Deploying a .NET 10 App to Azure using Bicep and GitHub Actions

Slides at scottsauber.com

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What you need

- Required:
  - An editor of some sort
  - GitHub account
  - Some basic Git experience (clone, commit, push, pull)
  - Fork this repo: https://github.com/scottsauber/workshop-dotnet-azure-github-bicep
- Email scott@saubersoftware.com if you're doing hands on to get free Azure access
  - Email you will use for Azure
  - GitHub username
- Optional:
  - .NET 10 (https://dot.net)
  - Editor/IDE that supports .NET 10 (Rider 2025.3+, VS 2026+, VS Code)
  - Bicep extensions are recommended

What we all need

- Azure to not go down
- GitHub to not go down
- GitHub Actions to not go down
- The conference interest to not go down
- 🙏🙏🙏🙏🙏
- (I do have recordings if needed but that’s less fun)

Audience

- Anyone interested in Azure, GitHub, or Bicep
- .NET Developers
- People interested in DevOps, but never got to do it
- People willing to ask questions – ask away – don’t wait!

Poll

- How many .NET Developers in the room?
- How many using Azure today?
- How many aren’t using Azure?
- How many have used Bicep?
- What about another IAC tool?
- How many are using GitHub Actions today?
- How many are using something else?
- Why are you here? What do you want to learn?

Agenda

- What is the final state of what we're building?
- What is Azure?
- What is Azure App Service? Plans?
- What is Bicep?
- What are GitHub Actions?
- Hands on all throughout
- This is a 2 day workshop, I'm gonna cram into 4 hours
- There is walkthroughs if you fall behind

Goals

- Learn GitHub Actions, Bicep, and Azure
- How they all integrate with a .NET app
- We likely won’t get to everything in a few hours
  - This is going to be… a lot
- The feedback loop on this is slow
- Take home a few things back to work, whether beginner or expert

Who am I?

- Director of Engineering at Lean TECHniques
- Microsoft MVP
- Dometrain Author
- Redgate Community Ambassador
- Co-organizer of Iowa .NET User Group


 @scottsauber  @scottsauber.com

What are we building?

- .NET 10 API
- Running on Azure App Service
- Configured using Infrastructure as Code with Bicep
- Deployed via GitHub Actions

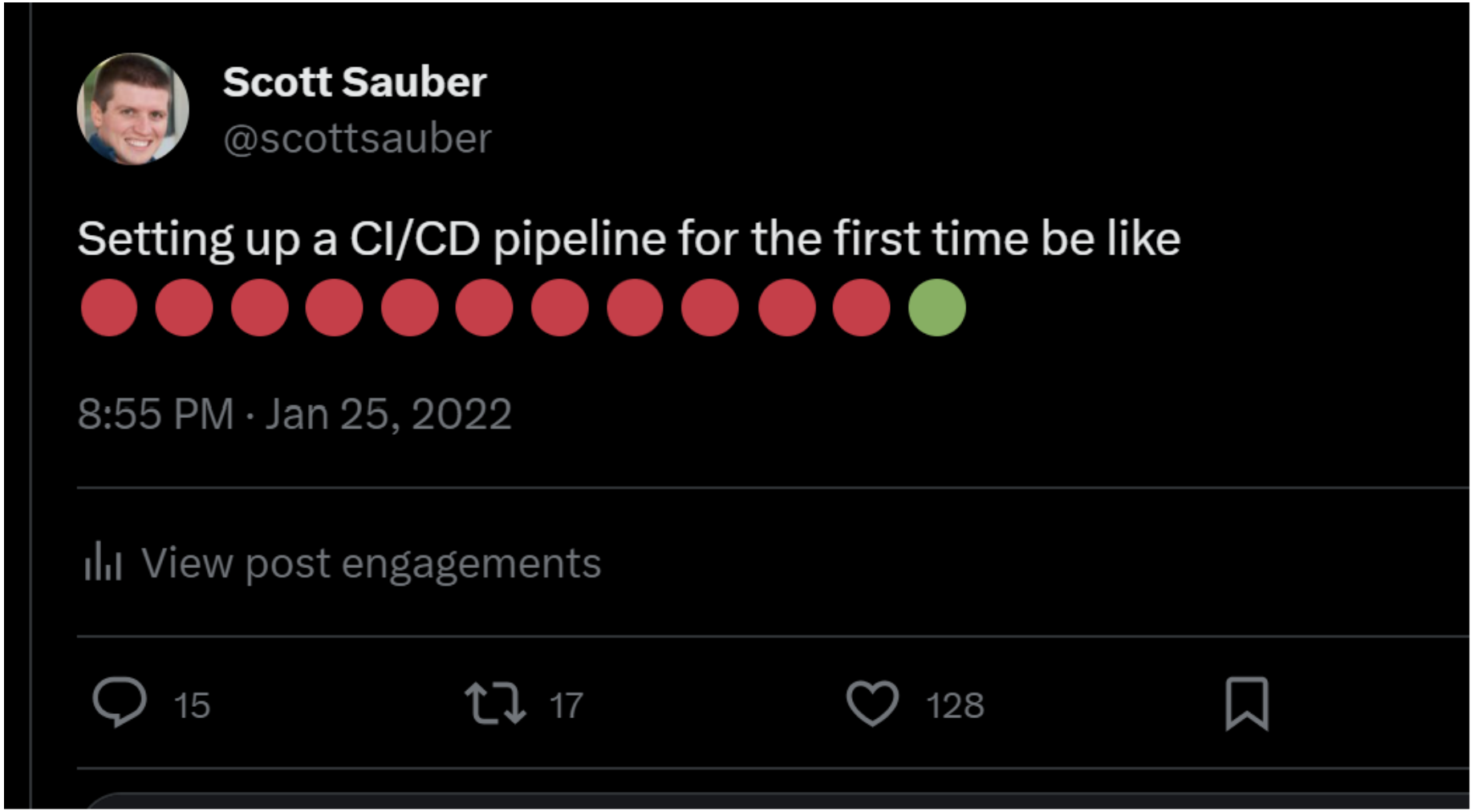
Features of What We're Building

- Zero Downtime Deployments
- Infrastructure managed by code, not clicking in the Azure Portal
- Automated Build and Deploys
- Follows Azure Naming Standards for naming resources
- Versioning your app so you know what's deployed*
- Health Checks*
- Secrets in Key Vault, not Source Control*
- Observability using Application Insights*

* Might not get to these in 4 hours.

Why is this important?

