[301] Web 1

Tyler Caraza-Harter

Learning Objectives Today

Network basics

- IP addresses
- host/domain names
- client/server and request/response

HTTP basics

- URLs
- GET/POST/etc
- headers
- status codes

Requests modules

- downloading data with requests.get
- remote calls with requests.post

Learning Objectives Today

Motivation

Networking Basics

HTTP (Hypertext Transfer Protocol)

Requests Module

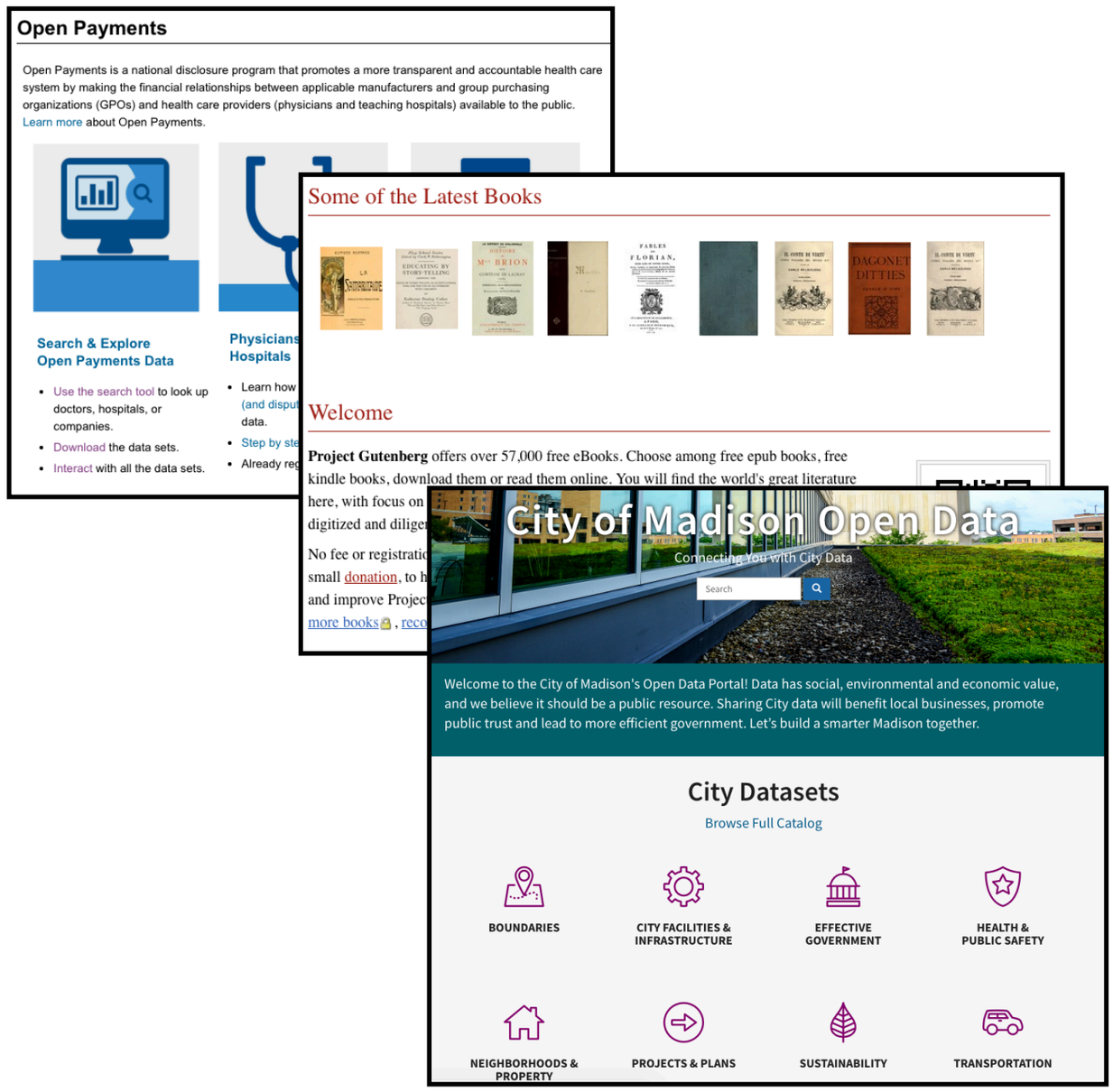
Data Science and the Internet

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



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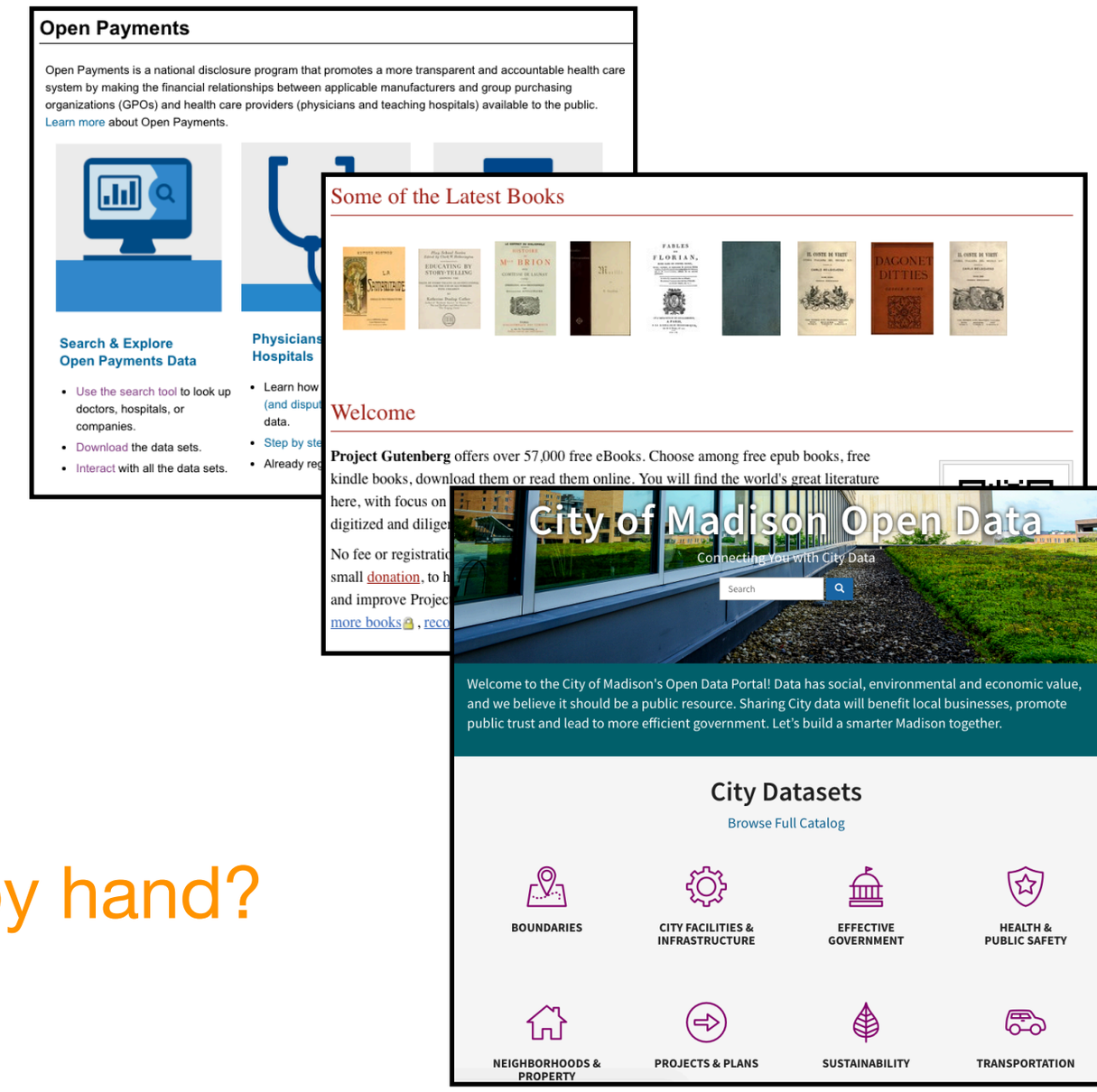
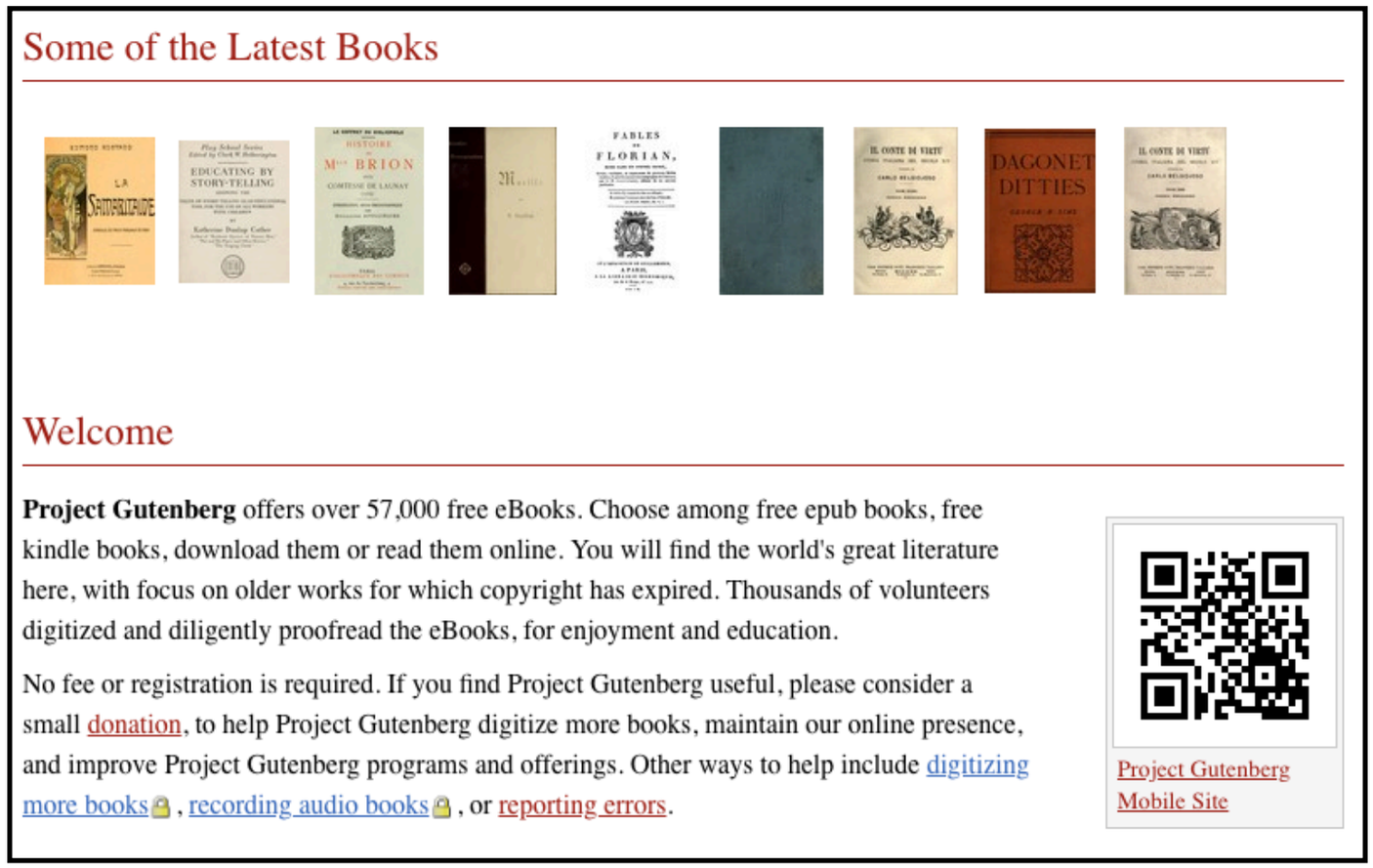


Why not just download data by hand?

Motivation 1: 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

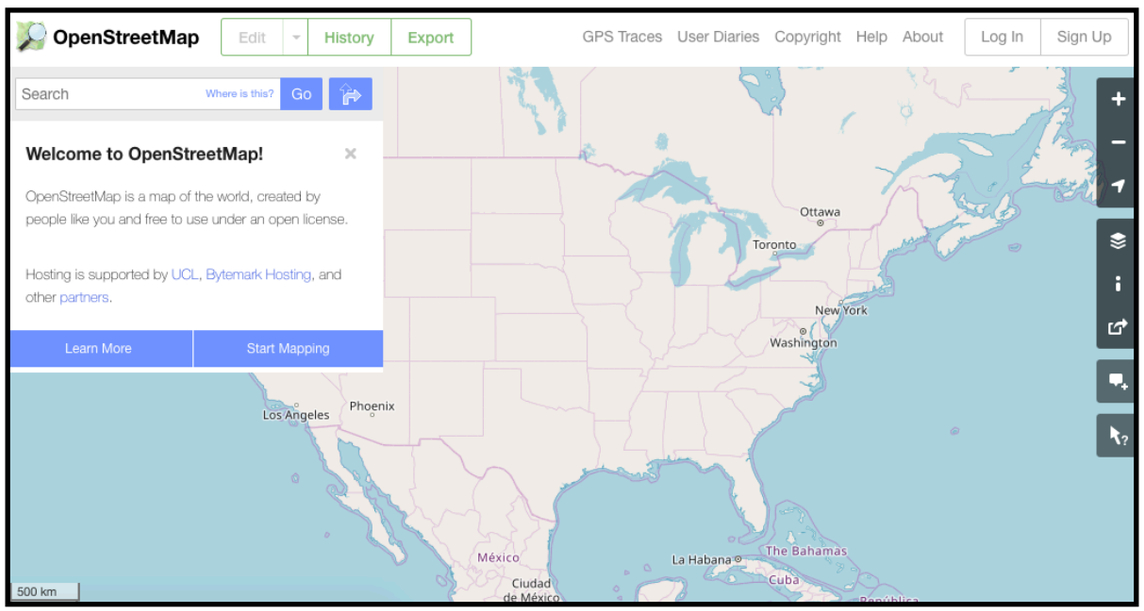


Motivation 2: data doesn't always come in files

Many datasets are difficult to download complete

Instead, you can make function calls to servers
(we'll learn how) to grab specific data

- Dataset: OpenStreetMap
- You issue calls to get specific data:
  1. specify latitude/longitude rectangle
  2. specify structures of interest (e.g., bike paths)



