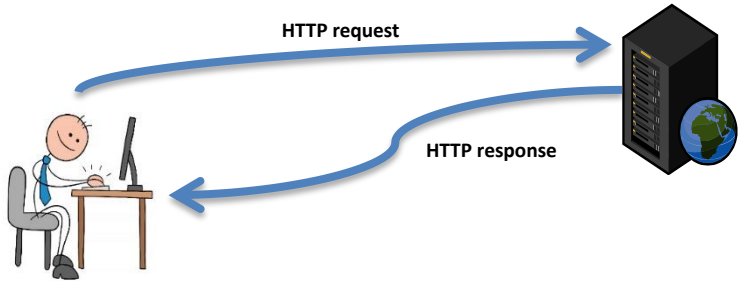
HTTP Protocol Headers

Web Engineering

utad UNIVERSIDADE DE TRÁS-OS-MONTES E ALTO DOURO

Recovering HTTP communication….



HTTP request message
(Port 80 of TCP)

HTTP Client
(for ex.,
the browser)

HTTP Server
(Apache, IIS,
etc.)

HTTP response message

Recovering HTTP communication….

HTTP Messages

Request

Request line CRLF

Header lines CRLF

CRLF

Body

Response

Status line CRLF

Header lines CRLF

CRLF

Body

HTTP Headers ???

HTTP headers let the client and the server pass additional information with an HTTP request or response. They contain metadata in key-value pairs that are sent along with HTTP requests and responses.

Headers can be grouped according to their contexts:

- **General Header:** This type of headers applied on Request and Response headers both but with out affecting the database body.
- **Request Header:** contains more information about the resource to be fetched, or about the client requesting the resource.
- **Response Header:** hold additional information about the response, like its location or about the server providing it.
- **Entity Header:** contains the information about the body of the resources like MIME type, Content-length.

Network Working Group
Request for Comments: 2616
Obsoletes: 2068
Category: Standards Track

R. Fielding
UC Irvine
J. Gettys
Compaq/W3C
J. Mogul
Compaq
H. Frystyk
W3C/MIT
L. Masinter
Xerox
P. Leach
Microsoft
T. Berners-Lee
W3C/MIT
June 1999

Everything about HTTP

Hypertext Transfer Protocol -- HTTP/1.1

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Copyright Notice

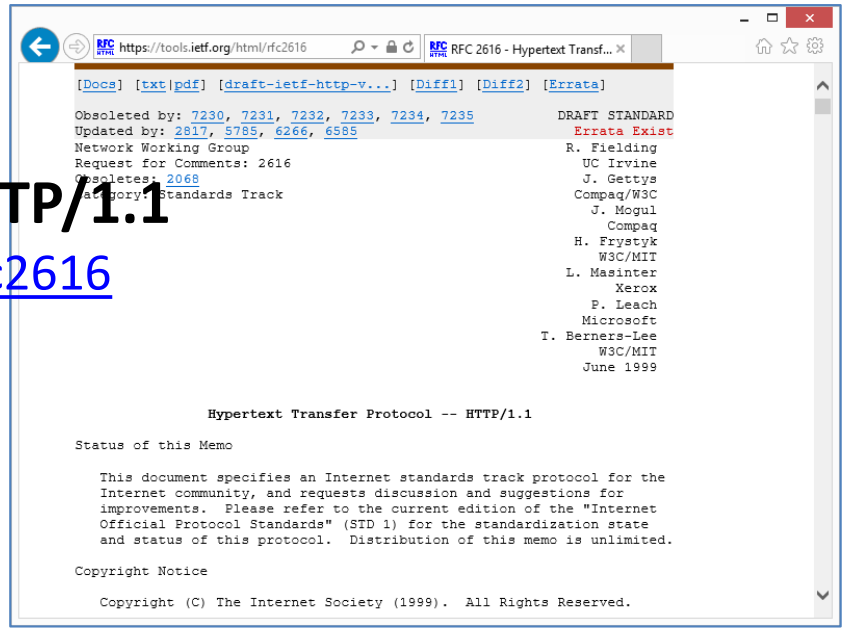
Some headers...

...more headers...

Complete header's list:

Hypertext Transfer Protocol -- HTTP/1.1

https://datatracker.ietf.org/doc/html/rfc2616



Let's see some examples

GET /tc/home.html HTTP/1.1
Host: www.tribunalconstitucional.pt
Date: Tue, 30 Sep 2008 13:45:29 GMT
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 6.0; en-US; rv:1.9.0.3) Gecko/2008092417 Firefox/3.0.3
Referer: http://home.utad.pt/~lfb/teste.htm
If-Modified-Since: Tue, 30 Sep 2008 13:40:29 GMT

HTTP/1.1 200 OK

Server: Microsoft-IIS/4.0

Date: Tue, 30 Sep 2008 13:45:38 GMT

Content-Type: text/html

Accept-Ranges: bytes

Last-Modified: Wed, 06 Jan 1999 18:56:06 GMT

Content-Length: 9934

Who (and when) sets (inserts) the request headers?

- Web clients (browsers) following a request for a resource and … web application's code

Who (and when) sets (inserts) the headers of static content responses?

- Web servers following the receipt of a content request

Who (and when) defines (inserts) the headers of the dynamic content responses?

- Web servers following the receipt of a resource request and … web application's code.

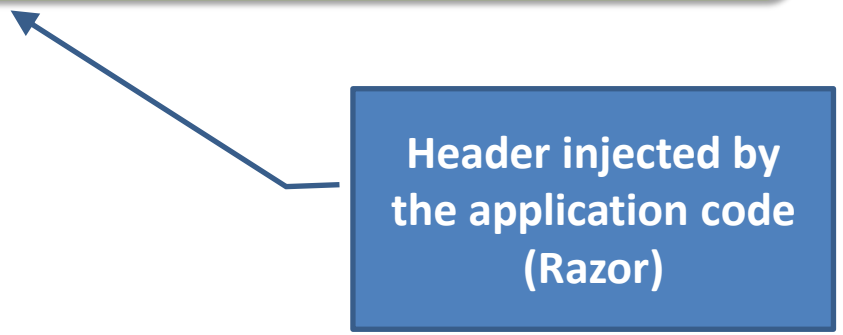
Programmatically in the browser (request)

```
function ajax(url, vars, callbackFunction) {
   var request = new XMLHttpRequest();
   request.open("POST", url, true);
   request.setRequestHeader(
              "Content-Type",
              "application/x-www-form-urlencoded");
   request.onreadystatechange = function() {
      if (request.readyState == 4 &&
          request.status == 200) {
             if (request.responseText) {
                callbackFunction(request.responseText);
             }
          }
   };
   request.send(vars);
}
```

Header injected by the application code (javascript)

Programmatically in the server (response)

```
@HttpContext.Current.Response.AddHeader("CustomHeader", "CustomValue")
<HTML>
<TITLE>Test</TITLE>
<BODY>
<p>This page has a custom HTTP header</p>
</BODY>
</HTML>
```



Dynamic content response

In the server (response)

This always work?

```
<HTML>
<TITLE>Test</TITLE>
<BODY>
<p>This page has a custom HTTP header</p>
@HttpContext.Current.Response.AddHeader("CustomHeader", "CustomValue")
</BODY>
</HTML>
```

Dynamic content response

Current servers implement response buffering:

When the output is buffered, the server will hold back the response to the browser until all of the server scripts have been processed, or until the script calls the Flush or End method.

Examples of buffer manipulation:

```
@HttpContext.Current.Response.ClearContent();
@HttpContext.Current.Response.ClearHeaders();
@HttpContext.Current.Response.Buffer = true;
@HttpContext.Current.Response.End();
```

Programmatically changing headers…

A **forbidden header name** is the name of any HTTP header that cannot be modified programmatically.

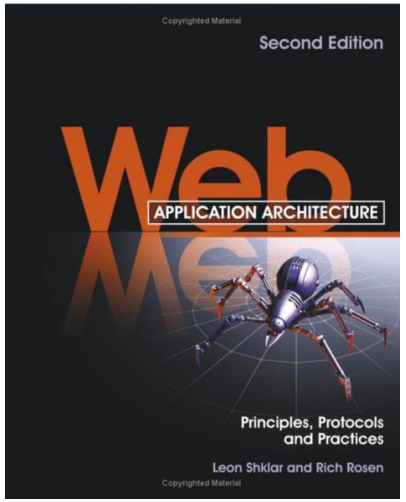
Modifying such headers is forbidden because the user agent retains full control over them.

