

HTTP Is Dead. Long Live HTTP/2!

Ben Ramsey
Ski PHP Conference
14 January 2016



HI, I'M BEN.

I'm a web craftsman, author, and speaker. I build a platform for professional photographers at ShootProof. I enjoy APIs, open source software, organizing user groups, good beer, and spending time with my family. Nashville, TN is my home.

- ▶ *Zend PHP Certification Study Guide*
- ▶ **Nashville PHP & Atlanta PHP user groups**
- ▶ **`array_column()`**
- ▶ **`ramsey/uuid`**
- ▶ **`league/oauth2-client`**

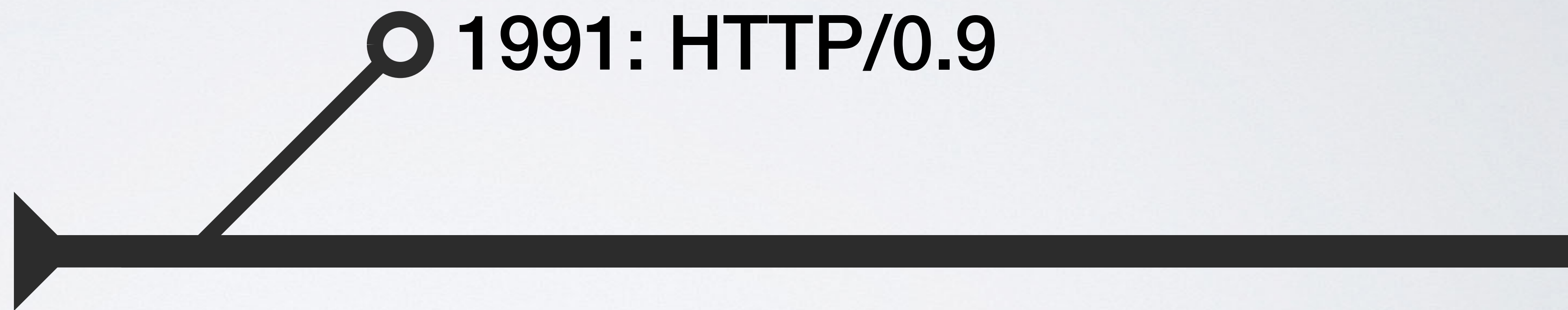


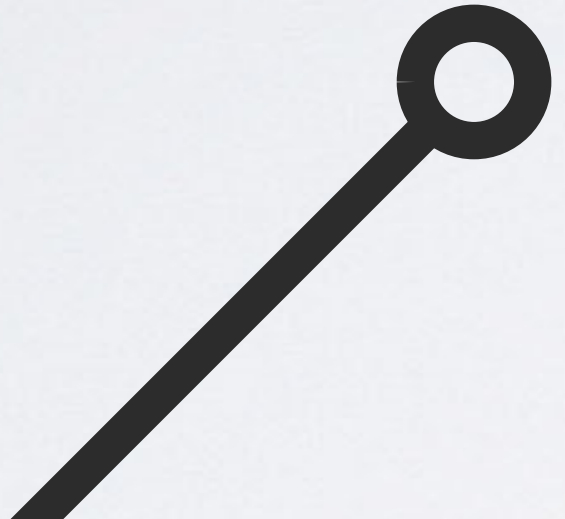
ShootProof []

We're hiring.