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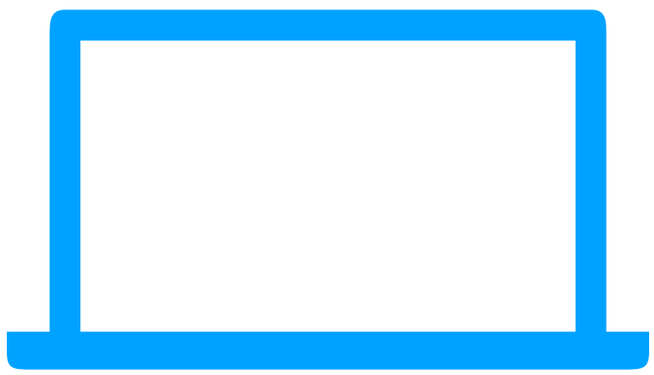
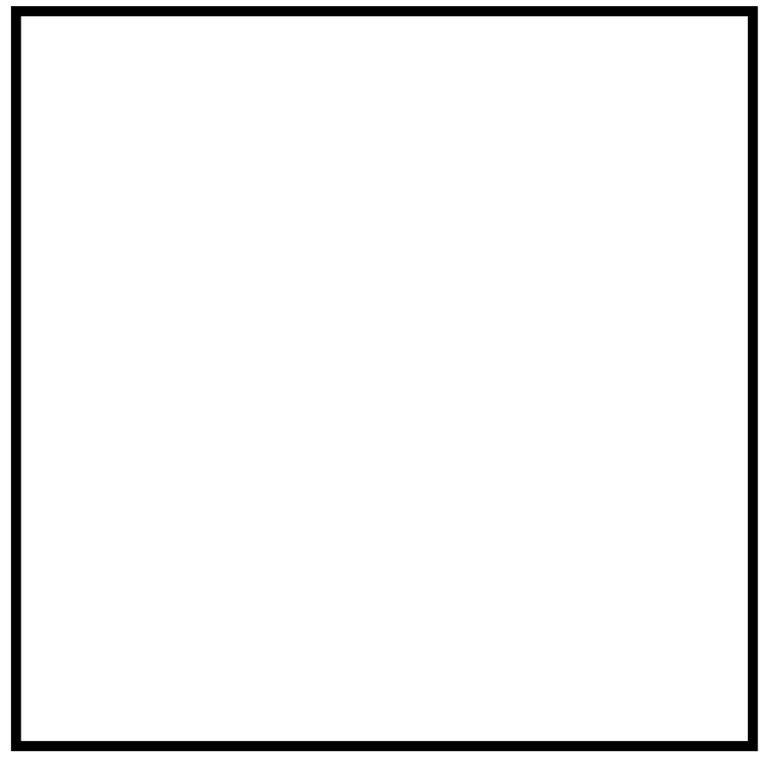
Networking Basics



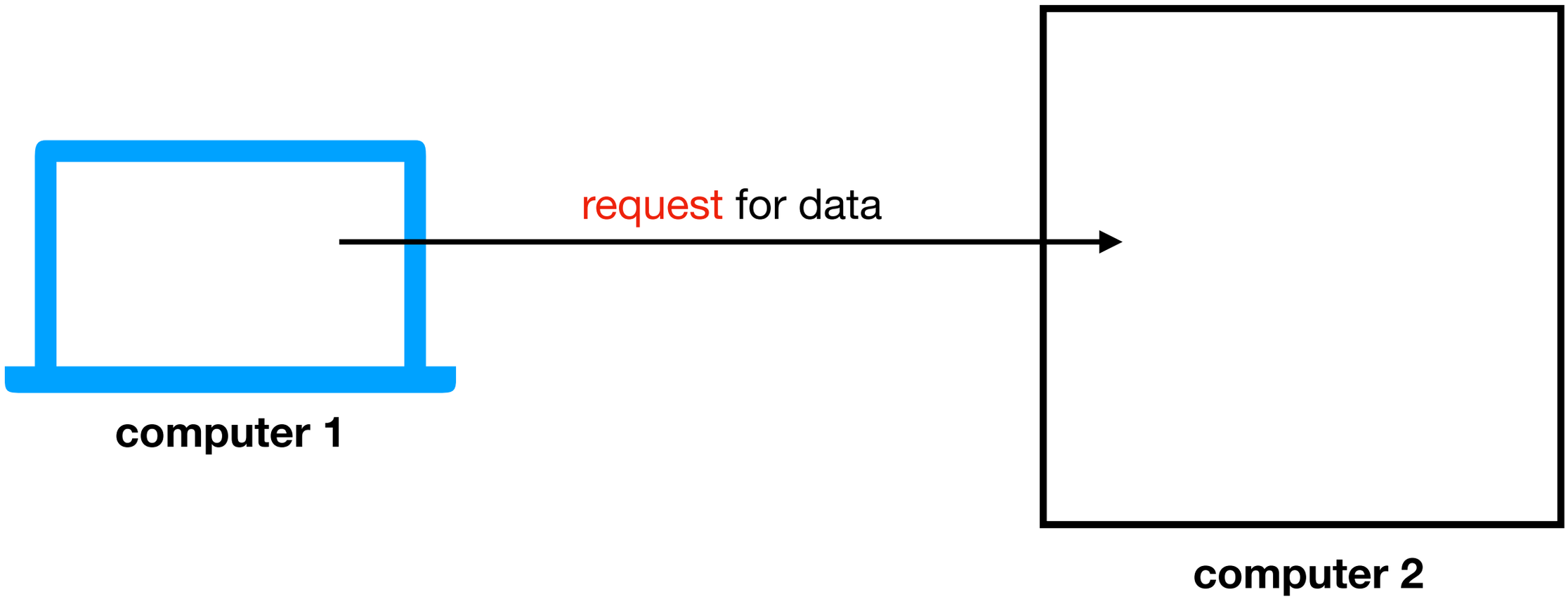
computer 1



computer 2

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

Networking Basics



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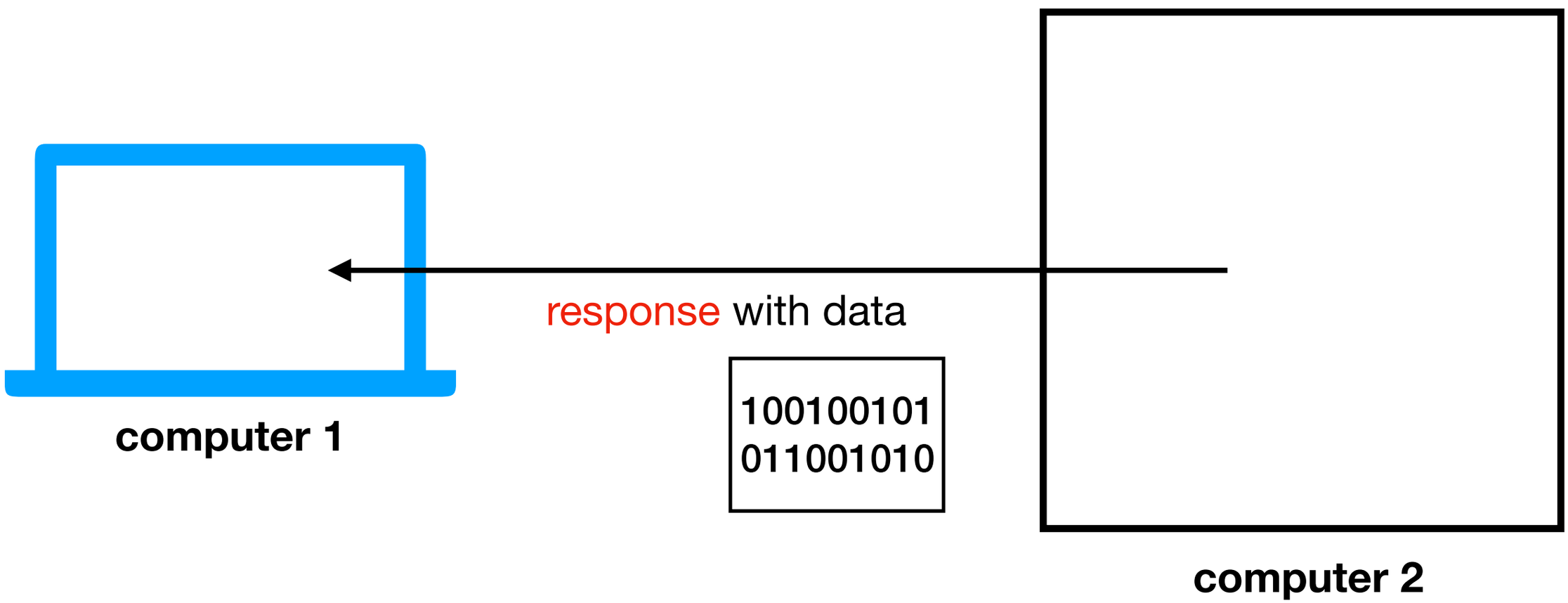

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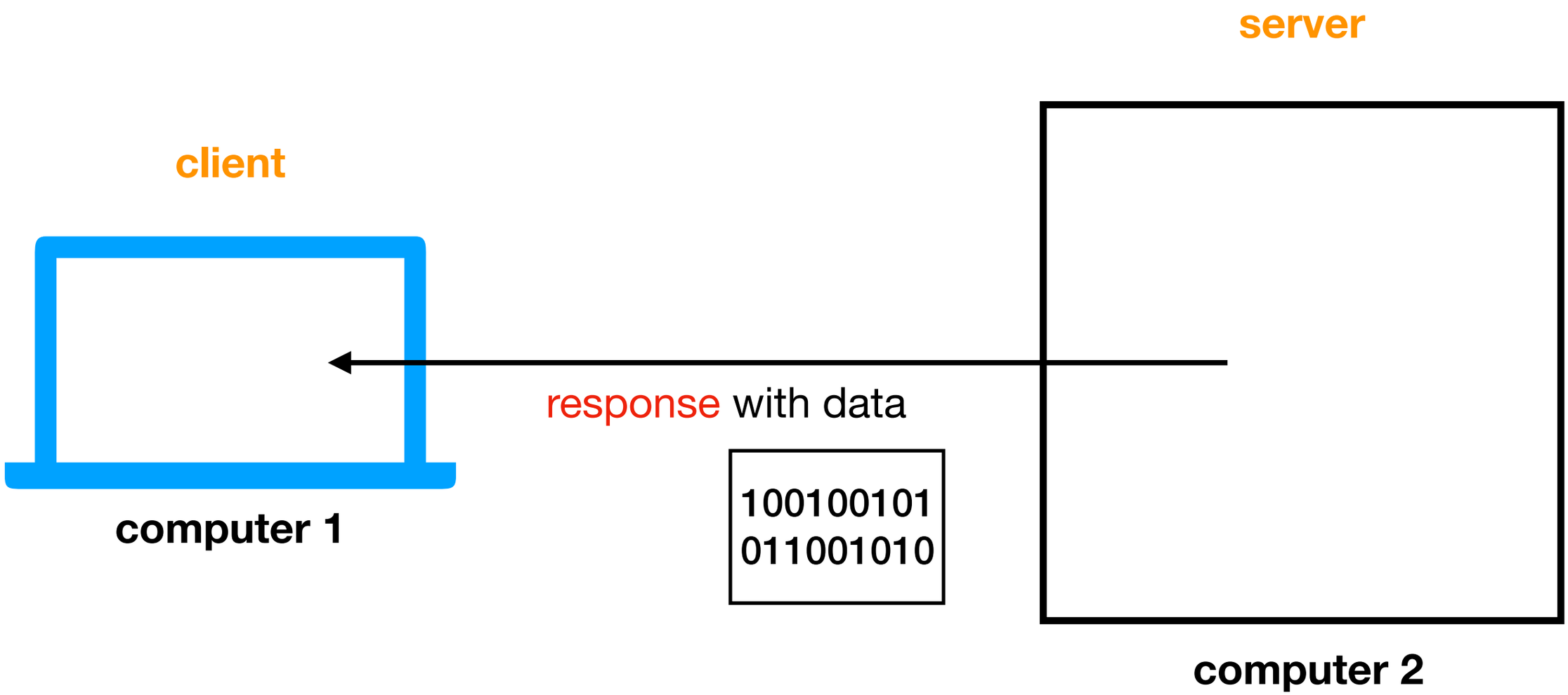

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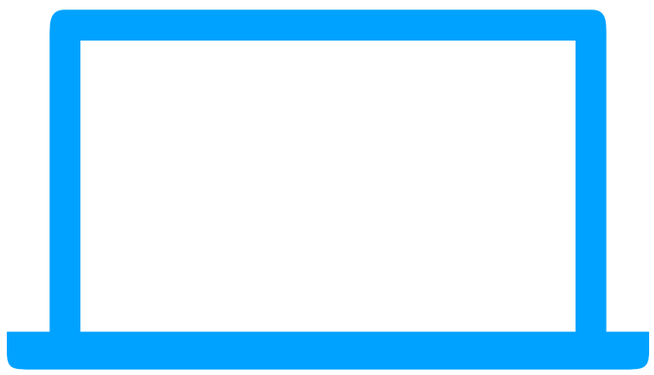

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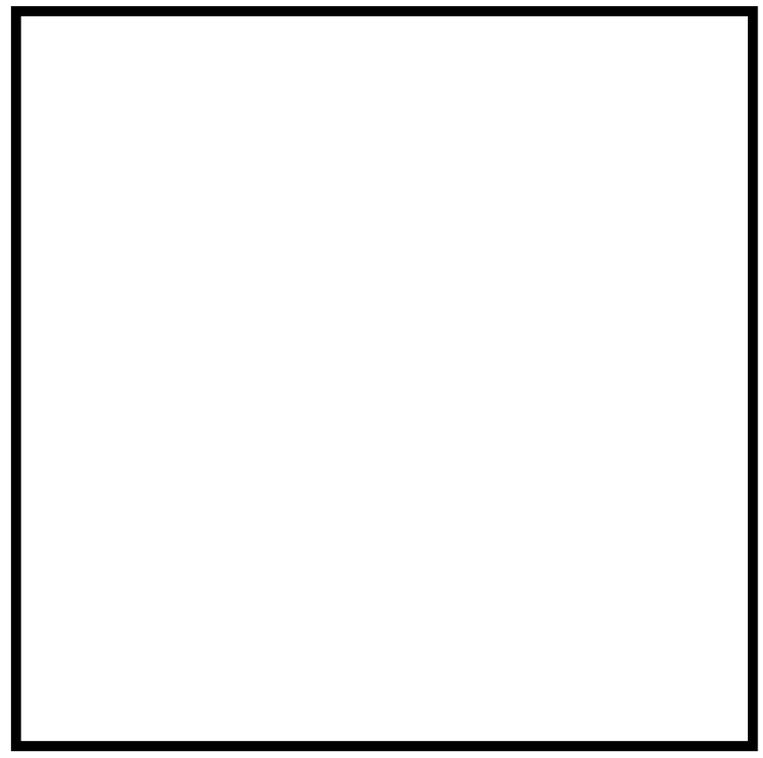


