

# CircleCI Server v2.16 Installation Guide

Final Documentation

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# Chapter 1

## Overview

CircleCI is a modern continuous integration and continuous delivery (CI/CD) platform installable inside your private cloud or data center.

CircleCI 2.x provides new infrastructure that includes the following improvements:

- New configuration with any number of jobs and workflows to orchestrate them.
- Custom images for execution on a per-job basis.
- Fine-grained performance with custom caching and per-job CPU or memory allocation.

Refer to the v2.16 Changelog at <https://circleci.com/server/changelog> for what's new in this release.

## Build Environments

CircleCI uses Nomad as the primary job scheduler in CircleCI 2.x. Refer to the Introduction to Nomad Cluster Operation to learn more about the job scheduler and how to perform basic client and cluster operations.

By default, CircleCI 2.x Nomad clients automatically provision containers according to the image configured for each job in your `.circleci/config.yml` file.

## Architecture

Figure 1.1 illustrates CircleCI core components, build orchestration services, and executors. The CircleCI API is a full-featured RESTful API that allows you to access all information and trigger all actions in CircleCI. The Insights page in the CircleCI UI is a dashboard showing the health of all repositories you are following including median build time, median queue time, last build time, success rate, and parallelism.

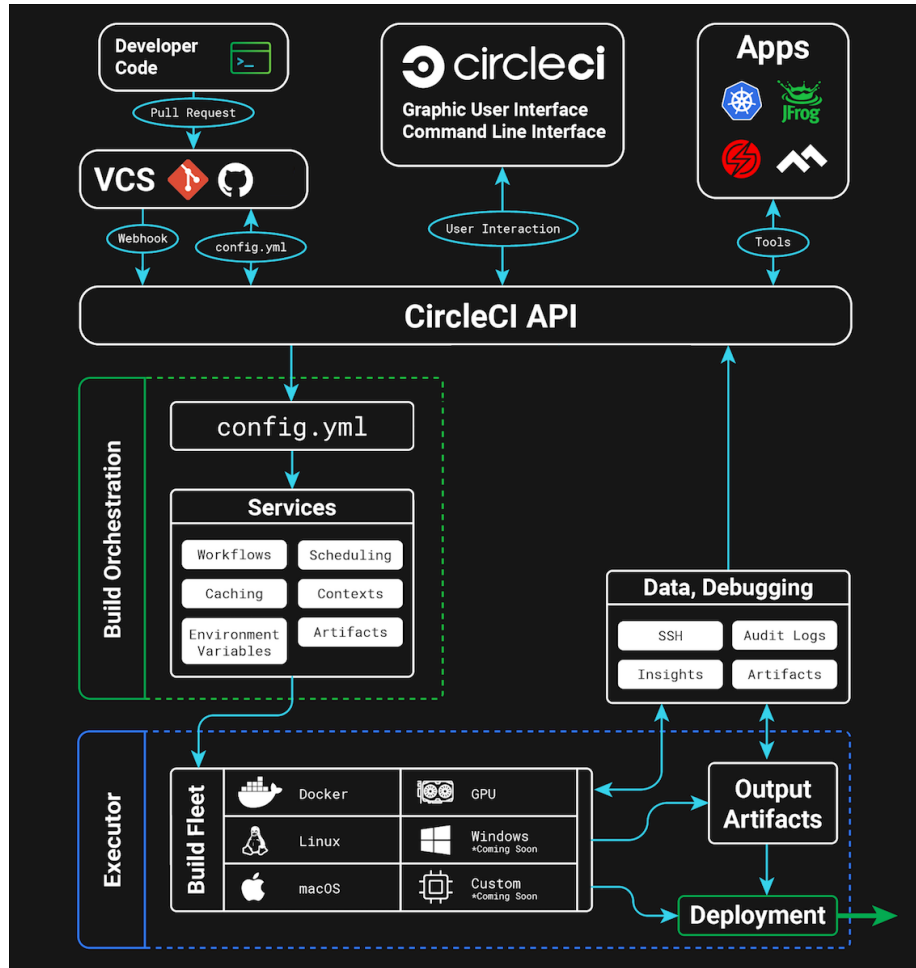


Figure 1.1: A Diagram of the CircleCI Services Architecture

CircleCI consists of two primary components: Services and Nomad Clients. Any number of Nomad Clients execute your jobs and communicate back to the Services. All components must access GitHub or your hosted instance of GitHub Enterprise on the network as illustrated in the following architecture diagram.

