# Key Indicators in HAProxy

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# Disclaimer

A high level presentation was given based on some of these slides at Dotscale 2018. This presentation will instead focus on deep-diving into the technical stuff.

# What does the LB see ?

- global failures (aborts, timeouts)
- abnormal delays caused by network retransmits
- connection failures and retries caused by bad tuning (*eg: conntrack*)
- connection slowdowns caused by inefficient firewall policies (*#rules*)

  ...

# What does the LB see (…) ?

- client-side issues (*BW limitations*)
- per-URL processing time (*application issues, svc partners*)
- per-node vs per-cluster variations
  => *narrow down to individual node or shared resource*
- deployment issues : new occasional error on a specific page, can be addressed before going full-scale

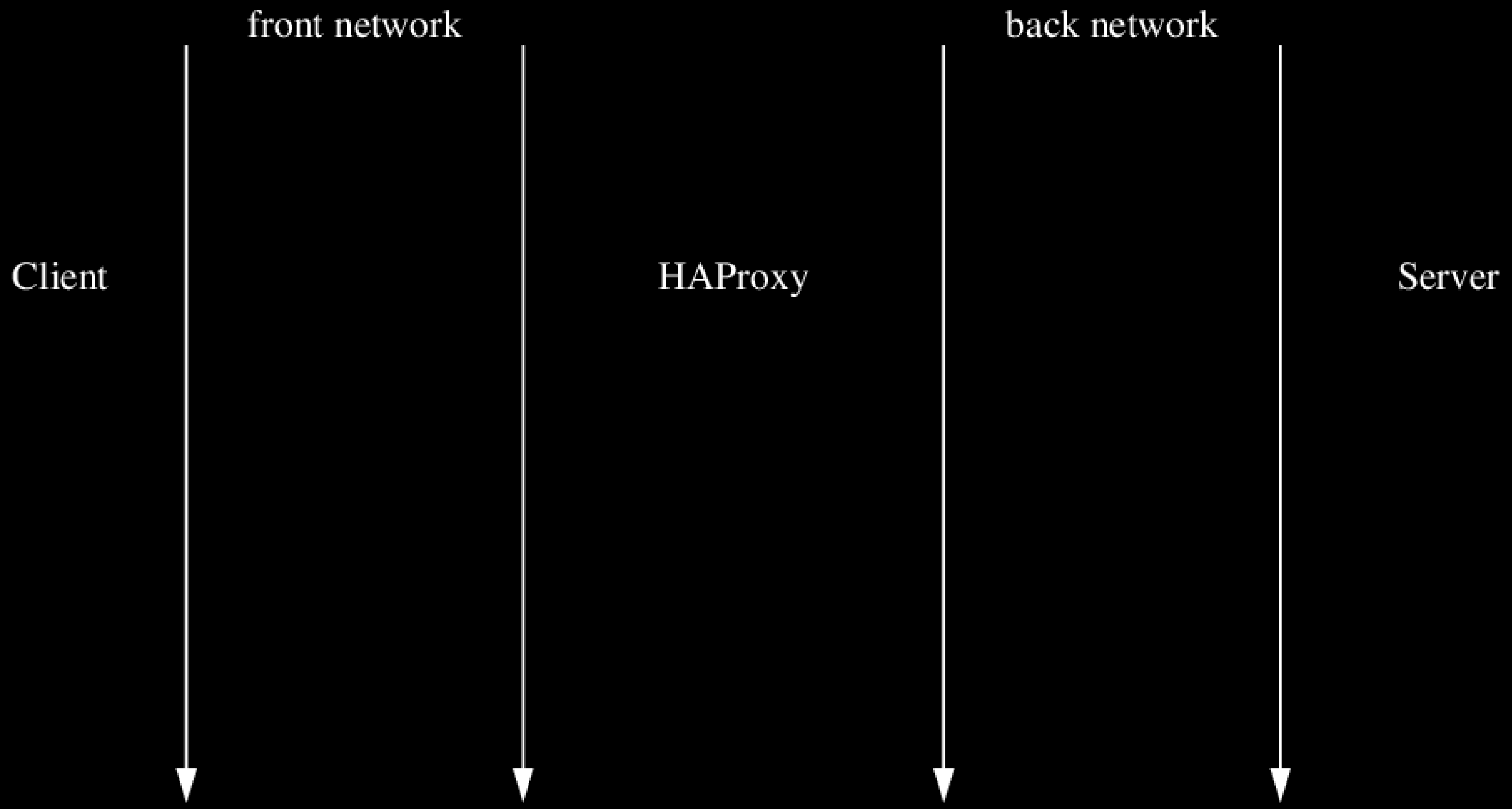
# Accessing metrics in HAProxy

- Logs :
- Halog, ELK, Prometheus, …
- Provides unique-id for tracing/event correlation

- Stats :
- Stats page, CLI, hatop

- Stick-tables (per arbitrary key like IP, URL, cookie) :
- Byte count, cumulated/concurrent conns, errors, …

# Sequence of events on HAProxy



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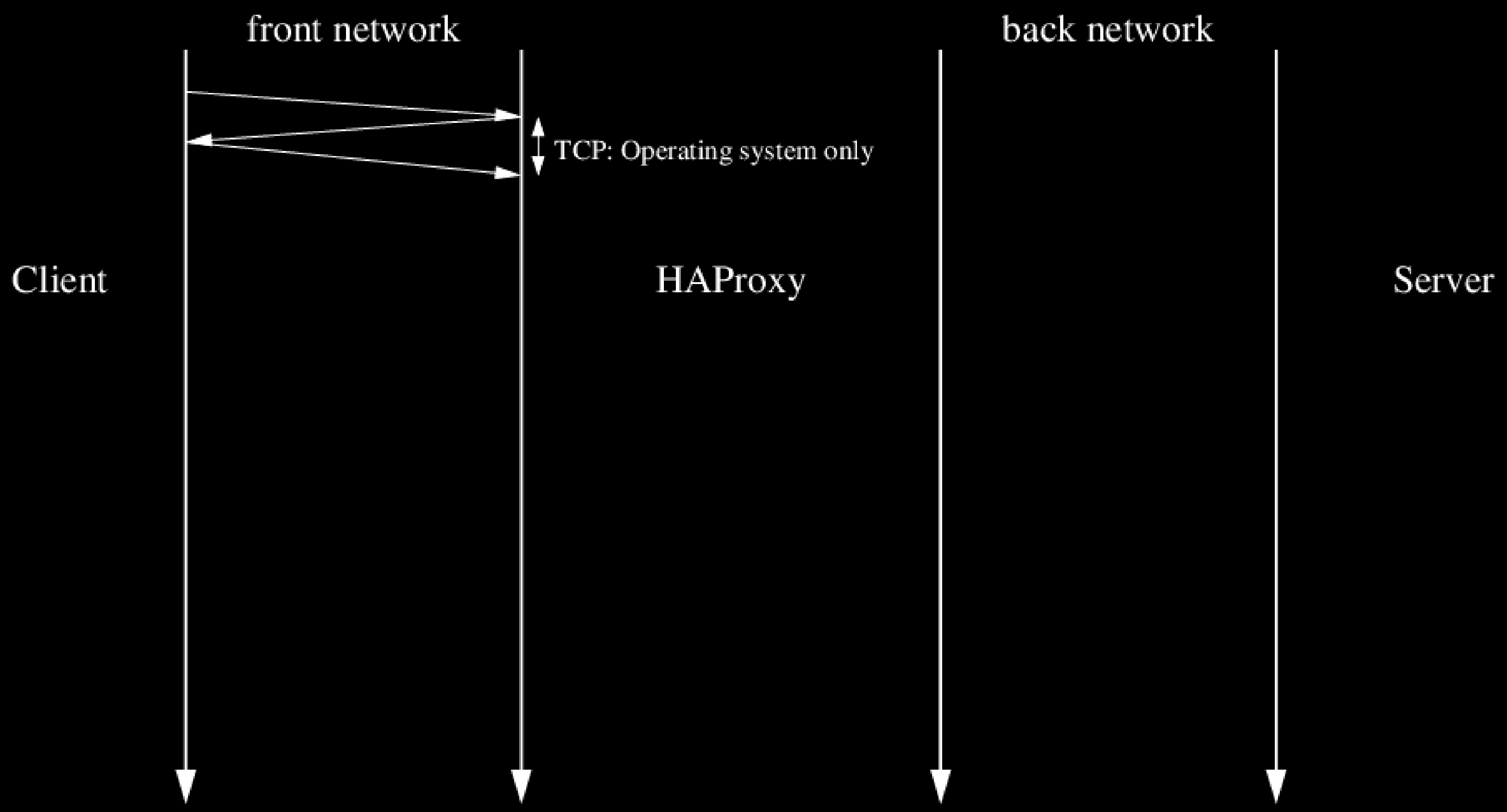

