/EXPRESS.JS

“You think, you can”

COMING UP

- **Part I: The Internet**
  - Clients & Servers
  - HTTP
  - TCP
  - IP
- **Part II: Node Servers**
- **Part III: Express**

PART I: THE INTERNET

CLIENTS & SERVERS

- Client requests a resource
- Server responds with resource
- Client initiates, server responds; not other direction
- These are *roles* — not technical specs or computer types

CLIENTS & SERVERS

CLIENTS & SERVERS

DEAR ABBY:

My Dad Objects To a Pet Monkey

DEAR ABBY: I am 10 years old and my Daddy said that when I saved enough money I could buy anything I wanted with it.

All my life, I have wanted a monkey. I have saved $14. I asked Daddy if I could buy a pet monkey and he said no, because I wouldn't know how to take care of it. My Mom is the fussy type. You know, everything has to be just so. Do you know anyone who has a pet monkey, and can give me some advice? WANTS A MONKEY

DEAR WANTS: I have had two pet monkeys (David and Bathsheba) and, although I love monkeys, your father is right. To quote my son (he was 4 at the time), "Monkeys should live with monkeys, and people should live with people."

ABIGAIL VAN BUREN

CLIENTS & SERVERS

CLIENTS & SERVERS

CLIENTS & SERVERS

CLIENTS & SERVERS

<RUNNING SERVER DEMO>

WEB SERVERS

- **Processes (running programs), not physical machines**
  - Might be running on a laptop,
  - or a Raspberry Pi,
  - or an enterprise-grade workstation…
- **Listening on a *port* for incoming requests**
- **Send back responses**
- **…but we are getting ahead of ourselves.**

