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Understanding Azure Resource Manager

Sonu Sathyadas

What is Azure Resource Manager?

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- Application infrastructure consists of many components – VM, storage, network, database etc.
- User need to deploy, manage and monitor them as a group.
- Azure Resource Manager (ARM) enables user to work on them as a group.
- User can deploy, update and delete resources for the solution in a single, coordinated operation.
- Resource Manager provides security, auditing and tagging features for resources.
- Azure Resource Manager enables you to repeatedly deploy your app and have confidence your resources are deployed in a consistent state.

Key terms

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- **Resource**:- A manageable item that is available through Azure. Eg: VM, storage account, Web App, Virtual Network etc.
- **Resource Group**:- A container that holds related resources for an Azure solution. Resource Group contains *related resources* for a solution.
- **Resource Provider**:- A service that supplies the resources you can deploy and manage through Resource Manager. eg: Microsoft.Compute, Microsoft.Storage, Microsoft.Web.
- **Resource Manager template**:- A JSON file that defines one or more resources to deploy to a resource group. It also defines the *dependencies* between the deployed resources.
- **Declarative syntax**:- Syntax that tells “What to be created” without writing commands. ARM template is an example.

Why Resource Manager?

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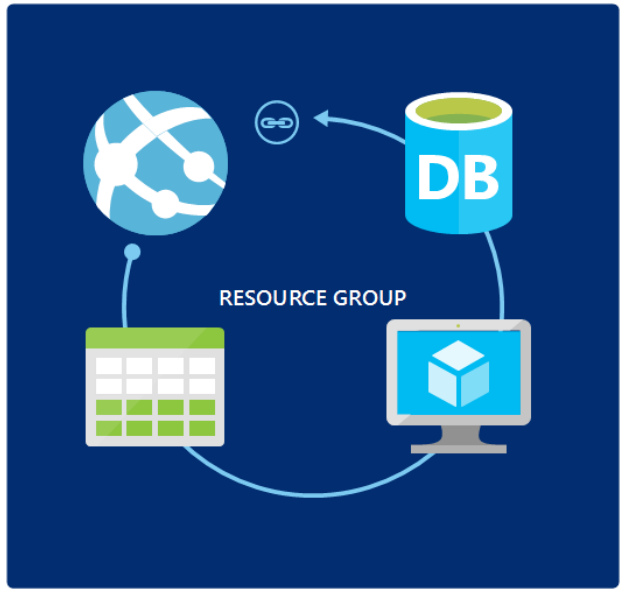
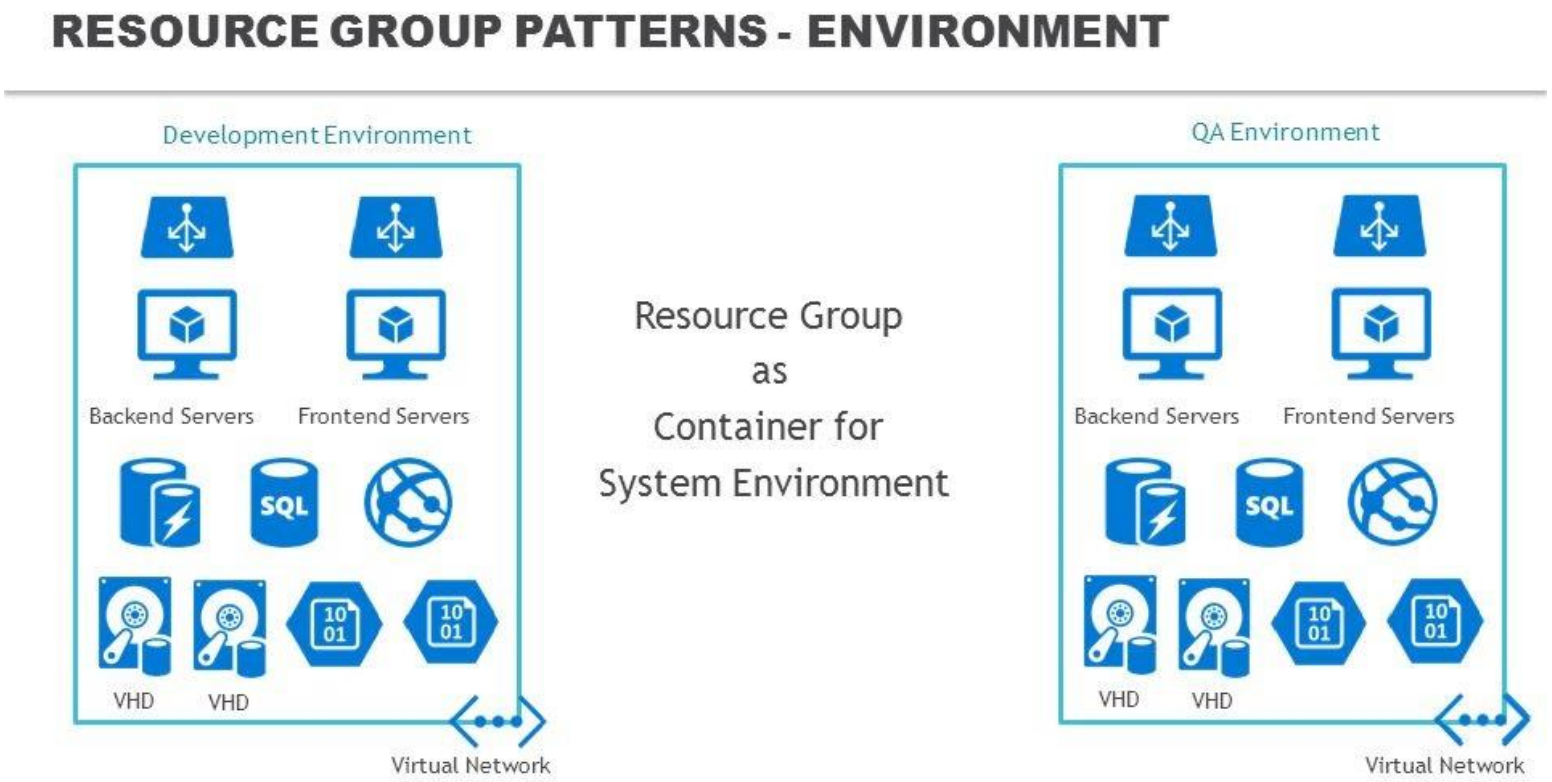
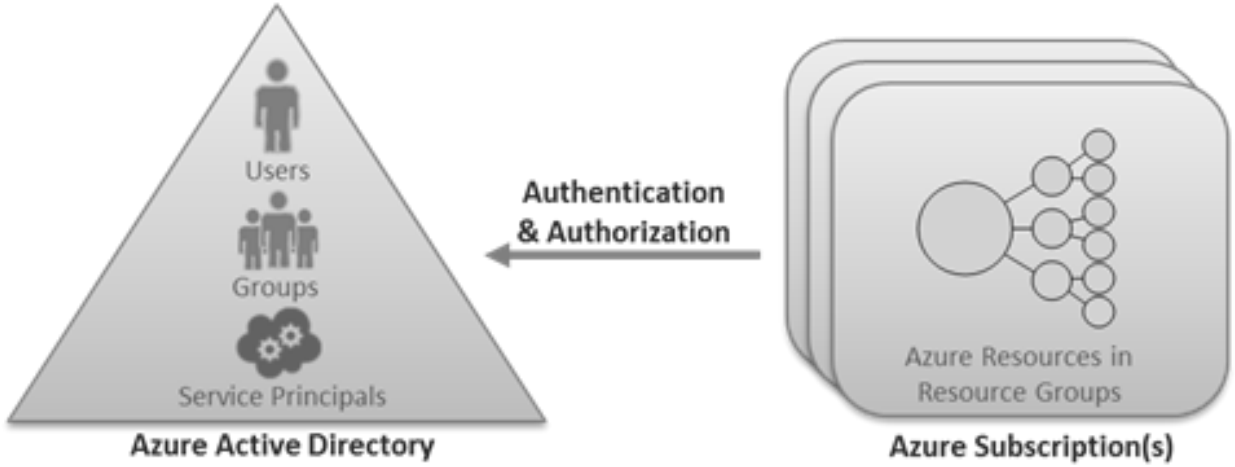
- Create, Deploy and Mange resources as a group.

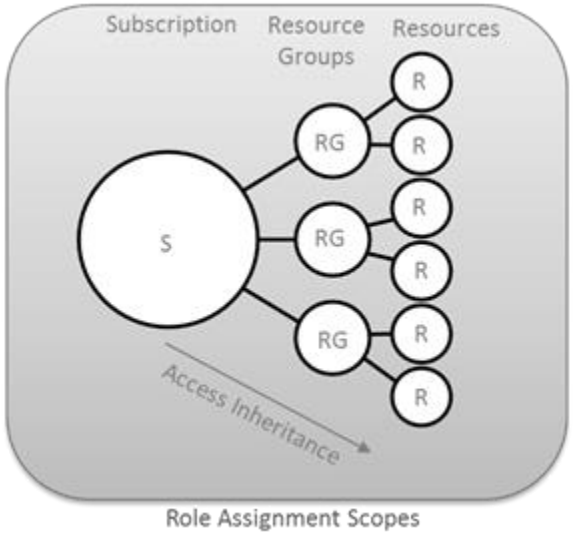




Why Resource Manager?

- Role Based Access Control - RBAC





Why Resource Manager?

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- Declarative code vs Imperative code.
- Azure RM Templates

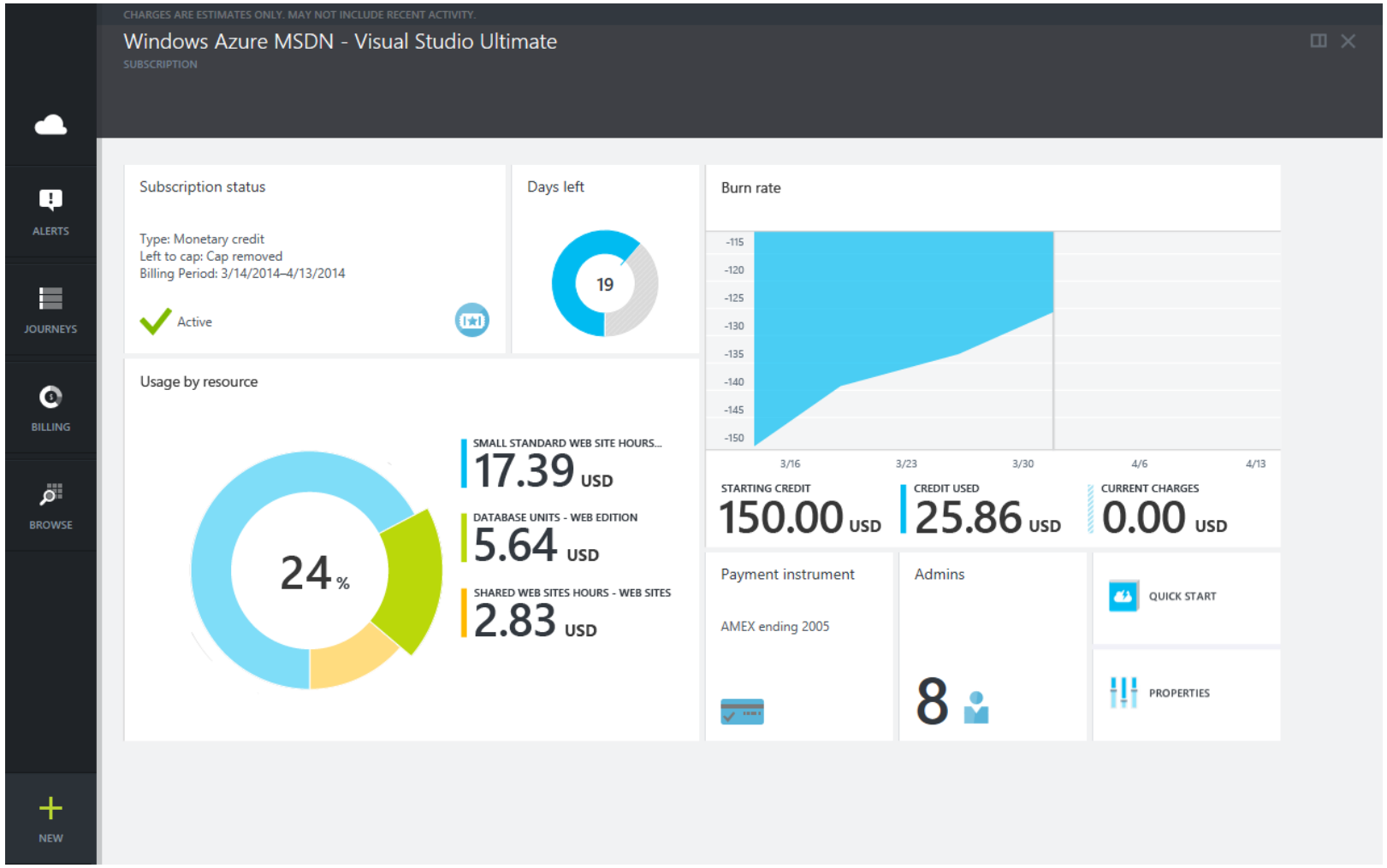
```
{
    "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
    "contentVersion": "1.0.0.0",
    "parameters": {
        "adminUsername": {
            "type": "string",
            "metadata": {
                "description": "Username for the Virtual Machine."
            }
        },
        "adminPassword": {
            "type": "securestring",
            "metadata": {
                "description": "Password for the Virtual Machine."
            }
        },
        "dnsLabelPrefix": {
            "type": "string",
            "metadata": {
                "description": "Unique DNS Name for the Public IP used to access the Virtual Machine."
            }
        },
        "windowsOSVersion": {
            "type": "string",
            "defaultValue": "2012-R2-Datacenter",
            "allowedValues": [
```

Why Resource Manager?

