CS 3650 – Computer Systems
Spring 2024
Peter Desnoyers

Lecture 23, Tue Apr 2 2024

Testing lab 4

hints to debug shell scripts

1) verbose mode - `sh -x fstest.sh`

2) copy & paste

```
gdb --args
./lab4fuse -s -d
-image
```

```
ls fs
  ⋮
```

```
struct X *ptr

(gdb) print *ptr
```

"connection failed" (?)

→ you crashed

"transport endpoint... "

Sockets & TCP

client

```
fd = socket(...)
connect(fd, <addr>)




write(fd, "abc", 3)
fd
```

server

```
listen_fd = socket(..)
bind(listen_fd, <addr>)
listen(lfd, 5)
loop:
    int fd = accept(lfd)
```

port #

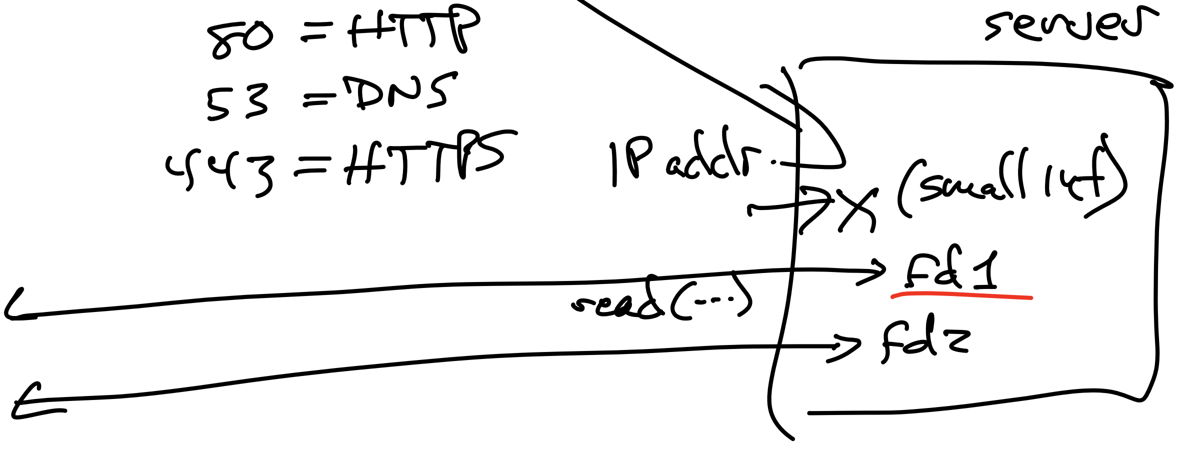
(/etc/services)

