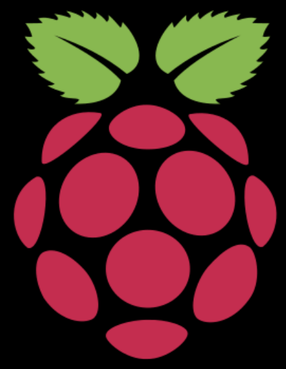


Projeto 04

Controle por Notificação – Teoria

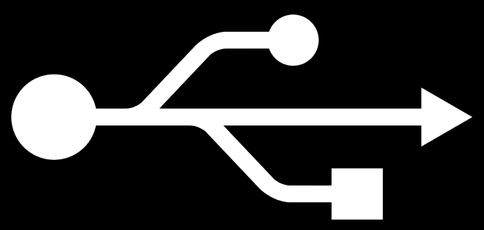
Jan K. S. – janks@puc-rio.br

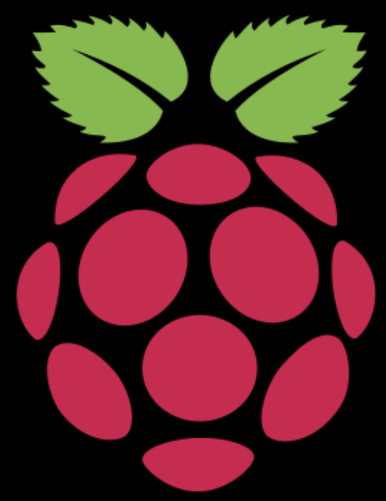
ENG1419 – Programação de Microcontroladores

Hardware

Webcam

USB





Comunicação via USB com o Sistema Operacional do Raspberry

Envio de Comandos para Programas que Controlam a Webcam

man.cx/fswebcam

Manpages

Manpage: go

Available in

(1)

Contents

NAME

fswebcam – Small and simple webcam for *nix.

SYNOPSIS

fswebcam [*<options>*] *<filename>* [[*<options>*] *<filename>* ...]

DESCRIPTION

fswebcam is a small and simple webcam app for *nix. It can capture images from a number of different sources and perform simple manipulation on the captured image. The image can be saved as one or more PNG or JPEG files.

The PNG or JPEG image can be sent to stdio using the filename "–". The output filename is formatted by **strftime**.

CONFIGURATION

Configuration File

Config files use the long version of options without the "––" prefix.
Comments start with a # symbol at the beginning of the line.

General Options

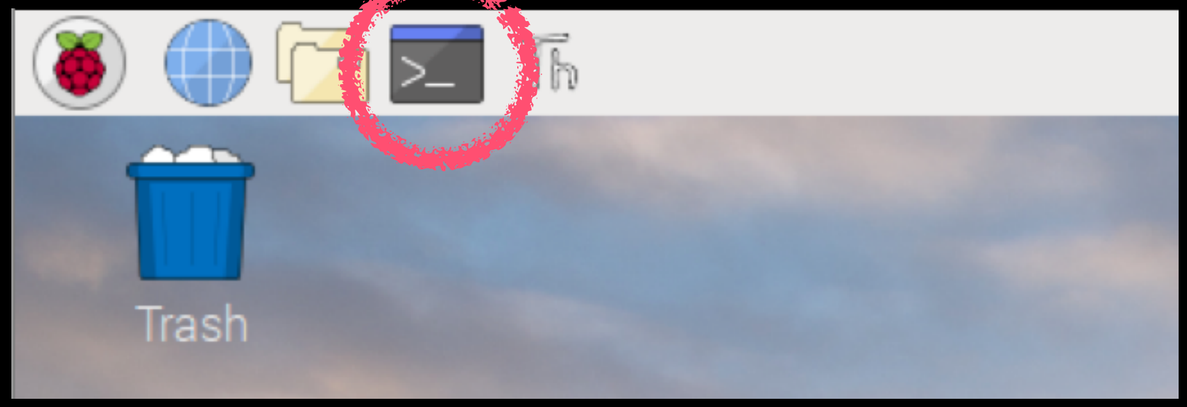
–?, **––help**

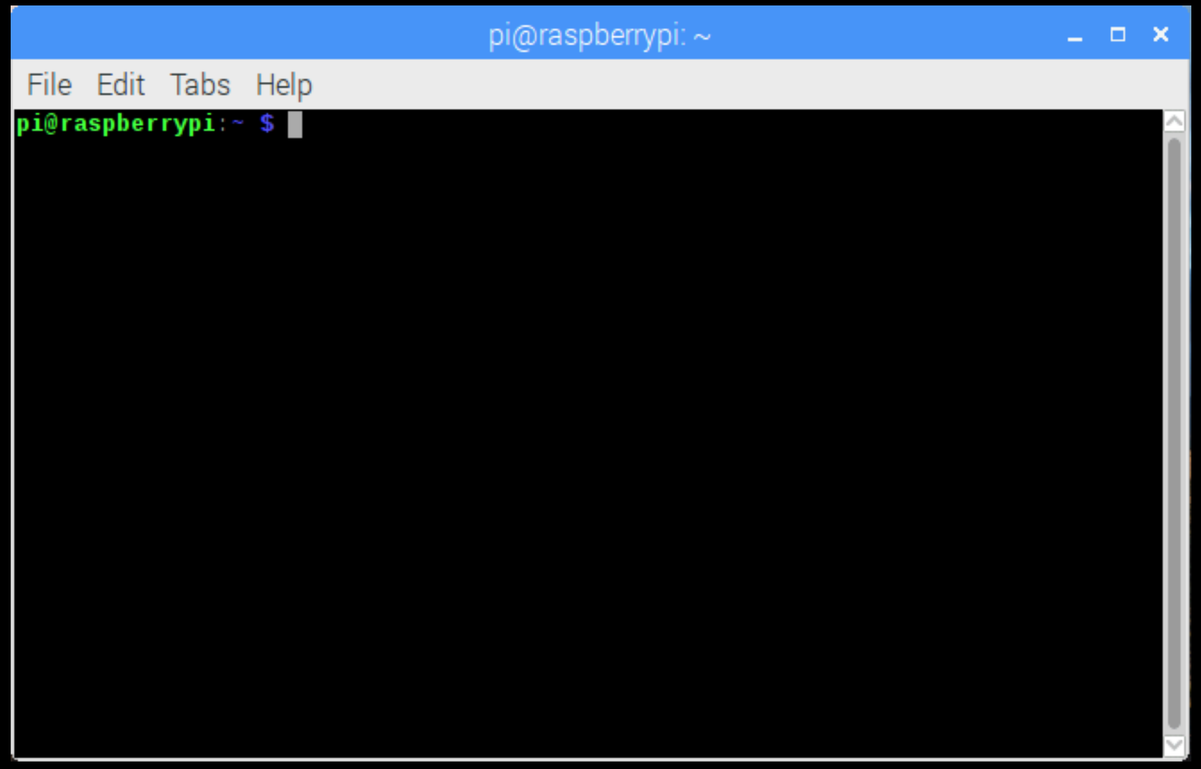
Show a usage summary.

–c, **––config**

Load options from a file. You can load more than one config file, and can mix them with command–line arguments.

Aplicativo FSWebcam



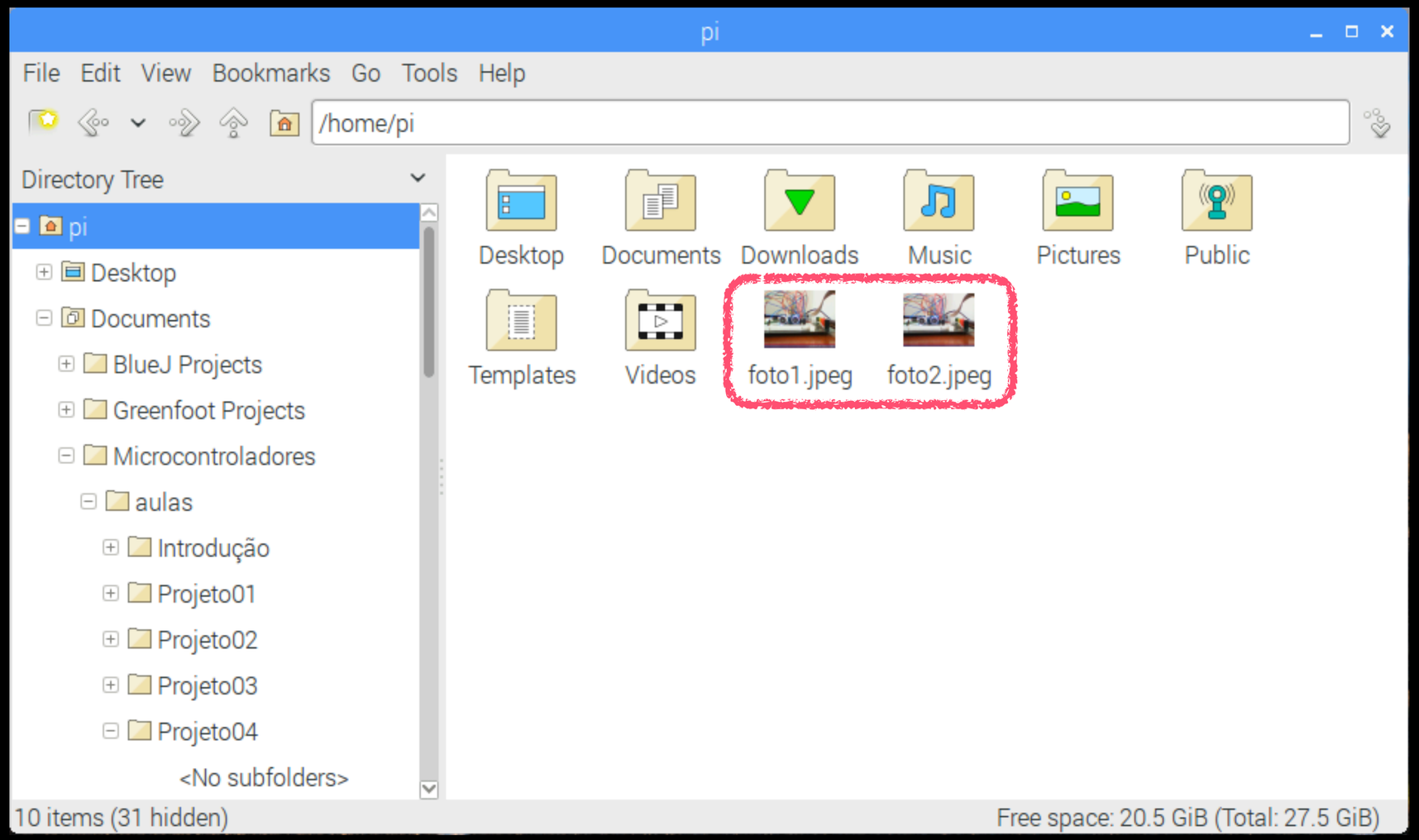


Aplicativo Terminal

```
aula@raspberrypi ~ $ fswebcam foto1.jpg
--- Opening /dev/video0...
Trying source module v4l2...
/dev/video0 opened.
No input was specified, using the first.
Adjusting resolution from 384x288 to 352x288.
--- Capturing frame...
Captured frame in 0.00 seconds.
--- Processing captured image...
Writing JPEG image to 'foto1.jpg'.
```

```
aula@raspberrypi ~ $ fswebcam --resolution 640x480 foto2.jpg
--- Opening /dev/video0...
Trying source module v4l2...
/dev/video0 opened.
No input was specified, using the first.
--- Capturing frame...
Captured frame in 0.00 seconds.
--- Processing captured image...
Writing JPEG image to 'foto2.jpg'.
```

