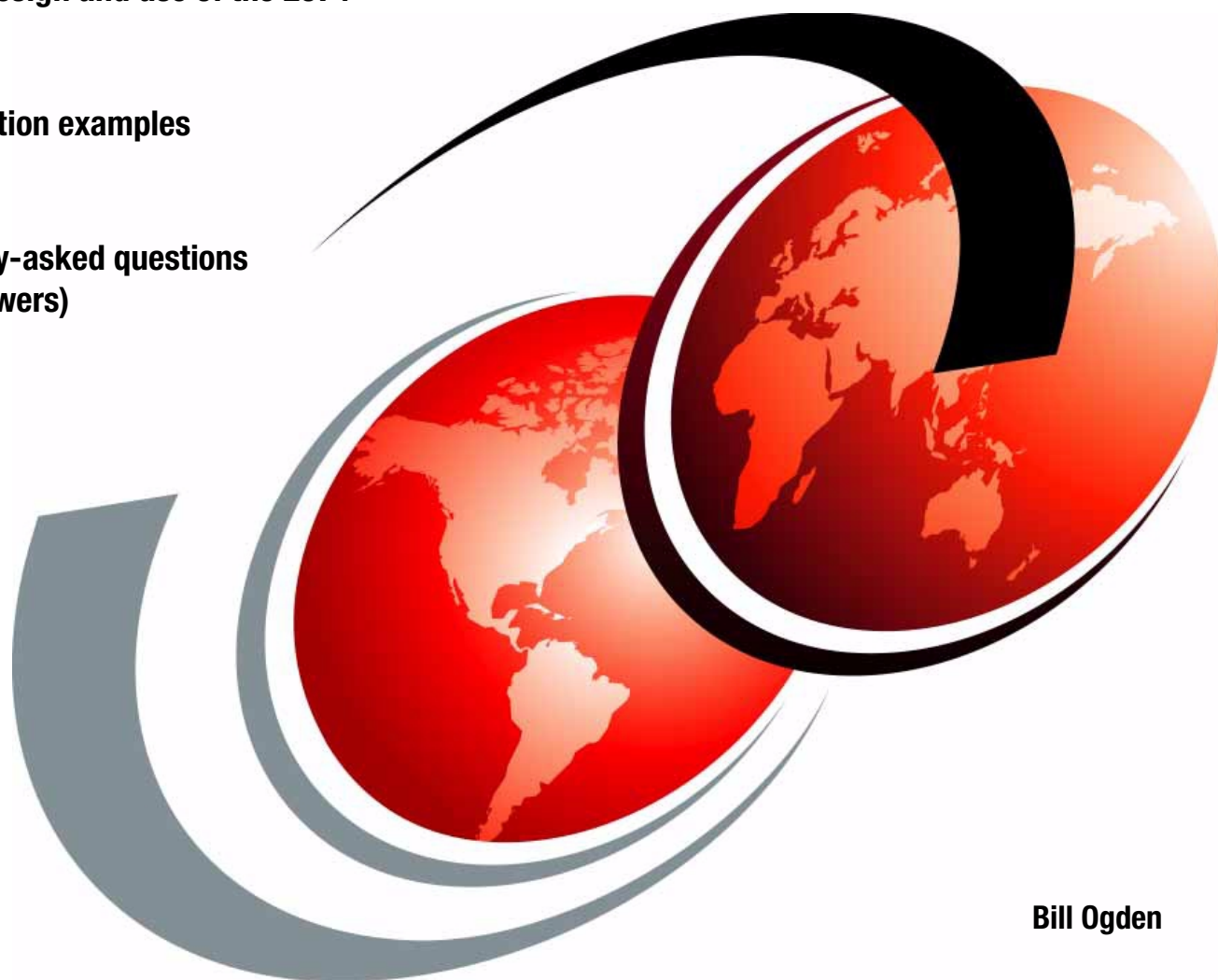


Introducing the IBM 2074 Control Unit

General design and use of the 2074

Configuration examples

Frequently-asked questions
(with answers)



Bill Ogden



International Technical Support Organization

SG24-5966-00

Introducing the IBM 2074 Control Unit

September 2000

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix C, "Special notices" on page 57.

First Edition (September 2000)

This edition applies to the initial release of the IBM 2074 Control Unit and associated support software.

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Preface

This redbook explains the design and use of the IBM 2074 Control Unit, based on ITSO experience with an early version of the 2074. A 2074 can be used with any S/390 operating system; however, this document discusses only its use with OS/390.

The 2074 typically replaces multiple local IBM 3174 control units to provide local connections for 3270 displays. In particular, one 2074 Control Unit can provide local 3270 connections for multiple LPARs, where the local 3270 sessions can be used for MVS master consoles and VTAM applications such as TSO and CICS.

This redbook describes typical customization controls for the 2074 and connected S/390 machines. This book assumes the reader is familiar with detailed S/390 and OS/390 terminology and uses such terminology without additional definitions.

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Martin Ziskind produced prototypes of the 2074 and guided these through extensive system testing and manufacturing. He is responsible for its hardware and bootable CD, and for the service plan.

Chuck Berghorn is an IBM Senior Technical Staff Member of the S/390 Division, and is a key designer of the 2074 Control Unit. He designed much of the emulated I/O technology used in P/370, P/390, R/390, S/390 Integrated Server, and Multiprise 3000 systems.

John Hupcey designed much of the software packaging and installation process that makes the 2074 easy to install and customize.

Nicki Anzivina, the 2074 product manager, helped us obtain access to early machines and helped us exchange experiences with other early users of the product.

Ken Kahn is responsible for the tn3270e function in the 2074 and helped us resolve a number of questions and early problems.

Boyd Andrews, with the S/390 test group, helped us ensure that the examples we documented work correctly.

Mike Shannon, team leader for OS/390 software testing, helped us with several extended IOCDs examples.

Comments welcome

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Chapter 1. Introduction

The IBM 2074 Control Unit can be used with any operating system that runs on S/390s and that supports local, non-SNA, DFT 3270 devices. This redbook describes its use with OS/390, but this should not be interpreted to mean that the 2074 cannot be used with other operating systems.

The IBM 2074 Control Unit addresses several problems:

- Most modern S/390 installations use multiple LPARs. Each LPAR requires one or more local 3270 devices/sessions for MVS consoles and a few TSO terminals. The local 3270 devices require a local IBM 3174 Control Unit for each LPAR. As the number of LPARs grows, the number of local 3174s also grows. Lack of additional 3174s can inhibit use of additional LPARs for test and development purposes.
- IBM is no longer producing 3174 Control Units.
- Most existing local 3174 Control Units were built for parallel channels. Channel cabling and switching arrangements for these, in a situation where LPAR flexibility is important, can become difficult.
- Even where sufficient ESCON 3174 control units are available, the switching arrangements (through ESCON directors) and IOCDs definitions for many control units potentially used by many LPARs can become unreasonably complex.

The IBM 2074 is a replacement for local, non-SNA 3174 Control Units. The 2074 is a shared control unit that can be used simultaneously by multiple LPARs, using EMIF-capable channels. For example, a single 2074 might provide MVS consoles (and TSO sessions) for ten LPARs. The LPARs might be in a single S/390 or spread across multiple S/390 systems.

The 2074 does not use existing “real” 3270 devices or connections. That is, it does not use coax cables or any of the family of “real” 3270 terminals. Instead, it uses TCP/IP connections (tn3270e) over LAN(s) to connect terminals (usually PCs) to the 2074. It uses ESCON channels to connect the 2074 to S/390 channels, either directly or through ESCON directors.

Figure 1 on page 2 provides a conceptual view of a 2074 installation. Practical details, with multiple channels, multiple systems, and ESCON directors, can make a more complex environment, but the basic concept remains the same.

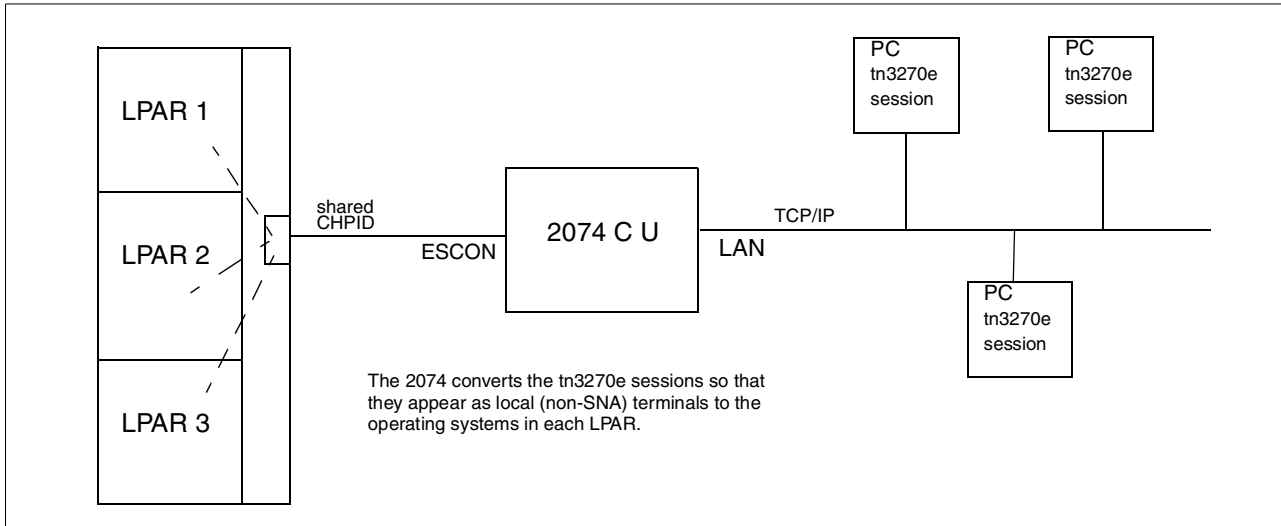


Figure 1. Conceptual view of IBM 2074 Control Unit usage

Referring to Figure 1, it does not especially matter which tn3270e package is used in the PCs, provided it supports all the structured fields and other features of current 3270 architecture.¹ The point is that the local 3270 terminals, seen by the host operating systems, are actually tn3270e sessions connected through a TCP/IP LAN.

Only tn3270e emulators, as opposed to tn3270 emulators, should be used. The tn3270e functions include an LU field that is vital for normal 2074 usage. All references to 3270 emulators in this document are intended to mean tn3270e.

The TCP/IP connection provided by the 2074 control unit is a full-function TCP/IP subsystem. Routing tables may be installed in the 2074. Full IP addresses are used. A name server could be used on the LAN, although this service is not provided by the 2074. The LAN might be connected to the Internet, although this would create security issues that would require very careful thought.² For the purposes of this document, we will assume that a private LAN is used. For maximum redundancy, two private LANs might be used.

1.1 Basic IBM 2074 specifications

The physical characteristics for the 2074 include the following:

- The 2074 is rack mounted, in a standard 19 inch rack. It requires 5.25 inches (3U) of vertical space. The unit depth is 26 inches. Open space on the left and right of the unit is required for air flow; this should be approximately 2 inches on each side. At least 4 inches is required in back of the unit for cable connections. The unit weighs about 60 pounds. It is relatively quiet, although it does have five internal fans.
- The 2074 is built around an IBM Netfinity PC. The PC has the normal display, keyboard, and mouse connections. It also contains a CD-ROM drive and a diskette drive. These are needed for installation and software maintenance,

¹ This statement represents the concept. In practice, IBM has tested only the IBM eNetwork Personal Communications tn3270 emulator (commonly known as PCOM) and this is the only *supported* emulator.

² There are no TCP/IP security issues unique to the 2074. However, given that MVS consoles are often used with no security controls whatsoever, one can question whether a LAN containing these should be connected to the Internet.

but not for routine operation (unless you elect to have 3270 sessions on the 2074 display).

- The Netfinity contains dual power supplies, for redundancy. A failing supply can be replaced without disrupting system operation.
- It contains multiple fans and can continue to operate if one fails. The fans are hot swappable.
- The Netfinity contains 128 MB memory, and is based on a 733 Mhz PC processor.
- A 19-inch display and keyboard may be included. The mouse function is integrated with the keyboard; a separate, physical mouse is not supplied. However, we refer to the integrated mouse function as a “mouse.” The only keyboard supported is the “U.S.” keyboard. The display and keyboard are optional; see Chapter 6, “Ordering selections” on page 41 for more information.
- An internal 9 GB SCSI disk drive is used for internal software, and is required for routine operation. The 2074 unit has space for several additional disk drives; this space is not used.
- One 10/100 Ethernet adapter is integrated with the 2074 circuit board, and an additional 10/100 PCI Ethernet adapter is included. Two 4/16 token ring adapters are also included with the basic 2074 unit.
- One ESCON adapter is included with the basic 2074.³
- One additional ESCON adapter is available as an option. This is the only significant optional feature available for the 2074.⁴
- All relevant software is provided on a bootable CD-ROM. No customer software is required or permitted. The bootable CD-ROM invokes programs to install the operational software on the hard disk.

The display (and keyboard, with integrated mouse) provided with the 2074 can be used for a limited number of 3270 sessions.⁵ IBM’s eNetwork Personal Communications product (commonly known as PCOM) is included with the 2074 to provide tn3270 client sessions on the 2074 console.

The functional characteristics of the 2074 include the following:

- All four LANs (two Ethernet and two token ring) can be used. Each LAN interface will have a different IP address. Multiple LAN connections to the same IP network (or subnetwork) are not supported. Each LAN interface that is used must be addressed as part of a different network or subnetwork.
- One or two ESCON channels can be used for host connections. The second channel can be used for additional connection paths and additional 3270 sessions. It does not provide failure redundancy for the first channel through multipathing mechanisms.
- An ESCON adapter interface is not synonymous with a logical control unit. Using the 2074 customization panels, you can define multiple control unit addresses that are accessed through a single ESCON interface.

³ The price list for the 2074 lists the ESCON adapter separately. This can be confusing. You must order the base 2074 unit and an ESCON adapter to have a working 2074.

⁴ Other options that must be selected are discussed in Chapter 6, “Ordering selections” on page 41.

⁵ The limitations are discussed in 1.1.1, “Limitations” on page 4.

- IBM has tested and supports up to sixteen 3270 sessions per ESCON channel. You can define and use up to 32 sessions per ESCON adapter, although this larger configuration has not been fully tested and is not “officially” supported. A 2074 with two ESCON channels can have up to 32 tn3270e sessions (tested and supported), or 64 sessions (not fully supported by IBM). These sessions can be split among LPARs and systems in many different ways, controlled by configuration definitions in the 2074. You must define the target LPAR for each allowed tn3270e session, using the 2074 configurator functions.
- Configurator functions are provided, using the 2074 display and keyboard, to define the nature and number of permitted tn3270e sessions.
- A tn3270e client selects which ESCON interface it wants to use by selecting the 2074 TCP/IP port address used to connect the tn3270e session. The 2074 administrator assigns different port addresses to the sessions associated with the two ESCON adapters. By default, these are ports 3270 and 3271, but these port numbers can be changed easily.
- Within an ESCON adapter set of sessions, the tn3270e client selects a session (where different sessions can be connected to different LPARs) by using the LU parameter available with modern tn3270e client software.⁶
- 3287 printers can also be emulated. Each emulated printer counts as a separate session.

Internally, the 2074 unit runs OS/2. The OS/2 software, with the additional software unique to the 2074, is packaged on a bootable CD-ROM. No OS/2 customization is required (or allowed). The OS/2 desktop is visible when the 2074 display is used, but is otherwise transparent to the user and system administrator.⁷

Users familiar with P/390 emulated I/O technology⁸ will recognize general 2074 operation and the 2074 configurator, although the multiple LPAR support has changed it somewhat. Users not familiar with emulated I/O technology should allow themselves time to read about it and to explore 2074 customization and usage before using it for production. Understanding emulated I/O technology is not difficult, but time is needed to become comfortable with the concepts and details.

1.1.1 Limitations

The 2074 uses PC components and technology and has the RAS characteristics of these components and technology. Other than the dual power supplies, there is no redundancy in the hardware. In the case of a single 2074, with all OS/390 consoles operating through it, a complete 2074 failure will cause all the 3270 sessions to be lost. If OS/390 loses all its consoles, it will automatically attempt to use the Operating System console function that is integrated with the S/390 Support Element (or HMC). This may or may not provide satisfactory recovery.

The 2074 (even with the second ESCON adapter) does not support multiple paths to a 3270 session. The optional second ESCON adapter does not provide

⁶ The 2074 administrator can also force certain client IP address to connect to selected 3270 host sessions. This is an alternative to using LU parameters to control session selection. Examples later should make this clearer.

⁷ IBM 3172 units used similar techniques. These used OS/2 internally, and OS/2 was visible only when the 3172 configurator functions were used.

⁸ As used on P/390, R/390, S/390 Integrated Server, and Multiprise 3000 systems.

automatic takeover if the other ESCON adapter fails. Different 3270 sessions exist for the two ESCON adapters; a given session cannot be switched between ESCON adapters.

There are four LAN adapters in a 2074. These do not provide automatic redundancy for each other. If both Ethernet adapters, for example, are connected to the same LAN (but not the same subnet!) and if one of the adapters fails (and fails in some manner that does not create a more general 2074 failure) then LAN users could reconnect to the surviving LAN adapter (at a different IP address). However, there is nothing automatic about this process.

Once the 2074 is configured, the display, keyboard, and mouse are not needed for routine operations (unless 3270 sessions have been defined using the 2074 display). They cannot be disconnected; the underlying PC will not work properly unless they remain connected. The display should be checked periodically for error messages.

