Article **Journal of Computational Technologies**
June, 2023 Vol.7 No.19 12-28

Implementation of a development environment within a virtualization environment in data center

Implementación de un ambiente de desarrollo dentro de un entorno de virtualización en centro de datos

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DOI: 10.35429/JOCT.2023.19.7.12.28 Received March 15, 2023; Accepted June 30, 2023

Resumen

Implementación de entorno de desarrollo para cargas de trabajo empresariales en clústeres de Kubernetes (RedHat Openshift, 2017) utilizando Red Hat Openshift, sobre las máquinas virtuales del hipervisor oVirt, logrando que los contenedores que se ejecutan en esta forma de implementación pueden obtener acceso directo al almacenamiento servido por el hipervisor oVirt. Realizando la configuración del entorno de desarrollo de Red Hat Openshift, así como la ejecución de los contenedores sobre las máquinas virtuales en el software oVirt, para obtener como resultado un mantenimiento sencillo a máquinas virtuales en bare metals teniendo múltiples métodos de instalación (IPI y UPI) y permitiendo el uso en su totalidad el hardware. Proporcionar una manera fácil de implementar los complementos para Openshift y lograr implementar una aplicación web sobre microservicios para demostrar el funcionamiento de los contenedores proporcionados por Openshift, Ofreciendo una plataforma integrada para administrar los contenedores en una diversidad de entornos operativos y como consecuencia, ayuda a reducir significativamente el tiempo que se toma para construirlos, implementarlos y escalarlos. Como herramienta de próxima generación en virtualización de código. Esta publicación es resultado de una tesis desarrollada en el centro de datos.

Virtualización, Contenedores, Servidores

Abstract

Deployment of a development environment for enterprise workloads in Kubernetes (RedHat Openshift, 2017) clusters using Red Hat Openshift, on top of the oVirt hypervisor virtual machines, ensuring that containers running in this form of deployment can directly access the storage served by the oVirt hypervisor. Carrying out the configuration of the Red Hat Openshift development environment, as well as the execution of the containers on the virtual machines in the oVirt software, to obtain as a result an easy maintenance of virtual machines in bare metals having multiple installation methods (IPI and UPI) and allowing the full use of the hardware. Provide an easy way to implement plugins for Openshift and achieve a web application on top of microservices to demonstrate the working of the containers provided by Openshift, Offering an integrated platform to manage containers in a variety of operating environments and as a consequence, helps to reduce significantly the time it takes to build, deploy, and scale them. As a next generation tool in code virtualization. This publication is the result of a thesis developed at the data center.

Virtualization, Containers, Servers

Citation: OLVERA-GONZÁLEZ, Edgar Alberto, CERDA-GARCÍA, Jorge Alejandro, VIRAMONTES-REYNA, José Luis and VELAZQUEZ-LEYVA, Erasmo. Implementation of a development environment within a virtualization environment in data center. Journal of Computational Technologies. 2023. 7-19: 12-28

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1. Introduction

Today's global enterprises handle a large amount of information and at the same time need to deploy numerous applications at the same time for their customers, suppliers, employees, etc.; in order to do this, cloud capabilities are needed to efficiently deploy applications.

OpenShift enables users to develop, deploy and manage container-based applications. It is a self-service platform that facilitates the creation, modification and deployment of container-based applications on demand, using faster development methodologies. Coupled with the right tools (installation media and where the software is hosted), Openshift is an amazing innovation for cloud-based applications and robust connectivity worldwide. Companies of different industries and sizes have been able to expand their operations faster.

One of the virtualization tools that is used and is a great option to choose as virtualization software is oVirt. Today, oVirt (Figure 3) is a fast, efficient and stable solution for enterprise workloads; it is easy to administer, fast to deploy and provides integrated storage management (IBM, 2021) (Figure 1). Deploying OpenShift on top of oVirt virtual machines benefits all of the advantages mentioned above. To go one step further, containers (NetApp, 2019) running on this form of deployment can get direct access to the storage served by oVirt.

Presented in the article is the in-depth analysis on the necessary information and process involved in implementing, configuring and putting Openshift into production under the open source software oVirt (virtualization solution) (Figure 4), which will be used to manage and keep track of an enterprise infrastructure. As well as the use of various tools that contribute to make the development environment easy to monitor and control.

The developed project is implemented and carried out in the data center facilities, in the area assigned to the software factory. The main objective to be carried out, is the implementation of said container software previously mentioned in a virtualized environment, this development environment will be left in operation and in conditions for its use, applications assembly, programs, etc.

a)

The steps to follow were:

- Deployment and configuration of the Red Hat Openshift development environment.
- Implementation of openshift on virtual machines in Red Hat oVirt software, as it is easy to maintain, has multiple installation methods (IPI and UPI), allows full use of the hardware and maintenance of virtual machines is easier than in bare metals (García I. J., 2021).
- It provides an easy way to implement openshift plug-ins.
- To implement a web application and mount it in Openshift to demonstrate the operation of the containers provided by Openshift.

