Plenary Discovery 6. Nov 2017

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Study of OpenStack Internal bus in a Fog/Edge Context

Orange/Inria - started 1. Oct 17

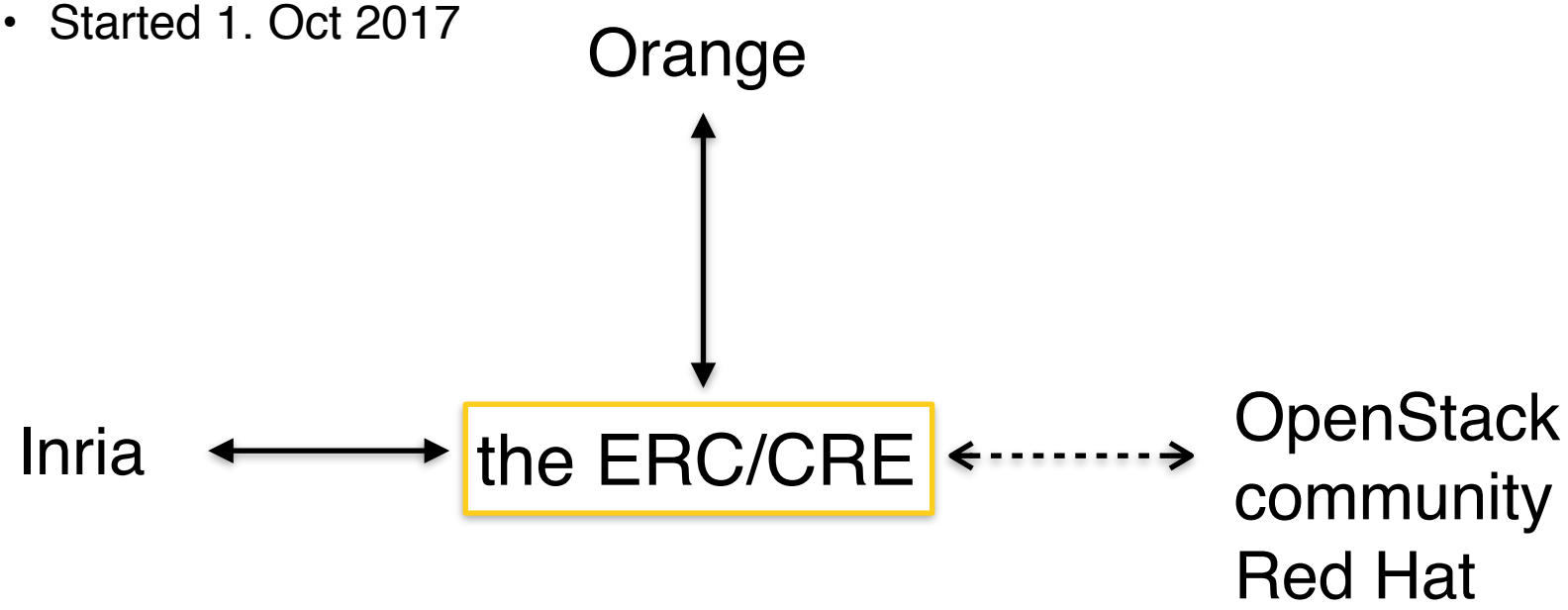
Abdelhadi Chari (Orange)
Adrien Lebre (IMT Nantes)
Ali Sanhaji (Orange)
Matthieu Simonin (Inria)
Alexandre Van Kempen (Inria)

01

Context

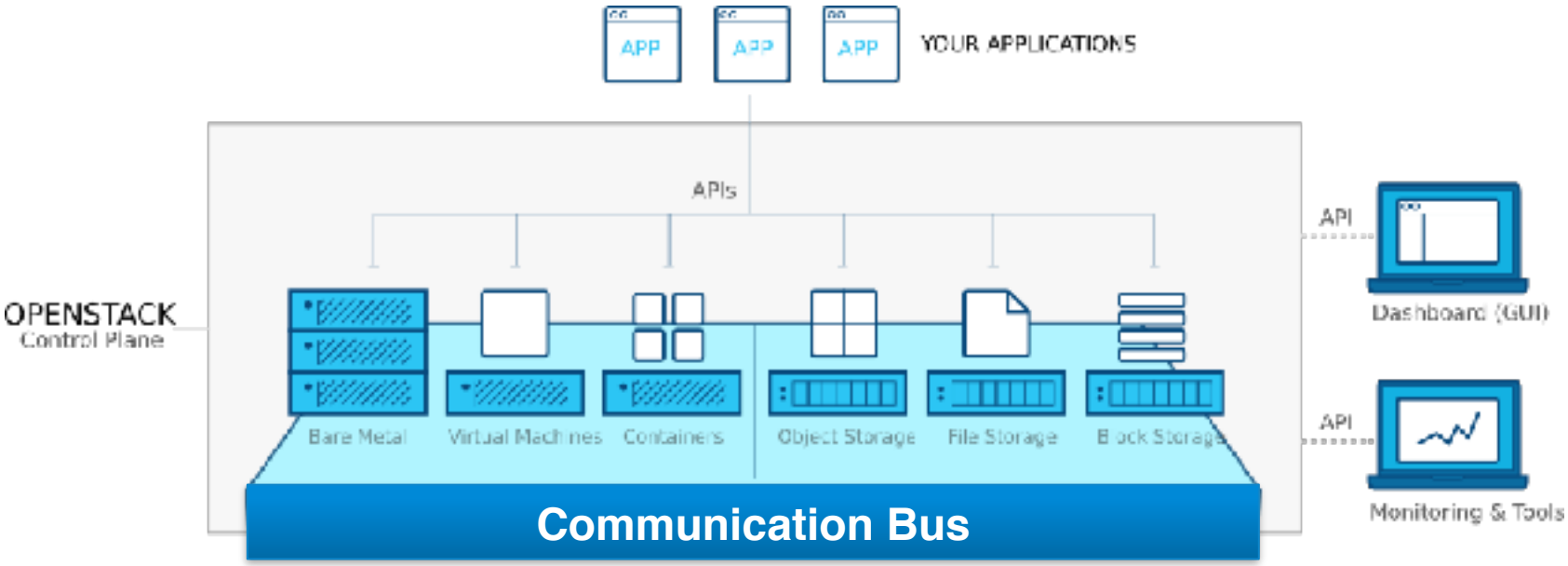
We got an ERC[1] !

- (en)ERC: Externalised Research Contract
- (fr)CRE: Contrat de Recherche Externalisée
- Signed between Orange and Inria
- Started 1. Oct 2017



1. this is not an ERC grant from the European Research Council

Technical environment : Openstack



Is the communication bus of OpenStack Fog/Edge ready ?

