

Infrastructure as Python Code

Peter Hoffmann

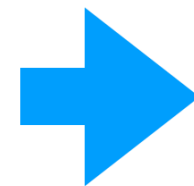
Senior Software Engineer
Blue Yonder

 [@peterhoffmann](https://twitter.com/peterhoffmann)

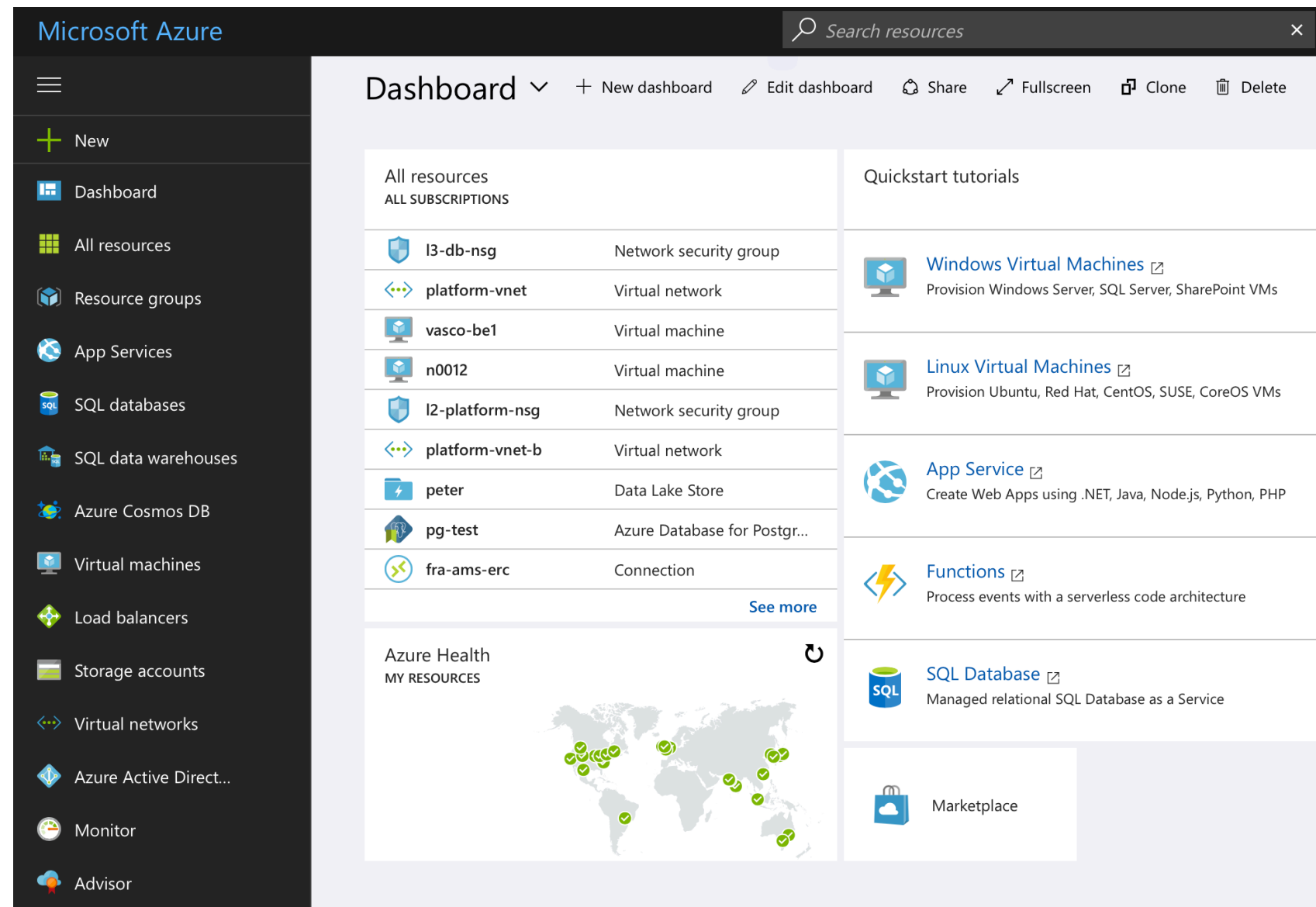
[github/blue-yonder/documents/](https://github.com/blue-yonder/documents/)



