

Chapter7

Serial Devices

Serial devices

- Terminal
- Modem
- Mice
- ...

Serial standard (1)

- RS-232 standard on DB25 connector
 - > Electrical characteristics
 - > Meaning of each signal wire
 - > Pin assignment
 - > DB25P (male)
 - > DB25S (female)
 - > DTE (Data Terminal Equipment)
 - > DCE (Data Circuit-terminating Equipment)



Serial standard (2)

- RS-232 signals and pin assignment

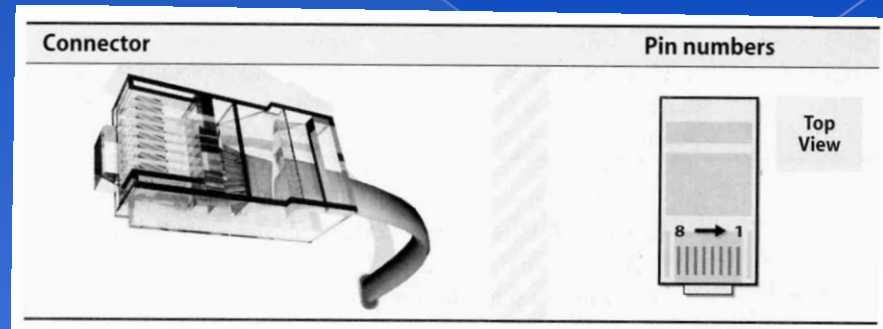
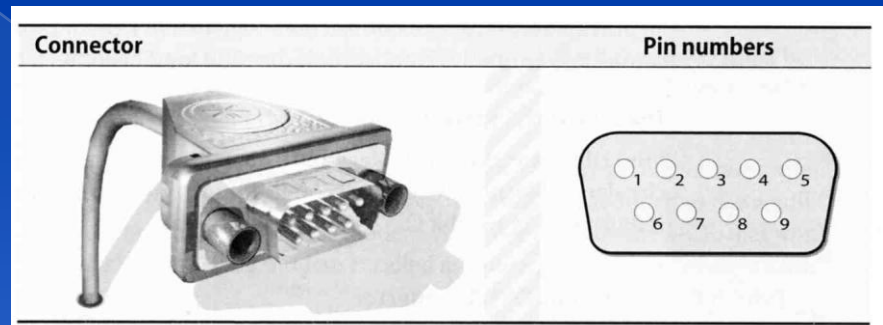
Pin	Name	Function	Pin	Name	Function
1	FG	Frame ground	14	STD	Secondary TD
2	TD	Transmitted data	15	TC	Transmit clock
3	RD	Received data	16	SRD	Secondary RD
4	RTS	Request to send	17	RC	Receive clock
5	CTS	Clear to send	18	-	Not assigned
6	DSR	Data set ready	19	SRTS	Secondary RTS
7	SG	Signal ground	20	DTR	Data terminal ready
8	DCD	Data carrier detect	21	SQ	Signal quality detector
9	-	Positive voltage	22	RI	Ring indicator
10	-	Negative voltage	23	DRS	Data rate selector
11	-	Not assigned	24	SCTE	Clock transmit external
12	SDCD	Secondary DCD	25	BUSY	Busy
13	SCTS	Secondary CTS			

Serial standard (3)

◉ Alternative connectors

> Since RS-232 is overkill for all real-world situations

- Mini DIN-8
- DB-9
- RJ-45



Serial standard (4)

◎ Cable Length

- > RS-232 specifies a maximum length of 75 feet at 9600 bps
 - $75 * 30.5 \approx 22 \text{ m}$
- > In reality, they hit the limit between 800 ~ 1000 feet

Serial Device File

- Serial ports are represented by device files under /dev
- The name of the device file is no big deal
 - behavior is determined by the major and minor device number

System	Device files for the first two serial ports
FreeBSD	/dev/ttyd[0,1] (com1, com2)
Red Hat	/dev/ttyS[0,1]
Solaris	/dev/term[a,b]
SunOS	/dev/tty[a,b]

```
lucky7:~ -lwhsu- ls -al /dev/ttyd0*
crw----- 1 root wheel 0, 33 Oct 19 20:51 /dev/ttyd0
crw----- 1 root wheel 0, 34 Oct 19 20:51 /dev/ttyd0.init
crw----- 1 root wheel 0, 35 Oct 19 20:51 /dev/ttyd0.lock
```

Kernel Configuration

- ◉ dmesg

- > \$ grep sio /var/run/dmesg.boot

```
sio0 <16550A-compatible COM port> port 0x2f8-0x2ff irq 3 on acpi0  
sio0: type 16550A  
sio1 <16550A-compatible COM port> port 0x2f8-0x2ff irq 3 on acpi0  
sio1: type 16550A
```

