

# HOW TO RUN SELF-HOSTED AZURE DEVOPS BUILD/RELEASE AGENTS



Microsoft Azure—Azure for short—is the Microsoft cloud services platform spanning [IaaS, PaaS, and SaaS services](#) from simple virtualized infrastructure to data warehousing, ML, and AI platforms.

The [Azure DevOps service](#) is one such SaaS offering that offers a fully featured [DevOps platform](#) consisting of:

- Azure Boards (Planning and Management of the Project)
- Azure Pipelines (CI/CD Pipeline)
- Azure Repos (Cloud-hosted private Git Repositories)
- Azure Test Plans (Manual and Exploratory testing tools)
- Azure Artifacts (Artifact Storage)

These platforms are augmented by a vast collection of extensions to integrate third-party tools and platforms and extend the functionality. [CI/CD pipeline](#) is one of the core components to power a software development process provided by the Azure Pipelines service. Azure Pipelines provides the option to utilize Microsoft-hosted or self-hosted agents to run CI/CD jobs.

In this article, we will look at how to configure self-hosted agents to be utilized in an Azure pipeline.

*(New to Azure DevOps? Start with our [beginner's guide](#).)*

# Why do we need self-hosted agents?

While it may seem a bit strange to utilize a self-hosted agent with a cloud-based service, there are some significant benefits of opting to go with a self-hosted agent.

One reason is cost. Microsoft does offer:

- One free Microsoft-hosted job with 1,800 minutes
- One self-hosted job with unlimited minutes

Though it may be sufficient for small-scale development, most users will inevitably need more flexibility to run multiple concurrent builds and releases. At the time of this article's writing, a Microsoft-hosted [agent will cost \\$40 USD per agent](#) while a self-hosted agent will cost only \$15, both with unlimited minutes. Thus, the self-hosted option provides cost savings when you need to scale up even with the added management overhead.

The second reason for self-hosting is customizability, which offers you the freedom to run the agent on any supported operating system, including Windows, Linux, and macOS. Even though Microsoft hosted agents allow users to select a specific image type, they are limited to what is available from Microsoft.

Additionally, agents can be configured as containers for further flexibility and can even run multiple agents on a single host to maximize resource usage.

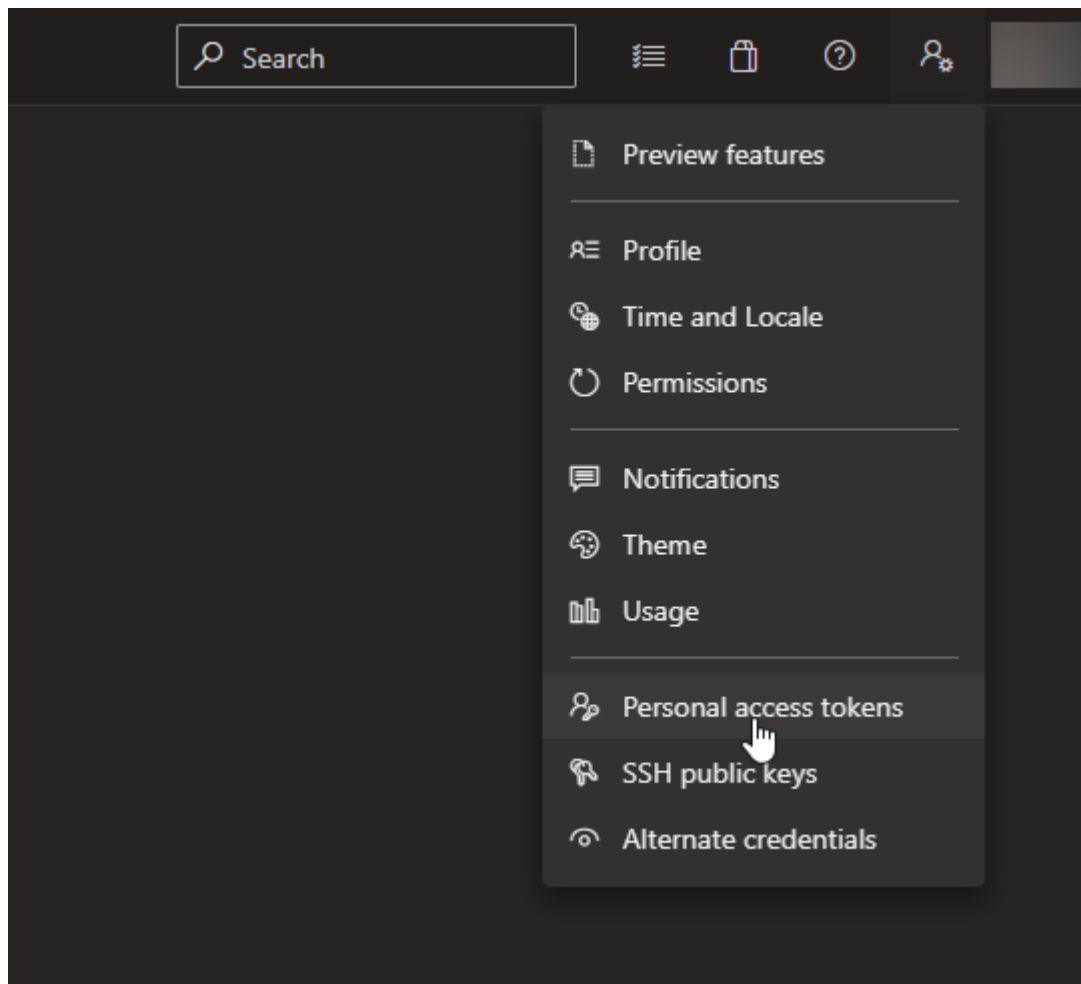
## Running your self-hosted agent

Setting up and running a self-hosted agent is a relatively simple process, with the primary requirement being running the correct agent for the specified operating system and underlying architecture. In this section, we will see how to run agents on a Windows and a Linux VM.

## Creating a Personal Access Token (PAT)

The first step before setting up an agent is to create a personal access token which will be used to connect the agent to the Azure Pipeline.

**Step 1.** Login to Azure DevOps organization, open user settings, and select "Personal access tokens"



Open up your terminal window and change directory to the folder containing the downloaded file. Inflate the file to view the contents.

First, you need to generate the agent configuration file using the interacting configuration generator script.

**Step 2.** In the Personal Access Tokens screen, click on “New Token” to create a token.

User settings

Account

Profile

Time and Locale

Permissions

Preferences

Notifications

Theme

Usage

Security

Personal access tokens

SSH public keys

Alternate credentials

Authorizations

Personal Access Tokens

These can be used instead of a password for applications like Git or can be passed in

+ New Token

Token name ↓	Status
Git: https:// Code (Read & write); Packaging (Read)	● Active

**Step 3.** Provide a name, expiration date, and the necessary permissions and click on Create to create the PAT.

## Create a new personal access token



Name

self-hosted-agent-token

Organization

Expiration (UTC)

30 days

12/30/2021



### Scopes

Authorize the scope of access associated with this token

Scopes ☐ Full access

☒ Custom defined

#### Work Items

Work items, queries, backlogs, plans, and metadata

☐ Read ☐ Read & write ☐ Read, write, & manage

#### Code

Source code, repositories, pull requests, and notifications

☒ Read ☒ Read & write ☒ Read, write, & manage ☒ Full ☒ Status

#### Build

Artifacts, definitions, requests, queue a build, and update build properties

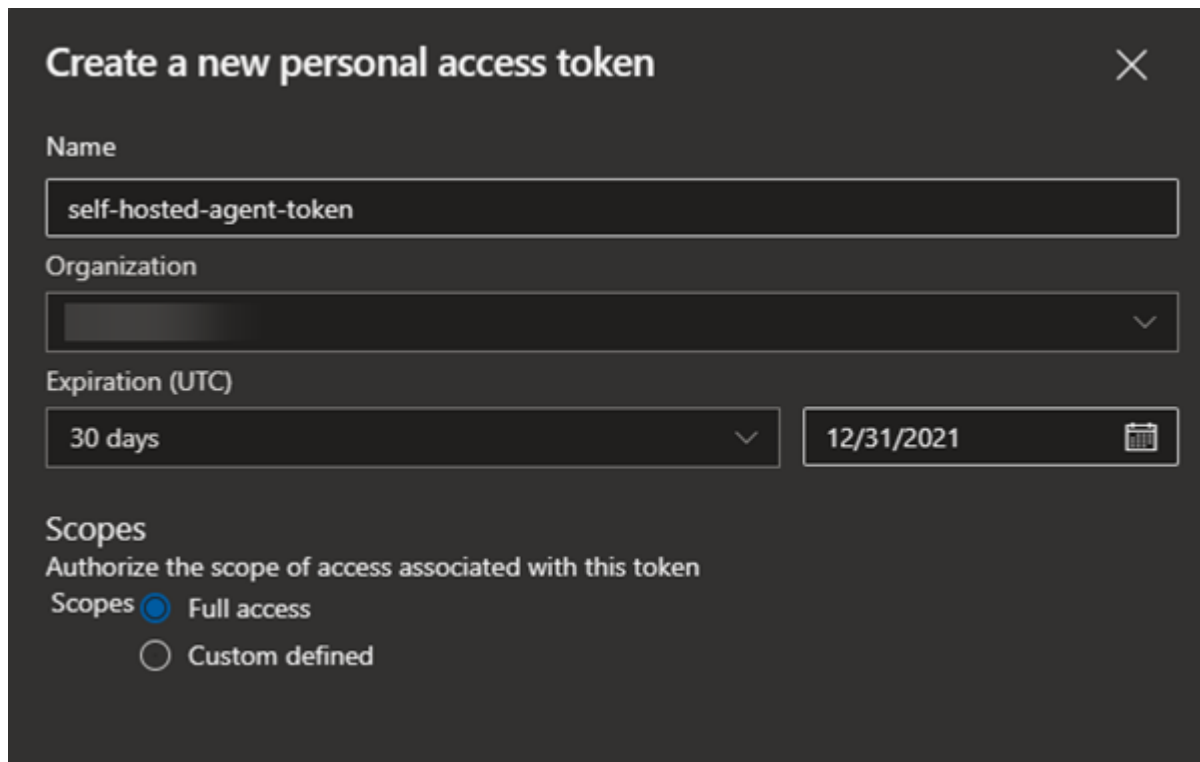
☒ Read ☒ Read & execute

Show all scopes (28 more)

Create

Cancel

**Note:** Ensure that all the correct permissions are granted. Otherwise, you will not be able to initialize the connection. If required, you can configure the agent to have Full access to Azure DevOps.



**Create a new personal access token**

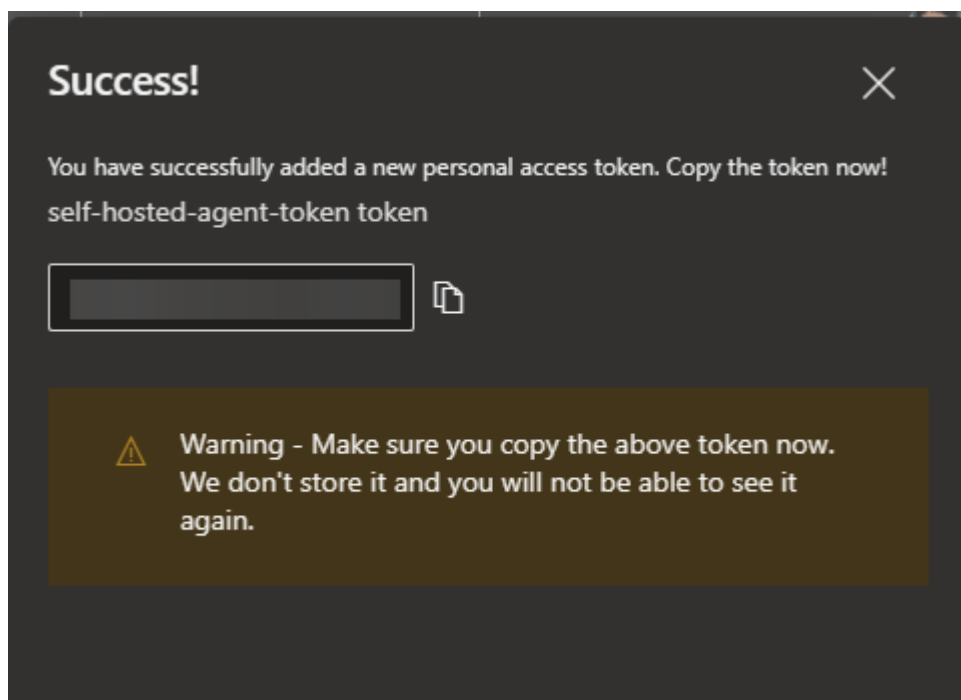
Name  
self-hosted-agent-token

Organization  
[Dropdown]

