CTP Series Circuit To Packet Platform

Interoperability With SAToP-Compliant Equipment Over T1/E1 Circuits

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Interoperability of T1/E1 Circuits With SAToP-Compliant Equipment, CTP Release 7.2, CTPView Release 7.2

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Table of Contents

Part 1 Overview

Chapter 1 **Overview of SAToP Bundles 3**

SAToP Bundle Overview 3
SAToP Encapsulation for E1 Interfaces 3
SAToP Interoperability with M Series E1/T1 Circuit Emulation PICs Overview 4
Adaptive Clocking for SAToP Bundles Overview 5
Determining Optimal Packet Size for SAToP Bundles Overview 5
Bandwidth for Transporting SAToP Data 6
Packet Creation Delay 6
Performance of the IP Network 6
Providing QoS for SAToP Bundles by Using Service Type Overview 7
Loss Of Signal Detection Capability on CTP Bundles and SAToP Bundles 8
Detection of LOS on Serial Interfaces 10
Detection of T1/E1 Interfaces 10
Guidelines for Configuring LOS Detection 11

Part 2 Configuration

Chapter 2 **Configuring SAToP Bundles 15**

Configuring the Default Bundle Data Protocol on the CTP Device (CTP Menu) 15
Configuring IP Parameters for SAToP Bundles (CTPView) 16
Configuring IP Parameters for SAToP Bundles (CTP Menu) 18
Configuring Virtual IP Parameters for SAToP Bundles (CTPView) 20
Configuring Virtual IP Parameters for SAToP Bundles (CTP Menu) 21
Configuring Circuit Restart Parameters for SAToP Bundles (CTPView) 22
Configuring Circuit Restart Parameters for SAToP Bundles (CTP Menu) 22
Configuring the Missing Packet Fill Pattern for SAToP Bundles (CTPView) 23
Configuring the Missing Packet Fill Pattern for SAToP Bundles (CTP Menu) 24
Configuring T1 and E1 Port Parameters for SAToP Bundles (CTPView) 24
Configuring T1 and E1 Port Parameters for SAToP Bundles (CTP Menu) 26
Configuring Adaptive Clocking for SAToP Bundles (CTPView) 28
Configuring Adaptive Clocking for SAToP Bundles (CTP Menu) 30
Configuring LOS Detection on CTP and SAToP Bundles (CTP Menu) 31

Part 3 Example

Chapter 3 **Example: Using SAToP Bundles to Interoperate with M Series Multiservice Edge Routers 35**

Example: CTP Interoperability with M Series T1/E1 Circuit Emulation PICs 35

PART 1

Overview

- Overview of SAToP Bundles on page 3

CHAPTER 1

Overview of SAToP Bundles

- SAToP Bundle Overview on page 3
- SAToP Interoperability with M Series E1/T1 Circuit Emulation PICs Overview on page 4
- Adaptive Clocking for SAToP Bundles Overview on page 5
- Determining Optimal Packet Size for SAToP Bundles Overview on page 5
- Providing QoS for SAToP Bundles by Using Service Type Overview on page 7
- Loss Of Signal Detection Capability on CTP Bundles and SAToP Bundles on page 8
- Guidelines for Configuring LOS Detection on page 11

SAToP Bundle Overview

Structure Agnostic TDM over Packet (SAToP) bundles use a standards-based transport mechanism for T1/E1 circuits that allows them to interoperate with other SAToP-compliant equipment.

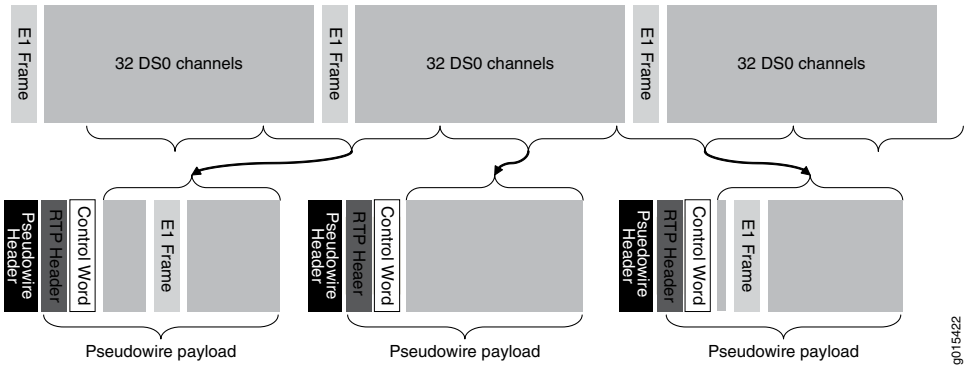
SAToP bundles comply with RFC 4553 to provide pseudowire encapsulation (PWE3) for TDM bit streams (T1, E1, T3, E3) that disregards any structure that may be imposed on these streams, in particular the structure imposed by the standard TDM framing.

You can configure SAToP bundles on CTP150 and CTP2000 platforms with T1/E1 interfaces or on CTP2000 platforms with serial interfaces that have T1/E1 daughter cards.

SAToP Encapsulation for E1 Interfaces

Figure 1 on page 4 shows an example of SAToP encapsulation for E1 interfaces.

Figure 1: SAToP Encapsulation for E1 Interfaces



SAToP encapsulation works as follows:

- The entire T1/E1 stream is packetized including all DS0s. The current state of the DS0s is not taken into consideration during this process.
- The T1/E1 stream is sliced into equal sized packets. The slice position is random and unrelated to the position of the frame bit. In other words, the process is structure agnostic.

Related Documentation

- SAToP Interoperability with M Series E1/T1 Circuit Emulation PICs Overview on page 4

SAToP Interoperability with M Series E1/T1 Circuit Emulation PICs Overview

You can use SAToP bundles to allow CTP devices to interoperate with Juniper Networks T1/E1 Circuit Emulation PICs on M Series Multiservice Edge Routers.

This interoperability allows you to deploy CTP150 and CTP2000 platforms to the customer edge by connecting them to existing M Series routers. By using existing routers and circuit emulation PICs with CTP equipment, you can provide services to smaller, remote locations without having to deploy additional M Series routers.

This feature uses a static Layer 2 circuit pseudowire that supports the use of GRE tunnels for carrying MPLS pseudowire traffic. To use this feature, you create a Layer 2 circuit and a GRE tunnel between the CTP device and the CE PIC on the router. Using SAToP encapsulation, you can provide a T1 TDM transport through the GRE tunnel.

The M Series router must have tunneling services available. These services can be built-in, as with the M7i, M120, and M360, or provided if you use an advanced services (AS) PIC that supports tunneling.

Related Documentation

- Example: CTP Interoperability with M Series T1/E1 Circuit Emulation PICs on page 35

Adaptive Clocking for SAToP Bundles Overview

The goal of adaptive clocking is to prevent buffer anomalies by adjusting the clocks so that they are the same at each end of the network. If the clocks are not the same at each end of the network, the data rate entering and exiting buffers will not be the same, which causes a buffer underflow or overflow.

Adaptive clocking works by gathering information on packets arriving from the IP network and using that information to determine if adjustments need to be made to the local clock to maintain frequency lock with the remote end. This process is called adaptive time domain processing (ATDP). ATDP provides rapid convergence to the correct clock, and does not vary due to changes in the average jitter buffer fill. As a result, a circuit continuously operates without a buffer re-center, even when clock references are not used.

SAToP bundles support adaptive clocking with the external transmit (TX) clock. With this type of clocking:

- Data received from the local user equipment that is bound to the IP network is clocked using the CTP external user clock (the transmit timing clock).
- Data received from the remote CTP device and bound for the interface is adaptively clocked with the recovered clock from the user equipment that is connected to the remote CTP device.

This configuration allows for independent adaptive configuration in each direction. With this method, the user equipment can send packets into the network with their local clock, and the remote end CTP devices adaptively recover this clock. This clocking method is useful when the port speed is high or the cable length between the user equipment and CTP device is large.

Related Documentation

- Configuring Adaptive Clocking for SAToP Bundles (CTP Menu) on page 30
- Configuring Adaptive Clocking for SAToP Bundles (CTPView) on page 28

Determining Optimal Packet Size for SAToP Bundles Overview

You can specify the size of IP packets that are created from data received at the T1/E1 interface. The CTP device uses packet size along with the interface rate to calculate the packet rate; that is, the rate that packets are created. The maximum packet rate is 1500 packets per second.

To determine the optimal packet size, consider the following:

- Bandwidth for transporting SAToP data
- Packet creation delay
- Performance of the IP network

For example, larger packet sizes are more bandwidth-efficient, but introduce more delay during packet creation.

Bandwidth for Transporting SAToP Data

When considering bandwidth in relation to deciding packet size, add overhead for both the Layer 2 encapsulation and the IP header. The IP header comprises 20 bytes; and the encapsulation overhead varies, but is typically either 6 or 8 bytes on serial links. This overhead causes smaller packets to be less efficient and result in serial data requiring more bandwidth.

Calculate the bandwidth required for a serial bit stream as follows:

IP Bandwidth = [Packet Size (bytes) + 20 (bytes for IP header) + 4 bytes MPLS + 4 bytes GRE + 4 (bytes for control word) x [Packet Rate (pps)] x 8

Packet Creation Delay

Data received at the CTP interface must be buffered long enough to allow a packet to be created. The delay to create the packet increases as either the size of the packet increases or as the rate of the interface decreases. Generally, this delay is minimal except when the rate of the interface is low and the packet size is large. We recommend that you set the packet size to a smaller value for lower-speed interfaces. Table 1 on page 6 provides examples of interface packet creation delay in milliseconds.

