Load balancing MySQL with HaProxy

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MYSQL WORLDWIDE CONFERENCE & EXPO

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Agenda

- What is HaProxy
- HaProxy configuration
- Load balancing topologies
- Checks
- Load balancing Percona XtraDB Cluster
- Load balancing master-slave Cluster managed by PRM
- Load balancing MySQL Cluster
- Writing custom checks, large scale issues

What is HaProxy

- http://haproxy.1wt.eu
- General purpose load balancer
  - We are using it at the TCP level
  - It doesn't understand the mysql wire protocol
  - It can check backend state on HTTP
  - Current stable version is 1.4
- Single process, event-driven

HaProxy configuration

- Global
  - Logging, user, group, ...
- Defaults
  - Mode, maxconn, timeouts, ...
- Frontend definitions
  - Port, default backed ...
- Backend definitions
  - Backend servers, check method, check interval...
- Listen
  - Frontend + backend

HaProxy configuration II.

- Global

```
global
log 127.0.0.1 local0
maxconn 4096
chroot /usr/share/haproxy
user haproxy
group haproxy
daemon
```

- Defaults

```
option redispatch
maxconn 2000
contimeout 5000
clitimeout 50000
srvtimeout 50000
```

HaProxy configuration III.

- Frontend

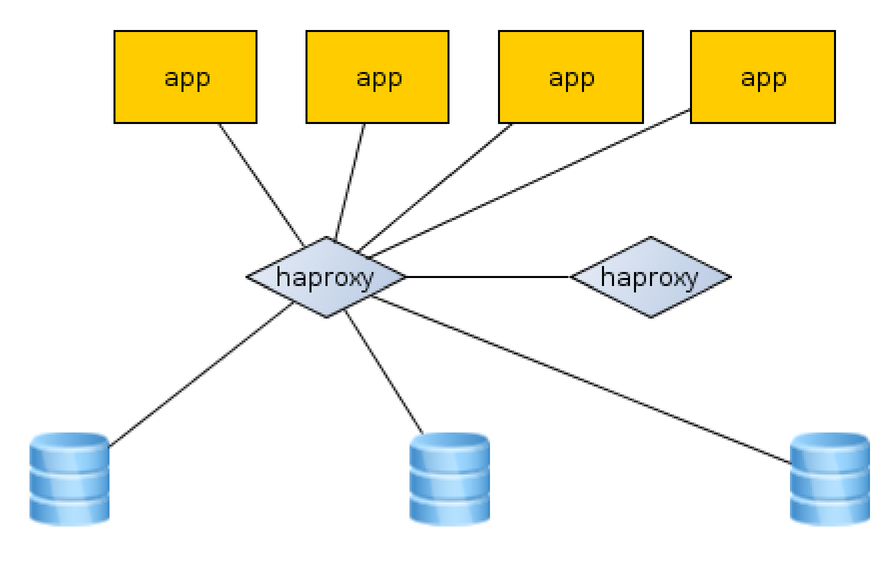
```
frontend stats-front
bind *:80
mode http
default_backend stats-back
```

- Backend

```
mode http
balance roundrobin
stats uri /haproxy/stats
stats auth pxcstats:secret
```