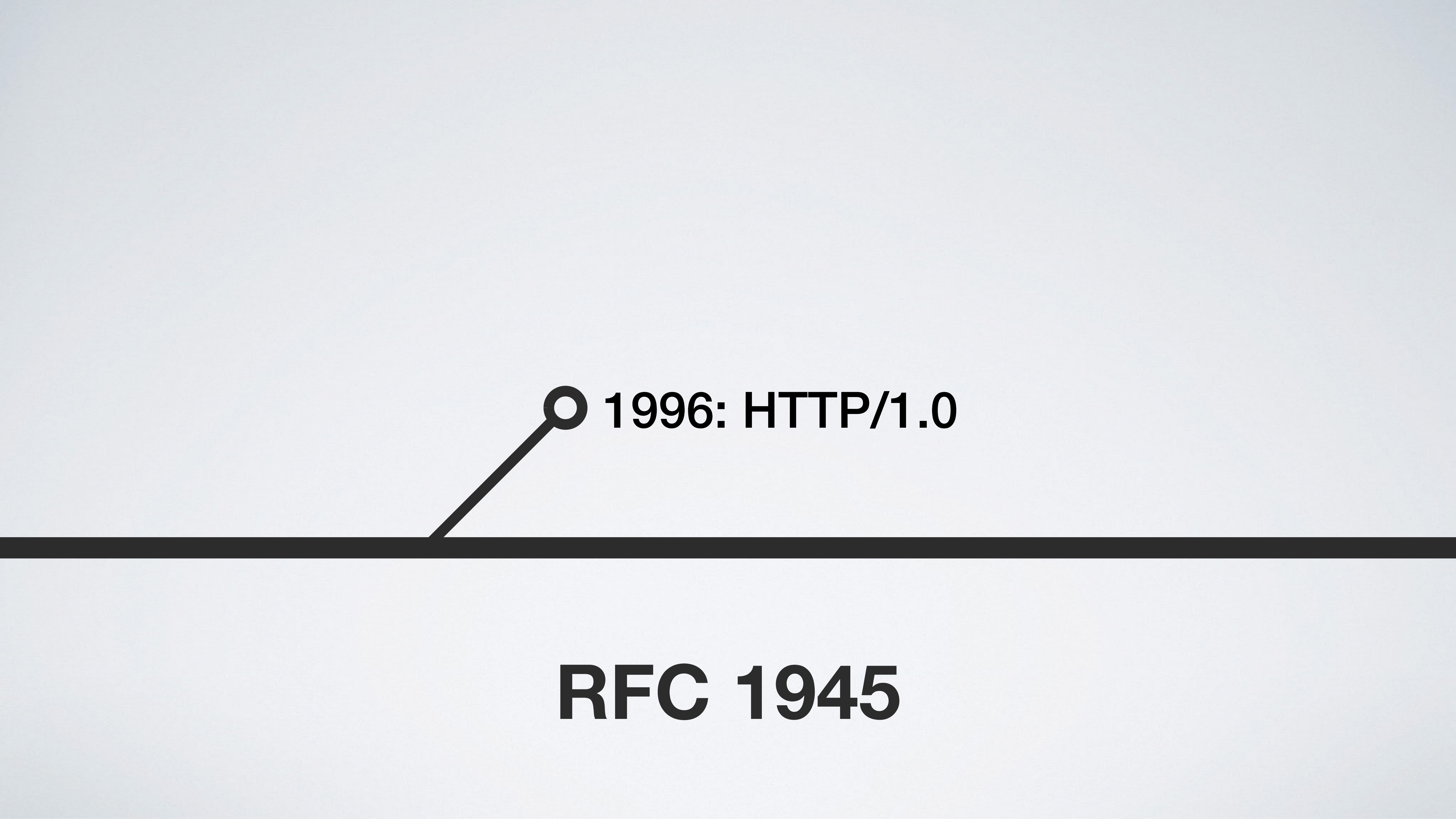
**HTTP Is Dead.
Long Live HTTP/2!**







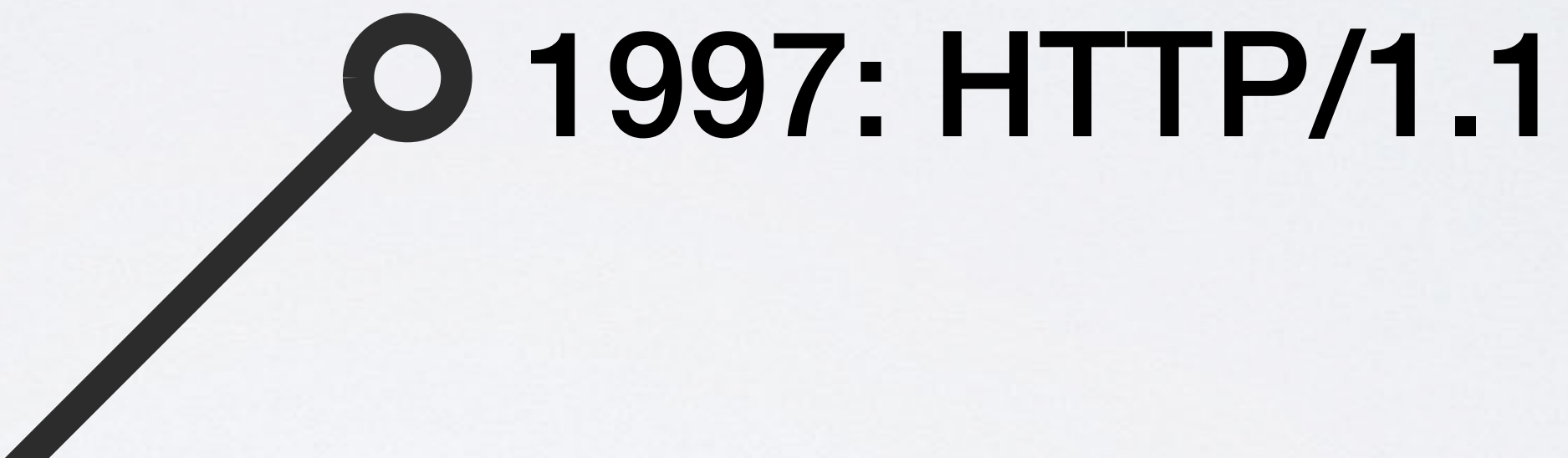
1992-95: HTTP/1.0 draft



A horizontal timeline is represented by a thick black line. A diagonal line segment branches off from this horizontal line, ending at a small open circle. To the right of this circle is the text '1996: HTTP/1.0'. Below the horizontal line, centered, is the text 'RFC 1945'.

