

Synchronizing Network Clocks

Reliable data transmission requires synchronized clocking throughout the network. The IPX, IGX, and BPX switches use a fault-tolerant network synchronization scheme to ensure reliability. This scheme provides network-wide clock synchronization and ensures that each node is synchronized to the nearest, most stable clock. The sections that follow describe how to synchronize a network and the applicable commands.

Understanding Network Synchronization

Available clock sources are defined within the network as primary (p), secondary (s), or tertiary (t). This hierarchy is based on clock source stability. Each trunk that can pass clock synchronization is defined. Each network node's clock is based on the most stable clock source. If multiple, equal clock sources are available, each node chooses the closest one (measured in number of hops).

Clock sources may be changed manually by the user, or automatically by the IPX/BPX. If there are no primary, secondary, or tertiary clock sources defined or working in a network, then the internal oscillator of one node is automatically selected as the active network clock source.

Whenever a clock source changes—because of a line repair or an operator's command, for example—the node ensures that the clock path remains hierarchical. Also, whenever a subnetwork is merged with another subnetwork, each node in the new network verifies that it has the nearest, most stable clock that is available.

Defining Clocks and Lines

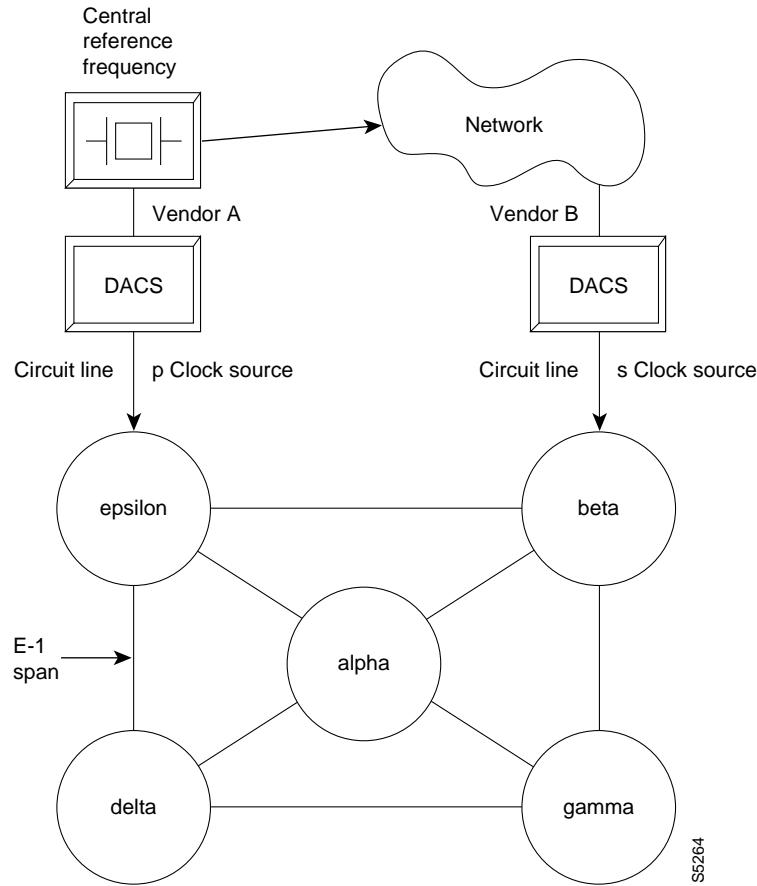
Ordinarily, a network's clock sources and line characteristics are configured as part of the node installation process. Thereafter, clock sources are redefined when a network is reconfigured or a line status is changed.

Clock sources are manually defined as primary, secondary, or tertiary. The definition depends on the stability of the clock source. Considerations for assessing and defining clock sources include:

- Stratum level of each clock source
- Reliability of each clock source (Figure 12-1 illustrates clock source reliability)
- Network configuration (topology, e.g., backbone, ring, star, mesh)
- Availability of multiple clock sources in a plesiochronous network

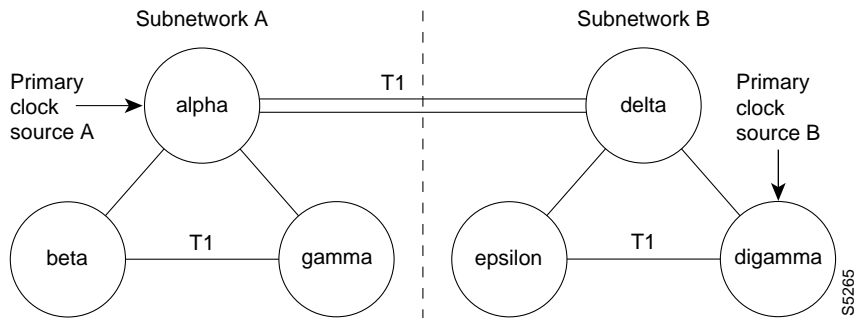
A plesiochronous network is a network in which there are two or more independent, active clock sources. For example, a network in which multiple vendors provide multiple lines that require clock mastership can be a plesiochronous network. The following depicts clock source reliability.