Comandos no Terminal para Captura de Fotos



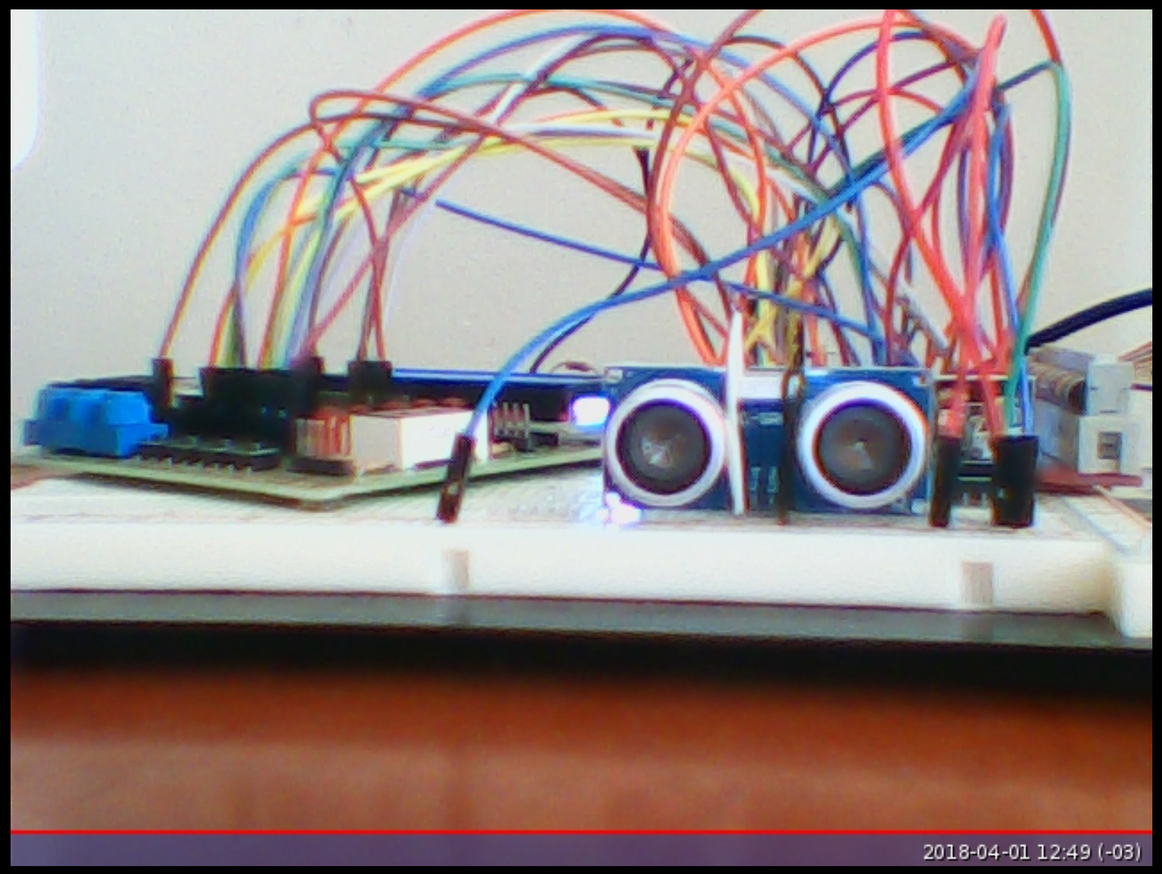
Arquivos Gerados no File Manager

foto1.jpg

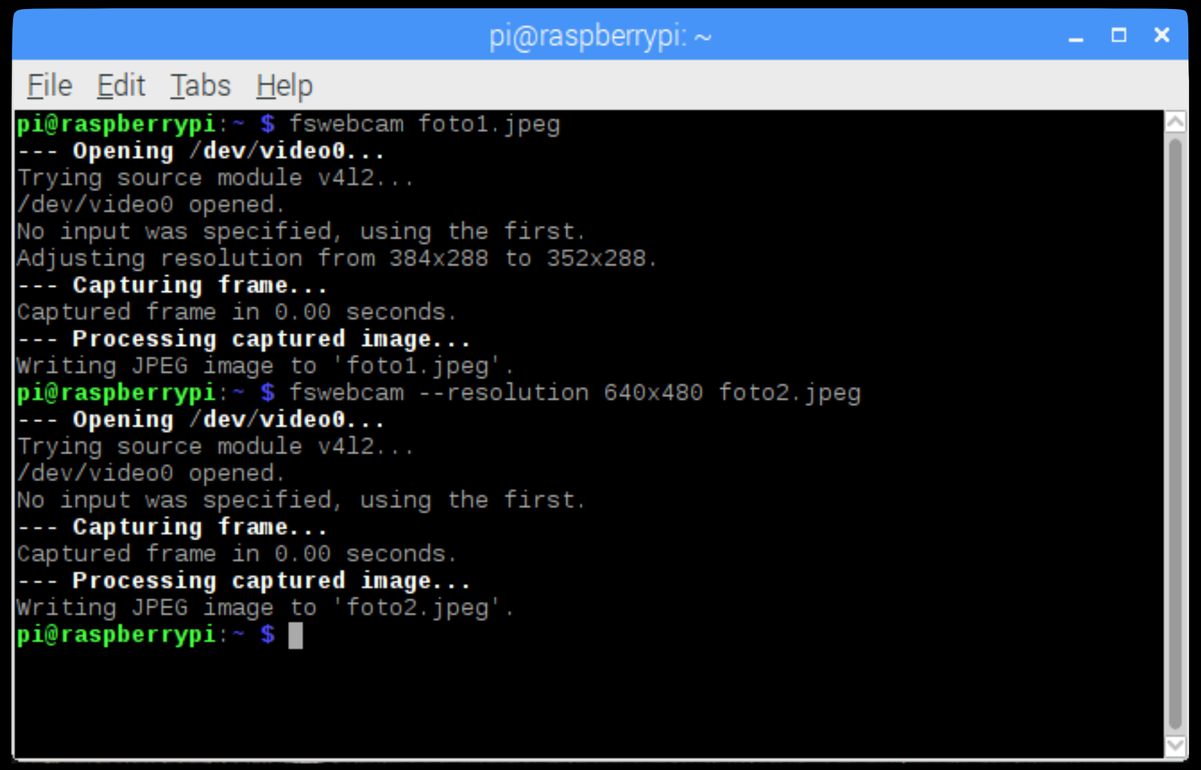
resolução padrão (352 × 288)

foto2.jpg

resolução 640x480



Comparação entre Diferentes Resoluções



Chamada de Comandos do Terminal em Python

As imagens são geradas na mesma pasta
do arquivo com o código Python.

```
>>> from os import system
>>> comando = "fswebcam foto1.jpg"
>>> system(comando)
>>> system("fswebcam --resolution 640x480 foto2.jpg")
```

Chamada de Comandos para Tirar uma Foto

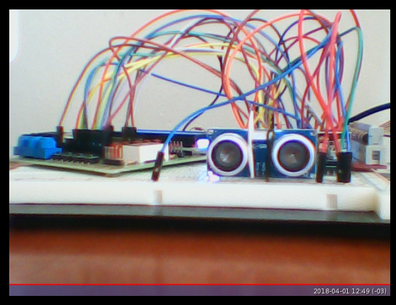


foto-15:25:37.jpg

```
>>> from os import system
>>> from datetime import datetime
>>> agora = datetime.now()
>>> hora = agora.strftime("%H:%M:%S")
>>> nome_do_arquivo = "foto_" + hora + ".jpg"
>>> comando = "fswebcam " + nome_do_arquivo
>>> comando
'fswebcam foto-15:25:37.jpg'
>>> system(comando)
```

Nome da Foto com Data e Hora

=

+

Microfone da Câmera Web

man.cx/arecord

Manpages

Manpage: go

Available in

(1)

Contents

NAME

arecord, aplay – command–line sound recorder and player for ALSA soundcard driver

SYNOPSIS

arecord [*flags*] [filename]
aplay [*flags*] [filename [filename]] ...

DESCRIPTION

arecord is a command–line soundfile recorder for the ALSA soundcard driver. It supports several file formats and multiple soundcards with multiple devices. If recording with interleaved mode samples the file is automatically split before the 2GB filesize.

aplay is much the same, only it plays instead of recording. For supported soundfile formats, the sampling rate, bit depth, and so forth can be automatically determined from the soundfile header.

If filename is not specified, the standard output or input is used. The **aplay** utility accepts multiple filenames.

OPTIONS

–h, ––help

Help: show syntax.

––version

Print current version.

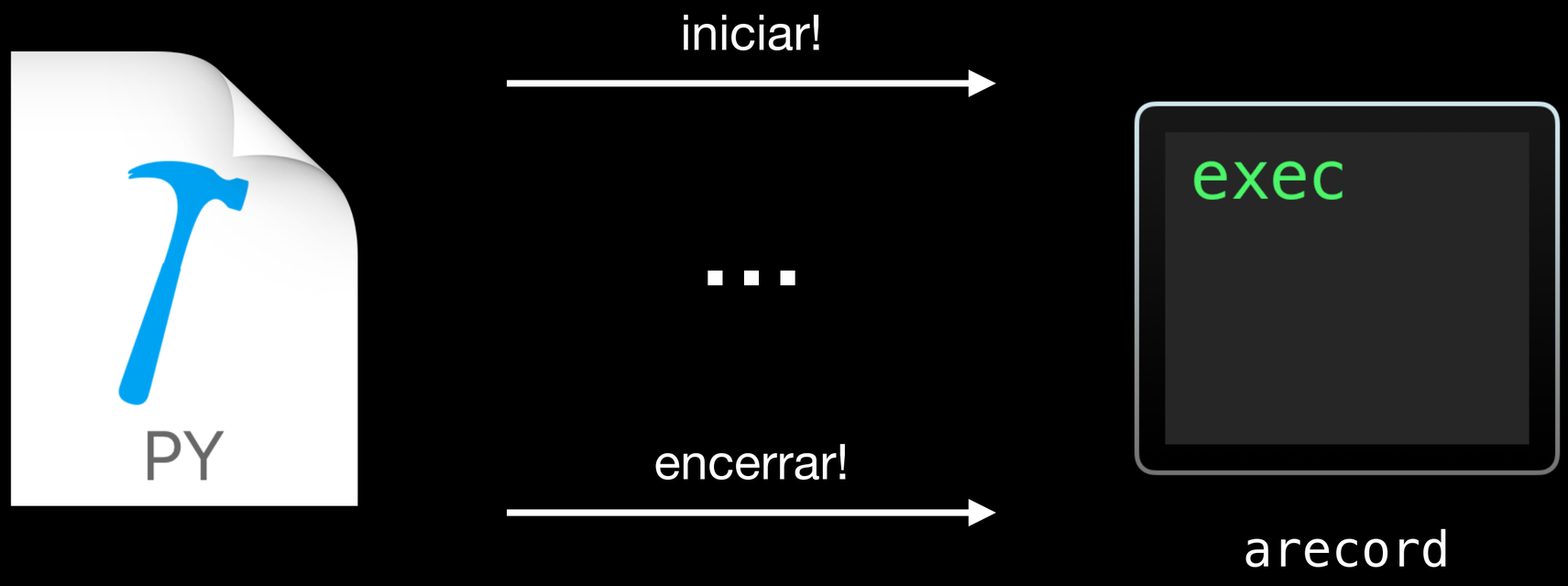
Aplicativo ARecord

audio1.wav
(baixa qualidade)

audio2.wav
(qualidade de CD)

```
>>> from os import system
>>> system("arecord --duration 3 audio1.wav")
>>> system("arecord --duration 3 --format cd audio2.wav")
```

Gravação de 3 Segundos de Áudio



Interrupção da Gravação de Áudio

```
>>> from subprocess import Popen
>>> global aplicativo
>>> aplicativo = None
>>> def iniciar_gravacao():
...     global aplicativo
...     # limite máximo de 30 segundos, caso não parem a gravação
...     comando = ["arecord", "--duration", "30", "audio.wav"]
...     aplicativo = Popen(comando) # executa em plano de fundo
...
>>> def parar_gravacao():
...     global aplicativo
...     if aplicativo != None:
...         aplicativo.terminate()
...         aplicativo = None
...
>>> iniciar_gravacao()
>>> # faz outras coisas no código...
>>> parar_gravacao()
```

audio.wav

Interrupção da Gravação de Áudio

audio.wav
516 kB

audio.mp3
47.8 kB

audio.ogg
28.9 kB

Conversão do Formato WAV para MP3 e para OGG

man.cx/lame

Manpages

Manpage: go

NAME

lame – create mp3 audio files

SYNOPSIS

lame [options] <infile> <outfile>

DESCRIPTION

LAME is a program which can be used to create compressed audio files. (Lame ain't an MP3 encoder). These audio files can be played back by popular MP3 players such as mpg123 or madplay. To read from stdin, use "–" for <infile>. To write to stdout, use "–" for <outfile>.

