

# QCon

全球软件开发大会【上海站】

## 从HTTP2到QUIC ——QQ空间Web加速实践

黄佳琳 (yippeehuang)



# 极客时间

重拾极客精神 · 提升技术认知

每天10分钟,邀请顶级技术专家,为你传道授业解惑。



扫一扫,试读专栏



主办方 **Geekbang**  **InfoQ**  
极客邦科技

# ArchSummit

全球架构师峰会 2017

12月8-9日 北京·国际会议中心





APSEC 2017



Geekbang  
极客邦科技

InfoQ

# APSEC 2017

24th Asia-Pacific Software Engineering Conference  
4-8 December 2017, Nanjing, Jiangsu, China

12月4-8日  
中国南京



了解详情



# AiCon

全球人工智能技术大会 2018

## 助力人工智能落地

2018.1.13 - 1.14 北京国际会议中心



扫描关注大会官网



# 个人介绍



#黄佳琳#



#QQ空间#

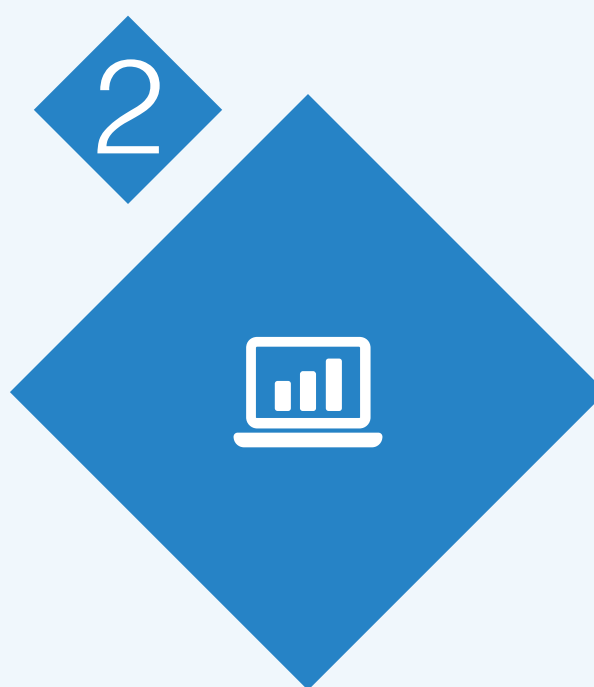


#前端开发#

# 目录



Web现状



协议演变



最佳实践





# PART 1

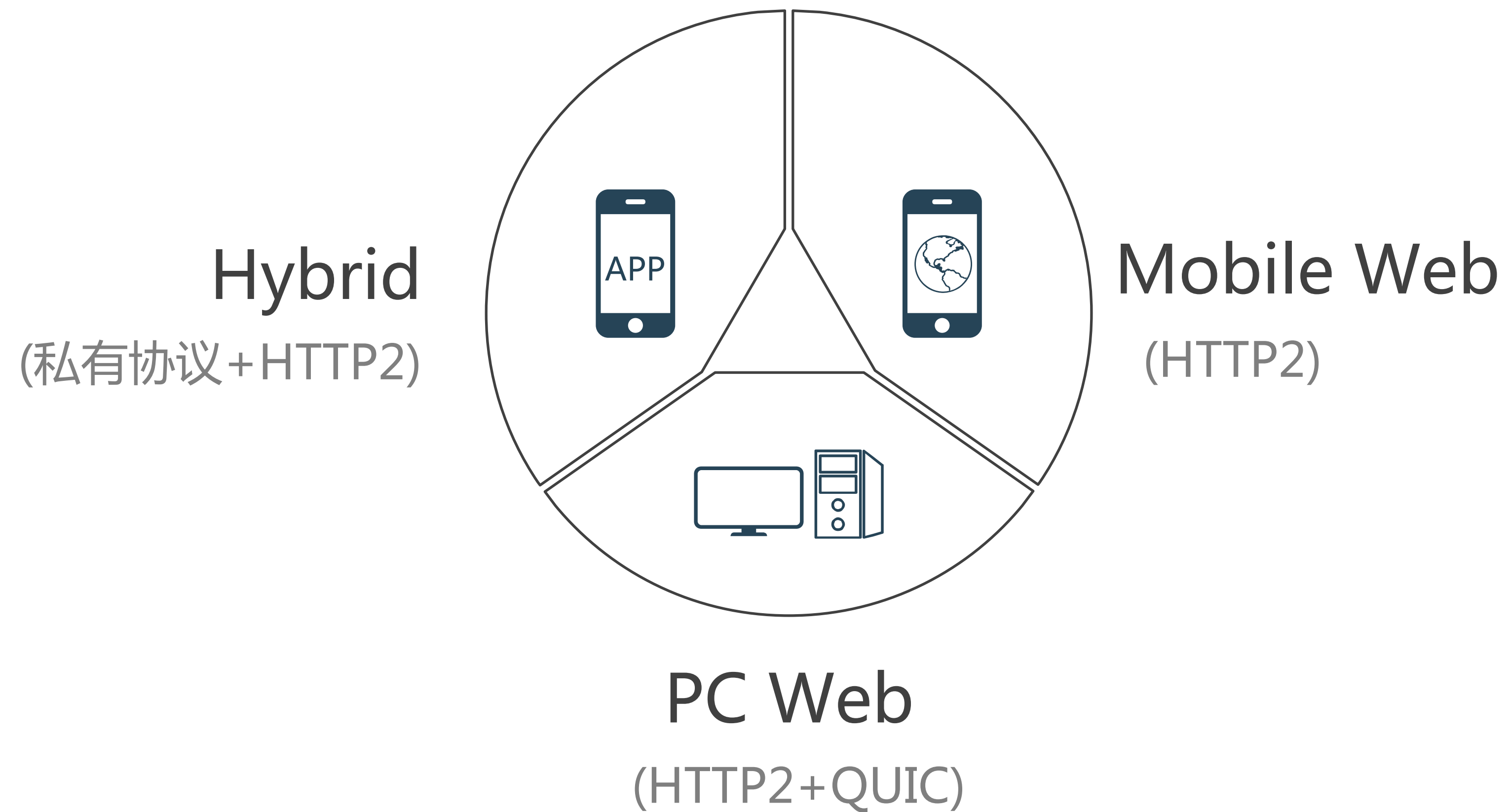
## QQ空间WEB现状

---

QQ空间Web主要有三种场景，对于不同的场景  
我们采用了不同的协议



# QQ空间Web现状







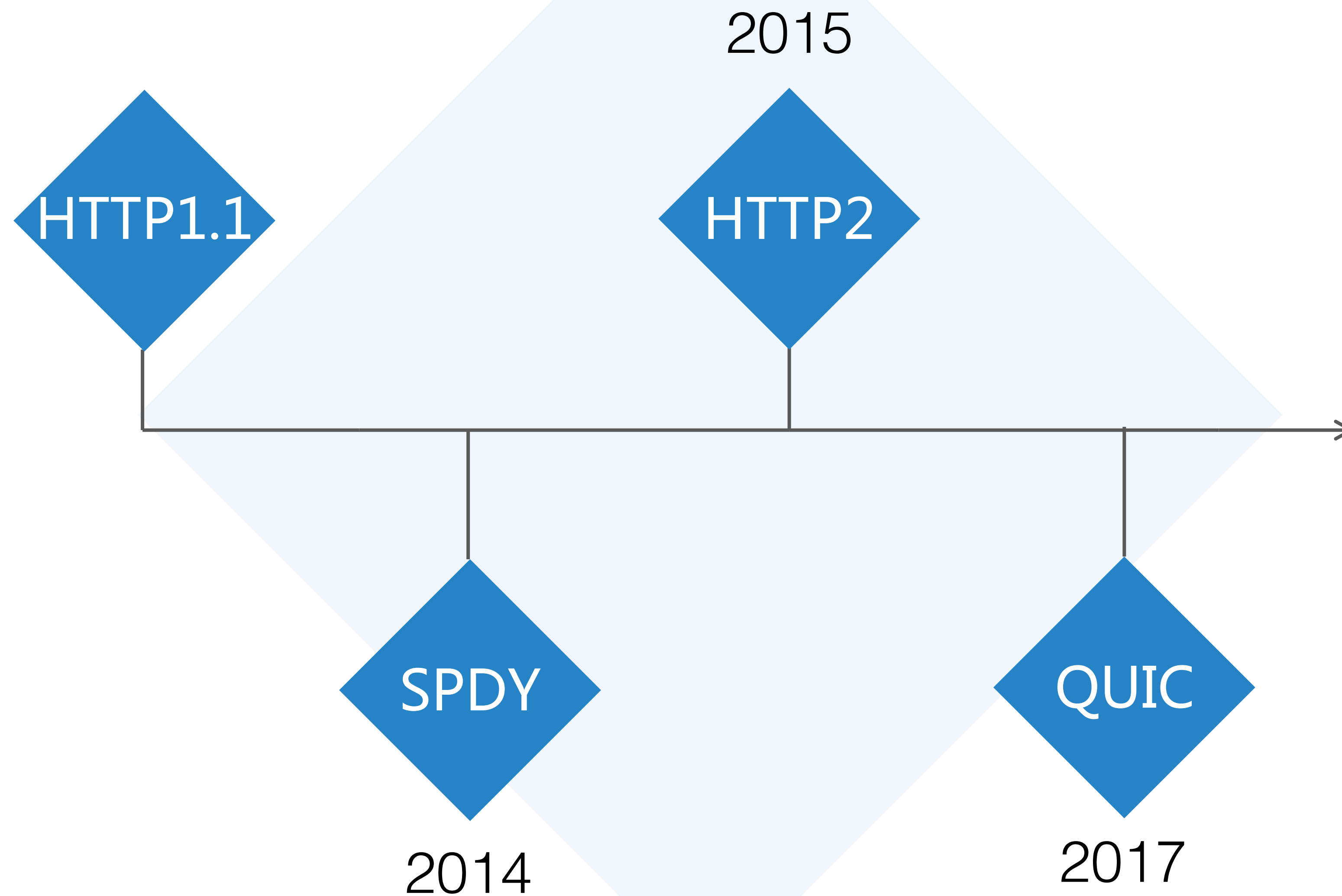
# PART 2

## 协议演变

详细分析HTTP2和QUIC协议的原理  
和实践数据

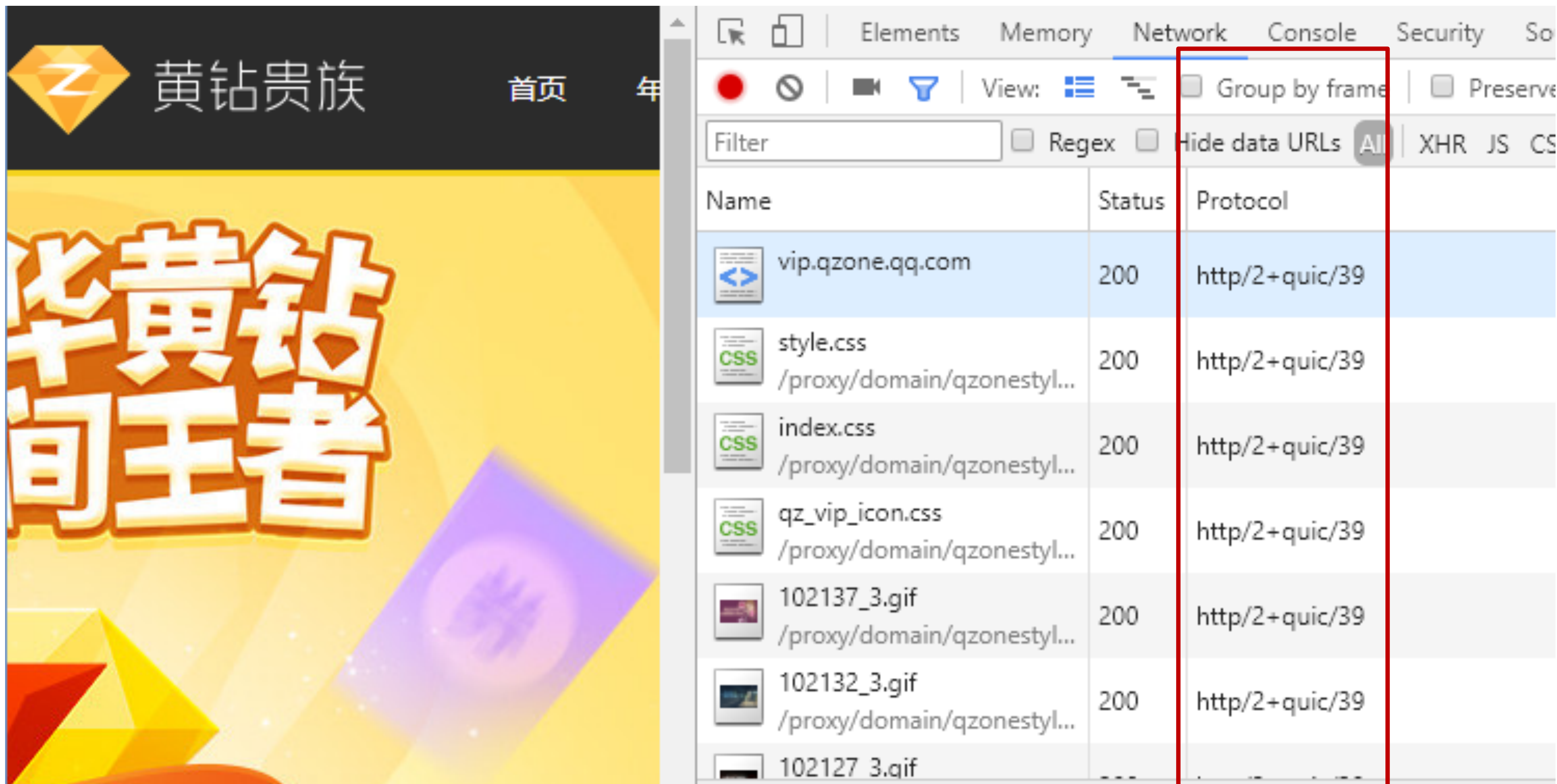


# 协议演变

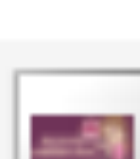
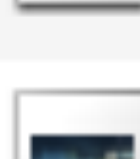




