

Basic Configuration

- ❑ Incorporate basic TCP/IP Configuration to Unix system
- ❑ Two techniques
 - Recompiling kernel
 - Loading dynamically linked kernel modules
- ❑ Some systems eliminate the need to compile the kernel, like HP-UX, Tru64Unix, Solaris
- ❑ Some encourage you to do so, like Linux, FreeBSD
- ❑ Using Dynamically loadable modules

Basic Configuration 1-1

Solaris

- ❑ Kernel configuration file
/etc/system
- ❑ New hardware
 - Install device driver
 - pkag -d device packagename
 - Which create proper entry in /dev and /kernel/dev
 - For example for DEC 21140, there are /dev/dnet and /kernel/drv/dnet
 - Then create empty file /reconfigure
 - Shutdown the system, install the new hardware
 - During the reboot, it will detect the hardware and load the dynamic module.

Basic Configuration 1-2

Solaris

- ❑ Check kernel module associated with a TCP/IP interface
 - ifconfig dnet0 modlist
- ❑ Configuration option for each module
 - Under /kernel/drv, there are arp.conf, ip.conf and dnet.conf, very limited control
 - Use ndd to control the module

```
[ruihong@cslserver drv]$ /usr/sbin/ndd /dev/arp \?  
?  
arp_cache_report      (read only)  
arp_debug             (read and write)  
arp_cleanup_interval  (read and write)  
arp_publish_interval  (read and write)  
arp_publish_count     (read and write)
```

Basic Configuration 1-3

Solaris

- ❑ There are lots options for /dev/ip.
 - ip_forwarding
 - Enable it for router function, value 1
 - Disable it to prevent acting like router, value 0
- ndd -set /dev/ip ip_forwarding [0|1]

Basic Configuration 1-4

Linux

- ❑ List installed modules : lsmod
- ❑ Module dependencies
- ❑ The meaning of (autoclean)
- ❑ Load the module manually:
 - insmod [-k] 3c509
 - modprobe smc-ultra
- ❑ Generate the dependency: depmod -a
- ❑ Remove module: rmmod
- ❑ Device driver can be dynamically loaded to compiled into the kernel.

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Linux

❑ driver modules in /lib/module

```
[root@dafinn net]# pwd; ls
/lib/modules/2.4.22-1.2166.nptlsm/kernl/drivers/net
3c509.o      b44.o      eeepro100.o netconsole.o pppox.o      tg3.o
3c59x.o      bonding    epic100.o   ns83820.o    ppp_synctty.o tlan.o
8139cp.o     de4x5.o    ethertap.o pcmcia       r8169.o      tulip
8139too.o    dl2k.o     fealnx.o   pcnet32.o    sis900.o     tun.o
82596.o      dmfe.o     irda       ppp_async.o  sk98lin      typhoon.o
8390.o       dummy.o    mii.o      ppp_deflate.o slhc.o       via-rhine.o
acenic.o     e100       natsemi.o  ppp_generic.o smc9194.o    wireless
amd8111e.o   e1000      ne2k-pci.o pppoe.o      starfire.o
```

- ❑ Recompiling the kernel
 - Make the kernel smaller
 - Add a new device
 - Modify a system parameter

Basic Configuration 1-6

Linux Kernel Configuration

- ❑ Download the source code and extract it under /usr/src
- ❑ Customize kernel configuration
 - make config
 - make menuconfig
 - make xconfig
- ❑ Two menu items: Networking options and Network device support
- ❑ Device support
 - Three options: y, m, n

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Linux: Networking Options

- ❑ Packet socket
 - tcpdump
- ❑ Kernel/user netlink socket
 - User code to interface with IPv4 routing, APR table, kernel fire wall code.
- ❑ Network packet filtering
 - function like firewall or NAT
 - Often enabled on router, disabled on host.
- ❑ TCP/IP networking
 - Kernel support for TCP/IP. More options available afterwards
 - IP Multicasting
 - IP:advanced router
 - If Linux is configured as primary router
 - Or an exterior router between autonomous system
 - Options are:
 - IP: policy routing
 - IP: equal cost multipath
 - IP: verbose route monitoring
 - IP: Large routing tables

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Linux: Networking Options

- IP: kernel level autoconfiguration
 - For diskless clients
 - Can be BOOTP or RARP
- IP: tunneling
 - Encapsulate datagram with an IP tunnel.
- IP: multicast routing
 - Only if you system is a multicast router, running mroute
- IP: TCP explicit congestion notification support
 - Many firewalls are incompatible with ECN.
- IP: TCP syncookie support
 - Counteract SYN flooding denial-of-service attacks.
- IP: Netfilter configuration
 - Select service for Netfilter firewall.

