Framework for Autonomic Management in Software Defined Networks

Phd proposal

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NMRG - IETF 99

Outline

Introduction

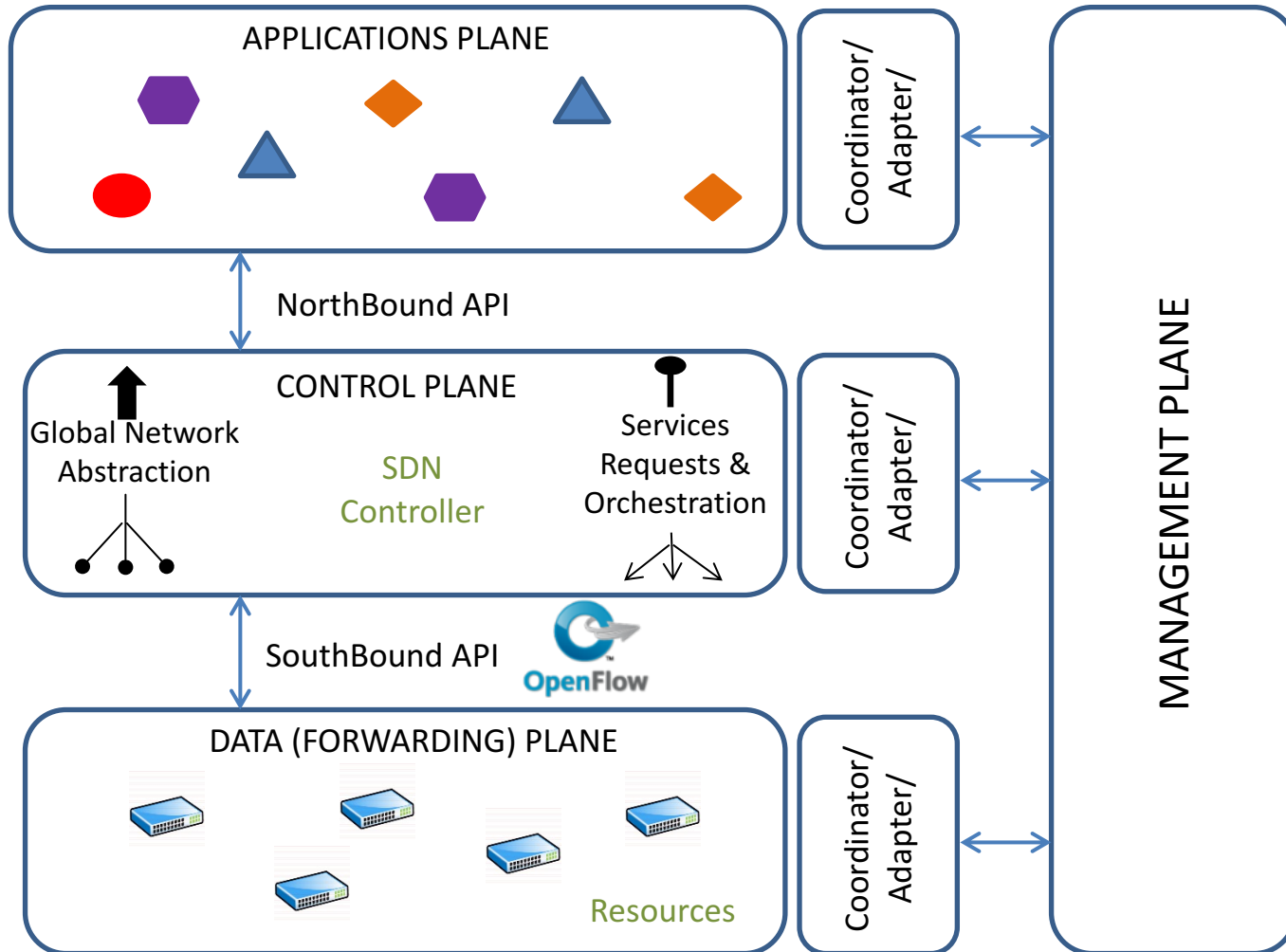Motivation

State-of-Art

Research Question and Hypothesis

Expected contributions

AutoSDN

Introduction
Software-Defined Networks

(ONF, 2014) (ITU, 2014) (Wickboldt et al., 2015) (Estrada et al., 2016)
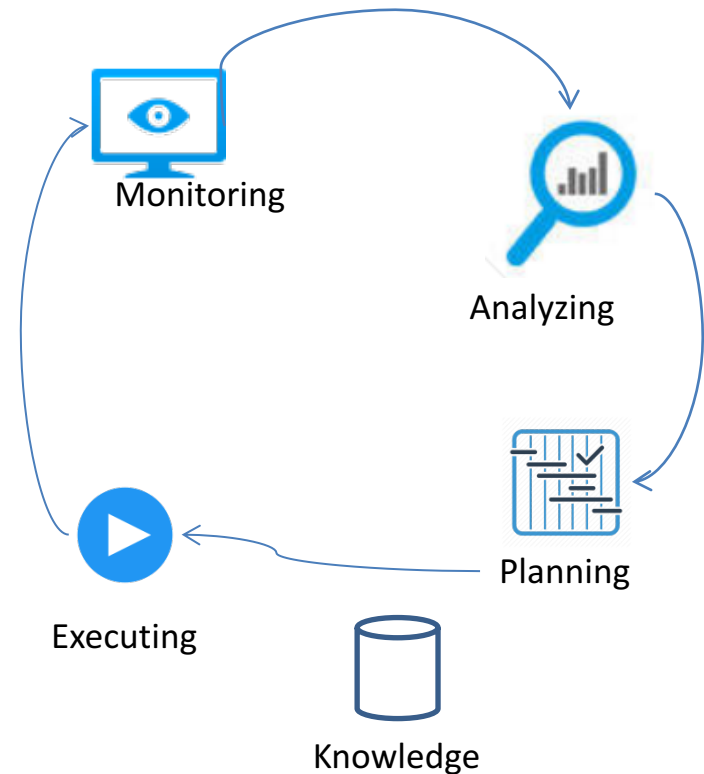SDNRG → RFC 7426

