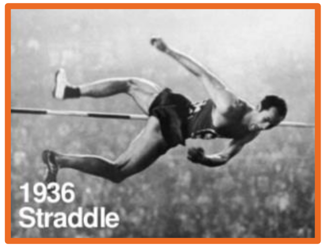
“GUI is dead, long live IaC”

IaC in the aspect of cloud automation
using a standardized module library

Olympic High Jump

Motto: *“Faster, Higher & Stronger”*

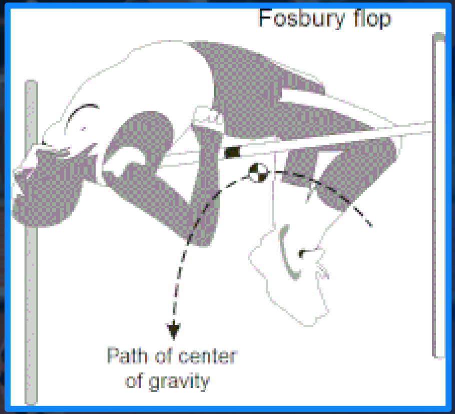


? Techniques

- Standing Jump
- Scissors
- Straddle
- Western Roll

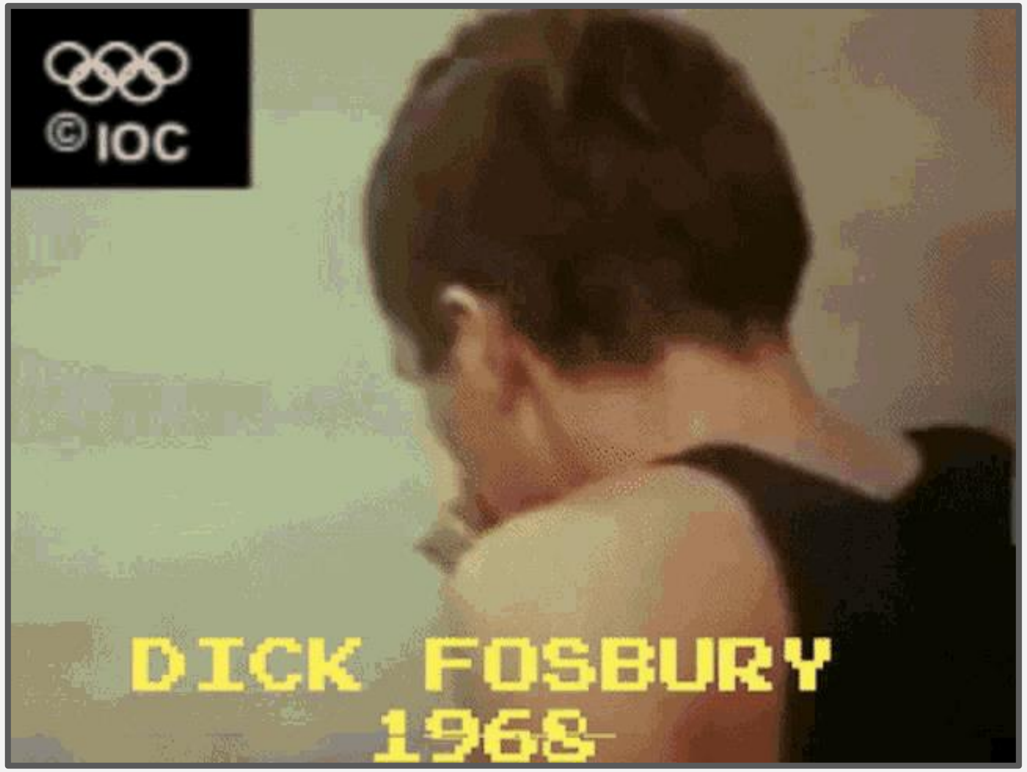
Fosbury Flop

- In 1968, Mexico City at the Olympic Games
- High Jump + Engineering Know-How = Center of gravity
- Newspapers wrote, …like a “two-legged-camel”… 🐫
- Result: 2,24 m – Gold Medal, Olympic Record 🥇
- *“I think quite a few kids will begin trying it my way now.”*



Revolutionary

“Fosbury Flop”

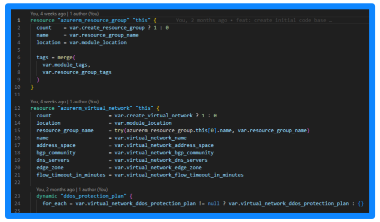


It is now the only way to do high jump! – Revolutionary!

Technology Shift/Change

Why: *“Infrastructure as Code”* (IaC)

Techniques → **GUI Deployment**



```
You, 4 weeks ago | 1 author (You)
resource "azurerm_resource_group" "this" {       You, 2 months ago • feat: create initial code base …
  count    = var.create_resource_group ? 1 : 0
  name     = var.resource_group_name
  location = var.module_location

  tags = merge(
    var.module_tags,
    var.resource_group_tags
  )
}

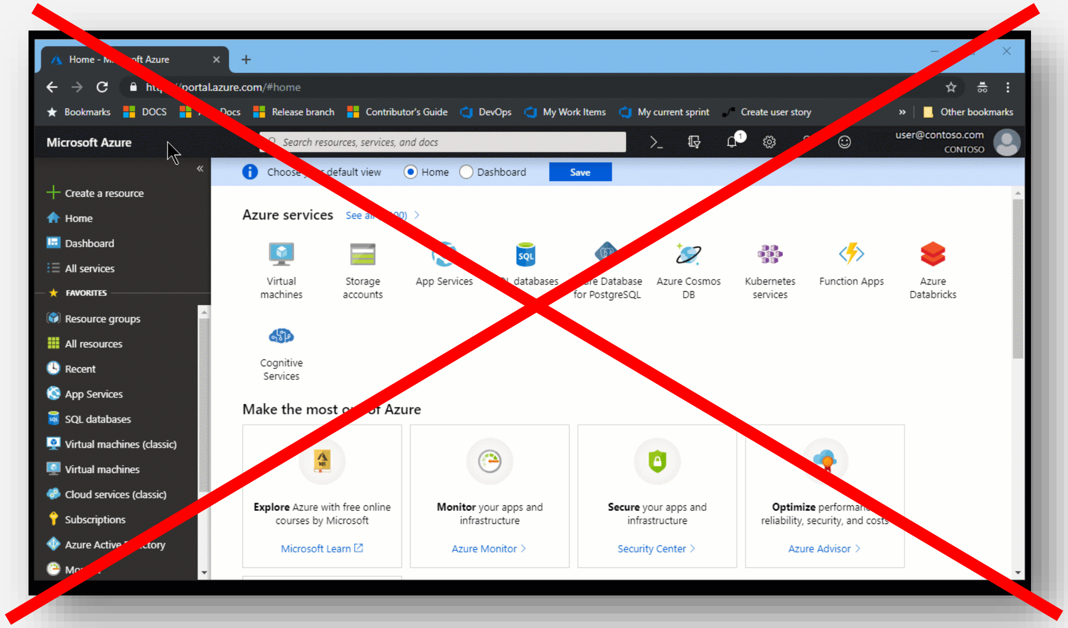
You, 4 weeks ago | 1 author (You)
resource "azurerm_virtual_network" "this" {
  count                   = var.create_virtual_network ? 1 : 0
  location                = var.module_location
  resource_group_name     = try(azurerm_resource_group.this[0].name, var.resource_group_name)
  name                    = var.virtual_network_name
  address_space           = var.virtual_network_address_space
  bgp_community           = var.virtual_network_bgp_community
  dns_servers             = var.virtual_network_dns_servers
  edge_zone               = var.virtual_network_edge_zone
  flow_timeout_in_minutes = var.virtual_network_flow_timeout_in_minutes

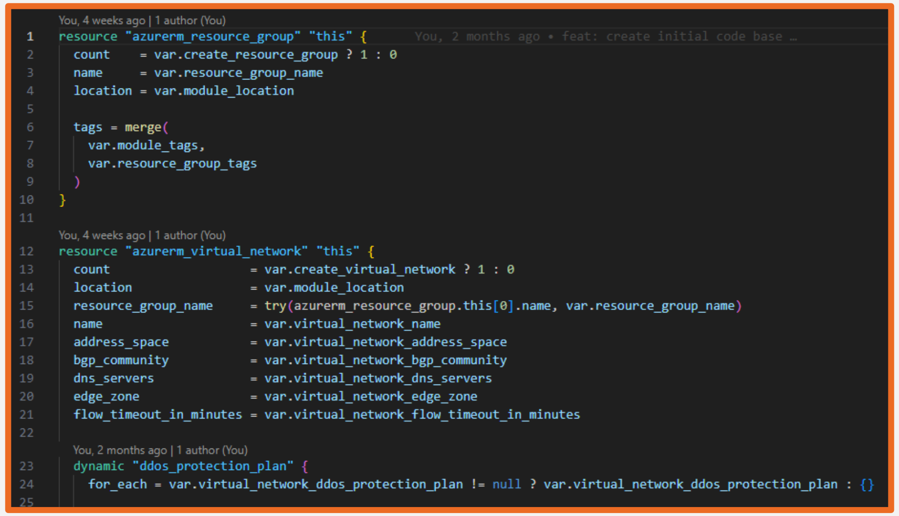
  You, 2 months ago | 1 author (You)
  dynamic "ddos_protection_plan" {
    for_each = var.virtual_network_ddos_protection_plan != null ? var.virtual_network_ddos_protection_plan : {}
```

Fosbury Flop → **Cloud Automation**

Mindset of IaC?

