**Terraform Interview Questions and Answers Part 1**

**1. What is the purpose of Terraform state? Why is it important in large environments?**

**Answer:**  
Terraform state is a critical component that tracks the current infrastructure managed by Terraform. It acts as a source of truth for resource mappings, dependencies, and metadata. In large environments, it enables:

* **Resource tracking**: Maintains bindings between resources and their configurations.
* **Performance**: Reduces the need for querying cloud providers.
* **Dependency management**: Enables ordering and correct application of changes.
* **Collaboration**: When stored remotely (e.g., in an S3 bucket), multiple team members can collaborate using the same infrastructure definition.

Without proper state handling, Terraform might attempt to recreate or delete resources, leading to configuration drifts or outages.

**Best practices include**:

* Always use remote backends like S3 with state locking via DynamoDB.
* Avoid manually editing the state file.

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**2. Explain the difference between terraform plan and terraform apply.**

**Answer:**

* terraform plan: Shows the changes Terraform will make to infrastructure **without actually applying** them. It provides a safe preview of add/modify/delete operations.
* terraform apply: Executes the plan and applies changes to real infrastructure.

**Why it's important**:

* Helps avoid unexpected changes.
* Ensures safer deployment pipelines when paired with terraform plan -out=tfplan followed by terraform apply tfplan.

This two-step process allows infrastructure changes to be reviewed and approved before execution, especially in CI/CD environments.

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**3. How does Terraform handle drift detection?**

**Answer:**  
Drift occurs when the actual infrastructure deviates from Terraform state. Terraform detects this during a terraform plan by comparing:

* The current state (stored locally or remotely)
* The actual resources queried from the provider

If any manual changes (e.g., a security group rule deleted manually in AWS) are found, Terraform will flag them as "changes" in the plan to restore the desired state.

However, Terraform doesn’t alert you passively—you must run terraform plan regularly or automate drift detection using tools like Terraform Cloud or Sentinel policies.

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**4. What are Terraform modules and why should you use them?**

**Answer:**  
Modules in Terraform are reusable containers for multiple resources that serve a specific purpose. They help:

* **DRY principle**: Reduce code duplication.
* **Consistency**: Standardize deployments (e.g., a VPC module can be reused across environments).
* **Maintainability**: Central updates affect all usage locations.
* **Team collaboration**: Teams can build and share modules through registries or Git.

A module has its own main.tf, variables.tf, outputs.tf, and optionally versions.tf. Modules can be local, remote (Git), or public (Terraform Registry).

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**5. What is terraform taint and how is it used?**

**Answer:**  
terraform taint is a command used to manually mark a resource for recreation during the next apply.

**Example**:

terraform taint aws\_instance.web

This tells Terraform that the current instance should be destroyed and re-created, even if no changes are detected.

**Use cases**:

* Force recreation of problematic resources.
* Apply patches not covered in code.

Note: As of Terraform v0.15+, it’s deprecated in favor of the terraform apply -replace=RESOURCE flag.

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**6. Explain the lifecycle block in Terraform and its usage.**

**Answer:**  
The lifecycle block allows fine-grained control over how resources behave during creation, update, and deletion.

**Common arguments**:

* prevent\_destroy: Prevents resource destruction.
* create\_before\_destroy: Useful in cases like immutable infra where the new resource should be ready before tearing down the old.
* ignore\_changes: Ignores specified attributes from triggering changes.

**Example**:

resource "aws\_instance" "example" {

ami = "ami-123"

instance\_type = "t2.micro"

lifecycle {

prevent\_destroy = true

ignore\_changes = [tags]

}

}

This block ensures protection from accidental deletions and change noise.

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**7. What is the difference between count and for\_each in Terraform?**

**Answer:**

| **Feature** | **count** | **for\_each** |
| --- | --- | --- |
| Input | Number (integer) | Map or set of strings |
| Indexing | count.index | Key or element (each.key) |
| Suitability | Identical resources | Resources that vary by keys |
| Flexibility | Less flexible | More flexible and descriptive |

**Example using for\_each:**

resource "aws\_s3\_bucket" "buckets" {

for\_each = toset(["dev", "prod", "stage"])

bucket = "my-${each.key}-bucket"

}

Use for\_each when working with named resources; count for identical iterations.

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**8. How can you manage multiple environments in Terraform?**

**Answer:**  
Multiple environments (e.g., dev, test, prod) can be handled via:

1. **Workspaces**: Native feature. Each workspace has its own state.
   * Command: terraform workspace new dev
2. **Directory structure**:
3. └── environments
4. ├── dev
5. └── prod

Each directory has its own .tfvars and state.

