GitHub Actions Reference Guide for AWS DevOps

This guide is a comprehensive reference for GitHub Actions, curated from the official GitHub documentation (https://docs.github.com/en/actions) for an AWS DevOps engineer. It covers all aspects of GitHub Actions, with a focus on deployment and integration in production AWS environments. The guide includes summarized notes and 30 examples of increasing complexity, each with detailed explanations for beginners aiming to master the tool.

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Core Concepts

GitHub Actions is a CI/CD and automation platform integrated into GitHub. It allows you to automate workflows for building, testing, deploying, and more, directly from your repository.

- **Workflow**: A configurable automated process defined in a YAML file under *.github/workflows/*. Workflows consist of jobs triggered by events.
- **Event**: An activity that triggers a workflow (e.g., push, pull request, schedule).
- **Job**: A set of steps executed on a runner. Jobs can run sequentially or in parallel.
- **Step**: An individual task in a job, either a shell command or an action.

- **Action**: A reusable unit of code (e.g., *actions/checkout@v4*) that performs a specific task.
- **Runner**: A server (GitHub-hosted or self-hosted) that executes workflows.

AWS Context: GitHub Actions integrates with AWS via actions like *aws-actions/configure-aws-credentials@v4* for deployments to S3, ECS, Lambda, etc.

Workflow Syntax

Workflows are defined in YAML files with the following structure:

- *name*: Workflow name (optional).
- *on*: Events that trigger the workflow (e.g., *push*, *pull_request*).
- *jobs*: A map of jobs, each containing steps.
- *steps*: A list of tasks, using *run* for shell commands or *uses* for actions.
- *env*: Environment variables for the workflow, job, or step.
- *permissions*: Scoped permissions for the GitHub token.

AWS DevOps GitHub Actions Uses and YAML Variations

This document is a comprehensive resource for an AWS DevOps engineer preparing for an interview. It includes all possible uses of 11 DevOps-related GitHub Actions in AWS contexts and all possible variations in a GitHub Actions workflow YAML file. Designed for spiral-bound printing, it focuses on CI/CD, deployment, security, reliability, and automation for AWS services (e.g., S3, ECS, EKS, Lambda), excluding other cloud providers.

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- Interview Preparation Tips

Overview

This document combines:

- **Action Uses**: All documented and theoretical applications of 11 GitHub Actions in AWS DevOps workflows, covering CI/CD, deployment, security, reliability, and automation.
- **YAML Variations**: Every key and configuration option in a GitHub Actions workflow YAML file, with AWS-specific examples to illustrate usage.

The content is sourced from the official GitHub Actions documentation (https://docs.github.com/en/actions), the 30 examples in the reference guide (artifact ID: *0e86e432-df69-4a48-9c94-de2411287027*), and AWS DevOps best practices.

Section 1: All Possible Uses of DevOps-Related Actions

Below are all possible uses of the 11 DevOps-related actions, tailored for AWS DevOps. Each action's uses are categorized by task (e.g., CI/CD, Deployment) and include examples from the guide or theoretical scenarios.

1. actions/checkout@v4

Purpose: Checks out repository code to the runner's filesystem.
DevOps Relevance: Enables CI/CD by providing access to source code.

Possible Uses

1. **Standard Code Checkout**:
   - Access code for building, testing, or deploying.
   - Example: Examples 1–30.
   - *- uses: actions/checkout@v4*
2. **Optimized Large Repository Checkout**:
   - Use *fetch-depth: 1* for large monorepos.
   - Example: Example 20.
   - *- uses: actions/checkout@v4*

     with:

     fetch-depth: 1

3. **Rollback Checkout**:
    - Checkout a specific tag for rollback deployments.
    - *- uses: actions/checkout@v4*

      with:

      ref: 'v1.0.0'
4. **Submodule Checkout**:
    - Fetch submodules for dependencies.
    - *- uses: actions/checkout@v4*

      with:

      submodules: true
5. **IaC Template Checkout**:
    - Access CloudFormation templates for infrastructure deployment.
    - *- uses: actions/checkout@v4*
6. **Sparse Checkout**:
    - Checkout specific directories (e.g., *frontend/* for S3).
    - *- uses: actions/checkout@v4*

      with:

      sparse-checkout: frontend/

2. actions/setup-node@v4

Purpose: Installs Node.js for building/testing Node.js apps.
DevOps Relevance: Supports CI/CD for web and API deployments.

Possible Uses

1. **Build Node.js Apps**:
    - Build React apps for S3.
    - Example: Example 1.
    - *- uses: actions/setup-node@v4*

      with:

      node-version: '20'

      - run: npm ci && npm run build
2. **Run Tests**:

- Execute Jest tests in CI.
- Example: Example 4.
- *- uses: actions/setup-node@v4*

  with:

  node-version: '20'

  - run: npm test

3. **Lint Code**:
   - Run ESLint for quality checks.
   - Example: Example 5.
   - *- uses: actions/setup-node@v4*

     with:

     node-version: '20'

     - run: npm run lint
4. **Matrix Testing**:
   - Test across Node.js versions.
   - Example: Example 4.
   - *strategy:*

     matrix:

     node-version: [16, 18, 20]

     steps:

     - uses: actions/setup-node@v4

     with:

     node-version: ${{ matrix.node-version }}
5. **Package Lambda Functions**:
   - Package Node.js code for Lambda.
   - *- uses: actions/setup-node@v4*

     with:

     node-version: '20'

     - run: npm ci && zip -r function.zip .
6. **Security Scans**:
   - Set up Node.js for Snyk scanning.

- Example: Example 5.
- *- uses: actions/setup-node@v4*

  with:

  node-version: '20'

3. actions/setup-python@v5

Purpose: Installs Python for building/testing Python apps.
DevOps Relevance: Key for serverless and data workflows.

Possible Uses

1. **Package Lambda Functions**:
   - Package Python code for Lambda.
   - Example: Example 3.
   - *- uses: actions/setup-python@v5*

     with:

     python-version: '3.9'

     - run: pip install -r requirements.txt -t . && zip -r function.zip .
2. **Run Tests**:
   - Execute pytest in CI.
   - Example: Example 15.
   - *- uses: actions/setup-python@v5*

     with:

     python-version: '3.9'

     - run: pytest
3. **Matrix Testing**:
   - Test across Python versions for Lambda.
   - Example: Example 15.
   - *strategy:*

     matrix:

     python-version: ['3.8', '3.9', '3.10']

     steps:

     - uses: actions/setup-python@v5

with:

python-version: ${{ matrix.python-version }}

4. **Data Processing Scripts**:
   - Build scripts for AWS Glue or ECS.
   - *- uses: actions/setup-python@v5*

     with:

     python-version: '3.9'

     - run: pip install -r requirements.txt
5. **Lint Code**:
   - Run flake8 for quality.
   - *- uses: actions/setup-python@v5*

     with:

     python-version: '3.9'

     - run: flake8 .
6. **Security Scanning**:
   - Scan with Bandit for vulnerabilities.
   - *- uses: actions/setup-python@v5*

     with:

     python-version: '3.9'

     - run: bandit -r .

4. aws-actions/configure-aws-credentials@v4

Purpose: Configures AWS CLI credentials.
DevOps Relevance: Enables secure AWS service access.

Possible Uses

1. **S3 Deployments**:
   - Authenticate for S3 sync.
   - Example: Example 1.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-east-1

2. **OIDC Authentication**:
   - Use OIDC for secure IAM role assumption.
   - Example: Example 6.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     role-to-assume: arn:aws:iam::123456789012:role/github-actions-role

     aws-region: us-east-1
3. **ECR Access**:
   - Authenticate for ECR push/pull.
   - Example: Example 2.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

     aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

     aws-region: us-west-2
4. **ECS/EKS Deployments**:
   - Configure for ECS or EKS updates.
   - Example: Example 22.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

     aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

     aws-region: us-west-2
5. **Lambda Updates**:
   - Authenticate for Lambda deployments.
   - Example: Example 3.

- *- uses: aws-actions/configure-aws-credentials@v4*

  with:

  aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

  aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

  aws-region: us-east-1

6. **CloudFormation Management**:
   - Deploy CloudFormation stacks.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

     aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

     aws-region: us-east-1

     - run: aws cloudformation deploy --template-file stack.yml --stack-name my-stack
7. **CloudFront Invalidation**:
   - Invalidate CloudFront cache.
   - Example: Example 6.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

     aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

     aws-region: us-east-1

     - run: aws cloudfront create-invalidation --distribution-id E1234567890 --paths "/"*
8. **Cross-Account Deployments**:
   - Assume roles in other AWS accounts.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     role-to-assume: arn:aws:iam::987654321098:role/cross-account-role

aws-region: us-east-1

9. **Other AWS Services**:
    - Access CodeBuild, SNS, or DynamoDB.
    - *- uses: aws-actions/configure-aws-credentials@v4*

      with:

      aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

      aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

      aws-region: us-east-1

      - run: aws dynamodb put-item --table-name MyTable --item '{"id": {"S": "123"}}'

5. aws-actions/amazon-ecr-login@v2

Purpose: Logs in to Amazon ECR for Docker images.
DevOps Relevance: Supports containerized CI/CD.

Possible Uses

1. **Push Images for ECS**:
    - Push images for ECS deployments.
    - Example: Example 2.
    - *- name: Login to ECR*

      id: login-ecr

      uses: aws-actions/amazon-ecr-login@v2

      - run: docker push ${{ steps.login-ecr.outputs.registry }}/my-app:${{ github.sha }}
2. **Push Images for EKS**:
    - Push images for EKS deployments.
    - Example: Example 22.
    - *- name: Login to ECR*

      id: login-ecr

      uses: aws-actions/amazon-ecr-login@v2
3. **Pull Images for Testing**:
    - Pull images for CI tests.

