

# Datagrams

by John S. Quarterman



## Renumbering

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**F**or many years, I've recommended that people avoid renumbering IP networks. That is, avoid having to change the Internet Protocol addresses for your hosts, servers and routers.

### How to Avoid Renumbering

In the old days (before around 1994), I'd recommend registering a network number and sticking to that number. This was to counter a common tendency for companies to just pick a number and use it internally regardless of whether it was in use elsewhere. For example, Sun Microsystems shipped machines still configured for its own internal company IP network number, and lots of customers didn't bother to change it. Companies could get away with this because many of them had internal IP networks (which are now trendily called intranets) that were not connected to the Internet. As soon as they connected, however, they had to renumber.

More recently, I've recommended using one of the network numbers that are reserved for internal use, such as net 10 (the old ARPANET Class A network number). Users inside the company can still reach the Internet through the use of proxy servers for popular services such as the World Wide Web.

However, outside crackers can't even see the internal structure of the company's intranet, and they have a hard time getting through a properly constructed firewall gateway. The firewall itself has to have an IP host number on a publicly registered network, but it's only a single machine or a small cluster of machines on a secure subnet, so if renumbering is needed, only those few machines have to change. Machines on the internal network know the proxy servers by interface addresses on the internal network, so they are not subject to renumbering.

The appearance of network numbers reserved for internal private use was driven by a need to conserve IP address space, which is fast being used up. Address space actually isn't the most pressing conservation issue: routing table entries are. To conserve routing table entries, a typical Internet service provider (ISP) these days prefers to route only customer IP addresses that are drawn from blocks of addresses registered to that ISP. Thus, the wide-area IP carriers can handle routing to the ISPs, letting the ISPs handle routing to their customers, and everybody's routing tables are kept small. A practical consequence of this technique is that a customer who changes ISPs usually

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has to change IP addresses. That's the main current cause of IP address renumbering.

After years of recommending that everyone should avoid renumbering, it's ironic that now Matrix Information and Directory Services Inc. (MIDS) has to renumber. Basically, we're splitting Texas Internet Consulting (TIC) and MIDS, which are two companies that have used the same network number with the domains `tic.com` and `mids.org`, into separate IP networks. We're also switching IP connection methods at the same time. The result is a need to renumber. I took notes as we did it, as a case study in the process of renumbering. This particular case was a bit more complicated than simple renumbering, because we also changed the domain names of some hosts. I'll note where that made a difference.

Here are some of the most essential steps. They are phrased in terms of UNIX systems. The precise filenames to change vary from one UNIX variant to another, but the general filename types are the same.

## Static Host Addresses

In these days of dynamic lookup of IP addresses for domain names through the Domain Name System (DNS), you might think there aren't any static maps left to modify. For most hosts, that is the case. But for the local host, there is still the matter of bootstrapping. The operating system has to set up its local interfaces and at least some routing before it can start using DNS. So renumbering means changing some static addresses:

- `/etc/nodename` – This is apparently System V convention for the name of the local host if there is no network interface. If you didn't change your domain name, you can leave this one alone.

- `/etc/hostname.le0` – This is a common convention for a network address hostname. If you didn't change your domain name, you can leave this one alone. The location and name of this file tend to vary. For example, under Red Hat Linux, it's `/etc/sysconfig/network-scripts/ifcfg-eth0`.

- `/etc/hosts` – This file contains host-to-IP address mappings. You need

to change the IP address for the local machine's hostname.

- `/etc/defaultroute` – This file determines the default route for reaching machines outside the local network. You will almost certainly need to change it. I suppose you could have this file use a symbolic name that you define in `/etc/hosts`, but there's not much benefit in doing that. This information may be elsewhere; for example, under Red Hat Linux it's the `GATEWAY` parameter in `/etc/sysconfig/network`.

## Domain Name System

DNS is essential for Internet access and often for internal intranet access:

- `/etc/resolv.conf` – This file determines where the local machine will look for DNS nameservers. The IP addresses in it need to be updated.

- `/etc/named.boot` – If the local machine is running a nameserver, you may need to change this file to determine where that nameserver looks for DNS information about the local domain. This is particularly necessary if the local machine is running a caching nameserver, which is usually a good idea.

- `/var/named` – The `/etc/named.boot` file says where the rest of the DNS parameter files are. Usually, they are in a directory such as `/var/named`. If the local host's nameserver is doing more than caching, that is, if it is acting as a primary server for the local domain, you will need to update the IP addresses for hosts on the affected network.

## Network Information Service

DNS isn't the only popular network name service protocol. Many local networks use a protocol invented by Sun, originally called YP and now called NIS, for Network Information Service:

- `/etc/defaultdomain` – If you're simply changing your IP addresses, you do not need to change this file, which specifies the NIS domain. Even if you're changing your DNS domain, you don't have to change this file, because the NIS domain and the DNS domain are two different things. You only need to change this file if you are changing the NIS domain. Of course, because it is typical for the NIS domain to be set to the same

text string as the DNS domain, usually if you change the DNS domain you do in fact change the NIS domain and, thus, this file as well.

