Infrastructure as Code & Terraform Basics

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Microsoft

Agenda

1. Infrastructure as Code (IaC)
2. Terraform
3. Known Providers
4. Q&A

Infrastructure as Code

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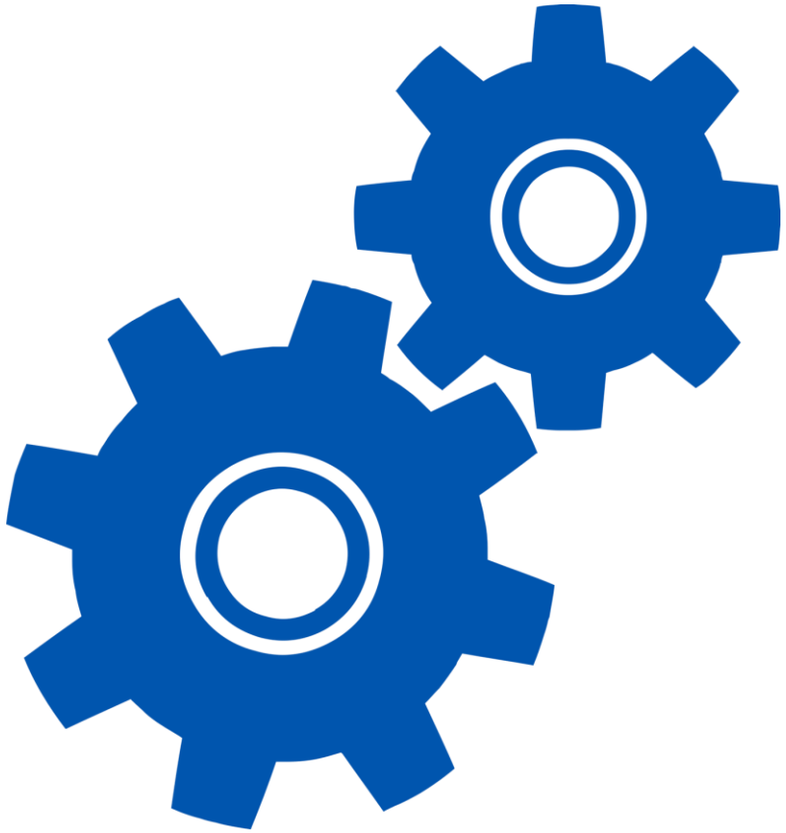
What is Infrastructure as Code (IaC)

- Build the infrastructure for an App all at once through automation
- Not just for Cloud, Software Defined Data Center
- Embedded Documentation
- Source Control
- Flexible Build Process



Why Infrastructure as Code (IaC)

- Less errors
- Faster to deliver
- Flexibility
- Code is documentation

Provisioning Services is Complicated

- No Visibility and Control
- Many Departments
- Siloed Tools
- Manual Hand-offs
- Lots of Wait Time

Business	Request Service	wait	wait	wait	wait	wait	wait	wait	wait	wait	Use Service
Service Mgmt.		Approve		CAB						CAB	
Server Admins			Provision Servers				Provision Middleware				
Network Engnrg.					Configure Network						Open Access
Storage Admins						Provision Storage					
Database Admins								Provision Database			
Application Ops									Deploy Apps		Open Access

10 to 30 Days

Emerging Islands of Automation

Platform-specific virtualization tools such as VMware, HyperV, and AWS

Platform-agnostic provisioning tools such as OpenStack, SaltStack or Docker

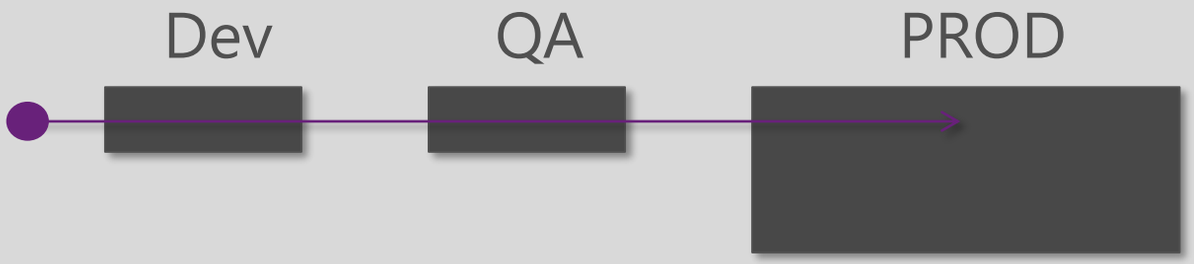
Platform-specific provisioning tools such as Puppet, Chef or SCCM

