OPERATIONS GUIDE

A guide for administrators of CircleCI Server installations on AWS or in private data-centers.

Docs Team

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Table of Contents

Overview

CircleCI Server is a modern continuous integration and continuous delivery (CI/CD) platform installable inside your private cloud or data center. Refer to the Changelog for what's new in this CircleCI Server release.

CircleCI Server v2.17 uses the CircleCI 2.0 architecture.

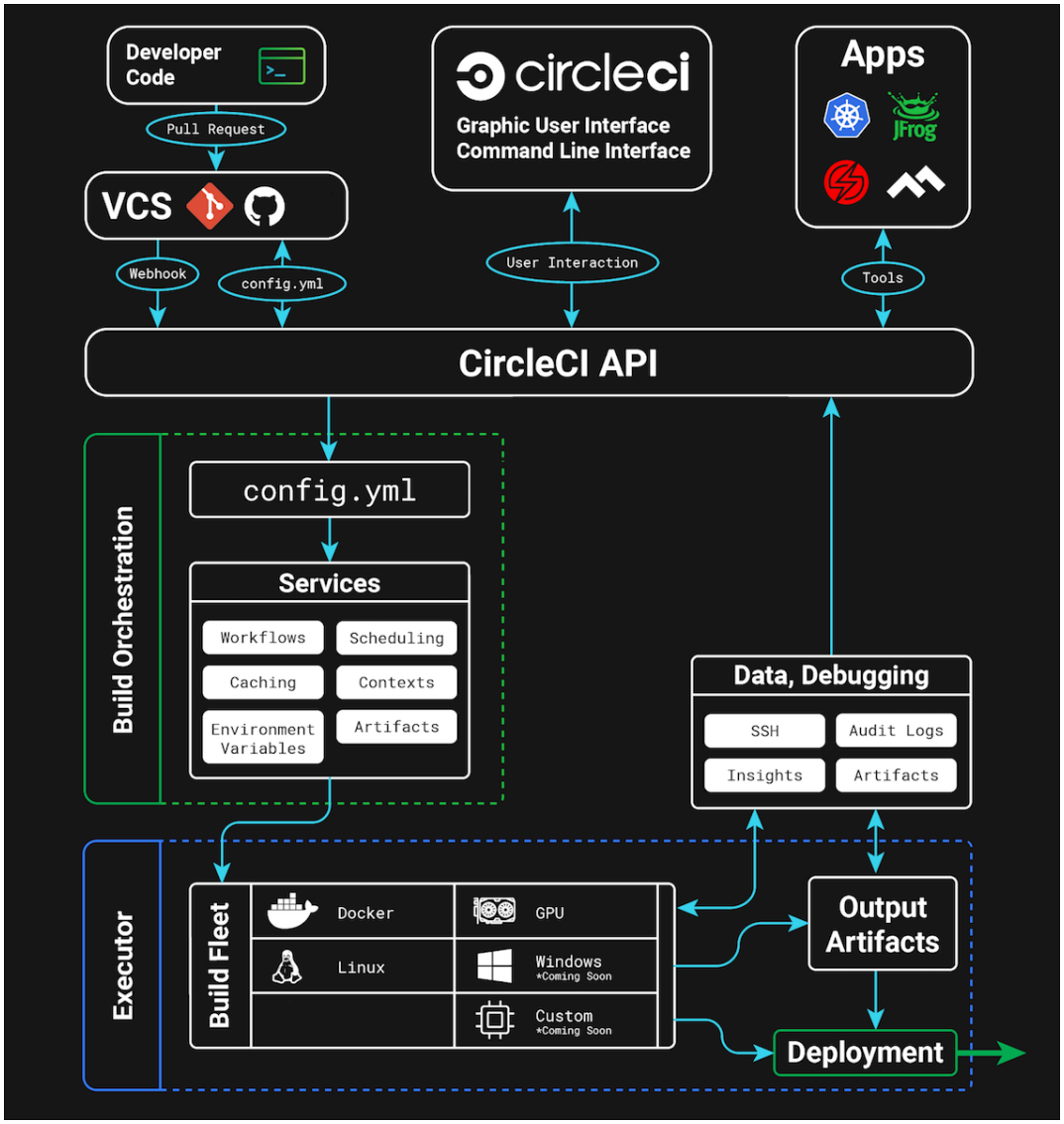


Figure 1. CircleCI Services Architecture

Build Environments

CircleCI 2.0 uses Nomad as the primary job scheduler. 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 2.0 Nomad clients automatically provision containers according to the image configured for each job in your `.circleci/config.yml` file.

