CS 725/825 & IT 725

Lecture 9

Application Layer

September 27, 2023

Main Operations

- Address resolution (DNS)
- Binding to a local port number
- Client opening connection to a server
- Server accepting connections from clients
- Sending and receiving data
- Getting and setting connection parameters
- Closing connection
- Server handling of simultaneous connections

Perspectives

- Reliable, stream-oriented service (TCP)
  - Connection-oriented client-side
  - Connection-oriented server-side
- Unreliable, datagram service (UDP)

In Python…

- Address resolution (DNS)
- Binding to a local port number
- Client opening connection to a server
- Server accepting connections from clients
- Sending and receiving data
- Getting and setting connection parameters
- Closing connection
- Server handling of simultaneous connections

Server

```
import socket
BUFFER_SIZE = 100

s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.bind(('', 54321))
s.listen(5)
ss, remote_address = s.accept()
print(‘Received’, ss.recv(BUFFER_SIZE).decode())
ss.send(’Message from agate\n’.encode())
ss.close()
```

Client

```
import socket
BUFFER_SIZE = 100

s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.connect(('agate.cs.unh.edu', 54321))
s.send('Message to agate\n’.encode())
print(‘Received', s.recv(BUFFER_SIZE).decode())
s.close()
```

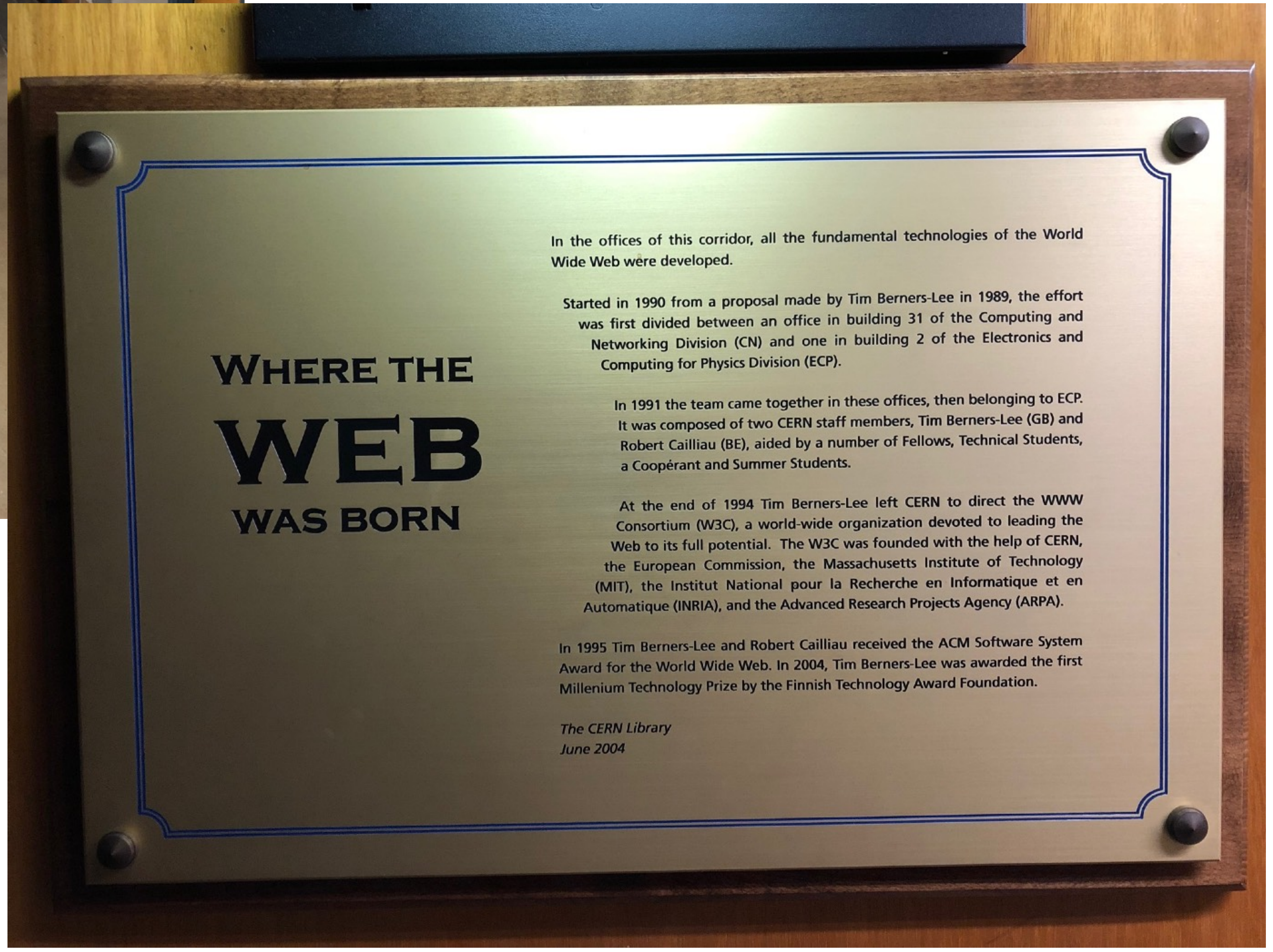
This is in no way an example of how to write networking code! Among other issues, the code does not even do the most trivial error checking

