Resource Management for Dynamic Service Chain Adaptation

proposed NFVRG, November 2014

draft-lee-nfvrg-resource-management-service-chain-00

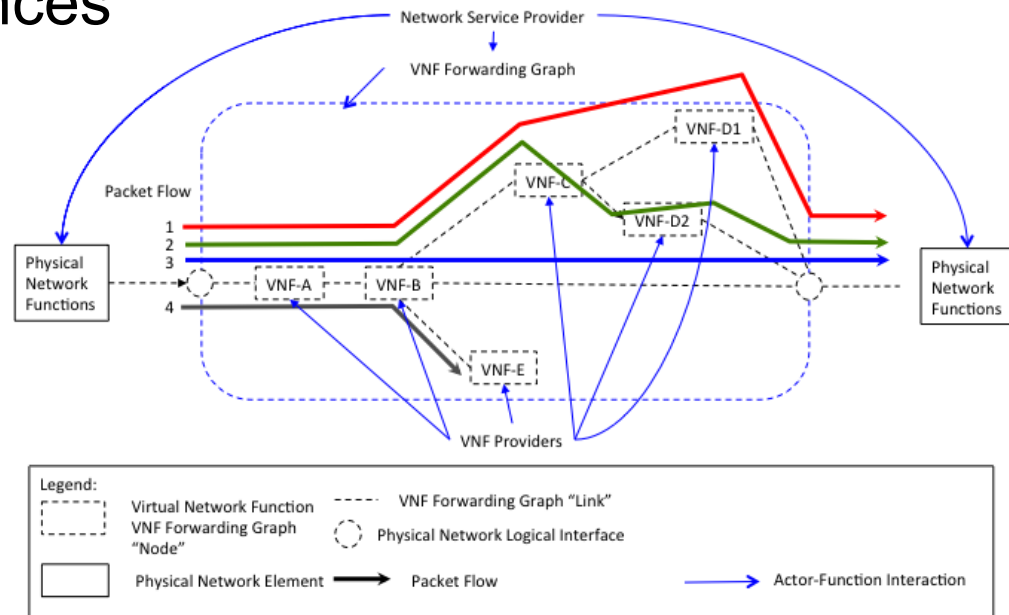S. Lee (ETRI) seungiklee@etri.re.kr

S. Pack (Korea Univ.) shpack@korea.ac.kr

M.-K. Shin (ETRI) mkshin@etri.re.kr

E. Paik (KT) eun.paik@kt.com

Background

- VNF forwarding graph (VNF-FG):
  – an ordered sequence of VNFs for composed services
- Network forwarding path (NFP):
  – an instance of VNF-FG
  – a chain of VNF instances

Background

- NFV resources composing NFP
  - VNF instance (VNF-I), virtual links (VL)
    - over NFVI-node (VM, compute, storage, ...)

- NFP depends on the resource states
  - Failure, performance, load, energy consumption, bandwidth, latency, ...