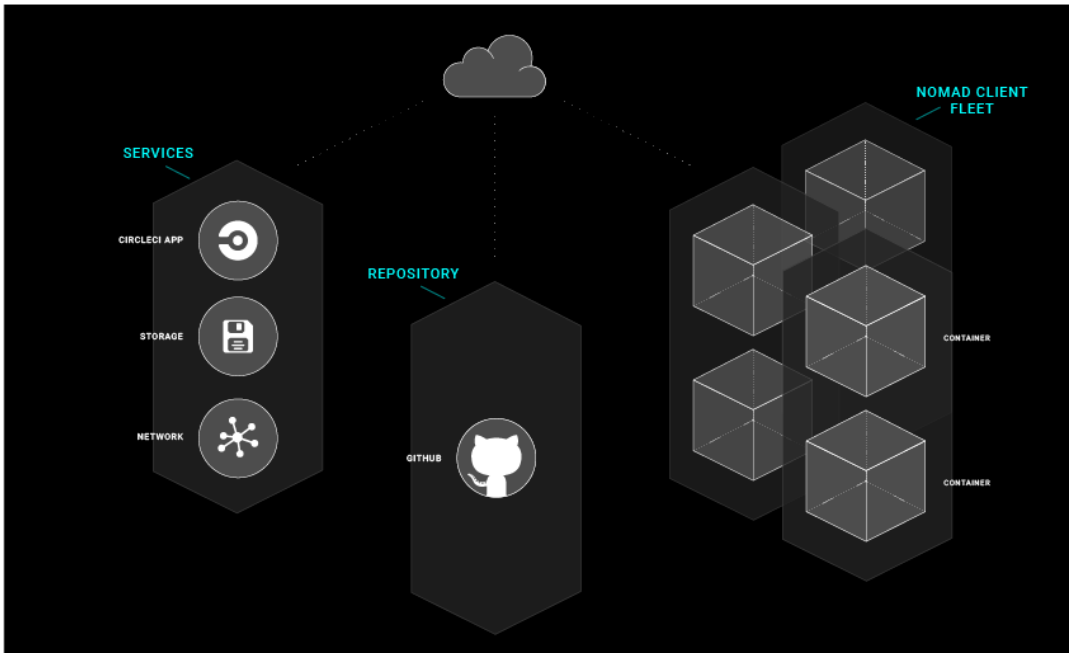
Architecture

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.

Within the CircleCI UI is the Insights page, which acts as a dashboard showing the health of all repositories you are following including:

- median build time
- median queue time
- last build time
- success rate
- parallelism.

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 Figure 2.



Services Machine

The Services machine must 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 a restart will result in downtime. Refer to the [Disaster Recovery] chapter for instructions.

DNS resolution may point to the IP address of the Services machine. It is also possible to point to a load balancer, for example an ELB in AWS. The following table describes the ports used for traffic on the Service machine:

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

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

To ensure enough Nomad clients are running to handle all builds, track the queued builds and increase the number of Nomad Client machines as needed to balance the load. For more on tracking metrics see [System Monitoring].

Each machine reserves two vCPUs 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.

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 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. This means CircleCI will inherit the authentication supported by your central SSO infrastructure.

CircleCI does not support changing the URL or backend Github instance after it has been set up. The following table describes the ports used on machines running GitHub to communicate with the Services and Nomad Client instances.

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

Introduction to Nomad Cluster Operation

This section provides conceptual and procedural information for operating, backing up, monitoring, and configuring a CircleCI server installation.

CircleCI 2.0 uses Nomad as the primary job scheduler. This chapter provides a basic introduction to Nomad for understanding how to operate the Nomad Cluster in your CircleCI 2.0 installation.

