Benchmarking for HTTP/2

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HTTP/2 is Great!!!

So...

- Which server software should I use? (Hopefully ATS)
- How many machines I need to buy?

Perspective of a System Engineer

Benchmarking Tool Needed

- h2load to the rescue
- part of nghttp2
- latest version is 1.4.0

Some examples

- Basic

h2load -n100 -c10 -m10 https://www.google.com/

- Adding/Changing header

h2load -n100 -c10 -m10 --header="accept-encoding: gzip" https://www.google.com/

More Examples

Multi-threading support

```
h2load -t2 -n100 -c10 -m10 --header="accept-encoding: gzip" https://www.google.com/
```

Timeout

```
h2load -t2 -n100 -c10 -m10 --header="accept-encoding: gzip" --connection-active-timeout=3 --connection-inactivity-timeout=3 https://www.google.com/
```

Protocols & Ciphers

- --npn-list
  - Allows you to define preferences of protocol to be used
  - Allows you to load test with h2, spdy/3.1 or http/1.1
- --ciphers
  - Allows you to define the ciphers to be used

Rate Mode / Timing Script

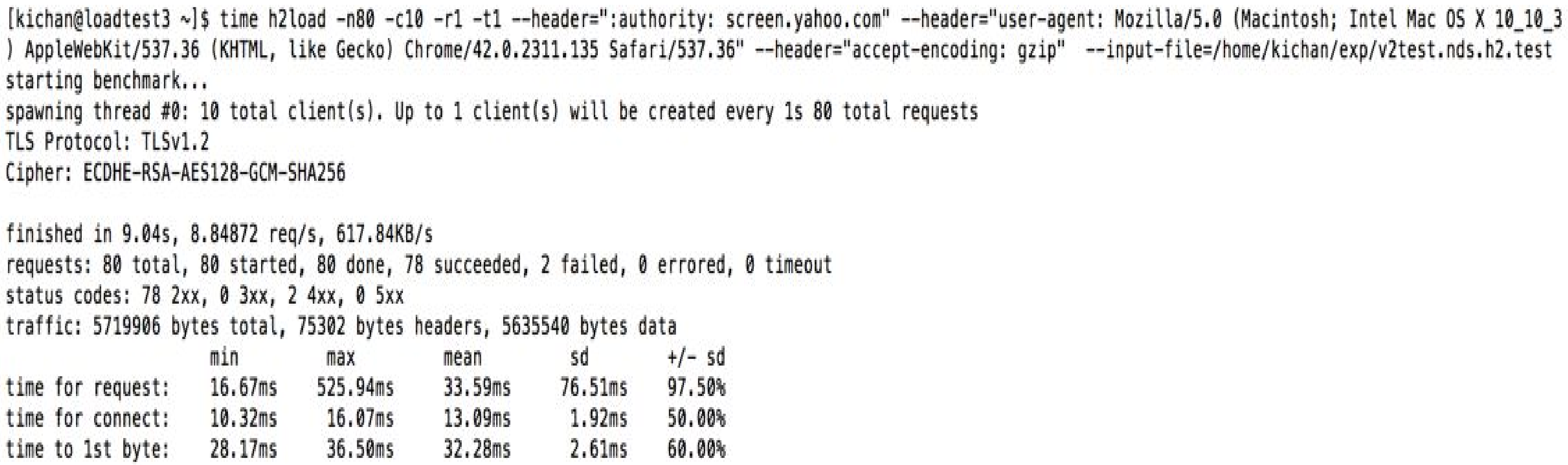
- Rate Mode - you can control # of connections per seconds
- Timing Script - you can define a list of URLs for each connection to cycle through. (each line is a time in millisecond, a tab and then the url) e.g

```
100.0	https://screen.yahoo.com/
200.0	/__rapid-worker-1.1.js
300.0	/__test.css
```