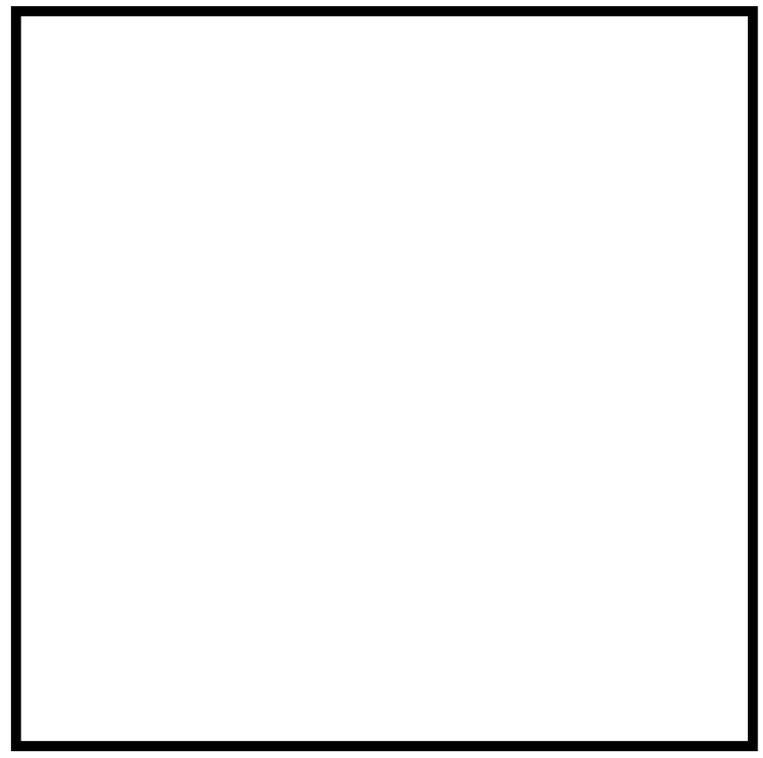
computer 2

Challenge: there are millions of computers.

How do we indicate which machine should get our request?

Internet Protocol

computer 1



computer 2

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

*some machines have more multiple addresses

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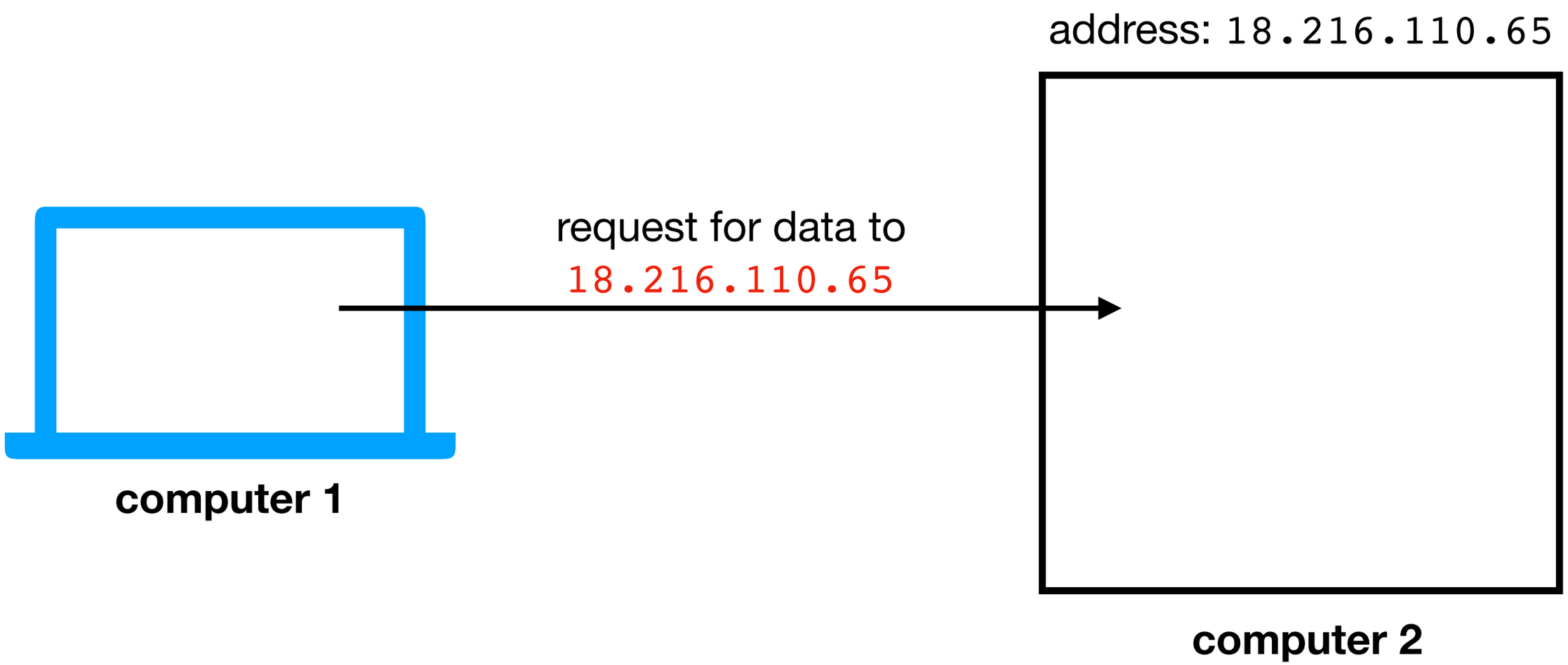

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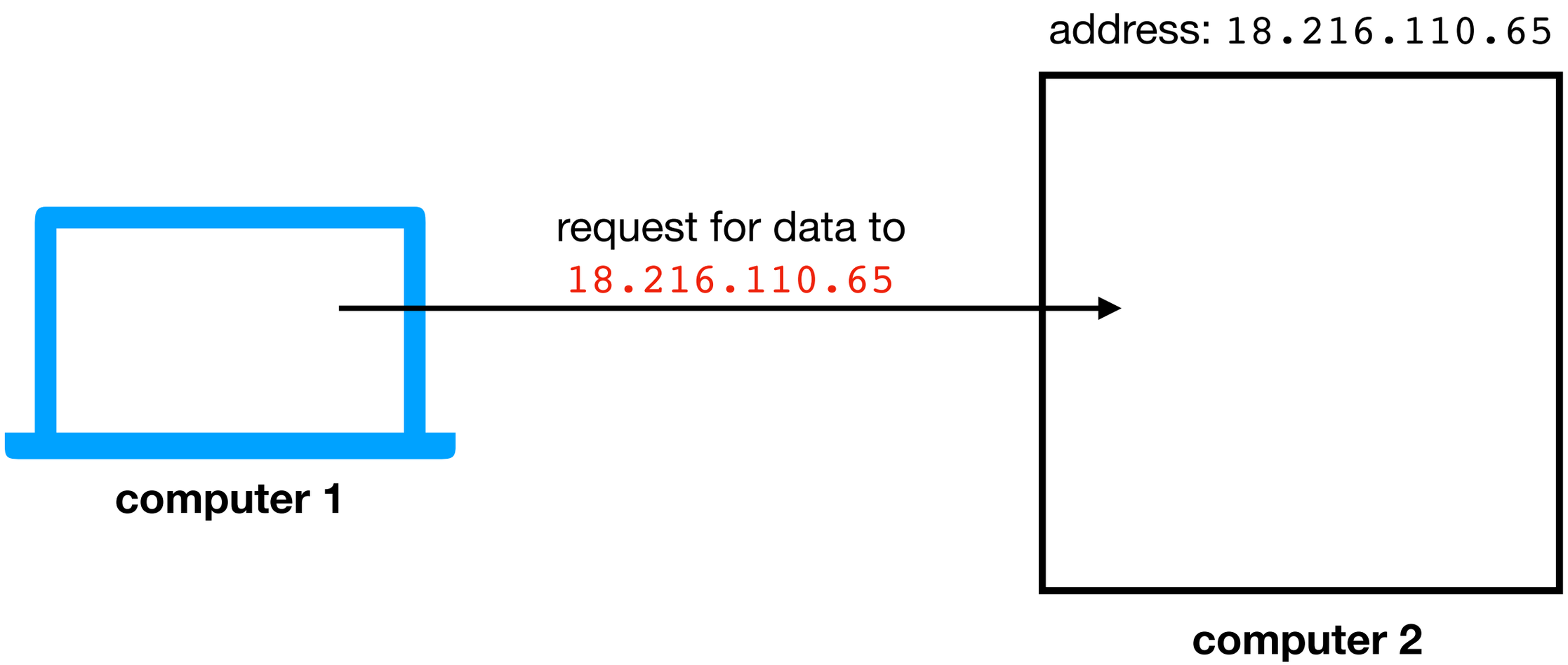
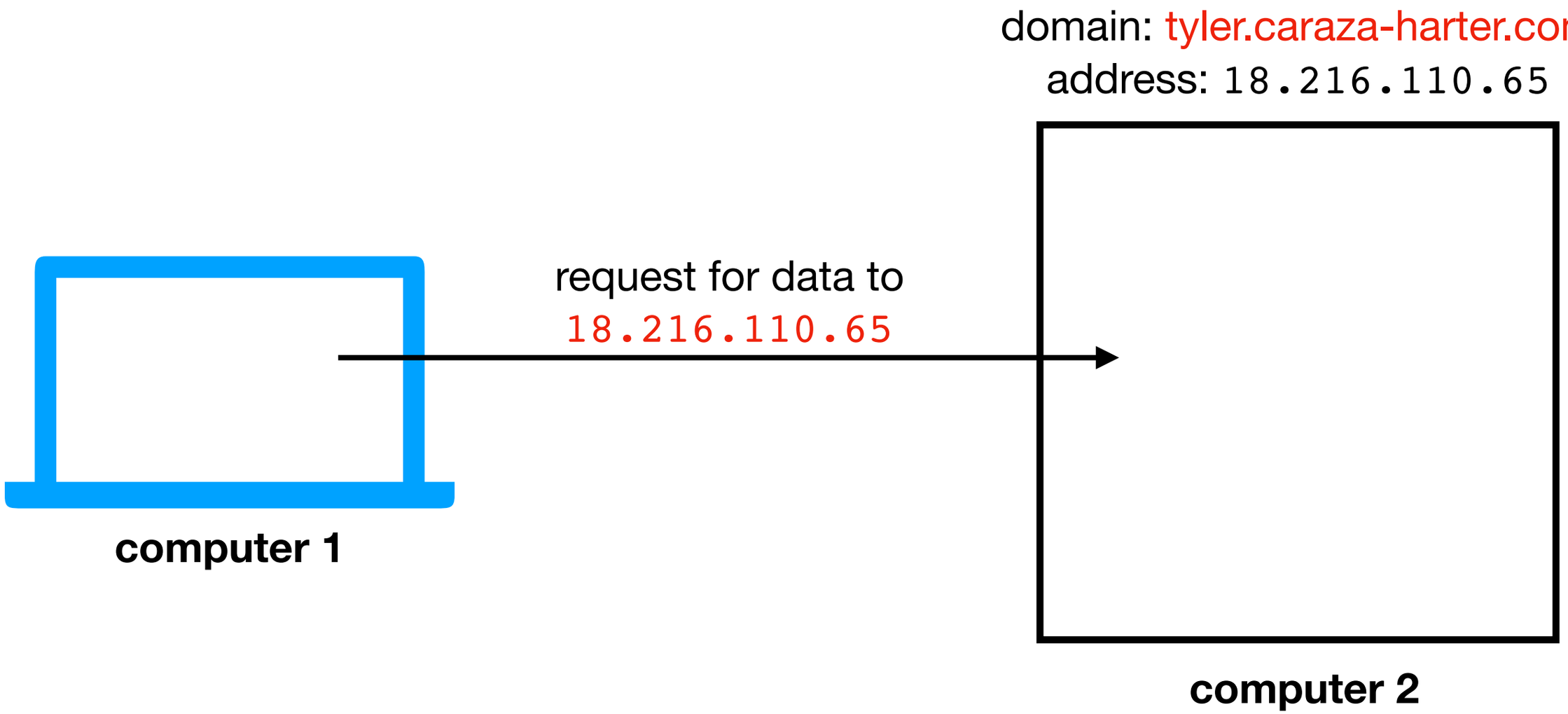


Challenge: it's hard to remember IP addresses.