Basic Terminology and Architecture

- **Nomad Server:** Nomad servers are the brains of the cluster; they receive and allocate jobs to Nomad clients. In CircleCI, a Nomad server runs on your Services machine as a Docker Container.
- **Nomad Client:** Nomad clients execute the jobs they are allocated by Nomad servers. Usually a Nomad client runs on a dedicated machine (often a VM) in order to fully take the advantage of machine power. You can have multiple Nomad clients to form a cluster and the Nomad server allocates jobs to the cluster with its scheduling algorithm.
- **Nomad Jobs:** A Nomad job is a specification, provided by a user, that declares a workload for Nomad. In CircleCI 2.0, a Nomad job corresponds to an execution of a CircleCI job. If the job uses parallelism, say 10 parallelism, then Nomad will run 10 jobs.
- **Build Agent:** Build Agent is a Go program written by CircleCI that executes steps in a job and reports the results. Build Agent is executed as the main process inside a Nomad Job.

Basic Operations

The following section is a basic guide to operating a Nomad cluster in your installation.

The `nomad` CLI is installed in the Service instance. It is pre-configured to talk to the Nomad cluster, so it is possible to use the `nomad` command to run the following commands in this section.

Checking the Jobs Status

The get a list of statuses for all jobs in your cluster, run:

```
nomad status
```

The `Status` is the most important field in the output, with the following status type definitions:

- `running`: Nomad has started executing the job. This typically means your job in CircleCI is started.
- `pending`: There are not enough resources available to execute the job inside the cluster.
- `dead`: Nomad has finished executing the job. The status becomes `dead` regardless of whether the corresponding CircleCI job/build succeeds or fails.

Checking the Cluster Status

To get a list of your Nomad clients, run:

```
nomad node-status
```

`nomad node-status` reports both Nomad clients that are currently serving (status `active`) and Nomad clients that were taken out of the cluster (status `down`). Therefore, you need to count the number of `active` Nomad clients to know the current capacity of your cluster.

To get more information about a specific client, run the following from that client:

```
nomad node-status -self
```

This will give information such as how many jobs are running on the client and the resource utilization of the client.

Checking Logs

As noted in the Nomad Jobs section above, a Nomad Job corresponds to an execution of a CircleCI job. Therefore, checking logs of Nomad Jobs sometimes helps you to understand the status of a CircleCI job if there is a problem. To get logs for a specific job, run:

```
nomad logs -job -stderr <nomad-job-id>
```

Be sure to specify the `-stderr` flag as this is where most Build Agent logs appear.

While the `nomad logs -job` command is useful, the command is not always accurate because the `-job` flag uses a random allocation of the specified job. The term `allocation` is a smaller unit in Nomad Job, which is out of scope for this document. To learn more, please see the official document.

Complete the following steps to get logs from the allocation of the specified job:

1. Get the job ID with `nomad status` command.
2. Get the allocation ID of the job with `nomad status <job-id>` command.
3. Get the logs from the allocation with `nomad logs -stderr <allocation-id>`

Scaling Up the Client Cluster

Refer to the [Scaling] section of the Configuration chapter for details about adding Nomad Client instances to an AWS auto scaling group and using a scaling policy to scale up automatically according to your requirements.

Shutting Down a Nomad Client

When you want to shutdown a Nomad client, you must first set the client to `drain` mode. In `drain` mode, the client will finish any jobs that have already been allocated but will not be allocated any new jobs.

- To drain a client, log in to the client and set the client to drain mode with `node-drain` command as follows:

```
nomad node-drain -self -enable
```

- Then, make sure the client is in drain mode using the `node-status` command:

```
nomad node-status -self
```

Alternatively, you can drain a remote node with `nomad node-drain -enable -yes <node-id>`.

Scaling Down the Client Cluster

To set up a mechanism for clients to shutdown, first entering `drain` mode, then waiting for all jobs to be finished before terminating the client, you can configure an ASG Lifecycle Hook that triggers a script for scaling down instances.

The script should use the commands in the section above to do the following:

1. Put the instance in drain mode
2. Monitor running jobs on the instance and wait for them to finish
3. Terminate the instance