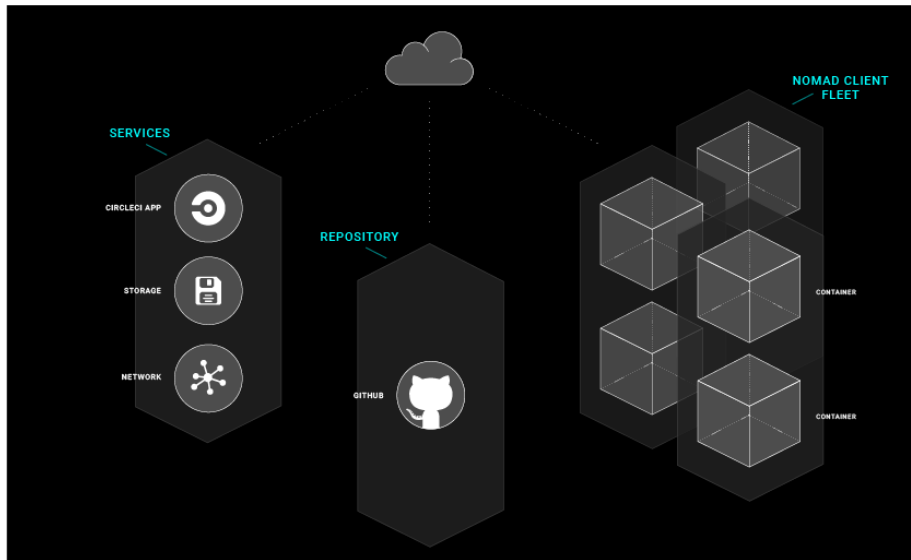


Figure 1.2: A Diagram of the CircleCI Architecture

## Services Instance

The machine on which the Services instance runs must not be restarted and may be backed up using VM snapshotting. If you must restart the Services machine, do so only as a last resort because restart will result in downtime. Refer to the Disaster Recovery chapter for instructions.

DNS resolution must point to the IP address of the machine on which the Services are installed. The following table describes the ports used for traffic on the Service instance:

Source	Ports	Use
End Users	80, 443 , 4434	HTTP/HTTPS Traffic
Administrators	22	SSH
Administrators	8800	Admin Console
Builder Boxes	all traffic / all ports	Internal Communication
GitHub (Enterprise or .com)	80, 443	Incoming Webhooks

## Nomad Clients

The Nomad Clients run without storing state, enabling you to increase or decrease the number of containers as needed.

To ensure that there are enough running to handle all of the builds, track the queued builds and increase the number of Nomad Client machines as needed to balance the load.

Each machine reserves two CPUs and 4GB of memory for coordinating builds. The remaining processors and memory create the containers. Larger machines are able to run more containers and are limited by the number of available cores after two are reserved for coordination.

**Note:** The maximum machine size for a Nomad client is 128GB RAM/ 64 CPUs, contact your CircleCI account representative to request use of larger machines for Nomad Clients.

The following table describes the ports used on the Nomad clients:

Source	Ports	Use
End Users	64535-65535	SSH into builds
Administrators	80 or 443	CCI API Access
Administrators	22	SSH
Services Machine	all traffic / all ports	Internal Comms
Nomad Clients (including itself)	all traffic / all ports	Internal Comms

## GitHub

CircleCI uses GitHub or GitHub Enterprise credentials for authentication which, in turn, may use LDAP, SAML, or SSH for access. That is, CircleCI will inherit the authentication supported by your central SSO infrastructure. The following table describes the ports used on machines running GitHub to communicate with the Services and Builder instances.

Source	Ports	Use
Services	22	Git Access
Services	80, 443	API Access
Nomad Client	22	Git Access
Nomad Client	80, 443	API Access



## Chapter 2

# Installing CircleCI v2.16 on Amazon Web Services with Terraform

This document provides step-by-step instructions for installing CircleCI v2.16 on Amazon Web Services (AWS) with Terraform in the following sections. Refer to <https://circleci.com/server/changelog> for what's new and fixed in this release.