The 2074 does not contain any form of UPS. An external UPS unit can be added, from any of the accepted UPS vendors, if appropriate. UPS power requirements are the same as for a medium-sized PC server. You would probably want to connect the 2074 display to the same UPS.

The tn3270e clients and the LAN wiring are likely to be more of a RAS problem than the basic 2074 unit itself. Typically, a “real” 3270 that is used as an MVS console has high-quality coax connections properly installed in such ways that they are unlikely to be accidentally disrupted. LAN connections and cables are not always as carefully installed. Also, not much can go wrong with a “real” 3270 terminal (other than the user turning the power off or disconnecting the coax cable), while a tn3270e client depends on an underlying operating system that has its own RAS characteristics. The client reliability provided by PCs and 3270 emulators is usually acceptable for TSO or CICS usage, but may need to be examined when intended for MVS console usage.

The 2074 does not support channel multipathing at the control unit level. As stated earlier, the two ESCON channel adapters do not provide multiple paths for any given 3270 session. Each channel adapter connects to a separate set of 3270 sessions. For a given channel adapter, each defined 3270 session (that is, each defined local 3270 (or 3287) device) can be directed to a different CHPID port on an ESCON director, but each session is connected to only one CHPID through an ESCON director. *There are no multiple or alternate paths to any given 3270 session.*

A maximum of two 3270 sessions may be defined for the 2074 console, using the PCOM emulator included with the 2074. These sessions are intended only for initial startup (if needed) and debugging. *They are not intended for routine usage.* The reason is to minimize risk associated with PCOM emulator failures. An emulator failure might cause OS/2 to fail and this would cause all 2074 sessions to be lost. This is rare and would not be a significant factor if only VTAM terminals were involved. However, the expected primary use for a 2074 is for MCS consoles and these have a different availability criteria.

If availability beyond what is normally associated with PC components and LAN connectivity is required, we strongly suggest using *two* 2074 Control Units (through separate ESCON Directors, if appropriate). MVS consoles can be

defined through both 2074s, providing a more fail-safe configuration. We expect most 2074 customers will deploy several 2074 units and much of the 2074 documentation and support material assumes this is the case. We believe two 2074s will provide adequate reliability for most S/390 installations.

Chapter 2. IBM 2074 customization panels

Installing and customizing a 2074 requires close planning of IOCDS parameters and 2074 parameters. We explore several examples of their interaction in Chapter 3, “Configuration and customization examples” on page 15. In this chapter we briefly examine the individual panels available for customizing the 2074. To really understand the 2074 customization functions, you will need to relate these panels to IOCDS and IODF specifications and we do this later, in Chapter 3. You will probably need to refer to the specific panel details in this chapter again, while reading Chapter 3.

When the 2074 is started⁹ it displays a minimal OS/2 desktop, somewhat as illustrated in Figure 2. The desktop may contain 3270 sessions (if you elected to configure 3270 sessions on the 2074 display). It will contain three windows (one of which can be ignored if you have a single ESCON channel adapter) for controlling 2074 functions. Each of these windows contains several options; you select an option by double-clicking it with the mouse. The options are:

- Start (“IML”) the 3174 emulation functions for the associated ESCON channel adapter
- Stop the 3174 emulation functions for the associated ESCON channel adapter
- Configure the 2074 for the associated ESCON channel adapter
- Trace 2074 activity (for debugging purposes) (for both channel adapters)
- Snapdump
- Send error and trace logs to IBM

For this chapter, we are interested in the panels obtained by clicking the Configure option.

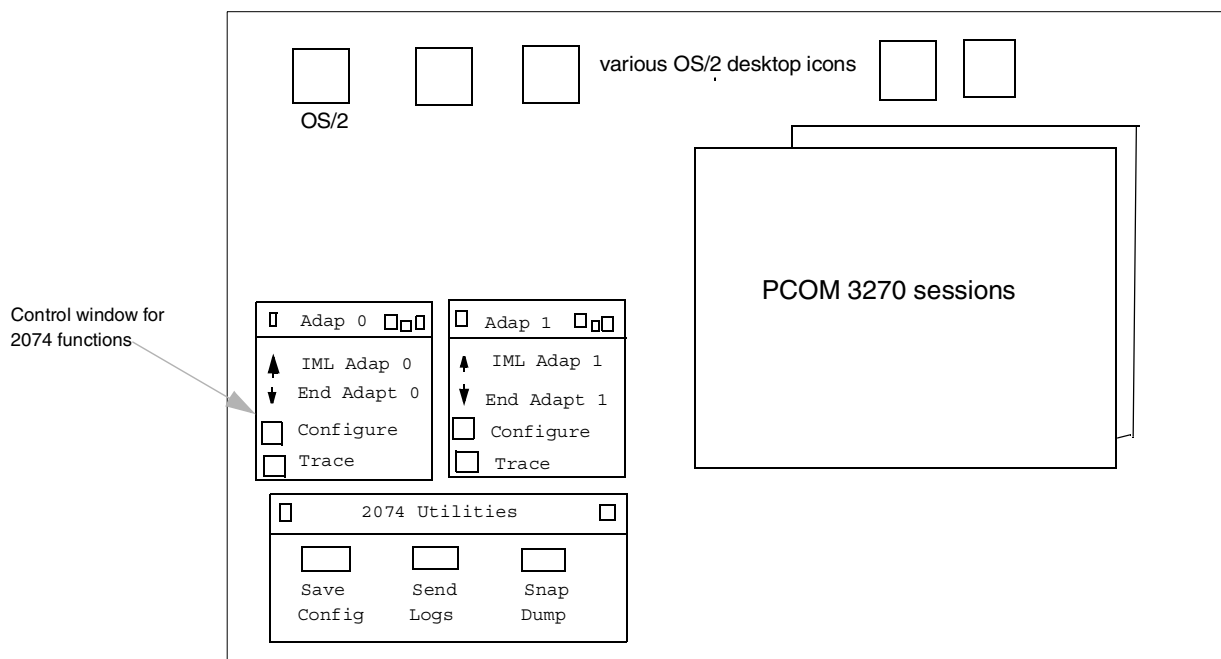


Figure 2. OS/2 Desktop for 2074

⁹ It could be started (or restarted) by power on, Ctl-Alt-Del on the keyboard, or the Reset button on the 2074.

Note: All the figures in this chapter are based on early versions of the 2074. There may be minor changes in the final version of the product.

The first Configuration panel is shown in Figure 3; this example is for ESCON Channel Adapter 0. The 2074 has four Device Maps (DEVMAPs) for each channel (each ESCON adapter).¹⁰ A DEVMAP contains the definitions that link tn3270e sessions to particular LPARs. Only one DEVMAP is used at one time by an ESCON Channel Adapter interface. You could have different definitions in the four different DEVMAPs, corresponding to different environments you may need to support at different times or in different situations. Each ESCON adapter has its own set of four DEVMAPs.

In the following text we refer to the first ESCON Channel Adapter as CA0, and the second as CA1.

In the example in Figure 3, DEVMAP0 (for CA0) is currently active. When a DEVMAP is activated (by a 2074 IML), it is copied to DEVMAP AC, which cannot be altered for the duration of the IML. All four original DEVMAPS (0 - 3) can be edited while the 2074 is running. Changes to these DEVMAPs have no effect until one of them is selected to be active on the next IML, and the corresponding CA is then IMLed. Study Figure 3 to find the active DEVMAP, the DEVMAP that will be used the next time the CA is IMLed, and so forth.

```
IBM 2074 ESCON Channel Adapter 0 Configuration

Device Map Selection
Currently Active Device Map:
  E:\DEVMAP\DEVMAPAC.CA0  SYS1      Configuration file for SYS1 basic
Active on Next IML Device Map:
  E:\DEVMAP\DEVMAP1.CA0  LPAR1    Two LPARs for OS/390 prod and recovery

Editable Device Maps:
  Device Map 0 >E:\DEVMAP\DEVMAP0.CA0  Configuration file for SYS1 basic
  Device Map 1 >E:\DEVMAP\DEVMAP1.CA0  Two LPARs for OS/390 prod and recovery
  Device Map 2 >E:\DEVMAP\DEVMAP2.CA0
  Device Map 3 >E:\DEVMAP\DEVMAP3.CA0

TAB the cursor to an Editable DEVMAP name and press ENTER to edit.
The Currently Active device map CANNOT be edited, only viewed.

To change the Active on Next IML DEVMAP, TAB the cursor
to an Editable DEVMAP and press F11.

NOTE: The ACTIVE DEVICE MAP was copied from E:\DEVMAP\DEVMAP0.CA0

F1 - Help          ENTER - Select Devmap          F10 - End Configurator
```

Figure 3. Device Map Selection panel

Moving the cursor to one of the DEVMAP names and pressing Enter produces the Functions panel shown in Figure 4 on page 9. Notice that this panel

¹⁰ Unlike Multiprise 3000 emulated I/O, the 2074 DEVMAPs are not tied to a host IOCDS number. You might use IOCDS A2 with 2074 DEVMAP 1.

indicates which DEVMAP you have selected to edit. Also note that the Save, End, and Quit options (F6, F8, and F10) are not the same function keys that are used with ISPF or most other S/390 software. You will need to use the F2, F3, and F4 options of the Functions panel to customize your 2074 control unit.

Functions

Current 2074 Program Level is: 1.0.0
Device Map is E:\DEVMAP\DEVMAP0.CA0

Major Functions	Description of Major Functions
F1 Help	
F2 Update System Devices	F2 Configure device addresses, LPARs, director ports, and tn3270 parms
F3 Set 2074 Name and Description	F3 Define the system LANID and a description of this DEVMAP
F4 Update LAN Configuration	F4 Change TCP/IP configuration parameters. Enable/disable LAN adapters.
F6 END - SAVE ALL, then EXIT	
F8 SAVE - SAVE ALL, do not EXIT	
F10 QUIT - Do not save anything	
F12 Edit Trace Entries	

Figure 4. Functions Panel

ESCON Channel Adapter 0 Device Configuration

Active Devices: 7 ————— MAX allowable device index is hex 20

Index	Device	LPAR#	Port	CU UA	Mgr	Parameters
01	3278	1	C0	0 01	1	/R=MVS1OP
02	3278	1	C0	0 02	1	/R=MVS1
03	3278	1	C0	0 03	2	/R=MVS1
04	3278	1	C0	0 04	2	/R=MVS1
05	3278	2	C0	0 05	2	/R=MVS2OP
06	3278	2	C0	0 06	2	/R=MVS2
07	3278	2	C0	0 07	2	/R=MVS2 10.10.10.149
08	3278	2	C0	0 08	2	10.10.10.150
09						
0A						

Mgr Codes: 1=AWS3274 2=LAN3274

F1 Help ALT+F1 Function Key Definitions F10 Main Menu ESC Cancel Input

Figure 5. ESCON Adapter Device Configuration

The F2 option (on the Functions panel) produces the ESCON Adapter Device Configuration panel shown in Figure 5. This is the key 2074 configuration panel and must be understood to successfully install a 2074 control unit. In this panel,

you can overwrite any field displayed in red, and enter new line items in any line containing an Index number. We need to examine each column:

- The Index column provides, in effect, internal line numbers for the configurator. There are index numbers, displayed in hex, corresponding to a session.¹¹ The numbers in this column are filled in automatically. These numbers have no external significance.
- The Device column should contain either 3278 (for a 3270 display session) or 3287 (for a 3270 printer device). The 3278 value should not be taken too literally: it does not restrict display sessions to the functions available for IBM 3278 display units.
- The LPAR column contains zero or an LPAR number. It *must* contain the value 0 to indicate a basic mode S/390 (without LPARs), *or a channel dedicated to a single LPAR*. If the channel is shared among several LPARs, then this column must contain the resource partition number (as defined in the IOCDs) that will use this session. The 3270 (or printer) session defined by this line can be used *only* with the indicated LPAR number. Other LPARs may see this session/device (via the CU address and Device Address) as a path not available.

This column will be nonzero only if you have LPARs defined and the host channel is shared by multiple LPARs.

- The Port number refers to the ESCON Director port address for the host CHPID associated with this session. It is not the ESCON Director port address connected to the 2074. If an ESCON Director is not used, this value must be 01. (If your host port address is expressed as two numbers, separated by a slash, you should use the first number for this parameter.)
- The CU and UA columns contain two values, each a hex number. The first value is the control unit (CU) address associated with this session. The second two digits are the unit address (UA) for this session. Both these values must correspond to values defined in the IOCDs. In a simple environment, the control unit address is usually 0, and the unit address is in the range 00 through 1F. Examples in the next chapter explore some of the uses of these fields. A control unit address is limited to a single hex digit; a unit address is limited to two hex digits.
- The Mgr value will be either 1 or 2¹². Value 1 (meaning the AWS3274 emulated I/O device manager) specifies that the 3270 session will be through the 2074 loopback address. That is, the terminal session will be on the 2074's display. Value 2 (meaning the LAN3274 emulated I/O device manager) means the session will be from a client on one of the LANs. (It could use any of the four LAN adapters.)
- The Parameters value can be in one of these formats:
 - The form /R=xxx means that a client tn3270e session must present a matching LU name to connect to this session. If multiple sessions have the same /R parameter, a tn3270e client will be connected to the first unused

¹¹ And a session corresponds to one emulated device. The index numbers go up to X'20', for 32 sessions or devices. Only 16 sessions are fully supported by IBM. You may define and use up to 32 sessions, but this number has not been fully tested and is not officially supported. You should not attempt to define or use more than 32 sessions. Remember that the definitions here are for one ESCON adapter. If you have two ESCON adapters, you will have another set of DEVMAPs to define up to 32 sessions (with up to 16 supported) for use through the other ESCON adapter.

¹² These numbers refer to a series of device managers listed at the bottom of the screen.

session with a matching /R parameter. (We recommend an LUsername be no longer than 8 characters.)

- The xxx.xxx.xxx.xxx format means that only a tn3270e client with this IP address can use this session. Several 2074 sessions could specify the same IP address. (Note that an IP address parameter does not begin with /R.)
- Using /R=xxx plus an IP address means that only a tn3270e client with this IP address can use this session. Furthermore, this specific session can be selected by the client by using a matching LU name.
- Any other format is regarded as a comment and ignored.

Again, you may overwrite any field displayed in red or enter valid fields in any blank line with an Index number. The PageUp and PageDown keys are used to scroll. After changes are complete, press F10 to return to the Functions panel.

The F11 key can be used to duplicate a line. This is useful since a configuration normally contains many almost identical lines. Be certain to further customize each duplicated line. The configurator will consider lines with duplicate parameters (LPAR number, port, CU and UA) to be an error.

The Start Device Manager Parameters panel, shown in Figure 6, specifies optional parameters that can be used by the two device managers. This panel is accessed by pressing F12 while in the Device Configuration panel (Figure 5). The only commonly used parameter here is an IP port number, as shown in the example. This is the TCP/IP port number that must be specified by client tn3270e sessions to connect to the 2074. The default IP port number is 3270 for sessions associated with the first ESCON adapter, and 3271 for sessions associated with the second ESCON adapter.

The two ESCON adapter session groups must have different IP port addresses. The same port address is used for the two device manager interfaces (AWS3274 and LAN3274) associated with each ESCON adapter. This port address can be entered in either of the lines shown in Figure 6. The required format is shown in Figure 6.¹³

Do not confuse IP port numbers with ESCON director port numbers. They are completely separate elements.

¹³ You could use port 23 here (with some other port number associated with your second ESCON adapter, if you have one), as 23 is the “normal” port for telnet (and tn3270) access. However, considering the specialized use (MCS consoles) for most 2074 units, we suggest using a nonstandard port, such as 3270 (and 3271).

```

Start Device Manager Parameter Input/Display

1 AWS3274 >
2 LAN3274 >/PORT=3270

F1=Help F7=Up F8=Down F10=Accept/Return ENTER=Accept Data ESC=Cancel

```

Figure 6. Start Device Manager Parameters

```

Set 2074 Name and Description

Set for Device Map 0 -> E:\DEVMAP\DEVMAP0.CA0

Configuration Description >

2074 Unit Name >

F1=Help ENTER=Accept Data, return to Main Menu ESC=No Changes

```

Figure 7. Set 2074 Name and Description panel

The 2074 Name and Description panel, shown in Figure 7, contains two fields. Whatever you enter in the Configuration Description field will be displayed next to the DEVMAP name in the Device Map Selection panel (Figure 3 on page 8). It is merely a way to provide a short description.

The 2074 Unit name is an 8-character field that is displayed in the Device Map Selection panel and is displayed in the initial screen sent to any tn3270e client. (This is usually overlaid by the VTAM USSTAB screen, but the initial 2074 display (containing this field) may persist for some time during IPL, for example.) This name can assure the user that he is connecting to the correct control unit.

