A PROJECT REPORT ON

A MULTI-TIER ARCHITECTURE FOR LOCAL WORDPRESS HOSTING USING DOCKER

WordPress

docker

MySQL

ACKNOWLEDGEMENT

I am profoundly grateful to the World Record Holder , TEDx speaker , Philanthropist , Senior IT consultant , Entrepreneur, Founder of Linux World Informatics Pvt. Ltd. & IIEC RISE and Expert Corporate Trainer in almost all Latest & High-End Technologies Mr. VIMAL DAGA for his expert guidance and encouragement throughout to see that this project rights its target since its commencement to its completion.

I would like to express my gratitude again to such a huge personality Mr. VIMAL Sir who gave me this golden opportunity to do this wonderful project , which helped me in doing a lot of research and I learned so many new things.

I would like to extend my special thanks to all the volunteers and staffs of IIEC (Indian Innovation and Entrepreneurship Community) as well as Linux World for giving me such a chance to join them. This project would not have completed without their enormous help and worthy experience. Whenever I was in need, they were there behind me .

Although this report has been prepared with utmost care and deep routed interest. Even then I would like to accept respondents and imperfections.

Thank You

KRUSHNA PRASAD SAHOO
RISE 2020.11.50.3
IIEC RISE 1.0

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This certificate is hereby bestowed upon

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for successfully completing the training on

EXPERTISE IN DOCKER

a 24 hour training that covers Orchestration of Multi Container Application Using Docker Compose under the Mentorship of Mr. Vimal Daga

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■ INTRODUCTION

In today's digital world, the place where most people in most markets go is to the internet, specifically a search engine like Google, Yahoo, Firefox. With 93% of business decisions starting with a search engine search that means if you don't have a website, you are only selling to 7% of your market. Having your website will give you a chance to introduce people to know of your products and services and a way to find you. Not only it gives you online identity but also a platform to tell them who you are and why you do it. One of its way is blogging .

Blogging is an easy way to express yourself. It's is an amazing way to drive traffic to your website and increase your SEO.A blog with useful content shows your audience and customers that you are a trusted source.

■ OBJECTIVE

My aim in this project is to host a WordPress (a blogging tool) site in my local machine for learning purpose. Moreover this hosting will be done using the most demanding containerization technology(Docker) for more reliability , flexibility & also for safety and security .

The purpose of this document is to provide information about the technology and technical aspects of a real industry use case. It covers the technology used for this project , its planning and implementation process , results & its future scope .

■ PROJECT IDEATION & TECHNICAL ASPECTS

In this project I'm going create a multi-tier architecture for hosting my blog using the WordPress framework on Docker container . For testing & leaning purpose it will be hosted in my local machine . I will be also able to access my site from the outside network .

WordPress is a open-source content management system (CMS) written in PHP and paired with database. To function, WordPress has to

be installed on a web server . For this I can use Apache web server . I am using Windows 10 as bare-metal setup on which I have a virtual machine of Red Hat Enterprise Linux 8 with the help of Oracle Virtual Box . I'll perform all implementation part of this project on RHEL8 only .

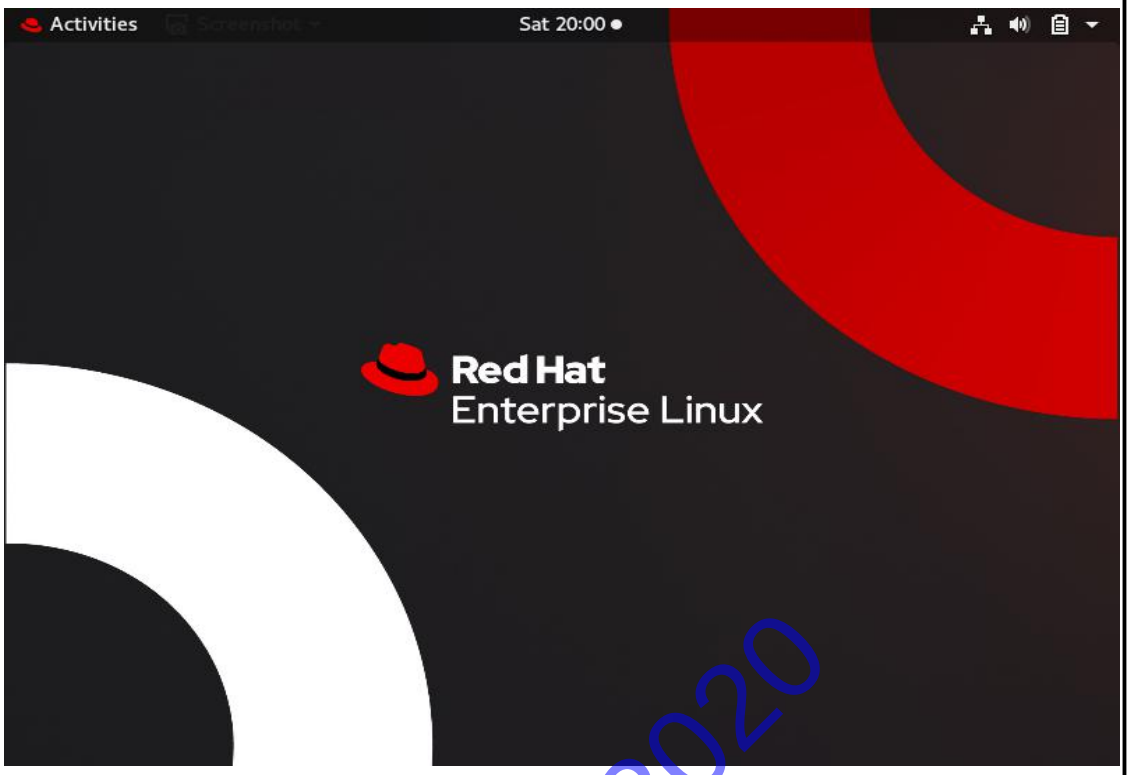
Wordpress will provide a dynamic website so I need to store the data what I will get from user while interacting with my website. Hence a dedicated database server is needed . Here I'm using MySQL server for this and to access & manage data I'm using MySQL client software .

For running any services or programs some RAM , CPU & storage are required or typically an well fitted environment is needed . To achieve greater performance & for safety ,security I would like to use two dedicated servers i.e one as web server another one database server. For this I may use virtualization technology where two dedicated virtual machines will work for me as servers . However running a single service won't consume much resources like RAM in GBs or higher CPUs . They need only some RAM in MBs. Hence not to waste my resources I am using Docker tool which is based on containerization technology in this project implementation . Some more such tools are Buildah , Podman etc.

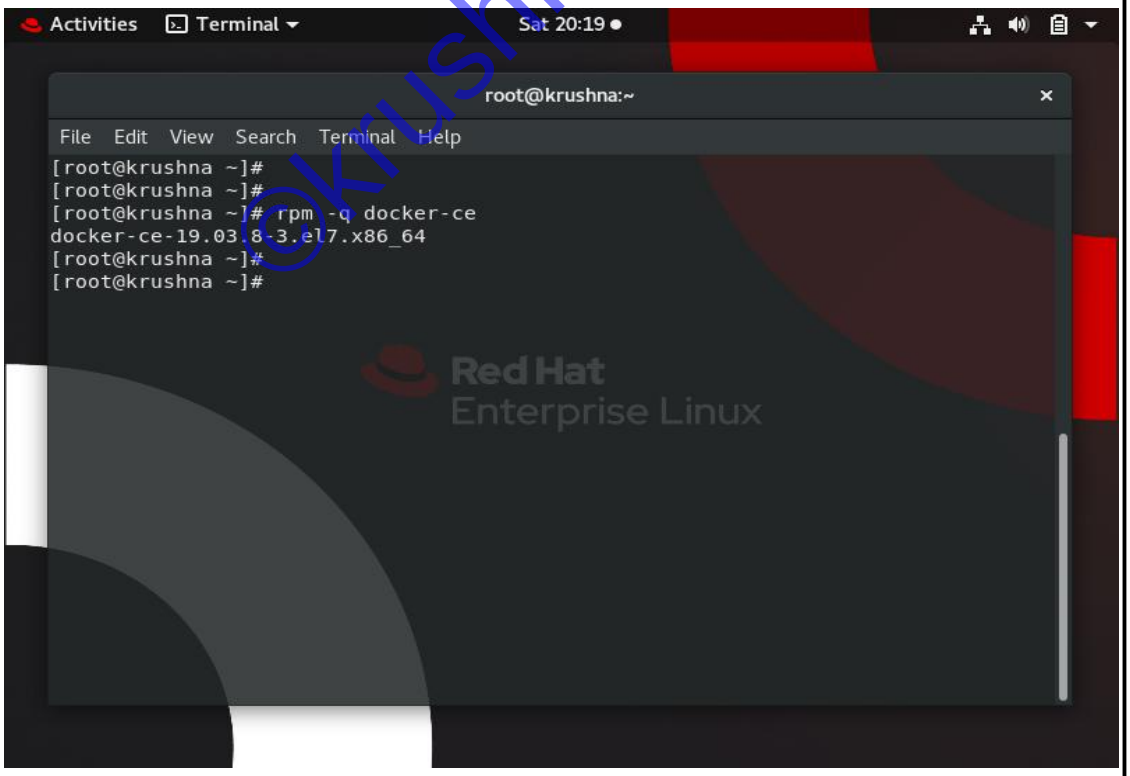
Docker is designed to make is easier to create , deploy and run applications using containers . Containers allow a developer to package up an application with all parts it needs, such as libraries and other dependencies, and deploy it as one package . And unlike a virtual machine, rather than creating a whole virtual operating system, Docker allows applications to use the same Linux kernel as the system that they're running on and only requires applications be shipped with things not already running on the host computer. This gives a significant performance boost and reduces the size of application. In this project Red Hat Enterprise Linux 8 is my docker host .

