



深入浅出 HTTP/2



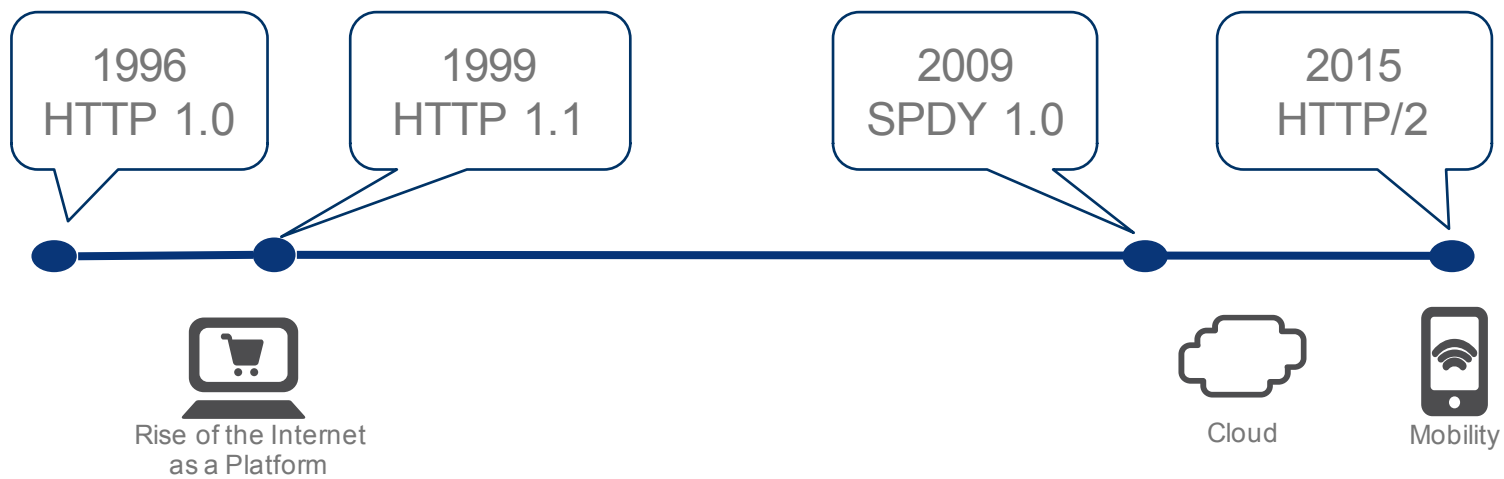
技术咨询: wazhang@akamai.com
400-609-1609



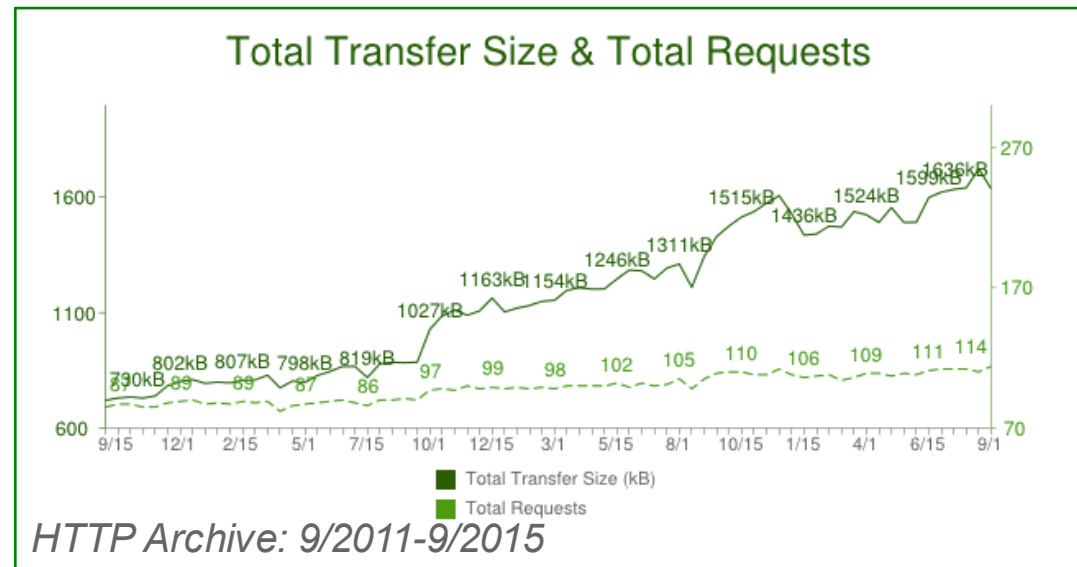
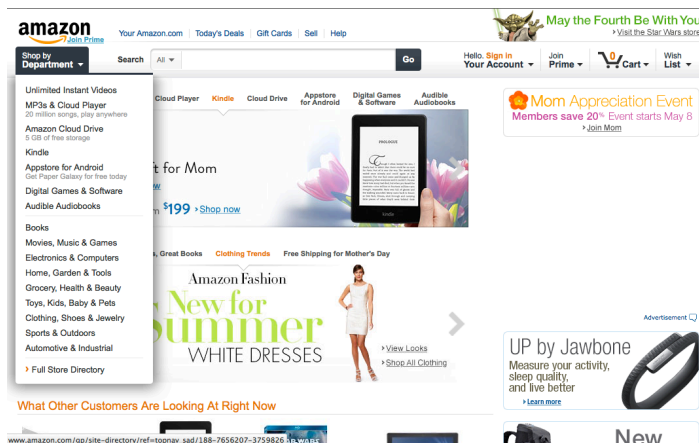
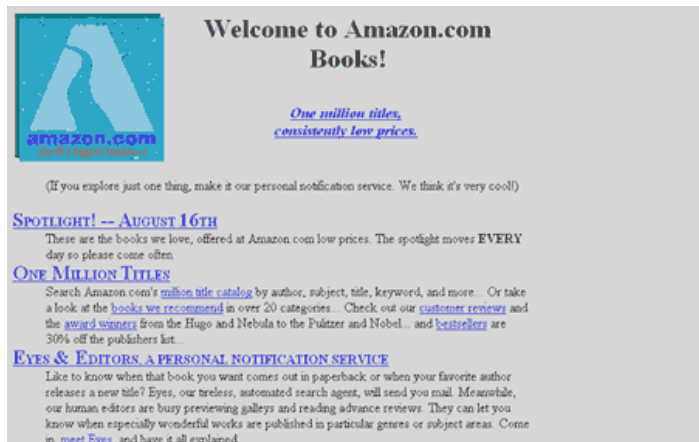
议程