2. Methodology

2.1. Software Research and Documentation

The Openshift software (Bluexp, 2021) was selected and the details that comprise it, such as specifications and requirements, functionalities, features, and its configuration, were studied. As also researched about oVirt virtualizer (oVirt, 2018) (Mutai, 2022), offered by Red Hat (RedHat Openshift, 2017).

2.2. RAID and operating system configuration on 8 Nodes

A configuration was performed on each of the RAID nodes (Garcia J. , 2023), the data center consists of 8 nodes, so this procedure will have to be performed 8 times, in the same way, each of the nodes, has the same hardware resources and will be configured in RAID 5. This version helps to protect data against possible losses, either by anomaly in a disk drive or damage caused to a disk. RAID 5 protection protects against a drive failure. If more than one disk fails, data must be restored from the backup media.

2.2.1 Configuración de RAID en 8 servidores

Power up the host, server or reboot it and through the KVM perform all the configuration. When the server starts to boot, press the CTRL + H keys on the keyboard to start the RAID configuration.

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a) Confirm the RAID card to be configured, in this case there is only one, click on the "Start" button.

b) After entering the interface, the main screen will be displayed showing the current status of the disk array and configured through the "Configuration Wizard".

c) You need to clear the previous RAID configuration, make sure that the data on the server is backed up. "Clear Configuration

i) The system warns that the operation of clearing the configuration, will cause the loss of data found there.

d) Create a new matrix and go to the next step

i) Leave the Manual Configuration, once the manual configuration is selected, click on the next button to proceed with the process.

ii) Leave Redundancy as Redundancy when it is possible.

e) Select all the disks row down, verify that all are selected, make sure that the Backplane is not selected, and then "Add to Array".

f) Once all disks have been added to Drive Groups, select "Accept DG" and click Next to proceed to the next step.

g) Add the Drive Group found in the Span Definition window to the other SPAN section by clicking on "Add to Span".

h) In the following Virtual Drive Definition window, you must configure the RAID level that were added to the SPAN, the Strip Size, Access Policy, Raid size, etc. In this case the RAID level to be configured will be number 5. Fill in the RAID size automatically and some other options automatically by pressing the update Size button, and then click "OK". Continue to the next window with Next

i) On the BBU screen, click on the "Yes" button in order to select BBU mode as a WriteBack.

ii) After the configuration is done, a test is performed.

i) Save the configuration that was made by clicking on the Yes button and initialize the new array. The progress will be displayed.

j) Now you can see that the RAID has correctly grouped the disks and created the Virtual Drive. Restart the server and this would be concluding the RAID configuration on the server.

k) This process was performed 8 times, because the RAID configuration was performed on the 8 servers to be used.

2.2.2 Installation and configuration of Rocky Linux on the 8 servers

Once RAID 5 is correctly configured, the Rocky Linux operating system (Memon, 2021) will be installed on each of the nodes that make up the cluster, the process will be exactly the same and will be repeated 8 times. What will tend to vary are the IP addresses that are assigned to the node, as well as the node's domain name.

l) Have a bootable memory with the ISO of the Rocky Linux Operating System, the server must be started from the installation media (Rocky Linux and the installation process begins). The initial screen to configure the installation is as follows.

m) When the installation process starts, select the English language and leave it as the default language of the system.

n) Select the keyboard layout, which is the "Keyboard" option, once inside the keyboard layout, remove the English layout and add the Latin Spanish layout, to save and confirm the changes click on "DONE".

o) Software Selection, select the version and base environment of our Rocky Linux operating system, for the installation of each one of the nodes the minimum version without GUI will be installed, confirm the changes by clicking on "DONE".

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p) Configure the network and host name, for this go to "NETWORK & HOSTNAME" (Wiki, 2022). First, configure the Network. Click on "Configure..."

i) Turn on the Network adapter which by default is turned off, make sure that it is turned on.

ii) Go to the IPv4 window and select the Manual method to assign the IP address manually. To add the IP address click on ADD. Enter the IP address of the node, its subnet mask and gateway.

iii) Add the additional DNS servers (CIRA, 2019), if there are multiple DNS server addresses, separate the addresses with a comma.

iv) Save the configuration in Save.

v) Assign hostname, enter the desired hostname in the "Hostname" section and click on "Apply" to apply the change.

q) Set the date and time of the operating system. Select the time by selecting the time zone on the map, set the time automatically and the date, save the changes by clicking on "Done".

r) Set a password to the root user, go to the Root Password section, enter a secure password and confirm, to save the changes click on Done.

s) Configure the installation destination, click on the Installation Destination option, select the local disk and the Storage configuration in Manual, click on Done.

i) To make the manual partitions easily, click on "Click here to create them automatically".

ii) The serpan mount points will be created intelligently.

iii) The Swap partition will be resized, the file system will remain in SWAP format and the capacity will be extended to 8 GB.

iv) The /boot partition, change the system files to ext4 format.

v) The /var partition is configured in the same way, only the file system will be changed to ext4, the capacity on the disk will be left exactly the same.

vi) The root partition will be deleted, as it will be assigned a different name, to do this select the partition and delete it, then create a new partition with the name /data and assign all the available storage capacity. Assign it the ext4 file system

vii) Modify the group volume name, a name of the volume group is assigned, all the nodes must have the same name of volume group, so that it can be configured in a global way.

t) The installation process will be carried out on the 7 subsequent operating systems nodes, it will be the same installation process for each of the nodes that make up the cluster.

