CSR1000v HA冗余部署指南，适用于Microsoft Azure with AzureCLI 2.0

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简介

本文档提供了一个分步配置指南，介绍如何在Microsoft Azure云中使用AzureCLI 2.0部署CSR1000v路由器以实现高可用性。 它旨在为用户提供对高可用性的实用知识和部署功能完备的测试平台的能力。

在Azure上部署映像有多种方法，大多数用户最熟悉的方法是通过Web门户。 但是，一旦您熟悉AzureCLI，它就会成为快速而强大的工具。

有关Azure的更深入背景、如何通过Web门户和HA部署CSR1000v，请参阅Cisco CSR 1000v Deployment Guide for Microsoft Azure and Related Information部分。

先决条件

要求

Cisco 建议您了解以下主题：

- Microsoft Azure帐户
- 2个CSR1000v和1个Windows/Linux虚拟机
- AzureCLI 2.0

使用的组件

本文档中的信息基于Cisco IOS-XE® Denali 16.7.1

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您的网络处于活动状态，请确保您了解所有命令的潜在影响。

目标

部署2台CSR1000v路由器和1台VM(windows/linux)。 模拟从私有数据中心(VM)到互联网(8.8.8.8)的连续流量。 模拟HA故障切换，并观察HA已成功通过确认Azure路由表已将流量从CSR-A切换到CSR-B的专用接口。

拓扑

为了充分了解拓扑和设计，在开始配置之前，这一点非常重要。这有助于在以后排除任何潜在问题。

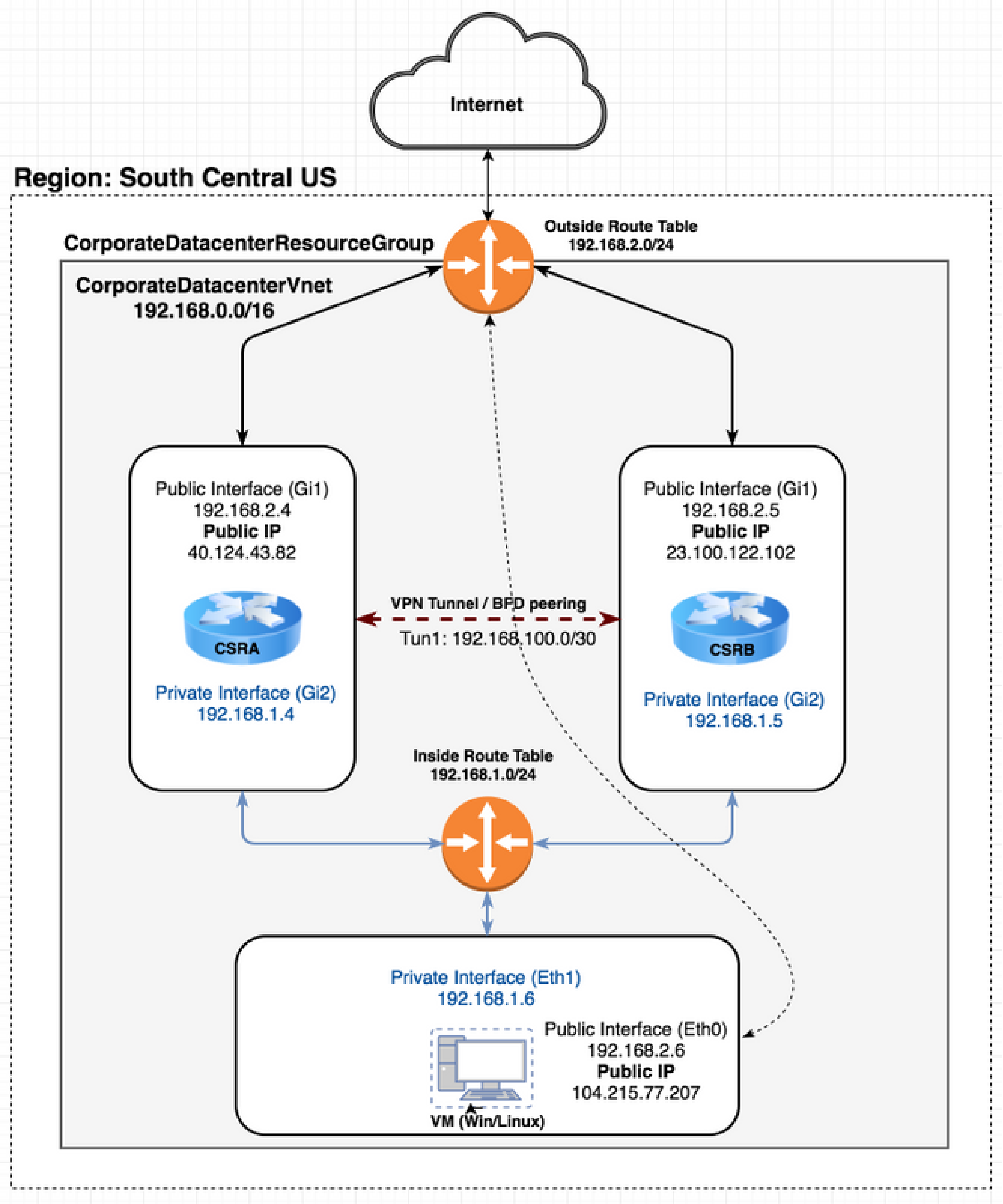
根据用户的要求，可能存在各种高可用性部署方案。在本例中，使用以下设置配置HA冗余：

- 1x — 区域（美国中南部）
- 1x — 资源组(CorporateDatacenterResourceGroup)
- 1x - VNET(CorporateDatacenterVnet)
- 6x — 网络接口（3x面向内部和3x面向外部）
- 2x — 路由表（InsideRoutetable和OutsideRoutetable）
- 2x - CSR1000v路由器(Cisco IOS-XE® Denali 16.7.1)
- 1x - VM(Linux/Windows)

目前，通过公共接口的互联网访问在VM上保持启用状态，以便您可以访问和配置它。通常，所有正常流量都应通过专用路由表。VM上的公共接口稍后可以禁用，以便不会意外泄漏任何流量。

流量模拟通过从VM的专用接口从路由表→ → CSRA → 8.8.8.8执行ping操作。在故障切换场景中，观察专用路由表已将路由切换到CSRB的专用接口。

网络图



术语

- 资源组 — Azure通过此方式跟踪您的所有资源（如虚拟机和vnet）。这通常用于管理所有项目并跟踪费用。
- Vnet — 虚拟网络。（与aws术语中的VPC类似）
- 路由表 — 包含子网规则，可将特定流量转发到IP地址或充当VPN终端。

