Service Reliability with the Cloud of Data Centers under Openstack

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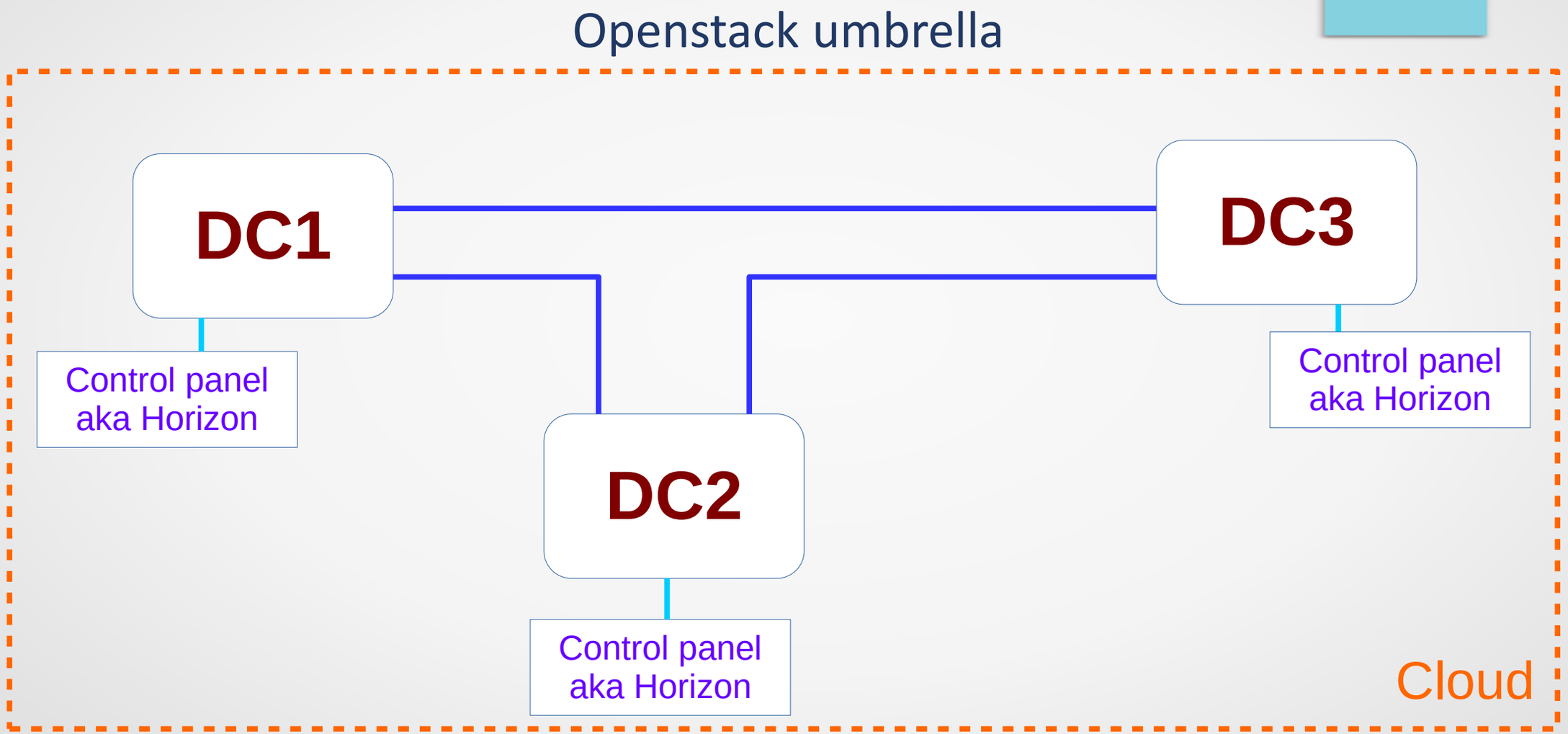
Outlook

- Cloud of Data Centers with Openstack
- Cloud Sevices
- Cloud Networking
- Software Defined Storage in cloud of Data Centers
- PoC Testbed

Cloud of Data Centers (basic configuration)



Cloud of Data Centers advantages

- Improve reliability for services.
- Possible scaling with adding new DCs to the cloud.
- Centralized administrative functionality to some extent.