1. HTTP/2 前世今生
2. HTTP/2 最佳实践
3. HTTP/2 未来演进

HTTP协议久未更新



但Web已经发生了巨大的变化



1. More Requests and Bytes
2. Mobile



基于HTTP 1.1如何优化？

精灵图片 - Spriting images

- 。 减少了下载次数和总时延
- 。 预处理复杂，缓存不友好
- 。 需要解码整个大图，消耗CPU和内存资源

```
#navlist {  
  position: relative;  
}
```

```
#navlist li {  
  margin: 0;  
  padding: 0;  
  list-style: none;  
  position: absolute;  
  top: 0;  
}
```

```
#navlist li, #navlist a {  
  height: 44px;  
  display: block;  
}
```

```
#home {  
  left: 0px;  
  width: 46px;  
  background: url('img_navsprites.gif') 0 0;  
}
```

```
#prev {  
  left: 63px;  
  width: 43px;  
  background: url('img_navsprites.gif') -47px 0;  
}
```

```
#next {  
  left: 129px;  
  width: 43px;  
  background: url('img_navsprites.gif') -91px 0;  
}
```



域名碎片 Domain sharding

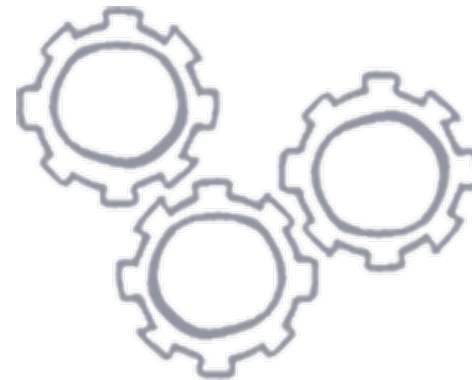
- 突破浏览器建连限制

- 引发拥塞和重传

GET	/	www.aftonbladet.se	html	205.71 KB	→ 32 ms
GET	general.css?57785785	www.aftonbladet.se	css	193.22 KB	→ 10 ms
GET	d-head.js?57785785	www.aftonbladet.se	js	190.40 KB	→ 20 ms
GET	aftonbladet.gif	gfx.aftonbladet-cdn.se	gif	6.33 KB	→ 44 ms
GET	sanna_lundell_white.jpg	gfx.aftonbladet-cdn.se	jpeg	3.01 KB	→ 44 ms
GET	pappa01.jpg	gfx2.aftonbladet-cdn.se	jpeg	18.66 KB	→ 228 ms
GET	forskare.jpg	gfx.aftonbladet-cdn.se	jpeg	6.88 KB	→ 44 ms
GET	story26jan.jpg	gfx.aftonbladet-cdn.se	jpeg	2.66 KB	→ 45 ms
GET	osbalk.jpg	gfx2.aftonbladet-cdn.se	jpeg	4.11 KB	→ 238 ms
GET	Bank.jpg	gfx2.aftonbladet-cdn.se	jpeg	16.09 KB	→ 247 ms
GET	Tatu.JPG	gfx.aftonbladet-cdn.se	jpeg	7.38 KB	→ 44 ms
GET	sve8.jpg	gfx.aftonbladet-cdn.se	jpeg	7.39 KB	→ 45 ms
GET	otto-tvaa.jpg	gfx.aftonbladet-cdn.se	jpeg	6.71 KB	→ 46 ms
GET	AStridTT.JPG	gfx.aftonbladet-cdn.se	jpeg	6.52 KB	→ 66 ms
GET	nimoy.jpg	gfx.aftonbladet-cdn.se	jpeg	7.87 KB	→ 67 ms
GET	PSYK0\$.jpg	gfx2.aftonbladet-cdn.se	jpeg	18.28 KB	→ 257 ms
GET	parislgh.jpg	gfx2.aftonbladet-cdn.se	jpeg	21.89 KB	→ 267 ms
GET	ProjectRunwayvinnare.jpg	gfx2.aftonbladet-cdn.se	jpeg	7.83 KB	→ 276 ms
GET	par_strand-opt.jpg	gfx2.aftonbladet-cdn.se	jpeg	5.72 KB	→ 286 ms
GET	mack.jpg	gfx2.aftonbladet-cdn.se	jpeg	16.27 KB	→ 299 ms
GET	skildaVpuffmitt.jpg	gfx1.aftonbladet-cdn.se	jpeg	4.49 KB	→ 144 ms
GET	socket_ny.jpg	gfx1.aftonbladet-cdn.se	jpeg	3.79 KB	→ 153 ms
GET	andreetta.jpg	gfx1.aftonbladet-cdn.se	jpeg	5.53 KB	→ 163 ms
GET	skidor_50.gif	gfx.aftonbladet-cdn.se	gif	3.20 KB	→ 70 ms