INTERNET COMMUNICATION PROTOCOLS

AFP

BitTorrent

TCP

HTTPS

POP

9P

IMAP

BGP

HTTP

UDP

SCP

SSL

ICMP

FTP

SSH

IP

PPP

NFS

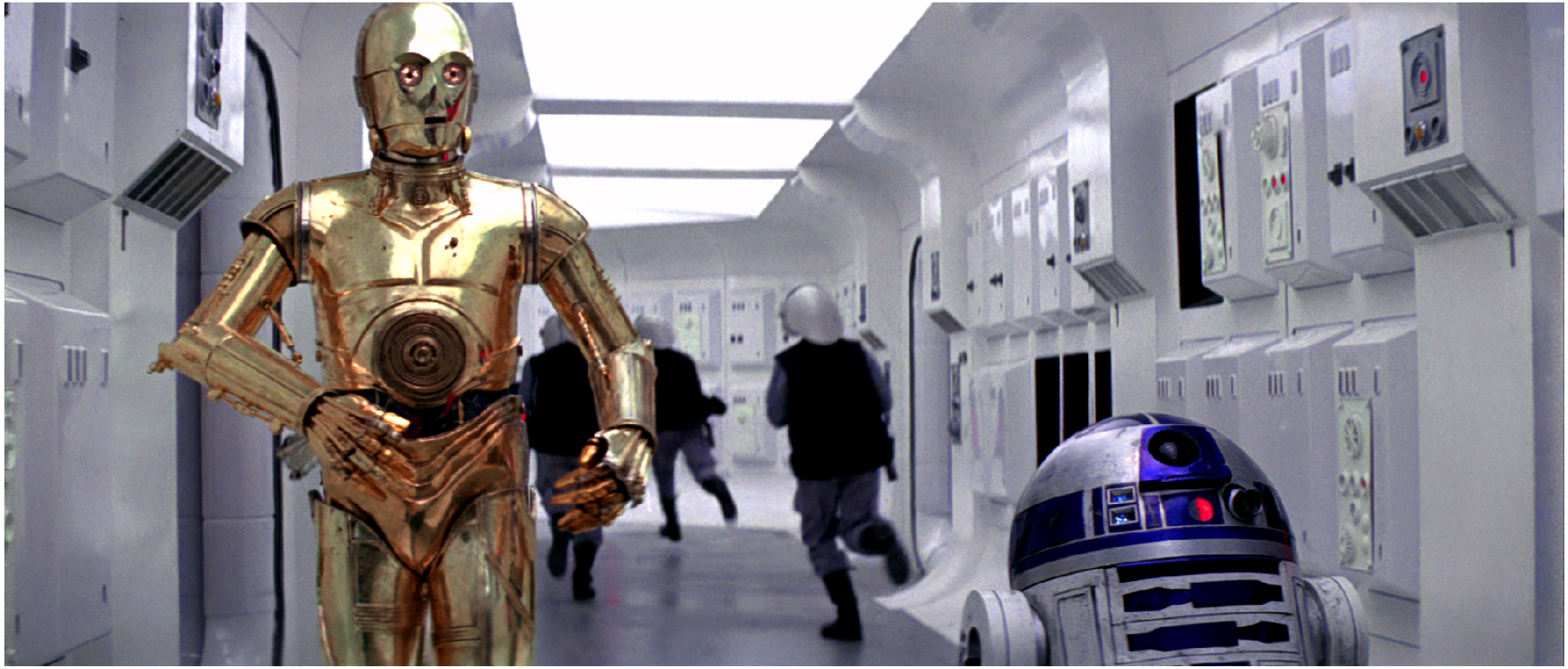
SMTP

PROTOCOL

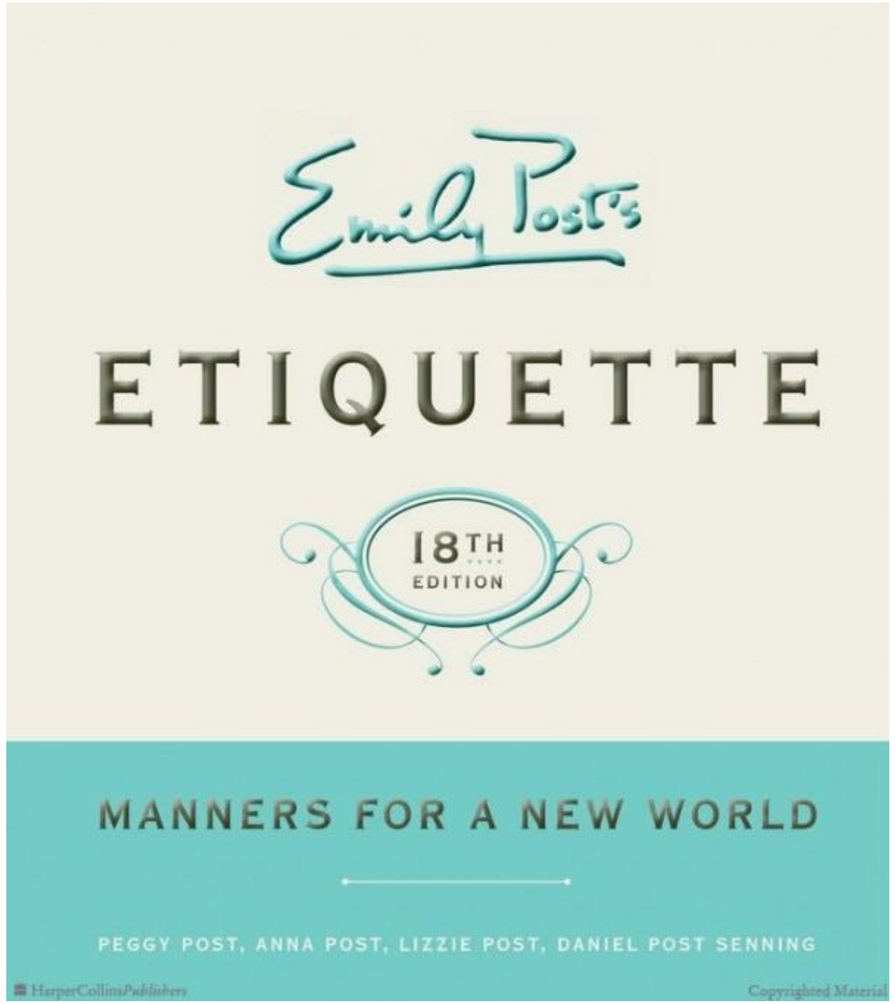
- Rules for interaction / communication
- Specification, not implementation