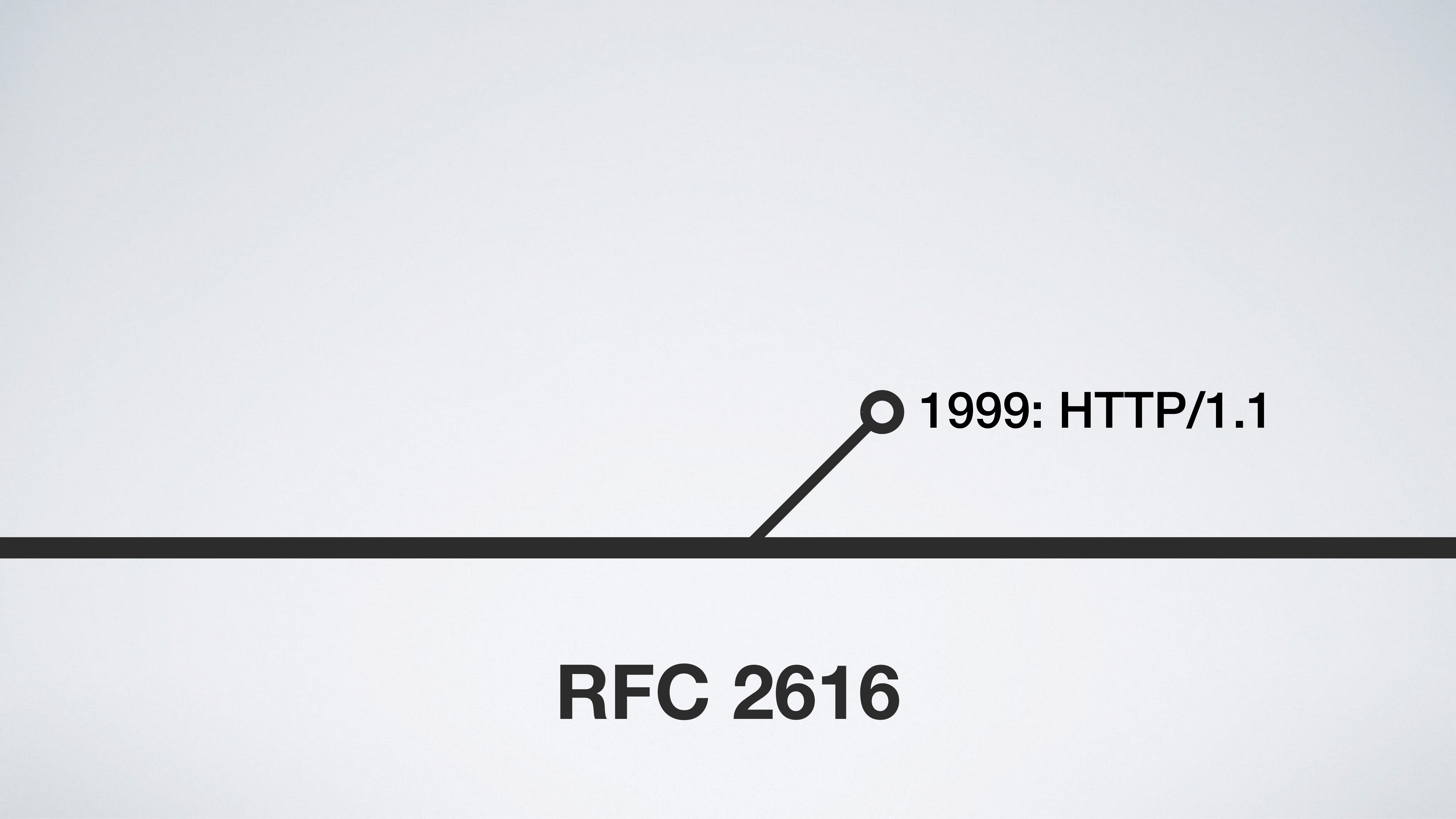
1996: HTTP/1.0

RFC 1945



1997: HTTP/1.1

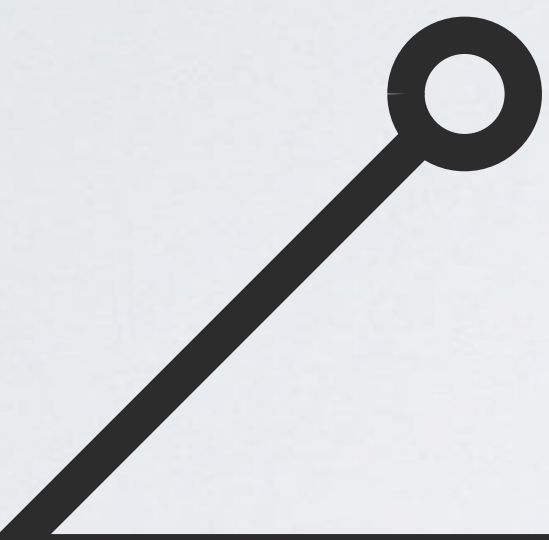
RFC 2068



A horizontal timeline line with a diagonal branch pointing to a specific point.

1999: HTTP/1.1

RFC 2616



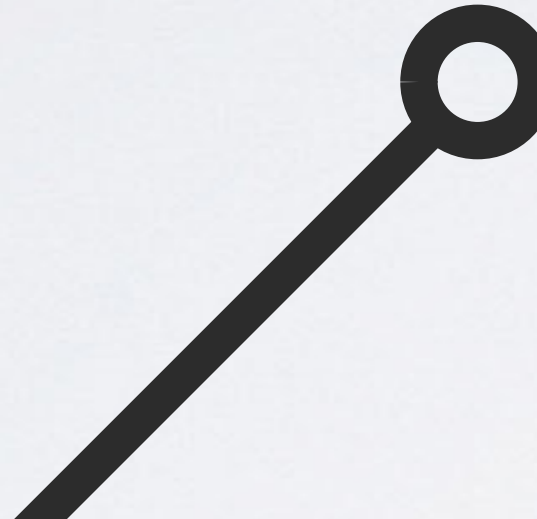
**2000: Upgrading to TLS
Within HTTP/1.1**

