



Configuring a Synchronous Serial WAN Interface

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Router Installation and Configuration Manual/Configuring a Synchronous Serial WAN Interface

This chapter describes how to configure the ImageStream router serial WAN interfaces without integrated CSU/DSUs and includes the following topics:

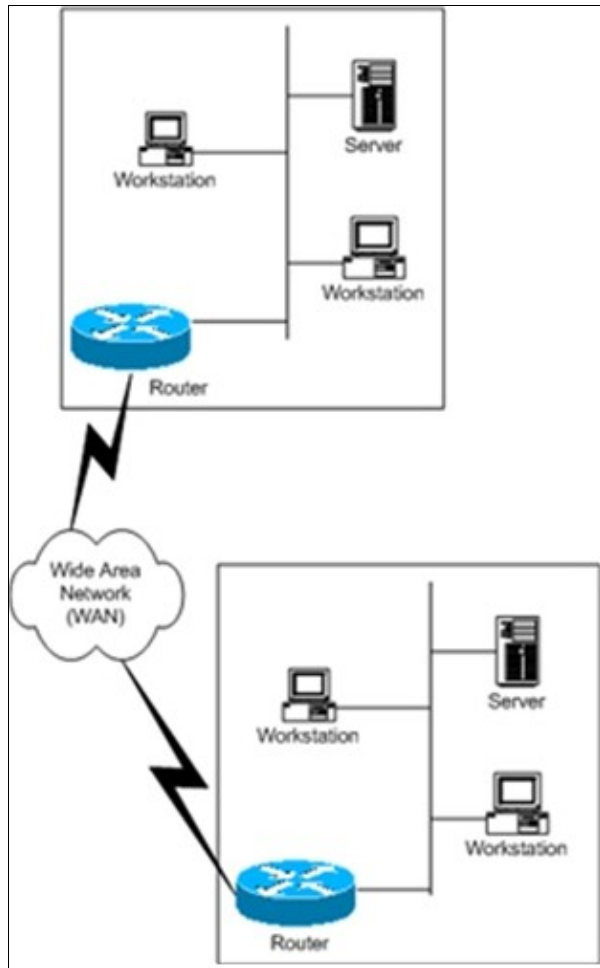
- ◇ WAN Port Uses
- ◇ Understanding the Network Interface Configuration File
- ◇ Configuring a Synchronous Serial WAN Interface
- ◇ Default Serial WAN Interface Configuration
- ◇ Customizing the Configuration
- ◇ Configuring Additional Serial Devices

Before configuring the WAN interface, you must make the appropriate cabling connection for your needs. Refer to the hardware installation guide for your ImageStream product for information on making the WAN connection. See the Command Reference for more detailed command descriptions and instructions.

WAN Port Uses

WAN ports are used for high-speed dedicated connections between two local area networks (LAN's). Once a connection is established between two sites, a wide area network (WAN) is achieved. WAN connections can be achieved through the use of dedicated leased lines such as T1, E1 or higher bandwidth lines, SONET/SDH connections, ATM connections, Frame Relay connections, or ISDN lines. Connection rates can range from 9600bps to 2.048Mbps (E1) to 2.488Gbps (OC-48). ImageStream routers support these connection types using one or more serial ports with or without integrated CSU/DSU's.

All WAN port connections are very similar and are represented in the diagram below.



For most applications, a dedicated line connects two routers, each located on a separate remote network. The following examples describe various uses for synchronous ports.

Routing over Leased Lines. A serial port with or without integrated CSU/DSU's can be used to connect to synchronous leased lines from 9600bps to T1 (1.544Mbps) or E1 (2.048Mbps) to DS3 (44.736Mbps) or E3 (34.368Mbps) for continuous operation. Synchronous optical network (SONET) or Synchronous Digital Hierarchy (SDH) interfaces use optical instead of copper wiring and commonly operate at speeds from OC-3/STM-1 (155.52Mbps) to OC-48/STM-16 (2.488Gbps) and higher. A channel service unit/digital service unit (CSU/DSU) must be attached to the serial port, or integrated into the serial card. For more information about configuring cards with integrated CSU/DSU's, see Chapter 8, Router Installation and Configuration Manual/Configuring an Integrated CSU/DSU WAN Interface.

