INTERFACING WITH THE RASPBERRY PI

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SSH

- Firewall: block some internet ports
- Secure Shell (SSH): Program that allow you to access machine remotely
- Telnet: SSH not secure
  - *Linus has an SSH client*
  - *RPie has an SSH server*
- ssh userName@IPAddress #Of server machine #Run SSH Client
- SSHDeamon: A process that waits a client to request a connection (not enabled by default)
- ifconfig #Get RPie IP address (wlan0) #Because it doesn't have a DN
- PS: IP address changes every time we reboot the RPie

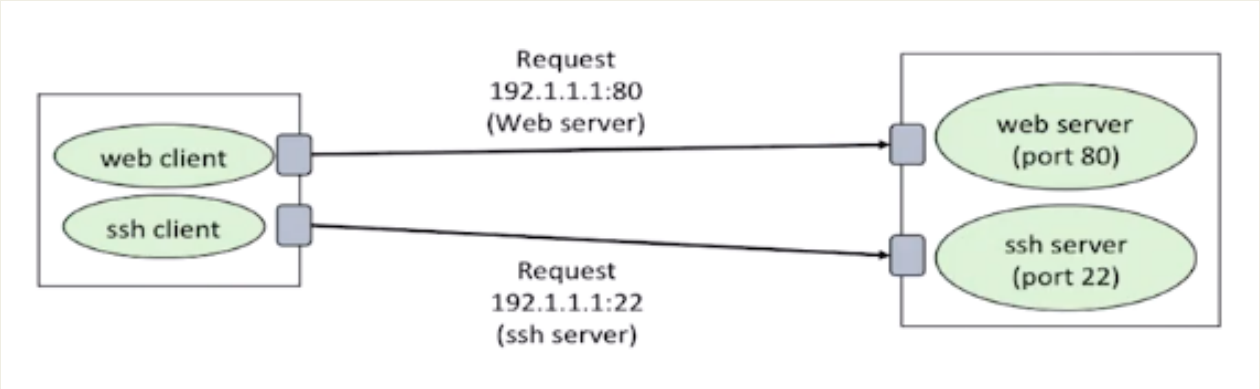
Protocols

- Protocol: Set of rules defining:
  - *How data should be transferred*
  - *What data contained in each packet*
- Every packet contains a header (destination, source) and payload (data)
  - *IP: Internet Protocol (Host to host)*
  - *UDP: Unreliable Datagram Protocol (Complicated, process to process)*
  - *TCP: Transmission Control Protocol (Simple)*

PS: Port + IP = Internet

- IPv6 (128 bit) vs IPv4 (32 bit)
- Ports: (Example: HTTP-80; SSH-22)
- nslookup domainName #Give IP@ of domainName
- Domain Name System: Determine between host name (@IP) and domain name (URL)

Sockets (1)



- Socket: End point of a connection
- Socket interface: Programming interface to perform network connection → Based on C/S programming
- Socket client:
- import socket #Socket python library
- ms = socket.socket(sock.AF_INET,socket.SOCK_STREAM) #Create a socket #Arg1: Internet, Arg2: TCP
- host = socket.gethostbyname("URL") #Convert URL to IP@
- ms.connect((host,80)) #Create connection to host on port 80
- message = "GET / HTTP/1.1\r\n\r\n" #/: Directory, 1.1: Version, \r\n\r\n: End of session
- ms.sendall(message) #Send data
- data = ms.recv(maxNumberOfBytes) #Recieve HTML data on a blocking wait
- ms.close()

Sockets (2)

- PS: Errors are commun with sockets

```
try:
        /* code with possible error*/
except errorType:
        /* executed when error occurs */
```

socket.error #Error type that contains all socket errors

gaie.error #Get address info error (when DNS operation occurs)

Import sys; sys.exit() #To quit the program in case of error

Sockets (3)

