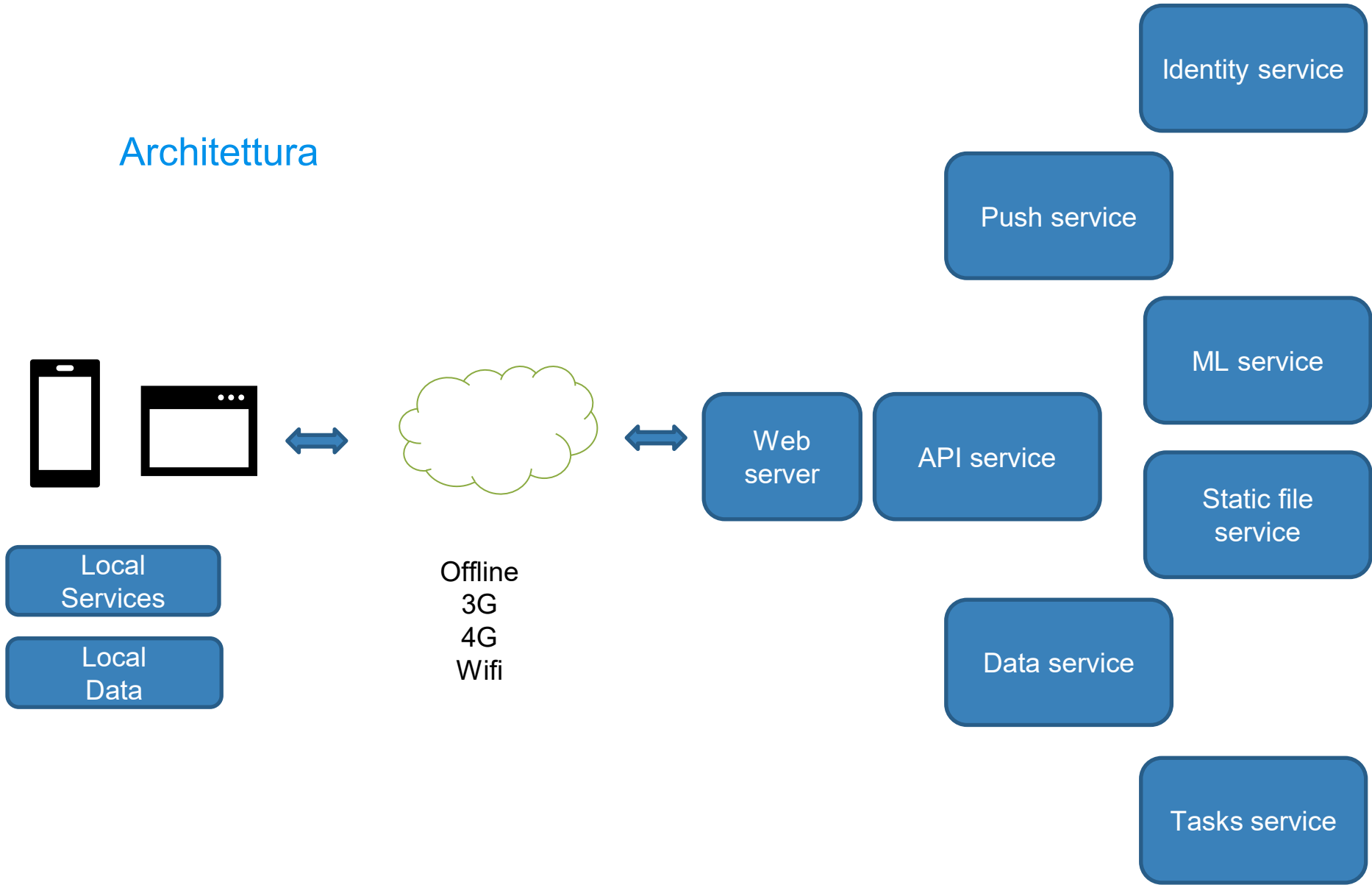


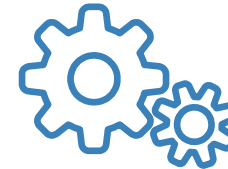
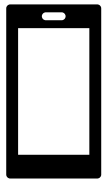
A decorative network diagram in the top-left corner, consisting of various sized grey circles (nodes) connected by thin grey lines (edges). Some nodes are solid grey, while others are hollow with a grey outline. The connections form a complex, branching structure.