Mind change administration interface





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You, 4 weeks ago | 1 author (You)
resource "azurerm_resource_group" "this" {       You, 2 months ago • feat: create initial code base …
  count    = var.create_resource_group ? 1 : 0
  name     = var.resource_group_name
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  tags = merge(
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}

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resource "azurerm_virtual_network" "this" {
  count                   = var.create_virtual_network ? 1 : 0
  location                = var.module_location
  resource_group_name     = try(azurerm_resource_group.this[0].name, var.resource_group_name)
  name                    = var.virtual_network_name
  address_space           = var.virtual_network_address_space
  bgp_community           = var.virtual_network_bgp_community
  dns_servers             = var.virtual_network_dns_servers
  edge_zone               = var.virtual_network_edge_zone
  flow_timeout_in_minutes = var.virtual_network_flow_timeout_in_minutes

  You, 2 months ago | 1 author (You)
  dynamic "ddos_protection_plan" {
    for_each = var.virtual_network_ddos_protection_plan != null ? var.virtual_network_ddos_protection_plan : {}
```

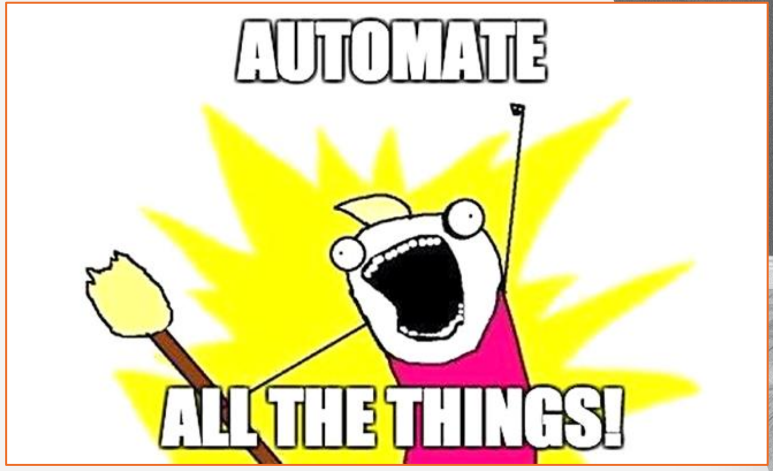
„Click-Click-Cloud“
„Clicky-Bunti“

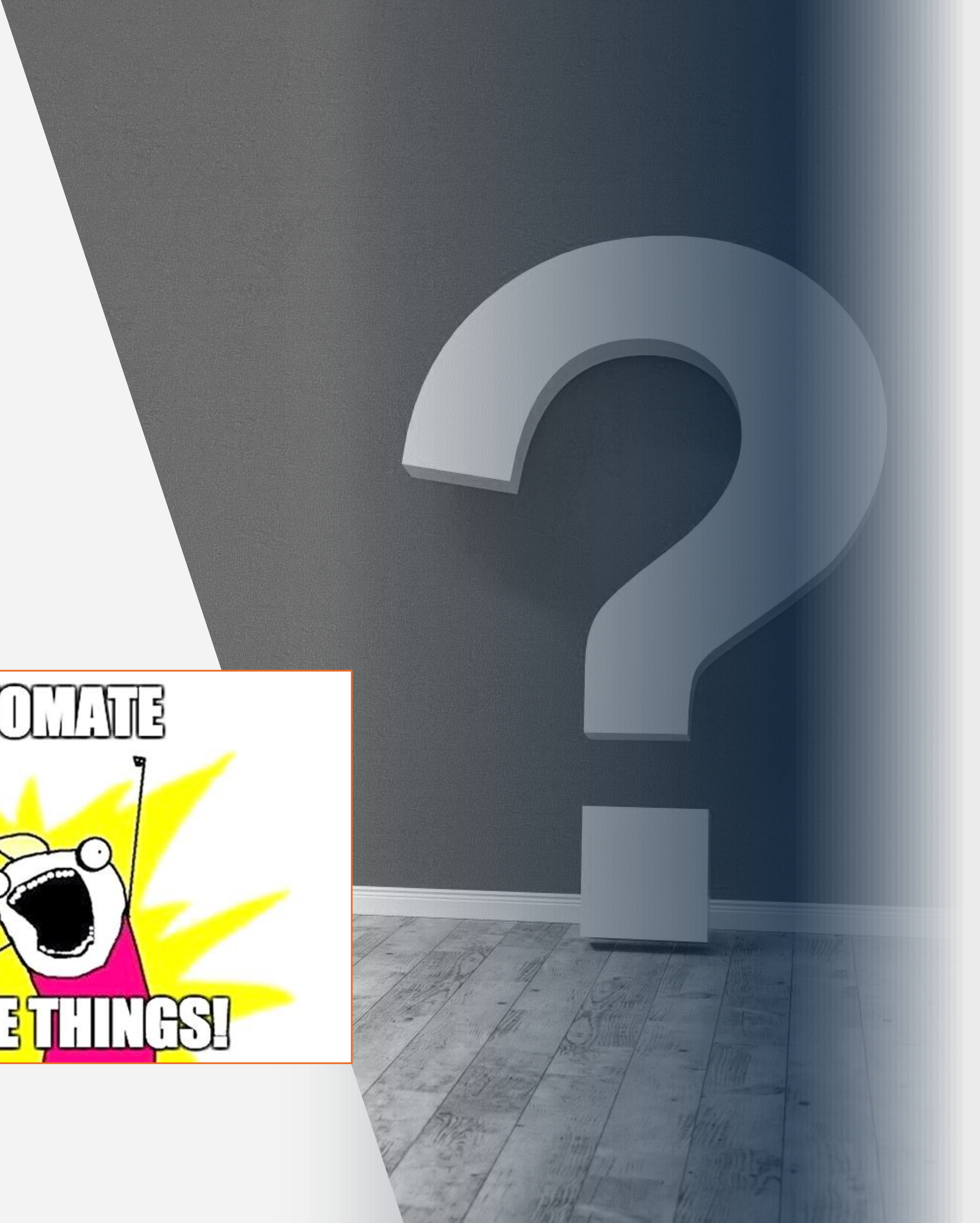
„Transition 2 cloud“
→ Shift from “*static*” to “*dynamic*” infrastructure

Cloud Operating Model

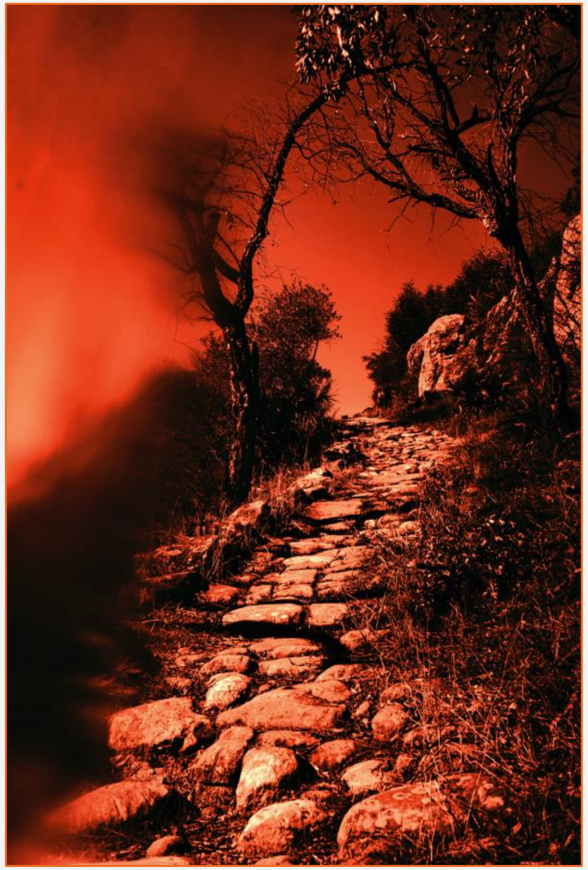
Using **IaC** deployment **templates** & **modules** in building out **your** individual Cloud Infrastructure!

Why using IaC instead of a GUI?