- ◉ Kernel configuration file

- > device sio

- ◉ Kernel Module

- ◉ /boot/kernel/sio.ko

- > # kldload sio

- > /boot/loader.conf:

- > sio_load="YES"

sio(4)

Software Configuration

- ◉ Depend on the type of serial device
 - > Hardwired terminal
 - > Modem

Configuration of Hardwired Terminals (1)

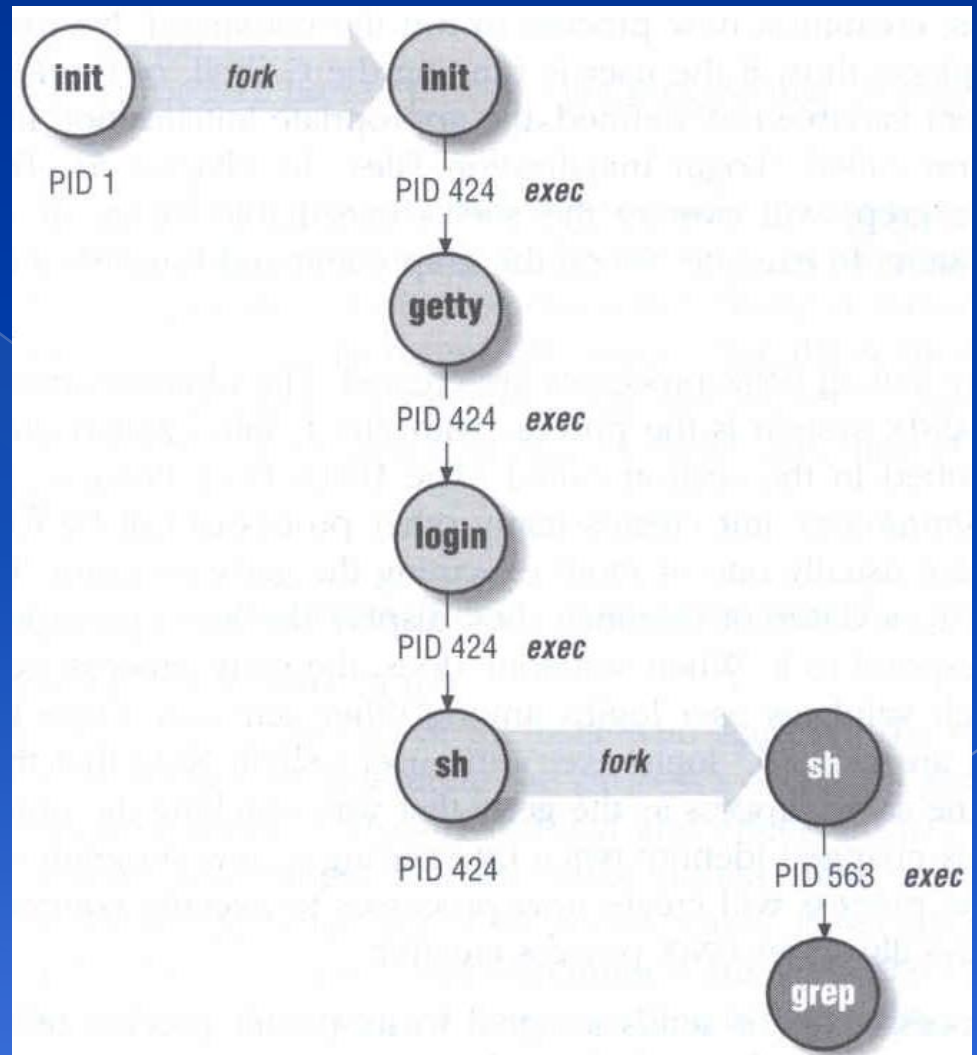
- ◎ Two main tasks

- > Make sure each process is attached to a terminal to accept logins
- > Make sure that information about the terminal is available once a user login

Configuration of Hardwired Terminals (2)

- The login process
 - > init spawn getty according to /etc/ttys
 - > getty sets the port's initial characteristics and print the prompt
 - > User enter login name
 - > getty executes login program
 - > login request password
 - > login prints /etc/motd
 - > login sets up environment variables
 - > login runs a shell for user

login(1)
getty(8)



Configuration of Hardwired Terminals (3)