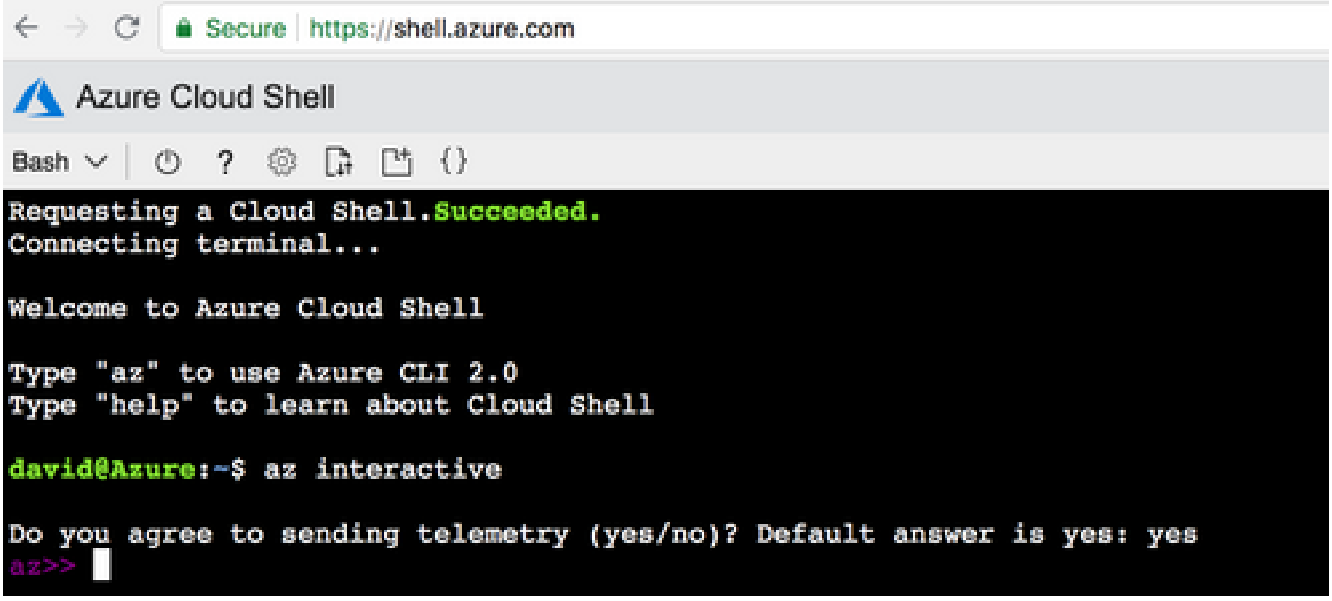
限制

- Azure本身在HA故障切换中可能会引入大约40-50秒的延迟。

配置

在Azure上部署VM的方法有几种：

1. Web门户- cisco.com上的HA文档
2. Powershell — 基于命令行的模型，用于管理Azure资源。
3. AzureCLI 2.0 — 也基于命令行。它是开源的，并以python编写，需要安装在本地系统上。要编写此文档，AzureCLI 2.0是最新版本。
4. Azure Cloud Shell — 选择**Bash shell**选项而不**是**Powershell选项，以通过外壳使用AzureCLI。此方法无需安装。



```
Requesting a Cloud Shell.Succeeded.
Connecting terminal...

Welcome to Azure Cloud Shell

Type "az" to use Azure CLI 2.0
Type "help" to learn about Cloud Shell

david@Azure:~$ az interactive

Do you agree to sending telemetry (yes/no)? Default answer is yes: yes
az>>
```

Powershell和AzureCLI相似，但AzureCLI的命令更简单。 这两种操作系统都可在Windows、MacOS和Linux上运行。 有关比较，请参阅为Azure选择正确的工具以及并排使用Azure CLI和PowerShell命令。

在本例中，使用AzureCLI或Cloud Shell部署所有资源。 AzureCLI可以安装在MacOS、Windows或Linux上，步骤稍有不同。 在AzureCLI和Azure Cloud Shell之间的其余步骤中，配置没有差异。

```
redundancy
 cloud provider azure 100
  bfd peer
  route-table
  default-gateway ip
  cidr ip
  app-key
  subscription-id
  app-id
  tenant-id
  resource-group
```

注意：此模板有助于跟踪所有ID和配置，这些ID和配置稍后用于在CSR上配置HA。

概述

步骤1.安装AzureCLI 2.0。

1. 在AzureCLI 2.0文档中，按照Windows、MacOS或Linux的安装步骤操作。
2. 对于MacOS:

```
$ brew update && brew install azure-cli
```

3. 登录Azure并按照说明对会话进行身份验证。

```
$ az login
```

4. 浏览器身份验证完成后，将以JSON格式返回您的Azure订阅信息：

```
[
  {
    "cloudName": "AzureCloud",
    "id": "09e13fd4-def2-46aa-xxxx-xxxxxxxxxxxx",
    "isDefault": true,
    "name": "Microsoft Azure Enterprise",
    "state": "Enabled",
    "tenantId": "ae49849c-2622-xxxx-xxxx-xxxxxxxxxxxx",
    "user": {
      "name": "cisco@cisco.com",
      "type": "user"
    }
  }
]
```

5. 在您开始执行其余的配置步骤之前，请在AzureCLI上提供一些有用的命令和提示。

- 要获取可用子命令及其执行的操作的帮助，请使**用 — h**选项。

```
$ az account -h
```

- 默认情况下，所有输出都以JSON格式返回。为便于阅读，可以使**用 — 输出**表选项在表中显示。

```
$ az account list-locations --output table
```

- 获取所有可用虚拟机的列表或将**—all**选项替换为下面的其他选项之一，以过滤表。

```
$ az vm image list --all --output table
You are retrieving all the images from server which could take more than a minute. To shorten
the wait, provide '--publisher', '--offer' or '--sku'. Partial name search is supported.
```

- 有关所有配置命令的详细信息，请参阅Microsoft的Azure CLI 2.0文档。

步骤2.创建资源组。

- 资源组是一个容器，它保存Azure解决方案的相关资源。 为资源组指定名称并选择部署容器的位置。 本示例使用South Central US。

```
$ az account list-locations --output table
DisplayName            Latitude    Longitude    Name
-------------------  ----------  -----------  ------------------
```

```
East Asia               22.267      114.188   eastasia
Southeast Asia           1.283      103.833   southeastasia
Central US              41.5908     -93.6208  centralus
East US                 37.3719     -79.8164  eastus
East US 2               36.6681     -78.3889  eastus2
West US                 37.783     -122.417   westus
North Central US        41.8819     -87.6278  northcentralus
South Central US        29.4167     -98.5     southcentralus

$ az group create --name CorporateDatacenterResourceGroup --location "South Central US"
{
  "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup",
  "location": "southcentralus",
  "managedBy": null,
  "name": "CorporateDatacenterResourceGroup",
  "properties": {
    "provisioningState": "Succeeded"
  },
  "tags": null
}
```

- 模板（添加资源组）

```
redundancy
 cloud provider azure 100
  bfd peer
  route-table
  default-gateway ip
  cidr ip
  app-key
  subscription-id
  app-id
  tenant-id
  resource-group CorporateDatacenterResourceGroup
```

步骤3.创建Vnet。

- Vnet是部署网络的IP地址空间。 然后，此范围将分割为更小的子网并分配给接口。 为vnet指定名称，将其分配到步骤2中创建的资源组，并分配前缀范围。 如果不指定前缀，Azure通常会分配10.0.0.0/16。

```
$ az network vnet create --name CorporateDatacenterVnet --resource-group
CorporateDatacenterResourceGroup --address-prefix 192.168.0.0/16
{
  "newVNet": {
    "addressSpace": {
      "addressPrefixes": [
        "192.168.0.0/16"
      ]
    },
    "ddosProtectionPlan": null,
    "dhcpOptions": {
      "dnsServers": []
    },
    "enableDdosProtection": false,
    "enableVmProtection": false,
    "etag": "W/\"7c39a7a9-46e5-4082-a016-xxxxxxxxxxxx\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/virtual
Networks/CorporateDatacenterVnet",
    "location": "southcentralus",
    "name": "CorporateDatacenterVnet",
    "provisioningState": "Succeeded",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "3d95d732-e46a-4fae-a34b-xxxxxxxxxxxx",
    "subnets": [],
    "tags": {},
    "type": "Microsoft.Network/virtualNetworks",
    "virtualNetworkPeerings": []
  }
}
```

步骤4.创建路由表。

1. 为面向内部的接口创建路由表。

   ```
   $ az network route-table create --name InsideRoutetable --resource-group
   CorporateDatacenterResourceGroup
   {
     "disableBgpRoutePropagation": false,
     "etag": "W/\"45088005-cb6f-4356-bb18-xxxxxxxxxxxx\"",
     "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
   xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ro
   uteTables/InsideRoutetable",
     "location": "southcentralus",
     "name": "InsideRoutetable",
     "provisioningState": "Succeeded",
     "resourceGroup": "CorporateDatacenterResourceGroup",
     "routes": [],
     "subnets": null,
     "tags": null,
     "type": "Microsoft.Network/routeTables"
   }
   ```