# 协议演变

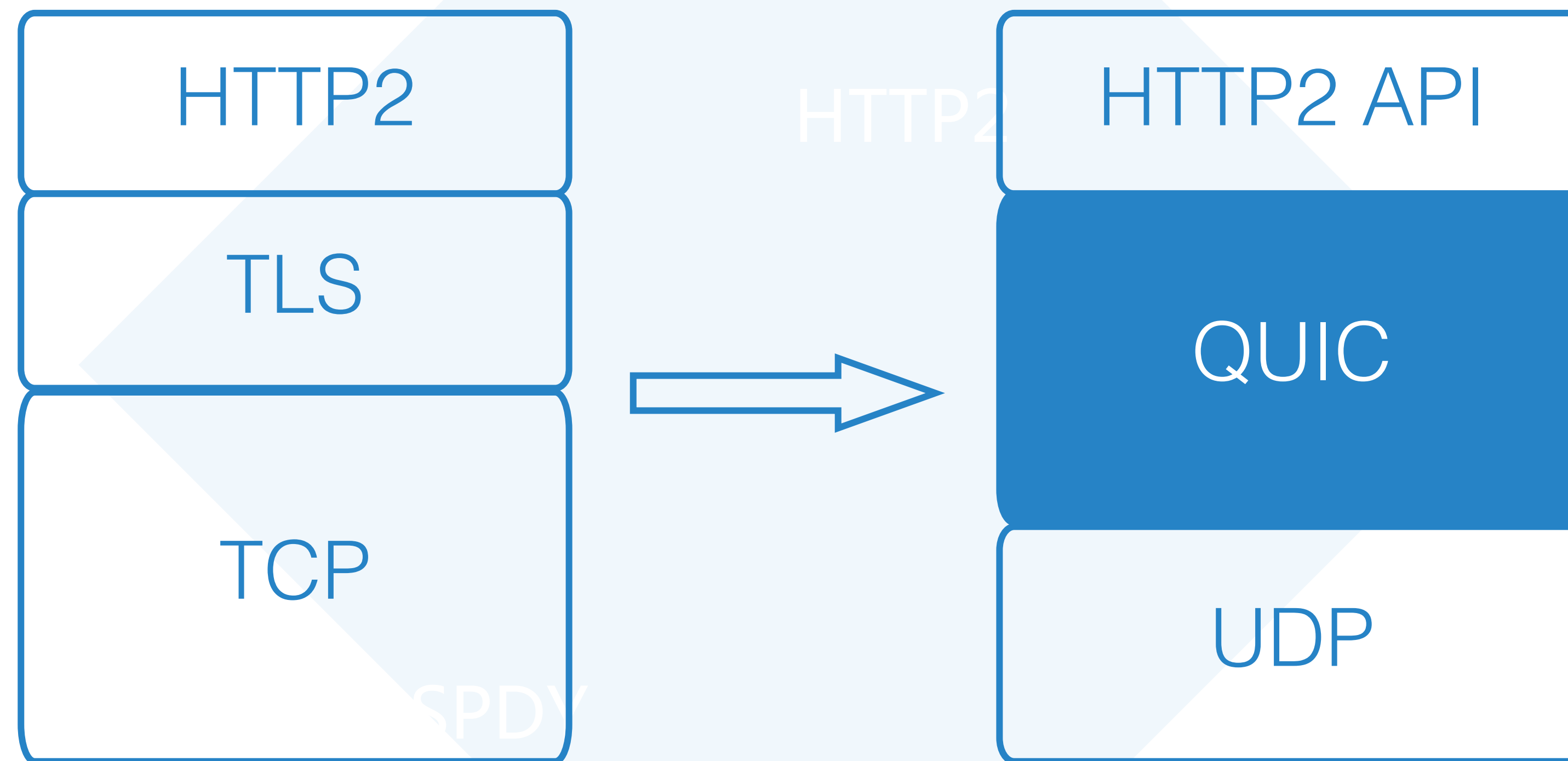


The screenshot shows a web browser displaying a page with a yellow header and a large yellow banner. The banner contains the text "黄钻贵族" and "黄钻王者". To the right, the Network tab of the browser's developer tools is open, showing a list of network requests. A red box highlights the 'Protocol' column, which shows 'http/2+quic/39' for all requests.

| Name                                                                                                                                | Status | Protocol       |
|-------------------------------------------------------------------------------------------------------------------------------------|--------|----------------|
|  vip.qzone.qq.com                                | 200    | http/2+quic/39 |
|  style.css<br>/proxy/domain/qzonestyl...         | 200    | http/2+quic/39 |
|  index.css<br>/proxy/domain/qzonestyl...       | 200    | http/2+quic/39 |
|  qz_vip_icon.css<br>/proxy/domain/qzonestyl... | 200    | http/2+quic/39 |
|  102137_3.gif<br>/proxy/domain/qzonestyl...    | 200    | http/2+quic/39 |
|  102132_3.gif<br>/proxy/domain/qzonestyl...    | 200    | http/2+quic/39 |
|  102127_3.gif                                  | ...    | ...            |

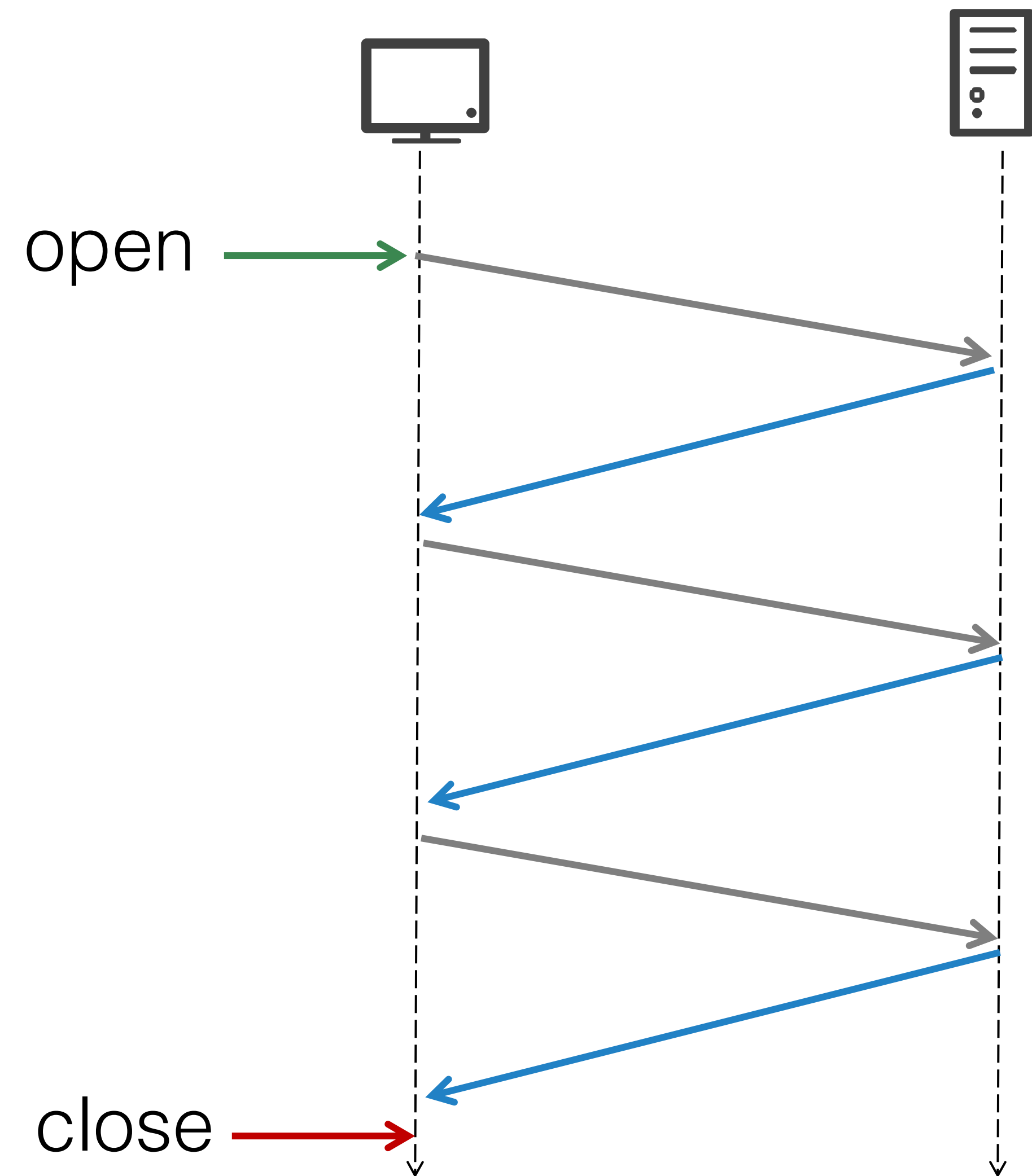
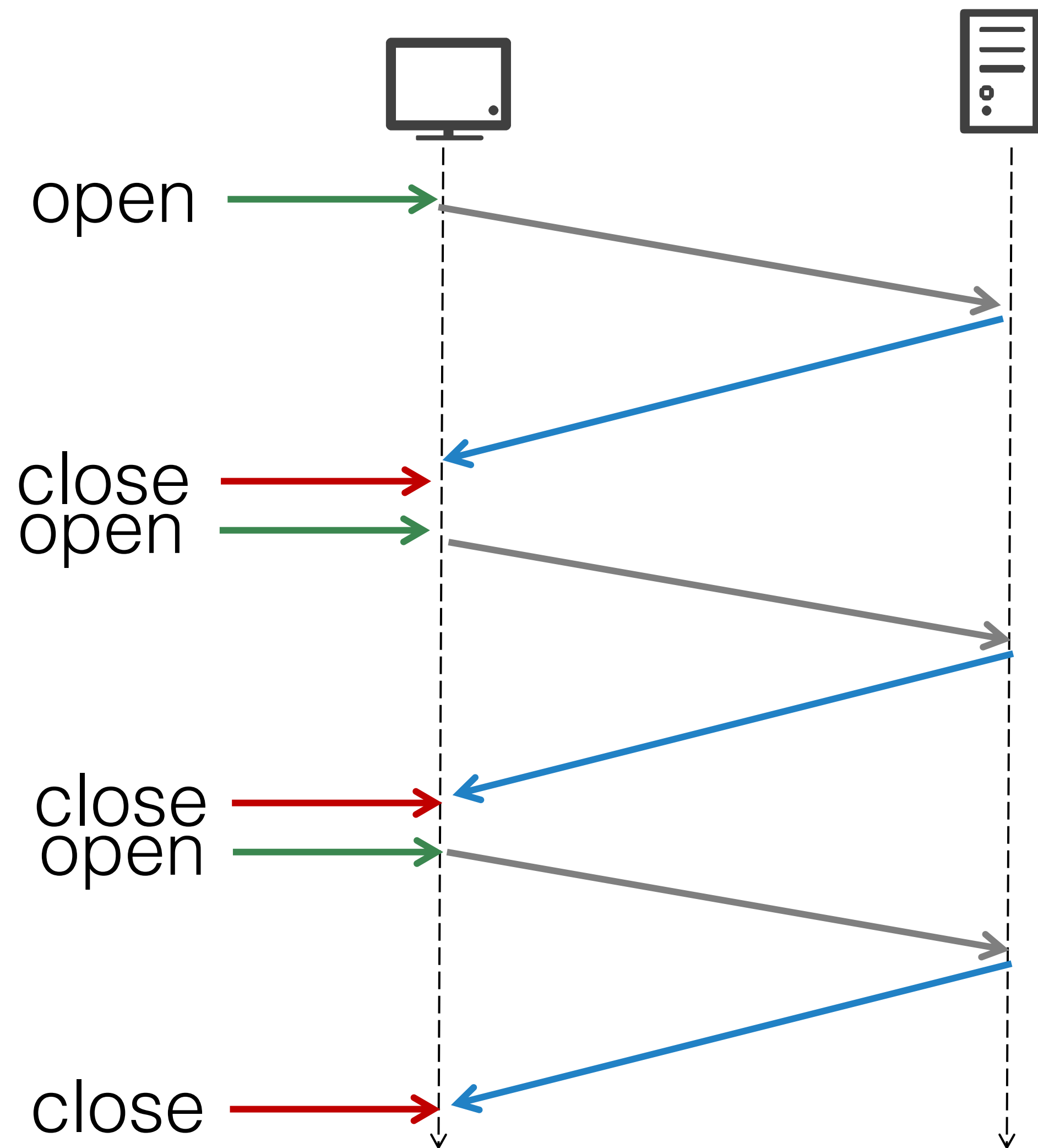


