dev up

Discovery B – 4:00 pm

# IaC Azure - Bakeoff

Mike Benkovich
@mbenko | mike@benko.com | www.benkoTips.com


SyllogisTeks

ArchitectNow

3Cloud

slalom

((CENTRIC))

CONCERO

Microsoft Azure

Edward Jones

REPLY

MiTek

OAKWOOD

VantageLinks

ADAPTIVE SOLUTIONS GROUP

Covenant TECHNOLOGY PARTNERS

TRIZETTO Provider Solutions
A Cognizant Company

SecureIdeas
professionally evil

SBS CREATIX
IT CONSULTANTS

NISA

aspire
A ServiceTitan Company

Progress

Talentporte

HUNTER Engineering Company

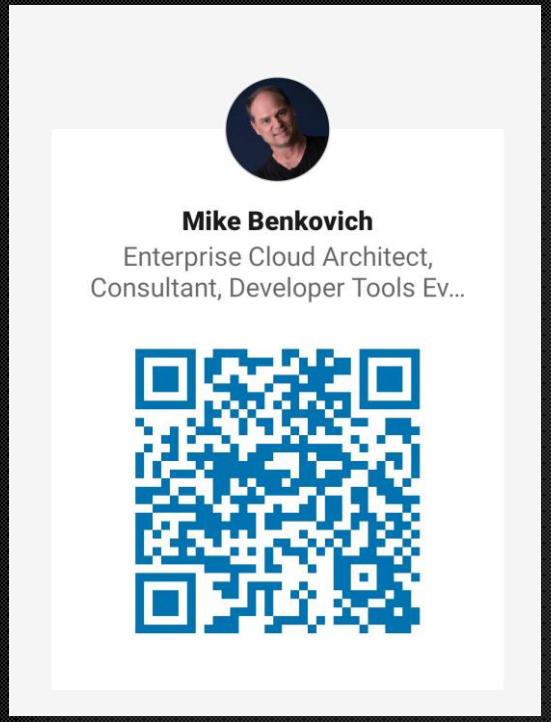
TEALS Program
Building equitable, inclusive computer science programs in high schools
Microsoft

ungerboeck

ais APPLIED INFORMATION SCIENCES

# Mike Benkovich

- **Developer** tools evangelist
- Cloud **Architect** & **Consultant**
- Live in **Chanhassen**
- Follow **@mbenko** on **Twitter**
- Blog www.**benko**TIPS.com
- Owner of **Imagine Technologies**, Inc.
- Developing Courses for **LinkedIn** Learning
- Founded **TechMasters** – Toastmasters for Geeks
- Send me **Feedback**! mike@benko.com



# My Sessions … this week!

- Permit to Cloud – Land with Confidence in Azure
  - Tuesday 6/7 11:00 am – Discovery D
- Performance Tuning Strategies for Cosmos DB
  - Tuesday 6/7 4:00 pm – Imagination B
- Infrastructure as Code Bake-off ARM vs Bicep vs TF
  - Wednesday 6/8 4:00 pm – Discovery B

