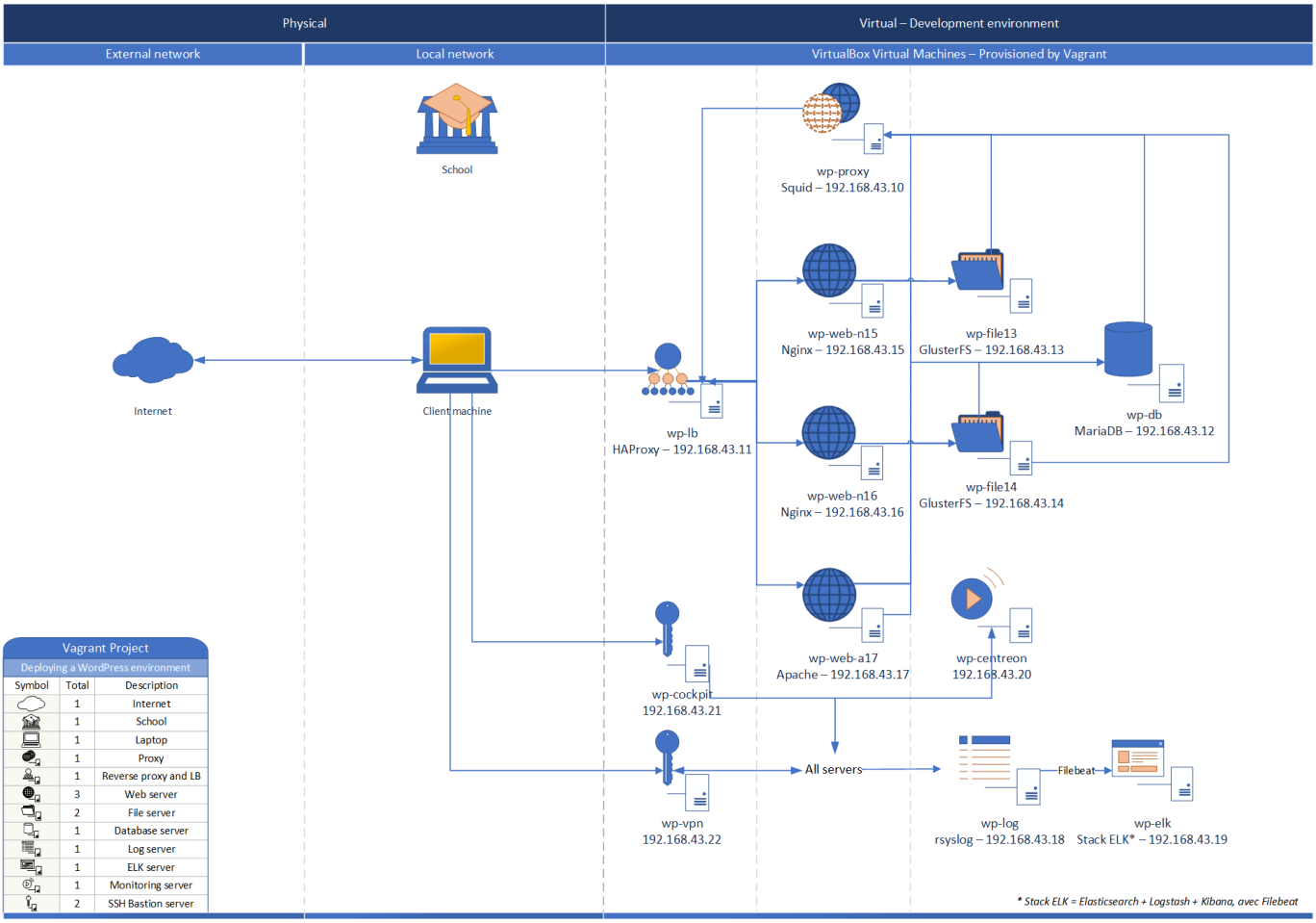
Wordpress environment deployment with Vagrant



This project can be used to deploy a complete Wordpress install in less than an hour. Vagrant is used to deploy and provision all the virtual machines. The Vagrantfile included, and customizable, is used to deploy the following machines (defaults values are shown):