# 协议演变



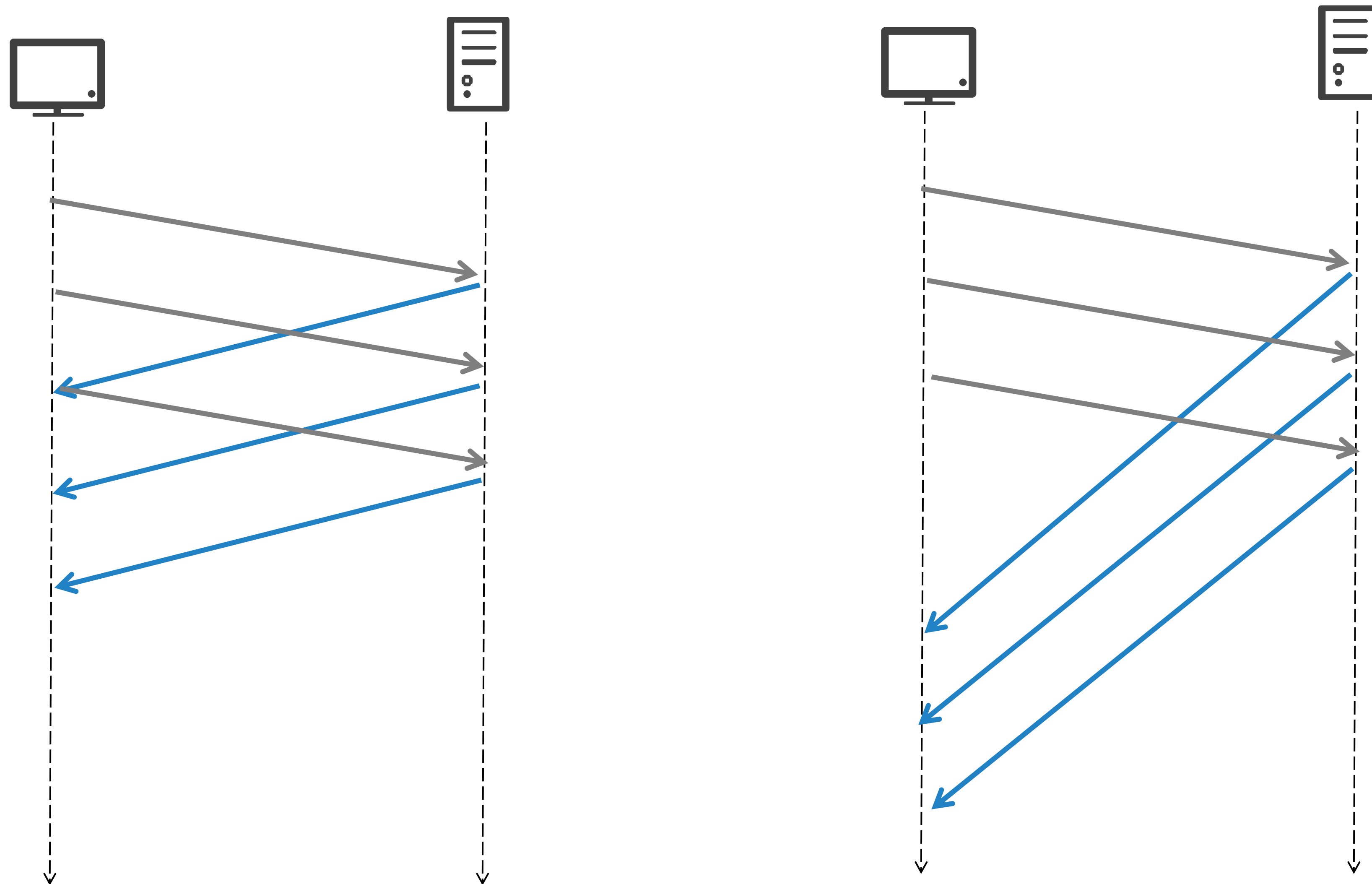


# HTTP2原理简述——多路复用



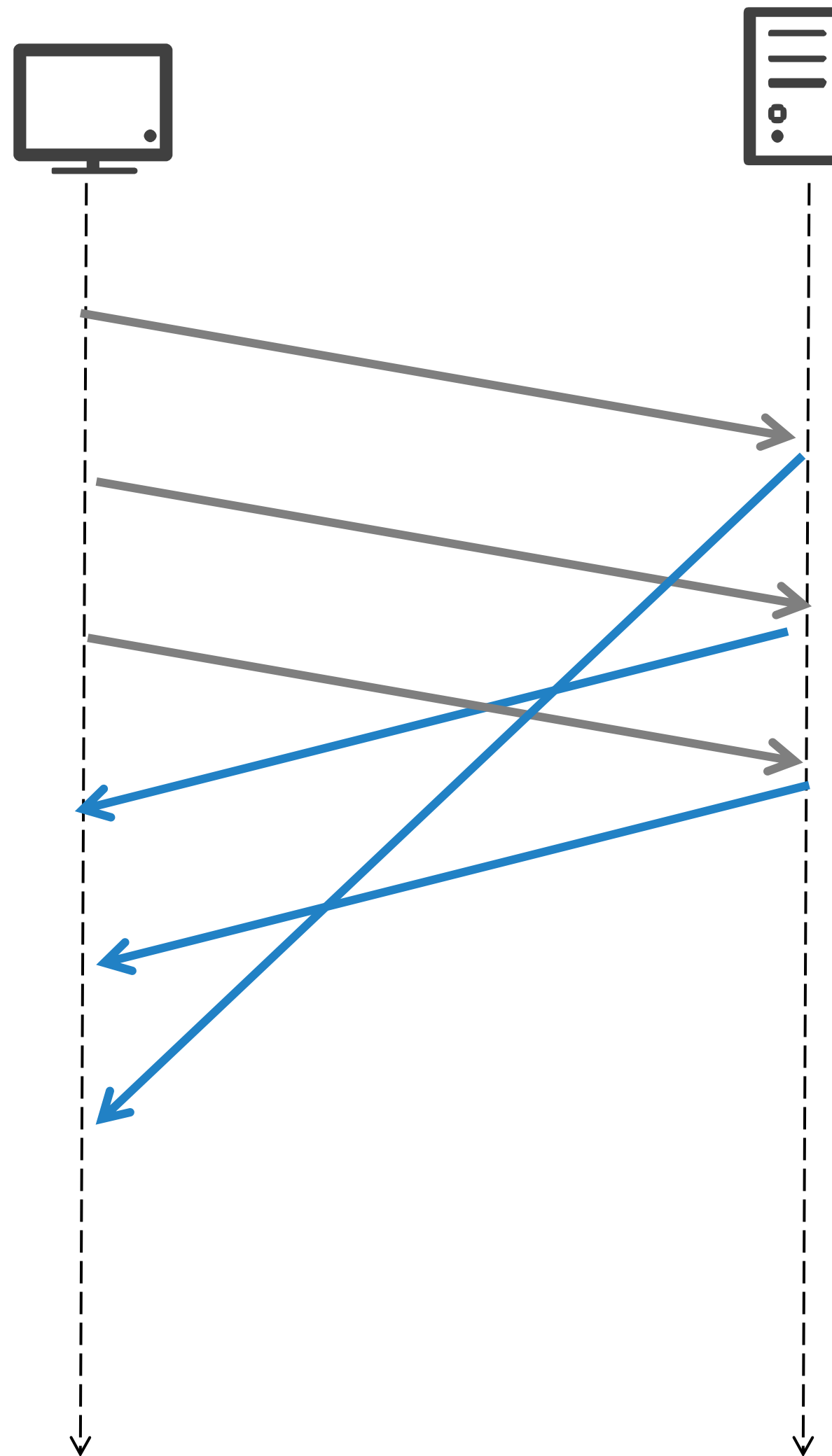


# HTTP2原理简述——多路复用

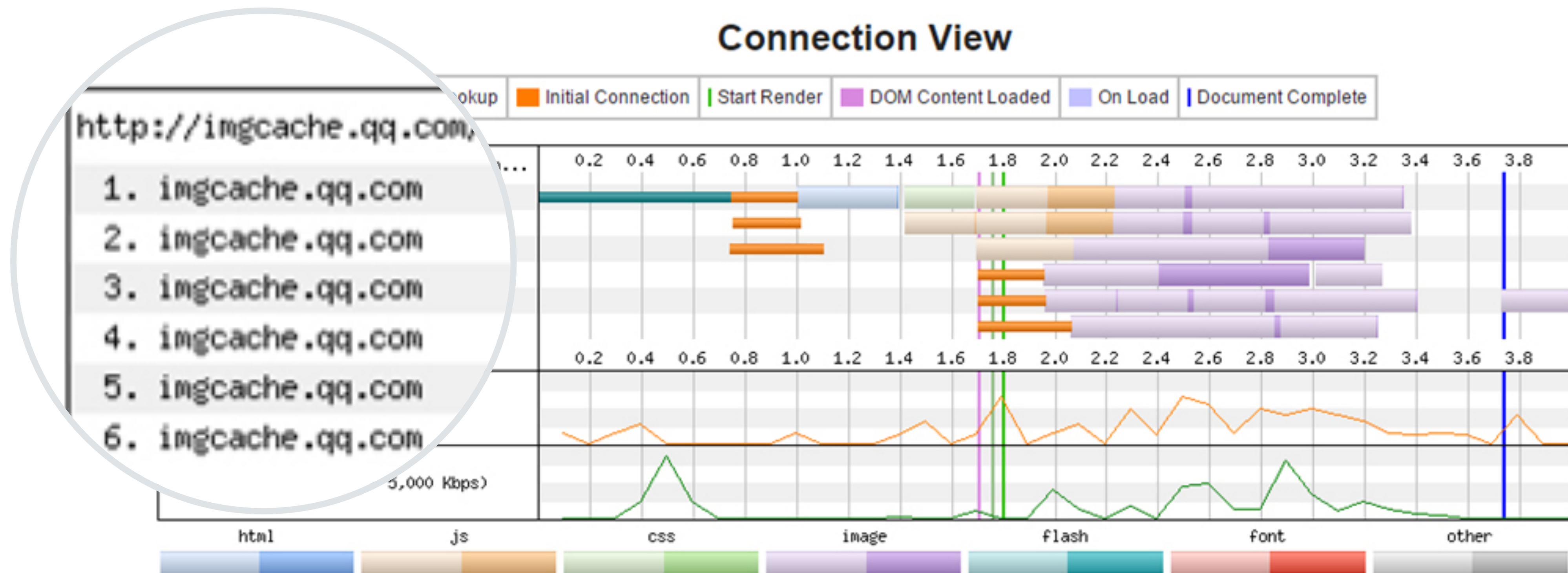




# HTTP2原理简述——多路复用



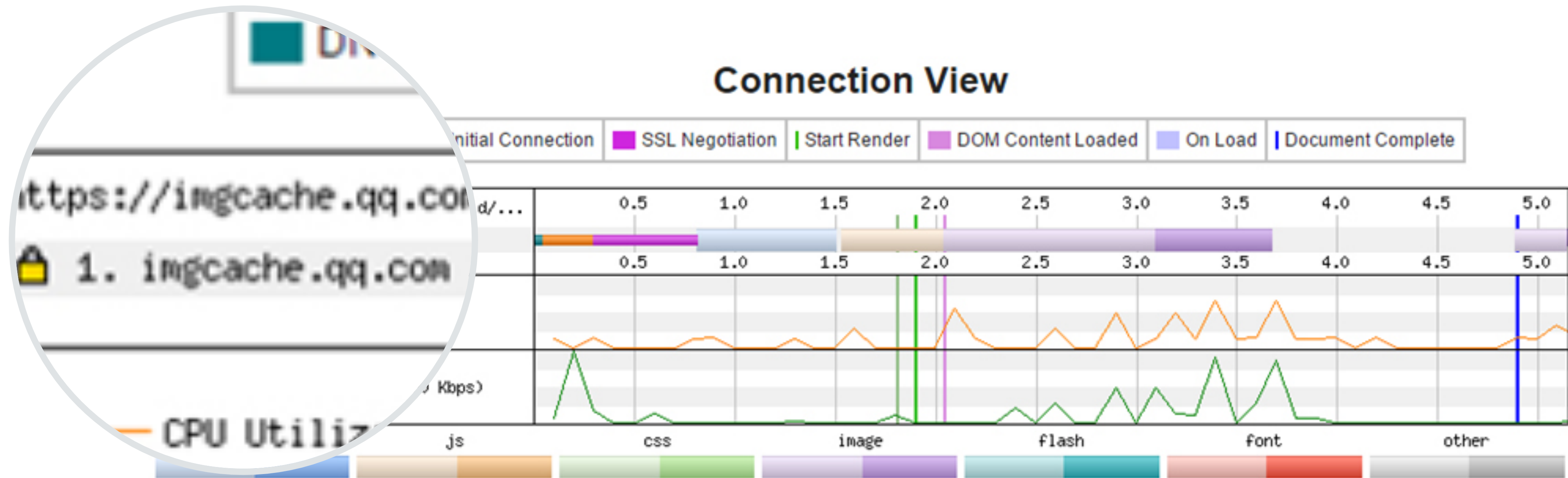
# HTTP2原理简述——多路复用



<http://www.webpagetest.org/>

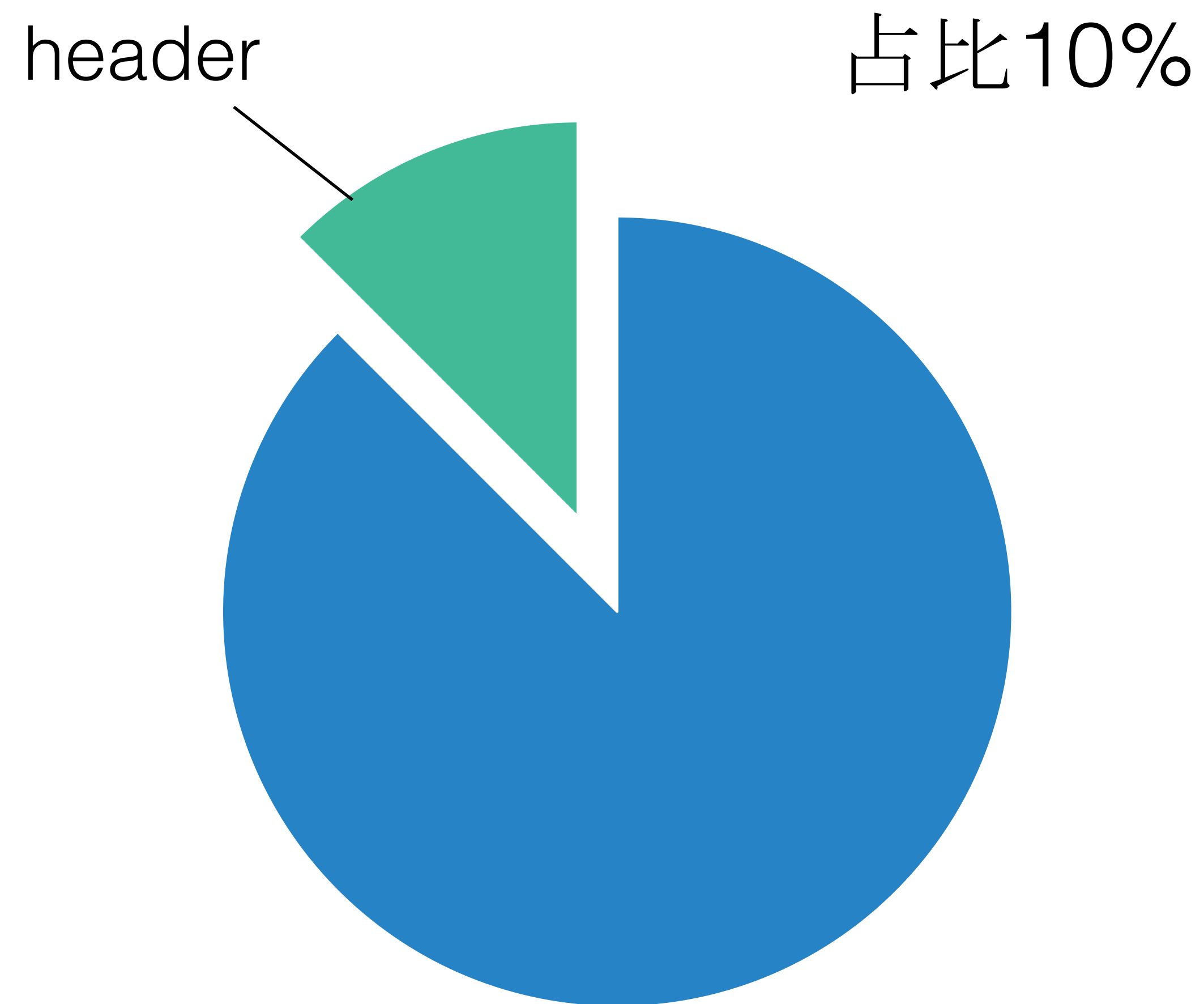


# HTTP2原理简述——多路复用



<http://www.webpagetest.org/>

# HTTP2原理简述——头部压缩





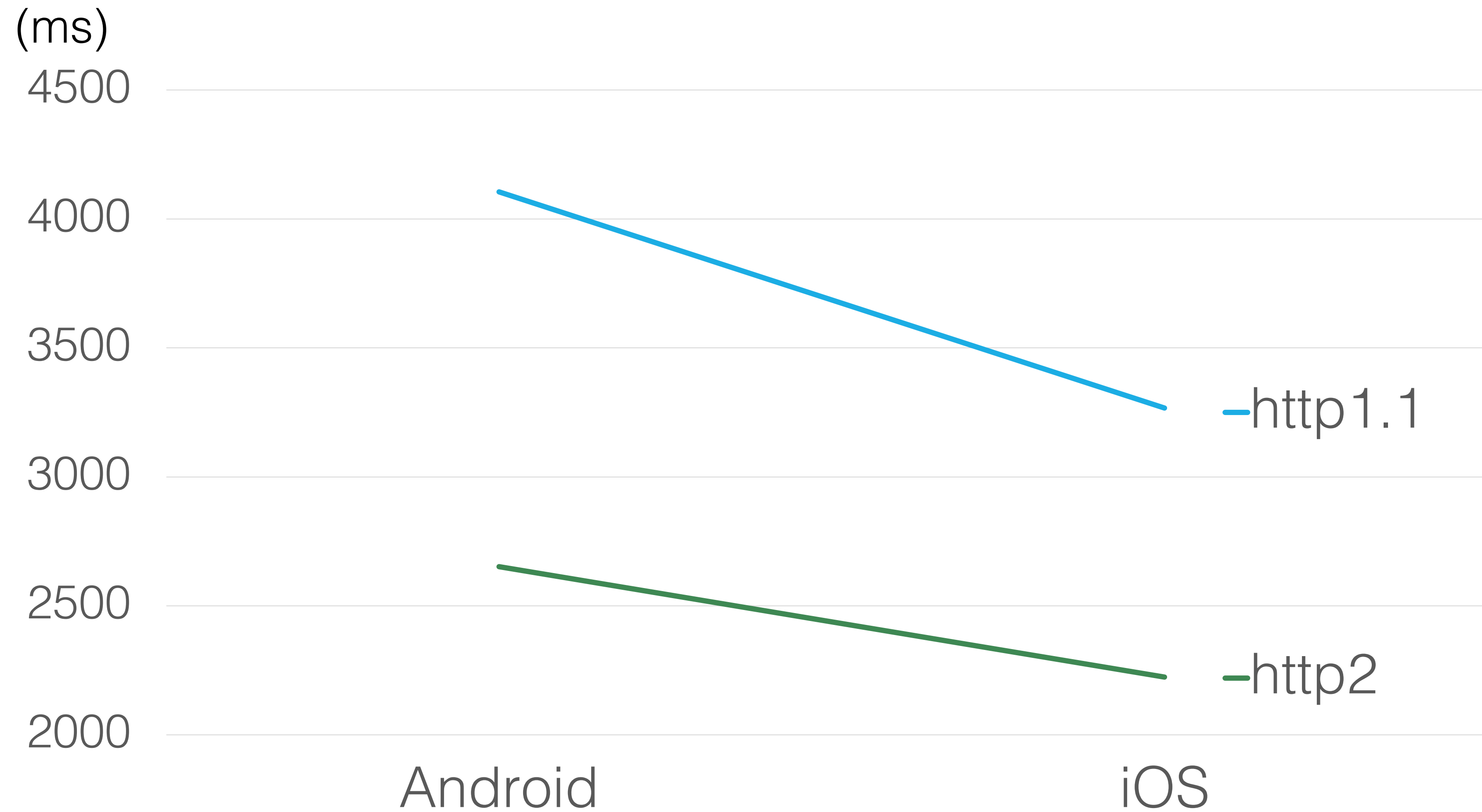
# HTTP2原理简述——头部压缩

减少60%

| Name<br>Path                                                                                                                                              | Method | Status<br>Text | Protocol | Type     | Initiator | Size<br>Content |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------|----------|----------|-----------|-----------------|
|  w.cgi?releaseversion=null&apn=null&touin=99785763&...<br>/wspeed.qq.com | GET    | 200            | h2       | document | Other     | 43 B<br>0 B     |

| Name<br>Path                                                                                                                                                | Method | Status<br>Text | Protocol | Type     | Initiator | Size<br>Content |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------|----------|----------|-----------|-----------------|
|  w.cgi?releaseversion=null&apn=null&touin=99785763&...<br>/wspeed.qq.com | GET    | 200<br>OK      | http/1.1 | document | Other     | 113 B<br>0 B    |