Azure Migration - Shift & Lift



Infrastructure as a service



The screenshot displays the Microsoft Azure management console. On the left is a dark sidebar with navigation options: New, Dashboard, All resources, Resource groups, App Services, SQL databases, SQL data warehouses, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Direct..., Monitor, and Advisor. The main area is titled 'Dashboard' and includes a search bar and action buttons like '+ New dashboard', 'Edit dashboard', 'Share', 'Fullscreen', 'Clone', and 'Delete'. It features a table of resources under 'All resources ALL SUBSCRIPTIONS', a 'Quickstart tutorials' section with links for Windows and Linux Virtual Machines, App Service, and Functions, and an 'Azure Health MY RESOURCES' section with a world map showing resource locations. A 'Marketplace' button is also visible at the bottom right.

Resource Name	Resource Type
I3-db-nsg	Network security group
platform-vnet	Virtual network
vasco-be1	Virtual machine
n0012	Virtual machine
I2-platform-nsg	Network security group
platform-vnet-b	Virtual network
peter	Data Lake Store
pg-test	Azure Database for Postgr...
fra-ams-erc	Connection

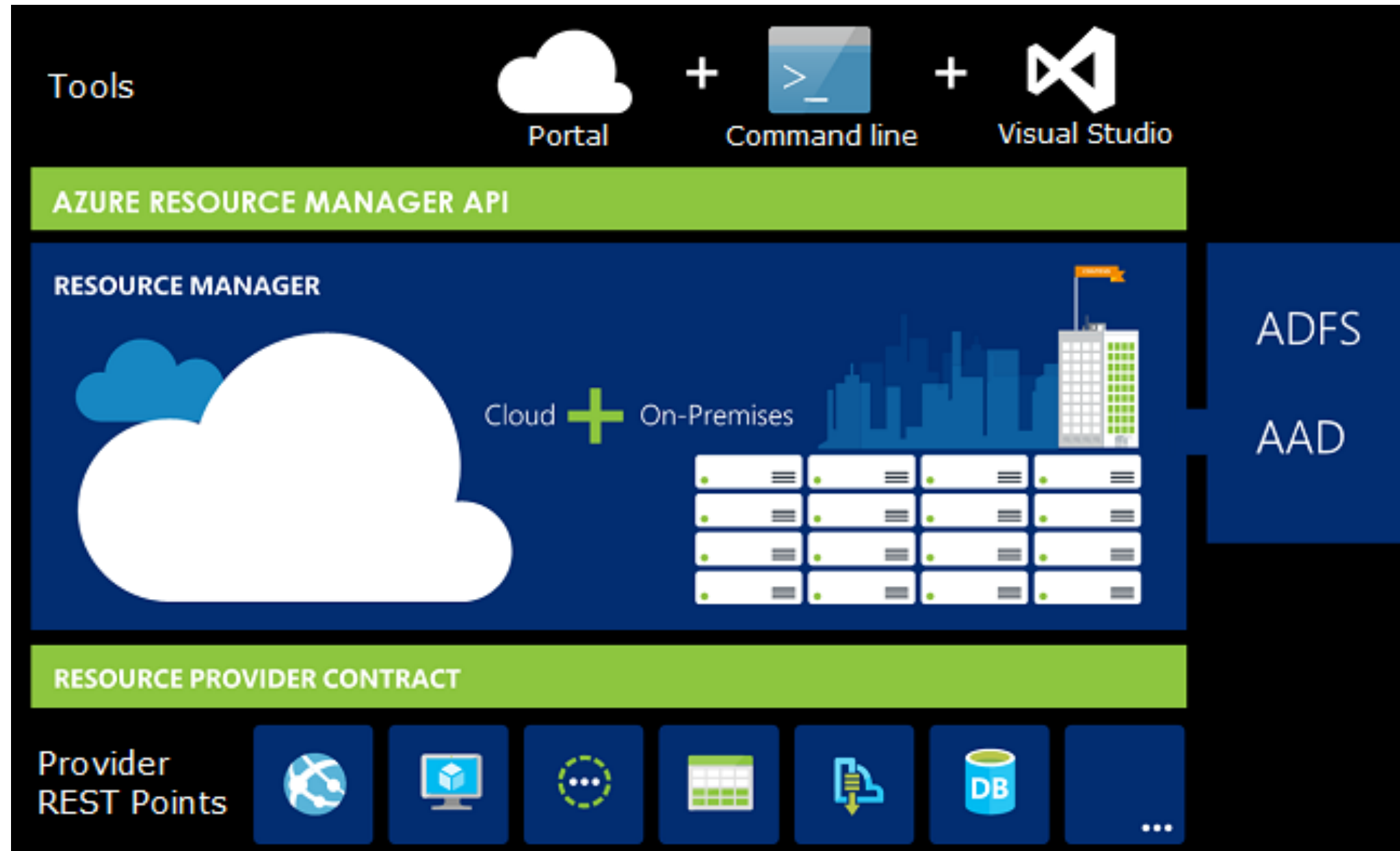
Quickstart tutorials

- [Windows Virtual Machines](#) - Provision Windows Server, SQL Server, SharePoint VMs
- [Linux Virtual Machines](#) - Provision Ubuntu, Red Hat, CentOS, SUSE, CoreOS VMs
- [App Service](#) - Create Web Apps using .NET, Java, Node.js, Python, PHP
- [Functions](#) - Process events with a serverless code architecture
- [SQL Database](#) - Managed relational SQL Database as a Service