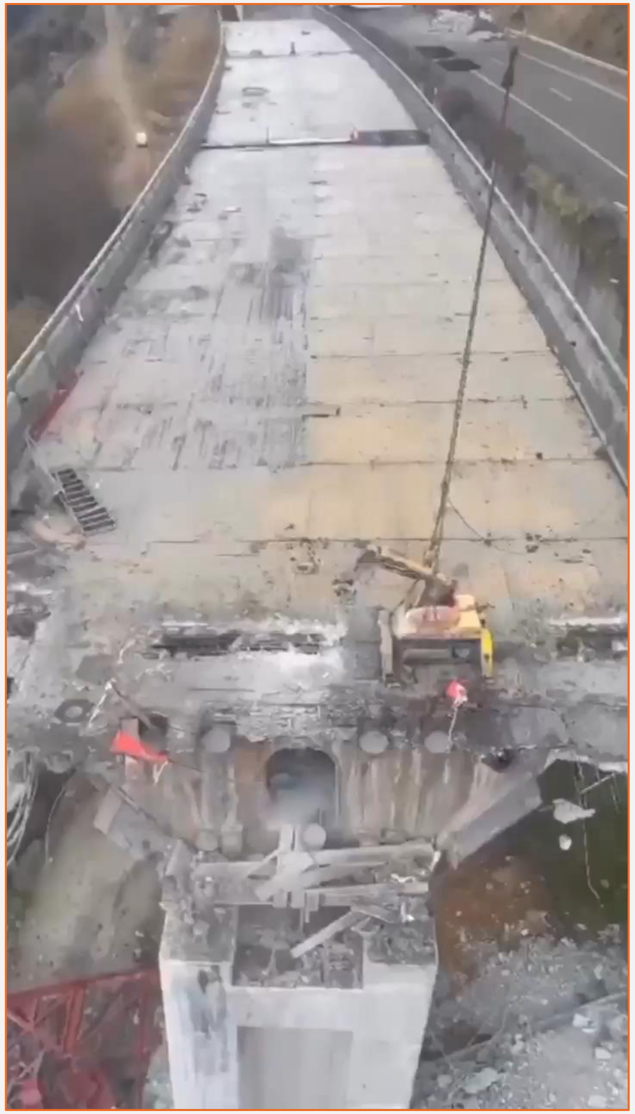




Avoid: Road to “*Modularization Hell*” 🔥 😈 🔥



Hell – How bad Cloud Automation (IaC) works?



Focus on IaC

What is IaC?

Managing/Provisioning of **infrastructures** using **code**.

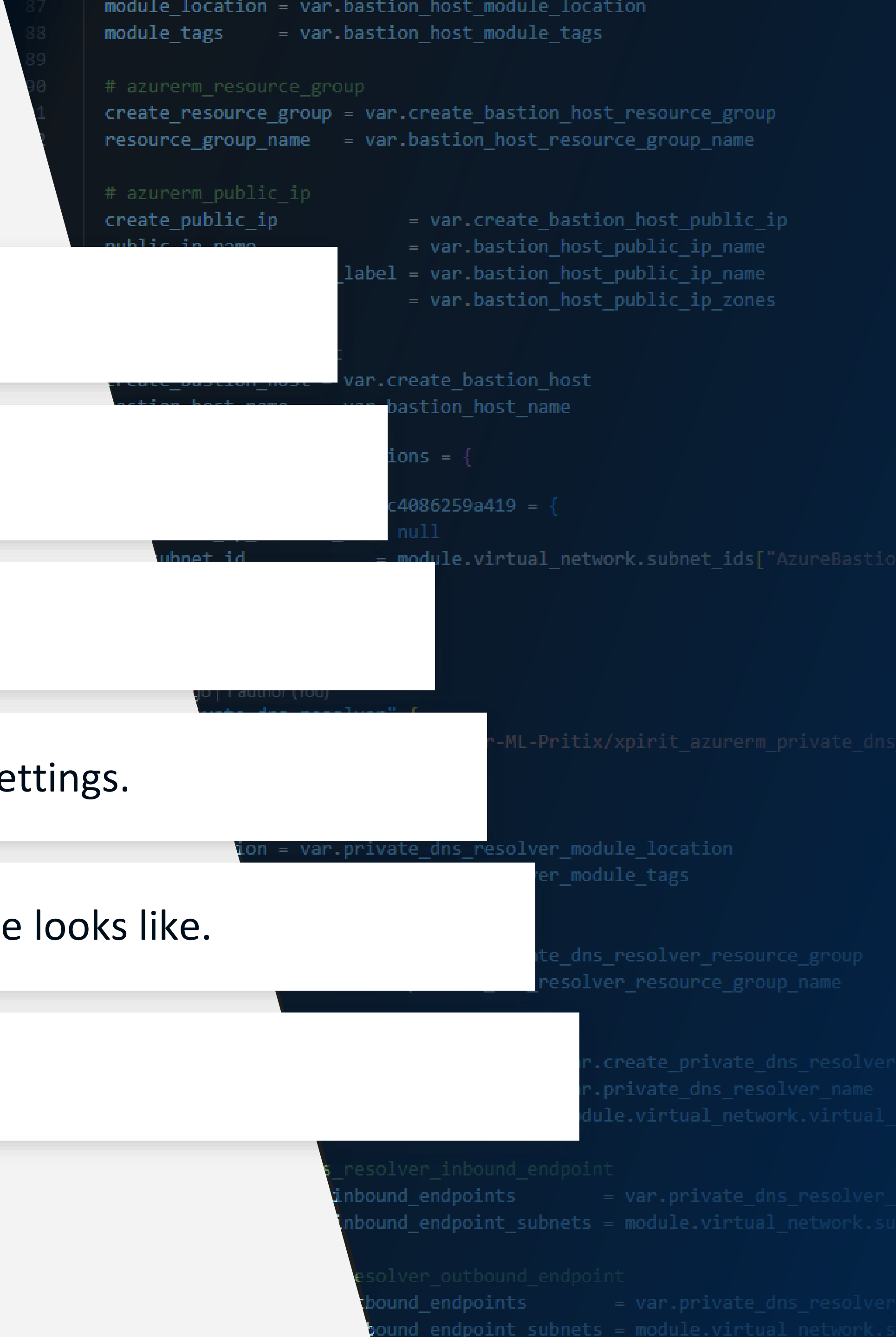
How resources, applications and environments are **configured**.

Code describes the resources and the whole **architecture landscapes**.

Declarative syntax can be used to specify the resources and detailed settings.

Human readable code files (`main.tf`) describe how the infrastructure looks like.

Definition of **variables** and their **values** of the environment.



```
module_location = var.bastion_host_module_location
module_tags     = var.bastion_host_module_tags

# azurerm_resource_group
create_resource_group = var.create_bastion_host_resource_group
resource_group_name   = var.bastion_host_resource_group_name

# azurerm_public_ip
create_public_ip            = var.create_bastion_host_public_ip
                            = var.bastion_host_public_ip_name
                      label = var.bastion_host_public_ip_name
                            = var.bastion_host_public_ip_zones

                     var.create_bastion_host
                     bastion_host_name

                          ions = {

                          c4086259a419 = {
                                      null
ubnet_id                   = module.virtual_network.subnet_ids["AzureBastio

                          -ML-Pritix/xpirit_azurerm_private_dns

ion = var.private_dns_resolver_module_location
                          er_module_tags

                          te_dns_resolver_resource_group
                          resolver_resource_group_name

