

Configuring LAT

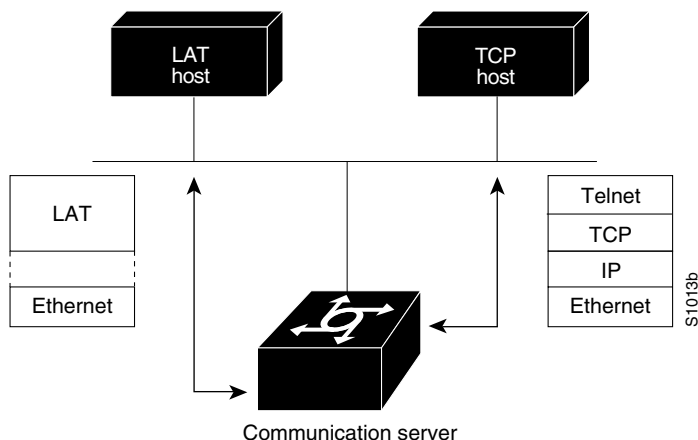
The Digital Equipment Corporation (Digital) Local Area Transport (LAT) protocol is the one used most often to connect to Digital hosts. LAT is a Digital-proprietary protocol. We provide LAT technology licensed from Digital. This chapter describes how to configure the LAT transmission protocol. For a complete description of the commands in this chapter, see the *Access Services Command Reference*. For information about making a LAT connection through a router, refer to the “Making Connection to Network Devices” chapter of the *Access Services Configuration Guide*.

Cisco’s Implementation of the LAT Protocol

The LAT protocol allows a user to establish a LAT connection to a host at another site, then pass the keystrokes from one system to the other. A user can establish a LAT connection through a router to a LAT host simply by entering the host name. The Cisco IOS software supports LAT 5.2 specification.

Unlike the Transmission Control Protocol/Internet Protocol (TCP/IP), LAT was designed to be used on local-area networks (LANs) and it cannot be routed because it does not have a routing layer. However, a bridge or combined bridge and router, such as the Cisco router, can be used to carry LAT traffic across a wide-area network (WAN). Protocol translation can be used to carry LAT traffic over a WAN by first translating LAT to X.25 or Telnet, as shown in Figure 37.

Figure 37 Comparing LAT and TCP/IP Protocol Stacks



LAT Functionality

The LAT protocol is asymmetrical; it has master and slave functionality. First, the LAT master starts a LAT circuit by sending a circuit start message, and then a LAT slave responds with its own circuit start message. From 1 to 255 LAT sessions can then be multiplexed on a circuit.

In a typical setup, where the user's terminal is connected to a router, the router acts as the master, and the target VMS host acts as the slave.

For example, the following command results in the device *Router1* acting as the master (or server) and the target VMS host, *wheel*, acting as the slave (or host).

```
Router1> lat wheel
```

A router can also act as a slave. This happens if the user connects from one access server to another. For example, the following command results in *Router1* acting as the master (server) and *Router2* acting as the slave (host).

```
Router1> lat Router2
```

In a LAT host-initiated connection, the VMS system always acts as the LAT slave. For example, a print job originating from a VMS system initiates or triggers the router to which the printer is connected to act as the LAT master. In short, the master-slave relationship also applies to host-initiated sessions from a LAT slave.

LAT Services

Resources such as modems, computers, and application software are viewed in a LAT network as *services* that, potentially, any user in the network can use. A LAT node can offer one or more such LAT services, and more than one LAT node can offer the same LAT service.

A LAT node that offers one or more services, collectively called *advertised services*, broadcasts its services in the form of Ethernet multicast messages, called *LAT service announcements*. Conversely, a LAT node can listen for LAT service announcements on the network. These messages are cached in a dynamic table of known LAT services, collectively called *learned services*.

The Cisco IOS software supports both learned and advertised LAT services; therefore, it also supports incoming and outgoing LAT sessions. The services rating of its advertised nodes are determined dynamically but can also be set statically.

To establish outgoing connections to a LAT service, the Cisco IOS software searches for the service in the learned services cache. If one or more nodes is offering the same service, the node with the highest rating is chosen. For example, a LAT connection to a service offered by a VAX cluster connects to the node in that cluster with the smallest load and thus the highest service rating. This is how load balancing works in relation to a group of nodes offering the same service.

