Contents

What is Azure Container Instances?

1/10/2020 • 2 minutes to read • Edit Online

Containers are becoming the preferred way to package, deploy, and manage cloud applications. Azure Container Instances offers the fastest and simplest way to run a container in Azure, without having to manage any virtual machines and without having to adopt a higher-level service.

Azure Container Instances is a great solution for any scenario that can operate in isolated containers, including simple applications, task automation, and build jobs. For scenarios where you need full container orchestration, including service discovery across multiple containers, automatic scaling, and coordinated application upgrades, we recommend Azure Kubernetes Service (AKS).

Fast startup times

Containers offer significant startup benefits over virtual machines (VMs). Azure Container Instances can start containers in Azure in seconds, without the need to provision and manage VMs.

Container access

Azure Container Instances enables exposing your container groups directly to the internet with an IP address and a fully qualified domain name (FQDN). When you create a container instance, you can specify a custom DNS name label so your application is reachable at *customlabel.azureregion*.azurecontainer.io.

Azure Container Instances also supports executing a command in a running container by providing an interactive shell to help with application development and troubleshooting. Access takes places over HTTPS, using TLS to secure client connections.

IMPORTANT

Starting January 13, 2020, Azure Container Instances will require all secure connections from servers and applications to use TLS 1.2. Support for TLS 1.0 and 1.1 will be retired.

Hypervisor-level security

Historically, containers have offered application dependency isolation and resource governance but have not been considered sufficiently hardened for hostile multi-tenant usage. Azure Container Instances guarantees your application is as isolated in a container as it would be in a VM.

Custom sizes

Containers are typically optimized to run just a single application, but the exact needs of those applications can differ greatly. Azure Container Instances provides optimum utilization by allowing exact specifications of CPU cores and memory. You pay based on what you need and get billed by the second, so you can fine-tune your spending based on actual need.

For compute-intensive jobs such as machine learning, Azure Container Instances can schedule Linux containers to use NVIDIA Tesla GPU resources (preview).

Persistent storage

To retrieve and persist state with Azure Container Instances, we offer direct mounting of Azure Files shares backed by Azure Storage.

Linux and Windows containers

Azure Container Instances can schedule both Windows and Linux containers with the same API. Simply specify the OS type when you create your container groups.

Some features are currently restricted to Linux containers:

- Multiple containers per container group
- Volume mounting (Azure Files, emptyDir, GitRepo, secret)
- Resource usage metrics with Azure Monitor
- Virtual network deployment
- GPU resources (preview)

For Windows container deployments, use images based on common Windows base images.

> **NOTE**
> Use of Windows Server 2019-based images in Azure Container Instances is in preview.

Co-scheduled groups

Azure Container Instances supports scheduling of multi-container groups that share a host machine, local network, storage, and lifecycle. This enables you to combine your main application container with other supporting role containers, such as logging sidecars.

Virtual network deployment

Currently available for production workloads in a subset of Azure regions, this feature of Azure Container Instances enables deployment of container instances into an Azure virtual network. By deploying container instances into a subnet within your virtual network, they can communicate securely with other resources in the virtual network, including those that are on premises (through VPN gateway or ExpressRoute).

Next steps

Try deploying a container to Azure with a single command using our quickstart guide:

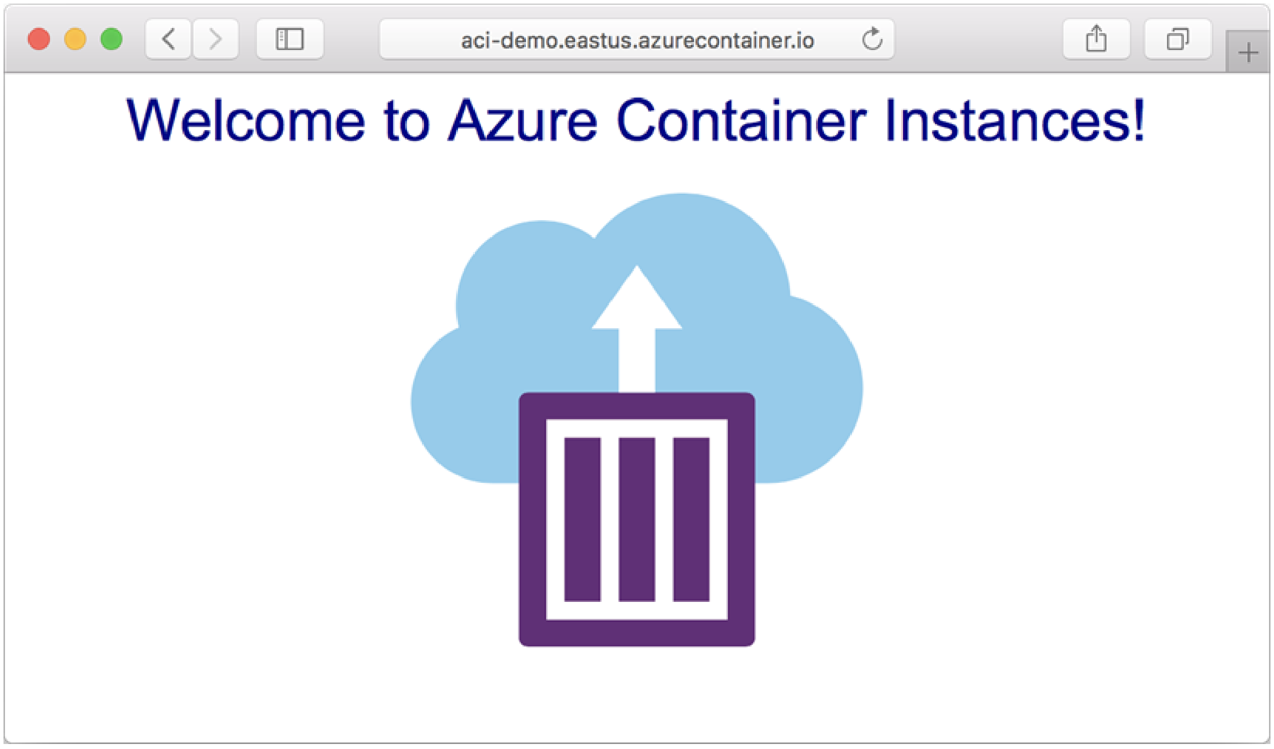
Azure Container Instances Quickstart

Quickstart: Deploy a container instance in Azure using the Azure CLI

11/26/2019 • 6 minutes to read • Edit Online

Use Azure Container Instances to run serverless Docker containers in Azure with simplicity and speed. Deploy an application to a container instance on-demand when you don't need a full container orchestration platform like Azure Kubernetes Service.

In this quickstart, you use the Azure CLI to deploy an isolated Docker container and make its application available with a fully qualified domain name (FQDN). A few seconds after you execute a single deployment command, you can browse to the application running in the container:

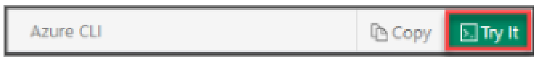

aci-demo.eastus.azurecontainer.io
Welcome to Azure Container Instances!

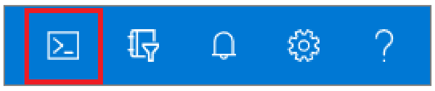
If you don't have an Azure subscription, create a free account before you begin.

Use Azure Cloud Shell

Azure hosts Azure Cloud Shell, an interactive shell environment that you can use through your browser. You can use either Bash or PowerShell with Cloud Shell to work with Azure services. You can use the Cloud Shell preinstalled commands to run the code in this article without having to install anything on your local environment.

To start Azure Cloud Shell:

OPTION	EXAMPLE/LINK
Select **Try It** in the upper-right corner of a code block. Selecting **Try It** doesn't automatically copy the code to Cloud Shell.	
Go to https://shell.azure.com, or select the **Launch Cloud Shell** button to open Cloud Shell in your browser.	

OPTION	EXAMPLE/LINK
Select the **Cloud Shell** button on the menu bar at the upper right in the Azure portal.	

To run the code in this article in Azure Cloud Shell:

1. Start Cloud Shell.
2. Select the **Copy** button on a code block to copy the code.
3. Paste the code into the Cloud Shell session by selecting **Ctrl**+**Shift**+**V** on Windows and Linux or by selecting **Cmd**+**Shift**+**V** on macOS.
4. Select **Enter** to run the code.

You can use the Azure Cloud Shell or a local installation of the Azure CLI to complete this quickstart. If you'd like to use it locally, version 2.0.55 or later is recommended. Run `az --version` to find the version. If you need to install or upgrade, see Install Azure CLI.

Create a resource group

Azure container instances, like all Azure resources, must be deployed into a resource group. Resource groups allow you to organize and manage related Azure resources.

First, create a resource group named *myResourceGroup* in the *eastus* location with the following az group create command:

```
az group create --name myResourceGroup --location eastus
```

Create a container

Now that you have a resource group, you can run a container in Azure. To create a container instance with the Azure CLI, provide a resource group name, container instance name, and Docker container image to the az container create command. In this quickstart, you use the public `mcr.microsoft.com/azuredocs/aci-helloworld` image. This image packages a small web app written in Node.js that serves a static HTML page.

You can expose your containers to the internet by specifying one or more ports to open, a DNS name label, or both. In this quickstart, you deploy a container with a DNS name label so that the web app is publicly reachable.

Execute a command similar to the following to start a container instance. Set a `--dns-name-label` value that's unique within the Azure region where you create the instance. If you receive a "DNS name label not available" error message, try a different DNS name label.

```
az container create --resource-group myResourceGroup --name mycontainer --image
mcr.microsoft.com/azuredocs/aci-helloworld --dns-name-label aci-demo --ports 80
```

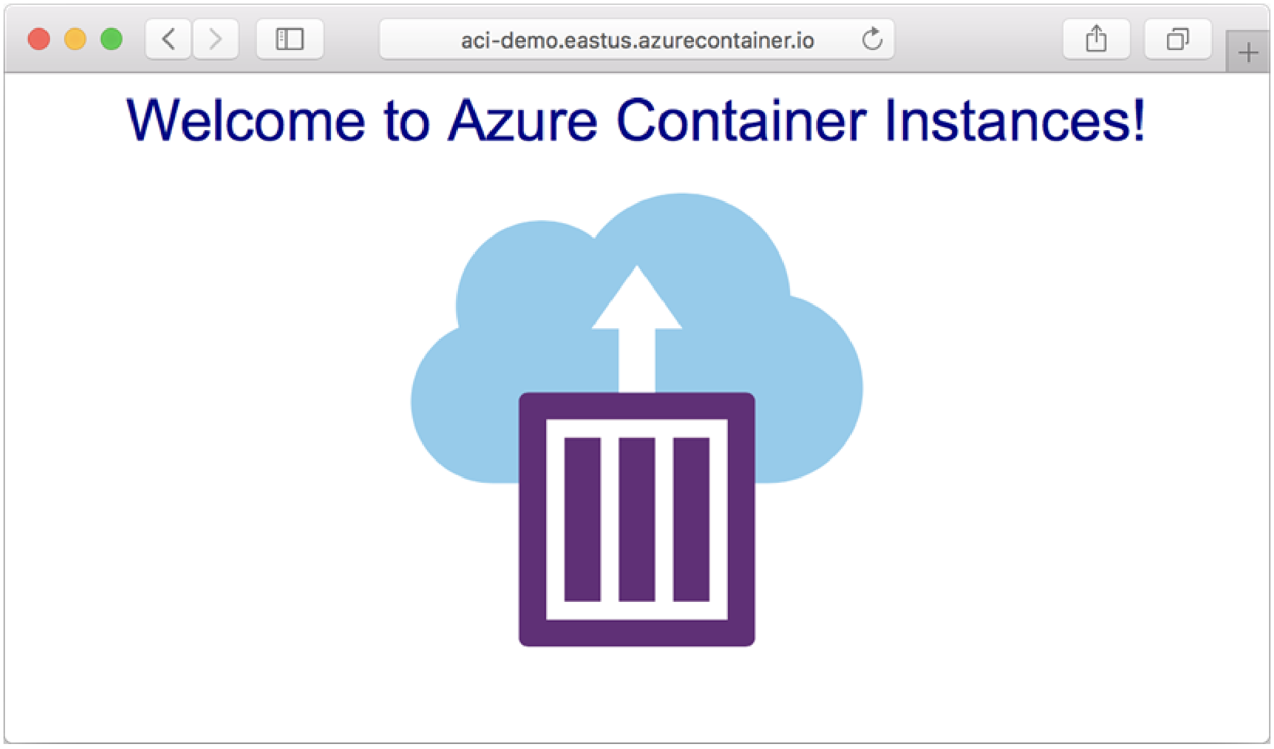
Within a few seconds, you should get a response from the Azure CLI indicating that the deployment has completed. Check its status with the az container show command:

```
az container show --resource-group myResourceGroup --name mycontainer --query "
{FQDN:ipAddress.fqdn,ProvisioningState:provisioningState}" --out table
```

When you run the command, the container's fully qualified domain name (FQDN) and its provisioning state are displayed.

```
$ az container show --resource-group myResourceGroup --name mycontainer --query "
{FQDN:ipAddress.fqdn,ProvisioningState:provisioningState}" --out table
FQDN                               ProvisioningState
---------------------------------  -------------------
aci-demo.eastus.azurecontainer.io  Succeeded
```

If the container's `ProvisioningState` is **Succeeded**, go to its FQDN in your browser. If you see a web page similar to the following, congratulations! You've successfully deployed an application running in a Docker container to Azure.


aci-demo.eastus.azurecontainer.io
Welcome to Azure Container Instances!

If at first the application isn't displayed, you might need to wait a few seconds while DNS propagates, then try refreshing your browser.

Pull the container logs

When you need to troubleshoot a container or the application it runs (or just see its output), start by viewing the container instance's logs.

Pull the container instance logs with the az container logs command:

```
az container logs --resource-group myResourceGroup --name mycontainer
```

The output displays the logs for the container, and should show the HTTP GET requests generated when you viewed the application in your browser.

```
$ az container logs --resource-group myResourceGroup --name mycontainer
listening on port 80
::ffff:10.240.255.55 - - [21/Mar/2019:17:43:53 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windows NT
10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
::ffff:10.240.255.55 - - [21/Mar/2019:17:44:36 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windows NT
10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
::ffff:10.240.255.55 - - [21/Mar/2019:17:44:36 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windows NT
10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
```

Attach output streams

In addition to viewing the logs, you can attach your local standard out and standard error streams to that of the container.

First, execute the az container attach command to attach your local console to the container's output streams:

```
az container attach --resource-group myResourceGroup --name mycontainer
```

Once attached, refresh your browser a few times to generate some additional output. When you're done, detach your console with `Control+C`. You should see output similar to the following:

```
$ az container attach --resource-group myResourceGroup --name mycontainer
Container 'mycontainer' is in state 'Running'...
(count: 1) (last timestamp: 2019-03-21 17:27:20+00:00) pulling image "mcr.microsoft.com/azuredocs/aci-
helloworld"
(count: 1) (last timestamp: 2019-03-21 17:27:24+00:00) Successfully pulled image
"mcr.microsoft.com/azuredocs/aci-helloworld"
(count: 1) (last timestamp: 2019-03-21 17:27:27+00:00) Created container
(count: 1) (last timestamp: 2019-03-21 17:27:27+00:00) Started container

Start streaming logs:
listening on port 80

::ffff:10.240.255.55 - - [21/Mar/2019:17:43:53 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windows NT
10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
::ffff:10.240.255.55 - - [21/Mar/2019:17:44:36 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windows NT
10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
::ffff:10.240.255.55 - - [21/Mar/2019:17:44:36 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windows NT
10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
::ffff:10.240.255.55 - - [21/Mar/2019:17:47:01 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windows NT
10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
::ffff:10.240.255.56 - - [21/Mar/2019:17:47:12 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windows NT
10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
```

Clean up resources

When you're done with the container, remove it using theaz container delete command:

```
az container delete --resource-group myResourceGroup --name mycontainer
```

To verify that the container has been deleted, execute the az container list command:

```
az container list --resource-group myResourceGroup --output table
```

The **mycontainer** container should not appear in the command's output. If you have no other containers in the resource group, no output is displayed.

If you're done with the *myResourceGroup* resource group and all the resources it contains, delete it with the az group delete command:

```
az group delete --name myResourceGroup
```

Next steps

In this quickstart, you created an Azure container instance by using a public Microsoft image. If you'd like to build a container image and deploy it from a private Azure container registry, continue to the Azure Container Instances tutorial.

Azure Container Instances tutorial

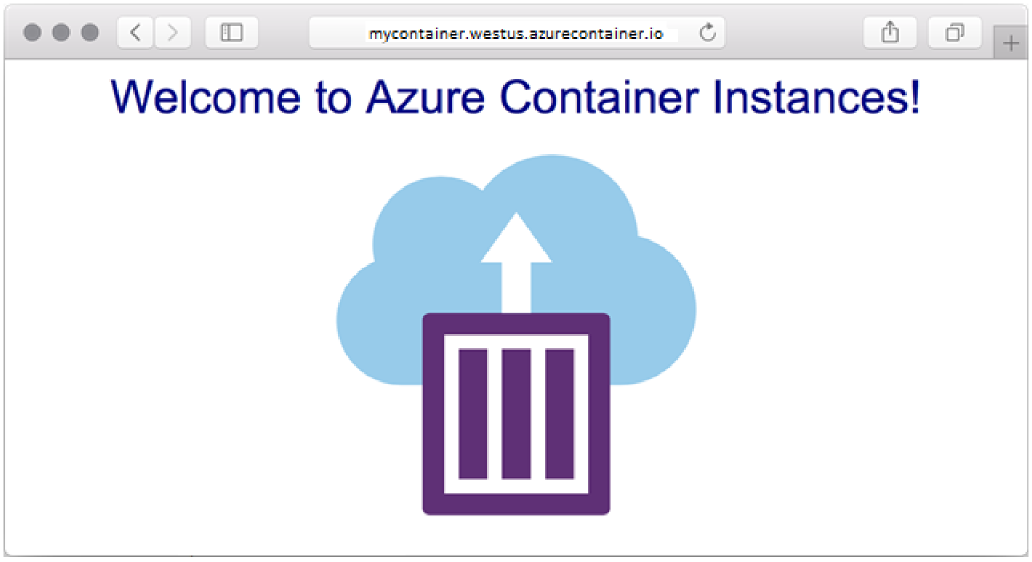
To try out options for running containers in an orchestration system on Azure, see the Azure Kubernetes Service (AKS) quickstarts.

Quickstart: Deploy a container instance in Azure using the Azure portal

11/26/2019 • 2 minutes to read • Edit Online

Use Azure Container Instances to run serverless Docker containers in Azure with simplicity and speed. Deploy an application to a container instance on-demand when you don't need a full container orchestration platform like Azure Kubernetes Service.

In this quickstart, you use the Azure portal to deploy an isolated Docker container and make its application available with a fully qualified domain name (FQDN). After configuring a few settings and deploying the container, you can browse to the running application:


mycontainer.westus.azurecontainer.io
Welcome to Azure Container Instances!

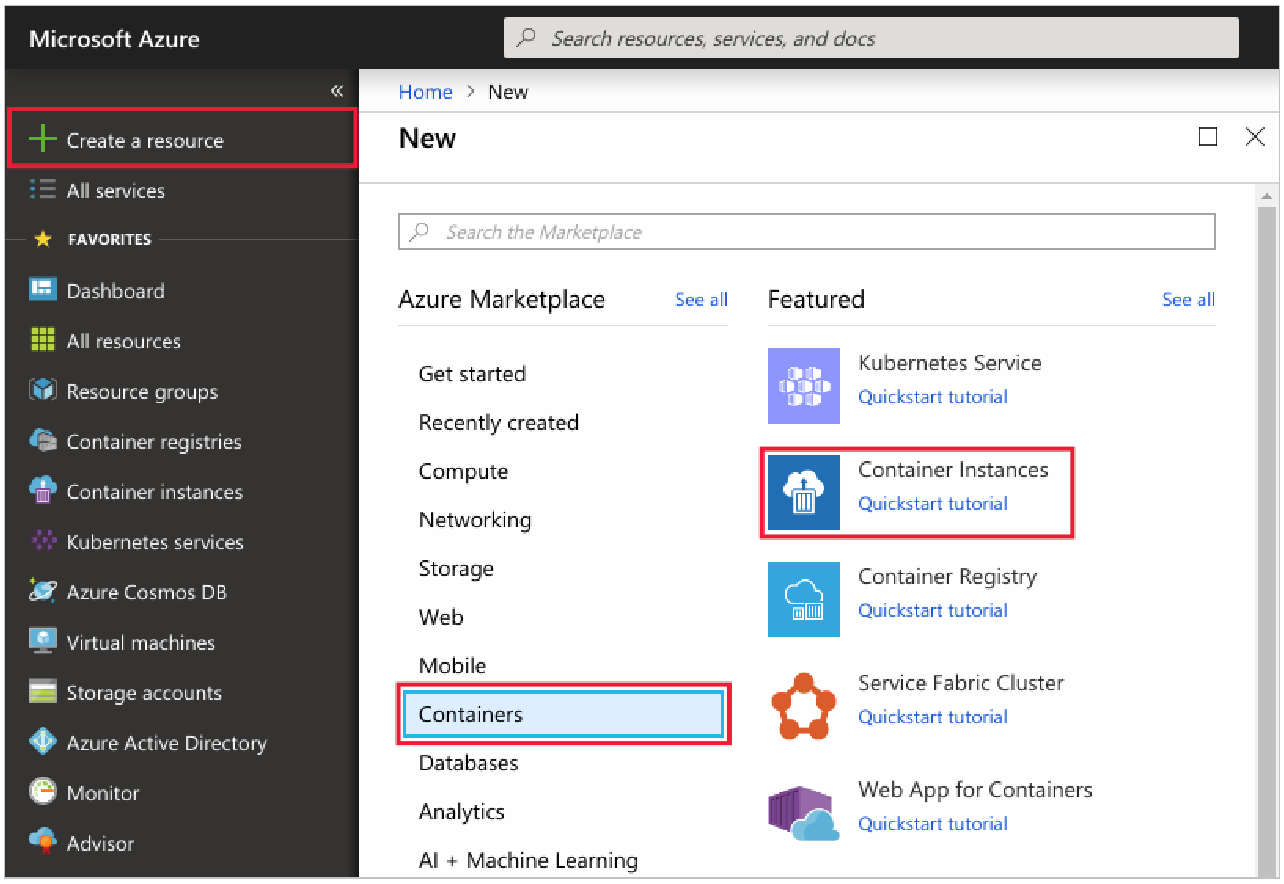
Sign in to Azure

Sign in to the Azure portal at https://portal.azure.com.

If you don't have an Azure subscription, create a free account before you begin.

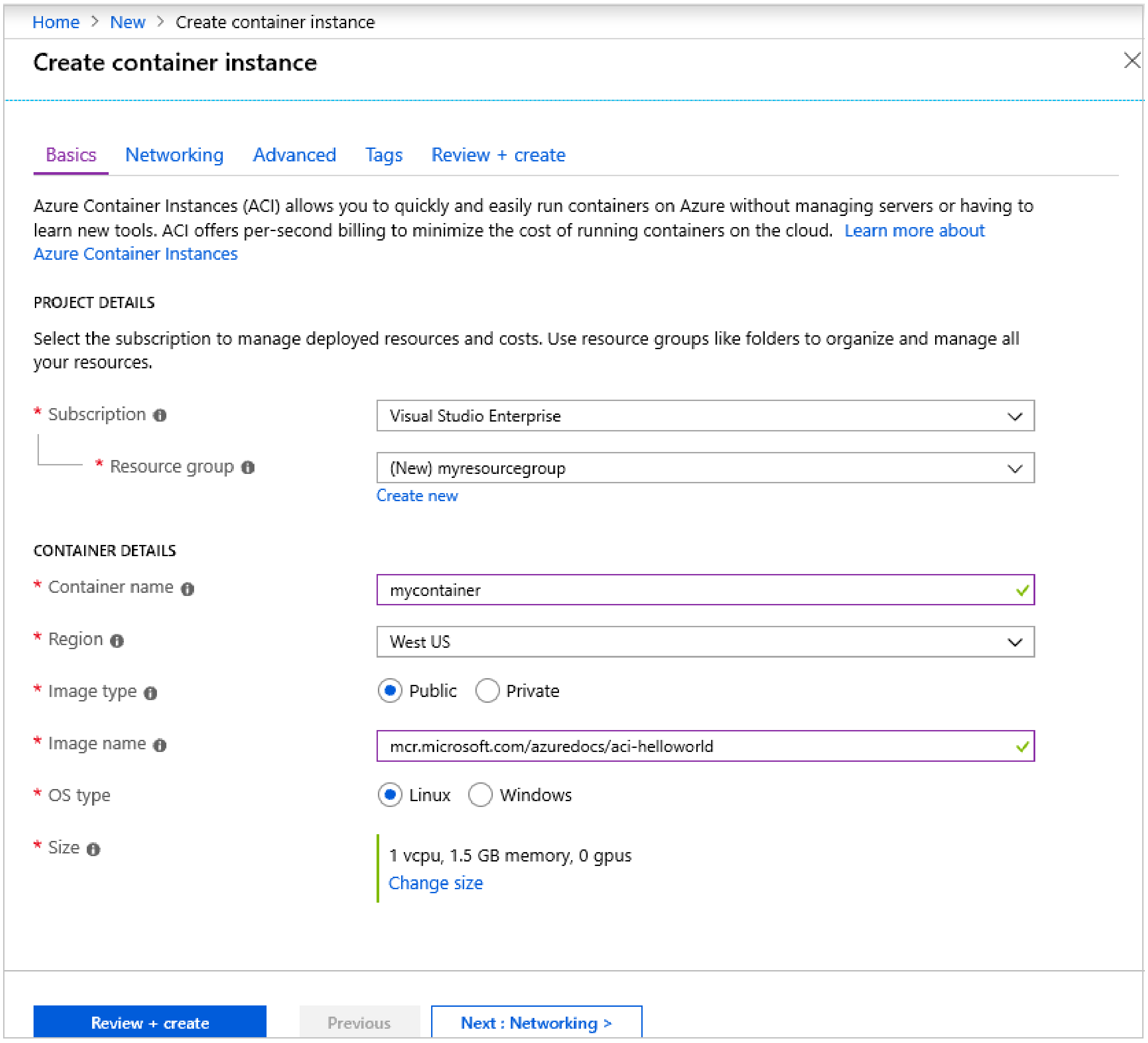
Create a container instance

Select the **Create a resource** > **Containers** > **Container Instances**.



On the **Basics** page, enter the following values in the **Resource group**, **Container name**, and **Container image** text boxes. Leave the other values at their defaults, then select **OK**.

- Resource group: **Create new** > `myresourcegroup`
- Container name: `mycontainer`
- Container image: `mcr.microsoft.com/azuredocs/aci-helloworld`


Home > New > Create container instance

Create container instance

Basics | Networking | Advanced | Tags | Review + create

Azure Container Instances (ACI) allows you to quickly and easily run containers on Azure without managing servers or having to learn new tools. ACI offers per-second billing to minimize the cost of running containers on the cloud. Learn more about Azure Container Instances

PROJECT DETAILS

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

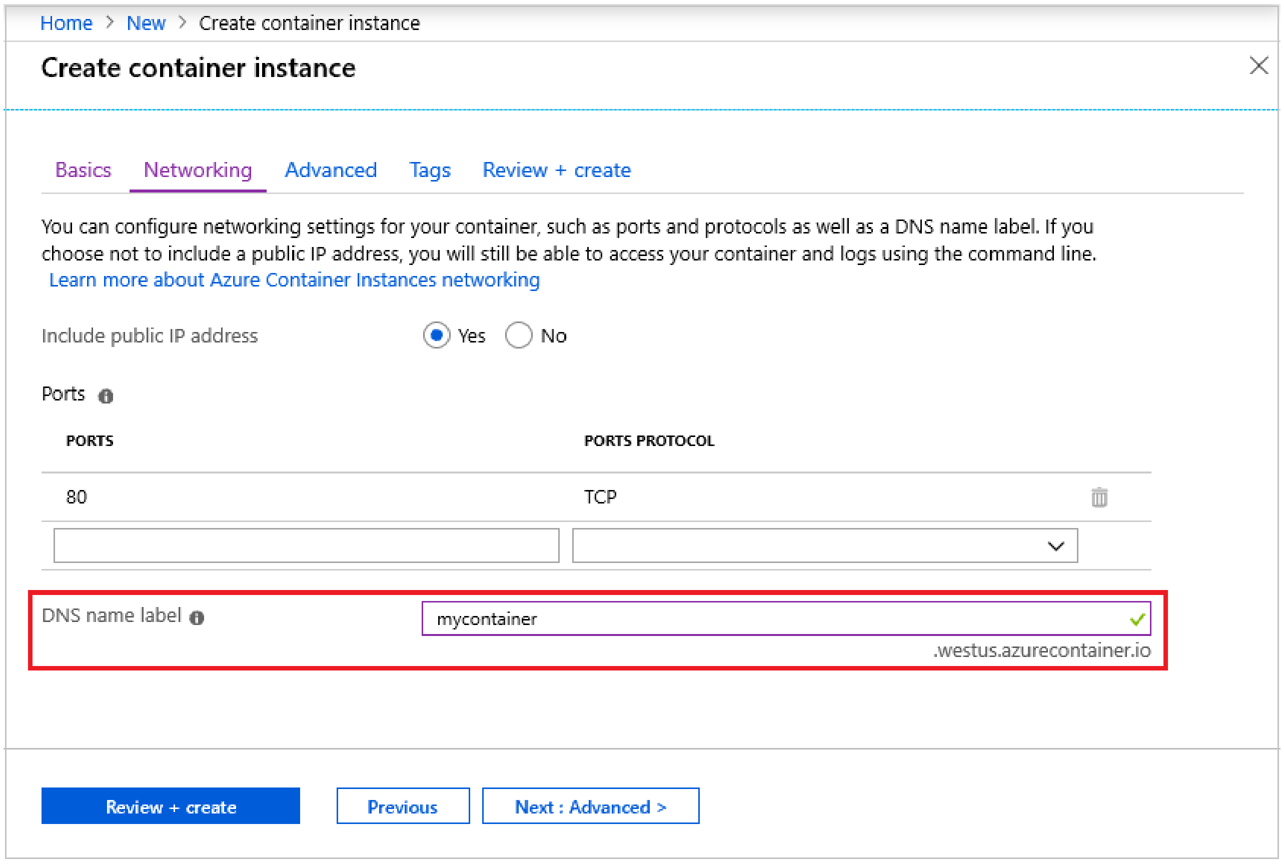
* Subscription	Visual Studio Enterprise
* Resource group	(New) myresourcegroup Create new

CONTAINER DETAILS

* Container name	mycontainer
* Region	West US
* Image type	[✓ Public] Private
* Image name	mcr.microsoft.com/azuredocs/aci-helloworld
* OS type	[✓ Linux] Windows
* Size	1 vcpu, 1.5 GB memory, 0 gpus Change size

For this quickstart, you use the default **Image type** setting of **Public** to deploy the public Microsoft `aci-helloworld` image. This Linux image packages a small web app written in Node.js that serves a static HTML page.

On the **Networking** page, specify a **DNS name label** for your container. The name must be unique within the Azure region where you create the container instance. Your container will be publicly reachable at `<dns-name-label>.<region>.azurecontainer.io`. If you receive a "DNS name label not available" error message, try a different DNS name label.


Home > New > Create container instance

Create container instance

Basics | Networking | Advanced | Tags | Review + create

You can configure networking settings for your container, such as ports and protocols as well as a DNS name label. If you choose not to include a public IP address, you will still be able to access your container and logs using the command line.
Learn more about Azure Container Instances networking

Include public IP address [✓ Yes] No

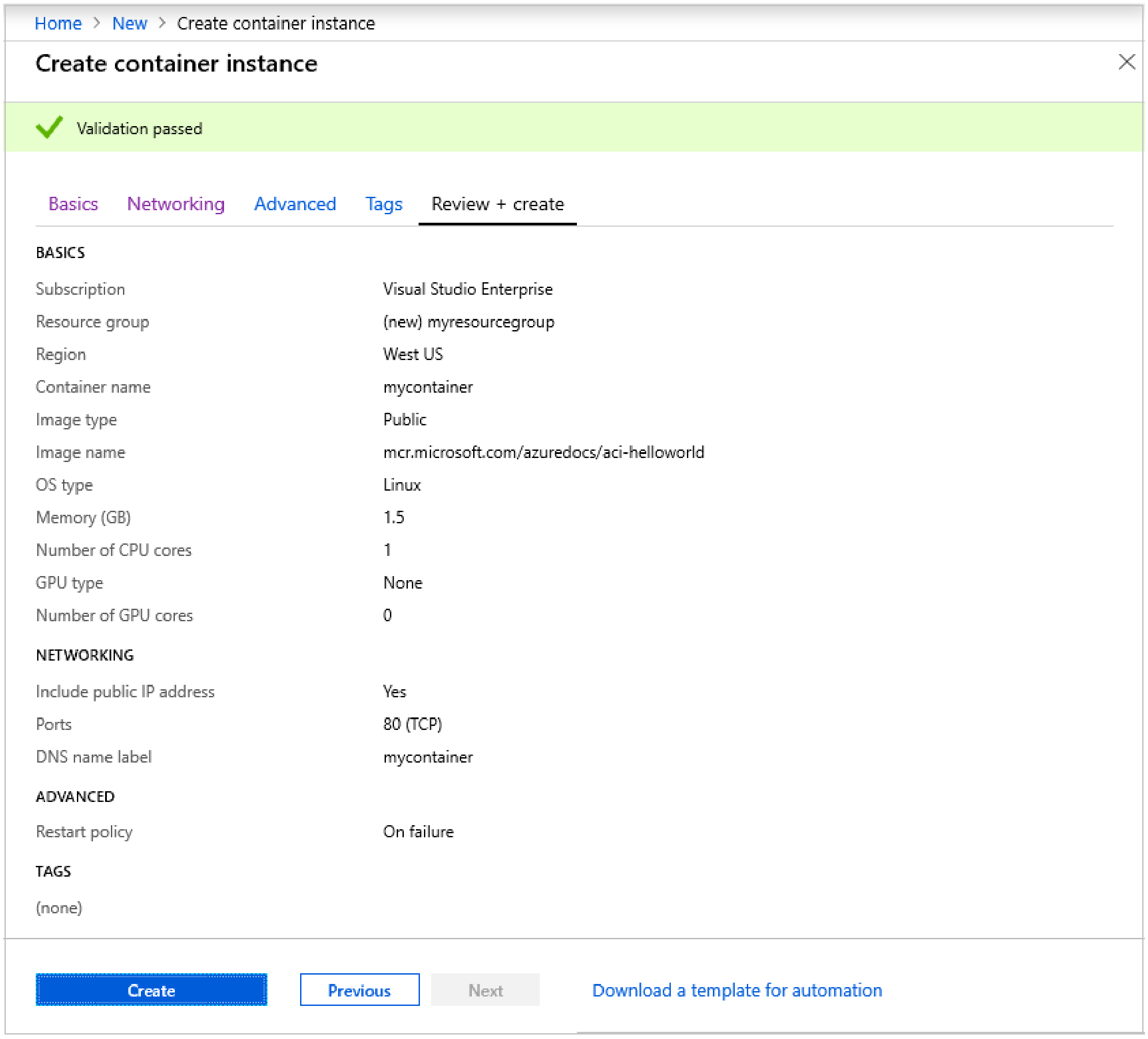
Ports

PORTS	PORTS PROTOCOL
80	TCP

DNS name label: mycontainer ✓ .westus.azurecontainer.io

Leave the other settings at their defaults, then select **Review + create**.

When the validation completes, you're shown a summary of the container's settings. Select **Create** to submit your container deployment request.


Home > New > Create container instance
Create container instance
Validation passed
Basics
Networking
Advanced
Tags
Review + create

BASICS

Subscription	Visual Studio Enterprise
Resource group	(new) myresourcegroup
Region	West US
Container name	mycontainer
Image type	Public
Image name	mcr.microsoft.com/azuredocs/aci-helloworld
OS type	Linux
Memory (GB)	1.5
Number of CPU cores	1
GPU type	None
Number of GPU cores	0

NETWORKING

Include public IP address	Yes
Ports	80 (TCP)
DNS name label	mycontainer

ADVANCED

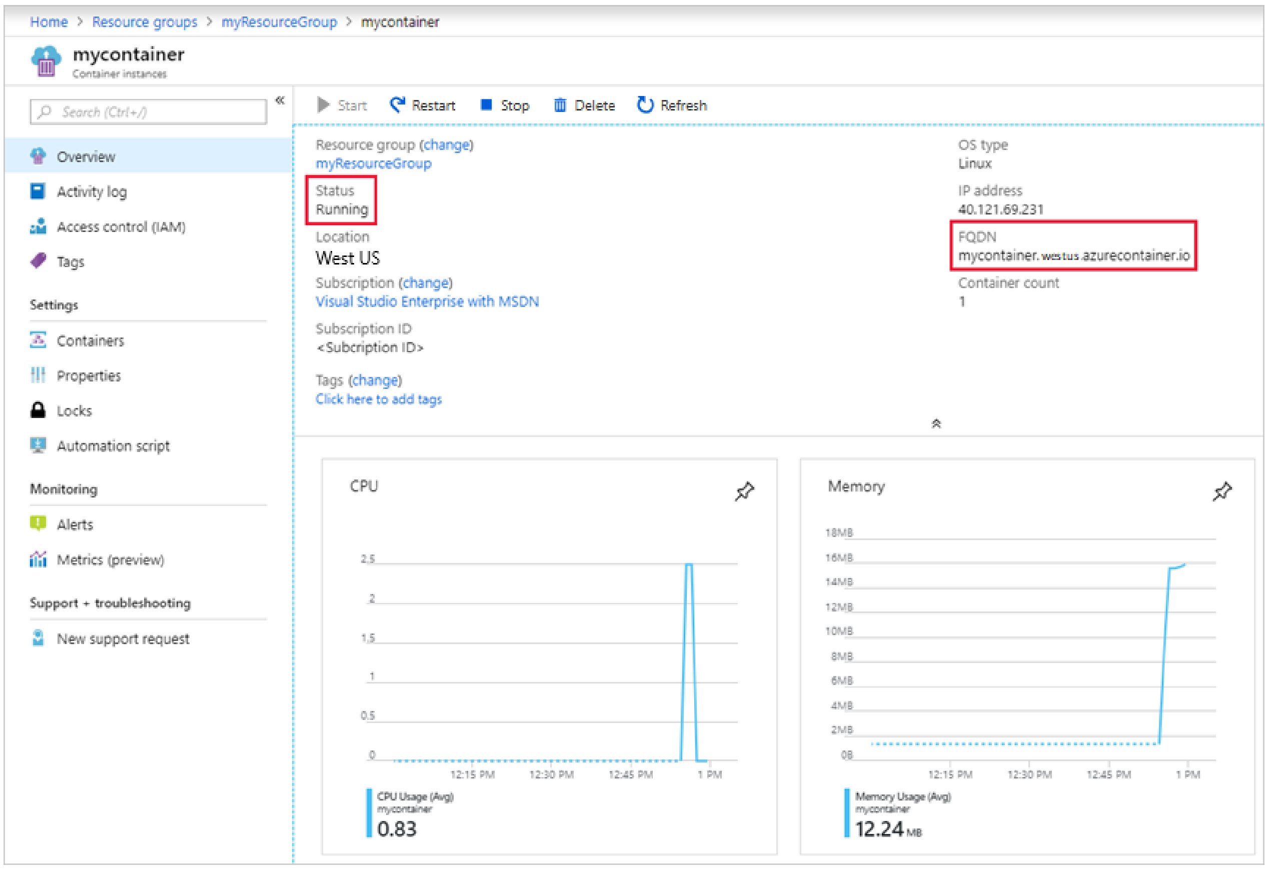
Restart policy	On failure

TAGS

(none)

When deployment starts, a notification appears indicating the deployment is in progress. Another notification is displayed when the container group has been deployed.

Open the overview for the container group by navigating to **Resource Groups** > **myresourcegroup** > **mycontainer**. Take note of the **FQDN** (the fully qualified domain name) of the container instance, as well its **Status**.

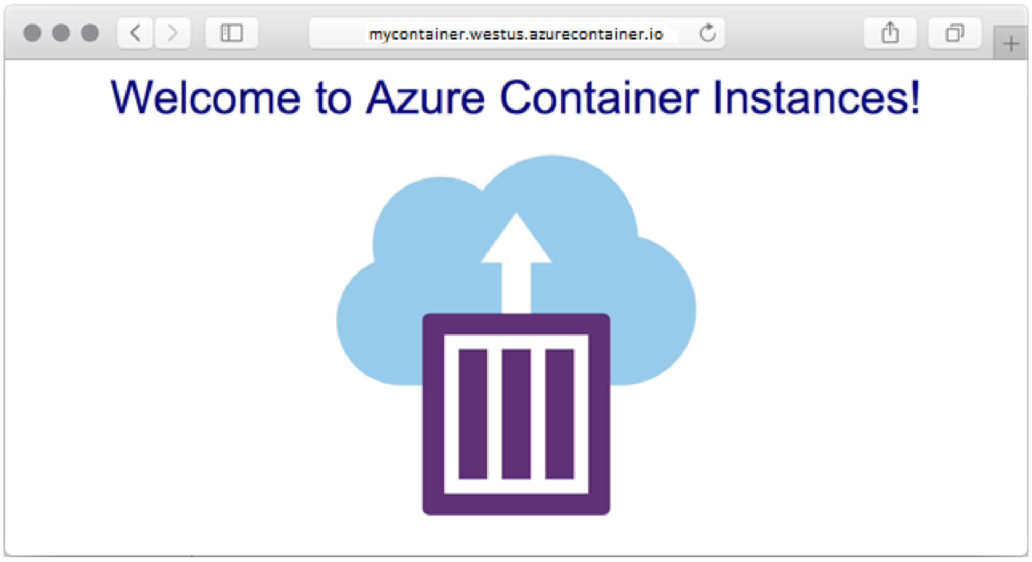


Resource group (change)
myResourceGroup
Status
Running
Location
West US
Subscription (change)
Visual Studio Enterprise with MSDN
Subscription ID
<Subcription ID>
Tags (change)
Click here to add tags

OS type
Linux
IP address
40.121.69.231
FQDN
mycontainer.westus.azurecontainer.io
Container count
1

CPU Usage (Avg) mycontainer 0.83
Memory Usage (Avg) mycontainer 12.24 MB

Once its **Status** is *Running*, navigate to the container's FQDN in your browser.