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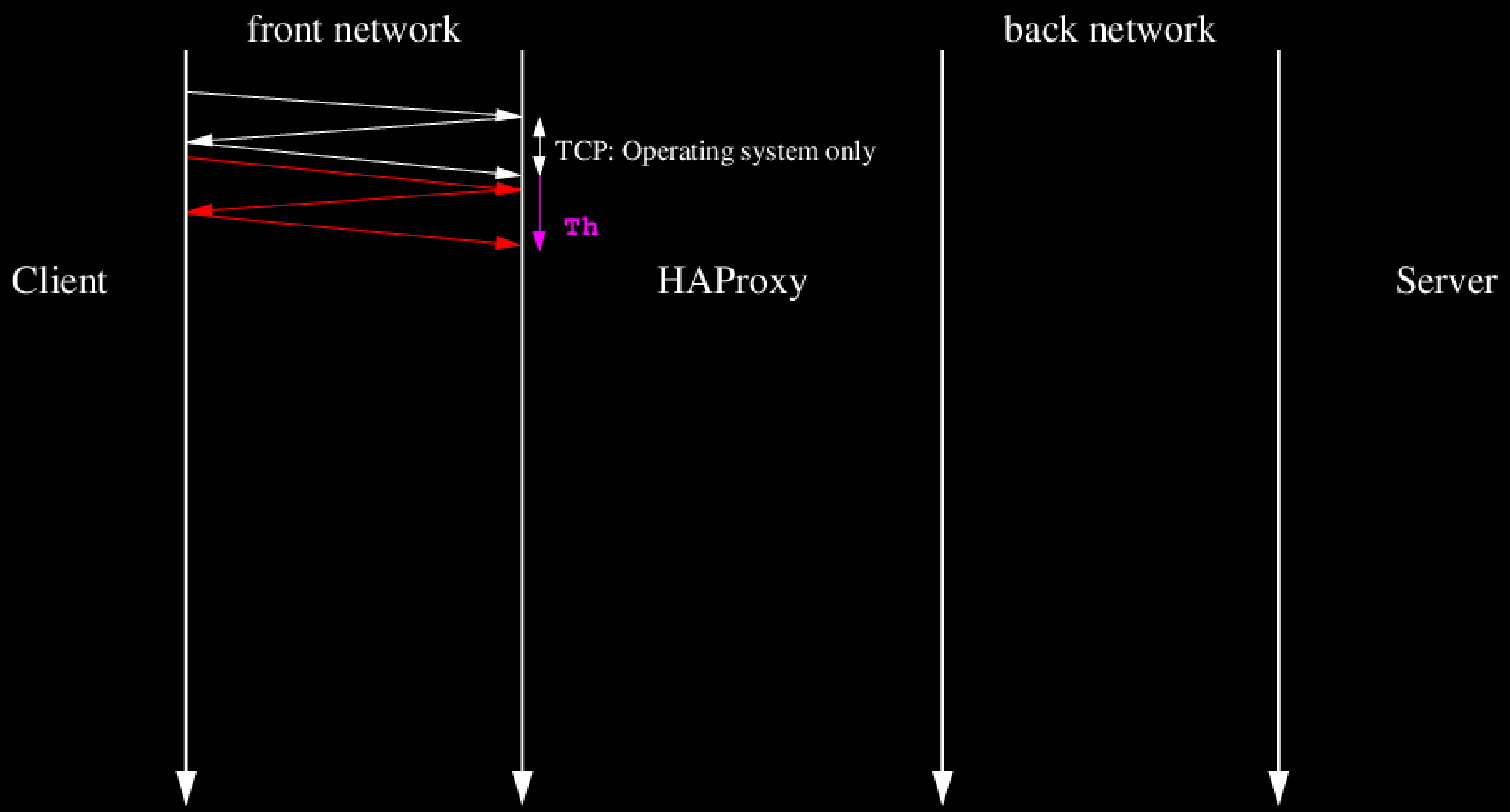

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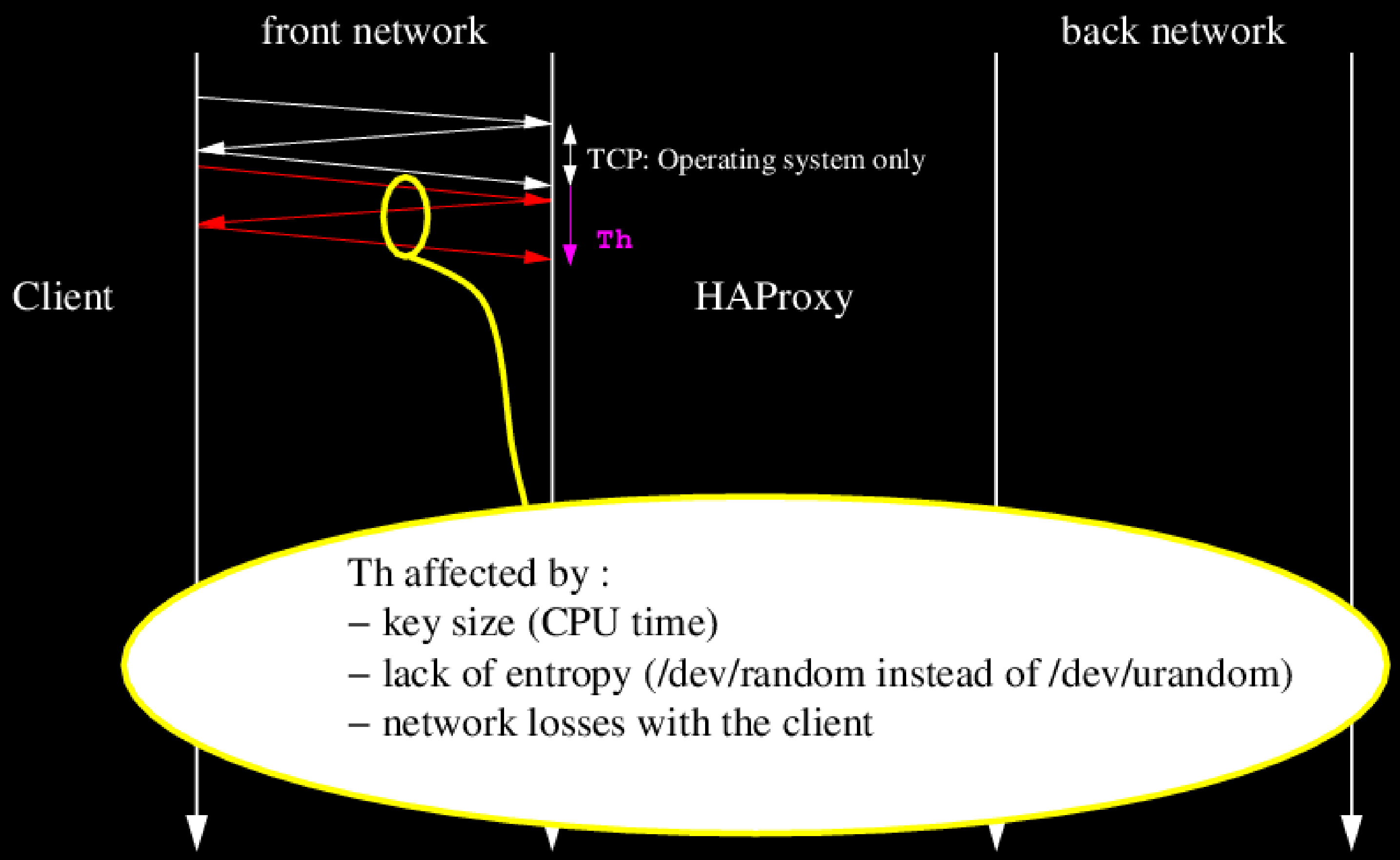


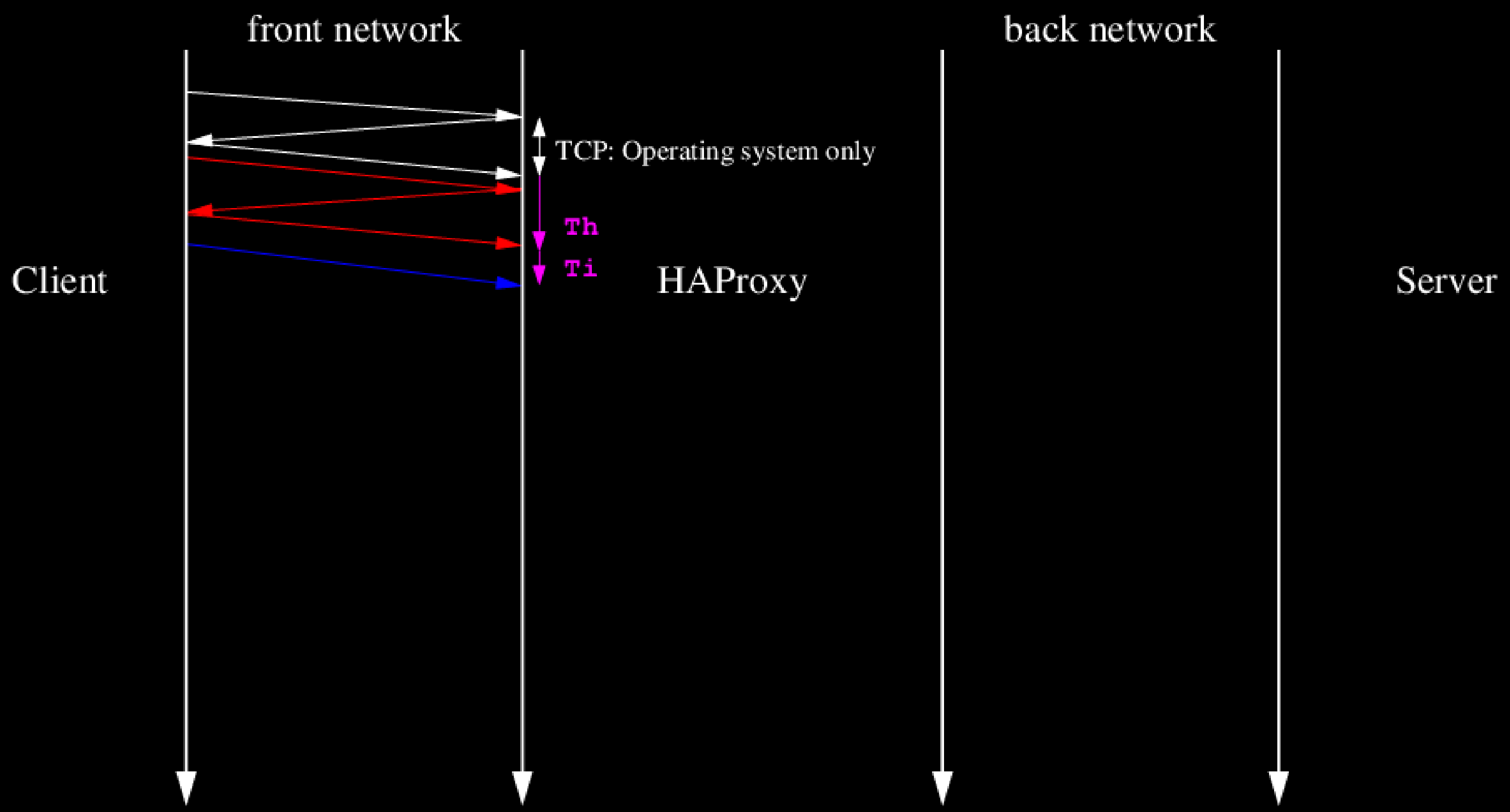
Th affected by :

