



Response Time Optimization in Web Applications



(in less than 10 minutes)

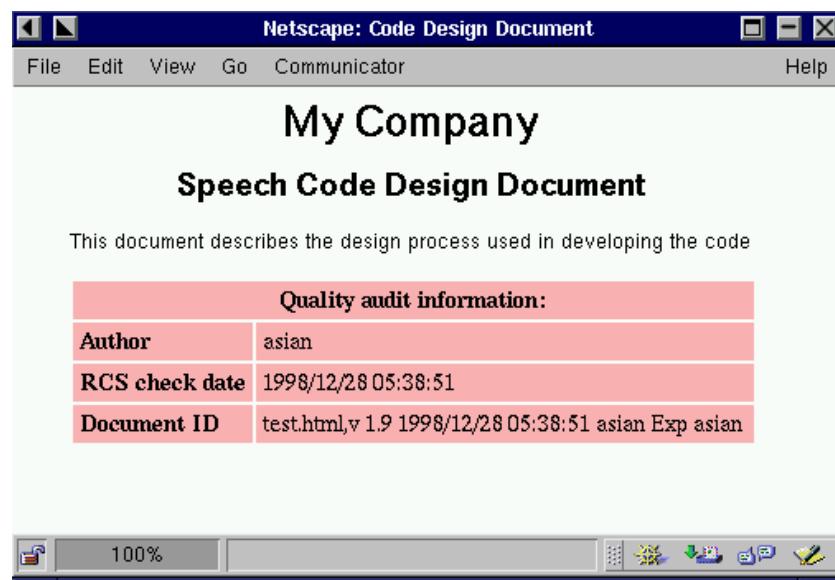
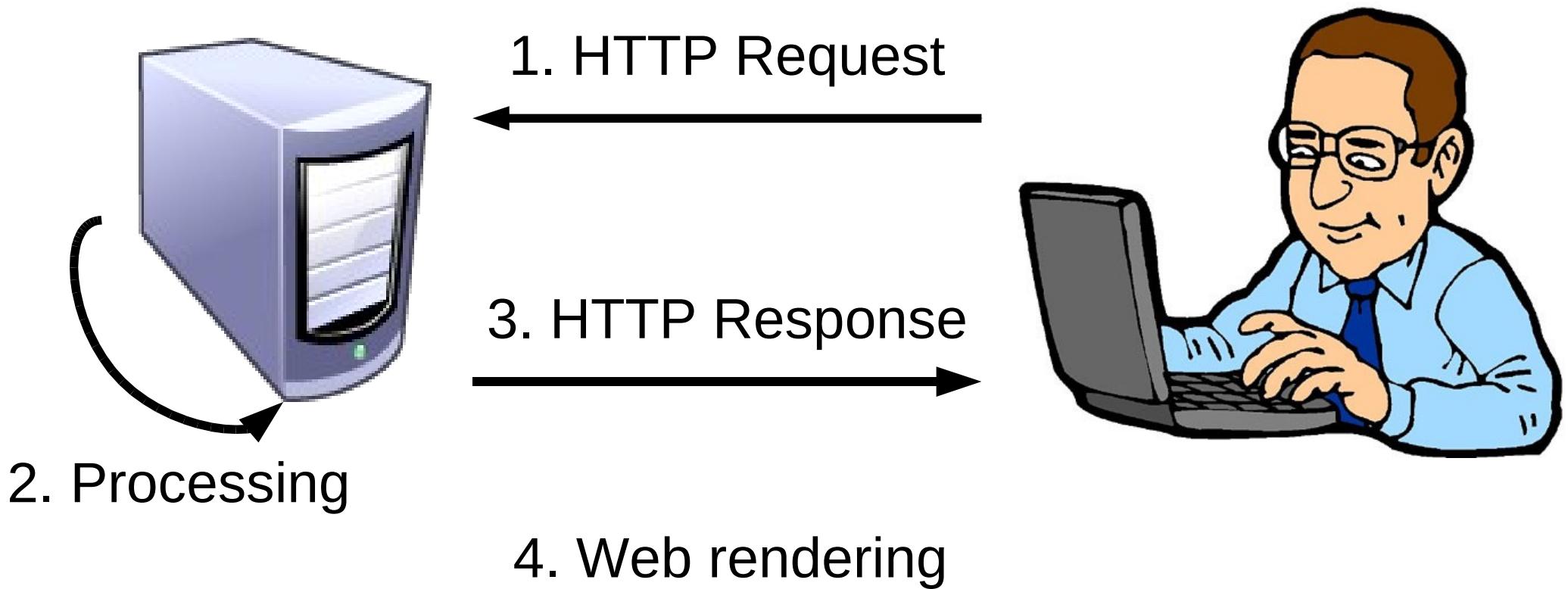
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What is response time?

