

none
Internet-Draft
Intended status: Informational
Expires: May 3, 2018

X. de Foy
A. Rahman
InterDigital Inc.
A. Galis
University College London
K. Makhijani
L. Qiang
Huawei Technologies
October 30, 2017

Interconnecting (or Stitching) Network Slice Subnets
draft-defoy-coms-subnet-interconnection-01

Abstract

This document aims to define a network slice subnet as a general concept, and to augment a baseline network slice model with attributes that describe interconnections between network slice subnets.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on May 3, 2018.

Copyright Notice

Copyright (c) 2017 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect

to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. Introduction	2
1.1. Terminology	3
2. Interconnection Concepts	3
3. Information Model	5
3.1. Representing Interconnections	5
3.2. Relation to NS Information Model	5
4. Operations	6
5. Security Considerations	6
6. Next Steps	6
7. IANA Considerations	7
8. Informative References	7
Authors' Addresses	7

1. Introduction

Network Slicing enables deployment and management of services with diverse requirements on end-to-end partitioned virtual networks, including compute and storage resources, over the same infrastructure. [I-D.geng-coms-problem-statement] describes a problem statement for supervised heterogeneous network slicing, enabling users to deploy network slices including connectivity, computing and storage components.

Nevertheless, defining and managing a network slice (NS) end-to-end does not always have to be done directly: it may be convenient to define and manage subsets of NS components. The concept of network slice subnet is defined originally in [NGMN_Network_Slicing], though we only need to retain its definition in the most universal form: network slice subnet instances are similar to slice instances in most ways but cannot be operated in isolation as a complete network slice. They can be interconnected with other NS subnets to form a complete, end-to-end network slice (i.e. interconnection and/or stitching of NS subnets). To summarize: a NS subnet can be seen as a network slice with unconnected links. The term "network slice segment" has also occasionally been used to designate a NS subnet. Use cases for using NS subnets include managing multi-domain network slices, or even within one domain, isolate management and maintenance of different portions of a network slice. It includes also mapping services to an ordered chain of network slice subnets instances.

A model for network slicing is currently being defined in [I-D.qiang-coms-netslicing-information-model]. One question we would like to address is how to augment this base model to describe interconnections between NS subnets. The base model is not technology specific, and therefore the description of interconnections should not be either. Moreover, such an augmentation should both enable describing the intent for interconnection, as well as describing actual interconnections once NS subnets have been stitched together.

1.1. Terminology

Network slicing related terminology used in this document should be interpreted as described in [I-D.geng-coms-problem-statement].

"Network slice subnet" is a term defined in this draft. It is comprised of groups of connectivity, compute and storage resources, possibly together with network functions and network management entities, forming a complete instantiated logical/physical network in support of certain network and service characteristics but cannot be activated in isolation as an overall network slice.

2. Interconnection Concepts

The general goal of an interconnection between 2 NS subnets is to have links established between nodes from both subnets. A secondary goal is to keep NS subnet descriptions isolated from each other. This relative isolation will contribute to simplify and decentralize management, as well as enabling operations such as substituting a subnet with another, composing slice subnets of different domains, etc.

As described in Figure 1, we can represent a network slice subnet as a network slice that also has one or more logical nodes, which terminate (at logical termination points) links that need to be interconnected with external nodes (cross-subnet links).

During a stitching operation, logical termination points from both NS subnets can be paired together into an interconnection point. When implemented at the infrastructure layer, this interconnection point may be either implemented as a gateway, or abstracted away, in which case nodes from both NS subnets end up being directly interconnected between each other. In any cases, interconnected links will need to have compatible QoS attributes.

