

Lab Assignment – Introduction to highly available clusters with “heartbeat”

Course outline:

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1.Introduction

The Linux-HA (High-Availability Linux) project provides a set of high-availability (clustering) solutions for Linux, FreeBSD, OpenBSD, Solaris and Mac OS X, being “Heartbeat” the main software product. It provides a set of useful features for reliability, availability, and serviceability (RAS) in a cluster environment.

It is available under a GNU Public License (GPL) and comes available with a set of useful scripts and tools to setup, manage and monitor a cluster environment.

2.Lab setup

This class was prepared in a lab environment in which the PCs have a specification similar to the one illustrated on Figure 1.

The host system can be any operating system (e.g. Linux or Windows). We need a browser and a virtual machine hypervisor and player, like `vmware` or `VirtualBox`. The proposed cluster has two nodes, which are two virtual machines with Ubuntu Server 14.04 LTS for 64 bits, configured with 512 Mbytes of RAM and 20 Gbytes of disk. It is also a good practice to have two different Network Interface Cards (NIC) configured in each virtual machine. One NIC should be configured as “Host Only” to connect directly with the other cluster node(s). The other NIC should be configured as NAT to access to the Internet. The NIC configured as “Host Only” will thus be cluster IP address, a virtual IP assigned to a virtual interface in the host that is “active” in each moment.

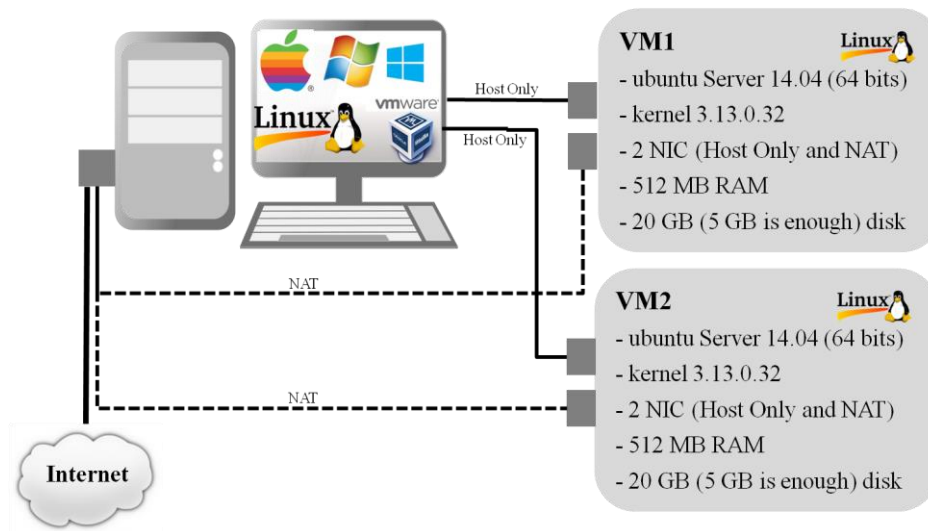


Figure 1- Lab setup specification

The NIC configured as “Host Only” can also be used to remotely administrate the virtual machines from the host system through a secure SSH connection, without using the internet access for administration tasks. To have SSH running we need to install `openssh-server` package and initiate the service with the default parameters, by executing as `root` the following command: `apt-get install openssh-server`. You may also intend to change any parameters on the `ssh` configuration file `/etc/ssh/sshd_config`. Any changes to the `ssh` configuration implies to restart the service, by issuing the command `service ssh start`.

After installing the virtual machine with Ubuntu 14.04 operating system, we have to download and install all the patches and security updates available on the official repositories, by executing as `root` the following commands:

- `apt-get install update`
- `apt-get install upgrade`

It is recommended that you reboot the Linux server after the upgrade process, by executing one of the command following commands:

- `shutdown -r 0`
- `reboot`

On a HA cluster IP configurations should be static and the IP addresses, including virtual IP address, have to remain the same after a reboot. Otherwise the connectivity between cluster nodes may not be available after a change on the IP addresses in NIC cards or on the cluster’s virtual IP address.

The host names should be resolved locally, by including in the file `/etc/hosts` of each node a line per each cluster node name, with the corresponding IP address.

3.Installation and administration tools

Heartbeat service is available under the Ubuntu repositories. To install the Heartbeat please use the following command line: `sudo apt-get install heartbeat`.