Table 1: Packet Creation Delay for T1/Et Interfaces

	T1/E1 Interface Delay (msec)					
	Packet Size (bytes)					
Interface Rate (Kbps)	128	256	512	768	1024	1400
1544	0.7	1.3	2.7	4.0	5.3	7.3
2048	.5	1.0	2.0	3.0	4.0	5.5

Performance of the IP Network

The number of packets created (packet rate) is inversely related to the packet size configured. For example, smaller packets result in a greater packet rate. When you configure the packet size, consider the packet-forwarding performance of the attached router and network. Table 2 on page 6 provides examples of packet rates for various packet sizes and serial interface rates.

Table 2: Packet Rate for Various Packet Size and T1/E1 Interface Rate Settings

	Packet Rate (Packets per Second)					
	Packet Size (Bytes)					
Interface Rate (Kbps)	128	256	512	768	1024	1400
1544	1507.8	753.9	277.0	251.3	188.5	137.9

Table 2: Packet Rate for Various Packet Size and T1/E1 Interface Rate Settings *(continued)*

Interface Rate (Kbps)	Packet Rate (Packets per Second) Packet Size (Bytes) 128	256	512	768	1024	1400
2048	2000.0	1000.0	500.0	333.3	250.0	182.9

Related Documentation

- Configuring IP Parameters for SAToP Bundles (CTP Menu) on page 18
- Configuring IP Parameters for SAToP Bundles (CTPView) on page 16

Providing QoS for SAToP Bundles by Using Service Type Overview

In IP networks, the IP flow is typically classified based on the Differentiated Services Code Point (DSCP) setting in the Type of Service (TOS) byte of the IP header. DSCP is a scalable solution for classifying flows in a large IP network based on the class of service desired on specific IP traffic flows.

With the CTP device, you can configure DSCP settings for each circuit's IP flow. For example, some circuits could be configured for the expedited forwarding (EF) class. When the network routers receive this EF marked flow from the CTP device, they place the marked traffic into a high priority queue, enabling this traffic to be serviced before lower priority traffic. As an EF marked flow transverses the IP network, routers can use its classification to provide the flow a more predictable level of performance across the network

When you configure the service type of a bundle, you specify the ToS byte to be used in IP headers of packets sent from the CTP device to the IP network. The ToS setting is applied to circuits created by the bundle for which the service type is configured.

Table 3 on page 7 shows the mapping for each DSCP class and setting to the ToS setting that you configure as the service type for a bundle. The expedited forwarding (EF) class (ToS setting 184) is commonly used for circuit traffic.

Table 3: DSCP Classes and Service Type

DSCP Class	DSCP Setting	ToS Setting
CS7	56	224
CS6	48	192
EF	46	184
CS5	40	160
AF43	38	152
AF42	36	144

Table 3: DSCP Classes and Service Type *(continued)*

DSCP Class	DSCP Setting	ToS Setting
AF41	34	136
CS4	32	128
AF33	30	120
AF32	28	112
AF31	26	104
CS3	24	96
AF23	22	88
AF22	20	80
AF21	18	72
CS2	16	64
AF13	13	52
AF12	12	48
AF11	10	40
CS1	8	32

Related Documentation

- Configuring IP Parameters for SAToP Bundles (CTP Menu) on page 18
- Configuring IP Parameters for SAToP Bundles (CTPView) on page 16

Loss Of Signal Detection Capability on CTP Bundles and SAToP Bundles

A loss of signal (LOS) alarm indicates that there is a physical link problem with the connection to the router receive port from the neighboring SONET equipment transmit port. An LOS alarm occurs when the port on the card is in service but no signal is being received. The cabling is not correctly connected to the ports, or no signal exists on the line. Possible causes for a loss of signal include upstream equipment failure or a fiber cut.

The CTP devices support a both-ended redundancy mechanism, in which two identical CTP circuit bundles are combined using Y cables at each end, enabling one bundle to act as a backup for the other. One of the bundles is in use (online), while the other is in the standby state (offline). Only the online bundle is allowed to drive the Y cable towards the user equipment, while the offline bundle is tristate. A communications channel (such

as redundancy by using a hardware link that uses a special Y cable or redundancy based on a software link that does not depend on a signaling hardware like the Y cable) between ports at each end determines which of the two ports on the Y cable is currently online. When one bundle fails, the failed bundle transitions to the offline and places the other bundle in the online state.

Consider a sample configuration scenario in which two CTP bundles (four CTP ports) are used in a Y-cable redundancy format. Software-based redundancy is enabled. In this type of configuration, 172.25.62.51:te-0/0(B0) is the left primary link and 172.25.62.51:te-0/1(B1) is the left secondary link. 172.25.62.52:te-0/0(B0) is the right primary link and 172.25.62.52:te-0/1(B1) is the right secondary link. In this redundant configuration, the circuit is very robust, protecting against many types of failures, such network failures, power failures, and equipment failures. However, one type of failure is not detected, which is when a cable is pulled out.

Starting with CTPOS Release 7.2R1, CTP devices support the detection of a loss of signal, which denotes a physical link problem. The following conditions are supported:

- In a serial both-ended Y-cable redundancy configuration (hardware-based redundancy or software-based Y cable link protocol), removal of Y cable leg from the CTP port of the online bundle must be able to force a switch to the standby bundle.
- In a T1/E1 both-ended Y cable configuration (hardware-based redundancy or software-based Y cable link protocol), removal of Y cable leg from the CTP port of the online bundle must be able to force a switch to the standby bundle.

The way in which CTP redundancy works is by using the bundle state to make decisions. When a bundle is in the RUNNING state, the following processes occur:

1. The remote CTP is operational and is able to generate and send packets into the IP network (towards us).
2. The network is able to transport bundle OAM and payload packets from the remote CTP to the local CTP.
3. A sufficient percentage of the bundle payload packets fills packet delay variation (PDV buffers) and maintain circuit data transport towards the locally connected user equipment.

Therefore, when a bundle is in the RUNNING state, it is “usable” and can be online in a redundant configuration.

Consider a network topology in which a failure occurs in the circuit path that does not cause the circuit to exit the RUNNING state. This phenomenon can be the case when the cable is pulled from the CTP port of a redundant online bundle. Although this condition might not typically be considered an actual failure, and instead more of a configuration error, this symptom can nevertheless be classified in the failure category. Therefore, a mechanism to be able to detect this condition in redundant setups and provide an online circuit switch to offline when the cable is removed is beneficial. CTP devices support the

evaluation of LOS conditions on serial interfaces and T1E1 interfaces in CTP bundles and SAToP bundles.

- Detection of LOS on Serial Interfaces on page 10
- Detection of T1/E1 Interfaces on page 10

Detection of LOS on Serial Interfaces

For serial interfaces, the determination of LOS condition is already performed in CTPOS releases earlier than Release 7.2R1. When a serial circuit is configured to use the TT input (on a data communication equipment [DCE] interface) for at least one of its five configured port clocks (for example, “Cfg Rate - Ext Clk), the external clock frequency is examined by the CTP device before the local bundle can go to the running state. If there is no external clock present or it is not the correct frequency, then the bundle transitions to the TtFAIL state and never go to RUNNING. Also, if the bundle is already in the RUNNING state, the external clock is verified every second to ensure that its frequency is still present and within range. If not, the bundle transitions from RUNNING to TtFAIL.

In the TtFAIL state, the bundle periodically transitions back to the EVAL state, where the external clock is checked again. If the clock fails or a bad frequency occurs, the bundle returns to the TtFAIL state. If the clock is properly functional, then the bundle transitions to the various states that eventually end in the RUNNING state. Such a method of change of states enable a graceful (if not instantaneous) recovery of a circuit where a cable is disconnected, but subsequently reconnected. Because removal of the cable on a serial port that is using an external clock can cause the bundle to exit the RUNNING state, that bundle switches offline, if currently online in a Y-cable redundancy setup.

Detection of T1/E1 Interfaces

The clock and data signals are embedded together on a T1/E1 interface in a single AMI (alternate mark inversion) electrical signal. The hardware line interface unit (LIU) that recovers the composite AMI signal into its component clock and data signals recovers a clock from the incoming AMI signal, even when none is present because it is based on a free running phase-locked loop (PLL) that generates a clock, even when it is not locked to an incoming signal. As a result, the CTP port interface receives an incoming external clock from the LIU, whether a valid T1/E1 signal is connected to the CTP or not. The LIU, however, cannot determine when it has a valid incoming T1/E1 signal, and in such a condition, the LIU indicates as a LOS status bit. This indication serves as the basis for detecting a cable disconnect in a Y-cable redundant configuration.

To use LOS as a way to take down a RUNNING bundle, the effective method implemented is to treat a T1/E1 LOS condition exactly the same as a serial port with a bad or missing external clock. When the CTP device performs its “check external clock” function, instead of returning an automatic success on T1/E1 ports, the LOS status bit is analyzed to determine whether it is a T1/E1 port. If the LIU LOS status indicates that there is no incoming signal, then the function returns a failure, which causes the bundle to move to the TtFAIL state. This state is the same as a missing external clock processing for a serial port. In this manner, the T1/E1 ports behave exactly the same way as serial ports.