■ PROJECT IMPLEMENTATION

a. I have Windows 10 as bare metal setup in my laptop . I'm running Red Hat Enterprise Linux 8 on it using virtualization . Hence my Docker host will be RHEL8 .

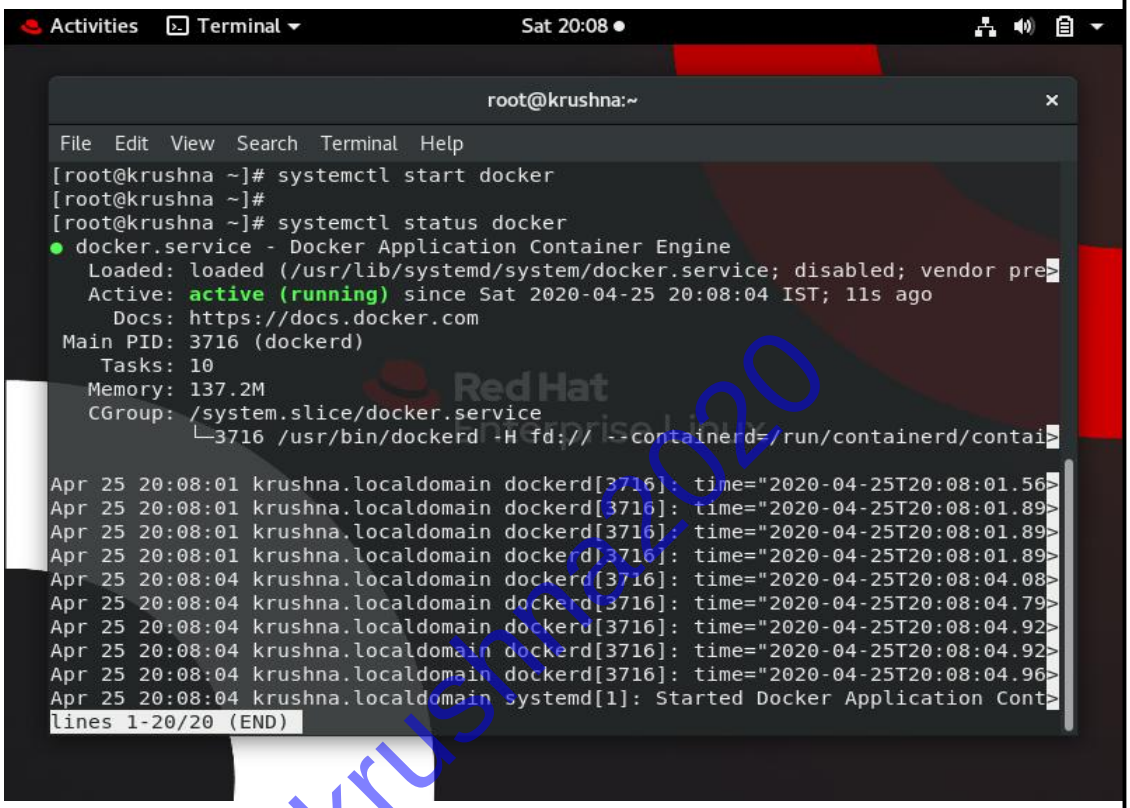


b. I have installed Docker community edition in it. We can check if this package is installed or not as following :



c. When Linux boots and starts the OS , the first program loaded in RAM or the first process starts that is “systemd” . Rest all processes

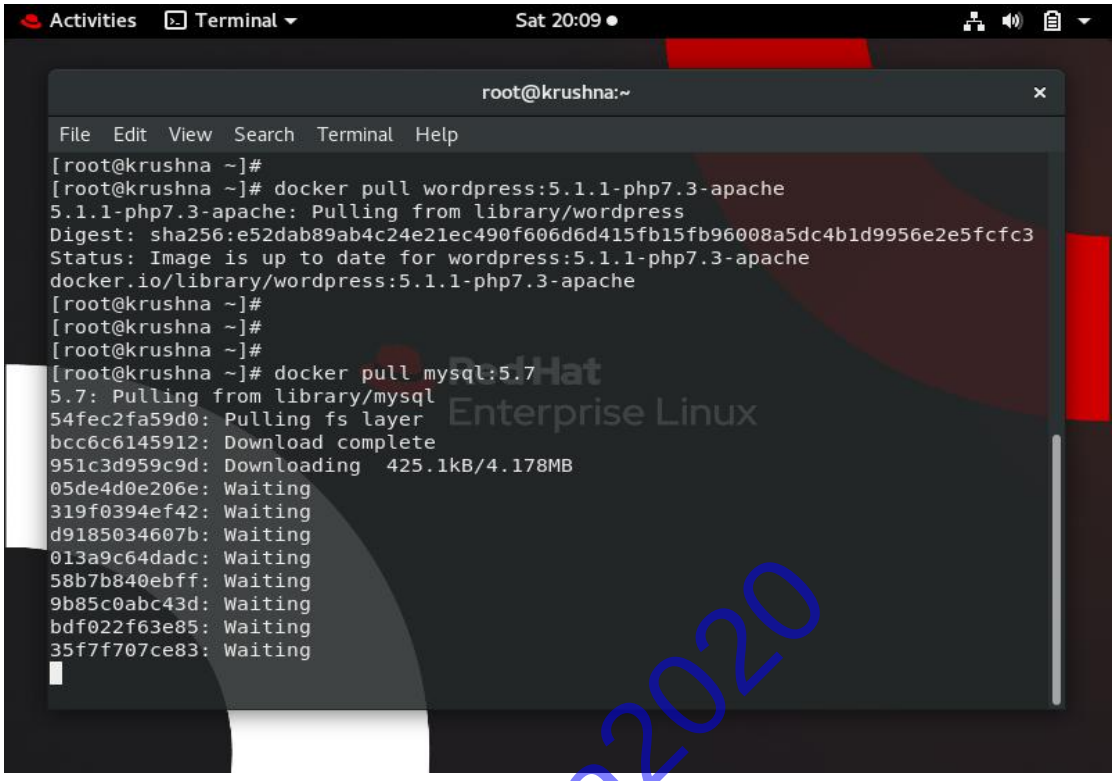
are child process of it. It has process id 1 .Docker is a program which will run in the background to provide docker service .Normally these are known as daemon .To start docker service we use systemctl command which comes from systemd . We can use this command to see the status of daemon if it is active or dead.



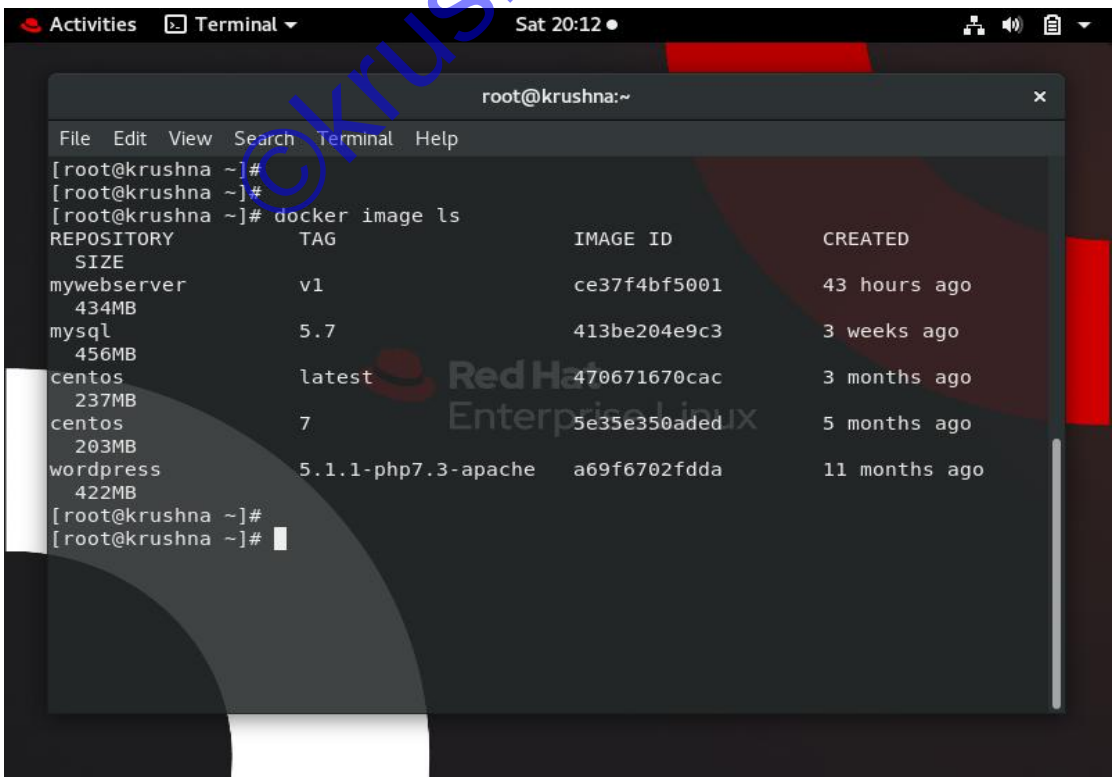
d. In general when we install an Operating system , we require CD/DVD or iso image file . Similarly, for creating a docker container or typically a light weight OS we need docker images . From a single image multiple container can be created .We can customize an image according to our need and commit it .

