Lab 04 - Docker

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Objectives:

At the end of this laboratory, we must be:

- Able to build our own Docker images
- Familiar with lightweight process supervision for Docker
- Able to understand core concepts for dynamic scaling of an application in production
- Able to put into practice decentralized management of web server instances

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Introduction:

In this lab, we will find many solutions to solve problems encounter with the achitecture developped in the previous lab. The objectif is to reconfigure and generate configurations files automatically, and be able to add or remove as much as end nodes webb servers we want to our infrastructure without need to reconfigure the HAProxy.

Task 0: Identify issues and install the tools

[M1] : No we can use the solution of the previous lab in a production environment. Because in that solution, we cannot dynamically add and remove web servers. To achieve this we must reconfigure manually the HAProxy to inform it if a webb server is added or removed (crashed).

[M2] : Description of the procedure to add new webapp container to the infrastructure of the previous lab:

- Update files in the `ha/scripts` directory:
  - add the command `sed -i 's/<s3>/$S3_PORT_3000_TCP_ADDR/g' /usr/local/etc/haproxy/haproxy.cfg` in the `run-daemon.sh` and `run.sh` files
- Update the `ha/config/haproxy.cfg` file: Add the command `server s3 <s3>:3000 check`
- Rebuild the image of ha: `cd /vagrant/ha`
  `docker build -t softengheigvd/ha .`
- Stop and force to remove the containers : `docker rm -f s1 s2 ha`
- Start the containers: `docker run -d --name s1 softengheigvd/webapp`
  `docker run -d --name s2 softengheigvd/webapp` `docker run -d --name s3 softengheigvd/webapp`
  `docker run -d -p 80:80 -p 1936:1936 -p 9999:9999 --link s1 --link s2 --link s3 --name ha softengheigvd/ha`

[M3] : Issues to the current solution
This solution is not good because we are doing update manually. The issue must be to do update automatically. Like we will do so far in this lab, we can write a script that will edit and run automatically the HAProxy when this one will be informed by a `serf agent` if a node is added or removed to the infrastructure.

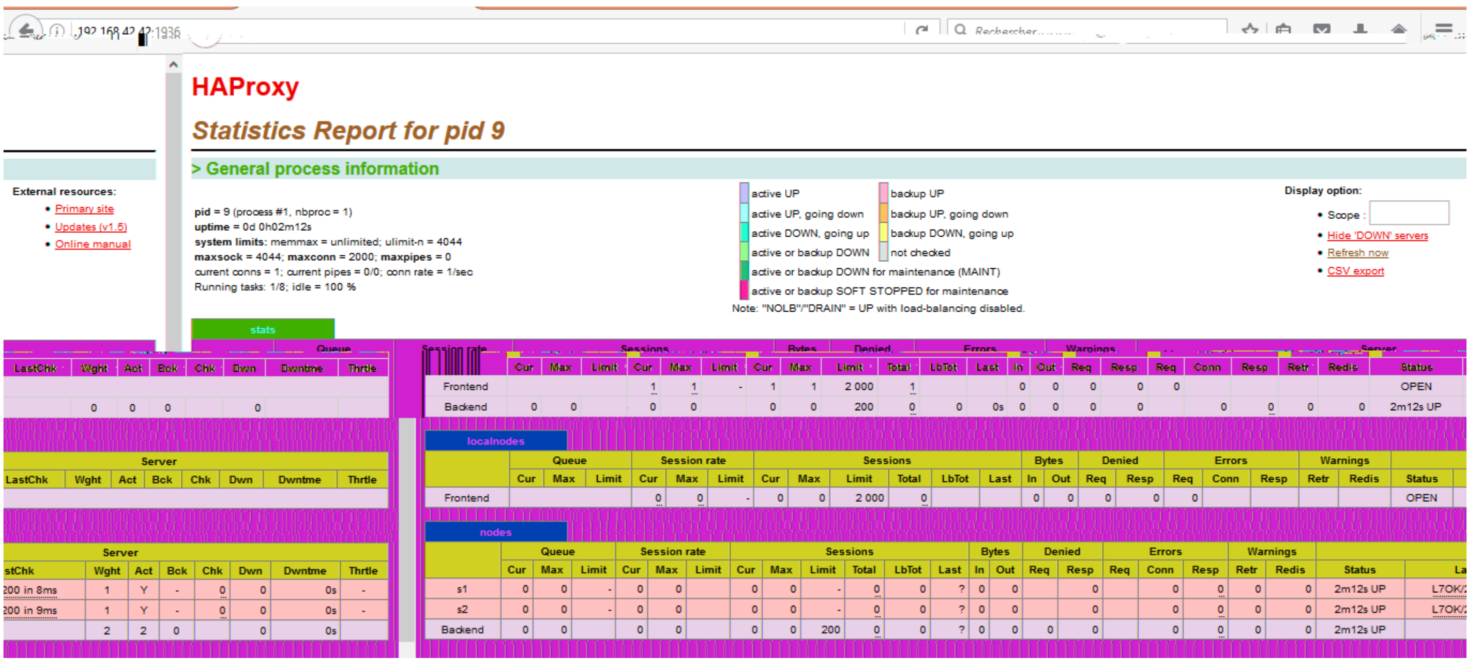
[M4] : Management of web app nodes
As we will see in **Task 5** of this lab, we can write two scripts `join` and `leave` that will generate a proper HAProxy configuration file.