PROTOCOL

PROTOCOL

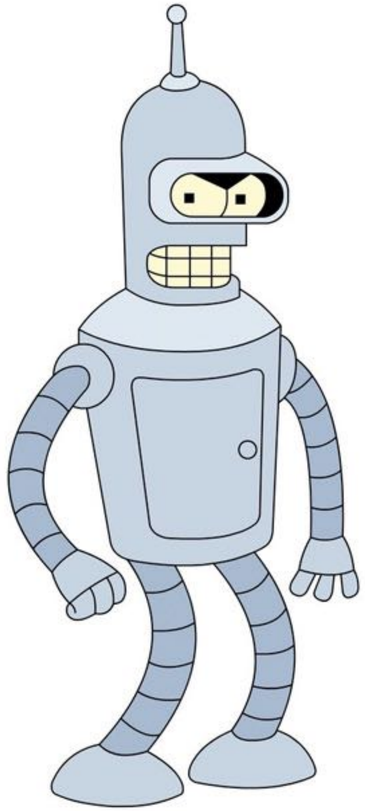


PROTOCOL


Emily Post's
ETIQUETTE
18TH EDITION
MANNERS FOR A NEW WORLD
PEGGY POST, ANNA POST, LIZZIE POST, DANIEL POST SENNING
HarperCollinsPublishers
Copyrighted Material


6940 Silver Creek Road
St. Louis, Missouri 63101
How beautiful is the day
that is touched by love
Mr. and Mrs. Donald Griffin
request the honour of your presence
at the marriage of their daughter
Jennifer Margaret
to
Chad Wesley Olsen
on Saturday, the third of August
Two thousand and thirteen
at four o'clock in the afternoon
Franklin Park Conservatory
2892 South River Boulevard
St. Louis, Missouri
Please reply on or before
July 19, 2013
M
persons will attend

PROTOCOL



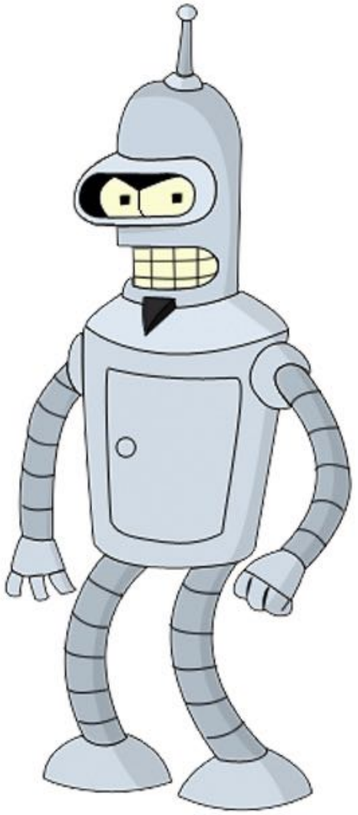
Knock, knock.

Broken state machine.

Knock, knock.

Who's there?

Broken state machine, who?



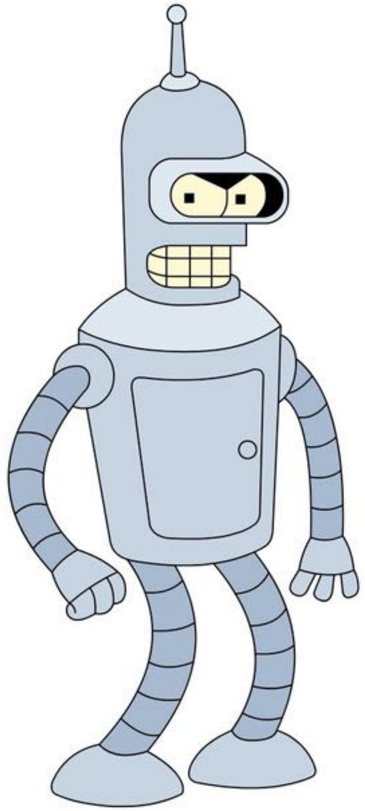
THE KNOCK-KNOCK MESSAGE PROTOCOL

- Joker opens connection with "knock, knock."
- Victim completes handshake with "who's there?"
- Joker transmits identity label: "<IDENTITY>"
- Victim requests clarification: "<IDENTITY> who?"
- Joker delivers payload: "<PUNCHLINE>"
- Joke is now delivered, close connection. Participants may optionally laugh and/or dodge fists.

