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OpenStack cloud efficiently with Terraform

e-INFRA cloud team
Ing. **František Řezníček**
e-INFRA CZ conference,
Praha, 2024-04-30

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Agenda

- e-INFRA CZ cloud compute portfolio
- What to expect from IaaS OpenStack cloud?
- Find your way deploying infrastructure into cloud
- Easy, scalable, declarative & automated infrastructure deployments
- Takeaways



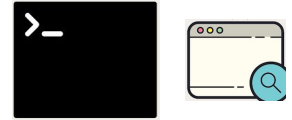
e-INFRA CZ cloud compute portfolio



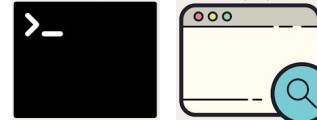
HyperQueue



- [e-INFRA CZ / MetaCentrum NGI Grid \(National Grid Infrastructure\)](#)
- [e-INFRA CZ / IT4I Supercomputer Grids](#)
- Distributed HPC / HTC grid computing (PBS, Slurm, ...)
- Entities: **grid computing jobs (wall time)**



- [e-INFRA CZ / MetaCentrum and IT4I Cloud](#)
- Infrastructure as a Service (IaaS) cloud (OpenStack)
- Entities: **Virtual servers / networks, block storage, object storage, loadbalancers, ...**



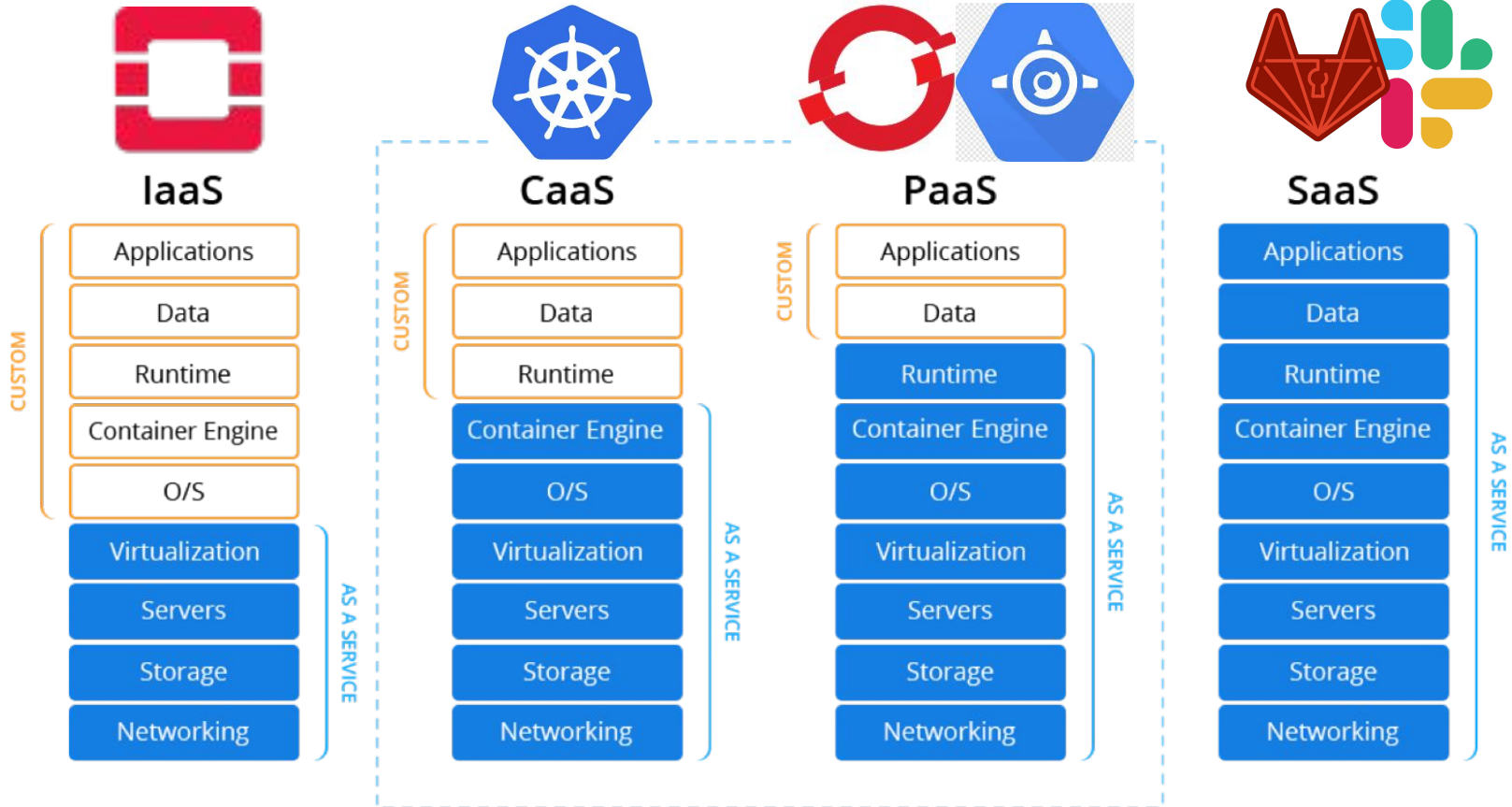
- [e-INFRA CZ / CERIT-SC container cloud](#)
- Container as a Service (CaaS) cloud (Kubernetes)
- Entities: **application containers, automated application blocks**