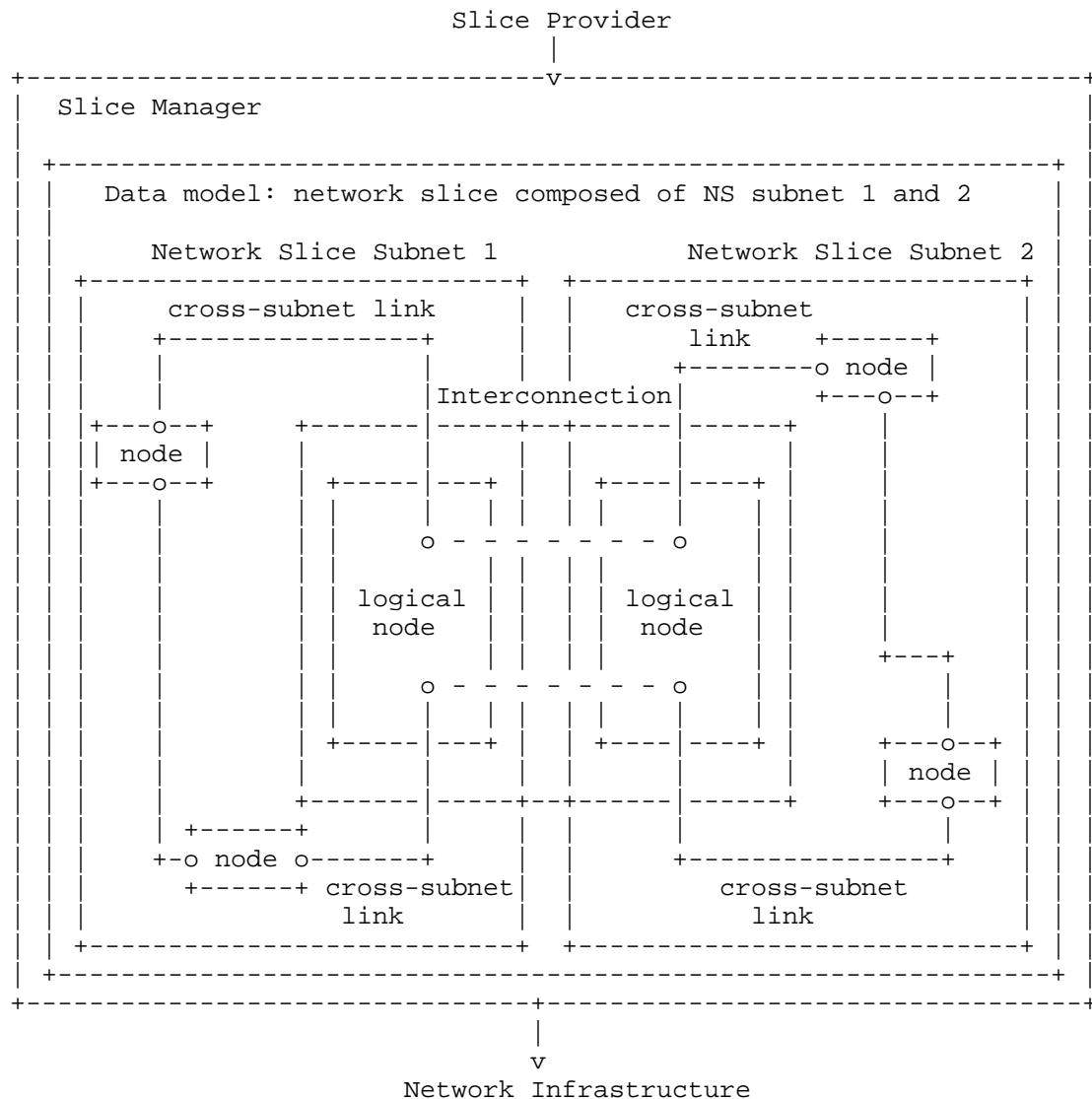


Figure 1: Network Slice Subnets Interconnection

Network slice interconnection information in data models can be used for different related purposes:

- o Anchoring interconnections at logical termination points: a NS subnet model should specify which link termination points are the "network slice subnet boundaries" that need to be interconnected.

- o Programming interconnections: a NS provider may set attributes in a NS subnet model to configure the interconnection with another NS subnet. For example, constraints on the interconnection (on throughput, latency, etc.) may be programmed to trigger an alarm that may lead the NS operator to disable NS subnets, replace NS subnets by others, etc. to maintain overall service performance.
- o Describing the state of interconnection (once NS subnets are interconnected).

3. Information Model

3.1. Representing Interconnections

A fairly minimal way to represent an interconnection is:

- o To represent an interconnection anchor in a subnet: a "logical termination point" in this subnet.
- o To program or represent an interconnection between subnets: a pair of logical termination points, one in each subnet.

Some form of grouping of logical termination points (for example, in logical nodes) may tell the NS manager to treat those termination points as a single unit for placement, implementation, etc.

