Cloud Computing

Course plan

Learning session 1

Intro

What is cloud

“What Is Cloud” lecture plan

- What do we need to run a product?
- Pitfalls of on-premise solutions
- What is Cloud?
- Cloud types
- Cloud pros/cons
- Cloud Resource Management

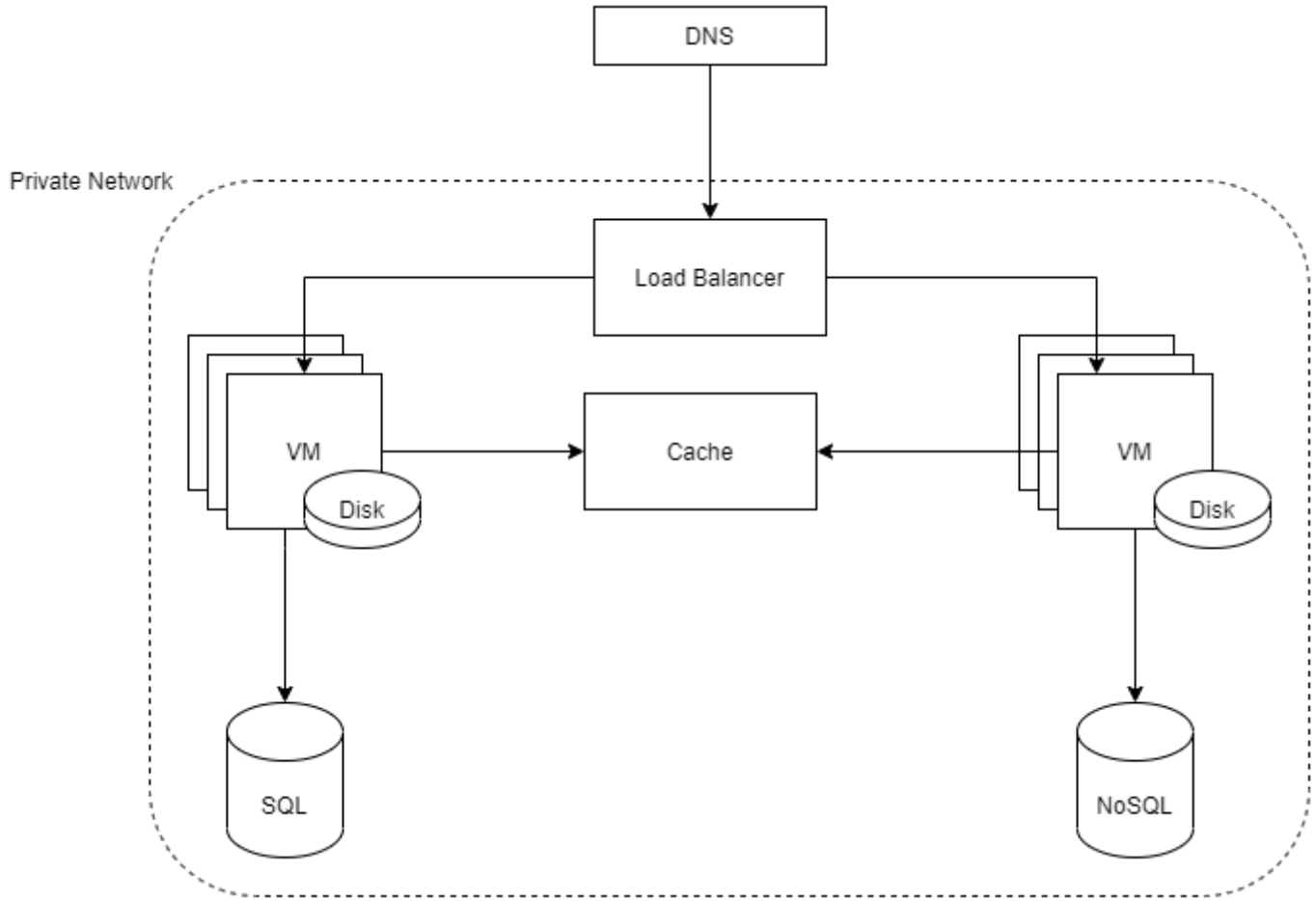
What do we need to run a Product?

What do we need to run a Product?

Product examples:

- Global:
  - Dropbox
  - Slack
  - Amazon (shop)
- Small:
  - Local shop homepage
  - https://declarations.com.ua/en/

What do we need to run a Product?



What do we need to run a Product?

On-premise - hardware, which is managed by a product team

Pitfalls of on-premise solutions

Pitfalls of on-premise solutions

Manage VM

- Add a new machine or replace existing
- Patch OS or software
- Handle load spikes

Pitfalls of on-premise solutions

Manage network and security

- Connectivity and network bandwidth
- Networking software and rules

Pitfalls of on-premise solutions

Manage physical infrastructure

- Electricity, cooling
- Natural disasters and wars (or just leaking roof)
- Legal issues

Pitfalls of on-premise solutions

Add a new service type

- Provision infrastructure resources
- Learn how to manage new service type

What is Cloud?

What is Cloud?