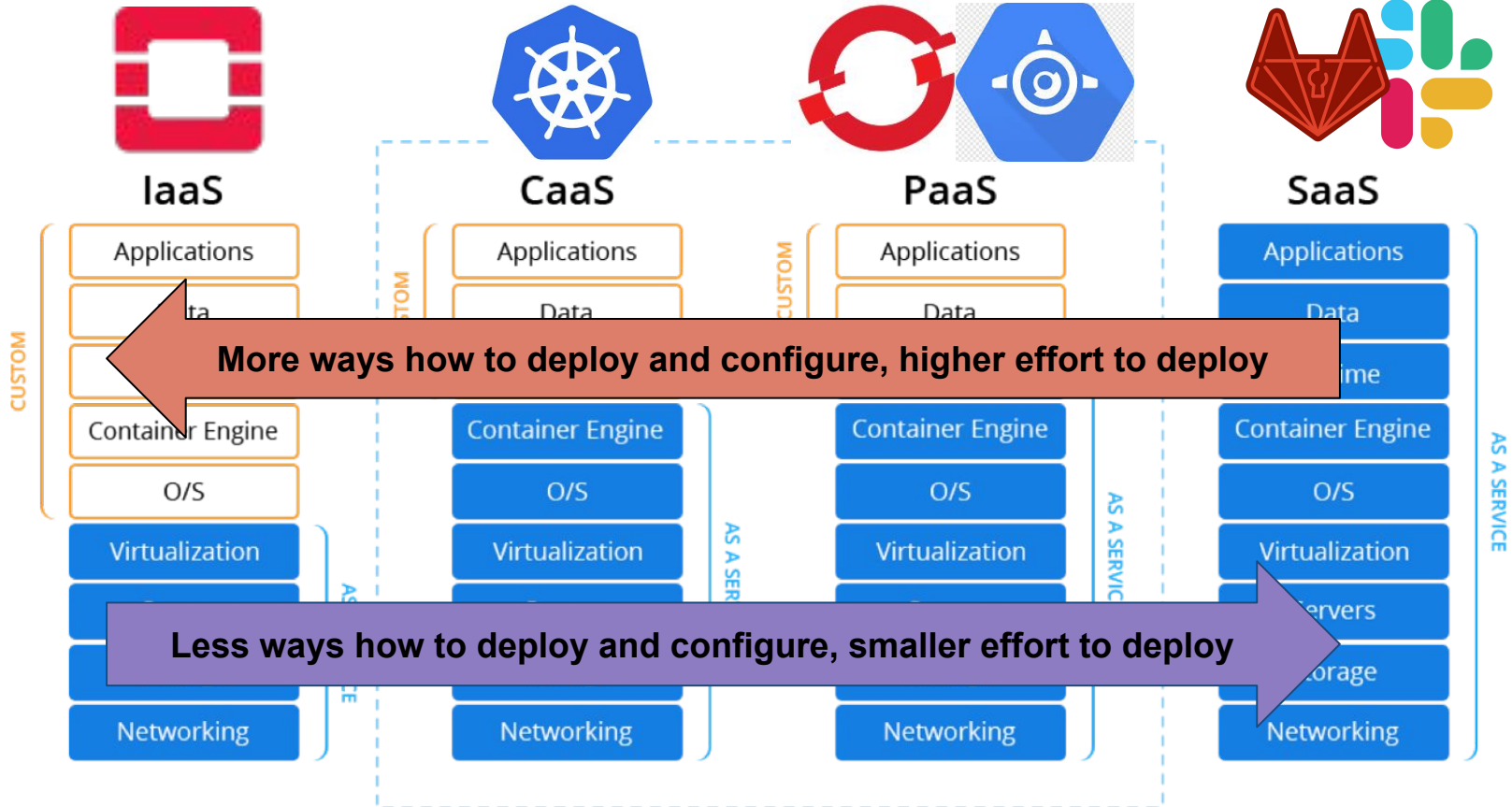
- [e-INFRA CZ / CERIT-SC \(Kubernetes\) SensitiveCloud](#)
- Secured Container as a Service (CaaS) k8s cloud environment
- Entities: **application containers, automated application blocks**



