Outsourcing Routing using SDN:

The Case for a Multi-Domain Routing Operating System

Vasileios Kotronis, Xenofontas Dimitropoulos, and Bernhard Ager

ETH Zurich, Switzerland

{vkotroni, fontas, bager}@tik.ee.ethz.ch

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

TIK Computer Engineering and Networks Laboratory

Motivation

1. **Internet routing is complex and expensive:**
   - ❑ Requires significant expertise and knowledge
   - ❑ Service requirements grow: IPTV, cloud computing
   - ❑ Misconfigurations can have widespread effects
   - ❑ Very difficult to change (BGP ossification)
   - ❑ Demanding in terms of man-hours and OPEX
2. **Transit doesn't pay:**
   - ❑ Profits in pure transit drop ($/Mbps)
   - ❑ "Bit pipe" ISP model under revision

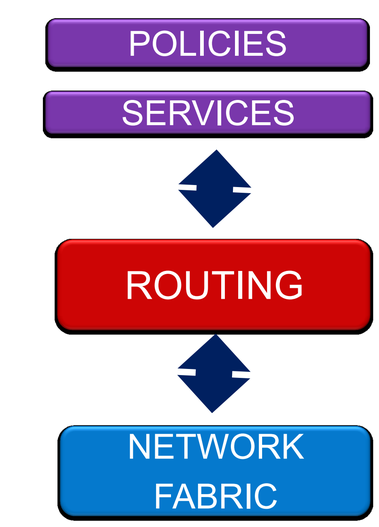
Routing is a layer of network functionality which is:

expensive, crucial for operations and **difficult** to get right.

Routing tasks from an operator's point of view

- ❑ Map SLAs to high-level policies
- ❑ Map policies to network behavior
- ❑ Satisfy increasing network requirements
- ❑ Counter errors and scalability issues
- ❑ Secure the network
- ❑ Deal with the outside world via BGP

All-in-all: Satisfy multiple objectives, both operational + economic



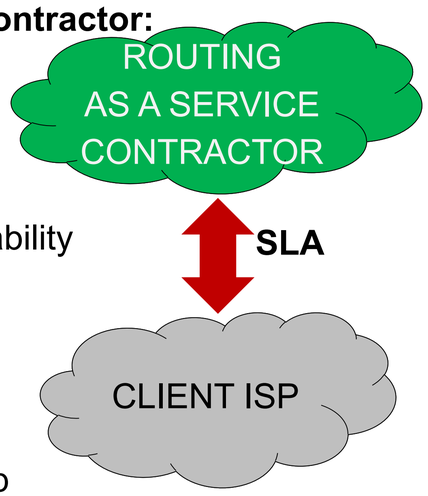
New Techno-Economic Model: Outsource the Routing Control Logic

Outsourcing ("Routing as a Service") contractor:

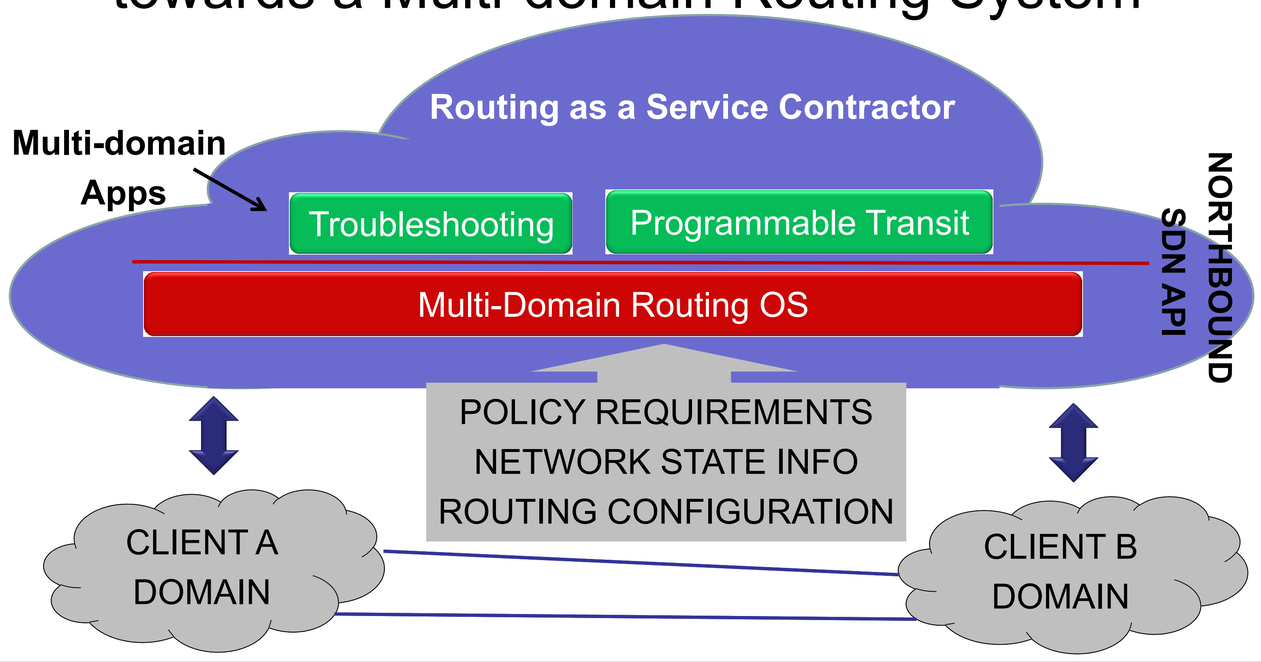
- ❑ Specializes in routing management
- ❑ Relieves the ISPs of the complex routing configuration process
- ❑ Offers better service to its clients in terms of efficiency, stability and availability
- ❑ Achieves an economy of scale