- Example Usage

```
h2load -c100 -r10 -t5 --header="accept-encoding: gzip" --timing-script-file=/tmp/myscript.txt
```

h2load output



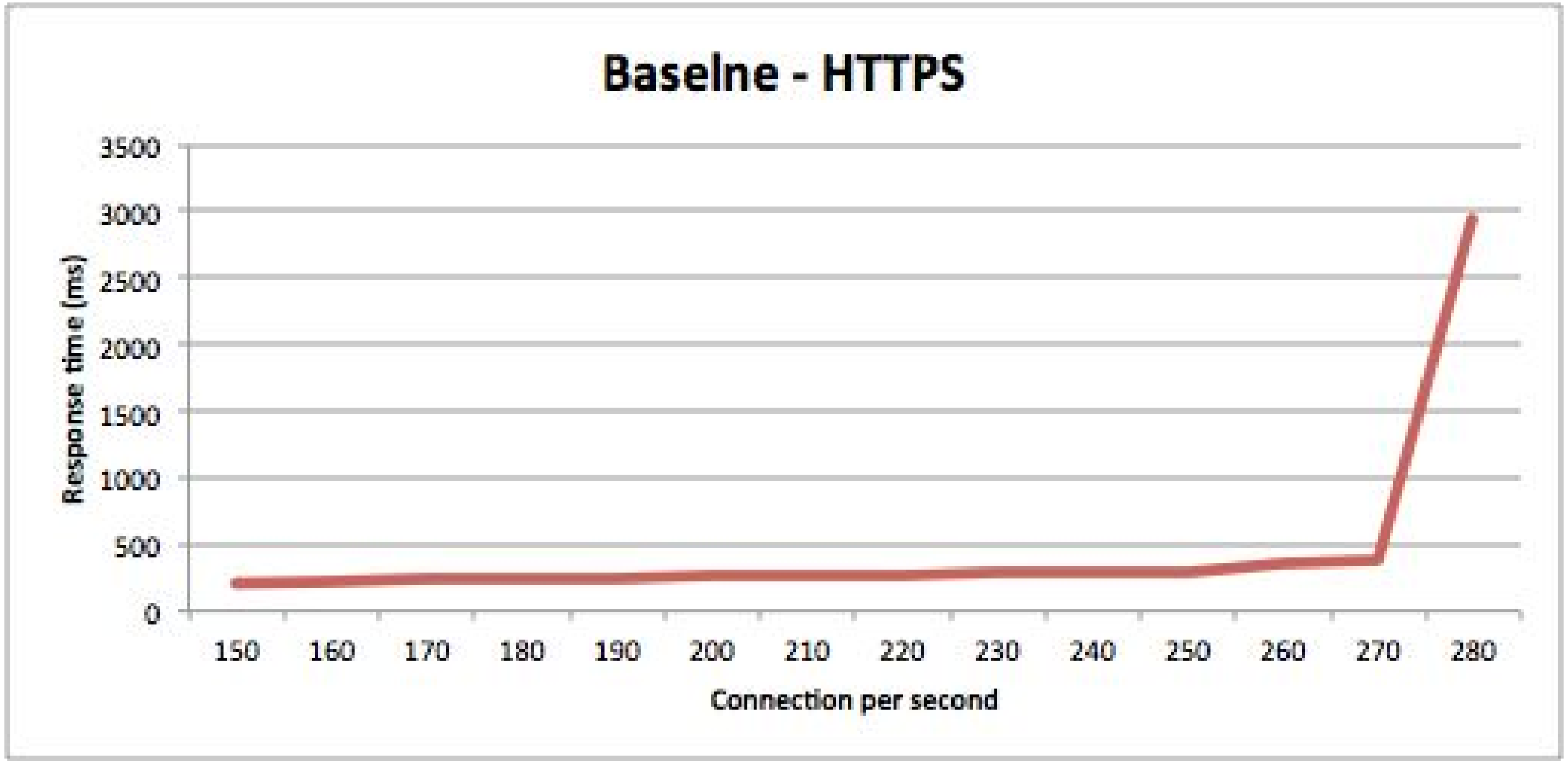
```
[kichan@loadtest3 ~]$ time h2load -n80 -c10 -r1 -t1 --header=":authority: screen.yahoo.com" --header="user-agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_3
) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/42.0.2311.135 Safari/537.36" --header="accept-encoding: gzip"  --input-file=/home/kichan/exp/v2test.nds.h2.test
starting benchmark...
spawning thread #0: 10 total client(s). Up to 1 client(s) will be created every 1s 80 total requests
TLS Protocol: TLSv1.2
Cipher: ECDHE-RSA-AES128-GCM-SHA256

finished in 9.04s, 8.84872 req/s, 617.84KB/s
requests: 80 total, 80 started, 80 done, 78 succeeded, 2 failed, 0 errored, 0 timeout
status codes: 78 2xx, 0 3xx, 2 4xx, 0 5xx
traffic: 5719906 bytes total, 75302 bytes headers, 5635540 bytes data
                     min         max         mean         sd        +/- sd
time for request:    16.67ms    525.94ms     33.59ms     76.51ms    97.50%
time for connect:    10.32ms     16.07ms     13.09ms      1.92ms    50.00%
time to 1st byte:    28.17ms     36.50ms     32.28ms      2.61ms    60.00%
```