Custom Scripts and provisioning tools for networks, SAN and storage

A wide array of server and software deployment tools

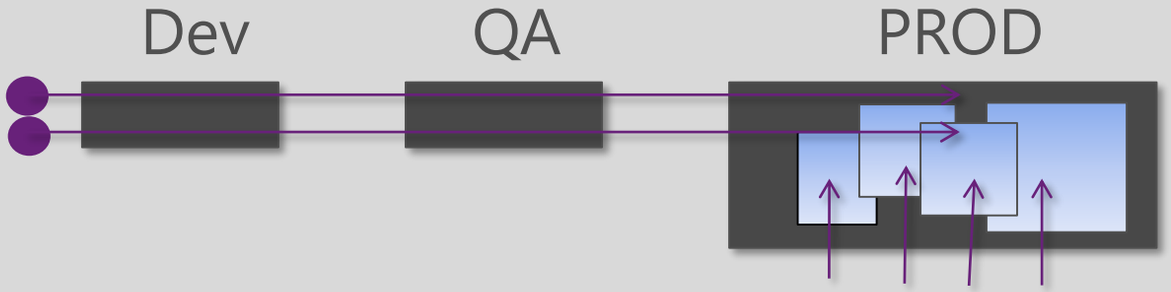
DevOps Confronts the Agile Challenge

Circa 2010



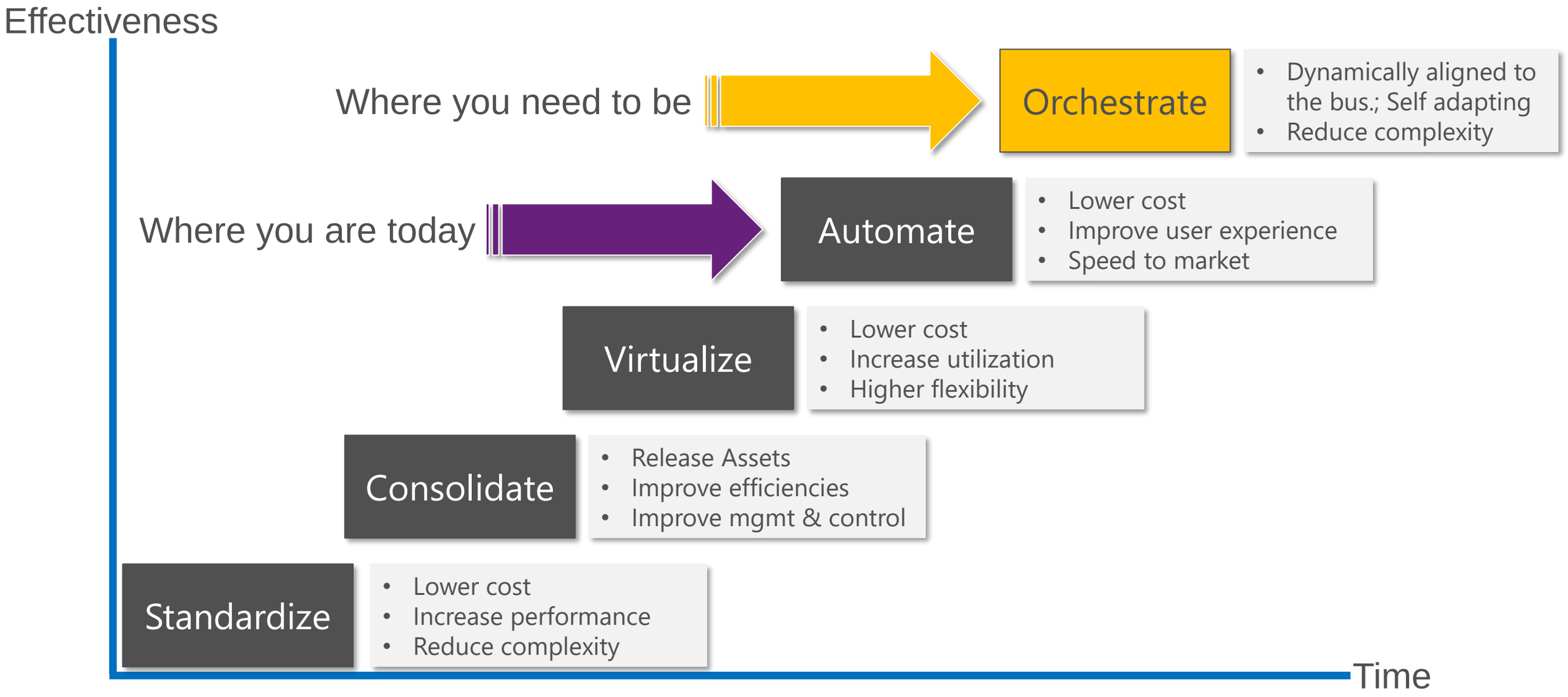
Development team leads DevOps	Select Single Applications	Virtual Machines	Infrastructure as Code	Continuous Integration

