About Me

Cesar White

Software/Cloud Architect

Over … (remember Radio Shack TRS-80 Model III?) years of experience developing and architecting solutions and applications primarily on Microsoft technology stack.

Hobbies: RC flying thingies, Designing 3D printers, Call of Duty, Chess…

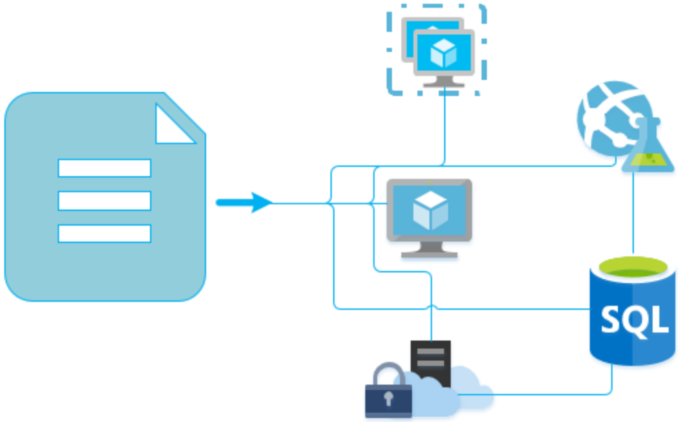
Favorite phrase: *slices hand with light saber* blah, blah, blah… No, I am your father…

LinkedIn https://www.linkedin.com/in/cesarwhite/

Microsoft CERTIFIED Professional

Implementing Microsoft Azure Infrastructure Solutions

Infrastructure As Code



Cesar White

April 21st, 2018

Mt. San Antonio College
& SoCal Microsoft Azure User Group

Presentation and Code will be available at:

https://github.com/cesarwhite/gab2018

Infrastructure As Code

What is Infrastructure as Code (IaC)?

Is the process of **managing** and **provisioning** computing **infrastructure** using a declarative approach

What is it for?

- To **solve** the problem of ***environment drift*** in the release pipeline

- Helps to **reduce/eliminate inconsistency** among environments that leads to issues during deployments

- Save time!!!

Infrastructure As Code

Benefits

•**Repeatedly** deploy your solution throughout the development lifecycle and have confidence your resources are deployed in a consistent state

•**Accelerate** provisioning of environments

•**Define** the dependencies between resources so they are deployed in the correct order and with the right specs

•**Facilitate** applying tags to resources to logically organize all the resources in your subscription. Helping to clarify your organization's billing by viewing costs for a group of resources sharing the same tag (e.g. Cost Center, Workload, Environment, etc.)

Infrastructure As Code

Key definitions so you know the lingo:

Azure Portal: Helps to build, manage and monitor from simple to complex cloud applications

Navigation Bar: Bar on the left with shortcuts to various resources type and services

Blade: Navigation pane where resource information, configuration, monitoring, etc. is presented to the Azure portal user

Resource Group (RG): Logical container for resources in Azure. It contains ***resources with the same lifecycle*** which should be secured, managed and deployed as a unit

Resources: Individual services in Azure such as Virtual Networks, Virtual Machines, Storage Accounts, Data Lakes, App Servers, etc.

Infrastructure As Code

Key definitions so you know the lingo (cont…):

Resource Provider: Each resource provider offers a set of resources and operations for working with an Azure service. Allows access to resources type and in turn allows communication between each resource and Azure Resource Manager API

The name of a resource type is in the format:

{resource-provider}/{resource-type}

For example, the Azure SQL server type is Microsoft.Sql/servers.

Azure Resource Manager (ARM API): Framework which allows us to provision and manage resources in Azure such as hosted databases, virtual machines, etc.

Infrastructure As Code

ARM Templates

Is what really **gives you the ability to roll out Azure IaC** since it defines the infrastructure and configuration of an Azure solution (IaaS, PaaS) **using a JSON file that can be checked into source control and managed like any other code file**.

The template allows you to declare the objects, type, names and properties of your solution but doesn't deploy code onto those resources, but you can use some other technology such as **DSC** or **PowerShell** to manage the deployments onto the infrastructure once it is deployed.

An **ARM template is *idempotent***, which means it can be executed as many times as you wish and the result will be the same every single time. Azure takes care of the execution and identifies the changes that need to be executed either create a new object or change an existing object that has the same *name* and *type*.

Quick Demo

Creating an Storage Account via the Azure Portal and view the ARM template

ARM Templates (cont…)

Do you remember that *environment drift*?

When a template is deployed you have the option of either using "*incremental*" or "complete" mode deployment.

Incremental mode: uses the template to add additional resources to an existing resource group. The benefit of this is that you don't lose any infrastructure that is missing from the template but the downside is that you will have to clean any old and unused resources.

Complete mode: deletes any objects that are not part of the template and the resource group you are deploying to. With this mode you get the ability to know that whenever you deploy will be in exactly the same state.

ARM Template sections

- **$schema** *(required)*
    - JSON schema file that describes the version of the template language
- **contentVersion** *(required)*
    - Used to make sure that the right template is being used and match your solution code
- **Parameters** *(optional)*
    - Are the way to customize the templates, the end-user inputs for various aspects of the template
- **Variables** *(optional)*
    - Are values that you either know beforehand or you can construct from the input parameters (example you application name, code, etc.)
- **Resources** *(required)*
    - Is the main section of the whole ARM template, where you define what resources should be deployed , define dependencies between resources, etc.
- **Outputs** *(optional)*
    - is used to output any values after the deployment of the ARM Template. This can output any Ids or connection strings based on the deployed resources.

ARM Template sections - Parameters

Parameter object properties:

- **type**: data Type of the parameter
    - string or secureString – any valid JSON string
    - int – any valid JSON integer
    - bool – any valid JSON boolean
    - object – any valid JSON object
    - array – any valid JSON array

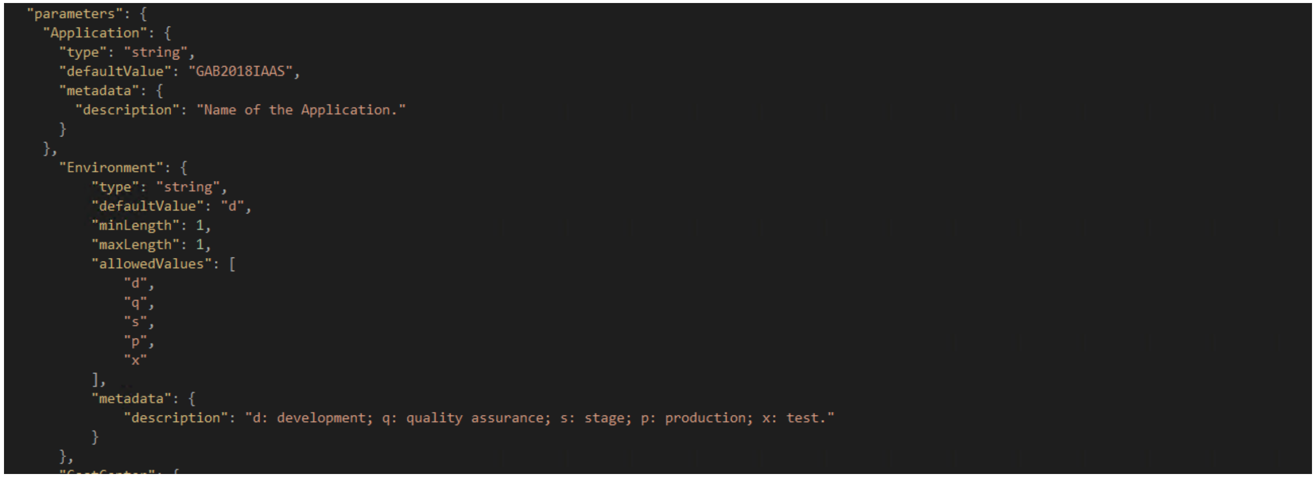
- **defaultValue**: the default value. End-user will be able to change this value when deploying the template but if no value is provided then this value is used

- **allowedValues**: an Array of values which are allowed for the parameter. Only a value from this set is allowed as an input

- **minLength**: the minimum length the parameter must have

- **metadata**: used to provide a description as to what the parameter means

ARM Template sections – Parameters (cont…)



```
"parameters": {
  "Application": {
    "type": "string",
    "defaultValue": "GAB2018IAAS",
    "metadata": {
      "description": "Name of the Application."
    }
  },
    "Environment": {
        "type": "string",
        "defaultValue": "d",
        "minLength": 1,
        "maxLength": 1,
        "allowedValues": [
            "d",
            "q",
            "s",
            "p",
            "x"
        ],
        "metadata": {
            "description": "d: development; q: quality assurance; s: stage; p: production; x: test."
        }
    },
    "CostCenter": {
```

Using parameters:

Use the ***parameters*** function in your template (in variables or resources section) by using square parenthesis (**[…]**) to indicate to the ARM engine to evaluate whatever is inside the parenthesis:

[***parameters***('windowsOSVersion')]

If the parameter value is assigned to a property

"sku": "[***parameters***('windowsOSVersion')]"

ARM Template structure – Parameters (cont…)

Best Practices:

•Provide complete descriptive names (no matter how long)

•Try to always provide *default values*

•Provide metadata so that you can provide insight as to what the parameter is used/meant for

•Use Pascal casing to name your parameters: First letter should be a lower case letter, then every new word will have the first letter as an upper case letter and no space between words. E.g. windowsOSVersion

•Use properties like minLength and Allowed values to impose restrictions. This reduces any human errors.

ARM Template structure – Variables

- Once defined, variables can be reused at multiple locations in the resources section and used to define a resource property

- Variables can be either simple or complex data types

- To make the template more generic the use of ***dynamic constructs*** (Helper Functions) is recommended [e.g. concat(), resourceID(), resourceGroup(), subscription(), listKeys(), etc]

Concat(): Can take many inputs and it will concatenate the value of all the inputs provided

resourceGroup(): Returns an object that represents the current resource group to which the template is being deployed. E.g.:

- resourceGroup().id
- resourceGroup().name
- resourceGroup().location

ARM Template sections – Variables (cont…)

subscription(): Returns details about the subscription for the current deployment

resourceID(): Use this function to determine the ID of a resource that already exists in Azure

resourceId ([subscriptionId], [resourceGroupName], resourceType, resourceName1, [resourceName2]…)

•subscriptionID *(optional)*- if you want to refer a different subscription. Default value is the current subscription

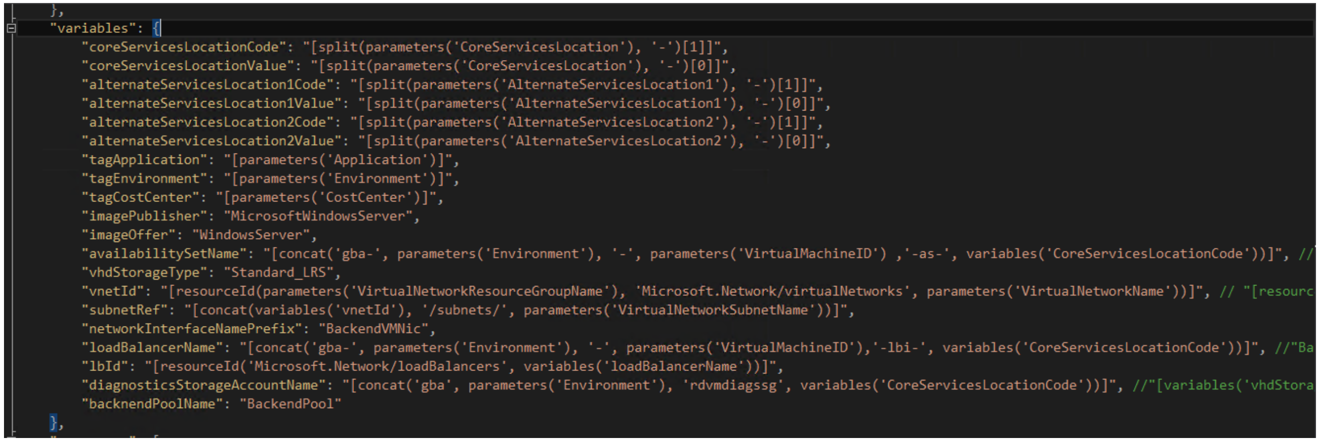
•resourceGroupName *(optional)* - Name of the resource group where the resource exists. Default is the current resource group in which you are deploying the template

•resource Type *(required)* - Type of resource including resource provider namespace

•resource Name 1 *(required)* - Name of the resource

•resource Name 2 *(optional)* - Next resource name segment if resource is nested.