VNF-B #1

Failure of VNF instance

Failure of the whole NFP

VNF-A #1

VNF-B #2
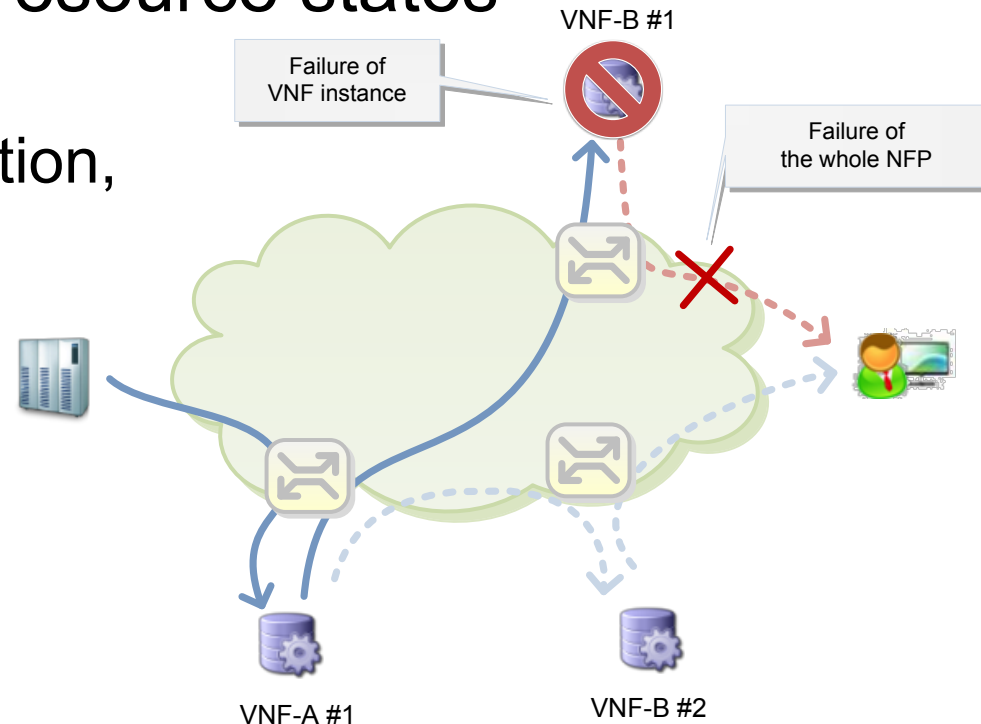
Problem Definition

- Goal
  - NFP needs to consider the state of NFV resources (VNF-I, VLs) at construction
  - NFP needs to adapt to the changes of the resource state dynamically
  - for optimization, fail-over, load balancing, ...

Use Cases

- Fail-over: reconstruct a NFP with replacing the failed VNF-I with new VNF-I selected

- End-to-end latency optimization: construct or maintain a NFP with low stretch considering the topological locations of VNF-Is and the properties of VLs

- Traffic optimization: construct or maintain NFPs to localize the traffic in the network considering load and administrative domains of VNF-Is and VLs.

- Load balancing: construct or maintain NFPs to distribute the load of shared VNF-Is

- Energy efficiency: construct or maintain NFPs to use the energy of VNF-Is efficiently

Target Actions

- Target actions
  - Select or evaluate VNF-Is and VLs to construct a NFP
  - Replace VNF-Is to update a NFP
  - Monitor attributes of VNF-Is and VLs
  - Migrate VNF-Is to different locations

Target Metrics

- Attributes of VNF instances
  - availability (failure)
  - topological location
  - workloads
  - throughput
  - energy consumption
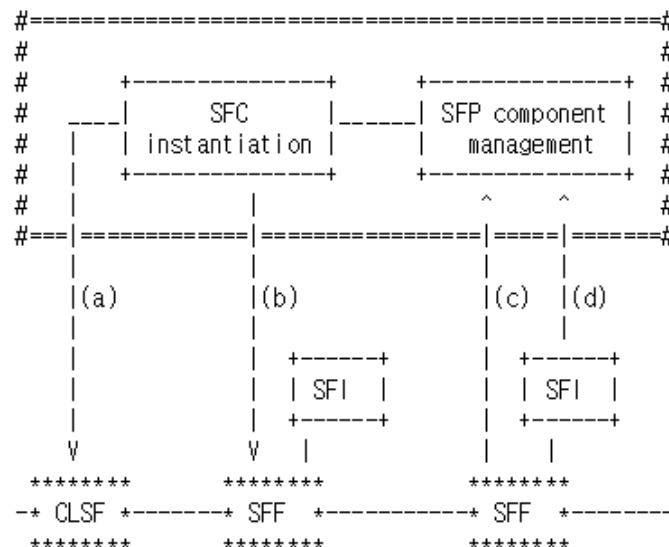- Attributes of virtual links
  - latency
  - bandwidth