文件合并 - Concatenating files (JavaScript, CSS)

- 。减少下载次数和总时延
- 。破坏模块化设计、缓存不友好
- 。拖慢运行速度



资源内连 - Resource inlining

- 减少小文件的请求次数
- 难以维护、无法缓存
- Base64编码有33% overhead

For example, if the HTML document looks like this:

```
<html>
<head>
  <link rel="stylesheet" href="small.css">
</head>
<body>
  <div class="blue yellow big bold">
    Hello, world!
  </div>
</body>
</html>
```

And the resource `small.css` is like this:

```
.yellow {background-color: yellow;}
.blue {color: blue;}
.big { font-size: 8em; }
.bold { font-weight: bold; }
```

Then PageSpeed Service will rewrite it to:

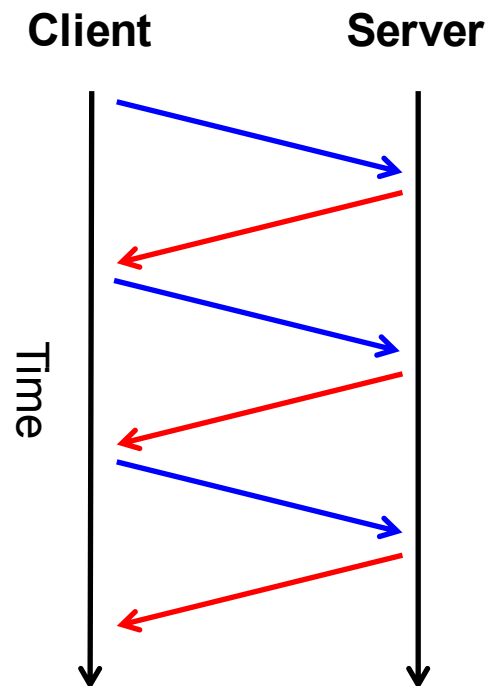
```
<html>
<head>
  <style>
    .yellow {background-color: yellow;}
    .blue {color: blue;}
    .big { font-size: 8em; }
    .bold { font-weight: bold; }
  </style>
</head>
<body>
  <div class="blue yellow big bold">
    Hello, world!
  </div>
</body>
</html>
```



