Network Virtualization – a view from the bottom

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Why NV matters to operators

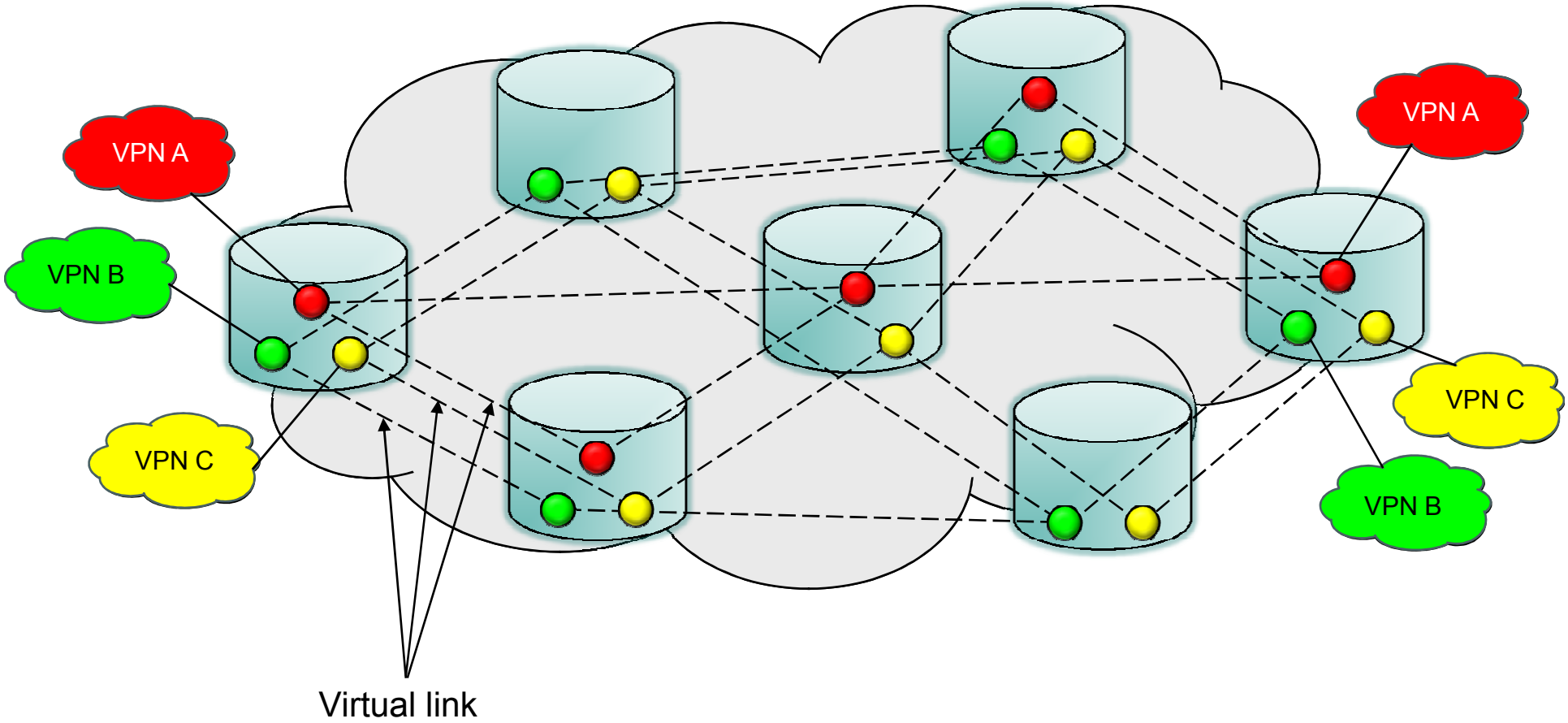
- Minimizing cost of ownership
- New revenues
  - Reselling infrastructure to 3rd parties
  - “Next-generation” managed services
- Flexible deployment of new technologies
- Technology diversity instead of “one size fits all” solution (as advocated by today’s IP-based convergence)

