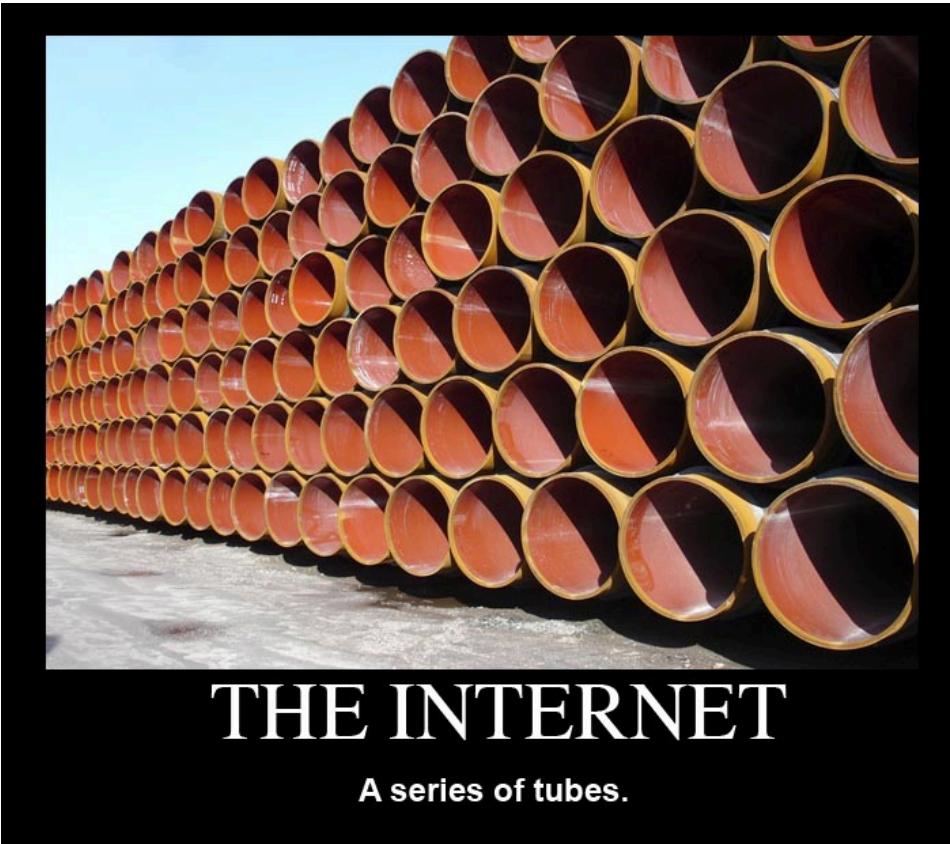


Networking

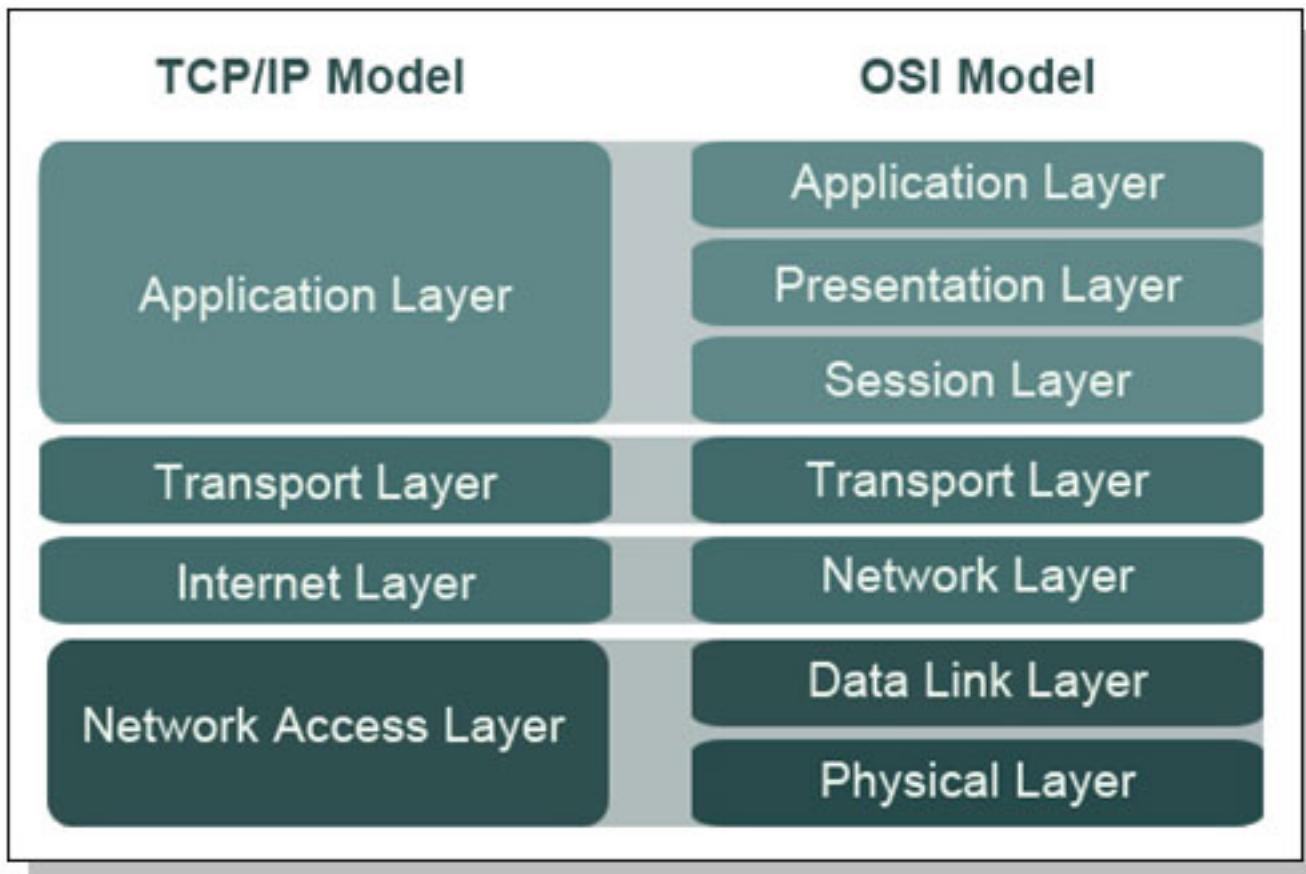
The Internet

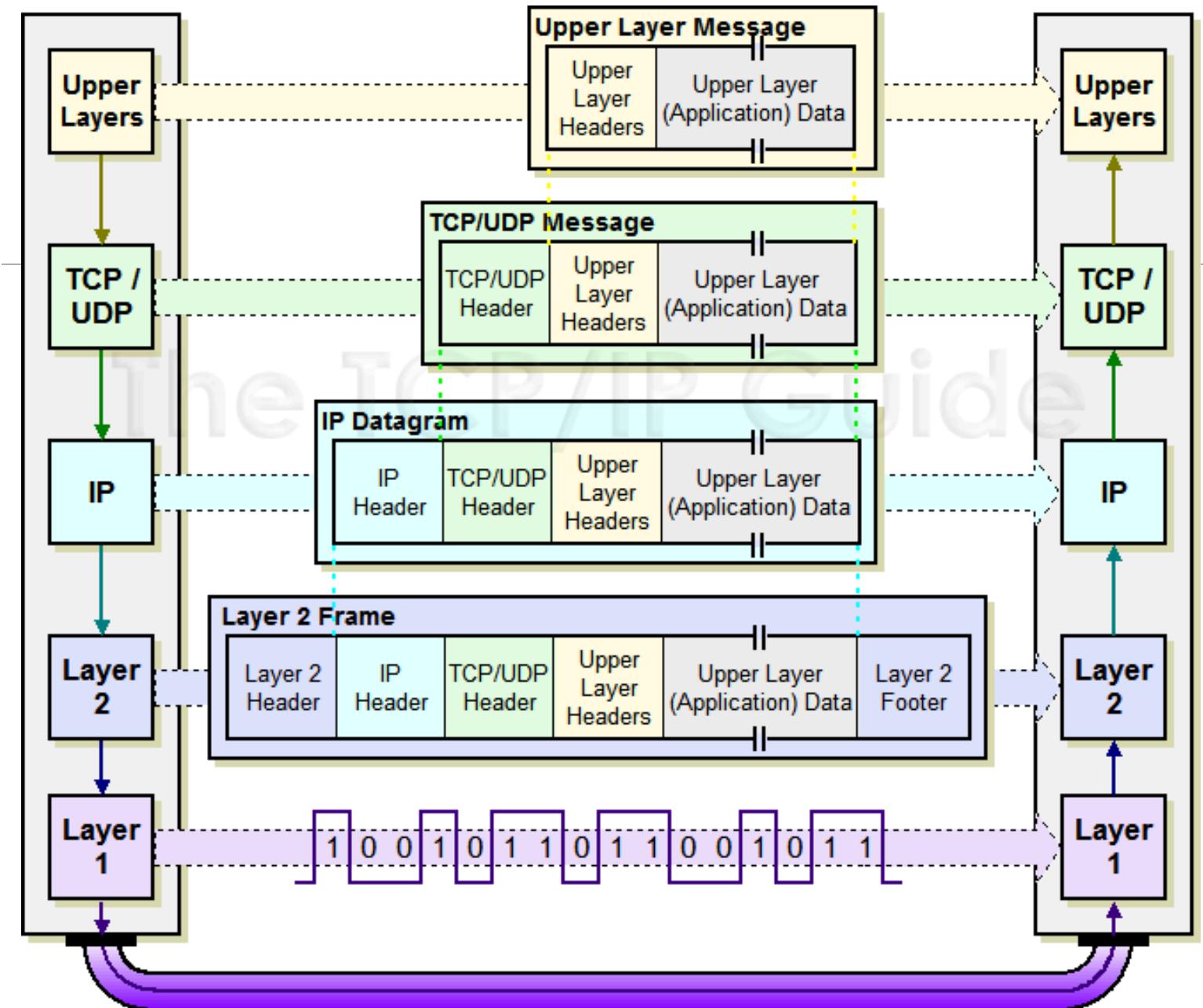


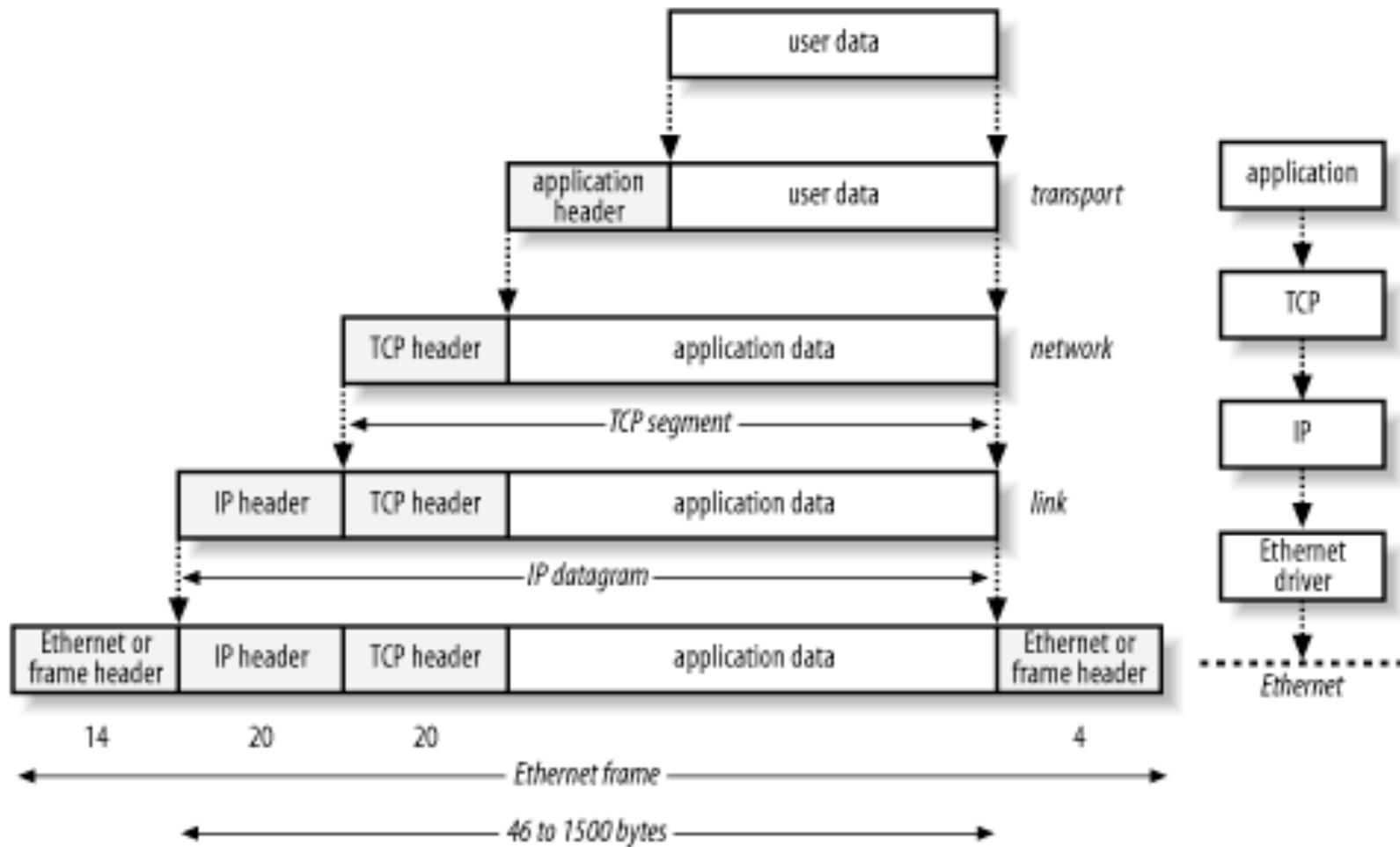
First, a video

https://www.youtube.com/watch?v=7_LPdttKXPc

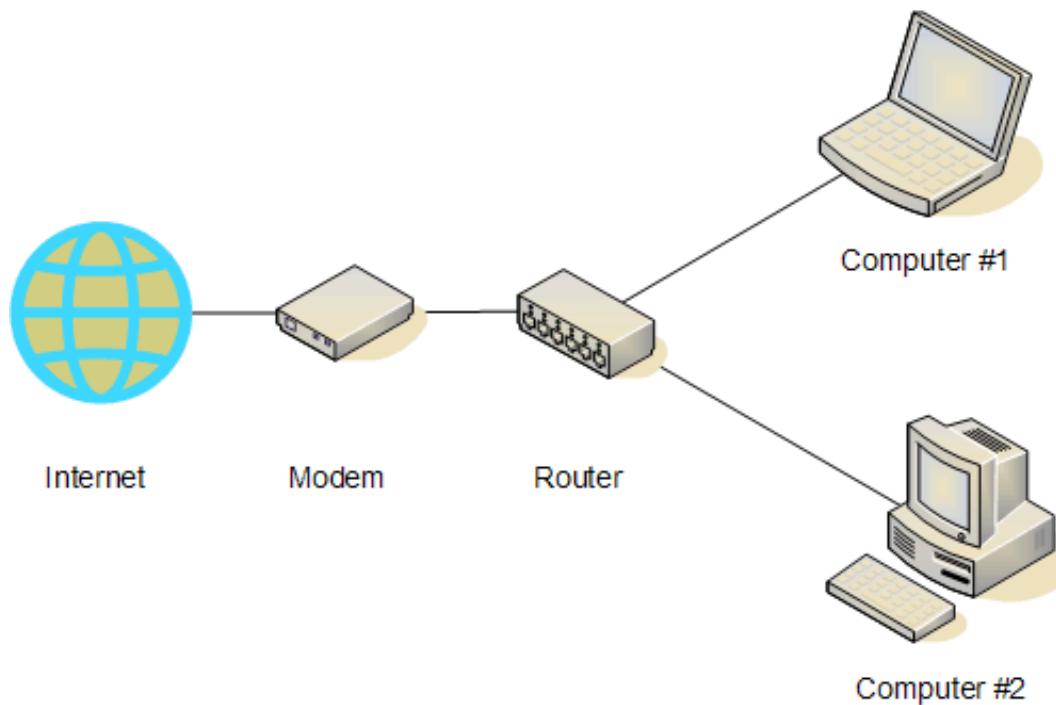
TCP/IP & OSI

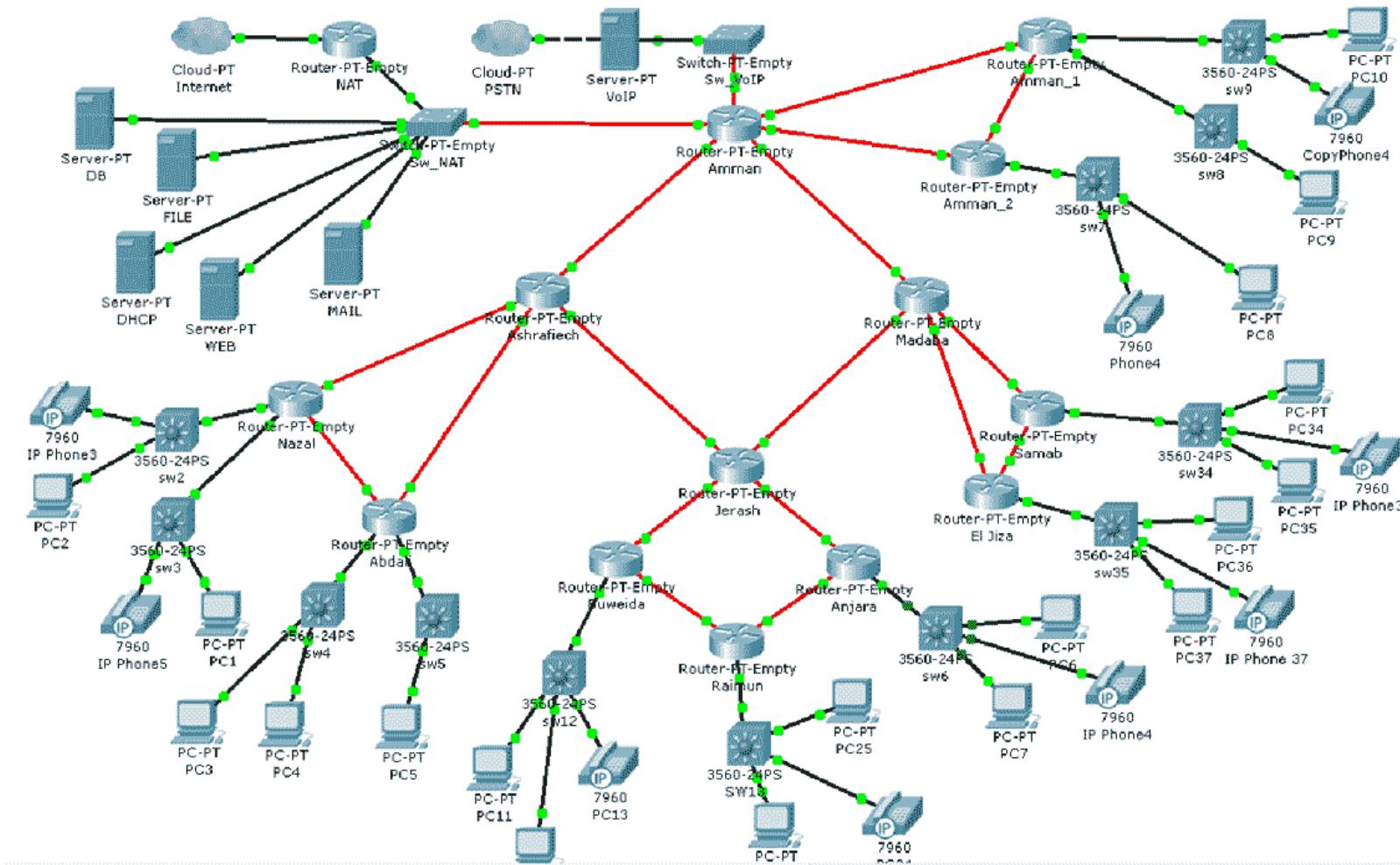






Routing





Hubs and Routers

https://www.youtube.com/watch?v=Ofjsh_E4HFY

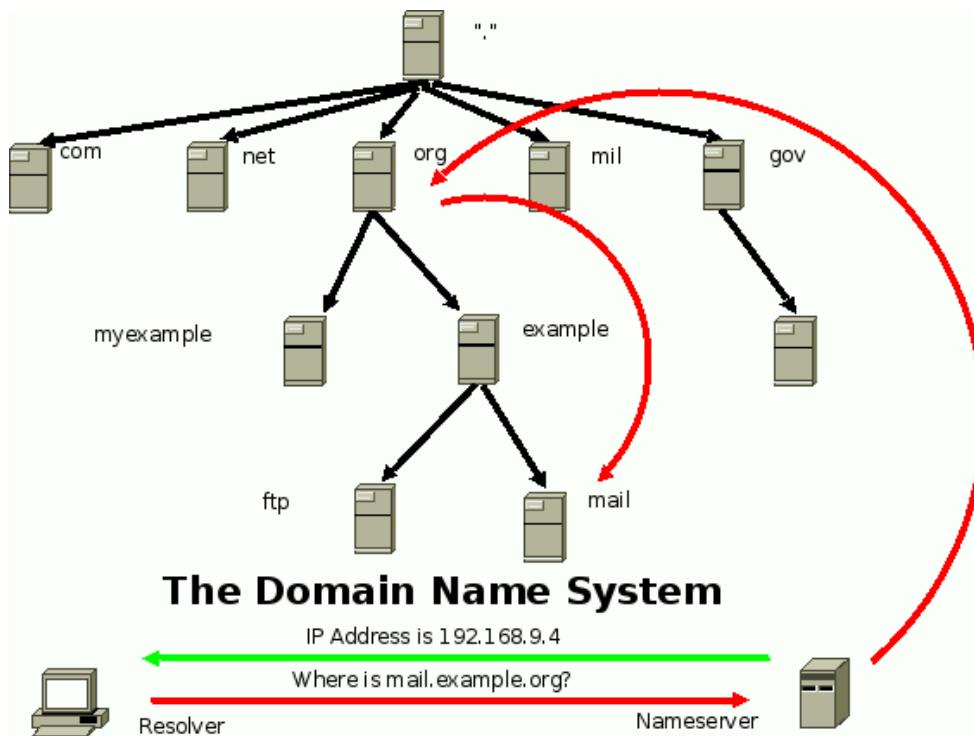
NAT

<https://www.youtube.com/watch?v=QBqPzHEDzvo>

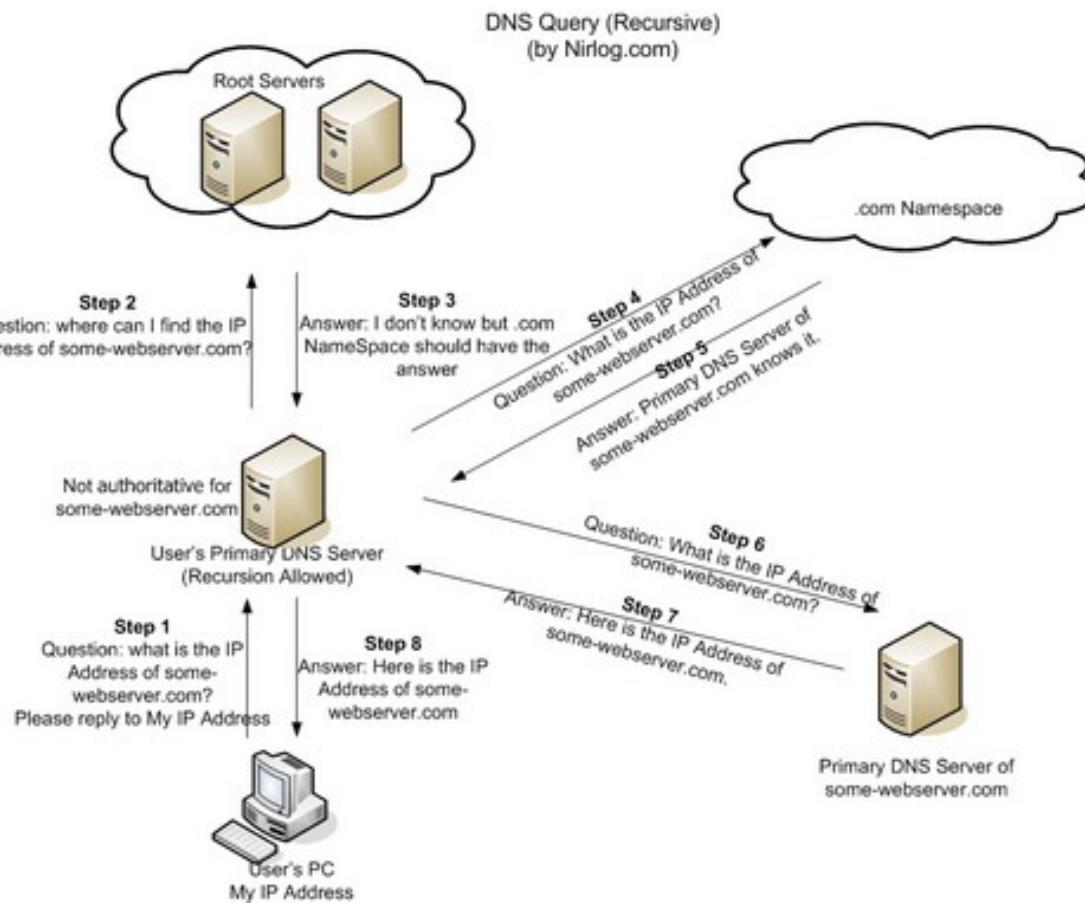
TCP vs UDP

<https://www.youtube.com/watch?v=Vdc8TCESlg8>

DNS

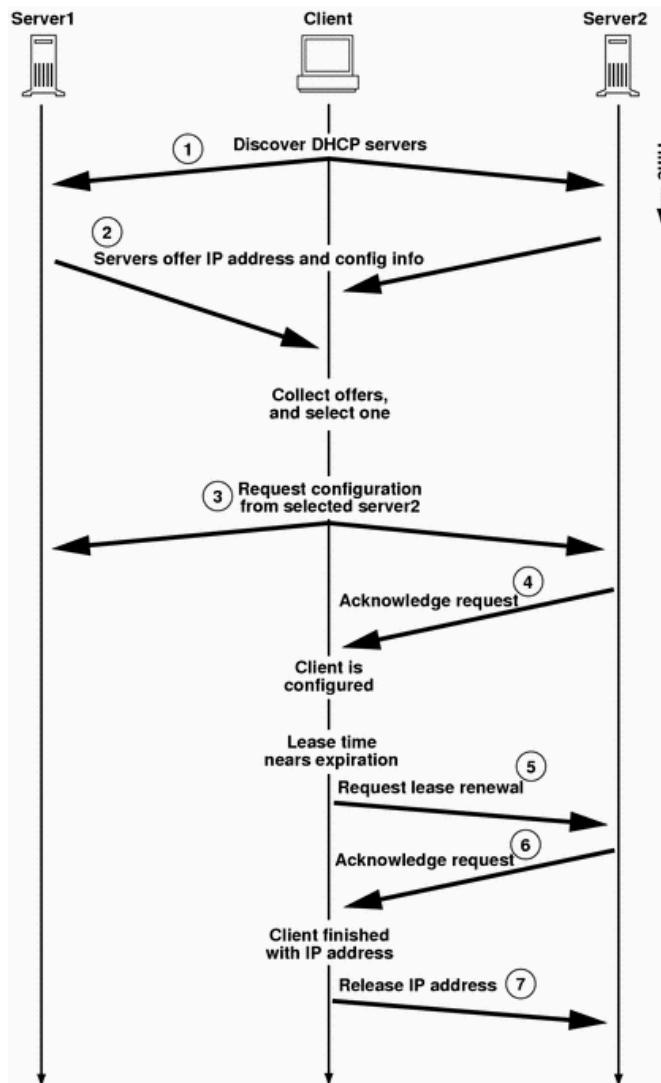


DNS



DNS

<https://www.youtube.com/watch?v=GIZC4Jwf3xQ>

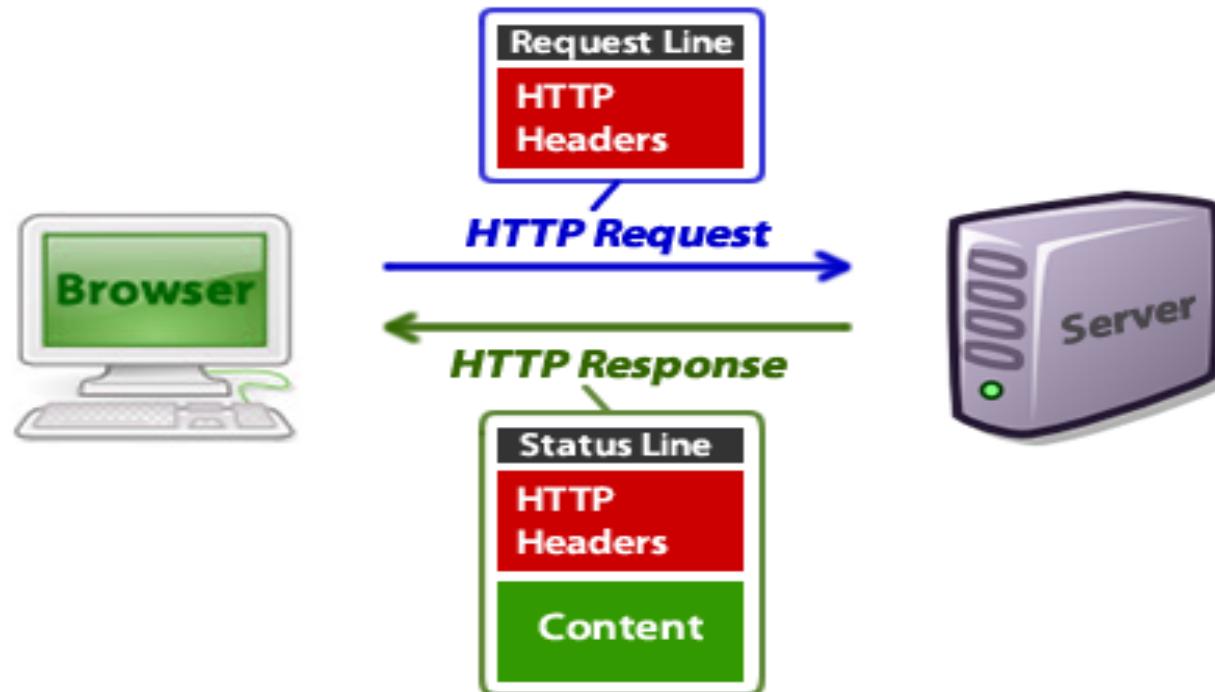


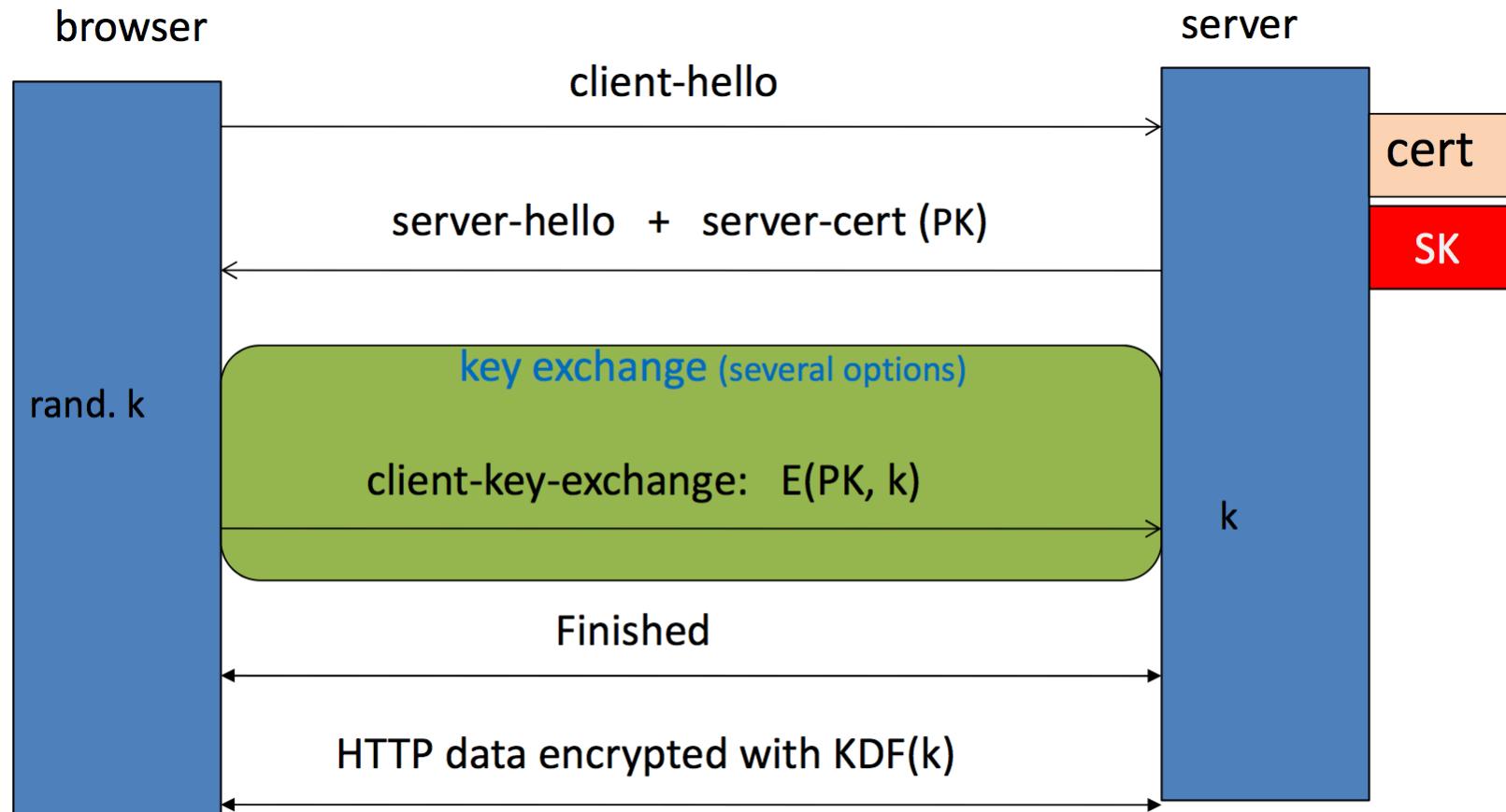
DHCP

<https://www.youtube.com/watch?v=RUZohsAxPxQ>

Traceroute and Port-scan