**Notes:** - CircleCI 2.0 may be installed without a support agreement on AWS using the examples and instructions in this document. - It is possible to install and configure CircleCI on Azure or any other platform used in your organization with a Platinum CircleCI support agreement. Contact CircleCI support or your account representative to get started.

## Externalization

With a Platinum support agreement, it is possible to configure the following services to run external to the Services machine for improved performance:

- PostgreSQL
- MongoDB
- Vault
- Rabbitmq
- Redis
- Nomad
- Slinger

Contact support to evaluate your installation against the current requirements for running external services.

## Installation Prerequisites

Install the following automated infrastructure provisioning software:

- Terraform, see the Download Terraform web site for links to packages for your architecture.

Have the following information available before beginning the installation procedure:

- CircleCI License file (.rli), contact CircleCI support for a license.
- AWS Access Key, AWS Secret Key.
- Name of AWS EC2 SSH key.
- AWS Region, for example `us-west-2`.
- AWS Virtual Private Cloud (VPC) ID and AWS Subnet ID. Your default VPC ID is listed under Account Attributes in Amazon if your account is configured to use a default VPC.
- Set your VPC `[enableDnsSupport]` setting to `true` to ensure that queries to the Amazon provided DNS server at the 169.254.169.253 IP address, or the reserved IP address at the base of the VPC IPv4 network range plus two will succeed. See the Using DNS with Your VPC Amazon Web Services documentation for additional details.

## Private Subnet Requirements

The following additional settings are required to support using private subnets on AWS with CircleCI:

- The private subnet for builder boxes must be configured with a NAT gateway or an internet gateway configured for the outbound traffic to the internet via attached route tables. **Note:** The subnet should be large enough to *never* exhaust the addresses.
- The VPC Endpoint for S3 should be enabled. Enabling the VPC endpoint for S3 should significantly improve S3 operations for CircleCI and other nodes within your subnet.
- Adequately power the NAT instance for heavy network operations. Depending on the specifics of your deployment, it is possible for NAT instances to become constrained by highly parallel builds using Docker and external network resources. A NAT that is inadequate could cause slowness in network and cache operations.
- If you are integrating with github.com, ensure that your network access control list (ACL) whitelists ports 80 and 443 for GitHub webhooks. When integrating with GitHub, either set up CircleCI in a public subnet, or set up a public load balancer to forward github.com traffic.
- See the Services section of the Administrator's Overview for more information on the specific ports that need to be accessible to instances in your CircleCI installation.

## Planning

Have available the following information and policies before starting the Preview Release installation:

- If you use network proxies, contact your Account team before attempting to install CircleCI 2.0.
- Plan to provision at least two AWS instances, one for the Services and one for your first set of Nomad Clients. Best practice is to use an `m4.2xlarge` instance with 8 vCPUs and 32GB RAM for the Services as well as Nomad Clients instances.
- AWS instances must have outbound access to pull Docker containers and to verify your license.
- In order to provision required AWS entities with Terraform you need an IAM User with following permissions:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": [
        "s3:*"
      ],
      "Effect": "Allow",
      "Resource": [
        "arn:aws:s3:::circleci-*",
        "arn:aws:s3:::circleci-*/*",
        "arn:aws:s3:::*"
      ]
    },
    {
      "Action": [
        "autoscaling:*",
        "sqs:*",
        "iam:*",
        "ec2:StartInstances",
        "ec2:RunInstances",
        "ec2:TerminateInstances",
        "ec2:Describe*",
        "ec2:CreateTags",
        "ec2:AuthorizeSecurityGroupEgress",
        "ec2:AuthorizeSecurityGroupIngress",
        "ec2:CreateSecurityGroup",
        "ec2>DeleteSecurityGroup",
        "ec2:DescribeInstanceAttribute",
        "ec2:DescribeInstanceStatus",
        "ec2:DescribeInstances",
```

