

# Thoughts on Transport SDN

Hans-Martin Foisel, Christoph Gerlach, Armin Ehrhardt  
20.03.2013

Life is for sharing.



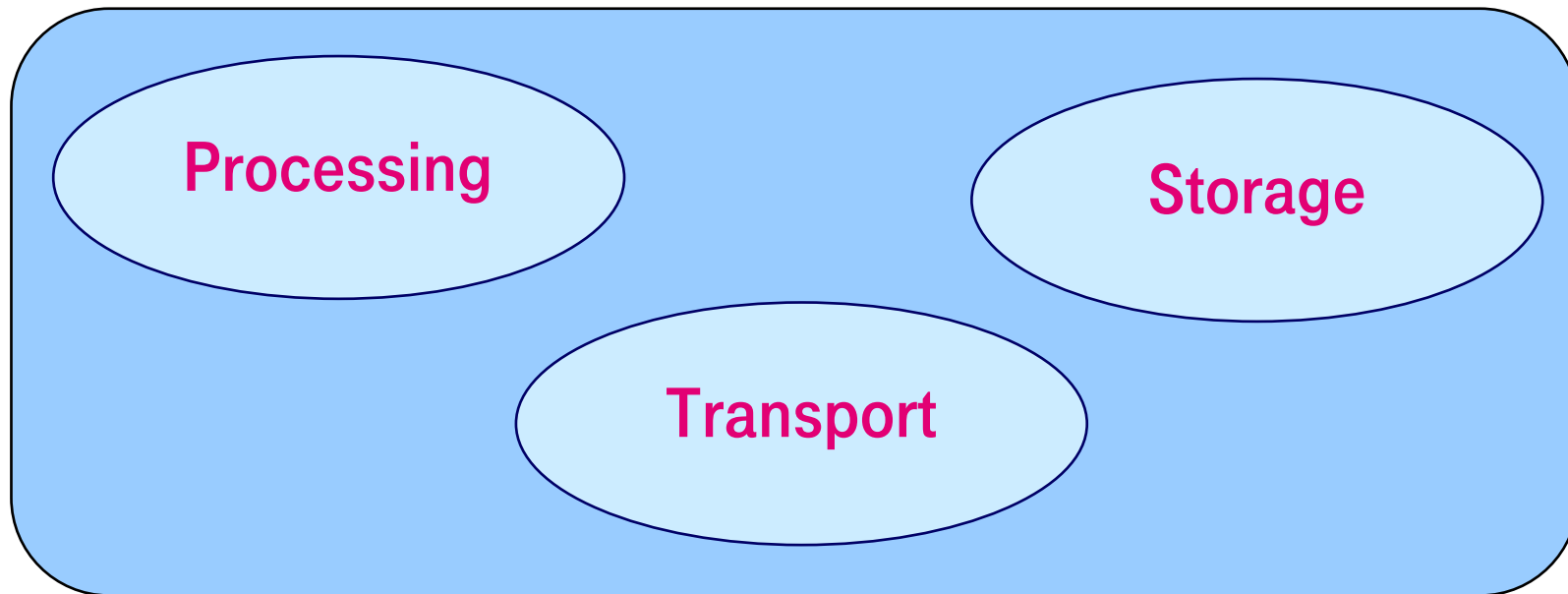
# Overview

- **Introduction**
- SDN Architecture Considerations
- Transport SDN Approaches and Applications
- SDN Implementation Examples
- Outlook



Introduction  
SDN – one main Aspect

# Orchestration



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# Introduction

## Expectations of Carriers

### What carriers want

- OPEX reduction:
  - Lean, consistent IT-systems and data bases for converged view infrastructure, available products & solutions, policies, billing– real time OSS
- CAPEX reduction:
  - Fewer, more efficient devices to buy, operate and upgrade, or at least fewer different types
  - Use of standardized devices to not get trapped in proprietary solutions
  - Network Function Virtualization to realize Infrastructure Cloud Model (IaaS)
- Gain agility, keep stability:
  - Reducing time from innovations in physical and virtual switching to high-confidence deployment → re-programming instead of re-architecting the network
  - Keep the network secure and stable despite multiple SW applications accessing controllers and NEs

