[301] Web 1

Tyler Caraza-Harter

Learning Objectives Today

Motivation

Networking Basics

HTTP (Hypertext Transfer Protocol)

Requests Module

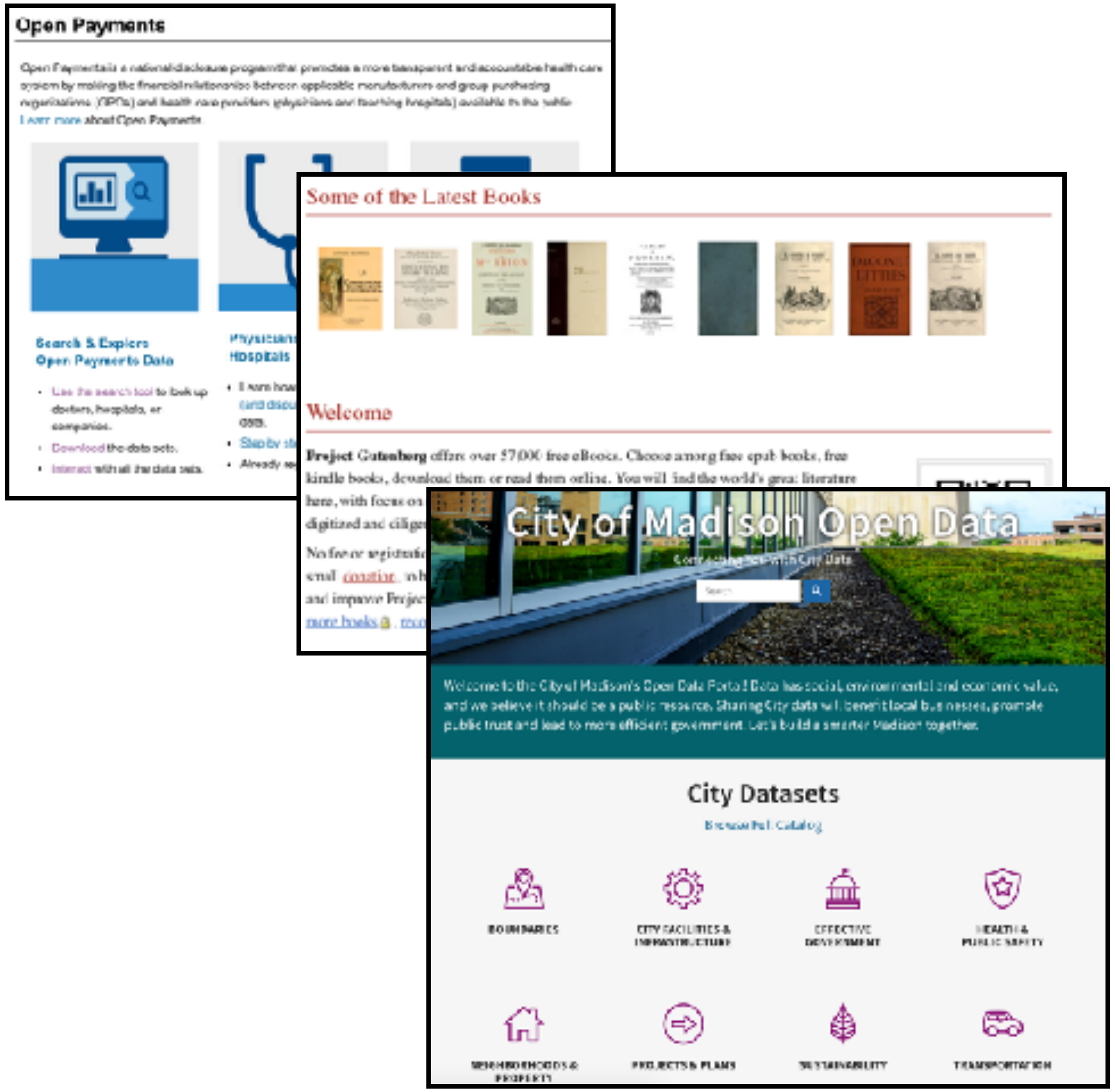
Data Science and the Internet

There are tons of online sources of data

- Examples: https://tyler.caraza-harter.com/cs301/fall18/datasets.html

Wide range of topics

- healthcare
- roads and city planning
- astronomy
- population
- business
- entertainment
- education
- etc



Open Payments

Open Payments is a national disclosure program that promotes a more transparent and accountable health care system by making the financial relationships between applicable manufacturers and group purchasing organizations (GPOs) and health care providers (physicians and teaching hospitals) available to the public. Learn more about Open Payments.

Search & Explore Open Payments Data

- Use the search tool to look up doctors, hospitals, or companies.
- Download the data sets.
- Interact with all the data sets.

Physicians Hospitals

Some of the Latest Books

Welcome

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City of Madison Open Data

Connecting You with City Data

Welcome to the City of Madison's Open Data Portal! Data has social, environmental and economic value, and we believe it should be a public resource. Sharing City data will benefit local businesses, promote public trust and lead to more efficient government. Let's build a smarter Madison together.

City Datasets

Browse Full Catalog

Data Science and the Internet

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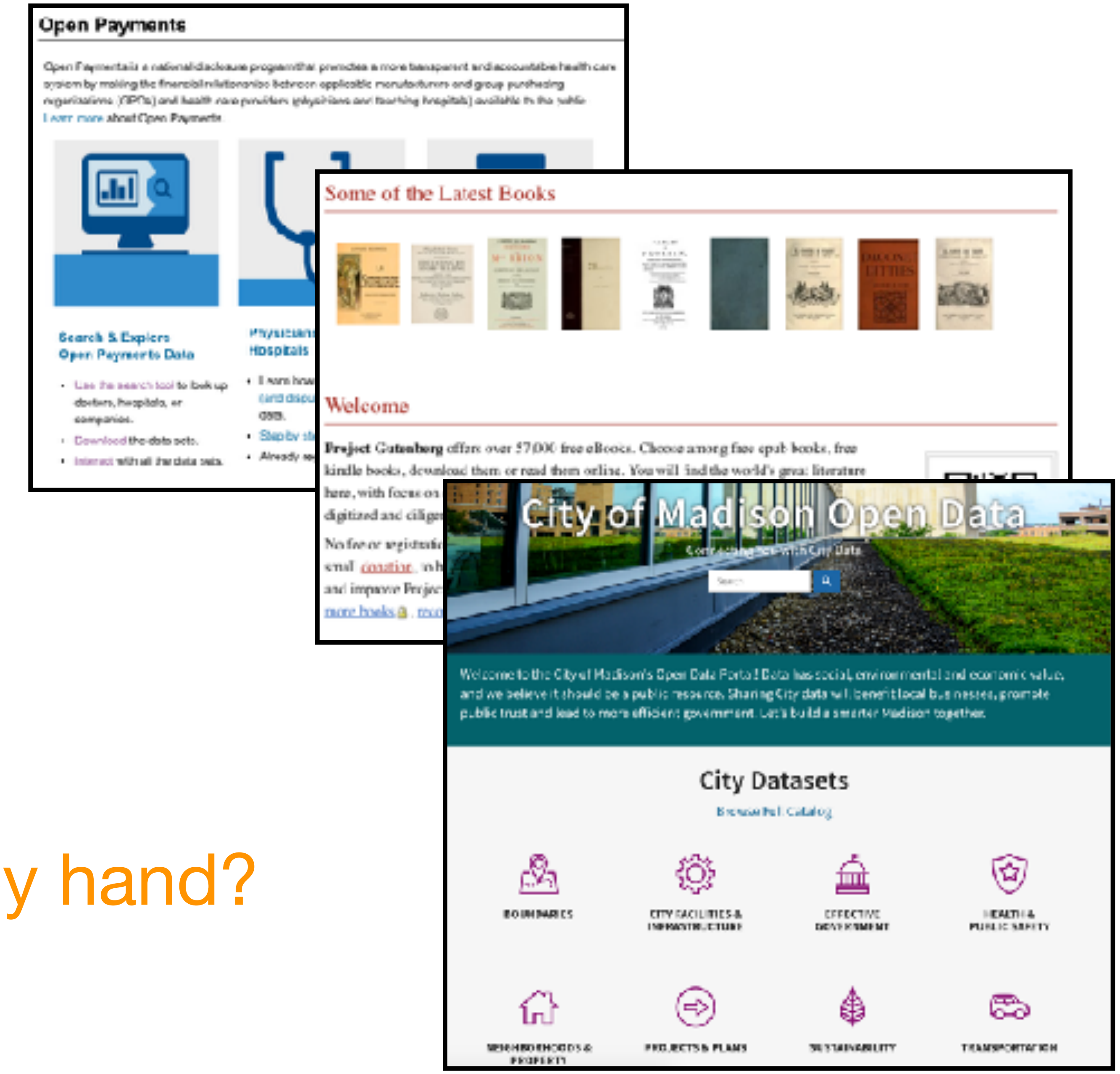

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- Step by st
- Already re

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City Datasets

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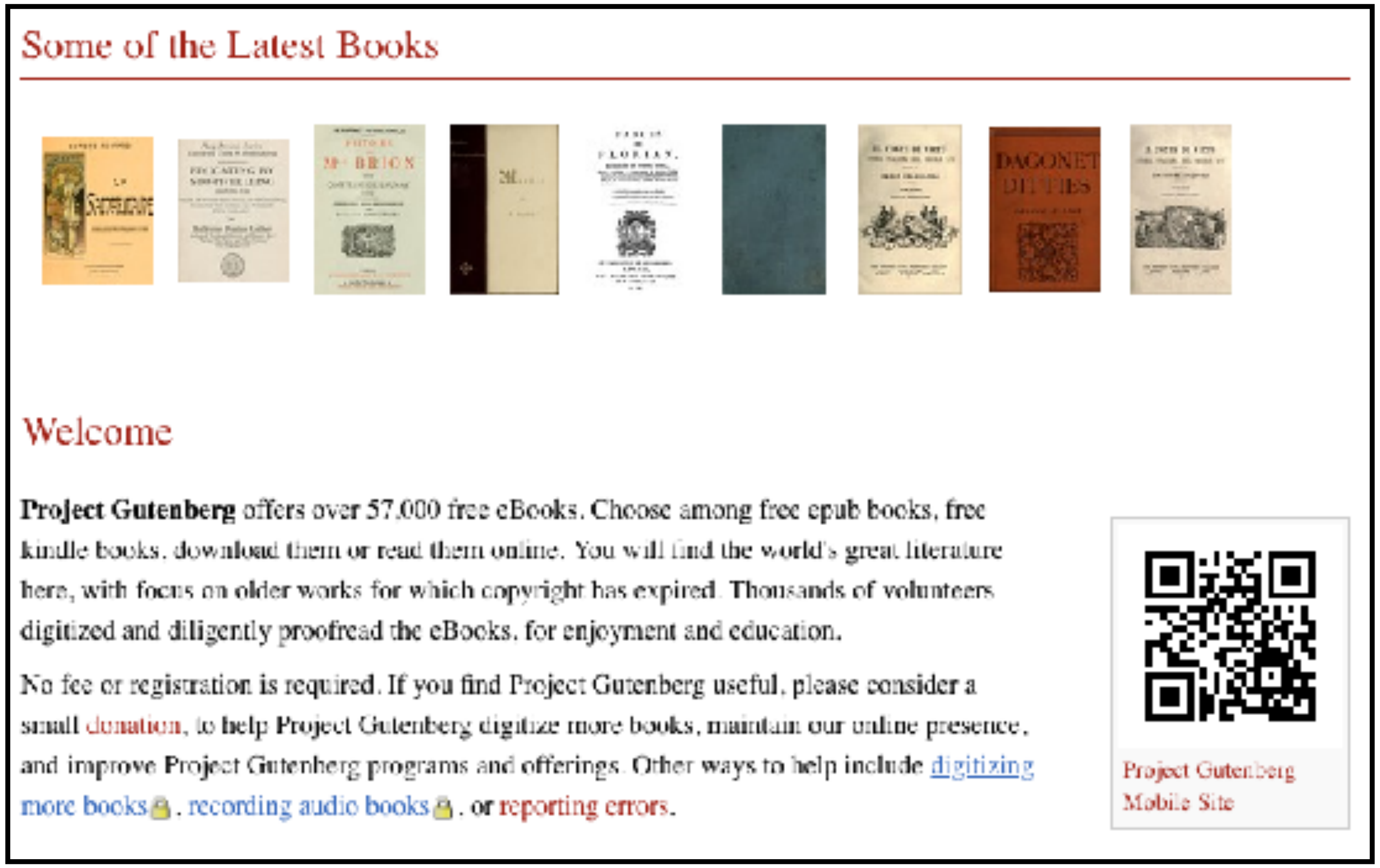
Why not just download data by hand?

Motivation: too much data

What if you're analyzing language trends over time?

- Dataset: Project Gutenberg has 57K free books
- Too much work to download one by one



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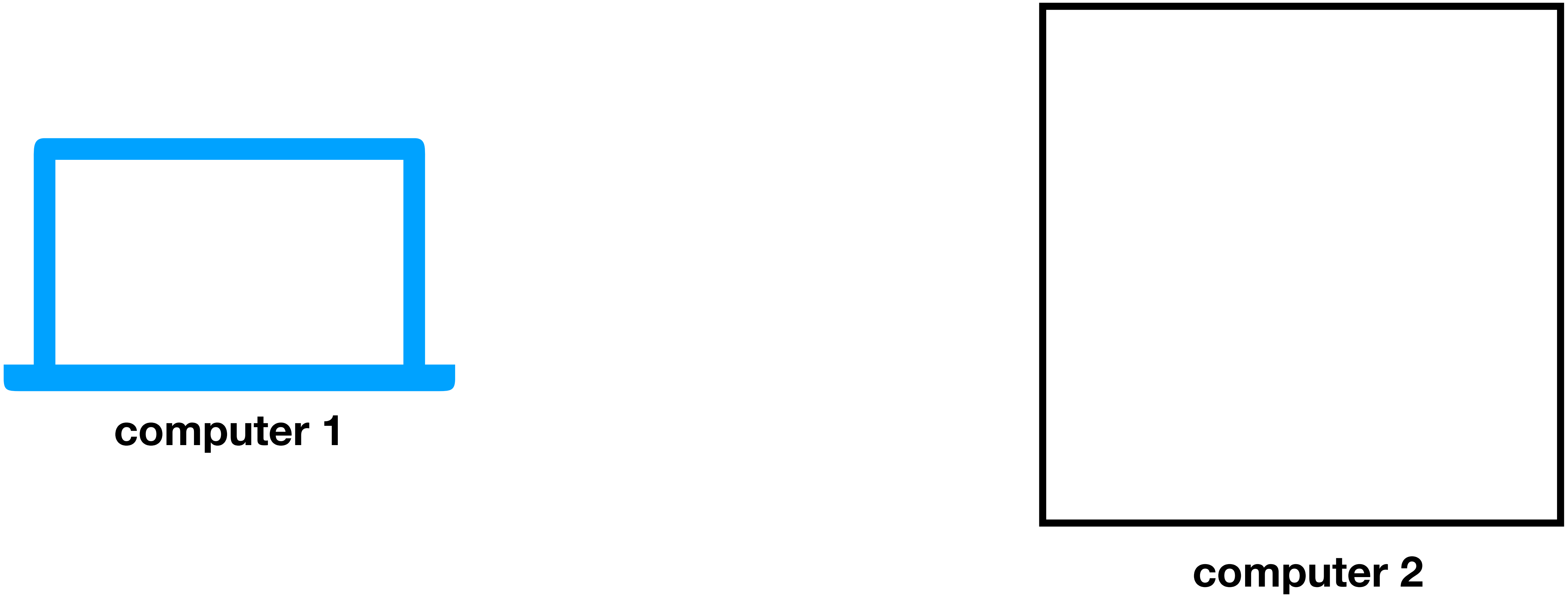
Networking Basics

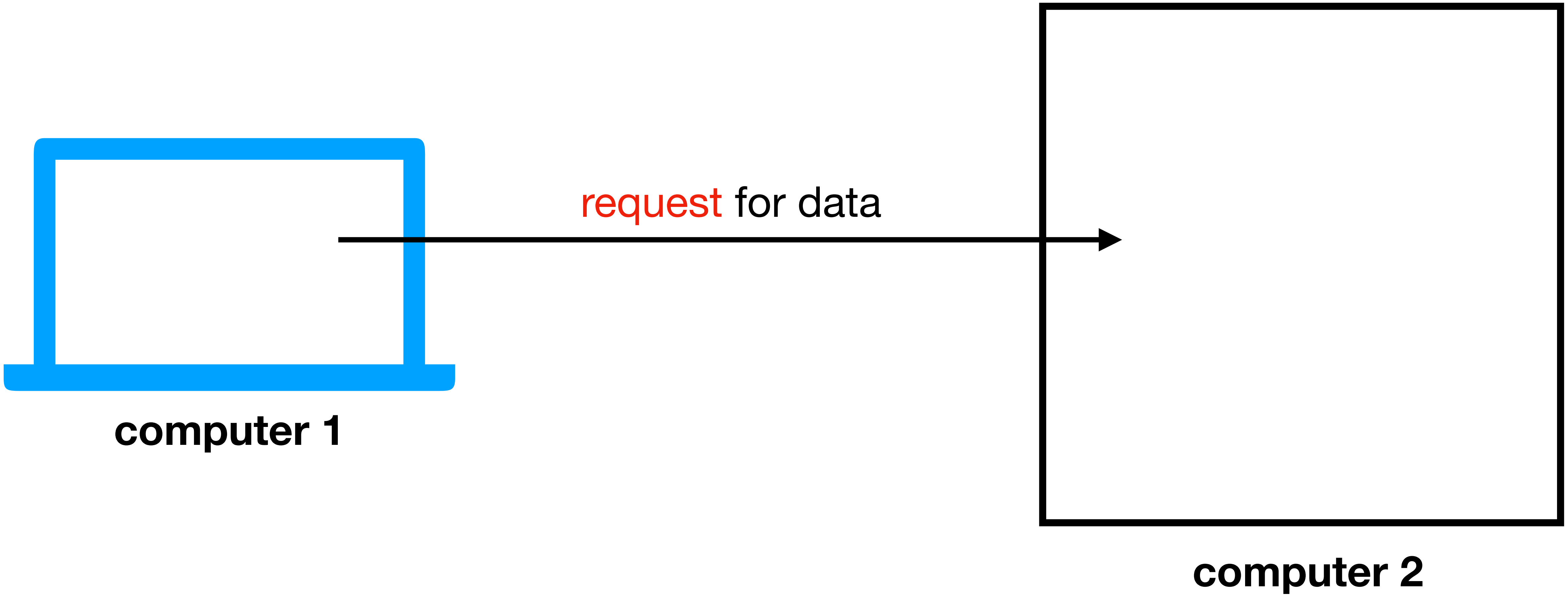


computer 1

computer 2

Computers communicate over a network (e.g., the Internet)
by sending messages to each other

Networking Basics



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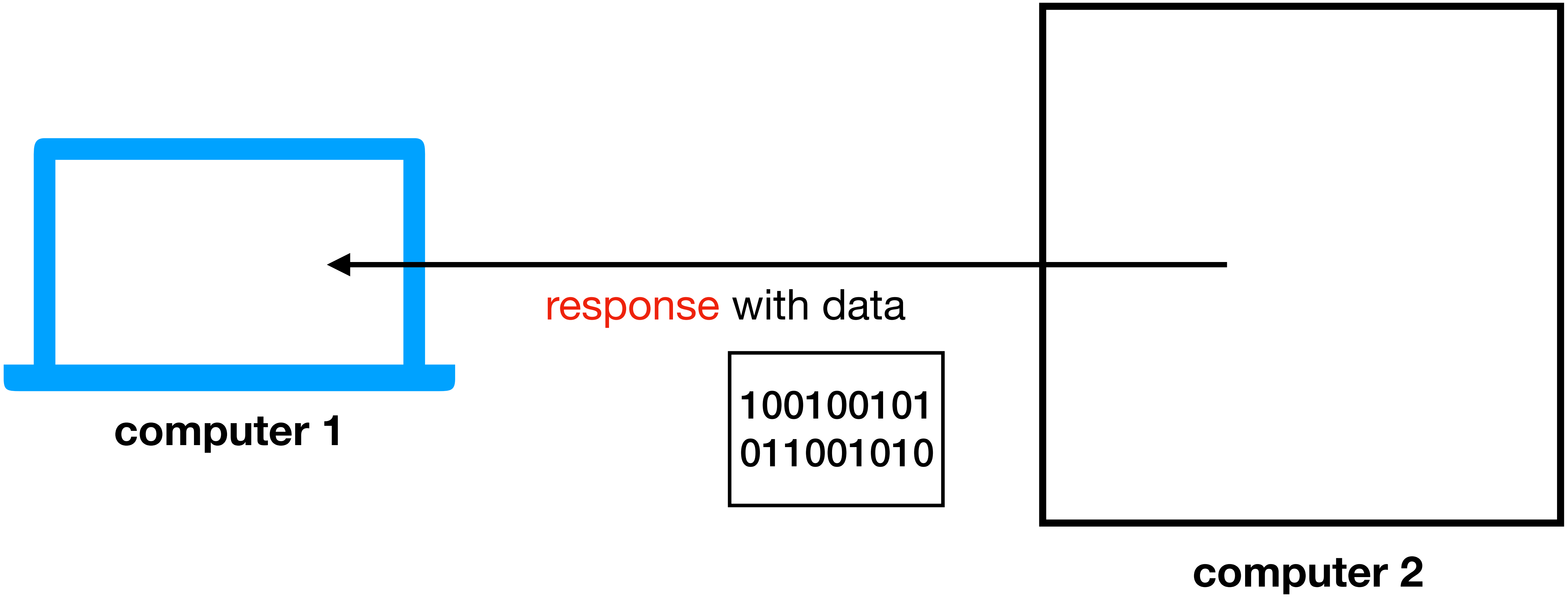