Qty	Scalable	Type	Package	Hostname	IP	CPU	RAM
1	✗	Proxy	squid	wp-proxy	192.168.43.10	2	GB
1	✗	Load balancer and reverse proxy	haproxy	wp-lb	192.168.43.11	2	2GB
1	✗	Database (WordPress data)	mariadb	wp-db	192.168.43.12	1	1.5GB
2	✓	File storage (WordPress files)	glusterfs	wp-fileXX	192.168.43.13-14	1	1.5GB
2	✓	Nginx web servers	nginx	wp-web-nXX	192.168.43.15-16	1	1.5GB
1	✓	Apache web servers	apache2	wp-web-aXX	192.168.43.17	1	1.5GB
1	✗	Centralized log server	rsyslog	wp-log	192.168.43.18	1	1GB

Qty	Scalable	Type	Package	Hostname	IP	CPU	RAM
1	✕	Elasticsearch Logstash Kibana server	ELK stack	wp-elk	192.168.43.19	2	2GB
1	✕	Centreon monitoring server	centreon	wp-centreon	192.168.43.20	2	1GB
1	✕	SSH Bastion	cockpit	wp-cockpit	192.168.43.21	1	1GB
1	✕	OpenVPN remote access server	openvpn	wp-vpn	192.168.43.22	1	1GB

> - ELK stands for Elasticsearch, Logstash, Kibana. They are the three main products of Elastic used to automate the log analysis.
> - `XX` in the hostname is replaced by the last two digits of the IP address.
> - All the machines access have been secured with iptables and iptables-persistent to make rules permanent even after rebooting the machine.

Usage

> VirtualBox is required to deploy this installation, as well as Vagrant. The `vagrant-dotenv` plugin is used to load the passwords without displaying them in the `Vagrantfile` or in the git repo. The plugin vagrant-env is installed with `vagrant plugin install vagrant-env` or automatically during the first deployment.

Before executing any command, a `.env` file must be placed along with the `Vagrantfile` and filled with the four passwords used in the project in the following way :

```
# A template for this .env file is placed at the root of this project. You can copy
it under the .env name and modify it to your needs.
HAPROXY_STATS_PASSWORD="Password for HAProxy stats"
DB_ROOT_PASSWORD="Root password for the database"
DB_USER_PASSWORD="Wordpress user password for the database"
WP_ADMIN_PASSWORD="Wordpress admin user password"
```

Once the environment variables are ready, the project can be deployed easily with one command : `vagrant up` from the project folder.

However, with the default values, some configurations of machines may fail due to network changes or computer resources. With my cellular network share, the network `192.168.43.0/24` is used and I took the 10 to 17 IP range. Moreover, deploying these 8 machines can only run in a computer with at least 16 GB of RAM. An i7 CPU is also recommended. All of these settings are customizable, as described in the following section

Common parameters and configuration

Some scripts in this projects are applied to all the machines, configuring some basics things in each system. Most of these scripts use an hash of variables declared in the beginning of the **`Vagrantfile`**. This hash, named `vm_params`, contains all the informations of the project environment. It allows to :

- Define each hostname and IP address of the machines with *xxxx_hostname* and *xxxx_ip*. The IP address corresponds to the bridged interface and is unique for the proxy, load balancer, and database. For the file storage, apache and nginx servers, a range of following IP addresses is defined and tells how many copies of the machines should be deployed. For one machine, the start of the range (*xxxx_ip_start*) and the end of the range (*xxxx_ip_end*) are set equally. Otherwise, the number of machines is the difference between the end of the range and the start of the range. For simplicity in the scripts, this only works with a range smaller than a `/24` or `255.255.255.0` network.
- Define the base of IP for ranges with `range_ip_base`. By default, it is `192.168.43.` and is completed with a final number when a range of IP is used.
- Define the `netmask` for all machines and defaulting to `255.255.255.0` which is high enough for this project.
- Define which interface is bridged with `bridgedif`. This is the name of the interface as displayed as in the result of the `VBoxManage list bridgedifs` command, chosing the right interface with Internet access.
- Define the name of the guest bridged interface with `bridgeif_guest_name`. In all the guests, the bridged interface is the second NIC and is named `eth1` by default.
- Define the `domain_name` which is given to the vhost configuration and also should match the certificate name to prevent warnings in the browser when visiting the website. Also define the `kibana_domain_name`, which must be different from the first one and used to access Kibana through the HAProxy server.
- Define the root of the certificates files. By default, the certificate files are placed in a `cert` directory right next to the `Vagrantfile` and the `cert_root` variables points towards them. Note that for simplicity, they are kept on a shared folder between the guests and the host machine. They are not pushed to any folder in the virtual machines. In my deployment, I have used a single certificate valid for the two domain names I have used.
- Define the `web_root` for the GlusterFS mount point. It is the root folder for all the vhosts (in web servers), defaulting to `/var/www/html`. ⚠ Contents of the folder will be removed during deployment. Be cautious not to place the folder anywhere critical for the system.
- Define the `glusterfs_root`, used to store the actual files of the website on the GlusterFS servers. It will be created if it does not exists (and it should definitely be a new folder) as with our `/data` default.
- Define the different database or WordPress variables. Go to the Database and WordPress sections to see more details on that part.