Circa 2014



Enterprise-wide DevOps	Shared Private/Hybrid Cloud Environments	Multiple enterprise applications	Orchestration and co-ordination is needed

You Are on the Doorstep of Better Results



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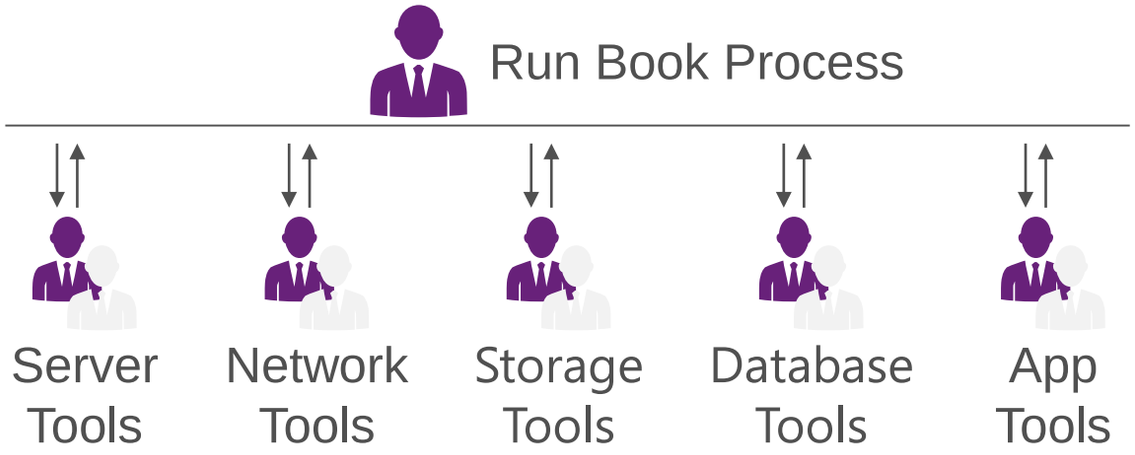
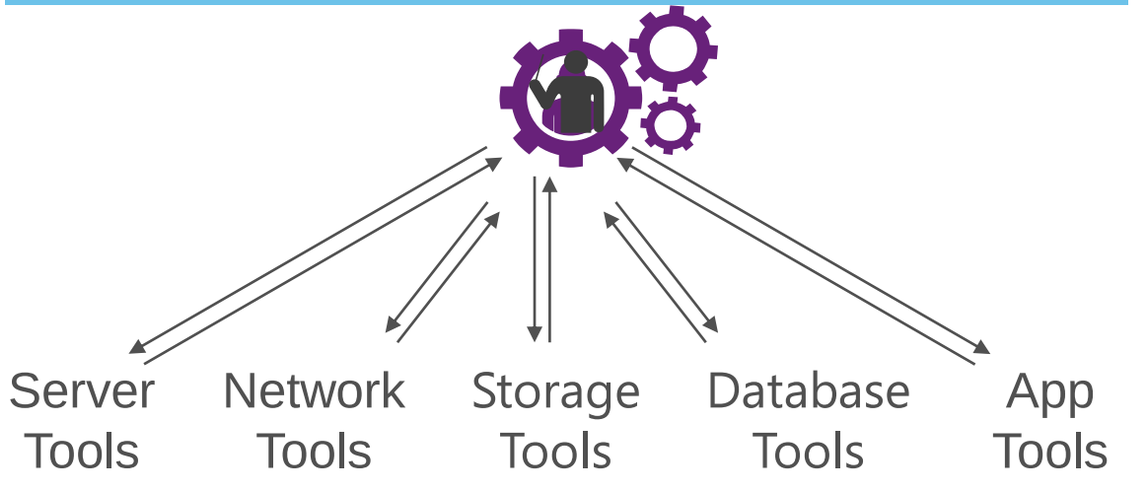
Tying Together Islands of Automation