In this project I need two dedicated servers for which I have to get their corresponding images . For web server and database server I can create my own images. However these are popular , so I can get them from docker hub.

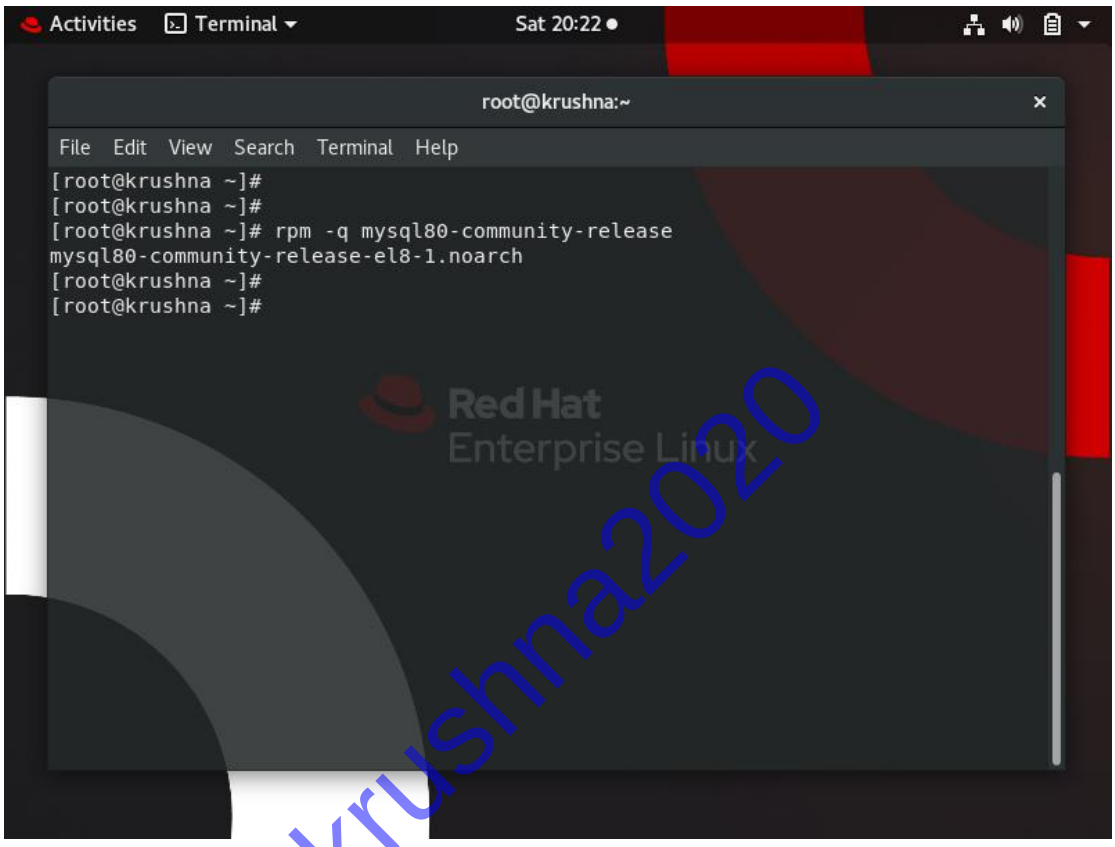
For database server I will be using mysql : 5.7 and for web server wordpress : 5.5.1-php7.3-apache . Both of them contains all my required packages. Docker pull command is used for this.



e. After downloading the images we can check our image list as follows :

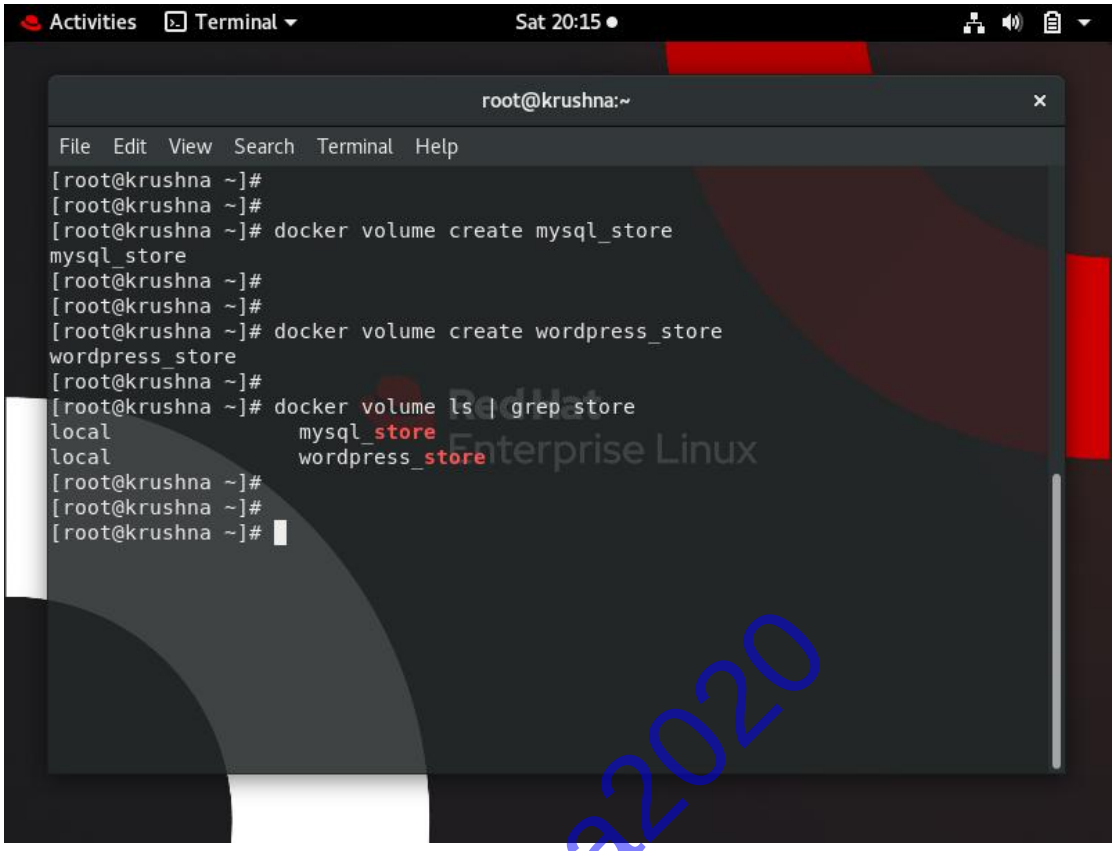


f. From base OS if I want some database management work , I need a client for accessing the server. Many clients are available for accessing mysql server. They can be installed using yum command. I've already one client program for it.