Outsourcing clients:

- ❑ "Buy" routing as an external service
- ❑ Reduce OPEX
- ❑ Form interactive business relationship



Centralizing beyond AS boundaries: towards a Multi-domain Routing System



Opportunities

- ❑ **More efficient routing**
- ❑ **Novel routing protocols**
- ❑ **New inter-ISP services**:
  - ❑ Collaborative security
  - ❑ Cooperative troubleshooting
  - ❑ Programmable transit
  - ❑ Global IPTV
- ❑ **Contractor can mediate policy tussles**

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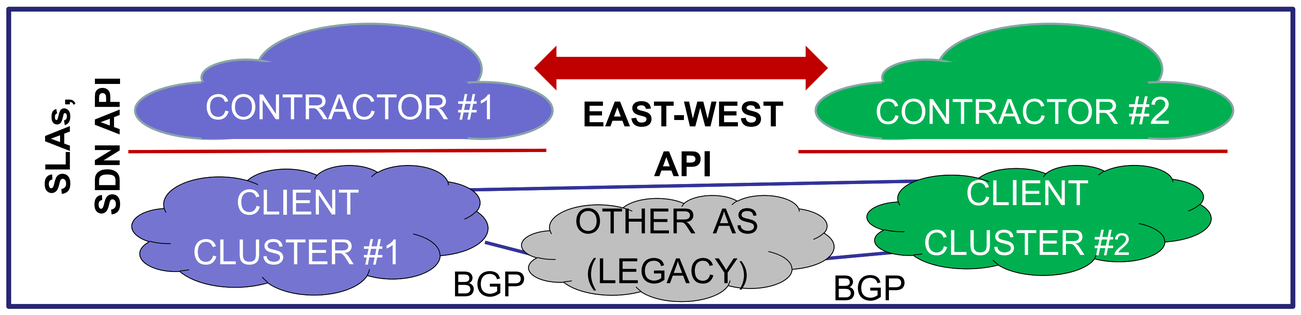
Challenges

- ❑ **Privacy and Security**
- ❑ **Market** models and issues
- ❑ **Resilience**
- ❑ **Interoperability**
- ❑ **Scalability**
- ❑ **Extensibility**
- ❑ **Policy conflicts**
  - ❑ Identification
  - ❑ Resolution



How to achieve?

- ❑ Identify the proper abstraction layer for routing control
- ❑ Define interface between client and contractor
- ❑ Define northbound API between OS and SDN routing services
- ❑ Define east-west interface between contractors
- ❑ Use algebraic frameworks for centralized routing algorithms
- ❑ Develop routing framework, test ([2]), compare with status quo

References

[1] V. Kotronis, X. Dimitropoulos, and B. Ager. ***Outsourcing the routing control logic: better Internet routing based on SDN principles.*** In Proc. of ACM HotNets-XI, 2012.

[2] ***OFELIA***: http://www.fp7-ofelia.eu/.

[3] M. Caesar, D. Caldwell, N. Feamster, J. Rexford, A. Shaikh, and J. van der Merwe. ***Design and implementation of a routing control platform.*** In Proc. of NSDI, 2005.

[4] C. E. Rothenberg, M. R. Nascimento, M. R. Salvador, C. N. A. Corrˆea, S. Cunha de Lucena, and R. Raszuk. ***Revisiting routing control platforms with the eyes and muscles of software-defined networking.*** In Proc. of HotSDN, 2012.

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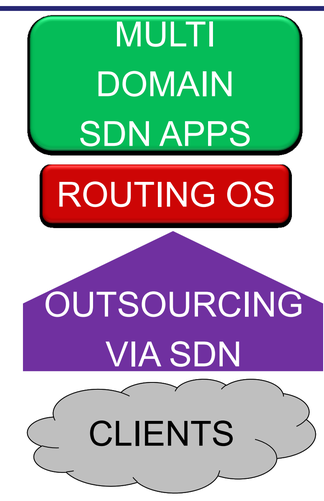
Summary of Key Ideas

- ❑ Internet routing is **hard to manage and evolve**
  - ➔ **Our goal is to overcome these obstacles**
- ❑ Outsource routing to **external contractor**
- ❑ **Build on SDN** to outsource routing control plane
- ❑ Centralize routing **beyond AS boundaries**
- ❑ Investigate market and **identify win-win scenarios**
- ❑ **Provide technical + financial incentives ([1])**



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