26 Managing Circuit Emulation Ports

Circuit emulation ports transport traditional T1 or E1 Time Division Multiplexing (TDM) and synchronous serial port traffic over ATM networks. Input data comes from traditional TDM or synchronous serial streams while output data goes out the ATM network in the form of a Constant Bit Rate (CBR) cell stream. Specifically, circuit emulation ports convert T1/E1 bits (or T1/E1 DS0 bundles) and serial data to ATM AAL1 cells.

Circuit Emulation works best when connected to an ATM network using a single reference clock. This combination is best because circuit emulation is very timing sensitive, requiring the ATM Class of Service with the highest priority and lowest Cell Delay Transfer Variation (CDTV). Circuit Emulation modules process data segmentation and reassembly according to the ATM Forum Circuit Emulation Service Interoperability Specification (CES-IS), version 2.

T1 and E1 ports support structured or unstructured data transfer, which you can configure through software. Additional T1/E1 configuration options include frame format, line coding, and Facility Datalink Protocol. T1 and E1 ports also support synchronous, Synchronous Residual Time Stamp (SRTS), and adaptive clocking. Circuit Emulation ports can store up to 24 hours of performance statistics for local and remote ports.

♦ Note ♦

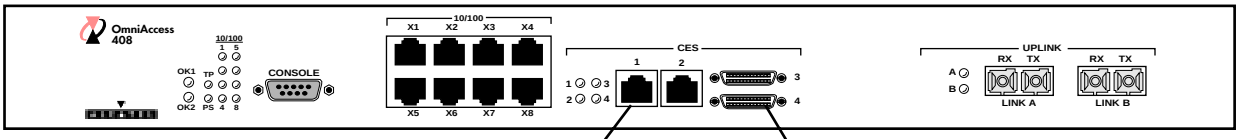
Additional overview and configuration information on T1/E1 ports can be found in Chapter 29, “Managing T1 and E1 Ports.”

This chapter is divided into two parts. The first part provides an overview of circuit emulation services and an application example. This first part runs from this page through page 26-8. The second part describes the configuration of the logical circuit emulation services supported on T1/E1 ports and the serial ports; this second part starts with the section, *The Circuit Emulation Menu* on page 26-9.

The Circuit Emulation Ports

In addition to T1/E1 ports, all OmniAccess 408 switches contain two synchronous serial ports. Serial ports support speeds from 56 KBPS to 2048 KBPS. Cable types used with serial ports can be V.35, X.21, RS-232, RS-449, or RS-530. Serial ports automatically detect cable type and initialize line drivers dynamically. Serial ports support unstructured data transfer only; they also support synchronous and Synchronous Residual Time Stamp (SRTS) clocking, but not adaptive clocking.

The Circuit Emulation Ports: An Overview



T1/E1 Ports

These two ports connect to traditional T1 or E1 links such as a PBX. Circuit emulation traffic from these ports is converted to ATM cells and switched out the ATM uplink port on this module. Physical layer parameters are configured through the T1/E1 menu, which is described in Chapter 29. Circuit emulation services are configured through the circuit emulation menu, which is described in this chapter.

Serial Ports

These universal serial ports connect to devices that support raw serial transport, such as a video server. Traffic from these ports is converted into ATM cells and switched out the ATM uplink port on this module. You can configure physical layer parameters, such as clock speed, as well as circuit emulation services through the circuit emulation menu, which is described later in this chapter.

Circuit Emulation T1/E1 Ports

Circuit emulation T1/E1 ports are *not* generic ATM ports like the ones on other ASM and CSM modules (e.g., CSM-AB-T1-4W, CSM-AB-IMA-T1-8W). Internally, a OmniAccess 408 is connected to the switch fabric as a single ATM port. The AAL1 SAR receives multiple cell streams from the same internal ATM port, converts them to a traditional TDM T1/E1 stream, and sends them out to appropriate T1/E1 ports based on the VCIs of incoming cell streams.

For example, if you use the **slot** command, circuit emulation ports 4/1, 4/2, 4/3, and 4/4 will be displayed. (See Chapter 6, "Configuring Switch-Wide Parameters," for more information on the **slot** command.) However, if you execute the **vcs** or **vvc** command, a single port, 4/1, will be displayed. (The **vvc** and **vcs** commands are described in Chapter 25, "Managing ATM Ports.")

If, for example, you create the following four (4) circuit emulation circuits with the **ceadd** command (which is described in *Creating a Virtual Channel Connection on a T1/E1 Port* on page 26-10):

```
ceadd 4/1 256
ceadd 4/2 288
ceadd 4/3 320
ceadd 4/4 352
```

The **vvc** and **vcs** commands will display these virtual circuits as 4/1 0/256, 4/1 0/288, 4/1 0/320, and 4/1 0/352. In this example, the AAL1 SAR receives and transmits cells *only* from and to port 4/1.

Configuring a Circuit Emulation Port

Due to the different port types on the OmniAccess 408, configuration of the module requires several general steps. There are differences in the configuration for logical-level circuit emulation parameters, T1/E1 physical parameters, and ATM uplink parameters. These general steps are as follows:

Step 1. Configure T1/E1 Ports

Configure framing, line encoding, signaling and other options through the **temod** command. This command sets up physical level parameters for the T1 or E1 port. See Chapter 29, "Managing T1 and E1 Ports," for directions on configuring a T1 or E1 port.

♦ Note ♦

Serial ports are configured while configuring circuit emulation parameters (in Step 3).

Step 2. Configure ATM Access Port

You use ATM menu commands to configure the ATM ports on the OmniAccess 408. See Chapter 25, "Managing ATM Ports," for information on those commands.

Step 3. Configure Circuit Emulation

You configure the circuit emulation service parameters on T1, E1, and serial ports through the **ceadd** and **cemodify** commands. You create circuit emulation virtual circuits through the **ceadd** command. These parameters include VPI, VCI, and Cell Delay Transfer Variation (CDTV). See *Creating a Virtual Channel Connection on a T1/E1 Port* on page 26-10 for T1 and E1 ports, or see *Creating a Virtual Channel Connection on a Serial Port* on page 26-14 for serial ports.

You can also optionally configure port-level circuit emulation parameters, such as service modes and service clock modes, through the **cemodify** command. If you do not configure these port-level parameters, defaults will be assigned to ports.

Circuit Emulation Services

Once data comes into a circuit emulation module through a T1/E1 port or a serial port, it is passed onto the ATM network as ATM cells. There are two services available for segmenting data into ATM cells: structured and unstructured. In general, time slot information will be retained in a structured service and will not be interpreted in an unstructured service. Since serial port data does not use time slots, only an unstructured service is available for these ports.

Unstructured Service

An unstructured circuit emulation service assigns a single virtual circuit to an entire T1 or E1 bit stream. The data stream is segmented into AAL1 cells without regard to any structure in the user data or byte alignment between the user data and the ATM cell payload. Unstructured service is intended primarily for simple point-to-point applications. This service does not require the use of time slots associated with T1 and E1 data traffic. It is the required service for use with the serial ports.

