UTnet Guide to TCP/IP Host Configuration

The Network Information Center
of the University of Texas at Austin (UT NIC)

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Introduction

This document describes the network configuration settings required for a host computer running **TCP/IP** network software and attached to UTnet, the University of Texas at Austin campus computer network. The guide is intended for system administrators or anyone setting up a host computer for attachment to the network system.

Correct host configuration is essential to the operation of UTnet. Improper configuration can cause unnecessary network traffic that places a heavy load on the network system. In the worst case, a misconfigured host can cause so many incorrect packets that no communication is possible for portions of the network system. The correct network configuration prevents these problems from occurring.

This document describes the configuration settings for the two network configurations in use at UT: departmental/building networks attached to the campus backbone system with Ethernet bridges, and departmental/building network attached to the campus backbone system with routers. Further information about these two configurations may be found in the document *Routers on UTnet.*

Before Configuration

Before attaching any computer to UTnet it must be registered with the UT Network Information Center (UT NIC).

The electronic mail address for the UT NIC is **utnic@utexas.edu.** Requests may be sent to that address, or call 471-3241 and ask for the Network Information Center.

It is essential that every machine attached to UTnet and running TCP/IP-based network software have a unique IP (Internet Protocol) address. The UT NIC will establish an IP address for the machine and enter the number along with other information into the UTnet host database.

Do not connect your machine to UTnet until it has been registered. Registration service for UTnet hosts is provided free of charge.

Once your host has been registered, then it may be configured with the host name and IP address that have been assigned. The manual for your system should indicate how to enter the host name and IP address for your system. Instructions vary for different systems. In SunOS, the *setup* program prompts for the host name and IP address, and automatically adds the information to the proper configuration files.

The configuration settings shown in the next section are specific to the UTnet system. In some cases they differ from the default configuration settings given for UNIX systems. In other cases they are in addition to the usual settings.

Section 1 — Configuring a Host for UTnet

This section describes the configuration settings required for operating a host attached to the UTnet system under both supported configurations of bridged networks and routed networks. The configuration settings in each case are the same. The exceptions to this rule are covered in the next section on *Routers and Host Configuration.*

Every computer vendor uses a different scheme for configuring their hosts. In order to make configuration changes, the host administrator should refer to the manuals that came with their computer system for instructions on how to change the host configuration settings.

Several of the configuration settings described below are *required* for correct operation on UTnet. Several of the required settings are designed to reduce or eliminate unnecessary broadcast packets, which improves the network's ability to handle traffic and helps prevent network broadcast storms.

Those settings that are required for operation on UTnet are accompanied by the heading **[REQUIRED].**

1.1. Network Interface Settings

Ifconfig is the program that initializes a host system's network interface on BSD UNIX systems and derivatives. The *ifconfig* settings for UTnet are:

[1] **A broadcast address of 128.83.0.0. [REQUIRED]** The correct broadcast address is essential for your host system to interoperate with other systems on UTnet.

[2] **A netmask of 255.255.0.0. [REQUIRED]** The correct netmask assures proper network routing and protects critical network gateways from overload.

[3] **Shut off trailers with the -trailers flag.** Shutting off the use of trailers ensures that all hosts on UTnet can interoperate.

1.2. Other settings.

[4] **Shut off in.rwhod. [REQUIRED]** The *rwho* daemon generates network-wide broadcast packets constantly to build a list of all other hosts on the network running *rwho.* This adds to the total broadcast level of the entire network system with the only gain being a list of other systems running *rwho.* You can tell if another system is available by using other programs that do not require constant broadcasts for their operation.

[5] **Shut off in.routed.** The *routed* program is not required for your host system to successfully communicate on UTnet. By shutting off *in.routed* you can insulate your host from incorrect routing information that may be propagated by misconfigured gateway machines.

[6] **Routing To External Networks.** Correct routing requires that the host be able to find a router capable of routing datagrams to subnets of the local network, or to other IP networks of the Internet. There is, as yet, no automatic

router discovery protocol for TCP/IP. This makes it necessary for the host administrator to set up the appropriate routing configuration for each host as shown in the next section.

Section 2 — Routers and Host Configuration

This section describes how to set up your host configuration for correct routing on the UTnet system. This section also discusses special configuration issues for a department with a routed network as opposed to a bridged connection to the backbone system.

The configuration settings shown in the last section are also valid for hosts on routed networks. However, there is a routing change that can be made to hosts on routed networks that can improve operations. There are also several configuration settings that *should not* be changed on hosts attached to routed networks, in order to avoid certain problems.

