

CS 3650 – Computer Systems
Spring 2024
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Lecture 21, Tue Mar 26 2024

FUSE

bash, ...

↑ user processes
open, close,
stat, readdir,
etc

~~lab4-fuse~~

↓ kernel

FUSE
file sys

\$./lab4-fuse -image
test.img fs

\$ ← Fork → lab4

in background

gdb

./lab4-fuse -s -d -image test.img

common errors:

* transport endpoint not conn'ed

→ fusemount -u fs

"signal SIGINT" ← send ^C

\$ ls fs

l/o error

→ bad st_mode in struct stat

octal:

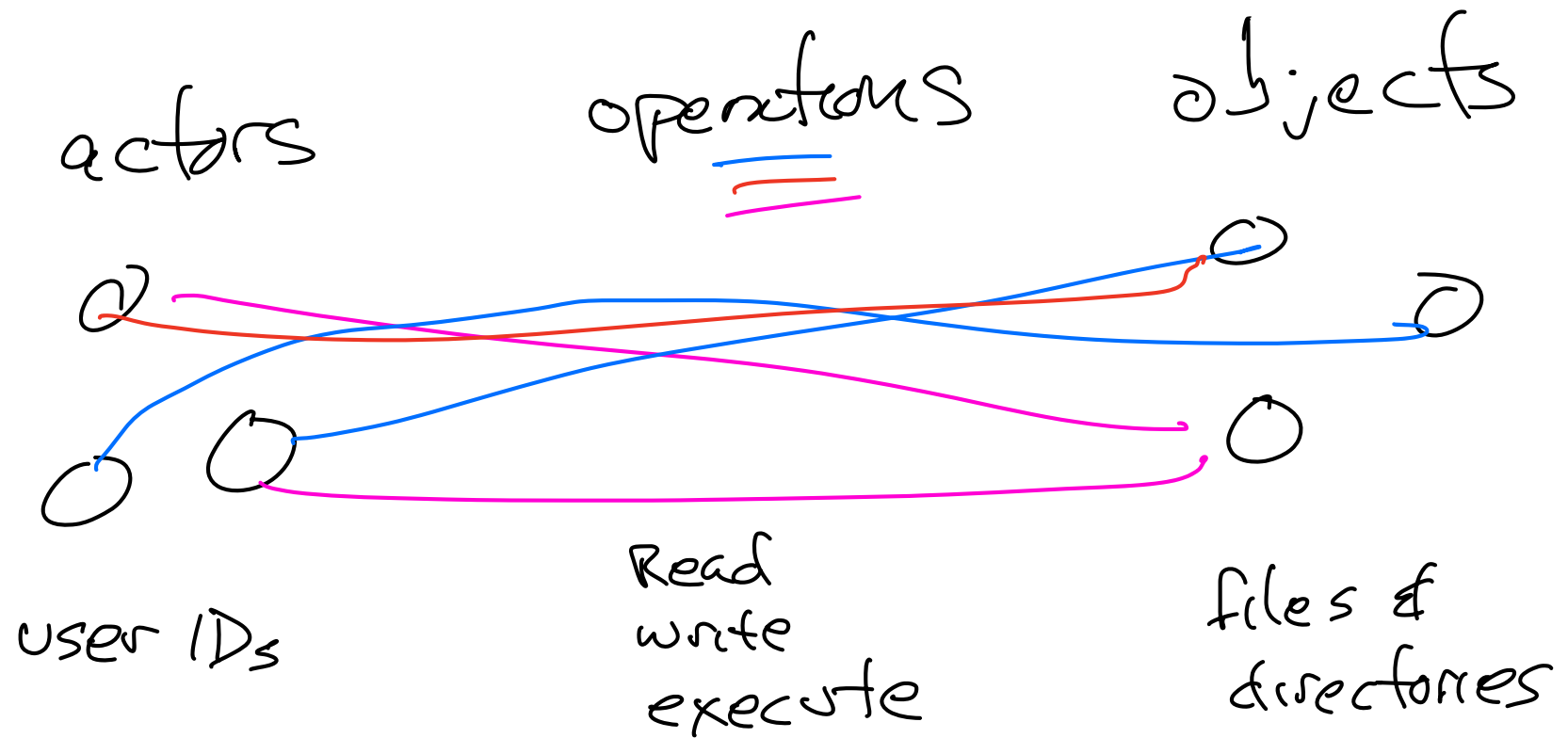
100
type

755
permissions

40755
dir

File permissions
Unix

Access control



object permissions

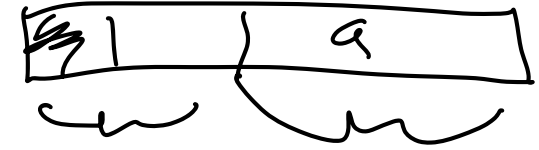
user IDs: login names

groups: sets of user IDs

id



16 bits



type

||| ||| |||

rwx rwx rwx



user group *

file: owner (uid)
group (gid)
R/w/x (user)
R/w/x (group)
R/w/x (world)

httpd (webserver)

user: httpd group httpd

↳ all data files: owned by httpd

chmod ← syscall, command

chmod ~~rw-----~~ file.txt

→ owner read only

chmod 600 file.txt

→ something

u+rw

g-r

o+r

↑

"other"

0 = . . .

1 = . . X

2 = .w.

5 = R-X

Directory permissions:

w : create / delete entries

r : list

x : traverse

ls dir1 \leftarrow R

cat dir1/file.txt

\uparrow
X

read dir

translate

typical dir perms:

RWX \leftarrow writable

R-X \leftarrow listable, traversable

--- \leftarrow not allowed

How does sudo work?