1. **Terragrunt**: Wrapper over Terraform that simplifies environment management.
2. **Backend separation**: Each environment uses a different state backend configuration.

Using directories with terraform.tfvars files is the most flexible and preferred in large orgs for clarity and GitOps.

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**9. What are backends in Terraform and name some commonly used ones?**

**Answer:**  
A backend in Terraform defines **where state is stored** and how operations like plan/apply are executed.

Common backends:

* **local** (default): State stored on disk.
* **s3** + **DynamoDB** (for locking): Common in AWS environments.
* **azurerm**: Azure Blob Storage.
* **gcs**: Google Cloud Storage.
* **remote**: Terraform Cloud or Enterprise.

**Example of S3 backend**:

terraform {

backend "s3" {

bucket = "my-tf-state"

key = "prod/terraform.tfstate"

region = "us-east-1"

dynamodb\_table = "terraform-locks"

}

}

Backends enable **collaboration, locking, and secure storage** of state files.

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**10. How do you manage secrets in Terraform securely?**

**Answer:**  
Secrets in Terraform should never be hardcoded. Instead:

* **Use environment variables**:
  + TF\_VAR\_db\_password="supersecret"
* **Leverage secret managers**:
  + AWS Secrets Manager, Azure Key Vault, HashiCorp Vault
* **Use data sources to fetch secrets** dynamically.
* **Avoid storing state files locally**, as they may contain sensitive output.
* **Use input variables with sensitive = true** to hide values.

**Example**:

variable "db\_password" {

type = string

sensitive = true

}

Additionally, use tools like sops, mojito, or helm-secrets when combining with Kubernetes/Helm charts.

**11. How does Terraform handle dependency management between resources?**

**Answer:**  
Terraform uses a **dependency graph** to determine the correct order in which resources should be created, updated, or destroyed.

* **Implicit dependencies**: Inferred from references in code.
* resource "aws\_instance" "web" {
* subnet\_id = aws\_subnet.main.id
* }
* **Explicit dependencies**: Defined using the depends\_on attribute.
* resource "aws\_instance" "web" {
* depends\_on = [aws\_security\_group.web\_sg]
* }

The graph ensures correct sequencing and parallel execution where possible, improving performance and avoiding race conditions.

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**12. What are dynamic blocks in Terraform and when should you use them?**

**Answer:**  
Dynamic blocks allow creation of nested repeated configurations dynamically. They are useful when nested blocks (like ingress, tags) must be generated based on variable input.

**Example**:

variable "ports" {

type = list(number)

}

resource "aws\_security\_group" "example" {

dynamic "ingress" {

for\_each = var.ports

content {

from\_port = ingress.value

to\_port = ingress.value

protocol = "tcp"

cidr\_blocks = ["0.0.0.0/0"]

}

}

}

This avoids redundant hardcoding of similar resource blocks.

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**13. Explain terraform import and its limitations.**

**Answer:**  
terraform import brings existing infrastructure into Terraform management.

**Example**:

terraform import aws\_instance.web i-1234567890abcdef0

**Limitations**:

* Only adds the resource to state, **does not generate configuration**.
* Requires manually writing the .tf file afterward to match the existing resource.
* Doesn’t import dependent resources automatically.

Useful during migration from manually created or legacy resources to Terraform.

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**14. What is the use of terraform graph?**

**Answer:**  
terraform graph generates a visual dependency graph of Terraform resources in DOT format.

**Usage**:

terraform graph | dot -Tpng > graph.png

It helps visualize:

* Resource dependencies
* Execution order
* Relationship bottlenecks

Helpful during debugging or in large-scale deployments to understand complex interdependencies.

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**15. How does Terraform Cloud differ from open-source Terraform?**

**Answer:**  
Terraform Cloud adds collaboration, governance, and automation features on top of Terraform OSS.

**Key differences**:

* **Remote state management**
* **VCS integration for GitOps**
* **Policy enforcement with Sentinel**
* **Terraform runs in remote agents**
* **Private module registry**

Terraform OSS runs locally without shared governance or automation features.

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**16. What is Sentinel in Terraform and where is it used?**

**Answer:**  
Sentinel is a **policy-as-code framework** used in Terraform Enterprise and Cloud to enforce governance rules.

**Example policies**:

* Prevent public S3 buckets
* Restrict instance sizes
* Enforce tagging standards

Policies are written in Sentinel language and enforce rules at:

* Plan
* Apply
* Destroy phases

Sentinel ensures compliance before changes are pushed to production.