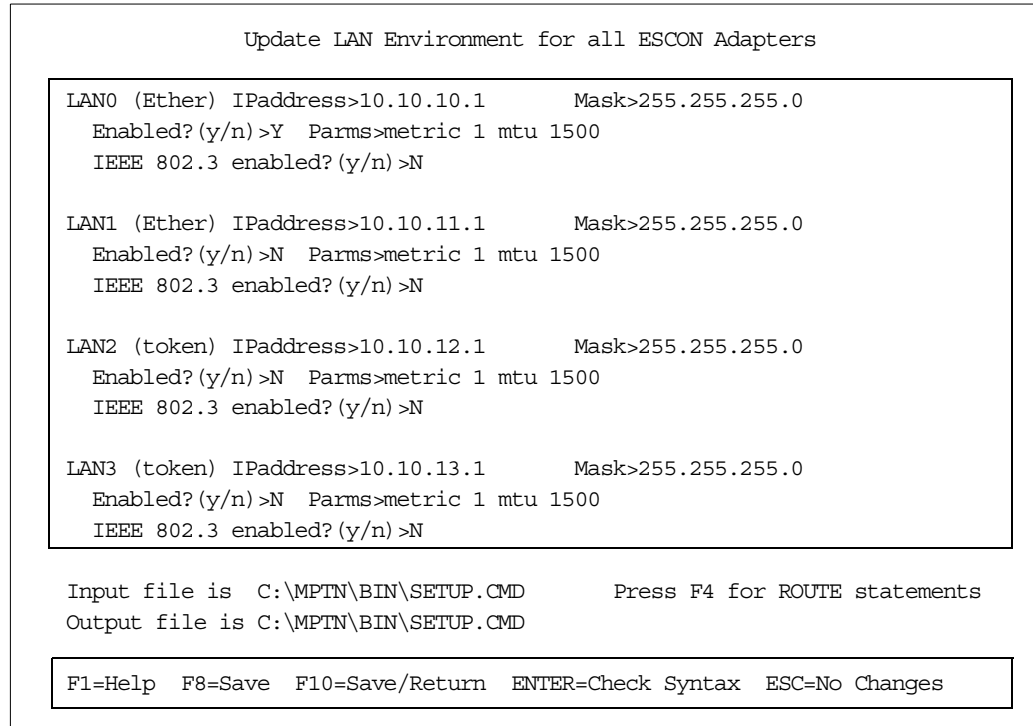


Figure 8. Update LAN Environment panel

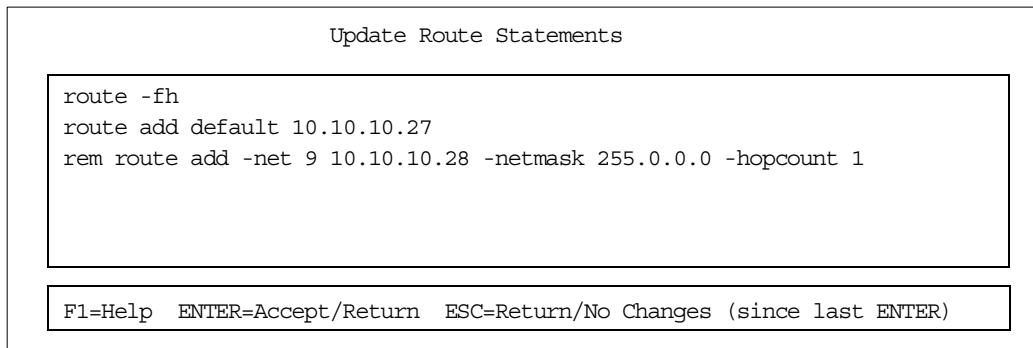


Figure 9. Update Route Statements Panel

The OS/2 TCP/IP system is mostly configured for you. The Update LAN Environment panel (Figure 8) contains the variables you must set. Unlike the panels described previously, this panel applies to sessions associated with both ESCON adapters. The example shows typical values. You can change any field displayed in red by overtyping it.

All 2074 units have the four LAN adapters shown, although you may elect not to use some of the adapters. You can set IP addresses that are appropriate for your installation. *Remember that multiple LAN adapters (belonging to the 2074) cannot be connected to the same subnet.* The indicated Maximum Transmission Unit (mtu) size is appropriate, and is the maximum valid value for Ethernet. The IEEE 802.3 option (meaningful only for Ethernet) permits the use of IEEE 802.3 packets, as opposed to DIX packets. If you are not familiar with this distinction, we suggest you leave this value set to N.

The two file names shown in the panel are an internal detail that can be ignored.

If your 2074 LAN(s) are connected to other LANs¹⁴, you will probably want to provide *route* statements. This can be done by pressing F4 while in the Update LAN Environment panel. This produces the Update Route Statements panel (Figure 9 on page 13). You can enter standard TCP/IP route commands in this panel. Again, they apply to all LAN adapters, used by both ESCON adapter interfaces.

2.1 Client customization

A client tn3270e session, on a PC, must be customized to specify:

- Which 2074 will be used
 - This is done by specifying the IP address of one of the LAN adapters of the target 2074. If a name server is available (and set with the proper values) the IP address could be specified as a domain name. An alternative is to use the client's TCP/IP hosts table. If neither of these is used, you can specify the IP address as a dotted-decimal number. In the restricted environment typical of 2074 usage (that is, restricted to OS/390 consoles and a few administrative TSO sessions), the dotted decimal method is common.
- Which ESCON director (or direct S/390 channel connection) in the 2074 will be used
 - This is done by specifying the port number associated with the ESCON interface the client wants to use. The defaults are 3270 and 3271.
- Which LPAR and device number ("address") will be used
 - This is done by specifying an LU name that is associated with the session you want. (The DEVMAP then associates this with an ESCON director port number, an LPAR number, a control unit address, and a unit address. An IOCDS converts the control unit and unit addresses into an MVS device number.)

These values are easy to specify in IBM's PCOM product, and should be easy to specify in most modern tn3270e emulators. Additional customization of the client may be appropriate, such as number of lines on the 3270 screen, keyboard character codes, and so forth. These details are transparent to the 2074 (but may not be transparent to VTAM or the host applications).

¹⁴ Again, we note that this may not be appropriate for LANs containing MVS console sessions.

Chapter 3. Configuration and customization examples

The examples in this chapter use OS/390 as the operating systems. This is done because (1) the majority of 2074 installations will probably be for OS/390, and (2) it allows us to use concrete and consistent examples. The 2074 can be used with other operating systems, of course, and you can apply the concepts explained here with other operating systems.

The 2074 emulates local, non-SNA 3270 DFT displays (and 3287 printers). The examples here assume that the operating systems involved have correctly defined the relevant display addresses. Our examples assume that OS/390 addresses 700-71F and 900-91F are defined as local 3270s in the operating system, and that 700 (and sometimes 701) are defined as MVS consoles. You are not restricted to these addresses, of course, but they are commonly used for several *preloaded systems* available for smaller S/390 processors.

For all cases discussed here, we assume the OS/390 already has 3174 control units and 3270 display devices defined (in its active IODF) at addresses corresponding to the IOCDS examples we use.¹⁵ Our examples use direct IOCDS source creation instead of using HCD¹⁶ to create IOCDSs. Attempting to explain HCD usage is beyond the scope of this redbook. Presenting the IOCDS statements in our examples illustrates the results you need to obtain if you generate your IOCDS by using HCD.

3.1 Basic mode

A system in basic mode might use the following additional lines in its IOCDS definition to utilize a 2074:

```
CHPID PATH=(04),TYPE=CNC
....
CNTLUNIT CUNUMBR=C400,PATH=04,CUADD=0,UNIT=3174,UNITADD=((00,4))
....
IODEVICE CUNUMBR=C400,ADDRESS=(900,4),UNIT=3270,UNITADD=00
.....
```

The following 2074 DEVMAP could be used with this IOCDS:

Index	Device	LPAR#	Port	CU	UA	Mgr	Parameters
01	3278	0	01	0	00	2	/R=MVS1
02	3278	0	01	0	01	2	/R=MVS1
03	3278	0	01	0	02	2	/R=MVS1
04	3278	0	01	0	03	2	/R=MVS1

In this example, we assume the 2074 is connected to CHPID 04 and does not go through an ESCON Director (as indicated by Port = 01). Client tn3270e sessions will be connected to the 2074 LANs (indicated by Mgr = 2), and the client sessions should all specify MVS1 as their LU names. Four “devices” (or sessions) are defined; the operating system will see these at addresses 900-903. The UNITADD and CUADD parameters in the CNTLUNIT and IODEVICE

¹⁵ Describing and explaining an IODF is beyond the scope of this redbook; we assume readers are already familiar with this aspect of OS/390 administration.

¹⁶ HCD is the OS/390 utility program that is used to generate IODF data sets and, optionally, to generate IOCDS files.

statements are not needed in this case¹⁷; however, they are often required for more complex 2074 definitions and are included here.

The 2074 TCP/IP parameters (see Figure 8 on page 13) might be defined as:

```
LAN0 (Ether) IPAddress>10.10.0.1    Mask>255.255.255.0
Enabled?(y/n)>Y  PArms>metric 1 mtu 1500
IEEE 802.3 enabled?(y/n)>N
```

with the other LAN interfaces disabled.

A tn3270e client could connect to one of these sessions by connecting to IP address 10.10.0.1, port 3270 (the default TCP/IP port address for the first channel adapter in the 2074).

3.2 Two LPARs with preplanned addresses

Consider the simple 2074 shown in Figure 1 on page 2, but with only two LPARs. The corresponding IOCDs definition might be:¹⁸

```
RESOURCE PARTITION=( (MVS1,1) , (MVS2,2) )
..
CHPID PATH=(04) , SHARED, PARTITION=( (MVS1,MVS2) ) , TYPE=CNC
..
CNTLUNIT CUNUMBR=700 , PATH=04 , UNITADD=( (00,32) ) , UNIT=3174
..
IODEVICE CUNUMBR=700 , ADDRESS=(700,32) , UNIT=3270
..
```

The matching 2074 Device Configuration might be:

Index	Device	LPAR#	Port	CU UA	Mgr	Parameters
01	3278	1	01	0 00	1	/R=MVS1OP
02	3278	2	01	0 01	1	/R=MVS2OP
03	3278	1	01	0 02	2	/R=MVS1
04	3278	1	01	0 03	2	/R=MVS1
..	
10	3278	1	01	0 0F	2	/R=MVS1
11	3278	2	01	0 10	2	/R=MVS2
12	3278	2	01	0 11	2	/R=MVS2
..	
20	3278	2	01	0 1F	2	/R=MVS2

We discuss this example in some detail, since it is a base for the other examples. We have a 2074 with a single ESCON adapter. The CHPID is shared by both LPARs. By default, the IODEVICES defined on a shared CNC CHPID are shared, so it is not necessary to code PART= for the IODEVICE statement. Considering the IOCDs source statements shown here, all the 3270 units (32 units) are shared devices accessible by both LPARs.

3270 displays on a “real” 3174 cannot be shared, and this would be an invalid configuration for a real 3174. Furthermore, sharing a given 3270 terminal among several LPARs does not make sense. The additional 2074 controls (the LPAR#

¹⁷ The CUADD in the CNTLUNIT statement defaults to 0, and the UNITADD in the IODEVICE statement defaults to the last two digits of the ADDRESS field.

¹⁸ An IOCDs definition would certainly be larger than this. We show only the statements relevant to the 2074 here and in the following examples.

field in the 2074 Device Configuration) causes each 3270 device to be dedicated to a specified LPAR.

In this example, the “software” addresses (device numbers) for the displays are 700, 701, 702, and so forth. LPAR 1 can use addresses 700 and 702-70F, and LPAR 2 can use addresses 701 and 710-71F. To LPAR 1, it appears that no path is available to address 701, for example.

For this example, we assume that two OS/390 systems are being used in the two LPARs, and that the OS/390 in LPAR 1 uses address 700 for its MVS console, and the OS/390 in LPAR 2 uses address 701 for its MVS console. In both systems, addresses 702-71F are defined as VTAM terminals.¹⁹ (VTAM will sense that no terminals are connected to the addresses not available to that LPAR.)

In this example, we have the first two 3270 sessions defined through the AWS3274 device manager. This means they will appear on the 2074 display, and use the 2074 keyboard. The other sessions are through the LAN3274 device manager and will be connected via the 2074 LANs. There is no requirement to use sessions on the 2074 display; however, for our examples, we elected to place the MVS console sessions on the 2074 display.²⁰

To use this configuration, we would define two PCOM sessions on the 2074 OS/2 system. These would connect to the loopback address (127.0.0.1), port 3270 (not shown in the definitions, but this is the default). One session would specify LU=MVS1OP and the other would specify LU=MVS2OP. These LU names would force the PCOM clients to connect to the sessions corresponding to address 700 and 701, and these would become MVS consoles for the two LPARs.

LAN users could configure their tn3270e clients to the IP address of any one of the 2074 LAN adapters (not shown in the example), port 3270. The LU name would be specified as MVS1 or MVS2, depending on which LPAR the user wants to access. The 2074 control program will connect a new LAN client session to the *first free session definition* that has a matching LU name.

Most of the essential details for understanding basic 2074 customization are contained in this example. We suggest you review it thoroughly before moving to the more complex examples in the rest of this chapter.

3.3 Two LPARs with overlapping addresses

Suppose we have two OS/390 systems that, for some reason, demand identical addresses for MVS consoles and VTAM terminals. (This is a common situation when *clones* of a single OS/390 are used in multiple LPARs and the same IODF is used for all clones.) For example, each LPAR might want complete use of addresses 700-70F. (We will assume 700 is for the MVS console, and the others are for VTAM.) There are several ways we could configure the 2074 to do this. There appears to be no *best* method. You should select a method you clearly understand and that matches the addressing philosophy you use with your other I/O devices.

¹⁹ This could be done other ways, of course. You might define to each VTAM only the addresses available to its LPAR. However, there is little overhead in defining all the addresses, and this makes administration much easier. Likewise, you could define address 700 and 701 as MVS consoles for both systems. Each system would then use only the MVS console that it can access.

²⁰ The use of sessions on the 2074 display is intended for debugging purposes only, as discussed in 1.1.1, “Limitations” on page 4. We found the 2074 sessions convenient in our small test environment.

3.3.1 First method

The first way is:

```
RESOURCE PARTITION=( (MVS1,1) , (MVS2,2) )
..
CHPID PATH=(04) , SHARED, PARTITION=( (MVS1,MVS2) ) , TYPE=CNC
..
CNTLUNIT CUNUMBR=700, PATH=04, UNITADD=( (00,32) ) , UNIT=3174
..
IODEVICE CUNUMBR=700, ADDRESS=(700,16) , UNIT=3270,
        UNITADD=0
..
```

This provides a string of 16 3270 devices, starting with address 700, that is known to all LPARs. This would be invalid with a real 3174 control unit, but works here because the 2074 can separate LPAR usage via its DEVMAP and the use of LUNAMES in the tn3270 sessions.

The matching 2074 Device Configuration (DEVMAP) might be:

Index	Device	LPAR#	Port	CU UA	Mgr	Parameters
01	3278	1	01	0 00	1	/R=MVS1OP
02	3278	1	01	0 01	2	/R=MVS1
03	3278	1	01	0 02	2	/R=MVS1
04	3278	1	01	0 03	2	/R=MVS1
..
10	3278	1	01	0 0F	2	/R=MVS1
11	3278	2	01	0 00	1	/R=MVS2OP
12	3278	2	01	0 01	2	/R=MVS2
..
20	3278	2	01	0 0F	2	/R=MVS2

Note that the display session with Index X'11' becomes address 700 for LPAR 2. If this is not clear, follow the unit address (from the CU UA fields) through the IOCDs definitions.

From the user point of view, this functions exactly like the original example in Chapter 3.2, "Two LPARs with preplanned addresses" on page 16. Alert users (or operators) might notice their display addresses are now in the range 700-70F (on both systems), but users normally do not care about their display addresses.

This is probably the simplest definition for overlapping addresses in multiple LPARs. The only disadvantage is that it may be confusing at first glance, because, based on the IOCDs contents, it appears that the same 3270s are being shared by both LPARs.

3.3.2 Second method

Another way is:

```
RESOURCE PARTITION=( (MVS1,1) , (MVS2,2) )
..
CHPID PATH=(04) , SHARED, PARTITION=( (MVS1,MVS2) ) , TYPE=CNC
..
CNTLUNIT CUNUMBR=700, PATH=04, UNITADD=( (00,32) ) , UNIT=3174
..
IODEVICE CUNUMBR=700, ADDRESS=(700,16) , UNIT=3270,
        UNITADD=0, PARTITION=(MVS1)
```

```

IODEVICE CUNUMBR=700,ADDRESS=(700,16),UNIT=3270,
        UNITADD=10,PARTITION=(MVS2)

```

..

This provides each partition with a string of sixteen 3270 devices, each starting with address 700. Note that the device UNITADD in the IODEVICE statements is different for the two strings.

The matching 2074 Device Configuration might be:

Index	Device	LPAR#	Port	CU UA	Mgr	Parameters
01	3278	1	01	0 00	1	/R=MVS1OP
02	3278	1	01	0 01	2	/R=MVS1
03	3278	1	01	0 02	2	/R=MVS1
04	3278	1	01	0 03	2	/R=MVS1
..
10	3278	1	01	0 0F	2	/R=MVS1
11	3278	2	01	0 10	1	/R=MVS2OP
12	3278	2	01	0 11	2	/R=MVS2
..
20	3278	2	01	0 1F	2	/R=MVS2

Note that the display session with Index X'11' becomes address 700 for LPAR 2. If this is not clear, follow the unit address (from the CU UA field) through the IOCDs definitions.

This method requires more statements in the IOCDs, but may be easier to understand because different unit address ranges are used for different LPARs.

3.3.3 Third method

Here is a third way:

```

RESOURCE PARTITION=( (MVS1,1), (MVS2,2) )
..
CHPID PATH=(04),SHARED,PARTITION=( (MVS1,MVS2) ),TYPE=CNC
..
CNTLUNIT CUNUMBR=700,PATH=04,UNITADD=( (00,16) ),UNIT=3174,CUADD=0
CNTLUNIT CUNUMBR=710,PATH=04,UNITADD=( (00,16) ),UNIT=3174,CUADD=1
..
IODEVICE CUNUMBR=700,ADDRESS=(700,16),UNIT=3270,
        UNITADD=0,PARTITION=(MVS1)
IODEVICE CUNUMBR=710,ADDRESS=(700,16),UNIT=3270,
        UNITADD=0,PARTITION=(MVS2)
..