RFC 2817

★ IETF forms the
HTTPbis WG

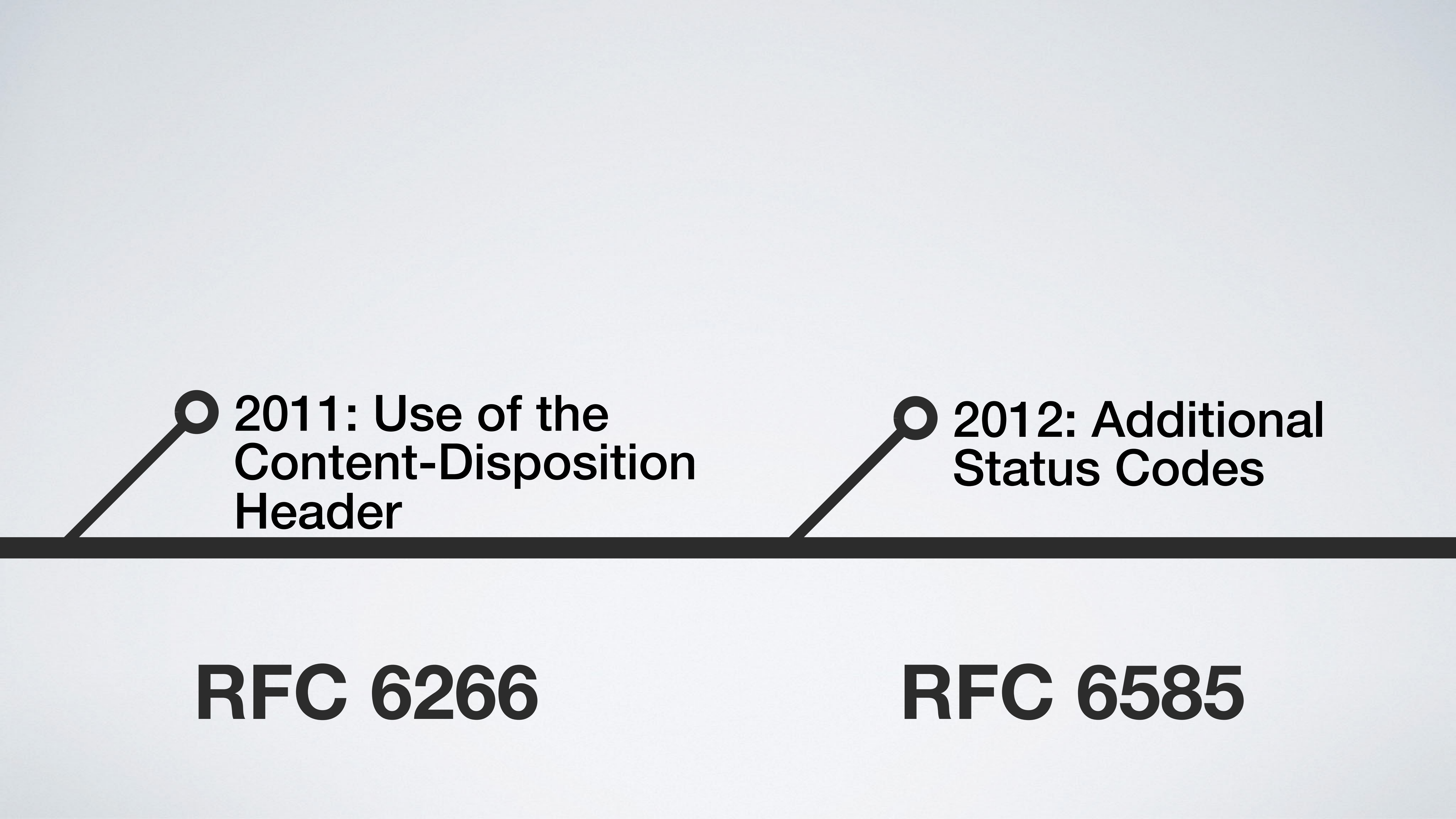
○ 2003

○ 2007



**2010: Defining Well-Known
Uniform Resource Identifiers**

RFC 5785

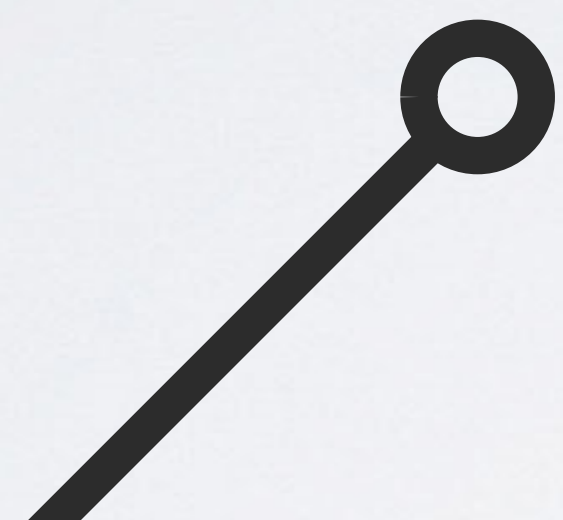


**2011: Use of the
Content-Disposition
Header**

RFC 6266

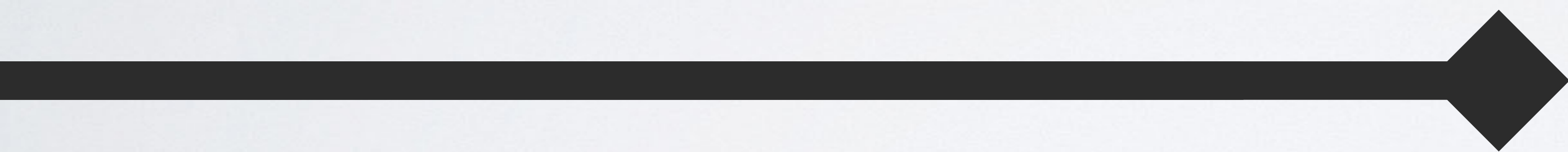
**2012: Additional
Status Codes**

RFC 6585



June 2014: HTTP/1.1

RFCs 7230-7235



May 2015

HTTP/2: RFC 7540

HTTP Is Dead.



RFC 2616 Is Dead.

- June 1999
- 176 pages
- Errata & ambiguity
- Web got bigger than anticipated



HTTPbis

- *bis* is the Latin adverb for “two”
- Chartered in October 2007 to refine and clarify HTTP
- Specifically forbidden from creating a new version of HTTP

“The Working Group must not introduce a new version of HTTP and should not add new functionality to HTTP. The WG is not tasked with producing new methods, headers, or extension mechanisms...”

—2007-10-23 charter

HTTP/1.1

RFC 7230: Message Syntax and Routing

RFC 7231: Semantics and Content

RFC 7232: Conditional Requests

RFC 7233: Range Requests

RFC 7234: Caching

RFC 7235: Authentication

**723x is the
new 2616**



RFC 7230

Message Syntax and Routing

Defines the architectural components,
URL schemes, network operation, and
connection management of HTTP
messages.

- Userinfo is disallowed
- Multi-line headers deprecated
- Two connection limit removed
- New term: *Effective Request URI*

RFC 7230

Message Syntax and Routing

**Highlighted changes
from RFC 2616**

GET /pub/WWW/TheProject.html HTTP/1.1
Host: www.example.org:8080

The effective request URI is:

http://www.example.org:8080/pub/WWW/TheProject.html

RFC 7231

Semantics and Content

Defines request and response semantics, including representations, request methods and headers, and response status codes and headers.

RFC 7231

Semantics and Content

**Highlighted changes
from RFC 2616**

- Safe methods have more strict requirements
- Body now allowed on GET requests
- Content-Range banned on PUT requests
- Expect header is no longer extensible

RFC 7231

Semantics and Content

**Highlighted changes
from RFC 2616**

- 201 allows for one or more resources created
- 301 & 302 may rewrite from POST to GET
- 400 no longer limited to syntax errors
- 426 Upgrade Required status code included

RFC 7231

Semantics and Content

**Highlighted changes
from RFC 2616**

- 204, 404, 405, 414, 501 are now cacheable
- Location may include relative URIs
- Method registry
- Status code registry
- Content-MD5 header removed

RFC 723²

Conditional Requests

Defines conditional request mechanisms, including how to handle conditionals for GET, PUT, and DELETE requests (to prevent “lost updates”).

- ETag is defined as applying to the selected representation
- Defined precedence for evaluation

RFC 7232

Conditional Requests

**Highlighted changes
from RFC 2616**

RFC 7233

Range Requests

Defines range requests and partial responses. Additionally, defines the `multipart/byteranges` media type.

RFC 7233

Range Requests

**Highlighted changes
from RFC 2616**

- Content-Range header only has meaning with 206 or 416 status codes
- Range unit registry (starting with “bytes”)
- multipart/byteranges can consist of a single part

RFC 723⁴

Caching

Defines aspects related to caching
and reusing response messages.

- Substantial clarification to meaning of directives
- Pragma deprecated
- One-year limit on Expires removed
- Cache directive registry
- Warn code registry

RFC 723⁴

Caching

**Highlighted changes
from RFC 2616**

RFC 7235

Authentication

Supersedes RFC 2617 to become the authoritative document, defining authentication schemes in HTTP.