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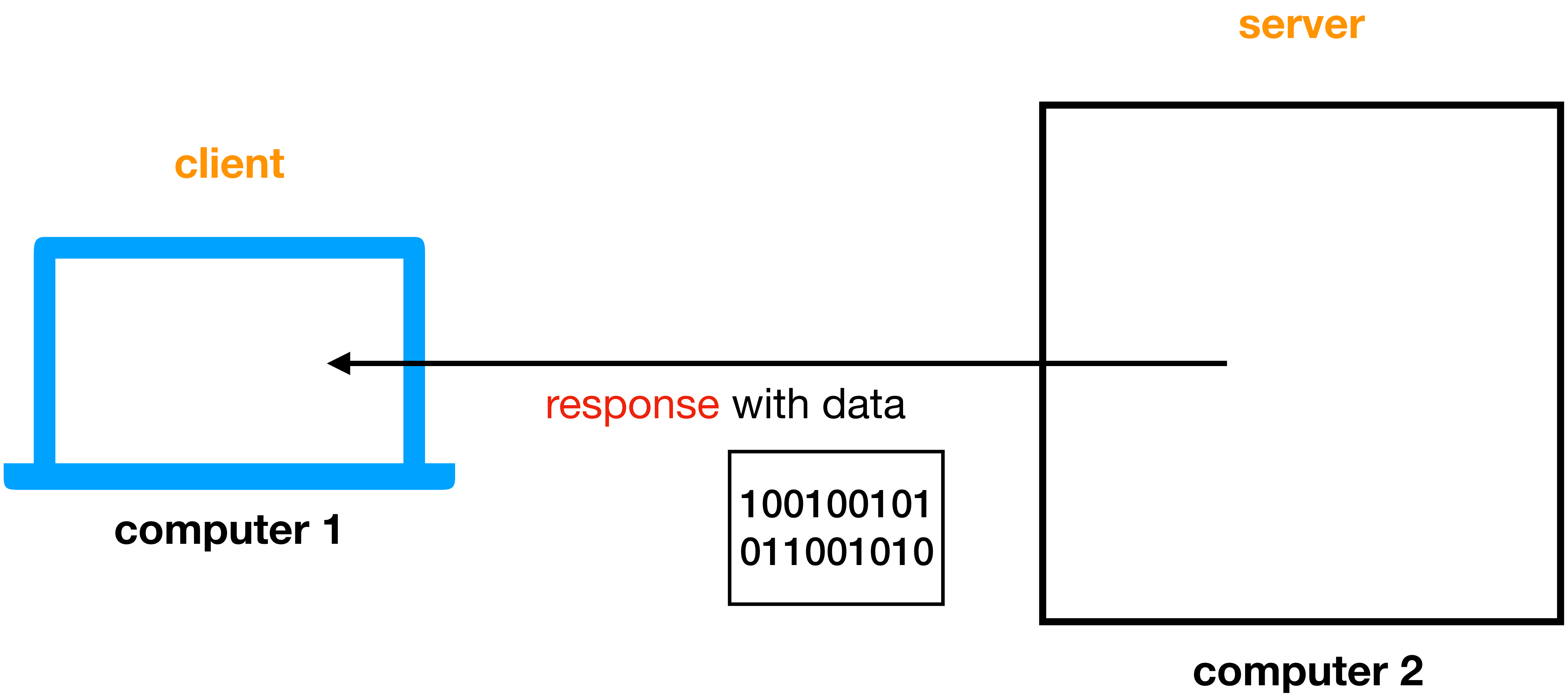

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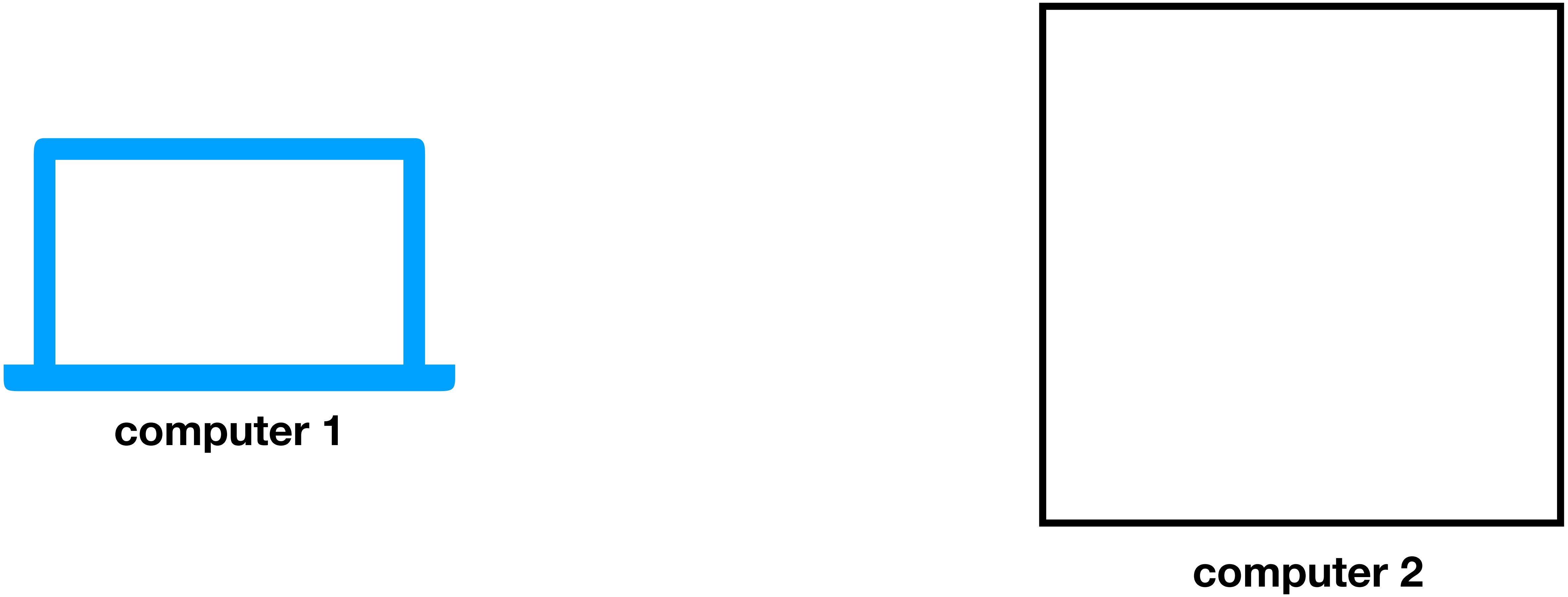


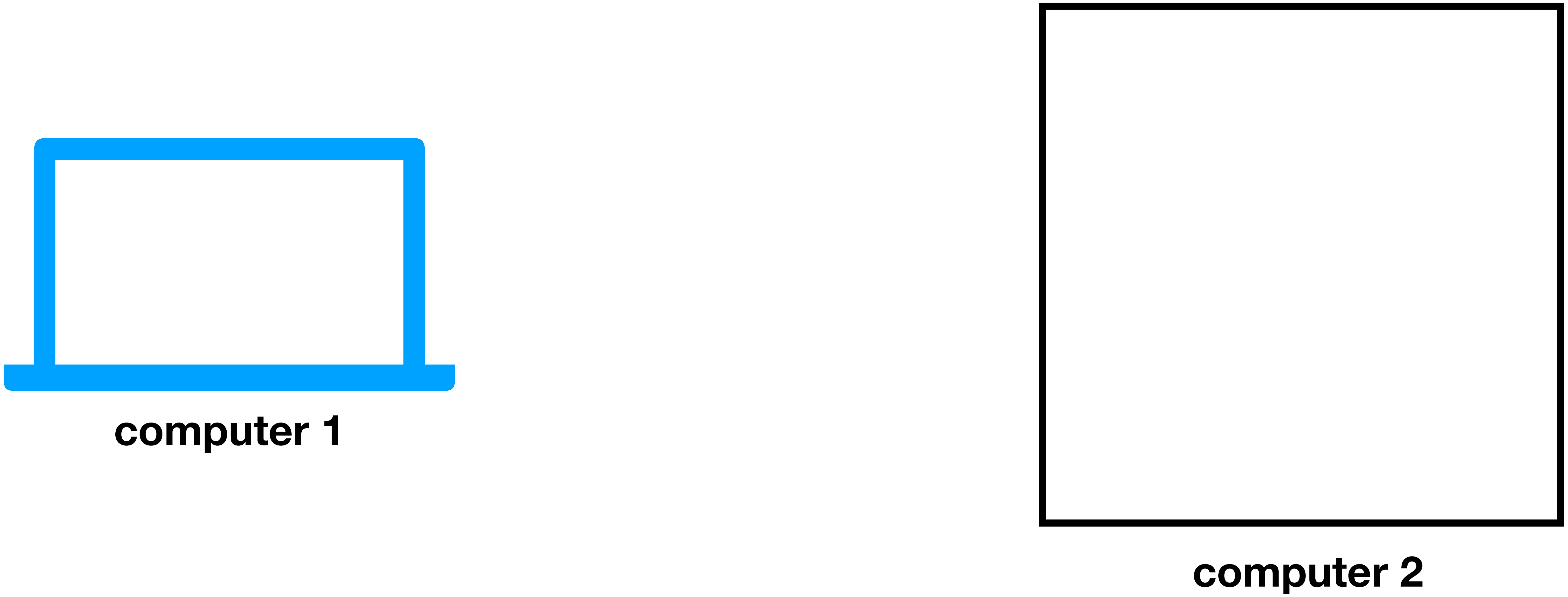
computer 1

computer 2

Challenge: there are millions of computers.

How do we indicate which machine should get our request?

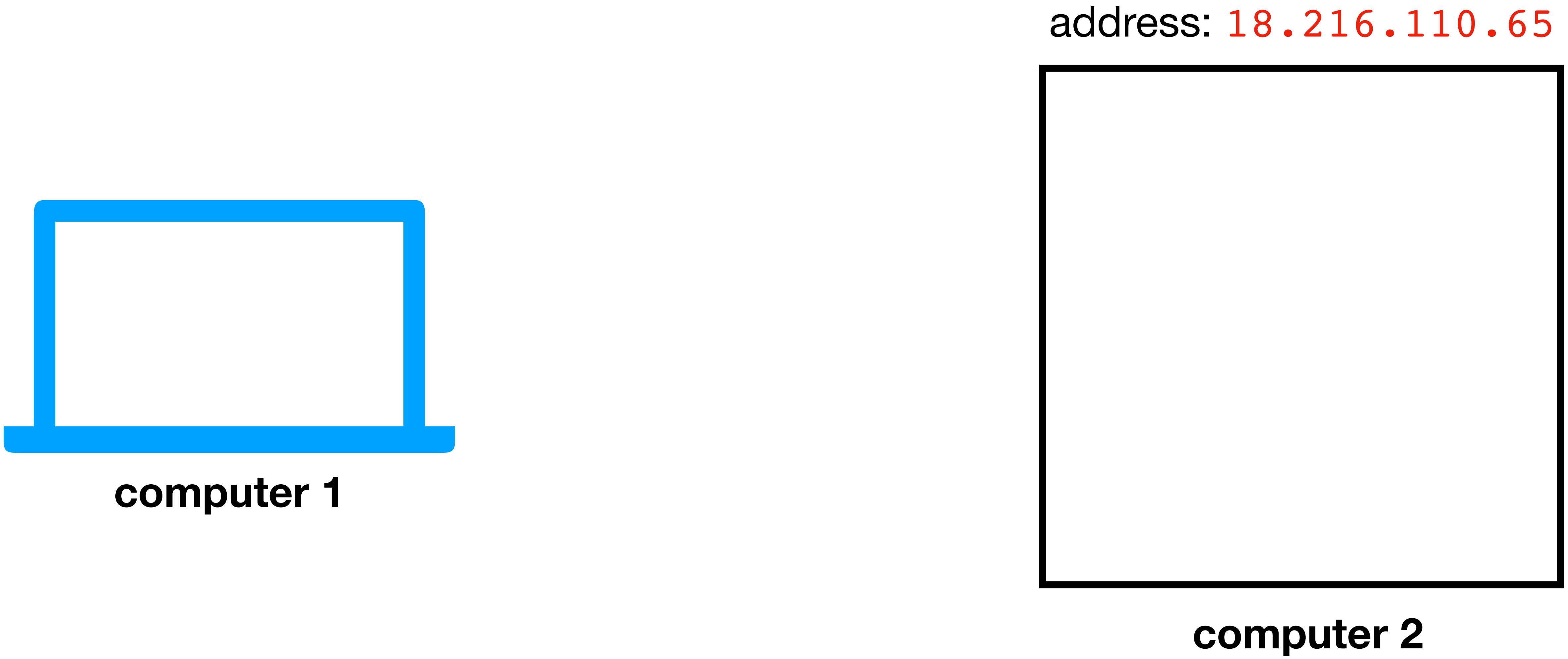
Internet Protocol



Solution: every machine* has an IP address (Internet Protocol).
Requests are sent to a specific IP address.

*some machines have more multiple addresses

Internet Protocol



address: 18.216.110.65

computer 1

computer 2

Solution: every machine* has an IP address (Internet Protocol).
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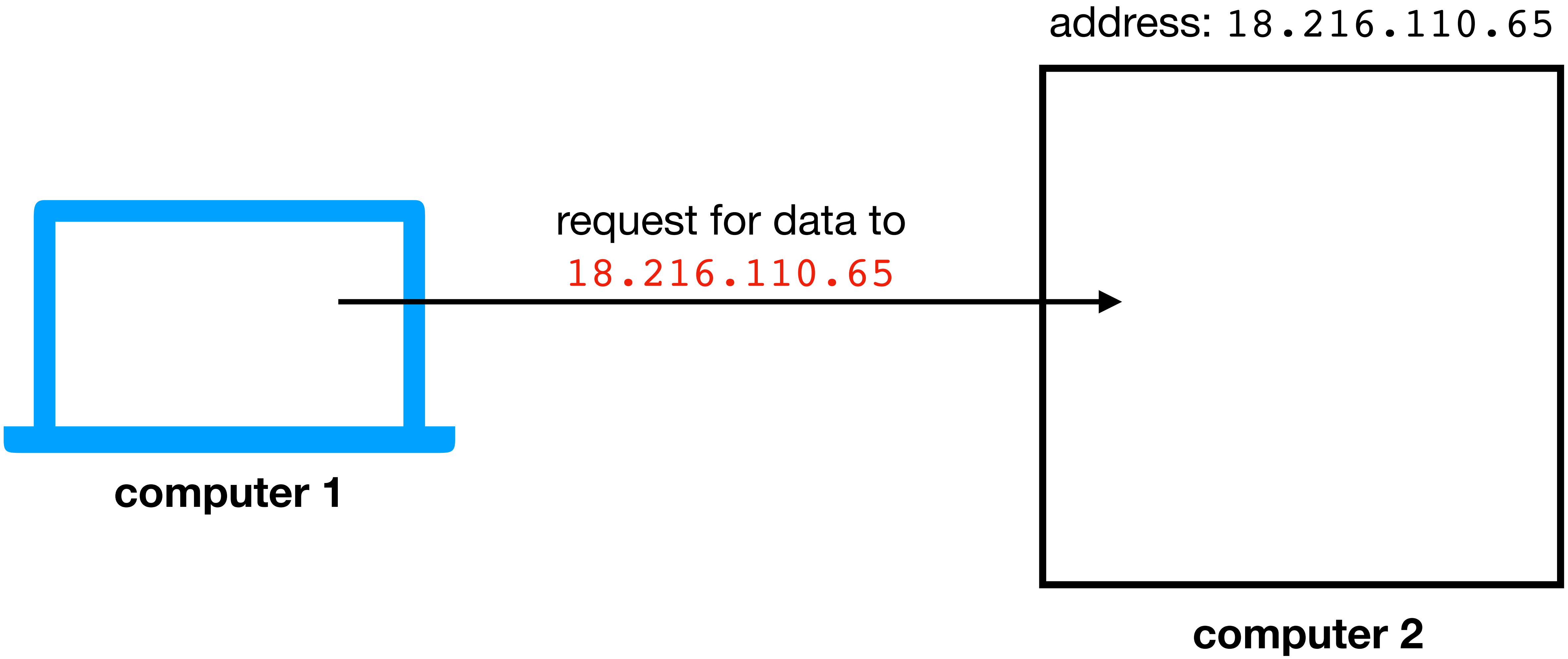
Internet Protocol



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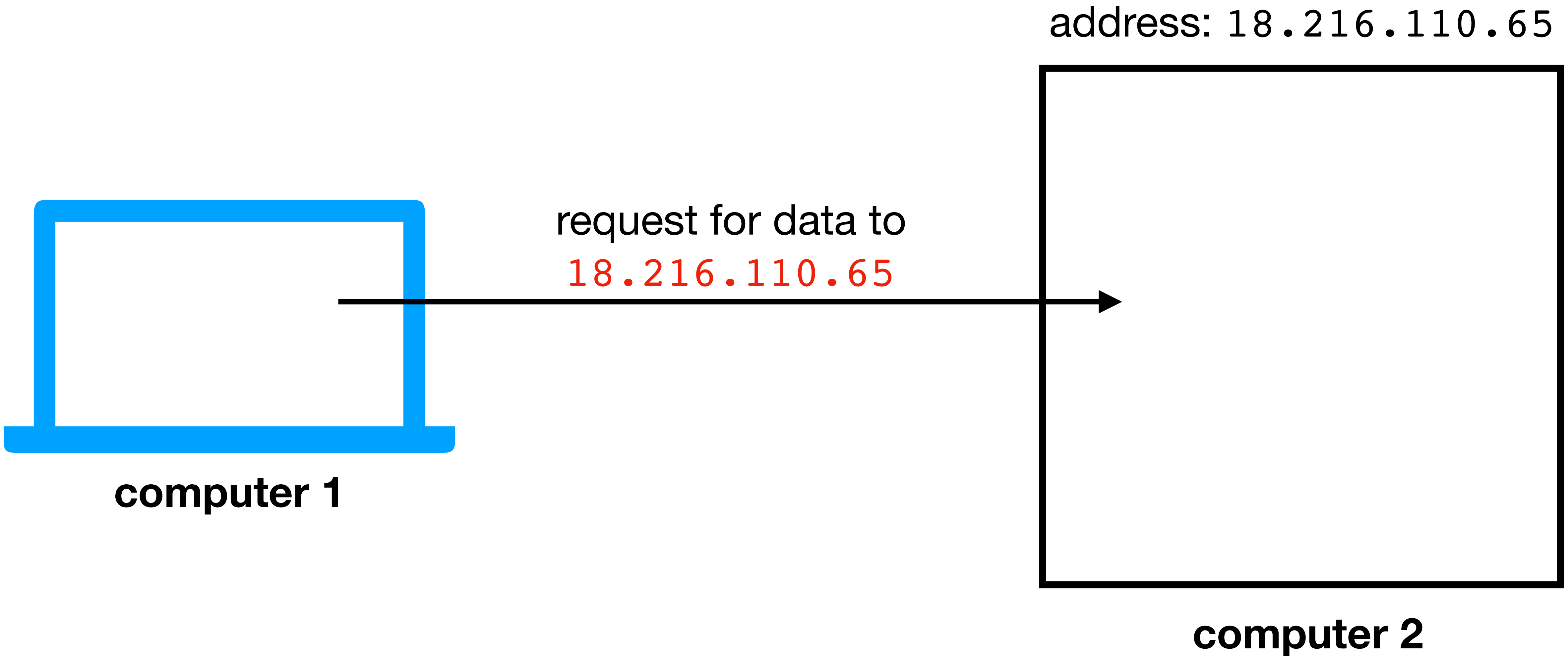
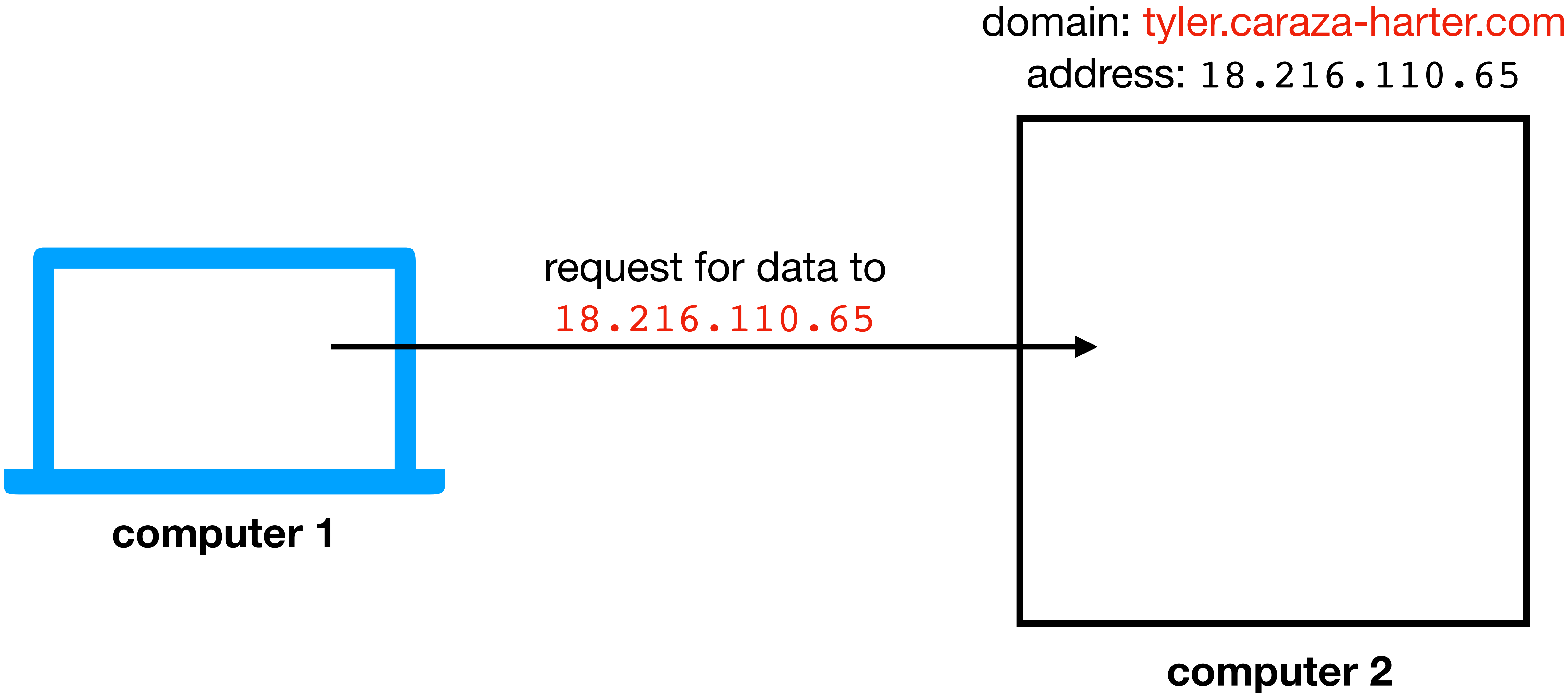


Challenge: it's hard to remember IP addresses.

