



# Network Virtualization within the 4WARD Project

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for the Work Package 3 – ‚VNet‘ of 4WARD  
<http://www.4ward-project.eu>



## Current Status

- ❖ Created an architectural framework for network virtualization in a commercial setting
- ❖ Project ends in mid of this year (2010)
- ❖ Implementation and evaluation of several feasibility tests for parts of the architecture (ongoing)



## (non-exhaustive) List of research topics

### Architectural framework for network virtualisation

- Definition of a basic architecture model

### Virtualisation of resources

- Link virtualisation (wired, wireless)
- Node virtualisation

### Provisioning, management and control

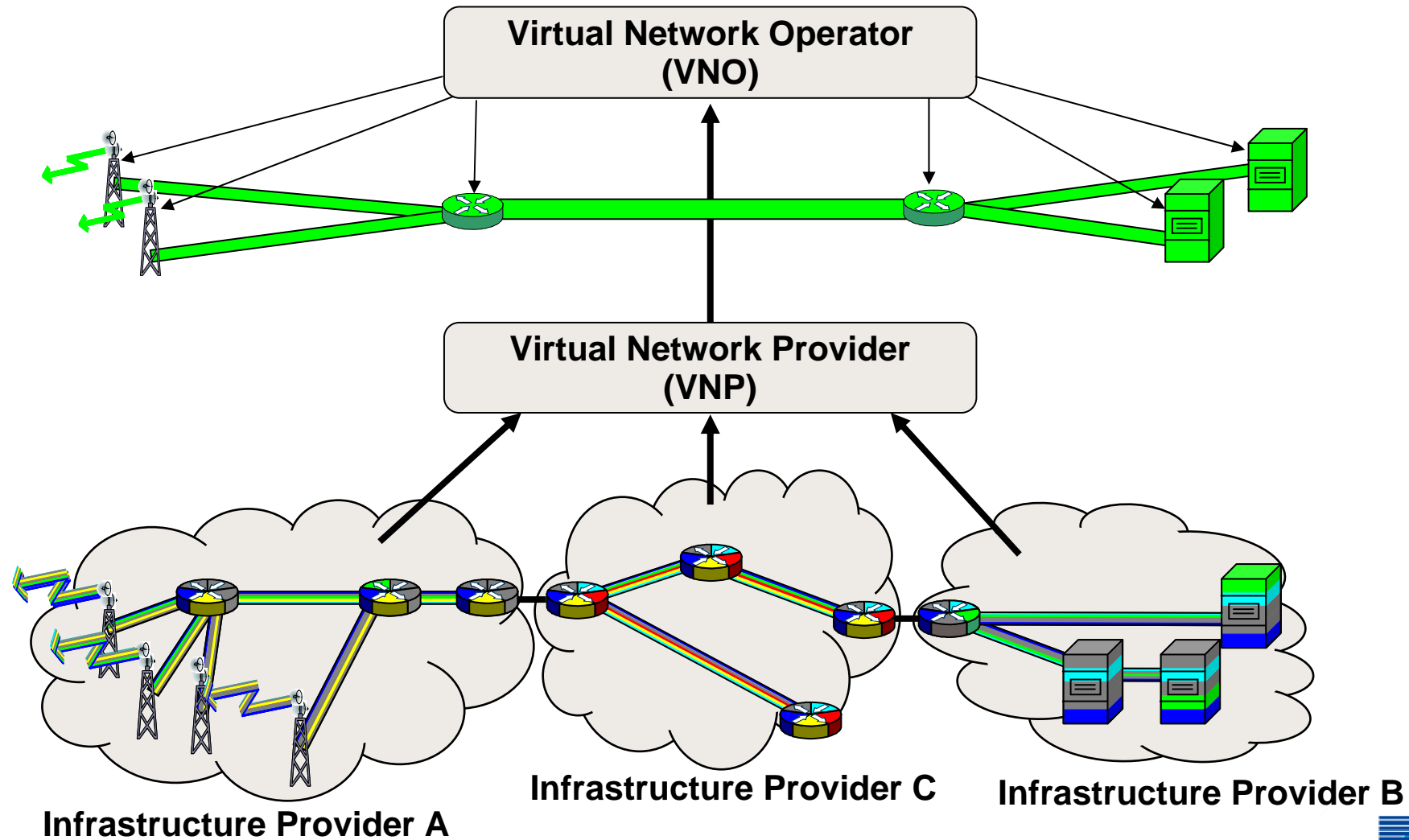
- Signaling and management protocols
- Description of virtual networks and resources
- Embedding of virtual resources; resource optimization
- Management of resources and isolation of virtual networks

### Interoperability

- Interoperability between stakeholders
- Interoperability between virtual networks (folding points)

