

SHREE RENUKA CONSTRUCTIONS

(1)

Room No. M/3, New Vaity Wadi, Hari Niwas, Naupada Thane - 400602.

Ref No.: DevOps - Day 1.

Date: 29th Jan 2025

* Typical Software Release process:

Idea → Requirement → Code IT → Test it → Build & package → Deploy it → Operate & Monitor

* Improvements

- Add new features
- fix bugs
- Optimize performance

* Software Versions:

1 . 4 . 2
(major) (minor) (Patch)
Replaced framework New feature Bugfix

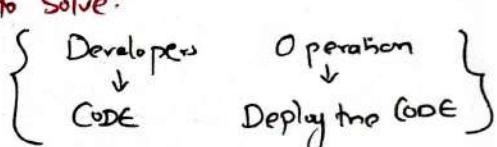
} Thus we understand, this is a continuous process of CD.
and DevOps is making this process of CD fast and with minimal error and bugs

• with Devops improvement gets created and delivered to users fast but also those improvements are of high quality and well-tested

CHALLENGE: "Quickly Delivering High Quality Code".

* Challenges which can be seen during CD which DevOps tries to solve?

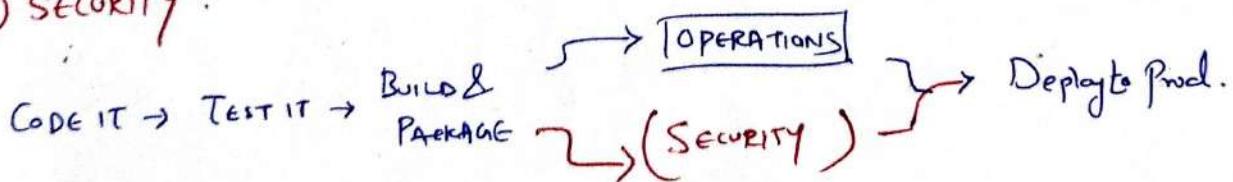
1.) Miscommunication betw Developers and Operation's
→ Release takes longer duration
→ No clearly defined automated process



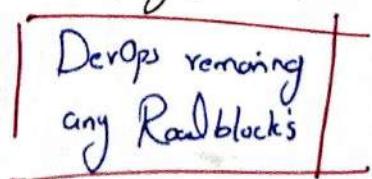
2) Conflict of Interest

① → New feature fast ② → Resist the speed of Release as they have to be sure and check its 100% Safe. [STABILITY].

3.) SECURITY :



Security affects the prod and its deployment as they follow the "Manual, bureaucratic process" / "checklist and documentation".



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Ref No.:

[Testing the app on different level] Date: _____

4) Application Testing :

- Test Specific feature's
- Testing on different environment
- End to End tests
- Performance test
- (" Can't rely on automated test's fully ")

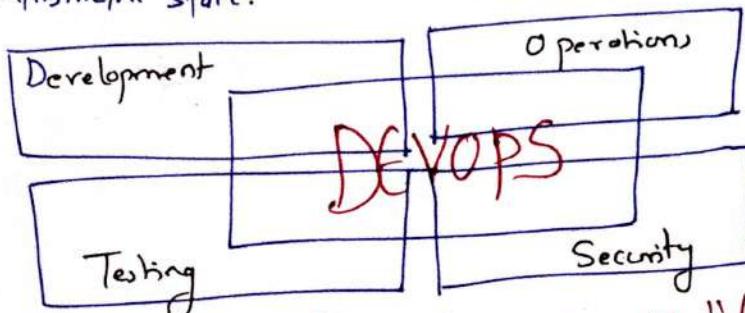
TESTER

5) MANUAL WORK :

{ Manually deploying app
—||— preparing the development environment
—||— Configuring Jenkins build jobs
—||— Configuring user access & permission. }

Because it's manually done, it is (i) Slow and more error-prone (ii) knowledge sharing is difficult

(iii) Intransparent, hard to trace, who executed what (iv) More difficult to recover and replicate exact infrastructure state.



Thus, DevOps tries to remove the roadblock's by making it "fully Automated process"
"Streamlined processes".

Devops Concept as a solution? → Combination of - - - - -
Cultural philosophies Practices Tools

- Anything that creates the process of releasing the software fast and with high quality.
- Main part is that Dev and ops to collaborate and work together more often.

* DevOps as a Separate Role ? *

Source Code management Continuous Integration / Delivery

Container Orchestration

{ DevOps Engineer }

Continuous monitoring

Treat Infrastructure as Code

Cloud

Package management

planning and
Collaborate

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(3)

Ref No.: " Devops Engineer Role is responsible for
Creating a Streamlined release process " Date: CODE REPOSITORY.


Tools and Concepts

One need to learn
as a Devops Engg.

1. Concept of Software development.

Developer's team will program
an application

Have Code Repository
for team to work on GIT.

- As a DevEngg we should know the following

- How developer's work
- Which Git Workflow
- How Application is Configured
- Automated Testing

OS & LINUX BASICS

- Linux Basics
- Shell Commands
- Compatible with CLI
- Linux file systems
- Server management

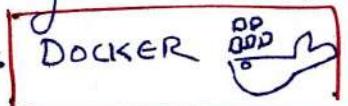
Basics of Security

- firewall, proxy servers
- HTTP / HTTPS
- Load balancers
- IP, DNS Name Resolution
- virtualization

CONTAINERS

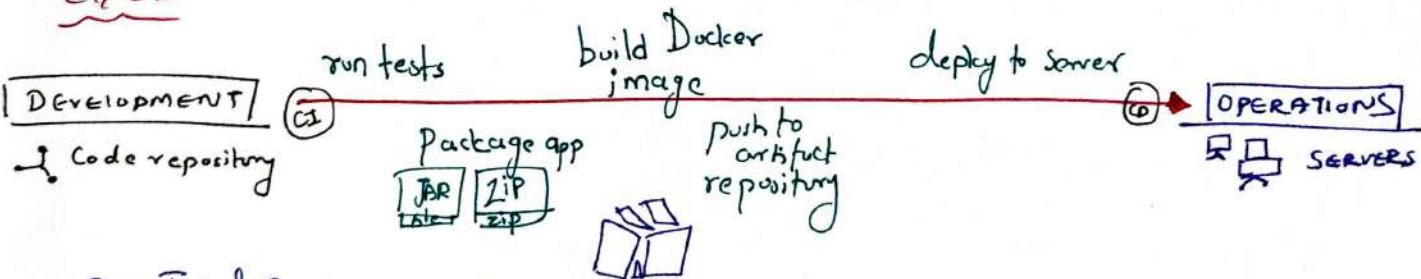
- ↳ are becoming the defacto Software package model.

↳ most popular technology is

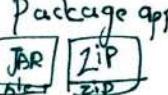
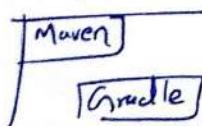


- Container.

Build Automation & CI/CD



- Build Tools & Package manager



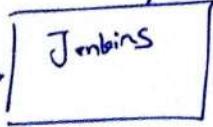
Commonly used tools

- Connect the pipeline with Repository to get the code is the part of CI.

↳ This gets controlled, tested and built and is the part of CD.

- Artifact Repository.

- Build Automation.

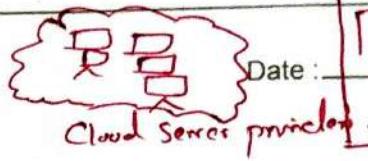


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④

Ref No.: Infrastructure as a Service



Date:

CONTAINER ORCHESTRATION.

Container needs to be manage. for smaller application's Docker Compose is enough.
However for large/big application we will use Kubernetes cluster.

MONITORING

→ Track performance → Discover problems.

Infrastructure as Code

PRODUCTION TESTNG DEVELOPMENT

- ✓ infrastructure provisioning
- ✓ Configuration management

use code to → - Create infrastructure
- Configure to run and deploy your app.

Scripting language

✓ Python

Version Control

→ Infrastructure as code.

✓ Learn GIT

Application code

* INSTALL WSL/UBUNTU on Windows.

Username : prasudks

Password : Prasud1997

* Installed

→ Visual Studio Code.

* Install and Configure Git and Github

Username : PrasudSantpure,

Gmail : → psantpure@gmail.com

password : Wseryt@12345

* Jenkins

↑
UN and password as above.

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(5)

Ref No.: Day 01 → To-do list.

Date: 31st Jan 2025

- i) Understand what Devops is → ✓
- ii) Learn the Devops Lifecycle → ✓
- iii) Setup your environment
 - { Install linux , Create Github acc }→ ✓

Day 02 - To-do list

- i) Practise basic Linux Commands. →
- ii) Learn Git Basics →
- iii) Create a simple Github project →
- iv) Install Jenkins and explore their basic functionalities →

Basic Linux Commands:

Shell : → is the program that takes command from the keyboard and gives it to O.S to perform which is also called as Command Line (CLI)

Terminal : → is a tool to used to pass Shell Command

Basic directory is "Root directory".

LS → List storage.

LS / → file system at the very beginning of hard drive.

Clear { Ctrl + L } → Clear screen

LS -L / →

Root is the most powerful user on UNIX or LINUX S/S.

CD ~ { cd tilde } → Change directory back to home.

Pwd → Print working directory.

However
-L Stands
for long listing

CD → Change directory

LS -L /etc → gives detailed information of the etc folder.

in the results if the starting of the line items we have

[d] → directory
[-] → file

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(6)

→ why git → free + open source + Scalable

Ref No.: What is Git.

- Git is a [version control system]

↓ CENTRALIZED ↓ DISTRIBUTED

Using GIT.

- The Command Line
- Code editors & IDEs
- Graphical User Interfaces (GUI)

→ git config --help
git config -h

→ Initializing the Repository : →

GIT COMMANDS:

Clone > Bring repository that is hosted somewhere like github into a folder on your local machine

add > Track your files and changes in GIT

Commit > Save your files in Git

Push > upload git commits to a remote depo like GitHub.

Pull > Download changes from remote repo to your local machine. opp of push.

→ helps to
• Track history
work together

Date: 01st feb 2025

" USE GITBASH "
Post - GIT

Why Command line.

- GUI tools have limitations
- GUI not always available.

• What is Version Control.

↳ The management of changes to documents, computers, programs, large web sites and other collections of information.

→ • TERMS USED.

Directory > folder

Interface for Terminal or Command Line > Text Commands

CLI > Command Line interface.

cd > change directory

Code Editor > word processor for writing code

Repository > Project or (code) folder / place where your project is kept

Github > A website to host your repository.

dir - force. → to see the hidden files in Repository

git - clone →

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(7)

Ref No: "CREATE A BASIC GIT PROJECT"

Date: 6th feb 2025

- ↳ Followed Introduction to GitHub on Git website and learnt the basics.
- ↳ "What is GitHub Actions?"
- Platform to automate developer's workflow
 - CI/CD is one of many workflows
- most common workflow for your repository.
- CI/CD pipeline
- Commit Code → Test → Build → Push → Deploy.
- Github Actions: → When something happens in or to your Repo.
| PR Created | Configuration | Github events |
↓
| Set | Label | Assign | Reproduce |
↓ → workflow.

* How to push local Repo to Remote. (VSC).

git init

git add .

git commit -m "first commit" / git commit -m "Initial Commit"

git push origin main

Syntax of Workflow

| Name | →

| on | → required

| jobs | → / one or more jobs

DOCKER

. Created a profile by GitHub integration to Docker.

• What is Docker Container?

↳ Own isolated environment

↳ Packaged with all needed config.

↳ One command to install the app.

↳ Run same app in 2 diff versions.

Application Deployment

Define Container

Developers → Operations

Config on Server needed

dependency version (conflicts)

misunderstanding → textual guide of deployment

Aftr Container

ops + Dev

→ work together to package the application in a container.

→ No environmental config needed on server.
[except Docker Runtime]

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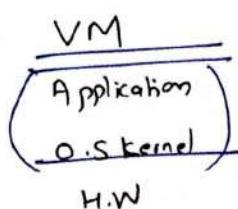
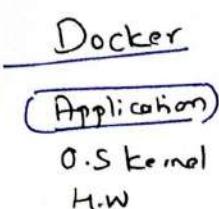
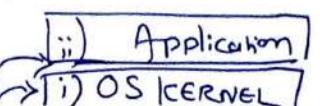
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(H)

Ref No.:

Date: 8th feb 2025

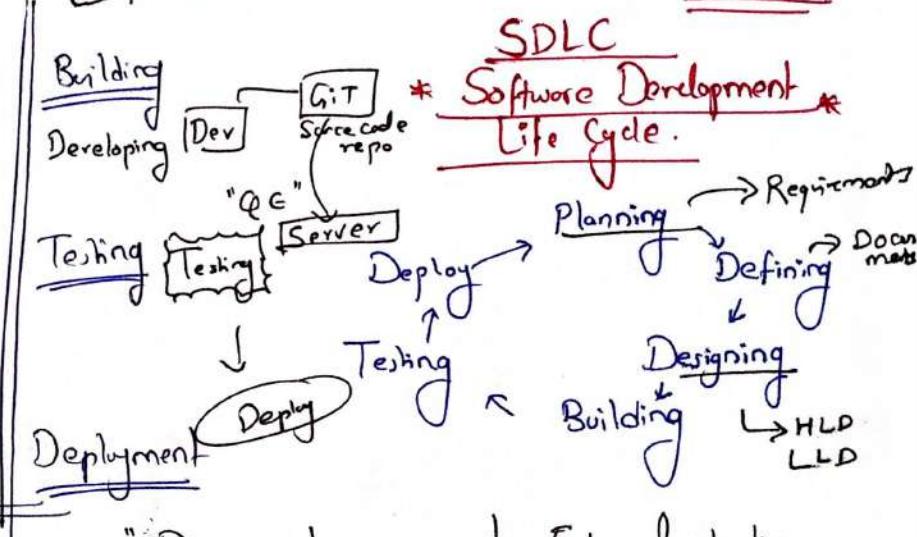
- O.S is made of 2 layers



→ Docker are much smaller in MB's and in GB's
Size maybe in MB's and in GB's
→ Docker runs faster
→ Docker can run on any O.S host.
→ VM of any O.S can run on any O.S host with docker.
Compatibility can't be done with docker.

11th feb 2025

BASIC Commands of Docker



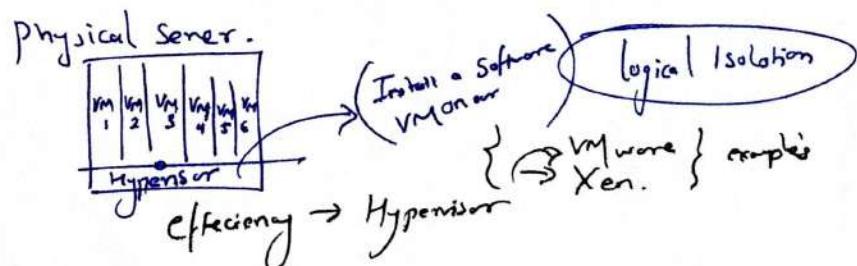
"Devops is to work across the team and make the process faster and improvised."

Virtual Machine

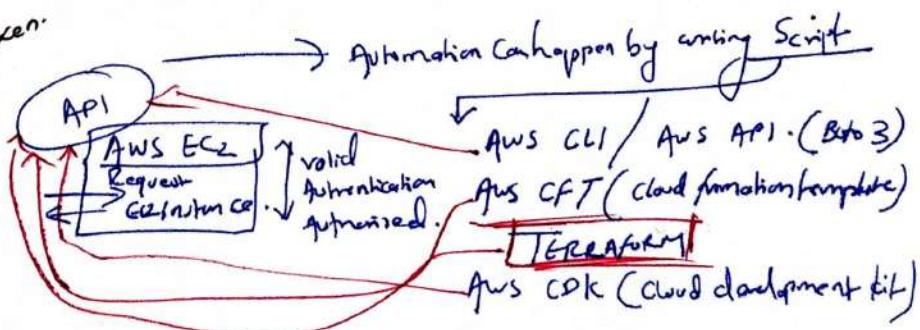
What is a Server?

Physical Server / virtual Server!

Hypervisor
Is a software ex: VMWare, Xen



How to create a VM?

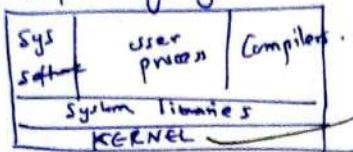


Real world example?

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(9)

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Ref No.: + Operating System

Kernel is heart of o/s.

Date: 12/02/2025

Sylib → responsible for performing tasks.
→ Device management
→ Memory management
→ process management
→ System Calls.

SHELL SCRIPTING → (mode of communication)

LS → List (shows files and folder in the Directory)

PWD → Present working directory

cd → Change directory

cd .. (cd space ..) → go back one directory

cd ... → LS -ltr → provides complete information

touch -prwod → file creation naming provided.

touch → Create a file.

Create a file and able to write the information on the file

→ vi-test → Create a file / press Esc / Click I / Insert mode / → now and start writing / esc.

once enter a file / press Esc / Click I / Insert mode / → now and start writing / esc.

: : : wq → Save file.

(Cat-test) → print info from the file.

mkdir → make directory.

rm -r → remove directory.

free -g → memory of Laptop / Server

nproc → no. of CPU.

df -h → Disk Size.

* Command to manage CPU/memory or task for the information.

top

for Better or more learning
Watch Shell Scripting O to H

How to Create EC2 Instance (AWS)

① Dashboard → Instances → free tier
 ② EC2 → (key value pair)

This is a pair of key / access key / instance

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(10)

* AWS project Using shell Scripting *

Ref No.: WRITE SCRIPT TO REPORT USAGE OF AWS IN YOUR PROJECT ??