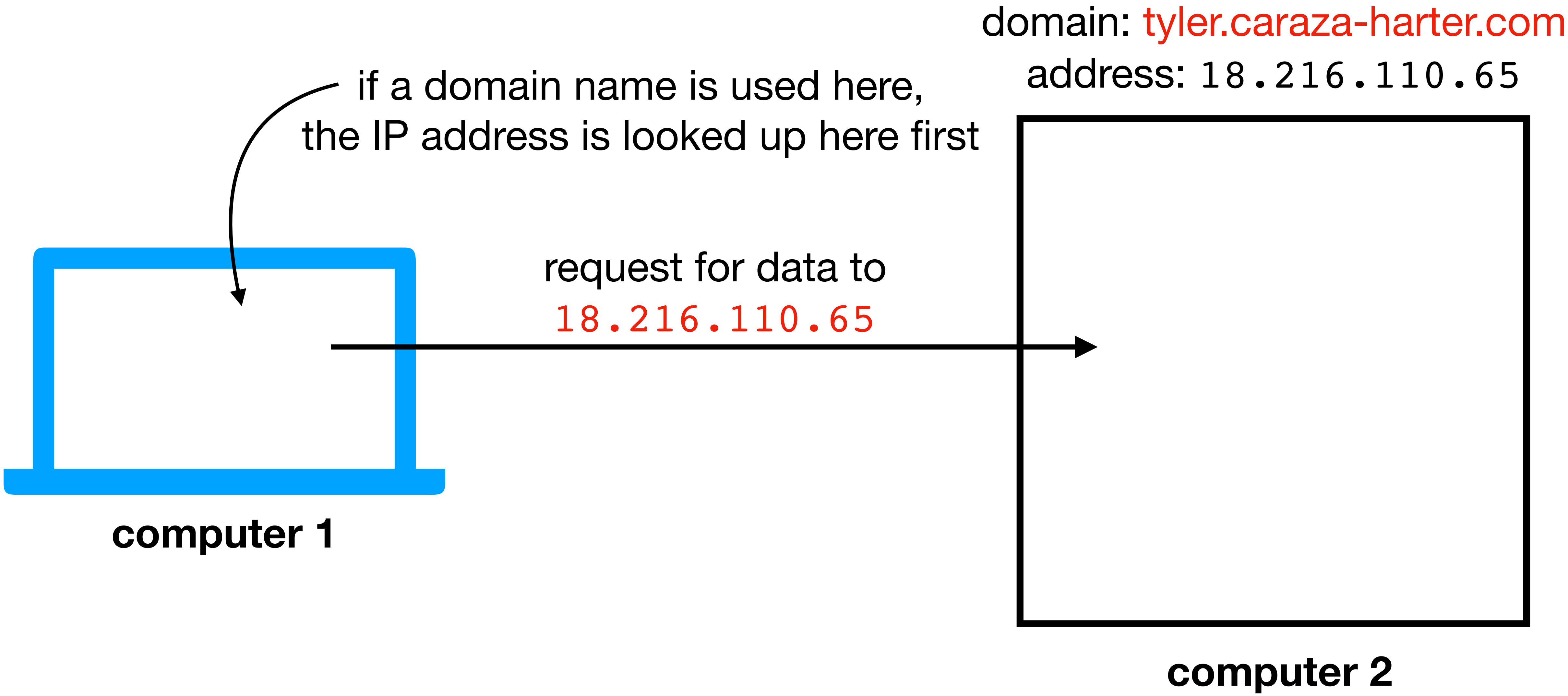
Imagine you had to type a number instead of www.google.com!

Domain Names



Solution: use "nicknames" (called domain names)
for IP addresses of machines that serve data

Domain Names



domain: tyler.caraza-harter.com

address: `18.216.110.65`

if a domain name is used here,
the IP address is looked up here first

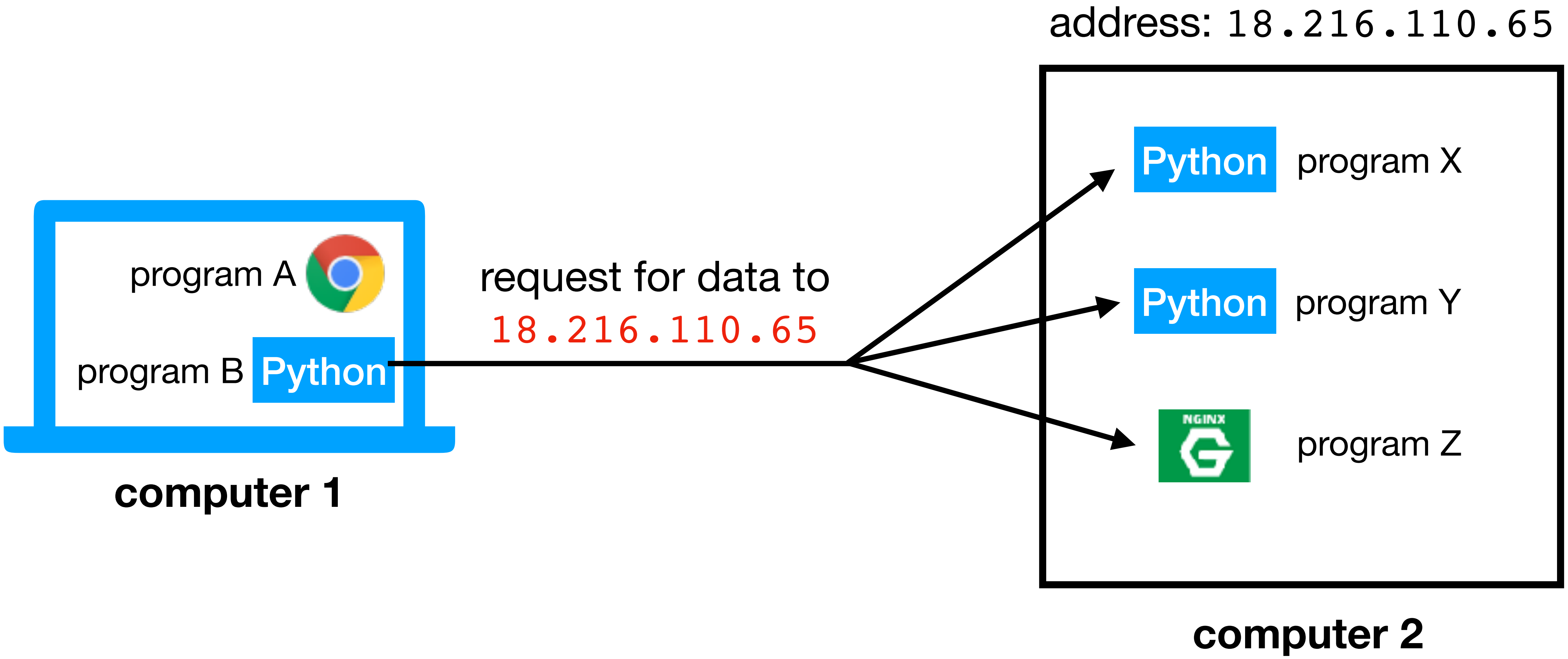
request for data to
`18.216.110.65`

computer 1

computer 2

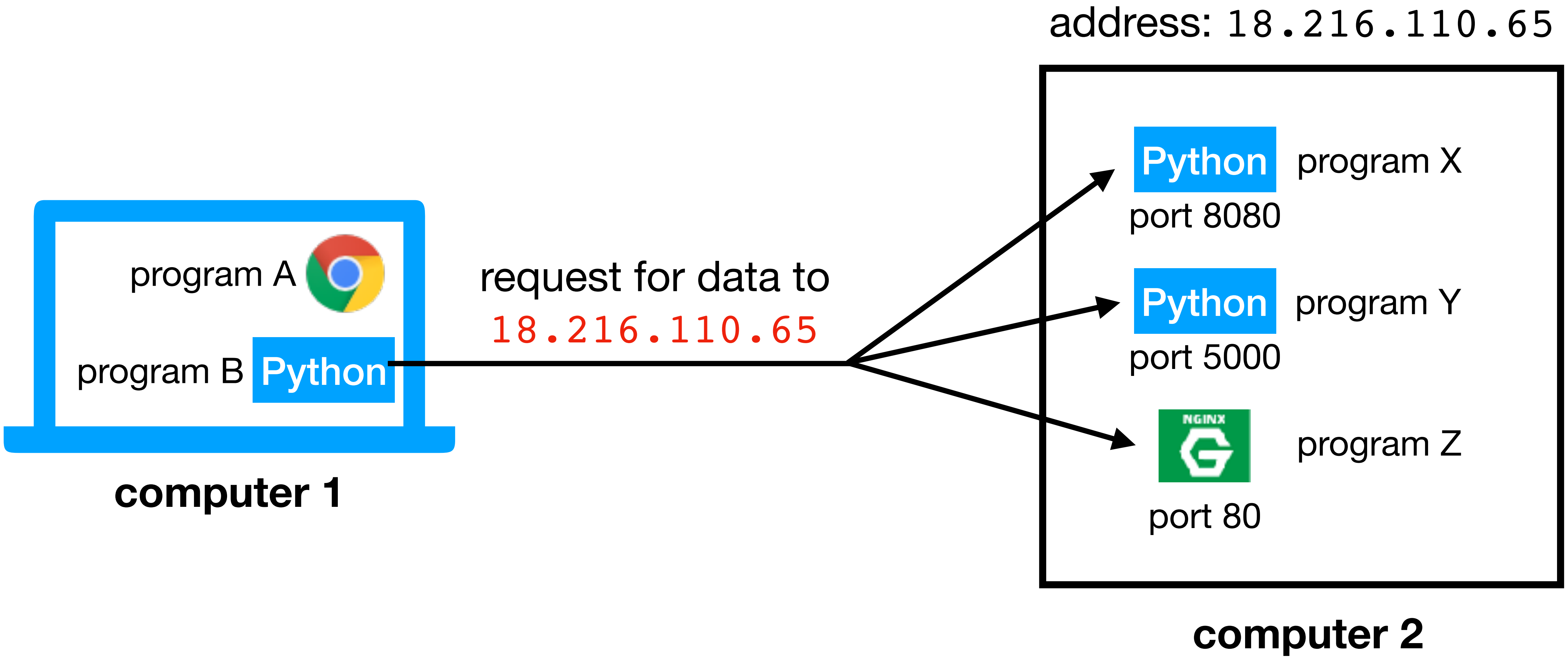
Solution: use “nicknames” (called domain names)
for IP addresses of machines that serve data

Port Numbers



Challenge: there may be multiple programs running on each computer.
How do we get the messages to the right program?

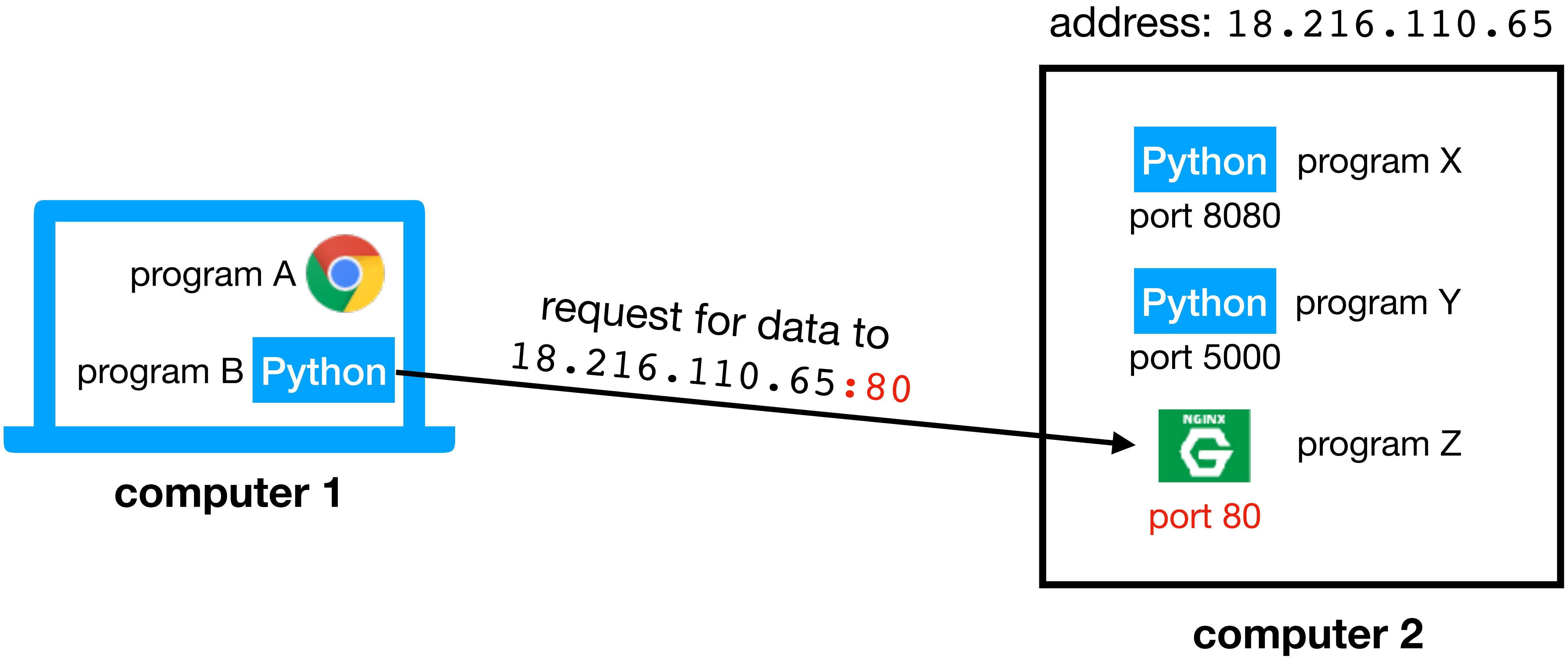
Port Numbers



Solution: give each program a unique ID (called a "port number")

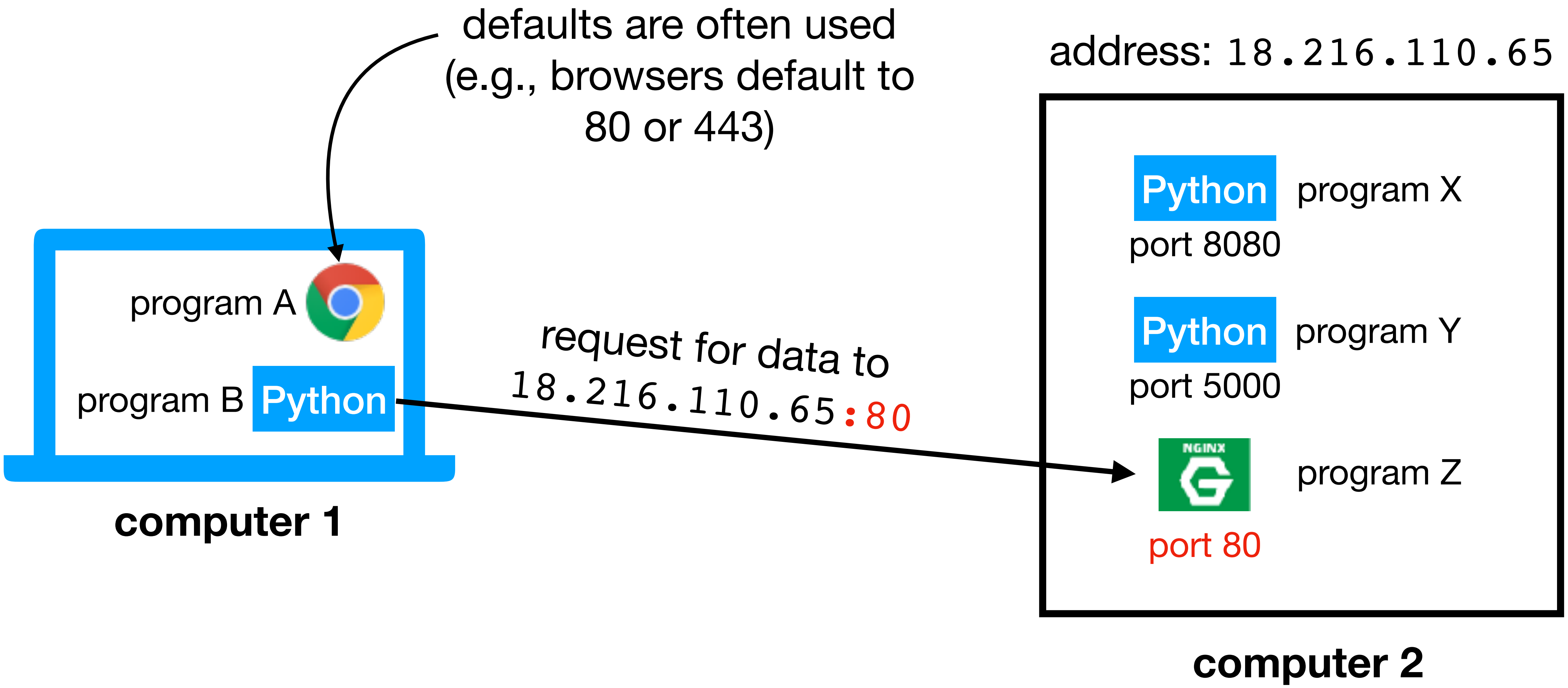
(like apartment numbers)