Azure Health MY RESOURCES

Marketplace

ARM - Azure Resource Management Mode



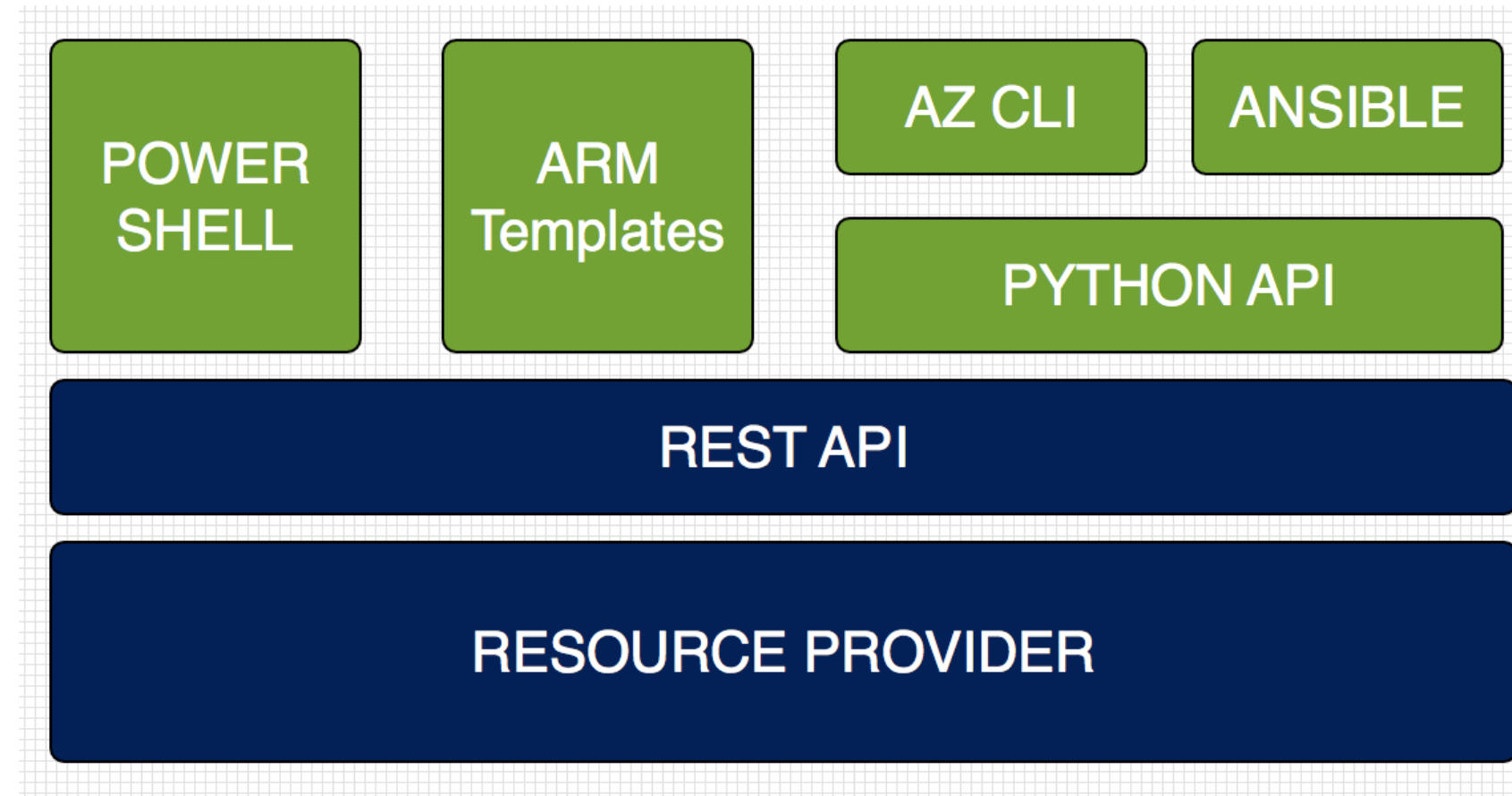
Azure Resource Manager API

different deployment options












imperative vs declarative deployment

REST API with Swagger Definitions

JSON Schema for payload



Resource Group

NAME 	TYPE 	LOCATION 
 devpi-avset1	Availability set	West Europe
 devpi-lb1	Load balancer	West Europe
 devpi-vm1-nic	Network interface	West Europe
 devpi-vm2-nic	Network interface	West Europe
 account1	Storage account	West Europe
 account2	Storage account	West Europe
 devpi-vm1	Virtual machine	West Europe
 devpi-vm2	Virtual machine	West Europe

container for multiple resources

resources exist in one and only one resource group

resource groups can span regions

resource groups can span services

deployment tracks template execution

Role-based Access Control (RBAC)

Resource Group - Access control (IAM)

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

+ Add - Remove Roles Refresh ? Help





Name ⁱ Type ⁱ Role ⁱ Scope ⁱ

 All 3 selected All scopes

Group by ⁱ

Role

4 items (1 Users, 3 Groups)

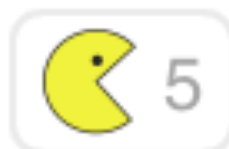
<input type="checkbox"/>	NAME	TYPE	ROLE	SCOPE
CONTRIBUTOR				
<input type="checkbox"/>	 Platform	Group	Contributor ⁱ	This resource
OWNER				
