Asynchronous Transfer Mode (ATM) Administrator's Guide

SG–2193 1.0

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Preface

This publication documents Asynchronous Transfer Mode (ATM) transmission technology, release 1.0, running on Cray Research systems with an IOS model E and on CRAY J90 and CRAY EL series systems. For Cray Research systems with an IOS model E, software support for ATM technology is included in the UNICOS 9.0 release and later. For CRAY EL series systems, software support for ATM technology is included in the UNICOS 8.0.4A release and later. For CRAY J90 series systems, software support for ATM technology is included in the UNICOS 8.0.4.1 release and later.

This publication describes the Bus Based Gateway (BBG) and VME interfaces used with ATM 1.0.

Related publications

The following documents contain additional information that may be helpful:

- *UNICOS Installation/Configuration Menu System User's Guide*, publication SG–2412
- *UNICOS Installation and Configuration Tool Reference Manual*, publication SR–3090

The *User Publications Catalog*, publication CP–0099, describes the availability and content of all Cray Research hardware and software manuals that are available to customers.

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Conventions

The following conventions are used throughout this manual:

Convention	Meaning
`command`	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
`manpage(`*x*`)`	Man page section identifiers appear in parentheses after man page names. The following list describes the identifiers: 1 User commands 1B User commands ported from BSD 2 System calls 3 Library routines, macros, and opdefs 4 Devices (special files) 4P Protocols 5 File formats 7 Miscellaneous topics 7D DWB-related information 8 Administrator commands
variable	Italic typeface denotes variable entries and words or concepts being defined.
`user input`	This bold fixed-space font denotes literal items that the user enters in interactive sessions. Output is shown in nonbold, fixed-space font.
[ ]	Brackets enclose optional portions of a command line.
...	Ellipses indicate that a preceding command-line element can be repeated.
KEY	This convention indicates a key on the keyboard.

The following machine naming conventions may be used throughout this manual:

Term	Definition
Cray PVP systems	All configurations of Cray parallel vector processing (PVP) systems, including the following: CRAY C90 series (CRAY C916, CRAY C92A, CRAY C94, CRAY C94A, and CRAY C98 systems) CRAY C90D series (CRAY C92AD, CRAY C94D, and CRAY C98D systems) CRAY EL series (CRAY Y-MP EL, CRAY EL92, CRAY EL94, and CRAY EL98 systems) CRAY J90 series (CRAY J916 and CRAY J932 systems) CRAY T90 series (CRAY T94, CRAY T916, and CRAY T932 systems) CRAY Y-MP E series (CRAY Y-MP 2E, CRAY Y-MP 4E, CRAY Y-MP 8E, and CRAY Y-MP 8I systems) CRAY Y-MP M90 series (CRAY Y-MP M92, CRAY Y-MP M94, and CRAY Y-MP M98 systems)
Cray MPP systems	All configurations of Cray massively parallel processing (MPP) systems, including the CRAY T3D series (CRAY T3D MC, CRAY T3D MCA, and CRAY T3D SC systems)
All Cray Research systems	All configurations of Cray PVP and Cray MPP systems that support this release
SPARC systems	All SPARC platforms that run the Solaris operating system version 2.3 or later

The default shell in the UNICOS 9.0 release, referred to in Cray Research documentation as the standard shell, is a version of the Korn shell that conforms to the following standards:

- Institute of Electrical and Electronics Engineers (IEEE) Portable Operating System Interface (POSIX) Standard 1003.2–1992
- X/Open Company Standard XPG4

The UNICOS 9.0 operating system also supports the optional use of the C shell.

The POSIX standard uses *utilities* to refer to executable programs that Cray Research documentation usually refers to as *commands*. Both terms appear in this document.

In this publication, *Cray Research*, *Cray*, and *CRI* refer to Cray Research, Inc. and/or its products.

Online information

The following types of online information products are available to Cray Research customers:

- CrayDoc online documentation reader, which lets you see the text and graphics of a manual online. The CrayDoc reader is available on workstations. To start the CrayDoc reader at your workstation, use the `cdoc`(1) command.
- Docview text-viewer system, which lets you see the text of a manual online. The Docview system is available on the Cray Research mainframe. To start the Docview system, use the `docview`(1) command.
- Man pages, which describe a particular element of the UNICOS operating system or a compatible product. To see a detailed description of a particular command or routine, use the `man`(1) command.
- UNICOS message system, which provides explanations of error messages. To see an explanation of a message, use the `explain`(1) command.
- Cray Research online glossary, which explains the terms used in a manual. To get a definition, use the `define`(1) command.

- `xhelp` help facility. This online help system is available within tools such as the Program Browser (`xbrowse`) and the MPP Apprentice tool.

For detailed information on these topics, see the *User's Guide to Online Information*, publication SG–2143.

Reader comments

If you have comments about the technical accuracy, content, or organization of this manual, please tell us. You can contact us in any of the following ways:

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We value your comments and will respond to them promptly.

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Introduction [1]

Asynchronous Transfer Mode (ATM) is a network technology that allows voice, data, and video transmission across a single medium. ATM technology offers a universal network connection for supercomputers, and also enables new applications for multimedia user interfaces, geographic independence of client-server resources, and ease of relocatable network modes.

Because off-the-shelf ATM hardware components do not fit into traditional Cray Research architectures, Cray Research has developed an external network adapter, a Bus Based Gateway (BBG), for these systems. The ATM interface for the CRAY EL series is called the Native ATM interface. This system uses a traditional VME interface for ATM technology. Software support for BBG technology is included in the UNICOS 9.0 release and later. Software support for Native ATM technology for the CRAY EL series is included in the UNICOS 8.0.4A release and later. Software support for Native ATM technology for the CRAY J90 series is included in the UNICOS 8.0.4.1 release and later.

This manual describes the BBG and VME interfaces used with ATM 1.0 and includes the following sections:

- Network requirements for BBG and VME interfaces
- Installation of BBG and VME interfaces
- Glossary of terms associated with ATM technology

The Cray Research product name *ATM* is derived from and is used interchangeably with the transmission technology Asynchronous Transfer Mode.

Network Requirements [2]

This section describes the Asynchronous Transfer Mode (ATM) network and the hardware and software requirements for the Bus Based Gateway (BBG) and VME interfaces.

Cray Research supports the following types of ATM interfaces:

- Optical carrier 3 (OC3), a 155Mbit/s interface that can run in synchronous optical network (SONET) or synchronous digital hierarchy (SDH) framing
- Transparent asynchronous transmitter/receiver interface (TAXI), a 100Mbit/s interface

Figure 1 shows an ATM network configuration with both BBG and VME interfaces used for Cray connectivity to ATM networks.

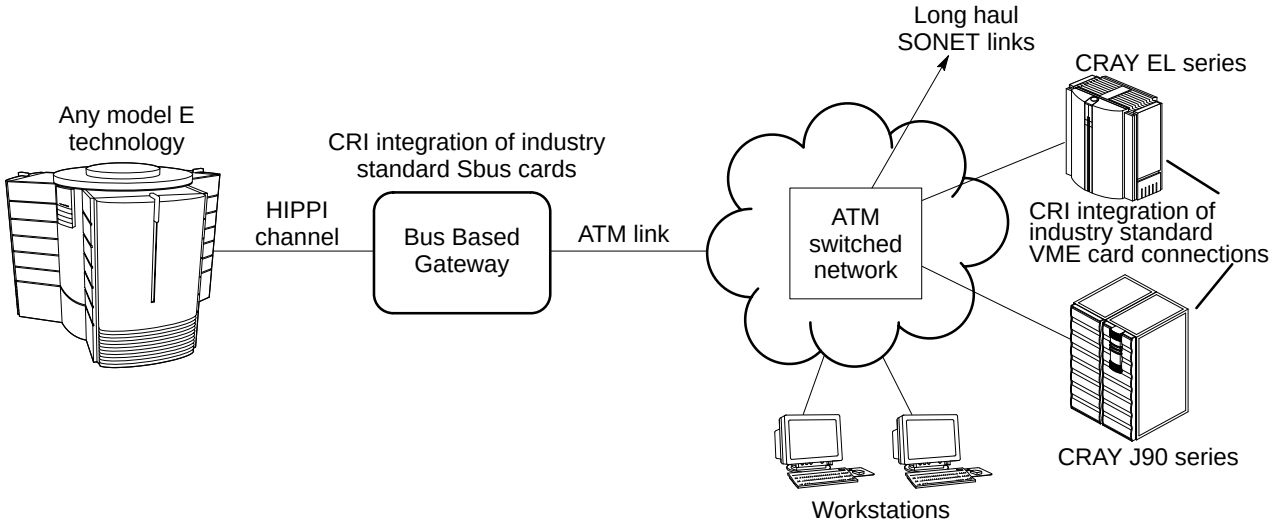

Figure 1. Network configuration with ATM

BBG interface
2.1

This subsection describes BBG hardware and software requirements.

BBG hardware requirements
2.1.1

The Cray Research Bus Based Gateway (BBG) differs from traditional external network adapters in that the resident ATM interface appears to be integral to the Cray I/O subsystem (IOS). After the BBG is initialized, you can manage the ATM interface cards in the BBG by using `ifconfig`(8), `netstat`(1B), and other UNICOS commands.

The following components comprise the Cray Research BBG interface:

- BBG cabinet
- HIPPI Sbus (source and destination) card
- ATM Sbus card

Any Cray Research system with an IOS model E can interface to an ATM channel by using the BBG for connectivity. However, besides using this external adapter, your site must also have the following hardware:

- IOS-E High Performance Parallel Interface (HIPPI) channel (HCA-3/HCA-4) running at 100 Mbyte/s. To support more than one BBG, you must use a HIPPI switch or multiple HIPPI channels.
- 62.5/125 micron multimode fiber with an appropriate connecting Square Connector (SC) or Straight Tip (ST) connector.