Port Numbers



Solution: specify port number in request

Port Numbers



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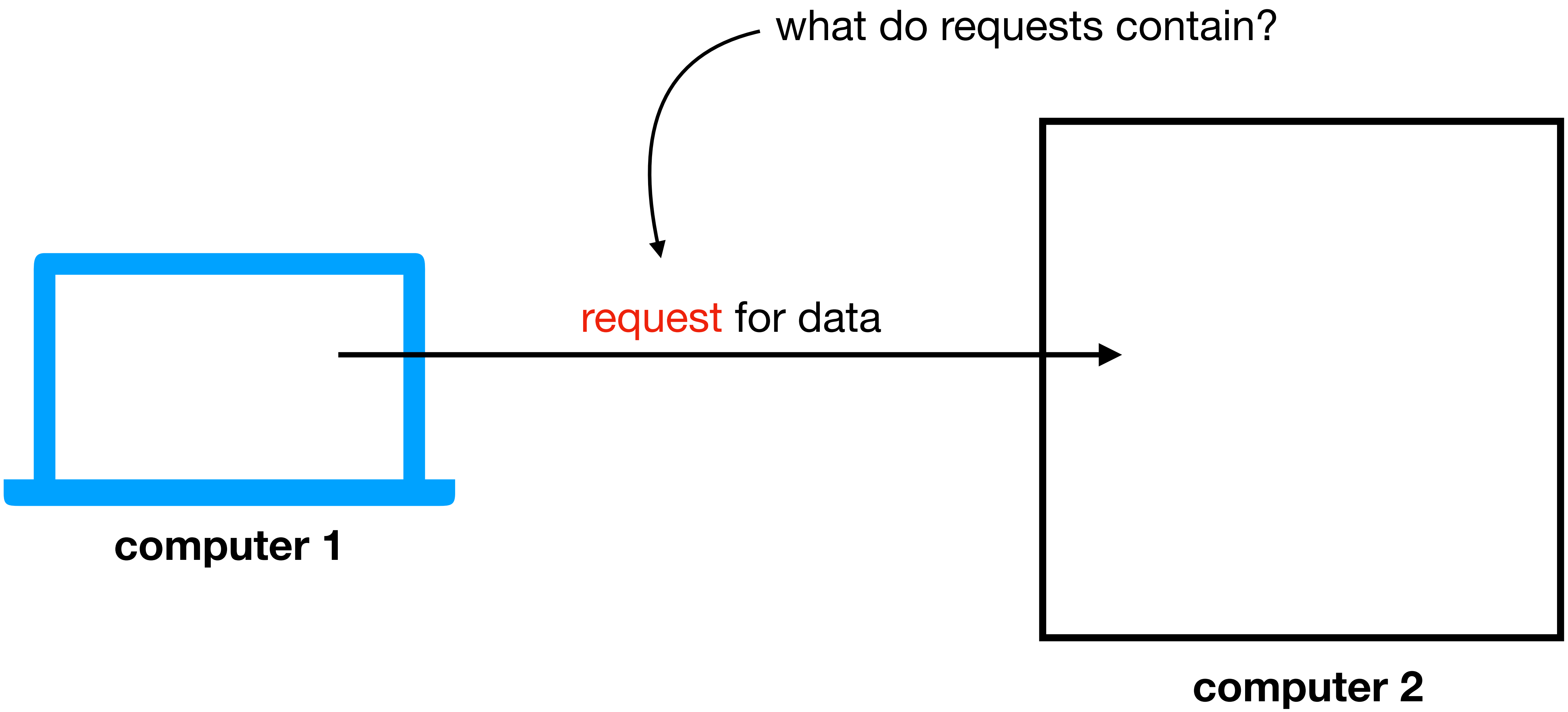
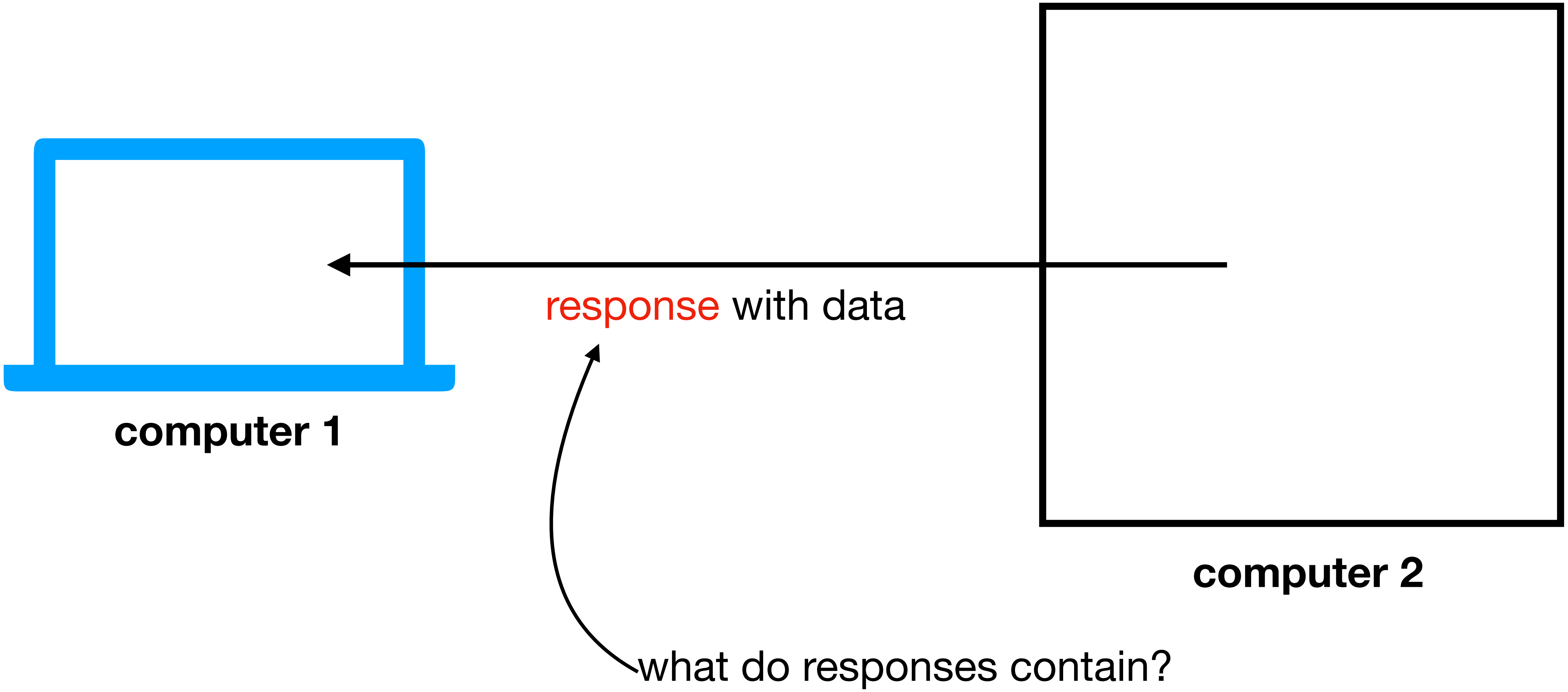


what do requests contain?

request for data

computer 1

computer 2



response with data

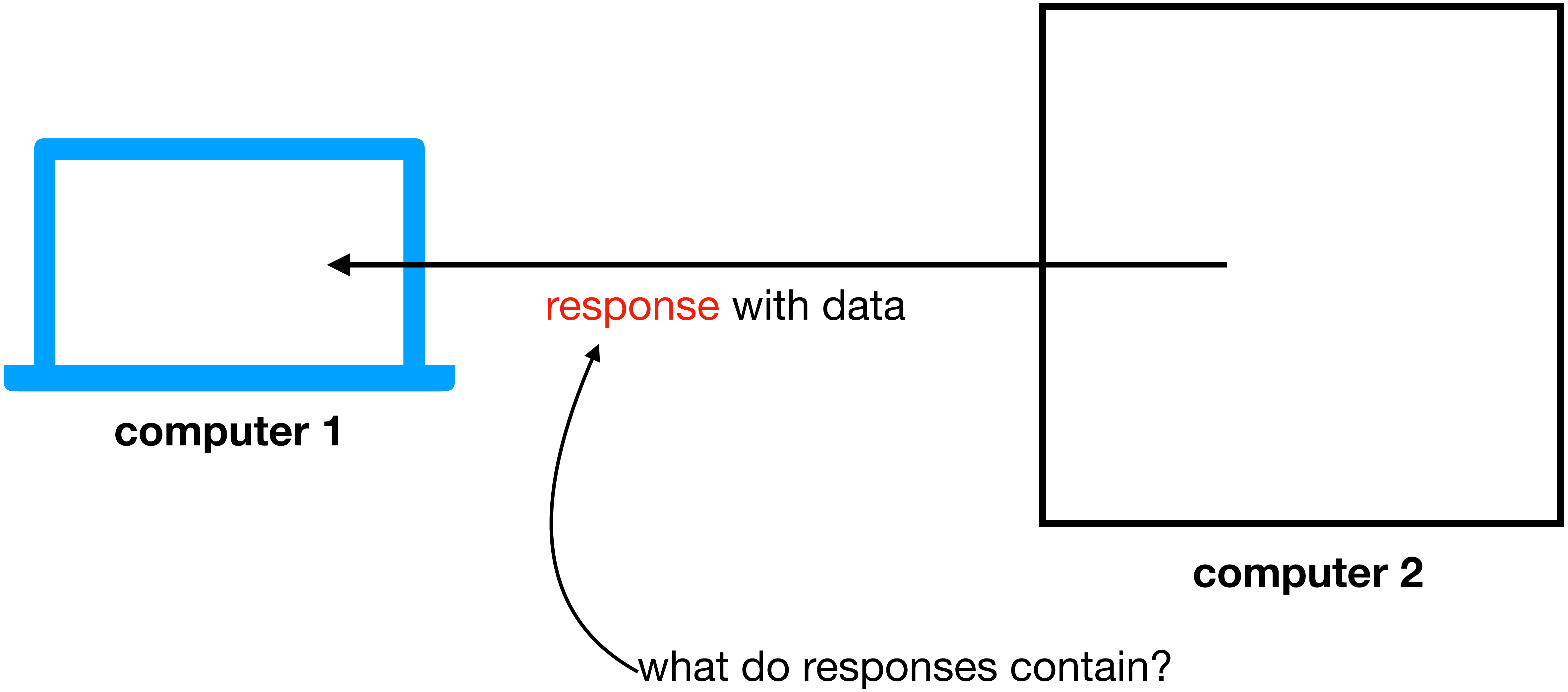
computer 1

computer 2

what do responses contain?

depends on application! (video chat, web browsing, etc)

we’ll only consider web applications for this semester



response with data

computer 1

computer 2

what do responses contain?

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Networking Basics

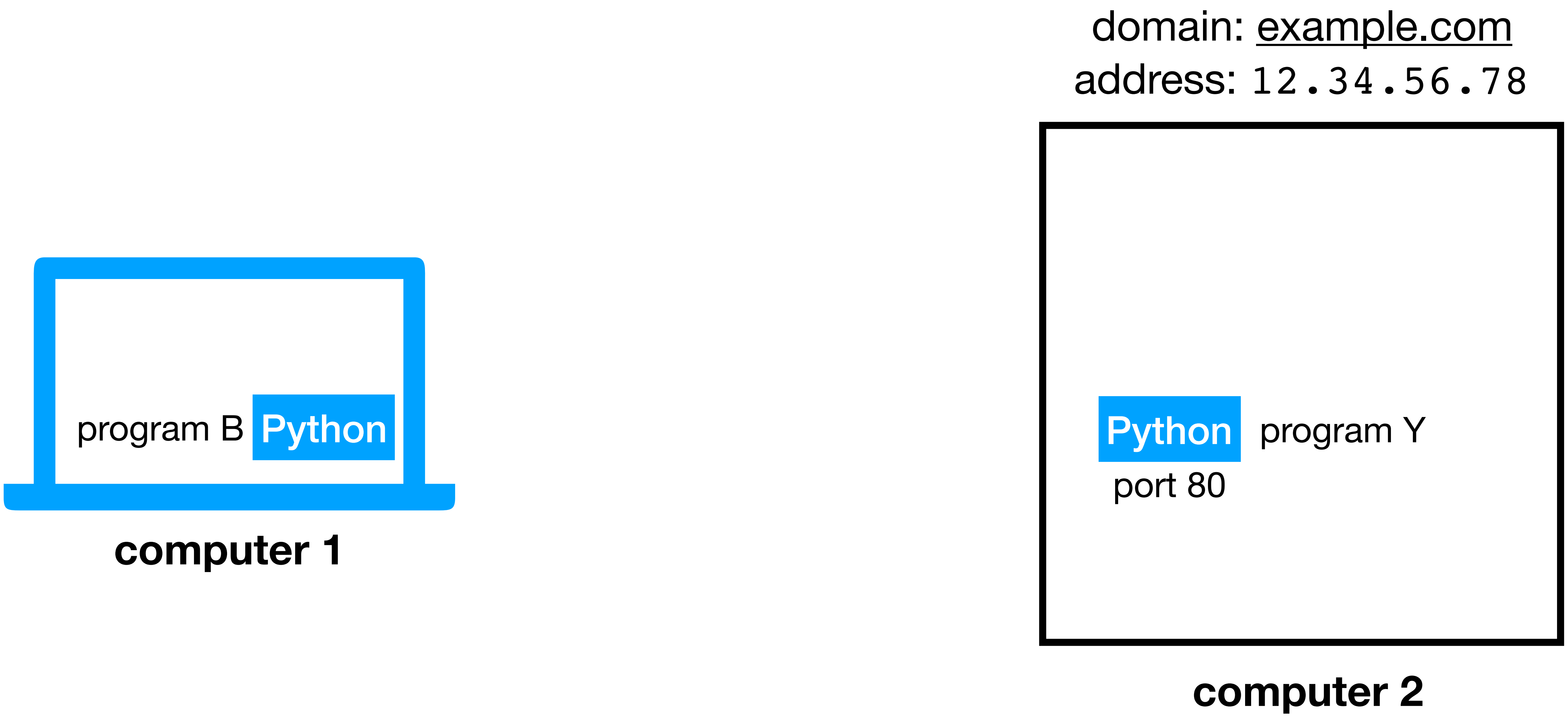
HTTP (Hypertext Transfer Protocol)

Requests Module

HTTP

Protocol for communicating web data

- downloading a specific webpage, image, etc



domain: example.com

address: `12.34.56.78`

program B Python

computer 1

Python program Y

port 80

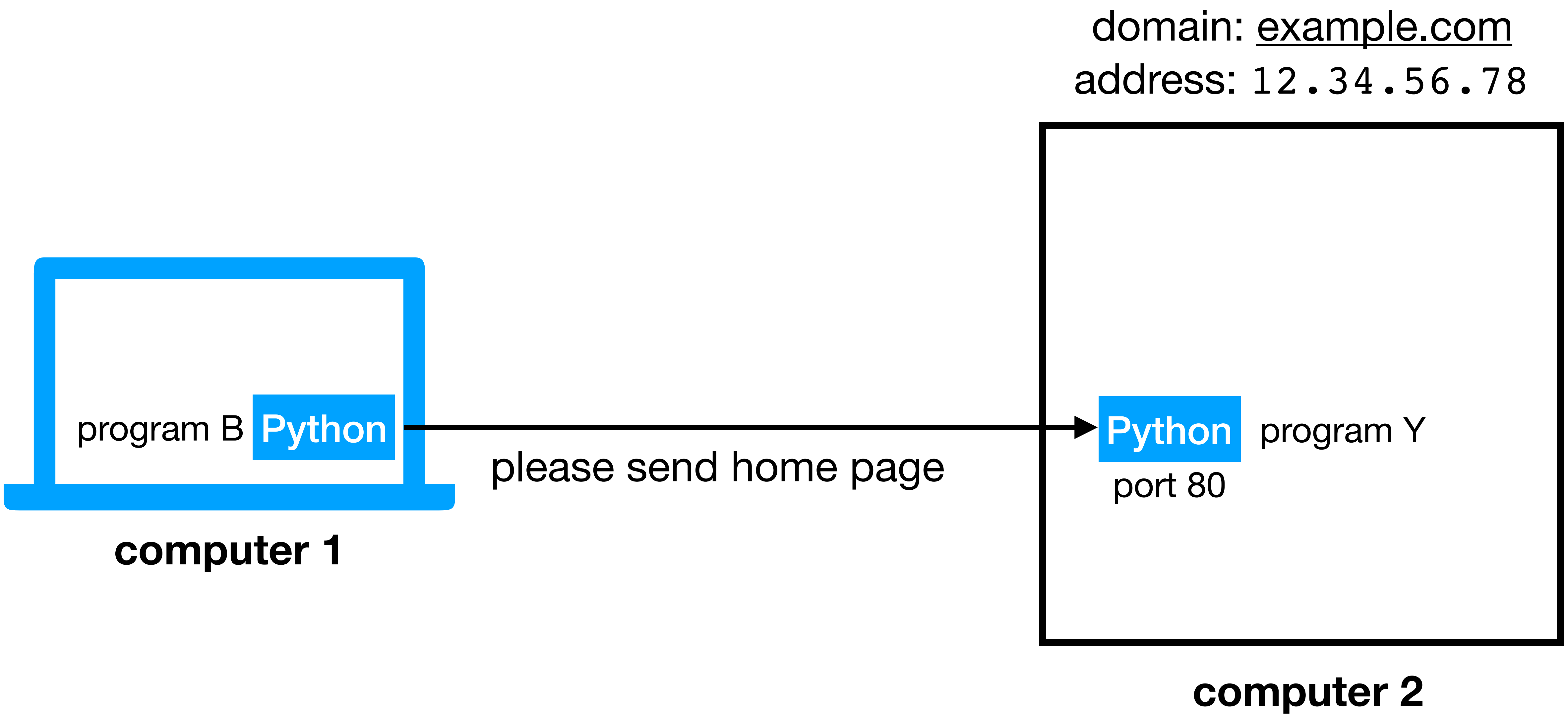
computer 2

Note: we won't talk about HTTPS today, which is HTTP with encryption

HTTP

Protocol for communicating web data

- downloading a specific webpage, image, etc



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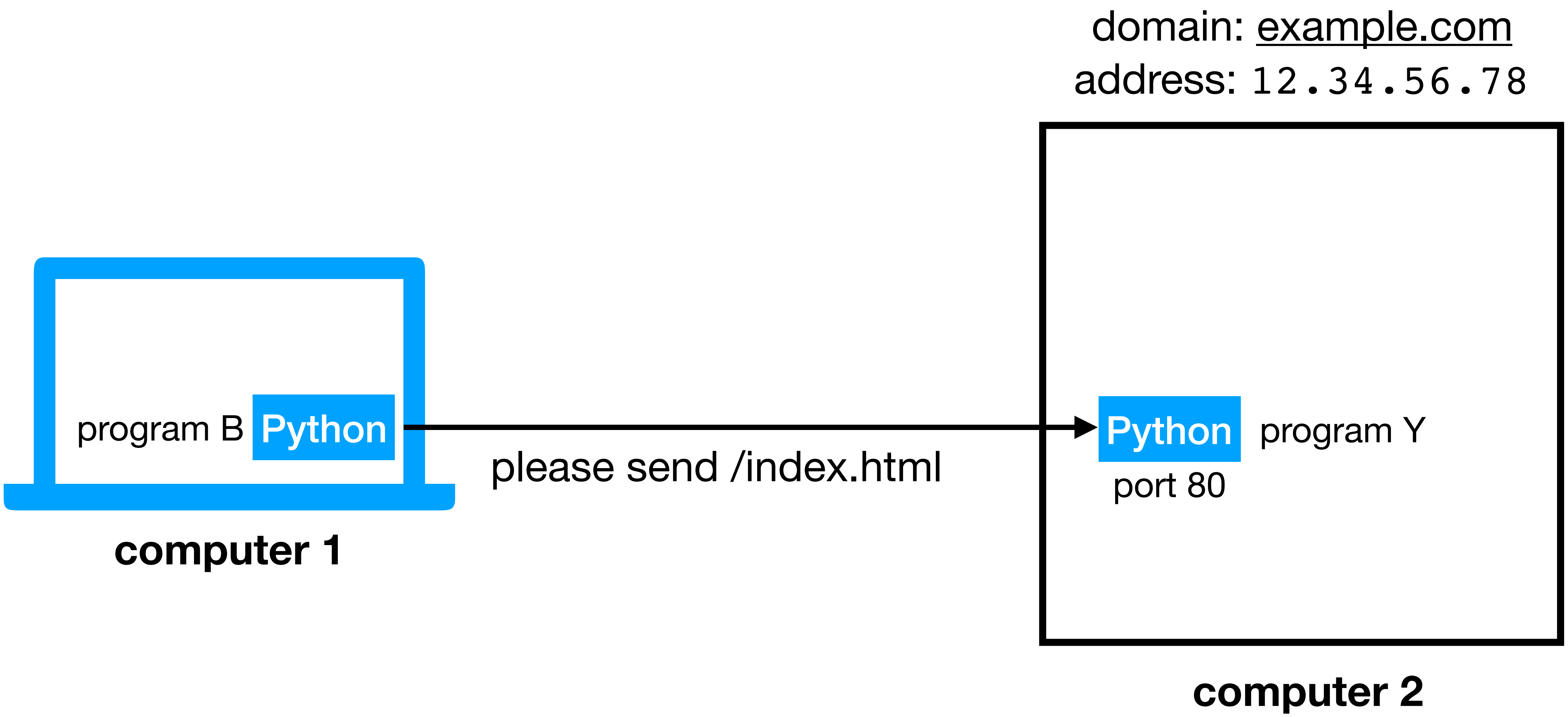