   模板（添加路由表）

   ```
   redundancy
    cloud provider azure 100
     bfd peer
     route-table InsideRoutetable
     default-gateway ip
     cidr ip
     app-key
     subscription-id
     app-id
     tenant-id
     resource-group CorporateDatacenterResourceGroup
   ```

2. 为面向外部的接口创建路由表。

   ```
   $ az network route-table create --name OutsideRoutetable --resource-group
   CorporateDatacenterResourceGroup
   {
     "disableBgpRoutePropagation": false,
     "etag": "W/\"a89b6230-9542-468c-b4b2-xxxxxxxxxxxx\"",
     "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
   xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ro
   uteTables/OutsideRoutetable",
     "location": "southcentralus",
     "name": "OutsideRoutetable",
     "provisioningState": "Succeeded",
     "resourceGroup": "CorporateDatacenterResourceGroup",
     "routes": [],
   ```

```
  "subnets": null,
  "tags": null,
  "type": "Microsoft.Network/routeTables"
}
```

步骤5.创建子网。

1. 从您在步骤3中为vnet分配的空间创建/24子网，然后将其分配给内部路由表。
   ```
   $ az network vnet subnet create --address-prefix 192.168.1.0/24 --name InsideSubnet --
   resource-group CorporateDatacenterResourceGroup --vnet-name CorporateDatacenterVnet --
   route-table InsideRoutetable
   {
     "addressPrefix": "192.168.1.0/24",
     "etag": "W/\"a0dbd178-3a45-48fb-xxxx-xxxxxxxxxxxx\"",
     "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
   xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/vi
   rtualNetworks/CorporateDatacenterVnet/subnets/InsideSubnet",
     "ipConfigurations": null,
     "name": "InsideSubnet",
     "networkSecurityGroup": null,
     "provisioningState": "Succeeded",
     "resourceGroup": "CorporateDatacenterResourceGroup",
     "resourceNavigationLinks": null,
     "routeTable": {
       "disableBgpRoutePropagation": null,
       "etag": null,
       "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
   xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ro
   uteTables/InsideRoutetable",
       "location": null,
       "name": null,
       "provisioningState": null,
       "resourceGroup": "CorporateDatacenterResourceGroup",
       "routes": null,
       "subnets": null,
       "tags": null,
       "type": null
     },
     "serviceEndpoints": null
   }
   ```

2. 从您为vnet分配的空间创建另一个/24子网，并将其分配给外部路由表。
   ```
   $ az network vnet subnet create --address-prefix 192.168.2.0/24 --name OutsideSubnet --
   resource-group CorporateDatacenterResourceGroup --vnet-name CorporateDatacenterVnet --
   route-table OutsideRoutetable
   {
     "addressPrefix": "192.168.2.0/24",
     "etag": "W/\"874d1019-90a0-44fd-a09c-0aed8f2ede5b\"",
     "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
   xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/vi
   rtualNetworks/CorporateDatacenterVnet/subnets/OutsideSubnet",
     "ipConfigurations": null,
     "name": "OutsideSubnet",
     "networkSecurityGroup": null,
     "provisioningState": "Succeeded",
     "resourceGroup": "CorporateDatacenterResourceGroup",
     "resourceNavigationLinks": null,
     "routeTable": {
       "disableBgpRoutePropagation": null,
   ```

```
    "etag": null,
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ro
uteTables/OutsideRoutetable",
    "location": null,
    "name": null,
    "provisioningState": null,
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "routes": null,
    "subnets": null,
    "tags": null,
    "type": null
  },
  "serviceEndpoints": null
}
```

步骤6.创建CSR1000v路由器。

每个虚拟机需要有2个接口（内部和外部），这意味着每个虚拟机有2个NIC。 创建2个NIC，并将公有IP与外部NIC关联。

1. 创建公有IP地址。

```
$ az network public-ip create --name CSRAPublicIP --resource-group
CorporateDatacenterResourceGroup --idle-timeout 30 --allocation-method Static
{
  "publicIp": {
    "dnsSettings": null,
    "etag": "W/\"38306703-153b-456b-b2e4-xxxxxxxxxxxx\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/pu
blicIPAddresses/CSRA",
    "idleTimeoutInMinutes": 30,
    "ipAddress": "40.124.43.82",
    "ipConfiguration": null,
    "ipTags": [],
    "location": "southcentralus",
    "name": "CSRAPublicIP",
    "provisioningState": "Succeeded",
    "publicIpAddressVersion": "IPv4",
    "publicIpAllocationMethod": "Static",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "610e1631-331a-4971-8502-xxxxxxxxxxxx",
    "sku": {
      "name": "Basic",
      "tier": "Regional"
    },
    "tags": null,
    "type": "Microsoft.Network/publicIPAddresses",
    "zones": null
  }
}
```

2. 创建外部NIC并将公有IP地址与其关联。

```
$ az network nic create --name CSRAOutsideInterface --resource-group
CorporateDatacenterResourceGroup --subnet OutsideSubnet --vnet CorporateDatacenterVnet  --
public-ip-address CSRAPublicIP
{
  "NewNIC": {
    "dnsSettings": {
      "appliedDnsServers": [],
      "dnsServers": [],
      "internalDnsNameLabel": null,
      "internalDomainNameSuffix": "plk2sxe5i0l1ccksytfab.jx.internal.cloudapp.net",
      "internalFqdn": null
    },
    "enableAcceleratedNetworking": false,
    "enableIpForwarding": false,
    "etag": "W/\"06fd60de-6547-4992-b506-xxxxxxxxxxxx\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/CSRAOutsideInterface",
    "ipConfigurations": [
      {
        "applicationGatewayBackendAddressPools": null,
        "applicationSecurityGroups": null,
        "etag": "W/\"06fd60de-6547-4992-xxxx-xxxxxxxxxxxx\"",
        "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/CSRAOutsideInterface/ipConfigurations/ipconfig1",
        "loadBalancerBackendAddressPools": null,
        "loadBalancerInboundNatRules": null,
        "name": "ipconfig1",
        "primary": true,
        "privateIpAddress": "192.168.2.4",
        "privateIpAddressVersion": "IPv4",
        "privateIpAllocationMethod": "Dynamic",
        "provisioningState": "Succeeded",
        "publicIpAddress": {
          "dnsSettings": null,
          "etag": null,
          "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/pu
blicIPAddresses/CSRAPublicIP",
          "idleTimeoutInMinutes": null,
          "ipAddress": null,
          "ipConfiguration": null,
          "ipTags": null,
          "location": null,
          "name": null,
          "provisioningState": null,
          "publicIpAddressVersion": null,
          "publicIpAllocationMethod": null,
          "resourceGroup": "CorporateDatacenterResourceGroup",
          "resourceGuid": null,
          "sku": null,
          "tags": null,
          "type": null,
          "zones": null
        },
        "resourceGroup": "CorporateDatacenterResourceGroup",
        "subnet": {
          "addressPrefix": null,
          "etag": null,
          "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/vi
rtualNetworks/CorporateDatacenterVnet/subnets/OutsideSubnet",
          "ipConfigurations": null,
          "name": null,
          "networkSecurityGroup": null,
          "provisioningState": null,
          "resourceGroup": "CorporateDatacenterResourceGroup",
          "resourceNavigationLinks": null,
          "routeTable": null,
          "serviceEndpoints": null
        }
      }
    ],
    "location": "southcentralus",
    "macAddress": null,
    "name": "CSRAOutsideInterface",
    "networkSecurityGroup": null,
    "primary": null,
    "provisioningState": "Succeeded",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "93413822-e819-4644-ac0d-xxxxxxxxxxxx",
    "tags": null,
    "type": "Microsoft.Network/networkInterfaces",
    "virtualMachine": null
  }
}
```