Experiment 0: Baseline

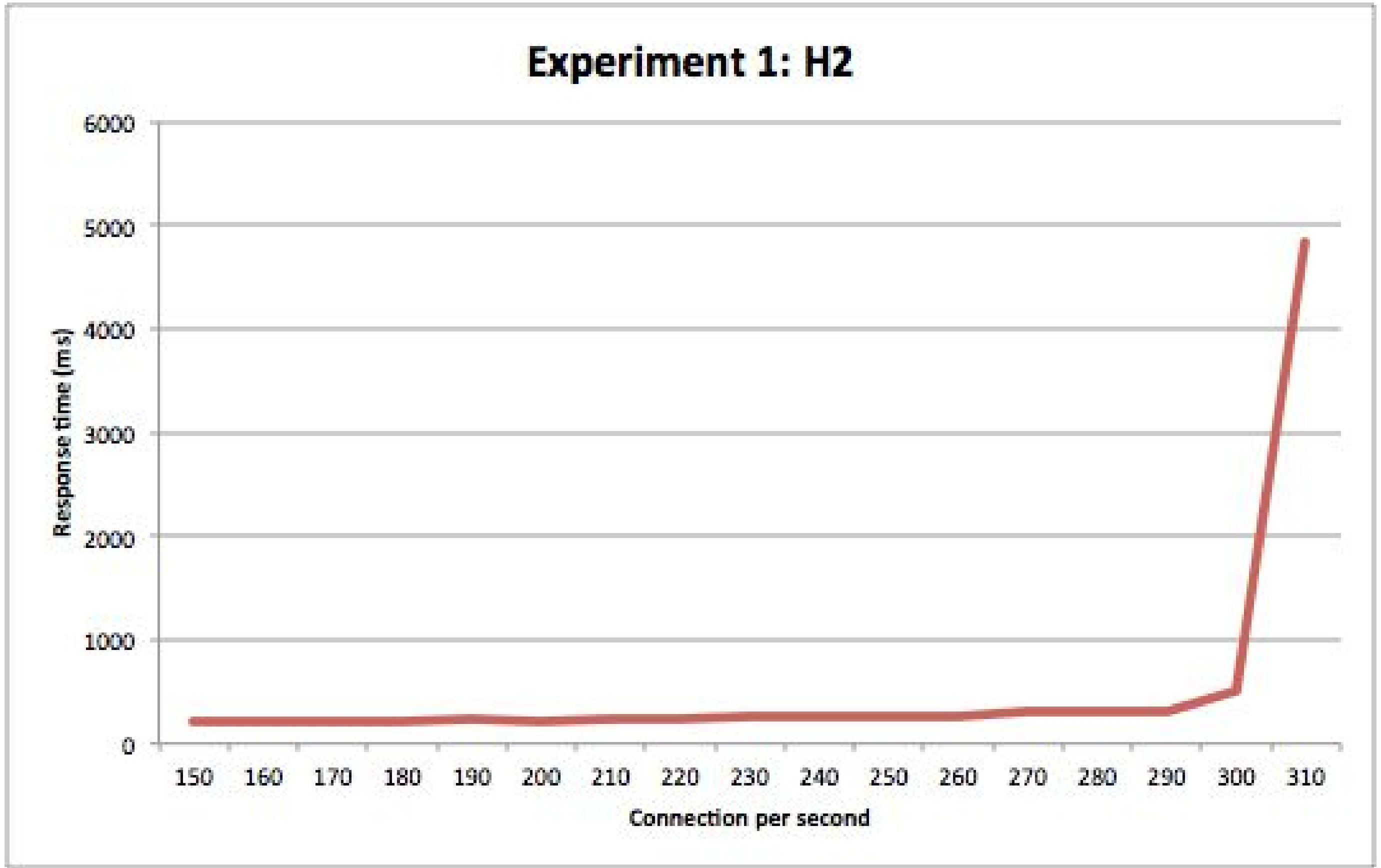
Background

- One page
- Heavy use of ESI - i.e. ATS is doing page assembly
- Other plugins use to validate cookie, finding out locations, determining buckets for testing + other stuff

