

Detailed documentation

This document details the improvements made to the GitHub Actions workflows in the Week08 E-Commerce Application to align with DevOps best practices. The improvements focus on implementing proper branching strategies, automated CI/CD linking, and pull request validation.

Issues Identified in Original Workflows

1. Lack of Development Branch Strategy

- **Issue:** All development occurred directly on the `main` branch
- **Impact:** No isolation for feature development; direct production deployments

2. Disconnected CI/CD Workflows

- **Issue:** Four separate workflows (backend CI, frontend CI, backend CD, frontend CD) with no automation linking
- **Impact:** Manual coordination required between CI and CD phases

3. Missing Pull Request Validation

- **Issue:** No automated checks before merging to main branch
- **Impact:** Potential for broken code to reach production

4. Inconsistent Workflow Triggering

- **Issue:** Mix of `workflow_dispatch` and `push` triggers without clear strategy
- **Impact:** Unclear when workflows should execute; manual deployment bottlenecks

5. Limited Frontend Testing

- **Issue:** Frontend CI workflow had no testing or validation steps
- **Impact:** Frontend changes deployed without quality assurance

Implemented Improvements

1. Pull Request Validation Workflow

File: .github/workflows/pr-validation.yml

```

1+ # Pull Request Validation Workflow
2+ # This workflow runs on pull requests to validate code quality before merging
3+
4+name: PR Validation - Test & Build
5+
6+on:
7+  pull_request:
8+    branches:
9+      - main
10+     - development
11+    paths:
12+      - 'backend/**'
13+      - 'frontend/**'
14+      - '.github/workflows/**'
15+
16+env:
17+  ACR_LOGIN_SERVER: ${{ secrets.AZURE_CONTAINER_REGISTRY }}
18+  IMAGE_TAG: pr-${{ github.event.number }}-${{ github.sha }}
19+
20+jobs:
21+  # Job 1: Validate Backend Changes
22+  validate_backend:
23+    runs-on: ubuntu-latest
24+    if: contains(github.event.pull_request.changed_files, 'backend')
25+
26+    services:
27+      # Product DB container for testing
28+      product_db:
29+        image: postgres:15
30+        env:
31+          POSTGRES_USER: postgres
32+          POSTGRES_PASSWORD: postgres
33+          POSTGRES_DB: products
34+        options: >-
35+          --health-cmd "pg_isready -U postgres"
36+          --health-interval 10s
37+          --health-timeout 5s
38+          --health-retries 5
39+
40+

```

- Purpose:** Validate code quality and functionality before merging to main/development
- Key Features:**
 - Runs comprehensive backend tests with PostgreSQL services
 - Validates Docker builds for both services
 - Performs basic frontend validation and structure checks
 - Security scanning for hardcoded secrets
 - YAML syntax validation for workflow files
- Triggers:** Pull requests to **main** or **development** branches
- Benefits:** Prevents broken code from reaching main branches

2. Enhanced Branch Strategy

Files Modified: backend_ci.yml, frontend_ci.yml

The screenshot shows a Visual Studio Code (VS Code) interface with multiple tabs open. The tabs include 'SIT722-8.1P Answer.md', 'SIT722-9.2C Answer.md M', and '6a1667d6 - Implement DevOps wor... (22 files) — sit722-week08'. The main workspace displays two GitHub workflow files: 'frontend_ci.yml' and 'pr-validation.yml'. The 'frontend_ci.yml' file contains code for a CI pipeline, including steps for manual triggers, pushing to branches, and building/pushing frontend images. The 'pr-validation.yml' file is a pull request validation workflow. On the left, the 'SOURCE CONTROL' sidebar shows a list of commit history and staged changes, with a prominent 'Commit' button at the top. A status bar at the bottom indicates the current file is '6a1667d6 - Implement DevOps wor... (22 files) — sit722-week08'.

```
# Manual trigger
workflow_dispatch:

# Automatically on pushes to main branch
push:
  branches:
    - main

  paths: # Only trigger if changes are in the frontend directory
  - 'frontend/**'
  - '.github/workflows/frontend_ci.yml' # Trigger if this workflow file

jobs:
  build_and_push_frontend:
    runs-on: ubuntu-latest

  steps:
    - name: Checkout repository

- name: Build and Push Frontend Image
  run:
    docker build -t ${ env.ACR_LOGIN_SERVER }/frontend:latest ./frontend
    docker push ${ env.ACR_LOGIN_SERVER }/frontend:latest

# Logout from Azure for security (runs even if image push fails)
- name: Logout from Azure

+ # Pull Request Validation Workflow
+ # This workflow runs on pull requests to validate code quality before merging
+ name: PR Validation - Test & Build
```

