

# Deutsche Telekom TeraStream: A Network Functions Virtualization (NFV) Using OpenStack Case Study

## Critical Issues

- Build a new, elastically scalable model for the core central-office data center optimized for performance, low latency and cost
- Deliver IPv4 services to customers in a native IPv6 network
- Automatically provision IPv4 and other L4-7 services quickly and efficiently
- Architect in compliance with core ETSI NFV documents
- Maintain prime directive of simplicity and openness

## Results

- Increased business agility with virtual carrier-grade networking service and pay-as-you-go licensing based on A10 Networks aCloud Services Architecture
- Differentiated services on a per-subscriber basis
- Reduced time-to-deploy IPv4 over IPv6 Software service with highly responsive partners

*“IPv4-over-IPv6 Softwire is the first example of a high-volume, data-plane-oriented network function that was virtualized.”*

**Axel Clauberg**

Vice President Aggregation, Transport, IP and Fixed Access  
Deutsche Telekom AG

## Deutsche Telekom TeraStream Virtualizes IPv4 Services with vThunder CGN

### Executive Summary

Deutsche Telekom is piloting TeraStream, an all-IP network that delivers triple-play and other services from the cloud, as a model for next-generation operator networks. TeraStream also is a proving ground for software-defined networking (SDN) and network functions virtualization (NFV), as Deutsche Telekom looks to automate and orchestrate cloud services to launch new revenue-generating services and adapt to customer needs more quickly.

Deutsche Telekom has partnered with A10 Networks® to develop a carrier-grade, IPv4-over-IPv6 Softwire solution as a virtualized network function, enabling Deutsche Telekom to differentiate and scale cloud services. A10 Networks' software-based and API-driven architecture, commitment to open standards like OpenStack, and a willingness to create innovative solutions were key to helping Deutsche Telekom develop what is widely regarded as one of the most innovative service provider networks today.

Today's hyper-connected world has not been kind to service providers. The demand for broadband has exploded, as customers want always-on connectivity for work and play, but don't want to pay a premium for their growing bandwidth consumption. In fact, fierce competition among traditional telcos, cable operators and mobile operators is driving average revenue per user (ARPU) lower and lower. Capturing new market growth, such as over-the-top (OTT) video and cloud services, requires innovation and speed. Yet many service providers are hampered by the complexity of their networks, which drives up lead time and cost, while their more nimble competitors and OTT service providers deliver services that are faster, cheaper and better. Traditional service delivery times, which require weeks or months to configure using conventional networking technologies, are no longer competitive.