Guidelines for Configuring LOS Detection

Keep the following points in mind when you configure the capability to detect LOS conditions on T1E1 interfaces:

- A cable disconnection of a serial port cannot be detected when no external clock is being used by the port. The following clock configurations use an external clock:
  - DCE/DTE: Cfg Rate – Ext Clk
  - DCE/DTE: All Clock – Ext Clk
  - DCE/DTE: Adap Rate – Ext Clk
  - DCE/DTE: Auto Rate – Ext Clk
  - DTE: All clocked by Ext Clk (ST/RT)
  - DTE: All clocked by User Clk (RT)
  - Any custom clock config that uses “TT”
- For any other serial clock configuration, a cable removal on the online port does not cause it to exit the running state.
- For T1/E1 ports, the recovered clock (which is equivalent to the external clock of a serial port) from the incoming T1/E1 AMI signal is used in all available T1/E1 preconfigured or canned clock configurations.
- The T1 LOS checking technique was primarily intended for CTP bundles. Because the T1/E1 SAToP bundle state machine also supports the bundle EVAL state as part of its bundle state machine, it can also benefit from the LOS checking functionality provided by this feature. However, the LOS detection feature on SAToP bundles is not useful for both ended redundancy, since both-ended Y-cable redundancy configurations only supports CTP bundles.
- CESoPSN and VCOMP bundles are not supported for detecting LOS conditions because their bundle state machines do not support an EVAL state.
- You can configure the LOS detection mechanism for T1/E1 ports in the same function that checks the external input clock. In addition, this T1/E1 LOS detection capability is processed under the control of a separate port configuration flag so that this LOS checking occurs only when this flag is active. Although this menu option to enable or disable the LOS detection functionality is shown regardless of the port type, such as serial interfaces or T1E1 interfaces, this setting becomes effective on a T1/E1 port only when it is connected to a CTP or SAToP bundle. If the LOS detection functionality is enabled on a serial port or other bundle types, the setting is not processed.
- Also, when you run the bundle query for CTP bundles and SAToP bundles, the T1E1 port type displays port configuration flags that are relevant to a T1E1 port. In the PortConfigFlags field displayed in the output of the bundle query, T1LoSCheck denotes that LOS detection is specified on a T1 port connected to a CTP bundle or a SAToP bundle, E1LoSCheck denotes that LOS detection is specified on a E1 port connected to a CTP bundle or a SAToP bundle, and the NoRdReclk flag signifies that the redundancy receiving (RX) clock is disabled. The NoRdReclk flag is also displayed

because this flag is default enabled for a T1/E1 port, whereas it is usually not enabled for a serial port.

PART 2

Configuration

- Configuring SAToP Bundles on page 15

CHAPTER 2

Configuring SAToP Bundles

- Configuring the Default Bundle Data Protocol on the CTP Device (CTP Menu) on page 15
- Configuring IP Parameters for SAToP Bundles (CTPView) on page 16
- Configuring IP Parameters for SAToP Bundles (CTP Menu) on page 18
- Configuring Virtual IP Parameters for SAToP Bundles (CTPView) on page 20
- Configuring Virtual IP Parameters for SAToP Bundles (CTP Menu) on page 21
- Configuring Circuit Restart Parameters for SAToP Bundles (CTPView) on page 22
- Configuring Circuit Restart Parameters for SAToP Bundles (CTP Menu) on page 22
- Configuring the Missing Packet Fill Pattern for SAToP Bundles (CTPView) on page 23
- Configuring the Missing Packet Fill Pattern for SAToP Bundles (CTP Menu) on page 24
- Configuring T1 and E1 Port Parameters for SAToP Bundles (CTPView) on page 24
- Configuring T1 and E1 Port Parameters for SAToP Bundles (CTP Menu) on page 26
- Configuring Adaptive Clocking for SAToP Bundles (CTPView) on page 28
- Configuring Adaptive Clocking for SAToP Bundles (CTP Menu) on page 30
- Configuring LOS Detection on CTP and SAToP Bundles (CTP Menu) on page 31

Configuring the Default Bundle Data Protocol on the CTP Device (CTP Menu)

The default bundle data protocol is GRE (47). Before you configure SAToP bundles, you should change the default bundle data protocol to a value other than GRE. Doing so prevents conflict between legacy CTP bundles and SAToP bundles that are using GRE for interoperability.

To configure the default data protocol for bundles from GRE using CTP Menu:

1. From the Main Menu, select **5) Node Operations**.
2. Select **3) Configure network settings**.
3. Select **6) CTP Bndl Data pkt** protocol.

   You are notified that changing this parameter requires a system reboot.
4. Enter a number other than **47** as the protocol for data packets.
5. Reboot the CTP device.

Configuring IP Parameters for SAToP Bundles (CTPView)

The CTP software uses the IP parameters to create IP packets.

Before you begin:

- Log in to the CTPView software at least at the Net_Admin level.
- Connect the CTPView server to the CTP device for which you want to configure bundles.

To configure IP parameters for SAToP bundles using CTPView:

1. In the side pane, select **Bundle** > **Configuration**.
2. Run your mouse over the **Display and Select an Existing Bundle** bar.
3. In the table of bundles, select the bundle that you want to modify.
4. Under **Bundle Options**, configure the parameters described in Table 4 on page 16, and click **Click to Submit Bundle AND Port Changes**.

Table 4: SAToP Bundle IP Parameter Settings in CTPView

Field	Function	Your Action
Bundle Description	Specifies identifying information about the bundle.	Type a description for the bundle.
State	Specifies whether the bundle is active or disabled.	Select DISABLED or ACTIVE.
Remote Address	Specifies the name and IP address of the remote CTP device.	In the first field, select the CTP device. In the second field, select an interface on the CTP device.
SAToP Circuit ID	If the SAToP protocol is set to UDP, specifies the source UDP port. The source UDP port is used as the circuit identifier; you must configure both circuit endpoints to use the same UDP port. The UDP port must be unique on the CTP device. You will not be able to activate a port if another port is using the same source UDP port number.	Enter a number from 1 through 65535.
Incoming MPLS Label	For SAToP bundles that are using GRE as the transport protocol, specifies the incoming MPLS label. The incoming label must be configured to agree with the remove device. For example, if the outgoing label on the CTP device is 1000002, the outgoing label on the remote device must be set to 1000002.	Enter a number from 299776 through 1048575.
Outgoing MPLS Label	For SAToP bundles that are using GRE as the SAToP protocol, specifies the outgoing MPLS label. The outgoing label must be configured to agree with the remove device. For example, if the outgoing label on the CTP device is 1000001, the incoming label on the remote device must be set to 1000001.	Enter a number from 299776 through 1048575.

Table 4: SAToP Bundle IP Parameter Settings in CTPView *(continued)*

Field	Function	Your Action
Packet Size	Specifies the size of IP packets that are created from data received at the port. The CTP device makes sure that the combination of packet size and data rate does not result in a packet rate that exceeds 1200 packets per second.	Select a packet size. For SAToP bundles, the packet size must be divisible by 32.
Min Buffer	Specifies the minimum average buffer size. Use a value that is greater than the expected jitter and less than the Buffer Set parameter. The minimum buffer ensures that the buffer does not become too small because of timing variances between the local and remote serial interfaces. The entire buffer is available for accommodating and smoothing packet delay jitter, regardless of the minimum buffer setting.	Enter a number from 0.001 through 9999.000 ms.
Buffer Set	Specifies the buffer size when the circuit enters a running state. This value must be large enough to accommodate the anticipated packet delay, and it must be set to a value greater than the minimum buffer size and lower than the maximum buffer size.	Enter a number from 0.001 through 9999.000 ms.
Max Buffer	Specifies the maximum buffer size. The maximum buffer ensures that the buffer does not become too large due to timing variances between the local and remote serial interfaces. If the buffer size exceeds the maximum buffer size, the buffer is recentered to the Buffer Set value. Periodic buffer recenters are not expected. If you notice recenters, we recommend that you verify the reference to the CTP (if used) or that you configure one port with adaptive clocking.	Enter a number from 0.001 through 9999.000 ms.
Service Type	Specifies the ToS byte to be used in the IP headers of packets sent from the CTP device to the IP network. For a mapping of ToS byte values to DSCP classes and settings, see "Providing QoS for SAToP Bundles by Using Service Type Overview" on page 7. You do not need to set the ToS value to the same value on local and remote bundles.	Enter a number from 0 through 255.
Time to Live	Specifies the maximum number of router hops that a packet can traverse. The CTP device sets the TTL value in IP packets that it sends to the IP network. The IP network does not alter or optimize the packet routing based on the TTL setting. You do not need to set the same TTL value on local and remote ports.	Enter a number from 0 through 255.
SAToP Protocol	Specifies the transport protocol that the bundle uses.	Select one: • GRE • UDP
Bundle Description	Specifies identifying information about the bundle.	Type a description for the bundle.

Related Documentation

- SAToP Bundle Overview on page 3
- Determining Optimal Packet Size for SAToP Bundles Overview on page 5

Configuring IP Parameters for SAToP Bundles (CTP Menu)

The CTP software uses the IP parameters to create IP packets.

To configure IP parameters for SAToP bundles using the CTP Menu:

1. From the Main Menu, select **1) Bundle Operations**.
2. Select **2) SAToP**.
3. Select a bundle from the list.

   If you select an active bundle, you are prompted to disable the bundle before configuring it.
4. Select **2) Config** to configure the bundle.
5. Configure the options as described in Table 5 on page 18.