- https://dora.dev/
- DORA
- We will touch on 6 of the 18 capabilities listed for high performing teams:
  1. Continuous Delivery
  2. Deployment Automation
  3. Flexible Infrastructure
  4. Continuous Integration
  5. Version Control
  6. Monitoring/Observability


Scott Sauber
@scottsauber
Setting up a CI/CD pipeline for the first time be like
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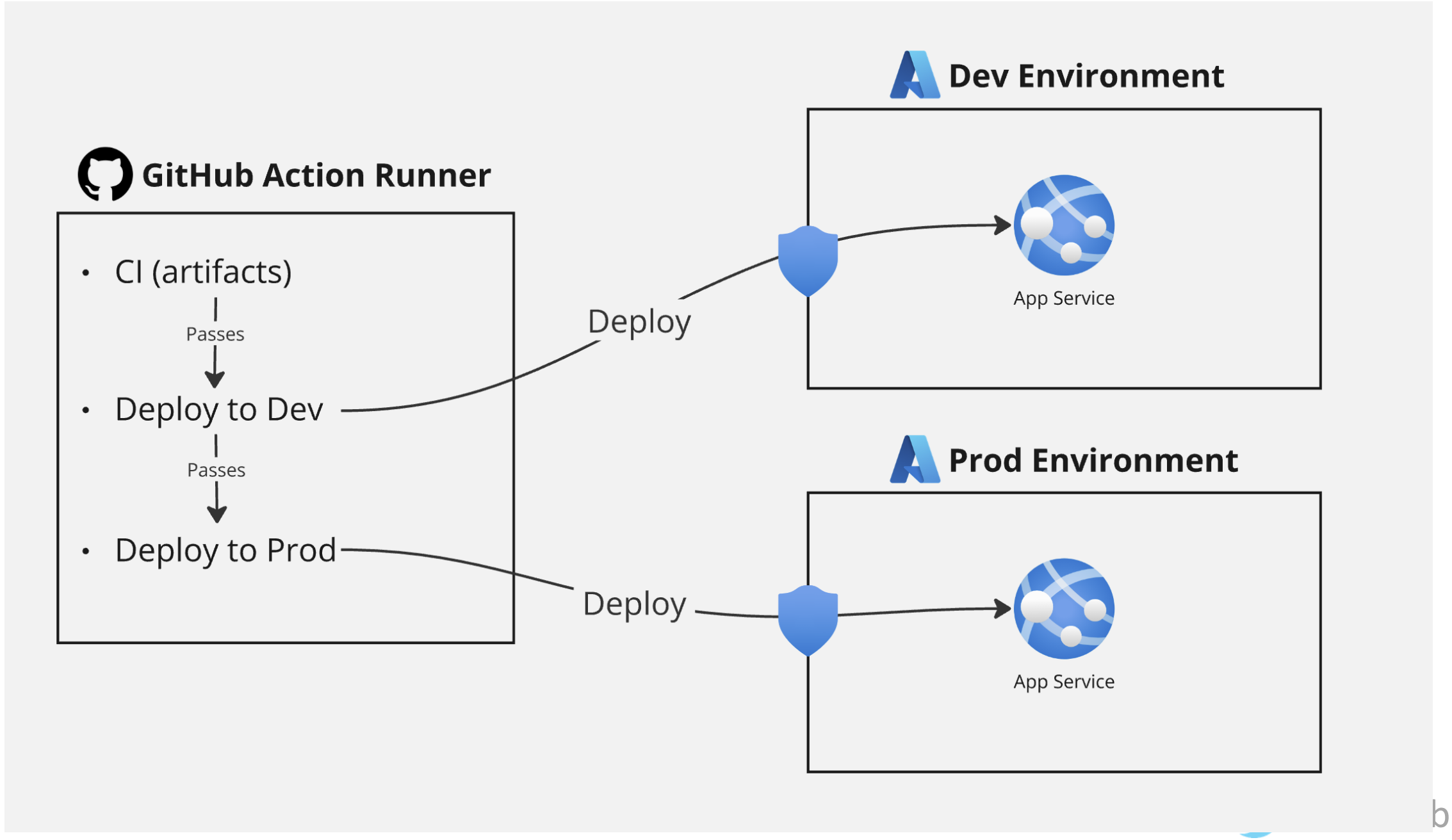
Dev Environment
GitHub Action Runner
CI (artifacts)
Passes
Deploy to Dev
Passes
Deploy to Prod
Deploy
App Service
Prod Environment
Deploy
App Service

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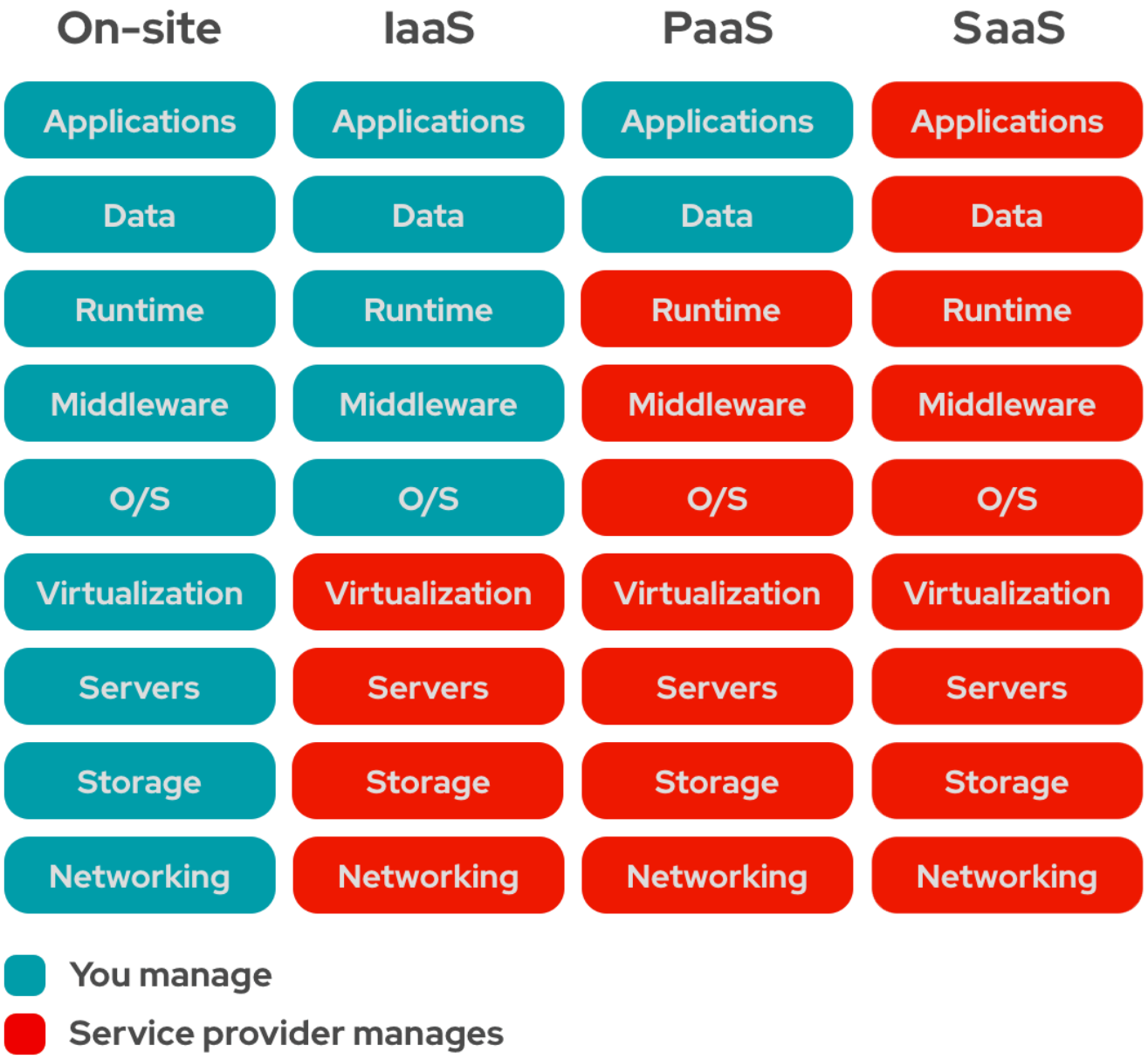
Azure

What is Azure?