[M5] :
With the current solution, it is not possible to run additional management processes beside the main web server / load balancer process in a container. Because the central tenet of the Docker design is the following principle `One process per container`. The issue of this problem is to install a process supervisor.

[M6] :
If we add more server nodes, we must also add more lines with the command `sed` in the `run.sh` script. For example, if we add server node s3, we must add line `sed -i 's/<s3>/$S3_PORT_3000_TCP_ADDR/g' /usr/local/etc/haproxy/haproxy.cfg` in the `run.sh` script. This solution is not dynamic. To solve this problem, we can use a template engine to easily generate configuration files like we will see in task 4 of this lab.

Deliverables:

1. Screenshot of the stats page of HAProxy :



192.168.42.42:1936

HAProxy

Statistics Report for pid 9

> General process information

pid = 9 (process #1, nbproc = 1)
uptime = 0d 0h02m12s
system limits: memmax = unlimited; ulimit-n = 4044
maxsock = 4044; **maxconn** = 2000; **maxpipes** = 0
current conns = 1; current pipes = 0/0; conn rate = 1/sec
Running tasks: 1/8; idle = 100 %

External resources:
- Primary site
- Updates (v1.5)
- Online manual

🟪 active UP	🟪 backup UP
🟦 active UP, going down	🟧 backup UP, going down
🟩 active DOWN, going up	🟨 backup DOWN, going up
🟩 active or backup DOWN	⬜ not checked
🟩 active or backup DOWN for maintenance (MAINT)	
🟥 active or backup SOFT STOPPED for maintenance	

Note: "NOLB"/"DRAIN" = UP with load-balancing disabled.

Display option:
- Scope :
- Hide 'DOWN' servers
- Refresh now
- CSV export

stats

	Queue			Session rate			Sessions						Bytes		Denied		Errors			Warnings		Server								
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	LastChk	Wght	Act	Bck	Chk	Dwn	Dwntme	Thrtle
Frontend				1	1	-	1	1	2 000	1			0	0	0	0	0					OPEN								
Backend	0	0		0	0		0	0	200	0	0	0s	0	0	0	0		0	0	0	0	2m12s UP		0	0	0		0		

localnodes

	Queue			Session rate			Sessions						Bytes		Denied		Errors			Warnings		Server								
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	LastChk	Wght	Act	Bck	Chk	Dwn	Dwntme	Thrtle
Frontend				0	0	-	0	0	2 000	0			0	0	0	0	0					OPEN								

nodes

	Queue			Session rate			Sessions						Bytes		Denied		Errors			Warnings		Server								
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	LastChk	Wght	Act	Bck	Chk	Dwn	Dwntme	Thrtle
s1	0	0	-	0	0		0	0	-	0	0	?	0	0		0		0	0	0	0	2m12s UP	L7OK/200 in 8ms	1	Y	-	0	0	0s	-
s2	0	0	-	0	0		0	0	-	0	0	?	0	0		0		0	0	0	0	2m12s UP	L7OK/200 in 9ms	1	Y	-	0	0	0s	-
Backend	0	0		0	0		0	0	200	0	0	?	0	0	0	0		0	0	0	0	2m12s UP		2	2	0		0	0s	

