



DG/UX® Driver Installation

Addendum to 4515/5515 PCI ATM Adapter Users Guide



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DG/UX® Driver Installation

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Overview

This document explains how to install and configure the 5515 adapter device driver suite for the DG/UX® System (Release R4.11MU03 or later) operating on an appropriate AViiON® system.

Available Drivers

The DG/UX ATM driver suite includes both hardware and software drivers used to build a custom DG/UX kernel with support for the 5515 adapter and TCP/IP networks utilizing ATM.

There is a single DG/UX hardware driver named **ia** for the 5515 adapter.

There are three types of DG/UX ATM software drivers:

- LAN Emulation SVC: **li**
- RFC-1577 SVC (IP over ATM) (no broadcast or multicast services): **ci**
- RFC-1483 PVC (no broadcast or multicast services): **pa**

The first two software drivers are for ATM Switched Virtual Circuits (SVCs) using the ATM Forum's User-Network Interface (UNI 3.0/3.1) signaling standard. The third software driver is for ATM Permanent Virtual Circuits (PVCs).



Available Drivers

Before installing and configuring the DG/UX ATM software and hardware driver(s), review the appropriate *DG/UX Release Notice(s)* and/or *Maintenance Update Notice(s)* included with the DG/UX software installed on your AViiON system. If you are not thoroughly familiar with ATM networking, read the *Introduction to ATM* chapter in the *4515/5515 PCI ATM Adapter User's Guide*.

A custom DG/UX kernel can be built with all three ATM software drivers; however, you can use only one of the three ATM software drivers in a given system at a time. To switch drivers, you don't need to build a new kernel; just reconfigure the system's TCP/IP configuration and reboot the AViiON system. This limitation restricting concurrent use of the three ATM software drivers will be removed in a future DG/UX release.



The procedures in this chapter assume that the 5515 adapter is already installed in the workstation. If the adapter is not installed, refer to the hardware installation chapters in the *4515/5515 PCI ATM Adapter User's Guide* for instructions.



See the appropriate DG/UX Release Notice(s) / Update Notices(s) for information about the supported AViiON systems, system-specific configuration limitations, and Notes/Warnings not included in this document.



DG/UX Documentation

Data General provides the DG/UX system documentation on CD-ROM. It contains the DG/UX system user, administrator, and programmer manuals and a set of Technical Briefs. Data General also provides a printed copy of the *Quick Start Guide for Viewing DG/UX Documentation, Installing the DG/UX System, and Preventing and Fixing Problems on the DG/UX System*. You may receive additional printed manuals, depending on which Data General product(s) you order. The following is an abbreviated list of available DG/UX manuals:

Table 1-1. Relevant DG/UX Documentation

Title	Order Number
Analyzing DG/UX System Performance	093-701129
Installing and Managing Printers on the DG/UX System	093-701135
Managing Mass Storage Devices and DG/UX File Systems	093-701136
Managing Modems and UUCP on the DG/UX System	069-000698
Managing ONC™/NFS® and Its Facilities on the DG/UX System	093-701049
Managing TCP/IP on the DG/UX System	093-701051
Managing the DG/UX System	093-701088
Preventing and Fixing Problems on the DG/UX System	093-701141
Programming in the DG/UX Kernel Environment	093-701083
Programming with TCP/IP on the DG/UX System	093-701024
Setting Up and Managing Terminals on the DG/UX System	069-701132

Table 1-1. Relevant DG/UX Documentation

Title	Order Number
Using TCP/IP on the DG/UX System	093-701023
Using the AViiON Diagnostics and the AV/Alert Diagnostic Support System—DG/UX Environment	014-002512
Using the DG/UX Kernel Debugger	093-701075
Using the DG/UX System	069-701035

Man pages for the ATM utilities for the 5515 adapter are included in the online *DG/UX Manual Pages*. See *DG/UX ATM Manual Pages* on page 35 for a list of these.

Software Driver Options

If you are installing the RFC-1577 IP over ATM software, skip to *DG/UX RFC-1577 SVC Software* on page 13.

If you are installing the RFC-1483 PVC software, skip to *DG/UX RFC-1483 PVC Software* on page 24.

Otherwise, continue with the next section to install the DG/UX LAN Emulation SVC Software.

DG/UX LAN Emulation SVC Software

This section explains how to install the DG/UX ATM Forum LAN Emulation (LANE) compatible software for the 5515 adapter. The software is designed to operate with the User-Network Interface (UNI) 3.0/3.1 signaling specification. The DG/UX LAN Emulation software for the 5515 adapter supports the LAN Emulation Client (LEC) only, with up to

four LAN Emulation Clients defined per adapter. The LAN Emulation Server (LES) and the Broadcast and Unknown frame Server (BUS) must be installed either on an ATM switch or on a server system providing those functions.

LAN Emulation System Requirements

Installing the LAN Emulation software for the 5515 adapter under DG/UX System Release R4.11MU03 or later requires a system with the following:

- A superuser login.
- A hostname and IP address for each LAN Emulation Client (LEC) that is to be installed.



Note

The hostname and IP address will be used in `/etc/hosts`, `/etc/tcpip.params`, and with other commands and files.