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**17. How do you use terraform workspace and what are its limitations?**

**Answer:**  
Workspaces isolate Terraform state files within the same configuration.

**Commands**:

terraform workspace new dev

terraform workspace select prod

**Limitations**:

* Same configuration/code used for all workspaces.
* No full environment isolation (unlike directory-based separation).
* Doesn’t support separate backends per workspace easily.

Best for lightweight environment isolation; use directories for more robust separation.

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**18. How can you execute provisioners in Terraform, and what are the risks?**

**Answer:**  
Provisioners (like remote-exec, local-exec) execute scripts on resources after creation.

**Example**:

provisioner "remote-exec" {

inline = [

"sudo apt-get update",

"sudo apt-get install nginx -y"

]

}

**Risks**:

* Tightly coupled to instance behavior.
* Can introduce non-idempotent configurations.
* Troubleshooting is hard due to limited logging.

**Best practice**: Use provisioners only as a last resort. Prefer configuration management tools (Ansible, Chef).

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**19. What are some best practices for writing reusable Terraform modules?**

**Answer:**

* Use **clear inputs and outputs**.
* Provide **default values** when possible.
* Keep modules **small and focused** (e.g., vpc, rds).
* Include versioning in modules (source = "git::...//?ref=v1.0.0").
* Write **README** documentation.
* Validate with terraform validate and terraform fmt.

This promotes reusability, maintainability, and team collaboration.

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**20. How can you perform conditional logic in Terraform?**

**Answer:**  
Terraform supports if expressions using the ternary operator.

**Example**:

resource "aws\_instance" "web" {

instance\_type = var.env == "prod" ? "t3.large" : "t3.micro"

}

Additionally, use count or for\_each with conditions:

count = var.enable\_resource ? 1 : 0

For complex logic, combine with locals and dynamic blocks for clean code.

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**21. Explain terraform validate, fmt, and refresh.**

**Answer:**

* terraform validate: Checks for syntax and semantic errors in configuration.
* terraform fmt: Formats Terraform files in canonical style.
* terraform refresh: Updates state with real-world infrastructure, useful for drift detection.

Use them in pre-commit hooks or pipelines to ensure code quality and consistency.

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**22. What is terraform lock.hcl and how does it help?**

**Answer:**  
terraform.lock.hcl is generated by terraform init and records provider versions used.

**Purpose**:

* Ensures provider version consistency across team members and CI/CD.
* Prevents unexpected behavior from newer versions.

It’s part of Terraform’s **dependency lock file** mechanism.

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**23. How do you upgrade a provider version in Terraform?**

**Answer:**

1. Update required\_providers block:

terraform {

required\_providers {

aws = {

source = "hashicorp/aws"

version = "~> 5.0"

}

}

}

1. Run terraform init -upgrade to fetch new version.
2. Review terraform plan for potential changes due to upgrade.

Always test provider upgrades in non-production environments first.

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**24. How do you import a resource into a module?**

**Answer:**  
To import a resource in a module:

terraform import module.module\_name.resource\_type.resource\_name resource\_id

Example:

terraform import module.ec2.aws\_instance.web i-12345678

Ensure the resource definition inside the module matches the actual resource properties for a smooth import.

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**25. What is the use of locals in Terraform?**

**Answer:**  
locals allow defining reusable values or expressions inside your configuration.

**Example**:

locals {

name\_prefix = "${var.env}-${var.app}"

}

You can reference them as local.name\_prefix throughout your code to avoid repetition and increase readability.

**26. What is the difference between terraform destroy and terraform apply -destroy?**

**Answer:**

* terraform destroy: Destroys all resources defined in the current workspace or configuration. It requires no plan file.
* terraform apply -destroy: Generates a destroy plan and then applies it, similar to a two-step plan-then-apply approach.

**Use Case**:  
apply -destroy is preferred in CI/CD or approval workflows where you want to review destruction via a plan file before execution:

terraform plan -destroy -out=tfplan

terraform apply tfplan

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**27. How can you restrict access to certain Terraform operations in a team setup?**

**Answer:**  
In Terraform Cloud or Enterprise:

* Use **Sentinel policies** to enforce guardrails.
* Assign **RBAC roles** like read-only, plan-only, or admin.
* Lock the state during runs to prevent conflicts.

In CLI setups:

* Enforce permission through **Git PR approvals**.
* Use terraform apply only in secured environments like CI/CD pipelines.