为什么要尽量减少HTTP请求？

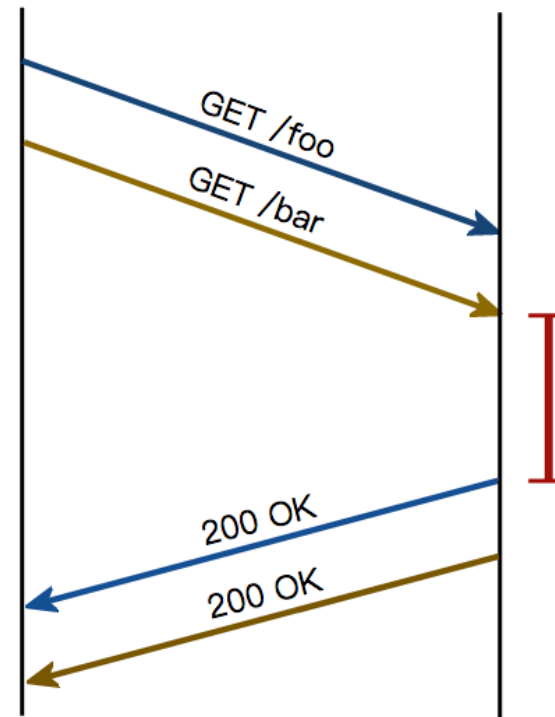
无法多路复用

No multiplexing

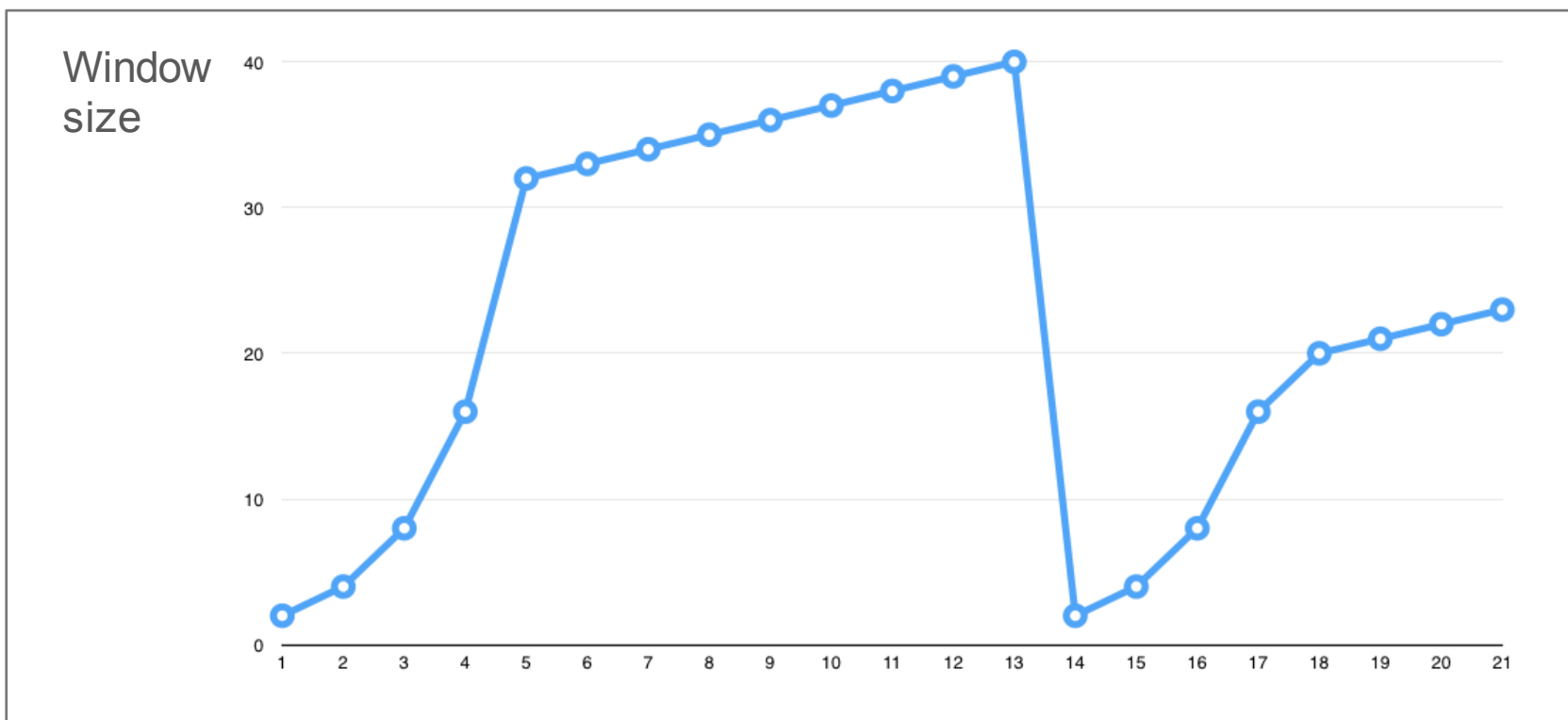


线头阻塞 – Head of line blocking

即使利用流水线技术，一个过大或过慢的响应依然会阻塞其他响应



TCP慢启动



HTTP1.1不能有效使用TCP

HTTP请求：持续时间短、瞬间峰值

TCP：更适用于长久连接

HTTP包头

Cookie, JSON API等越来越大

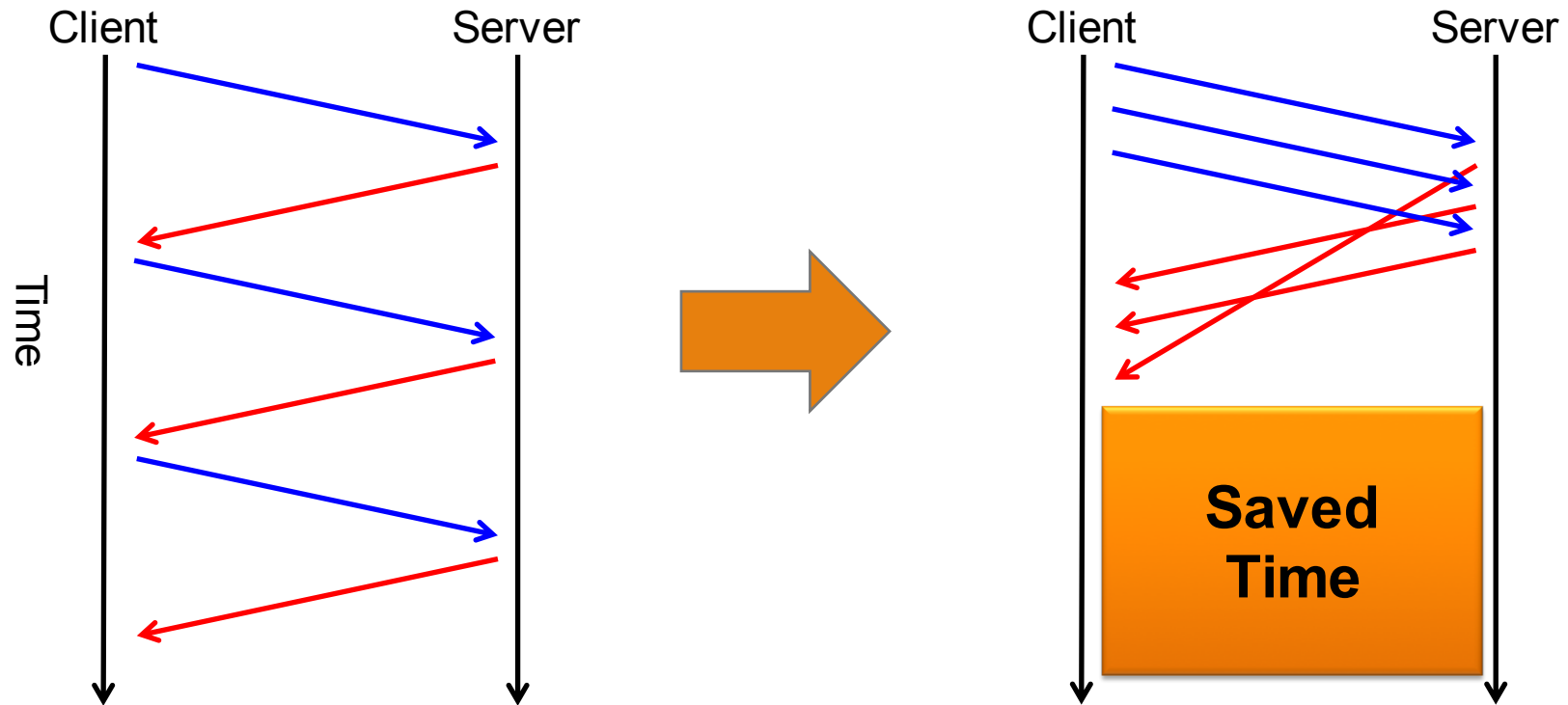
冗余重复信息很多



HTTP/2如何解决上述问题？

- 多路复用 – Multiplexing
- 头压缩 - Header Compression
- 服务器推送 - Server Push
- 优先级和流控 - Prioritization & Flow Control

多路复用-Multiplexing



HTTP 1.1

vs

HTTP 2



Client

Hello

Hello

May I have a picture of a house please.

Here is the house

May I also have a picture of a car.

Here is the car

May I also have a picture of a dog.

Here is the dog

Thanks, bye

Bye



Apps



Client

Hello

Hello

May I have a picture of a house please.