Expiration (UTC)  
30 days 12/31/2021

Scopes  
Authorize the scope of access associated with this token  
☒ Full access  
☐ Custom defined

**Step 4.** Once the token is generated, securely store it as it will not be accessible later.



**Success!**

You have successfully added a new personal access token. Copy the token now!

self-hosted-agent-token token

[Token Value] [Copy Icon]

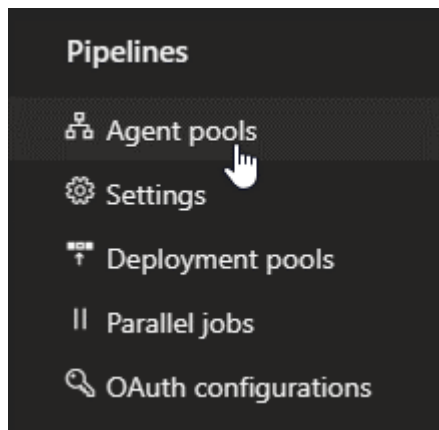
**Warning** - Make sure you copy the above token now. We don't store it and you will not be able to see it again.

## Installing & configuring the agents

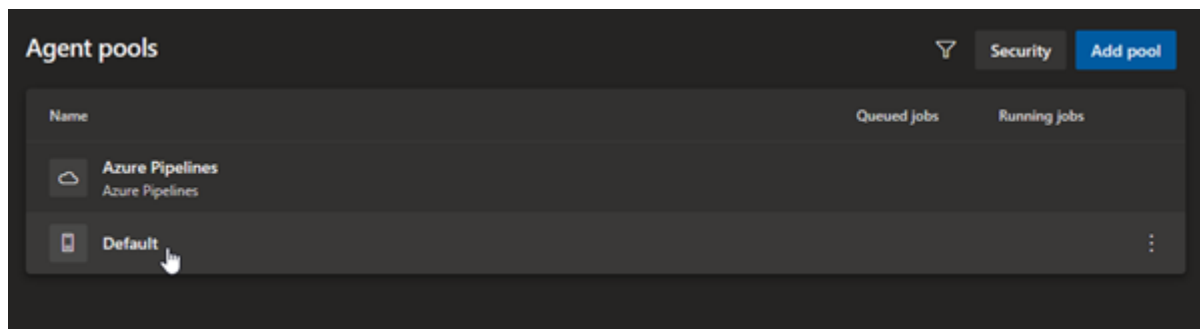
Since we have created the token, we can now move into setting up the agent. Any agent configuration can be obtained via the Pipelines Agent pools section in the organizational settings in the Azure DevOps dashboard.

## Obtaining Agent Configuration Instructions

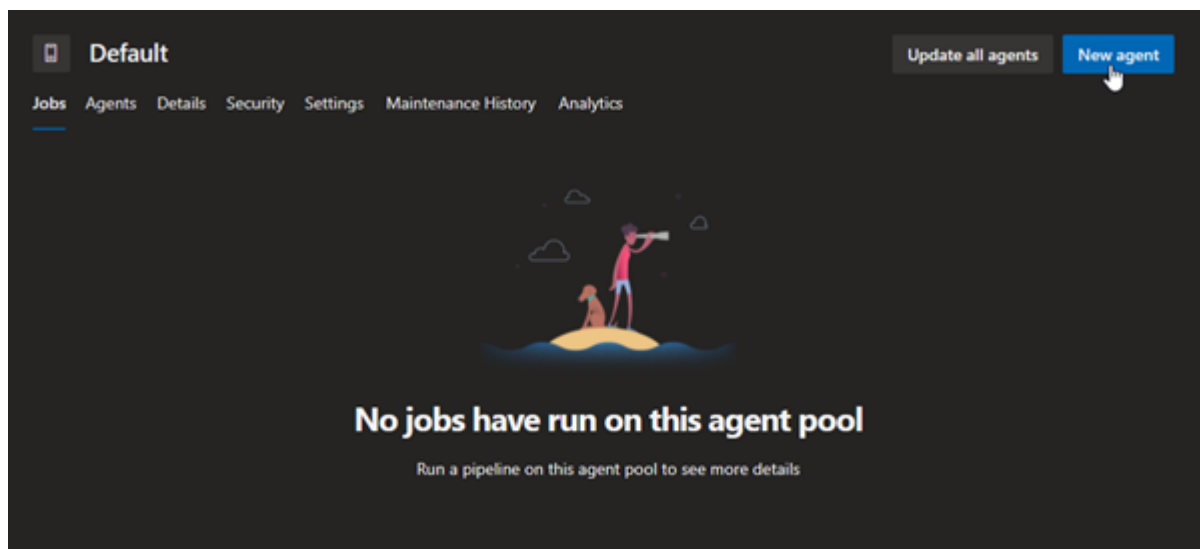
**Step 1.** Navigate to the Organization Settings and select Agent pools from the Pipeline section.



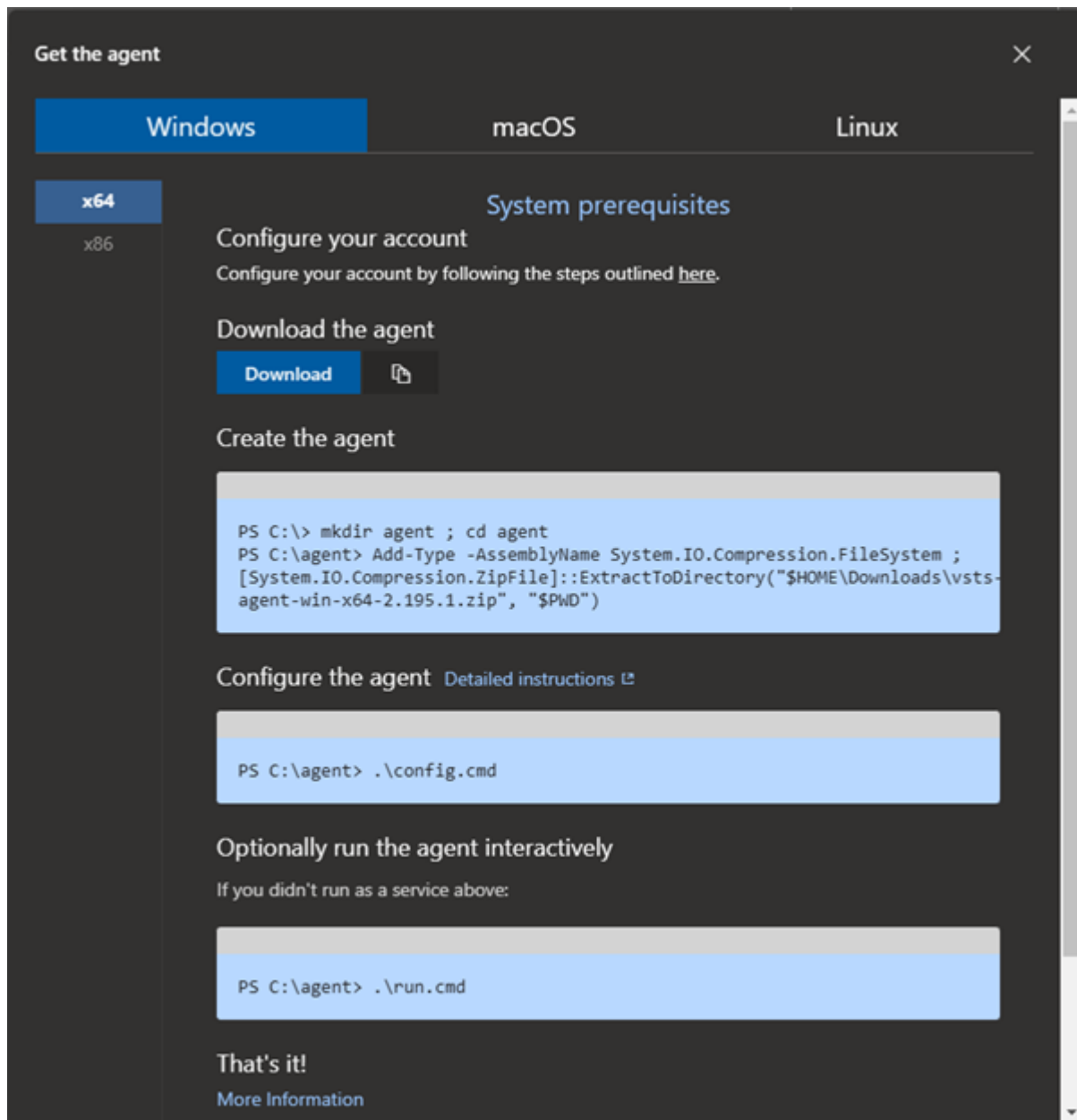
**Step 2.** Select the Default agent pool. (If needed, select the agent to other available pools or create a new pool and add the agent.)



**Step 3.** Click on the New Agent option to obtain the agent installation instructions.



**Step 4.** Select the desired operating system and system architecture and follow the instructions provided.



## Windows Installation

Let's see how to install the agent in Windows 10 on X64 architecture. Please refer to Microsoft's official [Windows agent guide](#) for a complete list of prerequisites and specifications.

**Step 1.** Download the agent. (It will be downloaded as a zip file.)

Invoke-WebRequest -Uri

`https://vstsagentpackage.azureedge.net/agent/2.195.1/vsts-agent-win-x64-2.195.1.zip -OutFile vsts-agent-win-x64-2.195.1.zip`

```
PS C:\> Invoke-WebRequest -Uri https://vstsagentpackage.azureedge.net/agent/2.195.1/vsts-agent-win-x64-2.195.1.zip -OutFile vsts-agent-win-x64-2.195.1.zip
```

```
Writing web request
Writing request stream... (Number of bytes written: 1310712)
```

**Step 2.** Extract the downloaded agent to the desired destination. It is recommended that the agent is extracted to a



folder named agents in the root of the C drive (C:\agents).

```
# Create directory and navigate to the directory
```

```
New-Item -Path "C:" -Name "agents" -ItemType "directory"
```

```
Set-Location -Path "C:\agents"
```

```
# Extract the downloaded zip file
```

```
Add-Type -AssemblyName System.IO.Compression.FileSystem ;
```

```
::ExtractToDirectory("C:\vsts-agent-win-x64-2.195.1.zip", "$PWD")
```

```
# Verify the extraction
```

```
Get-ChildItem
```

```
PS C:\> New-Item -Path "C:\\" -Name "agents" -ItemType "directory"

Directory: C:\

Mode                LastWriteTime         Length Name
----                -
d-----          30/11/2021  11:57 PM             agents

PS C:\> Set-Location -Path "C:\agents"
PS C:\agents> Add-Type -AssemblyName System.IO.Compression.FileSystem ; [System.IO.Compression.
ZipFile]::ExtractToDirectory("C:\vsts-agent-win-x64-2.195.1.zip", "$PWD")
PS C:\agents> Get-ChildItem

Directory: C:\agents

Mode                LastWriteTime         Length Name
----                -
d-----          30/11/2021  11:59 PM             bin
d-----          30/11/2021  11:59 PM          externals
-a-----          26/11/2021  11:16 AM          2967 config.cmd
-a-----          26/11/2021  11:16 AM          3190 run.cmd

PS C:\agents>
```

**Step 3.** Start the agent configuration by running the following command. (It is recommended to use Elevated Powershell prompt.)

```
.config.cmd
```

```

PS C:\agents> .\config.cmd

          agent v2.195.1          (commit fc94fec)

>> Connect:

Enter server URL > https://dev.azure.com/
Enter authentication type (press enter for PAT) > PAT
Enter personal access token > *****
Connecting to server ...

>> Register Agent:

Enter agent pool (press enter for default) >
Enter agent name (press enter for B ) > windows-10-agent-01
Scanning for tool capabilities.
Connecting to the server.
Successfully added the agent
Testing agent connection.
Enter work folder (press enter for _work) >
2021-11-30 18:39:25Z: Settings Saved.
Enter run agent as service? (Y/N) (press enter for N) > Y
Enter User account to use for the service (press enter for NT AUTHORITY\NETWORK SERVICE) >
Granting file permissions to 'NT AUTHORITY\NETWORK SERVICE'.
Service vstsagent. .Default.windows-10-agent-01 successfully installed
Service vstsagent. .Default.windows-10-agent-01 successfully set recovery option
Service vstsagent. .Default.windows-10-agent-01 successfully set to delayed auto start
Service vstsagent. .Default.windows-10-agent-01 successfully configured
Enter whether to prevent service starting immediately after configuration is finished? (Y/N) (press enter for N) > Y
PS C:\agents>