2. Architettura

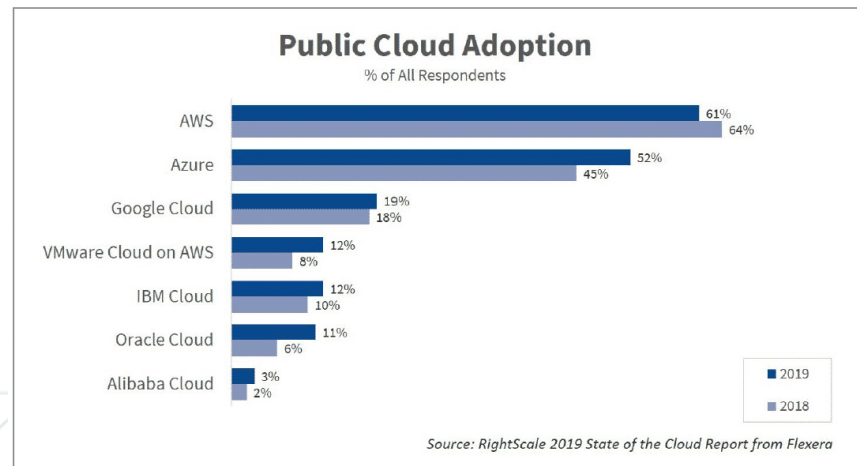
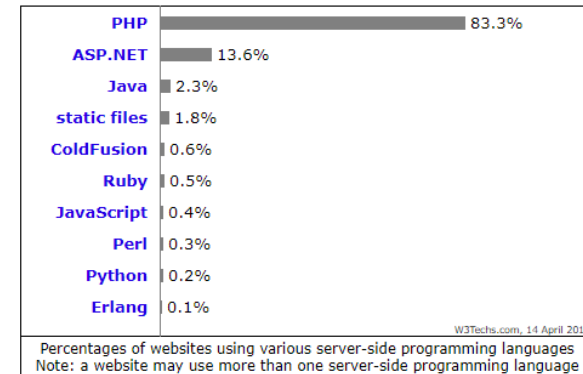
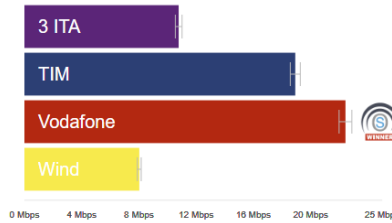
Architettura