2.3 DNS server installation and configuration - BIND9

Throughout this phase a DNS server is installed in a virtual machine that is hosted in the oVirt virtualized environment that was previously installed and configured. This DNS server will be responsible for resolving and translating IP addresses to domain names that the Openshift container software will occupy.

"Openshift requires two static IP addresses that are outside of the DHCP pool (De Luz, 2023), as well as creating the DNS entries for the OpenShift Container Platform REST API and application domain names."

Once the function of the DNS server has been defined, we will proceed to document the installation and configuration process of the DNS server using the BIND DNS software in Rocky Linux 8 (the virtual machine where the server will be installed has this system).

The Domain Name System is a hierarchical, decentralized naming system for computers, services or other resources connected to the Internet or a private network. It acts like an Internet phone book because it gives each computer an address with an associated FQDN. BIND9 (Berkeley Internet Name Domain) is the package that provides the name conversion to IP functionality.

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– Installing BIND DNS on Rocky Linux.

a) Run the following command in the terminal with root privileges, the Bind9 package installation will be performed.

b) We will wait until all the packages are installed correctly and the output indicates that the installation has been successful.

– Configuration of BIND9 DNS in Rocky Linux.

– Now we will proceed to configure BIND for domain name resolution. In the environment where the server is located, the following configuration is available:

DNS zone – contenedores.domainx.mx
Managed subnet – 10.xxx.xxx.xxx/24
DNS server IP 10.xxx.xxx.xxx

c) Edit the /etc/named.conf file with the "nano" or "vim" editor, make the following changes and create the forward and reverse zones.

i) Modify the following lines, so that it can listen to requests from anyone within the internal network and iterative queries.

Listen-on port 53 { any; }
Allow-query { any; }

ii) Create the forward zone, indicating the name assigned to it and the name of the file where the configuration will be saved.

Forward
zone "contenedores.domainx" IN {
type master;
file "openshiftDNS.forward";
allow-update { none; };

iii) The reverse file is configured in this same configuration file, putting the three octets in reverse, starting with the third last octet.

zone "9.xxx.xxx.in-addr.arpa" IN {
type master;
file "openshiftDNS.reverse";
allow-update { none; };
};

Note: If the DNS server IP for example is 172.29.10.5, the reverse zone will be 10.29.172.in-addr.arpa

iv) This is how /etc/named.conf would look like. Some parameters in the environment configuration file are modified.

– Create the zone files

Create the forward and reverse zone files, in which DNS records such as A, AAAA, MX and PTR records will be updated.

A: This is the host address or forward record and is only in the forward file (above).

PTR: This is the pointer record better known as the "reverse" and is only in the reverse file.

d) The file is created in the /var/named directory and edited with "nano" or "vim", the forward and reverse files are created.

"sudo vim /var/named/openshiftDNS.forward"

In this configuration a serial number must be set to a number that will increment each time you add a DNS record. This is to facilitate the management of large clusters. The name or FQDN of the host name or server is assigned its IP address. As you can also set each IP address of a hostname.

e) Create the corresponding reverse DNS file with the PTR records of the domains added in the forward zone file. Take into consideration that the same serial number in the reverse zone as the one used in the forward zone (Illustration 5).

f) Grant all the correct permissions to the files created above.

sudo chown root:named
/var/named/openshiftDNS.forward
sudo chown root:named
/var/named/openshiftDNS.reverse
sudo chmod 644
/var/named/openshiftDNS.forward
sudo chmod 644
/var/named/openshiftDNS.reverse

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– Allow DNS service through the Firewall (Forcepoint, 2021)

g) Configure the Firewall to allow DNS service with the commands:

sudo firewall-cmd --add-service=dns --permanent
sudo firewall-cmd –reload

– Verify the DNS configuration

h) Execute the commands in order to verify that the configuration is correct and that there are no syntax errors in the zone files.

sudo named-checkconf

i) Verify that the forwarding zone files are well configured, as well as the reverse file, passing as parameter the name of the zone and the file. It should give us an OK status.

named-checkzone contenedores.domainx.mx openshiftDNS.forward
named-checkzone 9.xxx.xxx.in-addr.arpa openshiftDNS.reverse

– Initialize the BIND service

j) Start and enable named.service to start the BIND service.

sudo systemctl enable --now named.service

k) Verify that the service has started correctly. It should be verified that the service is active and has loaded the zone files.

systemctl status named

– Test the DNS Bind service in Rocky Linux.

Now we are going to try to query the DNS server using the dig and nslookup command.

These commands and the above output help to verify that the DNS service is working. So you can start using the DNS server in Rocky Linux 8. You can also add more records to the DNS zone files.

2.4 Configuring GlustesFS Distributed Volume Mirroring

After installing the operating system on the nodes that make up our cluster, the GlusterFS distributed replicated volume (Gluster, 2022) must be configured on the operating system that has been installed which is Rocky Linux. Gluster is a free and open source scalable network file system (Snigdha, 2021) that enables the creation of large-scale distributed storage solutions for media streaming, data analysis and other data - bandwidth intensive tasks.