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
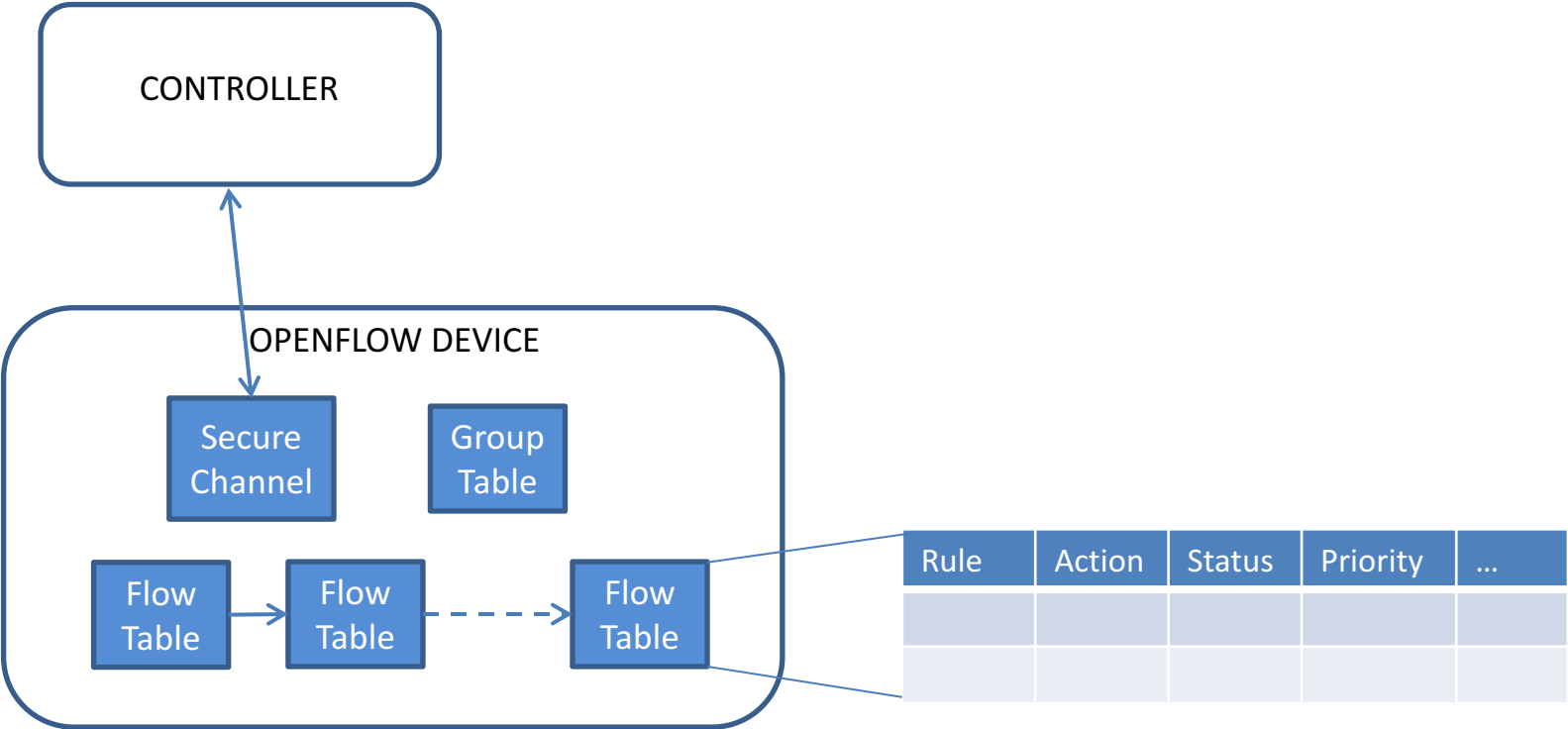 - self-protection