How to classify existing cloud technologies (XaaS) I



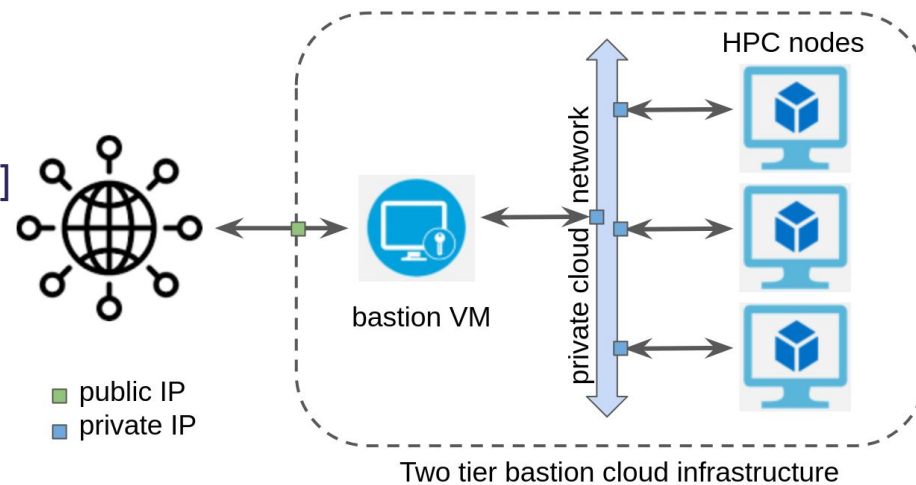
How to classify existing cloud technologies (XaaS) II



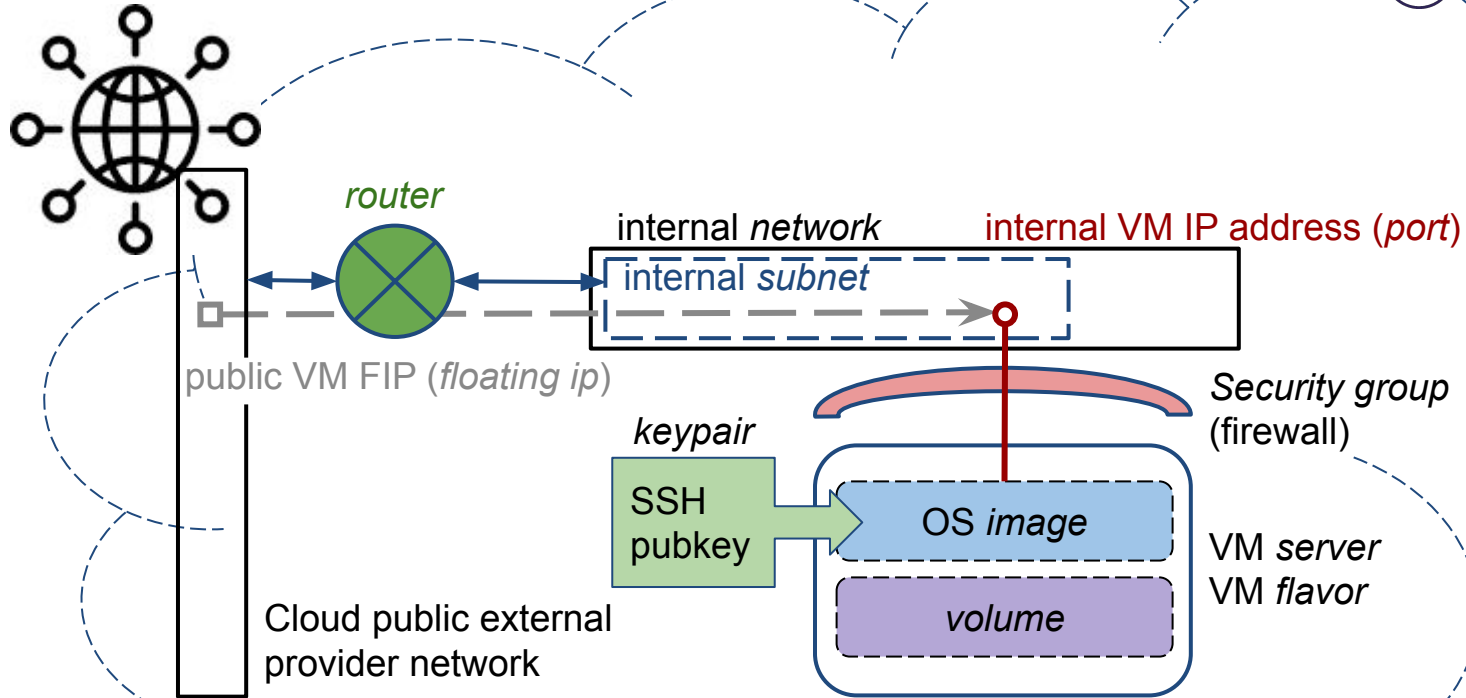
What to expect from IaaS OpenStack cloud?