The ATM cell format for unstructured service includes a 5-octet ATM cell header and a 1-octet AAL1 header. The 47 octets of data payload contain the T1 or E1 bit level data stream encapsulated in the same order they were received but without any structure. One ATM cell can hold 1.95 T1 frames (193 bit frames) or 1.47 E1 frames (256 bit frames).

Structured Service

In a structured circuit emulation service, time slots are considered before structuring data into ATM cells. Time slots allow a device such as a PBX to switch some data in one direction and other data in another direction. Time slots increase control over traffic and bandwidth.

A structured circuit emulation service preserves this extra control afforded by time slots when TDM traffic is converted to ATM cells. This service supports an *n* x 64 KBPS data format and assigns any combination of time slots to a virtual connection. Structured service supports up to 24 virtual connections on a T1 port and up to 31 virtual connections on an E1 port. This service can also optionally carry Channel Associated Signaling (CAS) bits.

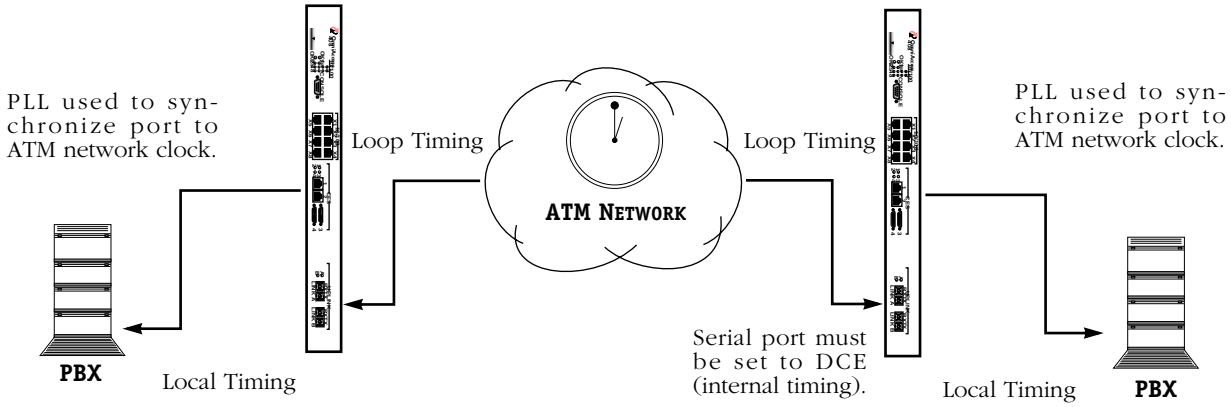
The ATM cell format for a structured service has a 5 octet ATM cell header and a 1- or 2-octet AAL1 header. The 46 or 47 octets of data payload contain the selected T1 or E1 channel and can optionally carry CAS bits. When CAS is included in the cell, it is collected from the appropriate time slots in the appropriate frame and placed at the end of the cell. A 2-octet AAL1 header has a 1-octet pointer (once every 8 cells) to point to the beginning of the multiframe.

Circuit Emulation Clocking Modes

The three service clock modes available for circuit emulation services are synchronous, Synchronous Residual Time Stamp (SRTS), and adaptive. The type of clocking that may be used depends on the circuit emulation service mode chosen. In structured service mode, synchronous and adaptive service clock modes are supported. In unstructured service mode, synchronous, adaptive, and SRTS clocking are supported.

Synchronous Clocking

Synchronous clocking can be used in an ATM network using a single master clock. Synchronous clocking is the most accurate form of clocking for circuit emulation services. The port uses a Phase Lock Loop (PLL) to synchronize to the ATM clock. This allows the port to derive and provide timing from the ATM network to attached devices.

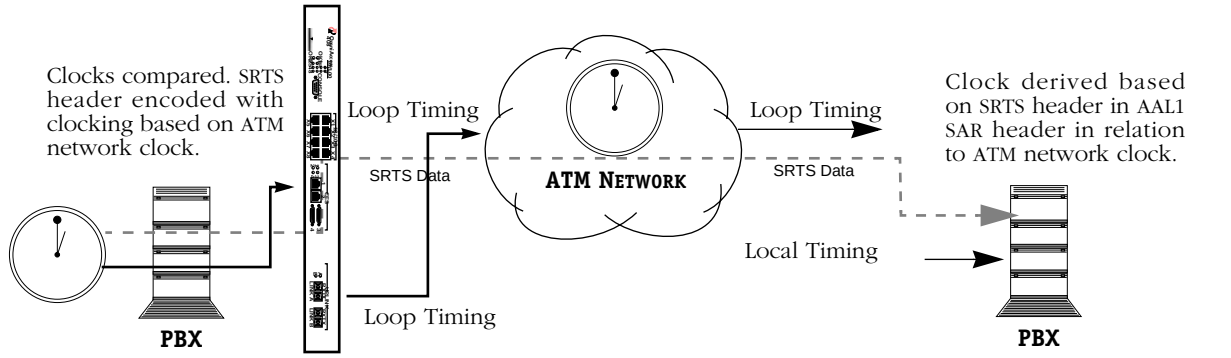


Synchronous Clocking

In a synchronous clocking mode, both sides of the connection (i.e., both circuit emulation ports) will use a local clock source. Therefore, the Transmit Clock Source setting should be set to *local timing*. The timing configuration for the port is shown in the above diagram.

Synchronous Residual Time Stamp (SRTS) Clocking

In SRTS clocking, the ATM network must provide a single master clock. The port receives the clock from the attached device, such as a PBX. The SRTS information is encoded within the AAL1 SAR header. The clock is derived and adjusted as needed on the remote port based on the SRTS information from the AAL1 SAR header.



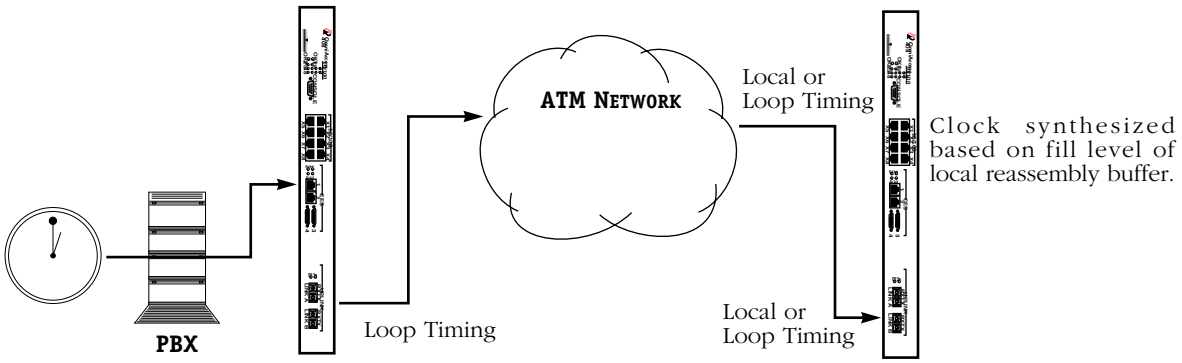
SRTS Clocking

In SRTS clocking, the port receives the clock on one end and regenerates the clock locally on the other end. In such a case, the Transmit Clock Source parameter for the port receiving the clock from the network should be configured to *loop timing* and the other end of the link should be configured to *local timing*.