  - self- programmability
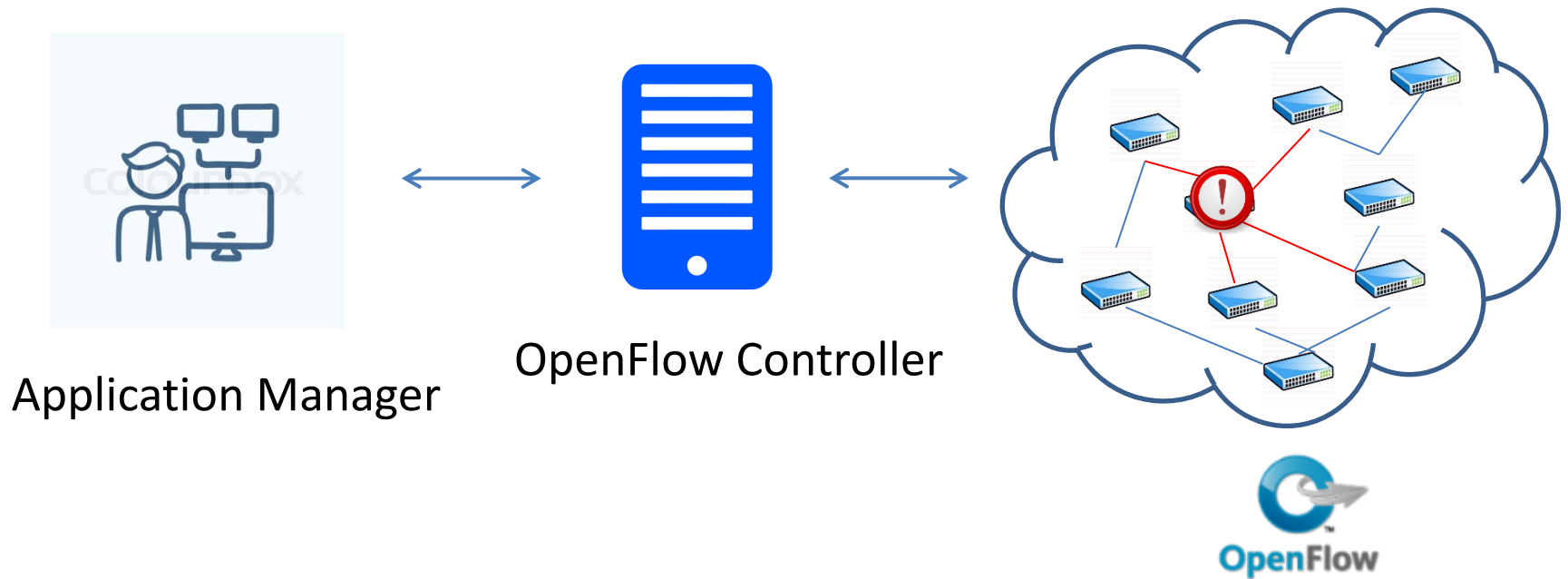
- Anima charters*

