

Server Operating Systems

Lecture 12

Networking 1

Chapter 12: Network Concepts

- Client/Server Computing
- Configuring Network card
- Network and Remote Access Utilities
- Directory Services
- Network Resource Sharing

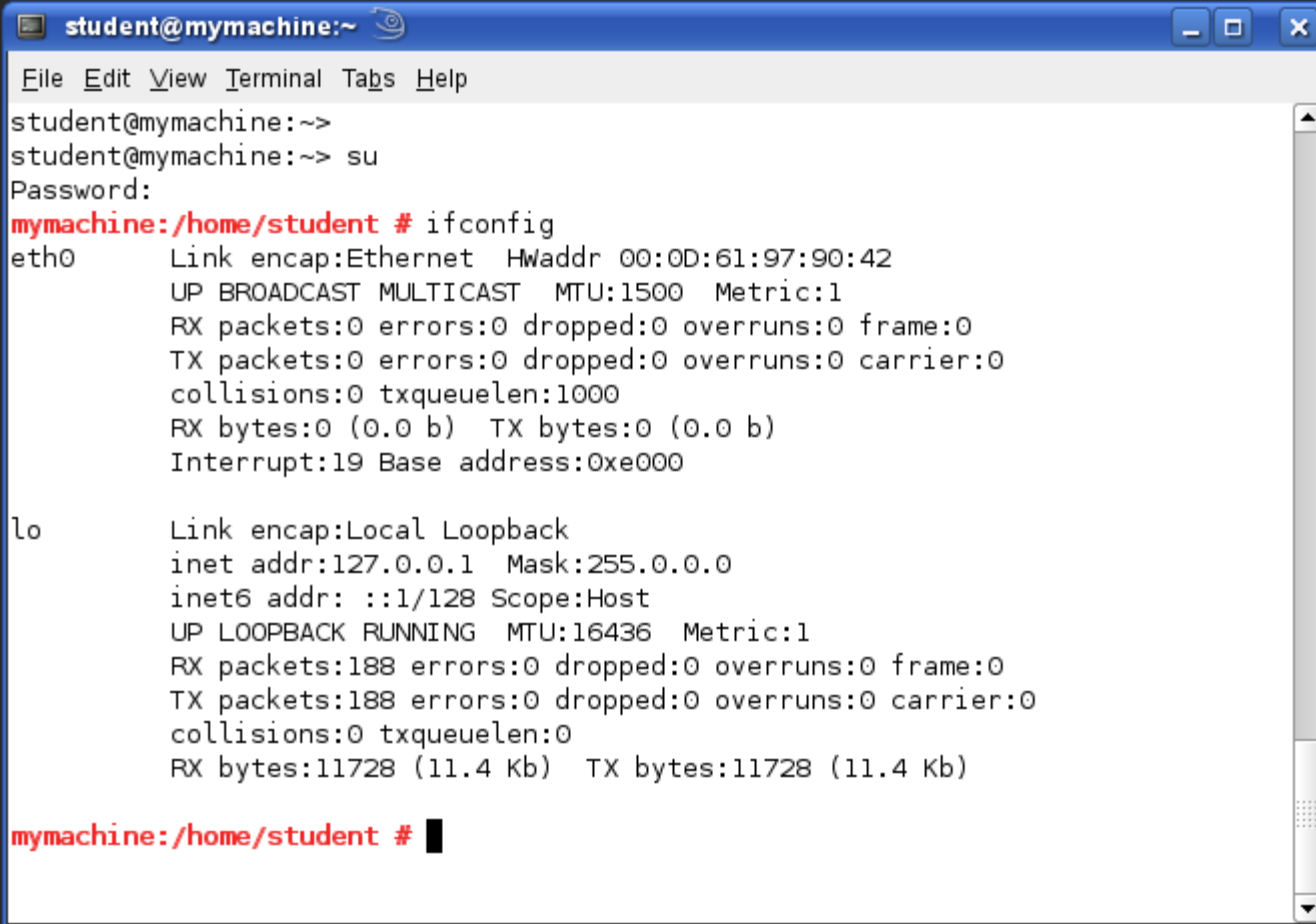
Client/Server Computing Model

- Distributes computation over multiple machines.
- Allows for sharing of resources between multiple computers.
- Unix is built around the client/server model.

Client/Server Computing Model

- Three types of computers in this model:
 - **Host** (local or remote)
 - Any computer on a Unix network running TCP/IP.
 - **Server**
 - Provides services to machines on a Unix network (runs daemons).
 - **Client**
 - A machine on a Unix network that uses the services a server provides.

Configure Network Card - CLI

A terminal window titled 'student@mymachine:~' with a menu bar (File, Edit, View, Terminal, Tabs, Help). The user runs 'su' and then 'ifconfig'. The output shows details for 'eth0' (Ethernet) and 'lo' (Local Loopback).

```
student@mymachine:~>
student@mymachine:~> su
Password:
mymachine:/home/student # ifconfig
eth0      Link encap:Ethernet  Hwaddr 00:0D:61:97:90:42
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)
          Interrupt:19 Base address:0xe000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:188 errors:0 dropped:0 overruns:0 frame:0
          TX packets:188 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:11728 (11.4 Kb)  TX bytes:11728 (11.4 Kb)

mymachine:/home/student #
```