```

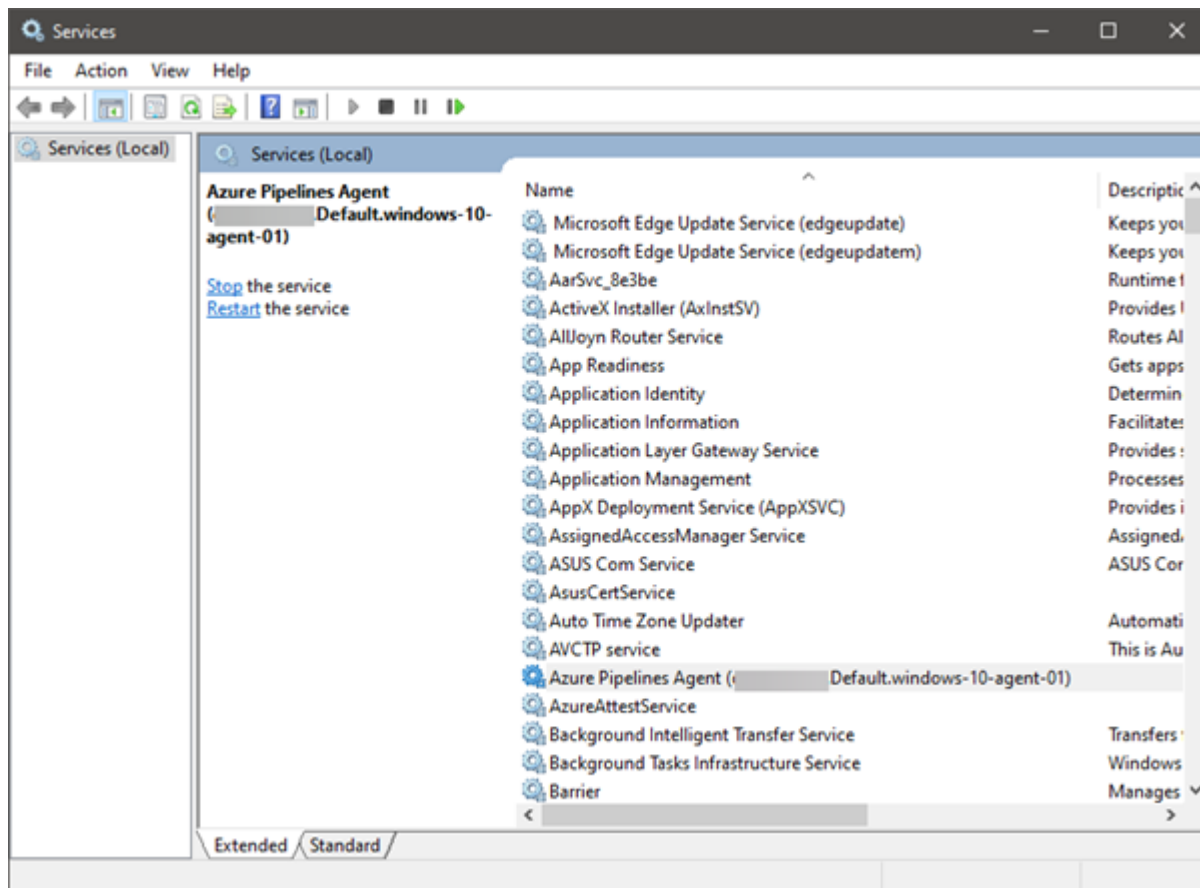
You will be

required to enter configuration details such as:

- Server URL (Azure organizational URL)
- Authentication type (Here, we have used the previously created authentication token)
- Agent details, including agent-pool and agent name

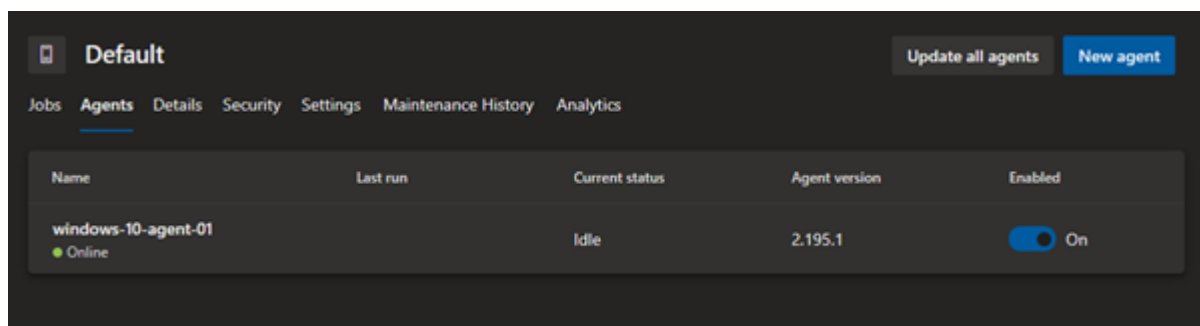
Finally, specify whether to configure the agent as a Windows service.

You will be able to see the configured Azure Pipelines Agent if you navigate to the Services section on Windows (services.msc).



**Step 4.** Navigate

back to the Agent pools in the Organizational settings, and you can see the newly configured agent as the Default pool in the Agents tab.



## Linux Installation

Installing and configuring the pipeline agent in Linux is similar to Windows. So, in this section, let's see how to install the agent in an Ubuntu environment. Full configuration details are available in the [Microsoft documentation](#).

