ADVA™ Optical Networking

Panel: The Future of Datacenter Networking

Software-Defined Networking (SDN) for Datacenter Interconnect and Cloud Computing

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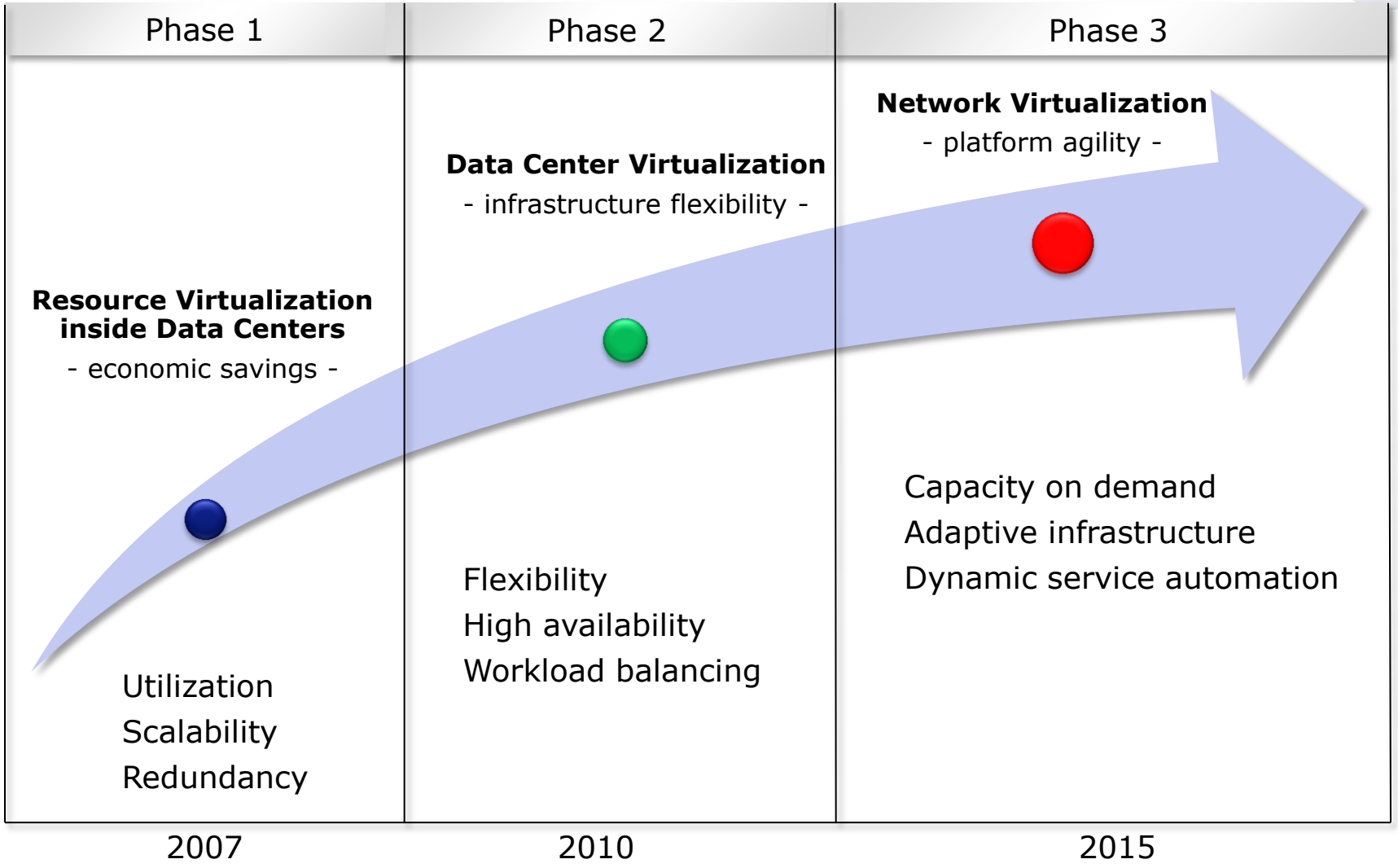
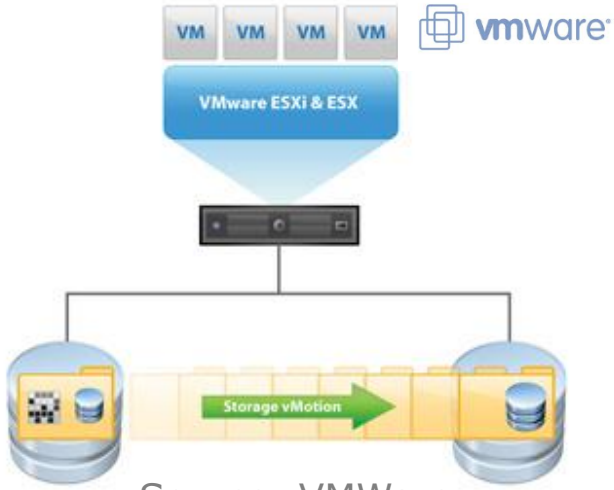
Evolution of cloud architectures