MESSAGING / APP VS. TRANSMISSION

- KnockKnock is an *application level* protocol
- It specifies the sequence and content of messages
- It does NOT specify how those messages are transmitted

KNOCK KNOCK OVER VOX



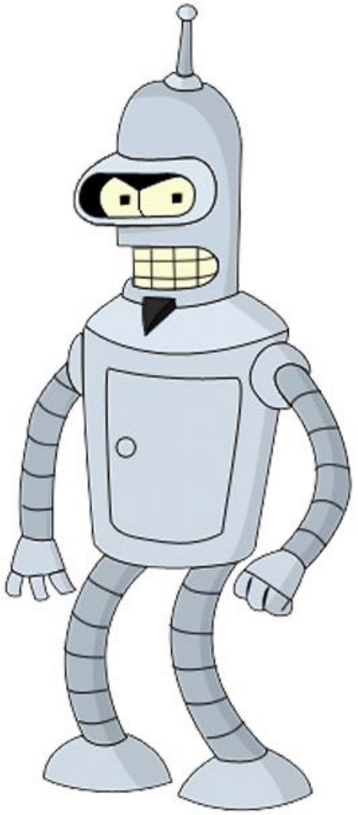
Knock, knock.

Broken state machine.

Knock, knock.

Who's there?

Broken state machine, who?



KNOCK KNOCK OVER TEXT

KNOCK KNOCK OVER BLACKBOARD

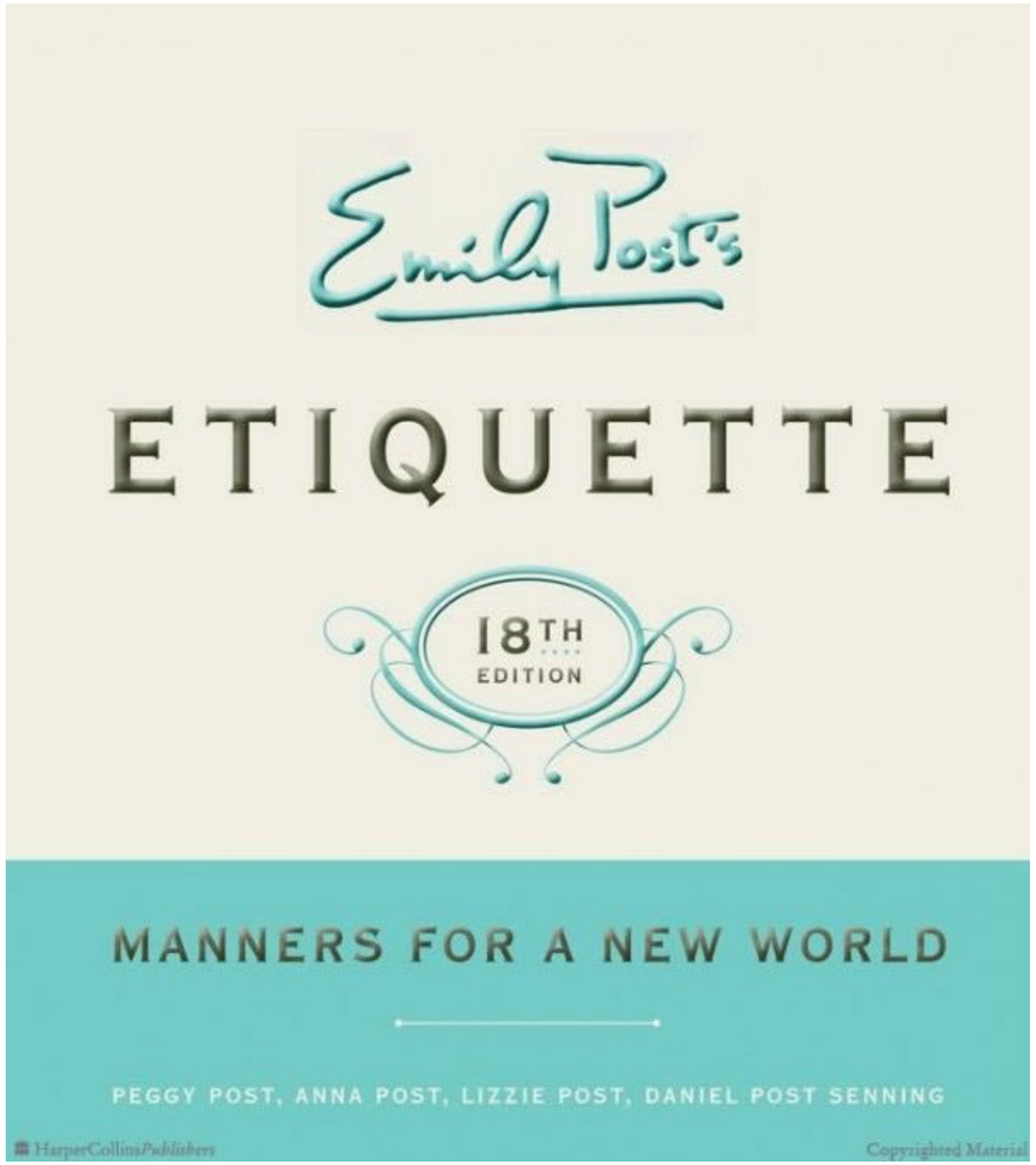
Knock, knock...