**Step 1.** Download the agent

```
wget
https://vstsagentpackage.azureedge.net/agent/2.195.1/vsts-agent-linux-x64-2.195.1.tar.gz
```

```
ubuntu@oc-ubser02-dok:~/Downloads$ wget https://vstsagentpackage.azureedge.net/agent/2.195.1/vsts-agent-linux-x64-2.195.1.tar.gz
--2021-11-30 19:28:56-- https://vstsagentpackage.azureedge.net/agent/2.195.1/vsts-agent-linux-x64-2.195.1.tar.gz
Resolving vstsagentpackage.azureedge.net (vstsagentpackage.azureedge.net)... 72.21.81.200, 2606:2800:11f:17a5:191a:18d5:537:22f9
Connecting to vstsagentpackage.azureedge.net (vstsagentpackage.azureedge.net)[72.21.81.200]:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 103686524 (99M) [application/octet-stream]
Saving to: 'vsts-agent-linux-x64-2.195.1.tar.gz'

vsts-agent-linux-x64-2.195.1 100%[=====] 98.88M 5.32MB/s in 18s
2021-11-30 19:29:14 (5.62 MB/s) - 'vsts-agent-linux-x64-2.195.1.tar.gz' saved [103686524/103686524]
```

**Step 2.** Create a

folder and extract the downloaded tar.gz file.

```
# Create directory and navigate to the directory
mkdir agent
cd agent
```

```
# Extract the downloaded zip file
tar xzf ~/Downloads/vsts-agent-linux-x64-2.195.1.tar.gz
```

```
# Verify the extraction
ls
```

```
ubuntu@oc-ubser02-dok:~/Downloads$ mkdir agent
ubuntu@oc-ubser02-dok:~/Downloads$ cd agent
ubuntu@oc-ubser02-dok:~/Downloads/agent$ tar xzf ~/Downloads/vsts-agent-linux-x64-2.195.1.tar.gz
ubuntu@oc-ubser02-dok:~/Downloads/agent$ ls
bin  config.sh  env.sh  externals  run.sh
ubuntu@oc-ubser02-dok:~/Downloads/agent$
```

**Step 3.** Start the

agent configuration by running the following command.

```
./config.sh
```

```
ubuntu@oc-ubser02-dok:~/Downloads/agent$ ./config.sh

Azure Pipelines
agent v2.195.1 (commit fc94fec)

>> End User License Agreements:

Building sources from a TFVC repository requires accepting the Team Explorer Everywhere End User License Agreement. This step is not required for building sources from Git repositories.

A copy of the Team Explorer Everywhere license agreement can be found at:
/home/ubuntu/Downloads/agent/externals/tee/license.html

Enter (Y/N) Accept the Team Explorer Everywhere license agreement now? (press enter for N) > Y

>> Connect:

Enter server URL > https://dev.azure.com/
Enter authentication type (press enter for PAT) > PAT
Enter personal access token > *****
Connecting to server ...

>> Register Agent:

Enter agent pool (press enter for default) >
Enter agent name (press enter for oc-ubser02-dok) > ubuntu-agent-01
Scanning for tool capabilities.
Connecting to the server.
Successfully added the agent
Testing agent connection.
Enter work folder (press enter for _work) >
2021-11-30 19:33:23Z: Settings Saved.
ubuntu@oc-ubser02-dok:~/Downloads/agent$
```

Similar to

Windows configuration, the users will be asked to enter the server details, authentication type, and the authentication token we created earlier. Then configure the agent details, and finally, the user

can start the agent by running the run.sh script.

**Step 4 (Optional).** You can configure the agent to run as a system service using the svc.sh script located in the agent directory. Specify the user and use the install command to configure the service.

```
sudo ./svc.sh install ubuntu
sudo ./svc.sh start
```

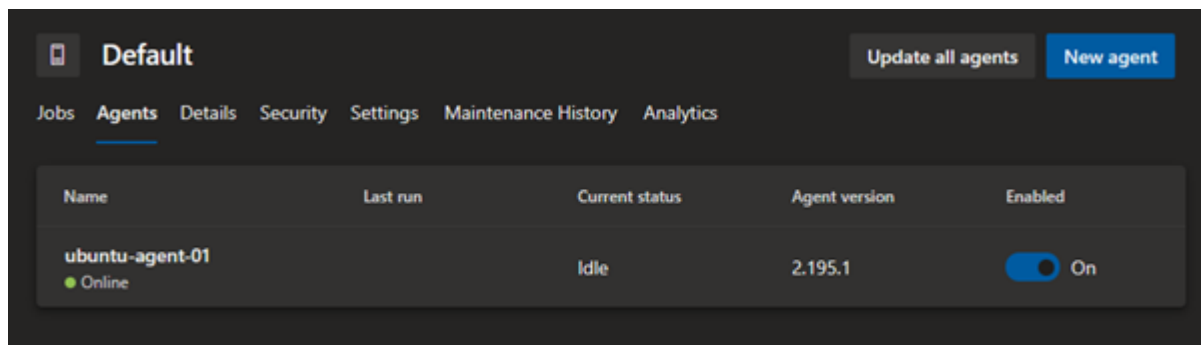
```
ubuntu@oc-ubser02-dok:~/Downloads/agent$ sudo ./svc.sh install ubuntu
Creating launch agent in /etc/systemd/system/vsts.agent.ubuntu.Default.ubuntu\x2dagent\x2d01.service
Run as user: ubuntu
Run as uid: 1001
gid: 1001
Created symlink /etc/systemd/system/multi-user.target.wants/vsts.agent.ubuntu.Default.ubuntu\x2dagent\x2d01.service -> /etc/systemd/system/vsts.agent.ubuntu.Default.ubuntu\x2dagent\x2d01.service.
ubuntu@oc-ubser02-dok:~/Downloads/agent$ sudo ./svc.sh start

/etc/systemd/system/vsts.agent.ubuntu.Default.ubuntu\x2dagent\x2d01.service
● vsts.agent.dragonfoxxsl.Default.ubuntu\x2dagent\x2d01.service - Azure Pipelines Agent (ubuntu-agent-01)
   Loaded: loaded (/etc/systemd/system/vsts.agent.ubuntu.Default.ubuntu\x2dagent\x2d01.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2021-11-30 19:44:50 UTC; 13ms ago
     Main PID: 229908 (runsvc.sh)
       Tasks: 2 (limit: 1099)
      Memory: 2.6M
     CGroup: /system.slice/vsts.agent.ubuntu.Default.ubuntu\x2dagent\x2d01.service
             └─229908 /bin/bash /home/ubuntu/Downloads/agent/runsvc.sh
               229911 ./externals/node10/bin/node ./bin/AgentService.js

Nov 30 19:44:50 oc-ubser02-dok systemd[1]: Started Azure Pipelines Agent (ubuntu-agent-01).
Nov 30 19:44:50 oc-ubser02-dok runsvc.sh[229908]: .path=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin_ap/bin
Hint: Some lines were ellipsized, use -l to show in full.
ubuntu@oc-ubser02-dok:~/Downloads/agent$
```

**Step 5.** Navigate

back to the Agent pools in the Organizational settings and then to the Default pool of the Agents tab to verify that the new Ubuntu agent is added as a self-hosted agent.