- Apply tags to resources to logically organize all the resources.
-

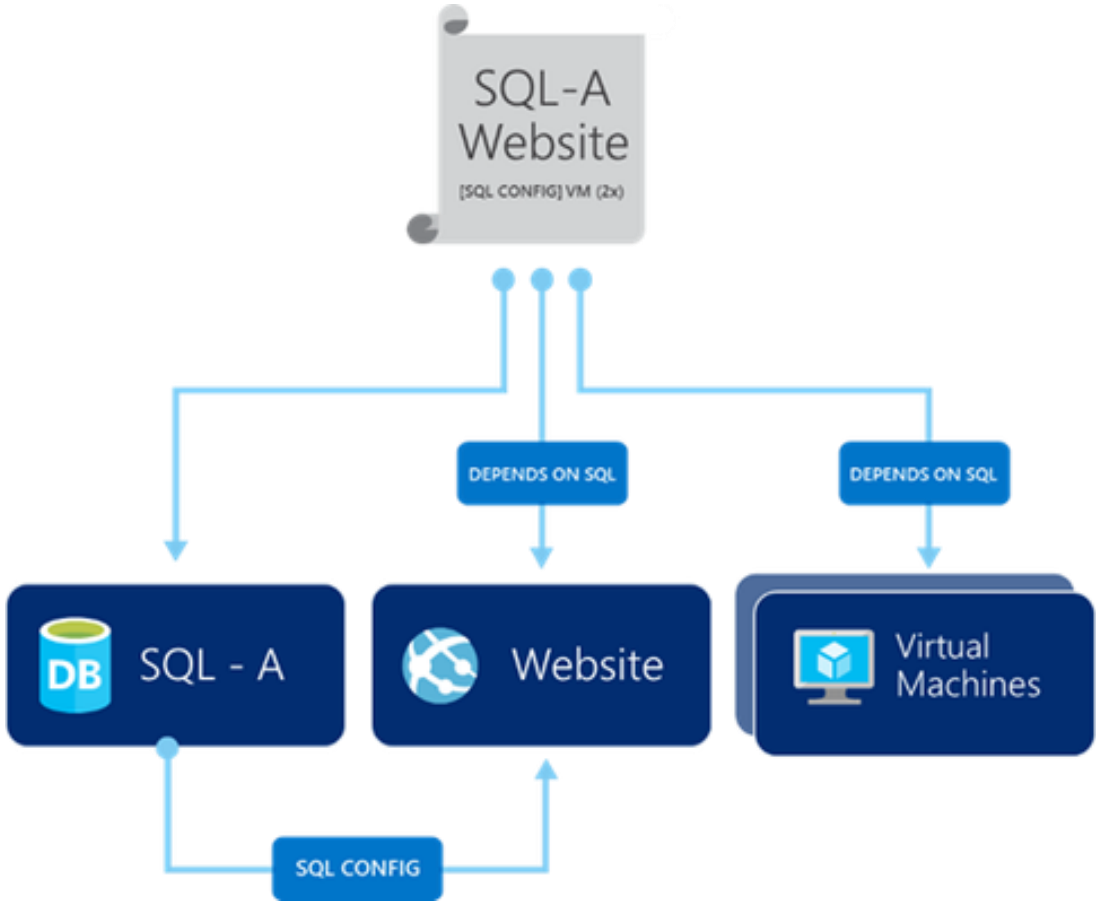
Why Resource Manager?

- Billing for Groups
- Cost for resources



Why Resource Manager?

- Repeated deployment using templates.



Resource

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- A single entity in Azure RM
- Eg: VM, Storage Account, LB, Cloud Service etc
- We can group them using Resource Group
- Provided by Resource Providers
  - Storage Account =>Microsoft.Storage
  - Virtual Machine => Microsoft.Compute
  - Load Balancer => Microsoft.Network
  - Virtual Network => Microsoft.Network
  - Cloud Service => Microsoft.Compute

Resource providers

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- Each resource provider offers set of resources.
- Retrieve list of resource providers using following PS command

  Powershell: **Get-AzureRmResourceProvider -ListAvailable**

  Azure CLI : **azure provider list**

- To get details about a resource provider, add the provider namespace to your command.

Powershell:

(Get-AzureRmResourceProvider -ProviderNamespace Microsoft.Compute).ResourceTypes

Azure CLI:

azure provider show Microsoft.Compute --json > c:\Azure\compute.json

Why Resource Group ?

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Microsoft Azure | CREDIT STATUS | Subscriptions | paulschnack@hotmail.com

ALL ITEMS
WEB APPS 1
VIRTUAL MACHINES 1
MOBILE SERVICES 0
CLOUD SERVICES 1
BATCH SERVICES 0
SQL DATABASES 0
STORAGE 5
HDINSIGHT 0
MEDIA SERVICES 0
SERVICE BUS 0
MOBILE ENGAGEMENT 0
VISUAL STUDIO ONLINE 0
CACHE 0

all items

NAME	TYPE	STATUS	SUBSCRIPTION	LOCATION
JABB-DC1	Cloud service	Stopped	Microsoft Partner Network	East US
expertit	Web app	Running	Microsoft Partner Network	East Asia
jabbsysprodvms	Storage Account	Online	Microsoft Partner Network	East US
paulschnack	Storage Account	Online	Microsoft Partner Network	Southeast Asia
portalvhds5jxbgjdv5hrzc	Storage Account	Online	Microsoft Partner Network	Australia Southeast
portalvhds7cm43qxh7n11k	Storage Account	Online	Microsoft Partner Network	West US
portalvhdsxws04twbhgbf5	Storage Account	Online	Microsoft Partner Network	East Asia
JABB-ASR	Azure Site Recovery...	Active	Microsoft Partner Network	Australia East
jabbsysprodbackup	Backup Vault	Active	Microsoft Partner Network	East US
Azure	Virtual Network	Created	Microsoft Partner Network	Southeast Asia
Group Group JABBSysProd	Virtual Network	Created	Microsoft Partner Network	East US
Tenant1_Vnet	Virtual Network	Created	Microsoft Partner Network	East US
4Sysops	Directory	Active	Shared by all 4Sysops su...	Asia, Europe, United...
JABB Systems	Directory	Active	Shared by all JABB Syste...	United States
Default Directory	Directory	Active	Shared by all Default Dir...	Asia, Europe, United...
expertit8587-bts	Active Directory Acc...	Active	Microsoft Partner Network	East Asia
Sysops	Automation Account	Ready	Microsoft Partner Network	East US 2
az597066	CDN Endpoint	Enabled	Microsoft Partner Network	-
JABB-DC1	Virtual machine	Stopped (D...	Microsoft Partner Network	East US

Resource groups – factors/guidelines

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- All the resources in a group should share the same lifecycle. Deploy, update, and delete them together.
- Each resource can only exist in one resource group.
- Can add or remove a resource to a resource group at any time.
- Can move a resource from one resource group to another group.
- A resource group can contain resources that reside in different regions.
- A resource group can be used to scope access control for administrative actions (RBAC).
- A resource can interact with resources in other resource groups. This interaction is common when the two resources are related but do not share the same lifecycle.

Consistent Management Layer

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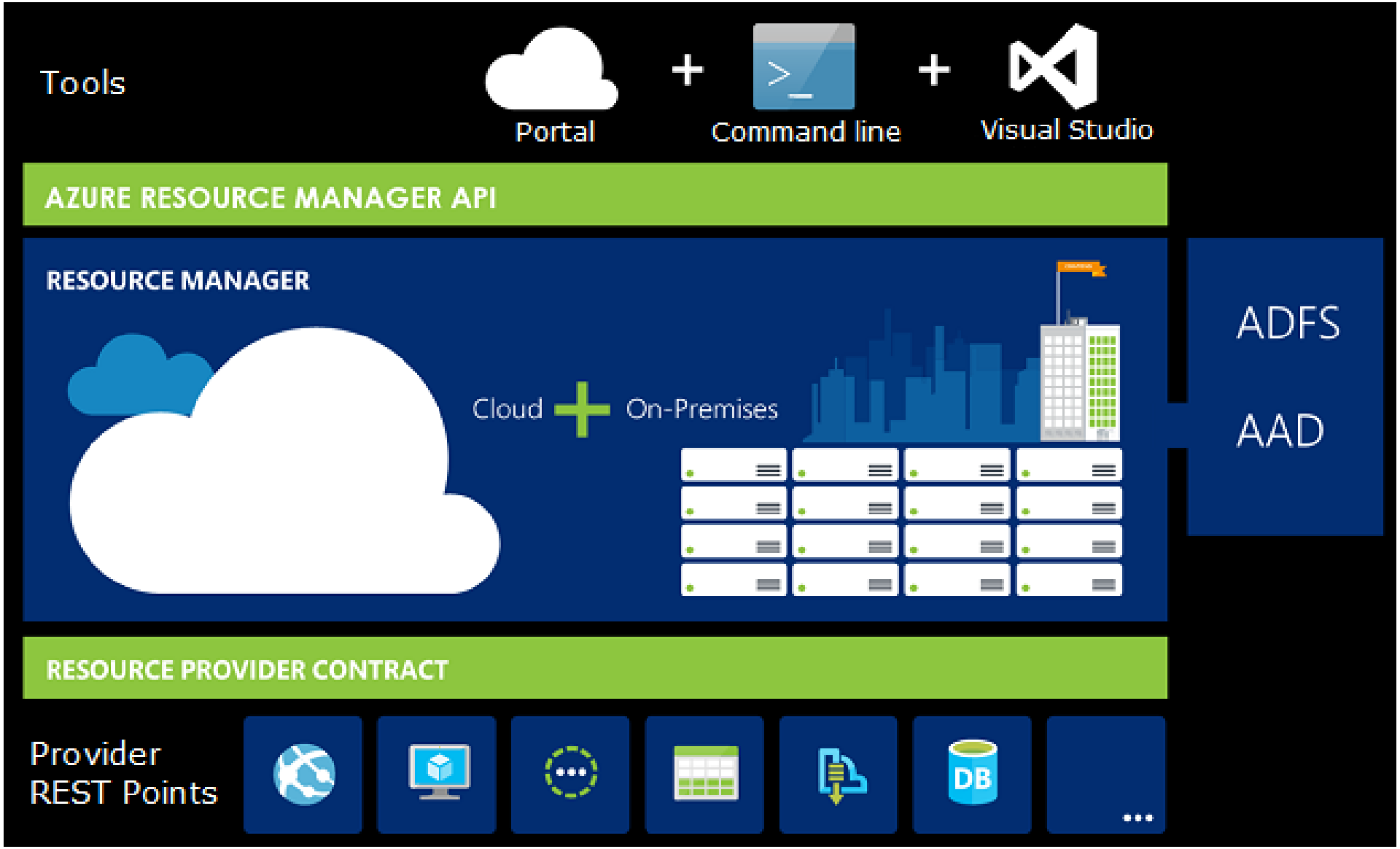
- RM provides a consistent management layer for the tasks we perform through Azure Powershell, Azure CLI, Azure portal, REST API and development tools.
  - The API passes requests to the Resource Manager service, which authenticates and authorizes the requests.
  - Resource Manager then routes the requests to the appropriate resource providers.

Consistent Management Layer



Classic VS RM deployments

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- In classic model resources are deployed independently, no groups.
- Difficult to maintain the order if dependent resources exists.
- Difficult to track related/dependent resources for a solution.
- RM deploys resources a group, manage as group and can delete as a group.
- Applies policies for a group of resources.
- Tags to logically organize the resources.
- Template support for RM
- Define dependencies and deploy in order.

Resource Manager with PowerShell

List all Providers and Resources

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Login-AzureRmAccount

Set-AzureRmContext -SubscriptionName ‘<Subscription name>’

Get-AzureRmResourceProvider –ListAvailable

(Get-AzureRmResourceProvider -ProviderNamespace Microsoft.Web).ResourceTypes

ARM Templates

ARM Templates

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- ARM template is a JSON file that defines the infrastructure and configuration of your Azure solution.
- Dependencies can be defined in ARM templates.
- When you create a solution from the portal, the solution automatically includes a deployment template.
- Resource Manager processes the template like any other request, parses the template and converts its syntax into REST API operations for the appropriate resource providers.

Template format

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

Element name	Required	Description
$schema	Yes	Location of the JSON schema file that describes the version of the template language.
contentVersion	Yes	Version of the template (such as 1.0.0.0). You can provide any value for this element. When deploying resources using the template, this value can be used to make sure that the right template is being used.
parameters	No	Values that are provided when deployment is executed to customize resource deployment.
variables	No	Values that are used as JSON fragments in the template to simplify template language expressions.
resources	Yes	Resource types that are deployed or updated in a resource group.
outputs	No	Values that are returned after deployment.

Expressions and functions in template

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- With expressions, you create values that are not strict literal values.
- Expressions are enclosed with brackets [and].
- Evaluated when the template is deployed.
- Expressions can appear anywhere in a JSON string value and always return another JSON value.
- To use a literal string that starts with a bracket [, you must use two brackets [[.
- Use expressions with functions to perform operations for configuring the deployment.
- Function calls are formatted as functionName(arg1,arg2,arg3).

Expressions and functions in template

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```
"variables": {
   "location": "[resourceGroup().location]",
   "usernameAndPassword": "[concat(parameters('username'), ':', parameters('password'))]",
   "authorizationHeader": "[concat('Basic ', base64(variables('usernameAndPassword')))]"
}
```

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

Parameters in Template

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- Specify which values you can input when deploying the resources.
- Parameter values enable you to customize the deployment by providing values that are tailored for a particular environment.
- Only parameters that are declared in the parameters section can be used in other sections of the template.

```
"parameters": {
   "<parameter-name>" : {
     "type" : "<type-of-parameter-value>",
     "defaultValue": "<default-value-of-parameter>",
     "allowedValues": [ "<array-of-allowed-values>" ],
     "minValue": <minimum-value-for-int>,
     "maxValue": <maximum-value-for-int>,
     "minLength": <minimum-length-for-string-or-array>,
     "maxLength": <maximum-length-for-string-or-array-parameters>,
     "metadata": {
         "description": "<description-of-the parameter>"
     }
   }
}
```

Variables in Templates

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- Construct values that can be used throughout the template.
- Typically, variables are based on values provided from the parameters.
- Not mandatory in templates.
- Simplify the template by reducing the complexity of expressions.