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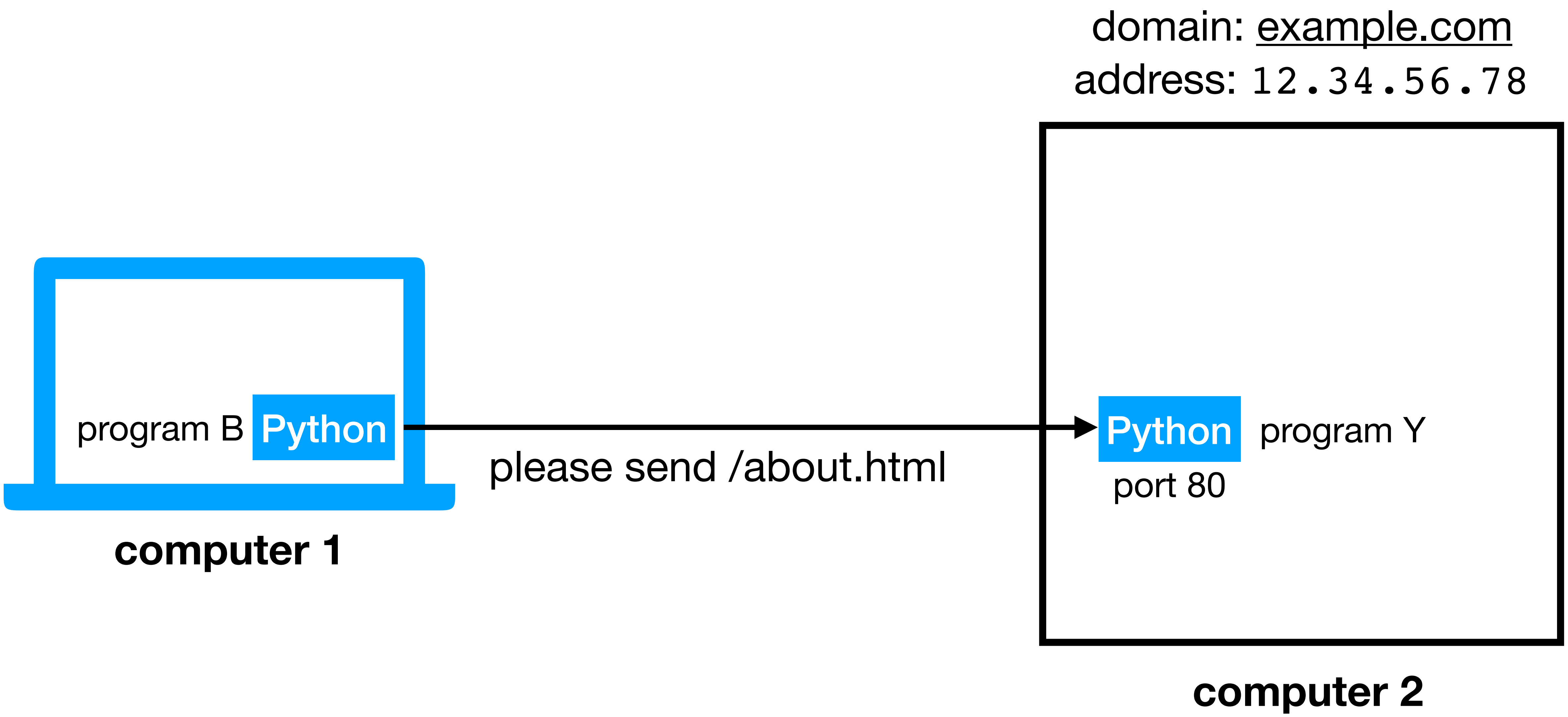
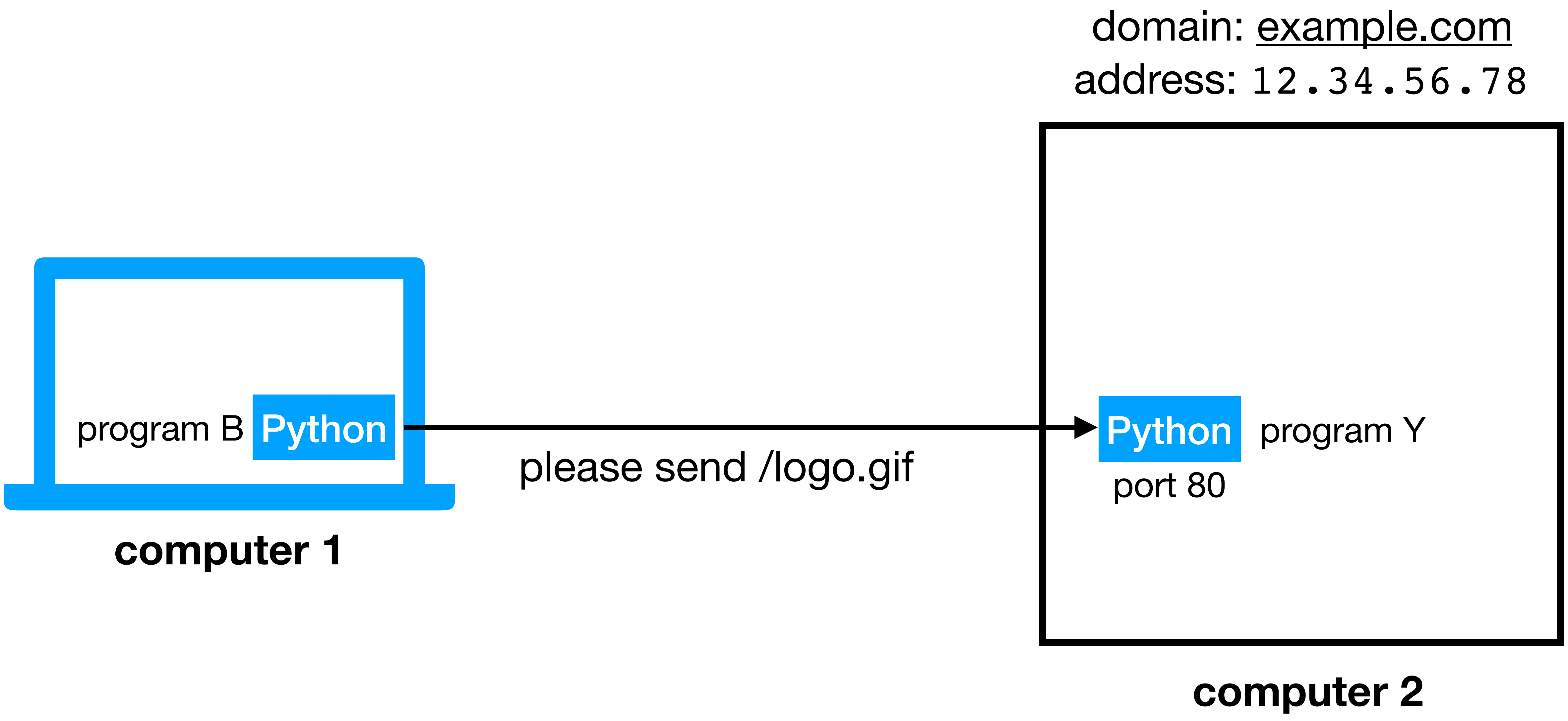


HTTP

Protocol for communicating web data

- downloading a specific webpage, image, etc



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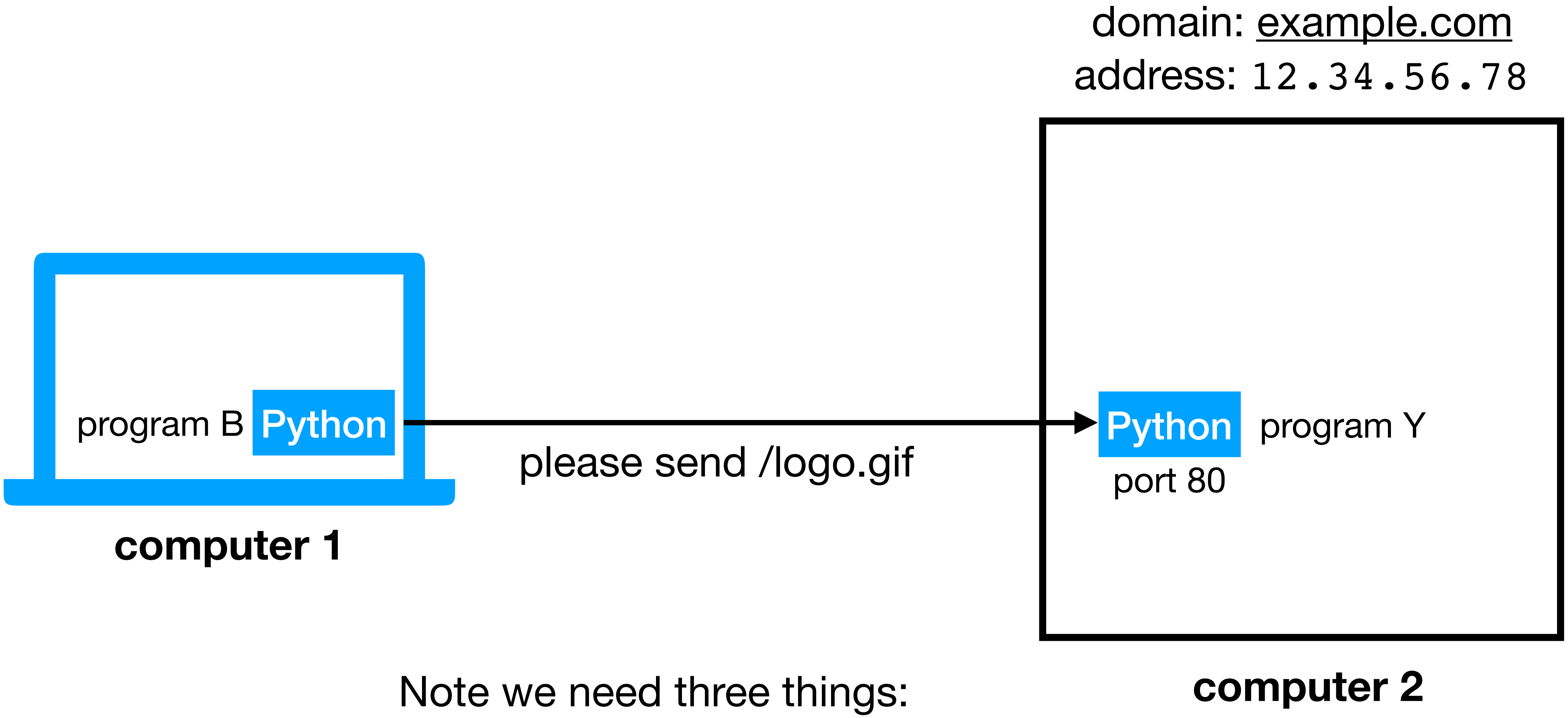
Protocol for communicating web data

- downloading a specific webpage, image, etc



Note we need three things:

1. domain name
2. port number
3. resource (file name)

HTTP

Protocol for communicating web data

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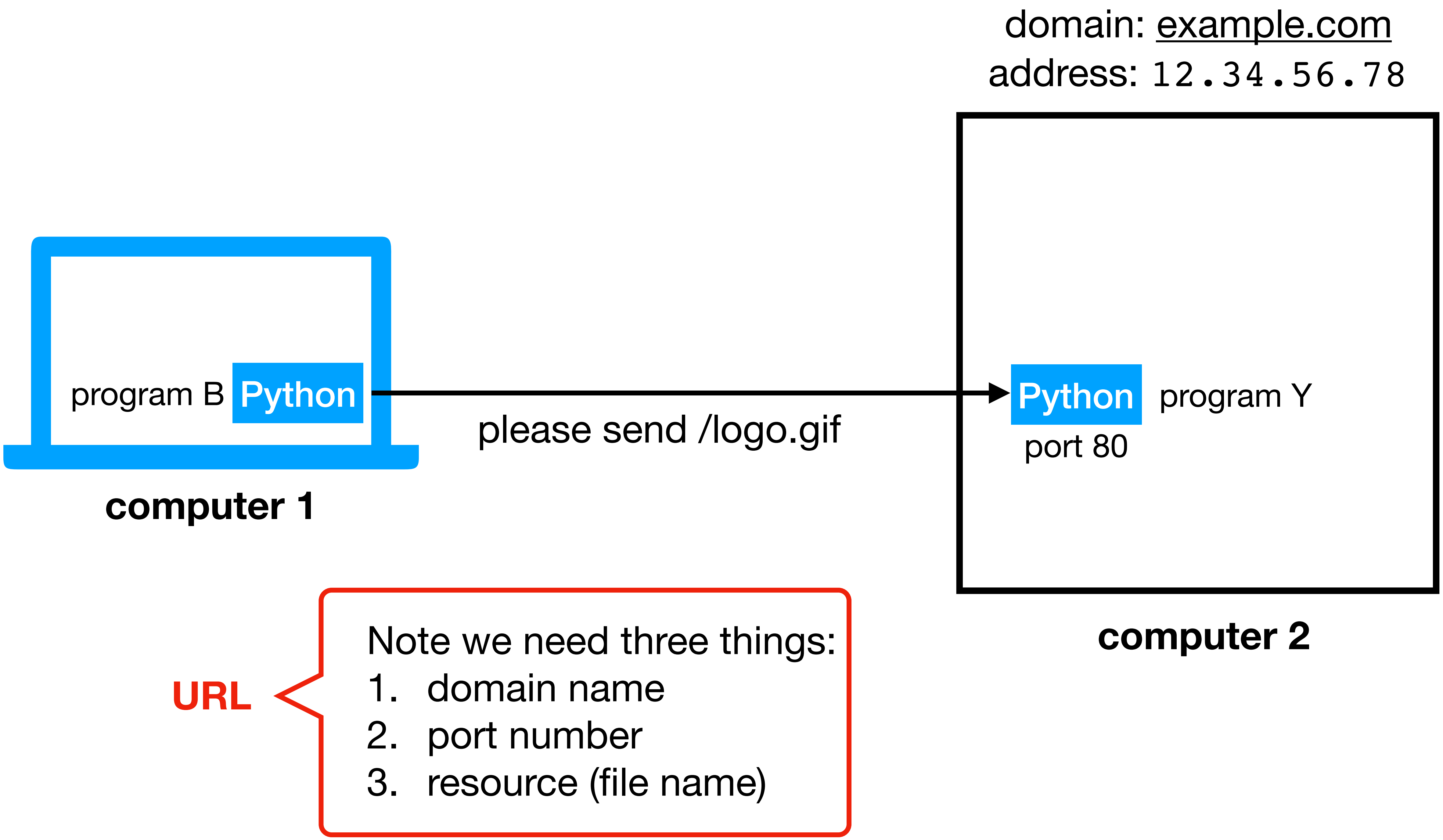

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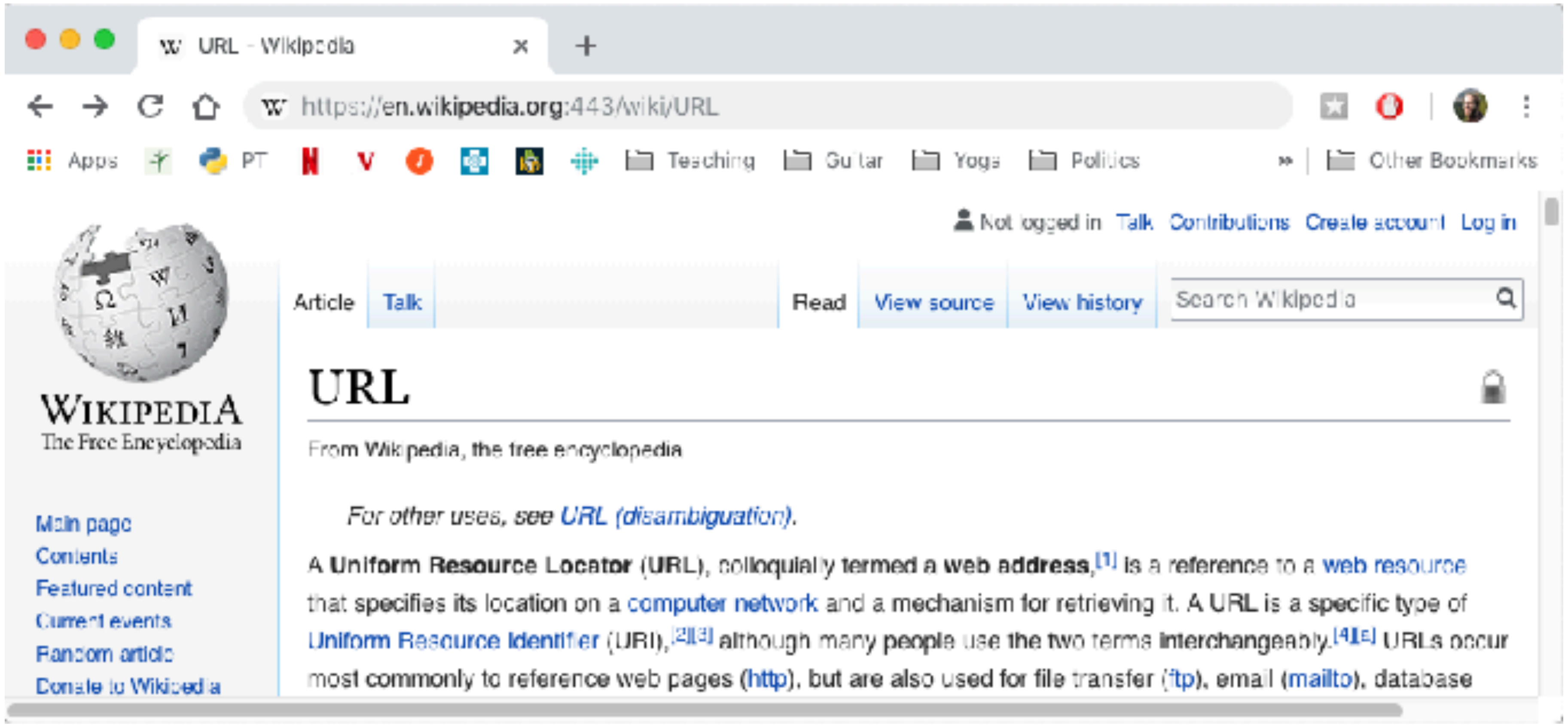
URLs

`https://en.wikipedia.org:443/wiki/URL`



URL

From Wikipedia, the free encyclopedia

For other uses, see URL (disambiguation).

A **Uniform Resource Locator** (**URL**), colloquially termed a **web address**,[1] is a reference to a web resource that specifies its location on a computer network and a mechanism for retrieving it. A URL is a specific type of Uniform Resource Identifier (URI),[2][3] although many people use the two terms interchangeably.[4][5] URLs occur most commonly to reference web pages (http), but are also used for file transfer (ftp), email (mailto), database

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URLs

domain name

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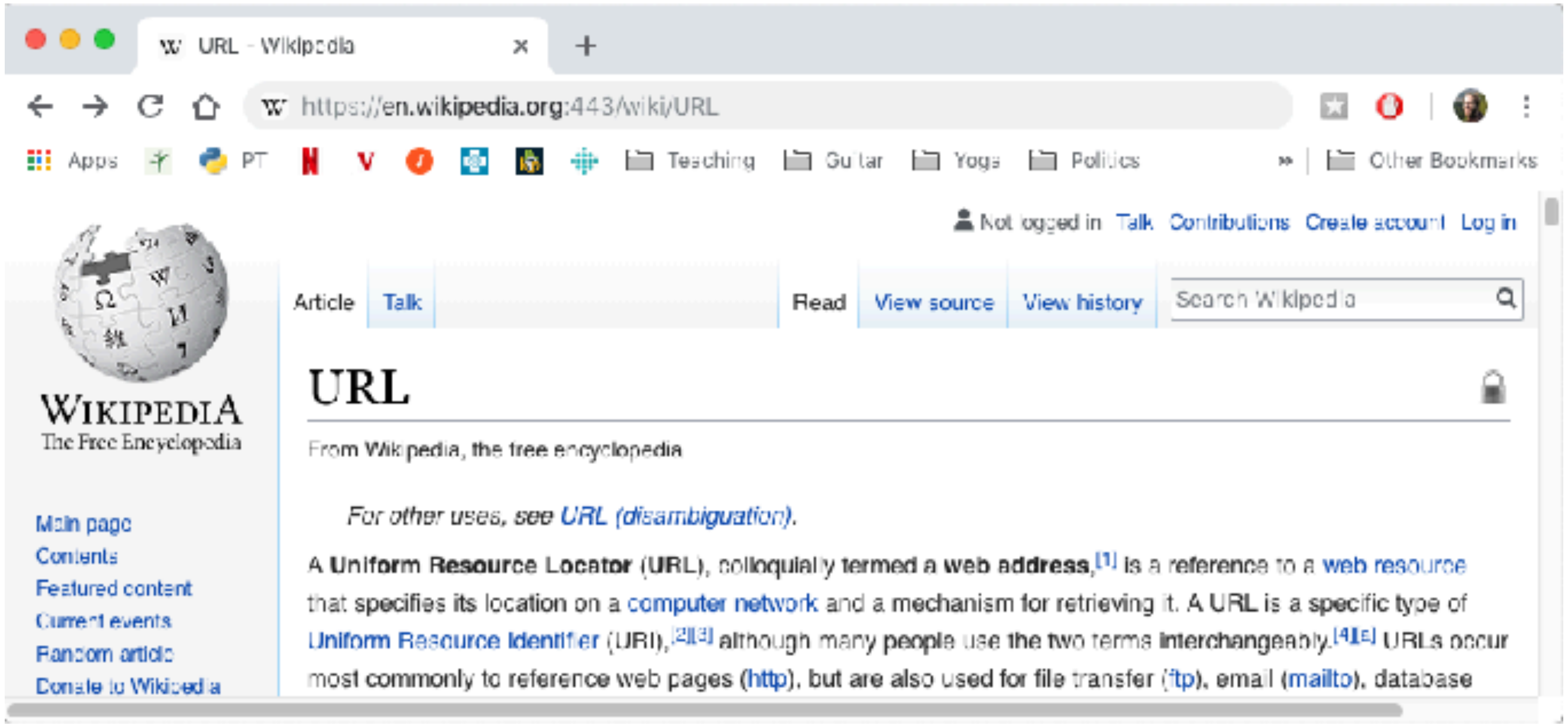