SRTS clocking is supported on T1, E1, and serial ports. It can only be used with an unstructured circuit emulation service mode. In addition, when used on serial ports, the clocking speed must be set to 1.544 Mbits or 2.048 Mbits.

Adaptive Clocking

In adaptive clocking, the ATM network does not need to be running on a single master clock. The port receives the clock from the attached device, such as a PBX. No information on clocking is passed across the ATM network. The clock is synthesized and adjusted on the remote port based on the fill level of the local ATM reassembly buffer. If the buffer fills too much, the clock frequency is increased; if the buffer fills too little, the clock frequency is decreased. Adaptive clocking is the least accurate form of clocking and the most prone to bit errors.



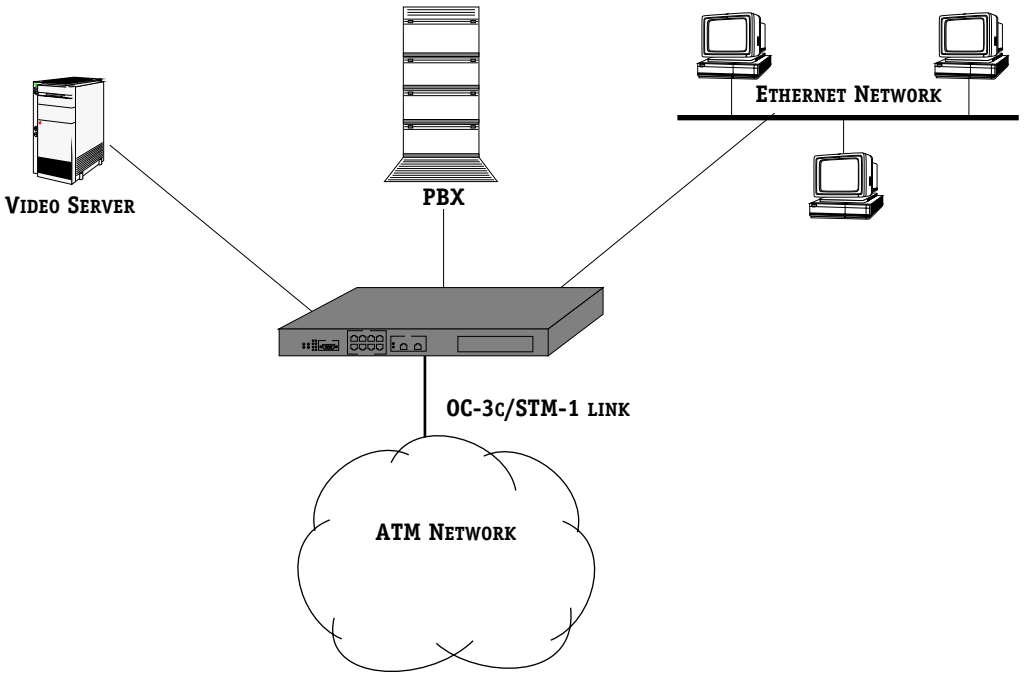
Adaptive Clocking

In adaptive clocking, the module receives the clock on one end and regenerates the clock locally on the other end. In such a case, the Transmit Clock Source parameter for the port receiving the clock from the network should be configured to *loop timing* and the other end of the link should be configured to *local timing*.

Adaptive clocking is supported for T1 and E1 ports only; it is not supported on serial ports.

Application Example

Circuit emulation modules are typically used in networks in which legacy T1/E1 or synchronous serial traffic needs to be transmitted over an ATM network. The module can accept input from T1/E1 sources, such as a private branch exchange (PBX), or from pure serial traffic sources, such as a video server. The diagram below illustrates a circuit emulation application using an OmniAccess 408..



Typical Circuit Emulation Configuration

In this example, the PBX connects to one of the T1 circuit emulation ports circuit, and the video server connects to one of the serial ports on an ASM-CE. The traffic from both of these sources is muxed and sent out as ATM cells through the ATM uplink port (in this case OC-3). This ATM port in turn connects into the wider ATM network of cell switches. Other traffic, such as 10/100 Ethernet LAN traffic, can also be switched out the ATM port.

The Circuit Emulation Menu

The commands for configuring and monitoring circuit emulation virtual channel connections are contained in the ATM circuit emulation submenu. These commands control the circuit emulation services on both T1/E1 ports and serial ports; they do not affect the ATM uplink port. This submenu displays as shown below and may be accessed (when in verbose mode) by entering **atmce** at a command line.

```
Command     ATM Circuit Emulation Management Menu
----------- ------------------------------------------------------------
cemodify    Modify a port or a virtual channel configuration
cestatus    View status of a port or a virtual channel connection
ceadd       Create a virtual channel connection
cedelete    Delete a virtual channel connection
cecls       Clear statistics of a virtual channel connection

    Main       File       Summary  VLAN      Networking
    Interface  Security   System   Services  Help
```

You create virtual channel connections through the **ceadd** command and modify those virtual channels later through the **cemodify** command. You can view the status of virtual channel connections through the **cestatus** command. Additionally, you can configure port-level circuit emulation parameters on T1/E1 ports and serial ports through the **cemodify** command.

♦ Important Note ♦

The front panel of an OA-408 switch is divided into several areas labeled **10/100**, **CES**, **UPLINK**, etc. Conceptually, think of these areas as a division of the switch into several modules, or slots. For more information on slot designations see Chapter 1, titled "OmniAccess 408 Switches."

Creating a Virtual Channel Connection on a T1/E1 Port

The **ceadd** command allows you to set up a circuit emulation virtual channel connection. The configuration parameters in this command are different for T1/E1 ports and serial ports. This section describes options for T1 and E1 ports.

To configure a virtual channel connection on a T1 or E1 port, enter the following command

ceadd 4/<port> <vci>

where **4** is the circuit emulation slot number, **<port>** is the T1 or E1 port number on the board (Port 2 or Port 3), and **<vci>** is the virtual channel identifier for the virtual channel that you want to add.

When selecting a VCI, you need to be aware of the ranges available for each circuit emulation port. The following VCI ranges are available for each port:

Circuit Emulation Port Number	Valid VCI Range
1 (T1/E1)	256–287
2 (T1/E1)	288–319
3 (serial)	320–351
4 (serial)	352–383

For example, to create a virtual channel with a VCI of 288 on port 2, you would enter

ceadd 4/2 288

A screen similar to the following displays (NOTE: If the port is configured for unstructured service, time slot information will not be displayed):

```
Slot 4 Port 2 Connection 288 Configuration

Available Time Slot:
   {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16,
    17, 18, 19, 20, 21, 22, 23, 24}

1) Description (30 chars max)                          : Connection 288
2) Administration Status { UP (1), DOWN (2) }          : UP
4) Partial Cell Fill Count (0-47)            : 0
5) Cell Loss Integration Period in second (1-64)       : 2
6) Cell Delay Variation Tolerance in frame (1-255)     : 10
7) Idle Code (0-FF)                                    : FF
8) Reassembly Buffer Size in frame (1-384)             : 20
9) Time slots used : { none }
   (Usage: "+/-<ts|all>" add/remove a time slot. For example,
    "9=+10+12-9" to add time slot 10 & 12 and remove time slot 9.
    "9=+all" add all time slots.  "9=-all" remove all time slots)
10) Connection Type { PVC (1), SPVC (2) }              : PVC
11) ATM uplink slot (2-2)                              : 2
12) ATM uplink port (1-1)                              : 1
13) Outgoing Virtual Path Identifier (0-128)           : 0
14) Outgoing Virtual Circuit Identifer (0-1023)        : 288
17) Signalling Code (0-F)                              : 0
```

1) Description

Enter a description for this virtual channel connection of up to 30 characters. This description will be used in screen displays to identify this connection.

