# WebTorrent tracker performance comparison

This is a performance comparison of several WebTorrent tracker implementations, using *aquatic_ws_load_test*.

## Setup

### Tested tracker implementations

| Tracker | URL | Commit / version |
|---|---|---|
| **aquatic_ws** | https://github.com/greatest-ape/aquatic | 373e827 |
| **bittorrent-tracker *** | https://github.com/webtorrent/bittorrent-tracker | 10.0.1 |
| **wt-tracker †** | https://github.com/Novage/wt-tracker | 400a436 |

\* Since bittorrent-tracker doesn't support TLS, it was configured to run behind Hitch (https://hitch-tls.org/), a high performance TLS proxy
† wt-tracker ended up also having to be run behind Hitch, since otherwise, it would only accept around 40 connections

### General information

• The test was run on a Hetzner CCX64 VM with 48 dedicated vCPUs (AMD Milan Epyc 7003)
• Connections were made over TLS 1.3
• Processes were limited to virtual CPUs corresponding to cores
• The idea was to simulate a relatively large amount of peers by running 12 load test workers, each opening 4096 connections. However, only aquatic_ws ended up handling this amount.

### Software versions

| Software | Version |
|---|---|
| **Debian** | Bullseye |
| **Linux** | 6.0.0 |
| **rustc** | 1.66.1 |
| **nodejs (for bittorrent-tracker)** | 18.13.0 |
| **nodejs (for wt-tracker)** | 12.22.12 |
| **Hitch** | 1.7.3 |

# Configuration files and build instructions

Generate TLS certificates by going to aquatic source directory and running:

```
./scripts/gen-tls.sh
```

Before running applications, run:

```
sysctl net.ipv4.ip_local_port_range="5000 61000"
sysctl net.ipv4.tcp_fin_timeout=10

ulimit -n 1024000 # Run in each shell before running application
```

## aquatic_http_load_test

```
num_workers = 12
num_connections_per_worker = 4096
connection_creation_interval_ms = 1
duration = 60
measure_after_max_connections_reached = true
```

Run with:

```
taskset -c 12-23,36-47 ./target/release-debug/aquatic_ws_load_test -c load-test-ws.toml
```

## aquatic_ws

```
[network]
enable_tls = true
tls_certificate_path = "./tmp/tls/cert.crt"
tls_private_key_path = "./tmp/tls/key.pk8"

[cleaning]
torrent_cleaning_interval = 1800
connection_cleaning_interval = 1800
```

## hitch

```
frontend = {
    host = "127.0.0.1"
    port = "3000"
}
backend = "[127.0.0.1]:3001"
workers = 1
daemon = off
pem-file = {
    cert = "./tmp/tls/cert.crt"
    private-key = "./tmp/tls/key.pem"
}
user = "hitch"
group = "hitch"
```

Hitch will by default bind to hyperthreads itself, which circumvents using taskset. To prevent this, before building it, run:

```
sed -i "s/#if defined(CPU_ZERO) && defined(CPU_SET)/#if 0/g" ./src/hitch.c
```

# bittorrent-tracker

Run with:

```
bittorrent-tracker -p 3001 --ws -q
```

# wt-tracker

```
{
  "servers": [{
      "server": {
        "port": 3001,
        "host": "127.0.0.1"
      },
      "websockets": {
        "path": "/*",
        "maxPayloadLength": 65536,
        "idleTimeout": 240,
        "compression": 1,
        "maxConnections": 0
      }
    }
  ],

  "tracker": {
    "maxOffers": 5,
    "announceInterval": 120
  },

  "websocketsAccess": {
  }
}
```

# Measurements

## aquatic_ws

Measurements with 49152 connections active, spread over 12 load test workers:

| CPU cores | taskset | Socket workers | Swarm workers | Responses per second |
|-----------|---------|----------------|---------------|---------------------:|
| **1** | **0,24** | **1** | **1** | **76849** |
| 2 | 0-1,24-25 | 1 | 1 | 75126 |
| **2** | **0-1,24-25** | **2** | **1** | **142766** |
| 4 | 0-3,24-27 | 3 | 1 | 241294 |
| **4** | **0-3,24-27** | **4** | **1** | **315299** |
| 6 | 0-5,24-29 | 5 | 1 | 425148 |
| **6** | **0-5,24-29** | **6** | **1** | **447878** |
| 8 | 0-7,24-31 | 8 | 1 | 431861 |
| 8 | 0-7,24-31 | 7 | 1 | 441358 |
| 8 | 0-7,24-31 | 7 | 2 | 456484 |
| **8** | **0-7,24-31** | **6** | **2** | **477142** |
| 10 | 0-9,24-33 | 9 | 1 | 499417 |
| **10** | **0-9,24-33** | **8** | **2** | **503506** |
| 12 | 0-11,24-35 | 9 | 3 | 549444 |
| **12** | **0-11,24-35** | **10** | **2** | **603316** |

Measurements with 1020 connections active, spread over 12 load test workers:

| CPU cores | taskset | Socket workers | Swarm workers | Responses per second |
|-----------|---------|----------------|---------------|---------------------:|
| **1** | **0,24** | **1** | **1** | **120125** |
| **2** | **0-1,24-25** | **2** | **1** | **185820** |
| **4** | **0-3,24-27** | **4** | **1** | **346925** |
| **6** | **0-5,24-29** | **6** | **1** | **550227** |
| **8** | **0-7,24-31** | **8** | **1** | **787045** |
| **10** | **0-9,24-33** | **10** | **1** | **913968** |
| **12** | **0-11,24-35** | **10** | **2** | **853236** |

## bittorrent-tracker + hitch

The application didn't manage to handle more than approximately 1020 connections due to hitch backend timeout errors. Measurements were made once that number of connections was active (12 load test workers, each opening 85 connections). Tracker CPU usage was maxed out.

| CPU cores | taskset | hitch workers | Responses per second |
|---|---|---|---|
| 1 | 0,24 | 1 | 24857 |
| 2 | 0,24; 1,25 (hitch) | 1 | 29830 |
| 4 | 0,24; 1-3,25-27 (hitch) | 3 | 23925 |
| 6 | 0,24; 1-5,25-29 (hitch) | 5 | 27350 |

## wt-tracker + hitch

The application didn't manage to handle more than approximately 1020 connections due to hitch backend timeout errors. Measurements were made once that number of connections was active (12 load test workers, each opening 85 connections). Tracker CPU usage was maxed out.