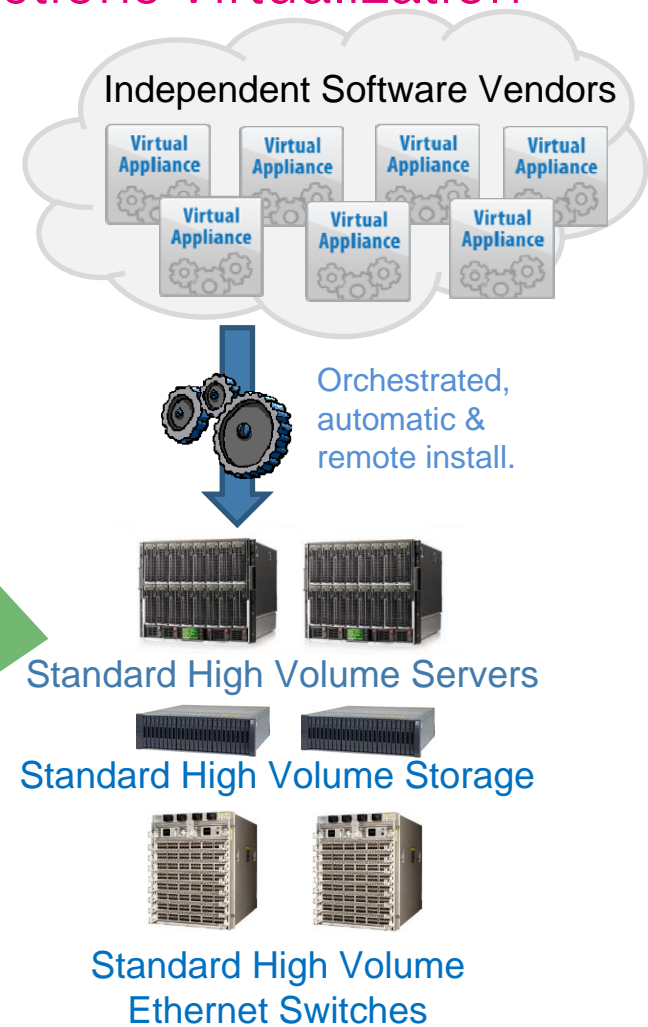


# SDN Architecture – Vision of Network Functions Virtualization

## Classical Network Appliance Approach

WAN Acceleration  
NAT  
BRAS  
Radio Access Network Nodes

Non-commodity hardware.  
High cost per appliance per site.  
Software development large barrier to entry for new entrants.  
Constraining innovation & competition.



## Network Virtualisation Approach

Source: Network Functions Virtualization (NFV), White Paper, <http://portal.etsi.org/portal/server.pt/community/NFV/367>

# Overview

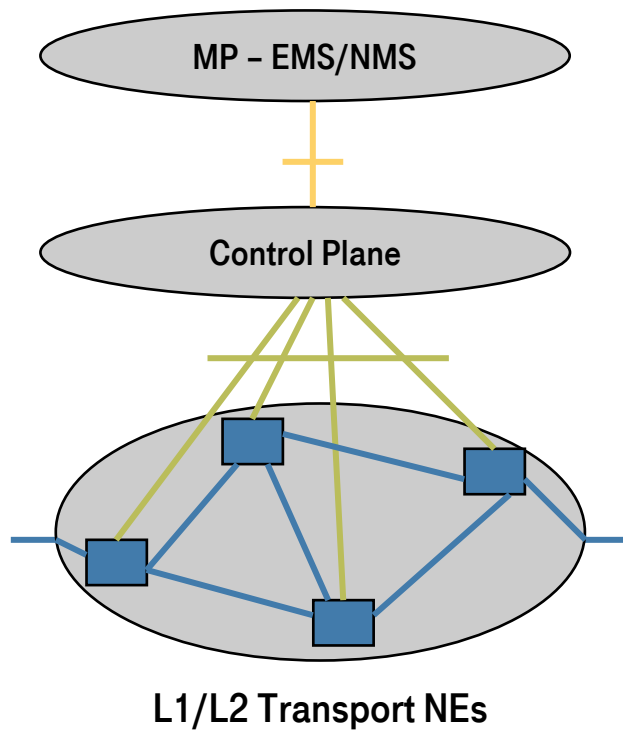
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# SDN Architecture - Standardization