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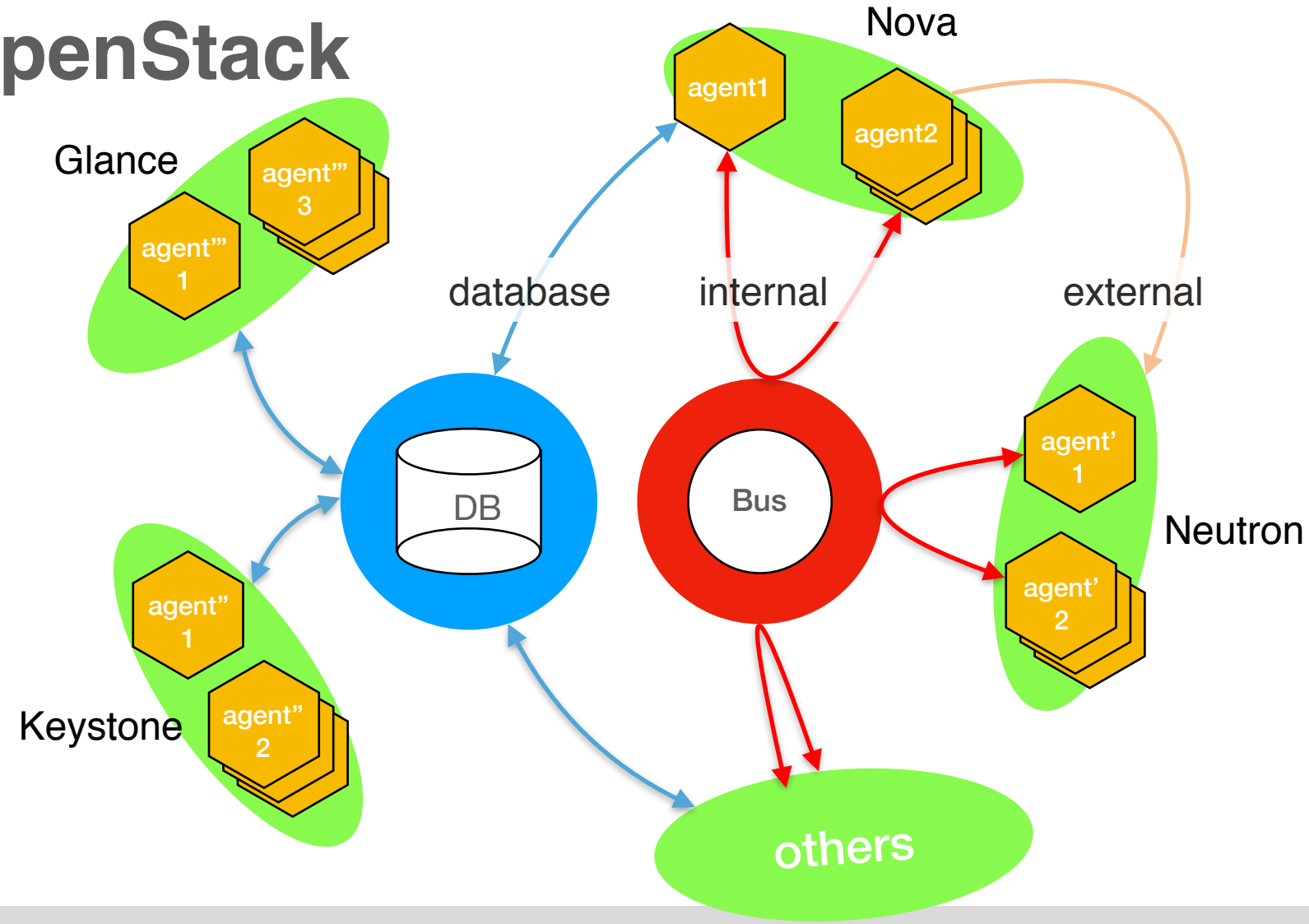
OpenStack



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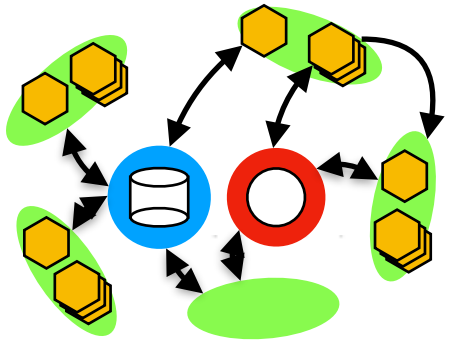
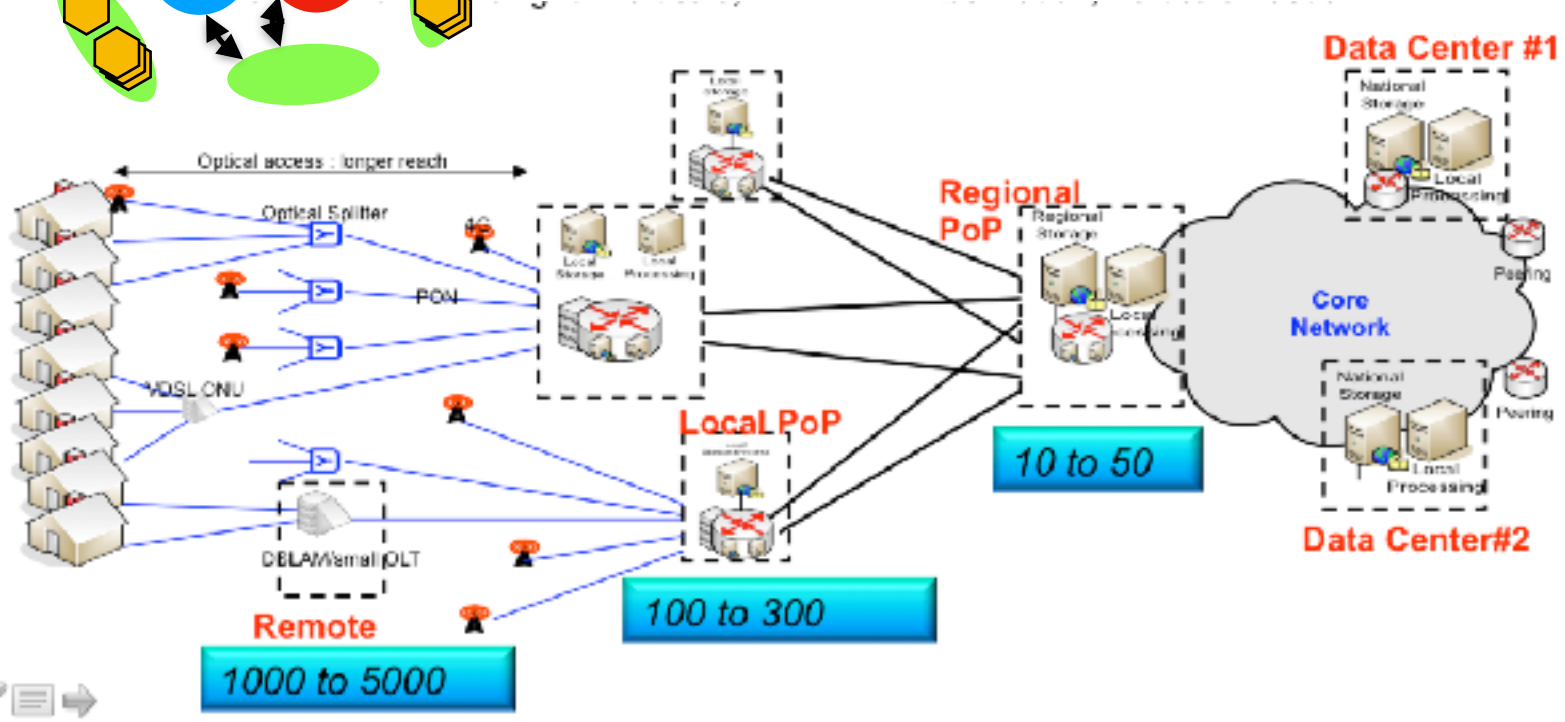
OpenStack: target infrastructure