NV 1st wave – Virtual Routers

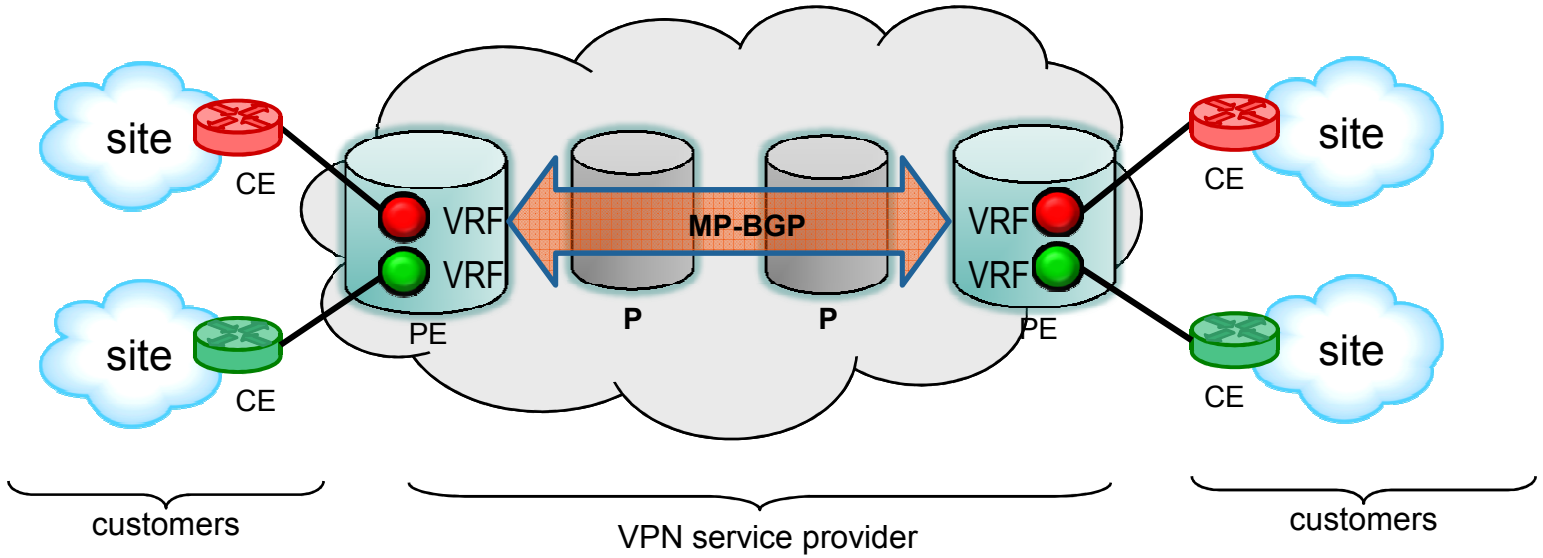
- From the user (VPN customer) standpoint, […] the VR [must] be as equivalent to a physical router as possible. In other words, with very minor and very few exceptions, the VR should appear for all purposes (configuration, management, monitoring, troubleshooting) like a dedicated physical router.
- A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