<input type="checkbox"/>	 Subscription Admin	Group	Owner ⁱ	Subscription (Inherited)
<input type="checkbox"/>	 Subscription admins	Group	Owner ⁱ	Subscription (Inherited)
USER ACCESS ADMINISTRATOR				
<input type="checkbox"/>	 JW JW	User	User Access Administrator ⁱ	Root (Inherited)

11:26 **Peter Hoffmann** Yep I nuked it. Sorry.

Andreas

did anyone remove the storage account 6b5llz ?

Posted in #azure | Today at 11:20



ARM Template

ARM Template

Azure Resource Manager templates are a **declarative** JSON based description of the **desired deployment state**. The Azure Resource Manager takes care of parallel provisioning with simple **rollback**.

```
az group deployment create \  
  --resource-group $RESOURCE_GROUP \  
  --mode Complete \  
  --template-file $TEMPLATE
```

ARM Template - Minimal

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

Azure / [azure-resource-manager-schemas](#)

Watch 50

Star 153

Fork 140

Code

Issues 46

Pull requests 9

Projects 0

Wiki

Insights

Branch: master

[azure-resource-manager-schemas](#) / [schemas](#) /

Create new file

Upload files

Find file

History

2014-02-26

Removed unicode BOM for some files (chokes on JSON validation with js...

a year ago

2015-01-01

Add new Microsoft.Network/trafficManagerProfiles version to deploymen...