To establish an incoming connection, a LAT session connects from another LAT node to the service advertised by the local LAT node.

LAT Groups

Because potentially any user can access any of the services on a LAT network, a LAT server manager uses the concept of *group codes* to allow or restrict access to the services.

When both the router and the LAT host share a common group code, a connection can be established between the two. If the default group codes have not been changed on either side, a user on any router can connect to any learned service on the network.

However, if you define groups for access servers or routers and LAT hosts, you can partition these services into logical subnetworks. You can organize the groups so that users on one device view one set of services, and users on another device (or another line on the same device) view a different set. You might also design a plan that correlates group numbers with organizational groups, such as departments. The section “Define a Group List for Outgoing Connections” in this chapter describes how to enter group code lists in your configuration file.

A LAT host node's services cannot be accessed individually; access is granted, per node, on an all-or-none basis.

LAT Sessions and Connection Support

A LAT session is a two-way logical connection between a LAT service and the router. All this is transparent to the user at a console connected to a LAT session; to the user it appears that connection has been made directly to the desired device or application program. There is no inherent upper limit to the number of LAT sessions you can create from an asynchronous terminal to the router.

When a host print job connects to a router, this is called a *host-initiated connection*. The Cisco IOS software maintains a queue of hosts requesting connection by sending periodic status messages to the requesting host.

You can establish host-initiated connections by specifying a port number or by defining a service. These same services are used for connections from other access servers or routers.

Note If a connection request is received that specifies a service and a destination port number, the port number is used to determine the line number for connection purposes. This allows a user to connect to a specified port simply by specifying any service on the server and a port number. (Earlier versions of the Cisco IOS software ignored the service name on inbound connections.)

Connect a VMS Host Using LAT

The process of connecting to a VMS host is slightly different if you are connecting to a VMS host running VMS Version 5.4 or earlier than when connecting to a VMS host running VMS Version 5.5 or later software.

VMS Version 5.4 or Earlier System

If a host-initiated connection is received that specifies a destination port number that corresponds to a virtual port on the router, a virtual EXEC process will be created for the user to log in with. This process can be used, in conjunction with the Digital **set host/dte** command on VMS, to connect to a router named router1 from a VMS host node, as shown in the following example:

```
$lcp :=$latcp
$lcp create port lta300:
$lcp set port lta300:/service=able /node=router1
$set host/dte lta300:
```

VMS Version 5.5 or Later System

To connect to a VMS host running VMS Version 5.5 or later, you must turn on the VMS LAT hosts's outgoing connections and use the Digital **set host/lat** command, as shown in the following example:

```
$lcp := $latcp
$lcp set node/connection =outgoing
$set host/lat able
```

Port Names When Configuring a LAT Printer

When you configure a LAT printer, the LAT port name is the line number without the "tty." For example, if you configure terminal line 10, named ABLE, to be a LAT printer port, you must use the OpenVMS command to associate an arbitrary LAT device to a LAT port name is as follows:

```
$lcp := $lcp
$lcp create port lta300:
$lcp set port/node=ABLE/port=10 lta300:
```

The LAT port name is the line number without the "tty," regardless of whether the format of the tty line number is decimal or octal. Refer to the line configuration chapter in this publication for more information about configuring the line to the correct terminal characteristics (for example, baud rate, EXEC, flow control, and so forth).

Additional LAT Capability

The Cisco IOS software fully supports the LAT protocol suite, and provides the following features:

- High-speed buffering—Handles a full screen of data (2000 characters) at full speed without requiring additional flow control.
- Protocol transparency—Handles connections transparently. The user needs no protocol information to establish a connection.
- Simplified configuration management—Uses logical names for LAT group codes to simplify the network structure.
- Maintenance Operation Protocol (MOP)—Supports Digital's protocol to support the request ID message, periodic system ID messages, and the remote console carrier functions for Ethernet interfaces.

LAT Configuration Task List

The Cisco IOS software LAT protocol is supplied with a default configuration and does not require additional configuration for you to use it. The software does provide commands for customizing the LAT software for your environment, if desired.

Perform the tasks in the following sections to enable LAT, to customize LAT for your particular network environment, and to monitor and maintain LAT connections:

- Enable LAT
- Define a LAT Node Name
- Define a Group List for Outgoing Connections
- Specify a Group List Logical Name
- Specify Groups to Be Advertised
- Enable Inbound Services
- Control Service Announcements and Service Solicitation
- Configure Traffic Timers
- Optimize Performance
- Define Access Lists
- Enable Remote LAT Modification
- Monitor and Maintain LAT

See “LAT Examples” at the end of this chapter for ideas on how to configure LAT in your network.