                          r.create_private_dns_resolver
                          r.private_dns_resolver_name
                          dule.virtual_network.virtual_

s_resolver_inbound_endpoint
inbound_endpoints         = var.private_dns_resolver_
inbound_endpoint_subnets = module.virtual_network.su

esolver_outbound_endpoint
tbound_endpoints          = var.private_dns_resolver
bound_endpoint_subnets = module.virtual_network
```

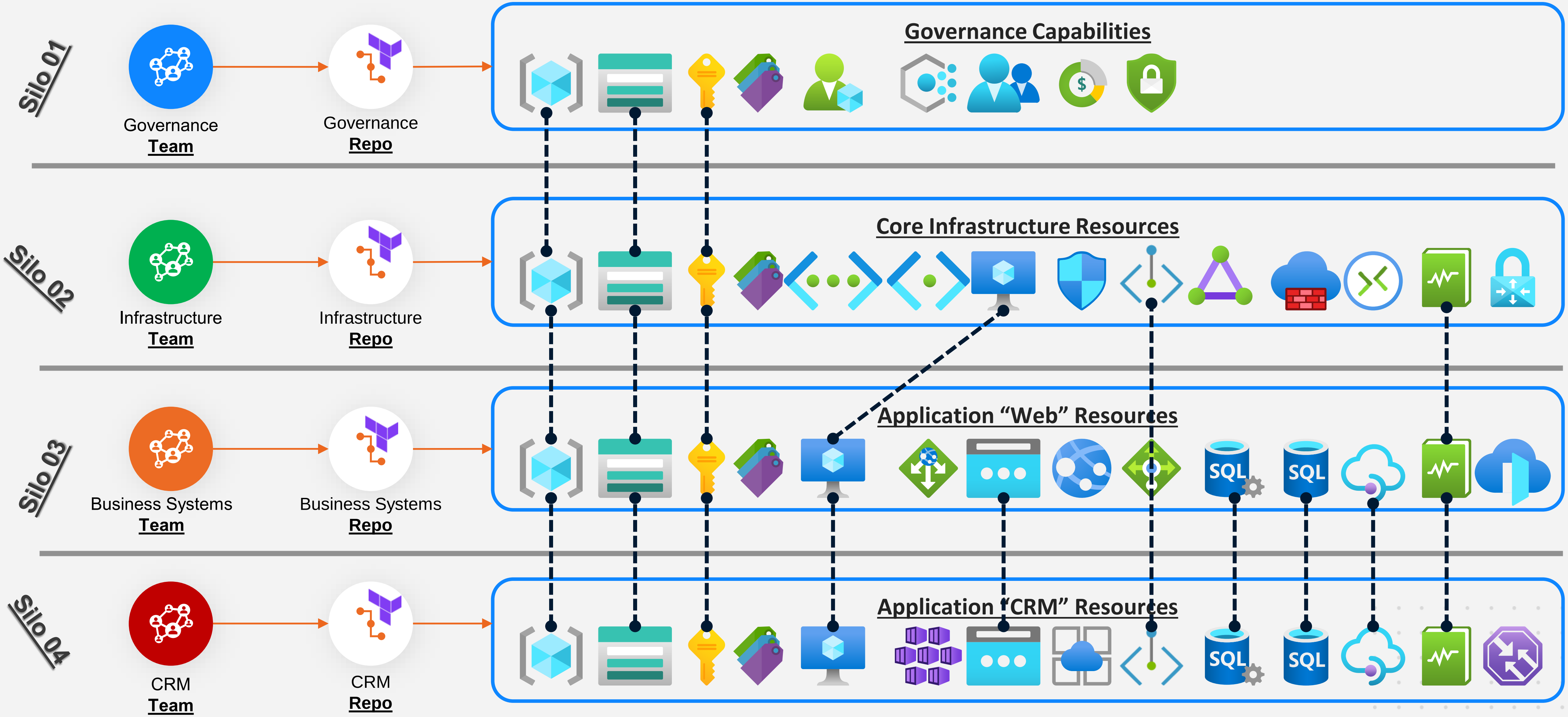
Demo: Terraform Code Example

Advantages of using an IaC approach

- Reusability - Creation of "repeating" infrastructures (**standardization/template**).
- Speed - **Faster** creation of resources and environments.
- Parallelization - Several developers can work on the same infrastructure **simultaneously**.
- Documentation - The **code definition file** is also the documentation of the environment.
- Consistency - The code reflects the **overall state** of the environment.
- Tracking - Use of source code management (**version control**).
- Order - Order of resource creation is managed **automatically**. Automate changes.
- Error/state handling - **No check** necessary if resources already exist ("*Desired State*").
- Quality - Less **human error** by using the same code ("*no-brainer*").
- Reproducibility - The **same code** always leads to the **same result**.
- Cost Reduction - Remove **manual** tasks. People refocus their efforts on enterprise tasks.

How IaC? – Modularization

IaC – Status quo Situation

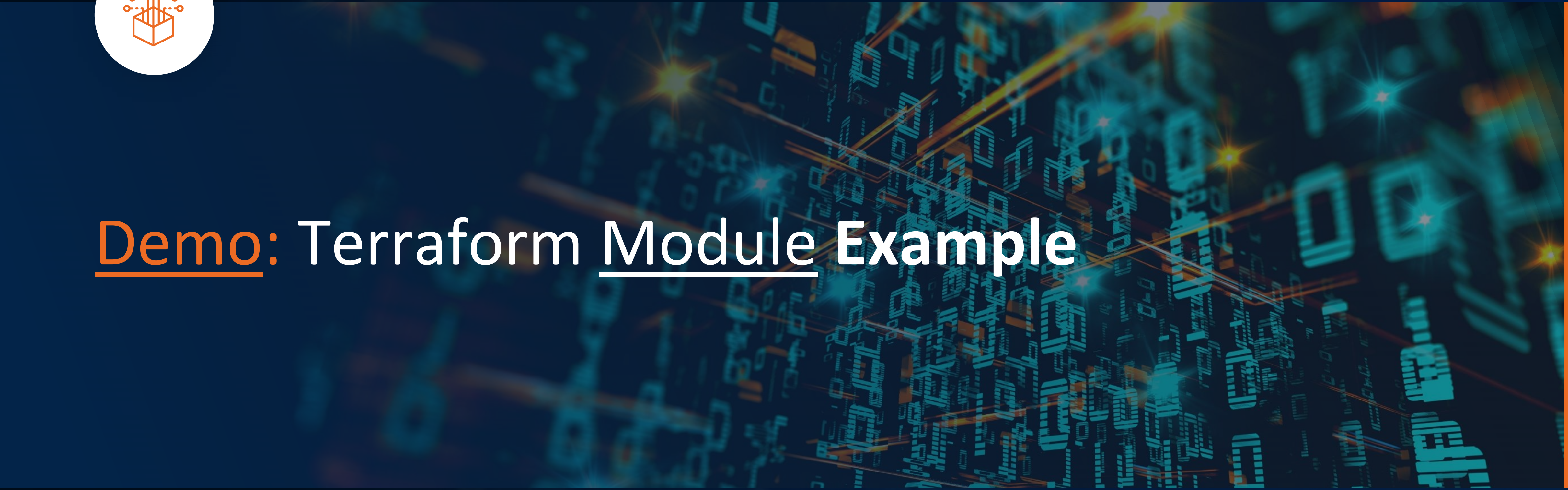


What is a module?

- Create lightweight **abstractions**
- Don’t describe **physical** objects
- Describe infrastructure in terms of its **architecture**
- Package and **reuse** resource configurations
- Separated in code **repositories**
- **Independently** usable & testable

> **“A module is a container for multiple resources that are used together.”**

Demo: Terraform Module Example

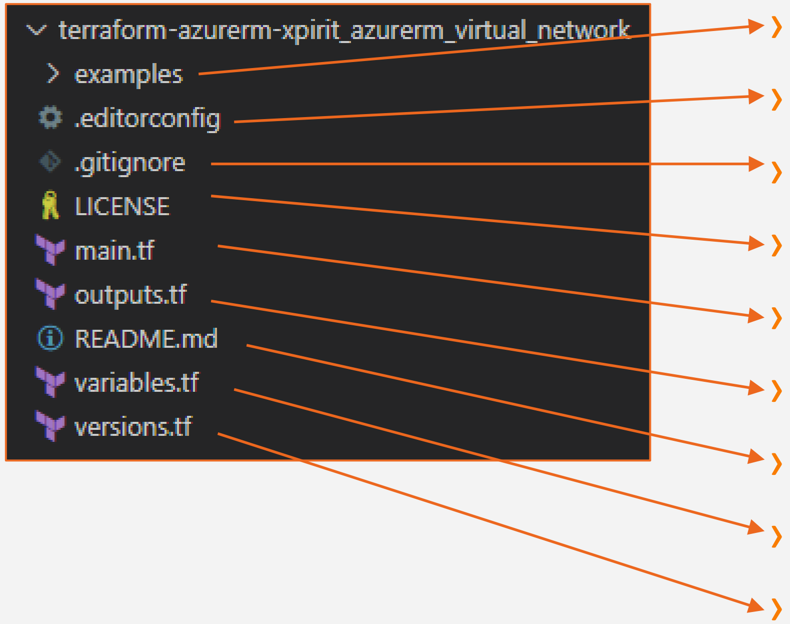


Standard (Terraform) Module Structure