Prerequisites for installation

a) If you have 8 nodes, you must have at least 6 nodes for the GlusterFS cluster (IONOS, 2021). An even number of bricks must be used in this type of volume.
b) Attach an extraction disk (which is different from the root partition /), so that it can be used to provide the gluster storage unit (brick).
c) Make sure that the time is synchronized between the cluster nodes, they should all have the same time.
d) Open the required Gluster ports/services in the firewall on all nodes in your cluster.

Gluster Volume Types

GlusterFS has support for different volume types offering various features, these include the following:

– Distributed: Files are distributed across the bricks in the volume.
– Replicated: Files are replicated across the bricks in the volume. Ensures high availability and reliability in storage.
– Distributed Replicated: Files are distributed across the replicated bricks in the volume. Ensures high reliability, scalability and improved read performance.
– Arbitrated Replicated: Files are replicated in two blocks in a replica set and only the metadata is replicated to the third block. It makes sure to guarantee data consistency.
– Dispersed: Files are dispersed across the blocks in the volume.

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– Distributed Dispersed: Data is distributed across dispersed sub volumes.
– GlusterFS distributed replicated volume configuration.

In a glusterfs distributed replicated configuration, the number of blocks must be a multiple of the number of replicas. In addition, the order in which the blocks are specified is crucial in the sense that adjacent blocks become replicas of each other.

1. List node details and information, such as hostname and IP address in order to install GlusterFS Check the GlusterFS server status: systemctl status glusterd on each of the nodes that have the Gluster server.

2. Open and Allow GlusterFS services and ports in the Firewall.

a) Configure distributed replicated storage volumen

The gluster volume create command should be used to create a distributed replicated storage volume. The full command syntax to be able to create a new volume in Gluster is:

gluster volume create NEW-VOLNAME [replica COUNT] [transport [tcp | rdma | tcp,rdma]] NEW-BRICK…

Points to consider

– It is necessary to use an even number of bricks when creating a distributed duplicate volume (in this case there are 8 of them). That means that the number of blocks or bricks must be a multiple of the number of replicas.

– The order in which the bricks are specified determines the order in which they replicate each other. For example, if you specify a two-way replica, this means that the first two adjacent bricks specified become a replica (mirror) of each other and the next two bricks in the sequence replicate each other.

b) Creation Two-way distributed replicated volumes

The cluster that has been configured consists of 8 nodes and a replica will be applied to the volume of two. This means that the first 2 adjacent blocks will form a replica, the same with the next two.

In the installation process, the data directory block will be named in three different ways, since the three logical partitions that the oVirt installer needs for its installation were created, the partitions are: data, storage, engine.

So this replication process must be performed in each of the partitions for the eight blocks. The directories will have the names: data-repl, vmstore-repl, engine-repl. In this case the process will be demonstrated using "vmstore-repl" as an example. If the directory does not exist, it will be created.

*gluster volume create vmstore-repl replica 2 transport tcp *
fsnodo1:/vmstore/vmstore01
*fsnodo2:/vmstore/vmstore02 *
fsnodo3:/vmstore/vmstore03
*fsnodo4:/vmstore/vmstore04 *
fsnodo5:/vmstore/vmstore05
*fsnodo6:/vmstore/vmstore06 *

Note: In this case the volume for the vmstore partition is being created, for the other volumes, vmstore is replaced by data or engine.

i) If the creation of the replicated distributed volume is successful. You should get the following confirmation message indicating successful creation

volume create: dist-repl-gfs: success: please start the volume to access data

c) To start the GlusterFS replicated distributed volume.

i) To initialize the Gluster volume with the volume start command. Initialize the volume with the name assigned to it during its creation process.

gluster volume start vmstore-repl

ii) In order to know and list additional information of the blocks and of each of the created volumes, apply the following commands, applying the correct name of the volume you want to obtain the information.

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gluster volume status vmstore-repl detail

d) Mount GlusterFS storage volumes on clients.

Once the mirrored volumes have been installed, they must be mounted on clients so that information and data can be written to them.

Demonstration of how to mount glusterfs volumes, we will be using and mounting on a client with RockyLinux.

Install GlusterFS native client on the operating system.

dnf install glusterfs glusterfs-fuse

e) Create a Gluster Storage mount point. The /gluster_bricks/vmstore directory will be used. There will be three different directories that will be found in the gluster_bricks directory, because the installation of three volumes was performed and the volumes need a mount point (the directories will be data, engine and vmstore). Perform this process in each of the nodes, this process must be done 7 times.

f) Apply the mount command, specifying the system file type as "glusterfs", along with the node name and volume name.

g) For automatic mounting during system boot, enter the following line in the /etc/fstab file, edit with nano or vim, replacing the particular glusterfs storage volume and the mount point that has been determined.

i) Three lines were added to the fstab file corresponding to each of the partitions, the name of the node and the volume. This must be applied to each of the nodes.

fsnodo1:/vmstore-repl /gluster_bricks/ glusterfs defaults,_netdev 0 0
fsnodo1:/data-repl /gluster_bricks/ glusterfs defaults,_netdev 0 0
fsnodo1:/engine-repl /gluster_bricks/ glusterfs defaults,_netdev 0 0

