HTTP: Hyper-Text Transfer Protocol
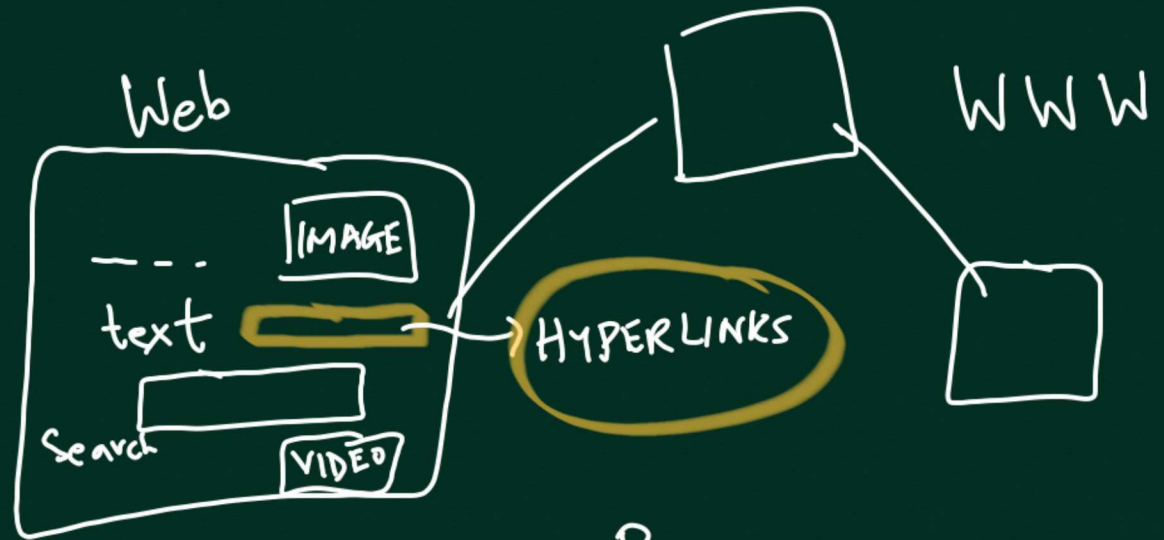
APPL. LAYER

P2P, DNS

see detailed example in Peterson & Davie (6th Ed.)

Web

IMAGE

text

Search

VIDEO

HYPERLINKS

WWW

DOWNLOAD PAGES

SUBMIT INFORMATION

PROXIES

Client1 HTTP → Proxy → Web Server

CACHE → Copy
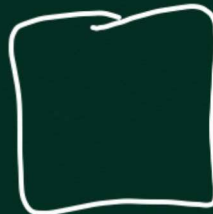
REDIRECTION

Client HTTP → Server1 → Server2

Page moved to XYZ.

HTTP (1.0, 1.1, 2, 3) 2022

TCP

QUIC UDP

obj1 obj2 obj3 obj4
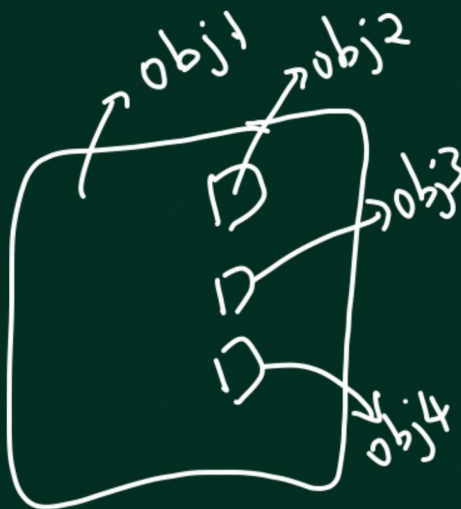
HTTP MESSAGE

FORMAT

(START LINE) — — — — — — . . ⟨CRLF⟩

underbrace: 2 ASCII CHAR

(MSG HDR) . — — — — — — ⟨CRLF⟩ } Ex. Content-length: 1256

⟨CRLF⟩ } bytes

. — . — — . . Expiry-time

empty line ← ⟨CRLF⟩ Encoding type etc.

MESSAGE BODY ← . — — —

. — . — .

Example of REQUEST

GET   <URL>

http://www.google.com/index.htms   HTTP/1.1

Alternatively   ↓ /index.html

In HDR : Host : www.google.com

Request Operations

GET → Retrieve Document

HEAD → Retrieve Meta Info
          (e.g. Last Modified, Length...)