Diffusione tecnologie



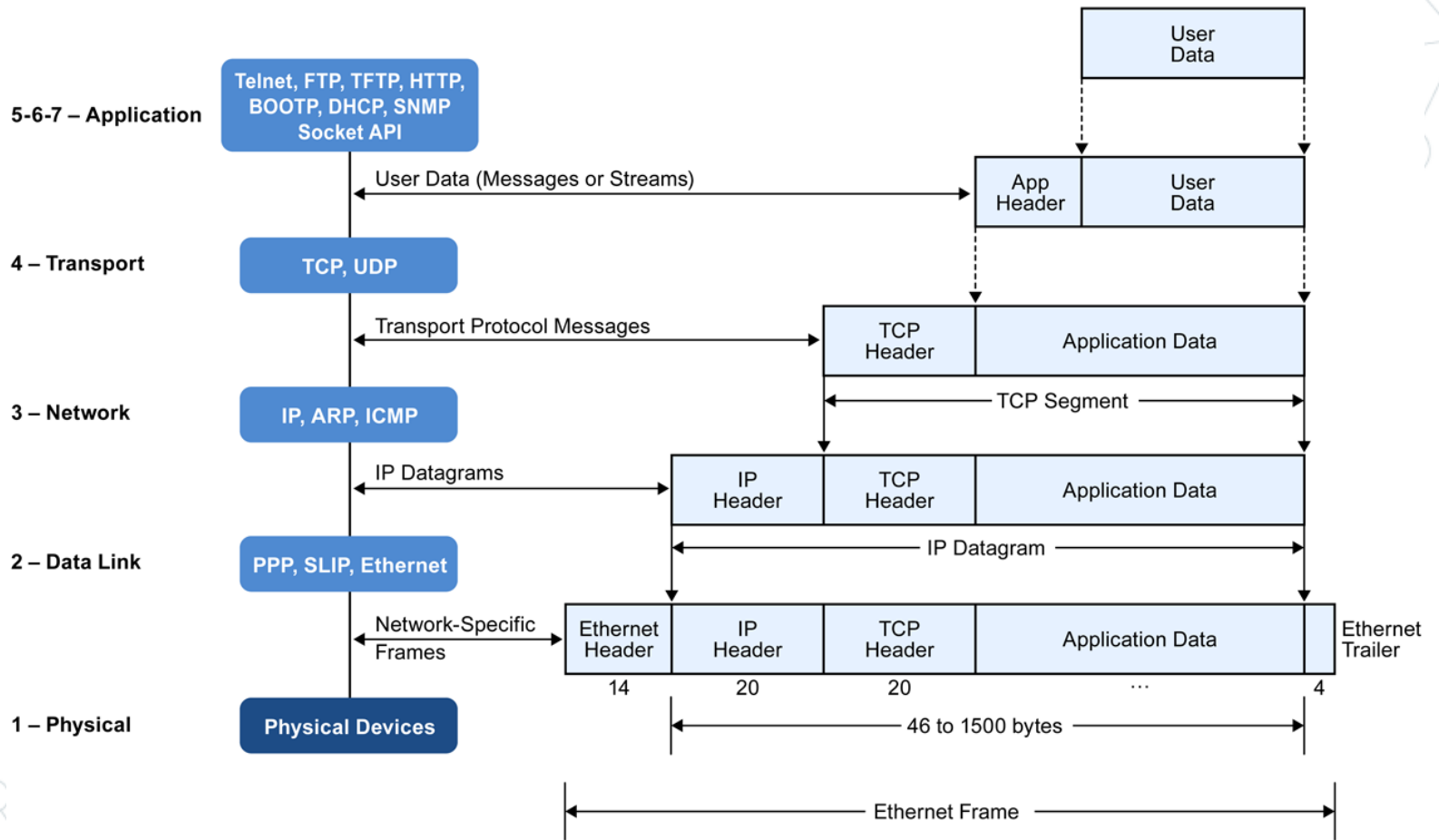
Download Speed: Overall OpenSignal



Protocolli

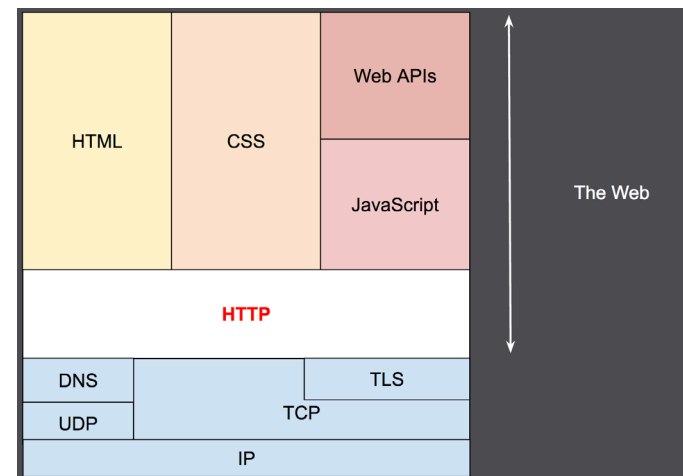


Modello ISO/OSI



HyperText Transfer Protocol (HTTP - rfc2616)

- Protocollo a livello applicativo
- A livello di trasporto si basa sul TCP (o TLS)
- Request/Response (Client / Server)
- Url composta da http://host:port/path/file
- Metodo: GET/POST/PUT/DELETE/OPTIONS..
- Stato nella risposta: 200/300/400/404/500
- Header di request e di response
- Gestione cookie
- Diversi content-type (html/text/image/json/xml)



HyperText Transfer Protocol

(1) User issues URL from a browser
http://host:port/path/file



(5) Browser formats the response and displays

Client (Browser)

(2) Browser sends a request message

```
GET URL HTTP/1.1  
Host: host:port  
.....  
.....
```