2. Host Routing Configuration

The basic goal in routing is to establish a path to which the local host system can send a datagram whose destination IP address is located off the local network. To do this the host must be able to discover the address of a router that can route datagrams to the external networks. In general, keeping the host routing setup as simple as possible and relying on routers for complex routing information works well. The two approaches shown next are based on this model.

The TCP/IP suite does not have an automatic mechanism for discovering the address of routers. There have been several approaches used to compensate for this such as listening in on routing protocols. Of these approaches, two are recommended as being stable and reliable mechanisms for host routing on UTnet. The two mechanisms are ARP-based routing and static default routing. Two mechanisms are shown to provide some flexibility in routing choices. The system administrator is free to choose whatever routing setup seems appropriate for the situation.

2.1. ARP-based Routing

ARP-based routing relies on the Address Resolution Protocol (ARP) software to dynamically discover the address of an external router in the same way that the ARP mechanism discovers the address of hosts on a local Ethernet system.

This setup has been applied to Sun workstations and other UNIX hosts with success, but a few TCP/IP implementations may not allow the setup shown below.

ARP based routing is set up using the *route* command. You use this command to enter your host's own IP address as the default route. The following example shows the default route command for a host with IP address 128.83.134.7.

Example:

/usr/etc/route add default 128.83.134.7 0 >/dev/console

A good place to add this line is before the entry for *in.routed* in the **/etc/rc.local** file.

Do not forget to enter the space and then the ‘‘0’’ following the host's IP address in the command string, as this is an essential part of the command.

This has the effect of convincing the host's routing code that the route for *every* destination address can be found on the interface with the IP address of the host. In other words, the host's interface is now seen by the routing software as being the route to everywhere.

This, in turn, causes the routing software to issue an ARP for every destination address it needs to send a datagram to. The ARP mechanism can be used as a kind of dynamic external router discovery mechanism with this approach to routing.

2.2. Static Default Routing

In the static default routing approach, an address for an external router located between the department and the outside world is entered into each departmental host's routing tables as a default route. This routing setup is very common in UNIX systems and should work on the vast majority of systems running TCP/IP protocols.

If you have a server machine with several clients then a default route entry must be set up on the server and on each client as well. This way, every host knows the address of an external router where it can send datagrams whose destination address is not on the local network.

The default route to the external router is explicitly set in the host's routing tables using the *route* command.

There are two choices for an external router address:

Departmental Router

If your department has a router attached to the campus network, then the best address to use is the address of that router, which is your closest external router. The convention in use on UTnet for departmental router addresses is to use address 250 of the department's subnet.

For example, given a department with a subnet address of 162, the router for the department will be at address 128.83.162.250.

To set a default external router address in SunOS add the following command line in /etc/rc.local:

Example:

```
/usr/etc/route add default 128.83.162.250 1    >/dev/console
```

A good place to add this line is before the entry for *in.routed*. The *in.routed* entry should be commented out to disable the unecessary *routed* software.

Do not forget to enter the space and then the 1 following the address **128.83.162.250** in the command string, as this is an essential part of the command.

No Departmental Router

If there is no departmental router, then as a last resort you may use the address of the main external router for the campus, located in the Network Operations Center. The address of this router is 128.83.1.250. You use this address in the same way as shown above for a departmental address.

The address shown is for **ut1.cc.utexas.edu,** the primary external router for UTnet.

3. Host Configuration for Departments with Routers

UTnet routers are configured so as to allow a router installation to occur without forcing any changes in the configuration of hosts on the departmental network. This is in keeping with the philosophy in the TCP/IP community that is best stated as, ‘‘Keep the complex routing information in the routers and keep the host configuration as simple as possible.’’

There *are* some host configuration issues affected by the installation of a router. These issues are described below.

3.1. Bridged Configuration

Hosts attached to bridged networks should be configured as follows:

- A **broadcast address** of **128.83.0.0.**
- A **netmask** of **255.255.0.0.**
- Trailers disabled, *routed* (RIP routing) disabled, *rwhod* disabled.
- A **default address** of you own IP address as shown in the section on ARP-based routing. Alternatively, the address of the local departmental router may be used as described below. As a last resort, the address of **128.83.1.250** for ut1.cc.utexas.edu, aka ‘‘arpagateway,’’ may be used

Some hosts may have slightly different configurations. For instance, some hosts may not be able to change their IP broadcast address, and may be using 128.83.255.255 as their IP broadcast address.

After a router is installed, hosts may continue to use the configuration settings shown above. The next section describes which changes may be safely made once a router is installed, and which changes in host configuration should be avoided.

3.2. Default Routes Will Continue to Work

After installation of a router, host access to networks located off campus (external networks) will proceed through the use of the same default route that the hosts currently have.