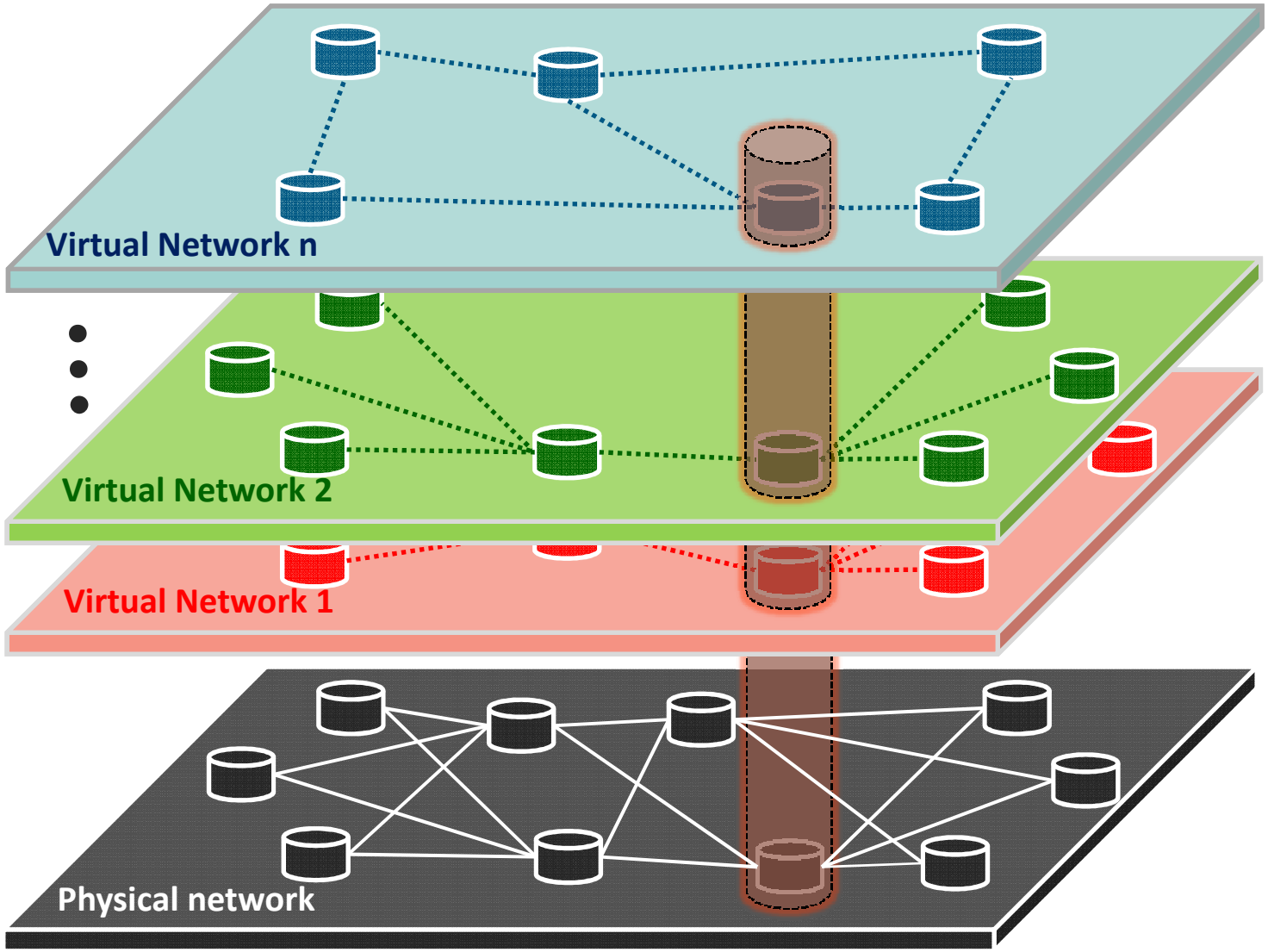
Building VR-based VPNs