Enable LAT

LAT is disabled by default. To enable LAT, perform the following task in interface configuration mode:

Task	Command
Enable the LAT protocol.	lat enabled

Define a LAT Node Name

You can give the router a node name that is different than the host name. Perform the following task in global configuration mode:

Task	Command
Define a LAT node name.	lat node <i>node-name</i>

Define a Group List for Outgoing Connections

You can define the list of services to which a user can connect. Do this by defining the group code lists used for connections from specific lines. Perform the following task in line configuration mode:

Task	Command
Define the group list for an outgoing connection on a specified line.	lat out-group { <i>groupname</i> <i>number</i> <i>range</i> all }

Specify a Group List Logical Name

You can limit the connection choices for an individual line by defining the group code lists for an outgoing connection. When a user initiates a connection with a LAT host, the user's line must share a common group number with the remote LAT host before a connection can be made.

Specify a Group List Logical Name

You can specify a name for group lists to simplify the task of entering individual group codes. A name makes it easier to refer to a long list of group code numbers. Perform the following task in global configuration mode:

Task	Command
Specify logical names for group lists.	lat group-list <i>groupname</i> { <i>number</i> <i>range</i> all } [enabled disabled]

To display the defined groups, use the **show lat groups** command.

Specify Groups to Be Advertised

You can specify a group code mask to use when advertising all services for a node. You can enter more than one group code by listing the numbers. You can also enter both a group code name and group codes. Perform the following task in global configuration mode:

Task	Command
Specify logical names for group lists.	lat service-group { <i>groupname</i> <i>number</i> <i>range</i> all } [enabled disabled]

Enable Inbound Services

Just as LAT services are offered by host computers, they also can be offered by access servers and routers, as they implement both the host and server portions of the LAT protocol. This allows connections from either hosts or local access servers or routers. When a host connects to a local device, this is called a *host-initiated connection*.

The tasks described in this section define support for host-initiated connections. This support includes refining the list of services that the router will support. An incoming session can be to either a port or a service. The port name is the terminal line number, as reported by the EXEC command **show users all**. Perform any of the following tasks in global configuration mode:

Task	Command
Set the LAT password for a service.	lat service <i>service-name</i> password <i>password</i>
Set the LAT service ID for a specific service.	lat service <i>service-name</i> ident <i>identification</i>
Specify a static service rating for a specific service.	lat service <i>service-name</i> rating <i>static-rating</i>
Configure a LAT rotary group.	lat service <i>service-name</i> rotary <i>group</i>
Associate a command with a specific service for auto-execution.	lat service <i>service-name</i> autocommand <i>command</i>
Enable inbound connections to a specific service.	lat service <i>service-name</i> enabled

Use the **show lat advertised** EXEC command to display LAT services offered to other systems on the network.

A service must be specifically enabled, but not all of the attributes in the previous task table are necessary in a particular environment.

Control Service Announcements and Service Solicitation

You can configure the Cisco IOS software to support the service responder feature that is part of the LAT Version 5.2 specification.

Specifically, the DECserver90L+, which has less memory than other DEC servers, does not maintain a cache of learned services. Instead, the DECserver90L+ solicits information about services as they are needed.

LAT Version 5.2 nodes can respond for themselves, but LAT Version 5.1 nodes, for example VMS Version 5.4 or earlier nodes, cannot. Instead, a LAT Version 5.2 node configured as a service responder can respond in proxy for those LAT Version 5.1 nodes.

The Cisco IOS software can be configured as a LAT service responder. Of course, if all your nodes are LAT Version 5.2 nodes, you do not need to enable the service responder features.