Installing the LAN Emulation SVC Software

All of the software required for LAN Emulation is included in the base DG/UX System Release R4.11MU03 software package, so no DG/UX installation media accompany the 5515 adapter. To install the LAN Emulation software for the 5515 adapter, do the following:

1. Log in as **root**.
2. Build a DG/UX custom kernel whose **system.devices** file includes:
 - **li()**
 - **ia(pci([0-1]), [0-1f])** and/or



- `ia(cpci([0-1]),[0-1f])` and/or
- `ia(xpci(pci([0-1]),[0-1f]),[0-1f])`



The DG/UX installer or `sysadm` kernel's `sysadm->system->kernel->config_and_build` menus will normally automatically create the `ia` device system file entries for any 5515 adapter(s) installed in the chassis of the AViiON system. See the `/usr/etc/probedevtab` file for the table of all possible device names. You need to create a manual entry for the `li()` driver in the device configuration file.

3. Configure the LAN Emulation Clients as described later in this chapter in *Configuring the LAN Emulation Clients* on page 6.
4. Configure this system's TCP/IP environment for the LAN Emulation Clients as described later in this chapter in *LANE TCP/IP Configuration* on page 11.
5. Reboot.

Configuring the LAN Emulation Clients

The DG/UX LAN Emulation SVC driver is designed to operate with the User-Network Interface signaling standard UNI 3.0/3.1. The default is UNI 3.0.





Note

Your ATM switch must be capable of supporting the UNI 3.0/3.1 signaling standard for Switched Virtual Circuits. Some switch vendors allow mixing of the two standards; some vendors require that all ports be set to either UNI 3.0 or UNI 3.1. Check your switch documentation for the proper settings.

Several utilities and files are available for configuring the LAN Emulation parameters. Some of the utilities are for you to monitor and display information on LAN Emulation clients and services. Refer to the online manual pages supplied with the software for detailed information about these utilities.

The following table lists the utilities included with the LAN Emulation SVC driver software. The LEC configuration files

Table 1-2. LAN Emulation Software Utilities

Utility	Description
iastat	Display adapter statistics
learp	Display LEC ARP table
lec	LEC configuration
leconfig	LEC reconfiguration
ledbg	Display client information
sigdbg	Enable/disable signaling debug output
signald	UNI 3.0/3.1 ILMI and signaling daemon
sigstat	Display link/connection status

described in Table 1-3 on page 8 are used to define the LAN

Table 1-3. ATM LEC Configuration Files

File	Description
leconf.proto	LANE Client prototype configuration file
leconf.0	First LANE Client configuration file
leconf.1	2nd LANE Client configuration file
leconf.2	3rd LANE Client configuration file
leconf.3	4th LANE Client configuration file
leconf.4	First LANE Client configuration file on second 5515 adapter.
leconf.5	2nd LANE Client configuration file on second 5515 adapter
leconf.6	3rd LANE Client configuration file on second 5515 adapter
leconf.7	4th LANE Client configuration file on second 5515 adapter

Emulation Client configuration parameters for an Emulated LAN (ELAN). The ATM driver signaling configuration files are described in Table 1-4 on page 11.

Only the **/etc/leconf.proto** file exists when DG/UX System Release R4.11MU03 is installed. You must create the other **leconf** files as part of the ATM LANE configuration process. The **leconf** files can also be modified to reconfigure the LAN Emulation software at a later time.

LEC Configuration

During software installation, a **leconf.proto** file is created in the **/etc** directory. The 5515 adapter instances are numbered from 0 and the LANE Client instances on each adapter are

numbered 0 through 3. For each LANE client that is enabled on each adapter, copy the default leconf file **/etc/leconf.proto** to **/etc/leconf.X**, where **X** is the instance number of the 5515 adapter times four plus the LANE client instance number on the adapter.



Each client on an adapter must be configured to a different ELAN.

Warning

For example, the first **leconf** file for the first LAN Emulation Client on the first 5515 adapter will be **/etc/leconf.0**, and the **leconf** file for the second LAN Emulation Client on the second 5515 adapter will be **/etc/leconf.5**. These files contain LANE client configuration parameters and must include your network information. See Figure 1-1 on page 9 for the contents of a sample **/etc/leconf.X** file. The LANE client configuration parameters are defined in the **leconf(4)** manual page.

```
lecs: 0
atmprefix: 47007900000000000000000000000000
atmesisel: 00A03E000000100
maxframesz: 1
```

Figure 1-1. Sample LECCONF File Contents

The following **leconf** parameters are supported:

- **lecs:** The *lecs* parameter can have two values: 0 and 1. If the value is zero, the client connects directly to the



LES, bypassing the **LECS**. Since DG/UX does not support **LECS**, the value of 1 is not supported. The address specified in the *atmprefix* and *atmesisel* parameters is the **LES** address.