1.
file & **directory** layout

2.
Distributed in separate repositories

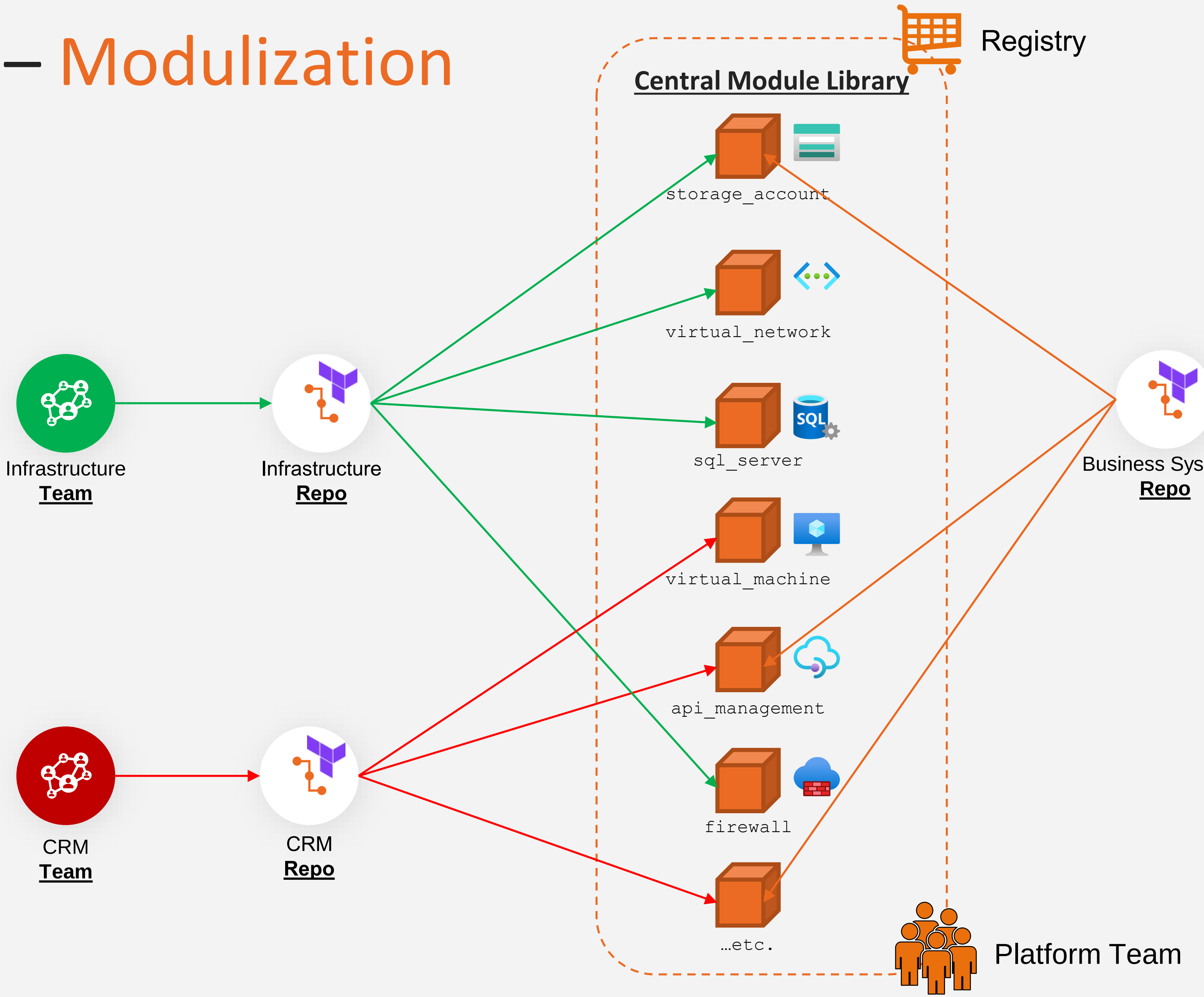
3.
Structure to generate documentation



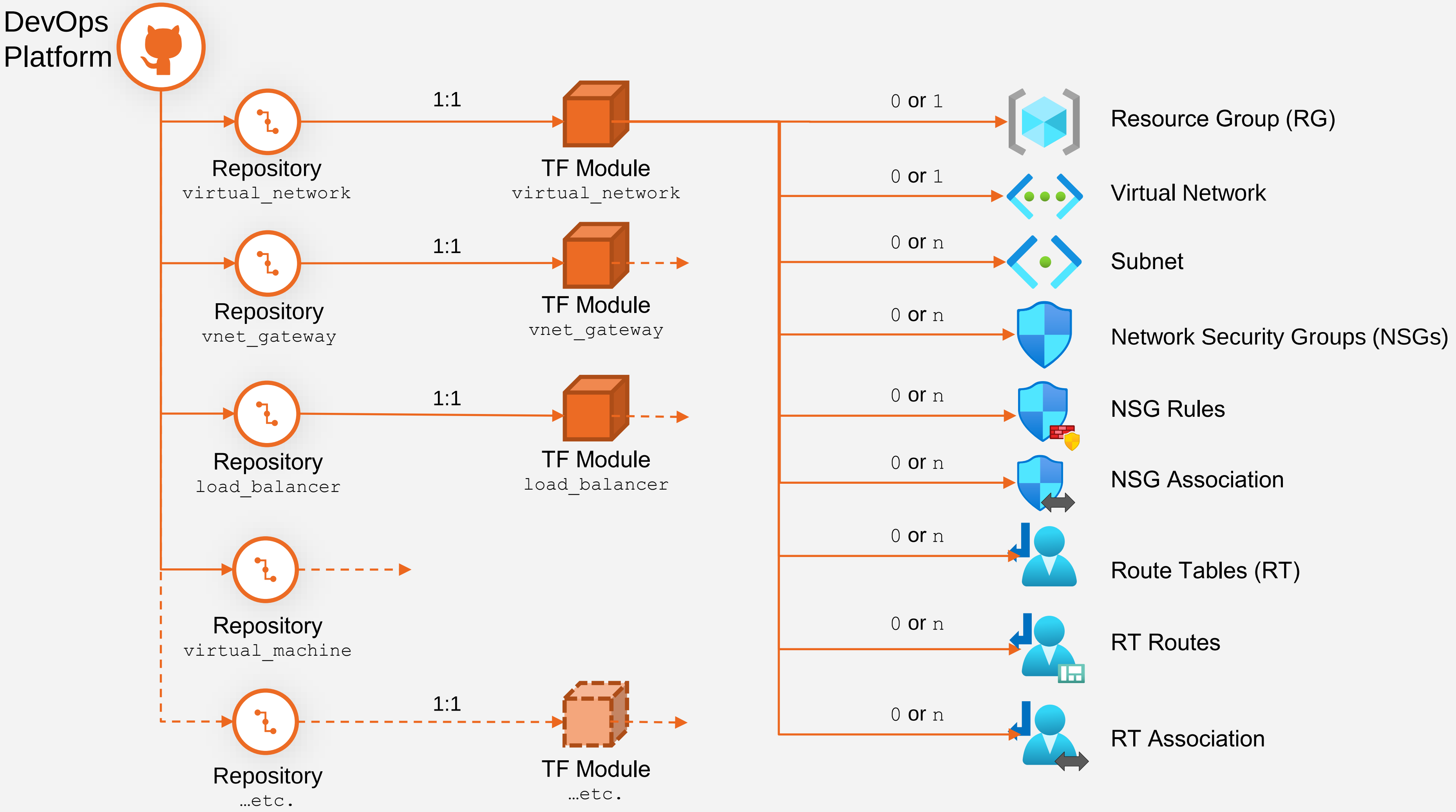
```
⌄ terraform-azurerm-xpirit_azurerm_virtual_network
  › examples
    .editorconfig
    .gitignore
    LICENSE
    main.tf
    outputs.tf
    README.md
    variables.tf
    versions.tf
```

- `examples/` – separate subdirectory for each example incl. `README.md`
- `.editorconfig` – maintain consistent code style (Example)
- `.gitignore` – primary (Example)
- `LICENSE` – which this module is available (publicly, privately)
- `main.tf` – primary entry point, containing all needed resources
- `outputs.tf` – to return results to the calling module
- `README.md` – what the module should be used for (basic documentation)
- `variables.tf` – (declaration) to accept values from the calling module.
- `versions.tf` – (constraint) define supported terraform & provider version

IaC – Modulization



Standard Module Architecture



Creating Good Modules

1. Do one thing and do it as simply as possible
2. Provide options, but not too many option ✓
3. Add value, do more than wrap a resource +
4. Version appropriately
5. Make them easy to obtain
6. Keep them updated
7. Start simple and evolve
8. Create great documentation
9. Evangelize and engage
10. KISS & DRY → But avoid “thin wrappers”

Source: Sam Cogan (Video: Reuse, Don’t Repeat) & Thomas Thornton (Link)

How to publish Modules?

Use a Terraform Registry

TF Cloud helps teams to **provision** infrastructure.

Support for **versioning** and list of **providers** and **modules**.

Handles **downloads** and **access** with TF Cloud API tokens.

Consumers do not need **direct** access to the module's repository.

Public Registry

https://**registry**.terraform.io

Share Terraform providers and Terraform modules public.

Private Registry

https://**app**.terraform.io

Hosted on an organization's private registry and are only available to members