– key size (CPU time)

– lack of entropy (/dev/random instead of /dev/urandom)

– network losses with the client

# Sequence of events on HAProxy



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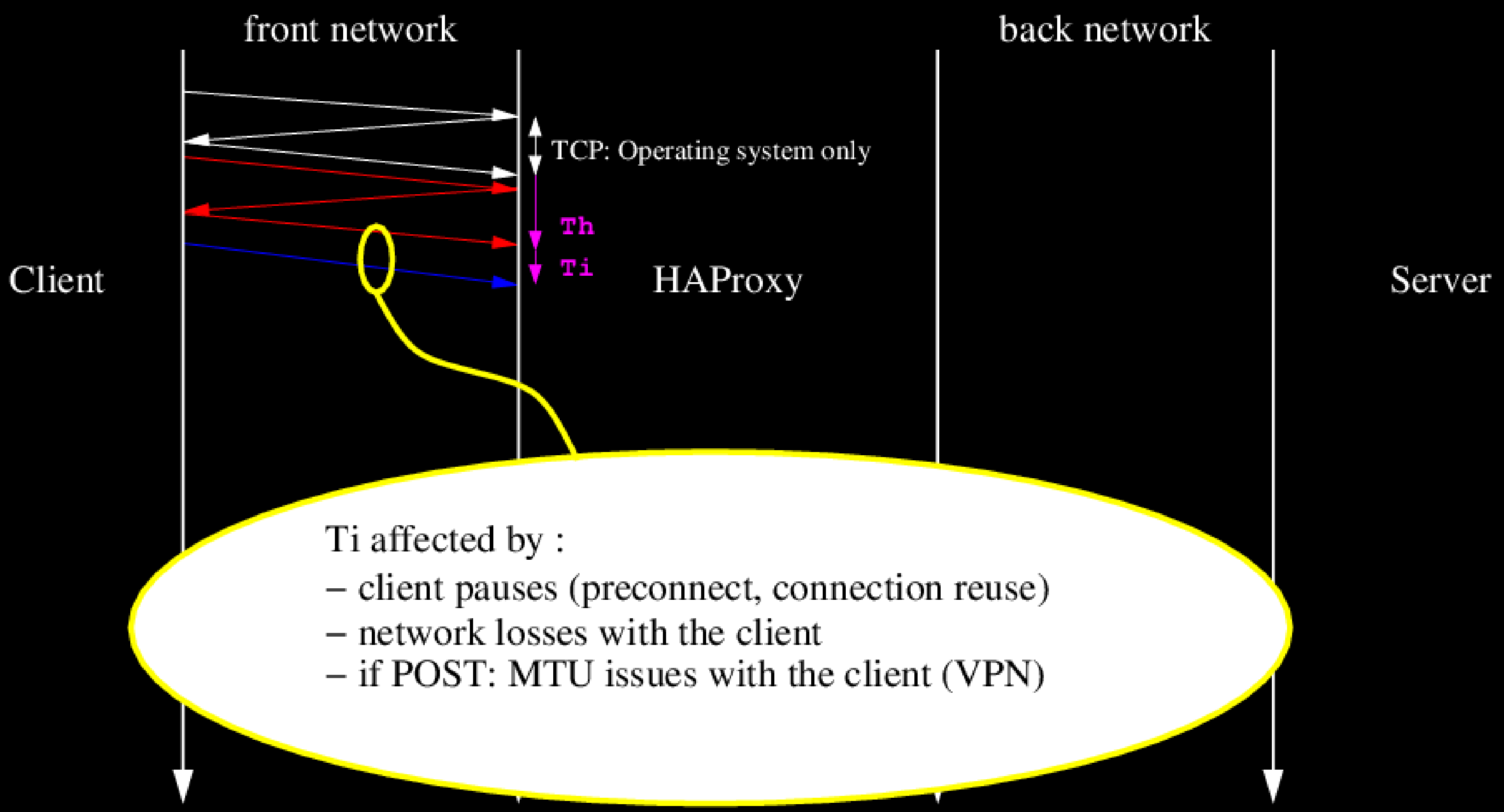

Ti affected by :

– client pauses (preconnect, connection reuse)
– network losses with the client
– if POST: MTU issues with the client (VPN)

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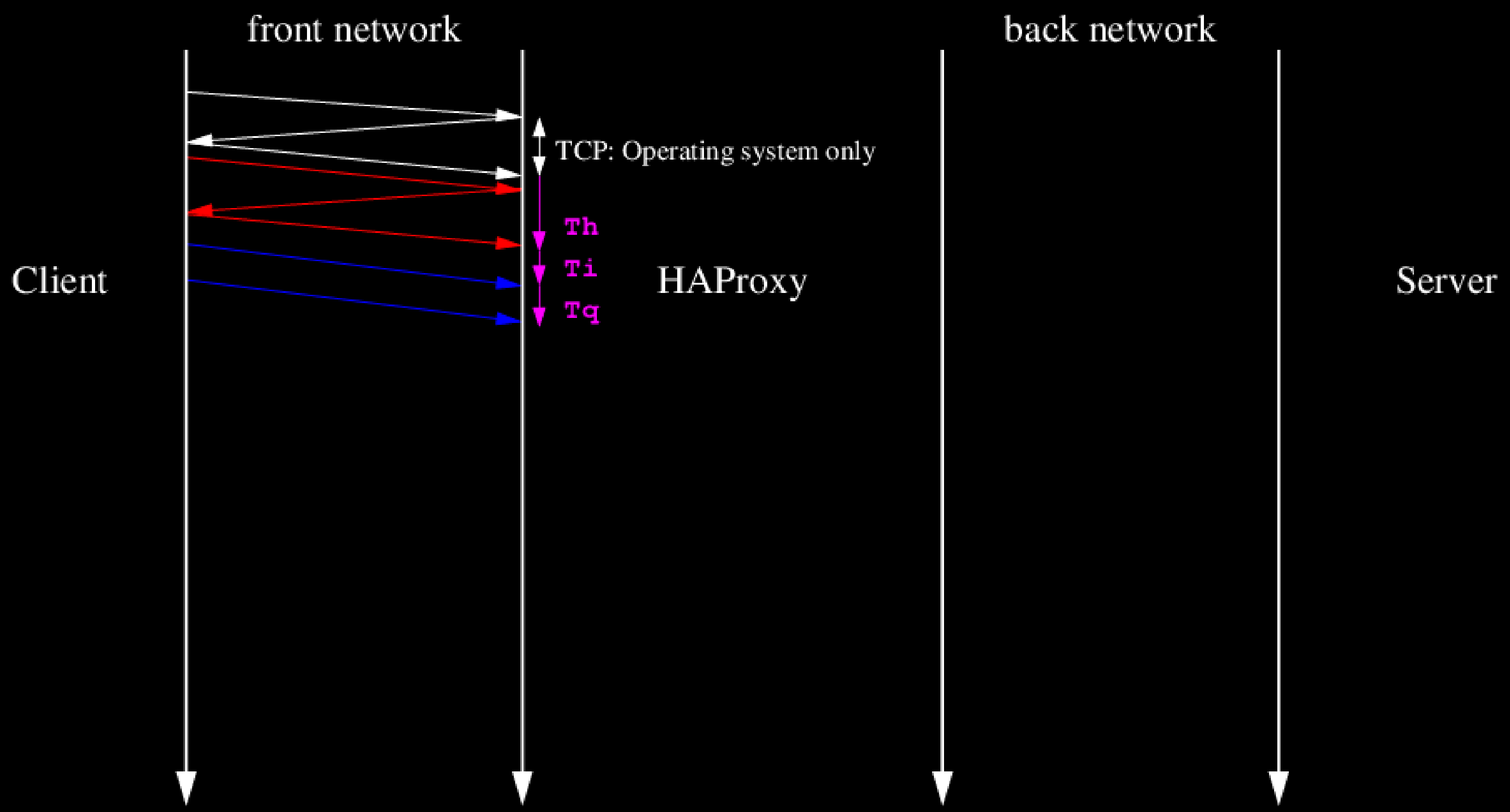

