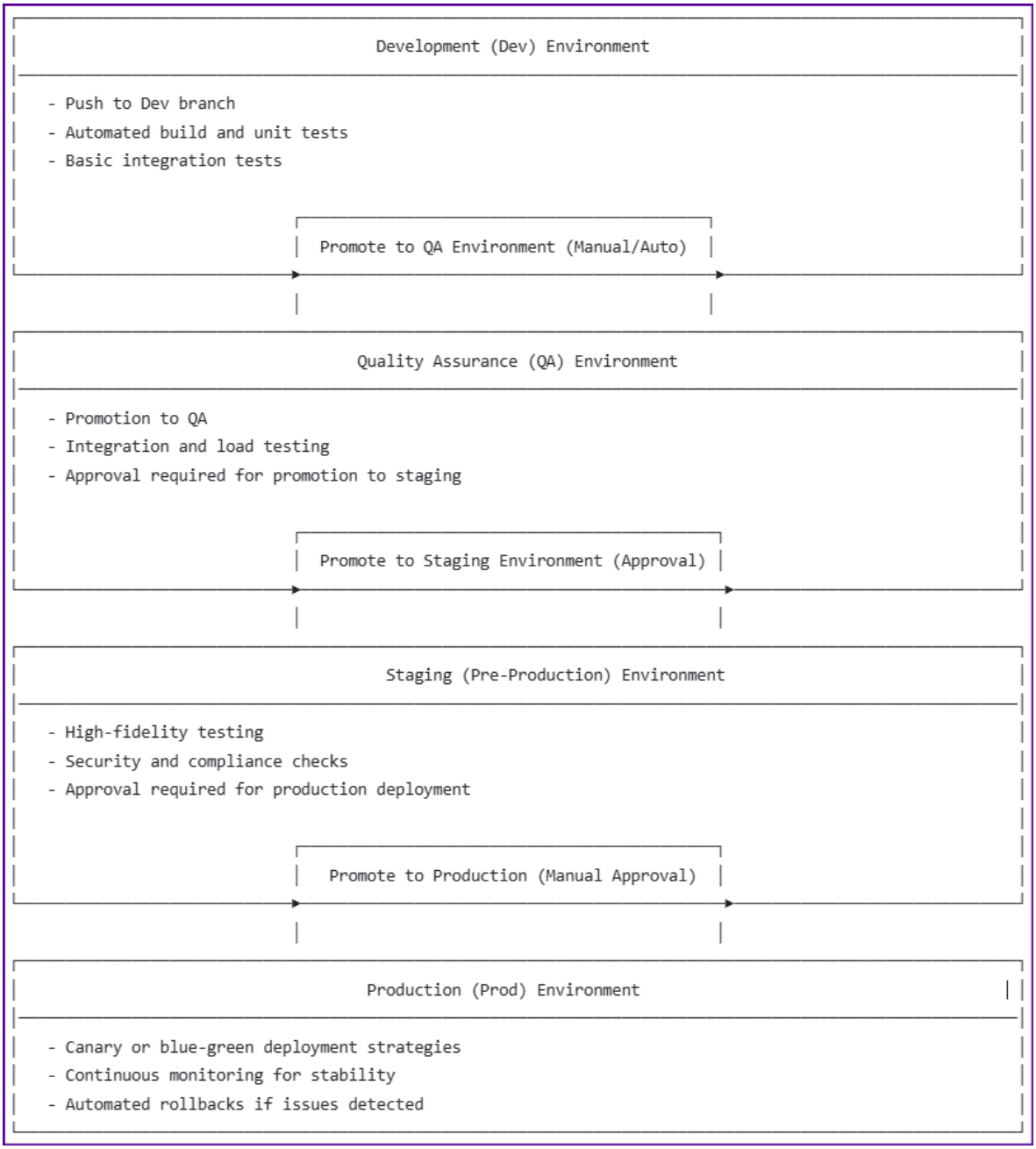
DevOps Shack

Promoting Deployments Across Environments



In DevOps, **promoting deployments across environments** (e.g., from Dev to QA to Production) is a controlled, automated process aimed at ensuring code quality, reliability, and stability.

Here's a breakdown of how deployment promotion typically happens, with examples:

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1. Environment Setup:

- **Development (Dev)**: Where developers initially deploy, test, and validate features.
- **Quality Assurance (QA)**: Where QA engineers test features in a controlled environment similar to production.
- **Staging/Pre-Production**: A final testing ground that mirrors the production environment closely.
- **Production (Prod)**: The live environment where end-users interact with the application.

2. Automated CI/CD Pipeline:

- The process is managed by Continuous Integration and Continuous Deployment (CI/CD) pipelines, often set up in tools like **Jenkins, GitLab CI/CD, Azure DevOps,** or **GitHub Actions**.
- The pipeline is configured to handle code promotions, starting from Dev to other environments, based on testing outcomes and approval gates.

3. Promotion Stages with Examples:

Each stage in the pipeline has defined tasks, approvals, and checks before promotion. Here’s how it typically works in each stage:

Example CI/CD Pipeline Stages for Promotion:

Let's take the example of a **web application**.

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1. Development (Dev) Stage:

- **Trigger**: Developers push code to a development branch (e.g., dev branch).
- **Build & Deploy**: The CI/CD pipeline automatically builds and deploys the code to the Dev environment.
- **Automated Tests**: The pipeline runs **unit tests, linting checks,** and **basic integration tests**.

- **Outcome**: If all tests pass, the application is deployed in Dev. Developers and testers can now validate the changes.

Example Command:

```
helm install dev-app ./mychart --namespace dev --set image.tag="latest-dev"
```

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2. QA Stage:

- **Trigger**: Code promotion to QA is usually manual or triggered when a Pull Request (PR) is merged to a qa branch or a feature branch.
- **Deployment to QA**: Once approved, the pipeline picks the latest code version and deploys it to the QA environment.
- **Integration & API Testing**: In QA, more rigorous testing like **integration, API, performance,** and **load tests** are executed.
- **Approval Gate**: After successful testing, QA teams may manually review and approve changes for promotion to Staging.

Example Command:

```
helm upgrade qa-app ./mychart --namespace qa --set image.tag="release-candidate"
```

3. Staging (Pre-Production) Stage:

- **Trigger**: Code is promoted to Staging after passing QA tests. The staging branch (e.g., staging) is updated and triggers deployment to the staging environment.
- **High Fidelity Testing**: Staging tests often mirror production with configurations and load testing to catch issues that may arise under real-world conditions.
- **Security and Compliance Checks**: Security checks, vulnerability scans, and compliance audits are usually conducted here.
- **Final Approval Gate**: After all checks, stakeholders (QA leads, security officers, etc.) approve the deployment to production.

Example Command:

```
helm upgrade staging-app ./mychart --namespace staging --set image.tag="pre-prod"
```

4. Production (Prod) Stage:

- **Trigger**: Once staging approval is granted, a production deployment is triggered. Sometimes, this is a manual trigger to ensure strict control.
- **Deployment**: The application is deployed with minimal to no downtime using **canary deployments, blue-green deployments,** or **rolling updates** to ensure stability.
- **Monitoring and Rollbacks**: Post-deployment, monitoring tools check for any issues. If issues arise, **rollback** is automated to quickly restore the previous stable version.

Example Command:

```
helm upgrade prod-app ./mychart --namespace production --set image.tag="v1.0.0"
```

4. Environment-Specific Configuration:

Each environment may have its own configuration (e.g., database URLs, API keys). In Helm, **values files** are used to manage these configurations:

- **values-dev.yaml** for Dev
- **values-qa.yaml** for QA
- **values-prod.yaml** for Production

When deploying, the respective values file is referenced to apply environment-specific settings:

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```
helm install app-release ./mychart -f values-prod.yaml
```

5. Promotion Best Practices:

- **Automated Testing and Approval Gates**: Automate testing and require approvals before promoting to higher environments.
- **Environment Parity**: Ensure QA and Staging environments mimic production as closely as possible.
- **Monitoring and Alerting**: Set up robust monitoring for production and automated rollbacks.
- **Immutable Infrastructure**: Use immutable releases so production changes do not affect previous deployments.

This pipeline-driven promotion process is key for DevOps teams, providing control, stability, and speed, all while reducing human intervention and potential errors in deploying applications across environments.