Open Loop Task Coordination



Closed Loop Orchestration

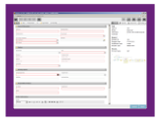


- Manual or semi-automated; simple process
- Specialized task execution tools in each group
- Serial stepping from group to group
- Semi-automated data exchange

- Fully automated, simple or complex process
- Existing specialized task execution tools
- Parallel or serial group operations
- Automated data exchange

An Orchestrated Example

1 Customer requests application for new branch office



2 Customer information is collected in Web form and workflow initiated by request

3 Orchestration triggers specialized tools to automate provisioning of required infrastructure

Create VM(s) or assign server

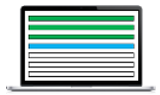
Connect and configure network ports and VLANS

Create and configure SAN(s) and storage resources

Other infrastructure resources

4 Orchestration triggers software deployment by specialized tools and loads application data

- Install and configure OS
- Install and configure WebLogic and other middleware
- Install and configure database
- Install application(s)
- Load data
- Test operation



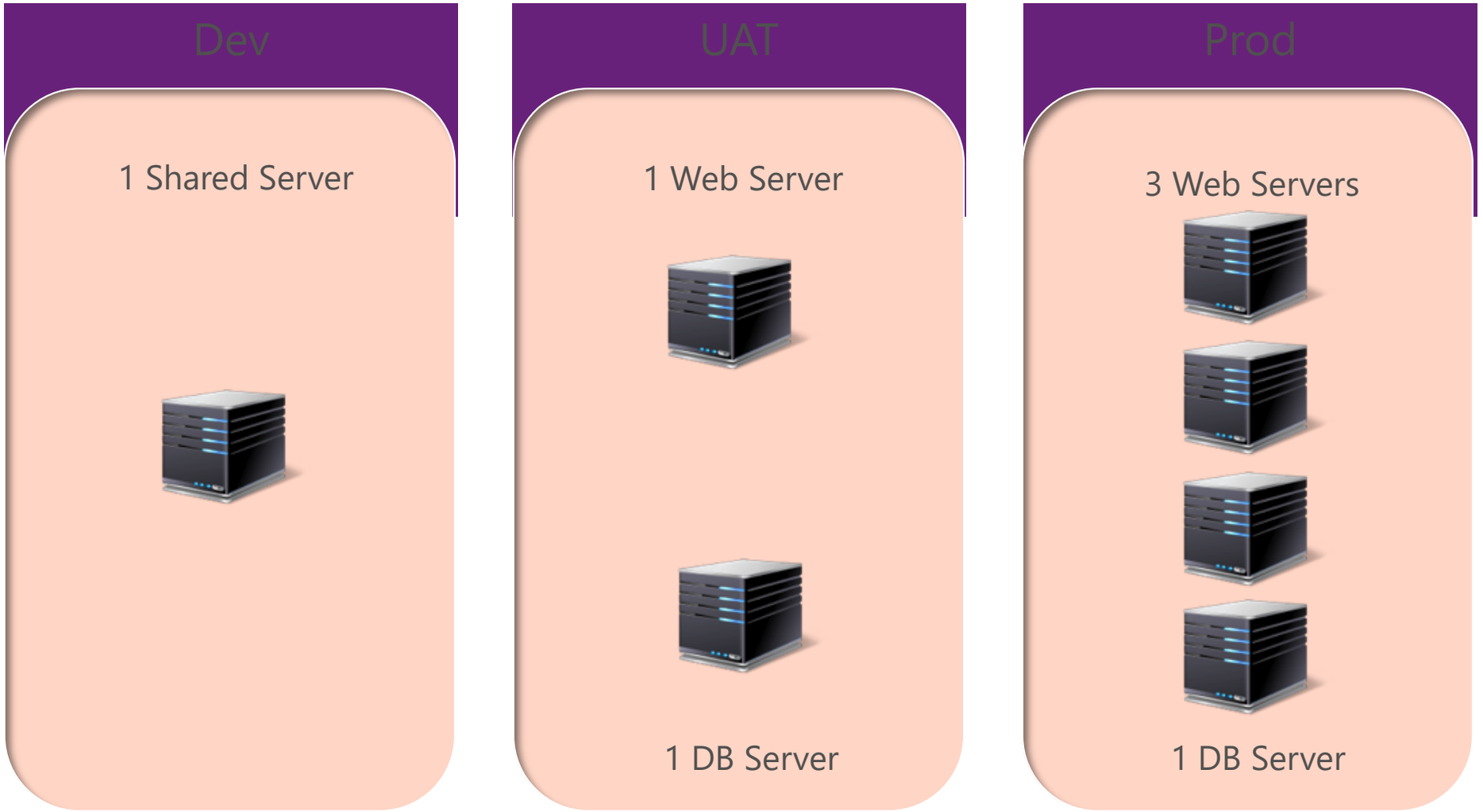
Real-time Progress

5 Network and application access automatically enabled so branch office can use app.

An hour or less later the branch office starts using application

No staff, no hand-off delays, no errors and no compliance problems

Infrastructure Changes over Cycle



How to Get Started

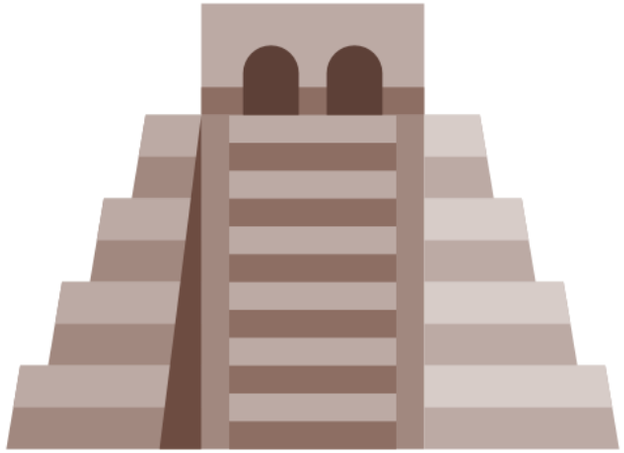
People → Process → Products

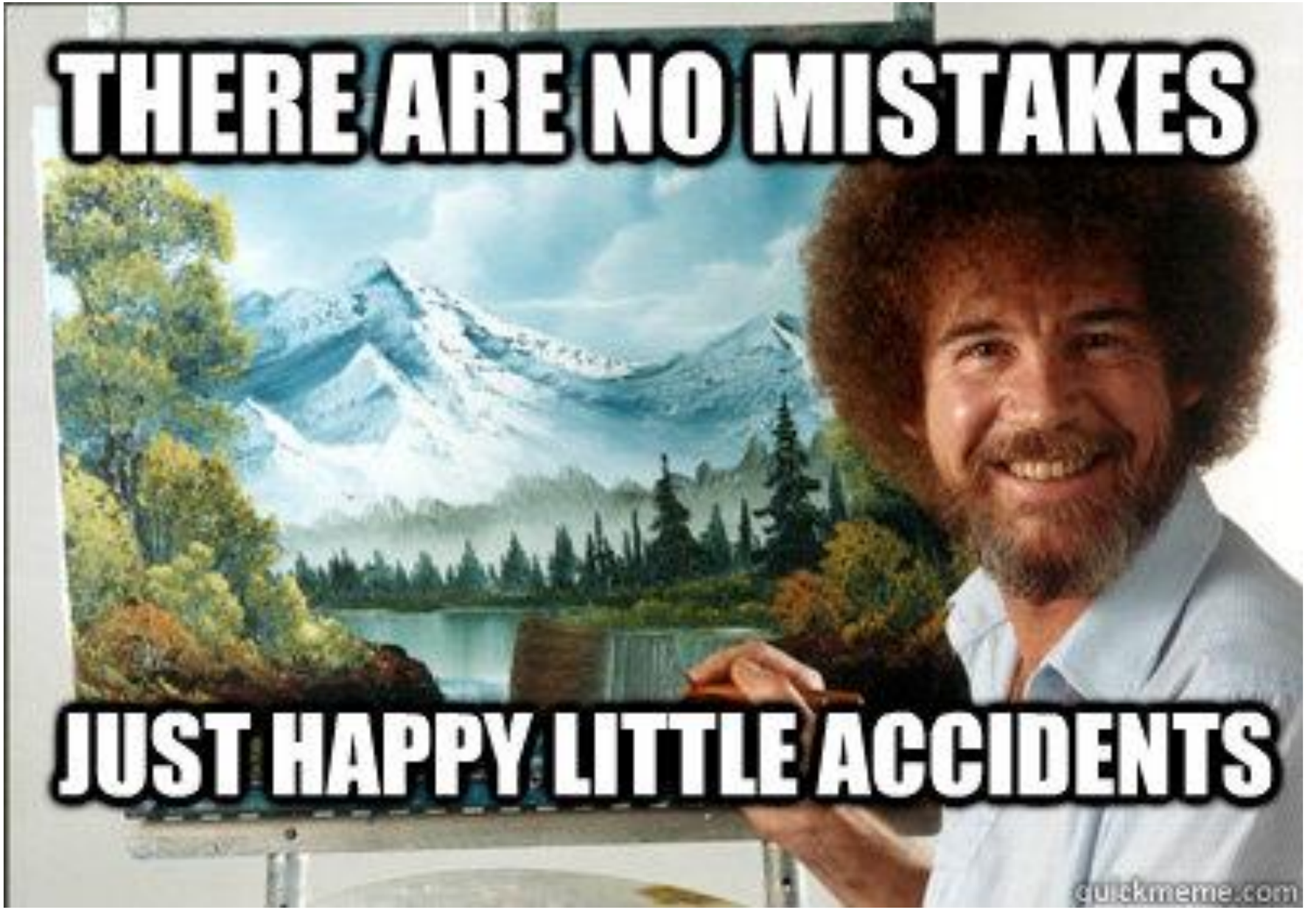
- Simplicity
- Modular
- Flexible
- Versioning

