Tru64 UNIX

Best Practice for Network Routing

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This best practice describes how to choose and implement a routing mechanism for the Tru64 UNIX operating system.

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All Tru64 UNIX systems (hosts and routers) connected to a network must be configured to support network routing in order to communicate with other systems on other networks. This best practice describes the choices that you as system administrator can make in order to implement network routing on your system.

See the Tru64 UNIX Best Practices Web page for more information about Best Practices documentation.

Is This Best Practice Right for You?

Not all best practices apply to all configurations, so you must be sure that it is appropriate for your system and circumstances. To use this best practice, you must meet the requirements described in the following table.

Requirement	Description
Operating System	All versions
System Configuration	The system must contain at least one network interface card (NIC) and be connected to a network.
Impact on Availability	None.
Network awareness	You need to know information about the network, its topology, routers and gateways, routing protocols, and connections to other networks.

If you do not meet the previous requirements, see *Alternative Practices* for information.

Before You Begin

Before you apply the best practice for network routing, you should understand the following information:

- Network routing terms and concepts
- SysMan Menu

- `route` command
- `netstat` command

Network Routing Terms and Concepts

A **route** is the path a packet takes through a network from one system to another. As such it enables you to communicate with other systems on other networks. Routes are stored on each system in the routing tables or routing database. Each route entry consists of the following:

- A destination address (either a network or a host)
- The address of the next hop from your system to the destination
- The address of your system on the network if the route is through an interface
- A network interface (for example, tu0 and fta0)
- Metrics (for example, hop count and MTU)

When you configure your Tru64 UNIX system you automatically get a route for your loopback interface (`lo0`). In addition, you get a route for each interface that you configure by using the SysMan Configure Interfaces application. If you want additional routes, you can do one of the following:

- Create routes manually based on your map of the network. These routes are called **static routes**. Any time there is physical change in the network, you might have to modify the routing tables on each system. This depends on whether nodes are changing addresses or subnets.
- Run either `gated` or `routed` to have routes dynamically created, maintained, and updated. These are called **dynamic routes**. Any time there is physical change in the network, these daemons receive messages from other nodes or routers to modify the routing table entries automatically.

In addition to either of the previous choices, additional routes might be added to your routing tables based on ICMP (Internet Control Message Protocol) redirect messages. These are messages from routers to hosts that tell the host to forward traffic to another router on the local network.

SysMan Menu

SysMan Menu enables a system administrator to obtain system management data and to run selected system management tasks. SysMan Menu provides a menu of system management tasks in a tree type display, with branches of management categories and leaves of actual tasks. Selecting a leaf or task invokes a task, which displays a dialog for

performing the task. This is the preferred method of creating routes and managing `gated` or `routed`.

SysMan Menu and its associated tasks can be run on an X Windows display, a terminal with curses capability, locally on a PC, or from a Web browser. For detailed information in running SysMan Menu from a PC or a Web browser, use your Web browser and go to:

`http://`*`your_machine_name`*`:2301/SYSMAN/index.html`

Online help is available for the SysMan Menu. To get help, select the Help button.

route Command

The `route` command enables you to add, change, delete, and monitor routes in a system's routing table. In most cases, you do not need to use this command, especially if you are running one of the system routing table management daemons, such as `gated` or `routed`.

Any additions, changes, or deletions to the routing table are valid only while the system is running; they are lost when the system is rebooted. If you want to make permanent changes to routes, you must put them in the `/etc/routes` file by using the SysMan Menu.

See `route`(8) of your version of the operating system for more information.

netstat Command

The `netstat` command displays network-related data in various formats. In addition to displaying information about active sockets and network interfaces, `netstat` also displays routing table information. The routing-table display format indicates available routes and the status of each in the following fields:

- Flags — The state of the route.
- Refs — The current number of active uses for the route.
- Use — A count of the number of packets sent using the route.
- Interface — The network interface used for the route.

If you specify the `-v` option, the routing table display includes the route metrics. An asterisk (*) indicates the metric is locked. If you specify the `-i`option, an asterisk next to the interface name indicates that the interface

is not in the UP state. See `netstat`(1) of your version of the operating system for more information.

Applying the Best Practice

Before you select a network routing method, be sure to follow the recommendations in *Before You Begin*.

When Should You Use Static Routes?

You should use static routes only if the types or values in the following table match your network and system requirements:

Static Routes Selection Criteria

Reason	Type or Value
Size of network	Small LAN (hosts and one gateway/router)
Network topology	Stable
Number of routes required	Loopback, network interface route, and a few others
Routers advertising routes	No
Configuration complexity	Low
System overhead	None

How do I create static routes?

You create static routes using the Set Up Static Routes task of SysMan, either through Quick Setup, the Network Setup Wizard, or Basic Network Services. This installs any routes you specify permanently in the `/etc/routes` file. When the system is started, it reads the `/etc/routes` file and builds the system routing table from the information in the file. See `routes`(4) of your version of the operating system for information that you need to create static routes.

What routes should I add?

A majority of routes are routes to other networks. If you have a small network with no connection to other networks or subnets, you do not have to add any static routes. This is the simplest case.

If your network has only one path to the Internet, you would add a **default route** to a router on your subnet (gateway) to which all non-local network traffic is directed. As long as the address of the

router stays the same or you remain on the same subnet, this is all you need to do. This is appropriate for most small corporate intranets.

If you cannot reach one or more hosts or remote network segments through the default route, you would add a static route to the host or hosts (**host route**) or networks (**network route**). You can also use host routes to control access to remote hosts and networks.