Table 5: SAToP Bundle IP Parameter Settings in the CTP Menu

Field	Function	Your Action
Remote Address	Specifies the name and IP address of the remote CTP device.	Enter the address of the remote CTP device.
Source UDP Port	For SAToP bundles that are using UDP as the transport protocol, specifies the source UDP port. The source UDP port is used as the circuit identifier; you must configure both circuit endpoints to use the same UDP port. The UDP port must be unique on the CTP device. You will not be able to activate a port if another port is using the same source UDP port number.	Enter a number from 1 through 65535.
Outgoing MPLS Label	For SAToP bundles that are using GRE as the transport protocol, specifies the outgoing MPLS label. This option appears only if you set the transport protocol to GRE. The outgoing label must be configured to agree with the remote device. For example, if the outgoing label on the CTP device is 1000001, the incoming label on the remote device must be set to 1000001.	Enter a number from 299776 through 1000001.
Incoming MPLS Label	For SAToP bundles that are using GRE as the transport protocol, specifies the incoming MPLS label. This option appears only if you set the transport protocol to GRE. The incoming label must be configured to agree with the remote device. For example, if the outgoing label on the CTP device is 1000002, the outgoing label on the remote device must be set to 1000002.	Enter a number from 299776 through 1048575.

Table 5: SAToP Bundle IP Parameter Settings in the CTP Menu *(continued)*

Field	Function	Your Action
Packet Size	Specifies the size of IP packets that are created from data received at the serial port. The CTP device makes sure that the combination of packet size and data rate does not result in a packet rate that exceeds 1200 packets per second.	Enter a number from 32 to 1456.
Min Buffer	Specifies the minimum average buffer size. Use a value that is greater than the expected jitter and less than the Pkt Buffer Set parameter. The minimum buffer ensures that the buffer does not become too small because of timing variances between the local and remote serial interfaces. The entire buffer is available for accommodating and smoothing packet delay jitter, regardless of the minimum buffer setting.	Enter a number from 0.001 through 9999.000 ms.
Pkt Buffer Set	Specifies the buffer size when the circuit enters a running state. This value must be large enough to accommodate the anticipated packet delay, and it must be set to a value greater than the minimum buffer size and lower than the maximum buffer size.	Enter a number from 0.001 through 9999.000 ms.
Max Buffer	Specifies the maximum buffer size. The maximum buffer ensures that the buffer does not become too large due to timing variances between the local and remote serial interfaces. If the buffer size exceeds the maximum buffer size, the buffer is recentered to the Buffer Set value. Periodic buffer recenters are not expected. If you notice recenters, we recommend that you verify the reference to the CTP (if used) or that you configure one port with adaptive clocking.	Enter a number from 0.001 through 9999.000 ms.
Service Type	Specifies the ToS byte to be used in the IP headers of packets sent from the CTP device to the IP network. For a mapping of ToS byte values to DSCP classes and settings, see "Providing QoS for SAToP Bundles by Using Service Type Overview" on page 7. You do not need to set the ToS value to the same value on local and remote bundles.	Enter a number from 0 through 255.
Time to Live	Specifies the maximum number of router hops that a packet can traverse. The CTP device sets the TTL value in IP packets that it sends to the IP network. The IP network does not alter or optimize the packet routing based on the TTL setting. You do not need to set the same TTL value on local and remote ports.	Enter a number from 0 through 255.
Transport	Specifies the transport protocol.	Select one: • GRE • UDP
Bundle Description	Specifies identifying information about the bundle.	Type a description for the bundle.

Related Documentation

- SAToP Bundle Overview on page 3

- Determining Optimal Packet Size for SAToP Bundles Overview on page 5

Configuring Virtual IP Parameters for SAToP Bundles (CTPView)

The virtual IP parameters allow you to use a separate IP address for each bundle and to use an address that is different from the IP address for the CTP device. If you configure the IP address on the:

- Same subnet as CTP IP address, you do not need a static route on the router.
- Different subnet as CTP IP address, you need a static route on the router.

Before you begin:

- Log in to the CTPView software at least at the Net_Admin level.
- Create a list of the virtual IP addresses that will be associated with the CTP device. To do so, select **Node > Maintenance > Configure *CTP Device* Virtual IPs**, and follow the instructions on the pane. You can create up to 56 virtual IP addresses.

  When you submit your new configuration, the CTP device reboots.
- Connect the CTPView server to the CTP device for which you want to configure bundles.

To configure virtual IP parameters for SAToP bundles using CTPView:

1. In the side pane, select **Bundle** > **Configuration**.
2. Run your mouse over the **Display and Select an Existing Bundle** bar.
3. In the table of bundles, select the bundle that you want to modify.
4. Under **Bundle Options**, place a check mark in the Advanced Options show check box to display advanced parameters, and configure the parameters described in Table 6 on page 20.
5. Click **Click to Submit Bundle AND Port Changes**.

Table 6: SAToP Bundle Virtual IP Parameter Settings in CTPView

Field	Function	Your Action
Use Virtual IP	Specifies whether or not the bundle uses an address that is different from the IP address of the CTP device. The virtual IP address is used in the IP packet's Origination Address field, and is used for the circuit's data and OAM flow.	Select one: • DISABLED—Circuits created by this bundle use the IP address of the CTP device. • ENABLED—Circuits created by this bundle use an address that is different from the CTP device.
Virtual IP [IPv4 only]	Specifies the virtual IP address for circuits created by this bundle.	Enter the virtual IP address. At the remote end of the bundle, specify this IP address as the Remote Address of the bundle.

Related Documentation
- SAToP Bundle Overview on page 3

Configuring Virtual IP Parameters for SAToP Bundles (CTP Menu)

The virtual IP parameters allow you to use a separate IP address for each bundle and to use an address that is different from the IP address for the CTP device. If you configure the IP address on the:

- Same subnet as the CTP IP address, you do not need a static route on the router.
- Different subnet as the CTP IP address, you need a static route on the router.

Before you begin:

- Create a list of the virtual IP addresses that will be associated with the CTP device. To do so, from the main menu select **Node Operations > Configure network settings > Virtual IP addresses**, and follow the onscreen instructions.

  When you submit your new configuration, the CTP device reboots.

To configure virtual IP parameters for SAToP bundles using the CTP Menu:

1. From the Main Menu, select **1) Bundle Operations**.
2. Select **2) SAToP**.
3. Select a bundle from the list.

   If you select an active bundle, you are prompted to disable the bundle before configuring it.
4. Select **2) Config**.
5. Select **10) Advanced Options**.
6. Configure the options as described in Table 7 on page 21.

Table 7: SAToP Bundle Virtual IP Parameter Settings in the CTP Menu

Field	Function	Your Action
Use virtual ip for port	Specifies whether or not the bundle uses an address that is different from the IP address of the CTP device. The virtual IP address is used in the IP packet's Origination Address field, and is used for the circuit's data and OAM flow.	Select one: • n (no)—Circuits created by this bundle use the IP address of the CTP device. • y (yes)—Circuits created by this bundle use an address that is different from the CTP device.
Virtual ip for port	Specifies the virtual IP address for circuits created by this bundle.	Select an IP address from the list displayed. At the remote end of the bundle, specify this IP address as the Remote Address of the bundle.

Related Documentation
- SAToP Bundle Overview on page 3

Configuring Circuit Restart Parameters for SAToP Bundles (CTPView)

This topic describes how to configure advanced options that are related to circuit starvation and restart. Set these parameters to the same values on the local and remote CTP devices.

Before you begin:

- Log in to the CTPView software at least at the Net_Admin level.
- Connect the CTPView server to the CTP device for which you want to configure bundles.

To configure circuit restart parameters for SAToP bundles using CTPView:

1. In the side pane, select **Bundle** > **Configuration**.
2. Run your mouse over the **Display and Select an Existing Bundle** bar.
3. In the table of bundles, select the bundle that you want to modify.
4. Under **Bundle Options**, place a check mark in the Advanced Options show check box to display advanced parameters, and configure the parameters described in Table 8 on page 22.
5. Click **Click to Submit Bundle AND Port Changes**.

Table 8: SAToP Bundle Advanced Options Parameter Settings for Circuit Restart in CTPView

Field	Function	Your Action
Consecutive Pkt Loss To Starvation	Specifies how many consecutive circuit packets the IP network must drop before the CTP device restarts the circuit. We recommend that you set the parameter to a larger value when the IP network uses packet-encrypting devices. These devices cause momentary interruption in packet flows when encryption keys are updated.	Enter a number from 1 to 64.
InSync Pkts After Starvation	Specifies the number of in-sequence packets the CTP device must receive after a starvation before the circuit transitions from in-sync to running.	Enter a number from 1 to 64.

Configuring Circuit Restart Parameters for SAToP Bundles (CTP Menu)

This topic describes how to configure advanced options that are related to circuit starvation and restart. Set these parameters to the same values on the local and remote CTP devices.

To configure circuit restart parameters using the CTP Menu:

1. From the Main Menu, select **1) Bundle Operations**.
2. Select **2) SAToP**.
3. Select a bundle from the list.

If you select an active bundle, you are prompted to disable the bundle before configuring it.

4. Select **2) Config**.
5. Select **10) Advanced Options**.
6. Configure the options as described in Table 9 on page 23.

Table 9: SATOP Bundle Advanced Options Parameter Settings for Circuit Restart in the CTP Menu

Field	Function	Your Action
Consecutive pkts loss to starve	Specifies how many consecutive circuit packets the IP network must drop before the CTP device restarts the circuit. We recommend that you set the parameter to a larger value when the IP network uses packet-encrypting devices. These devices cause momentary interruption in packet flows when encryption keys are updated.	Enter a number from 1 through 64.
In sequence pkts after starve	Specifies the number of in-sequence packets the CTP device must receive after a starvation before the circuit transitions from in-sync to running.	Enter a number from 1 through 64.

Related Documentation

- SAToP Bundle Overview on page 3

Configuring the Missing Packet Fill Pattern for SAToP Bundles (CTPView)

This topic describes how to specify the fill pattern that the CPT device inserts when IP packets are dropped.