Forbidden header names start with Proxy- or Sec-, or are one of the following names:

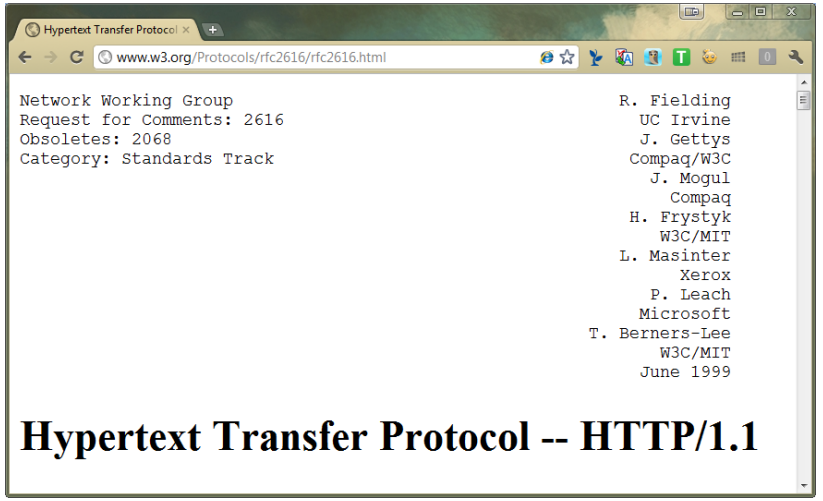
- Accept-Charset
- Accept-Encoding
- Connection
- Content-Length
- Origin
- Cookie
- Date
- Host
- Keep-Alive
- Referer
- …

Associated Readings

Web Application Architecture, Second Edition
Cap. 3: “Birth of the Web: HTTP”, pages 44 to 60.



Hypertext Transfer Protocol -- HTTP/1.1
http://www.w3.org/Protocols/rfc2616/rfc2616.html



MIME types in HTTP protocol

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Multipurpose Internet Mail Extensions

HTTP/1.1 200 OK
Server: Microsoft-IIS/4.0
Date: Tue, 30 Sep 2008 13:45:38 GMT
Content-Type: text/html
Accept-Ranges: bytes
Last-Modified: Wed, 06 Jan 1999 18:56:06 GMT
Content-Length: 9934

MIME encoding

Content-Type: type/subtype [; parameters]

```
Content-Type:  text/html
Content-Type:  text/plain
Content-Type:  text/css
Content-Type:  image/gif
Content-Type:  image/jpeg
Content-Type:  audio/x-wav
Content-Type:  audio/x-mpeg-2
Content-Type:  video/quicktime
Content-Type:  video/mpeg-2
```

MIME encoding

Content-Type: type/subtype [; parameters]

```
Content-Type: text/html ; charset = us-ascii
Content-Type: text/html ; charset = utf-8
```

(The default character set is ISO-8859-1.)

MIME encoding

Content-Type: type/subtype [; parameters]

```
Content-Type: multipart/x-mixed-replace ;
                                    boundary=XPTOText


. . .

--XPTOText
Content-Type: image/gif
. . .
--XPTOText
Content-Type: image/gif
. . .
--XPTOText--
```

Content-Type: multipart/form-data ; boundary=…

MIME encoding

Content-Type: type/subtype [; parameters]

```
Accept-Encoding: x-compress; x-zip
```

```
GET /encrypted-area HTTP/1.1
Host: www.example.com
Accept-Encoding: gzip, deflate
```

```
HTTP/1.1 200 OK
Date: mon, 28 Sep 2015 22:38:34 GMT
Server: Apache/1.3.3.7 (Unix)  (Red-Hat/Linux)
Last-Modified: Wed, 08 Jan 2003 23:11:55 GMT
Accept-Ranges: bytes
Content-Length: 438
Connection: close
Content-Type: text/html; charset=UTF-8
Content-Encoding: gzip
```

MIME encoding

Base64

often used to transmit binary data by transmission means that deal only with text

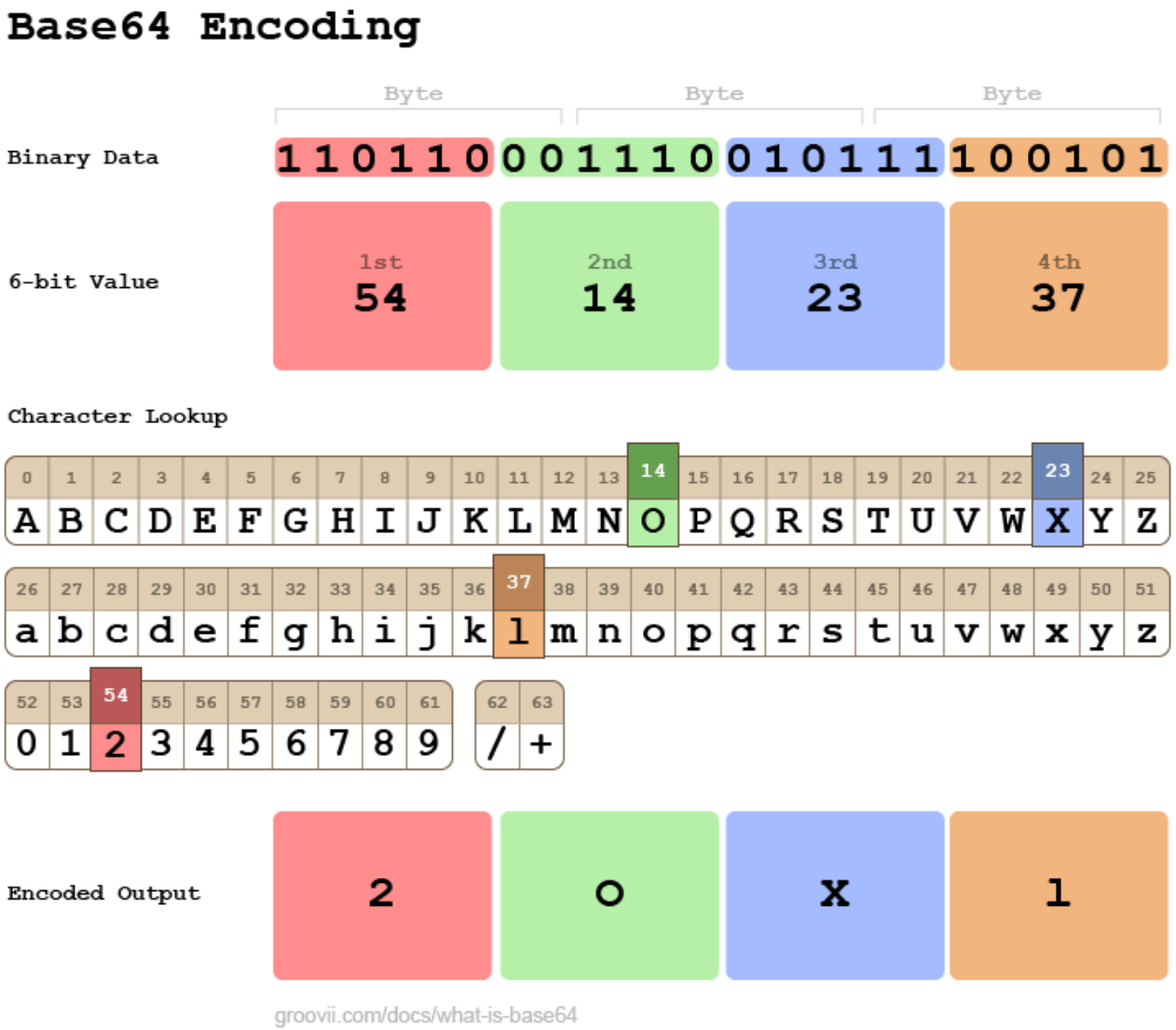
consisting of 64 characters ([A-Z],[a-z],[0-9], "/" e "+")

data:[<mediatype>][;base64],<data>

<img src=" …”
width=“…" height=“…" alt=“…">

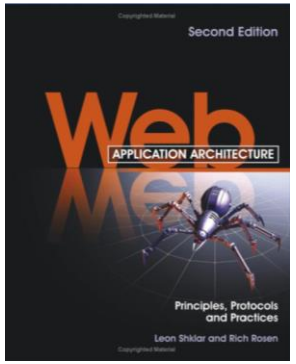
MIME encoding

How it works?