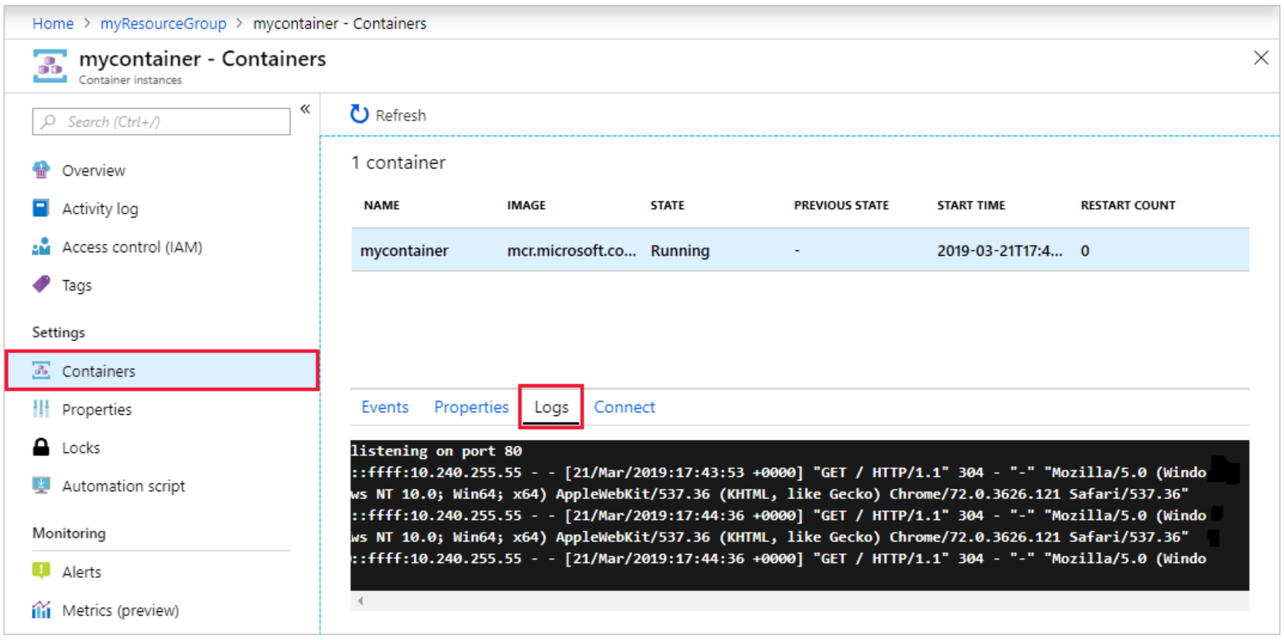
mycontainer.westus.azurecontainer.io
Welcome to Azure Container Instances!

Congratulations! By configuring just a few settings, you've deployed a publicly accessible application in Azure Container Instances.

View container logs

Viewing the logs for a container instance is helpful when troubleshooting issues with your container or the application it runs.

To view the container's logs, under **Settings**, select **Containers**, then **Logs**. You should see the HTTP GET request generated when you viewed the application in your browser.



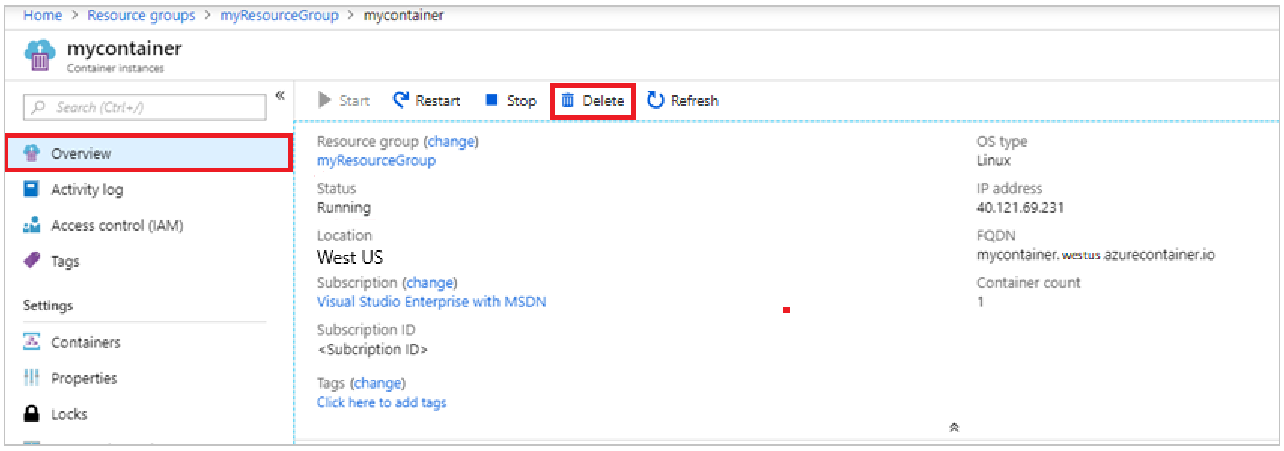
1 container

NAME	IMAGE	STATE	PREVIOUS STATE	START TIME	RESTART COUNT
mycontainer	mcr.microsoft.co...	Running	-	2019-03-21T17:4...	0

```
listening on port 80
::ffff:10.240.255.55 - - [21/Mar/2019:17:43:53 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windo
ws NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
::ffff:10.240.255.55 - - [21/Mar/2019:17:44:36 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windo
ws NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/72.0.3626.121 Safari/537.36"
::ffff:10.240.255.55 - - [21/Mar/2019:17:44:36 +0000] "GET / HTTP/1.1" 304 - "-" "Mozilla/5.0 (Windo
```

Clean up resources

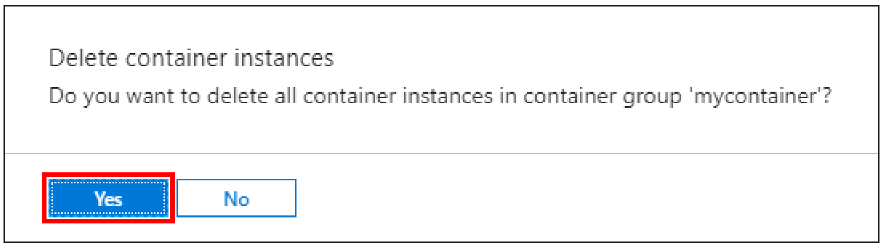
When you're done with the container, select**Overview** for the *mycontainer* container instance, then select **Delete**.



Resource group (change)
myResourceGroup
Status
Running
Location
West US
Subscription (change)
Visual Studio Enterprise with MSDN
Subscription ID
<Subcription ID>
Tags (change)
Click here to add tags

OS type
Linux
IP address
40.121.69.231
FQDN
mycontainer.westus.azurecontainer.io
Container count
1

Select **Yes** when the confirmation dialog appears.


Delete container instances
Do you want to delete all container instances in container group 'mycontainer'?

Next steps

In this quickstart, you created an Azure container instance from a public Microsoft image. If you'd like to build a container image and deploy it from a private Azure container registry, continue to the Azure Container Instances tutorial.

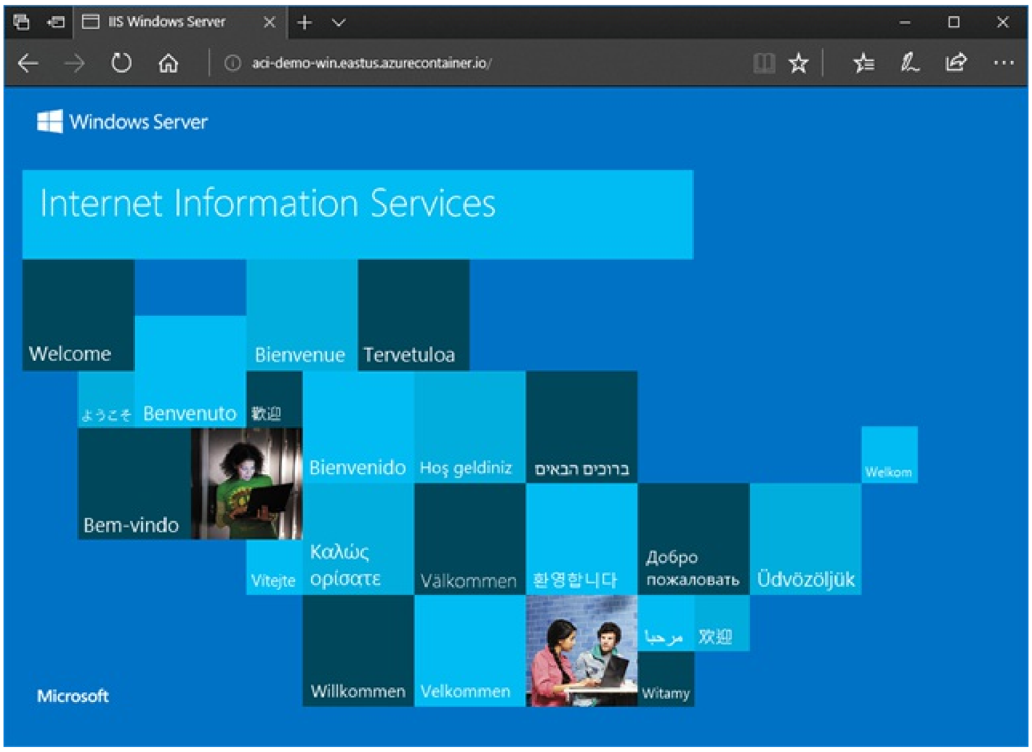
Azure Container Instances tutorial

Quickstart: Deploy a container instance in Azure using Azure PowerShell

11/26/2019 • 4 minutes to read • Edit Online

Use Azure Container Instances to run serverless Docker containers in Azure with simplicity and speed. Deploy an application to a container instance on-demand when you don't need a full container orchestration platform like Azure Kubernetes Service.

In this quickstart, you use Azure PowerShell to deploy an isolated Windows container and make its application available with a fully qualified domain name (FQDN). A few seconds after you execute a single deployment command, you can browse to the application running in the container:



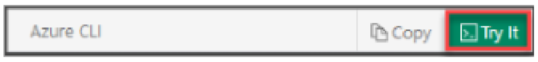
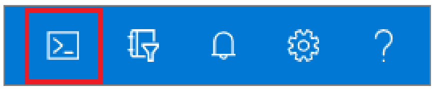
If you don't have an Azure subscription, create a free account before you begin.

> **NOTE**
>
> This article has been updated to use the new Azure PowerShell Az module. You can still use the AzureRM module, which will continue to receive bug fixes until at least December 2020. To learn more about the new Az module and AzureRM compatibility, see Introducing the new Azure PowerShell Az module. For Az module installation instructions, see Install Azure PowerShell.

Use Azure Cloud Shell

Azure hosts Azure Cloud Shell, an interactive shell environment that you can use through your browser. You can use either Bash or PowerShell with Cloud Shell to work with Azure services. You can use the Cloud Shell preinstalled commands to run the code in this article without having to install anything on your local environment.

To start Azure Cloud Shell:

OPTION	EXAMPLE/LINK
Select **Try It** in the upper-right corner of a code block. Selecting **Try It** doesn't automatically copy the code to Cloud Shell.	
Go to https://shell.azure.com, or select the **Launch Cloud Shell** button to open Cloud Shell in your browser.	
Select the **Cloud Shell** button on the menu bar at the upper right in the Azure portal.	

To run the code in this article in Azure Cloud Shell:

1. Start Cloud Shell.
2. Select the **Copy** button on a code block to copy the code.
3. Paste the code into the Cloud Shell session by selecting **Ctrl**+**Shift**+**V** on Windows and Linux or by selecting **Cmd**+**Shift**+**V** on macOS.
4. Select **Enter** to run the code.

If you choose to install and use the PowerShell locally, this tutorial requires the Azure PowerShell module. Run `Get-Module -ListAvailable Az` to find the version. If you need to upgrade, see Install Azure PowerShell module. If you are running PowerShell locally, you also need to run `Connect-AzAccount` to create a connection with Azure.

Create a resource group

Azure container instances, like all Azure resources, must be deployed into a resource group. Resource groups allow you to organize and manage related Azure resources.

First, create a resource group named *myResourceGroup* in the *eastus* location with the following New-AzResourceGroup command:

```
New-AzResourceGroup -Name myResourceGroup -Location EastUS
```

Create a container

Now that you have a resource group, you can run a container in Azure. To create a container instance with Azure PowerShell, provide a resource group name, container instance name, and Docker container image to the New-AzContainerGroup cmdlet. In this quickstart, you use the public `mcr.microsoft.com/windows/servercore/iis:nanoserver` image. This image packages Microsoft Internet Information Services (IIS) to run in Nano Server.

You can expose your containers to the internet by specifying one or more ports to open, a DNS name label, or both. In this quickstart, you deploy a container with a DNS name label so that IIS is publicly reachable.

Execute a command similar to the following to start a container instance. Set a `-DnsNameLabel` value that's unique within the Azure region where you create the instance. If you receive a "DNS name label not available" error message, try a different DNS name label.

```
New-AzContainerGroup -ResourceGroupName myResourceGroup -Name mycontainer -Image
mcr.microsoft.com/windows/servercore/iis:nanoserver -OsType Windows -DnsNameLabel aci-demo-win
```

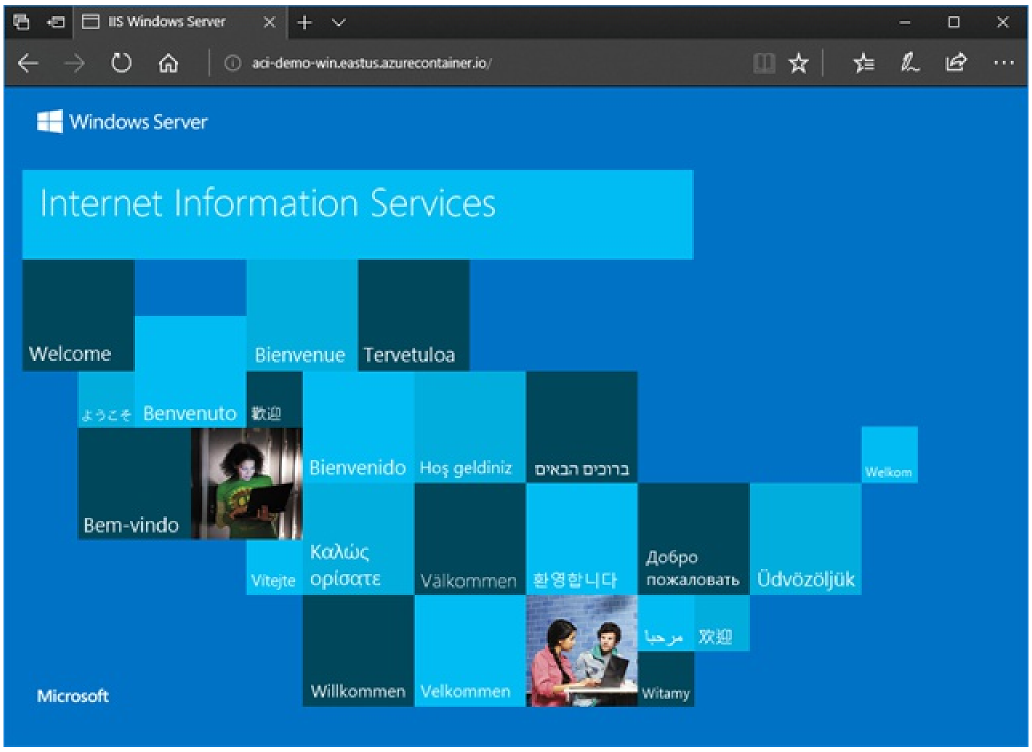
Within a few seconds, you should receive a response from Azure. The container's `ProvisioningState` is initially **Creating**, but should move to **Succeeded** within a minute or two. Check the deployment state with the Get-AzContainerGroup cmdlet:

```
Get-AzContainerGroup -ResourceGroupName myResourceGroup -Name mycontainer
```

The container's provisioning state, fully qualified domain name (FQDN), and IP address appear in the cmdlet's output:

```
PS Azure:\> Get-AzContainerGroup -ResourceGroupName myResourceGroup -Name mycontainer


ResourceGroupName        : myResourceGroup
Id                       : /subscriptions/<Subscription
ID>/resourceGroups/myResourceGroup/providers/Microsoft.ContainerInstance/containerGroups/mycontainer
Name                     : mycontainer
Type                     : Microsoft.ContainerInstance/containerGroups
Location                 : eastus
Tags                     :
ProvisioningState        : Creating
Containers               : {mycontainer}
ImageRegistryCredentials :
RestartPolicy            : Always
IpAddress                : 52.226.19.87
DnsNameLabel             : aci-demo-win
Fqdn                     : aci-demo-win.eastus.azurecontainer.io
Ports                    : {80}
OsType                   : Windows
Volumes                  :
State                    : Pending
Events                   : {}
```

Once the container's `ProvisioningState` is **Succeeded**, navigate to its `Fqdn` in your browser. If you see a web page similar to the following, congratulations! You've successfully deployed an application running in a Docker container to Azure.



Clean up resources

When you're done with the container, remove it with theRemove-AzContainerGroup cmdlet:

```
Remove-AzContainerGroup -ResourceGroupName myResourceGroup -Name mycontainer
```

Next steps

In this quickstart, you created an Azure container instance from an image in the public Docker Hub registry. If you'd like to build a container image and deploy it from a private Azure container registry, continue to the Azure Container Instances tutorial.

Azure Container Instances tutorial

Tutorial: Create a container image for deployment to Azure Container Instances

11/26/2019 • 3 minutes to read • Edit Online

Azure Container Instances enables deployment of Docker containers onto Azure infrastructure without provisioning any virtual machines or adopting a higher-level service. In this tutorial, you package a small Node.js web application into a container image that can be run using Azure Container Instances.

In this article, part one of the series, you:

- Clone application source code from GitHub
- Create a container image from application source
- Test the image in a local Docker environment

In tutorial parts two and three, you upload your image to Azure Container Registry, and then deploy it to Azure Container Instances.

Before you begin

You must satisfy the following requirements to complete this tutorial:

Azure CLI: You must have Azure CLI version 2.0.29 or later installed on your local computer. Run `az --version` to find the version. If you need to install or upgrade, see Install the Azure CLI.

Docker: This tutorial assumes a basic understanding of core Docker concepts like containers, container images, and basic `docker` commands. For a primer on Docker and container basics, see the Docker overview.

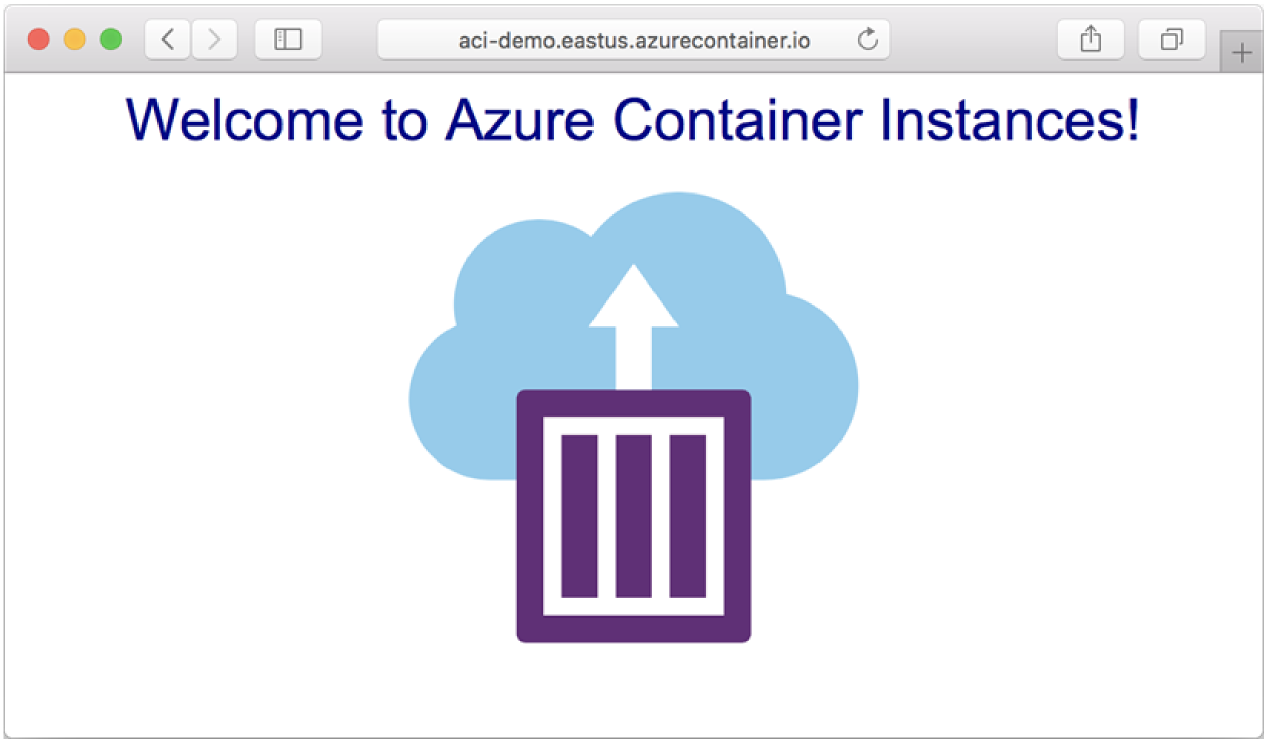
Docker: To complete this tutorial, you need Docker installed locally. Docker provides packages that configure the Docker environment on macOS, Windows, and Linux.

IMPORTANT

Because the Azure Cloud shell does not include the Docker daemon, you *must* install both the Azure CLI and Docker Engine on your *local computer* to complete this tutorial. You cannot use the Azure Cloud Shell for this tutorial.

Get application code

The sample application in this tutorial is a simple web app built in Node.js. The application serves a static HTML page, and looks similar to the following screenshot:


aci-demo.eastus.azurecontainer.io
Welcome to Azure Container Instances!

Use Git to clone the sample application's repository:

```
git clone https://github.com/Azure-Samples/aci-helloworld.git
```

You can also download the ZIP archive from GitHub directly.

Build the container image

The Dockerfile in the sample application shows how the container is built. It starts from an official Node.js image based on Alpine Linux, a small distribution that is well suited for use with containers. It then copies the application files into the container, installs dependencies using the Node Package Manager, and finally, starts the application.

```
FROM node:8.9.3-alpine
RUN mkdir -p /usr/src/app
COPY ./app/ /usr/src/app/
WORKDIR /usr/src/app
RUN npm install
CMD node /usr/src/app/index.js
```

Use the docker build command to create the container image and tag it as *aci-tutorial-app*:

```
docker build ./aci-helloworld -t aci-tutorial-app
```

Output from the docker build command is similar to the following (truncated for readability):

```
$ docker build ./aci-helloworld -t aci-tutorial-app
Sending build context to Docker daemon  119.3kB
Step 1/6 : FROM node:8.9.3-alpine
8.9.3-alpine: Pulling from library/node
88286f41530e: Pull complete
84f3a4bf8410: Pull complete
d0d9b2214720: Pull complete
Digest: sha256:c73277ccc763752b42bb2400d1aaecb4e3d32e3a9dbedd0e49885c71bea07354
Status: Downloaded newer image for node:8.9.3-alpine
 ---> 90f5ee24bee2
...
Step 6/6 : CMD node /usr/src/app/index.js
 ---> Running in f4a1ea099eec
 ---> 6edad76d09e9
Removing intermediate container f4a1ea099eec
Successfully built 6edad76d09e9
Successfully tagged aci-tutorial-app:latest
```

Use the docker images command to see the built image:

```
docker images
```

Your newly built image should appear in the list:

```
$ docker images
REPOSITORY          TAG       IMAGE ID        CREATED            SIZE
aci-tutorial-app    latest    5c745774dfa9    39 seconds ago     68.1 MB
```

Run the container locally

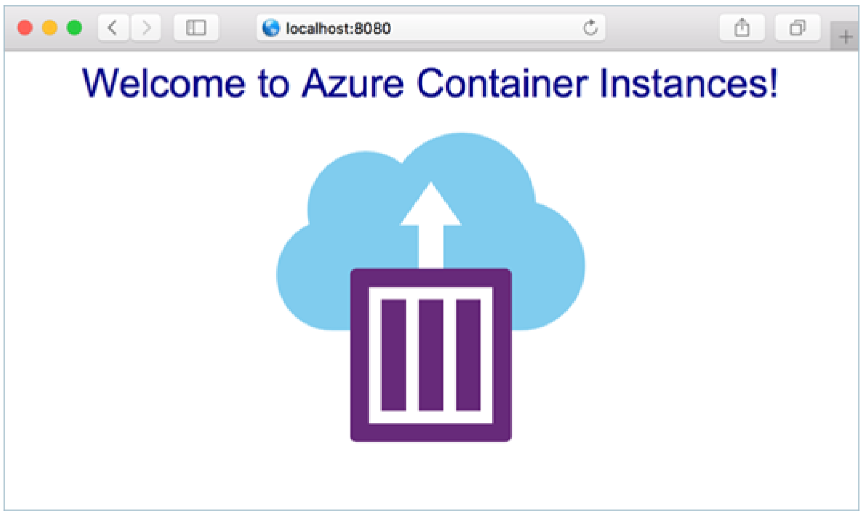
Before you deploy the container to Azure Container Instances, use docker run to run it locally and confirm that it works. The `-d` switch lets the container run in the background, while `-p` allows you to map an arbitrary port on your computer to port 80 in the container.

```
docker run -d -p 8080:80 aci-tutorial-app
```

Output from the `docker run` command displays the running container's ID if the command was successful:

```
$ docker run -d -p 8080:80 aci-tutorial-app
a2e3e4435db58ab0c664ce521854c2e1a1bda88c9cf2fcff46aedf48df86cccf
```

Now, navigate to `http://localhost:8080` in your browser to confirm that the container is running. You should see a web page similar to the following:



Next steps

In this tutorial, you created a container image that can be deployed in Azure Container Instances, and verified that it runs locally. So far, you've done the following:

- Cloned the application source from GitHub
- Created a container image from the application source
- Tested the container locally

Advance to the next tutorial in the series to learn about storing your container image in Azure Container Registry:

Push image to Azure Container Registry

Tutorial: Create an Azure container registry and push a container image

12/30/2019 • 5 minutes to read • Edit Online

This is part two of a three-part tutorial. Part one of the tutorial created a Docker container image for a Node.js web application. In this tutorial, you push the image to Azure Container Registry. If you haven't yet created the container image, return to Tutorial 1 – Create container image.

Azure Container Registry is your private Docker registry in Azure. In this tutorial, part two of the series, you:

- Create an Azure Container Registry instance with the Azure CLI
- Tag a container image for your Azure container registry
- Upload the image to your registry

In the next article, the last in the series, you deploy the container from your private registry to Azure Container Instances.

Before you begin

You must satisfy the following requirements to complete this tutorial:

Azure CLI: You must have Azure CLI version 2.0.29 or later installed on your local computer. Run `az --version` to find the version. If you need to install or upgrade, see Install the Azure CLI.

Docker: This tutorial assumes a basic understanding of core Docker concepts like containers, container images, and basic `docker` commands. For a primer on Docker and container basics, see the Docker overview.

Docker: To complete this tutorial, you need Docker installed locally. Docker provides packages that configure the Docker environment on macOS, Windows, and Linux.

IMPORTANT

Because the Azure Cloud shell does not include the Docker daemon, you *must* install both the Azure CLI and Docker Engine on your *local computer* to complete this tutorial. You cannot use the Azure Cloud Shell for this tutorial.

Create Azure container registry

Before you create your container registry, you need a *resource group* to deploy it to. A resource group is a logical collection into which all Azure resources are deployed and managed.

Create a resource group with the az group create command. In the following example, a resource group named *myResourceGroup* is created in the *eastus* region:

```
az group create --name myResourceGroup --location eastus
```

Once you've created the resource group, create an Azure container registry with the az acr create command. The container registry name must be unique within Azure, and contain 5-50 alphanumeric characters. Replace `<acrName>` with a unique name for your registry:

```
az acr create --resource-group myResourceGroup --name <acrName> --sku Basic
```

Here's example output for a new Azure container registry named *mycontainerregistry082* (shown here truncated):

```
$ az acr create --resource-group myResourceGroup --name mycontainerregistry082 --sku Basic
...
{
  "creationDate": "2018-03-16T21:54:47.297875+00:00",
  "id": "/subscriptions/<Subscription
ID>/resourceGroups/myResourceGroup/providers/Microsoft.ContainerRegistry/registries/mycontainerregistry082",
  "location": "eastus",
  "loginServer": "mycontainerregistry082.azurecr.io",
  "name": "mycontainerregistry082",
  "provisioningState": "Succeeded",
  "resourceGroup": "myResourceGroup",
  "sku": {
    "name": "Basic",
    "tier": "Basic"
  },
  "status": null,
  "storageAccount": null,
  "tags": {},
  "type": "Microsoft.ContainerRegistry/registries"
}
```

The rest of the tutorial refers to `<acrName>` as a placeholder for the container registry name that you chose in this step.

Log in to container registry

You must log in to your Azure Container Registry instance before pushing images to it. Use the az acr login command to complete the operation. You must provide the unique name you chose for the container registry when you created it.

```
az acr login --name <acrName>
```

The command returns `Login Succeeded` once completed:

```
$ az acr login --name mycontainerregistry082
Login Succeeded
```

Tag container image

To push a container image to a private registry like Azure Container Registry, you must first tag the image with the full name of the registry's login server.

First, get the full login server name for your Azure container registry. Run the following az acr show command, and replace `<acrName>` with the name of registry you just created:

```
az acr show --name <acrName> --query loginServer --output table
```

For example, if your registry is named *mycontainerregistry082*:

```
$ az acr show --name mycontainerregistry082 --query loginServer --output table
Result
------------------------
mycontainerregistry082.azurecr.io
```

Now, display the list of your local images with the docker images command:

```
docker images
```

Along with any other images you have on your machine, you should see the *aci-tutorial-app* image you built in the previous tutorial:

```
$ docker images
REPOSITORY          TAG       IMAGE ID        CREATED            SIZE
aci-tutorial-app    latest    5c745774dfa9    39 minutes ago     68.1 MB
```

Tag the *aci-tutorial-app* image with the login server of your container registry. Also, add the `:v1` tag to the end of the image name to indicate the image version number. Replace `<acrLoginServer>` with the result of the az acr show command you executed earlier.

```
docker tag aci-tutorial-app <acrLoginServer>/aci-tutorial-app:v1
```

Run `docker images` again to verify the tagging operation:

```
$ docker images
REPOSITORY                                            TAG       IMAGE ID        CREATED            SIZE
aci-tutorial-app                                      latest    5c745774dfa9    39 minutes ago     68.1 MB
mycontainerregistry082.azurecr.io/aci-tutorial-app    v1        5c745774dfa9    7 minutes ago      68.1 MB
```

Push image to Azure Container Registry

Now that you've tagged the *aci-tutorial-app* image with the full login server name of your private registry, you can push the image to the registry with the docker push command. Replace `<acrLoginServer>` with the full login server name you obtained in the earlier step.

```
docker push <acrLoginServer>/aci-tutorial-app:v1
```

The `push` operation should take a few seconds to a few minutes depending on your internet connection, and output is similar to the following:

```
$ docker push mycontainerregistry082.azurecr.io/aci-tutorial-app:v1
The push refers to a repository [mycontainerregistry082.azurecr.io/aci-tutorial-app]
3db9cac20d49: Pushed
13f653351004: Pushed
4cd158165f4d: Pushed
d8fbd47558a8: Pushed
44ab46125c35: Pushed
5bef08742407: Pushed
v1: digest: sha256:ed67fff971da47175856505585dcd92d1270c3b37543e8afd46014d328f05715 size: 1576
```

List images in Azure Container Registry

To verify that the image you just pushed is indeed in your Azure container registry, list the images in your registry with the az acr repository list command. Replace `<acrName>` with the name of your container registry.

```
az acr repository list --name <acrName> --output table
```

For example:

```
$ az acr repository list --name mycontainerregistry082 --output table
Result
----------------
aci-tutorial-app
```

To see the *tags* for a specific image, use the az acr repository show-tags command.

```
az acr repository show-tags --name <acrName> --repository aci-tutorial-app --output table
```

You should see output similar to the following:

```
$ az acr repository show-tags --name mycontainerregistry082 --repository aci-tutorial-app --output table
Result
--------
v1
```

Next steps

In this tutorial, you prepared an Azure container registry for use with Azure Container Instances, and pushed a container image to the registry. The following steps were completed:

- Created an Azure Container Registry instance with the Azure CLI
- Tagged a container image for Azure Container Registry
- Uploaded an image to Azure Container Registry

Advance to the next tutorial to learn how to deploy the container to Azure using Azure Container Instances:

Deploy container to Azure Container Instances

Tutorial: Deploy a container application to Azure Container Instances

11/26/2019 • 4 minutes to read • Edit Online

This is the final tutorial in a three-part series. Earlier in the series, a container image was created and pushed to Azure Container Registry. This article completes the series by deploying the container to Azure Container Instances.

In this tutorial, you:

- Deploy the container from Azure Container Registry to Azure Container Instances
- View the running application in the browser
- Display the container's logs

Before you begin

You must satisfy the following requirements to complete this tutorial:

Azure CLI: You must have Azure CLI version 2.0.29 or later installed on your local computer. Run `az --version` to find the version. If you need to install or upgrade, see Install the Azure CLI.

Docker: This tutorial assumes a basic understanding of core Docker concepts like containers, container images, and basic `docker` commands. For a primer on Docker and container basics, see the Docker overview.

Docker: To complete this tutorial, you need Docker installed locally. Docker provides packages that configure the Docker environment on macOS, Windows, and Linux.

IMPORTANT

Because the Azure Cloud shell does not include the Docker daemon, you *must* install both the Azure CLI and Docker Engine on your *local computer* to complete this tutorial. You cannot use the Azure Cloud Shell for this tutorial.

Deploy the container using the Azure CLI

In this section, you use the Azure CLI to deploy the image built in the first tutorial and pushed to Azure Container Registry in the second tutorial. Be sure you've completed those tutorials before proceeding.

Get registry credentials

When you deploy an image that's hosted in a private Azure container registry like the one created in the second tutorial, you must supply credentials to access the registry.

A best practice for many scenarios is to create and configure an Azure Active Directory service principal with *pull* permissions to your registry. See Authenticate with Azure Container Registry from Azure Container Instances for sample scripts to create a service principal with the necessary permissions. Take note of the *service principal ID* and *service principal password*. You use these credentials to access the registry when you deploy the container.

You also need the full name of the container registry login server (replace `<acrName>` with the name of your registry):

```
az acr show --name <acrName> --query loginServer
```

Deploy container

Now, use the az container create command to deploy the container. Replace `<acrLoginServer>` with the value you obtained from the previous command. Replace `<service-principal-ID>` and `<service-principal-password>` with the service principal ID and password that you created to access the registry. Replace `<aciDnsLabel>` with a desired DNS name.

```
az container create --resource-group myResourceGroup --name aci-tutorial-app --image <acrLoginServer>/aci-
tutorial-app:v1 --cpu 1 --memory 1 --registry-login-server <acrLoginServer> --registry-username <service-
principal-ID> --registry-password <service-principal-password> --dns-name-label <aciDnsLabel> --ports 80
```

Within a few seconds, you should receive an initial response from Azure. The `--dns-name-label` value must be unique within the Azure region you create the container instance. Modify the value in the preceding command if you receive a **DNS name label** error message when you execute the command.

Verify deployment progress

To view the state of the deployment, use az container show:

```
az container show --resource-group myResourceGroup --name aci-tutorial-app --query instanceView.state
```

Repeat the az container show command until the state changes from *Pending* to *Running*, which should take under a minute. When the container is *Running*, proceed to the next step.

View the application and container logs

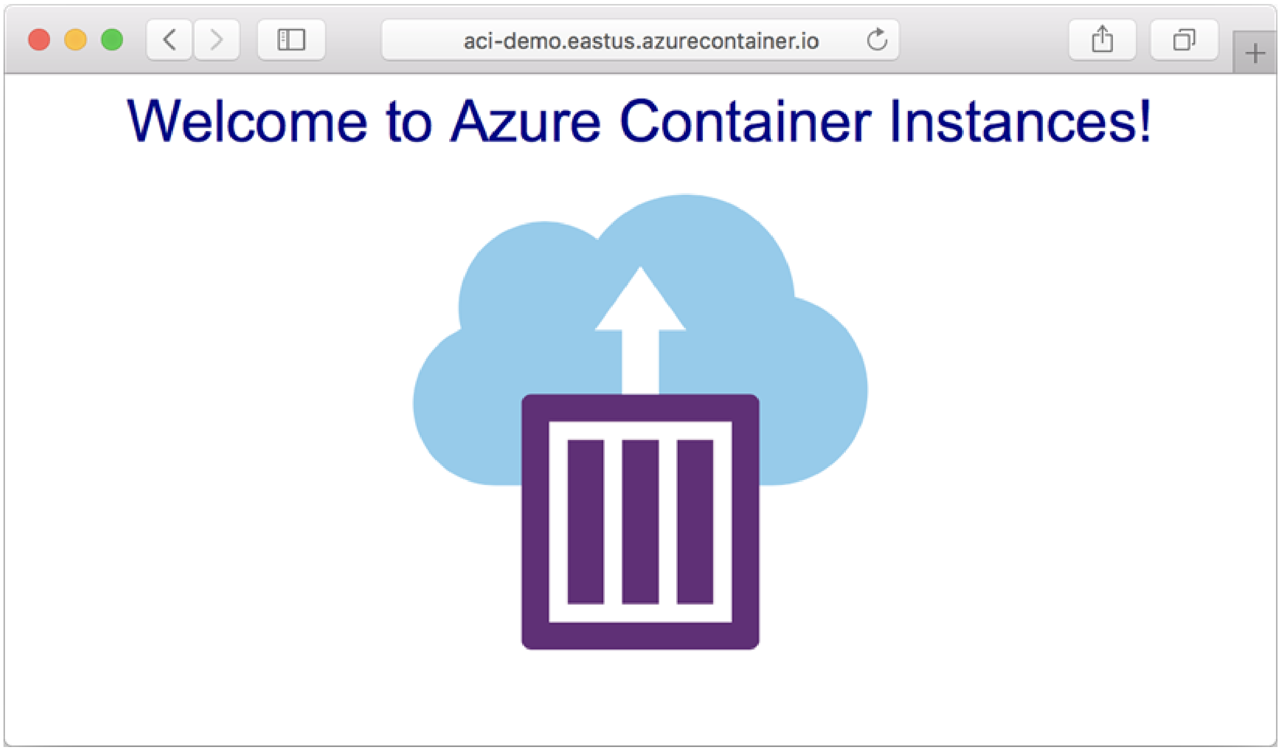
Once the deployment succeeds, display the container's fully qualified domain name (FQDN) with the az container show command:

```
az container show --resource-group myResourceGroup --name aci-tutorial-app --query ipAddress.fqdn
```

For example:

```
$ az container show --resource-group myResourceGroup --name aci-tutorial-app --query ipAddress.fqdn
"aci-demo.eastus.azurecontainer.io"
```

To see the running application, navigate to the displayed DNS name in your favorite browser:


aci-demo.eastus.azurecontainer.io
Welcome to Azure Container Instances!

You can also view the log output of the container:

```
az container logs --resource-group myResourceGroup --name aci-tutorial-app
```

Example output:

```
$ az container logs --resource-group myResourceGroup --name aci-tutorial-app
listening on port 80
::ffff:10.240.0.4 - - [21/Jul/2017:06:00:02 +0000] "GET / HTTP/1.1" 200 1663 "-" "Mozilla/5.0 (Macintosh;
Intel Mac OS X 10_12_5) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/59.0.3071.115 Safari/537.36"
::ffff:10.240.0.4 - - [21/Jul/2017:06:00:02 +0000] "GET /favicon.ico HTTP/1.1" 404 150 "http://aci-
demo.eastus.azurecontainer.io/" "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_12_5) AppleWebKit/537.36 (KHTML,
like Gecko) Chrome/59.0.3071.115 Safari/537.36"
```

Clean up resources

If you no longer need any of the resources you created in this tutorial series, you can execute the az group delete command to remove the resource group and all resources it contains. This command deletes the container registry you created, as well as the running container, and all related resources.

```
az group delete --name myResourceGroup
```

Next steps

In this tutorial, you completed the process of deploying your container to Azure Container Instances. The following steps were completed:

- Deployed the container from Azure Container Registry using the Azure CLI
- Viewed the application in the browser
- Viewed the container logs

Now that you have the basics down, move on to learning more about Azure Container Instances, such as how container groups work:

Container groups in Azure Container Instances

Tutorial: Deploy a multi-container group using a YAML file

11/26/2019 • 4 minutes to read • Edit Online

Azure Container Instances supports the deployment of multiple containers onto a single host using a container group. A container group is useful when building an application sidecar for logging, monitoring, or any other configuration where a service needs a second attached process.

In this tutorial, you follow steps to run a simple two-container sidecar configuration by deploying a YAML file using the Azure CLI. A YAML file provides a concise format for specifying the instance settings. You learn how to:

- Configure a YAML file
- Deploy the container group
- View the logs of the containers

NOTE

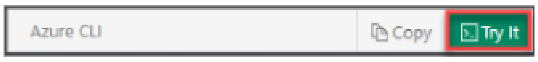
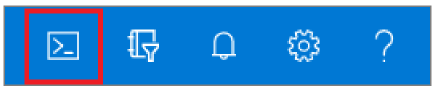
Multi-container groups are currently restricted to Linux containers.

If you don't have an Azure subscription, create a free account before you begin.

Use Azure Cloud Shell

Azure hosts Azure Cloud Shell, an interactive shell environment that you can use through your browser. You can use either Bash or PowerShell with Cloud Shell to work with Azure services. You can use the Cloud Shell preinstalled commands to run the code in this article without having to install anything on your local environment.

To start Azure Cloud Shell:

OPTION	EXAMPLE/LINK
Select **Try It** in the upper-right corner of a code block. Selecting **Try It** doesn't automatically copy the code to Cloud Shell.	
Go to https://shell.azure.com, or select the **Launch Cloud Shell** button to open Cloud Shell in your browser.	
Select the **Cloud Shell** button on the menu bar at the upper right in the Azure portal.	

To run the code in this article in Azure Cloud Shell:

1. Start Cloud Shell.
2. Select the **Copy** button on a code block to copy the code.
3. Paste the code into the Cloud Shell session by selecting **Ctrl**+**Shift**+**V** on Windows and Linux or by selecting **Cmd**+**Shift**+**V** on macOS.

4. Select **Enter** to run the code.

Configure a YAML file

To deploy a multi-container group with the az container create command in the Azure CLI, you must specify the container group configuration in a YAML file. Then pass the YAML file as a parameter to the command.

Start by copying the following YAML into a new file named **deploy-aci.yaml**. In Azure Cloud Shell, you can use Visual Studio Code to create the file in your working directory:

```
code deploy-aci.yaml
```

This YAML file defines a container group named "myContainerGroup" with two containers, a public IP address, and two exposed ports. The containers are deployed from public Microsoft images. The first container in the group runs an internet-facing web application. The second container, the sidecar, periodically makes HTTP requests to the web application running in the first container via the container group's local network.

```
apiVersion: 2018-10-01
location: eastus
name: myContainerGroup
properties:
  containers:
  - name: aci-tutorial-app
    properties:
      image: mcr.microsoft.com/azuredocs/aci-helloworld:latest
      resources:
        requests:
          cpu: 1
          memoryInGb: 1.5
      ports:
      - port: 80
      - port: 8080
  - name: aci-tutorial-sidecar
    properties:
      image: mcr.microsoft.com/azuredocs/aci-tutorial-sidecar
      resources:
        requests:
          cpu: 1
          memoryInGb: 1.5
  osType: Linux
  ipAddress:
    type: Public
    ports:
    - protocol: tcp
      port: '80'
    - protocol: tcp
      port: '8080'
tags: null
type: Microsoft.ContainerInstance/containerGroups
```

To use a private container image registry, add the `imageRegistryCredentials` property to the container group, with values modified for your environment:

```
  imageRegistryCredentials:
  - server: imageRegistryLoginServer
    username: imageRegistryUsername
    password: imageRegistryPassword
```

Deploy the container group

Create a resource group with the az group create command:

```
az group create --name myResourceGroup --location eastus
```

Deploy the container group with the az container create command, passing the YAML file as an argument:

```
az container create --resource-group myResourceGroup --file deploy-aci.yaml
```

Within a few seconds, you should receive an initial response from Azure.