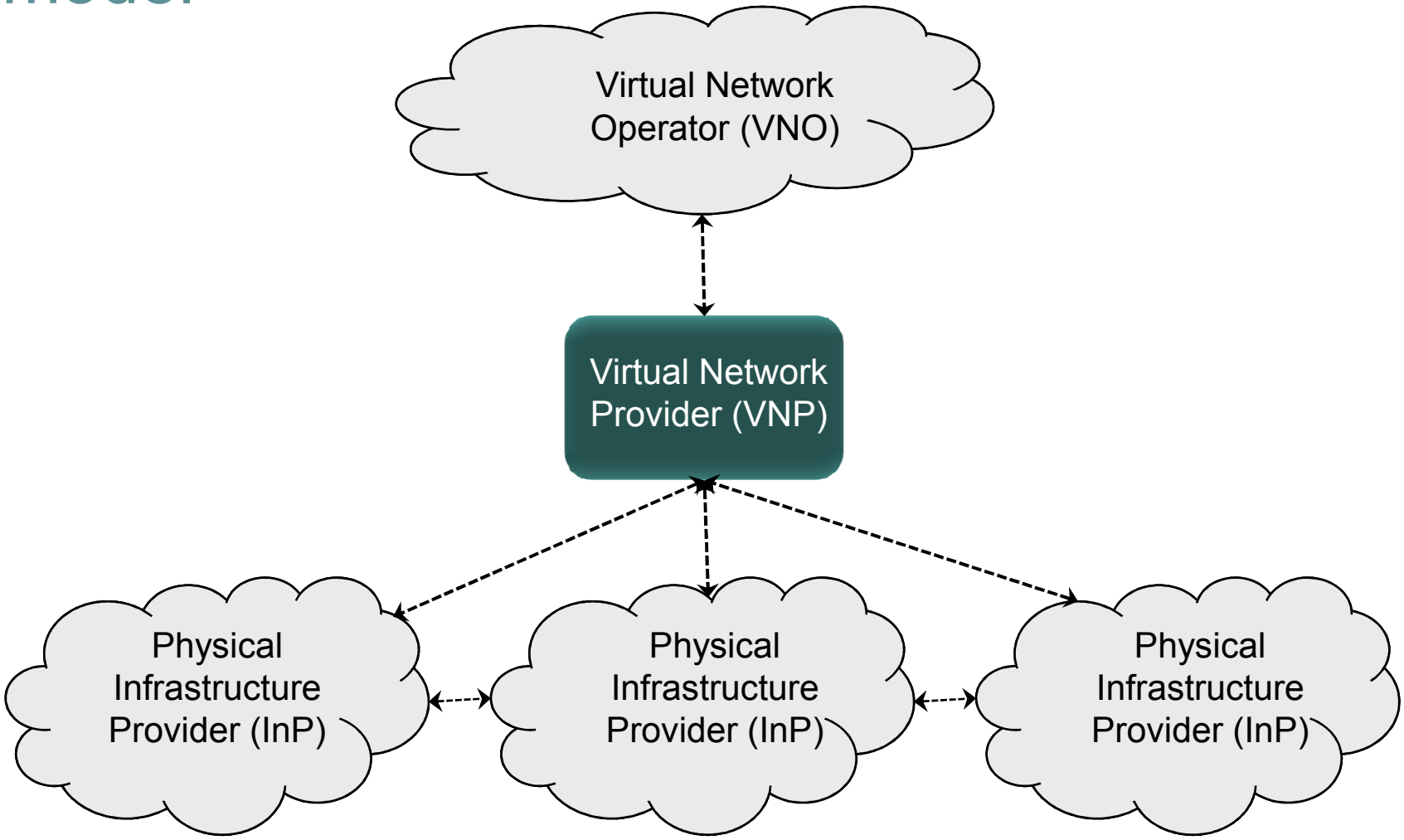
L3 VPN: RFC 4364 model (BGP/MPLS VPN)