- Microsoft offering for cloud hosting
- Offers many services from hosting web apps to databases to caching to messaging to…
- You should probably be picking PaaS offerings (i.e. not VMs)



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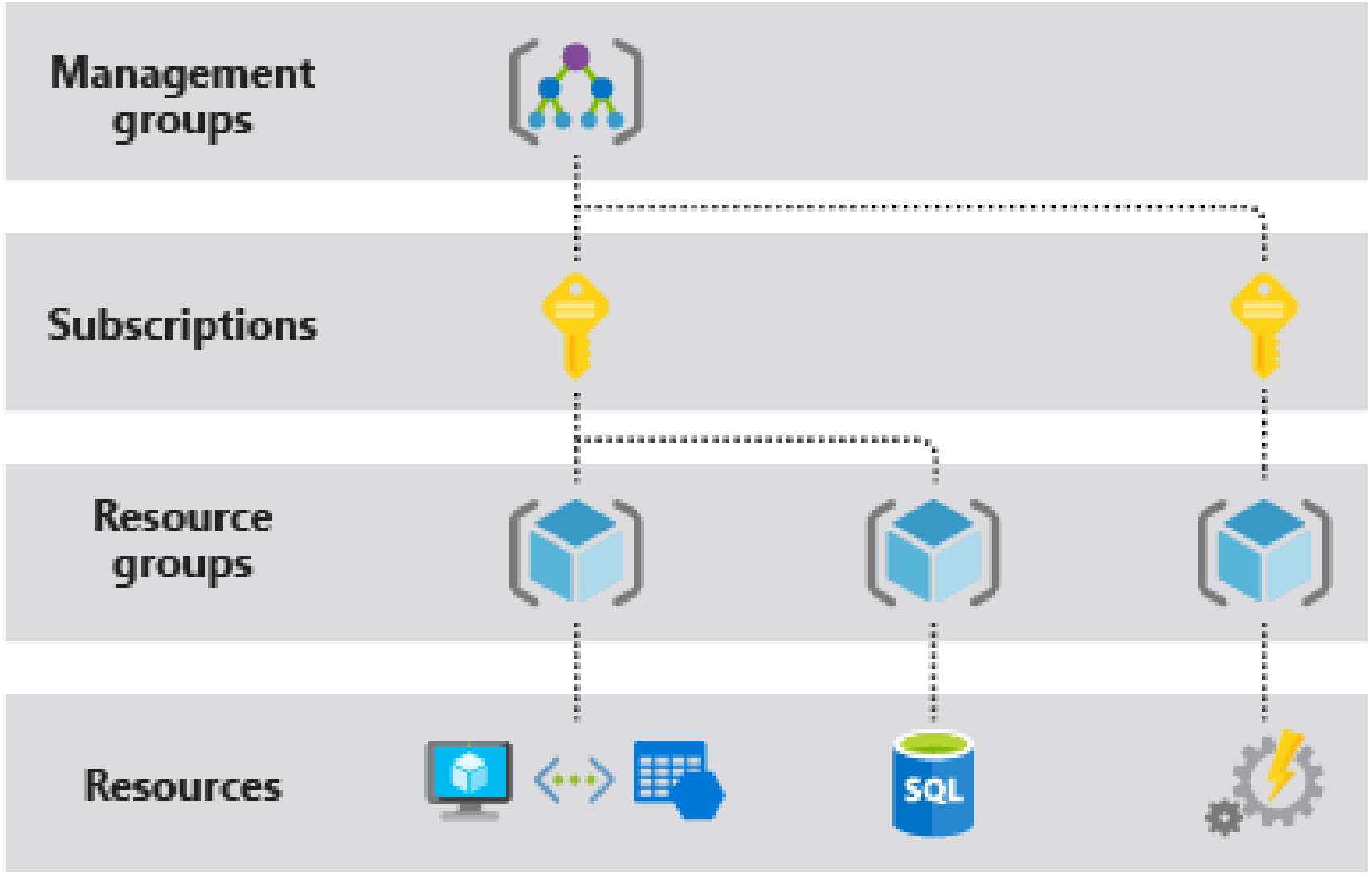
Subscriptions

- Top-ish level organization (ignoring Tenants, Management Groups for a minute)
- Recommended per team per environment
- My default naming convention: sub-<team/dept>-<environment>
  - Eg: sub-accounting-dev
- Role access separation
- Billing separation

Resource Groups

- Related groups of resources (i.e. web, DB, Key Vault, etc)
- Quickly view all resources related to that app
- Conceptually, RG = folder, and Resources = files
- Recommended per app per environment
- Default naming convention: rg-<product name>-<environment>
  - Eg: rg-fancyapp-dev
- May have many RG's in a single subscription
- Role access separation
- Billing separation



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Questions?

Azure App Service

What is Azure App Service?

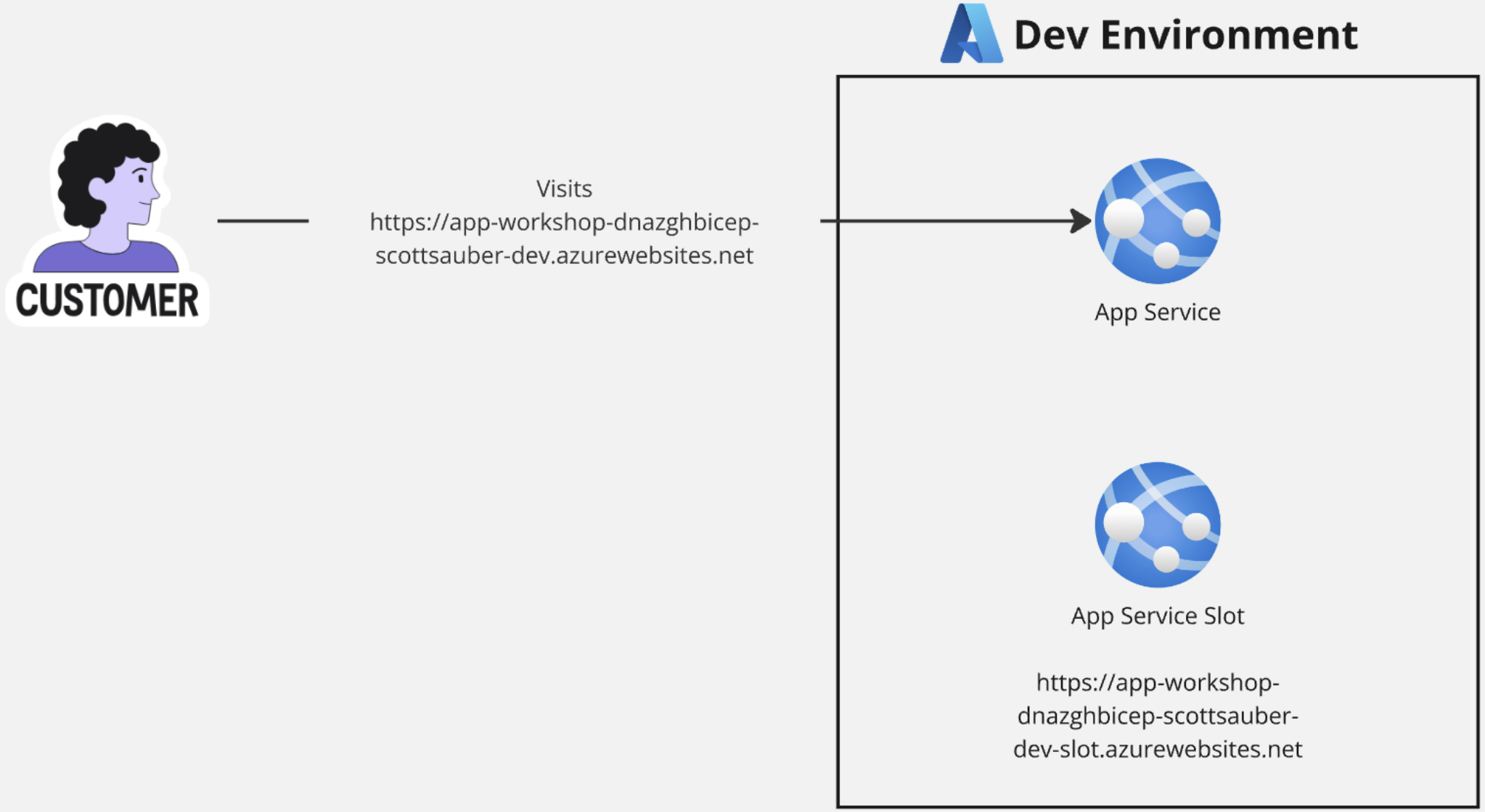
- PaaS offering for hosting applications
- ✅ Handles OS patches, Framework patches
- ✅ Zero downtime deployments with slots
- ✅ SSL Certs
- ✅ Autoscaling
- ✅ Custom Domains
- ✅ Very simple
- ✅ And More
- ❌ Less control because PaaS

