

## Meeting Summary and Next Steps:

### Welcome:

Network Function Virtualization Research Group (NFVRG) (Proposed)  
Interim meeting in SF Bay Area, USA; First meeting in Toronto as part of IETF 90  
Part of IRTF (research arm of IETF)

Chairs: Ramki Krishnan (Brocade), Dilip Krishnaswamy (IBM Research), Diego Lopez (Telefonica)

### Attendees:

#### Face-to-face: (in random order)

Hesham ElBakoury [Hesham.ElBakoury@huawei.com](mailto:Hesham.ElBakoury@huawei.com)  
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#### Remote: (in random order)

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Fedyk, Don [don.fedyk@hp.com](mailto:don.fedyk@hp.com)

### Meeting Agenda:

10:00am to 12:00pm

- Discuss proposed near-term charter
- Breakdown into smaller groups for discussing specific topics leading to IRTF drafts

12:00pm to 12:30pm

- Short lunch break

12:30pm to 3:00pm

- Continue discussing specific topics in smaller groups over a working lunch

3:00pm to 4:00pm

- Re-group to discuss output of small groups; each group to make a quick presentation

### Conclusion:

It was a free-flowing lively discussion with many face-to-face and remote attendees. For the near-term charter, the consensus was focus to on a few topics and dive-deeper into areas unique to NFV. Will be following up on 1) Conference call to discuss NFV security topics (security and service verification etc.) 2) Interim meeting in Europe (likely Spain) and India (Bangalore).

### Agreed Near Term Charter:

***Policy based Resource Management:*** NFV DCs are often constrained in compute and storage capacity. Since practically all NFV DCs are foreseen to be distributed, inter-DC network capacity is also a constraint. Additionally, energy is also a constraint, both as a general concern for NFV operators, and for specific-purpose NFV DCs such as those in mobile base stations, enterprise branch offices that often have power limitations. Hence, optimized resource management and workload distribution based on policy is a relevant area to focus on.

***Analytics for Visibility and Orchestration:*** Network functions should be supportable on general purpose commodity hardware. Real-time analytics providing insight into various components such as compute (e.g. dynamic CPU utilization), storage (e.g. dynamic capacity usage), network (e.g. dynamic bandwidth utilization), energy (e.g. dynamic power consumption) is key to not only providing visibility into the NFV infrastructure but also optimizing resource usage for the purposes of orchestration. This is a relevant area to focus on.

***Virtual Network Function (VNF) Performance Modelling to facilitate transition to NFV:*** While migrating from hardware network appliances, which are typically custom and monolithic, to virtualized software appliances running on commodity hardware a challenge which is often faced is to come up with an equivalence model especially in terms of performance. This is a relevant area to focus on.

***Security and Service Verification:*** NFV configuration is expected to be dynamic especially in the edge NFV DCs where capacity is limited; a very good example is handling a viral event such as mobile gaming application. While autonomic networking techniques could be used to automate the configuration process including modular updates, it is important to take into account that incomplete and/or inconsistent configuration may lead to security issues. Additionally, events such as distributed denial of service (DDoS) attacks could be an additional source of compromise with additional implications due to the dependency of NFV on a distributed infrastructure. Finally, elasticity of VNFs entails dynamic scale up/down/out with awareness of the resiliency considerations, completely different with the approach of monolithic implementations. Security issues and relevant solutions related to the elastic nature of VNFs is a potential area to consider.

### Next Steps - IRTF Draft Contribution Plan for IETF 91 (November 9<sup>th</sup> – 14<sup>th</sup>, Honolulu, USA):

- Internet draft cut-off date 10/27
- Plan to submit first version around 10/13 (two week review/edit time before cut-off)

### Topic 1: NFV Analytics Architecture for Visibility and Orchestration

#### Scope:

- Streaming analytics – real-time streaming of events, statistics etc.
- Network Service analytics - service level specification (SLS) verification at a Virtual Network Function (VNF) level etc.
- Aspects Unique to NFV and closely related to resource management
  - o Noisy neighbor (one VNF affecting another); explore minimum guarantee models and role of analytics
  - o Elastic VNF (Scale up/down/out, should include resiliency); explore pub-sub models for analytics as an alternative polling
  - o Identify top talker VNF; explore moving VNF rather than moving traffic
- Leverage ETSI NFV Architectural framework; Define open APIs across relevant interfaces

#### Contributors:

- Leads (co-ordinate discussions besides being key contributors): Zu Qiang/Dilip Krishnaswamy
- Zu Qiang, Dilip Krishnaswamy, Eswar Chinthalapati, Ramki Krishnan

#### Reviewers:

- Diego Lopez, Norival Figueira, Puneet Sharma, NFVRG team

#### Related topics:

- 1) Do we need to define SLS for NFV?

### Topic 2: NFV Architecture for Policy based Resource Management

#### Scope:

- Aspects Unique to NFV
  - o Customer co-existence policy in a physical server to avoid noisy neighbor issue.
  - o Joint policy across different sub-systems. An example - an energy policy limiting power usage on a physical server could cause VM migration
  - o Resolving policy conflicts across sub-systems
- Leverage ETSI NFV Architectural framework; Define open APIs across relevant interfaces

#### Contributors:

- Leads (co-ordinate discussions besides being key contributors): Norival Figueira/Ramki Krishnan
- Norival Figueira, Ramki Krishnan, Dilip Krishnaswamy, Diego Lopez, Hesham ElBakoury

#### Reviewers:

- Puneet, NFVRG team

#### Sub-topics in the area of resource management and related early stage drafts:

- [https://datatracker.ietf.org/doc/draft-lee-sfc-dynamic-instantiation/?include\\_text=1](https://datatracker.ietf.org/doc/draft-lee-sfc-dynamic-instantiation/?include_text=1)
- <http://tools.ietf.org/html/draft-krishnan-nfvrg-open-nfv-virality-00>

### Topic 3: NFV performance benchmarking in controlled environments

#### Scope:

- Aspects Unique to NFV
  - o Virtualization ecosystem (PCI pass through, SRIOV etc.)

- Examine related work in ETSI NFV, IETF BMWG
- Examine challenges in predictable performance? An example – L1/L2/L3 cache lookup in general purpose processors such as Intel may lead to variable latency
- Elastic VNF
  - Scale up, scale down, scale out etc. (should include resiliency)

Contributors:

- Leads (co-ordinate discussions besides being key contributors): Diego Lopez/Pedro Aranda

Reviewers:

- Puneet, NFVRG team

Related papers in the area of resource management:

1. Application-Driven Bandwidth Guarantees in Datacenters  
Paper: <http://dl.acm.org/authorize?N71243>; Slides:  
<http://conferences.sigcomm.org/sigcomm/2014/doc/slides/85.pdf>
2. Statesman: A Network-State Management Service  
Paper: <http://dl.acm.org/authorize?N71352>; Slides:  
<http://conferences.sigcomm.org/sigcomm/2014/doc/slides/96.pdf>
3. Corybantic: Towards the Modular Composition of SDN Control Programs  
<http://conferences.sigcomm.org/hotnets/2013/papers/hotnets-final120.pdf>