Demo





Most common: server authentication only

Certificates

Important Fields:

Serial Number 5814744488373890497 ←

Version 3

Signature Algorithm SHA-1 with RSA Encryption (1.2.840.113549.1.1.5)

Parameters none

Not Valid Before Wednesday, July 31, 2013 4:59:24 AM Pacific Daylight Time

Not Valid After Thursday, July 31, 2014 4:59:24 AM Pacific Daylight Time

Public Key Info

Algorithm Elliptic Curve Public Key (1.2.840.10045.2.1)

Parameters Elliptic Curve secp256r1 (1.2.840.10045.3.1.7)

Public Key 65 bytes : 04 71 6C DD E0 0A C9 76 ... ←

Key Size 256 bits

Key Usage Encrypt, Verify, Derive

Signature 256 bytes : 8A 38 FE D6 F5 E7 F6 59 ... ←

Equifax Secure Certificate Authority

↳ GeoTrust Global CA

↳ Google Internet Authority G2

↳ mail.google.com



mail.google.com

Issued by: Google Internet Authority G2

Expires: Thursday, July 31, 2014 4:59:24 AM Pacific Daylight Time

✓ This certificate is valid

Details

Subject Name

Country US

State/Province California

Locality Mountain View

Organization Google Inc

Common Name mail.google.com ←

Issuer Name

Country US

Organization Google Inc

Common Name Google Internet Authority G2



URLs

`http://www.google.com/search?q=facebook#result`

protocol domain path parameters fragment



SEO Cheat Sheet: Anatomy of A URL

1



SEO-FRIENDLY URL

- 1 Protocol
- 2 Subdomain
- 3 Domain
- 4 Top-Level Domain
- 5 Folders / Paths
- 6 Page
- 7 Named Anchor

Keyword Priority¹

Observed Google priority of keyword placement:

- (1) Domain
- (2) Subdomain
- (3) Folder
- (4) Path/Page

SEO Tips for URLs

- Use **subdomains** carefully. They may be treated as separate entities, splitting domain authority.
- Separate **path & page** keywords with hyphens ("").
- **Anchors** may help engines understand page structure.