- Powershell/Bash
- VS Code
- GitHub
- Azure Automation, Ansible, Terraform

Steps to Implement IaC

1. Find something easy to automate – low effort, low risk
2. Set the right expectations – experimentation is necessary
3. Prove that it works – show the time savings and effort needed
4. Don’t be shy about it – advocate
5. Do it again




THERE ARE NO MISTAKES
JUST HAPPY LITTLE ACCIDENTS
quickmeme.com

Terraform

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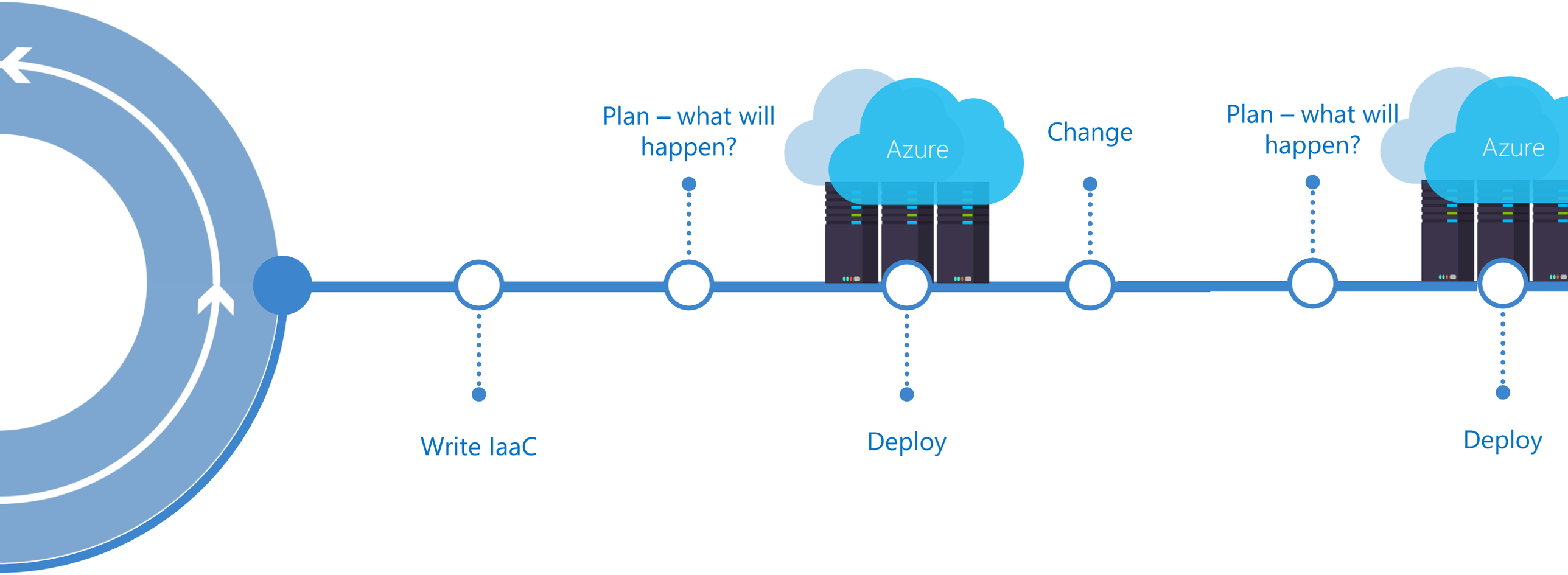
Terraform

Write, *plan* and create infrastructure as code
Same workflow for all deployment scenarios



