

Projeto 02

Controle Remoto – Teoria

Jan K. S. – janks@puc-rio.br

ENG 1419 – Programação de Microcontroladores

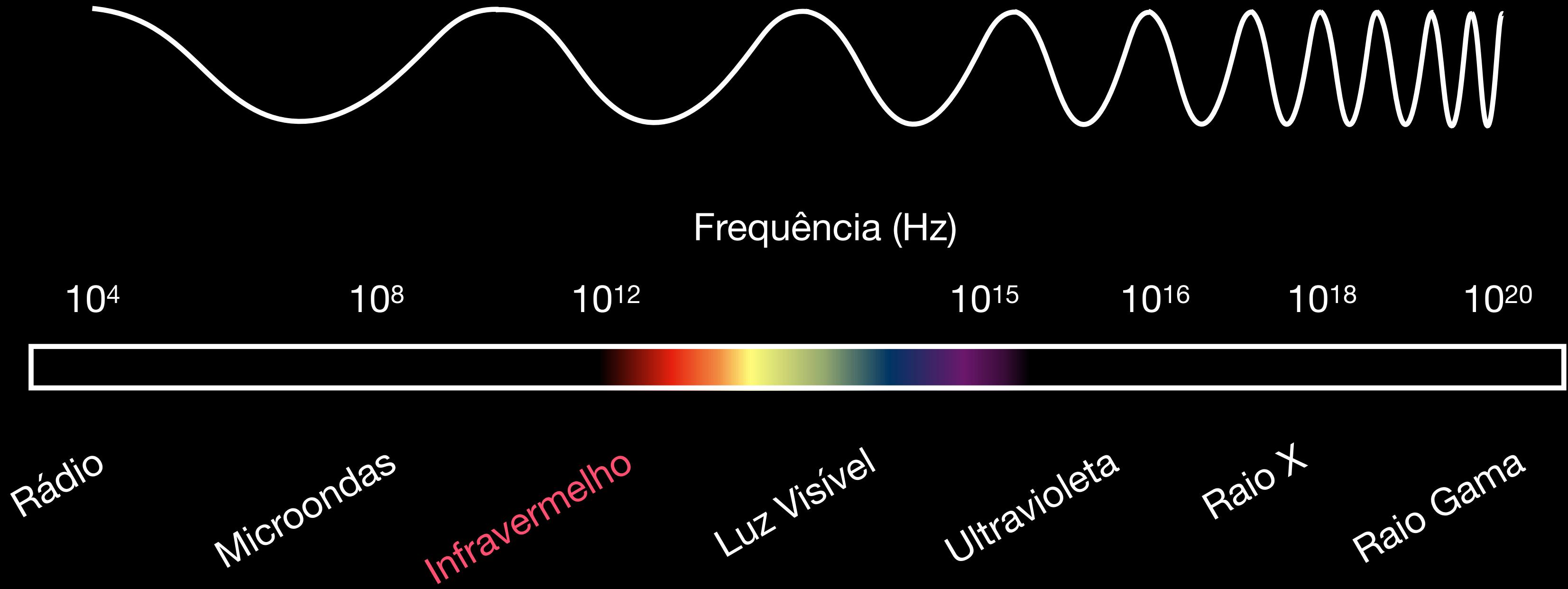
Hardware



Controle Remoto Infravermelho



Exemplos de Dispositivos com Controle Remoto Infravermelho

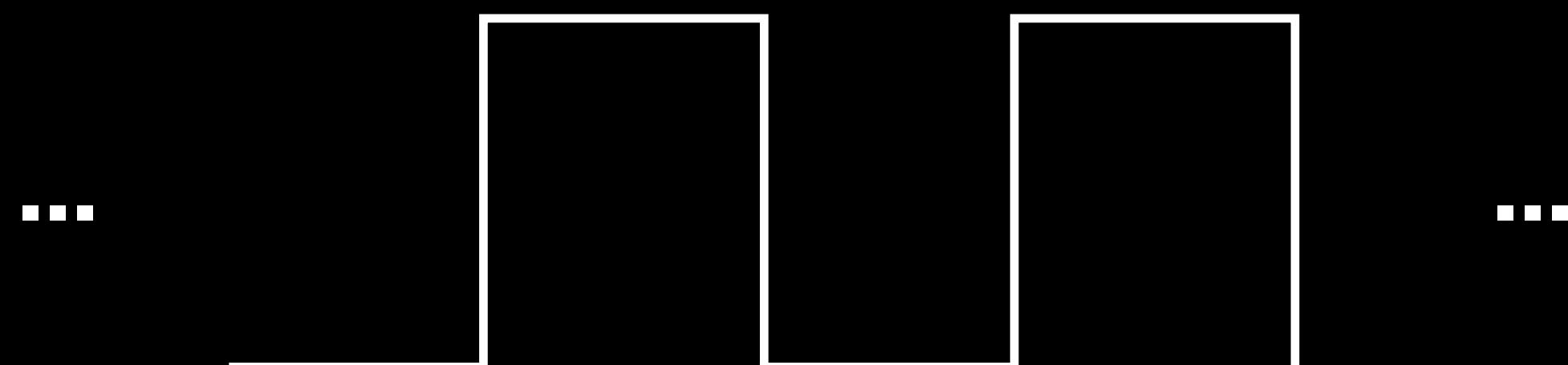
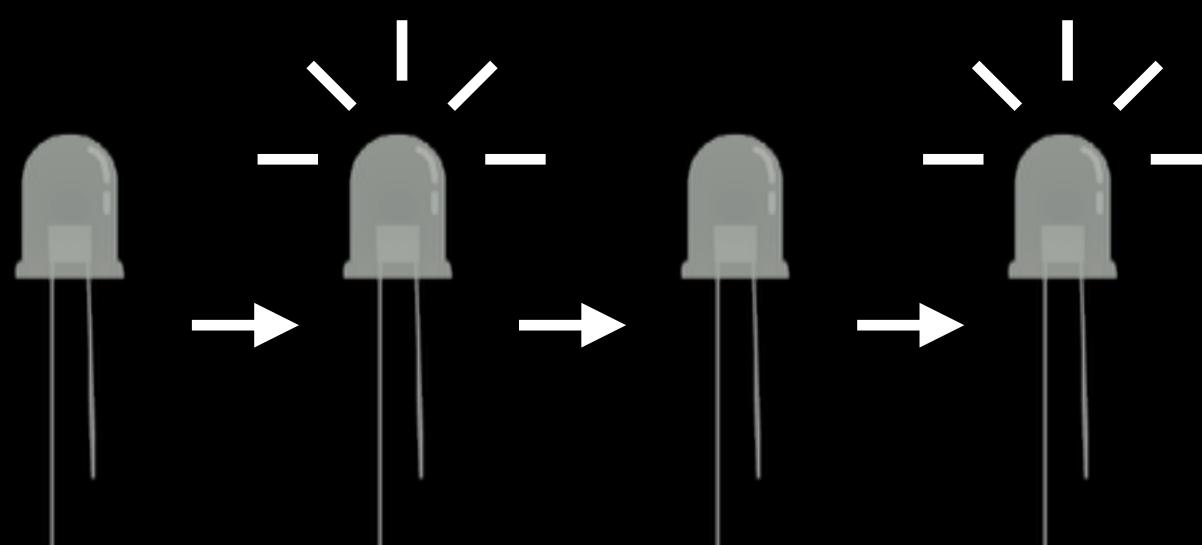
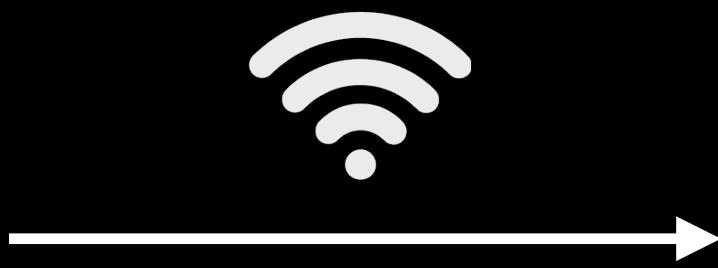
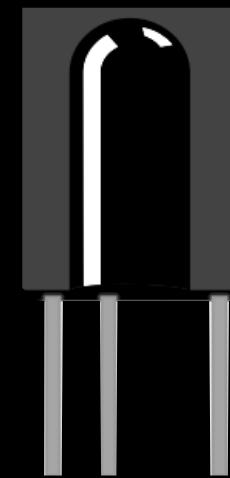


Diferentes Tipos de Onda Eletromagnética

LED Emissor Infravermelho



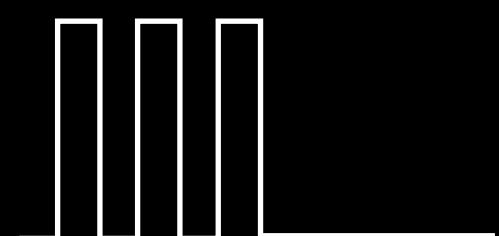
Receptor Infravermelho



Sinal Recebido ao Piscar o LED

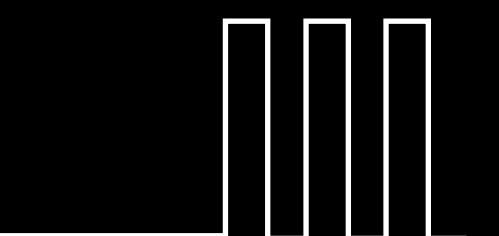
Transmissão de Comandos por Infravermelho

Bit 1

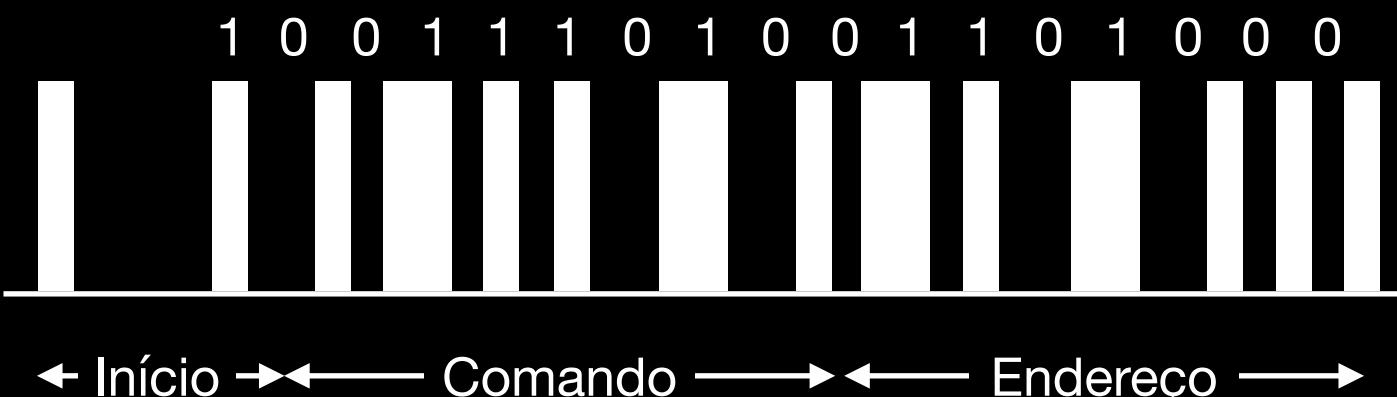


Nokia

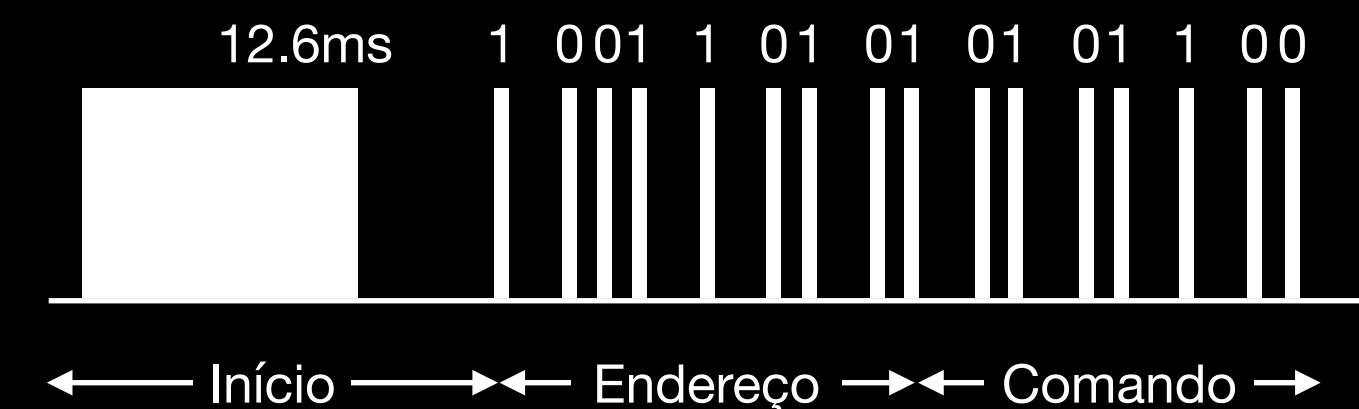
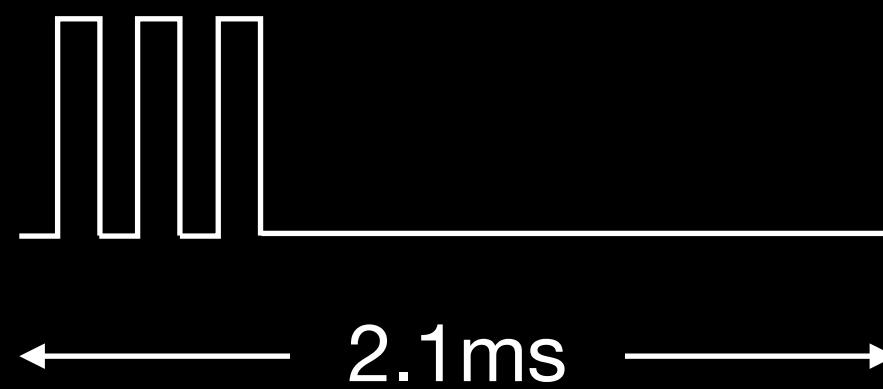
Bit 0



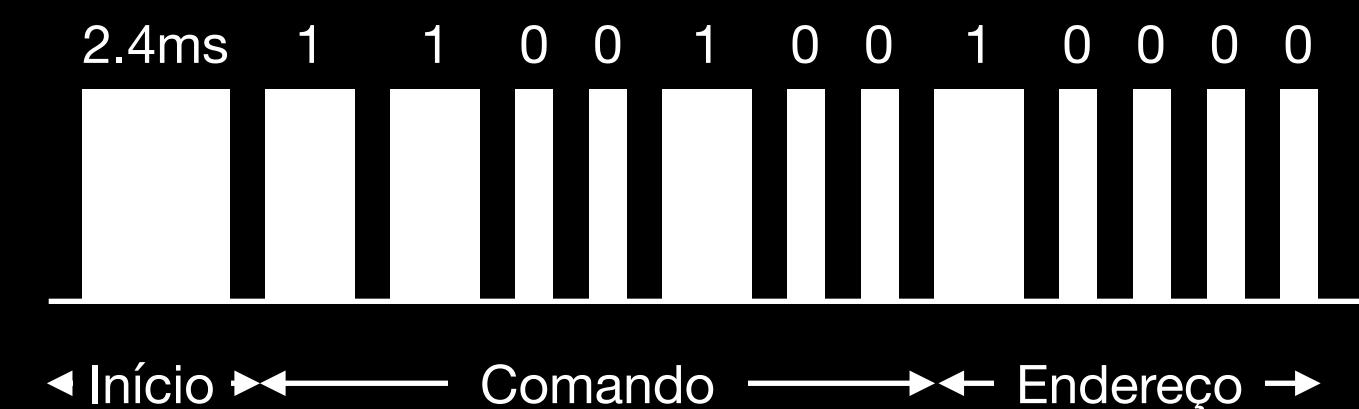
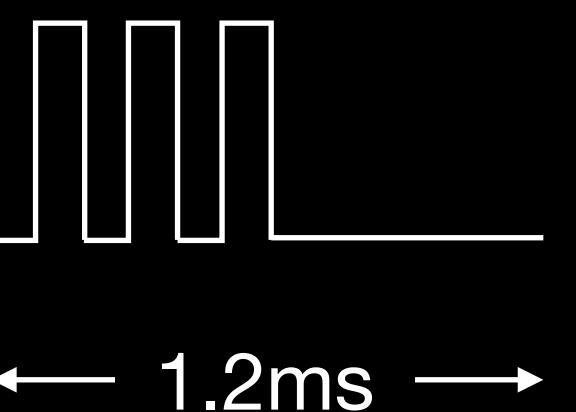
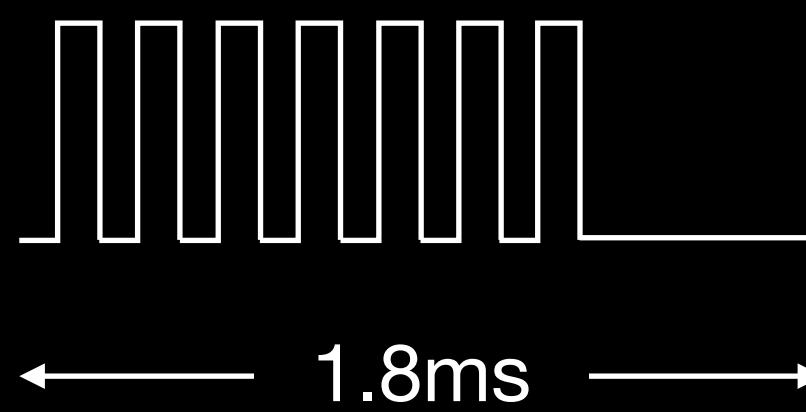
Padrão de Comandos



JVC



Sony



...

Diferentes Tipos de Codificação

Por que não escolheram
um padrão só?





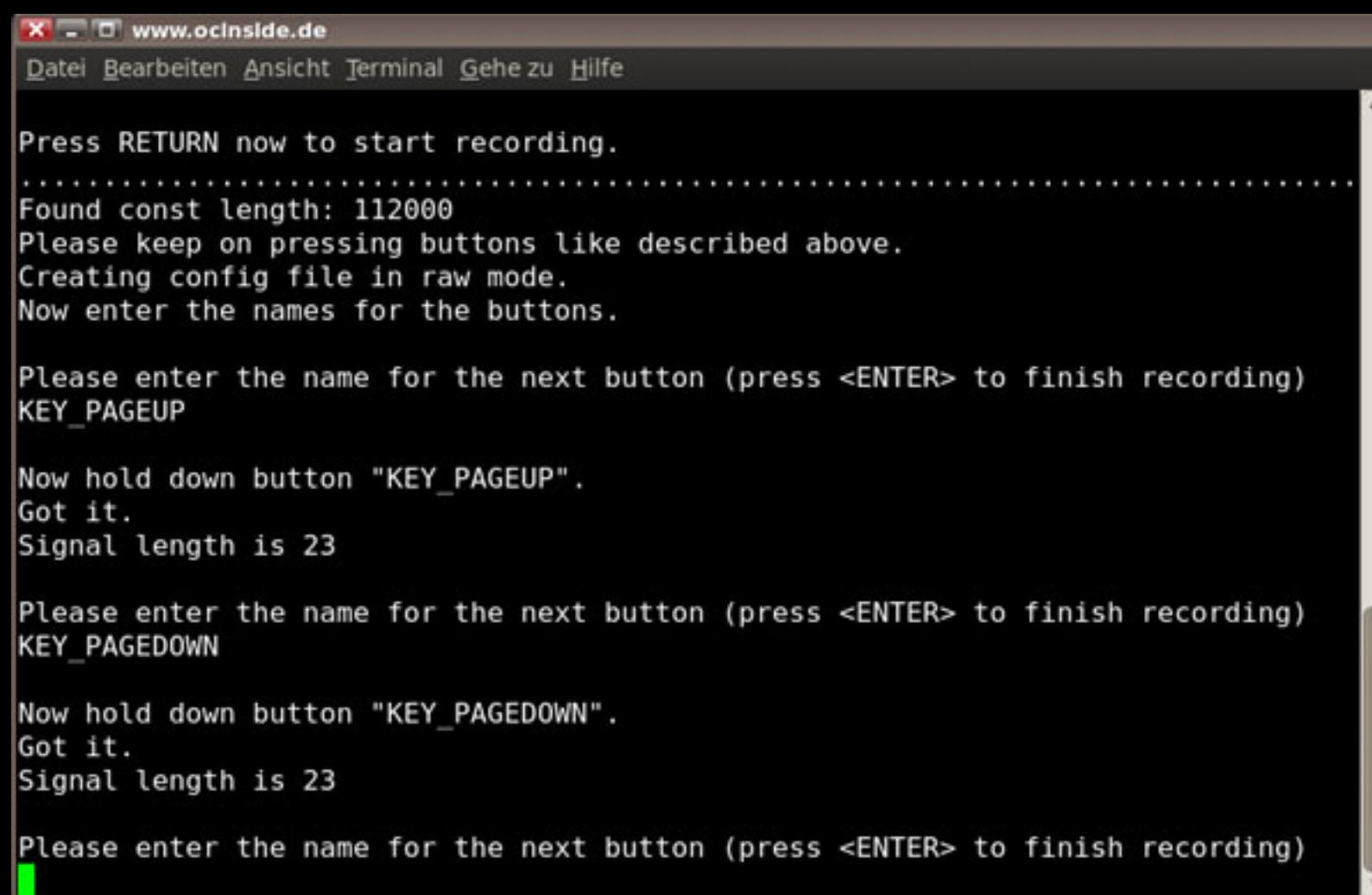
Linux Infrared Remote Control

Software para Emissão e Transmissão de Infravermelho no Linux

irsend: envio de sinais

```
root@raspberrypi:/etc/lirc#
root@raspberrypi:/etc/lirc# irsend LIST lircd.conf """
irsend: 0000000080bf3bc4 KEY_POWER
irsend: 0000000080bfe11e KEY_0
irsend: 0000000080bf49b6 KEY_1
irsend: 0000000080bfc936 KEY_2
irsend: 0000000080bf33cc KEY_3
irsend: 0000000080bf718e KEY_4
irsend: 0000000080bfff10e KEY_5
irsend: 0000000080bf13ec KEY_6
irsend: 0000000080bf51ae KEY_7
irsend: 0000000080bfd12e KEY_8
irsend: 0000000080bf23dc KEY_9
irsend: 0000000080bf738c KEY_OK
irsend: 0000000080bfa35c KEY_EXIT
irsend: 0000000080bf19e6 KEY_MENU
irsend: 0000000080bf5ba4 KEY_EPG
irsend: 0000000080bf41be KEY_BACK
irsend: 0000000080bf39c6 KEY_MUTE
irsend: 0000000080bf8976 KEY_PLAY
irsend: 0000000080bfb14e KEY_STOP
root@raspberrypi:/etc/lirc#
root@raspberrypi:/etc/lirc#
```

irrecord: "aprendizado" sobre um controle



```
www.ocinside.de
Datei Bearbeiten Ansicht Terminal Gehe zu Hilfe
Press RETURN now to start recording.
.....
Found const length: 112000
Please keep on pressing buttons like described above.
Creating config file in raw mode.
Now enter the names for the buttons.

Please enter the name for the next button (press <ENTER> to finish recording)
KEY_PAGEUP

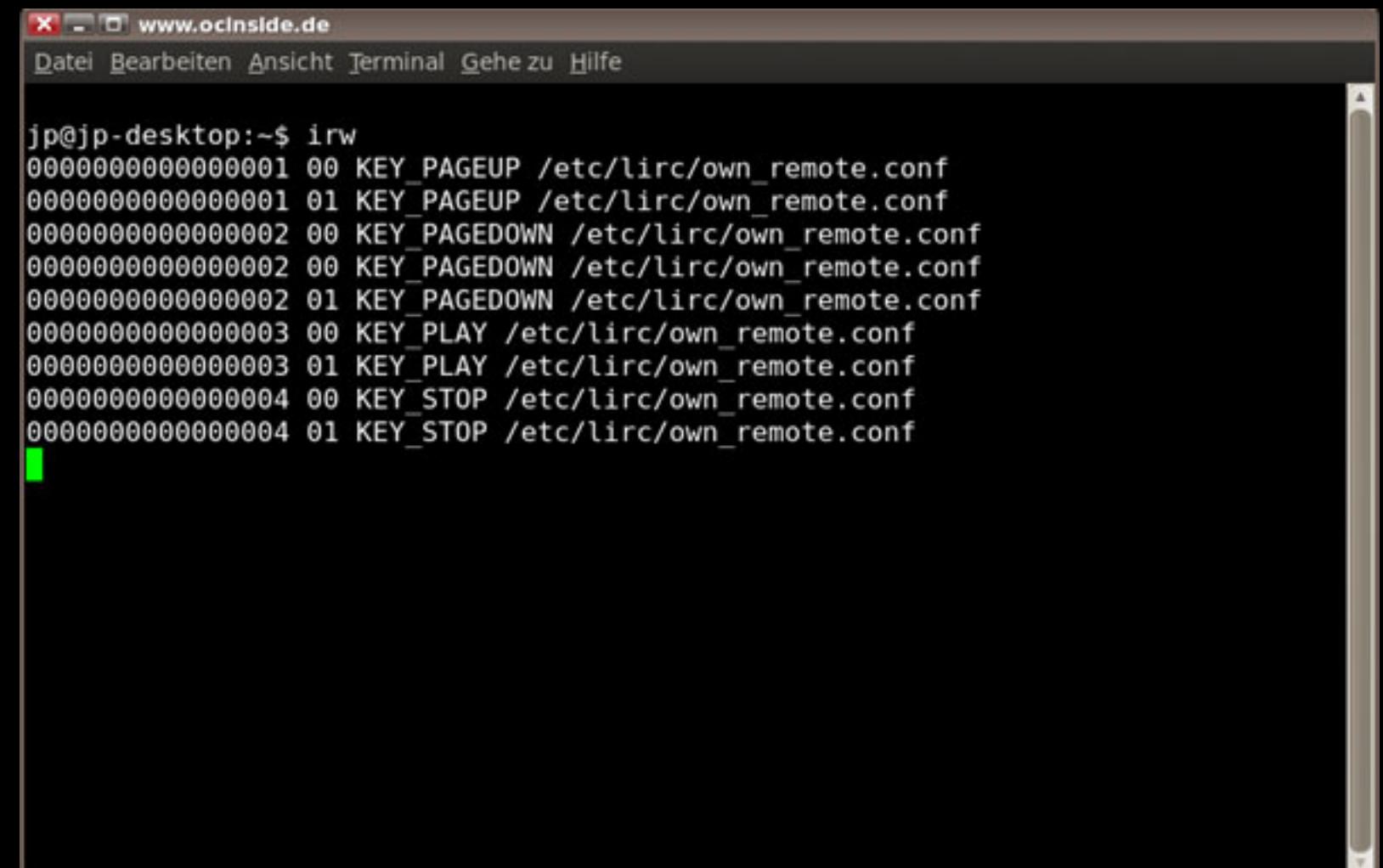
Now hold down button "KEY_PAGEUP".
Got it.
Signal length is 23

Please enter the name for the next button (press <ENTER> to finish recording)
KEY_PAGEDOWN

Now hold down button "KEY_PAGEDOWN".
Got it.
Signal length is 23

Please enter the name for the next button (press <ENTER> to finish recording)
```

irw: monitoramento de teclas pressionadas



```
www.ocinside.de
Datei Bearbeiten Ansicht Terminal Gehe zu Hilfe
jp@jp-desktop:~$ irw
0000000000000001 00 KEY_PAGEUP /etc/lirc/own_remote.conf
0000000000000001 01 KEY_PAGEUP /etc/lirc/own_remote.conf
0000000000000002 00 KEY_PAGEDOWN /etc/lirc/own_remote.conf
0000000000000002 00 KEY_PAGEDOWN /etc/lirc/own_remote.conf
0000000000000002 01 KEY_PAGEDOWN /etc/lirc/own_remote.conf
0000000000000003 00 KEY_PLAY /etc/lirc/own_remote.conf
0000000000000003 01 KEY_PLAY /etc/lirc/own_remote.conf
0000000000000004 00 KEY_STOP /etc/lirc/own_remote.conf
0000000000000004 01 KEY_STOP /etc/lirc/own_remote.conf
```

lircd.conf

```

# /etc/lirc/hardware.conf
#
# Arguments which will be used when launching lircd
LIRCD_ARGS="--uinput"

#Don't start lircmd even if there seems to be a good config file
#START_LIRCMD=false

#Don't start irexec, even if a good config file seems to exist.
#START_IRExec=false

#Try to load appropriate kernel modules
LOAD_MODULES=true

# Run "lircd --driver=help" for a list of supported drivers.
DRIVER="default"
# usually /dev/lirc0 is the correct setting for systems using udev
DEVICE="/dev/lirc0"
MODULES="lirc_rpi"

# Default configuration files for your hardware if any
LIRCD_CONF=""
LIRCMD_CONF=""

```

lircrc

```

begin
button = KEY_1
prog = aula
config = KEY_1
end

begin
button = KEY_2
prog = aula
config = KEY_2
end

begin
button = KEY_3
prog = aula
config = KEY_3
end

begin
button = KEY_4
prog = aula
config = KEY_4
end

```

lirc_options.conf

```

driver = default
device = /dev/lirc0

```

Diversos Arquivos de Configuração do LIRC

The screenshot shows a GitHub repository page for 'ChristopherRogers1991 / python-irsend'. The page includes a navigation bar with icons for file operations, a search bar, and a URL 'GitHub, Inc. github.com/ChristopherRogers1991/python-irsend'. Below the bar are sections for 'Code', 'Issues 0', 'Pull requests 0', 'Projects 0', and 'Pulse'. A 'README.md' file is listed under the code section. The main content area features a large title 'python-irsend' and a description: 'This is a simple wrapper for [lirc's irsend](#)'. A 'Install:' section contains the command 'pip install py_irsend'. A 'Basic Usage:' section shows Python code examples:

```
>>> from py_irsend import irsend
>>> irsend.list_remotes()
['lasko_heater', 'lights.conf', 'dynex_tv', 'logitech_z906', 'sabrent_hdmi_switch']
>>> irsend.list_codes('logitech_z906')
['POWER', 'INPUT', 'MUTE', 'LEVEL', 'EFFECT', 'VOLUME_DOWN', 'VOLUME_UP']
>>> irsend.send_once('logitech_z906', ['POWER'])
```

```
# Lista de nomes de todos os controles remotos  
list_remotes()  
  
# Lista de todos os códigos de tecla de um controle  
list_codes("nome do controle")
```

```
# Envia códigos de tecla de um controle  
send_once("nome do controle", lista_de_teclas)
```



```
>>> from py_irsend.irsend import send_once  
>>> send_once("mini", ["KEY_1", "KEY_2", "KEY_3"] )
```



```
# Também dá para enviar um comando de cada vez,  
# caso o dispositivo demore a processar as teclas
```

```
>>> from time import sleep  
>>> send_once("mini", ["KEY_LEFT"] )  
>>> sleep(0.5)  
>>> send_once("mini", ["KEY_UP"] )  
>>> sleep(0.5)  
>>> send_once("mini", ["KEY_OK"] )
```

ATENÇÃO: segundo parâmetro é
sempre uma LISTA de códigos

The screenshot shows a GitHub repository page for 'tompreston / python-lirc'. The page includes sections for README.md, PyPI, Install, Configure, and Use, each containing code examples.

Install

```
pip3 install python3-lirc
```

Configure

You need a valid [lircrc configuration file](#). For example:

```
$ cat ~/.lircrc
begin
    button = 1          # what button is pressed on the remote
    prog = myprogram   # program to handle this command
    config = one, horse # configs are given to program as list
end

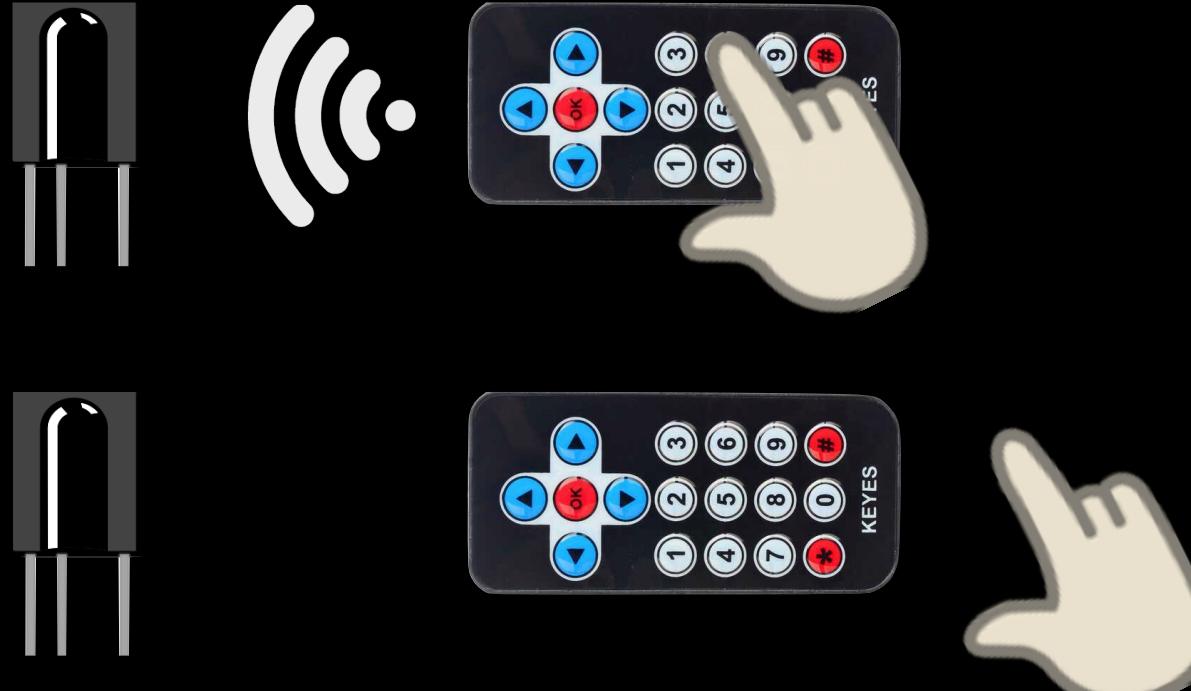
begin
    button = 2
    prog = myprogram
    config = two
end
```

Use

```
$ python3
>>> import lirc
>>> sockid = lirc.init("myprogram")
>>> lirc.nextcode()  # press 1 on remote after this
['one', 'horse']
>>> lirc.deinit()
```

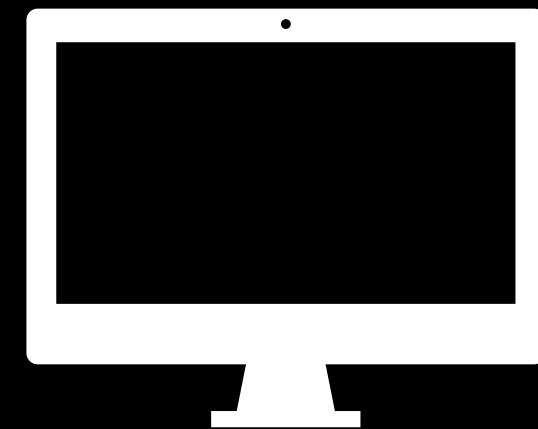
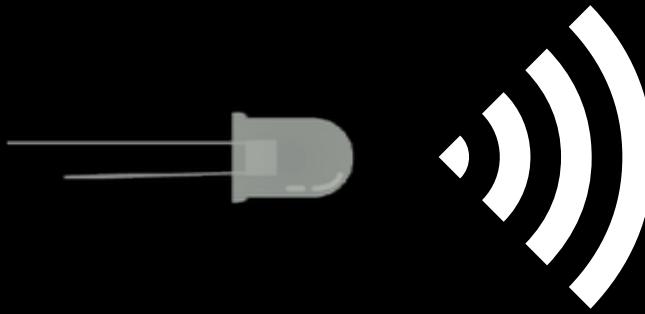
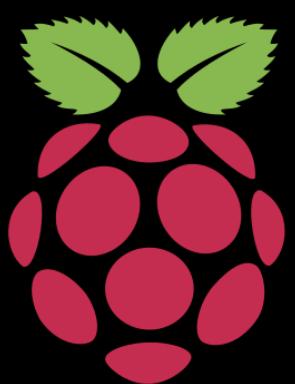
Biblioteca para Receber Sinais pelo LIRC

```
>>> from lirc import init, nextcode  
# "aula" é um nome definido na configuração do LIRC  
>>> init("aula", blocking=False)  
>>> nextcode()  
['KEY_6']  
>>> nextcode()  
[]
```

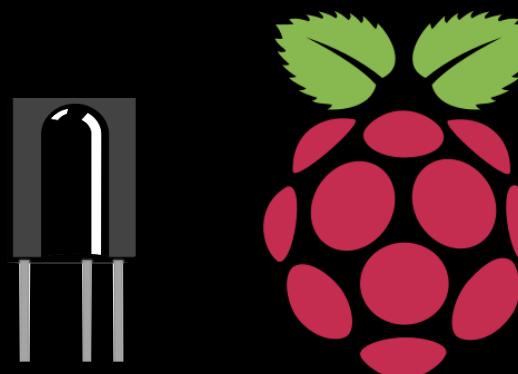
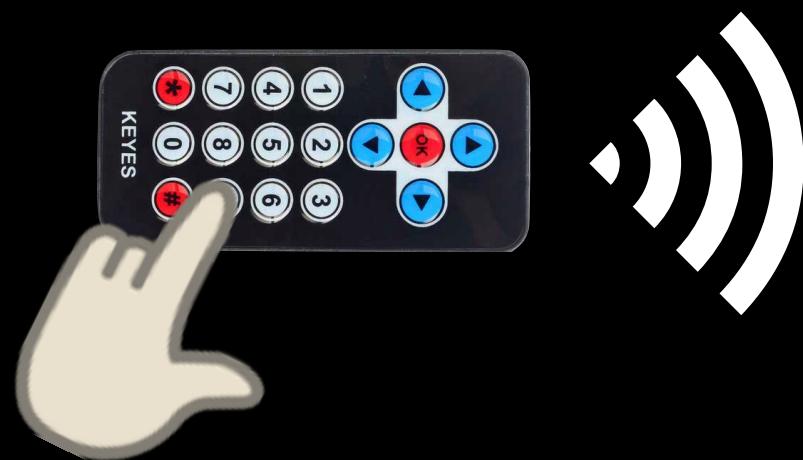


Recebimento de Comandos pelo Receptor Infravermelho

```
>>> from time import sleep
>>> from lirc import init, nextcode
>>> receptor = init("aula", blocking=False)
>>> while True:
...
    lista_com_codigo = nextcode()
...
    if lista_com_codigo != []:
...
        codigo = lista_com_codigo[0]
...
        if codigo == "KEY_LEFT":
...
            print("Tecla esquerda apertada")
...
        elif codigo == "KEY_2":
...
            print("Tecla 2 apertada")
...
        sleep(0.1)
```



```
send_once("nome do controle", ["KEY_1, "KEY_2", ...])
```



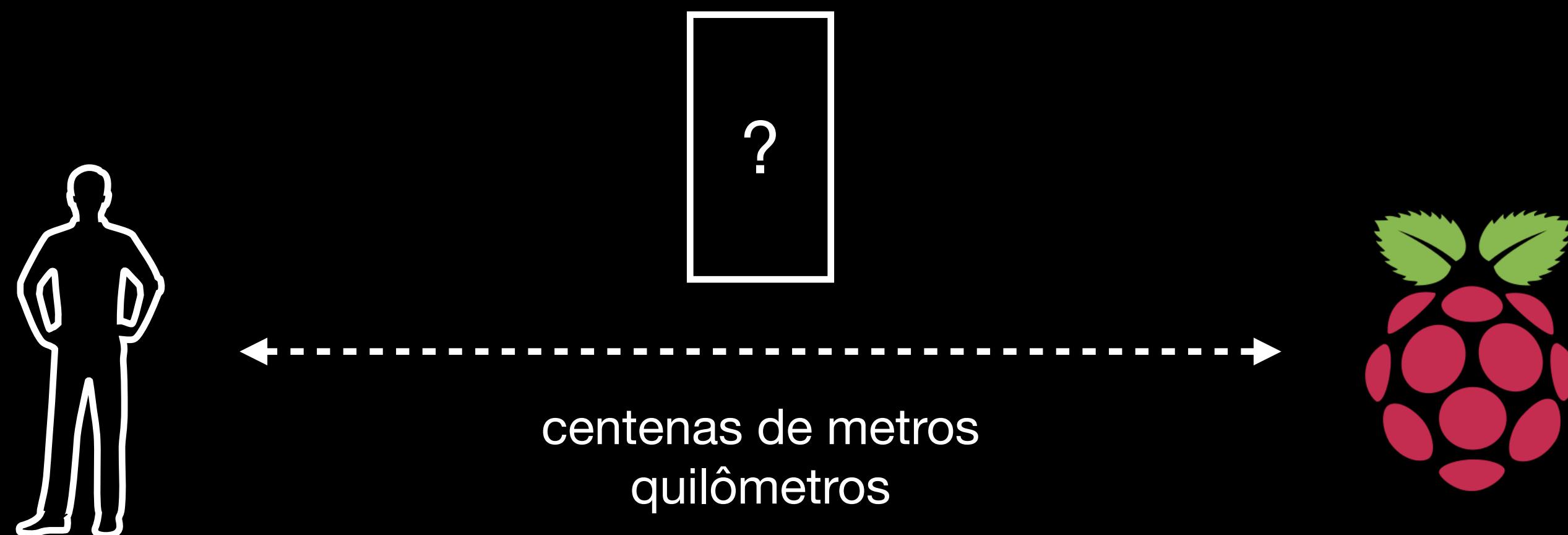
```
receptor = init("aula", blocking=False)
```

```
while True:
```

```
    lista_com_codigo = nextcode()
```

```
    ...
```

Software

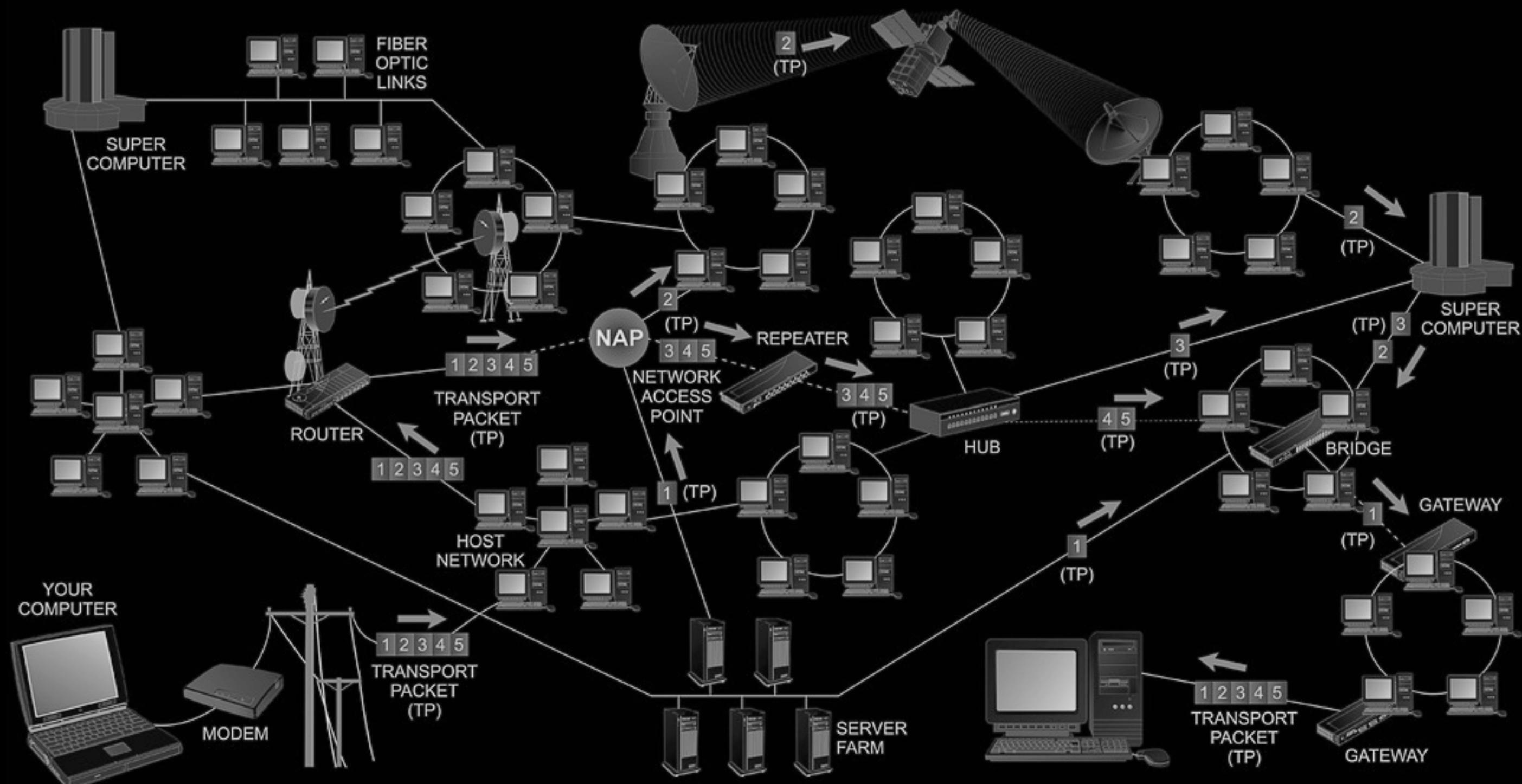


Comunicação Remota a Longas Distâncias

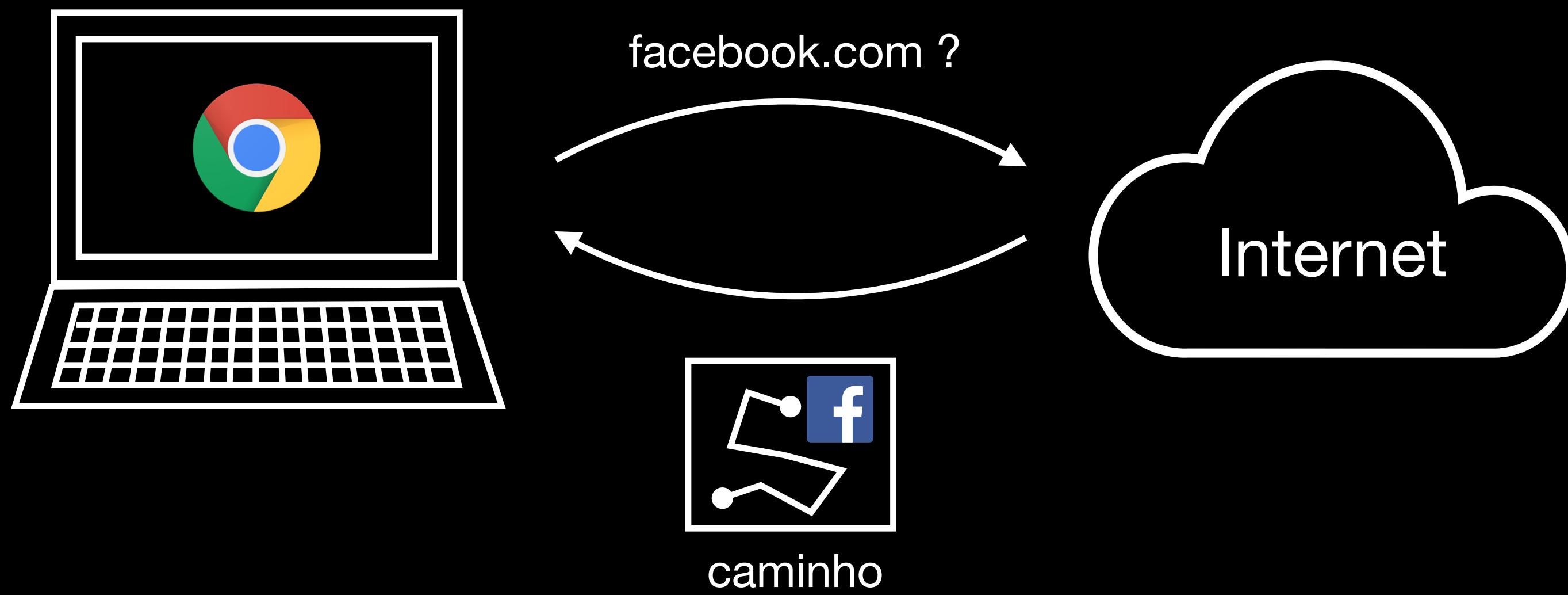


qualquer distância!

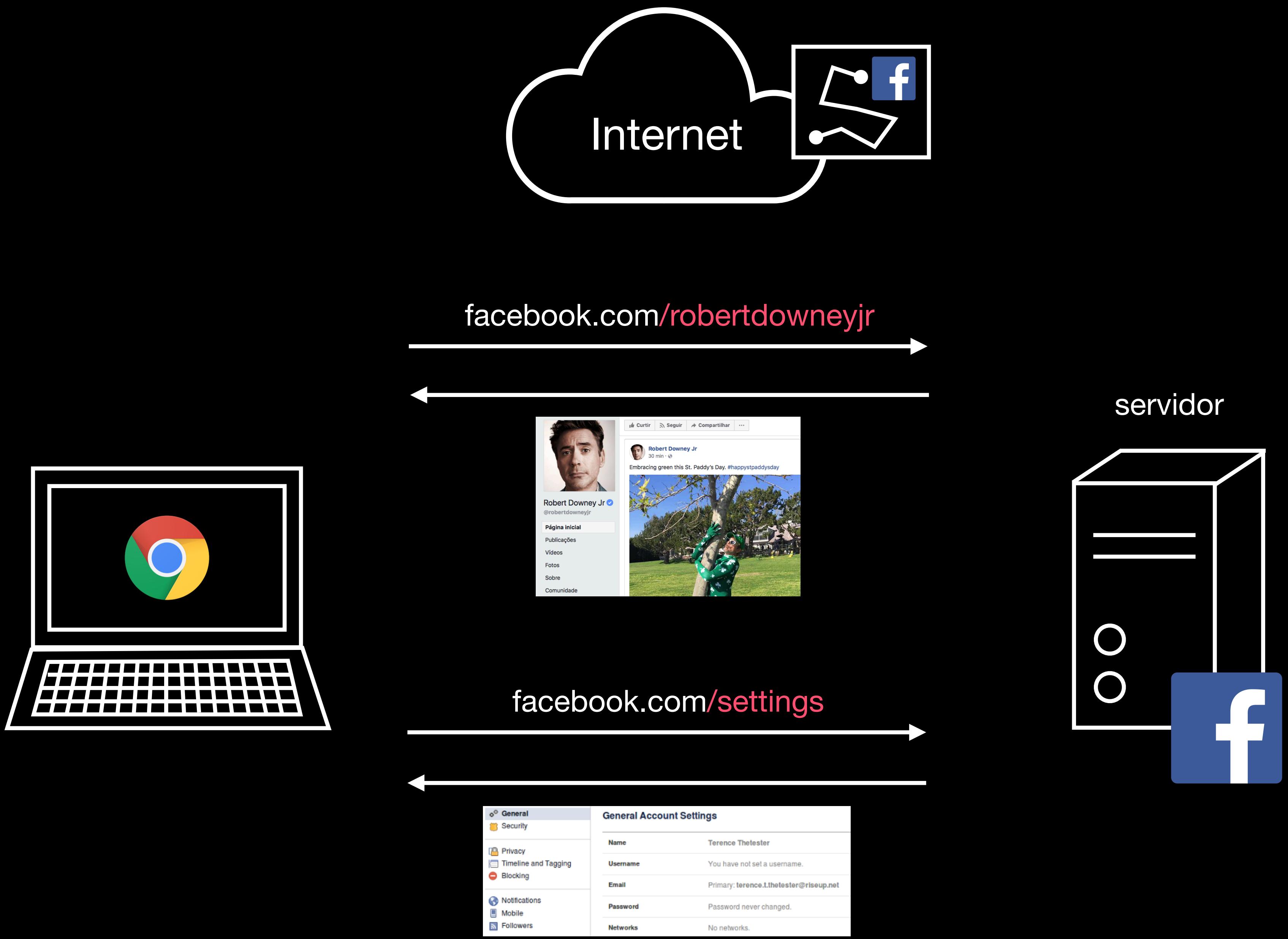
Mecanismo Mágico de Conexão Remota



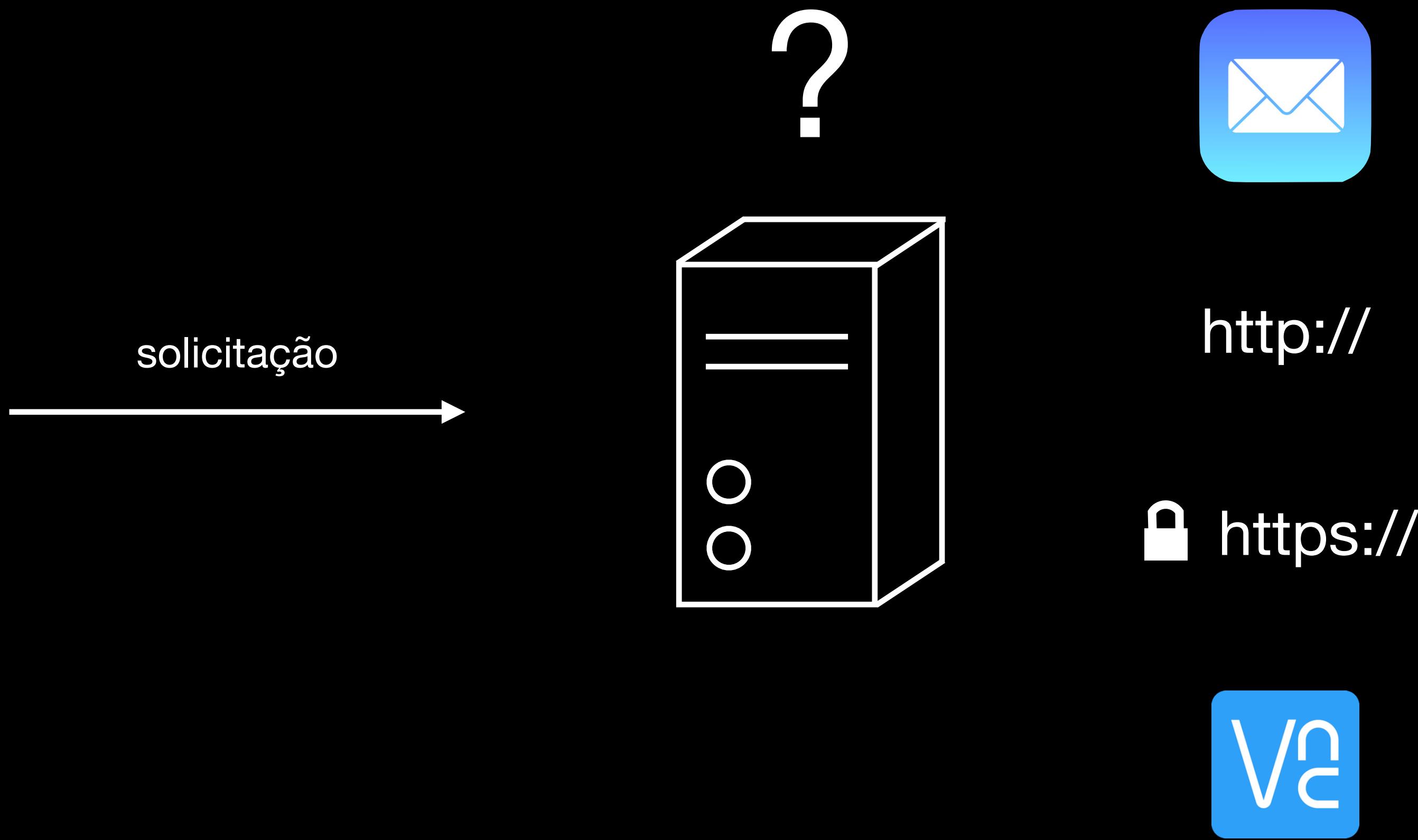
Rede de Computadores na Internet



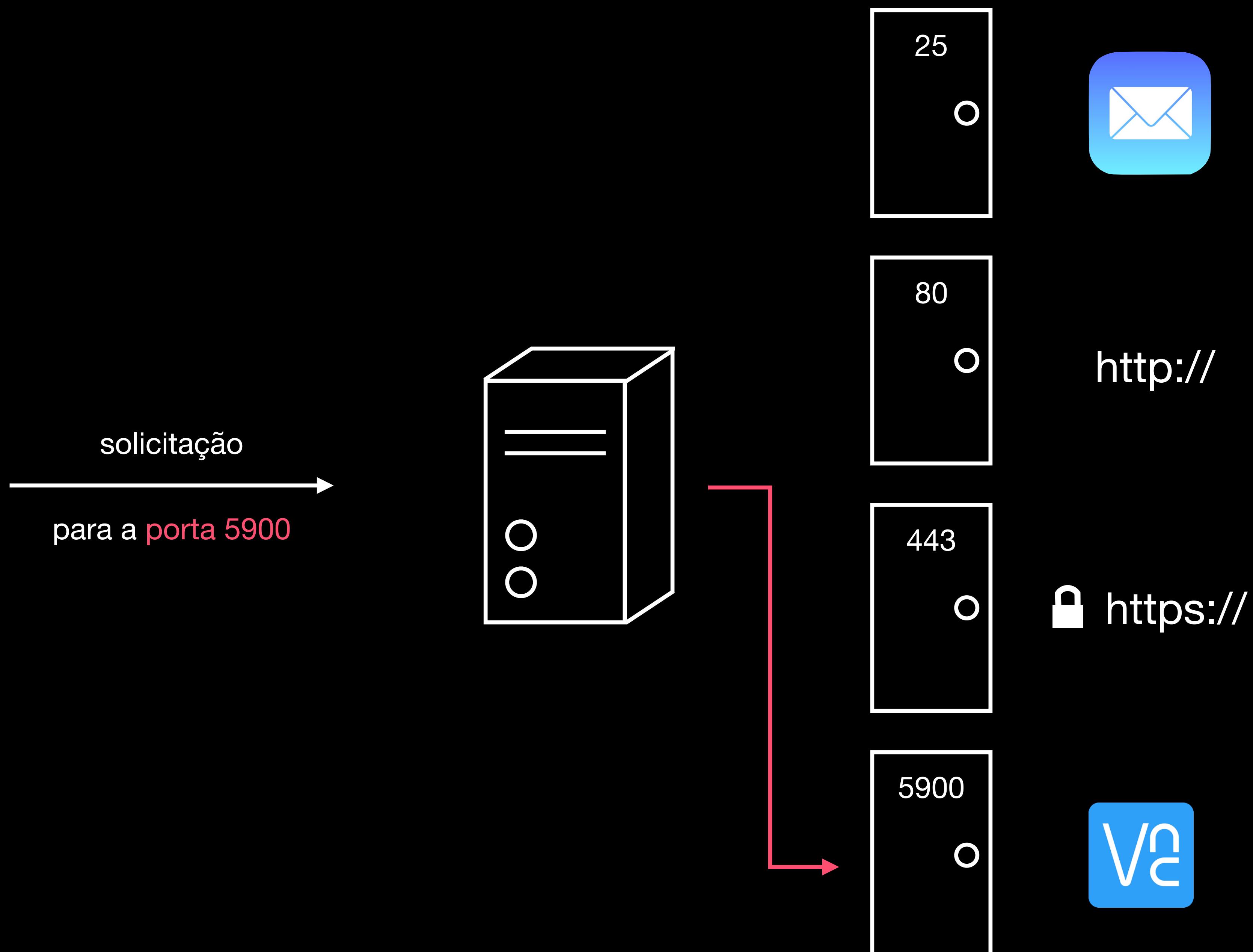
Conexão pela Internet a um Site



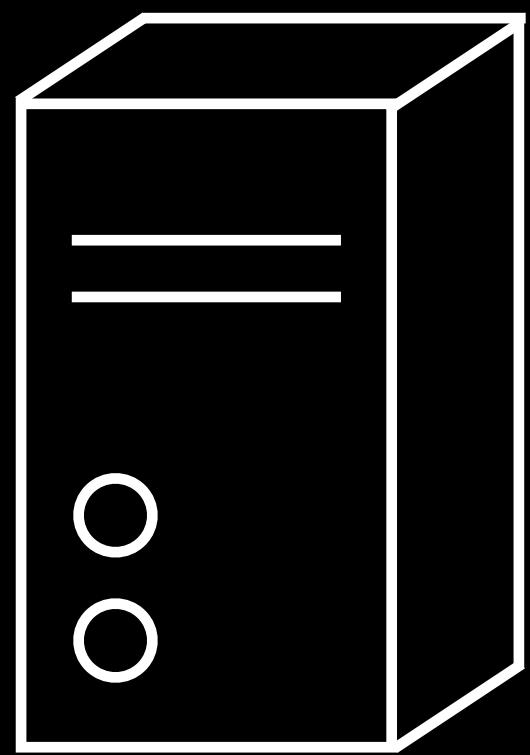
programas rodando
dentro do servidor



Múltiplos Aplicativos Rodando em um Servidor



Comunicação por Portas



=



Exemplos de Computadores para Criar um Servidor



Flask

web development,
one drop at a time

Framework Flask

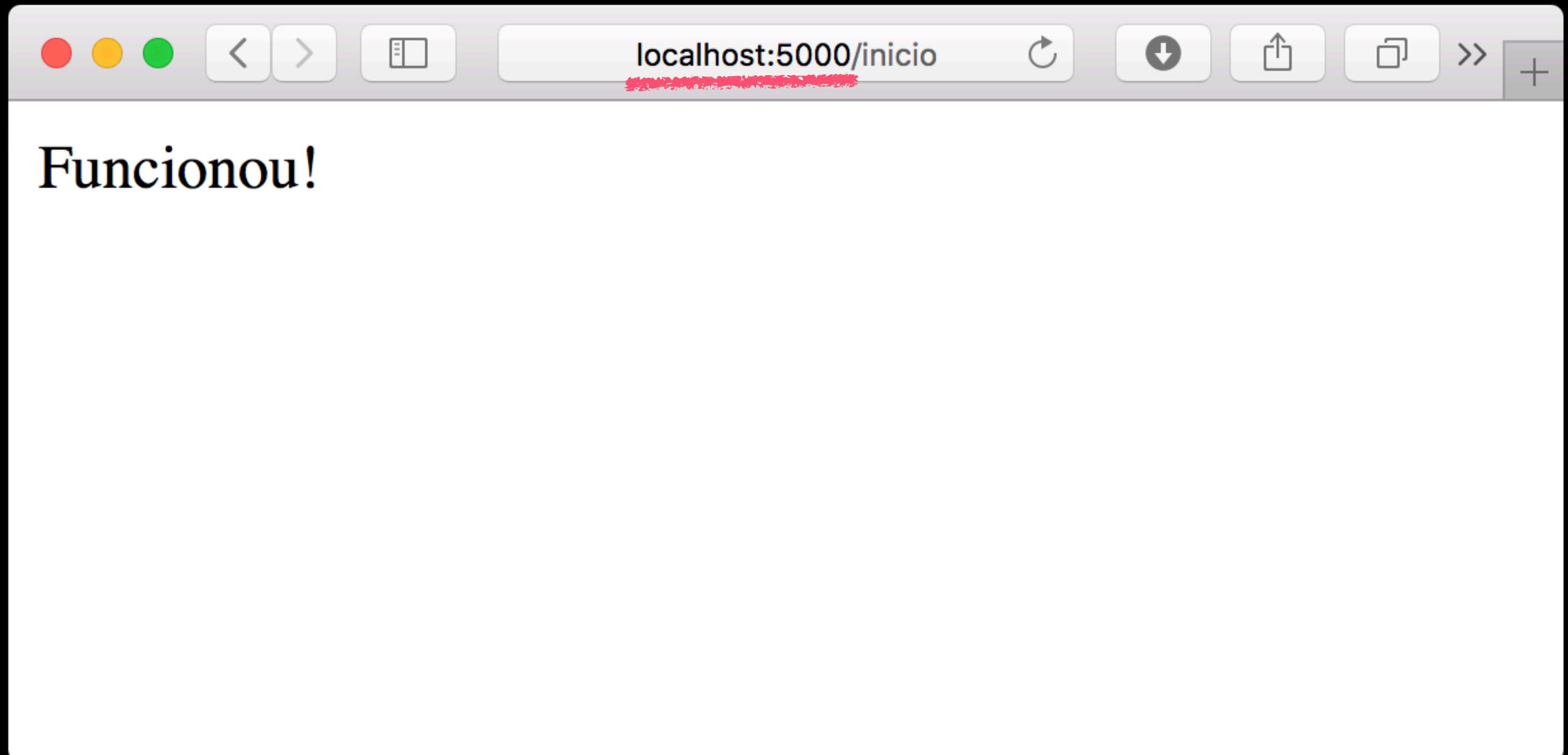
```
from flask import Flask

# initialize servidor com o nome deste arquivo
app = Flask(__name__)

# chame esta função ao acessar a página "inicio"
@app.route("/inicio")
def funcao_da_pagina_inicio():
    return "Funcionou!"

# rode o servidor na porta 5000
app.run(port=5000)
```

procure a página do nosso próprio computador na porta 5000



Carregamento da Página no Navegador

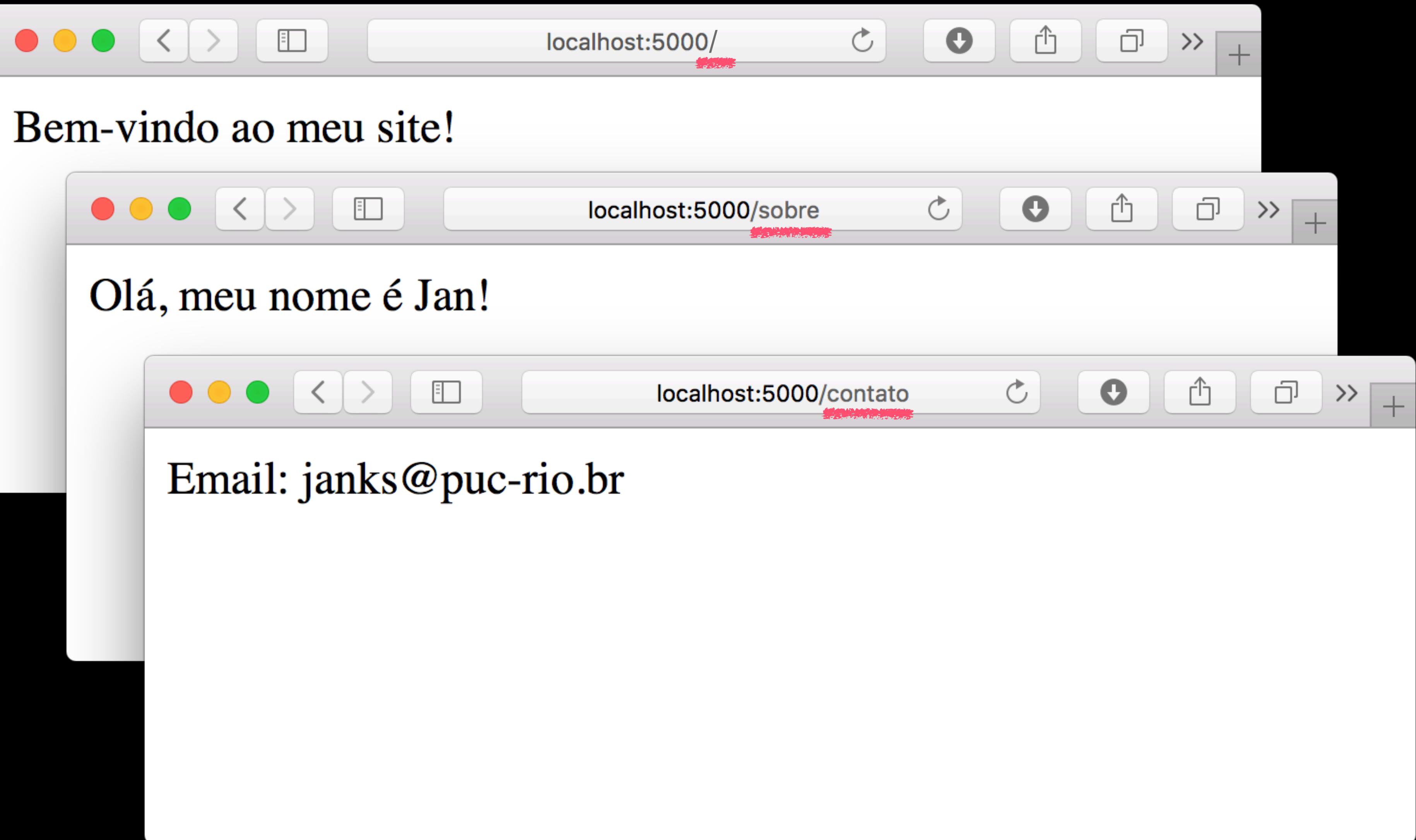
```
from flask import Flask
app = Flask(__name__)

@app.route("/")
def mostrar_pagina_principal():
    return "Bem-vindo ao meu site!"

@app.route("/sobre")
def mostrar_pagina_sobre():
    return "Olá, meu nome é Jan!"

@app.route("/contato")
def mostrar_pagina_de_contato():
    return "Email: janks@puc-rio.br"

app.run(port=5000)
```



Carregamento das Páginas no Navegador

```
from flask import Flask
app = Flask(__name__)

@app.route("/sequencia/<int:numero_final>")
def imprimir_sequencia(numero_final):
    texto_da_contagem = ""
    for numero in range(1, numero_final + 1):
        texto_da_contagem += str(numero) + " "
    return texto_da_contagem

app.run(port=5000)
```

The image displays two separate browser windows side-by-side, both showing the URL `localhost:5000/sequencia/` followed by a parameter value.

The top window shows the URL `localhost:5000/sequencia/10`. It displays the numbers 1 through 10, each on a new line.

The bottom window shows the URL `localhost:5000/sequencia/300`. It displays the numbers 1 through 300, each on a new line.

Parâmetro dentro da Rota da Página

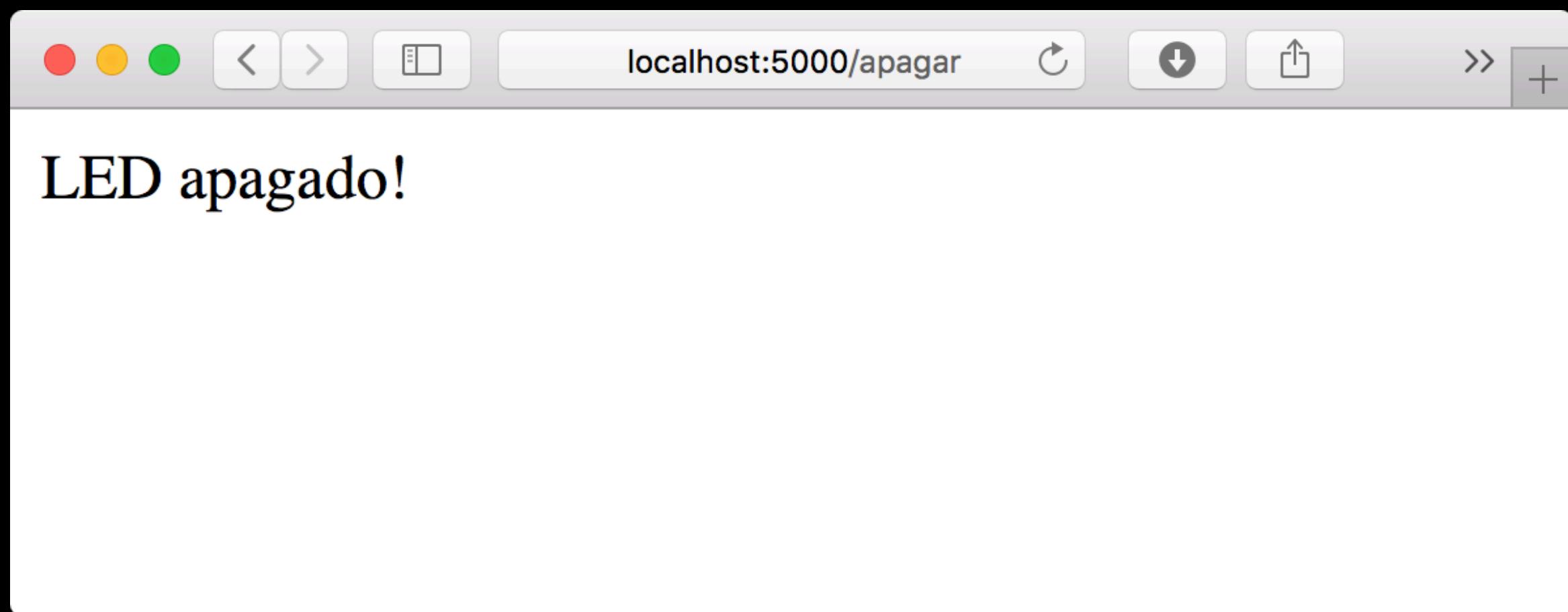
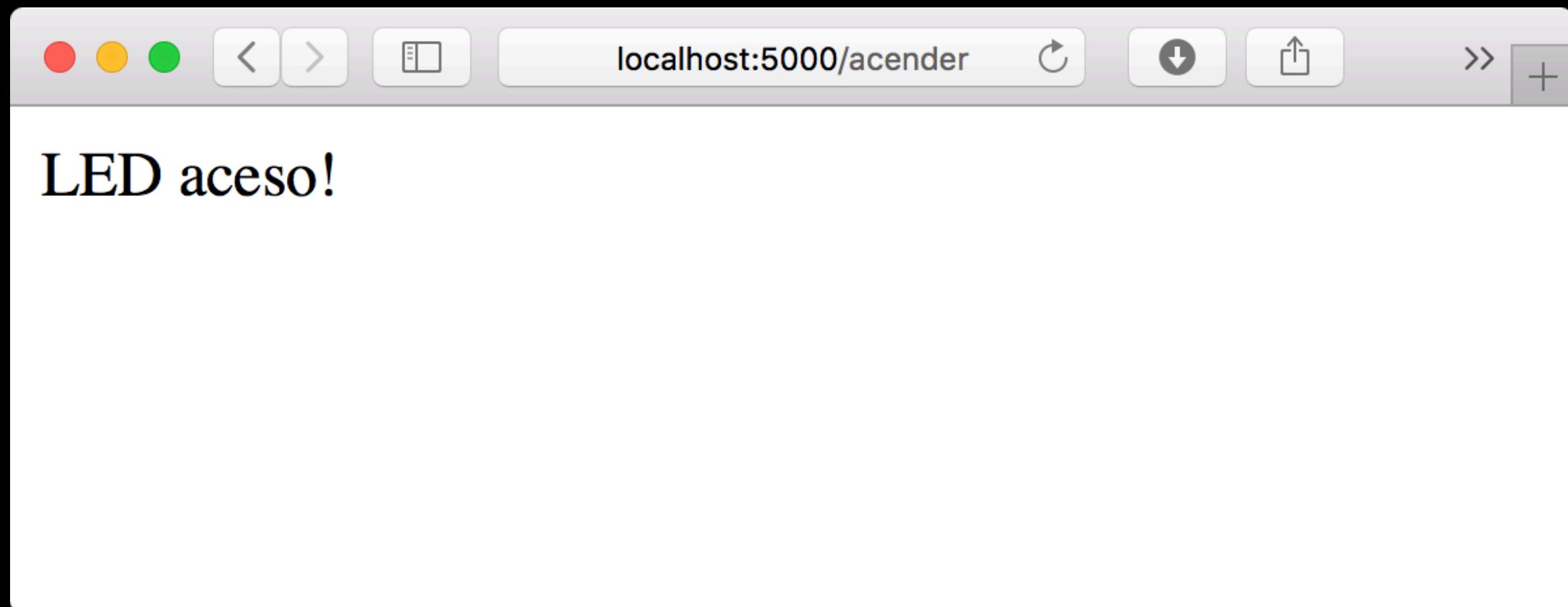
```
from gpiozero import LED  
from flask import Flask  
app = Flask(__name__)  
led = LED(21)
```

```
@app.route("/acender")  
def acender_led():  
    led.on()  
    return "LED aceso!"
```

```
@app.route("/apagar")  
def apagar_led():  
    led.off()  
    return "LED apagado!"
```

```
app.run(port=5000)
```

ATENÇÃO: não esqueça de retornar
um texto no final das funções



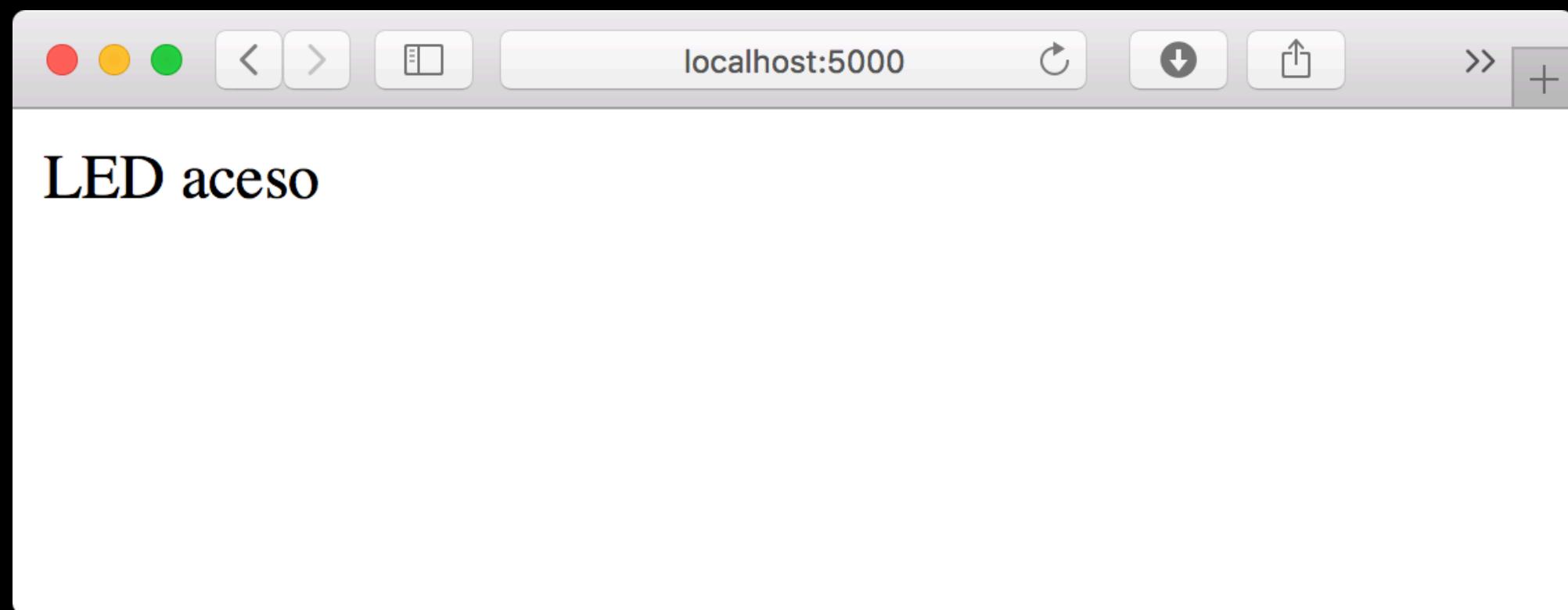
Controle de LED pelas Páginas no Navegador

```
from gpiozero import LED
from flask import Flask, redirect
app = Flask(__name__)
led = LED(21)

@app.route("/")
def pagina_principal():
    if led.is_lit:
        return "LED aceso"
    else:
        return "LED apagado"

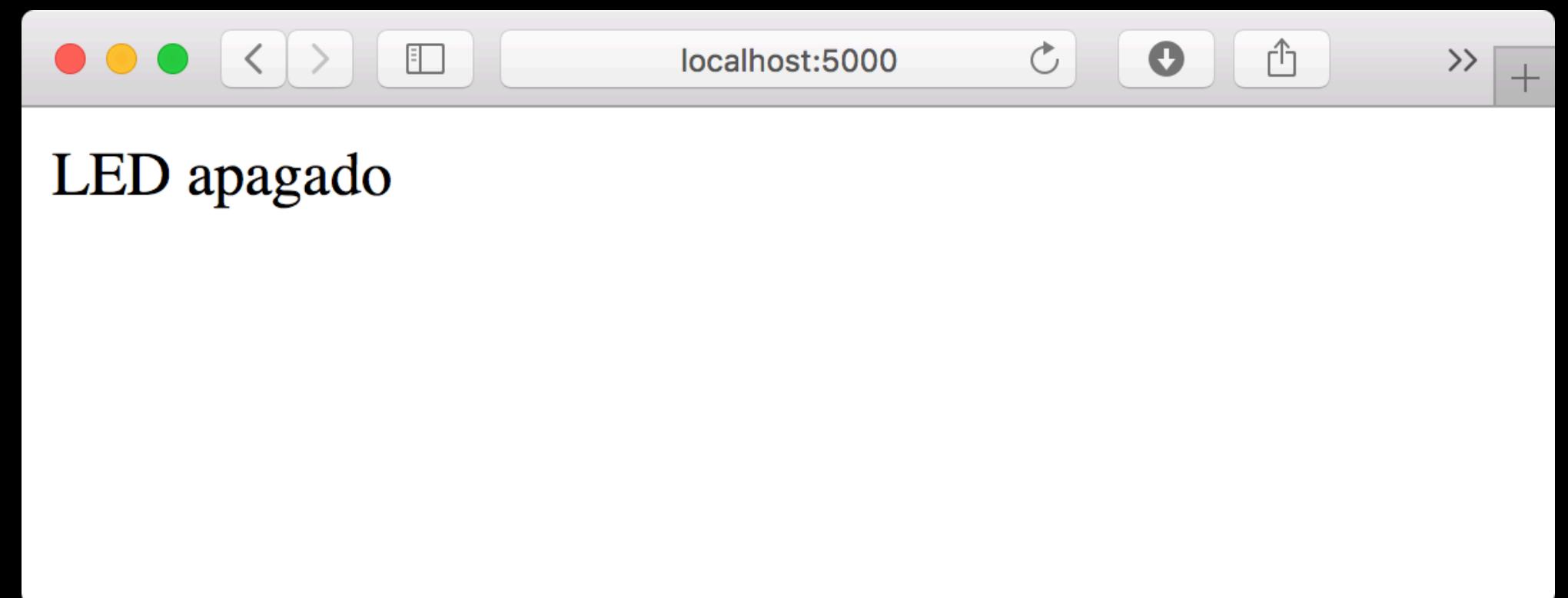
@app.route("/alterar")
def alterar():
    led.toggle()
    return redirect("/")

app.run(port=5000)
```

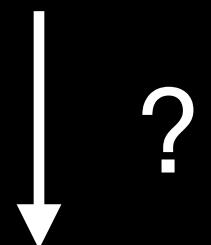
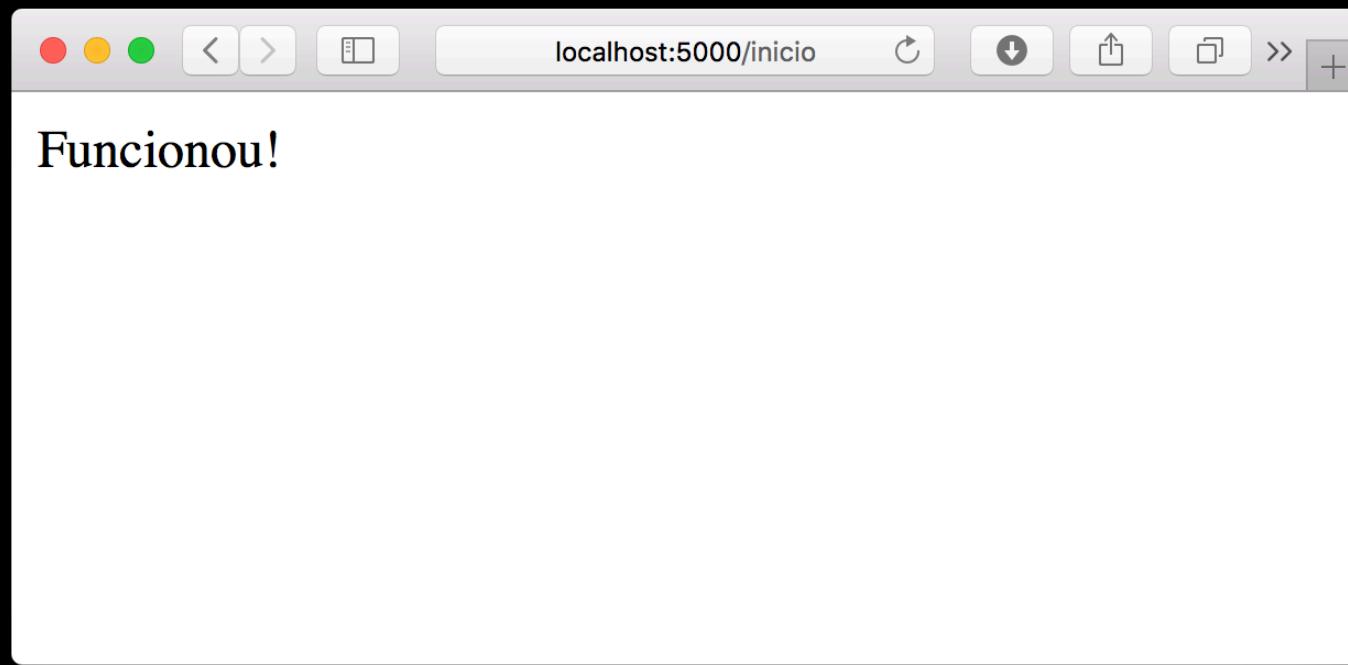


localhost:5000/alterar

redireciona
para /



Redirecionamento de Página



A screenshot of a web browser showing the Facebook login page at www.facebook.com. The page features the classic blue header with the word 'facebook'. On the left, there's a message about connecting with friends and a world map with user icons. On the right, there's a form for creating a new account, titled 'Abra uma conta' (Create an account). The form includes fields for Name, Surname, Phone number or email, and Password, along with dropdowns for Date of birth (set to 19 Mar 1993) and gender (radio buttons for Feminino and Masculino). A note at the bottom explains the terms and conditions for account creation.

Geração de Páginas com Formatação



Tecnologias para Gerar Páginas na Web

```
150      <!-- Column 2 / Sidebar -->
151      <div class="grid_4">
152
153          <h4>Catagories</h4>
154          <ul class="sidebar">
155              <li><a href="">So who are we?</a></li>
156              <li><a href="">Philosophy</a></li>
157              <li><a href="">History</a></li>
158              <li><a href="">Jobs</a></li>
159              <li><a href="">Staff</a></li>
160              <li><a href="">Clients</a></li>
161          </ul>
162
163          <h4>Latest News</h4>
164          <ul class="sidebar">
165              <li><a href="">Chickens rule the world</a></li>
166              <li><a href="">Chuck Bartowski is back!</a></li>
167              <li><a href="">Aurelius for sale</a></li>
168              <li><a href="">ThemeForest goes bust</a></li>
169          </ul>
170
171          <h4>Archives</h4>
172          <ul class="sidebar">
173              <li><a href="">January 2010</a></li>
174              <li><a href="">December 2009</a></li>
175              <li><a href="">November 2009</a></li>
```

Exemplo de Código Fonte em HTML

tag HTML

<elemento>

conteúdo do elemento

</elemento>

Elemento HTML como um Tag

Código	Resultado
<pre><p>Parágrafo 1</p> <p>Parágrafo 2</p></pre>	Parágrafo 1 Parágrafo 2
<pre>Negrito</pre>	Negrito
<pre></pre>	
<pre> Item 1 Item 2 Item 3 </pre>	<ul style="list-style-type: none"> • Item 1 • Item 2 • Item 3
<pre> Link para a Página </pre>	Link para a Página
Linha 1 Linha 2	Linha 1 Linha 2

```
from flask import Flask
app = Flask(__name__)

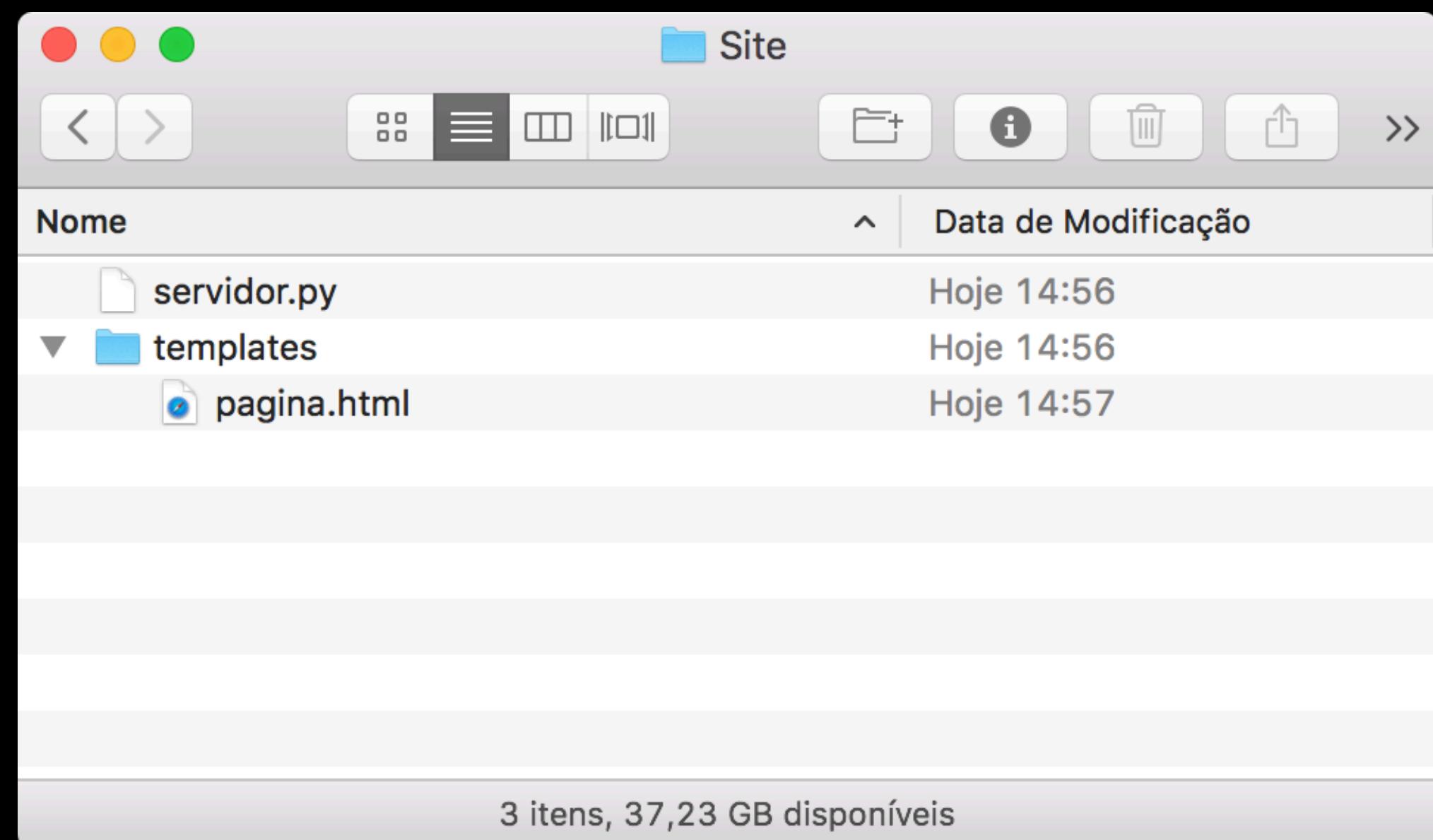
@app.route("/pagina_com_html")
def mostrar_pagina_com_html():
    return """
<p>Bem-vindo ao meu site!</p>
<p>Alguns links:</p>
<a href="/contato">Página de Contato</a>
<br>
<a href="https://www.google.com">Google</a>
<p>Tarefas:</p>
<ul>
    <li>Terminar de fazer a aula</li>
    <li>Dar a aula</li>
    <li>Arrumar a sala</li>
    <li>Dominar o mundo!</li>
</ul>
"""

app.run(port=5000)
```

O HTML ocupa muito espaço,
e confunde o código Python



Inclusão de Código HTML dentro do Código Python?



Organização de Arquivos com o Flask

```
from flask import Flask, render_template
app = Flask(__name__)

@app.route("/pagina_de_texto")
def mostrar_pagina_de_texto():
    return "Texto, texto, texto..."

@app.route("/pagina_com_html")
def mostrar_pagina_com_html():
    return render_template("pagina.html")

app.run(port=5000)
```

pagina.html

```
<p>Bem-vindo ao meu site!</p>
```

```
<p>Alguns links:</p>
```

```
<a href="/contato">Página de Contato</a>
```

```
<br>
```

```
<a href="https://www.google.com">Google</a>
```

```
<p>Tarefas:</p>
```

```
<ul>
```

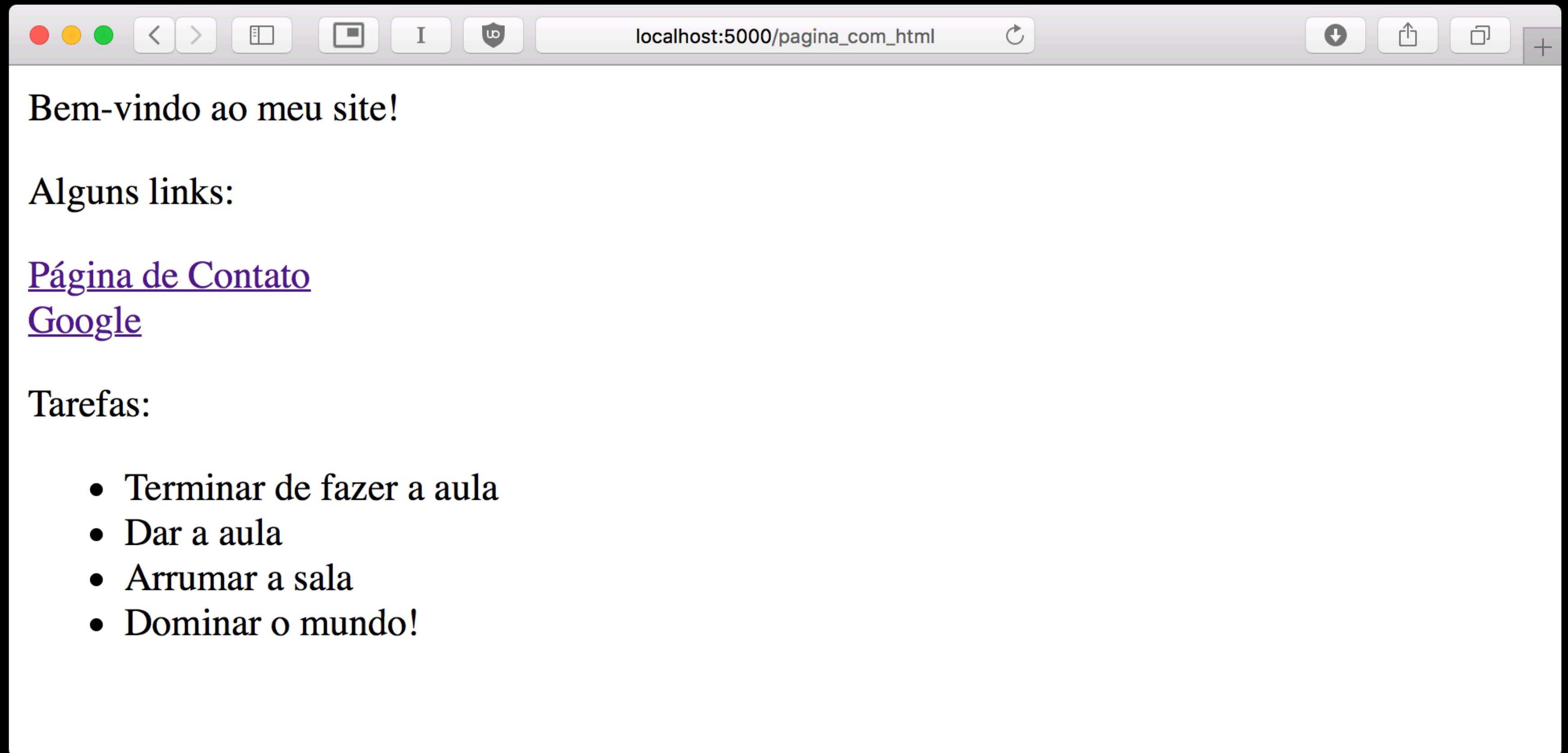
```
    <li>Terminar de fazer a aula</li>
```

```
    <li>Dar a aula</li>
```

```
    <li>Arrumar a sala</li>
```

```
    <li>Dominar o mundo!</li>
```

```
</ul>
```



Como fazer para o site ficar
acessível de fora do computador?



Acesso do Site sem Usar Localhost?

Screenshot of the Hover website showing domain search results for "meusite".

The page header shows the URL www.hover.com/domains/results?ut.

EXACT MATCH

meusite.com [MAKE AN OFFER](#)

FEATURED

meusite.design 😊 **\$5.99 / \$39.99** [+](#)
For those who can't help but create.

meusite.tech 😊 **\$7.99 / \$49.99** [+](#)
Showcase your creations with a .tech domain.

GENERIC

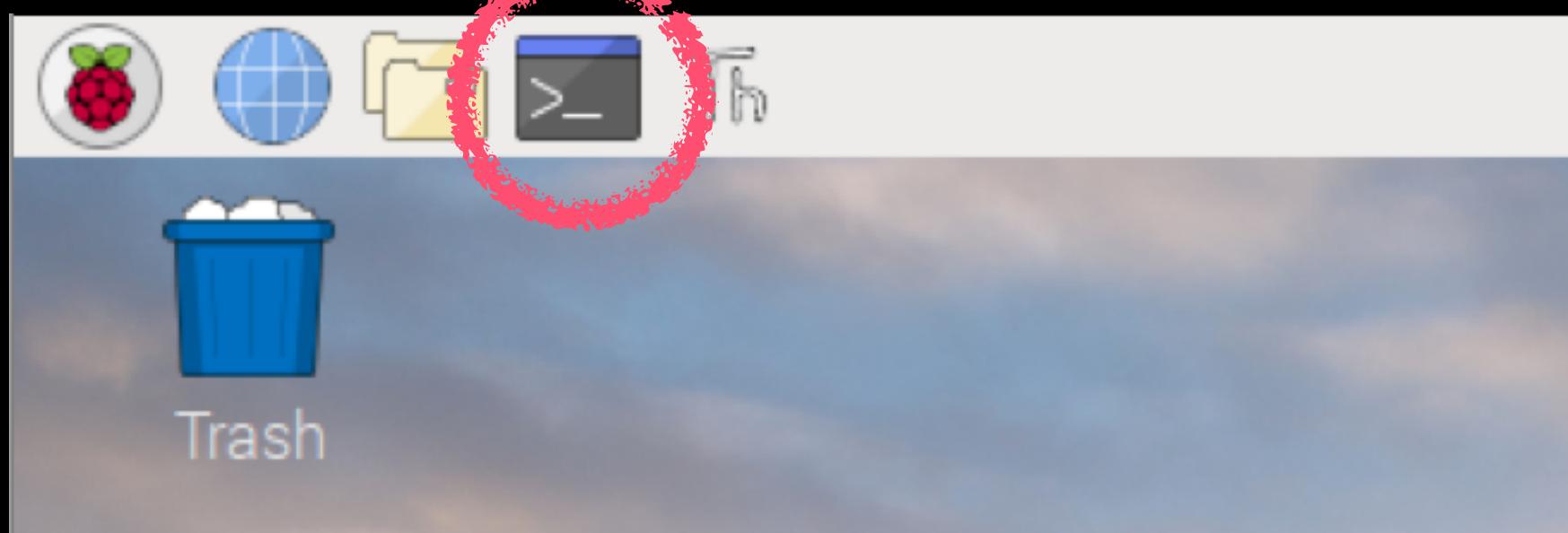
meusite.org  **\$13.99** [+](#)
meusite.site **\$32.99** [+](#)

Solução Demorada: Compra + Configuração de um Domínio

ngrok

"ngrok exposes local servers behind NATs and firewalls to the public internet over secure tunnels."

Solução Rápida: Ngrok



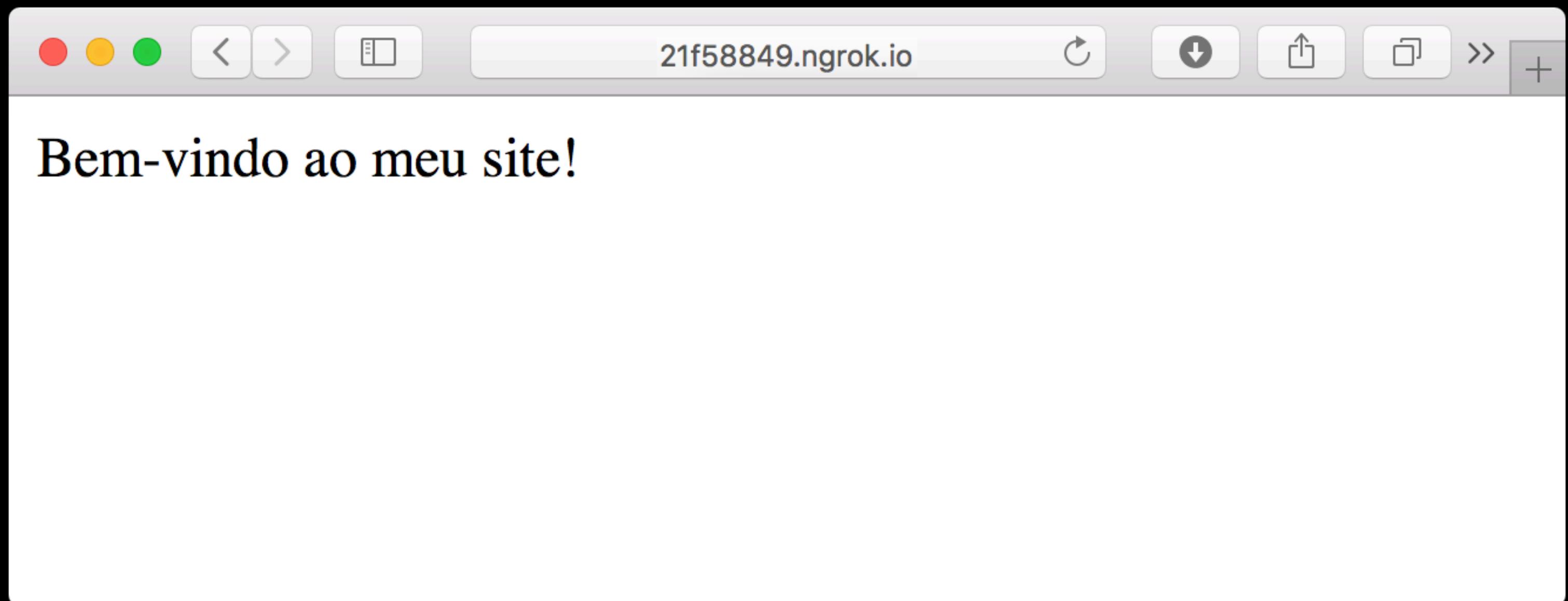
```
aula@raspberrypi ~ $ ngrok http 5000
```

```
ngrok by @inconshreveable  
(Ctrl+C to quit)
```

Session Status	online
Session Expires	7 hours, 59 minutes
Version	2.2.8
Region	United States (us)
Web Interface	http://127.0.0.1:4040
Forwarding	http://21f58849.ngrok.io -> localhost:5000
Forwarding	https://21f58849.ngrok.io -> localhost:5000
Connections	ttl opn rt1 rt5 p50 p90
	0 0 0.00 0.00 0.00 0.00



Executando o Ngrok no Terminal



Acessando o Site pelo Endereço do Ngrok

```

from flask import Flask
app = Flask(__name__)

@app.route("/")
def funcao_da_pagina_inicio():
    return "x = " + 2

app.run(port=5000)

```

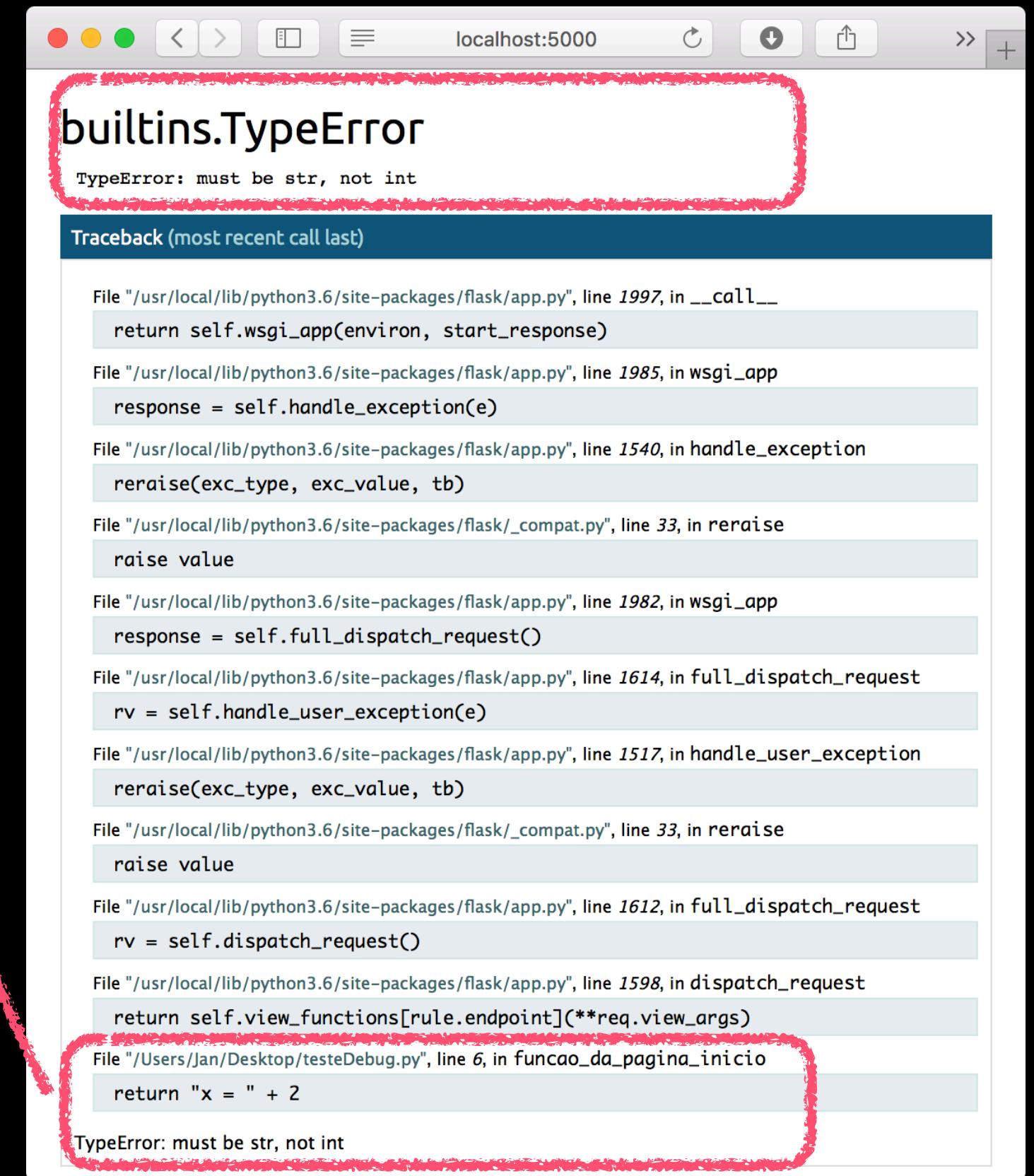
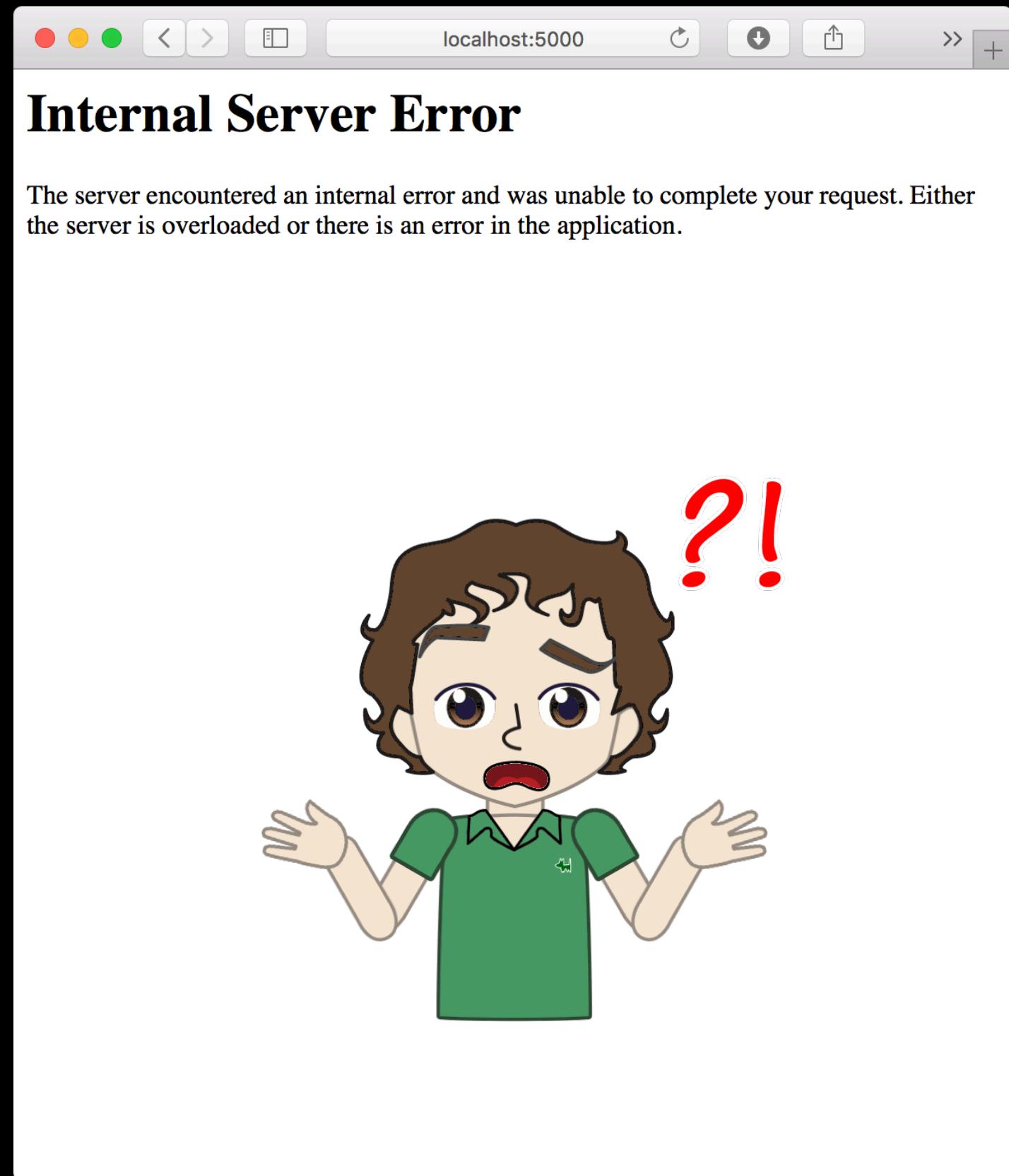
```

from flask import Flask
app = Flask(__name__)

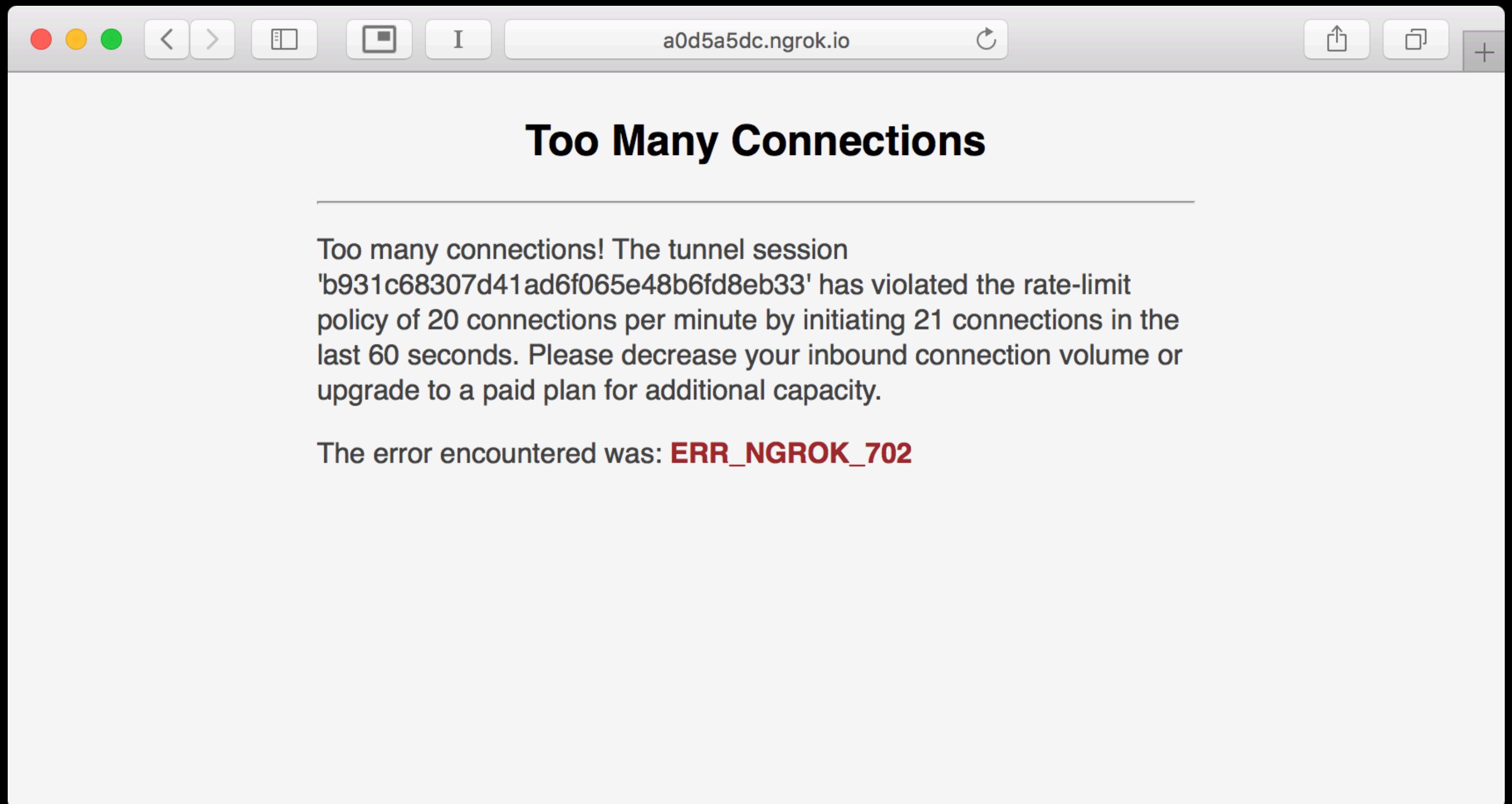
@app.route("/")
def funcao_da_pagina_inicio():
    > return "x = " + 2

app.run(port=5000, debug=True)

```



Modo "Debug" para Encontrar Erros



Limite de Acessos Usando o Ngrok

Resumo da Ópera

Funcionalidade

Envio de
Infravermelho

Recebimento de
Infravermelho

Servidor Flask
[acessar documentação](#)

HTML

Ngrok

Comandos

```
from py_irsend.irsend import send_once
send_once("nome do controle", ["KEY_1", "KEY_2"])

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

```
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"
```

```
<p>Parágrafo</p>

<a href="/pagina">Link</a>
```

```
@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)
```

```
<ul>
    <li>Item 1 da Lista</li>
    <li>Item 2 da Lista</li>
</ul>
```

abrir Terminal → ngrok http 5000

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
```

Funcionalidade	Comandos
Funções	<pre>x = input("Digite um número: ") • print("Resultado: ", x) from time import sleep • sleep(0.5)</pre>
Listas acessar documentação	<pre>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]</pre>
Dicionários acessar documentação	<pre>dicionario = {"chave 1": 42, "chave 2": [1, 2, 3]} dicionario["chave 1"] • dicionario["chave 3"] = "Olá!"</pre>
Textos (Strings) acessar documentação	<pre>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")</pre>
Condicionais	<pre>if x != 0: y = 4 elif x >= 0: y = 3 else: y = 0</pre>
Repetições	<pre>for elem in lista: ... for i in range(1, 4): while x > 1: ... def funcao1(x): return x + 2 def funcao2(x, y, z): global x x = 2</pre>
Criação de Funções e Variáveis Globais	