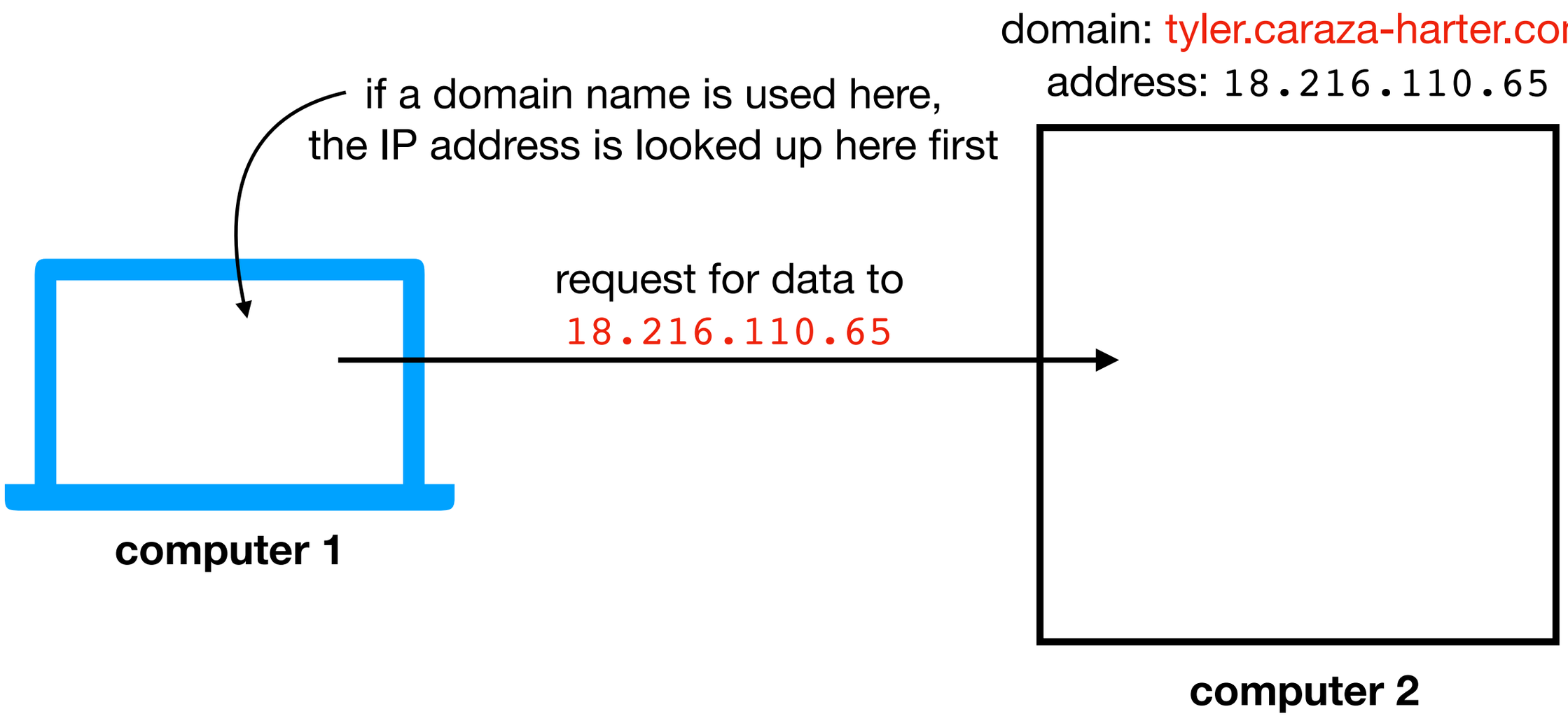
Imagine you had to type a number instead of www.google.com!

Domain Names



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

Domain Names



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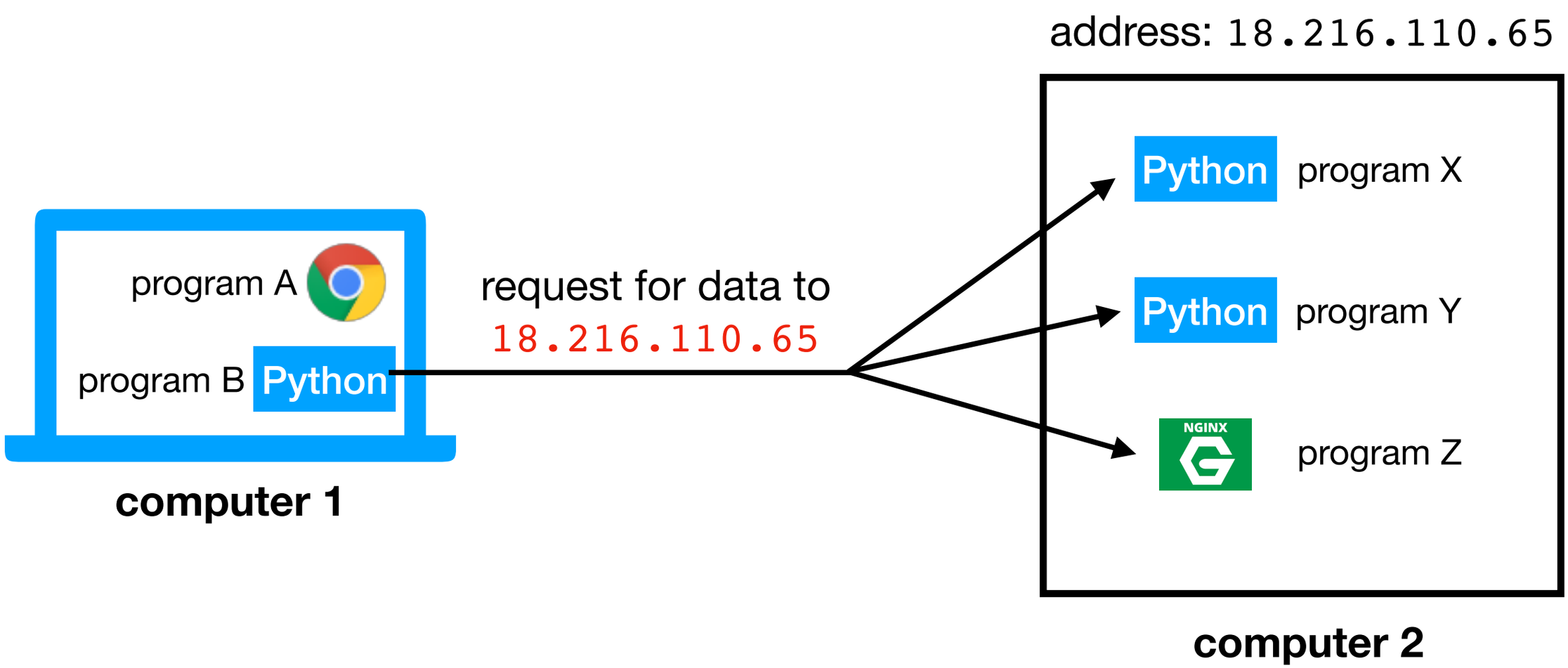
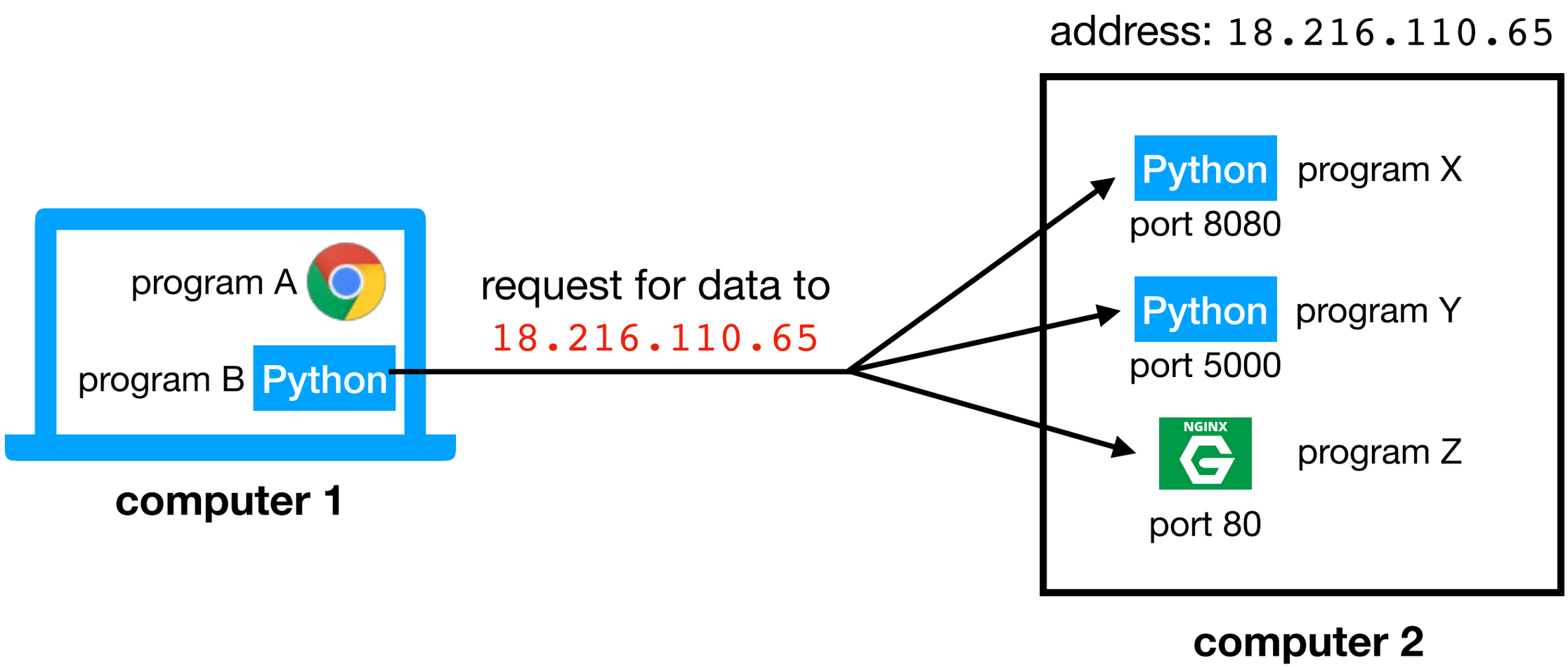
Port Numbers



Challenge: there may be multiple programs running on each computer.

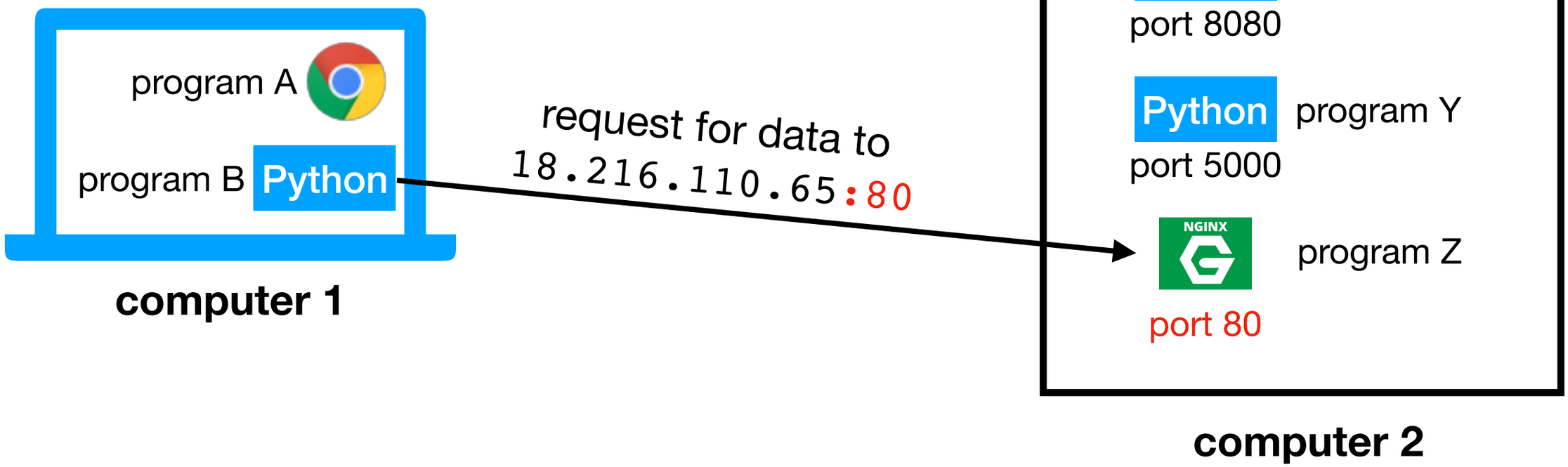
How do we get the messages to the right program?

Port Numbers



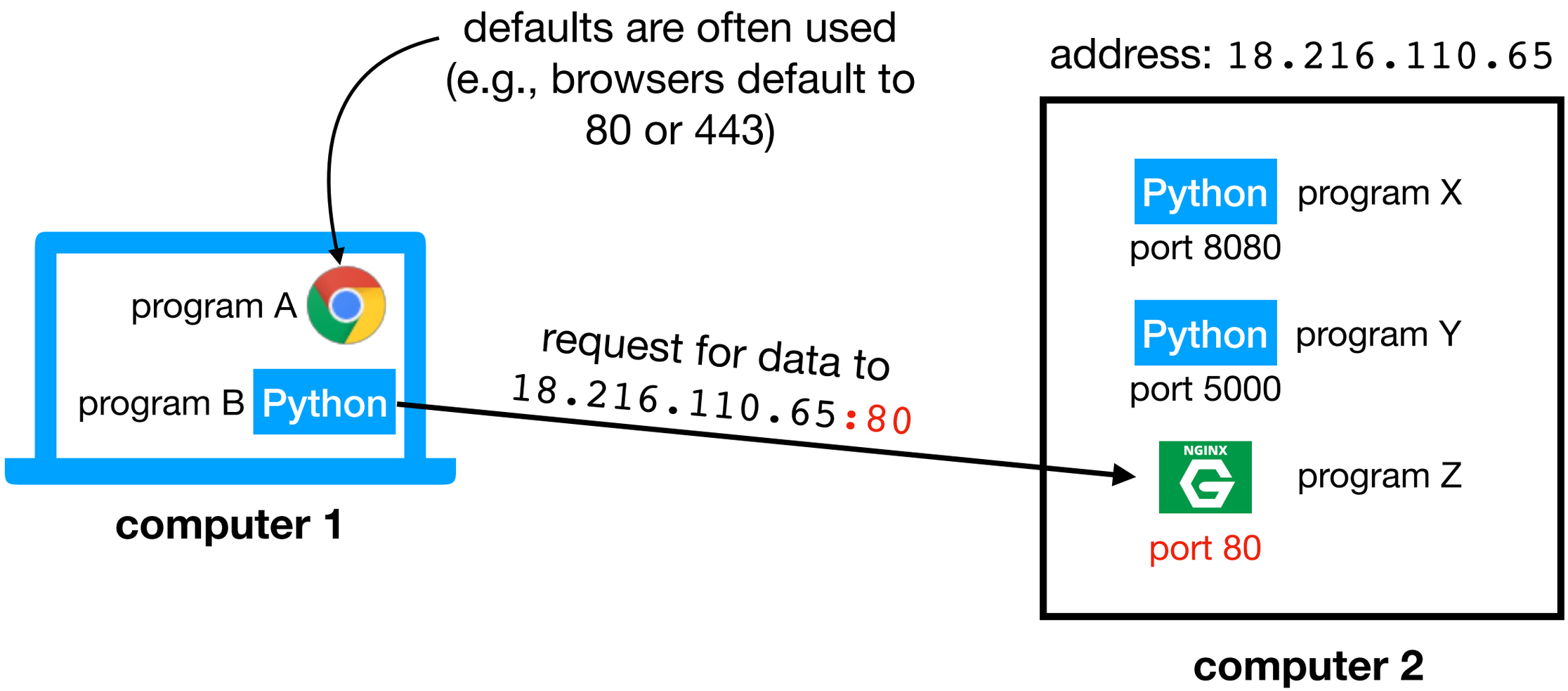
Solution: give each program a unique ID (called a “port number”)