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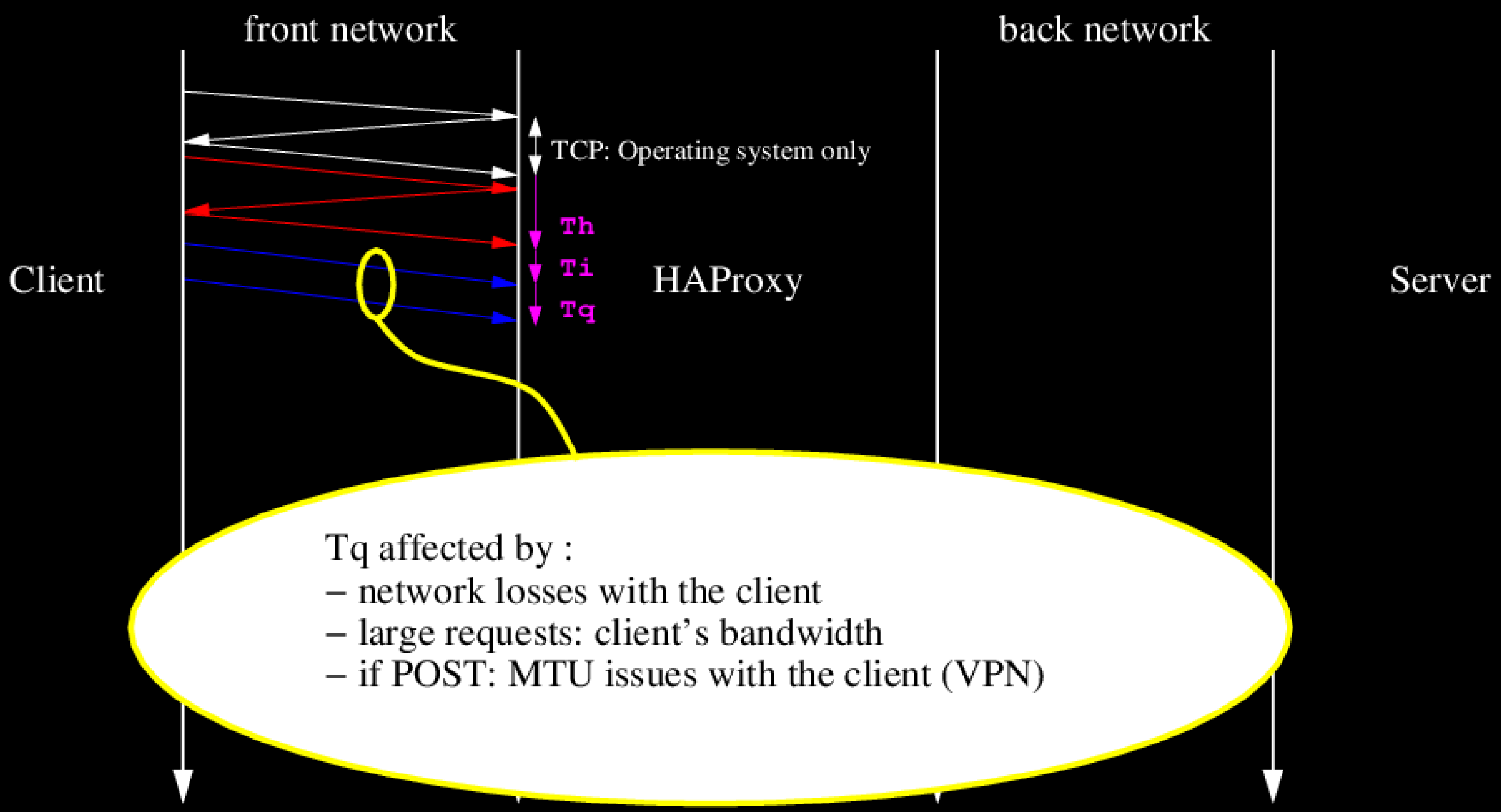


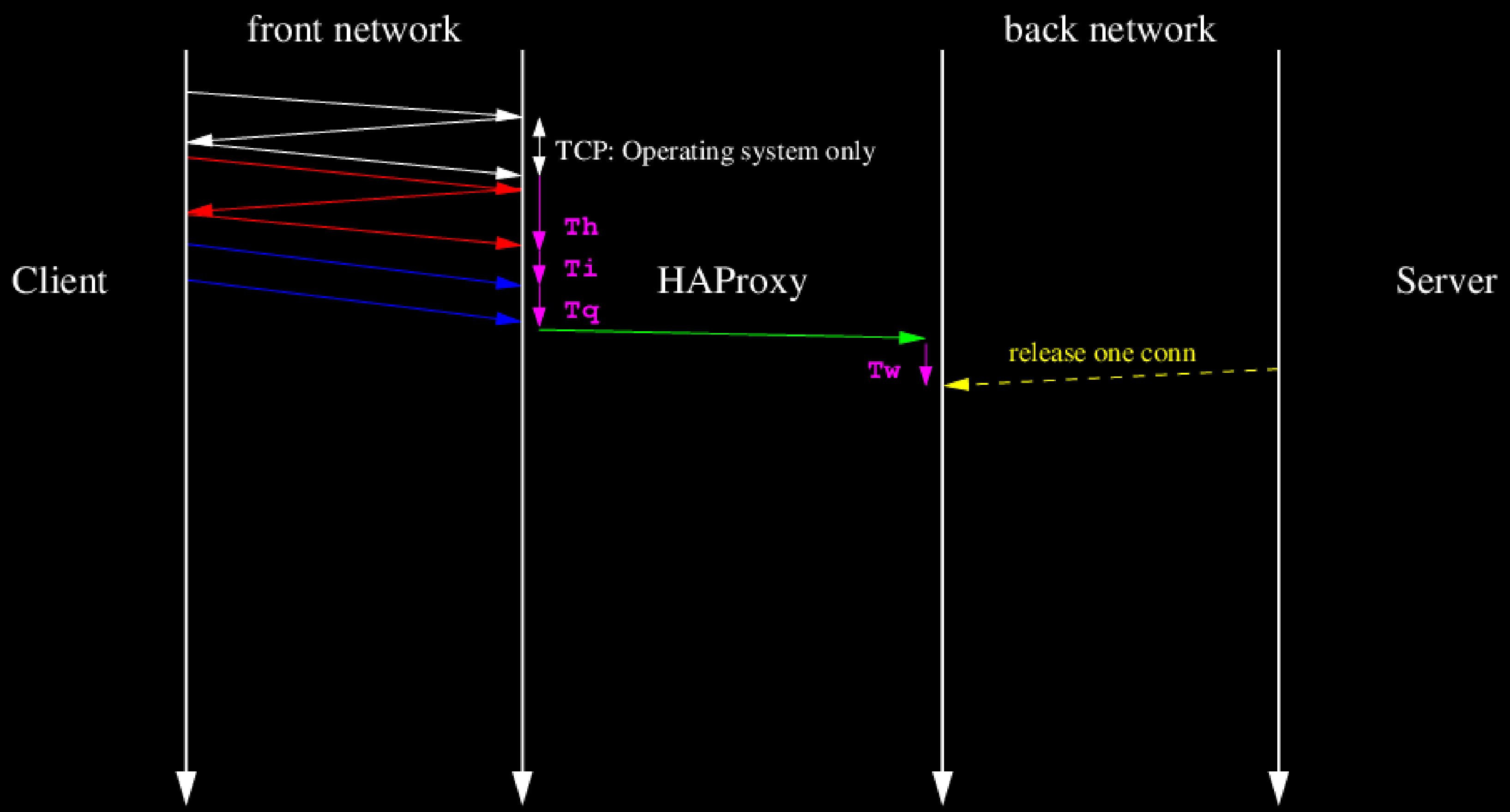
Tq affected by :

– network losses with the client

– large requests: client's bandwidth

– if POST: MTU issues with the client (VPN)

# Sequence of events on HAProxy



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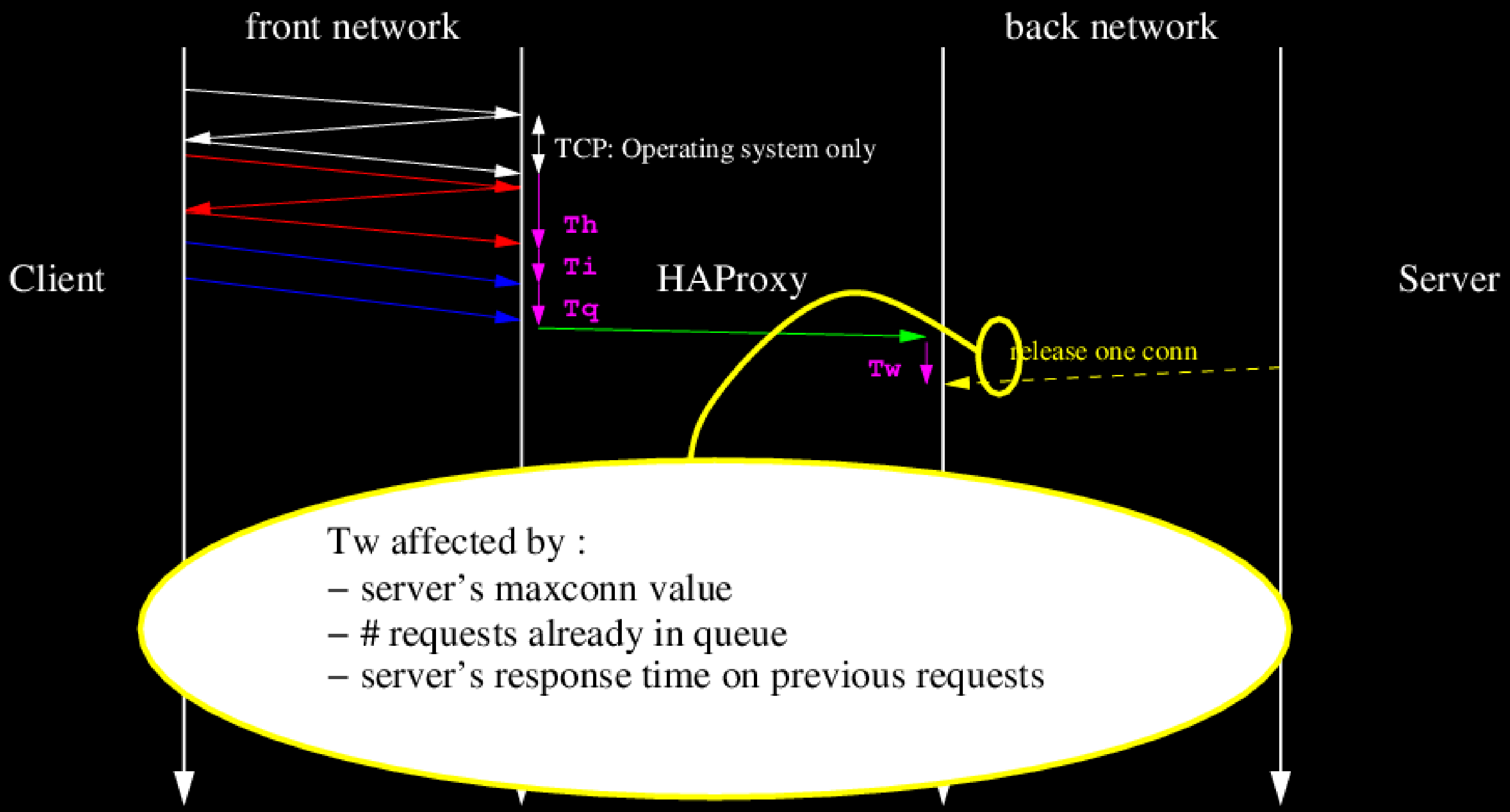


