DevOps Introduction

1.What is DevOps?

Answer:
DevOps is a set of practices that combines software development (Dev) and IT operations (Ops). Its goal is to shorten the system development life cycle and provide continuous delivery with high software quality.

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2. What are the key principles of DevOps?

Answer:
Key principles include:

- **Collaboration:** Between development and operations teams
- **Automation:** Of infrastructure, testing, and deployment
- **Continuous Integration and Continuous Delivery (CI/CD)**
- **Monitoring and feedback:** For improvement
- **Infrastructure as Code (IaC)**

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3. What are the common practices in DevOps?

Answer:

- Continuous Integration (CI)
- Continuous Delivery/Deployment (CD)
- Automated Testing
- Infrastructure as Code
- Configuration Management
- Monitoring and Logging
- Microservices Architecture

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4. What are the benefits of implementing DevOps?

Answer:

- Faster release cycles
- Improved deployment success rates
- Increased collaboration and communication
- Better quality and performance
- Quick recovery from failures
- More automation, leading to higher efficiency

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5. What is the role of automation in DevOps?

Answer:
Automation helps in reducing manual errors, speeding up deployments, improving consistency, and enabling scalability. It is applied in testing, configuration, deployment, and monitoring.

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6. What is Basic Git Setup in DevOps?

Answer:
Basic Git setup includes:

- Installing Git
- Configuring user details:

  ```
  arduino
  git config --global user.name "Your Name"
  git config --global user.email "you@example.com"
  ```

- Creating or cloning repositories
- Understanding basic commands like `git init`, `git add`, `git commit`, `git push`, `git pull`, etc.

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7. Why is Git important in DevOps?

Answer:
Git is a distributed version control system used to track code changes. It enables collaboration among teams, supports branching and merging, and integrates easily with CI/CD tools like Jenkins, GitHub Actions, etc.

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SDLC & Agile Programming

8. What is SDLC?

Answer:
SDLC (Software Development Life Cycle) is the process of planning, creating, testing, and deploying software. It includes stages such as

1. Requirement Gathering
2. Design
3. Development
4. Testing
5. Deployment
6. Maintenance

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9. What are the models of SDLC?

Answer:

- Waterfall Model
- Agile Model
- V-Model
- Spiral Model
- Iterative Model

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10. What is Agile Programming?

Answer:
Agile programming is a methodology that promotes iterative development, collaboration, and flexibility to changing requirements. It emphasizes working software, customer involvement, and quick feedback.

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11. What are the key principles of Agile?

Answer:

- Individuals and interactions over processes and tools
- Working software over documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

12. What is the difference between Agile and DevOps?

Answer:

- **Agile** focuses on development and delivering features in iterations.
- **DevOps** focuses on both development and operations, ensuring code is delivered and maintained efficiently.
  They complement each other but serve different purposes.

Git & GitHub

1. What is Git?

Answer:
Git is a distributed version control system used to track changes in source code during software development. It helps multiple developers collaborate and maintain a history of code changes.

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2. What is GitHub? How is it different from Git?

Answer:
GitHub is a web-based platform for hosting Git repositories. While Git is a local tool for version control, GitHub enables cloud-based collaboration, pull requests, issue tracking, and project management.

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3. What are some essential Git concepts?

Answer:

- **Repository (repo):** A storage space for your code project.
- **Commit:** A snapshot of your code at a specific time.
- **Branch:** A version of the code that can be worked on independently.
- **Merge:** Combining changes from different branches.
- **Remote:** A version of the project hosted online (e.g., on GitHub).

🔑 Basic Git Commands

4. What does `git init` do?

Answer:
`git init` initializes a new Git repository in the current directory, creating a `.git` folder to track changes.

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5. How do you clone a repository from GitHub?

Answer:
Use `git clone <repository_url>`.
Example:

```bash
git clone https://github.com/user/repo.git
```

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6. What is the use of `git add`?

Answer:
`git add` stages changes (files or updates) to be committed.
Example:

```bash
git add file1.txt
```

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7. What is a Git commit? How is it done?