And a car

And a dog

Here is the house

Here is the car

And a cat

Here is the dog

Here is the cat

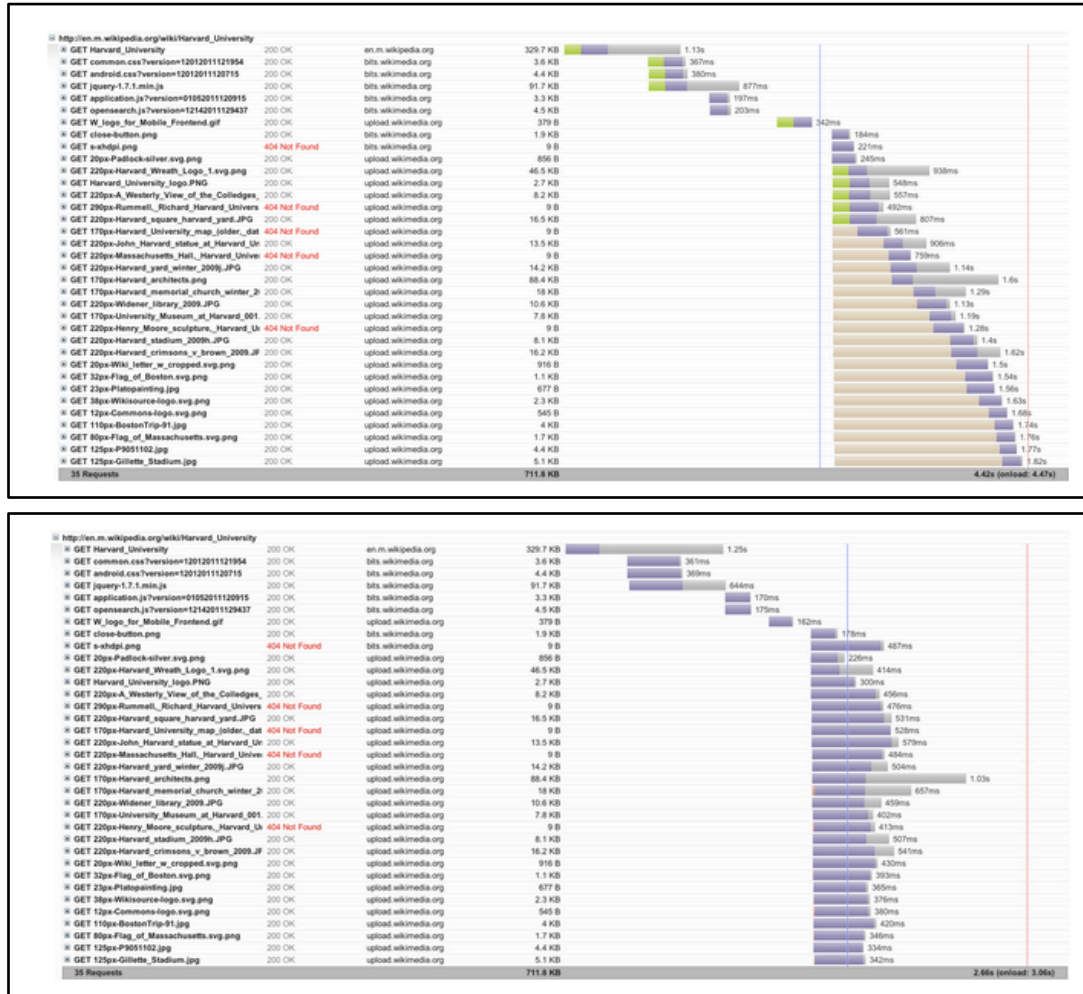
Thanks, bye

Bye

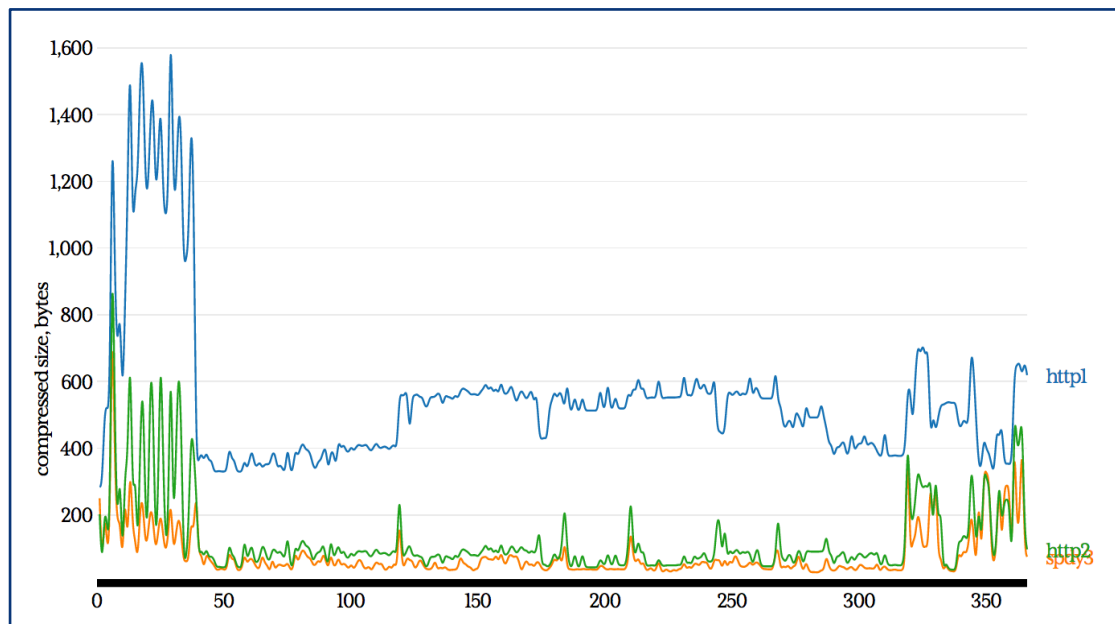


Apps

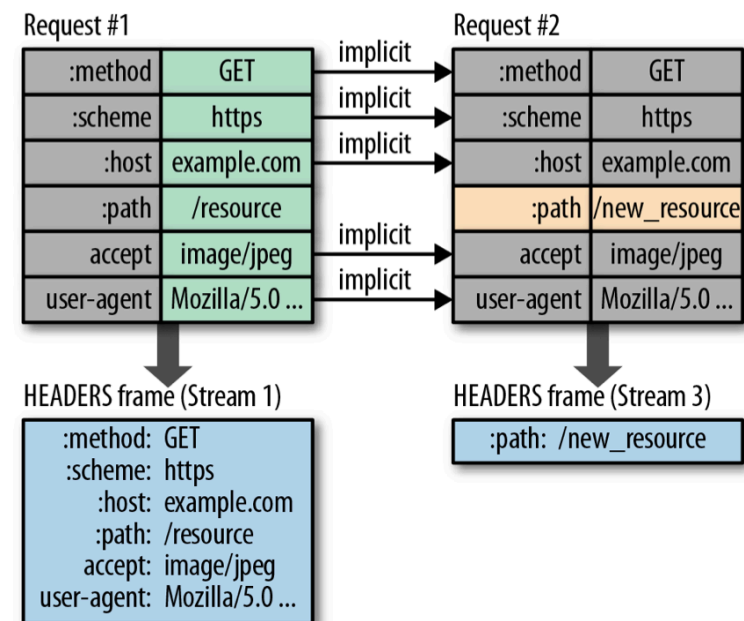
多路复用效果



头压缩-Header Compression



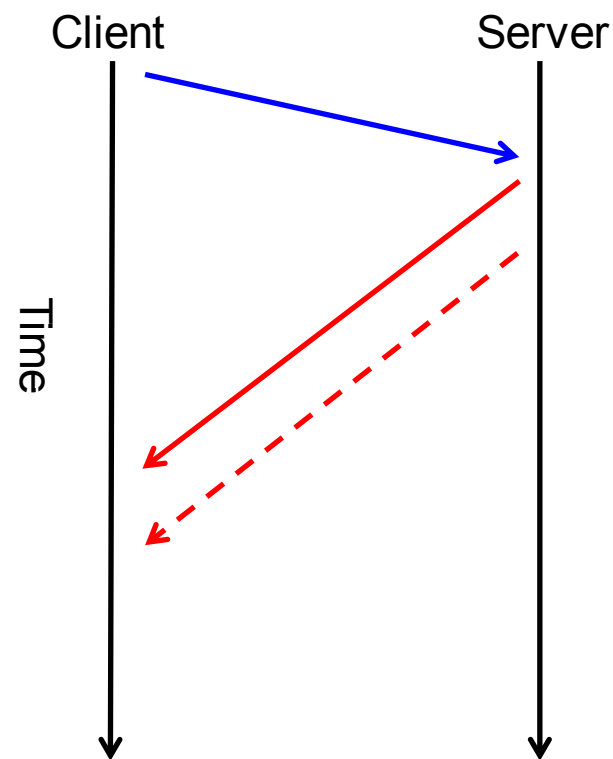
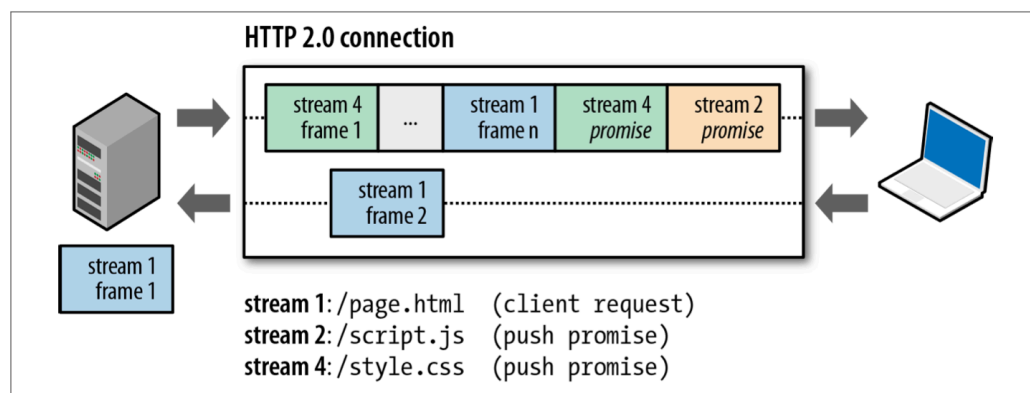
HPACK



服务端推送 - Server Push

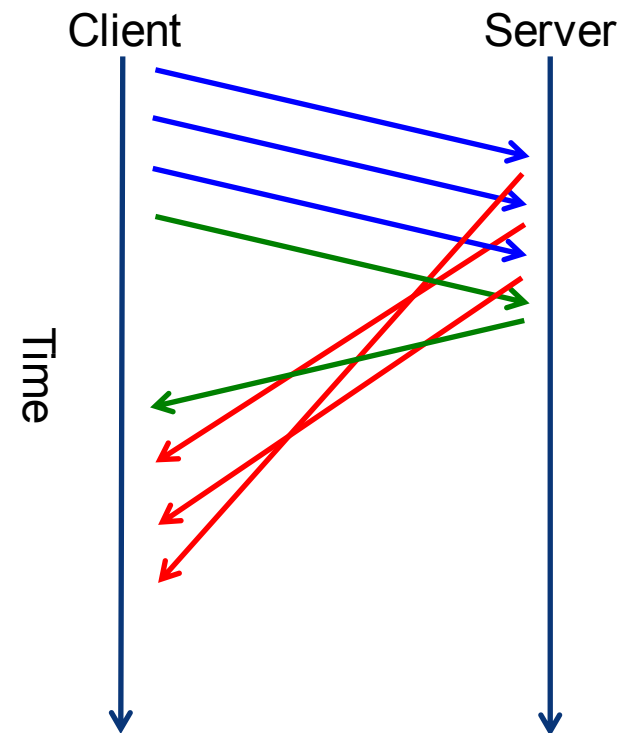
服务端可以在客户端请求前主动下发资源

Example: Prefetching



优先级和流控-Prioritization & Flow Control

- 可以指定不同流的优先级和依赖关系
- 优先加载重要资源，加快渲染速度





HTTP/2速度提升10-25%

HTTP/2 的兼容性

HTTP2向下兼容

HTTP/2 与 HTTP 1.1语义相同

浏览器支持情况

HTTP/2 protocol - OTHER

Global

76.17% + 5.19% = 81.36%

Networking protocol for low-latency transport of content over the web. Originally started out from the SPDY protocol, now standardized as HTTP version 2.