Figure 12-1



In this example of a network, vendor A provides the most reliable clock source.

Figure 12-2



If the packet lines in the T1 span between nodes alpha and delta are defined to pass clock synchronization, then node delta **could** attempt to synchronize with primary clock source A as well as with primary clock source B, since the distance in hops (as opposed to miles or kilometers) is the same: one.

If the packet lines in the T1 span from node alpha to node delta are defined **not** to pass clock synchronization, then a plesiochronous network would result.

One trunk parameter is the ability to pass a clock. A line passes a clock if the clock information transmitted from one end arrives as the identical clock at the other end. Normal T1 or E1 lines pass clock. Lines that do not normally pass clock include:

- Satellite lines.
- Lines that pass through a DACS (Digital Access Cross-connect Switch).
- Subrate lines

A long-distance line that passes through another provider's network may or may not pass clock. The default ability for an IPX or IGX trunk is to pass clock. The following applies to clocks and lines:

- Defining a trunk as a *clock source* is incompatible with defining it as passing clock.
- In an IPX/IGX/BPX network, a *clock source* functions as a source for the entire network.
- A trunk should be defined as a clock source only if a DACS-like device connects to the trunk.

Synchronizing the Network

Network synchronization includes specification of primary, secondary, and tertiary clock sources. The latter two sources serve as backups in case of clock failures. The **cnfclksrc** command specifies the source of a clock and can remove a previously specified clock source. Multiple primary sources, multiple secondary sources, and multiple tertiary sources are allowed.

The designation of the clock source depends on the stratum (or stability) of the clock source. Each node in the network synchronizes to the nearest (fewest number of hops) primary clock source. If no primary source is available, the nearest secondary clock source is used, and so on. If no other source is available, the network synchronizes to the internal oscillator of one of the nodes in the network. The following commands manage the network clocks.

- **cnfclksrc**, which can either specify or remove a primary, secondary, or tertiary clock source in a network.
- **dspclksrcs**, which displays all the currently defined clock sources.
- **dspcurclk**, displays the current clock source being used by the network.
- **clrclkalm**, which clears an alarm associated with a clock source. The cause of an alarm usually is a current clock source that fails or is outside of frequency limits. You must clear a clock source alarm before that clock source is usable.

Summary of Commands

The following list shows the full name and starting page for the description of each command.

Table 12-1

Command	Description	Page
clrclkalm	Clear clock alarm	12-4
cnfclksrc	Configure clock source	12-5
dspclksrcs	Display clock source	12-7
dspcurclk	Display current clock	12-9

clrclkalm

Clears the alarm status of a clock source. This clock source is either a circuit line or a trunk. Upon successful execution of **clrclkalm**, the system does not display any messages.

A clock test runs continuously in a node. The test compares the frequency of the node's clock source to a reference on the control card (such as BCC or NPM). If the test determines that a clock source is outside preset frequency limits, the controller declares the source defective and switches to another clock source. For the node to return to the original clock source, the alarm must be cleared using **clrclkalm**. The alarm can be either a "Bad Clock Source" or "Bad Clock Path" alarm.

Full Name

Clear clock alarm

Syntax

clrclkalm <line type> <line number>

Related Commands

cnfelksrc, dspelksrcs, dspclns, dspcurclk, dsptrks

Attributes

Privilege	1-5
Jobs	No
Log	Yes
Node	IPX, IGX, BPX
Lock	Yes

Example 1 Description

```
clrclkalm c 12
```

Clear a clock alarm on circuit line 12

Example 2 Description

```
clrclkalm p 12
```

Clear clock alarm on trunk 12

Table 12-2

Parameter	Description
c/p	Specifies the type of line. A "c" indicates a circuit line. A "p" indicates a trunk.
line number	Specifies the number of the circuit line or trunk.

cnfclksrc

Specifies a network-wide clock source. The clocking scheme ensures that all nodes in the network automatically synchronize to the nearest, most stable clock available. After you specify a clock source, the location and type of the network clock source goes out to all nodes in the network. This synchronization remains in effect despite line failures, power outages, controller card switchovers, line repairs, and the joining of subnetworks and all other network topology changes. Each node in the network maintains a list of the available clock sources for the network.

A clock *source* can be either circuit line (C), a trunk (P), or an external source (E). The clock *type* can be primary (P), secondary (S), or tertiary (T). To remove a clock source, enter its type as “r” at the end of the **cnfclksrc** command line.