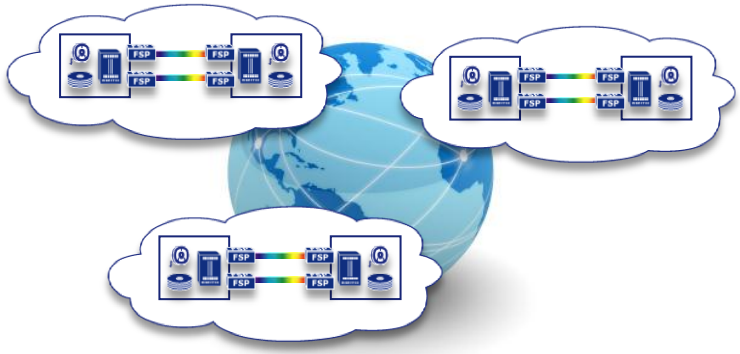


Long-Distance Datacenter Interconnect

- Datacenters are globally distributed and have to exchange / synchronize information
- Long distance carrier technology used for inter-DC networks
  - ROADM-based Long-haul, high capacity transmission, 10…100Gbit/s, 40/80/96 ch, …
- Datacenter operators are their own transport network customers
  → more flexible network operation
- Increasing programmability and flexibility of intra-datacenter connectivity
  → increasing flexibility and programmability for the long-distance data center interconnectivity



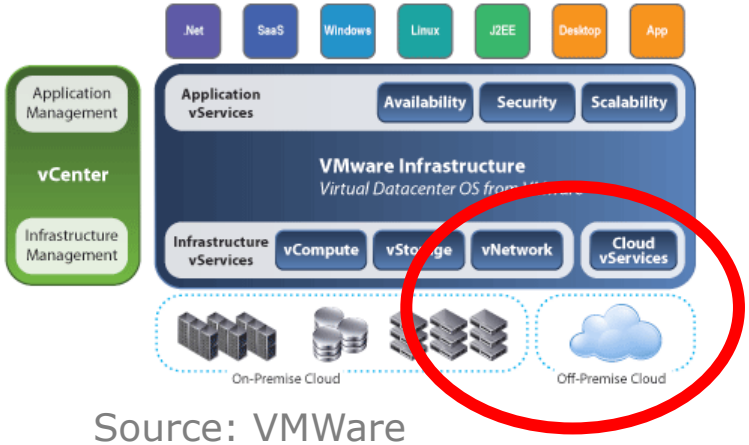
Source: VMWare



Cloud Computing

- Datacenter and Web 2.0 service providers have increasing impact on Transport Network
- Cloud computing is currently decoupled from the transport networking control and operation
- Goal is to converge cloud computing and networking
- This required a more dynamic mode of control and operation and new functionality of the network such as network virtualization