Experiment 0: Baseline



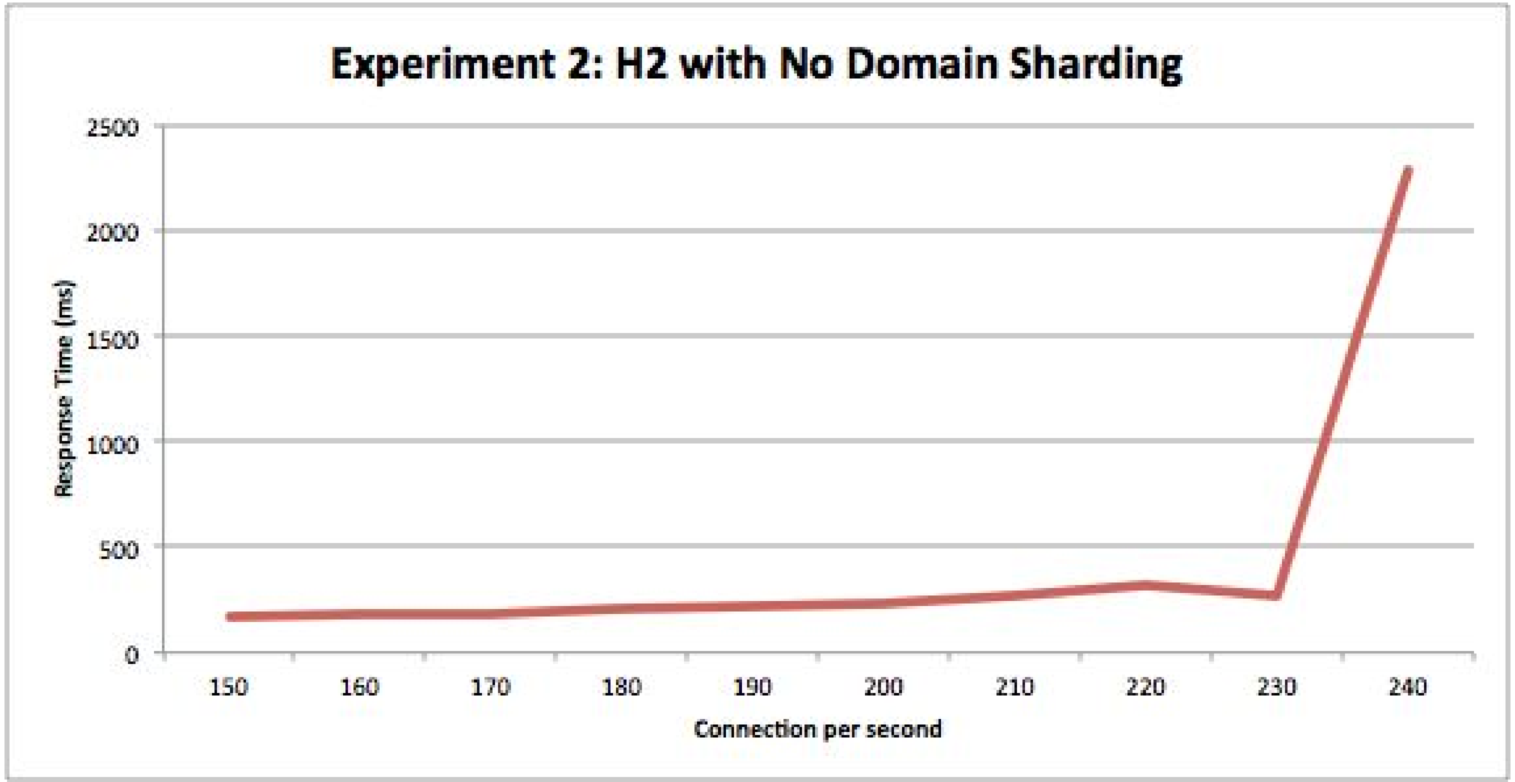
Experiment 1: Just turn H2 on



Experiment 2: No Domain Sharding

- Same page + 8 assets in one connection (e.g. CSS/JS/SWF/WOFF etc)