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Linux kernel

- ❑ After completing the configuration
- ❑ Build dependencies and Clean up:
 - make dep; make clean
- ❑ Build the kernel: make bzImage
- ❑ Copy it to /boot/vmlinuz from /usr/src/linux/i386/boot

!! Keep up with the change - check out latest Operating System Documents

Basic Configuration 1-10

Linux kernel parameters

- ❑ /proc filesystem
- ❑ sysctl tool
 - Manipulate kernel parameters at run time
 - #sysctl -a
 - #sysctl -w kernel.domainname="example.com"
 - Directly reading/modifying files in /proc/sys with cat or echo command
- ❑ /etc/sysctl.conf
 - Sysctl preload/configuration file
 - Read and set by sysctl
 - Read during system startup

Basic Configuration 1-11

Exercise

- ❑ Enable the kernel support for ATM
 - Refer to the paper "Free software low cost preplacement of a commercial internet WAN router" - section Software Requirement and then Kernel
 - Enable "Interphase ATM PCI x575/x525/x531"
 - Recompile the kernel

Basic Configuration 1-12

Startup files

- ❑ How to start other services not in kernel?
- ❑ BSD mode
 - /etc/rc, /etc/rc.boot and /etc/rc.local
- ❑ System V
 - Startup runlevels
 - init process and /etc/inittab file
 - On linux:
 - 0: shutdown and halt
 - 1 single-user mode
 - 2 multiuse mode, no file sharing
 - 3 full multiuser.
 - 4 unused
 - 5 X windows console
 - 6 shuts down and reboots

Basic Configuration 1-13

Startup files

- ❑ Understanding /etc/inittab
 - Label:runlevel:action:process

id:5:initdefault:

System initialization.

si::sysinit:/etc/rc.d/rc.sysinit

l0:0:wait:/etc/rc.d/rc 0

l1:1:wait:/etc/rc.d/rc 1

l2:2:wait:/etc/rc.d/rc 2

l3:3:wait:/etc/rc.d/rc 3

l4:4:wait:/etc/rc.d/rc 4

l5:5:wait:/etc/rc.d/rc 5

l6:6:wait:/etc/rc.d/rc 6

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Some Linux inittab action values

Action	Meaning
Boot	Runs when system boots
Bootwait	Init waits for complete
Ctrlaltdel	
Initdefault	Set the default runlevel
off	Disable the entry
Once	For every runlevel
Powerfail	When init receive SIGPWR signal
Powerokwait	SIGPWR and /etc/powerstatus has ok
Respawn	Restart the process whenever it terminates
Sysinit	Before any boot
Wait	Upon entering the run mode and waits to complete

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Startup files

- Initialize the system rc.sysinit
 - Initialize the swap space
 - Runs the filesystem check
 - Mounts /proc filesystem
 - Mount root as rw
 - Load kernel modules
- Scripts in rc?.d

```
[root@dafinn etc]# ls rc.d
init.d rc0.d rc2.d rc4.d rc6.d  rc.sysinit
rc      rc1.d rc3.d rc5.d rc.local
```
- Links to /etc/rc.d/init.d
- On Linux, you could use /etc/rc.local, which is linked to /etc/rc.[2-5]/S99local

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Internet Daemon

- ❑ Daemon inetd started at boot time
- ❑ Configuration file /etc/inetd.conf
 - Name, type, protocol, wait-status, uid, server, arguments

```
#
ftp      stream  tcp6    nowait  root    /usr/sbin/tcpd  in.ftpd
telnet   stream  tcp6    nowait  root    /usr/sbin/tcpd  in.telnetd
#
# Mail is a useful thing...
pop3     stream  tcp      nowait  root    /etc/mail/popper      popper -s
imap     stream  tcp      nowait  root    /etc/mail/imapd       imapd
```

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Internet Daemon

- ❑ When to modify /etc/inetd.conf
 - Disable a service
 - Add a # at the beginning of the entry
 - Send hang-up to inetd to re-read the configuration file
 - kill -HUP processid
 - Enable a service
 - Change the path
 - Modify arguments
- ❑ Exercise:
 - Is you telnet service enabled? If so, disable it.

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Extended Internet Daemon

- ❑ Daemon xinetd
- ❑ Configuration file /etc/xinetd.conf and /etc/xinetd.d
 - Attribute/value pair
 - Disable = yes/no

Example: /etc/xinetd.d/echo-udp

```
service echo
{
    type            = INTERNAL UNLISTED
    id              = echo-dgram
    socket_type     = dgram
    protocol        = udp
    user            = root
    wait            = yes
    disable         = yes
    port            = 7
}
```

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Exercise

- ❑ Let's take a look on one Linux machine
 - /etc/inittab
 - /etc/rc
 - /etc/rc.d/rc[0-6].d
 - /etc/init.d
 - /etc/xinetd.d
 - Update and query runlevel information for system services
 - /sbin/chkconfig
 - Re/start services
 - Disable services

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Summary

- ❑ Kernel configuration files
- ❑ Startup files
- ❑ Internet Daemon