Designation of the clock type depends on the stratum (or stability) of the clock source. In a large network, for example, you could designate all stratum 2 clocks as “primary,” all stratum 3 clocks as “secondary,” and all stratum 4 clocks as “tertiary.” The network regards all primary clocks as equal in the network clocking hierarchy, regards all secondary clocks as equal, and regards all tertiary clocks as equal. Each node synchronizes to the highest stratum clock source that is available. If multiple, equal clock sources are available, the node synchronizes to the source that is physically the closest. If none of the sources is available, the network synchronizes to the internal oscillator of one of the nodes in the network. When you are planning clock sources, consider the following:

- The **dspclksrcs** command displays all clock sources in a network. The **dspcurclk** command displays the clock source that a specific node is currently using and the path between the source and the local node.
- To avoid unnecessary clock disruptions, configure all primary clock sources for the network first.
- A line must be *upped* and not in an alarm before you can configure it as a network clock source.
- Before you define a trunk as a clock source, use **cnftrk** to specify that the trunk does not pass synchronization.

Full Name

Configure network clock source

Syntax

cnfclksrc <line type> <line number> <source type> [freq]

Related Commands

dspclksrcs, dspcurclk

Attributes

Privilege	1
Jobs	No
Log	Yes
Node	IPX, IGX, BPX
Lock	Yes

Example 1 Description

cnfclksrc c 15 p

Configure circuit line 15 as a primary clock. The network clock sources screen shows that circuit line 15 has been configured as a primary clock source for the network.

System Response

```
bootzilla      TRM   YourID:1          IPX 32      8.2      Mar. 15 1996 15:31 MST
```

Network Clock Sources

```
Primary
bootzilla CLN  15
```

```
Secondary
None
```

```
Tertiary
None
```

Last Command: cnfclksrc c 15 p

Next Command:

Table 12-3 cnfclksrc – Parameters

Parameter	Description
line type	Specifies whether the clock source is a trunk (p), circuit line (c), or external (e).
line number	For a network clock source of either a circuit (c) or trunk (p), this specifies the back slot location of the source. For external clock sources (e), enter either front card slot 1 or 2 as long as either slot has a card. This external source designation applies to IPX, IGX, and BPX nodes.
source type	Specifies where the clock fits in the hierarchy: p = primary; s = secondary; and t = tertiary. To remove the clock source configuration for the current type and line, enter an "r."

Table 12-4 cnfclksrc – Optional Parameters

Parameter	Description
freq	Specifies the frequency of the clock source. An entry is necessary only if the <i>line type</i> is an external line. The supported frequencies are 1.544 MHz and 2.048 MHz. Enter a "1" for 1.544 MHz or a "2" for 2.048 MHz.

dspclksrcs

Displays all clock sources for the network. The display for unreachable or failed clock sources flashes on and off.

Full Name

Display network clock sources

Syntax

dspclksrcs

Related Commands

cnfelksrc, dspcureclk

Attributes

Privilege	1-6
Jobs	No
Log	No
Node	IPX, IGX, BPX
Lock	No

Example 1 Description

dspclksrcs

Display the network clock sources

System Response

```
bootzilla      TRM  YourID: Numba 1  IPX 32  8.2  Mar. 15 1996 15:32 MST
```

Network Clock Sources

```
Primary  
bootzilla CLN  15
```

```
Secondary  
None
```

```
Tertiary  
None
```

```
Last Command: dspclksrcs
```

```
Next Command:
```


dspcurclk

Displays the current clock source. The display for **dspcurclk** contains the following information:

- Source Node: The node in the network where the clock source originates.
- Source Line: the type of line used as the clock source and its back slot number (for example, "CLN 15", TRK 22, "EXTERNAL 2", or "INTERNAL").
- Clock Type: the clock type configured for the source clock (primary, secondary, or tertiary). If the source clock for the node is an internal oscillator, no clock type is given.
- Clock Frequency: the received clock frequency as measured by the local NPC/BCC.
- Path to Source: the path from the current node to the node of the originating clock source. This includes all intermediate nodes and trunks.

Full Name

Display current clock sources

Syntax

dspcurclk

Related Commands

cnfelksrc, dspelksrcs

Attributes

Privilege	1-6
Jobs	No
Log	No
Node	IPX, IGX, BPX
Lock	No

Example 1 Description

dspcurclk

Display the current clock source

System Response

bootzilla TRM YourID:1 IPX 32 8.2 Mar. 15 1996 15:33 MST

Current Clock Source

Source Node: gamma
Source Line: Internal
Clock Type:
Clock Frequency: 1544015

Path to Source:
bootzilla 9--10gamma

Last Command: dspcurclk

Next Command: