HYBRID ACCESS DEPLOYMENT @ DT

BANANA BOF
IETF97, SEOUL
VERSION 1.4

Nicolai Leymann
Senior Network Architect, Deutsche Telekom
n.leymann@telekom.de

LIFE IS FOR SHARING.

AGENDA

1. Overview
2. Home Gateway
3. Requirements
4. Architecture
5. Summary

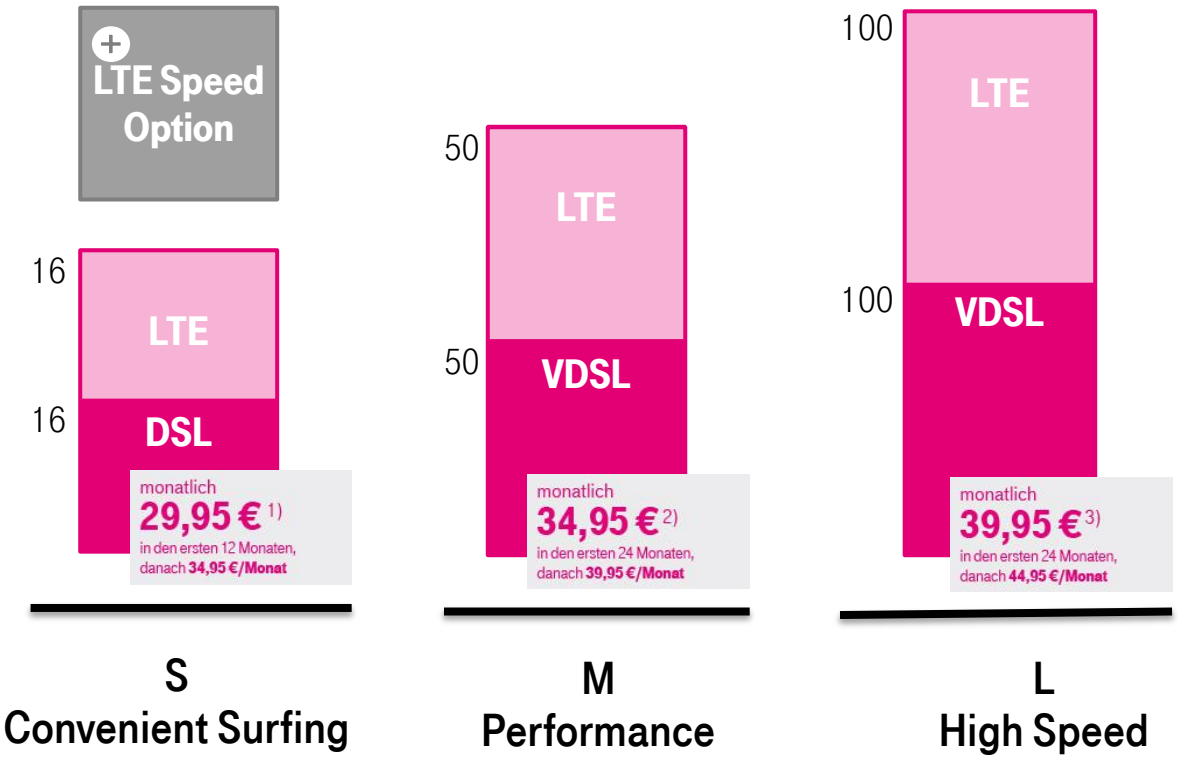
HYBRID ACCESS
PRODUCT OVERVIEW (1 OF 2)

- **Hybrid Access is a commercial product offered in Germany by Deutsche Telekom which bundles an existing DSL access with an LTE based access**
  - Initially aimed on the residential market but now also offerings for business customers, provides higher bandwidth as well as redundancy for end customers
  - New home gateway which integrates DSL and LTE (external antenna possible), customers can either rent or buy it
- **There is no difference in price if hybrid access is booked on top of a fixed line access product**
  - e.g. 50 Mbit/s VDSL has the same price as Hybrid M (50Mbit/s DSL + 50 Mbit/s Mobile Network) (exception is the LTE speed option on top of the (16+16) Mbit/s access)
- **Currently up to 200 Mbit/s, (DSL vectoring + LTE), plans to offer up to 550 Mbit/s in the future**
  - note: high benefit for customers with low fixed line bandwidth
- **Customer base end of 2015(1): roughly 155.000**
- **Development started in 2012, roll out in 2014 in Germany, other NatCos are following**

(1) http://www.geschaeftsbericht.telekom.com

HYBRID ACCESS
PRODUCT OVERVIEW (2 OF 2)

Bandwidth	▪ Higher bandwidth by packet based bonding of DSL and LTE.
Resilience	▪ Always online since mobile will jump in in case of an DSL outage (Data & VoIP).
Innovation	▪ Bonding solution combining DSL and mobile for consumer market.
Easy Order	▪ One contract covers whole solution.
Easy Usage	▪ No user interaction necessary.