```
"variables": {
    "<variable-name>": "<variable-value>",
    "<variable-name>": {
        <variable-complex-type-value>
    }
}
```

Resources in Templates

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- Define the resources that are deployed or updated.

```
"resources": [
   {
     "apiVersion": "<api-version-of-resource>",
     "type": "<resource-provider-namespace/resource-type-name>",
     "name": "<name-of-the-resource>",
     "location": "<location-of-resource>",
     "tags": "<name-value-pairs-for-resource-tagging>",
     "comments": "<your-reference-notes>",
     "dependsOn": [
       "<array-of-related-resource-names>"
     ],
     "properties": "<settings-for-the-resource>",
     "copy": {
       "name": "<name-of-copy-loop>",
       "count": "<number-of-iterations>"
     }
     "resources": [
       "<array-of-child-resources>"
     ]
   }
]
```

Template file execution

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Input Template file

```
"resources": [
  {
        "apiVersion": "2016-01-01",
        "type": "Microsoft.Storage/storageAccounts",
        "name": "mystorageaccount",
        "location": "westus",
        "sku": {
                "name": "Standard_LRS"
         },
         "kind": "Storage",
         "properties": { }
   }
]
```

Output API

```
PUT
https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupN
ame}/providers/Microsoft.Storage/storageAccounts/mystorageaccount?api-version=2016-01-01
REQUEST BODY
{
  "location": "westus",
  "properties": {
   },
   "sku": {
        "name": "Standard_LRS"
    },
   "kind": "Storage"
}
```

DEMO

Azure RM Templates

Templates using Visual Studio

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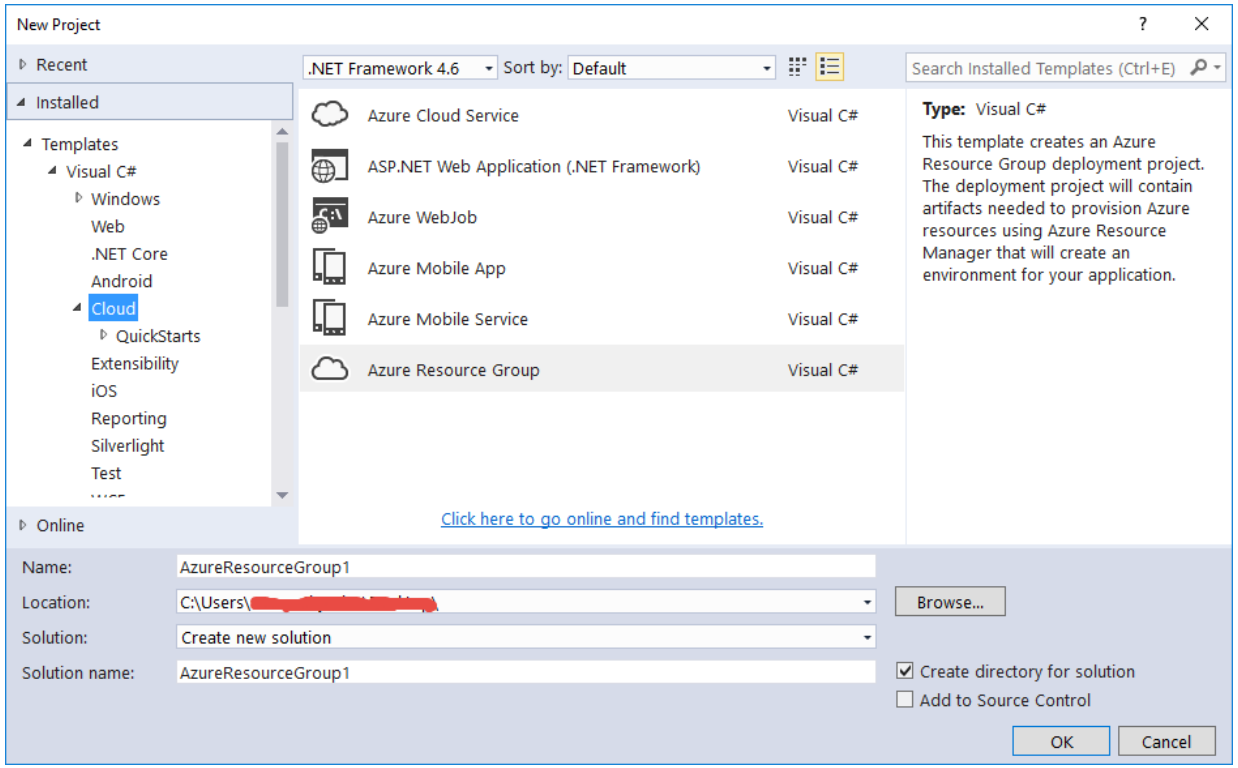
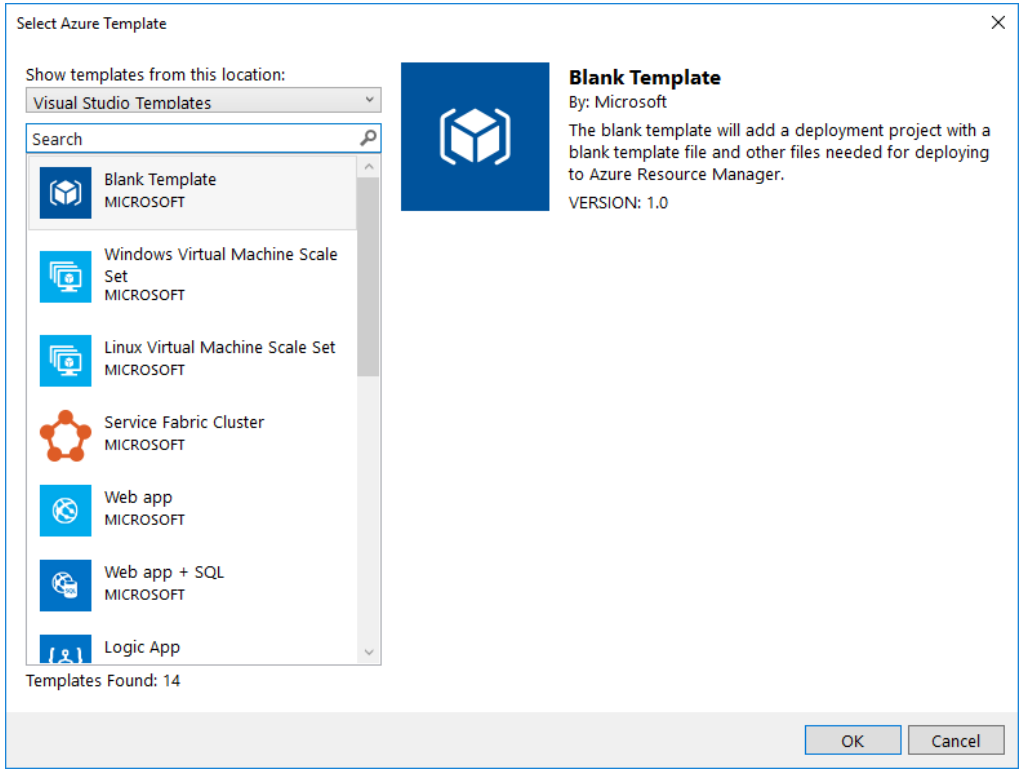
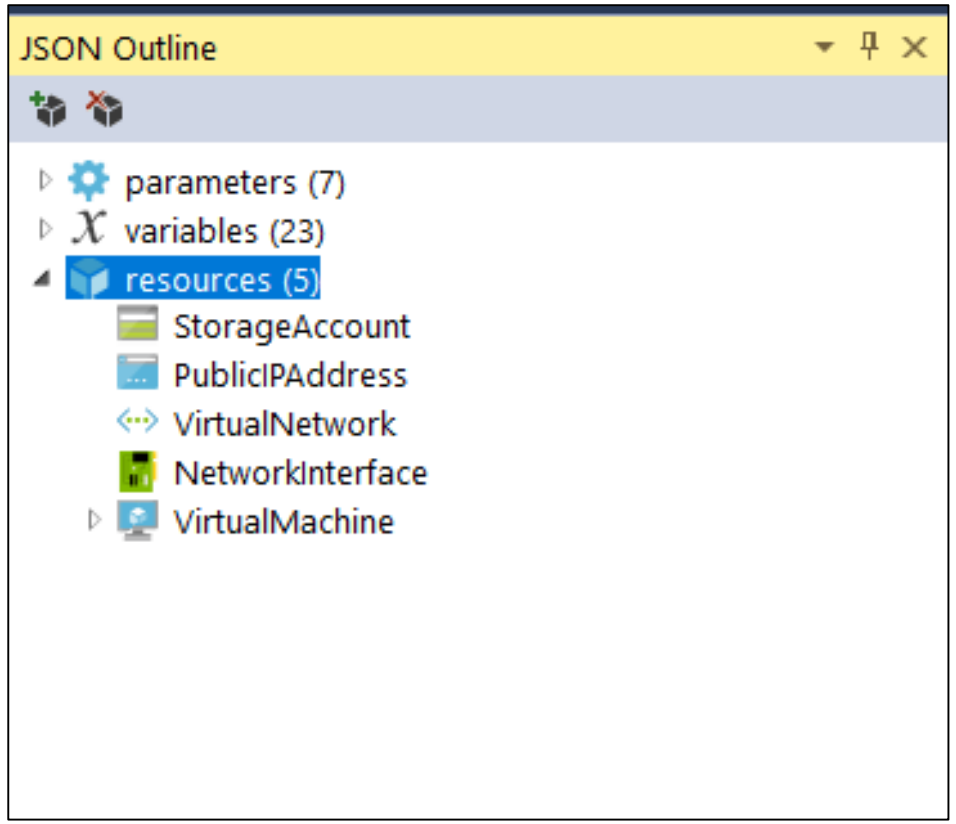
- Microsoft Azure Tools 2.6 or later
- Visual Studio 2015 or later
- File > New Project >Cloud >Resource Group





Templates using Visual Studio

- JSON Outline window shows the parameters, variables and resources



Adding resources to template using VS

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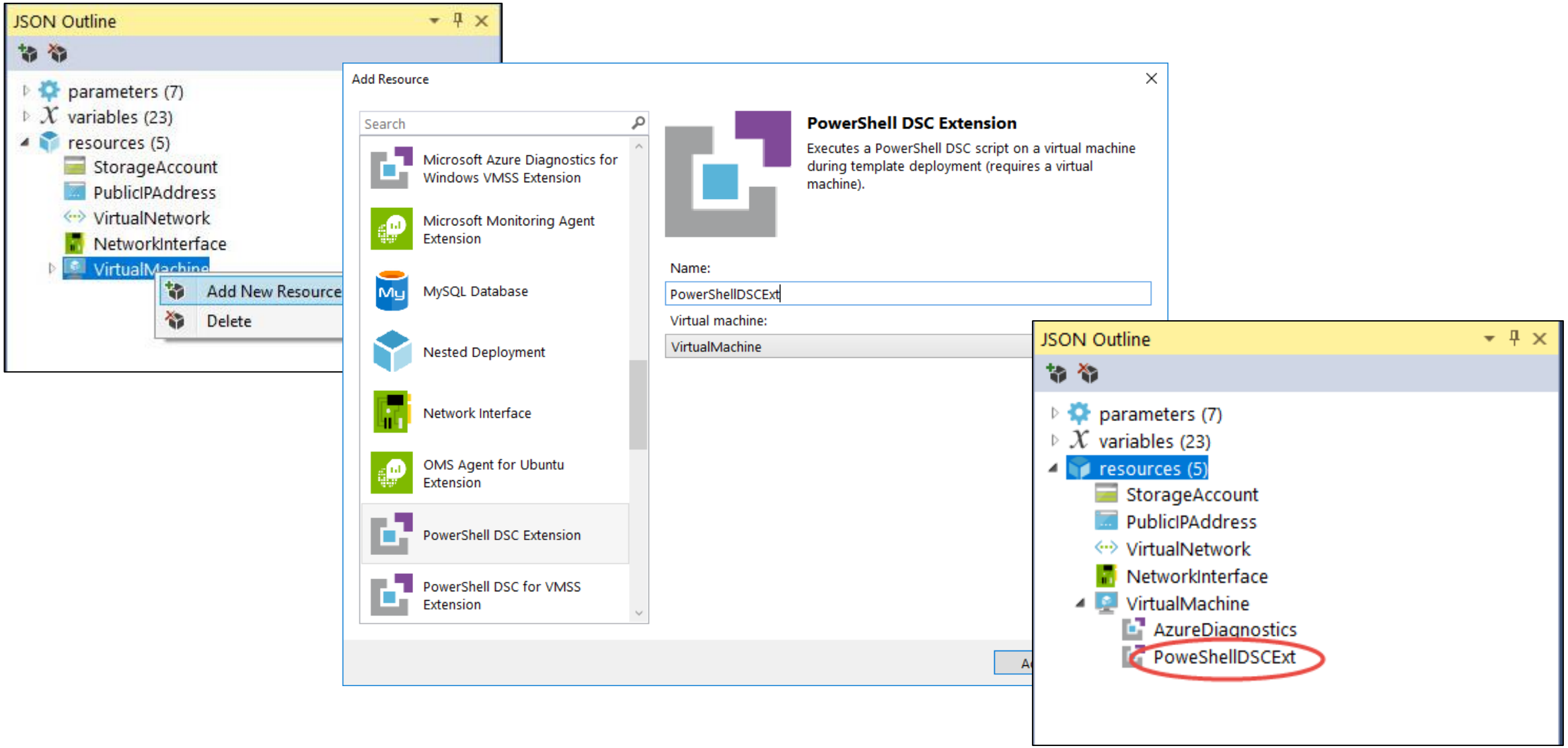
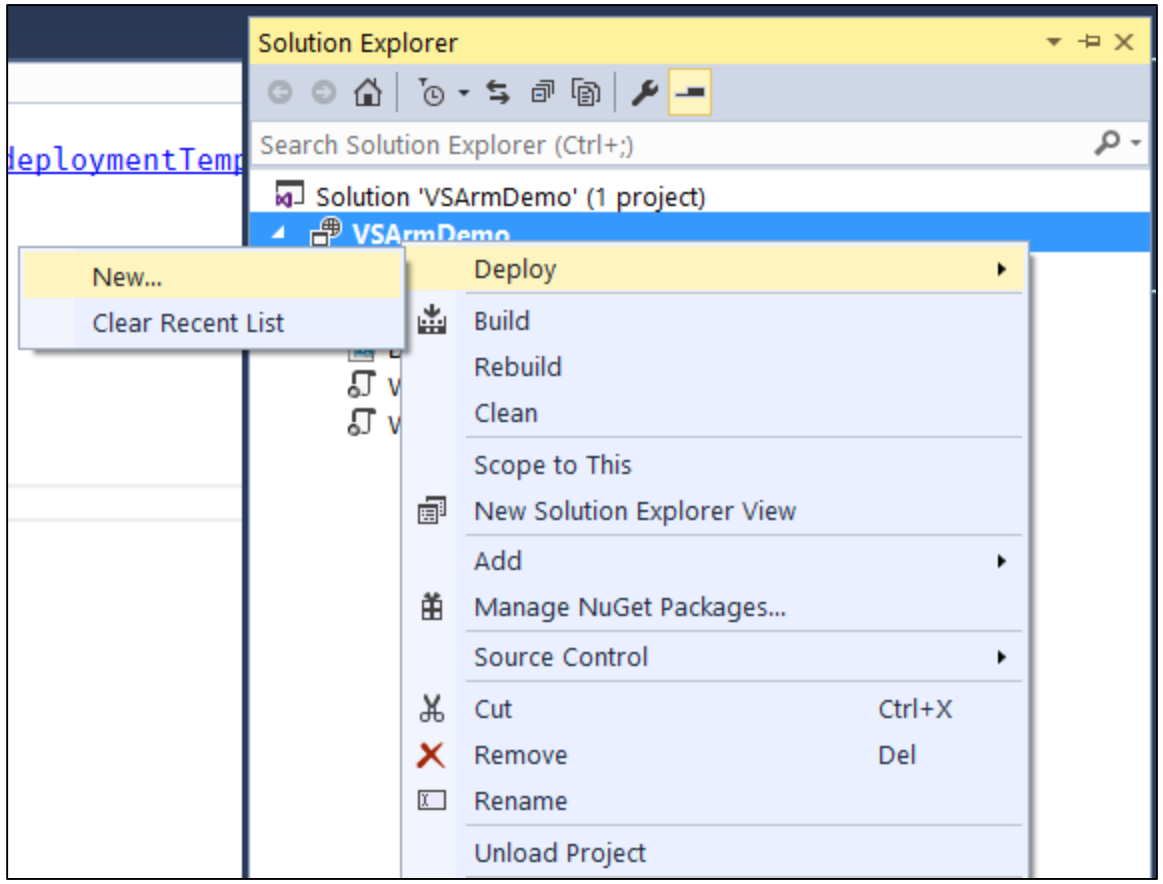
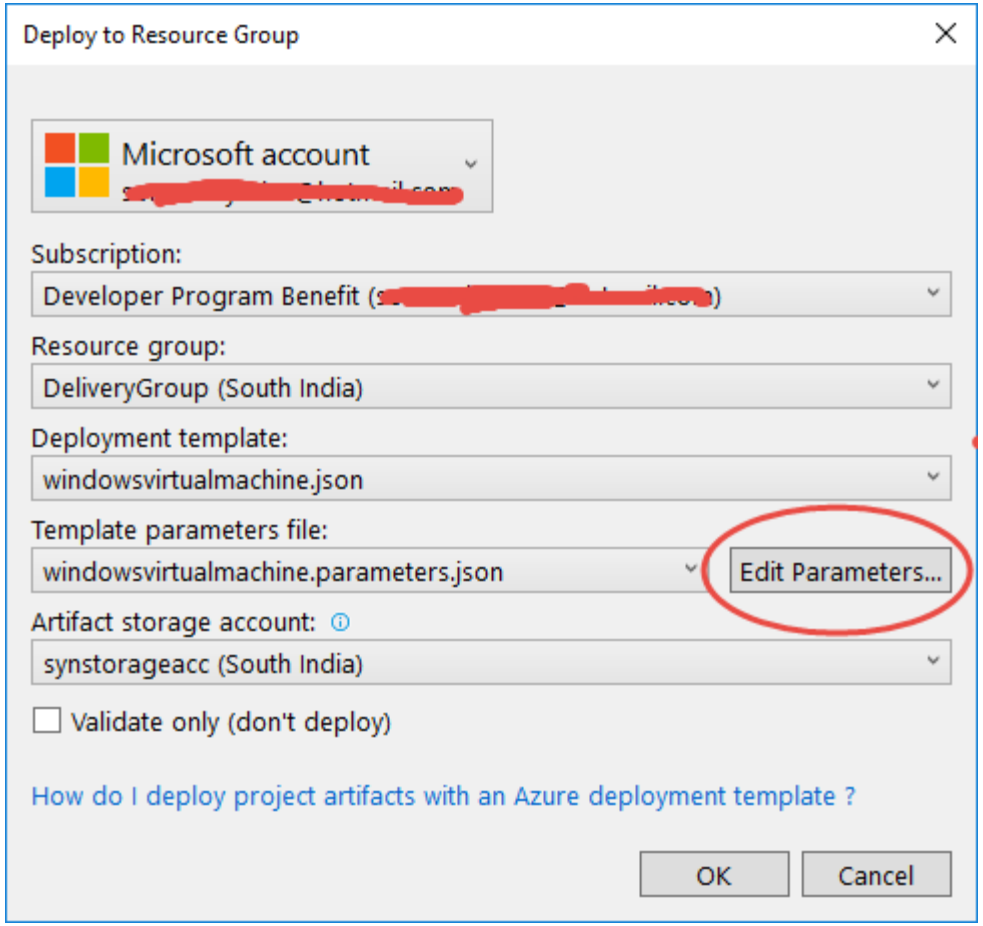


Deploying using Visual Studio





Deploying using Portal

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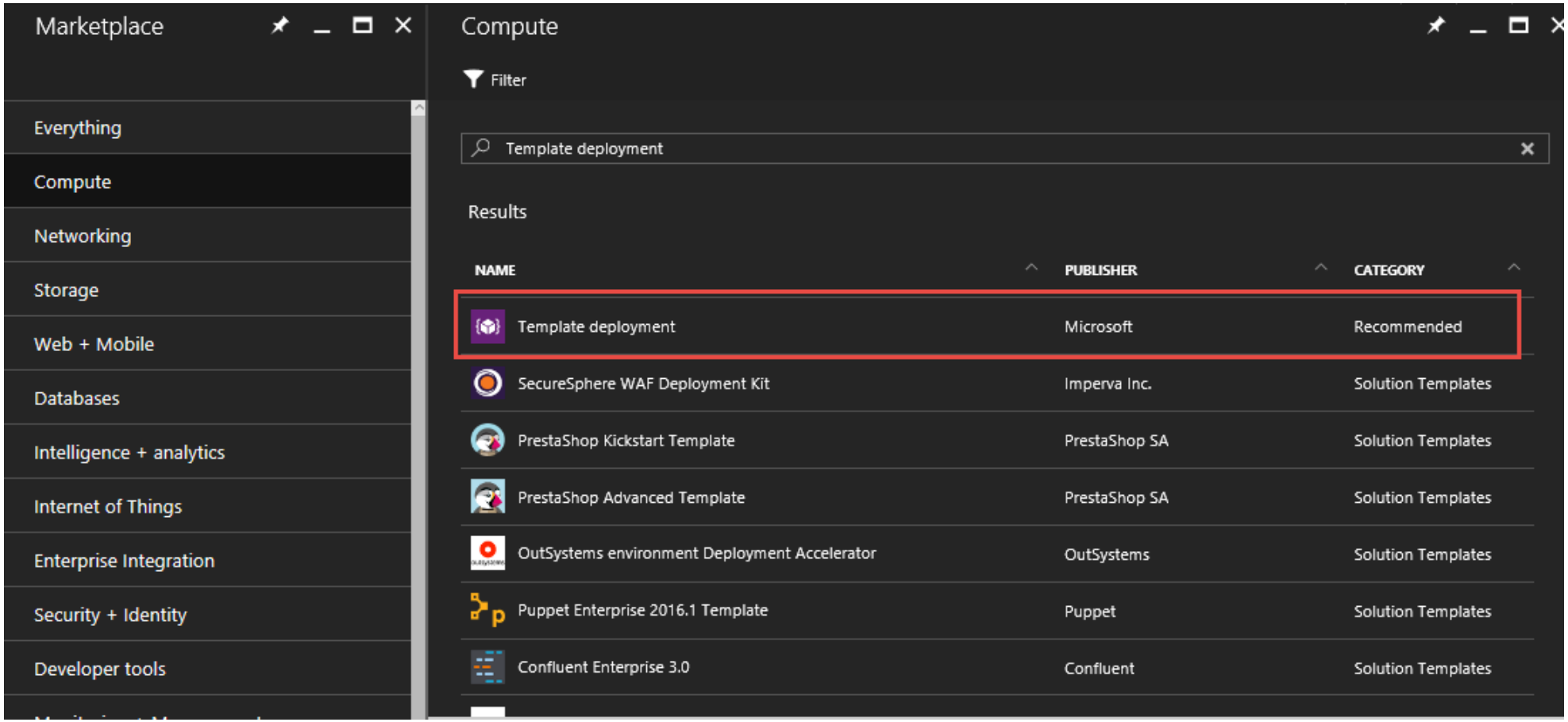
- Navigate to https:\\portal.azure.com and login to Azure account.
- Click on the +(New) to add a **Template deployment.**



Deploying using Portal

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Custom deployment

Deploy from a custom template

TEMPLATE

Template has no resources. Edit the template

Edit template

Edit your Azure Resource Manager template

Add resource | Quickstart tem... | Download

Copy and paste the template in the window, Click Save

- Parameters (7)
- Variables (23)
- Resources (5)
  - StorageAccount (Microsoft.Storag...
  - PublicIPAddress (Microsoft.Netwo...
  - VirtualNetwork (Microsoft.Networ...
  - NetworkInterface (Microsoft.Netw...
  - VirtualMachine (Microsoft.Comput...