BBG software requirements
2.1.2

The Bus Based Gateway (BBG) software requirements include the UNICOS 9.0 release or later and the BBG asynchronous software included in the `bbgrel.tar` file. To install the BBG asynchronous software, see subsection 3.2.4, page 11.

Figure 2 shows the relationship of the functional software units to the BBG interface.

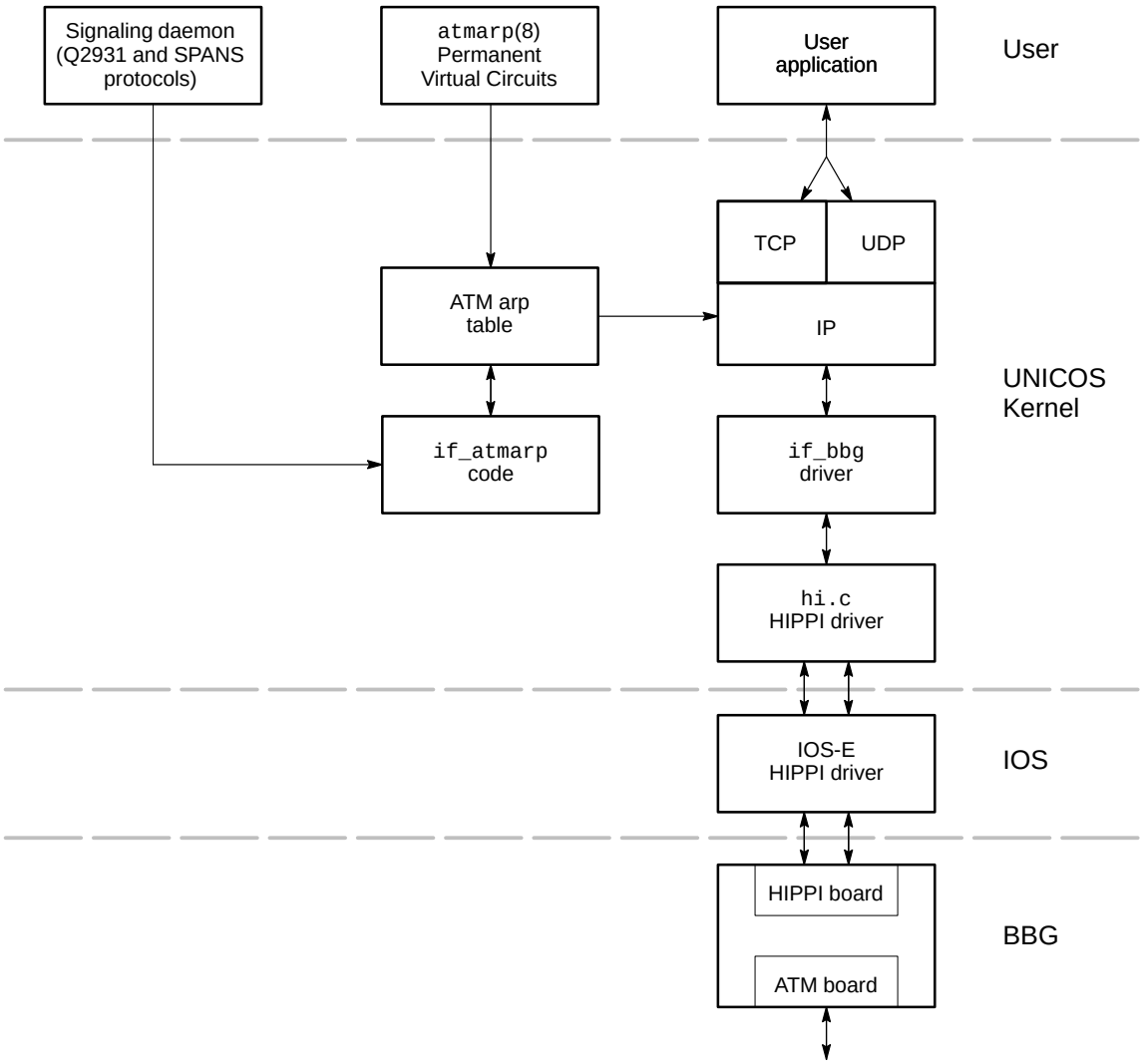

Figure 2. BBG functional software units

The following commands are unique to the BBG and can be found in the `/usr/lbin/bbg/bin` directory after you have installed the BBG software as described in subsection 3.2, page 10:

- `bbgatmstat`(8)
- `bbgconfig`(8)
- `bbghwconfig`(8)
- `bbgoc3config`(8)

Man pages are provided for these commands.

The following command can be found in the `/etc` directory:

- `bbgstart`(8)

A man page is provided for this command.

The following man page is provided as an introduction to BBG functionality:

- `bbg`(4)

VME interface
2.2

This subsection describes VME hardware and software requirements.

VME hardware requirements
2.2.1

Hardware requirements for the VME interface include a system in the CRAY EL series with the following features:

- A maximum of 16 ATM modules per system
- 62.5/125 micron multimode fiber with an appropriate connecting SC or ST connector
- One or more open IOS slots

To achieve maximum performance, it is recommended that only one ATM card be placed in each IOP.

VME software requirements
2.2.2

Software requirements for the VME interface include the following:

- IOS microcode file.
- IOS driver.
- UNICOS 8.0.4A release or later for CRAY EL systems; UNICOS 8.0.4.1 release or later for CRAY J90 systems (UNICOS release includes `atmadmin`(8) and `atmarp`(8) commands).

Figure 3 shows the relationship of the functional software units to the VME interface.

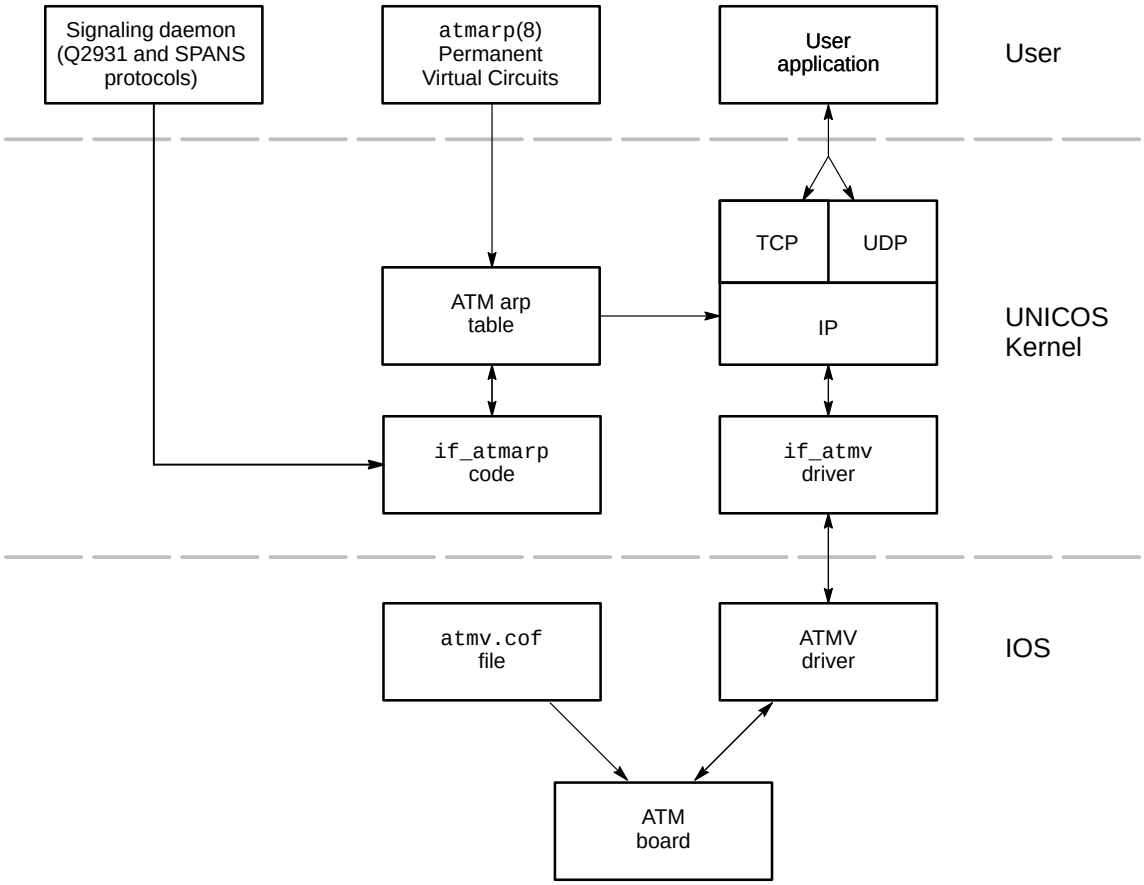

Figure 3. VME functional software units

Installation [3]

This section contains general installation information, and describes installation procedures for Bus Based Gateway (BBG) and VME (also called Native ATM) interfaces. See subsection 3.2, page 10, for information on installing BBG interfaces, and see subsection 3.3, page 29, for information on installing VME interfaces.

Installation information
3.1

This subsection contains general installation information that you might need when you install an ATM interface.