3. 创建内部NIC。

```
$ az network nic create --name CSRAInsideInterface --resource-group
CorporateDatacenterResourceGroup --subnet InsideSubnet --vnet CorporateDatacenterVnet
{
  "NewNIC": {
    "dnsSettings": {
      "appliedDnsServers": [],
      "dnsServers": [],
      "internalDnsNameLabel": null,
      "internalDomainNameSuffix": "gllzkplk2sxe5i0l1ccksytfab.jx.internal.cloudapp.net",
      "internalFqdn": null
    },
    "enableAcceleratedNetworking": false,
    "enableIpForwarding": false,
    "etag": "W/\"bebe539f-b5ff-40fa-a122-5c27951afeb1\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/CSRAInsideInterface",
    "ipConfigurations": [
      {
        "applicationGatewayBackendAddressPools": null,
        "applicationSecurityGroups": null,
        "etag": "W/\"bebe539f-b5ff-40fa-a122-5c27951afeb1\"",
        "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/CSRAInsideInterface/ipConfigurations/ipconfig1",
        "loadBalancerBackendAddressPools": null,
        "loadBalancerInboundNatRules": null,
        "name": "ipconfig1",
        "primary": true,
        "privateIpAddress": "192.168.1.4",
        "privateIpAddressVersion": "IPv4",
        "privateIpAllocationMethod": "Dynamic",
        "provisioningState": "Succeeded",
        "publicIpAddress": null,
        "resourceGroup": "CorporateDatacenterResourceGroup",
        "subnet": {
          "addressPrefix": null,
          "etag": null,
          "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/vi
rtualNetworks/CorporateDatacenterVnet/subnets/InsideSubnet",
          "ipConfigurations": null,
          "name": null,
          "networkSecurityGroup": null,
          "provisioningState": null,
          "resourceGroup": "CorporateDatacenterResourceGroup",
          "resourceNavigationLinks": null,
          "routeTable": null,
          "serviceEndpoints": null
        }
      }
    ],
    "location": "southcentralus",
    "macAddress": null,
    "name": "CSRAInsideInterface",
    "networkSecurityGroup": null,
    "primary": null,
    "provisioningState": "Succeeded",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "0f7ae52a-47c3-4563-9fe0-b1484e88296e",
    "tags": null,
    "type": "Microsoft.Network/networkInterfaces",
    "virtualMachine": null
  }
}
```

4. 列出Azure上可用的CSR1000v映像。 本示例使用**cisco:cisco-csr-1000v:16_7:16.7.120171201**的urn名称。

```
az vm image list --all --publisher Cisco --offer cisco-csr-1000v
[
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "16_5",
    "urn": "cisco:cisco-csr-1000v:16_5:16.5.120170418",
    "version": "16.5.120170418"
  },
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "16_5",
    "urn": "cisco:cisco-csr-1000v:16_5:16.5.220171128",
    "version": "16.5.220171128"
  },
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "16_6",
    "urn": "cisco:cisco-csr-1000v:16_6:16.6.120170804",
    "version": "16.6.120170804"
  },
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "16_6",
    "urn": "cisco:cisco-csr-1000v:16_6:16.6.220171219",
    "version": "16.6.220171219"
  },
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "16_7",
    "urn": "cisco:cisco-csr-1000v:16_7:16.7.120171201",
    "version": "16.7.120171201"
  },
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "3_16",
    "urn": "cisco:cisco-csr-1000v:3_16:3.16.420170208",
    "version": "3.16.420170208"
  },
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "3_16",
    "urn": "cisco:cisco-csr-1000v:3_16:3.16.520170215",
    "version": "3.16.520170215"
  },
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "csr-azure-byol",
    "urn": "cisco:cisco-csr-1000v:csr-azure-byol:16.40.120170206",
    "version": "16.40.120170206"
  },
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "csr-azure-byol",
    "urn": "cisco:cisco-csr-1000v:csr-azure-byol:3.16.0",
    "version": "3.16.0"
  },
  {
    "offer": "cisco-csr-1000v",
    "publisher": "cisco",
    "sku": "csr-azure-byol",
    "urn": "cisco:cisco-csr-1000v:csr-azure-byol:3.16.2",
    "version": "3.16.2"
  }
]
```

5. 使用映像的**urn** 名称部署CSR1000v。

```
$ az vm create --resource-group CorporateDatacenterResourceGroup --name CSRA --location
southcentralus --image cisco:cisco-csr-1000v:16_7:16.7.120171201 --nics
CSRAOutsideInterface CSRAInsideInterface --admin-username cisco --admin-password
"Cisco1234567" --authentication-type password
 Running ..
{
  "fqdns": "",
  "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Compute/vi
rtualMachines/CSRA",
  "location": "southcentralus",
  "macAddress": "00-0D-3A-5D-83-58,00-0D-3A-5D-89-27",
  "powerState": "VM running",
  "privateIpAddress": "192.168.2.4,192.168.1.4",
  "publicIpAddress": "40.124.43.82",
  "resourceGroup": "CorporateDatacenterResourceGroup",
  "zones": ""
}
```

几分钟后，新CSR1000v启动。

```
$ az vm list --resource-group CorporateDatacenterResourceGroup --show-details --output
table
Name          ResourceGroup    PowerState    PublicIps      Fqdns    Location    Zones
------------  ---------------  ------------  -------------  -------  ----------  -------
CSRA  CorporateDatacenterResourceGroup       VM running    40.124.43.82
southcentralus
```

6. 登录CSR1000v并验证功能。

```
$ ssh cisco@40.124.43.82
The authenticity of host '40.124.43.82 (40.124.43.82)' can't be established.
RSA key fingerprint is SHA256:q33FHw7RlkDn
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '40.124.43.82' (RSA) to the list of known hosts.
Password:

CSRA#
CSRA#show ip interface brief
Interface IP-Address OK? Method Status Protocol
GigabitEthernet1 192.168.2.4 YES DHCP up up
GigabitEthernet2 192.168.1.4 YES DHCP up up
```

步骤7.创建第二台CSR1000v路由器。

1. 创建公有IP地址。

```
$ az network public-ip create --name CSRBPublicIP --resource-group
CorporateDatacenterResourceGroup --idle-timeout 30 --allocation-method Static
{
  "publicIp": {
    "dnsSettings": null,
    "etag": "W/\"f0f98dac-ea56-4efe-8da6-81a221ac3474\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/pu
blicIPAddresses/CSRB",
    "idleTimeoutInMinutes": 30,
    "ipAddress": "23.100.122.102",
    "ipConfiguration": null,
    "ipTags": [],
    "location": "southcentralus",
    "name": "CSRBPublicIP",
    "provisioningState": "Succeeded",
    "publicIpAddressVersion": "IPv4",
    "publicIpAllocationMethod": "Static",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "aa03bc26-22df-4696-bd77-ca29df029d7d",
    "sku": {
      "name": "Basic",
      "tier": "Regional"
    },
    "tags": null,
    "type": "Microsoft.Network/publicIPAddresses",
    "zones": null
  }
}
```