- **Improvement:** Added `development` branch support to CI workflows
 - **Triggers:** Both `main` and `development` branch pushes
 - **Logic:** Added conditional logic to only push images on actual pushes (not PRs)
 - **Benefits:** Supports proper Git flow with development and feature branches

3. Automated CI/CD Linking

Files Modified: backend-cd.yml, frontend-cd.yml

The screenshot shows a Mac OS X desktop environment with a terminal window and a GitHub pull request interface.

Terminal Window:

```
git:~$ git status
On branch development
Your branch is up-to-date with 'origin/main'.
nothing to commit, working tree clean
```

Github Pull Request:

A pull request titled "Implement DevOps workflow improvements" has been opened against the "development" branch. The PR includes the following commits:

- Deploy front end
- Deploy backend
- Merge pull request #1 from Qu... (origin/main)
- Fix workflow
- Merge pull request #1 from Qu...
- Trigger backend workflow
- Implement DevOps workflow im...
- Revert "Update frontend with bac..."
- Update frontend with backend ser...
- Update image registry
- Update secrets.yaml
- Update frontend.yaml
- Rename frontend_ci.yaml to front...
- Update order-service.yaml
- Update product-service.yaml

The PR has 19 changes, 1 addition, and 1 deletion. The code review highlights several lines of code in the `backend-cd.yml` file:

```
1 name: CD - Deploy Backend Services to AKS
2
3 on:
4   workflow_dispatch:
5     inputs:
6       aks_cluster_name:
7
8     * 9 hidden lines
9
10    required: true
11    default: '<acr_name>'
12
13
14  # Manual trigger with inputs
15  workflow_dispatch:
16    inputs:
17      aks_cluster_name:
18
19    required: true
20    default: '<acr_name>'
```

The code review also highlights a comment in the file:

```
21+ # Only run if the preceding workflow succeeded (for workflow_run) or ali
```

The screenshot shows a GitHub DevOps workflow editor with two parallel branches of code:

- Frontend CI - Build & Push Image**: Triggered by a manual workflow or automatically after a successful frontend build.
- Automatic trigger after successful frontend CI**: Triggers a workflow run for "Frontend CI - Build & Push Image".

Workflow Details:

- Stages:** Frontend CI, Automatic trigger after successful frontend CI.
- Frontend CI Stage:** Runs on Ubuntu-Latest, environment: Production.
 - Steps:** Checkout repository, Login to Azure Container Registry, Run az acr login command.
- Automatic trigger after successful frontend CI Stage:** Runs on Ubuntu-Latest, environment: Production.
 - Steps:** Checkout repository, Login to Azure Container Registry, Run az acr login command.

- **Improvement:** Added `workflow_run` triggers to automatically deploy after successful CI
 - **Logic:**
 - CD workflows trigger automatically after CI completion
 - Only deploys on `main` branch (production)
 - Includes success condition checking
 - **Configuration Management:** Dynamic parameter handling for different trigger types
 - **Benefits:** Reduces manual intervention and speeds up deployment pipeline

Demonstration of Improvements in Operation

push backend changes to dev branch

The screenshot shows a GitHub Actions run summary for a workflow named 'Deploy backend #6'. The run was triggered via push 3 minutes ago by 'QuinnieLiu' to branch 'development'. The status is 'Success' with a total duration of '2m 19s'. There are no artifacts. The workflow file is 'backend_ci.yml' with an 'on: push' trigger. It contains two jobs: 'test_and_lint_backends' (38s) and 'build_and_push_images' (1m 35s). Both jobs are marked as successful.