- e-INFRA CZ / MetaCentrum (OpenStack) Cloud users are
- working in
 - (free-tier) personal projects
 - group projects
- creating infrastructure using
 - **Virtual servers**
 - **Virtual block / object storage**
 - Virtual networking (pre-created)
- **Computation jobs or services need to be deployed into virtual servers** after server[s] are provisioned by the cloud service
- [Documentation](#)



OpenStack basic infrastructure deep dive



Find your way managing infrastructure in the cloud



Questions

Do You need

- **S**calable
- **R**eproducible
- **D**elegable

infrastructure in a cloud?

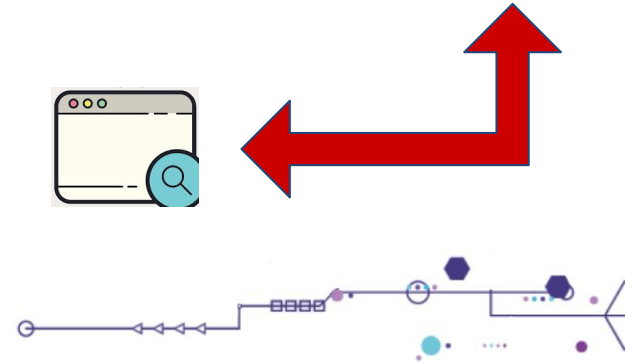
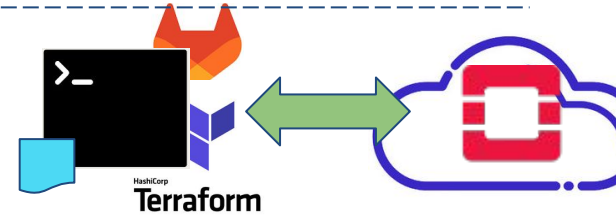
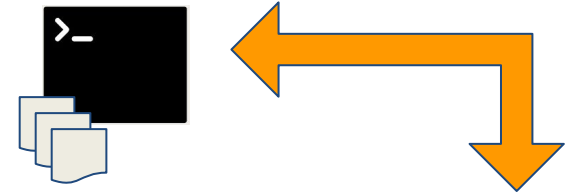


Find your way managing infrastructure in the cloud



OpenStack comes with

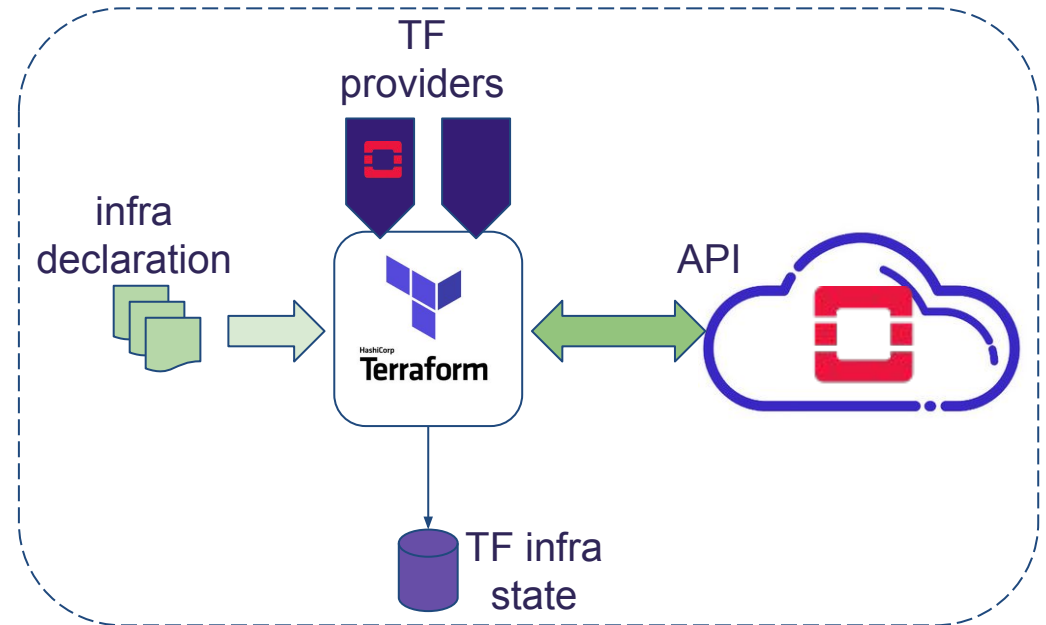
- Command-line access (client - server/API)
 - User normally needs to understand OpenStack terminology
-
- Infrastructure can be highly scalable, reproducible and declarative
 - There are ways how to make infrastructure easily
-
- GUI dashboard access (Horizon)
 - User do not need to dig deeper in OpenStack terminology
 - Infrastructure is likely neither scalable nor reproducible nor declarative