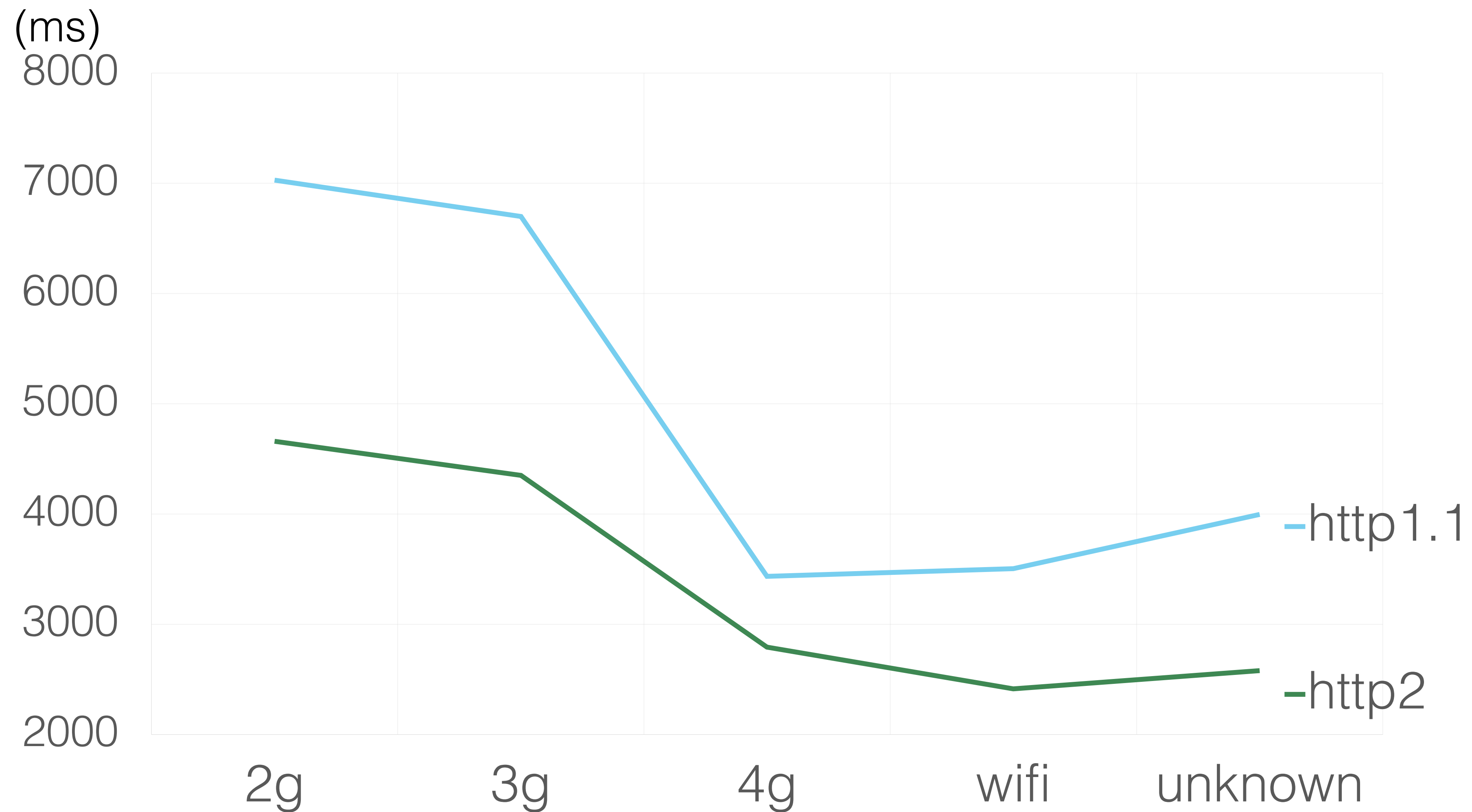
# HTTP 2 性能数据



不同操作系统对比

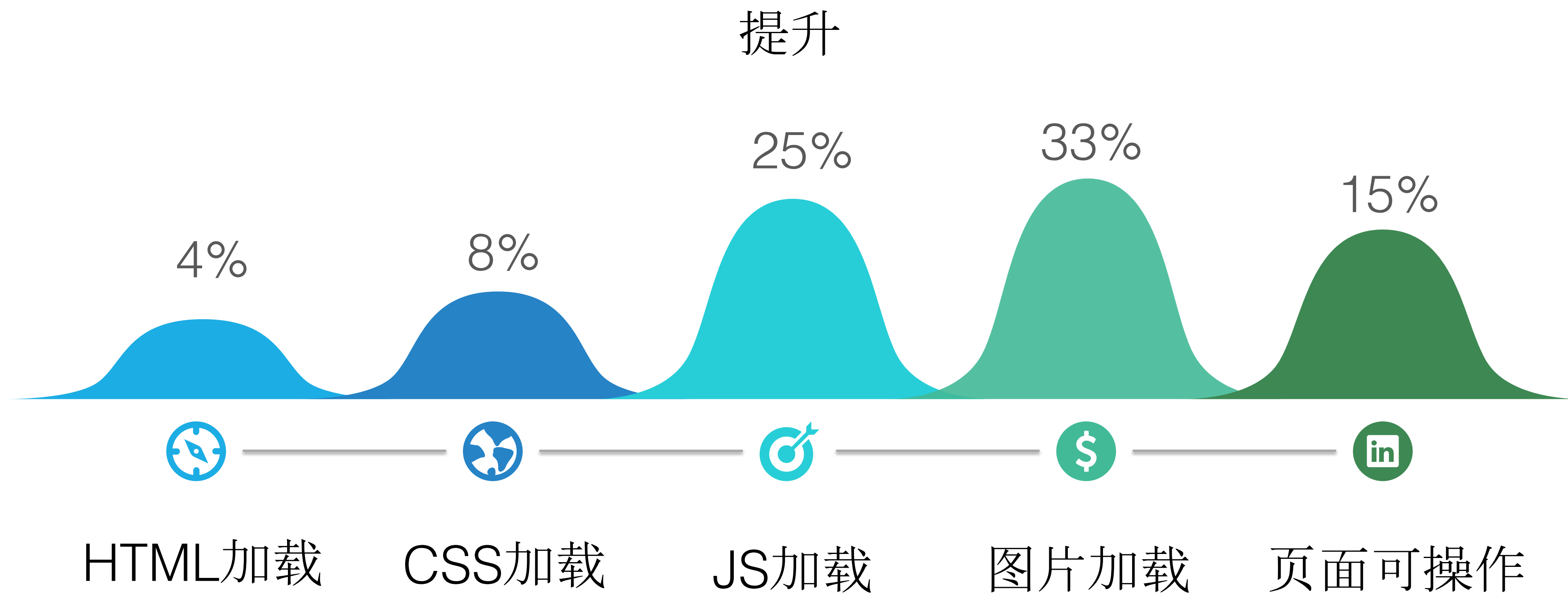


# HTTP 2 性能数据



不同网络情况对比

# HTTP2性能数据



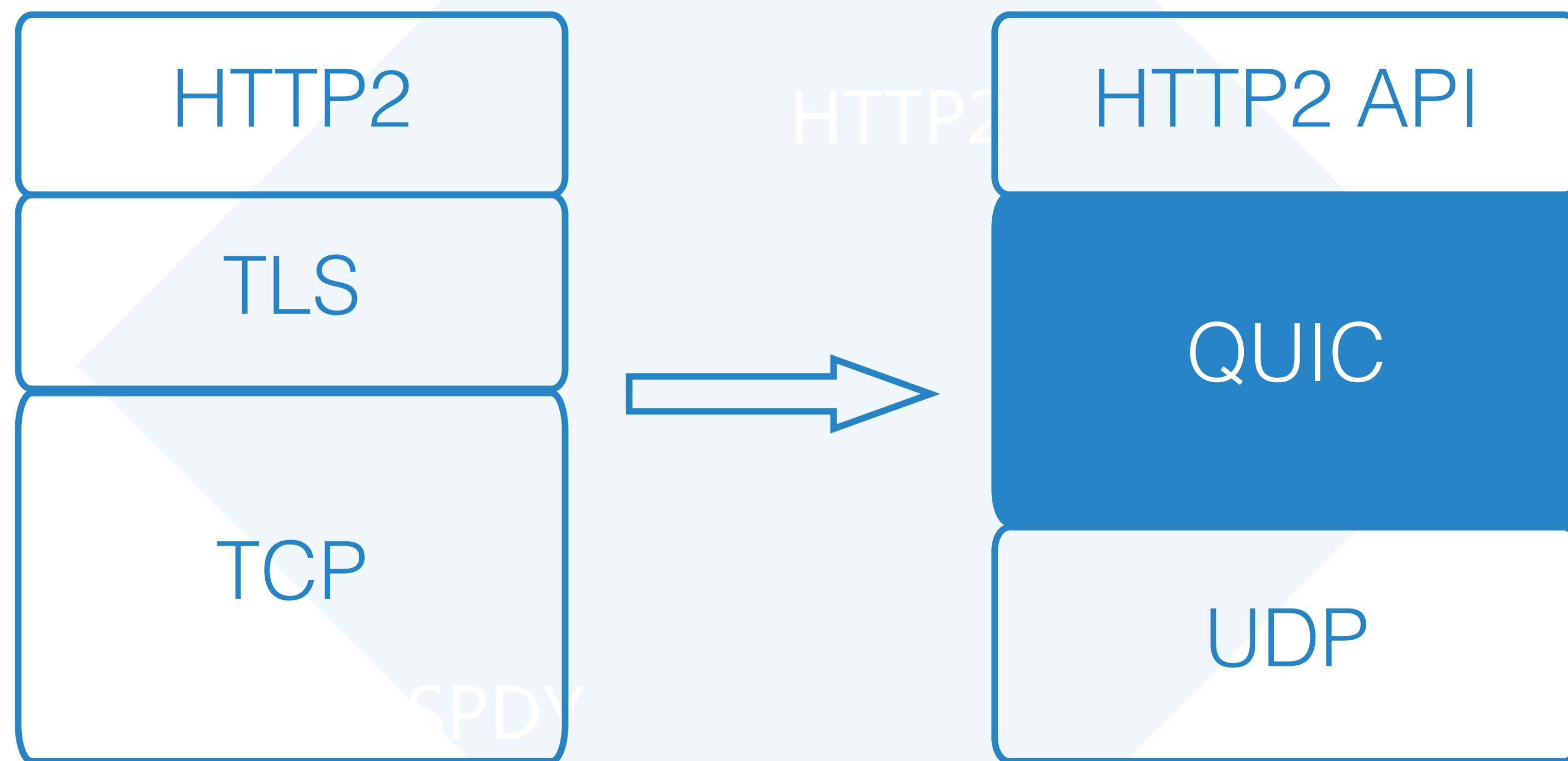


# QUIC原理简述

《Web性能权威指南》12.3.5章节中提到：  
对HTTP2.0 而言  
TCP 很可能就是下一个性能瓶颈。



# QUIC





## QUIC为什么quick ?

1

消灭队首阻塞

0/2T建连

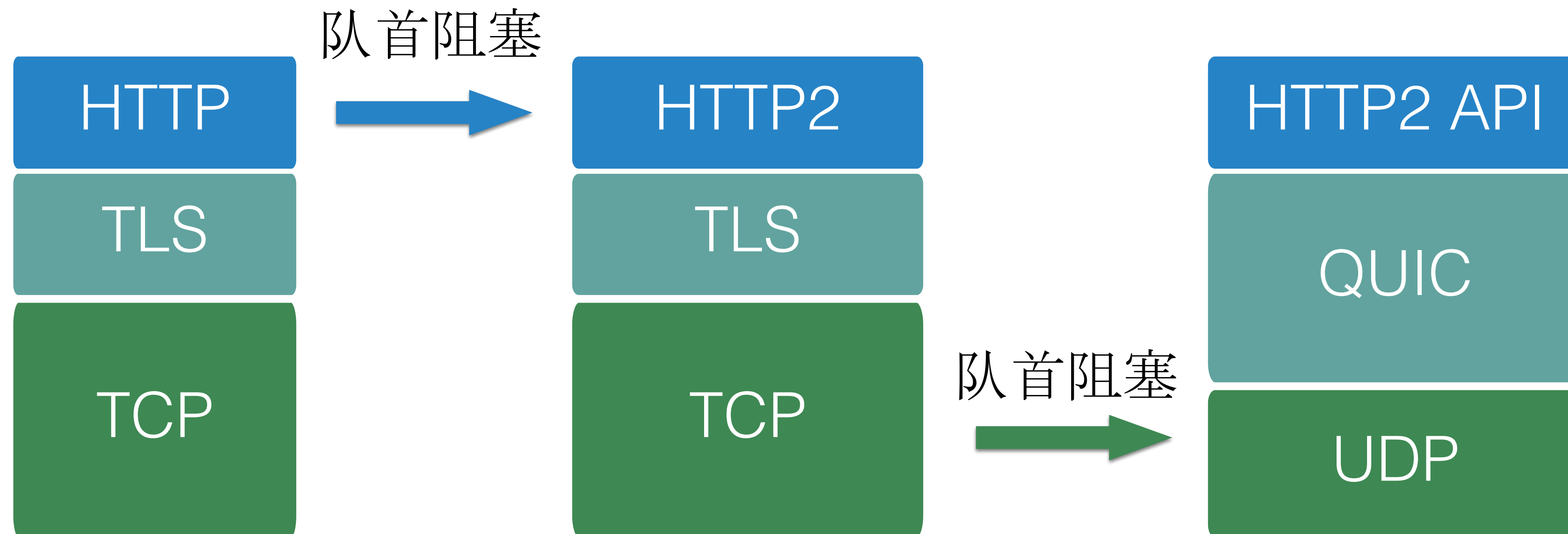