- **atmprefix:** The *atmprefix* parameter contains the network prefix part of the **LES**'s ATM address. The value is specified as a sequence of 13 hexadecimal octets. Each digit is significant and all 13 octets **must** be present.
- **atmesisel:** The *atmesisel* parameter contains the ESI and SEL part of the **LES**'s ATM address. The value is specified as a sequence of 7 hexadecimal octets. Each digit is significant and all 7 octets must be present.
- **maxframesz:** To request a maximum frame size of 1516, set this parameter to 1. To request a maximum frame size of 4544, set this parameter to 2. To request a maximum frame size of 9234, set this parameter to 3. Other values for the *maxframesz* parameter are not supported.



Each client on each adapter that has the corresponding **leconf.X** file in the */etc* directory is enabled at boot time. Clients can also be enabled and disabled from the command line with the **lec(1M)** utility. See the manual pages for **leconf(4)**, **leconfig(4)**, and **lec(1M)** for more information.

ATM Driver Signaling Configuration

The DG/UX System Release R4.11MU03 ATM software supports a maximum of two adapters per system. During DG/UX software installation, an **atmconf.proto** file is created in the */etc* directory. The 5515 adapter instances are numbered from 0. For each adapter, copy the default **atmconf** file */etc/atmconf.proto* to */etc/atmconf.X*, where **X** is the instance number of the 5515 adapter.



The **atmconf** file contains parameters that are applicable to the 5515 adapter as a whole. For example, whether an adapter is configured for UNI 3.0 or UNI 3.1 is specified in this file. See the manual page **atmconf(4)** for more details. For LAN Emulation, this file is only needed to specify UNI 3.1 signaling; the only parameter that should be specified in the **atmconf.X** file used for **LEC** is the **unirev** parameter. The remaining **atmconf** parameters are used only for **LES**, **BUS**, or **RFC-1577** support.

Table 1-4. ATM Adapter Configuration Files

File	Description
atmconf.prot	ATM Adapter prototype configuration file
atmconf.0	ATM configuration file for first adapter
atmconf.1	ATM configuration file for second adapter

For **LEC**, the **atmconf** file *unirev* parameter can have two values, 30 and 31. If *unirev* is 30, the adapter is configured for UNI3.0 signaling. If *unirev* is 31, the adapter is configured for UNI3.1 signaling.

LANE TCP/IP Configuration



Note

See *Managing TCP/IP on the DG/UX System*. It explains how to prepare for setup of Data General's TCP/IP (DG/UX) package on DG/UX computer systems. It also discusses how to tailor the software for your site, how to use **sysadm** to manage the package, and how to troubleshoot system problems.

Use the **admipinterface -o add -d liX** command to add the ATM interface to the **/etc/tcpip.params** file, where **X** matches the **/etc/leconf.X** instance number. So for the second LANE client on your first 5515 adapter, you would enter **admipinterface -o add -d li1**

And for the first LANE client on your second 5515 adapter, you would use **li4**.

TCP/IP requires this unit number. The **admipinterface** command creates an instance of the cloneable device, **/dev/li**, using the unit number you supply.

The minimum command would be:

```
admipinterface -o add -d liX hostname
```

The syntax for the **admipinterface -o add** command is:

```
admipinterface -o add -d device [-n netmask] \
[-b 0 | 1] [-p link protocol] [-t template] \
[-g group] [-i interface] [-r baudrate] hostname
```

See the DG/UX **admipinterface(1M)** man page for details about the other **admipinterface** command parameters.

A sample ATM interface entry in the **/etc/tcpip.params** file would be displayed by the **admipinterface -o list** command as:

```
Hostname: snafu-atm
Interface: li0
DEVICE: li0
Network Mask: 0xffffffff00
Broadcast Address: 128.222.5.255
Link Protocol: ether
IXE template: N/A
Baud Rate: N/A
```

Group: default

Status: DETACHED

After all the configurations are complete and a custom DG/UX kernel has been built including the necessary drivers, reboot the system using the following command: `reboot`



If the running DG/UX kernel already includes the necessary drivers, a reboot may not be necessary. Instead the network may be started by the appropriate change of the system *init* level or with the `admipinterface -o attach` command.

The installation of the LAN Emulation software for the 5515 adapter is now complete.

DG/UX RFC-1577 SVC Software

This section describes the procedure for installing the DG/UX RFC-1577, IP over ATM, compatible software for the 5515 adapter. The DG/UX RFC-1577 software is designed to allow transmission of IP packets over an ATM Network in a switched virtual circuit (SVC) environment. The RFC-1577 SVC driver for DG/UX is designed to operate with the User-Network Interface signaling specification UNI 3.0/3.1. The default is UNI 3.0.



Before beginning the installation, obtain the MAC address of the ARP Server. If this 5515 adapter interface is going to be used as the ARP Server and



DG/UX RFC-1577 SVC Software

you don't have the MAC address of the 5515 adapter, you can obtain it by using the DG/UX "snmpgettab localhost public ifTable" command after booting the DG/UX kernel containing the ATM drivers.



Note

Before beginning installation, obtain the ATM network prefix number for each ATM switch in the subnet where the 5515 adapter will be installed.

RFC-1577 System Requirements

Installing the RFC-1577 software for the 5515 adapter under DG/UX System Release R4.11MU03 requires a system with the following:

- A superuser login
- A hostname and IP address for each ATM LAN interface to be installed



Note

The hostname and IP address will be used in /etc/hosts, /etc/tcpip.params, and with other commands and files.