2) Administration Status

This option enables and disables the virtual circuit you are modifying. Setting this option to **Up** enables the circuit and allows data to be sent or received as long as the Operational Status is also Up. Setting this option to **Down** disables the circuit; no data can be sent on the circuit. The **Down** option is a good option to use when preconfiguring a virtual circuit in advance of live network operation.

4) Partial Cell Fill Count

Enables the partial cell fill count feature, which is used to decrease cell fill delay. In this field, indicate the minimum number of octets of user data allowed per ATM cell. No data cell will be transmitted out the ATM uplink port until it contains the number of bytes you specify here. If you set this parameter to zero (0), the partial cell fill count feature is disabled and all cells will be filled completely before they are sent.

5) Cell Loss Integration Period

The time, in seconds, after which lost cells will be declared lost. When cells are lost, this integration period begins. If cells are not recovered within this period, an internal variable will be set indicating that cells have been lost on this virtual circuit. This may affect statistics counters.

6) Cell Delay Variation Tolerance

The maximum cell delay variation of this virtual circuit in frame increments. One frame is defined as the size of the buffer that can store incoming data for up to time *T*. In structured mode, *T* equals 125 ms. In unstructured mode, a frame equals to 32 octets and the corresponding values for *T* are as follows:

- Unstructured T1 T = 166 ms
- Unstructured E1 T = 125 ms
- Unstructured serial port T = 32*8/speed

7) Idle Code

The idle character sent to the circuit emulation interface or to the ATM uplink port. This idle character is sent to T1/E1 time slots or to a serial port if the reassembly buffer for this virtual circuit is underrun or overrun. If an alarm is present on the T1/E1 port or if there is a cable drop on the serial port, this idle character will be sent upstream through the ATM network.

8) Reassembly Buffer Size

The maximum size of the ATM reassembly buffer, in frames. This buffer is used by the AAL1 SAR to buffer incoming data on the ATM uplink port. Data in the buffer is later passed on to the appropriate T1/E1 or serial port. This buffer allows some flexibility in the transmission of data to legacy T1/E1 and serial ports due to cell delay variation on the ATM network.

In unstructured mode, a frame equals 32 octets (256 bits). In structured mode, a frame is the number of time slots assigned to this virtual circuit. So, if 5 time slots are assigned to this virtual circuit and this parameter is set to 50, the total buffer size for all time slots in the virtual circuit is 250 bytes (each of the 5 time slots uses 50 bytes).

♦ Note ♦

The Reassembly Buffer Size must be greater than the Cell Delay Variation Tolerance.

9) Time Slots Used

Indicates which time slots this virtual circuit will use. You add time slots by entering **9=** followed by a plus sign (**+**) and the number of each time slot you want to add. For example to add time slots 14 and 15, you would specify:

```
9=+14+15
```

You can also enter a minus sign (**-**) followed by the number of the time slot you want to delete. For example, to delete time slot 14 from this virtual circuit, enter:

```
9=-14
```

♦ Note ♦

This field only appears if the T1/E1 port has been configured for Structured Service Mode. For more information on configuring the T1/E1 port, see *Configuring a Circuit Emulation T1/E1 Port* on page 26-15.

10) Connection Type

This field allows you to choose between Permanent Virtual Circuits (PVCs) and Soft Permament Virtual Circuits (SPVCs). The OmniAccess 408 only supports PVCs, so this field must always be set to **PVC**.

11) ATM uplink slot

The slot in this chassis where input circuit emulation traffic will be transmitted. For an OmniAccess 408 this must be set to **2**.

12) ATM uplink port

The port on the circuit emulation module where input circuit emulation traffic is transmitted. For the OmniAccess 408 this must be set to **1**.

13) Outgoing Virtual Path Identifier

This parameter represents the VPI for the permanent virtual circuit on which cell traffic will be sent on the ATM network.

♦ Note ♦

This field only appears if the VPI is being added to a T1/E1 port on a CSM-CE submodule.

14) Outgoing Virtual Circuit Identifer

The Virtual Path Identifier (VPI) with which the virtual channel connection you are setting up is associated. You should have already specified the Virtual Circuit Identifier (VCI) in the command line for **ceadd** (in the example screen above, the VCI is 288).

17) Signaling Code

Signaling code is used to carry signaling state information (e.g., on-hook, off-hook, ringing). Signaling bits are composed of four (4) bits for T1 Extended Superframe (ESF) and E1 Multiframe (MF) or two (2) bits for T1 Superframe (SF).

This field specifies the 4-bit signaling code to be sent to attached and far-end equipment (e.g., alarms, receive cell starvation overflow). To change this parameter, enter a hexadecimal value from **0** to **f**.

Creating a Virtual Channel Connection on a Serial Port

The **ceadd** command allows you to set up a circuit emulation virtual channel connection. The configuration parameters in this command are different for T1/E1 ports and serial ports. This section describes options for serial ports.

To configure a virtual channel connection on a serial port, enter the following command

ceadd 4/<port> <vci>

where **4** is the circuit emulation slot number, **<port>** is the serial port number (Port 3 or Port 4), and **<vci>** is the virtual channel identifier for the virtual channel that you want to add.

When selecting a VCI, you need to be aware of the ranges available for each Circuit Emulation serial port. The following VCI ranges are available for each port:

Circuit Emulation Port Number	Valid VCI Range
1 (T1/E1)	256–287
2 (T1/E1)	288–319
3 (Serial)	320–351
4 (Serial)	352–383

If you wanted to configure a virtual channel with a VCI of 320 on port 3, you would enter

ceadd 4/3 320

A screen similar to the following is displayed:

```
Slot 4 Port 3 Connection 320 Configuration

1) Description (30 chars max)                          : Connection 320
2) Administration Status { UP (1), DOWN (2) }          : UP
4) Partial Cell Fill Count (0-47)                      : 0
5) Cell Loss Integration Period in second (1-64)       : 2
6) Cell Delay Variation Tolerance in frame (1-255)     : 10
7) Idle Code (0-FF)                                    : FF
8) Reassembly Buffer Size in frame (1-512)             : 20
10) Connection Type { PVC (1), SPVC (2) }              : PVC
11) ATM uplink slot (2-2)                              : 2
12) ATM uplink port (1-1)                              : 1
13) Outgoing Virtual Path Identifier (0-128)           : 0
14) Outgoing Virtual Circuit Identifer (0-1023)        : 320
```

The **ceadd** parameters for serial ports are the same as those used for T1/E1 ports. The difference between the two configurations is that the serial ports do not require time slot information. Descriptions for all of these configuration options are provided in the section, *Creating a Virtual Channel Connection on a T1/E1 Port* on page 26-10.

