High Availability Load Balancing in the Agile Infrastructure

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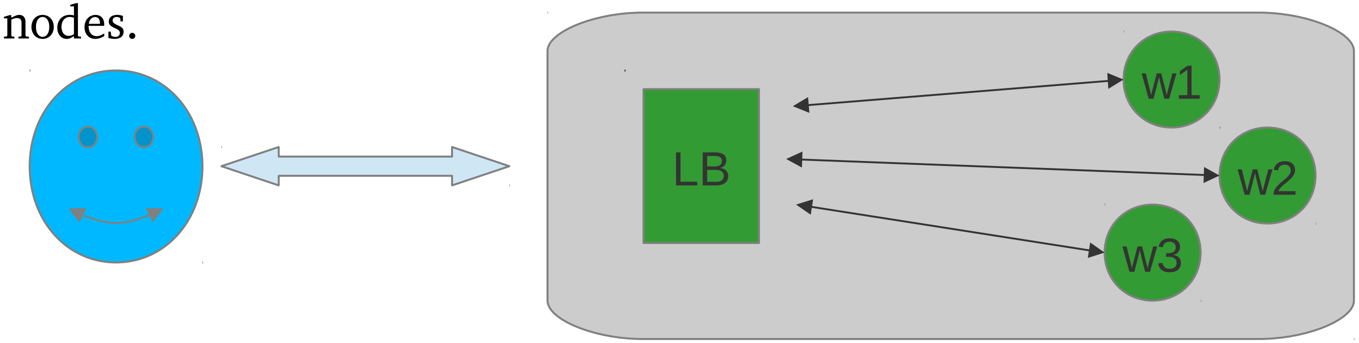
Outline

- Core Concepts
- Service Manager's Concerns
- DNS Load Balancing at CERN
- HA Services in the AI
- OpenStack LBaaS within Quantum
- CERN network restrictions
- Conclusions

Core Concepts

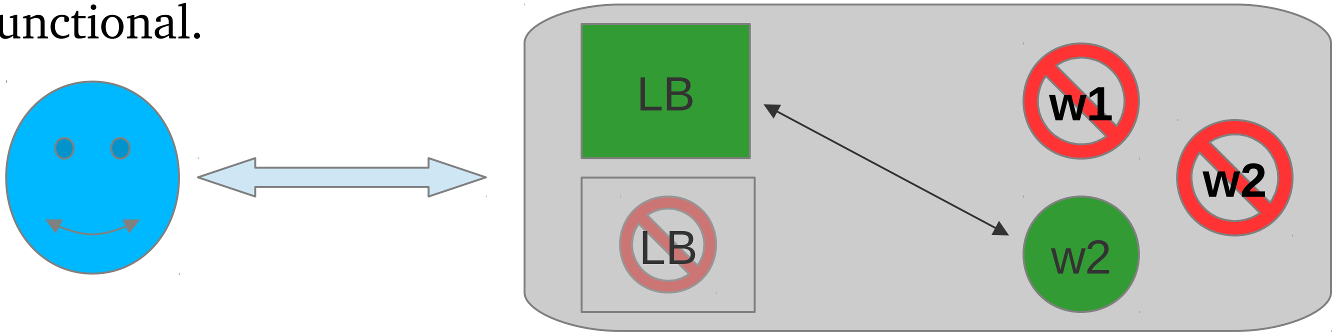
Load Balancing:

- Scale a single service by spreading it to multiple back-end nodes.



High Availability:

- From an end user's perspective, service should be always functional.



- Service should be available when some back-end or front-end nodes are unhealthy.

Service Manager Concerns

Implement high availability at the application Layer:

- Service components should interact without any single point of failure.
- Replicate physical nodes among independent subnets.
- Replicate VMs in different availability zones.

Service components are expected to fail:

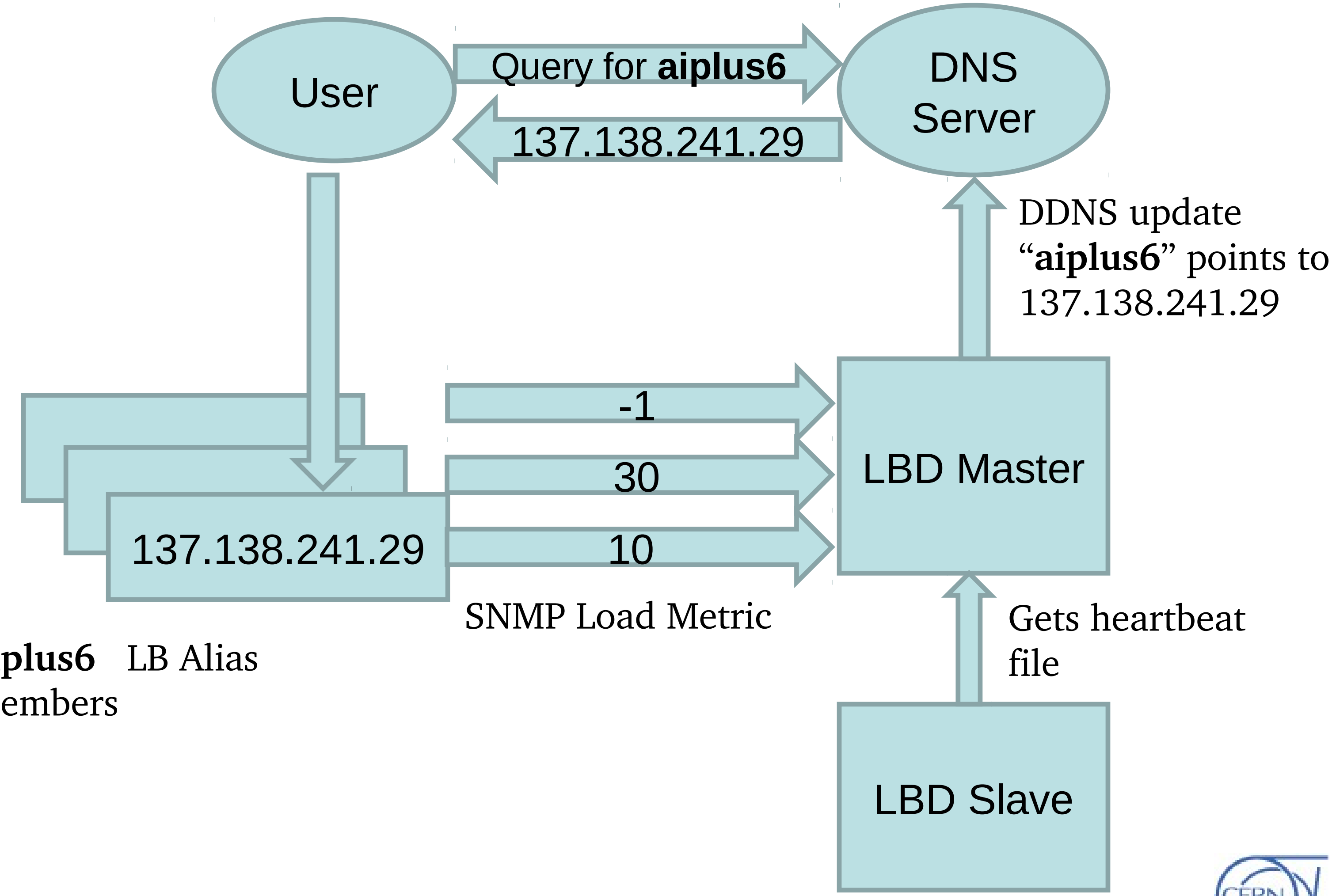
- Hardware failures (HDD, Switches, NIC, Electricity, etc.).
- Software failures (Bugs).
- Human errors.

DNS LB

- **We use a client/server architecture:**
  - LBD Master: Server which reports to DNS service.
  - LB Client: Daemon running in the hosts.

- LB Clients in the hosts provide LBD Master with load metrics as well as **availability checks** (SNMP communication).
- LBD Master decides which IP should be pointed by an LB alias.
- The LBD Master sends Dynamic DNS requests to update the IP address pointed by the LB alias.
- The LBD Master uses a fail-over slave server for high availability (The slave is consistent with the master).