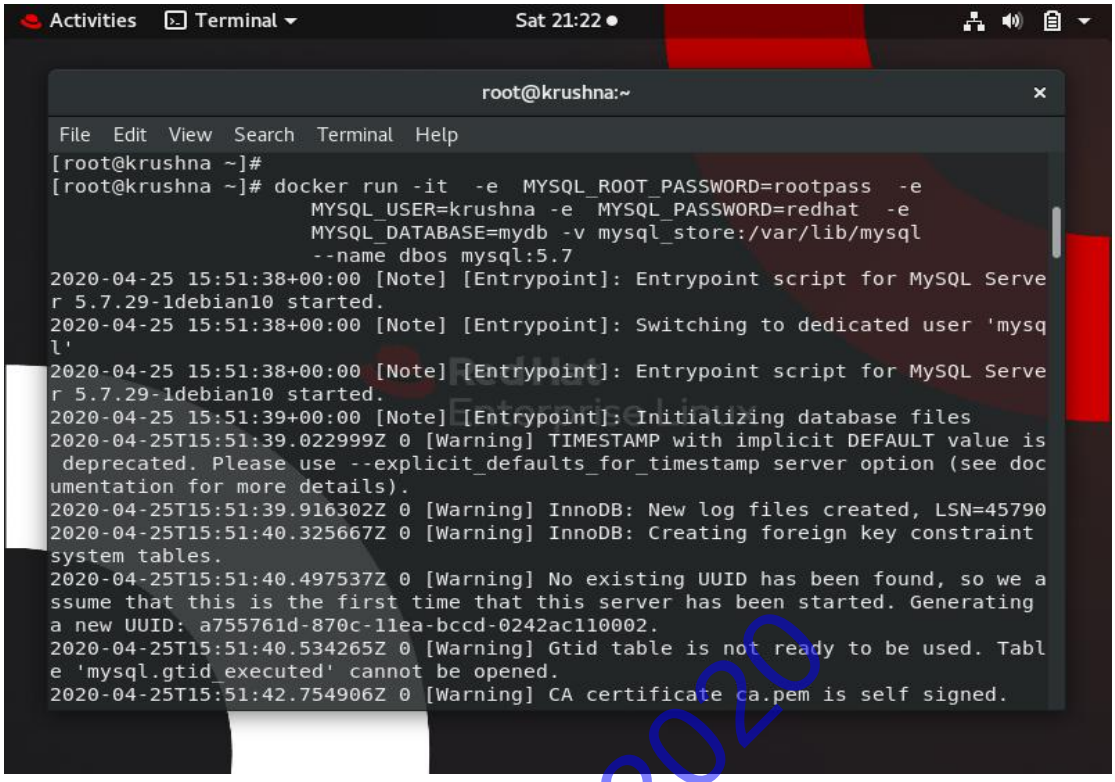


g. The data which will be stored in database server & web server are ephemeral in nature, because if due to any reason my containers terminated I'll loose my servers as well as data. However later I can launch new server containers again from those images but I won't be able to get data back. So I want to store data persistent.

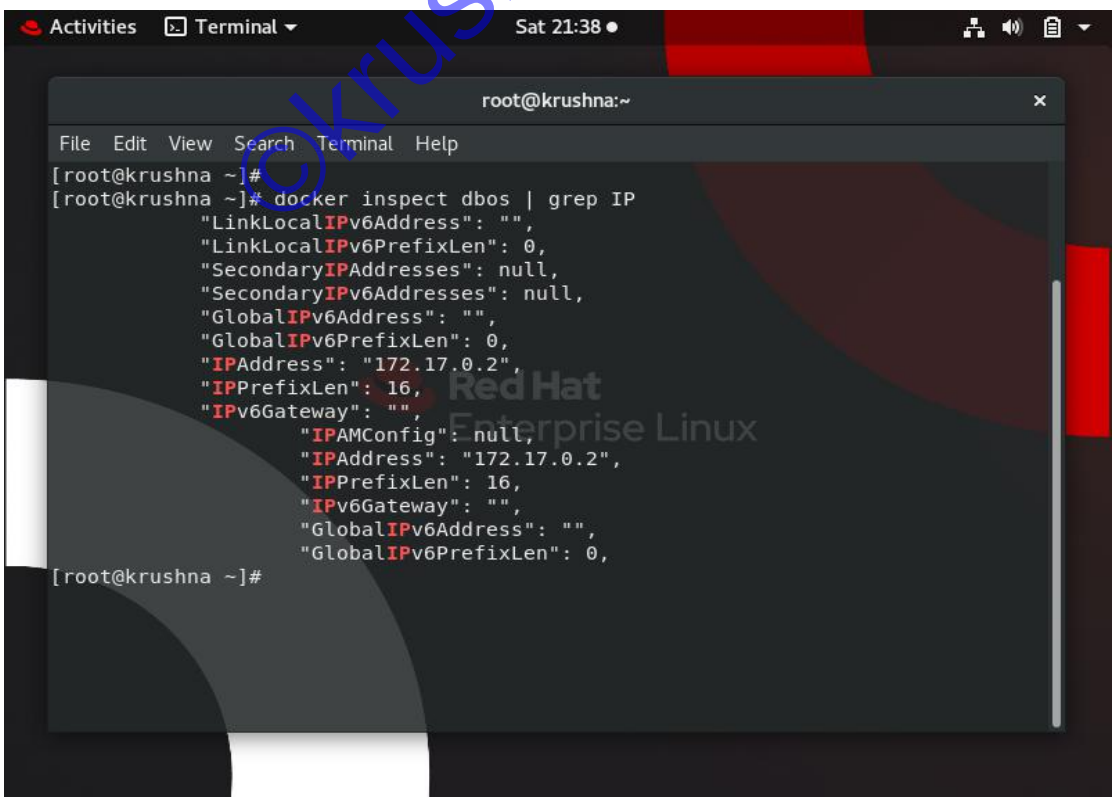
For this I'll create two separate docker volumes and attach them to the severs' document root where original data are stored. This docker volume takes storage from docker host. In my case it will consume space from RHEL8 . Docker volumes can be created as follows :



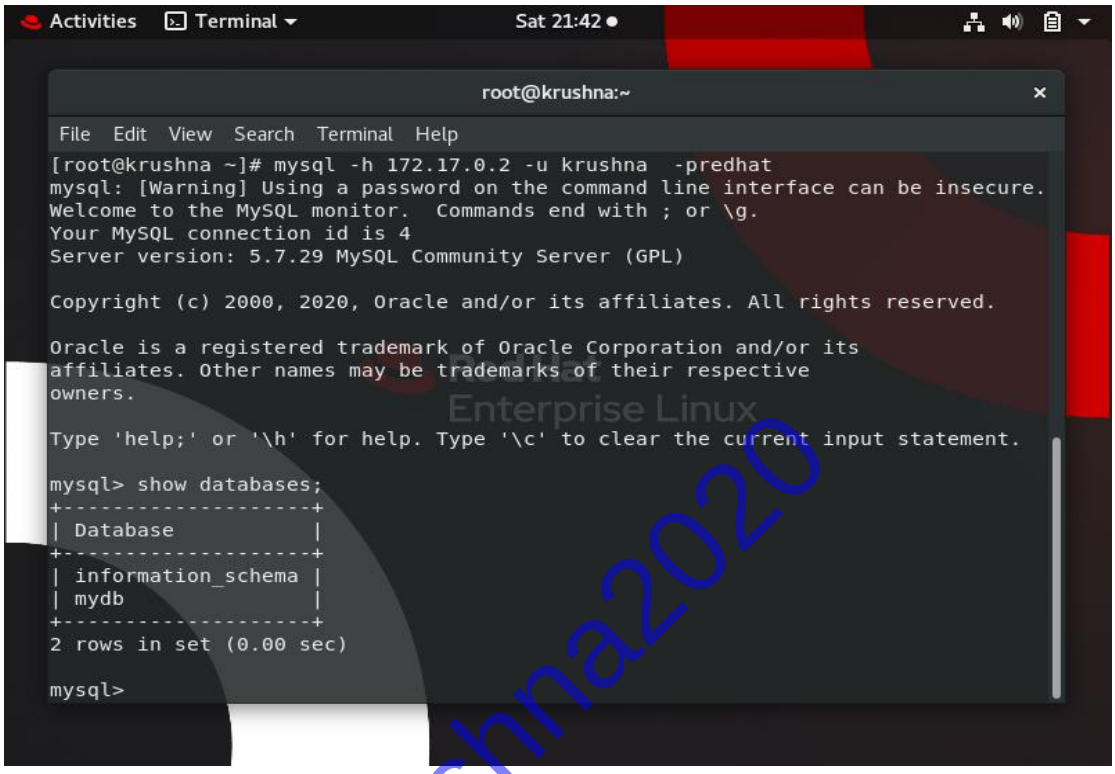
h. Now it's time to launch the servers . Here the database server I'm using has entry point which requires some environmental variables to be passed during container launch. This details are provided in the images documentation in docker hub. This DB server basically needs MYSQL_ROOT_PASSWORD (for root login), MYSQL_USER (create another user), MYSQL_PASSWORD(password for previous user created), MYSQL_DATABASE(creates database). In my context I've given rootpass, krushna , redhat, mydb respectively for above entry points. '-e' is used for environmental variables. '-v ' is used for mounting my created volume to the document root directory '/var/lib/mysql'. I have given the name of this server as dbos . Docker run command is used for launching the container from an image as shown below . The option '-it ' is used for getting an interactive terminal of the container . At last I need to mention the image name with version from which the container will be launched.