(4) Server returns a response message

```
HTTP/1.1 200 OK  
.....  
.....
```

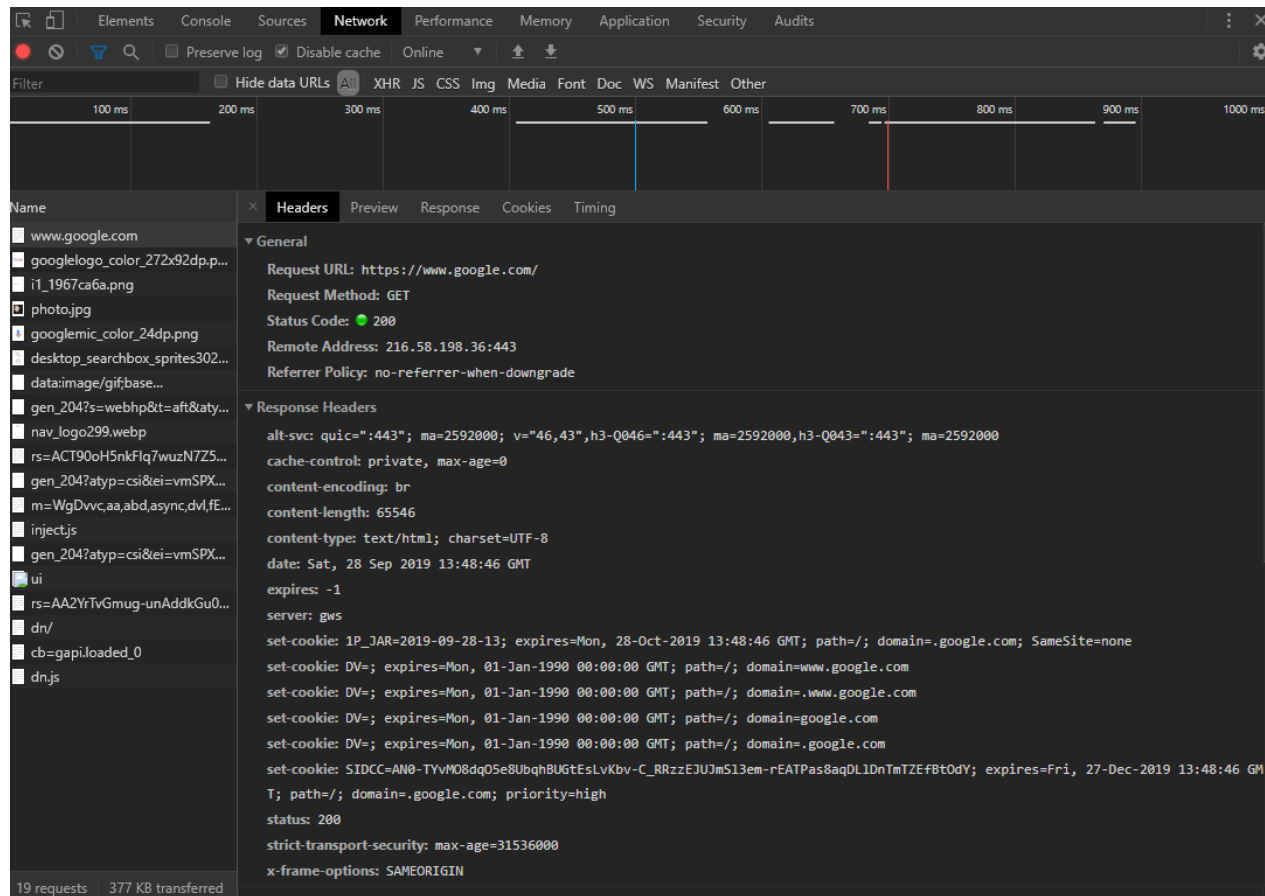
HTTP (Over TCP/IP)

(3) Server maps the *URL* to a file or program under the document directory.

Server (@ *host:port*)

HyperText Transfer Protocol

Studiare:
Headers – Metodi - Cookie – Status Code - Timing



The screenshot shows the Chrome DevTools Network tab with the 'Headers' sub-tab selected. The request is a GET to 'https://www.google.com/' with a status code of 200. The response headers include: alt-svc, cache-control, content-encoding, content-length, content-type, date, expires, server, set-cookie (multiple), status, strict-transport-security, and x-frame-options.