Before you begin:

- Log in to the CTPView software at least at the Net_Admin level.
- Connect the CTPView server to the CTP device for which you want to configure bundles.

To configure the missing packet fill pattern for SAToP bundles using CTPView:

1. In the side pane, select **Bundle** > **Configuration**.
2. Run your mouse over the **Display and Select an Existing Bundle** bar.
3. In the table of bundles, select the bundle that you want to modify.
4. Under **Bundle Options**, place a check mark in the Advanced Options show check box to display advanced parameters, and configure the parameters described in Table 10 on page 24.
5. Click **Click to Submit Bundle AND Port Changes**.

Table 10: SAToP Bundle Missing Packet Fill Pattern Parameter Setting in CTPView

Field	Function	Your Action
Missing Packet Fill Pattern	Specifies the data that the CTP device inserts into the circuit bit stream when an IP packet is dropped. The number of bits inserted is equal to the number of bits in the missed packet. This data insertion method prevents a loss of bit count integrity to attached circuit devices and encryptors.	Enter two hexadecimal digits. You must enter a value other than ff. This field does not require the 0x characters.

Configuring the Missing Packet Fill Pattern for SAToP Bundles (CTP Menu)

This topic describes how to specify the fill pattern that the CPT device inserts when IP packets are dropped.

To configure the missing packet fill pattern for SAToP bundles using the CTP Menu:

1. From the Main Menu, select **1) Bundle Operations**.
2. Select **1) CTP**.
3. Select a bundle from the list.

   If you select an active bundle, you are prompted to disable the bundle before configuring it.
4. Select **2) Config**.
5. Select **10) Advanced Options**.
6. Configure option **3) Missing pkt fill pattern** as described in Table 11 on page 24.

Table 11: SAToP Bundle Missing Packet Fill Pattern Parameter Setting in the CTP Menu

Field	Function	Your Action
Missing pkt fill pattern	Specifies the data that the CTP device inserts into the circuit bit stream when an IP packet is dropped. The number of bits inserted is equal to the number of bits in the missed packet. This data insertion method prevents a loss of bit count integrity to attached circuit devices and encryptors.	Enter two hexadecimal digits. You must enter a value other than ff. This field does not require the 0x characters.

Configuring T1 and E1 Port Parameters for SAToP Bundles (CTPView)

This topic describes how to configure port parameters for T1/E1 interfaces.

Before you begin:

- Log in to the CTPView software at least at the Net_Admin level.
- Connect the CTPView server to the CTP device for which you want to configure bundles.

To configure T1 and E1 port parameters for SATop Bundles using CTPView:

1. In the side pane, select **Bundle** > **Configuration**.
2. Run your mouse over the **Display and Select an Existing Bundle** bar.
3. In the table of bundles, select the bundle that you want to modify.
4. Under **Bundle Options**, configure the parameters described in Table 12 on page 25, and click **Click to Submit Bundle AND Port Changes**.

Table 12: SAToP Bundle T1 and E1 Port Parameter Settings in CTPView

Field	Function	Your Action
Port Description	Specifies a description for the port.	Enter a description of up to 62 alphanumeric characters. Do not use the following characters: `( ; ' " ) ]`
T1/E1 Choice	Specifies the type of interface.	Select one: • T1 • E1
T1 Line Coding	For T1 interfaces, specifies the T1 encoding method used on this bundle.	Select one: • B8ZS • AMI
E1 Connector Type	For E1 interfaces, configures the termination to work with either coax or RJ-48.	Select one: • RJ48 • COAX
Line Buildout	For T1 interfaces, specifies the line buildout. This option is supported only on IM-8P-T1/E1interface modules.	Select one: • ~133 ft • ~266 ft • ~399 ft • ~533 ft • ~655 ft • -7.5dB CSU • -15dB CSU • -22.5dB CSU

Table 12: SAToP Bundle T1 and E1 Port Parameter Settings in CTPView *(continued)*

Field	Function	Your Action
Clock Cfg	Specifies the type of clocking for the port.	Select one: • CTP is Clock Source—PBX either returns the clock received from the CTP device, or it returns a clock that is traceable to the same source as the CTP node clock reference. You typically use this configuration when you configure the CTP device with a clock reference input. • CTP is Looped Timed—PBX provides the clock, and the CTP device returns the same clock to the PBX. You typically use this configuration when the PBX has the more accurate clock source. You can configure the far end of the circuit with adaptive clocking to recover this clock if necessary. • CTP is Clock Source – Adap—PBX returns the clock received from the CTP device , and the CTP device uses the adaptive recovered clock. You typically use this configuration when the CTP device does not have a reference input and the PBX typically requires a clock from the distant PBX.

Related Documentation
- SAToP Bundle Overview on page 3

Configuring T1 and E1 Port Parameters for SAToP Bundles (CTP Menu)

This topic describes how to configure port parameters for T1/E1 interfaces.

To configure port parameters for T1/E1 interfaces or daughter cards for SAToP bundles using the CTP Menu:

1. From the Main Menu, select **1) Bundle Operations**.
2. Select **2) SAToP**.
3. Select a bundle from the list.

   If you select an active bundle, you are prompted to disable the bundle before configuring it.
4. Select **3) Port Config**.
5. If you are using a T1/E1 daughter card installed on a serial interface, select **1) Type**, and set the type to **Optional Interface: T1/E1**.
6. Follow the onscreen instructions, and configure the options as described in Table 13 on page 27.

   The options vary depending on whether the bundle is T1 or E1.

NOTE: BITS input is a T1/E1 line interface unit (LIU), with AMI (alternate mark inversion) encoding enabled and B8ZS/HDB3 (Zero Suppression) disabled. The equalization is set for a 0-133 feet cable. An internal 100 ohm termination is present, although it might need to be externally augmented based on the type of cabling used. Any valid AMI signal works properly and it is not restricted to only the "all 1" BITS signal but the ones density must be sufficient to prevent LOS (according to the ITU G.775 recommendation). The TTL input has a slice point of 3.3V/2 = 1.65V relative to chassis ground (GND). Therefore, any signal on the coaxial center conductor that transitions through that voltage registers a transition. There are many signals, besides TTL, that satisfy this criteria. An external termination must be provided that matches the impedance of the cable that goes to the BNC connector.

If you can configure the rate in CTP menu, then the TTL supports a frequency of 2048 KHz for the TTL clock input, provided the signal is good and noise-free (terminated properly). TTL is rate-agile, while BITS is restricted to T1/E1 frequencies.

The TTL input is high-impedance (no on-board termination provided) because a variety of cable types might exist that you can use to drive signal to this connector, such as RG-58 coax (50 ohm), RG-59 coax (75 ohm), or twisted pair (100-120 ohm). Instead of applying a particular impedance termination on the board and have it incorrectly done, we recommend that you configure the impedance termination based on your network environment. For example, a 50 ohm termination is needed if you are using RG-58/U coax cable, which has 50 ohm impedance.

Table 13: SAToP Bundle T1/E1 Port Parameter Settings in the CTP Menu

Field	Function	Your Action
Port descriptor	Specifies a description for the port.	Enter a description of up to 62 alphanumeric characters. Do not use the following characters: `( ; ' " ) ]`
Type	Specifies the type of interface.	Select one: • T1 • E1
Option (for T1)	Specifies the T1 encoding method used on this bundle.	Select one: • B8ZS • AMI
Option (for E1)	For E1 interfaces, configure the termination to work with either coax or RJ-48.	Select one: • RJ48 • COAX

Table 13: SAToP Bundle T1/E1 Port Parameter Settings in the CTP Menu *(continued)*

Field	Function	Your Action
BuildOut	For T1 interfaces, specifies the line buildout. This option is supported only on IM-8P-T1/E1 interface modules.	Select one: • 0) ~133 ft • 1) ~266 ft • 2) ~399 ft • 3) ~533 ft • 4) ~655 ft • 5) -7.5dB CSU • 6) -15dB CSU • 7) -22.5d BCSU
Clock synthesizer	The following clock synthesizer settings are set by the software, and you cannot change them: • For T1, the clock synthesizer is set to 1544 KHz. • For E1 the clock synthesizer is set to 2048 KHz.	
Clock Config	Specifies the type of clocking for the port.	Select one: • CTP is Clock Source—PBX either returns the clock received from the CTP device, or it returns a clock that is traceable to the same source as the CTP node clock reference. You typically use this configuration when you configure the CTP device with a clock reference input. • CTP is Loop Timed—PBX provides the clock, and the CTP device returns the same clock to the PBX. You typically use this configuration when the PBX has the more accurate clock source. You can configure the far end of the circuit with adaptive clocking to recover this clock if necessary. • CTP is Clock Source (Adaptive End)—PBX returns the clock received from the CTP device, and the CTP device uses the adaptive recovered clock. You typically use this configuration when the CTP device does not have a reference input and the PBX typically requires clock from the distant PBX.

Related Documentation

- SAToP Bundle Overview on page 3

Configuring Adaptive Clocking for SAToP Bundles (CTPView)

If you specify that the SAToP bundle uses the CTP as the clock source with the CTP as the adaptive end, you can modify attributes that affect the adaptive clocking algorithm. However, the default settings are acceptable for most applications. We recommend that you change these settings only with the assistance of JTAC.

Before you begin:

- Log in to the CTPView software at least at the Net_Admin level.

- Connect the CTPView server to the CTP device for which you want to configure bundles.

To configure adaptive clocking for SAToP bundles using CTPView:

1. In the side pane, select **Bundle** > **Configuration**.
2. Run your mouse over the **Display and Select an Existing Bundle** bar.
3. In the table of bundles, select the bundle that you want to modify.
4. Under **Bundle Options**, configure the parameters described in Table 14 on page 29, and click **Click to Submit Bundle AND Port Changes**.