In the NFV Framework

- Scope of NFV MANO
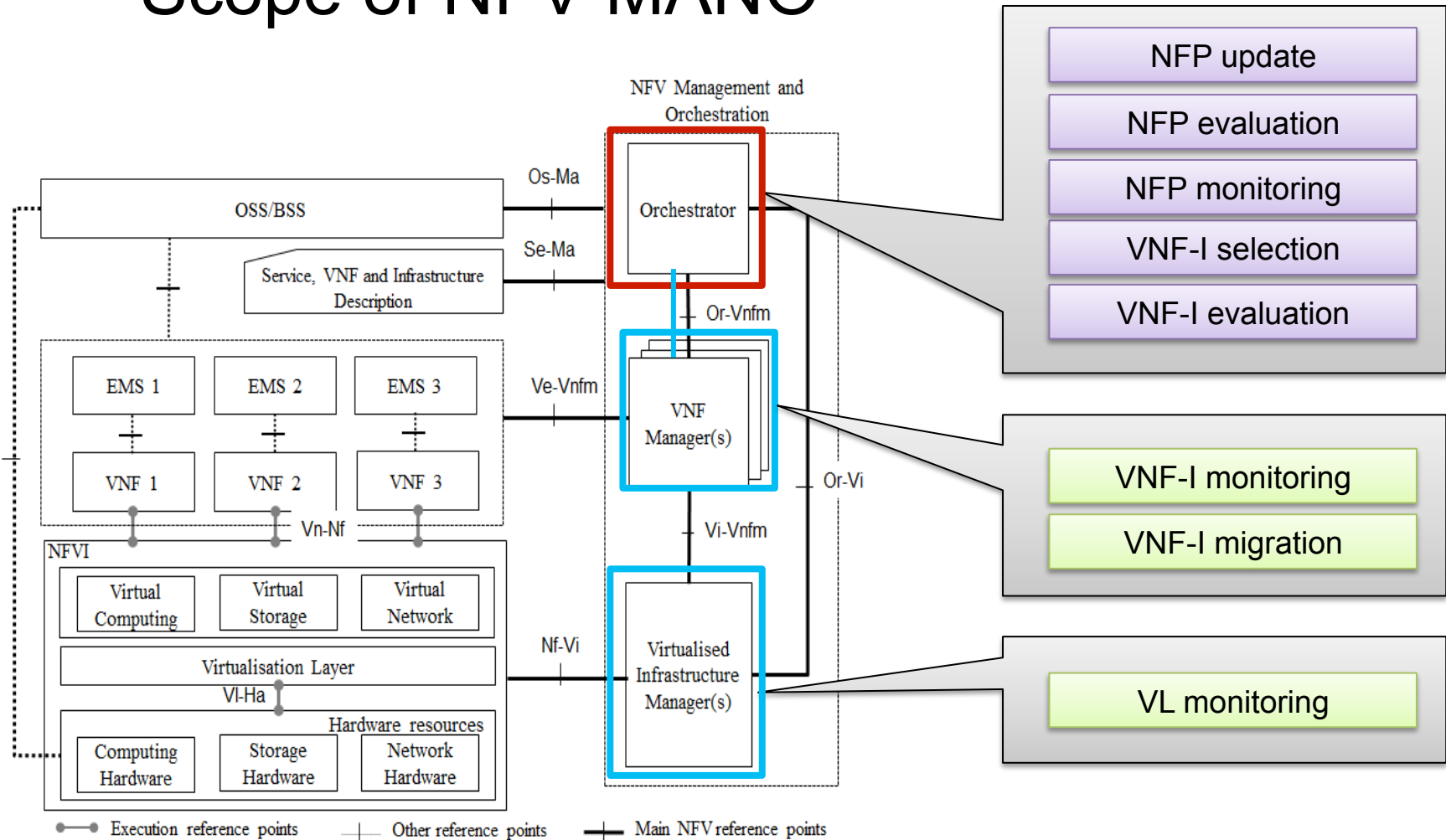
SFC Applicability

- draft-lee-sfc-dynamic-instantiation-01
  - SFP enforcement for classification (a)
  - SFP enforcement for update (b)
  - Resource monitoring (c)

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#=============================================#
#                                             #
#      +---------------+   +---------------+   #
#  ____|      SFC      |_____| SFP component |   #
#  |   | instantiation |   |   management  |   #
#  |   +---------------+   +---------------+   #
#  |           |                ^      ^       #
#===|==========|================|=====|=======#
    |          |                |     |
    |(a)       |(b)             |(c)  |(d)
    |          |                |     |
    |          |   +------+     |   +------+
    |          |   | SFI  |     |   | SFI  |
    |          |   +------+     |   +------+
    V          V   |           |     |
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```

Further Works

- Applicability to SFC
  - well fits to SFC control plane: select and manage SFs statically or dynamically for SFC
  - but currently outside scope of the architecture
- Adaptation of VNF-FG
  - changes the network service adaptively to context (e.g., traffic pattern, network status)
  - add or remove VNFs of FG
    - e.g., add DPI at a doubtful pattern of traffic
    - vs. NFP adaptation: changes VNF instances along the VNF-FG
- Considerations of NFVI resources (e.g., NFVI-nodes)
- Redundant NFPs with state synchronization for resiliency
- Programmability of VNF-FG/NFP adaptation