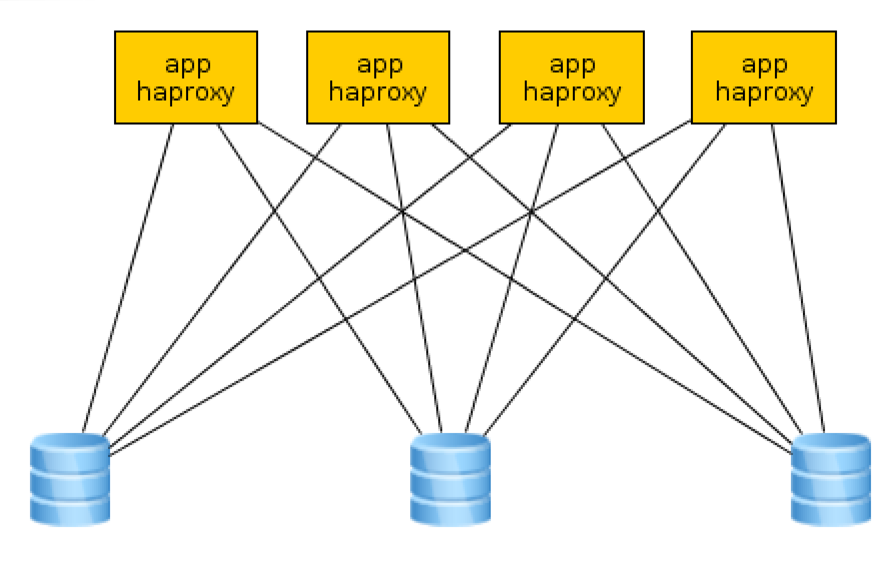
Deployment scenarios

Separate layer



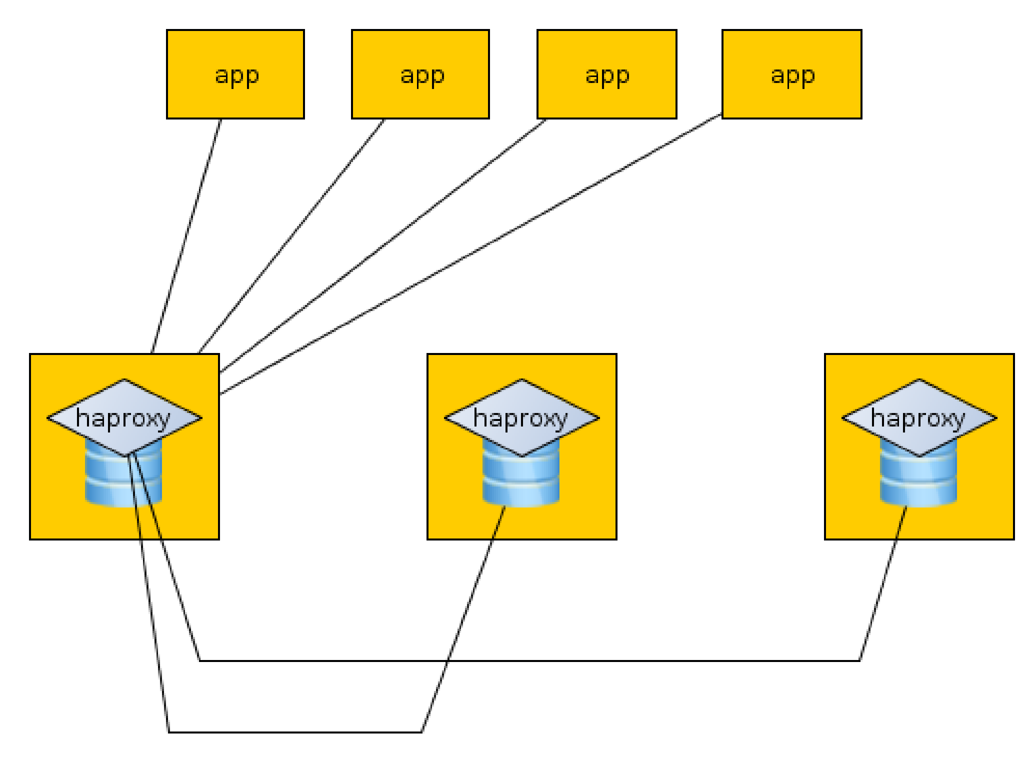
- 2xRTT in application response time
- Scaling: new load balancer pairs for new application servers
- On MySQL, it will look like every connection is coming from the load balancers

On the application



- No additional latency
- Load balancing layer scales with application layer
- A lot of checks will happen on the databases (each loadbalancer does it's own checks)
- Connections from application servers

