Institut für Kommunikations-Technik

Architecture and Algorithms for Virtual Routers as a Service

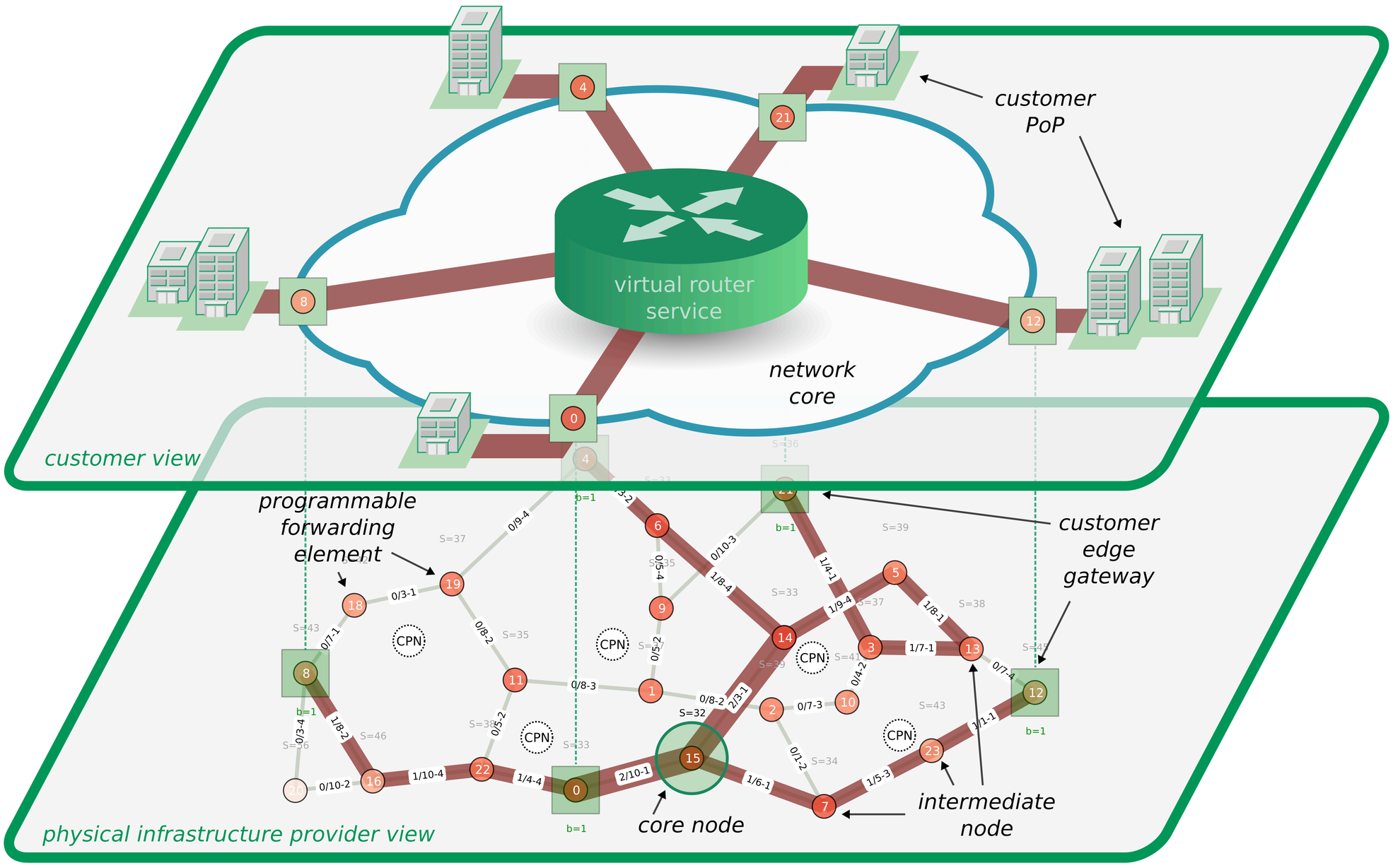
zdravko.bozakov@ikt.uni-hannover.de

Virtual Router Service

- Provides virtual router instance connecting multiple customer points of presence with specific demands
- Employs substrate network programmability to handle multiple physical devices as a single entity
- Virtual topology defined by customer requirements at edges, such as capacity or delays