Warning

Your ATM switch must be capable of supporting the UNI 3.0/3.1 signaling standard for Switched Virtual Circuits. Some switch vendors allow mixing of the



two standards; some vendors require that all ports be set to either UNI 3.0 or UNI 3.1. Check your switch documentation for the proper settings.

Installing the RFC-1577 Software

All of the software required for DG/UX RFC-1577 support is included in the base DG/UX System Release R4.11MU03 software package, so no DG/UX installation media accompany the 5515 adapter.

To install the RFC-1577 software for the 5515 adapter, do the following:

1. Log in as **root**.
2. Build a DG/UX custom kernel whose **system.devices** file includes:
 - **ci()**
 - **ia(pci([0-1]), [0-1f])** and/or
 - **ia(cpci([0-1]),[0-1f])** and/or
 - **ia(xpci(pci([0-1]),[0-1f]),[0-1f])**



The DG/UX installer or **sysadm** kernel's **sysadm->system->kernel->config_and_build** menus will normally automatically create **ia** device system file entries for any adapters installed in the chassis of the AViiON system. See the **/usr/etc/probedevtab** file for the table of all possible device names. The **ci()** driver must be added to the device configuration file.



Note

Select a system to be the ARP server. Make a note of this on your network map.

3. Assign a new IP subnet address for all systems that will contain a 5515 adapter.
4. Configure the RFC-1577 ATM configuration files for each IP Subnet as described in *Configuring the RFC-1577 Logical IP Subnet(s)* on page 17.
5. Configure this system's TCP/IP environment for the RFC-1577 IP Subnet as described in *RFC-1577 TCP/IP Configuration* on page 23.
6. Reboot.

Several utilities are available for monitoring and configuring the RFC-1577 parameters. The following table lists the utilities included with the RFC-1577 SVC driver software:

Table 1-5. DG/UX RFC-1577 Software Utilities

Utility	Description
iastat	Displays adapter statistics
ipatmconfig	Configures client/server
ipatmdbg	Displays driver information
sigdbg	Enables/disables signaling debug output
signald	UNI 3.0/3.1 ILMI and signaling daemon
sigstat	Displays link/connection status

See the manual pages supplied with the software for detailed information about these utilities.

Continue the installation with the instructions in the next section.

Configuring the RFC-1577 Logical IP Subnet(s)

The RFC-1577 driver must know the ATM network address of the endstation to which the ARP server is connected. If the ARP server is connected to the machine you are configuring, this machine is the *ARP server* for your network. Otherwise, the station is an *ARP client* to a server located elsewhere on the network.

When the system is powered up, the RFC-1577 driver software compares the network address of the station to the network address of the ARP server. If the two addresses are the same, this system acts as the ARP server. If the addresses do not match, the station becomes a client and places a call to the ARP server to establish a connection.

To configure the ARP Client/Server, do the following:

1. Obtain the ARP server's MAC address and write it down **in its expanded format. The leading zero must be included to form 6 bytes of two hexadecimal digits each.**

The MAC address **0:0:77:84:40:ae** in our example is an abbreviation of the expanded **00:00:77:84:40:ae**.

2. Using vi or your favorite editor, modify the configuration parameters in the **/etc/atmconf.X** file to the correct values, where **X** is 0 for the first adapter in the system, 1 for the second, and so forth.

A sample **atmconf.X** file follows:

```
ilmi: 1
ilmiprefix: 39000000000000000000000000000000
maxberate: 149
arpprefix: 39123412123456000012341234
arpsisel: 000077FFFFFF700
arpipaddr: 180.180.180.180
arpipmask: 255.255.255.0
clientipaddr: 180.180.180.180
```

Figure 1-2. Sample Default atmconf.X File

Each **atmconf.X** file contains default values for the configuration parameters. The appropriate parameters must be set to the values required for your ATM network. For RFC-1577, the parameters **arpprefix**, **arpsisel**, **arpipaddr**, **arpipmask**, and **clientipaddr** are used to configure the ARP Client/Server. The **unirev** parameter is used to configure the UNI Signaling version. The following parameters are supported:

- **ilmi:** The *ilmi* parameter can have two values: 0 and 1. If the value is 0, then **ILMI** is disabled. Otherwise, **ILMI** is enabled and the network prefix will be obtained from the switch.
- **ilmiprefix:** If **ILMI** is disabled, this parameter determines what network prefix will be used. The value is specified as a sequence of 13 hexadecimal octets. Each octet is significant and all 13 octets **must** be specified.
- **maxberate:** Some switches cannot accept *best effort* connection at the full interface line rate. In addition, you may want to configure an interface to run at less than the maximum line rate. This parameter is used to set the maximum cell rate that is used in signaling Classical IP connections.