2.5. oVirt installation and configuration

Installation of the required packages on all 8 nodes.

a) On all 8 nodes, perform the ovirt repos installation from https://resources.ovirt.org/pub/yum-repo/. For example, to subscribe to oVirt 4.4 repo.

yum install https://resources.ovirt.org/pub/yum-repo/ovirt-release44.rpm

b) On all 8 nodes, install the following packages

i) cockpit-ovirt-dashboard (provides a graphical environment for the installation)
ii) vdsm-gluster (plugin for managing los servicios de gluster

yum install cockpit-ovirt-dashboard vdsm-gluster ovirt-host

c) On the first host, install the following packages

i) ovirt-engine-appliance (for Engine virtual machine installation)
ii) gdeploy (a container tool around Ansible that helps to configure gluster volumes)

yum install ovirt-engine-appliance

– Gluster configuration and preparation for oVirt

d) In order to configure Gluster Hyperconverged, you need to access the first node, which is where the management panel for the installation of oVirt was installed, enter the root credentials to enter the node through the UI.

e) Go to the virtualization section and select the way in which oVIrt Engine will be installed in multiple nodes, in this case the Hyper Converged version will be chosen, which allows data replication and the Engine not to be centralized in only one node.

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f) Start the Gluster configuration wizard. Provide the hostname of the first three hosts that make up the Cluster, their hostname for the Storage and Public Network. The ansible cockpit to perform the gluster implementation on the hosts. It is necessary to have a key-based authentication setup for the root user between the host running the wizard and the 3 addresses provided for gluster hosts. The deployment process also adds the 3 hosts to the oVirt engine at the end of the deployment process. To ensure that the hosts are added via the management network/interface, provide the FQDN (LINUBE, 2020) to be used for the hosts on the tab.

g) This is an optional step: install additional required packages on all hosts. As this is an oVirt-Node based installation, all necessary packages are already available.

h) In this step of the wizard you define the gluster volumes that need to be created. These gluster volumes are going to be used later in the wizard to create domains (Network, 2021) of storage in oVirt. The first volume is going to be used for the Hosted Engine virtual disk. Two additional gluster volumes will be created. The name of the volume and the directory of the bricks where this volume will be hosted are assigned, for this purpose the directories were previously created in each of our nodes.

i) Vmstore: It is in charge of storing the virtual machine images.

ii) Data: It hosts the data disks of the virtual machines.

i) The Bricks tab configures the devices that will be used for the gluster volumes defined in the previous step. If the devices that are being used for the blocks are configured as RAID devices, the information must be provided in the RAID information section. These parameters are used to create the values for the LVM and file system created on the device. Select the type of RAID that is JBOD and configure. Assign the LV names and size.

j) The last section of the wizard, compiles through a YAML file, the installation configuration, you can modify parameters prior to installation. The installation process starts and once the installation is finished, it will indicate that Gluster has been successfully configured.

– Instalación de oVirt (Hosted Engine)

Through the hosted engine wizard, you can create the engine virtual machine from a pre-installed device to configure it on the fly. This can save a lot of time and ease the configuration. After Gluster has been configured through the cockpit that has been installed on the nodes, you will continue to install oVirt, the hosted engine.

a) Once the Hosted Engine Deployement wizard is initialized. Configuration data must be provided to create the hosted engine, such as VM FQDN, the ip that manages the virtualizer, DNS servers, assign passwords, as well as the resources that the hosted engine machine will occupy.

b) Engine configuration. Assign a password to the administrator portal and the configuration of notifications, server where the virtualizer notifications will be sent.

c) List of the configuration of the virtualizer to be created and the hosted engine, counting all the configuration options. Once you continue, the installation process will be performed.

d) Start the installation of oVirt, you will be able to follow all the installation with the logs that it provides, once the installation is finished, the logs will indicate that the installation is finished.

e) Configure the storage domain that will be used to store the disk of the virtual machine manager and administrator. Assign the Storage Connection and the mounting options.

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f) The disk is created and we wait until the storage domain is successfully configured and the disk with the designated capacity is attached to the hosted engine virtual machine. It will provide us with logs to follow the installation process.

g) Access the domain, FQDN that has been assigned to the virtualizer, when the FQDN is entered, it will redirect to the login screen, the assigned passwords are entered.

h) Now you can see the main screen of the virtualizer that lists the total resources of the virtualizer and the global use of the resources. Now you can manage according to the virtualizer's needs (Figure 2**).**

2.6. Instalación de Openshift en oVirt

– Requirements verification procedure for the oVirt development environment.

Verify that the oVirt environment meets the requirements for installing and running an Openshift Container cluster (Bluexp, 2021). Failure to meet these requirements may cause failures.

Procedure

– Verify that the version of oVirt is compatible with the installation of Openshift Container version 4.

i. In the oVirt administration portal, click on the ? sign (help) and select the "About" option.
ii. In the window that will open, note the oVirt Software Version section, it will give you the version of your oVirt.
iii. Confirm that the oVirt version is 4.4.