What is an Azure App Service Plan?

- Kinda like VM for your App Service(s)
- Pick how much memory, storage, CPU
- Multiple app service on one ASP (should you?)
- Many apps can get away with P0V3 ($62/mo for Linux)
- Need to be at least Standard to get Slots

$ an issue?

- Savings Plan – commit to $ amount
- Save 25% for 1 yr or 45% for 3 yr commitment
- Reservation – commit to compute tier
- Save 35% for 1 yr or 55% for 3 yr commitment


Dev Environment
CUSTOMER
Visits
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App Service
App Service Slot
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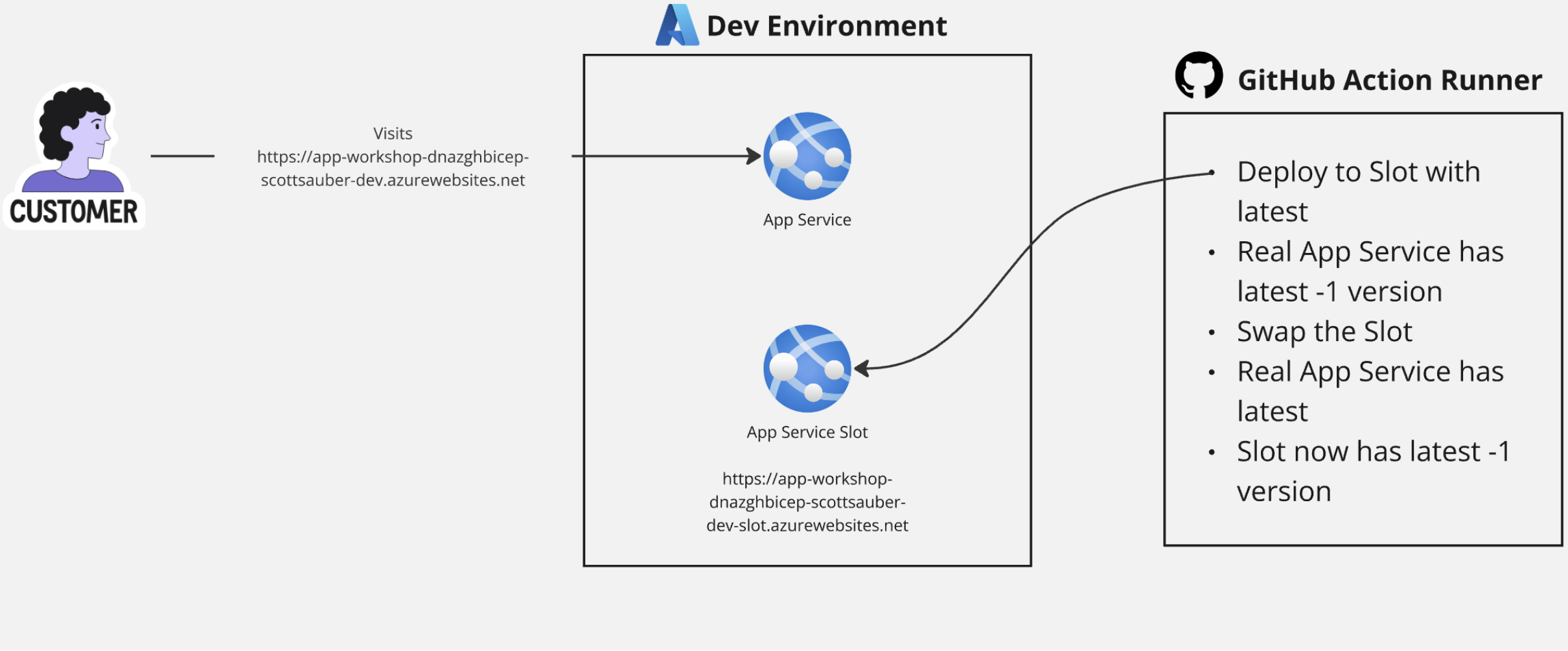
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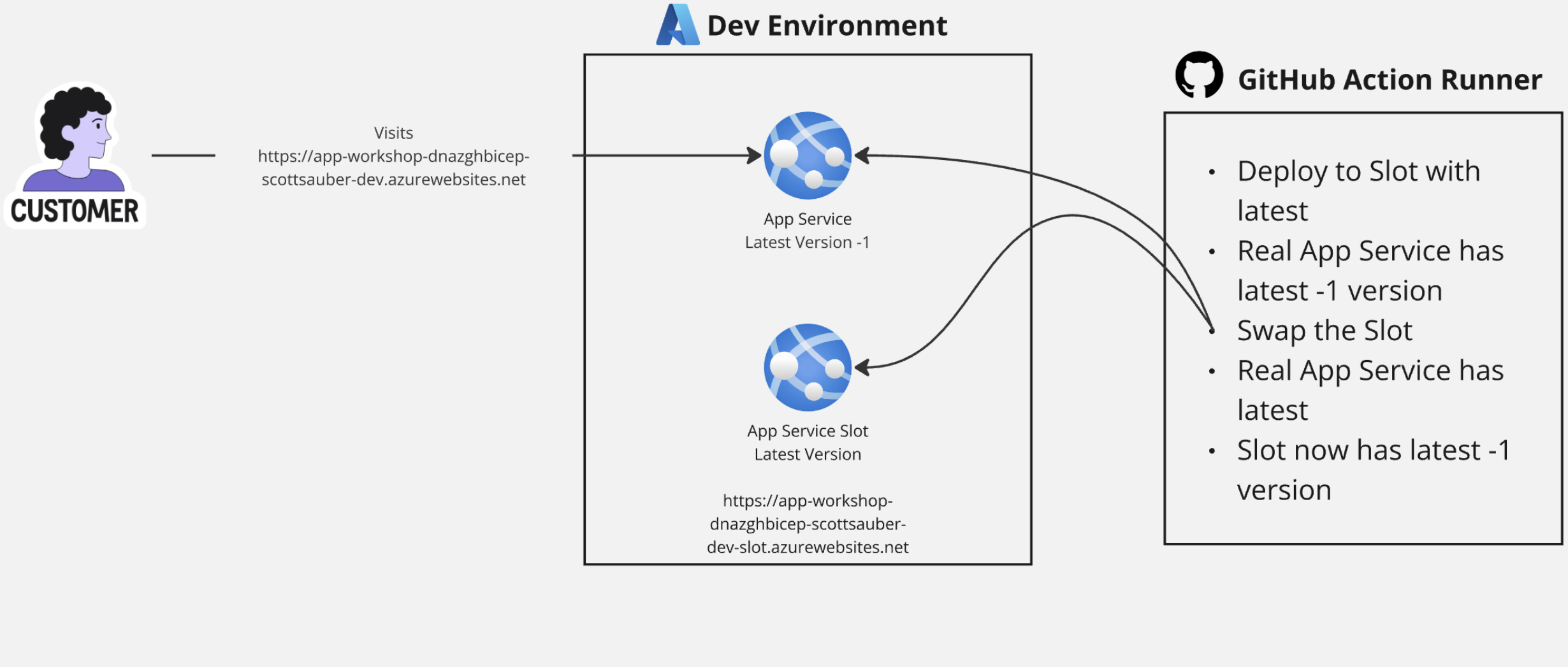
GitHub Action Runner
Deploy to Slot with latest
Real App Service has latest -1 version
Swap the Slot
Real App Service has latest
Slot now has latest -1 version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App Service
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App Service Slot
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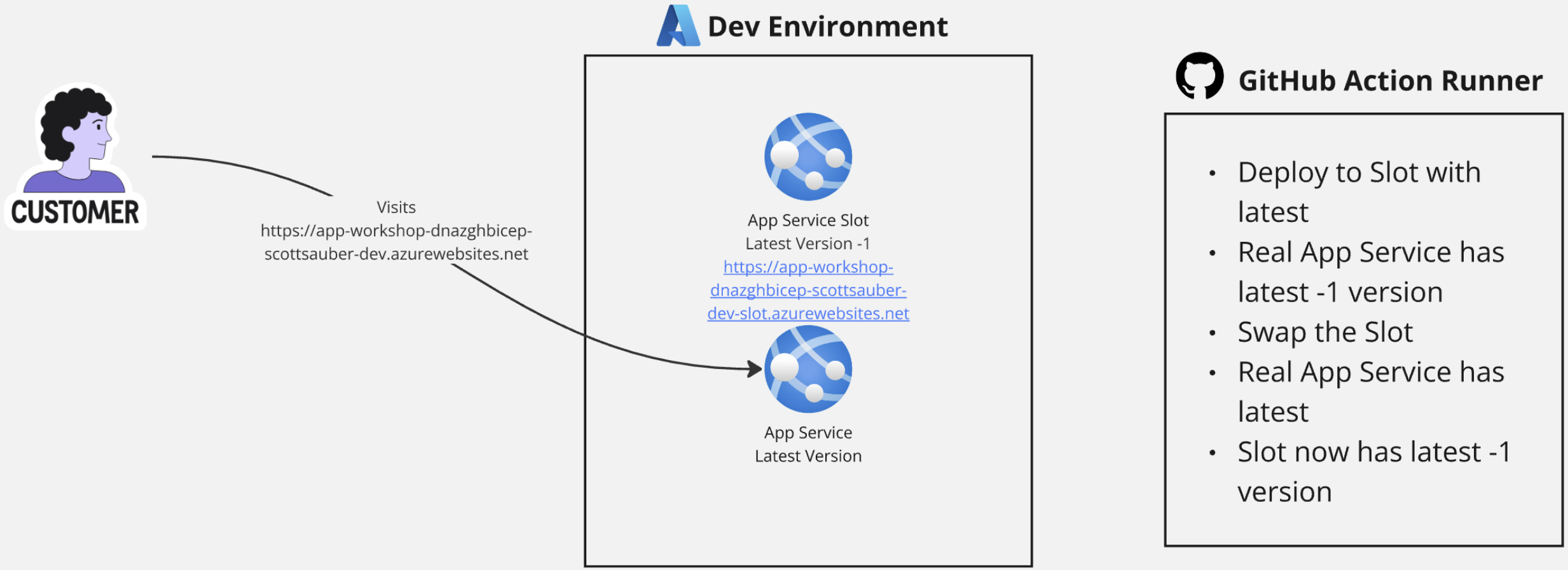
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Live Demo