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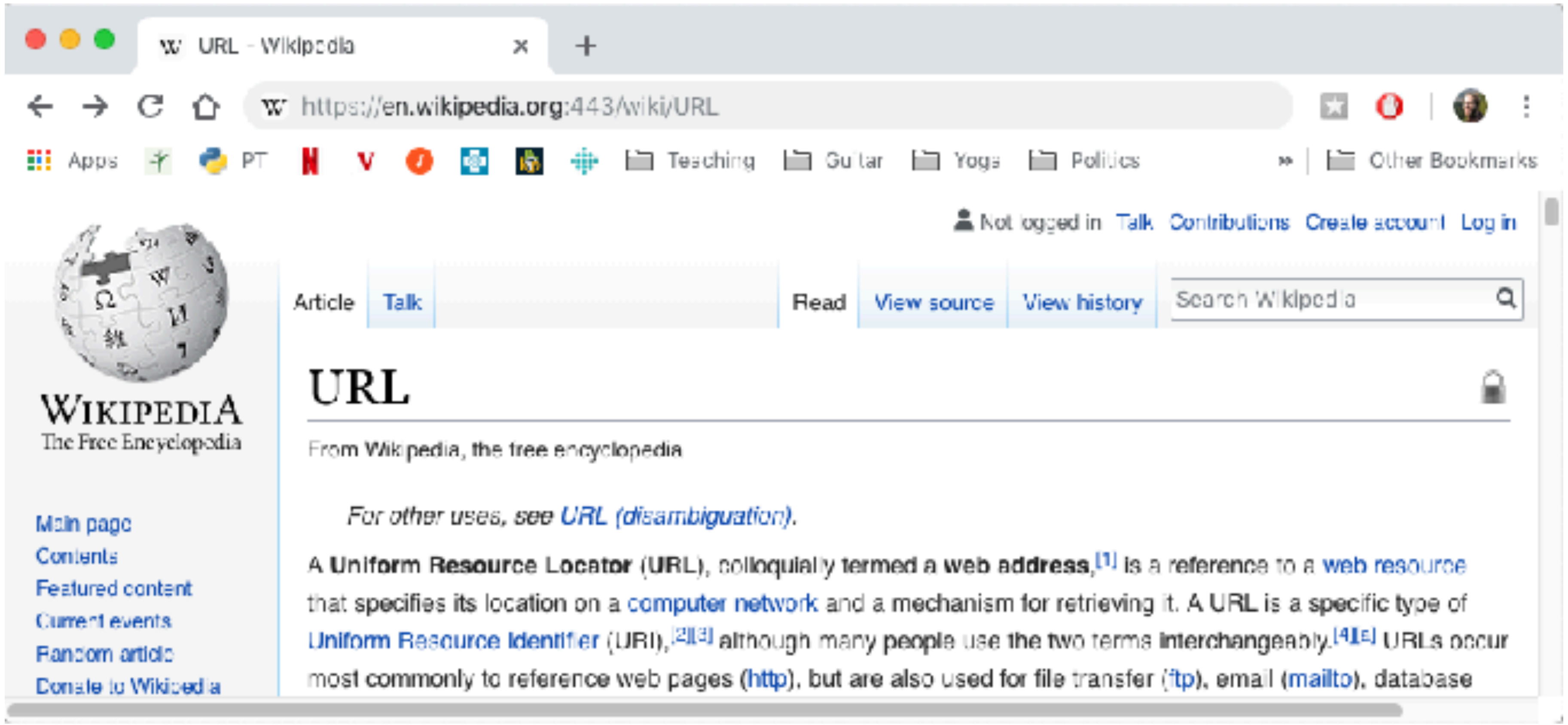
URLs

domain name

https://en.wikipedia.org:443/wiki/URL

port



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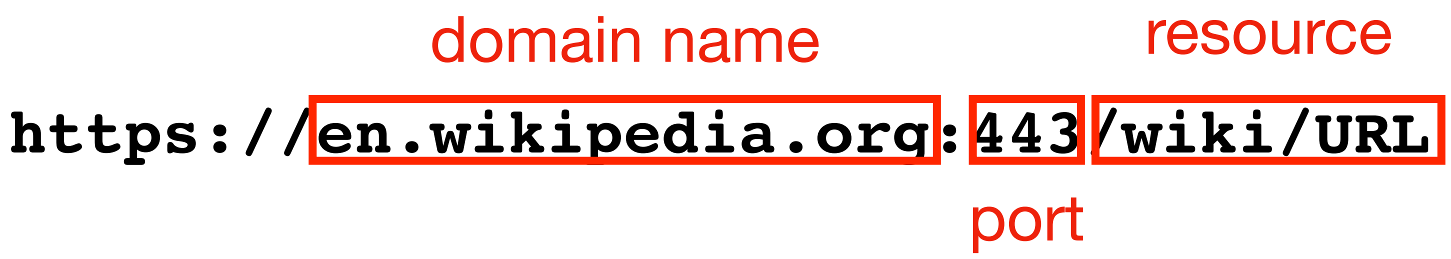

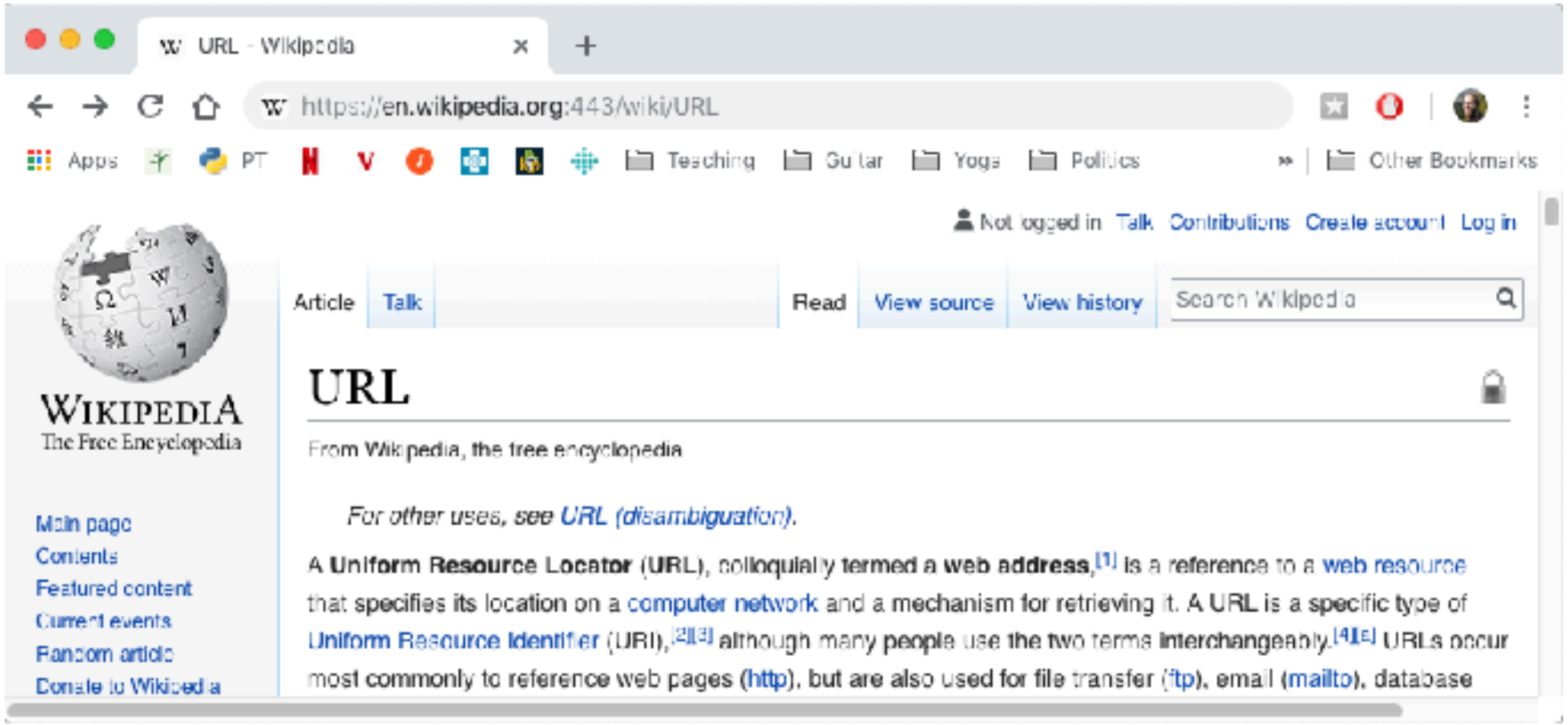

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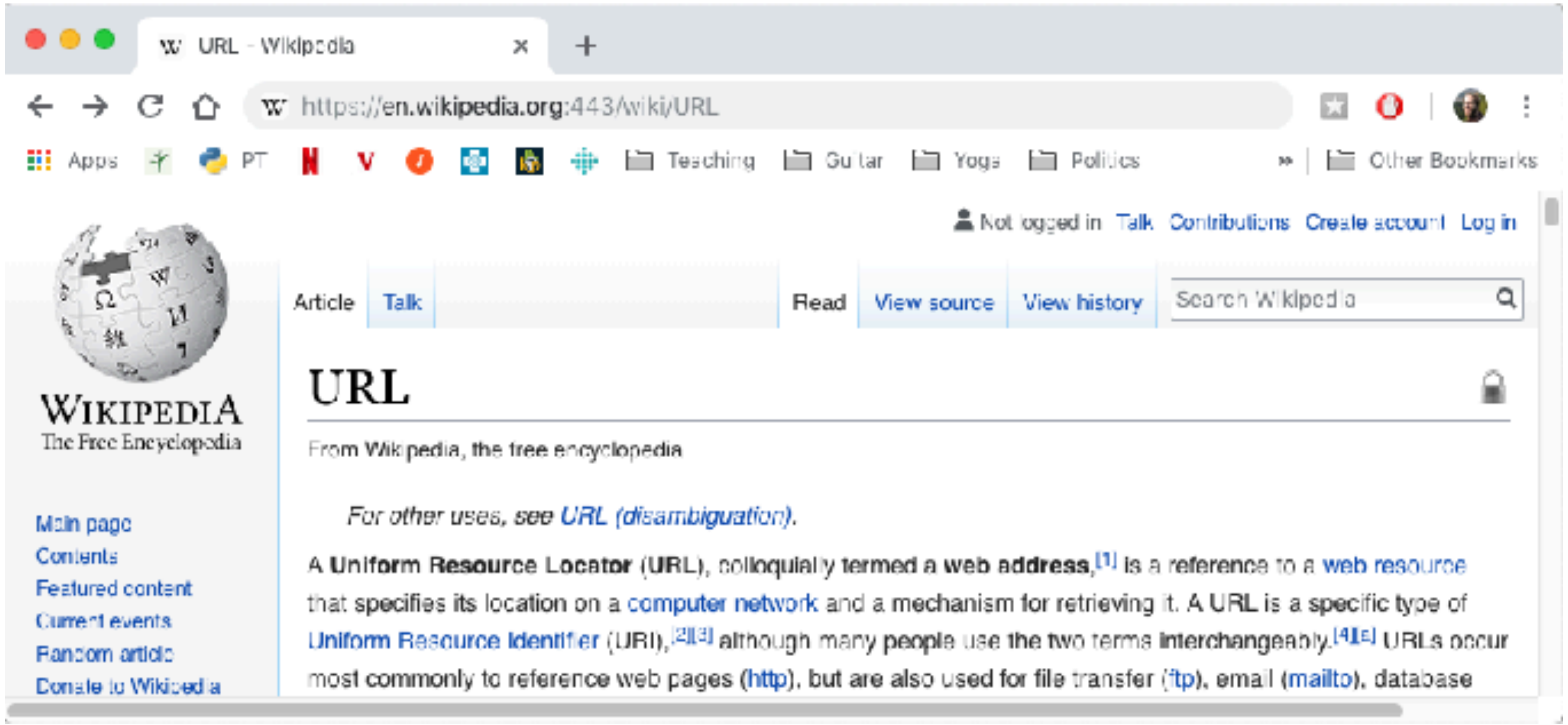
URLs

domain name resource

https://en.wikipedia.org/wiki/URL

port would have defaulted to 443 if not specified



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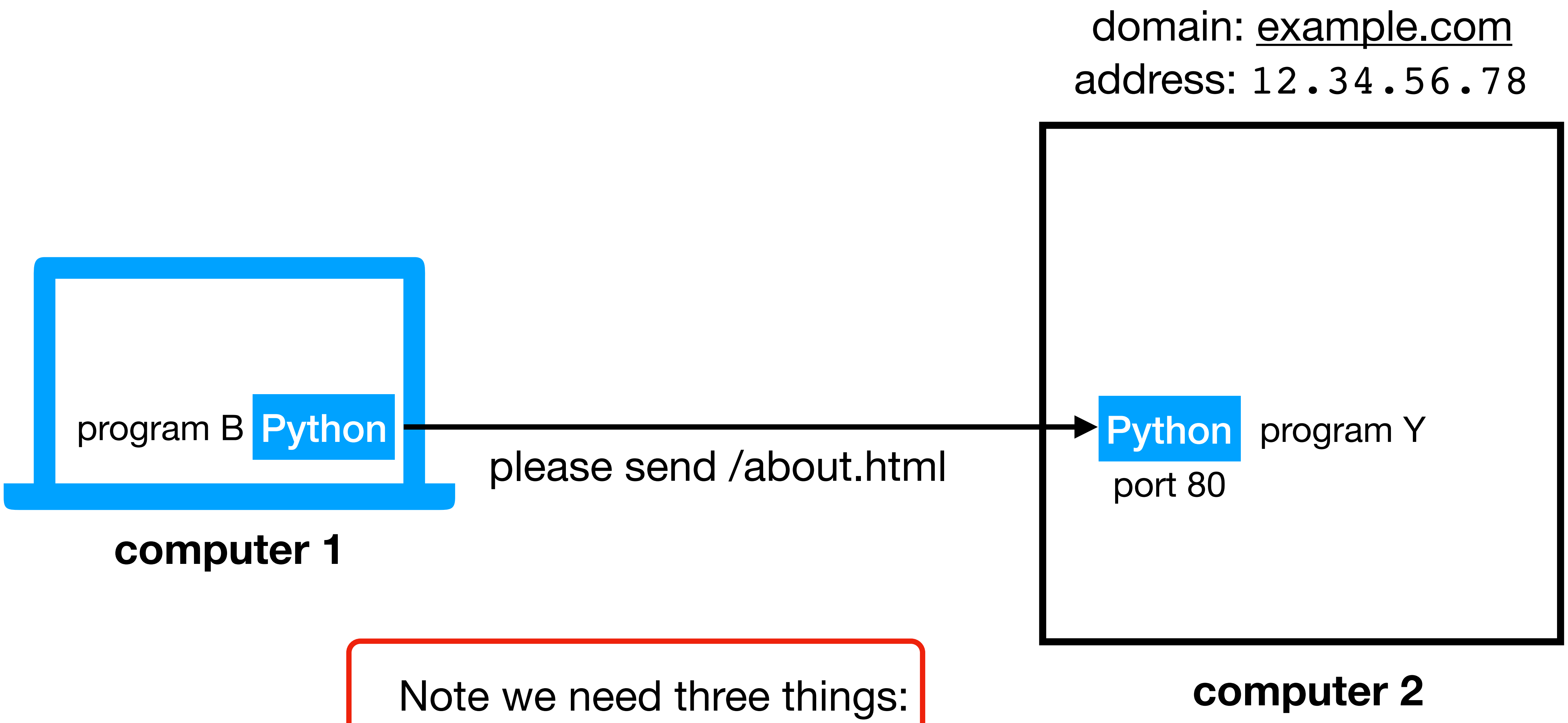
HTTP

Protocol for communicating web data

- downloading a specific webpage, image, etc



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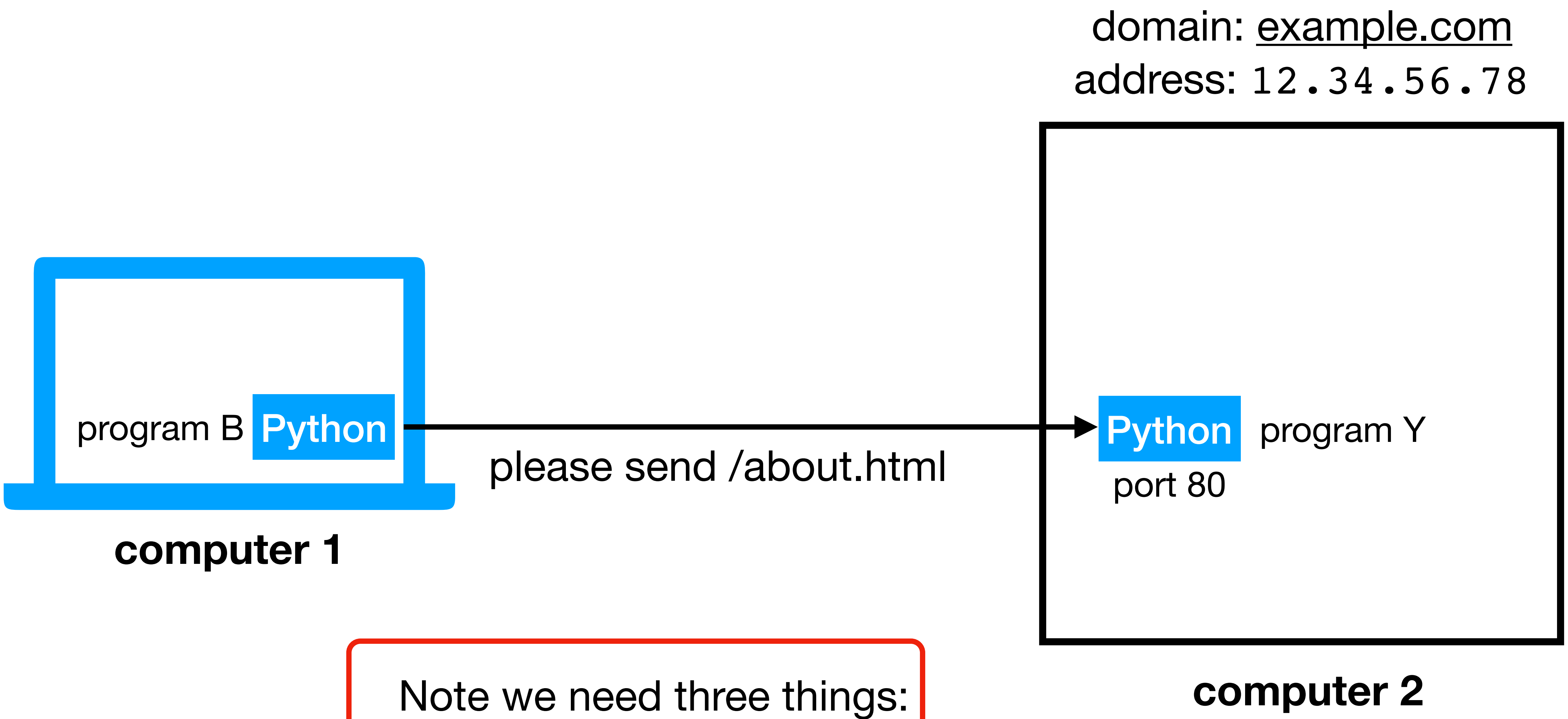

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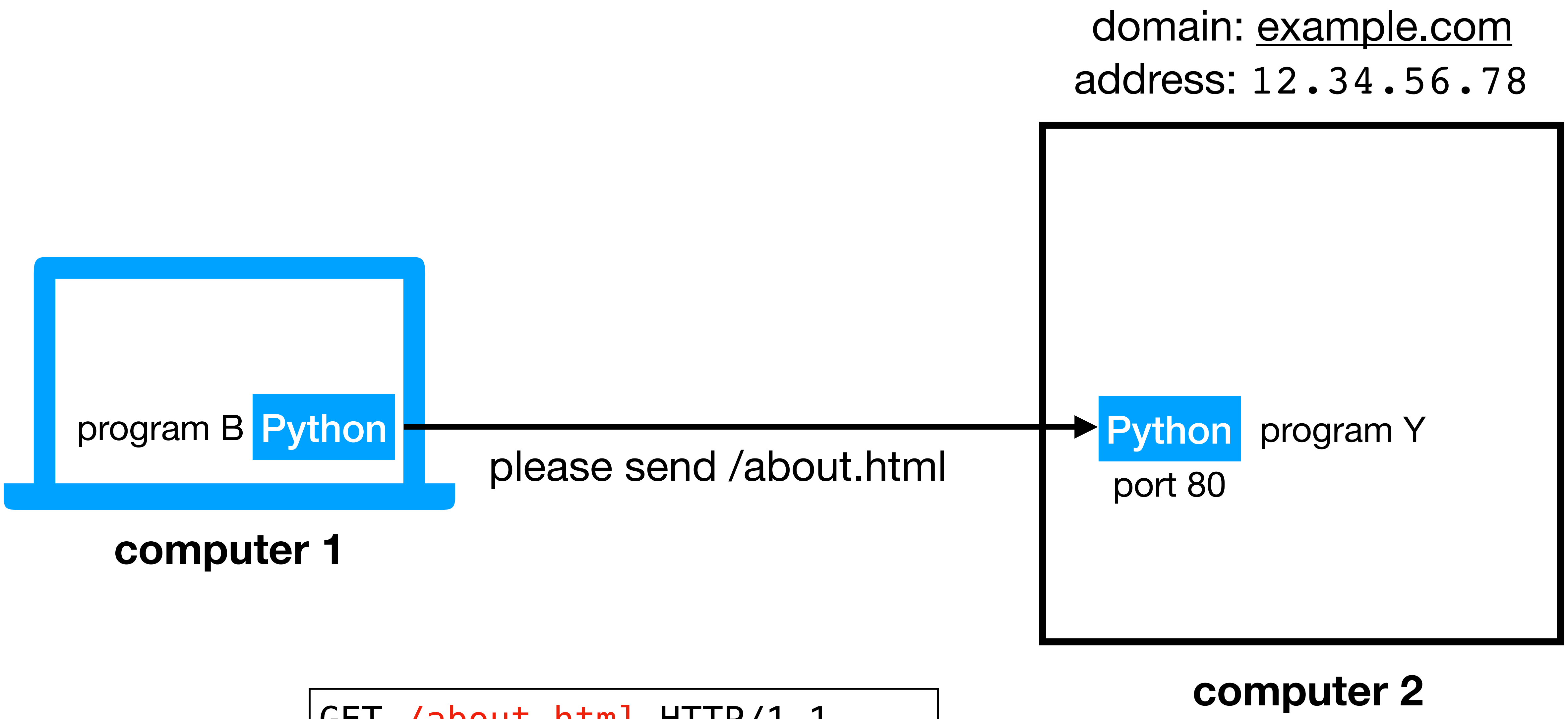