Use of ifconfig

Enable network card `ifconfig eth0 up`

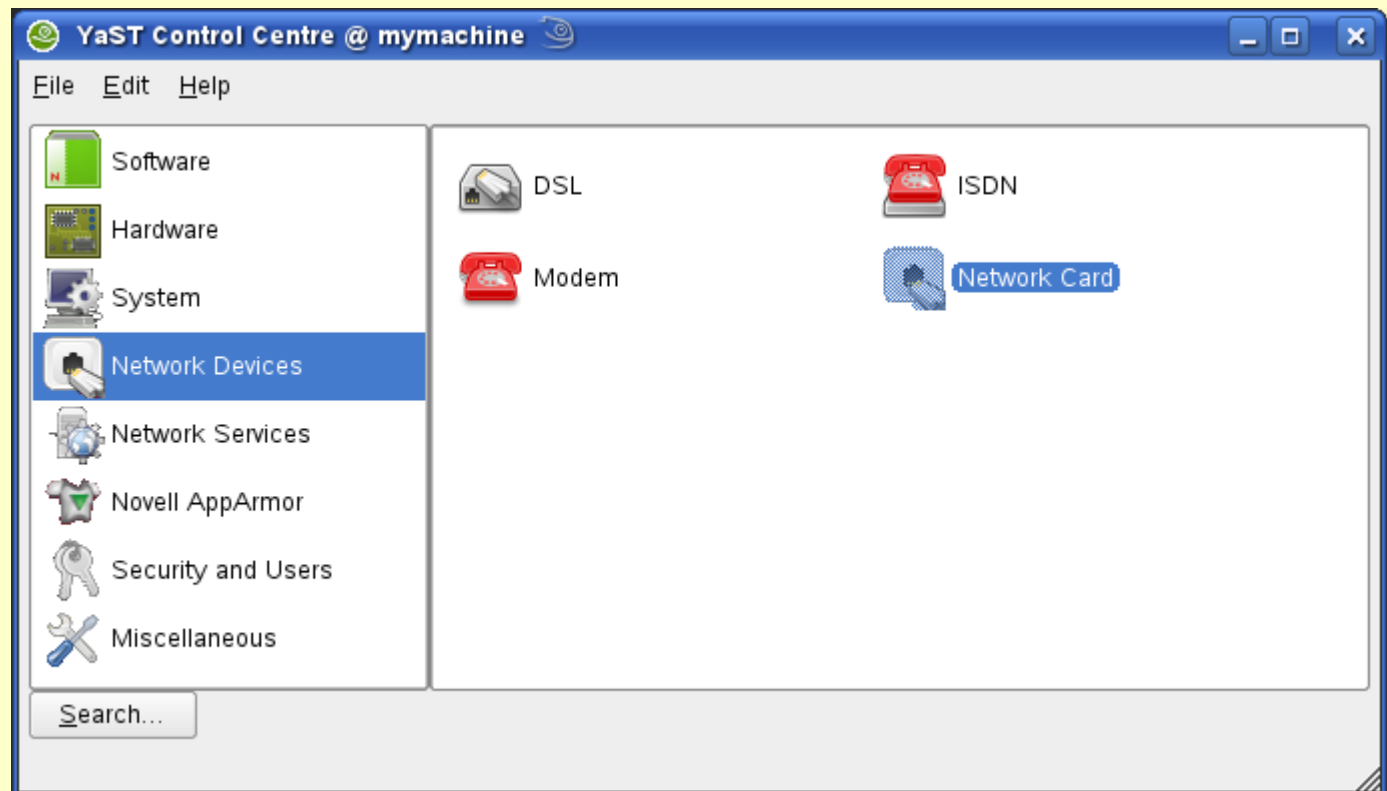
Disable network card `ifconfig eth0 down`

Configure IP address

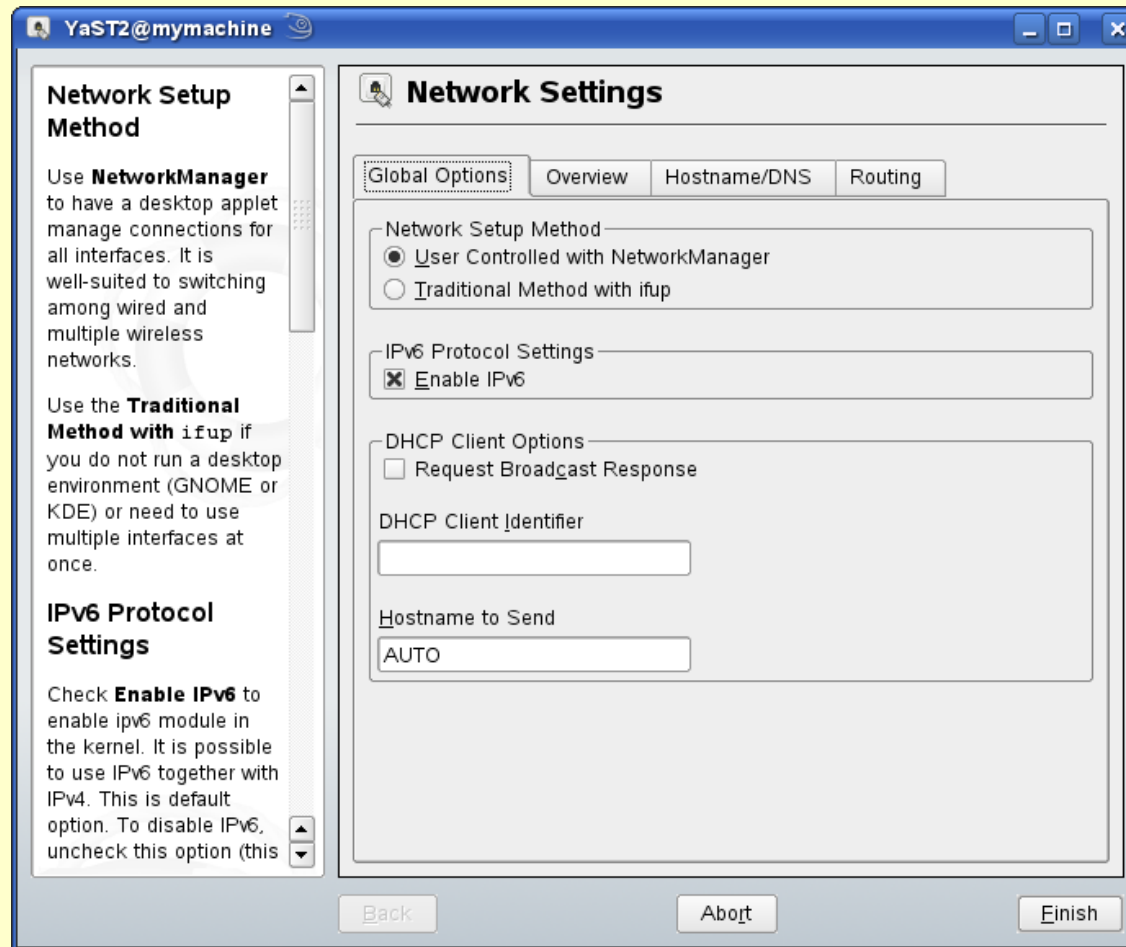
`ifconfig eth0 192.168.1.1 netmask 255.255.255.0`