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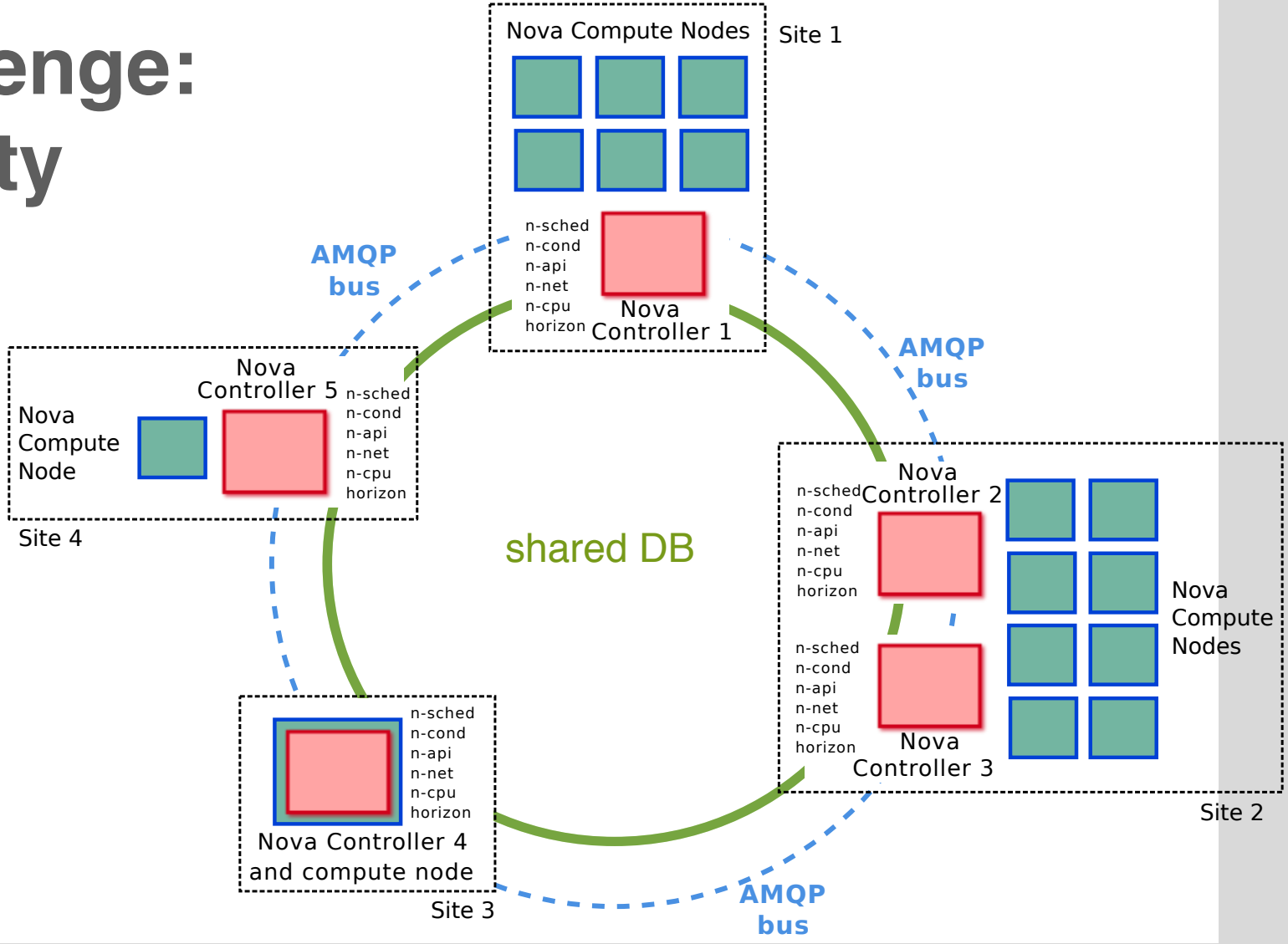
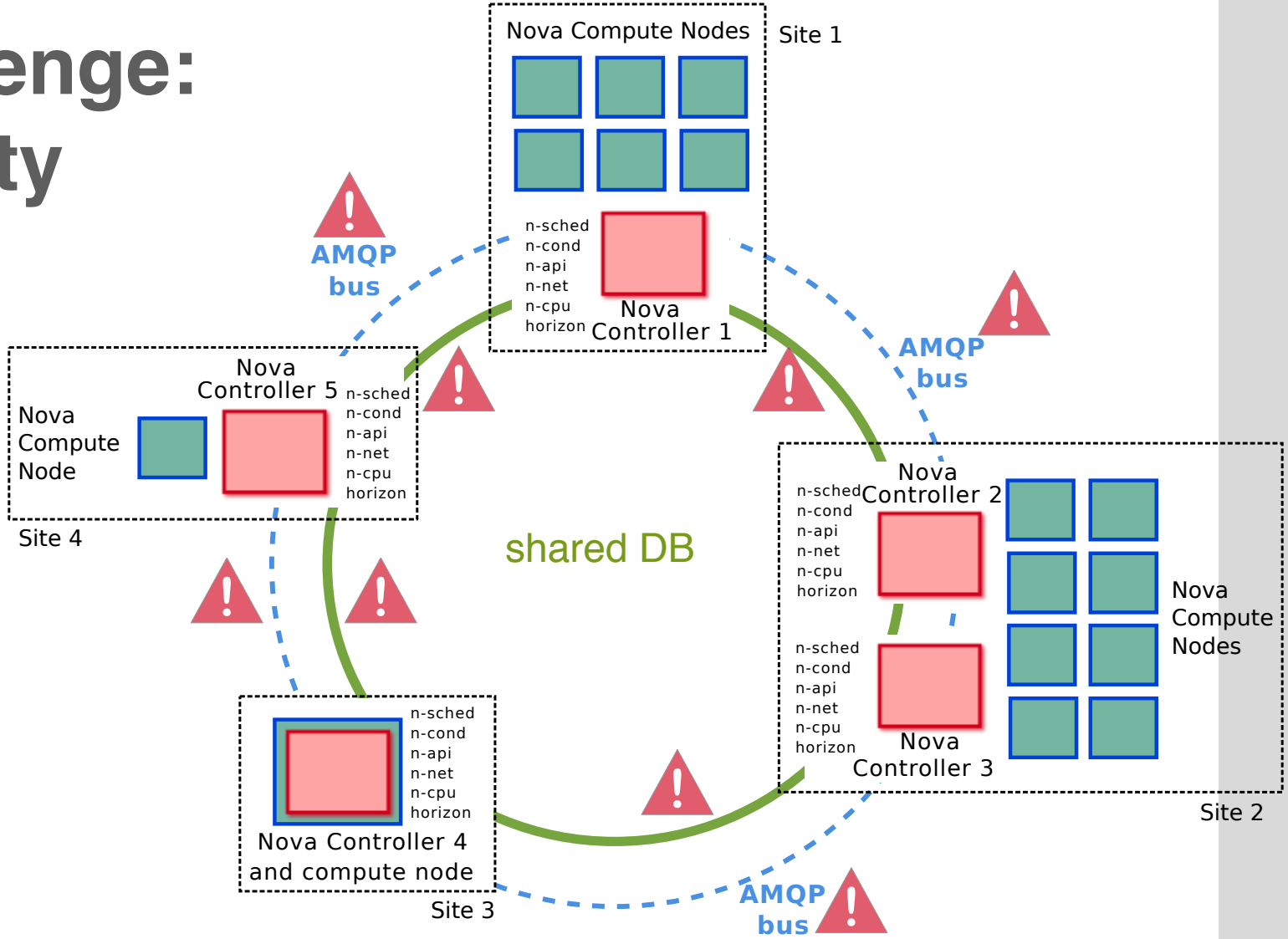
Challenge: locality