who's there?

HTTP

HTTP

- An *application-level* communications protocol. You might call it a *messaging* protocol.
- Specifies allowable *metadata* and *content* of messages.
- Does *NOT* specify *how* messages are transmitted!
- STATELESS: does *not* need to remember previous req-res!


Emily Post's
ETIQUETTE
18TH EDITION
MANNERS FOR A NEW WORLD
PEGGY POST, ANNA POST, LIZZIE POST, DANIEL POST SENNING
HarperCollinsPublishers
Copyrighted Material


6940 Silver Creek Road
St. Louis, Missouri 63901
How beautiful is the day
that is touched by love
Mr. and Mrs. Donald Griffin
request the honour of your presence
at the marriage of their daughter
Jennifer Margaret
to
Chad Wesley Olsen
on Saturday, the third of August
Two thousand and thirteen
at four o'clock in the afternoon
Franklin Park Conservatory
2892 South River Boulevard
St. Louis, Missouri
Please reply on or before
July 19, 2013
M
___ persons will attend

HTTP PROTOCOL

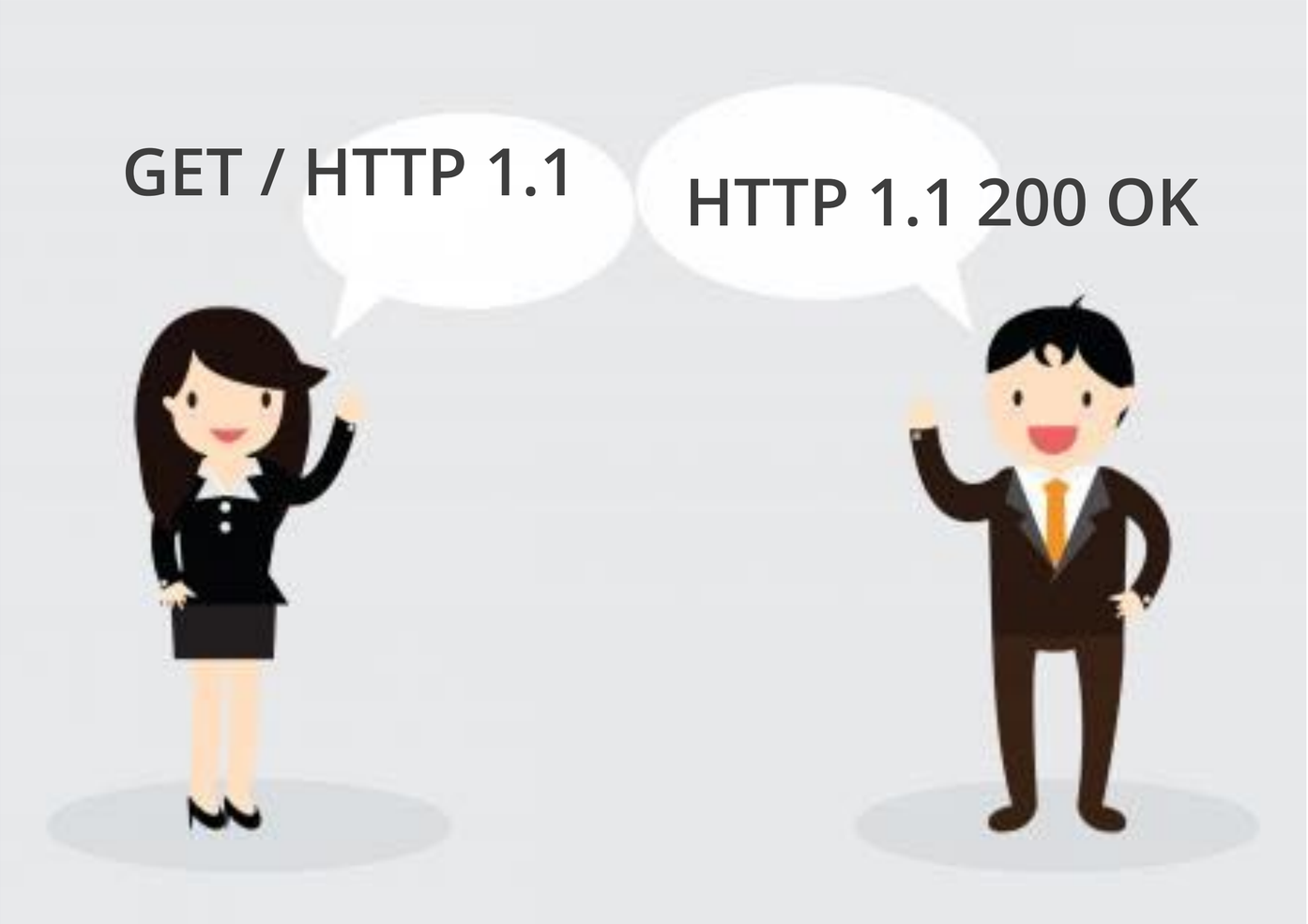
- RFC (Request For Comments) 7230 (link)
- By the IETF (Internet Engineering Task Force)
- But a *generic* messaging protocol
  - *"HTTP is a generic interface protocol for information systems. It is designed to hide the details of how a service is implemented... independent of the types of resources provided."*