SRD

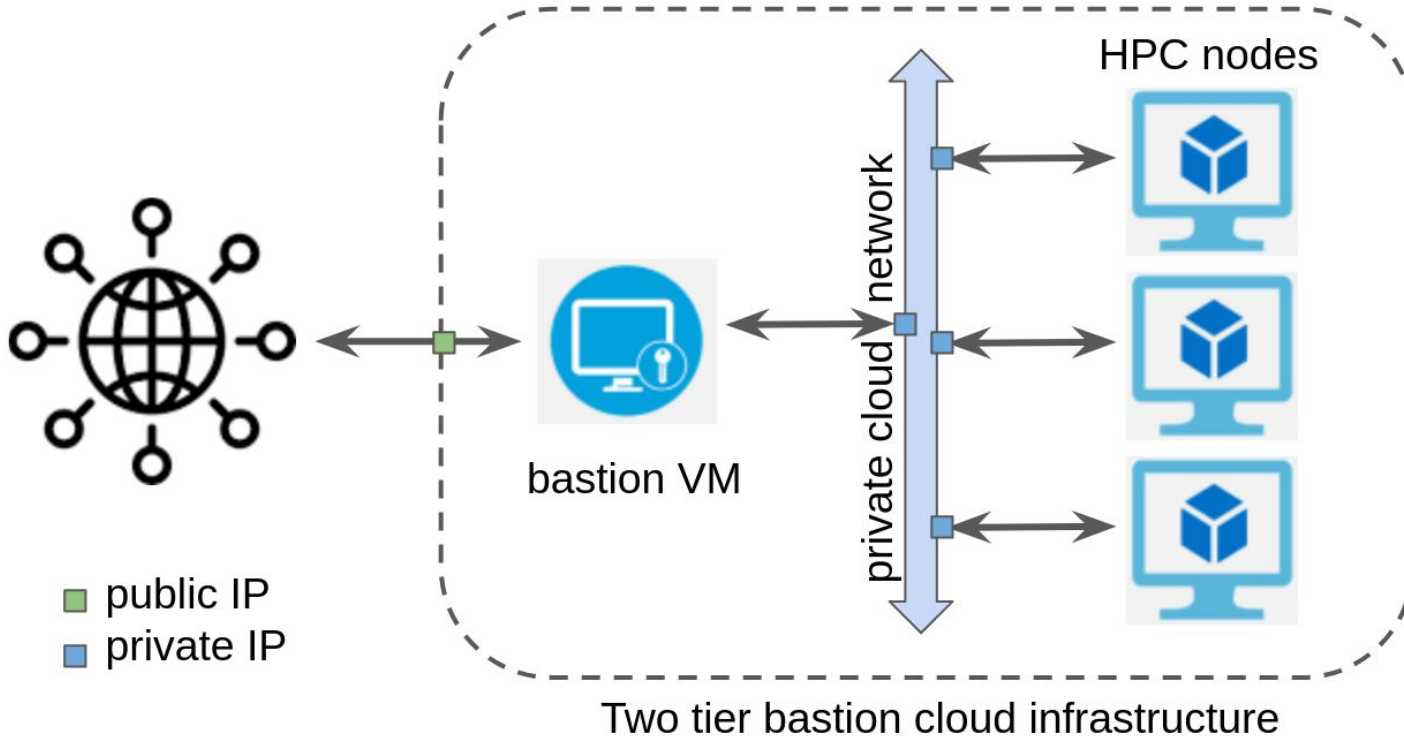
Terraform overview

- Terraform helps to define OpenStack IaaS infrastructure scalable and declarative way
- Terraform
 - reads infra declaration
 - applies infrastructure using TF providers
 - writes TF infra state