→ Software Defined Networking



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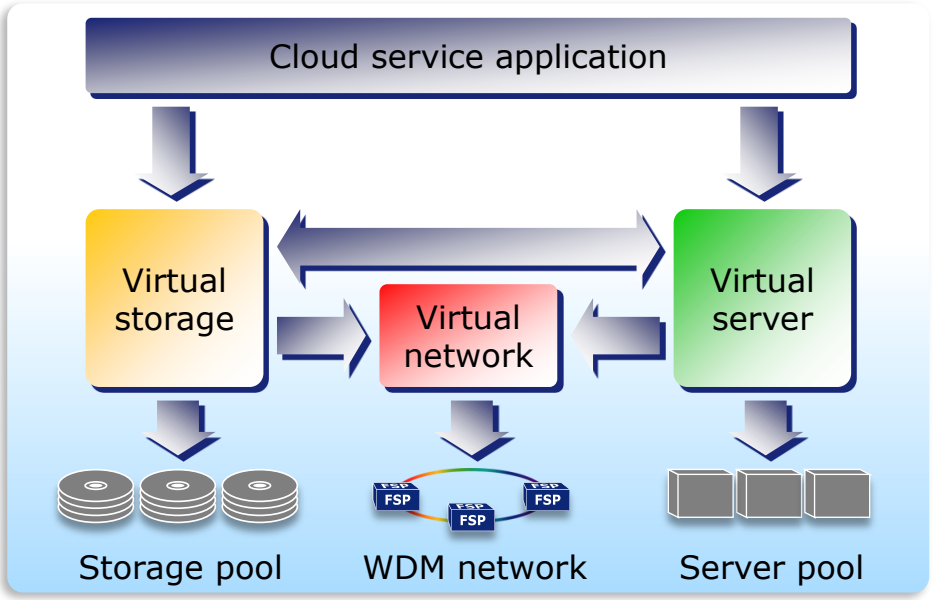
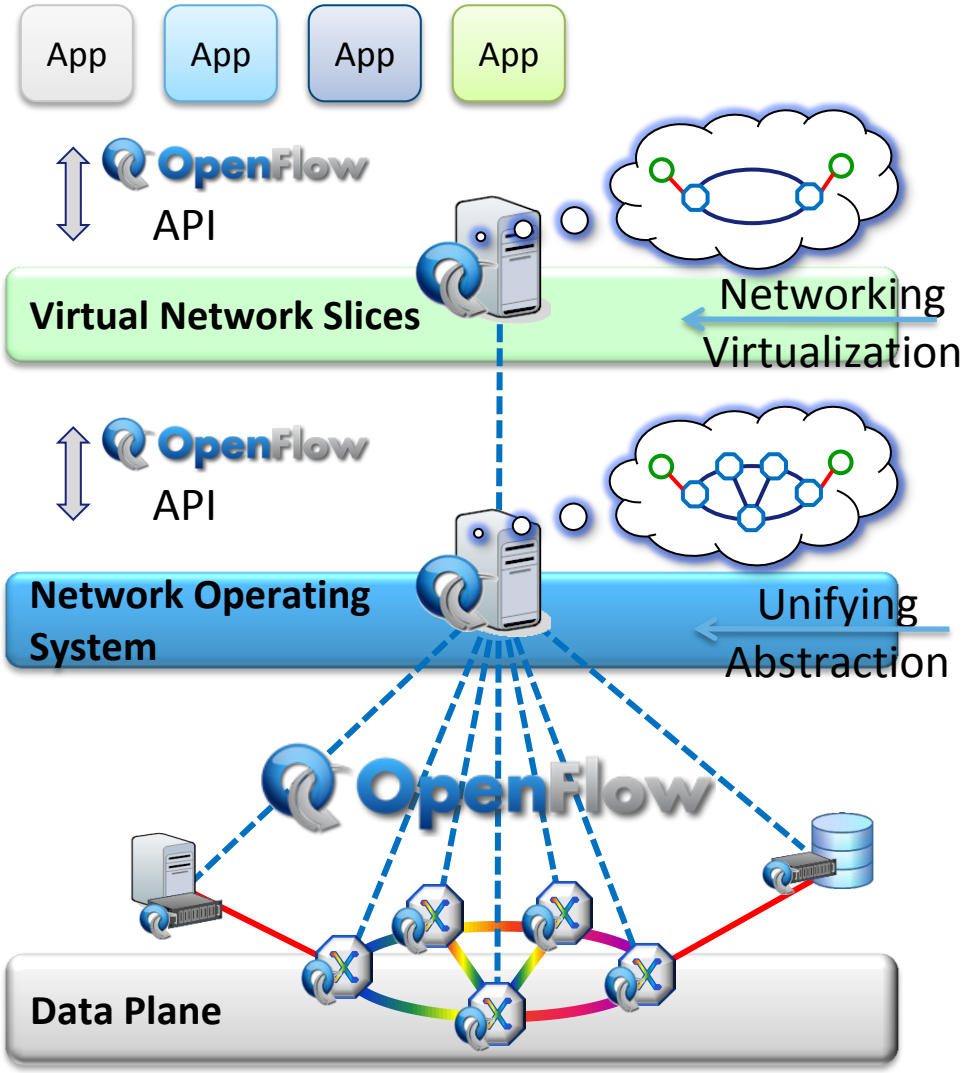