3 days ago

2015-02-01-preview

remove accessKeys from 2015-02-01-preview schema template

9 months ago

ARM Template - Example Storage Account

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

ARM Template - Tagging

```
{
  "resources": [
    {
      "apiVersion": "2016-01-01",
      "type": "Microsoft.Storage/storageAccounts",
      "name": "mystorageaccount",
      "location": "westeurope",
      "sku": {
        "name": "Standard_LRS"
      },
      "tags": {
        "costCenter": "finance", "role": "backup"
      }
    }
  ]
}
```

ARM Template Functions

```
{  
  "resources": [{  
    "type": "Microsoft.Storage/storageAccounts",  
    "kind": "Storage",  
    "name": "[uniqueString(resourceGroup().id)]",  
    "apiVersion": "2016-01-01",  
    "location": "[resourceGroup().location]"}]  
}
```

array

first index length

numeric

add mul div

string

substring base64 replace unquiestring

ARM Template Variables

```
{  
  "variables": {  
    "storageAccountName": "[uniqueString(resourceGroup().id)]"  
  },  
  "resources": [{  
    "type": "Microsoft.Storage/storageAccounts",  
    "kind": "Storage",  
    "name": "[variables('storageAccountName')]",  
    "apiVersion": "2016-01-01",  
    "location": "[resourceGroup().location]"}]  
}
```

ARM Template Outputs

```
{
  "variables": {
    "storageAccountName": "[uniqueString(resourceGroup().id, 'teststorage')]"
  },
  "resources": [{
    "type": "Microsoft.Storage/storageAccounts",
    "kind": "Storage",
    "name": "[variables('storageAccountName')]",
    "apiVersion": "2016-01-01",
    "location": "[resourceGroup().location]"},
  "outputs": {
    "storageAccountName1": {
      "type": "string",
      "value": "[variables('storageAccountName')]"
    }
  }
}
```

```
$ az group deployment create -g $RESOURCE_GROUP --mode Complete --template-file $TEMPLATE
{
  "name": "teststorage",
  "properties": {
    "mode": "Complete",
    "outputs": {
      "storageAccountName": {
        "type": "String",
        "value": "rzhqnqqr34ek"
      }
    }
  }
}
```


Template Parameters I

```
{
  "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "parameters": {
    "addressSpace": { "type": "string" },
    "subnetL1Prefix": { "type": "string" }
  },
  "resources": [
    {
      "apiVersion": "2016-03-30",
      "type": "Microsoft.Network/virtualNetworks",
      "name": "vnet1",
      "location": "[resourceGroup().location]",
      "properties": {
        "addressSpace": {
          "addressPrefixes": [ "[parameters('addressSpace')]" ]
        },
        "subnets": [
          {
            "name": "subnetL1",
            "properties": {
              "addressPrefix": "[parameters('subnetL1Prefix')]"
            }
          }
        ]
      }
    }
  ]
}
```

Template Parameters II

```
{
  "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentParameters.json#",
  "contentVersion": "1.0.0.0",
  "parameters": {
    "addressSpace": {
      "value": "10.3.0.0/16"
    },
    "subnetL1Prefix": {
      "value": "10.3.0.0/24"
    },
    "subnetL2Prefix": {
      "value": "10.3.1.0/24"
    }
  }
}
```

```
$ az group deployment create -g $RESOURCE_GROUP \
  --mode Complete --template-file $TEMPLATE \
  --parameters @$PARAMETERS
```

Protect your Sensitive Data

- do NOT put sensitive Data in your templates or parameter files
- use `secureString` and `secureObject` Types
- runtime retrieval with template functions (`listKey`, `list*`)
- reference azure Key Vault secrets
- turn of debug, logging in production

Azure Templates are much more complex than simple JSON Files.