Cloud is someone else's computers

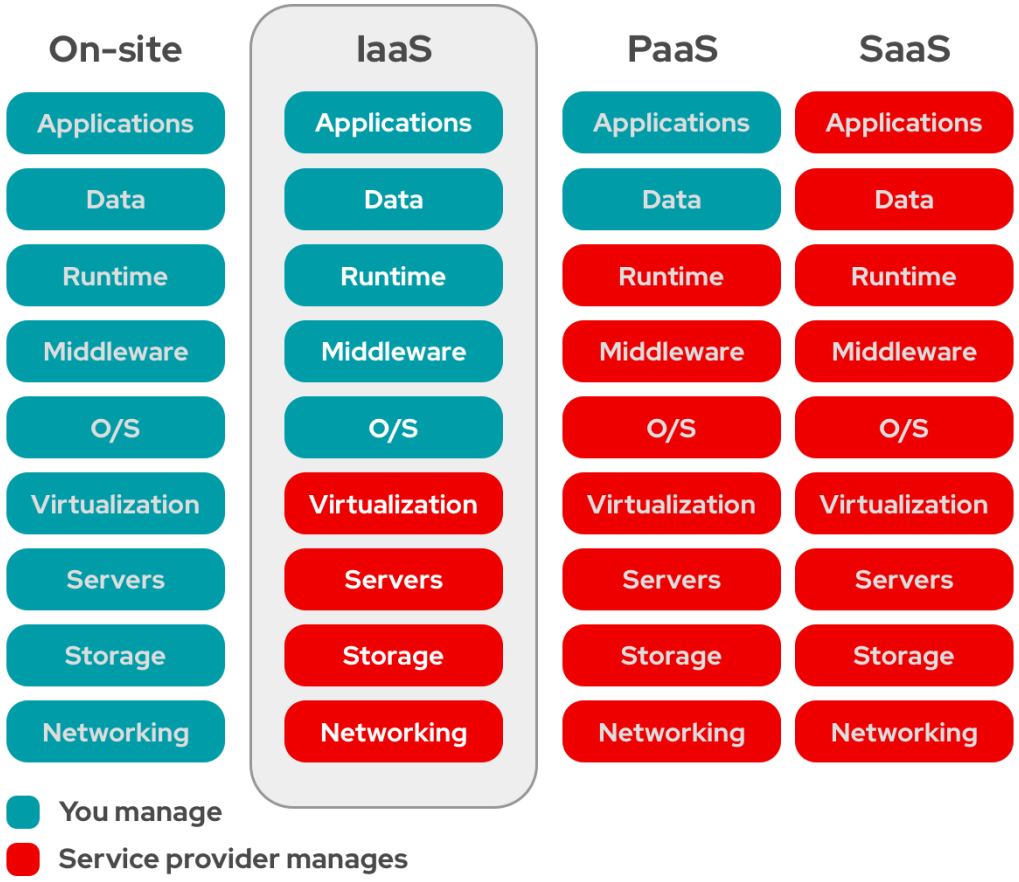
Cloud is a pool of resources, provisioned and managed by a third-party

What is Cloud?

Clouds could be grouped:

- By owner
  - Public (shared among several customers)
  - Private (one customer)
  - Hybrid
- By type
  - Infrastructure as a Service (IaaS)
  - Platform as a Service (PaaS)
  - Software as a Service (SaaS)

What is Cloud?



https://www.redhat.com/en/topics/cloud-computing/what-is-iaas

What is Cloud?

Infrastructure as a Service (IaaS)

- Managed VMs, Storage, Network
- hosted in **Data Centers**,
- that are organized into **Availability Zones**,
- and provisioned in multiple **Regions**

p.s.
Also, interface to provision, scale, deprovision resources

What is Cloud?

IaaS examples

- AWS
- Azure
- GCE
- Digital Ocean
- …

What is Cloud?

- AWS regions vs Azure regions vs GCP regions
- Azure underwater Data Center

What is Cloud?

When to use IaaS

- You want to control your software, but you do not want to bother with hardware
- Scalability and agility: ready-to-go resources at any point in time
- (often) cost efficiency: pay-as-you-go, pre-paid, spot-instances

What is Cloud?

There are small and big IaaS providers

- small providers often are cheaper
- but big providers get more customers:
  - they offer more services
  - more engineers know how to use them
  - often, they are easier to use

What is Cloud?

Platform as a Service (PaaS)

- A set of integrated services to cover a complete business use-case
- Opinionated user-flow

What is Cloud?

PaaS examples:

- Heroku
- Google App Engine
- IoT Platforms: Everyware Cloud, Azure IoT Hub, …
- AWS Lambda

What is Cloud?

When to use PaaS

- “One ring to rule them all” – do not bother about separate apps, but use a complete platform

What is Cloud?

Software as a Service (SaaS)

- Ready to use application
- No need (or less need) to manage software
- Interface to create, update, delete your instance
- Support

What is Cloud?

SaaS examples

- DBaaS: Elastic Cloud, Confluent cloud, Redis cloud
- Slack
- Gitlab
- Office365

What is Cloud?

When to use SaaS

- You just want to use the application, but do not want to manage it
- Unique offering, which is not available otherwise
- Lack of human-resources to manage it in-house

What is Cloud?

Demo

Cloud pros and cons

Cloud pros

- Faster pace
- Less operators to manage services
- Agility
- (often) cost efficiency
- Scalability
- Shifting risk

Cloud pros and cons

What if I can … “apply cloud” to VM management?

Press a button (or run a script) to:

- restart VM and apply security patch or update
- scale in/out

Cloud pros

What if I can … “apply cloud” to physical infrastructure?

Press a button (or run a script) to:

- add new Region;
- implement geo-redundant data replication;
- change network throughput.

Cloud pros

What if I can … “apply cloud” to adding new service type?

Press a button (or run a script) to provision managed:

- database;
- workload-orchestrator;
- event-streaming service;
- data-analytics.

Cloud pros

What if I can … “apply cloud” to resource demand spikes?