Is the **time** a **system** takes to react to a **given input.***

* Extracted from Wikipedia



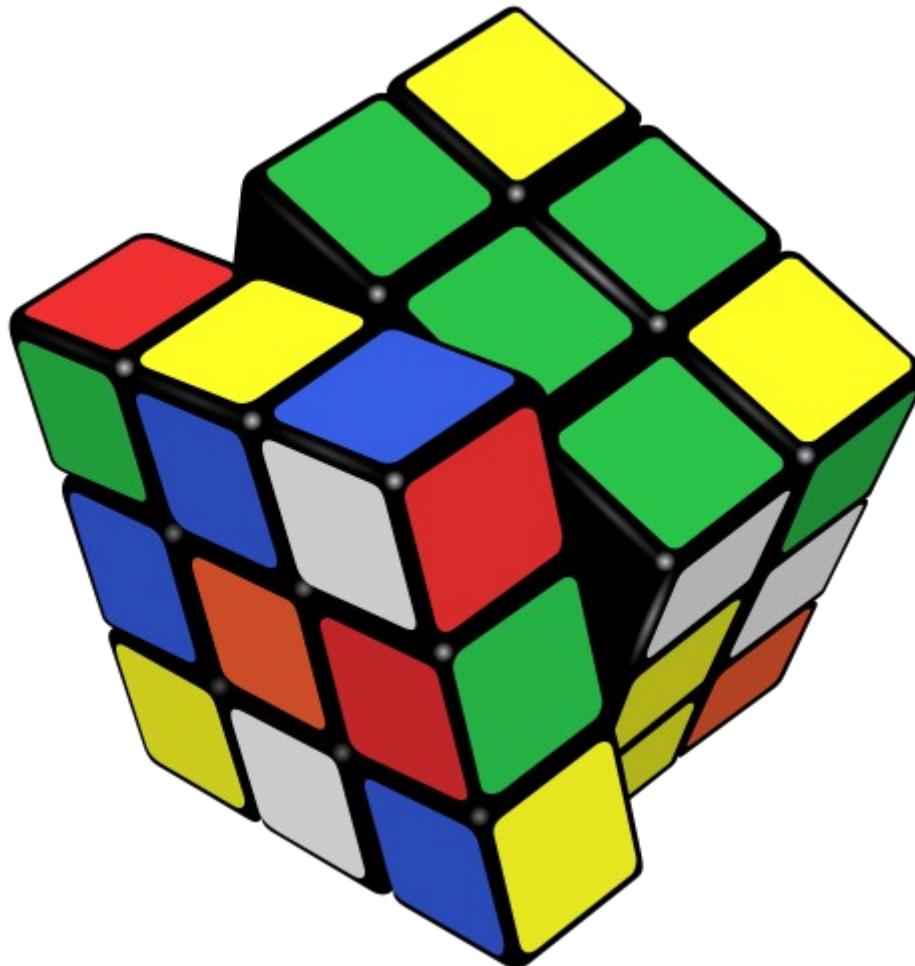
The Three Important Limits*

- 0.1 seconds
- 1.0 second
- 10.0 seconds



* [Miller 1968; Card et al. 1991]

The Problem



WEB



Browsers



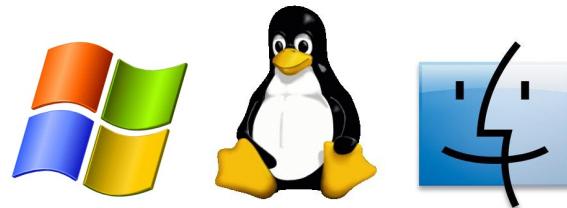
Net Protocols



Languages



Servers



OS



Hardware

Method 1: Reducing HTTP Requests





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 Millennium Technology Prize by the Finnish Technology Award Foundation.

