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A Centralized Controller for Intra-Domain Communication in Named Data Networking

A Dissertation

By

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Abstract

Abstract

Named Data Networking (NDN) is a provocative issue in the on-going revolution in Internet Architecture. NDN retains the same hourglass shape as the IP architecture, but changes the narrow waist from delivery of IP packets to destinations to the retrieval of named and signed data chunks. This conceptually simple change allows NDN networks to use almost all the Internet's well-tested engineering properties to solve not only communication problems, but also digital distribution and control problems. Also, it creates an abundance of new opportunities as well as many intellectual challenges in application development, network routing and forwarding, communication security and privacy.

Being motivated by Software-Defined Networking (SDN) in IP architecture, this thesis propose a design and develops a centralized controller for intra-domain communication in NDN. However, NDN controller differs from IP-based SDN controller a couple of fundamental ways. First, NDN controller uses Interest/Data packets to deliver routing updates, directly benefiting from NDN's data authenticity. Second, NDN controller take advantages of NDN's adaptive forwarding strategies to decide when to calculate a list of cost effective forwarding options for each name prefix. Since NDN is still in its early stage, however, none of these powerful features has been systematically designed, evaluated, or explored. The centralized controller is one of them.

In this thesis, we divide design, implementation and challenges of the centralized controller in following ways, First, we proposed communication model between nodes and controller in single domain. Second, we designed network dynamics to handle network failures. Third, we designed and implemented single/multi path algorithms at controller. Fourth, we implemented prototype and operational model of the centralized controller using NS3/ndnSIM simulator. Fifth, we showed some experiments and results of traffic overhead. We believe that the centralized controller can also serve a number of other purposes during the development and deployment of the NDN architecture in coming years.

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