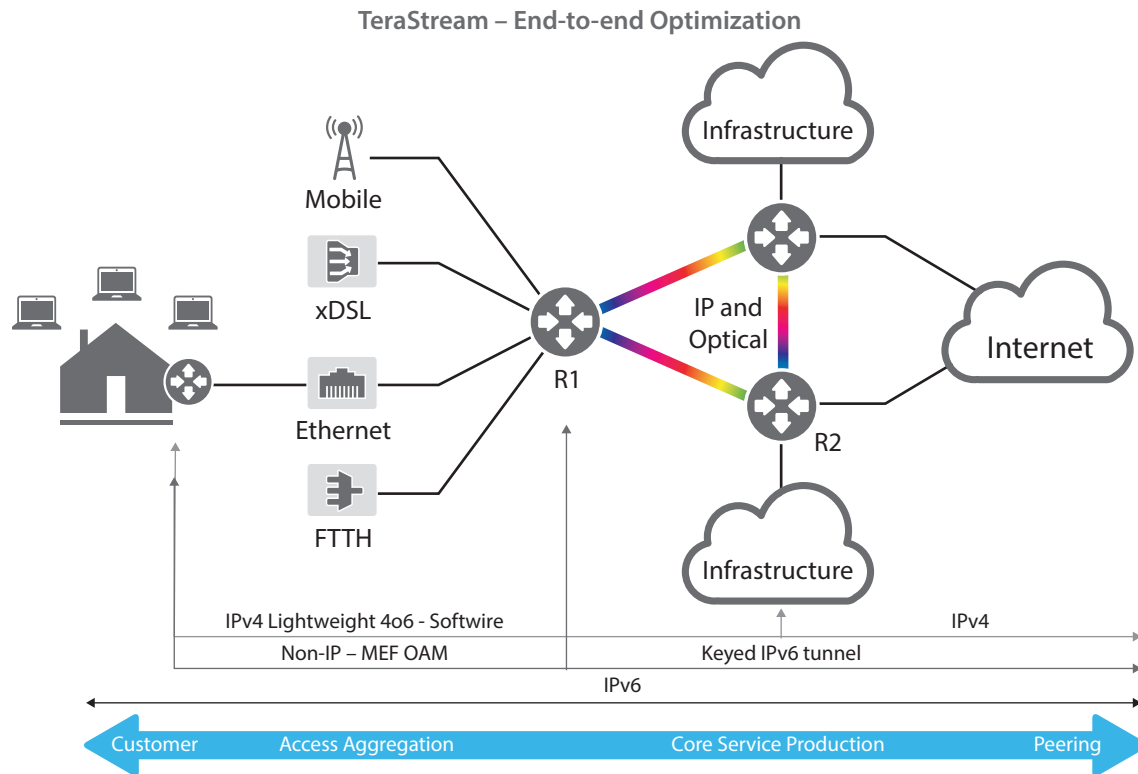


Figure 1: TeraStream is a model for next-generation operator networks – an IPv6 network that’s built on an infrastructure cloud model.

## A New Network Design for Innovation and Agility

Deutsche Telekom is on the vanguard of this change. As a leader in next-generation operator networks, Deutsche Telekom is piloting TeraStream, an all-IP cloud-enabled network, at Hrvatski Telekom in Croatia. In TeraStream, Deutsche Telekom has re-imagined the network to deliver all services, including voice, IPTV and Internet access, as cloud services that are provisioned on demand.

Deutsche Telekom has taken bold steps to fundamentally change how it delivers new services faster, at a lower cost and with a better user experience. TeraStream is an integrated packet-optical network that runs IPv6 in the core and is built on an infrastructure cloud model. TeraStream has drastically simplified network architecture and embraces the concepts of software-defined networking (SDN) and network functions virtualization (NFV), including software appliances, common-off-the-shelf (COTS) hardware, and automated provisioning and service orchestration.

“We designed TeraStream as an architecture that breaks many of the rules on the operator side,” said Axel Clauberg, Vice President of Aggregation, Transport, IP and Fixed Access at Deutsche Telekom AG. “The attitude of ‘things-were-always-done-this-way’ doesn’t exist here. We questioned all layers and all protocols in today’s network, and asked ‘how would you run an efficiently managed IP network moving forward?’ We realized that if we truly wanted to change our cost base, we needed to change the model.”

TeraStream is an open multivendor network, which allows for greater innovation and avoids vendor lock-in. “It is really key for operators to

build a foundation based on an open platform,” said Clauberg. “We don’t want a dependency on a single vendor in our critical infrastructure.”

TeraStream uses OpenStack for cloud orchestration, allowing it to control the compute, storage and network resources in its data centers, while empowering customers to provision resources easily. TeraStream virtualizes network functions so they can be chained together to create customized communications services quickly and as needed.

## Virtualizing Network Functions

As an IPv6 network, TeraStream does not have native support for IPv4. Yet it must still deliver IPv4 as a service to its customers to support legacy applications.

“There is an expectation that IPv4 traffic will go down significantly by the end of the decade, but we’ll need to deliver that function for some time,” said Clauberg. “Producing IPv4 as a service is ideal, because we can react based on our current load and we don’t need to drastically overprovision the way you might in a physical appliance scenario.”

The TeraStream team looked for a partner that could drive a scalable, virtualized Softwire encapsulation service in its data centers. There are multiple ways to transport IPv4 traffic over IPv6, and the team considered Mapping Address over Port (MAP) as well as Lightweight 4 over 6 (LW4o6), an emerging IETF standard that’s an extension of Dual-Stack Lite (DS-Lite). In DS-Lite, address translation is done at the operator, while LW4o6 moves this translation to the customer premise equipment. The team decided that the LW4o6 approach would scale more efficiently and allow tenants to be managed individually.



## About A10 Networks

A10 Networks is a leader in application networking, providing a range of high-performance application networking solutions that help organizations ensure that their data center applications and networks remain highly available, accelerated and secure. Founded in 2004, A10 Networks is based in San Jose, California, and serves customers globally with offices worldwide. For more information, visit:

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