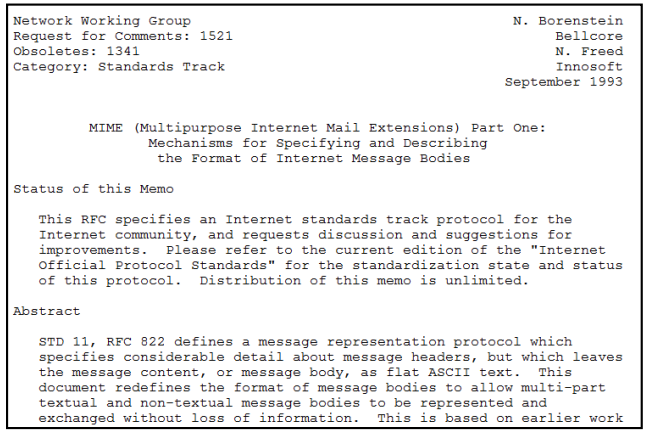
Associated Readings

Web Application Architecture, Second Edition
Cap. 3: “Birth of the Web: HTTP”, pages 46 to 49.



MIME (Multipurpose Internet Mail Extensions) Part One: Mechanisms for Specifying and Describing the Format of Internet Message Bodies

https://www.ietf.org/rfc/rfc1521.txt



Network Working Group — N. Borenstein
Request for Comments: 1521 — Bellcore
Obsoletes: 1341 — N. Freed
Category: Standards Track — Innosoft
September 1993

MIME (Multipurpose Internet Mail Extensions) Part One:
Mechanisms for Specifying and Describing
the Format of Internet Message Bodies

Status of this Memo

This RFC specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Abstract

STD 11, RFC 822 defines a message representation protocol which specifies considerable detail about message headers, but which leaves the message content, or message body, as flat ASCII text. This document redefines the format of message bodies to allow multi-part textual and non-textual message bodies to be represented and exchanged without loss of information. This is based on earlier work

