**GitHub Actions: Expressions, Conditions, Matrices, and Workflow Best Practices**

**🔁 GitHub Expressions Overview**

GitHub Expressions provide dynamic capabilities inside workflow files. They use the ${{ }} syntax to reference contexts, evaluate conditions, or call functions.

**🔹 Syntax**

${{ <expression> }}

**🔹 Example**

if: ${{ github.event\_name == 'push' }}

**✅ Common Contexts**

| **Context** | **Description** |
| --- | --- |
| github | Provides metadata about the event (e.g., github.actor, github.ref, github.event\_name) |
| env | Access to environment variables |
| matrix | Refers to the current matrix job’s values |
| steps | Used to reference outputs from previous steps |

**🧠 Conditional Execution in Steps/Jobs**

Conditions let you control when a job or step should run using if: followed by an expression.

**📌 Step-level Condition**

steps:

- name: Run only on push to main

if: github.ref == 'refs/heads/main' && github.event\_name == 'push'

run: echo "Pushed to main!"

**📌 Job-level Condition**

jobs:

build:

if: github.event\_name == 'push'

runs-on: ubuntu-latest

steps:

- run: echo "This runs only on push"

**🔁 Loops using Matrix Strategy**

GitHub Actions doesn’t support traditional loops, but matrices allow running jobs in parallel across multiple configurations.

**🎯 Use Case: Test on multiple Java versions**

jobs:

build:

runs-on: ubuntu-latest

strategy:

matrix:

java-version: [ '17', '21' ]

steps:

- name: Set up Java ${{ matrix.java-version }}

uses: actions/setup-java@v4

with:

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

distribution: 'adopt'

- run: ./mvnw package

**🔍 Custom Matrix Combinations**

matrix:

os: [ubuntu-latest, windows-latest]

java-version: [17, 21]

**🔫 Workflow Triggers**

Workflows can be automatically or manually triggered based on GitHub events.

on:

push:

branches: [ main ]

pull\_request:

branches: [ main ]

workflow\_dispatch:

workflow\_call:

**🧹 Trigger Types Explained**

| **Trigger** | **Description** |
| --- | --- |
| push | Runs on every push to the specified branch |
| pull\_request | Runs on PR creation/updates |
| workflow\_dispatch | Manual trigger via GitHub UI |
| workflow\_call | Allows workflows to be reused and called from other workflows |

**🧪 Exercise: Setup SonarCloud Scan for Spring PetClinic**

name: SonarCloud

on:

push:

branches: [ main ]

pull\_request:

types: [opened, synchronize, reopened]

workflow\_dispatch:

jobs:

build:

name: SonarCloud Scan

runs-on: ubuntu-latest

steps:

- uses: actions/checkout@v4

- name: Set up JDK 17

uses: actions/setup-java@v4

with:

java-version: 17

distribution: 'temurin'

- name: Cache SonarCloud packages

uses: actions/cache@v4

with:

path: ~/.sonar/cache

key: ${{ runner.os }}-sonar

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

- name: SonarCloud Scan

uses: SonarSource/sonarcloud-github-action@v2

with:

projectBaseDir: .

env:

SONAR\_TOKEN: ${{ secrets.SONAR\_TOKEN }}

**📺 Preview: CodeQL Scan Setup (Bonus)**

name: CodeQL

on:

push:

branches: [main]

pull\_request:

branches: [main]

jobs:

analyze:

name: Analyze

runs-on: ubuntu-latest

permissions:

security-events: write

strategy:

matrix:

language: [ 'java' ]

steps:

- uses: actions/checkout@v4

- uses: github/codeql-action/init@v3

with:

languages: ${{ matrix.language }}

- uses: github/codeql-action/analyze@v3

**✅ Optional Enhancements You Can Add**

* needs: – Run jobs in sequence
* continue-on-error: true – Let steps continue even if they fail
* matrix.include/exclude: – Fine-tune matrix combinations