```

We now have two control unit definitions, with two CUADD values. Each LPAR has its own control unit defined for it.

The matching 2074 Device Configuration might be:

Index	Device	LPAR#	Port	CU UA	Mgr	Parameters
01	3278	1	01	0 00	1	/R=MVS1OP
02	3278	1	01	0 01	2	/R=MVS1
03	3278	1	01	0 02	2	/R=MVS1
04	3278	1	01	0 03	2	/R=MVS1
..
10	3278	1	01	0 0F	2	/R=MVS1
11	3278	2	01	1 00	1	/R=MVS2OP

```

12 3278  2    01    1 01    2 /R=MVS2
.. .. . . . . . . . . . . . . . .
20 3278  2    01    1 0F    2 /R=MVS2

```

This method creates separate control units for the different LPARs, and may be the easiest to understand at first glance.

Typically, users will not be able to detect the differences between these methods of customization. The “under the covers” differences are:

- The first method uses the same control unit and device definitions for two LPARs. The control unit and devices appear to be shared. Client tn3270e sessions use LUNAMES to connect to a specific range of DEVMAP entries, and these DEVMAP entries specify which LPAR number they will use.
- The second method uses a single shared control unit definition, but defines separate IODEVICE statements for the LPARs, and uses separate ranges of Unit Addresses for the different LPARs.
- The third method defines separate control units, and, via separate IODEVICE statements, effectively assigns a different control unit to each LPAR.

The result is the same with all three methods. Note that in all cases, the client tn3270e sessions must specify LUNAMES to match the proper lines in the DEVMAP.

3.4 Adding ESCON Director(s)

Consider the configuration in Figure 10. You would probably never configure a system quite like this, but the indicated setup allows us to explain 2074 characteristics in this environment.

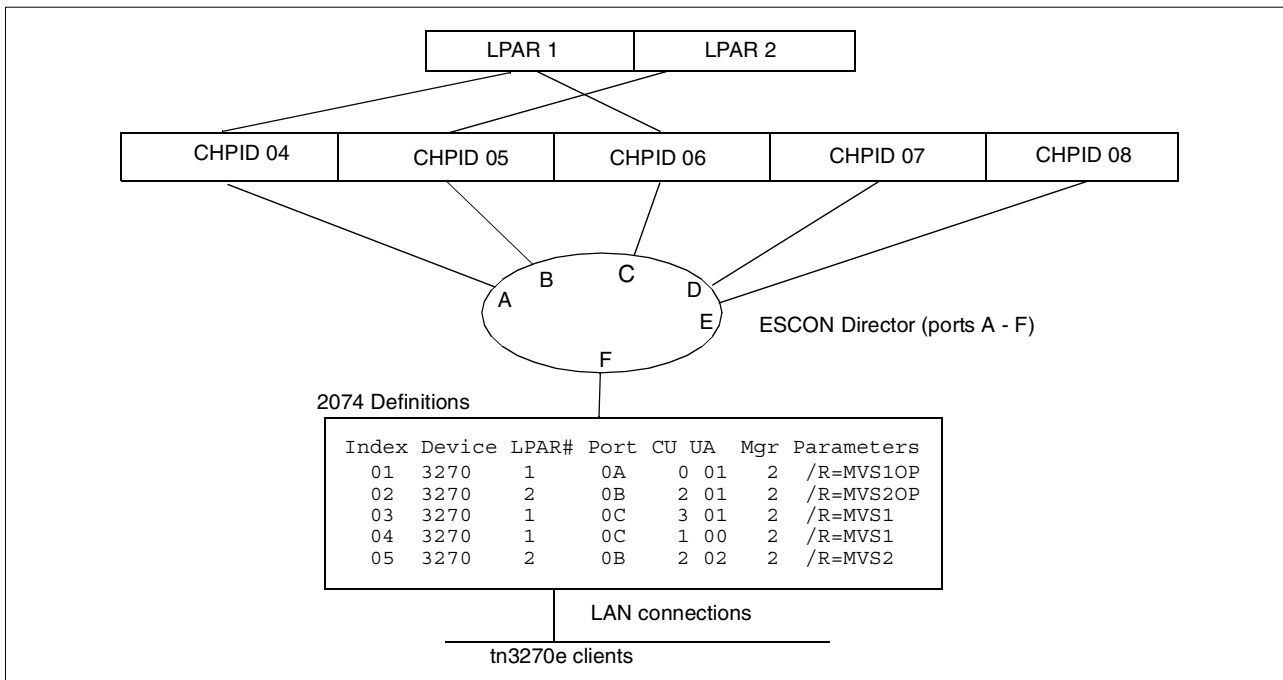


Figure 10. ESCON Director ports, LPARs, and a small 2074

IOCDs (and HCD) see four control units here:

- One on CHPID 04 (port A, CUADD 0), with one device (UNITADD 1)
- One on CHPID 05 (port B, CUADD 2), with two devices (UNITADD 1 and 2)
- One on CHPID 06 (port C, CUADD 3), with one device (UNITADD 1)
- One on CHPID 06 (port C, CUADD 1), with one device (UNITADD 0)

The point is that a given 2074 device (a line item in the 2074 definitions) is connected through an ESCON Director to a single port. The IOCDs definitions could be:

```
RESOURCE PARTITION= ( (MVS1,1) , (MVS2,2) )
..
CHPID PATH= (04) , PARTITION= ( (MVS1) ) , TYPE=CNC, SWITCH=A1, SHARED
CHPID PATH= (05) , PARTITION= ( (MVS2) ) , TYPE=CNC, SWITCH=A1, SHARED
CHPID PATH= (06) , PARTITION= ( (MVS1) ) , TYPE=CNC, SWITCH=A1, SHARED
..
CNTLUNIT CUNUMBR=0001, PATH=04, UNITADD= ( (01,1) ) , UNIT=3174, CUADD=0,
LINK= (0F)
CNTLUNIT CUNUMBR=0002, PATH=05, UNITADD= ( (01,2) ) , UNIT=3274, CUADD=2
LINK= (0F)
CNTLUNIT CUNUMBR=0003, PATH=06, UNITADD= ( (00,1) ) , UNIT=3274, CUADD=1
LINK= (0F)
CNTLUNIT CUNUMBR=0004, PATH=06, UNITADD= ( (01,1) ) , UNIT=3274, CUADD=3
LINK= (0F)
..
IODEVICE CUNUMBR=0001, ADDRESS= (700,1) , UNIT=3270,
UNITADD=01, PARTITION= (MVS1)
IODEVICE CUNUMBR=0002, ADDRESS= (700,2) , UNIT=3270,
UNITADD=01, PARTITION= (MVS2)
IODEVICE CUNUMBR=0003, ADDRESS= (710,1) , UNIT=3270,
UNITADD=00, PARTITION= (MVS1)
IODEVICE CUNUMBR=0004, ADDRESS= (720,1) , UNIT=3270,
UNITADD=01, PARTITION= (MVS1)
..
```

LPAR 1 can access the 2074 through two CHPIDs, 04 and 06. However, each session for LPAR 1 is defined to one or the other of these CHPIDs. There is no way for a second CHPID to act as an alternate path to a single device defined in the 2074.²¹

A second 2074 ESCON channel, added to this example, would require another set of session definitions. At this level, a 2074 with two ESCON channel adapters can be treated as two 2074s, each with a single channel adapter. (Well, not quite; the same LAN IP addresses are used to access the box with two ESCON channel adapters, but the sessions associated with each channel adapter have their own IP port address.)

3.5 Highly redundant 2074 configuration

The configuration in Figure 11 on page 22 is probably excessively redundant, but it illustrates principles of multiple 2074 usage. In this case, we have two 2074s, each with two channel adapters, connected through two ESCON Directors, to multiple CHPIDs (which might be shared) connected to an MVS image. Each 2074 is connected to two LANs. This situation would have multiple workstations

²¹ Again, we stress that you are very unlikely to define a system like the one shown. However, it illustrates the basic definitions involved in using an ESCON Director with a 2074.

connected to the LAN, but we show only one in the figure. The workstation has four 3270 sessions, each an MVS console for MVS1, and each session connected through a slightly different path.

Why four 3270 sessions? This is the maximum that can be completely displayed at once and remain reasonably readable on, say, a 19- or 21-inch display. A workstation using PCOM can have up to 26 sessions, but this is useful only in special cases. Why two LANs? A given installation will probably use either token ring or Ethernet, but not both. A 2074 has two adapters of each type.

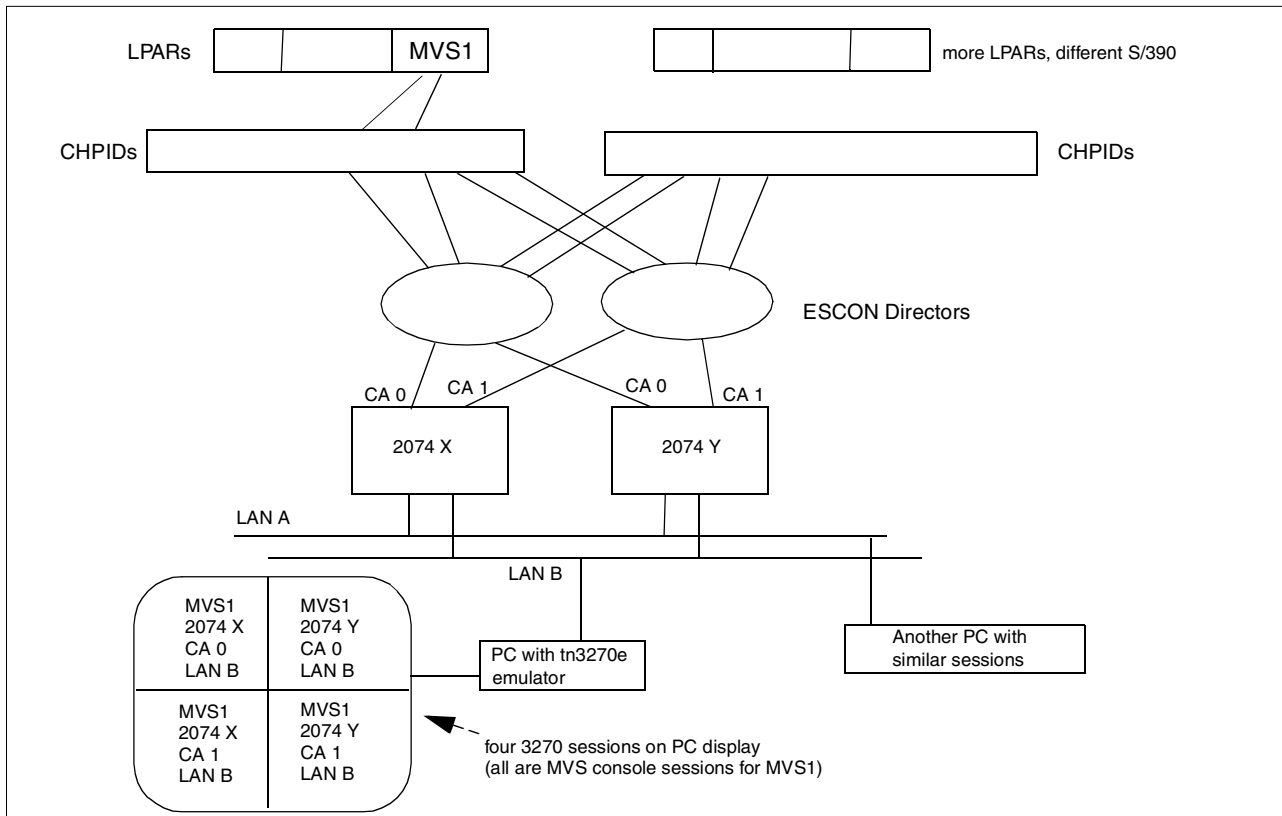


Figure 11. Redundant MVS console connections

OS/390 has a degree of automatic switching for consoles, using definitions in PARMLIB. This console switching, if defined, would be used automatically in the configuration shown. No other automatic switching is available for 2074 operation. If, for example, one of the LANs fails, then two of the MVS console sessions on the workstation would fail (but the other two would continue running).

One alternative is to have a workstation with an MVS console session from four different MVS images, with another (or several) workstations also having MVS console sessions for the same MVS images, but through different LAN, 2074, and channel connections. A failure would leave at least one MVS console session for each MVS image.

Designing a 2074 implementation for a complex group of systems requires considerable thought. The number of display stations can probably be reduced (from the number necessary with 3174 control units for each MVS image), but the reduction is limited by the need for redundant consoles for each MVS image.

3.6 Two 2074 channel adapters

We have not shown detailed examples of a 2074 with two channel adapters. From the S/390 viewpoint, we can regard such a unit as two 2074s, each with a single channel adapter. There is a separate set of configuration panels associated with each channel adapter, and the sessions defined for one adapter are completely independent of the sessions defined for the other adapter.

The only overlap is that the LAN adapters are shared by the functions for both channel adapters. A common set of IP addresses (one for each LAN interface that is used) are used by both adapters. A tn3270e client selects which channel adapter he wants to use by selecting the TCP/IP port number associated with that channel adapter. TCP/IP port 3270 is the default address for channel adapter 0, and 3271 is the default for channel adapter 1.

3.7 Extended examples

The following three examples illustrate more extreme configurations for the 2074 and illustrate the flexibility of the 2074. Only the 2074 Device Configuration data is shown. These examples are a bit simplistic, but they illustrate several points.

3.7.1 One session per LPAR, on same host

In this example, a single host has fifteen LPARs and one 2074 session is connected to each LPAR. A client session could select a target LPAR by using the appropriate LUname. The single session to each LPAR might be for an MCS console or a VTAM terminal.

Index	Device	LPAR#	Port	CU	UA	Mgr	Parameters
01	3270	1	11	0	00	2	/R=TL1
02	3270	2	11	0	00	2	/R=TL2
03	3270	3	11	0	00	2	/R=TL3
04	3270	4	11	0	00	2	/R=TL4
05	3270	5	11	0	00	2	/R=TL5
06	3270	6	11	0	00	2	/R=TL6
07	3270	7	11	0	00	2	/R=TL7
08	3270	8	11	0	00	2	/R=TL8
09	3270	9	11	0	00	2	/R=TL9
0A	3270	A	11	0	00	2	/R=TLA
0B	3270	B	11	0	00	2	/R=TLB
0C	3270	C	11	0	00	2	/R=TLC
0D	3270	D	11	0	00	2	/R=TLD
0E	3270	E	11	0	00	2	/R=TLE
0F	3270	F	11	0	00	2	/R=TLF

3.7.2 One session per host, all using LPAR 1

In this example we have fifteen host machines connected to the same ESCON director. Each host is using LPAR 1 (or it could be in basic mode if we specified LPAR 0 for each line). The single session to each host might be an MCS console or a VTAM terminal, and might differ between hosts.

Index	Device	LPAR#	Port	CU	UA	Mgr	Parameters
01	3270	1	11	0	00	2	/R=TL1
02	3270	1	12	0	00	2	/R=TL2
03	3270	1	13	0	00	2	/R=TL3

04	3270	1	14	0 00	2	/R=TL4
05	3270	1	15	0 00	2	/R=TL5
06	3270	1	16	0 00	2	/R=TL6
07	3270	1	17	0 00	2	/R=TL7
08	3270	1	18	0 00	2	/R=TL8
09	3270	1	19	0 00	2	/R=TL9
0A	3270	1	1A	0 00	2	/R=TLA
0B	3270	1	1B	0 00	2	/R=TLB
0C	3270	1	1C	0 00	2	/R=TLC
0D	3270	1	1D	0 00	2	/R=TLD
0E	3270	1	1E	0 00	2	/R=TLE
0F	3270	1	1F	0 00	2	/R=TLF

3.7.3 Many sessions, same LPAR, same host

In this example we have a single host (using LPAR 1) and fifteen sessions connected to that LPAR. The sessions might be a mixture of MCS consoles and VTAM terminals.

Index	Device	LPAR#	Port	CU UA	Mgr	Parameters
01	3270	1	11	0 00	2	/R=TL1
02	3270	1	11	0 01	2	/R=TL2
03	3270	1	11	0 02	2	/R=TL3
04	3270	1	11	0 03	2	/R=TL4
05	3270	1	11	0 04	2	/R=TL5
06	3270	1	11	0 05	2	/R=TL6
07	3270	1	11	0 06	2	/R=TL7
08	3270	1	11	0 07	2	/R=TL8
09	3270	1	11	0 08	2	/R=TL9
0A	3270	1	11	0 09	2	/R=TLA
0B	3270	1	11	0 0A	2	/R=TLB
0C	3270	1	11	0 0B	2	/R=TLC
0D	3270	1	11	0 0C	2	/R=TLD
0E	3270	1	11	0 0D	2	/R=TLE
0F	3270	1	11	0 0E	2	/R=TLF

3.8 Multiple paths not supported

The 2074 does not support multiple paths to a given device (session). For example, both of the following combinations are *invalid* for a 2074:

```
CNTLUNIT CUNUMBR=070, PATH=(04,05,06), CUADD=0, UNITADD=((60,16)), X
LINK=(F2,F2,F2), UNIT=3174
IODEVICE ADDRESS=(700,16), CUNUMBR=070, UNIT=3270, UNITADD=60, MODEL=X
```

```
CNTLUNIT CUNUMBR=0160, PATH=F8, UNIT=3174, UNITADD=((00,16)), LINK=B8, CUADD=0
CNTLUNIT CUNUMBR=0161, PATH=FC, UNIT=3174, UNITADD=((00,16)), LINK=B8, CUADD=1
IODEVICE ADDRESS=(0160,16), CUNUMBR=(0160,0161), UNIT=3270, UNITADD=0, MODEL=X
```

No automatic checking (in HCD, standalone IOCDS *build*, or the 2074) will detect this type of error. An invalid specification that produces multipathing can result in errors that are difficult to diagnose.