HTTP protocol response status codes

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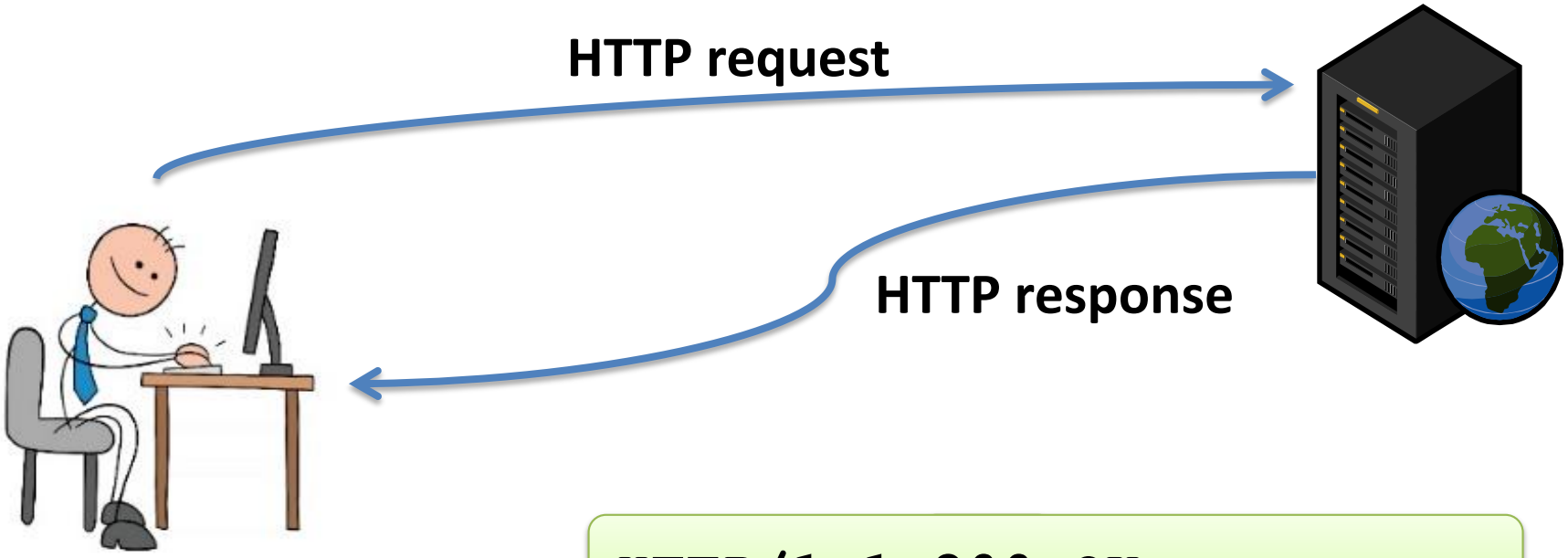
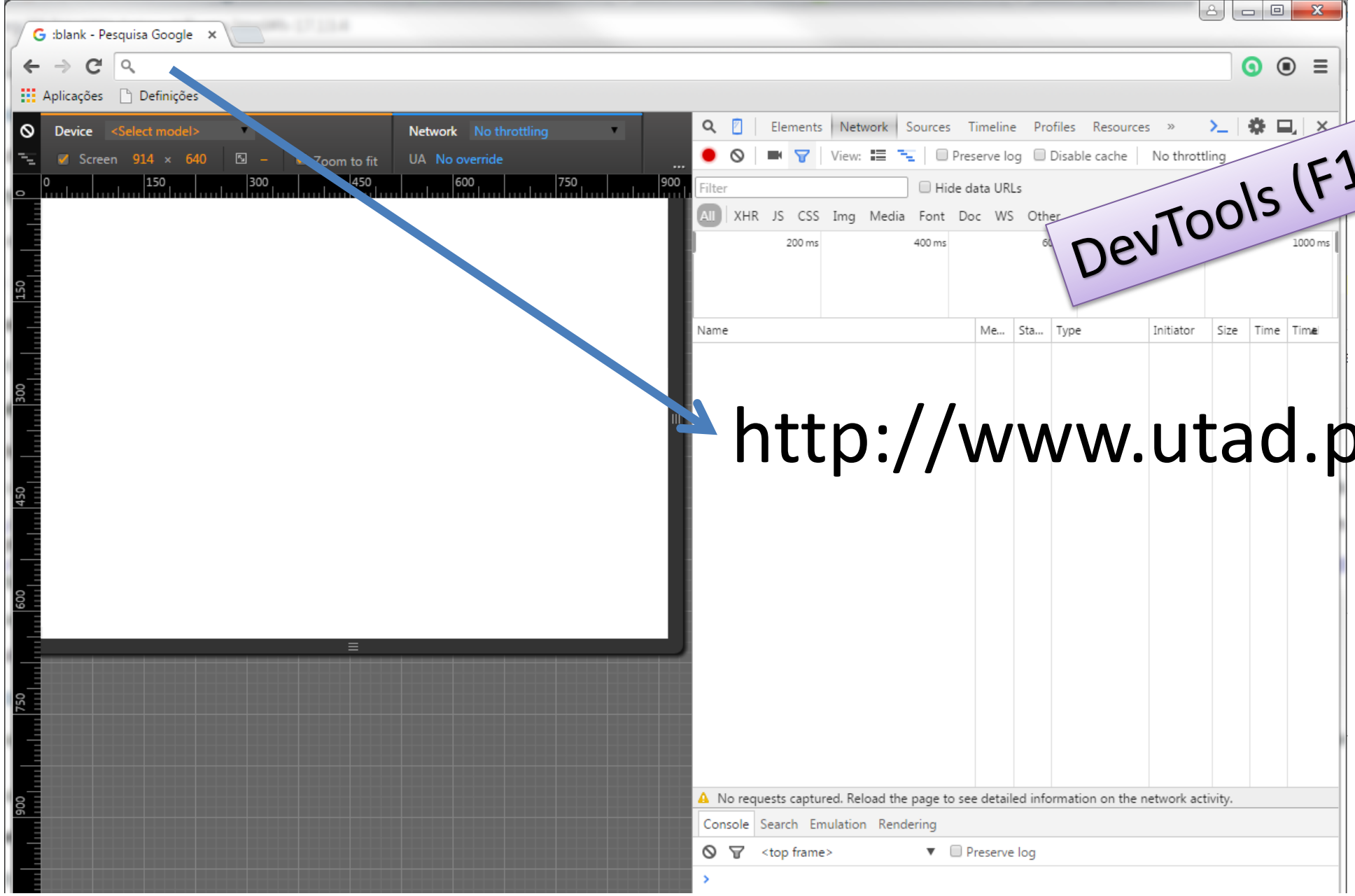
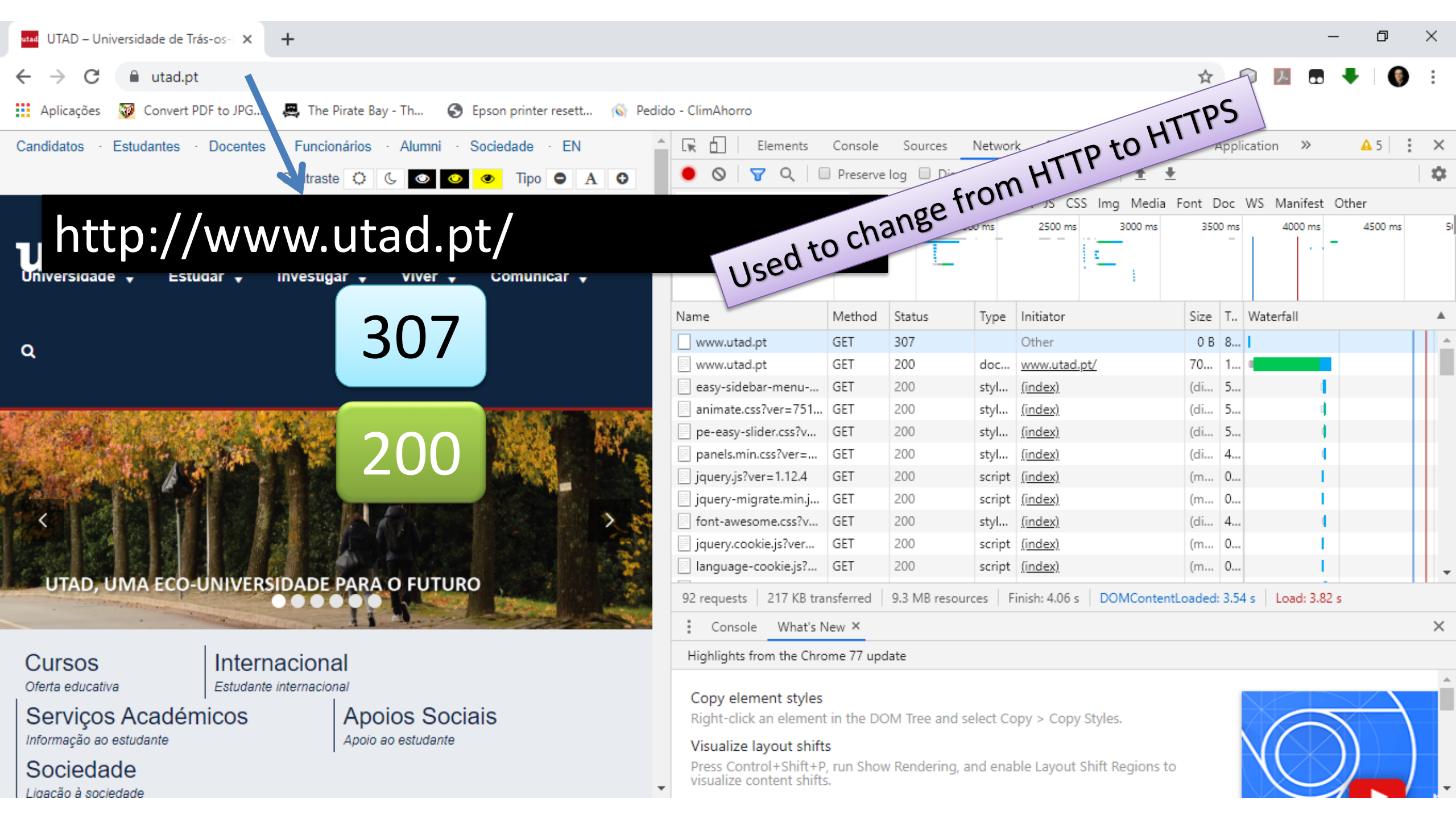
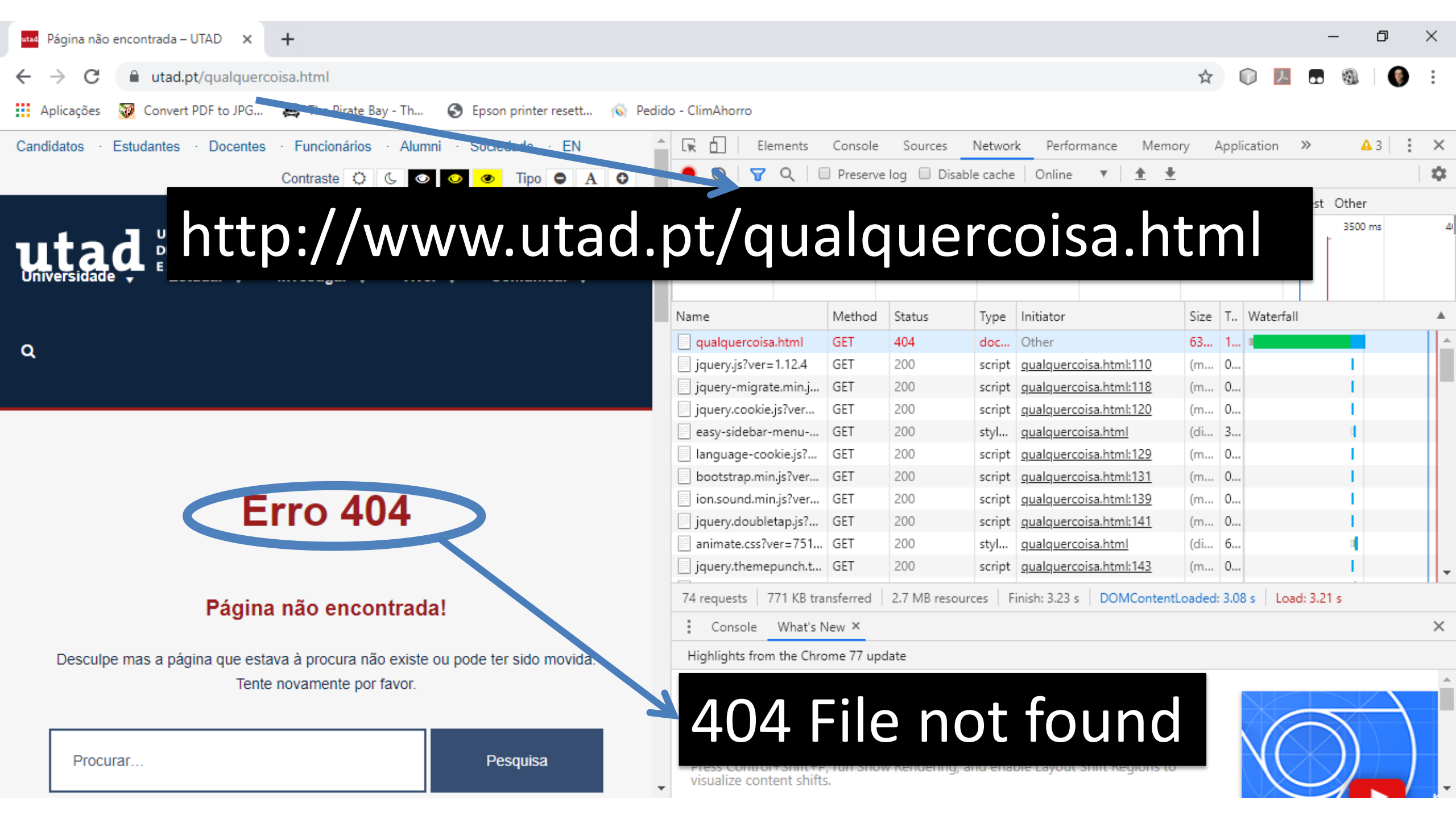
```
GET /tc/home.html HTTP/1.1
Host: www.tribunalconstitucional.pt
...
```