```

        "ec2:DescribeNetworkAcls",
        "ec2:DescribeSecurityGroups",
        "ec2:RevokeSecurityGroupEgress",
        "ec2:RevokeSecurityGroupIngress",
        "ec2:ModifyInstanceAttribute",
        "ec2:ModifyNetworkInterfaceAttribute",
        "cloudwatch:*",
        "autoscaling:DescribeAutoScalingGroups",
        "iam:GetUser"
    ],
    "Resource": [
        "*"
    ],
    "Effect": "Allow"
}
]
}

```

## Installation with Terraform

1. Clone the Setup repository (if you already have it cloned, make sure it is up-to-date and you are on the master branch: `git checkout master && git pull`).
2. Run `make init` to init `terraform.tfvars` file (your previous `terraform.tfvars` if any, will be backed up in the same directory).
3. Fill `terraform.tfvars` with appropriate AWS values for section 1.
4. Specify a `circle_secret_passphrase` in section 2, replacing ... with alpha numeric characters. Passphrase cannot be empty.
5. Specify the instance type for your Nomad Clients. By default, the value specified in the `terraform.tfvars` file for Nomad Clients is `m4.2xlarge` (8 vCPUs, 32GB RAM). To increase the number of concurrent CircleCI jobs that each Nomad Client can run, modify section 2 of the `terraform.tfvars` file to specify a larger `nomad_client_instance_type`. Refer to the AWS Amazon EC2 Instance Types guide for details. **Note:** The `builder_instance_type` is only used for 1.0 and is disabled by default in section 3.
6. Run `terraform apply` to provision.
7. Go to the provided URL at the end of Terraform output and follow the instructions.
8. Enter your license.
9. Register CircleCI as a new OAuth application in GitHub.com by following the instructions in the management console GitHub integration section.
  - **Note:** If you get an "Unknown error authenticating via GitHub. Try again, or contact us." message, try using `http:` instead of `https:` for the Homepage URL and callback URL.
8. Copy the Client ID from GitHub and paste it into the entry field for GitHub Application

Client ID.

9. Copy the Secret from GitHub and paste it into the entry field for GitHub Application Client Secret and click Test Authentication.
10. Complete the Storage section. It is best practice to use an instance profile for authentication (no additional configuration required).
11. Configure the vm-service if you plan to use Remote Docker or machine executor features (you can configure it later if necessary). Again, it is best to use an instance profile for authentication (no additional configuration required).
12. After applying settings you will be redirected to the Management Console Dashboard. It will take a few minutes to download all of the necessary Docker containers. If the Management Console reports that `Failure reported from operator: no such image` click Start again and it should continue.
13. After the application has started, log in to CircleCI and start running 2.0 builds!
14. You can use our realitycheck repo to check basic CircleCI functionality.

## Validating your Installation

1. Click the Open link in the dashboard to go to the CircleCI app. The Starting page appears for a few minutes as the CircleCI application is booting up, then automatically redirects to the homepage.
2. Sign up or sign in by clicking the Get Started button. Because you are the first user to log in, you become the Administrator.
3. Add a project using the Hello World document.

## Troubleshooting

If you're unable to run your first builds successfully please start with our Troubleshooting guide as well as an Introduction to Nomad Cluster Operation document for information about how to check status of Builders.

After the build containers start and complete downloading of images, the first build should begin immediately.

If there are no updates after about 15 minutes and you have clicked the Refresh button, contact CircleCI support for assistance.



## Chapter 3

# Troubleshooting

This chapter answers frequently asked questions and provides installation troubleshooting tips.

### FAQ

#### Can I monitor available build containers?

Yes, refer to the Introduction to Nomad Cluster Operation document for details. Refer to the Administrative Variables, Monitoring, and Logging section for how to enable additional container monitoring for AWS.

#### How do I provision admin users?

The first user who logs in to the CircleCI application will automatically be designated an admin user. Options for designating additional admin users are found under the Users page in the Admin section at [https://\[domain-to-your-installation\]/admin/users](https://[domain-to-your-installation]/admin/users).

#### How can I retrieve the passphrase and private IP address if it is lost?

SSH into the services box, and run the following:

```
$ # To get the passphrase
$ circleci get-secret-token
CIRCLE_SECRET_PASSPHRASE=xxxxxxxxxxxxxxxxxxxxxx
$
$ # To get private ip address
$ ifconfig eth0 | grep "inet addr"
```