Configure Network Card - GUI

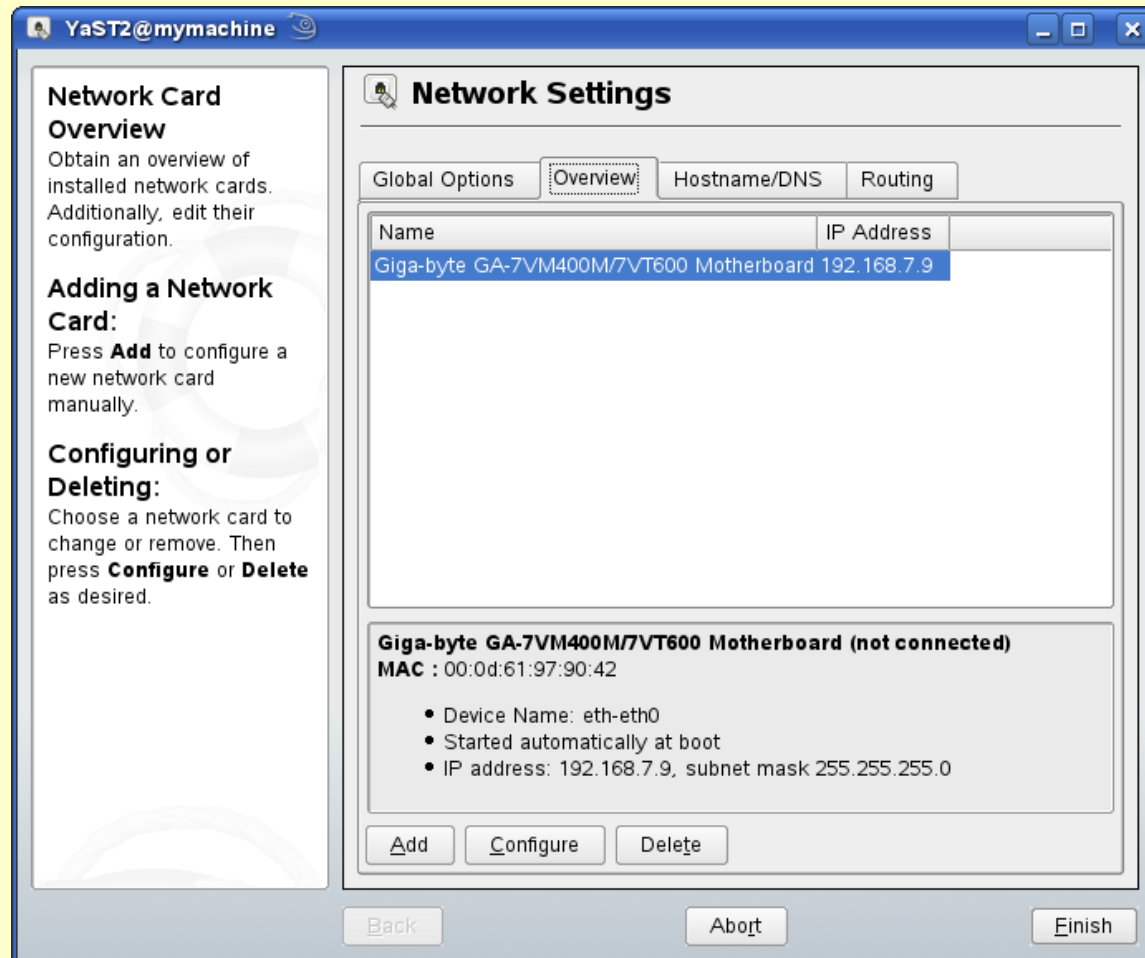
Use YAST



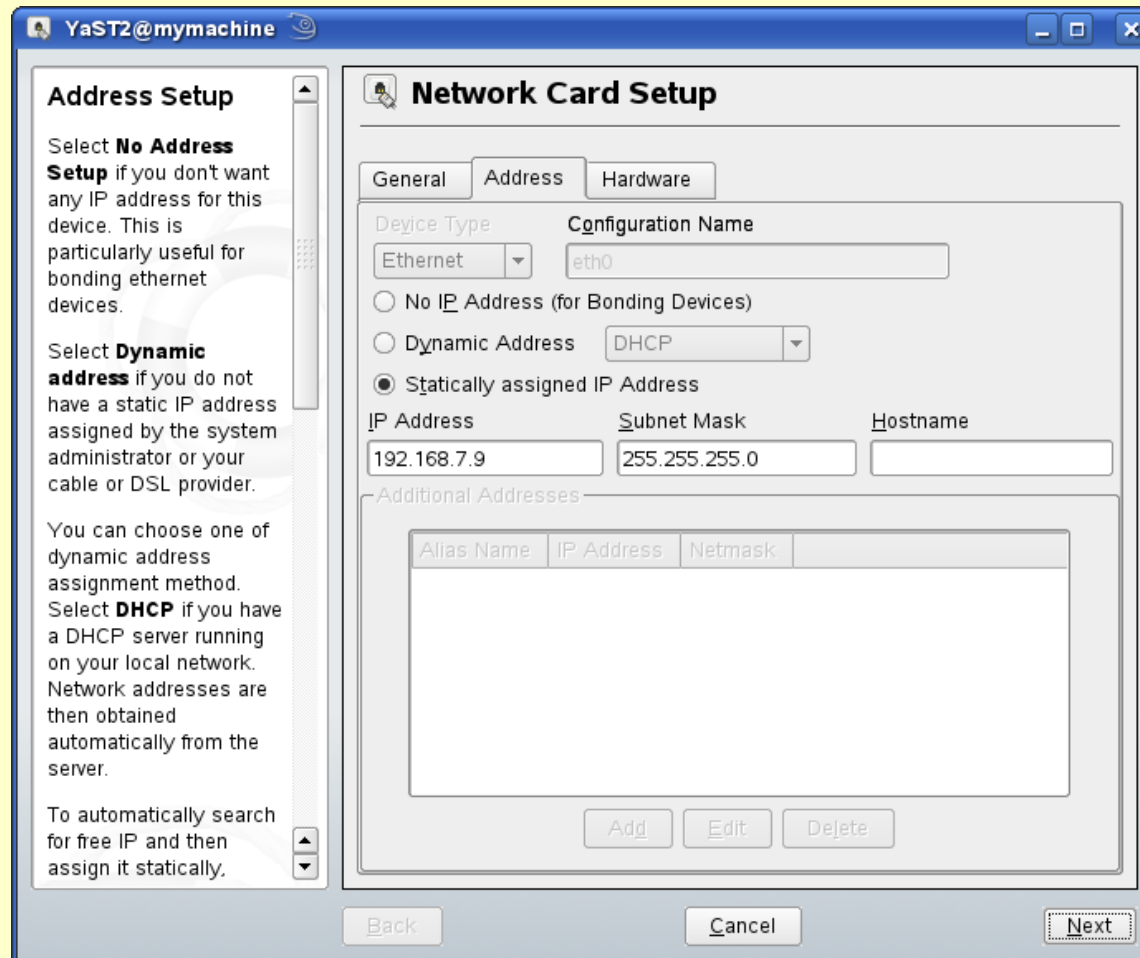
Configure Network Card - GUI



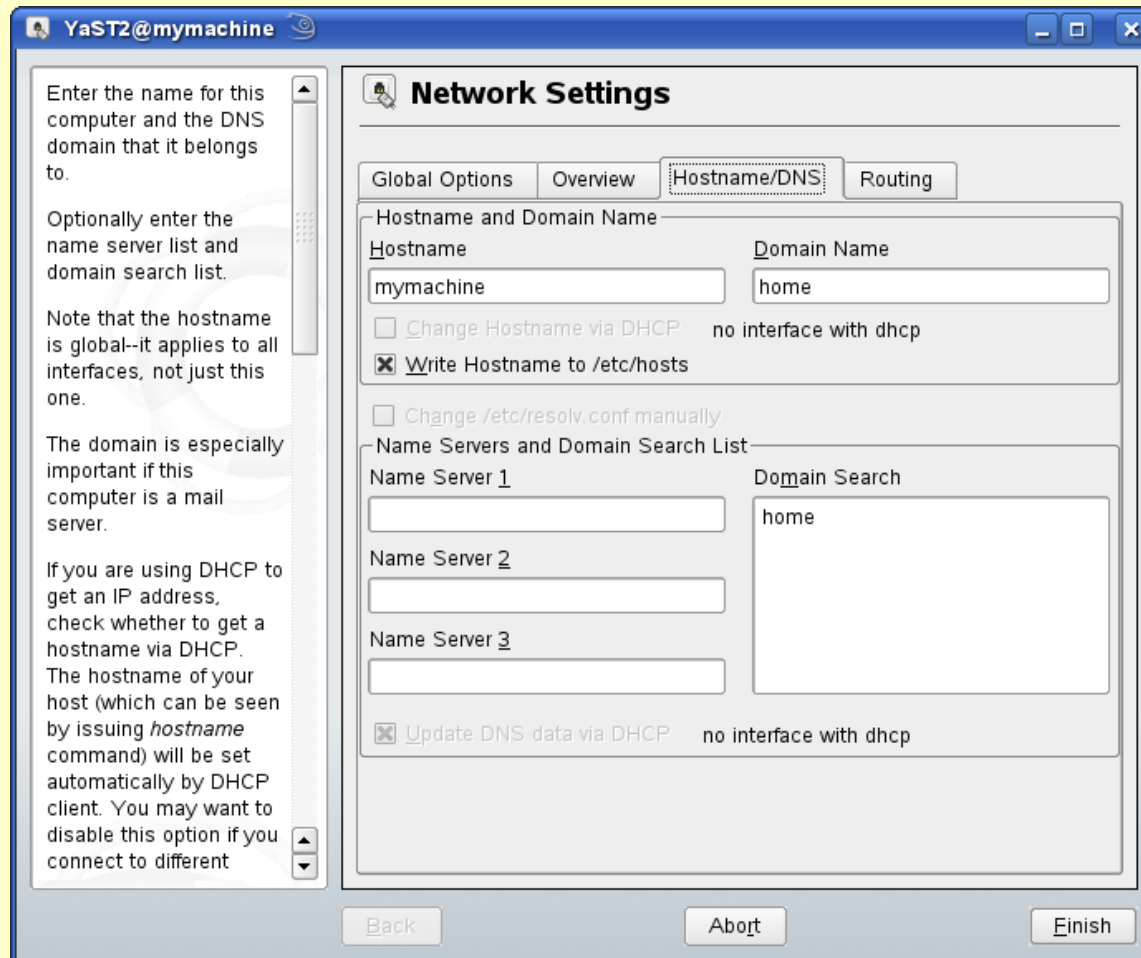
Configure Network Card - GUI



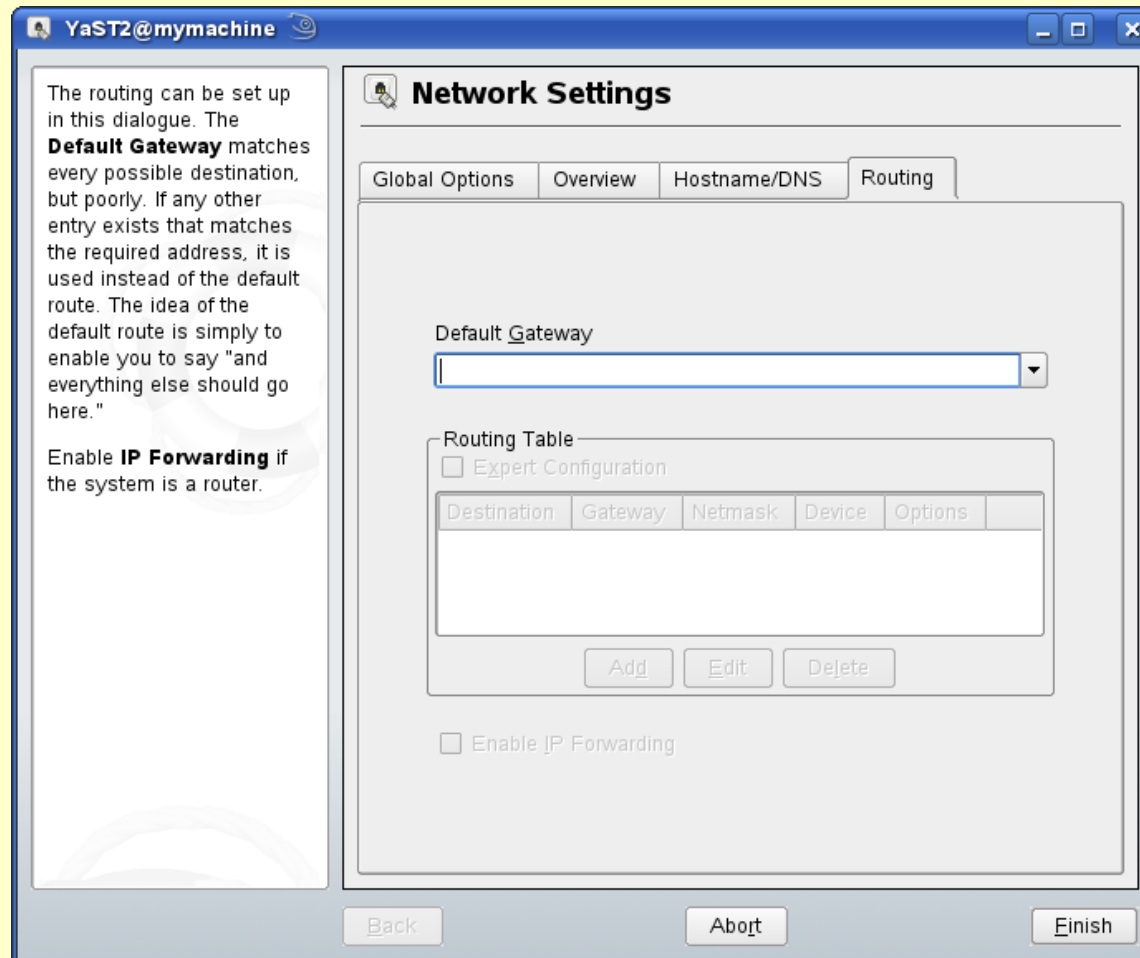
Configure Network Card - GUI



Configure Network Card - GUI

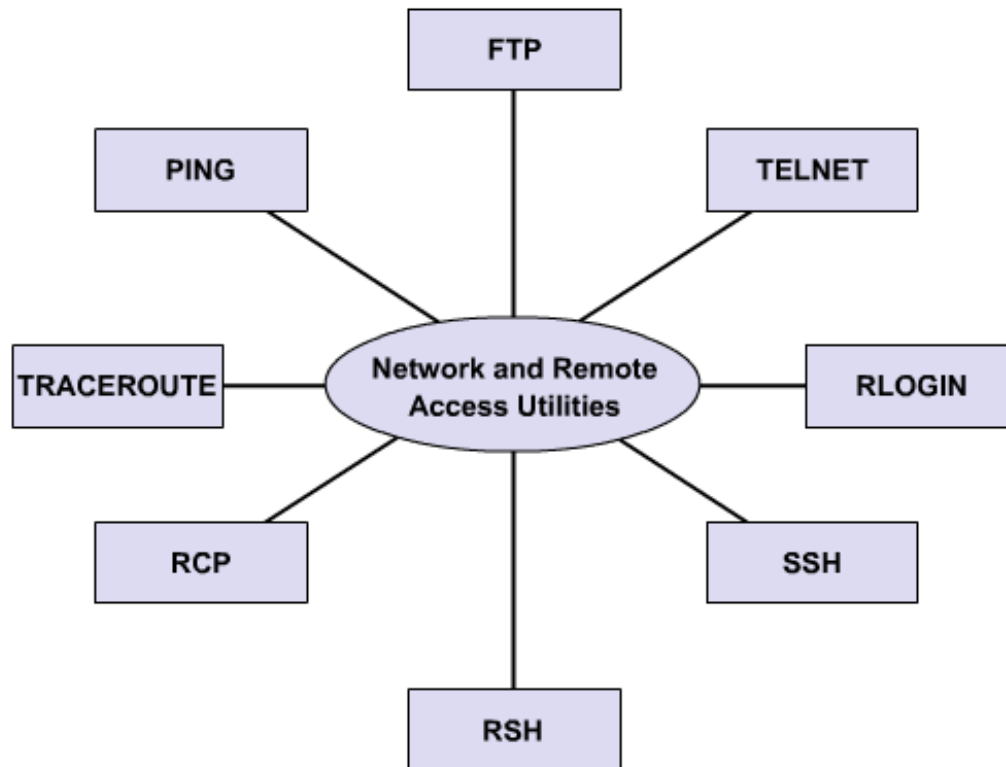


Configure Network Card - GUI



Network and Remote Access Utilities

Network and Remote Access Utilities



The `ping` Utility

- “Packet Internet Groper”
- Part of the TCP/IP protocols package and standard on Unix.