setuid permission bit

executable

S rwx --x --x

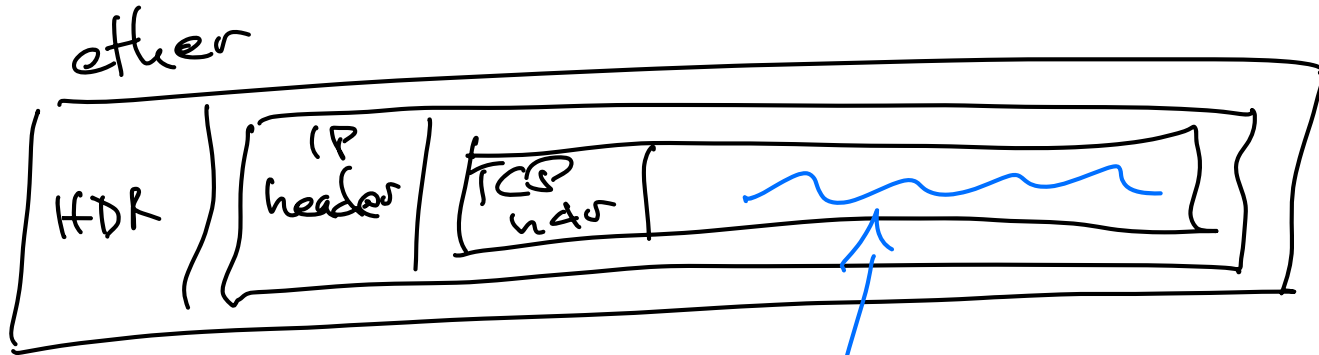
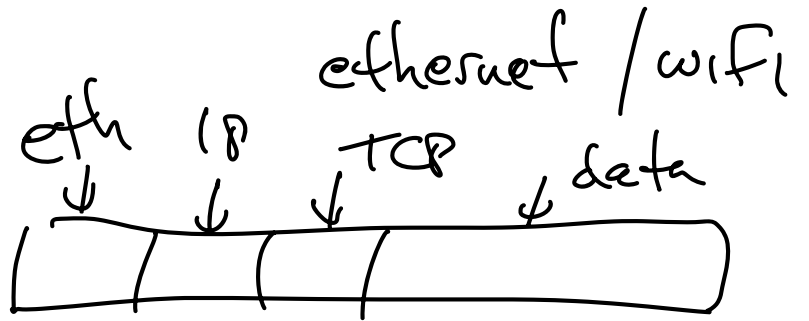
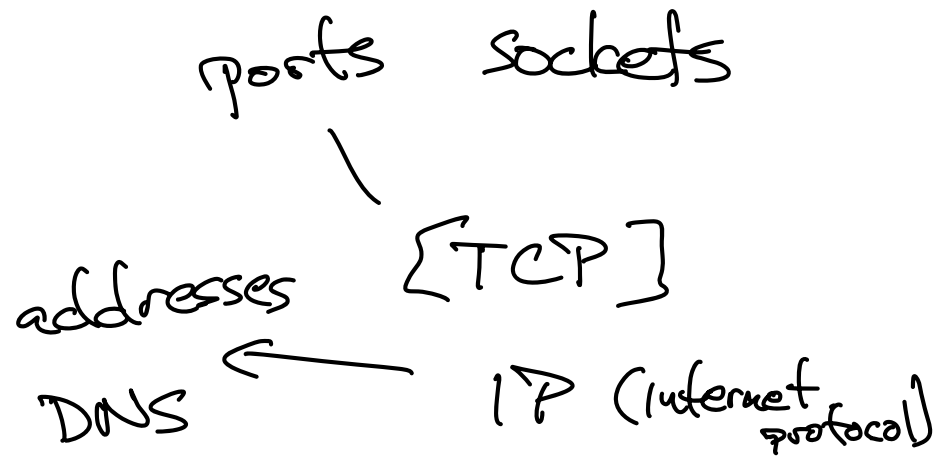
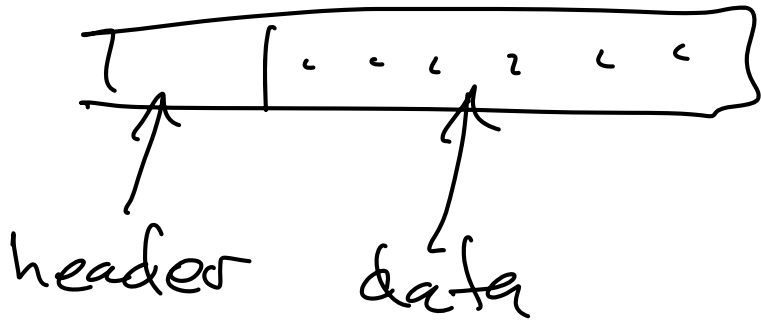
"program"

exec("program")

→ change user ID
of process to
owner of file

Networking

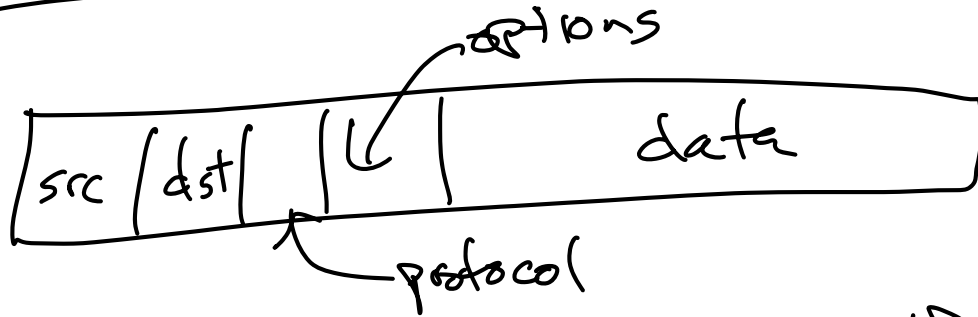
packet:



real user data

Internet protocol (IP)