## Today

Infrastructure as Code and Azure

Hello ARM and Bicep

Hello Terraform

Considerations

# An Application is an Idea...

Data

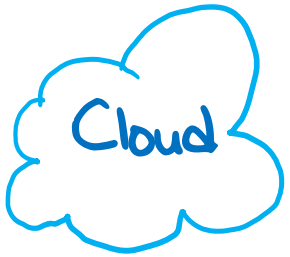
Code

+ Infrastructure

---

= Application


Cloud Application

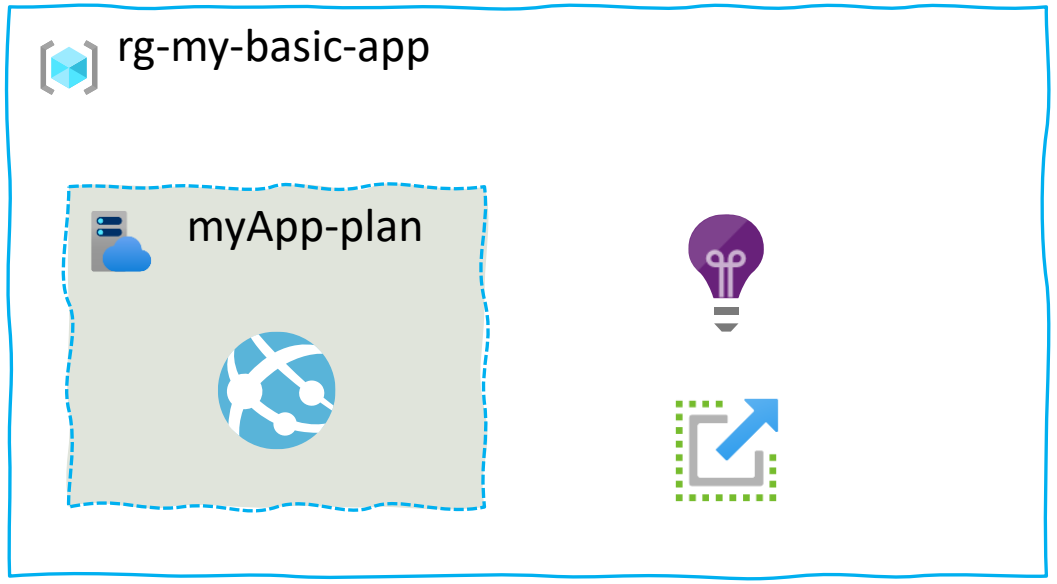



- Runs in a cloud datacenter
- Virtualized hardware
- Monitored
- Configurable
- Scalable

# Basic Infrastructure

Simple web app

- Resource Group
- Hosting Plan
- App Svc
- Insights
- Autoscale rule



# Questions?

What should I use?

What tools do I need?

Cross Cloud support or on-prem?

Who manages the state?

Learning curve?

Readability of the language?

Immediate support for new features?

Does it support modules?

How does it do DevOps processes?

# Azure Deployment Options

**Azure Native**

- Azure Portal
- Azure PowerShell
- Azure CLI
- ARM Templates
- Bicep

**Cross Cloud (3rd Party)**

- Terraform
- Pulumi
- Ansible
- Chef
- and more…

# Infrastructure as Code (IaC)

- Code
- Versioned & managed
- Repeatable
- Descriptive vs Procedural
- Environment drift
- Idempotent
- Current

main.bicep M

deploy > Bicep > main.bicep > ...

```bicep
@description('Specifies the location for resources.')
param location string = 'centralus'

param appName string
param envName string
param color string
@secure()
param secretValue string

targetScope = 'subscription'

resource rg 'Microsoft.Resources/resourceGroups@2021-04-01' = {
  name: 'bnk-${appName}-${envName}-rg'
  location: location
}

module site 'mywebsite.bicep' = {
  scope: resourceGroup(rg.name)
  name:  deployment().name
  params: {
    appName: appName
    envName: envName
    secretValue: secretValue
    color: color
  }
}

output rgName string = rg.name
```

# ARM

# ARM Template

- A declarative way to work with a resource provider
- Includes one or more resources
- Provides configuration information
- Each resource is translated into the REST call

# Template Structure

```
{
  "$schema":"https://schema.management.azure.com/schemas/20...
  "contentVersion": "1.0.0.0",
  "parameters": {  },
  "variables": {  },
  "resources": [  ],
  "outputs": {  }
}
```

# Resource section

```
"resources": [
    {
      "name": "[parameters('storageName')]",
      "type": "Microsoft.Storage/storageAccounts",
      "location": "[resourceGroup().location]",
      "apiVersion": "2016-01-01",
      "sku": {...},
      "dependsOn": [...],
      "tags": {...},
      "kind": "Storage"
    }  ... ]
```

# Tools for ARM

- Visual Studio – Resource Group Project
- VS Code – ARM Extension
- Azure Portal
- GitHub

# ARM Summary

- Native to Azure
- View deployments in Azure Portal
- Verbose
- Variables enable naming standards
- Parameters ease testing across environments

# Bicep

http://github.com/mbenko/du22-ptc

# Project Bicep

- ARM Transpiler, generates ARM as output
- Simpler syntax reduces complexity of ARM
- Modularity
- Support for all resource types and API versions
- A domain-specific-language for Azure
- No state or state files to manage
- No cost, open source

# Bicep File

```
targetScope = '<scope>’


@<decorator>(<argument>)
param <parameter-name> <parameter-data-type> = <default-value>


var <variable-name> = <variable-value>


resource <resource-symbolic-name> '<resource-type>@<api-version>' = {
  <resource-properties>
}


module <module-symbolic-name> '<path-to-file>' = {
  name: '<linked-deployment-name>’
  params: {
    <parameter-names-and-values>
  }
}


output <output-name> <output-data-type> = <output-value>
```

# Example Bicep Parameters

```
@minlength(3)
@description('Application Name')
param appName string

@allowed([
   'eus'
   'wus'
   'cus'
])
@description('Location of Data Center')
param loc string
```