- JSON Schema for content
- Content versioning of different resources/resource providers
- parameters and variables
- inline template expression language
- outputs
- template linking

Azure CLI v2

Azure CLI V2

- Build in python
- Autocompletion
- Different output formats
- Support for jmespath.org
- Generated from swagger definitions
- github.com/Azure/azure-cli

```
$ az
--debug          image
--help          interactive
--output        iot
--query         keyvault
--verbose       lab
-h              lock
-o              login
account        logout
acr            managedapp
acs            monitor
ad             mysql
appservice     network
batch          policy
cdn            postgres
cloud          provider
cognitiveservices redis
component     resource
configure     role
```

```
$ az storage account list -g $RESOURCE_GROUP
[
  {
    "creationTime": "2017-05-27T12:21:46.958192+00:00",
    "location": "westeurope",
    "name": "rzhqnqqr34ek",
    "primaryEndpoints": {
      "blob": "https://rzhqnqqr34ek.blob.core.windows.net/",
      "file": "https://rzhqnqqr34ek.file.core.windows.net/",
      "queue": "https://rzhqnqqr34ek.queue.core.windows.net/",
      "table": "https://rzhqnqqr34ek.table.core.windows.net/"
    },
    "primaryLocation": "westeurope",
    "provisioningState": "Succeeded",
    "resourceGroup": "phoffmann",
    "sku": {
      "name": "Standard_RAGRS",
      "tier": "Standard"
    },
    "tags": {},
    "type": "Microsoft.Storage/storageAccounts"
  }
]
```

Table output with **tabulate**

```
$ az storage account list -g $RESOURCE_GROUP --output table
```

Location	Name	ProvisioningState	ResourceGroup
westeurope	rzhqnqqr34ek	Succeeded	phoffmann

TSV output

```
$ az storage account list -g $RESOURCE_GROUP --output tsv
```

westeurope	rzhqnqqr34ek	Succeeded	phoffmann
------------	--------------	-----------	-----------

Jmespath query language support

```
$ az storage account list -g $RESOURCE_GROUP \  
  --query '[?sku.name == "Standard_RAGS"].{name: name, blob: primaryEndpoints.blob}'
```

```
[  
  {  
    "blob": "https://rzhqnqqr34ek.blob.core.windows.net/",  
    "name": "rzhqnqqr34ek"  
  }  
]
```

Azure & Ansible

Azure Deployment with Ansible

- Deploy ARM Templates with Ansible
- `azure_rm_*` modules to deploy resources directly via the REST API
- A dynamic inventory script as a bridge to your server/service ansible deployment

Ansible template deployment

```
- hosts: localhost
  connection: local
  tasks:

- azure_rm_deployment:
    deployment_mode: complete|incremental
    state: present|absent
    location: westeurope
    resource_group: test
    parameters:
      newStorageAccountName:
        value: teststorage
    template: "{{ lookup('file', 'resource-template.json') }}"
```

Ansible inline templates

```
- azure_rm_deployment:
  location: westeurope
  resource_group_name: test
  parameters:
    newStorageAccountName:
      value: teststorage
  template:
    $schema: "https://schema.management.azure.com/schemas/2015-01-01/"
    contentVersion: "1.0.0.0"
    resources:
      - type: "Microsoft.Storage/storageAccounts"
        name: "[parameters('newStorageAccountName')]"
        apiVersion: "2016-01-01"
        location: "westeurope"
        sku:
          name: "Standard_RAGRS"
```

Ansible modules azure_rm_*

Deployment

- **azure** - create or terminate a virtual machine in azure
- **azure_rm_deployment** - Create or destroy Azure Resource Manager template deployments
- **azure_rm_resourcegroup** - Manage Azure resource groups.

Networking

- **azure_rm_virtualnetwork** - Manage Azure virtual networks.
- **azure_rm_subnet** - Manage Azure subnets.
- **azure_rm_securitygroup** - Manage Azure network security groups.

Virtual Machines

- **azure_rm_virtualmachine** - Manage Azure virtual machines.
- **azure_rm_publicipaddress** - Manage Azure Public IP Addresses.
- **azure_rm_networkinterface** - Manage Azure network interfaces.

Storage

- **azure_rm_storageaccount** - Manage Azure storage accounts.
- **azure_rm_storageblob** - Manage blob containers and blob objects.