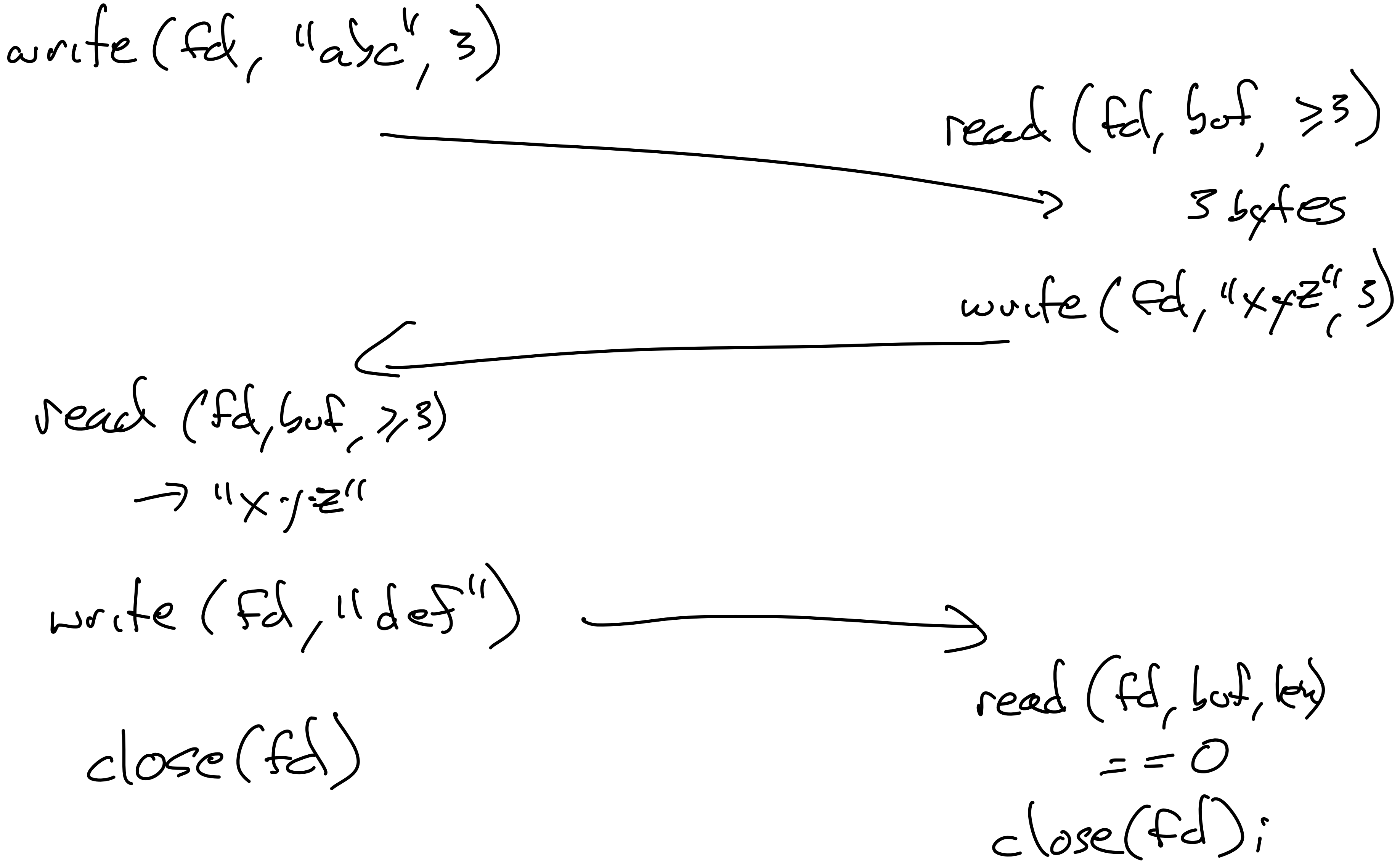
22 = SSH

80 = HTTP

53 = DNS

443 = HTTPS





write(fd, "abc", 3)

read(fd, buf, ≥3)

3 bytes

write(fd, "xyz", 3)

read(fd, buf, ≥3)

→ "xyz"

write(fd, "def")

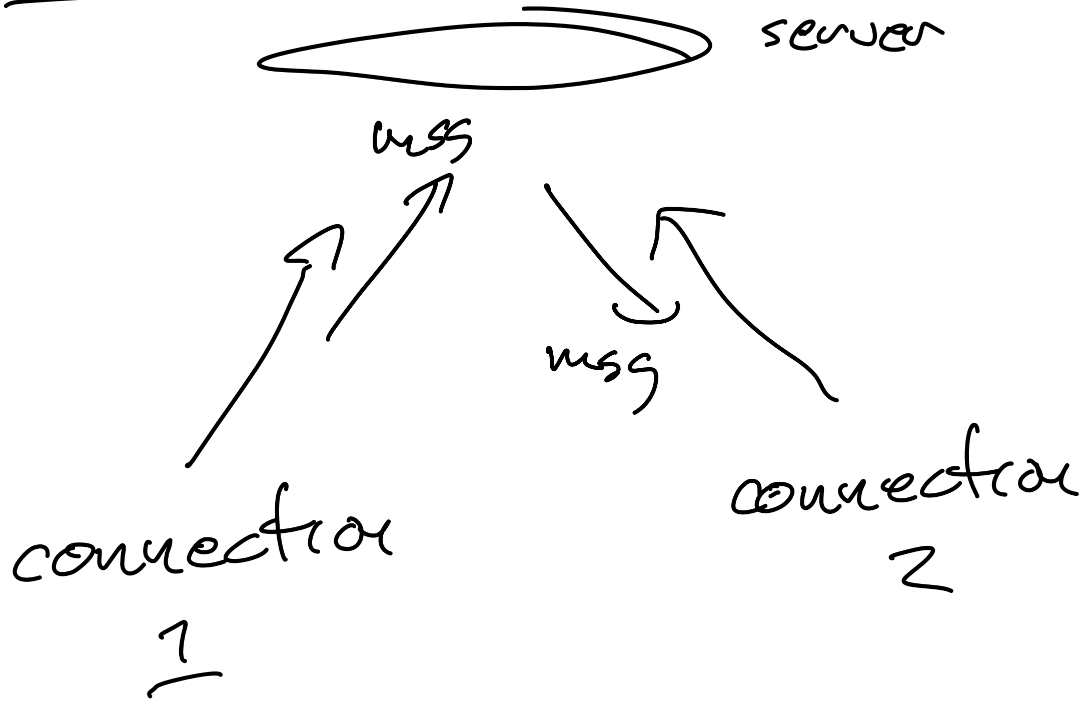
read(fd, buf, len)