Configuring a Circuit Emulation T1/E1 Port

The **cemodify** command allows you to configure port-level circuit emulation parameters, such as service and clock modes. Use of this command is not required, but if you do not specify parameters, default parameters will be used to set up circuit emulation services on this port.

To configure circuit emulation parameters on a T1 or E1 port, enter the following command

cemod 4/<port>

where **4** is the circuit emulation slot number, and **<port>** is the T1 or E1 port number (Port 1 or Port 2) that you want to modify. For example, to modify Port 2, enter

cemod 4/2

A screen similar to the following displays (the values shown are the default values):

```
Circuit Emulation Port Configuration for slot 4, port 2

1)  Description (30 chars max)                    : Circuit Emulation T1 Port
2)  Administration Status { UP (1), DOWN (2) }    : UP
3)  Service Mode { unstructured (1), structured (2) }  : structured
4)  Service Clock Mode { synchronous (1), srts (2),
                         adaptive (3) }           : synchronous
20) Configure T1/E1 Port Parameters

Enter (option=value/save/cancel) :
```

1) Description

Enter a textual description of this circuit emulation service port, up to 30 characters. This text will be used in other screen displays to identify this service port.

2) Administration Status

This option enables or disables the port. If set to **UP**, the port has been enabled and can transmit data as long as its Operational Status is also UP. If set to **DOWN**, the port will not pass data even if its physical connection is good.

3) Service Mode

The mode used to service data passing through this port. In **unstructured** mode, this circuit emulation service port passes all bits, including framing bits, through to the ATM network; an entire T1 or E1 bit stream is assigned to a single virtual circuit. The input data stream is segmented into AAL1 cells without regard to any structure in the data stream or byte alignment between the data and the ATM cell payload. In **structured** mode, time slots are assigned to each virtual channel connection. See *Circuit Emulation Services* on page 26-5 for further information on service modes.

4) Service Clock Mode

Specifies the clock mode used for this logical circuit emulation port. When using a synchronous clock, the ATM network must be running on and provide a single master clock. Synchronous clocking is the most accurate form of clocking used with circuit emulation; it is the least prone to bit errors. Synchronous clocking can be used with either structured or unstructured service modes.

Synchronous Residual Time Stamp (SRTS) clocking also requires a clock from the ATM network. However, the circuit emulation end system receives the clock provided from the

device being serviced. SRTS clocking requires the use of unstructured service. Both sides of the connection must be configured to use SRTS clocking.

Adaptive clocking does not require the ATM network to run on a single master clock. The end system receives the clock provided from the device being serviced. No information on clocking is passed across the ATM network. Adaptive clocking is the least accurate form of clocking; it is the most prone to bit errors. If using adaptive clocking with structured mode, time slot information must be set correctly; you configure time slots through the **cemod** command. Both sides of the connection must support adaptive clocking.

For more information on clock modes see *Circuit Emulation Clocking Modes* on page 26-6.

20) Configure T1/E1 Port Parameters

Entering this line number at the prompt opens the T1 Port Configuration menu. For information on this menu, see Chapter 29 titled “Managing T1 and E1 Ports.”

Configuring a Circuit Emulation Serial Port

The **cemodify** command allows you to configure port-level circuit emulation parameters, such as service and clock modes. Use of this command is not required, but if you do not specify parameters, default parameters will be used to set up the circuit emulation service on this port.

To configure circuit emulation parameters on a serial port, enter the following command

cemod 4/<port>

where **4** is thecircuit emulation slot number, and **<port>** is the serial port number (Port 3 or Port 4) that you want to modify. For example, to modify Port 3, enter

cemod 4/3

A screen similar to the following displays:

```
Circuit Emulation Port Configuration for slot 4, port 3

1)  Description (30 chars max)                    : Circuit Emulation Serial Port
2)  Administration Status { UP (1), DOWN (2) }    : UP
3)  DCE Clock Speed { 56000, 64000, 128000, 256000,
                      384000, 512000, 768000, 1024000,
                      1536000, 1544000, 2048000 } : 2048000
4)  DCE Clock Source { internal (1), split (3) }  : internal
5)  Receive Clock { non-inverted (1) , inverted (2) } : non-inverted
6)  Transmit Clock { non-inverted (1) , inverted (2) } : non-inverted
7)  Service Clock Mode { synchronous (1), srts (2),
                         adaptive (3) }           : synchronous
```

1) Description

Enter a textual description of this circuit emulation service port, up to 30 characters. This text will be used in other screen displays to identify this service port.

2) Administration Status

This option enables or disables the port. If set to **UP**, the port has been enabled and can transmit data as long as its Operational Status is also UP. If set to **DOWN**, the port will not pass data even if its physical connection is good.

3) DCE Clock Speed

Indicates the data rate for this serial port if the port is a DCE device. Possible clock speeds for serial ports, in bps, are 56000, 64000, 128000, 256000, 384000, 512000, 768000, 1024000, 1536000, 1544000, and 2048000.

4) DCE Clock Source

Sets the type of clocking used to clock transmit and receive data in and out of the serial port. This value is only relevant if this serial port operates in DCE mode. If clocking is not controlled by this serial port (i.e., it is controlled by an external DCE device, such as a DSU), the external device will control clocking and the data rate on this port.

If you set this value to **Internal**, transmit and receive data are based on the local clock.

Split clocking uses additional control signals (TXCE) to keep the ASM-CE and external DTE device in sync. In split clocking, the DTE takes the incoming clock signals (TX clock) and

loops them back out to the Circuit Emulation port. Split clocking should be used if the Circuit Emulation port is a physical DCE device and you are using a non-RS-232 cable, such as V.35.

♦ Important Note ♦

Split clocking is recommended if the access rate of the serial connection is greater than 256 Kbps. If split clocking is not used at these data rates, data out-of-phase errors, aborts, or CRC errors may occur. In cases where split clocking cannot be used because the clock is not returned, inverted clocking may be required.

5) Receive Clock

This parameter defines whether the serial port samples data on the falling or rising edge of the receive clock. If you select **non-inverted**, data is sampled on the falling edge of the receive clock. If you select **inverted**, data is sampled on the rising edge of the receive clock. Sampling data on the falling edge (non-inverted) is the appropriate option for most configurations. However, if the far-end is experiencing data errors due to a long cable, and therefore, propagation delay, you may need to invert the clock edge.

6) Transmit Clock

This parameter defines whether the serial port samples data on the falling or rising edge of the transmit clock. If you select **non-inverted**, data is sampled on the falling edge of the transmit clock. If you select **inverted**, data is sampled on the rising edge of the transmit clock. Sampling data on the falling edge (non-inverted) is the appropriate option for most configurations. However, if the far-end is experiencing data errors due to a long cable—and therefore, propagation delay—you may need to invert the clock edge.