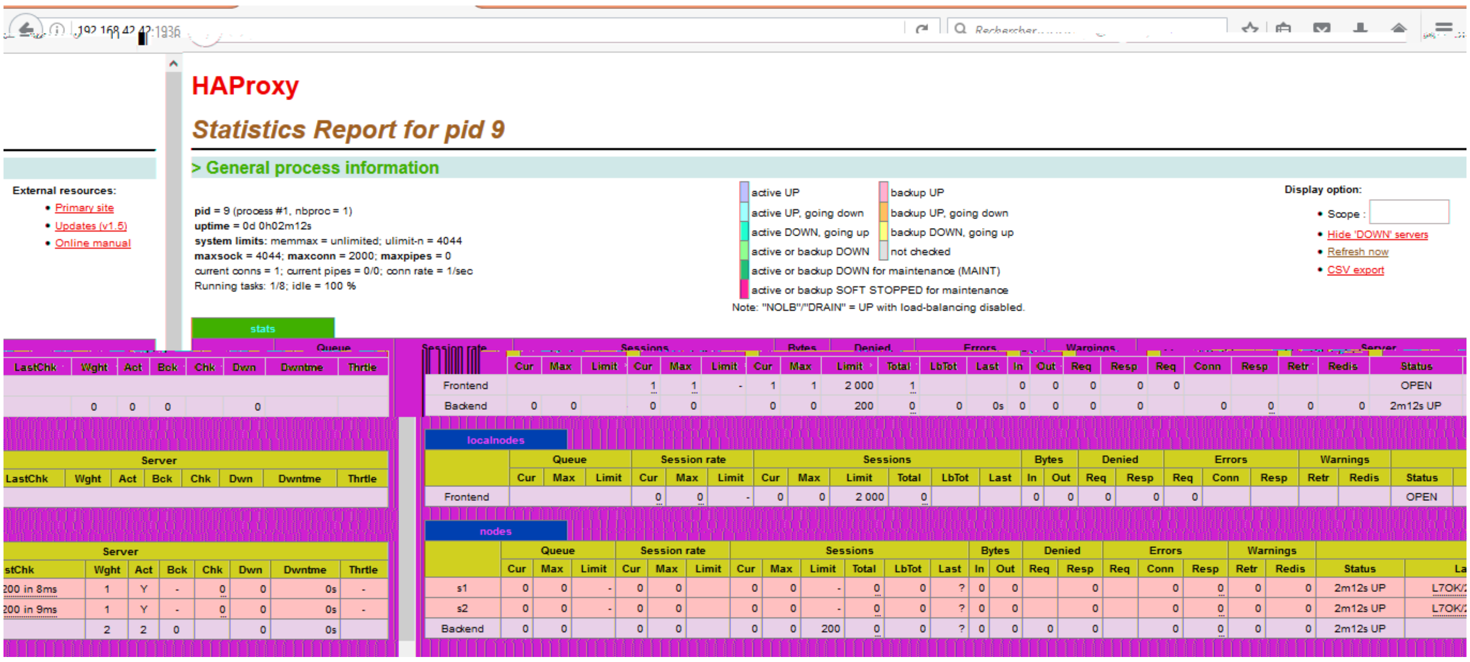
2. URL of our repository:

Our repository is here

Task 1: Add a process supervisor to run several processes

Deliverables:

1. Screenshot of the stats page of HAProxy at http://192.168.42.42:1936:



HAProxy

Statistics Report for pid 9

> General process information

External resources:
- Primary site
- Updates (v1.5)
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pid = 9 (process #1, nbproc = 1)
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system limits: memmax = unlimited; ulimit-n = 4044
maxsock = 4044; **maxconn** = 2000; **maxpipes** = 0
current conns = 1; current pipes = 0/0; conn rate = 1/sec
Running tasks: 1/8; idle = 100 %

▨	active UP	▨	backup UP
▨	active UP, going down	▨	backup UP, going down
▨	active DOWN, going up	▨	backup DOWN, going up
▨	active or backup DOWN	▨	not checked
▨	active or backup DOWN for maintenance (MAINT)		
▨	active or backup SOFT STOPPED for maintenance		

Note: "NOLB"/"DRAIN" = UP with load-balancing disabled.

Display option:
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stats

	Queue			Session rate			Sessions						Bytes		Denied		Errors			Warnings		Server
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status
Frontend				1	1	-	1	1	2 000	1			0	0	0	0	0					OPEN
Backend	0	0		0	0		0	0	200	0	0	0s	0	0	0	0		0	0	0	0	2m12s UP

LastChk	Wght	Act	Bck	Chk	Dwn	Dwntme	Thrtle
	0	0	0		0		

localnodes

	Queue			Session rate			Sessions						Bytes		Denied		Errors			Warnings		
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status
Frontend				0	0	-	0	0	2 000	0			0	0	0	0	0					OPEN

Server							
LastChk	Wght	Act	Bck	Chk	Dwn	Dwntme	Thrtle

nodes

	Queue			Session rate			Sessions						Bytes		Denied		Errors			Warnings			
	Cur	Max	Limit	Cur	Max	Limit	Cur	Max	Limit	Total	LbTot	Last	In	Out	Req	Resp	Req	Conn	Resp	Retr	Redis	Status	La
s1	0	0	-	0	0		0	0	-	0	0	?	0	0		0		0	0	0	0	2m12s UP	L7OK/
s2	0	0	-	0	0		0	0	-	0	0	?	0	0		0		0	0	0	0	2m12s UP	L7OK/
Backend	0	0		0	0		0	0	200	0	0	?	0	0	0	0		0	0	0	0	2m12s UP	