On the database

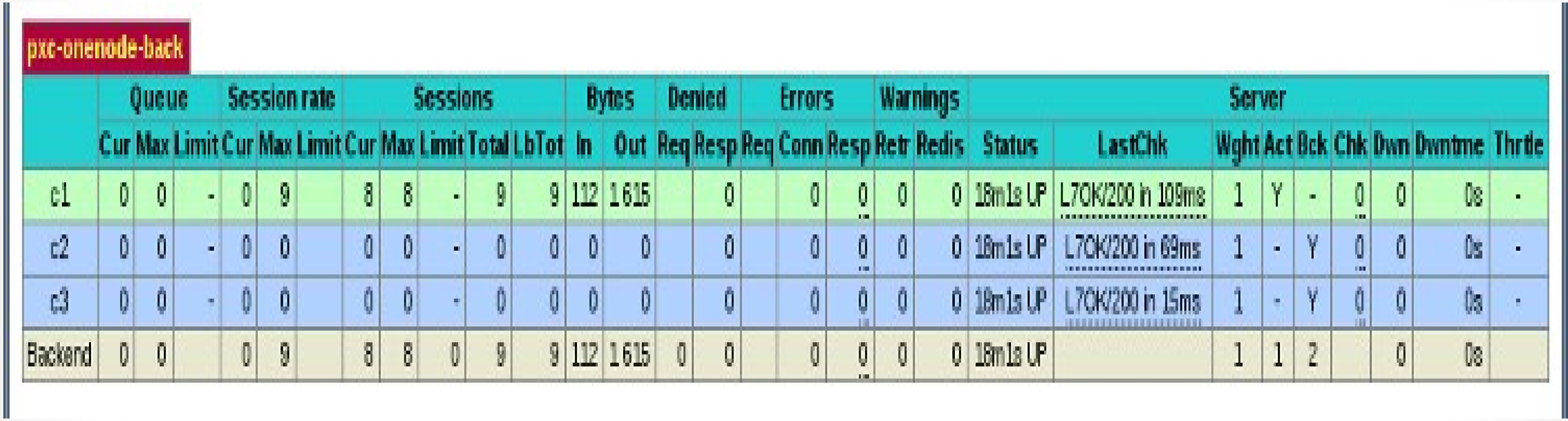


- No additional latency
- The load balancer consumer resources on the database server
- VIP management is still needed
- The databases will see that the connections are coming from the local IP

HaProxy performance

- Session rate
  - Determines if the load balancer can distribute all requests it receives
- Session concurrency
  - Related to the session rate, the slower the server, the higher the concurrency
- Data rate
  - Measured in MB/s, highest throughput comes with large sessions

Status page sample



pxc-onenode-back

	Queue			Session rate			Sessions					Bytes		Denied		Errors			Warnings		Server								
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	LastChk	Wght	Act	Bck	Chk	Dwn	Dwntme	Thrtle
c1	0	0	-	0	9		8	8	-	9	9	112	1615		0		0	0	0	0	18m1s UP	L7OK/200 in 109ms	1	Y	-	0	0	0s	-
c2	0	0	-	0	0		0	0	-	0	0	0	0		0		0	0	0	0	18m1s UP	L7OK/200 in 69ms	1	-	Y	0	0	0s	-
c3	0	0	-	0	0		0	0	-	0	0	0	0		0		0	0	0	0	18m1s UP	L7OK/200 in 15ms	1	-	Y	0	0	0s	-
Backend	0	0		0	9		8	8	0	9	9	112	1615	0	0		0	0	0	0	18m1s UP		1	1	2		0	0s	

Checks

```
server c1 10.116.39.76:3306 check port 9200 inter 1500 rise 3 fall 3
```

- TCP port 9200 is checked on HTTP
  - Response code 200 -> backend up
  - Response code 500 -> backend down
  - We need something which turns database state into HTTP response codes

Checks II.

- Clustercheck supplied with PXC
  - Shell script ran through xinetd
  - Simple and maintainable, 1 check can mean several forks
- With many application servers
  - Daemon, which “caches” results for the check period
  - Using non-blocking IO

Load balancing PXC

- PXC architecture
  - N (typically 3) active nodes
- Writes and reads can go to all nodes
- Checks dependent on wsrep variables

```
server c1 10.116.39.76:3306 check port 9200 inter 1500 rise 3 fall 3
server c2 10.195.206.117:3306 check port 9200 inter 1500 rise 3 fall 3 backup
server c3 10.202.23.92:3306 check port 9200 inter 1500 rise 3 fall 3 backup
```