- `ping hostname` OR `ping ip_address`
- Tests the physical connection and IP addressing.
- Sends **ICMP** (Internet Control Message Protocol) echo requests to the desired host and waits for a return.

The `traceroute` Utility

- Part of the TCP/IP protocols package and standard on Unix.
- `traceroute hostname` OR
- `traceroute ip_address`
- Good for checking the connection between hosts interconnected with a router.
- The output shows the time it takes to reach each router along the way to the destination (“hops”).

The `telnet` Utility

- `telnet hostname` or `telnet ip_address`
- Part of the TCP/IP protocols package and standard on Unix.
- Telnet simulates a shell that is running on a remote host.
- You have to log onto the remote shell and then it is just like working in a shell at the remote workstation you are logged in to.
- Telnet can be used to log into network devices as well (switches and routers).
- Sets up a connection to TCP port 23, where a `telnetd` (telnet daemon) program is running.

The `rlogin` Unix Command

- `rlogin hostname` or `rlogin ip_address`
- Login remotely to a server to run applications.
- Login remotely to your workstation to kill a process.
- Access information on another workstation that is not available otherwise.
- Access your workstation remotely to read mail.
- Can be set up to automatically enter your password.
- Sets up a connection to TCP port 513, where a `rlogind` (`rlogin daemon`) program is running.

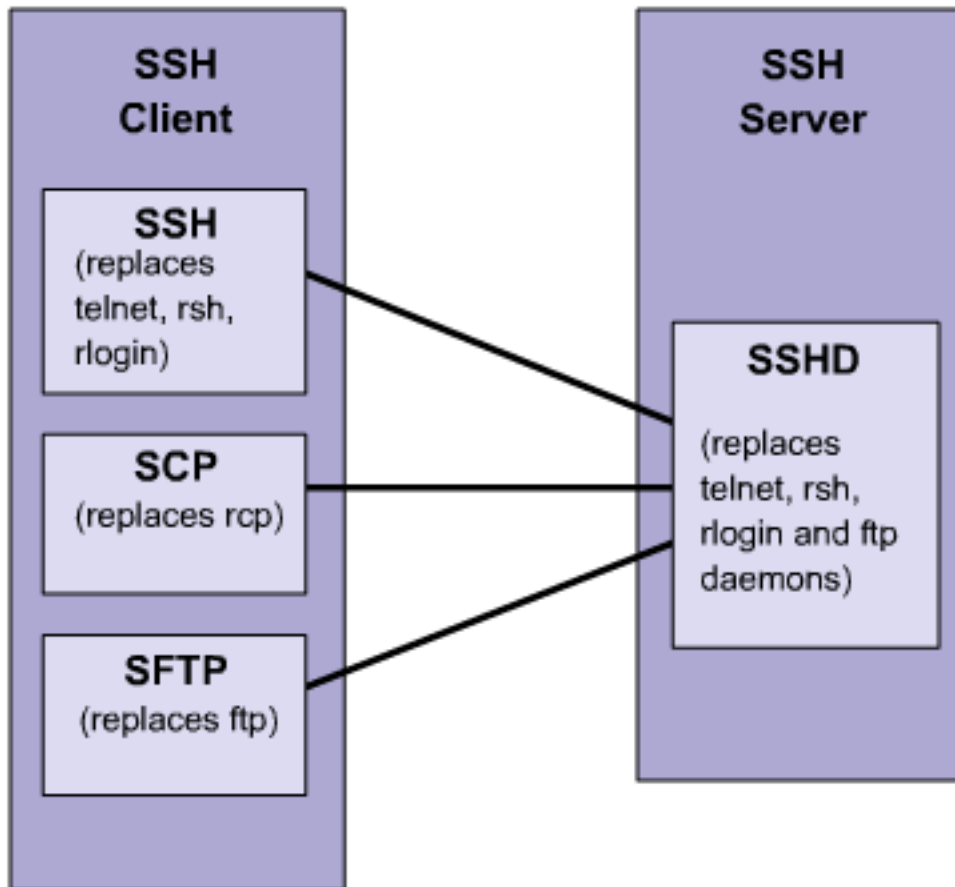
The FTP Unix Command

- “File Transfer Protocol”
- Part of the TCP/IP protocol suite.
- Allows files to be transferred in either ASCII or binary format between OS’s that can be alike or unlike.
- FTP commonly accepts an “anonymous” account with the username of “anonymous” and the user’s email address as the password.