Cloud Services

- Main cloud services:
  - Computing (VMs)
  - Storage: Software Defined Storage
  - Data transfer channels: Software Defined Network
    - Control channels (OpenVPN)
    - Regular channels (encrypted)
    - Quantum Key Distribution (QKD) channels

Network aspects on Georgaphically Distributed Software Defined Storage (GDSDS)

- First of all we have to keep in mind the CAP theorem:
  - NOT possible to guarantee all below requirements at the same time:
    - Consistency
    - Availability
    - Partitioning

GDSDS

- Important features:
  - Data storage and Data transfer
  - Reliability: *data replication, erasure coding*.
  - Reliability of long time data storage.
  - Security: *Data encryption (quantum key distribution)*.
  - Network architecture (SDN).
  - Automatic storage deployment by user request.

Possible allocation of instances of Virtual Storage

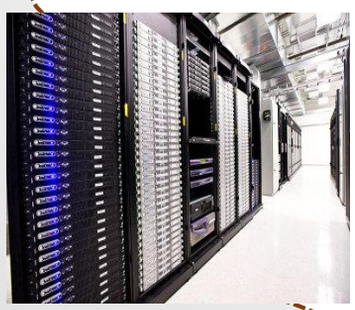
Client-1

Client-2

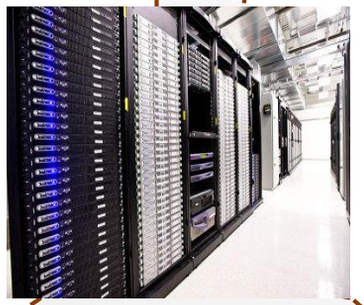
client=VM, desktop, mobile device, etc

CEPH
Virtual Storage-1

CEPH
Virtual Storage-2



DC-1



DC-2

DC-3

Service Reliability

- It is distinguished two type of DC problems:
  - DC is completely down.
  - DC is up, however connectivity with other DCs is down.
- Computing services:
  - When connectivity between DCs are down, the normal DCs operations might be continued in aspects not affected by the connectivity.
- Storage:
  - With enough replicas the cloud might continue normal operations.