Installer qualifications
3.1.1

To install the ATM interface, you should be familiar with the hardware and software for the system on which the ATM is to be installed. Prior experience in upgrading or installing the UNICOS operating system on a Cray Research system is advised. To configure ATM by using the UNICOS Installation/Configuration Menu System, prior knowledge of this menu system is required. (See the *UNICOS Installation and Configuration Tool Reference Manual*, publication SR–3090, for details.)

Removed parts disposition
3.1.2

If you remove parts, return the removed parts to the following address:

Cray Research Inc.
1000 Halbleib Road
Chippewa Falls, WI 54729
USA
Attn., REM

Spares issues
3.1.3

The Cray Research Logistics department reviews all field upgrade notices (FUNs) and determines whether to place spare parts at the country, parts banks, or local depot levels. Contact your local Logistics personnel for local spare parts issues.

Incident reporting
3.1.4

After the upgrade has been installed, the site must complete upgrade incident information within the appropriate database.

Installing a BBG interface
3.2

The following subsections contain the following procedures to install, configure, and test a BBG interface on a Cray Research system with an IOS model E (IOS-E) system:

1. Install UNICOS software
2. Install and verify the HIPPI channel
3. Install the BBG hardware
4. Build the BBG asynchronous software
5. Configure UNICOS for the BBG interface
6. Verify and test the BBG interface

Step 1: Install UNICOS software
3.2.1

Your Cray Research system must be running UNICOS release 9.0 or later. If this is not the case, follow the appropriate UNICOS release 9.0 installation instructions.

Step 2: Install and verify the HIPPI channel
3.2.2

To install the HIPPI channel, follow the instructions in section 3 of the *HIPPI Channel Administrator's Guide*, publication SG–2159. Follow the step-by-step instructions that describe the HIPPI channel installation on Cray Research systems with an IOS-E system.

To verify the HIPPI installation, perform the following steps. If any of the steps fail, correct the failure before moving to the next step. Success of these steps verifies that the HIPPI hardware and software are properly installed.

1. Run the offline HIPPI diagnostics. This step must be performed by the engineer-in-charge (EIC).
2. Attach a HIPPI loopback device to the HIPPI drop cables and run the `/etc/vht` command (see `vht`(8) for options).
3. Attach the HIPPI extension cables and again attach the HIPPI loopback device and execute the `/etc/vht` command.
4. If HIPPI switches are being used, determine the I-field for the Cray Research system, and run the `/etc/vht` command with the *I-field* option. Using the *I-field* option causes the switch to loop the data back to the Cray Research system.

Step 3: Install the BBG hardware
3.2.3

Connect the BBG to the HIPPI channel (or switch) and power it on. Ensure that the BBG front panel LCD display shows the BBG banner and the right hand LED begins to flash on and off about once every second. This will take a few seconds to occur. Following is an example of a BBG banner:

```
BBG V1.0 <ROM>
04/13/95 CRAY-BBG
```

Step 4: Build the BBG software
3.2.4

Copy the BBG software tar file, `bbgrel.tar`, into the directory in which the source will reside. Execute the following commands to extract and install the BBG software:

```
tar xvf bbgrel.tar
install_bbg
```

These commands install the BBG software in the `/usr/lbin/bbg` directory.

Step 5: Configure UNICOS for the BBG interface
3.2.5

To configure the UNICOS operating system for the BBG interface, you can use the UNICOS installation tool (see the following subsection), or you can configure the files manually (see subsection 3.2.5.2, page 22).

Using the installation tool to configure the BBG interface 3.2.5.1

This subsection describes the steps needed to configure the BBG interface by using the UNICOS installation tool. For information on how to use the installation tool, see the *UNICOS Installation/Configuration Menu System User's Guide*, publication SG–2412, and the *UNICOS Installation and Configuration Tool Reference Manual*, publication SR–3090.

When you configure the BBG interface in the UNICOS operating system, you will be updating the following files:

- `/etc/hosts`
- `/etc/networks`
- `/etc/config/interfaces`
- `/etc/config/bbg.config`
- `/etc/config/bbg.pvc`

To configure the BBG interface by using the installation tool, perform the following steps:

1. Enter the UNICOS Installation/Configuration Menu System by entering the following command:

   ```
   /etc/install/install
   ```

2. Once you are in the UNICOS Installation/Configuration Menu System, it is recommended that before you configure anything with this menu system, you use the `import` utility to update the system configuration. To import the current system configuration into the menu system, go to the `Import Options` option, as shown:

   ```
   UNICOS Installation/Configuration Menu System
   .    Utilities
   .    .    Import Utility
   .    .    .    Import Options
   ```

3. Set the import options to the following values:

```
              Import Options

S->   Import root mount point
      Stop import on error?              YES
      Import host or guest versions?     host
      Reload default import table ...
```

4. Exit the `Import Options` option and select the `Import Table` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Utilities
.    .    Import Utility
.    .    .    Import Table
```

Set to `NO` any `Import?` field parameters that your site does not use. Set the following `Import?` field parameters to `YES`:

```
                                Import Table

      Class      Description       Import?    Program       Options
      -----      -----------       -------    -------       -------
E->   HARDWARE   Param             YES        hdwparam.     sh-i $RELEA
      KERNEL     Config.h uts      YES        utsconfh.sh   -i $RELEA
      KERNEL     Param uts         YES        utsparam.sh   -i $RELEA
      KERNEL     Comm channels     YES        utscparam.sh  -i $RELEA
      HOSTS      Hosts             YES        utlimp.sh     hosts
      NETWORKS   Networks          YES        utlimp.sh     networks
      NETIF      Network Interfaces YES       netifs.sh     -i
```

5. Exit the `Import Table` option and select the `Import Utility` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Utilities
.    .    Import Utility
```

Set the `Import class to run` option to `ALL`, as shown:

```
                Import Utility
      Import options ==>
M->   Import table ==>
      Import class to run       ALL
      Run the import process ...
```

6. Execute the `Run the import process` option. This option overwrites the menu system database. Exit the `Import Utility` option and answer `y` (yes) to the following question.

```
Do you want to continue? y
```

7. Go to the `Host Address Configuration` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    General Network Configuration
.    .    .    .    Host Address Configuration
```

   To update the `/etc/hosts` file, use the n key to enter the host name for the ATM interface. Following is an example of a `/etc/hosts` file:

```
        Host Address Configuration

Proto    Name    Address    Comment
-----    ----    -------    -------
inet     atm01   128.162.102.25
```

   Following is a description of the configuration parameters:

Parameter	Description
`Proto`	Specifies the Internet protocol
`Name`	Specifies the IP address alias
`Address`	Specifies the standard IP address value

8. Exit the `Host Address Configuration` option and answer `y` (yes) to the following question:

```
Do you want to update form file? (y/n):  y
```

9. To update the `/etc/networks` file, go to the `Network Address Configuration` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    General Network Configuration
.    .    .    .    Network Address Configuration
```

Configure the ATM Internet network address for TCP/IP by creating an entry in the `/etc/networks` file for each ATM network. There will be a network address for each ATM interface that will communicate through TCP/IP. Following is an example of a `/etc/networks` file:

```
    Network Address Configuration

      Proto    Name    Address       Comment
      -----    ----    -------       -------
E->   inet     atm01   128.162.102.102
```

Following is a description of the configuration parameters:

Parameter	Description
`Proto`	Specifies the Internet protocol
`Name`	Specifies the IP address alias
`Address`	Specifies the standard IP address value

10. Exit the `Network Address Configuration` option and answer `y` (yes) to the following question:

```
Do you want to update form file? (y/n):  y
```

11. Go to the `Network Interface Configuration` option, as follows:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    General Network Configuration
.    .    .    .     Network Interface Configuration
```

To update the `/etc/config/interfaces` file, use the n key to enter the appropriate information to automatically configure up the ATM interface during a UNICOS boot for this system, as shown in the following example:

```
                        Network Interface Configuration

     Name      Hycf Family   Address Dest Subnet      Type Bcst   MTUsz
     ----      ---- -------  ------- ---- ------      ---- ----   -----
  E-> bbg0:atm1     inet     atm01        0xffffff00  pvc         9176
```

Following is a description of the configuration parameters:

Parameter	Description
`Name`	Specifies the interface name and ordinal of the ATM interface to be configured. This is the same as the BBG number shown in step 15, page 18.
`Hycf`	Not used.
`Family`	Must be set to `inet`.
`Address`	Specifies the IP host address for this interface connection. This parameter must be defined in the `/etc/hosts` file. The address shown in the example is the same as that shown in step 7, page 14.
`Dest`	Specifies the destination (point-to-point) address. This parameter is not needed for the ATM connection.
`Subnet`	Specifies the subnetwork address mask to be used for this interface.

Parameter	Description
`Type`	Specifies the interface type, used to select the type of signaling to be used across the ATM network. These values also imply the type of encapsulation used for IP datagrams. The following are the supported types: • `pvc` – Permanent Virtual Circuit. Implies 802.2 LLC encapsulation • `spans` – Simple Protocol for ATM Network Signaling (SPANS) protocol. Implies null encapsulation and Switched Virtual Circuits (SVC). • `q2931` – Q2931 is the Switched Virtual Circuit standard. This is under development and does not currently work. Implies 802.2 LLC encapsulation and Switched Virtual Circuits (SVC). **Note:** If the interface type is set to `pvc`, signaling will **not** be performed on that interface. However, if an interface is marked as `spans` or `q2931`, PVCs are still supported on that interface when you use the `atmarp` command to place them in the `atmarp` table.
`Bcst`	Not used.
`MTUsz`	Specifies an MTU size that is a multiple of 8, ranging from 9176 to 65536.

12. Exit the `Network Interface Configuration` option and answer `y` (yes) to the following question:

```
Do you want to update form file? (y/n):  y
```

13. Go to the `General Network Configuration` option, as follows:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    General Network Configuration
```

14. Activate general network configuration, as follows:

```
   General Network Configuration

   Host address configuration ==>
   Network address configuration ==>
   Networking services configuration ==>
   Network hardware address configuration ==>
   Network interface configuration ==>
   Import general network configuration ==>
A->Activate general network configuration
```

Answer `y` (yes) to the following question:

```
Do you want to proceed with the configuration
update?  y
```

15. Go to the `Adapter Configuration` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    BBG ATM Configuration
.    .    .    .     Adapter Configuration
```

Use the n key to enter the appropriate parameters to build the BBG entries in the `/etc/config/bbg.config` file. (If you are creating this file for the first time, the `cfdb/bbgadap.cfg` file (created by the installation tool) is empty. Subsequent installations will show the BBG entries already entered.) Following is an example of an `/etc/config/bbg.config` file:

```
                  Adapter Configuration

     BBG  I-Field   HIPPI CHANNEL  CONTROL PATH  ATM  DATA PATH  START
     ---  -------  -------------  ------------  ---  ---------  -----
E-> 0    00000000 /dev/hippi0    1             1    2          YES
```

Following is a description of the parameters:

Parameter	Description
BBG	Specifies the number of the BBG device. Valid values are 0 through 9.
I-Field	Specifies the HIPPI I-field to use for connecting to the BBG.

HIPPI CHANNEL	Specifies the device node to use for connecting to the BBG. A typical example is as follows:
	`/dev/hippi0`
	`/dev/hippi1`
	.
	.
	.

CONTROL PATH	Specifies the logical path of the HIPPI channel on which control information will be sent to and from the BBG. This value must be unique. See bbg(4) for details on setting this parameter.
ATM	Defines an ATM interface Sbus slot in the chassis. Indicates the BBG slot in which the ATM card has been placed.
DATA PATH	Specifies the logical path on the HIPPI channel to be used for data input and output. This value must be unique. See bbg(4) for details on setting this parameter.
START	Specifies whether this BBG ATM interface will be started at boot time.

16. Exit the `Adapter Configuration` option and answer `y` (yes) to the following question:

```
Do you want to update form file? (y/n):  y
```

17. For any remote hosts with which you will communicate by using Permanent Virtual Circuits, go to the `Permanent Virtual Circuit Configuration` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    BBG ATM Configuration
.    .    .    .    Permanent Virtual Circuit Configuration
```

To update the `/etc/config/bbg.pvc` file, use the n key to enter the Permanent Virtual Circuits (PVCs) for all remote hosts with which this system will communicate through the BBG interface. Following is an example of a `/etc/config/bbg.pvc` file:

```
                Permanent Virtual Circuit Configuration

      Remote Hostname       Interface  AAL  VPI  VCI QOS (Kb/s)
      ----------------      ---------  ---  ---  --- ----------
 E->  atm04                 bbg0:atm1   5    0    32  0
```

Following is a description of the parameters:

Parameter	Description
`Remote Hostname`	Specifies the IP host name of the remote host. This name must be located in the `/etc/hosts` file (see step 7, page 14).
`Interface`	Specifies the name of the BBG ATM interface that this system will use to reach the remote host. The name is as it appears in the output of the `netstat -i` command when the interface is configured up.
`AAL`	Specifies the ATM Adaptation Layer (AAL) to be used by this PVC. This value is based on ATM standards. Currently, the ATM connection supports only AAL 5. Specify this number in decimal form.

Parameter	Description
VPI	Specifies the Virtual Path Identifier (VPI) (sometimes known as the Virtual Path Index). The VPI is placed into each ATM cell header so that the cell can be routed through the ATM network. Currently, ATM interfaces support only VPI 0. Specify this number in decimal form.
VCI	Specifies the Virtual Channel Identifier (VCI). The VCI is placed into each ATM cell header so that the cell can be routed through the ATM network. This number should be between 32 and 1023. Consult your local network administrator when determining the VCI. Specify this number in decimal form.
QOS (Kb/s)	Specifies the quality of service expressed in kilobits per second. This is the peak data rate at which this host will deliver ATM cells to the remote host through the ATM interface. Placing a 0 in this field causes the peak rate control feature to be disabled when sending to this remote host, thus allowing unlimited bandwidth. Specify this number in decimal form.

18. Exit the Permanent Virtual Circuit Configuration menu and answer y (yes) to the following question:

```
Do you want to update form file? (y/n):  y
```

19. Go to the BBG/ATM Configuration option, as follows:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    BBG/ATM Configuration
```

20. Activate the BBG/ATM configuration, as follows:

```
   BBG/ATM Configuration

   Adapter configuration ==>
   Permanent Virtual Circuit configuration ==>
   Import the BBG/ATM configuration ... ==>
A->Activate the BBG/ATM configuration ...
```

Exit the BBG/ATM Configuration menu and answer y (yes) to the following question:

```
Do you want to proceed with the configuration
update?  y
```

21. Exit the UNICOS Installation/Configuration Menu System by typing q (quit) and answering y (yes) to the following question:

```
Do you want to quit?  y
```

For examples of the files that have been updated by the preceding process, see the following subsections.

Configuring the BBG ATM interface manually 3.2.5.2

The following subsections describe and show examples of each of the files that you must update when you configure the BBG ATM interface manually. These are the same files that are updated by the UNICOS installation tool. The examples in the following subsections show only the part of the files that relate to the ATM interface configuration. Exact parameter settings will be system dependent.

The files to be updated are as follows:

- /etc/config/bbg.config
- /etc/hosts
- /etc/networks
- /etc/config/bbg.pvc
- /etc/config/interfaces

`/etc/config/bbg.config` file
3.2.5.2.1

The `/etc/config/bbg.config` file contains the information necessary for the UNICOS kernel and user commands to communicate with and configure the BBG interfaces.

Create the following parameters in the `/etc/config/bbg.config` file:

Parameter	Description
`bbg.`*number*	The number of the BBG device.
`ifield`	HIPPI I-field for connecting to the BBG.
`infile`	HIPPI input device file.
`outfile`	HIPPI output device file.
`atm.`*number*	ATM interface Sbus slot in the chassis.
`devtype`	Device type. `SBA200` is the only valid type.

Following is an example of a `/etc/config/bbg.config` file:

```
# /etc/config/bbg.config file
.
.
.
bbg0 {
        ifield = 0x0100000c
        infile = /dev/hippi1/i06
        outfile = /dev/hippi1/o06
        atm1 {
                devtype = SBA200
                infile = /dev/hippi1/i05
                outfile = /dev/hippi1/o05
        };
};
start bbg0:atm1 yes
.
.
.
```

`/etc/hosts` file 3.2.5.2.2

The `/etc/hosts` file contains host names. Create the following parameters in this file:

Parameter	Description
address	Standard IP address value
name	IP address alias

Following is an example of a `/etc/hosts` file:

```
#/etc/hosts file

128.162.187.1          atm01
.
.
.
```

`/etc/networks` file 3.2.5.2.3

The `/etc/networks` file contains the name and address of your ATM network. Create the following parameters in this file:

Parameter	Description
name	IP address alias
address	Standard IP address value

Following is an example of a `/etc/networks` file:

```
#/etc/networks file

atm01      128.162.102
.
.
.
```

Create as many entries as there are ATM interfaces configured for TCP/IP.

`/etc/config/bbg.pvc` file 3.2.5.2.4

The `/etc/config/bbg.pvc` file shows the Permanent Virtual Circuits (PVCs) for all remote hosts that will communicate to the system through the ATM interfaces.

Create the following parameters in the `/etc/config/bbg.pvc` file:

Parameter	Description
remote.host.name	IP host name of the remote host. This name must be located in the `/etc/hosts` file.
interface	Name of the ATM interface that this system will use to reach the remote host. The name is as it appears in the output of the `netstat -i` command.
AAL.number	ATM Adaptation Layer (AAL) to be used by this PVC. This value is based on ATM standards. Currently, the ATM connection supports only AAL 5. Specify this number in decimal form.
VPI.number	Virtual Path Identifier (VPI) (sometimes known as the Virtual Path Index), placed into each ATM cell header so that the cell can be routed through the ATM network. Currently, ATM interfaces support only VPI 0. Specify this number in decimal form.
VCI.number	Virtual Channel Identifier (VCI), placed into each ATM cell header so that the cell can be routed through the ATM network. This number should be between 32 and 1023. Consult your local network administrator when determining the VCI. Specify this number in decimal form.
QOS.number	Quality of service expressed in kilobits per second. This is the peak data rate at which this host will deliver ATM cells to the remote host through the ATM interface. Placing a 0 in this field causes the peak rate control feature to be disabled when sending to this remote host, thus allowing unlimited bandwidth. Specify this number in decimal form.

Following is an example of a `/etc/config/bbg.pvc` file:

```
#/etc/config/bbg.pvc file

# hostname      ifc      AAL     VPI     VCI     QOS
# --------      ---      ---     ---     ---     ---
#
atm01       bbg0:atm1   5       0       99      1
shemp01     bbg1:atm1   5       0       99      1
```

`/etc/config/interfaces` file
3.2.5.2.5

The `/etc/config/interfaces` file contains the parameters required to configure up the BBG ATM interface by using the `/etc/initif` script. The `/etc/initif` script is executed automatically when the UNICOS system is booted.

Create the following parameters in the `/etc/config/interfaces` file:

Parameter	Description
name	Interface name and ordinal of the ATM interface to be configured.
family name	Interface family name. Must be designated as `inet`.
IP. host_ address	IP host address for this interface connection. This parameter must be defined in the `/etc/hosts` file.
hwloop	Allows the packet to go out to the adapter and to come back.
subnet	Subnetwork address mask to be used for this interface.
interface.type	Interface type, used to select the type of signaling to be used across the ATM network. These values also imply the type of encapsulation used for IP datagrams. The following are the supported types: • `pvc` – Permanent Virtual Circuit. Implies 802.2 LLC encapsulation.

Parameter	Description
	• `spans` – Simple Protocol for ATM Network Signaling (SPANS) protocol. Implies null encapsulation and Switched Virtual Circuits (SVC). • `q2931` – Q2931 is the Switched Virtual Circuit standard. This is currently under development and does not currently work. Implies 802.2 LLC encapsulation and Switched Virtual Circuits (SVCs). **Note:** If the interface type is set to `pvc`, signaling will **not** be performed on that interface. However, if an interface is marked as `spans` or `q2931`, PVCs are still supported on that interface when you use the `atmarp` command to place them in the `atmarp` table.

Following is an example of a `/etc/config/interfaces` file:

```
#/etc/config/interfaces file
# File format is:
#
# name  hycf_file    family  address         pt-to-pt-dest   args:
#                                                           netmask
#                                                           iftype
#                                                           broadcast
#                                                           mtu
#                                                           rbuf
#                                                           wbuf
#                                                           bg
#                                                           hwloop
bbg0:atm1    -       inet      atm01   hwloop  netmask 0xffffff00  iftype pvc
```

Step 6: Verify and test the BBG interface
3.2.6

Perform the following steps to verify and test the BBG interface:

1. Connect a fiber loopback cable on the ATM interface. Prior to running loopback, be sure that the interface is configured down.

2. Run loopback through the BBG device, as follows:

   ```
   /usr/lbin/bbg/progs/bbgatmloop bbgx:atmy
   ```

   `bbg`*x*`:atm`*y* is the name of the BBG and ATM interface in the `/etc/config/bbg.config` file (for example, `bbg0:atm1`).

3. Run loopback again and disconnect the fiber loopback cable while the test is running. Verify that the test stops. This test ensures that the packets are actually arriving at the hardware and coming back

4. Reconnect the loopback cable.

5. Execute the following commands to configure up the BBG and ATM interfaces:

   ```
   /etc/bbgstart
   /etc/initif bbgx:atmy
   ```

   `bbg`*x*`:atm`*y* is the name of the BBG and ATM interface in the `/etc/config/bbg.config` file.

   Note: For the `/etc/bbgstart` command to start up the BBG interface, the `/etc/config/bbg.config` file must have the `start` field for `bbg`*x*`:atm`*y* set to `yes`.

6. Ping the Internet address of the Cray Research system on the ATM network.

7. While the `ping` commands are running, disconnect the loopback fiber to verify that the pings are actually going out to the hardware.

   Note: The `/etc/config/interfaces` file must specify the `hwloop` parameter, or hardware loopback (`hwloop` option) must have been specified on the `ifconfig`(8) command when the interface was configured up.

8. Connect the ATM interface to the ATM network.

   Note: Steps 9 and 10 apply if the ATM network will be using Permanent Virtual Circuits (PVCs).

9. Determine the VCIs to which the BBG will be connecting and add these to the `/etc/config/bbg.pvc` file that was created in step 17, page 20.

10. Configure the Permanent Virtual Circuits (PVCs) in the ATM network (switches and other ATM nodes). You must use Classic IP (RFC 1577) when you set up the ATM PVCs for all of the nodes that will communicate with the Cray Research system.

11. Ping a remote node on the ATM network, as in the following example:

```
ping shemp01
```

Installing a VME interface
3.3

The following subsections contain an installation overview; instructions to install, configure, and test a VME (Native ATM) interface in a CRAY J90 or CRAY EL system; and a list of commands for debugging a VME problem.

Installation overview
3.3.1

The ATM implementation on the CRAY J90 or CRAY EL system consists of a VME module in an open IOS slot. Your site can have a maximum of 16 ATM devices per CRAY J90 or CRAY EL system. Cray Research recommends that only one ATM module reside in each IOS, but supports two ATM modules per IOS. Both synchronous optical network (SONET) and transparent asynchronous transmitter/receiver interface (TAXI) type interface options are supported. Cray Research uses a FORE Systems ForeRunner VMA-200 VMEbus Adapter module for the Native ATM connection.

Software support for the VME connection starts at the UNICOS 8.0.4.1 release for the CRAY J90 series and at the UNICOS 8.0.4A release for the CRAY EL series. ATM adaptation layer 5 (AAL 5) is supported and used for TCP/IP data streams in the UNICOS operating system. Raw I/O is not supported. The UNICOS operating system supports the `atmarp`(8) command for the Permanent Virtual Circuits (PVCs). Switched Virtual Circuit (SVC) support is under development and will be added to the UNICOS system at a later release. SVCs will be supported by means of the Q2931 ATM signaling standard as well as the Simple Protocol for ATM Network Signaling (SPANS) protocol.

Required materials and tools
3.3.1.1

The materials required for the installation include the following:

- ATM modules
- Two fiber-optic cables with Straight Tip (ST) connectors to connect from an ATM switch to the VME ATM module
- UNICOS 8.0.4.1 release or later for the CRAY J90 series and UNICOS 8.0.4A release or later for the CRAY EL series
- The *CRAY EL Series Troubleshooting and Maintenance Manual*, publication CMM–0431–0A0, or the appropriate Field Replacement Procedures.

No special tools are required for this upgrade. You will need the common hand-held tools that are included with the Customer Service toolkit.

Installation step summary
3.3.1.2

To install the VME component into your CRAY J90 or CRAY EL system, perform the following steps. The subsections that follow provide details of these steps.

Note: Before starting the installation, it is recommended that you back up the UNICOS file system.

Note: Some of the installation commands require super-user privilege.

1. Install the software
2. Modify the IOS configuration file
3. Configure UNICOS for the VME interfaces.
4. Install the VME hardware.
5. Load the IOS and boot the system.
6. Test the VME interfaces.
7. Configure up TCP/IP for the VME interfaces.

Step 1: Install the software
3.3.2

Your Cray Research system must be running UNICOS release 8.0.4.1 or later for the CRAY J90 series or UNICOS 8.0.4A or later for the CRAY EL series. If this is not the case, follow the installation instructions that accompany the tape for the appropriate CRAY J90 or CRAY EL UNICOS release.

Step 2: Modify the IOS configuration file
3.3.3

To modify the IOS configuration file, perform the following steps:

1. Edit the IOS configuration file and add the IOS ATM driver to the appropriate IOS files, as follows:

   ```
   exdf –i /config > /tmp/config
   vi /tmp/config
   ```

   The following code shows an example of the added IOS ATM driver to the IOS system named `IOS1` in the configuration file:

   ```
   IOS1: 2093 1228800
   #-----------------
   /dev/disk
   /dev/ipi
   /dev/esdi
   /dev/atmv
   ```

   Note: The VME connection requires that the `/dev/atmv.cof` file be resident on the IOS. The `atmv.cof` file is the firmware file that is downloaded to the ATM module when the IOS is loaded. The `atmv.cof` file is part of every CRAY J90 or CRAY EL UNICOS release, starting with the UNICOS 8.0.4.1 or 8.0.4A release, respectively.

2. Copy the updated configuration file to the IOS disk, as follows:

   ```
   exdf –ro /config < /tmp/config
   ```

Step 3: Configure UNICOS for the VME interface
3.3.4

To configure the UNICOS operating system for the VME interface, you can use the UNICOS installation tool (see the following subsection), or you can configure the files manually (see subsection 3.3.4.2, page 43).

Using the installation tool to configure the VME interface
3.3.4.1

This subsection describes the steps needed to configure the VME interface by using the installation tool. For information on how to use the installation tool, see the *UNICOS Installation/Configuration Menu System User's Guide*, publication SG–2412, and the *UNICOS Installation and Configuration Tool Reference Manual*, publication SR–3090.

When you configure the VME interface in the UNICOS operating system, you will be updating the following files:

- `/etc/config/param`
- `/etc/config/atm.pvc`
- `/etc/hosts`
- `/etc/networks`
- `/etc/config/interfaces`

To configure the VME interface by using the installation tool, perform the following steps:

1. Enter the UNICOS Installation/Configuration Menu System by entering the following command:

```
/etc/install/install
```

2. Once you are in the UNICOS Installation/Configuration Menu System, it is recommended that before you configure anything with this menu system, you use the `import` utility to update the system configuration. To import the current system configuration into the menu system, go to the `Import Options` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Utilities
.    .    Import Utility
.    .    .    Import Options
```

3. Set the import options to the following values:

```
              Import Options

S->   Import root mount point
      Stop import on error?              YES
      Import host or guest versions?     host
      Reload default import table ...
```

4. Exit the `Import Options` option and select the `Import Table` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Utilities
.    .    Import Utility
.    .    .    Import Table
```

Set to NO any Import? field parameters that your site does not use. Set the following Import? field parameters to YES:

```
                              Import Table

      Class     Description         Import?    Program       Options
      -----     -----------         -------    -------       -------
E->   HARDWARE  Param               YES        hdwparam.sh   -i $RELEA
      KERNEL    Config.h uts        YES        utsconfh.sh   -i $RELEA
      KERNEL    Param uts           YES        utsparam.sh   -i $RELEA
      KERNEL    Comm channels       YES        utscparam.sh  -i $RELEA
      HOSTS     Hosts               YES        utlimp.sh     hosts
      NETWORKS  Networks            YES        utlimp.sh     networks
      NETIF     Network Interfaces  YES        netifs.sh     -i
```

5. Exit the Import Table option and select the Import Utility option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Utilities
.    .    Import Utility
```