Server							
stChk	Wght	Act	Bck	Chk	Dwn	Dwntme	Thrtle
200 in 8ms	1	Y	-	0	0	0s	-
200 in 9ms	1	Y	-	0	0	0s	-
	2	2	0		0	0s	

Normally, there is only a single process running inside a container. Consequently, the container will run only when the process is running. This means that when the process stops, the container automatically stops as well. To solve this problem, we need to run several processes at the same time in a container. To achieve this, we need to have process supervisor. So we install an init system called `s6` in the Docker images of HAProxy and Web applications, and we configure it as our main process replacing the current one. The problen here is that when doing this, we don't have no more applications. To remedy to this, we create a folder `services` in HAProxy and Webb applications where we copy the starting scripts for `s6`, making the applications available again. We then copy these scripts in to the right pace in our Docker images and run them.

Deliverables:

You will find in the directory `logs/task_2` files containing Docker log output of each container `ha`, `s1` and `s2`. Files `ha_logs_i`, `s1_logs_i` and `s2_logs_i` contain output of docker log before creating Docker network. Files `ha_logs_f`, `s1_logs_f` and

reference: here

Task 3:

Deliverables:

1. Docker log output for each of the containers `ha` , `s1` and `s2` :

You will find in the directory `logs/task_3` files containing Docker log output of each container `ha` , `s1` and `s2` . The file `ha_logs_i` contains Docker log output of `ha` after starting one backend node, and the file `ha_logs_f` contains Docker log output of `ha` after starting two backends nodes.

2. Logs from the `ha` container gathered directly from the `/var/log/serf.log` :

You will find this output in the file `ha_logs_inside`

Task 4:

1. Techniques to reduce docker images size

If in our docker file we have command line like:

```
RUN command 1
RUN command 2
RUN command 3
```

or
`RUN command 1 && command 2 && command 3`

It is preferable to use the second example, because if `RUN command 1` fails to execute, `command 2` and `command 3` wil not be executed.So this will facilitate the building of our image. But, in the first example, the execution of each command is independent of the execution of the previous one.
To reduce the size of ours docker images, we can use `docker-squash` .
You can learn more here

2. Different approach to architecture our images to be able to reuse as much as possible what we have done.

Maximize Your Docker Image Caching Techniques. You can learn more here

3. Configuration files of HAProxy

All necessaries files are given in the directory: `logs/task_4`

4. Problems of the configuration files

The configuration files just give informations about the last container that has joined the cluster. It erase the informations about the previous nodes that have joined the cluster. The problem is that we do not write after the contents of the file but we replace its contain with the new information. So we cannot have informations of all nodes in the cluster.

Task 5:

Deliverables:

1. Files `/usr/local/etc/haproxy/haproxy.cfg` generated in the `ha` container:

- After running ha: `logs/task_5/haproxy.cfg`
- After running s1: `logs/task_5/haproxy_s1.cfg`
- After running s2: `logs/task_5/haproxy_s2.cfg`

- File containing output of `docker ps` : `logs/task_5/docker_ps`
- File containing output of `docker inspect` : `logs/task_5/ha_inspect` , `logs/task_5/s1_inspect` , `logs/task_5/s2_inspect`

2. List of files from the `/nodes` folder inside the `ha` container:

- File `logs/task_5/list_of_nodes`

3. Configuration file after we stop s1:

- File `logs/task_5/ha_proxy_s1_stop`

List of nodes:

- File `logs/task_5/nodes_s1_stop`

File containing the `docker ps` output:

- File `logs/task_5/docker_ps_s1_stop`

Task 6:

Delivrables

1. Screenshot of HAProxy stat page showing 3 nodes

- docker ps output file: `logs/task_6/docker_ps_3_nodes_start`

Screenshot of HAProxy stat page showing 5 nodes

- docker ps output file: `logs/task_6/docker_ps_5_nodes_start`

Screenshot of HAProxy stat page showing 2 nodes `s1` and `s2` removed

- docker ps output file: `logs/task_6/docker_ps_2_nodes_remove`

2. Comments about the final solution:

In this final solution, we have noticed that if we just have one back end node, the session id increment as we access and refresh the URL http://192.168.42.42. But if we have more than one node webb server, the session id doesn't increment, the requests are forwarded to each node consecutivelly, but when the same request is forwarded again to the same node, its session id doesn't increment. And this is not normal.

Difficulties:

Referring to the Task 4, we didn't really find a different approach to architecture our images to be able to reuse as much as possible what we have done; That is reduces our image size and to build them fastly.

Conclusion:

This lab was very instructive, since first of all it make us familiar with many docker commands (to build, run and stop containers), but from now, we are able to build an infrastructure with many processes running in a container by using a serf agent and configure automatically our HAProxy after avry events happening.