Easy, scalable, declarative & automated infra

Architecture

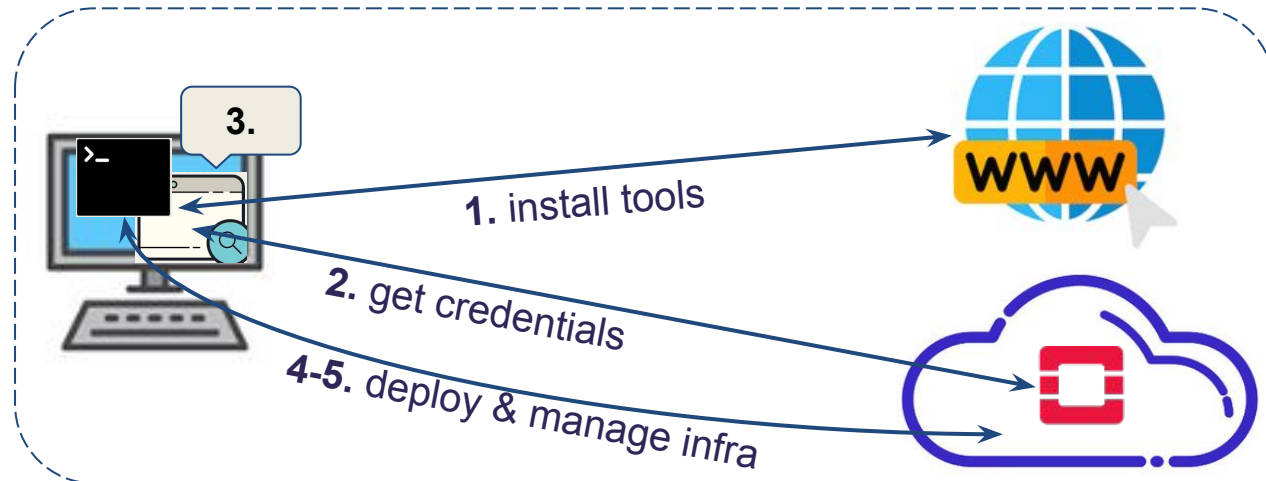


Easy, scalable, declarative & automated infra



Workflow overview

1. Install needed tools and code to your workstation
2. Get your OpenStack project (app) credentials via Horizon GUI
3. Configure desired infrastructure in few text files
4. Test OpenStack connection and deploy desired infrastructure
5. Maintain infrastructure as you need (destroy once not needed)

