Unifying Carrier and Cloud Networks: Problem Statement and Challenges draft-unify-nfvrg-challenges-02

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Reference Scenario and Motivation

Reference Scenario

- Integration between Network Infrastructure and DC Infrastructure
- Implementation of NFV (for Compute, Storage and Network resources)
- Implementation of SDN
- Implementation of Flexible Service Chaining solutions (supported by SDN and NFV technologies)
- Multi-vendor, multi-technology and multi-provider environments
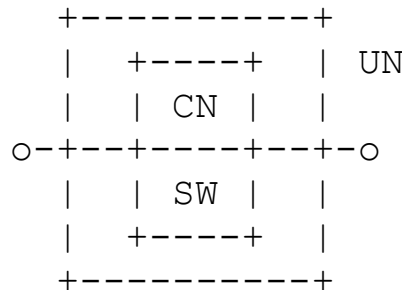
Motivation

- Compute and storage virtualization and network virtualization are tightly connected at multiple levels:
    - in a DC there are not only compute resources but also network resources, supposed to be virtualized to be shared
    - virtualized network resources in a SDN domain, if offered to clients, imply virtualization of compute resources if supposed to be shared

- Argument for: **joint software and network recursive programmatic interface**

New in -02

- Introduction of concept of Universal Node (UN)
- Introduction of Unified Interface (U) and Unified Recurrent Control (URC):
  - RO Control Plane with U and URC
  - zoom into PoP DC Network with U and URC
- New text for **Problem Statement** section

Universal Node

- An innovative element that integrates and manages in a unified platform both compute and networking components and can present also an inner local layer of orchestration, capable to interact with an external one

```
          +----------+
          |  +----+   |  UN
          |  | CN |   |
     o-+--+----+--+-o
          |  | SW |   |
          |  +----+   |
          +----------+
```
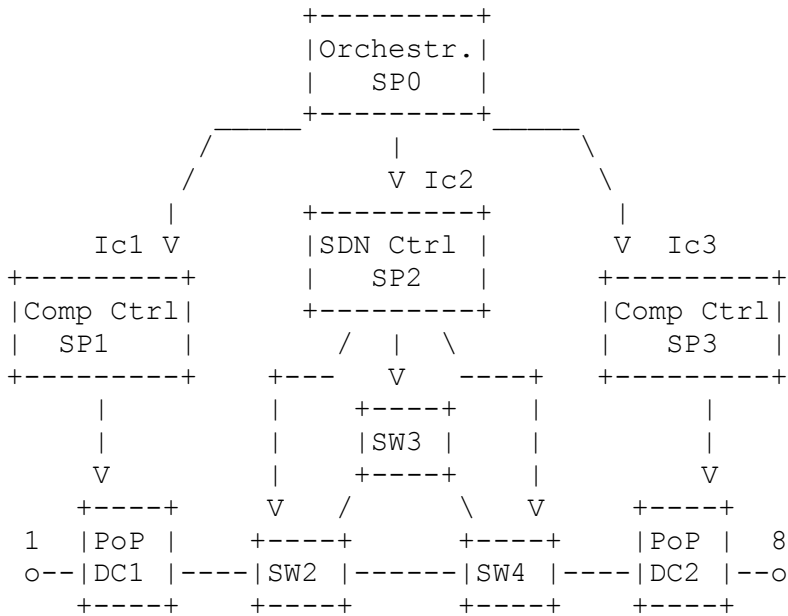
```
Legend:
  Switch (SW)
  Compute Node (CN)
  Universal Node (UN)
```
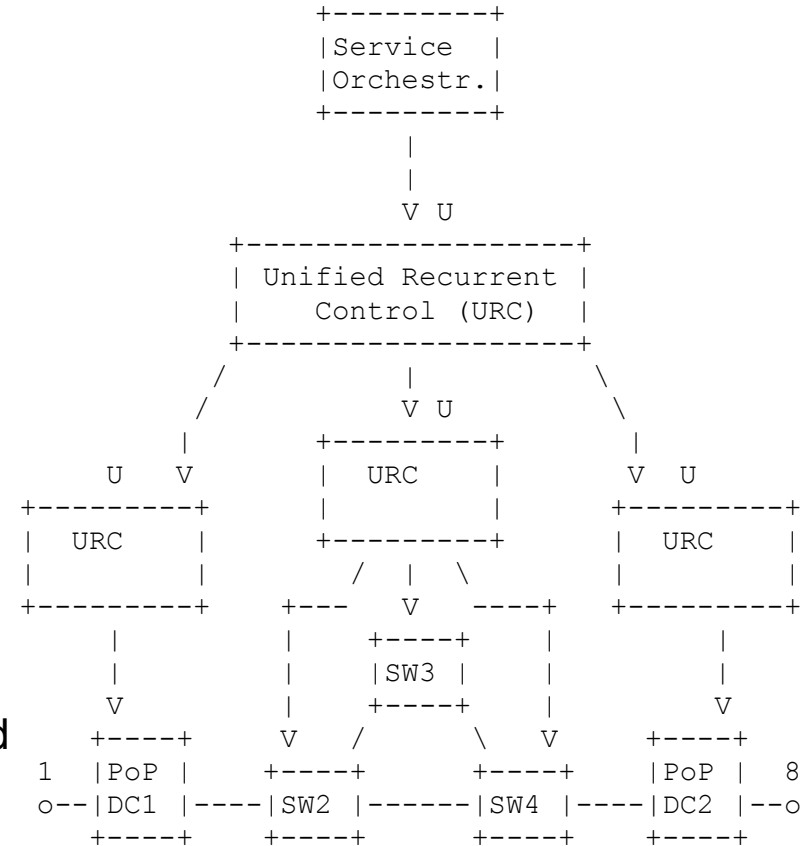
Unified Interface and Unified Recurrent Control