View deployment state

To view the state of the deployment, use the following az container show command:

```
az container show --resource-group myResourceGroup --name myContainerGroup --output table
```

If you'd like to view the running application, navigate to its IP address in your browser. For example, the IP is `52.168.26.124` in this example output:

```
Name              ResourceGroup    Status    Image
IP:ports              Network    CPU/Memory       OsType    Location
----------------  ---------------  --------  ----------------------------------------------------------------
----------------------------------  --------------------  ---------  ---------------  --------  ----------
myContainerGroup  danlep0318r      Running   mcr.microsoft.com/azuredocs/aci-tutorial-
sidecar,mcr.microsoft.com/azuredocs/aci-helloworld:latest  20.42.26.114:80,8080  Public     1.0 core/1.5 gb
Linux     eastus
```

View container logs

View the log output of a container using the az container logs command. The `--container-name` argument specifies the container from which to pull logs. In this example, the `aci-tutorial-app` container is specified.

```
az container logs --resource-group myResourceGroup --name myContainerGroup --container-name aci-tutorial-app
```

Output:

```
listening on port 80
::1 - - [21/Mar/2019:23:17:48 +0000] "HEAD / HTTP/1.1" 200 1663 "-" "curl/7.54.0"
::1 - - [21/Mar/2019:23:17:51 +0000] "HEAD / HTTP/1.1" 200 1663 "-" "curl/7.54.0"
::1 - - [21/Mar/2019:23:17:54 +0000] "HEAD / HTTP/1.1" 200 1663 "-" "curl/7.54.0"
```

To see the logs for the sidecar container, run a similar command specifying the `aci-tutorial-sidecar` container.

```
az container logs --resource-group myResourceGroup --name myContainerGroup --container-name aci-tutorial-
sidecar
```

Output:

```
Every 3s: curl -I http://localhost                          2019-03-21 20:36:41

  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
  0  1663    0     0    0     0      0      0 --:--:-- --:--:-- --:--:--     0
HTTP/1.1 200 OK
X-Powered-By: Express
Accept-Ranges: bytes
Cache-Control: public, max-age=0
Last-Modified: Wed, 29 Nov 2017 06:40:40 GMT
ETag: W/"67f-16006818640"
Content-Type: text/html; charset=UTF-8
Content-Length: 1663
Date: Thu, 21 Mar 2019 20:36:41 GMT
Connection: keep-alive
```

As you can see, the sidecar is periodically making an HTTP request to the main web application via the group's local network to ensure that it is running. This sidecar example could be expanded to trigger an alert if it received an HTTP response code other than `200 OK`.

Next steps

In this tutorial, you used a YAML file to deploy a multi-container group in Azure Container Instances. You learned how to:

- Configure a YAML file for a multi-container group
- Deploy the container group
- View the logs of the containers

You can also specify a multi-container group using a Resource Manager template. A Resource Manager template can be readily adapted for scenarios when you need to deploy additional Azure service resources with the container group.

Tutorial: Deploy a multi-container group using a Resource Manager template

11/26/2019 • 5 minutes to read • Edit Online

Azure Container Instances supports the deployment of multiple containers onto a single host using a container group. A container group is useful when building an application sidecar for logging, monitoring, or any other configuration where a service needs a second attached process.

In this tutorial, you follow steps to run a simple two-container sidecar configuration by deploying an Azure Resource Manager template using the Azure CLI. You learn how to:

- Configure a multi-container group template
- Deploy the container group
- View the logs of the containers

A Resource Manager template can be readily adapted for scenarios when you need to deploy additional Azure service resources (for example, an Azure Files share or a virtual network) with the container group.

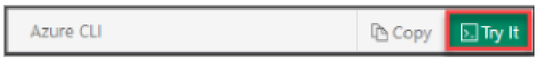
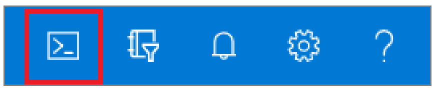
NOTE
Multi-container groups are currently restricted to Linux containers.

If you don't have an Azure subscription, create a free account before you begin.

Use Azure Cloud Shell

Azure hosts Azure Cloud Shell, an interactive shell environment that you can use through your browser. You can use either Bash or PowerShell with Cloud Shell to work with Azure services. You can use the Cloud Shell preinstalled commands to run the code in this article without having to install anything on your local environment.

To start Azure Cloud Shell:

OPTION	EXAMPLE/LINK
Select **Try It** in the upper-right corner of a code block. Selecting **Try It** doesn't automatically copy the code to Cloud Shell.	
Go to https://shell.azure.com, or select the **Launch Cloud Shell** button to open Cloud Shell in your browser.	Launch Cloud Shell
Select the **Cloud Shell** button on the menu bar at the upper right in the Azure portal.	

To run the code in this article in Azure Cloud Shell:

1. Start Cloud Shell.

2. Select the **Copy** button on a code block to copy the code.

3. Paste the code into the Cloud Shell session by selecting **Ctrl**+**Shift**+**V** on Windows and Linux or by selecting **Cmd**+**Shift**+**V** on macOS.

4. Select **Enter** to run the code.

Configure a template

Start by copying the following JSON into a new file named `azuredeploy.json`. In Azure Cloud Shell, you can use Visual Studio Code to create the file in your working directory:

```
code azuredeploy.json
```

This Resource Manager template defines a container group with two containers, a public IP address, and two exposed ports. The first container in the group runs an internet-facing web application. The second container, the sidecar, makes an HTTP request to the main web application via the group's local network.

```json
{
  "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "parameters": {
    "containerGroupName": {
      "type": "string",
      "defaultValue": "myContainerGroup",
      "metadata": {
        "description": "Container Group name."
      }
    }
  },
  "variables": {
    "container1name": "aci-tutorial-app",
    "container1image": "mcr.microsoft.com/azuredocs/aci-helloworld:latest",
    "container2name": "aci-tutorial-sidecar",
    "container2image": "mcr.microsoft.com/azuredocs/aci-tutorial-sidecar"
  },
  "resources": [
    {
      "name": "[parameters('containerGroupName')]",
      "type": "Microsoft.ContainerInstance/containerGroups",
      "apiVersion": "2018-10-01",
      "location": "[resourceGroup().location]",
      "properties": {
        "containers": [
          {
            "name": "[variables('container1name')]",
            "properties": {
              "image": "[variables('container1image')]",
              "resources": {
                "requests": {
                  "cpu": 1,
                  "memoryInGb": 1.5
                }
              },
              "ports": [
                {
                  "port": 80
                },
                {
                  "port": 8080
                }
              ]
            }
          },
          {
            "name": "[variables('container2name')]",
              "properties": {
                "image": "[variables('container2image')]",
                "resources": {
                  "requests": {
                    "cpu": 1,
                    "memoryInGb": 1.5
                  }
                }
              }
            }
          ],
          "osType": "Linux",
          "ipAddress": {
            "type": "Public",
            "ports": [
              {
                "protocol": "tcp",
                "port": "80"
              },
              {
                  "protocol": "tcp",
                  "port": "8080"
              }
            ]
          }
        }
      }
    ],
    "outputs": {
      "containerIPv4Address": {
        "type": "string",
        "value": "[reference(resourceId('Microsoft.ContainerInstance/containerGroups/',
parameters('containerGroupName'))).ipAddress.ip]"
      }
    }
}
```

To use a private container image registry, add an object to the JSON document with the following format. For an example implementation of this configuration, see the ACI Resource Manager template reference documentation.

```
"imageRegistryCredentials": [
  {
    "server": "[parameters('imageRegistryLoginServer')]",
    "username": "[parameters('imageRegistryUsername')]",
    "password": "[parameters('imageRegistryPassword')]"
  }
]
```

Deploy the template

Create a resource group with the az group create command.

```
az group create --name myResourceGroup --location eastus
```

Deploy the template with the az group deployment create command.

```
az group deployment create --resource-group myResourceGroup --template-file azuredeploy.json
```

Within a few seconds, you should receive an initial response from Azure.

View deployment state

To view the state of the deployment, use the following az container show command:

```
az container show --resource-group myResourceGroup --name myContainerGroup --output table
```

If you'd like to view the running application, navigate to its IP address in your browser. For example, the IP is `52.168.26.124` in this example output:

```
Name              ResourceGroup    Status    Image
IP:ports              Network    CPU/Memory       OsType    Location
----------------  --------------  --------  ------------------------------------------------------------------
---------------------------------  --------------------  ---------  --------------  --------  ----------
myContainerGroup  danlep0318r      Running   mcr.microsoft.com/azuredocs/aci-tutorial-
sidecar,mcr.microsoft.com/azuredocs/aci-helloworld:latest  20.42.26.114:80,8080  Public     1.0 core/1.5 gb
Linux     eastus
```

View container logs

View the log output of a container using the az container logs command. The `--container-name` argument specifies the container from which to pull logs. In this example, the `aci-tutorial-app` container is specified.

```
az container logs --resource-group myResourceGroup --name myContainerGroup --container-name aci-tutorial-app
```

Output:

```
listening on port 80
::1 - - [21/Mar/2019:23:17:48 +0000] "HEAD / HTTP/1.1" 200 1663 "-" "curl/7.54.0"
::1 - - [21/Mar/2019:23:17:51 +0000] "HEAD / HTTP/1.1" 200 1663 "-" "curl/7.54.0"
::1 - - [21/Mar/2019:23:17:54 +0000] "HEAD / HTTP/1.1" 200 1663 "-" "curl/7.54.0"
```

To see the logs for the sidecar container, run a similar command specifying the `aci-tutorial-sidecar` container.

```
az container logs --resource-group myResourceGroup --name myContainerGroup --container-name aci-tutorial-
sidecar
```

Output:

```
Every 3s: curl -I http://localhost                          2019-03-21 20:36:41

  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
  0  1663    0     0    0     0      0      0 --:--:-- --:--:-- --:--:--     0
HTTP/1.1 200 OK
X-Powered-By: Express
Accept-Ranges: bytes
Cache-Control: public, max-age=0
Last-Modified: Wed, 29 Nov 2017 06:40:40 GMT
ETag: W/"67f-16006818640"
Content-Type: text/html; charset=UTF-8
Content-Length: 1663
Date: Thu, 21 Mar 2019 20:36:41 GMT
Connection: keep-alive
```

As you can see, the sidecar is periodically making an HTTP request to the main web application via the group's local network to ensure that it is running. This sidecar example could be expanded to trigger an alert if it received an HTTP response code other than `200 OK`.

Next steps

In this tutorial, you used an Azure Resource Manager template to deploy a multi-container group in Azure Container Instances. You learned how to:

- Configure a multi-container group template
- Deploy the container group
- View the logs of the containers

For additional template samples, see Azure Resource Manager templates for Azure Container Instances.

You can also specify a multi-container group using a YAML file. Due to the YAML format's more concise nature, deployment with a YAML file is a good choice when your deployment includes only container instances.

Tutorial: Use an HTTP-triggered Azure function to create a container group

11/26/2019 • 6 minutes to read • Edit Online

Azure Functions is a serverless compute service that can run scripts or code in response to a variety of events, such as an HTTP request, a timer, or a message in an Azure Storage queue.

In this tutorial, you create an Azure function that takes an HTTP request and triggers deployment of a container group. This example shows the basics of using Azure Functions to automatically create resources in Azure Container Instances. Modify or extend the example for more complex scenarios or other event triggers.

You learn how to:

- Use Visual Studio Code with the Azure Functions extension to create a basic HTTP-triggered PowerShell function.
- Enable an identity in the function app and give it permissions to create Azure resources.
- Modify and republish the PowerShell function to automate deployment of a single-container container group.
- Verify the HTTP-triggered deployment of the container.

IMPORTANT

PowerShell for Azure Functions is currently in preview. Previews are made available to you on the condition that you agree to the supplemental terms of use. Some aspects of this feature may change prior to general availability (GA).

Prerequisites

See Create your first PowerShell function in Azure for prerequisites to install and use Visual Studio Code with the Azure Functions on your OS.

Some steps in this article use the Azure CLI. You can use the Azure Cloud Shell or a local installation of the Azure CLI to complete these steps. If you need to install or upgrade, see Install Azure CLI.

Create a basic PowerShell function

Follow steps in Create your first PowerShell function in Azure to create a PowerShell function using the HTTP Trigger template. Use the default Azure function name **HttpTrigger**. As shown in the quickstart, test the function locally, and publish the project to a function app in Azure. This example is a basic HTTP-triggered function that returns a text string. In later steps in this article, you modify the function to create a container group.

This article assumes you publish the project using the name *myfunctionapp*, in an Azure resource group automatically named according to the function app name (also *myfunctionapp*). Substitute your unique function app name and resource group name in later steps.

Enable an Azure-managed identity in the function app

Now enable a system-assigned managed identity in your function app. The PowerShell host running the app can automatically authenticate using this identity, enabling functions to take actions on Azure services to which the identity has been granted access. In this tutorial, you grant the managed identity permissions to create resources in the function app's resource group.

First use the az group show command to get the ID of the function app's resource group and store it in an environment variable. This example assumes you run the command in a Bash shell.

```
rgID=$(az group show --name myfunctionapp --query id --output tsv)
```

Run az functionapp identity app assign to assign a local identity to the function app and assign a contributor role to the resource group. This role allows the identity to create additional resources such as container groups in the resource group.

```
az functionapp identity assign \
  --name myfunctionapp \
  --resource-group myfunctionapp \
  --role contributor --scope $rgID
```

Modify HttpTrigger function

Modify the PowerShell code for the **HttpTrigger** function to create a container group. In file `run.ps1` for the function, find the following code block. This code displays a name value, if one is passed as a query string in the function URL:

```
[...]
if ($name) {
    $status = [HttpStatusCode]::OK
    $body = "Hello $name"
}
[...]
```

Replace this code with the following example block. Here, if a name value is passed in the query string, it is used to name and create a container group using the New-AzContainerGroup cmdlet. Make sure to replace the resource group name *myfunctionapp* with the name of the resource group for your function app:

```
[...]
if ($name) {
    $status = [HttpStatusCode]::OK
    New-AzContainerGroup -ResourceGroupName myfunctionapp -Name $name `
        -Image alpine -OsType Linux `
        -Command "echo 'Hello from an Azure container instance triggered by an Azure function'" `
        -RestartPolicy Never
    $body = "Started container group $name"
}
[...]
```

This example creates a container group consisting of a single container instance running the `alpine` image. The container runs a single `echo` command and then terminates. In a real-world example, you might trigger creation of one or more container groups for running a batch job.

Test function app locally

Ensure that the function runs properly locally before republishing the function app project to Azure. As shown in the PowerShell quickstart, insert a local breakpoint in the PowerShell script and a `Wait-Debugger` call above it. For debugging guidance, see Debug PowerShell Azure Functions locally.

Republish Azure function app

After you've verified that the function runs correctly on your local computer, it's time to republish the project to the existing function app in Azure.

> **NOTE**
>
> Remember to remove any calls to `Wait-Debugger` before you publish your functions to Azure.

1. In Visual Studio Code, open the Command Palette. Search for and select `Azure Functions: Deploy to function app...`.
2. Select the current working folder to zip and deploy.
3. Select the subscription and then the name of the existing function app (*myfunctionapp*). Confirm that you want to overwrite the previous deployment.

A notification is displayed after your function app is created and the deployment package is applied. Select **View Output** in this notification to view the creation and deployment results, including the Azure resources that you updated.

Run the function in Azure

After the deployment completes successfully, get the function URL. For example, use the **Azure: Functions** area in Visual Studio code to copy the **HttpTrigger** function URL, or get the function URL in the Azure portal.

The function URL includes a unique code and is of the form:

```
https://myfunctionapp.azurewebsites.net/api/HttpTrigger?
code=bmF/GljyfFWISqO0GngDPCtCQF4meRcBiHEoaQGeRv/Srx6dRcrk2M==
```

Run function without passing a name

As a first test, run the `curl` command and pass the function URL without appending a `name` query string. Make sure to include your function's unique code.

```
curl --verbose "https://myfunctionapp.azurewebsites.net/api/HttpTrigger?
code=bmF/GljyfFWISqO0GngDPCtCQF4meRcBiHEoaQGeRv/Srx6dRcrk2M=="
```

The function returns status code 400 and the text `Please pass a name on the query string or in the request body`:

```
[...]
> GET /api/HttpTrigger?code=bmF/GljyfFWISqO0GngDPCtCQF4meRcBiHEoaQGeRv/Srx6dRcrk2M== HTTP/2
> Host: myfunctionapp.azurewebsites.net
> User-Agent: curl/7.54.0
> Accept: */*
>
* Connection state changed (MAX_CONCURRENT_STREAMS updated)!
< HTTP/2 400
< content-length: 62
< content-type: text/plain; charset=utf-8
< date: Mon, 05 Aug 2019 22:08:15 GMT
<
* Connection #0 to host myfunctionapp.azurewebsites.net left intact
Please pass a name on the query string or in the request body.
```

Run function and pass the name of a container group

Now run the `curl` command by appending the name of a container group (*mycontainergroup*) as a query string `&name=mycontainergroup`:

```
curl --verbose "https://myfunctionapp.azurewebsites.net/api/HttpTrigger?
code=bmF/GljyfFWISqO0GngDPCtCQF4meRcBiHEoaQGeRv/Srx6dRcrk2M==&name=mycontainergroup"
```

The function returns status code 200 and triggers the creation of the container group:

```
[...]
> GET /api/HttpTrigger?ode=bmF/GljyfFWISqO0GngDPCtCQF4meRcBiHEoaQGeRv/Srx6dRcrk2M==&name=mycontainergroup
HTTP/2
> Host: myfunctionapp.azurewebsites.net
> User-Agent: curl/7.54.0
> Accept: */*
>
* Connection state changed (MAX_CONCURRENT_STREAMS updated)!
< HTTP/2 200
< content-length: 28
< content-type: text/plain; charset=utf-8
< date: Mon, 05 Aug 2019 22:15:30 GMT
<
* Connection #0 to host myfunctionapp.azurewebsites.net left intact
Started container group mycontainergroup
```

Verify that the container ran with the az container logs command:

```
az container logs --resource-group myfunctionapp --name mycontainergroup
```

Sample output:

```
Hello from an Azure container instance triggered by an Azure function
```

Clean up resources

If you no longer need any of the resources you created in this tutorial, you can execute the az group delete command to remove the resource group and all resources it contains. This command deletes the container registry you created, as well as the running container, and all related resources.

```
az group delete --name myfunctionapp
```

Next steps

In this tutorial, you created an Azure function that takes an HTTP request and triggers deployment of a container group. You learned how to:

- Use Visual Studio Code with the Azure Functions extension to create a basic HTTP-triggered PowerShell function.
- Enable an identity in the function app and give it permissions to create Azure resources.
- Modify the PowerShell function code to automate deployment of a single-container container group.
- Verify the HTTP-triggered deployment of the container.

For a detailed example to launch and monitor a containerized job, see the blog post Event-Driven Serverless Containers with PowerShell Azure Functions and Azure Container Instances and accompanying code sample.

See the Azure Functions documentation for detailed guidance on creating Azure functions and publishing a functions project.

Azure Resource Manager templates for Azure Container Instances

1/14/2020 • 2 minutes to read • Edit Online

The following sample templates deploy container instances in various configurations.

For deployment options, see the Deployment section. If you'd like to create your own templates, the Azure Container Instances Resource Manager template reference details template format and available properties.

Sample templates

Applications	
WordPress	Creates a WordPress website and its MySQL database in a container group. The WordPress site content and MySQL database are persisted to an Azure Files share. Also creates an application gateway to expose public network access to WordPress.
MS NAV with SQL Server and IIS	Deploys a single Windows container with a fully featured self-contained Dynamics NAV / Dynamics 365 Business Central environment.
Volumes	
emptyDir	Deploys two Linux containers that share an emptyDir volume.
gitRepo	Deploys a Linux container that clones a GitHub repo and mounts it as a volume.
secret	Deploys a Linux container with a PFX cert mounted as a secret volume.
Networking	
UDP-exposed container	Deploys a Windows or Linux container that exposes a UDP port.
Linux container with public IP	Deploys a single Linux container accessible via a public IP.
Deploy a container group with a virtual network (preview)	Deploys a new virtual network, subnet, network profile, and container group.
Azure resources	
Create Azure Storage account and Files share	Uses the Azure CLI in a container instance to create a storage account and an Azure Files share.

Deployment

You have several options for deploying resources with Resource Manager templates:

Azure CLI

Azure PowerShell

Azure portal

REST API

Container groups in Azure Container Instances

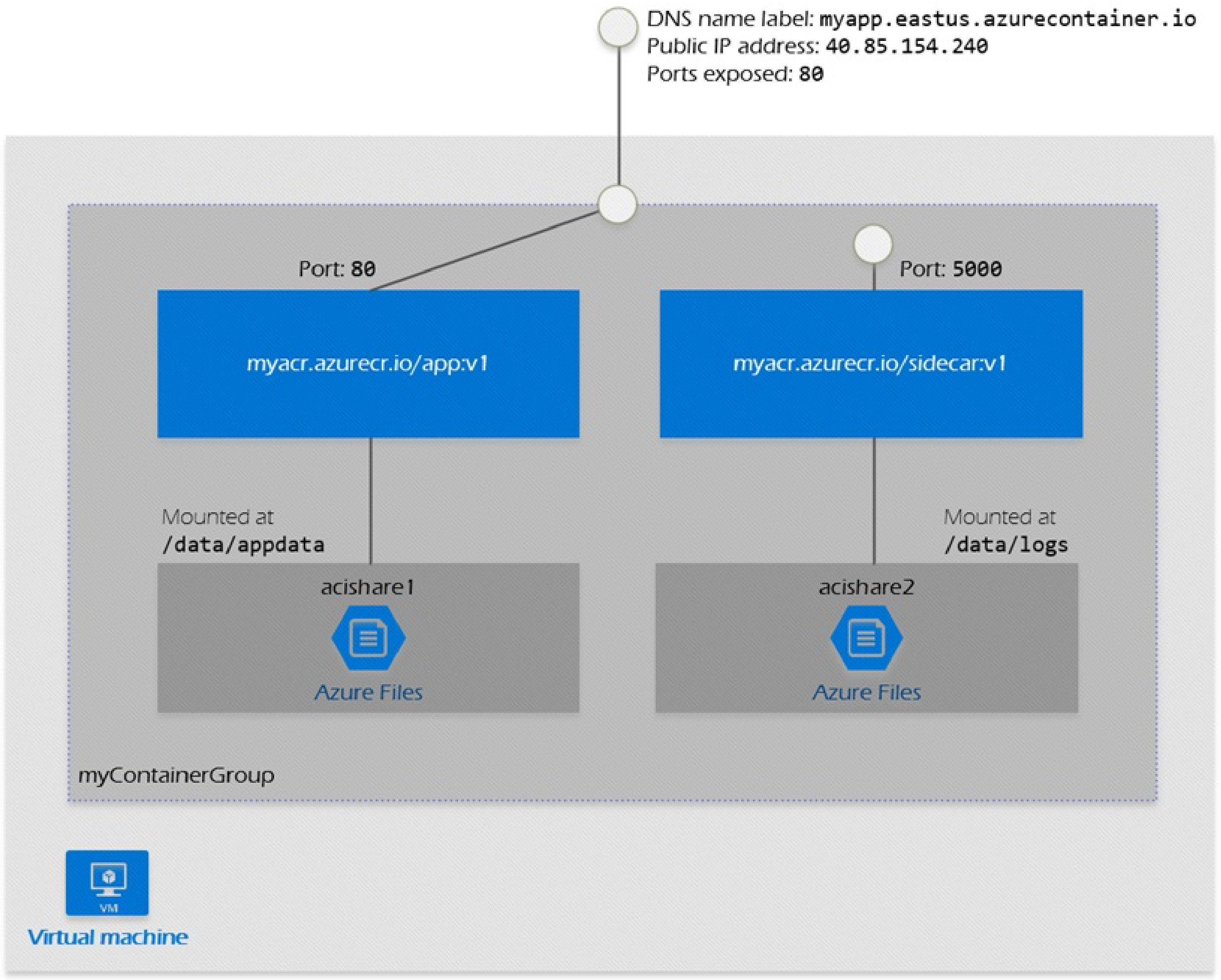
1/10/2020 • 4 minutes to read • Edit Online

The top-level resource in Azure Container Instances is the *container group*. This article describes what container groups are and the types of scenarios they enable.

What is a container group?

A container group is a collection of containers that get scheduled on the same host machine. The containers in a container group share a lifecycle, resources, local network, and storage volumes. It's similar in concept to a *pod* in Kubernetes.

The following diagram shows an example of a container group that includes multiple containers:



This example container group:

- Is scheduled on a single host machine.
- Is assigned a DNS name label.
- Exposes a single public IP address, with one exposed port.
- Consists of two containers. One container listens on port 80, while the other listens on port 5000.
- Includes two Azure file shares as volume mounts, and each container mounts one of the shares locally.

NOTE

Multi-container groups currently support only Linux containers. For Windows containers, Azure Container Instances only supports deployment of a single container instance. While we are working to bring all features to Windows containers, you can find current platform differences in the service Overview.

Deployment

Here are two common ways to deploy a multi-container group: use a Resource Manager template or a YAML file. A Resource Manager template is recommended when you need to deploy additional Azure service resources (for example, an Azure Files share) when you deploy the container instances. Due to the YAML format's more concise nature, a YAML file is recommended when your deployment includes only container instances. For details on properties you can set, see the Resource Manager template reference or YAML reference documentation.

To preserve a container group's configuration, you can export the configuration to a YAML file by using the Azure CLI command az container export. Export allows you to store your container group configurations in version control for "configuration as code." Or, use the exported file as a starting point when developing a new configuration in YAML.

Resource allocation

Azure Container Instances allocates resources such as CPUs, memory, and optionally GPUs (preview) to a multi-container group by adding the resource requests of the instances in the group. Taking CPU resources as an example, if you create a container group with two container instances, each requesting 1 CPU, then the container group is allocated 2 CPUs.

Resource usage by container instances

Each container instance in a group is allocated the resources specified in its resource request. However, the maximum resources used by a container instance in a group could be different if you configure its optional resource limit property. The resource limit of a container instance must be greater than or equal to the mandatory resource request property.

- If you don't specify a resource limit, the container instance's maximum resource usage is the same as its resource request.

- If you specify a limit for a container instance, the instance's maximum usage could be greater than the request, up to the limit you set. Correspondingly, resource usage by other container instances in the group could decrease. The maximum resource limit you can set for a container instance is the total resources allocated to the group.

For example, in a group with two container instances each requesting 1 CPU, one of your containers might run a workload that requires more CPUs to run than the other.

In this scenario, you could set a resource limit of 2 CPUs for the container instance. This configuration allows the container instance to use up to the full 2 CPUs if available.

Minimum and maximum allocation

- Allocate a **minimum** of 1 CPU and 1 GB of memory to a container group. Individual container instances within a group can be provisioned with less than 1 CPU and 1 GB of memory.

- For the **maximum** resources in a container group, see the resource availability for Azure Container Instances in the deployment region.

Networking

Container groups can share an external-facing IP address, one or more ports on that IP address, and a DNS label with a fully qualified domain name (FQDN). To enable external clients to reach a container within the group, you must expose the port on the IP address and from the container. Because containers within the group share a port namespace, port mapping isn't supported. A container group's IP address and FQDN will be released when the container group is deleted.

Within a container group, container instances can reach each other via localhost on any port, even if those ports aren't exposed externally on the group's IP address or from the container.

Optionally deploy container groups into an Azure virtual network to allow containers to communicate securely with other resources in the virtual network.

Storage

You can specify external volumes to mount within a container group. Supported volumes include:

- Azure file share
- Secret
- Empty directory
- Cloned git repo

You can map those volumes into specific paths within the individual containers in a group.

Common scenarios

Multi-container groups are useful in cases where you want to divide a single functional task into a small number of container images. These images can then be delivered by different teams and have separate resource requirements.

Example usage could include:

- A container serving a web application and a container pulling the latest content from source control.
- An application container and a logging container. The logging container collects the logs and metrics output by the main application and writes them to long-term storage.
- An application container and a monitoring container. The monitoring container periodically makes a request to the application to ensure that it's running and responding correctly, and raises an alert if it's not.
- A front-end container and a back-end container. The front end might serve a web application, with the back end running a service to retrieve data.

Next steps

Learn how to deploy a multi-container container group with an Azure Resource Manager template:

Deploy a container group

Quotas and limits for Azure Container Instances

2/10/2020 • 2 minutes to read • Edit Online

All Azure services include certain default limits and quotas for resources and features. This article details the default quotas and limits for Azure Container Instances.

Availability of compute, memory, and storage resources for Azure Container Instances varies by region and operating system. For details, see Resource availability for Azure Container Instances.

Service quotas and limits

RESOURCE	DEFAULT LIMIT
Standard sku container groups per region per subscription	100[1]
Dedicated sku container groups per region per subscription	0[1]
Number of containers per container group	60
Number of volumes per container group	20
Ports per IP	5
Container instance log size - running instance	4 MB
Container instance log size - stopped instance	16 KB or 1,000 lines
Container creates per hour	300[1]
Container creates per 5 minutes	100[1]
Container deletes per hour	300[1]
Container deletes per 5 minutes	100[1]

[1]To request a limit increase, create an Azure Support request.

Next steps

Certain default limits and quotas can be increased. To request an increase of one or more resources that support such an increase, please submit an Azure support request (select "Quota" for **Issue type**).

Resource availability for Azure Container Instances in Azure regions

2/21/2020 • 3 minutes to read • Edit Online

This article details the availability of Azure Container Instances compute, memory, and storage resources in Azure regions and by target operating system.

Values presented are the maximum resources available per deployment of a container group. Values are current at time of publication.

NOTE

Container groups created within these resource limits are subject to availability within the deployment region. When a region is under heavy load, you may experience a failure when deploying instances. To mitigate such a deployment failure, try deploying instances with lower resource settings, or try your deployment at a later time.

For information about quotas and other limits in your deployments, see Quotas and limits for Azure Container Instances.

Availability - General

The following regions and maximum resources are available to container groups with Linux and supported Windows Server 2016-based containers.

REGIONS	OS	MAX CPU	MAX MEMORY (GB)	STORAGE (GB)
Brazil South, Canada Central, Central India, Central US, East Asia, East US, East US 2, North Europe, South Central US, Southeast Asia, South India, UK South, West Europe, West US, West US 2	Linux	4	16	50
Australia East, Japan East	Linux	2	8	50
North Central US	Linux	2	3.5	50
Brazil South, Japan East, West Europe	Windows	4	16	20
East US, West US	Windows	4	14	20

REGIONS	OS	MAX CPU	MAX MEMORY (GB)	STORAGE (GB)
Australia East, Canada Central, Central India, Central US, East Asia, East US 2, North Central US, North Europe, South Central US, Southeast Asia, South India, UK South, West US 2	Windows	2	3.5	20

Availability - Windows Server 2019 LTSC, 1809 deployments (preview)

The following regions and maximum resources are available to container groups with Windows Server 2019-based containers (preview).

REGIONS	OS	MAX CPU	MAX MEMORY (GB)	STORAGE (GB)
Australia East, Brazil South, Canada Central, Central India, Central US, East Asia, East US, Japan East, North Central US, North Europe, South Central US, Southeast Asia, South India, UK South, West Europe	Windows	4	16	20
East US 2, West US 2	Windows	2	3.5	20

Availability - Virtual network deployment

The following regions and maximum resources are available to a container group deployed in an Azure virtual network.

Regions and resource availability

REGIONS	OS	MAX CPU	MAX MEMORY (GB)	STORAGE (GB)
Australia East, Canada Central, Central US, East US[1], East US 2, North Europe, South Central US[1], Southeast Asia, West Europe, West US 2[1]	Linux	4	16	50
Japan East	Linux	2	8	50
North Central US, South India, West US	Linux	2	3.5	50

[1]Region in which container group deployments to a virtual network are generally available for production workloads. In other regions, virtual network deployments are in preview.

Availability - GPU resources (preview)

The following regions and maximum resources are available to a container group deployed with GPU resources (preview).

IMPORTANT

GPU resources are available only upon request. To request access to GPU resources, please submit an Azure support request.

Region availability

REGIONS	OS	AVAILABLE GPU SKUS
East US, West Europe, West US 2	Linux	K80, P100, V100
Southeast Asia	Linux	P100, V100
Central India	Linux	V100
North Europe	Linux	K80

Resource availability

OS	GPU SKU	GPU COUNT	MAX CPU	MAX MEMORY (GB)	STORAGE (GB)
Linux	K80	1	6	56	50
Linux	K80	2	12	112	50
Linux	K80	4	24	224	50
Linux	P100	1	6	112	50
Linux	P100	2	12	224	50
Linux	P100	4	24	448	50
Linux	V100	1	6	112	50
Linux	V100	2	12	224	50
Linux	V100	4	24	448	50

Next steps

Let the team know if you'd like to see additional regions or increased resource availability at aka.ms/aci/feedback.

For information on troubleshooting container instance deployment, see Troubleshoot deployment issues with Azure Container Instances.

Azure Container Instances and container orchestrators

11/26/2019 • 3 minutes to read • Edit Online

Because of their small size and application orientation, containers are well suited for agile delivery environments and microservice-based architectures. The task of automating and managing a large number of containers and how they interact is known as *orchestration*. Popular container orchestrators include Kubernetes, DC/OS, and Docker Swarm.

Azure Container Instances provides some of the basic scheduling capabilities of orchestration platforms. And while it does not cover the higher-value services that those platforms provide, Azure Container Instances can be complementary to them. This article describes the scope of what Azure Container Instances handles, and how full container orchestrators might interact with it.

Traditional orchestration

The standard definition of orchestration includes the following tasks:

- **Scheduling**: Given a container image and a resource request, find a suitable machine on which to run the container.
- **Affinity/Anti-affinity**: Specify that a set of containers should run nearby each other (for performance) or sufficiently far apart (for availability).
- **Health monitoring**: Watch for container failures and automatically reschedule them.
- **Failover**: Keep track of what is running on each machine, and reschedule containers from failed machines to healthy nodes.
- **Scaling**: Add or remove container instances to match demand, either manually or automatically.
- **Networking**: Provide an overlay network for coordinating containers to communicate across multiple host machines.
- **Service discovery**: Enable containers to locate each other automatically, even as they move between host machines and change IP addresses.
- **Coordinated application upgrades**: Manage container upgrades to avoid application downtime, and enable rollback if something goes wrong.

Orchestration with Azure Container Instances: A layered approach

Azure Container Instances enables a layered approach to orchestration, providing all of the scheduling and management capabilities required to run a single container, while allowing orchestrator platforms to manage multi-container tasks on top of it.

Because the underlying infrastructure for container instances is managed by Azure, an orchestrator platform does not need to concern itself with finding an appropriate host machine on which to run a single container. The elasticity of the cloud ensures that one is always available. Instead, the orchestrator can focus on the tasks that simplify the development of multi-container architectures, including scaling and coordinated upgrades.

Scenarios

While orchestrator integration with Azure Container Instances is still nascent, we anticipate that a few different environments will emerge:

Orchestration of container instances exclusively

Because they start quickly and bill by the second, an environment based exclusively on Azure Container Instances offers the fastest way to get started and to deal with highly variable workloads.

Combination of container instances and containers in Virtual Machines

For long-running, stable workloads, orchestrating containers in a cluster of dedicated virtual machines is typically cheaper than running the same containers with Azure Container Instances. However, container instances offer a great solution for quickly expanding and contracting your overall capacity to deal with unexpected or short-lived spikes in usage.

Rather than scaling out the number of virtual machines in your cluster, then deploying additional containers onto those machines, the orchestrator can simply schedule the additional containers in Azure Container Instances, and delete them when they're no longer needed.

Sample implementation: virtual nodes for Azure Kubernetes Service (AKS)

To rapidly scale application workloads in an Azure Kubernetes Service (AKS) cluster, you can use *virtual nodes* created dynamically in Azure Container Instances. Virtual nodes enable network communication between pods that run in ACI and the AKS cluster.

Virtual nodes currently support Linux container instances. Get started with virtual nodes using the Azure CLI or Azure portal.

Virtual nodes use the open source Virtual Kubelet to mimic the Kubernetes kubelet by registering as a node with unlimited capacity. The Virtual Kubelet dispatches the creation of pods as container groups in Azure Container Instances.

See the Virtual Kubelet project for additional examples of extending the Kubernetes API into serverless container platforms.

Next steps

Create your first container with Azure Container Instances using the quickstart guide.

Security considerations for Azure Container Instances

1/17/2020 • 9 minutes to read • Edit Online

This article introduces security considerations for using Azure Container Instances to run container apps. Topics include:

- **Security recommendations** for managing images and secrets for Azure Container Instances
- **Considerations for the container ecosystem** throughout the container lifecycle, for any container platform

Security recommendations for Azure Container Instances

Use a private registry

Containers are built from images that are stored in one or more repositories. These repositories can belong to a public registry, like Docker Hub, or to a private registry. An example of a private registry is the Docker Trusted Registry, which can be installed on-premises or in a virtual private cloud. You can also use cloud-based private container registry services, including Azure Container Registry.

A publicly available container image does not guarantee security. Container images consist of multiple software layers, and each software layer might have vulnerabilities. To help reduce the threat of attacks, you should store and retrieve images from a private registry, such as Azure Container Registry or Docker Trusted Registry. In addition to providing a managed private registry, Azure Container Registry supports service principal-based authentication through Azure Active Directory for basic authentication flows. This authentication includes role-based access for read-only (pull), write (push), and other permissions.

Monitor and scan container images

Take advantage of solutions to scan container images in a private registry and identify potential vulnerabilities. It's important to understand the depth of threat detection that the different solutions provide.

For example, Azure Container Registry optionally integrates with Azure Security Center to automatically scan all Linux images pushed to a registry. Azure Security Center's integrated Qualys scanner detects image vulnerabilities, classifies them, and provides remediation guidance.

Security monitoring and image scanning solutions such as Twistlock and Aqua Security are also available through the Azure Marketplace.

Protect credentials

Containers can spread across several clusters and Azure regions. So, you must secure credentials required for logins or API access, such as passwords or tokens. Ensure that only privileged users can access those containers in transit and at rest. Inventory all credential secrets, and then require developers to use emerging secrets-management tools that are designed for container platforms. Make sure that your solution includes encrypted databases, TLS encryption for secrets data in transit, and least-privilege role-based access control. Azure Key Vault is a cloud service that safeguards encryption keys and secrets (such as certificates, connection strings, and passwords) for containerized applications. Because this data is sensitive and business critical, secure access to your key vaults so that only authorized applications and users can access them.

Considerations for the container ecosystem

The following security measures, implemented well and managed effectively, can help you secure and protect your container ecosystem. These measures apply throughout the container lifecycle, from development through production deployment, and to a range of container orchestrators, hosts, and platforms.

Use vulnerability management as part of your container development lifecycle

By using effective vulnerability management throughout the container development lifecycle, you improve the odds that you identify and resolve security concerns before they become a more serious problem.

Scan for vulnerabilities

New vulnerabilities are discovered all the time, so scanning for and identifying vulnerabilities is a continuous process. Incorporate vulnerability scanning throughout the container lifecycle:

- As a final check in your development pipeline, you should perform a vulnerability scan on containers before pushing the images to a public or private registry.
- Continue to scan container images in the registry both to identify any flaws that were somehow missed during development and to address any newly discovered vulnerabilities that might exist in the code used in the container images.

Map image vulnerabilities to running containers

You need to have a means of mapping vulnerabilities identified in container images to running containers, so security issues can be mitigated or resolved.

Ensure that only approved images are used in your environment

There's enough change and volatility in a container ecosystem without allowing unknown containers as well. Allow only approved container images. Have tools and processes in place to monitor for and prevent the use of unapproved container images.

An effective way of reducing the attack surface and preventing developers from making critical security mistakes is to control the flow of container images into your development environment. For example, you might sanction a single Linux distribution as a base image, preferably one that is lean (Alpine or CoreOS rather than Ubuntu), to minimize the surface for potential attacks.

Image signing or fingerprinting can provide a chain of custody that enables you to verify the integrity of the containers. For example, Azure Container Registry supports Docker's content trust model, which allows image publishers to sign images that are pushed to a registry, and image consumers to pull only signed images.

Permit only approved registries

An extension of ensuring that your environment uses only approved images is to permit only the use of approved container registries. Requiring the use of approved container registries reduces your exposure to risk by limiting the potential for the introduction of unknown vulnerabilities or security issues.

Ensure the integrity of images throughout the lifecycle

Part of managing security throughout the container lifecycle is to ensure the integrity of the container images in the registry and as they are altered or deployed into production.

- Images with vulnerabilities, even minor, should not be allowed to run in a production environment. Ideally, all images deployed in production should be saved in a private registry accessible to a select few. Keep the number of production images small to ensure that they can be managed effectively.

- Because it's hard to pinpoint the origin of software from a publicly available container image, build images from the source to ensure knowledge of the origin of the layer. When a vulnerability surfaces in a self-built container image, customers can find a quicker path to a resolution. With a public image, customers would need to find the root of a public image to fix it or get another secure image from the publisher.

- A thoroughly scanned image deployed in production is not guaranteed to be up-to-date for the lifetime of the application. Security vulnerabilities might be reported for layers of the image that were not previously known or were introduced after the production deployment.

  Periodically audit images deployed in production to identify images that are out of date or have not been updated in a while. You might use blue-green deployment methodologies and rolling upgrade mechanisms to update container images without downtime. You can scan images by using tools described in the preceding section.

- Use a continuous integration (CI) pipeline with integrated security scanning to build secure images and push them to your private registry. The vulnerability scanning built into the CI solution ensures that images that pass all the tests are pushed to the private registry from which production workloads are deployed.

  A CI pipeline failure ensures that vulnerable images are not pushed to the private registry that's used for production workload deployments. It also automates image security scanning if there's a significant number of images. Otherwise, manually auditing images for security vulnerabilities can be painstakingly lengthy and error prone.

Enforce least privileges in runtime

The concept of least privileges is a basic security best practice that also applies to containers. When a vulnerability is exploited, it generally gives the attacker access and privileges equal to those of the compromised application or process. Ensuring that containers operate with the lowest privileges and access required to get the job done reduces your exposure to risk.

Reduce the container attack surface by removing unneeded privileges

You can also minimize the potential attack surface by removing any unused or unnecessary processes or privileges from the container runtime. Privileged containers run as root. If a malicious user or workload escapes in a privileged container, the container will then run as root on that system.

Preapprove files and executables that the container is allowed to access or run

Reducing the number of variables or unknowns helps you maintain a stable, reliable environment. Limiting containers so they can access or run only preapproved or safelisted files and executables is a proven method of limiting exposure to risk.

It's a lot easier to manage a safelist when it's implemented from the beginning. A safelist provides a measure of control and manageability as you learn what files and executables are required for the application to function correctly.

A safelist not only reduces the attack surface but can also provide a baseline for anomalies and prevent the use cases of the "noisy neighbor" and container breakout scenarios.

Enforce network segmentation on running containers

To help protect containers in one subnet from security risks in another subnet, maintain network segmentation (or nano-segmentation) or segregation between running containers. Maintaining network segmentation may also be necessary to use containers in industries that are required to meet compliance mandates.

For example, the partner tool Aqua provides an automated approach for nano-segmentation. Aqua monitors container network activities in runtime. It identifies all inbound and outbound network connections to/from other containers, services, IP addresses, and the public internet. Nano-segmentation is automatically created based on monitored traffic.

Monitor container activity and user access

As with any IT environment, you should consistently monitor activity and user access to your container ecosystem to quickly identify any suspicious or malicious activity. Azure provides container monitoring solutions including:

- Azure Monitor for containers monitors the performance of your workloads deployed to Kubernetes environments hosted on Azure Kubernetes Service (AKS). Azure Monitor for containers gives you performance visibility by collecting memory and processor metrics from controllers, nodes, and containers that are available in Kubernetes through the Metrics API.