2. 创建外部NIC并将公有IP地址与其关联。

```
$ az network nic create --name CSRBOutsideInterface --resource-group
CorporateDatacenterResourceGroup --subnet OutsideSubnet --vnet CorporateDatacenterVnet  --
public-ip-address CSRBPublicIP
{
  "NewNIC": {
    "dnsSettings": {
      "appliedDnsServers": [],
      "dnsServers": [],
      "internalDnsNameLabel": null,
      "internalDomainNameSuffix": "gllzkplk2sxe5i0l1ccksytfab.jx.internal.cloudapp.net",
      "internalFqdn": null
    },
    "enableAcceleratedNetworking": false,
    "enableIpForwarding": false,
    "etag": "W/\"ee0a0b41-42f6-4ac2-91c2-xxxxxxxxxxxx\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/CSRBOutsideInterface",
    "ipConfigurations": [
      {
        "applicationGatewayBackendAddressPools": null,
        "applicationSecurityGroups": null,
        "etag": "W/\"ee0a0b41-42f6-4ac2-91c2-xxxxxxxxxxxx\"",
        "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/CSRBOutsideInterface/ipConfigurations/ipconfig1",
        "loadBalancerBackendAddressPools": null,
        "loadBalancerInboundNatRules": null,
        "name": "ipconfig1",
        "primary": true,
        "privateIpAddress": "192.168.2.5",
        "privateIpAddressVersion": "IPv4",
        "privateIpAllocationMethod": "Dynamic",
        "provisioningState": "Succeeded",
        "publicIpAddress": {
          "dnsSettings": null,
          "etag": null,
          "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/pu
blicIPAddresses/CSRBPublicIP",
          "idleTimeoutInMinutes": null,
          "ipAddress": null,
          "ipConfiguration": null,
          "ipTags": null,
          "location": null,
          "name": null,
          "provisioningState": null,
          "publicIpAddressVersion": null,
          "publicIpAllocationMethod": null,
          "resourceGroup": "CorporateDatacenterResourceGroup",
          "resourceGuid": null,
          "sku": null,
          "tags": null,
          "type": null,
          "zones": null
        },
        "resourceGroup": "CorporateDatacenterResourceGroup",
        "subnet": {
          "addressPrefix": null,
          "etag": null,
          "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/vi
rtualNetworks/CorporateDatacenterVnet/subnets/OutsideSubnet",
          "ipConfigurations": null,
          "name": null,
          "networkSecurityGroup": null,
          "provisioningState": null,
          "resourceGroup": "CorporateDatacenterResourceGroup",
          "resourceNavigationLinks": null,
          "routeTable": null,
          "serviceEndpoints": null
        }
      }
    ],
    "location": "southcentralus",
    "macAddress": null,
    "name": "CSRBOutsideInterface",
    "networkSecurityGroup": null,
    "primary": null,
    "provisioningState": "Succeeded",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "c3f05156-ad07-4abd-a006-xxxxxxxxxxxx",
    "tags": null,
    "type": "Microsoft.Network/networkInterfaces",
    "virtualMachine": null
  }
}
```

3. 创建内部NIC。

```
$ az network nic create --name CSRBInsideInterface --resource-group CorporateDatacenterResourceGroup --subnet InsideSubnet --vnet CorporateDatacenterVnet
{
  "NewNIC": {
    "dnsSettings": {
      "appliedDnsServers": [],
      "dnsServers": [],
      "internalDnsNameLabel": null,
      "internalDomainNameSuffix": "zkplk2sxe5i0l1ccksytfab.jx.internal.cloudapp.net",
      "internalFqdn": null
    },
    "enableAcceleratedNetworking": false,
    "enableIpForwarding": false,
    "etag": "W/\"15edf738-fc77-431c-80f3-xxxxxxxxxxxx\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/networkInterfaces/CSRBInsideInterface",
    "ipConfigurations": [
      {
        "applicationGatewayBackendAddressPools": null,
        "applicationSecurityGroups": null,
        "etag": "W/\"15edf738-fc77-431c-80f3-xxxxxxxxxxxx\"",
        "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/networkInterfaces/CSRBInsideInterface/ipConfigurations/ipconfig1",
        "loadBalancerBackendAddressPools": null,
        "loadBalancerInboundNatRules": null,
        "name": "ipconfig1",
        "primary": true,
        "privateIpAddress": "192.168.1.5",
        "privateIpAddressVersion": "IPv4",
        "privateIpAllocationMethod": "Dynamic",
        "provisioningState": "Succeeded",
        "publicIpAddress": null,
        "resourceGroup": "CorporateDatacenterResourceGroup",
        "subnet": {
          "addressPrefix": null,
          "etag": null,
          "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/virtualNetworks/CorporateDatacenterVnet/subnets/InsideSubnet",
          "ipConfigurations": null,
          "name": null,
          "networkSecurityGroup": null,
          "provisioningState": null,
          "resourceGroup": "CorporateDatacenterResourceGroup",
          "resourceNavigationLinks": null,
          "routeTable": null,
          "serviceEndpoints": null
        }
      }
    ],
    "location": "southcentralus",
    "macAddress": null,
    "name": "CSRBInsideInterface",
    "networkSecurityGroup": null,
    "primary": null,
    "provisioningState": "Succeeded",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "085c88fc-9e78-49be-a5a7-xxxxxxxxxxxx",
    "tags": null,
    "type": "Microsoft.Network/networkInterfaces",
    "virtualMachine": null
  }
}
```

4. 使用相同的映像cisco:cisco-csr-1000v:16_7:16.7.120171201部署第二个CSR1000v。

```
$ az vm create --resource-group CorporateDatacenterResourceGroup --name CSRB --location
southcentralus --image cisco:cisco-csr-1000v:16_7:16.7.120171201 --nics
CSRBOutsideInterface CSRBInsideInterface --admin-username cisco --admin-password
"Cisco1234567" --authentication-type password
{
  "fqdns": "",
  "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Compute/vi
rtualMachines/CSRB",
  "location": "southcentralus",
  "macAddress": "00-0D-3A-5D-8C-51,00-0D-3A-5D-85-2A",
  "powerState": "VM running",
  "privateIpAddress": "192.168.2.5,192.168.1.5",
  "publicIpAddress": "23.100.122.102",
  "resourceGroup": "CorporateDatacenterResourceGroup",
  "zones": ""
}
```

步骤8.使用步骤6中的相同步骤创建主机VM。 本示例使用UbuntuLTS。

1. 创建公有IP地址。

```
$ az network public-ip create --name VMHostPublicIP --resource-group
CorporateDatacenterResourceGroup --idle-timeout 30 --allocation-method Static
{
  "publicIp": {
    "dnsSettings": null,
    "etag": "W/\"5943a230-1eeb-4cf0-b856-xxxxxxxxxxxx\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/pu
blicIPAddresses/VMHostPublicIP",
    "idleTimeoutInMinutes": 30,
    "ipAddress": "104.215.77.207",
    "ipConfiguration": null,
    "ipTags": [],
    "location": "southcentralus",
    "name": "VMHostPublicIP",
    "provisioningState": "Succeeded",
    "publicIpAddressVersion": "IPv4",
    "publicIpAllocationMethod": "Static",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "ea19c10a-2fd3-498f-b984-xxxxxxxxxxxx",
    "sku": {
      "name": "Basic",
      "tier": "Regional"
    },
    "tags": null,
    "type": "Microsoft.Network/publicIPAddresses",
    "zones": null
  }
}
```