== 0

close(fd)

close(fd);

Chat server (lab 5)



fd1 ← client1

fd2 ← client2

```
{
 read(fd1, buf, len);
 read(fd2, buf2, len);
```

```
{ready_fds} = select(read = {fd1, fd2},
                     ~~write = {}~~
                     ~~args = {}~~ )
  if fd1 in ready_fds:
      read fd1
      write → fd2
  if fd2 ....
```

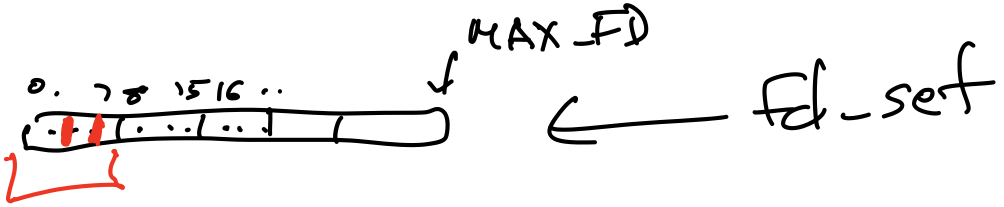
if fd1 is returned from select:

→ read(fd1) won't block

problem: C doesn't have sets

```
fd_set fds;
FD_ZERO (&fds)
FD_SET (fd1, &fds)
FD_SET (fd2, &fds)

max_fd = fd1
if fd2 > fd1
    max_fd = fd2
```



```
select(max_fd+1,
       &fds, NULL, NULL,
                   NULL)
```

↓

→ ready fds are set in 'fds'

```
if (FD_ISSET(fd1, &fds))
    read(fd1, buf, len)
```

More socket details

fd = socket (AF_INET, SOCK_STREAM) ← i.e. TCP

struct sockaddr_in { ← "internet"

sin_family AF_INET

sin_port

sin_addr ←

} addr

dest address

addr/port

connect ((struct sockaddr*) &addr, sizeof(myaddr), ..)

bind : addr = local address + port

↑ typically ANY

INADDR_ANY (?)