HTTP CLIENTS & SERVERS

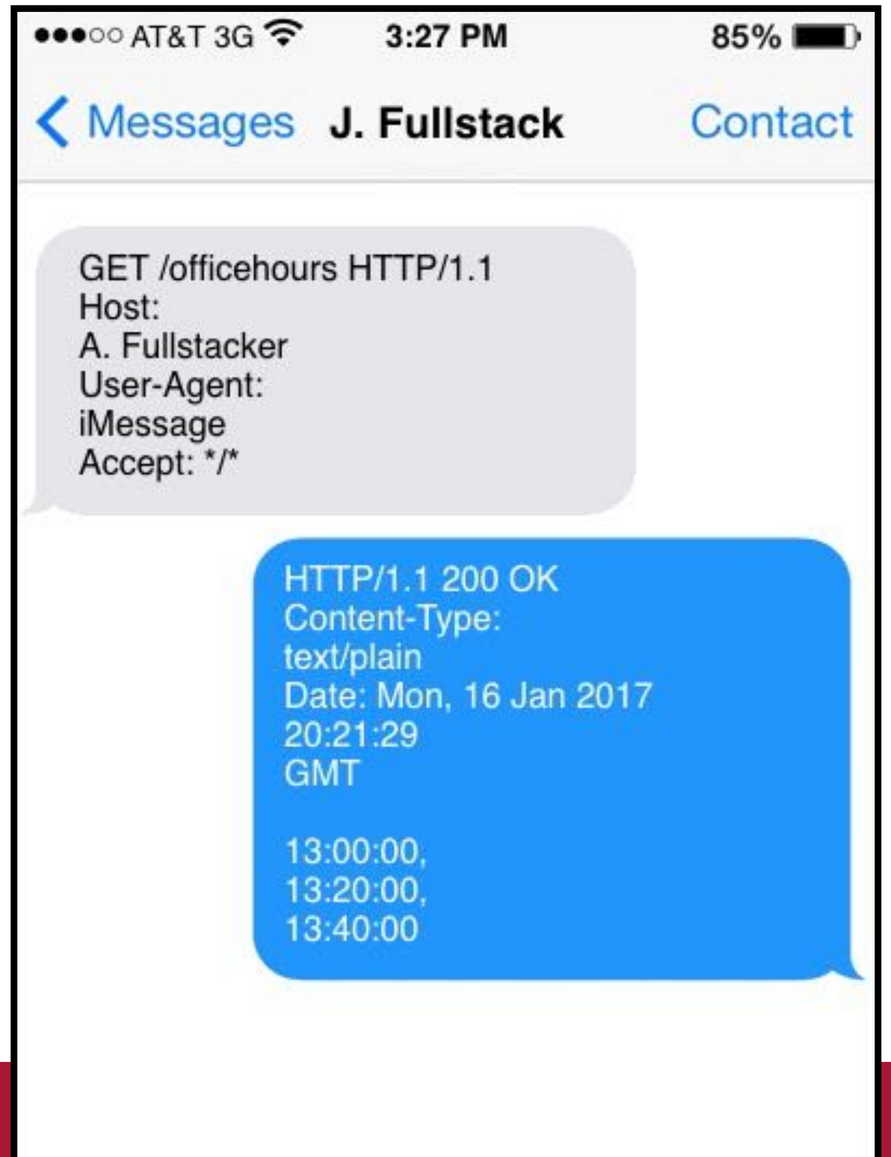
- **Example Clients**
  - web browsers
  - household appliances
  - stereos
  - firmware update scripts
  - command-line programs
  - mobile apps
  - communication devices
- **Example Servers**
  - web servers
  - home automation units
  - networking components
  - office machines
  - autonomous robots
  - news feeds
  - traffic cameras

NOT A TRANSMISSION PROTOCOL!

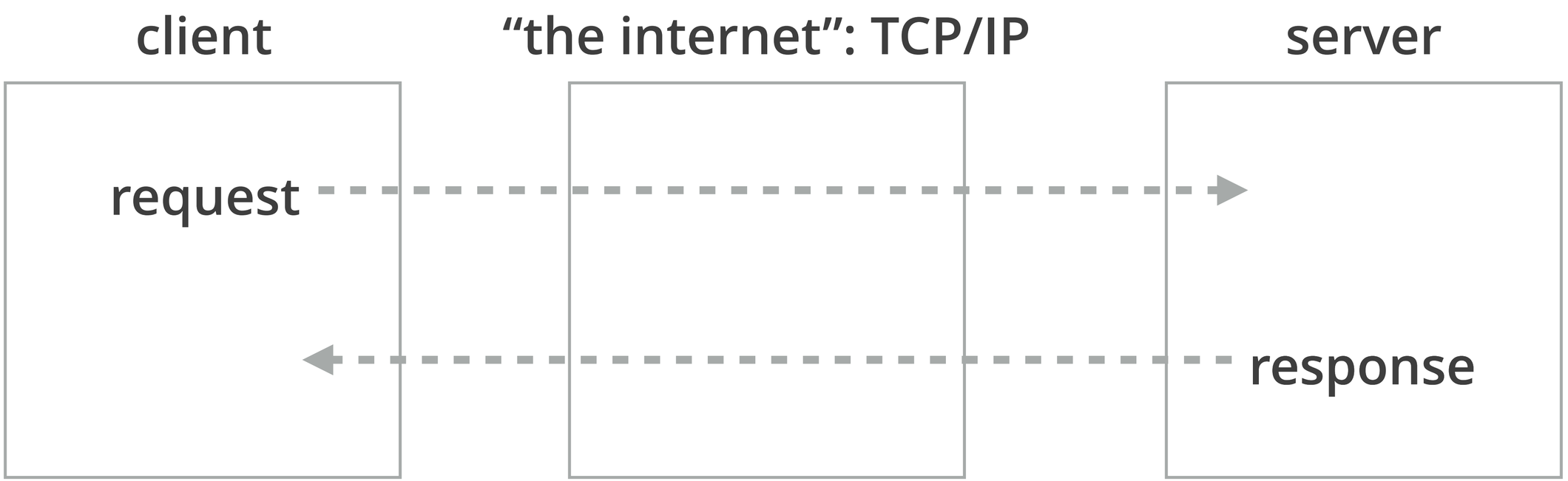
HTTP OVER VOX



HTTP OVER TEXT



HTTP OVER TCP/IP




F 3
G 2
G 2
2006.04.12 13:43

HTTP

Every request gets exactly one (total) response

(sometimes a response is broken up into chunks)