Port Numbers



Solution: specify port number in request

Port Numbers



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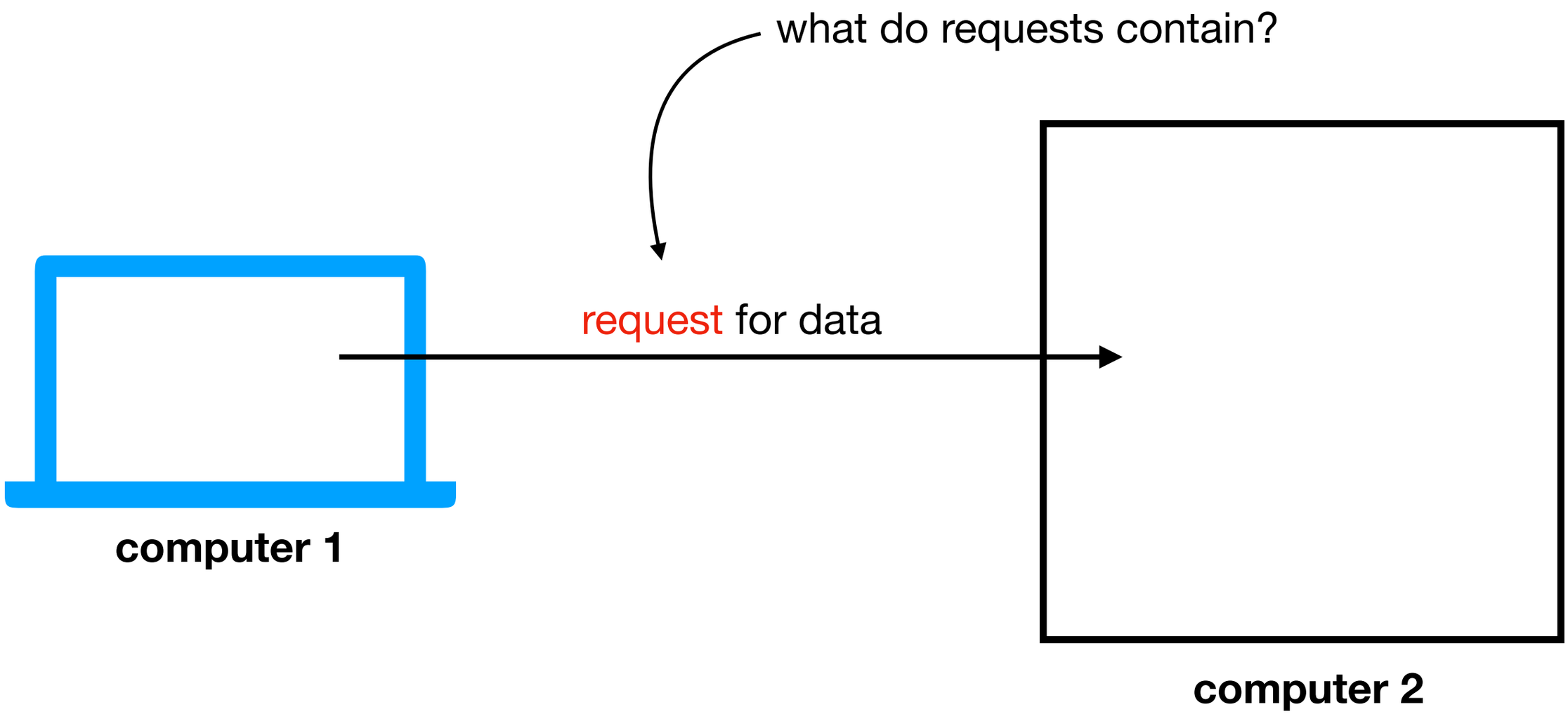
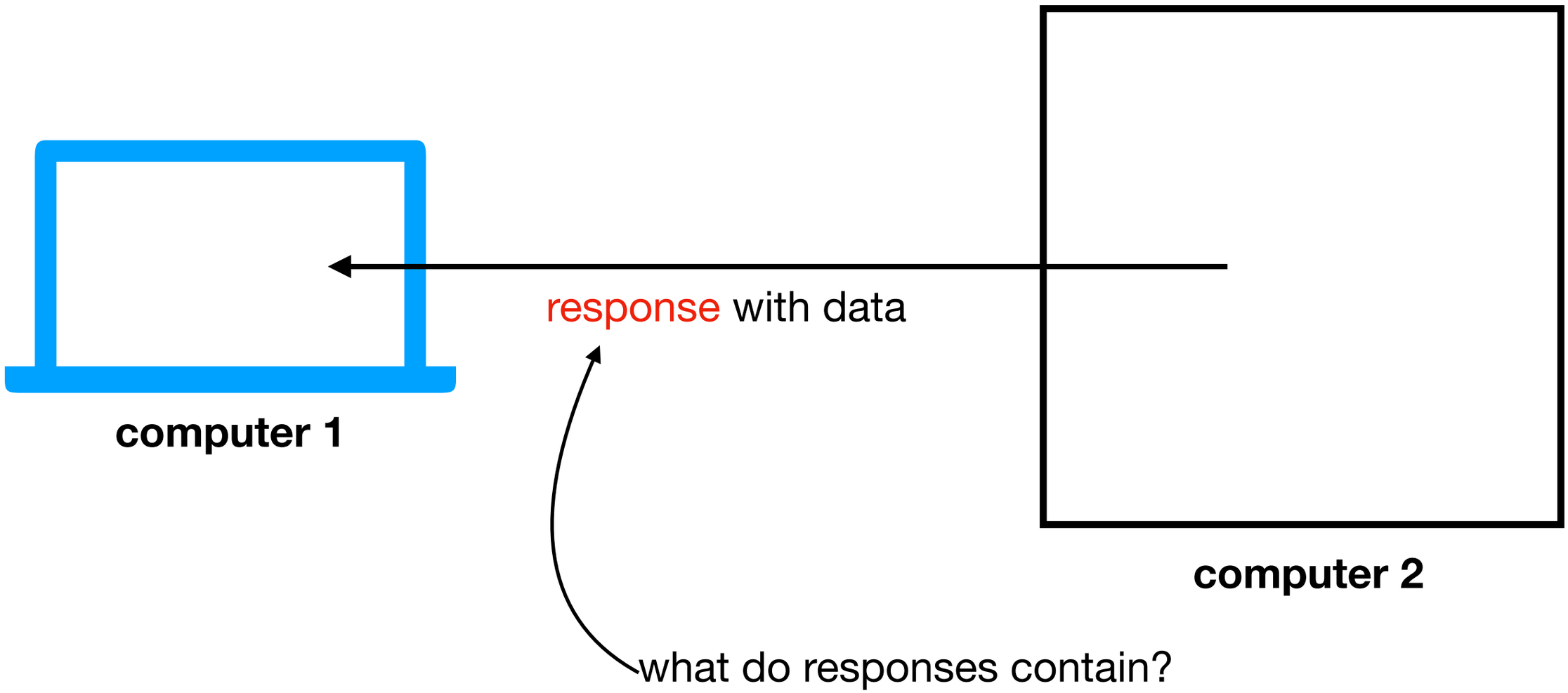
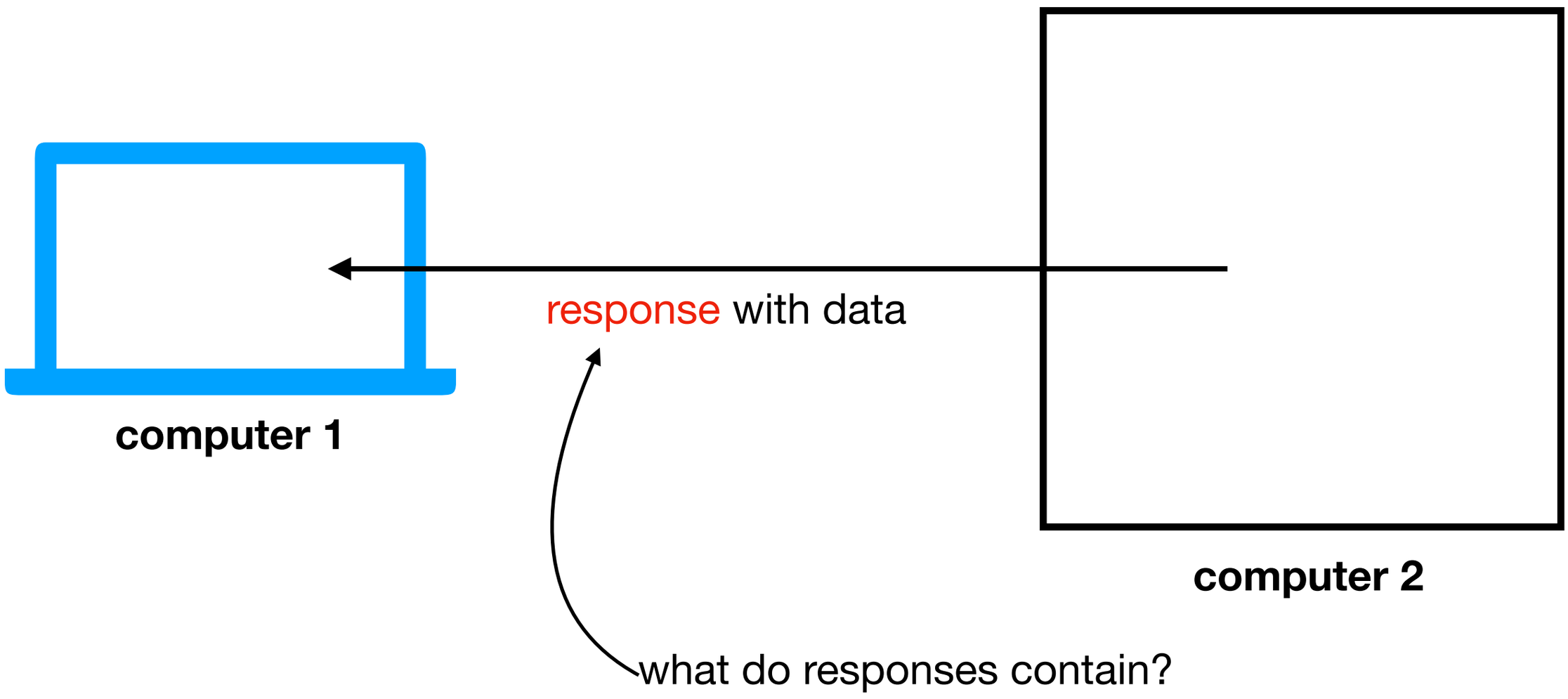

what do requests contain?
request for data
computer 1
computer 2


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



Learning Objectives Today

Motivation

Networking Basics

HTTP (Hypertext Transfer Protocol)

Requests Module

HTTP

Protocol for communicating web data

- downloading a specific webpage, image, etc

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

HTTP

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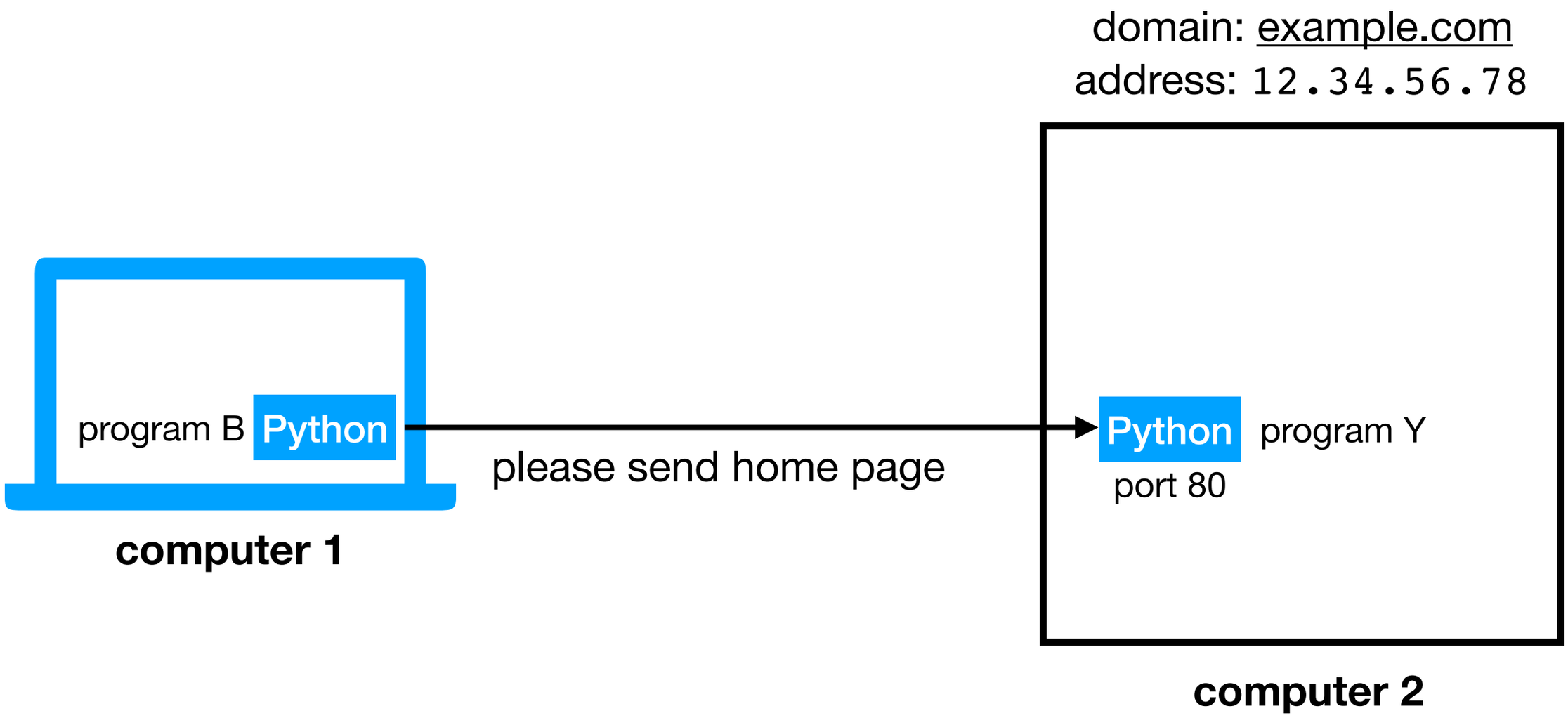