Questions?

Bicep

Infrastructure as Code (IaC)

- Source code defining what resources to provision
- Stored in version control
- Declarative – what resources to create, not how to create them
- Deployed via pipeline
- Need a new env? Few lines of code

Without IAC

- Clickety Clack Configuration™ (ClickOps)
- Repeat yourself for each environment
- “It worked in Dev/UAT/Staging, not Prod”
- “It works on my machine”

What is Azure Bicep?

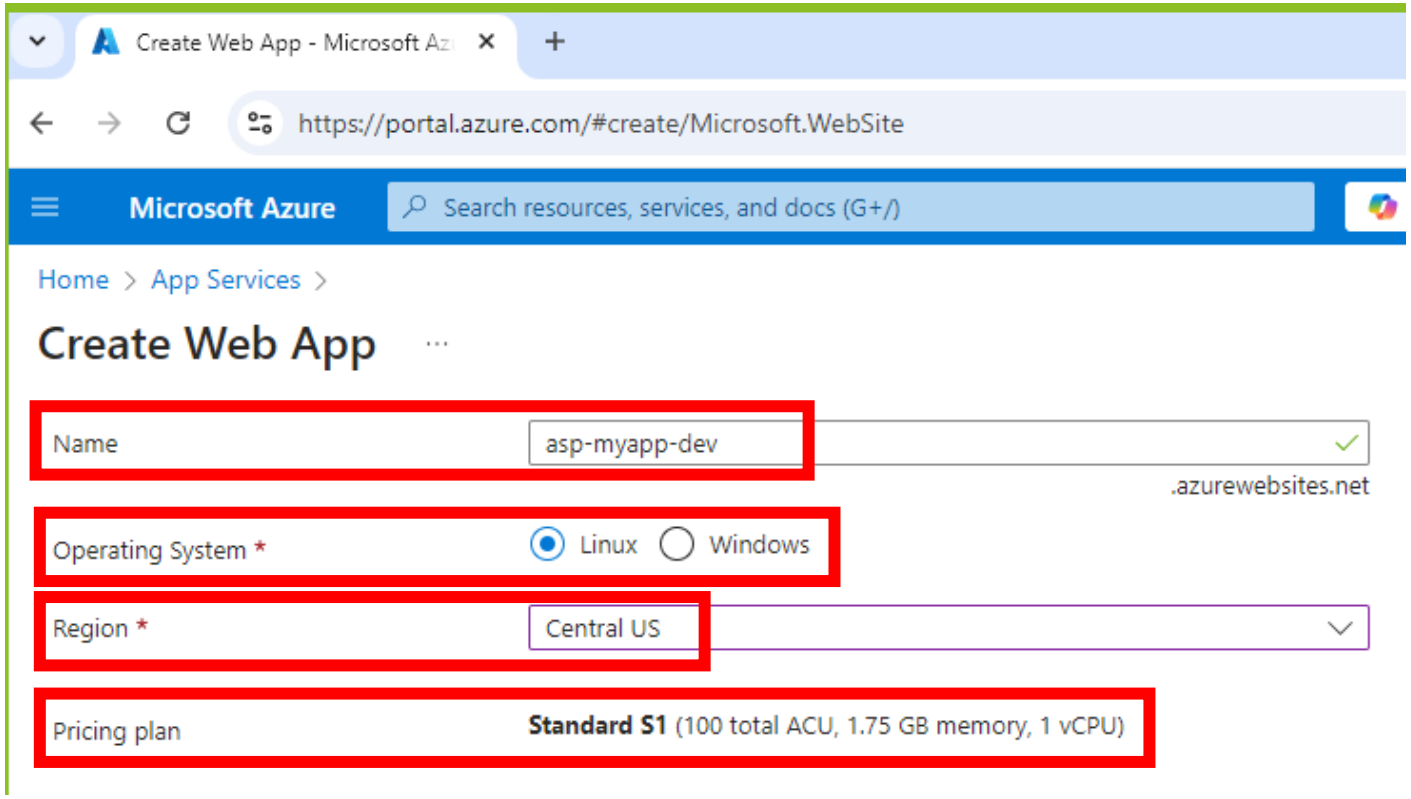
- Used to configure Azure resources
- Built and maintained by Microsoft
- Domain-specific language (fancy word for custom)
- Provides intellisense, error checking, “whatif,” and orders the resource creations
- Built on top of Azure Resource Manager (ARM) – don’t use ARM directly
- Can compose multiple files into “modules”
- Can pass data between modules via outputs
- No state file

What does Bicep look like?

```
resource appServicePlan 'Microsoft.Web/serverfarms@2022-09-01' = {
  name: 'asp-workshop-demo'
  location: 'centralus'
  sku: {
    name: 'S1'
  }
  kind: 'linux'
}
```

appservice.bicep

```
1   resource appServicePlan 'Microsoft.Web/serverfarms@2022-09-01' = {
2     name: 'asp-myapp-dev'
3     kind: 'linux'
4     location: 'centralus'
5     sku: {
6       name: 'S1'
7     }
8   }
```



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```bicep
resource appServicePlan 'Microsoft.Web/serverfarms@2022-09-01' = {
  name: 'asp-workshop-demo'
  location: 'centralus'
  sku: {
    name: 'S1'
  }
  kind: 'linux'
}
```

```bicep
resource appService 'Microsoft.Web/sites@2022-09-01' = {
  name: 'app-workshop-demo'
  location: 'centralus'
  properties: {
    serverFarmId: appServicePlan.id
    // others
  }
}
```

```
param appName string
@allowed(['dev', 'prod'])
param environment string
param location string

resource appServicePlan 'Microsoft.Web/serverfarms@2022-09-01' = {
  name: 'asp-${appName}-${environment}'
  location: location
  sku: {
    name: 'S1'
  }
  kind: 'linux'
}
```

dev.biccepparam file

```
using '../main.bicep'

param environment = 'dev'
```

But how do I deploy it?