- **arpprefix:** The RFC-1577 ARP Server ATM address will depend on the network prefix of the switch the ARP server is connected to. If the ARP server is connected to the same switch as the end system, this value will be the same as the end system's network prefix. The network prefix can be determined from the ATM switch's configuration.
- **arpesisel:** The RFC-1577 ARP Server ESI/SEL address is the ARP Servers MAC address plus the selector value. The SEL value can be any value from 00 to FF, but must match what the client will use. This means that all clients and the ARP Server must have the same values for the *arpprefix* and *arpesisel* parameters.
- **arpipaddr:** The RFC-1577 ARP Server IP address depends on the subnet the ARP Server belongs to.
- **arpipmask:** The RFC-1577 ARP Server IP mask depends on what network subnet the ARP Server belongs to.
- **clientipaddr:** The RFC-1577 Client IP address depends on what subnet this client belongs to. This IP address should belong to the same subnet the ARP Server is connected to.
- **unirev:** The *unirev* parameter can have two values, 30 and 31. If *unirev* is 30, the adapter is configured for UNI3.0 signaling. If *unirev* is 31, the adapter is configured for UNI3.1 signaling.

**Note**

If this system is to be the ARP Server, the values for the *arpipaddr* and *clientipaddr* parameters are the same.



You can obtain these parameter values from your network administrator or from your ATM switch configuration.

3. Enter the ATM network address for the ARP server.

The network address for the ARP server uses two parameters in the **atmconf.X** file.

The **arpprefix** parameter represents the *network prefix* of the ATM switch to which the ARP server is connected.

The second parameter, **arpesisel**, represents the *ESI/SEL* portion of the network address and consists of the MAC address for the ATM adapter (to which the ARP server is connected) plus a two-digit *selector* value.

The ARP server can be connected to the 5515 adapter you are currently configuring. In this case, you will need the network prefix of the ATM switch to which the adapter is connected and the MAC address of the 5515 adapter itself.

To enter the ATM address for the ARP server, using vi or your favorite editor, edit the **/etc/atmconf.X** file, and edit the following two parameters obtained from your network administrator:

a. Edit the **arpprefix parameter.**

The prefix is 26 hexadecimal digits in length. The default value as shown in Figure 1-2 on page 18 must be changed to the correct value for your ATM network. For example, an ARP server located in a station connected to an ATM switch with a network prefix of 4700dd01123456000043214321 requires the following entry:

```
arpprefix:4700dd01123456000043214321
```

b. Edit the **arpesisel parameter.**



This is the ESI/SEL value for the ATM adapter to which the ARP server is connected. The ESI portion of the value is the MAC address of the ATM adapter. The SEL value is normally zero, but can be any hexadecimal value from 00 to FF.

To obtain the correct ESI/SEL value, use the MAC address from step 1. Delete the colons and add an SEL value of **00** to the end of the string. Using our sample MAC address of **00:00:77:84:40:ae** for the local adapter, the entry is as follows:

```
arpesisel: 0000778440ae00
```

The RFC-1577 driver combines the **arpprefix** and **arpesisel** parameters to form the ATM network address of the adapter to which the ARP server is connected. Our sample entries for the ARP server yield a network address of:

```
4700dd011234560000432143210000778440ae00
```

4. Edit the **arpipaddr** parameter for the IP address of the ARP server.

Replace the default value of 180.180.180.180 with the actual IP address of the ATM adapter to which the ARP server is connected. For example, if the ARP server is connected to an endstation with an IP address of 123.1.2.152, the entry is:

```
arpipaddr: 123.1.2.152
```

5. Edit the **arpipmask** parameter for the IP netmask.

The default value of **255.255.255.0** is the **most common mask for the subnet**. If your mask is different, change the value accordingly. For example, if your subnet mask is 255.255.40.0, the entry is

```
arpipmask: 255.255.40.0
```

6. Edit the `clientipaddr` parameter for the IP address of the ARP client.

Replace the default value of 180.180.180.180 with the IP address of the 5515 adapter you are configuring. For example, if the IP address is 123.1.2.150, the entry is

`clientipaddr: 123.1.2.150`

7. Add/edit the `unirev` parameter if UNI 3.1 signaling is required or if the subnet is being reconfigured to use UNI 3.0 Signaling (the default is UNI 3.0). For example:

`unirev: 31`

A sample **atmconf.X** file is shown in Figure 1-3 on page 22 for a 5515 adapter which has an ARP server connected. This is the only case where the **arpipaddr** and **clientipaddr** parameters are the same.

```
ilmi: 1
ilmiprefix: 39000000000000000000000000000000
maxberate: 149
arpprefix: 4700dd01123456000043214321
arpesisel: 0000778440ae00
arpipaddr: 123.1.2.150
arpipmask: 255.255.255.0
clientipaddr: 123.1.2.150
unirev: 31
```

Figure 1-3. Sample atmconf.X File After Editing

RFC-1577 TCP/IP Configuration

**Note**

See *Managing TCP/IP on the DG/UX System*. This manual explains how to prepare for setup of Data General's TCP/IP (DG/UX) package on DG/UX computer systems. It also discusses how to tailor the software for your site, how to use `sysadm` to manage the package, and how to troubleshoot system problems.