Additional information may be useful to complement the description of an interconnections. Some attributes may be useful to describe an interconnection point anchor, while others may be useful to program or represent the state of an interconnection. For example, logical termination points may be associated with information that facilitates placement or stitching operations. Future work should determine what type of information would be useful to specify or represent a NS interconnection.

3.2. Relation to NS Information Model

The network slice information model defined in [I-D.qiang-coms-netslicing-information-model] will be used as a base. This model is itself based on the "ietf-network" model defined in [I-D.ietf-i2rs-yang-network-topo]

Individual network slice data model instances ("network" attributes of the "ietf-network" model) can represent network slice subnets. If there is a need to tie multiple subnets together, a parent network slice may be added to the model if necessary, but this is out of scope of the present draft. A "network" attribute may also represent

a full, end-to-end slice, in which case it does not need be interconnected using the mechanisms described in the present draft.

Interconnection anchors are logical termination points (TP) included in logical nodes. The base model can be augmented as described below. Those new logical node and logical TP attributes will typically be used only for nodes and termination points used as interconnection anchors. Logical nodes should be as simple as possible (e.g. should not include any compute or storage unit), so that they can be abstracted away in underlying networks during the interconnection operation, if needed.

```
module: ietf-network
+--rw networks
  +--rw network* [network-id]
    +--rw network-id
    +--rw network-types
    +--rw supporting-network* [network-ref]
      | +--rw network-ref
    +--rw node* [node-id]
      | +--... (augmented with new attributes of logical nodes)
      | +--rw nt:termination-point* [tp-id]
      | | ... (augmented with new attributes of logical TP)
    ...
```

4. Operations

Stitching may occur when network slice subnets are initially instantiated, or later after instantiation.

5. Security Considerations

Access control mechanisms for managing network slices can likely be reused for network slice subnets, since their models should be similar to each other.

Stitching 2 NS subnets together may be subject to some form of authorization by a NS tenant.

6. Next Steps

The present draft investigates one aspect of a non-technology specific representation of a network slice. It may therefore be part of the larger discussion on the need for such a representation.

Beyond this, next steps can include the following:

- o Discussing the definition and need for NS subnets. Is "NS with unconnected links" an adequate simple definition? Is there an agreement on the use cases? Should NS subnet interconnection be standardized?
- o Assuming there is some interest in this, further work is needed to better understand what attributes and operations are needed, and how to integrate them in a baseline NS model.
- o Additionally, we can also further study NS composition mechanisms, beyond the simple connect/disconnect mechanism in the present draft.

7. IANA Considerations

This document has no actions for IANA.

8. Informative References

- [I-D.geng-coms-problem-statement]
67, 4., Slawomir, S., Qiang, L., Matsushima, S., Galis, A., and L. Contreras, "Problem Statement of Supervised Heterogeneous Network Slicing", draft-geng-coms-problem-statement-00 (work in progress), September 2017.
- [I-D.ietf-i2rs-yang-network-topo]
Clemm, A., Medved, J., Varga, R., Bahadur, N., Ananthakrishnan, H., and X. Liu, "A Data Model for Network Topologies", draft-ietf-i2rs-yang-network-topo-17 (work in progress), October 2017.
- [I-D.qiang-coms-netslicing-information-model]
Qiang, L., Galis, A., 67, 4., kiran.makhijani@huawei.com, k., Martinez-Julia, P., Flinck, H., and X. Foy, "Technology Independent Information Model for Network Slicing", draft-qiang-coms-netslicing-information-model-01 (work in progress), October 2017.
- [NGMN_Network_Slicing]
NGMN, "Description of Network Slicing Concept", 10 2016, <https://www.ngmn.org/uploads/media/161010_NGMN_Network_Slicing_framework_v1.0.8.pdf>.

Authors' Addresses

Xavier de Foy
InterDigital Inc.
1000 Sherbrooke West
Montreal
Canada

Email: Xavier.Defoy@InterDigital.com

Akbar Rahman
InterDigital Inc.
1000 Sherbrooke West
Montreal
Canada

Email: Akbar.Rahman@InterDigital.com

Alex Galis
University College London

Email: a.galis@ucl.ac.uk

Kiran Makhijani
Huawei Technologies
2890 Central Expressway
Santa Clara CA 95050
USA

Email: kiran.makhijani@huawei.com

Li Qiang
Huawei Technologies
Huawei Campus, No. 156 Beiqing Rd.
Beijing 100095

Email: qiangli3@huawei.com