```
inet addr:10.0.0.235 Bcast:10.0.0.255 Mask:255.255.255.0
```

### How can I change my passphrase?

1. Change your passphrase on the system console (services box port 8800) settings page.
2. Restart the application.
3. Update `CIRCLE_SECRET_PASSPHRASE` in the `init` script that you use to add Nomad Clients to your fleet.

New Nomad Clients joining the fleet will use the new passphrase. Existing Nomad Clients with the old passphrase will also continue functioning. But, it is best practice to restart these boxes as soon as you can to use the consistent passphrase across your fleet.

### How can I gracefully shutdown Nomad Clients?

Refer to the Introduction to Nomad Cluster Operation chapter for details.

### Is it possible to run iOS/macOS builds on CircleCI?

Support for running your own macOS fleet is coming soon. Contact your account team to express interest in getting on the early access list.

### Why is Test GitHub Authentication failing?

This means that the GitHub Enterprise server is not returning the intermediate SSL certificates. Check your GitHub Enterprise instance with <https://www.ssllabs.com/ssltest/analyze.html> - it may report some missing intermediate certs. You can use commands like `openssl` to get the full certificate chain for your server.

In some cases authentication fails when returning to the configuration page after it was successfully set up once. This is because the secret is encrypted, so when returning checking it will fail.

### How can I use HTTPS to access CircleCI?

While CircleCI creates a self-signed cert when starting up, that certificate only applies to the management console and not the CircleCI product itself. If you want to use HTTPS, you'll have to provide certificates to use under the `Privacy` section of the settings in the management console.



### Why doesn't terraform destroy every resource?

CircleCI sets the services box to have termination protection in AWS and also writes to an s3 bucket. If you want terraform to destroy every resource, you'll have to either manually delete the instance, or turn off termination protection in the `circleci.tf` file. You'll also need to empty the s3 bucket that was created as part of the terraform install.

### Do the Nomad Clients store any state?

They can be torn down without worry as they don't persist any data.

### How do I verify TLS settings are failing?

Make sure that your keys are in unencrypted PEM format, and that the certificate includes the entire chain of trust as follows:

```
-----BEGIN CERTIFICATE-----
your_domain_name.crt
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
intermediate 1
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
intermediate 2
-----END CERTIFICATE-----
...
```

### How do I debug the Management Console (Replicated)?

If you're experiencing any issues with Replicated, here are a few ways to debug it.

#### Check the current version of Replicated installed

First, make sure you have the CLI tool for Replicated installed:

```
replicated -version
```

#### Restart Replicated and the CircleCI app

Try restarting Replicated services. You can do this by running the following commands on the service box for Ubuntu 14.04:

```
sudo restart replicated-ui
sudo restart replicated
sudo restart replicated-agent
```

For Ubuntu 16.04, run the following commands:

```
sudo systemctl restart replicated-ui
sudo systemctl restart replicated
sudo systemctl restart replicated-operator
```

Then, go to your services box admin (for example, <https://YOUR-CCIE-INSTALL:8800>) and try restarting with “Stop Now” and “Start Now”.

### Try to log into Replicated

Try to log in to Replicated. You can do this by running the following commands on the service box. You will only be asked to enter password, which is the same one used to unlock the admin (i.e.: <https://YOUR-CCIE-INSTALL:8800>).

```
replicated login
```

If you could login, then please run the following command too and give us the output.

```
sudo replicated apps
```

You are getting Error: request returned Unauthorized for API route.. error probably because you are not logged into Replicated, so please check if you are still getting the error after successful login.

### Check Replicated logs

You can find Replicated logs under `/var/log/replicated`.

### Check output of docker ps

Replicated starts many Docker containers to run CCIE, so it may be useful to check what containers are running.

You should see something similar to this output:

```
sudo docker ps
CONTAINER ID  IMAGE  COMMAND  CREATED  STATUS  PORTS  NAMES
03fb873adf26  <service-box-ip>:9874/circleci-frontend:0.1." /docker-
entrypoint.s"
3 days ago
Up 3 days  0.0.0.0:80->80/tcp, 0.0.0.0:443-
>443/tcp,
0.0.0.0:4434->4434/tcp  e53e4f74259a6ec0a268d8c984ac6277
```