# QUIC原理简述

## 1 消灭队首阻塞



# QUIC原理简述



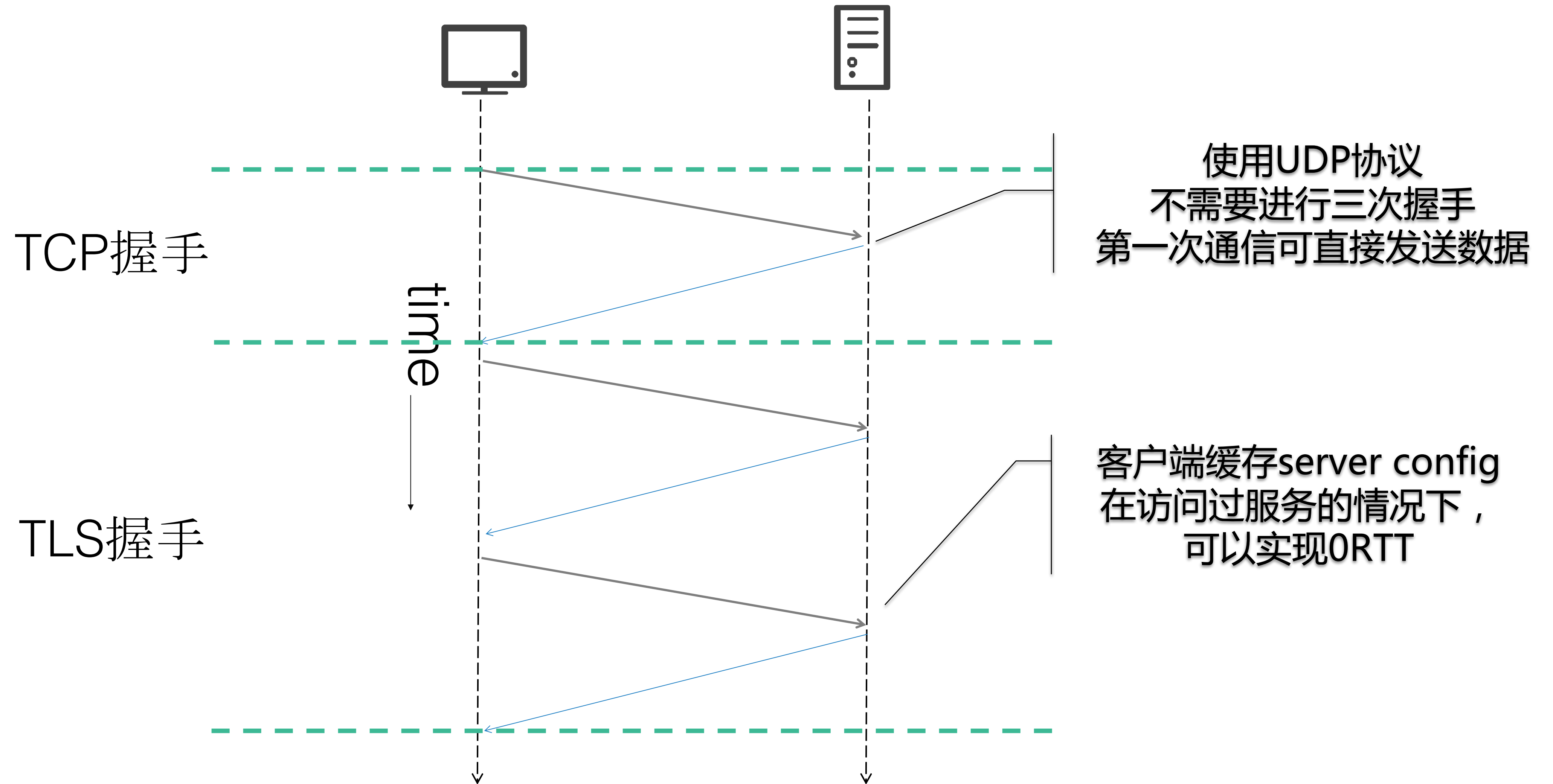


# QUIC原理简述

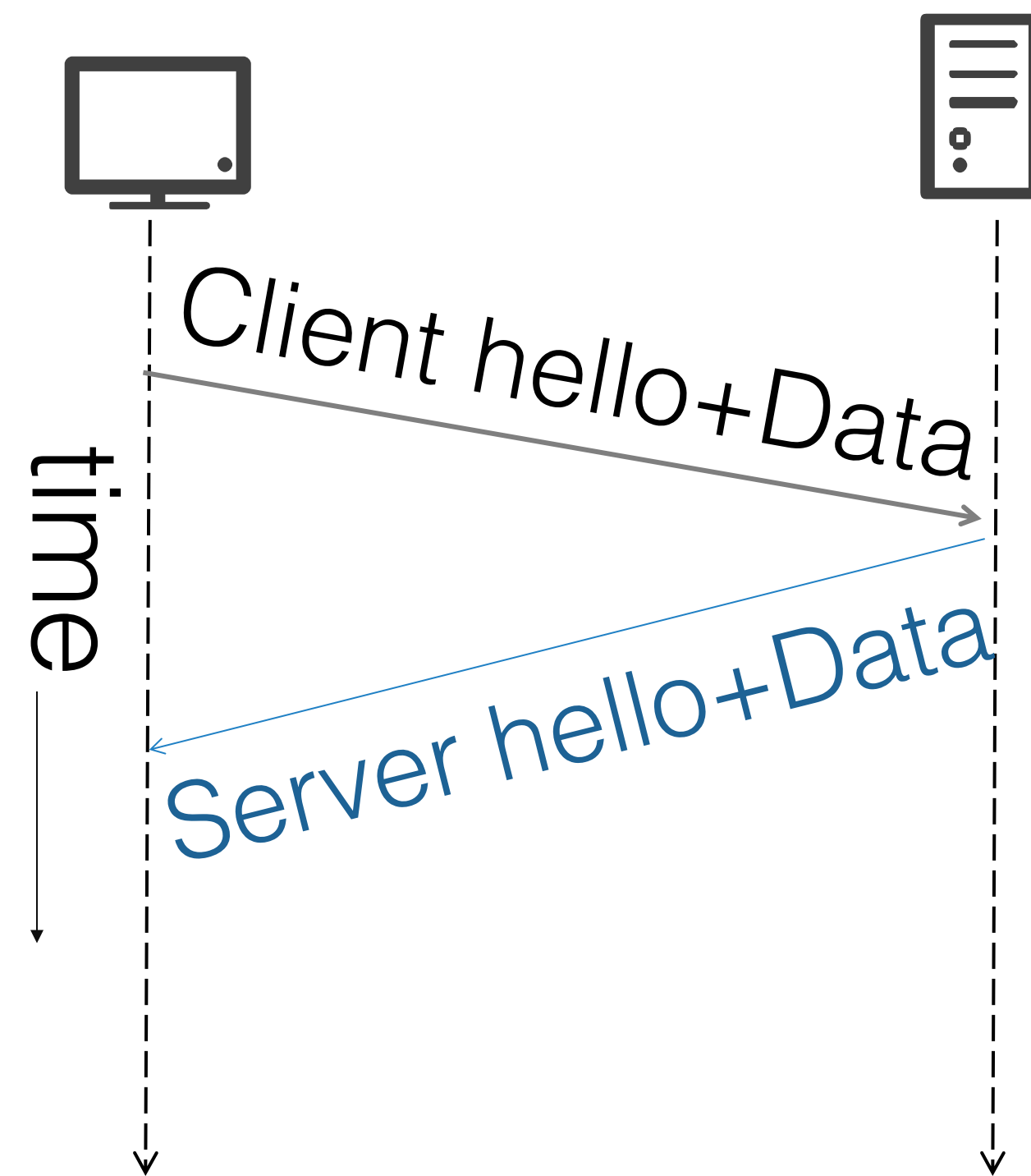
## 2 ORTT建连



# QUIC原理简述



# QUIC原理简述



# QUIC原理简述

| 测速点  | TCP  | UDP |
|------|------|-----|
| 可靠性  | 可靠   | 不可靠 |
| 连接性  | 面向连接 | 无连接 |
| 流量控制 | 有    | 无   |
| 拥塞控制 | 有    | 无   |
| 效率   | 低    | 高   |