Experiment 2: no domain sharding



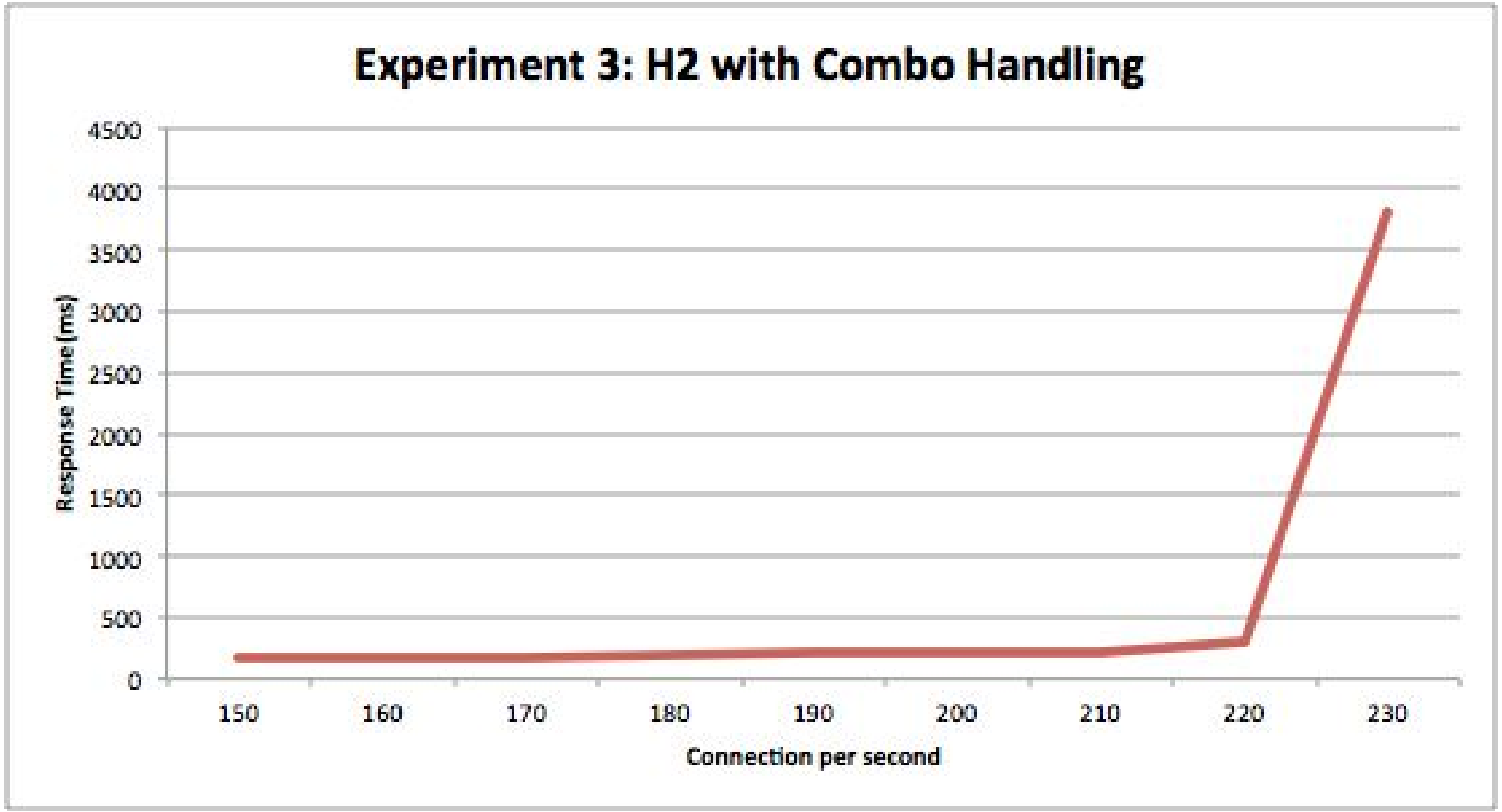
Experiment 3 & 4: combo handling or not

- Combo Handling of assets. e.g.