The FTP Unix Command

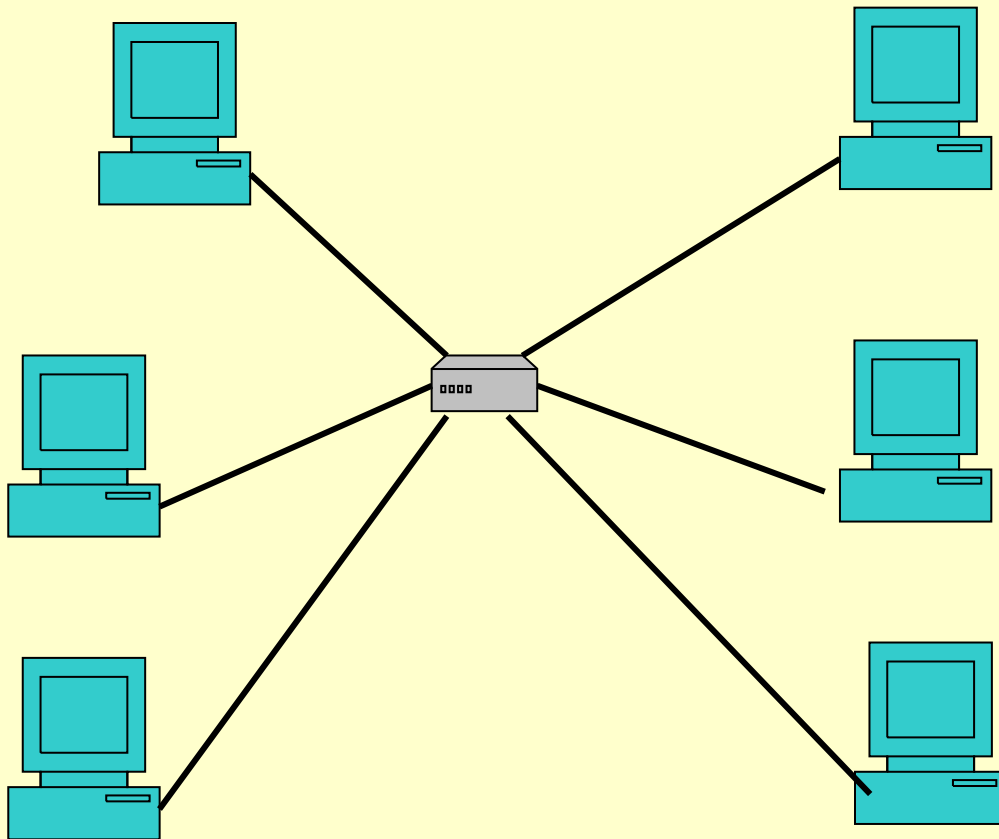
- `ftp hostname` OR `ftp ip_address`
- Many Unix commands can be used on the remote system such as `cd` and `ls`.
 - To issue these commands locally, while in an FTP session, put an 'l' in front of the Unix command. An example is `lcd`.
- Some common FTP commands are `put`, `mput`, `get`, and `mget`.
- Sets up a connection to TCP port 20 / 21, where an `ftpd` (ftp daemon) program is running.

The SSH Utility



- A newer utility that provides *secure* access to remote hosts.
- None of the previous utilities provided secure connections (they send passwords unencrypted).
- Most Linux systems set up links so that, for example, although you typed ftp, you are actually running sftp.
- Uses port 22 to communicate with SSHD.

What is a Directory Service?

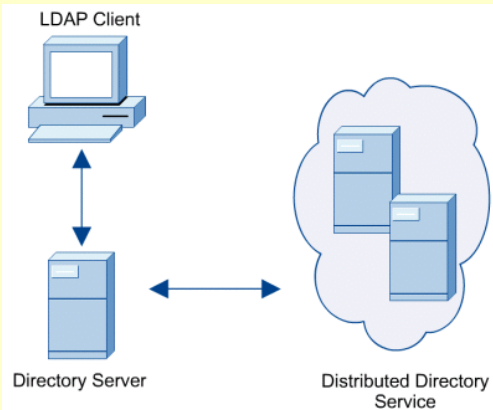


Peer to Peer network.

Each computer that wishes to access a resource on another computer, needs to have a user account on that computer.

This can take time to set up on a large network.

What is a Directory Service?



A computer is set up as a directory server.

Each shared resource has an entry in the directory.

The server associates a resource name with an address.

(Why it's sometimes called a Name service.)

Users can locate and access them without ever knowing on which machine the resources physically reside.

Directory Service Standards

To operate within a NOS, different directory services need to have a common method of naming and referencing objects.

X.500 defines the Electronic Directory Service (EDS) standards.

Developed by the ITU (International Telecommunications Union) in 1980s.

Originally designed for online phone directories.

LDAP (Lightweight Directory Access Protocol) based on X. 500.

