Enos: a Holistic Framework for Conducting Scientific Evaluations of OpenStack

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Inria, France

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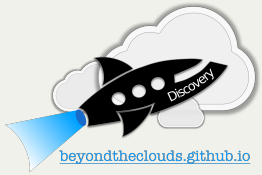
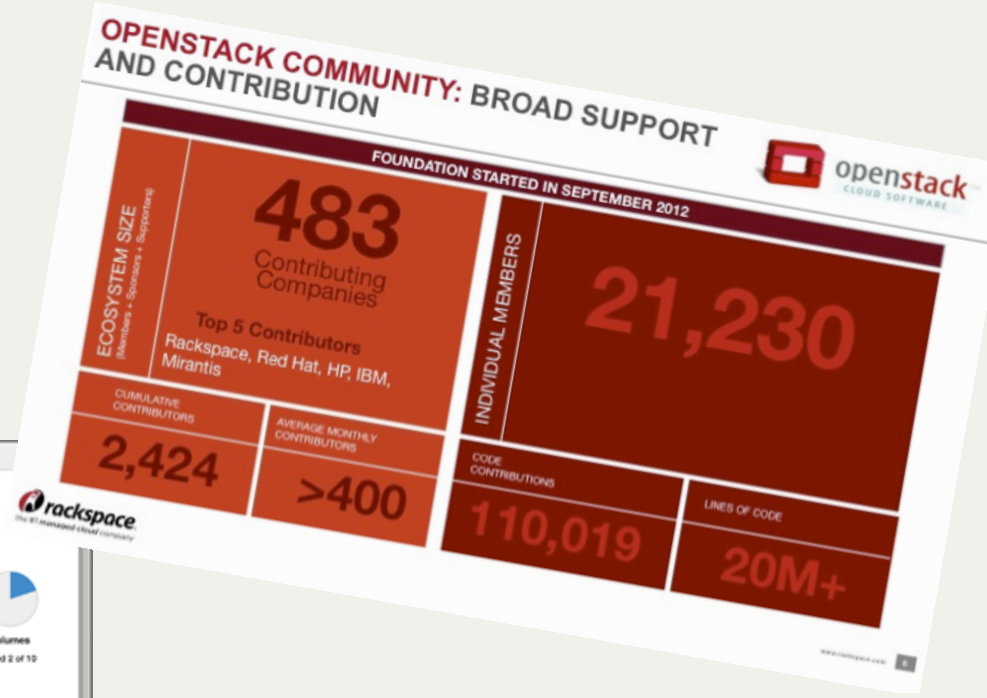
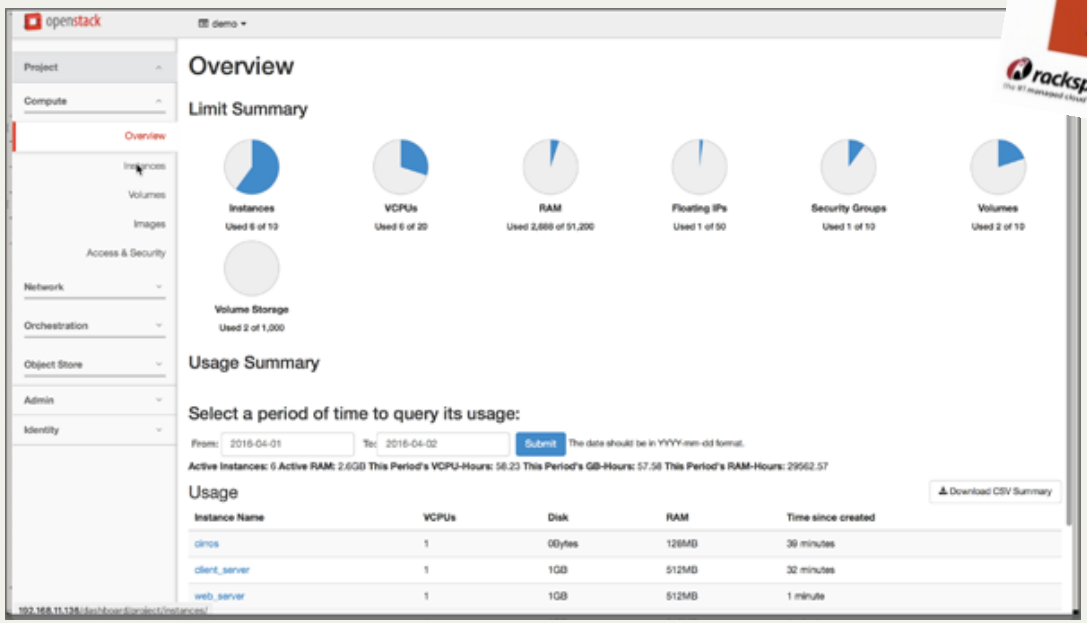