```
az deployment group create
  --name dev-deployment-1
  --template-file infrastructure/main.bicep
  --parameters infrastructure/environments/dev.bicepparam
  --resource-group rg-some-name-here
  --verbose
```

Key Concepts – Quiz time!

- Resources
- Modules
- Parameters
- .bicepparam
- Outputs
- --whatif

Benefits

- No manual work of configuring in the portal (and repeating for each env)
- Eliminate configuration drift
- Traceability of who, did what, and when
- Give Contributor access to the pipeline – not to individuals

Additional Resources

- Documentation for various Bicep resources:
  - https://learn.microsoft.com/en-us/azure/templates/microsoft.web/sites?pivots=deployment-language-bicep

Live Demo

Questions?

Break then Hands On

Hands On for 25 mins

Module 4:

https://github.com/scottsauber/workshop-dotnet-azure-github-bicep

CI/CD Pipelines

Continuous Integration

- Automated verification of your application that generates artifacts
- Compiles the app
- Runs the tests
- Independent witness - eliminates “works on my machine”

Continuous Delivery

- Takes the artifacts from CI and deploys them automatically
- Doesn’t deploy all the way to Production
- Deploying to Production is a button click

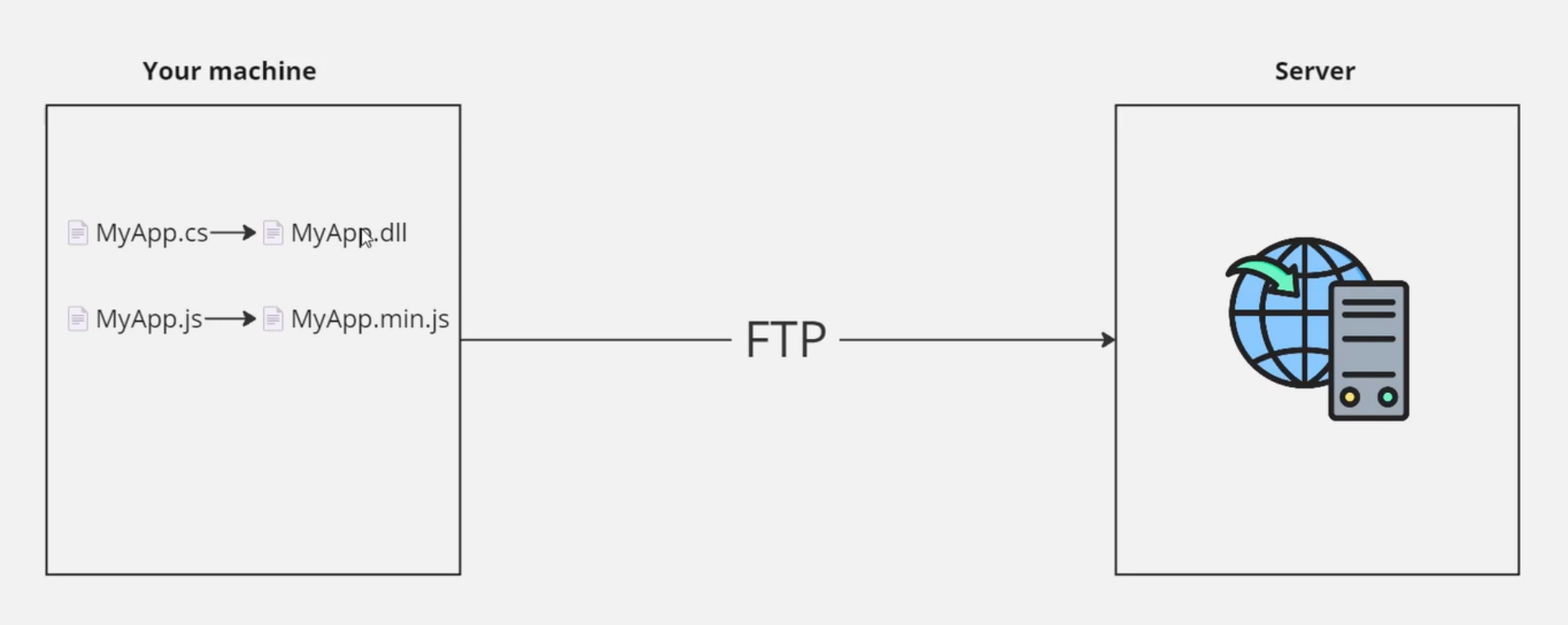