Routing over ATM. ATM (asynchronous transfer mode) is a dedicated-connection switching technology that organizes digital data into 53-byte cell units (48 bytes of data, 5 bytes of overhead) and transmits them over a physical medium using digital signal technology. Individually, a cell is processed asynchronously relative to other related cells. Like frame relay, two advantages over a leased line network are lower cost and the ability to have multiple virtual circuits (VC's) come into a single physical port. It is especially popular for DSL service and hub-and-spoke network arrangements. However, unlike frame relay, ATM is designed for easy implementation in hardware

(rather than software) and is designed for optical links at higher speeds. For more information about configuring ATM, see Chapter 9, Router Installation and Configuration Manual/Configuring an ATM Interface.

Routing over Frame Relay. Frame Relay provides connectivity using a packet switched network. Its two advantages over a leased line network are lower cost and the ability to have multiple permanent virtual circuits (PVC's) come into a single physical port. It is especially popular for hub-and-spoke network arrangements. For example, a dozen field offices with T1 or fractional T1 Frame Relay connections can connect to a central office using a single DS3, fractional DS3 or T1 Frame Relay connection. The central office requires only one CSU/DSU and serial port on the router, instead of twelve. For more information about configuring frame relay, see the Chapter 10, Router Installation and Configuration Manual/Configuring a Frame-Relay Interface.

Routing over ISDN. Integrated Services Digital Network (ISDN) provides fast dial-up connectivity for applications where the expense of a dedicated Frame Relay, ATM or leased line connection is not appropriate for the amount and nature of the traffic. For more information about ISDN Basic Rate Interface (BRI) connections, see Chapter 11, Router Installation and Configuration Manual/Configuring an ISDN BRI Interface.

Understanding the Network Interface Configuration File

The **wan.conf** file is explained in detail in Chapter 5, Router Installation and Configuration Manual/Configuring a LAN Interface, and in Chapter 31, Router Installation and Configuration Manual/Basic Networking.

Configuring a Synchronous Serial WAN Interface

Once you have determined the type of synchronous connection to use between your remote locations, the synchronous port on each end of the connection must be configured. If your WAN interface has an integrated CSU/DSU, please Chapter 8, Router Installation and Configuration Manual/Configuring an Integrated CSU/DSU WAN Interface.

```
Configuration menu
1. AAA (Password) Configuration
2. Global configuration
3. Network interface configuration
4. Firewall and QOS configuration
5. Service configuration
6. Dynamic routing configuration
7. Save configuration to flash
0. ISis-Router main menu
```

From the "Configuration menu", select the "Network interface configuration" option by pressing 3 and **Enter**. This will open the ImageStream router's primary configuration file, **wan.conf** in the default editor. The **wan.conf** file is also accessible from the command line in the **/usr/local/sand** directory.

Default Serial WAN Interface Configuration

The default values of cards equipped with a Serial interface are as follows:

- ◇ Cards equipped with a multi-interface cable serial interface (cards whose part name ends in "-SE") default to V.35 operation.
- ◇ All cards use external (also known as "line" or "network") clocking. No port description is configured for any port.
- ◇ PPP encapsulation is enabled.
- ◇ Bridging is not configured.
- ◇ Remember that default settings are not necessarily shown in the configuration file.

Customizing the Configuration

To customize the WAN port configurations, complete the following sections. The ordering of the commands is done by convention, but a specific order is not required. Likewise, all configurations are indented to make configurations easy to read, but indentation is not required. In general, ImageStream follows this ordering convention:

1. Comments
2. Port description
3. Bandwidth scaling statement
4. Interface type settings
5. Other optional settings
6. IP address/netmask
7. Secondary IP addresses/netmasks

Setting the Port Description

You can assign description to all WAN ports. Although this feature is optional, it may be particularly useful to assign names to facilitate administration. Setting a description does not change the operation or name of the port.