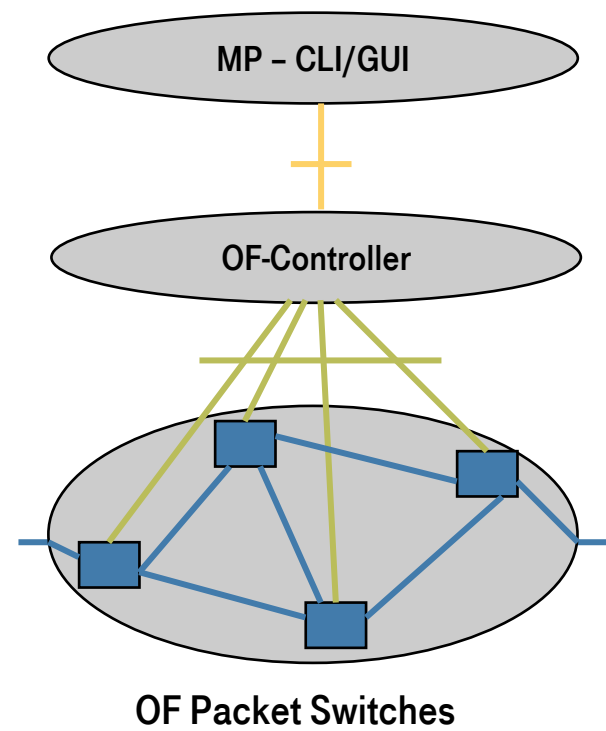
*Mature*

ITU-T, IETF, OIF  
ASON / GMPLS  
(G.8080 / G.771x,...)