– Inspect and verify the Data Center, Cluster and Storage.

iv) In the oVirt administration portal, click on Compute -> Data Centers.
v) Confirm that the Data Center where the Openshift Container installation is planned to be performed is accessible.
vi) Click on the Data Center name
vii) In the Data Center details, in the Storage section, confirm that the storage domain where Openshift Container will be installed is Active.
viii) Take into account the domain name, as it will be used later.
ix) Confirm that the Free Storage has a minimum available storage of 230 GiB.
x) In the Data Center details, go to the clusters section.
xi) Find the oVirt cluster where you plan to install oVirt. Find the cluster name to use later.

– Inspect oVirt host resources.

vii) In the cluster details, click on the Hosts option and tab.
viii) Inspect the hosts and confirm that they all have a combined total of 28 Logical CPU Cores available for the Openshift Container Cluster.
ix) Store the number of Logical CPUs for later use.
x) Confirm that these CPU cores are distributed, so that each of the seven virtual machines that are created during the installation must have at least 4 cores.
xi) Confirm that, collectively, all hosts have 112 GiB of maximum free memory for the newly distributed virtual machines to meet the requirements of each of the following Openshift Container machines:
xii) 16 GiB para la máquina de bootstrap
xiii) 16 GiB required for each of the three virtual machines of the three "control plane machines".
xiv) 16 GiB required for each one of the three compute machines.
xv) To find out the maximum amount of memory to program new virtual machines for later use.

– Verify that the virtual network to install Openshift Container has access to the oVirt Engine REST API. From a virtual machine in this network, use curl to reach the REST API.

$ curl -k -u <username>@<profile>:<password> \ https://<engine-fqdn>/ovirt-engine/api

The <username> part specifies the username of the oVirt account with sufficient privileges to create and manage an Openshift Container Cluster in oVirt. For the <profile> section you must specify the login profile, which can be obtained through the oVirt Administration portal, in the Profile section a dropdown that, on mouseover, will give the full user. While <password> refers to the password for that user.

For <engine-fqdn>, specify the full domain name of the oVirt environment.

– Preparing the network environment in oVirt Configure two static IP addresses for the Openshift Container cluster and create DNS entries using those addresses.

Procedure

1. Reserve two IP addresses

a. On the network where the Openshift Container installation is planned (Bluexp, 2021), identify two IP addresses that are outside the DHCP pool range.

b. Connect to a host that is on this network and verify that each of these IP addresses are not in use. For example, use "Address Resolution Protocol (ARP)" to verify that none of the addresses have entries or are being used.

$ arp 10.35.1.19
10.35.1.1910.35.1.19) -- no entry

c. Remember these IP addresses for later use

2. Create DNS entries for the Openshift Container REST API and application domain names in this format:

api.<cluster-name>.<base-domain> <ip-address>
**.apps.<cluster-name>.<base-domain> <ip-address>*

For the <cluster-name> part specify the cluster name, in this case "containers" will be used, in <base-domain> specify the base domain and in <ip-address> enter the IP address for the Openshift Container API.

Assign the same as above but a different address for the Openshift Container apps.

api.my-cluster.virtlab.example.com 10.35.1.19
**.apps.my-cluster.virtlab.example.com*
10.35.1.20

– Installing Openshift Container Platform on oVirt RHV in insecure mode

By default, the Openshift installer creates a CA certificate, requests a confirmation and stores the certificate that is used during the installation process. It is not necessarily required to create or install one manually.

Although not recommended, it is possible to bypass this automatically generated functionality and proceed with the OpenShift Container Platform installation without verifying a certificate by installing OpenShift Container Platform on RHV in non-secure mode.

– Procedure

a) Create a file named ~/.ovirt/ovirt-config.yaml
b) Add the following content to the created file (ovirt-config.yaml)

ovirt_url: https://www.ovirt.org/download/
ovirt_fqdn: ovirt.example.com - 2
ovirt_pem_url: ""
ovirt_username: ocpadmin@internal
ovirt_password: super-secret-password - 3
ovirt_insecure: true

– In number 1 you must specify the host name or address that corresponds to our oVirt virtualized.

– Number 2 is the full name of the oVirt virtualizer domain name.

– In number 3 you must specify the oVirt virtualizer administrator's password.

c) Installation mode by generating a private SSH key and adding it to the agent.

Generate an SSH key required by the installation program, it is used on Fedora CoreOS (FCOS) nodes through their configuration files, it is also used to authenticate SSH access to the nodes.

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This key can be used to be able to access the boot machine in a public cluster to troubleshoot installation problems.

"In a production environment, it is essential to have this SSH key, as disaster recovery and debugging are required."

– Procedure

i. If you do not have an SSH key that is generated by default in the operating system, you must create one. In the Linux operating system, it is created with the command:

*ssh-keygen -t ed25519 -N '' *
-f <path>/<file_name> - 1

Where in 1 in <path> you must specify the path and filename as ~/.ssh/idOKD, of the new SSH key. If you have existing keys, make sure that the SSH key is located in the ~/.ssh directory, as the Openshift installer takes that path.

iii) Start the ssh-agent process and task as a background task.