To assign a description to a port, enter this command in the wan.conf file in the Serial interface configuration section:

```
description string
```

Using the configuration below, we have modified the description for Serial0:

```
!  
interface Serial0  
shutdown  
description Connection to provider encapsulation hdlc  
ip address 192.168.10.1 255.255.255.252  
!
```


Setting the IP Address and Netmask

During the initial installation process, you will set the IP address and netmask for the Serial interface. To change the IP address and netmask of the Serial interface from the default, modify the ip address command. The syntax of this command is:

```
ip address ipaddress netmask
```

Set the IP address to the address to be used by the serial interface of the router on your network. If you have divided your network into subnets, enter the subnet mask that identifies how your network addresses are divided between the network portion and the host portion.

Using the default configuration below, we have set the Serial0 IP address to 20.0.0.2 with a netmask of 255.255.255.252. Often, with numbered point-to-point Serial links, the netmask will be a /30 (a subnet with 2 valid addresses). You will need to substitute your address and netmask for your network.

```
!  
interface Serial0  
shutdown  
description Connection to provider encapsulation hdlc  
ip address 20.0.0.2 255.255.255.252  
!
```

Setting Serial Transport Encapsulation

The serial transport encapsulation must be set for a synchronous serial port. Only one encapsulation may be specified, and this setting must match the one used on the remote end of the serial interface. If your provider has specified an encapsulation type, use this value. Normal encapsulations for a serial link are: hdlc, ppp, frame-relay ietf, or atm. The syntax of this command is:

```
encapsulation type
```

In the configuration below, we have specified HDLC encapsulation. This encapsulation type is the default on most Cisco routers. If you are not connecting to a Cisco router, you will likely use PPP encapsulation. ATM and frame relay encapsulation types require special configurations and will be discussed in later chapters. You will need to set the encapsulation type for your network.

```
!  
interface Serial0  
shutdown  
description Connection to provider encapsulation hdlc  
ip address 20.0.0.2 255.255.255.252  
!
```

Enabling or Disabling a Serial Interface

To disable an interface, use the shutdown interface configuration command. Unlike other command line interfaces, the wan.conf file does not require a "no" version of a command to reverse the operation. Entering "no" followed by a command will be ignored by SAND.

By default, Serial0 is disabled in the default configuration below because the shutdown command has been entered.

```
!
interface Serial0
shutdown
description Connection to provider encapsulation hdlc
ip address 20.0.0.2 255.255.255.252
!
```

To enable Serial0 in the configuration, remove the shutdown command. Do not use "no shutdown," as this will be ignored by SAND. It is not necessary to enter "no" and a command to negate the command. Simply remove the command from the configuration file.

Adding Comments to a Serial Configuration

Comments may be added to the Serial configuration, or anywhere in the wan.conf file by inserting a line that begins with the # symbol. The contents of the line will be ignored by SAND. Comments may be used to place contact information, ticket numbers, circuit IDs or any other information into the **wan.conf** file. There are no limits on the number or length of comments that may be inserted.

```
!
interface Serial0
#NOC phone: 800-555-1212 - Our account #58935 description Connection to provider
encapsulation hdlc
ip address 20.0.0.2 255.255.255.252
!
```

Scaling the Connection Speed Calculation

For some media, such as Ethernet and Token Ring, the bandwidth is fixed; for other media, such as serial lines, you can change the actual bandwidth by adjusting the hardware. For both classes of media, you can use the bandwidth configuration command to communicate the current bandwidth to the router's statistical output program and other programs. The bandwidth command sets an informational parameter only to communicate the current bandwidth to other programs.

The bandwidth command does not adjust the actual bandwidth of an interface. For certain types of interfaces (Bonder, Ethernet, ATM, ports with integrated CSU/DSUs), the bandwidth value is automatically calculated for you. For synchronous serial interfaces, the bandwidth value cannot be determined automatically, so you must set it. The syntax of the bandwidth command is:

```
bandwidth <bits per second>
```

In the default example below, we have added a bandwidth equal to a full T1 line (less overhead) to the Serial0 interface:

```
!
interface Serial0
#NOC phone: 800-555-1212 - Our account #58935 description Connection to provider
bandwidth 1536000
encapsulation hdlc
ip address 20.0.0.2 255.255.255.252
```

!