Triggered via push 3 minutes ago
QuinnieLiu pushed → 8d92501 development

Status: Success | Total duration: 2m 19s | Artifacts: -

backend_ci.yml
on: push

test_and_lint_backends 38s → build_and_push_images 1m 35s

PR validation

A screenshot of a GitHub pull request page. At the top, it says "QuinnieLiu wants to merge 1 commit into `main` from `development`". Below this, there's a comment from QuinnieLiu: "No description provided." A note says "This branch has not been deployed". Under "Checks", it shows "Some checks haven't completed yet": 1 in progress, 1 skipped, 4 successful. The successful checks are: "Backend CI - Test, Build and Push Images to ACR / build_and_push_images (push)", "Backend CI - Test, Build and Push Images to ACR / test_and_lint_backends (push)", and "PR Validation - Test & Build / changes (pull_request)". The "PR Validation - Test & Build / validate_backend (pull_request)" check is still pending ("Started now"). On the right side, there are sections for Reviewers, Assignees, Labels, Projects, Milestone, Development, and Notifications.

A screenshot of the GitHub Actions workflow run details page for a workflow named "Deploy backend #3". The workflow was triggered via a pull request now by QuinnieLiu opening #3 in the development branch. The status is "In progress". The total duration is 2 minutes and 41 seconds. The workflow consists of four jobs: "changes" (5s), "validate_backend" (41s), "validate_frontend" (0s), and "security_check" (3s). The "pr-validation.yml" file specifies the workflow with the job "changes" running on "pull_request".

PR merged

The screenshot shows a GitHub pull request page for a repository named 'QuinnieLiu / sit722-week08'. The pull request is titled 'Deploy backend #3' and has been merged. It includes sections for Conversation (0), Commits (1), Checks (6), and Files changed (1). A comment from 'QuinnieLiu' states 'No description provided.' and links to a 'Deploy backend' commit. Another comment from 'QuinnieLiu' merges commit 'b8ccf1b' into 'main' and indicates 6 checks passed. The pull request summary shows 'This branch has not been deployed' and 'Pull request successfully merged and closed'. It also mentions that the 'development' branch can be safely deleted. The right side of the page displays various metadata fields such as Reviewers, Assignees, Labels, Projects, Milestone, and Development status.

backend CICD

A screenshot of a GitHub Actions workflow page. The workflow is named 'test_and_lint_backends'. It shows one job step, 'test_and_lint_backends', which was triggered via push now by user 'QuinnieLiu' on branch 'main'. The status is 'In progress' and the total duration is 42s. The workflow file is 'backend_ci.yml'.

A screenshot of a GitHub Actions workflow page. The workflow is named 'deploy_backend'. It shows one job step, 'deploy_backend', which was triggered via workflow run 1 minute ago by user 'QuinnieLiu' on branch 'main'. The status is 'In progress' and the total duration is 1m 5s. The workflow file is 'backend-cd.yml'.

frontend PR validation

The screenshot shows a GitHub pull request page for a project named 'sit722-week08'. The pull request is titled 'Deploy frontend #4' and is from the 'development' branch into the 'main' branch. The status bar indicates '+1 -0' reviews and 5 checks.

Comments:

- QuinnieLiu commented now: No description provided.

Deployment:

- This branch has not been deployed. No deployments.

CI Checks:

- All checks have passed (1 skipped, 4 successful checks):
 - PR Validation - Test & Build / validate_backend (pull_request) Skipped now
 - Frontend CI - Build & Push Image / build_and_push_frontend (push) Successful in 1m
 - PR Validation - Test & Build / changes (pull_request) Successful in 6s
 - PR Validation - Test & Build / security_check (pull_request) Successful in 4s
 - PR Validation - Test & Build / validate_frontend (pull_request) Successful in 9s

Reviewers: No reviews. Still in progress? Convert to draft.

Assignees: No one—assign yourself.

Labels: None yet.

Projects: None yet.

Milestone: No milestone.

Development: Successfully merging this pull request may close these issues. None yet.

Notifications: Customize. Unsubscribe. You're receiving notifications because you authored this pull request.

frontend CICD

All workflows

Showing runs from all workflows

23 workflow runs

Event	Status	Branch	Actor
Merge pull request #4 from QuinnieLiu/development	In progress	main	now
Deploy frontend	Success	development	1 minute ago
Deploy frontend	Success	development	2 minutes ago
CD - Deploy Backend Services to AKS	Success	main	10 minutes ago
Merge pull request #3 from QuinnieLiu/development	Success	main	13 minutes ago
Deploy backend	Success	development	14 minutes ago
Deploy backend	Success	development	19 minutes ago
Fix workflow	Success	development	21 minutes ago