- The Azure Container Monitoring solution helps you view and manage other Docker and Windows container hosts in a single location. For example:

- View detailed audit information that shows commands used with containers.
    - Troubleshoot containers by viewing and searching centralized logs without having to remotely view Docker or Windows hosts.
    - Find containers that may be noisy and consume excess resources on a host.
    - View centralized CPU, memory, storage, and network usage and performance information for containers.

  The solution supports container orchestrators including Docker Swarm, DC/OS, unmanaged Kubernetes, Service Fabric, and Red Hat OpenShift.

Monitor container resource activity

Monitor your resource activity, like files, network, and other resources that your containers access. Monitoring resource activity and consumption is useful both for performance monitoring and as a security measure.

Azure Monitor enables core monitoring for Azure services by allowing the collection of metrics, activity logs, and diagnostic logs. For example, the activity log tells you when new resources are created or modified.

Metrics are available that provide performance statistics for different resources and even the operating system inside a virtual machine. You can view this data with one of the explorers in the Azure portal and create alerts based on these metrics. Azure Monitor provides the fastest metrics pipeline (5 minutes down to 1 minute), so you should use it for time-critical alerts and notifications.

Log all container administrative user access for auditing

Maintain an accurate audit trail of administrative access to your container ecosystem, including your Kubernetes cluster, container registry, and container images. These logs might be necessary for auditing purposes and will be useful as forensic evidence after any security incident. Azure solutions include:

- Integration of Azure Kubernetes Service with Azure Security Center to monitor the security configuration of the cluster environment and generate security recommendations
- Azure Container Monitoring solution
- Resource logs for Azure Container Instances and Azure Container Registry

Next steps

- Learn more about using Azure Security Center for real-time threat detection in your containerized environments.
- Learn more about managing container vulnerabilities with solutions from Twistlock and Aqua Security.

Deploy container instances into an Azure virtual network

2/13/2020 • 12 minutes to read • Edit Online

Azure Virtual Network provides secure, private networking for your Azure and on-premises resources. By deploying container groups into an Azure virtual network, your containers can communicate securely with other resources in the virtual network.

Container groups deployed into an Azure virtual network enable scenarios like:

- Direct communication between container groups in the same subnet
- Send task-based workload output from container instances to a database in the virtual network
- Retrieve content for container instances from a service endpoint in the virtual network
- Container communication with virtual machines in the virtual network
- Container communication with on-premises resources through a VPN gateway or ExpressRoute

IMPORTANT

Container group deployments to a virtual network are generally available for production workloads only in the following regions: **East US, South Central US, and West US 2**. In other regions where the feature is available, virtual network deployments are currently in preview, with general availability planned in the near future. Previews are made available to you on the condition that you agree to the supplemental terms of use.

Virtual network deployment limitations

Certain limitations apply when you deploy container groups to a virtual network.

- To deploy container groups to a subnet, the subnet cannot contain any other resource types. Remove all existing resources from an existing subnet prior to deploying container groups to it, or create a new subnet.
- You can't use a managed identity in a container group deployed to a virtual network.
- You can't enable a liveness probe or readiness probe in a container group deployed to a virtual network.
- Due to the additional networking resources involved, deploying a container group to a virtual network is typically slower than deploying a standard container instance.

Regions and resource availability

REGIONS	OS	MAX CPU	MAX MEMORY (GB)	STORAGE (GB)
Australia East, Canada Central, Central US, East US[1], East US 2, North Europe, South Central US[1], Southeast Asia, West Europe, West US 2[1]	Linux	4	16	50
Japan East	Linux	2	8	50

REGIONS	OS	MAX CPU	MAX MEMORY (GB)	STORAGE (GB)
North Central US, South India, West US	Linux	2	3.5	50

[1]Region in which container group deployments to a virtual network are generally available for production workloads. In other regions, virtual network deployments are in preview.

Container resource limits may differ from limits for non-networked container instances in these regions. Currently only Linux containers are supported for this feature. Windows support is planned.

Unsupported networking scenarios

- **Azure Load Balancer** - Placing an Azure Load Balancer in front of container instances in a networked container group is not supported
- **Virtual network peering**
  - VNet peering will not work for ACI if the network that the ACI VNet is peering to uses a public IP space. The peered network needs an RFC 1918 private IP space in order for VNet peering to work.
  - You can only peer your VNet to one other VNet
- **Virtual network traffic routing** - Custom routes cannot be set up around public IPs. Routes can be set up within the private IP space of the delegated subnet in which the ACI resources are deployed
- **Network security groups** - Outbound security rules in NSGs applied to a subnet delegated to Azure Container Instances aren't currently enforced
- **Public IP or DNS label** - Container groups deployed to a virtual network don't currently support exposing containers directly to the internet with a public IP address or a fully qualified domain name
- **Internal name resolution** - Name resolution for Azure resources in the virtual network via the internal Azure DNS is not supported

Network resource deletion requires additional steps once you've deployed container groups to the virtual network.

Required network resources

There are three Azure Virtual Network resources required for deploying container groups to a virtual network: the virtual network itself, a delegated subnet within the virtual network, and a network profile.

Virtual network

A virtual network defines the address space in which you create one or more subnets. You then deploy Azure resources (like container groups) into the subnets in your virtual network.

Subnet (delegated)

Subnets segment the virtual network into separate address spaces usable by the Azure resources you place in them. You create one or several subnets within a virtual network.

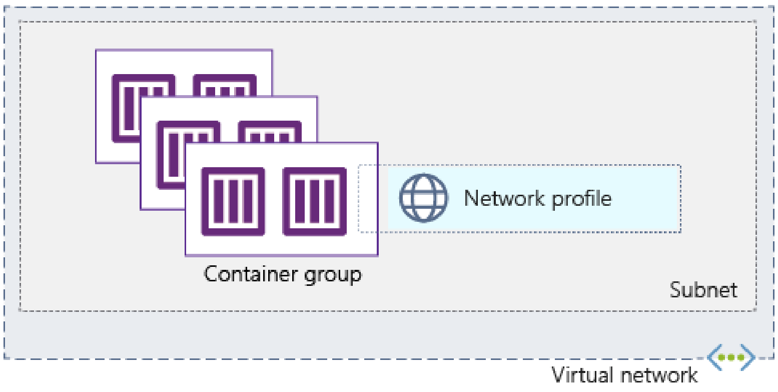
The subnet that you use for container groups may contain only container groups. When you first deploy a container group to a subnet, Azure delegates that subnet to Azure Container Instances. Once delegated, the subnet can be used only for container groups. If you attempt to deploy resources other than container groups to a delegated subnet, the operation fails.

Network profile

A network profile is a network configuration template for Azure resources. It specifies certain network properties for the resource, for example, the subnet into which it should be deployed. When you first use the az container create command to deploy a container group to a subnet (and thus a virtual network), Azure creates a network profile for you. You can then use that network profile for future deployments to the subnet.

To use a Resource Manager template, YAML file, or a programmatic method to deploy a container group to a subnet, you need to provide the full Resource Manager resource ID of a network profile. You can use a profile previously created using az container create, or create a profile using a Resource Manager template (see template example and reference). To get the ID of a previously created profile, use the az network profile list command.

In the following diagram, several container groups have been deployed to a subnet delegated to Azure Container Instances. Once you've deployed one container group to a subnet, you can deploy additional container groups to it by specifying the same network profile.



Deployment scenarios

You can use az container create to deploy container groups to a new virtual network and allow Azure to create the required network resources for you, or deploy to an existing virtual network.

New virtual network

To deploy to a new virtual network and have Azure create the network resources for you automatically, specify the following when you execute az container create:

- Virtual network name
- Virtual network address prefix in CIDR format
- Subnet name
- Subnet address prefix in CIDR format

The virtual network and subnet address prefixes specify the address spaces for the virtual network and subnet, respectively. These values are represented in Classless Inter-Domain Routing (CIDR) notation, for example `10.0.0.0/16`. For more information about working with subnets, see Add, change, or delete a virtual network subnet.

Once you've deployed your first container group with this method, you can deploy to the same subnet by specifying the virtual network and subnet names, or the network profile that Azure automatically creates for you. Because Azure delegates the subnet to Azure Container Instances, you can deploy *only* container groups to the subnet.

Existing virtual network

To deploy a container group to an existing virtual network:

1. Create a subnet within your existing virtual network, use an existing subnet in which a container group is already deployed, or use an existing subnet emptied of *all* other resources
2. Deploy a container group with az container create and specify one of the following:
   - Virtual network name and subnet name
   - Virtual network resource ID and subnet resource ID, which allows using a virtual network from a different resource group
   - Network profile name or ID, which you can obtain using az network profile list

Once you deploy your first container group to an existing subnet, Azure delegates that subnet to Azure Container Instances. You can no longer deploy resources other than container groups to that subnet.

Deployment examples

The following sections describe how to deploy container groups to a virtual network with the Azure CLI. The command examples are formatted for the **Bash** shell. If you prefer another shell such as PowerShell or Command Prompt, adjust the line continuation characters accordingly.

Deploy to a new virtual network

First, deploy a container group and specify the parameters for a new virtual network and subnet. When you specify these parameters, Azure creates the virtual network and subnet, delegates the subnet to Azure Container instances, and also creates a network profile. Once these resources are created, your container group is deployed to the subnet.

Run the following az container create command that specifies settings for a new virtual network and subnet. You need to supply the name of a resource group that was created in a region where container group deployments in a virtual network are available. This command deploys the public Microsoft aci-helloworld container that runs a small Node.js webserver serving a static web page. In the next section, you'll deploy a second container group to the same subnet, and test communication between the two container instances.

```
az container create \
    --name appcontainer \
    --resource-group myResourceGroup \
    --image mcr.microsoft.com/azuredocs/aci-helloworld \
    --vnet aci-vnet \
    --vnet-address-prefix 10.0.0.0/16 \
    --subnet aci-subnet \
    --subnet-address-prefix 10.0.0.0/24
```

When you deploy to a new virtual network by using this method, the deployment can take a few minutes while the network resources are created. After the initial deployment, additional container group deployments complete more quickly.

Deploy to existing virtual network

Now that you've deployed a container group to a new virtual network, deploy a second container group to the same subnet, and verify communication between the two container instances.

First, get the IP address of the first container group you deployed, the *appcontainer*:

```
az container show --resource-group myResourceGroup --name appcontainer --query ipAddress.ip --output tsv
```

The output should display the IP address of the container group in the private subnet:

```
$ az container show --resource-group myResourceGroup --name appcontainer --query ipAddress.ip --output tsv
10.0.0.4
```

Now, set `CONTAINER_GROUP_IP` to the IP you retrieved with the `az container show` command, and execute the following `az container create` command. This second container,*commchecker*, runs an Alpine Linux-based image and executes `wget` against the first container group's private subnet IP address.

```
CONTAINER_GROUP_IP=<container-group-IP-here>

az container create \
    --resource-group myResourceGroup \
    --name commchecker \
    --image alpine:3.5 \
    --command-line "wget $CONTAINER_GROUP_IP" \
    --restart-policy never \
    --vnet aci-vnet \
    --subnet aci-subnet
```

After this second container deployment has completed, pull its logs so you can see the output of the `wget` command it executed:

```
az container logs --resource-group myResourceGroup --name commchecker
```

If the second container communicated successfully with the first, output should be similar to:

```
$ az container logs --resource-group myResourceGroup --name commchecker
Connecting to 10.0.0.4 (10.0.0.4:80)
index.html           100% |*******************************|  1663   0:00:00 ETA
```

The log output should show that `wget` was able to connect and download the index file from the first container using its private IP address on the local subnet. Network traffic between the two container groups remained within the virtual network.

Deploy to existing virtual network - YAML

You can also deploy a container group to an existing virtual network by using a YAML file, a Resource Manager template, or another programmatic method such as with the Python SDK. To deploy to a subnet in a virtual network, you specify several additional properties in the YAML:

- `ipAddress`: The IP address settings for the container group.
    - `ports`: The ports to open, if any.
    - `protocol`: The protocol (TCP or UDP) for the opened port.
- `networkProfile`: Specifies network settings like the virtual network and subnet for an Azure resource.
    - `id`: The full Resource Manager resource ID of the `networkProfile`.

To deploy a container group to a virtual network with a YAML file, you first need to get the ID of the network profile. Execute the az network profile list command, specifying the name of the resource group that contains your virtual network and delegated subnet.

```
az network profile list --resource-group myResourceGroup --query [0].id --output tsv
```

The output of the command displays the full resource ID for the network profile:

```
$ az network profile list --resource-group myResourceGroup --query [0].id --output tsv
/subscriptions/<Subscription
ID>/resourceGroups/myResourceGroup/providers/Microsoft.Network/networkProfiles/aci-network-profile-aci-vnet-
aci-subnet
```

Once you have the network profile ID, copy the following YAML into a new file named *vnet-deploy-aci.yaml*. Under `networkProfile`, replace the `id` value with ID you just retrieved, then save the file. This YAML creates a container group named *appcontaineryaml* in your virtual network.

```
apiVersion: '2018-09-01'
location: westus
name: appcontaineryaml
properties:
  containers:
  - name: appcontaineryaml
    properties:
      image: mcr.microsoft.com/azuredocs/aci-helloworld
      ports:
      - port: 80
        protocol: TCP
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
  ipAddress:
    type: Private
    ports:
    - protocol: tcp
      port: '80'
  networkProfile:
    id: /subscriptions/<Subscription
ID>/resourceGroups/myResourceGroup/providers/Microsoft.Network/networkProfiles/aci-network-profile-aci-vnet-
subnet
  osType: Linux
  restartPolicy: Always
tags: null
type: Microsoft.ContainerInstance/containerGroups
```

Deploy the container group with the az container create command, specifying the YAML file name for the `--file` parameter:

```
az container create --resource-group myResourceGroup --file vnet-deploy-aci.yaml
```

Once the deployment has completed, run the az container show command to display its status:

```
$ az container show --resource-group myResourceGroup --name appcontaineryaml --output table
Name              ResourceGroup    Status    Image                                       IP:ports     Network
CPU/Memory       OsType    Location
----------------  ---------------  --------  ------------------------------------------  -----------  -------
--  ---------------  --------  ----------
appcontaineryaml  myResourceGroup  Running   mcr.microsoft.com/azuredocs/aci-helloworld  10.0.0.5:80  Private
1.0 core/1.5 gb  Linux     westus
```

Clean up resources

Delete container instances

When you're done working with the container instances you created, delete them with the following commands:

```
az container delete --resource-group myResourceGroup --name appcontainer -y
az container delete --resource-group myResourceGroup --name commchecker -y
az container delete --resource-group myResourceGroup --name appcontaineryaml -y
```

Delete network resources

This feature currently requires several additional commands to delete the network resources you created earlier. If you used the example commands in previous sections of this article to create your virtual network and subnet, then you can use the following script to delete those network resources. The script assumes that your resource group contains a single virtual network with a single network profile.

Before executing the script, set the `RES_GROUP` variable to the name of the resource group containing the virtual network and subnet that should be deleted. Update the name of the virtual network if you did not use the `aci-vnet` name suggested earlier. The script is formatted for the Bash shell. If you prefer another shell such as PowerShell or Command Prompt, you'll need to adjust variable assignment and accessors accordingly.

WARNING

This script deletes resources! It deletes the virtual network and all subnets it contains. Be sure that you no longer need *any* of the resources in the virtual network, including any subnets it contains, prior to running this script. Once deleted, **these resources are unrecoverable**.

```
# Replace <my-resource-group> with the name of your resource group
# Assumes one virtual network in resource group
RES_GROUP=<my-resource-group>

# Get network profile ID
# Assumes one profile in virtual network
NETWORK_PROFILE_ID=$(az network profile list --resource-group $RES_GROUP --query [0].id --output tsv)

# Delete the network profile
az network profile delete --id $NETWORK_PROFILE_ID -y

# Delete virtual network
az network vnet delete --resource-group $RES_GROUP --name aci-vnet
```

Next steps

To deploy a new virtual network, subnet, network profile, and container group using a Resource Manager template, see Create an Azure container group with VNet.

Several virtual network resources and features were discussed in this article, though briefly. The Azure Virtual Network documentation covers these topics extensively:

- Virtual network
- Subnet
- Service endpoints
- VPN Gateway
- ExpressRoute

Deploy to Azure Container Instances from Azure Container Registry

2/19/2020 • 5 minutes to read • Edit Online

Azure Container Registry is an Azure-based, managed container registry service used to store private Docker container images. This article describes how to pull container images stored in an Azure container registry when deploying to Azure Container Instances. A recommended way to configure registry access is to create an Azure Active Directory service principal and password, and store the login credentials in an Azure key vault.

Prerequisites

Azure container registry: You need an Azure container registry--and at least one container image in the registry--to complete the steps in this article. If you need a registry, see Create a container registry using the Azure CLI.

Azure CLI: The command-line examples in this article use the Azure CLI and are formatted for the Bash shell. You can install the Azure CLI locally, or use the Azure Cloud Shell.

Configure registry authentication

In a production scenario where you provide access to "headless" services and applications, it's recommended to configure registry access by using a service principal. A service principal allows you to provide role-based access control to your container images. For example, you can configure a service principal with pull-only access to a registry.

Azure Container Registry provides additional authentication options.

> **NOTE**
>
> You can't authenticate to Azure Container Registry to pull images during container group deployment by using a managed identity configured in the same container group.

In the following section, you create an Azure key vault and a service principal, and store the service principal's credentials in the vault.

Create key vault

If you don't already have a vault in Azure Key Vault, create one with the Azure CLI using the following commands.

Update the `RES_GROUP` variable with the name of an existing resource group in which to create the key vault, and `ACR_NAME` with the name of your container registry. For brevity, commands in this article assume that your registry, key vault, and container instances are all created in the same resource group.

Specify a name for your new key vault in `AKV_NAME`. The vault name must be unique within Azure and must be 3-24 alphanumeric characters in length, begin with a letter, end with a letter or digit, and cannot contain consecutive hyphens.

```
RES_GROUP=myresourcegroup # Resource Group name
ACR_NAME=myregistry       # Azure Container Registry registry name
AKV_NAME=mykeyvault       # Azure Key Vault vault name

az keyvault create -g $RES_GROUP -n $AKV_NAME
```

Create service principal and store credentials

Now create a service principal and store its credentials in your key vault.

The following command uses az ad sp create-for-rbac to create the service principal, and az keyvault secret set to store the service principal's **password** in the vault.

```
# Create service principal, store its password in vault (the registry *password*)
az keyvault secret set \
  --vault-name $AKV_NAME \
  --name $ACR_NAME-pull-pwd \
  --value $(az ad sp create-for-rbac \
                --name http://$ACR_NAME-pull \
                --scopes $(az acr show --name $ACR_NAME --query id --output tsv) \
                --role acrpull \
                --query password \
                --output tsv)
```

The `--role` argument in the preceding command configures the service principal with the *acrpull* role, which grants it pull-only access to the registry. To grant both push and pull access, change the `--role` argument to *acrpush*.

Next, store the service principal's *appId* in the vault, which is the **username** you pass to Azure Container Registry for authentication.

```
# Store service principal ID in vault (the registry *username*)
az keyvault secret set \
    --vault-name $AKV_NAME \
    --name $ACR_NAME-pull-usr \
    --value $(az ad sp show --id http://$ACR_NAME-pull --query appId --output tsv)
```

You've created an Azure key vault and stored two secrets in it:

- `$ACR_NAME-pull-usr`: The service principal ID, for use as the container registry **username**.
- `$ACR_NAME-pull-pwd`: The service principal password, for use as the container registry **password**.

You can now reference these secrets by name when you or your applications and services pull images from the registry.

Deploy container with Azure CLI

Now that the service principal credentials are stored in Azure Key Vault secrets, your applications and services can use them to access your private registry.

First get the registry's login server name by using the az acr show command. The login server name is all lowercase and similar to `myregistry.azurecr.io`.

```
ACR_LOGIN_SERVER=$(az acr show --name $ACR_NAME --resource-group $RES_GROUP --query "loginServer" --output tsv)
```

Execute the following az container create command to deploy a container instance. The command uses the service principal's credentials stored in Azure Key Vault to authenticate to your container registry, and assumes you've previously pushed the aci-helloworld image to your registry. Update the `--image` value if you'd like to use a different image from your registry.

```
az container create \
    --name aci-demo \
    --resource-group $RES_GROUP \
    --image $ACR_LOGIN_SERVER/aci-helloworld:v1 \
    --registry-login-server $ACR_LOGIN_SERVER \
    --registry-username $(az keyvault secret show --vault-name $AKV_NAME -n $ACR_NAME-pull-usr --query value -o
tsv) \
    --registry-password $(az keyvault secret show --vault-name $AKV_NAME -n $ACR_NAME-pull-pwd --query value -o
tsv) \
    --dns-name-label aci-demo-$RANDOM \
    --query ipAddress.fqdn
```

The `--dns-name-label` value must be unique within Azure, so the preceding command appends a random number to the container's DNS name label. The output from the command displays the container's fully qualified domain name (FQDN), for example:

```
$ az container create --name aci-demo --resource-group $RES_GROUP --image $ACR_LOGIN_SERVER/aci-helloworld:v1 -
-registry-login-server $ACR_LOGIN_SERVER --registry-username $(az keyvault secret show --vault-name $AKV_NAME -
n $ACR_NAME-pull-usr --query value -o tsv) --registry-password $(az keyvault secret show --vault-name $AKV_NAME
-n $ACR_NAME-pull-pwd --query value -o tsv) --dns-name-label aci-demo-$RANDOM --query ipAddress.fqdn
"aci-demo-25007.eastus.azurecontainer.io"
```

Once the container has started successfully, you can navigate to its FQDN in your browser to verify the application is running successfully.

Deploy with Azure Resource Manager template

You can specify the properties of your Azure container registry in an Azure Resource Manager template by including the `imageRegistryCredentials` property in the container group definition. For example, you can specify the registry credentials directly:

```
[...]
"imageRegistryCredentials": [
  {
    "server": "imageRegistryLoginServer",
    "username": "imageRegistryUsername",
    "password": "imageRegistryPassword"
  }
]
[...]
```

For complete container group settings, see the Resource Manager template reference.

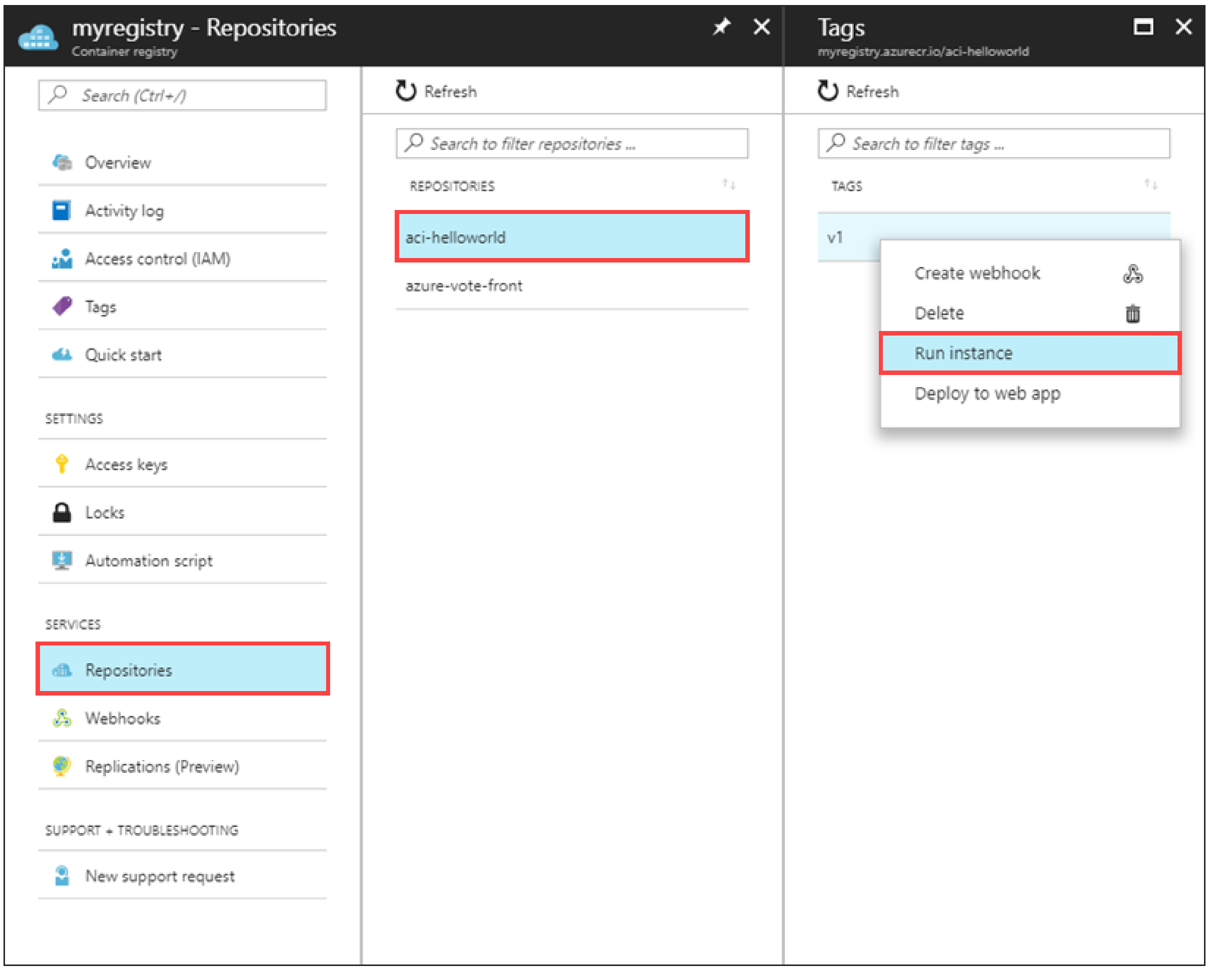
For details on referencing Azure Key Vault secrets in a Resource Manager template, see Use Azure Key Vault to pass secure parameter value during deployment.

Deploy with Azure portal

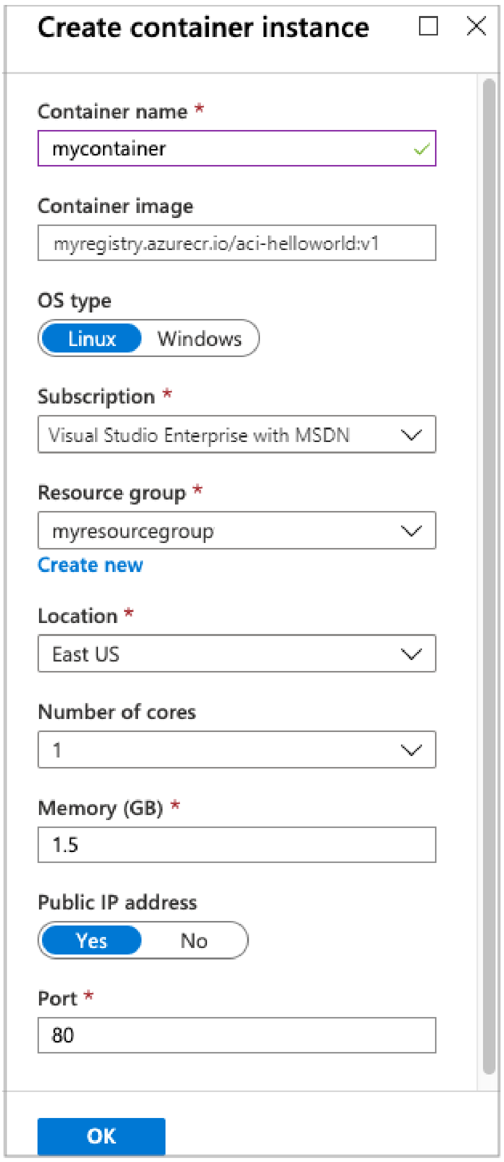
If you maintain container images in an Azure container registry, you can easily create a container in Azure Container Instances using the Azure portal. When using the portal to deploy a container instance from a container registry, you must enable the registry's admin account. The admin account is designed for a single user to access the registry, mainly for testing purposes.

1. In the Azure portal, navigate to your container registry.
2. To confirm that the admin account is enabled, select **Access keys**, and under **Admin user** select **Enable**.
3. Select **Repositories**, then select the repository that you want to deploy from, right-click the tag for the

container image you want to deploy, and select **Run instance**.



4. Enter a name for the container and a name for the resource group. You can also change the default values if you wish.


Create container instance

Container name *
mycontainer

Container image
myregistry.azurecr.io/aci-helloworld:v1

OS type
[✓ Linux] Windows

Subscription *
Visual Studio Enterprise with MSDN

Resource group *
myresourcegroup
Create new

Location *
East US

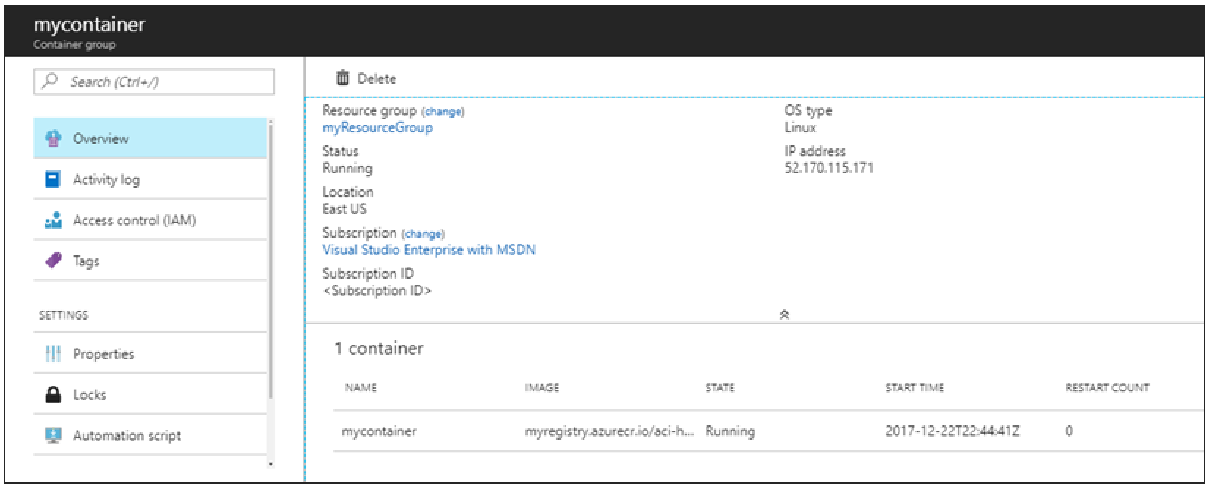
Number of cores
1

Memory (GB) *
1.5

Public IP address
[✓ Yes] No

Port *
80

5. Once the deployment completes, you can navigate to the container group from the notifications pane to find its IP address and other properties.


mycontainer
Container group

Resource group (change)
myResourceGroup
Status
Running
Location
East US
Subscription (change)
Visual Studio Enterprise with MSDN
Subscription ID
<Subscription ID>

OS type
Linux
IP address
52.170.115.171

1 container

NAME	IMAGE	STATE	START TIME	RESTART COUNT
mycontainer	myregistry.azurecr.io/aci-h...	Running	2017-12-22T22:44:41Z	0

Next steps

For more information about Azure Container Registry authentication, see Authenticate with an Azure container registry.

Encrypt deployment data

2/21/2020 • 6 minutes to read • Edit Online

When running Azure Container Instances (ACI) resources in the cloud, the ACI service collects and persists data related to your containers. ACI automatically encrypts this data when it is persisted in the cloud. This encryption protects your data to help meet your organization's security and compliance commitments. ACI also gives you the option to encrypt this data with your own key, giving you greater control over the data related to your ACI deployments.

About ACI data encryption

Data in ACI is encrypted and decrypted using 256-bit AES encryption. It is enabled for all ACI deployments, and you don't need to modify your deployment or containers to take advantage of this encryption. This includes metadata about the deployment, environment variables, keys being passed into your containers, and logs persisted after your containers are stopped so you can still see them. Encryption does not affect your container group performance, and there is no additional cost for encryption.

Encryption key management

You can rely on Microsoft-managed keys for the encryption of your container data, or you can manage the encryption with your own keys. The following table compares these options:

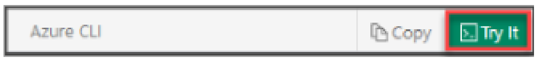
	MICROSOFT-MANAGED KEYS	CUSTOMER-MANAGED KEYS
Encryption/decryption operations	Azure	Azure
Key storage	Microsoft key store	Azure Key Vault
Key rotation responsibility	Microsoft	Customer
Key access	Microsoft only	Microsoft, Customer

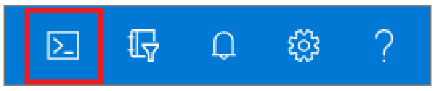
The rest of the document covers the steps required to encrypt your ACI deployment data with your key (customer-managed key).

Use Azure Cloud Shell

Azure hosts Azure Cloud Shell, an interactive shell environment that you can use through your browser. You can use either Bash or PowerShell with Cloud Shell to work with Azure services. You can use the Cloud Shell preinstalled commands to run the code in this article without having to install anything on your local environment.

To start Azure Cloud Shell:

OPTION	EXAMPLE/LINK
Select **Try It** in the upper-right corner of a code block. Selecting **Try It** doesn't automatically copy the code to Cloud Shell.	

OPTION	EXAMPLE/LINK
Go to https://shell.azure.com, or select the **Launch Cloud Shell** button to open Cloud Shell in your browser.	
Select the **Cloud Shell** button on the menu bar at the upper right in the Azure portal.	

To run the code in this article in Azure Cloud Shell:

1. Start Cloud Shell.
2. Select the **Copy** button on a code block to copy the code.
3. Paste the code into the Cloud Shell session by selecting **Ctrl**+**Shift**+**V** on Windows and Linux or by selecting **Cmd**+**Shift**+**V** on macOS.
4. Select **Enter** to run the code.

Encrypt data with a customer-managed key

Create Service Principal for ACI

The first step is to ensure that your Azure tenant has a service principal assigned for granting permissions to the Azure Container Instances service.

The following CLI command will set up the ACI SP in your Azure environment:

```
az ad sp create --id 6bb8e274-af5d-4df2-98a3-4fd78b4cafd9
```

The output from running this command should show you a service principal that has been set up with "displayName": "Azure Container Instance Service."

Create a Key Vault resource

Create an Azure Key Vault using Azure portal, CLI, or PowerShell.

For the properties of your key vault, use the following guidelines:

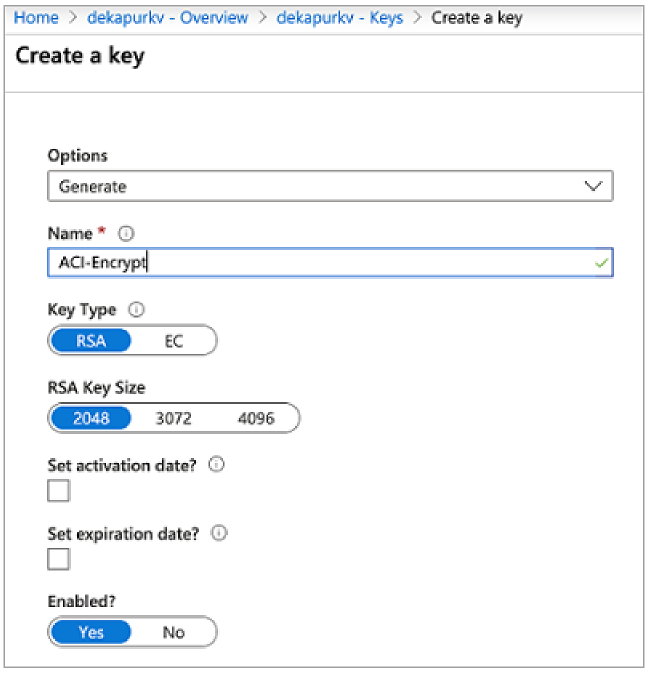
- Name: A unique name is required.
- Subscription: Choose a subscription.
- Under Resource Group, either choose an existing resource group, or create new and enter a resource group name.
- In the Location pull-down menu, choose a location.
- You can leave the other options to their defaults or pick based on additional requirements.

IMPORTANT

When using customer-managed keys to encrypt an ACI deployment template, it is recommended that the following two properties be set on the key vault, Soft Delete and Do Not Purge. These properties are not enabled by default, but can be enabled using either PowerShell or Azure CLI on a new or existing key vault.

Generate a new key

Once your key vault is created, navigate to the resource in Azure portal. On the left navigation menu of the resource blade, under Settings, click **Keys**. On the view for "Keys," click "Generate/Import" to generate a new key. Use any unique Name for this key, and any other preferences based on your requirements.


Home > dekapurkv - Overview > dekapurkv - Keys > Create a key

Create a key

Options: Generate

Name *: ACI-Encrypt

Key Type: [✓ RSA] EC

RSA Key Size: [✓ 2048] 3072 4096

Set activation date? ☐

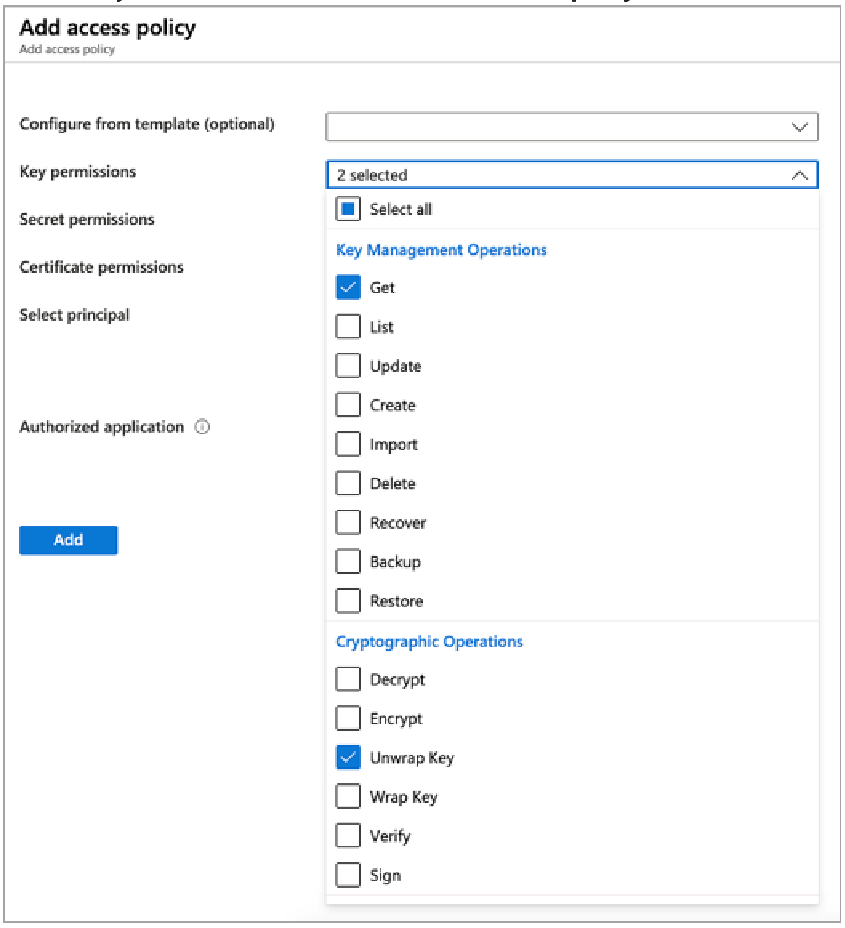
Set expiration date? ☐

Enabled? [✓ Yes] No

Set access policy

Create a new access policy for allowing the ACI service to access your Key.

- Once your key has been generated, back in your key vault resource blade, under Settings, click **Access Policies**.
- On the "Access Policies" page for your key vault, click **Add Access Policy**.
- Set the *Key Permissions* to include **Get** and **Unwrap Key**


Add access policy
Add access policy

Configure from template (optional):

Key permissions: 2 selected

Secret permissions

Certificate permissions

Select principal

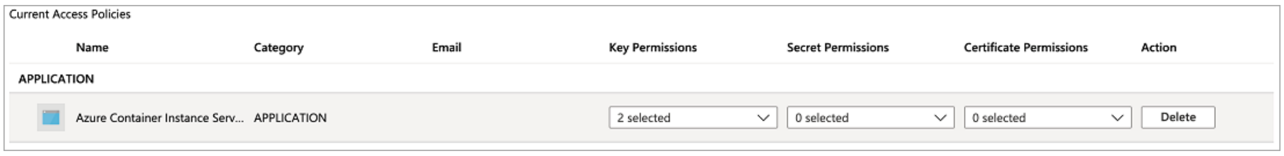
Authorized application

Key Management Operations: ✓ Get, ☐ List, ☐ Update, ☐ Create, ☐ Import, ☐ Delete, ☐ Recover, ☐ Backup, ☐ Restore

Cryptographic Operations: ☐ Decrypt, ☐ Encrypt, ✓ Unwrap Key, ☐ Wrap Key, ☐ Verify, ☐ Sign

- For *Select Principal*, select **Azure Container Instance Service**
- Click **Add** at the bottom

The access policy should now show up in your key vault's access policies.


Current Access Policies

Name	Category	Email	Key Permissions	Secret Permissions	Certificate Permissions	Action
APPLICATION						
Azure Container Instance Serv...	APPLICATION		2 selected	0 selected	0 selected	Delete

Modify your JSON deployment template

IMPORTANT

Encrypting deployment data with a customer-managed key is available in the latest API version (2019-12-01) that is currently rolling out. Specify this API version in your deployment template. If you have any issues with this, please reach out to Azure Support.

Once the key vault key and access policy are set up, add the following properties to your ACI deployment template. Learn more about deploying ACI resources with a template in the Tutorial: Deploy a multi-container group using a Resource Manager template.

- Under `resources`, set `apiVersion` to `2019-12-01`.
- Under the container group properties section of the deployment template, add an `encryptionProperties`, which contains the following values:
  - `vaultBaseUrl`: the DNS Name of your key vault, can be found on the overview blade of the key vault resource in Portal
  - `keyName`: the name of the key generated earlier
  - `keyVersion`: the current version of the key. This can be found by clicking into the key itself (under "Keys" in the Settings section of your key vault resource)
- Under the container group properties, add a `sku` property with value `Standard`. The `sku` property is required in API version 2019-12-01.