ARM Template sections – Variables (cont…)



```
    },
    "variables": {
        "coreServicesLocationCode": "[split(parameters('CoreServicesLocation'), '-')[1]]",
        "coreServicesLocationValue": "[split(parameters('CoreServicesLocation'), '-')[0]]",
        "alternateServicesLocation1Code": "[split(parameters('AlternateServicesLocation1'), '-')[1]]",
        "alternateServicesLocation1Value": "[split(parameters('AlternateServicesLocation1'), '-')[0]]",
        "alternateServicesLocation2Code": "[split(parameters('AlternateServicesLocation2'), '-')[1]]",
        "alternateServicesLocation2Value": "[split(parameters('AlternateServicesLocation2'), '-')[0]]",
        "tagApplication": "[parameters('Application')]",
        "tagEnvironment": "[parameters('Environment')]",
        "tagCostCenter": "[parameters('CostCenter')]",
        "imagePublisher": "MicrosoftWindowsServer",
        "imageOffer": "WindowsServer",
        "availabilitySetName": "[concat('gba-', parameters('Environment'), '-', parameters('VirtualMachineID') ,'-as-', variables('CoreServicesLocationCode'))]", //
        "vhdStorageType": "Standard_LRS",
        "vnetId": "[resourceId(parameters('VirtualNetworkResourceGroupName'), 'Microsoft.Network/virtualNetworks', parameters('VirtualNetworkName'))]", // "[resourc
        "subnetRef": "[concat(variables('vnetId'), '/subnets/', parameters('VirtualNetworkSubnetName'))]",
        "networkInterfaceNamePrefix": "BackendVMNic",
        "loadBalancerName": "[concat('gba-', parameters('Environment'), '-', parameters('VirtualMachineID'),'-lbi-', variables('CoreServicesLocationCode'))]", //"Ba
        "lbId": "[resourceId('Microsoft.Network/loadBalancers', variables('loadBalancerName'))]",
        "diagnosticsStorageAccountName": "[concat('gba', parameters('Environment'), 'rdvmdiagssg', variables('CoreServicesLocationCode'))]", //"[variables('vhdStora
        "backnendPoolName": "BackendPool"
    },
```

Using variables:

Use the ***variables*** function in your template (in variables or resources section) by using the square parenthesis (**[…]**) to indicate to the ARM engine to evaluate whatever is inside the parenthesis:

"storageAccountName“ : "[variables('storageAccountName')]"

ARM Template sections – Variables (cont…)

Best Practices:

- Provide complete descriptive names (no matter how long)

- Use *dynamic constructs to* dynamically generate variables. This reduces any human errors

- Use Pascal casing to name your parameters: First letter should be a lower case letter, then every new word will have the first letter as a upper case letter and no space between words. E.g. storageAccountName

- Anything that is used more than once and is not required to be entered by an end-user should be created as a variable

ARM Template sections – Resources

This is where you define what resources should be deployed as well as the dependencies between resources. A resource object contain different elements:

apiVersion *(required)* - Version of the API. e.g. "2015-06-15“

type *(required)* - Type of the resource. This value is a combination of the namespace of the resource provider and the resource type that the resource provider supports. e.g. Azure SQL server will have type as “Microsoft.Sql/servers”

name *(required)* - Name of the resource. The name must follow URI component restrictions and also the Azure naming restrictions if any. e.g. Storage account name can only be lower case and has to be globally unique (due the public endpoint)

location *(optional)* - Use supported geo-locations of the provided resource without any spaces. Or use the resource group's location dynamically

tags *(optional, but highly recommended)* - Tags that are associated with the resource. Defining tags will **facilitate billing in your organization**. Example CostCenter, Environment, Workload, Application

ARM Template sections – Resources

dependsOn *(optional)* - Other resources in the same template, that the current resource being defined depends on. The dependencies between resources are evaluated and resources are deployed in their dependent order.

When resources are not dependent on each other, they are attempted to be deployed in parallel. The value can be a comma-separated list of resource names or resource unique identifiers.

properties *(optional)* - Resource specific configuration settings. e.g. Account type property for a Storage Account name.

Resources *(optional)* - Child resources that depend on the resource being defined. e.g. Extension resources for a Virtual Machine resource.

ARM Template sections – Outputs

Use to output any values after the deployment of the ARM Template. Outputs are any IDs or connection strings based on the deployed resources. It can be used for when working with Linked Templates

Each output object has 2 properties:

- **Type** - Data Type of the output
- **Value** - Value of the output

ARM Templates Limits

- Template size limit of 1 MB*
- Parameter file size limit of 64 KB
- 256 parameters
- 256 variables
- 800 resources (including copy count)
- 64 output values
- 24,576 characters in a template expression

*Limit applies to the final state of the template

Execution during deployment:

The “*Resource Management*” REST API takes the ARM template and:

•Parses the JSON Document

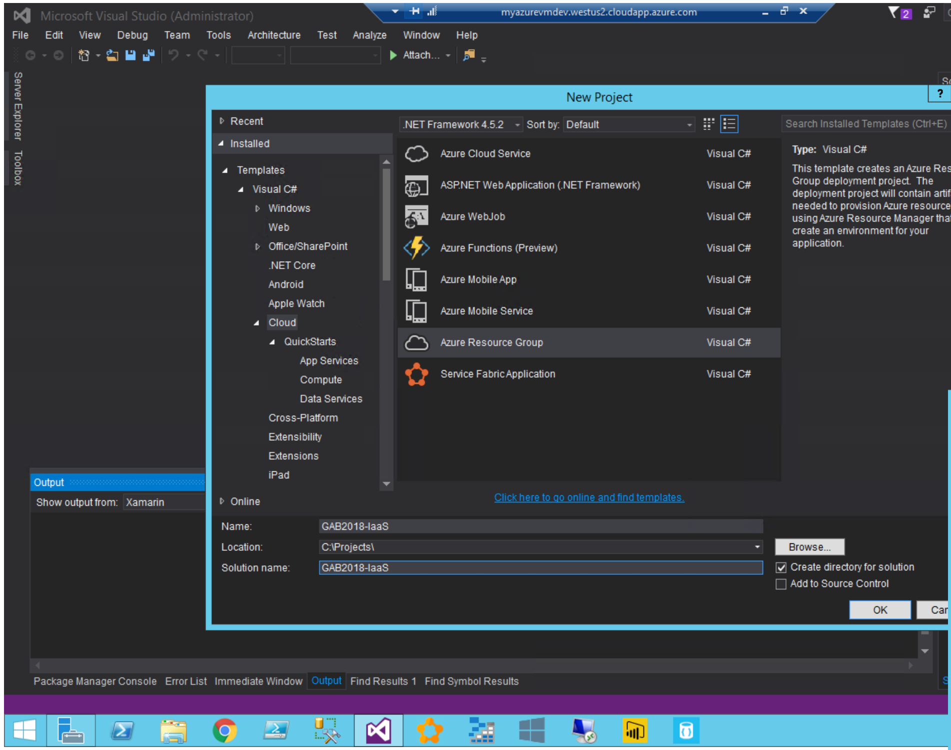
•Fills-in any parameters that are passed in

•Executes any ARM template functions

•Calls the REST API of whatever type of resource that needs to be created to create it

To create an ARM Template in Visual Studio

New Project
- Installed
  - Templates
    - Visual C#
      - Cloud
        - Azure Resource Group



New Project

- Recent
- Installed
  - Templates
    - Visual C#
      - Windows
      - Web
      - Office/SharePoint
      - .NET Core
      - Android
      - Apple Watch
      - Cloud
        - QuickStarts
          - App Services
          - Compute
          - Data Services
      - Cross-Platform
      - Extensibility
      - Extensions
      - iPad
- Online

.NET Framework 4.5.2 Sort by: Default

Search Installed Templates (Ctrl+E)

Azure Cloud Service	Visual C#
ASP.NET Web Application (.NET Framework)	Visual C#
Azure WebJob	Visual C#
Azure Functions (Preview)	Visual C#
Azure Mobile App	Visual C#
Azure Mobile Service	Visual C#
Azure Resource Group	Visual C#
Service Fabric Application	Visual C#

Type: Visual C#

This template creates an Azure Resource Group deployment project. The deployment project will contain artifacts needed to provision Azure resources using Azure Resource Manager that will create an environment for your application.

Click here to go online and find templates.

Name: GAB2018-IaaS

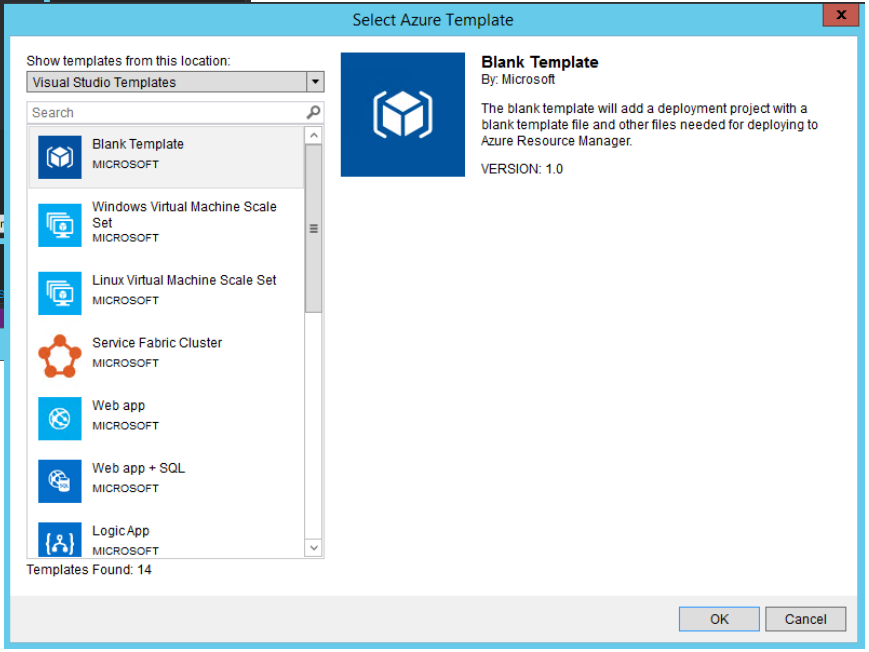
Location: C:\Projects\ Browse...

Solution name: GAB2018-IaaS

☑ Create directory for solution

□ Add to Source Control

OK Car


Select Azure Template

Show templates from this location: Visual Studio Templates

Search

- Blank Template MICROSOFT
- Windows Virtual Machine Scale Set MICROSOFT
- Linux Virtual Machine Scale Set MICROSOFT
- Service Fabric Cluster MICROSOFT
- Web app MICROSOFT
- Web app + SQL MICROSOFT
- Logic App MICROSOFT

Templates Found: 14

Blank Template

By: Microsoft

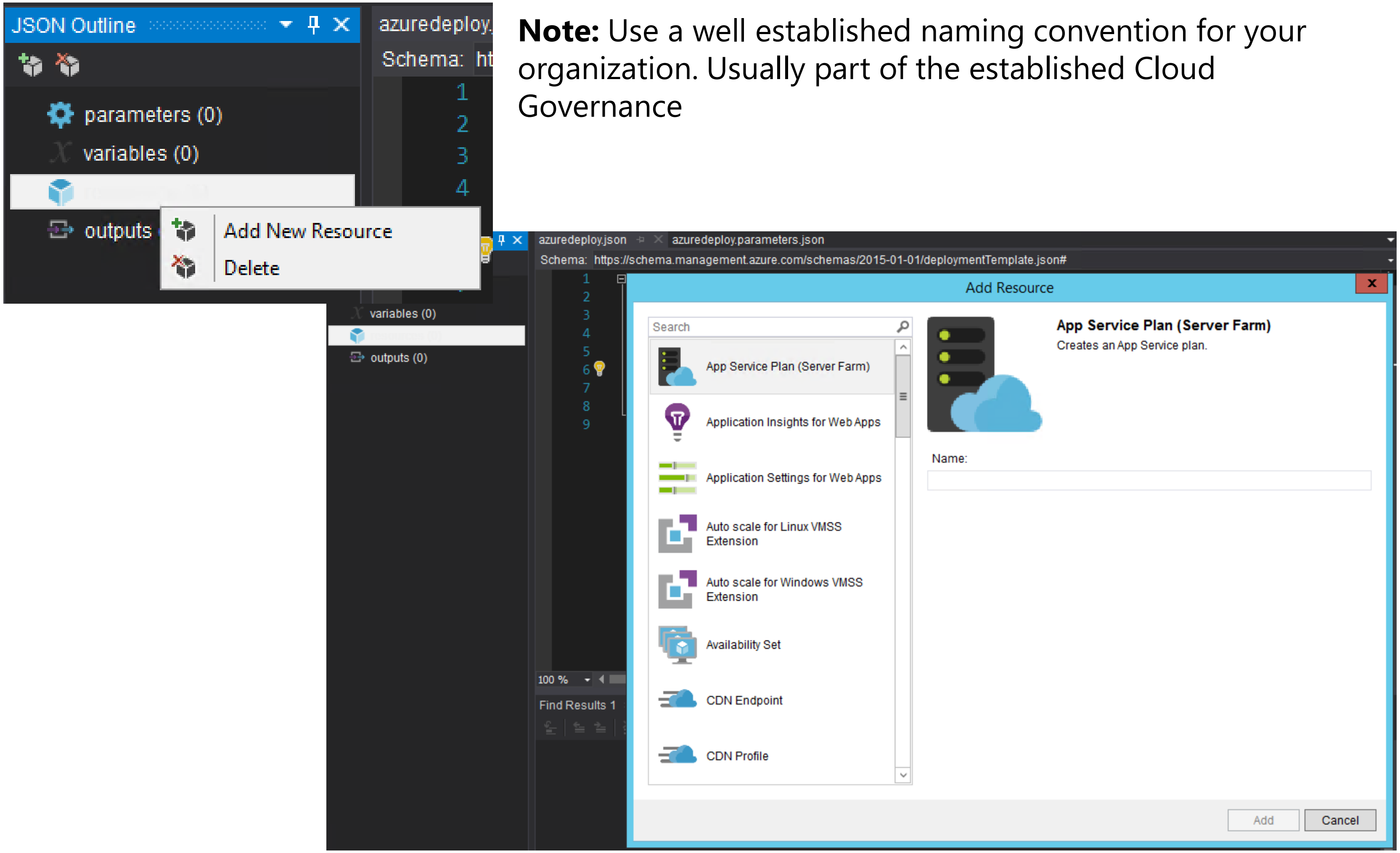
The blank template will add a deployment project with a blank template file and other files needed for deploying to Azure Resource Manager.

VERSION: 1.0

OK Cancel

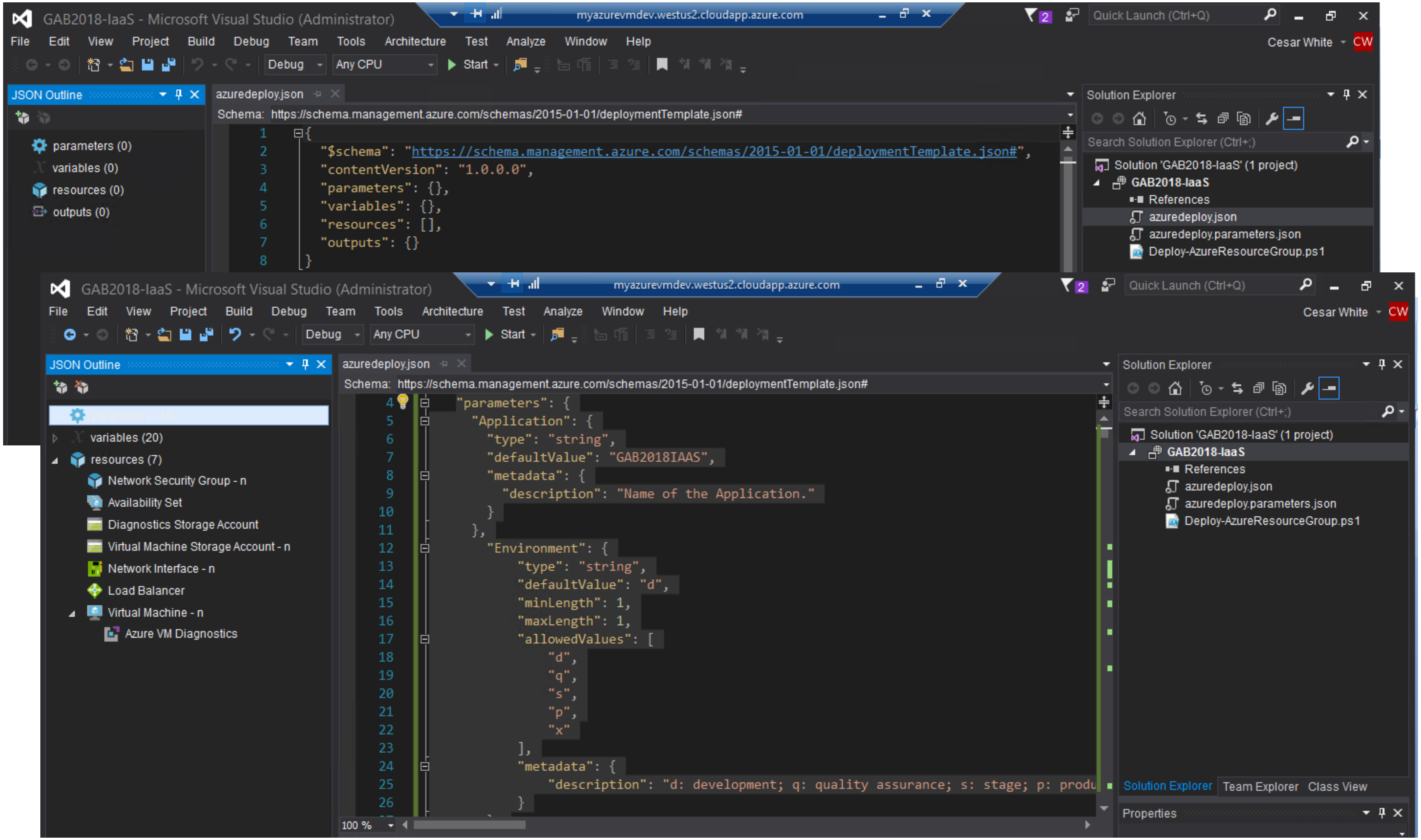
Adding Resources

Note: Use a well established naming convention for your organization. Usually part of the established Cloud Governance


JSON Outline
azuredeploy.
Schema: ht
parameters (0)
variables (0)
outputs
Add New Resource
Delete
azuredeploy.json
azuredeploy.parameters.json
Schema: https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#
variables (0)
outputs (0)
100 %
Find Results 1
Add Resource
Search
App Service Plan (Server Farm)
Application Insights for Web Apps
Application Settings for Web Apps
Auto scale for Linux VMSS Extension
Auto scale for Windows VMSS Extension
Availability Set
CDN Endpoint
CDN Profile
App Service Plan (Server Farm)
Creates an App Service plan.
Name:
Add
Cancel

Infrastructure As Code

ARM Template in Visual Studio



Schema: https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#

```
{
    "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
    "contentVersion": "1.0.0.0",
    "parameters": {},
    "variables": {},
    "resources": [],
    "outputs": {}
}
```

- parameters (0)
- variables (0)
- resources (0)
- outputs (0)

Solution 'GAB2018-IaaS' (1 project)
- GAB2018-IaaS
  - References
  - azuredeploy.json
  - azuredeploy.parameters.json
  - Deploy-AzureResourceGroup.ps1

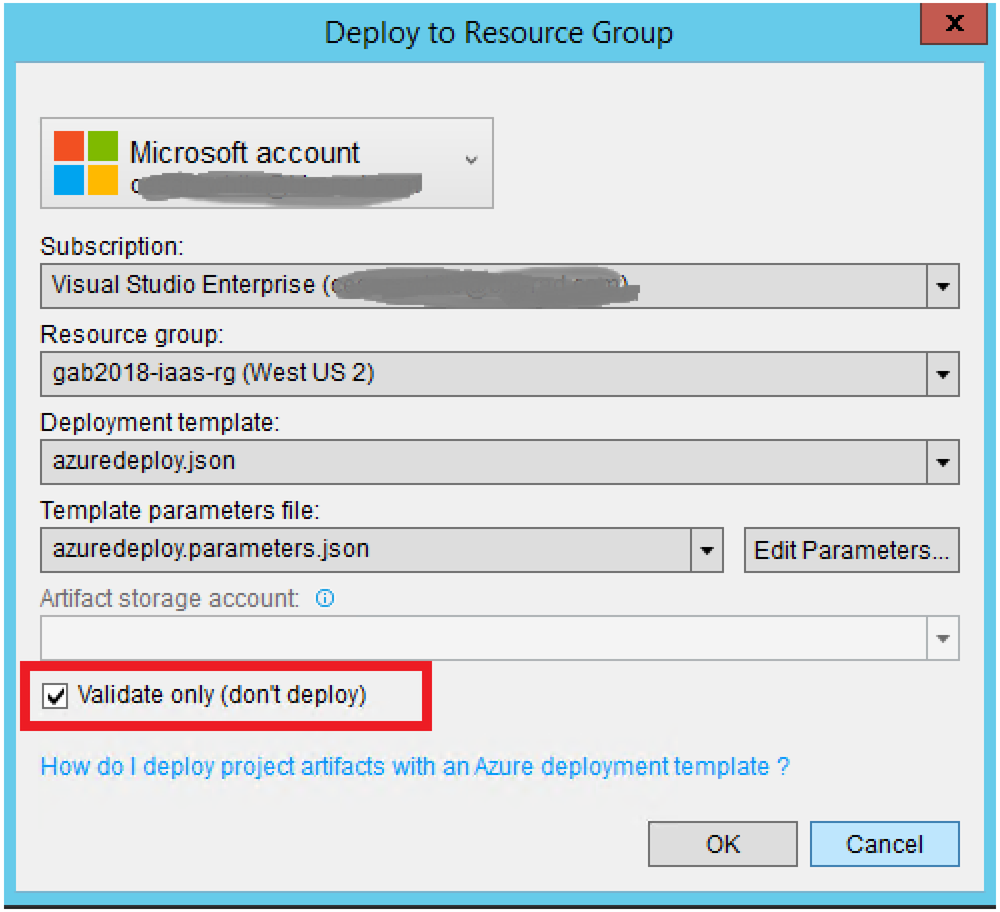
```
  "parameters": {
    "Application": {
      "type": "string",
      "defaultValue": "GAB2018IAAS",
      "metadata": {
        "description": "Name of the Application."
      }
    },
    "Environment": {
        "type": "string",
        "defaultValue": "d",
        "minLength": 1,
        "maxLength": 1,
        "allowedValues": [
            "d",
            "q",
            "s",
            "p",
            "x"
        ],
        "metadata": {
            "description": "d: development; q: quality assurance; s: stage; p: produ
        }
```

- parameters (18)
- variables (20)
- resources (7)
  - Network Security Group - n
  - Availability Set
  - Diagnostics Storage Account
  - Virtual Machine Storage Account - n
  - Network Interface - n
  - Load Balancer
  - Virtual Machine - n
    - Azure VM Diagnostics

Solution 'GAB2018-IaaS' (1 project)
- GAB2018-IaaS
  - References
  - azuredeploy.json
  - azuredeploy.parameters.json
  - Deploy-AzureResourceGroup.ps1

ARM Template Validation

*Always validate your ARM template before any deployment



Deploy to Resource Group

Microsoft account
[redacted]

Subscription: Visual Studio Enterprise ([redacted]

Resource group: gab2018-iaas-rg (West US 2)

Deployment template: azuredeploy.json

Template parameters file: azuredeploy.parameters.json

Artifact storage account:

☑ Validate only (don't deploy)

How do I deploy project artifacts with an Azure deployment template ?

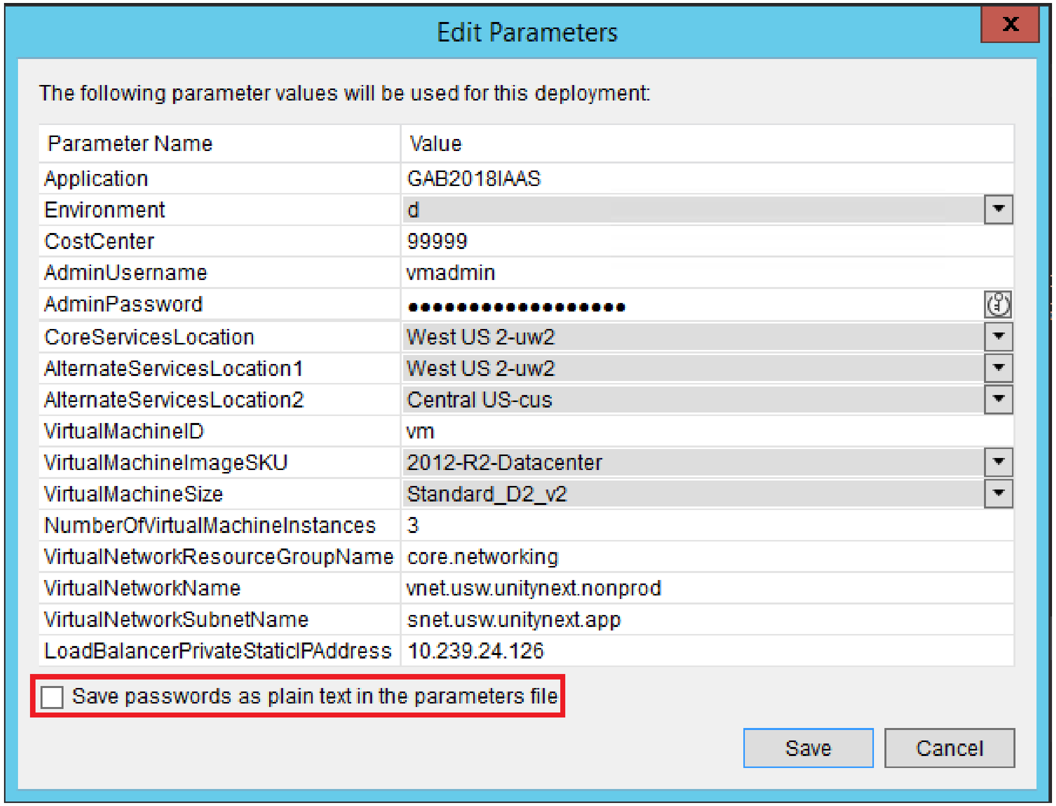
ARM Template Validation

```
03:02:32 - The following parameter values will be used for this operation:
03:02:32 -     Application: GAB2018IAAS
03:02:32 -     Environment: d
03:02:32 -     CostCenter: 99999
03:02:32 -     AdminUsername: admin
03:02:32 -     AdminPassword: <securestring>
03:02:32 -     CoreServicesLocation: West US 2-uw2
03:02:32 -     AlternateServicesLocation1: West US 2-uw2
03:02:32 -     AlternateServicesLocation2: Central US-cus
03:02:32 -     VirtualMachineID: vm
03:02:32 -     VirtualMachineImageSKU: 2012-R2-Datacenter
03:02:32 -     VirtualMachineSize: Basic_A0
03:02:32 -     NumberOfVirtualMachineInstances: 3
03:02:32 -     VirtualNetworkResourceGroupName: core.networking
03:02:32 -     VirtualNetworkName: vnet.usw.unitynext.nonprod
03:02:32 -     VirtualNetworkSubnetName: snet.usw.unitynext.app
03:02:32 -     LoadBalancerPrivateStaticIPAddress: 10.239.24.125
03:02:32 - Build started.
03:02:32 - Project "GAB2018-IaaS.deployproj" (StageArtifacts target(s)):
03:02:32 - Project "GAB2018-IaaS.deployproj" (ContentFilesProjectOutputGroup target(s)):
03:02:32 - Done building project "GAB2018-IaaS.deployproj".
03:02:32 - Done building project "GAB2018-IaaS.deployproj".
03:02:32 - Build succeeded.
03:02:32 - Launching PowerShell script with the following command:
03:02:32 - 'C:\Projects\GAB2018-IaaS\GAB2018-IaaS\bin\Debug\staging\GAB2018-IaaS\Deploy-AzureResourceGroup.ps1' -StorageAccountName '' -ResourceGroupName 'gab2018-iaas-rg' -ResourceGroupLocation 'westus2' -
TemplateFile 'c:\projects\gab2018-iaas\gab2018-iaas\azuredeploy.json' -TemplateParametersFile 'c:\projects\gab2018-iaas\gab2018-iaas\azuredeploy.parameters.json' -ArtifactStagingDirectory '.' -DSCSourceFolder '.\DSC' -
ValidateOnly
03:03:00 - 
03:03:00 - 
03:03:00 - Environment           : AzureCloud
03:03:00 - Account               : cesar_white@xxxxxxx.com
03:03:00 - TenantId              : xxxxxxxx-xxxxxxxx-xxxxxxxx-xxxxxxxxxxxxxxxx
03:03:00 - SubscriptionId        : xxxxxxxx-xxxxxxxx-xxxxxxxx-xxxxxxxxxxxxxxxx
03:03:00 - SubscriptionName      : Visual Studio Enterprise
03:03:00 - CurrentStorageAccount : 
03:03:00 - 
03:03:03 - [VERBOSE] Performing the operation "Replacing resource group ..." on target "".
03:03:04 - [VERBOSE] 3:03:04 AM - Created resource group 'gab2018-iaas-rg' in location 'westus2'
03:03:04 - 
03:03:04 - ResourceGroupName : gab2018-iaas-rg
03:03:04 - Location          : westus2
03:03:04 - ProvisioningState : Succeeded
03:03:04 - Tags              : 
03:03:04 - TagsTable         : 
03:03:04 - ResourceId        : /subscriptions/ xxxxxxxx-xxxxxxxx-xxxxxxxx-xxxxxxxxxxxxxxxx /resourc
03:03:04 -                     eGroups/gab2018-iaas-rg
03:03:04 - 
03:03:06 - 
03:03:06 - Template is valid.
03:03:06 - 
03:03:06 - 
03:03:06 - 
03:03:06 - Validated template 'azuredeploy.json' against resource group 'gab2018-iaas-rg'.
```

Infrastructure As Code

2018 Global Azure BOOTCAMP

ARM Template Parameters



The following parameter values will be used for this deployment:

Parameter Name	Value
Application	GAB2018IAAS
Environment	d
CostCenter	99999
AdminUsername	vmadmin
AdminPassword	•••••••••••••••••••
CoreServicesLocation	West US 2-uw2
AlternateServicesLocation1	West US 2-uw2
AlternateServicesLocation2	Central US-cus
VirtualMachineID	vm
VirtualMachineImageSKU	2012-R2-Datacenter
VirtualMachineSize	Standard_D2_v2
NumberOfVirtualMachineInstances	3
VirtualNetworkResourceGroupName	core.networking
VirtualNetworkName	vnet.usw.unitynext.nonprod
VirtualNetworkSubnetName	snet.usw.unitynext.app
LoadBalancerPrivateStaticIPAddress	10.239.24.126

☐ Save passwords as plain text in the parameters file

*Do not save the passwords for production, etc.

Best practice

Create a parameters file per environment:

azuredeploy.**dv**.parameters.json

azuredeploy.**qa**.parameters.json

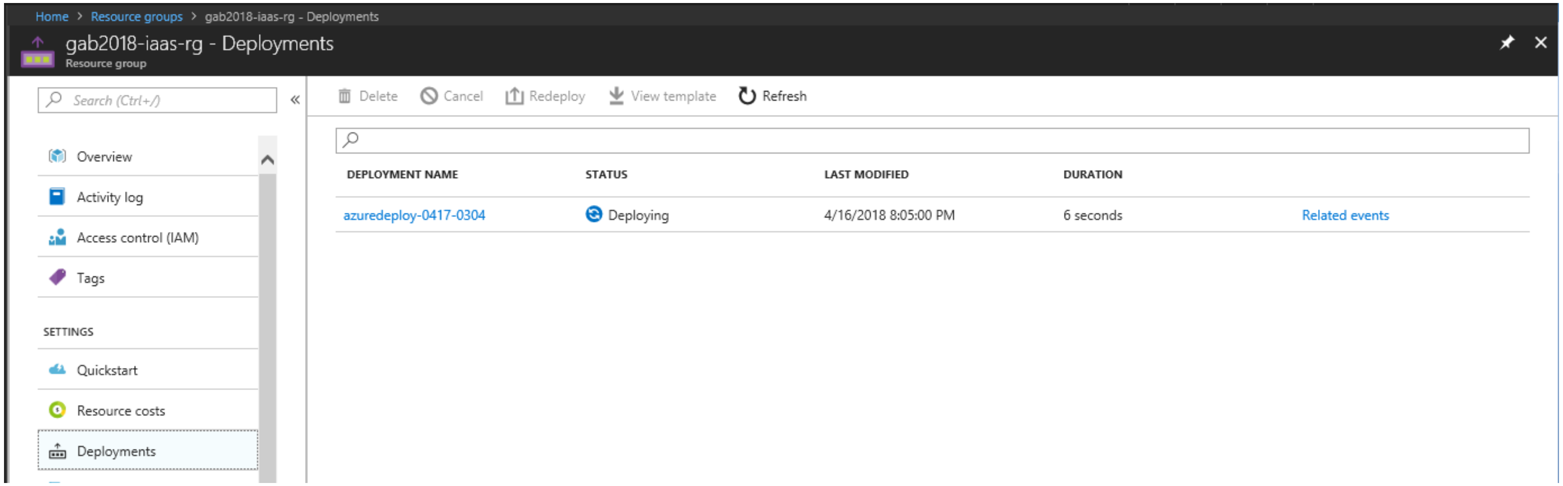
azuredeploy.**st**.parameters.json

azuredeploy.**pr**.parameters.json

Infrastructure As Code

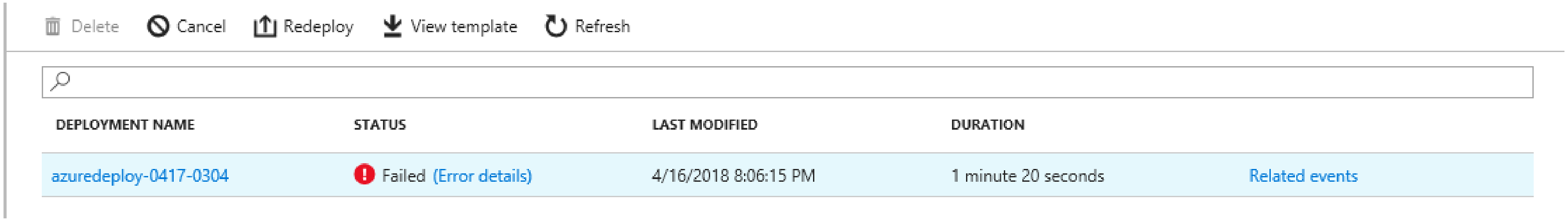
No because the template was validated…

and deploying…

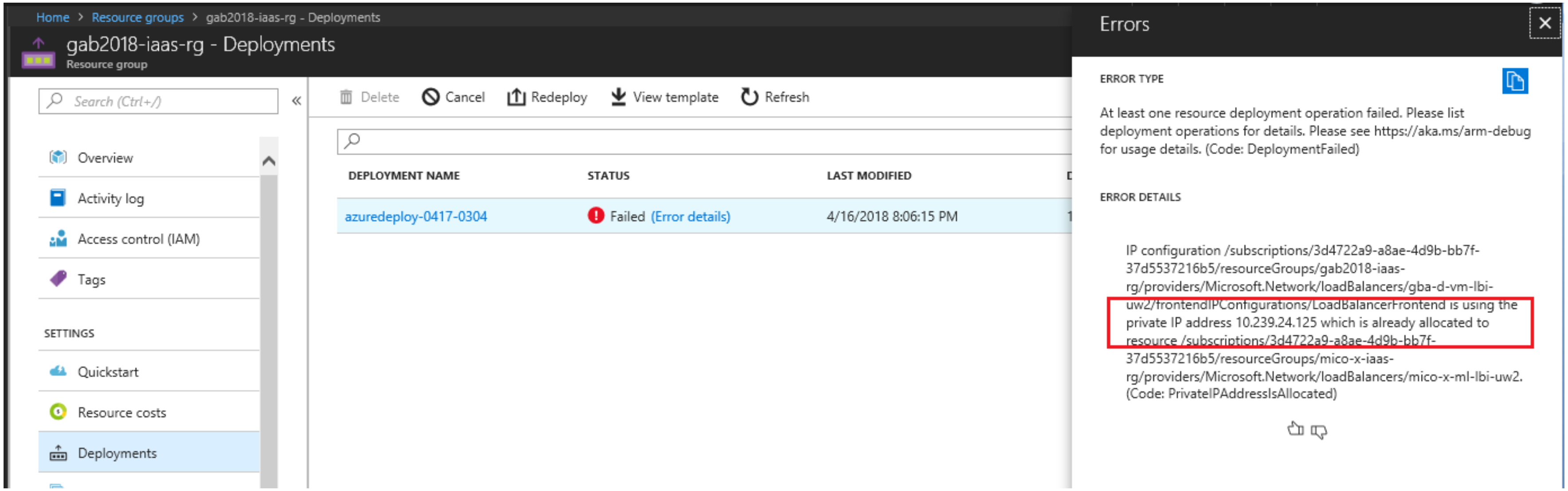


DEPLOYMENT NAME	STATUS	LAST MODIFIED	DURATION	
azuredeploy-0417-0304	Deploying	4/16/2018 8:05:00 PM	6 seconds	Related events

Errors might happen…



DEPLOYMENT NAME	STATUS	LAST MODIFIED	DURATION	
azuredeploy-0417-0304	❗ Failed (Error details)	4/16/2018 8:06:15 PM	1 minute 20 seconds	Related events



DEPLOYMENT NAME	STATUS	LAST MODIFIED
azuredeploy-0417-0304	❗ Failed (Error details)	4/16/2018 8:06:15 PM

ERROR TYPE

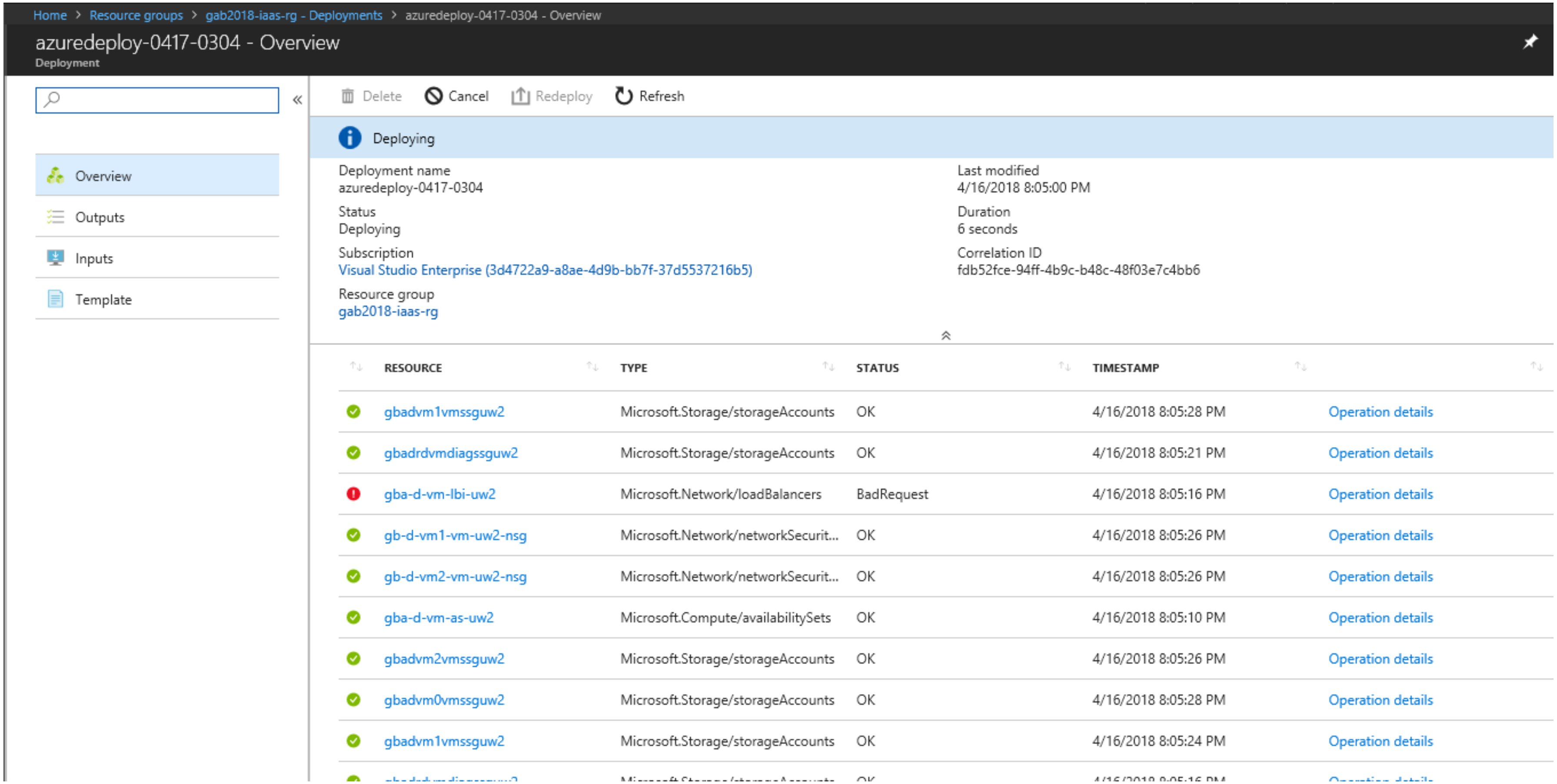
At least one resource deployment operation failed. Please list deployment operations for details. Please see https://aka.ms/arm-debug for usage details. (Code: DeploymentFailed)

ERROR DETAILS

IP configuration /subscriptions/3d4722a9-a8ae-4d9b-bb7f-37d5537216b5/resourceGroups/gab2018-iaas-rg/providers/Microsoft.Network/loadBalancers/gba-d-vm-lbi-uw2/frontendIPConfigurations/LoadBalancerFrontend is using the private IP address 10.239.24.125 which is already allocated to resource /subscriptions/3d4722a9-a8ae-4d9b-bb7f-37d5537216b5/resourceGroups/mico-x-iaas-rg/providers/Microsoft.Network/loadBalancers/mico-x-ml-lbi-uw2. (Code: PrivateIPAddressIsAllocated)

Infrastructure As Code

Some resources will be provisioned…



Home > Resource groups > gab2018-iaas-rg - Deployments > azuredeploy-0417-0304 - Overview

azuredeploy-0417-0304 - Overview
Deployment

Deploying

Deployment name
azuredeploy-0417-0304

Status
Deploying

Subscription
Visual Studio Enterprise (3d4722a9-a8ae-4d9b-bb7f-37d5537216b5)

Resource group
gab2018-iaas-rg

Last modified
4/16/2018 8:05:00 PM

Duration
6 seconds

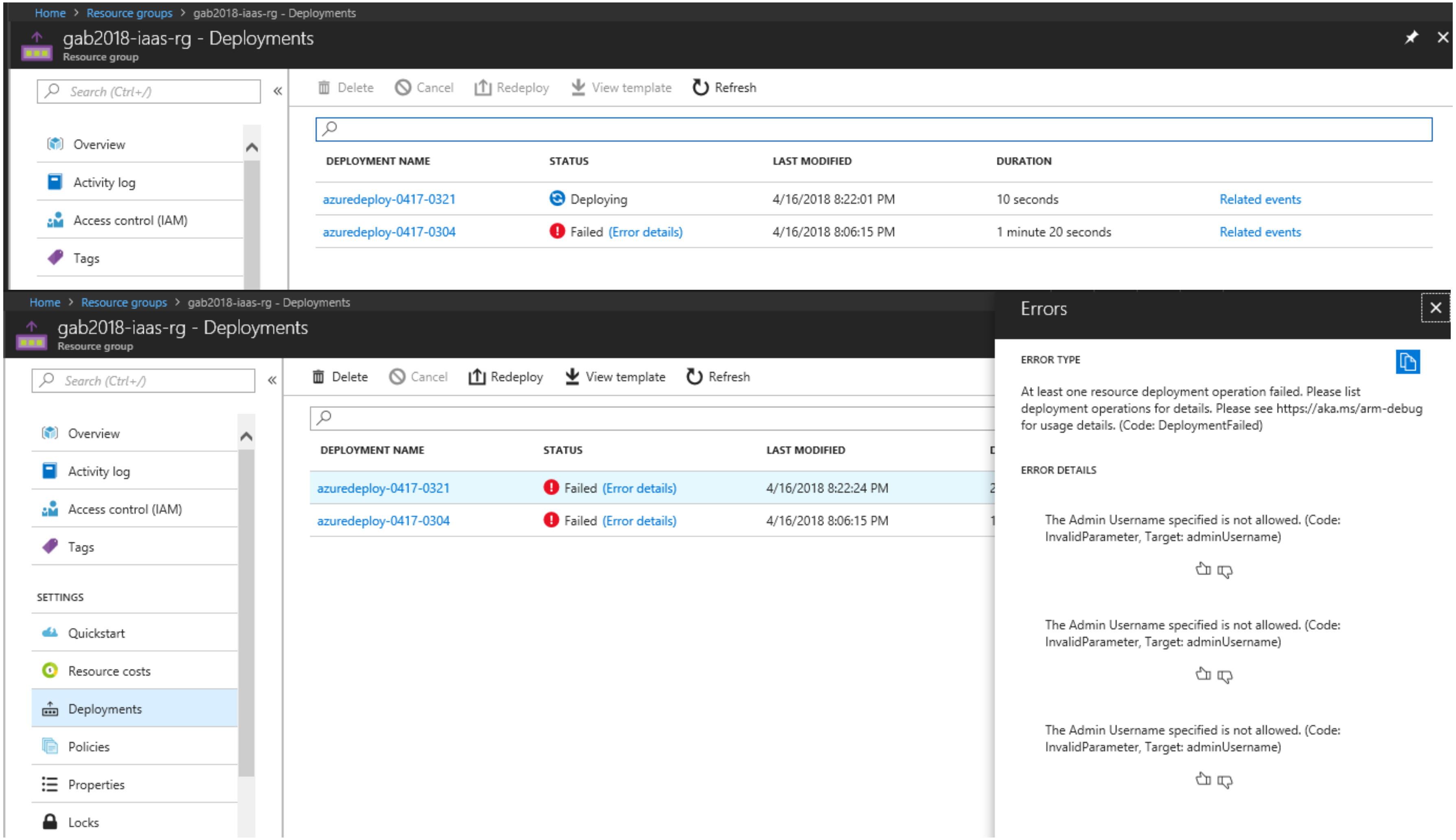
Correlation ID
fdb52fce-94ff-4b9c-b48c-48f03e7c4bb6

	RESOURCE	TYPE	STATUS	TIMESTAMP	
✓	gbadvm1vmssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:05:28 PM	Operation details
✓	gbadrdvmdiagssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:05:21 PM	Operation details
!	gba-d-vm-lbi-uw2	Microsoft.Network/loadBalancers	BadRequest	4/16/2018 8:05:16 PM	Operation details
✓	gb-d-vm1-vm-uw2-nsg	Microsoft.Network/networkSecurit...	OK	4/16/2018 8:05:26 PM	Operation details
✓	gb-d-vm2-vm-uw2-nsg	Microsoft.Network/networkSecurit...	OK	4/16/2018 8:05:26 PM	Operation details
✓	gba-d-vm-as-uw2	Microsoft.Compute/availabilitySets	OK	4/16/2018 8:05:10 PM	Operation details
✓	gbadvm2vmssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:05:26 PM	Operation details
✓	gbadvm0vmssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:05:28 PM	Operation details
✓	gbadvm1vmssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:05:24 PM	Operation details
✓	gbadrdvmdiagssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:05:16 PM	Operation details

Infrastructure As Code

2018 Global Azure BOOTCAMP

You can try again…



DEPLOYMENT NAME	STATUS	LAST MODIFIED	DURATION	
azuredeploy-0417-0321	Deploying	4/16/2018 8:22:01 PM	10 seconds	Related events
azuredeploy-0417-0304	Failed (Error details)	4/16/2018 8:06:15 PM	1 minute 20 seconds	Related events

DEPLOYMENT NAME	STATUS	LAST MODIFIED	D
azuredeploy-0417-0321	Failed (Error details)	4/16/2018 8:22:24 PM	2
azuredeploy-0417-0304	Failed (Error details)	4/16/2018 8:06:15 PM	1

ERROR TYPE

At least one resource deployment operation failed. Please list deployment operations for details. Please see https://aka.ms/arm-debug for usage details. (Code: DeploymentFailed)

ERROR DETAILS

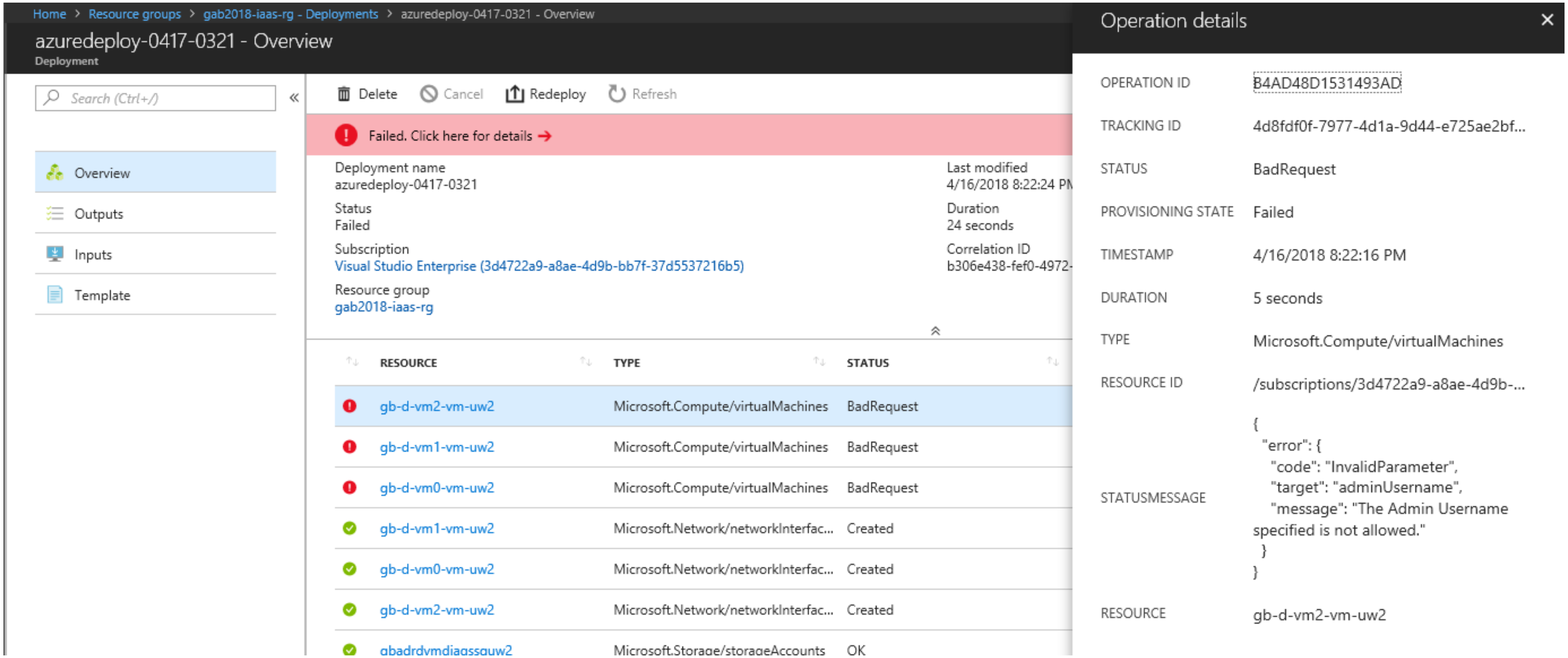
The Admin Username specified is not allowed. (Code: InvalidParameter, Target: adminUsername)

The Admin Username specified is not allowed. (Code: InvalidParameter, Target: adminUsername)

The Admin Username specified is not allowed. (Code: InvalidParameter, Target: adminUsername)

Infrastructure As Code

You might encounter new errors…



Home > Resource groups > gab2018-iaas-rg - Deployments > azuredeploy-0417-0321 - Overview

azuredeploy-0417-0321 - Overview
Deployment

Failed. Click here for details →

Deployment name azuredeploy-0417-0321	Last modified 4/16/2018 8:22:24 PM
Status Failed	Duration 24 seconds
Subscription Visual Studio Enterprise (3d4722a9-a8ae-4d9b-bb7f-37d5537216b5)	Correlation ID b306e438-fef0-4972-
Resource group gab2018-iaas-rg	

	RESOURCE	TYPE	STATUS
!	gb-d-vm2-vm-uw2	Microsoft.Compute/virtualMachines	BadRequest
!	gb-d-vm1-vm-uw2	Microsoft.Compute/virtualMachines	BadRequest
!	gb-d-vm0-vm-uw2	Microsoft.Compute/virtualMachines	BadRequest
✓	gb-d-vm1-vm-uw2	Microsoft.Network/networkInterfac...	Created
✓	gb-d-vm0-vm-uw2	Microsoft.Network/networkInterfac...	Created
✓	gb-d-vm2-vm-uw2	Microsoft.Network/networkInterfac...	Created
✓	gbadrdvmdiagssauw2	Microsoft.Storage/storageAccounts	OK

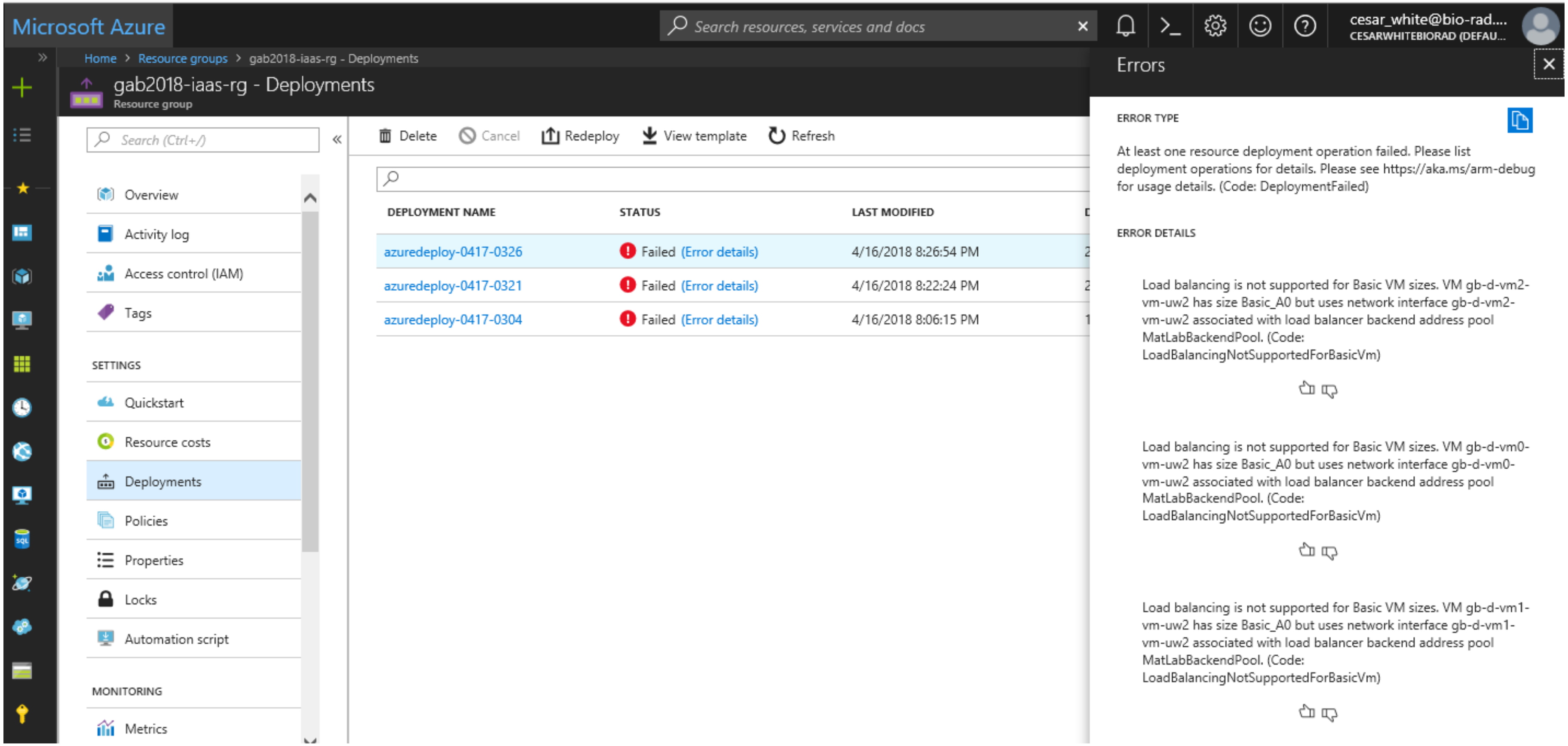
Operation details

OPERATION ID	B4AD48D1531493AD
TRACKING ID	4d8fdf0f-7977-4d1a-9d44-e725ae2bf...
STATUS	BadRequest
PROVISIONING STATE	Failed
TIMESTAMP	4/16/2018 8:22:16 PM
DURATION	5 seconds
TYPE	Microsoft.Compute/virtualMachines
RESOURCE ID	/subscriptions/3d4722a9-a8ae-4d9b-...
STATUSMESSAGE	{ "error": { "code": "InvalidParameter", "target": "adminUsername", "message": "The Admin Username specified is not allowed." } }
RESOURCE	gb-d-vm2-vm-uw2

Infrastructure As Code

2018 Global Azure BOOTCAMP

And more new errors…



DEPLOYMENT NAME	STATUS	LAST MODIFIED	D
azuredeploy-0417-0326	Failed (Error details)	4/16/2018 8:26:54 PM	2
azuredeploy-0417-0321	Failed (Error details)	4/16/2018 8:22:24 PM	2
azuredeploy-0417-0304	Failed (Error details)	4/16/2018 8:06:15 PM	1

ERROR TYPE

At least one resource deployment operation failed. Please list deployment operations for details. Please see https://aka.ms/arm-debug for usage details. (Code: DeploymentFailed)

ERROR DETAILS

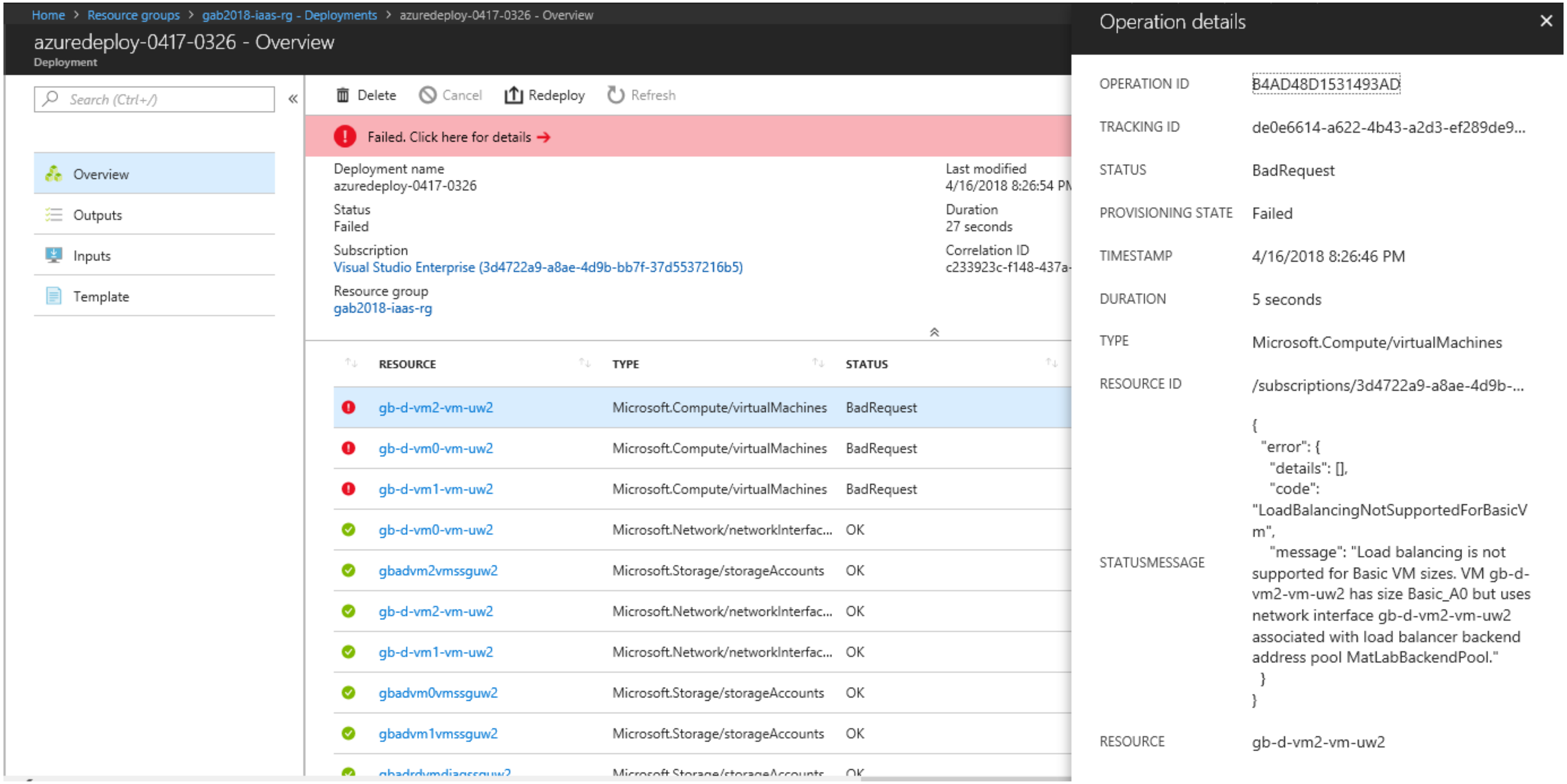
Load balancing is not supported for Basic VM sizes. VM gb-d-vm2-vm-uw2 has size Basic_A0 but uses network interface gb-d-vm2-vm-uw2 associated with load balancer backend address pool MatLabBackendPool. (Code: LoadBalancingNotSupportedForBasicVm)

Load balancing is not supported for Basic VM sizes. VM gb-d-vm0-vm-uw2 has size Basic_A0 but uses network interface gb-d-vm0-vm-uw2 associated with load balancer backend address pool MatLabBackendPool. (Code: LoadBalancingNotSupportedForBasicVm)

Load balancing is not supported for Basic VM sizes. VM gb-d-vm1-vm-uw2 has size Basic_A0 but uses network interface gb-d-vm1-vm-uw2 associated with load balancer backend address pool MatLabBackendPool. (Code: LoadBalancingNotSupportedForBasicVm)

Infrastructure As Code

2018 Global Azure BOOTCAMP



Home > Resource groups > gab2018-iaas-rg - Deployments > azuredeploy-0417-0326 - Overview

azuredeploy-0417-0326 - Overview

Deployment

Failed. Click here for details →

Deployment name
azuredeploy-0417-0326

Status
Failed

Subscription
Visual Studio Enterprise (3d4722a9-a8ae-4d9b-bb7f-37d5537216b5)

Resource group
gab2018-iaas-rg

Last modified
4/16/2018 8:26:54 PM

Duration
27 seconds

Correlation ID
c233923c-f148-437a-

	RESOURCE	TYPE	STATUS
!	gb-d-vm2-vm-uw2	Microsoft.Compute/virtualMachines	BadRequest
!	gb-d-vm0-vm-uw2	Microsoft.Compute/virtualMachines	BadRequest
!	gb-d-vm1-vm-uw2	Microsoft.Compute/virtualMachines	BadRequest
✓	gb-d-vm0-vm-uw2	Microsoft.Network/networkInterfac...	OK
✓	gbadvm2vmssguw2	Microsoft.Storage/storageAccounts	OK
✓	gb-d-vm2-vm-uw2	Microsoft.Network/networkInterfac...	OK
✓	gb-d-vm1-vm-uw2	Microsoft.Network/networkInterfac...	OK
✓	gbadvm0vmssguw2	Microsoft.Storage/storageAccounts	OK
✓	gbadvm1vmssguw2	Microsoft.Storage/storageAccounts	OK
✓	gbadrdvmdiagssguw2	Microsoft.Storage/storageAccounts	OK

Operation details

OPERATION ID	B4AD48D1531493AD
TRACKING ID	de0e6614-a622-4b43-a2d3-ef289de9...
STATUS	BadRequest
PROVISIONING STATE	Failed
TIMESTAMP	4/16/2018 8:26:46 PM
DURATION	5 seconds
TYPE	Microsoft.Compute/virtualMachines
RESOURCE ID	/subscriptions/3d4722a9-a8ae-4d9b-...

STATUSMESSAGE

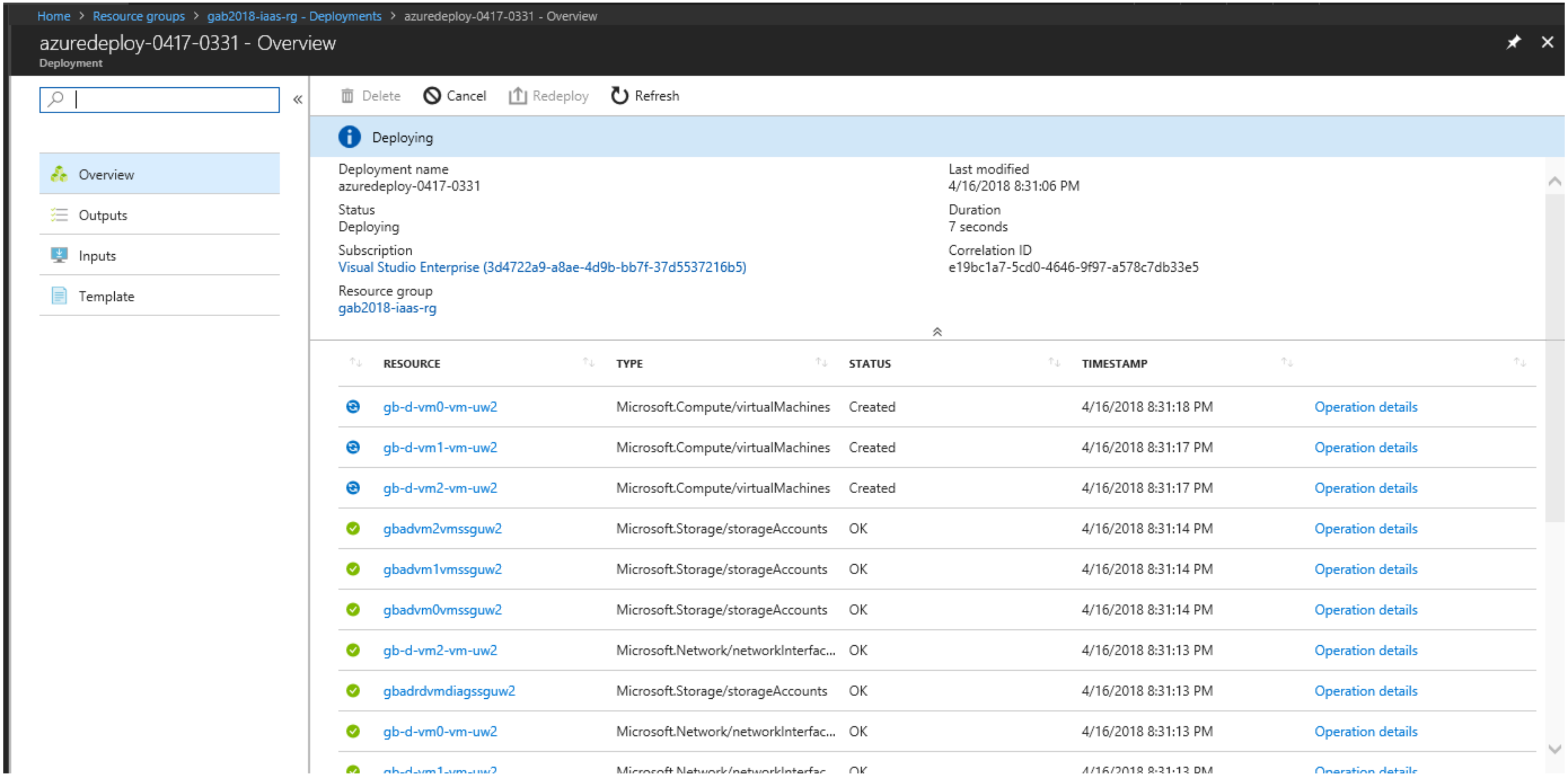
```
{
  "error": {
    "details": [],
    "code":
"LoadBalancingNotSupportedForBasicV
m",
    "message": "Load balancing is not
supported for Basic VM sizes. VM gb-d-
vm2-vm-uw2 has size Basic_A0 but uses
network interface gb-d-vm2-vm-uw2
associated with load balancer backend
address pool MatLabBackendPool."
  }
}
```

RESOURCE gb-d-vm2-vm-uw2

Infrastructure As Code

2018
Global Azure
BOOTCAMP

Don’t give up…


Home > Resource groups > gab2018-iaas-rg - Deployments > azuredeploy-0417-0331 - Overview
Delete
Cancel
Redeploy
Refresh
Overview
Outputs
Inputs
Template

azuredeploy-0417-0331 - Overview
Deployment

Deploying

Deployment name
azuredeploy-0417-0331

Status
Deploying

Subscription
Visual Studio Enterprise (3d4722a9-a8ae-4d9b-bb7f-37d5537216b5)

Resource group
gab2018-iaas-rg

Last modified
4/16/2018 8:31:06 PM

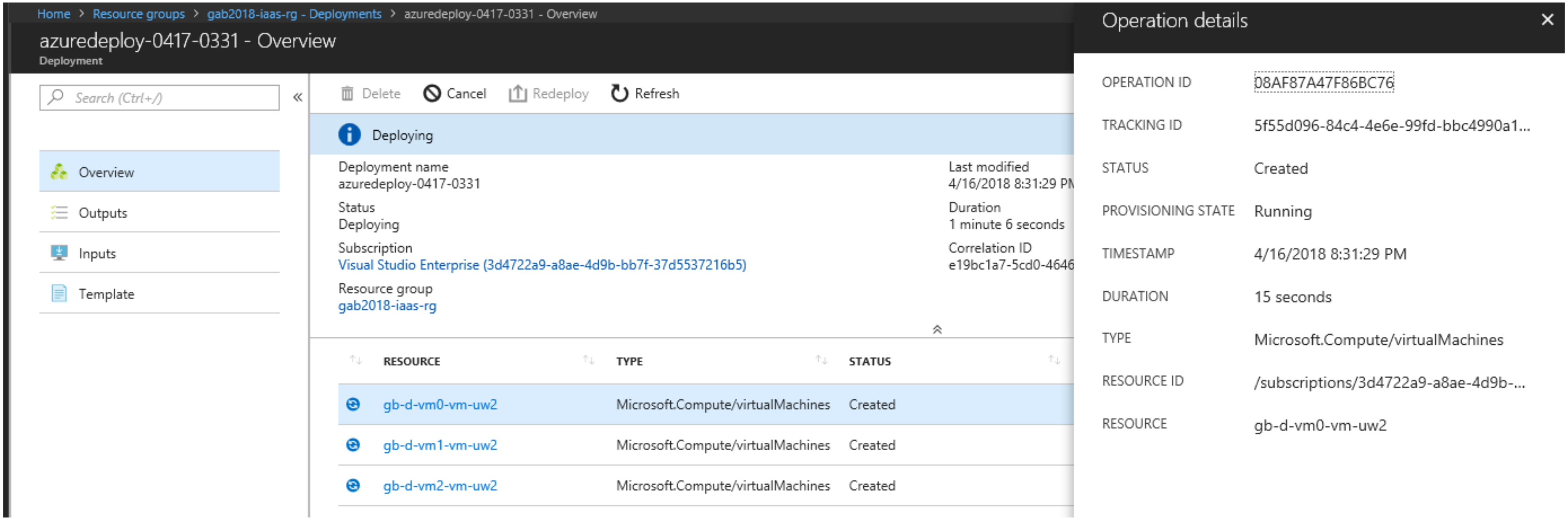
Duration
7 seconds

Correlation ID
e19bc1a7-5cd0-4646-9f97-a578c7db33e5

RESOURCE	TYPE	STATUS	TIMESTAMP	
gb-d-vm0-vm-uw2	Microsoft.Compute/virtualMachines	Created	4/16/2018 8:31:18 PM	Operation details
gb-d-vm1-vm-uw2	Microsoft.Compute/virtualMachines	Created	4/16/2018 8:31:17 PM	Operation details
gb-d-vm2-vm-uw2	Microsoft.Compute/virtualMachines	Created	4/16/2018 8:31:17 PM	Operation details
gbadvm2vmssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:31:14 PM	Operation details
gbadvm1vmssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:31:14 PM	Operation details
gbadvm0vmssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:31:14 PM	Operation details
gb-d-vm2-vm-uw2	Microsoft.Network/networkInterfac...	OK	4/16/2018 8:31:13 PM	Operation details
gbadrdvmdiagssguw2	Microsoft.Storage/storageAccounts	OK	4/16/2018 8:31:13 PM	Operation details
gb-d-vm0-vm-uw2	Microsoft.Network/networkInterfac...	OK	4/16/2018 8:31:13 PM	Operation details
gb-d-vm1-vm-uw2	Microsoft.Network/networkInterfac	OK	4/16/2018 8:31:13 PM	Operation details

Infrastructure As Code

With time...



Home > Resource groups > gab2018-iaas-rg - Deployments > azuredeploy-0417-0331 - Overview

azuredeploy-0417-0331 - Overview

Deployment

Deploying

Deployment name
azuredeploy-0417-0331

Status
Deploying

Subscription
Visual Studio Enterprise (3d4722a9-a8ae-4d9b-bb7f-37d5537216b5)

Resource group
gab2018-iaas-rg

Last modified
4/16/2018 8:31:29 PM

Duration
1 minute 6 seconds

Correlation ID
e19bc1a7-5cd0-4646

RESOURCE	TYPE	STATUS
gb-d-vm0-vm-uw2	Microsoft.Compute/virtualMachines	Created
gb-d-vm1-vm-uw2	Microsoft.Compute/virtualMachines	Created
gb-d-vm2-vm-uw2	Microsoft.Compute/virtualMachines	Created

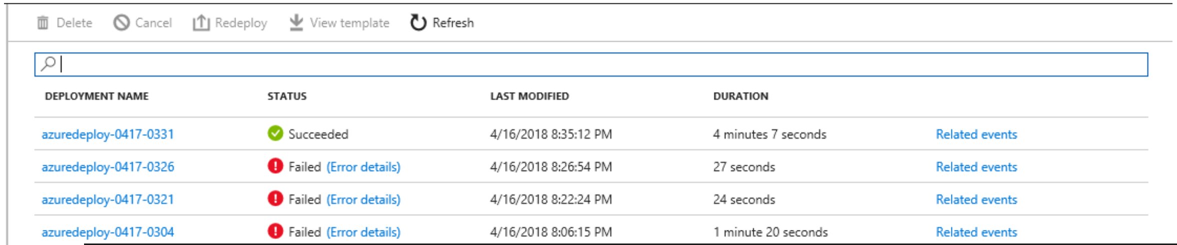
Operation details

OPERATION ID	08AF87A47F86BC76
TRACKING ID	5f55d096-84c4-4e6e-99fd-bbc4990a1...
STATUS	Created
PROVISIONING STATE	Running
TIMESTAMP	4/16/2018 8:31:29 PM
DURATION	15 seconds
TYPE	Microsoft.Compute/virtualMachines
RESOURCE ID	/subscriptions/3d4722a9-a8ae-4d9b-...
RESOURCE	gb-d-vm0-vm-uw2

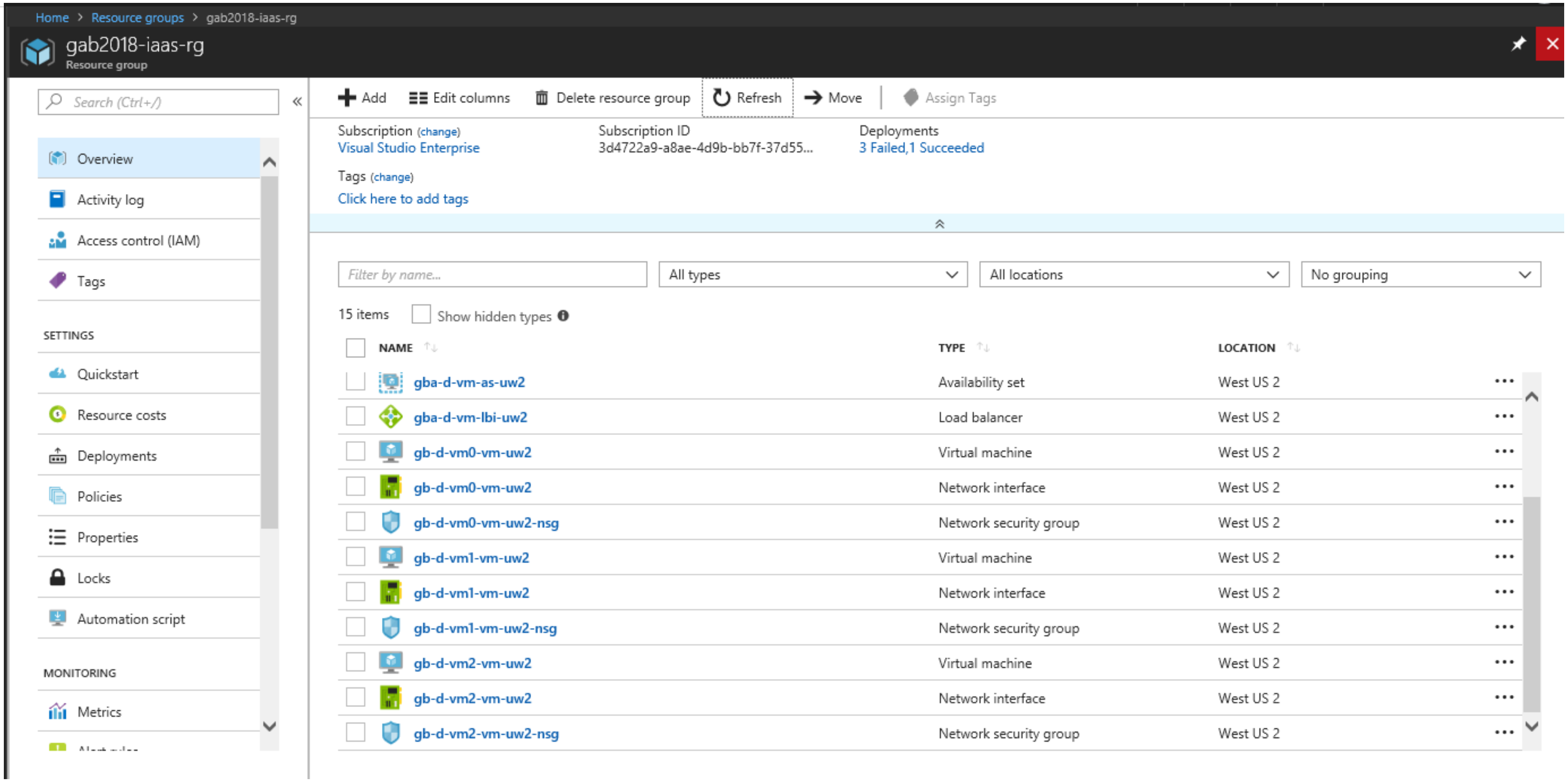
Infrastructure As Code

2018 Global Azure BOOTCAMP

You will deploy error free templates...



DEPLOYMENT NAME	STATUS	LAST MODIFIED	DURATION	
azuredeploy-0417-0331	✓ Succeeded	4/16/2018 8:35:12 PM	4 minutes 7 seconds	Related events
azuredeploy-0417-0326	! Failed (Error details)	4/16/2018 8:26:54 PM	27 seconds	Related events
azuredeploy-0417-0321	! Failed (Error details)	4/16/2018 8:22:24 PM	24 seconds	Related events
azuredeploy-0417-0304	! Failed (Error details)	4/16/2018 8:06:15 PM	1 minute 20 seconds	Related events



Subscription (change)
Visual Studio Enterprise

Subscription ID
3d4722a9-a8ae-4d9b-bb7f-37d55...

Deployments
3 Failed,1 Succeeded

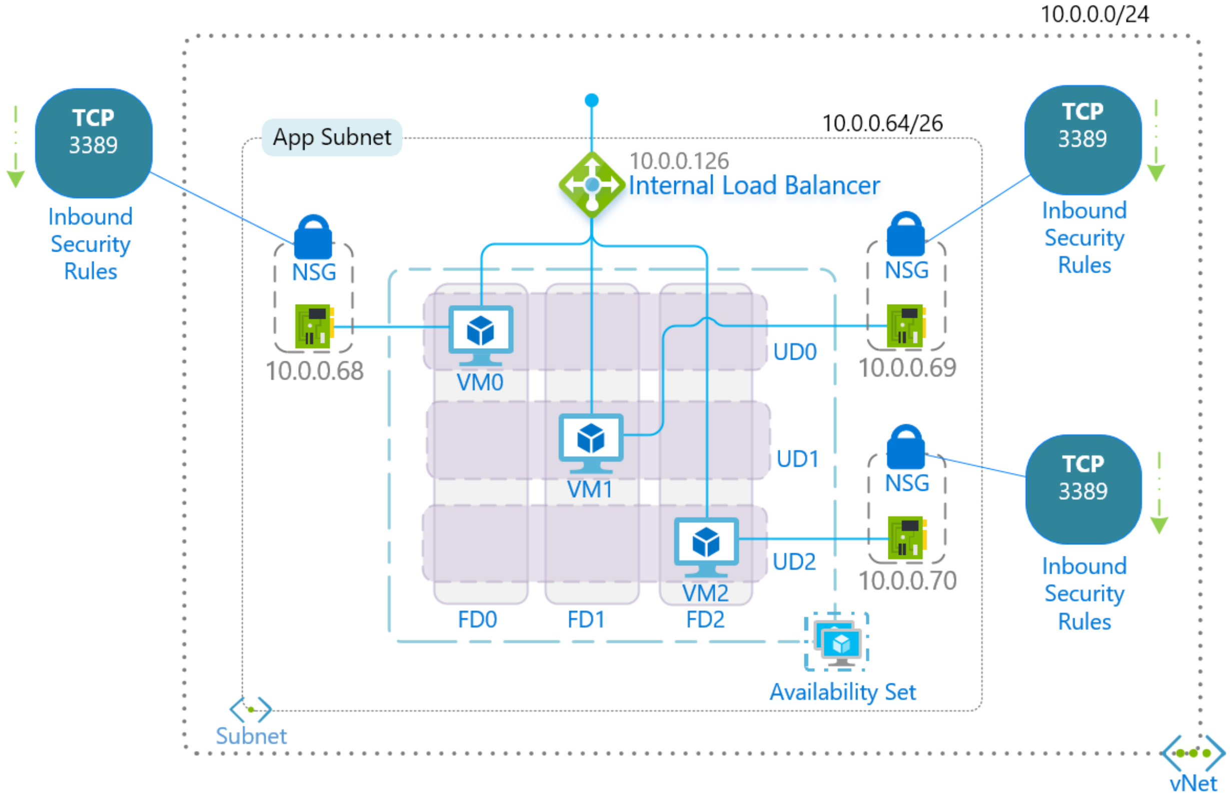
Tags (change)
Click here to add tags

Filter by name... | All types | All locations | No grouping

15 items □ Show hidden types

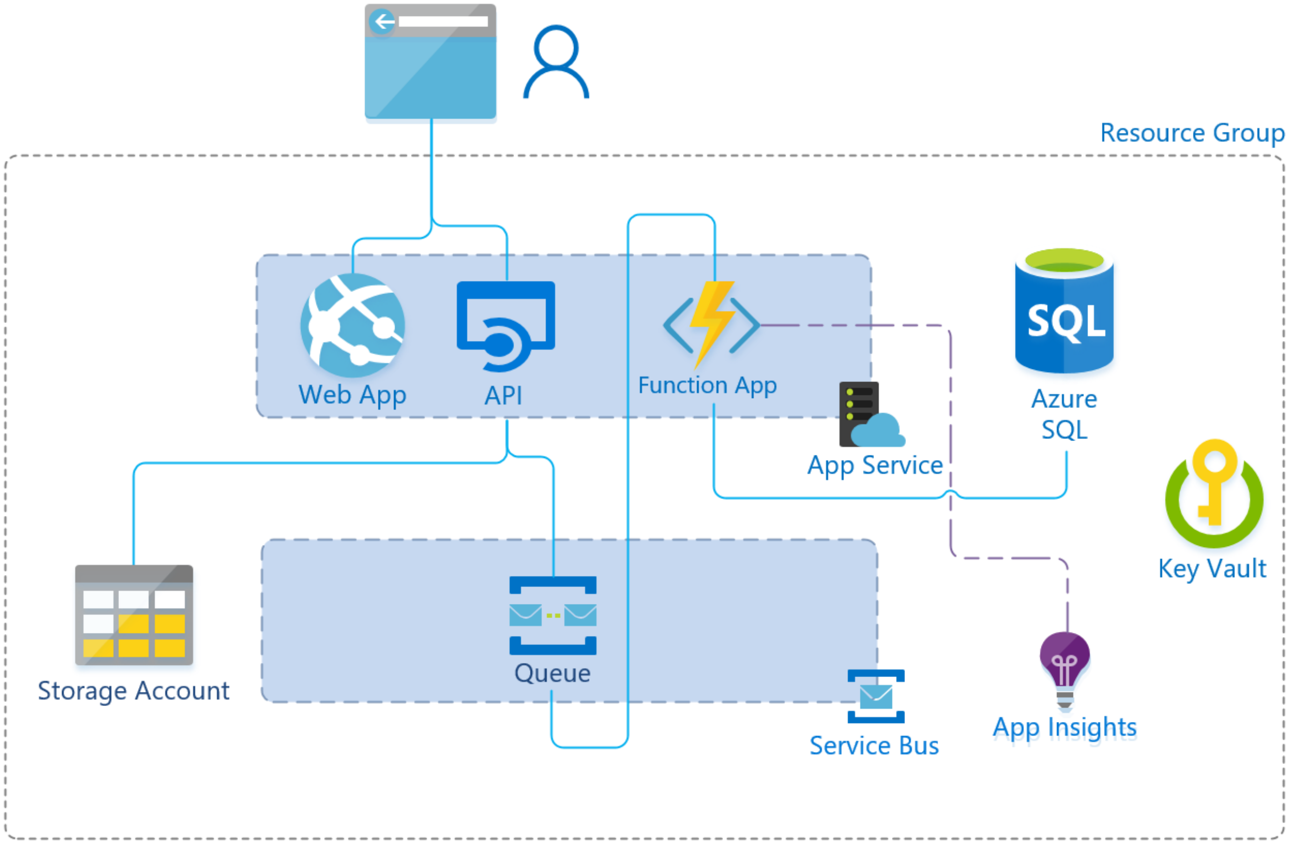
□ NAME	TYPE	LOCATION
□ gba-d-vm-as-uw2	Availability set	West US 2
□ gba-d-vm-lbi-uw2	Load balancer	West US 2
□ gb-d-vm0-vm-uw2	Virtual machine	West US 2
□ gb-d-vm0-vm-uw2	Network interface	West US 2
□ gb-d-vm0-vm-uw2-nsg	Network security group	West US 2
□ gb-d-vm1-vm-uw2	Virtual machine	West US 2
□ gb-d-vm1-vm-uw2	Network interface	West US 2
□ gb-d-vm1-vm-uw2-nsg	Network security group	West US 2
□ gb-d-vm2-vm-uw2	Virtual machine	West US 2
□ gb-d-vm2-vm-uw2	Network interface	West US 2
□ gb-d-vm2-vm-uw2-nsg	Network security group	West US 2

Infrastructure As A Service - Demo



- •Availability Set
- •Fault Domain
- •Upgrade Domain
- •n VM's
- •Load Balancer
- •NSG/Rules

Platform As A Service - Demo



- App Service
- Web App
- API
- Function App
- App Insights
- Service Bus / Queue
- Storage Account
- Azure SQL
- Key Vault

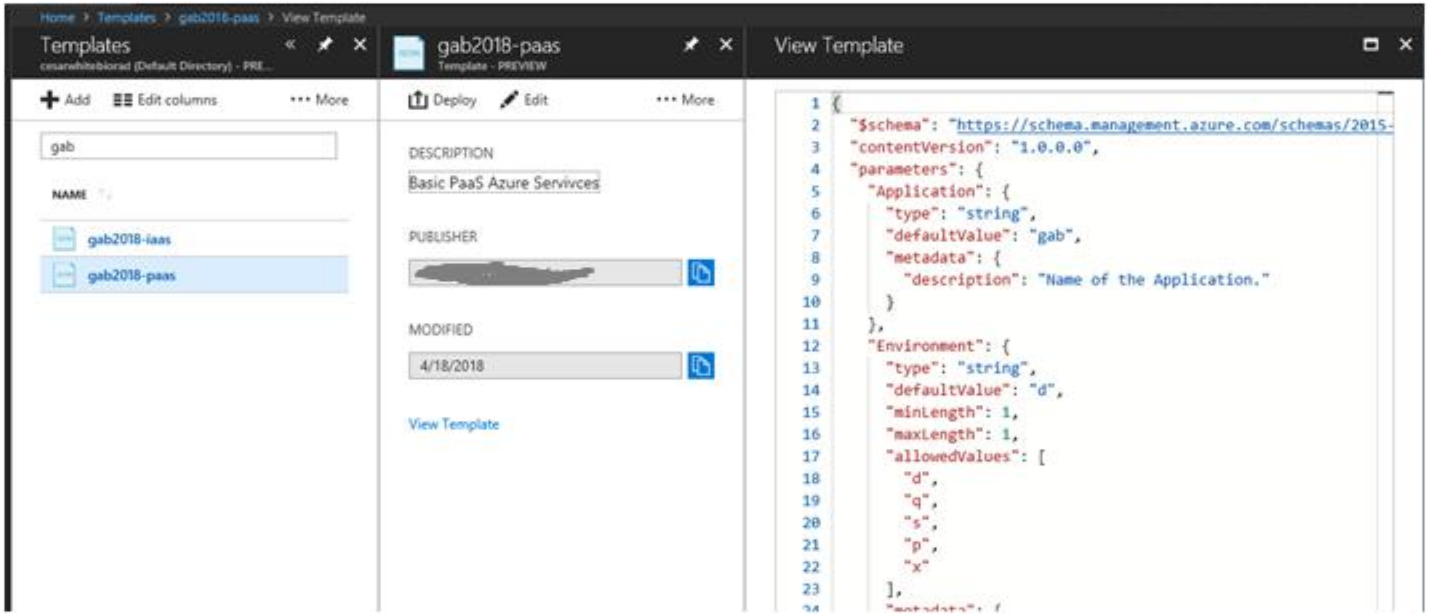
Infrastructure As Code

Tips & Tricks

- Azure Portal Templates
- Behind the scenes of the Azure Portal… the resources
- Quick Start Templates
- Break down your templates with Linked Templates

Tips & Tricks – Azure Portal Templates

- Create a library of your ARM templates
- Deploy within the Azure Portal
- Share ARM templates across your enterprise
- Support an Agile environment



Home > Templates > gab2018-paas > View Template

Templates
cesarwhitebiorad (Default Directory) - PRE...

gab

NAME

- gab2018-iaas
- gab2018-paas

gab2018-paas
Template - PREVIEW

DESCRIPTION
Basic PaaS Azure Servivces

PUBLISHER
[redacted]

MODIFIED
4/18/2018

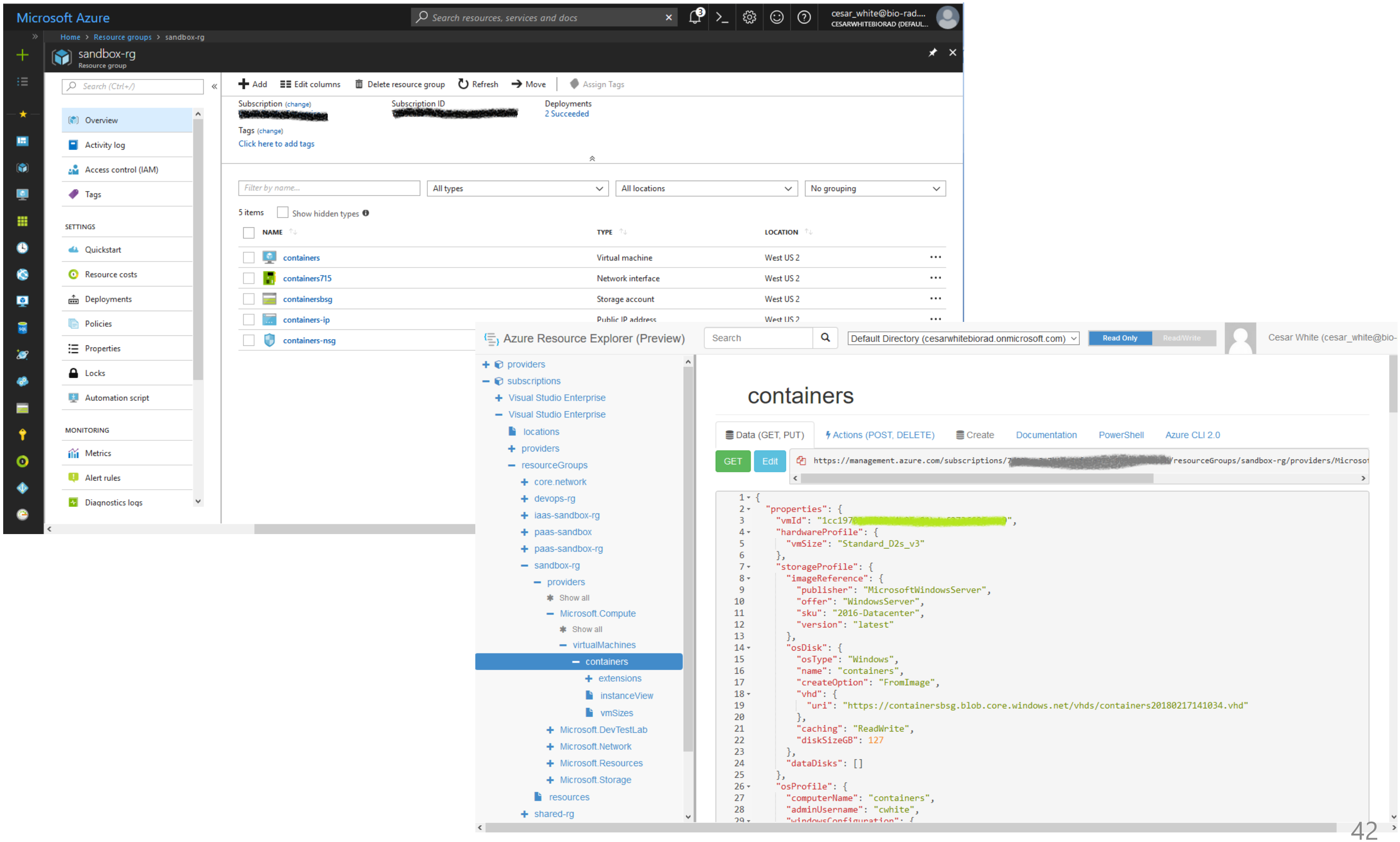
View Template

View Template

```
{
  "$schema": "https://schema.management.azure.com/schemas/2015-
  "contentVersion": "1.0.0.0",
  "parameters": {
    "Application": {
      "type": "string",
      "defaultValue": "gab",
      "metadata": {
        "description": "Name of the Application."
      }
    },
    "Environment": {
      "type": "string",
      "defaultValue": "d",
      "minLength": 1,
      "maxLength": 1,
      "allowedValues": [
        "d",
        "q",
        "s",
        "p",
        "x"
      ],
      "metadata": {
```

Infrastructure As Code

Tips & Tricks - Behind the scenes of the Azure Portal… https://**resources**.azure.com/



Microsoft Azure — Search resources, services and docs — cesar_white@bio-rad.... CESARWHITEBIORAD (DEFAUL...

Home > Resource groups > sandbox-rg

sandbox-rg
Resource group

Search (Ctrl+/)

- Overview
- Activity log
- Access control (IAM)
- Tags

SETTINGS

- Quickstart
- Resource costs
- Deployments
- Policies
- Properties
- Locks
- Automation script

MONITORING

- Metrics
- Alert rules
- Diagnostics logs

Add | Edit columns | Delete resource group | Refresh | Move | Assign Tags

Subscription (change): [redacted]

Subscription ID: [redacted]

Deployments: 2 Succeeded

Tags (change): Click here to add tags

Filter by name... | All types | All locations | No grouping

5 items □ Show hidden types

NAME	TYPE	LOCATION
containers	Virtual machine	West US 2
containers715	Network interface	West US 2
containersbsg	Storage account	West US 2
containers-ip	Public IP address	West US 2
containers-nsg		

Azure Resource Explorer (Preview) — Search — Default Directory (cesarwhitebiorad.onmicrosoft.com) — Read Only | Read/Write — Cesar White (cesar_white@bio-

- providers
- subscriptions
  - Visual Studio Enterprise
  - Visual Studio Enterprise
    - locations
    - providers
    - resourceGroups
      - core.network
      - devops-rg
      - iaas-sandbox-rg
      - paas-sandbox
      - paas-sandbox-rg
      - sandbox-rg
        - providers
          - Show all
          - Microsoft.Compute
            - Show all
            - virtualMachines
              - containers
                - extensions
                - instanceView
                - vmSizes
          - Microsoft.DevTestLab
          - Microsoft.Network
          - Microsoft.Resources
          - Microsoft.Storage
        - resources
      - shared-rg

containers

Data (GET, PUT) | Actions (POST, DELETE) | Create | Documentation | PowerShell | Azure CLI 2.0

GET | Edit — https://management.azure.com/subscriptions/7[redacted]/resourceGroups/sandbox-rg/providers/Microsof

```
{
  "properties": {
    "vmId": "1cc197[redacted]",
    "hardwareProfile": {
      "vmSize": "Standard_D2s_v3"
    },
    "storageProfile": {
      "imageReference": {
        "publisher": "MicrosoftWindowsServer",
        "offer": "WindowsServer",
        "sku": "2016-Datacenter",
        "version": "latest"
      },
      "osDisk": {
        "osType": "Windows",
        "name": "containers",
        "createOption": "FromImage",
        "vhd": {
          "uri": "https://containersbsg.blob.core.windows.net/vhds/containers20180217141034.vhd"
        },
        "caching": "ReadWrite",
        "diskSizeGB": 127
      },
      "dataDisks": []
    },
    "osProfile": {
      "computerName": "containers",
      "adminUsername": "cwhite",
      "windowsConfiguration": {
```

Infrastructure As Code

Tips & Tricks - Templates Access and Quick Start Templates

if you know the provider and type you can access the documentation as follows:

https://docs.microsoft.com/azure/templates/***{provider-namespace}***/***{resource-type}***

Example:

https://docs.microsoft.com/en-us/azure/templates/Microsoft.Sql/servers

Quick Start Templates

https://github.com/Azure/azure-quickstart-templates

https://azure.microsoft.com/en-us/resources/templates/

Tips & Tricks - Break down your templates with Linked Templates

To help create a modular template solution to for the enterprise:

https://docs.microsoft.com/en-us/azure/azure-resource-manager/resource-group-linked-templates

https://blog.kloud.com.au/2016/04/16/break-down-your-templates-with-linked-templates-part-1/

Infrastructure As Code

GTK (Good To Know)

ARM Templates References

https://docs.microsoft.com/en-us/rest/api/

https://github.com/Azure/azure-rest-api-specs

https://docs.microsoft.com/en-us/azure/azure-resource-manager/resource-group-template-functions#resource-functions

Terraform with Azure (Beyond ARM Templates)

https://docs.microsoft.com/en-us/azure/terraform/terraform-overview

Questions?

Thank you!!!

Have a great Cloudy rest of your day :D