✓ QUIC

✓ QUIC

✓ QUIC

✓ QUIC





# QUIC原理简述——可靠性

大家都知道UDP无状态不可靠，如何解决丢包问题？

前向纠错

失败重发



# QUIC原理简述——连接性

使用GUID来标识一个连接



# QUIC原理简述——流量控制

基于流和连接

更新偏移量限制





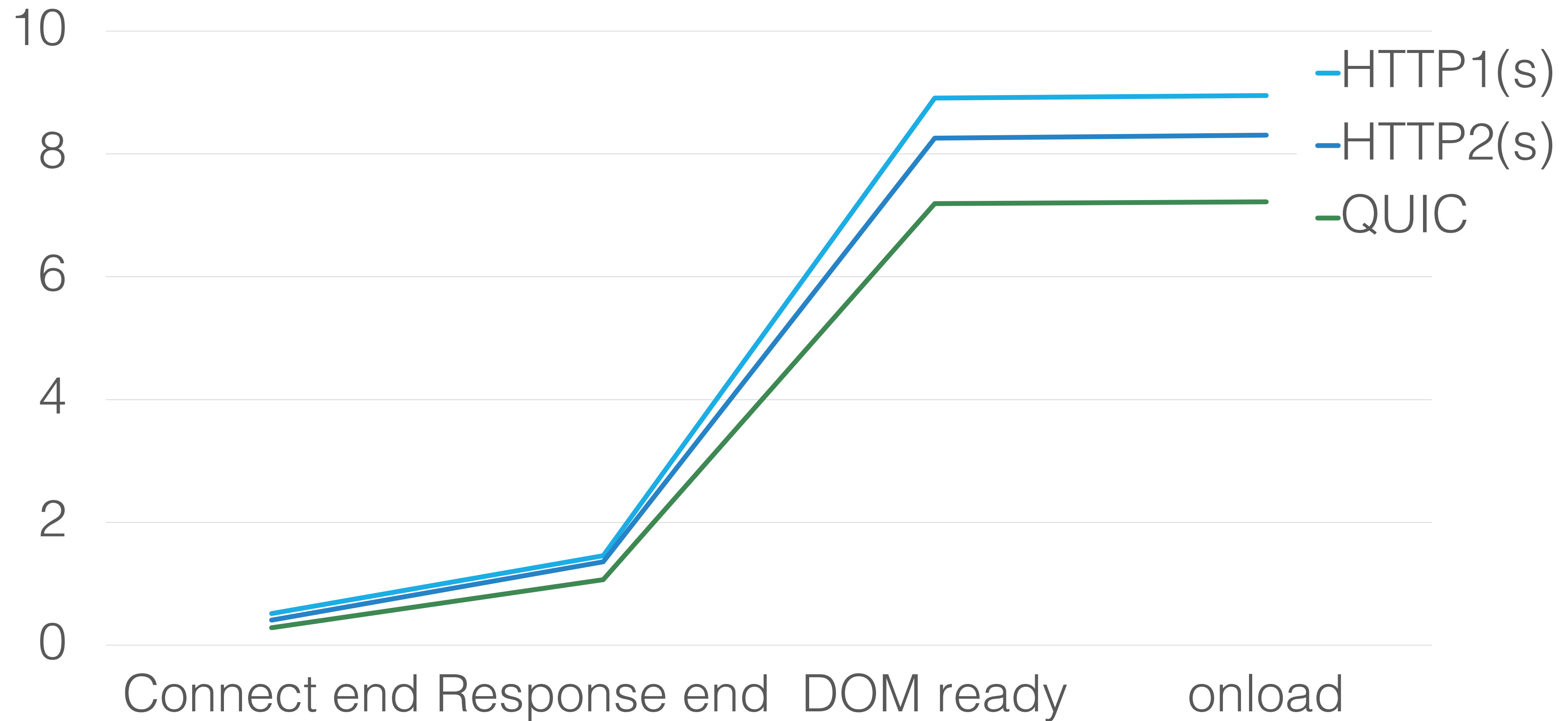
# QUIC原理简述——拥塞控制

可插拔

避免重传歧义

更多的ACK块

# QUIC性能数据





# PART 3



## 最佳实践

经过长期、多个业务的实践  
我们总结出了一些经验



# 如何部署

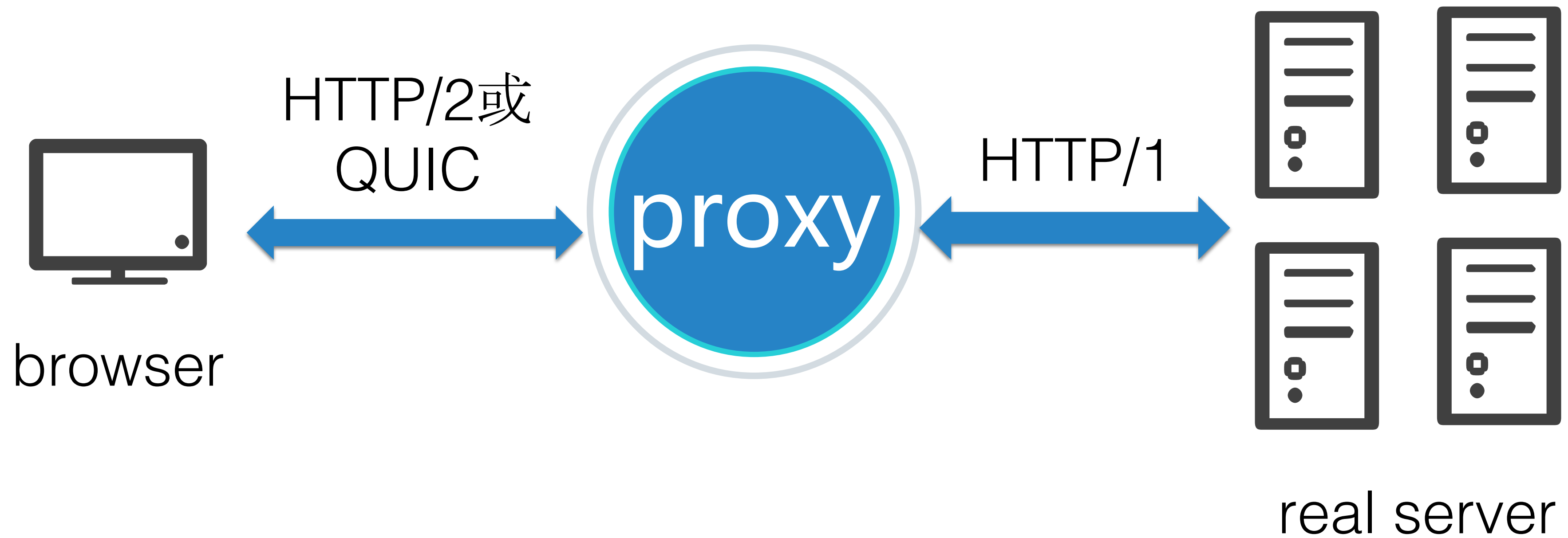


caddy



腾讯云CLB

# 接入架构



# 统计支持度



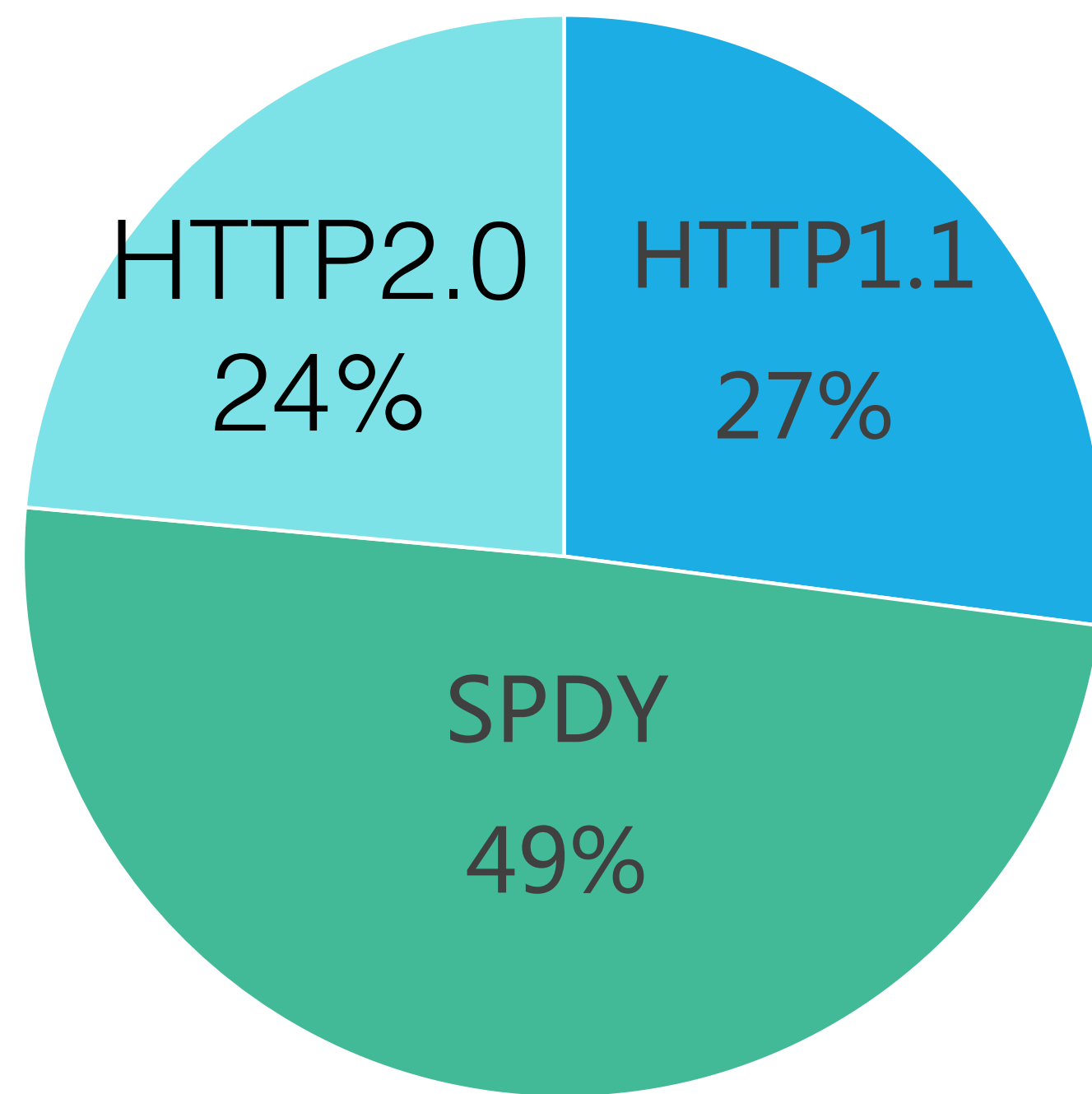
是否支持HTTP2



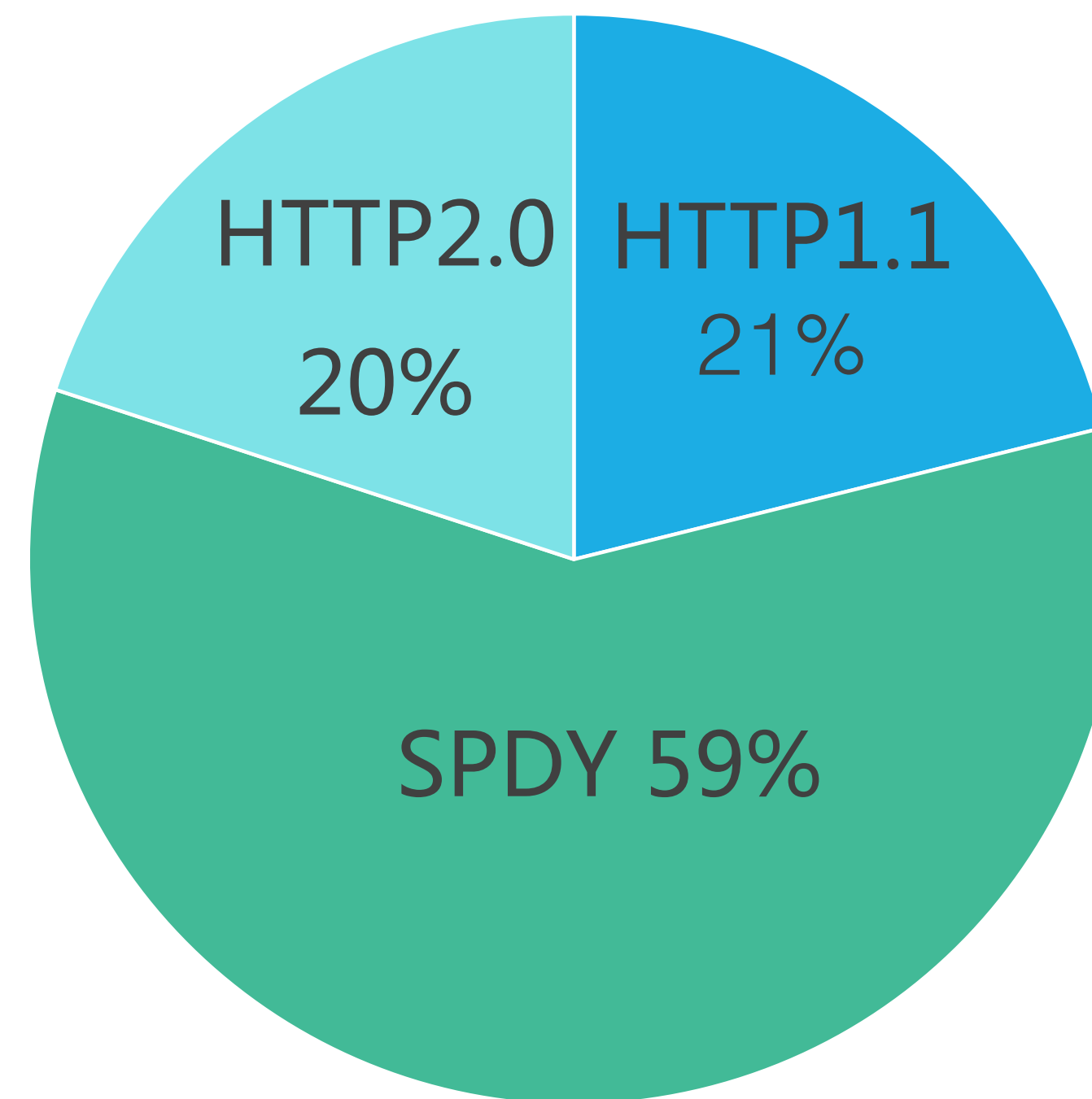
是否支持QUIC



# 手机侧支持率

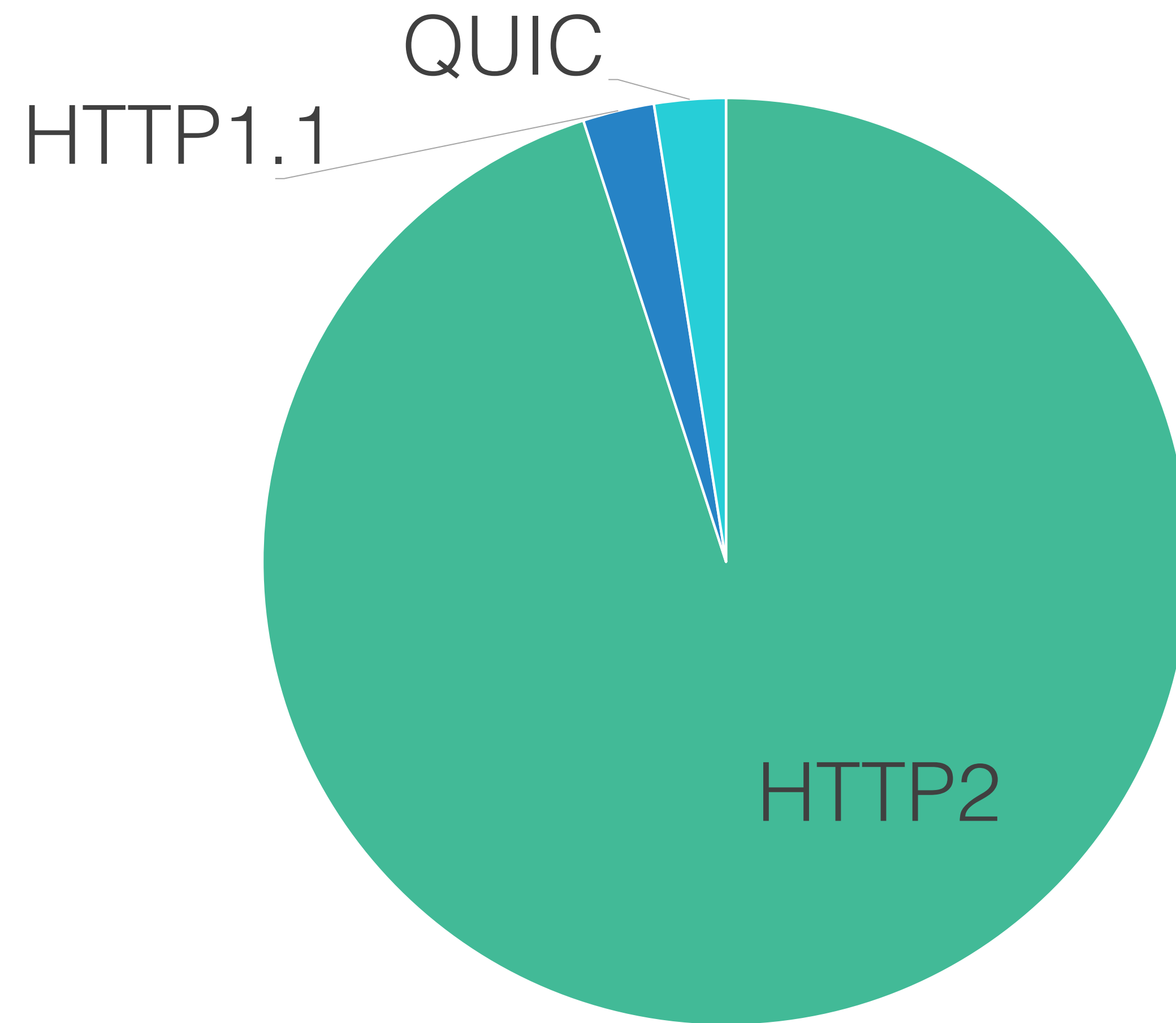


Android支持率



iOS支持率

# PC侧支持率



# 统计性能数据

连接时间、首字节时间



**Performance  
timing**

握手时间、是否复用



**Server**

JS、图片加载时间



异步资源

操作系统、网络环境



用户环境



# 调试工具

|                                     |                |                         |                                                                               |
|-------------------------------------|----------------|-------------------------|-------------------------------------------------------------------------------|
| (?)                                 | QUIC vip.qzone |                         | 15 of 158                                                                     |
| <input type="checkbox"/>            | ID             | Source Type             | Description                                                                   |
| <input type="checkbox"/>            | 2              | HTTP_SERVER_PROPERTIES  |                                                                               |
| <input type="checkbox"/>            | 103238         | HTTP_STREAM_JOB         | https://vip.qzone.qq.com/                                                     |
| <input type="checkbox"/>            | 103239         | QUIC_STREAM_FACTORY_JOB |                                                                               |
| <input type="checkbox"/>            | 103241         | HOST_RESOLVER_IMPL_JOB  | vip.qzone.qq.com                                                              |
| <input type="checkbox"/>            | 103272         | HTTP_STREAM_JOB         | https://vip.qzone.qq.com/                                                     |
| <input type="checkbox"/>            | 103273         | URL_REQUEST             | https://vip.qzone.qq.com/                                                     |