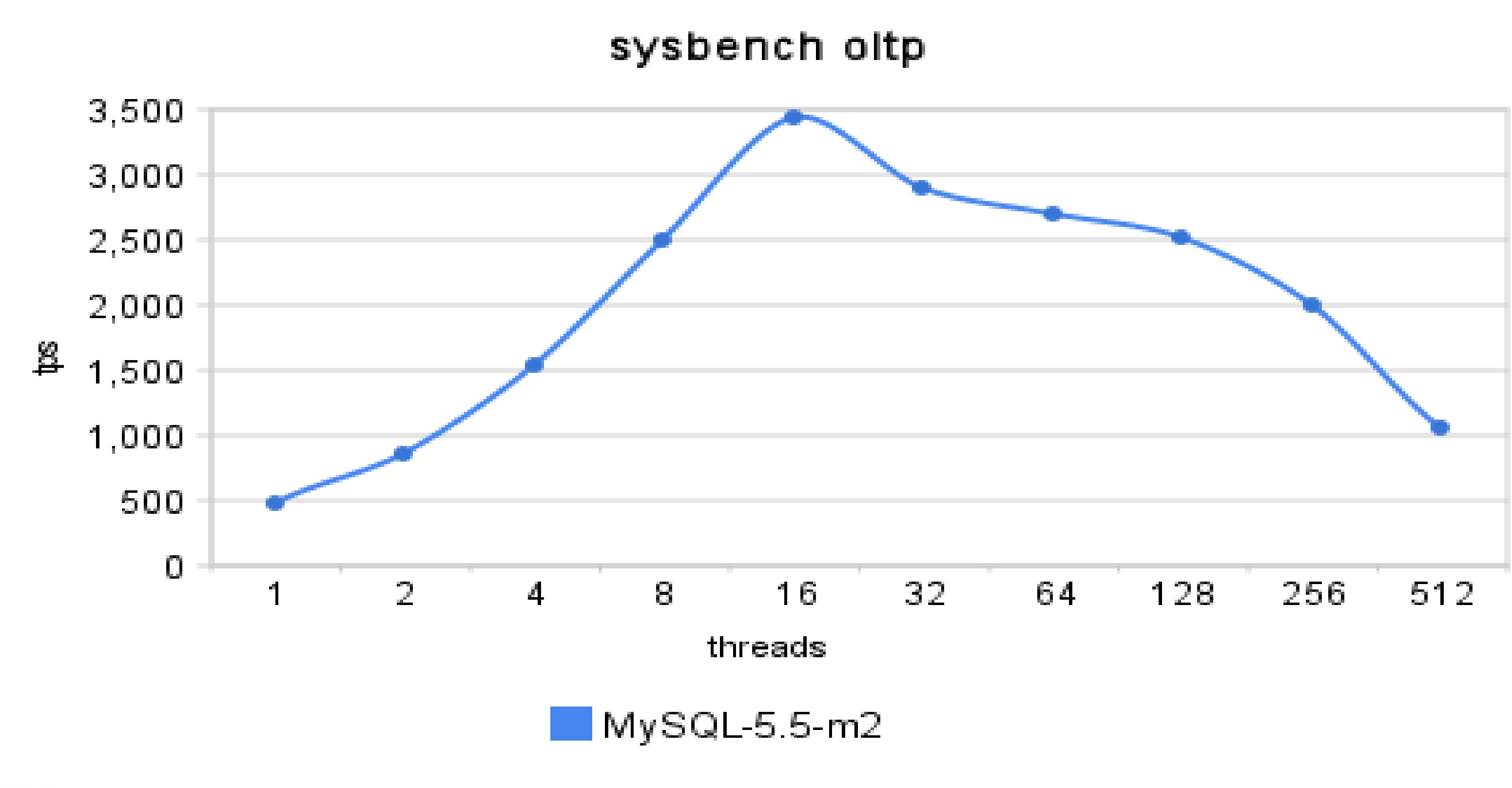
Load balancing PRM

- PRM architecture
  - One master, n slave
- Separate backend definition for the master and slave
- Check for read_only=0 flag for master
- Check if the node is managed by pacemaker

Load balancing MySQL Cluster

- MySQL Cluster architecture
  - All mysql servers are active
- One backend definition containing all the servers
- Check: if mysql is up and ndbcluster is registered as a storage engine, server is up

Performance vs Parallelism



From: mysqlperformanceblog.com

Additional Features

- Queueing
  - maxqueue >> maxconn
  - Only maxconn TCP connections can be there
  - The rest of the connections will be queued on TCP/IP level
- Ramp-up (slowstart Xs)
  - A server is not getting the full traffic when it comes online
  - The server's weight is adjusted dynamically