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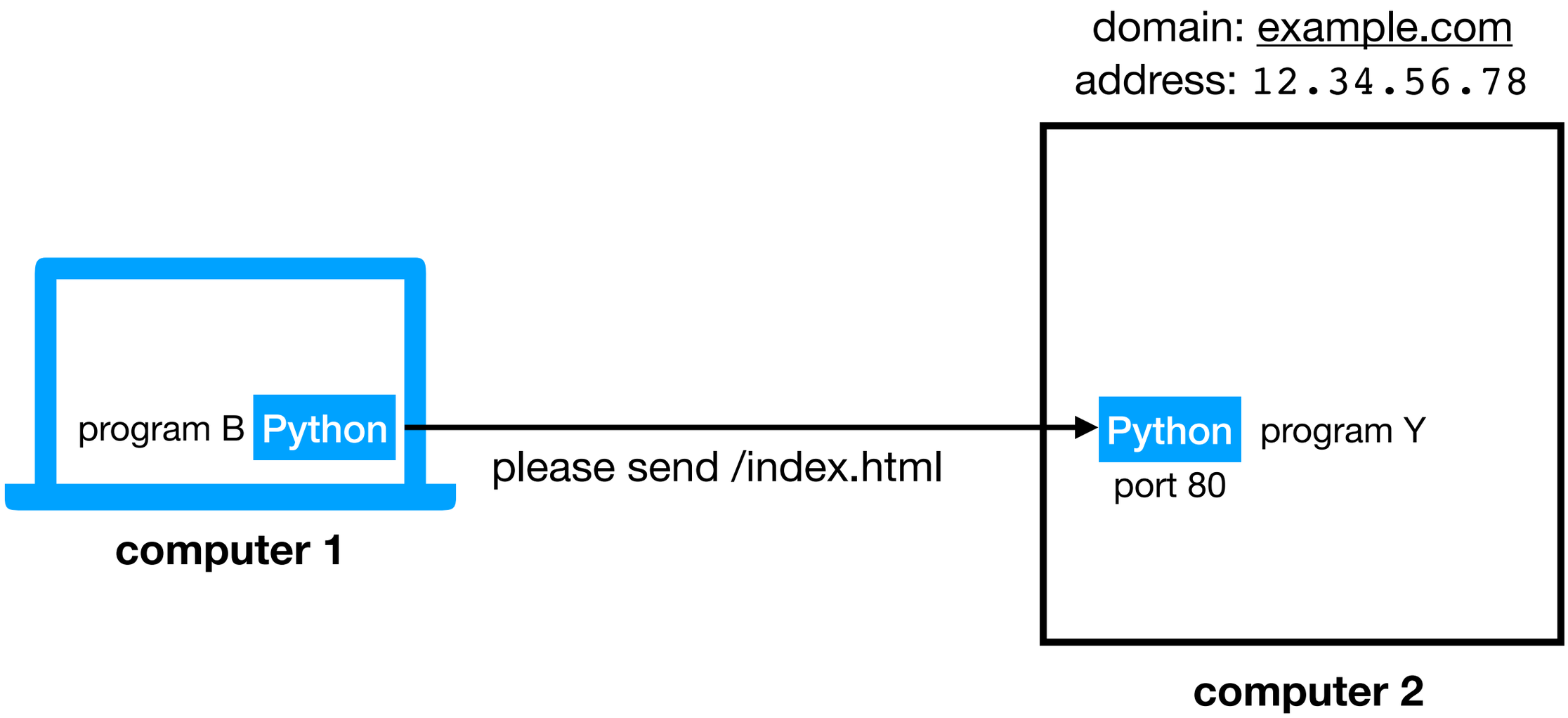

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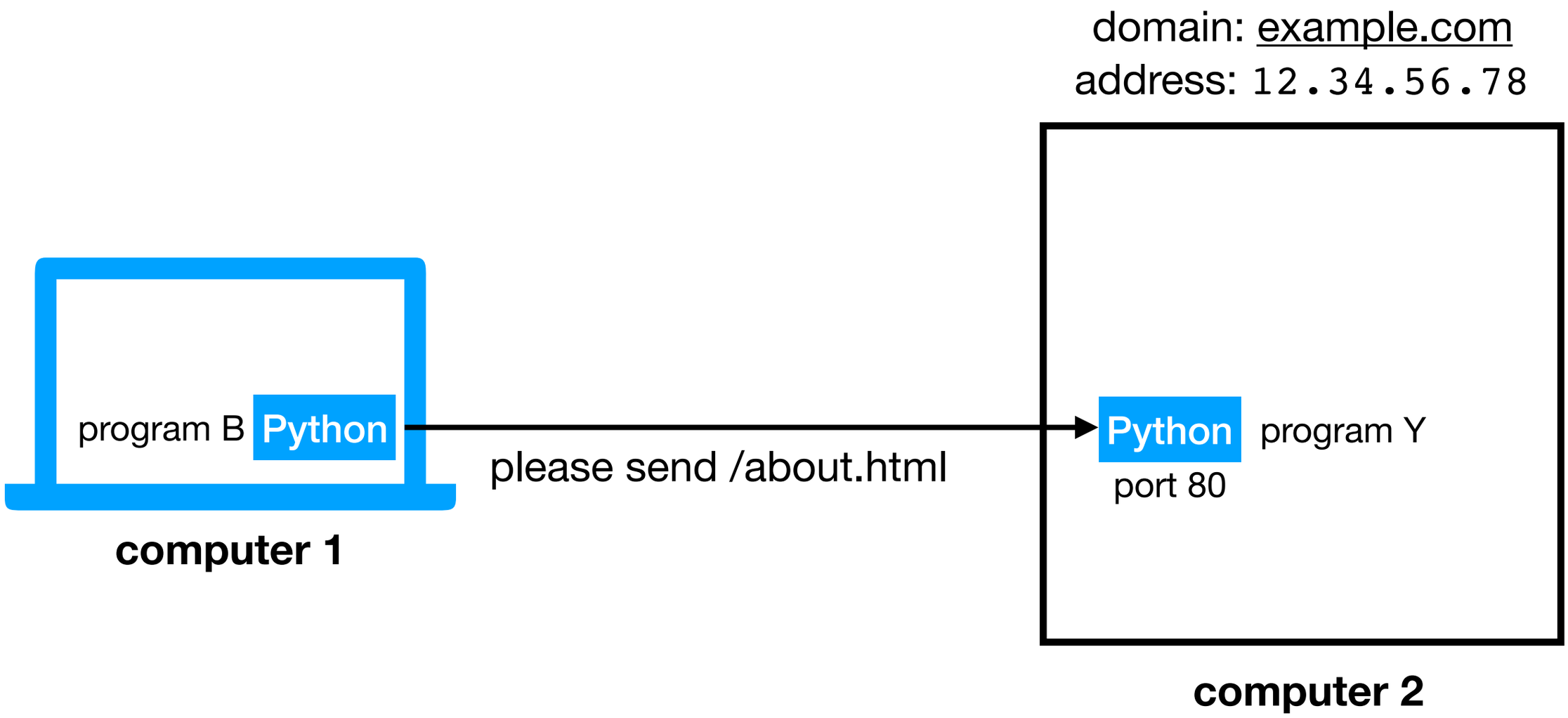

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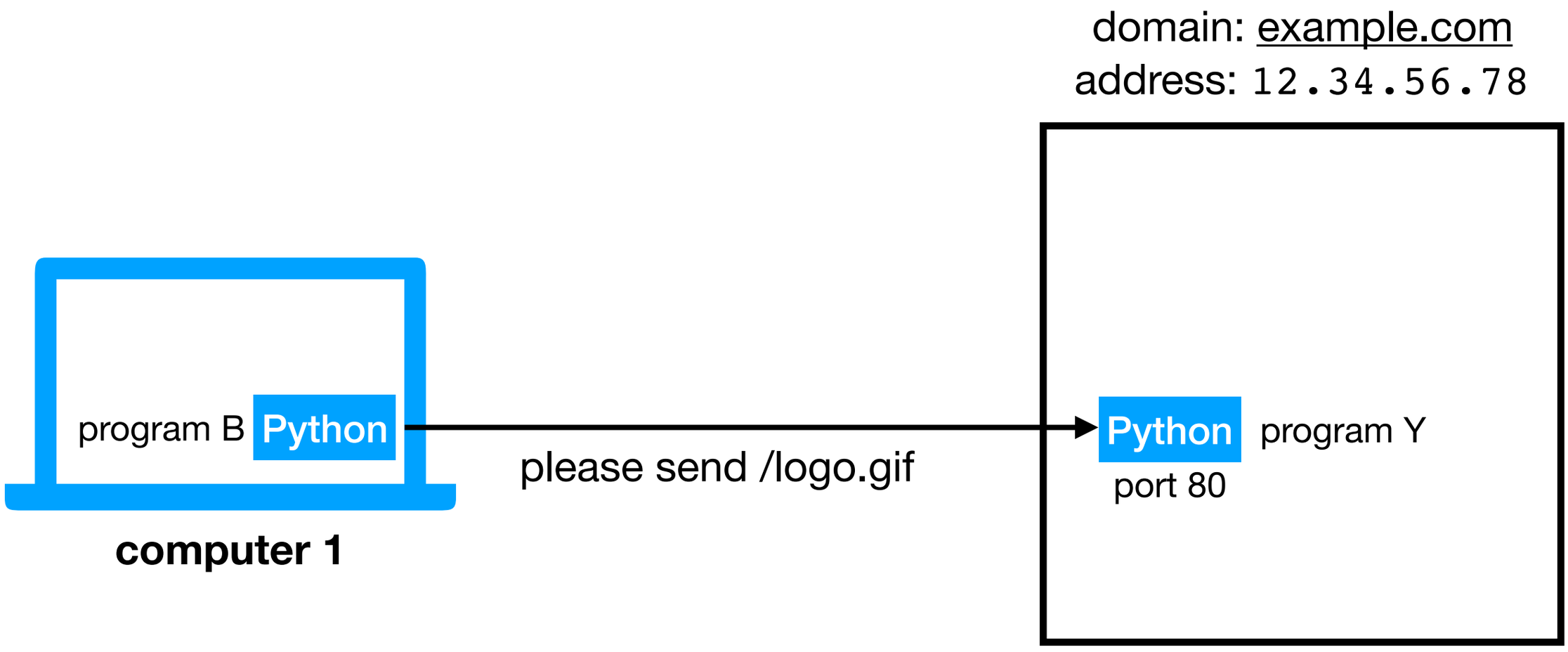

Note we need three things:

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

HTTP

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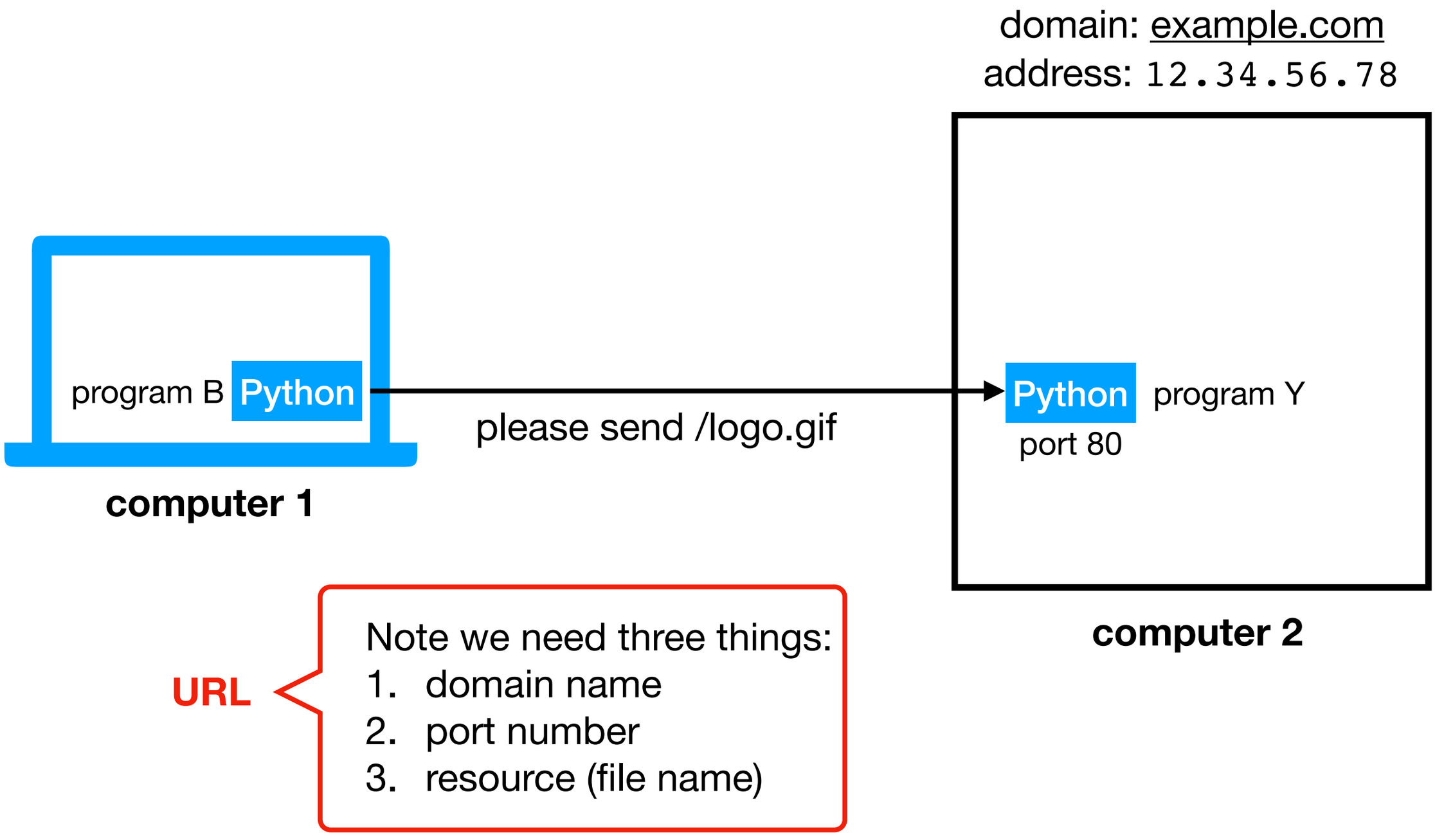

