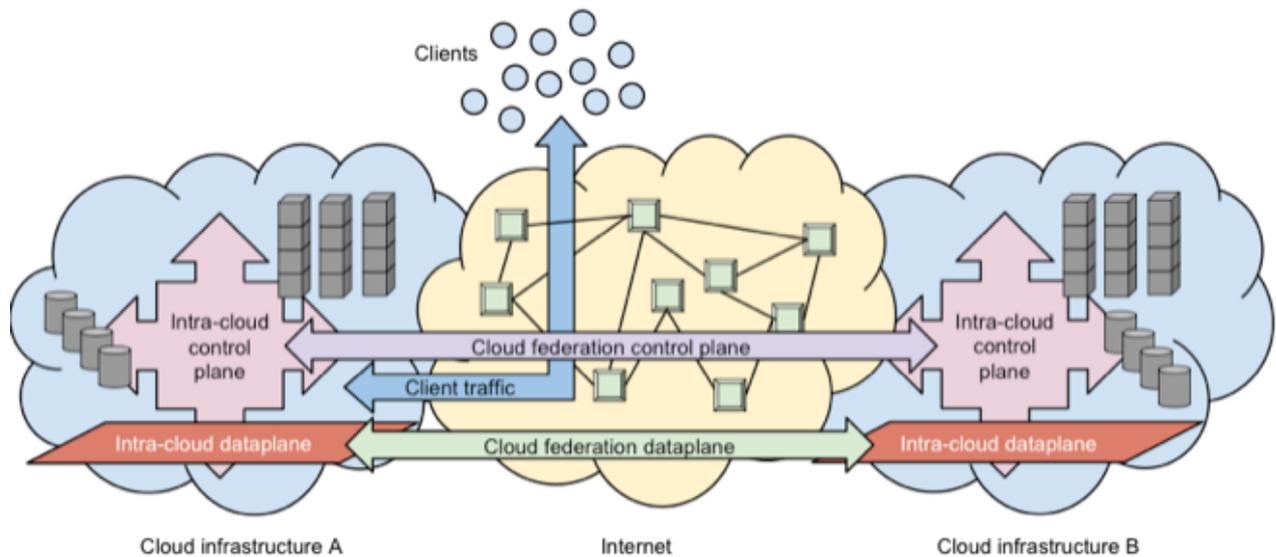


Masters Project

Scalable and Secure Infrastructures for Cloud Operations



After starting out as a marketing term, Cloud computing is seeing fast adoption by users and companies using it to run their end-user services and mission-critical applications. It allows companies to focus on their operating business while company email, document exchange and remote desktops instead of workstations can be provided as software services. Lower level infrastructure service abstractions allow for the construction of massive-scale digital businesses with the necessary resources provided by professionally run data-centers worldwide.

At the same time, challenges remain in organizational and technical aspects. **Security** is still the largest concern, with certain applications such as healthcare bound by strict legal regulation to safeguard the sensitive information. Where **availability** is a concern, companies are wary when outsourcing mission-critical applications to a third party. Incompatible standards and interface still create the effect of **vendor lock-in**.

This Masters Project

In the recent past, the open source cloud operation software OpenStack has created enormous momentum. While the software is still in a turbulent and fast-moving stage of development, it has attracted an impressive number of contributors and supporters (both users and companies) that are working together to create common technical standards and an understanding of what the future cloud operation system should look like.

In this project, we have the following goals:

- Give you a glimpse on the current state of OpenStack, let you work with it in practice to let you gather working knowledge of something that could be valuable expertise later on.
- Integrate novel technologies from the field of security, cloud federation, load balancing and network technology to address current challenges.
- Let you find something that interests you and let you find your own way to go about it.

We see interesting challenges in the following fields:

Reproducible Cloud Test Environments: Research and development for OpenStack is hard - because you need a working setup of it first. Getting there involves a steep learning curve and a lot of manual work. In the previous project, we have created a one-click deployable virtual installation of OpenStack Kilo, which uses nested virtualization to run a multi-node OpenStack cluster on a single machine. Using current automation tools (such as Ansible, Puppet, Chef etc.) , this installation should be extended and modularized to create features-configurable test environments.

Cloud federation: Private-cloud operators are increasingly joining their resources to create virtual, unified clouds of trustworthy national operators. Intelligent algorithms are required to place workload and data to achieve an optimal balance between cost, speed and satisfy data privacy and security requirements at the same time. We develop a policy language that can specify constraints on where data can be stored and processed in a federated infrastructure.

Secure Operations: Traditional Encryption of data can effectively protect the confidentiality of data stored in the cloud. At the same time, traditional encryption severely limits the possibilities to process data in the cloud. Novel cryptographic techniques (partially homomorphic and searchable encryption schemes) allow certain computations while still ensuring data confidentiality. Implementation examples using these schemes can provide an insight into their current readiness for practical use and execution speed.