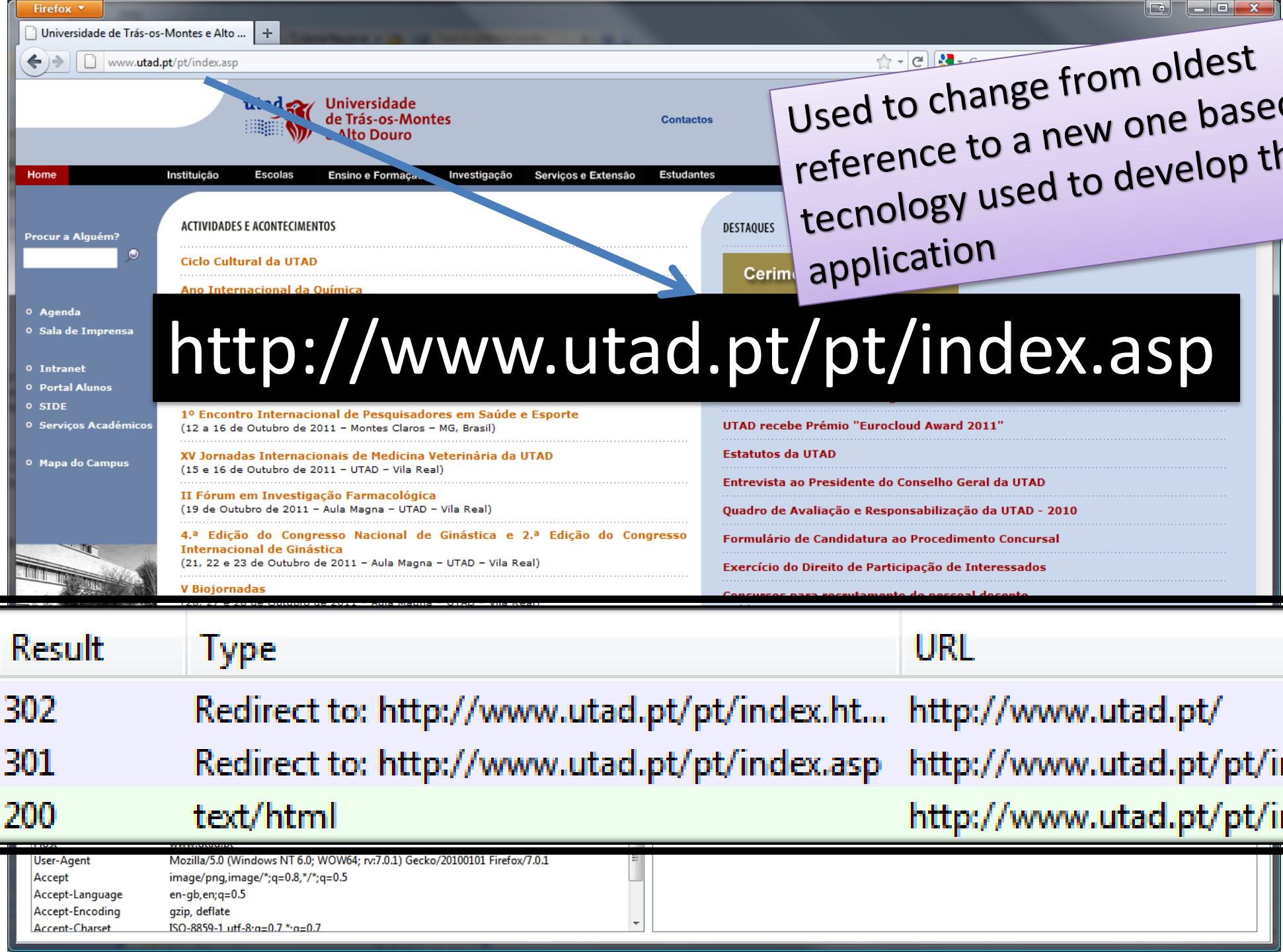



```
HTTP/1.1 200 OK
Content-Type: text/html
Content-Length: 9934
...
```


:blank - Pesquisa Google
Aplicações
Definições
Device
<Select model>
Screen
914 × 640
Zoom to fit
Network
No throttling
UA
No override
Elements
Network
Sources
Timeline
Profiles
Resources
Preserve log
Disable cache
No throttling
Filter
Hide data URLs
All
XHR
JS
CSS
Img
Media
Font
Doc
WS
Other
200 ms
400 ms
1000 ms
Name
Me...
Sta...
Type
Initiator
Size
Time
No requests captured. Reload the page to see detailed information on the network activity.
Console
Search
Emulation
Rendering
<top frame>
Preserve log
DevTools (F12)
http://www.utad.pt


UTAD – Universidade de Trás-os-
utad.pt
Aplicações
Convert PDF to JPG...
The Pirate Bay - Th...
Epson printer resett...
Pedido - ClimAhorro
Candidatos · Estudantes · Docentes · Funcionários · Alumni · Sociedade · EN
Tipo
http://www.utad.pt/
Used to change from HTTP to HTTPS
Universidade
Estudar
Investigar
Viver
Comunicar
307
200
UTAD, UMA ECO-UNIVERSIDADE PARA O FUTURO
Cursos
Oferta educativa
Internacional
Estudante internacional
Serviços Académicos
Informação ao estudante
Apoios Sociais
Apoio ao estudante
Sociedade
Ligação à sociedade
Elements
Console
Sources
Network
Application
Preserve log
JS CSS Img Media Font Doc WS Manifest Other
2500 ms
3000 ms
3500 ms
4000 ms
4500 ms
Name
Method
Status
Type
Initiator
Size
T..
Waterfall
www.utad.pt GET 307 Other 0 B 8...
www.utad.pt GET 200 doc... www.utad.pt/ 70... 1...
easy-sidebar-menu-... GET 200 styl... (index) (di... 5...
animate.css?ver=751... GET 200 styl... (index) (di... 5...
pe-easy-slider.css?v... GET 200 styl... (index) (di... 5...
panels.min.css?ver=... GET 200 styl... (index) (di... 4...
jquery.js?ver=1.12.4 GET 200 script (index) (m... 0...
jquery-migrate.min.j... GET 200 script (index) (m... 0...
font-awesome.css?v... GET 200 styl... (index) (di... 4...
jquery.cookie.js?ver... GET 200 script (index) (m... 0...
language-cookie.js?... GET 200 script (index) (m... 0...
92 requests
217 KB transferred
9.3 MB resources
Finish: 4.06 s
DOMContentLoaded: 3.54 s
Load: 3.82 s
Console
What's New
Highlights from the Chrome 77 update
Copy element styles
Right-click an element in the DOM Tree and select Copy > Copy Styles.
Visualize layout shifts
Press Control+Shift+P, run Show Rendering, and enable Layout Shift Regions to visualize content shifts.