Table 14: SAToP Bundle Adaptive Clocking Settings in CTPView

Field	Function	Your Action
Initialize Adaptive Settings	Sets the adaptive clocking configuration to the default settings.	Place a check mark in the **Yes** check box.
Aggressive Calc Period	Specifies the time period during initial start of adaptive clocking, during which packet samples that are experiencing the least delay through the network are collected. These samples are used for aggressive state calculations.	Enter a number from 3 through 200 sec.
Maintenance Calc Period	Specifies the time period during normal adaptive clocking during which packet samples that are experiencing the least delay through the network are collected. These samples are used for maintenance state calculations.	Enter a number from 3 through 300 sec.
Slope for Maintenance	Specifies the number of packets per minute, which when reached, causes the adaptive clocking algorithm to change from aggressive state to maintenance state. Lower values result in longer switchover times with a clock value closer to the remote clock.	Enter a number from 1 through 100 packets per minute.
Maintenance Decay	Specifies how quickly the clocking corrects to the buffer set point while in maintenance state.	Enter a number from 2 though 120 sec.
Max Clock Adjustment Value	Specifies a cap for frequency acceleration, which constrains the frequency adjustments to the adaptive clock.	Enter a number from 1 through 200 parts per billion.
Max Clock Offset	Specifies a cap for frequency velocity, which constrains the frequency velocity of the adaptive clock.	Enter a number from 1 through 400 packets per minute.
Max Buffer Error	Specifies the buffer error rate required to change the adaptive clocking algorithm state from maintenance to aggressive.	Enter a number from 100 through 1,000,000 sec.

Related Documentation

- Adaptive Clocking for SAToP Bundles Overview on page 5
- SAToP Bundle Overview on page 3

Configuring Adaptive Clocking for SAToP Bundles (CTP Menu)

If you specify that the SAToP bundle uses the CTP as the clock source with the CTP as the adaptive end, you can modify attributes that affect the adaptive clocking algorithm. However, the default settings are acceptable for most applications. We recommend that you change these settings only with the assistance of JTAC.

To configure adaptive clocking for SAToP bundles using the CTP Menu:

1. From the Main Menu, select **1) Bundle Operations**.
2. Select **2) SAToP**.
3. Select a bundle from the list.

   If you select an active bundle, you are prompted to disable the bundle before configuring it.
4. Select **3) Port Config**.
5. Select **3) Clock Config**.
6. Select **3) CTP is Clock Source (Adaptive End)**.
7. Select **4) Set Adaptive Parameters**.
8. Configure the options as described in Table 15 on page 30.

Table 15: SAToP Bundle Adaptive Clocking Settings in the CTP Menu

Field	Function	Your Action
Set to Defaults	Sets the adaptive clocking configuration to the default settings.	Select **Set to Defaults**.
AGGR Seconds/Calc	Specifies the time period during initial start of adaptive clocking, during which packet samples that are experiencing the least delay through the network are collected. These samples are used for aggressive state calculations.	Enter a number from 3 through 200 sec.
MNTN Seconds/Calc	Specifies the time period during normal adaptive clocking during which packet samples that are experiencing the least delay through the network are collected. These samples are used for maintenance state calculations.	Enter a number from 3 through 300 sec.
Slope for MNTN in ppm	Specifies the number of packets per minute, which when reached, causes the adaptive clocking algorithm to change from aggressive state to maintenance state. Lower values result in longer switchover times with a clock value closer to the remote clock.	Enter a number from 1 through 100 packets per minute.
Maintenance Decay in calcs	Specifies how quickly the clocking corrects to the buffer set point while in maintenance state.	Enter a number from 2 though 120 sec.
Max Clock Adjust in ppb	Specifies a cap for frequency acceleration, which constrains the frequency adjustments to the adaptive clock.	Enter a number from 1 through 1000 parts per billion.

Table 15: SAToP Bundle Adaptive Clocking Settings in the CTP Menu *(continued)*

Field	Function	Your Action
Max Clock Offset in ppm	Specifies a cap for frequency velocity, which constrains the frequency velocity of the adaptive clock.	Enter a number from 1 through 400 packets per minute.
Max Buffer Error in usec	Specifies the buffer error rate required to change the adaptive clocking algorithm state from maintenance to aggressive.	Enter a number from 100 through 1,000,000 sec.

Related Documentation

- Adaptive Clocking for SAToP Bundles Overview on page 5
- SAToP Bundle Overview on page 3

Configuring LOS Detection on CTP and SAToP Bundles (CTP Menu)

Starting with CTPOS Release 7.2R1, CTP devices support the detection of a loss of signal, which denotes a physical link problem. The following conditions are supported:

- In a serial both-ended Y-cable redundancy configuration (hardware-based redundancy or software-based Y cable link protocol), removal of Y cable leg from the CTP port of the online bundle must be able to force a switch to the standby bundle.
- In a T1/E1 both-ended Y cable configuration (hardware-based redundancy or software-based Y cable link protocol), removal of Y cable leg from the CTP port of the online bundle must be able to force a switch to the standby bundle.

A CTP series device provides two types of Y-cable redundancy.

- Redundancy by using a hardware link that uses a special Y cable
- Redundancy by using a software link that does not depend on a signaling hardware like the Y cable

The CTP devices support a both-ended redundancy mechanism, in which two identical CTP circuit bundles are combined using Y cables at each end, enabling one bundle to act as a backup for the other. One of the bundles is in use (online), while the other is in the standby state (offline). Only the online bundle is allowed to drive the Y cable towards the user equipment, while the offline bundle is tristate. A communications channel (such as redundancy by using a hardware link that uses a special Y cable or redundancy based on a software link that does not depend on a signaling hardware like the Y cable) between ports at each end determines which of the two ports on the Y cable is currently online. When one bundle fails, the failed bundle transitions to the offline and places the other bundle in the online state.

Before you begin:

- Disable the bundle before you modify the bundle options.

To configure the capability to detect LOS alarms in a Y-cable redundancy configuration for CTP and SAToP bundles by using the CTP Menu:

1. From the Main Menu, select **1) Bundle Operations**.
2. Select **1) CTP**.
3. Select a bundle from the list.

   If you select an active bundle, you are prompted to disable the bundle before configuring it.
4. Select **3) Port Config**.
5. Select **4) Advanced Options** to configure advanced attributed for the CTP bundle.
6. Select **20) LOS checking (T1E1 only)** to configure the functionality to detect LOS for the T1E! interfaces in a CTP bundle or SAToP bundle.
7. Follow the onscreen instructions and configure the options as described Table 16 on page 32.

Table 16: LOS Settings in the CTP Menu

Field	Function	Your Action
Check LOS on T1/E1 ports for CTP/SAToP bundles? y[n]	Specifies that the capability to identify LOS alarms on T1E1 interfaces in SAToP or CTP bundles needs to be enabled. A loss of signal (LOS) alarm indicates that there is a physical link problem with the connection to the router receive port from the neighboring SONET equipment transmit port. An LOS alarm occurs when the port on the card is in service but no signal is being received. The cabling is not correctly connected to the ports, or no signal exists on the line. Possible causes for a loss of signal include upstream equipment failure or a fiber cut.	Enter **y** or **n** to enable or disable the LOS detection capability. NOTE: Although this menu option to enable or disable the LOS detection functionality is shown regardless of the port type, such as serial interfaces or T1E1 interfaces, this setting becomes effective on a T1/E1 port only when it is connected to a CTP or SAToP bundle. If the LOS detection functionality is enabled on a serial port or other bundle types, the setting is not processed.

PART 3

Example

- Example: Using SAToP Bundles to Interoperate with M Series Multiservice Edge Routers on page 35

CHAPTER 3

Example: Using SAToP Bundles to Interoperate with M Series Multiservice Edge Routers

- Example: CTP Interoperability with M Series T1/E1 Circuit Emulation PICs on page 35

Example: CTP Interoperability with M Series T1/E1 Circuit Emulation PICs

This example describes how to configure an M Series router and a CTP device to create a T1 SAToP circuit that can interoperate between the router and the CTP device. Topics include:

- Requirements on page 35
- Overview and Topology on page 35
- Configuration on page 37
- Verification on page 44

Requirements

This example uses the following software and hardware components:

- Juniper Networks CTP150 or CTP2000 Circuit to Packet platform with a T1/E1 interface or a serial interface with a T1/E1 daughter card
- CTPOS 6.0 or later
- Juniper Networks M Series Multiservice Edge Router with the following:
  - PB-12T1E1-CE-TELCO 12-port discrete T1/E1 Telco connector
  - PB-TUNNEL-1 PIC

Overview and Topology

The topology used in this example consists of an M Series router used as the provider edge (PE) router and a CTP device at the customer edge (CE).

- On the router, you configure a Layer 2 circuit that provides a point-to-point Layer 2 connection transported by means of MPLS. It is represented by a logical interface that

connects the router (PE) to the CTP device (CE). You configure the Layer 2 circuit as a static Layer 2 circuit pseudowire that has static values for the incoming and outgoing MPLS labels needed to enable the pseudowire connection. You then configure a GRE tunnel that is used to transport the Layer 2 circuit.

- On the CTP device, you configure a SAToP bundle that has the remote address of the Layer 2 circuit on the router and the incoming and outgoing MPLS labels that correspond to the labels configured on the router. GRE is used as the transport protocol for the SAToP bundle.

Figure 2 on page 36 shows the topology for this example.

