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Purpose of Terraform State

JUMP TO SECTION

State is a necessary requirement for Terraform to function. It is often asked if it is possible for Terraform to work without state, or for Terraform to not use state and just inspect cloud resources on every run. This page will help explain why Terraform state is required.

As you'll see from the reasons below, state is required. And in the scenarios where Terraform may be able to get away without state, doing so would require shifting massive amounts of complexity from one place (state) to another place (the replacement concept).

Mapping to the Real World

Terraform requires some sort of database to map Terraform config to the real world. When you have a resource `resource "aws_instance" "foo"` in your configuration, Terraform uses this map to know that instance `i-abcd1234` is represented by that resource.

For some providers like AWS, Terraform could theoretically use something like AWS tags. Early prototypes of Terraform actually had no state files and used this method. However, we quickly ran into problems. The first major issue was a simple one: not all resources support tags, and not all cloud providers support tags.

Therefore, for mapping configuration to resources in the real world, Terraform uses its own state structure.

Terraform expects that each remote object is bound to only one resource instance, which is normally guaranteed by Terraform being responsible for creating the objects and recording their identities in the state. If you instead import objects that were created outside of Terraform, you'll need to check yourself that each distinct object is imported to only one resource instance.

If one remote object is bound to two or more resource instances then Terraform may take unexpected actions against those objects, because the mapping from configuration to the remote object state has become ambiguous.

Metadata

Alongside the mappings between resources and remote objects, Terraform must also track metadata such as resource dependencies.

Terraform typically uses the configuration to determine dependency order. However, when you delete a resource from a Terraform configuration, Terraform must know how to delete that resource. Terraform can see that a mapping exists for a resource not in your configuration and plan to destroy. However, since the configuration no longer exists, the order cannot be determined from the configuration alone.

To ensure correct operation, Terraform retains a copy of the most recent set of dependencies within the state. Now Terraform can still determine the correct order for destruction from the state when you delete one or more items from the configuration.

One way to avoid this would be for Terraform to know a required ordering between resource types. For example, Terraform could know that servers must be deleted before the subnets they are a part of. The complexity for this approach quickly explodes, however: in addition to Terraform having to understand the ordering semantics of every resource for every cloud, Terraform must also understand the ordering *across providers*.

Terraform also stores other metadata for similar reasons, such as a pointer to the provider configuration that was most recently used with the resource in situations where multiple aliased providers are present.

Performance

In addition to basic mapping, Terraform stores a cache of the attribute values for all resources in the state. This is the most optional feature of Terraform state and is done only as a performance improvement.

When running a `terraform plan`, Terraform must know the current state of resources in order to effectively determine the changes that it needs to make to reach your desired configuration.

For small infrastructures, Terraform can query your providers and sync the latest attributes from all your resources. This is the default behavior of Terraform: for every plan and apply, Terraform will sync all resources in your state.

For larger infrastructures, querying every resource is too slow. Many cloud providers do not provide APIs to query multiple resources at once, and the round trip time for each resource is hundreds of milliseconds. On top of this, cloud providers almost always have API rate limiting so Terraform can only request a certain number of resources in a period of time. Larger users of Terraform make heavy use of the `-refresh=false` flag as well as the `-target` flag in order to work around this. In these scenarios, the cached state is treated as the record of truth.

Syncing

In the default configuration, Terraform stores the state in a file in the current working directory where Terraform was run. This is okay for getting started, but when using Terraform in a team it is important for everyone to be working with the same state so that operations will be applied to the same remote objects.

Remote state (/docs/language/state/remote.html) is the recommended solution to this problem. With a fully-featured state backend, Terraform can use remote locking as a measure to avoid two or more different users accidentally running Terraform at the same time, and thus ensure that each Terraform run begins with the most recent updated state.