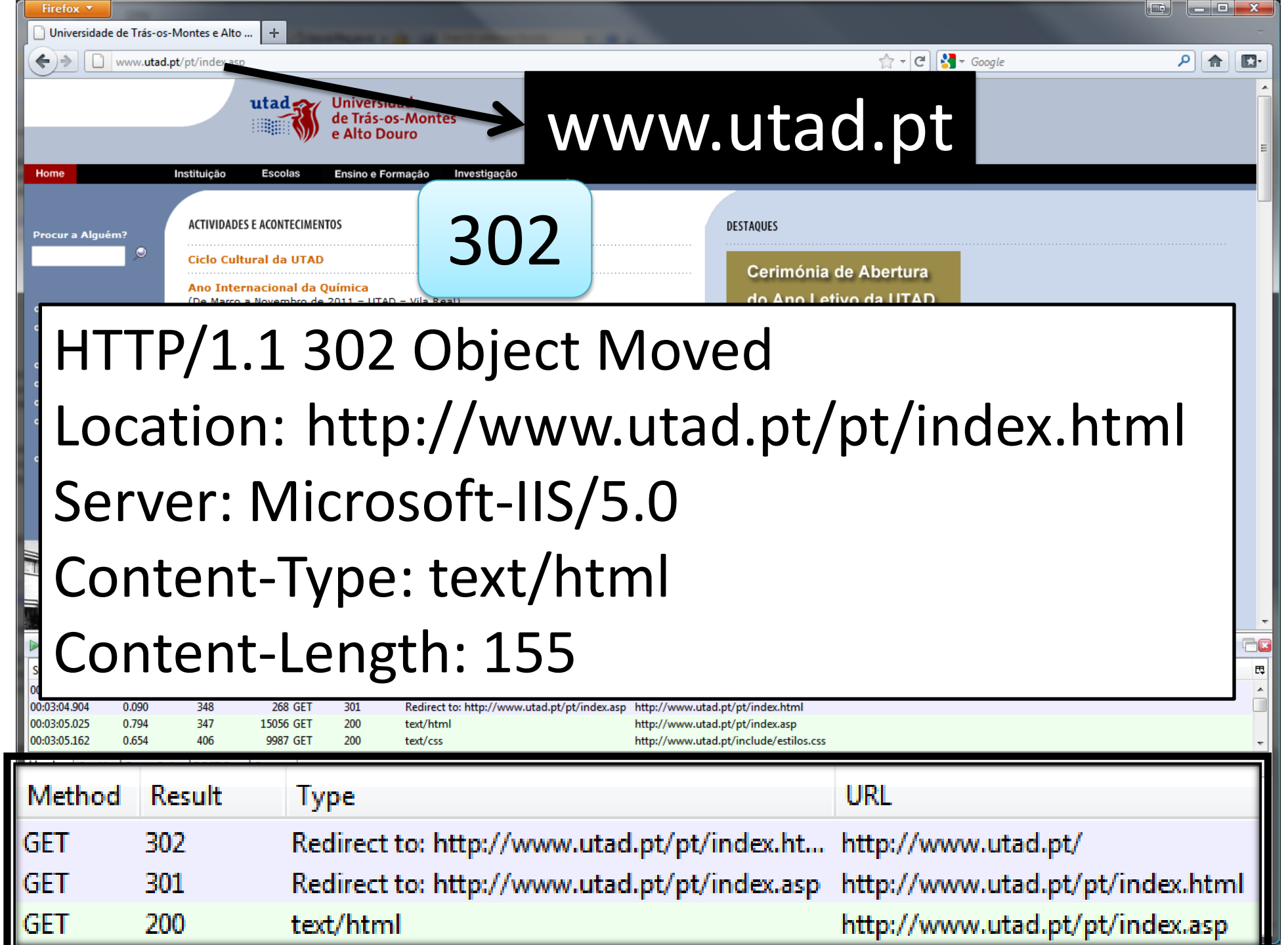

Página não encontrada – UTAD
utad.pt/qualquercoisa.html
Aplicações
Convert PDF to JPG...
Epson printer resett...
Pedido - ClimAhorro
Candidatos · Estudantes · Docentes · Funcionários · Alumni · EN
Contraste
Tipo
utad
Universidade
http://www.utad.pt/qualquercoisa.html
Erro 404
Página não encontrada!
Desculpe mas a página que estava à procura não existe ou pode ter sido movida.
Tente novamente por favor.
Procurar...
Pesquisa
Elements
Console
Sources
Network
Performance
Memory
Application
Preserve log
Disable cache
Online
Other
3500 ms
Name
Method
Status
Type
Initiator
Size
T..
Waterfall
qualquercoisa.html GET 404 doc... Other 63... 1...
jquery.js?ver=1.12.4 GET 200 script qualquercoisa.html:110 (m... 0...
jquery-migrate.min.j... GET 200 script qualquercoisa.html:118 (m... 0...
jquery.cookie.js?ver... GET 200 script qualquercoisa.html:120 (m... 0...
easy-sidebar-menu-... GET 200 styl... qualquercoisa.html (di... 3...
language-cookie.js?... GET 200 script qualquercoisa.html:129 (m... 0...
bootstrap.min.js?ver... GET 200 script qualquercoisa.html:131 (m... 0...
ion.sound.min.js?ver... GET 200 script qualquercoisa.html:139 (m... 0...
jquery.doubletap.js?... GET 200 script qualquercoisa.html:141 (m... 0...
animate.css?ver=751... GET 200 styl... qualquercoisa.html (di... 6...
jquery.themepunch.t... GET 200 script qualquercoisa.html:143 (m... 0...
74 requests
771 KB transferred
2.7 MB resources
Finish: 3.23 s
DOMContentLoaded: 3.08 s
Load: 3.21 s
Console
What's New
Highlights from the Chrome 77 update
404 File not found
visualize content shifts.

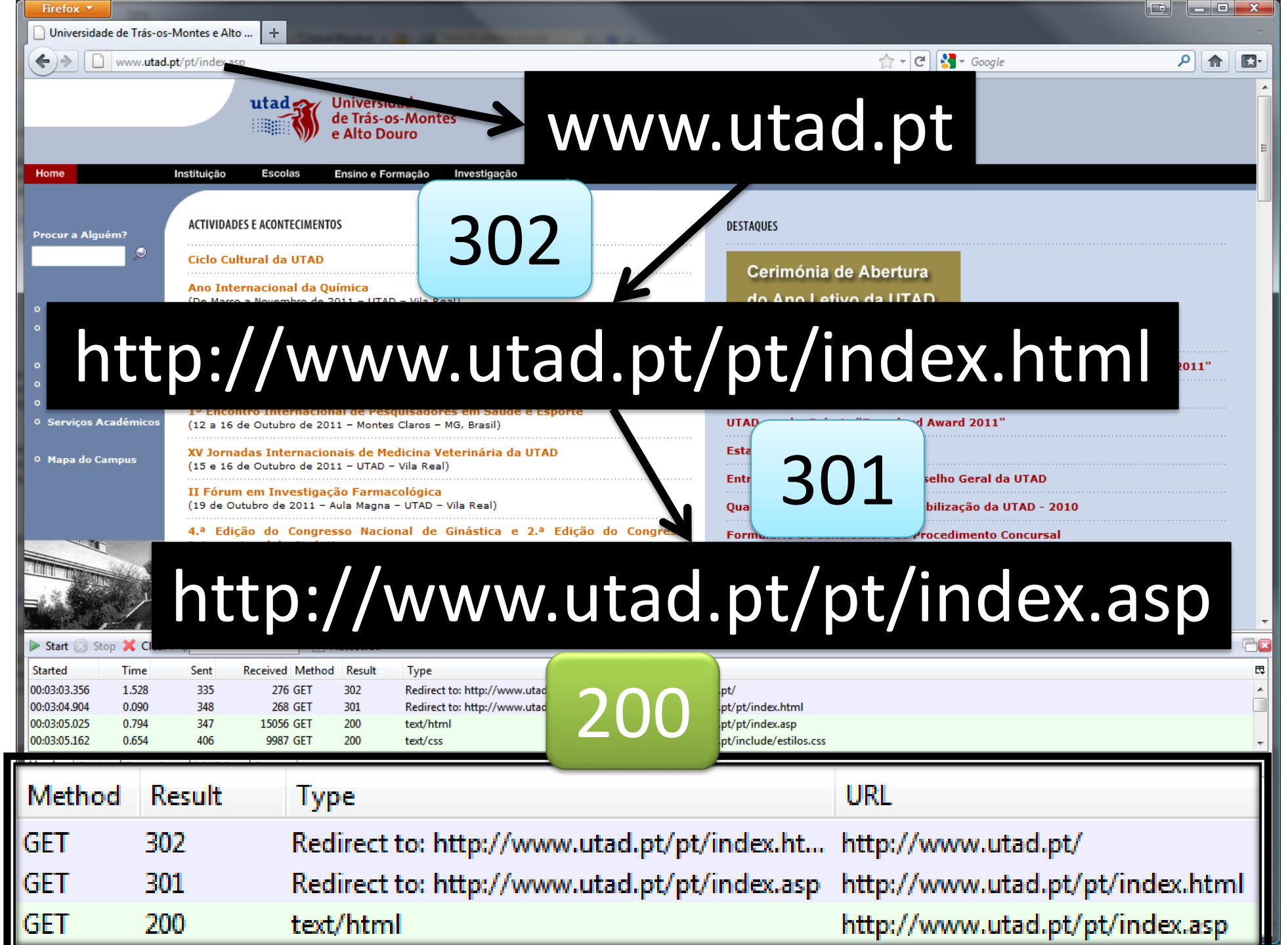


Used to change from oldest reference to a new one based on the tecnology used to develop the web application