Objectives/
Policies/Rules

Monitoring

Analyzing

Planning

Executing

Knowledge

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

Motivation

OpenFlow Specification

Rule	Action	Status	Priority	...

An Intelligent Framework for Autonomic Management in Software Defined Networks
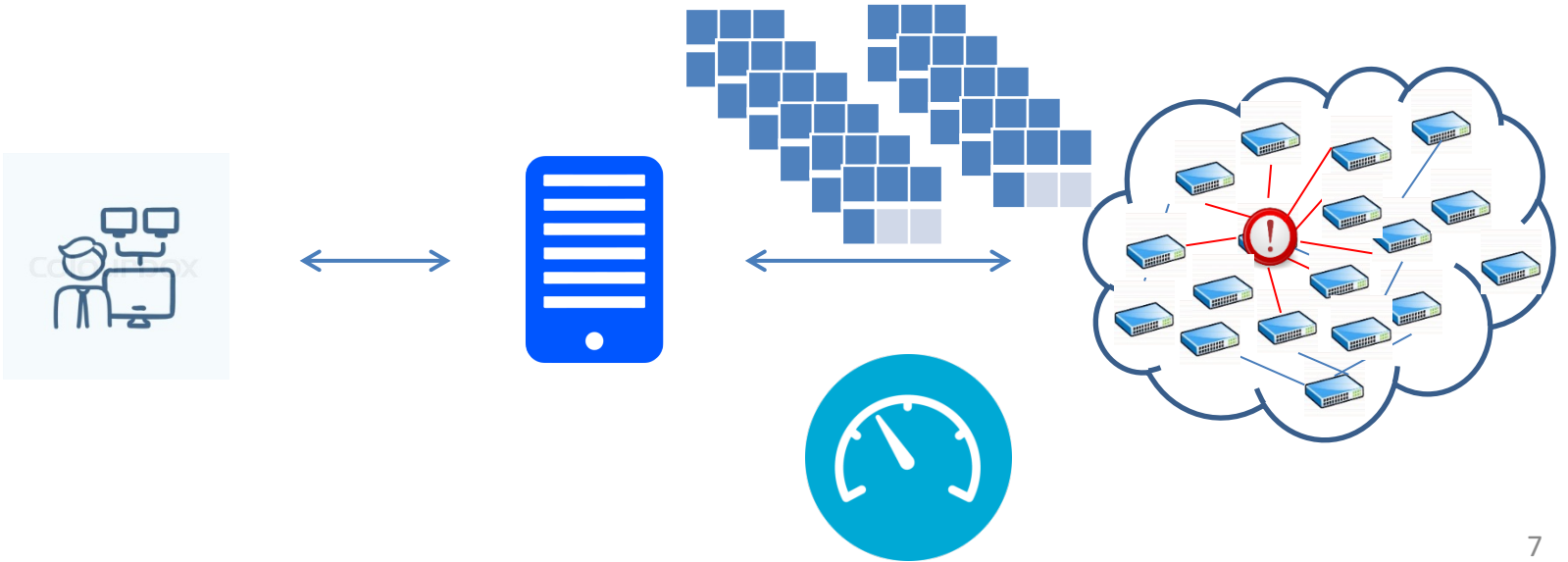
Motivation