- Keyword effectiveness in URLs decreases as URL length and keyword position increases.¹

¹ SEOmoz correlational data (2009)

2



OLD DYNAMIC URL

- 1 Protocol
- 2 Subdomain
- 3 Domain
- 4 Top-Level Domain
- 5 Page / File Name
- 6 File Extension
- 7 CGI Parameters

Popular TLDs²

- .com - commercial
- .net - infrastructure
- .org - non-profit
- .edu - schools
- .info - informational
- .biz - small business
- .name - personal sites

Popular ccTLDs*

- .cn - China
- .de - Germany
- .uk - United Kingdom
- .nl - Netherlands
- .eu - European Union
- .ru - Russian Federation
- .ar - Argentina

Popular Extensions

- .htm - Static HTML
- .html - Static HTML
- .php - PHP code
- .asp - ASP code
- .aspx - ASP.NET
- .cfm - ColdFusion
- .jsp - Java Code

² Verisign domain report (2009)

* ccTLD = Country Code TLD

①	②	③	④	⑤	⑥	⑦	⑧
scheme://	login.password@	address:	port	/path/to/resource	?query_string	#fragment	

① Scheme/protocol name

② Indicator of a hierarchical URL (constant)

③ Credentials to access the resource (optional)

④ Server to retrieve the data from

⑤ Port number to connect to (optional)

⑥ Hierarchical Unix path to a resource

⑦ "Query string" parameters (optional)

⑧ "Fragment identifier" (optional)

"Authority"

URL Schemes

Tons of supported schemes

- <https://www.iana.org/assignments/uri-schemes/uri-schemes.xhtml>

Supporting these can lead so some weirdness

Common ones you may see:

- file://
- ftp://
- http://
- https://
- mailto://
- sms://

Things can get weird

`http://127.0.0.1/`

- This is a canonical representation of an IPv4 address.

`http://0x7f.1/`

- This is a representation of the same address that uses a hexadecimal number to represent the first octet and concatenates all the remaining octets into a single decimal value.