```
1  {
2    "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
3    "contentVersion": "1.0.0.0",
4    "parameters": {
5      "adminUsername": {
6        "type": "string",
7        "minLength": 1,
8        "metadata": {
9          "description": "Username for the Virtual Machine."
10       }
11     },
12     "adminPassword": {
13       "type": "securestring",
14       "metadata": {
15         "description": "Password for the Virtual Machine."
16       }
17     },
18     "dnsNameForPublicIP": {
19       "type": "string",
20       "minLength": 1,
21       "metadata": {
22         "description": "Globally unique DNS Name for the Public IP used to access the Virtual Machine."
23       }
24     },
25     "windowsOSVersion": {
```

Save | Discard

Deploying using Portal

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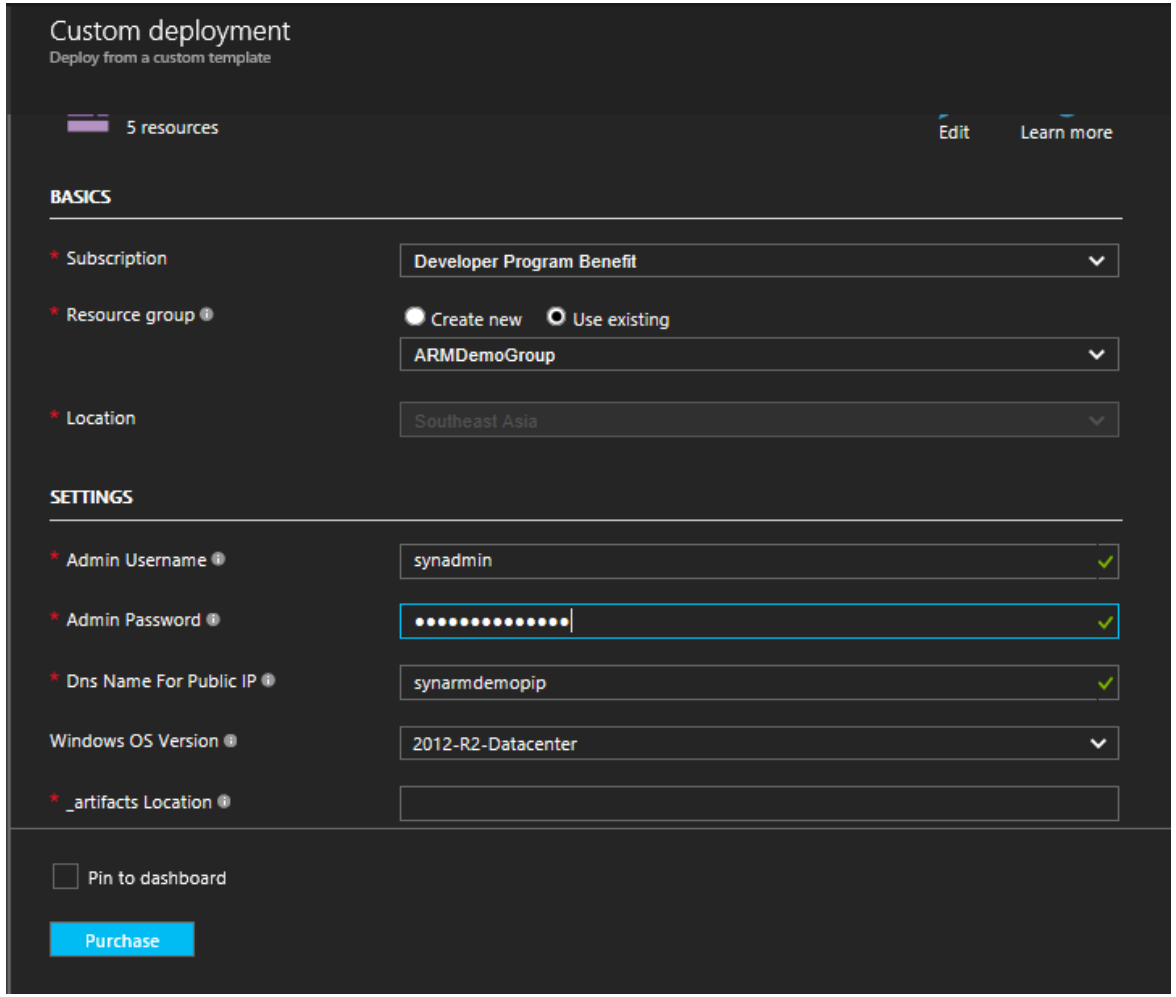
- Specify the subscription, resource group name and parameter values.



Deploying using PowerShell

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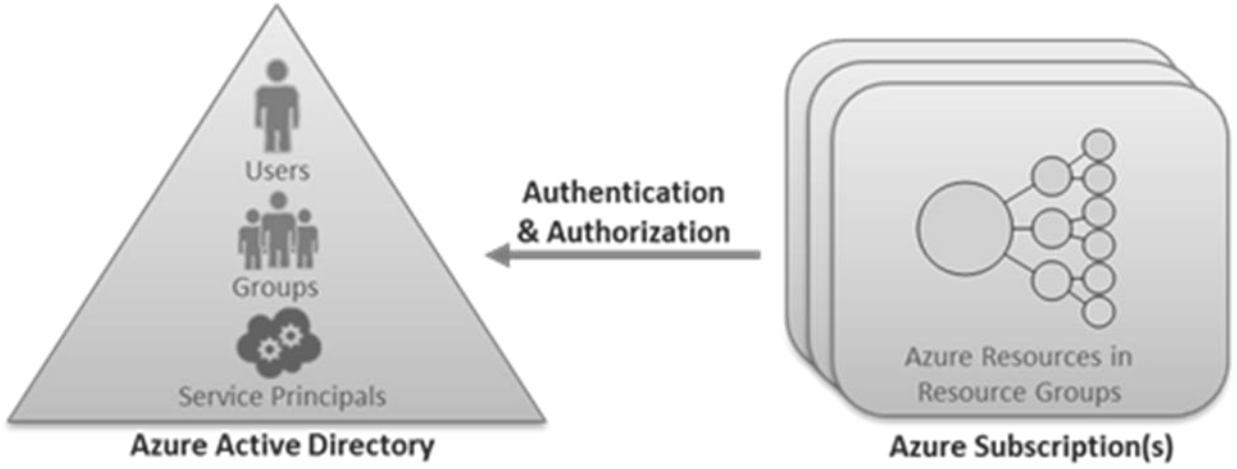
```
Login-AzureRmAccount