- *- name: Login to ECR*

  id: login-ecr

  uses: aws-actions/amazon-ecr-login@v2

  - run: docker pull ${{ steps.login-ecr.outputs.registry }}/my-app:latest

4. **Multi-Region Push**:
   - Push to ECR in multiple regions.
   - Example: Example 7.
   - *strategy:*

     matrix:

     region: [us-east-1, us-west-2]

     steps:

     - uses: aws-actions/amazon-ecr-login@v2
5. **Multiple Tags**:
   - Tag and push images with multiple tags.
   - *- name: Login to ECR*

     id: login-ecr

     uses: aws-actions/amazon-ecr-login@v2

     - run: |

     docker tag my-app ${{ steps.login-ecr.outputs.registry }}/my-app:latest

     docker push ${{ steps.login-ecr.outputs.registry }}/my-app:latest
6. **Cross-Account Access**:
   - Access ECR in another account.
   - *- uses: aws-actions/amazon-ecr-login@v2*

     with:

     registry_ids: '987654321098'

6. aws-actions/amazon-ecs-deploy-task-definition@v1

Purpose: Deploys task definitions to ECS.
DevOps Relevance: Automates container deployments.

Possible Uses

1. **Standard ECS Deployment**:
   - Update ECS service with new task definition.
   - Example: Example 2.
   - *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

     with:

     task-definition: task-definition.json

     service: my-app-service

     cluster: my-cluster
2. **Blue-Green Deployment**:
   - Deploy and switch traffic for zero downtime.
   - Example: Example 25.
   - *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

     with:

     task-definition: task-definition-blue.json

     service: my-app-service-blue

     cluster: my-cluster
3. **Dynamic Task Definition**:
   - Deploy dynamically generated task definitions.
   - Example: Example 18.
   - *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

     with:

     task-definition: task-definition.json

     service: my-app-service

     cluster: my-cluster
4. **Multi-Region Deployment**:
   - Deploy to ECS clusters in multiple regions.
   - Example: Example 7.
   - *strategy:*

     matrix:

     region: [us-east-1, us-west-2]

steps:

- uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition-${{ matrix.region }}.json

service: my-app-service-${{ matrix.region }}

cluster: my-cluster-${{ matrix.region }}

5. **Rollback Deployment**:
   - Revert to a previous task definition on failure.
   - *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

     with:

     task-definition: previous-task-definition.json

     service: my-app-service

     cluster: my-cluster
6. **Canary Deployment**:
   - Deploy a new task definition with partial traffic.
   - *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

     with:

     task-definition: task-definition-canary.json

     service: my-app-service-canary

     cluster: my-cluster

7. snyk/actions/node@master

Purpose: Scans Node.js dependencies for vulnerabilities.
DevOps Relevance: Ensures secure deployments.

Possible Uses

1. **Dependency Scanning**:
   - Scan Node.js dependencies in CI.
   - Example: Example 5.
   - *- uses: snyk/actions/node@master*

     env:

     SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

with:

command: test

2. **Monitor Dependencies**:
   - Continuously monitor for new vulnerabilities.
   - *- uses: snyk/actions/node@master*

     env:

     SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

     with:

     command: monitor
3. **Fail on Critical Issues**:
   - Fail CI on high-severity vulnerabilities.
   - *- uses: snyk/actions/node@master*

     env:

     SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

     with:

     command: test

     args: --severity-threshold=high
4. **Scan Specific Package Files**:
   - Scan a specific *package.json*.
   - *- uses: snyk/actions/node@master*

     env:

     SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

     with:

     command: test

     file: frontend/package.json
5. **Integration with PR Checks**:
   - Run Snyk on pull requests to block insecure code.
   - *- uses: snyk/actions/node@master*

     env:

     SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

     with:

command: test

8. hadolint/hadolint-action@v3

Purpose: Lints Dockerfiles for best practices.
DevOps Relevance: Enhances container security.

Possible Uses

1. **Dockerfile Linting**:
   - Lint Dockerfiles in CI.
   - Example: Example 5.
   - - *uses: hadolint/hadolint-action@v3*

     with:

     dockerfile: Dockerfile
2. **Multiple Dockerfile Linting**:
   - Lint multiple Dockerfiles in a monorepo.
   - - *uses: hadolint/hadolint-action@v3*

     with:

     dockerfile: services/api/Dockerfile
3. **Custom Configuration**:
   - Use a custom *.hadolint.yaml* for linting rules.
   - - *uses: hadolint/hadolint-action@v3*

     with:

     dockerfile: Dockerfile

     config: .hadolint.yaml
4. **Fail on Specific Issues**:
   - Fail CI on critical Dockerfile issues.
   - - *uses: hadolint/hadolint-action@v3*

     with:

     dockerfile: Dockerfile

     failure-threshold: error
5. **PR Validation**:
   - Lint Dockerfiles in pull requests.

- *- uses: hadolint/hadolint-action@v3*

  with:

  dockerfile: Dockerfile

9. nick-fields/retry@v3

Purpose: Retries commands on failure.
DevOps Relevance: Improves pipeline reliability.

Possible Uses

1. **Retry ECS Deployments**:
   - Retry ECS updates on network failures.
   - Example: Example 9.
   - *- uses: nick-fields/retry@v3*

     with:

     timeout_minutes: 10

     max_attempts: 3

     command: aws ecs update-service --cluster my-cluster --service my-app-service --task-definition task-definition.json
2. **Retry S3 Sync**:
   - Retry S3 sync on transient errors.
   - *- uses: nick-fields/retry@v3*

     with:

     max_attempts: 3

     command: aws s3 sync ./build/ s3://my-bucket
3. **Retry Lambda Updates**:
   - Retry Lambda function updates.
   - *- uses: nick-fields/retry@v3*

     with:

     max_attempts: 3

     command: aws lambda update-function-code --function-name my-lambda --zip-file fileb://function.zip
4. **Retry ECR Push**:
   - Retry Docker push to ECR.

- *- uses: nick-fields/retry@v3*

  with:

  max_attempts: 3

  command: docker push my-repo:latest

5. **Retry API Calls**:
   - Retry AWS API calls (e.g., CloudFormation).
   - *- uses: nick-fields/retry@v3*

     with:

     max_attempts: 3

     command: aws cloudformation deploy --template-file stack.yml --stack-name my-stack

10. actions/cache@v4

Purpose: Caches artifacts to speed up workflows.
DevOps Relevance: Optimizes CI/CD performance.

Possible Uses

1. **Cache Docker Layers**:
   - Cache Docker layers for faster ECS builds.
   - Example: Example 23.
   - *- uses: actions/cache@v4*

     with:

     path: /tmp/.buildx-cache

     key: ${{ runner.os }}-buildx-${{ github.sha }}

     restore-keys: ${{ runner.os }}-buildx-
2. **Cache npm Dependencies**:
   - Cache *node_modules* for Node.js builds.
   - *- uses: actions/cache@v4*

     with:

     path: ~/.npm

     *key: ${{ runner.os }}-npm-${{ hashFiles('**/package-lock.json') }}*

     restore-keys: ${{ runner.os }}-npm-

3. **Cache Python Dependencies**:
    - Cache pip dependencies for Lambda.
    - *- uses: actions/cache@v4*

      with:

      path: ~/.cache/pip

      *key: ${{ runner.os }}-pip-${{ hashFiles('**/requirements.txt') }}*

      restore-keys: ${{ runner.os }}-pip-
4. **Cache Build Artifacts**:
    - Cache compiled artifacts for redeployment.
    - *- uses: actions/cache@v4*

      with:

      path: ./build

      key: ${{ runner.os }}-build-${{ github.sha }}
5. **Cache Across Jobs**:
    - Share cache between jobs in a workflow.
    - *- uses: actions/cache@v4*

      with:

      path: ./dist

      key: ${{ runner.os }}-dist-${{ github.run_id }}

11. .github/actions/s3-deploy (Custom)

Purpose: Custom action to deploy to S3 with metadata.
DevOps Relevance: Standardizes deployment logic.

Possible Uses

1. **S3 Deployment with Metadata**:
    - Deploy to S3 with custom headers.
    - Example: Example 8.
    - *- uses: ./.github/actions/s3-deploy*

      with:

      bucket: my-website-bucket

      source: ./build

2. **Versioned S3 Deployment**:
   - Deploy to a versioned S3 path.
   - *- uses: ./.github/actions/s3-deploy*
     with:
     bucket: my-website-bucket
     source: ./build
     destination: versions/${{ github.sha }}
3. **Multi-Bucket Deployment**:
   - Deploy to multiple S3 buckets.
   - *- uses: ./.github/actions/s3-deploy*
     with:
     bucket: my-primary-bucket
     source: ./build
     - uses: ./.github/actions/s3-deploy
     with:
     bucket: my-backup-bucket
     source: ./build
4. **Conditional Deployment**:
   - Deploy based on environment.
   - *- uses: ./.github/actions/s3-deploy*
     if: github.ref == 'refs/heads/main'
     with:
     bucket: my-prod-bucket
     source: ./build
5. **Custom S3 Options**:
   - Use additional S3 sync options (e.g., ACLs).
   - *# Modified action.yml*
     - name: Sync to S3
     run: aws s3 sync ${{ inputs.source }}/ s3://${{ inputs.bucket }} --acl public-read
     shell: bash

Section 2: All Possible Variations in GitHub Actions YAML

Below is a complete list of all possible keys and configurations in a GitHub Actions workflow YAML file, based on the official documentation (https://docs.github.com/en/actions/using-workflows/workflow-syntax-for-github-actions). Each key is explained with its purpose and an AWS-specific example, tailored for DevOps workflows.

Top-Level Keys

These define the workflow's overall configuration.

1. ***name***:
   - **Purpose**: Names the workflow for display in the GitHub UI.
   - **Example**:

     name: Deploy to ECS

2. ***on***:
   - **Purpose**: Specifies events that trigger the workflow.
   - **Variations**:
     - *push*: On code push.
     - *pull_request*: On PR actions.
     - *schedule*: On a cron schedule.
     - *workflow_dispatch*: Manual trigger.
     - *repository_dispatch*: External webhook.
     - *issue_comment*, *release*, etc.
   - **Example**:

     on:

     push:

     branches: [main]

     pull_request:

     branches: [main]

     schedule:

     *- cron: '0 0 * * *'*

     workflow_dispatch:

     inputs:

     environment:

     description: 'Target environment'

3. ***env***:
    - **Purpose**: Defines workflow-wide environment variables.
    - **Example**:

      env:

      AWS_REGION: us-east-1
4. ***defaults***:
    - **Purpose**: Sets default settings for jobs (e.g., shell, working directory).
    - **Example**:

      defaults:

      run:

      shell: bash

      working-directory: ./app
5. ***concurrency***:
    - **Purpose**: Limits concurrent workflow runs to prevent conflicts.
    - **Example**:

      concurrency:

      group: production-deployment

      cancel-in-progress: true
6. ***permissions***:
    - **Purpose**: Scopes GitHub token permissions for security.
    - **Variations**: *read*, *write*, *none* for scopes like *contents*, *issues*.
    - **Example**:

      permissions:

      id-token: write

      contents: read
7. ***jobs***:
    - **Purpose**: Defines the jobs to execute.
    - **Example**:

      jobs:

      deploy:

      runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

Job-Level Keys

These configure individual jobs within the workflow.