## Running your self-hosted agent in Docker

Running the agent as a [container](#) is another option we can use to run the agent. Both Windows and Linux are supported as container hosts.

In the following section, let's look at how to create a container image with the Azure pipeline agent and spin up the image as a container. We will be utilizing the Docker Desktop in a Windows environment to create a Linux (Ubuntu) based agent container.

**Step 1.** Create a folder named dockeragent and then create a Dockerfile within the folder with ubuntu:18.04 as the base image with the required configurations. (The configuration is available via [Microsoft documentation](#).)

```
FROM ubuntu:18.04
```

```
# To make it easier for build and release pipelines to run apt-get,
```

```

# configure apt to not require confirmation (assume the -y argument by
default)
ENV DEBIAN_FRONTEND=noninteractive

RUN echo "APT::Get::Assume-Yes \"true\";" > /etc/apt/apt.conf.d/90assume-yes

RUN apt-get update && apt-get install -y --no-install-recommends
    ca-certificates
    curl
    jq
    git
    iputils-ping
    libcurl4
    libicu60
    libunwind8
    netcat
    libssl1.0
    && rm -rf /var/lib/apt/lists/*

RUN curl -Ls https://aka.ms/InstallAzureCLIDeb | bash
    && rm -rf /var/lib/apt/lists/*

ARG TARGETARCH=amd64
ARG AGENT_VERSION=2.194.0

WORKDIR /azp
RUN if ; then
    AZP_AGENTPACKAGE_URL=https://vstsagentpackage.azureedge.net/agent/${AGENT_VERSION}/vsts-agent-linux-x64-${AGENT_VERSION}.tar.gz;
    else
    AZP_AGENTPACKAGE_URL=https://vstsagentpackage.azureedge.net/agent/${AGENT_VERSION}/vsts-agent-linux-${TARGETARCH}-${AGENT_VERSION}.tar.gz;
    fi;
    curl -LsS "$AZP_AGENTPACKAGE_URL" | tar -xz

COPY ./start.sh .
RUN chmod +x start.sh

ENTRYPOINT

Step 2. Create the startup script (start.sh) and put it within the same folder. Ensure that the line
endings are configured as Unix-style (LF) line endings.

fi

    AZP_TOKEN_FILE=/azp/.token
    echo -n $AZP_TOKEN > "$AZP_TOKEN_FILE"
fi

```

```

unset AZP_TOKEN

if ; then
    mkdir -p "$AZP_WORK"
fi

export AGENT_ALLOW_RUNASROOT="1"

cleanup() {
    if ; then
        print_header "Cleanup. Removing Azure Pipelines agent..."

        # If the agent has some running jobs, the configuration removal process
        # will fail.
        # So, give it some time to finish the job.
        while true; do
            ./config.sh remove --unattended --auth PAT --token $(cat
"$AZP_TOKEN_FILE") && break

            echo "Retrying in 30 seconds..."
            sleep 30
        done
    fi
}

print_header() {~
    lightcyan='\033[1;36m'
    nocolor='\033[0m'
    echo -e "${lightcyan}$1${nocolor}"
}

# Let the agent ignore the token env variables
export VSO_AGENT_IGNORE=AZP_TOKEN,AZP_TOKEN_FILE

source ./env.sh

print_header "1. Configuring Azure Pipelines agent..."

./config.sh --unattended
--agent "${AZP_AGENT_NAME:-$(hostname)}"
--url "$AZP_URL"
--auth PAT
--token $(cat "$AZP_TOKEN_FILE")
--pool "${AZP_POOL:-Default}"
--work "${AZP_WORK:-_work}"
--replace

```



```
--acceptTeeEula & wait $!
```

```
print_header "2. Running Azure Pipelines agent..."
```

```
trap 'cleanup; exit 0' EXIT
trap 'cleanup; exit 130' INT
trap 'cleanup; exit 143' TERM
```