Set-AzureRmContext -SubscriptionName ‘<subscription name>'

New-AzureRmResourceGroup -Name ‘MyResourceGroup' `
                         -Location 'SouthEast Asia'

New-AzureRmResourceGroupDeployment -Name 'ARMDeploymentDemo' `
        -ResourceGroupName ‘MyResourceGroup' `
        -TemplateFile 'WindowsVirtualMachine.json' `
        -TemplateParameterFile 'WindowsVirtualMachine.parameters.json' `
        -Force -Verbose
```

Role Based Access Control (RBAC)

Role Based Access Control (RBAC)

- RBAC is a way to manage the access to different resources in Azure.
- Provide user or group of users access to different parts of azure subscription.
- Azure Active Directory.



Role Based Access Control

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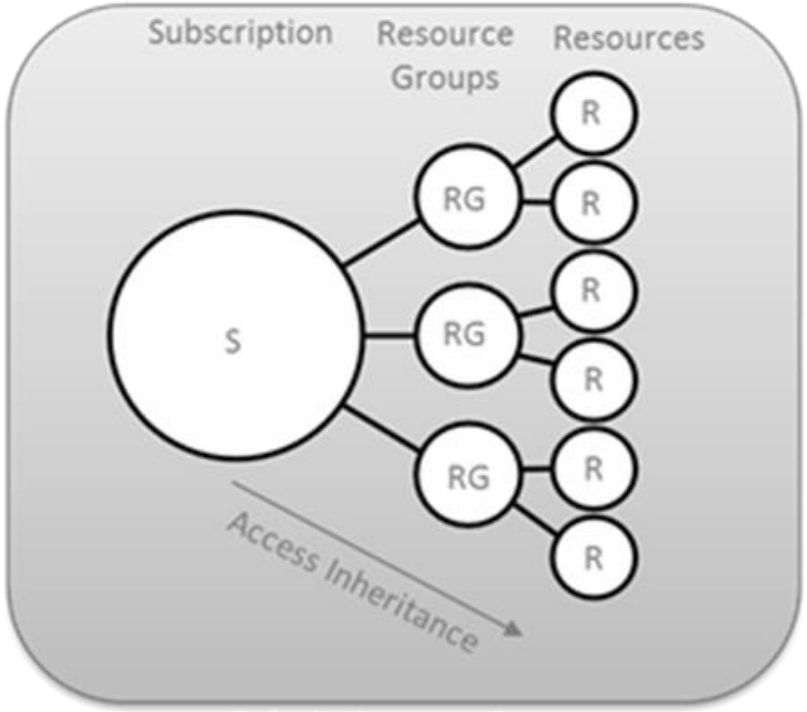
- Role
  - A collection of actions that can be performed on a resource.
  - Built-in Roles
- Role Assignment
  - Users
  - Groups
  - Service Principals

Role Based Access Control

- Resource Scope
  - Access to a single resource
  - Access to a resource group
  - Inherited access policies



Role Assignment Scopes

RBAC vs Co-Administrators

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- Co-administrators and RBAC?
  - Full access
  - Subscription level
  - Owners of the subscription
  - RBAC does not provide access to old portal and APIs.
  - RBAC roles are not co-administrators

RBAC Users and Groups

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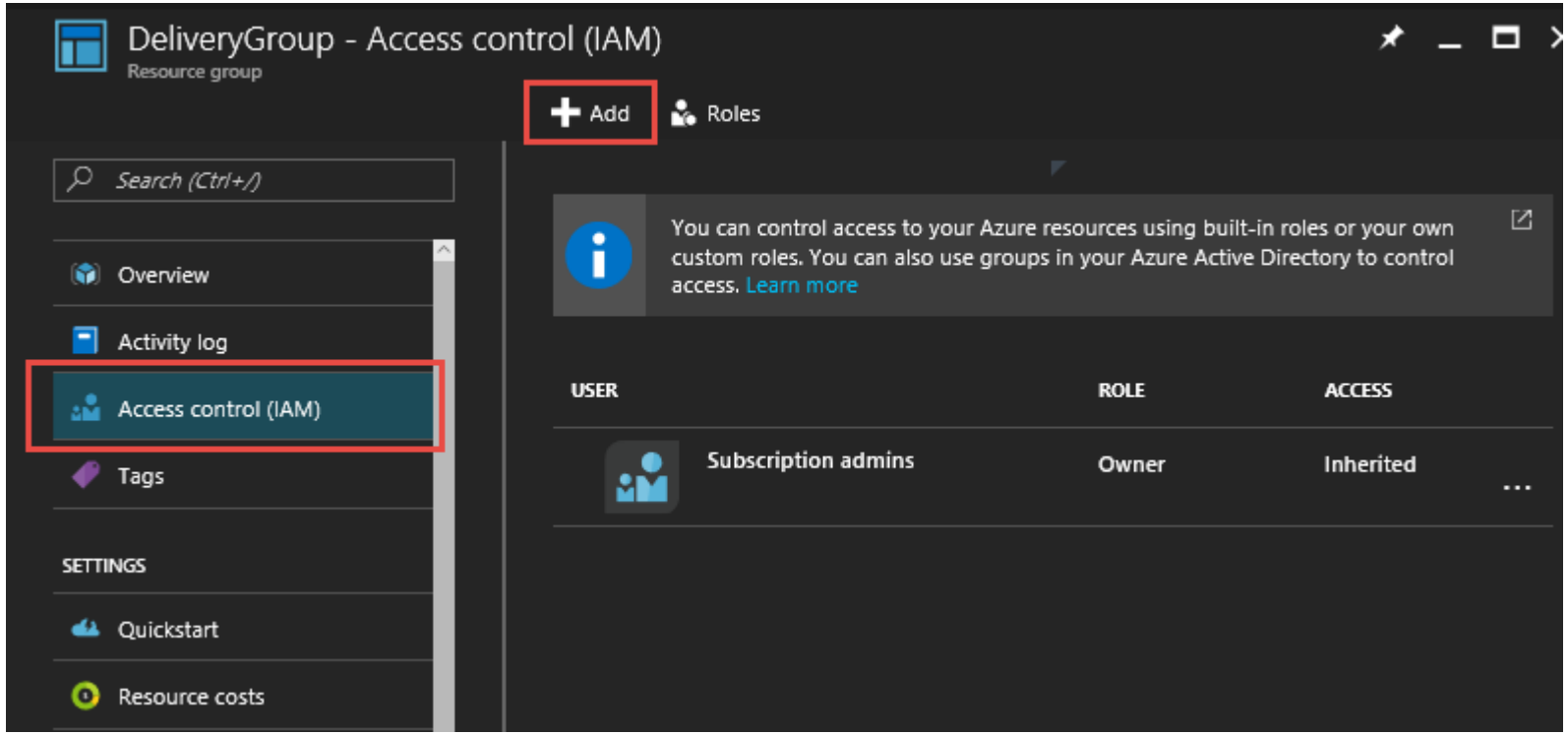
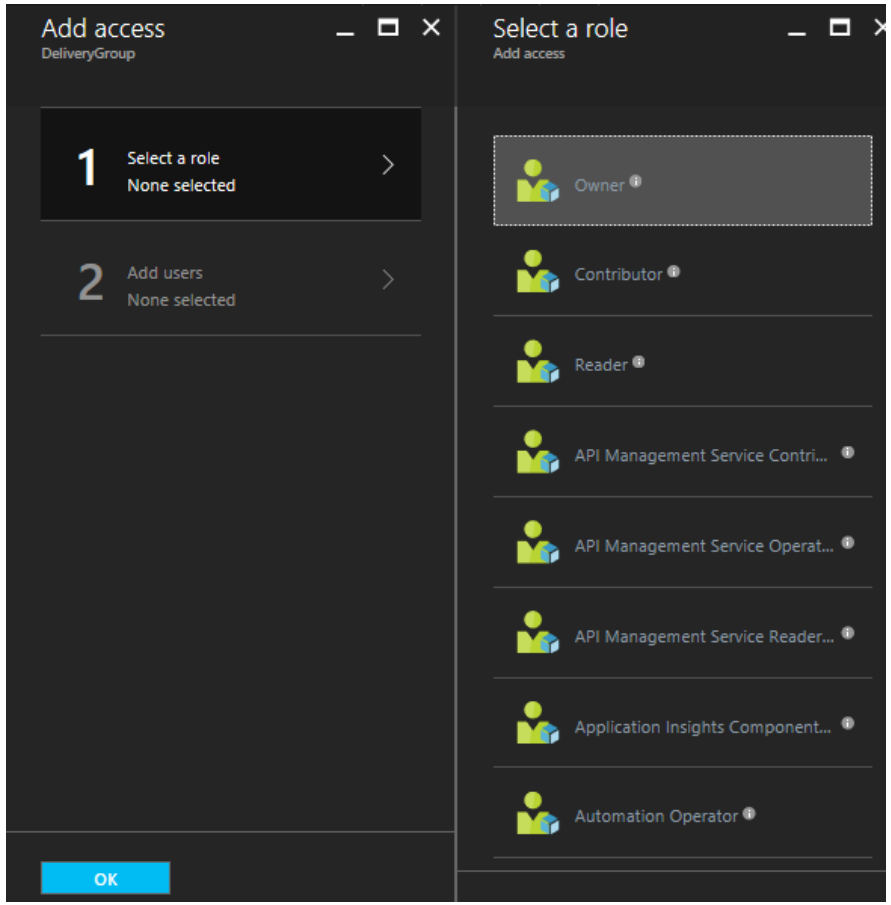
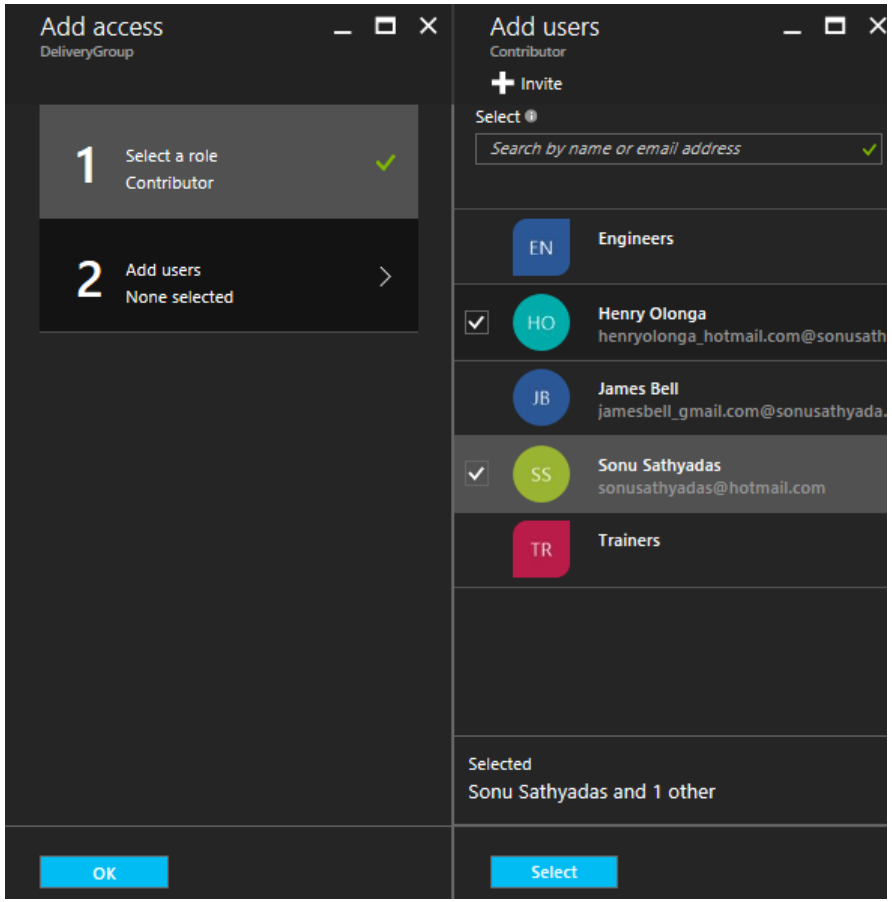
- Add roles to users and groups on a resource group.
- Open portal and select the resource group.
- Select Access Control(IAM) from the settings blade.
- Click on '+Add' from command bar to add user or roles.



RBAC Users and Groups

- Choose the role and Users/Groups.
- User can be an external user also.





RBAC- Add external users to subscription

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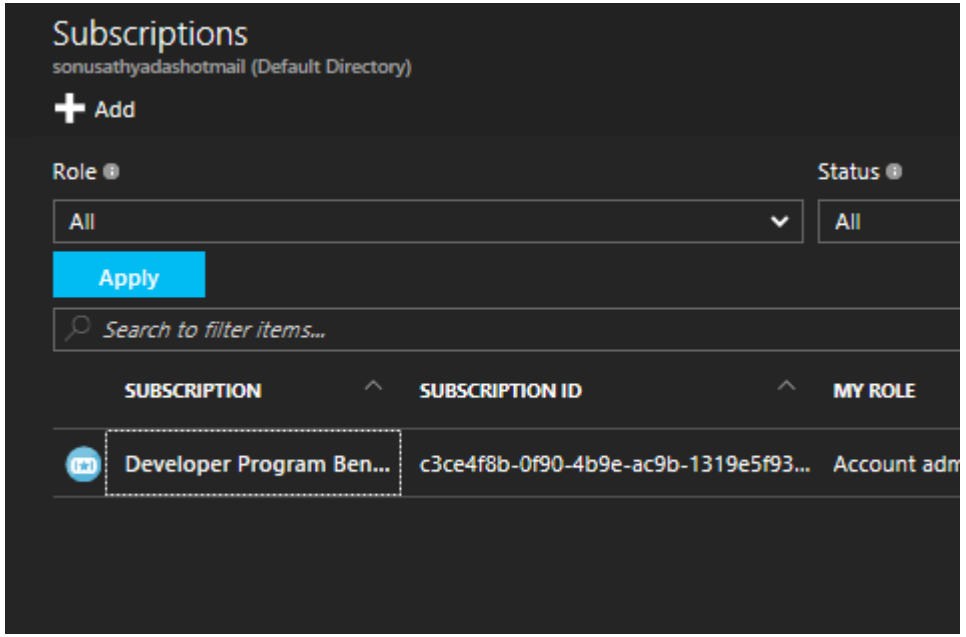
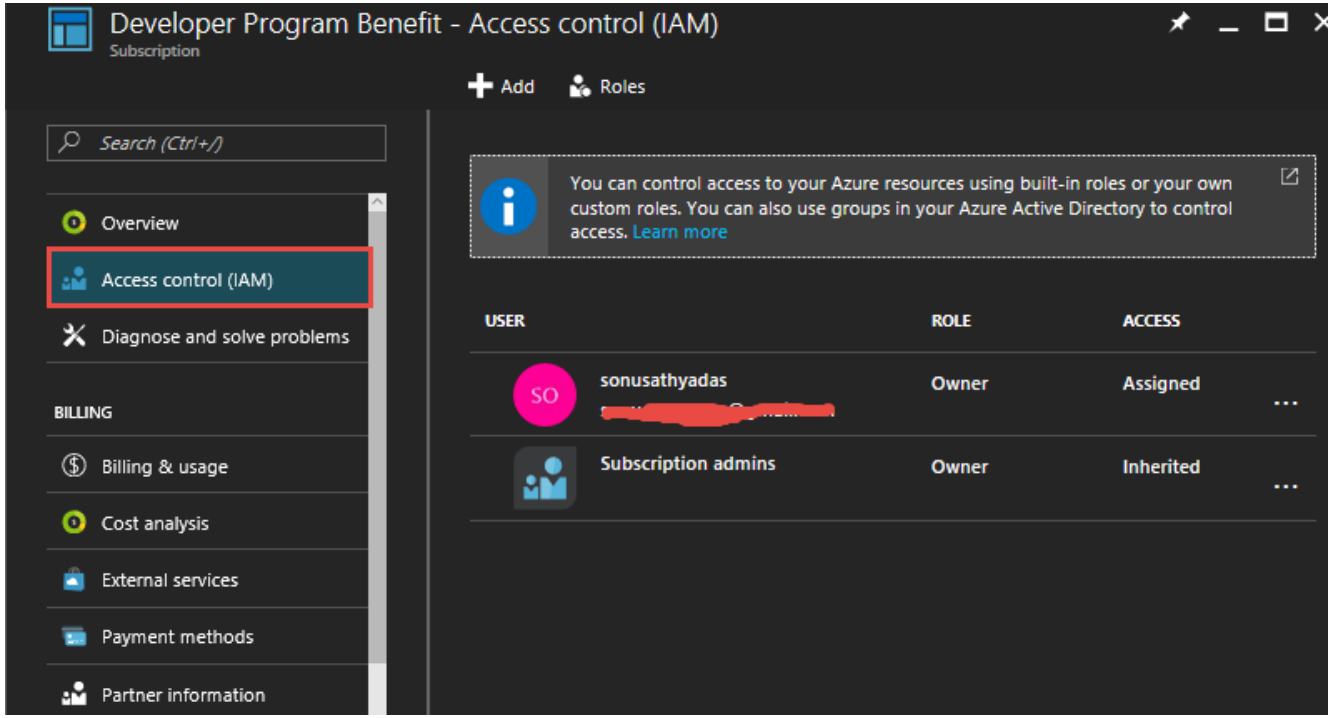
- Open Azure Portal and Navigate to subscriptions.
- Choose your subscription.





RBAC- Add external users to subscription

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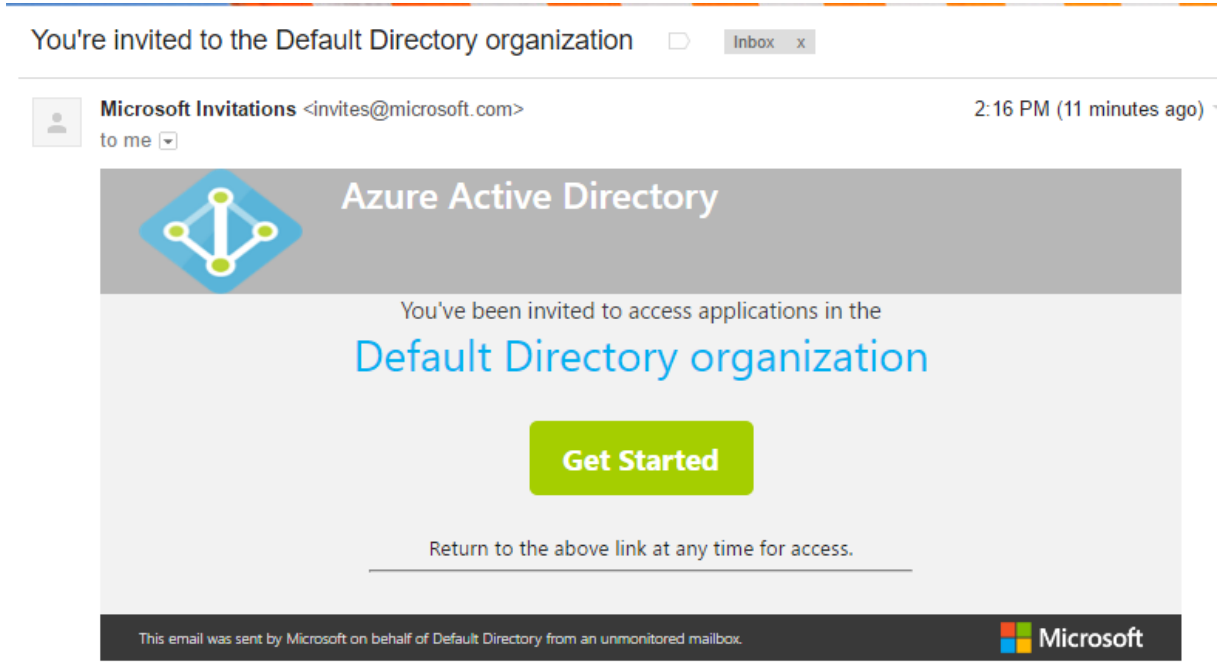
- Click on Add and choose role and username(email id).