Terraform

- Ansible, Chef, Puppet, Saltstack have a focus on automating the installation and configuration of software
- Keeping the machines in compliance, in a certain state
- Terraform can automate provisioning of the infrastructure itself

  e.g. Using the AWS, DigitalOcean, Azure API
- Works well with automation software like ansible to install software after the infrastructure is provisioned

Terraform

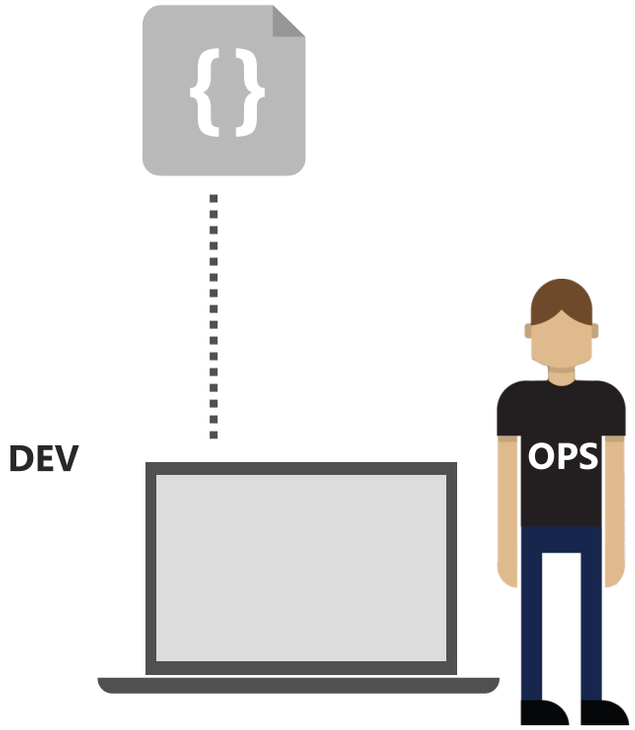
- Everything in one file is not great.
- Use variables to hide secrets
- You don't want the AWS credentials in your git repository
- Use variables for elements that might change
- AMIs are different per region
- Use variables to make it yourself easier to reuse terraform files

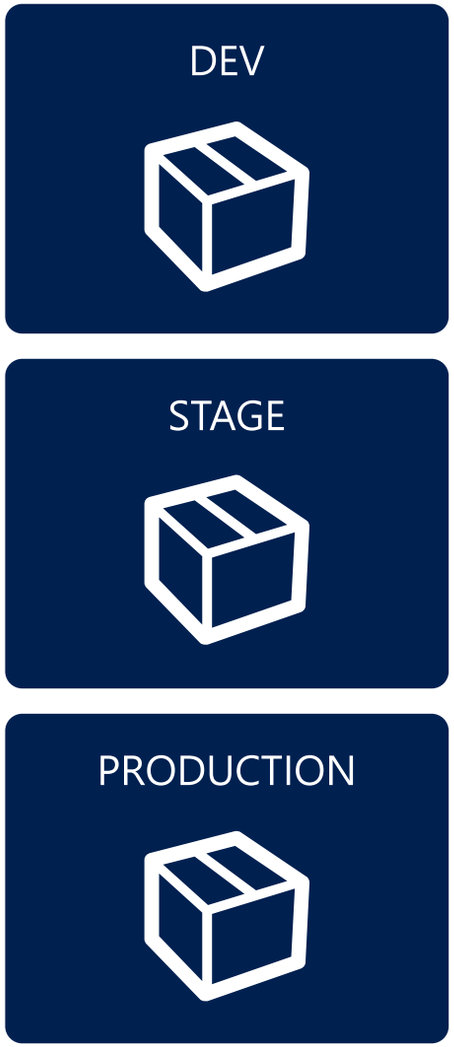
Creating Terraform Templates

```
resource "azurerm_virtual_network" "virtual_network1" {
  name                = "${var.config["virtual_network_name"]}"
  address_space       = ["${var.config["address_prefix"]}"]
  location            = "${var.resource_group_location}"
  resource_group_name = "${azurerm_resource_group.resource_group.name}"
}

resource "azurerm_subnet" "subnet1" {
  name                 = "${var.config["subnet_name"]}"
  resource_group_name  = "${azurerm_resource_group.resource_group.name}"
  virtual_network_name = "${azurerm_virtual_network.virtual_network1.name}"
  address_prefix       = "${var.config["subnet_prefix"]}"
}
```