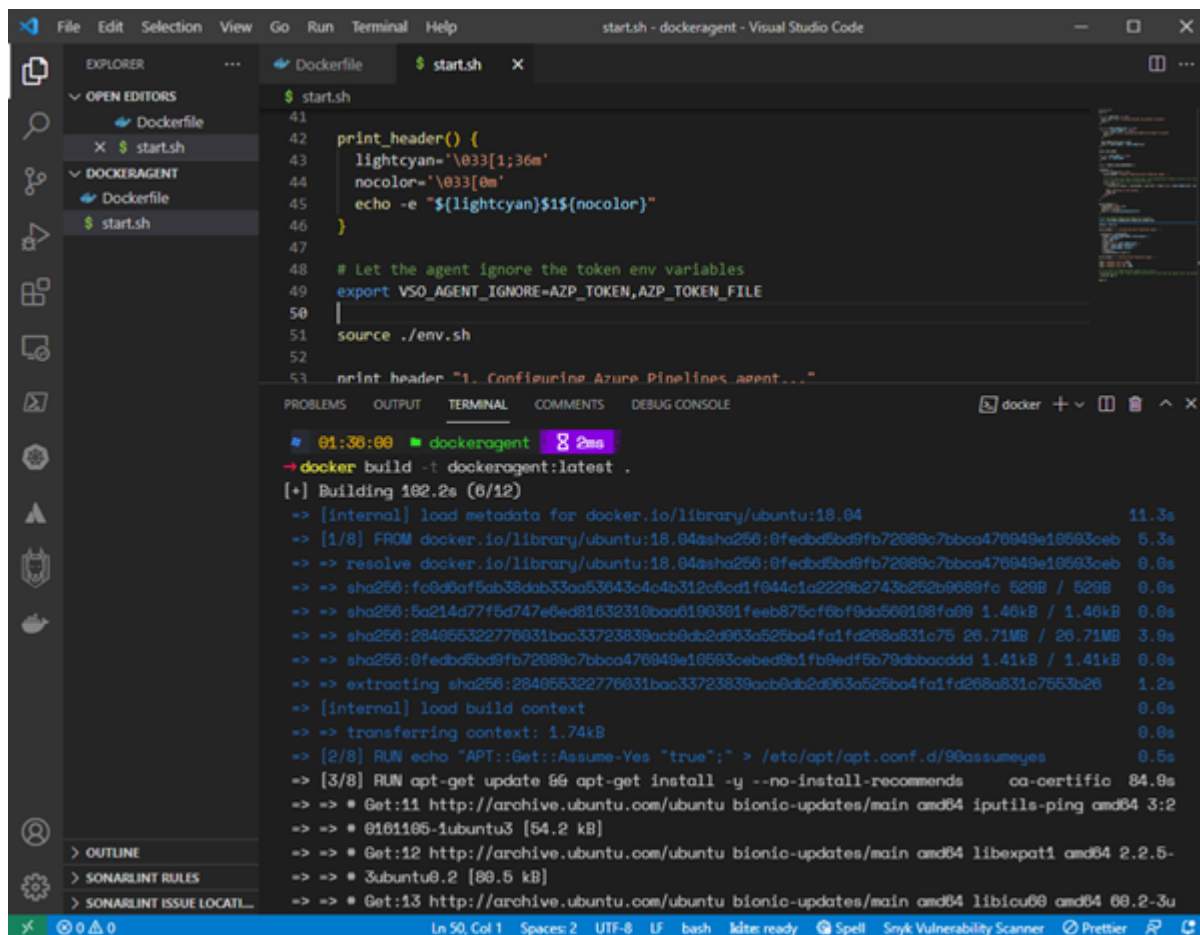
```
# To be aware of TERM and INT signals call run.sh
```

```
# Running it with the --once flag at the end will shut down the agent after
the build is executed
```

```
./run.sh "$@" & wait $!
```

**Step 3.** Build the Image by running the following command in the dockeragent folder.

```
docker build -t dockeragent:latest .
```

The screenshot shows the Visual Studio Code interface. The Explorer sidebar on the left shows the file structure with 'Dockerfile' and 'start.sh' under the 'DOCKRAGENT' folder. The main editor displays the 'start.sh' script. The script includes a 'print\_header' function, sets environment variables for 'VSO\_AGENT\_IGNORE', and sources './env.sh'. The terminal at the bottom shows the execution of 'docker build -t dockeragent:latest .', which is building the image successfully. The terminal output includes progress bars for various steps like 'load metadata', 'FROM', 'resolve', 'sha256', 'extracting', 'load build context', 'transferring context', and 'RUN' commands for 'echo', 'apt-get update', and 'apt-get install'.

**Step 4.** Create a container using the docker run command with the newly created docker image. We can pass [environment variables](#) when creating the container. In this instance, we will be passing the server URL (AZP\_URL), PAT token (AZP\_TOKEN), and agent name (AZP\_AGENT\_NAME) as variables.

```
docker run -e AZP_URL=https://dev.azure.com/ -e AZP_TOKEN= -e
AZP_AGENT_NAME=docker-agent-01 dockeragent:latest
```



```
- docker run -e AZP_URL=https://dev.azure.com/ -e AZP_TOKEN=f
ama -e AZP_AGENT_NAME=docker-agent-01 dockeragent:latest
1. Configuring Azure Pipelines agent...

agent v2.194.0 (commit 7dbde4c)

>> End User License Agreements:

Building sources from a TFVC repository requires accepting the Team Explorer Everywhere End User License Agreement. This
step is not required for building sources from Git repositories.

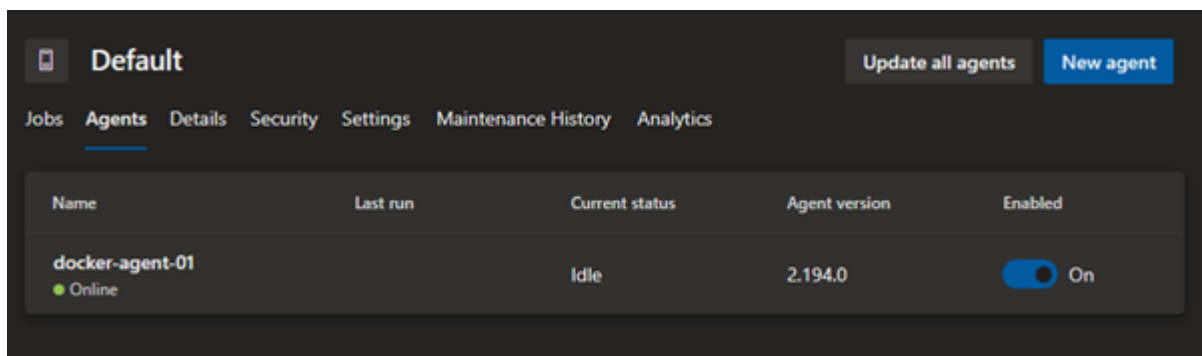
A copy of the Team Explorer Everywhere license agreement can be found at:
/azp/externals/tee/license.html

>> Connect:

Connecting to server ...

>> Register Agent:
```

**Step 5.** We can verify if the container is added as an agent by looking at the Default agent pool in the Azure DevOps dashboard.



## Self-hosted agents for Azure DevOps

Self-hosted agents in Azure DevOps Pipelines offer cost savings and more flexibility to configure and run build and release agents in any supported environment. These pipeline agents can be utilized to extend the functionality of the CI/CD pipeline from running in bare-metal servers to [VMs](#) and even as containers.

## Related reading

- [BMC DevOps Blogs](#)
- [GitHub, GitLab, Bitbucket & Azure DevOps: What's The Difference?](#)
- [AWS vs Azure vs GCP: Comparing The Big 3 Cloud Platforms](#)
- [Azure Certifications: An Introduction](#)
- [How To Set Up a Continuous Integration & Delivery \(CI/CD\) Pipeline](#)
- [DevOps Branching Strategies Explained](#)