7) Service Clock Mode

Specifies the clock mode used for this logical circuit emulation port. When using a synchronous clock, the ATM network must be running on and provide a single master clock. Synchronous clocking is the most accurate form of clocking used with circuit emulation; it is the least prone to bit errors. Synchronous clocking is supported for all serial port clock speeds.

Synchronous Residual Time Stamp (SRTS) clocking also requires a clock from the ATM network. However, the circuit emulation end system receives the clock provided from the device being serviced. SRTS clocking only operates at a clock speed of 1544000 or 2048000 bps.

Adaptive clocking is not supported on serial ports.

For more information on clock modes see *Circuit Emulation Clocking Modes* on page 26-6.

Modifying a Virtual Channel Connection

The **cemodify** command allows you to change circuit emulation virtual channel connection parameters that you previously set up through the **ceadd** command. The configuration parameters in this command are the same as those used in **ceadd**.

To modify a virtual channel connection, enter the following command

cemod 4/<port> <vci>

where **<slot>** is the circuit emulation slot, **<port>** is the port number, and **<vci>** is the virtual channel identifier for the virtual channel that you want to modify. For example, to modify a virtual channel with a VCI of 288 on Port 2, enter

cemod 4/2 288

A screen similar to the following displays:

```
Slot 4 Port 2 Connection 288 Configuration

Available Time Slot:
   {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16,
    17, 18, 19, 20, 21, 22, 23, 24}

1) Description (30 chars max)                          : Connection 288
2) Administration Status { UP (1), DOWN (2) }          : UP
4) Partial Cell Fill Count (0-47)              : 0
5) Cell Loss Integration Period in second (1-64)       : 2
6) Cell Delay Variation Tolerance in frame (1-255)     : 10
7) Idle Code (0-FF)                                    : FF
8) Reassembly Buffer Size in frame (1-384)             : 20
9) Time slots used : { none }
   (Usage: "+/-<ts|all>" add/remove a time slot. For example,
    "9=+10+12-9" to add time slot 10 & 12 and remove time slot 9.
    "9=+all" add all time slots.  "9=-all" remove all time slots)
10) Connection Type { PVC (1), SPVC (2) }              : PVC
11) ATM uplink slot (2-2)                              : 2
12) ATM uplink port (1-1)                              : 1
13) Outgoing Virtual Path Identifier (0-128)           : 0
14) Outgoing Virtual Circuit Identifer (0-1023)        : 288
17) Signalling Code (0-F)                              : 0
```

The **cemodify** parameters for virtual channel connections are the same as those used in the **ceadd** command. In the example above, a VCC on a T1 port is being modified. The screen displayed for VCCs on a serial port is the same as when a VCC is created on a serial port.

For definitions of these parameters, please refer to *Creating a Virtual Channel Connection on a T1/E1 Port* on page 26-10 for T1 and E1 ports, and *Creating a Virtual Channel Connection on a Serial Port* on page 26-14 for serial ports.

Deleting a Virtual Circuit

You can delete a circuit emulation virtual circuit as long as you know its VCI and the port where it exists. To delete a virtual circuit, enter the following command

cedelete 4/<port> <VCI>

where **4** is the circuit emulation slot number, **<port>** is the port where the virtual circuit is located, and **<VCI>** is the identification number for the virtual circuit. For example, to delete virtual circuit 300 on Port 3, enter:

cedelete 4/3 300

The system returns the following prompt to confirm the deletion:

This will delete Slot 4, Port 3, VCI 300. Continue? {(Y)es, (N)o} (N)

Enter a **Y** to confirm the deletion or press **<Enter>** to cancel the deletion.

Viewing Information for a T1/E1 Virtual Circuit

To obtain circuit emulation service information on a virtual circuit configured on a T1 or E1 port, enter the following command

cestatus 4/<port> <VCI>

where **4** is the slot number for the circuit emulation ports, **<port>** is the port number on the board, and **<VCI>** is the virtual channel identifier for the virtual channel for which you want to view information. For example, to view information on a virtual channel with a VCI of 257 on Port 1 of the board in switch slot 4, enter

cestatus 4/2 289

This command displays a screen similar to the following:

```
        Circuit Emulation Status for slot 4, port 2, vci = 289

Description             : Connection 289
VPI/VCI                 : 0/289
Time Slot Used          : {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12}
Admin/Oper Status       : UP/UP
Idle Code               : FF
Elapsed Time            : 0 days, 00:36:18.68
Receive Buffer Size     : 384                 CDVT              : 20

                                                 Total          Rate
Transmit Data Cells                     :      4280757          4097
Transmit Conditioned Cells              :        65543             0
Transmit Cells Suppressed               :            0             0
Receive Data Cells                      :      4310044          4097
Receive Bad Sequence Number Cells       :            0             0
Receive Cells Dropped Pointer Search    :          183             0
Receive Cells Dropped Queue Underrun    :          183             0
Receive Cells Dropped Queue Overrun     :            0             0
```

Descriptions for fields in the top portion of this screen display (except for Elapsed Time) are described in the section, *Creating a Virtual Channel Connection on a T1/E1 Port* on page 26-10.

Descriptions for fields in the bottom half of the display are provided below. Values in the **Total** column indicate the total number of cells transmitted or received on this virtual channel connection. Values in the **Rate** column indicate the number of cells transmitted or received in the last second.

Elapsed Time. This field identifies the length of time since the last time the virtual circuit statistics were cleared via the **cecls** command (see *Clearing ATM Circuit Emulation Statistics* on page 26-31 for more information). Elapsed Time is displayed in the format "xxx days, hh:dd:ss.tt."

Transmit Data Cells. The number of cells on this virtual circuit containing user data that has been transmitted upstream.

Transmit Conditioned Cells. The number of cells transmitted upstream on this virtual circuit when there are one or more active alarms on the port where this virtual circuit is configured.

Transmit Cells Suppressed. The number of cells that were dropped on this virtual circuit due to line resynchronization.

Receive Data Cells. The total number of data cells received on this virtual circuit.

Receive Bad Sequence Number Cells. The number of times that cells received had a bad sequence number in the AAL1 SAR header. This value indicates the number of times hardware *detected* bad sequence numbers, but the actual number of cells lost may be higher.

Receive Cells Dropped Pointer Search. The number of times the port dropped incoming cells during the pointer searching process. This value indicates the number of times hardware *detected* dropped cells due to this condition, but the actual number of cells lost may be higher.

Receive Cells Dropped Queue Underrun. The number of times the port dropped incoming cells because the reassembly buffer underran. This value indicates the number of times hardware *detected* dropped cells due to this condition, but the actual number of cells lost may be higher.

Receive Cells Dropped Queue Overrun. The number of times the port dropped incoming cells because the reassembly buffer overran. This value indicates the number of times hardware *detected* dropped cells due to this condition, but the actual number of cells lost may be higher.