Use the **`admipinterface -o add ciX`** command to add the ATM interface to the `/etc/tcpip.params` file, where **X** matches the `/etc/atmconf.X` instance number. So for your first 5515 adapter, you would enter **`admipinterface -o add ci0`**

TCP/IP requires this unit number. The **`admipinterface`** command creates an instance of the cloneable device, `/dev/ci`, using the unit number you supply.

See the DG/UX **`admipinterface(1M)`** man page for details about the other **`admipinterface`** command parameters.

A sample ATM interface entry in the `/etc/tcpip.params` file would be displayed by the **`admipinterface -o list`** command as:

```
Hostname: snafu-atm
Interface: ci0
DEVICE: ci0
Network Mask: 0xffffffff00
Broadcast Address: 123.1.2.255
Link Protocol: ether
IXE template: N/A
```



DG/UX RFC-1483 PVC Software

Baud Rate: N/A
Group: default
Status: DETACHED

When the installation is complete, reboot the system: **reboot**



Note

If the running DG/UX kernel already includes the necessary drivers, a reboot may not be necessary. Instead the network may be started by the appropriate change of the system *init* level or with the *admipinterface -o attach* command.

The installation of the RFC-1577 driver is now complete.



DG/UX RFC-1483 PVC Software



The DG/UX RFC-1483 ATM software driver for the 5515 adapter is designed for PVC-configured networks. In this environment, the network connectivity between two endstations is statically configured in the switch (or switches) and the PVC VCI for each remote station is then configured on each endstation.

The DG/UX PVC software driver supports only IP interfaces. IP datagrams are enclosed in an LLC/SNAP frame as defined in RFC-1483, and then encoded in an AAL5 frame for transmission. Any other endstation following this convention should be able to interoperate with the system. Alternately, the IP datagrams can be null-encapsulated. The encapsulation method is specified using the **pvcarp** command. (See *Setting Up PVCs on DG/UX Systems* on page 27.)

There is no support for IP multicast or IP broadcast.



RFC-1483 System Requirements

Installing the 5515 adapter software requires a system with the following:

- A superuser login.
- A hostname and IP address for the ATM LAN subnet.



Note

The hostname and IP address will be used in */etc/hosts*, */etc/tcpip.params*, and with other commands and files.

Installing RFC-1483 Software

All of the software required for RFC-1483 PVC is included in the base DG/UX System Release R4.11MU03 software package. There is no DG/UX installation media included with the 5515 adapter.

To install the RFC-1483 PVC software for the 5515 adapter, do the following:

1. Log in as **root**.



Note

The DG/UX installer or *sysadm* kernel's *sysadm->system->kernel->config_and_build* menus will normally automatically create *ia* device system file entries for any adapters installed in the chassis of the AViiON system. See the */usr/etc/probedevtab* file for the table of all possible device names. The *pa()* driver must be added to the device configuration file.

2. Build a DG/UX custom kernel whose **system.devices** file includes:
 - **pa()**
 - **ia**(pci([0-1]), [0-1f]) and/or
 - **ia**(cpci([0-1]),[0-1f]) and/or
 - **ia**(xpci(pci([0-1]),[0-1f]),[0-1f])
3. Configure the RFC-1483 ATM PVC configuration files for each IP subnet as described in *Setting Up PVCs on DG/UX Systems* on page 27.
4. Configure this system's TCP/IP environment for the RFC-1483 IP subnet as described in *RFC-1483 TCP/IP Configuration* on page 28.
5. Reboot.

The following table lists the utilities included with the RFC-1483 PVC driver software:

Table 1-6. RFC-1483 Software Utilities

Utility	Description
iastat	Displays adapter statistics
pvcarp	IP address to VCI mapping

After the configuration is complete, reboot the system using the following command:

reboot

The installation of the RFC-1483 PVC software driver is complete. You must now configure the PVCs for the 5515 adapter as explained in the next section.

Setting Up PVCs on DG/UX Systems

This section describes how to set up Permanent Virtual Circuits (PVCs) on systems running DG/UX Release R4.11MU03. This must be done on all systems on the network.

In the Interphase PVC implementation used by the DG/UX system, the correlation between a remote endstation (IP address) and a PVC VCI is done via the standard system ARP table. The **pvcarp(1M)** command is used to configure the ARP table for all endstations on the network that the local host is to communicate with.

The **pvcarp(1M)** command is also used to configure the VC tables used by the 5515 adapter to support these connections. This can be done by using either vi or your favorite editor to add, delete, or modify entries in the **/etc/atmpvctab.X** file, where **X** is the instance number of the 5515 adapter. You create this file by either copying it from the **/etc/atmpvctab.proto** file which contains sample entries, or using the interactive **pvcarp -f /etc/atmpvctab.X** command. ARP and InARP are not supported, so the ARP table *must* be configured before two end points can communicate with each other.

VCI Mapping

The method used for VCI mapping is to encode the VCI number, and other information about a PVC connection, as a MAC address, and enter it in the system ARP table. The **pvcarp(1M)** command can do this for you, as well as allow you to view, remove, or update this information. See the **pvcarp(1M)** man pages for interface details.

Since the ARP table is memory-resident, it must be reconfigured upon each system boot. To facilitate this, **pvcarp(1M)** has a file input option that allows the network configuration to be defined and read from a single file.