Ansible Basic VM Deployment

- name: Create a VM with existing storage account and NIC

```
azure_rm_virtualmachine:
```

```
  resource_group: Testing
```

```
  name: testvm002
```

```
  vm_size: Standard_D4
```

```
  storage_account: testaccount001
```

```
  admin_username: adminUser
```

```
  ssh_public_keys:
```

```
    - path: /home/adminUser/.ssh/authorized_keys
```

```
      key_data: {{ssh_key}}
```

```
  network_interfaces: testvm001
```

```
  image:
```

```
    offer: Debian
```

```
    sku: '8'
```

```
    version: latest
```

Dynamic inventories

```
ansible-playbook -i ./azure_rm.py azure_deploy.yml
```

```
{  
  "azure": ["frontend", "backend", "jumphost"],  
  "westeurope": ["frontend", "backend", "jumphost"],  
  "testgroup": ["jumphost"],  
  "role": ["jumphost"],  
  "role_dmz": ["jumphost"],  
}
```


Ansible Azure Deployment

- only support for limited set of resources
- does not work with latest azure client libraries
- ok for simple tasks, for more complex tasks switch to azure resource manager templates
- dynamic inventory helpful
- using the template deployment and instrumenting it with parameters from ansible

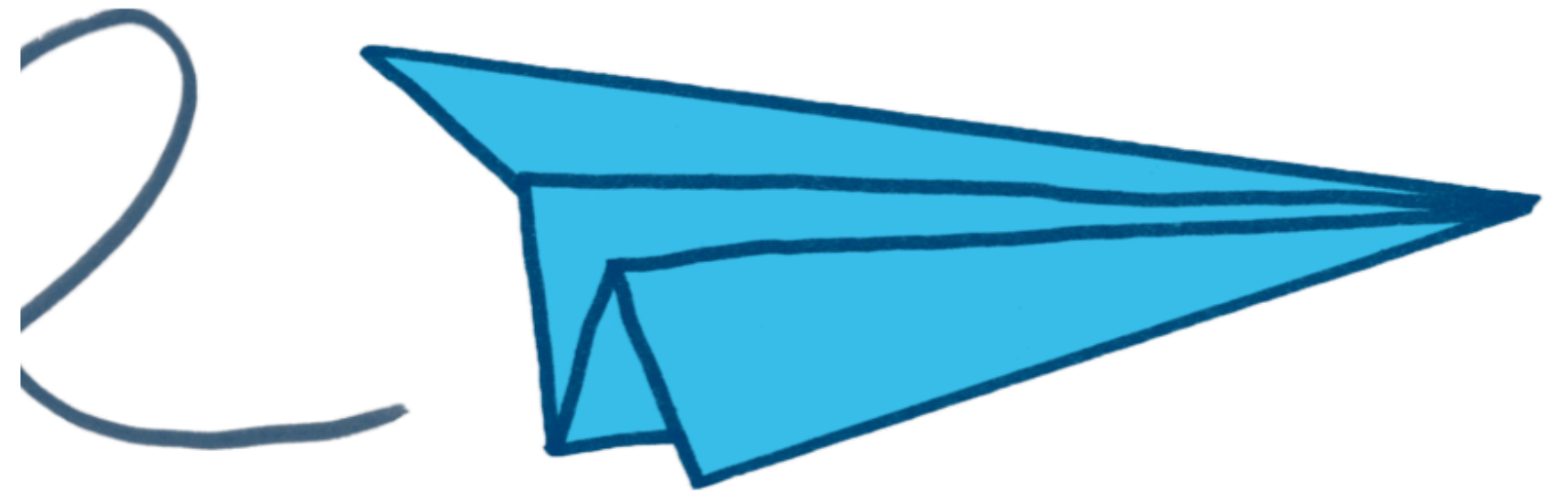
Infrastructure as Python Code

Peter Hoffmann

Senior Software Engineer
Blue Yonder

 [@peterhoffmann](https://twitter.com/peterhoffmann)

[github/blue-yonder/documents/](https://github.com/blue-yonder/documents/)



blue yonder

Forward looking. Forward thinking.