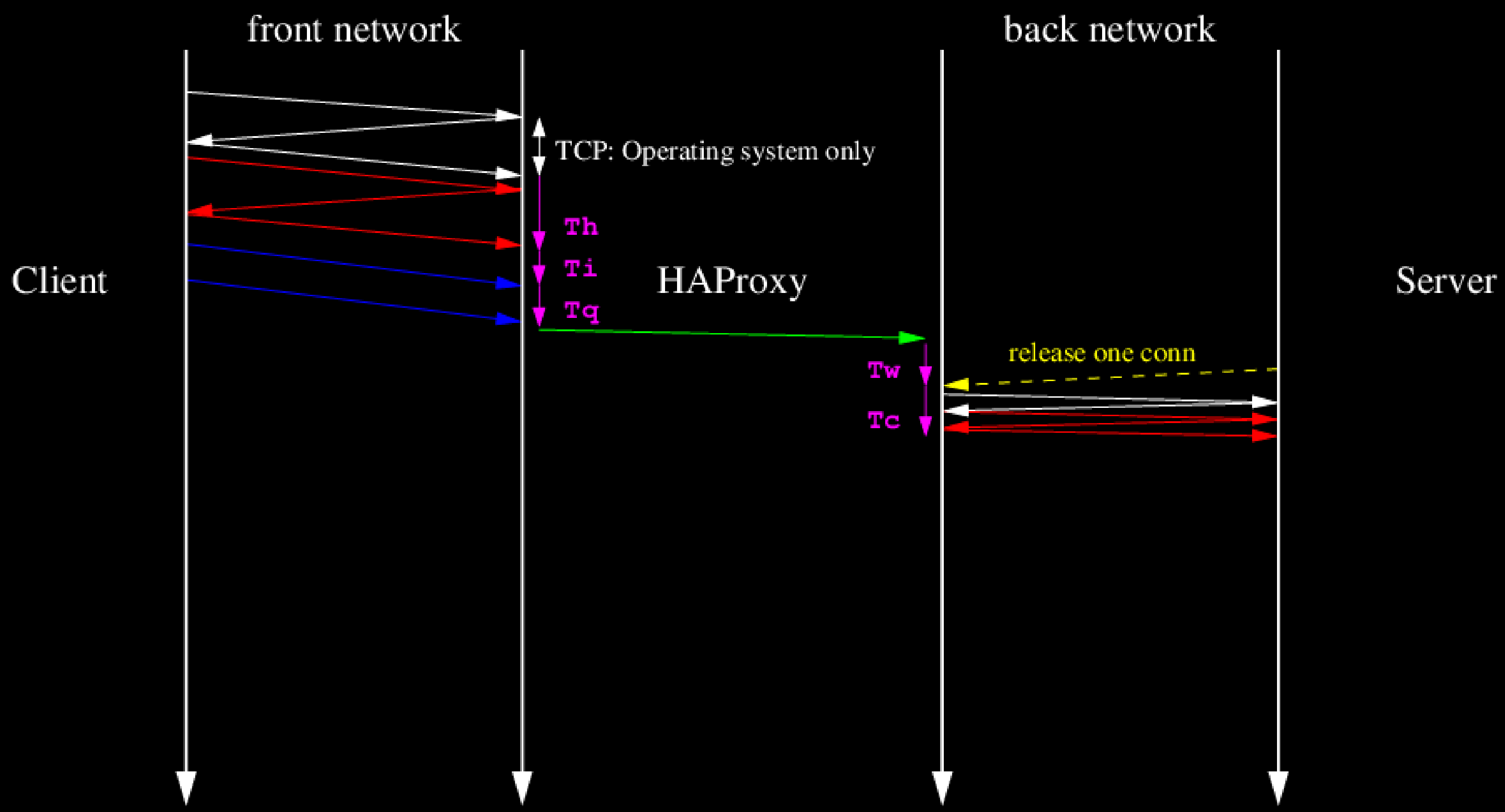
Tw affected by :

– server's maxconn value

– # requests already in queue

– server's response time on previous requests

# Sequence of events on HAProxy



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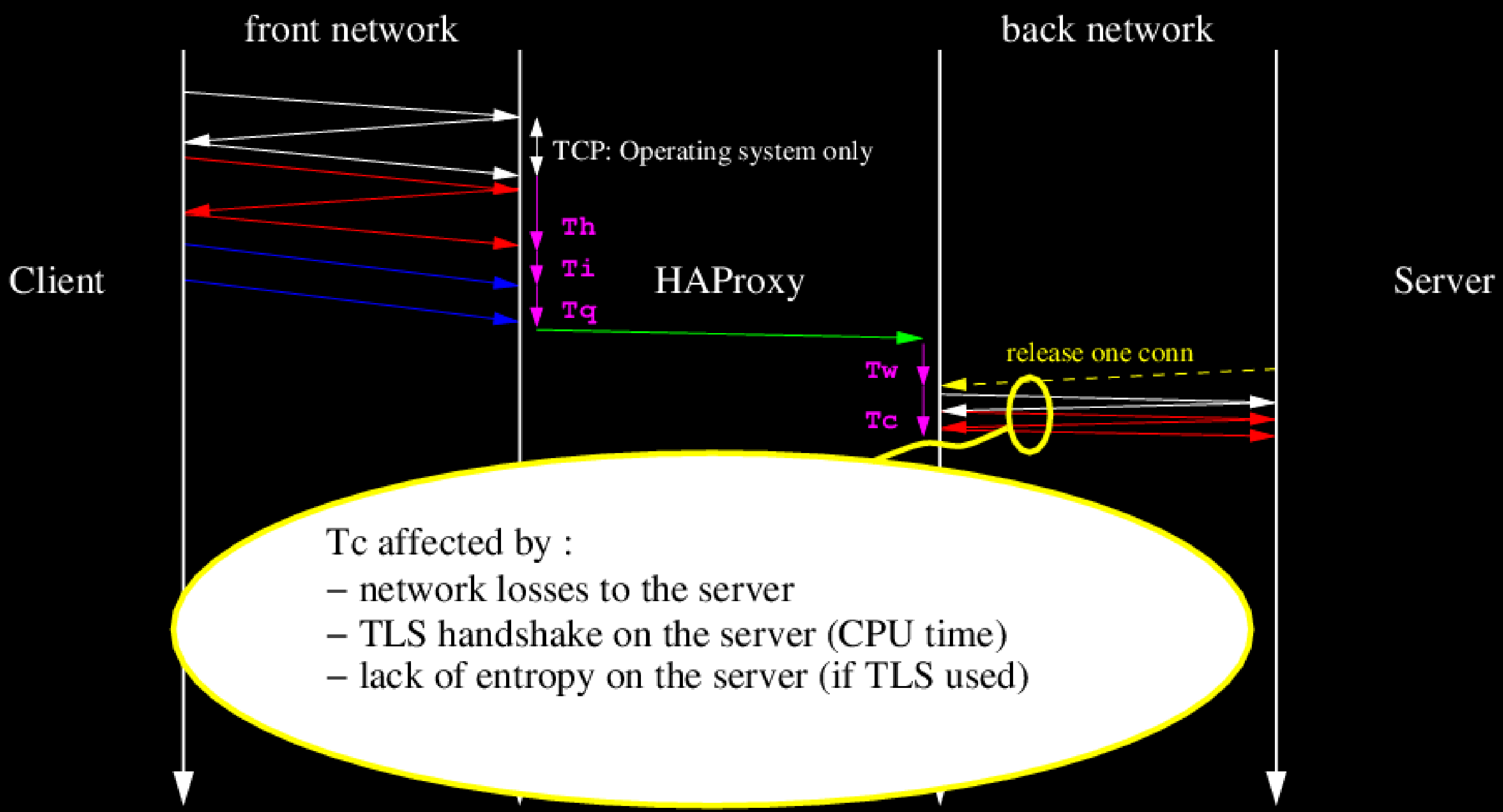
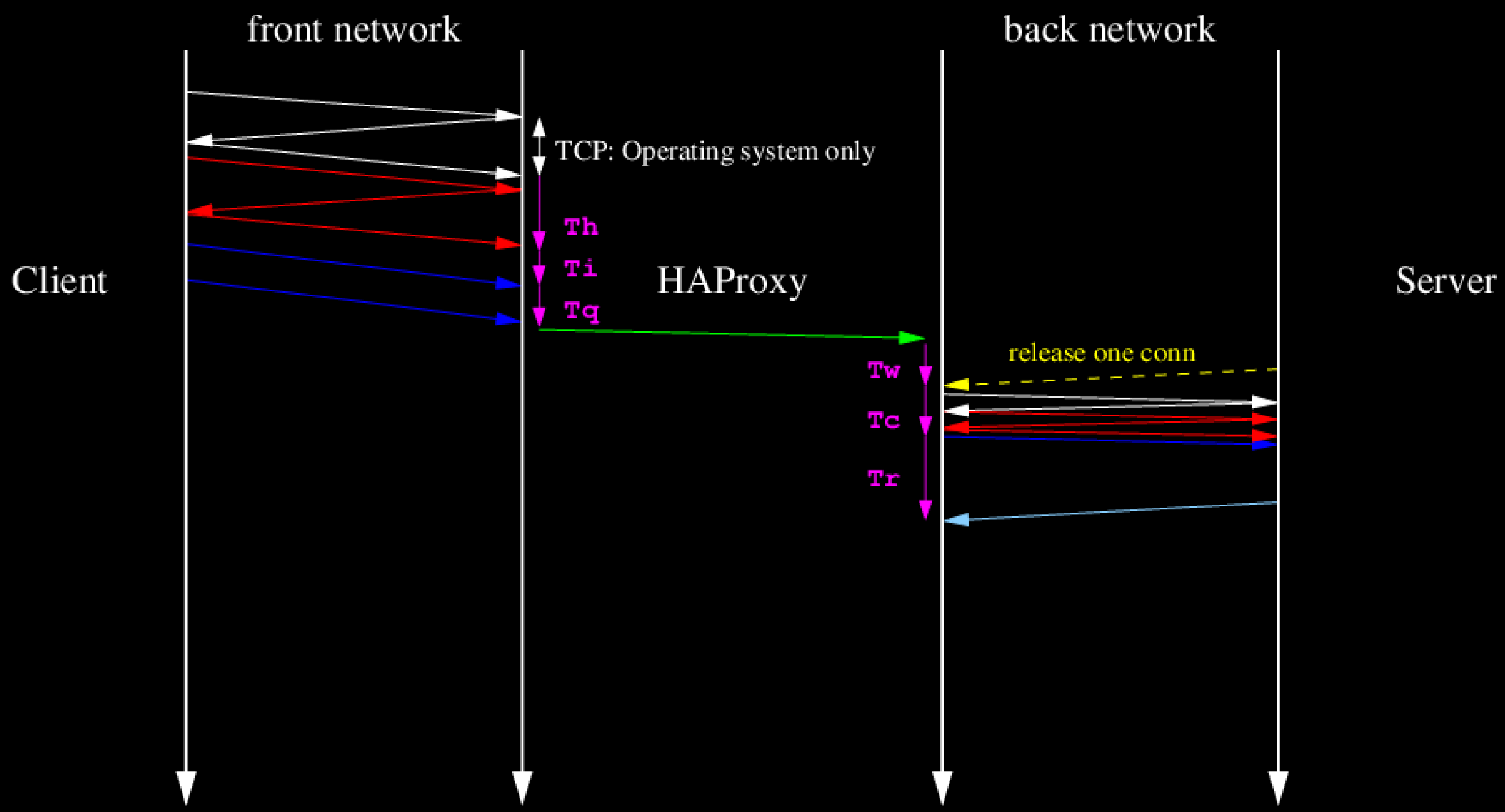