Viewing Information for a Serial Port Virtual Circuit

To obtain circuit emulation service information on a virtual circuit configured on a serial port, enter the following command

cestatus 4/<port> <VCI>

where **4** is the slot number for circuit emulation ports, **<port>** is the port number on the board, and **<VCI>** is the virtual channel identifier for the virtual channel for which you want to view information. For example, to view information on a virtual channel with a VCI of 320 on port 3, enter

cestatus 4/3 320

This command displays a screen similar to the following:

```
Circuit Emulation Status for slot 4, port 3, vci = 320

Description              : Connection 320
VPI/VCI                  : 0/320
Admin/Oper Status        : UP/UP
Idle Code                : FF
Elapsed Time             : 0 days, 00:36:18.68
Receive Buffer Size      : 100              CDVT                  : 20

                                                  Total          Rate
Transmit Data Cells                          : 438420442          5448
Transmit Conditioned Cells                   :         0             0
Transmit Cells Suppressed                    :         0             0
Receive Data Cells                           : 438420442          5448
Receive Bad Sequence Number Cells            :         0             0
Receive Cells Dropped Pointer Search         :         0             0
Receive Cells Dropped Queue Underrun         :         1             0
Receive Cells Dropped Queue Overrun          :         0             0
```

Descriptions for fields in the top portion of this screen display are described in the section, *Creating a Virtual Channel Connection on a Serial Port* on page 26-14. Descriptions for fields in the bottom half of the display are described above in the section, *Viewing Information for a T1/E1 Virtual Circuit* on page 26-29.

Viewing Circuit Emulation Information

The **ces** command provides circuit emulation information, including configuration parameters, time slot information, status, and statistics. You can obtain general circuit emulation information the circuit emulation slot, all circuit emualtion ports, an individual ports, and individual virtual circuits. You receive different displays depending upon which level you choose. The sections below describe all ways to use the **ces** command.

Viewing General Circuit Emulation Information

To obtain circuit emulation service information on on the CES slot, enter the **ces** command without any parameters as follows:

```
ces
```

This command displays a screen similar to the following:

Circuit Emulation Chassis Status

Slot/Port	Port Description	Admin/ Oper Status	Interface Type	Clock Speed	Setup VCCs
4/1	Circuit Emulation E1 Port	UP/UP	E1	2048000	2
4/2	Circuit Emulation E1 Port	UP/UP	E1	2048000	1
4/3	Circuit Emulation Serial Port	UP/DN	*NONE*	0	1
4/4	Circuit Emulation Serial Port	UP/DN	*NONE*	0	1

Each row in the table corresponds to a physical port on an board in the switch. The following sections describe the columns shown in this table:

Slot/Port. The first number in this column is the slot in the switch where this module is installed. The second number is the port number on the module.

Port Description. The textual description of this port as entered through the **cemodify** command.

Admin/Oper Status. This column shows the Administrative and Operational Status of this port. The status indicator before the slash refers to the Administrative Status. If **UP**, the port has been enabled and can transmit data as long as its Operational Status is also **UP**. If the Administrative Status is **DN**, the port will not pass data even if its physical connection is good.

The status indicator after the slash refers to the Operational Status. If **UP**, the port is capable of passing data as long as it has been logically enabled at the Administrative level. If **DN**, the port cannot pass data because of a problem in the physical connection (e.g., cable disconnected, hardware could not detect cable type) or because the port is Administratively Down.

Interface Type. This column indicates the physical cable type connected to this port. This cable type is automatically sensed by hardware.

For serial ports, this column indicates the cable type and whether it is DCE or DTE. The following values may display in this column

- **V35DTE** (V.35 DTE cable)
- **V35DCE** (V.35 DCE cable)
- **232DTE** (RS-232 DTE cable)
- **232DCE** (RS-232 DCE cable)
- **X21DTE** (X.21 DTE cable)
- **X21DCE** (X.21 DCE cable)
- **530DTE** (RS-530 or RS-449 EIA DTE cable)
- **530DCE** (RS-530 or RS-449 EIA DCE cable)
- **T1** (T1 CES port)
- **E1** (E1 CES port)

The OmniAccess 408 sees RS-530 and RS-449 cables the same because they are electrically identical. However, this does not affect the operation of either cable type. Both RS-530 and RS-449 cables are supported.

If no serial port cable is connected to a port, this column will display

NONE

T1 and E1 ports will display their interface type whether or not a cable is attached. If an error has been detected on the port (e.g., cable type could not be detected), the following value displays:

ERROR!

Clock Speed. Indicates the data rate of the interface. T1 and E1 ports (ports 2 and 3) will always be set to 1544000 or 2048000, respectively. The clock speed of serial ports (ports 4 and 5) is dynamically derived from the cell rate. Possible clock speeds for serial ports, in bps, are 56000, 64000, 128000, 256000, 384000, 512000, 768000, 1024000, 1536000, 1544000, and 2048000.

Setup VCCs. The number of virtual channel connections (VCCs) that have been set up for the corresponding port in the table. Virtual channel connections are configured through the **ceadd** command, which is described on page 26-10.

Viewing Information on the CES slot

To obtain circuit emulation service information on all ports in the CES slot, enter the following command

ces 4

where **4** is the circuit emulation slot number. For example, to display information on the board in switch slot 4, enter

ces 4

This command displays a screen similar to the following:

Circuit Emulation Status for slot 4

Port	Port Description	Admin/ Oper Status	Interface Type	Clock Speed	Setup VCCs
1	Circuit Emulation E1 Port	UP/UP	E1	2048000	2
2	Circuit Emulation E1 Port	UP/UP	E1	2048000	1
3	Circuit Emulation Serial Port	UP/DN	*NONE*	0	1
4	Circuit Emulation Serial Port	UP/DN	*NONE*	0	1

Descriptions of the columns in this table are given under the description of the **ces** command for all boards in a switch. Please refer to *Viewing General Circuit Emulation Information* on page 26-24.

Viewing Information for a T1 or E1 Port

To obtain circuit emulation service information on one T1 or E1 port, enter the following command

ces 4/<port>

where **4** is the circuit emulation slot number and **<port>** is the port number on the board for which you want to view information. For example, to view information on Port 2, enter

ces 4/2

This command displays a screen similar to the following:

```
Circuit Emulation Status for slot 4, port 2

Description              : Circuit Emulation E1 Port
Admin/Oper Status        : UP/UP
Service Mode             : structured
Service Clock Mode       : synchronous
Available Time Slots     : { none }

Virtual Circuit Information

                                                 Admin/Oper   No. of
 VPI/VCI          Channel  Description           Status       Time Slots
==========  ============================  ==========  ==========
 0/256       Connection 256                UP/UP          4
 0/257       Connection 257                UP/UP         27
```

Description. A textual description for this port entered when the port was configured through the **cemodify** command.

Admin/Oper Status. This field is described in *Viewing General Circuit Emulation Information* on page 26-24.

Service Mode, **Service Clock Mode**. Descriptions of these two fields are given in the section, *Configuring a Circuit Emulation T1/E1 Port* on page 26-15.

Available Time Slots. The time slots that are available for virtual circuits on this port. Time slots are assigned to virtual circuits through the **ceadd** command, which is described in *Creating a Virtual Channel Connection on a T1/E1 Port* on page 26-10.