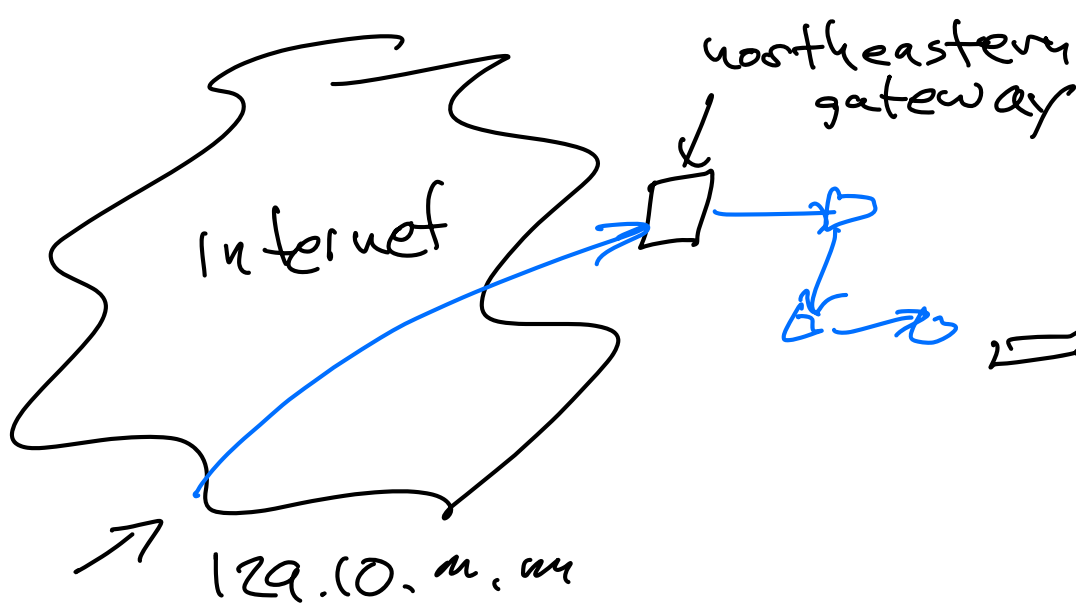
(no IPv6)



IP address: 32 bits

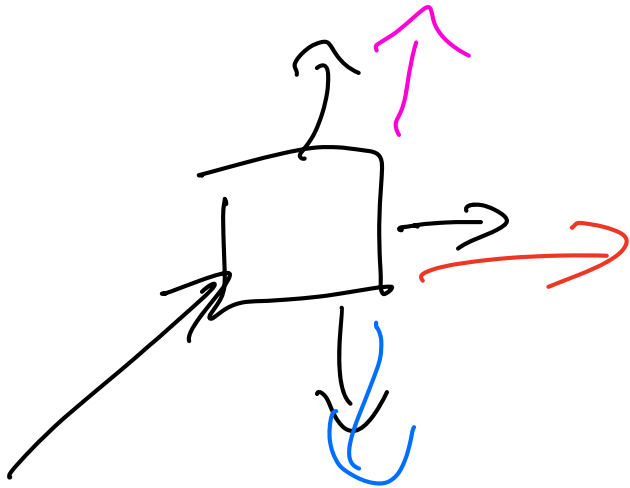
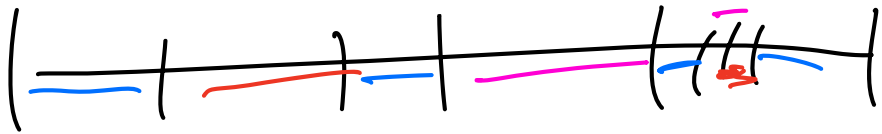
Northeastern

129.10.113.66



topologically significant

IP address ranges



129.10
 81. 0A
 10000001 0000 1100 ...
 ← 16 bit prefix →

129.10.13.16 ... 31
 810A 71 10 4
 10000100001100 ... 1111
 ← 28 bit prefix → subnet address

DNS (Domain Name System)

→ root →
.edu?