```

113b9ea03b46 <service-box-ip>:9874/circleci-slanger:0.4 "/docker-
entrypoint.s"
3 days ago
    Up 3 days          0.0.0.0:4567->4567/tcp, 0.0.0.0:8081-
>8080/tcp              d262cc492bd5d692d467f74d8cc39748
0a66adfb2f0 <service-box-ip>:9874/postgres:9.4.6      "/docker-
entrypoint.s"
3 days ago
    Up 3 days          0.0.0.0:5432-
>5432/tcp              423e0e6c4099fa99cd89c58a74355ffe
1c72cbef1090 <service-box-ip>:9874/circleci-exim:0.2   "/docker-
entrypoint.s"
3 days ago
    Up 3 days          0.0.0.0:2525-
>25/tcp                94de52d61d464b7543f36817c627fe56
df944bb558ed <service-box-ip>:9874/mongo:2.6.11       "/entrypoint.sh mongo"
3 days ago
    Up 3 days          0.0.0.0:27017-
>27017/tcp              04a57db9f97a250c99dfdbeec07c3715
66be98cd54fe <service-box-ip>:9874/redis:2.8.23        "/entrypoint.sh redis"
3 days ago
    Up 3 days          0.0.0.0:6379->6379/tcp
    e2ce5e702c4114648718d2d5840edc56
ac2faa662bbe <service-box-ip>:9874/tutum-logrotate:latest "crond -
f"
3 days ago
    Up 3 days          34e4d4165947f14d185d225191ba4ce8
796013f64732 <service-box-ip>:9874/redis:2.8.23        "/entrypoint.sh redis"
3 days ago
    Up 3 days          0.0.0.0:32773-
>6379/tcp              dce3519e7aff9a365bd3b42ed3a6f77f

```

Providing support with the output of `sudo docker ps` in service box will be helpful in diagnosing the problem.



## Chapter 4

# Appendix

### System Requirements

This section defines the system requirements for installing CircleCI v2.16.

#### Services Machine

The Services machine hosts the core of the Server product, including the user-facing website, API engine, datastores, and Nomad job scheduler. It is best practice to use an isolated machine.

The following table defines the Services machine CPU, RAM, and disk space requirements:

Number of daily active CircleCI users	CPU	RAM	Disk space	NIC speed
<50	8 cores	32GB	100GB	1Gbps
50-250	12 cores	64GB	200GB	1Gbps
251-1000	16 cores	128GB	500GB	10Gbps
1001-5000	20 cores	256GB	1TB	10Gbps
5000+	24 cores	512GB	2TB	10Gbps

#### Nomad Clients

Nomad client machines run the CircleCI jobs that were scheduled by the Services machine. Following are the Minimum CPU, RAM, and disk space requirements per client:

- CPU: 4 cores
- RAM: 16GB
- Disk space: 100GB
- NIC speed: 1Gbps

The following table defines the number of Nomad clients to make available as a best practice. Scale up and down according to demand on your system:

Number of daily active CircleCI users	Number of Nomad client machines
<50	1-5
50-250	5-10
250-1000	10-15
5000+	15+

### Server Ports

Following is the list of ports for machines in a CircleCI 2.0 installation:

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
Services Machine	80	TCP	Inbound	End users	HTTP web app traffic	
	443	TCP	Inbound	End users	HTTPS web app traffic	
	7171	TCP	Inbound	End users	Artifacts access	
	8081	TCP	Inbound	End users	Artifacts access	
	22	TCP	Inbound	Administrators	SSH	
	8800	TCP	Inbound	Administrators	Admin console	
	8125	UDP	Inbound	Nomad Clients	Metrics	
	8125	UDP	Inbound	Nomad Servers	Metrics	Only if using externalised Nomad Servers
	8125	UDP	Inbound	All Database Servers	Metrics	Only if using externalised databases

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
<b>Services Machine</b>	4647	TCP	Bi-directional	Nomad Clients	Internal communication	
	8585	TCP	Bi-directional	Nomad Clients	Internal communication	
	7171	TCP	Bi-directional	Nomad Clients	Internal communication	
	3001	TCP	Bi-directional	Nomad Clients	Internal communication	
	80	TCP	Bi-directional	GitHub Enterprise / GitHub.com (whichever applies)	Webhooks / API access	
	443	TCP	Bi-directional	GitHub Enterprise / GitHub.com (whichever applies)	Webhooks / API access	