Challenge: locality



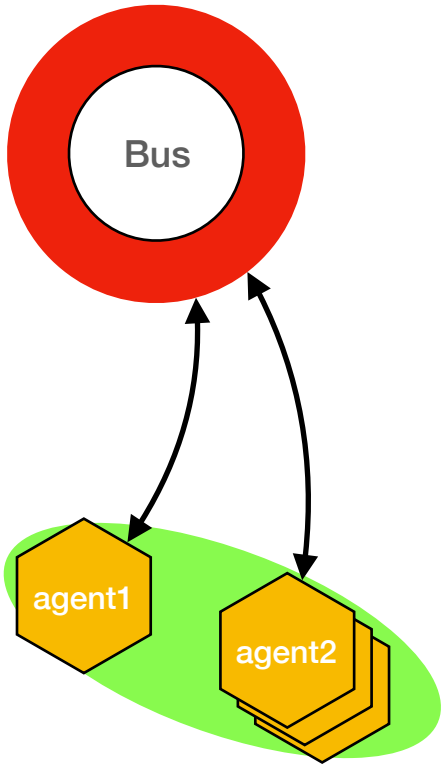
Challenge: locality

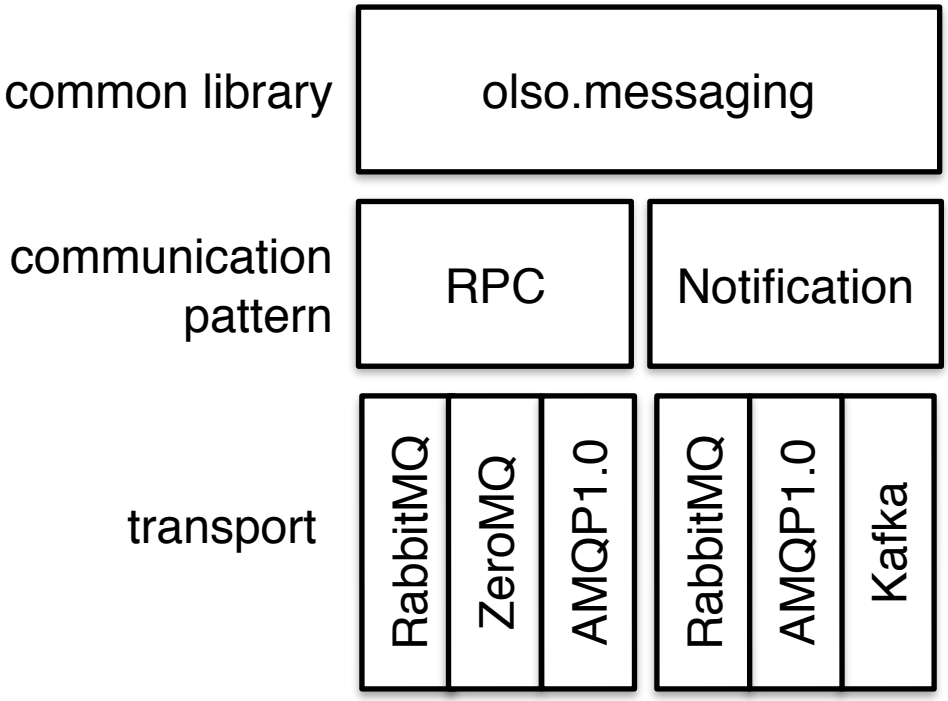
- Distributing the database :
  - ~~Ronan's talk tomorrow~~ Next Talk from Ronan
- Distributing the message bus
  - Current talk

02

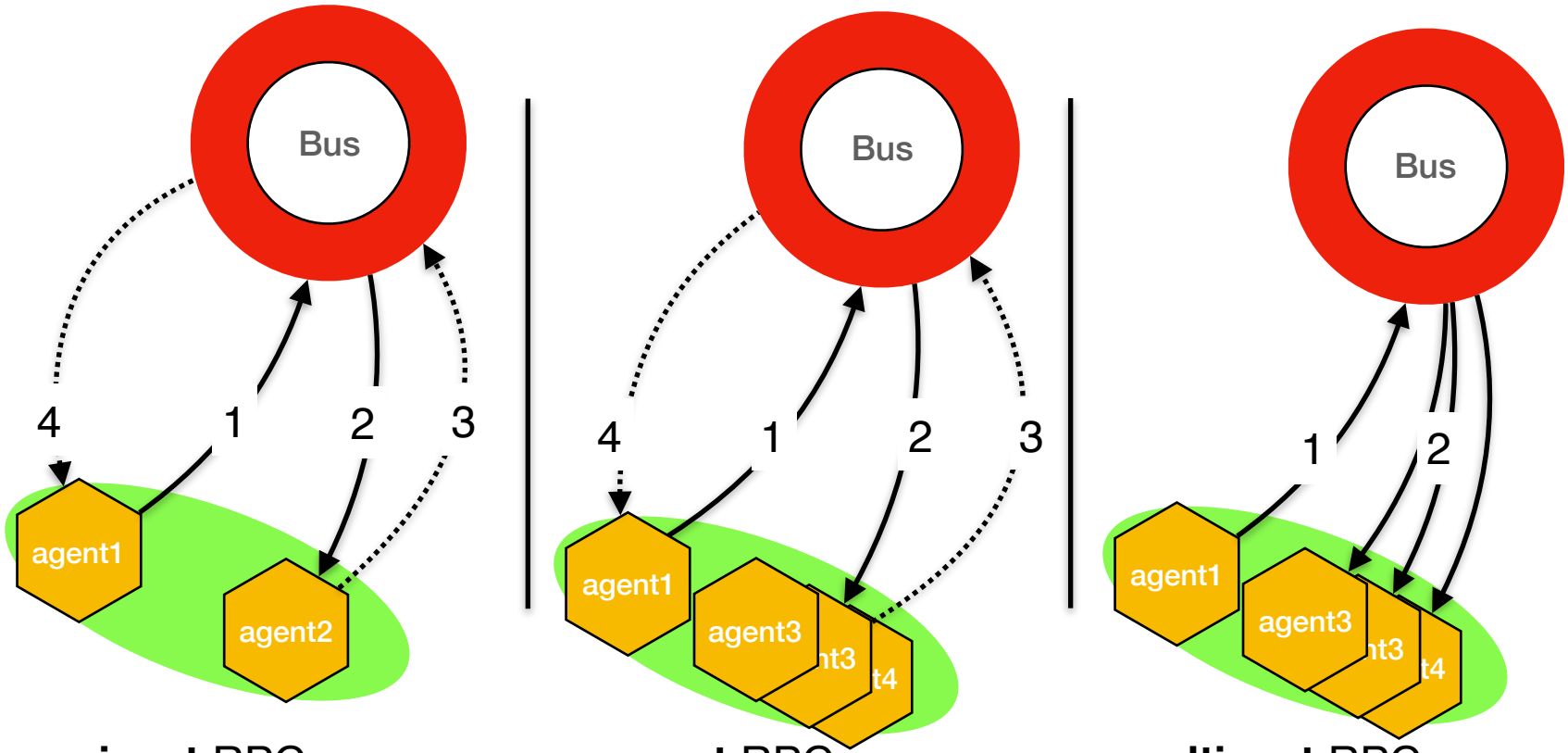
Communication bus of OpenStack

OpenStack : bus implementation





OpenStack : RPC patterns



unicast RPC
blocking & non blocking

anycast RPC
blocking & non blocking

multicast RPC
non blocking only

OpenStack : RPC transport

- RabbitMQ driver (main stream)
  - Centralized broker solution
  - First bottleneck when scaling the deployment
- ZeroMQ driver
  - « embarrassingly » distributed - brokerless
  - only suitable for small deployments
  - less supported
- AMQP1.0
  - new driver (beta version)
  - can use a mesh of routers to route messages

03

Planned Activity

CRE: planned activities

RPC Transport :

- Which RPC transport protocol in the Fog/Edge context ?

Communication patterns and service agents deployment:

- Anti-patterns in the Fog/Edge clouds context?
- Locality requirements

CRE: planned activities

Experimental protocol and objectives are being approved

https://review.openstack.org/#/c/491818

- In brief:
  - Emulate a target fog/edge infrastructure on Grid'5000
  - Choose a message bus and deploy it
  - Evaluate all the messaging patterns
  - Evaluate the resilience of the message bus
  - Evaluate the overall performance of (a distributed) OpenStack