Continuous Deployment

- Deploys all the way to Production automatically
- If the pipeline is green, it’s going to Production

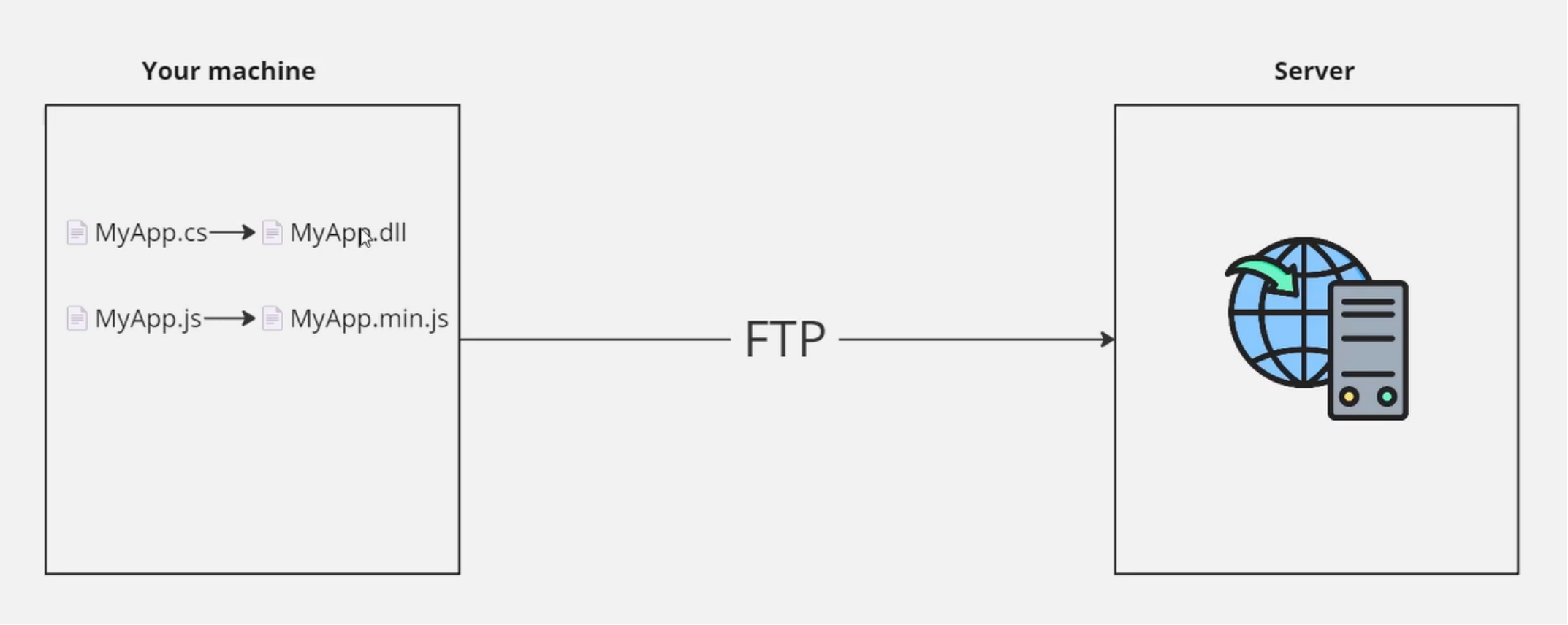
Confident Green

- If our build passes – why aren't we shipping to Production?
- Likely lack of confidence
- Likely missing automated tests or zero downtime deployments, let's fix that
- Ok now why?
- Repeat

Before CI/CD


Your machine
MyApp.cs
MyApp.dll
MyApp.js
MyApp.min.js
FTP
Server

After CI/CD


Your machine
MyApp.cs
MyApp.dll
MyApp.js
MyApp.min.js
FTP
Server

What's in a Pipeline?

Continuous Integration

- ☑ Restore Packages
- ☑ Compile
- ☑ Test
- ☑ Format
- ☑ Linting
- ☑ Security Scans
- ☑ Upload Artifacts
- ☑ Alerting on Failure

Continuous Delivery/Deployment

- ☑ Download Artifacts
- ☑ Deploy Artifacts
- ☑ Zero Downtime
- ☑ Deploy IAC
- ☑ Smoke Tests
- ☑ Alerting on Failure

GitHub Actions

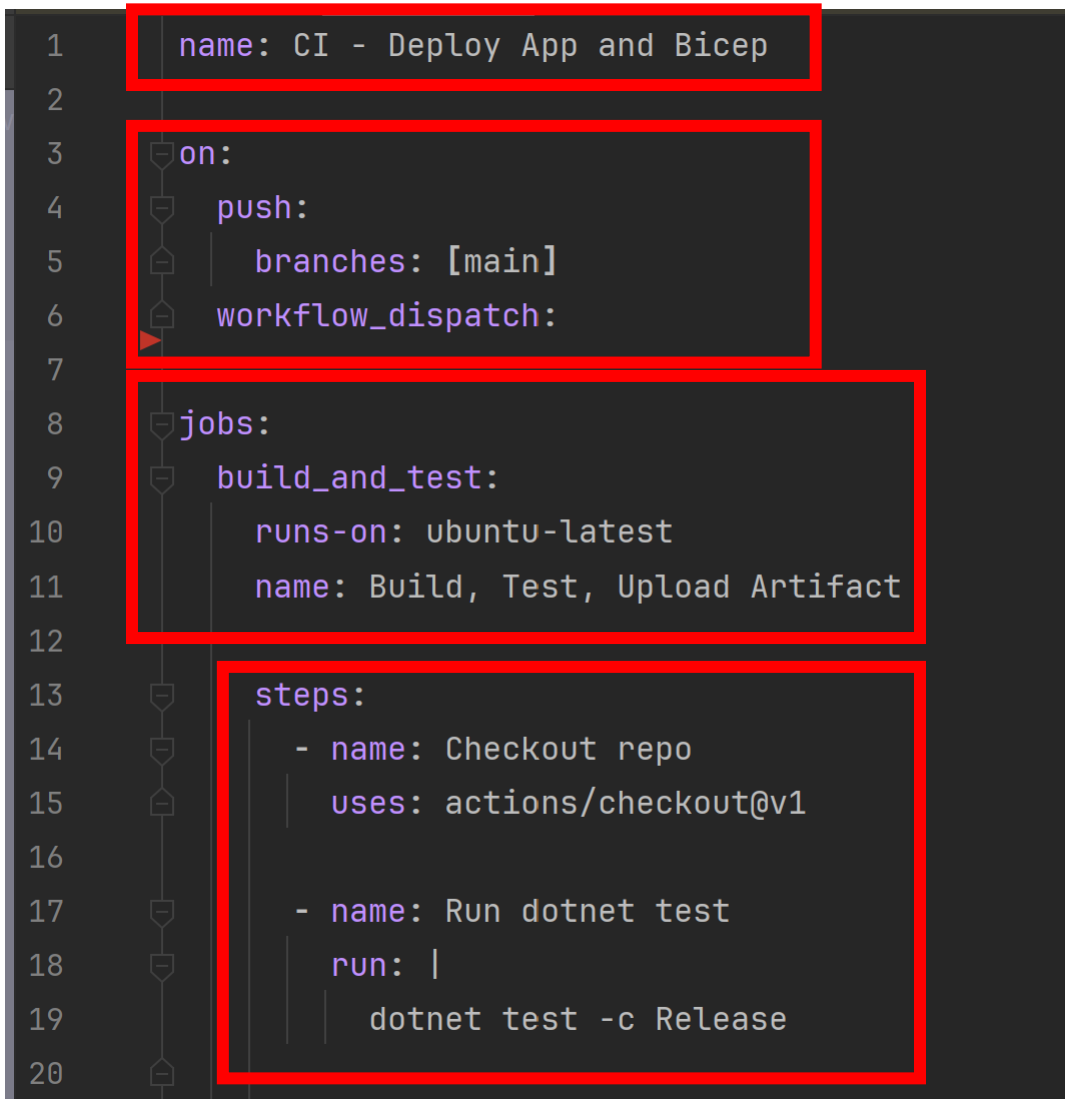
What is GitHub Actions?

- Thing doer on a trigger
- Trigger could be PR, push to main branch, open an issue, etc
- Automatically build and deploys your application
- Including the infrastructure (i.e. Bicep) and Database Migrations

Concepts

- Workflows
- Triggers
- Jobs
- Steps
- Inputs
- Secrets

What does GitHub Actions Look Like?