Chapter 4. Operational details

A number of initial design topics and day-to-day usage considerations are involved with 2074 operation. This chapter discusses several of these areas, in an arbitrary order.

4.1 Changing a DEVMAP

You can change any of the DEVMAPs in the 2074 at any time, using the customization panels described in Chapter 2, “IBM 2074 customization panels” on page 7. Changes are not effective until you IML the 2074 channel adapter associated with the changed DEVMAP. To IML, you need to:

- Click the **End Adapter n** option in the 2074 control window (on the OS/2 desktop). This stops current operations for that channel adapter, and any current 3270 sessions for that channel are lost.
- If necessary, select another DEVMAP to be activated at the next IML.
- Click the **IML Adapter n** option in the 2074 control window.

The two channel adapters, and their associated DEVMAPs, can be activated and managed independently of each other (except for OS/2 TCP/IP definitions that are common to all LAN adapters).

4.2 Unusual OS/2 functions

If you open an OS/2 command window on your 2074, you will find the OS/2 prompt is unusual. It might look like this:

```
(4000) [C:\]
```

The 4000 (or whatever number) is the return code from the last command completed in this window. This is useful in the case of well-behaved programs that produce defined return codes. However, not all programs set return codes, so this field may display meaningless numbers in some cases. The rest of the prompt indicates the current drive and directory.

In some cases a low-level program failure can cause an OS/2 *trap dump* (128 MB) to be written on drive partition D. This will overwrite any existing files and directories. A 2074 program checks for the existence of a dump on D during OS/2 startup. If one is found, it is copied to drive partition E (without overwriting other files), provided a previous dump does not already exist on drive E. If one exists, the new dump on D is ignored. After copying it to E, the dump is deleted and the SWAPPER file for OS/2 will return to its full size (512 MB) after the next restart of OS/2. (If an OS/2 trapdump dump is taken, it overwrites the existing SWAPPER file on D.)

The SWAPPER file (512 MB) is not used during normal 2074 operation. It largely functions as a placeholder on the D drive. Dump management between the D and E drives is intended to be automatic. The 2074 owner should not need to delete dump files.

4.3 Stopping the 2074

The 2074 uses OS/2 as its internal operating system. In general, you should stop OS/2 properly, by using the shutdown icon on the OS/2 toolbar. (The toolbar has very small icons; you can move the mouse pointer over these to obtain a text label for each one.) A proper shutdown eliminates any need to run chkdsk the next time OS/2 starts. (OS/2 will run chkdsk automatically, if needed.)

In typical production use, a 2074 will seldom be shut down, except for planned software maintenance or planned reconfiguration activities. Unplanned shutdowns will probably be due to power failures, and the resulting chkdsk runs (when power returns) will add a few minutes to the 2074 startup time.

4.4 Lights and Indicators

The 2074 has more lights and indicators than most current equipment, although you need to open the unit to see many of them. One of the internal indicators is unusual.

The front panel contains a power on/off button, a reset button (which causes OS/2 to reboot), a power indicator LED, and these indicator LEDs:

- SCSI Activity
- Ethernet Tx/Rx Activity (for the integrated Ethernet adapter)
- Ethernet Link Status
- System Information (ON indicates a failed power supply)
- System Error (ON indicates that one or more of the internal error LEDs is on)

The rear panel contains indicator lights on the two token ring adapters, the Ethernet adapter card, and the ESCON adapter cards.

Internally, the ESCON adapter cards contain a small five-character display that constantly scrolls adapter information. Our adapter displayed the following:

```
Heap avl 94%.  
4 conn open  
channel online  
mem avail 99%  
FW version AP9 v2.573
```

Some of the meanings are obvious; we had 4 sessions defined at the time, and the 2074 ESCON channel was online to our Multiprise 3000. There is no documentation for the other information. This display is intended only for debugging purposes, but it is interesting.

Also internally, there is a strip of small LED indications near the power supplies. These indicate:

- Power supply 1 failure
- Power supply 2 failure
- Excessive (over specification) current from power supplies
- Non-maskable interrupt occurred
- Excessive temperature
- Fan failure

- Memory (DIMM) failure
- CPU failure (Netfinity can have two processors; a 2074 has only one)
- Error on primary PCI channel or the system board
- Error on secondary PCI channel or the system board
- A voltage regulator (VRM) failure (also individual LEDs on VRMs)
- Hot swap HDD planar board 1 failure
- Hot swap HDD planar board 2 failure
- Service processor failure (not used by 2074)

In addition to this strip of error LEDs, there are several more LEDs scattered over the system board. These include CPU failed (2), service processor error (1), and VRM failed (3) indicators.

4.5 ESCON firmware levels

The ESCON adapter contains its own software (“firmware”), and updates for this are to be expected. OS/2 can automatically run specified programs as part of its startup process. One of the programs run on the 2074 causes the ESCON adapters to be *flushed* to the firmware level contained in an application file on OS/2. Thus software maintenance for the 2074 can consist solely of updates to OS/2 files. Updating the correct file will cause new firmware to be loaded in the ESCON adapters the next time the system is restarted.

4.6 PCOM key definitions

There is one default PCOM session defined for the 2074 when the initial software is installed. There is a desktop icon for this session. Double-clicking the icon will start the session; double-clicking it again will start another session, and so forth.

The default session has the large typewriter Enter key and the right-hand *Ctrl* key both defined as the 3270 Enter function. This may not be what you want. Experienced ISPF users, in particular, expect the large Enter key to function as a 3270 New Line function. You can easily redefine the meaning of keys, using the *Assist* option in the PCOM toolbar, and then using the Keyboard Setup option.

You may also want to change the square brackets on the keyboard so they are defined as *apl ad* and *apl bd* (for the left and right brackets, respectively). These definitions will produce square brackets that function as expected under OS/390 UNIX System Services.

4.7 2074 operator functions

While in routine use, there are no 2074 operator functions. The 2074 keyboard (and integrated mouse) must remain connected, but the display can be turned off. Operator (or administrator) actions are needed to customize the 2074, and to take traces or dumps in the case of problems. Otherwise, the 2074 will IML itself when power is turned on, and no specific operator actions are needed.

When first installed, we expect you will probably experiment with 2074 customization and will probably check the display for error messages during the first few weeks of operation.

4.8 MVS operator commands

From the viewpoint of OS/390, the 2074 appears as one or more 3174 control units. All the normal device commands may apply. Particular commands that may be useful when first experimenting with the 2074 include:

```
d m=chp(04)                (assuming you are using CHPID 04)
cf chp(04),online
cf chp(04),offline
v path(701,04),online      (assuming your 3270 address is 701)
d net,majnodes             (find your VTAM major node names)
v net,act,id=nsna70x       (activate a major node)
v net,inact,id=nsan70x
v 701,online               (assuming the addresses shown)
v 700,console              (assuming 700 is defined as a console)
d u,,,700,4
d consoles
v xxx,mstcons              (change the master console)
```

4.9 Client connection id

When a tn3270e client (internal in the 2074, or external on one of the 2074 LANs) connects to the 2074, a *connection id* display similar to the following is sent to the client 3270 session:

```
** 2074 Index 01 connected to SYS1 via IP Address 127.0.0.1:3270 **
** CA=0 Index=01 LPAR=0 Port=01 CU=0 UA=70 LUName=MVS1 **
** Type=007490 Model=001 Mfg=IBM SN=000000000001 Tag=0F0 Status=Active **
```

Line 1 contains IP connection information:

- The index number from the DEVMAP (01).
- The 2074 Unit name from the Name and Description panel (SYS1) (see Figure 7 on page 12).
- The target IP address and port number (127.0.0.1:3270). This is an IP address set in the LAN Environment panel (Figure 8 on page 13) and the port number set in the Start Device Manager panel (Figure 6 on page 12). IP address 127.0.0.1 is a special case and is automatically used by the AWS3274 device manager for sessions on the 2074 display.

Line 2 contains DEVMAP-related information:

- The ESCON Channel Adapter number (0) corresponding to this DEVMAP.
- The index number from the DEVMAP (01).
- The target LPAR number (0) from the DEVMAP. (The value 0 implies a basic mode system, without LPARs.)
- The ESCON director port number connected to a CHPID on the target LPAR and S/390 (01). The value 01 means that an ESCON director is not used.
- The control unit address being emulated by this session.
- The unit address being emulated by this session.
- The LU name required for connection to this session. (Asterisks in this field mean that an LU name is not used.)

Line 3 contains data retrieved from the “other end” of the 2074’s ESCON connection; that is, from an ESCON director or from a S/390 CHPID. (The values in the example correspond to a P/390 ESCON channel adapter.) If the connection is to an ESCON director, the Tag value is the ESCON port number

directly connected to the 2074. This line may also contain a LINK or PORT keyword and value.

4.10 Client connection status

The status of a connection from a tn3270e client to the 2074 may not always be obvious. “Real” 3270 displays²² include a connection status line at the bottom of the screen. Most emulators have similar indicators. The examples used in Figure 12 are from the PCOM emulator that is included with the 2074.

In these status indicators, the large M is a constant. The smaller underlined A indicates a certain type of terminal protocol (which is constant). Following these is a rectangle (“block”) that can be a solid color, empty, or empty with a character in it. Next is a letter indicating the session number (“a” in these examples). After this may appear a broken line to indicate “no communication” and an error number.

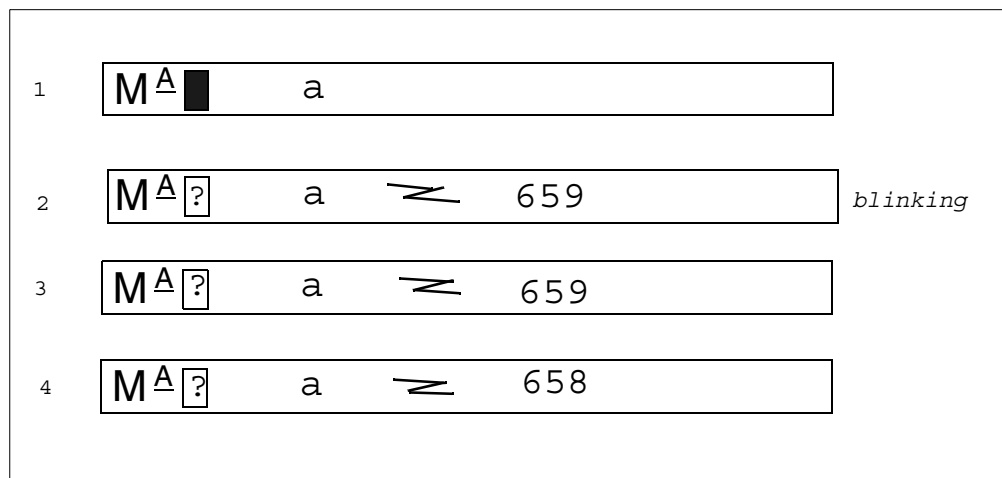


Figure 12. 3270 Emulator status indicators

Four examples of status lines are shown in the figure²³. These correspond to the following situations:

1. The tn3270e emulator session is properly connected to the 2074. See additional comments below about the display state, given this status indication.
2. If this status message is *blinking*, it indicates that an incorrect LUname (not matching any entry in the DEVMAP) was used for the emulator session.
3. If this status message is *not blinking*, it indicates that the tn3270e emulator disconnected its communication. (With PCOM, you need to use the Communications option in the toolbar to reconnect.)
4. This status indicates that an invalid TCP/IP port number was used, or the 2074 is not IMLed, or the device manager (AWS3274 or LAN3274) is not running. (The default is port 3270 or 3271.)

²² In this case, we are using IBM 3279 displays as the prototypical units.

²³ There are many more 3270 status indications than shown here. The four shown here are particularly relevant for 2074 operation. The exact interpretation of these indicators, explained in this section, is unique to the 2074. Do not attempt to use exactly the same diagnostic explanations with other tn3270e servers (including AWS3274 and LAN3274 device managers on other platforms).

If correct communication exists with the 2074 (corresponding to the first case in Figure 12), the emulated 3270 might display one of the following:

1. The 2074 status lines.
2. An operating system or application banner, such as a VTAM logo screen.
3. Nothing.

The 2074 status lines are displayed when a 3270 emulator session correctly connects to a 2074. The 2074 status lines remain on the emulator screen until the host system issues its first *write* to the 3270 device. There are three primary states indicated by the 2074 status messages, and these are shown in Figure 13. These message sets will change (on the 3270 display) when the ESCON connection status changes.

```
** 2074 Index 01 connected to SYS1 via IP Address 127.0.0.1:3270 **
** CA=0 Index=01 LPAR=0 Port=01 CU=0 UA=70 LUName=MVS1 **
** -- No ESCON Connection Detected -- **

** 2074 Index 01 connected to SYS1 via IP Address 127.0.0.1:3270 **
** CA=0 Index=01 LPAR=0 Port=01 CU=0 UA=70 LUName=MVS1 **
** Type=007490 Model=001 Mfg=IBM SN=000000000001 Tag=0F0 Status=Active **

** 2074 Index 01 connected to SYS1 via IP Address 127.0.0.1:3270 **
** CA=0 Index=01 LPAR=0 Port=01 CU=0 UA=70 LUName=MVS1 **
** Type=007490 Model=001 Mfg=IBM SN=000000000001 Tag=0F0 Status=InActive**
```

Figure 13. 2074 status messages

In Figure 13:

1. The first message set indicates that no ESCON connection has ever existed (since IMLing the 2074 channel).
2. The second message set indicates a normal ESCON connection to the host. The fact that this message set can be seen (on the 3270 session) indicates that the host has not written anything to the 3270.
3. The third message set indicates that a normal ESCON connection existed, but was dropped. (Note the word *InActive* at the end of the third line of the message set.)

If a correct 3270 connection exists and the 3270 screen is blank, this probably means that the host is intentionally ignoring the unit and has possibly sent commands to clear the screen (and thus erased the 2074 status messages).

If the device number (“address”) corresponding to the 3270 session is managed by VTAM, then VTAM will detect a new connection and write its logo screen.

If a client session specifies a correct IP address and port number, with an LUNAME that is known in the DEVMAP but is not correct for this user’s purposes, the results are somewhat unpredictable, depending on what system and service the specified LUNAME implies. For example, the user might receive a VTAM logo screen when he was expecting an MCS console connection.

A terminal intended solely for MCS usage is a special case. MCS does not automatically detect the activation²⁴ of a terminal and will ignore it until an operator issues a `VARY xxx, CONSOLE` command (from another MCS console). In the meantime, the terminal session will display the 2074 status lines or a blank screen.

4.11 Using HCD to define 2074 devices

For a basic mode S/390, no changes to existing definitions (for 3174-connected devices) is required. For an LPAR-mode definition where a given 2074 channel is not shared among LPARs²⁵, no HCD changes should be necessary.

If the local 3270 devices for a given 2074 channel will be shared among several LPARs, then some IOCDs changes are necessary. In most cases, users create their IOCDs through HCD, and this means HCD changes for the existing system definitions are required.

One method to do this is:

- Specify the `PATH (CHPID)` to the 2074 as `SHARED`, and specify the appropriate partition names.
- For each `IODEVICE` (for each 3270/3287, or range of these), define a `PARTITION` name. This is done by using the `Candidate List = YES` option in the appropriate HCD frame, and specifying the appropriate LPAR name (a single name!) in the candidate list.

This corresponds to Chapter 3.3.2, “Second method” on page 18.

4.12 MVS console definitions

This is a moderately complex topic that must be understood in order to create an optimum 2074 implementation (assuming that the primary purpose of the 2074 is to provide MVS consoles). The definitive definitions for this area are in the various standard MVS manuals; this section of this redbook is intended as a brief terminology review.

4.12.1 Terminology

The terms *MVS console*, *master console*, *MVS master console*, *MVS operator console*, *MCS console*, and *operator console* are often used interchangeably. This is not quite correct. For example, the *master console* is typically the first full-function console, defined in the relevant `PARMLIB CONSOLxx` member, that is operational during system startup (after NIP completes). For the purposes of this document, we can ignore this distinction and treat all these terms as synonyms.

The term *system console* is also sometimes used as another synonym. This is not correct, although the intended meaning is usually clear. The *system console* is the limited-function Operating System console that is provided by the Support Element on current models of S/390. Somewhat older S/390 (and S/370) machines used the name *system console* for the display function where IPL

²⁴ MCS automatically detects its terminals only at IPL time.

²⁵ That is, for a one-to-one replacement of a 3174, except that a 2074 can replace two 3174s (in this style) by using the two 2074 channels.

addresses and the like were set. In yet older systems, *system console* could be a synonym for the primary operating system console. With current S/390 machines, the system console function is often remoted to a Hardware Management Console.

In the following text, *system console* can mean either a Support Element function or a Hardware Management Console function. The system console function cannot be extended to 2074-attached devices.

MVS consoles (including the master console) are defined by a member in PARMLIB. This member can define up to 99 consoles. Each one can point to an alternate console (which must be one of the defined consoles) that will automatically receive messages if the original console fails. This alternate console can also specify an alternate, and so forth. This is sometimes known as the *console chain*, although automatic progression through a console chain is no longer supported.²⁶ Limited-function devices, such as printers, can also be MVS consoles, but we ignore these here.