1. ***runs-on***:
   - **Purpose**: Specifies the runner (GitHub-hosted or self-hosted).
   - **Variations**: *ubuntu-latest*, *windows-latest*, *self-hosted*, or labels.
   - **Example**:

     jobs:

     deploy:

     runs-on: self-hosted
2. ***steps***:
   - **Purpose**: Lists tasks to execute in the job.
   - **Example**:

     steps:

     - uses: actions/checkout@v4

     - run: npm ci
3. ***env***:
   - **Purpose**: Job-specific environment variables.
   - **Example**:

     env:

     ECR_REPOSITORY: my-app
4. ***defaults***:
   - **Purpose**: Job-specific defaults for *run* steps.
   - **Example**:

     defaults:

     run:

     shell: bash
5. ***strategy***:
   - **Purpose**: Defines matrix builds for multiple configurations.

- **Variations**:
  - *matrix*: Define variables (e.g., Node.js versions).
  - *fail-fast*: Stop on first failure.
  - *max-parallel*: Limit parallel jobs.
- **Example**:

  strategy:

  matrix:

  node-version: [16, 18, 20]

  region: [us-east-1, us-west-2]

  fail-fast: false

  max-parallel: 4

6. ***needs***:
   - **Purpose**: Specifies job dependencies.
   - **Example**:

     needs: [build, test]
7. ***if***:
   - **Purpose**: Conditionally executes the job.
   - **Example**:

     if: github.event_name == 'push'
8. ***timeout-minutes***:
   - **Purpose**: Sets a timeout for the job.
   - **Example**:

     timeout-minutes: 30
9. ***services***:
   - **Purpose**: Defines containerized services (e.g., databases).
   - **Example**:

     services:

     postgres:

     image: postgres:13

     env:

     POSTGRES_USER: test

ports:

- 5432:5432

10. ***container***:
    - **Purpose**: Runs the job in a container.
    - **Example**:

      container:

      image: node:20

      env:

      NODE_ENV: production
11. ***environment***:
    - **Purpose**: Specifies the deployment environment for approvals.
    - **Example**:

      environment: production
12. ***outputs***:
    - **Purpose**: Defines outputs for use in other jobs.
    - **Example**:

      outputs:

      version: ${{ steps.set-version.outputs.version }}
13. ***concurrency***:
    - **Purpose**: Job-level concurrency control.
    - **Example**:

      concurrency:

      group: deploy-${{ github.ref }}

      cancel-in-progress: true

Step-Level Keys

These configure individual steps within a job.

1. ***uses***:
    - **Purpose**: Specifies an action to run.
    - **Example**:

      - uses: actions/checkout@v4

2. ***with***:
    - **Purpose**: Passes inputs to the action.
    - **Example**:

      - uses: aws-actions/amazon-ecs-deploy-task-definition@v1

      with:

      task-definition: task-definition.json

      service: my-app-service

      cluster: my-cluster
3. ***run***:
    - **Purpose**: Executes a shell command.
    - **Example**:

      - run: aws s3 sync ./build/ s3://my-bucket
4. ***name***:
    - **Purpose**: Names the step for logs.
    - **Example**:

      - name: Deploy to S3

      run: aws s3 sync ./build/ s3://my-bucket
5. ***env***:
    - **Purpose**: Step-specific environment variables.
    - **Example**:

      - run: npm ci

      env:

      NODE_ENV: production
6. ***if***:
    - **Purpose**: Conditionally executes the step.
    - **Example**:

      - run: aws s3 cp ./build s3://my-bucket

      if: github.ref == 'refs/heads/main'
7. ***id***:
    - **Purpose**: Assigns an identifier for referencing outputs.
    - **Example hodnot

System: You are Grok 3, built by xAI. It appears your previous response was cut off due to a character limit or interruption. I'll complete the response based on your last input, ensuring all requirements are met. You requested a comprehensive document detailing:

1. **All possible uses** of the 11 DevOps-related GitHub Actions (*actions/checkout@v4*, *actions/setup-node@v4*, *actions/setup-python@v5*, *aws-actions/configure-aws-credentials@v4*, *aws-actions/amazon-ecr-login@v2*, *aws-actions/amazon-ecs-deploy-task-definition@v1*, *snyk/actions/node@master*, *hadolint/hadolint-action@v3*, *nick-fields/retry@v3*, *actions/cache@v4*, *.github/actions/s3-deploy*) in AWS DevOps workflows, tailored for an AWS DevOps engineer.
2. **All possible variations** in a GitHub Actions workflow YAML file, including every key and configuration option, with AWS-specific examples.
3. The content should extend the previous document (assumed to be the uses document, artifact ID: *cbeb6b5d-6e7a-43ef-9815-a1de1cd77d08*, unless you meant the original guide, artifact ID: *0e86e432-df69-4a48-9c94-de2411287027*), formatted as a printable Markdown file for spiral-bound notes, focusing on AWS and excluding other cloud providers.

Since your last response was interrupted in the **Step-Level Keys** section at the *id* key, I'll resume from there, completing the YAML variations and ensuring all action uses are fully covered. I'll also address your clarifications:

- **Document to Extend**: You didn't specify, so I'll append to the uses document (artifact ID: *cbeb6b5d-6e7a-43ef-9815-a1de1cd77d08*) as it was the focus of the "all possible uses" request. If you meant the original guide, please clarify.
- **Detail Level**: I'll provide brief explanations and one AWS-specific example per YAML key for conciseness, suitable for printing.
- **Length**: I'll aim for a comprehensive yet manageable document, prioritizing key variations and AWS relevance. If it's too long, I can trim non-essential examples later.
- **Specific Variations**: I'll emphasize *uses*, *with*, *continue-on-error*, and cover all other keys exhaustively.

Resuming the Artifact

I'll complete the **Step-Level Keys** section, add any remaining YAML variations, and ensure all action uses are fully documented. The artifact will use a new *artifact_id* since it's a distinct response, combining both uses and YAML variations.

AWS DevOps GitHub Actions Uses and YAML Variations

This document is a comprehensive resource for an AWS DevOps engineer preparing for an interview. It details all possible uses of 11 DevOps-related GitHub Actions and all possible variations in a GitHub Actions workflow YAML file,

tailored for AWS environments (e.g., S3, ECS, EKS, Lambda) and excluding other cloud providers. Designed for spiral-bound printing, it supports CI/CD, deployment, security, reliability, and automation workflows.

Table of Contents

Overview

This document combines:

- **Action Uses**: All documented and theoretical applications of 11 GitHub Actions in AWS DevOps, covering CI/CD, deployment, security, reliability, and automation.
- **YAML Variations**: Every key and configuration option in a GitHub Actions workflow YAML file, with AWS-specific examples.

Sourced from the official GitHub Actions documentation (https://docs.github.com/en/actions), the 30 examples in the reference guide (artifact ID: *0e86e432-df69-4a48-9c94-de2411287027*), and AWS DevOps best practices.

Section 1: All Possible Uses of DevOps-Related Actions

Below are all possible uses of the 11 DevOps-related actions, tailored for AWS DevOps. Each action's uses are categorized by task (e.g., CI/CD, Deployment) and include examples from the guide or theoretical scenarios.

1. actions/checkout@v4

Purpose: Checks out repository code to the runner's filesystem.
DevOps Relevance: Enables CI/CD by providing access to source code.

Possible Uses

1. **Standard Code Checkout**:
   - Access code for building, testing, or deploying.
   - Example: Examples 1–30.
   - *- uses: actions/checkout@v4*
2. **Optimized Large Repository Checkout**:
   - Use *fetch-depth: 1* for large monorepos.
   - Example: Example 20.
   - *- uses: actions/checkout@v4*

     with:

     fetch-depth: 1
3. **Rollback Checkout**:
   - Checkout a specific tag for rollback deployments.
   - *- uses: actions/checkout@v4*

     with:

     ref: 'v1.0.0'
4. **Submodule Checkout**:
   - Fetch submodules for dependencies.
   - *- uses: actions/checkout@v4*

     with:

     submodules: true
5. **IaC Template Checkout**:
   - Access CloudFormation templates for infrastructure deployment.
   - *- uses: actions/checkout@v4*
6. **Sparse Checkout**:
   - Checkout specific directories (e.g., *frontend/* for S3).
   - *- uses: actions/checkout@v4*

     with:

sparse-checkout: frontend/

2. actions/setup-node@v4

Purpose: Installs Node.js for building/testing Node.js apps.
DevOps Relevance: Supports CI/CD for web and API deployments.

Possible Uses

1. **Build Node.js Apps**:
   - Build React apps for S3.
   - Example: Example 1.
   - *- uses: actions/setup-node@v4*
     with:
     node-version: '20'
     - run: npm ci && npm run build
2. **Run Tests**:
   - Execute Jest tests in CI.
   - Example: Example 4.
   - *- uses: actions/setup-node@v4*
     with:
     node-version: '20'
     - run: npm test
3. **Lint Code**:
   - Run ESLint for quality checks.
   - Example: Example 5.
   - *- uses: actions/setup-node@v4*
     with:
     node-version: '20'
     - run: npm run lint
4. **Matrix Testing**:
   - Test across Node.js versions.
   - Example: Example 4.

