Internet Route Configuration

This chapter provides guidelines to help you customize your routing with Cisco IOS for S/390. This chapter includes these sections:

- Manually Specifying Internet Routes

  Describes how to tailor the ROUTE statements for your site.

- ROUTE Statement

  Describes the parameters for the ROUTE statement.

Manually Specifying Internet Routes

The ROUTE statement in TCPCFGxx provides Cisco IOS for S/390 with routing information for packets addressed to hosts beyond the local network. For example:

```
ROUTE DEST(DEFAULT) ROUTER(129.1.128.1) MEDIA(TOKEN1)
ROUTE DEST(0.0.0.0) ROUTER(129.1.64.1) MEDIA(ETHER1)
```

These entries specify the default router to use for routing from the local network (the one to which Cisco IOS for S/390 is connected) to a remote network. In this particular environment, the host is connected to two networks and the default router is a single IP router connected to each of the two IP networks. The router has a unique address for each of the two IP networks.

These ROUTE statements specify that any IP packet to be routed to a host that is *not* located on either local Ethernet or token ring networks be sent to the router at 129.1.128.1 for routing to the final destination.

Note that Cisco IOS for S/390 automatically selects the correct interface for all packets destined to either of the locally attached networks such that the router is not used by Cisco IOS for S/390 to route traffic to either of the local networks.

The ROUTE statement in the TCPCFGxx member provides Cisco IOS for S/390 with routing information for packets addressed to hosts beyond the local network. Read the ROUTE Statement for detailed information on ROUTE statements and what to do if you have multiple routers and networks. If you do not have any routers to other networks/subnets, you need not code a ROUTE statement.

This statement is distributed as comments so you must un-comment it as you make changes.

ROUTE Statement

The IP statement controls whether Cisco IOS for S/390 acts as a router. One or more route statements can be coded to control IP routing. ROUTE statements must follow the MEDIA and NETWORK statements they are related to, or all ROUTE statements may be placed anywhere after the last NETWORK statement as long as each ROUTE statement specifies the MEDIANAME keyword.

Use the ROUTE statement in the TCPCFGxx member to make outbound route selections from Cisco IOS for S/390. The ROUTE statement determines these items:

* which router, if any, is used for an outgoing packet

* which local network is used to send the packet

* default routes when GateD is inactive

The three basic types of route entries, HOST ROUTE, NET/SUBNET, and DEFAULT, are described in these paragraphs.

The HOST ROUTE entry describes one particular remote host that may have special routing considerations or forwarding options.

The NET/SUBNET entry describes a remote network or subnet. Opinions differ about whether a local host should know about a remote network's subnets. In case the need should arise to define a route to a particular remote subnet, the facility is being provided for with this entry.

The DEFAULT ROUTER entry describes which route should be selected when no other HOST ROUTE or NET/SUBNET route entry has been defined for the remote destination. At least one DEFAULT ROUTER entry should be defined.

When specifying the DEST entry, the destination Internet address is a fully qualified address in dot notation (for example, 127.0.0.2). With the NET/SUBNET entry, the destination address is the Internet address in dot notation of the NET/SUBNET, and the HOST address is 0 (for example, 127.0.0.0). On the DEFAULT ROUTER entry, the specified Internet address is zeroes (for example, 0.0.0.0).

Whenever the outbound connection is being established, Cisco IOS for S/390 chooses the route in the following order. First, the route table is searched for an exact match for the remote destination. If that is not found, it looks for a match on the subnet if the subnet is part of one of your attached networks. If no match is found for the subnet, then a match is attempted on the network. And finally, if no match is found on the network, the first default route is chosen.

For multihomed systems, if an interface is supplied to the route search routine, that interface takes precedence, in other words, a network route on the specified interface takes precedence over a host route on a different interface.

The routing table is updated dynamically based on ICMP redirects received so that the best routing is chosen depending upon traffic on the network. If a local router is determined to be "dead", that router is not used. If a new connection comes in on that router, or an ICMP redirect is received, the router is then marked as "up" and will be included in routing choices.

ROUTE Statement Syntax

ROUTE DEST (*host_address* **|** *subnet* **|** *network* **| DEFAULT**)

    ROUTER (*a.b.c.d*)

    [LOCAL]

    [MEDIANAME (*media_name*)**]**

    [MASK (*mask*)**]**

Syntax Description

DEST (*host_address* | *subnet* | *network* | **DEFAULT**)	Specifies the remote IP address on point-to-point links. Failure to set this parameter for point-to-point links may cause the generation of incorrect routing table entries.
	host_address—host ip address in dotted decimal notation.
	subnet—subnet number in dotted decimal notation.
	network—network number in dotted decimal notation.
	DEFAULT—Keyword to indicate a default route.
	Default: None
ROUTER (*a.b.c.d*)	Specifies the router IP address in dotted decimal notation.
	Default: None
LOCAL	When LOCAL is specified, the destination specified by DEST (whether it is a host, a subnet, or a network) is considered to be on the same network specified by the MEDIANAME keyword. When LOCAL is specified, the DEST and MEDIANAME keywords must be specified; the MASK keyword is optional. All other parameters cannot be specified.
MEDIANAME (*media_name*)	Specifies the name on the associated NETWORK statement.
	Default: If this option is not specified, the system tries to make the network association based on the router information and the remote destination. If the system cannot decide what interface to use, the statement fails.
MASK (*mask*)	Specifies the subnet or network mask of the remote subnet/net in dot notation. This operand should not be specified on host or default router entries.
	Default: If the subnet is part of a network defined by a NETWORK statement, the subnet mask defined on the NETWORK statement is used. Otherwise, the mask for the class of network is used.