OPTIONS → Available Options (HTTP version at server)

POST → Give New Information To Server

PUT → Store/Modify Info At Specified URL on Server

DELETE → Delete specified URL

RESPONSES

Example

(START LINE)   HTTP/1.1   (202)   ACCEPTED <CRLF>
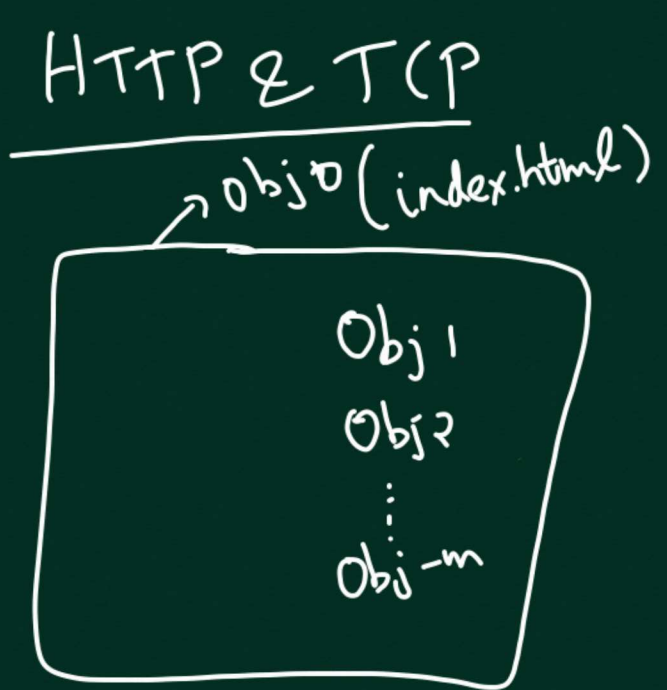
(HDR)   Content-length: ___.

         Expiry-time:

         <CRLF>

(BODY)

RESULT CODES

1xx   Informational

2xx   Success

3xx   Redirection

4xx   Client Error

5xx   Server Error

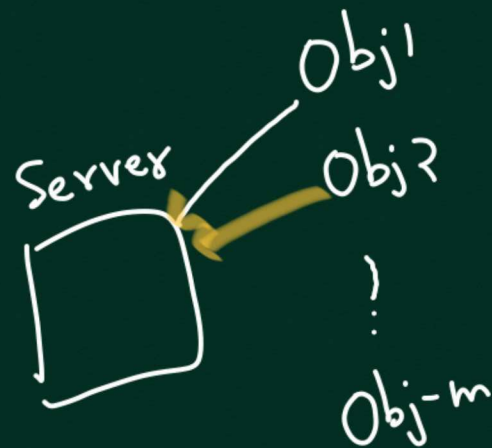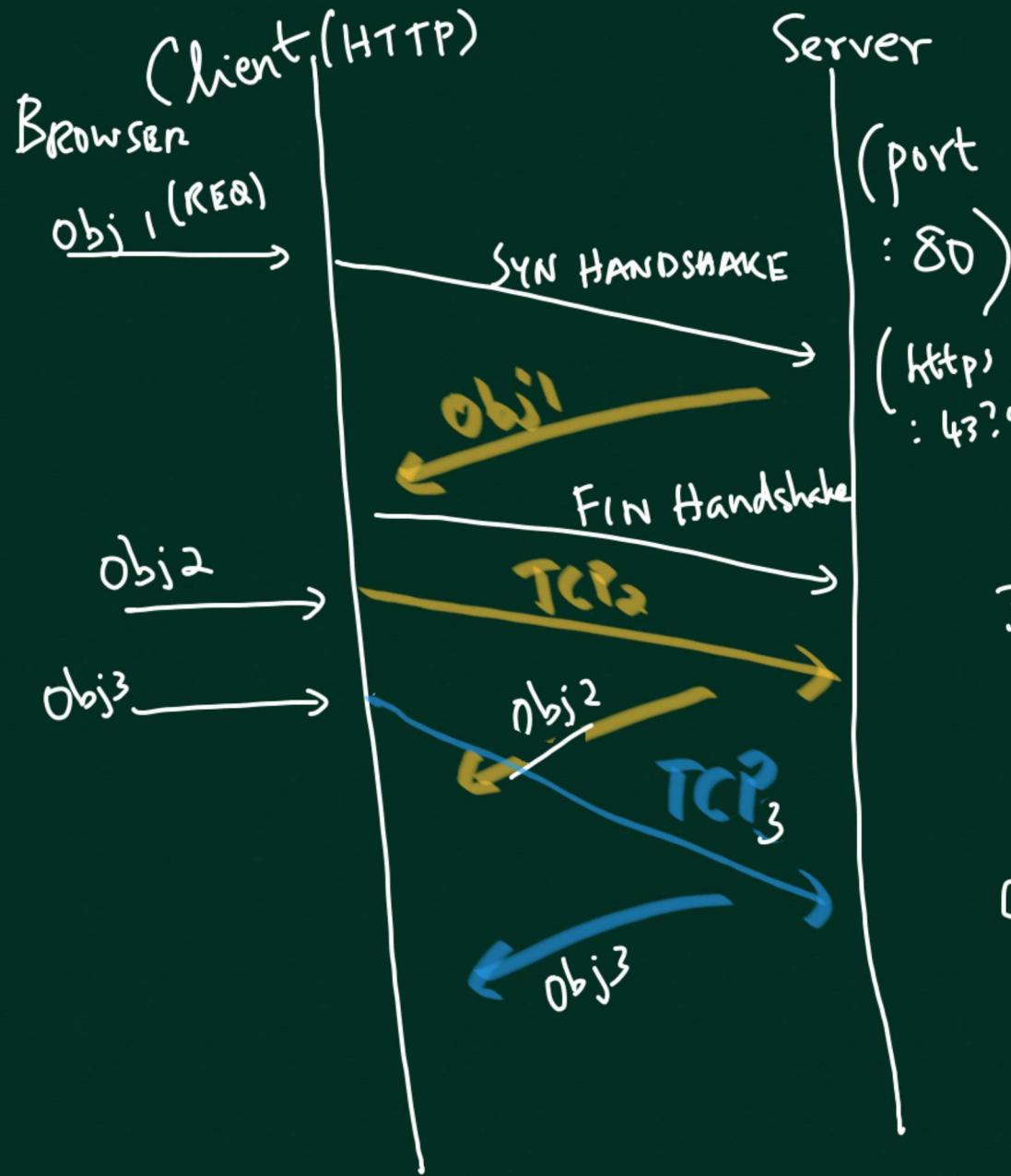# HTTP & TCP

