Framework for Autonomic Management in Software Defined Networks

Phd proposal

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NMRG - IETF 99
Outline

Introduction
Motivation
State-of-Art
Research Question and Hypothesis
Expected contributions
AutoSDN
Introduction
Software-Defined Networks

APPLICATIONS PLANE

CONTROL PLANE

DATA (FORWARDING) PLANE

MANAGEMENT PLANE

Global Network Abstraction

SDN Controller

Services Requests & Orchestration

OpenFlow

Resources

NorthBound API

SouthBound API

Coordinator/Adapter/

Coordinator/Adapter/

Coordinator/Adapter/

Coordinator/Adapter/

(ONF, 2014) (ITU, 2014) (Wickboldt et al., 2015) (Estrada et al., 2016)

SDNRG → RFC 7426
Introduction

Autonomic Network Management (ANM)

• Reduce human intervention
• Adaptation to context changes
  – MAPE-K model
  – Autonomic Control Loops (ACLs)
  – Decision elements
• Self-* features
  – self-configuration
  – self-healing
  – self- optimization
  – self-protection
  – self- programmability
• Anima charters*

(Jennings et al., 2007) (Samaan and Karmouch, 2009) (Behringer et al., 2016)
Motivation
OpenFlow Specification

An Intelligent Framework for Autonomic Management in Software Defined Networks
Motivation

Application Manager → OpenFlow Controller → OpenFlow

An Intelligent Framework for Autonomic Management in Software Defined Networks
Motivation

Restoration
Motivation

Protection

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Motivation

It is needed a management system that provides an appropriate solution to network events, based on the analysis of current (and past) state of the network.
Motivation

SDN and ANM share their objective:

Enabling programmable, manageable, dynamically, self-adaptable and cost-effective networks and services.

(Wendong et al., 2012) (Tsagkaris et al., 2015)
State-of-art

• Autonomicity Design in OpenFlow Based Software Defined Networking (Wendong et al., 2012)
• CogMan (Kim, 2013)
• PolicyCop (Bari et al., 2013)
• Integrating Autonomic Network Management and Software-Dened Networking (Tsagkaris et al., 2015)
• Towards a programmable management plane for SDN and legacy networks (Sieber et ai., 2016)
• An Autonomic QoS Management Architecture for Software-Defined Networking Environments (Volpato et al., 2017)
State-of-art

Shortcomings

- Ignore recent proposal of vertical management plane
- No emphasis on intelligent algoritmic components
- No autonomicity at node level
- Recent reference models could be adapted
  - Generic Autonomic Networking Architecture (ITU AFI, 2016)
  - Anima Reference Model (Behringer et al., 2015)
Research Question and Hypothesis

How to efficiently manage an SDN with vertical management plane, being aware of changes in network state, with minute human intervention?

Layered decision elements in an SDN with vertical management plane, supported on intelligent-ACLs, could contribute to perform self-* functionalities, achieving efficient management.
Expected contributions

• Reduce reconfiguration time
• Distributed management tasks
  • micro-loops (faster reaction)
  • Loops (slower reaction)
AutoSDN Framework Overview

NEs - Network Elements (NEs)
RRM - Resource Representation Model
DE – Decision Element

ONIX – Overlay Network for Information eXchange
MBTS – Model-Based-Translation-Service
AutoSDN

Autonomic Network Element: OpenFlow-based switch?
AutoSDN

Under consideration

- Follow recent reference models
  - GANA
  - Anima Reference Model
- Vertical management plane
- Hierarchical architecture (for DEs and ACLs) \( \rightarrow \) relation?
- Designed specifically for SDN
- Knowledge plane
  - Information model ?
  - Data model \( \rightarrow \) Yang,…
- Provide intelligent capabilities to network elements (Idnet)
AutoSDN
To be defined

- Policy treatment
  - Intents?
  - Supa WG
- Decision elements/Inter-loop communication
  - Grasp?
- Priority of events
- Reporting
- A name?
References


Thank you!

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