Tc affected by :
– network losses to the server
– TLS handshake on the server (CPU time)
– lack of entropy on the server (if TLS used)

# Sequence of events on HAProxy



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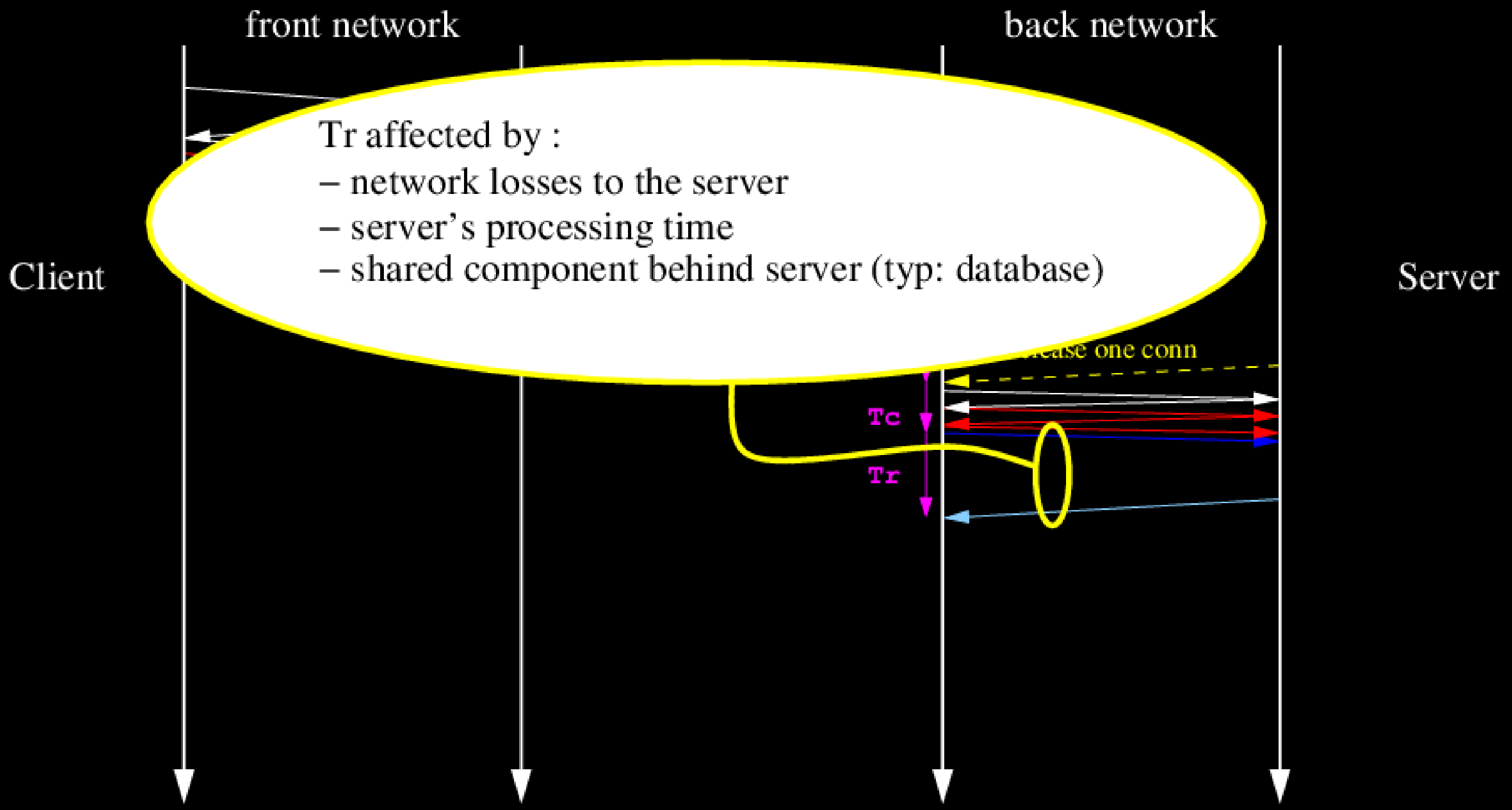
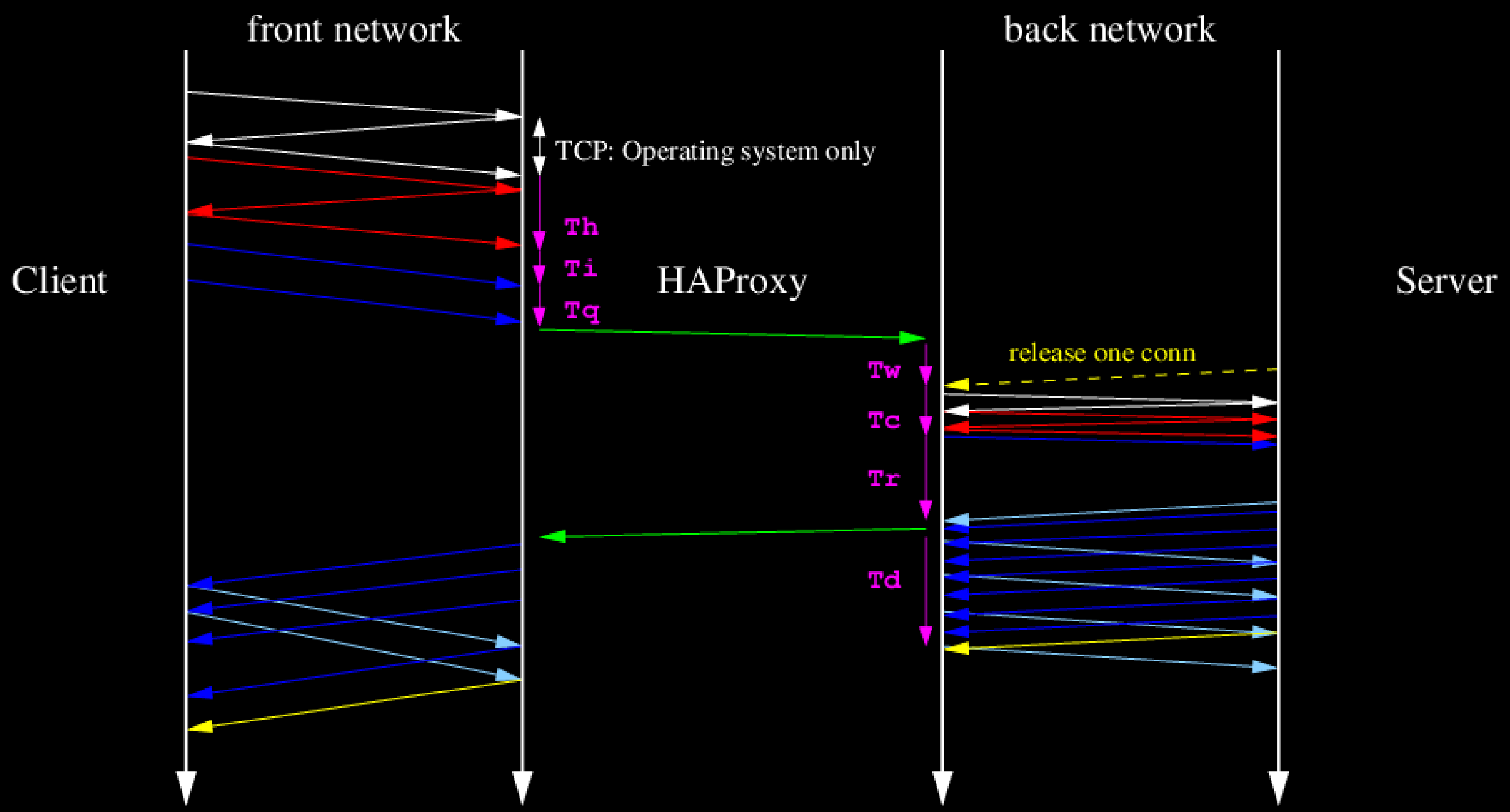


