POLITECNICO DI TORINO

Dipartimento di Automatica e Informatica

PhD in Computer and Control Engineering

XXIX cycle

Advisor

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End-to-End QoS Provisioning in Next-Generation Networks

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1. Introduction

The control-plane of a communication network is the software implementing all the algorithms for making decision about the treatments of packets that are injected into the network by the end-user applications. Quality-of-Service (QoS) is an advanced feature that prioritizes some classes of Internet traffic to minimize the impact of busy bandwidth when this is shared by many sources at the same time (Ref. 1).

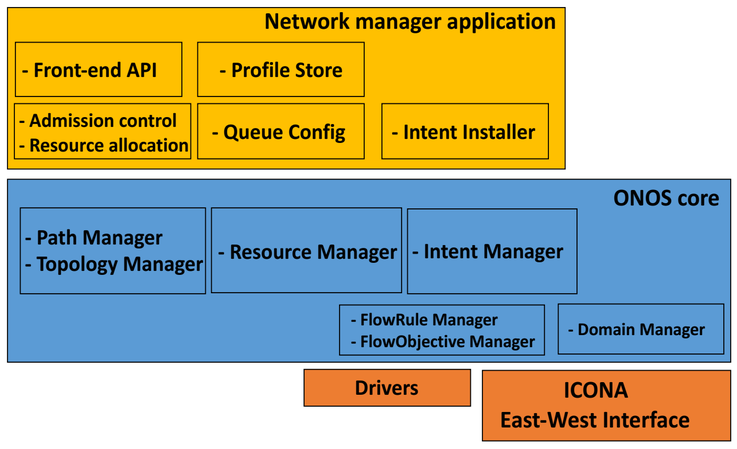

Figure 2: High level software components

Upon the experience gained in the three years activity the PhD candidate presents a distributed control plane architecture to feature real-time end-user applications with the capability of requesting at any time a customised end-to-end Quality-of-Service (QoS) profile to keep for a limited amount of time. Since these applications will have terminals deployed all around the globe, the end-to-end provisioning will have to span a chain of authoritative domains, requiring a new East-West communication interface to convey the proper information between centralised network controllers (Fig. 1).

2. Motivations

Internet-Service-Providers (ISPs) need to be ready to re-architect their software control-plane in order to fully exploit the enormous potentials offered by their infrastructures (low-latency and ultra-fast access links). Current network control plane schemes lack of an operational framework for end-to-end QoS provisioning. This is due to the adoption of distributed control algorithms that forces each network nodes to run a specific protocol or extension protocol (e.g. RSVP, BGP-LS), not taking into account the resistances inevitably present between device vendors and between administrative domains. For this reason the Service-Level-Agreements (SLAs) between the ISP and the customers or between ISPs are still mainly static.

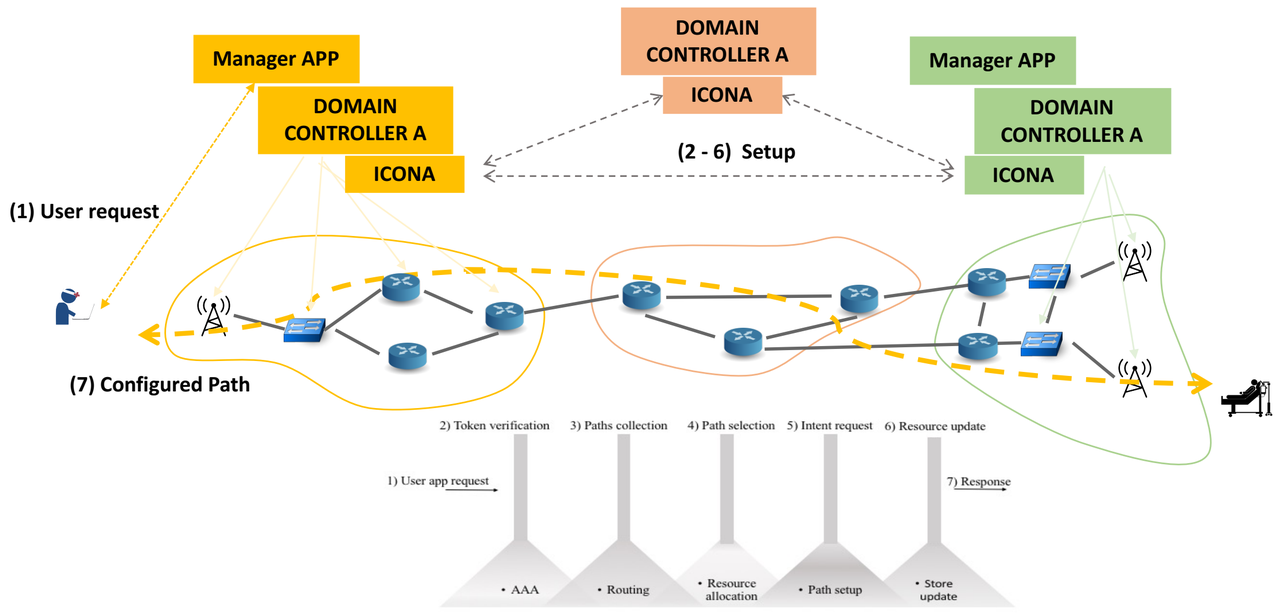

Figure 1: Scenario and basic system workflow

Our aim is to solve the interoperability problem in provisioning dynamic end-to-end guaranteed services, in a multi-vendor, multi-technology and multi-domain environment by exploiting current software technology advances.

3. Architecture

The main functional modules in the control plane are *protocol agnostic*. A composition of specific communication mechanisms could actually coexists within the same domain and in the communication interface between domains. In each domain we have (Fig. 2):

- A logically centralised network controller with a NorthBound (NB) interface exposed to the applications and a SouthBound (SB) interface to access the data-plane devices.
- An AAA system for the subscribed users. This component can be physically and logically separated by the controller.
- A set of APIs available to the end-user applications that are used to request an end-to-end priority flow to the operator the user is subscribed to.
- A network manager application implements the *admission control routine* and the *resource allocation scheme*. It guarantees the correctness of the QoS provisioning to the end-user applications.
- As many drivers as the number of different devices in the underlying network topology (Fig. 3).
- An East-West communication interface used to exchange the information between the domain network controllers.

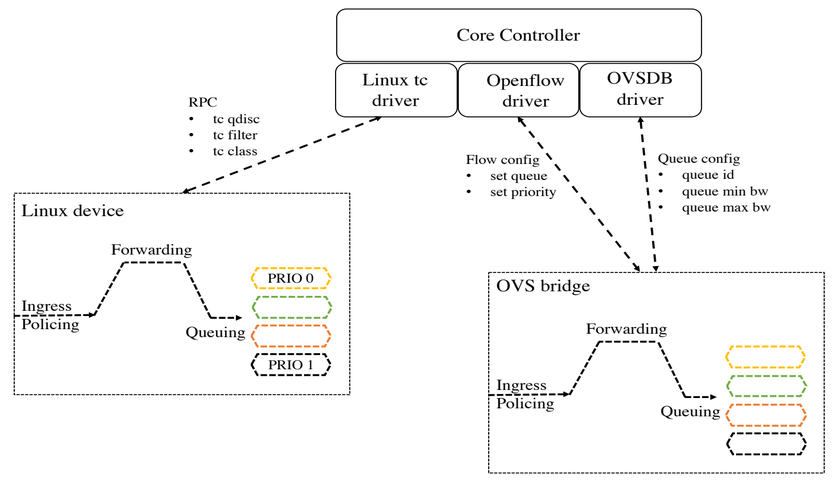

Figure 3: Driver modules for vendor-specific network devices

4. Technologies

Our prototype is built on the cutting-edge network controller ONOS (Ref. 2). The manager application is a pure java 8 on-platform application, while we use three different communication mechanims in the southbound interface:

- RPC in Linux environmnet
- Openflow 1.3 + OVSDB
- ICONA (Ref. 3) which is the component enabling the East-West communication interface.

5.References

1. *F. Lucrezia, G. Marchetto, F. Risso, "In-network Support for Over-The-Top (OTT) Video QoE" – AFIN 2014*
2. *http://wiki.onosproject.org/*
3. *M. Gerola, F. Lucrezia, Michele Santuari, Elio Salvadori, "ICONA:* a peer-to-peer approach for Software Defined Wide Area Networks using ONOS" – EWSDN 2016