Current aligned		Usage relative		Date relative		Show all									
IE		Edge *		Firefox		Chrome		Chrome 49		Opera Mini *		Android Browser *		Chrome for Android	
								Support info		Browser version					
						2 49		✓ Supported		Released Mar 3, 2016					
						2 4 56		Notes		Usage					
						2 4 57		2 Only supports HTTP2 over TLS (https)		Global: 1.21%					
1 2 11		2 14		2 52		2 4 58		2 3 10.1		2 4 44		2 10.3		all	
				2 54		2 4 59		2 3 TP		2 4 45					
				2 55		2 4 60				2 4 46					
				2 56		2 4 61									

Notes Known issues (0) Resources (6) Feedback

See also support for the SPDY protocol, precursor of HTTP2.

1 Partial support in IE11 refers to being limited to Windows 10.

2 Only supports HTTP2 over TLS (https)

3 Partial support in Safari refers to being limited to OSX 10.11+

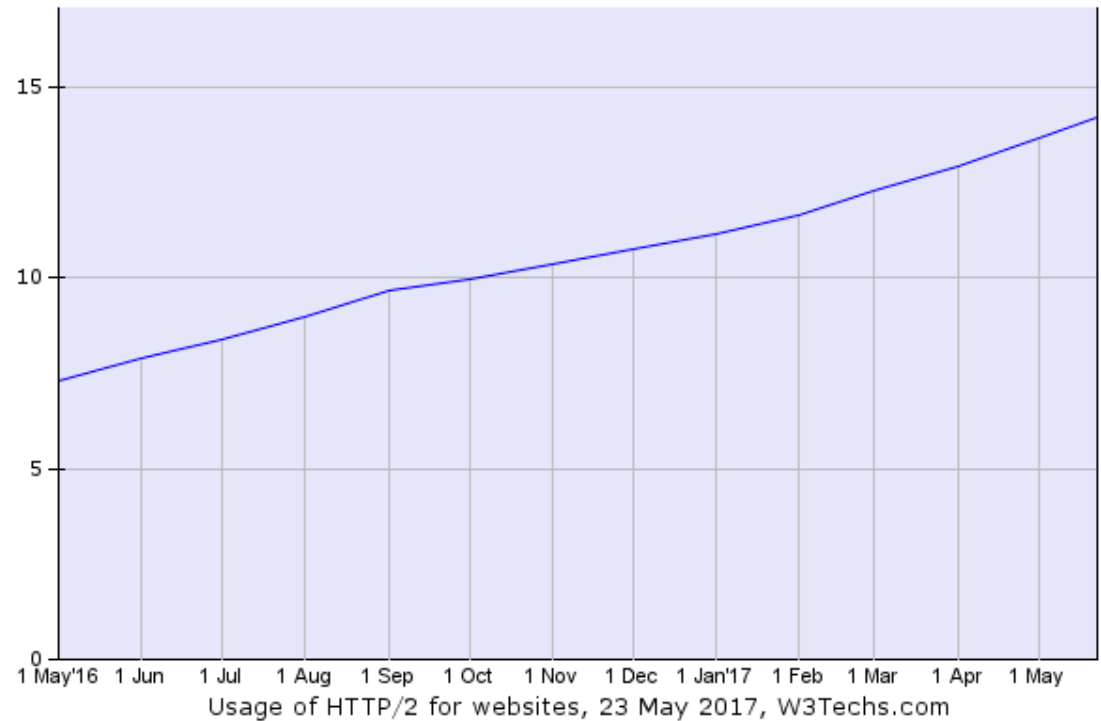
4 Only supports HTTP2 if servers support protocol negotiation via ALPN

HTTP/2使用统计– Alexa Top 10Million

Overall	14.2%
top 1,000,000	18.0%
top 100,000	23.3%
top 10,000	26.5%
top 1,000	29.5%
W3Techs.com, 23 May 2017	
Percentages of websites using HTTP/2 broken down by ranking	

Popular sites using HTTP/2

- Google.com
- Youtube.com
- Facebook.com
- Wikipedia.org
- Yahoo.com
- Google.co.in
- Google.co.jp
- Vk.com
- Sohu.com
- Twitter.com



如何让我的站点支持HTTP2?

- 改造源站：升级Apache, NGINX到新版本
- 不改造源站：利用CDN来支持HTTP2

HTTP2的未来演进

TLS/1.3

基于UDP而非TCP，如QUIC(Quick UDP Internet Connections)

HTTP/3



Q & A