https://s.yimg.com/zz/combo?/os/stencil/2.0.26/styles.css&/os/mit/td/lasso-1.2.197/cinematron-simple-dark/cinematron-simple-dark-min.css

- First experiment retrieving one page and 5 combo assets URLs
- Second experiment retriveing one page and the “un-combo-ed” URLs of the above 5 combo assets URLs (80+ URLs)

Experiment 3: Combo Handling



Experiment 4: No combo handling

- Latency/Response time is too high even with low CPS

Experiment 5: ATS vs nghttpx

- Settings - access/error log turned on, no ocsp stapling, no cache for ATS, same # of execution theads
- Just do http/2 termination and proxy the requests
- Requests - 3 large image objects (60K to 200K) per connection

Experiment 5: Results

- Process CPU utilization during idle - ATS: 0.5%, nghttpx: 0%
- System CPU utilization during idle - ATS: 7%, nghttpx: 6.5%
- Peak System CPU utilization under same traffic load - ATS: 18%, nghttpx: 15%

- Imply nothing! Simply a comparison worth investigating further for a very particular scenario.

Final Words

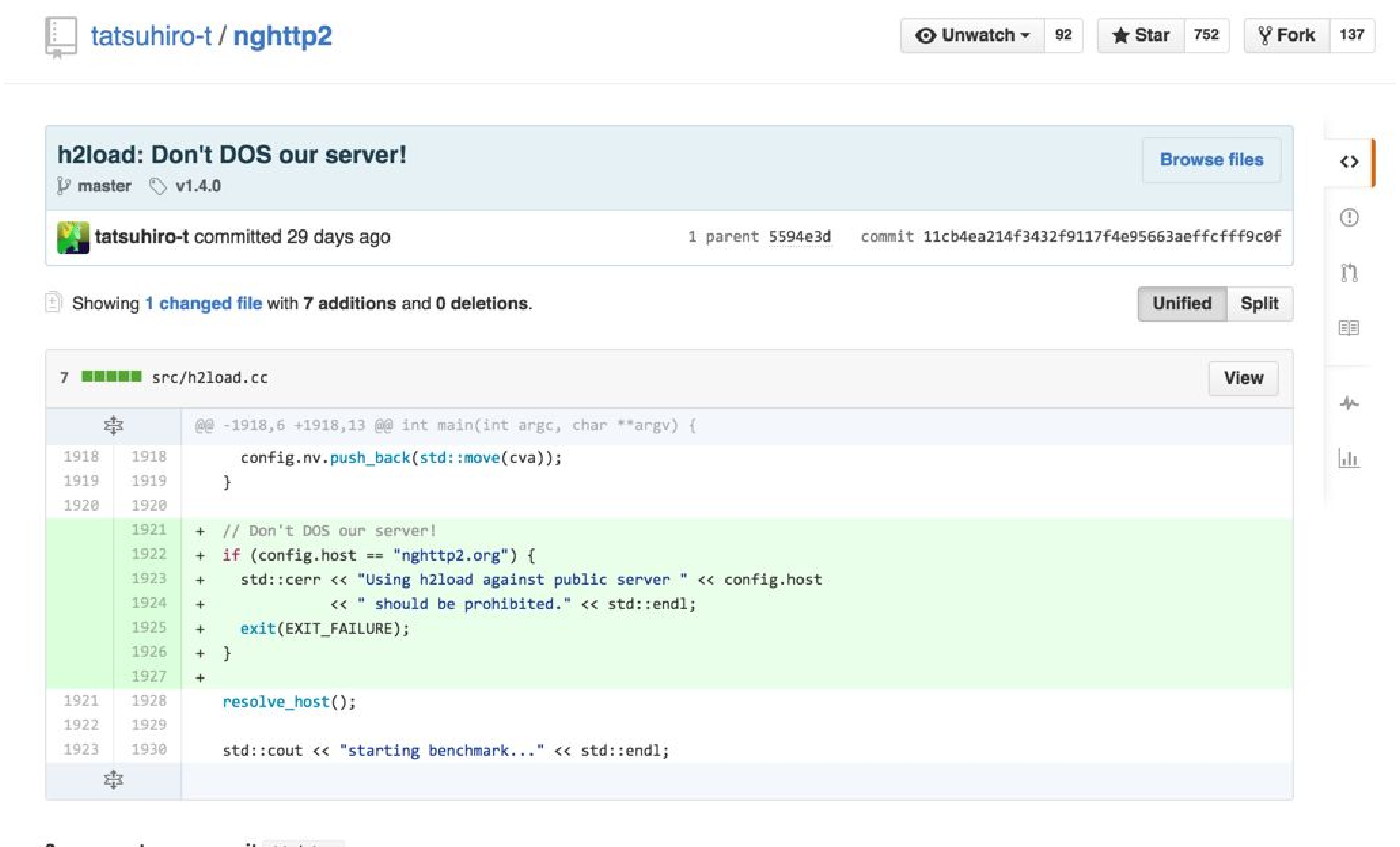
- We need to consider server capacity for H2 and related deployment
- h2load far from perfect
  - Contribution opportunities!!!