- Unified Interface (U): a joint recursive programmatic interface to use for both compute and network resources

- Unified Recurrent Control (URC): an element that performs both compute and network control and that can be used in a hierarchy structure
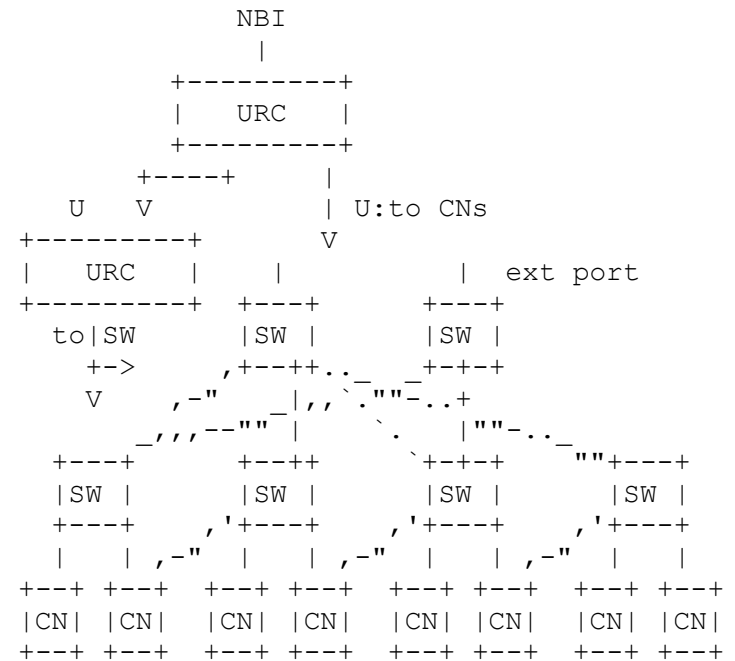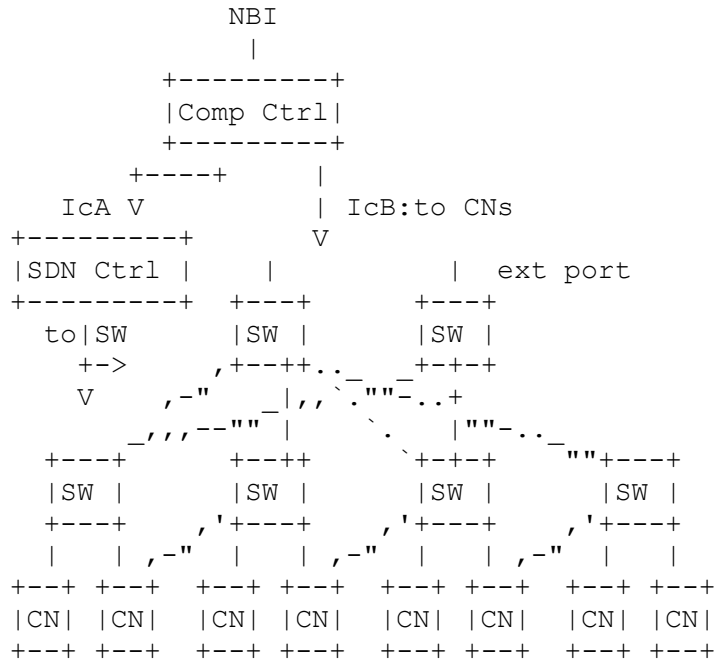
RO Control Plane with U and URC

```
                    +---------+
                    |Orchestr.|
                    |   SP0   |
                    +---------+
                  /     ____|____     \
                 /     |     |     |     \
                /            V Ic2         \
               |      +---------+          |
        Ic1 V  |      |SDN Ctrl |    V  Ic3
      +---------+     |   SP2   |  +---------+
      |Comp Ctrl|     +---------+  |Comp Ctrl|
      |  SP1    |     /  |  \       |   SP3   |
      +---------+  +---   V  ----+  +---------+
          |        |   +----+   |       |
          |        |   |SW3 |   |       |
          V        |   +----+   |       V
        +----+     V  /      \  V     +----+
      1 |PoP |  +----+      +----+    |PoP |  8
      o--|DC1 |----|SW2 |------|SW4 |----|DC2 |--o
        +----+     +----+      +----+    +----+
```

```
                              +---------+
                              |Service  |
                              |Orchestr.|
                              +---------+
                                   |
                                   |
                                   V U
                    +-------------------+
                    | Unified Recurrent |
                    |  Control (URC)    |
                    +-------------------+
                   /         |          \
                  /          V U          \
                 |      +---------+        |
            U    V      |  URC    |     V  U
      +---------+       |         |   +---------+
      |  URC    |       +---------+   |  URC    |
      |         |       /  |  \       |         |
      +---------+    +---  V  ----+   +---------+
          |         |   +----+   |        |
          |         |   |SW3 |   |        |
          V         |   +----+   |        V
        +----+      V  /      \  V      +----+
      1 |PoP |  +----+      +----+     |PoP |  8
      o--|DC1 |----|SW2 |------|SW4 |----|DC2 |--o
        +----+     +----+      +----+    +----+
```