3.3. Changing Host Configurations

Once a router is installed between the departmental network and the campus backbone system, several changes take place. The first and most important is that all of the former pseudo-subnets on the departmental or building network become true subnets for the purpose of TCP/IP routing. The goal is to make sure that this major change in routing primarily affects the router and not the hosts, so as to keep the disruptions for the hosts to a minimum.

To meet this goal, there are several things that *must not* change in host configurations or they will cause host routing failures.

3.4. Leave Broadcast Address at 128.83.0.0

DO NOT change the host broadcast address to reflect a true subnet broadcast address. This is especially important if the departmental/building LAN is supporting multiple IP subnets. Multiple subnets on a single building network are common at UT. In this case, a departmental/building network wire supporting multiple pseudo-subnets becomes a departmental/building network with multiple true subnets upon the installation of a router.

> To make sure that the hosts on such a network segment will be able to coexist in the multiple true subnet condition they must all agree as to the IP broadcast address. In this case, the simplest thing is to leave the IP broadcast at 128.83.0.0 since nearly all hosts currently agree on it.
>
> If you want to change the IP broadcast address to conform to the current IP standard of 128.83.255.255 the following must be true:
>
> - all of the hosts must support the ability to change the broadcast address and,
> - the change can be done all at once for all hosts on the network to minimize protocol interactions that may cause network packet storms.
>
> For a network segment supporting multiple departments and multiple subnet numbers, it's probably easier to defer changing the broadcast address to 128.83.255.255 until the time when each true subnet in the building also has its own network segment.
>
> Typically this means that more Ethernets would need to be installed in the building, one per IP subnet number in use. Once each department has their own network segment, then interactions between hosts with variant IP broadcast addresses will be held to a minimum, and it will be easier to change the IP broadcast address to conform to the current standard of using the network address plus all ones.

3.5. Leave Netmask at 255.255.0.0

DO NOT change the netmask to reflect a true subnet netmask. A true subnet mask would be 128.83.<your-subnet-number>.255, for example. Changing the subnet mask in this way would force the hosts to attempt to do their own routing based on the exact IP subnet to which they are attached. This can cause several problems.

If a host uses a default address that happens to be an IP address with a subnet other than the one to which the host is attached (this is the common case at UT Austin), then setting the host to use a subnetted mask may cause the host to announce that the network is unreachable for all attempts to send packets to an external network.

The standard Class B netmask will work fine even when a router is installed. As mentioned above, the less each individual host knows about routing the better.

Appendix A — MultiNet Configuration

Configuring a MultiNet System

MultiNet is a software package originally written at SRI International that makes it possible for Digital Equipment Corporation VMS-based systems to communicate via the TCP/IP protocol suite. The following configuration information is taken from a brief guide made available by the UT Systems Office of Telecommunications Services.

(1) Install MultiNet according to the instructions in the MultiNet reference manual. During installation, when you are asked if you want to configure MultiNet, type ‘‘NO.’’

(2) After the installation has completed, configure MultiNet as follows.

(a) Type the command: **MULTINET CONFIGURE**

(b) Configure the host’s Ethernet/IEEE 802.3 device. If you are using a DEC shared Ethernet interface (DELUA, DEUNA, DEQNA, etc.), use device SE0. After typing the command: **ADD SE0**
the configuration utility will prompt you for several other pieces of information. You should specify information to ONLY the following prompts:
VAX/VMS Device [XEA0]
IP Address: [NONE]
Non-Standard IP Broadcast Address:[NONE]

For each of the above prompts the following information should be entered:
• For the device prompt specify the VMS device name of the network controller in response to ‘‘VAX/VMS Device’’ using one of XEA0, XQA0, ETA0, etc. as your entry.

• For the IP address prompt, specify the IP address you have obtained from your departmental networking coordinator or from the UTnet Network Information Center.

• For the IP broadcast address prompt, specify the IP broadcast address for UTnet. The value **128.83.0.0** is the non-standard IP broadcast address currently used by UTnet.

(c) While in the configuration utility, type the following commands:

SET DEFAULT-ROUTE 128.83.1.250

SET DOMAIN-NAMESERVERS 128.83.1.33,128.83.134.2,128.83.139.9

SET HOST-NAME your-hostname
SET LOCAL-DOMAIN local-domainname
SET SMTP-POSTMASTER postmaster-account
SET TIMEZONE CST

In the above settings, *your-hostname* is the full hostname of your machine (for example, UTADNX.CC.UTEXAS.EDU), *local-domainname* is the name of your local domain (for example, AE.UTEXAS.EDU), and *postmaster-account* is the account on your system where questions about failed mail and other general system inquiries should be sent (usually the SYSTEM account).