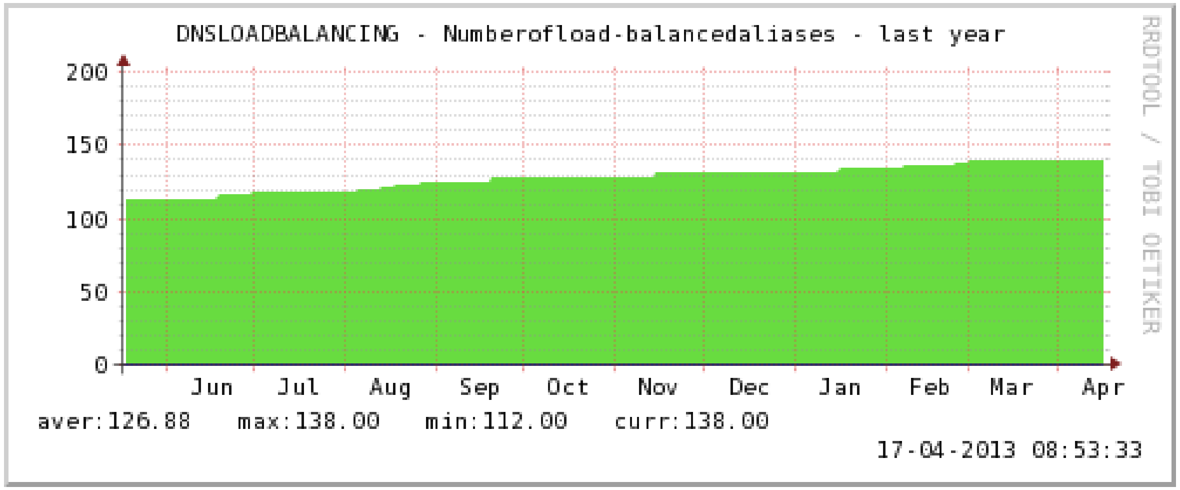
DNS LB



aiplus6 LB Alias members

DNS LB

- Able to provide a general service for almost 150 different aliases.



- It does so without network traffic bottleneck.

DNS LB

- No session persistence; needed for web applications that are statefull.
- No virtual IPs supported.
- Manual action required to define new LB aliases in the DNS service: Network engineer required to define new aliases.
- Delegation only effective once the LB alias has been created.

Components

- VMs in our OpenStack private cloud (KVM, HyperV).
- Configuration Management with puppet.
- Node Classification with foreman.
- Monitoring with Lemon.
- LBD
- HAProxy (Application Layer Load Balancer)

HAProxy Background

- HAProxy is a free, very fast and reliable solution offering Load Balancing.
- It is a layer-7 Load Balancer capable of support proxying for TCP and HTTP-based applications.
- It can operate under a pass-through or redirect reverse proxying configuration.