`http://017700000001/`

- The same address is denoted using a 0-prefixed octal value, with all octets concatenated into a single 32-bit integer.

`http://example.com&gibberish=1234@167772161/`

- Where do you think this goes?

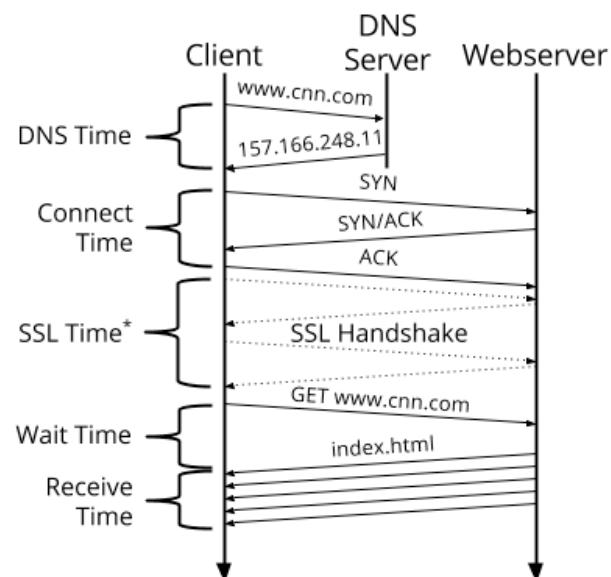
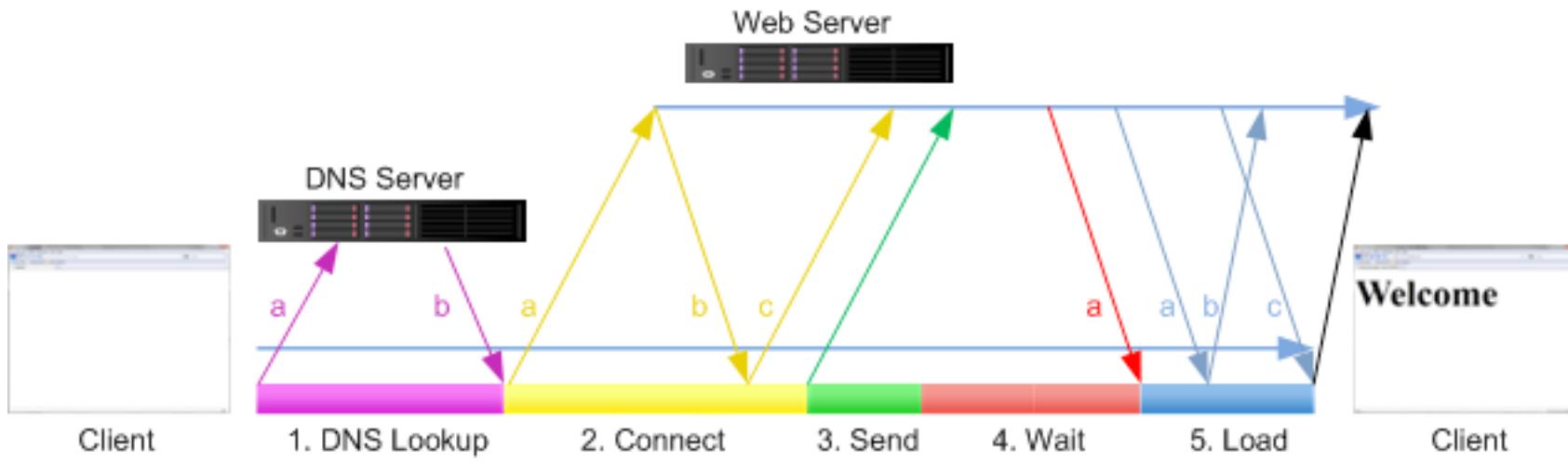
`http://example.com\@coredump.cx/`

- How about this one?

`http://example.com;.coredump.cx/`

- And this?

Source: Tangled Web by Michal Zalewski (pages 26 and 30)



HTTP Requests

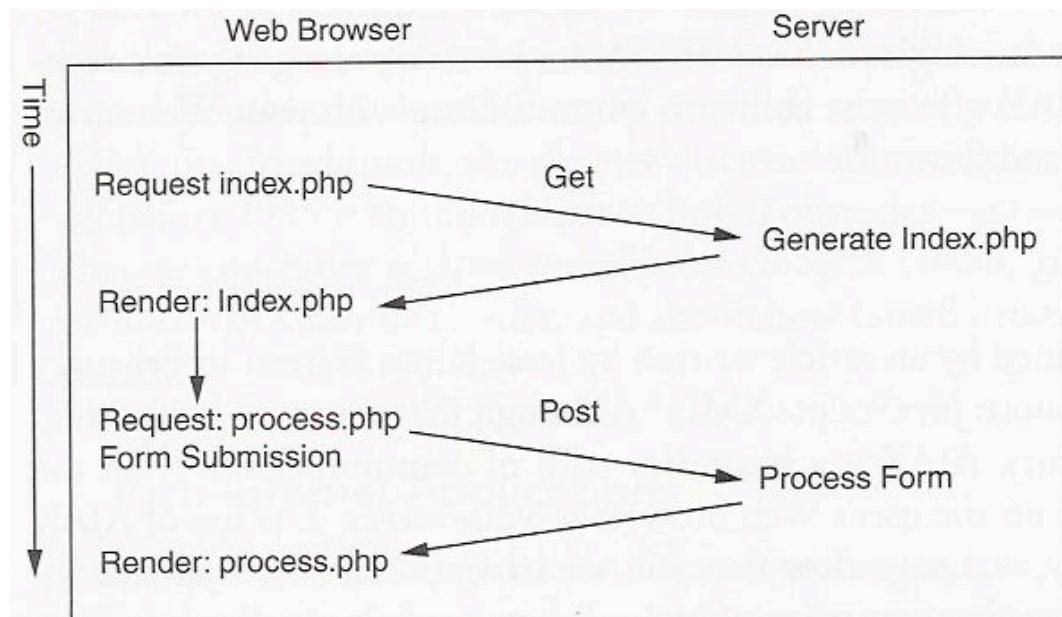


FIGURE 1-1
Web application request flow

HTTP Request/Response

```
POST /fuzzy_bunnies/bunny_dispenser.php HTTP/1.1
Host: www.fuzzybunnies.com
User-Agent: Bunny-Browser/1.7
Content-Type: text/plain
Content-Length: 17
Referer: http://www.fuzzybunnies.com/main.html
I REQUEST A BUNNY
```

```
HTTP/1.1 200 OK
Server: Bunny-Server/0.9.2
Content-Type: text/plain
Connection: close
BUNNY WISH HAS BEEN GRANTED
```