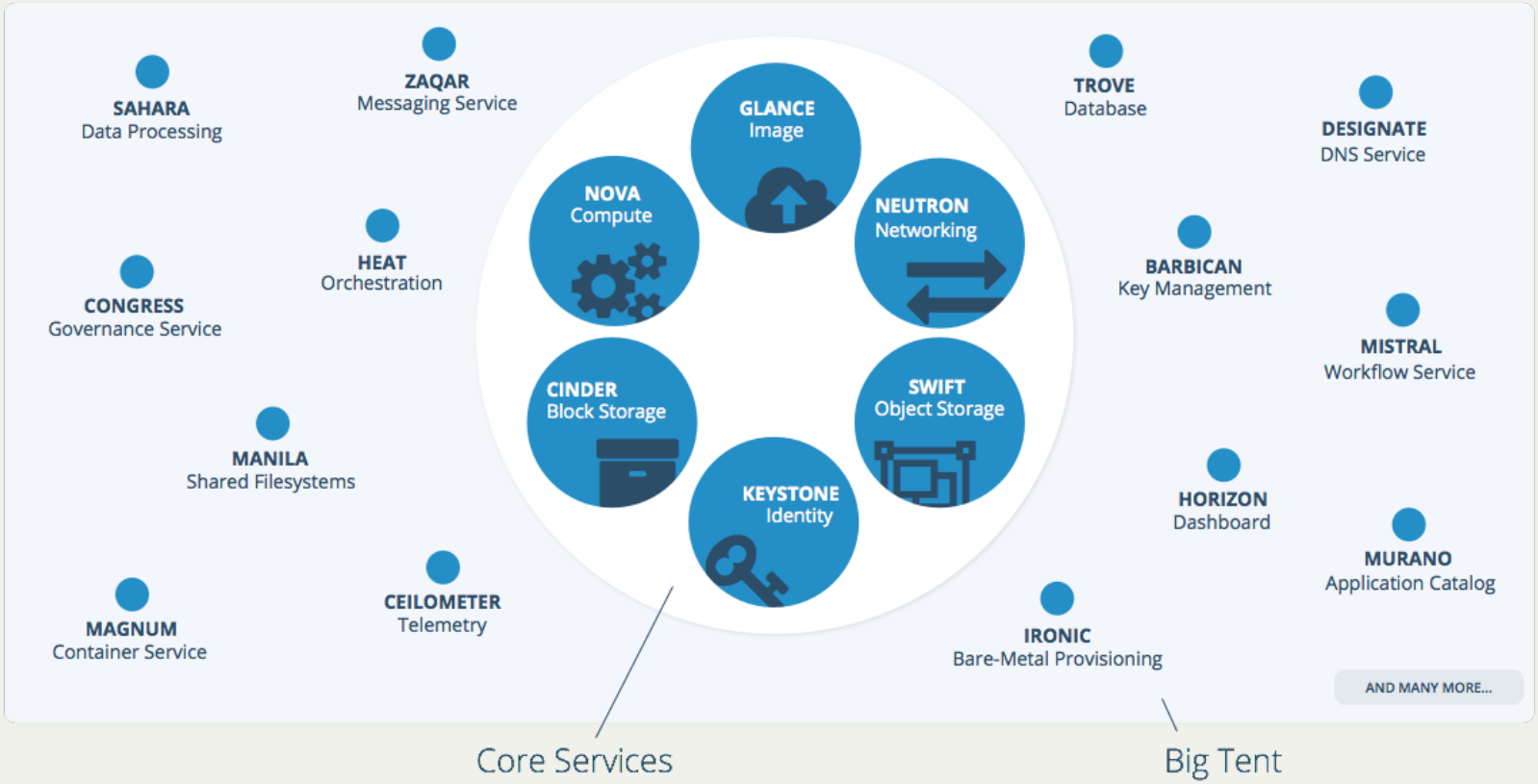
OpenStack

Industry standard for creating public and private clouds



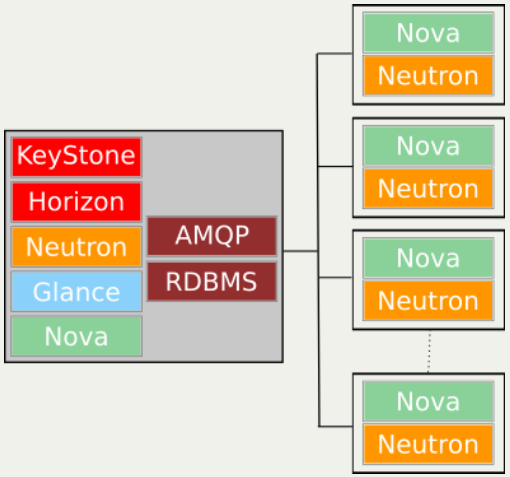


OpenStack



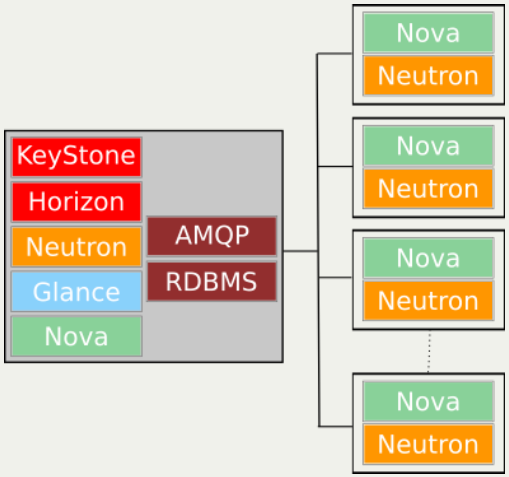
- **164 services** in OpenStack
- Some services are composed of **sub-services** (e.g. nova-scheduler, nova-conductor, ...)