# Example Bicep Variables

```
var prefix = '${loc}-poc-'
var hostName_var = '${prefix}${appName}-plan'
var siteName_var = '${prefix}${appName}-site'
```

# Example Bicep Resources

```
resource host 'Microsoft.Web/serverfarms@2021-01-15' = {
  name: hostName
  location: resourceGroup().location
  sku: {
    name: 'F1'
  }
}
```

# Get started with Bicep

- Decompile existing ARM templates
- Code Extension enables snippets to simplify dev
- Deployment via same calls as for ARM

# Terraform

# Terraform

Created by Hashicorp

HCL Language

Multi-cloud

Tool for versioning infrastructure

Uses state information for execution plan

Install is simple download of the executable and run

# Install/setup Terraform

Built in to the Azure Cloud Shell in the portal

Download the executable from Terraform's site, copy exe to path

Use Chocolaty installation

```
> choco install terraform
```

# Workspace and Files

- Create folder for workspace
- Initialize terraform in folder
  - Associates workspace with backend
  - Loads necessary modules
- Add template files *.tf and *.tfvar files
  - main.tf, vars.tf, output.tf, etc.

# Terraform Providers

```
terraform {
  required_providers {
    azurerm = {
      source  = "hashicorp/azurerm"
      version = ">= 2.0"
    }
  ...
}
provider "azurerm" { ...
}
```

# Terraform Variables

```
variable "prefix" {
  type = string
  default = "dadapp"
}

variable "src" {
  type = list
  default =  ["azARM", "code", "bicep", "terraform"]
}
```

# Terraform Resources

```
resource "azurerm_app_service_plan" "plan" {
  name                = "tf-${var.prefix}-plan"
  location            = "${azurerm_resource_group.main.location}"
  resource_group_name = "${azurerm_resource_group.main.name}"

  sku {
      tier = "Free"
      size = "F1"
  }
}
```

# Terraform Commands

| | |
|---|---|
| init | Initializes the environment |
| plan | Compares the template to the saved state and shows what will change if applied |
| apply | Runs the template |
| destroy | Removes what was created |

# Terraform Summary

- HCL Language less noisy
- Cross cloud support
- Environmental testing code takes some thought
- State management
- Secrets
- Consider how you will secure your state

# Pulumi

# Pulumi

A developer focused collection of packages and libraries that can be run from within a custom application to operate cloud APIs to create and manage infrastructure.

**PROS**

- Multiple languages and APIs
- Compiled into native runtime
- Developers don’t have to another language
- State and secret management
-

**CONS**

- Vendor managed running of api’s
- Need paid plan for CI/CD integration
- State is 3rd party to Azure

# IaC Considerations

- Learning Curve & Tools
- Variables and Parameters
- Preview
- History
- Modularity
- Looping
- Security
- Current

# IaC Comparison notes...

## ARM/Bicep

- JSON or Bicep language
- Parameters & variables
- State managed by Azure natively
- can see deployments in Az Portal
- path to modules
- dynamic map data type
- module convention = 1 file
- secrets

## Terraform

- HCL
- Locals, variables & TFVars
- State managed by TF*
- No History of deployments*
- need to run tf init to load modules
- map defines structure & elements
- module convention = 3 files
- secrets in plain text in state

# State Management

- Working with same code in different environments
- Securing it is your responsibility
- Updating/fixing if something goes wrong
- How to import external changes

# Comparison

| Feature | ARM/Bicep | Terraform | Pulumi |
|---|---|---|---|
| **Language** | JSON + Bicep | HCL/DSL | Code Native, e.g. JavaScript, Python, C#... |
| **Clouds** | Azure only | Agnostic + on-prem | Agnostic + on-prem |
| **State Files** | Uses Azure Resource Manager natively | Plain-text | Encrypted |
| **Naming standards** | Variables & Parameters | Locals | Language native |
| **Environments** | Parameter files | Folder structure | Stacks |
| **Preview Changes** | az deployment … what-if | terraform plan | pulumi preview |
| **Infrastructure Cleanup** | No | terraform destroy | pulumi destroy |
| **Deployment History** | Yes – View in Portal | SCM, TF Cloud* | SCM, Pulumi Enterprise* |
| **Code Reuse** | Hosted JSON URIs | Modules + Registry | Code native packages, NPM |

* refers to a premium feature from vendor, i.e. Terraform Cloud or Pulumi Enterprise
Source: https://julie.io/writing/arm-terraform-pulumi-infra-as-code

# ARM

## Overview

Azure native solution for infrastructure as code, provides idempotent declarative way to describe infrastructure shape and the ARM engine in Azure makes it so