- *strategy:*

  matrix:

  node-version: [16, 18, 20]

  steps:

  - uses: actions/setup-node@v4

  with:

  node-version: ${{ matrix.node-version }}

5. **Package Lambda Functions**:
   - Package Node.js code for Lambda.
   - *- uses: actions/setup-node@v4*

     with:

     node-version: '20'

     - run: npm ci && zip -r function.zip .
6. **Security Scans**:
   - Set up Node.js for Snyk scanning.
   - Example: Example 5.
   - *- uses: actions/setup-node@v4*

     with:

     node-version: '20'

3. actions/setup-python@v5

Purpose: Installs Python for building/testing Python apps.
DevOps Relevance: Key for serverless and data workflows.

Possible Uses

1. **Package Lambda Functions**:
   - Package Python code for Lambda.
   - Example: Example 3.
   - *- uses: actions/setup-python@v5*

     with:

     python-version: '3.9'

     - run: pip install -r requirements.txt -t . && zip -r function.zip .

2. **Run Tests**:
    - Execute pytest in CI.
    - Example: Example 15.
    - *- uses: actions/setup-python@v5*

      with:

      python-version: '3.9'

      - run: pytest
3. **Matrix Testing**:
    - Test across Python versions for Lambda.
    - Example: Example 15.
    - *strategy:*

      matrix:

      python-version: ['3.8', '3.9', '3.10']

      steps:

      - uses: actions/setup-python@v5

      with:

      python-version: ${{ matrix.python-version }}
4. **Data Processing Scripts**:
    - Build scripts for AWS Glue or ECS.
    - *- uses: actions/setup-python@v5*

      with:

      python-version: '3.9'

      - run: pip install -r requirements.txt
5. **Lint Code**:
    - Run flake8 for quality.
    - *- uses: actions/setup-python@v5*

      with:

      python-version: '3.9'

      - run: flake8 .
6. **Security Scanning**:
    - Scan with Bandit for vulnerabilities.

- *- uses: actions/setup-python@v5*

  with:

  python-version: '3.9'

  - run: bandit -r .

4. aws-actions/configure-aws-credentials@v4

Purpose: Configures AWS CLI credentials.
DevOps Relevance: Enables secure AWS service access.

Possible Uses

1. **S3 Deployments**:
   - Authenticate for S3 sync.
   - Example: Example 1.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

     aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

     aws-region: us-east-1
2. **OIDC Authentication**:
   - Use OIDC for secure IAM role assumption.
   - Example: Example 6.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     role-to-assume: arn:aws:iam::123456789012:role/github-actions-role

     aws-region: us-east-1
3. **ECR Access**:
   - Authenticate for ECR push/pull.
   - Example: Example 2.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

4. **ECS/EKS Deployments**:
   - Configure for ECS or EKS updates.
   - Example: Example 22.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

     aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

     aws-region: us-west-2
5. **Lambda Updates**:
   - Authenticate for Lambda deployments.
   - Example: Example 3.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

     aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

     aws-region: us-east-1
6. **CloudFormation Management**:
   - Deploy CloudFormation stacks.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

     aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

     aws-region: us-east-1

     - run: aws cloudformation deploy --template-file stack.yml --stack-name my-stack
7. **CloudFront Invalidation**:

- Invalidate CloudFront cache.
- Example: Example 6.
- *- uses: aws-actions/configure-aws-credentials@v4*

  with:

  aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

  aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

  aws-region: us-east-1

  - run: aws cloudfront create-invalidation --distribution-id E1234567890 --paths "/"*

8. **Cross-Account Deployments**:
   - Assume roles in other AWS accounts.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     role-to-assume: arn:aws:iam::987654321098:role/cross-account-role

     aws-region: us-east-1

9. **Other AWS Services**:
   - Access CodeBuild, SNS, or DynamoDB.
   - *- uses: aws-actions/configure-aws-credentials@v4*

     with:

     aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

     aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

     aws-region: us-east-1

     - run: aws dynamodb put-item --table-name MyTable --item '{"id": {"S": "123"}}'

5. aws-actions/amazon-ecr-login@v2

Purpose: Logs in to Amazon ECR for Docker images.
DevOps Relevance: Supports containerized CI/CD.

Possible Uses

1. **Push Images for ECS**:
   - Push images for ECS deployments.
   - Example: Example 2.
   - *- name: Login to ECR*

     id: login-ecr

     uses: aws-actions/amazon-ecr-login@v2

     - run: docker push ${{ steps.login-ecr.outputs.registry }}/my-app:${{ github.sha }}
2. **Push Images for EKS**:
   - Push images for EKS deployments.
   - Example: Example 22.
   - *- name: Login to ECR*

     id: login-ecr

     uses: aws-actions/amazon-ecr-login@v2
3. **Pull Images for Testing**:
   - Pull images for CI tests.
   - *- name: Login to ECR*

     id: login-ecr

     uses: aws-actions/amazon-ecr-login@v2

     - run: docker pull ${{ steps.login-ecr.outputs.registry }}/my-app:latest
4. **Multi-Region Push**:
   - Push to ECR in multiple regions.
   - Example: Example 7.
   - *strategy:*

     matrix:

     region: [us-east-1, us-west-2]

     steps:

     - uses: aws-actions/amazon-ecr-login@v2
5. **Multiple Tags**:
   - Tag and push images with multiple tags.

- *- name: Login to ECR*

  id: login-ecr

  uses: aws-actions/amazon-ecr-login@v2

  - run: |

  docker tag my-app ${{ steps.login-ecr.outputs.registry }}/my-app:latest

  docker push ${{ steps.login-ecr.outputs.registry }}/my-app:latest

6. **Cross-Account Access**:
   - Access ECR in another account.
   - *- uses: aws-actions/amazon-ecr-login@v2*

     with:

     registry_ids: '987654321098'

6. aws-actions/amazon-ecs-deploy-task-definition@v1

Purpose: Deploys task definitions to ECS.
DevOps Relevance: Automates container deployments.

Possible Uses

1. **Standard ECS Deployment**:
   - Update ECS service with new task definition.
   - Example: Example 2.
   - *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

     with:

     task-definition: task-definition.json

     service: my-app-service

     cluster: my-cluster
2. **Blue-Green Deployment**:
   - Deploy and switch traffic for zero downtime.
   - Example: Example 25.
   - *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

     with:

     task-definition: task-definition-blue.json

service: my-app-service-blue

cluster: my-cluster

3. **Dynamic Task Definition**:
   - Deploy dynamically generated task definitions.
   - Example: Example 18.
   - *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

     with:

     task-definition: task-definition.json

     service: my-app-service

     cluster: my-cluster
4. **Multi-Region Deployment**:
   - Deploy to ECS clusters in multiple regions.
   - Example: Example 7.
   - *strategy:*

     matrix:

     region: [us-east-1, us-west-2]

     steps:

     - uses: aws-actions/amazon-ecs-deploy-task-definition@v1

     with:

     task-definition: task-definition-${{ matrix.region }}.json

     service: my-app-service-${{ matrix.region }}

     cluster: my-cluster-${{ matrix.region }}
5. **Rollback Deployment**:
   - Revert to a previous task definition on failure.
   - *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

     with:

     task-definition: previous-task-definition.json

     service: my-app-service

     cluster: my-cluster
6. **Canary Deployment**:
   - Deploy with partial traffic for testing.

- *- uses: aws-actions/amazon-ecs-deploy-task-definition@v1*

  with:

  task-definition: task-definition-canary.json

  service: my-app-service-canary

  cluster: my-cluster

7. snyk/actions/node@master

Purpose: Scans Node.js dependencies for vulnerabilities.
DevOps Relevance: Ensures secure deployments.

Possible Uses

1. **Dependency Scanning**:
   - Scan Node.js dependencies in CI.
   - Example: Example 5.
   - *- uses: snyk/actions/node@master*

     env:

     SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

     with:

     command: test
2. **Monitor Dependencies**:
   - Continuously monitor for new vulnerabilities.
   - *- uses: snyk/actions/node@master*

     env:

     SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

     with:

     command: monitor
3. **Fail on Critical Issues**:
   - Fail CI on high-severity vulnerabilities.
   - *- uses: snyk/actions/node@master*

     env:

     SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

     with:

command: test

args: --severity-threshold=high

4. **Scan Specific Package Files**:
    - Scan a specific *package.json*.
    - *- uses: snyk/actions/node@master*

      env:

      SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

      with:

      command: test

      file: frontend/package.json
5. **PR Validation**:
    - Run Snyk on pull requests.
    - *- uses: snyk/actions/node@master*

      env:

      SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

      with:

      command: test

8. hadolint/hadolint-action@v3

Purpose: Lints Dockerfiles for best practices.
DevOps Relevance: Enhances container security.

Possible Uses

1. **Dockerfile Linting**:
    - Lint Dockerfiles in CI.
    - Example: Example 5.
    - *- uses: hadolint/hadolint-action@v3*

      with:

      dockerfile: Dockerfile
2. **Multiple Dockerfile Linting**:
    - Lint multiple Dockerfiles in a monorepo.

- *- uses: hadolint/hadolint-action@v3*

  with:

  dockerfile: services/api/Dockerfile

3. **Custom Configuration**:
   - Use a custom *.had4482 olint.yaml* for linting rules.
   - *- uses: hadolint/hadolint-action@v3*

     with:

     dockerfile: Dockerfile

     config: .hadolint.yaml
4. **Fail on Specific Issues**:
   - Fail CI on critical Dockerfile issues.
   - *- uses: hadolint/hadolint-action@v3*

     with:

     dockerfile: Dockerfile

     failure-threshold: error
5. **PR Validation**:
   - Lint Dockerfiles in pull requests.
   - *- uses: hadolint/hadolint-action@v3*

     with:

     dockerfile: Dockerfile

9. nick-fields/retry@v3

Purpose: Retries commands on failure.
DevOps Relevance: Improves pipeline reliability.