2. 创建外部NIC，并将外部子网和公有IP地址关联到它。 当子网与NIC关联时，IP地址会自动分配给NIC。在本例中，OutsideSubnet为192.168.2.0/24，自动分配给网卡的IP地址为192.168.2.6。

```
$ az network nic create --name VMHostOutsideInterface --resource-group
CorporateDatacenterResourceGroup --subnet OutsideSubnet --vnet CorporateDatacenterVnet  --
public-ip-address VMHostPublicIP
{
  "NewNIC": {
    "dnsSettings": {
      "appliedDnsServers": [],
      "dnsServers": [],
      "internalDnsNameLabel": null,
      "internalDomainNameSuffix": "gzkplk2sxe5i0l1ccksytfab.jx.internal.cloudapp.net",
      "internalFqdn": null
    },
    "enableAcceleratedNetworking": false,
    "enableIpForwarding": false,
    "etag": "W/\"2c70c97b-6470-42c8-b481-xxxxxxxxxxxx\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/VMHostOutsideInterface",
    "ipConfigurations": [
      {
        "applicationGatewayBackendAddressPools": null,
        "applicationSecurityGroups": null,
        "etag": "W/\"2c70c97b-6470-42c8-b481-xxxxxxxxxxxx\"",
        "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/VMHostOutsideInterface/ipConfigurations/ipconfig1",
        "loadBalancerBackendAddressPools": null,
        "loadBalancerInboundNatRules": null,
        "name": "ipconfig1",
        "primary": true,
        "privateIpAddress": "192.168.2.6",
        "privateIpAddressVersion": "IPv4",
        "privateIpAllocationMethod": "Dynamic",
        "provisioningState": "Succeeded",
        "publicIpAddress": {
          "dnsSettings": null,
          "etag": null,
          "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/pu
blicIPAddresses/VMHostPublicIP",
          "idleTimeoutInMinutes": null,
          "ipAddress": null,
          "ipConfiguration": null,
          "ipTags": null,
          "location": null,
          "name": null,
          "provisioningState": null,
          "publicIpAddressVersion": null,
          "publicIpAllocationMethod": null,
          "resourceGroup": "CorporateDatacenterResourceGroup",
          "resourceGuid": null,
          "sku": null,
          "tags": null,
          "type": null,
          "zones": null
        },
        "resourceGroup": "CorporateDatacenterResourceGroup",
        "subnet": {
          "addressPrefix": null,
          "etag": null,
          "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/vi
rtualNetworks/CorporateDatacenterVnet/subnets/OutsideSubnet",
          "ipConfigurations": null,
          "name": null,
          "networkSecurityGroup": null,
          "provisioningState": null,
          "resourceGroup": "CorporateDatacenterResourceGroup",
          "resourceNavigationLinks": null,
          "routeTable": null,
          "serviceEndpoints": null
        }
      }
    ],
    "location": "southcentralus",
    "macAddress": null,
    "name": "VMHostOutsideInterface",
    "networkSecurityGroup": null,
    "primary": null,
    "provisioningState": "Succeeded",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "89588a04-6ba6-467d-a86f-xxxxxxxxxxxx",
    "tags": null,
    "type": "Microsoft.Network/networkInterfaces",
    "virtualMachine": null
  }
}
```

3. 创建内部NIC。

```
$ az network nic create --name VMHostInsideInterface --resource-group
CorporateDatacenterResourceGroup --subnet InsideSubnet --vnet CorporateDatacenterVnet
{
  "NewNIC": {
    "dnsSettings": {
      "appliedDnsServers": [],
      "dnsServers": [],
      "internalDnsNameLabel": null,
      "internalDomainNameSuffix": "zkplk2sxe5i0l1ccksytfab.jx.internal.cloudapp.net",
      "internalFqdn": null
    },
    "enableAcceleratedNetworking": false,
    "enableIpForwarding": false,
    "etag": "W/\"dda7eacf-4670-40c2-999c-xxxxxxxxxxxx\"",
    "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/VMHostInsideInterface",
    "ipConfigurations": [
      {
        "applicationGatewayBackendAddressPools": null,
        "applicationSecurityGroups": null,
        "etag": "W/\"dda7eacf-4670-40c2-999c-xxxxxxxxxxxx\"",
        "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ne
tworkInterfaces/VMHostInsideInterface/ipConfigurations/ipconfig1",
        "loadBalancerBackendAddressPools": null,
        "loadBalancerInboundNatRules": null,
        "name": "ipconfig1",
        "primary": true,
        "privateIpAddress": "192.168.1.6",
        "privateIpAddressVersion": "IPv4",
        "privateIpAllocationMethod": "Dynamic",
        "provisioningState": "Succeeded",
        "publicIpAddress": null,
        "resourceGroup": "CorporateDatacenterResourceGroup",
        "subnet": {
          "addressPrefix": null,
          "etag": null,
          "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/vi
rtualNetworks/CorporateDatacenterVnet/subnets/InsideSubnet",
          "ipConfigurations": null,
          "name": null,
          "networkSecurityGroup": null,
          "provisioningState": null,
          "resourceGroup": "CorporateDatacenterResourceGroup",
          "resourceNavigationLinks": null,
          "routeTable": null,
          "serviceEndpoints": null
        }
      }
    ],
    "location": "southcentralus",
    "macAddress": null,
    "name": "VMHostInsideInterface",
    "networkSecurityGroup": null,
    "primary": null,
    "provisioningState": "Succeeded",
    "resourceGroup": "CorporateDatacenterResourceGroup",
    "resourceGuid": "8ef12cdd-cc31-432e-99cf-xxxxxxxxxxxx",
    "tags": null,
    "type": "Microsoft.Network/networkInterfaces",
    "virtualMachine": null
  }
}
```

4. 部署Ubuntu VM。本示例使用UbuntuLTS。

```
az vm image list --output table
You are viewing an offline list of images, use --all to retrieve an up-to-date list
Offer          Publisher               Sku                Urn
UrnAlias             Version
-------------  ----------------------  ------------------  --------------------------------
------------------------------  -------------------  ---------
CentOS         OpenLogic               7.3                OpenLogic:CentOS:7.3:latest
CentOS               latest
CoreOS         CoreOS                  Stable             CoreOS:CoreOS:Stable:latest
CoreOS               latest
Debian         credativ                8                  credativ:Debian:8:latest
Debian               latest
openSUSE-Leap  SUSE                    42.3               SUSE:openSUSE-Leap:42.3:latest
openSUSE-Leap        latest
RHEL           RedHat                  7.3                RedHat:RHEL:7.3:latest
RHEL                 latest
SLES           SUSE                    12-SP2             SUSE:SLES:12-SP2:latest
SLES                 latest
UbuntuServer   Canonical               16.04-LTS          Canonical:UbuntuServer:16.04-
LTS:latest                         UbuntuLTS            latest
WindowsServer  MicrosoftWindowsServer  2016-Datacenter
MicrosoftWindowsServer:WindowsServer:2016-Datacenter:latest     Win2016Datacenter    latest
WindowsServer  MicrosoftWindowsServer  2012-R2-Datacenter
MicrosoftWindowsServer:WindowsServer:2012-R2-Datacenter:latest  Win2012R2Datacenter  latest
WindowsServer  MicrosoftWindowsServer  2012-Datacenter
MicrosoftWindowsServer:WindowsServer:2012-Datacenter:latest     Win2012Datacenter    latest
WindowsServer  MicrosoftWindowsServer  2008-R2-SP1
MicrosoftWindowsServer:WindowsServer:2008-R2-SP1:latest         Win2008R2SP1         latest
```

```
$ az vm create --resource-group CorporateDatacenterResourceGroup --name VmHost --location
southcentralus --image UbuntuLTS --admin-user cisco --admin-password Cisco1234567 --nics
VMHostOutsideInterface VMHostInsideInterface --authentication-type password
{
"fqdns": "",
"id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Compute/vi
rtualMachines/VmHost",
"location": "southcentralus",
"macAddress": "00-0D-3A-5D-B7-CB,00-0D-3A-5D-B8-9B",
"powerState": "VM running",
"privateIpAddress": "192.168.2.6,192.168.1.6",
"publicIpAddress": "104.215.77.207",
"resourceGroup": "CorporateDatacenterResourceGroup",
"zones": ""
}
```