OPTIONS

Input options:

–r Assume the input file is raw pcm. Sampling rate and mono/stereo/jstereo must be specified on the command line. For each stereo sample, LAME expects the input data to be ordered left channel first, then right channel. By default, LAME expects them to be signed integers with a bitwidth of 16 and stored in little-endian. Without **–r,** LAME will perform several *fseek()'s* on the input file looking for WAV and AIFF headers.

Might not be available on your release.

–x Swap bytes in the input file (or output file when using **––decode).**

Available in

(1)

Contents

man.cx/opusenc

Manpages

Manpage: lame go

Available in

(1)

Contents

NAME

opusenc – encode audio into the Opus format

SYNOPSIS

opusenc [**-h**] [**-V**] [**--help-picture**] [**--quiet**] [**--bitrate** *kbit/sec*] [**--vbr**] [**--cvbr**] [**--hard-cbr**] [**--comp** *complexity*] [**--framesize** *2.5, 5, 10, 20, 40, 60*] [**--expect-loss** *pct*] [**--downmix-mono**] [**--downmix-stereo**] [**--max-delay** *ms*] [**--title** *'track title'*] [**--artist** *author*] [**--album** *'album title'*] [**--genre** *genre*] [**--date** *YYYY-MM-DD*] [**--comment** *tag=value*] [**--picture** *filename|specification*] [**--padding** *n*] [**--discard-comments**] [**--discard-pictures**] [**--raw**] [**--raw-bits** *bits/sample*] [**--raw-rate** *Hz*] [**--raw-chan** *N*] [**--raw-endianness** *flag*] [**--ignorelength**] [**--serial** *serial number*] [**--save-range** *file*] [**--set-ctl-int** *ctl=value*] *input.wav output.opus*

DESCRIPTION

opusenc reads audio data in Wave, AIFF, FLAC, Ogg/FLAC, or raw PCM format and encodes it into an Ogg Opus stream. If the input file is "-" audio data is read from stdin. Likewise, if the output file is "-" the Ogg Opus stream is written to stdout.

Unless quieted **opusenc** displays fancy statistics about the encoding progress.

OPTIONS

General options

-h, --help

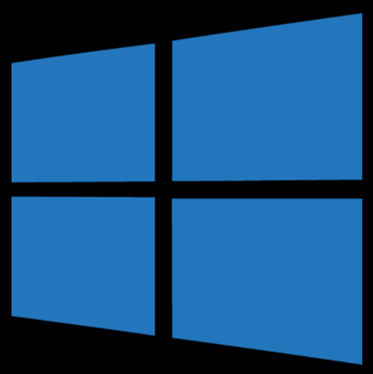
Show command help

Aplicativos Lame e OpusEnc


```
>>> from os import system
>>> system("lame audio.wav audio.mp3")
>>> system("opusenc audio.wav audio.ogg")
```

Conversão de WAV para MP3 e para OGG em Python

```
fswebcam foto1.jpg
arecord --duration 3 audio1.wav
opusenc audio.wav audio.ogg
lame audio.wav audio.mp3
```

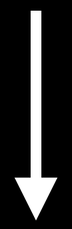


?

Alternativas para Windows e Mac?

LINUX

```
system("fswebcam --resolution 640x480 --skip 10 foto.jpg")
```



WINDOWS

```
system("CommandCam /filename foto.jpg /delay 500")
```

MAC

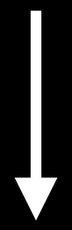
provavelmente 0 ou 1

```
system("ffmpeg -y -pix_fmt uyvy422 -ss 0.5 -f avfoundation -r 30 -i 0
foto.jpg")
```

Comandos Alternativos para Captura de Foto

LINUX

```
system("arecord --duration 3 audio.wav")
```



WINDOWS

```
system('ffmpeg -y -f dshow -i audio="COLOQUE AQUI O SEU
MICROFONE" -t 00:03 audio.wav')
```

MAC

provavelmente :0 ou :1

```
system("ffmpeg -y -f avfoundation -i :1 -t 3 audio.wav")
```

Comandos Alternativos para Captura de Áudio

LINUX

```
comando = ["arecord", "--duration", "30", "audio.wav"]
aplicativo = Popen(comando)
```

WINDOWS

SEM ASPAS!

```
comando = ["ffmpeg", "-y", "-f", "dshow", "-i", "audio=COLOQUE
AQUI O SEU MICROFONE", "-t", "00:30", "audio.wav"]
```

MAC

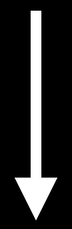
provavelmente :0 ou :1

```
comando = ["ffmpeg", "-y", "-f", "avfoundation", "-i", ":1", "-t", "30",
"audio.wav"]
```

Comandos Alternativos para Captura de Áudio com a POpen

LINUX

```
system("lame audio.wav audio.mp3")
system("opusenc audio.wav audio.ogg")
```

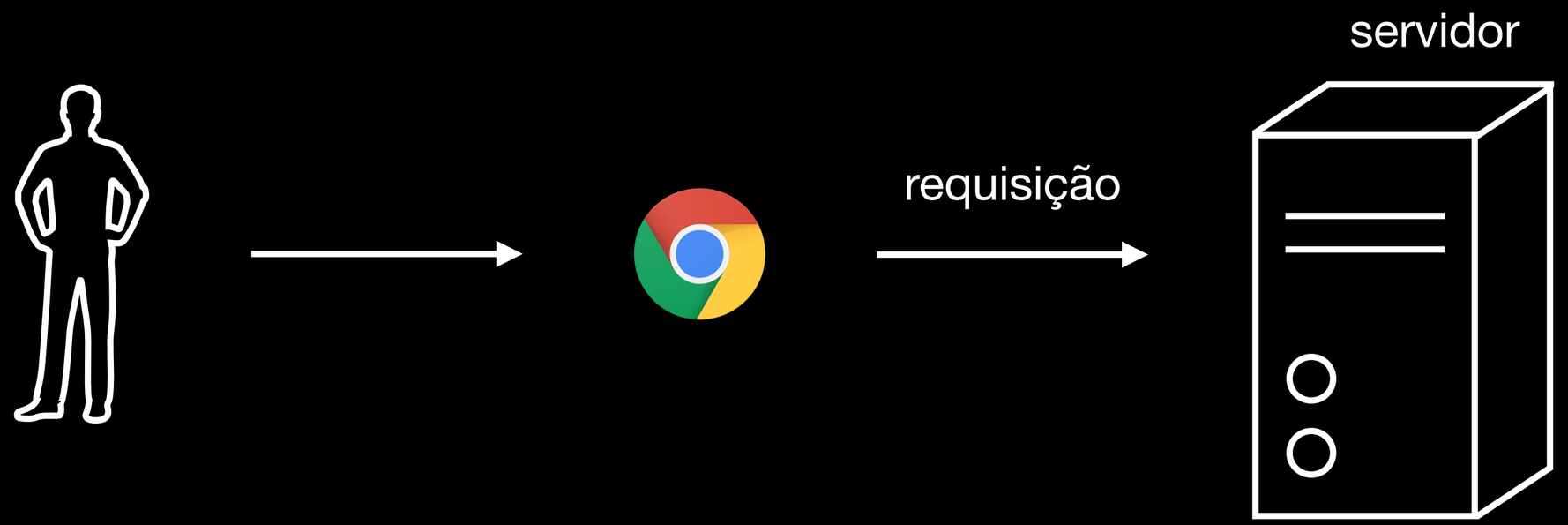


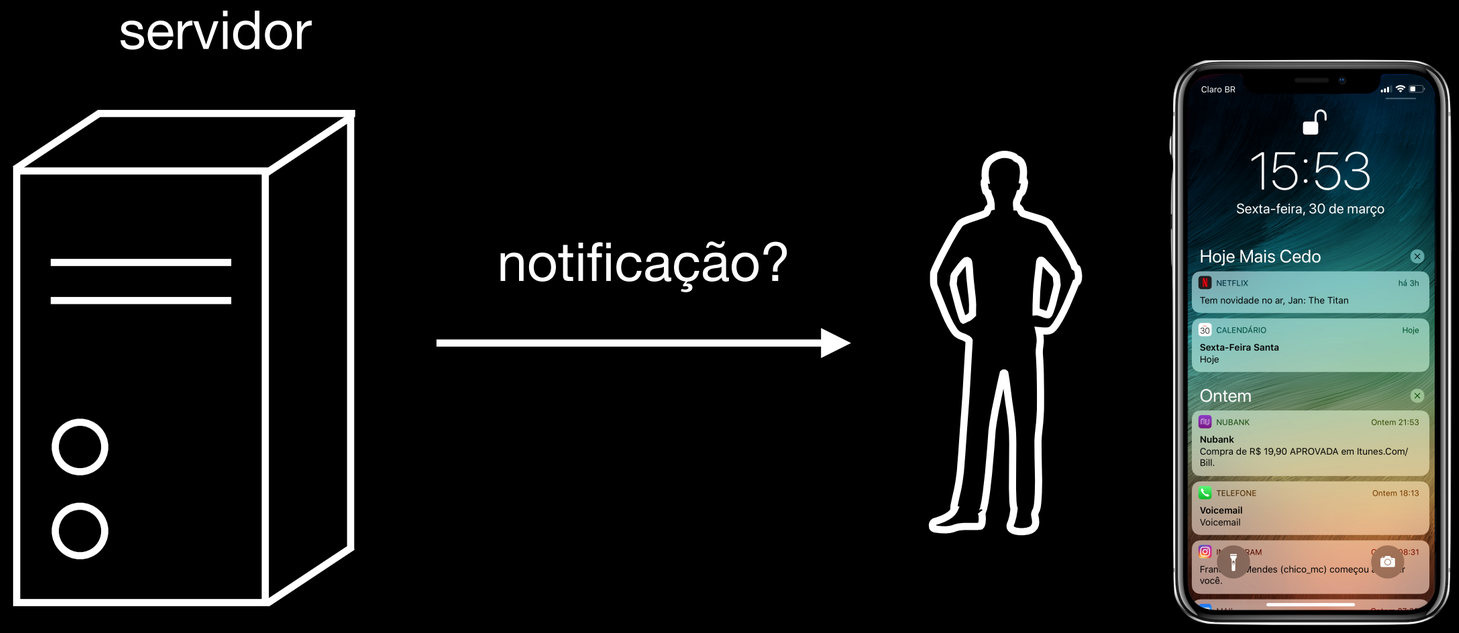
WINDOWS e MAC

```
system("ffmpeg -y -i audio.wav audio.mp3")
system("ffmpeg -y -i audio.wav -acodec libopus audio.ogg")
```