| <input checked="" type="checkbox"/> | 103276         | QUIC_SESSION            | vip.qzone.qq.com                                                              |
| <input type="checkbox"/>            | 103285         | HTTP_STREAM_JOB         | https://vip.qzone.qq.com/                                                     |
| <input type="checkbox"/>            | 103286         | HTTP_STREAM_JOB         | https://vip.qzone.qq.com/                                                     |
| <input type="checkbox"/>            | 103336         | URL_REQUEST             | https://vip.qzone.qq.com/proxy/domain/qzonestyle.gtimg.cn/qzone/space_item/bc |
| <input type="checkbox"/>            | 103341         | URL_REQUEST             | https://vip.qzone.qq.com/proxy/domain/qzonestyle.gtimg.cn/qzone/space_item/bc |
| <input type="checkbox"/>            | 103361         | HTTP_STREAM_JOB         | https://vip.qzone.qq.com/                                                     |
| <input type="checkbox"/>            | 103362         | HTTP_STREAM_JOB         | https://vip.qzone.qq.com/                                                     |
| <input type="checkbox"/>            | 103364         | HTTP_STREAM_JOB         | https://vip.qzone.qq.com/                                                     |
| <input type="checkbox"/>            | 103365         | HTTP_STREAM_JOB         | https://vip.qzone.qq.com/                                                     |

```
>
t=16525 [st= 3] QUIC_SESSION_STREAM_FRAME_SENT
-> fin = false
-> length = 1024
-> offset = "0"
-> stream_id = 1
t=16525 [st= 3] QUIC_SESSION_PACKET_SENT
-> packet_number = "1"
-> sent_time_us = "2059301100513"
-> size = 1350
-> transmission_type = 0
t=16536 [st= 14] QUIC_CHROMIUM_CLIENT_STREAM_SEND_REQUEST_HEADERS
-> :authority: vip.qzone.qq.com
   :method: GET
   :path: /
   :scheme: https
   accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/w
   accept-encoding: gzip, deflate, br
   accept-language: zh-CN,zh;q=0.8,en;q=0.6,zh-TW;q=0.4
   cache-control: max-age=0
   cookie: [482 bytes were stripped]
   upgrade-insecure-requests: 1
   user-agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537
-> quic_priority = 0
-> quic_stream_id = 5
t=16537 [st= 15] QUIC_SESSION_STREAM_FRAME_SENT
-> fin = false
-> length = 634
-> offset = "0"
-> stream_id = 3
t=16537 [st= 15] QUIC_SESSION_PACKET_SENT
-> packet_number = "2"
-> sent_time_us = "2059301100513"
```