Application Manager

OpenFlow Controller

Motivation

Restoration

Motivation

Protection

Rule	Action	Status	Priority	...
Backup path				

Rule	Action	Status	Priority	...
Backup path				
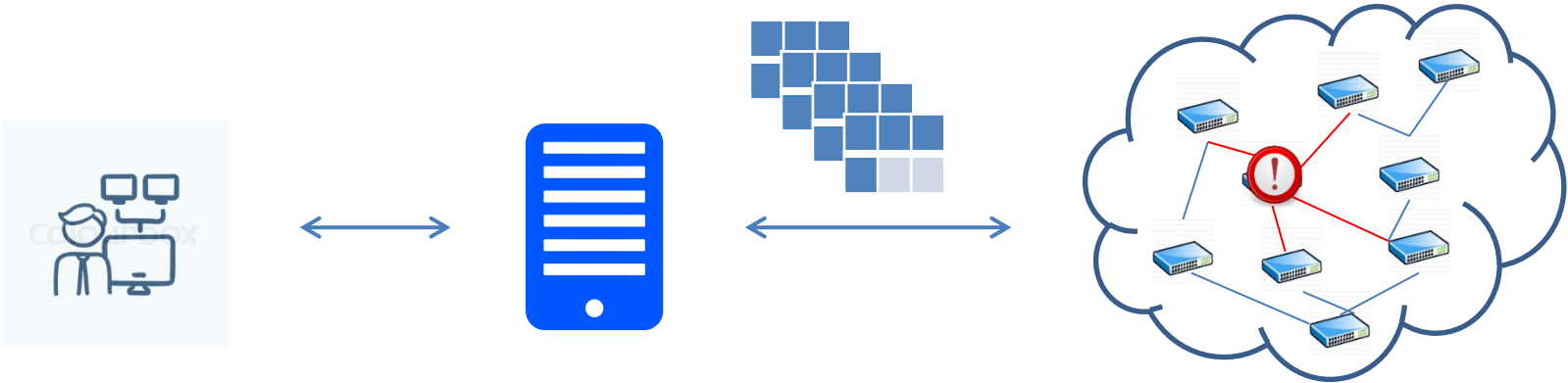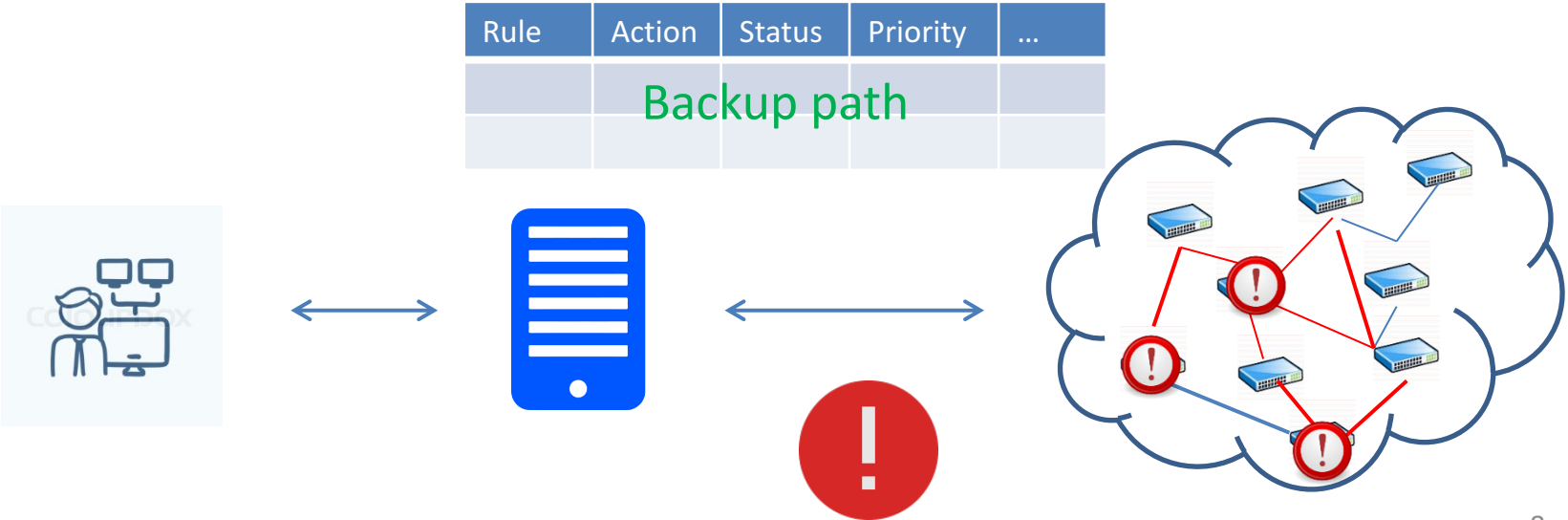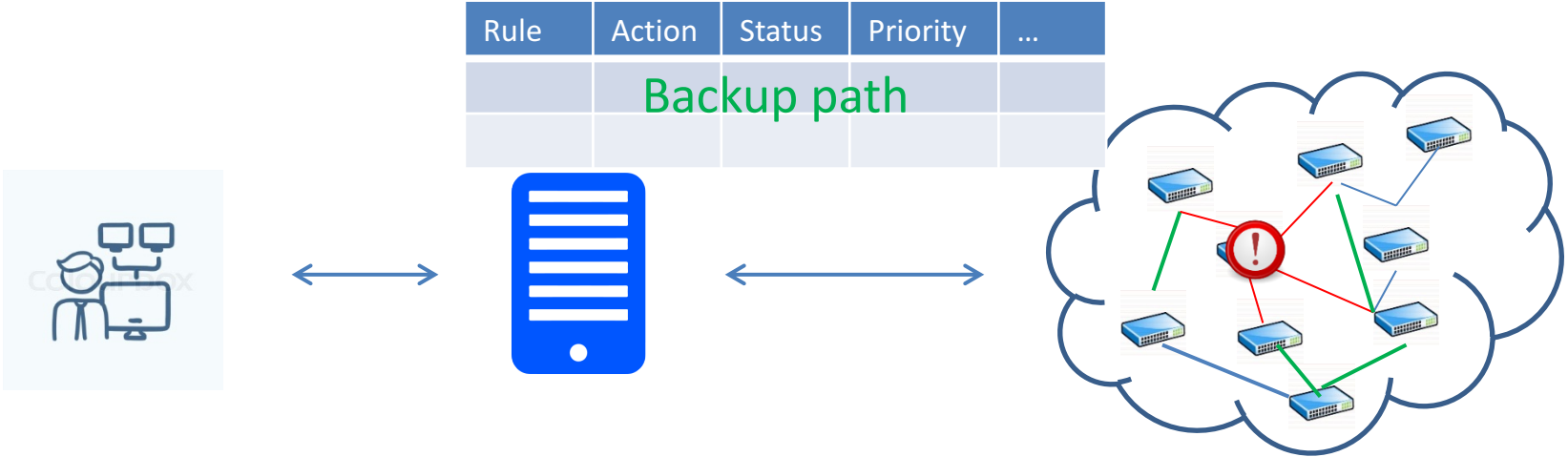
Motivation

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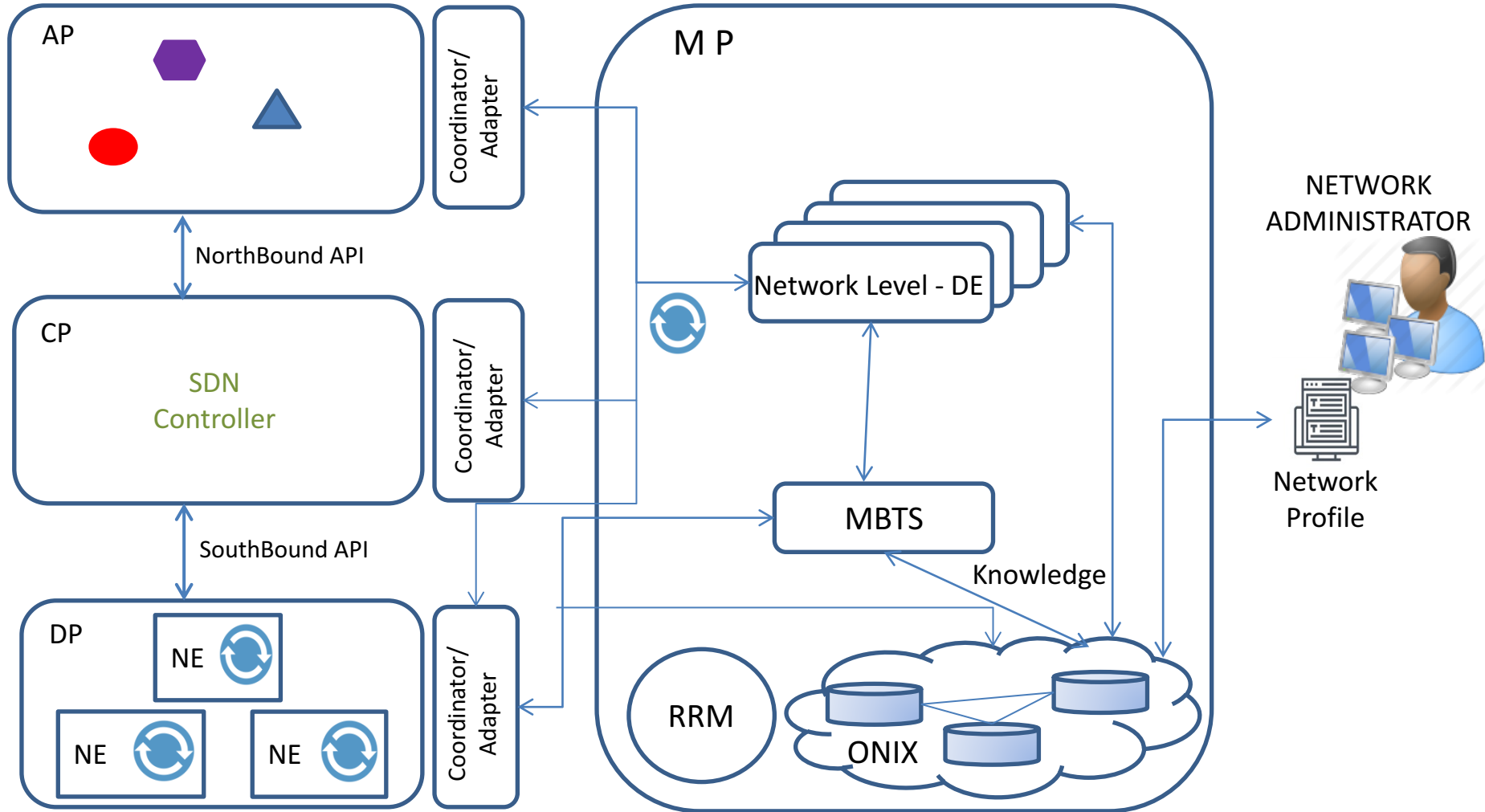
Layered decision elements in an SDN with vertical management plane, supported on intelligent-ACLs, could contribute to perform self-* functionalities, achieving efficient management.

Expected contributions

- Reduce reconfiguration time
- Distribuited management tasks
  - micro-loops (faster reaction)
  - Loops (slower reaction)

AutoSDN
Framework Overview

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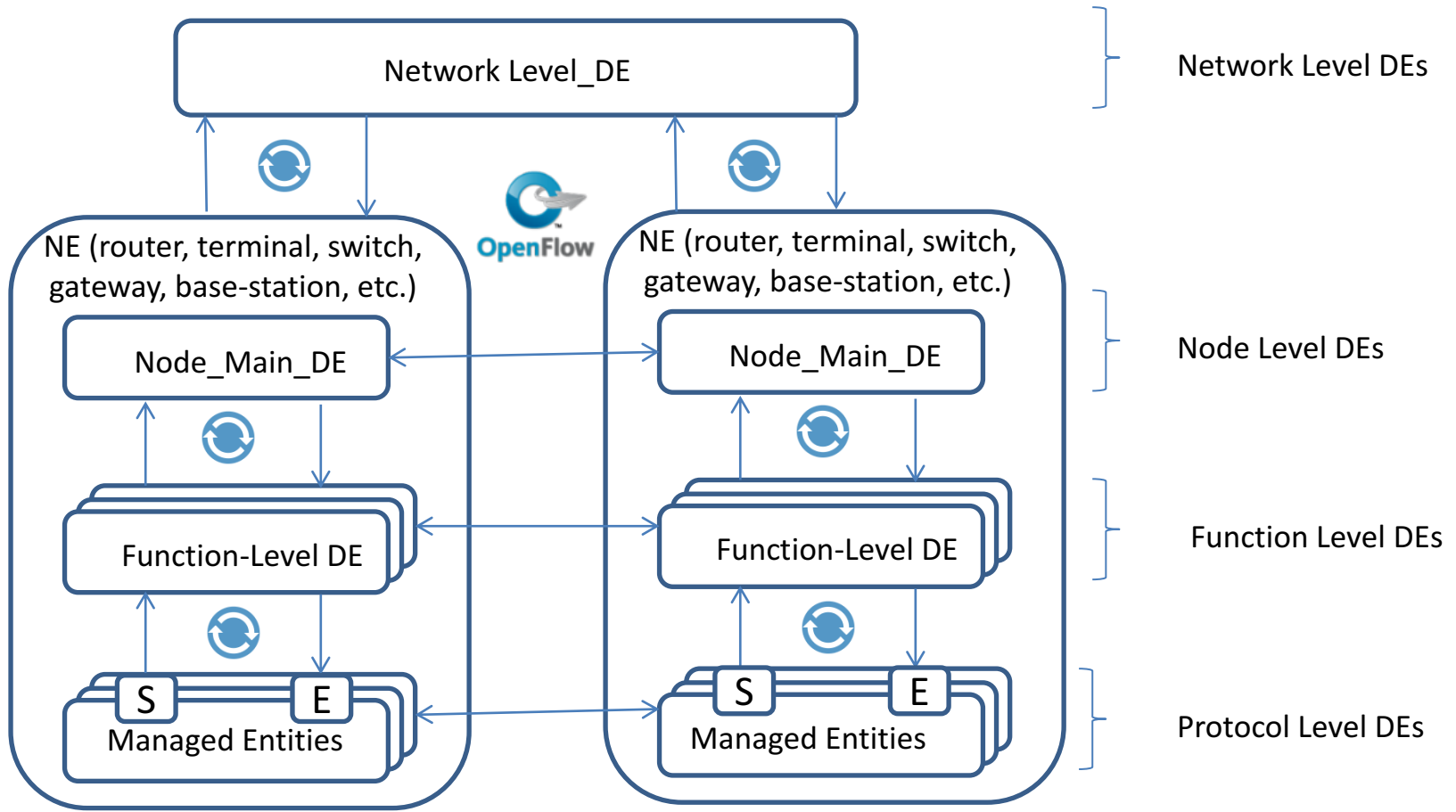RRM - Resource Representation Model
DE – Decision Element

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

AutoSDN

Autonomic Network Element: OpenFlow-based switch ?

Network Level_DE

Network Level DEs

NE (router, terminal, switch, gateway, base-station, etc.)

Node_Main_DE

Node Level DEs

Function-Level DE

Function Level DEs

S   E
Managed Entities

Protocol Level DEs

NE (router, terminal, switch, gateway, base-station, etc.)

Node_Main_DE

Function-Level DE

S   E
Managed Entities

OpenFlow

S – Sensor
E - Effector

AutoSDN

Under consideration

- Follow recent reference models
  - GANA
  - Anima Reference Model
- Vertical management plane
- Hierarchical architecture (for DEs and ACLs) → relation?
- Designed specifically for SDN
- Knowledge plane
  - Information model ?
  - Data model → 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?

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Thank you!

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