RFC-1483 TCP/IP Configuration



Note

See *Managing TCP/IP on the DG/UX System*. This manual explains how to prepare for setup of Data General's TCP/IP (DG/UX) package on DG/UX computer systems. It also explains how to tailor the software for your site, use `sysadm` to manage the package, and troubleshoot system problems.

Use the `admipinterface -o add paX` command to add the ATM interface to the `/etc/tcpip.params` file, where **X** matches the 5515 adapter instance number. So for your first 5515 adapter, you would enter `admipinterface -o add pa0`

TCP/IP requires this unit number. The `admipinterface` command creates an instance of the cloneable device, `/dev/pa`, using the unit number you supply.

See the DG/UX `admipinterface(1M)` man page for details about the other `admipinterface` command parameters.

A sample ATM interface entry in the `/etc/tcpip.params` file would be displayed by the `admipinterface -o list` command as:

```
Hostname: snafu-atm
Interface: pa0
DEVICE: pa0
Network Mask: 0xffffffff00
Broadcast Address: 128.222.5.255
Link Protocol: ether
IXE template: N/A
Baud Rate: N/A
```



```
Group: default
Status: DETACHED
```

When the installation is complete, reboot the system: **reboot**

DG/UX pvcarp Command Examples

The following examples illustrate IP communications between endstations over PVC connections. VC numbers can range from 0 to 2047, inclusive; VCs 0-31 are reserved and not available to the end user.

To set up PVCs, which must be reconfigured each time the system is booted, type:

```
pvcarp -s <hostname or IP address of other node> \
        <vci_num> <rate_in_mbits> <llc_snap (y/n)>
```

To set up permanent PVCs, add PVC entries to the **/etc/atmpvctab** file.

Example **/etc/atmpvctab** file:

```
#
# IP address to VC number table
# For Interphase S/ATM 5515 PVC package.
#
# IP    VCI number  [Rate] [LLC/SNAP (y/n)]
#
sys1-atm    32
sys2-atm    33        10
sys3-atm    34        10
sys4-atm    35        20        N
sys5-atm    36        6         N
```

PVC Setup Examples

The following example illustrates the use of **pvcarp** to set up PVCs in a back-to-back configuration.

Example 1—Back-to-Back Systems Configuration

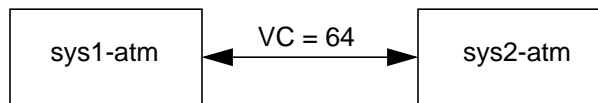


Figure 1-4. PVC Setup for a Back-to-Back Configuration

On system 1, type:

```
sys1-atm# pvcarp -s sys2-atm 64
```

On system 2, type:

```
sys2-atm# pvcarp -s sys1-atm 64
```

In order for the PVCs to automatically be configured each time the system is booted, add the following PVC entry to the **/etc/atmpvctab** file on system 1 and on system 2:

```
sys2-atm 64
```

The following example illustrates the use of **pvcarp(1M)** to set up PVCs in a system-to-switch configuration.

Example 2—System-to-Switch Configuration

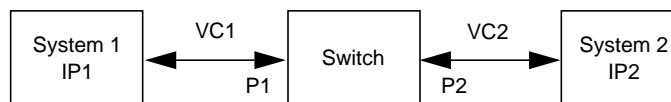


Figure 1-5. PVC Setup for a System-to-Switch Configuration

P1 is the switch port to which system 1 is connected.

P2 is the switch port to which system 2 is connected.

IP1 is the IP address of system 1.

IP2 is the IP address of system 2.

- VC1 is the VC number of the link between system 1 and the switch for the PVC connection between systems 1 and 2.
- VC2 is the VC number of the link between system 2 and the switch for the PVC connection between systems 1 and 2.

On the switch, make a PVC connection between ports P1 and P2. For this PVC connection, the VC number for port 1 is VC1 and the VC number for port 2 is VC2.

- If you are **not** using **/etc/atmpvctab** to enter your host names and VC numbers:

On system 1, type:

```
pvcarp -s <IP2> <VC1>
```

On system 2, type:

```
pvcarp -s <IP1> <VC2>
```

- If you are using the **/etc/atmpvctab** to automatically configure each system at bootup, add the following entries to the **/etc/atmpvctab** on each system:

On System 1, enter:

```
IP2 VC1
```

On System 2, enter:

```
IP1 VC2
```

Systems 1 and 2 are now set up to do networking commands, such as telnet and ftp, between them.

Each system can be connected to multiple systems over separate PVC connections. Establish a PVC between any two systems that need to communicate with each other, as described above.



Remember to set up the PVC connections in the switch.

Note

PVC Transmission Rate and IP Encapsulation

If data transmission exceeds the aggregate line rate of a PVC, the switch will be forced to drop cells destined for that PVC. To minimize the need to drop cells, it may be necessary to manually configure the transmission rate for each PVC.