- Socket server: Server need to wait for a request to come in
- ms.bind(“”,port) #“” to receive from any host, port=1234 for example
- ms.listen(backLog=numberOfClientsWaitingInLine) #Get ready to accept requests
- conn, IPaddr = ms.accept() #Accept request to receive and send data
- conn.sendall() ; conn.recv() ; conn.close() ; ms.close()
- resp = conn.getresponse(); content = resp.read() #Read content
- Live server: Server that continues its life (after a request)
- PS: if data==b’message’ #Convert to byte array because data’s type is a byte array
- PuTTY: SSH program for Windows
- NetCat: Program that sends and receives requests
- nc IP@ Port #Send a request
- nc –l Port #Listen for a request

Sockets (4)

```
import socket
import sys

mysock = socket.socket(socket.AF_INET,
                       socket.SOCK_STREAM)
try:
      mysock.bind("", 1234)
except socket.error:
      print("Failed to bind")
      sys.exit()
mysock.listen(5)
while True:
      conn, addr = mysock.accept()
      data = conn.recv(1000)
      if not data:
            break
      conn.sendall(data)

conn.close()
mysock.close()
```

```
import socket
import sys

try:
      mysock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
except socket.error:
      print("Failed to create socket")
      sys.exit()
try:
      host = socket.gethostbyname("www.google.com")
except socket.gaierror:
      print("Failed to get host")
      sys.exit()
mysock.connect(host, 80)
message = "GET / HTTP/1.1\r\n\r\n"
try:
      mysock.sendall(message)
except socket.error:
      print("Failed to send")
      sys.exit()
data = mysock.recv(1000)
print(data)
mysock.close()
```

Protocol-Specific Libraries

- Socket library → Low level library → Good for ad hoc communication (Must know protocols)
- PS: RPie can't handle some operations → Need of online servers and clouds
- import http.client
- conn = httplib.HTTPConnection("URL")
- conn.request("GET","/") #GET=Operation; /=Directory
- Web-based services = Services in the cloud → "HTTP" messages: Remote server x Client request
- API: Application Programming Interface → Format of messages between client and server (Basic-HTTP)
- SDK: Software Development Kit → Set of tools to support the use of an API (library functions)

Twython

- sudo apt-get update
- sudo apt-get install python –pip #PIP: Python installer for packages
- sudo pip install twython

→ 4 keys for authentification

- from Twython import Twython
- #We do initialization for the 4 keys
- api=Twython(key1,key2,key3,key4)
- api.update_statuts(status="messageToSend") #Post a tweet
- class myStreamer (TwythonStreamer) #Extend a class and change what you want
- statuses.filter() #Search for text in streams
- stream.status_filter(track='wordToTrack') #Search for a word in stream
- execfile("filename.extension") #Python command to execute a file

```
class MyStreamer(TwythonStreamer):
    def on_success(self, data):
        if 'text' in data:
            print("Found it.")
```

Camera

- Camera: by USB vs by CSI (Camera Serial Interface)
- sudo raspi-config → Enable camera → Reboot Pi
- sudo apt-get install python3-picamera
- import picamera
- camera = picamera.PiCamera() #Create a camera object
- camera.capture(“nameOfImage.jpg”) #Capture an image
- camera.start_preview() ; camera.stop_preview() ; #Take a preview
- import time; camera.start_recording(“nameOfVideo.h264”)
- time.sleep(timeInSeconds); camera.stop_recording() #Create a video
- for filename in camera.capture_continuous(): time.sleep(timeInSeconds) #Take picture every sec

```
mysocket = socket.socket()
mysocket.connect(('aserver', 8000))
conn = mysocket.makefile('wb')
camera.capture(conn, 'jpeg')
```

Servo

- DC: Control the speed vs Servo: Control the angle
- 1 ms width = 0 degrees → 2 ms width = 180 degrees
  - For motors, we use external power supply because they consume a lot of power
  - We want all the grounds to be related → Common ground (Battery, RPie, Servo)
  - Only pin 12 & 24 are PWM
  - Resistor is needed between the servo and the pin for protection (1kΩ)
- pwm=GPIO.PWM(pinNumber, Frequency=50) #Set pin as PWM
- pwm.start(0) #Set duty cycle to low all the time
- pwm.ChangeDutyCycle(valueOfDutyCycle)
- PS: Any object that is related to pin, we do a PULL UP for it