All those variables are transmitted as environment variables to the provisioning scripts when necessary (a warning header is included in each script where they are used). This allow to modify in one place all the parameters without having to replace each occurence in the files of the project.

Parameters summary

All these parameters are found at the begining of the `Vagrantfile` or in the `.env` file.

Name	Type	Default value	Usage	Constraints
range_ip_base	String	192.168.43	Fixed part of IP	/24 or less netword required
netmask	String	255.255.255.0	Netmask used for all machines	/24 or less network required

Name	Type	Default value	Usage	Constraints
bridgeif	String	Intel(R) Wireless-AC 9560 160MHz	Name of the host interface	see`VBoxManage list bridgedifs`
bridgeif_guest_name	String	eth1	Name of the guest interface	See `ip -c a`
squid_hostname	String	wp-proxy	Hostname of proxy	Unique
squid_ip	String	192.168.43.10	IP of proxy	Unique
haproxy_hostname	String	wp-lb	Hostname of load balancer	Unique
haproxy_ip	String	192.168.43.11	IP of load balancer	Unique
haproxy_stats_user	String	admin	Username of stats user	No special characters
haproxy_stats_password	String	ENV['HAPROXY_STATS_PASSWORD']	Password of the stats user	Defined in `.env` file
mariadb_hostname	String	wp-db	Hostname of the database	Unique
mariadb_ip	String	192.168.43.12	IP of the database	Unique
database_name	String	wordpress	Name of the database	Unique, not equal to mysql, information_schema
database_username	String	wordpressuser	Username of the WordPress user	Unique, no special characters
database_root_password	String	ENV['DB_ROOT_PASSWORD']	Password for the root database user	Defined in `.env` file

Name	Type	Default value	Usage	Constraints
database_user_password	String	ENV['DB_USER_PASSWORD']	Password for the wordpress user	Defined in `.env` file
glusterfs_hostname_base	String	wp-file	Hostname base for file storage	Unique, last digits of each IP are appended
glusterfs_ip_start	Number	13	First IP of file servers	Unique, less than glusterfs_ip_end
glusterfs_ip_end	Number	14	Last IP of file servers	Unique, more or equal than glusterfs_ip_start
glusterfs_root	String	/data	Root of the GlusterFS volume bricks	Valid, non existing path
nginx_hostname_base	String	wp-web-n	Hostname base for Nginx servers	Unique, last digits of each IP are appended
nginx_ip_start	Number	15	First IP of Nginx servers	Unique, less than nginx_ip_start
nginx_ip_end	Number	16	Last IP of Nginx servers	Unique, equal or more than nginx_ip_end
apache_hostname_base	String	wp-web-a	Hostname base for Apache servers	Unique, last digits of each IP are appended
apache_ip_start	Number	17	First IP of Apache servers	Unique, less than apache_ip_end
apache_ip_end	Number	17	Last IP of Apache servers	Unique, equal or more than apache_ip_start
https_enabled	Boolean	true	Defines if HTTPS is used	If true, a valid certificate is required