Credits/Shoutouts

Nora - patches for timeout, rate mode and its multithread support

Kenny - patches for header, running most of the experiments

Tatsuhiro Tsujikawa - Owner of the nghttp2 project - https://nghttp2.org/



h2load: Don't DOS our server!

master v1.4.0

tatsuhiro-t committed 29 days ago 1 parent 5594e3d commit 11cb4ea214f3432f9117f4e95663aeffcfff9c0f

Showing 1 changed file with 7 additions and 0 deletions.

7 src/h2load.cc

```
@@ -1918,6 +1918,13 @@ int main(int argc, char **argv) {
      config.nv.push_back(std::move(cva));
    }

+   // Don't DOS our server!
+   if (config.host == "nghttp2.org") {
+     std::cerr << "Using h2load against public server " << config.host
+               << " should be prohibited." << std::endl;
+     exit(EXIT_FAILURE);
+   }
+
    resolve_host();

    std::cout << "starting benchmark..." << std::endl;
```

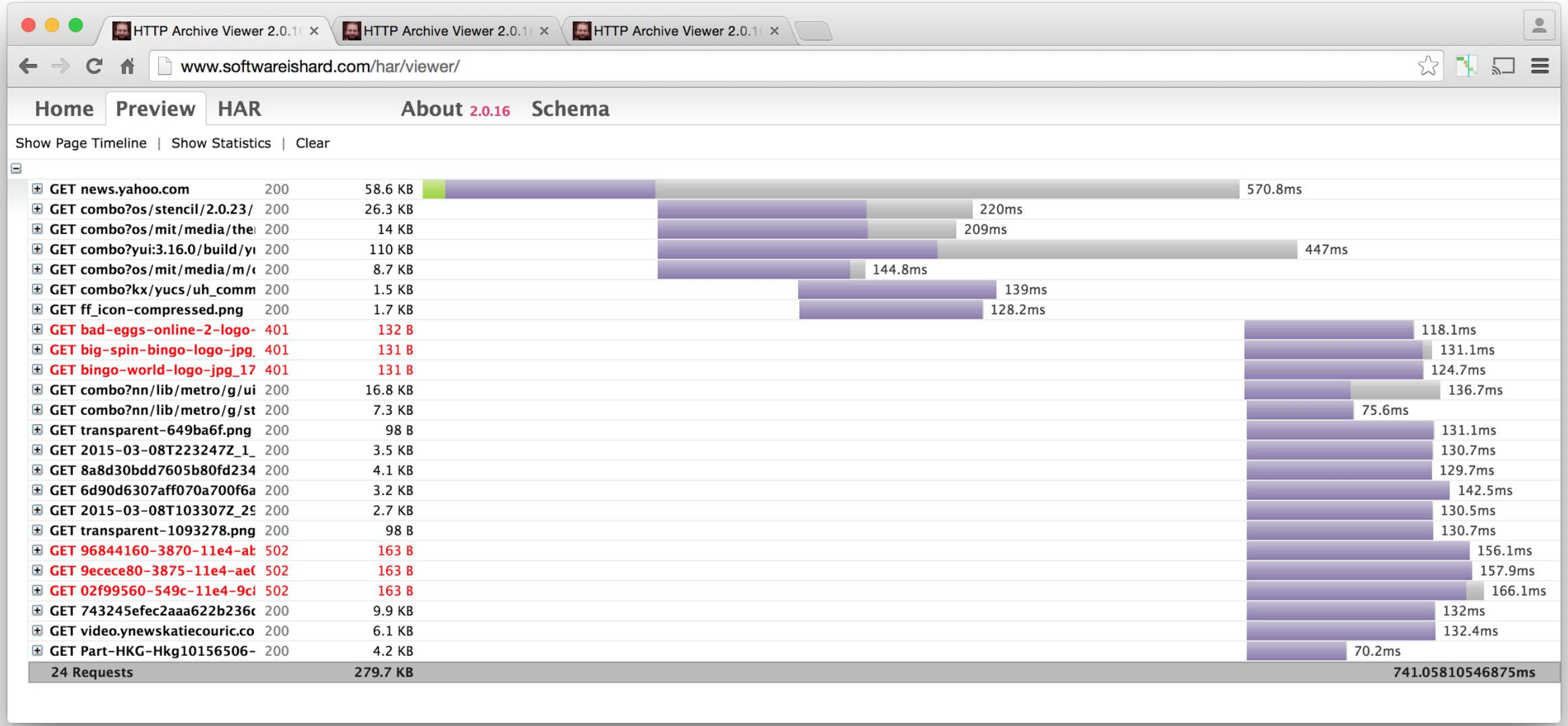
Thanks

Bonus - Generating HAR

e.g. -

```
nghttp -nv --har=/tmp/sample.out https://www.google.com/
```

Bonus - HAR Viewer


HTTP Archive Viewer 2.0.1
HTTP Archive Viewer 2.0.1
HTTP Archive Viewer 2.0.1
www.softwareishard.com/har/viewer/
Home
Preview
HAR
About 2.0.16
