Flexible NFV+SDN Orchestration

Enabled by ALTO

draft-bertz-alto-sdnnfvalto-02
Overview

• Network Function Virtualization (NFV)
  - SDN + NFV (SDN pulled out of ETSI NFV View)
• AlTO in the SDN + NFV environment
• Requirement 1: AlTO MUST support Aggregation
• Orchestrator's Task
• Orchestration Algorithm
• New Use Cases for AlTO
• Measurement Initiation
• Proposed System
• Road Ahead
NOTE: SDN Controller / Switches are often considered to be part of VIM but may also be VNFs.
NFV / SDN + ALTO

NOTE: SDN Controller / Switches may be part of VIM and/or themselves VNFs.
REQ 1: ALTO MUST support Aggregation

- Aggregation of data concept is required in ALTO
  - Client side integration is complex and defeats the ease of Service ALTO provides
  - There will be multiple domains and with filters people are likely to share data
- Biggest issue for ALTO is an incorrect assumption of number of sources, esp. SDN Controllers
  - SDN controllers must remain close to their switches if they are supporting signaling protocols
  - Cannot push a bunch of data from multiple SDN Controllers to an ALTO server then throw 99% of it away
  - Controller separation for security purposes is a reality
  - SDN Controllers are considered part of the VIM
  - The number of NFV instances (VIM + rest of OpenStack) is MUCH higher than anyone anticipated
    - Roughly 4-12 very dense racks can be managed as one set of VIM instances
      - This implies an SDN Controller for every 8-12 racks...
      - The more protocols you pack into controllers the higher probability it can serve less
        - This can be countered in IETF by developing transport / signaling protocols that meet many needs and scale easily but is a lofty goal...

ALTO must support aggregation
Orchestrator’s Task(s)

• How to request from VIM(s) what you need (and get it) given a VNF Forwarding Graph (VNF FG)?
  • Splitting up a VNF FG means you need to know how VIMs can connect, i.e. you need network topology.
  • VNFs have constraints
    • Some are resource, e.g. CPU, Memory, etc.
    • Some are performance, e.g. total latency < 50ms

• What is the VIM doing?
  • According to suppliers it is efficiently packing virtual machines, containers, etc.
    • It is doing this on a constant basis
    • Isn’t this some form of Bin Packing?
STEP 1 – Orchestrator generates partial solutions, i.e. subgraph, of the VNF FG that can be satisfied by the VIM’s resource information. These become candidate partial solutions CX for a subgraph of the VNF FG X.

STEP 2 – Compute Matrices

*Subgraph Matrix*

Each row is a subgraph of the VNF FG

<table>
<thead>
<tr>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
</tr>
</thead>
</table>

*VIM Candidate Matrix*

Each row is a candidate partial solution, i.e. subgraph, of the VNF FG for a specific VIM

<table>
<thead>
<tr>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
</tr>
</thead>
</table>

Any row w/o negative values is a valid candidate

Performance Constraints of VIM provided via ALTO

VIM Candidate Suitability Matrix

*Subgraph Matrix*

Resources Consumed by subgraph

<table>
<thead>
<tr>
<th>Resources from VIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Constraints of VIM</td>
</tr>
</tbody>
</table>

All constraints are set up so that if value > 0 constraint is satisfied...
Step 3 - Ranking

Any row w/o negative values is a valid candidate (n x m Matrix)

= Weight Vector (m x 1 matrix)

= Weighted Solution Values (n x 1 vector)
**NEW Use Cases for ALTO**

When data was not present in VIM candidate matrix:

**UC 1:** Data is present in underlying Server BUT not visible in ALTO Server (implies a Filter)

=> ALTO MUST support Server side filtering (On Demand Measurements is proposed)

**UC 2:** Data is not present server at all => ALTO MUST support some form of Measurement Initiation

**UC 3:** Metric not currently supported by ALTO Sever => Dynamic loading of measurement data

*VIM Candidate Matrix*
UC2 Overview

1: Cost of metric M from EP1 to EP2?

2: Cost of metric M from EP1 to EP2?

3: Cost of metric M from EP1 to EP2?

4: Get PID for EP2
5: Get PID Property “measurement initiator” for PID Y”

Measurement Initiation – negotiation & start (outside of ALTO Scope?)
Communication with a Programmable VIM

Orchestrator ‘asks’ VIM by sending a set of 4 rows

**VIM Data** – It shows the ALTO (performance) + Resource Information that was used to determine the selection

**Request Row**

**VIM Data Row**

**Upper Bounds Row**

**Lower Bounds Row**

VNF FG Subgraph’s Requirements

**Upper Bounds**

that the VIM may auto-scale the VNFs in the VNF FG subgraph to w/o querying the VIM

**Lower Bounds**

where if they are maintained for a pre-defined period will require the VIM to notify the Orchestrator.
Proposed System

• Elements
  • ALTO Server integrated SDN Controller
  • ALTO aggregators
  • Measurement Initiators (may be part of Controllers)
  • ALTO integrated NFVO
  • ALTO integrated VNF EM (optional)
  • ALTO Client based Orchestrator

• Features
  • ALTO aggregation for Scaling over multiple SDN Controllers / NFVI domains
  • On Demand Measurements / Measurement Initiation to adapt to different Orchestrator information needs
  • Minimal interchange between VIM and Orchestrator
  • Orchestrator can get data from ANY ALTO source
  • System can
    • Adapt to new metrics from VNFs
    • Send only data that is required
    • Auto discovery of VIMs, Aggregators and Orchestrators via ALTO

• Still permits differentiation for Orchestrators and VIMs
Road Ahead

• Feedback requested.
  – (Thank you to those who have already provided it!)
• Should this become a Requirements Document for ALTO?