- `/var/yp/bindings` – Even if you do not change the NIS domain, you will need to change the IP addresses of the NIS domain nameservers, which are found in a directory such as `/var/yp/bindings`. You will need to use commands such as these to do so:

```
ypinit -c
ypinit -m
```

The exact commands and syntax vary with the version of NIS and the UNIX platform, so further details are left to the reader.

## Applications

You can't do much of anything on the new network number until you have adjusted the static host files, DNS and NIS, as above. Once you've done that, you can proceed to applications. Or, if you're brave, you can change the application parameter files at the same time. And if you're only renumbering and not changing your domain name, you may not have to change many application parameter files.

## Network File System

If you're using the Network File System (NFS), you probably won't need to change much because NFS normally uses domain names, not IP addresses, in its parameter files. Of course, if you are also changing your domain name, you will need to change the files that control the exporting and importing of DNS file systems. Most systems administrators know where those files are, usually something like `/etc/fstab` or `/etc/vfstab` for import, and `/etc/exports` or `/etc/dfs/dfstab` for export.

A slightly more obscure case involves a mixture of NIS and NFS:

- `/var/yp/mapinput/auto.direct` – If you're using automount file systems, you will need to change this file if you have changed domain names.

- `/var/yp/mapinput/netgroup` – If you're using netgroups and you have changed domain names, you will also need to change this file.

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It's common to export groups of directories to netgroups of clients, which is one case where NIS and NFS mix. Or you may need to change one or the other file separately. In both cases, you will need to do `yppush` or the equivalent.

## Electronic Mail

Electronic mail is still the most widely used network application protocol above the file system level and outside the workgroup.

- **Server** – If you're only changing IP addresses, you probably won't have to change any electronic mail parameters, depending on your setup. But if you're changing your domain name, you will need to change some mail parameters. If you are running `sendmail`, the likely files are `/etc/sendmail.cf` and `/etc/aliases`.

- **Client** – Even if you are not changing your domain name, you may have your `sendmail` set up to forward mail to another server, which may have changed if you've changed ISPs. The file for `sendmail` is `/etc/sendmail.cf`. Each mail user agent also has its own parameter file, for example, `/util/mh/mtstailor` for MH. This is a good argument for running your own local mail server.

## Authentication

- **rlogin** – If you've changed domain names and you want `rlogin` and `rsh` to work, you will probably need to change `/etc/hosts.equiv`, and each user may need to change their own `$HOME/.rhosts` file.

- **tcpd** – If you've changed your domain name, you will need to update `/etc/hosts.allow` and `/etc/hosts.deny` for `tcpd`, or TCP Wrappers.

- **ssh** – If you're using `ssh`, the Secure Shell, you will need to update some things even if you've only changed IP addresses. The main item is `/etc/ssh_host_key`. This is usually done with something like the following one-line command:

```
sudo ssh-keygen -b 1024 -f
    /etc/ssh_host_key -N ''
```

Each user may have to fiddle with their own `$HOME/.shosts` and `$HOME/`

`.ssh/` files. To regenerate a personal `ssh` key, use `ssh-keygen` with no arguments.

Your print servers may also require a little tweaking. The System V print server, for example, often has IP addresses wired in too many places, which may include `/etc/lp/Systems` and `/etc/lp/printers/*/configuration`. If the print servers are using DNS symbolic names such as `printserver.domain`, you will need to update the IP addresses for those names in `/var/named` or the equivalent.

## What's Left?

If you've changed domain names, remember that `tcsh` may have hostnames wired into `/etc/csh.cshrc`, and the various Bourne shell lookalikes may have the same in `/etc/.profile`. Even if you change all the above files, don't be surprised if there's some further gotcha that I haven't mentioned. It's not uncommon for application protocols to wire in IP addresses for efficiency. If you're running a USENET news server,

for example, such servers often do a hostname-to-IP address lookup when they start up, so you'll need to tell the news server to reinitialize itself.

Most organizations have some Macintoshes or IBM-compatible PCs. These will all need their local IP addresses, DNS server addresses and default routes changed. A UNIX column is not the place to go into detail about that, however.

Renumbering is a tedious task. If you also have to change some domain names, it's even more tedious. In general, it is a good idea to try rebooting after changing all the likely parameters. You want each system stable enough that it will come back up correctly after a power failure or other reboot. The only way to tell for sure is to try it.

All this renumbering tedium is a good argument for using a proxy gateway and one of the private IP network numbers internally. That would avoid most causes of renumbering. But if you do have to renumber, we've just reviewed the major points that are involved. ✍