$ eval "$(ssh-agent -s)"
Salida de la consola
Agent pid 31874

iv) Adding the private SSH key to the ssh-agent

$ ssh-add <path>/<file_name>

The following console output is obtained:

Identity added: /home/<you>/<path>/<file_name> (<computer_name>)

When installing Openshift Container Platform, the public SSH key must be provided to the installation program. We can see the contents of the key.

– Get the installation program

Before the Openshift Container Platform is installed, install the installation file on the local computer where the Openshift deployment process is being performed.

– Client computer requirements for installing the software

You must have a computer running Linux or Mac OS with 500MB of available storage.

– Procedure

i. Access the infrastructure provider's page on the OpenShift Cluster Manager site. You must have a Red Hat account. Log in with the correct credentials. If not, create an account on the platform.

ii. Select the infrastructure provider.

iii. Go to the page corresponding to the type of installation to be performed, download the installation program for the operating system you have and place the file in the directory where the installation configuration files will be stored. The installation program creates several files on the computer that you use to install your cluster. It is necessary to save the installation program because it has utilities that can be used after the cluster is installed. Both files are required to remove the cluster.

iv. *"The installation program creates multiple files on the computer that it uses to install your cluster. You should keep the installation program and the files that the installation program creates after the cluster installation is complete. Both files are needed to remove the cluster later if desired or required."*

– Extract the installation program

Extract the installation program. For example, on a computer using a Linux-based operating system, the following command should be executed:

$ tar xvf openshift-install-linux.tar.gz

Unzip the installer and from now on you can start the cluster installation process.

– Extract the installation program

Openshift Container Platform can be installed on a supported cloud platform.

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"Execute the create cluster command of the installation program only once, during the initial installation process."

– Prerequisites

Open the ovirt-imageio port to the Administrator from the machine running the installer. By default, the port is 54322.

Obtain the OpenShift Container Platform installer and the pull secret for the cluster.

– Procedure

Change to the directory where the installation program was unzipped and contains the installation program and start the cluster deployment:

*$ ./openshift-install create cluster --dir <installation_directory> *
--log-level=info

– For <installation_directory>, specify the directory where the files generated during the installation will be stored.

– For different information or details of the installation, specify "warn", "debug", or "error" instead of "info".

Respond to the indications of the installation program

a. Optional: For the SSH key, select a public key without a password, such as ~/.ssh/id_rsa.pub. This key authenticates connections to the new Openshift Container Platform cluster.

b. For Platform, select the "oVirt" option.

c. For Engine FQDN[:PORT], the fully qualified domain name (FQDN) for the RHV environment must be entered.

For example:

rhv-env.virtlab.example.com:443

d) The installer automatically generates a CA certificate. For the "Would you like to use the above certificate to connect to the Manager?" answer yes or no, depending on whether you want to install Openshift in insecure mode or with certificate. If the answer is N, you should install Openshift Container Platform in insecure mode.

e) For the oVirt Engine username, enter the oVirt RHV admin panel username and profile, using the following format:

<username>@<profile>

For the <username> option, you must provide the username as an administrator or other type of user who has access to oVirt. For <profile>, specify the login profile. For example: admin@internal.

f) For the Engine Password part, the oVirt RHV admin password or specified user must be entered, with the key that is entered into oVirt.

g) For "Cluster", select the oVirt RHV cluster to install the Openshift Container Platform.

h) For "Storage Domain", select the storage domain to install Openshift Container Platform

i) For the Network option, select a virtual network that has access to the RHV Manager REST API.

j) For "Internal API Virtual IP", enter the static IP address that we select for the REST API of the cluster.

k) For "Ingress Virtual API", enter the IP address that was reserved for the application domain.

l) For the Base Domain, enter the base domain of the Openshift Container Platform cluster. If this cluster is to appear on the public network, it must be a valid domain recognized by the DNS infrastructure.

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m) For Cluster Name, a name must be assigned to the cluster. For example, my-cluster. Use the cluster name of the externally registered DNS entries that were created for the Openshift Container Platform REST API and the domain names of the applications.

n) For "Pull Secret", copy the pull secret found in the pull-secret.txt file or on the Red Hat OpenShift Cluster Manager page.

When the cluster installation is complete, instructions on how to access the cluster, including a link to the web console and credentials for the kubeadmin user, will be displayed via the terminal.

INFO Install complete!
INFO To access the cluster as the system:admin user when using 'oc', run 'export KUBECONFIG=/home/myuser/install_dir/auth/kubeconfig'
INFO Access the OpenShift web-console here: https://console-openshift-console.apps.mycluster.example.com
INFO Login to the console with user: "kubeadmin", and password: "4vYBz-Ee6gm-ymBZj-Wt5AL"
INFO Time elapsed: 36m22s

Neither the installation program nor the files created by the installation program should be deleted. Both are required to remove the cluster.

o) Accessing the Openshift Container Platform web console from RHV

After the Openshift Container Platform cluster is removed, you can log in and access the OpenShift Container Platform web console.

Procedure

1. In the Red Hat Virtualization (RHV) Administration Portal, open Compute → Cluster.

2. Verify that the installation program creates the corresponding virtual machines.

3. Return to the command prompt where the installation program is running. When the installation program finishes, it will display the user name and temporary password to be able to log in to the Openshift Container Platform web console.