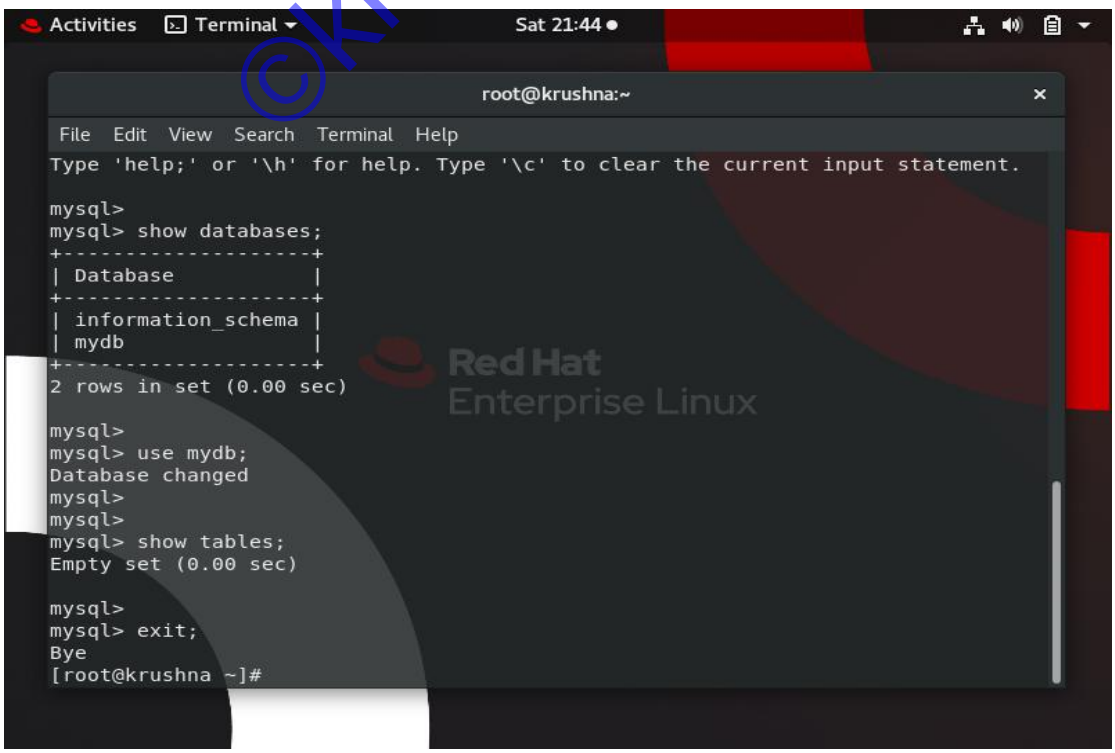
i. Now to access database from my client program first I need the IP address of the server. Docker inspect command gives the all details of the respective container. For IP address :



j. Now after getting IP , I can access to the database , manage data and everything by providing the user name(krushna) & password(redhat).



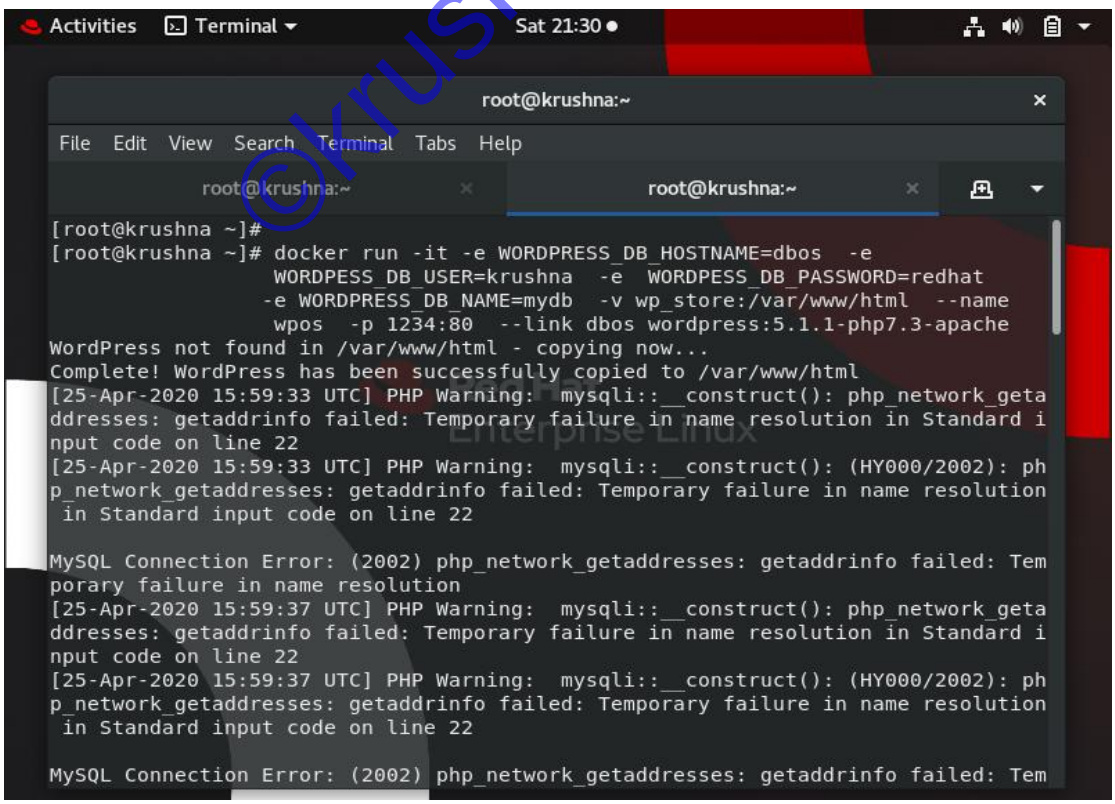
k. Now I can see that 'mydb' database is created. But it is empty.



l. Now web server will be launched. It also requires some environmental variables like WORDPRESS_DB_HOSTNAME (database host name), WORDPRESS_DB_USER (database user), WORDPRESS_DB_PASSWORD (password of previous user), WORDPRESS_DB_NAME(the database on which WordPress depends). I've provided the details as dbos, krushna, redhat, mydb respectively. I'll also bind my previously created docker volume to its document root where my webpages will be stored . I've given name of this container as wpos

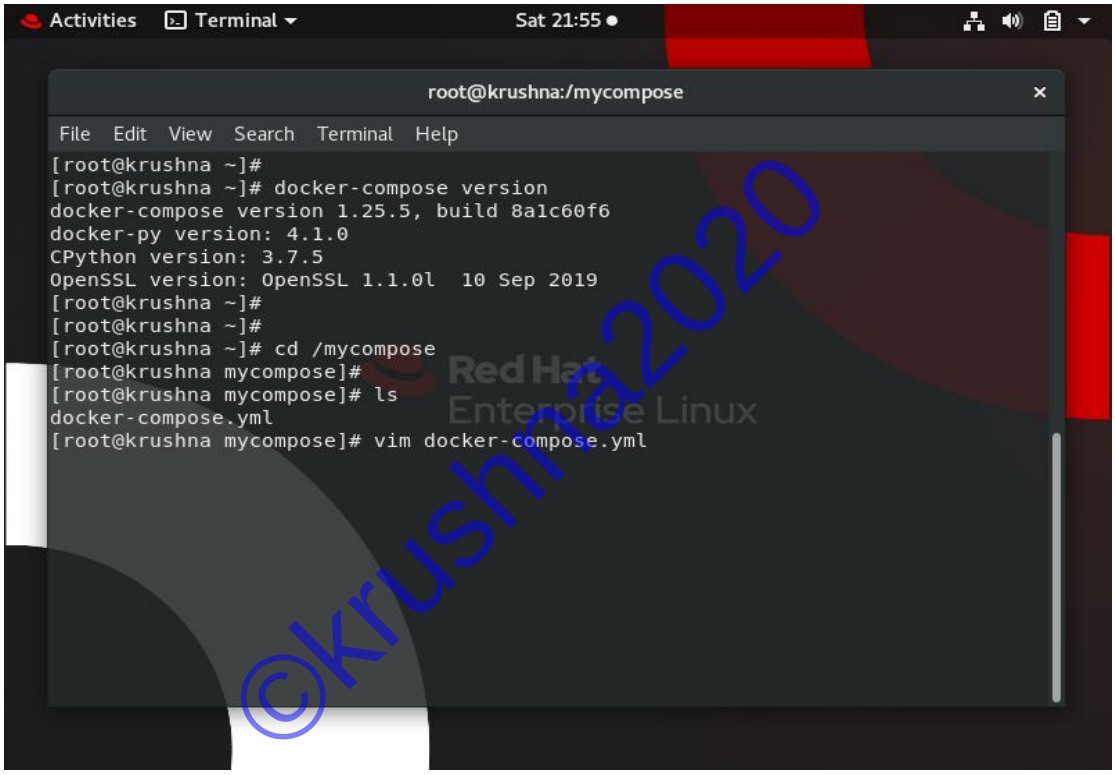
In a machine processes or services run on port numbers. There are 65,536 logical ports are there. Web server basically uses port no. 80. As my server will be in internal network so from outside world having public IPs can't connect to it. For achieving this I'll use the Port Address Translation concept. By this my web server container will be exposed to outside network.