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**28. What are some challenges with managing Terraform state and how do you overcome them?**

**Answer:**  
**Challenges**:

* Conflicts during concurrent runs.
* Sensitive data in state.
* State file corruption or loss.

**Solutions**:

* Use **remote state backends** like S3 with locking (DynamoDB).
* Use **encryption** at rest and in transit.
* Back up state regularly.
* Avoid direct editing of .tfstate.

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**29. Can you run Terraform without internet access? How?**

**Answer:**  
Yes, but with limitations.

**Requirements**:

* Use **local providers** with pre-downloaded binaries.
* Use **local modules** instead of remote Git/Registry modules.

Steps:

1. Download providers via terraform init on an internet machine.
2. Copy .terraform and .terraform.lock.hcl to offline machine.
3. Use TF\_PLUGIN\_CACHE\_DIR for caching plugins.

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**30. What is a data source in Terraform and how is it different from a resource?**

**Answer:**

* **Resource**: Creates or manages an infrastructure object.
* **Data Source**: Reads and retrieves existing data from a provider **without managing it**.

**Example**:

data "aws\_ami" "latest" {

most\_recent = true

owners = ["amazon"]

filter {

name = "name"

values = ["amzn2-ami-hvm-\*"]

}

}

Data sources help integrate existing infrastructure with Terraform-managed resources.

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**31. How do you debug Terraform execution issues?**

**Answer:**

1. Use TF\_LOG=DEBUG for detailed logs.
2. Use terraform plan to inspect expected changes.
3. Use terraform show to examine current state.
4. Inspect .terraform directory for plugin and module errors.
5. Validate JSON output with terraform plan -out=tfplan && terraform show -json tfplan.

Logs can be redirected:

TF\_LOG=DEBUG terraform apply > debug.log

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**32. What is the difference between terraform output and outputs.tf?**

**Answer:**

* outputs.tf: A file containing output blocks that define what values to expose.
* terraform output: A command used to display those output values after apply.

**Example output block**:

output "vpc\_id" {

value = aws\_vpc.main.id

}

Outputs can be used in CI/CD pipelines or by other modules (via terraform\_remote\_state).

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**33. How do you share data between Terraform modules?**

**Answer:**

1. **Use Outputs** from one module and pass them as **inputs** to another.
2. module "vpc" {
3. source = "./vpc"
4. }
5. module "subnet" {
6. source = "./subnet"
7. vpc\_id = module.vpc.vpc\_id
8. }
9. **Remote state**: Share output across separate Terraform configurations via data block.

data "terraform\_remote\_state" "vpc" {

backend = "s3"

config = {

bucket = "state-bucket"

key = "vpc/terraform.tfstate"

region = "us-east-1"

}

}

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**34. What are the risks of using ignore\_changes in the lifecycle block?**

**Answer:**  
While ignore\_changes prevents Terraform from managing certain attributes, it introduces **configuration drift**.

**Risks**:

* Hidden changes in infrastructure.
* Terraform will no longer detect updates made outside code.
* Might miss security misconfigurations (e.g., open ports).

Use it carefully and only for attributes that are known to change often (e.g., user\_data, tags).

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**35. What is the benefit of terraform plan -out?**

**Answer:**

* It **generates a plan file** that can be reviewed and applied later.
* Ensures **what you apply is exactly what was reviewed**.
* Helps in **change approval processes** and CI/CD pipelines.

Example:

terraform plan -out=review.plan

terraform apply review.plan

Prevents the risk of last-minute configuration drift or variable changes.

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**36. How do you pass secrets to Terraform securely in CI/CD?**

**Answer:**

* Use **environment variables** (TF\_VAR\_secret\_key).
* Integrate with **secret managers** like Vault, AWS Secrets Manager.
* Use **secure CI/CD vaults** (GitHub Secrets, GitLab Variables).
* Mark sensitive variables with sensitive = true.

**Example**:

env:

TF\_VAR\_db\_password: ${{ secrets.DB\_PASSWORD }}

Avoid hardcoding secrets in .tf files or version control.

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**37. How do you handle Terraform in a monorepo with multiple teams?**

**Answer:**

* Use **separate directories/modules** per team or application.
* Use **workspaces or separate backends** for isolation.
* Implement **CI pipelines per subfolder**.
* Use terragrunt to manage DRY patterns across modules.
* Apply code owners and review policies in Git.

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**38. Can you create a resource conditionally in Terraform?**

**Answer:**  
Yes, using count or for\_each with a conditional expression.

resource "aws\_instance" "example" {

count = var.create\_instance ? 1 : 0

}

Access the resource with:

aws\_instance.example[0].id

Be cautious: Referencing a resource with count = 0 requires array indexing to avoid null errors.