The following template snippet shows these additional properties to encrypt deployment data:

```
[...]
"resources": [
    {
        "name": "[parameters('containerGroupName')]",
        "type": "Microsoft.ContainerInstance/containerGroups",
        "apiVersion": "2019-12-01",
        "location": "[resourceGroup().location]",
        "properties": {
            "encryptionProperties": {
                "vaultBaseUrl": "https://example.vault.azure.net",
                "keyName": "acikey",
                "keyVersion": "xxxxxxxxxxxxxxxx"
            },
            "sku": "Standard",
            "containers": {
                [...]
            }
        }
    }
]
```

Following is a complete template, adapted from the template in Tutorial: Deploy a multi-container group using a Resource Manager template.

```
{
  "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "parameters": {
    "containerGroupName": {
      "type": "string",
      "defaultValue": "myContainerGroup",
      "metadata": {
        "description": "Container Group name."
      }
    }
  },
  "variables": {
    "container1name": "aci-tutorial-app",
    "container1image": "mcr.microsoft.com/azuredocs/aci-helloworld:latest",
    "container2name": "aci-tutorial-sidecar",
    "container2image": "mcr.microsoft.com/azuredocs/aci-tutorial-sidecar"
  },
  "resources": [
    {
      "name": "[parameters('containerGroupName')]",
      "type": "Microsoft.ContainerInstance/containerGroups",
      "apiVersion": "2019-12-01",
      "location": "[resourceGroup().location]",
      "properties": {
        "encryptionProperties": {
            "vaultBaseUrl": "https://example.vault.azure.net",
            "keyName": "acikey",
            "keyVersion": "xxxxxxxxxxxxxxxx"
        },
        "sku": "Standard",
        "containers": [
          {
            "name": "[variables('container1name')]",
            "properties": {
              "image": "[variables('container1image')]",
              "resources": {
                "requests": {
                  "cpu": 1,
                  "memoryInGb": 1.5
                }
              },
              "ports": [
                {
                  "port": 80
                },
                {
                  "port": 8080
                }
              ]
            }
          },
          {
            "name": "[variables('container2name')]",
            "properties": {
              "image": "[variables('container2image')]",
              "resources": {
                "requests": {
                  "cpu": 1,
                  "memoryInGb": 1.5
                }
              }
            }
          }
        ],
        "osType": "Linux",
        "ipAddress": {
          "type": "Public",
          "ports": [
            {
              "protocol": "tcp",
              "port": "80"
            },
            {
                "protocol": "tcp",
                "port": "8080"
            }
          ]
        }
      }
    }
  ],
  "outputs": {
    "containerIPv4Address": {
      "type": "string",
      "value": "[reference(resourceId('Microsoft.ContainerInstance/containerGroups/',
parameters('containerGroupName'))).ipAddress.ip]"
    }
  }
}
```

Deploy your resources

If you created and edited the template file on your desktop, you can upload it to your Cloud Shell directory by dragging the file into it.

Create a resource group with the az group create command.

```
az group create --name myResourceGroup --location eastus
```

Deploy the template with the az group deployment create command.

```
az group deployment create --resource-group myResourceGroup --template-file deployment-template.json
```

Within a few seconds, you should receive an initial response from Azure. Once the deployment completes, all data related to it persisted by the ACI service will be encrypted with the key you provided.

Deploy on dedicated hosts

2/1/2020 • 2 minutes to read • Edit Online

"Dedicated" is an Azure Container Instances (ACI) sku that provides an isolated and dedicated compute environment for securely running containers. Using the dedicated sku results in each container group having a dedicated physical server in an Azure datacenter, ensuring full workload isolation to help meet your organization's security and compliance requirements.

The dedicated sku is appropriate for container workloads that require workload isolation from a physical server perspective.

Prerequisites

- The default limit for any subscription to use the dedicated sku is 0. If you would like to use this sku for your production container deployments, create an Azure Support request to increase the limit.

Use the dedicated sku

IMPORTANT

Using the dedicated sku is only available in the latest API version (2019-12-01) that is currently rolling out. Specify this API version in your deployment template.

Starting with API version 2019-12-01, there is a `sku` property under the container group properties section of a deployment template, which is required for an ACI deployment. Currently, you can use this property as part of an Azure Resource Manager deployment template for ACI. Learn more about deploying ACI resources with a template in the Tutorial: Deploy a multi-container group using a Resource Manager template.

The `sku` property can have one of the following values:

- `Standard` - the standard ACI deployment choice, which still guarantees hypervisor-level security
- `Dedicated` - used for workload level isolation with dedicated physical hosts for the container group

Modify your JSON deployment template

In your deployment template, modify or add the following properties:

- Under `resources`, set `apiVersion` to `2012-12-01`.
- Under the container group properties, add a `sku` property with value `Dedicated`.

Here is an example snippet for the resources section of a container group deployment template that uses the dedicated sku:

```
[...]
"resources": [
    {
        "name": "[parameters('containerGroupName')]",
        "type": "Microsoft.ContainerInstance/containerGroups",
        "apiVersion": "2019-12-01",
        "location": "[resourceGroup().location]",
        "properties": {
            "sku": "Dedicated",
            "containers": {
                [...]
            }
        }
    }
]
```

Following is a complete template that deploys a sample container group running a single container instance:

```json
{
    "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
    "contentVersion": "1.0.0.0",
    "parameters": {
      "containerGroupName": {
        "type": "string",
        "defaultValue": "myContainerGroup",
        "metadata": {
          "description": "Container Group name."
        }
      }
    },
    "resources": [
        {
            "name": "[parameters('containerGroupName')]",
            "type": "Microsoft.ContainerInstance/containerGroups",
            "apiVersion": "2019-12-01",
            "location": "[resourceGroup().location]",
            "properties": {
                "sku": "Dedicated",
                "containers": [
                    {
                        "name": "container1",
                        "properties": {
                            "image": "nginx",
                            "command": [
                                "/bin/sh",
                                "-c",
                                "while true; do echo `date`; sleep 1000000; done"
                            ],
                            "ports": [
                                {
                                    "protocol": "TCP",
                                    "port": 80
                                }
                            ],
                            "environmentVariables": [],
                            "resources": {
                                "requests": {
                                    "memoryInGB": 1.0,
                                    "cpu": 1
                                }
                            }
                        }
                    }
                ],
                "restartPolicy": "Always",
                "ipAddress": {
                    "ports": [
                        {
                            "protocol": "TCP",
                            "port": 80
                        }
                    ],
                    "type": "Public"
                },
                "osType": "Linux"
            },
            "tags": {}
        }
    ]
}
```

Deploy your container group

If you created and edited the deployment template file on your desktop, you can upload it to your Cloud Shell directory by dragging the file into it.

Create a resource group with the az group create command.

```
az group create --name myResourceGroup --location eastus
```

Deploy the template with the az group deployment create command.

```
az group deployment create --resource-group myResourceGroup --template-file deployment-template.json
```

Within a few seconds, you should receive an initial response from Azure. A successful deployment takes place on a dedicated host.

Deploy and manage Azure Container Instances by using Azure Logic Apps

1/16/2020 • 2 minutes to read • Edit Online

With Azure Logic Apps and the Azure Container Instance connector, you can set up automated tasks and workflows that deploy and manage container groups. The Container Instance connector supports the following actions:

- Create or delete a container group
- Get the properties of a container group
- Get a list of container groups
- Get the logs of a container instance

Use these actions in your logic apps for tasks such as running a container workload in response to a Logic Apps trigger. You can also have other actions use the output from Container Instance actions.

This connector provides only actions, so to start your logic app, use a separate trigger, such as a **Recurrence** trigger to run a container workload on a regular schedule. Or, you might have need to trigger a container group deployment after an event such as arrival of an Outlook e-mail.

If you're new to logic apps, review What is Azure Logic Apps?

Prerequisites

- An Azure subscription. If you don't have an Azure subscription, sign up for a free Azure account.
- Basic knowledge about how to create logic apps and how to create and manage container instances
- The logic app where you want to access your container instances. To use an action, start your logic app with another trigger, for example, the **Recurrence** trigger.

Add a Container Instance action

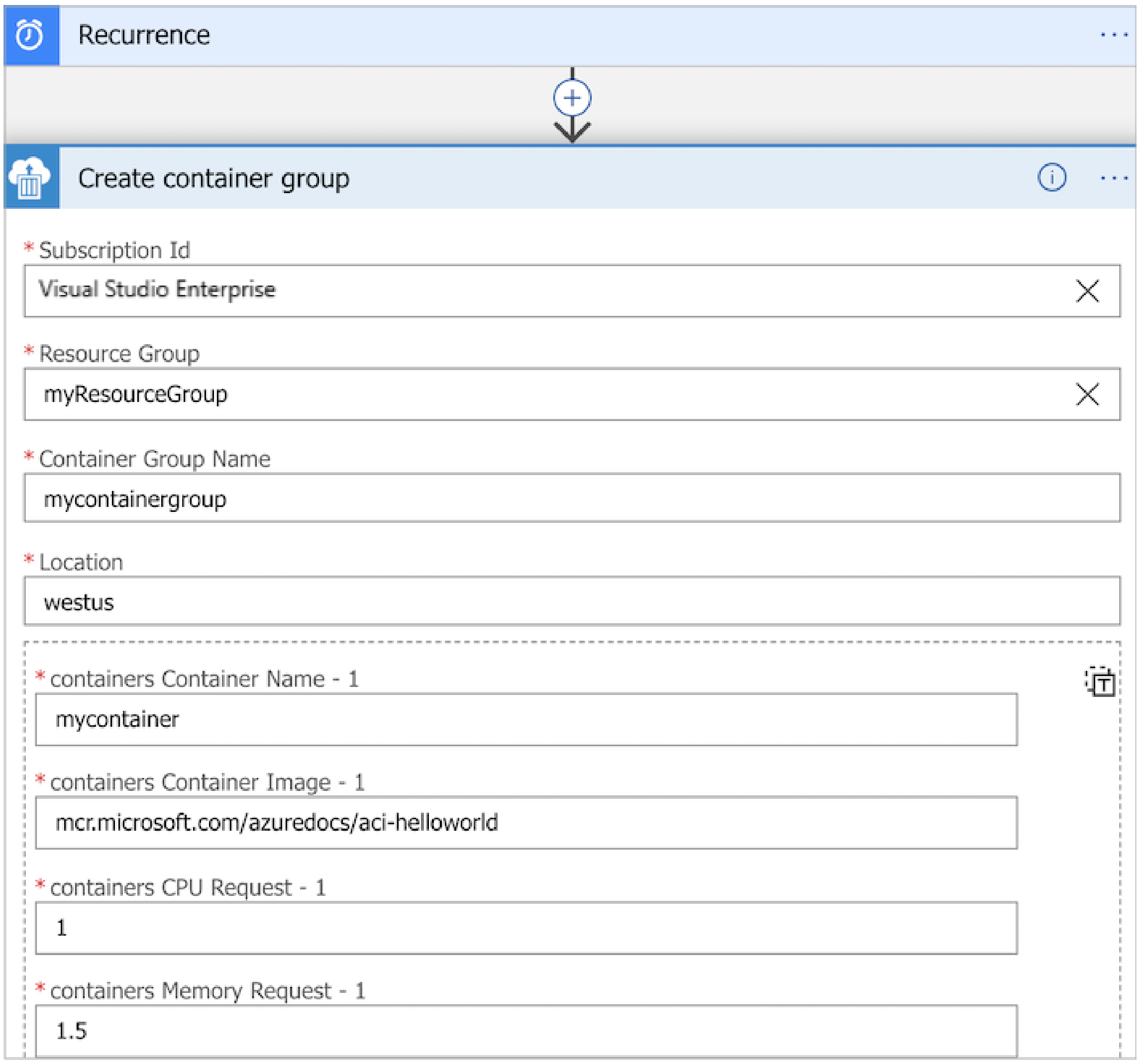
When you use a trigger or action that accesses a service for the first time, the Logic Apps Designer prompts you to create a *connection* to that service. You can then provide the necessary connection information directly from your logic app inside the designer.

1. Sign in to the Azure portal, and open your logic app in Logic App Designer, if not open already.
2. Choose a path:
   - Under the last step where you want to add an action, choose **New step**.

     -or-

   - Between the steps where you want to add an action, move your pointer over the arrow between steps. Choose the plus sign (**+**) that appears, and then select **Add an action**.
3. In the search box, enter "container instance" as your filter. Under the actions list, select the Azure Container Instance connector action you want.
4. Provide a name for your connection.
5. Provide the necessary details for your selected action and continue building your logic app's workflow.

For example, select **Create container group** and enter the properties for a container group and one or more container instances in the group, as shown in the following image (partial detail):



* Subscription Id
Visual Studio Enterprise

* Resource Group
myResourceGroup

* Container Group Name
mycontainergroup

* Location
westus

* containers Container Name - 1
mycontainer

* containers Container Image - 1
mcr.microsoft.com/azuredocs/aci-helloworld

* containers CPU Request - 1
1

* containers Memory Request - 1
1.5

Connector reference

For technical details about triggers, actions, and limits, which are described by the connector's OpenAPI (formerly Swagger) description, review the connector's reference page or container group YAML reference.

Next steps

- See a sample logic app that runs a container in Azure Container Instances to analyze the sentiment of e-mail or Twitter text
- Learn about other Logic Apps connectors

Run containerized tasks with restart policies

11/26/2019 • 2 minutes to read • Edit Online

The ease and speed of deploying containers in Azure Container Instances provides a compelling platform for executing run-once tasks like build, test, and image rendering in a container instance.

With a configurable restart policy, you can specify that your containers are stopped when their processes have completed. Because container instances are billed by the second, you're charged only for the compute resources used while the container executing your task is running.

The examples presented in this article use the Azure CLI. You must have Azure CLI version 2.0.21 or greater installed locally, or use the CLI in the Azure Cloud Shell.

Container restart policy

When you create a container group in Azure Container Instances, you can specify one of three restart policy settings.

RESTART POLICY	DESCRIPTION
`Always`	Containers in the container group are always restarted. This is the **default** setting applied when no restart policy is specified at container creation.
`Never`	Containers in the container group are never restarted. The containers run at most once.
`OnFailure`	Containers in the container group are restarted only when the process executed in the container fails (when it terminates with a nonzero exit code). The containers are run at least once.

Specify a restart policy

How you specify a restart policy depends on how you create your container instances, such as with the Azure CLI, Azure PowerShell cmdlets, or in the Azure portal. In the Azure CLI, specify the `--restart-policy` parameter when you call az container create.

```
az container create \
    --resource-group myResourceGroup \
    --name mycontainer \
    --image mycontainerimage \
    --restart-policy OnFailure
```

Run to completion example

To see the restart policy in action, create a container instance from the Microsoft aci-wordcount image, and specify the `OnFailure` restart policy. This example container runs a Python script that, by default, analyzes the text of Shakespeare's Hamlet, writes the 10 most common words to STDOUT, and then exits.

Run the example container with the following az container create command:

```
az container create \
    --resource-group myResourceGroup \
    --name mycontainer \
    --image mcr.microsoft.com/azuredocs/aci-wordcount:latest \
    --restart-policy OnFailure
```

Azure Container Instances starts the container, and then stops it when its application (or script, in this case) exits. When Azure Container Instances stops a container whose restart policy is `Never` or `OnFailure`, the container's status is set to **Terminated**. You can check a container's status with the az container show command:

```
az container show --resource-group myResourceGroup --name mycontainer --query
containers[0].instanceView.currentState.state
```

Example output:

```
"Terminated"
```

Once the example container's status shows *Terminated*, you can see its task output by viewing the container logs. Run the az container logs command to view the script's output:

```
az container logs --resource-group myResourceGroup --name mycontainer
```

Output:

```
[('the', 990),
 ('and', 702),
 ('of', 628),
 ('to', 610),
 ('I', 544),
 ('you', 495),
 ('a', 453),
 ('my', 441),
 ('in', 399),
 ('HAMLET', 386)]
```

This example shows the output that the script sent to STDOUT. Your containerized tasks, however, might instead write their output to persistent storage for later retrieval. For example, to an Azure file share.

Next steps

Task-based scenarios, such as batch processing a large dataset with several containers, can take advantage of custom environment variables or command lines at runtime.

For details on how to persist the output of your containers that run to completion, see Mounting an Azure file share with Azure Container Instances.

Set environment variables in container instances

11/25/2019 • 5 minutes to read • Edit Online

Setting environment variables in your container instances allows you to provide dynamic configuration of the application or script run by the container. This is similar to the `--env` command-line argument to `docker run`.

To set environment variables in a container, specify them when you create a container instance. This article shows examples of setting environment variables when you start a container with the Azure CLI, Azure PowerShell, and the Azure portal.

For example, if you run the Microsoft aci-wordcount container image, you can modify its behavior by specifying the following environment variables:

NumWords: The number of words sent to STDOUT.

MinLength: The minimum number of characters in a word for it to be counted. A higher number ignores common words like "of" and "the."

If you need to pass secrets as environment variables, Azure Container Instances supports secure values for both Windows and Linux containers.

NOTE
This article has been updated to use the new Azure PowerShell Az module. You can still use the AzureRM module, which will continue to receive bug fixes until at least December 2020. To learn more about the new Az module and AzureRM compatibility, see Introducing the new Azure PowerShell Az module. For Az module installation instructions, see Install Azure PowerShell.

Azure CLI example

To see the default output of the aci-wordcount container, run it first with this az container create command (no environment variables specified):

```
az container create \
    --resource-group myResourceGroup \
    --name mycontainer1 \
    --image mcr.microsoft.com/azuredocs/aci-wordcount:latest \
    --restart-policy OnFailure
```

To modify the output, start a second container with the `--environment-variables` argument added, specifying values for the *NumWords* and *MinLength* variables. (This example assume you are running the CLI in a Bash shell or Azure Cloud Shell. If you use the Windows Command Prompt, specify the variables with double-quotes, such as `--environment-variables "NumWords"="5" "MinLength"="8"`.)

```
az container create \
    --resource-group myResourceGroup \
    --name mycontainer2 \
    --image mcr.microsoft.com/azuredocs/aci-wordcount:latest \
    --restart-policy OnFailure \
    --environment-variables 'NumWords'='5' 'MinLength'='8'
```

Once both containers' state shows as *Terminated* (use az container show to check state), display their logs with az container logs to see the output.

```
az container logs --resource-group myResourceGroup --name mycontainer1
az container logs --resource-group myResourceGroup --name mycontainer2
```

The output of the containers show how you've modified the second container's script behavior by setting environment variables.

```
azureuser@Azure:~$ az container logs --resource-group myResourceGroup --name mycontainer1
[('the', 990),
 ('and', 702),
 ('of', 628),
 ('to', 610),
 ('I', 544),
 ('you', 495),
 ('a', 453),
 ('my', 441),
 ('in', 399),
 ('HAMLET', 386)]

azureuser@Azure:~$ az container logs --resource-group myResourceGroup --name mycontainer2
[('CLAUDIUS', 120),
 ('POLONIUS', 113),
 ('GERTRUDE', 82),
 ('ROSENCRANTZ', 69),
 ('GUILDENSTERN', 54)]
```

Azure PowerShell example

Setting environment variables in PowerShell is similar to the CLI, but uses the `-EnvironmentVariable` command-line argument.

First, launch the aci-wordcount container in its default configuration with this New-AzContainerGroup command:

```
New-AzContainerGroup `
    -ResourceGroupName myResourceGroup `
    -Name mycontainer1 `
    -Image mcr.microsoft.com/azuredocs/aci-wordcount:latest
```

Now run the following New-AzContainerGroup command. This one specifies the *NumWords* and *MinLength* environment variables after populating an array variable, `envVars`:

```
$envVars = @{'NumWords'='5';'MinLength'='8'}
New-AzContainerGroup `
    -ResourceGroupName myResourceGroup `
    -Name mycontainer2 `
    -Image mcr.microsoft.com/azuredocs/aci-wordcount:latest `
    -RestartPolicy OnFailure `
    -EnvironmentVariable $envVars
```

Once both containers' state is *Terminated* (use Get-AzContainerInstanceLog to check state), pull their logs with the Get-AzContainerInstanceLog command.

```
Get-AzContainerInstanceLog -ResourceGroupName myResourceGroup -ContainerGroupName mycontainer1
Get-AzContainerInstanceLog -ResourceGroupName myResourceGroup -ContainerGroupName mycontainer2
```

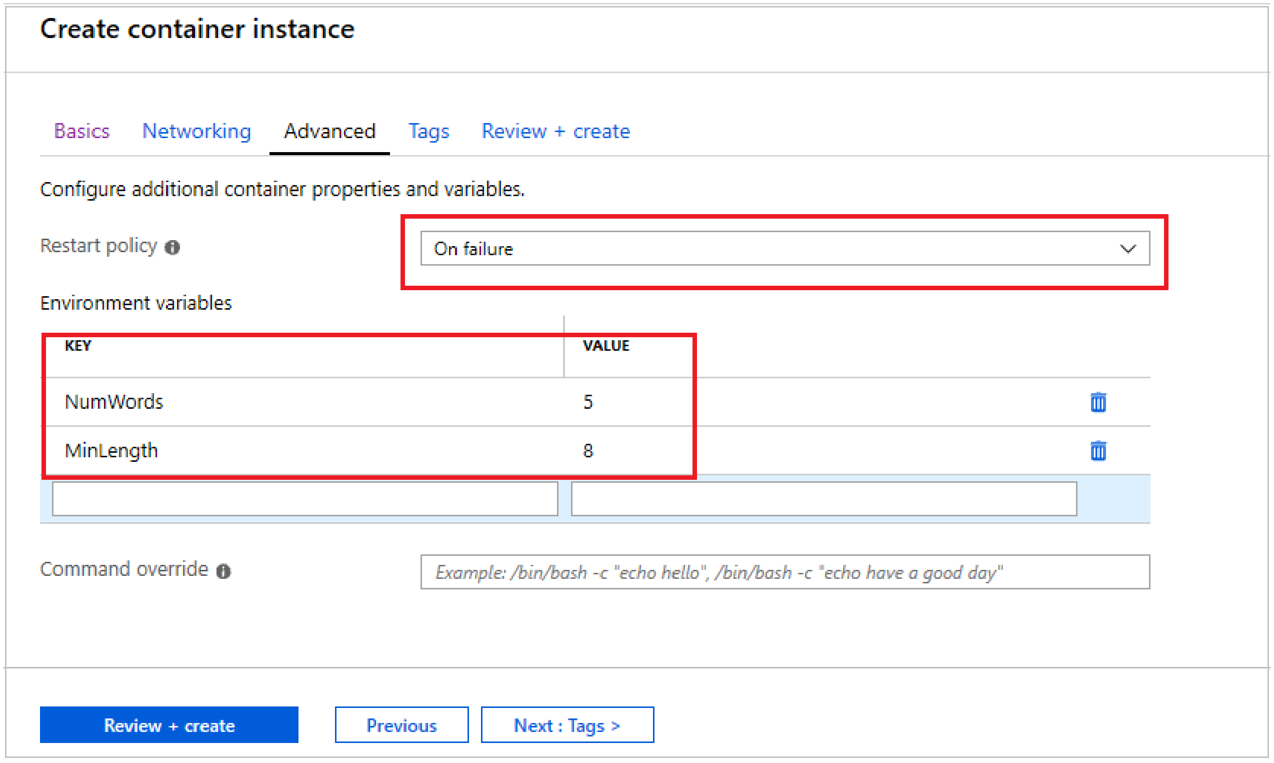
The output for each container shows how you've modified the script run by the container by setting environment variables.

```
PS Azure:\> Get-AzContainerInstanceLog -ResourceGroupName myResourceGroup -ContainerGroupName mycontainer1
[('the', 990),
 ('and', 702),
 ('of', 628),
 ('to', 610),
 ('I', 544),
 ('you', 495),
 ('a', 453),
 ('my', 441),
 ('in', 399),
 ('HAMLET', 386)]

Azure:\
PS Azure:\> Get-AzContainerInstanceLog -ResourceGroupName myResourceGroup -ContainerGroupName mycontainer2
[('CLAUDIUS', 120),
 ('POLONIUS', 113),
 ('GERTRUDE', 82),
 ('ROSENCRANTZ', 69),
 ('GUILDENSTERN', 54)]

Azure:\
```

Azure portal example

To set environment variables when you start a container in the Azure portal, specify them in the **Advanced** page when you create the container.

1. On the **Advanced** page, set the **Restart policy** to *On failure*
2. Under **Environment variables**, enter `NumWords` with a value of `5` for the first variable, and enter `MinLength` with a value of `8` for the second variable.
3. Select **Review + create** to verify and then deploy the container.



Configure additional container properties and variables.

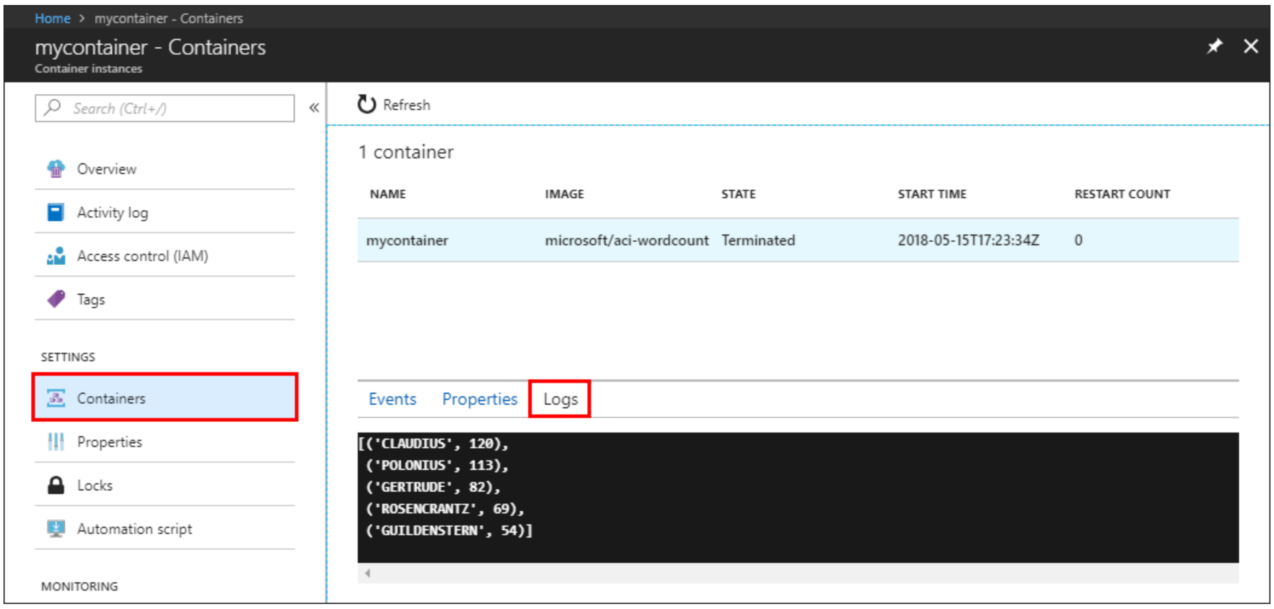
Restart policy: On failure

Environment variables

KEY	VALUE
NumWords	5
MinLength	8

Command override: Example: /bin/bash -c "echo hello", /bin/bash -c "echo have a good day"

To view the container's logs, under **Settings** select **Containers**, then **Logs**. Similar to the output shown in the previous CLI and PowerShell sections, you can see how the script's behavior has been modified by the environment variables. Only five words are displayed, each with a minimum length of eight characters.



1 container

NAME	IMAGE	STATE	START TIME	RESTART COUNT
mycontainer	microsoft/aci-wordcount	Terminated	2018-05-15T17:23:34Z	0

```
[('CLAUDIUS', 120),
 ('POLONIUS', 113),
 ('GERTRUDE', 82),
 ('ROSENCRANTZ', 69),
 ('GUILDENSTERN', 54)]
```

Secure values

Objects with secure values are intended to hold sensitive information like passwords or keys for your application. Using secure values for environment variables is both safer and more flexible than including it in your container's image. Another option is to use secret volumes, described in Mount a secret volume in Azure Container Instances.

Environment variables with secure values aren't visible in your container's properties--their values can be accessed only from within the container. For example, container properties viewed in the Azure portal or Azure CLI display only a secure variable's name, not its value.

Set a secure environment variable by specifying the `secureValue` property instead of the regular `value` for the variable's type. The two variables defined in the following YAML demonstrate the two variable types.

YAML deployment

Create a `secure-env.yaml` file with the following snippet.

```
apiVersion: 2018-10-01
location: eastus
name: securetest
properties:
  containers:
  - name: mycontainer
    properties:
      environmentVariables:
        - name: 'NOTSECRET'
          value: 'my-exposed-value'
        - name: 'SECRET'
          secureValue: 'my-secret-value'
      image: nginx
      ports: []
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
  osType: Linux
  restartPolicy: Always
tags: null
type: Microsoft.ContainerInstance/containerGroups
```

Run the following command to deploy the container group with YAML (adjust the resource group name as necessary):

```
az container create --resource-group myResourceGroup --file secure-env.yaml
```

Verify environment variables

Run the az container show command to query your container's environment variables:

```
az container show --resource-group myResourceGroup --name securetest --query
'containers[].environmentVariables'
```

The JSON response shows both the insecure environment variable's key and value, but only the name of the secure environment variable:

```
[
  [
    {
      "name": "NOTSECRET",
      "secureValue": null,
      "value": "my-exposed-value"
    },
    {
      "name": "SECRET",
      "secureValue": null,
      "value": null
    }
  ]
]
```

With the az container exec command, which enables executing a command in a running container, you can verify that the secure environment variable has been set. Run the following command to start an interactive bash session in the container:

```
az container exec --resource-group myResourceGroup --name securetest --exec-command "/bin/bash"
```

Once you've opened an interactive shell within the container, you can access the `SECRET` variable's value:

```
root@caas-ef3ee231482549629ac8a40c0d3807fd-3881559887-5374l:/# echo $SECRET
my-secret-value
```

Next steps

Task-based scenarios, such as batch processing a large dataset with several containers, can benefit from custom environment variables at runtime. For more information about running task-based containers, see Run containerized tasks with restart policies.

Set the command line in a container instance to override the default command line operation

11/26/2019 • 3 minutes to read • Edit Online

When you create a container instance, optionally specify a command to override the default command line instruction baked into the container image. This behavior is similar to the `--entrypoint` command-line argument to `docker run`.

Like setting environment variables for container instances, specifying a starting command line is useful for batch jobs where you need to prepare each container dynamically with task-specific configuration.

Command line guidelines

- By default, the command line specifies a *single process that starts without a shell* in the container. For example, the command line might run a Python script or executable file. The process can specify additional parameters or arguments.
- To execute multiple commands, begin your command line by setting a shell environment that is supported in the container operating system. Examples:

OPERATING SYSTEM	DEFAULT SHELL
Ubuntu	`/bin/bash`
Alpine	`/bin/sh`
Windows	`cmd`

  Follow the conventions of the shell to combine multiple commands to run in sequence.

- Depending on the container configuration, you might need to set a full path to the command line executable or arguments.
- Set an appropriate restart policy for the container instance, depending on whether the command-line specifies a long-running task or a run-once task. For example, a restart policy of `Never` or `OnFailure` is recommended for a run-once task.
- If you need information about the default entrypoint set in a container image, use the docker image inspect command.

Command line syntax

The command line syntax varies depending on the Azure API or tool used to create the instances. If you specify a shell environment, also observe the command syntax conventions of the shell.

- az container create command: Pass a string with the `--command-line` parameter. Example: `--command-line "python myscript.py arg1 arg2"`).
- New-AzureRmContainerGroup Azure PowerShell cmdlet: Pass a string with the `-Command` parameter. Example: `-Command "echo hello"`.

- Azure portal: In the **Command override** property of the container configuration, provide a comma-separated list of strings, without quotes. Example: `python, myscript.py, arg1, arg2`).
- Resource Manager template or YAML file, or one of the Azure SDKs: Specify the command line property as an array of strings. Example: the JSON array `["python", "myscript.py", "arg1", "arg2"]` in a Resource Manager template.

  If you're familiar with Dockerfile syntax, this format is similar to the *exec* form of the CMD instruction.

Examples

	AZURE CLI	PORTAL	TEMPLATE
Single command	`--command-line "python myscript.py arg1 arg2"`	**Command override**: `python, myscript.py, arg1, arg2`	`"command": ["python", "myscript.py", "arg1", "arg2"]`
Multiple commands	`--command-line "/bin/bash -c 'mkdir test; touch test/myfile; tail -f /dev/null'"`	**Command override**: `/bin/bash, -c, mkdir test; touch test/myfile; tail -f /dev/null`	`"command": ["/bin/bash", "-c", "mkdir test; touch test/myfile; tail -f /dev/null"]`

Azure CLI example

As an example, modify the behavior of the microsoft/aci-wordcount container image, which analyzes text in Shakespeare's *Hamlet* to find the most frequently occurring words. Instead of analyzing *Hamlet*, you could set a command line that points to a different text source.

To see the output of the microsoft/aci-wordcount container when it analyzes the default text, run it with the following az container create command. No start command line is specified, so the default container command runs. For illustration purposes, this example sets environment variables to find the top 3 words that are at least five letters long:

```
az container create \
    --resource-group myResourceGroup \
    --name mycontainer1 \
    --image mcr.microsoft.com/azuredocs/aci-wordcount:latest \
    --environment-variables NumWords=3 MinLength=5 \
    --restart-policy OnFailure
```

Once the container's state shows as *Terminated* (use az container show to check state), display the log with az container logs to see the output.

```
az container logs --resource-group myResourceGroup --name mycontainer1
```

Output:

```
[('HAMLET', 386), ('HORATIO', 127), ('CLAUDIUS', 120)]
```

Now set up a second example container to analyze different text by specifying a different command line. The Python script executed by the container, *wordcount.py*, accepts a URL as an argument, and processes that page's content instead of the default.

For example, to determine the top 3 words that are at least five letters long in *Romeo and Juliet*:

```
az container create \
    --resource-group myResourceGroup \
    --name mycontainer2 \
    --image mcr.microsoft.com/azuredocs/aci-wordcount:latest \
    --restart-policy OnFailure \
    --environment-variables NumWords=3 MinLength=5 \
    --command-line "python wordcount.py http://shakespeare.mit.edu/romeo_juliet/full.html"
```

Again, once the container is *Terminated*, view the output by showing the container's logs:

```
az container logs --resource-group myResourceGroup --name mycontainer2
```

Output:

```
[('ROMEO', 177), ('JULIET', 134), ('CAPULET', 119)]
```

Next steps

Task-based scenarios, such as batch processing a large dataset with several containers, can benefit from custom command lines at runtime. For more information about running task-based containers, see Run containerized tasks with restart policies.

Execute a command in a running Azure container instance

11/25/2019 • 2 minutes to read • Edit Online

Azure Container Instances supports executing a command in a running container. Running a command in a container you've already started is especially helpful during application development and troubleshooting. The most common use of this feature is to launch an interactive shell so that you can debug issues in a running container.

Run a command with Azure CLI

Execute a command in a running container with az container exec in the Azure CLI:

```
az container exec --resource-group <group-name> --name <container-group-name> --exec-command "<command>"
```

For example, to launch a Bash shell in an Nginx container:

```
az container exec --resource-group myResourceGroup --name mynginx --exec-command "/bin/bash"
```

In the example output below, the Bash shell is launched in a running Linux container, providing a terminal in which `ls` is executed:

```
$ az container exec --resource-group myResourceGroup --name mynginx --exec-command "/bin/bash"
root@caas-83e6c883014b427f9b277a2bba3b7b5f-708716530-2qv47:/# ls
bin   dev  home  lib64 mnt  proc  run  srv  tmp  var
boot  etc  lib  media opt  root  sbin  sys  usr
root@caas-83e6c883014b427f9b277a2bba3b7b5f-708716530-2qv47:/# exit
exit
Bye.
```

In this example, Command Prompt is launched in a running Nanoserver container:

```
$ az container exec --resource-group myResourceGroup --name myiis --exec-command "cmd.exe"
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.

C:\>dir
 Volume in drive C has no label.
 Volume Serial Number is 76E0-C852

 Directory of C:\

03/23/2018  09:13 PM    <DIR>          inetpub
11/20/2016  11:32 AM             1,894 License.txt
03/23/2018  09:13 PM    <DIR>          Program Files
07/16/2016  12:09 PM    <DIR>          Program Files (x86)
03/13/2018  08:50 PM           171,616 ServiceMonitor.exe
03/23/2018  09:13 PM    <DIR>          Users
03/23/2018  09:12 PM    <DIR>          var
03/23/2018  09:22 PM    <DIR>          Windows
               2 File(s)        173,510 bytes
               6 Dir(s)  21,171,609,600 bytes free

C:\>exit
Bye.
```

Multi-container groups

If your container group has multiple containers, such as an application container and a logging sidecar, specify the name of the container in which to run the command with `--container-name`.

For example, in the container group *mynginx* are two containers, *nginx-app* and *logger*. To launch a shell on the *nginx-app* container:

```
az container exec --resource-group myResourceGroup --name mynginx --container-name nginx-app --exec-command
"/bin/bash"
```

Restrictions

Azure Container Instances currently supports launching a single process with az container exec, and you cannot pass command arguments. For example, you cannot chain commands like in `sh -c "echo FOO && echo BAR"`, or execute `echo FOO`.

Next steps

Learn about other troubleshooting tools and common deployment issues in Troubleshoot container and deployment issues in Azure Container Instances.

2 minutes to read

How to use managed identities with Azure Container Instances

1/30/2020 • 11 minutes to read • Edit Online

Use managed identities for Azure resources to run code in Azure Container Instances that interacts with other Azure services - without maintaining any secrets or credentials in code. The feature provides an Azure Container Instances deployment with an automatically managed identity in Azure Active Directory.

In this article, you learn more about managed identities in Azure Container Instances and:

- Enable a user-assigned or system-assigned identity in a container group
- Grant the identity access to an Azure key vault
- Use the managed identity to access a key vault from a running container

Adapt the examples to enable and use identities in Azure Container Instances to access other Azure services. These examples are interactive. However, in practice your container images would run code to access Azure services.

NOTE

Currently you cannot use a managed identity in a container group deployed to a virtual network.

Why use a managed identity?

Use a managed identity in a running container to authenticate to any service that supports Azure AD authentication without managing credentials in your container code. For services that don't support AD authentication, you can store secrets in an Azure key vault and use the managed identity to access the key vault to retrieve credentials. For more information about using a managed identity, see What is managed identities for Azure resources?

IMPORTANT

This feature is currently in preview. Previews are made available to you on the condition that you agree to the supplemental terms of use. Some aspects of this feature may change prior to general availability (GA). Currently, managed identities on Azure Container Instances, are only supported with Linux containers and not yet with Windows containers.

Enable a managed identity

In Azure Container Instances, managed identities for Azure resources are supported as of REST API version 2018-10-01 and corresponding SDKs and tools. When you create a container group, enable one or more managed identities by setting a ContainerGroupIdentity property. You can also enable or update managed identities after a container group is running - either action causes the container group to restart. To set the identities on a new or existing container group, use the Azure CLI, a Resource Manager template, or a YAML file.

Azure Container Instances supports both types of managed Azure identities: user-assigned and system-assigned. On a container group, you can enable a system-assigned identity, one or more user-assigned identities, or both types of identities.

- A **user-assigned** managed identity is created as a standalone Azure resource in the Azure AD tenant that's trusted by the subscription in use. After the identity is created, the identity can be assigned to one or more

Azure resources (in Azure Container Instances or other Azure services). The lifecycle of a user-assigned identity is managed separately from the lifecycle of the container groups or other service resources to which it's assigned. This behavior is especially useful in Azure Container Instances. Because the identity extends beyond the lifetime of a container group, you can reuse it along with other standard settings to make your container group deployments highly repeatable.

- A **system-assigned** managed identity is enabled directly on a container group in Azure Container Instances. When it's enabled, Azure creates an identity for the group in the Azure AD tenant that's trusted by the subscription of the instance. After the identity is created, the credentials are provisioned in each container in the container group. The lifecycle of a system-assigned identity is directly tied to the container group that it's enabled on. When the group is deleted, Azure automatically cleans up the credentials and the identity in Azure AD.

Use a managed identity

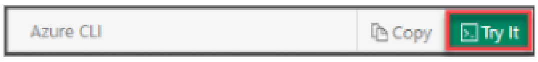
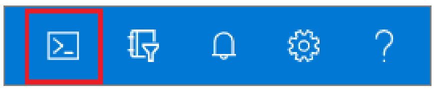
To use a managed identity, the identity must initially be granted access to one or more Azure service resources (such as a web app, a key vault, or a storage account) in the subscription. To access the Azure resources from a running container, your code must acquire an *access token* from an Azure AD endpoint. Then, your code sends the access token on a call to a service that supports Azure AD authentication.

Using a managed identity in a running container is essentially the same as using an identity in an Azure VM. See the VM guidance for using a token, Azure PowerShell or Azure CLI, or the Azure SDKs.

Use Azure Cloud Shell

Azure hosts Azure Cloud Shell, an interactive shell environment that you can use through your browser. You can use either Bash or PowerShell with Cloud Shell to work with Azure services. You can use the Cloud Shell preinstalled commands to run the code in this article without having to install anything on your local environment.

To start Azure Cloud Shell:

OPTION	EXAMPLE/LINK
Select **Try It** in the upper-right corner of a code block. Selecting **Try It** doesn't automatically copy the code to Cloud Shell.	
Go to https://shell.azure.com, or select the **Launch Cloud Shell** button to open Cloud Shell in your browser.	
Select the **Cloud Shell** button on the menu bar at the upper right in the Azure portal.	

To run the code in this article in Azure Cloud Shell:

1. Start Cloud Shell.

2. Select the **Copy** button on a code block to copy the code.

3. Paste the code into the Cloud Shell session by selecting **Ctrl**+**Shift**+**V** on Windows and Linux or by selecting **Cmd**+**Shift**+**V** on macOS.

4. Select **Enter** to run the code.

If you choose to install and use the CLI locally, this article requires that you are running the Azure CLI version 2.0.49 or later. Run `az --version` to find the version. If you need to install or upgrade, see Install Azure CLI.

Create an Azure key vault

The examples in this article use a managed identity in Azure Container Instances to access an Azure key vault secret.

First, create a resource group named *myResourceGroup* in the *eastus* location with the following az group create command:

```
az group create --name myResourceGroup --location eastus
```

Use the az keyvault create command to create a key vault. Be sure to specify a unique key vault name.

```
az keyvault create \
  --name mykeyvault \
  --resource-group myResourceGroup \
  --location eastus
```

Store a sample secret in the key vault using the az keyvault secret set command:

```
az keyvault secret set \
  --name SampleSecret \
  --value "Hello Container Instances" \
  --description ACIsecret --vault-name mykeyvault
```

Continue with the following examples to access the key vault using either a user-assigned or system-assigned managed identity in Azure Container Instances.

Example 1: Use a user-assigned identity to access Azure key vault

Create an identity

First create an identity in your subscription using the az identity create command. You can use the same resource group used to create the key vault, or use a different one.

```
az identity create \
  --resource-group myResourceGroup \
  --name myACIId
```

To use the identity in the following steps, use the az identity show command to store the identity's service principal ID and resource ID in variables.

```
# Get service principal ID of the user-assigned identity
spID=$(az identity show --resource-group myResourceGroup --name myACIId --query principalId --output tsv)

# Get resource ID of the user-assigned identity
resourceID=$(az identity show --resource-group myResourceGroup --name myACIId --query id --output tsv)
```

Enable a user-assigned identity on a container group

Run the following az container create command to create a container instance based on Microsoft's `azure-cli` image. This example provides a single-container group that you can use interactively to run the Azure CLI to access other Azure services. In this section, only the base Ubuntu operating system is used.