- An email will be sent to the user.
- Click on it to add a Microsoft account.
- Verify the account after creating it.
- Login to Azure and start using it.



DEMO: RBAC using Powershell

Organize resources using Tags

Tags

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- Logically organize resources.
- Key/value pairs that identify resources.
- Same tag for resources that belongs to same category.
- Not limited to only resources in the same resource group, across multiple resource groups.
- Organize resources for billing or management.
- Each resource or resource group can have a maximum of 15 tags.
- Tag name is limited to 512 characters, and the tag value is limited to 256 characters.

Tag a resource using template

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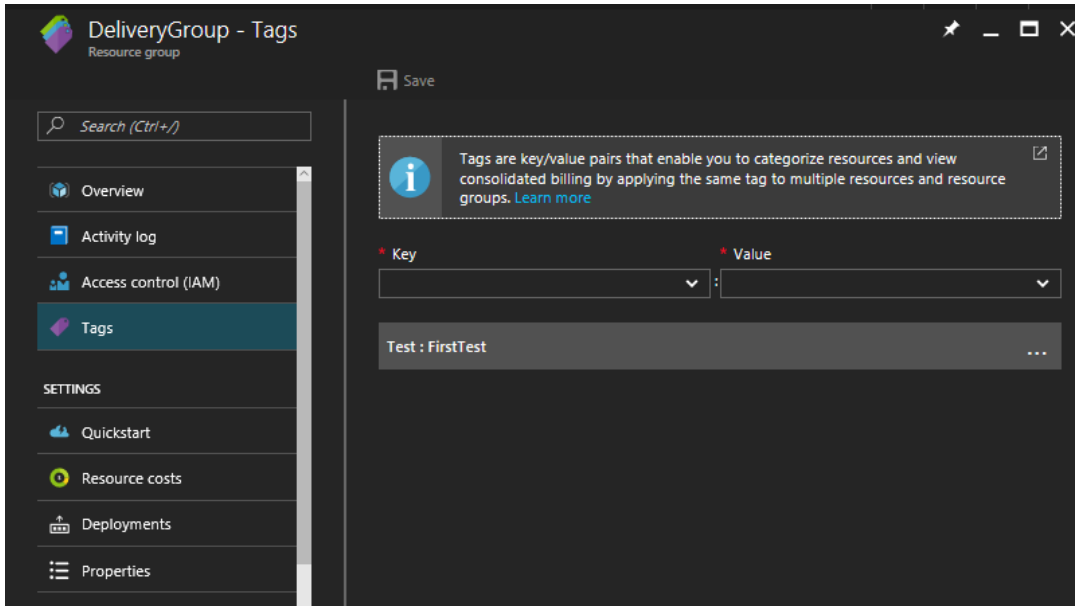
- Add the **tags** element to the resource

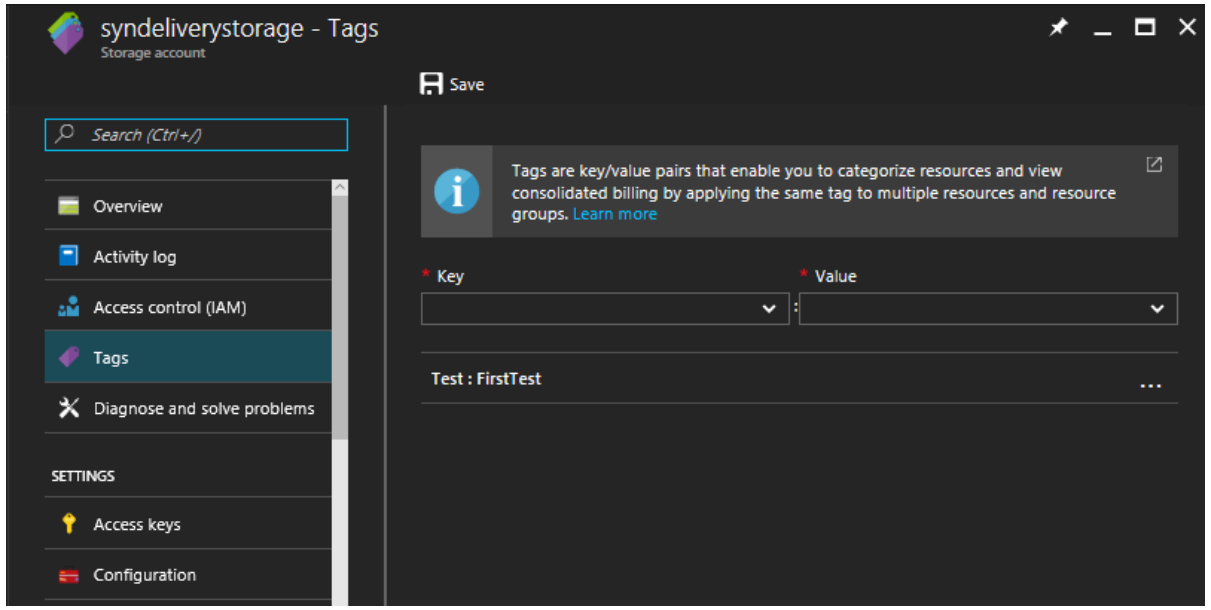
```
"resources": [
    {
        "type": "Microsoft.Storage/storageAccounts",
        "apiVersion": "2015-06-15",
        "name": "[concat('storage', uniqueString(resourceGroup().id))]",
        "location": "[resourceGroup().location]",
        "tags": {
            "dept": "Finance"
        },
        "properties":
        {
            "accountType": "Standard_LRS"
        }
    }
]
```

Tag a resource using Portal

- Select the resource group and Click on the Tags option.
- Enter key and value for the tag.



For a Resource Group



For a storage account

Tags using Portal

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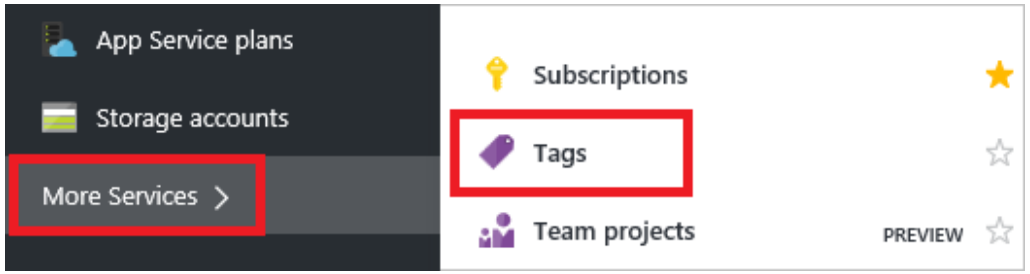
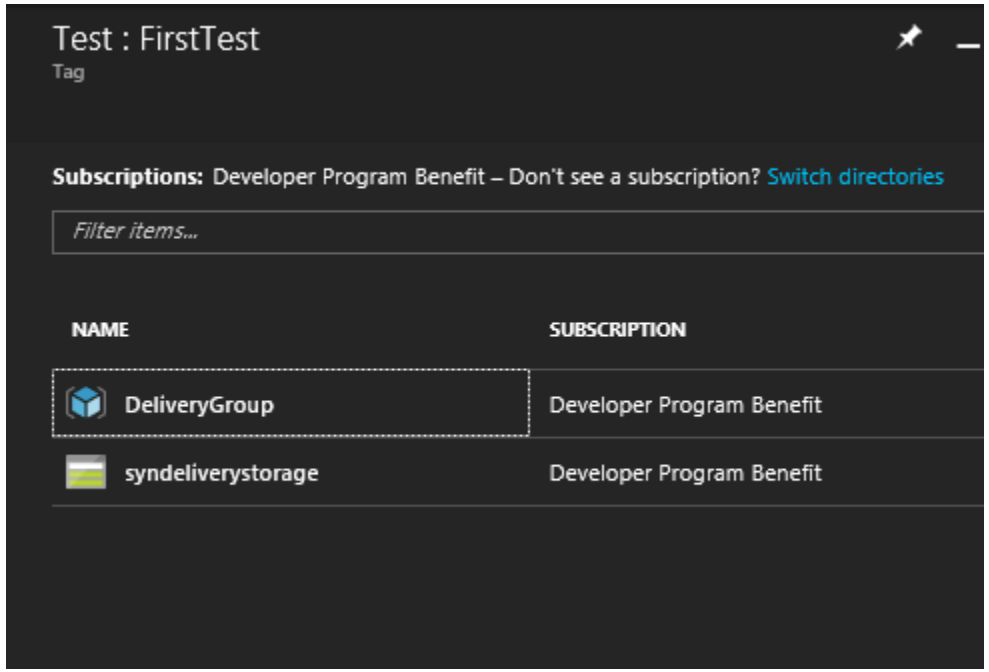
- To view your taxonomy of tags in the portal, select **More Services** and **Tags**.
- Select any of the tags to display the resources and resource groups with that tag





Tags using PowerShell

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```
Get-Module -ListAvailable -Name AzureRm.Resources | Select Version

# Old : For powershell version <3.0.0
New-AzureRmResourceGroup -Tags @{ Name = "testtag"; Value = "testval" } `
                    -Name DeliveryGroup `
                    -Location 'SouthEast Asia'

# New : For powershell version >3.0.0
New-AzureRmResourceGroup -Tag @{ testtag = "testval" } `
                    -Name DeliveryGroup `
                    -Location 'SouthEast Asia'
```