→ .edu
northeastern.edu?

northeastern.edu

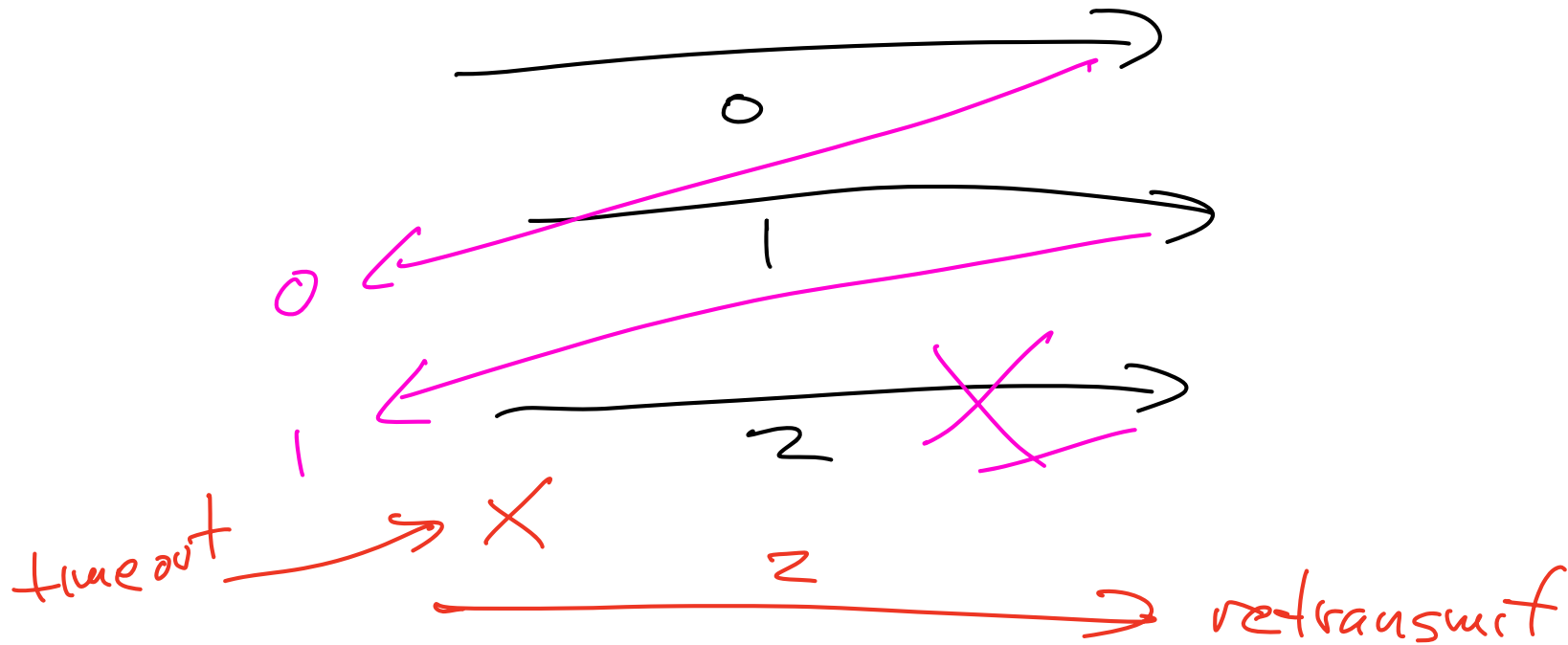
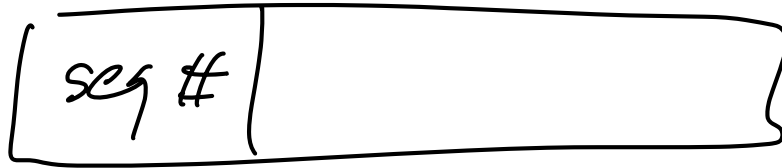
↙ ↘
khoury.northeastern.edu?

k.northeastern.edu

→
github, k.u.edu??

TCP

retransmission
"ports" ← naming



Next:

more on TCP ← "ports"

sockets programming