Answer:
A commit saves the staged changes to the local repository.
Command:

```bash
git commit -m "Your commit message"
```

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8. What is the difference between `git push` and `git pull`?

Answer:

- `git push`: Uploads local changes to the remote repository.
- `git pull`: Downloads changes from the remote repository and merges them into the local branch.

💻 GitHub Operations

9. What is forking in GitHub?

Answer:
Forking creates a personal copy of someone else's repository under your GitHub account. It's useful for contributing to open-source projects.

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10. What is a pull request (PR)?

Answer:
A pull request lets you notify the repository owner about changes you want to merge from your forked repo or branch. It’s a way to propose changes and discuss them.

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11. How does merging work in Git?

Answer:
Merging combines the changes from one branch into another. It’s typically done with:

```
bash

git merge <branch_name>
```

Version Control and DevOps

12. Why is Git important for version control?

Answer:
Git allows tracking changes, reverting to previous versions, branching for features or bug fixes, and collaborating with multiple developers without overwriting each other’s work.

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13. How is Git used in modern DevOps practices?

Answer:
Git is central to DevOps because:

- It's used in **CI/CD pipelines** for code integration and deployment.
- Helps in **collaboration** and **code reviews** using platforms like GitHub/GitLab.
- Enables **Infrastructure as Code (IaC)** by versioning configuration files.
- Works well with tools like Jenkins, GitHub Actions, and Docker.

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14. What are Git workflows commonly used in teams?

Answer:

- **Git Flow:** Uses feature branches, develop, and release branches.
- **GitHub Flow:** Simple workflow using pull requests on the main branch.
- **Trunk-Based Development:** All developers commit to a single branch (often `main`) with feature flags.

GitLab Essentials

1. What is GitLab? How is it different from GitHub?

Answer:
GitLab is a web-based DevOps lifecycle platform that provides Git repository management, CI/CD pipelines, issue tracking, and more in a single application.
Difference from GitHub:
GitLab is more focused on end-to-end DevOps with built-in CI/CD, while GitHub relies on integrations (like GitHub Actions or third-party tools).

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2. What is GitLab Web IDE?

Answer:
The GitLab Web IDE is an in-browser code editor that allows users to:

- Edit files directly in a GitLab repository
- Commit changes
- Create branches
- Create and edit merge requests
  It's useful for quick changes without cloning the repo locally.

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3. How can Git commands be used with GitHub and GitLab?

Answer:
Git commands are the same for both GitHub and GitLab because both use Git.
Example workflow:

```
bash
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git clone <repo_url>
cd project
git checkout -b feature-branch
git add .
git commit -m "Feature update"
git push origin feature-branch
```

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4. What is CI/CD?

Answer:
CI/CD stands for **Continuous Integration** and **Continuous Deployment/Delivery**.

- **CI**: Automates testing and integration of code into a shared repo.
- **CD**: Automates deployment of code to production or staging environments.

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5. How does GitLab implement CI/CD?

Answer:
GitLab has **built-in CI/CD**. You define a `.gitlab-ci.yml` file in the repo root that specifies:

- Jobs
- Stages
- Runners
  GitLab executes pipelines based on this configuration.

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6. What is a `.gitlab-ci.yml` file?

Answer:
It is a YAML configuration file that defines the CI/CD pipeline in GitLab.
Example:

```
yaml
CopyEdit
stages:
  - build
  - test
  - deploy

build-job:
  stage: build
  script:
    - echo "Building project..."

test-job:
  stage: test
  script:
    - echo "Running tests..."

deploy-job:
  stage: deploy
  script:
    - echo "Deploying to production..."
```

7. What are GitLab Runners?

Answer:
GitLab Runners are agents that execute CI/CD jobs defined in the `.gitlab-ci.yml` file. They can be:

- **Shared Runners** (provided by GitLab)
- **Specific Runners** (self-hosted by users)

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8. What are some CI/CD capabilities of GitLab?

