1. Jenkins Basics

1.1. Introduction to Jenkins

- **What is Jenkins?**

    - Jenkins as a CI/CD automation server.

    - Key features: open-source, extensibility with plugins, and distributed builds.

- **Installing Jenkins**

    - Installation on Linux, Windows, and macOS.

    - Running Jenkins in Docker containers.

    - Initial setup and unlocking Jenkins.

1.2. Jenkins Architecture

- Master-agent architecture.

- Understanding the Jenkins pipeline and workspace.

- Distributed builds and scalability.

2. Jenkins Configuration

2.1. Configuring Jenkins

- Configuring system settings: global tools (JDK, Maven, Git).

- Setting up credentials for secure access (SSH keys, AWS keys).

- Customizing user roles and permissions using Role-Based Access Control (RBAC).

2.2. Jenkins Plugins

- **Essential Plugins for DevOps**

- Git plugin for version control.

- Pipeline plugin for declarative pipelines.

- Blue Ocean plugin for a modern UI.

- Build tools plugins (e.g., Maven, npm).

3. Jenkins Pipelines

3.1. Introduction to Pipelines

- **Types of Pipelines**

  - Freestyle projects.

  - Declarative pipelines.

  - Scripted pipelines.

- Advantages of using pipelines over freestyle jobs.

3.2. Declarative Pipelines

- Writing a `Jenkinsfile`.

- Stages and steps: `pipeline`, `agent`, `stages`, `steps`.

- Parallel stages for concurrent execution.

3.3. Scripted Pipelines

- Using Groovy syntax for complex workflows.

- Dynamic stages and advanced scripting.

4. Integrating Jenkins with AWS

4.1. Setting Up Jenkins on AWS

- Running Jenkins on EC2 instances.

- Setting up auto-scaling Jenkins agents on AWS using the EC2 plugin.

- Storing Jenkins backups on S3.

4.2. CI/CD Integration

- **AWS CodeDeploy Integration**
  - Automating deployments to EC2 instances, or on-premise servers.
- **Terraform**
  - Managing AWS infrastructure from Jenkins pipelines.
  - Automating infrastructure deployment.

5. Job Management

5.1. Creating and Configuring Jobs

- Freestyle jobs: configuring build steps, triggers, and post-build actions.
- Pipeline jobs: linking to `Jenkinsfile` in Git repositories.
- Multibranch pipelines for managing multiple Git branches.

5.2. Triggers

- **Build Triggers**
  - Poll SCM for changes.
  - Webhooks for real-time builds (e.g., GitHub or Bitbucket triggers).
  - Scheduled builds using CRON syntax.

6. Continuous Integration

6.1. Source Code Management

- Configuring Git repositories in Jenkins.
- Integrating with GitHub, GitLab, or Bitbucket.
- Handling branches and tags in SCM.

6.2. Testing Automation

- Running unit and integration tests in Jenkins pipelines.

- Using testing tools like JUnit, Selenium, or Cypress.

- Publishing test results and code coverage reports.

7. Continuous Delivery/Deployment

7.1. Artifact Management

- Storing artifacts in Jenkins workspace.

- Publishing artifacts to S3, Nexus, or Artifactory.

7.2. Deployment Automation

- Deploying applications to AWS ECS, EKS, or Lambda.

- Rolling updates and canary deployments using Jenkins pipelines.

- Integrating with Docker for containerized deployments.

8. Jenkins and Docker

8.1. Running Jenkins in Docker

- Installing and running Jenkins in a Docker container.

- Managing Jenkins data persistence with volumes.

- Networking and scaling Jenkins with Docker Compose.

8.2. Docker Integration

- Using Docker plugins to build and push images.

- Automating container builds for Kubernetes deployment.

9. Jenkins Security

9.1. Security Best Practices

- Enabling HTTPS for Jenkins.

- Configuring authentication with LDAP or Active Directory.

- Managing user roles and permissions.

9.2. Credential Management

- Storing and using sensitive data securely.

- Using Jenkins credentials in pipelines (`withCredentials` block).

10. Monitoring and Maintenance

10.1. Monitoring Jenkins

- Monitoring Jenkins logs and usage metrics.

- Integrating with monitoring tools (e.g., Prometheus, Grafana).

- Using the Jenkins Monitoring plugin.

10.2. Backup and Restore

- Automating Jenkins backups to AWS S3.

- Restoring Jenkins from backup files.

11. Advanced Jenkins Topics

11.1. Distributed Builds

- Setting up Jenkins agents for distributed builds.

- Configuring agents on EC2 or Kubernetes.

12. Troubleshooting Jenkins

- Debugging pipeline failures.

- Resolving plugin compatibility issues.

- Scaling Jenkins for high availability.