

Software Defined Networking - Inter-Domain Routing

Research question

“How can we redesign our inter-domain routing protocols in the SDN context? What are the benefits in comparison with legacy approaches?”

Goals

- Design an inter-controller protocol for OpenFlow controllers which control different OpenFlow-enabled domains → evolution of BGP, completely distributed routing scheme on the inter-domain level, logically centralized on the intra-domain level.
- The protocol will at least take care of inter-network reachability information dissemination, like today’s BGP. Additionally, SDN-related features will be added dynamically for the exhibition of further benefits that SDN-based routing schemes provide. Example: signaling for inter-domain path setup.
- Implementation of the protocol, evaluation based on simulation and emulation, and finally testing on a real-world federated testbed experimentation infrastructure (e.g., OFELIA)
- Comparison with existing legacy-based solutions, like standard eBGP.
- Deduction of conclusions about the feasibility of the scheme in today’s networks, together with incentives for ISPs to adopt it.

Expected Benefits

- Exhibit how a protocol such as BGP can be redesigned to fit in the “SDN-era”.
- Show the benefits of an SDN-based inter-domain scheme against the current status-quo.
- Design and implement the scheme in a legacy-compatible way and without violating today’s distributed architecture (multiple independent AS).

Approach

- Initially, assume “eBGP”-like sessions between controllers, where each domain is managed by a single controller (1:1 relationship). Later, take into consideration “iBGP”-like sessions between controllers, where multiple controllers control subparts of a domain (much like BGP confederations). At each step, analyze the problems that arise and potential solutions.
- Evolve the inter-controller protocol design in order to exploit SDN features such as logical centralization (1 controller for N switches).
- Evolve the notion of inter-domain routing calculation process taking into account the provided logical centralization. Use of RCP-like approaches [1].
- Build a prototype routing scheme on top of the RouteFlow and NOX-POX platforms (right platform to be determined) → extend the code-bases of these open-source software solutions.
- Evaluate possibilities for maintaining legacy compatibility with BGP.

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Requirements: Python or Java. This thesis offers primarily practical tasks on the design of a routing protocol.

Related Work:

[1] Nick Feamster, Hari Balakrishnan, Jennifer Rexford, Aman Shaikh, and Jacobus van der Merwe. 2004. The case for separating routing from routers. In *Proceedings of the ACM SIGCOMM workshop on Future directions in network architecture* (FDNA '04). ACM, New York, NY, USA, 5-12.