- viral article/discussion/trend;
- seasonal load (holidays, black-friday)
- daily/nightly traffic

Cloud cons

- (sometimes) more expensive
- (sometimes) slower
- Less control
- Vendor locks
- Could fail not because of you ¯_(ツ)_/¯

Cloud pros and cons

Neither side is a silver bullet. It very depends on:

- TEAM
- Technical design
- Configuration
- Available resources

Cloud pros and cons

Cloud also [can fail]

Cloud pros and cons

… and be expensive

We Burnt $72K testing Firebase + Cloud Run and almost went Bankrupt [Part 1]

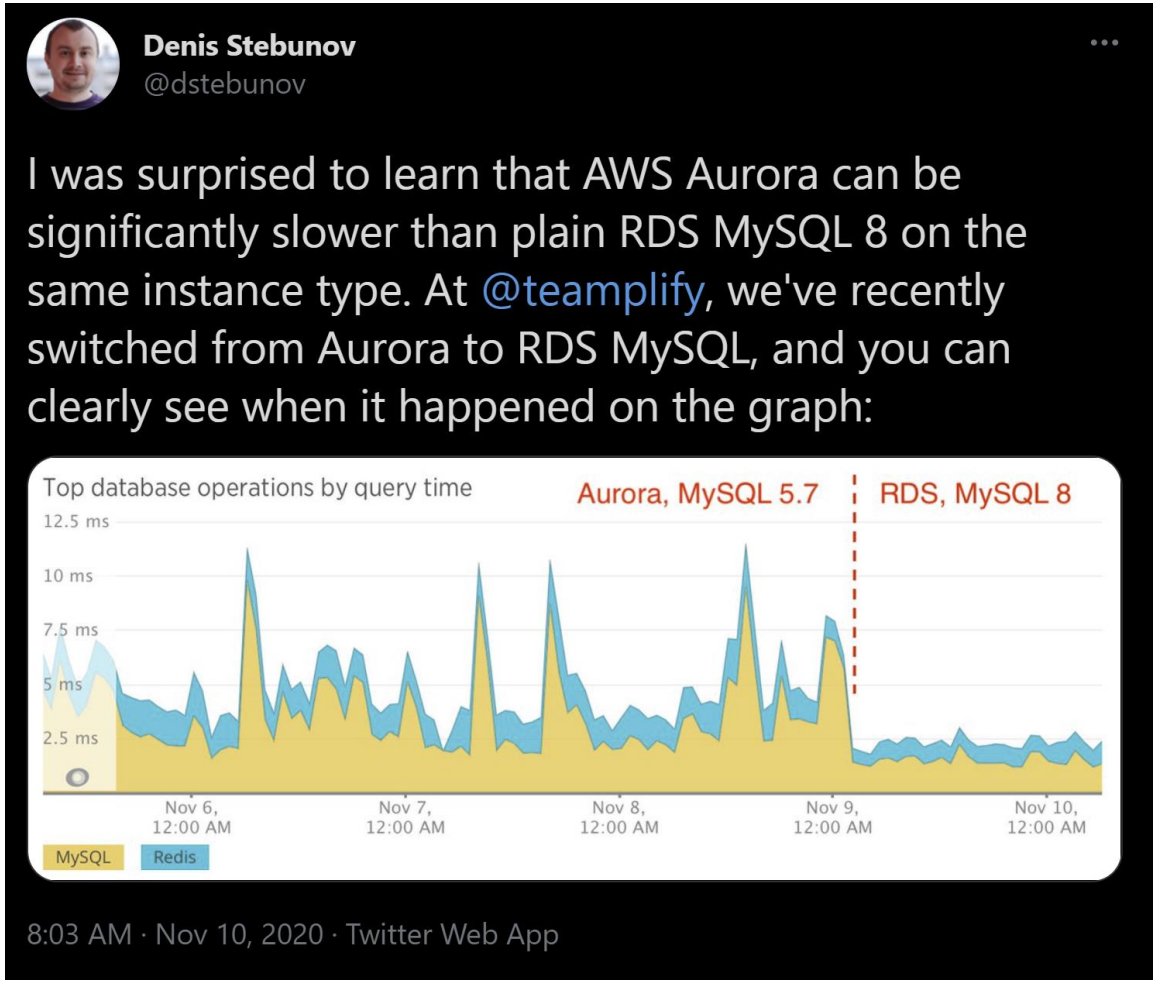
Sudeep Chauhan

About author

Dec 08, 2020 · 9 mins read

Cloud pros and cons

… and be slower



Cloud pros and cons

Sometimes, you just do not need 99.999 availability

How do you get to be 10 times cheaper than the cloud? … when you drop that requirements from 99.999% to just 99%, you are making an incredible amount of savings on the infrastructure…