The CERN Library
June 2004

RFC1945 - HTTP/1.0 - 1996

RFC2616 - HTTP/1.1 - 1999

HTTP Response

```
HTTP/1.1 200 OK
Date: Mon, 23 May 2008 22:38:34 GMT
Server: Apache/1.3.3.7 (Unix) (Red-Hat/Linux)
Last-Modified: Wed, 08 Jan 2003 23:11:55 GMT
Etag: "3f80f-1b6-3e1cb03b"
Accept-Ranges: bytes
Content-Length: 4096
Connection: close
Content-Type: text/html; charset=UTF-8
```

```
<html>
<header>
...
</header>
<body>
.....
<body>
</html>
```

Examples

[+]	GET index2.htm	200 OK	127.0.0.1	838 B		28ms		
[+]	GET css01.css	200 OK	127.0.0.1	6 KB		2ms		
[+]	GET css02.css	200 OK	127.0.0.1	6 KB		2ms		
[+]	GET script01.js	200 OK	127.0.0.1	2 KB		1ms		
[+]	GET script02.js	200 OK	127.0.0.1	3 KB		13ms		
[+]	GET script03.js	200 OK	127.0.0.1	3 KB		2ms		
[+]	GET script04.js	200 OK	127.0.0.1	3 KB		4ms		
7 requests				21 KB				94ms

~30%

[+]	GET index2.htm	200 OK	127.0.0.1	582 B		42ms		
[+]	GET css01.css	200 OK	127.0.0.1	12 KB		3ms		
[+]	GET script01.js	200 OK	127.0.0.1	8 KB		2ms		
3 requests				21 KB				65ms

Method 2:
Flush the buffer



Examples

Ex 1:

...

pause(1 second)

...

Ex 2:

...

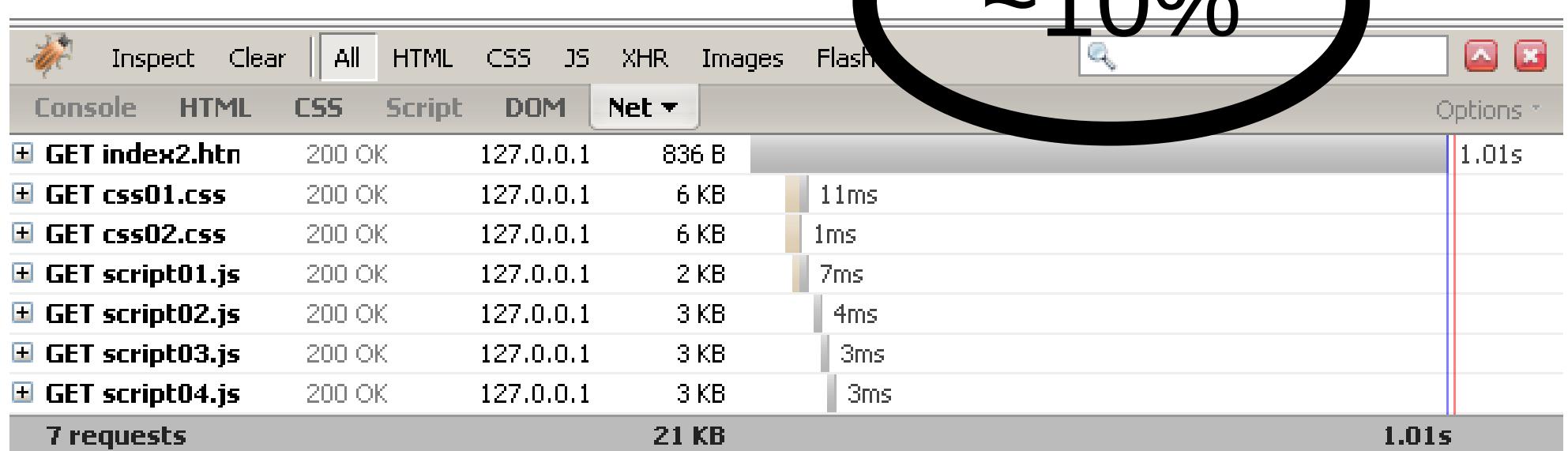
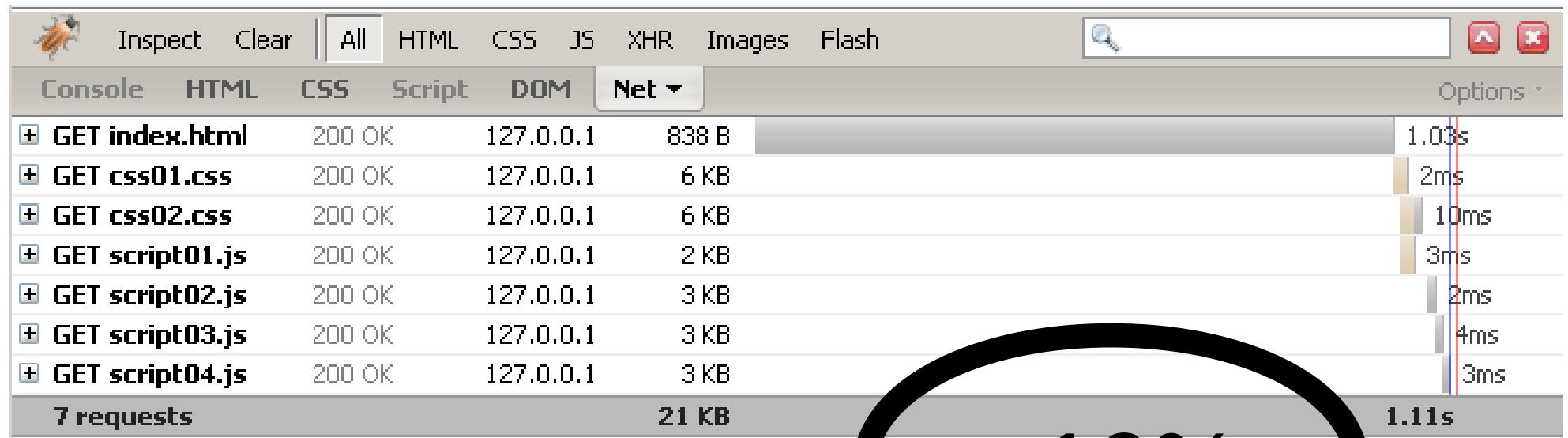
</head>