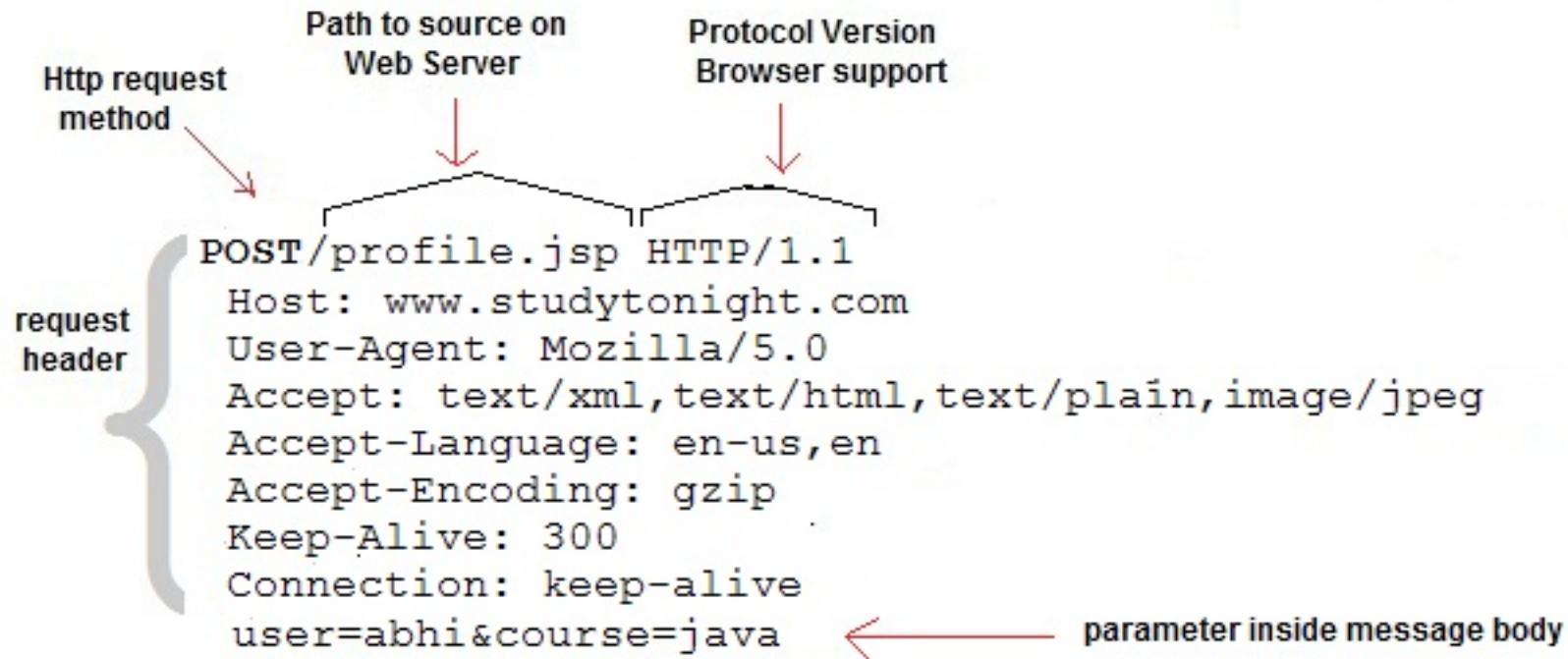
GET Request

request header {

Http request method Path to source on Web Server Parameters Protocol Version
GET /profile.jsp?user=abhi&course=java HTTP/1.1

Host: www.studytonight.com
User-Agent: Mozilla/5.0
Accept: text/xml, text/html, text/plain, image/jpeg
Accept-Language: en-us, en
Accept-Encoding: gzip
Keep-Alive: 300
Connection: keep-alive

POST Request



HTTP Methods

Method	Description
GET	Request to read a Web page
HEAD	Request to read a Web page's header
PUT	Request to store a Web page
POST	Append to a named resource (e.g., a Web page)
DELETE	Remove the Web page
TRACE	Echo the incoming request
CONNECT	Reserved for future use
OPTIONS	Query certain options

HTTP Headers

Define the operating parameters of the HTTP transaction

There are tons “official” ones:

- https://en.wikipedia.org/wiki/List_of_HTTP_header_fields

Colon separated

Ultimately they can be whatever you want

No limit on size of name or value

Cookies

A small bit of data sent by a web server to a browser that is stored by the browser and sent back with subsequent requests

Designed to provide a storage mechanism for stateful information and record a user's browsing activity

Structure

- Name
- Value
- 0+ attributes

Cookie Attributes

Domain and Path

- Defines scope of cookie

Expires and Max-age

- Defines when the browser should delete the cookie

Secure

- Directs the browser on whether or not to send the cookie over encrypted connection only or not

HttpOnly

- Directs the browser on JavaScripts access to the cookie

Cookies

GET /index.html HTTP/1.1

Host: www.example.org

...

HTTP/1.0 200 OK

Content-type: text/html

Set-Cookie: theme=light

Set-Cookie: sessionToken=abc123;

Expires=Wed, 09 Jun 2021 10:18:14 GMT

...