Cloud pros and cons

Or your team has [enough expertise to run on-premise] with lower bill

Lesson #5: Bare-Metal vs Managed

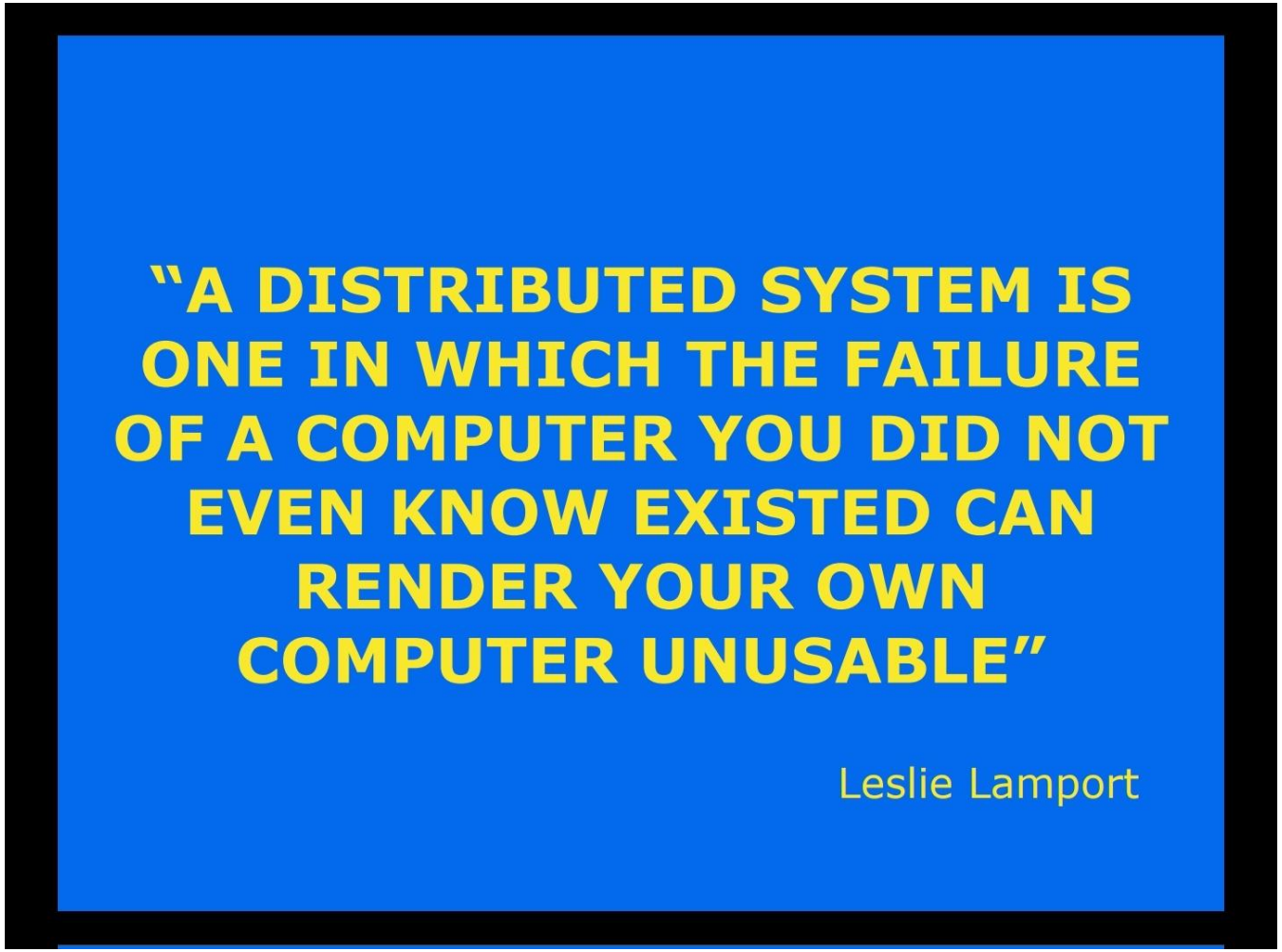
We first built our initial cluster on AWS, but we quickly realized that the cost would be too high. Storing 630TB of data on EBS, even at the cheapest possible tier, would cost 16k$/month — and that's just in EBS costs, not including any machine costs! By our estimations at the time, running on bare-metal would potentially be at least twice cheaper.

- As seen in the later *lesson #7*, bare-metal means machine monitoring at a deeper level
- Backups and data security have to be handled manually

Cloud pros and cons

… or you just have hardware already

p.s.

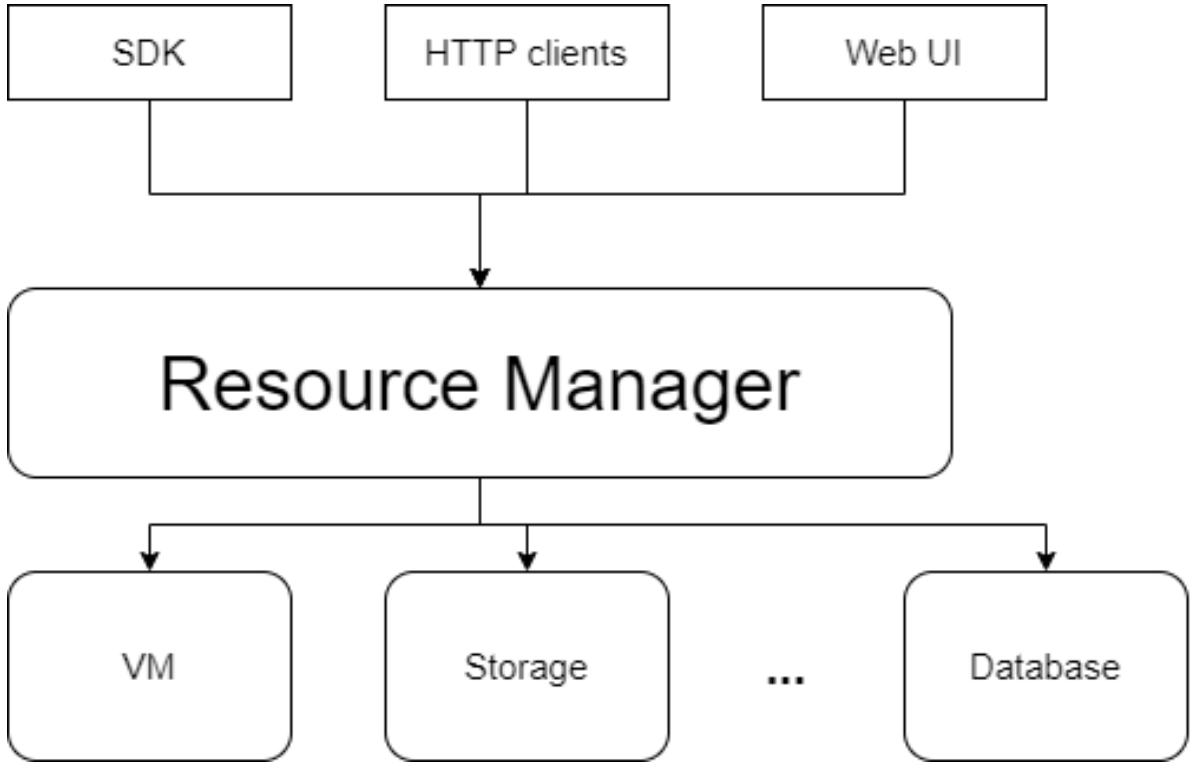

"A DISTRIBUTED SYSTEM IS ONE IN WHICH THE FAILURE OF A COMPUTER YOU DID NOT EVEN KNOW EXISTED CAN RENDER YOUR OWN COMPUTER UNUSABLE"
Leslie Lamport

Resource Management

Resource Management

- Interface to create, update, delete components
- Service to (de)provision components as a result of API request
- Monitoring

Resource Management



Resource Manager is a kind of Cloud gateway.
It gives a consistent interface to:

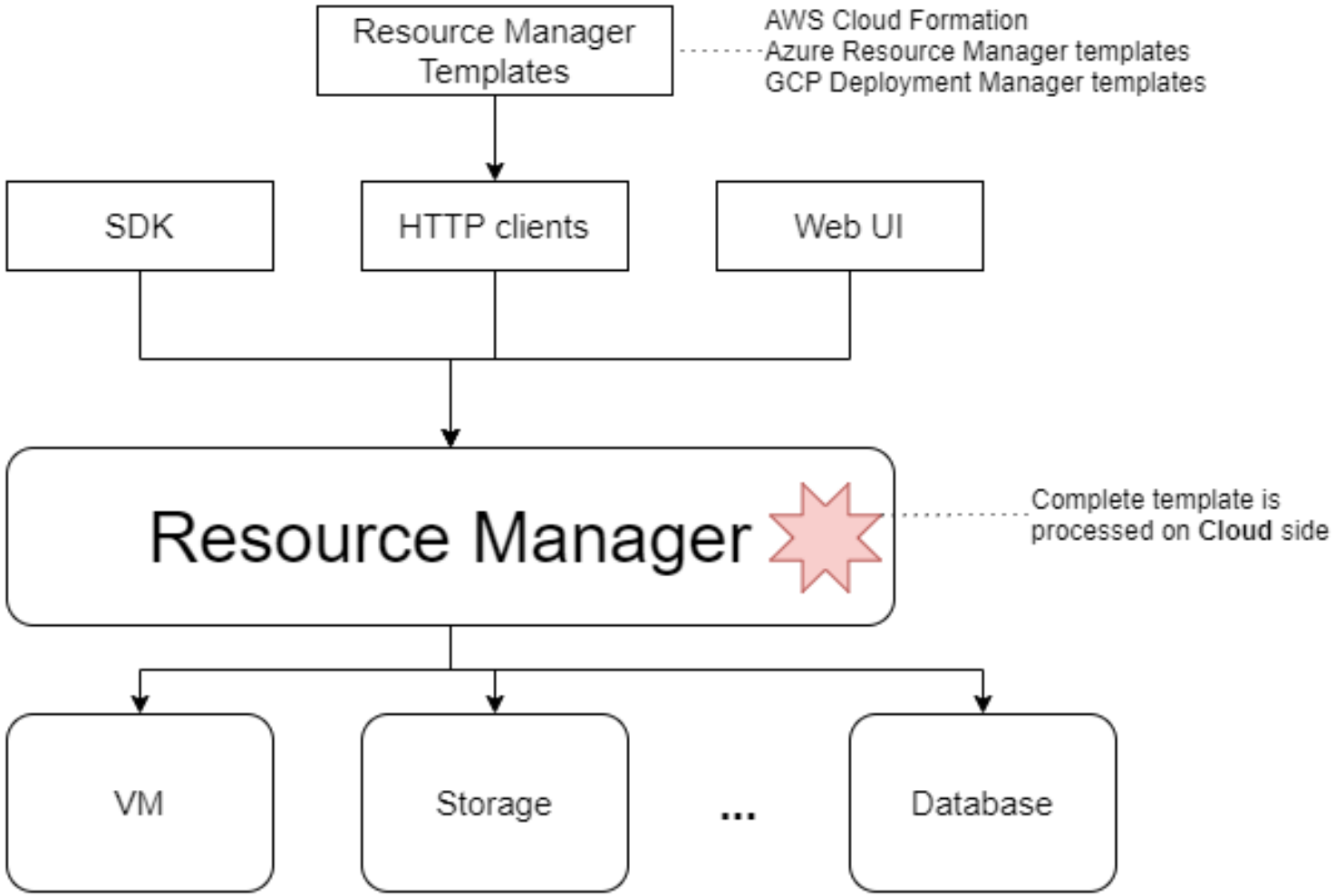
- Authenticate and authorize requests
- Validate change requests
- Predict change-set
- Retrieve components state

Resource Management

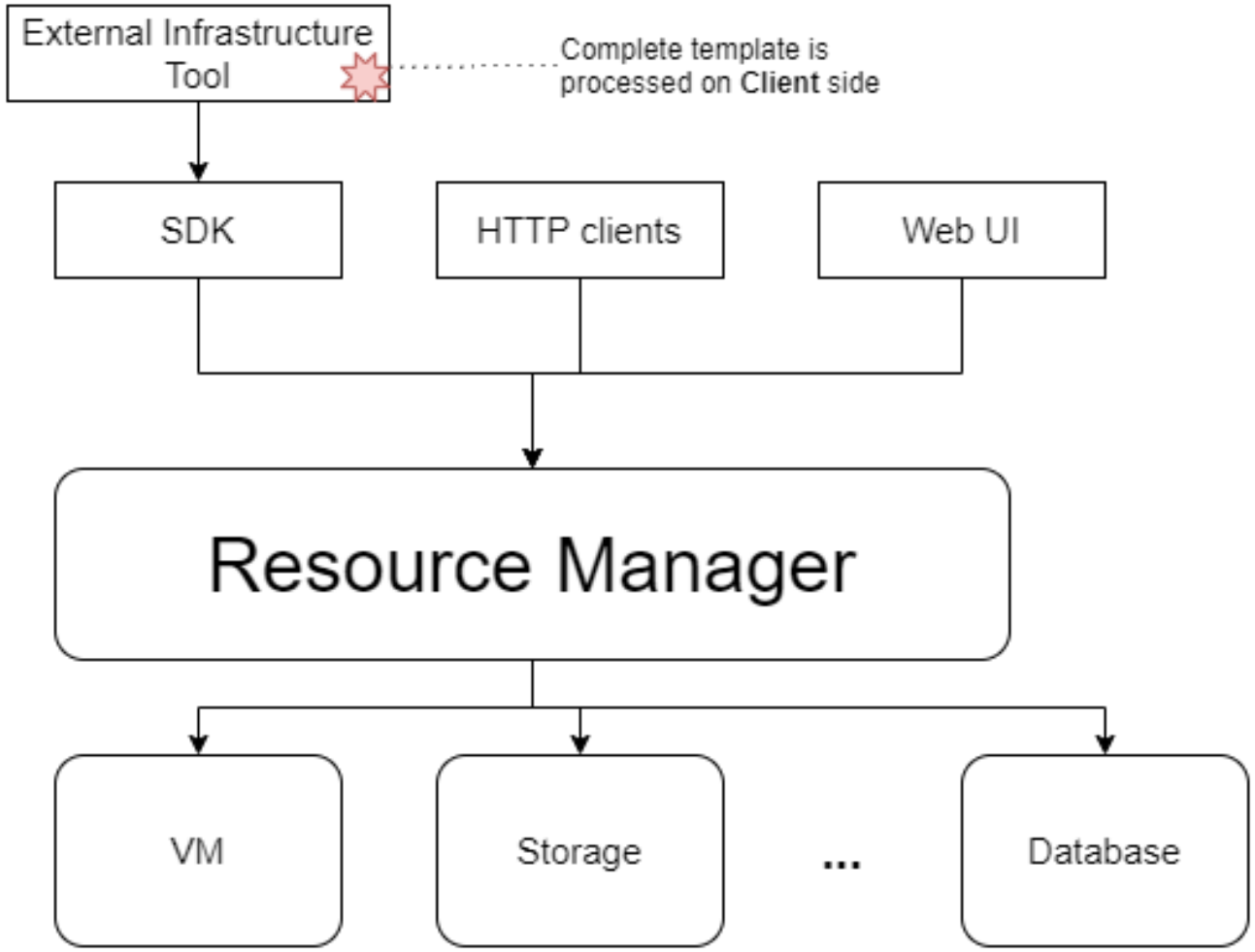
Tools:

- Native
  - aws: Cloud Formation or Cloud Development Kit
  - azure: ARM templates (is being replaced by bicep)
  - gcp: Cloud Deployment Manager
  - cli
- Terraform
- Pulumi

Resource Management



Resource Management

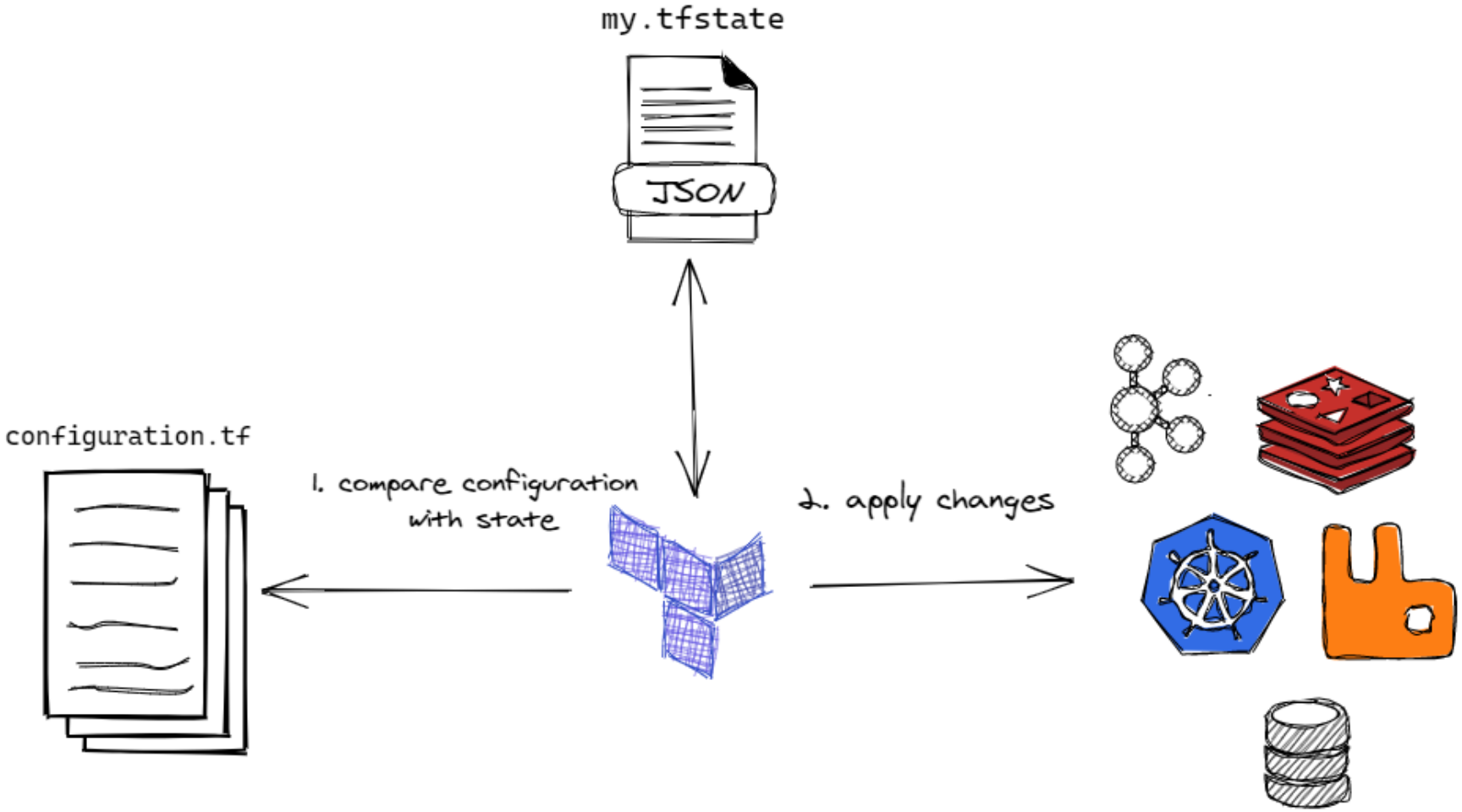


Resource Management

Why do I need a tool?