◉ Terminal Configuration Files

> On/Off

- whether the terminal should be run a getty

> Term type

- virtual console, network, dial-in

> Parameter

System	On/Off	Term Type	Parameters	Monitor
FreeBSD	/etc/ttys	/etc/ttys	/etc/gettytab	getty
Red Hat	/etc/inittab	/etc/ttytype	/etc/gettydefs	getty
SunOS	/etc/ttytab	/etc/ttytab	/etc/gettytab	getty
Solaris	_sactab	_sactab	zsmon/_pmtab	ttymon

Configuration of Hardwired Terminals (4)

◉ FreeBSD: /etc/ttys

> Format

device program termttype {on|off} [secure]

> Restart init process

- kill -1 1
- kill -HUP 1

```
#name      getty      type      status  comments
ttyv1     "/usr/libexec/getty Pc"  cons25   on      secure
ttyv2     "/usr/libexec/getty Pc"  cons25   on      secure
ttyd0     "/usr/libexec/getty std.9600"  dialup   off     secure
ttyd1     "/usr/libexec/getty std.9600"  dialup   off     secure
ttyp0     none      network
ttyp1     none      network
```

Configuration of Hardwired Terminals (5)

◎ FreeBSD: /etc/gettytab

- > Associate symbolic names with port configuration information, such as speed, parity, prompt
- > man gettytab

```
default:\
      :cb:ce:ck:lc:fd#1000:im=\r\n%s/%m (%h) (%t)\r\n\r\n:sp#1200:\
      :if=/etc/issue:
2|std.9600|9600-baud:\
      :np:sp#9600:
P|Pc|Pc console:\
      :ht:np:sp#115200:
```

Special Characters and The terminal driver

- The terminal driver supports several special function when typing special keys

Name	Default	Function
Erase	^H	Erases one character of input
WErase	^W	Erases one word of input
Kill	^U	Erases the entire line of input
EOF	^D	Sends an "end of file" indication
INTR	^C	Interrupts the currently running process
Quit	^\	Kills the current process with a core dump
Stop	^S	Stops output to the screen
Start	^Q	Restarts output to the screen
Discard	^O	Throws away pending output
Suspend	^Z	Suspends the current process
LNext	^V	Interprets the next character literally

stty – Set Terminal Options

- Change and query various settings of the terminal drivers
 - > There are about a zillion options
- Example
 - > stty intr "^C" kill "^U" erase "^H"
 - > stty -a
 - > reset tty
 - reset
 - stty sane

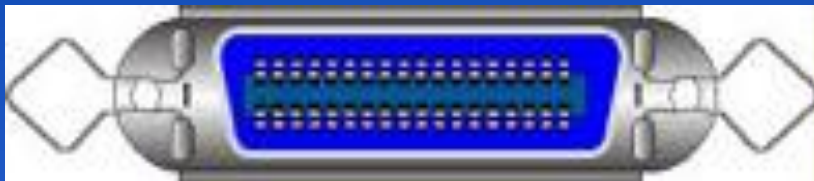
```
speed 38400 baud; 24 rows; 80 columns;
lflags: icanon isig iexten echo echoe -echok echoke -echonl echoctl
        -echoprt -altwerase -noflsh -tostop -flusho pendin -nokerninfo
        -extproc
iflags: -istrip icrnl -inlcr -igncr ixon -ixoff ixany imaxbel -ignbrk
        brkint -inpck -ignpar -parmrk
oflags: opost onlcr -ocrnl -oxtabs -onocr -onlret
cflags: cread cs8 -parenb -parodd hupcl -clocal -cstopb -crtcts -dsrflow
        -dtrflow -mdmbuf
cchars: discard = ^O; dsusp = ^Y; eof = ^D; eol = <undef>;
        eol2 = <undef>; erase = ^?; erase2 = ^H; intr = ^C; kill = ^U;
        lnext = ^V; min = 1; quit = ^\; reprint = ^R; start = ^Q;
        status = ^T; stop = ^S; susp = ^Z; time = 0; werase = ^W;
```

tty(4)
stty(1)

Other Common I/O ports (1)

- Parallel ports

- > Similar to serial ports in concept, but parallel ports transfer 8 bits of data at once
- > IEEE-1284 standard
- > Male DB25 \leftrightarrow male Centronics connector



Female Centronics connector



Male Centronics connector

Other Common I/O ports (2)

- ◎ USB – Universal Serial Bus
 - > Up to 127 devices can be connected
 - > Standardized connectors
 - > Devices can be connected and disconnected without powering down
 - > Up to 12Mb/s
- ◎ USB 2.0
 - > Up to 480Mb/s

Serial Console

- ◉ /boot/loader.conf:
 - > console="vidconsole,comconsole"
- ◉ Connect
 - > PuTTY
 - > tip(1)
 - > comms/minicom