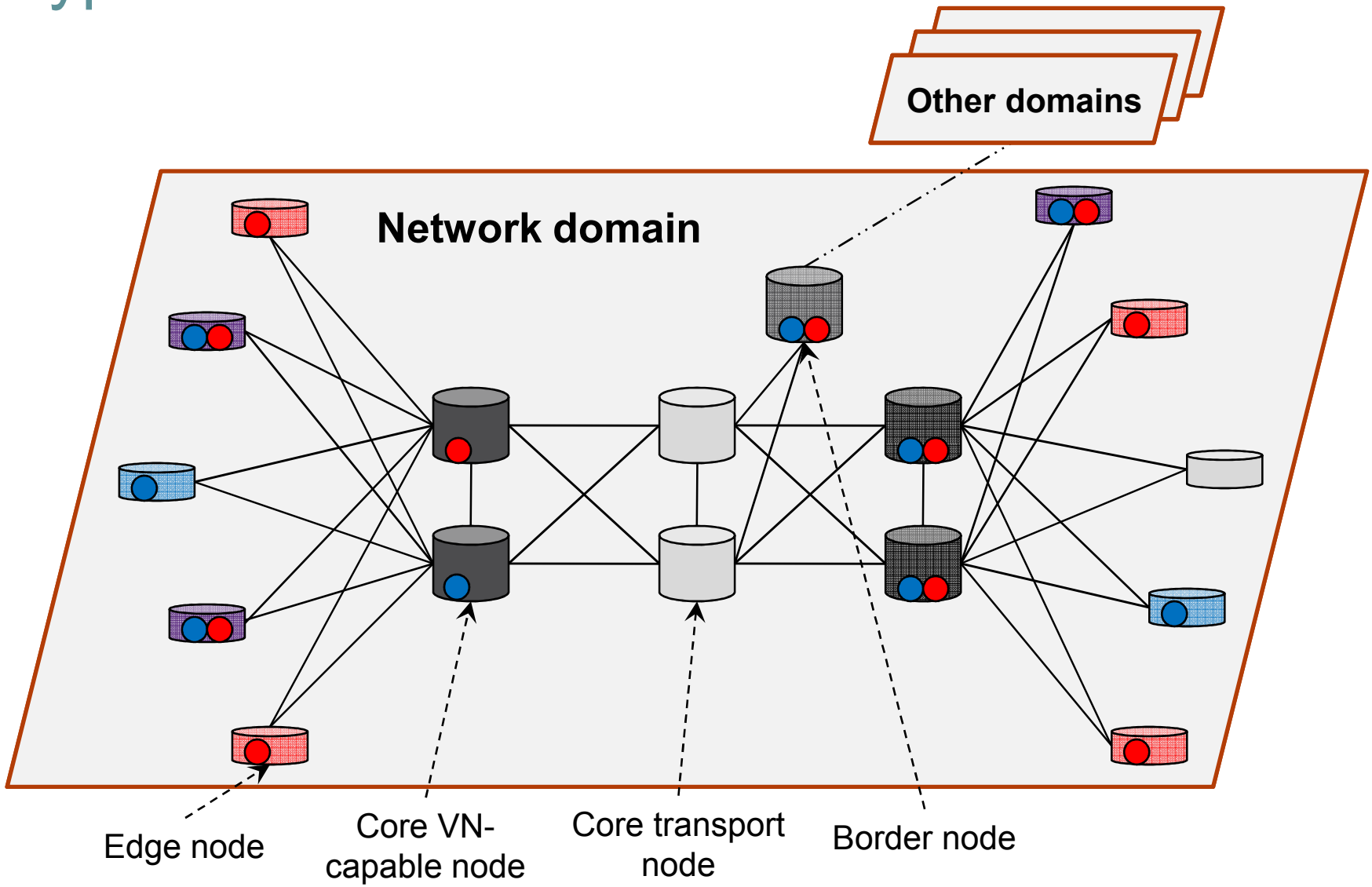
Network Virtualisation – general overview