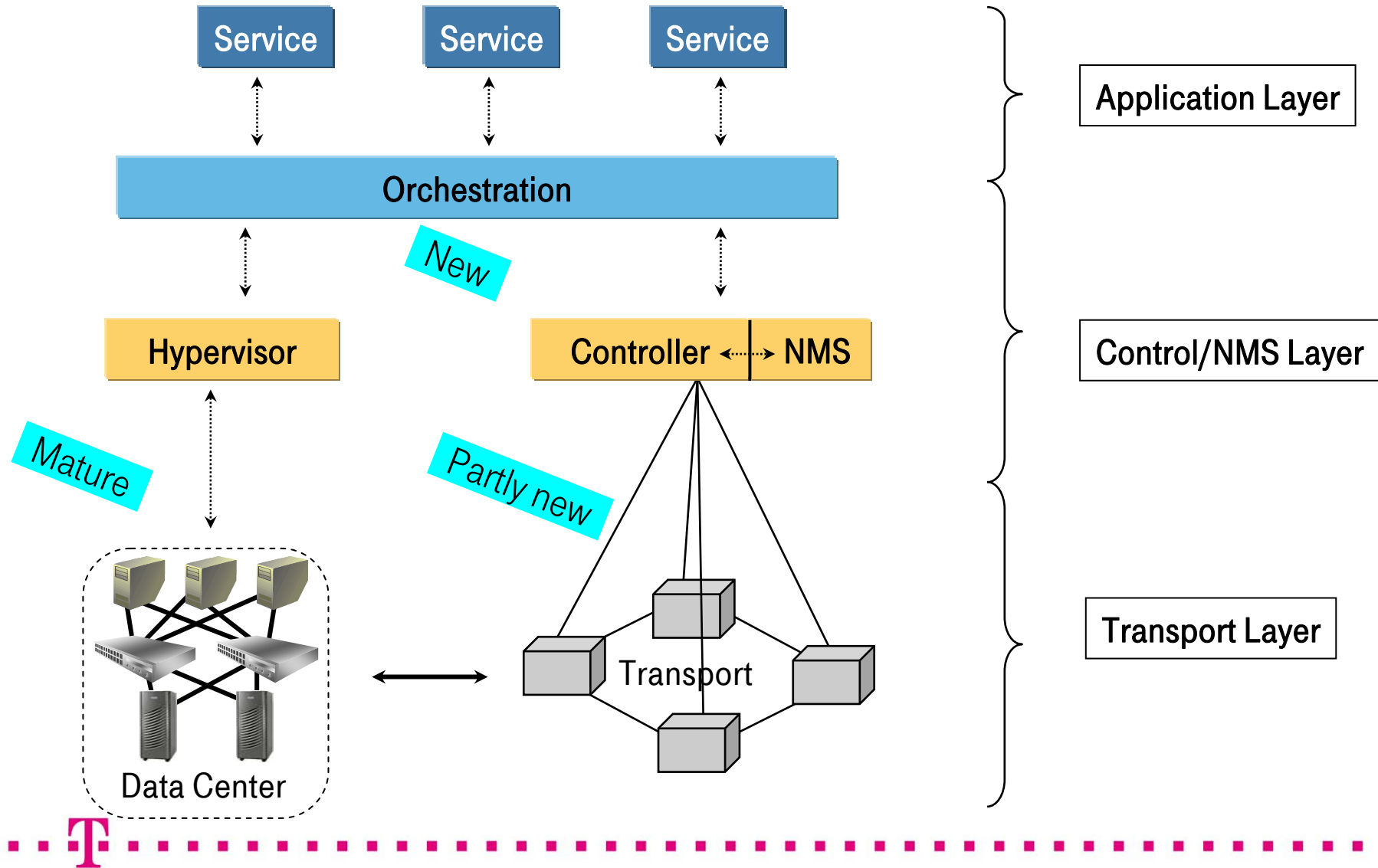


*New*

ONF  
OpenFlow Switch Spec. 1.3.1  
OF Config. & Mgt Protocol 1.1

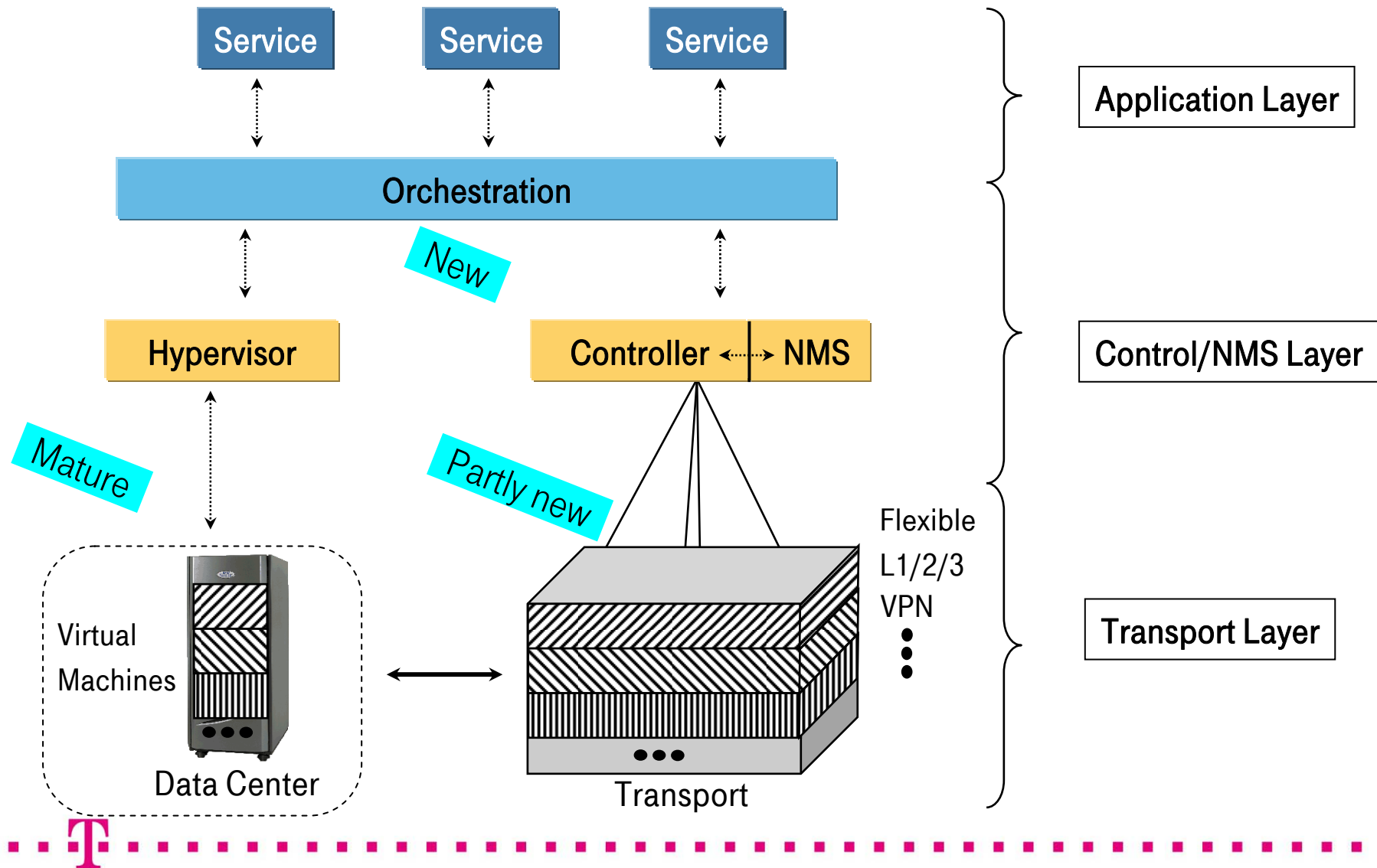


# SDN Architecture - Principle





# SDN Architecture - Virtualization and Slicing



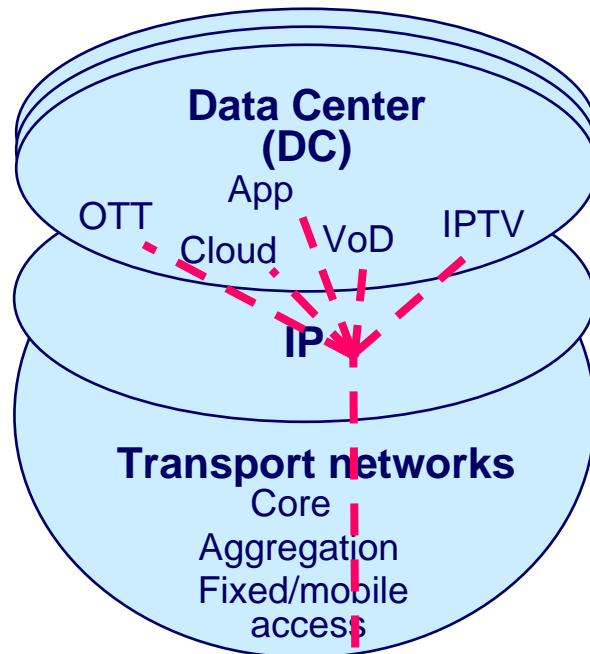
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# SDN Application Services for Residential Customers

- Mass market services are provided by applications hosted in in DCs over IP- and TN
- Efficient network and DC infrastructure utilization and better customer experience with time varying traffic demands and stringent QoS requirements (IPTV, VoD)
- Apply variable resiliency schemes based on IP- and TN platform utilization and SLA