HTTP REQUEST

just a message with a certain format

verb URI

headers

```
POST /docs/1/related HTTP/1.1
Host: www.test101.com
Accept: image/gif, image/jpeg, */*
Accept-Language: en-us
Accept-Encoding: gzip, deflate
User-Agent: Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1)

bookId=12345&author=Nimit
```

body

(from http://www.ntu.edu.sg/home/ehchua/programming/webprogramming/HTTP_Basics.html)

COMMON VERBS

GET	“read”
POST	“create”
PUT	“update”
DELETE	“delete”

HTTP RESPONSE

status

headers

```
HTTP/1.1 200 OK
Date: Sun, 18 Oct 2009 08:56:53 GMT
Server: Apache/2.2.14 (Win32)
Last-Modified: Sat, 20 Nov 2004 07:16:26 GMT
ETag: "10000000565a5-2c-3e94b66c2e680"
Accept-Ranges: bytes
Content-Length: 44
Connection: close
Content-Type: text/html
X-Pad: avoid browser bug

<html><body><h1>It works!</h1></body></html>
```

(from http://www.ntu.edu.sg/home/ehchua/programming/webprogramming/HTTP_Basics.html)

payload/body

COMMON STATUSES

200	“OK”
201	“created”
304	“cached”
400	“bad request”
401	“unauthorized”
404	“not found”
500	“server error”

PROTOCOL

- Rules
- Specification, NOT implementation
- Often used for communication

node's `http` library is an implementation of HTTP

EXPRESS

A node library for request handling

<CODE>

</CODE>

EXPRESS

- Treats requests as objects, created by event
- Matches on verb AND route
- Allows chaining of many handlers
- Enables modular layering with “routers”

POP QUIZ

CLIENT

Something that makes (HTTP) requests

SERVER

Something that responds to (HTTP) requests

REQUEST

A formatted message sent over the network by a client.
Contains VERB, URI (route), headers, and body.

RESPONSE

A server's reply to a request (formatted message).
Contains headers, payload, and status.

REQUEST-RESPONSE CYCLE

*The client **always** initiates by sending a request, and the server completes it by sending **exactly one** response*

EXPRESS MIDDLEWARE

A function that handles an incoming request, either by A) producing a side effect (e.g. logging), B) modifying the existing request or potential response (e.g. body parsing), and/or C) completing the response (e.g. an HTTP endpoint).

Has the form: `function(req, res, next){…}`

REQUEST QUERY STRING

A way to pass data from client to server.

verb route

```
POST /docs/index?x=123&foo=that HTTP/1.1
Host: www.test101.com
Accept: image/gif, image/jpeg, */*
Accept-La
Accept-En
User-Agent: Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1)

bookId=12345&author=Nimit
```

headers

body

In express…

```
request.query = {x:123, foo: 'that'}
```

(from http://www.ntu.edu.sg/home/ehchua/programming/webprogramming/HTTP_Basics.html)

REQUEST BODY

A way to pass data from client to server.

verb route

headers

```
POST /docs/index?x=123&foo=that HTTP/1.1
Host: www.test101.com
Accept: image/gif, image/jpeg, */*
Ac
Ac
Us

bookId=12345&author=Nimit
```

body

In express…

```
request.body = {bookId:12345, author: 'Nimit'}
```

(from http://www.ntu.edu.sg/home/ehchua/programming/webprogramming/HTTP_Basics.html)

REQUEST PARAMS

A variable portion of the URI.

ROUTER

A “layer” of route handlers (middlewares).

GOTCHAS

- `app.get` v `app.get`
- routes are not file paths
- order matters
- `req.params` v `req.query` v `req.body`
- `app.use` v `app.all`