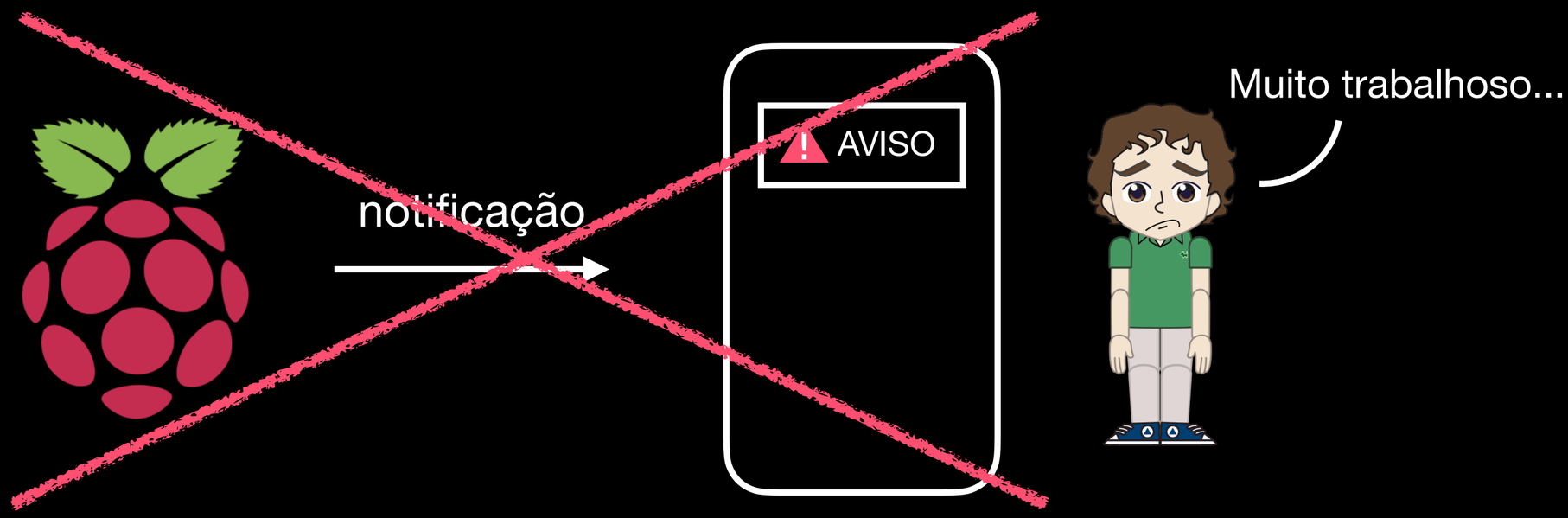
Comandos Alternativos para Conversão para MP3 ou OGG

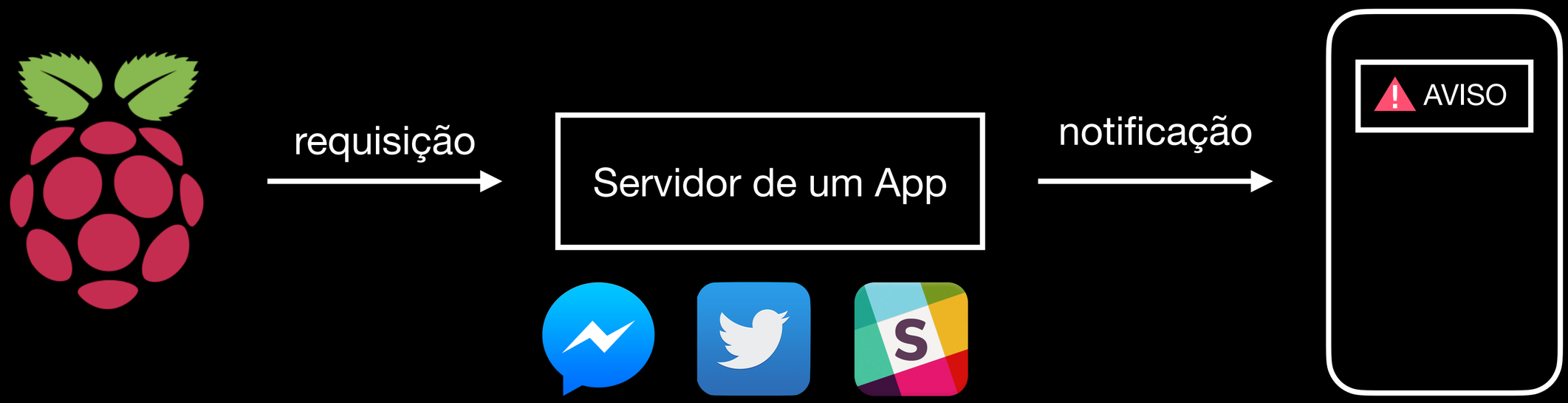
Software



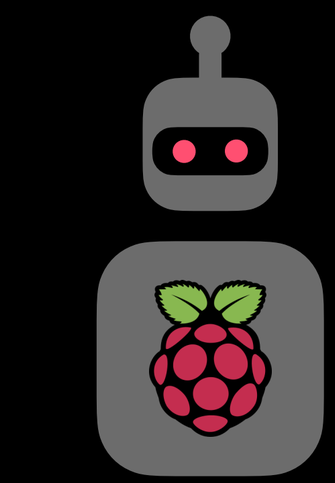


Requisição x Notificação





Notificações com um Servidor Intermediário



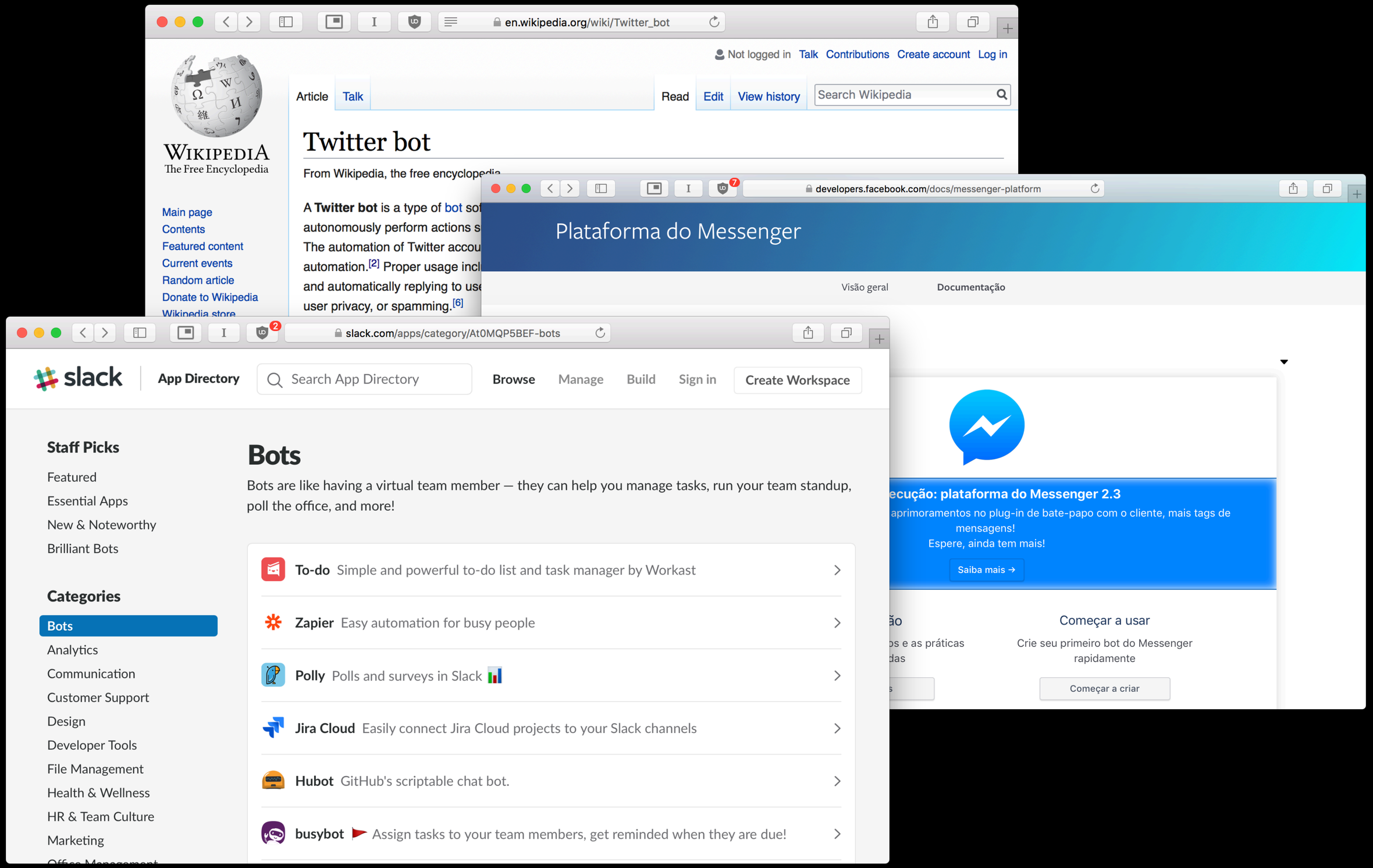
bot

requisição

Servidor de um App

objetivo do Projeto 04

Notificações via Bots



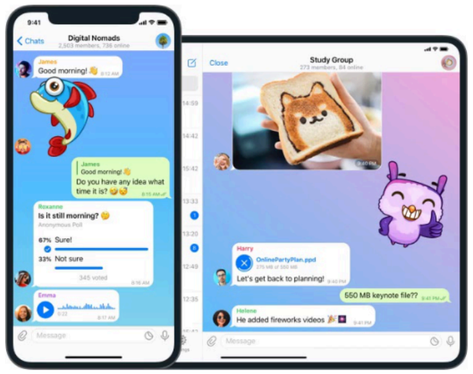
Exemplos de Comunicação entre Bots e Apps