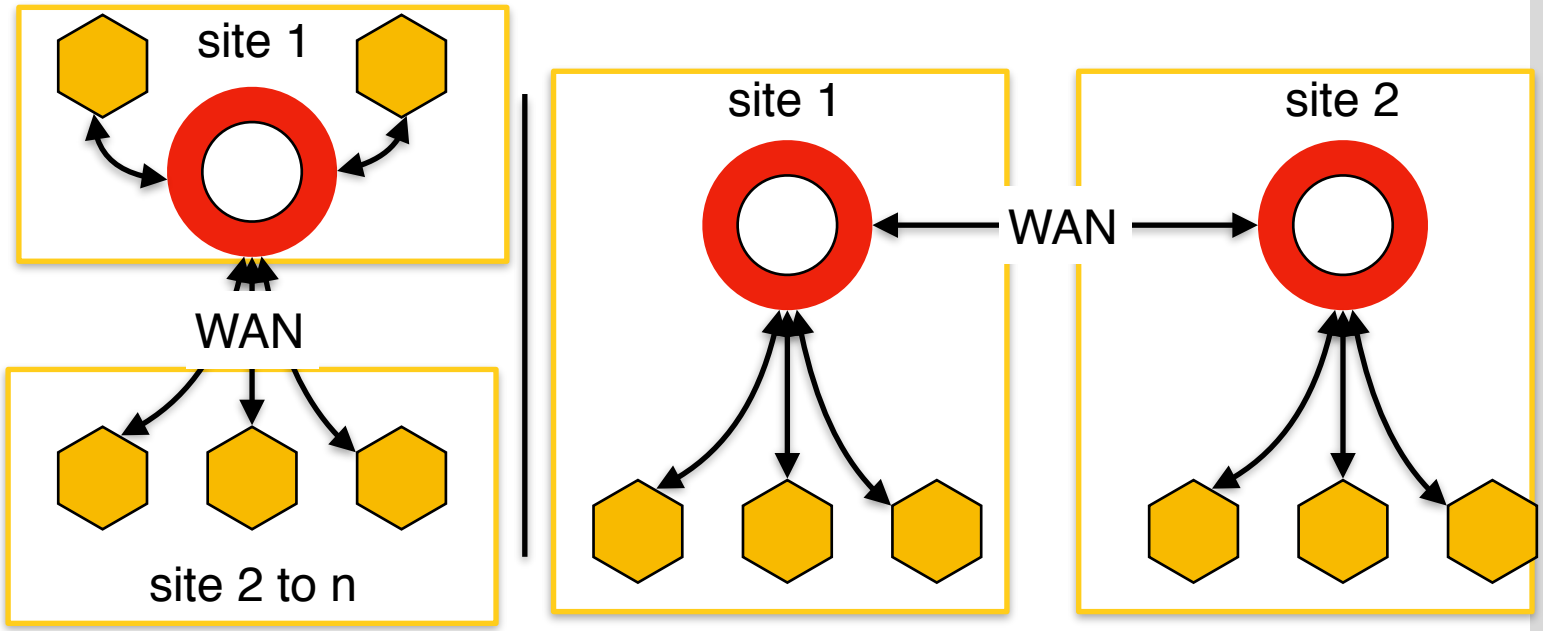
CRE: tools

- EnOSlib (Inria - Discovery)
  - Experimental workflow description/deployment/ execution
- Ombt (kgiusti - oslo.messaging core dev)
  - Benchmarking & orchestration tool for oslo.messaging
- Os-fault (OpenStack - Performance team)
  - Failure injection framework (agnostic)
- Osprofiler (OpenStack - Performance team)
  - Distributed tracing system
  - -> Identification of the communication patterns

CRE: short term

Short Term: Evaluation of RabbitMQ

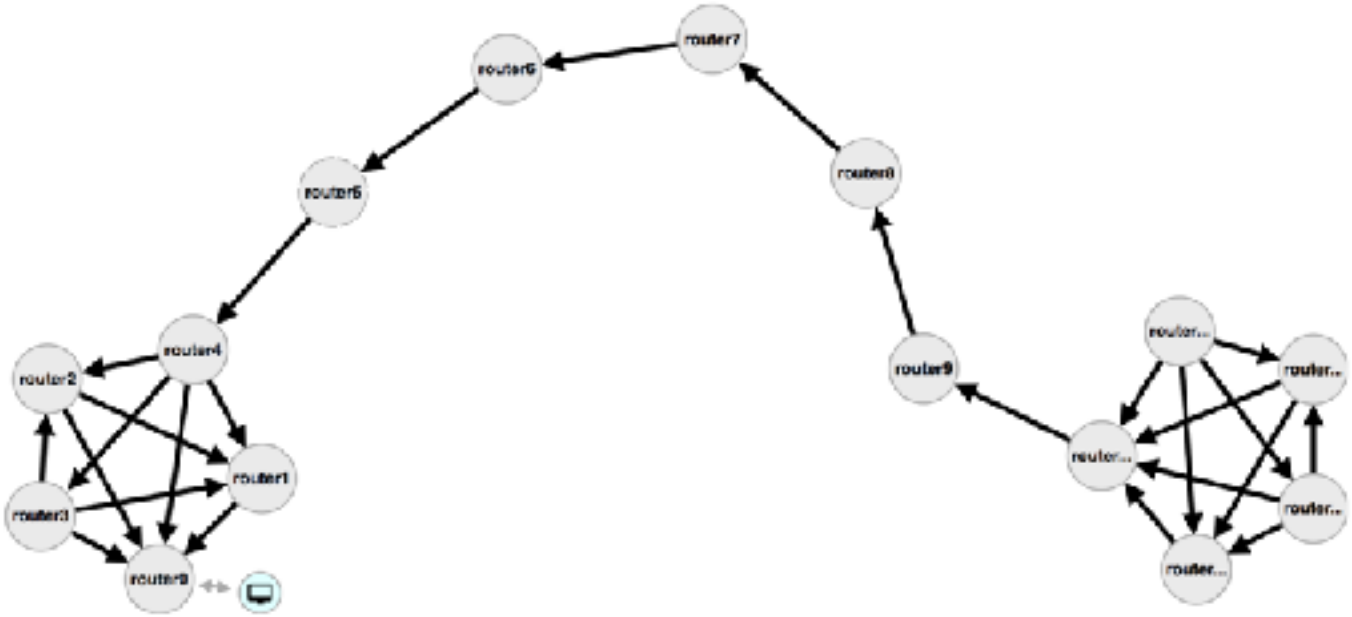
- Central RabbitMQ and many edge servers
- Distributed RabbitMQ through federations



CRE: short term

Mid Term: Evaluation of AMQP1.0 (qpid-dispatch-router)

- Collaboration with Red Hat



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Vancouver (05/18): Distributing OpenStack

Distribution of the message broker

- Joint work with
  - Red Hat (qpid dispatch router)
  - oslo.messaging

=> CRE Orange

Distribution of the database

- Joint work with
  - CockroachDB (newSQL implementation)
  - oslo.db

=> next talk tomorrow

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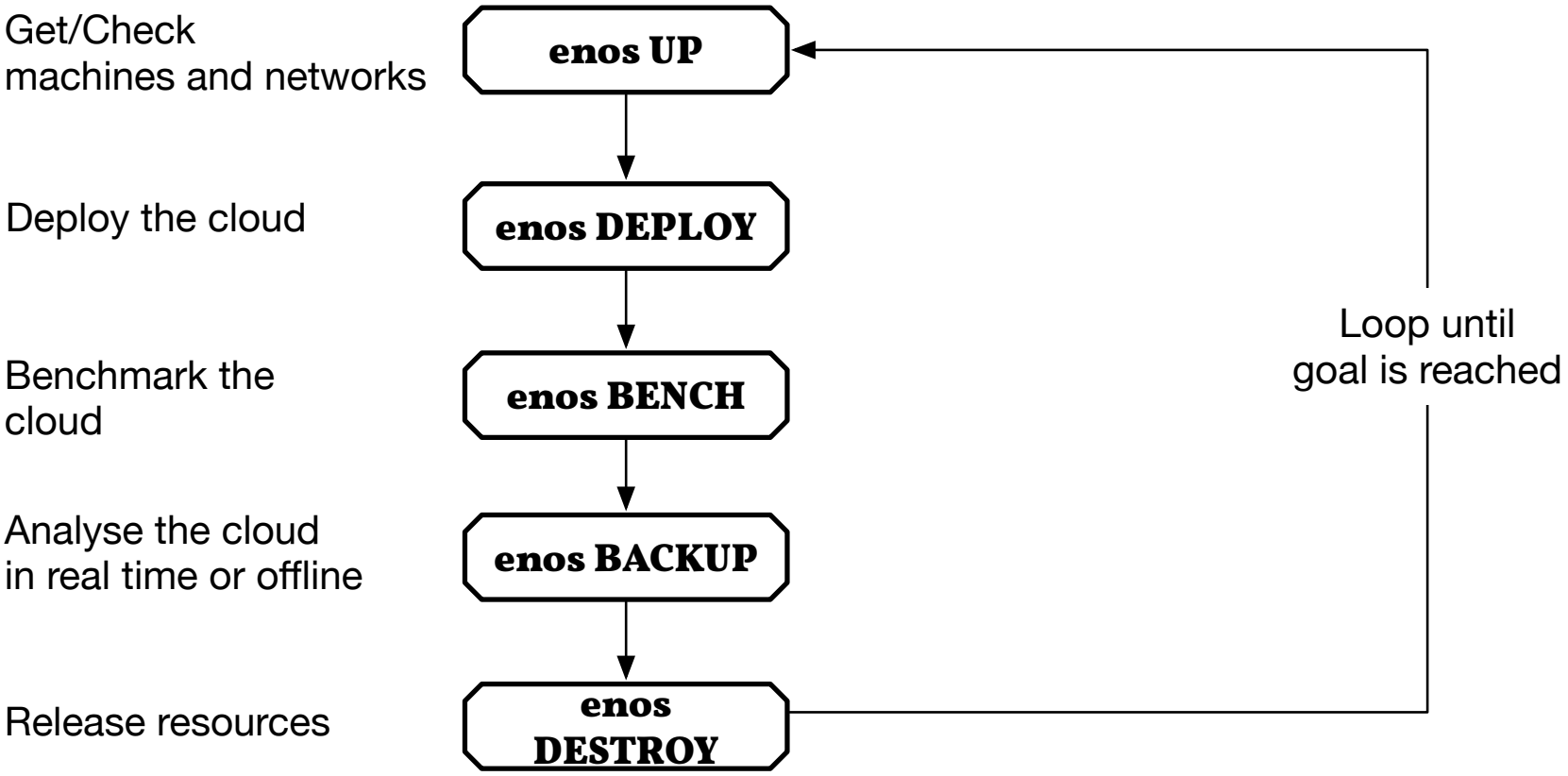
CRE: using EnOS(lib)