Software Defined Networking



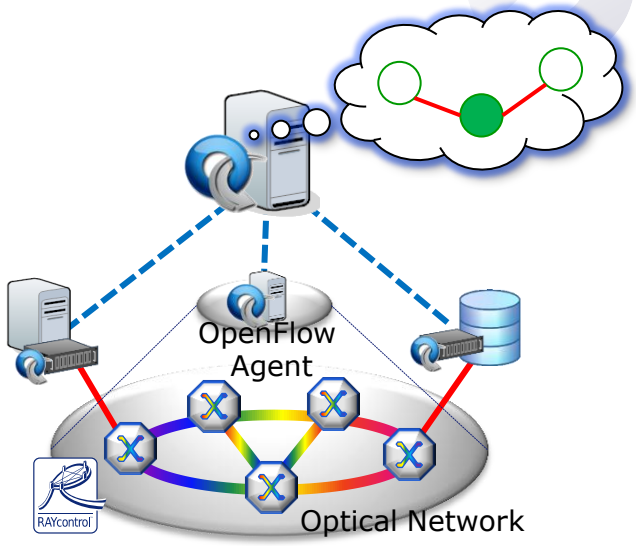
- Open interface between a (centralized) control and the forwarding plane
- Key Goal: Network Virtualization
- Convergence of the virtualized networks with VMs in the data centers
- One possible solution: OpenFlow
  - focused on packet based networks (Ethernet, IP, MPLS Networks)
- Key benefit: Simplicity
- Main issues:
  - Scalability and security
  - Not well suited for circuit switched and optical networks yet

Network Virtualization and API's

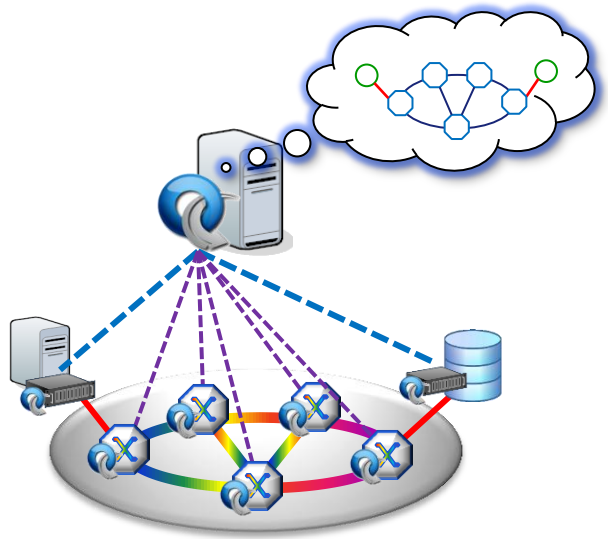
- Network resource sharing driven by specific use cases
  - Beyond today's VPNs
  - Includes physical layer resource carve-out
  - Must be convenient and drive revenue opportunities
- Tools/mechanisms for carving out an entire virtual network topology from an existing physical network
  - Dynamically and rapidly reconfigure network infrastructure in response to specific use cases
  - Analogy to bringing up OS instances on a whim within cloud computing infrastructures
  - Examples present in Ethernet networks in datacenters using OpenFlow
  - How can the same functionalities be realized within a packet-optical transport network?
- APIs… Application Programming Interfaces
  - Applications aware of (virtualized) network resources
  - Able to dynamically reserve, reconfigure and release network components, to serve their specific needs