4WARD Network Virtualisation business model



Types of substrate nodes

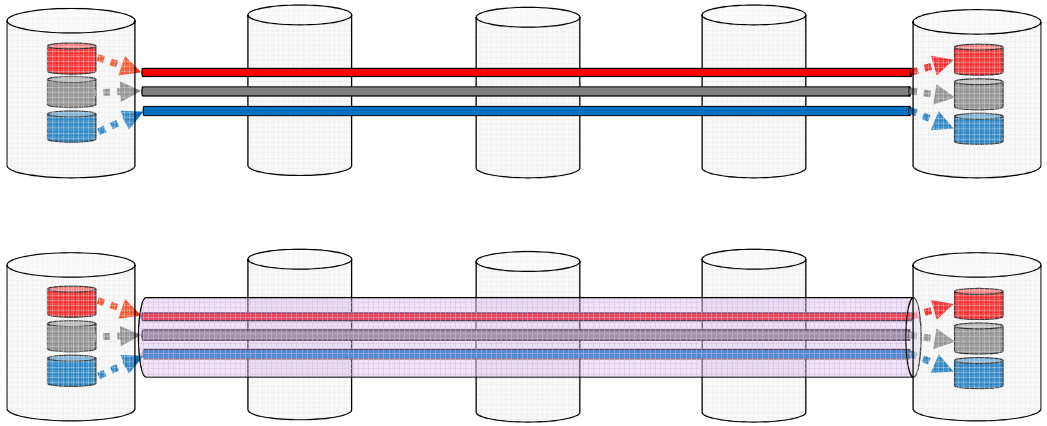


Network Virtualisation key challenges

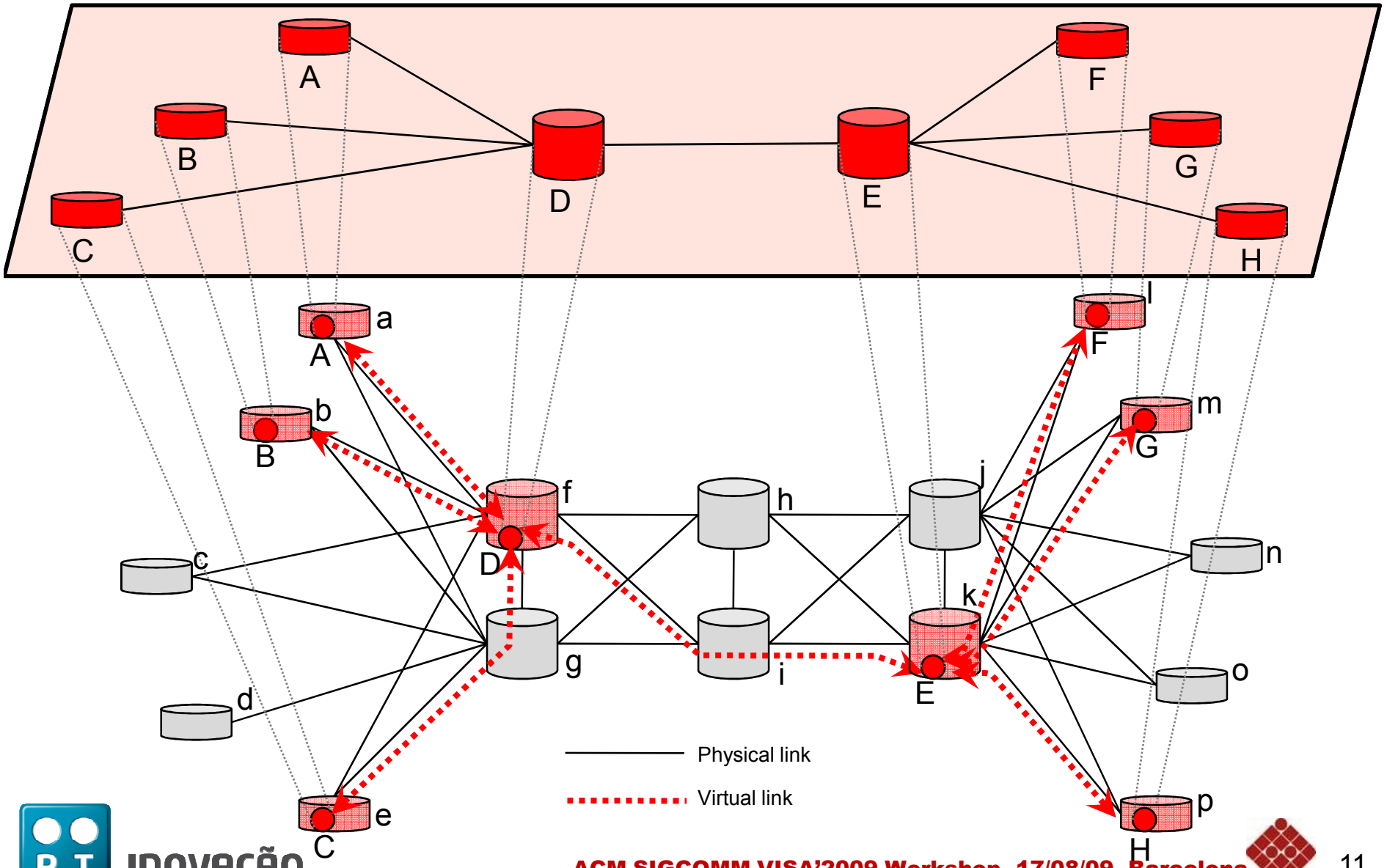
- Scalability
- Efficient and dynamic resource management
- Seamless VN / infrastructure separation
- Strict inter-VN isolation