You can control service announcements and service solicitations by performing the tasks in the following sections:

- Enable Proxy Solicitation Support
- Disable Broadcasts of Service Announcements
- Adjust the Time Between Service Announcements

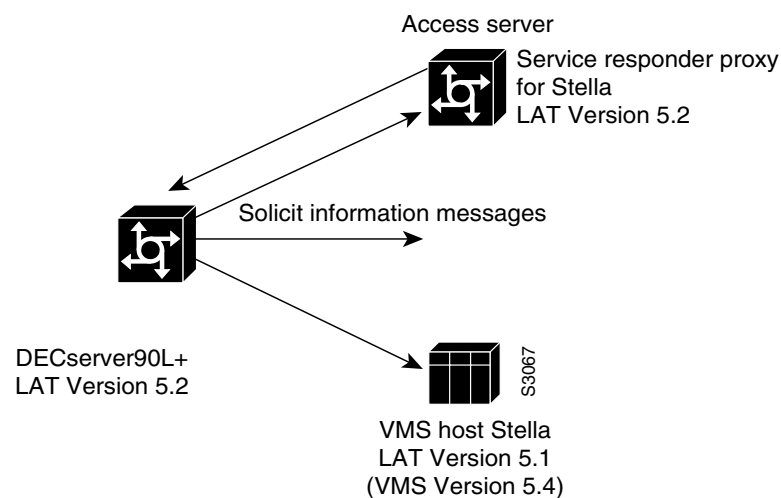
Enable Proxy Solicitation Support

You can configure the Cisco IOS software to respond to solicit information requests addressed to LAT Version 5.1 nodes. This function allows nodes that do not cache service advertisements to interoperate with nodes that do not respond to solicit requests. Perform the following task in global configuration mode:

Task	Command
Enable a proxy node to respond to solicit-information multicast messages.	lat service-responder

Figure 38 shows how a router can act as a proxy for LAT servers.

Figure 38 Router as Proxy for LAT Server



The DECserver90L+ broadcasts a solicit information request in search of service “stella’s” address. The VMS host, stella, is unable to respond to the request because it is running LAT Version 5.1. The access server is running LAT Version 5.2 with service responder enabled and informs the DECserver90L+ of stella’s address.

Disable Broadcasts of Service Announcements

You can disable periodic broadcasts of service announcements. If service announcements are enabled, the LAT node will periodically broadcast service advertisements. If service announcements are disabled, the LAT node will not send service announcements, so a remote node requiring connection to the local node has to use solicit information messages to look up node information. Perform the following task in global configuration mode:

Task	Command
Disable periodic broadcasts of service advertisements.	no lat service-announcements

Only disable service announcements if all of the nodes on the LAN support the service responder feature.

Adjust the Time Between Service Announcements

You can adjust the time between LAT service advertisements for services offered. This is useful in large networks with many LAT services and limited bandwidth. Perform the following task in global configuration mode:

Task	Command
Adjust the time between service announcements.	lat service-timer <i>interval</i>

Configure Traffic Timers

You can customize the environment for transmitting LAT messages. The Cisco IOS implementation of LAT allows you to set the following features:

- The number of retransmissions before declaring a system unreachable
- The interval of time LAT waits before sending a keepalive message on an idle connection
- The interval of time LAT waits between transmission of messages

These features affect all LAT connection types. Perform the following tasks in global configuration mode, as necessary:

Task	Command
Set the message retransmit limit.	lat retransmit-limit <i>number</i>
Set the keepalive timer.	lat ka-timer <i>seconds</i>
Set the virtual-circuit timer.	lat vc-timer <i>milliseconds</i>

Optimize Performance

You can optimize performance for your LAT environment by performing the tasks in the following sections:

- Set the Number of Sessions on a Virtual Circuit
- Set the Number of Messages Received by a Host Node
- Set the Number of Messages Received by a Server Node
- Set a Delayed Acknowledgment for Incoming LAT Slave Connections

Set the Number of Sessions on a Virtual Circuit

You can set the number of sessions multiplexed over a single a LAT virtual circuit. The maximum, (and default) number of sessions is 255. Perform the following task in global configuration mode:

Task	Command
Set the maximum number of sessions on a LAT virtual circuit.	lat vc-sessions <i>number</i>

Set the Number of Messages Received by a Host Node

You can set the number of messages received by a host at one time. Increasing this number can enhance performance. Before LAT Version 5.2, LAT allowed only one outstanding message at one time on a virtual circuit. This restriction could limit the performance of the Cisco IOS software processing a large number of messages because only one Ethernet packet of data could be in transit at a time. During virtual circuit startup, each side communicates to the other how many outstanding messages it is willing to accept. Perform the following task in global configuration mode:

Task	Command
Allow a LAT host node to receive more than one message at a time.	lat host-buffers <i>receive-buffers</i>

Set the Number of Messages Received by a Server Node

You can set the number of messages received by a server at one time. Increasing this number can enhance performance. Before LAT Version 5.2, LAT allowed only one outstanding message on a virtual circuit at a time. This restriction limited the performance of Cisco IOS software when it processed a large number of messages, because only one Ethernet packet of data could be in transit at a time. With LAT Version 5.2, nodes can indicate that they are willing to receive more than one message at a time. During virtual circuit startup, each side communicates to the other how many outstanding messages it is willing to accept. Perform the following task in global configuration mode:

Task	Command
Allow a LAT server node to receive more than one message at a time.	lat server-buffers <i>receive-buffers</i>

Set a Delayed Acknowledgment for Incoming LAT Slave Connections

You can set a user-defined delay for the acknowledgment for incoming LAT slave connections. This is useful in situations where you need to control the delay. For example, if data is being transferred between a Digital server (using LAT) and a UNIX host (using Telnet) via a protocol translator, the protocol translator imposes the LAT delay on the Telnet as well as the LAT service, where Telnet may timeout due to the LAT restriction. Perform this task in global configuration mode, where *number* is milliseconds:

Task	Command
Specify the delay acknowledgment for incoming LAT slave connections.	lat host-delay <i>number</i>

Define Access Lists

Because LAT groups were not intended to implement security or access control, the Cisco IOS software supports *access lists* to provide these functions. An access list is a sequential collection of permit and deny conditions that serve to restrict access to or from LAT nodes on a specific terminal line. Each access list statement defines a permit or deny condition and a matching criterion for the node name.

When a LAT connection is attempted (either incoming or outgoing), the node name of the destination service (*not* the service name) is compared against the regular expression. If they match, the connection is permitted or denied as specified.

Perform the following tasks to define access lists and conditions:

Task	Command
Step 1 Enter global configuration mode.	configure terminal
Step 2 Specify an access condition.	lat access-list <i>number</i> { permit deny } <i>nodename</i>
Step 3 Enter line configuration mode.	line <i>line-number</i>
Step 4 Restrict incoming and outgoing connections between a particular terminal line or group of lines and the node names in an access list.	access-class <i>access-list-number</i> { in out }

Enable Remote LAT Modification

You can configure a LAT line so that a remote LAT node can change the operating characteristics of the line. To enable remote LAT modification, perform the following task in line configuration mode:

Task	Command
Enable remote LAT modification of line characteristics.	lat remote-modification

Monitor and Maintain LAT

To monitor and maintain LAT activity, perform one or more of the following tasks in EXEC mode:

Task	Command
Delete an entry from the queue.	clear entry <i>number</i>
Display queued host-initiated connections.	show entry
Display LAT services offered to other LAT systems.	show lat advertised
Display defined LAT groups.	show lat groups
Display information about LAT nodes.	show lat nodes
Display information about LAT learned services.	show lat services
Display active LAT sessions.	show lat sessions [<i>line-number</i>]
Display traffic and resource utilization statistics.	show lat traffic
Display information about LAT nodes. Information is displayed in the same way as in the Digital interface.	show node [all <i>node-name</i>] [counters status summary]
Display LAT learned services.	show service [<i>service-name</i>]

LAT Examples

The following sections contain LAT configuration examples:

- Establishing Basic LAT Service Example
- Establishing a LAT Service with Selected Group Codes Example
- Displaying the LAT Services on the Same LAN Example
- Establishing an Outbound LAT Session Example
- Logically Partitioning LAT Services by the Terminal Line Example
- Configuring LAT Rotary Groups Example
- LAT Access List Example
- Associating a Rotary Group with a Service Example

Establishing Basic LAT Service Example

The following example establishes the LAT service *ABLE* for your router. Subsequently, your router advertises *ABLE* (with default group code 0) on the LAN. Other LAT nodes can connect to you using LAT service *ABLE*, provided the group codes on the LAT nodes and the group codes for *ABLE* intersect. By default, most LAT nodes, such as OpenVMS Version 5.5 hosts, have user group code set to 0, so you have default access to *ABLE*.

```
! Create LAT service with password protection and
! identification string using the following global configuration commands
lat service ABLE password secret
lat service ABLE ident Welcome to my machine
```