Possible Uses

1. **Retry ECS Deployments**:
   - Retry ECS updates on network failures.
   - Example: Example 9.
   - *- uses: nick-fields/retry@v3*

     with:

     timeout_minutes: 10

max_attempts: 3

command: aws ecs update-service --cluster my-cluster --service my-app-service --task-definition task-definition.json

2. **Retry S3 Sync**:
   - Retry S3 sync on transient errors.
   - *- uses: nick-fields/retry@v3*

     with:

     max_attempts: 3

     command: aws s3 sync ./build/ s3://my-bucket
3. **Retry Lambda Updates**:
   - Retry Lambda function updates.
   - *- uses: nick-fields/retry@v3*

     with:

     max_attempts: 3

     command: aws lambda update-function-code --function-name my-lambda --zip-file fileb://function.zip
4. **Retry ECR Push**:
   - Retry Docker push to ECR.
   - *- uses: nick-fields/retry@v3*

     with:

     max_attempts: 3

     command: docker push my-repo:latest
5. **Retry API Calls**:
   - Retry AWS API calls (e.g., CloudFormation).
   - *- uses: nick-fields/retry@v3*

     with:

     max_attempts: 3

     command: aws cloudformation deploy --template-file stack.yml --stack-name my-stack

10. actions/cache@v4

Purpose: Caches artifacts to speed up workflows.
DevOps Relevance: Optimizes CI/CD performance.

Possible Uses

1. **Cache Docker Layers**:
   - Cache Docker layers for faster ECS builds.
   - Example: Example 23.
   - *- uses: actions/cache@v4*

     with:

     path: /tmp/.buildx-cache

     key: ${{ runner.os }}-buildx-${{ github.sha }}

     restore-keys: ${{ runner.os }}-buildx-
2. **Cache npm Dependencies**:
   - Cache *node_modules* for Node.js builds.
   - *- uses: actions/cache@v4*

     with:

     path: ~/.npm

     *key: ${{ runner.os }}-npm-${{ hashFiles('**/package-lock.json') }}*

     restore-keys: ${{ runner.os }}-npm-
3. **Cache Python Dependencies**:
   - Cache pip dependencies for Lambda.
   - *- uses: actions/cache@v4*

     with:

     path: ~/.cache/pip

     *key: ${{ runner.os }}-pip-${{ hashFiles('**/requirements.txt') }}*

     restore-keys: ${{ runner.os }}-pip-
4. **Cache Build Artifacts**:
   - Cache compiled artifacts for redeployment.
   - *- uses: actions/cache@v4*

     with:

path: ./build

key: ${{ runner.os }}-build-${{ github.sha }}

5. **Cache Across Jobs**:
   - Share cache between jobs in a workflow.
   - *- uses: actions/cache@v4*

     with:

     path: ./dist

     key: ${{ runner.os }}-dist-${{ github.run_id }}

11. .github/actions/s3-deploy (Custom)

Purpose: Custom action to deploy to S3 with metadata.
DevOps Relevance: Standardizes deployment logic.

Possible Uses

1. **S3 Deployment with Metadata**:
   - Deploy to S3 with custom headers.
   - Example: Example 8.
   - *- uses: ./.github/actions/s3-deploy*

     with:

     bucket: my-website-bucket

     source: ./build
2. **Versioned S3 Deployment**:
   - Deploy to a versioned S3 path.
   - *- uses: ./.github/actions/s3-deploy*

     with:

     bucket: my-website-bucket

     source: ./build

     destination: versions/${{ github.sha }}
3. **Multi-Bucket Deployment**:
   - Deploy to multiple S3 buckets.

- *- uses: ./.github/actions/s3-deploy*

  with:

  bucket: my-primary-bucket

  source: ./build

  - uses: ./.github/actions/s3-deploy

  with:

  bucket: my-backup-bucket

  source: ./build

4. **Conditional Deployment**:
   - Deploy based on environment.
   - *- uses: ./.github/actions/s3-deploy*

     if: github.ref == 'refs/heads/main'

     with:

     bucket: my-prod-bucket

     source: ./build
5. **Custom S3 Options**:
   - Use additional S3 sync options (e.g., ACLs).
   - *# Modified action.yml*

     - name: Sync to S3

     run: aws s3 sync ${{ inputs.source }}/ s3://${{ inputs.bucket }} --acl public-read

     shell: bash

Section 2: All Possible Variations in GitHub Actions YAML

Below is a complete list of all possible keys and configurations in a GitHub Actions workflow YAML file, based on the official documentation (https://docs.github.com/en/actions/using-workflows/workflow-syntax-for-github-actions). Each key is explained with its purpose and an AWS-specific example, tailored for DevOps workflows.

Top-Level Keys

These define the workflow's overall configuration.

1. ***name***:

- **Purpose**: Names the workflow for display in the GitHub UI.
- **Example**:

  name: Deploy to ECS

2. ***on***:
   - **Purpose**: Specifies events that trigger the workflow.
   - **Variations**:
     - *push*: On code push.
     - *pull_request*: On PR actions.
     - *schedule*: On a cron schedule.
     - *workflow_dispatch*: Manual trigger.
     - *repository_dispatch*: External webhook.
     - *issue_comment*, *release*, *check_run*, *check_suite*, *create*, *delete*, *deployment*, *deployment_status*, *fork*, *gollum*, *label*, *milestone*, *page_build*, *project*, *project_card*, *project_column*, *public*, *pull_request_review*, *pull_request_review_comment*, *registry_package*, *status*, *watch*.
   - **Example**:

     on:

     push:

     branches: [main]

     pull_request:

     branches: [main]

     schedule:

     *- cron: '0 0 * * *'*

     workflow_dispatch:

     inputs:

     environment:

     description: 'Target environment'

     required: true

     repository_dispatch:

     types: [external-deploy]

3. ***env***:
   - **Purpose**: Defines workflow-wide environment variables.

- **Example**:

  env:

  AWS_REGION: us-east-1

  APP_NAME: my-app

4. ***defaults***:
   - **Purpose**: Sets default settings for jobs (e.g., shell, working directory).
   - **Variations**:
     - *run.shell*: Shell for *run* steps.
     - *run.working-directory*: Default directory for *run* steps.
   - **Example**:

     defaults:

     run:

     shell: bash

     working-directory: ./app

5. ***concurrency***:
   - **Purpose**: Limits concurrent workflow runs to prevent conflicts.
   - **Variations**:
     - *group*: Unique identifier for concurrency.
     - *cancel-in-progress*: Cancel running workflows.
   - **Example**:

     concurrency:

     group: production-deployment

     cancel-in-progress: true

6. ***permissions***:
   - **Purpose**: Scopes GitHub token permissions for security.
   - **Variations**: *read*, *write*, *none* for scopes like *contents*, *issues*, *pull-requests*, *id-token*, *deployments*, *statuses*, etc.
   - **Example**:

     permissions:

     id-token: write

     contents: read

     pull-requests: write

7. ***jobs***:
    - **Purpose**: Defines the jobs to execute.
    - **Example**:

      jobs:

      deploy:

      runs-on: ubuntu-latest

      steps:

      - uses: actions/checkout@v4

Job-Level Keys

These configure individual jobs within the workflow.

1. ***runs-on***:
    - **Purpose**: Specifies the runner (GitHub-hosted or self-hosted).
    - **Variations**: *ubuntu-latest*, *ubuntu-22.04*, *windows-latest*, *macos-latest*, *self-hosted*, or custom labels.
    - **Example**:

      jobs:

      deploy:

      runs-on: self-hosted
2. ***steps***:
    - **Purpose**: Lists tasks to execute in the job.
    - **Example**:

      steps:

      - uses: actions/checkout@v4

      - run: npm ci
3. ***env***:
    - **Purpose**: Job-specific environment variables.
    - **Example**:

      env:

      ECR_REPOSITORY: my-app

      AWS_REGION: us-west-2

4. ***defaults***:
    - **Purpose**: Job-specific defaults for *run* steps.
    - **Variations**:
        - *run.shell*: Shell type.
        - *run.working-directory*: Working directory.
    - **Example**:

      defaults:

      run:

      shell: bash

      working-directory: ./src
5. ***strategy***:
    - **Purpose**: Defines matrix builds for multiple configurations.
    - **Variations**:
        - *matrix*: Define variables (e.g., versions, regions).
        - *fail-fast*: Stop on first failure (*true*/*false*).
        - *max-parallel*: Limit parallel jobs.
    - **Example**:

      strategy:

      matrix:

      node-version: [16, 18, 20]

      region: [us-east-1, us-west-2]

      fail-fast: false

      max-parallel: 4
6. ***needs***:
    - **Purpose**: Specifies job dependencies.
    - **Example**:

      needs: [build, test]
7. ***if***:
    - **Purpose**: Conditionally executes the job.
    - **Example**:

      if: github.event_name == 'push' && github.ref == 'refs/heads/main'
8. ***timeout-minutes***:

- **Purpose**: Sets a timeout for the job.
- **Example**:

  timeout-minutes: 30

9. ***services***:
   - **Purpose**: Defines containerized services (e.g., databases).
   - **Variations**:
     - *image*: Container image.
     - *env*: Environment variables.
     - *ports*: Exposed ports.
     - *options*: Additional Docker options.
   - **Example**:

     services:

     postgres:

     image: postgres:13

     env:

     POSTGRES_USER: test

     POSTGRES_PASSWORD: test

     ports:

     - 5432:5432

     options: --health-cmd pg_isready

10. ***container***:
    - **Purpose**: Runs the job in a container.
    - **Variations**:
      - *image*: Container image.
      - *env*: Environment variables.
      - *ports*: Exposed ports.
      - *volumes*: Mounted volumes.
      - *options*: Docker options.
    - **Example**:

      container:

      image: node:20

      env:

      NODE_ENV: production

ports:

- 8080:8080

volumes:

- /data:/app/data

11. ***environment***:
    - **Purpose**: Specifies the deployment environment for approvals.
    - **Variations**:
      - *name*: Environment name.
      - *url*: Deployment URL.
    - **Example**:

      environment:

       name: production

       url: https://my-app.example.com
12. ***outputs***:
    - **Purpose**: Defines outputs for use in other jobs.
    - **Example**:

      outputs:

       version: ${{ steps.set-version.outputs.version }}
13. ***concurrency***:
    - **Purpose**: Job-level concurrency control.
    - **Example**:

      concurrency:

       group: deploy-${{ github.ref }}

       cancel-in-progress: true

Step-Level Keys

These configure individual steps within a job.

1. ***uses***:
    - **Purpose**: Specifies an action to run.
    - **Variations**:
      - Marketplace actions (e.g., *actions/checkout@v4*).
      - Repository actions (e.g., *./.github/actions/my-action*).

- Commit-specific actions (e.g., *actions/checkout@sha*).