- Most of which can be disabled/enabled depending on one's needs

Deployment topologies



Single controller, multiple compute nodes

Deployment topologies



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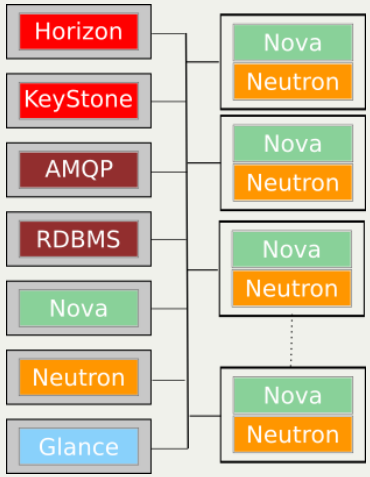
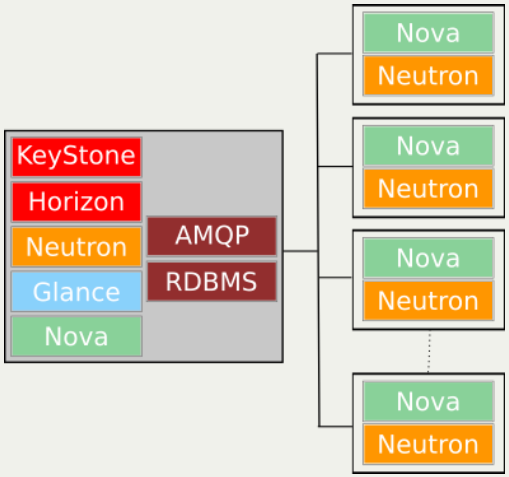


