Framework for Large-scale SDN Experiments via Software Defined Federated Infrastructures

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Introduction

• Testing of innovative solutions for network control calls for experimentation using large-scale testbeds
  – emulate near real-world testing conditions and allow for wide technical and industrial impact

• **Network programmability** via Software Defined Networking (SDN) and dynamic on-demand network service provisioning are key ingredients

• **Experimental research infrastructures** are a reality for this thanks to efforts in Europe, Asia, and the Americas

• **FELIX** is part of this research experimentation infrastructure line of work
  – Future Internet Research Experimentation (FIRE) framework in EU
  – special focus on using SDN and Bandwidth on Demand (based on the Network Service Interface – NSI) for dynamic transit network connectivity
FELIX in a Nutshell

Facts

• EC (EU), MIC & NICT (JP) collaborative project
• Project running from April 2013 till March 2016

Objectives/Results

• A large-scale testbed federated across two continents
• A reference common architecture for SDN testbeds
• **Slice**
  – Experimental facilities to be provided dynamically on top of the FELIX physical infrastructure (federated testbeds)
• All experimental facilities are controlled programmatically
  – facilities are composed of computing and network resources (CR and NR) belonging to distributed SDN islands in FELIX infrastructure
  – resource orchestration in a multi-domain environment
  – in a slice, facilities are interconnected via transit network (TN) service-controlled domains
• User has access and control of a provided slice
The **FELIX Space** provides users with slices for their own use. Users request slices to an RO.

- RO: Resource Orchestrator
- RM: Resource Manager
- PHY RES: physical resources (testbed)

The **User Space** consists of any tools and applications that a user wants to deploy to control a slice or execute particular operations.
RO Hierarchical Structure Options

Centralized

Distributed

Full mesh

Selected for implementation

Hybrid

Global RO

Continent RO

Island RO
FELIX Architecture: Example Request Flows

- :::: Policy EU-0 ::::
  * Send request to
    1. EU-1 or JP-0
    2. EU-2

- :::: Policy JP-0 ::::
  * Send request to
    1. JP-1
    2. JP-2
    3. EU-0

- :::: Policy EU-1 ::::
  * Send request to
    1. EU-0
  * Accept requests of
    1. EU-0

- :::: Policy EU-2 ::::
  * Send request to
    1. EU-0
  * Accept requests of
    1. EU-0

- :::: Policy JP-1 ::::
  * Send request to
    1. JP-0
  * Accept requests of
    1. JP-0

- :::: Policy JP-2 ::::
  * Send request to
    1. JP-0
  * Accept requests of
    1. JP-0

EU

RO

EU-0

JP-0

RO

JP-1

RO

JP-2

C/SDN-RM

TN-RM

MON

AAA

Request#1

Request#2

Policy engine
FELIX Island Instantiations

Source: www.ict-felix.eu
Summary

- FELIX facilitates the federation and integration of different network and computing resources controlled via SDN and Network Service Interface (NSI) / bandwidth on demand (BoD) in a multi-domain heterogeneous environment across spanning Europe and Japan.
- FELIX designed and implements a common control framework where users can request, monitor and manage a slice provisioned over distributed and distant SDN experimental facilities.
- FELIX orchestration and resource management software is currently deployed in a number of interconnected SDN island across Europe and Japan.
- The FELIX framework uses a combination of recursive and policy-based hierarchical configurations for orchestration, request delegation and inter-domain dependency management.
- Resource orchestrating entities are responsible for the synchronization of resources available in particular administrative domains.
Further Info


4. FELIX Tutorial at EWSDN 2015 (www.ewsdsn.org) in Bilbao, Spain.
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Thanks for your attention!

Questions and comments?