RFC 723⁵

Authentication

**Highlighted changes
from RFC 2616**

- Supersedes RFC 2617
- “realm” no longer required on challenges
- Authentication scheme registry introduced

Registries & Stuff



HTTP Method Registry

HTTP Status Code Registry

HTTP Range Unit Registry

HTTP Cache Directive Registry

HTTP Warn Codes

HTTP Authentication Scheme Registry

All may be found at iana.org/protocols

RFC 7236: Authentication Scheme Registrations

RFC 7237: Method Registrations

RFC 7238: 308 Permanent Redirect

RFC 7239: Forwarded Header

RFC 7240: Prefer Header

respond-async

POST /collection HTTP/1.1

Host: example.org

Content-Type: text/plain

Prefer: respond-async

{Data}

HTTP/1.1 202 Accepted

Location: http://example.org/collection/123

Preference-Applied: respond-async

return=minimal

POST /collection HTTP/1.1

Host: example.org

Content-Type: text/plain

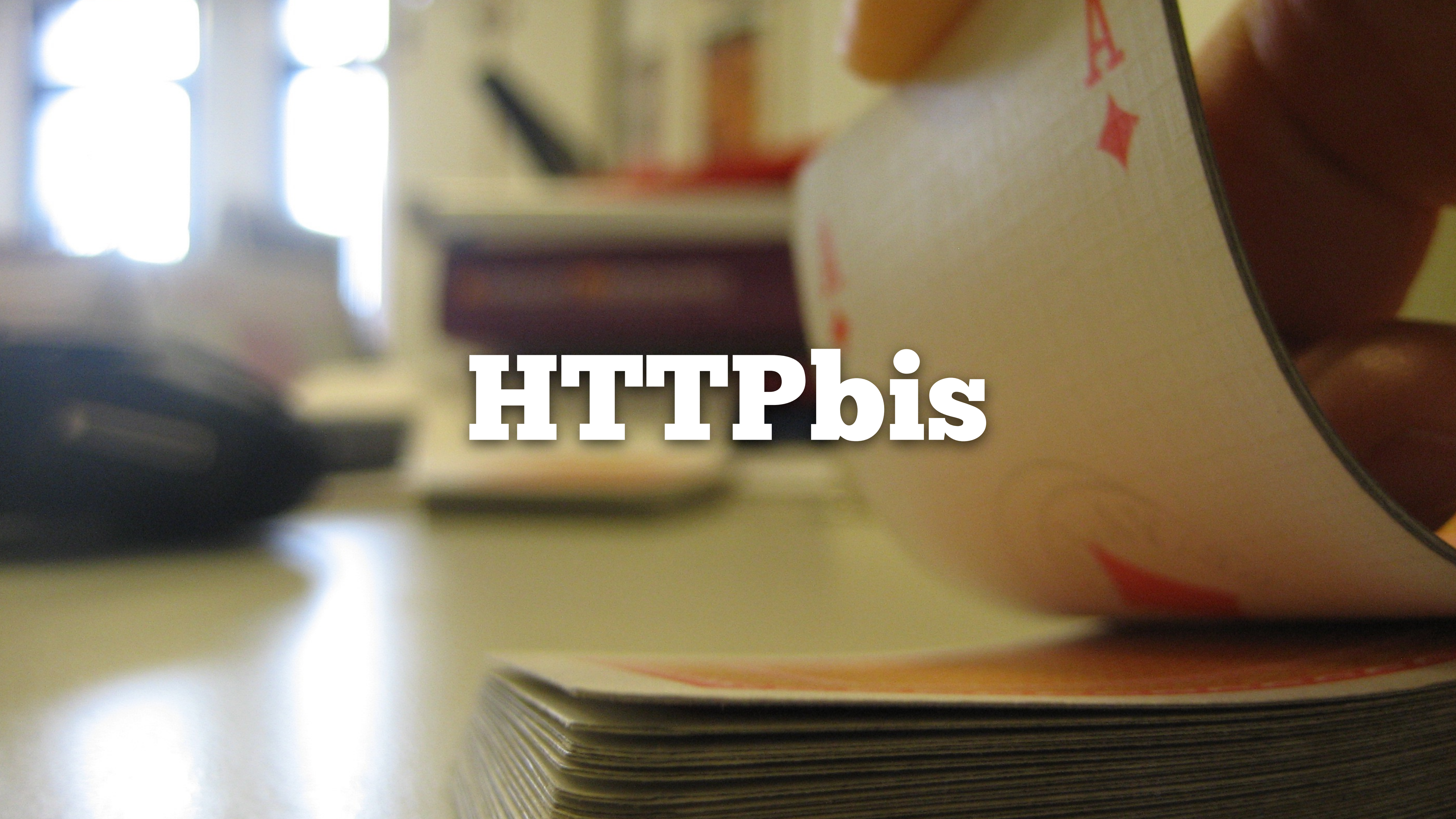
Prefer: return=minimal

{Data}

HTTP/1.1 201 Created

Location: http://example.org/collection/123

Preference-Applied: return=minimal



HTTPbis

2007: “The Working Group **must not**
introduce a new version of HTTP...”

2009: Google announces their SPDY protocol project to increase the speed of the Web.

2010: Google releases SPDY support in Chrome for all versions of Chrome 6.

2011: Google deploys SPDY across all Google services.

2012:

Twitter deploys SPDY on its servers.

Facebook announces plans for SPDY.

Wordpress.com announces support.

...

IETF amends the HTTPbis charter.

“There is emerging implementation experience and interest in a protocol that retains the semantics of HTTP, without the legacy of HTTP/1.x message framing and syntax. The Working Group will leverage this to **create a new major version of HTTP.**”

—2012-03-19 charter

**May
2015:**

RFC 7540 is published, defining
hypertext transfer protocol version 2
(or HTTP/2).