Environment Parity





Same Terraform Code

Replace Dedicated Staging

Speed Up Infra provisioning

Known Providers

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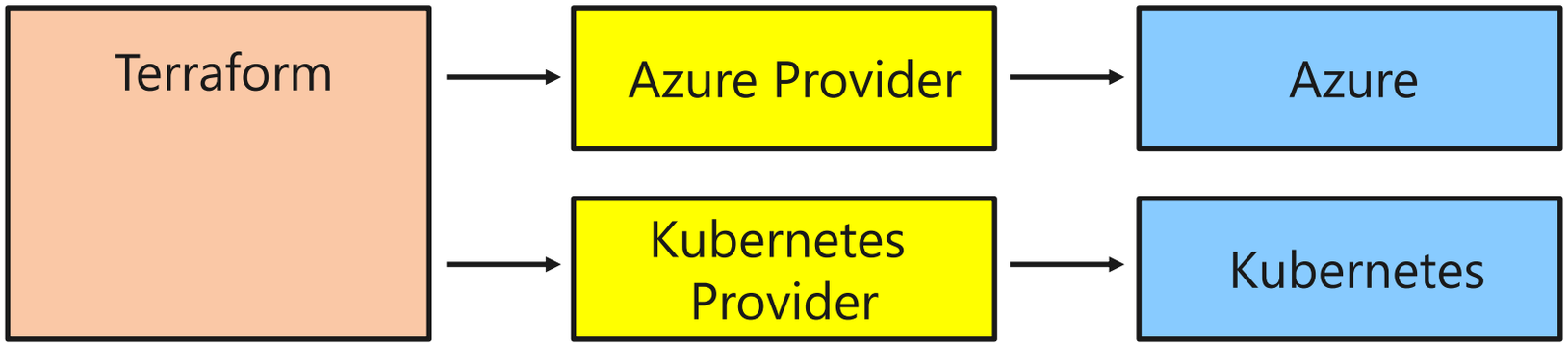
Providers

What is a Terraform provider?

- Terraform ‘extensions’ for deploying resources
- Manages cloud / endpoint specific API interactions
- Available for major clouds and other platforms
- Hand authored (azurerm)



Basic resource creation

Deployment foundations.

- Resource Type: required provider
- Name: internal name
- Configuration: deployment details

Resource Type

Name

```
resource "azurerm_resource_group" "demo-rg" {
    name = "demo-rg"
    location = "westus"
}
```

Resource Configuration

Basic Terraform commands

Once we have authored, how do we deploy?

- Terraform init – initializes working directory
- Terraform plan – pre-flight validation
- Terraform apply – deploys and updates resources
- Terraform destroy – removes all resources defined in a configuration

Variables and output

- Input variables: parameters for Terraform modules
- Environment variables: TF_VAR_azureclientid
- Output: Displayed and retrieved from state

```
$ TF_VAR_azureclientid = “00000000-0000-0000-0000-000000000000”

variable “azureclientid” {}
```

String Interpolation

Interpolation: the insertion of something of a different nature into something else.

- Variables
- Other resources
- Functions: ${count.index + 1}
- Others (Docs)

```
resource "azurerm_container_group" "demo-aci" {
    name = "demo-aci"
    location = "${azurerm_resource_group.demo-rg.location"
}
```

from resource

Dependencies

How are resource dependencies managed?

- Implicit – derived from interpolation
- Explicit – hard coded / explicit dependency

```
resource "azurerm_container_group" "demo-aci” {
    name = “demo-aci”

    depends_on = [“azure_cosmosdb_account.vote-db”]
}
```

State / Backend

What is Terraform state and why store it remotely?

Issues with local state:

- No collaboration
- Easy to delete / loose
- State files include secrets

Alternative:

- Store state in a backend (AWS S3)

State / Backend

- You can keep the terraform.tfstate in version control
- e.g. git
- It gives you a history of your terraform.tfstate file (which is just a big JSON file)
- It allows you to collaborate with other team members
- Unfortunately, you can get conflicts when 2 people work at the same time
- Local state works well in the beginning, but when you project becomes bigger, you might want to store your state remote

Data Sources

What is a Terraform data source?

- External data source for Terraform configuration
- Uses a provider just like in resource creation

Data Source Provider

Name

```
data "terraform_remote_state" "azurerm" {
    <configuration goes here>
}
```

```
"${data.terraform_remote_state.azurerm.resource-group}"
```

Automation and process integration

Once we are cooking, many opportunities for automation and process integration.

- Terraform Backends
- Environment variables
- GitHub
- Web Hooks
- Azure DevOps
- Etc.

Q&A?

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