The `--assign-identity` parameter passes your user-assigned managed identity to the group. The long-running command keeps the container running. This example uses the same resource group used to create the key vault, but you could specify a different one.

```
az container create \
  --resource-group myResourceGroup \
  --name mycontainer \
  --image mcr.microsoft.com/azure-cli \
  --assign-identity $resourceID \
  --command-line "tail -f /dev/null"
```

Within a few seconds, you should get a response from the Azure CLI indicating that the deployment has completed. Check its status with the az container show command.

```
az container show \
  --resource-group myResourceGroup \
  --name mycontainer
```

The `identity` section in the output looks similar to the following, showing the identity is set in the container group. The `principalID` under `userAssignedIdentities` is the service principal of the identity you created in Azure Active Directory:

```
[...]
"identity": {
    "principalId": "null",
    "tenantId": "xxxxxxxx-f292-4e60-9122-xxxxxxxxxxxx",
    "type": "UserAssigned",
    "userAssignedIdentities": {
      "/subscriptions/xxxxxxxx-0903-4b79-a55a-
xxxxxxxxxxxx/resourcegroups/danlep1018/providers/Microsoft.ManagedIdentity/userAssignedIdentities/myACIId": {
        "clientId": "xxxxxxxx-5523-45fc-9f49-xxxxxxxxxxxx",
        "principalId": "xxxxxxxx-f25b-4895-b828-xxxxxxxxxxxx"
      }
    }
  },
[...]
```

Grant user-assigned identity access to the key vault

Run the following az keyvault set-policy command to set an access policy on the key vault. The following example allows the user-assigned identity to get secrets from the key vault:

```
 az keyvault set-policy \
    --name mykeyvault \
    --resource-group myResourceGroup \
    --object-id $spID \
    --secret-permissions get
```

Use user-assigned identity to get secret from key vault

Now you can use the managed identity within the running container instance to access the key vault. First launch a bash shell in the container:

```
az container exec \
  --resource-group myResourceGroup \
  --name mycontainer \
  --exec-command "/bin/bash"
```

Run the following commands in the bash shell in the container. To get an access token to use Azure Active Directory to authenticate to key vault, run the following command:

```
curl 'http://169.254.169.254/metadata/identity/oauth2/token?api-version=2018-02-
01&resource=https%3A%2F%2Fvault.azure.net' -H Metadata:true -s
```

Output:

```
{"access_token":"xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx1QiLCJhbGciOiJSUzI1NiIsIng1dCI6Imk2bEdrM0ZaenhSY1ViMkMzbkVRN3
N5SEpsWSIsImtpZCI6Imk2bEdrM0ZaenhSY1ViMkMzbkVRN3N5SEpsWSJ9......xxxxxxxxxxxxxxxxx","refresh_token":"","expires
_in":"28799","expires_on":"1539927532","not_before":"1539898432","resource":"https://vault.azure.net/","token_
type":"Bearer"}
```

To store the access token in a variable to use in subsequent commands to authenticate, run the following command:

```
token=$(curl 'http://169.254.169.254/metadata/identity/oauth2/token?api-version=2018-02-
01&resource=https%3A%2F%2Fvault.azure.net' -H Metadata:true | jq -r '.access_token')
```

Now use the access token to authenticate to key vault and read a secret. Be sure to substitute the name of your key vault in the URL (*https://mykeyvault.vault.azure.net/...*):

```
curl https://mykeyvault.vault.azure.net/secrets/SampleSecret/?api-version=2016-10-01 -H "Authorization: Bearer
$token"
```

The response looks similar to the following, showing the secret. In your code, you would parse this output to obtain the secret. Then, use the secret in a subsequent operation to access another Azure resource.

```
{"value":"Hello Container
Instances","contentType":"ACIsecret","id":"https://mykeyvault.vault.azure.net/secrets/SampleSecret/xxxxxxxxxxx
xxxxxxxxx","attributes":
{"enabled":true,"created":1539965967,"updated":1539965967,"recoveryLevel":"Purgeable"},"tags":{"file-
encoding":"utf-8"}}
```

Example 2: Use a system-assigned identity to access Azure key vault

Enable a system-assigned identity on a container group

Run the following az container create command to create a container instance based on Microsoft's `azure-cli` image. This example provides a single-container group that you can use interactively to run the Azure CLI to access other Azure services.

The `--assign-identity` parameter with no additional value enables a system-assigned managed identity on the group. The identity is scoped to the resource group of the container group. The long-running command keeps the container running. This example uses the same resource group used to create the key vault, but you could specify a different one.

```
# Get the resource ID of the resource group
rgID=$(az group show --name myResourceGroup --query id --output tsv)

# Create container group with system-managed identity
az container create \
  --resource-group myResourceGroup \
  --name mycontainer \
  --image mcr.microsoft.com/azure-cli \
  --assign-identity --scope $rgID \
  --command-line "tail -f /dev/null"
```

Within a few seconds, you should get a response from the Azure CLI indicating that the deployment has completed. Check its status with the az container show command.

```
az container show \
  --resource-group myResourceGroup \
  --name mycontainer
```

The `identity` section in the output looks similar to the following, showing that a system-assigned identity is created in Azure Active Directory:

```
[...]
"identity": {
    "principalId": "xxxxxxxx-528d-7083-b74c-xxxxxxxxxxxx",
    "tenantId": "xxxxxxxx-f292-4e60-9122-xxxxxxxxxxxx",
    "type": "SystemAssigned",
    "userAssignedIdentities": null
},
[...]
```

Set a variable to the value of `principalId` (the service principal ID) of the identity, to use in later steps.

```
spID=$(az container show --resource-group myResourceGroup --name mycontainer --query identity.principalId --
out tsv)
```

Grant container group access to the key vault

Run the following az keyvault set-policy command to set an access policy on the key vault. The following example allows the system-managed identity to get secrets from the key vault:

```
 az keyvault set-policy \
   --name mykeyvault \
   --resource-group myResourceGroup \
   --object-id $spID \
   --secret-permissions get
```

Use container group identity to get secret from key vault

Now you can use the managed identity to access the key vault within the running container instance. First launch a bash shell in the container:

```
az container exec \
  --resource-group myResourceGroup \
  --name mycontainer \
  --exec-command "/bin/bash"
```

Run the following commands in the bash shell in the container. First log in to the Azure CLI using the managed identity:

```
az login --identity
```

From the running container, retrieve the secret from the key vault:

```
az keyvault secret show \
  --name SampleSecret \
  --vault-name mykeyvault --query value
```

The value of the secret is retrieved:

```
"Hello Container Instances"
```

Enable managed identity using Resource Manager template

To enable a managed identity in a container group using a Resource Manager template, set the `identity` property of the `Microsoft.ContainerInstance/containerGroups` object with a `ContainerGroupIdentity` object. The following snippets show the `identity` property configured for different scenarios. See the Resource Manager template reference. Specify a minimum `apiVersion` of `2018-10-01`.

User-assigned identity

A user-assigned identity is a resource ID of the form:

```
"/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.ManagedIdentity/userAs
signedIdentities/{identityName}"
```

You can enable one or more user-assigned identities.

```
"identity": {
    "type": "UserAssigned",
    "userAssignedIdentities": {
        "myResourceID1": {
            }
        }
    }
```

System-assigned identity

```
"identity": {
    "type": "SystemAssigned"
    }
```

System- and user-assigned identities

On a container group, you can enable both a system-assigned identity and one or more user-assigned identities.

```
"identity": {
    "type": "System Assigned, UserAssigned",
    "userAssignedIdentities": {
        "myResourceID1": {
            }
        }
    }
...
```

Enable managed identity using YAML file

To enable a managed identity in a container group deployed using a YAML file, include the following YAML. Specify a minimum `apiVersion` of `2018-10-01`.

User-assigned identity

A user-assigned identity is a resource ID of the form

```
'/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.ManagedIdentity/userAssignedIdentities/{identityName}'
```

You can enable one or more user-assigned identities.

```
identity:
  type: UserAssigned
  userAssignedIdentities:
    {'myResourceID1':{}}
```

System-assigned identity

```
identity:
  type: SystemAssigned
```

System- and user-assigned identities

On a container group, you can enable both a system-assigned identity and one or more user-assigned identities.

```
identity:
  type: SystemAssigned, UserAssigned
  userAssignedIdentities:
   {'myResourceID1':{}}
```

Next steps

In this article, you learned about managed identities in Azure Container Instances and how to:

- Enable a user-assigned or system-assigned identity in a container group
- Grant the identity access to an Azure key vault
- Use the managed identity to access a key vault from a running container

- Learn more about managed identities for Azure resources.

- See an Azure Go SDK example of using a managed identity to access a key vault from Azure Container Instances.

Deploy container instances that use GPU resources

2/21/2020 • 6 minutes to read • Edit Online

To run certain compute-intensive workloads on Azure Container Instances, deploy your container groups with *GPU resources*. The container instances in the group can access one or more NVIDIA Tesla GPUs while running container workloads such as CUDA and deep learning applications.

This article shows how to add GPU resources when you deploy a container group by using a YAML file or Resource Manager template. You can also specify GPU resources when you deploy a container instance using the Azure portal.

IMPORTANT

This feature is currently in preview, and some limitations apply. Previews are made available to you on the condition that you agree to the supplemental terms of use. Some aspects of this feature may change prior to general availability (GA).

Preview limitations

In preview, the following limitations apply when using GPU resources in container groups.

Region availability

REGIONS	OS	AVAILABLE GPU SKUS
East US, West Europe, West US 2	Linux	K80, P100, V100
Southeast Asia	Linux	P100, V100
Central India	Linux	V100
North Europe	Linux	K80

Support will be added for additional regions over time.

Supported OS types: Linux only

Additional limitations: GPU resources can't be used when deploying a container group into a virtual network.

About GPU resources

IMPORTANT

GPU resources are available only upon request. To request access to GPU resources, please submit an Azure support request.

Count and SKU

To use GPUs in a container instance, specify a *GPU resource* with the following information:

- **Count** - The number of GPUs: **1**, **2**, or **4**.
- **SKU** - The GPU SKU: **K80**, **P100**, or **V100**. Each SKU maps to the NVIDIA Tesla GPU in one the following

Azure GPU-enabled VM families:

SKU	VM FAMILY
K80	NC
P100	NCv2
V100	NCv3

Resource availability

OS	GPU SKU	GPU COUNT	MAX CPU	MAX MEMORY (GB)	STORAGE (GB)
Linux	K80	1	6	56	50
Linux	K80	2	12	112	50
Linux	K80	4	24	224	50
Linux	P100	1	6	112	50
Linux	P100	2	12	224	50
Linux	P100	4	24	448	50
Linux	V100	1	6	112	50
Linux	V100	2	12	224	50
Linux	V100	4	24	448	50

When deploying GPU resources, set CPU and memory resources appropriate for the workload, up to the maximum values shown in the preceding table. These values are currently larger than the CPU and memory resources available in container groups without GPU resources.

Things to know

- **Deployment time** - Creation of a container group containing GPU resources takes up to **8-10 minutes**. This is due to the additional time to provision and configure a GPU VM in Azure.
- **Pricing** - Similar to container groups without GPU resources, Azure bills for resources consumed over the *duration* of a container group with GPU resources. The duration is calculated from the time to pull your first container's image until the container group terminates. It does not include the time to deploy the container group.

  See pricing details.
- **CUDA drivers** - Container instances with GPU resources are pre-provisioned with NVIDIA CUDA drivers and container runtimes, so you can use container images developed for CUDA workloads.

  We support CUDA 9.0 at this stage. For example, you can use following base images for your Docker file:

  - nvidia/cuda:9.0-base-ubuntu16.04
  - tensorflow/tensorflow: 1.12.0-gpu-py3

YAML example

One way to add GPU resources is to deploy a container group by using a YAML file. Copy the following YAML into a new file named *gpu-deploy-aci.yaml*, then save the file. This YAML creates a container group named *gpucontainergroup* specifying a container instance with a K80 GPU. The instance runs a sample CUDA vector addition application. The resource requests are sufficient to run the workload.

```
additional_properties: {}
apiVersion: '2018-10-01'
name: gpucontainergroup
properties:
  containers:
  - name: gpucontainer
    properties:
      image: k8s-gcrio.azureedge.net/cuda-vector-add:v0.1
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
          gpu:
            count: 1
            sku: K80
  osType: Linux
  restartPolicy: OnFailure
```

Deploy the container group with the az container create command, specifying the YAML file name for the `--file` parameter. You need to supply the name of a resource group and a location for the container group such as *eastus* that supports GPU resources.

```
az container create --resource-group myResourceGroup --file gpu-deploy-aci.yaml --location eastus
```

The deployment takes several minutes to complete. Then, the container starts and runs a CUDA vector addition operation. Run the az container logs command to view the log output:

```
az container logs --resource-group myResourceGroup --name gpucontainergroup --container-name gpucontainer
```

Output:

```
[Vector addition of 50000 elements]
Copy input data from the host memory to the CUDA device
CUDA kernel launch with 196 blocks of 256 threads
Copy output data from the CUDA device to the host memory
Test PASSED
Done
```

Resource Manager template example

Another way to deploy a container group with GPU resources is by using a Resource Manager template. Start by creating a file named `gpudeploy.json`, then copy the following JSON into it. This example deploys a container instance with a V100 GPU that runs a TensorFlow training job against the MNIST dataset. The resource requests are sufficient to run the workload.

```
{
    "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
    "contentVersion": "1.0.0.0",
    "parameters": {
      "containerGroupName": {
        "type": "string",
        "defaultValue": "gpucontainergrouprm",
        "metadata": {
          "description": "Container Group name."
        }
      }
    },
    "variables": {
      "containername": "gpucontainer",
      "containerimage": "microsoft/samples-tf-mnist-demo:gpu"
    },
    "resources": [
      {
        "name": "[parameters('containerGroupName')]",
        "type": "Microsoft.ContainerInstance/containerGroups",
        "apiVersion": "2018-10-01",
        "location": "[resourceGroup().location]",
        "properties": {
            "containers": [
            {
              "name": "[variables('containername')]",
              "properties": {
                "image": "[variables('containerimage')]",
                "resources": {
                  "requests": {
                    "cpu": 4.0,
                    "memoryInGb": 12.0,
                    "gpu": {
                        "count": 1,
                        "sku": "V100"
                  }
                }
              }
            }
          }
        ],
        "osType": "Linux",
        "restartPolicy": "OnFailure"
        }
      }
    ]
}
```

Deploy the template with the az group deployment create command. You need to supply the name of a resource group that was created in a region such as *eastus* that supports GPU resources.

```
az group deployment create --resource-group myResourceGroup --template-file gpudeploy.json
```

The deployment takes several minutes to complete. Then, the container starts and runs the TensorFlow job. Run the az container logs command to view the log output:

```
az container logs --resource-group myResourceGroup --name gpucontainergrouprm --container-name gpucontainer
```

Output:

```
2018-10-25 18:31:10.155010: I tensorflow/core/platform/cpu_feature_guard.cc:137] Your CPU supports
instructions that this TensorFlow binary was not compiled to use: SSE4.1 SSE4.2 AVX AVX2 FMA
2018-10-25 18:31:10.305937: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1030] Found device 0 with
properties:
name: Tesla K80 major: 3 minor: 7 memoryClockRate(GHz): 0.8235
pciBusID: ccb6:00:00.0
totalMemory: 11.92GiB freeMemory: 11.85GiB
2018-10-25 18:31:10.305981: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1120] Creating TensorFlow
device (/device:GPU:0) -> (device: 0, name: Tesla K80, pci bus id: ccb6:00:00.0, compute capability: 3.7)
2018-10-25 18:31:14.941723: I tensorflow/stream_executor/dso_loader.cc:139] successfully opened CUDA library
libcupti.so.8.0 locally
Successfully downloaded train-images-idx3-ubyte.gz 9912422 bytes.
Extracting /tmp/tensorflow/input_data/train-images-idx3-ubyte.gz
Successfully downloaded train-labels-idx1-ubyte.gz 28881 bytes.
Extracting /tmp/tensorflow/input_data/train-labels-idx1-ubyte.gz
Successfully downloaded t10k-images-idx3-ubyte.gz 1648877 bytes.
Extracting /tmp/tensorflow/input_data/t10k-images-idx3-ubyte.gz
Successfully downloaded t10k-labels-idx1-ubyte.gz 4542 bytes.
Extracting /tmp/tensorflow/input_data/t10k-labels-idx1-ubyte.gz
Accuracy at step 0: 0.097
Accuracy at step 10: 0.6993
Accuracy at step 20: 0.8208
Accuracy at step 30: 0.8594
...
Accuracy at step 990: 0.969
Adding run metadata for 999
```

Clean up resources

Because using GPU resources may be expensive, ensure that your containers don't run unexpectedly for long periods. Monitor your containers in the Azure portal, or check the status of a container group with the az container show command. For example:

```
az container show --resource-group myResourceGroup --name gpucontainergroup --output table
```

When you're done working with the container instances you created, delete them with the following commands:

```
az container delete --resource-group myResourceGroup --name gpucontainergroup -y
az container delete --resource-group myResourceGroup --name gpucontainergrouprm -y
```

Next steps

- Learn more about deploying a container group using a YAML file or Resource Manager template.
- Learn more about GPU optimized VM sizes in Azure.

Enable an SSL endpoint in a sidecar container

2/18/2020 • 7 minutes to read • Edit Online

This article shows how to create a container group with an application container and a sidecar container running an SSL provider. By setting up a container group with a separate SSL endpoint, you enable SSL connections for your application without changing your application code.

You set up an example container group consisting of two containers:

- An application container that runs a simple web app using the public Microsoft aci-helloworld image.
- A sidecar container running the public Nginx image, configured to use SSL.

In this example, the container group only exposes port 443 for Nginx with its public IP address. Nginx routes HTTPS requests to the companion web app, which listens internally on port 80. You can adapt the example for container apps that listen on other ports.

See Next steps for other approaches to enabling SSL in a container group.

Use Azure Cloud Shell

Azure hosts Azure Cloud Shell, an interactive shell environment that you can use through your browser. You can use either Bash or PowerShell with Cloud Shell to work with Azure services. You can use the Cloud Shell preinstalled commands to run the code in this article without having to install anything on your local environment.

To start Azure Cloud Shell:

OPTION	EXAMPLE/LINK
Select **Try It** in the upper-right corner of a code block. Selecting **Try It** doesn't automatically copy the code to Cloud Shell.	
Go to https://shell.azure.com, or select the **Launch Cloud Shell** button to open Cloud Shell in your browser.	
Select the **Cloud Shell** button on the menu bar at the upper right in the Azure portal.	

To run the code in this article in Azure Cloud Shell:

1. Start Cloud Shell.

2. Select the **Copy** button on a code block to copy the code.

3. Paste the code into the Cloud Shell session by selecting **Ctrl**+**Shift**+**V** on Windows and Linux or by selecting **Cmd**+**Shift**+**V** on macOS.

4. Select **Enter** to run the code.

You can use the Azure Cloud Shell or a local installation of the Azure CLI to complete this article. If you'd like to use it locally, version 2.0.55 or later is recommended. Run `az --version` to find the version. If you need to install or upgrade, see Install Azure CLI.

Create a self-signed certificate

To set up Nginx as an SSL provider, you need an SSL certificate. This article shows how to create and set up a self-signed SSL certificate. For production scenarios, you should obtain a certificate from a certificate authority.

To create a self-signed SSL certificate, use the OpenSSL tool available in Azure Cloud Shell and many Linux distributions, or use a comparable client tool in your operating system.

First create a certificate request (.csr file) in a local working directory:

```
openssl req -new -newkey rsa:2048 -nodes -keyout ssl.key -out ssl.csr
```

Follow the prompts to add the identification information. For Common Name, enter the hostname associated with the certificate. When prompted for a password, press Enter without typing, to skip adding a password.

Run the following command to create the self-signed certificate (.crt file) from the certificate request. For example:

```
openssl x509 -req -days 365 -in ssl.csr -signkey ssl.key -out ssl.crt
```

You should now see three files in the directory: the certificate request (`ssl.csr`), the private key (`ssl.key`), and the self-signed certificate (`ssl.crt`). You use `ssl.key` and `ssl.crt` in later steps.

Configure Nginx to use SSL

Create Nginx configuration file

In this section, you create a configuration file for Nginx to use SSL. Start by copying the following text into a new file named `nginx.conf` . In Azure Cloud Shell, you can use Visual Studio Code to create the file in your working directory:

```
code nginx.conf
```

In `location` , be sure to set `proxy_pass` with the correct port for your app. In this example, we set port 80 for the `aci-helloworld` container.

```
# nginx Configuration File
# https://wiki.nginx.org/Configuration

# Run as a less privileged user for security reasons.
user nginx;

worker_processes auto;

events {
  worker_connections 1024;
}

pid        /var/run/nginx.pid;

http {

    #Redirect to https, using 307 instead of 301 to preserve post data

    server {
        listen [::]:443 ssl;
        listen 443 ssl;

        server_name localhost;
        # Protect against the BEAST attack by not using SSLv3 at all. If you need to support older browsers
(IE6) you may need to add
        # SSLv3 to the list of protocols below.
        ssl_protocols              TLSv1.2;

        # Ciphers set to best allow protection from Beast, while providing forwarding secrecy, as defined by
Mozilla - https://wiki.mozilla.org/Security/Server_Side_TLS#Nginx
        ssl_ciphers                ECDHE-RSA-AES128-GCM-SHA256:ECDHE-ECDSA-AES128-GCM-SHA256:ECDHE-RSA-AES256-
GCM-SHA384:ECDHE-ECDSA-AES256-GCM-SHA384:DHE-RSA-AES128-GCM-SHA256:DHE-DSS-AES128-GCM-SHA256:kEDH+AESGCM:ECDHE-
RSA-AES128-SHA256:ECDHE-ECDSA-AES128-SHA256:ECDHE-RSA-AES128-SHA:ECDHE-ECDSA-AES128-SHA:ECDHE-RSA-AES256-
SHA384:ECDHE-ECDSA-AES256-SHA384:ECDHE-RSA-AES256-SHA:ECDHE-ECDSA-AES256-SHA:DHE-RSA-AES128-SHA256:DHE-RSA-
AES128-SHA:DHE-DSS-AES128-SHA256:DHE-RSA-AES256-SHA256:DHE-DSS-AES256-SHA:DHE-RSA-AES256-SHA:AES128-GCM-
SHA256:AES256-GCM-SHA384:ECDHE-RSA-RC4-SHA:ECDHE-ECDSA-RC4-SHA:AES128:AES256:RC4-
SHA:HIGH:!aNULL:!eNULL:!EXPORT:!DES:!3DES:!MD5:!PSK;
        ssl_prefer_server_ciphers  on;

        # Optimize SSL by caching session parameters for 10 minutes. This cuts down on the number of expensive
SSL handshakes.
        # The handshake is the most CPU-intensive operation, and by default it is re-negotiated on every
new/parallel connection.
        # By enabling a cache (of type "shared between all Nginx workers"), we tell the client to re-use the
already negotiated state.
        # Further optimization can be achieved by raising keepalive_timeout, but that shouldn't be done unless
you serve primarily HTTPS.
        ssl_session_cache    shared:SSL:10m; # a 1mb cache can hold about 4000 sessions, so we can hold 40000
sessions
        ssl_session_timeout  24h;


        # Use a higher keepalive timeout to reduce the need for repeated handshakes
        keepalive_timeout 300; # up from 75 secs default

        # remember the certificate for a year and automatically connect to HTTPS
        add_header Strict-Transport-Security 'max-age=31536000; includeSubDomains';

        ssl_certificate      /etc/nginx/ssl.crt;
        ssl_certificate_key  /etc/nginx/ssl.key;

        location / {
            proxy_pass http://localhost:80; # TODO: replace port if app listens on port other than 80

            proxy_set_header Connection "";
            proxy_set_header Host $host;
            proxy_set_header X-Real-IP $remote_addr;
            proxy_set_header X-Forwarded-For $remote_addr;
        }
    }
}
```

Base64-encode secrets and configuration file

Base64-encode the Nginx configuration file, the SSL certificate, and the SSL key. In the next section, you enter the encoded contents in a YAML file used to deploy the container group.

```
cat nginx.conf | base64 > base64-nginx.conf
cat ssl.crt | base64 > base64-ssl.crt
cat ssl.key | base64 > base64-ssl.key
```

Deploy container group

Now deploy the container group by specifying the container configurations in a YAML file.

Create YAML file

Copy the following YAML into a new file named `deploy-aci.yaml`. In Azure Cloud Shell, you can use Visual Studio Code to create the file in your working directory:

```
code deploy-aci.yaml
```

Enter the contents of the base64-encoded files where indicated under `secret`. For example, `cat` each of the base64-encoded files to see its contents. During deployment, these files are added to a secret volume in the container group. In this example, the secret volume is mounted to the Nginx container.

```
api-version: 2018-10-01
location: westus
name: app-with-ssl
properties:
  containers:
  - name: nginx-with-ssl
    properties:
      image: nginx
      ports:
      - port: 443
        protocol: TCP
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
      volumeMounts:
      - name: nginx-config
        mountPath: /etc/nginx
  - name: my-app
    properties:
      image: mcr.microsoft.com/azuredocs/aci-helloworld
      ports:
      - port: 80
        protocol: TCP
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
  volumes:
  - secret:
      ssl.crt: <Enter contents of base64-ssl.crt here>
      ssl.key: <Enter contents of base64-ssl.key here>
      nginx.conf: <Enter contents of base64-nginx.conf here>
    name: nginx-config
  ipAddress:
    ports:
    - port: 443
      protocol: TCP
    type: Public
  osType: Linux
tags: null
type: Microsoft.ContainerInstance/containerGroups
```

Deploy the container group

Create a resource group with the az group create command:

```
az group create --name myResourceGroup --location eastus
```

Deploy the container group with the az container create command, passing the YAML file as an argument.

```
az container create --resource-group <myResourceGroup> --file deploy-aci.yaml
```

View deployment state

To view the state of the deployment, use the following az container show command:

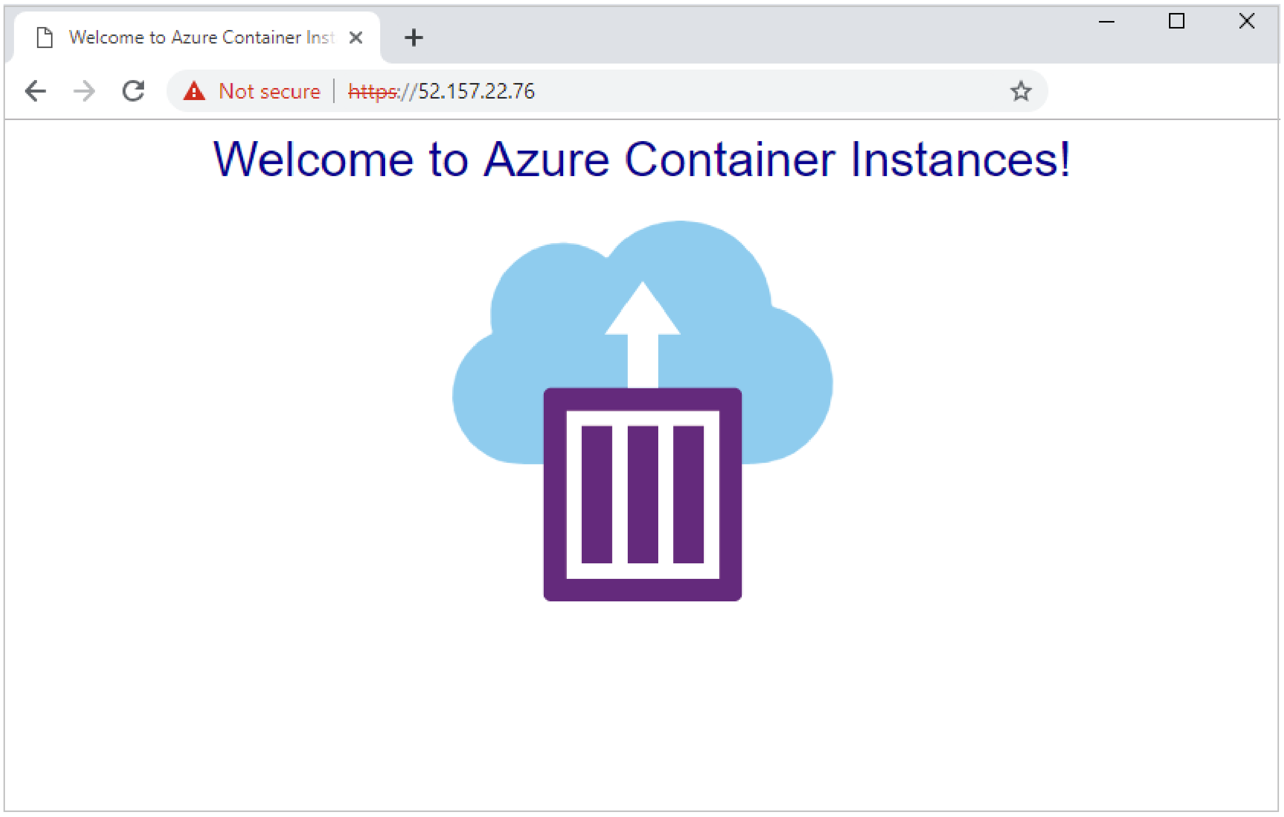
```
az container show --resource-group <myResourceGroup> --name app-with-ssl --output table
```

For a successful deployment, output is similar to the following:

```
Name          ResourceGroup     Status    Image                                                   IP:ports
Network    CPU/Memory       OsType    Location
------------  ---------------  --------  -------------------------------------------------------  -------------
------  ---------  ---------------  --------  ----------
app-with-ssl  myresourcegroup  Running   nginx, mcr.microsoft.com/azuredocs/aci-helloworld
52.157.22.76:443     Public     1.0 core/1.5 gb  Linux     westus
```

Verify SSL connection

Use your browser to navigate to the public IP address of the container group. The IP address shown in this example is `52.157.22.76`, so the URL is **https://52.157.22.76**. You must use HTTPS to see the running application, because of the Nginx server configuration. Attempts to connect over HTTP fail.


Welcome to Azure Container Inst
Not secure
~~https~~://52.157.22.76
Welcome to Azure Container Instances!

NOTE

Because this example uses a self-signed certificate and not one from a certificate authority, the browser displays a security warning when connecting to the site over HTTPS. You might need to accept the warning or adjust browser or certificate settings to proceed to the page. This behavior is expected.

Next steps

This article showed you how to set up an Nginx container to enable SSL connections to a web app running in the container group. You can adapt this example for apps that listen on ports other than port 80. You can also update the Nginx configuration file to automatically redirect server connections on port 80 (HTTP) to use HTTPS.

While this article uses Nginx in the sidecar, you can use another SSL provider such as Caddy.

If you deploy your container group in an Azure virtual network, you can consider other options to enable an SSL endpoint for a backend container instance, including:

- Azure Functions Proxies
- Azure API Management
- Azure Application Gateway - see a sample deployment template.

Mount an Azure file share in Azure Container Instances

12/31/2019 • 6 minutes to read • Edit Online

By default, Azure Container Instances are stateless. If the container crashes or stops, all of its state is lost. To persist state beyond the lifetime of the container, you must mount a volume from an external store. As shown in this article, Azure Container Instances can mount an Azure file share created with Azure Files. Azure Files offers fully managed file shares hosted in Azure Storage that are accessible via the industry standard Server Message Block (SMB) protocol. Using an Azure file share with Azure Container Instances provides file-sharing features similar to using an Azure file share with Azure virtual machines.

NOTE

Mounting an Azure Files share is currently restricted to Linux containers. Find current platform differences in the overview.

Mounting an Azure Files share to a container instance is similar to a Docker bind mount. Be aware that if you mount a share into a container directory in which files or directories exist, these files or directories are obscured by the mount and are not accessible while the container runs.

Create an Azure file share

Before using an Azure file share with Azure Container Instances, you must create it. Run the following script to create a storage account to host the file share, and the share itself. The storage account name must be globally unique, so the script adds a random value to the base string.

```
# Change these four parameters as needed
ACI_PERS_RESOURCE_GROUP=myResourceGroup
ACI_PERS_STORAGE_ACCOUNT_NAME=mystorageaccount$RANDOM
ACI_PERS_LOCATION=eastus
ACI_PERS_SHARE_NAME=acishare

# Create the storage account with the parameters
az storage account create \
    --resource-group $ACI_PERS_RESOURCE_GROUP \
    --name $ACI_PERS_STORAGE_ACCOUNT_NAME \
    --location $ACI_PERS_LOCATION \
    --sku Standard_LRS

# Create the file share
az storage share create \
  --name $ACI_PERS_SHARE_NAME \
  --account-name $ACI_PERS_STORAGE_ACCOUNT_NAME
```

Get storage credentials

To mount an Azure file share as a volume in Azure Container Instances, you need three values: the storage account name, the share name, and the storage access key.

- **Storage account name** - If you used the preceding script, the storage account name was stored in the `$ACI_PERS_STORAGE_ACCOUNT_NAME` variable. To see the account name, type:

```
echo $ACI_PERS_STORAGE_ACCOUNT_NAME
```

- **Share name** - This value is already known (defined as `acishare` in the preceding script)
- **Storage account key** - This value can be found using the following command:

```
STORAGE_KEY=$(az storage account keys list --resource-group $ACI_PERS_RESOURCE_GROUP --account-name
$ACI_PERS_STORAGE_ACCOUNT_NAME --query "[0].value" --output tsv)
echo $STORAGE_KEY
```

Deploy container and mount volume - CLI

To mount an Azure file share as a volume in a container by using the Azure CLI, specify the share and volume mount point when you create the container with az container create. If you followed the previous steps, you can mount the share you created earlier by using the following command to create a container:

```
az container create \
    --resource-group $ACI_PERS_RESOURCE_GROUP \
    --name hellofiles \
    --image mcr.microsoft.com/azuredocs/aci-hellofiles \
    --dns-name-label aci-demo \
    --ports 80 \
    --azure-file-volume-account-name $ACI_PERS_STORAGE_ACCOUNT_NAME \
    --azure-file-volume-account-key $STORAGE_KEY \
    --azure-file-volume-share-name $ACI_PERS_SHARE_NAME \
    --azure-file-volume-mount-path /aci/logs/
```

The `--dns-name-label` value must be unique within the Azure region where you create the container instance. Update the value in the preceding command if you receive a **DNS name label** error message when you execute the command.

Manage files in mounted volume

Once the container starts up, you can use the simple web app deployed via the Microsoft aci-hellofiles image to create small text files in the Azure file share at the mount path you specified. Obtain the web app's fully qualified domain name (FQDN) with the az container show command:

```
az container show --resource-group $ACI_PERS_RESOURCE_GROUP \
  --name hellofiles --query ipAddress.fqdn --output tsv
```

After saving text using the app, you can use the Azure portal or a tool like the Microsoft Azure Storage Explorer to retrieve and inspect the file or files written to the file share.

Deploy container and mount volume - YAML

You can also deploy a container group and mount a volume in a container with the Azure CLI and a YAML template. Deploying by YAML template is a preferred method when deploying container groups consisting of multiple containers.

The following YAML template defines a container group with one container created with the `aci-hellofiles` image. The container mounts the Azure file share *acishare* created previously as a volume. Where indicated, enter the name and storage key for the storage account that hosts the file share.

As in the CLI example, the `dnsNameLabel` value must be unique within the Azure region where you create the container instance. Update the value in the YAML file if needed.

```
apiVersion: '2018-10-01'
location: eastus
name: file-share-demo
properties:
  containers:
  - name: hellofiles
    properties:
      environmentVariables: []
      image: mcr.microsoft.com/azuredocs/aci-hellofiles
      ports:
      - port: 80
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
      volumeMounts:
      - mountPath: /aci/logs/
        name: filesharevolume
  osType: Linux
  restartPolicy: Always
  ipAddress:
    type: Public
    ports:
      - port: 80
    dnsNameLabel: aci-demo
  volumes:
  - name: filesharevolume
    azureFile:
      sharename: acishare
      storageAccountName: <Storage account name>
      storageAccountKey: <Storage account key>
tags: {}
type: Microsoft.ContainerInstance/containerGroups
```

To deploy with the YAML template, save the preceding YAML to a file named `deploy-aci.yaml`, then execute the az container create command with the `--file` parameter:

```
# Deploy with YAML template
az container create --resource-group myResourceGroup --file deploy-aci.yaml
```

Deploy container and mount volume - Resource Manager

In addition to CLI and YAML deployment, you can deploy a container group and mount a volume in a container using an Azure Resource Manager template.

First, populate the `volumes` array in the container group `properties` section of the template.

Then, for each container in which you'd like to mount the volume, populate the `volumeMounts` array in the `properties` section of the container definition.

The following Resource Manager template defines a container group with one container created with the `aci-hellofiles` image. The container mounts the Azure file share *acishare* created previously as a volume. Where indicated, enter the name and storage key for the storage account that hosts the file share.

As in the previous examples, the `dnsNameLabel` value must be unique within the Azure region where you create the container instance. Update the value in the template if needed.

```
{
  "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "variables": {
    "container1name": "hellofiles",
    "container1image": "mcr.microsoft.com/azuredocs/aci-hellofiles"
  },
  "resources": [
    {
      "name": "file-share-demo",
      "type": "Microsoft.ContainerInstance/containerGroups",
      "apiVersion": "2018-10-01",
      "location": "[resourceGroup().location]",
      "properties": {
        "containers": [
          {
            "name": "[variables('container1name')]",
            "properties": {
              "image": "[variables('container1image')]",
              "resources": {
                "requests": {
                  "cpu": 1,
                  "memoryInGb": 1.5
                }
              },
              "ports": [
                {
                  "port": 80
                }
              ],
              "volumeMounts": [
                {
                  "name": "filesharevolume",
                  "mountPath": "/aci/logs"
                }
              ]
            }
          }
        ],
        "osType": "Linux",
        "ipAddress": {
          "type": "Public",
          "ports": [
            {
              "protocol": "tcp",
              "port": "80"
            }
          ],
          "dnsNameLabel": "aci-demo"
        },
        "volumes": [
          {
            "name": "filesharevolume",
            "azureFile": {
                "shareName": "acishare",
                "storageAccountName": "<Storage account name>",
                "storageAccountKey": "<Storage account key>"
            }
          }
        ]
      }
    }
  ]
}
```

To deploy with the Resource Manager template, save the preceding JSON to a file named `deploy-aci.json`, then execute the az group deployment create command with the `--template-file` parameter:

```
# Deploy with Resource Manager template
az group deployment create --resource-group myResourceGroup --template-file deploy-aci.json
```

Mount multiple volumes

To mount multiple volumes in a container instance, you must deploy using an Azure Resource Manager template, a YAML file, or another programmatic method. To use a template or YAML file, provide the share details and define the volumes by populating the `volumes` array in the `properties` section of the file.

For example, if you created two Azure Files shares named *share1* and *share2* in storage account *myStorageAccount*, the `volumes` array in a Resource Manager template would appear similar to the following:

```
"volumes": [{
  "name": "myvolume1",
  "azureFile": {
    "shareName": "share1",
    "storageAccountName": "myStorageAccount",
    "storageAccountKey": "<storage-account-key>"
  }
},
{
  "name": "myvolume2",
  "azureFile": {
    "shareName": "share2",
    "storageAccountName": "myStorageAccount",
    "storageAccountKey": "<storage-account-key>"
  }
}]
```

Next, for each container in the container group in which you'd like to mount the volumes, populate the `volumeMounts` array in the `properties` section of the container definition. For example, this mounts the two volumes, *myvolume1* and *myvolume2*, previously defined:

```
"volumeMounts": [{
  "name": "myvolume1",
  "mountPath": "/mnt/share1/"
},
{
  "name": "myvolume2",
  "mountPath": "/mnt/share2/"
}]
```

Next steps

Learn how to mount other volume types in Azure Container Instances:

- Mount an emptyDir volume in Azure Container Instances
- Mount a gitRepo volume in Azure Container Instances
- Mount a secret volume in Azure Container Instances

Mount a secret volume in Azure Container Instances

11/26/2019 • 3 minutes to read • Edit Online

Use a *secret* volume to supply sensitive information to the containers in a container group. The *secret* volume stores your secrets in files within the volume, accessible by the containers in the container group. By storing secrets in a *secret* volume, you can avoid adding sensitive data like SSH keys or database credentials to your application code.

All *secret* volumes are backed by tmpfs, a RAM-backed filesystem; their contents are never written to non-volatile storage.

NOTE

Secret volumes are currently restricted to Linux containers. Learn how to pass secure environment variables for both Windows and Linux containers in Set environment variables. While we're working to bring all features to Windows containers, you can find current platform differences in the overview.

Mount secret volume - Azure CLI

To deploy a container with one or more secrets by using the Azure CLI, include the `--secrets` and `--secrets-mount-path` parameters in the az container create command. This example mounts a *secret* volume consisting of two secrets, "mysecret1" and "mysecret2," at `/mnt/secrets`:

```
az container create \
    --resource-group myResourceGroup \
    --name secret-volume-demo \
    --image mcr.microsoft.com/azuredocs/aci-helloworld \
    --secrets mysecret1="My first secret FOO" mysecret2="My second secret BAR" \
    --secrets-mount-path /mnt/secrets
```

The following az container exec output shows opening a shell in the running container, listing the files within the secret volume, then displaying their contents:

```
$ az container exec --resource-group myResourceGroup --name secret-volume-demo --exec-command "/bin/sh"
/usr/src/app # ls -1 /mnt/secrets
mysecret1
mysecret2
/usr/src/app # cat /mnt/secrets/mysecret1
My first secret FOO
/usr/src/app # cat /mnt/secrets/mysecret2
My second secret BAR
/usr/src/app # exit
Bye.
```

Mount secret volume - YAML

You can also deploy container groups with the Azure CLI and a YAML template. Deploying by YAML template is the preferred method when deploying container groups consisting of multiple containers.

When you deploy with a YAML template, the secret values must be **Base64-encoded** in the template. However, the secret values appear in plaintext within the files in the container.

The following YAML template defines a container group with one container that mounts a *secret* volume at `/mnt/secrets`. The secret volume has two secrets, "mysecret1" and "mysecret2."

```
apiVersion: '2018-10-01'
location: eastus
name: secret-volume-demo
properties:
  containers:
  - name: aci-tutorial-app
    properties:
      environmentVariables: []
      image: mcr.microsoft.com/azuredocs/aci-helloworld:latest
      ports: []
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
      volumeMounts:
      - mountPath: /mnt/secrets
        name: secretvolume1
  osType: Linux
  restartPolicy: Always
  volumes:
  - name: secretvolume1
    secret:
      mysecret1: TXkgZmlyc3Qgc2VjcmV0IEZPTwo=
      mysecret2: TXkgc2Vjb25kIHNlY3JldCBCQVIK
tags: {}
type: Microsoft.ContainerInstance/containerGroups
```

To deploy with the YAML template, save the preceding YAML to a file named `deploy-aci.yaml`, then execute the az container create command with the `--file` parameter:

```
# Deploy with YAML template
az container create --resource-group myResourceGroup --file deploy-aci.yaml
```

Mount secret volume - Resource Manager

In addition to CLI and YAML deployment, you can deploy a container group using an Azure Resource Manager template.

First, populate the `volumes` array in the container group `properties` section of the template. When you deploy with a Resource Manager template, the secret values must be **Base64-encoded** in the template. However, the secret values appear in plaintext within the files in the container.

Next, for each container in the container group in which you'd like to mount the *secret* volume, populate the `volumeMounts` array in the `properties` section of the container definition.

The following Resource Manager template defines a container group with one container that mounts a *secret* volume at `/mnt/secrets`. The secret volume has two secrets, "mysecret1" and "mysecret2."

```json
{
  "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "variables": {
    "container1name": "aci-tutorial-app",
    "container1image": "microsoft/aci-helloworld:latest"
  },
  "resources": [
    {
      "name": "secret-volume-demo",
      "type": "Microsoft.ContainerInstance/containerGroups",
      "apiVersion": "2018-06-01",
      "location": "[resourceGroup().location]",
      "properties": {
        "containers": [
          {
            "name": "[variables('container1name')]",
            "properties": {
              "image": "[variables('container1image')]",
              "resources": {
                "requests": {
                  "cpu": 1,
                  "memoryInGb": 1.5
                }
              },
              "ports": [
                {
                  "port": 80
                }
              ],
              "volumeMounts": [
                {
                  "name": "secretvolume1",
                  "mountPath": "/mnt/secrets"
                }
              ]
            }
          }
        ],
        "osType": "Linux",
        "ipAddress": {
          "type": "Public",
          "ports": [
            {
              "protocol": "tcp",
              "port": "80"
            }
          ]
        },
        "volumes": [
          {
            "name": "secretvolume1",
            "secret": {
              "mysecret1": "TXkgZmlyc3Qgc2VjcmV0IEZPTwo=",
              "mysecret2": "TXkgc2Vjb25kIHNlY3JldCBCQVIK"
            }
          }
        ]
      }
    }
  ]
}
```

To deploy with the Resource Manager template, save the preceding JSON to a file named `deploy-aci.json`, then execute the az group deployment create command with the `--template-file` parameter:

```
# Deploy with Resource Manager template
az group deployment create --resource-group myResourceGroup --template-file deploy-aci.json
```

Next steps

Volumes

Learn how to mount other volume types in Azure Container Instances:

- Mount an Azure file share in Azure Container Instances
- Mount an emptyDir volume in Azure Container Instances
- Mount a gitRepo volume in Azure Container Instances

Secure environment variables

Another method for providing sensitive information to containers (including Windows containers) is through the use of secure environment variables.