4. In a browser, open the Openshift Container Platform web console URL. The URL has the following format:

console-openshift-console.apps.<clustername>.<basedomain>
Para <clustername>.<basedomain>, especificar el nombre del cluster y el nombre de dominio

For example

console-openshift-console.apps.my-cluster.virtlab.example.com

Figure 1 Logical management environment of a Data Center
https://www.ovirt.org/documentation/administration_guide/

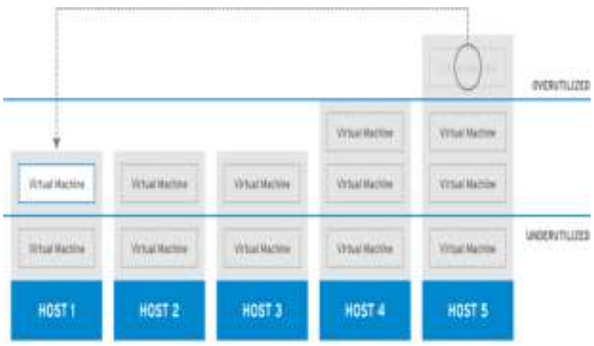

Figure 2 Scheduling policies to virtual machines, *https://www.ovirt.org/documentation/administration_guide/#sect-Scheduling_Policies*

Figura 3 Configuración del motor alojado oVirt *https://www.ovirt.org/dropped/gluster-hyperconverged/chap-Single_node_hyperconverged.html*

Figura 4 Dashboard hipervisor oVirt, *https://www.ovirt.org/download*

Results

The Openshift Container Platform has been left in optimal and functional conditions, as well as the virtualizer where Openshift is mounted, it was achieved that the virtualizer can perform the task of administration and management of KVM. Openshift has been left in its best conditions, to be exploited to the fullest and use its maximum capacity, because it was allocated resources for high performance, allows you to design, deploy and run applications uniformly in the cloud, on premises or at the edge of the network. Thanks to Openshift, applications developed and assembled on Kubernetes (RedHat Openshift, 2017) (Spot by NetApp, 2021), and can be put into production more easily and efficiently.

The free, open source virtualization management platform offered by Red Hat, oVirt, was implemented. The software is capable of migrating virtual machines to different hosts and storage domains, monitoring the status and resources consumed by the virtual machines and the cluster in general, and has high availability on the 8 nodes that make up the cluster.

The implementation of oVirt is of great benefit, since it offers many resources for the development and production of applications that are developed in the software factory area, in addition to the fact that it uses a bare metal environment that offers higher performance and better management in the use of hardware resources. Thanks to the considerable amount of resources available in the cluster (storage, RAM memory and CPU cores), virtual machines of different profiles, desktop machines, servers and high performance machines can be created and configured according to the needs and scope of the project or tool.

On the other hand, a local DNS server was implemented, using a virtual machine hosted in the oVirt virtualizer, the DNS Bind9 server which has the function of managing local network queries, different rules were configured to reach local computers through their private IP addresses, this DNS server was mainly used for Openshift, it used two static IP addresses for the OpenShift Container Platform cluster and DNS entries had to be created using these addresses. The DNS server can be used for internal uses of the cluster (all machines hosted on oVirt).

Finally, the container platform was implemented using the two previously mentioned softwares, the configuration of resources to be used by the container application was performed, as well as the virtual machines (workers and masters) to optimize its operation, according to the number of applications and microservices that will be mounted in this development environment.

As an improvement, it is planned to perform a migration of currently operating services that use this same technology in order to make the operation and deployment of the applications in the data center faster and reduce infrastructure costs.

Thanks

We would like to express our most sincere thanks to the Universidad Tecnológica de San Luis Potosí for its invaluable support during our stay as professors. The experience we have lived in this institution has been truly enriching and transforming, and much of this is due to the constant support we have received from this prestigious university, thank you very much in advance.

ISSN 2523-6814

Funding

Funding: This work has been funded by the Universidad Tecnológica de San Luis Potosí [grant: annual support for publication of scientific and technological articles].

Conclusions

For the correct operation of the virtualizer, it is necessary to perform scans and monitoring to each of the nodes, install system updates and activate services that sometimes stop working, this can be done from the cockpit (GUI) of each of the servers, in addition to relying on opensource monitoring tools for the physical interfaces of the cluster such as use of processing, memory, disk space, file system and network.

As for Openshift, after installation. The cluster administrator can configure and customize the following components according to the needs and deployment of applications:

– Configure Storage By default, containers work with ephemeral storage or transient local storage. Ephemeral storage has a lifetime limitation, it is necessary to perform persistent storage configuration to store data for a long time. Storage can be configured in dynamic provisioning and static provisioning.

– Configure network: As a cluster administrator, it is necessary to configure cluster traffic ingress, network policy, enable cluster-wide proxy.

Depending on the needs and requirements, pods can be added to a service or project to improve its performance. These process instances can encapsulate from 1 to many containers that execute shared processes to other instances that require the service regardless of whether or not they are dependent on it, making the service or services always available under a shared environment and in constant communication and also sharing resources, volumes and storage in a single entity.

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