步骤9.向路由表和虚拟机添加路由。

1. 通过将下一跳IP地址设置为192.168.1.4，为内部子网添加默认路由以通过CSR A路由流量。这在InsideRouteTable上完成。

```
$ az network route-table route create --address-prefix 8.8.8.8/32 --name default_route --
next-hop-type VirtualAppliance --resource-group CorporateDatacenterResourceGroup --route-
table-name InsideRouteTable --next-hop-ip-address 192.168.1.4
{
  "addressPrefix": "8.8.8.8/32",
  "etag": "W/\"ef9e650a-5d70-455d-b958-5a0efc07e7ad\"",
  "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ro
uteTables/InsideRouteTable/routes/default_route",
  "name": "default_route",
  "nextHopIpAddress": "192.168.1.4",
  "nextHopType": "VirtualAppliance",
  "provisioningState": "Succeeded",
  "resourceGroup": "CorporateDatacenterResourceGroup"
}
```

2. 在OutsideRouteTable上为网络中的流量添加到达互联网的路由。

```
$ az network route-table route create --address-prefix 8.8.8.8/32 --name internet --next-
hop-type Internet --resource-group CorporateDatacenterResourceGroup --route-table-name
OutsideRouteTable
{
  "addressPrefix": "8.8.8.8/32",
  "etag": "W/\"d2c7e32e-8d32-4856-a3a6-xxxxxxxxxxxx\"",
  "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ro
uteTables/OutsideRouteTable/routes/internet",
  "name": "internet",
  "nextHopIpAddress": null,
  "nextHopType": "Internet",
  "provisioningState": "Succeeded",
  "resourceGroup": "CorporateDatacenterResourceGroup"
}
```

3. 登录Ubuntu VM并添加路由以强制流量通过内部接口到8.8.8.8。 Azure路由表自动使用子网中的第一个IP作为其网关。 内部接口(eth1)的子网是192.168.1.0/24，这意味着192.168.1.1是主机VM的默认gw地址。

```
$ ifconfig
```

```
eth0 Link encap:Ethernet HWaddr 00:0d:3a:5d:b7:cb
inet addr:192.168.2.6 Bcast:192.168.2.255 Mask:255.255.255.0
inet6 addr: fe80::20d:3aff:fe5d:b7cb/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:3986 errors:0 dropped:0 overruns:0 frame:0
TX packets:2881 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:3475393 (3.4 MB) TX bytes:592740 (592.7 KB)

eth1 Link encap:Ethernet HWaddr 00:0d:3a:5d:b8:9b
inet addr:192.168.1.6 Bcast:192.168.1.255 Mask:255.255.255.0
inet6 addr: fe80::20d:3aff:fe5d:b89b/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:2 errors:0 dropped:0 overruns:0 frame:0
TX packets:14 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:762 (762.0 B) TX bytes:1620 (1.6 KB)
```

```
$ sudo route add -host 8.8.8.8 gw 192.168.1.1 dev eth1
$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         192.168.2.1     0.0.0.0         UG    0      0        0 eth0
8.8.8.8         192.168.1.1     255.255.255.255 UGH   0      0        0 eth1
168.63.129.16   192.168.2.1     255.255.255.255 UGH   0      0        0 eth0
169.254.169.254 192.168.2.1     255.255.255.255 UGH   0      0        0 eth0
192.168.1.0     0.0.0.0         255.255.255.0   U     0      0        0 eth1
192.168.2.0     0.0.0.0         255.255.255.0   U     0      0        0 eth0
```

模板（添加cidr ip）

```
redundancy
 cloud provider azure 100
  bfd peer
  route-table InsideRoutetable
  default-gateway ip
  cidr ip 8.8.8.8/32
  app-key
  subscription-id
  app-id
  tenant-id
  resource-group CorporateDatacenterResourceGroup
```

注意：在步骤10中，必须在CSR1000v路由器上配置NAT，才能ping通Internet(8.8.8.8)。**注意**：第10-14步包括HA的CSR1000v路由器的配置。 从"配置信任池"开始，提供了《Cisco CSR 1000v Microsoft Azure部署指南》中的缩略步骤。请访问指南，了解完整详细信息。

步骤10.配置CSR1000v路由器。

1. 在两台CSR1000v路由器上配置信任池

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.

Router(config)#crypto pki trustpool import url
http://www.cisco.com/security/pki/trs/ios.p7b
Reading file from http://www.cisco.com/security/pki/trs/ios.p7b
Loading http://www.cisco.com/security/pki/trs/ios.p7b !!!
% PEM files import succeeded.
```

2. 在Cisco CSR 1000v路由器之间配置ipsec隧道，并在路由器之间的隧道上启用双向转发检测

(BFD)和路由协议（EIGRP或BGP），以便进行对等体故障检测。 **注意：**配置中的隧道目标地址是对等CSR的公有IP地址。CSRA配置

```
crypto isakmp policy 1
 encr aes 256
 authentication pre-share
crypto isakmp key cisco address 0.0.0.0
!
crypto ipsec transform-set uni-perf esp-aes 256 esp-sha-hmac
 mode tunnel
!
crypto ipsec profile vti-1
 set security-association lifetime kilobytes disable
 set security-association lifetime seconds 86400
 set transform-set uni-perf
 set pfs group2
!
interface Tunnel1
 ip address 192.168.101.1 255.255.255.252
 bfd interval 500 min_rx 500 multiplier 3
 tunnel source GigabitEthernet1
 tunnel mode ipsec ipv4
 tunnel destination 23.100.122.102 /* Public IP of the peer CSR */
 tunnel protection ipsec profile vti-1
!
router eigrp 1
bfd all-interfaces
network 192.168.101.0
```

CSRB配置

```
crypto isakmp policy 1
 encr aes 256
 authentication pre-share
crypto isakmp key cisco address 0.0.0.0
!
crypto ipsec transform-set uni-perf esp-aes 256 esp-sha-hmac
 mode tunnel
!
crypto ipsec profile vti-1
 set security-association lifetime kilobytes disable
 set security-association lifetime seconds 86400
 set transform-set uni-perf
 set pfs group2
!
interface Tunnel1
 ip address 192.168.101.2 255.255.255.252
 bfd interval 500 min_rx 500 multiplier 3
 tunnel source GigabitEthernet1
 tunnel mode ipsec ipv4
 tunnel destination 40.124.43.82 /* Public IP of the peer CSR */
 tunnel protection ipsec profile vti-1
!
router eigrp 1
bfd all-interfaces
network 192.168.101.0
```

3. CSR1000v路由器上使用相同的NAT和路由配置。这是为了通过内部接口实现VM互联网可达性。

```
interface GigabitEthernet1
 ip nat outside
!
interface GigabitEthernet2
 ip nat inside
!
ip nat inside source list 10 interface GigabitEthernet1 overload
```

```
access-list 10 permit 192.168.1.0 0.0.0.255 /* Translating the inside subnet of the VM */
!
ip route 0.0.0.0 0.0.0.0 192.168.2.1
ip route 192.168.1.0 255.255.255.0 GigabitEthernet2 192.168.1.1
```

4. 为路由表添加访问控制(IAM)。 在AzureCLI中，允许应用程序（CSRA和CSRB）在故障转移期间修改Azure中的InsideRouteTable。 请注意在下一节中用作 — **scopes**选项的InsideRouteTable的ID。

```
$ az network route-table show --resource-group CorporateDatacenterResourceGroup --name
InsideRoutetable
{
  "disableBgpRoutePropagation": false,
  "etag": "W/\"f0c85464-bba0-465a-992a-xxxxxxxxxxxx\"",
  "id": "/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ro
uteTables/InsideRoutetable",
  "location": "southcentralus",
  "name": "InsideRoutetable",

...
```

模板（添加订用ID）

```
redundancy
 cloud provider azure 100
  bfd peer
  route-table InsideRoutetable
  default-gateway ip
  cidr ip 8.8.8.8/32
  app-key
  subscription-id 09e13fd4-xxxx-xxxx-xxxx-xxxxxxxxxxxx
  app-id
  tenant-id
  resource-group CorporateDatacenterResourceGroup
```

5. 为InsideRouteTable创建IAM角色。**-范围**选项取自上一输出的id字段。 注意**app-id**、**password**（即app-key）和租户**id**。