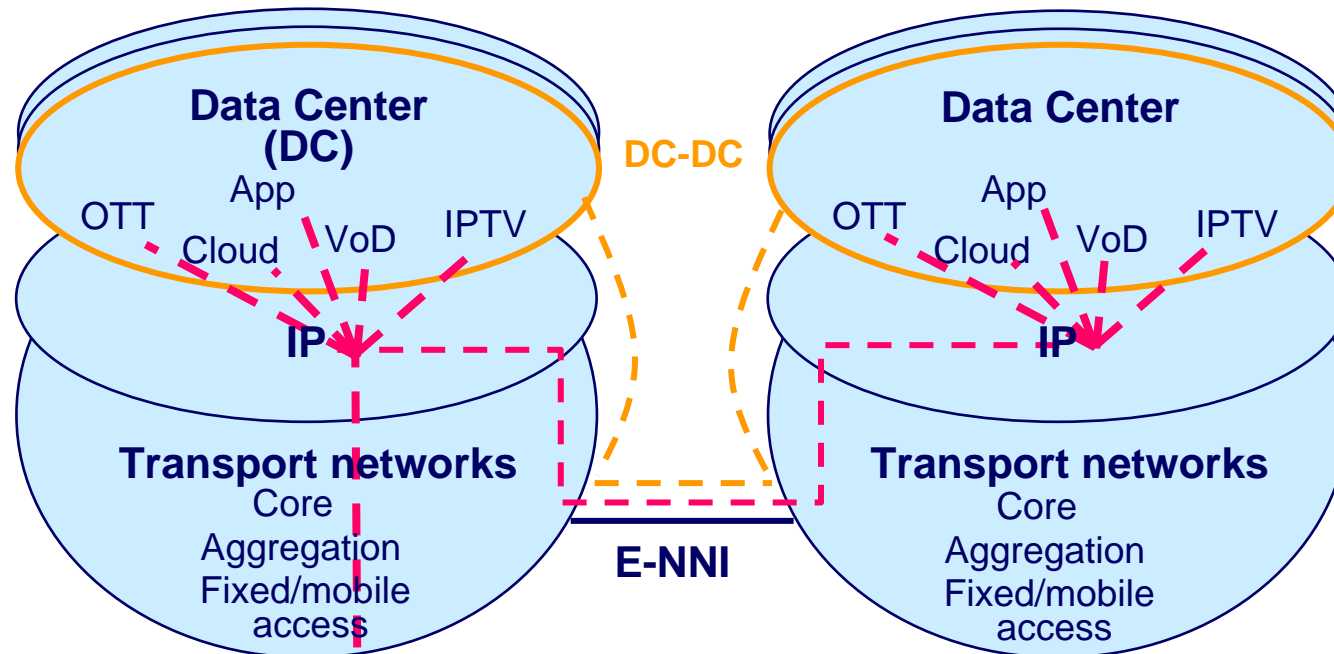
## Residential Customers



# SDN Application

## Services for Residential Customers – on Global Scale

- For supporting residential customer services in a multi-domain environment
  - Multiple IP-/transport domains must be interconnected
  - Multiple DC must be interconnected via transport networks