```
module_location = var.bastion_host_module_location
module_tags     = var.bastion_host_module_tags

# azurerm_resource_group
create_resource_group = var.create_bastion_host_resource_group
resource_group_name   = var.bastion_host_resource_group_name

# azurerm_public_ip
create_public_ip             = var.create_bastion_host_public_ip
public_ip_name               = var.bastion_host_public_ip_name
public_ip_domain_name_label  = var.bastion_host_public_ip_name
public_ip_zones              = var.bastion_host_public_ip_zones

# azurerm_bastion_host
create_bastion_host = var.create_bastion_host
...tion_host_name   = var.bastion_host_name
weeks ago | 1 author (You)
ion_host_ip_configurations = {
 4 weeks ago | 1 author (You)
2a8947-2efa-4b0e-ac61-c4086259a419 = {
public_ip_address_id = null
ubnet_id             = module.virtual_network.subnet_ids["AzureBastio

go | 1 author (You)
_dns_resolver" {
p.terraform.io/Customer-ML-Pritix/xpirit_azurerm_private_dns
.53.0-0.0.2"

ion = var.private_dns_resolver_module_location
    = var.private_dns_resolver_module_tags

urce_group
_group = var.create_private_dns_resolver_resource_group
ame    = var.private_dns_resolver_resource_group_name

_dns_resolver
_resolver                   = var.create_private_dns_resolver
r_name                      = var.private_dns_resolver_name
r_virtual_network_id        = module.virtual_network.virtual

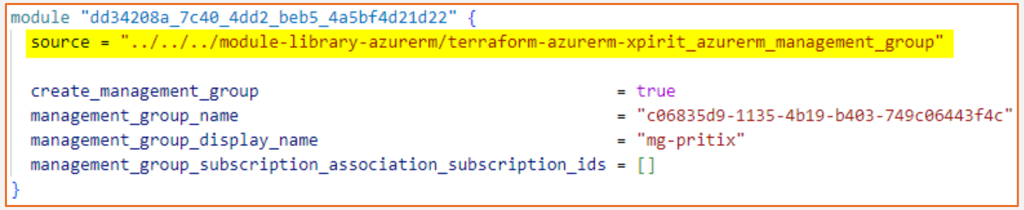
_resolver_inbound_endpoint
inbound_endpoints           = var.private_dns_resolver
inbound_endpoint_subnets    = module.virtual_network.su

esolver_outbound_endpoint
bound_endpoints             = var.private_dns_resolver
ound_endpoint_subnets       = module.virtual_network
```

Demo: Terraform Cloud – **Private** Registry

How to publish Modules?

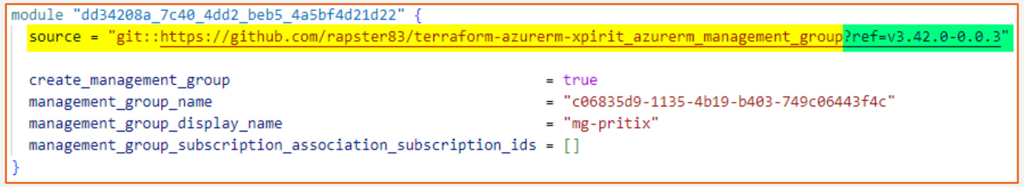
- Local file system



```
module "dd34208a_7c40_4dd2_beb5_4a5bf4d21d22" {
  source = "../../../module-library-azurerm/terraform-azurerm-xpirit_azurerm_management_group"

  create_management_group                                  = true
  management_group_name                                    = "c06835d9-1135-4b19-b403-749c06443f4c"
  management_group_display_name                            = "mg-pritix"
  management_group_subscription_association_subscription_ids = []
}
```

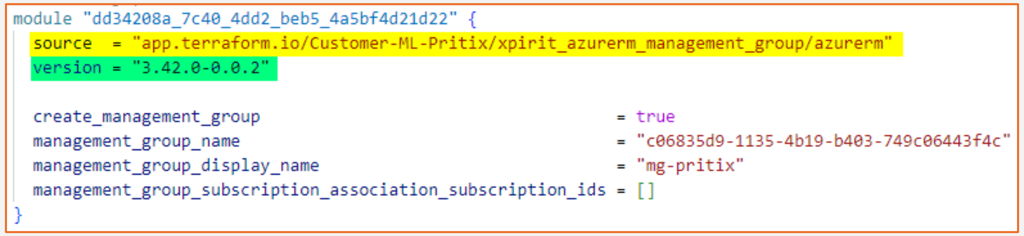
- Directly from the repository



```
module "dd34208a_7c40_4dd2_beb5_4a5bf4d21d22" {
  source = "git::https://github.com/rapster83/terraform-azurerm-xpirit_azurerm_management_group?ref=v3.42.0-0.0.3"

  create_management_group                                  = true
  management_group_name                                    = "c06835d9-1135-4b19-b403-749c06443f4c"
  management_group_display_name                            = "mg-pritix"
  management_group_subscription_association_subscription_ids = []
}
```

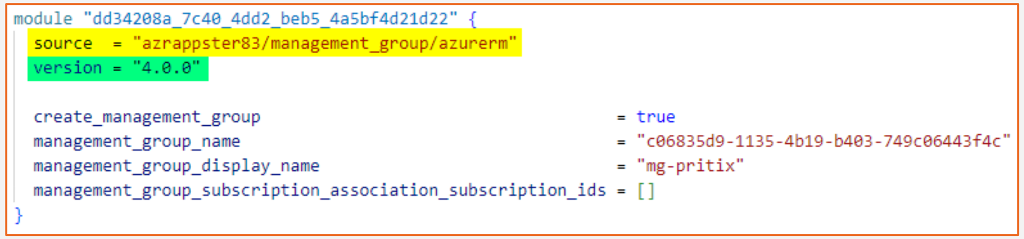
- Private registry



```
module "dd34208a_7c40_4dd2_beb5_4a5bf4d21d22" {
  source  = "app.terraform.io/Customer-ML-Pritix/xpirit_azurerm_management_group/azurerm"
  version = "3.42.0-0.0.2"