JOKER



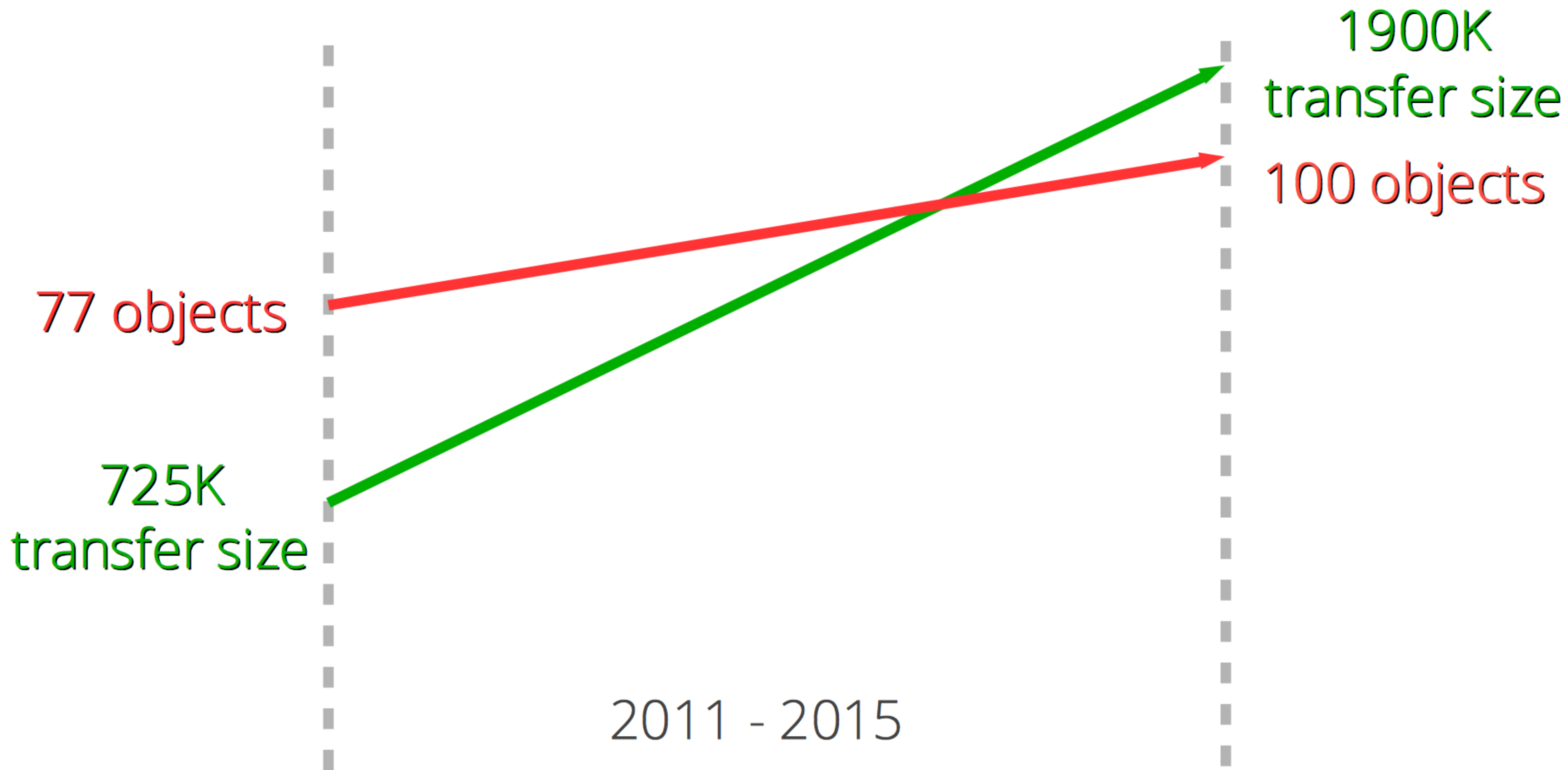
ДЖОКЕР



Why HTTP/2?

