Cognitive Routing in SDN

EC-1: Project Defense

CS F441 - Selected Topics in Computer Science

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2014A7PS108P

SDN: Software-Defined Networking

- **What?**

  Software-defined networking (**SDN**) is an approach to networking that allows us to programmatically *initialize, control, change, and manage network behavior dynamically via open interfaces.*

- **Why?**

  The current static architecture of traditional networks doesn't support the dynamic, scalable computing and storage needs of more modern computing environments.

- **How?**

  This is done by decoupling the brain of the network (system that makes decisions about where traffic is sent) from the underlying systems that forward traffic to the selected destination.

ROUTING

- **Routing** is the process of selecting a path for traffic in a network, or between or across multiple networks.

The Cognitive Part

- How do we humans route?
- Case Study: Human Traffic Management
- Example: BITS Layout

Key Idea: Capture the network state

- Use the current state to decide how to route a flow
- Pick a path that satisfies the QoS requirements
- **Problem**: Constraint based path finding* is NP-Hard and cannot be used in the scenario under consideration as millions of decisions have to be taken in a very small time frame.
- Important aspects: Efficiency and Optimization

* Ref: Kuipers, Fernando, et al. "Performance evaluation of constraint-based path selection algorithms." IEEE network 18.5 (2004): 16-23

3 Steps

- Precompute (during Network boot) feasible paths
- Choose path from the precomputed paths at runtime on request
- Create an overlay on the network using OpenFlow messages

Precomputation

- Ant Colony – Bio-Inspired Algorithm
- Demo: https://www.youtube.com/watch?v=eVKAIufSrHs&t=191s

Choosing a path

- Gather network state information
- Calculate the QoS of path
- If satisfying, select the path
- Improvisation: Apply RL with explore if the need be else exploit previously computed paths

Create overlay path in the network

- Use openflow messages to interact with the data plane and install rules corresponding to the chosen path.

Summary

- Using network state and intelligent decision making, we can achieve better traffic engineering leading to efficient utilization of the network.
- Thus building a cognitive system for providing routing as a cognitive service in Software-Defined Networks.