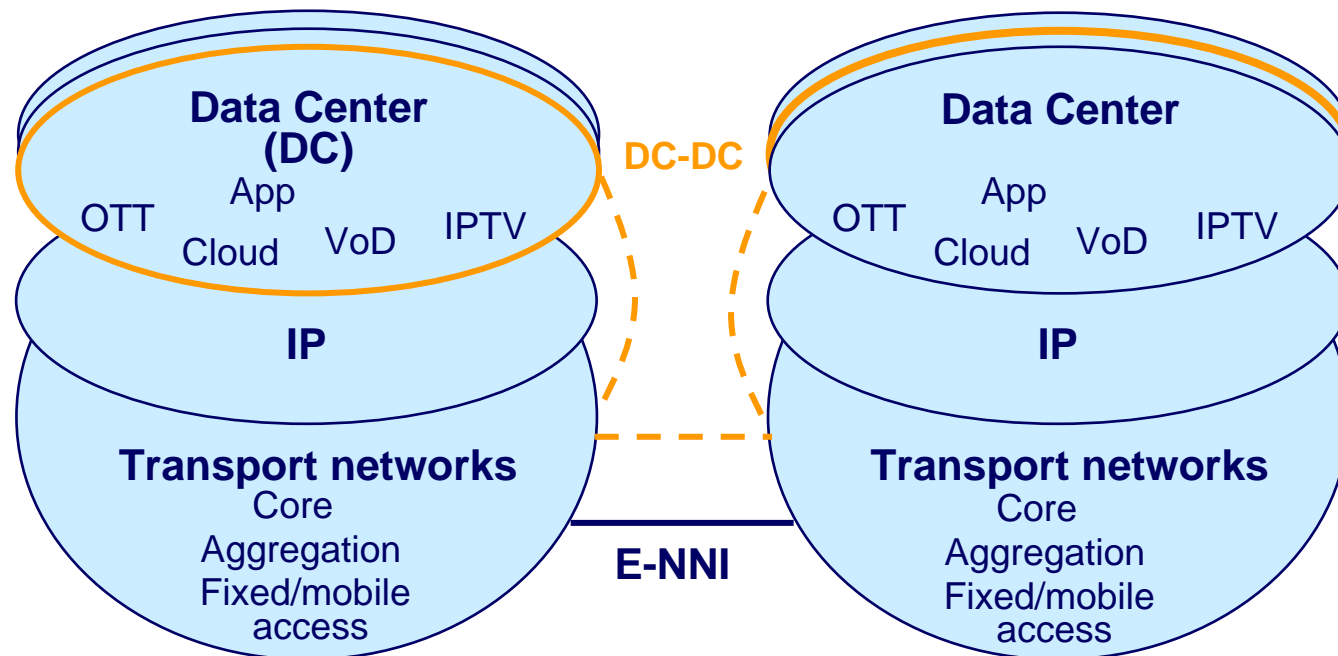
Residential Customers

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# SDN Application

## Data Center Coupling

- Required for content backup & synchronization, DC-maintenance/upgrades
- Very versatile demands: vastly differing BW, QoS, and timing requirements (scheduled/on-demand, duration), virtual topology (pair wise, tree, mesh)



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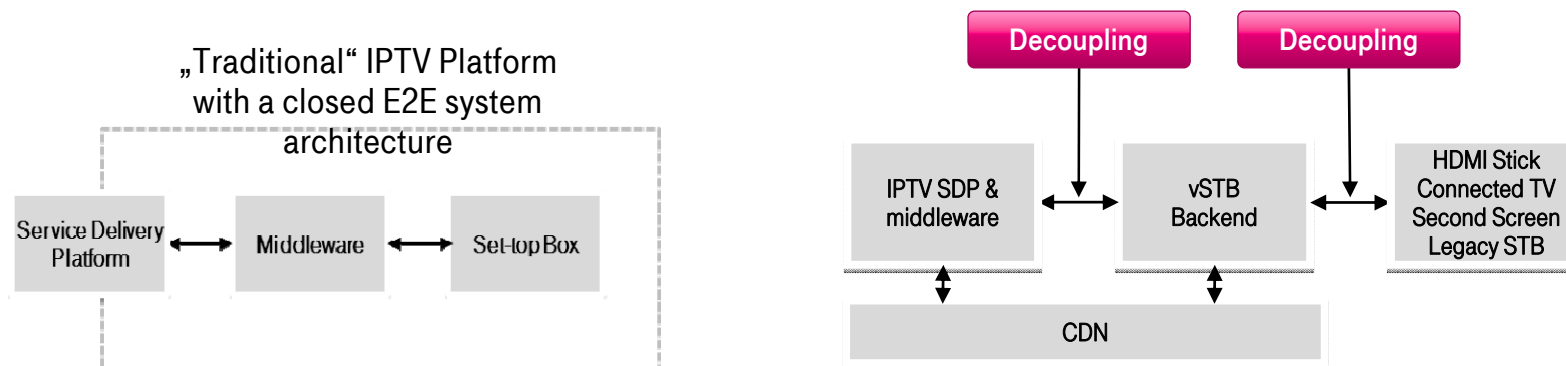


# SDN Implementation Example

## Virtual STB

### Virtual STB innovation characteristics

- Project addresses a crucial pain point in IPTV infrastructure and operation: the STB  
→ Re-location and virtualization of STB functionality to the Cloud
- Strategic decoupling of main IPTV system components via injection of vSTB component and openness of all interfaces
- Keeps investment in existing IPTV middleware low
- Quick and cost-efficient scaling, extension of media type deliveries and new services launches via virtualized vSTB components