Multiple controllers, multiple compute nodes

Deployment topologies



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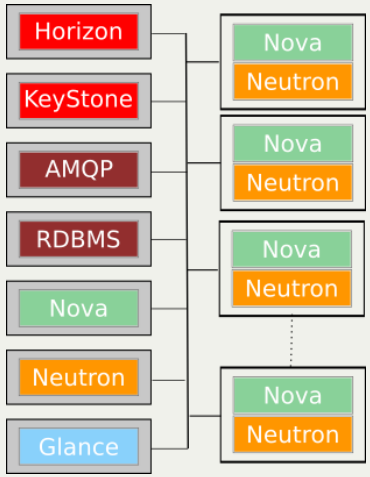
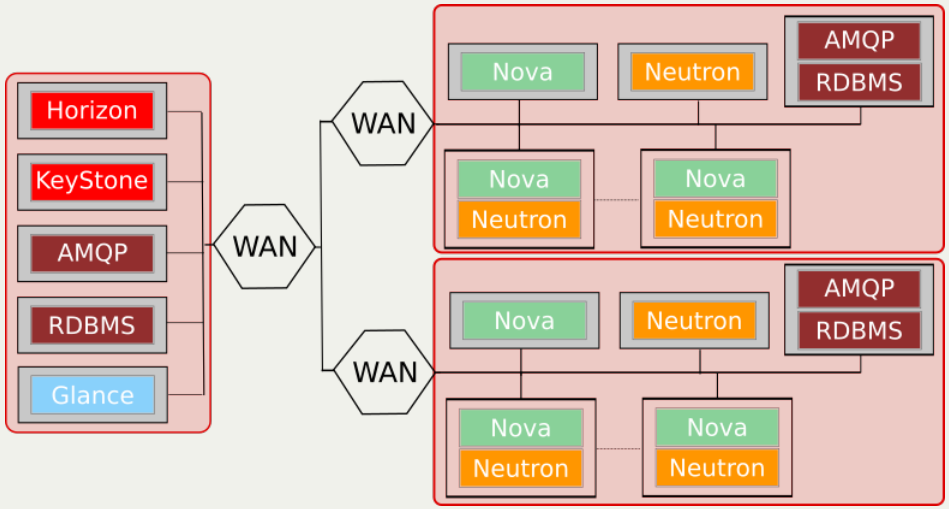


Multiple controllers, multiple compute nodes



Multiple controllers, multiple compute nodes, multiple regions

Motivation

Goals:

- Favour **reproducible scientific evaluations**
- Automated *Performance Regression Testing*
- Help developers evaluate their code with multiple setups and topologies

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Typical experimental workflow:

1. Book and provision servers
2. Deploy OpenStack
3. Perform benchmarks
4. Collect and save metrics
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⇒ Automation & reproducibility means **all these steps** must be **scripted**.

Contribution: Enos

A holistic framework for scientific evaluations of OpenStack

- Container based OpenStack deployment with Kolla-ansible-ansible
- Rally benchmark (control plane)/Shaker benchmark (data plane)
- Metrics collection with cAdvisor and collectd and stored in InfluxDB
- Query metrics with Grafana
- Query logs with Heka

Based on **high level specifications**

Enos: a typical workflow

1. `enos deploy`:
   - Gets testbed resources
   - Deploys OpenStack
   - Populates OpenStack with cirros image, public/private network
2. `enos bench`:
   - Runs benchmarks
   - Measures CPU/RAM/Network consumption per site/node/service
3. `enos backup`:
   - Performs post-mortem analysis

Enos Workflow

```
enos deploy
```

```
enos bench
```

```
enos backup
```

`enos deploy`

A *Provider* gets testbed resources

- Resource: anything running a Docker daemon and Enos can `ssh` to.
- Supports Grid'5000, VirtualBox, OpenStack and Chameleon
- Easy to extend: ~500 LOC

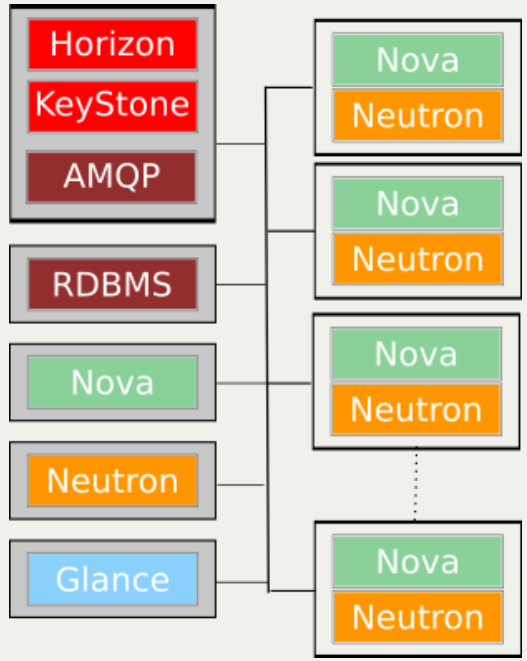
```
provider: g5k
resources:
  paravance:
    control: 1
    network: 1
    compute: 50
```

⇒

1. Get 52 nodes from the paravance cluster;
2. `ssh` and install Python and Docker daemon;
3. Return a list of IP addresses to install OpenStack to.