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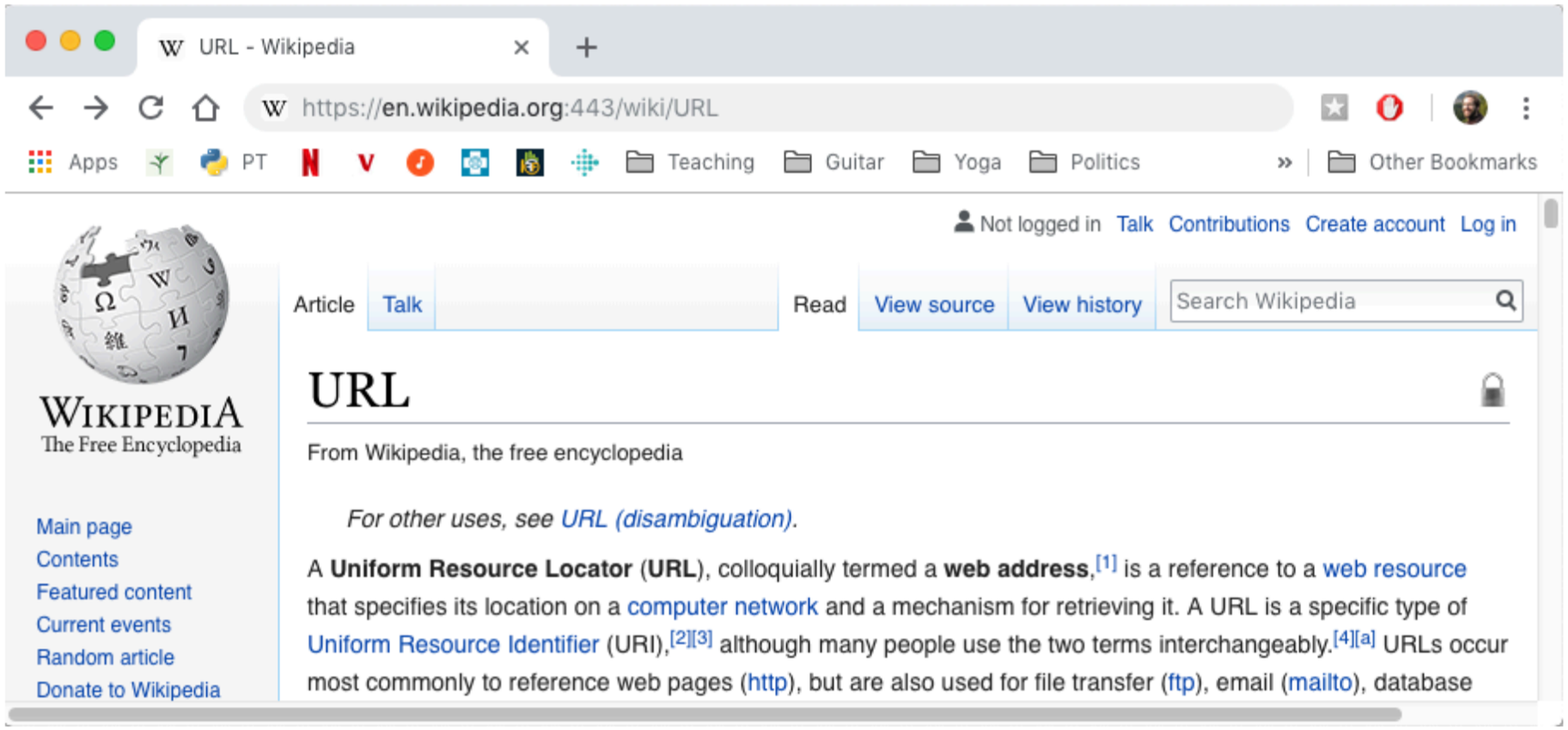
URLs

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



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URLs

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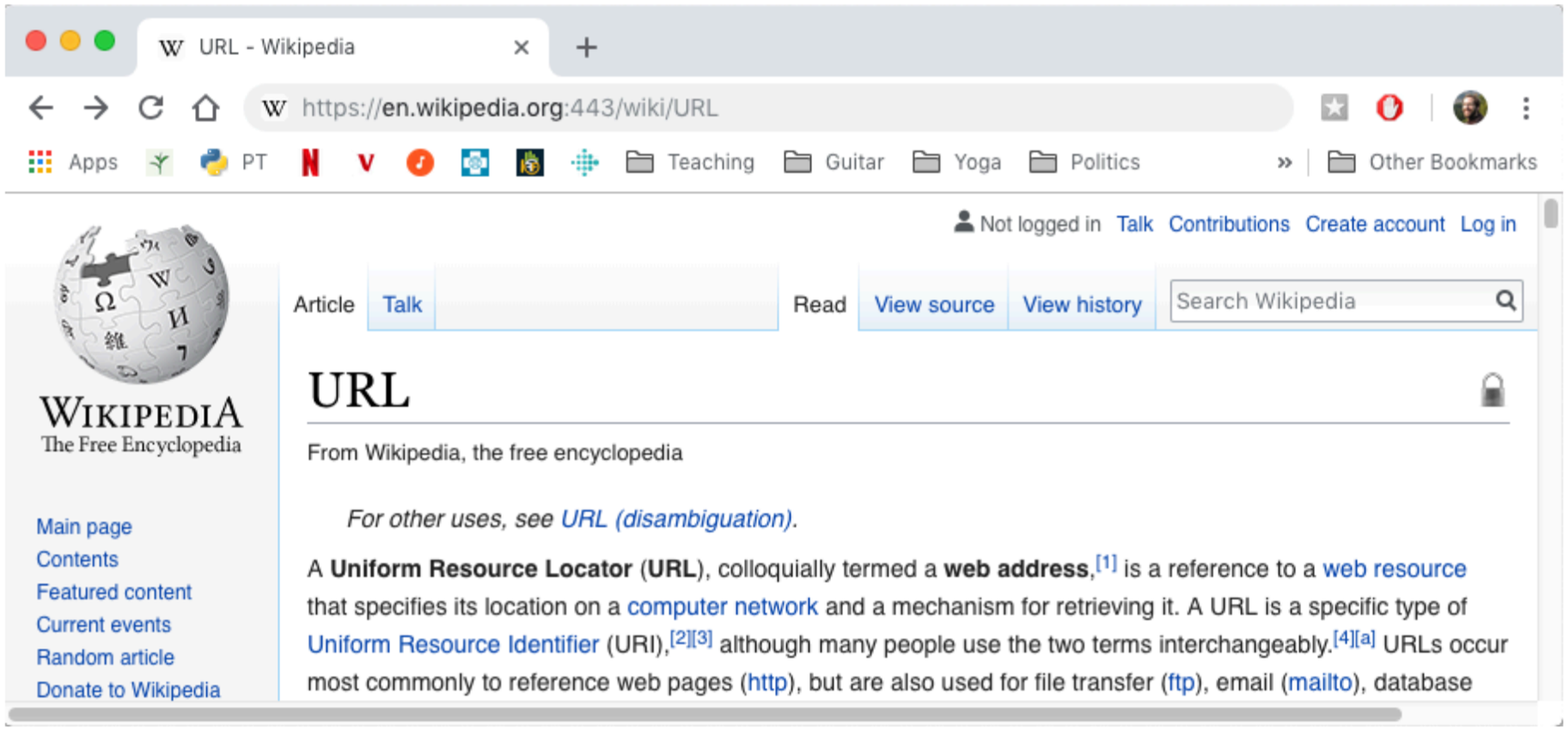

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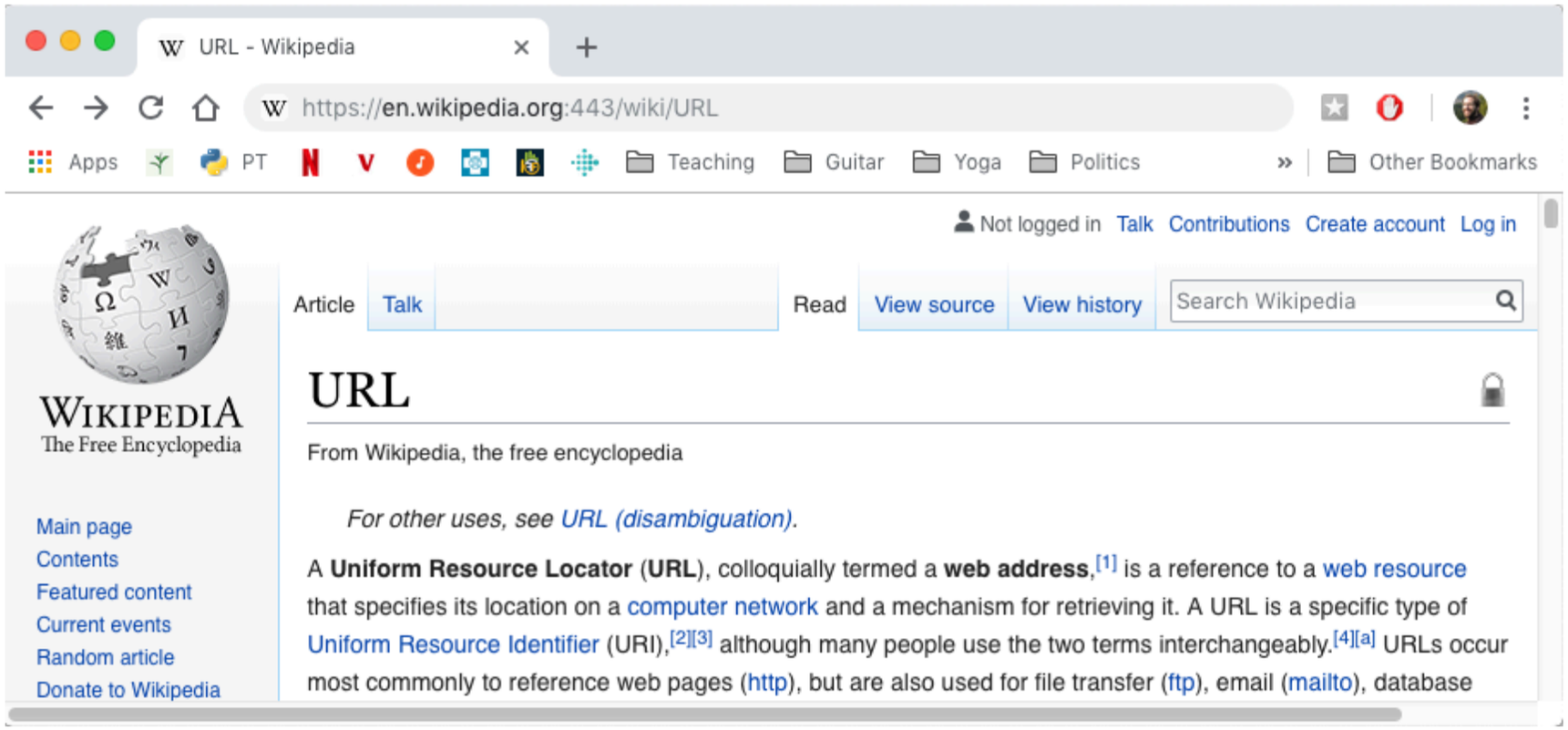

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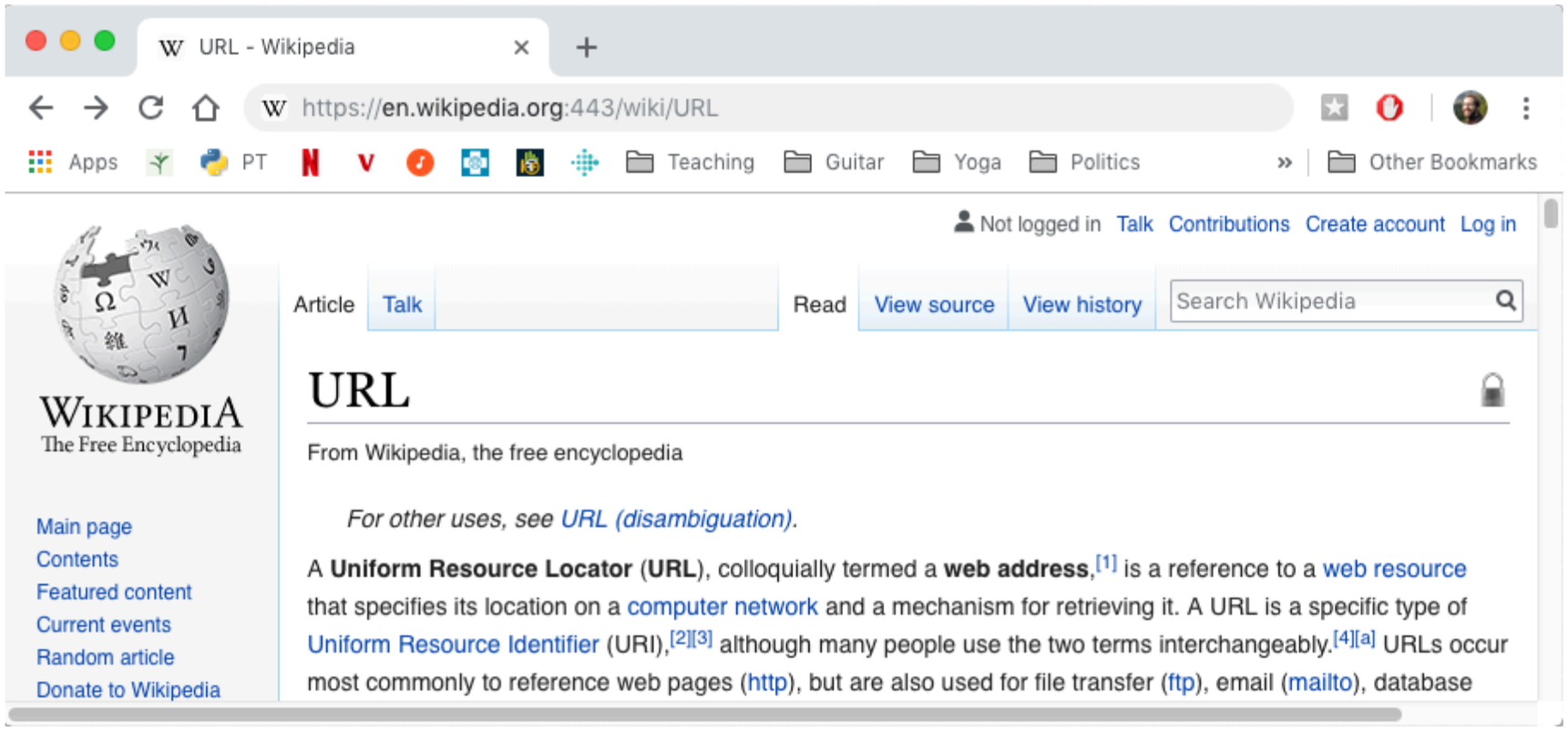