Telegram

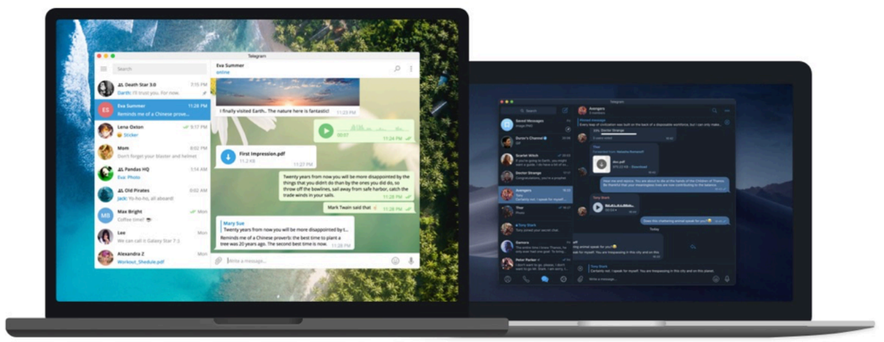
telegram.org

Telegram Messenger

Telegram para **Android**



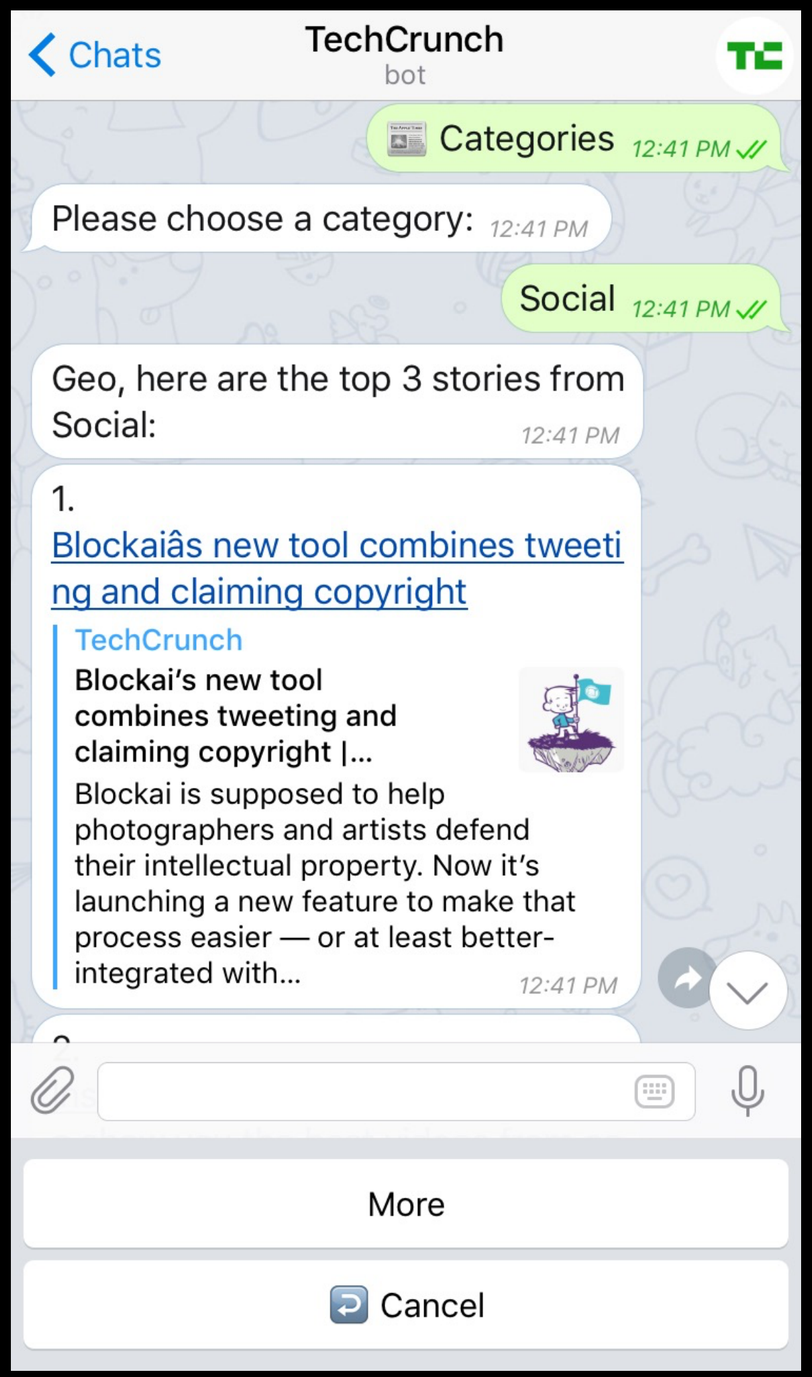
Telegram para **iPhone** / **iPad**

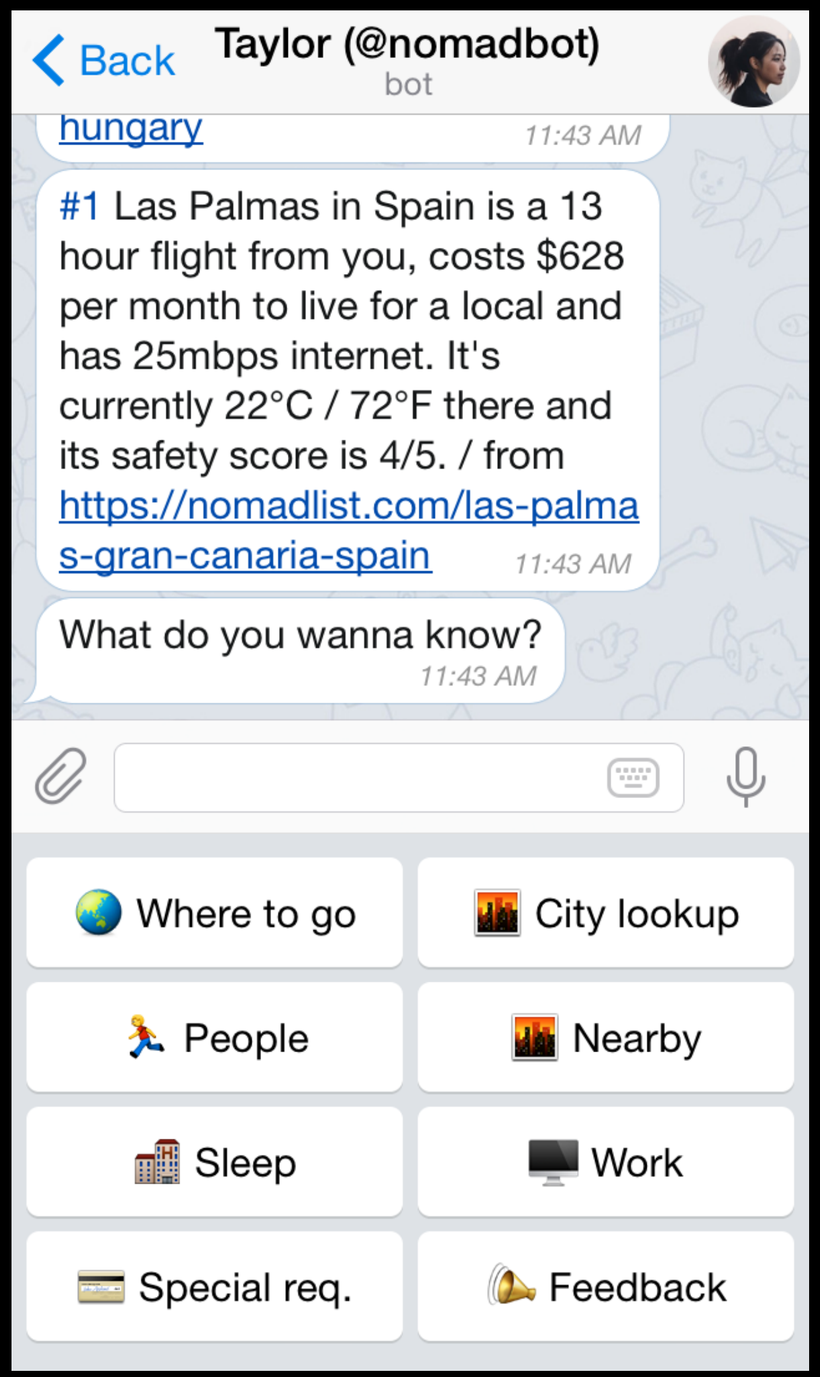


Telegram para **PC/Mac/Linux**

Telegram para **macOS**

Plataformas do Telegram



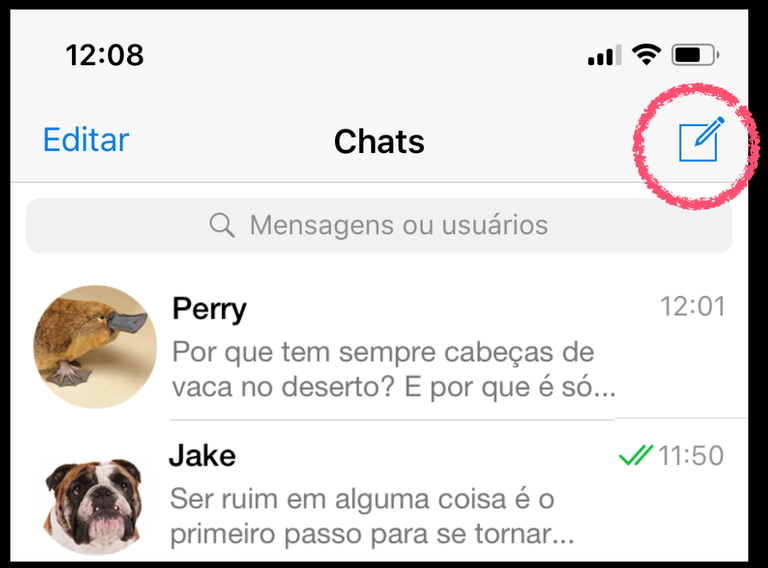


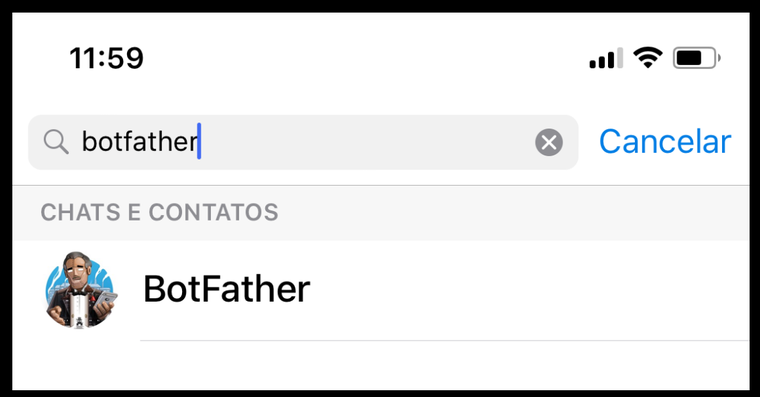
Exemplos de Conversas com Bots

BotFather is the one bot to rule them all.
Use it to create new bot accounts and manage your existing bots.

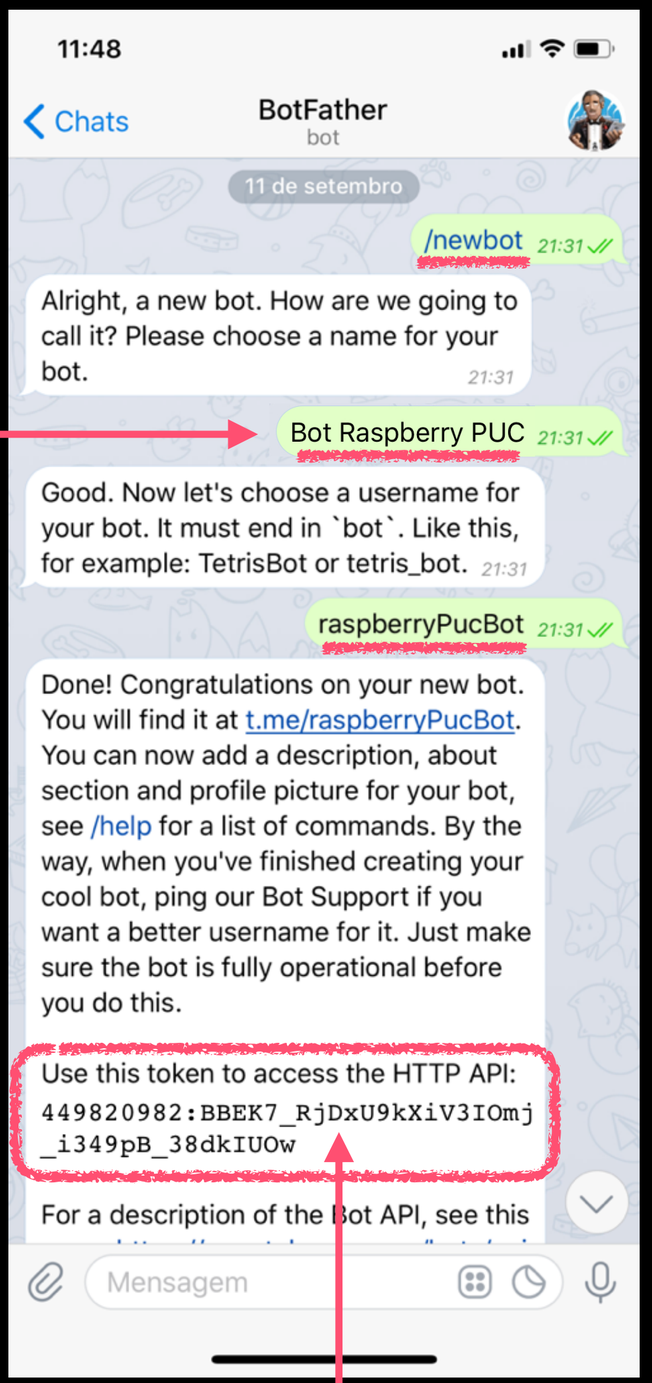
Criação de Bots no Telegram via BotFather

1





invente um nome seu!