You might also want to use static routes over slow WAN links to reduce the network traffic that is generated from advertising routes and route availability messages.

How do I maintain routes?

When the physical connectivity on a route is disrupted or the network topology changes (for example, adding and deleting routers), the route has to be changed or removed in order for packets to be routed to the destination.

One method occurs automatically. If you have gateways on your network, they send an ICMP Redirect message back to your system. The routing software will add a redirect route to your routing table, enabling traffic to get to its intended destination. However, the original route remains in the routing table.

The other method is for you to add or delete static routes manually. You can either create a permanent route using SysMan Menu or create a temporary route (good until the next system reboot) by using the `route` command.

Static routes are appropriate for many cases. Even in an environment in which routers broadcast RIP messages, one or two default static routes might be all you need. Any topology changes are left for the routers or those who maintain the routers to resolve.

When Should You Use the gated Daemon?

You should use the `gated` daemon to manage your routes dynamically only if the types or values in the following table match your network and system requirements:

`gated` Daemon Selection Criteria

Reason	Type or Value
Size of network	Medium to large, with multiple subnets
Network topology	Variable
Number of routes required	Loopback, network interface route, and many others
Routers advertising routes	Yes
Configuration complexity	Moderate to high
System overhead	Low
System role	Host, router, or cluster member

How do I configure `gated`?

You configure and start `gated` by using the Set Up Routing Services task of SysMan, either through Quick Setup, the Network Setup Wizard, or Basic Network Services.

By default, the `gated` configuration file, `/etc/gated.conf`, is set up to run `gated` like `routed` in Quiet mode, listening to RIP messages but not advertising routes to other hosts or routers. This is adequate for most host systems with only one NIC.

Tru64 UNIX cluster members must be configured as routers and must run `gated` to listen to RIP messages. See the TruCluster Server *Software Installation* manual. In clusters, the `gated` configuration is by default under control of the Cluster Alias Daemon (`aliasd`). The `aliasd` daemon uses `gated` to publish and to maintain cluster alias IP addresses. Therefore, it needs to control `gated` configuration file. Cluster members always use RIP for routing updates.

If you are running your system as a router or have additional protocol or interface needs, you can edit the `/etc/gated.conf` (or another file) and specify the protocols and options you want. Then, you when you start `gated`, the daemon reads the `/etc/gated.conf` file and starts. See `gated.conf`(4), `gated.proto`(4), and `gated.control`(4) of your version of the operating system for more information.

The following table summarizes the routing protocols that `gated` supports and the type of system that uses the protocol. Note that routers, particularly edge or border routers usually run more than one protocol. For example, the router might run OSPF to communicate with internal routers and BGP to communicate with other border routers on the Internet.

Routing Protocol	Used By
RIP Versions 1 and 2	Host or cluster member
Open Shortest Path First (OSPF)	Internet/intranet router connected to other internet/intranet routers
Border Gateway Protocol (BGP) Versions 1, 2, or 3	Edge or border router connected to other edge or border routers
Exterior Gateway Protocol (EGP)	Edge or border router (deprecated)
Router Discovery	Router server and host client

The `gated` daemon supports most of the current routing protocol RFCs. As such, it is more up-to-date than `routed`. See `gated`(8) of your version of the operating system for more information.

How do I maintain routes?

The task is automatic and depends on the protocol or protocols chosen. For RIP, the `gated` daemon listens to route advertisements and selects a default route to a destination host or network based on which route has a lower metric (number of hops). If the physical connectivity on a route is disrupted or the network topology changes, the `gated` daemon makes the necessary changes in the routing table.

For OSPF, `gated` listens to the link state advertisements of all routers and selects a route to a destination host based on the shortest path. If the physical connectivity on a route is disrupted or the network topology changes, the `gated` daemon makes the necessary changes in the link-state database and routing table. Both together describe the entire network topology.

For BGP, `gated` listens to internal and external connections to other routers and selects routes based on the route's length, stability, and weight; all these are considered path metrics. If the physical connectivity on a route is disrupted or the network topology changes, the `gated` daemon makes the necessary changes in the routing table.

When Should You Use the routed Daemon?

You should use the `routed` daemon to manage your routes dynamically only if the types or values in the following table match your network and system requirements:

`routed` Daemon Selection Criteria

Reason	Type or Value
Size of network	Medium to large LAN/WAN, with multiple subnets
Network topology	Variable
Number of routes required	Loopback, network interface route, and many others
Routers advertising routes	Yes
Configuration complexity	Low
System overhead	Low

How do I configure `routed`?

You configure and start `routed` by using the Set Up Routing Services task of SysMan, either through Quick Setup, the Network Setup Wizard, or Basic Network Services.

How do I maintain routes?

The task is automatic. The `routed` daemon listens to RIP Version 1 route advertisements and selects a default route to a destination host or network based on which route has a lower metric (number of hops). If the physical connectivity on a route is disrupted or the network topology changes, the `routed` daemon makes the necessary changes in the routing table.

Verifying Success

After you apply the best practice for network routing, you can verify whether it was successful. Do the following:

1. Display the routing table by issuing the `netstat -rn` command.

   ```
   # netstat -rn
   ```

   See `netstat`(1) of your version of the operating system for more information.

2. Ping a node on your subnet
3. Ping a node off your subnet.

If the best practice was not successful, see *Troubleshooting* for information about identifying and solving problems.

Troubleshooting

Not applicable.

Alternative Practices

Not applicable.

Comments and Questions

We value your comments and questions on the information in this document. Please mail your comments to us at this address:

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