HTTP Request:

```
GET /about.html HTTP/1.1
Host: example.com
User-Agent: ...
Accept: */*
```

HTTP

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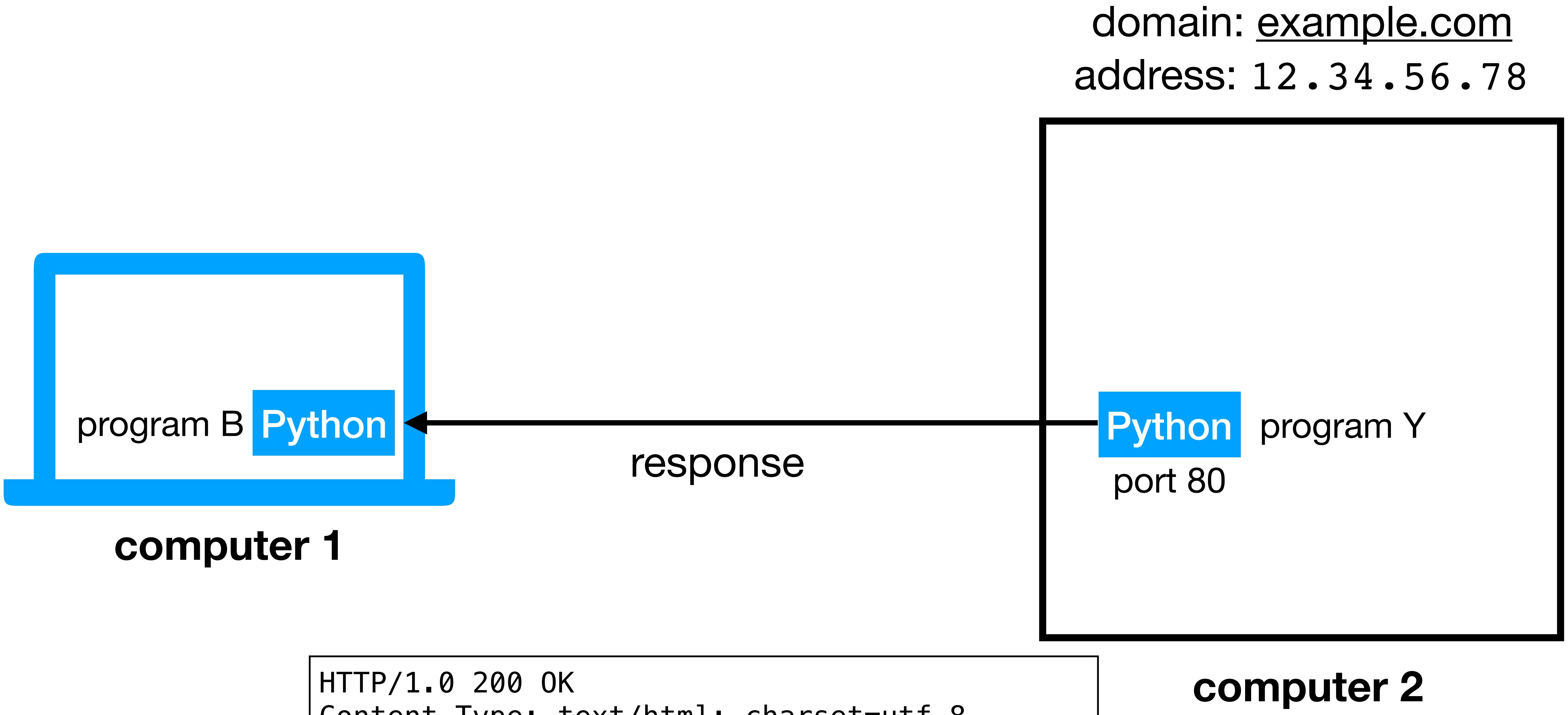

HTTP Response:

```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 74
Server: Werkzeug/0.14.1 Python/3.6.6
Date: Sun, 11 Nov 2018 17:00:29 GMT

all the contents
```

Request and Response

HTTP Request:

```
GET /about.html HTTP/1.1
Host: example.com
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```

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all the contents
```

There are **LOTS** of details here we don’t care about right now

Request and Response

we want the about.html page

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data in about.html

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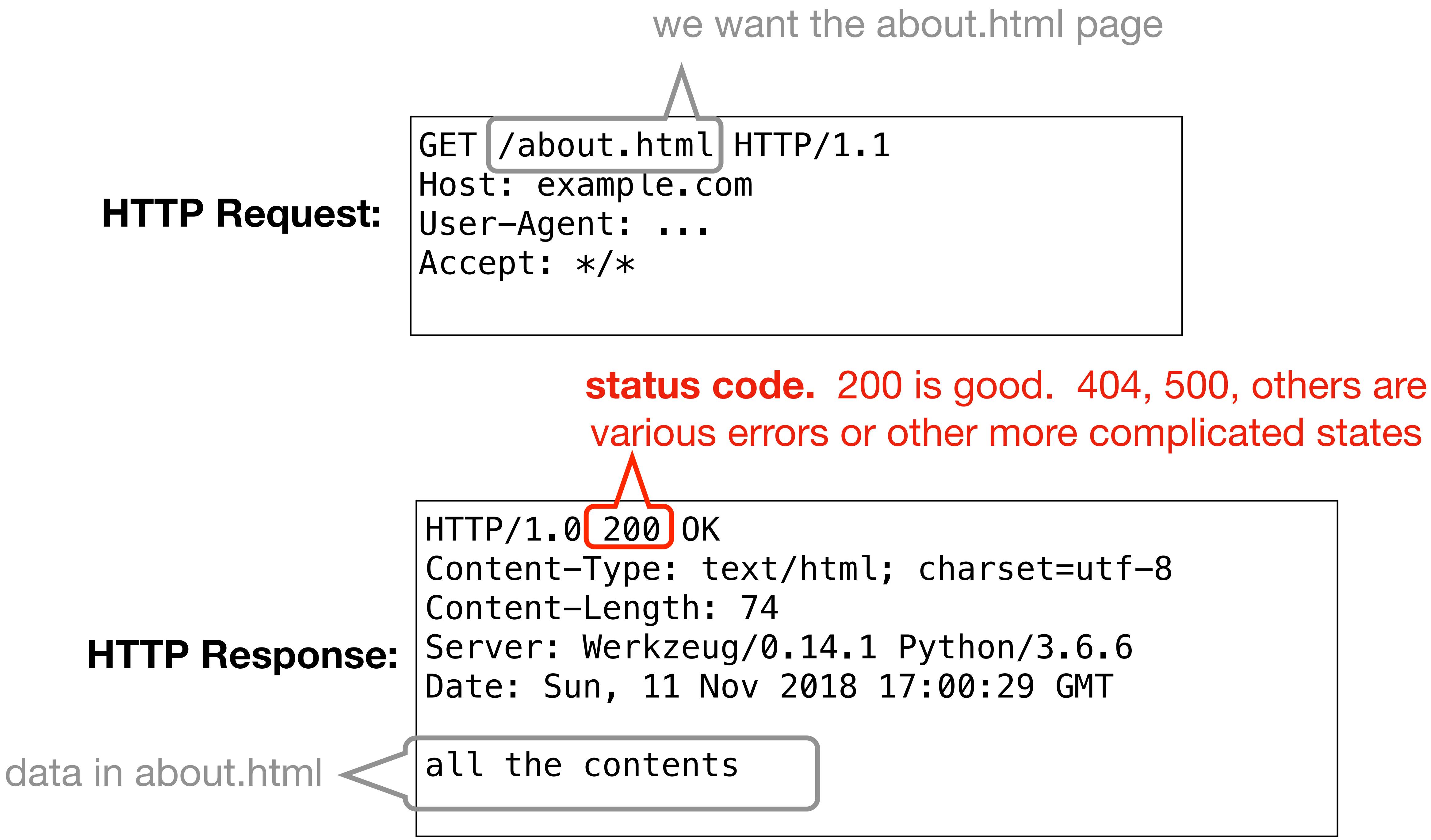

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status code. 200 is good. 404, 500, others are various errors or other more complicated states

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data in about.html

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method. *GET* is simple download. *POST* means we are uploading data as part of our request. We won't talk about others today.

we want the about.html page

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data in about.html

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Learning Objectives Today

Motivation

Networking Basics

HTTP (Hypertext Transfer Protocol)

Requests Module

Requests module

Purpose

- easily send requests to a server and parse the response
- *“HTTP for Humans™”*

Installation

- comes with Anaconda
- otherwise run this:

  ```
  pip install requests
  ```

Using it

- just import:

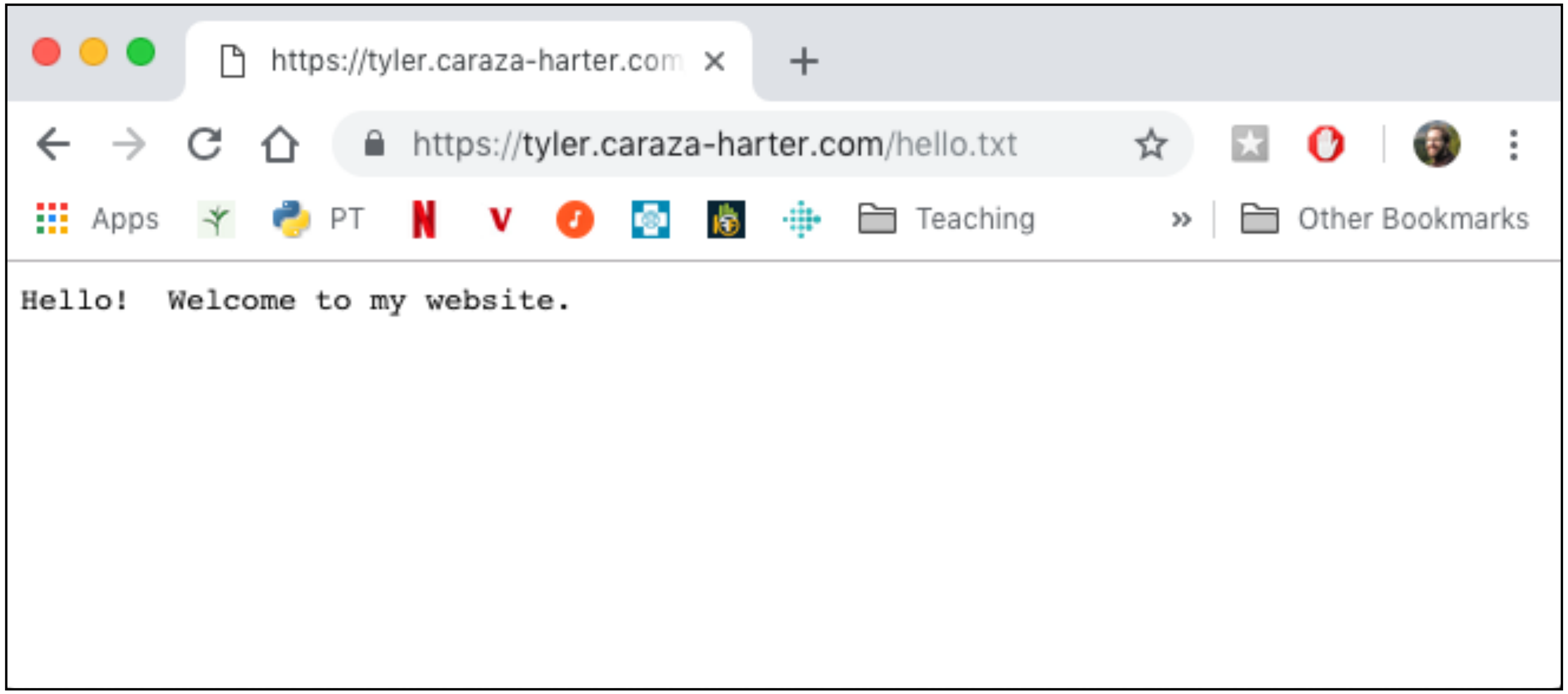
  ```
  import requests
  ```

GET Request

```
import requests

url = “https://tyler.caraza-harter.com/hello.txt"

requests.get(url)
```



https://tyler.caraza-harter.com
https://tyler.caraza-harter.com/hello.txt
Apps
PT
Teaching
Other Bookmarks

```
Hello!  Welcome to my website.
```

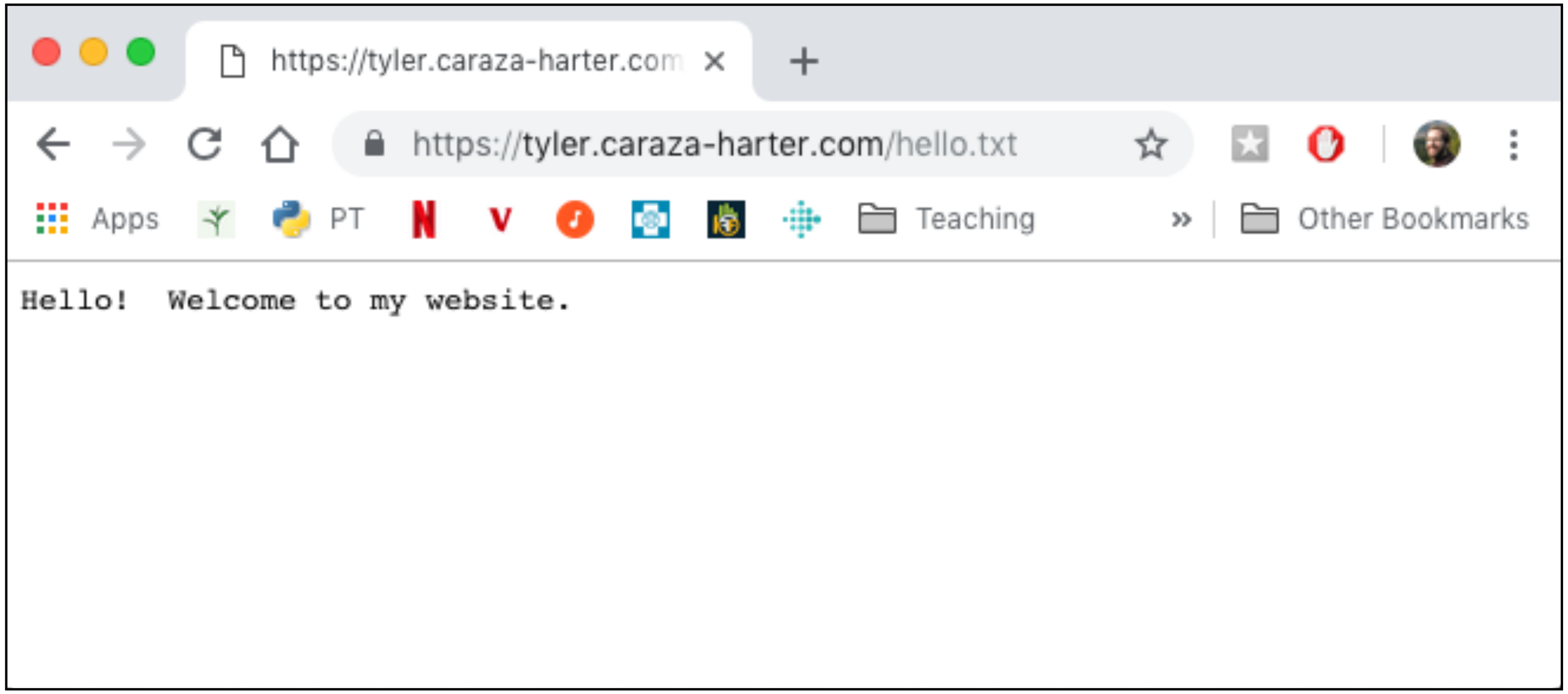
GET Request

```
import requests

url = “https://tyler.caraza-harter.com/hello.txt"

requests.get(url)
```

sends a **GET** request to tyler.caraza-harter.com, asking for the contents of the **/hello.txt** page



https://tyler.caraza-harter.com
https://tyler.caraza-harter.com/hello.txt
Apps
PT
Teaching
Other Bookmarks

```
Hello!  Welcome to my website.
```

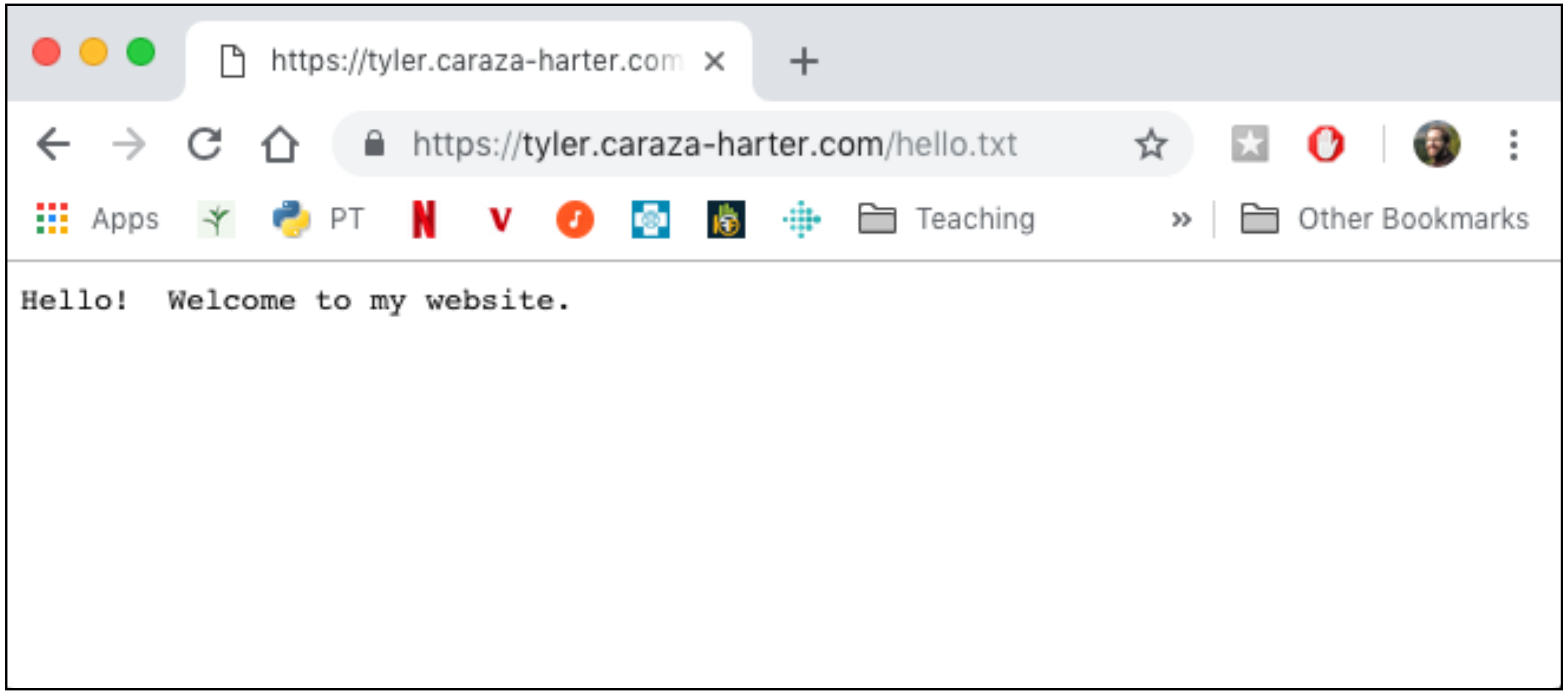
GET Request

```
import requests

url = “https://tyler.caraza-harter.com/hello.txt"

resp = requests.get(url)
```

put response from tyler.caraza-harter.com in the resp variable


https://tyler.caraza-harter.com
https://tyler.caraza-harter.com/hello.txt
Apps
PT
Teaching
Other Bookmarks

```
Hello!  Welcome to my website.
```