Example of LDAP Directory entry

The following entry is an example of the posixAccount class:

```
dn: uid=lester, dc=aja, dc=com
objectClass: top
objectClass: account
objectClass: posixAccount
uid: lester
cn: Lester the Nightfly
userPassword: {crypt}X5/DBrWPOQQaI
gecos: Lester
loginShell: /bin/csh
uidNumber: 10
gidNumber: 10
homeDirectory: /home/lester
```

This corresponds the UNIX system password file entry:

```
lester:X5/DBrWPOQQaI:10:10:Lester:/home/lester:/bin/sh
```


Popular Directory Services

LDAP is used as the basis for Microsoft's Directory Service:

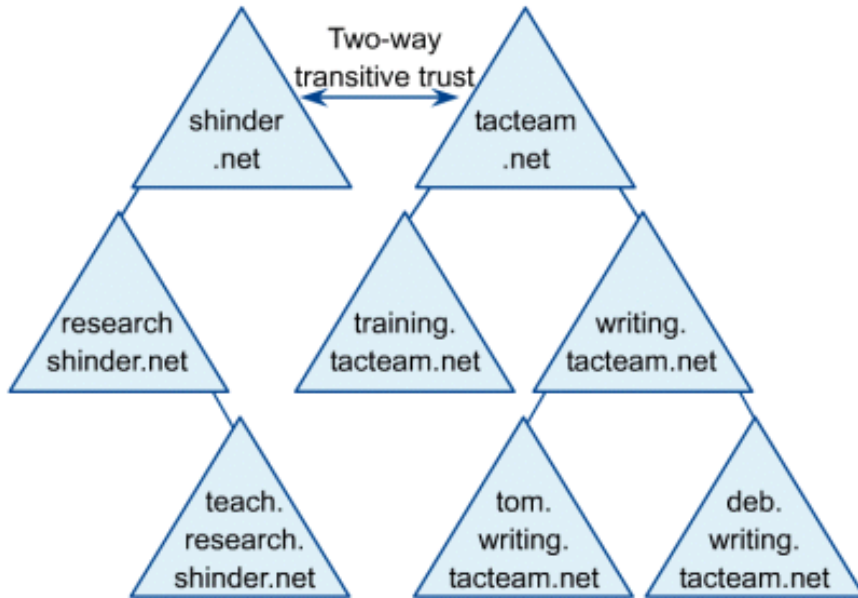
Active Directory.

UNIX has a similar system:

NIS+ (Network Information System)

developed by Sun Microsystems.

Windows Active Directory



The logical structure of the Active Directory is based on units called Domains.

Windows networks can have multiple domains, organized into domain trees.

These trees can be joined to other trees to form forests.

Active Directory uses Organizational Units (OUs) to organize resources within domains.

Windows 2000 Active Directory

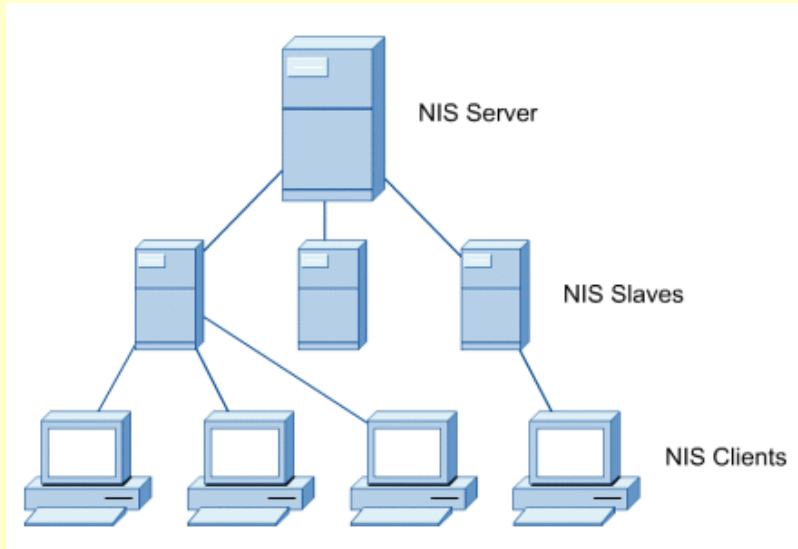
To use Active Directory, at least one server must be configured as a Domain Controller (DC).

It is recommended that there be at least two DCs in each domain, for fault tolerance.

Active Directory uses multimaster replication to copy directory information between the domain controllers in a domain.

Each object in Active Directory has an Access Control List (ACL) that contains all access permissions associated with that object. Permissions can be either explicitly allowed or denied.

Network Information Service (NIS+)



Linux uses its own version of Directory Services called the Network Information Service (NIS+).

The network consists of the NIS server, slaves, and clients.

The NIS Server is where the NIS database is created and maintained.

The NIS databases are copied to all the NIS slave servers.

They must be kept synchronised.

DNS: Domain Name System

- You could view this as a very specialised type of directory service.
- DNS performs resolution or translation of host name to Internet (IP) address between hosts within the user's local administrative domain and across domain boundaries.
- A collection of workstations networked together that use DNS is a *DNS Namespace*.
- Before DNS, each workstation on a network would use the */etc/hosts* files to list all of the IP to host name conversions.

NFS: The Network File System

- A network service that allows users to transparently access files and directories located on another disk on the network.
- Users on varying OS's can access the same files without noticing the difference, as long as they run NFS.
- Setting up shared folders, permissions and mounting of the NFS into the user's file system is handled automatically.

SMB/CIFS Protocol

- SMB = “Server Message Block”
 - Microsoft protocol for sharing files and printers on a network.
 - Provides the same functionality for Windows users that NFS does for Unix users.
 - Renamed to CIFS: “Common Internet File System”
- Samba is an Opensource application that implements the SMB/CIFS protocol for UNIX systems.

Configure Services/Daemons