Inadequate use of TCP

Transfer sizes and number of objects



Latency issues

HTTP Pipelining Problems

Head of line blocking



#HTTPproblems



```

```

```

/*! jQuery v1.11.3 | (c) 2005, 2015 jQuery Foundation, Inc. | jquery.org/license */
!function(a,b){"object"==typeof module&&"object"==typeof module.exports?module.exports=a.document?b(a,!0):function(a){if(!a.document)throw new Error("jQuery requires a window with a document");return b(a)}:b(a)}("undefined"!=typeof window>window:this,function(a,b){var c=[],d=c.slice,e=c.concat,f=c.push,g=c.indexOf,h={},i=h.toString,j=h.hasOwnProperty,k={},l="1.11.3",m=function(a,b){return new m.fn.init(a,b)},n=/^\s\uFEFF\xA0+|[\s\uFEFF\xA0]+$/g,o="/^ms-/",p="/-(\da-z))/gi,q=function(a,b){return b.toUpperCase()};m.fn=m.prototype={jquery:l,constructor:m,selector:"",length:0,toArray:function(){return d.call(this)},get:function(a){return null!=a?a>this.length?:this[a]:d.call(this)},pushStack:function(a){var b=m.merge(this.constructor(),a);return b.prevObject=this,b.context=this.context,b},each:function(a,b){return m.each(this,a,b)},map:function(a){return this.pushStack(m.map(this,function(b,c){return a.call(b,c,b)}))},slice:function(){return this.pushStack(d.apply(this,arguments))},first:function(){return this.eq(0)},last:function(){return this.eq(-1)},eq:function(a){var b=this.length,c=++a?(0>a?b:0);return this.pushStack(c>=0&&b>c?[this[c]]:[])},end:function(){return this.prevObject||this.constructor(null)},push:f,sort:c.sort,slice:c.splice},m.extend=m.fn.extend=function(){var a,b,c,d,e,f,g=arguments[0]||{},h=1,i=arguments.length,j=!1;for("boolean"==typeof g&&(j=g,g=arguments[h]||{}),h++),"object"==typeof g||m.isFunction(g)||!(g={}),(h===i&&(g=this,h--));i>h;h++)if(null!=(e=arguments[h]))for(d in e)a=g[d],c=e[d],g!==c&&(j&&c&&(m.isPlainObject(c)||!(b=m.isArray(c)))?(b?(b=!1,f=a&&m.isArray(a)?a[:]):f=a&&m.isPlainObject(a)?a:{},g[d]=m.extend(j,f,c)):void 0!==c&&(g[d]=c));return g},m.extend({expando:"jQuery"+(l+Math.random()).replace(/\D/g,""),isReady:!0,error:function(a){throw new Error(a)},noop:function(){},isFunction:function(a){return"function"===m.type(a)},isArray:Array.isArray||function(a){return"array"===m.type(a)},isWindow:function(a){return null!=a&&a===a.window},isNumeric:function(a){return!m.isArray(a)&&aparseFloat(a)+1>=0},isEmptyObject:function(a){var b;for(b in a)return!1;return!0},isPlainObject:function(a){var b;if(!a||"object"!==m.type(a)||a.nodeType||m.isWindow(a))return!1;try{if(a.constructor&&j.call(a,"constructor")&&j.call(a.constructor.prototype,"isPrototypeOf"))return!1}catch(c){return!1}if(k.ownLast)for(b in a)return j.call(a,b);for(b in a);return void 0===b||j.call(a,b)},type:function(a){return null==a?a+"":"object"==typeof a||"function"==typeof a?h[i.call(a)]||"object":typeof a},globalEval:function(b){b&&m.trim(b)&&(a.execScript||function(b){a.eval.call(a,b)})(b)},camelCase:function(a){return a.replace(o,"ms-").replace(p,q)},nodeName:function(a,b){return a.nodeName&&a.nodeName.toLowerCase()===b.toLowerCase()},each:function(a,b,c){var d,e=0,f=a.length,g=r(a);if(c){if(g){for(;f>e;e++)if(d=b.call(a[e],c),d===!1)break}else for(e in a)if(d=b.call(a[e],e,a[e]),d===!1)break}else if(g){for(;f>e;e++)if(d=b.call(a[e],e,a[e]),d===!1)break}else for(e in a)if(d=b.call(a[e],e,a[e]),d===!1)break;return a},trim:function(a){return null==a?"":(a+"").replace(n,"")},makeArray:function(a,b){var c=b||[];return null!=a&&(r(Object(a))?m.merge(c,"string"==typeof a?[a]:a):f.call(c,a)),c},inArray:function(a,b,c){var d;if(b){if(g)return g.call(b,a,c);for(d=b.length,c=c?0>c?Math.max(0,d+c):c:0;d>c;c++)if(c in b&&b[c]===a)return c}return-1},merge:function(a,b){var c=+b.length,d=0,e=a.length;while(c>d)a[e++]=b[d++];if(c!==c)while(void 0!==b[d])a[e++]=b[d++];return a.length=e,a},grep:function(a,b,c){for(var d,e=[],f=0,g=a.length,h=!c;g>f;f++)d=!b(a[f],f),d!==h&&e.push(a[f]);return e},map:function(a,b,c){var d,f=0,g=a.length,h=r(a),i=[];if(h)for(;g>f;f++)d=b(a[f],f,c),null!=d&&i.push(d);else for(f in a)d=b(a[f],f,c),null!=d&&i.push(d);return e.apply([],i)},guid:1,proxy:function(a,b){var c,e,f;return"string"==typeof b&&(f=a[b],b=a,a=f),m.isFunction(a)?(c=d.call(arguments,2),e=function(){return a.apply(b||this,c.concat(d.call(arguments)))}),e.guid=a.guid=a.guid||m.guid++,e):void 0},now:function(){return+new Date},support:k}),m.each("Boolean Number String Function Array Date RegExp Object Error".split(" "),function(a,b){h["["+b+"]"]=b.toLowerCase()});function r(a){var b="length"in a&&a.length,c=m.type(a);return"function"===c||m.isWindow(a)?!1:1===a.nodeType&&b?!0:"array"===c||0===b||"number"==typeof b&&b>0&&b-1 in a}var s=function(a){var b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u="sizzle"+1*new Date,v=a.document,w=0,x=0,y=ha(),z=ha(),A=ha(),B=function(a,b){return a===b&&(l=!0)},C=1<<31,D={}.hasOwnProperty,E=[],F=E.pop,G=E.push,H=E.push,I=E.slice,J=function(a,b){for(var c=0,d=a.length;d>c;c++)if(a[c]===b)return c;return-1},K="checked|selected|async|autofocus|autoplay|controls|defer|disabled|hidden|ismap|loop|multiple|open|readonly|required|scoped",L="[\\x20\\t\\r\\n\\f]",M="(?:\\\\\\\\.|[\\\\w-]|[^\\\\x00-\\\\xa0])+",N=M.replace("w","w#"),O="\\\\["+L+"*(\"+M+\"(?:\":\"\\\\\\\\.|[\\\\w-]|[^\\\\x00-\\\\xa0])*\"|\"((?:\\\\\\\\.|[\\\\w-]|[^\\\\x00-\\\\xa0])*\\\\)|(\"+N+\"))*\\\\|((?:\\\\\\\\.|[\\\\w-]|[^\\\\x00-\\\\xa0])*\\\\|\"+O+\"))*\\\\|\\.*)\\\\\\\\|)",Q=new RegExp(L+"+", "g"),R=new RegExp("^"+L+"+((?:^|[\\\\w-])(?:\\\\\\\\.|[\\\\w-]|[^\\\\x00-\\\\xa0])*\\\\|\"+N+\"))*\\\\|((?:\\\\\\\\.|[\\\\w-]|[^\\\\x00-\\\\xa0])*\\\\|\"+O+\"))*\\\\|\\.*)\\\\\\\\|)",S=new RegExp("^"+L+"*", "+L"+"*"),T=new RegExp("^"+L+"*([>+~]|"+L+")"+L+"*" ),U=new RegExp("="+L+"*([\\\\w-]'\\\\)*?"+L+"*\\\\\\\\|", "g"),V=new RegExp(P),W=new RegExp("^"+N+"$"),X={ID:new RegExp("#("+M+")"),CLASS:new RegExp("^\\\\\\.("+M+")"),TAG:new RegExp("^("+M.replace("w","w*")+")"),ATTR:new RegExp("^"+O),PSEUDO:new RegExp("^"+P),CHILD:new RegExp("^:(only|first|last|nth|nth-last)-(child|of-type)(?:\\\\\\\\("+L+"*(even|odd|(([+-]|)(\\\\d*)n|)" +L+"*(?:([+-]|)" +L+"*(\\\\d+) |))"+L+"*\\\\\\\\|)" , "i"),bool:new RegExp("^(?:="+K+")$", "i"),needsContext:new RegExp("^"+L+"*([>+~]|:|(even|odd|eq|gt|lt|nth|first|last)(?:\\\\\\\\("+L+"*((?:-\\\\\\\\d)?\\\\\\\\d*)" +L+"*\\\\\\\\|)" )?(?=[^-]|$)" , "i")},Y=/^(?:input|select|textarea|button)$/i,Z/^h\d$/i,$=/^[^]+\{\s*\[native \w/,_=/^(?:(#([\w-]+)|([\w+)]|\.( [\w-]+))$)/,aa=/[+~]/,ba=/'\\/\\/g,ca=new RegExp("\\\\\\\\([\\\\\\\\da-f]{1,6}" +L+"?|"+L
```