Instead of defining alternate consoles, you should define console groups by using the CNGRPxx member in PARMLIB. All the consoles in a group are alternates for each other. This is a much more general method than defining an alternate for each console and is the preferred method.²⁷

All the full-function display MVS consoles (defined in PARMLIB) must be local, non-SNA 3270 terminals.²⁸ They are reserved for use by the MVS multiple console support function; they should not be defined to VTAM, for example.²⁹ An installation might have six MVS consoles: the first near the system, two in a printer area, two in a networking/OLTP control area, and one in a schedulers' area. All six might be in the same console group; if one fails, its output will be routed to another console in the group.³⁰ None of the six are defined to VTAM and they cannot be used as TSO or CICS terminals. Likewise, a terminal normally used by TSO (and thus defined to VTAM) cannot be used directly³¹ as an MVS console without removing it from the VTAM definition, adding it to the CONSOLxx member in PARMLIB, and re-IPLing.

The master console is the first to be activated, has no security, and has full authority. Other MVS consoles may also have full authority, or might be restricted to a subset of this authority. Once the system is running, there is no practical difference between the MVS master console and other full-authority MVS consoles.

The term *MCS console* refers to Multiple Console Support, which was a major function when it was added to the operating system many years ago. Before MCS, the operating system had only one console. Once the system is running, all the MVS consoles are MCS consoles. Currently, a system can have up to 99

²⁶ That is, if a console fails and MVS tries to use the alternate, and if the alternate is not available, MVS will no longer then attempt to use the alternate's alternate console. It will no longer "run the chain" looking for an operational console.

²⁷ The ALTERNATE keyword is still supported for console definitions (in the CONSOLxx member), but the IBM developers for this area have clearly stated that their direction is to use alternate console groups (ALTGRP keyword) instead.

²⁸ Since we are interested only in "normal" 3270 terminals for the 2074, we will ignore the more specialized devices that can be used as MVS consoles.

²⁹ There are exceptions to this. If the console is offline during IPL, it will not be reserved as an MVS console even though it is defined in CONSOLxx. It could be defined to VTAM and, if later brought online, used as a TSO terminal. This is not a recommended setup, but has been found, for example, in AD CD-ROM releases.

³⁰ This implies that all the consoles in the group may see the messages routed to a failing console. If you actively use routing codes to segregate messages, you would need several console groups defined.

³¹ This ignores the TSO/E extended MCS console function, which is not quite relevant to this discussion.

MCS consoles, all of which must be local, channel-attached, non-SNA devices defined in the CONSOLxx member of PARMLIB.

There is yet another MVS console, used for a short period during initial startup. This is the *NIP console*, named for the Nucleus Initialization Program. Only one NIP console is used, and it is assigned through HCD and not through PARMLIB. With HCD, it is possible to assign alternate NIP consoles; the first working console in the definition list is used. In practice, the NIP console is almost always defined as the same device that will be the MVS master console (that is, the first display console in the PARMLIB member). The first few messages during IPL are sent to the NIP console.³² Once the MCS function starts, the NIP console function is not used. In practice (when the NIP console and the master console are the same device) you can see the display switch modes after the first few messages. Once MCS is active, all the other MVS consoles become active.

An *extended MCS console* is usually a TSO terminal (connected through VTAM) that is authorized to enter MVS commands and receive MVS messages. It can also be an authorized program that uses *extended MCS console APIs*. In our discussions of MVS consoles in this document, we are not addressing extended MCS consoles.

Other PARMLIB members that affect MVS consoles are PFKTABxx (which assigns default PFK meanings), and MPFLSTxx (which can suppress selected console messages). For the basic discussions in this document, we ignore these optional PARMLIB controls.

Parallel Sysplex consoles

A Parallel Sysplex environment changes the concepts described here slightly. There is a limit of 99 MCS consoles for the whole sysplex. The MCS consoles are part of the single system image of the sysplex, and all the members of the sysplex can be operated from all the systems' MCS consoles.

In normal operation, the consoles (and their control units) can be connected to a single member of the sysplex. However, for non-routine use (where a system is not participating in the sysplex), it would be necessary to have MCS consoles (and their control unit) connected directly to that system.

With appropriate planning, one or two 2074 units should be capable of handling the MCS console functions for many variations of systems normally used as a Parallel Sysplex, but sometimes used as isolated systems.

4.12.2 Recovery planning

If possible, you should plan your MCS consoles with these factors in mind:

- Use console group definitions, instead of alternate console definitions.
- A console group should contain consoles routed through two 2074 units, if possible. In this way there will be a smooth, automatic use of the surviving group members.
- A console group should contain consoles routed through two separate LANs, if possible.

³² Including the well-known "Specify System Parameters" message.

- A *console*, as used here, is a 3270 session. Several of these sessions may appear on the display of a single PC workstation. A console group should include sessions that utilize at least two separate workstations.

If possible, we suggest you perform drastic tests (such as disconnecting a LAN from a 2074, or forcing a 2074 to reboot, while a test system is operational) as part of your 2074 implementation. These tests are to verify that enough of your consoles remain in a usable state after various types of failures.

4.13 PCOM backup links

IBM eNetwork Personal Communications product (PCOM) can have backup links (alternate IP addresses) defined. If the primary IP address is not operational (that is, if no tn3270 or tn3270e server is detected), it will automatically try the backup link. This is yet another way to configure additional links. The switchover to the backup link is automatic within PCOM, but a tn3270e server (which, in this discussion, is the 2074) sees the new link as a different session. From the viewpoint of MCS or VTAM, a PCOM switch to a backup link address is the same as starting a new terminal session.

For the OS/2 version of PCOM, you must directly edit the WS file (where PCOM stores the customization information for a given session definition) to add the backup link information. Other versions of PCOM have fields for this data as part of their normal GUI configuration panels.

We have not provided examples of using the backup PCOM links. They would probably make sense only in an intricately planned implementation with multiple 2074s and well-configured MCS alternate console groups.

4.14 tn3270e client machines

A tn3270e emulator (that is, a *client* program) is normally considered a light load for a personal computer. A personal computer can typically handle several (or many) tn3270e (or tn3270) sessions.³³ This is the case for normal 3270 handling through VTAM, when used, for example, for TSO or CICS sessions. This normal usage provides half-duplex communication, driven by various 3270 keys that produce interrupts.

This is not the case for 3270 sessions used for MCS. These provide a more demanding load on the personal computer. This is due to the smooth, full-duplex function produced for MCS consoles. The underlying MCS programming can produce frequent screen updates or buffer reads (several times per second) that are not paced by operator keystrokes.

This should not be a significant problem for a single MCS session through a tn3270e emulator on a personal computer. However, it can become a problem if several MCS sessions are run on a personal computer that is not fast enough. If you expect to run more than one or two MCS sessions on a single personal computer, we suggest you use a relatively modern machine--for example, 600 Mhz or faster.³⁴ We were unable to obtain specific measurements (Mhz required per MCS session) during our early 2074 usage. We did have a problem when we

³³ An informal, unscientific survey indicated that the overhead of a 3270 emulator varies widely, depending on which emulator is used and what underlying PC operating system is used. The comments in this section assume typical PCs using PCOM (and not using OS/2).

³⁴ 600 Mhz probably overstates the requirement, but even inexpensive new PCs are at least this fast.

attempted to run multiple MCS sessions on an older PC running at less than 200 Mhz.

Other workloads on the PC can make the situation more complex. For example, a Web browser displaying video (“Web TV”) would probably be a bad companion on a PC with several 3270e emulator sessions used for MVS consoles. This is an extreme example, of course. We noticed problems with complex e-mail functions (part of an enterprise-level productivity package) on the same PC with several MCS consoles.

4.15 Security

We have mentioned security several times. Depending on how you connect your tn3270e client systems, you may or may not have security concerns. Security concerns and issues include the following points:

- Are your 2074s connected to secure, private LANs? That is, LANs that exist only in your controlled operations area. 3270 MCS consoles (with their coax connections to 3174 control units) are often connected this way, and it would not be unreasonable to limit 2074 LANs to the same areas. This is the best security situation, provided the PCs used as tn3270e clients do not have other TCP/IP interfaces.
- An alternative to physically-local LANs is the use of one or more Virtual Private Networks (VPNs). You need to ensure the correct setup of routing tables for the VPNs, but, in the best case with proper precautions, this should be acceptably secure.
- If VPNs are used, it might be advisable to preassign every defined connection (in the DEVMAP) with the IP address of the matching client. This adds an additional bit of security to the total environment. (You could do the same thing for local LANs, but it should not be needed if the local LANs are contained solely in your secure operational areas.)
- You may want to require operator logon (“RACF logon”) in order to use an MCS console. However, this may not be convenient or practical in many cases. Also, it does not apply to the NIP console or the initial master console.
- Personal computers used for tn3270e clients can produce unexpected exposures. If these PCs have other IP connections (to another LAN or by dial-up to an ISP), they can provide a back door to the LAN containing your MCS consoles. Enabling *IP forwarding* in the PC substantially increases the risk.³⁵ In our opinion, the use of a second IP interface, including a dial-up connection, should be prohibited for a PC providing MCS consoles for a production S/390.
- Are your 2074s connected to your enterprise LANs (including LANs “behind” firewalls and proxy servers)? This is substantially different than connecting your 2074s to LANs that are private to the S/390 operational areas. In the larger case, we suggest this is not an acceptable situation for several reasons:
 - Simple mistakes, or unusual timing circumstances, might allow a normal user (within your enterprise LAN) to connect as an MCS console.

³⁵ This may appear to be an unlikely problem, but Internet connections--even transient dial-in connections to an ISP--are frequently exposed to “probes” from unknown sources. The people behind the probes sometimes have sophisticated programming that explores the available functions on a probed machine. Many PC users are not aware of IP forwarding concepts, or internal routing tables, and have no idea how their PC is configured for these areas.

- Larger enterprises often have employees who enjoy “testing” security barriers. Their intentions may not be malevolent, but they may accidentally damage your system.
- It is more likely that *IP forwarding* holes exist in the larger enterprise network, and these could offer an attacker a path to your 2074 interfaces.

We are not suggesting that the 2074 is inherently a security problem. We do say that, *if you cable it in such a way that the potential connections are much wider than your previous MCS 3174 coax connections*, you should consider the security issues carefully.

Chapter 5. Installation, traces, maintenance

The 2074 is a IBM-installed, customer-customized product. IBM service personnel can assist with customization, but a service fee will be charged if this is requested.

All the internal software for the 2074 is supplied on a bootable CD-ROM. When booted, it provides two installation options:

- Full installation, in which all disk partitions are created, formatted, and loaded with files from the CD-ROM.
- Partial installation, in which only the C and D partitions are loaded from the CD-ROM.

The full installation partitions the 2074 disk as follows:

- Partition C: 1 GB (FAT), used for OS/2 and all 2074 programs.
- Partition D: 512 MB (FAT), for OS/2 trap dumps. An OS/2 SWAPPER file is allocated to fill this drive; this prevents any other routine OS/2 usage. A trap dump will overwrite this whole partition, including the SWAPPER file. A subsequent reboot (necessary after a trap dump) will manage the dump and another reboot will create the large SWAPPER file again.
- Partition E: 512 MB (FAT), used for DEVMAPs, a small amount of customer information (entered during initial installation), process dumps, and the first OS/2 trap dump.
- Drive F: the CD-ROM drive.
- Partition G: approximately 6.6 GB (JFS), unused.

These partition sizes and usage should be considered fixed. Automatic processes (during OS/2 startup, or in case of program errors) depend on this partition arrangement and usage.

One of the 2074 icons can be used to back up your customization data to diskette. In the unlikely event that OS/2 is destroyed, it can be reinstalled from the CD. The customization data can then be reloaded. The line command `CFGSR` can be used instead of the icon to create the diskette. The diskette contains your DEVMAPs, 3270 WS (session definition) files, and other customization data.

Warning! Never attempt to edit a DEVMAP file with an editor (or word processor). A DEVMAP is not a simple character file and an editor is likely to destroy it by adding CR and LF characters.

5.1 General installation overview

2074 control units will be used in complex S/390 installations. We cannot provide a step-by-step installation guide that will cover all circumstances. The general process will include the following steps:

- Plan the complete installation. Make drawings. Some of the figures in this document might provide starting points. At a minimum, you need to plan the following:

- LPAR numbers, CHPIDs, and ESCON director ports (host-side port numbers) to be used.
- Assign LU names for tn3270 connections. These do not correspond to any existing parameters, and can be created as part of the 2074 plan.
- Determine how many MCS (and TSO) terminals you want to provide through your 2074s for each LPAR, observing the limitation of 99 MCS terminals for each MVS. (Parallel Sysplex has a limitation of 99 for the total number of MCS consoles.)
- Plan control unit addresses and unit addresses, as might be used if multiple “real” 3174s were being used.
- Identify (or install) LAN components, including hubs, MAUs, routers, cables, and so forth.
- Plan and build new IOCDS, CONSOLxx, and IODF definitions.
- Install client PCs for your tn3270 sessions. The choice of operating system and other software is up to you.
- Install PCOM (or another tn3270e emulator) on each client and define several 3270 sessions. Include the appropriate LU name (from your overall 2074 installation plan) for each session.
- Obtain (or create) IP addresses. Four different addresses (on four different subnets) are needed if all LAN adapters are used. Use these to customize the LAN panel in the 2074.
- Assign IP port addresses for each ESCON adapter in the 2074. If you have no specific requirements, we suggest you use the default port numbers of 3270 and 3271.
- Create a unit name and description associated with each ESCON adapter (and each DEVMAP that you will use) in the 2074. These do not correspond to any existing parameters.
- Begin defining devices in the primary 2074 configuration panel. We suggest defining a few and testing them before attempting to define a large configuration.

5.2 Maintenance

IBM service personnel will install fixes for 2074 software. These will be installed, as required, to address problems. There will be few, if any, general updates distributed to all 2074 owners.

Fixes (for 2074-unique software, not for OS/2) will be posted on the Web site: <ftp://p390.ibm.com> or <ftp://s390is.pok.ibm.com>. Such postings are intended for IBM service personnel. General instructions for installing these patches (intended for IBM service personnel) are given in the document *2074 Console Support Controller Installation and Maintenance Information*, G229-9028. The 2074PAT program, included with the system, is used to install software patches.

The 2074 does not have a *call home* function. Initial problem diagnosis is a customer responsibility. For example: are any error lights on? It may be necessary to open the cover to check these. We strongly suggest that you obtain (or print from a Web site) the maintenance document just mentioned.

You can run a program to verify that the ESCON adapter(s) and LAN adapters are installed in the correct slots and connected to the correct IRQs. This is the CHECKPCI program, which can be run from an OS/2 command line. If this program finds exceptions, it will display appropriate messages. The 2074 will then attempt to continue operation with the current configuration. The most likely cause of exceptions would be the replacement of a LAN adapter with another adapter that does not return identical information in response to sense commands.³⁶ The displayed messages list the expected sense identification data and the actual sense identification data.

Adapters in the 2074 are required to be in fixed slot positions:

- Slot 1 - first ESCON adapter
- Slot 2 - second ESCON adapter (if present)
- Slot 3 - Ethernet adapter (second Ethernet; first is on the planar board)
- Slot 4 - Token Ring adapter (first token ring LAN)
- Slot 5 - Token Ring Adapter (second token ring LAN)

The CD-ROM containing the 2074 software also has a number of diskette images that contain various diagnostic programs for 2074 components. The instructions for retrieving these diagnostics are in the *Installation and Maintenance Information* document.

5.3 Traces and dumps

The trace function and the dump functions available in the 2074 windows (on the OS/2 desktop) are for use only when requested by IBM service personnel. They produce OS/2 file(s) that are sent to IBM for problem diagnosis. The trace and dump internal formats are not documented and are subject to change.

No user-oriented trace facilities are available.

Certain types of failures may produce large dump files (up to 128 MB) on the D and E drive partitions. These are automatically managed such that they will not grow and fill the disk. Do not attempt to send these to IBM without specific instructions.

Specific dump, trace, and error locations include the following:

- The E:\SADUMP\ directory is for long-term storage of an OS/2 trap dump. The dump is first captured on the D drive and then moved to this directory. There is normally never more than one dump in this directory. If you are having 2074 problems, IBM service may need this dump (if it exists) for problem resolution. If you notice a dump in this directory and you are not having 2074 problems, you can delete it.
- The E:\PDUMP\ directory contains process dumps. There may be a number of these. 128 MB is reserved on the E drive for a copy of a trap dump file; the remainder of the E drive can be filled by process dumps. IBM may need these for diagnostic purposes. If you are not having 2074 problems, you can delete these.
- The C:\2074\SNAPDUMP\ directory contains dumps created by using the **snappedump** icon. You can delete these if you do not require them.

³⁶ An updated version of the CHECKPCI program might be available (from the ftp site) to support newer adapter cards.

- The C:\BTI\ directory contains traces from the ESCON adapters. One trace file is written every time an ESCON adapter is initialized. The files are named DUMP.MEM, DUMP01.MEM, ..., DUMP99.MEM. Each file is about 640 K bytes. Once DUMP99.MEM is reached, the older files are overwritten starting with DUMP.MEM. These files may be needed by IBM for diagnostic purposes. You can delete them if you are not having 2074 problems.

If two ESCON adapters are installed, the file names are in the form DUMP001 (first adapter) and DUMP101 (second adapter).³⁷

- The C:\2074\AWSERROR.LOG file is a cumulative log of error messages from many of the unique (non-OS/2) 2074 modules. This file is never automatically trimmed, and, in principle, could become large. This is unlikely to happen, but you can trim or delete the file if necessary. (A new one will be started when the next AWS error message occurs.)
- The C:\2074\INSTALL.LOG is a cumulative log of 2074 installation activity. In the unlikely event it becomes too large, you can trim or delete it.
- The C:\OS2POPOP.LOG file is a cumulative log of various OS/2 pop-up messages. In the unlikely event it becomes too large, you can trim or delete it.
- The C:\IBMCOM\LANTRAN.LOG file contains messages from the most recent startup of the LAN adapters. It is not cumulative, and is created (or overwritten) each time the system is started. This file is one of the key resources for investigating LAN connectivity problems.