Persistent connections

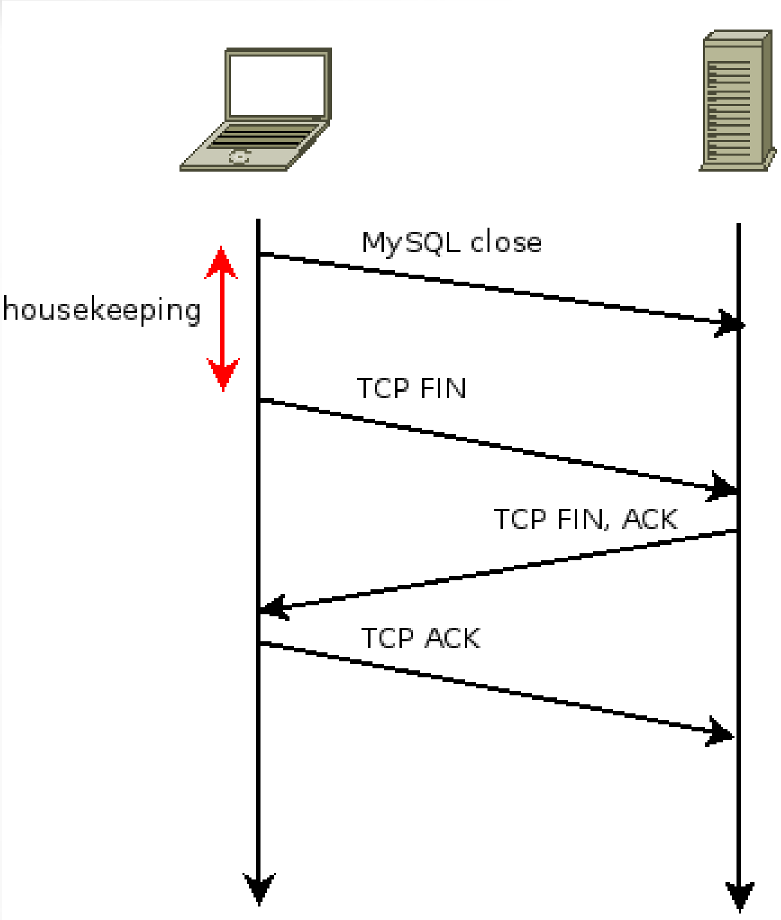
- HaProxy decides where the connection will go at TCP handshake
- Once the TCP session is established sessions will stay where they are
- Be cautious with persistent connections
  - Configuring connection pool properly
  - Important parameters are minimum, maximum connections and connection lifetime

High traffic issues

- Show themselves later if haproxy is deployed on each application server.
- Not specific to haproxy
  - Limitations in MySQL client-server protocol
  - Linux TCP/IP implementation

http://blog.exceliance.fr/2012/12/12/haproxy-high-mysql-request-rate-and-tcp-source-port-exhaustion/

MySQL client-server communication



- This means that the connection at the TCP level can be in TIME_WAIT state in minutes
- Leads to souce ip:port paris exhaustion

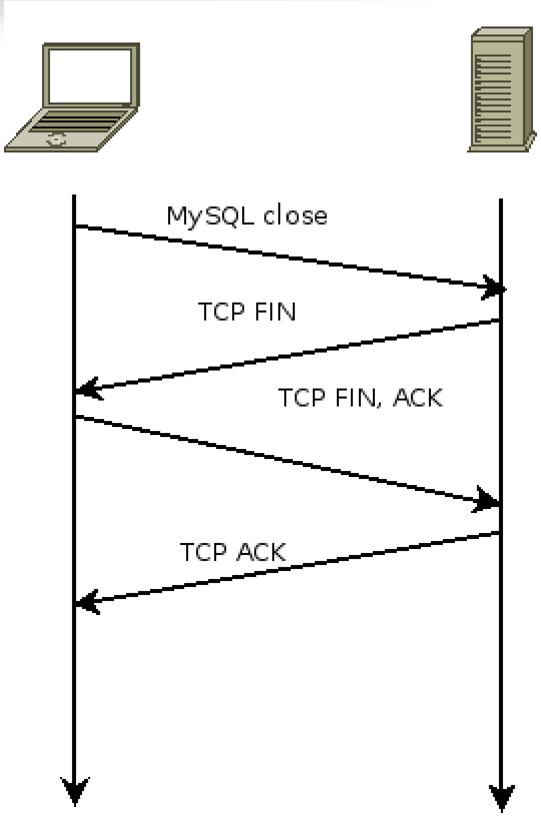
Possible solutions

- Using more than one IP address
- Tune max local port range
  - `/proc/sys/net/ipv4/ip_local_port_range`
- Tune allow tw_recycle, tw_reuse
  - `/proc/sys/net/ipv4/tcp_tw_recycle`
  - `/proc/sys/net/ipv4/tcp_tw_reuse`
- Allow the kernel to kill the connections
  - `/proc/sys/net/ipv4/tcp_max_tw_buckets`
    - This is very high by default

Possible solutions II.

- Haproxy's nolinger option
  - Needs 1.4
  - Connections in TIME_WAIT and FIN_WAIT1
- “Nolinger” patch for glb by Frederic Descamps
  - Using SO_LINGER in setsockopt() helps if this happens at the proxy level
  - But not if a real client is connecting and disconnecting to MySQL too fast

Server closing TCP connection



- If the server closed the connection, the issue would not be there.

Q&A

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