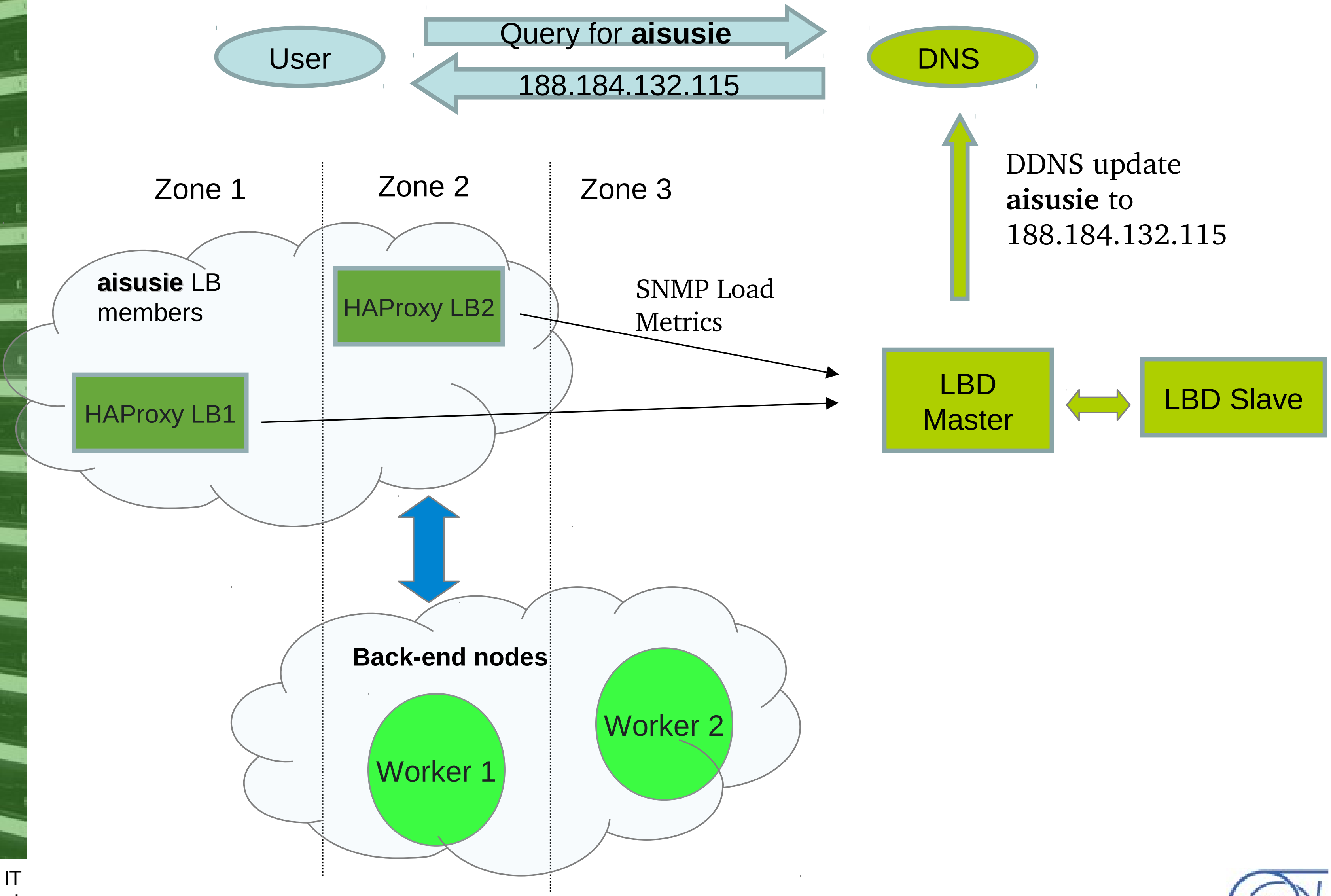
HAProxy Background

- HAProxy is flexible to configure and supports various Load Balancing policies:
  - round-robin
  - weighted round-robin
  - leastconn
  - source-IP (affinity)
  - rdp-cookie (persistence)
- Availability check.
- It is the software Load Balancer used in Grizzly release of OpenStack.

Recommended Scenario

- Service manager deploys and replicates back-end nodes in different availability zones.
- Chooses HAProxy as the actual load balancer for his application.
- Deploys instances running front-end HAProxy balancers in different availability zones.
- Creates an alias for his service.
- Frond-ends report to LB Master.
- DNS resolves service IP to a healthy front-end, which redirect traffic accordingly.