The following table columns also display for each virtual circuit on this port.

VPI/VCI. The Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI) for virtual channels on which information is provided. You configure the VPI and VCI for virtual channel connections through the **ceadd** command, which is described in *Creating a Virtual Channel Connection on a T1/E1 Port* on page 26-10.

Channel Description. A textual description of this virtual channel of up to 30 characters. This channel description is configured through the **ceadd** command.

Admin/Oper Status. This field is described in *Creating a Virtual Channel Connection on a T1/E1 Port* on page 26-10.

No. of Time Slots. The number of time slots for the given virtual circuit. You assign time slots to each virtual circuit through the **ceadd** command. Only circuit emulation services using a structured service mode require the use of time slots.

Viewing Information for a Serial Port

To obtain circuit emulation service information on a circuit emulation serial port, enter the following command

ces 4/<port>

where **4** is the circuit emulation slot number and **<port>** is the port number for which you want information. For example, to view information on Port 3, enter

ces 4/3

This command displays a screen similar to the following:

```
Circuit Emulation Status for slot 4, port 3

Description            : Circuit Emulation Serial Port
Admin/Oper Status      : UP/DOWN
Service Mode           : unstructured
Service Clock Mode     : synchronous
Clock Speed            : 0
Interface Type         : *NONE*          DCE Clock Source     : internal
Transmit Clock         : non-inverted    Receive Clock        : non-inverted

Virtual Circuit Information
                                                  Admin/Oper   No. of
 VPI/VCI          Channel  Description            Status       Time Slots
========== ============================== ========== ==========
 0/320      Connection 320                 UP/UP          N/A
```

Descriptions for the fields in the top section of this display can be found in *Configuring a Circuit Emulation Serial Port* on page 26-17.

Descriptions for the fields in the bottom section of the display can be found in *Viewing Information for a T1 or E1 Port* on page 26-27.

Viewing Information for a T1/E1 Virtual Circuit

To obtain circuit emulation service information on a virtual circuit configured on a T1 or E1 port, enter the following command

ces 4/<port> <VCI>

where **4** is the circuit emulation slot number, **<port>** is the port number on the board, and **<VCI>** is the virtual channel identifier for the virtual channel for which you want to view information. For example, to view information on a virtual channel with a VCI of 257 on Port 1, enter

ces 4/1 257

This command displays a screen similar to the following:

```
Circuit Emulation Status for slot 4, port 1, vci = 257

Description          : Connection 257
VPI/VCI              : 0/257
Time Slot Used       : {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 24}
Admin/Oper Status    : UP/UP
Idle Code            : FF
Elapsed Time         : 0 days, 00:36:18.68
Receive Buffer Size  : 384                  CDVT                 : 20

                                              Total        Rate
Transmit Data Cells                        :  4280757      4097
Transmit Conditioned Cells                 :    65543         0
Transmit Cells Suppressed                  :        0         0
Receive Data Cells                         :  4310044      4097
Receive Bad Sequence Number Cells          :        0         0
Receive Cells Dropped Pointer Search       :      183         0
Receive Cells Dropped Queue Underrun       :      183         0
Receive Cells Dropped Queue Overrun        :        0         0
```

Descriptions for fields in the top portion of this screen display (except for Elapsed Time) are described in the section, *Creating a Virtual Channel Connection on a T1/E1 Port* on page 26-10.

Descriptions for fields in the bottom half of the display are provided below. Values in the **Total** column indicate the total number of cells transmitted or received on this virtual channel connection. Values in the **Rate** column indicate the number of cells transmitted or received in the last second.

Elapsed Time. This field identifies the length of time since the last time the virtual circuit statistics were cleared via the **cecls** command (see page 26-31). Elapsed Time is displayed in the format "xxx days, hh:dd:ss.tt."

Transmit Data Cells. The number of cells on this virtual circuit containing user data that has been transmitted upstream.

Transmit Conditioned Cells. The number of cells transmitted upstream on this virtual circuit when there are one or more active alarms on the port where this virtual circuit is configured.

Transmit Cells Suppressed. The number of cells that were dropped on this virtual circuit due to line resynchronization.

Receive Data Cells. The total number of data cells received on this virtual circuit.

Receive Bad Sequence Number Cells. The number of times that cells received had a bad sequence number in the AAL1 SAR header. This value indicates the number of times hardware *detected* bad sequence numbers, but the actual number of cells lost may be higher.

Receive Cells Dropped Pointer Search. The number of times the port dropped incoming cells during the pointer searching process. This value indicates the number of times hardware *detected* dropped cells due to this condition, but the actual number of cells lost may be higher.

Receive Cells Dropped Queue Underrun. The number of times the port dropped incoming cells because the reassembly buffer underran. This value indicates the number of times hardware *detected* dropped cells due to this condition, but the actual number of cells lost may be higher.

Receive Cells Dropped Queue Overrun. The number of times the port dropped incoming cells because the reassembly buffer overran. This value indicates the number of times hardware *detected* dropped cells due to this condition, but the actual number of cells lost may be higher.

Viewing Information for a Serial Port Virtual Circuit

To obtain circuit emulation service information on a virtual circuit configured on a serial port, enter the following command

ces 4/<port> <VCI>

where **4** is the circuit emulation slot number, **<port>** is the port number on the board, and **<VCI>** is the virtual channel identifier for the virtual channel for which you want to view information. For example, to view information on a virtual channel with a VCI of 320 on port 3, enter

ces 4/3 320

This command displays a screen similar to the following:

```
Circuit Emulation Status for slot 4, port 3, vci = 320

Description              : Connection 320
VPI/VCI                  : 0/320
Admin/Oper Status        : UP/UP
Idle Code                : FF
Elapsed Time             : 0 days, 00:36:18.68
Receive Buffer Size      : 100              CDVT                 : 20

                                              Total          Rate
Transmit Data Cells                        : 438420442      5448
Transmit Conditioned Cells                 :         0         0
Transmit Cells Suppressed                  :         0         0
Receive Data Cells                         : 438420442      5448
Receive Bad Sequence Number Cells          :         0         0
Receive Cells Dropped Pointer Search       :         0         0
Receive Cells Dropped Queue Underrun       :         1         0
Receive Cells Dropped Queue Overrun        :         0         0
```

Descriptions for fields in the top portion of this screen display are described in the section, *Creating a Virtual Channel Connection on a Serial Port* on page 26-14. Descriptions for fields in the bottom half of the display are described above in the section, *Viewing Information for a T1/E1 Virtual Circuit* on page 26-29.

Clearing ATM Circuit Emulation Statistics

To clear the accumulated statistics for a circuit, use the **cecls** command, as follows:

```
cecls 4/<port> <VCI>
```

where **4** is the circuit emulation slot number, **<port>** is the port number on the board, and **<VCI>** is the virtual channel identifier for the virtual channel whose statistics you want to clear. For example, to clear the statistics on a virtual channel with a VCI of 256 on port 1, enter

```
cecls 4/1 256
```

Once the statistics have been cleared, the following message will be displayed:

```
Statistics of Virtual Circuit 256 on 4/1 have been cleared.
```