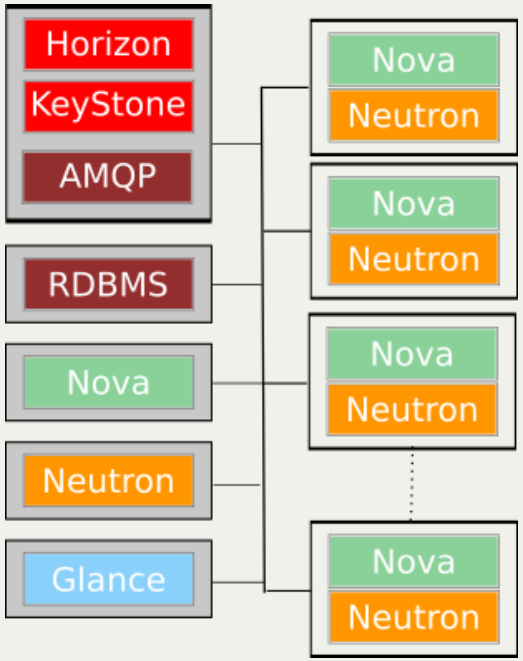
Topology control: `reservation.yaml`

```
provider: g5k
resources:
  paravance:
    control: 1
    database: 1
    nova-conductor: 1
    network: 1
    storage: 1
    compute: 50
```



Topology control: `inventory.yaml`

```
[keystone:children]
control

[horizon:children]
control

[rabbitmq:children]
control

[mariadb:children]
database

...

[nova-compute:children]
compute
```



Network control

```
provider: g5k
resources:
  grp1:
    paravance:
      control: 1
      database: 1
      nova-conductor: 1
      network: 1
      storage: 1
  grp2:
    paravance:
      compute: 50
```

```
network_constraints:
  - src: grp1
    dst: grp2
    delay: 150ms
    rate: 100mbit
    symetric: true
```

OpenStack customization

```
kolla:
  openstack_release: 4.0.0

patches:
  - name: patch mariadb bootstrap
    src: mariadb_bootstrap.yml
    dst: kolla/ansible/roles/mariadb/tasks/bootstrap.yml
    enabled: "yes"
  - name: patch galera.cnf.j2
    src: galera.cnf.j2
    dst: kolla/ansible/roles/mariadb/templates/galera.cnf.j2
    enabled: "yes"
  - name: patch haproxy.cfg.j2
    src: haproxy.cfg.j2
    dst: kolla/ansible/roles/haproxy/templates/haproxy.cfg.j2
    enabled: "yes"
```

Enos Workflow

```
enos deploy

enos bench

enos backup
```

enos bench

Execute arbitrary Rally benchmark

```
rally:
  enabled: true
  args:
    concurrency:
      - 5
      - 10
    times:
      - 100
    scenarios
      - name: boot and list servers
        file: nova-boot-list-cc.yml
```

```
$ enos bench --workload=run.yml
```