The LAN3274.DOC file (an OS/2 file installed on the 2074) contains more information about additional trace functions. In general, these additional functions are intended for use only when working with IBM support services.

³⁷ The production models of the 2074 may save fewer than 100 trace files (per adapter). Also, the naming convention may be slightly different than what is described here.

Chapter 6. Ordering selections

You have several configuration options when ordering a 2074 unit. The key choices are these:

- Do you want the second ESCON adapter?
- Do you want a display and keyboard? These are ordered as a single package.
 - If so, do you want a Northern or Southern Hemisphere display unit?

2074 units can be connected to a *switch* that permits up to eight 2074 units to be switched to a single display/keyboard/mouse combination. Such switches are commonly used to switch a display/keyboard/mouse among a number of PC servers.

The only switch that has been tested with the 2074 is part of the IBM NetFinity product line, and is:

P/N 94G7445	Console Server Selector Switch
P/N 94G7447	Cable set (order one set per 2074)

This switch is not part of the 2074 product and, if wanted, it must be ordered separately. This unit connects up to eight 2074s to a single display and keyboard mouse set. Special key combinations (on the keyboard) are used to switch between connected 2074s. It uses a standard PC power cord, and is listed for 100-120 and 200-240 volt service. The cable sets appear to be about twelve feet long, and have the display, keyboard, and mouse cables molded together in a convenient form.³⁸

Note that IBM has not tested (and does not formally support) mixed use of the switch, with both PCs and 2074 units attached to it. Likewise, IBM has not tested other, similar PC switches used to connect a number of PCs to a smaller number of display/keyboard/mouse elements.

The 2074 is rack-mounted, but no rack is included with the unit. Most S/390 installations have space available in existing IBM racks. If this is not the case, you can order the following IBM components:

P/N 9306200	Netbay22 Rack (9306-220)
P/N 36L9702	Rack extension (required; for deep components)
P/N 94G6666	115 volt internal power distribution unit (2 required), or
P/N 94G7450	240 volt internal power distribution unit (2 required)
P/N 94G6670	Blank filler plates

This is a half-high rack (“22U” height) that could be used for up to seven 2074 control units. These rack components are not part of your 2074 order; they are ordered separately. You need one filler plate for every 2074 that is not installed in the rack.

³⁸ With eight 2074s connected, plus the local display, keyboard, and mouse, the cable connection area of the switch can become very congested. We suggest using the cable sets listed here; they are molded in a form that minimizes the cable congestion.

Chapter 7. Common questions

Q: Why do all your examples show IOCDS source statements? We use HCD to create our production IOCDS files.

A: HCD is an interactive utility and it is difficult to succinctly illustrate HCD I/O definitions in a document when a number of different HCD panels are involved in producing the definitions. An IOCDS listing provides a more compact illustration. Also, installations might elect to install 2074s by direct IOCDS source changes--in some cases this is easier than changing multiple HCD/IODF definitions for multiple LPARs.

Q: Can I apply P/390 (or Multiprise 3000) emulated I/O updates to the 2074? It appears they use the same OS/2-based device managers.

A: No. There are internal design and coding differences between the various systems that use Emulated I/O and the modules are not interchangeable.

Q: Does the 2074 have more LAN bandwidth than the emulated I/O for the Multiprise 3000 (or for a P/390)?

A: Probably. Bandwidth depends on a complex interaction of CCW processing and buffer handling. These are both performed by programs running under OS/2. The faster PC processor in the 2074 should give it an edge over the other platforms. We made no effort to measure any differences.

Q: Can I use both Emulated LAN I/O and a 2074 with my Multiprise 3000?

A: Yes, certainly. However, the maximum you can offload from Multiprise 3000 emulated I/O is 16 or 32 (depending on whether you have one or two ESCON channels) supported LAN3274 sessions, per 2074.

Q: Sometimes you discuss "3270 sessions" and sometimes you discuss "2074 defined devices" (or something similar). What is the difference?

A: None. We are sorry for the sloppy terminology, but it is common for the 2074 (and for other products that use P/390 technology). From the viewpoint of OS/390, IOCDS, and HCD, the 2074 provides up to 16 fully supported local devices (3270s or 3287s) per ESCON channel adapter. From the viewpoint of 2074 administration, these are usually known as sessions, possibly because tn3270e emulator sessions are involved.

Q: Can I run minor OS/2 applications on the 2074 OS/2 system?

A: No. The software in the 2074 is tuned for the 2074 function. If you alter this in any way, you have an unsupported machine. Furthermore, IBM software updates for the 2074 might alter or destroy your application or data, or fail to install as designed. The 2074 contains a fully functional OS/2 system, and has a diskette drive and a CD-ROM drive. We cannot prevent you from installing other software, but we stress that doing so (or altering the provided OS/2 control parameters) may make it impossible for IBM to service your 2074.

Q: What release of OS/2 is used?

A: The VER command shows release 4.5. This corresponds to the OS/2 eBusiness Server that was developed under the name Aurora.

Q: What happens if there is a minor disruption on the LAN?

A: Typically, any tn3270e sessions are lost if there is a LAN disruption. For VTAM terminals (TSO, for example), you would need to logon again; you could probably reconnect to your existing TSO session. For MCS consoles, MCS will drop the

terminal. Alternate processing (ALTERNATE console, or ALTGRP group) will occur. To regain use of the LAN connection, the tn3270e session must be restarted (if necessary) and the operator, using another MCS console, must vary the failed address to console use again.

Q: Are OS/2 file and printer server functions available?

A: No.

Q: Is the OS/2 desktop locked? Is Cntl-Alt-Delete disabled?

A: No and no. We assume that 2074s will be installed in secure locations where only authorized people can access the unit.

Q: How far from the 2074 can I place its display and keyboard?

A: By default, not very far--the same distance for any common PC display and keyboard. We have not experimented with display cable amplifiers, keyboard extenders, and so forth. Likewise, we have not experimented with OEM switches used to connect multiple PCs to a single display/keyboard/mouse. These may or may not work--we have no experience with them.

Q: Once it is customized, can I disconnect the 2074 display and keyboard? Will it reboot properly without these? Is this a reasonable way to run the 2074?

A: No. We were unable to boot our 2074 with the keyboard disconnected. You can turn the display power off, of course, but you should check the display periodically for error messages.

Q: Do I need to monitor the 2074 display?

A: There is absolutely nothing of interest displayed during normal operation. A failure may produce an OS/2 pop-up message, but no one is expected to continually monitor the 2074 display. If it fails (while running many MCS sessions) there will be ample indications from surviving MCS consoles. You might then check the 2074 screen for error messages. (You can turn it on, if it was off, to check for messages.)

Q: After an unexpected power failure, will the 2074 automatically reboot and start its emulated I/O functions? Are operator actions required? How long does a complete boot up (from the time power is applied) take?

A: Yes, it will reboot automatically. No operator intervention is required. The complete power-up cycle takes less than 10 minutes.

Q: You mentioned that the 2074 is rack-mounted. Is a rack included?

A: No, the rack is not included. Most S/390 installations have several IBM racks with space in them. An example would be a 3172 rack. You may order an IBM rack if you need one.

Q: Do the dual power supplies have dual power plugs? Are they universal power supplies?

A: They are universal (100-240v, 50/60 Hertz) power supplies. There are two power cables and you must provide two power outlets. Two *extender* cables are provided for some racks, to match power outlets in the rack.

Q: I am unable to find a convenient arrangement for my PCOM sessions that allows me to easily switch between LPAR and basic operation. This happens on my Multiprise 3000 and 2074. What am I doing wrong?

A: We had the same situation. The problem is with LU names in the PCOM sessions; these need to match the LU names in your DEVMAP (whether a

Multiprise 3000 DEVMAP, or a 2074 DEVMAP). It is easy to match LU names between PCOM sessions and a single DEVMAP. The problem is when multiple DEVMAPs are used (as would be the case when switching from basic to LPAR modes). One method, for the basic mode DEVMAP, is to use the same LU names that correspond to multiple LPARs--this can be slightly misleading to someone reading the DEVMAP, but it can work. Another way, which we did not try, would be to create a different set of PCOM sessions for the different modes.

Q: I already have tn3270e emulators in my client PCs. Must I also install PCOM?

A: Probably not. IBM has not tested other tn3270e emulators, but we see no reason why other modern tn3270e emulators should not work. However, you may need to reproduce a problem using PCOM on the 2074 when seeking IBM service.

Q: I use the AD CD-ROM system. Can I use any or all of the 3270 devices defined in the IODF for 2074 sessions?

A: No. The 3270 devices defined in the AD system are generally intended for emulated I/O with a P/390 or Multiprise 3000 system. This emulated I/O does not require that a corresponding control unit be defined in the IODF,³⁹ and some of the 3270 devices in the AD system IODF do not have control units defined for them. The 2074 is a control unit (and appears to MVS as a 3174 control unit), and any 3270 device implemented through a 2074 must have a control unit defined in the IODF. For the OS/390 R8 AD system, addresses 700-70F and 900-90F have 3174 control units defined, and these addresses can be used with a 2074 without changing anything in the IODF. (If you are not using the AD system, or are not using emulated I/O for 3270 sessions, this discussion is not relevant.)

Q: Why do you make a distinction between tn3270 and tn3270e? I have a good tn3270 client package I want to use.

A: There are several additional functions in a tn3270e client that are not present in a tn3270 client. The tn3270e function required by the 2074 is the ability to send an LU name to the tn3270e server. For practical purposes, you need the LU name⁴⁰ to control which OS/390 image will be connected to the client session.

Q: Can I reuse all my coax wiring I have installed for my "real" 3270s?

A: No. At least not in any simple way. (In particular, you should not try to use existing 3270 coax as Ethernet "thin-wire" coax. It is the wrong type of coax; short lengths may work, but longer lengths will not work.)

Q: You indicate that the 2074 can also support 3287 printers, but you provide no additional information. Why?

A: The small experimental environment we used simply did not have a use for 3287 printers. See the formal 2074 documentation for more information about printer sessions.

Q: I notice the 2074 has an Advanced System Management processor and serial port. Are these supported?

A: No, they are not used. (The base Netfinity can use these when configured as

³⁹ An IODF is created with the HCD utility. You can use HCD to modify an existing IODF; for example, you could define additional 3174 control units for the 3270 device definitions that are missing these.

⁴⁰ LU names were originally part of SNA topology. P/390-type device emulation (including the 2074) uses the LU name for a completely different purpose, having nothing to do with SNA. It provides a convenient field, standard with tn3270e clients, that can be used to pass a name between the client and the tn3270e server.

a normal PC LAN server.) Likewise, the USB connections, serial ports, and parallel port are not used by the 2074.

Q: It is possible to operate the P/390 configurator through a telnet session to OS/2. Is this possible with the 2074? Can I operate it remotely? For example, can I remotely IML one of the channel adapter interfaces?

A: No, there are no *supported* methods to remotely configure the 2074 or remotely operate it.

Q: The 2074s appear to be a good way to solve future needs for more 3174s for more LPARs. Should I consider replacing my current 3174s?

A: There is no correct answer to this question. Reasons to replace your current 3174s include:

- Replacing parallel channel 3174s with ESCON devices (2074s) can reduce channel connectivity bottlenecks and switching complexity.
- The physical number of displays needed for operations (if “real” 3270s are used) can be reduced by having multiple sessions on displays connected to the 2074 LANs.
- Your 3270 displays are old and dim; bright, new PC displays would be a nice improvement. (You might consider flat-panel displays.)
- Floor space for a number of 3174s can be recovered.

Reasons you might not want to replace current 3174s include:

- You already own your 3174s.
- You may be reluctant to provide a number of PCs (to be used for 2074 sessions) in your operations environment. They are subject to misuse, must be managed, someone must maintain whatever PC operating system is used, and so forth.
- The 3174s, with hard-wired coax connections to “real” 3270s might be regarded as a more reliable base.

Q: What national languages are provided for the 2074?

A: The 2074 functions and documentation are U.S. English, only. However, the 3270 data streams passing through the 2074 can be in any national language supported by the S/390 applications involved.

Q: Can FICON channels be used?

A: Not directly. However, the 2074 can be connected to an ESCON director that is fed by FICON channels.

Q: Can a Host-on-Demand (Java-based tn3270e) client be used?

A: Maybe, although there is no official support for this. The Web server providing the HoD Java client would need to be configured to permit sessions with other tn3270 servers (such as the 2074). MCS places a much heavier load on a 3270 emulator than normal VTAM usage. Java operation provides additional overhead. We suggest you try HoD for one or more MCS sessions before deciding to go this route. (If you do not have a 2074, you could test with any P/390, R/390, S/390 Integrated Server⁴¹, or Multiprise 3000 emulated I/O system. All these use approximately the same tn3270e server function.)

Q: Are multiple screen sizes supported?

A: Yes, although this is primarily a function of the tn3270e emulator.

⁴¹ You should have a LAN3274.EXE module dated 6/2/99 or later for a P/390 or Integrated Server.

Q: We wrote applications that drive local 3270s directly, through our own channel programs. Will these work?

A: Probably. We think all reasonable CCWs were tested with the 2074. However, we cannot guarantee that your channel programs will work, especially if they violate conventions about timing, or self-modifying chains, and so forth. If this is critical, we suggest you find a way to test your program with a 2074 before replacing any 3174s. Remember that 3270 device orders are performed by the tn3270e emulator, not the 2074. You may also need to test various emulators with your programs.

We do note a few restriction in this area. The device data sent by a CCW must contain an SBA (set buffer address) order. A program cannot depend on the SBA address being carried over from a previous CCW in the channel program. A write CCW that does not send an SBA order will write at unpredictable addresses in the 3270 buffer.

Data transferred by a *read buffer*, *read modified*, or *read modified all* CCW begins at the beginning of the 3270 buffer, not at the point where a previous channel CCW stopped reading. However, a read CCW chained from a *write*, *erase write*, or *erase write alternate* CCW will begin at the address where the write finished.

A *keyboard unlock* WCC takes effect immediately on the 2074; on a 3174 it takes effect at the end of the channel program.

Q: You briefly mentioned the Netfinity switch (in Chapter 6, “Ordering selections” on page 41) but you did not expand on its use. Is this a practical option? What are the limitations?

A: A single PC display/keyboard switch could be a single point of failure. Other than this, we are not aware of any particular concerns using the switch. Our test configuration was not large enough to warrant buying the switch and we had limited first-hand use of one.

As discussed here, the switch “condenses” the consoles for a number of 2074s to a single physical display/keyboard. A 2074 console displays an OS/2 desktop, including the configuration screens for the 2074 application. It may also contain up to two tn3270e sessions, and these could be used for MCS consoles or VTAM terminals⁴². There is no reason to constantly display the OS/2 desktop for a number of 2074s (assuming there are no useful 3270 sessions on the desktops). Once the 2074 is configured and in production, the OS/2 desktop information would be used only for rare error situations. Using a switch to reduce the number of physical 2074 displays is a practical option. It might also be a practical option if the OS/2 desktops contain active 3270 sessions, but you would need to plan this more carefully so that the 3270 sessions are visible when they are needed.

Q: How far away from a group of 2074s can I place the switch? How far from the switch can I place the master display and keyboard? I want to place the 2074s in an existing IBM rack, but the rack is in the back of my raised floor.

A: Not very far. All the cables involved are “local” display/keyboard/mouse cables and are only a few feet long. (The molded cables available with the switch are about 12 feet long.) Remember: You do not need to use *any* 3270 sessions on the 2074 displays. Your normal operator (and VTAM) sessions are connected to the 2074 by LANs and these can be placed anywhere the LAN goes.

⁴² Remember, IBM recommends that these sessions be used only for debugging purposes.

Q: You talk about connecting 2074s to a switch. Could I connect the client PCs (running tn3270e sessions from the 2074s) to a switch instead?

A: Yes, of course, but probably not the *same* switch. However, you need to consider carefully how many active MCS console sessions can be usefully condensed to a single physical display.

Q: Should I specify unique LUNAMES for each intended MCS session (in the DEVMAP)?

A: This is up to you, but we suggest that unique LUNAMES would be a good approach. This permits you to easily map (via the control unit address, the device address, and the IOCDS) the session to an MVS unit number (“address”). This is needed to issue the proper `VARY xxxxx, CONSOLE` command. Unique LUNAMES are not needed for TSO sessions, since VTAM will automatically respond to a terminal/session activation by presenting the VTAM logo screen.

Q: There is some effort involved in creating a correct DEVMAP. Can I copy a DEVMAP from one 2074 to another 2074 and use this as a starting point for customizing the second unit?

A: Yes. A DEVMAP is a binary OS/2 file that you can copy. However, you should never attempt to edit a DEVMAP with an editor or word processor; this will destroy the DEVMAP.

Q: We have many MCS sessions defined. We use only a few different LUNames in the DEVMAP. For example, one LUName for MCS consoles in the tape area, another for MCS consoles in the scheduling area, and so forth. We sometimes need to issue `VARY xxxxx, CONSOLE` commands to activate (or reactivate) one of these MCS terminals. How do I know what address (device number) to use in the `VARY` command? It seems that a given 3270 session (with a given LUName) might connect (at different times) to any of the DEVMAP sessions with the same LUName.

A: You are correct. In the situation you describe, you could trace the CU and UA addresses (shown in the 2074 status lines that are displayed in the 3270 session) through your IOCDS and determine the MVS device number for that 3270 terminal. You might create a chart (to post in all MCS areas) showing the relationship between the CU UA addresses and the MVS device numbers. An alternative is to define a unique LUName (in the DEVMAP and at the 3270 emulator) for every MCS terminal, thus having a fixed MVS device number for each MCS console.