查看工具：chrome://net-internals

# 潜在问题

坑

## QUIC需要的网络环境：

开放UDP端口443

对于UDP没有限速

UDP丢包率没有异常



# 潜在问题

## 调整用户使用的协议

浏览器检测

端口未开放

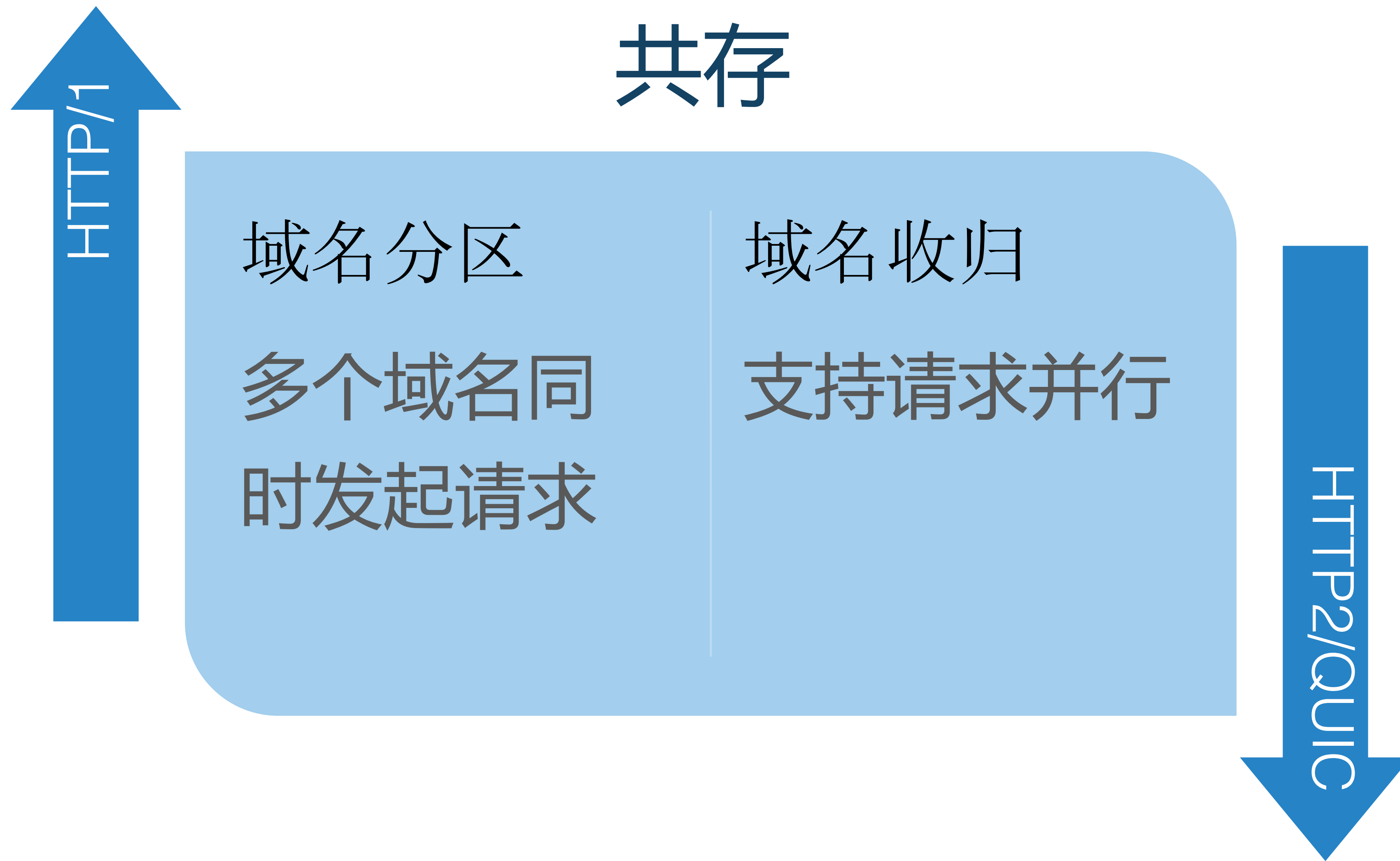
记录和对比用户  
使用UDP和  
使用TCP打开页  
面的速度

限速

异步发送检测  
请求，测试连  
通性

丢包





## 共存

HTTP/1

请求合并  
减少请求数

请求分离  
提高缓存  
利用率

HTTP2/QUIC

# 请求分离

| Name                                                                                                                      | Protocol | Size              |
|---------------------------------------------------------------------------------------------------------------------------|----------|-------------------|
| qzonestyle.gtimg.cn...                                                                                                    |          | 0.52 KB           |
|  base.mod.js<br>qzonestyle.gtimg.cn... | http/1.1 | 35.0 KB<br>144 KB |
|  analysis.js<br>qzonestyle.gtimg.cn... | http/1.1 | 4.6 KB<br>10.9 KB |
|  analysis.js<br>qzonestyle.gtimg.cn... | http/1.1 | 7.9 KB<br>23.0 KB |
|  index.js<br>qzonestyle.gtimg.cn...  | http/1.1 | 37.3 KB<br>139 KB |
|  index.js<br>qzonestyle.gtimg.cn...  | http/1.1 | 2.4 KB<br>3.8 KB  |
| 10 / 42 requests   154 KB / 842 KB transferred   Finish:                                                                  |          |                   |

HTTP1.1



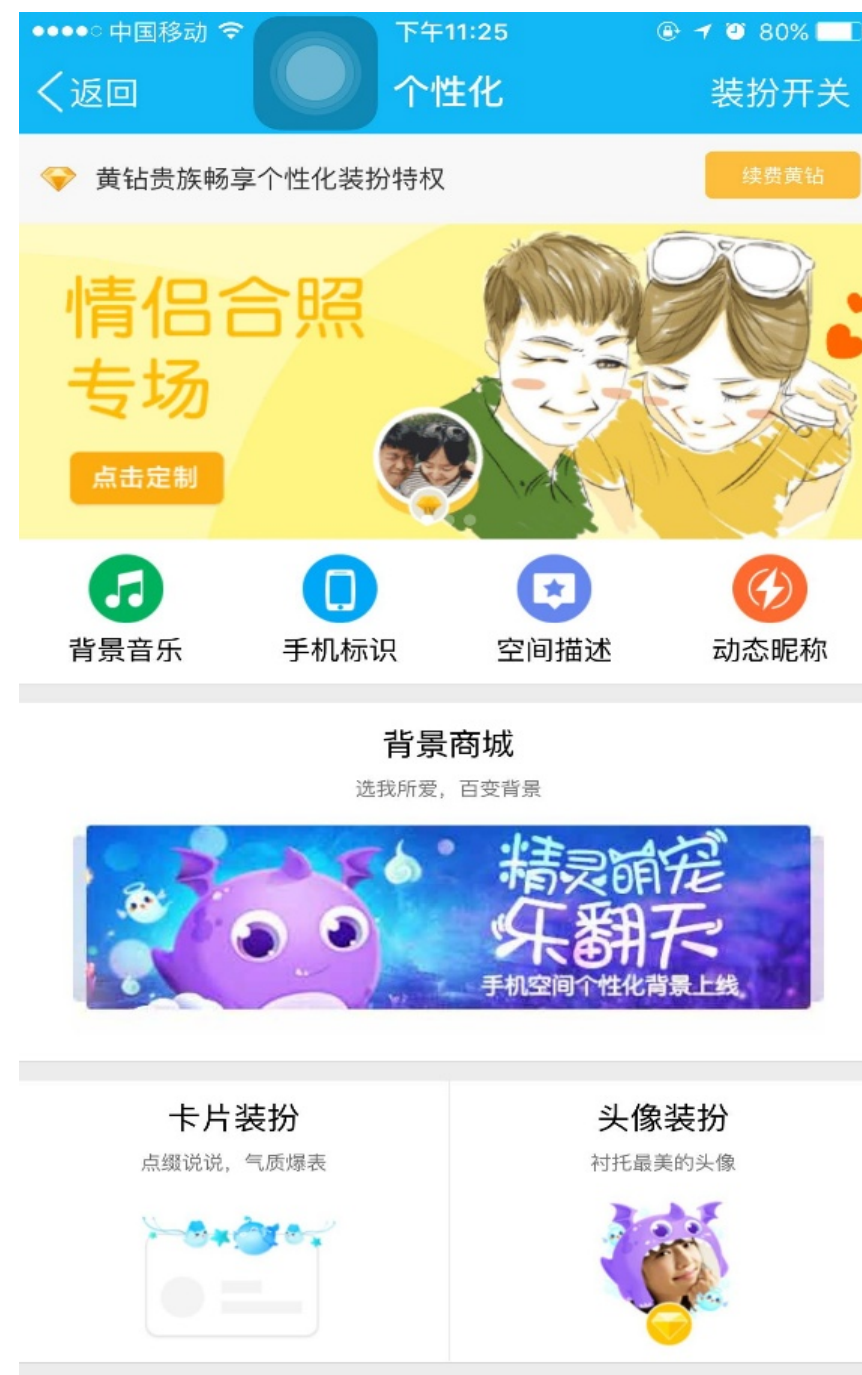
# 请求分离

| Name                                                                                                                       | Protocol | Size              |
|----------------------------------------------------------------------------------------------------------------------------|----------|-------------------|
|  index.js<br>qzonestyle.gtimg.cn...      | h2       | 3.4 KB<br>8.9 KB  |
|  analysis.js<br>qzonestyle.gtimg.cn...   |          | 4.3 KB<br>10.9 KB |
|  index.js<br>qzonestyle.gtimg.cn...      | h2       | 4.0 KB<br>12.1 KB |
|  index.js<br>qzonestyle.gtimg.cn...    |          | 2.1 KB<br>3.8 KB  |
|  identity.js<br>qzonestyle.gtimg.cn... | h2       | 1.3 KB<br>1.9 KB  |
| 39 / 71 requests   159 KB / 849 KB transferred   Finish:                                                                   |          |                   |

## HTTP2



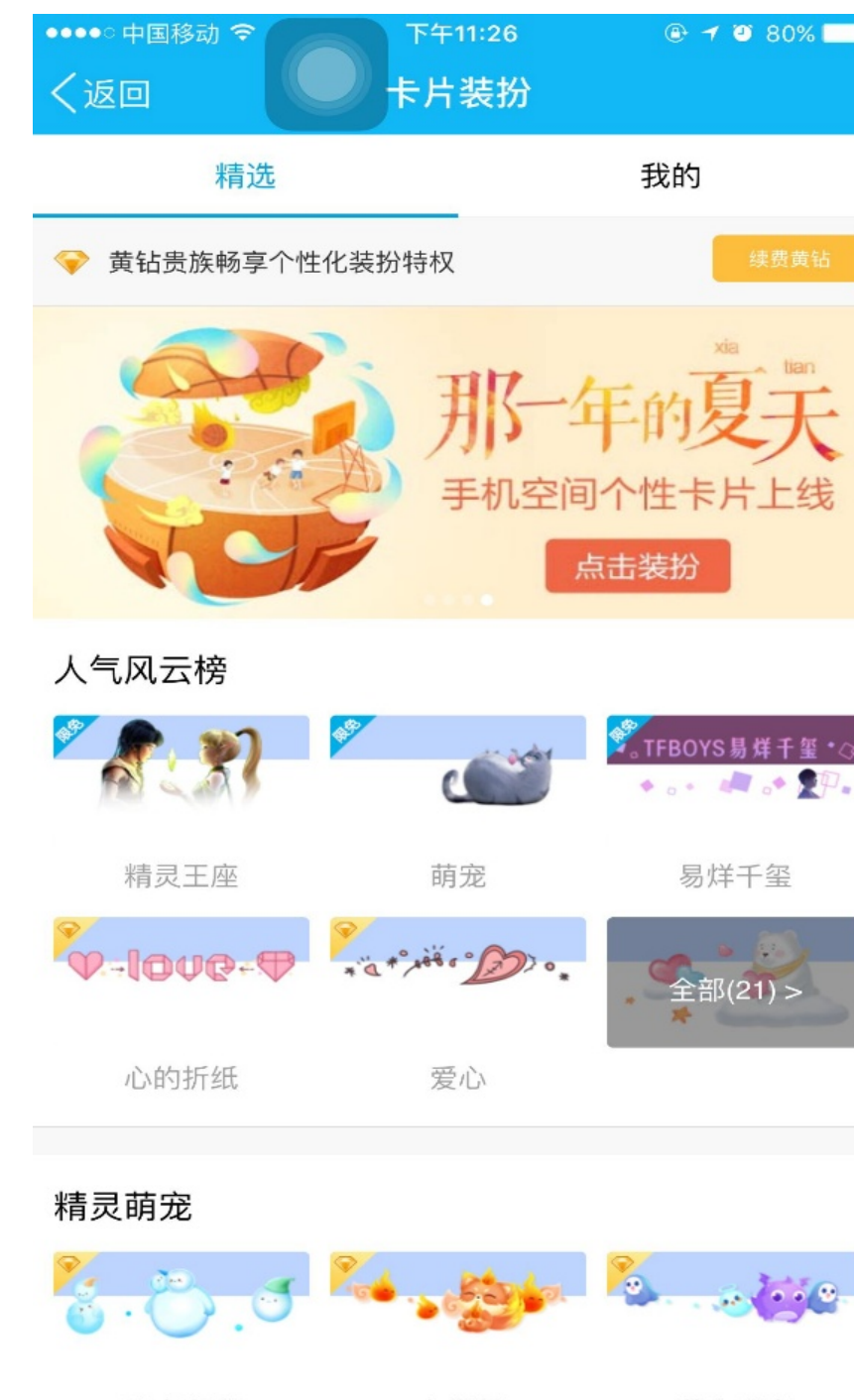
# 预建连接



入口

 复用率75%

提前  
建立  
连接



实际页面

 提升400ms



# Q&A

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关注QCon微信公众号  
获得更多干货!

# Thanks!

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