One more thing, technically this server depends on DB server. Till now I've just given the DB host name , but I need to update the DNS record too. '--link ' is used for it.



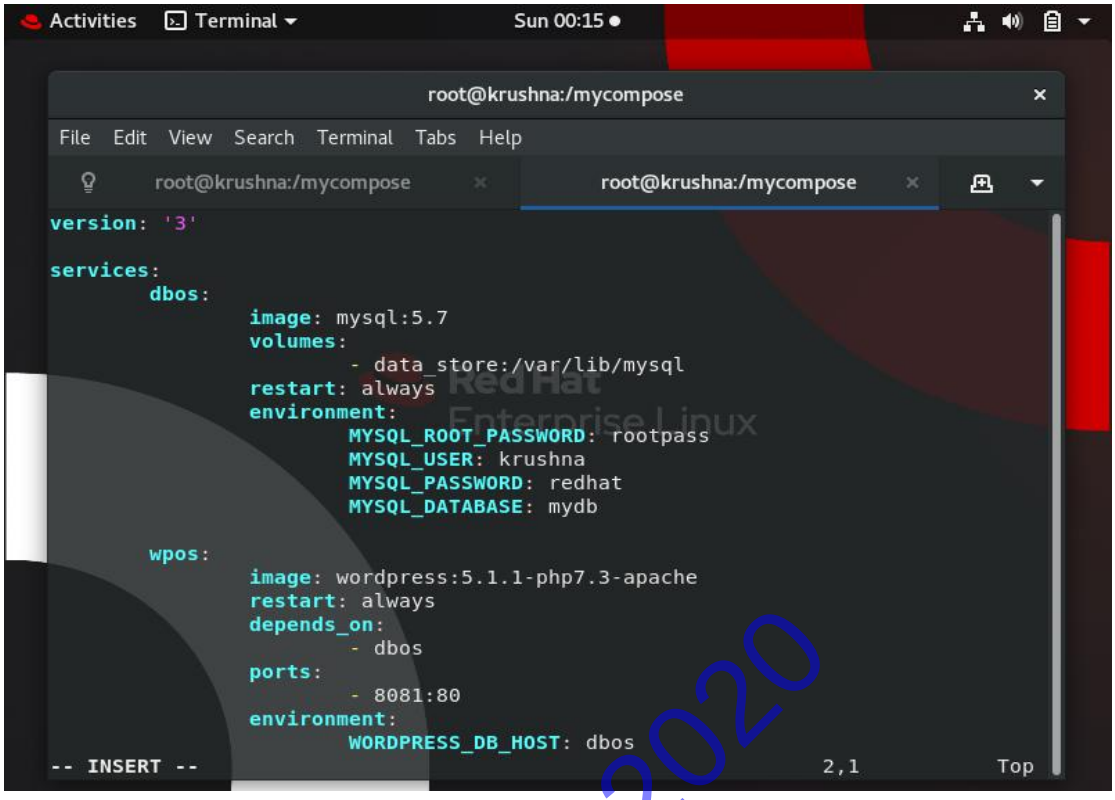
m. Now up to this I've made this infrastructure step by step by commands. So if in any other environment I want to make this set up again I have follow the whole steps again . There is a chance of mistakes too. Thus I can write a code which will automate the things for me.

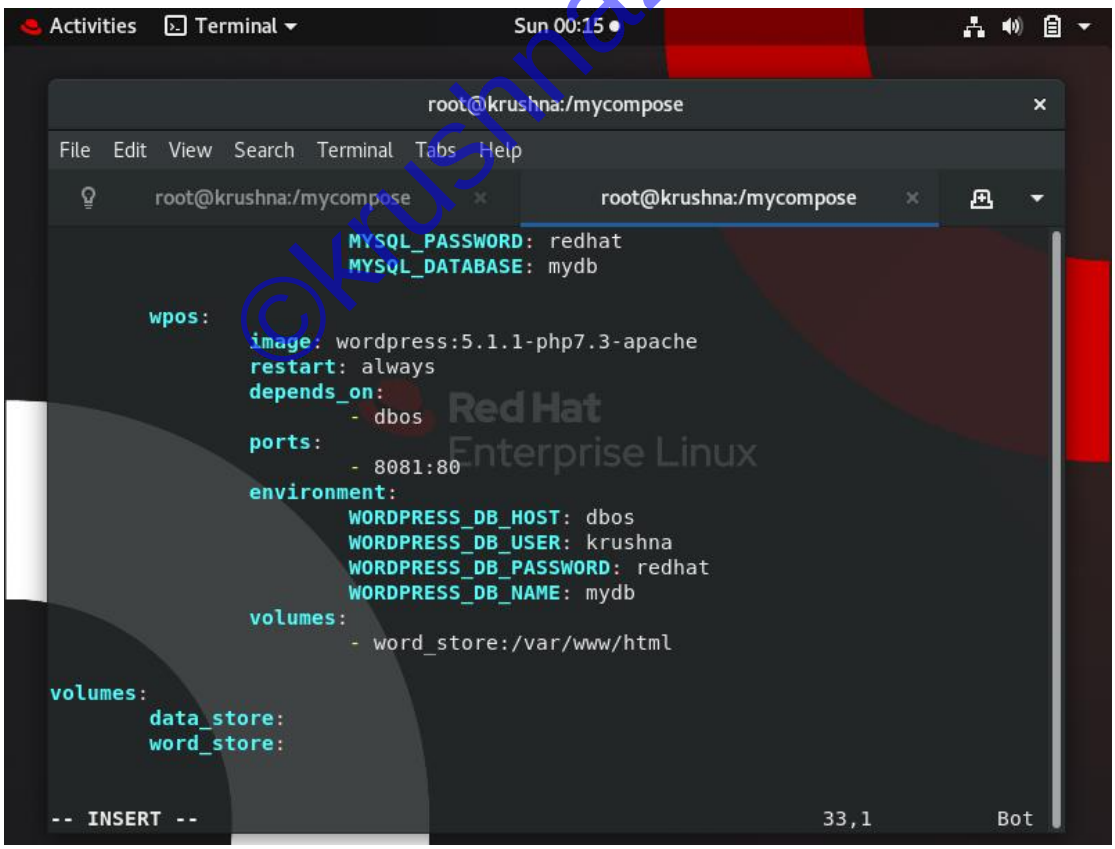
To achieve this I'll use the concept of 'Infrastructure As Code'. This is possible using Docker-compose . It does not come with docker-community edition by default. I've installed it separately .



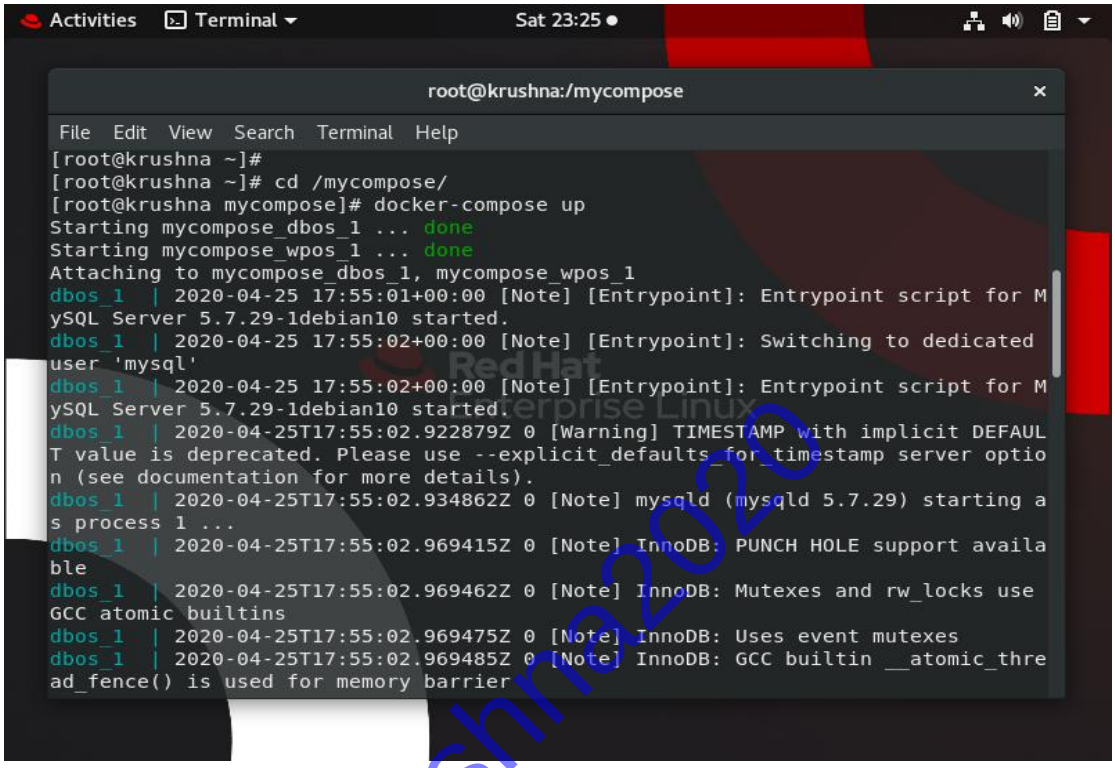
n. Now I created a directory 'mycompose' , inside which the main program is written in yml format and saved as 'docker-compose.yml' .