- Shell script can be integrated with CronJob

Date: 13/02/2025
EXAMPLE ORG.

EC2
S3
Lambda
IAM

17/01/2025

↳ Continued by 19

" Understanding Day 5 → Video "

→ Created AWS Account:



This gives us access to create VM (virtual machine), we can configure it as our/ organization/project requirement. { pre-requisite → (O.S / C.P.U / RAM) and so on. }

VM ⇒ is called as EC2 i.e (Amazon Elastic Compute Cloud) is a web service that allows user to create and run VM (instances) in cloud.



→ Downloaded (MobaXterm):

→ i To launch EC2 instance.

→ open MX

→ Click on Session

→ Click SSH

→ Remote Host (public IP Address of EC2 instance)

→ AWS can create 1000's of instances
→ But has limitation to open and access every VM at a time, even if we increased the timeout limit eventually tends to close up. This to support handle such challenges we have different software such as ex) MX ✓ This software gets connected with EC2 instances and can Access upto (10 free) EC2 instances, above that it's chargeable.

→ Specify username (Ubuntu).

→ click on Advance SSH settings

→ private key

→ We get the private key while creating the EC2 instance.
It is in PEM file format (.pem)

→ **OK** → **Accept**.

→ ii By following i we understood that we can access multiple EC2 instances from our local system. This feature helps us to understand how to work on multiple VM using single platform.

ii We can use MX locally on our P.C as a Terminal as it has a better UI.

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(11)

Ref No.: Automate: →

It's on binary.

Date: _____

We can automate AWS services using AWS CLI (AWS Command Line Interface).

(Installed AWS CLI package in our PC)

AWS CLI can't solely act as a medium for automation or changes in our AWS profile.

Thus, we have to configure our S/m with AWS.

⇒ Now we can refer to

AWS CLI, to use the CLI
as a shortcut to get info,
to create new instance, bucket,
and many other reasons for
automation.

: Access key
: Secret A.Key
: us-east-1
: json

→ CREATED ACCESS KEY for my profile
→ AK and SAK
→ AWS Configure (Command on Terminal)
i) AK -
ii) SAK -
iii) region - [us-east-1]
iv) o/p format - [json]

" Shell Scripting for DevOps (Extra classes for S.S special) " "

1.) Why do we need Shell Scripting?

→ Ideally process are manual, and upto some instance the repetitive work can be done.
However, executing the same process and automating it is the main purpose.

" process of automating our day to day activity "

2.) How to write a Shell Scripting?

↳ we need a file ↳ Creating a file ↳ extension → .sh *

(touch first-shell-script.sh)

↳ To know more about the created file → ls -ltr

Identification: → Man command not installed.

checked and understood → "cygstart" was missing and can be
installed by "apt install Cygutils".

Suffix: man
followed by: touch.
man touch ⇒ result
gives more information about the command
touch and description.

Here learning is, Different Terminal has different commands, I was using a (WSL) Windows S/s for Linux
↳ in maximum now I open the (Linux based Terminal) → for better interaction for video learning's.

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(12)

Ref No.: Command `Vi` → open a file
Double click the Content → Copy
Right click mouse → paste.

q → quit

:wq! (wq or :x)
Date: (exit without saving)
no Change exit
Save (Save and exit)

Thus we use touch in automation to make it a file opening action, rather to create a file only.)

Vim is used to write a file at the same time when it opens.

#!/ Shebang

#!/bin/ { bash
dash
sh
ksh } → different executables.

① #!/bin/sh . . . ↗ linkin

② #!/bin/bash ↗

③ #!/bin/dash ↗

(Interview Q's)

Earlier ① was linked into ② J was using either of command bash was the executable which used to action, however some OS has changed their linkin

Configuration from ①-2 to ①-3 i.e. (dash). J now we have to be sure that we use `#!/bin/bash` correctly in order to have bash executable to work.

Vi → open file

i → insert mode.

wq! → Save file

Cat : Command used to see the Content inside the file without opening it multiple time (Shortcut)

(sh)(.): Any executable file can be executed by using dot slash

[chmod] change permission command
[chmod 777]

pwd: present working directory.

mkdir: create directory / folder

cd : Change directory.

→ in a Script is used before a Comment, so that the executable understand. 'just the intrah.'

df → Available Storage
nproc → CPU
free → print memory of machine.

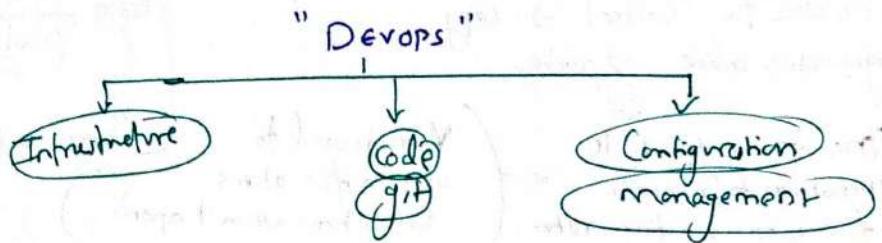
TOP → Complete information

Linux user formula → 4 → Read
Change permission 2 → write
1 → execute.

We have to grant permission and set the abilities
→ Root user] You.
→ which group] your group
→ What are permissions] All users

intrah.

" HOW SHELL SCRIPTING IS USED IN ORGANIZATION "



ex: John (Devops engineer in Amazon).

10,000 VM's → Linux is what he is handling to check Node health.

(CPU, memory) → concern from client or reported to John.

John visiting all 10,000 VM's and checking will not be a practical example..

Thus John creates a shell script



↳ S.S. is a powerful tool for D.E, helping with
Automation (Server setup, CI/CD, backups)

Monitoring (log analysis, system health check)

Infrastructure Management (Cloud provisioning, scaling)

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(13)

Ref No.:

Date: _____

Advanced Shell Scripting Class :

- Write a shell script, understand node health of the VM.

SET -x → Command which executes the op with the (ide/frame) / info/ command
↳ Used to get the op.
↳ Debug mode.

ps {
ps -ef ps → process status
 -e → Show all process (Including those not attached to terminal)
 -f → full format (display detailed info)

GREP and PIPE Command

Used to search for text pattern's within files or command o/p.

[1] pipe operator is used to send the o/p of one command as i/p to another. helps in filtering and processing command results efficiently.

ls -l | grep ".sh"
ls -l | wc -l

Basic Syntax: grep [options] "Pattern" file.

grep "error" logfile.txt

Interview Q's: Why [Date | Echo "Today is"] the pipe command don't execute, and gets the correct op.

- Ans) i) Pipe does not work with "echo" because echo does not read from Standard input (stdin)
ii) Use Command Substitution (\$(command)) or Xargs to achieve op.

"AWK" Command :

Awk is a powerful text-processing tool used for pattern scanning, filtering, and text manipulation.

Basic syntax: awk 'pattern{action}' file.

Defines when the action should be applied ↓
Specifies what to do with matching lines

SET -E → (exits the script op when there is an error)

SET -o → (exit in pipeline)

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34

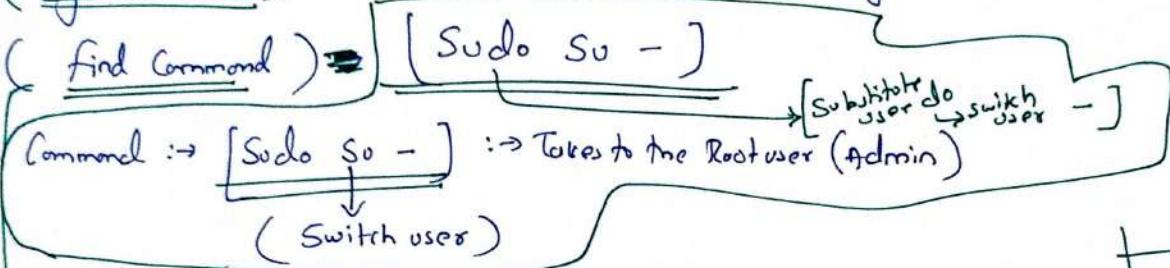
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Ref No.: What is the major use of Devops engineer?

Date: 20/02/2025

If there are 1000's of application running, and 1 of the app is failing, → We use Log file.
→ Log file is consisting of error details. → It is mostly stored on the storage ex → Amazon S3
→ (Syntax: → cat log file | grep error) → It is for the local file. but we know most of the time the log file are uploaded we use Curl command → (Syntax: curl (followed by the URL) | grep error)

(Wget Command): → This command will download the logfile.