  create_management_group                                  = true
  management_group_name                                    = "c06835d9-1135-4b19-b403-749c06443f4c"
  management_group_display_name                            = "mg-pritix"
  management_group_subscription_association_subscription_ids = []
}
```

- Public registry (→ TF Registry)

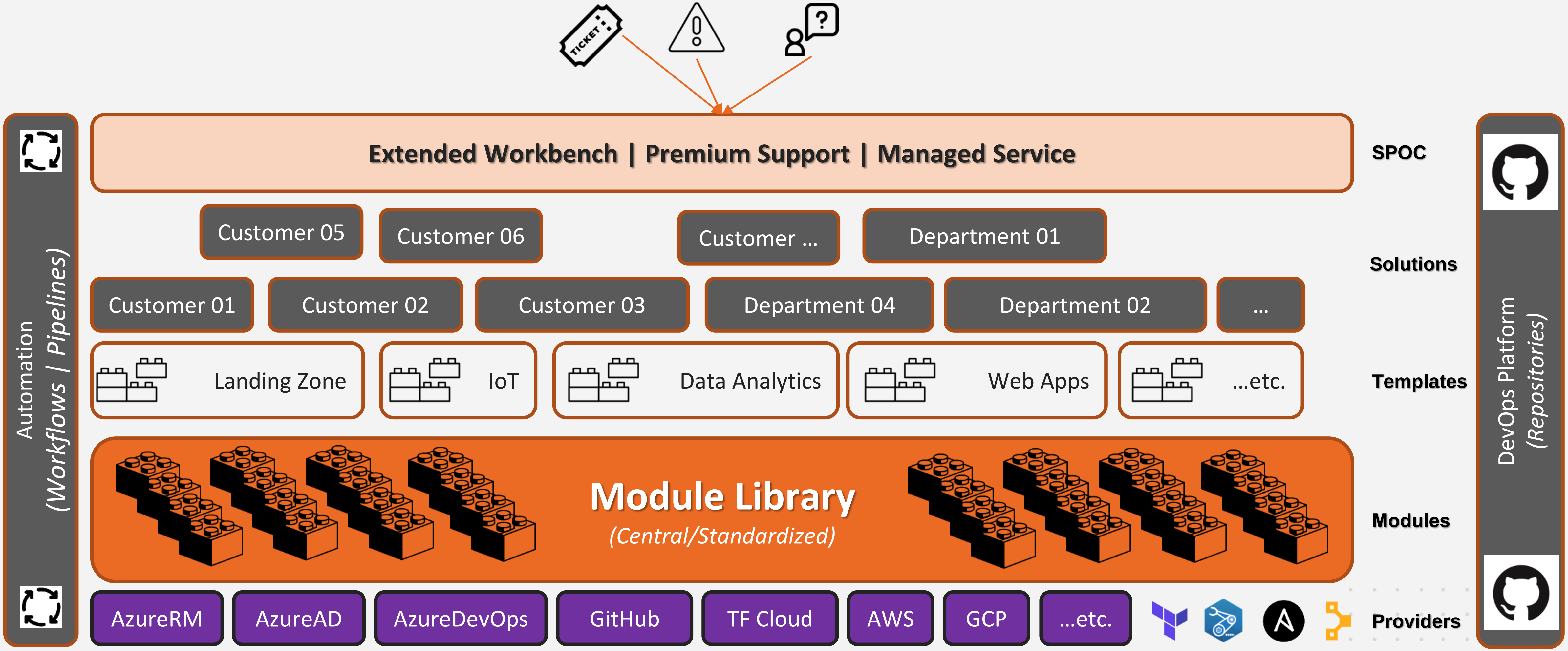


```
module "dd34208a_7c40_4dd2_beb5_4a5bf4d21d22" {
  source  = "azrappster83/management_group/azurerm"
  version = "4.0.0"