   Set the Import class to run option to ALL, as follows:

```
                Import Utility
       Import options ==>
M->    Import table ==>
       Import class to run       ALL
       Run the import process ...
```

6. Execute the Run the import process option. This option overwrites the menu system database. Exit the Import Utility option and answer y (yes) to the following question:

```
Do you want to continue? y
```

7. Go to the Native ATM Configuration option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    UNICOS Kernel Configuration
.    .    .    Communication Channel Configuration
.    .    .    .    Native ATM Configuration
```

Enter the appropriate parameters to build the `atmdev` entries in the `/etc/config/param` file, as in the following example:

```
           Native ATM Configuration

S->   ATM device ordinal  0
      I/O cluster number  0
      IOP number          0
      IOP Channel number  020
```

Following is a description of the parameters:

Parameter	Description
`ATM device ordinal`	Specifies the VME interface that will be defined in the `param` file. Possible values are 0 through 15.
`I/O cluster number`	Specifies the IOS in which the ATM module will reside. Possible values are 0 through 15.
`IOP number`	Value must be 0.
`IOP Channel number`	Specifies the channel number that the I/O processor (IOP) uses to communicate with the ATM module in the IOS. This number is unique to each IOS. Valid values for this field are octal 20 and octal 21. Use octal 20 for the first module and octal 21 for the second module in each IOS or I/O cluster.

Create entries for all VME interfaces that are being installed.

8. Exit the `Native ATM Configuration` option and answer `y` (yes) to the following question:

```
Do you want to update form file? (y/n):  y
```

9. To configure the VME interfaces, go to the `Network Parameters` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    UNICOS Kernel Configuration
.    .    .    Network Parameters
```

To update the `/etc/config/param` file, enter the appropriate network parameters, as shown in the following example:

```
                    Network Parameters

Number of TCP memory buffers (TCP_NMBSPACE)     4000
Max. Native ATM network devices (atmmaxdevs)    2
ATM ARP receive space (atmarp_recv)             131072
ATM ARP send space (atmarp_send)                65536
Max. ATM ARP entries (atmarp_entries)           1024
```

Following is a description of the parameters:

Parameter	Description
`Number of TCP memory buffers (TCP_NMBSPACE)`	Specifies the number of mbufs to be defined for the system. This value is system dependent.
`Max. Native ATM network devices (atmmaxdevs)`	Specifies the maximum number of ATM modules allowed for this system. Valid values are 1 through 16. Set this value to the number of ATM interfaces to be installed in this system.
`ATM ARP receive space (atmarp_recv)`	Specifies the amount of socket receive space used by the `atmarp`(1) command. This value should always be a power of 2. The default value of 131072 should be sufficient for most systems.

Parameter	Description
`ATM ARP send space (atmarp_send)`	Specifies the amount of socket send space used by the `atmarp`(1) command. This value should always be a power of 2. The default value of 65536 should be sufficient for most systems.
`Max. ATM ARP entries (atmarp_entries)`	Specifies the maximum number of address resolution protocol (ARP) entries allowed in the ATM ARP table. The default value of 1024 should be sufficient for most systems. This value is directly related to the number of remote hosts that communicate through the ATM.

10. To activate the kernel configuration, go to the `Activate the Kernel Configuration` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    UNICOS Kernel Configuration
.    .    .    Activate the Kernel Configuration
```

    Before you answer `y` (yes) or `n` (no) to the question, `Do you want to proceed with the configuration update?`, consider the following conditions:

    Because some of the menus are associated with other configuration files, other files than the ones mentioned at the beginning of this subsection will be updated. If you started with the UNICOS Installation/Configuration Menu System that resembles your system's configuration, everything will be updated appropriately. If your system's configuration does not match the UNICOS Installation/Configuration Menu System, answer `no` to the question and perform step 2, page 32. Otherwise, answer `yes`.

You need to complete the next two steps only if you will be configuring Permanent Virtual Circuits (PVCs) for remote hosts with which this system will communicate through the VME interface. PVCs provide a means to state a path to a remote host specifically. PVCs are created and deleted by using the `atmarp`(8) command. The next two steps configure the parameters that will be used by the `atmarp`(8) command.

Note: Switched Virtual Circuit (SVC) support is under development and will be added to the UNICOS system at a later release. SVCs are a dynamic way to create a path to a remote host. SVCs use a protocol called *signaling* to set up and delete an available path between two hosts. The software performs SVCs automatically.

11. Exit the `Activate the Kernel Configuration` option and go to the `Permanent Virtual Circuit Configuration` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    Native ATM Configuration
.    .    .    .    Permanent Virtual Circuit Configuration
```

To update the `/etc/config/atm.pvc` file, use the n key to enter the Permanent Virtual Circuits (PVCs) for all remote hosts with which this system will communicate through the VME interface. Following is an example of a `/etc/config/atm.pvc` file:

```
                Permanent Virtual Circuit Configuration

     Remote Hostname      Interface  AAL   VPI   VCI QOS (Kb/s)
     ----------------     ---------  ---   ---   --- ----------
  E-> remotehost_atm0     atm0       5     0     32  1
     remotehost_atm1      atm1       5     0     33  1
```

Following is a description of the parameters:

Parameter	Description
`Remote Hostname`	Specifies the IP host name of the remote host. This name must be located in the `/etc/hosts` file.
`Interface`	Specifies the name of the VME interface that this system will use to reach the remote host. The name is as it appears in the output of the `netstat -i` command.

Parameter	Description
AAL	Specifies the ATM Adaptation Layer (AAL) to be used by this PVC. This value is based on ATM standards. Currently, the ATM connection supports only AAL 5. Specify this number in decimal form.
VPI	Specifies the Virtual Path Identifier (VPI). The VPI is placed into each ATM cell header so that the cell can be routed through the ATM network. Currently, ATM interfaces support only VPI 0. Specify this number in decimal form.
VCI	Specifies the Virtual Channel Identifier (VCI). The VCI is placed into each ATM cell header so that the cell can be routed through the ATM network. This number should be between 32 and 1023. Consult your local network administrator when determining the VCI. Specify this number in decimal form.
QOS (Kb/s)	Specifies the quality of service expressed in kilobits per second. This is the peak data rate at which this host will deliver ATM cells to the remote host through the ATM interface. Placing a 0 in this field causes the peak rate control feature to be disabled when sending to this remote host, thus allowing unlimited bandwidth. Specify this number in decimal form.

12. Exit the `Permanent Virtual Circuit Configuration` option and answer `y` (yes) to the following question:

```
Do you want to update form file? (y/n):  y
```

13. To activate the VME (Native ATM) configuration, go to the `Activate the Native ATM Configuration` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    Native ATM Configuration
.    .    .    .    Activate the Native ATM Configuration
```

Answer `y` (yes) to the following question:

```
Do you want to proceed with the configuration
update?  y
```

14. Exit the `Activate the Native ATM Configuration` option and go to the `Host Address Configuration` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    General Network Configuration
.    .    .    .    Host Address Configuration
```

To update the `/etc/hosts` file, use the n key to configure the VME connection for TCP/IP. Following is an example of a `/etc/hosts` file:

```
            Host Address Configuration

 Proto  Name             Address        Comment
 -----  ----             -------        -------
 inet   edge-atm0        128.162.102.25
 inet   remotehost_atm0  128.162.102.30
 inet   remotehost_atm1  128.162.102.31
```

Following is a description of the configuration parameters:

Parameter	Description
`Proto`	Specifies the Internet protocol
`Name`	Specifies the IP address alias
`Address`	Specifies the standard IP address value

15. To update the `/etc/networks` file, go to the `Network Address Configuration` option, as shown:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    General Network Configuration
.    .    .    .    Network Address Configuration
```

Configure the ATM Internet network address for TCP/IP by creating an entry in the `/etc/networks` file for each ATM network. There will be a network address for each ATM interface that will communicate through TCP/IP. Following is an example of a `/etc/networks` file:

```
    Network Address Configuration

      Proto    Name    Address       Comment
      -----    ----    -------       -------
E->   inet     atm01   128.162.102.102
```

Following is a description of the configuration parameters:

Parameter	Description
`Proto`	Specifies the Internet protocol
`Name`	Specifies the IP address alias
`Address`	Specifies the standard IP address value

16. Exit the `Network Address Configuration` option and go to the `Network Interface Configuration` option, as follows:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    General Network Configuration
.    .    .    .    Network Interface Configuration
```

To update the `/etc/config/interfaces` file, use the n key to enter the appropriate information to automatically configure up the VME interface during a UNICOS boot for this system, as shown in the following example:

```
                    Network Interface Configuration

     Name Hycf Family Address         Dest Subnet       Type   Bcst
     ---- ---- ------ -------         ---- ------       ----   ----
     lo0       inet   localhost
     en0       inet   edge.cray.com        0xffffff00
     fddi0     inet   edge-fddi.cray.com   0xffffff00         128.16
E-> atm0       inet   edge-atm0            0xffffff00   pvc
```

Following is a description of the configuration parameters:

Parameter	Description
`Name`	Specifies the interface name and ordinal of the ATM interface to be configured. The syntax is atm*x*, where *x* is the ordinal number of the ATM interface.
`Hycf`	Not used.
`Family`	Must be set to `inet`.
`Address`	Specifies the IP host address for this interface connection. This parameter must be defined in the `/etc/hosts` file.
`Dest`	Specifies the destination (point-to-point) address. It is not needed for the ATM connection.
`Subnet`	Specifies the subnetwork address mask to be used for this interface.
`Type`	Specifies the interface type, used to select the type of signaling to be used across the ATM network. These values also imply the type of encapsulation used for IP datagrams. The following are the supported types: • `pvc` – Permanent Virtual Circuit. Implies 802.2 LLC encapsulation • `spans` – Simple Protocol for ATM Network Signaling (SPANS) protocol. Implies null encapsulation and Switched Virtual Circuits (SVC).