Scalability

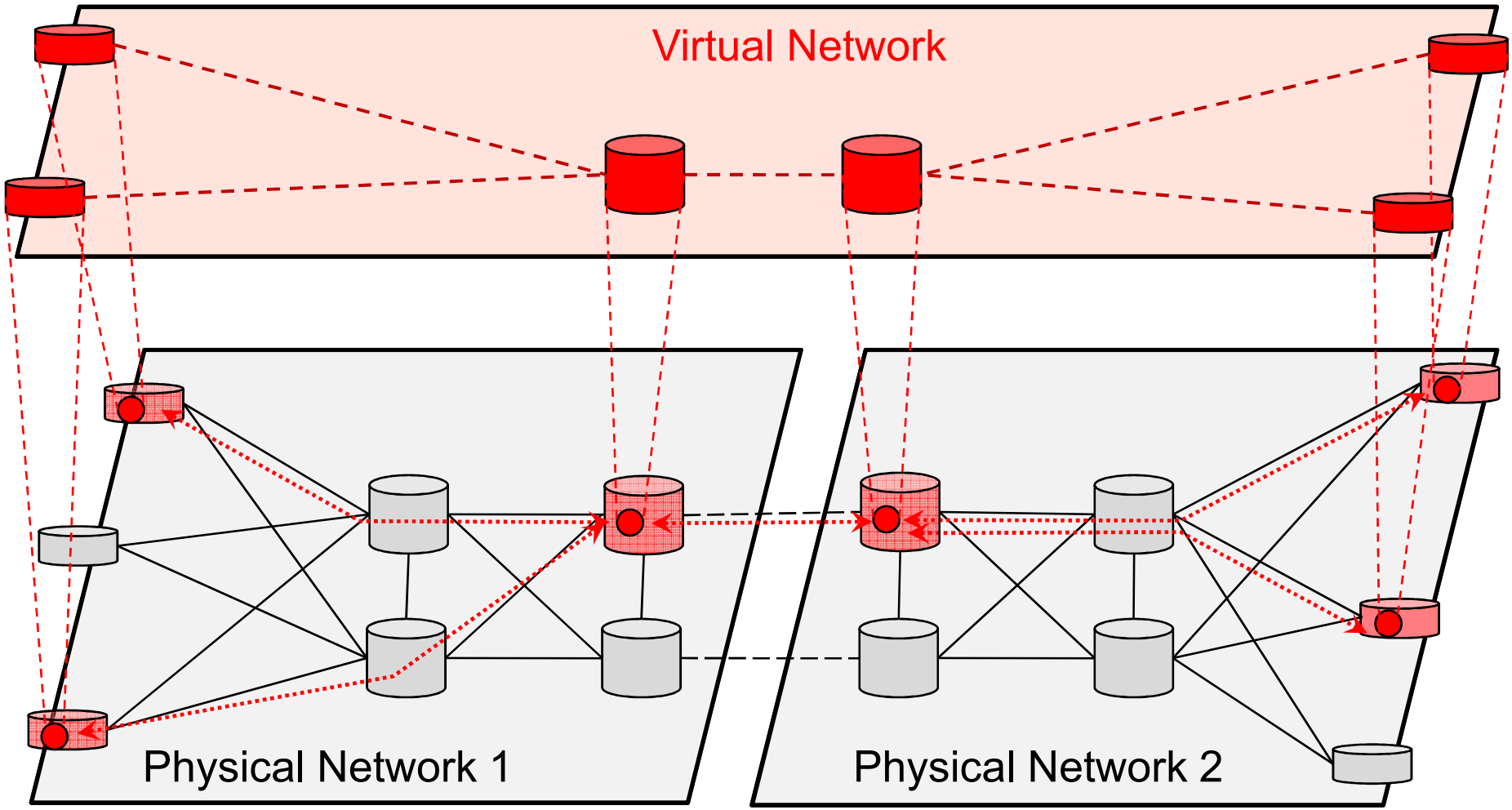
- Node scalability (# of VNs per physical node)
- Global architecture scalability
  - State information maintained in core nodes
  - Virtual link aggregation favours separation of transport and virtualized nodes
  - Trade-off between fine-grained resource control (VN isolation) and link aggregation (scalability)