Lock resources

Lock resources

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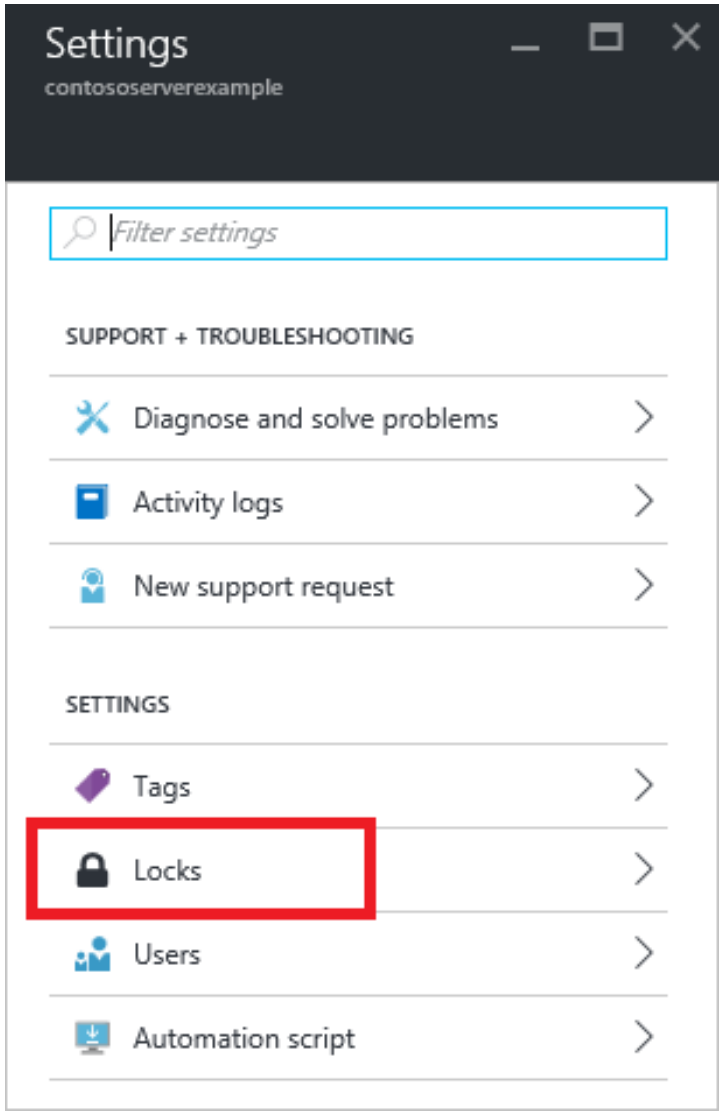
- Lock a subscription, resource group, or resource to prevent other users from accidentally deleting or modifying critical resources.
- Set the lock level to **CanNotDelete** or **ReadOnly**.
  - **CanNotDelete** :authorized users can still read and modify a resource, but they can't delete the resource.
  - **ReadOnly** :authorized users can read a resource, but they can't delete or update the resource.

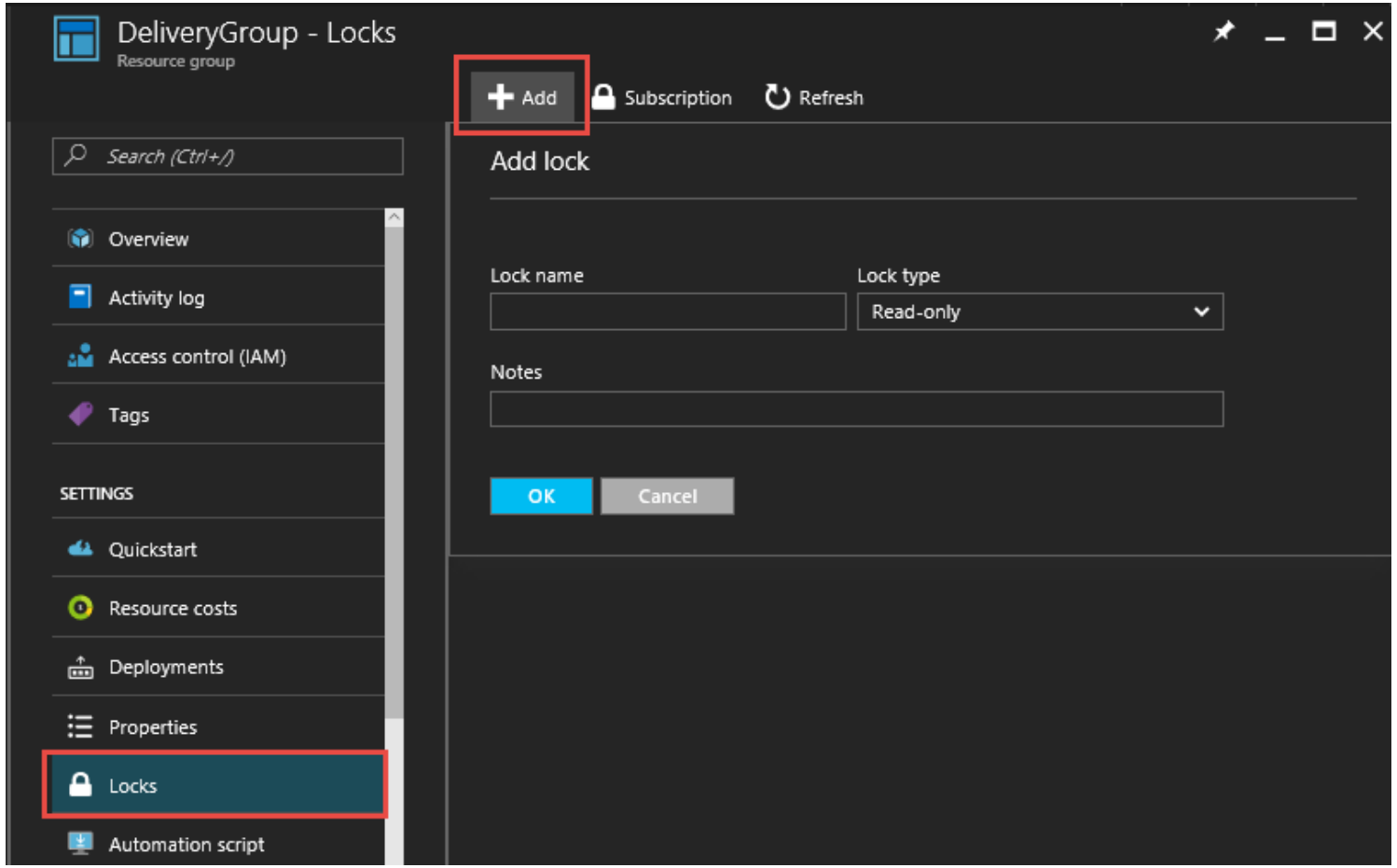
Applying locks using Portal

- In the Settings blade for the resource, resource group, or subscription that you wish to lock, select **Locks**.



Applying locks using Portal

- Click on the Add, specify the name and lock type.



Applying/Removing locks using PowerShell

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```
New-AzureRmResourceLock -LockLevel CanNotDelete `
                -LockName LockStorage `
                -ResourceName mystoragename `
                -ResourceType Microsoft.Storage/storageAccounts `
                -ResourceGroupName TestRG1