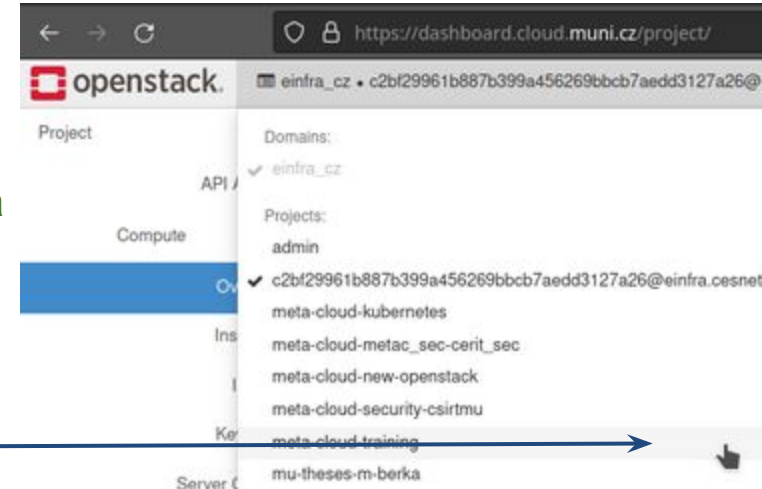


Easy, scalable, declarative & automated infra



1 2 Preparing the environment

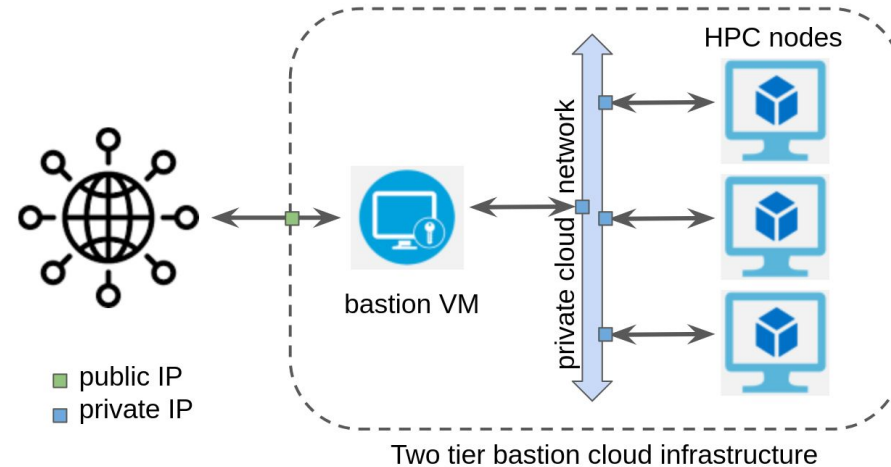
- Installing container-runtime (docker / podman), git
- Clone/download [example infrastructure git repository](#)
 - a. `git clone https://gitlab.ics.muni.cz/cloud/terraform/modules/dask-distributed-2t-infra.git`
- Logging into e-INFRA CZ OpenStack cloud Horizon GUI and getting credentials
 - a. [Log into OpenStack Horizon dashboard](#)
 - b. [Switch to your OpenStack project](#)
 - c. [Request OpenStack project application credentials and save them to text file](#)



Easy, scalable, declarative & automated infra

3 Tune the desired infrastructure

- Two tier bastion cloud infrastructure
 - a. Tiny bastion has public address
 - b. HPC server farm have internal addresses only
- Infra configuration, edit [main.tf](#) file, see basic configuration
 - a. **infra_name** name of the infrastructure
 - b. **nodes_count** number of HPC farm nodes
 - c. **nodes_flavor** size & performance of HPC farm nodes
 - d. ...



Easy, scalable, declarative & automated infra



4

5

Test cloud connection & deploy

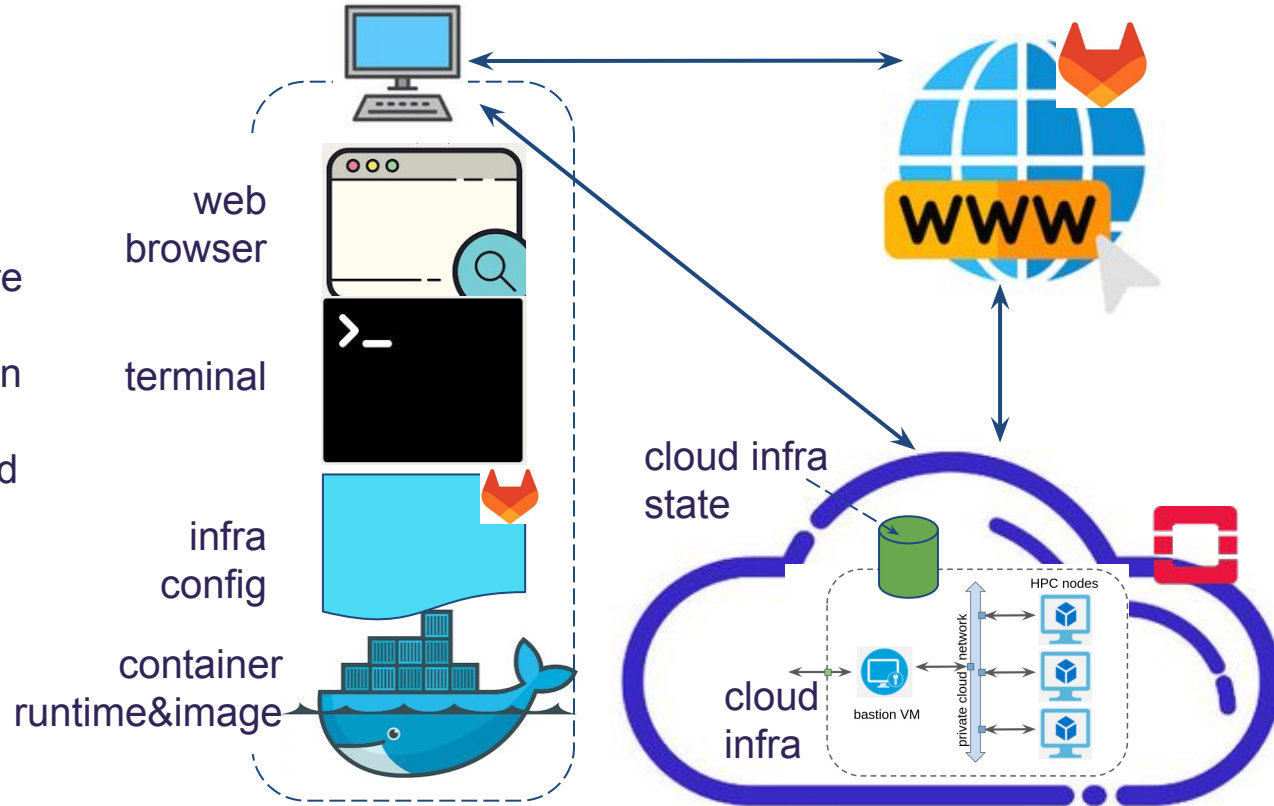
- Use pre-created repository and container image
 - a. <https://gitlab.ics.muni.cz/cloud/terraform/modules/dask-distributed-2t-infra>
 - b. <registry.gitlab.ics.muni.cz:443/cloud/terraform/modules/dask-distributed-2t-infra:1>
- Test cloud connection
 - a. `./infra-action.sh cloud-connect`
- Deploy desired infrastructure
 - a. `./infra-action.sh infra-deploy`
- Scale infrastructure and redeploy
 - a. Edit infra configuration ([main.tf](#) file)
 - b. `./infra-action.sh infra-deploy`
- Destroy infrastructure once it is not needed
 - a. `./infra-action.sh infra-destroy`