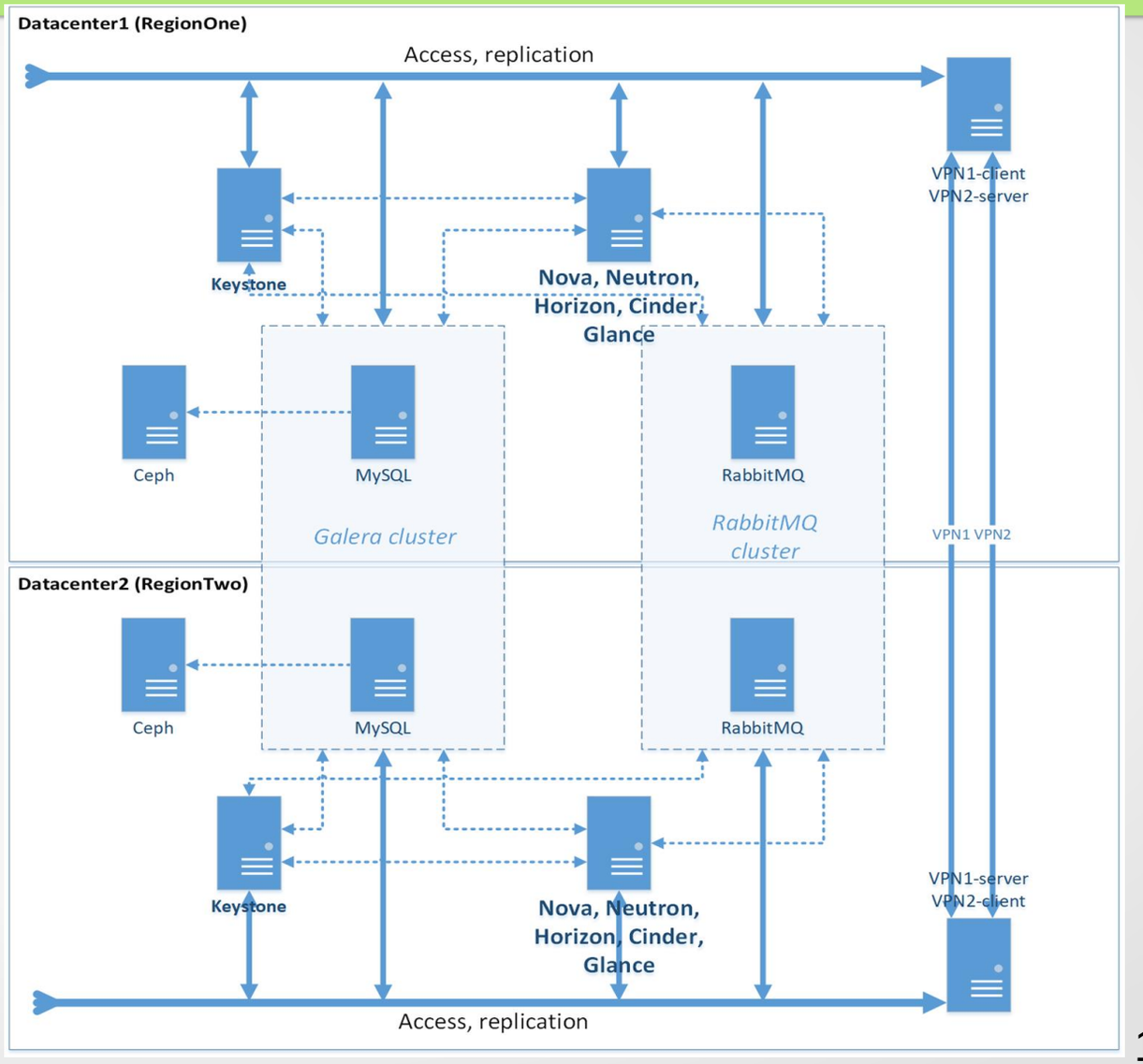
Testbed architecture of Common Keystone Database for two DCs

Each DC runs under own Openstack with own region.

Created Galera cluster provides synch between different regions (DCs).

Each region (DC) has own address space.

Created RabbitMQ cluster provides command transfer between DCs.