Mount an emptyDir volume in Azure Container Instances

2/10/2020 • 2 minutes to read • Edit Online

Learn how to mount an *emptyDir* volume to share data between the containers in a container group in Azure Container Instances. Use *emptyDir* volumes as ephemeral caches for your containerized workloads.

NOTE

Mounting an *emptyDir* volume is currently restricted to Linux containers. While we are working to bring all features to Windows containers, you can find current platform differences in the overview.

emptyDir volume

The *emptyDir* volume provides a writable directory accessible to each container in a container group. Containers in the group can read and write the same files in the volume, and it can be mounted using the same or different paths in each container.

Some example uses for an *emptyDir* volume:

- Scratch space
- Checkpointing during long-running tasks
- Store data retrieved by a sidecar container and served by an application container

Data in an *emptyDir* volume is persisted through container crashes. Containers that are restarted, however, are not guaranteed to persist the data in an *emptyDir* volume. If you stop a container group, the *emptyDir* volume is not persisted.

The maximum size of a Linux *emptyDir* volume is 50 GB.

Mount an emptyDir volume

To mount an emptyDir volume in a container instance, you can deploy using an Azure Resource Manager template, a YAML file, or other programmatic methods to deploy a container group.

First, populate the `volumes` array in the container group `properties` section of the file. Next, for each container in the container group in which you'd like to mount the *emptyDir* volume, populate the `volumeMounts` array in the `properties` section of the container definition.

For example, the following Resource Manager template creates a container group consisting of two containers, each of which mounts the *emptyDir* volume:

```
{
  "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "variables": {
    "container1name": "aci-tutorial-app",
    "container1image": "mcr.microsoft.com/azuredocs/aci-helloworld:latest",
    "container2name": "aci-tutorial-sidecar",
    "container2image": "mcr.microsoft.com/azuredocs/aci-tutorial-sidecar"
  },
  "resources": [
    {
      "name": "volume-demo-emptydir",
      "type": "Microsoft.ContainerInstance/containerGroups",
      "apiVersion": "2018-10-01",
      "location": "[resourceGroup().location]",
      "properties": {
        "containers": [
          {
            "name": "[variables('container1name')]",
            "properties": {
              "image": "[variables('container1image')]",
              "resources": {
                "requests": {
                  "cpu": 1,
                  "memoryInGb": 1.5
                }
              },
              "ports": [
                {
                  "port": 80
                }
              ],
              "volumeMounts": [
                {
                  "name": "emptydir1",
                  "mountPath": "/mnt/empty"
                }
              ]
            }
          },
          {
            "name": "[variables('container2name')]",
            "properties": {
              "image": "[variables('container2image')]",
              "resources": {
                "requests": {
                  "cpu": 1,
                  "memoryInGb": 1.5
                }
              },
              "volumeMounts": [
                {
                  "name": "emptydir1",
                  "mountPath": "/mnt/empty"
                }
              ]
            }
          }
        ],
        "osType": "Linux",
        "ipAddress": {
          "type": "Public",
          "ports": [
            {
              "protocol": "tcp",
              "port": "80"
            }
          ]
        },
        "volumes": [
          {
            "name": "emptydir1",
            "emptyDir": {}
          }
        ]
      }
    }
  ]
}
```

To see examples of container group deployment, see Deploy a multi-container group using a Resource Manager template and Deploy a multi-container group using a YAML file.

Next steps

Learn how to mount other volume types in Azure Container Instances:

- Mount an Azure file share in Azure Container Instances
- Mount a gitRepo volume in Azure Container Instances
- Mount a secret volume in Azure Container Instances

Mount a gitRepo volume in Azure Container Instances

11/26/2019 • 4 minutes to read • Edit Online

Learn how to mount a *gitRepo* volume to clone a Git repository into your container instances.

NOTE

Mounting a *gitRepo* volume is currently restricted to Linux containers. While we are working to bring all features to Windows containers, you can find current platform differences in the overview.

gitRepo volume

The *gitRepo* volume mounts a directory and clones the specified Git repository into it at container startup. By using a *gitRepo* volume in your container instances, you can avoid adding the code for doing so in your applications.

When you mount a *gitRepo* volume, you can set three properties to configure the volume:

PROPERTY	REQUIRED	DESCRIPTION
`repository`	Yes	The full URL, including `http://` or `https://`, of the Git repository to be cloned.
`directory`	No	Directory into which the repository should be cloned. The path must not contain or start with "`..`". If you specify "`.`", the repository is cloned into the volume's directory. Otherwise, the Git repository is cloned into a subdirectory of the given name within the volume directory.
`revision`	No	The commit hash of the revision to be cloned. If unspecified, the `HEAD` revision is cloned.

Mount gitRepo volume: Azure CLI

To mount a gitRepo volume when you deploy container instances with the Azure CLI, supply the `--gitrepo-url` and `--gitrepo-mount-path` parameters to the az container create command. You can optionally specify the directory within the volume to clone into (`--gitrepo-dir`) and the commit hash of the revision to be cloned (`--gitrepo-revision`).

This example command clones the Microsoft aci-helloworld sample application into `/mnt/aci-helloworld` in the container instance:

```
az container create \
    --resource-group myResourceGroup \
    --name hellogitrepo \
    --image mcr.microsoft.com/azuredocs/aci-helloworld \
    --dns-name-label aci-demo \
    --ports 80 \
    --gitrepo-url https://github.com/Azure-Samples/aci-helloworld \
    --gitrepo-mount-path /mnt/aci-helloworld
```

To verify the gitRepo volume was mounted, launch a shell in the container with az container exec and list the directory:

```
$ az container exec --resource-group myResourceGroup --name hellogitrepo --exec-command /bin/sh
/usr/src/app # ls -l /mnt/aci-helloworld/
total 16
-rw-r--r--    1 root     root           144 Apr 16 16:35 Dockerfile
-rw-r--r--    1 root     root          1162 Apr 16 16:35 LICENSE
-rw-r--r--    1 root     root          1237 Apr 16 16:35 README.md
drwxr-xr-x    2 root     root          4096 Apr 16 16:35 app
```

Mount gitRepo volume: Resource Manager

To mount a gitRepo volume when you deploy container instances with an Azure Resource Manager template, first populate the `volumes` array in the container group `properties` section of the template. Then, for each container in the container group in which you'd like to mount the *gitRepo* volume, populate the `volumeMounts` array in the `properties` section of the container definition.

For example, the following Resource Manager template creates a container group consisting of a single container. The container clones two GitHub repositories specified by the *gitRepo* volume blocks. The second volume includes additional properties specifying a directory to clone to, and the commit hash of a specific revision to clone.

```
{
  "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "variables": {
    "container1name": "aci-tutorial-app",
    "container1image": "microsoft/aci-helloworld:latest"
  },
  "resources": [
    {
      "name": "volume-demo-gitrepo",
      "type": "Microsoft.ContainerInstance/containerGroups",
      "apiVersion": "2018-02-01-preview",
      "location": "[resourceGroup().location]",
      "properties": {
        "containers": [
          {
            "name": "[variables('container1name')]",
            "properties": {
              "image": "[variables('container1image')]",
              "resources": {
                "requests": {
                  "cpu": 1,
                  "memoryInGb": 1.5
                }
              },
              "ports": [
                {
                  "port": 80
                }
```

```
       ],
       "volumeMounts": [
        {
         "name": "gitrepo1",
         "mountPath": "/mnt/repo1"
        },
        {
         "name": "gitrepo2",
         "mountPath": "/mnt/repo2"
        }
       ]
      }
     }
    ],
    "osType": "Linux",
    "ipAddress": {
     "type": "Public",
     "ports": [
      {
       "protocol": "tcp",
       "port": "80"
      }
     ]
    },
    "volumes": [
     {
      "name": "gitrepo1",
      "gitRepo": {
       "repository": "https://github.com/Azure-Samples/aci-helloworld"
      }
     },
     {
      "name": "gitrepo2",
      "gitRepo": {
       "directory": "my-custom-clone-directory",
       "repository": "https://github.com/Azure-Samples/aci-helloworld",
       "revision": "d5ccfcedc0d81f7ca5e3dbe6e5a7705b579101f1"
      }
     }
    ]
   }
  }
 ]
}
```

The resulting directory structure of the two cloned repos defined in the preceding template is:

```
/mnt/repo1/aci-helloworld
/mnt/repo2/my-custom-clone-directory
```

To see an example of container instance deployment with an Azure Resource Manager template, see Deploy multi-container groups in Azure Container Instances.

Private Git repo authentication

To mount a gitRepo volume for a private Git repository, specify credentials in the repository URL. Typically, credentials are in the form of a user name and a personal access token (PAT) that grants scoped access to the repository.

For example, the Azure CLI `--gitrepo-url` parameter for a private GitHub repository would appear similar to the following (where "gituser" is the GitHub user name, and "abcdef1234fdsa4321abcdef" is the user's personal access token):

```
--gitrepo-url https://gituser:abcdef1234fdsa4321abcdef@github.com/GitUser/some-private-repository
```

For an Azure Repos Git repository, specify any user name (you can use "azurereposuser" as in the following example) in combination with a valid PAT:

```
--gitrepo-url https://azurereposuser:abcdef1234fdsa4321abcdef@dev.azure.com/your-org/_git/some-private-
repository
```

For more information about personal access tokens for GitHub and Azure Repos, see the following:

GitHub: Creating a personal access token for the command line

Azure Repos: Create personal access tokens to authenticate access

Next steps

Learn how to mount other volume types in Azure Container Instances:

- Mount an Azure file share in Azure Container Instances
- Mount an emptyDir volume in Azure Container Instances
- Mount a secret volume in Azure Container Instances

Configure liveness probes

1/31/2020 • 3 minutes to read • Edit Online

Containerized applications may run for extended periods of time, resulting in broken states that may need to be repaired by restarting the container. Azure Container Instances supports liveness probes so that you can configure your containers within your container group to restart if critical functionality is not working. The liveness probe behaves like a Kubernetes liveness probe.

This article explains how to deploy a container group that includes a liveness probe, demonstrating the automatic restart of a simulated unhealthy container.

Azure Container Instances also supports readiness probes, which you can configure to ensure that traffic reaches a container only when it's ready for it.

NOTE

Currently you cannot use a liveness probe in a container group deployed to a virtual network.

YAML deployment

Create a `liveness-probe.yaml` file with the following snippet. This file defines a container group that consists of an NGNIX container that eventually becomes unhealthy.

```
apiVersion: 2018-10-01
location: eastus
name: livenesstest
properties:
  containers:
  - name: mycontainer
    properties:
      image: nginx
      command:
        - "/bin/sh"
        - "-c"
        - "touch /tmp/healthy; sleep 30; rm -rf /tmp/healthy; sleep 600"
      ports: []
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
      livenessProbe:
        exec:
            command:
                - "cat"
                - "/tmp/healthy"
        periodSeconds: 5
  osType: Linux
  restartPolicy: Always
tags: null
type: Microsoft.ContainerInstance/containerGroups
```

Run the following command to deploy this container group with the above YAML configuration:

```
az container create --resource-group myResourceGroup --name livenesstest -f liveness-probe.yaml
```

Start command

The deployment includes a `command` property defining a starting command that runs when the container first starts running. This property accepts an array of strings. This command simulates the container entering an unhealthy state.

First, it starts a bash session and creates a file called `healthy` within the `/tmp` directory. It then sleeps for 30 seconds before deleting the file, then enters a 10-minute sleep:

```
/bin/sh -c "touch /tmp/healthy; sleep 30; rm -rf /tmp/healthy; sleep 600"
```

Liveness command

This deployment defines a `livenessProbe` that supports an `exec` liveness command that acts as the liveness check. If this command exits with a non-zero value, the container is killed and restarted, signaling the `healthy` file could not be found. If this command exits successfully with exit code 0, no action is taken.

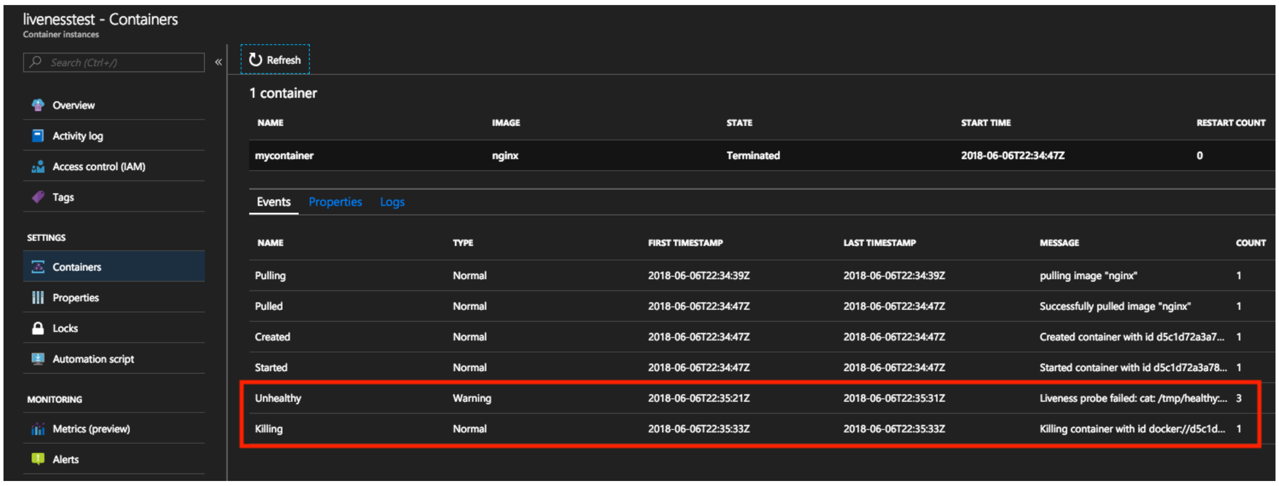
The `periodSeconds` property designates the liveness command should execute every 5 seconds.

Verify liveness output

Within the first 30 seconds, the `healthy` file created by the start command exists. When the liveness command checks for the `healthy` file's existence, the status code returns 0, signaling success, so no restarting occurs.

After 30 seconds, the `cat /tmp/healthy` command begins to fail, causing unhealthy and killing events to occur.

These events can be viewed from the Azure portal or Azure CLI.



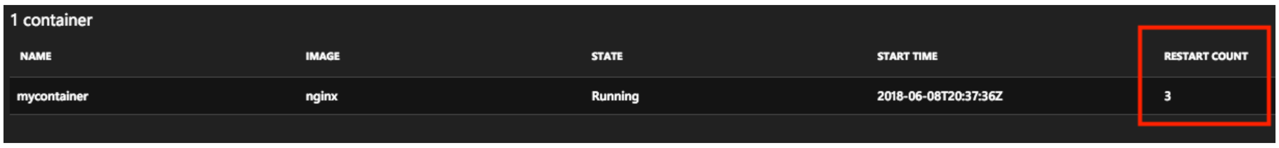
1 container

NAME	IMAGE	STATE	START TIME	RESTART COUNT
mycontainer	nginx	Terminated	2018-06-06T22:34:47Z	0

NAME	TYPE	FIRST TIMESTAMP	LAST TIMESTAMP	MESSAGE	COUNT
Pulling	Normal	2018-06-06T22:34:39Z	2018-06-06T22:34:39Z	pulling image "nginx"	1
Pulled	Normal	2018-06-06T22:34:47Z	2018-06-06T22:34:47Z	Successfully pulled image "nginx"	1
Created	Normal	2018-06-06T22:34:47Z	2018-06-06T22:34:47Z	Created container with id d5c1d72a3a7...	1
Started	Normal	2018-06-06T22:34:47Z	2018-06-06T22:34:47Z	Started container with id d5c1d72a3a78...	1
Unhealthy	Warning	2018-06-06T22:35:21Z	2018-06-06T22:35:31Z	Liveness probe failed: cat: /tmp/healthy:...	3
Killing	Normal	2018-06-06T22:35:33Z	2018-06-06T22:35:33Z	Killing container with id docker://d5c1d...	1

By viewing the events in the Azure portal, events of type `Unhealthy` are triggered upon the liveness command failing. The subsequent event is of type `Killing`, signifying a container deletion so a restart can begin. The restart count for the container increments each time this event occurs.

Restarts are completed in-place so resources like public IP addresses and node-specific contents are preserved.



1 container

NAME	IMAGE	STATE	START TIME	RESTART COUNT
mycontainer	nginx	Running	2018-06-08T20:37:36Z	3

If the liveness probe continuously fails and triggers too many restarts, your container enters an exponential back-off delay.

Liveness probes and restart policies

Restart policies supersede the restart behavior triggered by liveness probes. For example, if you set a `restartPolicy = Never` *and* a liveness probe, the container group will not restart because of a failed liveness check. The container group instead adheres to the container group's restart policy of `Never`.

Next steps

Task-based scenarios may require a liveness probe to enable automatic restarts if a pre-requisite function is not working properly. For more information about running task-based containers, see Run containerized tasks in Azure Container Instances.

Configure readiness probes

1/31/2020 • 3 minutes to read • Edit Online

For containerized applications that serve traffic, you might want to verify that your container is ready to handle incoming requests. Azure Container Instances supports readiness probes to include configurations so that your container can't be accessed under certain conditions. The readiness probe behaves like a Kubernetes readiness probe. For example, a container app might need to load a large data set during startup, and you don't want it to receive requests during this time.

This article explains how to deploy a container group that includes a readiness probe, so that a container only receives traffic when the probe succeeds.

Azure Container Instances also supports liveness probes, which you can configure to cause an unhealthy container to automatically restart.

NOTE

Currently you cannot use a readiness probe in a container group deployed to a virtual network.

YAML configuration

As an example, create a `readiness-probe.yaml` file with the following snippet that includes a readiness probe. This file defines a container group that consists of a container running a small web app. The app is deployed from the public `mcr.microsoft.com/azuredocs/aci-helloworld` image. This containerized app is also demonstrated in Deploy a container instance in Azure using the Azure CLI and other quickstarts.

```yaml
apiVersion: 2018-10-01
location: eastus
name: readinesstest
properties:
  containers:
  - name: mycontainer
    properties:
      image: mcr.microsoft.com/azuredocs/aci-helloworld
      command:
        - "/bin/sh"
        - "-c"
        - "node /usr/src/app/index.js & (sleep 240; touch /tmp/ready); wait"
      ports:
      - port: 80
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
      readinessProbe:
        exec:
          command:
          - "cat"
          - "/tmp/ready"
        periodSeconds: 5
  osType: Linux
  restartPolicy: Always
  ipAddress:
    type: Public
    ports:
    - protocol: tcp
      port: '80'
tags: null
type: Microsoft.ContainerInstance/containerGroups
```

Start command

The deployment includes a `command` property defining a starting command that runs when the container first starts running. This property accepts an array of strings. This command simulates a time when the web app runs but the container isn't ready.

First, it starts a shell session and runs a `node` command to start the web app. It also starts a command to sleep for 240 seconds, after which it creates a file called `ready` within the `/tmp` directory:

```
node /usr/src/app/index.js & (sleep 240; touch /tmp/ready); wait
```

Readiness command

This YAML file defines a `readinessProbe` which supports an `exec` readiness command that acts as the readiness check. This example readiness command tests for the existence of the `ready` file in the `/tmp` directory.

When the `ready` file doesn't exist, the readiness command exits with a non-zero value; the container continues running but can't be accessed. When the command exits successfully with exit code 0, the container is ready to be accessed.

The `periodSeconds` property designates the readiness command should execute every 5 seconds. The readiness probe runs for the lifetime of the container group.

Example deployment

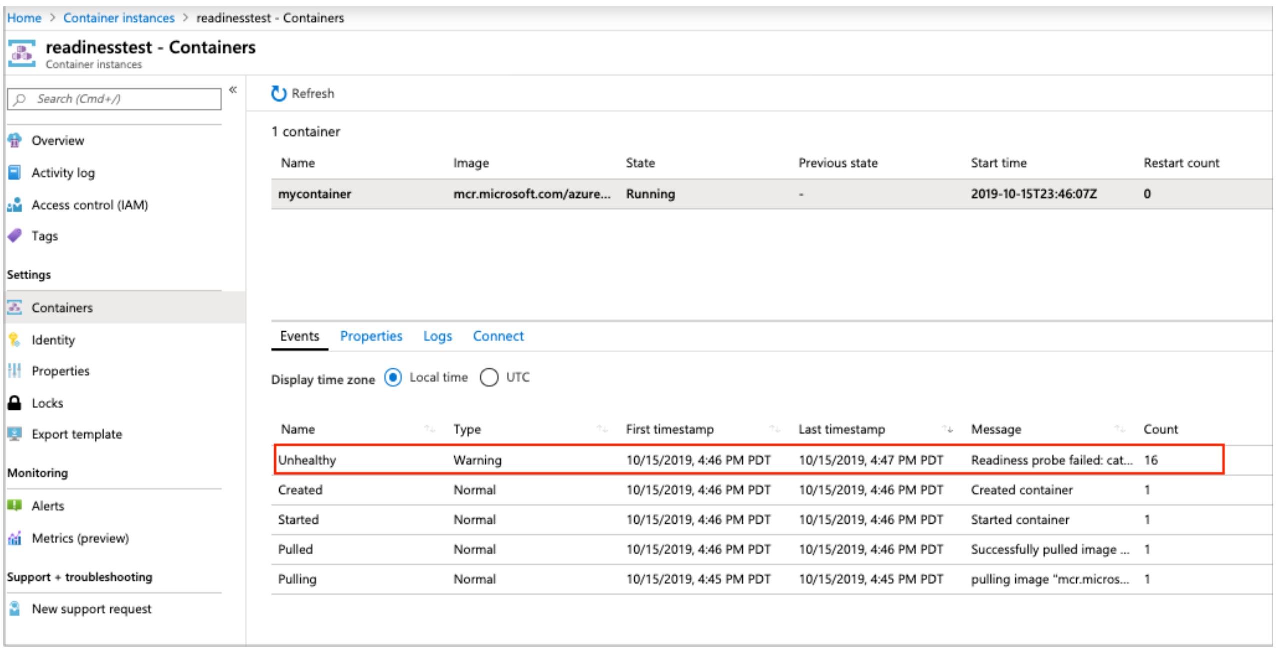
Run the following command to deploy a container group with the preceding YAML configuration:

```
az container create --resource-group myResourceGroup --file readiness-probe.yaml
```

View readiness checks

In this example, during the first 240 seconds, the readiness command fails when it checks for the `ready` file's existence. The status code returned signals that the container isn't ready.

These events can be viewed from the Azure portal or Azure CLI. For example, the portal shows events of type `Unhealthy` are triggered upon the readiness command failing.



1 container

Name	Image	State	Previous state	Start time	Restart count
mycontainer	mcr.microsoft.com/azure...	Running	-	2019-10-15T23:46:07Z	0

Display time zone [✓ Local time] UTC

Name	Type	First timestamp	Last timestamp	Message	Count
Unhealthy	Warning	10/15/2019, 4:46 PM PDT	10/15/2019, 4:47 PM PDT	Readiness probe failed: cat...	16
Created	Normal	10/15/2019, 4:46 PM PDT	10/15/2019, 4:46 PM PDT	Created container	1
Started	Normal	10/15/2019, 4:46 PM PDT	10/15/2019, 4:46 PM PDT	Started container	1
Pulled	Normal	10/15/2019, 4:46 PM PDT	10/15/2019, 4:46 PM PDT	Successfully pulled image ...	1
Pulling	Normal	10/15/2019, 4:45 PM PDT	10/15/2019, 4:45 PM PDT	pulling image "mcr.micros...	1

Verify container readiness

After starting the container, you can verify that it's not accessible initially. After provisioning, get the IP address of the container group:

```
az container show --resource-group myResourceGroup --name readinesstest --query "ipAddress.ip" --out tsv
```

Try to access the site while the readiness probe fails:

```
wget <ipAddress>
```

Output shows the site isn't accessible initially:

```
$ wget 192.0.2.1
--2019-10-15 16:46:02--  http://192.0.2.1/
Connecting to 192.0.2.1... connected.
HTTP request sent, awaiting response...
```

After 240 seconds, the readiness command succeeds, signaling the container is ready. Now, when you run the `wget` command, it succeeds:

```
$ wget 192.0.2.1
--2019-10-15 16:46:02--  http://192.0.2.1/
Connecting to 192.0.2.1... connected.
HTTP request sent, awaiting response...200 OK
Length: 1663 (1.6K) [text/html]
Saving to: ‘index.html.1’

index.html.1                       100%[=================================================================>]
1.62K  --.-KB/s    in 0s

2019-10-15 16:49:38 (113 MB/s) - ‘index.html.1’ saved [1663/1663]
```

When the container is ready, you can also access the web app by browsing to the IP address using a web browser.

NOTE

The readiness probe continues to run for the lifetime of the container group. If the readiness command fails at a later time, the container again becomes inaccessible.

Next steps

A readiness probe could be useful in scenarios involving multi-container groups that consist of dependent containers. For more information about multi-container scenarios, see Container groups in Azure Container Instances.

Manually stop or start containers in Azure Container Instances

11/26/2019 • 2 minutes to read • Edit Online

The restart policy setting of a container group determines how container instances start or stop by default. You can override the default setting by manually stopping or starting a container group.

Stop

Manually stop a running container group - for example, by using the az container stop command or Azure portal. For certain container workloads, you might want to stop a long-running container group after a defined period to save on costs.

When a container group enters the Stopped state, it terminates and recycles all the containers in the group. It does not preserve container state.

When the containers are recycled, the resources are deallocated and billing stops for the container group.

The stop action has no effect if the container group already terminated (is in either a Succeeded or Failed state). For example, a container group with run-once container tasks that ran successfully terminates in the Succeeded state. Attempts to stop the group in that state do not change the state.

Start

When a container group is stopped - either because the containers terminated on their own or you manually stopped the group - you can start the containers. For example, use the az container start command or Azure portal to manually start the containers in the group. If the container image for any container is updated, a new image is pulled.

Starting a container group begins a new deployment with the same container configuration. This action can help you quickly reuse a known container group configuration that works as you expect. You don't have to create a new container group to run the same workload.

All containers in a container group are started by this action. You can't start a specific container in the group.

After you manually start or restart a container group, the container group runs according to the configured restart policy.

Restart

You can restart a container group while it is running - for example, by using the az container restart command. This action restarts all containers in the container group. If the container image for any container is updated, a new image is pulled.

Restarting a container group is helpful when you want to troubleshoot a deployment problem. For example, if a temporary resource limitation prevents your containers from running successfully, restarting the group might solve the problem.

All containers in a container group are restarted by this action. You can't restart a specific container in the group.

After you manually restart a container group, the container group runs according to the configured restart policy.

Next steps

Learn more about restart policy settings in Azure Container Instances.

In addition to manually stopping and starting a container group with the existing configuration, you can update the settings of a running container group.

Update containers in Azure Container Instances

11/26/2019 • 3 minutes to read • Edit Online

During normal operation of your container instances, you may find it necessary to update the running containers in a container group. For example, you might wish to update the image version, change a DNS name, update environment variables, or refresh the state of a container whose application has crashed.

NOTE

Terminated or deleted container groups can't be updated. Once a container group has terminated (is in either a Succeeded or Failed state) or has been deleted, the group must be deployed as new.

Update a container group

Update the containers in a running container group by redeploying an existing group with at least one modified property. When you update a container group, all running containers in the group are restarted in-place, usually on the same underlying container host.

Redeploy an existing container group by issuing the create command (or use the Azure portal) and specify the name of an existing group. Modify at least one valid property of the group when you issue the create command to trigger the redeployment, and leave the remaining properties unchanged (or continue to use default values). Not all container group properties are valid for redeployment. See Properties that require delete for a list of unsupported properties.

The following Azure CLI example updates a container group with a new DNS name label. Because the DNS name label property of the group is one that can be updated, the container group is redeployed, and its containers restarted.

Initial deployment with DNS name label *myapplication-staging*:

```
# Create container group
az container create --resource-group myResourceGroup --name mycontainer \
    --image nginx:alpine --dns-name-label myapplication-staging
```

Update the container group with a new DNS name label, *myapplication*, and leave the remaining properties unchanged:

```
# Update DNS name label (restarts container), leave other properties unchanged
az container create --resource-group myResourceGroup --name mycontainer \
    --image nginx:alpine --dns-name-label myapplication
```

Update benefits

The primary benefit of updating an existing container group is faster deployment. When you redeploy an existing container group, its container image layers are pulled from those cached by the previous deployment. Instead of pulling all image layers fresh from the registry as is done with new deployments, only modified layers (if any) are pulled.

Applications based on larger container images like Windows Server Core can see significant improvement in deployment speed when you update instead of delete and deploy new.

Limitations

Not all properties of a container group support updates. To change some properties of a container group, you must first delete, then redeploy the group. For details, see Properties that require container delete.

All containers in a container group are restarted when you update the container group. You can't perform an update or in-place restart of a specific container in a multi-container group.

The IP address of a container won't typically change between updates, but it's not guaranteed to remain the same. As long as the container group is deployed to the same underlying host, the container group retains its IP address. Although rare, and while Azure Container Instances makes every effort to redeploy to the same host, there are some Azure-internal events that can cause redeployment to a different host. To mitigate this issue, always use a DNS name label for your container instances.

Terminated or deleted container groups can't be updated. Once a container group has stopped (is in the *Terminated* state) or has been deleted, the group is deployed as new.

Properties that require container delete

As mentioned earlier, not all container group properties can be updated. For example, to change the ports or restart policy of a container, you must first delete the container group, then create it again.

These properties require container group deletion prior to redeployment:

- OS type
- CPU
- Memory
- Restart policy
- Ports

When you delete a container group and recreate it, it's not "redeployed," but created new. All image layers are pulled fresh from the registry, not from those cached by a previous deployment. The IP address of the container might also change due to being deployed to a different underlying host.

Next steps

Mentioned several times in this article is the **container group**. Every container in Azure Container Instances is deployed in a container group, and container groups can contain more than one container.

Container groups in Azure Container Instances

Deploy a multi-container group

Manually stop or start containers in Azure Container Instances

Monitor container resources in Azure Container Instances

11/26/2019 • 3 minutes to read • Edit Online

Azure Monitor provides insight into the compute resources used by your containers instances. This resource usage data helps you determine the best resource settings for your container groups. Azure Monitor also provides metrics that track network activity in your container instances.

This document details gathering Azure Monitor metrics for container instances using both the Azure portal and Azure CLI.

IMPORTANT

Azure Monitor metrics in Azure Container Instances are currently in preview, and some limitations apply. Previews are made available to you on the condition that you agree to the supplemental terms of use. Some aspects of this feature may change prior to general availability (GA).

Preview limitations

At this time, Azure Monitor metrics are only available for Linux containers.

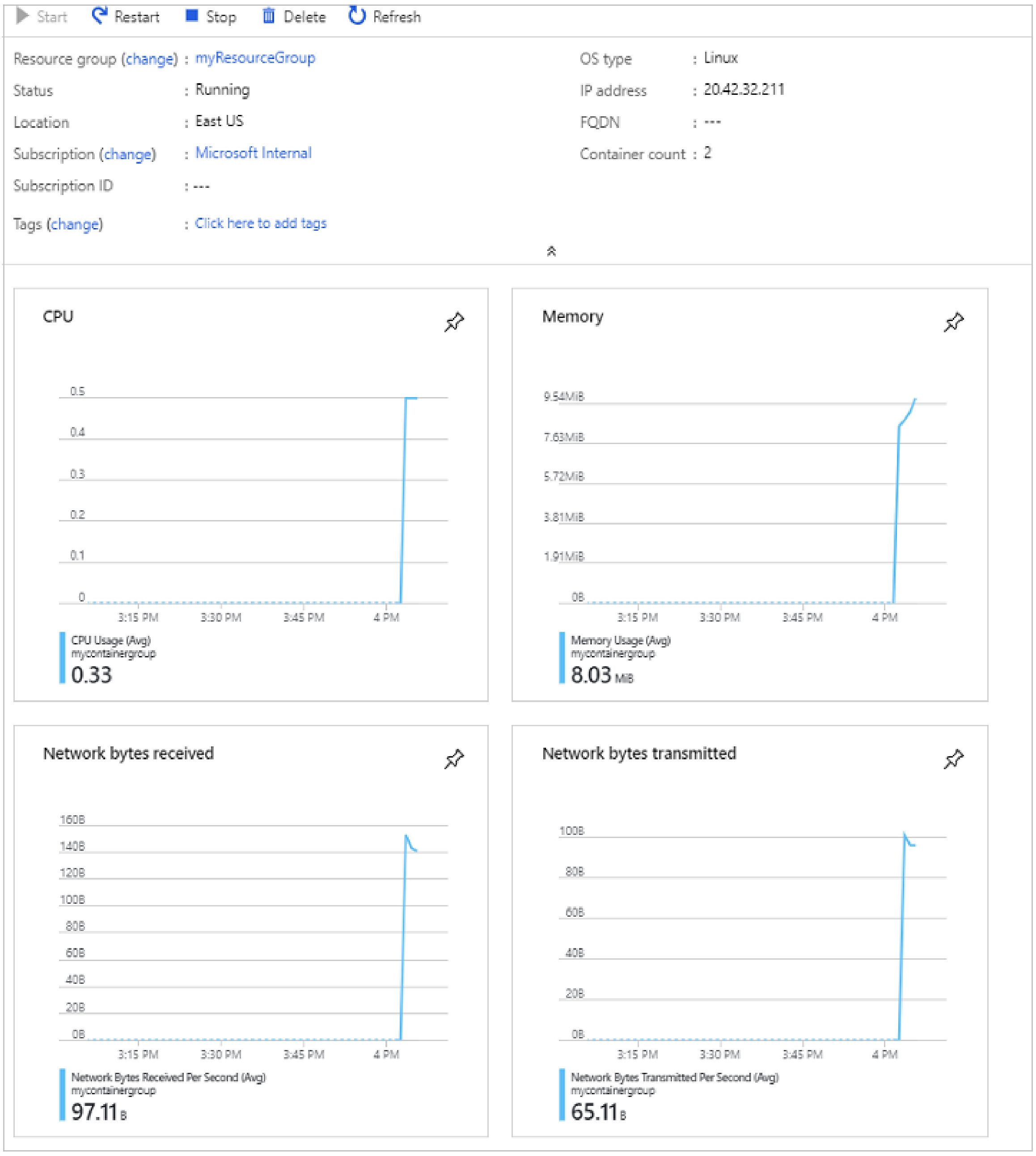
Available metrics

Azure Monitor provides the following metrics for Azure Container Instances. These metrics are available for a container group and individual containers.

- **CPU Usage** - measured in **millicores**. One millicore is 1/1000th of a CPU core, so 500 millicores (or 500 m) represents 50% usage of a CPU core. Aggregated as **average usage** across all cores.
- **Memory Usage** - aggregated as **average bytes**.
- **Network Bytes Received Per Second** and **Network Bytes Transmitted Per Second** - aggregated as **average bytes per second**.

Get metrics - Azure portal

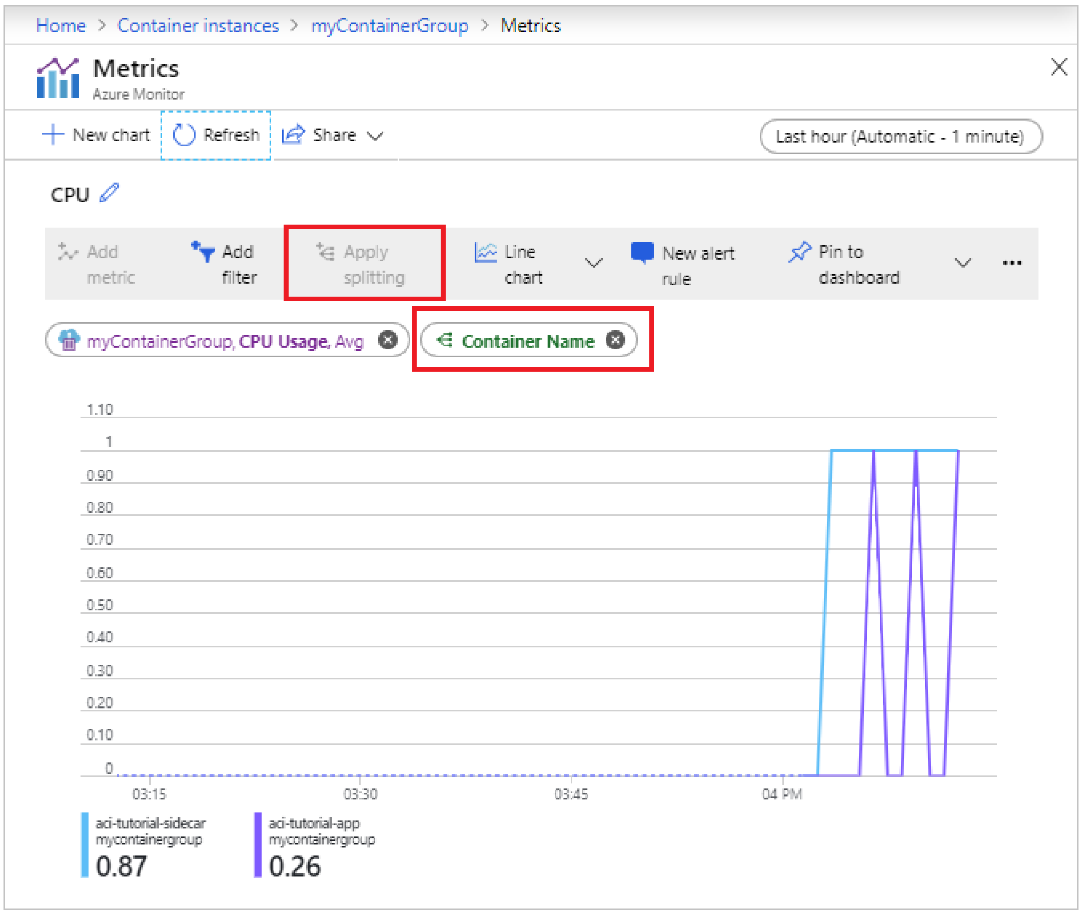
When a container group is created, Azure Monitor data is available in the Azure portal. To see metrics for a container group, go to the **Overview** page for the container group. Here you can see pre-created charts for each of the available metrics.



Resource group (change)	: myResourceGroup
Status	: Running
Location	: East US
Subscription (change)	: Microsoft Internal
Subscription ID	: ---
Tags (change)	: Click here to add tags
OS type	: Linux
IP address	: 20.42.32.211
FQDN	: ---
Container count	: 2

In a container group that contains multiple containers, use a dimension to present metrics by container. To create a chart with individual container metrics, perform the following steps:

1. In the **Overview** page, select one of the metric charts, such as **CPU**.
2. Select the **Apply splitting** button, and select **Container Name**.


Home > Container instances > myContainerGroup > Metrics
Metrics
Azure Monitor
New chart
Refresh
Share
Last hour (Automatic - 1 minute)
CPU
Add metric
Add filter
Apply splitting
Line chart
New alert rule
Pin to dashboard
myContainerGroup, CPU Usage, Avg
Container Name
aci-tutorial-sidecar mycontainergroup 0.87
aci-tutorial-app mycontainergroup 0.26

Get metrics - Azure CLI

Metrics for container instances can also be gathered using the Azure CLI. First, get the ID of the container group using the following command. Replace `<resource-group>` with your resource group name and `<container-group>` with the name of your container group.

```
CONTAINER_GROUP=$(az container show --resource-group <resource-group> --name <container-group> --query id --output tsv)
```

Use the following command to get **CPU** usage metrics.

```
$ az monitor metrics list --resource $CONTAINER_GROUP --metric CPUUsage --output table

Timestamp            Name       Average
-------------------  ---------  ---------
2019-04-23 22:59:00  CPU Usage
2019-04-23 23:00:00  CPU Usage
2019-04-23 23:01:00  CPU Usage  0.0
2019-04-23 23:02:00  CPU Usage  0.0
2019-04-23 23:03:00  CPU Usage  0.5
2019-04-23 23:04:00  CPU Usage  0.5
2019-04-23 23:05:00  CPU Usage  0.5
2019-04-23 23:06:00  CPU Usage  1.0
2019-04-23 23:07:00  CPU Usage  0.5
2019-04-23 23:08:00  CPU Usage  0.5
2019-04-23 23:09:00  CPU Usage  1.0
2019-04-23 23:10:00  CPU Usage  0.5
```

Change the value of the `--metric` parameter in the command to get other supported metrics. For example, use the following command to get **memory** usage metrics.

```
$ az monitor metrics list --resource $CONTAINER_GROUP --metric MemoryUsage --output table

Timestamp            Name          Average
-------------------  ------------  ----------
2019-04-23 22:59:00  Memory Usage
2019-04-23 23:00:00  Memory Usage
2019-04-23 23:01:00  Memory Usage  0.0
2019-04-23 23:02:00  Memory Usage  8859648.0
2019-04-23 23:03:00  Memory Usage  9181184.0
2019-04-23 23:04:00  Memory Usage  9580544.0
2019-04-23 23:05:00  Memory Usage  10280960.0
2019-04-23 23:06:00  Memory Usage  7815168.0
2019-04-23 23:07:00  Memory Usage  7739392.0
2019-04-23 23:08:00  Memory Usage  8212480.0
2019-04-23 23:09:00  Memory Usage  8159232.0
2019-04-23 23:10:00  Memory Usage  8093696.0
```

For a multi-container group, the `containerName` dimension can be added to return metrics per container.

```
$ az monitor metrics list --resource $CONTAINER_GROUP --metric MemoryUsage --dimension containerName --output
table

Timestamp            Name          Containername             Average
-------------------  ------------  --------------------  -----------
2019-04-23 22:59:00  Memory Usage  aci-tutorial-app
2019-04-23 23:00:00  Memory Usage  aci-tutorial-app
2019-04-23 23:01:00  Memory Usage  aci-tutorial-app      0.0
2019-04-23 23:02:00  Memory Usage  aci-tutorial-app      16834560.0
2019-04-23 23:03:00  Memory Usage  aci-tutorial-app      17534976.0
2019-04-23 23:04:00  Memory Usage  aci-tutorial-app      18329600.0
2019-04-23 23:05:00  Memory Usage  aci-tutorial-app      19742720.0
2019-04-23 23:06:00  Memory Usage  aci-tutorial-app      14786560.0
2019-04-23 23:07:00  Memory Usage  aci-tutorial-app      14651392.0
2019-04-23 23:08:00  Memory Usage  aci-tutorial-app      15470592.0
2019-04-23 23:09:00  Memory Usage  aci-tutorial-app      15450112.0
2019-04-23 23:10:00  Memory Usage  aci-tutorial-app      15339520.0
2019-04-23 22:59:00  Memory Usage  aci-tutorial-sidecar
2019-04-23 23:00:00  Memory Usage  aci-tutorial-sidecar
2019-04-23 23:01:00  Memory Usage  aci-tutorial-sidecar  0.0
2019-04-23 23:02:00  Memory Usage  aci-tutorial-sidecar  884736.0
2019-04-23 23:03:00  Memory Usage  aci-tutorial-sidecar  827392.0
2019-04-23 23:04:00  Memory Usage  aci-tutorial-sidecar  831488.0
2019-04-23 23:05:00  Memory Usage  aci-tutorial-sidecar  819200.0
2019-04-23 23:06:00  Memory Usage  aci-tutorial-sidecar  843776.0
2019-04-23 23:07:00  Memory Usage  aci-tutorial-sidecar  827392.0
2019-04-23 23:08:00  Memory Usage  aci-tutorial-sidecar  954368.0
2019-04-23 23:09:00  Memory Usage  aci-tutorial-sidecar  868352.0
2019-04-23 23:10:00  Memory Usage  aci-tutorial-sidecar  847872.0
```

Next steps

Learn more about Azure Monitoring at the Azure Monitoring overview.