If, in the system-to-switch configuration shown in Figure 9-6, *PVC Setup for a System-to-Switch Configuration*, all PVCs are using the default configuration for the available line rate, and if system 1 and system 2 simultaneously send large streams of data to system 3, the switch would have to drop some of the arriving data. However, if the transmission rates for system 1 and system 2 were set such that their sum was less than or equal to the rate of system 3, no data would have to be dropped.

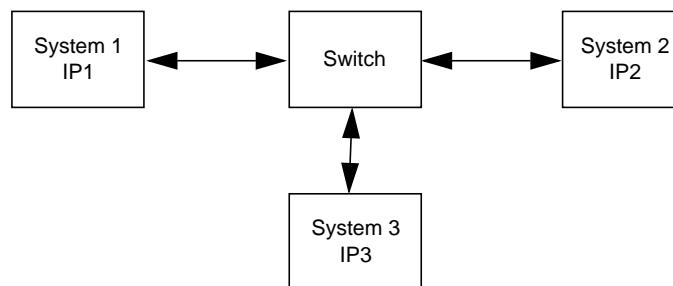


Figure 1-6. PVC Setup for a System-to-Switch Configuration

Manually configuring transmission rates is also an effective way to limit resources for a particular PVC connection. In this way, a PVC connection for a low-priority application could be constrained from using bandwidth needed by another PVC on the same host.

The **pvcarp** command can be used to assign transmission rates to PVCs at the time the PVCs are defined. With the DG/UX driver, this is accomplished with the **pvcarp** command as follows:

```
pvcarp -s <hostname or IP address of other node> \  
          <vci_num> <rate_in_mbits> <llc_snap (y/n)>
```

A `vci_num` must be specified and can be entered in decimal or hexadecimal format (for example, 64 or 0x40).

`rate_in_mbits` specifies the PVC transmission rate. Specifying the rate is optional. If no rate is specified, a best effort rate will be assigned based on the available bandwidth. There are five rates, a default rate and four user-definable rates. The default rate is known as a *best-effort-rate*. If no other rates are defined, the default rate will be used. The best-effort-rate will operate at the line rate while there are no other rates defined requiring data to be transmitted.

Use `rate_in_mbits` to define up to four additional rates. The first time a rate is used in a `pvcarp` command, the rate is registered in the driver and a corresponding rate queue is configured. Subsequent PVCs defined with the same rate will be associated with this rate queue. In other words, frames transmitted on these PVCs are sent at the rate associated with the rate queue. Multiple frames are queued and transmitted in a first-in-first-out (FIFO) order.

Moving the Adapter to a New Slot

The sum of the rates defined *must* not exceed the available line rate. If the sum exceeds the available line rate, the transmission rates can no longer be guaranteed, and data can be dropped. You must ensure that no more than four unique rates are defined. These rates are unrelated to data reception.

`llc_snap` is optional. This field is used to specify Null IP encapsulation or LLC/SNAP encapsulation. If no encapsulation method is specified, the default is LLC/SNAP.

Examples

For example, to define the remote system `grumpy-atm` to be associated with VC 64 on link zero, using the default best effort, or unspecified bit rate, and default IP LLC/SNAP encapsulation, the following command could be issued:

```
pvcarp -s grumpy-atm 64
```

The same result can be obtained with:

```
pvcarp -s grumpy-atm 64 y
```

To define the remote system `sneezy-atm2`, associated with VC 128 on the second ATM link with a 33 Mbps rate and null IP encapsulation, issue the following command:

```
pvcarp -s grumpy-atm2 128 33 n
```

Moving the Adapter to a New Slot

1. Shut down the system and turn the power off.
2. Physically move the board to another slot.
3. Turn the power on.
4. Reboot the machine.

5. Reconfigure/modify the appropriate LAN Emulation, Classical IP over ATM, PVC, and/or TCP/IP configuration files.
6. Build a new custom DG/UX kernel if the appropriate software and hardware driver(s) for the 5515 adapter(s) have not been installed previously.

DG/UX ATM Manual Pages

The following manual pages are available for the DG/UX LAN Emulation, RFC-1577 SVC, and RFC-1483 PVC software drivers. The man pages are available online once the DG/UX System Release R4.11MU03 software is installed:

atmbind(1M): Bind ATM to the STREAM Utility
atmconf(4): LANE or RFC-1577 Adapter Configuration File
ci(7): Classical IP STREAMS Driver
ia(7): 5515 Adapter Device Driver
iastat(1M): Adapter Device Driver Statistics
ipatmconfig(1M): Reconfigure RFC-1577 Client
ipatmdbg(1M): RFC-1577 Debug Information
ipatmsetup(1M): RFC-1577 Setup Utility
lanesetup(1M): LANE Setup Utility
learp(1M): LANE MAC Address Resolution
lec(1M): LANE Client Configuration
leconf(4): LANE Client Configuration File
ledbg(1M): LANE Client Tables
li(7): LANE STREAMS Driver
pa(7): RFC-1483 PVC STREAMS Driver
pvcarp(1M): PVC ARP Utility
pvcsetup(1M): PVC Setup Utility
sigdbg(1M): Toggles for Debug Output



DG/UX ATM Manual Pages

signald(1M): UNI, ILMI, & Signaling Manager
sigstat(1M): SVC Statistics