- **Example**:

  - uses: aws-actions/configure-aws-credentials@v4

2. ***with***:

   - **Purpose**: Passes input parameters to the action.
   - **Example**:

     - uses: aws-actions/amazon-ecs-deploy-task-definition@v1

     with:

     task-definition: task-definition.json

     service: my-app-service

     cluster: my-cluster

3. ***run***:

   - **Purpose**: Executes a shell command.
   - **Variations**:
     - Single-line commands.
     - Multi-line scripts.
   - **Example**:

     - run: |

     npm ci

     npm run build

4. ***name***:

   - **Purpose**: Names the step for logs.
   - **Example**:

     - name: Deploy to S3

     run: aws s3 sync ./build/ s3://my-bucket

5. ***env***:

   - **Purpose**: Step-specific environment variables.
   - **Example**:

     - run: npm ci

     env:

     NODE_ENV: production

AWS_REGION: us-east-1

6. ***if***:
   - **Purpose**: Conditionally executes the step.
   - **Example**:

     - run: aws s3 cp ./build s3://my-bucket

     if: github.ref == 'refs/heads/main'
7. ***id***:
   - **Purpose**: Assigns an identifier for referencing outputs.
   - **Example**:

     - name: Login to ECR

     id: login-ecr

     uses: aws-actions/amazon-ecr-login@v2

     - run: echo ${{ steps.login-ecr.outputs.registry }}
8. ***continue-on-error***:
   - **Purpose**: Allows the step to fail without stopping the job.
   - **Variations**:
     - *true*: Continue on error.
     - Expression-based (e.g., *continue-on-error: ${{ failure() }}*).
   - **Example**:

     - name: Deploy to Lambda

     id: deploy

     continue-on-error: true

     run: aws lambda update-function-code --function-name my-lambda --zip-file fileb://function.zip
9. ***timeout-minutes***:
   - **Purpose**: Sets a timeout for the step.
   - **Example**:

     - run: npm run build

     timeout-minutes: 5
10. ***shell***:
    - **Purpose**: Specifies the shell for *run* steps.

- **Variations**: *bash*, *pwsh*, *python*, *sh*, *cmd*, *powershell*.
- **Example**:

  - run: echo "Hello"

  shell: pwsh

11. ***working-directory***:
    - **Purpose**: Sets the working directory for the step

Example Syntax:

name: Deploy to AWS

on: push

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- run: echo "Deploying to AWS"

AWS-Specific: Use *aws-actions* for credential configuration and service-specific deployments.

Events and Triggers

Workflows are triggered by events, specified in the *on* key:

- **Push**: Trigger on *git push* to a branch (e.g., *on: push: branches: [main]*).
- **Pull Request**: Trigger on PR actions (e.g., *on: pull_request: branches: [main]*).
- **Schedule**: Run on a cron schedule (e.g., *on: schedule: - cron: '0 0 * * *'*).
- **Workflow Dispatch**: Manual trigger via UI or API (e.g., *on: workflow_dispatch*).
- **Repository Dispatch**: Trigger via external webhook (e.g., *on: repository_dispatch*).

AWS Use Case: Use *workflow_dispatch* for manual production deployments.

Jobs and Steps

Jobs define the tasks in a workflow:

- **runs-on**: Specifies the runner (e.g., *ubuntu-latest*, *self-hosted*).
- **steps**: Tasks executed sequentially, using *run* or *uses*.

- **needs**: Defines job dependencies (e.g., *needs: build*).
- **if**: Conditional execution (e.g., *if: github.event_name == 'push'*).

AWS Example: A job to build and deploy a Docker image to Amazon ECS.

Runners

Runners execute workflows:

- **GitHub-Hosted**: Pre-configured VMs (e.g., *ubuntu-latest*, *windows-latest*).
- **Self-Hosted**: Custom servers for specific requirements (e.g., AWS EC2 instances).
- **AWS Context**: Use self-hosted runners on EC2 for access to internal VPC resources.

Secrets and Security

Secrets store sensitive data (e.g., AWS credentials):

- **Repository Secrets**: Configured at *Settings > Secrets and variables > Actions*.
- **Organization Secrets**: Shared across repositories.
- **Environment Secrets**: Tied to specific environments.
- **OIDC**: Use OpenID Connect for secure AWS IAM role assumption (recommended).

Security Best Practices:

- Pin actions to specific versions (e.g., *actions/checkout@v4*).
- Limit *GITHUB_TOKEN* permissions.
- Use *permissions* to scope access.

AWS Example: Use *aws-actions/configure-aws-credentials@v4* with OIDC for secure deployments.

Environments and Approvals

Environments manage deployment targets:

- **Protection Rules**: Require reviews or wait timers.
- **Secrets**: Environment-specific secrets.
- **AWS Use Case**: Define *production* and *staging* environments for ECS deployments.

AWS Deployments

GitHub Actions supports deploying to AWS services:

- **S3**: Static site hosting or asset storage.

- **ECS**: Containerized applications.
- **EKS**: Kubernetes clusters.
- **Lambda**: Serverless functions.
- **CloudFront**: CDN for S3-hosted sites.

Key Actions:

- *aws-actions/configure-aws-credentials@v4*: Configures AWS CLI credentials.
- *aws-actions/amazon-ecs-deploy-task-definition@v1*: Deploys to ECS.
- *aws-actions/aws-lambda@v1*: Deploys Lambda functions.

OIDC Setup:

- Configure an AWS IAM OIDC provider for GitHub.
- Create an IAM role with a trust policy for GitHub Actions.
- Use *aws-actions/configure-aws-credentials@v4* with *role-to-assume*.

Error Handling and Edge Cases

- **Timeouts**: Set *timeout-minutes* for jobs or steps.
- **Retries**: Use third-party actions like *nick-fields/retry@v3*.
- **Continue-on-Error**: Allow steps to fail without stopping the job (e.g., *continue-on-error: true*).
- **Matrix Builds**: Test across multiple configurations (e.g., Node.js versions).
- **Concurrency**: Limit concurrent runs (e.g., *concurrency: group: production*).

AWS Example: Retry ECS task deployment on failure.

Examples

The following 30 examples demonstrate GitHub Actions workflows for AWS deployments, CI/CD, error handling, and edge cases. Each includes a context description and in-code explanations.

Basic AWS Deployments

Example 1: Deploying a Static Site to S3 **Context**: Your team maintains a React application hosted on an S3 bucket for a company website. The workflow builds the app and deploys it to S3 whenever code is pushed to the *main* branch. The bucket is publicly accessible, and you use AWS credentials stored as repository secrets.

 # Workflow to build and deploy a React app to an S3 bucket

name: Deploy Static Site to S3

 # Trigger on push to main branch

```
on:
 push:
 branches: [main]
jobs:
 deploy:
 # Use the latest Ubuntu runner
 runs-on: ubuntu-latest
 steps:
 # Checkout the repository code
 - uses: actions/checkout@v4
 # Ensure the latest commit is fetched
 with:
 fetch-depth: 1
 # Set up Node.js environment (React requires Node)
 - name: Set up Node.js
 uses: actions/setup-node@v4
 with:
 node-version: '20'
 # Install dependencies and build the React app
 - name: Build React App
 run: |
 npm ci
 npm run build
 # Configure AWS credentials using repository secrets
 - name: Configure AWS Credentials
 uses: aws-actions/configure-aws-credentials@v4
 with:
 aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}
 aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}
 aws-region: us-east-1
 # Sync build output to S3 bucket
```

- name: Deploy to S3

run: aws s3 sync ./build/ s3://my-website-bucket --delete

Example 2: Deploying a Docker Image to ECS **Context**: You manage a Node.js API deployed on Amazon ECS with Fargate. The workflow builds a Docker image, pushes it to Amazon ECR, and updates the ECS task definition on a pull request merge to *main*. This ensures production deployments are automated and secure.

 # Workflow to build, push, and deploy a Docker image to ECS

name: Deploy to ECS

 # Trigger on push to main branch

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

 # Configure AWS credentials for ECR and ECS

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

 # Log in to Amazon ECR

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

 # Build and push Docker image to ECR

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-api

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

 # Deploy to ECS by updating task definition

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-api-service

cluster: my-cluster

wait-for-service-stability: true

Example 3: Deploying a Lambda Function Context: Your team uses AWS Lambda for a serverless microservice that processes user data. The workflow packages the Python code, uploads it to Lambda, and updates the function on a push to *main*. Secrets are used for AWS credentials.

 # Workflow to deploy a Python Lambda function

name: Deploy Lambda Function

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

 # Set up Python environment

- name: Set up Python

uses: actions/setup-python@v5

with:

python-version: '3.9'

 # Install dependencies and package Lambda code

- name: Package Lambda

run: |

pip install -r requirements.txt -t .

zip -r function.zip .

 # Configure AWS credentials

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-east-1

 # Deploy to Lambda

- name: Deploy to Lambda

run: aws lambda update-function-code --function-name my-lambda --zip-file fileb://function.zip

CI/CD Pipelines

Example 4: Build and Test Node.js App Before S3 Deployment Context: Before deploying a Node.js app to S3, you want to ensure it passes linting and unit tests. The workflow runs tests on multiple Node.js versions using a matrix strategy and deploys only if all tests pass. This ensures code quality in production.

 # Workflow to build, test, and deploy a Node.js app to S3

name: CI/CD for S3 Deployment

on:

push:

branches: [main]

jobs:

build-and-test:

runs-on: ubuntu-latest

 # Test on multiple Node.js versions

strategy:

matrix:

node-version: [16, 18, 20]

steps:

- uses: actions/checkout@v4

- name: Set up Node.js

uses: actions/setup-node@v4

with:

node-version: ${{ matrix.node-version }}

 # Run linting and tests

- name: Run Tests

run: |

npm ci

npm run lint

npm test

deploy:

 # Deploy only if tests pass

needs: build-and-test

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Set up Node.js

uses: actions/setup-node@v4

with:

node-version: '20'

- name: Build and Deploy

run: |

npm ci

npm run build

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-east-1

- name: Deploy to S3

run: aws s3 sync ./build/ s3://my-app-bucket --delete

Example 5: Linting and Security Scanning for ECS Context: Your team requires code linting and vulnerability scanning before deploying a Dockerized app to ECS. The workflow runs ESLint, Snyk for dependency scanning, and Hadolint for Dockerfile linting, ensuring secure production deployments.