The Discovery Inria Project Lab

Cloud computing

- centralized
- small number of large datacenter
- user locality unaware

Edge computing

- distributed
- large number of small datacenter
- user locality aware

Fog computing

https://beyondtheclouds.github.io/

OpenStack Internal bus in a Fog/Edge Context

CRE-Orange/Inria - started 1. Oct 17

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Thank you!

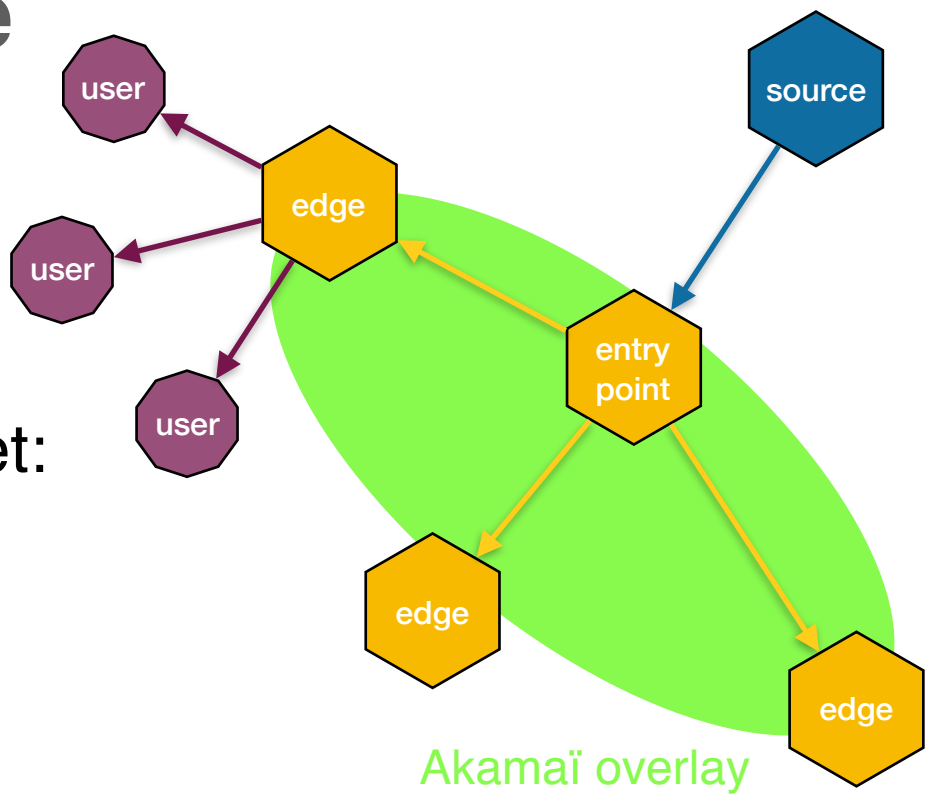
05

Conclusion

Foundation	Board of directors		Technical committee	User committee
Project Teams	Neutron	Nova	Glance	Swift Keystone +50 more
Working groups	API* Scientific*	Large Deployment Team	Fog/Edge Massively distributed clouds +20 more	

* SIG :Special Interest Group

The Akamaï case



Akamaï Internet in Internet:

- more distributed
- faster
- more reliable

- but only for content delivery

https://www.akamai.com/us/en/multimedia/documents/technical-publication/the-akamai-network-a-platform-for-high-performance-internet-applications-technical-publication.pdf

The Akamaï case

Peak Usage*:

- 10+ millions simultaneous video streams
- traffic :50+ Tbps

* estimation made in 2009 for the next 5 years

https://www.akamai.com/us/en/multimedia/documents/technical-publication/the-akamai-network-a-platform-for-high-performance-internet-applications-technical-publication.pdf

02

EnOS: performance toolkit for OpenStack

From the performance angle

Goal:

- Discovery/Inria to be visible in the OpenStack community
- Fog/Edge use case to be visible

Mean:

- Working groups (Performance + FEMDC)
- Summit presentations
- **A toolkit for the performance study of OpenStack**

Challenge:

- Small task force

« The PhD student problem »

This includes :

- Dealing with OpenStack deployment
- Maintaining code + deployment
- Ensuring the reproducibility (at least reusability) of the experiments
- Scaling the experiment

In summary :

- **What makes an experimental validation technically trustworthy**

EnOS

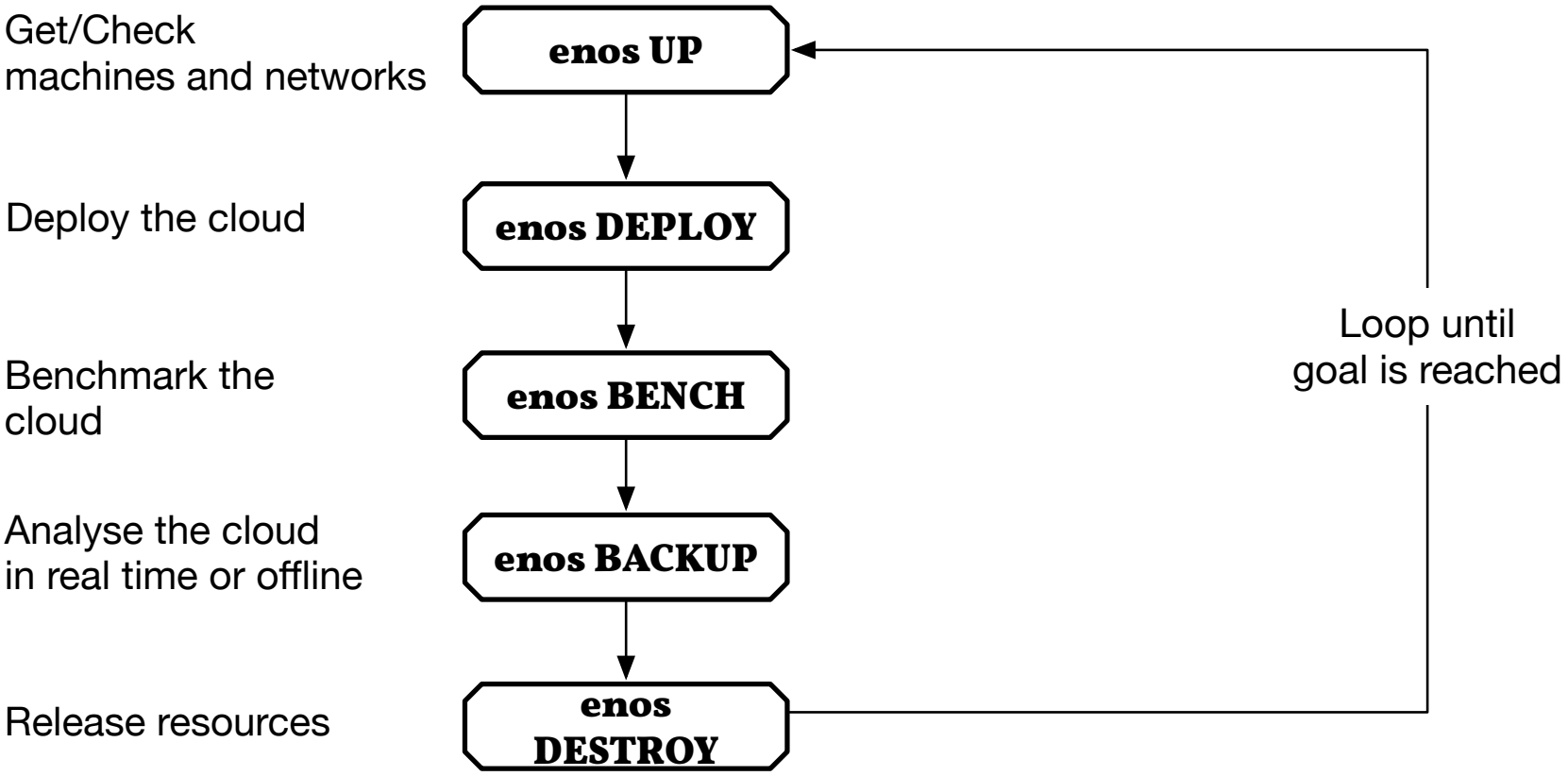
EnOS : Experimental ENvironment for OpenStack