Enos Workflow

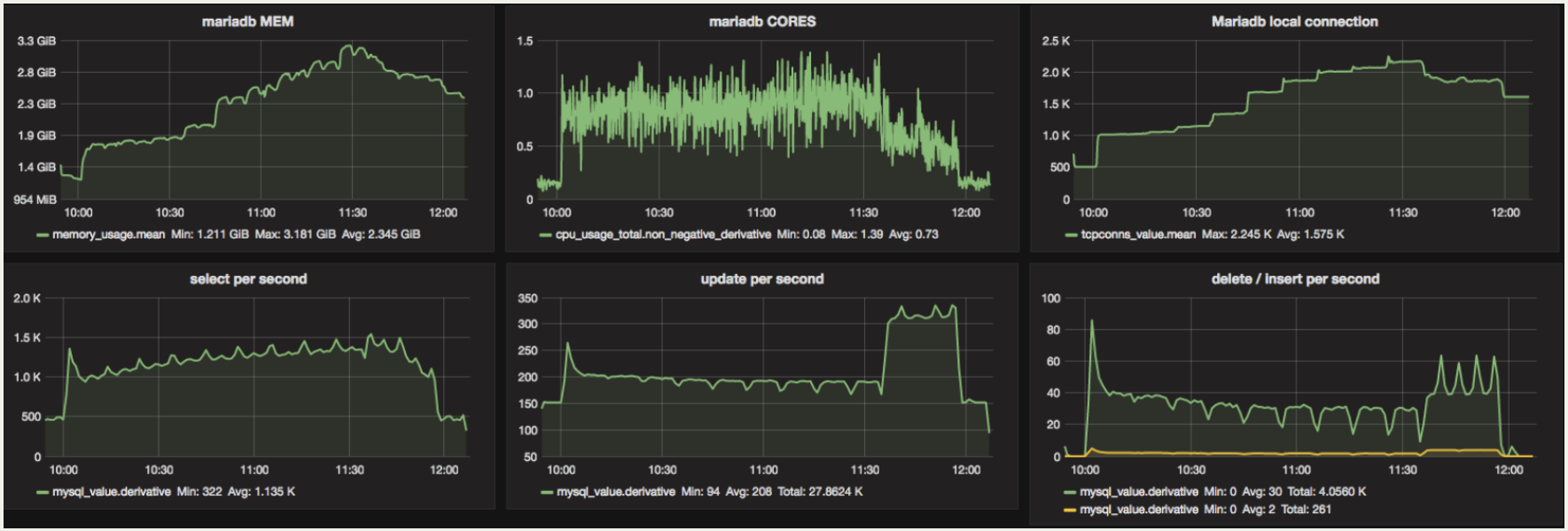
```
enos deploy

enos bench

enos backup
```

`enos backup`

`enos backup` produces a archive with ready-to-share results:

- Rally/Shaker reports
- OpenStack logs
- InfluxDB database filled with collected metrics
- Grafana server for visualisation

Measures Output



Conclusion

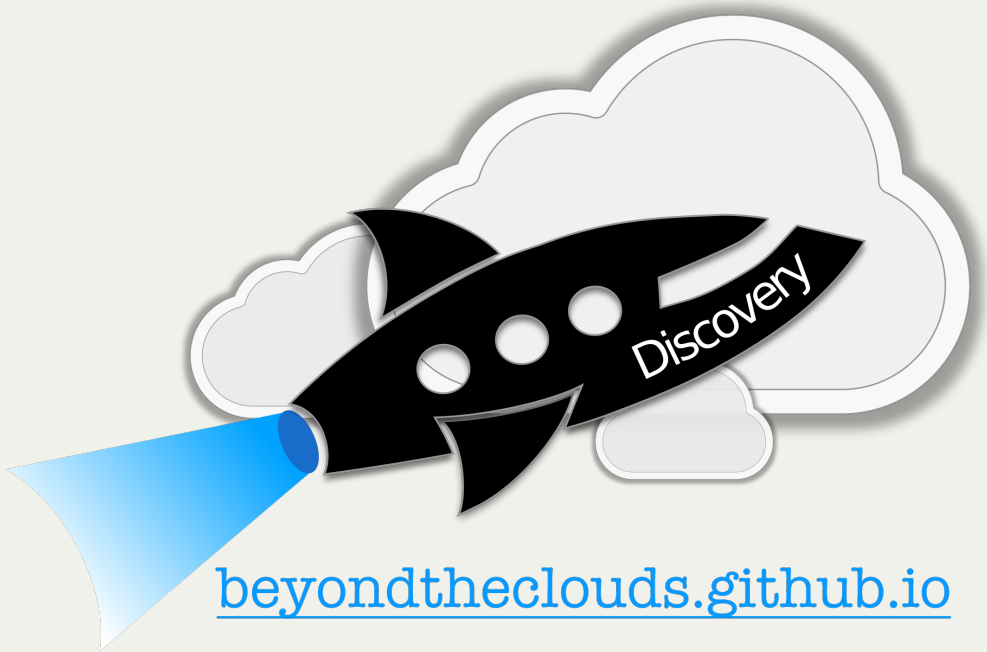
Enos

- Complete solution to deploy and evaluate OpenStack
  `https://github.com/BeyondTheClouds/enos`
- Integrated, reproducible and sharable
- Fine control over deployment topology and network
- Ready-to-use recipes:
  `https://github.com/BeyondTheClouds/enos-scenarios`

Future works

- Multiple Regions
- WANwide OpenStack
- OSProfiler Integration
- Adapt to other complex software stacks

Thank you



beyondtheclouds.github.io

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