Answer:

- Built-in pipeline editor and visualizations
- Automated testing and deployment
- Parallel and sequential job execution
- Scheduled pipelines
- Integration with Docker, Kubernetes, and cloud providers
- Manual approvals and triggers

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9. What are common security issues in using GitLab?

Answer:

- Hardcoded secrets in repos
- Improper access controls
- Insecure CI/CD scripts
- Outdated dependencies and packages
- Lack of code scanning

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10. How does GitLab handle security and compliance?

Answer:
GitLab provides:

- **SAST** (Static Application Security Testing)
- **DAST** (Dynamic Application Security Testing)
- **Dependency Scanning**
- **Container Scanning**
- **Secret Detection**
- **Audit logs and compliance dashboards**

11. What are GitLab's best practices for security?

Answer:

- Use environment variables for secrets
- Apply role-based access control (RBAC)
- Enable 2FA for user accounts
- Regularly scan code with GitLab’s security tools
- Review merge requests and pipelines for vulnerabilities

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12. Can GitLab be self-hosted? What are the security implications?

Answer:
Yes, GitLab can be self-hosted.

Implications:

- More control over data and configurations
- Responsibility for patching and securing the instance
- Need to manage backups, SSL, and server security

Jenkins CI/CD

1. What is Jenkins?

Answer:
Jenkins is an open-source automation server used to implement **Continuous Integration (CI)** and **Continuous Delivery/Deployment (CD)**. It automates the building, testing, and deployment of applications.

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2. What are the key features of Jenkins?

Answer:

- Open-source and extensible
- Wide range of plugins
- Integration with Git, GitHub, Docker, Maven, etc.
- Pipeline as code using Jenkinsfile
- Distributed builds with master-agent architecture
- Real-time build monitoring

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3. How do you install Jenkins?

Answer:
On a local machine:

- Install Java (JDK)
- Download Jenkins `.war` file or install via package manager (e.g., `apt`, `brew`)
- Run Jenkins:

  ```
  bash
  java -jar jenkins.war
  ```

- Access it via: `http://localhost:8080`
- Unlock with admin password, then install recommended plugins and create the first user

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4. What is a Jenkins pipeline?

Answer:
A pipeline is a suite of plugins that supports implementing and integrating continuous delivery pipelines using **Pipeline as Code** (via `Jenkinsfile`).

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5. What are the types of Jenkins pipelines?

Answer:

- **Declarative Pipeline:** Uses structured syntax (`Jenkinsfile`)
- **Scripted Pipeline:** Uses Groovy-like scripting

Example Declarative Pipeline:

```
groovy

pipeline {
  agent any
  stages {
    stage('Build') {
      steps {
        echo 'Building...'
      }
    }
    stage('Test') {
      steps {
        echo 'Testing...'
      }
    }
    stage('Deploy') {
      steps {
        echo 'Deploying...'
      }
    }
  }
}
```

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6. How do you set up a basic CI/CD pipeline for a web application in Jenkins?

Answer:
Steps:

1. Install Jenkins
2. Connect Jenkins to GitHub
3. Create a pipeline or freestyle job
4. Configure build steps:
   - Pull code from GitHub
   - Build (e.g., compile, test)
   - Deploy to a local HTTP server (e.g., copy files to `/var/www/html`)
5. Trigger builds on code commits or manually

---

7. How do you deploy a web app to a local HTTP server using Jenkins?

Answer:

- Use a build step like `Execute shell` in a freestyle job or `sh` in a pipeline
- Sample command:

  ```
  bash
  cp -r * /var/www/html/
  ```

- Ensure Jenkins has permissions to access the deployment directory

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8. How do you integrate Jenkins with GitHub?

Answer:

1. Generate a GitHub Personal Access Token (PAT)
2. In Jenkins:
   - Add GitHub credentials
   - Use GitHub plugin
3. In the Jenkins job:
   - Configure source code management (Git) with your repo URL
4. Optionally, enable **webhooks** on GitHub to trigger builds automatically on push events

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9. How is Jenkins used in large-scale enterprise environments?

Answer:
In large-scale environments, Jenkins is used for:

- Orchestrating complex CI/CD pipelines across microservices
- Supporting multiple teams with shared and dedicated agents
- Integrating with cloud providers (AWS, GCP, Azure)
- Managing infrastructure with IaC tools like Terraform and Ansible
- Implementing secure and compliant pipelines with auditing

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10. What challenges can arise when using Jenkins at scale?

Answer:

- Plugin conflicts or maintenance
- Master-slave (agent) management complexity
- Scaling pipeline execution
- Managing thousands of jobs
- Ensuring pipeline security and access control

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11. What are some strategies to manage Jenkins in large-scale environments?

Answer:

- Use **Pipeline as Code** with version-controlled Jenkinsfiles
- Set up **distributed builds** with scalable agents (Kubernetes, cloud VMs)
- Automate Jenkins configuration (e.g., using Jenkins Configuration as Code plugin)
- Monitor Jenkins health and job performance
- Implement security best practices (e.g., role-based access control, credentials management)

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12. Can you give an example of a company using Jenkins at scale?

Answer:
Example:
Netflix uses Jenkins to support CI/CD for its microservices architecture. It integrates Jenkins with Spinnaker for advanced deployment strategies and uses scalable infrastructure to handle hundreds of builds daily.

Docker & Continuous Deployment

1. What is Docker?

Answer:
Docker is an open-source platform that enables developers to build, package, and deploy applications as containers. It simplifies software deployment by bundling the application with all its dependencies.

2. What is containerization?

Answer:
Containerization is the process of packaging an application and its dependencies into a container, which is a lightweight, portable, and isolated execution environment. Containers ensure consistency across development, testing, and production.

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3. What are the main components of Docker architecture?

Answer:

- **Docker Engine:** The runtime that runs containers
- **Docker Daemon (`dockerd`)**: Manages Docker objects (images, containers, etc.)
- **Docker CLI:** Command-line tool to interact with the daemon
- **Docker Images:** Read-only templates used to create containers
- **Docker Containers:** Running instances of images
- **Docker Hub/Registry:** Cloud-based repository for Docker images

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4. What is the difference between Docker images and containers?

Answer:

- **Image**: A snapshot/template containing the application and its environment.
- **Container**: A running instance of an image; it's the live, executable version.

⚙Docker Commands

5. What does `docker build` do?

Answer:
It builds a Docker image from a `Dockerfile`.
Example:

```
bash
docker build -t my-app .
```

---

6. What does `docker run` do?

Answer:
It creates and starts a new container from a Docker image.
Example:

```
bash
docker run -d -p 80:80 my-app
```

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7. What does `docker images` show?

Answer:
It lists all Docker images stored on the local system.

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8. What does `docker ps` show?

Answer:
It lists running containers. Use `docker ps -a` to show all (including stopped) containers.

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9. How do you deploy a web app on Docker?

Answer:

1. Create a `Dockerfile` with app configuration
2. Build the image:

```
bash
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docker build -t my-web-app .
```

3. Run the container:

```
bash
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docker run -d -p 8080:80 my-web-app
```

4. Access the app on `http://localhost:8080`

🔄 Docker Management

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10. How can you manage Docker containers?

Answer:

- **Start container:** `docker start <container_id>`
- **Stop container:** `docker stop <container_id>`
- **Remove container:** `docker rm <container_id>`
- **View logs:** `docker logs <container_id>`
- **Access shell:** `docker exec -it <container_id> bash`

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11. What is Docker Compose?

Answer:
Docker Compose is a tool to define and run multi-container applications using a `docker-compose.yml` file. It allows managing services, volumes, and networks in one place.

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12. What is the role of Docker in Continuous Deployment?

Answer:
Docker ensures consistent deployment across environments by:

- Packaging the app and dependencies in one unit
- Enabling fast deployment and rollback
- Integrating easily with CI/CD tools like Jenkins, GitLab CI, etc.

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13. Why is container security important?

Answer:
Because containers share the host OS, any vulnerability can lead to privilege escalation, data leaks, or compromise of other containers or the host system.

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14. What are best practices to secure Docker images and containers?

Answer:

- **Use official or verified base images**
- **Keep images small and updated**
- **Scan images for vulnerabilities** (use tools like `Trivy` or Docker Hub scanning)
- **Run containers as non-root users**
- **Use Docker secrets for managing sensitive data**
- **Limit container capabilities using `--cap-drop` and `--read-only` flags**
- **Regularly audit Dockerfiles and CI/CD scripts**
- **Use a private image registry with access control**

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15. What tools can be used to enhance Docker security?

Answer:

- **Trivy:** For image vulnerability scanning
- **Docker Bench for Security:** Automated security checks
- **Aqua Security / Sysdig Falco:** Runtime container protection
- **Notary:** Content trust and image signing
- **SELinux / AppArmor:** Security modules to control access

Ansible & Configuration Management

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1. What is Configuration Management?

Answer:
Configuration Management (CM) is the process of systematically handling changes to ensure that a system maintains integrity over time. In software, it means managing and automating system setup, software installation, and maintenance across multiple servers.

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2. What is Ansible?

Answer:
Ansible is an open-source automation tool used for configuration management, application deployment, and task automation. It uses **YAML-based playbooks**, requires no agent, and operates over SSH.

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3. Why is Ansible popular for configuration management?

Answer:

- **Agentless** (uses SSH)
- **Human-readable YAML syntax**
- **Idempotent** (repeating tasks has no side effects)
- **Extensible with modules**
- Good for managing complex deployments across many servers

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4. What is an Ansible Playbook?

Answer:
A playbook is a YAML file that defines tasks to be executed on remote hosts. It contains:

- `hosts`: Target systems
- `tasks`: Actions to perform
- `vars`: Variables
- `handlers`: Triggered only when notified

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5. What does a basic Ansible Playbook look like?

Answer:

```
yaml

- name: Install Apache on web servers
  hosts: webservers
  become: true
  tasks:
    - name: Install Apache
      apt:
        name: apache2
        state: present
```

---

6. What language is used to write Ansible Playbooks?

Answer:
Ansible Playbooks are written in **YAML (Yet Another Markup Language)**, which is designed to be human-readable and easy to use for configuration files.

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7. What are Push and Pull models in configuration management?

Answer:

- **Push Model (Ansible):** The control node pushes configurations to target systems.
- **Pull Model (like in Puppet):** The managed nodes pull configurations from a central server at regular intervals.

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8. What is the difference between Ansible and other CM tools like Puppet or Chef?

Answer:

Feature	Ansible	Puppet	Chef
Agentless	✅ Yes	❌ No	❌ No
Language	YAML	DSL (Ruby-like)	Ruby
Model	Push	Pull	Pull
Learning Curve	Easy	Moderate	Steep

9. Why is playbook maintainability important?

Answer:
Maintainable playbooks ensure that infrastructure can be updated, debugged, and scaled without causing errors or confusion. It also helps with onboarding new team members and reducing human error.

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10. What are some best practices for writing scalable Ansible Playbooks?

Answer:
✅ **Use roles** to organize playbooks (separate tasks, variables, handlers)
✅ **Avoid hardcoding values**; use variables and `group_vars/host_vars`
✅ **Use handlers** for service restarts instead of repeating actions
✅ **Include comments** for clarity
✅ **Idempotency:** Ensure repeated runs don't cause issues
✅ **Use tags** to run specific tasks
✅ **Test playbooks** with `ansible-playbook --check` and in staging environments
✅ **Modularize** tasks using includes or imports
✅ **Version control** playbooks with Git
✅ **Validate YAML** syntax before running

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11. What are Ansible roles and why should you use them?

Answer:
Roles are a way to group related tasks, files, variables, and handlers into a reusable structure. Roles promote **modularity**, **reusability**, and **maintainability** of playbooks.

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12. How can Ansible be integrated into a CI/CD pipeline?

Answer:

- Run playbooks after successful builds to configure servers
- Use with Jenkins or GitLab CI
- Validate playbooks using lint tools (e.g., `ansible-lint`)
- Use `ansible-playbook --check` for dry-run validation before applying changes