A common good for the IPL :

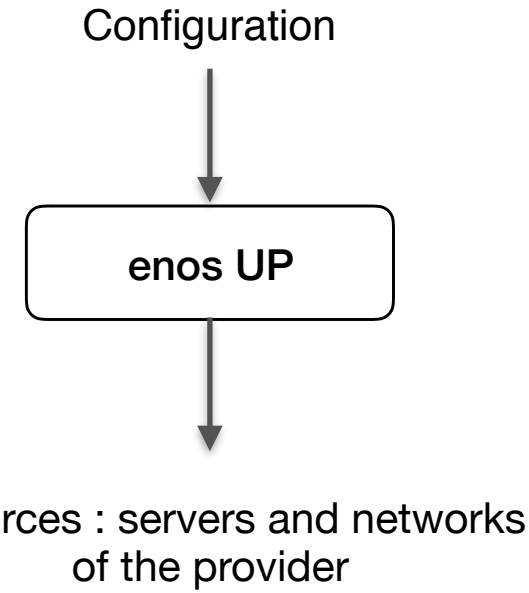
- Take care of the deployment
- Can be customized easily
- Allow the emulation of geo-distributed ressources

Ronan-Alexandre Cherrueau, Dimitri Pertin, Anthony Simonet, Adrien Lèbre, Matthieu Simonin: **Toward a Holistic Framework for Conducting Scientific Evaluations of OpenStack.** CCGrid2017

EnOS workflow



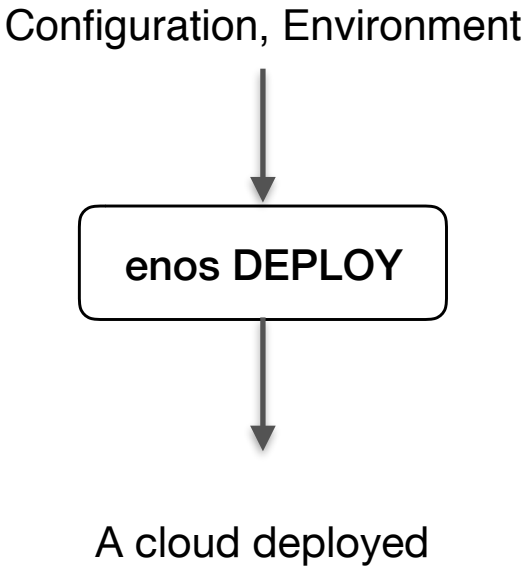
EnOS workflow : up



Different providers :

- Local machines
  - virtual box
  - libvirt
- Testbeds
  - Grid'5000
  - OpenStack
  - Chameleon Cloud

EnOS workflow : deploy

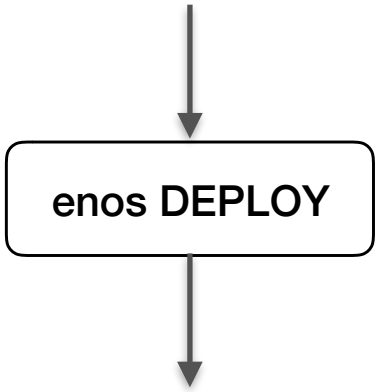


small-sized deployments
(100 machines)

- approx 500 agents to deploy

EnOS workflow : deploy

Configuration, Environment

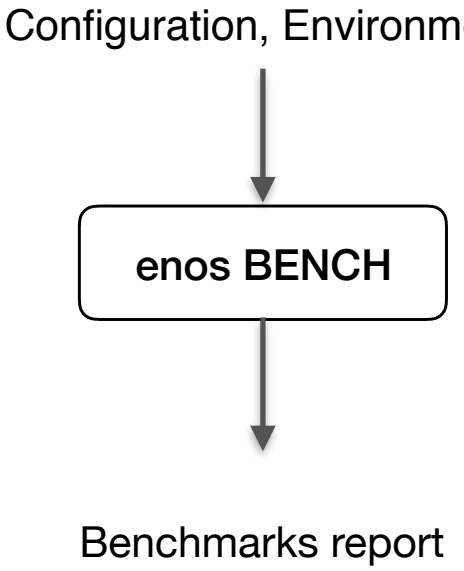


A cloud deployed

EnOS is flexible:

- Custom topology
- Different scales

EnOS workflow : bench

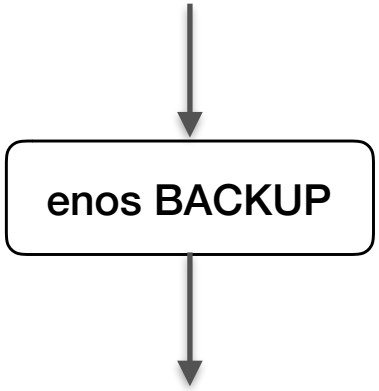


Integrated evaluation tools:

- Rally (control plane)
- Shaker (data plane)
- OSProfiler (tracing)