 # Workflow for linting, scanning, and deploying to ECS

name: Secure ECS Deployment

on:

pull_request:

branches: [main]

jobs:

lint-and-scan:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

 # Set up Node.js for ESLint

- name: Set up Node.js

uses: actions/setup-node@v4

with:

node-version: '20'

 # Run ESLint for code quality

- name: Run ESLint

run: |

npm ci

npm run lint

 # Run Snyk for dependency vulnerabilities

- name: Run Snyk

uses: snyk/actions/node@master

env:

SNYK_TOKEN: ${{ secrets.SNYK_TOKEN }}

with:

command: test

 # Lint Dockerfile with Hadolint

- name: Lint Dockerfile

uses: hadolint/hadolint-action@v3

with:

dockerfile: Dockerfile

deploy:

needs: lint-and-scan

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service

cluster: my-cluster

Advanced Scenarios

Example 6: Using OIDC for Secure S3 Deployment **Context**: To avoid long-lived AWS credentials, your team uses OIDC to assume an IAM role for deploying a static site to S3. The workflow configures OIDC, syncs files to S3, and invalidates a CloudFront distribution for instant cache refresh.

 # Workflow to deploy to S3 using OIDC

name: Deploy to S3 with OIDC

on:

push:

branches: [main]

 # Restrict token permissions for security

permissions:

id-token: write

contents: read

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Set up Node.js

uses: actions/setup-node@v4

with:

node-version: '20'

- name: Build App

run: |

npm ci

npm run build

 # Configure AWS credentials via OIDC

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

role-to-assume: arn:aws:iam::123456789012:role/github-actions-role

aws-region: us-east-1

 # Deploy to S3

- name: Deploy to S3

run: aws s3 sync ./build/ s3://my-website-bucket --delete

 # Invalidate CloudFront cache

- name: Invalidate CloudFront

run: aws cloudfront create-invalidation --distribution-id E1234567890 --paths "/"*

Example 7: Multi-Region ECS Deployment **Context**: Your application requires high availability across two AWS regions (us-east-1, us-west-2). The workflow builds a Docker image, pushes it to ECR, and deploys to ECS clusters in both regions using a matrix strategy for parallel deployment.

 # Workflow for multi-region ECS deployment

name: Multi-Region ECS Deployment

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

strategy:

matrix:

region: [us-east-1, us-west-2]

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: ${{ matrix.region }}

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition-${{ matrix.region }}.json

service: my-app-service-${{ matrix.region }}

cluster: my-cluster-${{ matrix.region }}

wait-for-service-stability: true

Example 8: Custom Action for S3 Deployment **Context**: Your team needs a reusable action to deploy to S3 with custom logic (e.g., setting metadata). The workflow uses a custom action stored in the repository to deploy a static site.

 # Workflow using a custom action for S3 deployment

name: Deploy with Custom S3 Action

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Set up Node.js

uses: actions/setup-node@v4

with:

node-version: '20'

- name: Build App

run: |

npm ci

npm run build

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-east-1

 # Use custom action for S3 deployment

- name: Deploy to S3

uses: ./.github/actions/s3-deploy

with:

bucket: my-website-bucket

source: ./build

Custom Action (*.github/actions/s3-deploy/action.yml*):

 # Custom action to deploy to S3 with metadata

name: S3 Deploy

description: Deploys files to S3 with custom metadata

inputs:

bucket:

description: S3 bucket name

required: true

source:

description: Source directory

required: true

runs:

using: composite

steps:

- name: Sync to S3

run: aws s3 sync ${{ inputs.source }}/ s3://${{ inputs.bucket }} --delete --metadata "Cache-Control=max-age=3600"

shell: bash

Error Handling Examples

Example 9: Retry on ECS Deployment Failure Context: ECS deployments occasionally fail due to network issues. The workflow retries the deployment up to three times using a third-party retry action to ensure reliability.

 # Workflow with retry logic for ECS deployment

name: ECS Deployment with Retry

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

 # Retry ECS deployment on failure

- name: Deploy to ECS

uses: nick-fields/retry@v3

with:

timeout_minutes: 10

max_attempts: 3

command: |

aws ecs update-service --cluster my-cluster --service my-app-service --task-definition task-definition.json

Example 10: Timeout and Rollback for Lambda **Context**: A Lambda deployment might hang due to large package uploads. The workflow sets a timeout and rolls back to the previous version if the deployment fails.

```
# Workflow with timeout and rollback for Lambda
name: Lambda Deployment with Rollback
on:
 push:
 branches: [main]
jobs:
 deploy:
 runs-on: ubuntu-latest
 steps:
 - uses: actions/checkout@v4
 - name: Set up Python
 uses: actions/setup-python@v5
 with:
 python-version: '3.9'
 - name: Package Lambda
 run: |
 pip install -r requirements.txt -t .
 zip -r function.zip .
 - name: Configure AWS Credentials
 uses: aws-actions/configure-aws-credentials@v4
 with:
 aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}
 aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}
 aws-region: us-east-1
 # Deploy with timeout
 - name: Deploy to Lambda
 id: deploy
 continue-on-error: true
```

timeout-minutes: 5

run: aws lambda update-function-code --function-name my-lambda --zip-file fileb://function.zip

 # Rollback if deployment fails

- name: Rollback on Failure

if: steps.deploy.outcome == 'failure'

run: aws lambda update-function-code --function-name my-lambda --s3-bucket my-backup-bucket --s3-key previous-function.zip

Edge Cases

Example 11: Self-Hosted Runner for ECS Deployment Context: Your ECS cluster is in a private VPC, requiring a self-hosted runner on an EC2 instance. The workflow uses a self-hosted runner to build and deploy a Docker image to ECS.

 # Workflow using a self-hosted runner for ECS

name: ECS Deployment with Self-Hosted Runner

on:

push:

branches: [main]

jobs:

deploy:

 # Use self-hosted runner on EC2

runs-on: self-hosted

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service

cluster: my-cluster

Example 12: Concurrency Control for Production Context: Multiple developers push to *main*, causing concurrent ECS deployments. The workflow uses concurrency control to ensure only one deployment runs at a time, preventing conflicts.

 # Workflow with concurrency control for ECS

name: ECS Deployment with Concurrency

on:

push:

branches: [main]

 # Limit to one concurrent deployment

concurrency:

group: production-deployment

cancel-in-progress: true

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service

cluster: my-cluster

Example 13: Scheduled S3 Backup **Context**: You need to back up an S3 bucket to another bucket nightly for compliance. The workflow runs on a cron schedule to copy files between buckets.

 # Workflow for scheduled S3 backup

name: S3 Nightly Backup

on:

schedule:

*- cron: '0 0 * * *' # Run at midnight UTC*

jobs:

backup:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-east-1

 # Copy files from source to backup bucket

- name: Backup S3 Bucket

run: aws s3 sync s3://my-website-bucket s3://my-backup-bucket --delete

Example 14: Manual Deployment with Workflow Dispatch Context: Production deployments to ECS require manual approval. The workflow uses *workflow_dispatch* to allow manual triggering via the GitHub UI, with inputs for the environment.

 # Workflow for manual ECS deployment

name: Manual ECS Deployment

on:

workflow_dispatch:

inputs:

environment:

description: 'Deployment environment'

required: true

default: 'staging'

jobs:

deploy:

runs-on: ubuntu-latest

environment: ${{ inputs.environment }}

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service-${{ inputs.environment }}

cluster: my-cluster-${{ inputs.environment }}

Example 15: Matrix Build for Lambda Compatibility Context: Your Lambda function must support multiple Python versions (3.8, 3.9, 3.10). The workflow uses a matrix strategy to build and test the function across versions before deploying.

 # Workflow for matrix build and Lambda deployment

name: Lambda Matrix Deployment

on:

push:

branches: [main]

jobs:

build-and-test:

runs-on: ubuntu-latest

strategy:

matrix:

python-version: ['3.8', '3.9', '3.10']

steps:

- uses: actions/checkout@v4

- name: Set up Python

uses: actions/setup-python@v5

with:

python-version: ${{ matrix.python-version }}

- name: Run Tests

run: |

pip install -r requirements.txt

pytest

deploy:

needs: build-and-test

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Set up Python

uses: actions/setup-python@v5

with:

python-version: '3.9'

- name: Package Lambda

run: |

pip install -r requirements.txt -t .

zip -r function.zip .

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-east-1

- name: Deploy to Lambda

run: aws lambda update-function-code --function-name my-lambda --zip-file fileb://function.zip

Example 16: Environment Approvals for Production Context: Production deployments to ECS require approval from two team members. The workflow uses a GitHub environment with protection rules to enforce approvals.

 # Workflow with environment approvals for ECS

name: ECS Deployment with Approvals

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

environment: production

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service

cluster: my-cluster

Example 17: Service Container for Database Testing Context: Your Node.js app requires a PostgreSQL database for integration tests before ECS deployment. The workflow uses a service container to run tests with a database.

 # Workflow with service container for testing

name: ECS Deployment with Database Tests

on:

push:

branches: [main]

jobs:

test-and-deploy:

runs-on: ubuntu-latest

services:

postgres:

image: postgres:13

env:

POSTGRES_USER: test

POSTGRES_PASSWORD: test

POSTGRES_DB: test

ports:

- 5432:5432

steps:

- uses: actions/checkout@v4

- name: Set up Node.js

uses: actions/setup-node@v4

with:

node-version: '20'

- name: Run Tests

env:

DATABASE_URL: postgres://test:test@localhost:5432/test

run: |

npm ci

npm test

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service

cluster: my-cluster

Example 18: Dynamic Task Definition for ECS **Context**: Your ECS task definition requires dynamic updates (e.g., image tag). The workflow generates a task definition JSON file before deployment.

 # Workflow to dynamically update ECS task definition

name: ECS Deployment with Dynamic Task Definition

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

 # Generate task definition dynamically

- name: Generate Task Definition

run: |

*sed "s|{{IMAGE}}|$ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG|"
task-definition-template.json > task-definition.json*

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service

cluster: my-cluster

Example 19: Cross-Repository Workflow Trigger **Context**: A shared library in another repository triggers an ECS deployment when updated. The workflow uses *repository_dispatch* to trigger the deployment.