When running with built-in TLS (i.e., not running behind hitch), only around 40 connections would be established and no measurements could be recorded.

| CPU cores | taskset | hitch workers | Responses per second |
|---|---|---|---|
| 1 | 0,24 | 1 | 58603 |
| 2 | 0,24; 1,25 (hitch) | 1 | 56593 |
| 4 | 0,24; 1-3,25-27 (hitch) | 3 | 65328 |
| 6 | 0,24; 1-5,25-29 (hitch) | 5 | 64418 |

# Results
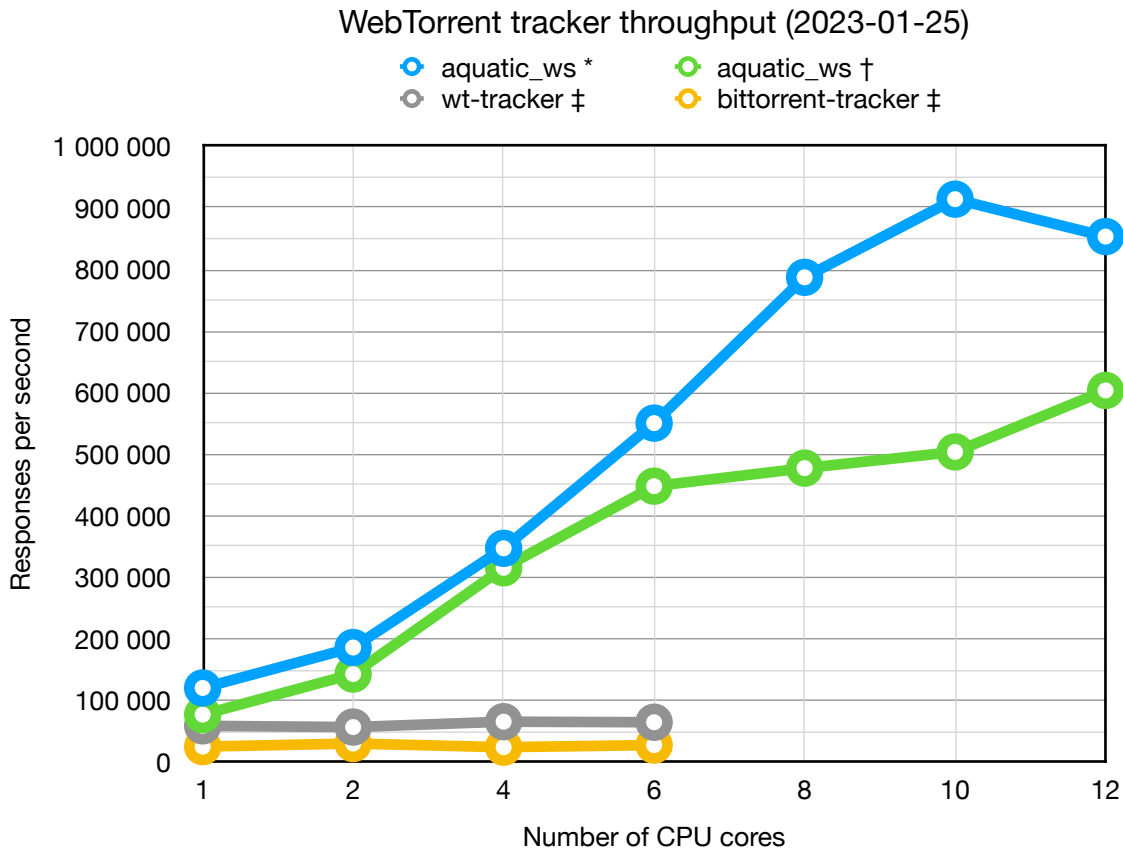
## WebTorrent tracker throughput (2023-01-25)

○ aquatic_ws *        ○ aquatic_ws †
○ wt-tracker ‡        ○ bittorrent-tracker ‡



* With 1020 connections (active peers)
† With 49 152 connections
‡ With 1020 connections, since higher numbers were not attainable; ran behind hitch TLS proxy

## WebTorrent tracker throughput (2023-01-25)

| | Responses per second | | | |
| --- | --- | --- | --- | --- |
| CPU cores | aquatic_ws * | aquatic_ws † | wt-tracker ‡ | bittorrent-tracker ‡ |
| 1 | 120125 | 76849 | 58603 | 24857 |
| 2 | 185820 | 142766 | 56593 | 29830 |
| 4 | 346925 | 315299 | 65328 | 23925 |
| 6 | 550227 | 447878 | 64418 | 27350 |
| 8 | 787045 | 477142 | | |
| 10 | 913968 | 503506 | | |
| 12 | 853236 | 603316 | | |

\* With 1020 connections (active peers)
† With 49 152 connections
‡ With 1020 connections, since higher numbers were not attainable; ran behind hitch TLS proxy