Modes of Operation

- Network API (aka Big Fat Switch)
  - Optical Network acts as one Virtual Switch
  - Plain packet-based OpenFlow Controller
  - Optical layer functionality is abstracted by single OpenFlow agent
  - internal signaling can be based on existing GMPLS control plane (OpenFlow UNI)

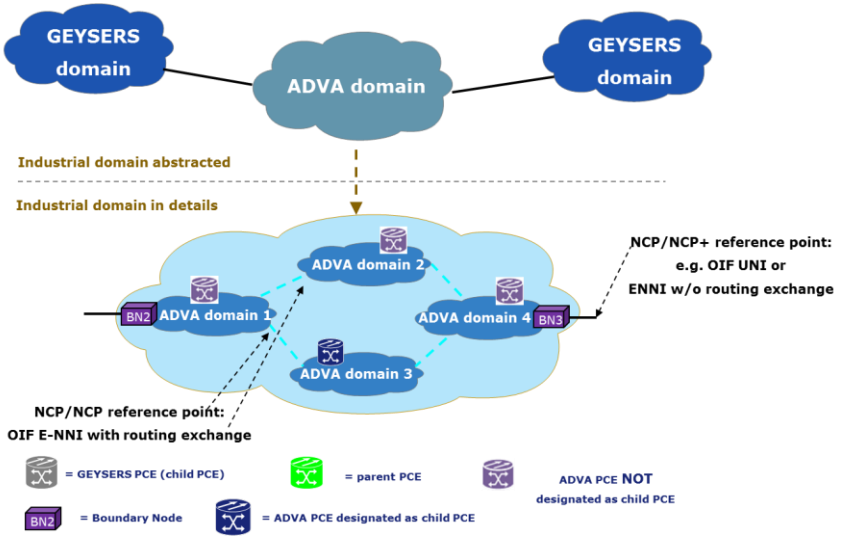


- Network Element API
  - Optical Network fully controlled by OpenFlow API
  - OpenFlow Controller and OpenFlow Protocol requires Optical extensions
  - OpenFlow agent on each NE models optical constraints

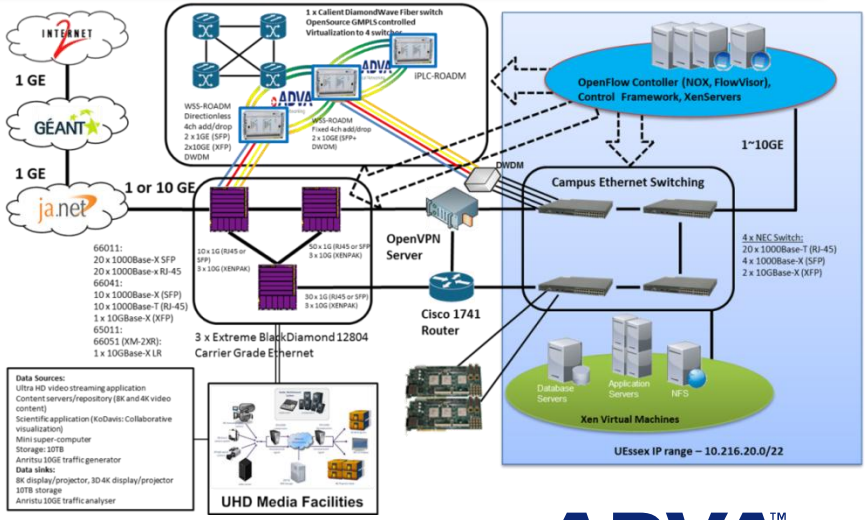


ADVA's Activities towards SDON

- Geysers
  - green aware extensions on the industrial CP class solution
  - verification of interworking with legacy GMPLS-based virtualization mechanisms
    - slice of network as specified and fixed set of labels (wavelengths, time slots etc.)
    - slice of network as a number of unspecified labels



- OpenFlow in Europe – Linking Infrastructure and Applications



First ROADM-based optical OpenFlow networking testbed developed in cooperation with University of Essex

Thank you

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