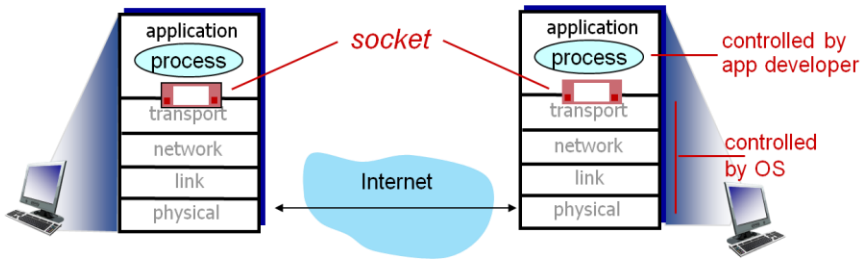
Socket programming

goal: learn how to build client/server applications that communicate using sockets

socket: door between application process and end-end-transport protocol



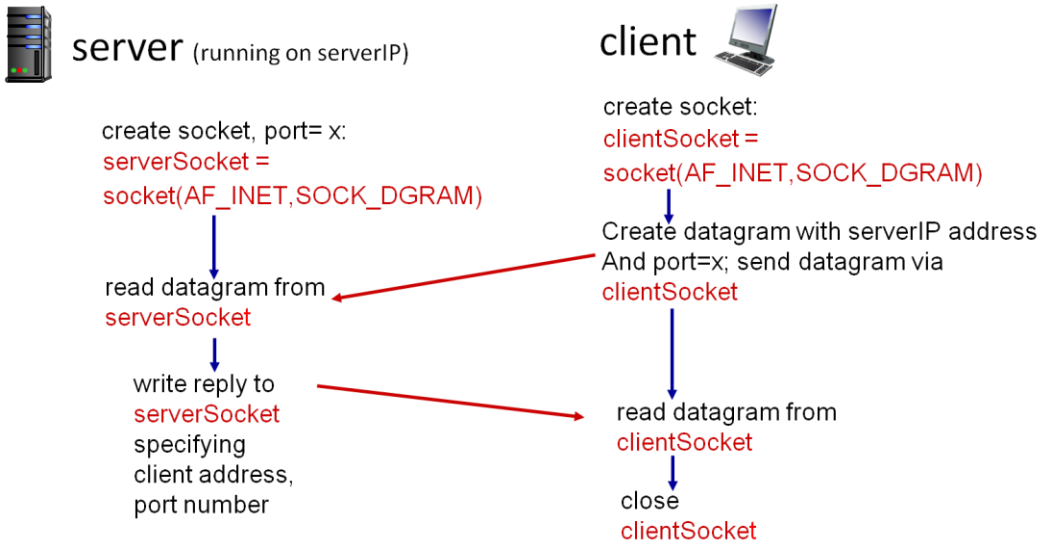
Two socket types for two transport services:

- *UDP:* unreliable datagram
- *TCP:* reliable, byte stream-oriented

UDP: no “connection” between client and server:

- no handshaking before sending data
- sender explicitly attaches IP destination address and port # to each packet
- receiver extracts sender IP address and port# from received packet

Client/server socket interaction: UDP



Example app: UDP client

Python UDPClient

include Python's socket library → `from socket import *`
`serverName = 'hostname'`
`serverPort = 12000`
create UDP socket → `clientSocket = socket(AF_INET, SOCK_DGRAM)`
get user keyboard input → `message = input('Input lowercase sentence:')`
attach server name, port to message; send into socket → `clientSocket.sendto(message.encode(), (serverName, serverPort))`
read reply data (bytes) from socket → `modifiedMessage, serverAddress = clientSocket.recvfrom(2048)`
print out received string and close socket → `print(modifiedMessage.decode())`
`clientSocket.close()`

Note: this code update (2023) to Python 3

Example app: UDP server

Python UDPServer

```
from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(('', serverPort))
print('The server is ready to receive')
while True:
    message, clientAddress = serverSocket.recvfrom(2048)
    modifiedMessage = message.decode().upper()
    serverSocket.sendto(modifiedMessage.encode(),
                        clientAddress)
```

create UDP socket

bind socket to local port number 12000

loop forever

Read from UDP socket into message, getting client's address (client IP and port)

send upper case string back to this client

Note: this code update (2023) to Python 3

Syntax to use ns3:

All code files must be in specific folder to be executed, write following commands:

- Cd ns3-allinone-
- Cd ns-3.x
- Cd scratch
- Touch file.py

Run command:

- ./ns3 run file.py

Libraries:

- import ns.applications
- import ns.core
- import ns.internet
- import ns.network
- import ns.point_to_point
- From socket import *

Output: