Software Service Defined Network: Centralized Network Information Service

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Introduction

Traditional SDN controller architecture
Challenges of Current SDN Architecture

- Low interoperability and development efficiency: the controller modules and applications can be used on a specific controller implementation
- Less flexibility: SDN controller’s modules are not interchangeable across different vendors
- Poor scalability: Can not just scale-out the service with the most workload
- Inefficient manageability: Adding or upgrading a controller’s module or service can cause interruption of the controller’s network services
- Lack of communication between controllers: domain-specific information is not shared with other controllers. The separation makes it difficult to obtain a global optimization across multiple domains.
- Insufficient resiliency: the working controller and the backup controllers of a domain may fail at the same time
Software Service Defined Network

• NSSL: Network Software Service Layer
• CNIB: Central Network Information Base
• ESB: Enterprise Service Bus
Flexible Network Software Module

Module 1

Module 2

SDN Controller

RESTful API

Flexible Network Software Module

Internal API

Module integrates in the controller

Module registers to the ESB as a service
Flexible Network Service Architecture

Vendor A
Network Diagnose Service

Vendor B
Traffic Engineering Service

Vendor C
Traffic Engineering Service

ESB

Vendor A
Network Diagnose Service

Vendor B
Traffic Engineering Service

Vendor C
Traffic Engineering Service

Firewall
Routing
(PCE)

Vendor A
$20K/M

Vendor B
$30K/M

Vendor C
$40K/M

Vendor A
$15K/M

Vendor B
$20K/M

Vendor C
$25K/M

Integrate

Integrate

Firewall
Routing

Core functions

SDN controller

Vendors list

Vendor A
$20K/M

Vendor B
$30K/M

Vendor C
$40K/M

Vendor A
$15K/M

Vendor B
$20K/M

Vendor C
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ESB

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Integrate

Integrate

Firewall
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Core functions

SDN controller

Vendors list
Central Network Information Base

• All controllers on a ESB replicate its database to the CNIB
• CNIB provides APIs for basic operations: inserting, querying, modifying, and deleting data
• CNIB serves different controllers, network services, and applications
• When a controller fails, its backup controller or the controllers from other domains can retrieve the information from the CNIB and replace the failed controller
• Permissions are checked when an network entity queries the CNIB
Achieve global optimization
CNIB Federation
ESB Messaging Modes

Publish/Subscribe (Pub/Sub)

- Company A Traffic Engineering
- Company B Traffic Engineering
- Company C Traffic Engineering

Routing Service

Controller

Topology Service

Topology updated!
ESB Messaging Modes

Point to Point (PTP)
SSDN Service Chaining Example

Switch → Packet In → Controller → Request for routing → PCE → Request for topology → Topology Service → Response with topology → Response with the routing → Packet Out

Switch
Controller
PCE
Topology Service

Packet In
Request for routing
Request for topology
Response with topology
Response with the routing
Packet Out
SSDN Service Orchestration Example: TE

- Easy scale-out: create more instances of a service
- Achieve separate life cycle management
- Achieve global optimization: topology may be retrieved from multiple domains’ CNIB

\[ \text{Traffic Engineering Application} \rightarrow \text{Topology Service} \rightarrow \text{CNIB} \rightarrow \text{Configuration Service} \]

- Request for topology information
- Response with topology information
- Request for traffic information
- Response with traffic information
- Request for configuration
- Response
Benefits of SSDN

• Improve interoperability and development efficiency
• Enable controller agility
• Increase scalability
• Achieve separate life-cycle management
• Enable inter-controller communication
• Enhance network resiliency
New Business Opportunities and Ecosystem

• **Vendors**
  • Bring to the market their controller modules, network services or applications

• **Users**
  • Customize their own SDN controllers according to their requirements

• **New Ecosystem**
  • Multiple vendors can contribute to the same or different controller modules, network services and applications
  • Users can choose their favorite network elements according to their requirements from the vendor list
  • Open the market to small and medium companies
Thank You