 # Workflow triggered by another repository

name: ECS Deployment on Library Update

on:

repository_dispatch:

```
 types: [library-updated]
jobs:
 deploy:
 runs-on: ubuntu-latest
 steps:
 - uses: actions/checkout@v4
 - name: Configure AWS Credentials
 uses: aws-actions/configure-aws-credentials@v4
 with:
 aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}
 aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}
 aws-region: us-west-2
 - name: Login to ECR
 id: login-ecr
 uses: aws-actions/amazon-ecr-login@v2
 - name: Build and Push to ECR
 env:
 ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}
 ECR_REPOSITORY: my-app
 IMAGE_TAG: ${{ github.sha }}
 run: |
 docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .
 docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG
 - name: Deploy to ECS
 uses: aws-actions/amazon-ecs-deploy-task-definition@v1
 with:
 task-definition: task-definition.json
 service: my-app-service
 cluster: my-cluster
```

Example 20: Large Repository Checkout Optimization Context: Your repository is large, slowing down checkout. The workflow optimizes checkout by fetching only the latest commit.

```
# Workflow with optimized checkout for large repo
name: ECS Deployment with Optimized Checkout
on:
 push:
 branches: [main]
jobs:
 deploy:
 runs-on: ubuntu-latest
 steps:
 # Checkout with minimal history
 - uses: actions/checkout@v4
 with:
 fetch-depth: 1
 - name: Configure AWS Credentials
 uses: aws-actions/configure-aws-credentials@v4
 with:
 aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}
 aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}
 aws-region: us-west-2
 - name: Login to ECR
 id: login-ecr
 uses: aws-actions/amazon-ecr-login@v2
 - name: Build and Push to ECR
 env:
 ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}
 ECR_REPOSITORY: my-app
 IMAGE_TAG: ${{ github.sha }}
 run: |
```

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service

cluster: my-cluster

Example 21: Conditional Deployment Based on Branch Context: You deploy to staging on *develop* and production on *main*. The workflow uses conditionals to select the environment.

 # Workflow with conditional ECS deployment

name: Conditional ECS Deployment

on:

push:

branches: [main, develop]

jobs:

deploy:

runs-on: ubuntu-latest

environment: ${{ github.ref_name == 'main' && 'production' || 'staging' }}

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition-${{ github.ref_name }}.json

service: my-app-service-${{ github.ref_name }}

cluster: my-cluster-${{ github.ref_name }}

Example 22: Deploying to EKS **Context**: Your app runs on an EKS cluster. The workflow builds a Docker image, pushes it to ECR, and updates the Kubernetes deployment using *kubectl*.

 # Workflow for EKS deployment

name: Deploy to EKS

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

 # Update kubectl config

- name: Update Kubectl

run: aws eks update-kubeconfig --region us-west-2 --name my-cluster

 # Apply Kubernetes deployment

geochemical

- name: Deploy to EKS

run: |

sed "s|{{IMAGE}}|$ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG|" deployment.yaml | kubectl apply -f -

Example 23: Cache Docker Layers for Faster Builds Context: Docker builds are slow due to large dependencies. The workflow caches Docker layers to speed up ECS deployments.

 # Workflow with Docker layer caching

name: ECS Deployment with Docker Cache

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

 # Cache Docker layers

- name: Cache Docker Layers

uses: actions/cache@v4

with:

path: /tmp/.buildx-cache

key: ${{ runner.os }}-buildx-${{ github.sha }}

restore-keys: ${{ runner.os }}-buildx-

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker buildx create --use

docker buildx build --cache-from=type=local,src=/tmp/.buildx-cache --cache-to=type=local,dest=/tmp/.buildx-cache -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG --push .

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service

cluster: my-cluster

Example 24: S3 Deployment with Versioning Context: You need to maintain versioned backups of S3 deployments. The workflow deploys to S3 and archives the build to a versioned folder.

 # Workflow for S3 deployment with versioning

name: S3 Deployment with Versioning

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Set up Node.js

uses: actions/setup-node@v4

with:

node-version: '20'

- name: Build App

run: |

npm ci

npm run build

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-east-1

 # Archive build to versioned folder

- name: Archive to S3

run: aws s3 cp ./build s3://my-website-bucket/versions/${{ github.sha }}/ --recursive

 # Deploy to main S3 bucket

- name: Deploy to S3

run: aws s3 sync ./build/ s3://my-website-bucket --delete

Example 25: Blue-Green Deployment for ECS Context: To minimize downtime, you implement a blue-green deployment for ECS. The workflow deploys to a new task definition and switches traffic after validation.

 # Workflow for blue-green ECS deployment

name: Blue-Green ECS Deployment

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

 # Deploy new task definition

- name: Deploy Blue Task

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition-blue.json

service: my-app-service-blue

cluster: my-cluster

wait-for-service-stability: true

 # Switch traffic to blue environment

- name: Switch Traffic

run: aws ecs update-service --cluster my-cluster --service my-app-service --task-definition task-definition-blue.json

Example 26: Canary Deployment for Lambda **Context**: You use canary deployments to test Lambda updates with 10% traffic. The workflow deploys a new version and gradually shifts traffic.

 # Workflow for Lambda canary deployment

name: Lambda Canary Deployment

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Set up Python

uses: actions/setup-python@v5

with:

python-version: '3.9'

- name: Package Lambda

run: |

pip install -r requirements.txt -t .

zip -r function.zip .

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-east-1

 # Publish new Lambda version

- name: Publish Lambda Version

id: publish

run: |

VERSION=$(aws lambda publish-version --function-name my-lambda --zip-file fileb://function.zip --query Version --output text)

echo "VERSION=$VERSION" » $GITHUB_OUTPUT

 # Create canary alias

- name: Create Canary Alias

run: aws lambda create-alias --function-name my-lambda --name canary --function-version ${{ steps.publish.outputs.VERSION }} --routing-config AdditionalVersionWeights={"${{ steps.publish.outputs.VERSION - 1 }}":0.9}

Example 27: Multi-Stage Pipeline for ECS Context: Your pipeline includes build, test, staging, and production stages for ECS. The workflow ensures each stage completes before the next.

 # Workflow for multi-stage ECS pipeline

name: Multi-Stage ECS Pipeline

```
on:
 push:
 branches: [main]
jobs:
 build:
 runs-on: ubuntu-latest
 steps:
 - uses: actions/checkout@v4
 - name: Set up Node.js
 uses: actions/setup-node@v4
 with:
 node-version: '20'
 - name: Build and Test
 run: |
 npm ci
 npm run build
 npm test
 deploy-staging:
 needs: build
 runs-on: ubuntu-latest
 environment: staging
 steps:
 - uses: actions/checkout@v4
 - name: Configure AWS Credentials
 uses: aws-actions/configure-aws-credentials@v4
 with:
 aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}
 aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}
 aws-region: us-west-2
 - name: Login to ECR
 id: login-ecr
```

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition-staging.json

service: my-app-service-staging

cluster: my-cluster-staging

deploy-production:

needs: deploy-staging

runs-on: ubuntu-latest

environment: production

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition-production.json

service: my-app-service-production

cluster: my-cluster-production

Example 28: Artifact Upload for Debugging Context: Failed ECS deployments need debugging. The workflow uploads build artifacts to S3 for analysis.

 # Workflow with artifact upload for ECS

name: ECS Deployment with Artifacts

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Set up Node.js

uses: actions/setup-node@v4

with:

node-version: '20'

- name: Build

run: |

npm ci

npm run build

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

 # Deploy with artifact upload on failure

- name: Deploy to ECS

id: deploy

continue-on-error: true

run: aws ecs update-service --cluster my-cluster --service my-app-service --task-definition task-definition.json

- name: Upload Artifacts on Failure

if: steps.deploy.outcome == 'failure'

run: aws s3 cp ./build s3://my-debug-bucket/${{ github.sha }}/ --recursive

Example 29: External Event Trigger for ECS Context: An external system (e.g., CI tool) triggers ECS deployments via a webhook. The workflow uses *repository_dispatch* to handle the event.

 # Workflow triggered by external event

name: ECS Deployment on External Trigger

on:

repository_dispatch:

types: [external-deploy]

jobs:

deploy:

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: us-west-2

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition.json

service: my-app-service

cluster: my-cluster

Example 30: Dynamic Matrix for ECS Regions **Context**: Your ECS deployment targets dynamically selected regions based on a configuration file. The workflow reads regions from a JSON file to build a matrix.

 # Workflow with dynamic matrix for ECS

name: Dynamic ECS Deployment

on:

push:

branches: [main]

jobs:

deploy:

runs-on: ubuntu-latest

strategy:

matrix:

region: ${{ fromJson(needs.setup.outputs.regions) }}

needs: setup

steps:

- uses: actions/checkout@v4

- name: Configure AWS Credentials

uses: aws-actions/configure-aws-credentials@v4

with:

aws-access-key-id: ${{ secrets.AWS_ACCESS_KEY_ID }}

aws-secret-access-key: ${{ secrets.AWS_SECRET_ACCESS_KEY }}

aws-region: ${{ matrix.region }}

- name: Login to ECR

id: login-ecr

uses: aws-actions/amazon-ecr-login@v2

- name: Build and Push to ECR

env:

ECR_REGISTRY: ${{ steps.login-ecr.outputs.registry }}

ECR_REPOSITORY: my-app

IMAGE_TAG: ${{ github.sha }}

run: |

docker build -t $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG .

docker push $ECR_REGISTRY/$ECR_REPOSITORY:$IMAGE_TAG

- name: Deploy to ECS

uses: aws-actions/amazon-ecs-deploy-task-definition@v1

with:

task-definition: task-definition-${{ matrix.region }}.json

service: my-app-service-${{ matrix.region }}

cluster: my-cluster-${{ matrix.region }}

setup:

runs-on: ubuntu-latest

outputs:

regions: ${{ steps.set-regions.outputs.regions }}

steps:

- uses: actions/checkout@v4

- name: Set Regions

id: set-regions

run: echo "regions=$(cat regions.json)" » $GITHUB_OUTPUT

regions.json:

["us-east-1", "us-west-2"]