EnOS workflow : backup

Configuration, Environment



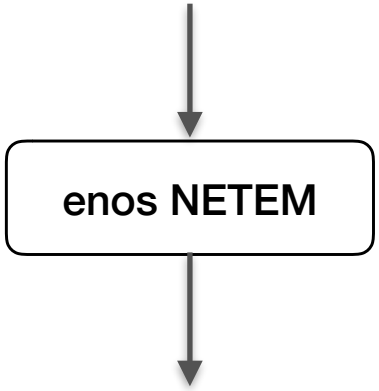
A tarball with settings/results

Backups include

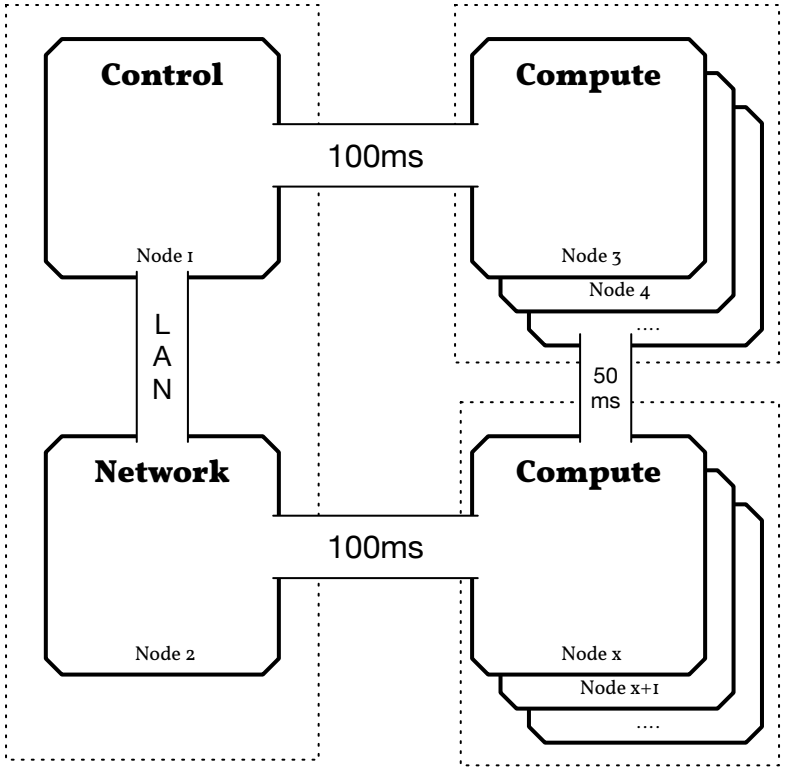
- Logs/Configurations
- Benchmark reports
- Metrics gathered

EnOS workflow : netem

Configuration, Environment



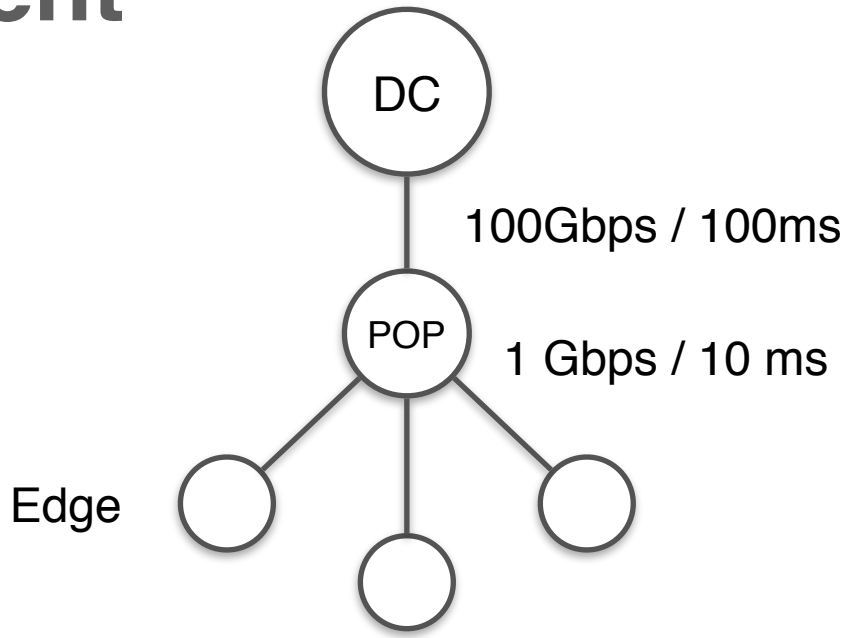
Network emulated



03

EnOS: Case studies

Monitoring functions placement



Mohamed Abderrahim, Meryem Ouzzif, Karine Guillouard, Jerome Francois, Adrien Lèbre. A Holistic Monitoring Service for Fog/Edge Infrastructures: a Foresight Study. *The IEEE 5th International Conference on Future Internet of Things and Cloud (FiCloud 2017)*, Aug 2017, Prague, Czech Republic.

Large scale deployment

Collaboration

Achievements:

- « Chasing 1000 nodes scalability »
- Joint Work with Mirantis
- G5K official listed as official testbed for OpenStack performance evaluation

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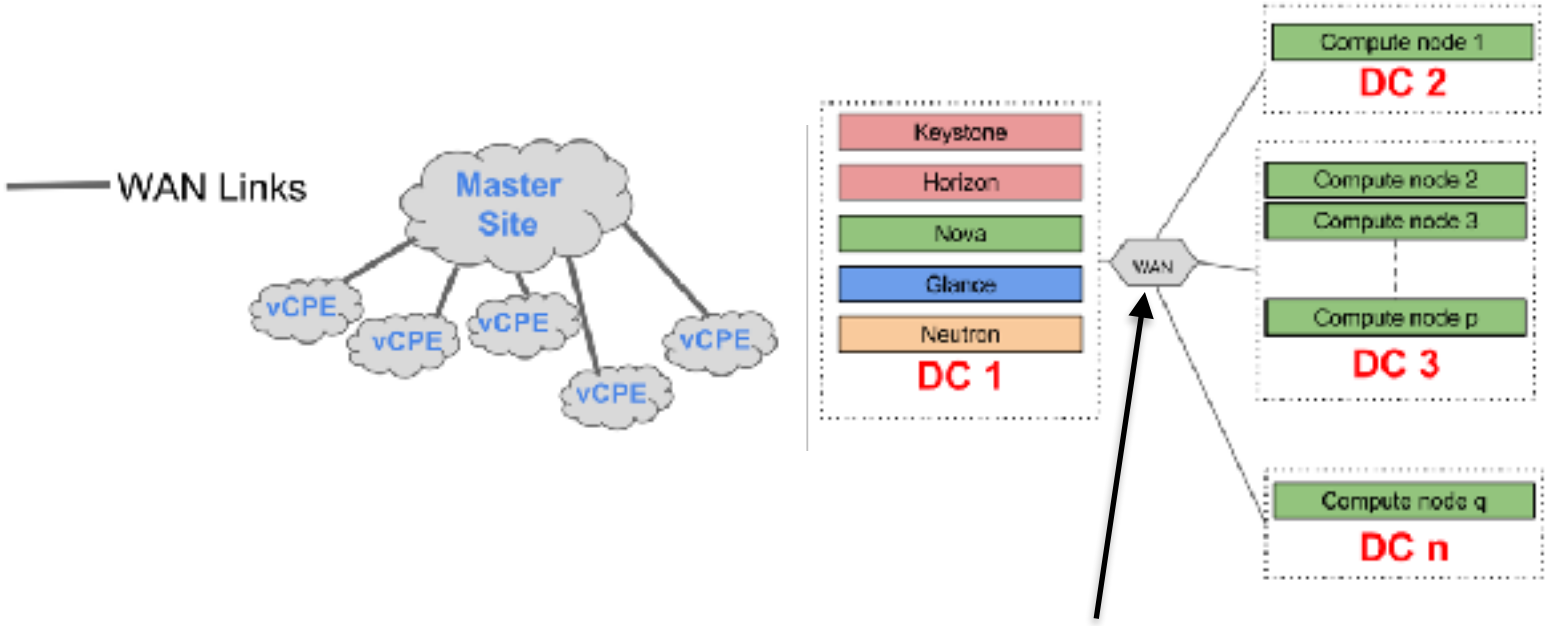
OpenStack WANWide

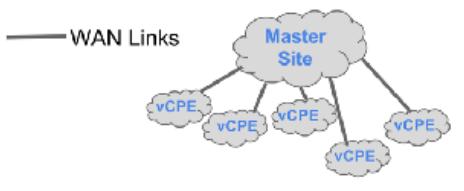
Collaboration



Network emulation :
latency/bandwitdth/loss

OpenStack WANWide

Collaboration



Achievements:

- Experiments run on **Grid'5000** and **Chameleon** independently
- Fully automatized
- 250 benchmarks (approx. 100 running hours) on each testbeds
- Results followed the same trends
- experimental setup : https://github.com/beyondtheclouds/enos-scenarios
- results : https://enos.irisa.fr/html

OpenStack IOT

FBK (Italy) - FEMDC active members

- OpenStack with EnOS on an IOT use case
- Results will be presented @Openstack day Italy (Milan 28 Sept. 17)
- EnOS contributions

Fed4fire+

- Benchmarks comparisons between Open Nebula and OpenStack
- Results will be presented in the next engineering conference (Volos 4-6 Oct. 17)
- EnOS contributions