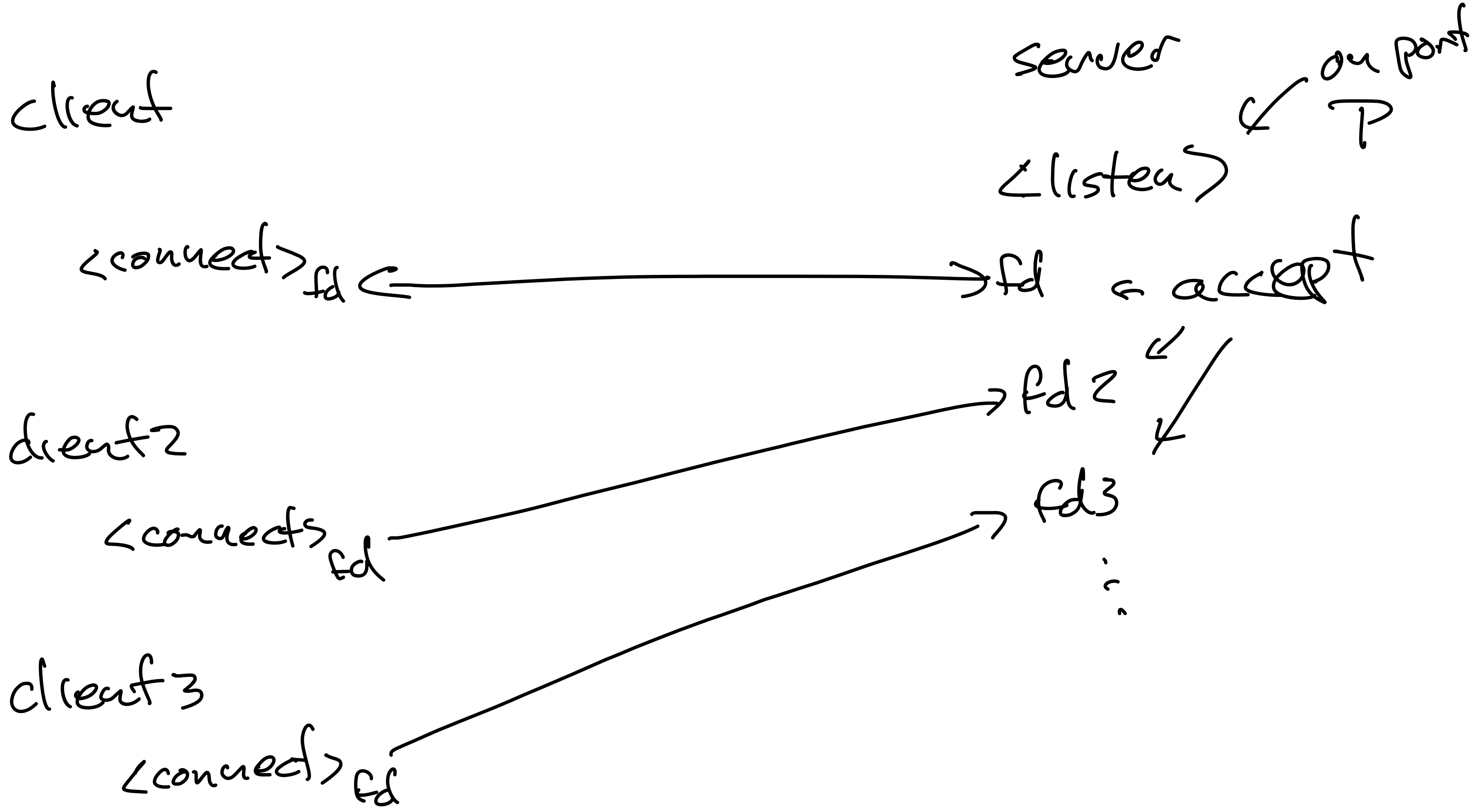
fd0 = socket

bind

listen.

fd ← accept

Recap


client
<connect>
fd
server
on port
P
<listen>
fd
= accept
fd2
fd3
client2
<connects
fd
client3
<connect>
fd

$$\underbrace{\text{set of fds}}_{\text{to wait on}} \longrightarrow \text{select} \longrightarrow \underbrace{\text{set of fds}}_{\text{ready to read}}$$

fd_set

FD_ZERO
FD_SET
FD_ISSET

Network protocols

- ethernet / wifi
- IP protocol – IP address
- TCP retransmission

  byte stream

  client - server model

  sockets
- HTTP

32 bits

power-of-2 ranges

topologically significant

129.10.*.* → NU

x810A.....

→ NAT net addr translation

GET /path HTTP/1.0 ← 1995 or so

HTTP/1.1

Host: www.somewhere.com

- - - .

[← blank line

HTTP reply!

200 OK

404 Not found
etc.

HTTP/v.v <code> <msg>
field
field
content-length: <n>
content-encoding: < >

blank

data

or content len

end of connection

HTTP "verbs"

GET

PUT

DELETE

POST ← HTML forms

S3: GET url

http://s3/pjd-image-backups/
file.txt

PUT url
(data)

DELETE url