Category	Header/Field	Value
General	Request URL	https://www.google.com/
General	Request Method	GET
General	Status Code	200
General	Remote Address	216.58.198.36:443
General	Referrer Policy	no-referrer-when-downgrade
Response Headers	alt-svc	quic=":443"; ma=2592000; v="46,43",h3-Q046=":443"; ma=2592000,h3-Q043=":443"; ma=2592000
Response Headers	cache-control	private, max-age=0
Response Headers	content-encoding	br
Response Headers	content-length	65546
Response Headers	content-type	text/html; charset=UTF-8
Response Headers	date	Sat, 28 Sep 2019 13:48:46 GMT
Response Headers	expires	-1
Response Headers	server	gws
Response Headers	set-cookie	1P_JAR=2019-09-28-13; expires=Mon, 28-Oct-2019 13:48:46 GMT; path=/; domain=.google.com; SameSite=none
Response Headers	set-cookie	DV=; expires=Mon, 01-Jan-1990 00:00:00 GMT; path=/; domain=www.google.com
Response Headers	set-cookie	DV=; expires=Mon, 01-Jan-1990 00:00:00 GMT; path=/; domain=.www.google.com
Response Headers	set-cookie	DV=; expires=Mon, 01-Jan-1990 00:00:00 GMT; path=/; domain=google.com
Response Headers	set-cookie	DV=; expires=Mon, 01-Jan-1990 00:00:00 GMT; path=/; domain=.google.com
Response Headers	set-cookie	SIDCC=AN0-TYVM08dq05e8UubqhBUGtEslvKbv-C_RRzzEJU7mS13em-rEATPas8aqDL1DnTmTZEfBt0dY; expires=Fri, 27-Dec-2019 13:48:46 GMT; path=/; domain=.google.com; priority=high
Response Headers	status	200
Response Headers	strict-transport-security	max-age=31536000
Response Headers	x-frame-options	SAMEORIGIN

HyperText Transfer Protocol

The screenshot shows the 'Headers' tab of a web browser's developer tools. The request is a GET to www.google.it. The response status is 200 OK, with a time of 69ms and a size of 5.57 KB. The response headers are listed in a table below.

KEY	VALUE	DESCRIPTION
Key	Value	Description
Date	Sat, 28 Sep 2019 14:00:55 GMT	
Expires	-1	
Cache-Control	private, max-age=0	
Content-Type	text/html; charset=ISO-8859-1	
P3P	CP="This is not a P3P policy! See g.co/p3phelp for more info."	
Content-Encoding	gzip	
Server	gws	
Content-Length	4996	
X-XSS-Protection	0	
X-Frame-Options	SAMEORIGIN	
Set-Cookie	1P_JAR=2019-09-28-14; expires=Mon, 28-Oct-2019 14:00:55 GMT; path=/; domain=.google.it; SameSite=none	
Set-Cookie	NID=188=bYVhzxIbugZ36jBJEs90gZwulQ8oVHVIVPWDzr4d-JQkMWk-hFF75qXqnZWQjmq-mLeIKe3NoLb9_UN4oNnZMCm6fWI3jbTmNbM7...	

HyperText Transfer Protocol

Limiti del protocollo:

- Una connessione per request/response
- Mancanza di gestione delle priorità su connessioni multiple
- Bassa compressione (no header compression)

Es: Apache Web Server Settings

Concurrent Connections

By default apache2 is configured to support 150 concurrent connections. This forces all parallel requests beyond that limit to wait. Especially if, for example, active sync clients maintain a permanent connection for push events to arrive.