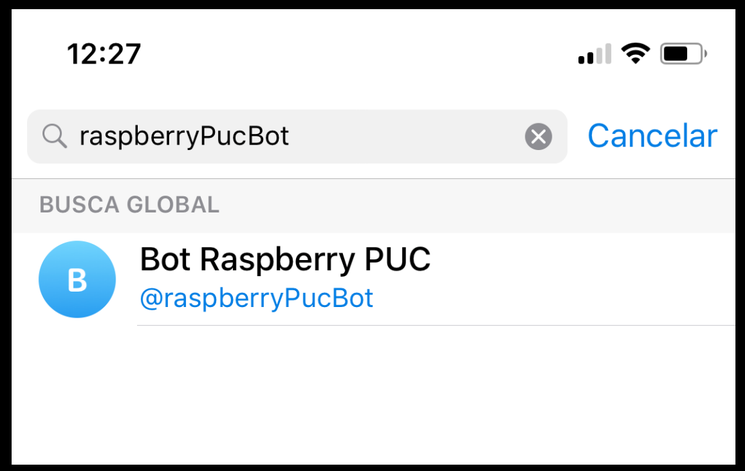


anote esta CHAVE!

Passo 1: Crie o Bot via BotFather e Anote a Chave

2

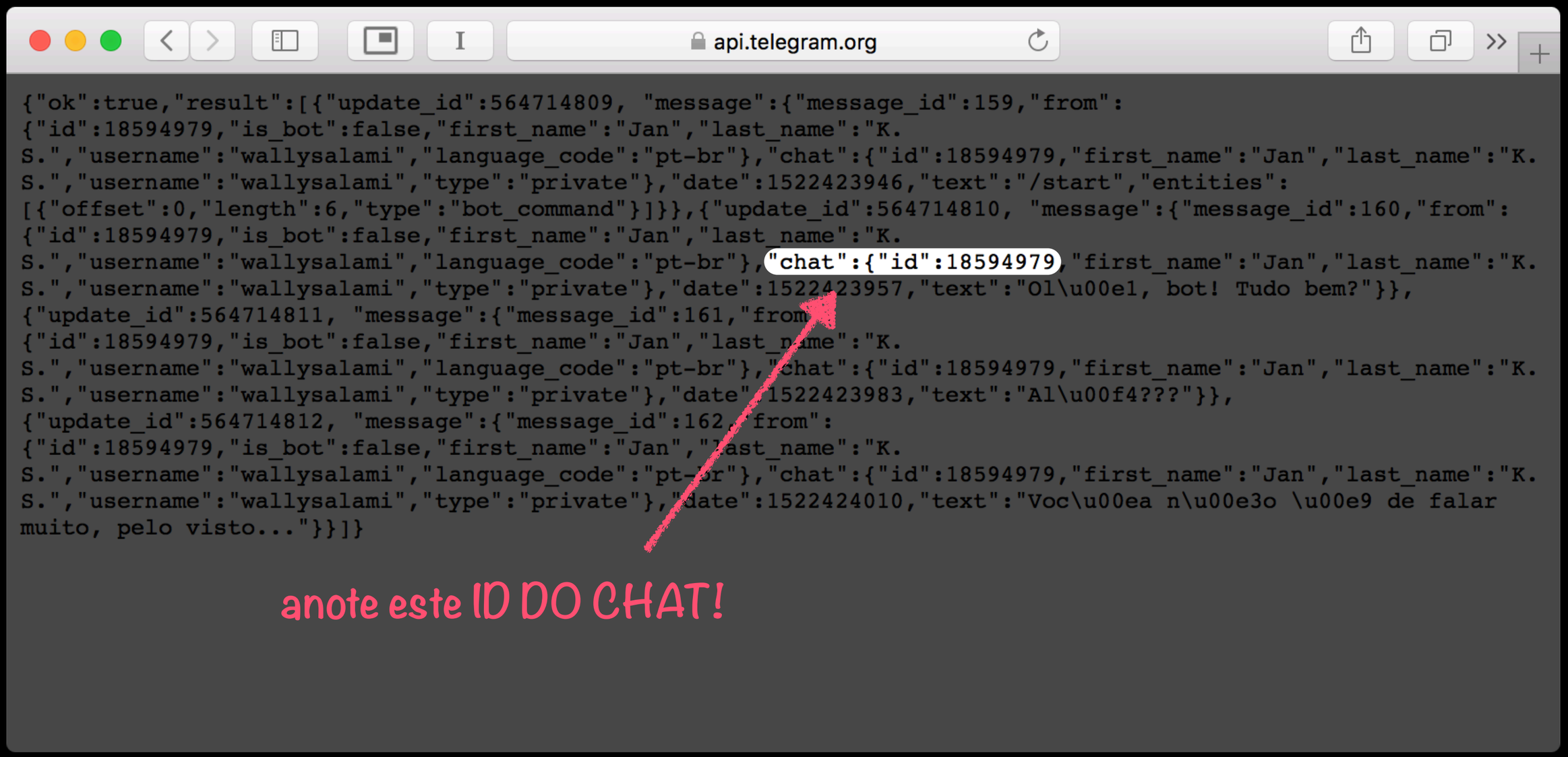
pesquise o nome
do SEU bot!



Passo 2: Converse com o Seu Bot

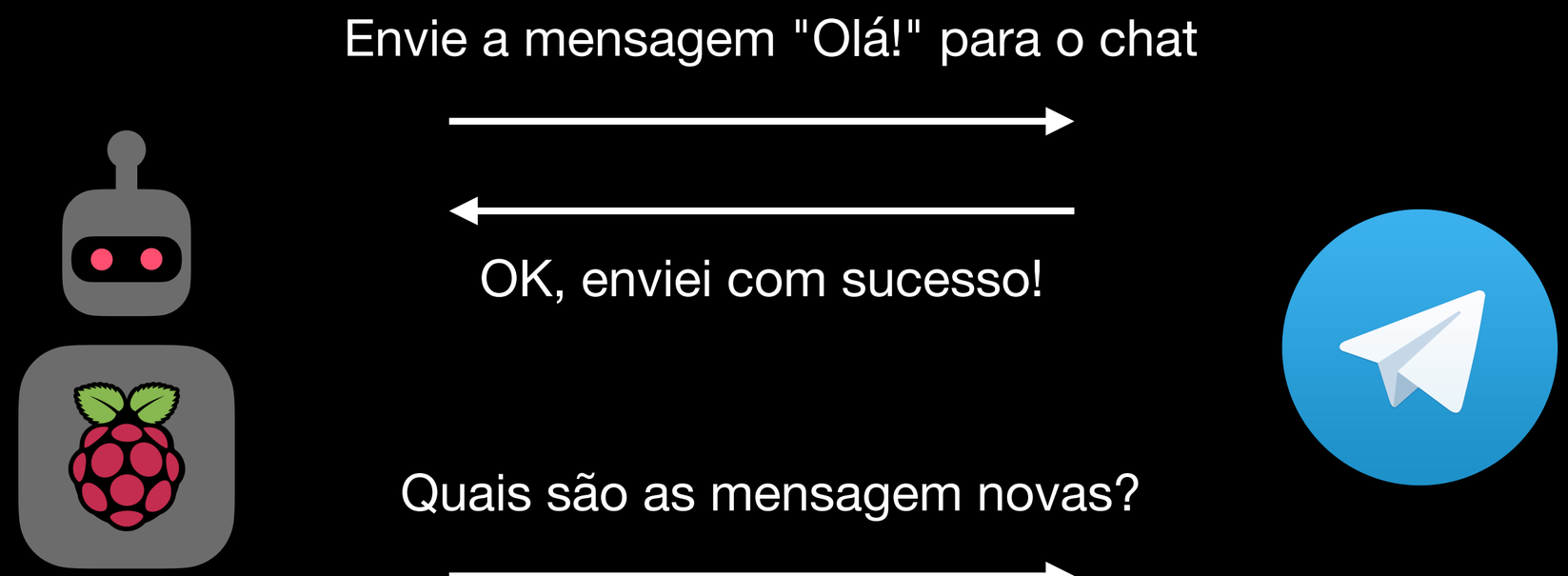
3

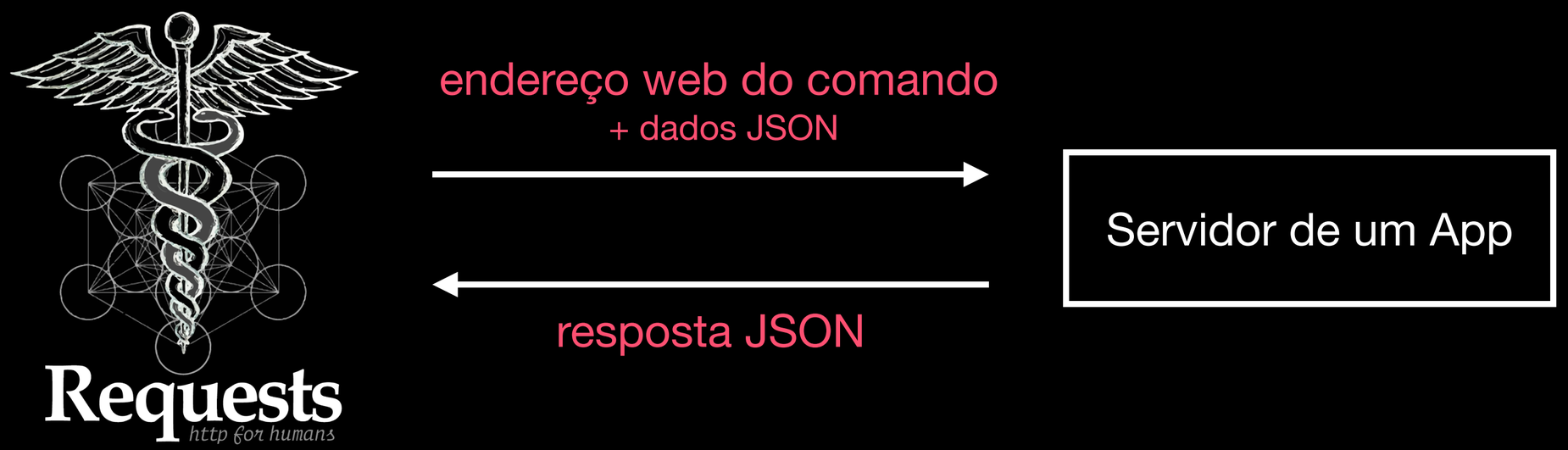
api.telegram.org/botSUA_CHAVE_SECRETA/getUpdates



Passo 3: Obtenha o Id do Seu Chat com o Bot

Biblioteca para Requisições HTTP





Requisição Web a um Servidor

`https://api.telegram.org/botSUA_CHAVE_SECRETA/<COMANDO>`

+

`dados extras`

Ação	Comando	Dados Extras
Enviar Texto	`sendMessage`	id do chat + texto
Enviar Foto	`sendPhoto`	id do chat + arquivo
Enviar Áudio	`sendVoice`	id do chat + arquivo
Receber Mensagens	`getUpdates`	id da atualização
Obter Link do Arquivo	`getFile`	id do arquivo
Dados do Bot	`getMe`	(nenhum)

...