Remove-AzureRmResourceLock -LockName LockStorage `
                -ResourceName mystoragename `
                -ResourceType Microsoft.Storage/storageAccounts `
                -ResourceGroupName TestRG1
```

Export templates

Export templates

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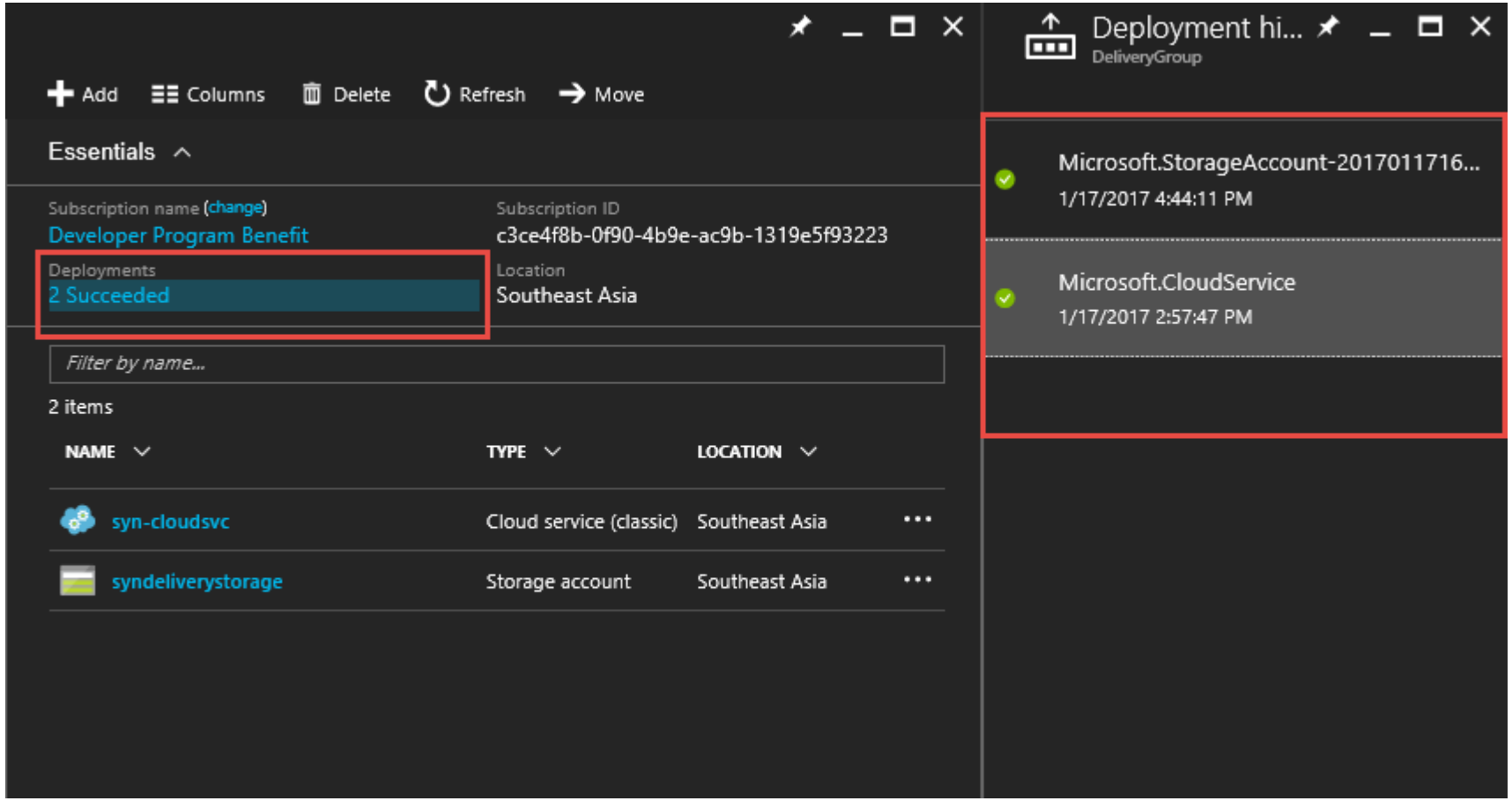
- RM enables you to export a RM template from existing resources.
- Exported template can be used for redeployment.
- Two types of templates can be exported
  - You can export the actual template that you used for a deployment.
  - You can export a template that represents the current state of the resource group.

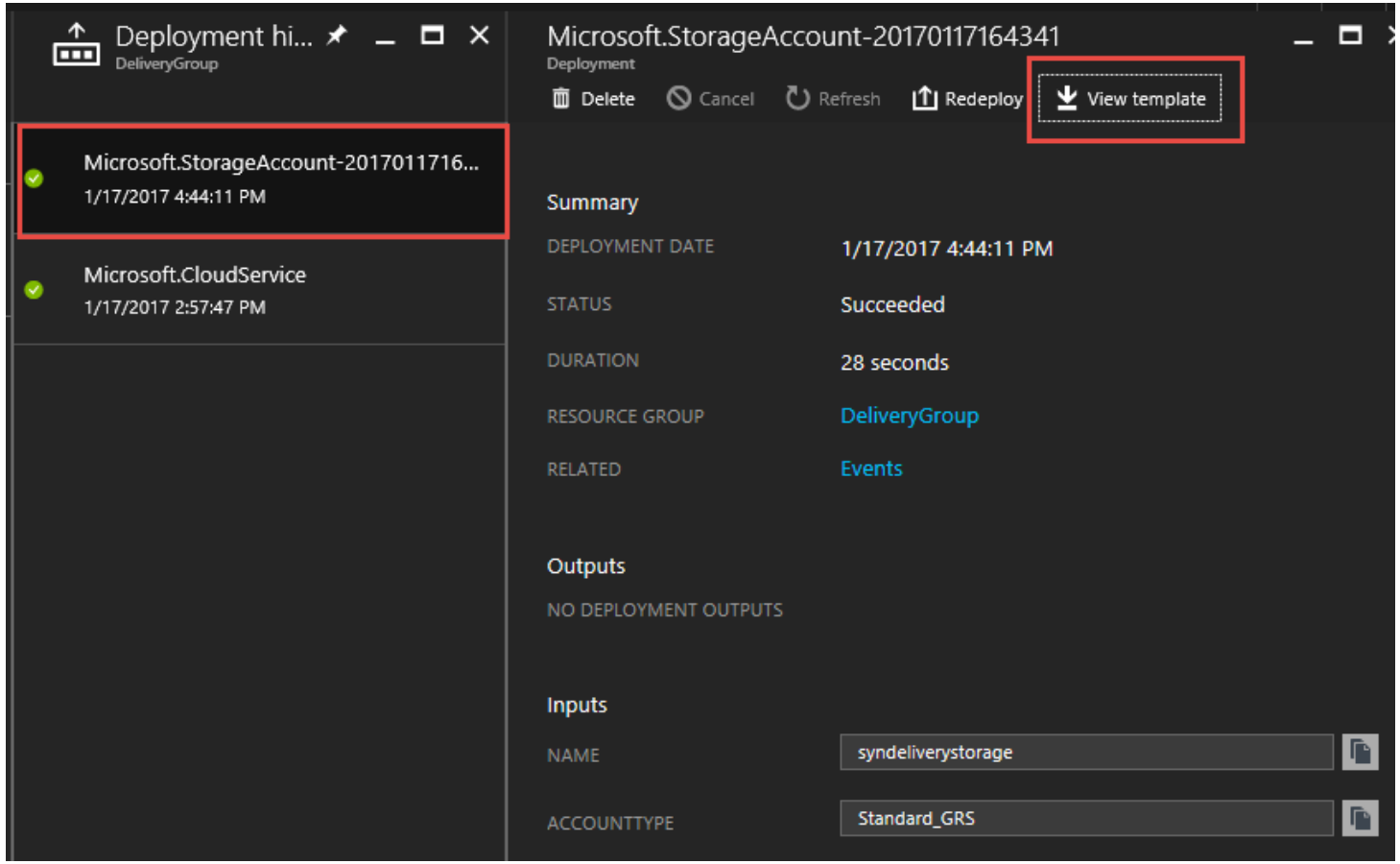
Export template using Portal

- Navigate to the resource group and click on the Deployments .
- It shows the deployment history.



Export template using Portal

- Select any of the deployment from the history, click on the view template.



Export template using Portal

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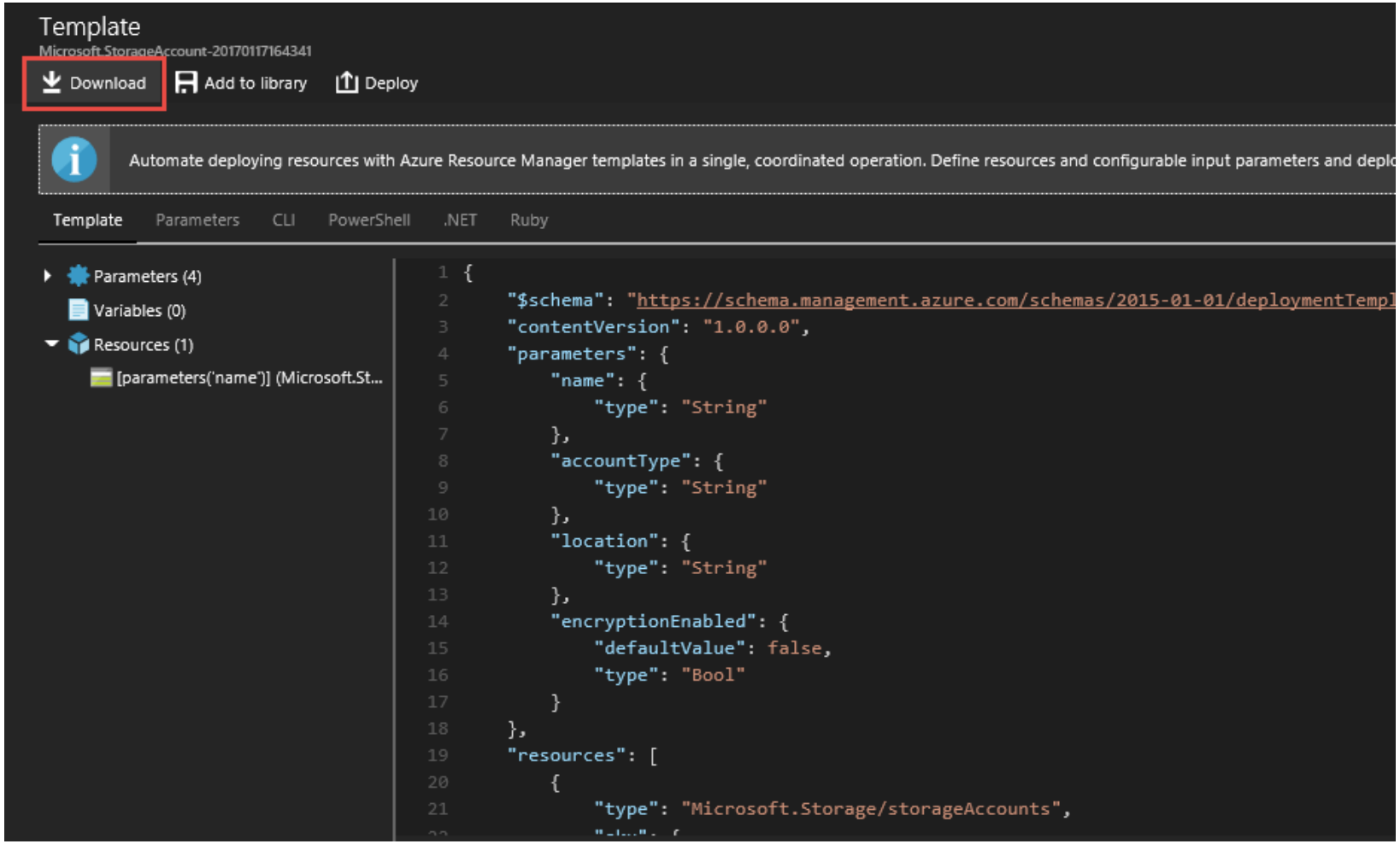
- Click the download button to download the template.



Export template for resource group

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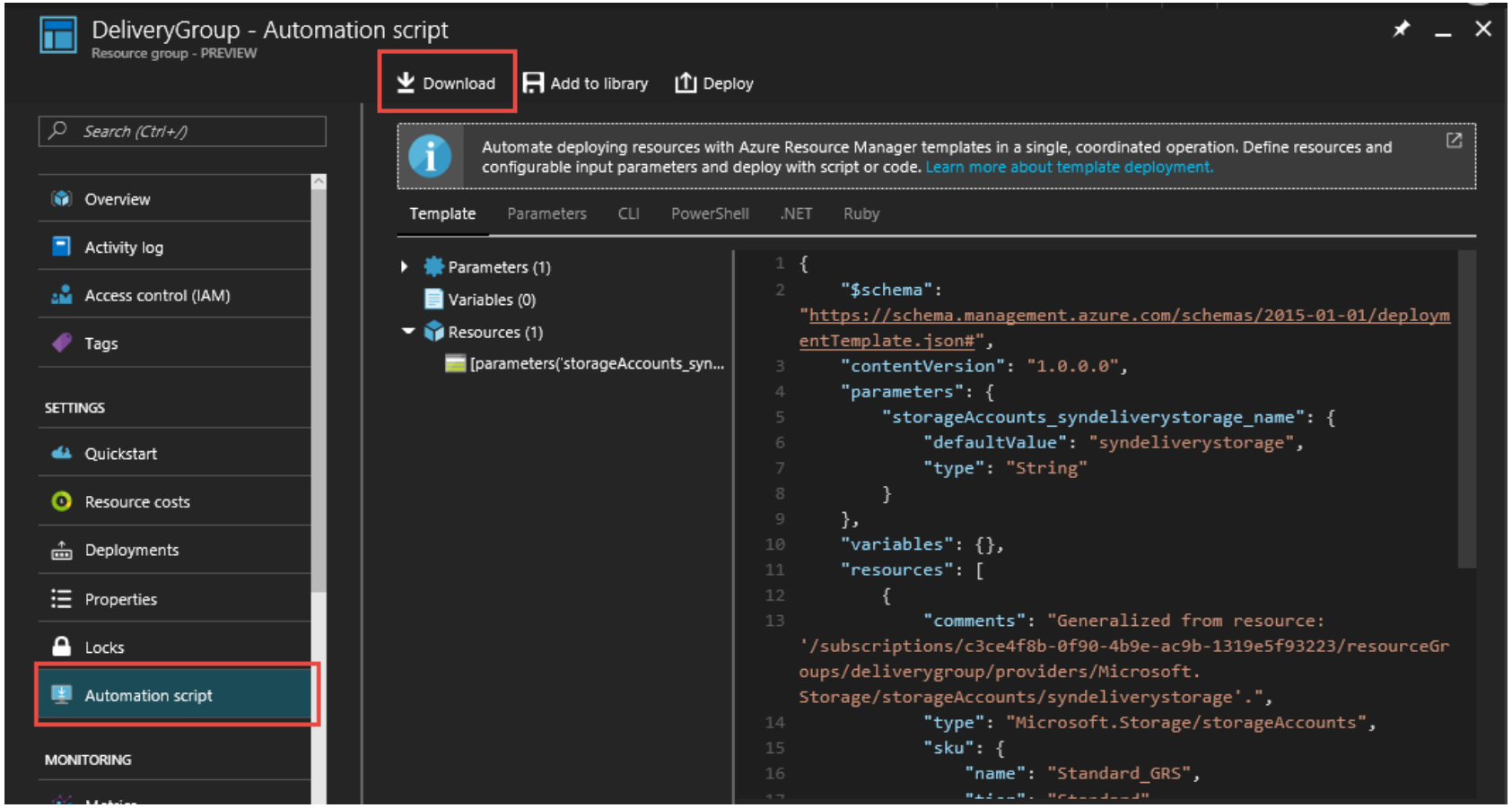
- Select the Resource group and click on the **Automation script** option.
- Click on the download button to download the template.



Export template using PowerShell

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```
Export-AzureRmResourceGroup -ResourceGroupName TestRG1 `
                -Path c:\Azure\Templates\Downloads\TestRG1.json
```

Remove resources or resource group

Removing Resources/Resource group

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- You can remove a resource or resource group. When you remove a resource group, you also remove all the resources within that resource group.

Removing Resources/Resource group using PowerShell

```
Remove-AzureRmResource -ResourceName mystoragename `
                -ResourceType Microsoft.Storage/storageAccounts `
                -ResourceGroupName TestRG1

Remove-AzureRmResourceGroup -Name TestRG1
```

THANK YOU