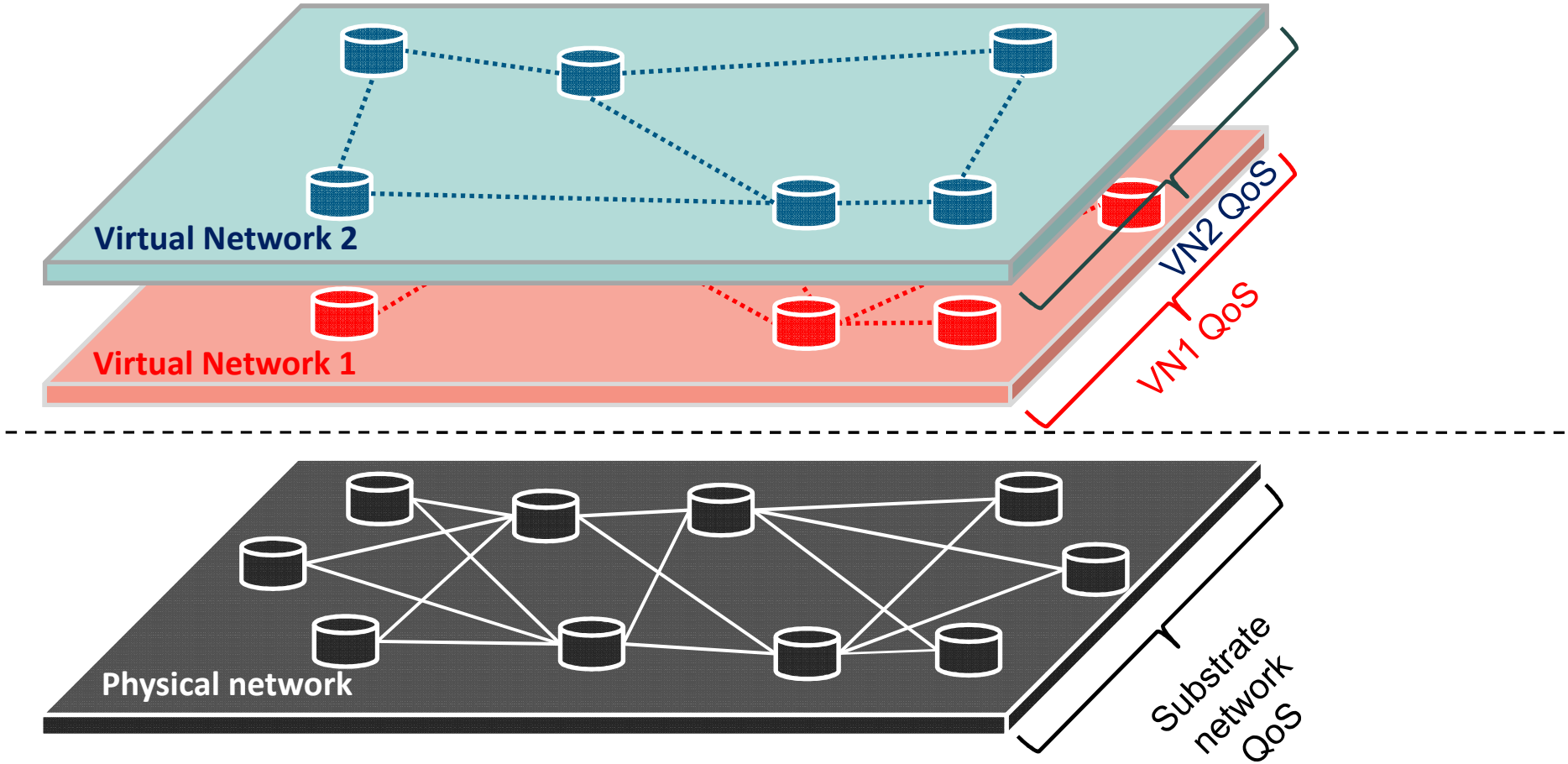
Resource management



Seamless VN/infrastructure separation



Virtual Network isolation



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.