●	200	GET	 bGrylBofXZj.png	fbstatic-a.akamaihd.net	png	9.55 KB
●	200	GET	 ogYrclupeJV.png	fbstatic-a.akamaihd.net	png	0.36 KB
●	200	GET	5le_bKxh8O6.js	fbstatic-a.akamaihd.net	js	2.70 KB
●	200	GET	 CKlzqMErmXn.png	fbstatic-a.akamaihd.net	png	5.03 KB
●	200	GET	 F_YpVPz_DUt.png	fbstatic-a.akamaihd.net	png	6.02 KB
●	200	POST	logging	www.facebook.com	js	0.07 KB
●	200	GET	 log_ticker_render.php?__a=1&__dyn=7nm8RW8B...	pixel.facebook.com	png	0.09 KB
●	200	GET	reconnect.php?__user=756315701&__a=1&__dyn=7n...	www.facebook.com	js	0.97 KB
●	200	POST	/	www.facebook.com	js	0.07 KB
●	200	GET	OK4jK5lyv9v.js	fbstatic-a.akamaihd.net	js	6.08 KB
●	200	GET	 K82nAaNiU-F.gif	fbstatic-a.akamaihd.net	gif	2.35 KB
●	200	GET	 oqLrJBGG3i7.png	fbstatic-a.akamaihd.net	png	42.88 KB
●	200	GET	 gNoma6Fvobm.png	fbstatic-a.akamaihd.net	png	0.77 KB
●	200	GET	 a2H-zWhdTye.png	fbstatic-a.akamaihd.net	png	2.69 KB
●	200	GET	 close.png	www.facebook.com	png	0.17 KB
●	200	GET	 10435119_10152449766045756_2312842984381...	scontent-ord1-1.xx.fbcdn.net	jpeg	4.49 KB
●	200	GET	 11203130_371600326379074_433213524671678...	scontent-ord1-1.xx.fbcdn.net	jpeg	3.52 KB
●	200	GET	 11265319_1628124887400567_68366925280205...	fbcdn-profile-a.akamaihd.net	jpeg	4.96 KB
●	200	GET	 spacer.gif	www.facebook.com	gif	0.05 KB
●	200	GET	 11069618_10205951700378967_2881821541950...	fbcdn-profile-a.akamaihd.net	jpeg	3.06 KB
●	200	GET	 11150381_771001305795_269088363704208318...	fbcdn-profile-a.akamaihd.net	jpeg	2.33 KB

HTTP/2 Attempts to Fix These Problems



Binary protocol

Binary frames

Multiplexed streams

Priorities and dependencies

Header compression

Server push

**Great, Ben.
But how does
it affect me?**



**Mostly seamless for
web developers...**

- No more image sprites
- Inlining images a thing of the past
- CSS/JS can be in multiple files
- Domain sharding is unnecessary (and may reduce performance in HTTP/2)

**Awesome! I'm going to
go do all that right
now!**

Not so fast.

**We're still in an
HTTP/1 world.**

But folks are catching up.

IE	Edge *	Firefox	Chrome	Safari	Opera	iOS Safari *	Opera Mini *	Android Browser *	Chrome for Android
8								4.3	
9			² 45					4.4	
10	² 12	² 42	² 46			8.4		4.4.4	
^{1 2} 11	² 13	² 43	² 47	^{2 3} 9	² 34	² 9.2	8	46	² 47
	² 14	² 44	² 48	^{2 3} 9.1	² 35	² 9.3			
		² 45	² 49		² 36				
		² 46	² 50						

Screenshot from caniuse.com/#search=HTTP2, captured 2016-01-13

- Apache $\geq$ 2.4.17 now ships with mod_http2
- Nginx $\geq$ 1.9.5 has support for HTTP/2
- IIS 10 includes support for HTTP/2

Long Live HTTP/2!



Until HTTP/3

THANK YOU. ANY QUESTIONS?

If you want to talk more, feel free to contact me.

 joinind.in/talk/b68cd

 benramsey.com

 [@ramsey](https://twitter.com/ramsey)

 github.com/ramsey

 ben@benramsey.com

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Ramsey, Ben. "HTTP Is Dead. Long Live HTTP/2!" Ski PHP Conference. Noah's Event Venue, South Jordan, Utah. 14 Jan. 2016. Conference presentation.

LINKS TO RESOURCES

1. *http2 Explained* by Daniel Stenberg, <http://daniel.haxx.se/http2/>
2. HTTP/2 home page, <http://http2.github.io/>
3. HTTP Working Group, <https://httpwg.github.io/>
4. RFC 7230, <https://httpwg.github.io/specs/rfc7230.html>
5. RFC 7231, <https://httpwg.github.io/specs/rfc7231.html>
6. RFC 7232, <https://httpwg.github.io/specs/rfc7232.html>
7. RFC 7233, <https://httpwg.github.io/specs/rfc7233.html>
8. RFC 7234, <https://httpwg.github.io/specs/rfc7234.html>
9. RFC 7235, <https://httpwg.github.io/specs/rfc7235.html>
10. RFC 7540 (HTTP/2), <https://httpwg.github.io/specs/rfc7540.html>

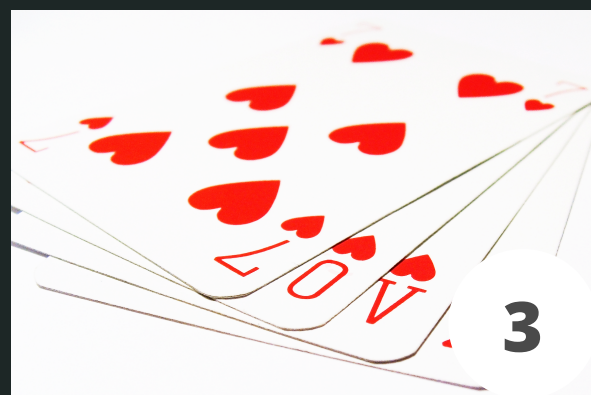


PHOTO CREDITS

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