Exemplos de Comandos para Bots do Telegram

```
>>> chave = "COLOQUE A SUA CHAVE DO BOTFATHER AQUI!"
>>> id_da_conversa = "COLOQUE O ID DA SUA CONVERSA AQUI!"
>>> endereco_base = "https://api.telegram.org/bot" + chave
```

Atenção ao "s"!

```
>>> from requests import post
>>> endereco = endereco_base + "/sendMessage"
>>> dados = {"chat_id": id_da_conversa, "text": "Oi!"}
>>> resposta = post(endereco, json=dados)

>>> resposta.text
'{"ok":true,"result":{"message_id":291,"from":
{"id":449820982,"is_bot":true,"first_name":"Bot Raspberry
PUC","username":"raspberryPucBot"},"chat":
{"id":18594979,"first_name":"Jan","last_name":"K.
S.","username":"wallysalami","type":"private"},"date":153
5815441,"text":"Oi!"}}'
```

Chamada POST para Envio de Mensagens de Texto

Mensagem Enviada pelo Bot na Conversa

```
>>> from requests import post
>>> endereco = endereco_base + "/sendPhoto"
>>> dados = {"chat_id": id_da_conversa}
>>> arquivo = {"photo": open("foto.jpg", "rb")}
>>> resposta = post(endereco, data=dados, files=arquivo)
```

Envio de Fotos

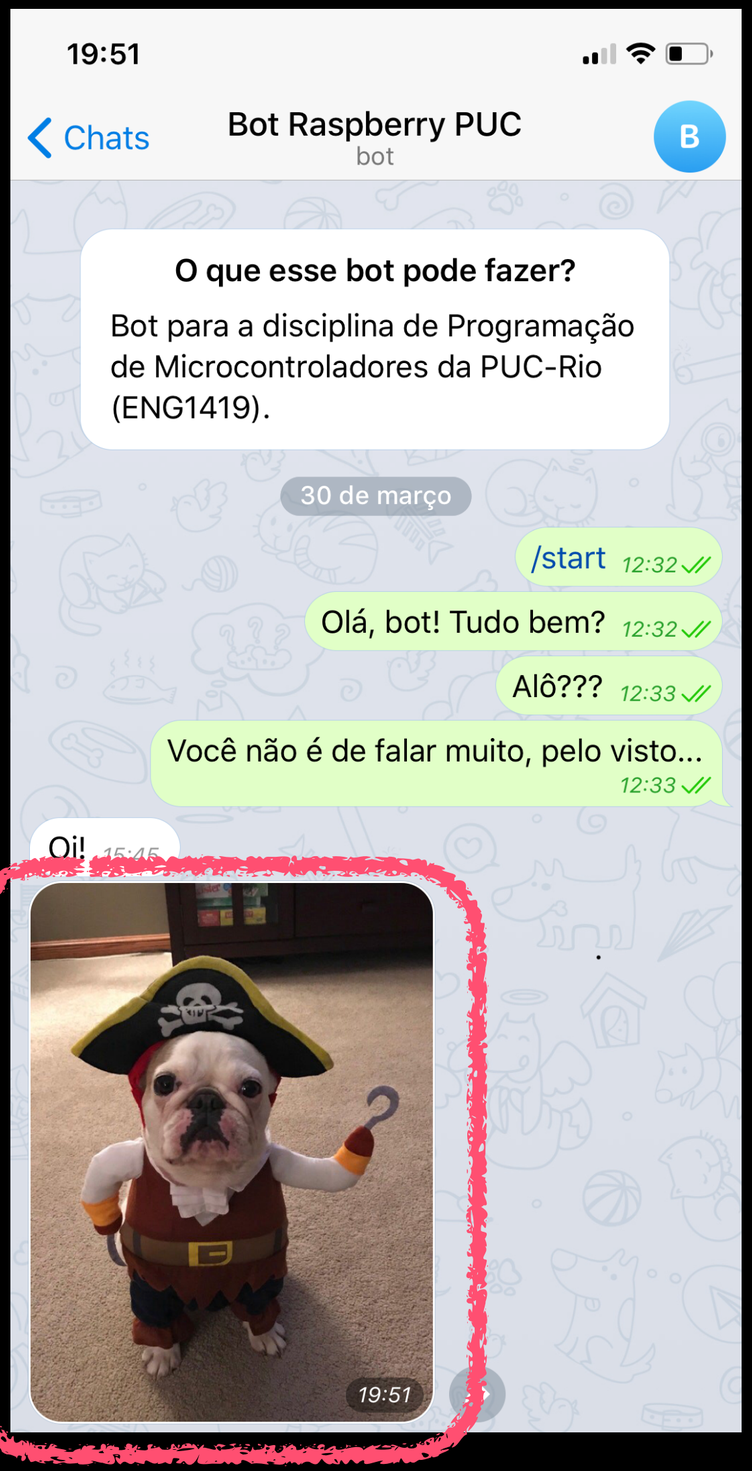


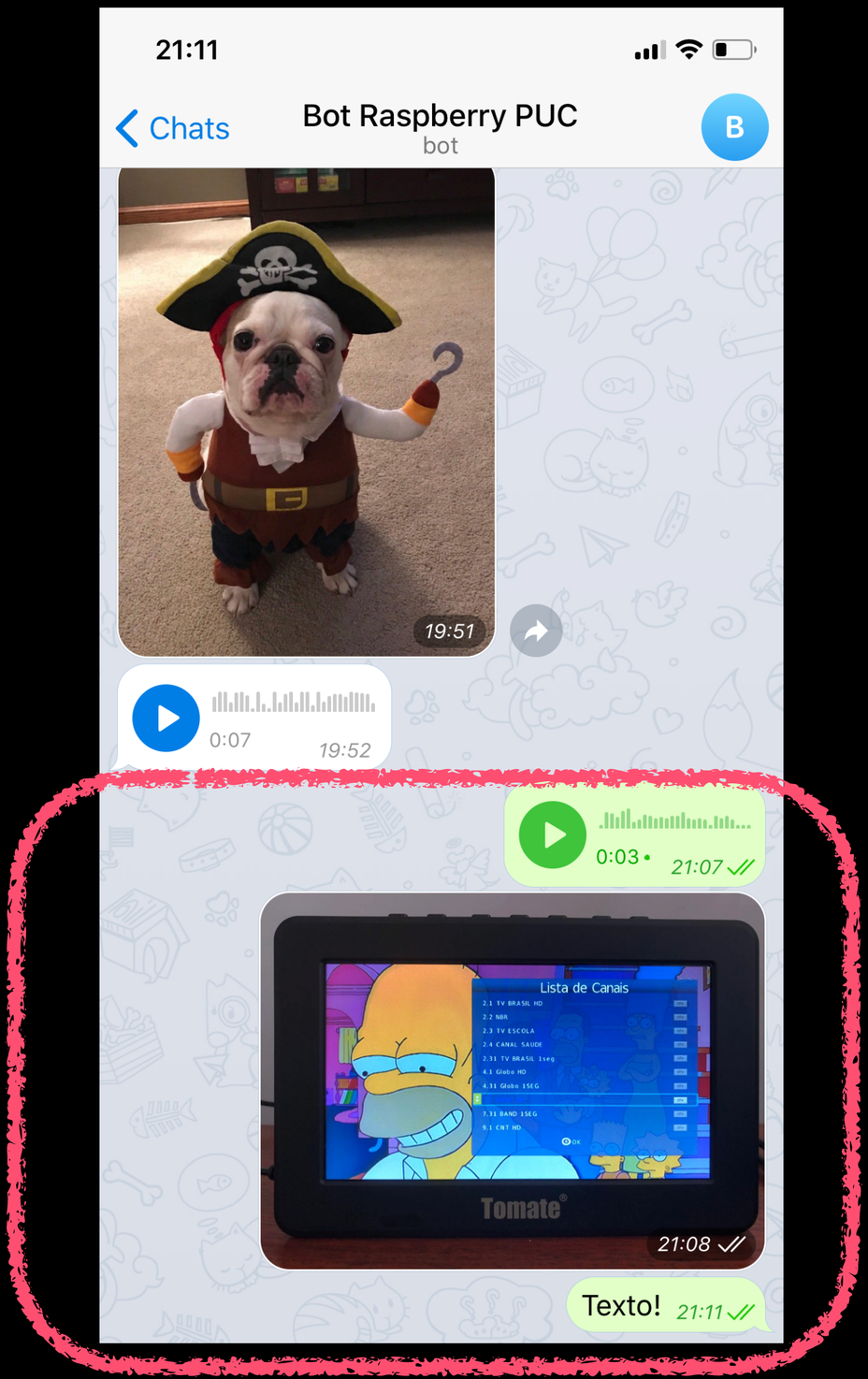
Foto Enviada pelo Bot na Conversa

Use sempre o formato OGG para enviar áudio via Telegram.

```
>>> from requests import post
>>> endereco = endereco_base + "/sendVoice"
>>> dados = {"chat_id": id_da_conversa}
>>> arquivo = {"voice": open("audio.ogg", "rb")}
>>> resposta = post(endereco, data=dados, files=arquivo)
```

Envio de Áudio

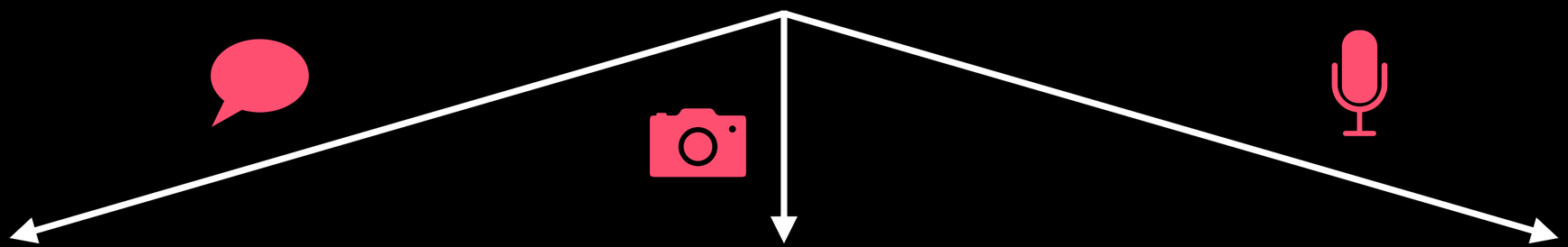
Áudio Enviado pelo Bot na Conversa



Recebimento de Outros Tipos de Mensagens

busca novas mensagens
(a partir de um certo update_id)

para cada nova mensagem:
verifica o tipo



analisa o texto

baixa a imagem

baixa o áudio

anota o último update_id

Algoritmo para Busca Contínua de Novas Mensagens

/getUpdates →


```
{
   "ok":true,
   "result":[
      {
         "update_id":564714813,
         "message":{
            "voice":{
               "file_id":"AwADAQADJAADQzTwRQGVIkswNsWHAg",
               ...
            },
            ...
         }
      },
      {
         "update_id":564714814,
         "message":{
            "photo":[
               {
                  "file_id":"AgADAQAD1qcxGxFkkC7VB-drDDA",
                  "file_size":1438,
                  ...
               },
               ...
            ]
         }
      },
      {
         "update_id":564714815,
         "message":{
            "text":"Texto!",
            ...
         }
      }
   ]
}
```


Dicionário (JSON) com as Atualizações de Mensagens

{json}

KEEP CALM AND PERCORRE O JSON

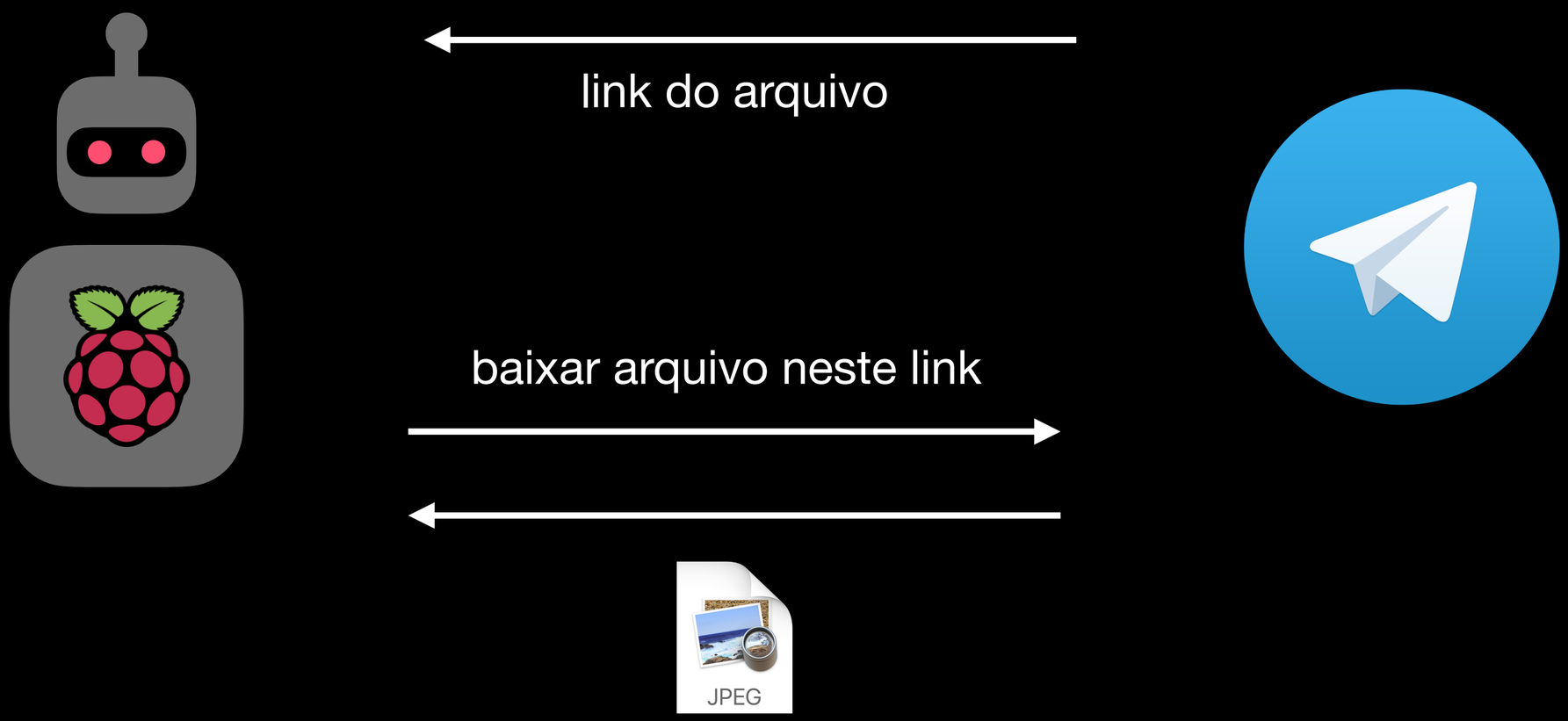
```
>>> proximo_id_de_update = 0

>>> while True:
...     endereco = endereco_base + "/getUpdates"
...     dados = {"offset": proximo_id_de_update}
...     resposta = get(endereco, json=dados)
...     dicionario_da_resposta = resposta.json()

...     for resultado in dicionario_da_resposta["result"]:
...         mensagem = resultado["message"]
...         if "text" in mensagem:
...             texto = mensagem["text"]
...         elif "voice" in mensagem:
...             id_do_arquivo = mensagem["voice"]["file_id"]
...             # depois baixa o arquivo e faz algo com ele...
...         elif "photo" in mensagem:
...             foto_mais_resolucao = mensagem["photo"][-1]
...             id_do_arquivo = foto_mais_resolucao["file_id"]
...             # depois baixa o arquivo e faz algo com ele...

...         proximo_id_de_update = resultado["update_id"] + 1

...     sleep(1)
```

Código para Busca Contínua de Novas Mensagens

id_do_arquivo

download?

Download de um Arquivo pelo Id



Download de um Arquivo pelo Id

```
>>> % depois de pegar o id_do_arquivo na getUpdate...
>>> endereco = endereco_base + "/getFile"
>>> dados = {"file_id": id_do_arquivo}
>>> resposta = get(endereco, json=dados)
>>> dicionario = resposta.json()
>>> final_do_link = dicionario["result"]["file_path"]
>>> final_do_link
'photos/file_117.jpg'
>>> link_do_arquivo = "https://api.telegram.org/file/bot" +
chave + "/" + final_do_link


>>> from urllib.request import urlretrieve
>>> arquivo_de_destino = "meu_arquivo.jpg"
>>> urlretrieve(link_do_arquivo, arquivo_de_destino)
```

Download de um Arquivo de Chat

Muita coisa...

Receitas para Telegram do Chef Jan K. S.

Download do Telegram

Resumo da Opera

Funcionalidade	Comandos
Capturar Foto fswebcam	`from os import system` `system("fswebcam --resolution 640x480 --skip 10 foto.jpg")`

Capturar Áudio
arecord
	`from os import system • from subprocess import Popen`
	`system("arecord --duration 3 --format cd audio.wav")`
	`comando = ["arecord", "--duration", "30", "audio.wav"]`
	`aplicativo = Popen(comando) • aplicativo.terminate()`

Conversão lame / opusenc	`from os import system • system("lame audio.wav audio.mp3")` `system("opusenc audio.wav audio.ogg")`

Telegram
acessar documentação
	`from requests import post, get`
	`base = "https://api.telegram.org/bot" + chave`
	`endereco = base + "/sendMessage"`
	`dados = {"chat_id": id_da_conversa, "text": "Olá!"}`
	`resposta = post(endereco, json=dados)`
	`print(resposta.text) • dicionario = resposta.json()`
	`endereco = base + "/sendPhoto" • endereco = base + "/sendVoice"`
	`arquivo = {"photo": open("foto.jpg", "rb")}`
	`resposta = post(endereco, data=data, files=arquivo)`
	`dados = {"offset": proximo_id_de_update}`
	`resposta = get(base + "/getUpdates", json=dados)`
	`from urllib.request import urlretrieve`
	`resposta = get(base + "/getFile", json= {"file_id": id})`
	`final_do_endereco = resposta.json()["result"]["file_path"]`
	`urlretrieve(endereco_do_arquivo, nome_do_arquivo_baixado)`

Resumo para o Projeto 04

Funcionalidade	Comandos

Datas e Horários
acessar documentação
	`from datetime import datetime, timedelta`
	`tempo = datetime(2018, 3, 28, 15, 35, 12) • datetime.now()`
	`intervalo = timedelta(months=4) • intervalo.total_seconds()`
	`tempo2 = tempo1 + intervalo • intervalo = tempo2 - tempo1`
	`tempo2 > tempo1 • texto = tempo.strftime("%d/%m/%Y %H:%M")`

Campainha
acessar documentação
	`from gpiozero import Buzzer • buzzer = Buzzer(16)`
	`buzzer.on() • buzzer.off() • buzzer.toggle()`
	`buzzer.is_active • buzzer.beep()`
	`buzzer.beep(n=4, on_time=0.5, off_time=2)`

Sensor de Distância
acessar documentação
	`from gpiozero import DistanceSensor`
	`sensor = DistanceSensor(trigger=17, echo=18)`
	`sensor.distance • sensor.threshold_distance`
	`s.when_in_range = funcao • s.when_out_of_range = funcao`

MongoDB
acessar documentação
	`from pymongo import MongoClient, ASCENDING, DESCENDING`
	`cliente = MongoClient("localhost", 27017)`
	`banco = cliente["nome"] • colecao = banco["nome"]`
	`dados = {"nome": "Jan K. S.", "idade": 32}`
	`colecao.insert(dados) • colecao.insert([dados1, dados2])`
	`busca = {"chave1": valor1, "chave2": {"$gt": valor2}}`
	`ordenacao = [ ["idade", DESCENDING] ]`
	`documento = colecao.find_one(busca, sort=ordenacao)`
	`documentos = list( colecao.find(busca, sort=ordenacao) )`

Resumo para o Projeto 03

Funcionalidade	Comandos
Envio de Infravermelho	`from py_irsend.irsend import send_once` `send_once("nome do controle", ["KEY_1", "KEY_2"])`

Recebimento de Infravermelho	`from lirc import init, nextcode • init("aula", blocking=False)`
	`while True:`
	`lista_com_codigo = nextcode()`
	`if lista_com_codigo != []:`
	`codigo = lista_com_codigo[0]`

Servidor Flask
acessar documentação
	`from flask import Flask`
	`app = Flask(__name__)`
	
	`@app.route("/")`
	`def mostrar_inicio():`
	`return "Bem-vindo!"`
	
	`@app.route("/contato")`
	`def mostrar_contato():`
	`return "janks@puc-rio.br"`
	
	`@app.route("/numero/<int:x>")`
	`def mostrar_numero(x):`
	`return "x = " + str(x)`
	
	`return redirect("/outrapagina")`
	
	`return render_template("index.html")`
	
	`app.run(port=5000, debug=False)`

HTML	`<p>Parágrafo</p>`
	`<img src="site.com/imagem">`
	`<a href="/pagina">Link</a>`
	
	`<ul>`
	`<li>Item 1 da Lista</li>`
	`<li>Item 2 da Lista</li>`
	`</ul>`

Ngrok	abrir Terminal → `ngrok http 5000`

Resumo para o Projeto 02

Funcionalidade	Comandos

LED
acessar documentação
	`from gpiozero import LED • led = LED(21)`
	`led.on() • led.off() • led.toggle() • led.is_lit`
	`led.blink() • led.blink(n=4, on_time=0.5, off_time=2)`

Botão
acessar documentação
	`from gpiozero import Button`
	`botao = Button(11)`
	`botao.is_pressed`
	`botao.when_pressed = funcao`
	`botao.when_released = funcao`
	`botao.when_held = funcao`

LCD
acessar documentação
	`from Adafruit_CharLCD import Adafruit_CharLCD`
	`lcd = Adafruit_CharLCD(2, 3, 4, 5, 6, 7, 16, 2)`
	`lcd.clear()`
	`lcd.message("Texto 1\nTexto 2")`

MPlayer	`from mplayer import Player • player = Player()`
	`player.loadfile("Musica.mp3") • player.loadlist("lista.txt")`
	`player.pause() • player.paused • player.quit()`
	`player.time_pos = 2 • player.length • player.pt_step(-1)`
	`player.metadata["Title"] • player.metadata["Artist"]`
	`player.volume = 70 • player.speed = 2`

Resumo para o Projeto 01

Funcionalidade	Comandos
Funções	`x = input("Digite um número: ")` • `print("Resultado: ", x)` `from time import sleep` • `sleep(0.5)`

Listas
acessar documentação
	`lista = [1, 2, 3]` • `lista2 = ["texto", [0, 0], 5]`
	`lista[0]` • `lista[1:3]` • `total_de_elementos = len(lista)`
	`lista.append(novo_elemento)` • `del lista[indice]`

Dicionários acessar documentação	`dicionario = {"chave 1": 42, "chave 2": [1, 2, 3]}` `dicionario["chave 1"]` • `dicionario["chave 3"] = "Olá!"`

Textos (Strings)
acessar documentação
	`texto = "olá!"` • `texto[0]` • `texto[1:4]` • `len(texto)`
	`texto + str(numero)` • `"x = %.2f, y = %d" % (num1, num2)`
	`2 + int("11")` • `4 / float("23.5")`

Condicionais	`if x == 0 and z < 4:`
	`    y = 4`
	
	`if x not in [1, 2]:`
	`    y = 4`
	`else:`
	`    y = 0`
	
	`if x != 0:`
	`    y = 4`
	`elif x >= 0:`
	`    y = 3`
	`else:`
	`    y = 0`

Repetições	`for elem in lista:`
	`    ...`
	
	`for i in range(1, 4):`
	`    ...`
	
	`while x > 1:`
	`    ...`

Criação de Funções e Variáveis Globais	`def funcao1(x):`
	`    return x + 2`
	
	`def funcao2(x, y, z):`
	`    ...`
	
	`global x`
	`x = 2`