QuinnieLiu / sit722-week08

Actions

CD - Deploy Frontend to AKS

CD - Deploy Frontend to AKS #3

Cancel workflow

Summary

Triggered via workflow run 1 minute ago

QuinnieLiu completed ~835d67f

Status: In progress

Total duration: -

Artifacts: -

frontend-cd.yml

on: workflow_run

deploy_frontend 55s

Deploying to Production

AKS workloads

The screenshot shows the Microsoft Azure portal interface. The top navigation bar includes tabs for 'Azure Command', 'Create Your Azur...', 'sit722-week08...', 'CD - Deploy Bac...', 'CD - Deploy Fron...', '4.237.165.90:80...', '4.237.237.97:80...', and a plus sign icon. The main title is 'sit722-week08-aks | Workloads'. The left sidebar has sections like Overview, Activity log, Access control (IAM), Tags, Monitor, Diagnose and solve problems, Microsoft Defender for Cloud, Cost analysis, Resource visualizer, Kubernetes resources, Namespaces, Workloads, Services and ingresses, Storage, Configuration, Custom resources, Events, Run command, and Settings. The 'Workloads' section is currently selected. The main content area displays a table of Deployments:

Name	Namespace	Ready	Age	CPU	Memory
coredns	kube-system	2/2	1 hour	Enable metrics	
coredns-autoscaler	kube-system	1/1	1 hour		
konnectivity-agent	kube-system	2/2	1 hour		
konnectivity-agent-autoscaler	kube-system	1/1	1 hour		
metrics-server	kube-system	2/2	1 hour		
product-db-deployment-w08e1	default	1/1	12 minutes		
order-db-deployment-w08e1	default	1/1	12 minutes		
product-service-w08e1	default	1/1	12 minutes		
order-service-w08e1	default	1/1	12 minutes		
frontend	default	1/1	2 minutes		

visit frontend

The screenshot shows a browser window with the URL 'Not Secure 104.209.81.9'. The page title is 'E-commerce Application (Week 08)'. The main content area displays a 'Product Management' form with fields for 'Add New Product' (Name, Price, Stock Quantity), 'Description', and a large text area. A blue button at the bottom says 'Add Product'. To the right of the browser window is a developer tools Network tab. The Network tab shows a timeline with several requests and their details:

Name	Status	Type	Initiator	Size	Time
104.209.81.9	200	docu...	Other	13.1 ...	35 ms
main.js	200	script	(index):7	20.2...	28 ms
products/	200	fetch	main.js:55	0.2 kB	67 ms
orders/	200	fetch	main.js:312	0.2 kB	68 ms

At the bottom of the Network tab, it says 'Attempting to fetch products from URL: http://4.237.165.90:8000/products/'. The developer tools also show tabs for Elements, Console, Network, and other developer features.

all workflow runs

The screenshot shows a GitHub Actions interface with a sidebar on the left and a main content area on the right.

Actions Sidebar:

- New workflow
- All workflows (selected)
- Backend CI - Test, Build and Push Image...
- CD - Deploy Backend Services to AKS
- CD - Deploy Frontend to AKS
- Frontend CI - Build & Push Image
- PR Validation - Test & Build
- Management
 - Caches
 - Deployments
 - Attestations
 - Runners
 - Usage metrics
 - Performance metrics

Main Content Area:

24 workflow runs

Event	Status	Branch	Actor
CD - Deploy Frontend to AKS	Completed	main	QuinnieLiu
Merge pull request #4 from QuinnieLiu/development	Completed	main	QuinnieLiu
Deploy frontend	Completed	development	QuinnieLiu
Deploy frontend	Completed	development	QuinnieLiu
CD - Deploy Backend Services to AKS	Completed	main	QuinnieLiu
Merge pull request #3 from QuinnieLiu/development	Completed	main	QuinnieLiu
Deploy backend	Completed	development	QuinnieLiu
Deploy backend	Completed	development	QuinnieLiu
Fix workflow	Completed	development	QuinnieLiu

References

1. <https://docs.github.com/en/actions>
2. <https://docs.github.com/en/actions/security-guides/security-hardening-for-github-actions>
3. Laster, B. & Dunn, J. C. (2023). *Learning GitHub Actions: Automation and Integration of CI/CD with GitHub*. O'Reilly Media.
4. Kaufmann, M., Bos, R., de Vries, M., & Hanselman, S. (2025). *Github Actions in Action: Continuous Integration and Delivery for DevOps*. Manning Publications.
5. <https://docs.microsoft.com/en-us/azure/devops/learn/>