	80	TCP	Outbound	AWS API endpoints	API access	Only if running on AWS
	443	TCP	Outbound	AWS API endpoints	API access	Only if running on AWS
	5432	TCP	Outbound	PostgreSQL Servers	PostgreSQL database connection	Only if using externalised databases. Port is user-defined, assuming the default PostgreSQL port.

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
Services Machine	27017	TCP	Outbound	MongoDB Servers	MongoDB database connection	Only if using externalised databases. Port is user-defined, assuming the default MongoDB port.
	5672	TCP	Outbound	RabbitMQ Servers	RabbitMQ connection	Only if using externalised RabbitMQ
	6379	TCP	Outbound	Redis Servers	Redis connection	Only if using externalised Redis
	4647	TCP	Outbound	Nomad Servers	Nomad Server connection	Only if using externalised Nomad Servers
	443	TCP	Outbound	CloudWatch Endpoints	Metrics	Only if using AWS CloudWatch

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
Nomad Clients	64535-65535	TCP	Inbound	End users	SSH into builds feature	
	80	TCP	Inbound	Administrators	CircleCI Admin API access	
	443	TCP	Inbound	Administrators	CircleCI Admin API access	
	22	TCP	Inbound	Administrators	SSH	



Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
	22	TCP	Outbound	GitHub Enterprise / GitHub.com (whichever applies)	Download Code From Github.	
	4647	TCP	Bi-directional	Services Machine	Internal communication	
	8585	TCP	Bi-directional	Services Machine	Internal communication	
	7171	TCP	Bi-directional	Services Machine	Internal communication	
	3001	TCP	Bi-directional	Services Machine	Internal communication	
	443	TCP	Outbound	Cloud Storage Provider	Artifacts storage	Only if using external artifacts storage
	53	UDP	Outbound	Internal DNS Server	DNS resolution	This is to make sure that your jobs can resolve all DNS names that are needed for their correct operation

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
GitHub Enterprise / GitHub.com (whichever applies)	22	TCP	Inbound	Services Machine	Git access	

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
	22	TCP	Inbound	Nomad Clients	Git access	
	80	TCP	Inbound	Nomad Clients	API access	
	443	TCP	Inbound	Nomad Clients	API access	
	80	TCP	Bi-directional	Services Machine	Webhooks / API access	
	443	TCP	Bi-directional	Services Machine	Webhooks / API access	

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
<b>PostgreSQL Servers</b>	5432	TCP	Bi-directional	PostgreSQL Servers	PostgreSQL replication	Only if using externalised databases. Port is user-defined, assuming the default PostgreSQL port.

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
<b>MongoDB Servers</b>	27017	TCP	Bi-directional	MongoDB Servers	MongoDB replication	Only if using externalised databases. Port is user-defined, assuming the default MongoDB port.

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
<b>RabbitMQ Servers</b>	5672	TCP	Inbound	Services Machine	RabbitMQ connection	Only if using externalised RabbitMQ
	5672	TCP	Bi-directional	RabbitMQ Servers	RabbitMQ mirroring	Only if using externalised RabbitMQ

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
<b>Redis Servers</b>	6379	TCP	Inbound	Services Machine	Redis connection	Only if using externalised Redis
	6379	TCP	Bi-directional	Redis Servers	Redis replication	Only if using externalised Redis and using Redis replication (optional)

Machine type	Port number	Protocol	Direction	Source / destination	Use	Notes
Nomad Servers	4646	TCP	Inbound	Services Machine	Nomad Server connection	Only if using externalised Nomad Servers
	4647	TCP	Inbound	Services Machine	Nomad Server connection	Only if using externalised Nomad Servers
	4648	TCP	Bi-directional	Nomad Servers	Nomad Servers internal communication	Only if using externalised Nomad Servers