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URLs

domain name resource

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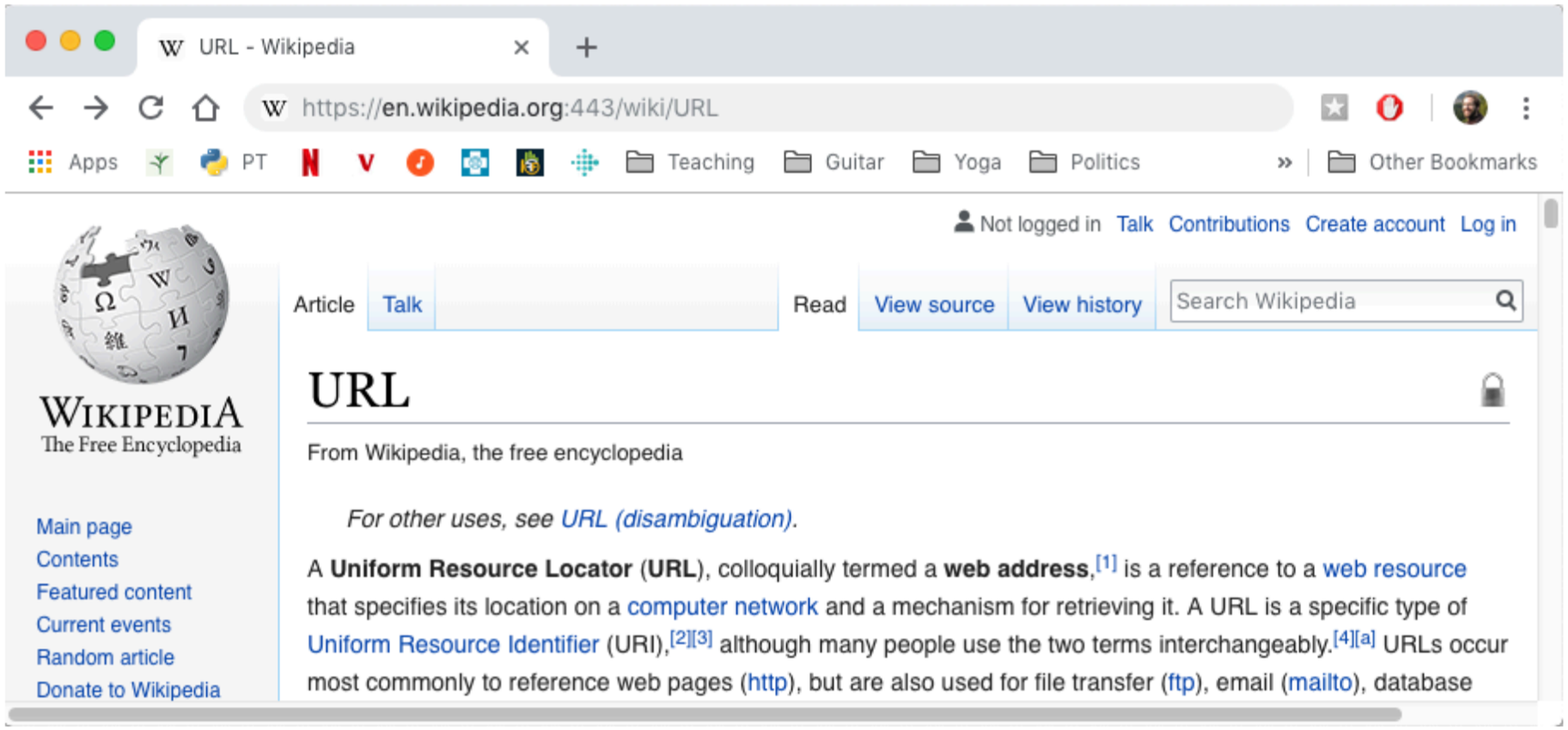
port would have defaulted to 443 if not specified



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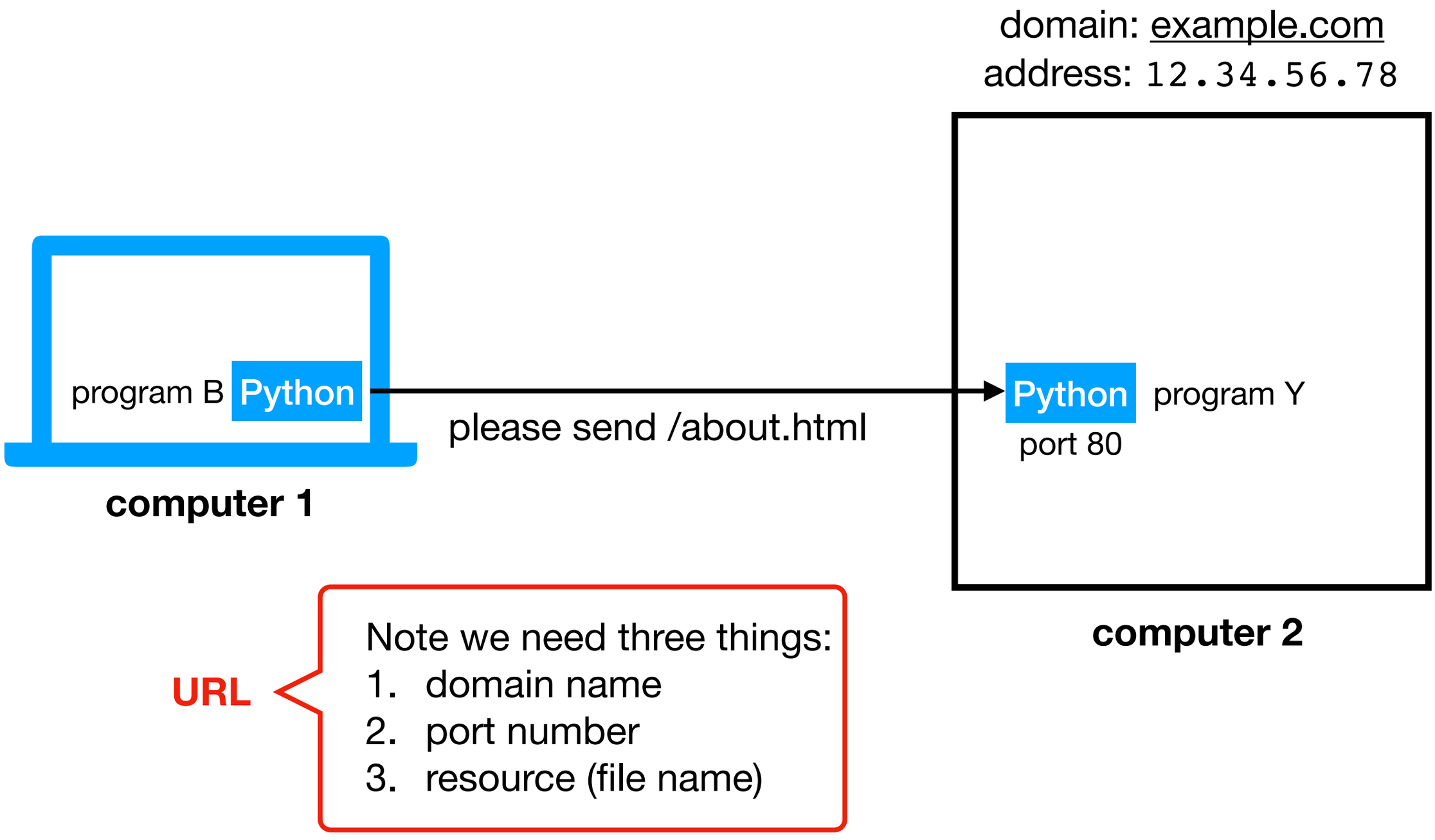

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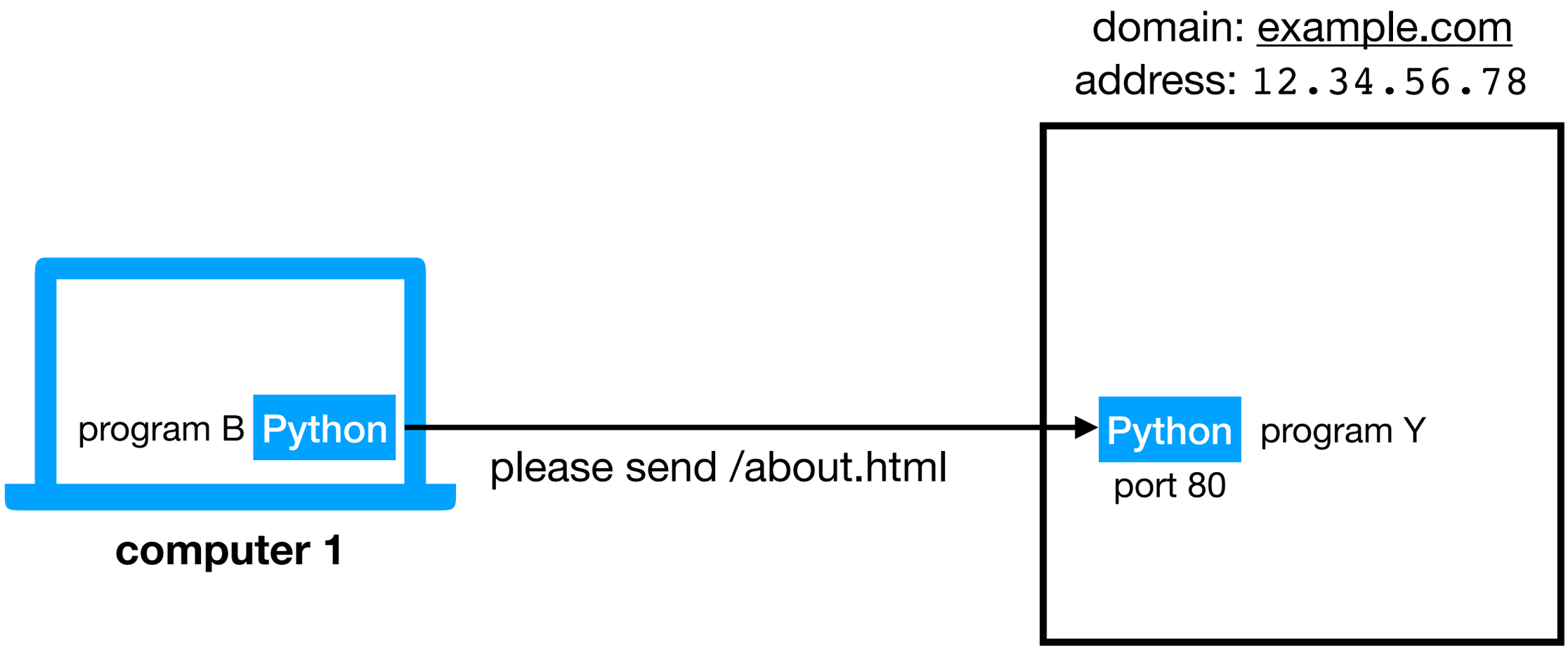

HTTP Request:

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

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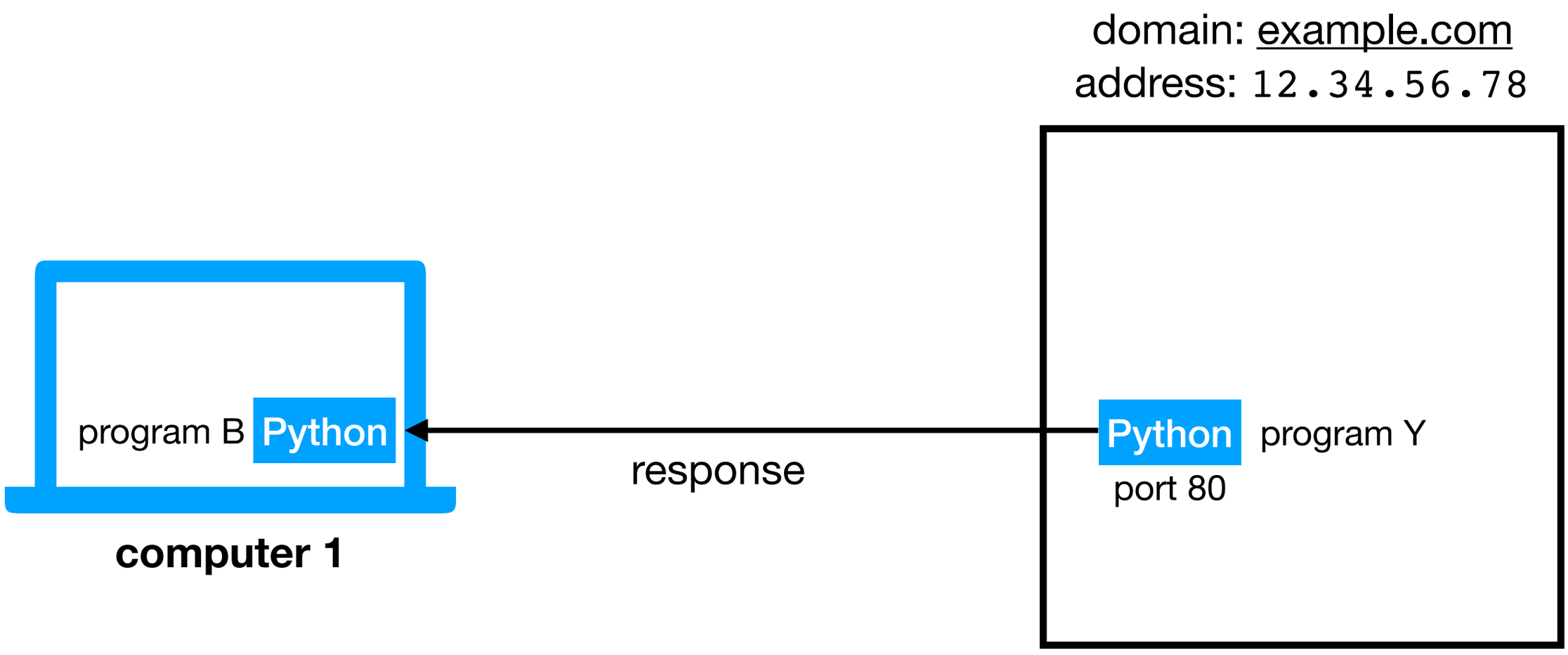

HTTP Response:

```
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

we want the about.html page

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data in about.html

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Request and Response

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

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method. *GET* is simple download. *POST* means we are uploading data as part of our request. We wont talk about others today.

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