Parameter	Description
	• `q2931` – Q2931 is the Switched Virtual Circuit standard. This is under development and does not currently work. Implies 802.2 LLC encapsulation and Switched Virtual Circuits (SVC). **Note:** If the interface type is set to `pvc`, signaling will **not** be performed on that interface. However, if an interface is marked as `spans` or `q2931`, PVCs are still supported on that interface when you use the `atmarp` command to place them in the `atmarp` table.
`Bcst`	Specifies broadcast address.

17. Exit the `Network Interface Configuration` option and answer `y` (yes) to the following question:

```
Do you want to update form file? (y/n):  y
```

18. Go to the `General Network Configuration` option, as follows:

```
UNICOS Installation/Configuration Menu System
.    Configure System
.    .    Network Configuration
.    .    .    General Network Configuration
```

19. Activate general network configuration, as follows:

```
   General Network Configuration

   Host address configuration ==>
   Network address configuration ==>
   Networking services configuration ==>
   Network hardware address configuration ==>
   Network interface configuration ==>
   Import general network configuration ==>
A->Activate general network configuration
```

Answer `y` (yes) to the following question:

```
Do you want to proceed with the configuration
update?  y
```

20. Exit the UNICOS Installation/Configuration Menu System by typing `q` (quit) and answering `y` (yes) to the following question:

```
Do you want to quit?  y
```

For examples of the files that have been updated by the preceding process, see the following subsections.

For the final steps for completing the software installation, see subsection 3.3.4.3, page 50.

Configuring the VME interface manually 3.3.4.2

The following subsections describe and show examples of each of the files that you must update when you configure the VME interface manually. These are the same files that are updated by the UNICOS installation tool. The examples in the following subsections show only the part of the files that relate to the ATM interface configuration. Exact parameter settings will be system dependent.

The files to be updated are as follows:

- `/etc/config/param`
- `/etc/config/atm.pvc`
- `/etc/hosts`
- `/etc/networks`
- `/etc/config/interfaces`

`/etc/config/param` file 3.3.4.2.1

The `/etc/config/param` file contains the parameters needed to configure the VME interface for the host system.

In the `network` section of the file, you must create entries for all VME interfaces that are being installed. Enter appropriate values for the following parameters:

Parameter	Description
`tcp_nmbspace`	Number of TCP memory buffers. Specifies the number of mbufs to be defined for the system. This value is system dependent.
`atmmaxdevs`	Maximum VME (Native ATM) network devices. Specifies the maximum number of VME modules allowed for this system. Valid values are 1 through 16. Set this value to the number of VME interfaces to be installed in this system.
`atmarp_recv`	ATM ARP receive space. Specifies the amount of socket receive space used by the `atmarp`(1) command. This value should always be a power of 2. The default value of 131072 should be sufficient for most systems.
`atmarp_send`	ATM ARP send space. Specifies the amount of socket send space used by the `atmarp`(1) command. This value should always be a power of 2. The default value of 65536 should be sufficient for most systems.
`atmarp_entries`	Maximum ATM ARP entries. Specifies the maximum number of address resolution protocol (ARP) entries allowed in the ATM ARP table. The default value of 1024 should be sufficient for most systems. This value is directly related to the number of remote hosts that communicate through the ATM.
`atmdev`	ATM device ordinal. Specifies the ATM interface that will be defined in the `param` file. Possible values are 0 through 15.

Parameter	Description
`iopath`	I/O path that consists of the following three parameters: `cluster`, `eiop`, and `channel`.
`cluster`	I/O cluster number. Specifies the IOS in which the ATM module will reside. Possible values are 0 through 15.
`eiop`	IOP number. This number will always be 0.
`channel`	IOP channel number. Specifies the channel number that the I/O processor (IOP) uses to communicate with the ATM module in the IOS. This number is unique to each IOS. Valid values for this field are octal 20 and octal 21. Use octal 20 for the first module and octal 21 for the second module.

Following is an example of a `/etc/config/param` file:

```
# /etc/config/param file
.
.
.
network {
  4000 tcp_nmbspace;
     2 atmmaxdevs;
131072 atmarp_recv;
 65536 atmarp_send;
 1024 atmarp_entries;
.
.
.
atmdev  0 {
      iopath {
           cluster 0;
         eiop 0;
         channel 020;
             }
       }
     }
.
.
.
```

`/etc/config/atm.pvc` file 3.3.4.2.2

The `/etc/config/atm.pvc` file shows the Permanent Virtual Circuits (PVCs) for all remote hosts that will communicate to this system through the ATM interfaces.

Create the following parameters in the `/etc/config/atm.pvc` file:

Parameter	Description
remote.host.name	IP host name of the remote host. This name must be located in the `/etc/hosts` file.
interface	Name of the ATM interface that this system will use to reach the remote host. The name is as it appears in the output of the `netstat -i` command.

Parameter	Description
AAL.number	ATM Adaptation Layer (AAL) to be used by this PVC. This value is based on ATM standards. Currently, the ATM connection supports only AAL 5. Specify this number in decimal form.
VPI.number	Virtual Path Identifier (VPI), placed into each ATM cell header so that the cell can be routed through the ATM network. Currently, ATM interfaces support only VPI 0. Specify this number in decimal form.
VCI.number	Virtual Channel Identifier (VCI), placed into each ATM cell header so that the cell can be routed through the ATM network. This number should be between 32 and 1023. Consult your local network administrator when determining the VCI. Specify this number in decimal form.
QOS.number	Quality of service expressed in kilobits per second. This is the peak data rate at which this host will deliver ATM cells to the remote host through the ATM interface. Placing a 0 in this field causes the peak rate control feature to be disabled when sending to this remote host, thus allowing unlimited bandwidth. Specify this number in decimal form.

Following is an example of a `/etc/config/atm.pvc` file:

```
#/etc/config/atm.pvc file

# hostname      ifc     AAL     VPI     VCI     QOS
# --------      ---     ---     ---     ---     ---
#
remotehost_atm0 atm0    5       0       32      0
remotehost_atm1 atm1    5       0       33      0
```

/etc/hosts file 3.3.4.2.3

The /etc/hosts file contains host names. Create the following parameters in this file:

Parameter	Description
address	Standard IP address value
name	IP address alias

Following is an example of a /etc/hosts file:

```
#/etc/hosts file

128.162.102.25          edge-atm0
128.162.102.30          remotehost_atm
128.162.102.31          remotehost_atm1
```

/etc/networks file 3.3.4.2.4

The /etc/networks file contains the name and address of your ATM network. Create the following parameters in this file:

Parameter	Description
name	IP address alias
address	Standard IP address value

Following is an example of a /etc/networks file:

```
#/etc/networks file

atm01      128.162.102
.
.
.
```

Create as many entries as there are VME ATM interfaces configured for TCP/IP.

/etc/config/interfaces file 3.3.4.2.5

The /etc/config/interfaces file contains the parameters required to configure up the ATM interface by using the /etc/initif script.

Create the following parameters in the `/etc/config/interfaces` file:

Parameter	Description
name	Interface name and ordinal of the ATM interface to be configured.
family	Interface family name. Must be set to `inet`.
IP. host_ address	IP host address for this interface connection. This parameter must be defined in the `/etc/hosts` file.
subnet	Subnetwork address mask to be used for this interface.
interface.type	Interface type, used to select the type of signaling to be used across the ATM network. These values also imply the type of encapsulation used for IP datagrams. The following are the supported types: • `pvc` – Permanent Virtual Circuit. Implies 802.2 LLC encapsulation. • `spans` – Simple Protocol for ATM Network Signaling (SPANS) protocol. Implies null encapsulation and Switched Virtual Circuits (SVCs). • `q2931` – Q2931 is the Switched Virtual Circuit standard. This is under development and does not currently work. Implies 802.2 LLC encapsulation and Switched Virtual Circuits (SVC). **Note:** If the interface type is set to `pvc`, signaling will **not** be performed on that interface. However, if an interface is marked as `spans` or `q2931`, PVCs are still supported on that interface when you use the `atmarp` command to place them in the `atmarp` table.

Following is an example of a `/etc/config/interfaces` file:

```
#/etc/config/interfaces file
# File format is:
#
# name  hycf_file    family  address         pt-to-pt-dest   args:
#                                                           netmask
#                                                           iftype
#                                                           broadcast
#                                                           mtu
#                                                           rbuf
#                                                           wbuf
#                                                           bg
#                                                           hwloop
atm0    -         inet    edge-atm0 -  netmask 0xffffff00 iftype pvc
```

Completing the software installation
3.3.4.3

To complete the software installation, perform the following steps:

1. Operating from the system console, save the original `param` file and copy the updated `param` file to the IOS disk by executing the following commands:

   % CONTROL-A (toggles to the IOS)
   IOS> **`cp /sys/param /sys/param.bak`**
   % CONTROL-A (toggles to the UNICOS system)
   % **`exdf -ro /sys/param < /etc/config/param`**

2. Shut down the UNICOS system by executing the following commands:

   `/etc/shutdown 0`
   CONTROL-A (toggles to the IOS)

Step 4: Install the VME hardware
3.3.5

The installation of the VME hardware consists of the following procedures:

- Powering down and removing panels
- Setting VMA-200 module switches and jumpers

Note: The labels on the ATM module cables have the following meaning:

Transmit [T] = output
Receive [R] = input

Warning: Before handling any piece of computer equipment, use proper electrostatic discharge (ESD) grounding techniques and wear proper ESD apparel.