- Existing separated compute and network programming interfaces cannot easily provide recursions and cannot always satisfy key requirements for multi-vendor, multi-technology and multi-provider interoperability

PoP DC Network with U and URC

```
            NBI
             |
         +---------+
         |Comp Ctrl|
         +---------+
       +----+      |
    IcA V         | IcB:to CNs
  +---------+     V
  |SDN Ctrl |   |         | ext port
  +---------+ +---+    +---+
   to|SW     |SW |    |SW |
     +->    ,+--++.._  _+-+-+
      V   ,-"  _|,,`."""-..+
        _,'',--""_ |   `.   |""-.._
    +---+     +--++   `+-+-+    ""+---+
    |SW |     |SW |    |SW |     |SW |
    +---+   ,'+---+   ,'+---+   ,'+---+
    |  | ,-" |   | ,-" |   | ,-" |   |
  +--+ +--+  +--+ +--+  +--+ +--+  +--+ +--+
  |CN| |CN|  |CN| |CN|  |CN| |CN|  |CN| |CN|
  +--+ +--+  +--+ +--+  +--+ +--+  +--+ +--+
```

```
                NBI
                 |
             +---------+
             |   URC   |
             +---------+
           +----+      |
        U     V         | U:to CNs
      +---------+       V
      |   URC   |   |         | ext port
      +---------+ +---+    +---+
       to|SW     |SW |    |SW |
         +->    ,+--++.._  _+-+-+
          V   ,-"  _|,,`."""-..+
            _,'',--""_ |   `.   |""-.._
        +---+     +--++   `+-+-+    ""+---+
        |SW |     |SW |    |SW |     |SW |
        +---+   ,'+---+   ,'+---+   ,'+---+
        |  | ,-" |   | ,-" |   | ,-" |   |
      +--+ +--+  +--+ +--+  +--+ +--+  +--+ +--+
      |CN| |CN|  |CN| |CN|  |CN| |CN|  |CN| |CN|
      +--+ +--+  +--+ +--+  +--+ +--+  +--+ +--+
```

- Joint compute, storage and network programmatic U Interface and URC allow multi-level recursion and facilitate orchestration of resources

Problem Statement

- This section has been revisited for better and clearer understanding with reference to the idea of tight connection between compute virtualization and network virtualization

Summary

- Introduction of new concepts like Universal Node (UN), Unified Interface (U) and Unified Recurrent Control (URC)

- New figures added for:
  - RO Control Plane with U and URC
  - zoom into PoP DC Network with U and URC

- Editorial changes and improvements made with reference to Problem Statement section

References

- draft-unify-nfvrg-challenges-02

- www.fp7-unify.eu