Establishing a LAT Service with Selected Group Codes Example

The following example establishes the LAT service *ABLE* from your router with selected group codes 1, 4 through 7, and 167. This limits inbound access to those LAT nodes that have group codes that intersect with those for LAT service *ABLE*.

```
! Establish a LAT group list
lat group-list HUBS 1 4-7 167
!
! Enable LAT group list for the service-group
lat service-group HUBS enabled
!
! Create LAT service with password protection and
! identification string
lat service ABLE password secret
lat service ABLE ident Welcome to my machine
```

Displaying the LAT Services on the Same LAN Example

The following example demonstrates how you can check which LAT services are on the same LAN as your router. Note that your router's own LAT service *ABLE* is also listed, with the "Interface" column listing the interface as "Local."

```
able> show lat services

Service Name      Rating  Interface  Node (Address)
CAD                16     Ethernet0  WANDER
ABLE              16      Local
CERTIFY33 Ethernet0  STELLA
```

Establishing an Outbound LAT Session Example

The following example establishes a LAT session to remote LAT service *HELLO* using an interactive session:

```
able> lat HELLO
```

Logically Partitioning LAT Services by the Terminal Line Example

The following example illustrates how LAT services are logically partitioned by terminal line. At the example site, lines 1 through 7 go to the shop floor, lines 8 through 11 go to the Quality Assurance department, and lines 12 through 16 go to a common area.

```
! Define LAT groupnames
lat group-list DEFAULT 0
lat group-list FLOOR 3
lat group-list QA 4

line 1 7
lat out-group FLOOR enabled
lat out-group DEFAULT disabled
line 8 11
lat out-group QA enabled
lat out-group DEFAULT disabled
line 12 16
lat out-group DEFAULT QA FLOOR enabled
```

Configuring LAT Rotary Groups Example

The following example illustrates how to configure a range of lines for rotary connections, then establishes the LAT service named *Modems* for rotary connection:

```
! Establish rotary groups
line 3 7
  rotary 1
!
! Establish modem rotary service
!
  lat service Modems rotary 1
  lat service Modems enabled
```

See the section “Configure Rotary Groups” in the “Configuring Terminal Lines and Modem Support” chapter for more information about rotary groups.

LAT Access List Example

The following example illustrates incoming permit conditions for all IP hosts and LAT nodes with specific characters in their names and a deny condition for X.25 connections to a printer. Outgoing connections, however, are less restricted.

```
! Permit all IP hosts, LAT nodes beginning with "VMS" and no X.25
! connections to the printer on line 5
!
access-list 1 permit 0.0.0.0 255.255.255.255
lat access-list 1 permit ^VMS.*
x29 access-list 1 deny .*
!
line 5
  access-class 1 in
!
! Meanwhile, permit outgoing connections to various places on all the
! other lines.
!
! Permit IP access within cisco
access-list 2 permit 172.30.0.0 0.0.255.255
!
! Permit LAT access to the Stella/blue complexes.
lat access-list 2 permit ^STELLA$
lat access-list 2 permit ^BLUE$
!
! Permit X25 connections to infonet hosts only.
x29 access-list 2 permit ^31370
!
line 0 99
  access-class 2 out
```

The following example illustrates how to define access lists that permit all connections, thereby conforming to software behavior prior to Software Release 9.0. Keep in mind that the value supplied for the *list* argument in both variations of the **access-class** commands is used for *all* protocols supported by the Cisco IOS software. If you are already using an IP access list, it will be necessary to define LAT (and possibly X.25) access lists permitting connections to everything, to emulate the behavior of earlier software versions.

```
access-list 1 permit 172.30.0.0 0.0.255.255
access-list 1 permit 172.30.0.0 0.0.255.255
!
```

```
line 1 40
  access-class 1 out
! define LAT access list that permits all connections
lat access-list 1 permit .*
```

Associating a Rotary Group with a Service Example

The following example defines a service that communicates with a specific line and defines a rotary with only that line specified. Establish rotary groups using line configuration commands and the **rotary** line configuration command.

```
hostname ciscots
! Service name for the access server as a whole
lat service ciscopt enable
! Set up some lines with unique service names
line 1
  rotary 1
  lat service ciscopt1 rotary 1
  lat service ciscopt1 enable
!
line 2
  rotary 2
  lat service ciscopt2 rotary 2
  lat service ciscopt2 enable
```