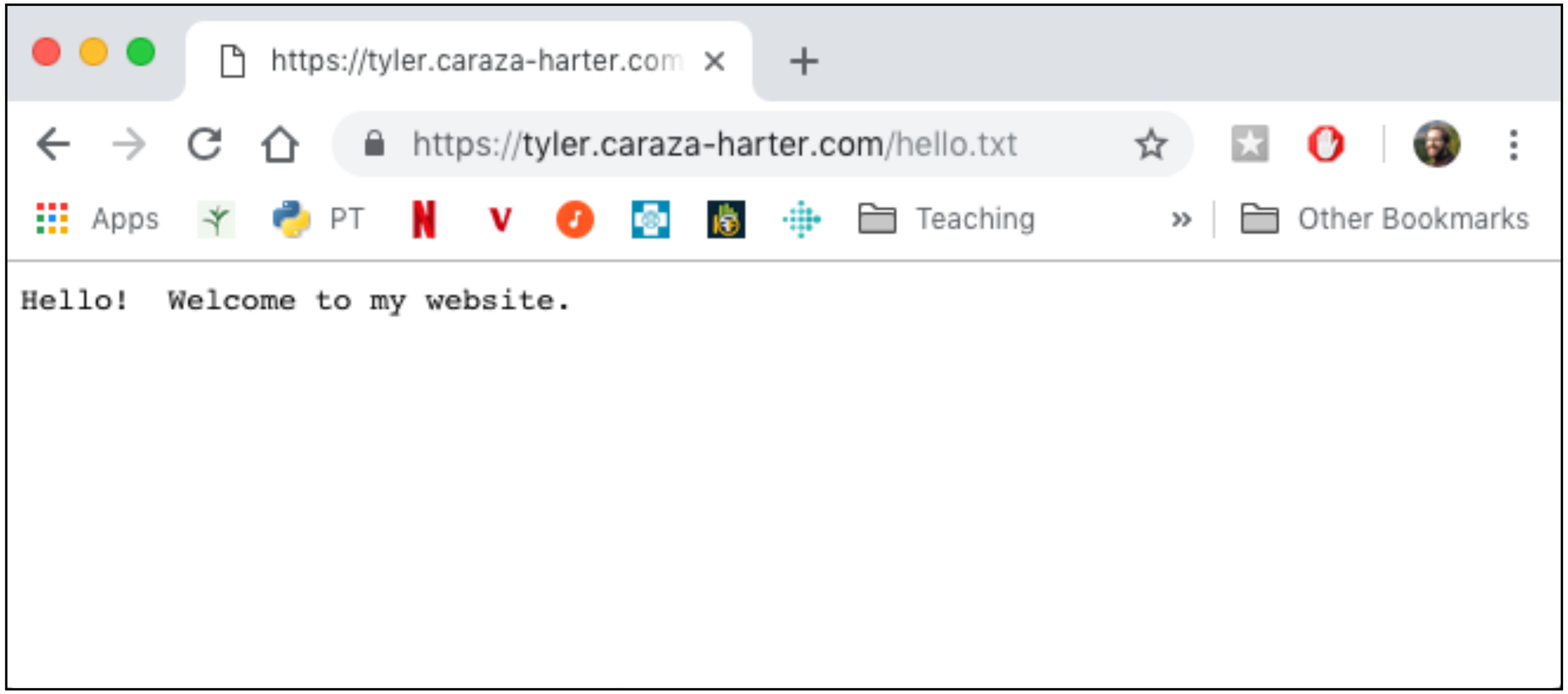
GET Request

```
import requests

url = "https://tyler.caraza-harter.com/hello.txt"

resp = requests.get(url)

# make sure we got 200 (success) back
assert(resp.status_code == 200)
```



https://tyler.caraza-harter.com
https://tyler.caraza-harter.com/hello.txt
Apps
PT
Teaching
Other Bookmarks

```
Hello!  Welcome to my website.
```

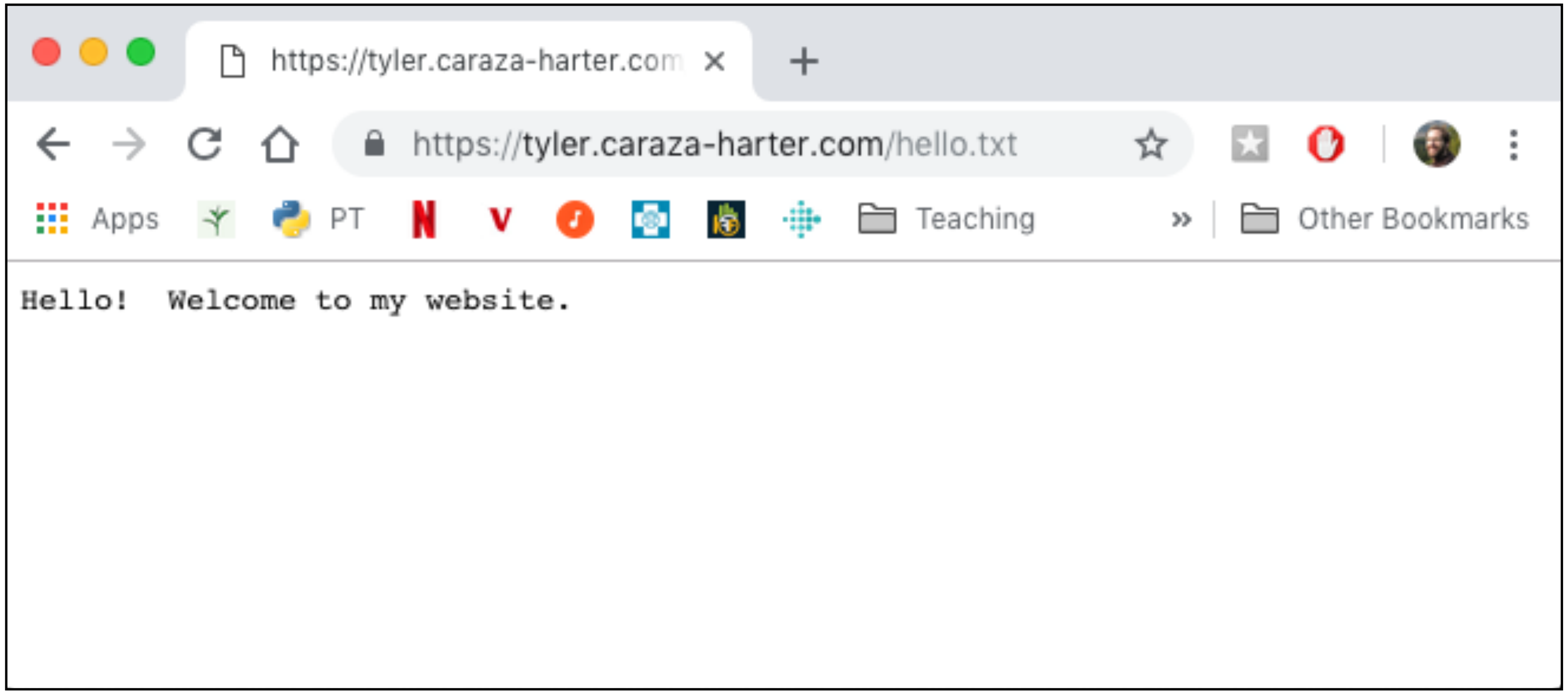
GET Request

```
import requests

url = "https://tyler.caraza-harter.com/hello.txt"

resp = requests.get(url)

resp.raise_for_status() # shortcut
```



https://tyler.caraza-harter.com
https://tyler.caraza-harter.com/hello.txt
Apps
PT
Teaching
Other Bookmarks

```
Hello!  Welcome to my website.
```

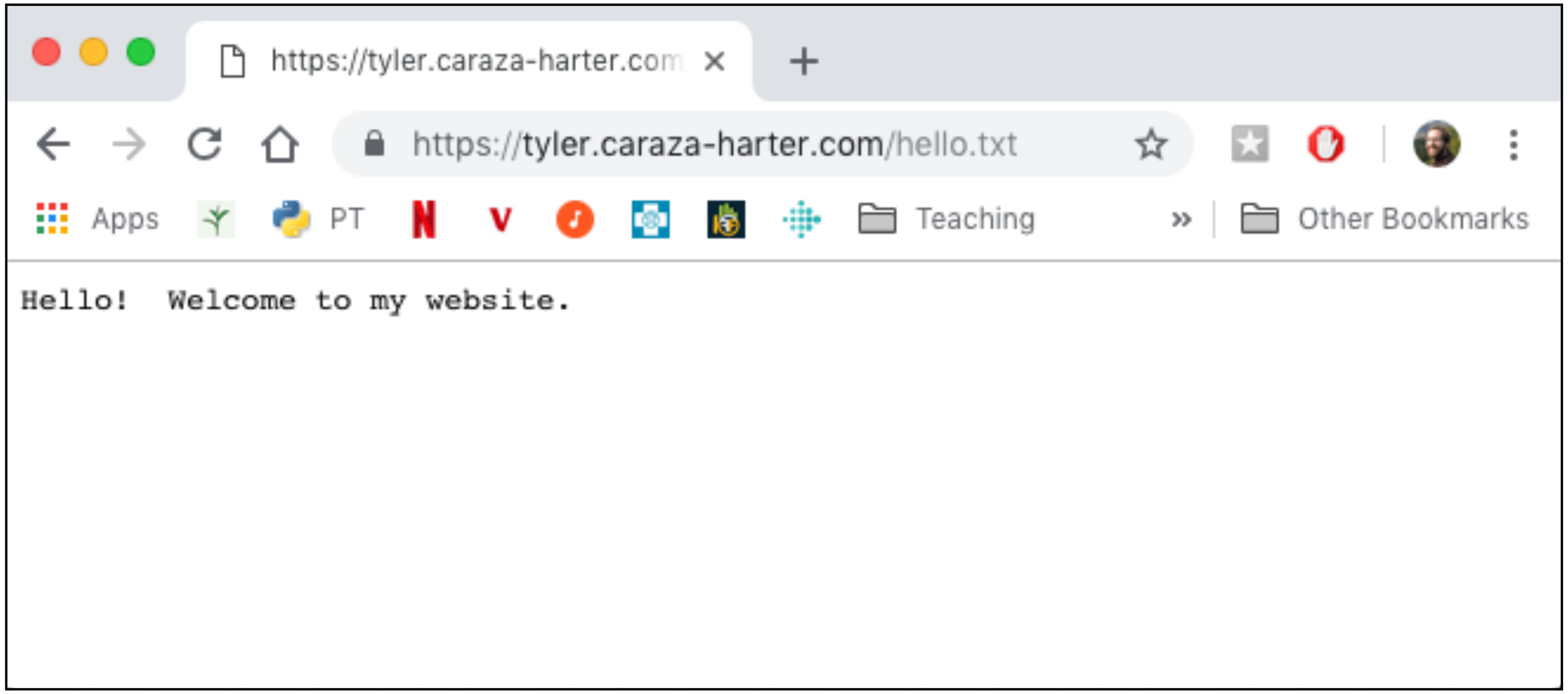
GET Request

```
import requests

url = "https://tyler.caraza-harter.com/hello.txt"

resp = requests.get(url)

resp.raise_for_status() # shortcut
print(resp.text) # “Hello! Welcome to my website.”
```



https://tyler.caraza-harter.com
https://tyler.caraza-harter.com/hello.txt
Apps
PT
Teaching
Other Bookmarks

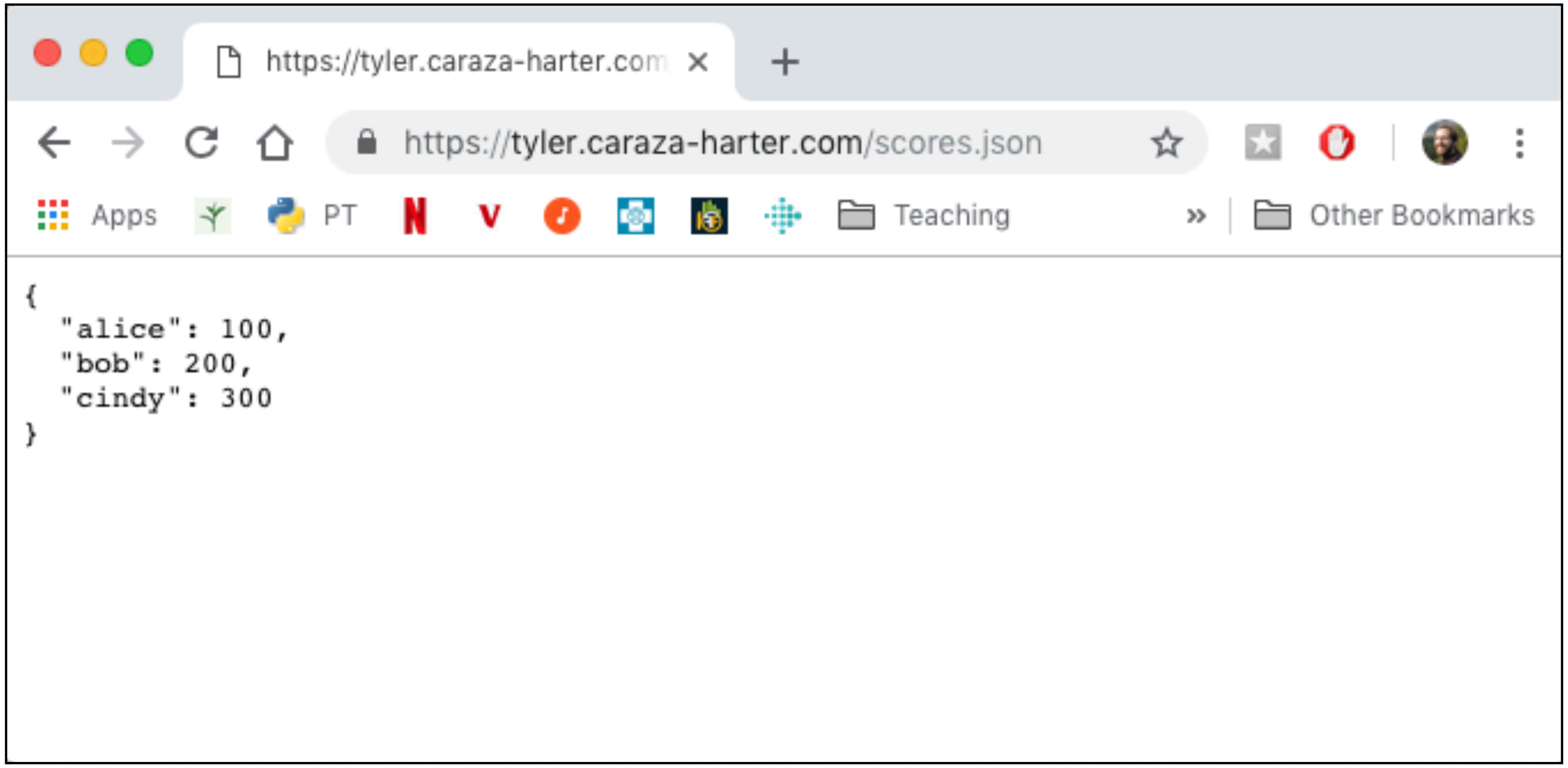
```
Hello!  Welcome to my website.
```

JSON Responses

```
import requests, json

url = “https://tyler.caraza-harter.com/scores.json”
resp = requests.get(url)

scores = json.loads(resp.text)
```



https://tyler.caraza-harter.com
https://tyler.caraza-harter.com/scores.json
Apps
PT
Teaching
Other Bookmarks

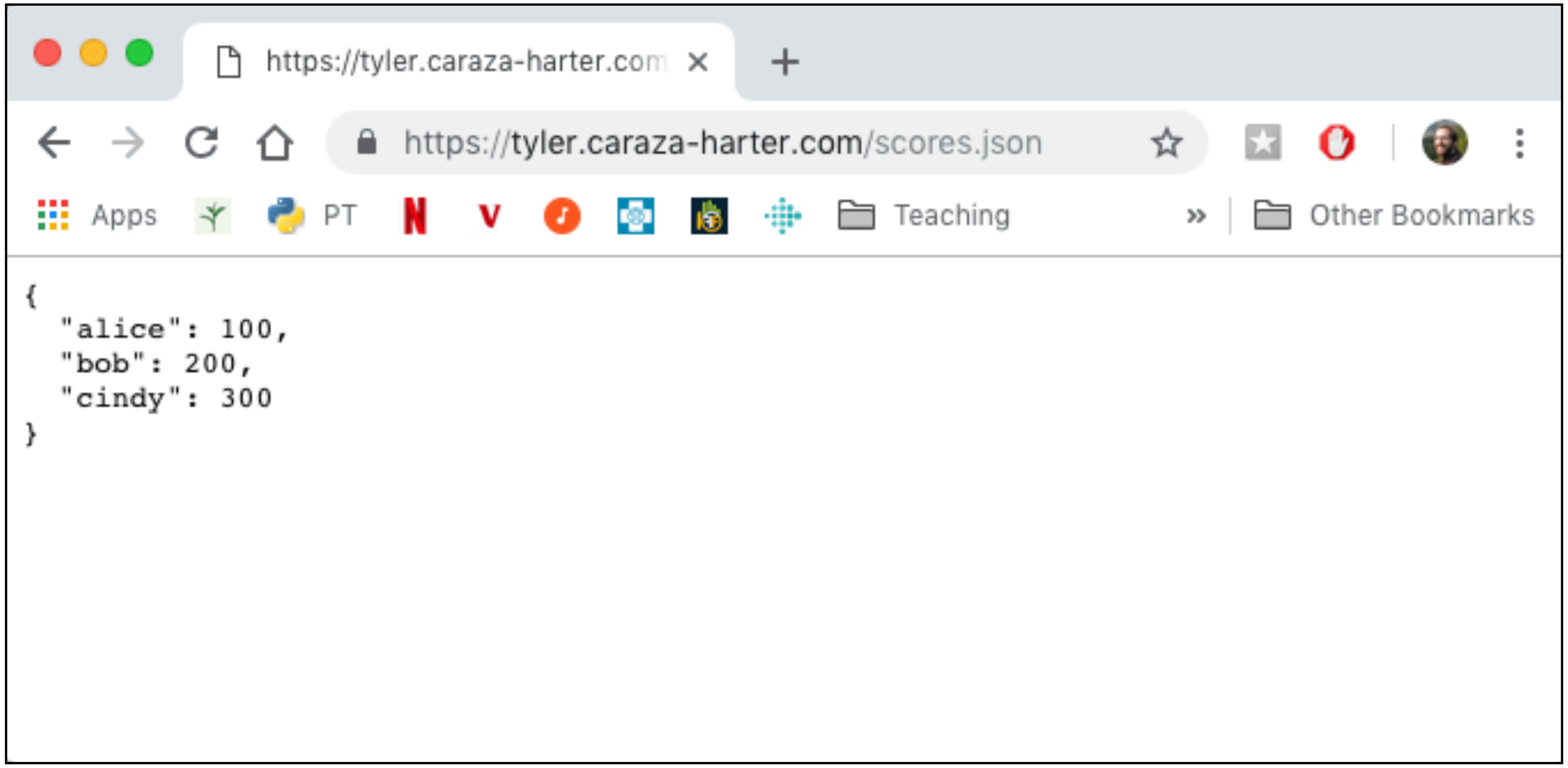
```
{
  "alice": 100,
  "bob": 200,
  "cindy": 300
}
```

JSON Responses

```
import requests~~, json~~

url = “https://tyler.caraza-harter.com/scores.json"
resp = requests.get(url)

~~scores = json.loads(resp.text)~~
scores = resp.json() # shortcut
```


https://tyler.caraza-harter.com
https://tyler.caraza-harter.com/scores.json
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```
{
  "alice": 100,
  "bob": 200,
  "cindy": 300
}
```

Demo: State Populations

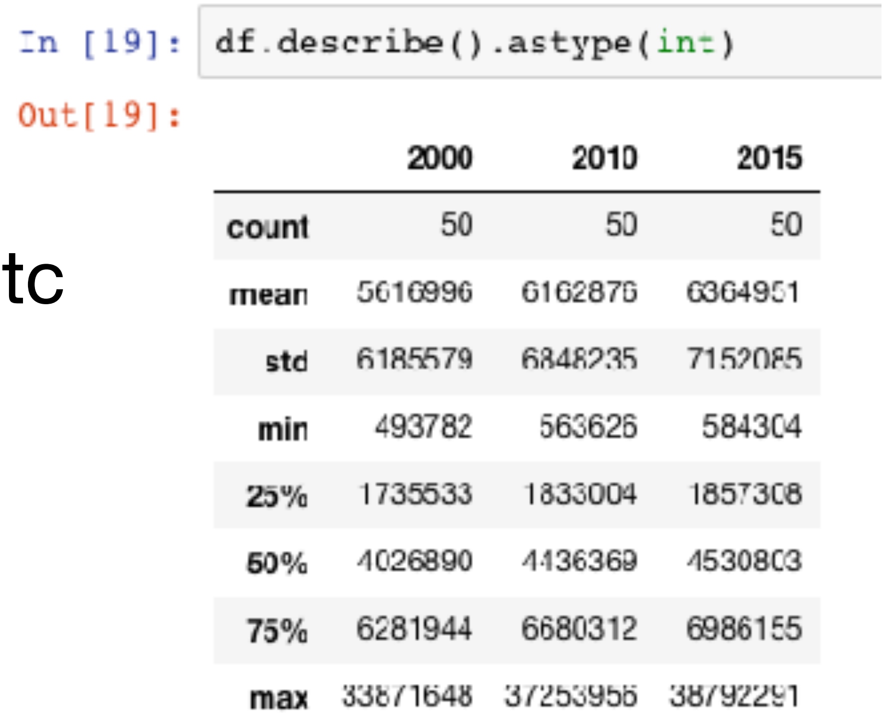
Goal: fetch population data for all states and provide summary stats

Input:

- List of state files: https://tyler.caraza-harter.com/cs301/fall18/materials/code/lec-28/state_files.txt
- The 50 JSON files

Output:

- Stats about population: mean, max, min, etc



In [19]:
```
df.describe().astype(int)
```

Out[19]:

	2000	2010	2015
count	50	50	50
mean	5616996	6162876	6364951
std	6185579	6848235	7152085
min	493782	563626	584304
25%	1735533	1833004	1857308
50%	4026890	4436369	4530803
75%	6281944	6680312	6986155
max	33871648	37253956	38792291