After the installation process is finished the Heartbeat daemon **will not** be started automatically. However, Heartbeat may be monitored by the usual commands and tools, namely:

- `service heartbeat {start|status|restart|stop|...}`
- `/etc/init.d/heartbeat {start|status|restart|stop|...}`

There are other ways to identify if the cluster daemon is running and to analyze any error or warning that may have occurred during the startup. A list of verification and validation commands can be found below:

- `ps -ef | grep heartbeat`
- `tail /var/log/syslog`
- `tail /var/log/ha-log #default log file`
- `netstat -anu #UDP port 694 by default`

4.Directories and main configuration files

Heartbeat service configuration is made through the edition of text configuration files located in the directory `/etc/ha.d/`. The most important configuration files are described below:

<code>ha.cf</code>	Main configuration file that handles global definitions for cluster configuration.
<code>haresources</code>	File with the definition of the primary node, virtual IP address and other options that could be applied during node takeover.
<code>authkeys</code>	File with the authentication process used during heartbeat configurations in the cluster

In `/usr/share/doc/heartbeat/` there are also useful files to help on cluster setup. The parameter `logfile` in `ha.cf` file holds the directory and file with the log messages collected during cluster startup and failover processes. By default log messages are stored in `/var/logs/ha-log`.

5.Configuration example

The Heartbeat configuration process is made through a set of configuration, spread by the files described previously on Section 4. An example of a running configuration is described below:

- Main heartbeat configuration file (/etc/ha.d/ha.cf):

```
debugfile /var/log/ha-debug
logfile /var/log/ha-log
logfacility local0
keepalive 10
deadtime 30
warntime 15
initdead 100
udpport 694
bcast eth0 # Linux
mcast eth0 225.0.0.1 694 1 0
auto_failback on
node hostA
node hostB
```

In this example the heartbeat interval is 10 seconds and the node is supposed to be dead after 30 seconds. Heartbeat service will listen to heartbeat messages in UDP port 694. The messages are sent through interface `eth0`, assuming this is the interface with access to all the other nodes of the cluster. The cluster has two nodes, resolved by the following names: "hostA" and "hostB".

- Resources configuration file (/etc/ha.d/haresources):

```
hostA 172.16.170.199 apache2
```

In this cluster "hostA" assumes the role of "primary node" for the resource group, namely a virtual IP address and a list of services for takeover. In this case, the former is the IP address 172.16.170.199, in the same network as the node's interface cards and the later is composed by the web server `apache2`.

It is important to emphasize that IP configuration, including virtual IP, should be static and the IP addresses have to remain the same after a reboot. Otherwise the connectivity between cluster nodes may not be available after a change on the IP addresses in NIC cards or on the cluster's virtual IP address.

- Authentication file (/etc/ha.d/authkeys):

```
auth 1
1 crc
```

This file stores the type of authentication will be used in the cluster to exchange heartbeat messages. This file has to have the permissions with 600, that is we have to execute the following command: `chmod 600 authkeys`.

The cluster configuration files should be the same in both cluster nodes. After configuring the files in one node, we have to copy them to the other cluster node(s).

6.Exercises

Before starting the proposed exercises it is important to validate the following check list:

- ☐ The setup to the exercises is done, with a similar configuration to the one described on Section 2.
- ☐ Heartbeat service installation procedure is done (Section 3)
- ☐ Heartbeat service is configured and the daemon is working properly.
- ☐ Services that are part of the resource group are installed and configured.
- ☐ Directories and configuration files were observed in general and there is a good understanding about their meaning and why we need them.
- ☐ The topics covered in this class related with high availability clusters in Linux with Heartbeat are assimilated and there is a good understanding on how to configure.

The lab exercise described below aims to consolidate the topics covered in this class. We plan to configure a scenario with two different clusters, each one for a specific service: `apache2` and `dhcp`. The standby node is the same for both clusters, being the primary node different for each service. That is, we need to have three different cluster nodes.

The cluster should implement the following features:

- Heartbeat interval = 4 seconds
- Dead interval = 10 seconds
- When available, the cluster's primary node should be the same during the whole cluster lifetime

7.Additional Exercise

In this exercise we aim to configure two Heartbeat clusters, one for HTTP and another for Proxy servers. There should be a single server that could be able to recover for a failure of both services simultaneously.

8.Bibliography

- [DOCS]: Linux-HA wiki - <http://www.linux-ha.org/>