Schema
Show Page Timeline | Show Statistics | Clear

GET news.yahoo.com	200	58.6 KB	570.8ms
GET combo?os/stencil/2.0.23/	200	26.3 KB	220ms
GET combo?os/mit/media/the	200	14 KB	209ms
GET combo?yui:3.16.0/build/yu	200	110 KB	447ms
GET combo?os/mit/media/m/	200	8.7 KB	144.8ms
GET combo?kx/yucs/uh_comm	200	1.5 KB	139ms
GET ff_icon-compressed.png	200	1.7 KB	128.2ms
GET bad-eggs-online-2-logo-	401	132 B	118.1ms
GET big-spin-bingo-logo-jpg_	401	131 B	131.1ms
GET bingo-world-logo-jpg_17	401	131 B	124.7ms
GET combo?nn/lib/metro/g/ui	200	16.8 KB	136.7ms
GET combo?nn/lib/metro/g/st	200	7.3 KB	75.6ms
GET transparent-649ba6f.png	200	98 B	131.1ms
GET 2015-03-08T223247Z_1_	200	3.5 KB	130.7ms
GET 8a8d30bdd7605b80fd234	200	4.1 KB	129.7ms
GET 6d90d6307aff070a700f6a	200	3.2 KB	142.5ms
GET 2015-03-08T103307Z_29	200	2.7 KB	130.5ms
GET transparent-1093278.png	200	98 B	130.7ms
GET 96844160-3870-11e4-ab	502	163 B	156.1ms
GET 9ecece80-3875-11e4-ae(	502	163 B	157.9ms
GET 02f99560-549c-11e4-9c	502	163 B	166.1ms
GET 743245efec2aaa622b236	200	9.9 KB	132ms
GET video.ynewskatiecouric.co	200	6.1 KB	132.4ms
GET Part-HKG-Hkg10156506-	200	4.2 KB	70.2ms
24 Requests		279.7 KB	741.05810546875ms