Easy, scalable, declarative & automated infra

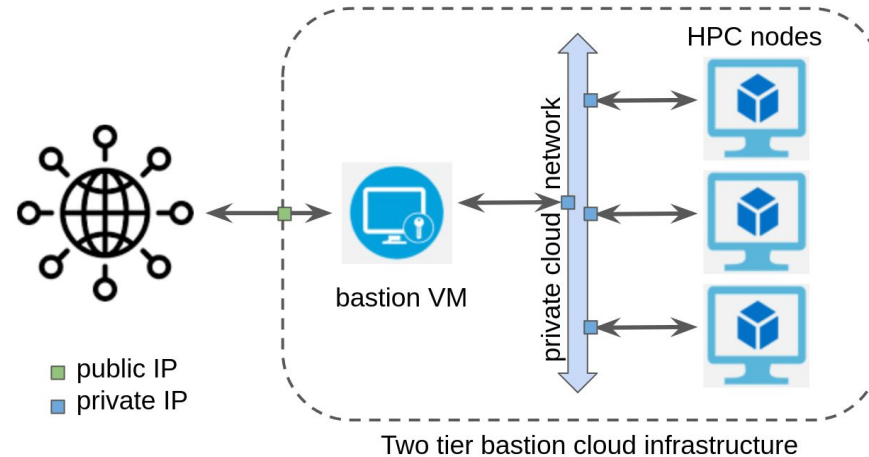
Cloud infrastructure management summary

- Your workstation contains
 - a. browser
 - b. terminal
 - c. container runtime
 - d. infra configuration
- You manage the infrastructure from your workstation and store infra state in the cloud in the infra state
 - a. all cloud tools are stored in public published container image which you execute



Takeaways

- e-INFRA CZ compute cloud portfolio
- Cloud infrastructure modelling into OpenStack cloud
- Accessing OpenStack IaaS cloud
- Presented easy way kickstarting infrastructure using OpenStack and Terraform
 - Complete cloud example available at <http://bit.ly/4bdswq4>
 - Declarative and reusable infra description IaC, (GitOps ready)
 - Toolset available in pre-created container image
 - Scalability and life-cycle management
 - Initial knowledge barrier lowered



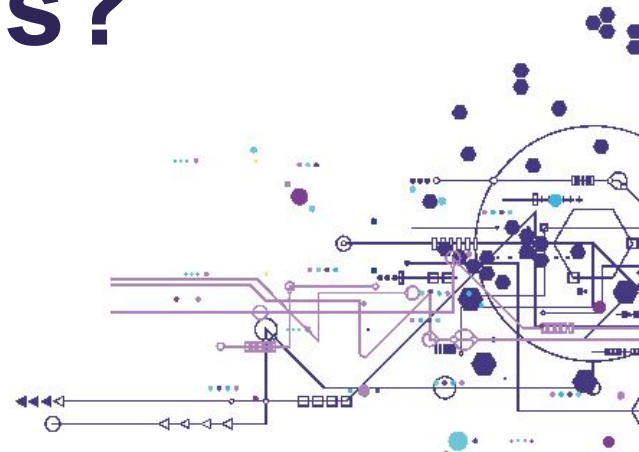


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Thank you for your attention!

Questions?



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