This is an example configuration to provide 8000 concurrent connections.

```
<IfModule mpm_worker_module>
  ServerLimit          250
  StartServers         10
  MinSpareThreads      75
  MaxSpareThreads      250
  ThreadLimit          64
  ThreadsPerChild      32
  MaxRequestWorkers    8000
  MaxConnectionsPerChild 10000
</IfModule>
```

Browsers:

Version	Maximum connections
Internet Explorer® 7.0	2
Internet Explorer 8.0 and 9.0	6
Internet Explorer 10.0	8
Internet Explorer 11.0	13
Firefox®	6
Chrome™	6
Safari®	6
Opera®	6
iOS®	6
Android™	6

HTTP2 - rfc7540

Multiplexing

Upwork

HTTP 1.1

3 TCP CONNECTIONS



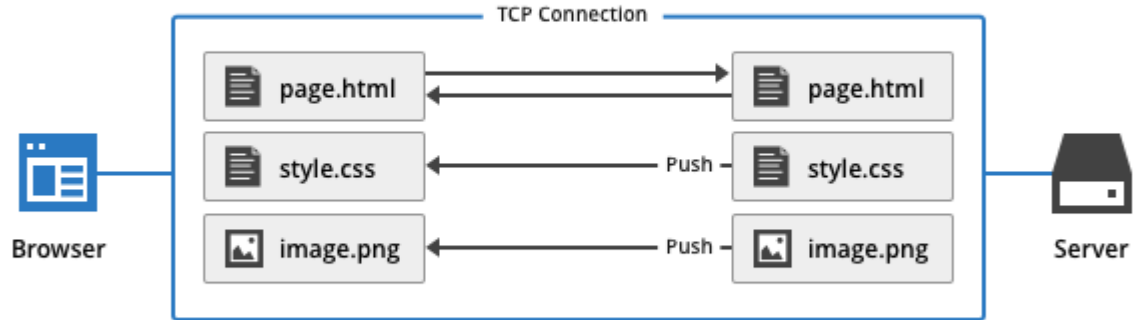
HTTP/2

1 TCP CONNECTION

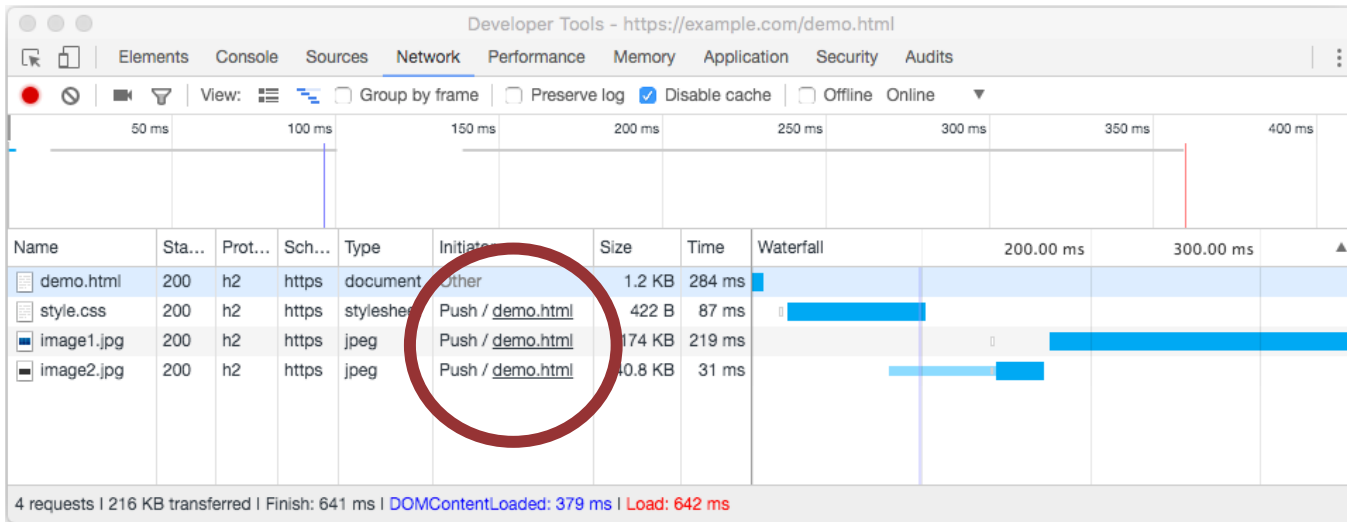


HTTP2

HTTP/2 (With Server Push)



Single TCP Connection, Single HTTP Request



WebSocket - rfc6455

Limiti del protocollo:

- Primo handshake su http
- Se tutto va bene il protocollo della connessione passa da http a websocket (usando la connessione Tcp precedentemente aperta dalla prima connessione http)
- A questo punto rimane solo il protocollo websocket
- Scambio messaggi bidirezionale

