Network Virtualization – a view from the bottom

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Why NV matters to operators

• Minimizing cost of ownership
• New revenues
  – Reselling infrastructure to 3rd parties
  – “Next-generation” managed services
• Flexible deployment of new technologies
• Technology diversity instead of “one size fits all” solution (as advocated by today’s IP-based convergence)
NV 1st wave – Virtual Routers

• From the user (VPN customer) standpoint, [...] the VR [must] be as
equivalent to a physical router as possible. In other words, with very
minor and very few exceptions, the VR should appear for all purposes
(configuration, management, monitoring, troubleshooting) like a
dedicated physical router.

• A VR [...] simply has to provide the illusion that a dedicated router is
available to satisfy the needs of the network(s) to which it is
connected.

[RFC2917 - A Core MPLS IP VPN Architecture, September 2000]
Building VR-based VPNs
L3 VPN: RFC 4364 model (BGP/MPLS VPN)
Network Virtualisation – general overview
4WARD Network Virtualisation business model

Virtual Network Operator (VNO)

Virtual Network Provider (VNP)

Physical Infrastructure Provider (InP)

Physical Infrastructure Provider (InP)

Physical Infrastructure Provider (InP)
Types of substrate nodes

Network domain

- Edge node
- Core VN-capable node
- Core transport node
- Border node

Other domains
Network Virtualisation key challenges

• Scalability
• Efficient and dynamic resource management
• Seamless VN / infrastructure separation
• Strict inter-VN isolation
Scalability

- Node scalability (# of VNs per physical node)
- Global architecture scalability
  - State information maintained in core nodes
  - Virtual link aggregation favours separation of transport and virtualized nodes
  - Trade-off between fine-grained resource control (VN isolation) and link aggregation (scalability)
Resource management
Seamless VN/infrastructure separation

Virtual Network

Physical Network 1

Physical Network 2
Virtual Network isolation

Virtual Network 1

Virtual Network 2

Physical network

Substrate network QoS

VN1 QoS

VN2 QoS
Conclusions

• Network virtualization is a promising concept for operators in several contexts and scenarios
• VPNs can be seen as precursors of full-blown network virtualization and should provide useful lessons
• Issues to be faced before network virtualization can be deployed in large scale commercial scenarios
  – Scalability
  – Resource management
  – VN / infrastructure separation
  – VN isolation.