Learn how to create metric alerts to get notified when a metric for Azure Container Instances crosses a threshold.

Retrieve container logs and events in Azure Container Instances

1/5/2020 • 2 minutes to read • Edit Online

When you have a misbehaving container in Azure Container Instances, start by viewing its logs with az container logs, and stream its standard out and standard error with az container attach. You can also view logs and events for container instances in the Azure portal, or send log and event data for container groups to Azure Monitor logs.

View logs

To view logs from your application code within a container, you can use the az container logs command.

The following is log output from the example task-based container in Set the command line in a container instance, after having provided an invalid URL using a command-line override:

```
$ az container logs --resource-group myResourceGroup --name mycontainer
Traceback (most recent call last):
  File "wordcount.py", line 11, in <module>
    urllib.request.urlretrieve (sys.argv[1], "foo.txt")
  File "/usr/local/lib/python3.6/urllib/request.py", line 248, in urlretrieve
    with contextlib.closing(urlopen(url, data)) as fp:
  File "/usr/local/lib/python3.6/urllib/request.py", line 223, in urlopen
    return opener.open(url, data, timeout)
  File "/usr/local/lib/python3.6/urllib/request.py", line 532, in open
    response = meth(req, response)
  File "/usr/local/lib/python3.6/urllib/request.py", line 642, in http_response
    'http', request, response, code, msg, hdrs)
  File "/usr/local/lib/python3.6/urllib/request.py", line 570, in error
    return self._call_chain(*args)
  File "/usr/local/lib/python3.6/urllib/request.py", line 504, in _call_chain
    result = func(*args)
  File "/usr/local/lib/python3.6/urllib/request.py", line 650, in http_error_default
    raise HTTPError(req.full_url, code, msg, hdrs, fp)
urllib.error.HTTPError: HTTP Error 404: Not Found
```

Attach output streams

The az container attach command provides diagnostic information during container startup. Once the container has started, it streams STDOUT and STDERR to your local console.

For example, here is output from the task-based container in Set the command line in a container instance, after having supplied a valid URL of a large text file to process:

```
$ az container attach --resource-group myResourceGroup --name mycontainer
Container 'mycontainer' is in state 'Unknown'...
Container 'mycontainer' is in state 'Waiting'...
Container 'mycontainer' is in state 'Running'...
(count: 1) (last timestamp: 2019-03-21 19:42:39+00:00) pulling image "mcr.microsoft.com/azuredocs/aci-
wordcount:latest"
Container 'mycontainer1' is in state 'Running'...
(count: 1) (last timestamp: 2019-03-21 19:42:39+00:00) pulling image "mcr.microsoft.com/azuredocs/aci-
wordcount:latest"
(count: 1) (last timestamp: 2019-03-21 19:42:52+00:00) Successfully pulled image
"mcr.microsoft.com/azuredocs/aci-wordcount:latest"
(count: 1) (last timestamp: 2019-03-21 19:42:55+00:00) Created container
(count: 1) (last timestamp: 2019-03-21 19:42:55+00:00) Started container

Start streaming logs:
[('the', 22979),
 ('I', 20003),
 ('and', 18373),
 ('to', 15651),
 ('of', 15558),
 ('a', 12500),
 ('you', 11818),
 ('my', 10651),
 ('in', 9707),
 ('is', 8195)]
```

Get diagnostic events

If your container fails to deploy successfully, review the diagnostic information provided by the Azure Container Instances resource provider. To view the events for your container, run the az container show command:

```
az container show --resource-group myResourceGroup --name mycontainer
```

The output includes the core properties of your container, along with deployment events (shown here truncated):

```
{
  "containers": [
    {
      "command": null,
      "environmentVariables": [],
      "image": "mcr.microsoft.com/azuredocs/aci-helloworld",
      ...
        "events": [
          {
            "count": 1,
            "firstTimestamp": "2019-03-21T19:46:22+00:00",
            "lastTimestamp": "2019-03-21T19:46:22+00:00",
            "message": "pulling image \"mcr.microsoft.com/azuredocs/aci-helloworld\"",
            "name": "Pulling",
            "type": "Normal"
          },
          {
            "count": 1,
            "firstTimestamp": "2019-03-21T19:46:28+00:00",
            "lastTimestamp": "2019-03-21T19:46:28+00:00",
            "message": "Successfully pulled image \"mcr.microsoft.com/azuredocs/aci-helloworld\"",
            "name": "Pulled",
            "type": "Normal"
          },
          {
            "count": 1,
            "firstTimestamp": "2019-03-21T19:46:31+00:00",
            "lastTimestamp": "2019-03-21T19:46:31+00:00",
            "message": "Created container",
            "name": "Created",
            "type": "Normal"
          },
          {
            "count": 1,
            "firstTimestamp": "2019-03-21T19:46:31+00:00",
            "lastTimestamp": "2019-03-21T19:46:31+00:00",
            "message": "Started container",
            "name": "Started",
            "type": "Normal"
          }
        ],
        "previousState": null,
        "restartCount": 0
      },
      "name": "mycontainer",
      "ports": [
        {
          "port": 80,
          "protocol": null
        }
      ],
      ...
    }
  ],
  ...
}
```

Next steps

Learn how to troubleshoot common container and deployment issues for Azure Container Instances.

Learn how to send log and event data for container groups to Azure Monitor logs.

Container group and instance logging with Azure Monitor logs

1/8/2020 • 5 minutes to read • Edit Online

Log Analytics workspaces provide a centralized location for storing and querying log data not only from Azure resources, but also on-premises resources and resources in other clouds. Azure Container Instances includes built-in support for sending logs and event data to Azure Monitor logs.

To send container group log and event data to Azure Monitor logs, specify an existing Log Analytics workspace ID and workspace key when creating a container group. The following sections describe how to create a logging-enabled container group and how to query logs.

NOTE

This article was recently updated to use the term Azure Monitor logs instead of Log Analytics. Log data is still stored in a Log Analytics workspace and is still collected and analyzed by the same Log Analytics service. We are updating the terminology to better reflect the role of logs in Azure Monitor. See Azure Monitor terminology changes for details.

NOTE

Currently, you can only send event data from Linux container instances to Log Analytics.

Prerequisites

To enable logging in your container instances, you need the following:

- Log Analytics workspace
- Azure CLI (or Cloud Shell)

Get Log Analytics credentials

Azure Container Instances needs permission to send data to your Log Analytics workspace. To grant this permission and enable logging, you must provide the Log Analytics workspace ID and one of its keys (either primary or secondary) when you create the container group.

To obtain the log analytics workspace ID and primary key:

1. Navigate to your Log Analytics workspace in the Azure portal
2. Under **Settings**, select **Advanced settings**
3. Select **Connected Sources** > **Windows Servers** (or **Linux Servers**--the ID and keys are the same for both)
4. Take note of:
   - **WORKSPACE ID**
   - **PRIMARY KEY**

Create container group

Now that you have the log analytics workspace ID and primary key, you're ready to create a logging-enabled container group.

The following examples demonstrate two ways to create a container group that consists of a single fluentd container: Azure CLI, and Azure CLI with a YAML template. The fluentd container produces several lines of output in its default configuration. Because this output is sent to your Log Analytics workspace, it works well for demonstrating the viewing and querying of logs.

Deploy with Azure CLI

To deploy with the Azure CLI, specify the `--log-analytics-workspace` and `--log-analytics-workspace-key` parameters in the az container create command. Replace the two workspace values with the values you obtained in the previous step (and update the resource group name) before running the following command.

```
az container create \
    --resource-group myResourceGroup \
    --name mycontainergroup001 \
    --image fluent/fluentd \
    --log-analytics-workspace <WORKSPACE_ID> \
    --log-analytics-workspace-key <WORKSPACE_KEY>
```

Deploy with YAML

Use this method if you prefer to deploy container groups with YAML. The following YAML defines a container group with a single container. Copy the YAML into a new file, then replace `LOG_ANALYTICS_WORKSPACE_ID` and `LOG_ANALYTICS_WORKSPACE_KEY` with the values you obtained in the previous step. Save the file as **deploy-aci.yaml**.

```
apiVersion: 2018-10-01
location: eastus
name: mycontainergroup001
properties:
  containers:
  - name: mycontainer001
    properties:
      environmentVariables: []
      image: fluent/fluentd
      ports: []
      resources:
        requests:
          cpu: 1.0
          memoryInGB: 1.5
  osType: Linux
  restartPolicy: Always
  diagnostics:
    logAnalytics:
      workspaceId: LOG_ANALYTICS_WORKSPACE_ID
      workspaceKey: LOG_ANALYTICS_WORKSPACE_KEY
tags: null
type: Microsoft.ContainerInstance/containerGroups
```

Next, execute the following command to deploy the container group. Replace `myResourceGroup` with a resource group in your subscription (or first create a resource group named "myResourceGroup"):

```
az container create --resource-group myResourceGroup --name mycontainergroup001 --file deploy-aci.yaml
```

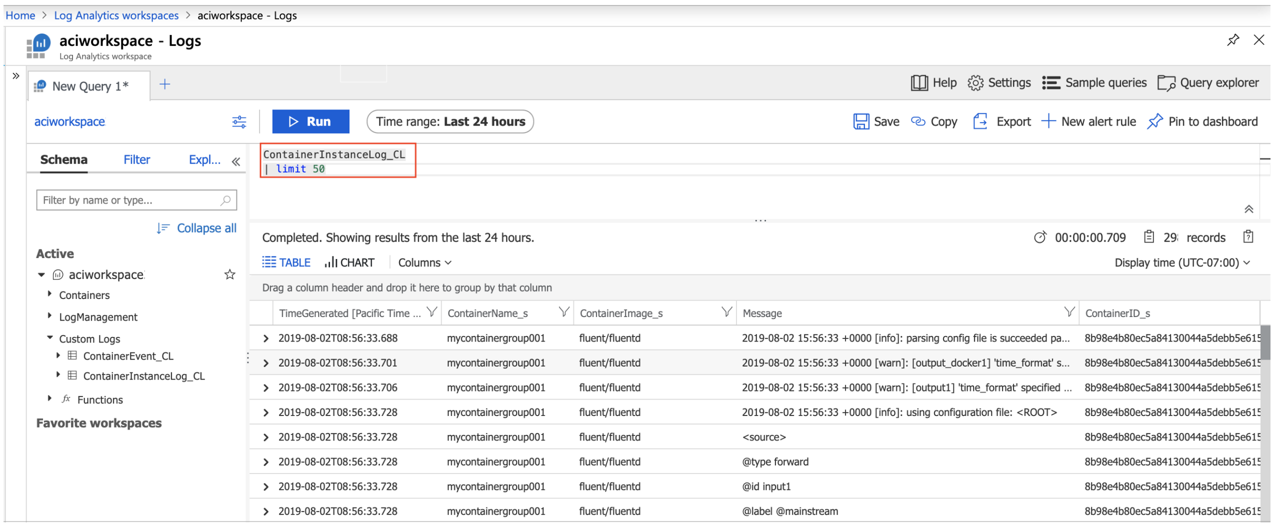
You should receive a response from Azure containing deployment details shortly after issuing the command.

View logs

After you've deployed the container group, it can take several minutes (up to 10) for the first log entries to appear in the Azure portal. To view the container group's logs in the `ContainerInstanceLog_CL` table:

1. Navigate to your Log Analytics workspace in the Azure portal
2. Under **General**, select **Logs**
3. Type the following query: `ContainerInstanceLog_CL | limit 50`
4. Select **Run**

You should see several results displayed by the query. If at first you don't see any results, wait a few minutes, then select the **Run** button to execute the query again. By default, log entries are displayed in **Table** format. You can then expand a row to see the contents of an individual log entry.



```
ContainerInstanceLog_CL
| limit 50
```

Completed. Showing results from the last 24 hours. 00:00:00.709 29 records

TABLE CHART Columns Display time (UTC-07:00)

Drag a column header and drop it here to group by that column

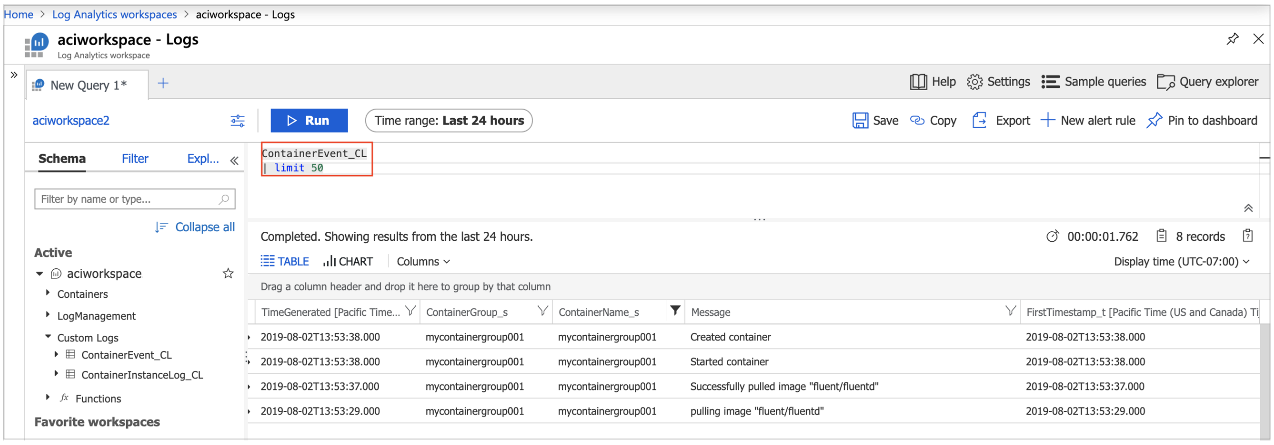
TimeGenerated [Pacific Time ...	ContainerName_s	ContainerImage_s	Message	ContainerID_s
2019-08-02T08:56:33.688	mycontainergroup001	fluent/fluentd	2019-08-02 15:56:33 +0000 [info]: parsing config file is succeeded pa...	8b98e4b80ec5a84130044a5debb5e615
2019-08-02T08:56:33.701	mycontainergroup001	fluent/fluentd	2019-08-02 15:56:33 +0000 [warn]: [output_docker1] 'time_format' s...	8b98e4b80ec5a84130044a5debb5e615
2019-08-02T08:56:33.706	mycontainergroup001	fluent/fluentd	2019-08-02 15:56:33 +0000 [warn]: [output1] 'time_format' specified ...	8b98e4b80ec5a84130044a5debb5e615
2019-08-02T08:56:33.728	mycontainergroup001	fluent/fluentd	2019-08-02 15:56:33 +0000 [info]: using configuration file: <ROOT>	8b98e4b80ec5a84130044a5debb5e615
2019-08-02T08:56:33.728	mycontainergroup001	fluent/fluentd	<source>	8b98e4b80ec5a84130044a5debb5e615
2019-08-02T08:56:33.728	mycontainergroup001	fluent/fluentd	@type forward	8b98e4b80ec5a84130044a5debb5e615
2019-08-02T08:56:33.728	mycontainergroup001	fluent/fluentd	@id input1	8b98e4b80ec5a84130044a5debb5e615
2019-08-02T08:56:33.728	mycontainergroup001	fluent/fluentd	@label @mainstream	8b98e4b80ec5a84130044a5debb5e615

View events

You can also view events for container instances in the Azure portal. Events include the time the instance is created and when it is started. To view the event data in the `ContainerEvent_CL` table:

1. Navigate to your Log Analytics workspace in the Azure portal
2. Under **General**, select **Logs**
3. Type the following query: `ContainerEvent_CL | limit 50`
4. Select **Run**

You should see several results displayed by the query. If at first you don't see any results, wait a few minutes, then select the **Run** button to execute the query again. By default, entries are displayed in **Table** format. You can then expand a row to see the contents of an individual entry.



```
ContainerEvent_CL
| limit 50
```

Completed. Showing results from the last 24 hours. 00:00:01.762 8 records

TABLE CHART Columns Display time (UTC-07:00)

Drag a column header and drop it here to group by that column

TimeGenerated [Pacific Time...	ContainerGroup_s	ContainerName_s	Message	FirstTimestamp_t [Pacific Time (US and Canada) Ti
2019-08-02T13:53:38.000	mycontainergroup001	mycontainergroup001	Created container	2019-08-02T13:53:38.000
2019-08-02T13:53:38.000	mycontainergroup001	mycontainergroup001	Started container	2019-08-02T13:53:38.000
2019-08-02T13:53:37.000	mycontainergroup001	mycontainergroup001	Successfully pulled image "fluent/fluentd"	2019-08-02T13:53:37.000
2019-08-02T13:53:29.000	mycontainergroup001	mycontainergroup001	pulling image "fluent/fluentd"	2019-08-02T13:53:29.000

Query container logs

Azure Monitor logs includes an extensive query language for pulling information from potentially thousands of lines of log output.

The basic structure of a query is the source table (in this article, `ContainerInstanceLog_CL` or `ContainerEvent_CL`) followed by a series of operators separated by the pipe character (`|`). You can chain several operators to refine the results and perform advanced functions.

To see example query results, paste the following query into the query text box, and select the **Run** button to execute the query. This query displays all log entries whose "Message" field contains the word "warn":

```
ContainerInstanceLog_CL
| where Message contains "warn"
```

More complex queries are also supported. For example, this query displays only those log entries for the "mycontainergroup001" container group generated within the last hour:

```
ContainerInstanceLog_CL
| where (ContainerGroup_s == "mycontainergroup001")
| where (TimeGenerated > ago(1h))
```

Next steps

Azure Monitor logs

For more information about querying logs and configuring alerts in Azure Monitor logs, see:

- Understanding log searches in Azure Monitor logs
- Unified alerts in Azure Monitor

Monitor container CPU and memory

For information about monitoring container instance CPU and memory resources, see:

- Monitor container resources in Azure Container Instances.

Troubleshoot common issues in Azure Container Instances

11/26/2019 • 8 minutes to read • Edit Online

This article shows how to troubleshoot common issues for managing or deploying containers to Azure Container Instances. See also Frequently asked questions.

If you need additional support, see available **Help + support** options in the Azure portal.

Issues during Container Group deployment

Naming conventions

When defining your container specification, certain parameters require adherence to naming restrictions. Below is a table with specific requirements for container group properties. For more information on Azure naming conventions, see Naming conventions in the Azure Architecture Center.

SCOPE	LENGTH	CASING	VALID CHARACTERS	SUGGESTED PATTERN	EXAMPLE
Container group name	1-64	Case insensitive	Alphanumeric, and hyphen anywhere except the first or last character	`<name>-<role>-CG<number>`	`web-batch-CG1`
Container name	1-64	Case insensitive	Alphanumeric, and hyphen anywhere except the first or last character	`<name>-<role>-CG<number>`	`web-batch-CG1`
Container ports	Between 1 and 65535	Integer	Integer between 1 and 65535	`<port-number>`	`443`
DNS name label	5-63	Case insensitive	Alphanumeric, and hyphen anywhere except the first or last character	`<name>`	`frontend-site1`
Environment variable	1-63	Case insensitive	Alphanumeric, and underscore (_) anywhere except the first or last character	`<name>`	`MY_VARIABLE`

SCOPE	LENGTH	CASING	VALID CHARACTERS	SUGGESTED PATTERN	EXAMPLE
Volume name	5-63	Case insensitive	Lowercase letters and numbers, and hyphens anywhere except the first or last character. Cannot contain two consecutive hyphens.	`<name>`	`batch-output-volume`

OS version of image not supported

If you specify an image that Azure Container Instances doesn't support, an `OsVersionNotSupported` error is returned. The error is similar to following, where `{0}` is the name of the image you attempted to deploy:

```
{
  "error": {
    "code": "OsVersionNotSupported",
    "message": "The OS version of image '{0}' is not supported."
  }
}
```

This error is most often encountered when deploying Windows images that are based on Semi-Annual Channel release 1709 or 1803, which are not supported. For supported Windows images in Azure Container Instances, see Frequently asked questions.

Unable to pull image

If Azure Container Instances is initially unable to pull your image, it retries for a period of time. If the image pull operation continues to fail, ACI eventually fails the deployment, and you may see a `Failed to pull image` error.

To resolve this issue, delete the container instance and retry your deployment. Ensure that the image exists in the registry, and that you've typed the image name correctly.

If the image can't be pulled, events like the following are shown in the output of az container show:

```
"events": [
  {
    "count": 3,
    "firstTimestamp": "2017-12-21T22:56:19+00:00",
    "lastTimestamp": "2017-12-21T22:57:00+00:00",
    "message": "pulling image \"mcr.microsoft.com/azuredocs/aci-hellowrld\"",
    "name": "Pulling",
    "type": "Normal"
  },
  {
    "count": 3,
    "firstTimestamp": "2017-12-21T22:56:19+00:00",
    "lastTimestamp": "2017-12-21T22:57:00+00:00",
    "message": "Failed to pull image \"mcr.microsoft.com/azuredocs/aci-hellowrld\": rpc error: code 2 desc
Error: image t/aci-hellowrld:latest not found",
    "name": "Failed",
    "type": "Warning"
  },
  {
    "count": 3,
    "firstTimestamp": "2017-12-21T22:56:20+00:00",
    "lastTimestamp": "2017-12-21T22:57:16+00:00",
    "message": "Back-off pulling image \"mcr.microsoft.com/azuredocs/aci-hellowrld\"",
    "name": "BackOff",
    "type": "Normal"
  }
],
```

Resource not available error

Due to varying regional resource load in Azure, you might receive the following error when attempting to deploy a container instance:

```
The requested resource with 'x' CPU and 'y.z' GB memory is not available in the location 'example region' at
this moment. Please retry with a different resource request or in another location.
```

This error indicates that due to heavy load in the region in which you are attempting to deploy, the resources specified for your container can't be allocated at that time. Use one or more of the following mitigation steps to help resolve your issue.

- Verify your container deployment settings fall within the parameters defined in Region availability for Azure Container Instances
- Specify lower CPU and memory settings for the container
- Deploy to a different Azure region
- Deploy at a later time

Issues during Container Group runtime

Container continually exits and restarts (no long-running process)

Container groups default to a restart policy of **Always**, so containers in the container group always restart after they run to completion. You may need to change this to **OnFailure** or **Never** if you intend to run task-based containers. If you specify **OnFailure** and still see continual restarts, there might be an issue with the application or script executed in your container.

When running container groups without long-running processes you may see repeated exits and restarts with images such as Ubuntu or Alpine. Connecting via EXEC will not work as the container has no process keeping it alive. To resolve this problem, include a start command like the following with your container group deployment to keep the container running.

```
## Deploying a Linux container
az container create -g MyResourceGroup --name myapp --image ubuntu --command-line "tail -f /dev/null"
```

```
## Deploying a Windows container
az container create -g myResourceGroup --name mywindowsapp --os-type Windows --image
mcr.microsoft.com/windows/servercore:ltsc2019
 --command-line "ping -t localhost"
```

The Container Instances API and Azure portal includes a `restartCount` property. To check the number of restarts for a container, you can use the az container show command in the Azure CLI. In the following example output (which has been truncated for brevity), you can see the `restartCount` property at the end of the output.

```
...
 "events": [
   {
     "count": 1,
     "firstTimestamp": "2017-11-13T21:20:06+00:00",
     "lastTimestamp": "2017-11-13T21:20:06+00:00",
     "message": "Pulling: pulling image \"myregistry.azurecr.io/aci-tutorial-app:v1\"",
     "type": "Normal"
   },
   {
     "count": 1,
     "firstTimestamp": "2017-11-13T21:20:14+00:00",
     "lastTimestamp": "2017-11-13T21:20:14+00:00",
     "message": "Pulled: Successfully pulled image \"myregistry.azurecr.io/aci-tutorial-app:v1\"",
     "type": "Normal"
   },
   {
     "count": 1,
     "firstTimestamp": "2017-11-13T21:20:14+00:00",
     "lastTimestamp": "2017-11-13T21:20:14+00:00",
     "message": "Created: Created container with id
bf25a6ac73a925687cafcec792c9e3723b0776f683d8d1402b20cc9fb5f66a10",
     "type": "Normal"
   },
   {
     "count": 1,
     "firstTimestamp": "2017-11-13T21:20:14+00:00",
     "lastTimestamp": "2017-11-13T21:20:14+00:00",
     "message": "Started: Started container with id
bf25a6ac73a925687cafcec792c9e3723b0776f683d8d1402b20cc9fb5f66a10",
     "type": "Normal"
   }
 ],
 "previousState": null,
 "restartCount": 0
...
}
```

NOTE

Most container images for Linux distributions set a shell, such as bash, as the default command. Since a shell on its own is not a long-running service, these containers immediately exit and fall into a restart loop when configured with the default **Always** restart policy.

Container takes a long time to start

The three primary factors that contribute to container startup time in Azure Container Instances are:

- Image size
- Image location
- Cached images

Windows images have additional considerations.

Image size

If your container takes a long time to start, but eventually succeeds, start by looking at the size of your container image. Because Azure Container Instances pulls your container image on demand, the startup time you see is directly related to its size.

You can view the size of your container image by using the `docker images` command in the Docker CLI:

```
$ docker images
REPOSITORY                              TAG       IMAGE ID        CREATED          SIZE
mcr.microsoft.com/azuredocs/aci-helloworld    latest    7367f3256b41    15 months ago    67.6MB
```

The key to keeping image sizes small is ensuring that your final image does not contain anything that is not required at runtime. One way to do this is with multi-stage builds. Multi-stage builds make it easy to ensure that the final image contains only the artifacts you need for your application, and not any of the extra content that was required at build time.

Image location

Another way to reduce the impact of the image pull on your container's startup time is to host the container image in Azure Container Registry in the same region where you intend to deploy container instances. This shortens the network path that the container image needs to travel, significantly shortening the download time.

Cached images

Azure Container Instances uses a caching mechanism to help speed container startup time for images built on common Windows base images, including `nanoserver:1809`, `servercore:ltsc2019`, and `servercore:1809`. Commonly used Linux images such as `ubuntu:1604` and `alpine:3.6` are also cached. For an up-to-date list of cached images and tags, use the List Cached Images API.

> **NOTE**
>
> Use of Windows Server 2019-based images in Azure Container Instances is in preview.

Windows containers slow network readiness

On initial creation, Windows containers may have no inbound or outbound connectivity for up to 30 seconds (or longer, in rare cases). If your container application needs an Internet connection, add delay and retry logic to allow 30 seconds to establish Internet connectivity. After initial setup, container networking should resume appropriately.

Cannot connect to underlying Docker API or run privileged containers

Azure Container Instances does not expose direct access to the underlying infrastructure that hosts container groups. This includes access to the Docker API running on the container's host and running privileged containers. If you require Docker interaction, check the REST reference documentation to see what the ACI API supports. If there is something missing, submit a request on the ACI feedback forums.

Container group IP address may not be accessible due to mismatched ports

Azure Container Instances doesn't yet support port mapping like with regular docker configuration. If you find a container group's IP address is not accessible when you believe it should be, ensure you have configured your container image to listen to the same ports you expose in your container group with the `ports` property.

If you want to confirm that Azure Container Instances can listen on the port you configured in your container image, test a deployment of the `aci-helloworld` image that exposes the port. Also run the `aci-helloworld` app so that it listens on the port. `aci-helloworld` accepts an optional environment variable `PORT` to override the default port 80 it listens on. For example, to test port 9000, set the environment variable when you create the container group:

1. Set up the container group to expose port 9000, and pass the port number as the value of the environment variable. The example is formatted for the Bash shell. If you prefer another shell such as PowerShell or Command Prompt, you'll need to adjust variable assignment accordingly.

   ```
   az container create --resource-group myResourceGroup \
   --name mycontainer --image mcr.microsoft.com/azuredocs/aci-helloworld \
   --ip-address Public --ports 9000 \
   --environment-variables 'PORT'='9000'
   ```

2. Find the IP address of the container group in the command output of `az container create`. Look for the value of **ip**.

3. After the container is provisioned successfully, browse to the IP address and port of the container app in your browser, for example: `192.0.2.0:9000`.

   You should see the "Welcome to Azure Container Instances!" message displayed by the web app.

4. When you're done with the container, remove it using the `az container delete` command:

   ```
   az container delete --resource-group myResourceGroup --name mycontainer
   ```

Next steps

Learn how to retrieve container logs and events to help debug your containers.

YAML reference: Azure Container Instances

12/5/2019 • 8 minutes to read • Edit Online

This article covers the syntax and properties for the YAML file supported by Azure Container Instances to configure a container group. Use a YAML file to input the group configuration to the az container create command in the Azure CLI.

A YAML file is a convenient way to configure a container group for reproducible deployments. It is a concise alternative to using a Resource Manager template or the Azure Container Instances SDKs to create or update a container group.

NOTE

This reference applies to YAML files for Azure Container Instances REST API version `2018-10-01`.

Schema

The schema for the YAML file follows, including comments to highlight key properties. For a description of the properties in this schema, see the Property values section.

```
name: string  # Name of the container group
apiVersion: '2018-10-01'
location: string
tags: {}
identity:
  type: string
  userAssignedIdentities: {}
properties: # Properties of container group
  containers: # Array of container instances in the group
  - name: string # Name of an instance
    properties: # Properties of an instance
      image: string # Container image used to create the instance
      command:
      - string
      ports: # External-facing ports exposed on the instance, must also be set in group ipAddress property
      - protocol: string
        port: integer
      environmentVariables:
      - name: string
        value: string
        secureValue: string
      resources: # Resource requirements of the instance
        requests:
          memoryInGB: number
          cpu: number
          gpu:
            count: integer
            sku: string
        limits:
          memoryInGB: number
          cpu: number
          gpu:
            count: integer
            sku: string
      volumeMounts: # Array of volume mounts for the instance
      - name: string
        mountPath: string
        readOnly: boolean
        readOnly: boolean
      livenessProbe:
        exec:
          command:
          - string
        httpGet:
          path: string
          port: integer
          scheme: string
        initialDelaySeconds: integer
        periodSeconds: integer
        failureThreshold: integer
        successThreshold: integer
        timeoutSeconds: integer
      readinessProbe:
        exec:
          command:
          - string
        httpGet:
          path: string
          port: integer
          scheme: string
        initialDelaySeconds: integer
        periodSeconds: integer
        failureThreshold: integer
        successThreshold: integer
        timeoutSeconds: integer
  imageRegistryCredentials: # Credentials to pull a private image
  - server: string
    username: string
    password: string
  restartPolicy: string
  ipAddress: # IP address configuration of container group
    ports:
    - protocol: string
      port: integer
    type: string
    ip: string
    dnsNameLabel: string
  osType: string
  volumes: # Array of volumes available to the instances
  - name: string
    azureFile:
      shareName: string
      readOnly: boolean
      storageAccountName: string
      storageAccountKey: string
    emptyDir: {}
    secret: {}
    gitRepo:
      directory: string
      repository: string
      revision: string
  diagnostics:
    logAnalytics:
      workspaceId: string
      workspaceKey: string
      logType: string
      metadata: {}
  networkProfile: # Virtual network profile for container group
    id: string
  dnsConfig: # DNS configuration for container group
    nameServers:
    - string
    searchDomains: string
    options: string
```

Property values

The following tables describe the values you need to set in the schema.

Microsoft.ContainerInstance/containerGroups object

NAME	TYPE	REQUIRED	VALUE
name	string	Yes	The name of the container group.
apiVersion	enum	Yes	2018-10-01
location	string	No	The resource location.
tags	object	No	The resource tags.
identity	object	No	The identity of the container group, if configured. - ContainerGroupIdentity object
properties	object	Yes	ContainerGroupProperties object

ContainerGroupIdentity object

NAME	TYPE	REQUIRED	VALUE
type	enum	No	The type of identity used for the container group. The type 'SystemAssigned, UserAssigned' includes both an implicitly created identity and a set of user assigned identities. The type 'None' will remove any identities from the container group. - SystemAssigned, UserAssigned, SystemAssigned, UserAssigned, None
userAssignedIdentities	object	No	The list of user identities associated with the container group. The user identity dictionary key references will be Azure Resource Manager resource IDs in the form: '/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.ManagedIdentity/userAssignedIdentities/{identityName}'.

ContainerGroupProperties object

NAME	TYPE	REQUIRED	VALUE
containers	array	Yes	The containers within the container group. - Container object
imageRegistryCredentials	array	No	The image registry credentials by which the container group is created from. - ImageRegistryCredential object
restartPolicy	enum	No	Restart policy for all containers within the container group. - `Always` Always restart- `OnFailure` Restart on failure- `Never` Never restart. - Always, OnFailure, Never
ipAddress	object	No	The IP address type of the container group. - IpAddress object
osType	enum	Yes	The operating system type required by the containers in the container group. - Windows or Linux
volumes	array	No	The list of volumes that can be mounted by containers in this container group. - Volume object
diagnostics	object	No	The diagnostic information for a container group. - ContainerGroupDiagnostics object
networkProfile	object	No	The network profile information for a container group. - ContainerGroupNetworkProfile object
dnsConfig	object	No	The DNS config information for a container group. - DnsConfiguration object

Container object

NAME	TYPE	REQUIRED	VALUE
name	string	Yes	The user-provided name of the container instance.

NAME	TYPE	REQUIRED	VALUE
properties	object	Yes	The properties of the container instance. - ContainerProperties object

ImageRegistryCredential object

NAME	TYPE	REQUIRED	VALUE
server	string	Yes	The Docker image registry server without a protocol such as "http" and "https".
username	string	Yes	The username for the private registry.
password	string	No	The password for the private registry.

IpAddress object

NAME	TYPE	REQUIRED	VALUE
ports	array	Yes	The list of ports exposed on the container group. - Port object
type	enum	Yes	Specifies if the IP is exposed to the public internet or private VNET. - Public or Private
ip	string	No	The IP exposed to the public internet.
dnsNameLabel	string	No	The Dns name label for the IP.

Volume object

NAME	TYPE	REQUIRED	VALUE
name	string	Yes	The name of the volume.
azureFile	object	No	The Azure File volume. - AzureFileVolume object
emptyDir	object	No	The empty directory volume.
secret	object	No	The secret volume.
gitRepo	object	No	The git repo volume. - GitRepoVolume object

ContainerGroupDiagnostics object

NAME	TYPE	REQUIRED	VALUE
logAnalytics	object	No	Container group log analytics information. - LogAnalytics object

ContainerGroupNetworkProfile object

NAME	TYPE	REQUIRED	VALUE
id	string	Yes	The identifier for a network profile.

DnsConfiguration object

NAME	TYPE	REQUIRED	VALUE
nameServers	array	Yes	The DNS servers for the container group. - string
searchDomains	string	No	The DNS search domains for hostname lookup in the container group.
options	string	No	The DNS options for the container group.

ContainerProperties object

NAME	TYPE	REQUIRED	VALUE
image	string	Yes	The name of the image used to create the container instance.
command	array	No	The commands to execute within the container instance in exec form. - string
ports	array	No	The exposed ports on the container instance. - ContainerPort object
environmentVariables	array	No	The environment variables to set in the container instance. - EnvironmentVariable object
resources	object	Yes	The resource requirements of the container instance. - ResourceRequirements object
volumeMounts	array	No	The volume mounts available to the container instance. - VolumeMount object

NAME	TYPE	REQUIRED	VALUE
livenessProbe	object	No	The liveness probe. - ContainerProbe object
readinessProbe	object	No	The readiness probe. - ContainerProbe object

Port object

NAME	TYPE	REQUIRED	VALUE
protocol	enum	No	The protocol associated with the port. - TCP or UDP
port	integer	Yes	The port number.

AzureFileVolume object

NAME	TYPE	REQUIRED	VALUE
shareName	string	Yes	The name of the Azure File share to be mounted as a volume.
readOnly	boolean	No	The flag indicating whether the Azure File shared mounted as a volume is read-only.
storageAccountName	string	Yes	The name of the storage account that contains the Azure File share.
storageAccountKey	string	No	The storage account access key used to access the Azure File share.

GitRepoVolume object

NAME	TYPE	REQUIRED	VALUE
directory	string	No	Target directory name. Must not contain or start with '..'. If '.' is supplied, the volume directory will be the git repository. Otherwise, if specified, the volume will contain the git repository in the subdirectory with the given name.
repository	string	Yes	Repository URL
revision	string	No	Commit hash for the specified revision.

LogAnalytics object

NAME	TYPE	REQUIRED	VALUE
workspaceId	string	Yes	The workspace id for log analytics
workspaceKey	string	Yes	The workspace key for log analytics
logType	enum	No	The log type to be used. - ContainerInsights or ContainerInstanceLogs
metadata	object	No	Metadata for log analytics.

ContainerPort object

NAME	TYPE	REQUIRED	VALUE
protocol	enum	No	The protocol associated with the port. - TCP or UDP
port	integer	Yes	The port number exposed within the container group.

EnvironmentVariable object

NAME	TYPE	REQUIRED	VALUE
name	string	Yes	The name of the environment variable.
value	string	No	The value of the environment variable.
secureValue	string	No	The value of the secure environment variable.

ResourceRequirements object

NAME	TYPE	REQUIRED	VALUE
requests	object	Yes	The resource requests of this container instance. - ResourceRequests object
limits	object	No	The resource limits of this container instance. - ResourceLimits object

VolumeMount object

NAME	TYPE	REQUIRED	VALUE

NAME	TYPE	REQUIRED	VALUE
name	string	Yes	The name of the volume mount.
mountPath	string	Yes	The path within the container where the volume should be mounted. Must not contain colon (:).
readOnly	boolean	No	The flag indicating whether the volume mount is read-only.

ContainerProbe object

NAME	TYPE	REQUIRED	VALUE
exec	object	No	The execution command to probe - ContainerExec object
httpGet	object	No	The Http Get settings to probe - ContainerHttpGet object
initialDelaySeconds	integer	No	The initial delay seconds.
periodSeconds	integer	No	The period seconds.
failureThreshold	integer	No	The failure threshold.
successThreshold	integer	No	The success threshold.
timeoutSeconds	integer	No	The timeout seconds.

ResourceRequests object

NAME	TYPE	REQUIRED	VALUE
memoryInGB	number	Yes	The memory request in GB of this container instance.
cpu	number	Yes	The CPU request of this container instance.
gpu	object	No	The GPU request of this container instance. - GpuResource object

ResourceLimits object

NAME	TYPE	REQUIRED	VALUE
memoryInGB	number	No	The memory limit in GB of this container instance.

NAME	TYPE	REQUIRED	VALUE
cpu	number	No	The CPU limit of this container instance.
gpu	object	No	The GPU limit of this container instance. - GpuResource object

ContainerExec object

NAME	TYPE	REQUIRED	VALUE
command	array	No	The commands to execute within the container. - string

ContainerHttpGet object

NAME	TYPE	REQUIRED	VALUE
path	string	No	The path to probe.
port	integer	Yes	The port number to probe.
scheme	enum	No	The scheme. - http or https

GpuResource object

NAME	TYPE	REQUIRED	VALUE
count	integer	Yes	The count of the GPU resource.
sku	enum	Yes	The SKU of the GPU resource. - K80, P100, V100

Next steps

See the tutorial Deploy a multi-container group using a YAML file.

See examples of using a YAML file to deploy container groups in a virtual network or that mount an external volume.

Frequently asked questions about Azure Container Instances

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This article addresses frequently asked questions about Azure Container Instances.

Deployment

How large can my container image be?

The maximum size for a deployable container image on Azure Container Instances is 15 GB. You might be able to deploy larger images depending on the exact availability at the moment you deploy, but this is not guaranteed.

The size of your container image impacts how long it takes to deploy, so generally you want to keep your container images as small as possible.

How can I speed up the deployment of my container?

Because one of the main determinants of deployment times is the image size, look for ways to reduce the size. Remove layers you don't need, or reduce the size of layers in the image (by picking a lighter base OS image). For example, if you're running Linux containers, consider using Alpine as your base image rather than a full Ubuntu Server. Similarly, for Windows containers, use a Nano Server base image if possible.

You should also check the list of pre-cached images in Azure Container Images, available via the List Cached Images API. You might be able to switch out an image layer for one of the pre-cached images.

See more detailed guidance on reducing container startup time.

What Windows base OS images are supported?

Windows Server 2016 base images

- Nano Server: `10.0.14393.x`, `sac2016`
- Windows Server Core: `ltsc2016`, `10.0.14393.x`

NOTE

Windows images based on Semi-Annual Channel release 1709 or 1803 are not supported.

Windows Server 2019 and client base images (preview)

- Nano Server: `1809`, `10.0.17763.x`
- Windows Server Core: `ltsc2019`, `1809`, `10.0.17763.x`
- Windows: `1809`, `10.0.17763.x`

What .NET or .NET Core image layer should I use in my container?

Use the smallest image that satisfies your requirements. For Linux, you could use a *runtime-alpine* .NET Core image, which has been supported since the release of .NET Core 2.1. For Windows, if you are using the full .NET Framework, then you need to use a Windows Server Core image (runtime-only image, such as *4.7.2-windowsservercore-ltsc2016*). Runtime-only images are smaller but do not support workloads that require the .NET SDK.

Availability and quotas

How many cores and memory should I allocate for my containers or the container group?

This really depends on your workload. Start small and test performance to see how your containers do. Monitor CPU and memory resource usage, and then add cores or memory based on the kind of processes that you deploy in the container.

Make sure also to check the resource availability for the region you are deploying in for the upper bounds on CPU cores and memory available per container group.

What underlying infrastructure does ACI run on?

Azure Container Instances aims to be a serverless containers-on-demand service, so we want you to be focused on developing your containers, and not worry about the infrastructure! For those that are curious or wanting to do comparisons on performance, ACI runs on sets of Azure VMs of various SKUs, primarily from the F and the D series. We expect this to change in the future as we continue to develop and optimize the service.

I want to deploy thousand of cores on ACI - can I get my quota increased?

Yes (sometimes). See the quotas and limits article for current quotas and which limits can be increased by request.

Can I deploy with more than 4 cores and 16 GB of RAM?

Not yet. Currently, these are the maximums for a container group. Contact Azure Support with specific requirements or requests.

When will ACI be in a specific region?

Current region availability is published here. If you have a requirement for a specific region, contact Azure Support.

Features and scenarios

How do I scale a container group?

Currently, scaling is not available for containers or container groups. If you need to run more instances, use our API to automate and create more requests for container group creation to the service.

What features are available to instances running in a custom VNet?

You can deploy container groups in an Azure virtual network of your choice, and delegate private IPs to the container groups to route traffic within the VNet across your Azure resources. Deployment of a container group into a virtual network is currently available for production workloads in a subset of Azure regions.

Pricing

When does the meter start running?

Container group duration is calculated from the time that we start to pull your first container's image (for a new deployment) or your container group is restarted (if already deployed), until the container group is stopped. See details at Container Instances pricing.

Do I stop being charged when my containers are stopped?

Meters stop running once your entire container group is stopped. As long as a container in your container group is running, we hold the resources in case you want to start the containers up again.

Next steps

- Learn more about Azure Container Instances.
- Troubleshoot common issues in Azure Container Instances.