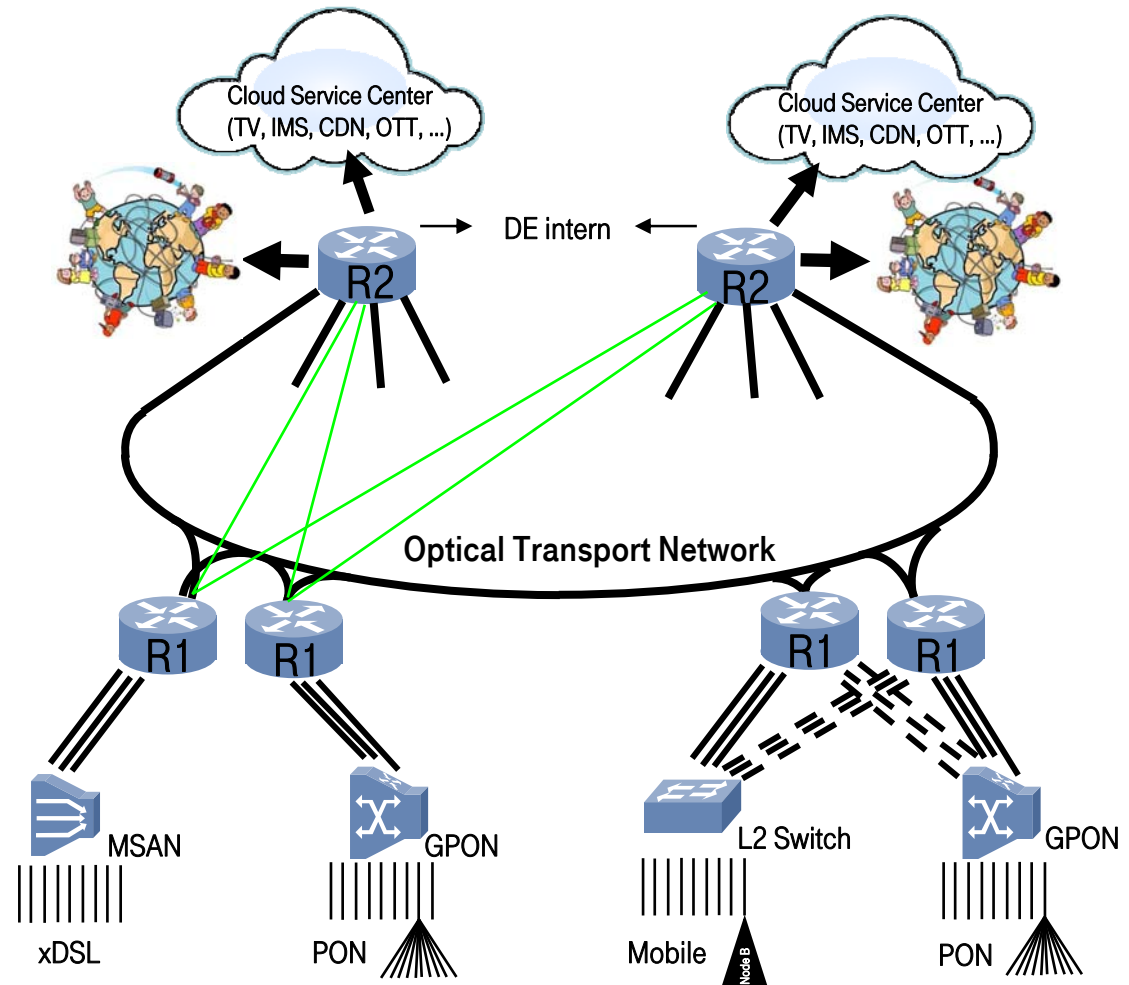


# SDN Implementation Example

## TeraStream - A Cloud-enabled native IP Architecture

### A cloud-enabled native IP architecture

- Reduce complexity
- Improve operational efficiency
- “From real-time OSS to a Software Defined Networks”
- Future steps
  - OF integration in cloud service center
  - OF in access
  - Hybrid
  - Evaluation in a pilot





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# Outlook

## Where are we, where do we go from here?

- Current implementations
  - Not carrier grade - single, well defined and separated network domains
- Medium term potential - Hybrid approaches likely
  - Re-use existing flexible transport network functionalities and installed Control Planes (IP-MPLS, ASON, GMPLS)
  - Provide OpenFlow IF from TN towards higher layer (Routers, Switches) SDN controllers
- Long term development - A clear Transport SDN architecture needs to be defined
  - Evolve SDN standards and specifications towards carrier grade multi-layer and multi-domain solutions without making them too complex to handle
    - Enhance OF for non-packet devices
    - Where will Application / Client / Network Control Functions, Flow Visor, etc. be allocated and implemented? Which target architectures are feasible?
    - How do these functions interact in a multi-domain network environment?
    - How do they relate to and communicate with existing NMS, ASON-Ctrl., PCE, EMS?



Thanks for your attention!