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**39. What are null resources in Terraform and when should you use them?**

**Answer:**  
A null\_resource is used for actions that are not tied to a real infrastructure resource (e.g., running scripts).

resource "null\_resource" "example" {

provisioner "local-exec" {

command = "echo Hello"

}

}

**Use cases**:

* Run scripts
* Trigger builds
* Bridge with external tools

They should be avoided for critical infrastructure logic.

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**40. How do you use Terraform to provision infrastructure across multiple cloud providers?**

**Answer:**

* Use separate **provider blocks** for each cloud.
* Use **aliases** to distinguish between providers.

provider "aws" {

alias = "aws1"

region = "us-east-1"

}

provider "azurerm" {

features = {}

}

Specify the provider at resource level:

resource "aws\_instance" "example" {

provider = aws.aws1

}

Terraform supports multi-cloud natively, allowing hybrid cloud setups.

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**41. How do you test Terraform modules?**

**Answer:**  
Use tools like:

* **Terratest** (Go-based): Infrastructure testing.
* **Kitchen-Terraform**: Test Kitchen with InSpec.
* **Checkov**: Static analysis and policy checks.
* **tflint**: Linter for Terraform code.

Also use terraform validate, plan, and apply in isolated environments for manual testing.

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**42. How do you manage Terraform state versioning and backups?**

**Answer:**

* Use **remote backends** (S3, Terraform Cloud) that support versioning.
* Enable **S3 versioning** to recover from accidental state corruption.
* Use terraform state pull to back up local state periodically.
* Audit changes using terraform show on older versions.

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**43. What are input validation rules in Terraform?**

**Answer:**  
Terraform 0.13+ supports validation blocks inside variables.

**Example**:

variable "region" {

type = string

validation {

condition = contains(["us-east-1", "us-west-1"], var.region)

error\_message = "Region must be us-east-1 or us-west-1."

}

}

Prevents bad values during terraform apply.

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**44. What is terraform state rm and when would you use it?**

**Answer:**  
Removes a resource from the Terraform state file **without deleting** it in real infrastructure.

**Example**:

terraform state rm aws\_instance.orphaned

Use case: Detach a resource you want to manage manually or re-import later.

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**45. How can you use count and for\_each together in Terraform?**

**Answer:**  
You cannot use both in the same resource, but can mix them in a module or different resource definitions.

# Using count

resource "aws\_s3\_bucket" "count\_example" {

count = 2

bucket = "bucket-${count.index}"

}

# Using for\_each

resource "aws\_s3\_bucket" "each\_example" {

for\_each = toset(["dev", "prod"])

bucket = "bucket-${each.key}"

}

Choose based on your need: index-based vs key-based iteration.

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**46. What’s the difference between terraform state list and terraform show?**

**Answer:**

* terraform state list: Lists all resources in the current state.
* terraform show: Provides full detail of the state file (in HCL or JSON).

**Use cases**:

* list: Find resource addresses.
* show: Debug values and metadata.

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**47. Can Terraform modules be nested? How does this affect state?**

**Answer:**  
Yes, modules can call other modules (nested modules). Each nested module’s resources are tracked in the **same state file**, under their full address (e.g., module.network.module.subnets.aws\_subnet.main).

Helps organize code, but overly nested modules can increase complexity.

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**48. How do you roll back changes in Terraform if something goes wrong?**

**Answer:**

* **State-based rollback** is not automatic.
* Options:
  + Use versioned backend (like S3) to roll back state.
  + Revert .tf code and re-apply.
  + Use terraform destroy to remove bad changes.
  + Take backups of state before risky changes.

Terraform lacks an in-built rollback like Kubernetes.

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**49. What are precondition and postcondition blocks in Terraform 1.2+?**

**Answer:**  
They validate expectations before and after resource creation.

**Example**:

resource "aws\_s3\_bucket" "example" {

bucket = var.bucket\_name

lifecycle {

precondition {

condition = length(var.bucket\_name) > 5

error\_message = "Bucket name must be longer than 5 characters"

}

}

}

Improves control and safety of configurations.

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**50. How do you manage multiple provider versions in the same configuration?**

**Answer:**  
Use **provider aliases** and specify different versions via required\_providers.

terraform {

required\_providers {

aws = {

source = "hashicorp/aws"

version = "~> 4.0"

}

}

}

provider "aws" {

alias = "old"

region = "us-east-1"

}

Allows managing legacy and new resources in the same project with different provider versions.

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