flush()

pause(1 second)

...

Examples



Other options



Network technologies

- Use a Content Delivery Network
- Use expire headers
- Automatic component compression
- Reduce DNS lookups
- eTags configuration



Application architecture

- Avoid redirections (301 - 302)
- Reduce the number of DOM elements
- Do not use iframes
- Reduce the size of cookies
- Use cookie-free domains
for multimedia components



Javascript and CSS

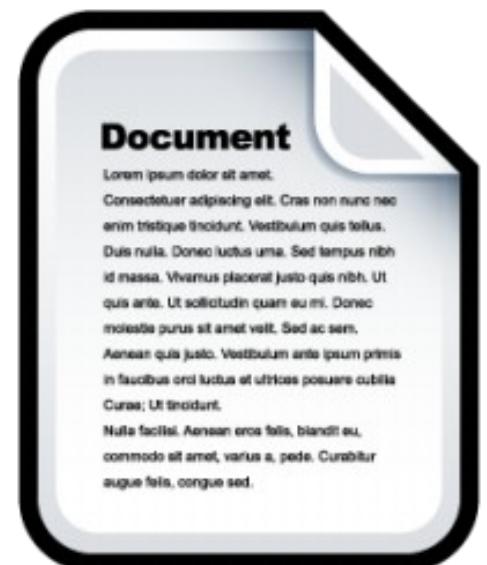
- Position Cascade Style Sheets and scripts
- Avoid the usage of CSS expressions
- Avoid duplicating scripts
- Use GET request for Web Services
- Cache AJAX
- Optimize Javascript

```
h1 { color: white;  
background: orange;  
border: 1px solid black;  
padding: 0 0 0 0;  
font-weight: bold;  
}  
/* begin: seaside-theme */  
  
body {  
background-color:white;  
color:black;  
font-family:Arial,sans-serif;  
margin: 0 4px 0 0;  
border: 12px solid;  
}
```

CSS

Other components

- Externalize component files
- Minify plaintext files
- Preload components
- Optimize images
- Reduce the favicon



Thank you!

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