Network Virtualization Problem Statement

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Objective

- Discuss the problems and requirements for network virtualization in several contexts

Virtualization

- The abstraction of computer resources
  - Hide the physical characteristics of computing resources from the way in which other systems, applications, or end users interact with those resources
- Benefits of virtualization
  - Abstraction: To simplify the use of the underlying resource
  - Partitioning: To create multiple instances of the resource
  - Isolation: To separate the uses of the underlying resource

Network virtualization

- Definition
  - Enables the creation of logically isolated network partitions over shared physical network infrastructures
  - Multiple heterogeneous virtual networks can simultaneously coexist
  - Support aggregation of multiple resources so as to appear as a single resource
- Goal
  - Reduce total cost by sharing network resources while still maintaining secure separation

Motivation

- Complete isolation of virtual networks over physical infrastructure
  - Different virtual networks may use different network technologies without interference
- Easily programmable
  - Can experiment on any layer(s) according to user's requirements
  - Define a new layering architecture without interfering the operation of other virtual networks
- Reduce the total cost by increasing the utilization of resources

Problem description

- Not complete isolation between multiple network services
  - Unexpected behavior of a service may affect other coexisting services
    - Security problems, performance degradation of other services
- Provided network resources' capabilities are bound to the physical capability of the resources
  - Hard to provide resources encompassing the physical capability of the resources
- Restriction on the network scalability
  - User's demands on network (ex. number of routers, switches, etc) are physically limited
  - Network providers are hard to offer more numbers of routers than they have

Network virtualization requirements

- Creating network topologies easily and rapidly and reconfiguring them dynamically
- Providing the complete performance isolation among virtual networks
- Utilizing lower-layer transmission technologies provided by a transport network
- Abstracting the physical network information and providing the simple interface for resource control
- Regulating the upper limit of resource consumption by each virtual network in order to maintain the overall utility and performance

Network virtualization use cases

- Isolation perspective
  - Separate network facility provider and service provider
  - Customized logical network based on the service providers' requirements
  - Provide services and applications without building its own network infrastructure
  - Increase utilization and reduce operational cost
  - Reduce the cost for building network infrastructure and utilize the flexibility
- Aggregation perspective
  - Logically aggregate multiple resources into a single resource
  - Logical network element can support various functions and can easily expand its capability by aggregating multiple network elements

Next steps

- Status: Problem statement document covers problems, requirements and basic use cases
  - Anything missing?
  - Solicit more comments
- Investigating problems and challenges in virtual network is within the scope of RG
  - Adopt RG document and use it as a starting point for discussion?