflict 39
channel emulator adapter, for 3174 45
channel emulator adapter, installation 9
channel emulator adapter, limitations 12
channel emulator adapter, ordering 11
channel emulator adapter, PSF 39
channel emulator adapter, speeds 11
channel emulator, reset 56
channel-attached printers 8

CKD disks 2
CM/2 customization 63
coax-attached printers 45
code pages 30
CONFIG.SYS, channel emulator 11
configuration controls, general 5

D

Distributed Print Facility, description 37
DPF, description 37
duplex printing 29

E

ESA instruction set 2

F

FCB, forms control buffer 35
fonts, 240 vs 300 dpi 26
FORMDEF names 57
forms control, function 29

H

HCD, introduction 49
HCD, walkthrough 51

I

Interprocess Systems, Inc. 53
IPDS 4
IPL with IODF, walkthrough 50

J

JES2 parms, 3130 printer 22
JES2 parms, 3812 printer 46
JES2 parms, 3820 printer 17
JES2 parms, 3900 printer 13
JES2 parms, 4248 printer 16
JES2 parms, AWS2821 printer 31
JES2PARM 7

L

LAPS, for SNA LAN printers 22
line mode printing 3

M

MVS, used 1

O

Optra printer, description 30
Overland tape drive 53

P

P/390 MVS, terminology 1
PAGEDEF names 57
paging rate 7
parallel port printers 29
PC printer, sharing 58
PC printers 29
PC Server System/390 1
print server, comment 60
Print Service Adapter 47
Print Services Facility 4
PSA (adapter) 47
PSF 4
PSF entry in VTAM 24
PSF procedure, 3130 printer 23
PSF procedure, 3812 printer 46
PSF procedure, 3820 printer 18
PSF procedure, 3900 printer 14
PSF/2, introduction 37

R

RAID adapter 2
reference diskette, PC 10

S

SCSI3820 device manager 53
sharing PC printer 58
simplex printing 29
SNA 3174, use 45
SYS1.FONTLIB 26
SYS1.FONTLIBB 26

T

token-ring, minimal ring 39

V

VSE, for print server 60
VTAM mode table assembly 25
VTAM mode table, 3812 printer 47
VTAM modetab, 3820 printer 18
VTAM modetable, 3130 printer 25
VTAM parms, 3130 printer 24
VTAM parms, 3812 printer 47
VTAM parms, 3820 printer 18
VTAM parms, PSF procedure 24



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