```
$ az ad sp create-for-rbac -n "InsideRouteTableIAM" --role "network contributor" --scopes
/subscriptions/09e13fd4-def2-46aa-xxxx-
xxxxxxxxxxxx/resourceGroups/CorporateDatacenterResourceGroup/providers/Microsoft.Network/ro
uteTables/InsideRoutetable --years 2099
{
"appId": "576dd4f1-c08d-xxxx-xxxx-xxxxxxxxxxxxx",
"displayName": "InsideRouteTableIAM",
"name": "http://InsideRouteTableIAM",
"password": "aaafc573-e84e-42ac-b4e3-xxxxxxxxxxxxx",
"tenant": "ae49849c-2622-xxxx-xxxx-xxxxxxxxxxxxx"
}
```

模板（添加应用密钥、应用ID和租户ID）

```
redundancy
 cloud provider azure 100
  bfd peer
  route-table InsideRoutetable
  default-gateway ip
  cidr ip 8.8.8.8/32
  app-key aaafc573-e84e-42ac-b4e3-xxxxxxxxxxxxx
  subscription-id 09e13fd4-xxxx-xxxx-xxxx-xxxxxxxxxxxx
  app-id 576dd4f1-c08d-46b9-cccc-xxxxxxxxxxxxx
  tenant-id ae49849c-2622-xxxx-xxxx-xxxxxxxxxxxxx
  resource-group CorporateDatacenterResourceGroup
```

6. 在两台路由器上配置云冗余。两台路由器上配置的唯一区别是bfd对等体和默认网关。

CSRA配置

```
redundancy
 cloud provider azure 100
  bfd peer 192.168.101.2
  route-table InsideRoutetable
  default-gateway ip 192.168.1.4
  cidr ip 8.8.8.8/32
  app-key aaafc573-e84e-42ac-b4e3-xxxxxxxxxxxxx
  subscription-id 09e13fd4-xxxx-xxxx-xxxx-xxxxxxxxxxxx
  app-id 576dd4f1-c08d-46b9-cccc-xxxxxxxxxxxxx
  tenant-id ae49849c-2622-xxxx-xxxx-xxxxxxxxxxxxx
  resource-group CorporateDatacenterResourceGroup
```

CSRB配置

```
redundancy
 cloud provider azure 100
  bfd peer 192.168.101.1
  route-table InsideRoutetable
  default-gateway ip 192.168.1.5
  cidr ip 8.8.8.8/32
  app-key aaafc573-e84e-42ac-b4e3-xxxxxxxxxxxxx
  subscription-id 09e13fd4-xxxx-xxxx-xxxx-xxxxxxxxxxxx
  app-id 576dd4f1-c08d-46b9-cccc-xxxxxxxxxxxxx
  tenant-id ae49849c-2622-xxxx-xxxx-xxxxxxxxxxxxx
  resource-group CorporateDatacenterResourceGroup
```

验证高可用性

1. 检查BFD和云配置。

   ```
   CSRA#show ip interface brief
   Interface              IP-Address      OK? Method Status                Protocol
   GigabitEthernet1       192.168.2.4     YES DHCP   up                    up
   GigabitEthernet2       192.168.1.4     YES DHCP   up                    up
   Tunnel1                192.168.101.1   YES manual up                    up

   CSRB#show ip interface brief
   Interface              IP-Address      OK? Method Status                Protocol
   GigabitEthernet1       192.168.2.5     YES DHCP   up                    up
   GigabitEthernet2       192.168.1.5     YES DHCP   up                    up
   Tunnel1                192.168.101.2   YES NVRAM  up                    up

   CSRA#show bfd neighbors

   IPv4 Sessions
   NeighAddr                              LD/RD         RH/RS     State     Int
   192.168.101.2                        4097/4097       Up        Up        Tu1

   CSRA#show redundancy cloud provider azure 100
   Cloud HA: work_in_progress=FALSE
   Provider : AZURE node 100
     State : idle
     BFD peer     = 192.168.101.2
     BFD intf     = Tunnel1
     resource group  = CorporateDatacenterResourceGroup
     subscription id = 09e13fd4-def2-46aa-xxxx-xxxxxxxxxxxx
     tenant id = ae49849c-2622-4d45-b95e-xxxxxxxxxxxx
     application id = 1e0f69c3-b6aa-46cf-b5f9-xxxxxxxxxxxx
     application key = aaafc573-e84e-42ac-b4e3-xxxxxxxxxxxxx
     route-table  = InsideRoutetable
     cidr         = 8.8.8.8/32
     Default Gateway IP = 192.168.1.4
   ```

2. 从VM对目标运行ping和traceroute。确保ping通过内部eth1接口。

   ```
   $ ping -I eth1 8.8.8.8
   PING 8.8.8.8 (8.8.8.8) from 192.168.1.6 eth1: 56(84) bytes of data.
   64 bytes from 8.8.8.8: icmp_seq=1 ttl=54 time=10.5 ms
   ```

```
64 bytes from 8.8.8.8: icmp_seq=2 ttl=54 time=10.6 ms

$ traceroute 8.8.8.8
traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
 1  192.168.1.4 (192.168.1.4)  1.516 ms  1.503 ms  1.479 ms

cisco@VmHost:~$ ping -I eth1 8.8.8.8
PING 8.8.8.8 (8.8.8.8) from 192.168.1.6 eth1: 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=117 time=10.3 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=117 time=10.3 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=117 time=10.3 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=117 time=10.2 ms
```

3. Traceroute显示从VM到8.8.8.8的路径是通过CSRA的内部接口。

```
cisco@VmHost:~$ sudo traceroute -I 8.8.8.8
traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
 1  192.168.1.4 (192.168.1.4)  34.003 ms  34.000 ms  33.998 ms
```

4. 关闭CSRA的tunnel 1接口以模拟故障转移。

```
CSRA#config t
Enter configuration commands, one per line.  End with CNTL/Z.
CSRA(config)#int tunnel1
CSRA(config-if)#sh
```

5. 观察流量现在通过CSRB的专用接口。

```
cisco@VmHost:~$ sudo traceroute -I 8.8.8.8
traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
 1  192.168.1.5 (192.168.1.5)  1.294 ms  1.291 ms  1.290 ms
```

注意：Azure云在故障切换时可能会导致延迟。延迟不应超过1分钟。

故障排除

- 启用调试以观察HA故障切换期间的消息。

```
CSRA#debug redundancy cloud all
CSRA#debug ip http all
```

- 身份验证和凭证错误是由于访问控制无效导致的，该访问控制允许CSR1000v对Azure路由表进行API调用。 仔细检查步骤10中是否配置了正确的ID。

```
*Jul 13 23:29:53.365: CLOUD-HA : res content iov_len=449
iov_base={"error":"invalid_client","error_description":"AADSTS70002:
Error validating credentials. AADSTS50012: Invalid client secret is provided.\r\nTrace ID:
56873e4b-3781-4ee6-8bd9-xxxxxxxxxxxx\r\n
Correlation ID: cce94817-29eb-4ebd-833a-\r\nTimestamp: 2018-07-13
23:29:54Z","error_codes":[70002,50012],"timestamp":"2018-07-13
23:29:54Z","trace_id":"56873e4b-3781-4ee6-8bd9-xxxxxxxxxxxx","correlation_id":"cce94817-29eb-
4ebd-833a"}
```

相关信息

- Azure CLI 2.0
- Cisco CSR 1000v Microsoft Azure部署指南
- 为Azure选择正确的工具并并排选择Azure CLI和PowerShell命令