**PROS**

- Native to Azure
- Works with the Portal
- Tooling is ok in VS, better in Code

**CONS**

- Verbose, hard to read
- Complex
- Cloud specific

# Bicep

A domain specific transpiler for creating Azure ARM templates from a language that provides constructs for variables, looping, modules and scoped deployments

**PROS**

- Day 1 Current
- Easier to read and write thanks to tooling
- Output is ARM
- History is Azure Resource Manager native
-

**CONS**

- Newer to the field
- Cloud specific
-

# Terraform

A popular cross-cloud tool for managing infrastructure by processing templates written in HCL into calls to management APIs, keeping track of state information describing cloud resources and services, available in Open Source and paid versions

**PROS**

- Declarative description of infrastructure
- HCL is easier to read, less clutter
- Works in multiple Cloud providers & on prem
- Broad adoption

**CONS**

- State management separate from cloud
- Changing between environments
- History/visibility of deployments
- Secrets stored in clear text in state

# Pulumi

A developer focused collection of packages and libraries that can be run from within a custom application to operate cloud APIs to create and manage infrastructure.

**PROS**

- Multiple languages and APIs
- Compiled into native runtime
- Developers don’t have to another language
- State and secret management
-

**CONS**

- Vendor managed running of api’s
- Need paid plan for CI/CD integration
- State is 3rd party to Azure

# Conclusion

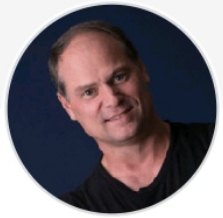
**Terraform** is a powerful and popular tool for IaC that supports multi-cloud deployments, but you have to be careful with your state and secrets

**Bicep** is always current, uses Azure Resource Manager for State, secures secrets by default, and is a powerful domain specific language for IaC with Azure with great tooling

Understanding/architecting an effective **cloud infrastructure** still requires thought, vision and execution, but you have to decide on your priorities.

# References


- Bicep and Terraform compared · Thorsten Hans' blog (thorsten-hans.com)
- Design Principles and Practices for Terraform | by Fernando Villalba | The Startup | Medium
- Getting started with Azure Bicep for ARM template creation (zimmergren.net)
- How to Create Terraform Multiple Environments (getbetterdevops.io)
- ARM Templates vs Terraform: Comparison and Fundamental Differences | Dinarys
- ARM Templates vs Terraform vs Pulumi - Infrastructure as Code in 2021 | Julie Ng



**Mike Benkovich**

Enterprise Cloud Architect, Consultant, Developer Tools Ev...

# Call to Action...

## *Where can I get more info?*

Give me feedback on LinkedIn
*(Scan the QR Code to the left)*

Visit my blog [www.benkotips.com](http://www.benkotips.com)

Azure Office Hour Fridays!
https://bit.ly/BnkAzHrs

Try it out with **low hanging fruit**

## Takeaways from today

How to go from **Idea** to **Cloud** App

Discover **Visual Studio** tools to build **Connected** Apps

Use **Resource Group** projects to manage cloud **access**!

Enable Continuous **Value** with **DevOps**

**Blueprints** create **Landing Zones** with **Cloud Governance**

# The Dad App

Web Application
- Mobile friendly
- ASP.NET Core Web App
- Calls API for Joke

Configuration

Monitored

Keep it simple!
- Use existing tools
- Click to deploy
- Manage in Portal


http://github.com/mbenko/du22-ptc

# Azure DevOps vs. Github

**Azure DevOps**

- Microsoft Team Services
- Enterprise focus
- Private repos by default
- One-stop-shop
  - Repos, Boards, Pipelines
  - Artifacts, Testing

**Github**

- Open Source favorite
- Community focus
- Public repos by default
- New capabilities
  - Actions
  - Boards

# GitHub Actions for CI/CD

Triggered by changes to Code

YAML based syntax

Defines steps to build & deploy

Extendable

http://github.com/mbenko/du22-ptc

# Azure DevOps

| | |
|---|---|
| **Boards** | Manage the work of a project |
| **Repositories** | Stores your code in GIT or TFVC |
| **Pipelines** | Automation workflow to build and publish code |
| **Test Plans** | Automate the testing process |
| **Artifacts** | The output of Pipelines and Code |
| **DevOps Server** | An on-premises installation of Azure DevOps (TFS) |

# Azure DevOps Pipelines

A cloud **automation service** to enable building, testing and delivery of code of any language to project type

Enables **consistent execution** of build and delivery processes

Hosted and custom pipeline agents including Windows, Linux and MacOS support processing of **any** software project type

Supports **triggers** and wide variety of **approvals** and **quality** gates