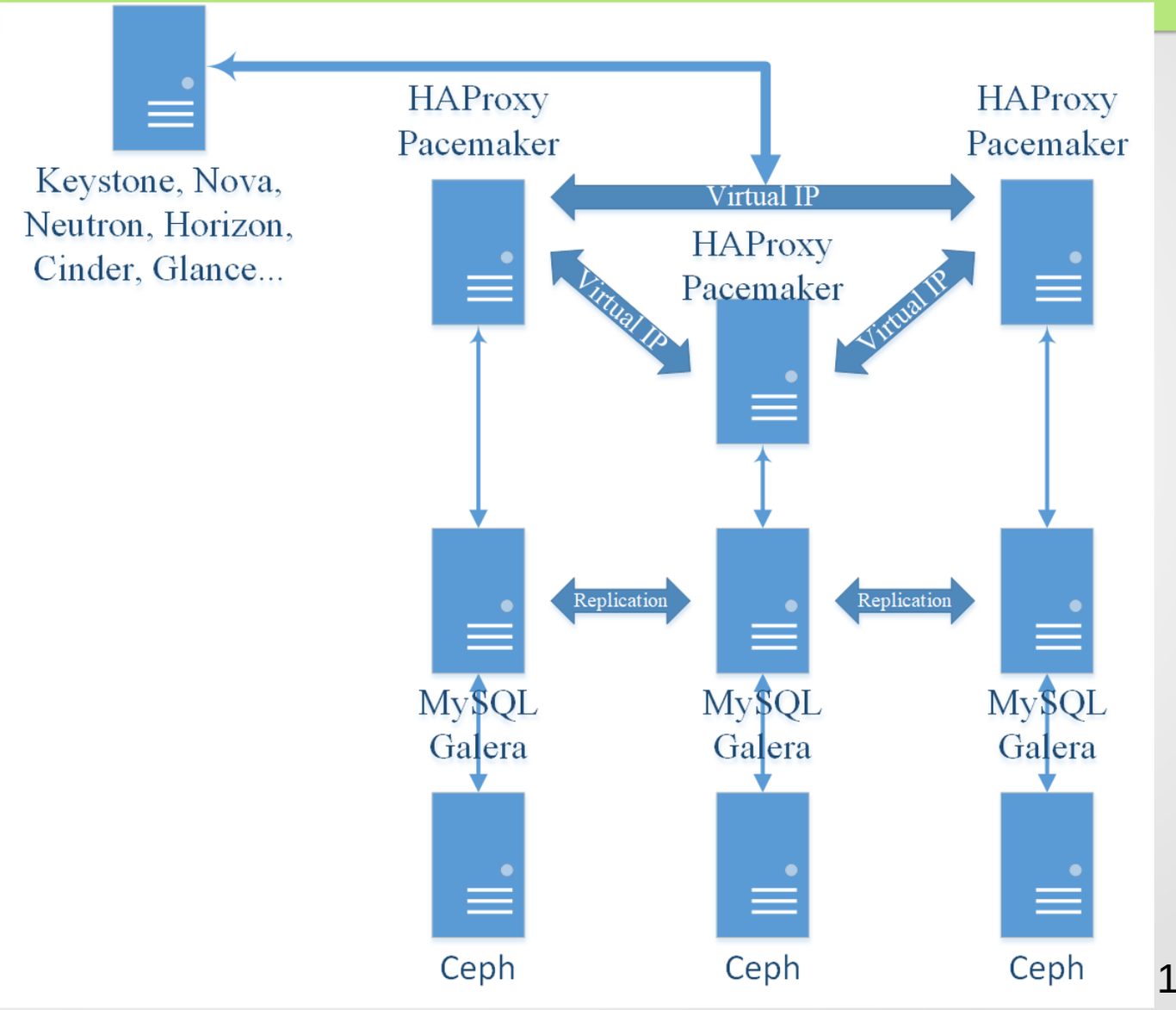
Three DCs testbed configuration

High Availability Proxy

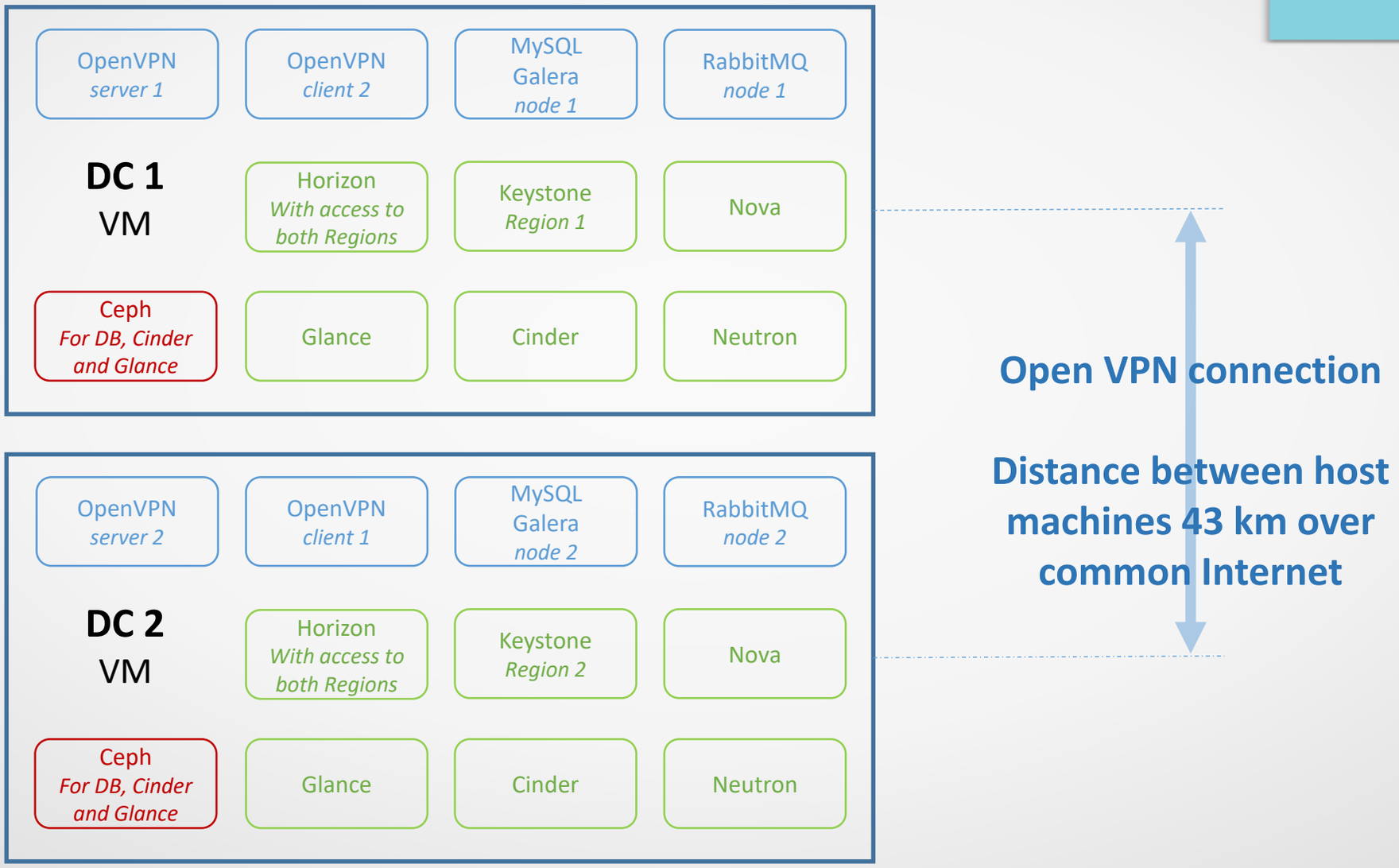
Virtual IP for Keystone and DB access between regions

Pacemaker for service stability and checking

CEPH is used just as storage: different pools for different MySQL.



Basic testbed configuration



Conclusion

- In developed testbed is possible:
  - enter into Horizon DC1 , start and see running VMs and other resources of both regions (DCs) and vice versa.
  - shutdown DC1 and continue to use DC2 and vice versa.
  - use (with light modification by adding third DC in form of VM) Virtual IP to enter the most appropriate at time region (DC).
  - Experimental distributed CEPH cluster (as part of future GDSDS) is used in testbed. It is running more than two years. It passed through many updates, sudden power off, unplanned reboot, but no data corruption.

References

- Justin Riley, John Noss, Wes Dillingham, James Cuff, Ignacio M. Llorente, "A High-Availability Cloud for Research Computing", Computer, vol. 50, issue 6 , pp. 92-95, 2017.
- M. Nabi, M. Toeroe, F. Khendek, "Availability in the Cloud", *J. Network and Computer Applications*, vol. 60, pp. 54-67, 2016.

Time for questions & suggestions!