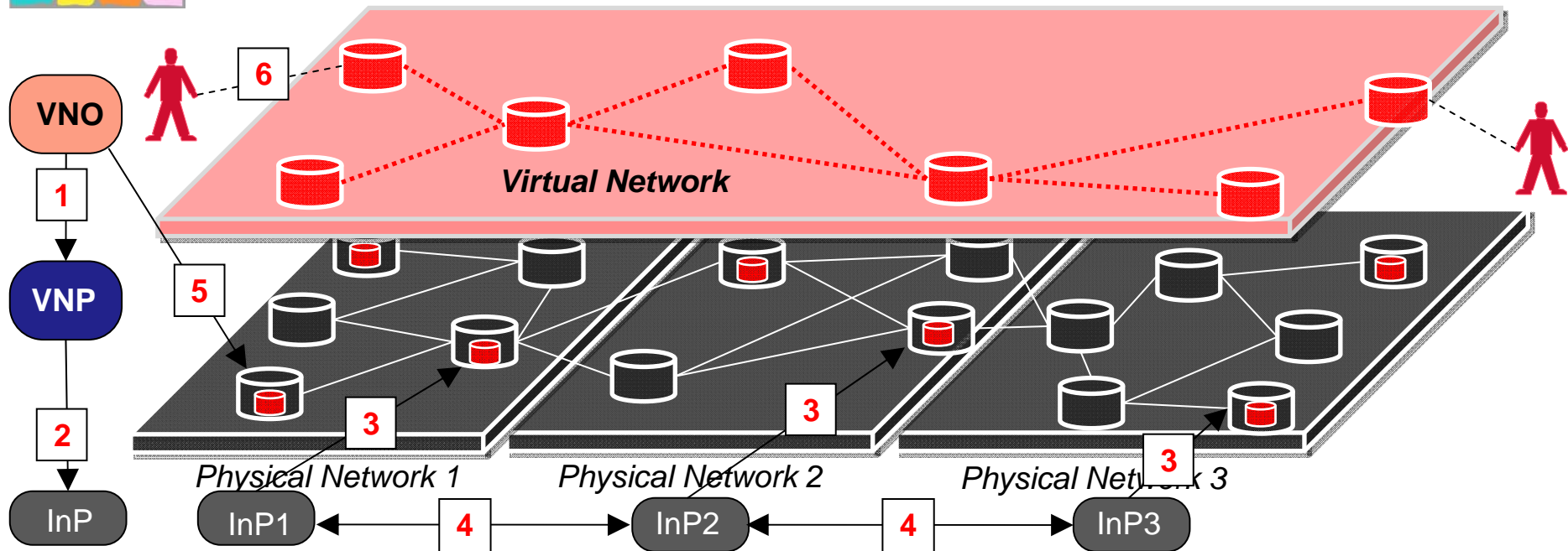


# 4WARD Network Virtualization business model





# Architecture interfaces



1	VNO/VNP	Virtual network description and request
2	VNP/InP	Request and negotiation of virtual resources
3	InP/Network elements	Setup of virtual nodes and virtual links
4	InP/InP (+VNP)	Setup of inter-domain virtual links and virtual networks
5	VNO/InP	“Out of band” virtual node access for bootstrapping/rebooting/configuration
6	End user/VNO	End user attachment



# Virtual Link Setup

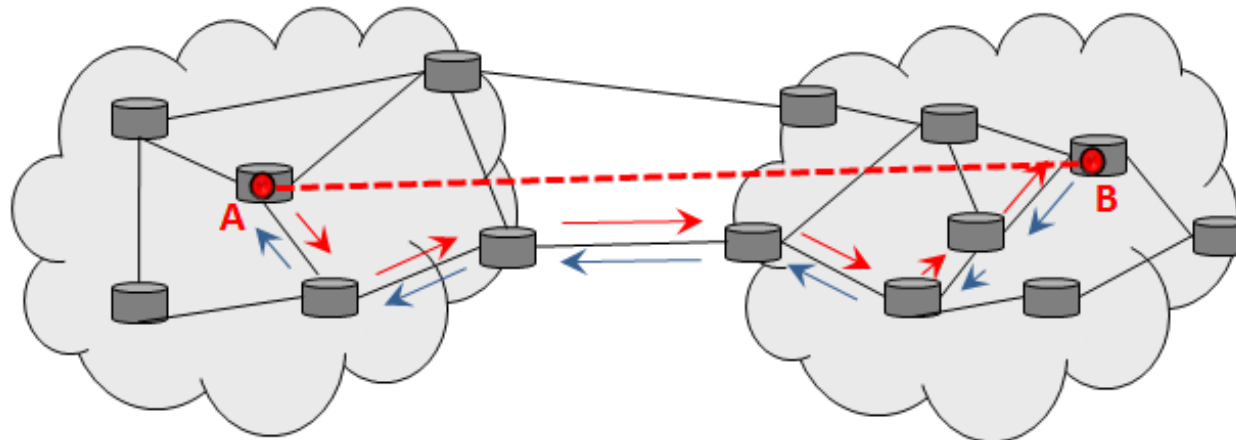
## ❖ Two variants: intra-domain and inter-domain

### – Intra-domain:

- Basically an extension of Constraint-Based Routing for Traffic Engineering?

### – Inter-domain:

- Standardization is required to enable interoperability between different InP domains
- Currently, a prototype uses an additional object for QoS NSLP
  - path-coupled signaling for QoS reservation combined with virtual link setup





# Topics for discussion/standardization (1)

- ❖ **Common network virtualization framework**
  - Terminology, definition of reference points, interfaces
- ❖ **Namespaces**
  - Globally unique VNet IDs (e.g. for end user attachment to VNets) represent a global namespace that needs to be standardized
- ❖ **Resource Description Language** 1
  - Describing networks and network resources is essential for provisioning and management of virtual networks (VNPs to specify resources to be requested from InPs; InPs to describe resources provided to VNPs).
- ❖ **VNet Resource Request Protocol** 2
  - required for VNP to InP interaction
  - InP doesn't want to publish too much of its internals



## Topics for discussion/standardization (2)

### ❖ Virtual Node Setup Protocol 3

- To setup the virtual nodes that make up virtual networks running inside a single infrastructure domain; required for vendor interoperability.

### ❖ Virtual Link Setup/Management 4

- Inter-domain virtual links setup required
  - Inter-AS MPLS-VPNs are considered in RFC4364, Section 10
  - But this is limited to the MPLS-VPN model
- a new approach for the control plane (virtual link setup) is required
- monitoring capabilities/debugging support

### ❖ Cross InP Virtual Network Management 5

- need to locate virtual resources (VNO)
- probably distributed management architecture

### ❖ End-user attachment 6

- users must find their Virtual Access Node
- users/apps must attach to the correct VNet (in case of multiple VNets)