

The CloudNets Network Virtualization

Architecture and Prototype

Johannes Grassler, Stefan Schmid, Anja Feldmann



Vision and Architecture

Our goal is to enable customers to specify arbitrary virtual topology graphs and get them implemented in a turn-key manner. To this end we devised an architecture [1] based on a hierarchy of roles modelling economic players likely to be involved in the process on various levels:

- SP Service provider:** Specifies the requirements of a service it provides.
- VNO Virtual Network Operator:** Refines the SP's specification into a topology graph.
- VNP Virtual Network Provider:** Splits the VNO's topology into partial graphs and allocates them to one or more PIPs.
- PIP Physical Infrastructure Provider:** Implements VNP's partial graphs on its infrastructure.

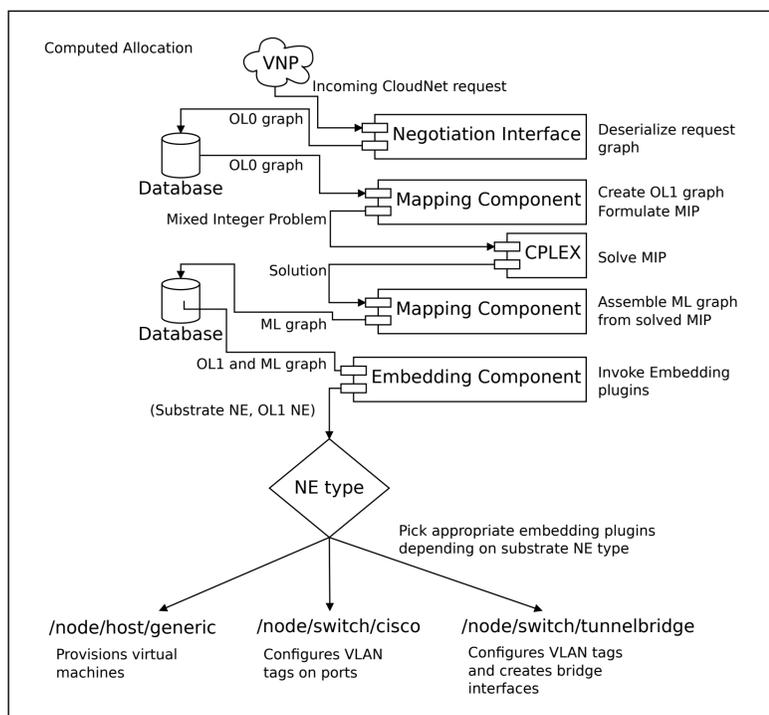


Fig. 1: An overview of the stages in our software architecture and their role in processing an incoming CloudNet request graph (OLO graph).

CloudNet Embedding

We envision a 2 stage embedding process [2] for CloudNets:

- First, the new CloudNet is mapped using a fast heuristic.
- In the second stage allocations for long-lived and large CloudNets are optimized using a mixed integer program.

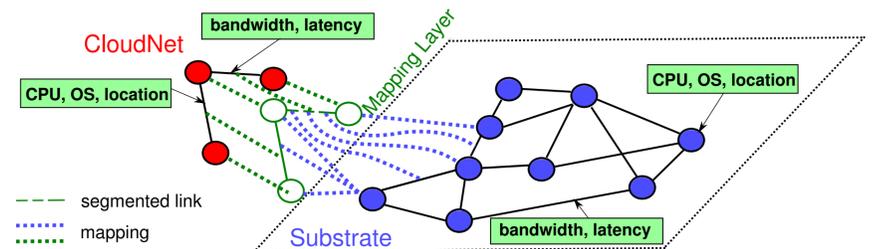


Fig. 2: Sample CloudNet embedding.

We implemented an automatic allocation pipeline: given a high-level CloudNet specification, we formulate a linear program, solve it, and subsequently automatically implement the resource allocations and virtual links as virtual machines and paths through the substrate graph.

Migration: with the Sun or Moon?

Our architecture allows us to migrate latency-critical services closer to the users (move with demand/"with the sun") [3]. Non-critical CloudNets can be migrated to locations where resources are abundant and energy is cheap (move against demand /"with the moon").

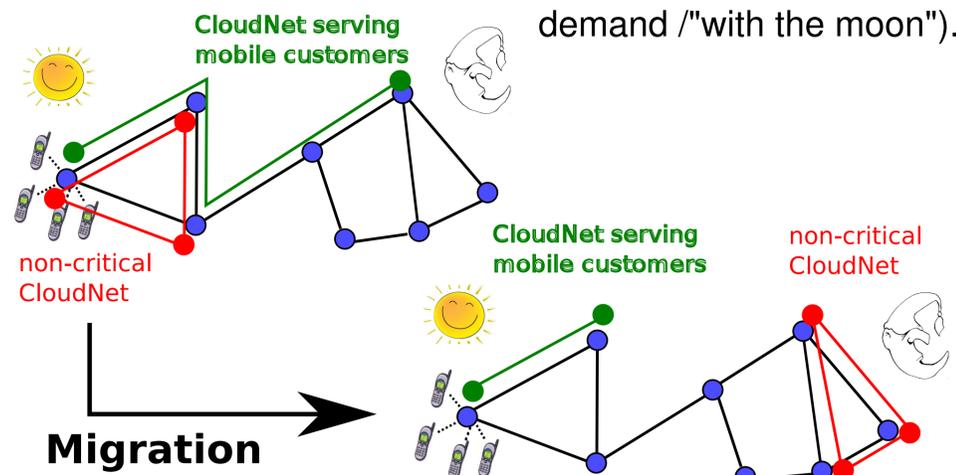


Fig. 3: Possible migration scenario.

Collaborating and Contributing Prototype Source

Our prototype's source code (so far the PIP and VNP roles are implemented) is available from our prototype page:

<https://projects.net.t-labs.tu-berlin.de/projects/cloudnets-framework>

If you are interested in participating or collaborating please contact us!

Google Summer of Code

We are participating in Google's Summer of Code programme as a Mentor organization. Please approach us if you would like to take on one of the projects from our ideas page or have a proposal of your own!

Further Information

See <http://www.net.t-labs.tu-berlin.de/~stefan/virtu.shtml> or contact Stefan Schmid <stefan@net.t-labs.tu-berlin.de>.

References:

- [1] E. Abarca, J. Grassler, G. Schaffrath, S. Schmid; A Federated CloudNet Architecture: The PIP and the VNP Role; ArXiv Technical Report 1303.6753, 2013. **(on prototype)**
- [2] G. Schaffrath, S. Schmid, A. Feldmann; Optimizing Long-Lived CloudNets with Migrations; 5th IEEE/ACM Conference on Utility and Cloud Computing (UCC), 2013 **(on embedding and service migration)**
- [3] M. Bienkowski, A. Feldmann, J. Grassler, G. Schaffrath, S. Schmid; The Wide-Area Virtual Service Migration Problem: A Competitive Analysis Approach; IEEE/ACM Transactions on Networking (TON), 2013. **(on network migration)**