Name	Type	Default value	Usage	Constraints
domain_name	String	opensource.axelfloquet.fr	Domain name	Valid and resolved (in hosts or DNS) domain name or IP
cert_root	String	/vagrant/cert	Certificate files root	Valid certificate for the above domain (Let's Encrypt for example)
web_root	String	/var/www/html	Website files root	Valid existing path - Emptied on provisioning
rsyslog_hostname	String	wp-log	Hostname for centralized log server	Unique
rsyslog_ip	String	192.168.43.18	IP of the log centralized server	Unique
elk_hostname	String	wp-elk	Hostname for ELK server	Unique
elk_ip	String	192.168.43.19	IP of the ELK server	Unique
kibana_domain_name	String	kibana.opensource.axelfloquet.fr	Domain name for kibana	Valid and resolved (in hosts or DNS) domain name or IP
centreon_hostname	String	wp-centreon	Hostname for the monitoring server	Unique
centreon_ip	String	192.168.43.20	IP for the monitoring server	Unique
centreon_root	String	/	Root for the centreon server	None

Name	Type	Default value	Usage	Constraints
centreon_domain_name	String	centreon.opensource.axelfloquet.fr	Domain name to access centreon	Unique, with valid cert for HTTPS
cockpit_hostname	String	wp-cockpit	Hostname for the SSH bastion	Unique
cockpit_ip	String	192.168.43.21	IP for the SSH bastion	Unique
cockpit_domain_name	String	cockpit.opensource.axelfloquet.fr	Domain name to access cockpit	Unique, with valid cert for HTTPS
openvpn_hostname	String	wp-vpn	Hostname for the OpenVPN server	Unique
openvpn_ip	String	192.168.43.22	IP for the SSH OpenVPN server	Unique
website_prefix	String	os1_	Prefix for table names	Short and no special characters
website_name	String	Open Source	Title of the website	Can be omitted for GUI install - No special constraints
website_username	String	admin	Username of the admin WordPress user	Can be omitted for GUI install - No special constraints
website_password	String	ENV['WP_ADMIN_PASSWORD']	Password of this admin user	Can be omitted for GUI install - Strong passwords only in `.env`
website_email	String	contact@opensource.fr	Email for this admin account	Can be omitted for GUI install - valid mail address

Name	Type	Default value	Usage	Constraints
noindex	Number	0	Search engine indexing	Only 0 or 1

> Omitted allowed parameters are just left empty

Hosts

This project does not include a DNS server. So, in order to be able to use hostnames, the `/etc/hosts` file of each machine is configured to resolve all the other machines of the project. The result of the corresponding script used like this `./common/sethosts.sh current_hostname` gives as example the following result file :

```
127.0.0.1       localhost       wp-web-n15      opensource.axelfloquet.fr
127.0.1.1       wp-web-n15      wp-web-n15

# The following lines are desirable for IPv6 capable hosts
::1     localhost ip6-localhost ip6-loopback
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
192.168.43.10   wp-proxy
192.168.43.11   wp-lb
192.168.43.12   wp-db
192.168.43.13   wp-file13
192.168.43.14   wp-file14
192.168.43.15   wp-web-n15
192.168.43.16   wp-web-n16
192.168.43.17   wp-web-a17
192.168.43.18   wp-log
192.168.43.19   wp-elk
192.168.43.20   wp-centreon
192.168.43.21   wp-cockpit
192.168.43.22   wp-vpn
```

APT

All systems needs package installation with each one its specific requirements. For this purpose, a simple script used as `.common/apt.sh 'list of packages here'` does the operation of updating the repos, installing the given packages, as well as upgrading the system (this last command is commented for speed purposes in test deployments).

Enable services

Services also needs to be enabled on each system. To be able to enable and start them, this three line script is used as follow :

```
./common/enableservices.sh service_1 service_2
```

Iptables

All servers have iptables configured to allow only the necessary services. Some rules are common to all machines. Hence, they are place in this script used to provision all the machines :

```
./common/iptables.sh
```

This file includes protection against ICMP bursts, several port scans, and defines the default policies for input, forward and output (but it can be overriden on each host). SSH, DNS and NTP are also added to be accepted. As it is a common script, no specific rule is found here but each machine have an `iptables.sh` script for custom rules in the corresponding folder. Some of these scripts may require an argument, you can open them and see each header with a usage instruction to know.