Obj0 (index.html)

Obj 1
Obj 2
⋮
Obj-m

BROWSER
↓ REQUESTS

HTTP → Q. Send all requests at once
        or sequentially?

↓

TCP → ONE REQ. PER TCP connection?

Server
Obj1
Obj2
⋮
Obj-m

HTTP 1.0

NEW TCP CONNECTION
FOR EACH "GET"

Browser **Client** (HTTP)   Server

Obj 1 (REQ) →

SYN HANDSHAKE →

Obj1 (returning)

FIN Handshake →

Obj2 →

TCP2

Obj3 →

Obj2

TCP3

Obj3

(port : 80)

(https : 43? 443?)

ISSUES:

1) EACH TCP connec. takes time to learn optimal CW

2) Overheads (Handshakes)

3) Server state is large due to multiple TCP connections being open

4) Fairness TCP1

TCP2

N

Client 1 ⟶ ⟶ ⟶

m TCP connections

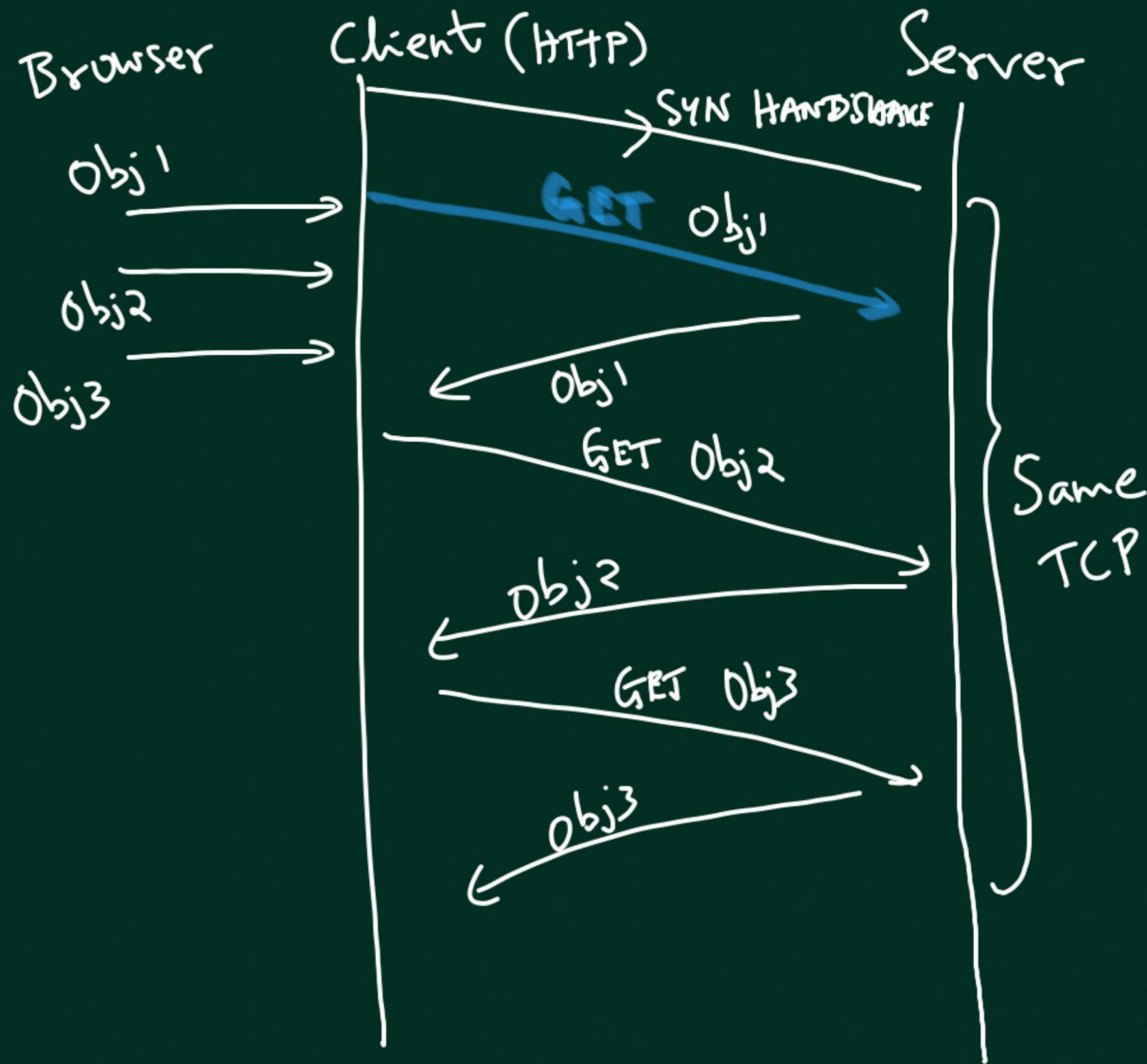Client 2 ⟶ 1 TCP

C link capacity