Figure 2: Network Topology for a T1 SAToP Circuit between a CE PIC and a CTP Device

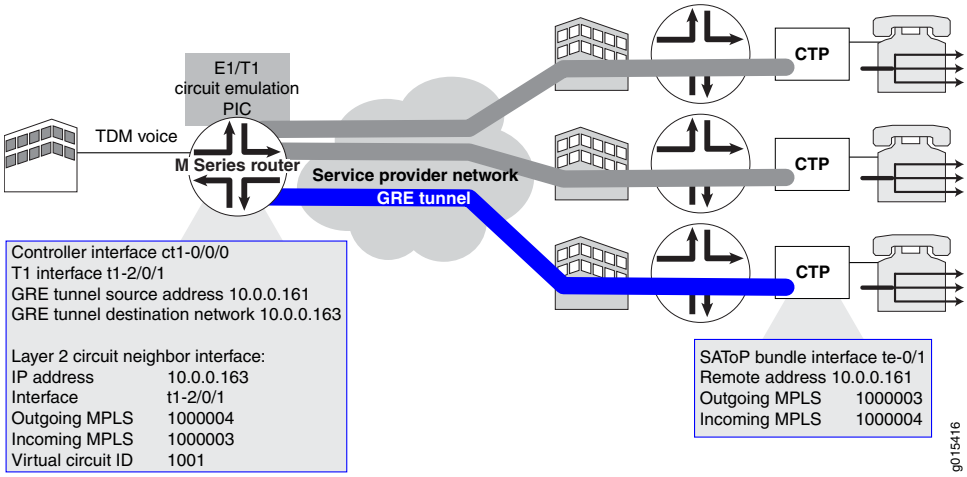


Table 17 on page 36 shows the configuration of the SAToP bundle on the CTP device and the configuration of the M Series router.

Table 17: Configuration Components for CTP Interoperability with M Series T1/E1 Circuit Emulation PIC

Device	Property	Setting
CTP Platform SATop Bundle	Interface	te-0/1
	Remote address	10.0.0.161
	Outgoing MPLS label	1000003
	Incoming MPLS label	1000004
	Transport protocol	GRE

Table 17: Configuration Components for CTP Interoperability with M Series T1/E1 Circuit Emulation PIC *(continued)*

Device	Property	Setting
Router	Controller interface	ct1-0/0/0
	T1 interface	t1-2/0/1
	GRE tunnel source address	10.0.0.161
	GRE tunnel destination network	10.0.0.163
	Layer 2 circuit neighbor interface: IP address Interface Outgoing MPLS label Incoming MPLS label Virtual circuit ID	 10.0.0.163 t1-2/0/1 1000004 1000003 1001

Configuration

In this example, the CTP device is configured using CTP Menu.

To configure the CTP device and the router, perform these tasks:

- Configuring the Default Bundle Data Protocol on the CTP Device on page 38
- Creating a SAToP Bundle on the CTP Device on page 38
- Configuring the Port Settings for the SAToP Bundle on the CTP Device on page 39
- Configuring the Bundle Settings for the SAToP Bundle on the CTP Device on page 39
- Configuring the Controller Interface on the Router on page 40
- Configuring SAToP Emulation on the T1 interface on the Router on page 41
- Enabling MPLS on the T1 Interface on the Router on page 42
- Configuring the Static Layer 2 Circuit on the Router on page 42
- Configuring the GRE Tunnel on the Router on page 43
- Activating the SAToP Bundle on the CTP Device on page 44

Configuring the Default Bundle Data Protocol on the CTP Device

Step-by-Step Procedure

The default bundle data protocol is GRE (47). Before you configure SAToP bundles, you should change the default bundle data protocol to a value other than GRE. Doing so prevents conflict between legacy CTP bundles and SAToP bundles that are using GRE for interoperability.

To configure the default data protocol for bundles to a value other than GRE using CTP Menu:

1. From the Main Menu, select **5) Node Operations**.
2. Select **3) Configure network settings**.
3. Select **6) CTP Bndl Data pkt** protocol.

   You are notified that changing this parameter requires a system reboot.
4. Enter **46** as the protocol for data packets.
5. Reboot the system.

Results

```
Please select a number from the following list:
-------------------------------------
 0) Back to Previous Menu
 1) Supported Protocols:        IPv4&IPv6
 2) IPv4 Configuration
 3) IPv6 Configuration
 4) Virtual IP addresses
 5) OAM port (IPv4):            16
 6) CTP Bndl Data pkt protocol: 46
 7) CTP Bndl OAM port (IPv6):   32
 8) VLAN Configuration
 9) Current Configuration (active on reboot)
10) Port operations (PBS/bridge)
11) Config port operational mode (CE/PBS/bridge)
12) Config access ip filtering
13) SNMP Configuration
------------ Your choice [0]:
```

Creating a SAToP Bundle on the CTP Device

Step-by-Step Procedure

To create a SAToP bundle:

1. From the Main Menu, select **1) Bundle Operations**.
2. Select **2) SAToP**.
3. Enter **add**, and select a T1/E1 interface or select a serial interface that has a T1/E1 daughter card.

   The CTP device creates a new SAToP bundle.

Configuring the Port Settings for the SAToP Bundle on the CTP Device

Step-by-Step Procedure

To configure the port settings:

1. From the Main Menu, select **3) Port Config**.
2. Select **2) Interface**.
3. Select **1) Type**, and set the type to **T1** or (for daughter cards) to **Optional Interface: T1/E1**
4. Select **2) Option** and select **B8ZS**.
5. Select **3) Clock Config** and select **1) CTP is Clock Source**.

Results

```
========================================================================
= (g74 04/20/10 18:51:58 GMT) | Config Menu for Port te-0/1
========================================================================

Please select a number from the following list:
-----------------------------------
 0) Back to Previous Menu
 1) Port descriptor text:
 2) Interface:            T1-B8ZS
 3) Clock Config:         CTP is Clock Source
------------ Your choice [2]:
```

Configuring the Bundle Settings for the SAToP Bundle on the CTP Device

Step-by-Step Procedure

To configure the bundle settings:

1. From the Main Menu, select **3) Port Config**.
2. Select **10) Transport** and set the transport protocol to GRE.
3. Select **1) Remote Address** and specify the remote circuit IP address 10.0.0.161.
4. Select **2) Outgoing MPLS Label**, and set the outgoing label to 1000003.
5. Select **3) Incoming MPLS Labe**l, and set the incoming MPLS label to 1000004.
6. Select **4) Packet Size**, and set the packet size. We recommend that you set the packet size to 1024 bytes or higher to reduce the overhead associated with the headers and to reduce the packet size. SAToP requires that both endpoints are configured to use the same packet payload size.

Results

```
================================================================================
= (g74 04/20/10 19:01:42 GMT) | Config Menu for Bundle 1
= Bundle type: SAToP | Bundle source is Port te-0/1
= Bundle description:
================================================================================

Please select a number from the following list:
-----------------------------------
 0) Back to Previous Menu
 1) Remote Address:        10.0.0.1
 2) Outgoing MPLS Label:   1000003
 3) Incoming MPLS Label:   1000004
 4) Packet Size:           1024
 5) Min Buffer (ms):       8.000
 6) Pkt Buffer Set (ms):   12.000
 7) Max Buffer (ms):       16.000
 8) Service Type:          0
 9) Time to Live:          255
10) Transport:             GRE
11) Advanced Options...
12) Bundle descriptor text:
------------ Your choice [10]:
8
```

Configuring the Controller Interface on the Router

CLI Quick Configuration

To quickly configure the controller interface, copy the following commands and paste them into the router terminal window:

```
[edit]
edit interfaces ct1-0/0/0
set clocking internal
set no-partition interface-type t1
```

Step-by-Step Procedure

To configure a controller interface:

1. Create the controller interface.

   ```
   [edit]
   user@sp-router# edit interfaces ct1-0/0/0
   ```

2. Set the clocking to internal.

   ```
   [edit interfaces ct1-0/0/0]
   user@sp-router# set clocking internal
   ```

3. Specify that the controller interface is unpartitioned, and specify the interface type.

   ```
   [edit interfaces ct1-0/0/0]
   user@sp-router# set no-partition interface-type t1
   ```

Configuration Results

Display the results of the configuration.

```
[edit interfaces]
user@sp-router# show
ct1-0/0/0 {
    clocking internal;
    no-partition interface-type t1;
```

```
}
```

Configuring SAToP Emulation on the T1 interface on the Router

CLI Quick Configuration

To quickly configure SAToP Emulation on the T1 interface, copy the following commands and paste them into the router terminal window:

```
[edit]
edit interfaces t1-2/0/1
set encapsulation satop
set unit 0
set satop-options payload-size 1024
set satop-options jitter-buffer-packets 8
set clocking internal
```

Step-by-Step Procedure

To configure the T1 interface:

1. Create the T1 interface.

   ```
   [edit]
   user@sp-router# edit interfaces t1-2/0/1
   ```

2. Set the encapsulation type to SAToP.

   ```
   [edit interfaces t1-2/0/1]
   user@sp-router# set encapsulation satop
   ```

3. Specify the unit number.

   ```
   [edit interfaces t1-2/0/1]
   user@sp-router# set unit 0
   ```

4. Specify the payload size, in bytes. We recommend that you set the packet payload size to 1024 bytes or higher to reduce the overhead associated with the headers and to reduce the packet size. SAToP requires that both endpoints are configured to use the same packet payload size.