Subnets Are Local

Cisco IOS for S/390 supports multiple subnets on a physical network (subnets are local). This allows an interface send directly within the local area network (LAN) to hosts on the distinct subnets.   The mechanism combines both the data link and network layers. The link layer issues ARP requests and replies for the multiple subnets, and the network layer forwards the datagrams directly to a host instead of to a router. You can use the LOCAL parameter of the ROUTE statement to activate this feature.

Usage Notes for the ROUTE Statement

GateD Influence

If you are running Cisco IOS for S/390 with GateD (optional), GateD will update the routing table as required.

Statement Order

ROUTE statements must follow the MEDIA and NETWORK statements they are related to, or all ROUTE statements may be placed anywhere after the last NETWORK statement as long as each ROUTE statement specifies the MEDIANAME keyword.

Automatic Network Selection

In a multi-homed environment, a specific remote destination may be accessible only through one of the local interfaces. If the remote destination is on one of the local subnets defined on a NETWORK statement, the network selection automatically takes place.

If the remote destination is not on a local subnet, a ROUTE NET/SUBNET entry should be defined indicating what local network to use to reach the connection, unless the remote destination is accessible through routers on all interfaces.

Note   Network 127 is *not* a valid network number.

Examples

Table 5-1 illustrates an example for subnet masks.

Table 5-1   ROUTE Statement Example

Destination	Mask	Host Address	Types
127.0.0.1	255.0.0.0	0.0.0.1	Host
127.0.0.0	255.0.0.0	0.0.0.0	Network
127.128.1.0	255.0.0.0	0.128.1.0	Host
127.128.1.0	255.255.0.0	0.0.1.0	Host
127.128.1.0	255.255.255.0	0.0.0.0	Subnet

ROUTE Statement Example 1

In this example, router 129.1.128.1 is used for all remote destination except those on subnet
129.1.65.0.

```
MEDIA NAME(TOKEN1) TOKEN16
NETWORK IPADDRESS(129.1.128.2)
        SUBNET(255.255.255.0)
LCS DEVADDR(0400) NAME(T3172)
LINK.LCSNAME(T3172) ADAPTER(0)
MEDIA NAME(ETHER1) ETHERNET
NETWORK IPADDRESS(129.1.64.12)
        SUBNET(255.255.255.0)
        LINK LCSNAME(T3172) ADAPTER(2)
      .
      .
ROUTE DEST(DEFAULT) ROUTE(129.1.128.1) MEDIANAME(TOKEN1)
ROUTE DEST(129.1.65.0) ROUTE(129.1.64.1)  MEDIANAME(ETHER1)
```

ROUTE Statement Example 2

```
*
IP FORWARD
*
*  LOCAL NETWORK DEFINITIONS
*
MEDIA NAME(ETHER1) ETHERNET
NETWORK NAME(HOST1) IPADDRESS(127.127.0.1) SUBNET(255.255.0.0)
LCS DEVADDR(0400) NAME(T3172)
LINK.LCSNAME(T3172) ADAPTER(0)
MEDIA NAME(ETHER2) ETHERNET
NETWORK NAME(HOST2) IPADDRESS(127.128.0.1) SUBNET(255.255.0.0)
*
*  HOST ROUTE ENTRIES
*
ROUTE DEST(129.192.192.002) ROUTE(127.127.0.3)
ROUTE DEST(129.192.192.003) ROUTE(127.127.0.3)
*
*  NETWORK/SUBNET ROUTE ENTRIES
*
ROUTE  DEST(129.192.0.0)      ROUTE(127.127.0.4)
ROUTE  DEST(129.193.0.0)      ROUTE(127.128.0.6)
ROUTE  DEST(129.195.0.0)      ROUTE(127.127.0.4)
ROUTE  DEST(129.194.1.0)      ROUTE(127.127.0.4)
  SUBNET(255.255.255.0)

*
*  DEFAULT ROUTER ENTRIES
*
ROUTE DEST(0.0.0.0)      ROUTE(127.127.0.3)
*
* END OF CONFIGURATION
*
```

In this example:

- The local subnet mask for both nets is 255.255.0.0.

- These routers are on the ETHER1 network: 127.127.0.3, 127.127.0.4.

- There is one router on the ETHER2 network, 127.128.0.6.

- Router 127.127.0.3 is the default router.

- Hosts 129.192.192.002 and 129.192.192.003 on the HOST1 network will have packets forwarded to them through 127.127.0.3.

- Network 129.192.0.0 is reachable only through router 127.127.0.4.

- Network 129.193.0.0 is reachable only through router 127.128.0.6.

- Subnet 129.194.1.0 is reachable only through router 127.127.0.4.

- No default router is specified for the loopback network.

- The IP statement permits packet forwarding.