Server

$(m+1)$
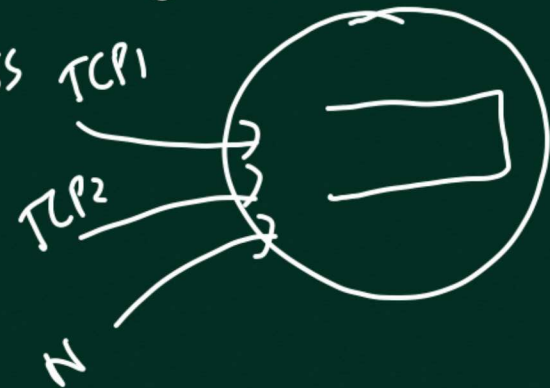
Each gets $\dfrac{C}{m+1}$ (assuming same TCP version, RTT etc.)

$C \cdot \dfrac{m}{m+1} \longrightarrow$ client 1

$C \cdot \dfrac{1}{m+1} \longrightarrow$ client 2

HTTP 1.1 PERSISTENT TCP CONNECTION

Browser   Client (HTTP)   Server

SYN HANDSHAKE

Obj1

GET Obj1

Obj2

Obj3

Obj1

GET Obj2

Obj2

GET Obj3

Obj3

Same TCP

HoL Blocking

Obj'n' gets delayed because Obj(n-1) is taking time to download

HTTP2 → Single TCP, Streams

→ time

STREAM 1 [GET] [RESPONSE (obj₁)]

$F_{1,1}$ $F_{1,2}$ $F_{1,3}$ $F_{1,4}$ → FRAMES

STREAM 2 [GET] [RESP]

$F_{2,1}$ $F_{2,2}$ $F_{2,3}$

STREAM 3 [GET] [RESP.]

$F_{3,2}$ $F_{3,3}$ . . .