  create_management_group                                  = true
  management_group_name                                    = "c06835d9-1135-4b19-b403-749c06443f4c"
  management_group_display_name                            = "mg-pritix"
  management_group_subscription_association_subscription_ids = []
}
```

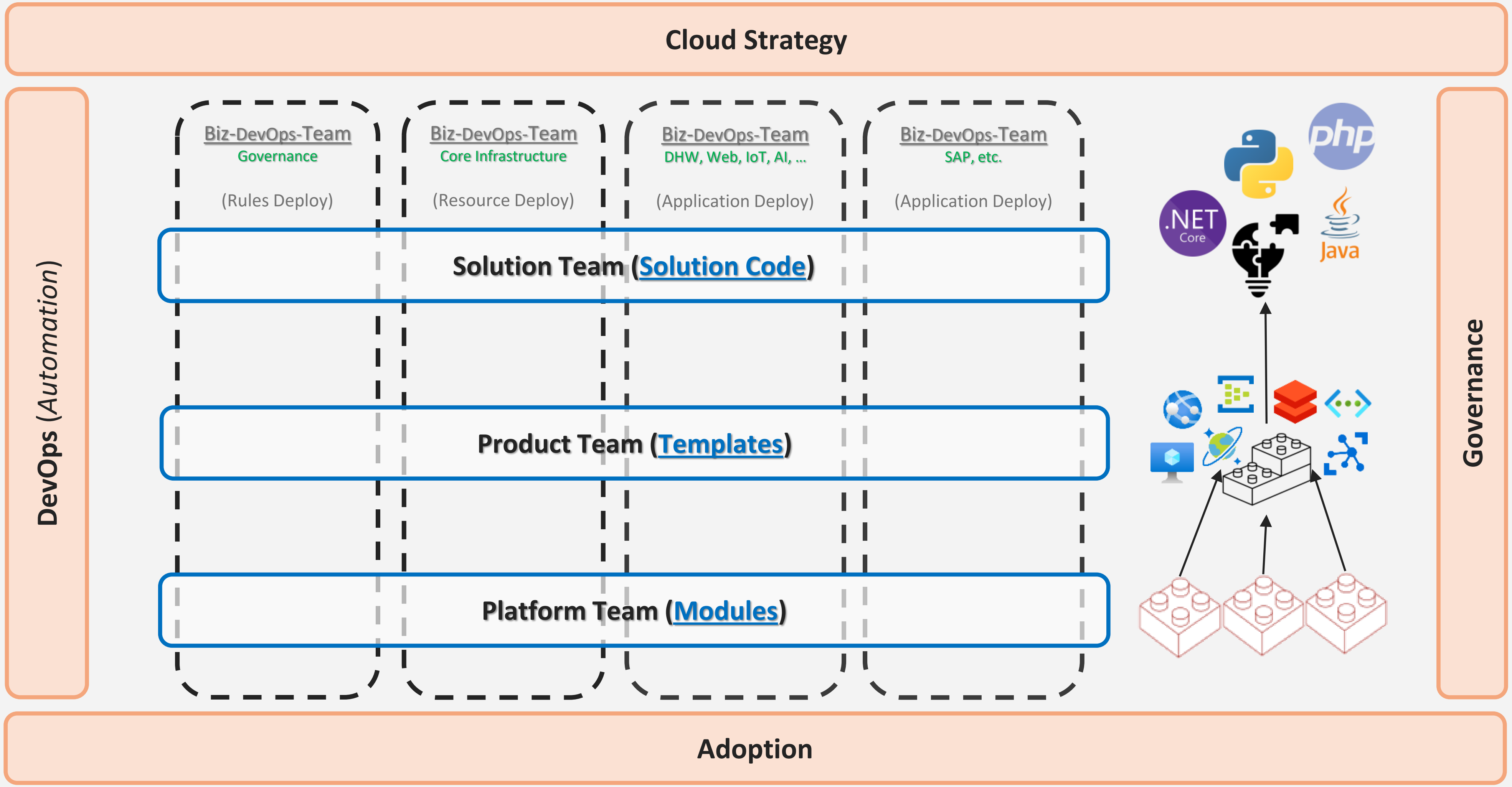
Cloud Operating Model

IaC – Organization (Modules & Templates)



Future Cloud Operationing Model

Principal: *“You deploy it“ – “You own it”* *”You build it” – “You run it”*



Cloud Strategy

DevOps *(Automation)*

Biz-DevOps-Team
Governance
(Rules Deploy)

Biz-DevOps-Team
Core Infrastructure
(Resource Deploy)

Biz-DevOps-Team
DHW, Web, IoT, AI, …
(Application Deploy)

Biz-DevOps-Team
SAP, etc.
(Application Deploy)

Solution Team (Solution Code)

Product Team (Templates)

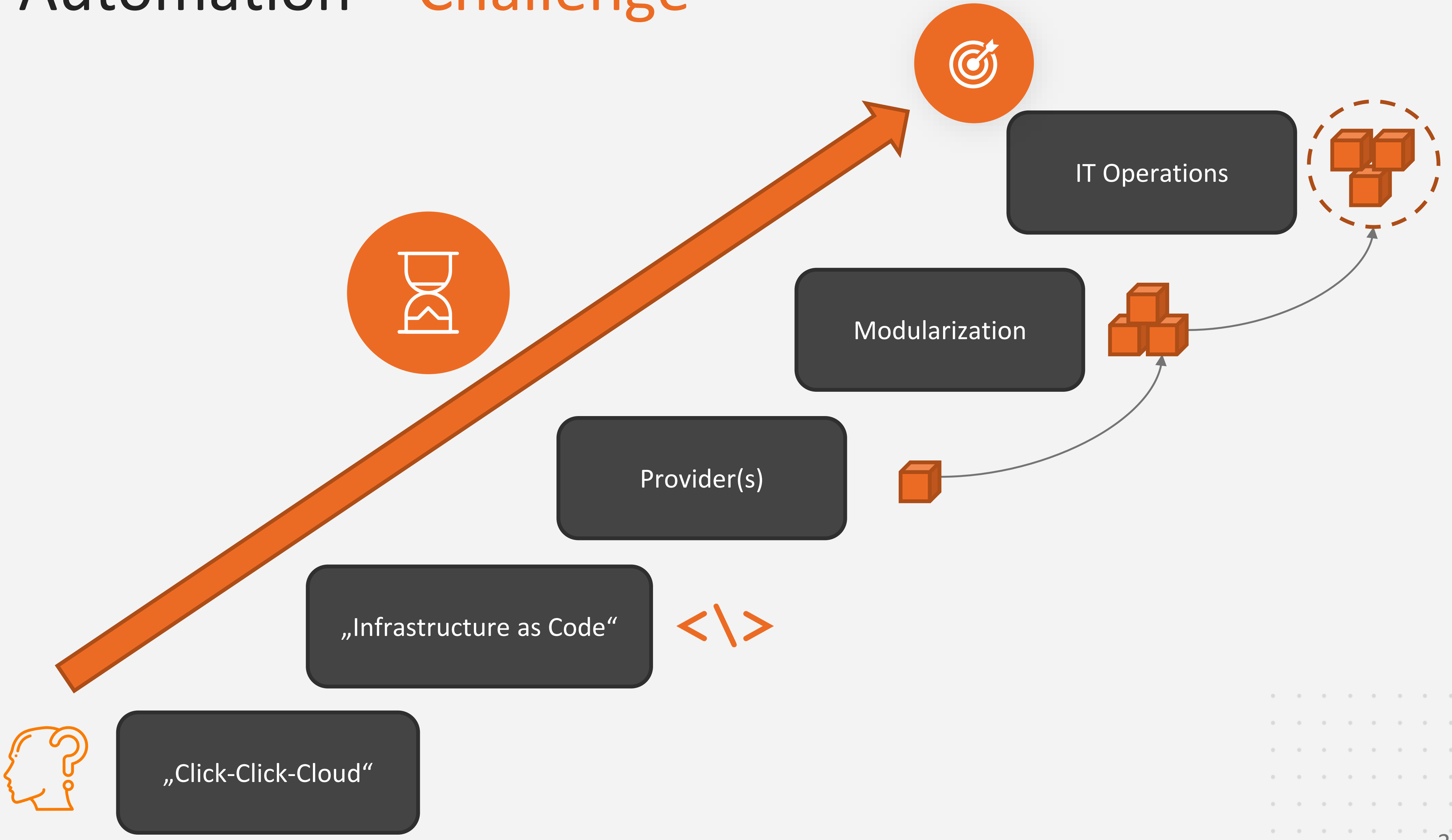
Platform Team (Modules)

Governance

Adoption

Essentials (Summary)

Cloud Automation – Challenge

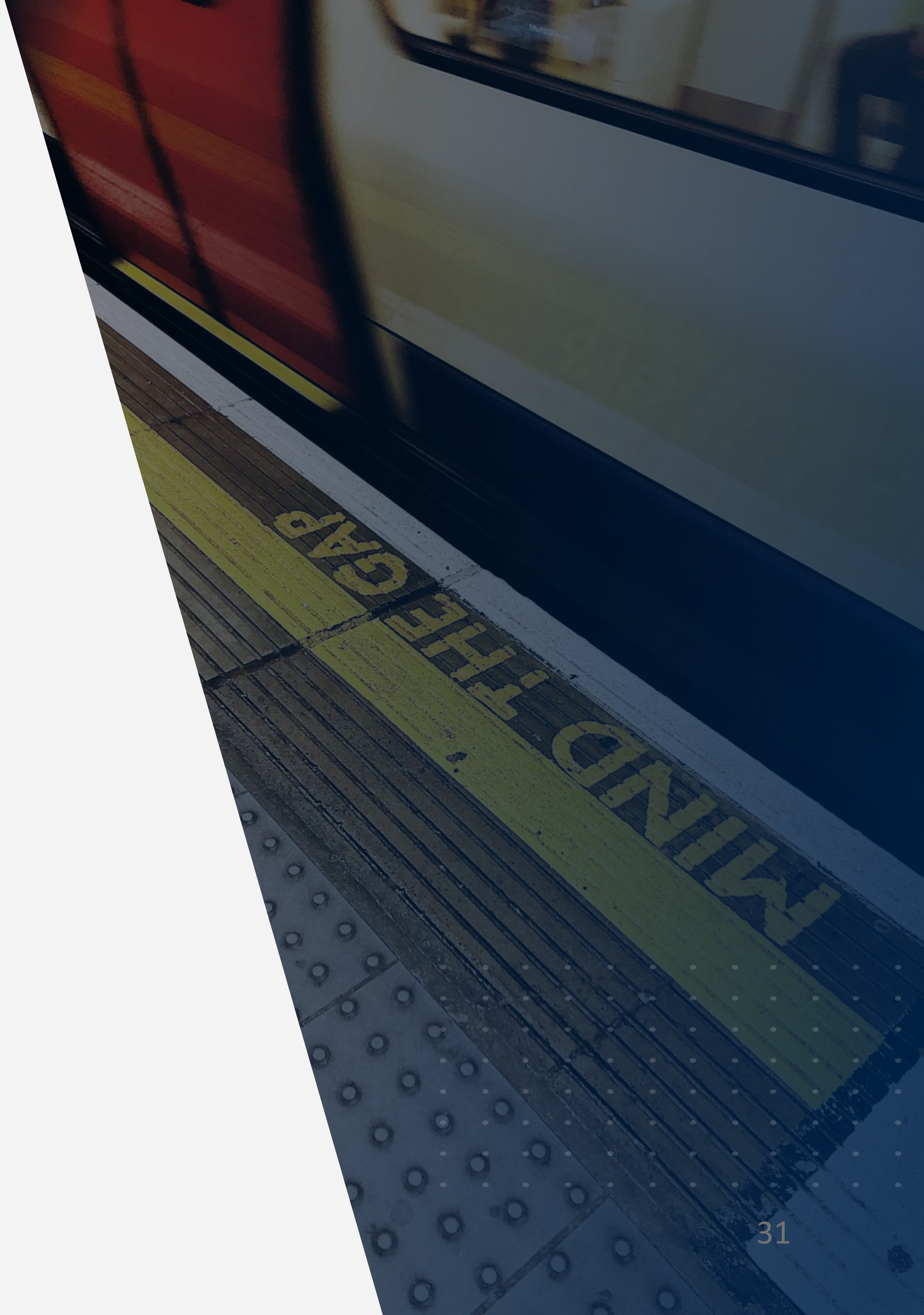


Mind the Gap

*"…In a cloud-first and increasingly automated world, infrastructure and operations (I&O) leaders must **rethink** how infrastructures are utilized and managed…"*

*"Strategic infrastructure **standardization**, modernization and **automation** efforts will be **critical** for successful digital transformation."*

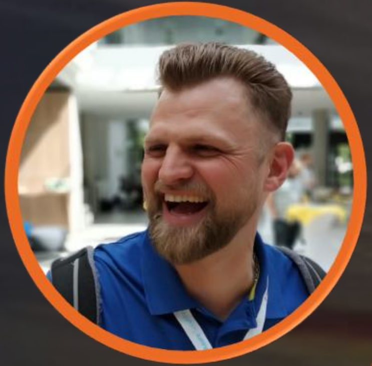
Source: Gartner (*4 Predictions for I&O Leaders on the Path to Digital Infrastructure*)



Modularization Best-Practices

1. Establish **central** (standardized) module libraries (**Registry**)
2. Multi-Cloud **Scenarios** → Multi-Provider **Modules**
3. Be familiar provider docs, updates and changelogs
4. Keep pace with the provider **releases** (“*Don’t get left behind!*”)
5. Strive for feature completion & automation
6. Provide `default` values and `descriptions` for variables
7. Put code guidelines in place (naming consistency)
8. Use `versions.tf` in the **module**
9. Follow the “*shit in – shit out*” principal (less validations)
10. Separate the state files into logical pieces →

Stefan Rapp



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- @rapster83
- https://blog.misterazure.com

Microsoft CERTIFIED EXPERT

- 15 years in IT Consulting
- 6 years MS Development & Infrastructure
- Since 2018 Azure Governance & Infrastructure
- Application Modernization towards Azure
- Pushing IaC (Terraform) at customers

Thank you (Q&A)

Blog	: https://blog.misterazure.com
GitHub	: @rapster83
LinkedIn	: https://www.linkedin.com/in/rapster83/