Proxy server

The proxy server, Squid, is necessary for all the machines to be able to reach Internet. It is not scalable and is automatically configured on all hosts of this project via the `common/setproxy.sh` script used this way :

```
./common/setproxy.sh wp-proxy
```

The main goal of this machine is to filter out which websites can be visited from the internal network, and also cache requests to speed up the navigation and prevent too high bandwidth usage. Therefore, access to the Internet without proxy is prevented by the firewall.

Load balancer and reverse proxy

HAProxy is used to spread the load to several web servers splitted in two machines groups (Nginx and Apache). One frontend `wp-front` is defined to serve the website with HTTPS, using a certificate generated with Let's Encrypt, accessed in the folder defined by the `cert_root` variable. The website deployed here of course corresponds to one backend named `wp-back`, configured with a roundrobin balance and also accessed with HTTPS by default (with the same certificate by default, but it can be manually overriden by placing the certificate named haproxy.pem in the cert folder). On the first visit, a cookie with the ID of the web server is placed in the browser. This way, the same web server is used during a session. This does not prevent switching to another web server in case of any downtime of the current web server. It is also the only machine that can access the web severs, the other machines being blocked by the iptables firewall.

Database

MariaDB has been used for the database on one host only. It is not replicated and not in high availability in this project. Only one database for the WordPress website is configured with all privileges users for each web server. Iptables is also configured to let access to the database only to the web servers. A few variables are available to configure the database :

- database_name : the name of the database. Defaults to `wordpress`
- database_user : the name of the WordPress user. Defaults to `wordpressuser`.
- database_root_password : the password for the root user.
- database_user_password : the password for the WordPress user.

File storage

GlusterFS have been chosen to provide high availability and synchronized storage between all the web nodes. Using this type of storage, each modification of the website is quickly reproduced to all the other web servers, preventing differences between each host. By default, two servers are configured to start a volume named `wordpress` with two replicated bricks on each node. This will guarantee a better access to the files at any moment, only reserved for the web servers with iptables.

Server 1	*wp-file13*	**Server 2**	*wp-file14*
Brick 1 : `/data/wordpress-1`	Brick 2 : `/data/wordpress-2`	Brick 1 : `/data/wordpress-1`	Brick 2 : `/data/wordpress-2`

Web servers

For all the web servers, one vhost is configured to give HTTPS access by default to the wordpress install. Iptables rules are also configured to allow access to the website only from the load balancer machine. They also are the only machines to be able to access to the database and the GlusterFS volume. The configuration used is mostly the default vhost configuration given by WordPress in their documentation. If you want to disable HTTPS for all web servers, you can set the `https_enabled` to `false`.

Nginx

By default, two Nginx servers are configured to serve the website. They both use the GlusterFS client to mount the website files from first to last server (first is master, other servers are used as backup).

Apache

By default, one Apache server is configured to serve the website. It also uses the GlusterFS mountpoint to share the same files as the other web servers. For the Apache servers, the order of connection is reversed. It means that the last file server of the range acts as master, and the other ones are backup servers.

WorpPress

The latest version of WordPress is automatically downloaded and installed after the creation of the worpdress GlusterFS volume. It is also configured automatically to use the previously created database, generating the well known `wp-config.php` in the process. If the website itself is defined in the variables, it is also configured ans saved to the database. In case of anything going wrong, nothing is done and the normal graphical installation can be accessed upon first connection. Here are the variables that can be set to install the website :

- `website_name` : sets the title of the WordPress install. Defaults to `Open Source`.
- `website_username` : sets the username of the administrative user. Defaults to `admin`.
- `website_password` : sets the password of the administrative user.
- `website_email` : sets the email associated to the administrative user. Defaults to `contact@opensource.fr`
- `noindex` : this variable is used to tell the search engines what to do with the website. Two values are possible :
    - 0 : Website will not be indexed and will not show up in search results.
    - 1 : Website will be indexed and show up in the search results.