- Repeatable and predictable deployments;
- Provision a bunch of services in one go
- Store everything as a code (infrastructure, configuration, policies):
  - Validation
  - Collaboration: Pull-Requests and reviews, sharing
  - Versioning

Resource Management: terraform



Resource Management: terraform

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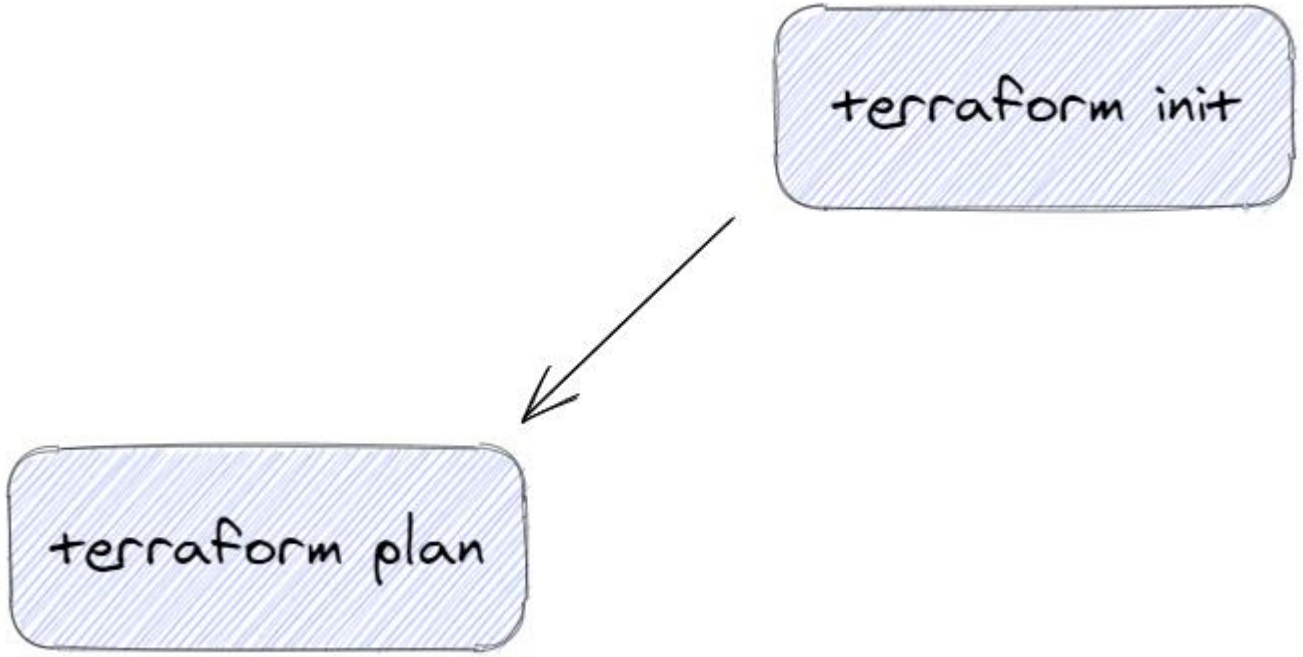

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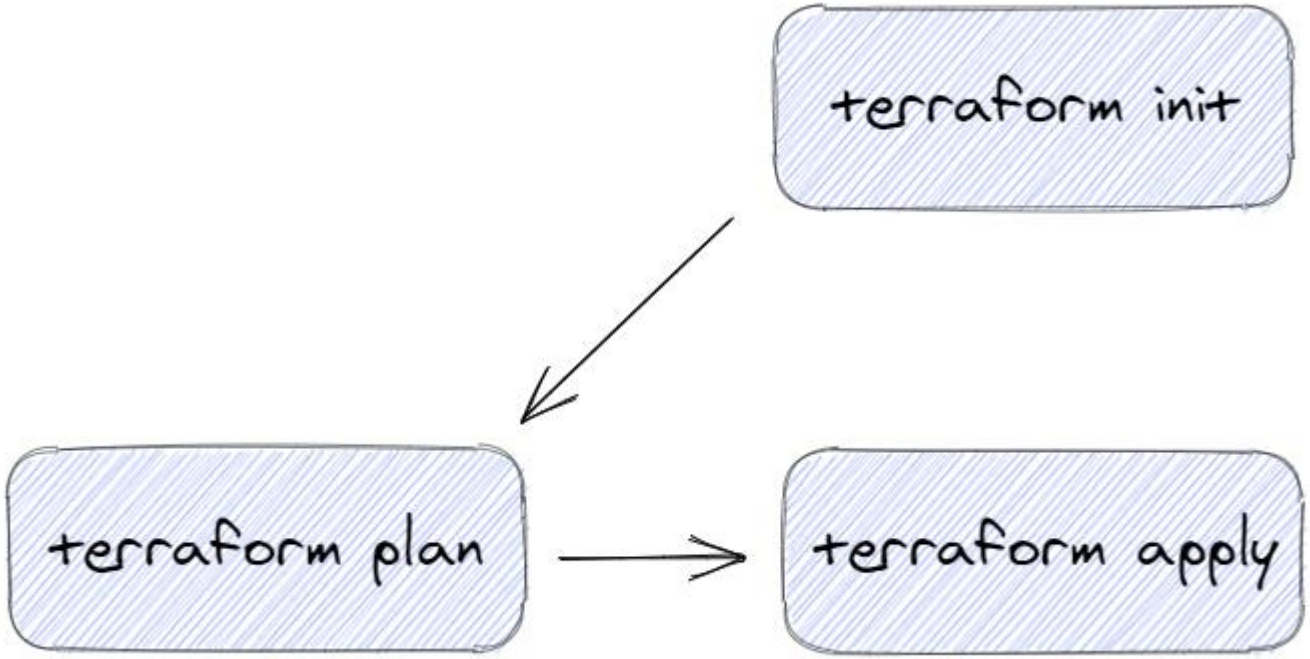