HA Services in the Agile Infrastructure



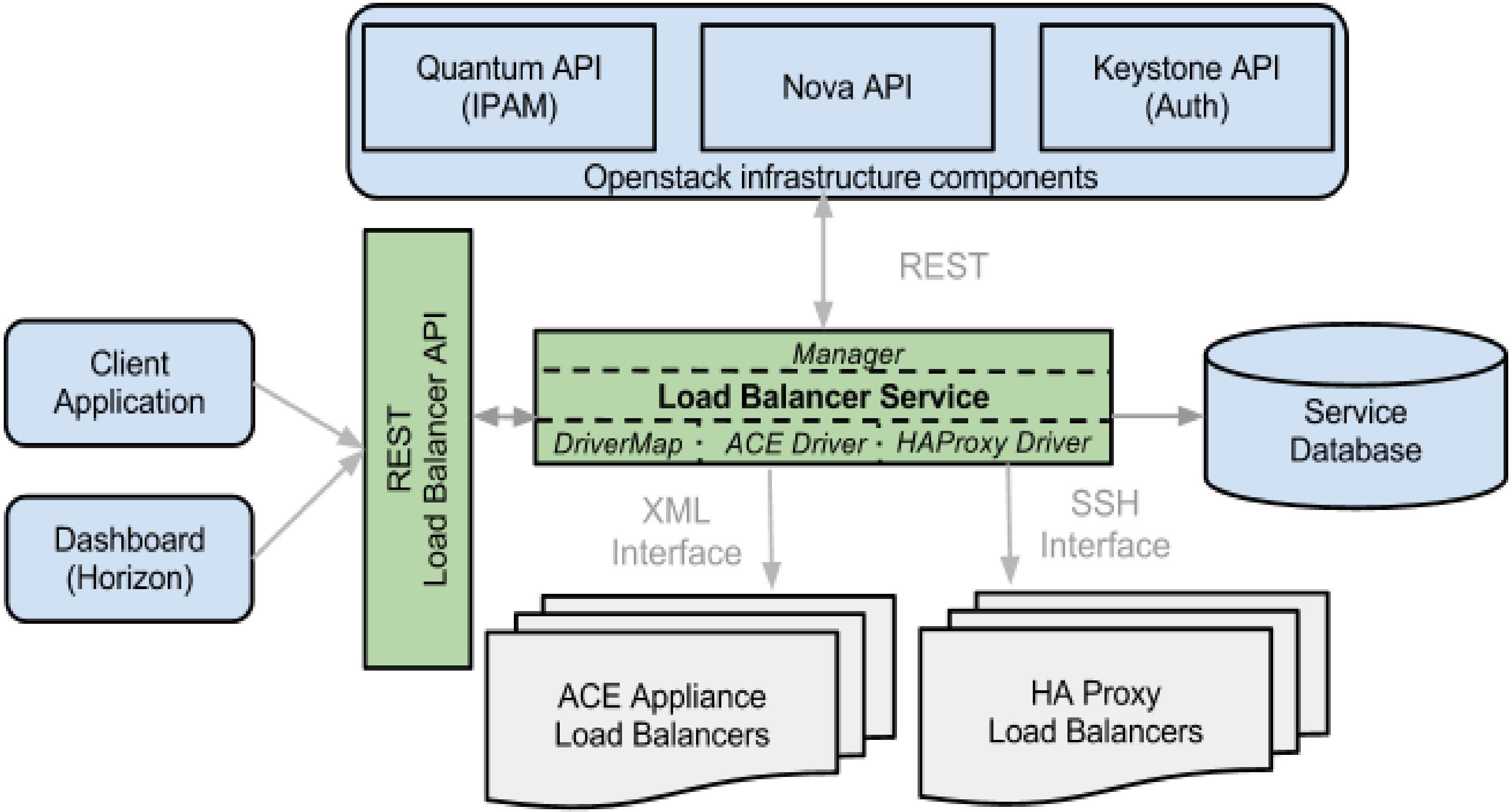
Intoduction to LBaaS

- OpenStack user should be able to create Load Balancers from the Dashboard (Horizon).
- Infrastructure should provide API for this functionality.
- User should be able to configure the Load balancing service from the API.
- No access to the actual load balancer.

OpenStack LBaaS (Equilibrium)

- Implemented in Python, from Mirantis, using OpenStack templates.
  - Based on OpenStack common code.
  - Uses OpenStack Services.
- Integrated with OpenStack Horizon GUI.
- Referenced by Quantum OpenStack network component.

OpenStack LBaaS (Equilibrium)



🟩 - Load Balancer service components

🟦 - External services

OpenStack LBaaS (Equilibrium)

Key Features

- REST API for cloud admins: manage a pool of HW and SW load-balancing appliances.
- REST API for OpenStack tenants: load balancing as a service, multi-tenancy support and isolation.
- Drivers supporting load balancers from different vendors such as HAProxy (sw) and Cisco ACE (hw).

Equilibrium Tenant API (1)

- Load Balancers API:
  - Get a List of Existing LB.
  - Create Load Balancer Instance.
  - Delete Load Balancer Instance.
  - Update Load Balancer Instance.
  - Get Load Balancer Instance Detailed Information.
  - Get Load Balancer status.
  - Get Load Balancing statistics.

- Load Balancer Node API:
  - Add Node to Existing LB.
  - Get List of Nodes.
  - Delete Node from Load Balancer.
  - Update Node in Load Balancer.
  - Change state of Node.

Equilibrium Tenant API (2)

- Health Monitoring API:
  - Get List of Probes Attached to Load Balancer.
  - Add Probe to Load Balancer.
  - Delete Probe from Load Balancer.
- Session Persistence API:
  - Get a List of Session Persistence Configured for Load Balancer.
  - Add session persistence rule for Load Balancer.
  - Delete Configured Stickiness.
- Configuration:
  - Get a List of Supported Load Balancing Protocols.
  - Get a List of Supported Load Balancing Algorithms.

LBaaS in our Cloud

- In our CERN private Cloud we intend to provide LBaaS.
- We start evaluating Mirantis Equilibrium.
- Equilibrium meets our needs.

LBaaS in our Cloud

Restrictions due to CERN's network structure:

- Virtual IPs in CERN's network cannot move out of a network service (normally corresponding to a subnet).
- They should all appear behind the same network box (switch or other).
- Automatic registration of IP aliases not supported (requires human intervention).

Conclusion – Future Plans

For LBaaS we need:

- Back-end nodes running equilibrium instances.
- A pool of sw (or hw) Load Balancers, running HAProxy instances.
- A service manager maintaining this pool and the puppet modules for equilibrium.

LBaaS will support:

- Session persistence.
- Virtual IPs.
- Unified Configuration of LBs with Rest-full API.
- Application Layer LB.
- Availability check.

Closing

Thank you for you attention!

Questions???