

# ADT Mercury: Mid-Term Review



**Ronan-Alexandre Cherrueau**

*Leader: Adrien Lebre, Supervisor: Matthieu Simonin*

Inria, Discovery Initiative



# Context: IPL Discovery (I)

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Study Fog/Edge infrastructure

- New form of Cloud infrastructure
  - Many micro to nano data centers (dozen of compute nodes)
  - Spread all over the network backbone/edge (wireless) backbone (called PoP)
  - A data center collaborates with the others
- ⇒ Massively distributed cloud at the edge of the network

## Context: IPL Discovery (2)

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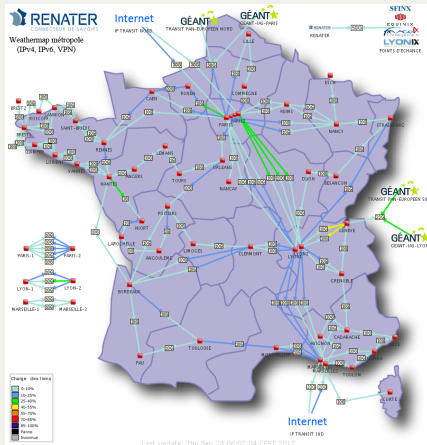
Such infra offers a new paradigm: *Fog/Edge computing*

- Reliable – No single point of failure
- Governance – As a french, I can ask for a compute node in a french PoP
- Reduces end-user to compute node latency – For latency critic app
  - Smart cars
  - Internet of Things
  - Video streaming
  - NFV (telco)
  - ...

# Context: IPL Discovery (3)

## Architecture (Renater backbone)

- A red point is a PoP
- A micro data center in each PoP
- PoPs collaborate to offer Cloud Computing functionalities

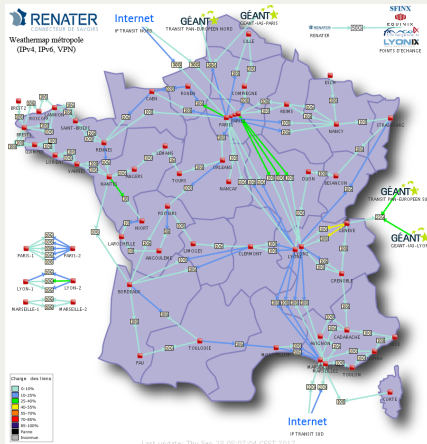


# Context: IPL Discovery (3)

## Architecture (Renater backbone)

- A red point is a PoP
- A micro data center in each PoP
- PoPs collaborate to offer Cloud Computing functionalities

**Question: How to Operate such a Massively Distributed Cloud Infrastructure?**



# Context: OpenStack

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IaaS manager for Cloud Infrastructures

- Compute with Nova (VM), Ironic (bare metal) and Magnum (container)
- Network with Neutron
- Storage with Cinder (volume) and Swift (object)

The *de facto* open-source solution



# OpenStack for Fog/Edge

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OpenStack fails on two aspects when operating Fog/Edge infra.

- Services rely on centralized components (database, message bus)
- Services behave wrong in case of high latency (message bus)

**IPL Discovery: Make OpenStack an IaaS Manager for Fog/Edge Infrastructure**

# Mercury ADT

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## Assists IPL Discovery

1. Help Discovery Researchers in developing PoC around OpenStack
  - PoC for a database that scales
  - PoC for a message bus that is latency tolerant
  - ...
2. Provide a platform to test different OpenStack deployments
  - Ease and automatize the deployments of several OpenStack
  - Compare the execution of several OpenStack
3. Make Discovery/Inria shines into OpenStack community
4. Develop an application that leverages the desiderata