HTTP/HTML History

Cité des Sciences et de l’Industrie, Paris

HTTP/HTML History

CERN, Geneva



WHERE THE
WEB
WAS BORN

In the offices of this corridor, all the fundamental technologies of the World Wide Web were developed.

Started in 1990 from a proposal made by Tim Berners-Lee in 1989, the effort was first divided between an office in building 31 of the Computing and Networking Division (CN) and one in building 2 of the Electronics and Computing for Physics Division (ECP).

In 1991 the team came together in these offices, then belonging to ECP. It was composed of two CERN staff members, Tim Berners-Lee (GB) and Robert Cailliau (BE), aided by a number of Fellows, Technical Students, a Coopérant and Summer Students.

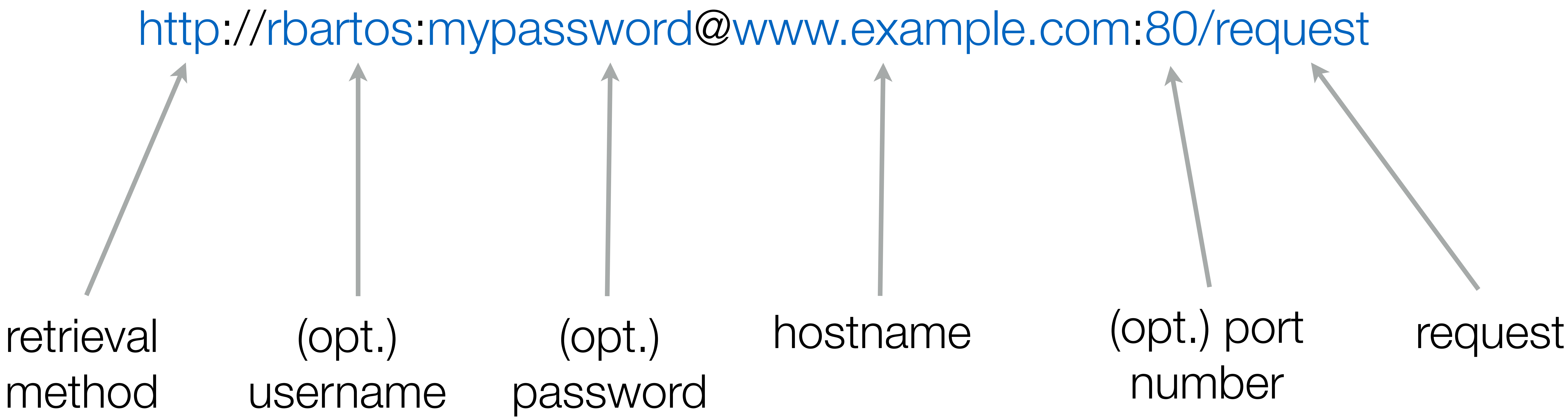
At the end of 1994 Tim Berners-Lee left CERN to direct the WWW Consortium (W3C), a world-wide organization devoted to leading the Web to its full potential. The W3C was founded with the help of CERN, the European Commission, the Massachusetts Institute of Technology (MIT), the Institut National pour la Recherche en Informatique et en Automatique (INRIA), and the Advanced Research Projects Agency (ARPA).

In 1995 Tim Berners-Lee and Robert Cailliau received the ACM Software System Award for the World Wide Web. In 2004, Tim Berners-Lee was awarded the first Millenium Technology Prize by the Finnish Technology Award Foundation.

The CERN Library
June 2004

HTTP

- HyperText Transfer Protocol (HTTP)
- URL (Universal Resource Locator)



http://rbartos:mypassword@www.example.com:80/request

retrieval method

(opt.) username

(opt.) password

hostname

(opt.) port number

request

HTTP

- HyperText Transfer Protocol (HTTP)
- Runs on to of (reliable, transparent, connection oriented) TCP
- A stateless…
- … request/response protocol.
- protocol and payload not secured by default
- “work in progress”: HTTP/1.1 → HTTP/2 → HTTP/3