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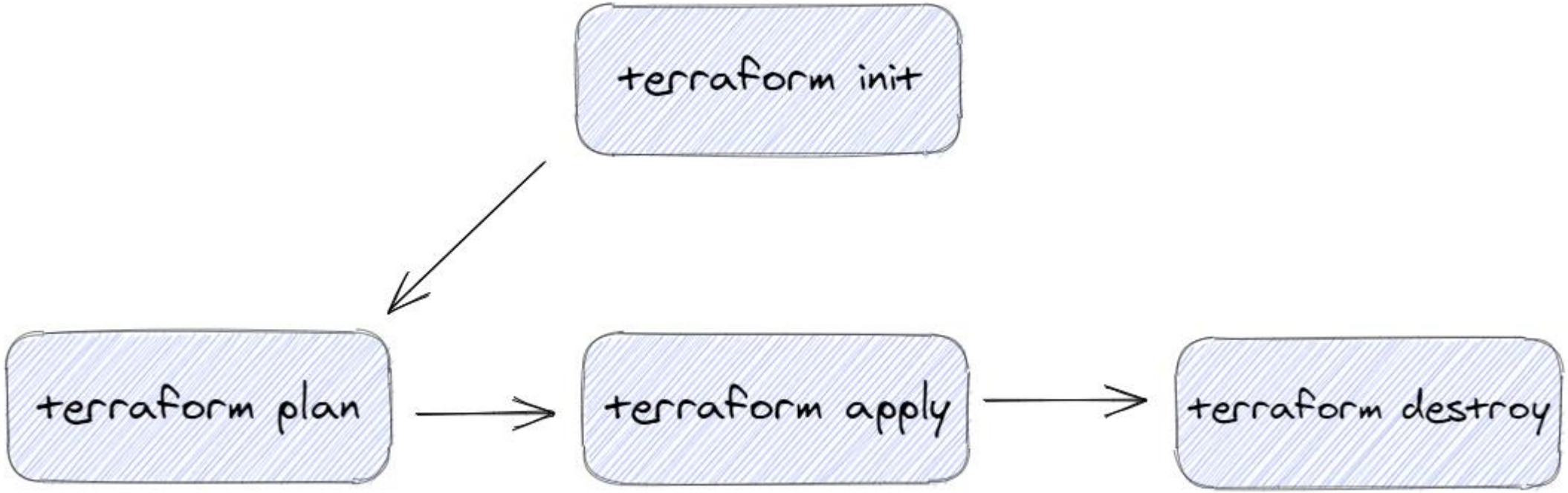

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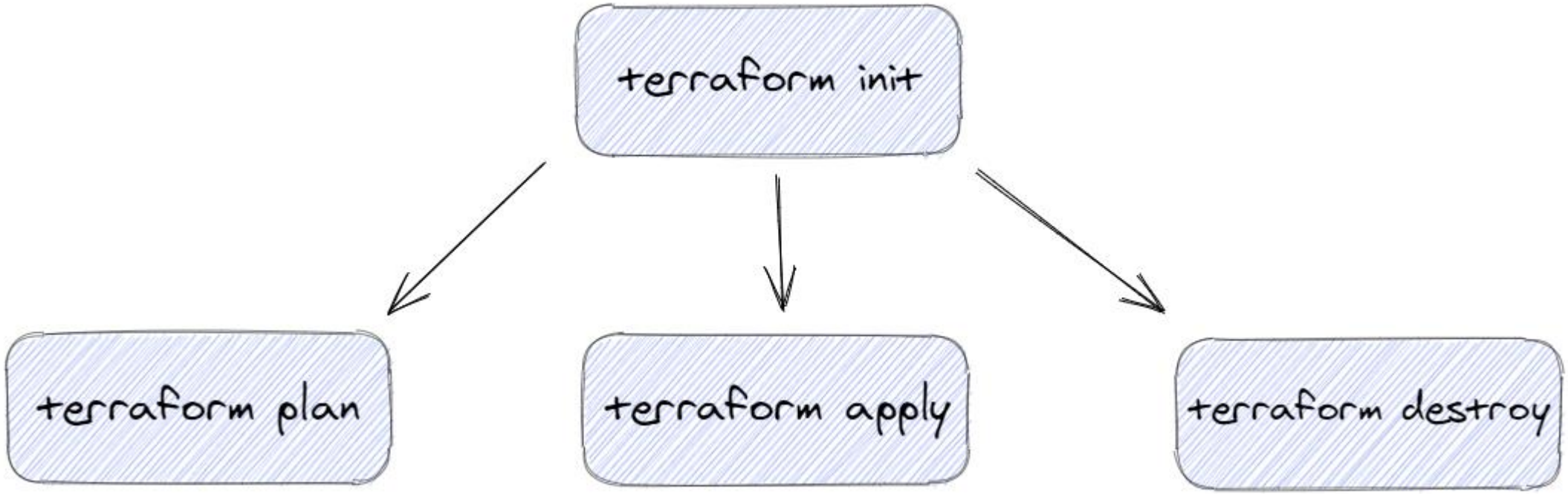

Resource Management

Demo

Summary

Summary

- On-premise: you manage it
- Cloud: someone else manages it for you
  - IaaS/SaaS/PaaS
- Both have pros and cons
- Resource management

Cloud-starter tips

- Start within free-tier
- Set billing alerts at 50-90% of your limits
- Delete services after tests
- Clouds evolve all the time. Even for services you think you know, always check docs

Cloud-starter tips

- Compare GCP to others: single table
- Compare Azure to others: GCP and AWS
- + IBM, Oracle, Alibaba at Compare Clouds

Additional materials

Recommended:

- (whitepaper) Cloud Computing definitions by National Institute of Standards and Technology
- (tutorial) https://learn.hashicorp.com/terraform

Additional materials

Optional:

- (article) Small vs Big IaaS clouds
- (article) We Burnt $72K testing Firebase: eng and ru
- Internet Archive Book Scanning uses bare-metal podcast and video
- (youtube) Google Data Center
- (youtube) What is Cloud by Scott Hanselman