Log management: rsyslog, filebeat, logstash, elasticseach and kibana

With the increasing amount of machines in this environment, managing all the generated logs by each application and system in a centralized place becomes critical. In order to achieve this, all the logs are sent with rsyslog to a dedicated machine `wp-log`, which will store all the logs with a file format. But analyzing these raw logs by hand is very tile consuming and not very efficient. That's the goal of the second log server `wp-elk`, containing an ELK stack which contains three packages (plus one in `wp-log`) :

- Filbeat (installed in `wp-log`) : part of the elastic beats series, this package allows the logs to be sent in Logstash in our case (it could be sent directly into elasticsearch, if Logstash weren't used). It is composed of different modules for each application, which sends the corresponding files with some parameters used later to filter correctly. A custom module for squid has been added to the environment as it is not natively present in Filebeat.
- Logstash : contains a set of filters created for our log files and enables separation of each part of the log lines into split variables. This log parsing makes the data simpler to analyze later in Kibana, as each piece of log is sent to different fields.
- Elasticsearch : it is a NoSQL database containing all the processed data output by Logstash. The database only contains two indices with this configuration, `filebeat-<version>-<date>` for the Logstash output, and `_kibana` to store the settings, field definition, and different items of Kibana dashboards.
- Kibana : it is the package used to visualize the data. It looks into the `filebeat-*` index pattern to look for the data, which can be displayed in a simple table at first. But the goal of the Kibana web application is to create visualization to view a single data, and combine them into dashboards to view multiple piece of data at once.

There is near to nothing to configure for these two machines. The only parameter to add to hostname and IP is the domain name used to access the Kibana website. It is configured in HAProxy and is used to redirect to the correct backend, so the name must be resolved, either locally with the hosts file, either by a DNS server. When Kibana is opened for the first time, it asks for an index pattern creation, which is simply `filebeat-*`. This has to be done just once to allow Kibana to find the data.

There are some visualizes and dashboards included with this repo in the elk folder. It is a single `ndjson` file which can be imported directly in Kabana in the `Management > Kibana > Saved Objects` section. These one only show some basic information on HAProxy and the web servers and works only if the *hostnames have not been modified*.

Logs in the Kibana dashboard mainly contains HAProxy, Squid, Nginx, Apache, some MariaDB messages and the auth facility (containing itself many command lines as sudo, su, or useradd)at this point of the configuration.

Monitoring: centreon

As the numbers of machines increases, it also becomes crucial to be able to monitor them easily and in a central interface. This is exactly the goal of centreon, an agentless software that can remotely monitor the servers health. The scripts included in this repo handles all the CLI compilation and installation part. The web install wizard then needs to be filled to complete the install and begin to monitor servers. There is near to nothing to configure for this machine apart its hostname, domain name and IP address. The local database root password has been copied from mariadb server for simplicity, but it can easily be changed in the machine or by adding a variable in the Vagrantfile.

The database part is then filled this way :

- Host: localhost
- Port: 3306

- User: root
- Password: `same_password_as_mariadb_server`
- Remaining fields as wanted

> During the wizard, there will be an invalid path that just needs to be replaced by the following value : /usr/lib/centreon-broker/cbmod.so

There is absolutely no constraints for the admin user creation.

SSH Bastion: cockpit

In order to centralize the SSH access to the servers and be able to detect any malicious activity (from internal or external users), a server with cockpit is also installed. All the SSH connections must originate from this server. This can open the ability to save all the sessions and replay them and gives a central point to access machines of the network, instead of anyone connecting directly to any machine.

As with centreon, there is near to nothing to configure here except the hostname, IP, and domain name.

Remote access with OpenVPN

Remote access can be useful whenever employees cannot come onsite. By this service they can connect from their home or some other place for them to work as if they were at the office. The configuration is mainly handled by script and the ovpn files for two users are ready to be gathered on the machine in the `/etc/clients-configs`. All the certificates and the certificate authority are created by the install script.

Some parameters as the remote server may be changed to match the current VPN server, but it should be ready to use in a OpenVPN client.

Conclusion

This project allows you to deploy a full WordPress environment quickly and easily. It is highly available for the file storage and the web part, but due to some physical restrictions, the database and the log management have been kept on single servers, not scalable in any way (this means that if the database crashes, all Wordpress services are down for example, so it is a downside). Two log management servers are also included in this branch, which means that with some dashboard configuration (begining with the given elements for example), this environment activity is also easy to watch.