GET /spec.html HTTP/1.1

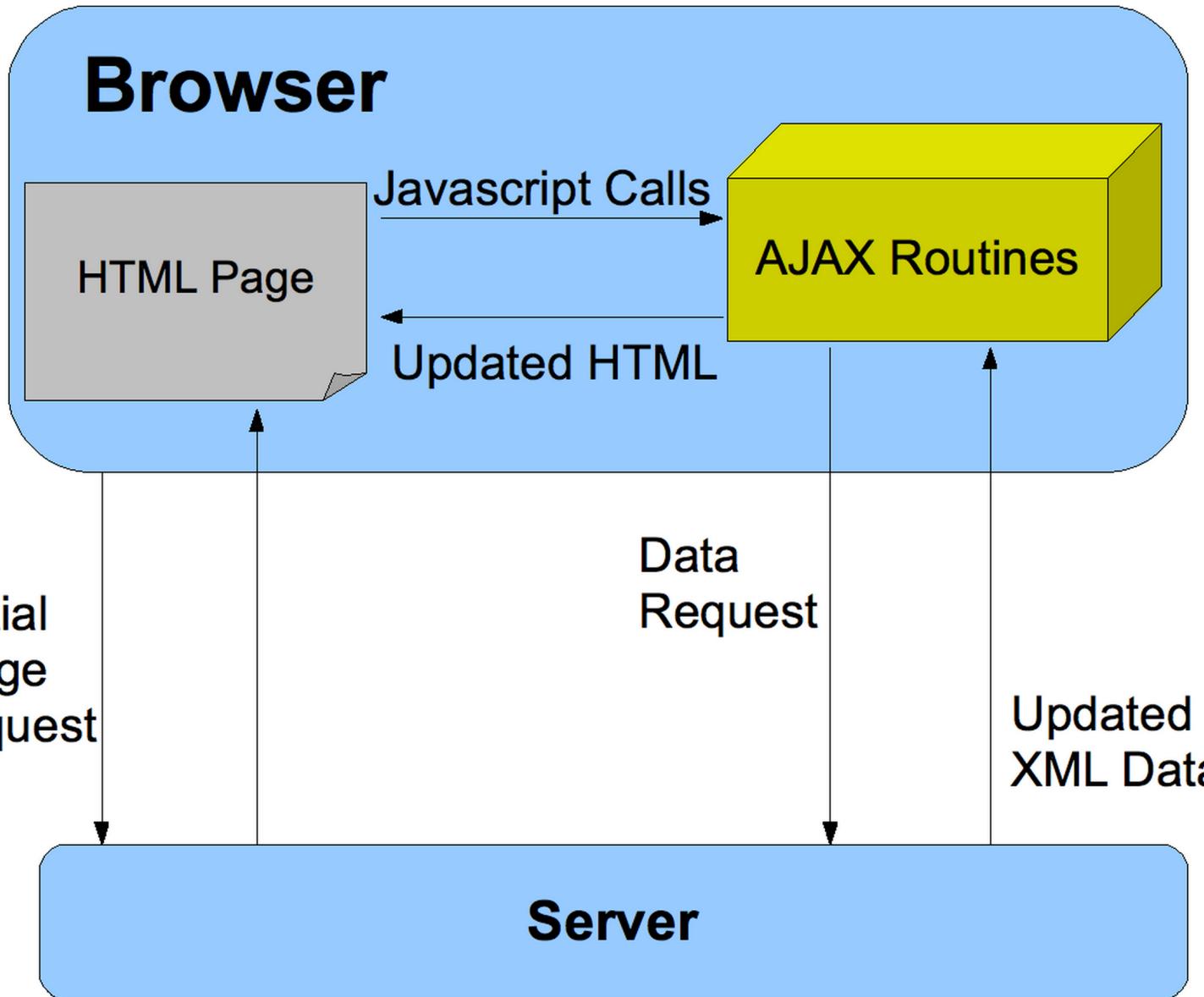
Host: www.example.org

Cookie: theme=light; sessionToken=abc123

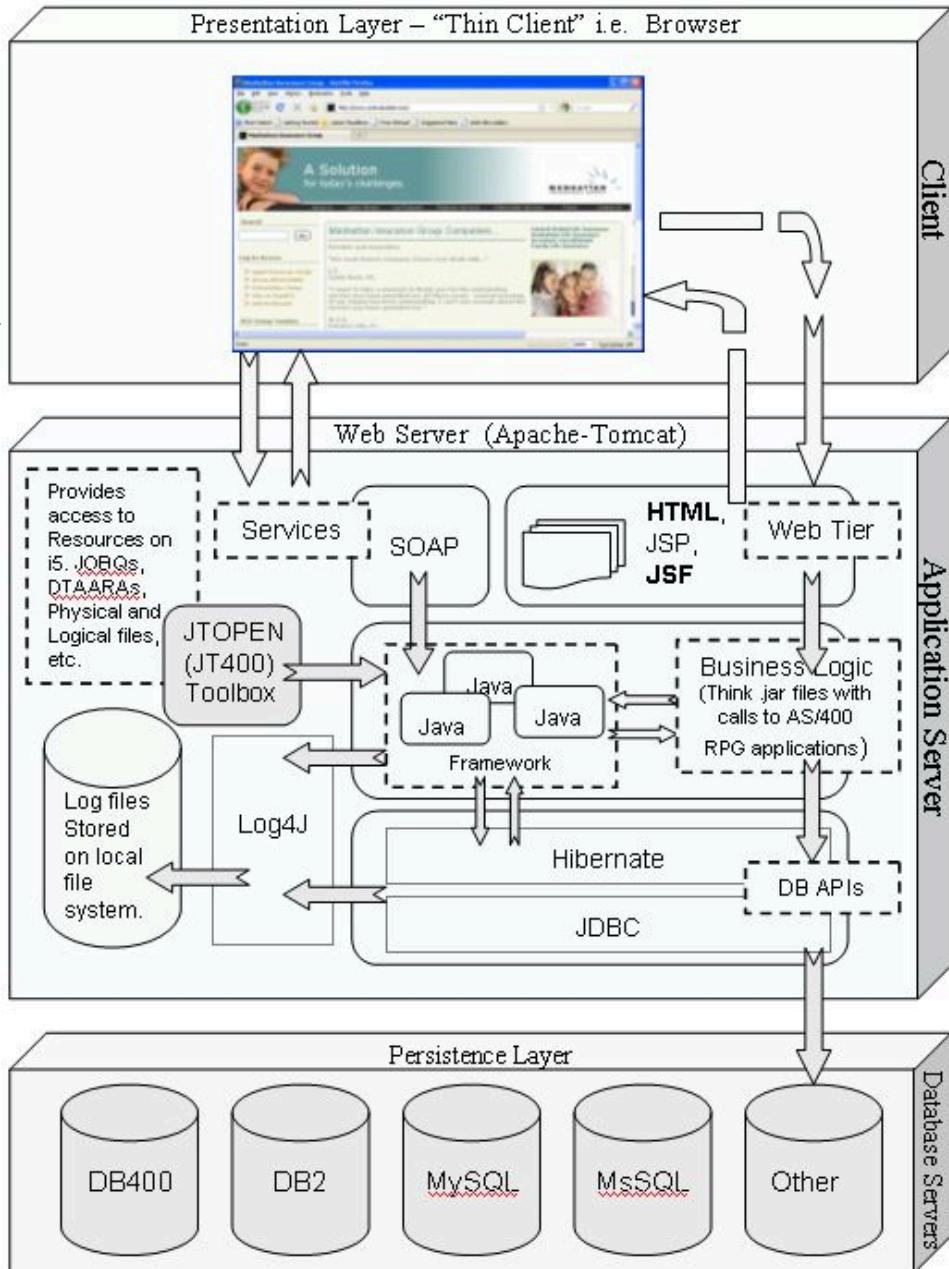
...

Anatomy of a Web Application

- Frontend
 - Content delivered to client
 - HTML, JavaScript, CSS
 - Ajax
- Middle layer
 - PHP, Python, RoR, Node, ASP.NET
 - Pages are dynamically generated
 - Requests parameters are parsed
- Database
 - MySQL, MSSQL, PostgreSQL, Sqlite
 - Direct queries or through ORM



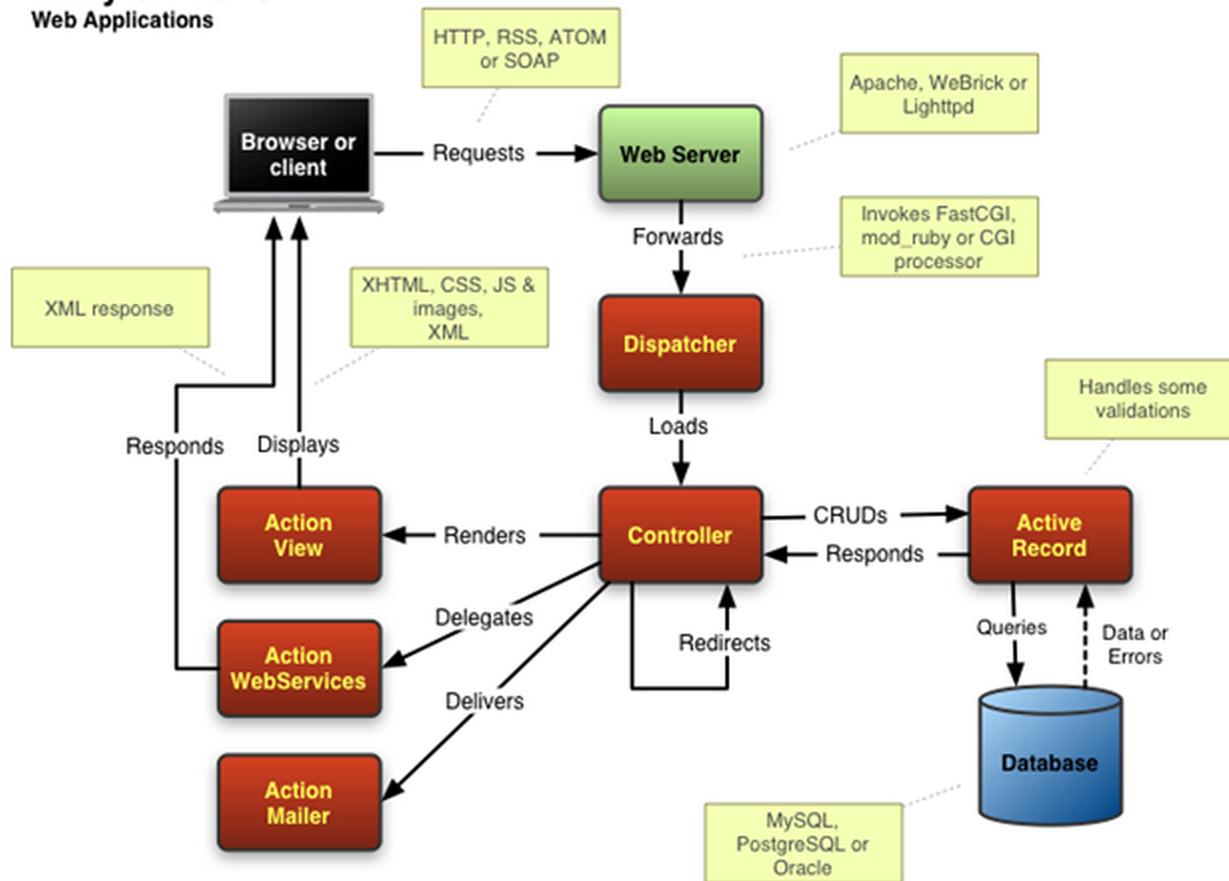
- Way more happening clientside
- Lots of Ajax
- Lots of moving parts
- Interfacing with host system more
- Increase reliance on 3rd party code



MVC Frameworks

Ruby on Rails

Web Applications



See in Action

Browsing by hand

Burp Suite

Demo