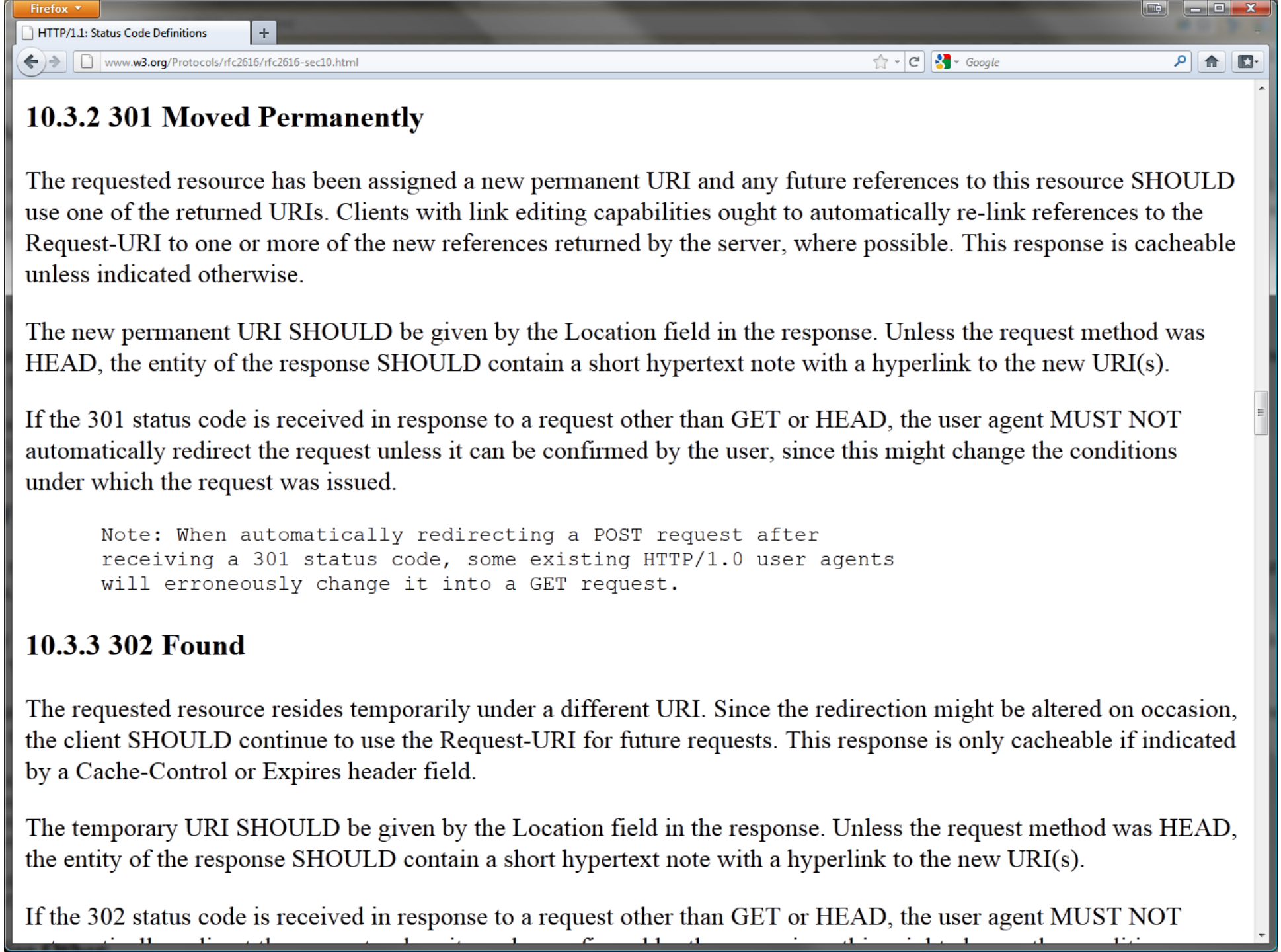
http://www.utad.pt/pt/index.asp

Method	Result	Type	URL
GET	302	Redirect to: http://www.utad.pt/pt/index.ht...	http://www.utad.pt/
GET	301	Redirect to: http://www.utad.pt/pt/index.asp	http://www.utad.pt/pt/index.html
GET	200	text/html	http://www.utad.pt/pt/index.asp


Firefox
Universidade de Trás-os-Montes e Alto ...
www.utad.pt/pt/index.asp
Google
www.utad.pt
utad
Universidade de Trás-os-Montes e Alto Douro
Home
Instituição
Escolas
Ensino e Formação
Investigação
302
Procur a Alguém?
ACTIVIDADES E ACONTECIMENTOS
Ciclo Cultural da UTAD
Ano Internacional da Química
DESTAQUES
Cerimónia de Abertura
HTTP/1.1 302 Object Moved
Location: http://www.utad.pt/pt/index.html
Server: Microsoft-IIS/5.0
Content-Type: text/html
Content-Length: 155
00:03:04.904 0.090 348 268 GET 301 Redirect to: http://www.utad.pt/pt/index.asp http://www.utad.pt/pt/index.html
00:03:05.025 0.794 347 15056 GET 200 text/html http://www.utad.pt/pt/index.asp
00:03:05.162 0.654 406 9987 GET 200 text/css http://www.utad.pt/include/estilos.css
Method Result Type URL
GET 302 Redirect to: http://www.utad.pt/pt/index.ht... http://www.utad.pt/
GET 301 Redirect to: http://www.utad.pt/pt/index.asp http://www.utad.pt/pt/index.html
GET 200 text/html http://www.utad.pt/pt/index.asp



Method	Result	Type	URL
GET	302	Redirect to: http://www.utad.pt/pt/index.ht...	http://www.utad.pt/
GET	301	Redirect to: http://www.utad.pt/pt/index.asp	http://www.utad.pt/pt/index.html
GET	200	text/html	http://www.utad.pt/pt/index.asp



10.3.2 301 Moved Permanently

The requested resource has been assigned a new permanent URI and any future references to this resource SHOULD use one of the returned URIs. Clients with link editing capabilities ought to automatically re-link references to the Request-URI to one or more of the new references returned by the server, where possible. This response is cacheable unless indicated otherwise.

The new permanent URI SHOULD be given by the Location field in the response. Unless the request method was HEAD, the entity of the response SHOULD contain a short hypertext note with a hyperlink to the new URI(s).

If the 301 status code is received in response to a request other than GET or HEAD, the user agent MUST NOT automatically redirect the request unless it can be confirmed by the user, since this might change the conditions under which the request was issued.

```
Note: When automatically redirecting a POST request after
receiving a 301 status code, some existing HTTP/1.0 user agents
will erroneously change it into a GET request.
```

10.3.3 302 Found

The requested resource resides temporarily under a different URI. Since the redirection might be altered on occasion, the client SHOULD continue to use the Request-URI for future requests. This response is only cacheable if indicated by a Cache-Control or Expires header field.

The temporary URI SHOULD be given by the Location field in the response. Unless the request method was HEAD, the entity of the response SHOULD contain a short hypertext note with a hyperlink to the new URI(s).