Refer to the *CRAY Y-MP EL Troubleshooting and Maintenance Manual*, publication CMM–0431–0B0 and the appropriate Field Replacement Procedures (FRPs) that correspond to the system on which the ATM module will be installed.

Power down procedure for CRAY EL systems
3.3.5.1

Use FRP 2 to power down CRAY EL systems.

Power down procedure for CRAY J90 systems
3.3.5.2

To power down CRAY J90 systems, power down the cabinet, using J90 FRP 1 for an individual cabinet.

VMA-200 module switch and jumper settings
3.3.5.3

This subsection describes procedures for setting VMA-200 module switches and jumpers.

1. Position the module on an electrostatic discharge (ESD) mat or table so that the semiconductor chips are face up and the VME connectors are on the top of the module.
2. Dip switch number 1 (SW1) and dip switch number 2 (SW2) are located on the right side of the module. Set the dip switches to the following settings.

First ATM module in an IOS:

		1	2	3	4	5	6	7	8
SW1	on		X			X	X		
	off	X		X	X			X	X

		1	2	3	4	5	6	7	8
SW2	on	X			X	X	X	X	X
	off		X	X					

Second ATM module in an IOS:

		1	2	3	4	5	6	7	8
SW1	on	X	X		X	X	X		
	off			X				X	X

		1	2	3	4	5	6	7	8
SW2	on	X			X	X	X	X	
	off		X	X					X

3. Ensure that jumper blocks for JP1 are set open for all ATM modules.

4. Insert the ATM modules in the leftmost open slot in the IOS chassis. If there are other open slots in the IOS chassis, ensure that the proper backplane jumpers are installed in the open slots so that all VME signals are available to modules that are located to the right of the open slot. See the *CRAY EL Series Troubleshooting and Maintenance Manual*, publication CMM–0431–0A0, or the appropriate Field Replacement Procedures for more details.

5. Power on the IOS cabinet.

Step 5: Load the IOS and boot the system 3.3.6

To boot the system, perform the following steps from the system console:

1. To load the IOS, enter the following command at the IOS prompt:

   ```
   load
   ```

   If the ATM module is recognized in the IOS, you should see the following message displayed:

   ```
   ATM: Unit 0 – detected
   ```

   If there are two ATM modules in an IOS, you should see the following message also:

   ```
   ATM: Unit 1 – detected
   ```

   If you do not see these messages, you might see the following message:

   ```
   drv_exec: /DEV/ATMV initialization failed
   ```

   If you do see this message, perform the following steps:

   a. Power down the IOS.
   b. Remove the ATM modules.
   c. Recheck DIP switch settings.
   d. Recheck the jumper settings.
   e. Reinstall the ATM modules.
   f. Perform the IOS load again.

2. Boot the system to single-user mode by entering the following command:

   ```
   boot
   ```

3. Enter multiuser mode in the UNICOS system by entering the following command:

   ```
   /etc/init 2
   ```

Step 6: Test the VME interfaces 3.3.7

To test the VME interface, perform the following steps:

1. Connect one end of an ATM cable to the receive port of the ATM module by connecting the cable to the receive connector (R) at the bulkhead connector.

2. Connect the other end of the same ATM cable used in step 1 to the transmit port of the ATM module by connecting the cable to the transmit connector (T) at the bulkhead connector. There now should be one single strand of fiber connected between the R and T ports of the bulkhead connecter. This will form a loopback configuration.

3. Configure down the VME interfaces by using the following command:

   ```
   /etc/ifconfig atm0 down
   ```

   Repeat this command for each VME interface.

4. Configure up each VME interface with hardware loopback turned on for the interface by issuing the following `ifconfig` command:

```
/etc/ifconfig atm0 edge_atm0 netmask 0xffffff00 hwloop
```

   Repeat this command for each VME interface. Change the ATM IP address and network mask values to the site's chosen values.

5. Configure an ATM ARP table entry by issuing the following `atmarp` command:

   ```
   /etc/atmarp –s edge_atm0 atm0 5 0 50
   ```

   Substitute your system's ATM IP address in this command.

6. With the cable connected in loopback configuration (from the transmit connector to the receive connector), use the `ping` command to test the ATM, as shown in the following example:

   ```
   /etc/ping edge_atm0
   ```

Execute the following command to see the input and output packets (`Ipkts` and `Opkts` fields, respectively) for each of the VME interfaces:

```
netstat -i
```

The following example shows the output from a `netstat -i` command:

```
netstat -i

Name   Mtu    Network     Address     Ipkts   Ierrs Opkts  Oerrs
en0    1496   128.162.101 edge        253535  0     61027  0
fddi0  4352   128.162.84  edge-fddi   204070  0     24363  0
atm0   9180   128.162.83  edge_atm0   56      0     56     0
hi0*   65536  none        none        0       0     0      0
lo0    65535  127         localhost   200366  0     200366 0
```

7. Remove one end of the cable to verify that the ping processes stop. This verifies that the packets are going out of the transmit port of the ATM card and being received through the receive port. If the ping process continues to run, verify that each step in this section was performed.

8. Make the ATM network connection.

9. At this point, you can perform other tests across the loopback connection. Some TCP tests that can be executed are `nettest`(8), `ftp`(1B), and `telnet`(1B).

10. After performing these tests, disable the hardware loopback on each VME interface by executing the following command:

    ```
    /etc/ifconfig atm0 down
    ```

    Repeat this command for each VME interface.

Step 7: Configure up TCP/IP for the VME interfaces
3.3.8

To configure TCP/IP for the VME interface, issue the `initif` command, as follows:

```
/etc/initif atm0
```

The `initif`(8) command configures up the interface by performing an `ifconfig up` command, and creates `atmarp` entries for each Permanent Virtual Circuit (PVC). Repeat this command for each VME interface.

Debugging a VME problem
3.3.9

You can use the following commands as tools to debug a VME problem:

- `ifconfig`(8)
- `netstat`(1B)
- `atmarp`(8)
- `atmadmin`(8)

Glossary

ATM adaptation layer

The layer that adapts higher level data into formats that are compatible with the ATM layer requirements. This layer depends on the higher layer services being transported; several different ATM Adaptation Layers (AALs) have been defined for services such as data-only transport, voice, video, and others.

The AAL is an end-to-end process used only by the two communicating entities to insert and remove data from the ATM layer. Different types of AALs deal with different types of traffic, but they all ultimately end up with 48-byte segments for packing into the cell payload.

ATM cell

A cell that is 53 bytes long and consists of a 5-byte header that contains the address and a 48-byte information (payload) field. Unlike other technologies, such as Ethernet and FDDI, in which variable length frames ranging from very few bytes (64) to many bytes (4500) are transmitted on the media at once, ATM transmits fixed-length cells of 53 bytes on the media. Packets must be segmented into the 48-byte information field of the ATM cells for transfer. This information is then reassembled into a packet at the receiving end.

ATM signaling

A protocol that provides the facilities used by other software to set up required network connections. ATM is a connection-oriented technology. Packets cannot be sent between two nodes (hosts) on an ATM network without first having established a connection.

Classic IP

A method of transporting Internet Protocol (IP) datagrams across ATM networks. The Internet Engineering Task Force (IETF) has defined this standard in RFC 1577, "Classic IP." Other related RFCs are RFC 1483 and RFC 1626.

IP encapsulation

The method of carrying Internet Protocol (IP) traffic over an ATM network.

Permanent Virtual Circuit (PVC)

A circuit through an ATM network; it is used for dedicated, long-term information transfer between locations.

Q.2931 signaling

The standards-based ATM signaling protocol. The ATM Forum developed the Q.2931 signaling protocol. It is specified in the User-Network Interface (UNI) 3.0 specification.

segmentation and reassembly

Segmentation is the process in which a packet is broken up to fit into the 48-byte information field of an ATM cell when transmitted. Reassembly is the reverse process, which puts the cells back together into a packet. SAR is the common term used when discussing this process.

Simple Protocol for ATM Network Signaling (SPANS)

A signaling protocol.

Switched Virtual Circuit (SVC)

A circuit through an ATM network; it is used for information transfer between two locations, lasting only for the duration of the transfer.

virtual channel (VC)

A connection between two communicating ATM entities. It may consist of a concatenation of several ATM links. All communications proceed along this same VC, which preserves cell sequence and provides a certain grade or quality of service. ATM uses the concept of VCs and virtual paths (VPs) to accomplish routing of ATM cells between end users.

Although the VCs are associated with a VP, they are not unbundled or processed in any way. The cell sequence of each VC is still preserved and the grade of service of the VP is established by the most demanding of the constituent VCs. The ATM cell header contains both the Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI), allowing each ATM cell to be given a unique VC identifier and to be associated with a particular VP by having its VPI in common with other VCs. A cell also may not be associated with any VP, in which case it would have null VPI and only a unique VCI.

Virtual Channel Identifier (VCI)

The address or label of a virtual channel (VC).

virtual path (VP)

A group of virtual channels (VCs) carried between two points. VPs may involve many ATM links. VPs provide a convenient way of bundling traffic heading to the same destination.

Because the ATM cell header contains all of the virtual path and circuit information, each cell is a stand-alone entity, and the ATM switch equipment can route it through the network quickly and efficiently.

Virtual Path Identifier (VPI)

The address or label of a virtual path (VP).

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