Setting the Serial Interface Type

Most ImageStream synchronous serial interfaces are capable of operating with several different wiring interfaces. All cards whose part name ends in "-SE" are multi-interface capable. The default setting is for V.35 interfaces, but the multi-interface serial cards can also support RS-232, RS-422/RS-449/X.21 wiring connections when coupled with the correct cable and wiring interface setting.

The **dctype** command is used to set the serial card's daughter card to use a particular wiring interface. In most cases, the synchronous serial connection to the external CSU/DSU will be V.35 or X.21. The dctype must be set to match the wiring interface used. The syntax of the dctype command is:

```
dctype type-code
```

where the type code is either 0 (V.35), 1 (RS-422/RS-449/X.21), or 2 (RS-232). In the default example from above, we have omitted the dctype command since the connection to the CSU/DSU is V.35. Optionally, the command dctype 0 could be added for V.35 operation, although it would have the same effect as omitting the command.

Adding Secondary Serial Addresses

Although rarely necessary, depending on your network configuration, you may need to configure more than one address on a Serial device. This task is accomplished by adding the secondary keyword to the ip address line used previously. The secondary keyword is used for all addresses on a Serial device other than the primary address. Only one primary address can be configured on a Serial device. Configuring more than one primary address or leaving the secondary keyword off of a secondary address configuration will cause the last primary IP address to be used when the port is configured by SAND.

Using the default configuration below, we have added two secondary IP addresses to Serial0. You will need to substitute your address and netmask for your network.

```
!
interface Serial0
#NOC phone: 800-555-1212 - Our account #58935 description Connection to provider
bandwidth 1536000
encapsulation hdlc
ip address 20.0.0.2 255.255.255.252
ip address 20.0.1.1 255.255.255.0 secondary
!
```

Configuring X.21 Connections

In many non-North American countries, X.21 wiring interfaces are used instead of V.35. X.21 wiring, which provides a balanced signal, differs from other wiring interfaces in that no Data Carrier Detect (DCD) or Data Terminal Ready (DTR) pins are used. Setting dctype 1 sets only the hardware wiring

interface. The router must also be configured to ignore the DCD and DTR signals and use the Request To Send (RTS) and Clear To Send (CTS) signals to determine interface status.

For proper X.21 operation, enter the command `x21-clockmode`. Failing to enter this command will prevent your X.21 connection from becoming active. This command is not necessary for any other wiring interface, including standard RS-422 and RS-449 wiring interfaces which also share the `dctype 1` configuration command.

Configuring Additional Serial Devices

If your router is equipped with multiple Serial devices, you can add additional interface configurations to the `wan.conf` file. Although the order of the devices in the file does not matter, ImageStream by convention keeps the interfaces in order. Additional Serial devices are configured in the same manner as Serial0 in our example configuration. Add an additional interface command for each additional Serial port, separating each section with a `!` symbol. The syntax of the interface command is:

```
interface DeviceName
```

In the default example below, we have added a second Serial port at Serial1 (note the use of the `dctype` command and `x21-clockmode` command for X.21 operation) and a third Serial port at Serial2.

```
!
interface Serial0
#NOC phone: 800-555-1212 - Our account #58935 description Connection to provider
bandwidth 1536000
encapsulation hdlc
ip address 20.0.0.2 255.255.255.252
ip address 20.0.1.1 255.255.255.0 secondary
!
interface Serial1
description Connection to London office bandwidth 2048000
encapsulation ppp
dctype 1
x21-clockmode
ip address 25.0.0.1 255.255.255.252
!
interface Serial2
#HSSI card
description fractional DS3 to NYC bandwidth 10000000
encapsulation hdlc
ip address 30.0.0.1 255.255.255.252
!
```

Note: You must save the settings to the router's non-volatile flash memory! If the router is rebooted before saving, your changes will be lost! See Chapter 26, Router Installation and Configuration Manual/Backup/Restore Menu: Managing Configurations for more information.