Tr affected by :
– network losses to the server
– server’s processing time
– shared component behind server (typ: database)

# Sequence of events on HAProxy



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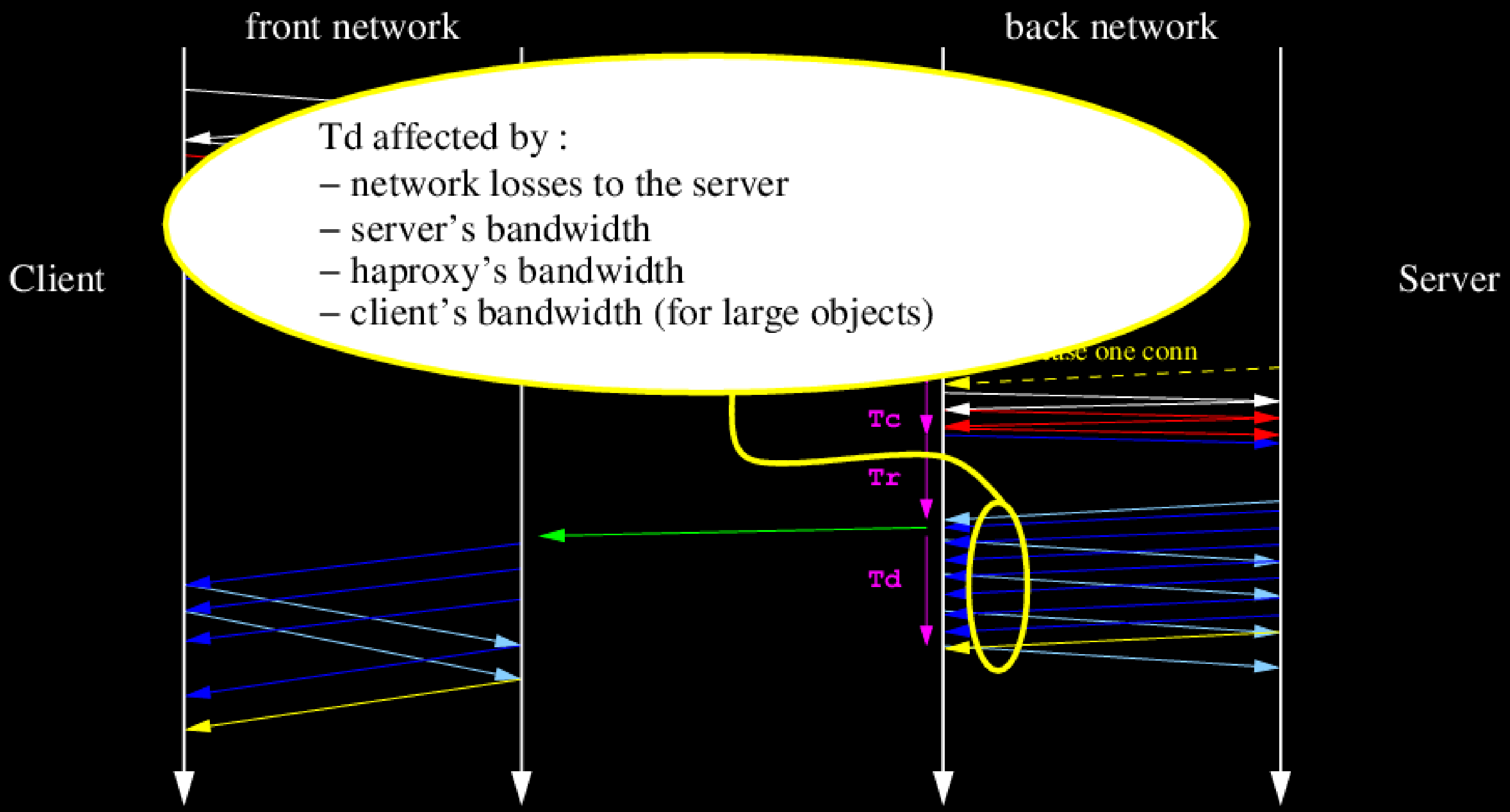


Td affected by :

– network losses to the server

– server’s bandwidth

– haproxy’s bandwidth

– client’s bandwidth (for large objects)

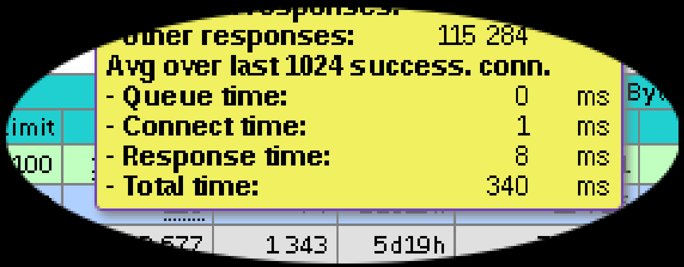
# More timers to come in HAProxy 1.9

- HAProxy now supports heavier per-request workloads (Lua, device identification, …)
- Processing times over 200 µs can become noticeable

Actions:

- log per-request total CPU time spent in analysers
- log per-request total CPU time spent in TLS handshake
- log per-request total latency added by other tasks
- log per-process total stolen time by other processes
- Ability to kill offending tasks
- Ability to alert on high latencies

# Event timing reports

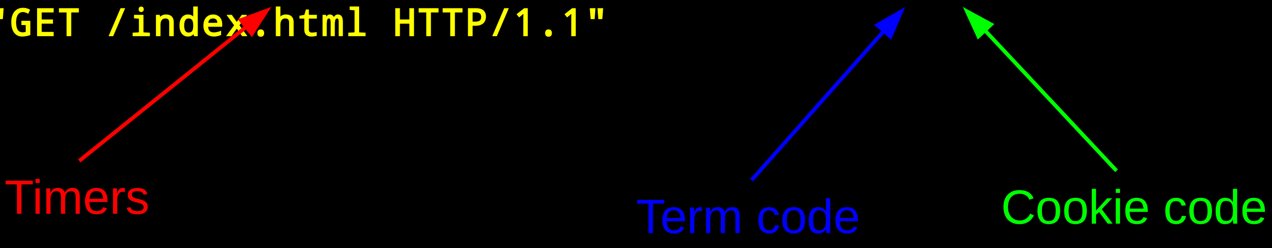


other responses: 115 284
Avg over last 1024 success. conn.
- Queue time: 0 ms
- Connect time: 1 ms
- Response time: 8 ms
- Total time: 340 ms

- Timers are averaged in the stats
- Each timer appears in the logs
- Halog -rt/-RT/-pct for quick analysis
- Each timer crossing a limit triggers a timeout
- Each abort at a specific step causes a hard error

=> *termination codes*

```
haproxy[14389]: 10.0.1.2:33317 [06/Feb/2018:12:14:14.655] http-in
   static/srv1 10/0/30/69/109 200 2750 - - SDNN 1/1/1/1/0 0/0 {haproxy.org}
   {} "GET /index.html HTTP/1.1"
```



Timers

Term code

Cookie code

# Termination codes

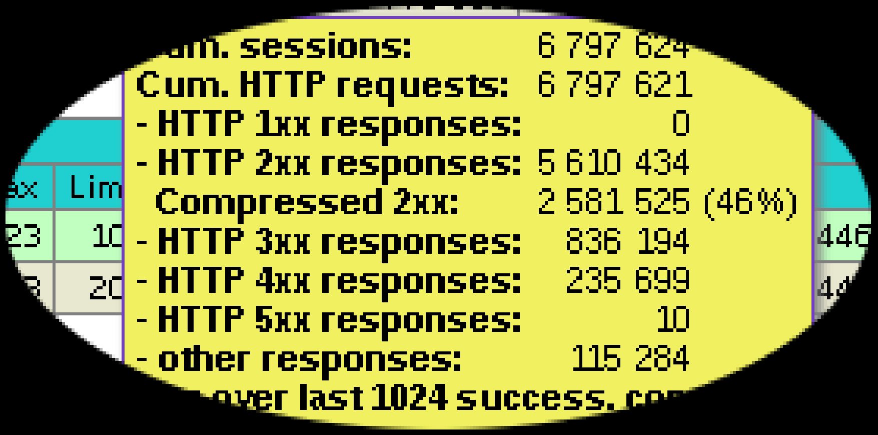
- Distinguish between timeout and abort
- Indicate whom (*client, server, haproxy, kill, ...*)
- Indicate when (*req,queue,connect,response...*)
- Completed by persistence cookie indications
- Filtered and sorted by halog :

```
# halog -tcn|-TCN ... # for filtering
# halog -tc           # for sorting
```

# Other relevant metrics : HTTP status distribution

- Stats page: distribution per frontend/backend/server
- Filter by ranges: halog -hs/-HS
- Sorted output: halog -st

*=> graph the distribution and watch for variations between application deployments*

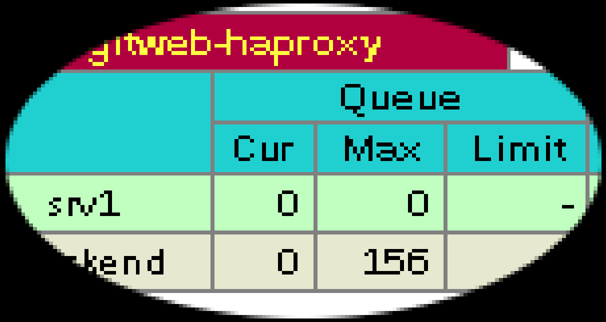


```
um. sessions:              6 797 624
Cum. HTTP requests:        6 797 621
- HTTP 1xx responses:              0
- HTTP 2xx responses:      5 610 434
  Compressed 2xx:          2 581 525 (46%)
- HTTP 3xx responses:        836 194
- HTTP 4xx responses:        235 699
- HTTP 5xx responses:             10
- other responses:           115 284
  over last 1024 success. co
```

