TCP Proxies are widely deployed in modern networks [1].
- Level 7 load balancers.
- Redirection proxies.
- In many cases, the proxy is only required during the initial phases of the connection.
- Often TCP connections carry just a single HTTP request [2].
- With the increase of TLS encrypted traffic only the first few frames of the connection can be (meaningfully) processed by the proxy [3].

**Motivation**

**Solution**

**Idea:** Can established connections be offloaded from the TCP proxy?

**Solution:** Use programmable switches to offload an established TCP connection
- When proxy’s operations are limited to relaying packets.
- Bypass operations:
  - NAPT (Network Address & Port Translation) operation.
  - ACK and SEQ number translation
- Handle TCP Options:
  - The same set of options has to be negotiated for both client and server.
  - Server side options can be cached and then negotiated with the client.

**Expected benefit:** Save precious resources by transparently remove a TCP proxy from the data path.

**PoC Implementation**

**Unikernel TCP proxy (Miniproxy [4]) plus a Programmable Switch (PISCES [5]).**
- The operating system needs to expose additional information at socket level.
- The switch has to parse and modify TCP header fields, such as TCP sequence and ACK numbers.
- The switch performs the bypass operations and the packet forwarding for the offloaded connections.

**Considerations on system load:**
- Configuration: proxy as a virtual machine and PISCES as software switch.
- Typical configuration one core assigned for each proxy, at least one core for the software switch.
- With all the connections offloaded, the proxy’s CPU cores stay idle, while the switch resource consumption does not increase.

**Impact on congestion control**

TCP flow for 60s over a 100Mbps link. After 30s (25s in rightmost pic.), additional delay is added on the link, summing up to a total RTT value of 100ms for all the cases.

- Removal of a proxy corresponds to a sudden variation of the perceived end-to-end RTT.
- To avoid side effects on the connection’s throughput, we introduce a gradual synthetic delay, e.g., in steps of 20ms, before performing the connection offload.

**REFERENCES**


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