Q: Can I obtain a cabinet for my 2074? Rack mounting is not convenient in our situation.

A: As far as we know, the answer is no. The 2074 is rather deep, and will not fit in the cabinets used for Netfinity processors with the same size face panel (but that are not as deep).

Q: You said to “create or obtain IP addresses”. How do I do this?

A: If you use private, isolated LANs for your 2074s, you can use any IP addresses you select. In this case, we suggest using the sample addresses in this document; these are class A addresses in the 10.x.x.x range, with a subnet mask of 255.255.255.0. If you are connecting to an existing LAN, you *must* request IP addresses from a LAN administrator.⁴³ If your LAN is part of the Internet

⁴³ You *might* be able to use the 10.x.x.x addresses on your existing LAN, since these particular addresses are not routable. This assumes all your 2074-connected clients are on the same LAN. Exploring the IP addressing options that might be used is beyond the scope of this redbook.

(contrary to our security advice), you may have problems negotiating enough fixed IP addresses for all the PCs used for MCS sessions.

Q: Can I use our existing DHCP function to provide IP addresses?

A: Not for the 2074 addresses; remember, the 2074 provides *server* functions (a tn3270e server). Furthermore, this is probably not practical for the PCs used for MCS console sessions.

Q: Is your terminology, using *IOCDS*, correct? We usually say *IOCP*.

A: You are probably more correct. We should say *source code for an IOCDS* instead of *IOCDS* when discussing the listings in this redbook. However, we think the meaning is clear. In some cases, the term *IOCP* might imply the presence MVS-related parameters as well as *IOCDS* parameters, so we have avoided the term *IOCP* because the examples usually do not show MVS-related parameters. We apologize if the terminology is not exactly correct.

Q: Can I “hot plug” the 2074 LAN connections?

A: In our experience, the answer is *yes* for Ethernet and *no* for token ring. We are not aware of any specific product specifications in this area. It appears that, once a token ring connection is broken, OS/2 will not automatically restart it. The 2074 application code, including its interfaces with OS/2, is moderately complex and there appears to be no interface for entering a restart command for a LAN driver. In any event, a “hot” connection will not activate an MCS console; MVS operator commands would be needed for this.

Q: Can I use a FICON bridge?

A: Yes, since the 2074 sees only the resulting ESCON connection from an ESCON director.

Q: I seem to require `MODEL=X` in my `IODEVICE` statements, but you sometimes do not show this. Why?

A: We expect this is because direct entry of *IOCDS* source statements (to the support element) did not require a model number. (This is an example of an MVS-related parameter.) Working through HCD will require the model parameter.

Q: Can I enter your source *IOCDS* examples exactly as shown, via HCD?

A: Possibly not. HCD may invoke more error checking than the standalone support element *IOCDS build* function. For example, you will need to include a `MODEL` parameter with 3270 definitions. You may need to create CU addresses for 2074 sessions such that HCD does not think you have overlapping control unit addresses. (This was done in the example in 3.4, “Adding ESCON Director(s)” on page 20.)

Q: I am having trouble with the LPAR number in my `DEVMAPs`.

A: If you want to include `PARTITION` parameters in `IODEVICE` statements, you must ensure that the `CHPID` is defined as `SHARED`. It is automatically `SHARED` only if multiple `PARTITIONS` are defined in the `CHPID` statement. If a `CHPID` is not shared, the LPAR number in the device map must be 0, regardless of the real `CHPID` number being used. We suggest you always define the `CHPIDs` as `SHARED`.

Q: I have two 2074 units connected to the same ESCON director. Can I define a session with exactly the same parameters (LPAR, port, CU, UA) in both 2074s?

A: No. It appears you are attempting yet another way to provide a form of

multiple path recovery. This will not work and may produce errors that are difficult to diagnose.

Q: Should I use token ring or Ethernet LANs? The 2074 appears to support both equally well.

A: Use whatever you already have installed. If you have neither (or both) we note that Ethernet use appears to tolerate “hot plugging” of the LAN connection, while token ring does not. However, token ring has some advantages due to its inherent wiring redundancy.

Appendix A. Complete IOCDS and DEVMAP listings

This appendix provides listings of the IOCDS and DEVMAPs for basic mode and LPAR mode environments used at the ITSO. The listings (and corresponding IOCDSs and DEVMAPs) are small. The goal is to illustrate simple usage of a 2074. Once this is understood, the user can create more complex implementations based on the same principles.

A.1 Basic mode system

The following IOCDS and 2074 DEVMAP are from a basic mode Multiprise 3000 running the OS/390 AD CD-ROM system. (The AD system is a small, straightforward OS/390 system, customized for immediate use, that is distributed on CD-ROMs.) The operating system is resident on 3390 volumes in the address range AA0-AAF. The 2074 is customized to provide four 3270 sessions at addresses 900-903.¹ Three more 3270 sessions (addresses 700-702) are provided by Multiprise 3000 emulated I/O functions. (The AD system uses address 700 for its MVS console, and addresses 701-71F and 900-91F are defined as 3270 sessions and defined to VTAM.) The IOCDS contains:

```
ID      MSG1=' 2074BASC',MSG2=' SYS1.IODF99',SYSTEM=(7060,1)
CHPID  PATH=(FC),TYPE=EIO
CHPID  PATH=(FD),TYPE=DSD
CHPID  PATH=(04),TYPE=CNC
CNTLUNIT CUNUMBR=FD00,PATH=(FD),CUADD=0,UNITADD=((00,16)), *
        UNIT=3990-2
IODEVICE ADDRESS=(AA0,16),CUNUMBR=FD00,UNIT=3390,UNITADD=00
CNTLUNIT CUNUMBR=0400,PATH=04,CUADD=00,UNIT=3174, *
        UNITADD=((00,4))
IODEVICE CUNUMBR=0400,ADDRESS=(900,4),UNIT=3270,UNITADD=00
CNTLUNIT CUNUMBR=FC70,PATH=(FC),UNITADD=((70,001)),UNIT=3174
CNTLUNIT CUNUMBR=FC71,PATH=(FC),UNITADD=((71,001)),UNIT=3174
CNTLUNIT CUNUMBR=FC72,PATH=(FC),UNITADD=((72,001)),UNIT=3174
IODEVICE ADDRESS=700,MODEL=X,UNITADD=70,CUNUMBR=(FC70), *
        UNIT=3270
IODEVICE ADDRESS=701,MODEL=X,UNITADD=71,CUNUMBR=(FC71), *
        UNIT=3270
IODEVICE ADDRESS=702,MODEL=X,UNITADD=72,CUNUMBR=(FC72), *
        UNIT=3270
```

The 2074 DEVMAP corresponding to this IOCDS contains:

Index	Device	LPAR#	Port	CU	UA	Mgr	Parameters
01	3278	0	01	0	00	1	
02	3278	0	01	0	01	1	
03	3278	0	01	0	02	2	
04	3278	0	01	0	03	2	

The 2074 is connected to CHPID 04, which is a normal ESCON channel on the Multiprise 3000. The other two channels (types EIO and DSD) are special types used by the Multiprise 3000. They are not directly related to 2074 usage and are shown here because they were necessary for the Multiprise 3000 that we used.

¹ The addresses used here are those present in the AD CD-ROM system. There is nothing special about these particular addresses. They were selected for the AD CD-ROM system simply because they matched the hardware addresses on the S/390 machine used to build the AD system.

The four PCOM sessions (which we defined on the 2074 console) did not contain LU names. LU names are required to (a) direct a particular PCOM session to a particular DEVMAP definition, or (b) to direct sessions (defined by lines in the DEVMAP) to a particular LPAR. In this case, we do not have LPARs and do not care which PCOM session (in the 2074) connects to which session defined in the 2074 DEVMAP.

Multiple 2074 sessions are defined by a single CNTLUNIT and IODEVICE pair in the IOCDS. Multiprise 3000 emulated I/O requires a CNTLUNIT and IODEVICE pair for each emulated device. Other S/390 systems, not using emulated I/O, would have different IOCDS definitions.

In this example, the MVS console will appear in the first 3270 session (on the Multiprise 3000 console, using address 700), while the other sessions on the Multiprise 3000 console and on the LAN will have VTAM logos and can be used for TSO (or CICS or any other VTAM application).

The 2074 sessions are on the 2074 console. LAN sessions could be used in addition to (or instead) of these. The 2074 DEVMAP would use Mgr 2 instead of Mgr 1 for the LAN sessions. In addition, the 2074 panels for LAN customization (setting an IP address, and so forth) would need to be set correctly.

In the 2074 DEVMAP, notice that the CU address for all the sessions is 0, and the UA address starts with 00. This is the normal situation for a simple installation.

A.2 LPAR system

The following is a minimal IOCDS for two LPARs, each running OS/390, and not using a 2074. This example is for a Multiprise 3000, and uses four emulated I/O 3270 sessions. Each of the OS/390 systems² (in the two LPARs) uses address 700 for its MVS console, and each has a single TSO terminal at address 702. Sixteen 3390 devices are defined (addresses AA0-AAF) and are shared by both LPARs. Chpid 04 is defined, but not used; it will be used to connect the 2074 later. This may not be a practical environment, but it works and can be used to illustrate one 2074 implementation. The IOCDS contains:

```

ID      MSG1=' TEST2074' ,MSG2=' SYS1.IODF99' ,SYSTEM=(7060,1)
RESOURCE PARTITION=( (MVS1,1) , (MVS2,2) )
CHPID  PATH=( FC ) ,TYPE=EIO,SHARED,PARTITION=( (MVS1,MVS2) )
CHPID  PATH=( FD ) ,TYPE=DSD,SHARED,PARTITION=( (MVS1,MVS2) )
CHPID  PATH=( 04 ) ,TYPE=CNC,SHARED,PARTITION=( (MVS1,MVS2) )
CNTLUNIT CUNUMBR=FD00,PATH=( FD ) ,CUADD=0,UNITADD=( (00,16) ) ,      *
        UNIT=3990-2
CNTLUNIT CUNUMBR=FC70,PATH=( FC ) ,UNITADD=( (70,001) ) ,UNIT=3174
CNTLUNIT CUNUMBR=FC71,PATH=( FC ) ,UNITADD=( (71,001) ) ,UNIT=3174
CNTLUNIT CUNUMBR=FC72,PATH=( FC ) ,UNITADD=( (72,001) ) ,UNIT=3174
CNTLUNIT CUNUMBR=FC73,PATH=( FC ) ,UNITADD=( (73,001) ) ,UNIT=3174
IODEVICE ADDRESS=( AA0,16 ) ,CUNUMBR=FD00,UNIT=3390,UNITADD=00
IODEVICE ADDRESS=700,UNITADD=70,CUNUMBR=( FC70 ) ,UNIT=3270,      *
        PARTITION=( MVS1)
IODEVICE ADDRESS=700,UNITADD=71,CUNUMBR=( FC71 ) ,UNIT=3270,      *
        PARTITION=( MVS2)
IODEVICE ADDRESS=702,UNITADD=72,CUNUMBR=( FC72 ) ,UNIT=3270,      *

```

² We used the AD CD-ROM prepackaged system for one of the OS/390s, and a locally-built two-volume system for the other OS/390. There were no volser conflicts between the two systems, and both systems shared all the DASD volumes. The process described here is not dependent on particular OS/390 implementations.

```

PARTITION=(MVS1)
IODEVICE ADDRESS=702,UNITADD=73,CUNUMBR=(FC73),UNIT=3270,*
PARTITION=(MVS2)

```

The Multiprise 3000 emulated I/O DEVMAP that corresponds to this IOCDs contains:

Addr	Device	Label	Atype	Size	Mgr	FN/P
70	3278		Dspy		3	/R=MVS1OP
71	3278		Dspy		3	/R=MVS2OP
72	3278		Dspy		4	/R=MVS1
73	3278		Dspy		4	/R=MVS2

In this system Mgr number 3 is AWS3274, which emulated 3270 sessions on the Multiprise 3000 console.³ Manager 4 is LAN3274. Four PCOM sessions were created on the Multiprise 3000 console and LAN, with LU names of MVS1OP, MVS2OP, MVS1, and MVS2.

A conventional larger S/390 would not have the emulated I/O (and associated DEVMAP), but would probably have two 3174 control units defined on two CHPIDs, with each LPAR owning one of the CHPIDs. Each 3174 would furnish the MVS console display(s) and the additional 3174 ports would probably be defined to VTAM. We use the Multiprise 3000 example because it is the system we used for our early 2074 experience.

We then converted this system to use a 2074 instead of the emulated I/O sessions on the Multiprise 3000 console. This was a one-to-one conversion, with only four sessions defined for the 2074. The new IOCDs contains:

```

ID MSG1='TEST2074',MSG2='SYS1.IODF99',SYSTEM=(7060,1)
RESOURCE PARTITION=((MVS1,1),(MVS2,2))
CHPID PATH=(FC),TYPE=EIO,SHARED,PARTITION=((MVS1,MVS2))
CHPID PATH=(FD),TYPE=DSD,SHARED,PARTITION=((MVS1,MVS2))
CHPID PATH=(04),TYPE=CNC,SHARED,PARTITION=((MVS1,MVS2))
CNTLUNIT CUNUMBR=FD00,PATH=(FD),CUADD=0,UNITADD=((00,16)),*
UNIT=3990-2
CNTLUNIT CUNUMBR=C400,PATH=04,UNITADD=((00,4)),UNIT=3174
IODEVICE ADDRESS=(AA0,16),CUNUMBR=FD00,UNIT=3390,UNITADD=00
IODEVICE ADDRESS=700,UNITADD=00,CUNUMBR=(C400),UNIT=3270,*
PARTITION=(MVS1)
IODEVICE ADDRESS=700,UNITADD=01,CUNUMBR=(C400),UNIT=3270,*
PARTITION=(MVS2)
IODEVICE ADDRESS=702,UNITADD=02,CUNUMBR=(C400),UNIT=3270,*
PARTITION=(MVS1)
IODEVICE ADDRESS=702,UNITADD=03,CUNUMBR=(C400),UNIT=3270,*
PARTITION=(MVS2)

```

The 2074 DEVMAP that corresponds to this IOCDs contains:

Index	Device	LAPR#	Port	CU	UA	Mgr	Parameters
01	3278	1	01	0	00	2	/R=MVS1OP
02	3278	2	01	0	01	2	/R=MVS2OP
03	3278	1	01	0	02	2	/R=MVS1
04	3278	2	01	0	03	2	/R=MVS2

³ The emulated I/O functions on the Multiprise 3000 are based on the same technology as the 2074. The function of the AWS3274 device manager is the same, for example, for the Multiprise 3000 and the 2074.. The DEVMAP looks a little different on the 2074, due to the addition of CU and LPAR control fields.

The PCOM client sessions (on the 2074 LAN) are configured the same as for the Multiprise 3000. (That is, the four sessions specify the same LU names: MVS1OP, MVS2OP, MVS1, and MVS2.)

This example is slightly odd in that the 3270 addresses for each LPAR (700 and 702) contain a gap in the address range.⁴ If it were not for this gap, we would use a single IODEVICE statement for each LPAR, and specify a range of addresses in each IODEVICE.⁵

When this IOCDS, along with 2074 DEVMAP and PCOM definitions, is used, two of the sessions on the 2074 LAN are used for MVS consoles (one for each MVS), and the other two sessions are used for TSO (one for each MVS). Additional 2074 sessions can easily be added, of course.

⁴ This was done because our two-volume OS/390 system had two MVS consoles specified at addresses 700 and 701. We wanted only one MVS console, so we intentionally did not provide a display at address 701.

⁵ It is not possible to use a single IOCDS IODEVICE (or CNTLUNIT) statement to define multiple emulated I/O devices for Multiprise 3000 systems. This restriction does not apply to 2074 devices. A single IOCDS statement can specify a range of 2074 unit addresses. As far as a Multiprise 3000 is concerned, 2074 devices are not emulated I/O devices; they are “real” channel-attached, local 3174/3270 devices.

Appendix B. Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

B.1 IBM Redbooks

For information on ordering these publications see “How to get IBM Redbooks” on page 59.

- *Multiprise 3000 Technical Introduction*, SG24-5633
- *Multiprise 3000 Basic Emulated I/O Definitions*, SG24-5669

B.2 IBM Redbooks collections

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B.3 Other resources

These publications are also relevant as further information sources:

- *2074 Console Support Controller Installation and Maintenance Information*, G229-9028
- *2074 Console Support Controller Configuration Guide*, SC28-6806
- *OS/390 MVS Planning: Operations*, GC28-1760
- *OS/390 MVS Initialization and Tuning Reference*, SC28-1752
- *OS/390 MVS System Commands*, GC28-1781

B.4 Referenced Web sites

These Web sites are also relevant as further information sources:

<ftp://p390.ibm.com> may have update information and modules

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Introducing the IBM 2074 Control Unit



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General design and use of the 2074

This redbook explains the design and use of the IBM 2074 Control Unit, based on ITSO experience with an early version of the 2074. A 2074 can be used with any S/390 operating system; however, this document discusses only its use with OS/390.

Configuration examples

The 2074 typically replaces multiple local IBM 3174 Control Units to provide local connections for 3270 displays. In particular, one 2074 Control Unit can provide local 3270 connections for multiple LPARs, where the local 3270 sessions can be used for OS/390 consoles and VTAM applications such as TSO and CICS.

Frequently-asked questions (with answers)

This redbook describes typical customization controls for the 2074 and connected S/390 machines. It also assumes that the reader is familiar with S/390 and OS/390 terminology.

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SG24-5966-00

ISBN 0738418356