As shown following is the code in vim editor of redhat. It is written in yml format with proper indentation. In the following code I've just created two new volumes data_store for mysql database & word_store for webpages hosting.

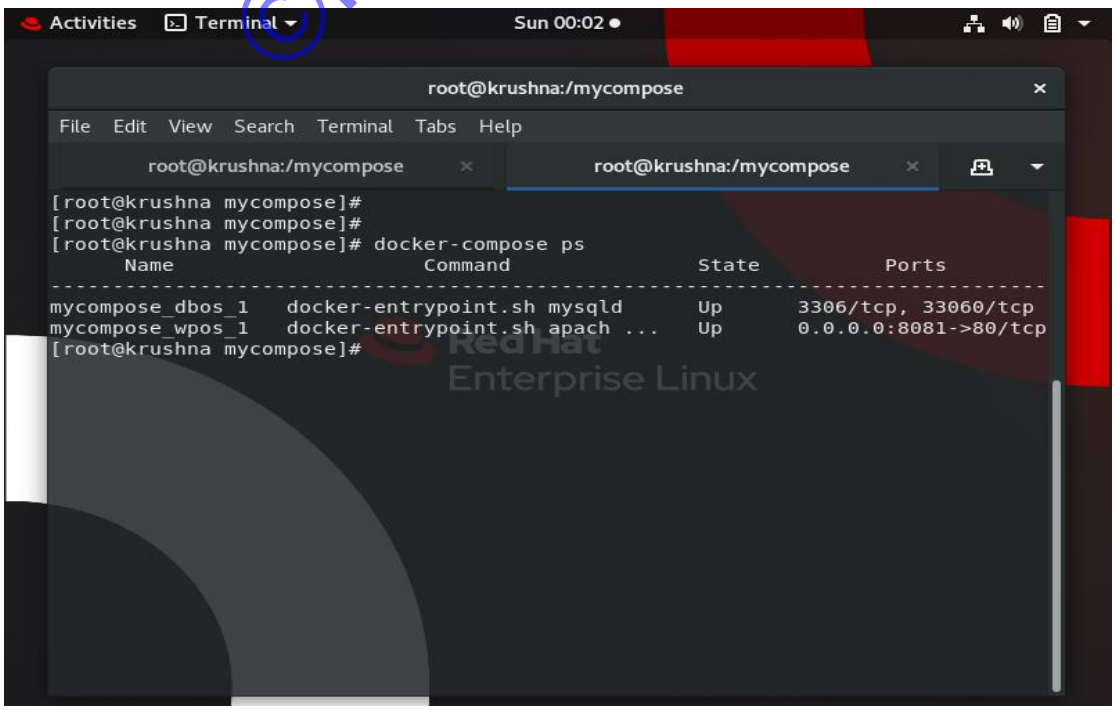




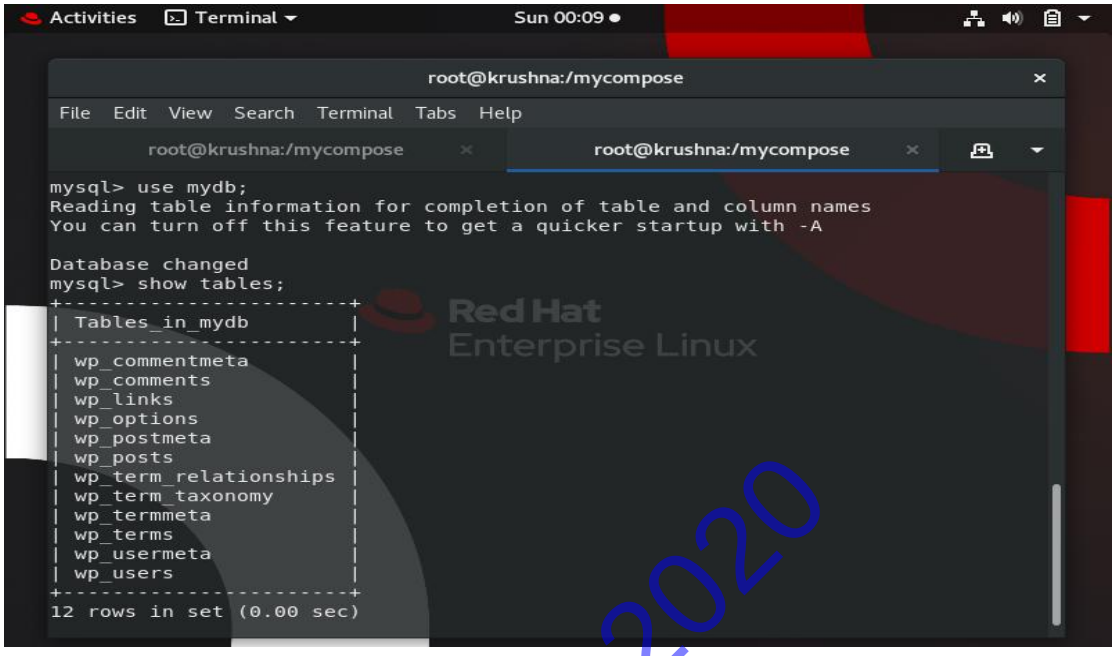
o. Now after this from the same directory I'll execute my program using docker-compose up command. It will do all the manual steps automatically for me.



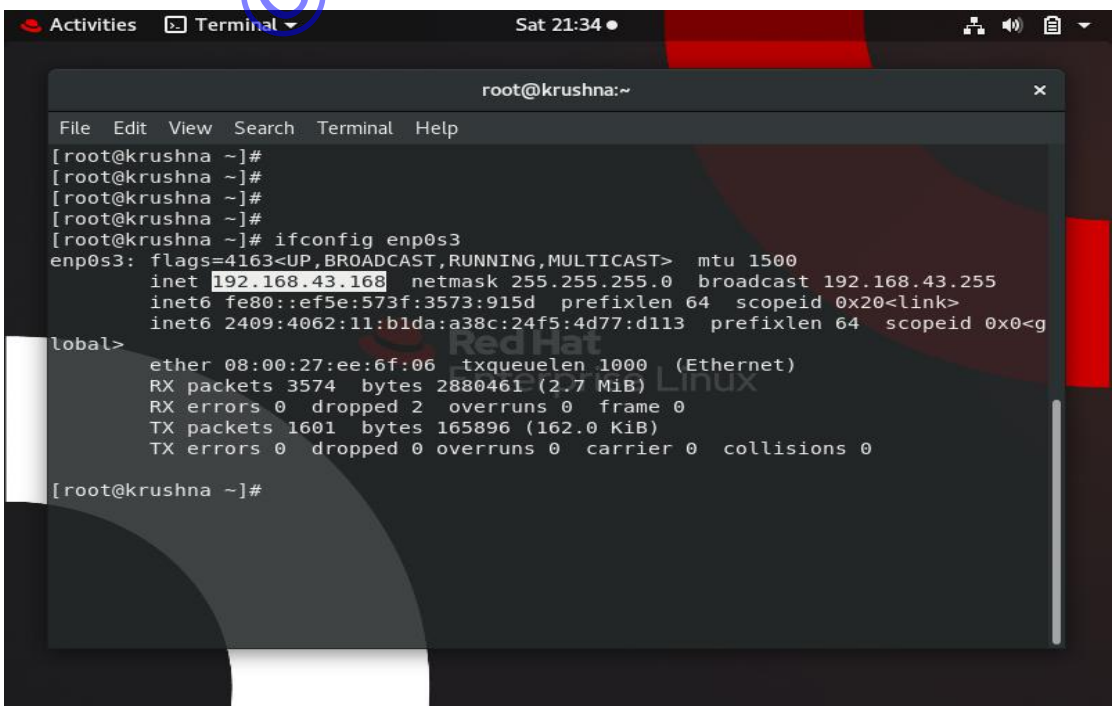
p. Now using docker-compose ps command I can see the running containers .



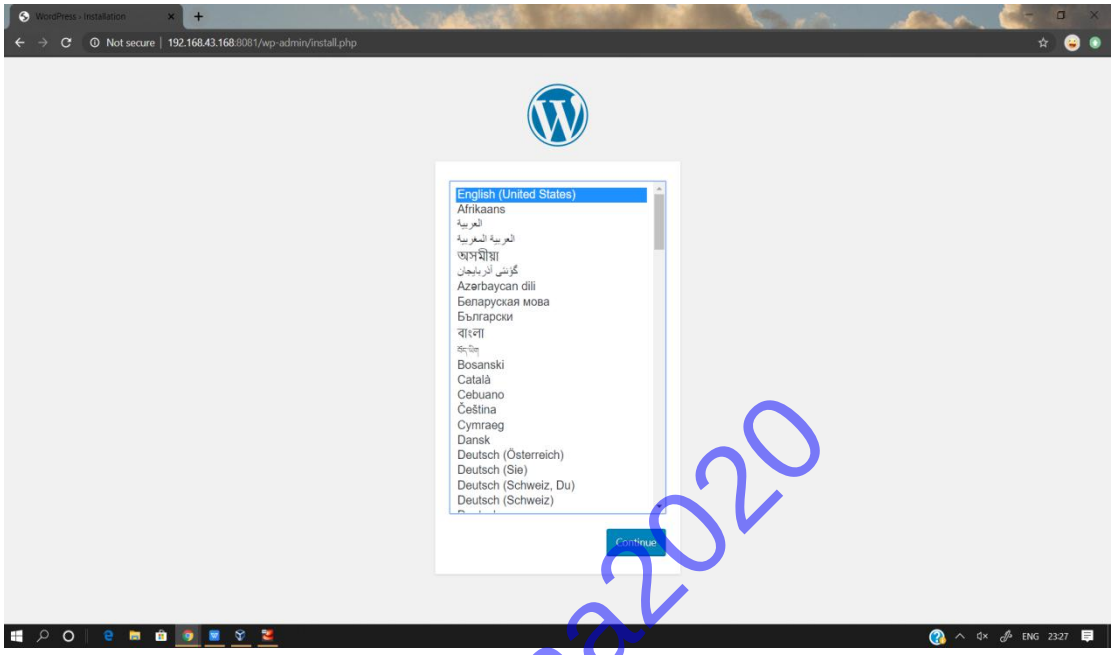
q. Now if I check my database , I can see the inside 'mydb' some tables are created.



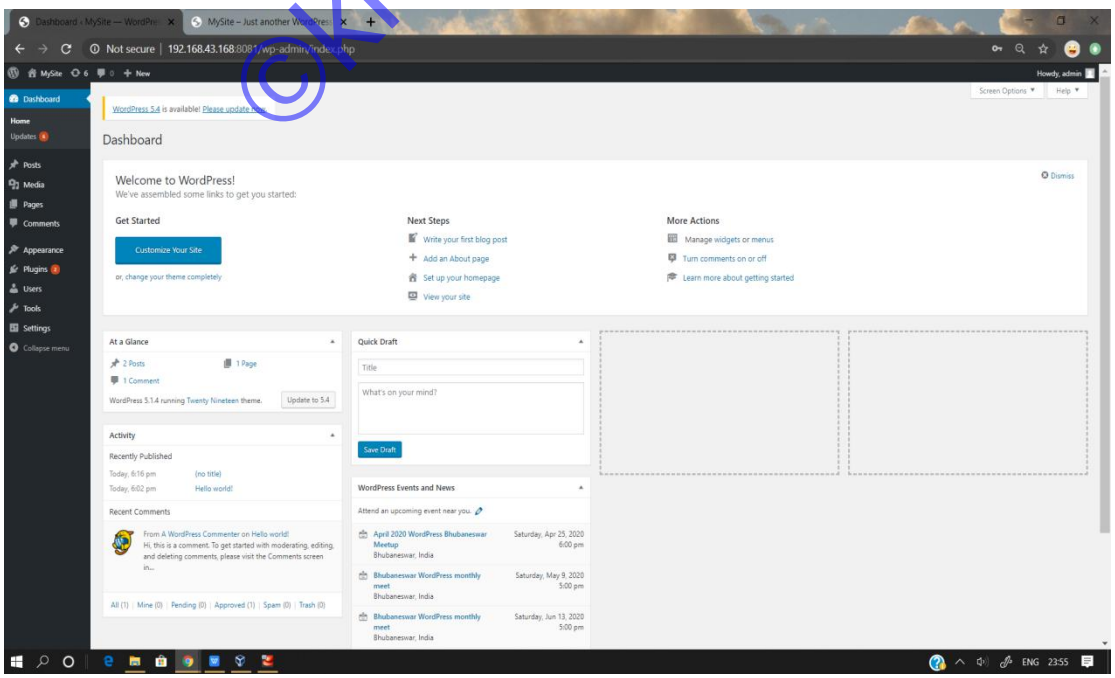
r. Now my back end architecture is ready. Let's check go to the front end part. I'll access front end from Windows 10 browser and design there my blog. For this I need my IP address of Docker host as I've enabled port forwarding so when any client request come to IP '192.168.43.168' on port no. 8081, router will forward it to the webserver on port 80.



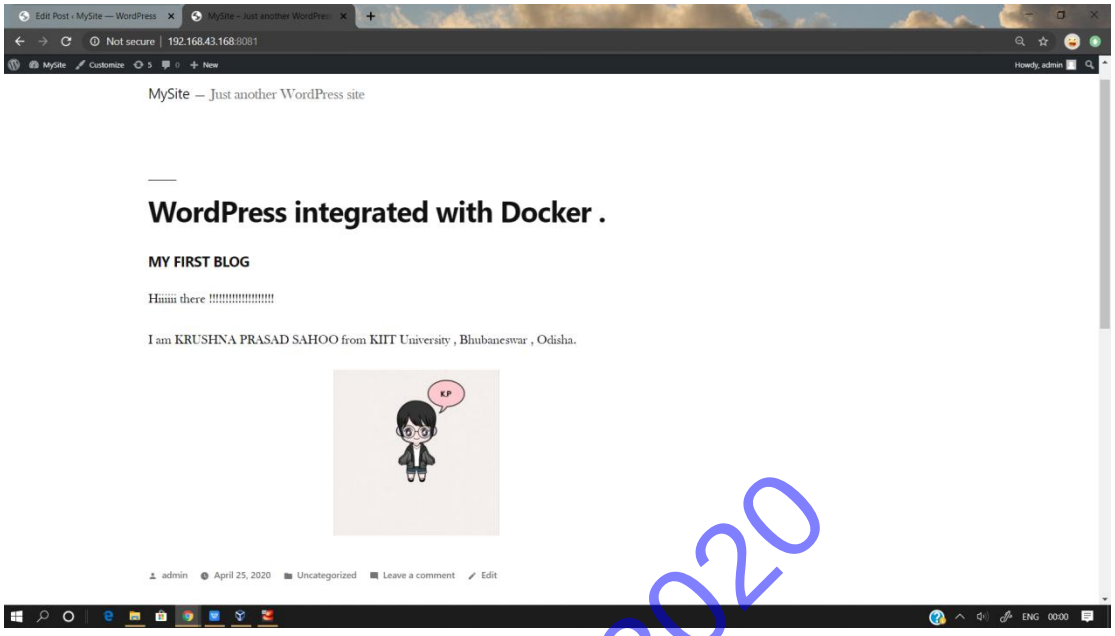
s. Now in my Windows Chrome browser I browse for address ' 192.168.43.168:8081 '. Then I can access my WordPress installation page.



t. After installation & following subsequent steps I can find the administrator dashboard. There I can create my own blog post using various GUI features.



u. After creating my page and all , I published the page. Now I can successfully access to my web page.



■ RESULTS AND DISCUSSIONS

The purpose of this project is achieved after these much steps.This project surely helped me a lot to gain knowledge in the fields which I've had only heard about and never researched on it.

Thanks to this project, I covered from basics to intermediate level of Docker technology, which is used in DevOps to manage software parts as isolated , self-sufficient containers, and can be deployed and run in any environment. Docker reduces back and worth between Dev and Ops in continuous deployment, which eliminates overheads and cuts operational costs . It also motivated me to learn Kubernetes, Jenkins, Openshift kind of High-End technologies.

Also , I got to know about the WordPress CMS tool, using which simple, attractive and user-friendly websites can be made very easily . It provides GUIs and variety plugins which can be used for web development.

■ FUTURE SCOPE

In this project I've integrated WordPress with Docker tool in small scale. This idea can be implemented in large scale for real industry use cases. For any small business organisation or companies, they can develop a full-fledged website on the top of Docker. Kubernetes can also be used in this case.

Automation in the industrial workplace provides the advantages of improving productivity and quality while reducing errors and resource wastage, increasing safety, and adding flexibility to the manufacturing process. Achieving automation across process flows is not a easy task, but DevOps by improving collaboration between development and operations team, helps to reach a very high limit of productivity by automating workflows. This is the future demand in fact .

■ CONCLUSION

At the end I would like to say that Technology is always created by human and in turn re-defining what we can and will do. Every single technological change is now impacting humanity in much deeper way than ever before because it'll soon impact our own biology , primarily via the rise of genome editing and AI .Technology is no longer just a tool we use to achieve something , the merging of machine capability and human consciousness is already happening.

However, Mankind's greatest fear is unknown. So a continually co-evolving well dynamic relationship should exit between Technology and Human Culture .Technological developments should be done for a good cause of our country & our world .