```yaml
name: CI - Deploy App and Bicep

on:
  push:
    branches: [main]
  workflow_dispatch:

jobs:
  build_and_test:
    runs-on: ubuntu-latest
    name: Build, Test, Upload Artifact

    steps:
      - name: Checkout repo
        uses: actions/checkout@v1

      - name: Run dotnet test
        run: |
          dotnet test -c Release
```

How do I reuse workflows?

```yaml
name: CI - Deploy App and Bicep

on:
  push:
    branches: [main]
  workflow_dispatch:

jobs:
  build_and_test:
    runs-on: ubuntu-latest
    name: Build, Test, Upload Artifact

    steps:
      - name: Checkout repo
        uses: actions/checkout@v1

      - name: Run dotnet test
        run: |
          dotnet test -c Release

      - name: Run dotnet publish
        run: |
          dotnet publish ./src/WorkshopDemo/WorkshopDemo.csproj -c Release -o ./publish
```

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How do I reuse workflows?

```yaml
name: Step - Test and Publish

on:
  workflow_call:
    inputs:
      project_path:
        required: true
        type: string

jobs:
  build_and_test:
    runs-on: ubuntu-latest
    name: Build, Test, Upload Artifact

    steps:
      - name: Checkout repo
        uses: actions/checkout@v1

      - name: Run dotnet test
        run: |
          dotnet test -c Release

      - name: Run dotnet publish
        run: |
          dotnet publish ${{ inputs.project_path }} -c Release -o ./publish
```

How do I consume this reusable workflow?

```yaml
name: CI - Test and Publish

on:
  push:
    branches: [main]
  workflow_dispatch:

jobs:
  build_and_test:
    uses: ./.github/workflows/step-build-and-test.yml
    with:
      project_path: ./src/WorkshopDemo/WorkshopDemo.csproj
```

How do I consume this from another repo?

```yaml
name: CI - Test and Publish

on:
  push:
    branches: [main]
  workflow_dispatch:

jobs:
  build_and_test:
    uses: my-org-or-username/repo-name/step-build-and-test.yml
    with:
      project_path: ./src/WorkshopDemo/WorkshopDemo.csproj

```

Live Demo

Questions?

Hands On for 45 mins

Module 6:
https://github.com/scottsauber/workshop-dotnet-azure-github-bicep

Reminder: Email scott@saubersoftware.com if you're doing hands on to get free Azure access:

- **Email you will use for Azure**
- **GitHub username**

You will receive an email with some guids you will use later, check Spam!

Bonus: Additional .NET Integrations in modules

- .NET integrations with:
  - Health Checks
  - Azure Key Vault
  - Azure Log Analytics

Bonus: GitHub Environments

- GitHub natively has the concept of Environments
- These environments can have secrets
- You can also set up Protection Rules on environments
- Let’s refactor our code to use Environments!

Bonus: PR Checks for Infrastructure

- When you change some Bicep it'd be nice to know what it's going to do
- --whatif for PR's
- Have the –whatif comment back on the PR what it's going to do
- Example

Bonus: PR Checks for Infrastructure

- Checkov security scanner
- Tells you if something is misconfigured
- ie TLS 1.2 is not the minimum TLS setting for an App Service
- Public Storage Accounts

```
➜  bicep checkov -d /Users/maciejpoborca/Desktop/temp/bicep
[ bicep framework ]: 100%|                    |[1/1], Current File Scanned=main.bicep


       _               _
   ___| |__   ___  ___| | _______   __
  / __| '_ \ / _ \/ __| |/ / _ \ \ / /
 | (__| | | |  __/ (__|   < (_) \ V /
  \___|_| |_|\___|\___|_|\_\___/ \_/

By bridgecrew.io | version: 2.1.75
Update available 2.1.75 -> 2.1.87
Run pip3 install -U checkov to update


bicep scan results:

Passed checks: 0, Failed checks: 6, Skipped checks: 0

Check: CKV_AZURE_132: "Ensure cosmosdb does not allow privileged escalation by restricting management plane changes"
        FAILED for resource: Microsoft.DocumentDB/databaseAccounts.cosmosAccount
        Severity: MEDIUM
        File: /main.bicep:46-63
        Guide: https://docs.bridgecrew.io/docs/bc_azr_storage_4

                46 | resource cosmosAccount 'Microsoft.DocumentDB/databaseAccounts@2021-04-15' = {
                47 |   name: cosmosAccountName
                48 |   kind: 'GlobalDocumentDB'
                49 |   location: location
                50 |   properties: {
                51 |     consistencyPolicy: {
                52 |       defaultConsistencyLevel: 'Session'
                53 |     }
                54 |     locations: [
                55 |       {
                56 |         locationName: location
                57 |         failoverPriority: 0
                58 |         isZoneRedundant: false
                59 |       }
                60 |     ]
                61 |     databaseAccountOfferType: 'Standard'
                62 |   }
                63 | }

Check: CKV_AZURE_15: "Ensure web app is using the latest version of TLS encryption"
```

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Takeaways

- How to leverage Azure
- Why IAC is useful and how Bicep works
- How to create GitHub Actions and applies IAC to Azure
- Some takeaway tips even if you had experience with this stuff

Resources

- Slides at scottsauber.com (and in the repo)
- https://github.com/scottsauber/workshop-dotnet-azure-github-bicep
  - Main has the “final” state of things

Questions?

Contact: ssauber@leantechniques.com

@scottsauber

@scottsauber.com

Feedback:

Slides at scottsauber.com

Thanks!

Feedback:

Slides at scottsauber.com

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