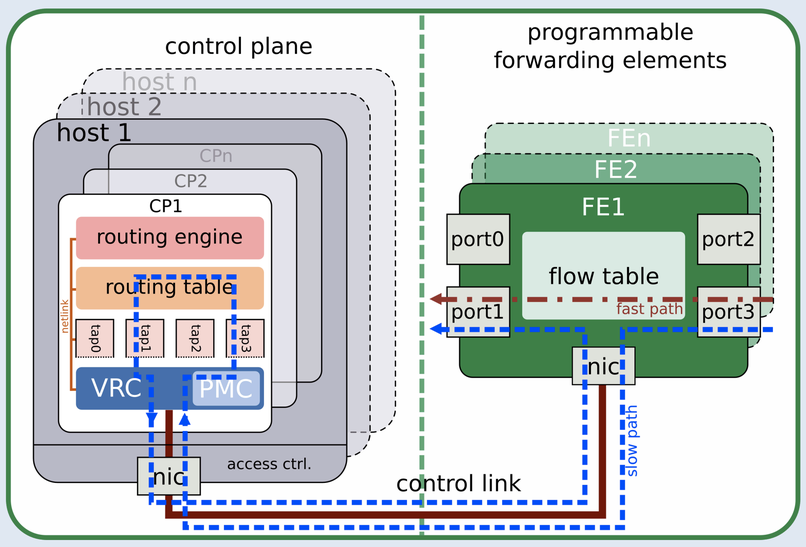
Framework Benefits

- Enables new business models for both physical infrastructure operators as well as customers
- Facilitates management and reduces cost of ownership
- Improves resource and energy utilization in backbone
- Enables adaption to varying customer demands and network conditions using live migration



Service Architecture

- Substrate network consists of programmable forwarding elements (e.g. Openflow devices)
- Each VRS is associated with a control plane hosted in a virtual machine (VM) running on commodity servers distributed within the network core
- Virtual router controller (VRC) and path management controller (PMC) running in control plane transparently map routing tables and paths to corresponding forwarding elements
- *Core node* performs layer three forwarding decisions
- *Intermediate nodes* perform layer two forwarding from/towards core node
- Transparent migration of VRS instance coordinated by virtual router controller



VRS Embedding

- Algorithms minimize allocated capacity per VRS: star like topologies yields minimal cost
- VRS allocation more tractable than general virtual network embedding problem
  - Selection of optimal core node location
  - Least cost paths w.r.t. capacity constraints
- Enable efficient on-demand VRS adaptation to changing demands

Future Work

- Distribution of core node functionality over multiple devices
- Extension of allocation and reservation algorithms
- Performance analysis

References

[1] E. Keller and J. Rexford, “The ”platform as a service” model for networking,” in Proc. INM/WREN ’10, April 2010.

[2] M. Yu, Y. Yi, J. Rexford, and M. Chiang, “Rethinking virtual network embedding: substrate support for path splitting and migration,” SIGCOMM CCR, vol. 38, pp. 17–29, March 2008.

[3] N. McKeown et. al., “Openflow: enabling innovation in campus networks,” SIGCOMM CCR, vol. 38, no. 2, 2008.

[4] Y. Zhu and M. Ammar, “Algorithms for assigning substrate network resources to virtual network components,” in Proc. IEEE INFOCOM 2006, Apr. 2006, pp. 1 –12.

Leibniz Universität Hannover

VIRTURAMA

Sponsored by the Federal Ministry of Education and Research (BMBF) as part of the G-Lab Virturama Project