   ```
   [edit interfaces t1-2/0/1]
   user@sp-router# set satop-options payload-size 1024
   ```

5. Specify the number of packets in the jitter buffer.

   ```
   [edit interfaces t1-2/0/1]
   user@sp-router# set satop-options jitter-buffer-packets 8
   ```

6. Set clocking to internal.

   ```
   [edit interfaces t1-2/0/1]
   user@sp-router# set clocking internal
   ```

Configuration Results

Display the results of the configuration.

```
[edit interfaces]
user@sp-router# show
ct1-0/0/0 {
   clocking internal;
   no-partition interface-type t1;
}
   t1-2/0/1 {
```

```
    satop-options {
      payload-size 1024;
      jitter-buffer-packets 8;
    }
    clocking internal;
    encapsulation satop;
    unit 0;
  }
```

Enabling MPLS on the T1 Interface on the Router

CLI Quick Configuration

To quickly enable MPLS on the T1 interface, copy the following commands and paste them into the router terminal window:

```
[edit]
edit protocols
set mpls interface t1-2/0/1
```

Step-by-Step Procedure

To enable MPLS on the T1 interface:

1. Access the protocol configuration.

   ```
   [edit]
   user@sp-router# edit protocols
   ```

2. Enable MPLS on the T1 interface.

   ```
   [edit protocols]
   user@sp-router# set mpls interface t1-2/0/1
   ```

Configuration Results

Display the results of the configuration.

```
[edit protocols]
user@sp-router# show
mpls {
  interface t1-2/0/0.1;
}
```

Configuring the Static Layer 2 Circuit on the Router

CLI Quick Configuration

To quickly configure the Layer 2 circuit, copy the following commands and paste them into the router terminal window:

```
[edit]
edit protocols l2circuit
edit neighbor 10.0.0.163
edit interface t1-2/0/1
set static incoming-label 1000003
set static outgoing-label 1000004
set virtual-circuit-id 1001
```

Step-by-Step Procedure

To configure a static Layer 2 circuit:

1. Create the Layer 2 circuit.

   ```
   [edit]
   ```

```
user@sp-router# edit protocols l2circuit
```

2. Create the neighbor interface for the Layer 2 circuit.

```
[edit protocols l2circuit]
user@sp-router# edit neighbor 10.0.0.163
user@sp-router# edit interface t1-2/0/1
```

3. Configure static values for the in and out labels needed to enable the pseudowire connection.

```
[edit protocols l2circuit neighbor 10.0.0.163 interface t1-2/0/0.1]
user@sp-router# set static incoming-label 1000003
user@sp-router# set static outgoing-label 1000004
```

4. Specify the virtual circuit identifier.

```
[edit protocols l2circuit neighbor 10.0.0.163 interface t1-2/0/0.1]
user@sp-router# set virtual-circuit-id 1001
```

Configuration Results

Display the results of the configuration.

```
[edit protocols l2circuit]
user@sp-router# show
neighbor 10.0.0.163 {
   interface t1-2/0/1.0 {
      static {
         incoming-label 1000003;
         outgoing-label 1000004;
      }
      virtual-circuit-id 1001;
   }
}
```

Configuring the GRE Tunnel on the Router

CLI Quick Configuration

To quickly configure the GRE tunnel, copy the following commands and paste them into the router terminal window:

```
[edit]
edit routing-options
edit dynamic-tunnels gre-ctp
set gre
set source-address 10.0.0.161
set destination-networks 10.0.0.163/32
```

Step-by-Step Procedure

To configure a GRE tunnel:

1. Create a dynamic tunnel.

```
[edit]
user@host# edit routing-options
user@host# edit dynamic-tunnels gre-ctp
```

2. Specify the type of tunnel.

```
[edit routing-options dynamic-tunnels gre-ctp]
user@host# set gre
```

3. Specify the source address for the GRE tunnel. The source address is used as the source for the local tunnel endpoint.

```
[edit routing-options dynamic-tunnels gre-ctp]
user@host# set source-address 10.0.0.161
```

4. Specify the IPv4 prefix range for the destination network. Only tunnels within the specified IPv4 prefix range can be created.

```
[edit routing-options dynamic-tunnels gre-ctp]
user@host# set destination-networks 10.0.0.163/32
```

Configuration Results

Display the results of the configuration.

```
[edit routing-options]
user@sp-router# show
dynamic-tunnels {
  gre-ctp {
    source-address 10.0.0.161;
    gre;
    destination-networks {
      10.0.0.163/32;
    }
  }
}
```

Activating the SAToP Bundle on the CTP Device

Step-by-Step Procedure

To activate the SAToP bundle

1. From the Main Menu, select **1) Bundle Operations**.
2. Select **2) SAToP**.
3. Select the SAToP bundle from the list.
4. Select **4) Activate** .
5. Verify that you want to activate the bundle.

Verification

To confirm that the configuration is working properly, perform these tasks:

- Verifying the SAToP Circuit Using a Node Summary on the CTP Device on page 44
- Verifying the SAToP Circuit Using a Bundle Query on the CTP Device on page 45
- Verifying That the GRE Route is Added to Routing Table on Router on page 46
- Verifying the Layer 2 Circuit Connections on Router on page 47

Verifying the SAToP Circuit Using a Node Summary on the CTP Device

Purpose

Verify that the circuit is running.

Action From the Main Menu of CTP Menu, select **3) Node Summary**

```
CTP Code version     : 6.0R1 100325 (Compile Time 09:18:24 AM)

>>>>> Circuit Emulation Bundles <<<<<
Bndl BndlTyp    Port      TS         RemAddr     CID    LCID RunState RCtr
================================================================================
   0   SAToP  te-0/0     N/A      10.0.0.161 1000003 1000004  RUNNING    0
================================================================================
Checked out PPS - All Bundles: 376, System Maximum: 12500
   (1 PPS = full duplex packet transfer, Bundle <---> IP network)
```

Meaning The display shows that the SAToP bundle is in the **RUNNING** state.

Verifying the SAToP Circuit Using a Bundle Query on the CTP Device

Purpose Verify that the circuit is running.

Action From the Main Menu of CTP Menu, select **1) Query**

```
########### Bundle 0 type    SAToP ############
##### Bundle 0 is transporting Port te-0/0 ####

--------- Bundle 0 Config ---------
DBase State:         ACTIVE
Remote Addr:         10.0.0.161
Outgoing MPLS Label: 1000003
Incoming MPLS Label: 1000004
Using Virtual IP:    10.0.0.163
Packet size:         512
Buf Max/Set/Min(ms): 24.000/16.000/8.000
IP Hdr TOS:          0 (decimal)
Port(s) in bundle:   te-0/0
Bndl Config Flags:   TunGRE

---------- Port te-0/0 Config ----------
Interface type:      T1-B8ZS
Framing type:        N/A
Line Buildout:       ~133 ft
Clock Config:        CTP is Clock Source (Adaptive End)

Hit Carriage Return to Continue...

--------- Bundle 0 State ----------
Run State:           RUNNING
T1E1 flags:          No_Alarm
Adaptive State:      Maintain   (20 us)
Adap Recovered Freq: 1544.009918 kHz
Checked out PPS:     Bndl: 376, All Bndl: 376, Sys Max: 12500

--------- Bundle 0 Counters -------
I/F bound packets:   358288
NET bound packets:   358288
Late pkts:           0
Missing pkts:        0
Buffer restarts:     0
Buffer underflows:   0
Buffer overflows:    0
Buffer starves:      0
Buffer max samples:  377
Buff Max/Avg/Min:    16.25/16.24/15.54
Buff Last Minute:    16.25/16.24/15.56
Last counter clear:  0wk, 0d, 0h, 15m, 51s
```

Meaning The display shows that the SAToP bundle is in the **ACTIVE** state and that the run state is **RUNNING**.

Verifying That the GRE Route is Added to Routing Table on Router

Purpose Verify that the GRE route has been added to the inet.3 routing table.

Action

```
user@host> show route 10.0.0.163
inet.3: 2 destinations, 3 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.163/32      *[Tunnel/300] 05:35:04
                    > via gr-2/3/0.32769
                    [Tunnel/300] 7w0d 03:12:32
                      Tunnel
```

Meaning The display shows that

Verifying the Layer 2 Circuit Connections on Router

Purpose Verifying that the Layer 2 circuit connections are running on the router.

Action

```
user@host> show l2circuit connections
Layer-2 Circuit Connections:

Legend for connection status (St)
EI -- encapsulation invalid      NP -- interface h/w not present
MM -- mtu mismatch               Dn -- down
EM -- encapsulation mismatch     VC-Dn -- Virtual circuit Down
CM -- control-word mismatch      Up -- operational
VM -- vlan id mismatch           CF -- Call admission control failure
OL -- no outgoing label          IB -- TDM incompatible bitrate
NC -- intf encaps not CCC/TCC    TM -- TDM misconfiguration
BK -- Backup Connection          ST -- Standby Connection
CB -- rcvd cell-bundle size bad  SP -- Static Pseudowire
LD -- local site signaled down   RS -- remote site standby
RD -- remote site signaled down  XX -- unknown

Legend for interface status
Up -- operational
Dn -- down
Neighbor: 10.0.0.163
    Interface                 Type  St     Time last up          # Up trans
    t1-2/0/1.0(vc 1001)(SP)   rmt   Up     Apr 20 14:06:12 2010           1
      Remote PE: 10.0.0.163, Negotiated control-word: Yes (Non-null)
      Incoming label: 1000003, Outgoing label: 1000004
      Negotiated PW status TLV: No
      Local interface: t1-2/0/1.0, Status: Up, Encapsulation: SATOP-T1
```

Meaning The display shows that the Layer 2 circuit connection to neighbor 10.0.0.163 is up.

Related Documentation

- SAToP Interoperability with M Series E1/T1 Circuit Emulation PICs Overview on page 4
- SAToP Bundle Overview on page 3