# Other relevant metrics : queue length

- Uses server maxconn
- Grows exponentially with slowdowns : easy to detect!
- Tells you how many extra servers you need
- Reported by halog -Q/-QS
- Shown in real time on the stats page per backend/srv

*=> If you watch only one metric, watch this one!*



gitweb-haproxy

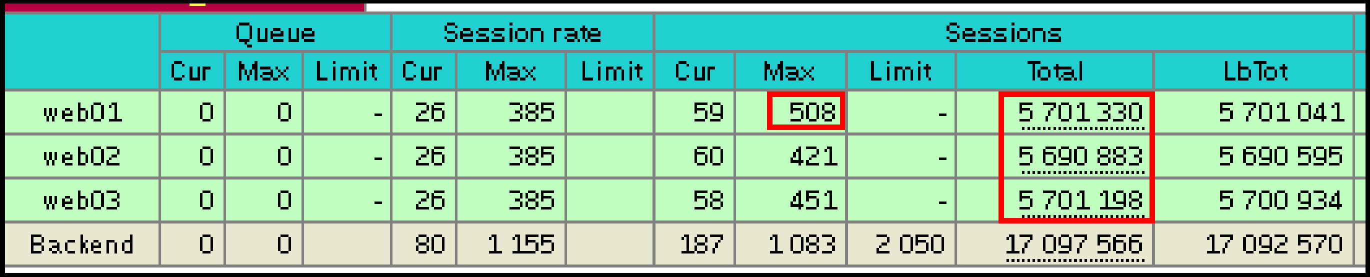
| | Queue | | |
|---|---|---|---|
| | Cur | Max | Limit |
| srv1 | 0 | 0 | - |
| kend | 0 | 156 | |

# Other relevant metrics : LB fairness

LB algorithm implies fairness between servers :

- Equal request count with roundrobin
  => Higher than average concurrency indicates abnormally slow server
- Equal load with leastconn
  => Low req count indicates abnormally slow server

=> *graph relevant values within the farm*

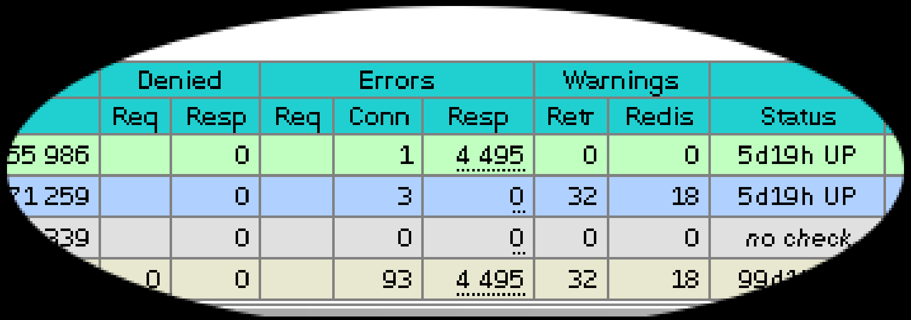


| | Queue | | | Session rate | | | Sessions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cur | Max | Limit | Cur | Max | Limit | Cur | Max | Limit | Total | LbTot |
| web01 | 0 | 0 | - | 26 | 385 | | 59 | 508 | - | 5 701 330 | 5 701 041 |
| web02 | 0 | 0 | - | 26 | 385 | | 60 | 421 | - | 5 690 883 | 5 690 595 |
| web03 | 0 | 0 | - | 26 | 385 | | 58 | 451 | - | 5 701 198 | 5 700 934 |
| Backend | 0 | 0 | | 80 | 1 155 | | 187 | 1 083 | 2 050 | 17 097 566 | 17 092 570 |

# Other relevant metrics : error rate

- Global: halog -e
- Per server: halog -srv
- Per client IP: halog -e -ic *(detect bad CDN nodes)*
- Per URL: halog -ue
- Stats page: per frontend/backend/server
- Stick-tables: per arbitrary key using http_err_rate()

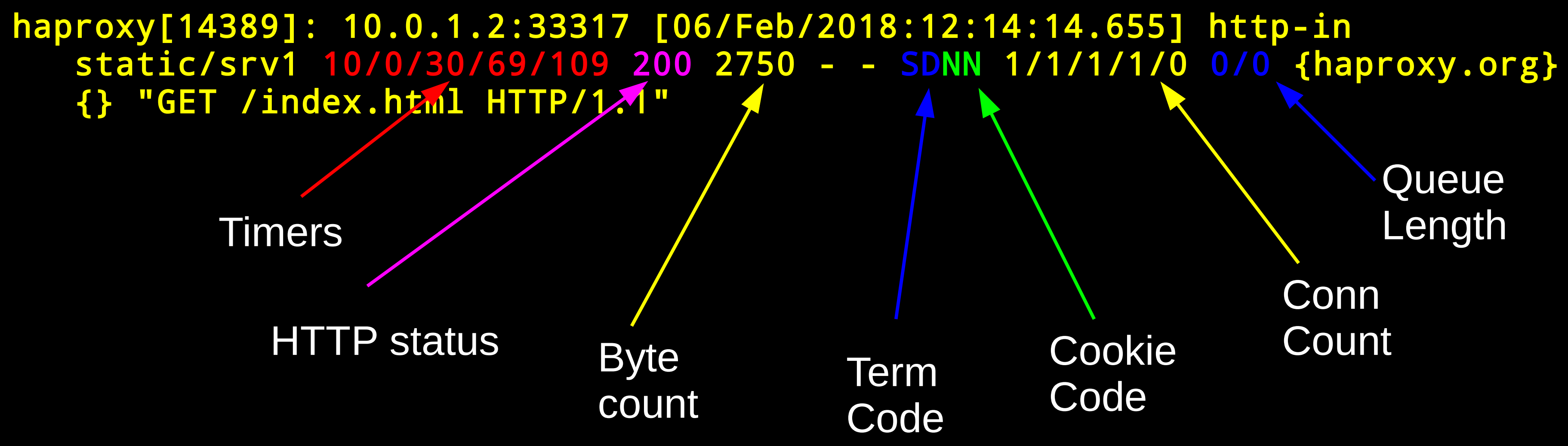
*=> no threshold, watch for variations*



| | Denied | | Errors | | | Warnings | | |
|---|---|---|---|---|---|---|---|---|
| | Req | Resp | Req | Conn | Resp | Retr | Redis | Status |
| 55 986 | | 0 | | 1 | 4 495 | 0 | 0 | 5d19h UP |
| 71 259 | | 0 | | 3 | 0 | 32 | 18 | 5d19h UP |
| 339 | | 0 | | 0 | 0 | 0 | 0 | no check |
| | 0 | 0 | | 93 | 4 495 | 32 | 18 | 99d1 |

# Useful entries in log-format

- Default httplog format is quite rich
- Can be improved using the `log-format` directive
- Hint: log stick-table stats for similar keys



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# Tips: sampling : why / when

*"I can't enable logs, I have too much traffic!"*

- an average syslog server can store 20k events/s without sweating
- that's 1.7B events/day or 350GB of uncompressed haproxy logs/day
- compresses to 1TB/month
- for $100 you can store 4 months with no loss
- have more traffic / not interested in this level of detail ?

```
# log only 5% of requests
http-request set-log-level silent unless { rand(100) -lt 5 }
```

# Tips: selective logging: why / when

- you only want to catch suspicious events
- disable logging unless Tc/Tq/Tr/Tw/... is above a certain threshold
- on the fly for selected keys from the CLI + stick-table
- also see "`option dontlognormal`"
- **WARNING**: you'll lose any valid reference

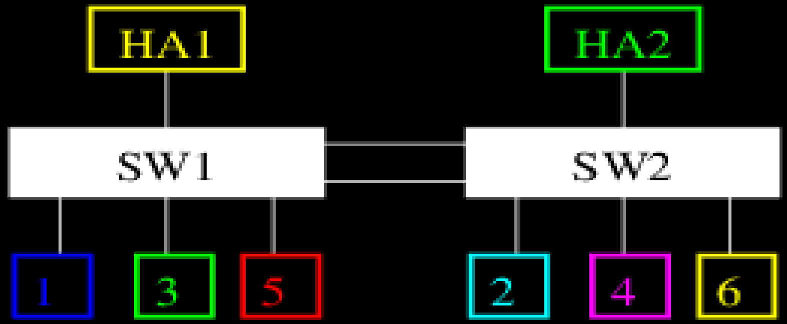
# Tips: other halog goodies

- Poorly documented, use `halog --help`
- response time per url: `halog -uat`
- errors per server: `halog -srv`
- Percentiles on req/queue/conn/resp times: `halog -pct`
- detect stolen CPU / swap : `halog -ac … -ad …`
- very fast (1-2 GB per second)

***=> Use it in production to figure the relevant metrics***

# Success stories

*Customer spotting a broken fiber between two core switches*



- Tc from HA1 to srv 1,2,3,5 always low, srv 4,6 high at 99 pct
- Tc from HA2 to srv 1,2,4,6 always low, srv 3,5 high at 99 pct
  => both haproxy and *servers out of cause*
- issue rate stable at various traffic levels => *not congestion*
- inter-switch link apparently at cause but not for all flows
- inter-switch link made of two fibers balanced on MAC tuple
- thanks to long-term logs, origin could even be identified

# Success stories

*Customer figuring a wrong web server configuration using /dev/random*

- Tc abnormally high with lots of random values to several seconds, and only for TLS
- timer also covers TLS handshake
  *=> not a network, hardware or performance issue, only server config.*
  *=> system was regularly running out of entropy due to mistakenly using /dev/random as a random source for SSL*

# Conclusion

- exploit your stats
- enable logs on LBs, no excuse for not doing it!
- process them automatically, manually once in a while
- compare numbers between similar objects
- detect anomalies
- fix problems before they are witnessed
- profit :-)