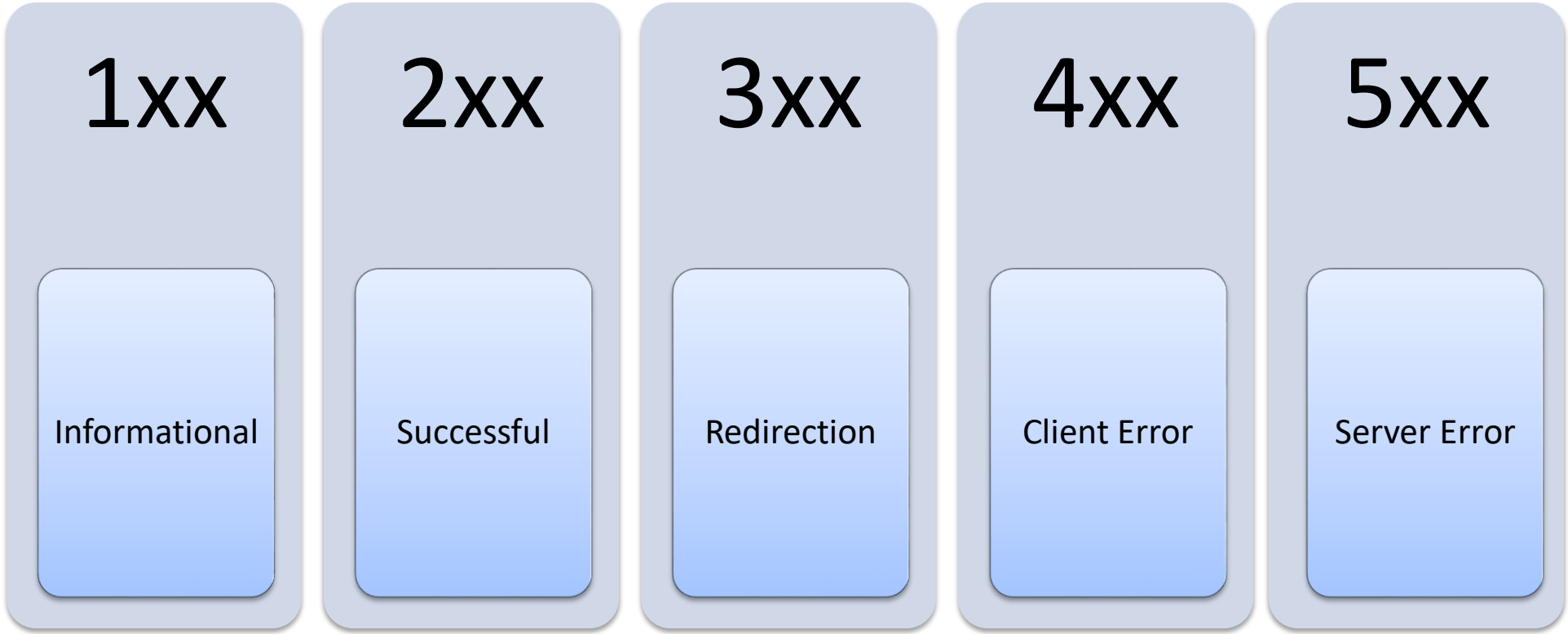
If the 302 status code is received in response to a request other than GET or HEAD, the user agent MUST NOT

```
public ActionResult Index()
{
 return View();
}
```

HTTP/1.1 200 OK
Server: Kestrel
Date: Wed, 11 Oct 2023 13:05:44 GMT
Content-Type: text/html; charset=utf-8
Content-Length: 24570
…

```
[HttpPost]
public ActionResult Index(string Name)
{
 return RedirectToRoute("MyRoute");
}
```

HTTP/1.1 302 Found
Content-Length: 0
Date: Wed, 11 Oct 2023 22:05:48 GMT
Server: Kestrel
Location: /MyController/MyRoute
…



- 1xx (Informational): The request was received, continuing process
- 2xx (Successful): The request was successfully received, understood, and accepted
- 3xx (Redirection): Further action needs to be taken in order to complete the request
- 4xx (Client Error): The request contains bad syntax or cannot be fulfilled
- 5xx (Server Error): The server failed to fulfill an apparently valid request

Informational 1xx

- 100 Continue

Successful 2xx

- 200 OK
- …
- 206 Partial Content

Redirection 3xx

- 301 Moved Permanently
- 302 Found
- 303 See Other
- 304 Not Modified
- …
- 307 Temporary Redirect
- 308 Permanent Redirect

Client Error 4xx

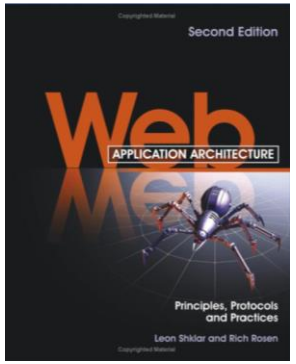
- 400 Bad Request
- 401 Unauthorized
- …
- 403 Forbidden
- 404 Not Found
- …
- 411 Length Required

Server Error 5xx

- 500 Internal Server Error
- …
- 502 Bad Gateway
- 503 Service Unavailable
- …
- 505 HTTP Version Not Supported

Associated Readings

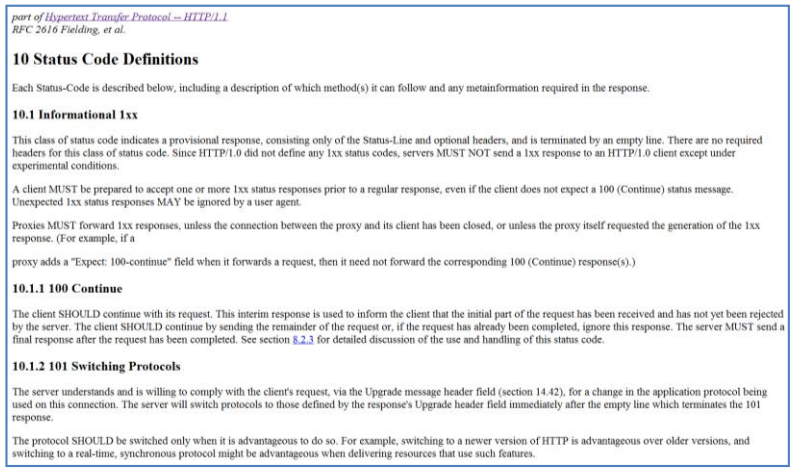
Web Application Architecture, Second Edition
Cap. 3: “Birth of the Web: HTTP”, pages 41 to 44.



Section 15 of the HTTP protocol specification:

“Status Codes”

https://www.rfc-editor.org/rfc/rfc9110.html#name-status-codes



part of Hypertext Transfer Protocol -- HTTP/1.1
RFC 2616 Fielding, et al.

10 Status Code Definitions

Each Status-Code is described below, including a description of which method(s) it can follow and any metainformation required in the response.

10.1 Informational 1xx

This class of status code indicates a provisional response, consisting only of the Status-Line and optional headers, and is terminated by an empty line. There are no required headers for this class of status code. Since HTTP/1.0 did not define any 1xx status codes, servers MUST NOT send a 1xx response to an HTTP/1.0 client except under experimental conditions.

A client MUST be prepared to accept one or more 1xx status responses prior to a regular response, even if the client does not expect a 100 (Continue) status message. Unexpected 1xx status responses MAY be ignored by a user agent.

Proxies MUST forward 1xx responses, unless the connection between the proxy and its client has been closed, or unless the proxy itself requested the generation of the 1xx response. (For example, if a

proxy adds a "Expect: 100-continue" field when it forwards a request, then it need not forward the corresponding 100 (Continue) response(s).)

10.1.1 100 Continue

The client SHOULD continue with its request. This interim response is used to inform the client that the initial part of the request has been received and has not yet been rejected by the server. The client SHOULD continue by sending the remainder of the request or, if the request has already been completed, ignore this response. The server MUST send a final response after the request has been completed. See section 8.2.3 for detailed discussion of the use and handling of this status code.

10.1.2 101 Switching Protocols

The server understands and is willing to comply with the client's request, via the Upgrade message header field (section 14.42), for a change in the application protocol being used on this connection. The server will switch protocols to those defined by the response's Upgrade header field immediately after the empty line which terminates the 101 response.

The protocol SHOULD be switched only when it is advantageous to do so. For example, switching to a newer version of HTTP is advantageous over older versions, and switching to a real-time, synchronous protocol might be advantageous when delivering resources that use such features.

Resume

HTTP PROTOCOL HEADERS

WHAT ARE? WHAT DO THEY CONSIST OF?
WHAT TYPES (OR GROUPS) EXIST?
WHAT ARE FORBIDDEN HEADER NAMES?
WHO INSERTS HEADERS INTO MESSAGES?
KNOW SOME OF THE MOST COMMON HEADERS.

MYME TYPES IN HTTP PROTOCOL

WHAT ARE MIME-TYPES?
WHAT IS THE PURPOSE/IMPORTANCE OF ITS USE?
CAN ITS VALUE BE PROGRAMMATICALLY CHANGED?

HTTP RESPONSE STATUS

GENERALLY SPEAKING, WHAT DO STATE CODES MEAN?
WHAT ARE THE EXISTING GROUPS?
WHAT DOES EACH GROUP REPRESENT?
UNDERSTAND THE MEANING AND CONSEQUENCES OF USING THE MOST COMMON CODES…

Next section

RESOLVING ADDRESSES ON HTTP SERVERS

Readings until October 19's class

3.4 Better Information Through Headers
- 3.4.1 Support for content types
- 3.4.2 Caching control
- 3.4.3 Security

3.5 Evolution of the HTTP Protocol
- 3.5.1 Virtual hosting

6 Web Servers
- 6.1 Basic Operation
  - 6.1.1 HTTP request processing
  - 6.1.2 Delivery of static content
  - 6.1.3 Delivery of dynamic content

6.3 Advanced Functionality
- 6.3.1 Virtual hosting