→ { find / -name pnm } → { sudo find / -name pnm }

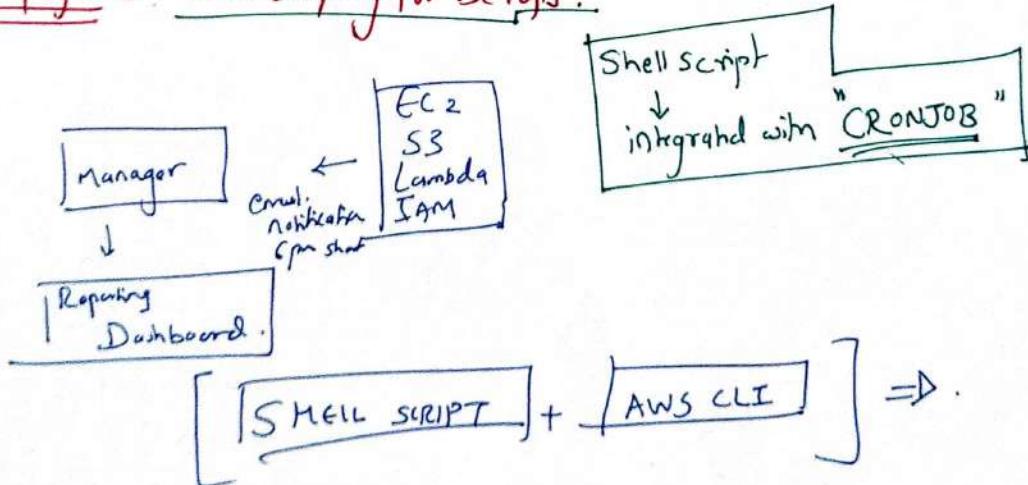
[Loops: → IF, If else, For .]

CTRL + C
AC
↓
Terminate the action.

[TRAP (Command)] → Used for Trapping Signal.
[LINUX SIGNAL LIST] [KILL -9 1111]
 ↓
 (kill) command is used to kill the session.

(21/02/2025)

Aws Project 1: Shell Scripting for Devops.



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(15)

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Ref No.:

Date : 11/03/2025

1.) Linking local Rep to Github

git remote add origin (...url...)

Verify Remote Repo

git remote -v

2.) 1st Time push to GH.

git push -u origin main / git push -u origin master

3.) Configure PAT in git

Enable Credential storage.

→ Update Remote URL with PAT

git config --global credential.helper store git remote set -url origin
https://yourgithubusername -PAT
@github.comgit

Push to Github

git push -u origin main.

(More notes on WF → Chatgpt notes day 11-03-25)

BRANCHING :

- * Master/Main Branch
- * Feature branch
- * Release branch

Hotfix branches.

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(16)

Ref No.:

Date : 1/04/2015

- * Completed project "Deploy and Export the Node.js app to AWS".

→ Top AWS Services that every DevOps Engineer should know?

- 1.) EC2 → Amazon's Elastic Compute Cloud
- 2.) VPC → Virtual private cloud
- 3.) EBS (volumes) {Amazon Elastic Block Store}
- 4.) S3 (storage) (Simple storage Service) [S3]
- 5.) IAM [Identity and Access Management]
- 6.) Cloud Watch [Monitoring & Observing] Serverless, event driven Compute service that allows you to run code without provisioning or managing servers.
- 7.) Lambda → [AWS Lambda]
- 8.) Cloud Build Services : → [CI/CD]
AWS Code Pipeline } CI → (jar file)
AWS Code Build } → (E2)
AWS Code Deploy } continuous changes are taken care.
AWS Code Deploy
- 9.) AWS Configuration.
- 10.) Billing & Costing.
- 11.) AWS KMS [Key Management Services].
- 12.) Cloud Trail → helps you enable operational and risk auditing, governance and compliance of your AWS account. Action taken are recorded.
- 13.) Amazon EKS [Elastic Kubernetes Services].
- 14.) Amazon ECS [Elastic Container Service]
- 15.) Amazon ELK [Elasticsearch, Logstash, Kibana].

Q's

EKS vs ECS.

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(17)

Ref No.:

"Configuration Management"

Date: _____

- CM is a method to manage Server Configuration and Infrastructure efficiently.
- Traditionally,
 - managed Server manually
 - Sys Admin → upgrades, Security patch, software installation → Server-by-Server
 - managing large scale I.S was still complex.

Thus Need for CM Tools come in picture :-

To automate and standardize Server Configuration

(ANSIBLE) - defines below ^{left} Square.

- Passwordless Setup for Ansible Guy Access to the microservice, (EC2 instance)
- 1) ssh-keygen
 - id_rsa
 - id_rsa.pub
 - known hosts

2) Main Server & Targeted Server

3) publickey of main server is to be copied → pasted in the authorized_keys file of the target server for passwordless access.

from Server 1 → (SSH - public IP Add).

thus we are connected to Server 2 from Server 1 passwordless.

2/4/25.

- Scripts created for Ansible Task are called as Playbooks.
- Command in ansible is called Ansible Adhoc Commands.

Ansible	Commands	Playbooks
"ANSIBLE"	Ad-hoc Commands	→ YAML based file that define Set of task to be executed in sequence
- open source automation tool. - used for Configuration management, application deployment, task automation and orchestration	→ One time immediate execution	→ Use CL arguments and flags
- Agentless • Idempotent	→ Requires inventory and necessary modules but no structured files	→ Use YAML Syntax and handlers.
- Declarative language (YAML) - Modules & plugin	→ Minimal Logging mostly standard op. sys command.	→ Can be spread and used multiple times
- Push based architecture.	(ansible all -m ping)	→ Requires YAML file and admin role structure
	(ansible-playbook site.yml)	→ Supports Structured log handler and error.

SHREE RENUKA CONSTRUCTIONS

(18)

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Ref No.:

" Verbosity "

Date: _____

Ansible provides V-level to control the amount of o/p displayed during execution. The V is controlled using the [-v] flag (upto 4 levels).

- v Basic details Shows task execution details
- vv (More debug info) displays module arguments and detailed log
- vvv (Maximum debugging) - Show connection details, SSH Commⁿ and raw module ip/op.
- vvvv (Extreme --) → Show existing, low level communications, API calls.

"Using Ansible to configure a kubernetes Cluster"

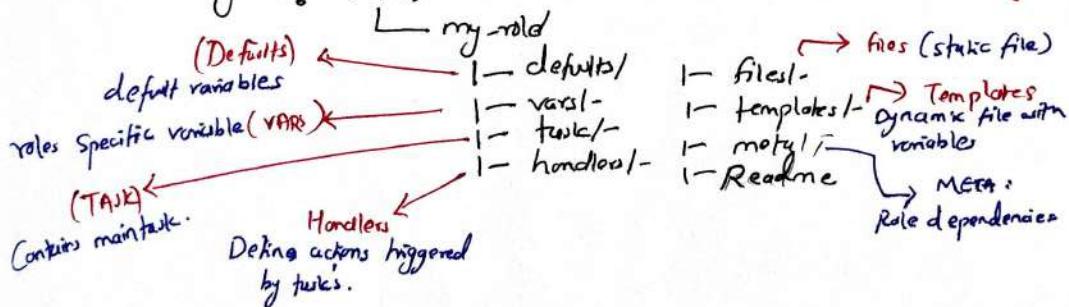
- Create 3 EC2 instance on AWS, and Configure 1 as master and other 2 as worker
 - (Terraform)
 - (Ansible)
 - (Ansible)

Ansible Roles: Roles are way to organize playbooks into reusable, modular components.

They help in structuring automation task more efficiently by separating Configuration, file, variables, and tasks (Common to each Role)

Role Directory ↴ roles/

↳ Ansible galaxy Pinit roles/repo/



Task : CREATE own PLAYBOOKS.
CREATE ROLE
and
Practise

SHREE RENUKA CONSTRUCTIONS

(19)

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Ref No.:

"TERRAFORM"

Date : 04/04/2025

- Manage any Infrastructure
- Standardize Configurations
- Track your IS
- Collaborate
- Automate changes

Terraform Life cycle :

Write : Define IS in Configuration file.

Plan : Review the changes, Terraform will make to your I.S

Apply : Terraform provisions your I.S and update the state files.

Terraform Runs on basic 4 Commands :

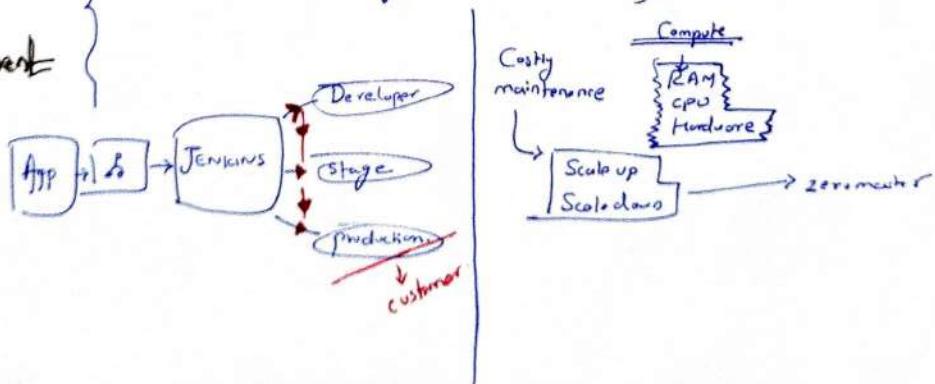
- | | | |
|-------------------|----------------|-----------------------|
| 1) Terraform init | → (Initialize) | 3.) Terraform Apply |
| 2) Terraform plan | → (Dry Run) | 4.) Terraform destroy |

CI/CD.

(10/04/2025)

Continuous Integration . Continuous Deployment.

- Unit testing
→ Static Code Analysis
→ Code Quality / Vulnerability
→ Automation
→ Reports
→ Deployment
- { → updates flows to VCS → v₁ v₂ v₃ → once the version is finalized it goes to the deployment by automation (CI/CD) from VCS → [JENKINS] → (CI/CD tool used in the current example) }
Jenkins is integrated to know any push action, and follow the informed automation after trigger via (orchestration).



SHREE RENUKA CONSTRUCTIONS

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Ref No.:

Docker Crash Course (NANA).

Date: 25/10/2025.

Development before Container?

→ Each developer needs to install and configure all services directly on their OS on their local machine.

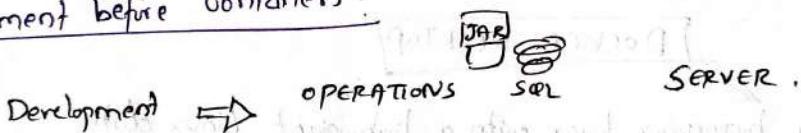
Container Solves this problem.

- Own isolated environment
- postgres packaged with all dependencies and config's.
- Start service as a Docker container using (2 Docker command)
- Command same for all OS.

"Docker standardizes process of running any service on any local dev environment".

→ Easy to run different versions of same app without any conflict.

Deployment before Container?



With Container:



- Install Docker runtime on the server.

DOCKER

→ VIRTUALIZATION TOOL.

WHAT PART of O.S do they virtualize ?

Docker

Virtual Machine

O.S Application layer

OS Kernel

Hardware

O.S App layer

O.S kernel

Hardware.

→ Docker image (MB) | size VM image, (couple of GB)

→ Containers take seconds to start / Speed Takes minute to start

(Can't run directly): | compatibility VM is compatible with all O.S.

DD Application

DD Kernel

HARDWARE

Linux App

→ where Linux application cannot

use the windows kernel in order to proceed.



Docker Desktop

use a hypervisor layer with a lightweight Linux distro

thus can help Linux app to run on windows app.

DOCKER IMAGE

vs

DOCKER CONTAINER

→ Package or Artifact created by

Docker.

→ executable application artifact.

→ include app Source code.

→ add environment variables.

→ actually start the application.

→ Running instance of an image is
(called) container.

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(21)

Ref No.:

Docker Registries. \Rightarrow [Docker Hub]

Date: _____

- A storage and distribution Sys for Docker image
- official image avail from app like Redis, Mongo, Postgres etc
- " " are maintained by software authors, or in GitHub with Docker commit

Pull docker nginx:1.23

Specify the version as 1.23.

run docker nginx:1.23

\hookrightarrow Docker will download the latest.

if we dont

Ctrl + C. (to exit to the running container)

Run docker image Separately \Rightarrow run -d nginx:1.23

docker ps \Rightarrow shows running docker images.

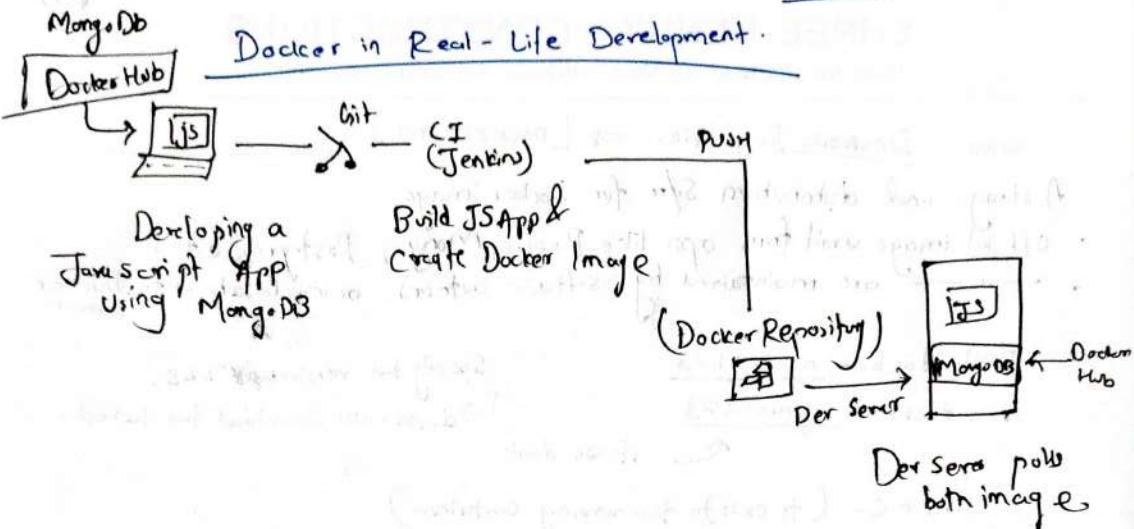
If any image is not present locally, it will directly download from Repo.

"PORT BINDING"

- Application inside Container runs in an isolated Docker network.
- We need to expose the container port to the host

[docker run -d (-P) 9000:80 nginx:1.23]

↓
publish



November 3rd : KUBERNETES Components.



- Smallest Unit of k8's
- Abstraction over Container
- 1 application per POD
- Each POD gets its own IP Add
- New IP address on re-creation

Explanation: →

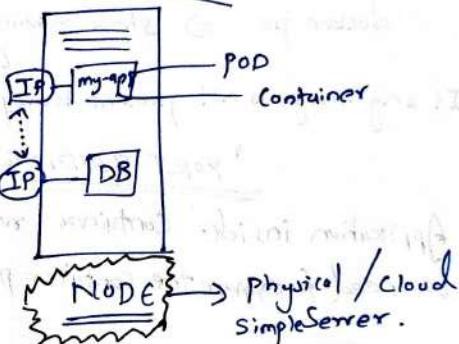
→ POD does is,
K8s create a running env. or layer on top of the Container.

The reason, is to abstract the Container runtime or Container technology

So we can replace it if we want - also we don't have to interact with the Container technology used & only interact with k8s later.

→ POD has its own database. → Each POD gets its own IP Address, for communication purposes.

→ POD are ~~shorter~~ Ephemeral, (which means they can die very easily)



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Service is also a load balancer

Ref No.:

SERVICE: \Rightarrow Permanent IP Address attached to each Pod.

Date:

\rightarrow Lifecycle of Service & pod are not connected. (even if pod dies, Service stay)

- Need of Having Application accessible through browser:

for this we need to have external Service (Internal Service \rightarrow private usage).

for neat URL we can need to connect or talk to our own application, there is another component called **INGRESS**.

\hookrightarrow Instead of Service, the request goes to ingress and it does forward it to Service.

4 Components Done

NODE	POD	SERVICE	INGRESS
------	-----	---------	---------

\Rightarrow **Config-map**: \Rightarrow would usually contain Configuration data like URL's of database and other service we used.

\rightarrow In k8s we connect it to Pod, and Pod gets data from the URL from the Config-map. contains:

- No need to build new image
- complete cycle of work
- is skipped,

Pod of External Service can have Username & Password

- which may often change
- which may often change

\rightarrow putting this data in Config-map is not secure.

\rightarrow putting this data in **SECRET** \rightarrow To use to store secret data

\rightarrow "so" comes up with **SECRET**

\rightarrow It base 64 encoded

we can use the data from Config-map & Secret in our application by using environmental variable " or even as property file.

2 components Done

Config-map	Secrets
------------	---------

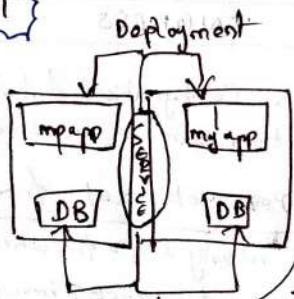
- Database data and data log needs to be (secure) persisted, reliably for longer
- We can do this in k8s by using **VOLUMES**

It attach physical storage to Pod at (locally or even cloud storage)
 (K8s does not manage data)

→ We will not be creating lot of Pod's by ourselves. Instead, those all config will be added in our next component called **DEPLOYMENT**, which is like a blue print for the complete process.

↳ DB Can't be replicated via deployment. → Abstraction of Pod's.

STATEFULSET



Configured by Deployment
 however, DB Cannot be deployment,
 as DB use a state (storage)
 If multiple DB are replicated, they are
 Connected to the local and which needs to have
 mechanism to manage (R, W, E) access,
 in order to maintain DB statefulness.
 Thus, DB is not created and managed by

Deployment and there is another service called **STATEFULSET**.

3 Components done

VOLUMES

DEPLOYMENT

STATEFULSET

and their types

empty	empty dir
hostPath	empty dir

SHREE RENUKA CONSTRUCTIONS

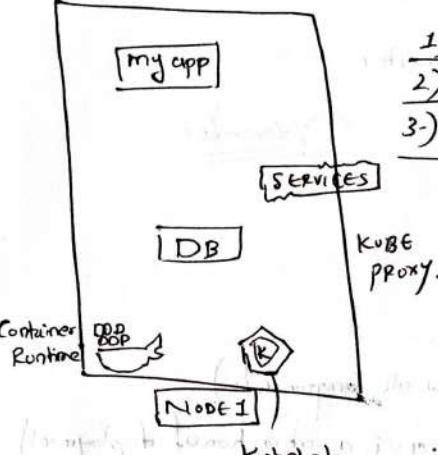
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Ref No.:

K8s ARCHITECTURE

Date: _____

WORKER NODE



• 3 process must be installed on every node.

1) Container Runtime

2) kubelet : interact with both container & node.
Kubelet starts POD with Container inside

3-) Kube proxy: Responsible for forwarding the request from Services to POD, \therefore
→ has intelligent forwarding logic inside.

→ makes sure Communication is working properly.

MASTER NODE

4 must processes



It decides on which node new pod needs to be scheduled. However the pod gets started with kubelet.

Detect state changing & ask scheduler to restart the POD.

etcd is the cluster brain

Cluster changes get stored in key value store

← Cluster brain



key value store

Application data is (NOT) stored in etcd
(only cluster state data).

ADVANTAGE OF K8s

- Replication is much easier
- Self-healing of k8s
- Smart Scheduling
-

MINIKUBE: open source tool.

Master and local Node processes run on one machine
 Docker runtime will be pre-installed
 It will run via (Virtual box) in our laptop / system
 for Testing purpose.

KUBECTL: Command line Tool for k8s cluster

Basic Commands:

6th November

- 1) kubectl get pod
- 2) kubectl get services
- 3) kubectl create (-h) → help will show all components.
 (will not create Pod, as it is a abstraction of deployment)

kubectl create deployment nginx-depl --image=nginx.

↓
 -blueprint for creating
 POD

- 4) kubectl get replicaset (∵ Replicaset: is managing the replicas of a Pod)

Layers of Abstraction



Deployment manager



Replicaset manager



Pod is an abstraction of



Container

Everything below
 deployment should
 be managed by
 k8s.

SHREE RENUKA CONSTRUCTIONS

(29)

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Ref No.: Debugging Pod.

Date: _____

- 5) kubectl logs [pod-name].
6) kubectl delete deployment (nameofdeploy).

10th November

K8s YAML file Explained.

Configuration file has "3" important parts:

- 1.) Metadata 2.) Specification 3.) "status".

This is automatically added by k8s, (Self-healing)

This information of status ←
(comes to k8s from etcd) {the cluster brain} → (it holds current status of)
any component

"Store the config file with your code".

Connecting components (labels & selectors) & pods.

Contains (Labels)

(Selectors)

12th November

Complete Application Setup with K8s Components

Deploy 2 App

mongo-express.

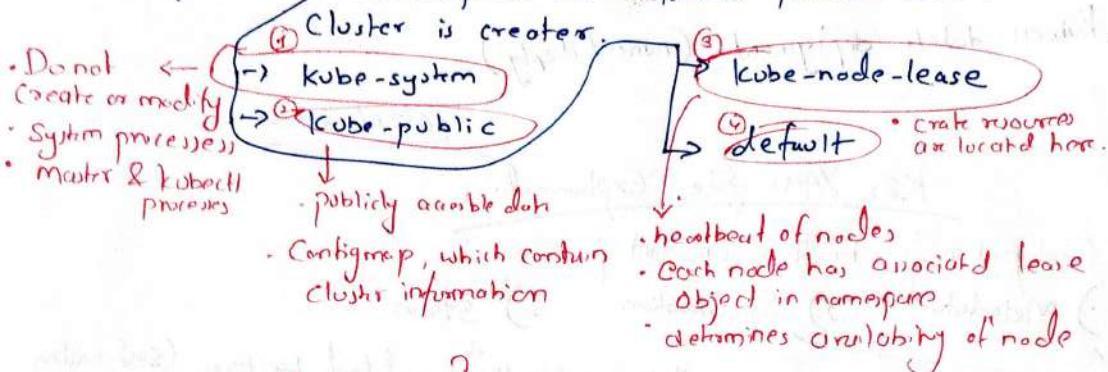
MongoDB

23 November

"Namespaces"

→ Virtual cluster inside a cluster is called "Namespace".

→ Default → 4 namespaces are defaulted formed when



Why to use Namespace?

- 1) Resources grouped in Namespaces. (Rather, everything in 1 namespace)
- 2.) Conflicts (many Team, same application)
- 3.) Resource sharing: Staging and development
- 4.) Resource sharing: Blue / Green deployment
- 5.) Access and Resource limits on NS.

→ Each NS must define their own "ConfigMap"

→ However, ↓ Access Semire from another NS.
(they can)

This thing
Services can't be put
in any NS.

Volume
Node

live globally in cluster
we can't isolate them

→ Change the active NS with kubens.

SHREE RENUKA CONSTRUCTIONS

(25)

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Ref No.:

K8s INGRESS



Date: _____

→ External Service to access application is okay, when in testing env. for ease of access ie. `http://192.168.1.10:8080`...
However final product should look like → `http://myapp.com`

→ Ingress won't be configured alone by itself, thus we need an implementation for it.
It is called Ingress Controller

Function of Ingress Controller is to evaluate all the rules, manage redirection, endpoint to cluster.

"HELM" & "HELM Charts"

→ Package Manager for K8s.

• To package YAML files and distribute them in public & private Repository

Elastic Stack for logging

- Bundle of YAML files
- Create your own helm chart with helm
- Push them to helm repo.
- Download and use existing one.

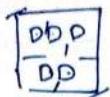
14th November

Pods and Container: Kubernetes Networking

In K8s Pod is the Smallest unit and not the containers.

Every Pod has unique IP Address ↗ Reachable from all the other PODS in the K8s cluster

Scenario



If 100's of containers are running on port, how do we understand which ports are free for the connection.

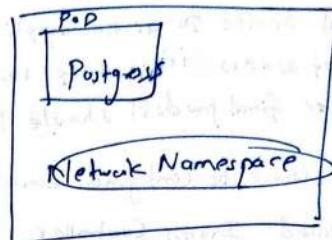
* K8s Solve this problem statement : by : → "Pod Abstraction".

- Pod itself have its own IP Address
- It usually contain 1 container

when Pod is created on Node. ← :

→ It gets its own → Network Namespace.
→ Virtual ethernet connection.

→ (Range of network allocate)
(Ports) to



* Replacing Container Runtime easily. →

* Pause Container → It is in each Pod

→ also called "Sand box" container. → Reserves and holds network namespace (netns)

→ enable communication between containers.

(K8s Volumes)

• How to persist data in k8s using Volume?

Persistent volume



Persistent volume claim



Storage class.



K8s don't give storage out of the box.

Thus it's own responsibility to configure the storage.

that doesn't depend on Pod lifecycle.

SHREE RENUKA CONSTRUCTIONS

26

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Storage Req:

Ref No.:

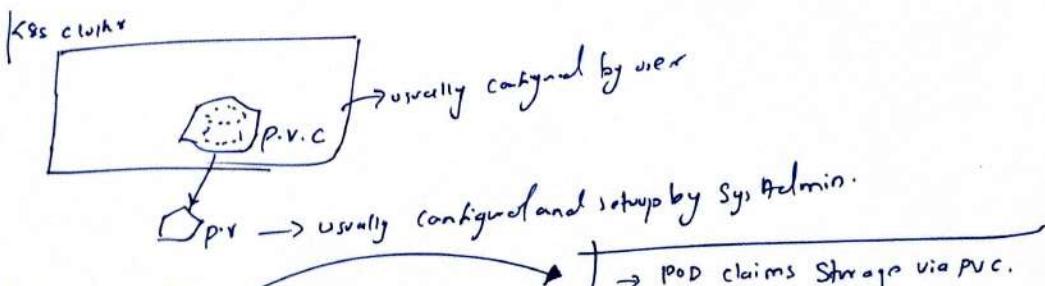
Date: _____

- i.) Storage that doesn't depend on POD L.C.
- ii) — must be avail on all POD.
- iii) — need to survive even if cluster crashes.

PERSISTENT VOLUME: Directory (Application that writes and reads from pre-configured directory, / could be session file for application,) Thus it can be configured with k8s P.V.

- A cluster resource.
- It can be created via YAML file.
- As P.V is an abstracted component, it has to take the storage from the actual physical storage. (ie Local Harddrive, cloud-storage, nfs server).
- They are not namespaced. Accessible to whole cluster

PERSISTENT VOLUME CLAIM:



- STORAGE CLASS:
- provision PVC dynamically.
 - when PVC claim it
 - Storage Backend is defined in S.C component
 - via "provisioner" attribute
 - each Storage backend has own provisioner
 - internal provision - k8s.io
 - external provisioner
 - SC create PV that meets the need of the claim
 - POD ↓
 - PVC ↓
 - S.C ↓
 - PV

"CLOUD"

- Delivery of Computer Services over the Internet is called "CLOUD".
- Instead of buying, owning, owning the Cloud Data centers, we switch to acquire Compute, Storage, database on as need basis.

By: Margarita Ilić
Emily Bayek
Mai-nishitani.

" CLOUD COMPUTING "

On-Demand delivery of IT resources and applications through the internet with pay-as-you-go pricing.

" DISTRIBUTED COMPUTING ARCHITECTURE "

Method of making multiple computer work together to solve a common problem. It makes Computer network appears as a powerful Single Computer that provides large scale resources to deal with complex challenges.

Advantages : Scalability, Availability, Consistency, Transparency, Efficiency.

" Types of DCA "

In DC, you design application that can run on several computers instead of on just one computer. You achieve this by designing the software so that different computer perform different functions and communicate to develop the final solution.

4 Main Types of DISTRIBUTED ARCHITECTURE :

- Client Server
- N-tier
- Three tier
- peer-to-peer.

"Cloud Computing Models"

Infrastructure as a Service
Platform as a Service
Software as a Service

(IaaS)
(PaaS)
(SaaS)

ex: (AWS) (Azure) (GCP)
Basic building blocks for
Cloud I.T and typically
provide access to
networking features,
Computers and data storage
(I.T resources).

Removes need for organisation to manage
the underlying infrastructure. (H.W and O.S)
and allows to focus on deployment
management of the applications.
ex: (Google App Engine) (AWS Elastic Beanstalk).

Completed product that is run and
managed by the Service provider.
ex: Web based email.

"Cloud Computing Deployment Model's"

CLOUD HYBRID ON-PREMISES

Global Infrastructure

Physical locations around the world where we cluster
DATA CENTERS → (REGIONS) {Each Region has 1 or more AZ}.

Each group of logical Data Centers are called ⇒ (Availability Zones)

Cloud based product offered ⇒ (Services)

AWS Cloud Resilience

Cloud Resilience refers to the ability for an application to resist or
recover from disruption, including those related to Infrastructure,
dependent services, misconfigurations.

SIX Advantages of Cloud Computing.

(2)

- 1.) TRADE fixed expense for variable expense
- 2.) Benefit from massive economies of Scale.
- 3.) Stop guessing capacity.
- 4.) Increase speed and agility.
- 5.) Stop Spending money running and maintaining data centers.
- 6.) Go-global in minutes.

AWS: is responsible for protecting the infrastructure that runs all of services offered in cloud.
 [H.W., S.W., Network, and other facilities].

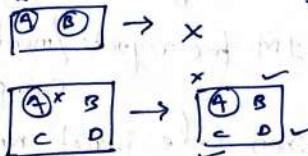
SECURITY of THE CLOUD:

will depend on the AWS ←
 cloud services that customer selects.

Customer:

11th Oct 2025

- Monolithic Architecture
- Micro Service architecture

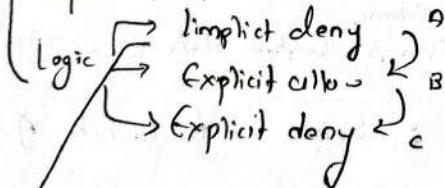


Types of Services:

Managed / fully managed / Serverless

IAM : . Controlled Identity access . Simple U.I . System generated policies

. Access limits



B can override A.

However, B cannot override C.

It is a default policy for all new identities.

Amazon S3: Object Storage. [Storage Service, offering durability, availability, performance, security and virtually unlimited scalability at low cost.

Elastic and scales automatically. files are always replicated across multiple AZ in a Region.

AWS Lambda: Serverless Compute Service that can use to run function code without provisioning or managing servers.

→ Removes all administration for application or backend source that can be processed in snippets of code.

AWS Lambda has a 15 minute limit on its runtime for each invocation.

If computing needs require more than 15 min for runtime, then you would need to use an EC2 instance instead of Lambda.

AWS Lambda Cost: → Always free usage tier

includes 1M free requests/month and 400,000 GB second of compute time per month.

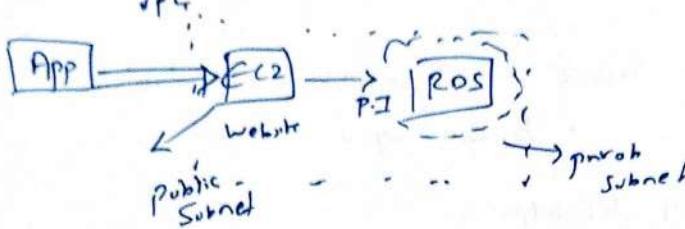
No charge when code is not running.

Amazon DB: Serverless non-relational database that can store and retrieve any amount of data and serve any level of request traffic.

Relational → Store data in rows and columns

non-relational → each row doesn't have to contain data for each column.

Amazon VPC: (Virtual private cloud) : Service used to launch AWS Resources in a logically isolated virtual network.



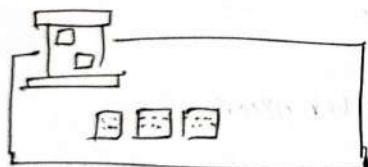
14th october

Introduction To Storage.

Computer uses data to complete tasks, and this data must be stored to be accessed. → Some data can be saved on Computer itself (→ files, which help computer on on/off)

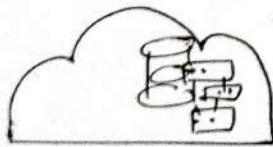
Data can be stored in server, when data is on a Server in the cloud, people around world can access it

on-premises storage



- The server is hosted within organization's infrastructure and might be physically on-site.
- Company controls administrator's and maintains server.
- Data and other information are shared between computers through local network.

Cloud storage



- outside service provider like AWS host your data
- cloud provider procure, install and maintain all HW/SW and other supporting I.S. in its data center
- we access this services and manage your account through the internet

BENEFITS:

- Cost efficient . Secure . Accessible . Scalable
- Managed . Backed up.

Types of STORAGE

Block



Breaks data into blocks and Then stores those blocks as Separate pieces each with Unique Identifiers.

FILE



It helps user to access data in a Shared file sys.

OBJECT.



Files are stored as object based on attribute and metadata. Each object consists of data, metadata and object key.

Block Use case:

HOSTING DATABASE INSTANCES

BIG DATA ANALYTICS

ENTERPRISE APPLICATION

Object use case:

DISASTER RECOVERY

DATA LEAKS

CLOUD NATIVE APPLICATION

Amazon Elastic Block Store (Amazon EBS)

" " " file system (Amazon EFS)

" " " Simple Storage Service (Amazon S3)

Object ownership: Access CONTROL LIST (ACL).

Default = Turn off ACL.

Block public access:

Default = no public access.

VERSIONING:

Bucket Security :

Encryption:

(9)

- Client Side Encryption
- Server Side encryption.

Moving large amount of data into Amazon S3:

S3 Transfer Acceleration

Aws Snowcone

Aws Snowball

Aws Snowmobile .

15 October 2025

Getting started with Compute:

- Computing is brain behind I.T Application's .
 - Main Component's
 - CPU
 - RAM (Memory)
 - Hard Drive
 - Network performance
- Operating System → windows / Linux / OS. Mac] .

Instance → (vm) is Computing resource in cloud, works like on-premises server. Supports + web hosting, applications, databases, etc
we can treat it as temporary and disposable

use case - ① HOSTING environment ② Development and test env.
③ Backup and disaster recovery .

Containers: → method of o.s virtualisation that you can use to run on application and its dependencies in resource-isolated process.

By using container, you can package an application's code, configurations, and dependencies into simple building block that deliver environments consistency, operational efficiency, developer productivity and v.c.

Consistency, operational efficiency, developer productivity and v.c.
Container smaller than VM. → Do not contain entire o.s

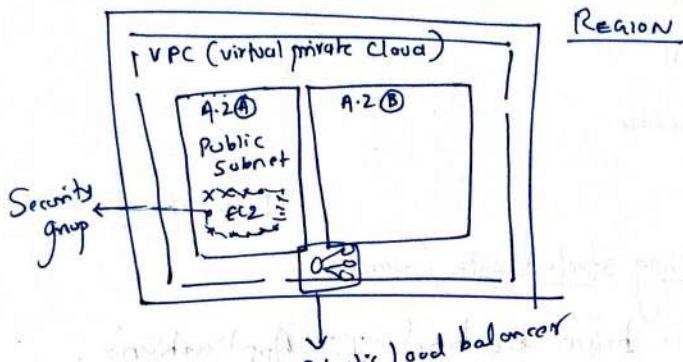
use case ① Building microservice architecture ② video rendering service
③ Quick development & deployment

Serverless → use case ① file processing ② web application
③ mobile backend ④ cron jobs.

AWS Computing Services.

- ① EC2
- ② Lambda
- ③ ECS
- ④ EKS
- ⑤ Fargate
- ⑥ Beanstalk

EC2 Architecture



TENANCY:

SHARED

DEDICATED INSTANCE

DEDICATED HOST

Introduction to Networking :

21st Oct.

(5)

- Networking is how Computer's communicate with each other.

Node → (X) ← Node. (ie Node : Computer).
 Root

- Nodes are divided into 2 cat:

Host Node : ex: file Server
 Email Server
 Web Server

Client Node : Computer, printer, mobile device.

- Network Connecting Devices : → ROUTER, SWITCH.

HUB / SWITCH (A switch makes a direct link b/w Trans device and Recv. device (only the intended receiver will be notified)).
 ↓
 Any transmitted data that is received on one port is rebroadcast to all the ports on the HUB.

OSI (Open Systems Interconnection) model :

- Suite of protocol, or rules to govern how computers communicate.

Application layer → closest to user → Identifying communicating partner
 → Determining resource availability and
 → Synchronizing communication.

Presentation → formatting and delimiting info, based on the syntax that application accept,

Session → opening, closing and managing sessions

Transport → transparent transfer of data b/w users.

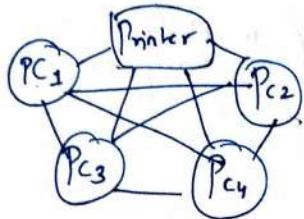
Network → responsible for communication across diff network.

Data link → defines standard for transmitting data b/w adj. network nodes in a WAN or b/w nodes on same LAN.

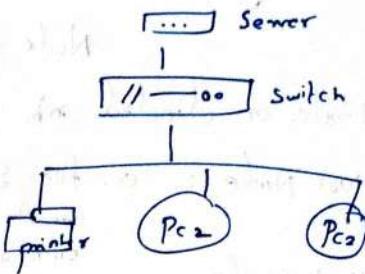
Physical → defines std for transmitting raw data (bits).

NETWORK MODELS.

PEER-TO-PEER MODEL

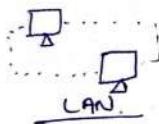


CLIENT-SERVER MODEL



- User are responsible for backing up each node.
- Security requirements are not restrictive.
- A limited no. of peer are used (most biz networking archtchtris).
- file server and desktop clients
- print servers & " "

NETWORK Types



Internet Protocol (IP) Addresses.

IP STRUCTURE

Bit number	1	2	3	4	5	6	7	8
Bit value placeholder	128	64	32	16	8	4	2	1
Bit value selected	1	1	0	0	0	0	0	0

IPv4

Ex. 192.0.2.0

32 bits in length

provides upto 4.3 billion IPAddm

IPv6

Ex: 2600:1f18:::----

128 bits in length

→ provides practically an unlimited no of IP addm.

will eventually replace

IPv4.

Classless Intr-Domain Routing (CIDR).

To Define a network's IP range, is CIDR block.

192.0.2.0 / 24

Netmask

The Netmask number tells you how many of 32 bits of routing prefix must be fixed or allocated for the network identifier.

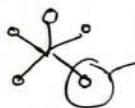
The bits that are not fixed are allocated to

Change to give you a group of IP address that are consecutive to each other. In this way, the netmask determine the n. of IP addr in your network.

1/24 Netmask \Rightarrow 256 IP Addresses

1/16 Netmask \Rightarrow 65,536

SUBNET.



$\otimes \rightarrow$ Network within networks
Called Subnet.

Each Subnet Comprised a specified range of consecutive IP Address for the partition of network.

If IP needs to reach to an IP in another Subnet, then it must travel through the router.

(NETWORK)

Subnet A:
10.0.0.0 to 10.0.0.255

Subnet B:
10.0.1.0 to 10.0.1.255

Subnet C:
10.0.2.0 to 10.0.2.255

Subnet D:
10.0.3.0 to 10.0.3.255

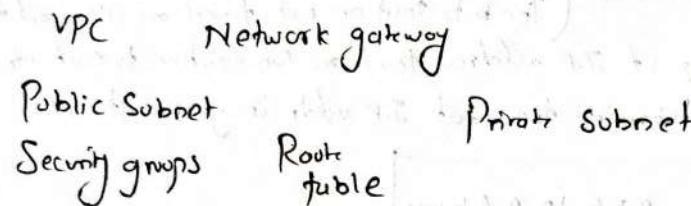
SUBNET CIDR Block.

Amazon VPC

VPC → Region specific.

Subnet → Availability zone (multiple subnet can be created.)

Amazon VPC Components



NACL (Network access Control List).

22nd October

"GETTING STARTED: DATABASES"

- A Database is a logically organized collection of information, designed in such a way that the info within can be accessed for later use by a computer program.
- Database gives access to the data while keeping the integrity of the data in a secure environment.

DATA MODELS

STRUCTURED

- Series of data values.
- formatted
- processing & analysis
- Complex

UN-STRUCTURED

- Stored as files
- Lacks predefined structure
- Special tools to catalog and query

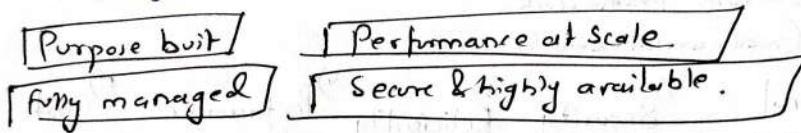
SEMI-STRUCTURED

- Highly flexible.
- Analyzed

DATA BASE terms and Concepts.

- SCHEMA
- READ / WRITE
- I/Ops. (Input o/p operations per second) is the measure of performance of read and writes to a storage location like database.
- ACID / BASE compliance
 - ACID - Atomicity, Consistency, isolation, durability (ACID) Compliance, used in structured database. (Return to most recent version of data)
 - BASE Compliance is used in a structured or semi-structured database. support data integrity in non-relational database.
- OLAP / OLTP
 - Online transaction processing (OLTP) / Online analytical processing (OLAP).
- INDEXES. → Allow query to quickly find the data needed to produce result.
- SQL query language → Structured Query language.

Why AWS Database



AMAZON RELATIONAL DATABASE SERVICE (RDS).

A-RDS is a fully managed Relational database Service that supports the major relational database engine.

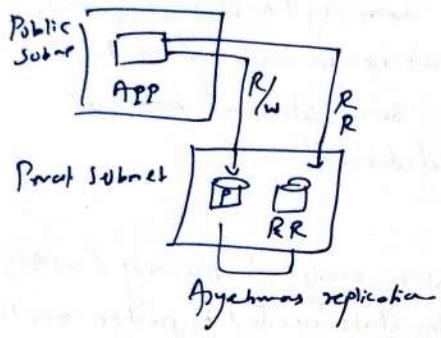
It also pass-on responsibility and engineering efforts as below.

- 1.) Backup & restore
- 2.) Software installation and Patching
- 3.) Managing hardware
- 4.) Scaling servers
- 5.) Highly available environment
- 6.) Maintenance for migration

Benefits of RDS.

- Easy to administer
- Available and durable
- Highly Scalable
- fast
- Secure
- Inexpensive.

RDS Read Replica.



→ Elastically Scale out beyond the capacity constraints of a single database instance for R/W heavy database workload.

→ Create 1 or more replicas of a given source database instance to increase aggregate read throughput

"CLOUD OPERATION"

AWS - WA framework.
(Well-architected)

6.) Sustainability

- 1) operational excellence
- 2) Security
- 3) Reliability
- 4) Performance efficiency
- 5) Cost optimization

- 1) AWS payment method.
 - 1.) Pay as you go
 - 2.) Save when you commit
 - 3.) pay less ^(by) Using more

IAns

Intro. to SERVERLESS.

24 october 25 (8)

Microservices.

Architectural and organization approach to S.D. (Software development)
Software is Composed of Small independent Services.
Communicate over well-defined API.

Architecture: Tightly & loosely Coupled infrastructure.
(monolithic) (Microservices).

Microservices & Serverless architecture

↓ is a method of building your architecture

is a service that is used to build the Architecture.

↓ it is a method of loosely coupling Section of your architecture

↳ Services are tools that you use to build out those Section,

Common to use a blend of both services, and non-service Services.

Event-driven Architecture.

BENEFITS.

- Scale and fail independently
- Audit with ease
- Develop with agile
- Cut costs

BENEFITS

- No Service management
- Pay for value Services
- Continuous Scaling
- High availability

"AWS Lambda"

is a Serverless, event driven compute Service that lets you run code for virtually any type of application or backend Service without provisioning or managing servers.

Types of Invocation.

Synchronous

Asynchronous

Polling