# I. Help Developing PoCs in OpenStack

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## Database Distribution

- Original idea was NoSQL/ROME [Pastor, 2016]
- Now focus on NewSQL/CockroachDB (joint work with Cockroach Lab)
- Internship: “Make Keystone use CockroachDB”
  - Only a few lines to patch in Keystone to make it works
  - These lines are under review in the Keystone project
- Full evaluation planned for Vancouver 05/2018

## Bus Distribution

- Replace RabbitMQ by QPid-dispatch (joint work with Red Hat)
- Full evaluation planned for Vancouver 05/2018

## 2. Enos: Experimental Env. for OpenStack

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Motivation: Conducting performance analysis

- Scientifically and reproducibly (automation)
- At small and large-scale
- Under different network topologies (traffic shaping)
- Between various releases

Workflow

1. enos deploy: Get testbed resources; Deploys OpenStack; Applies network constraints
2. enos bench: Runs benchmarks; Measures CPU/RAM/Network consumption per service/node
3. enos backup: Get benchmarks results

# Enos Use Case: Large Scale Deployment

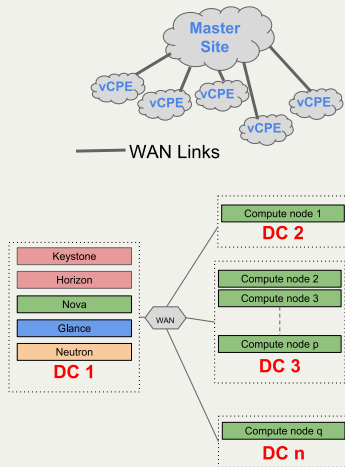
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- “Chasing 1000 nodes scalability”
  - Joint Work with Mirantis
  - Presented at the OpenStack Summit in Barcelona (October 2016)
- ⇒ Leverage Enos flexibility to find the correct topology
- ⇒ G5K as official testbed for OpenStack performance evaluation



# Enos Use Case: OpenStack WANWide (I)

- Single OpenStack to operate remote resources deployed at the Edge.
  - Joint work with Chameleon (UChicago)
  - Presented at the OpenStack Summit in Boston (April 2017)
- ⇒ Leverage Enos network constraints to show current limitations



## Enos Use Case: OpenStack WANWide (2)

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- Experiments run independently on *Grid'5000* and *Chameleon*
- Fully automatized (software defined experiments leveraging Enos).
- 250 benchmarks (approx. 100 running hours) on each testbed.
- Results lead to the same conclusion whatever the testbed (collected performance are almost identical).
- Experimental setup: <https://github.com/BeyondTheClouds/enos-scenarios/>
- Results: <http://enos.irisa.fr/html/>

# Enos Use Case: OpenStack IoT

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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 contributors

Fed4fire+ (European project)

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

### 3. Make Discovery Shines into OpenStack

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Get into the community with our expertise in performance analysis

- Participation into Working Groups Performance and Massively Distributed Clouds
  - Enos lets us do performance analysis of many OpenStack configurations
- ⇒ Results have been returned to the community, making Discovery an expert on such topics
- ⇒ The OpenStack foundation now considers Discovery as a key collaborator for the design of Fog/Edge cloud infrastructure

## 4. Develop an App. for Fog/Edge infra

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- First desiderata planned for next OpenStack Summit (Vancouver, 05 2018)
- ⇒ Application should follow



# Conclusion

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## Huge implication in the OpenStack Community

- Pros:

- Many discussions/collaborations with Cloud actors (Mirantis, Red Hat, CockroachDB, AT&T, Verizon, ...)
- ⇒ The OpenStack foundation considers Discovery for questions relative to the Fog/Edge computing

- Cons:

- OpenStack is a complex system (20 million LoC)
- Doing a modification, even a small one, is not an obvious process
- OpenStack review system takes time
- ⇒ Slow down momentum inherent to research project – There is no PoC in OpenStack

# Questions?

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# Références (I)

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Pastor, J. (2016).

*Contributions to massively distributed Cloud Computing infrastructures.*  
Theses, Ecole des Mines de Nantes.