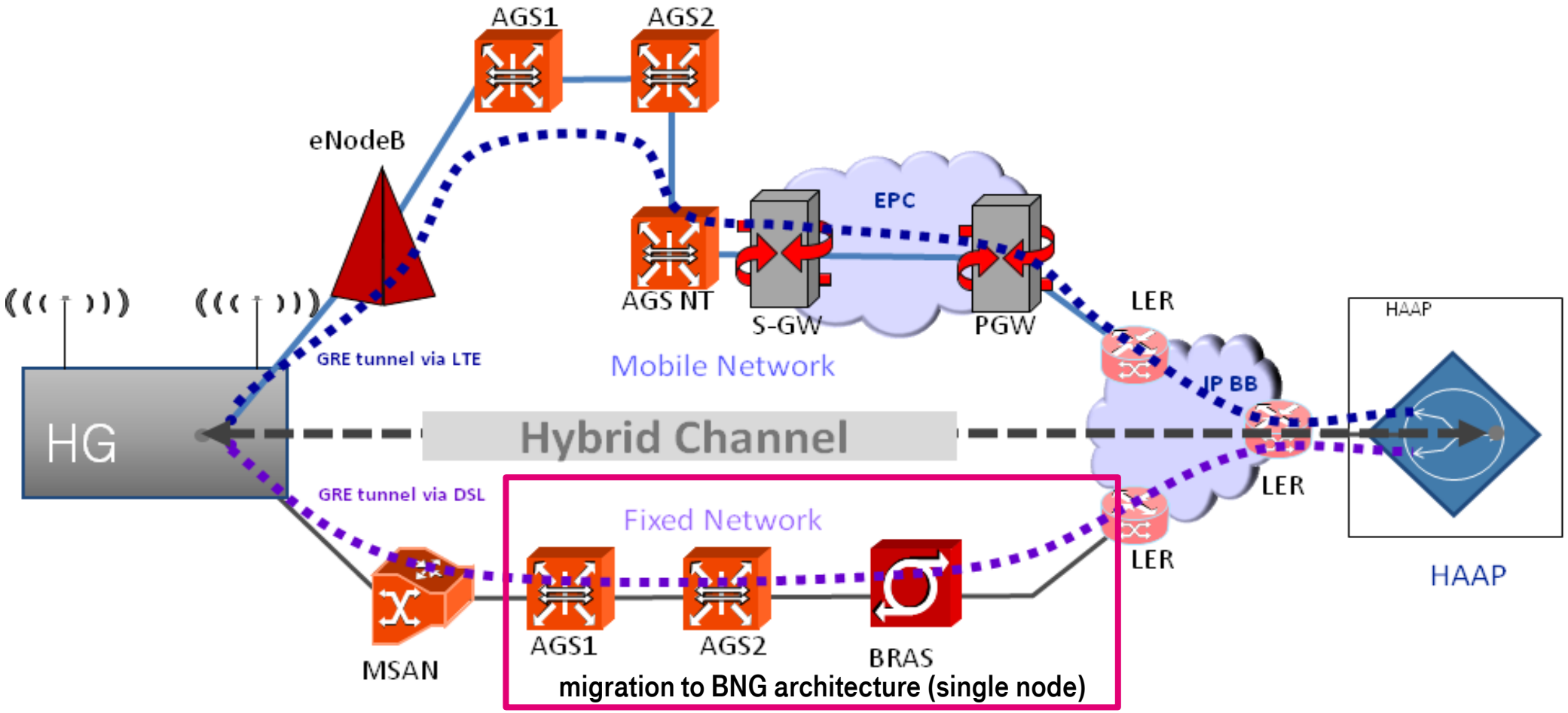


HYBRID ACCESS REQUIREMENTS

Requirements

- Available for **all clients** in the home network **without software changes at the clients**
- Support for **TCP and UDP** (e.g. QUIC, trend to move more towards UDP based protocols)
- **Single session** should be able to **consume full tunnel bandwidth** (from fixed and mobile network)
- Support for **IPv4 and IPv6** (with the tunnel being an IPv6 only tunnel)
  - mobile and fixed line network are IPv6 enabled, supporting DT's strategy to move towards IPv6
- **Cheapest pipe first** (including the ability to **move traffic** from mobile path back to fixed line if capacity is available)
- **Bypass traffic** (e.g. multicast, traffic from certain service areas, VoIP, gaming, ...)
  - no bypass at mobile network
- OTT solution (e.g. decoupling of tunneling from underlying fixed/mobile network)
  - ensures interoperability to old "legacy" network architecture
  - no tight integration within existing network architecture (currently, new BNG architecture being rolled out)

HYBRID ACCESS ARCHITECTURE (TUNNEL)

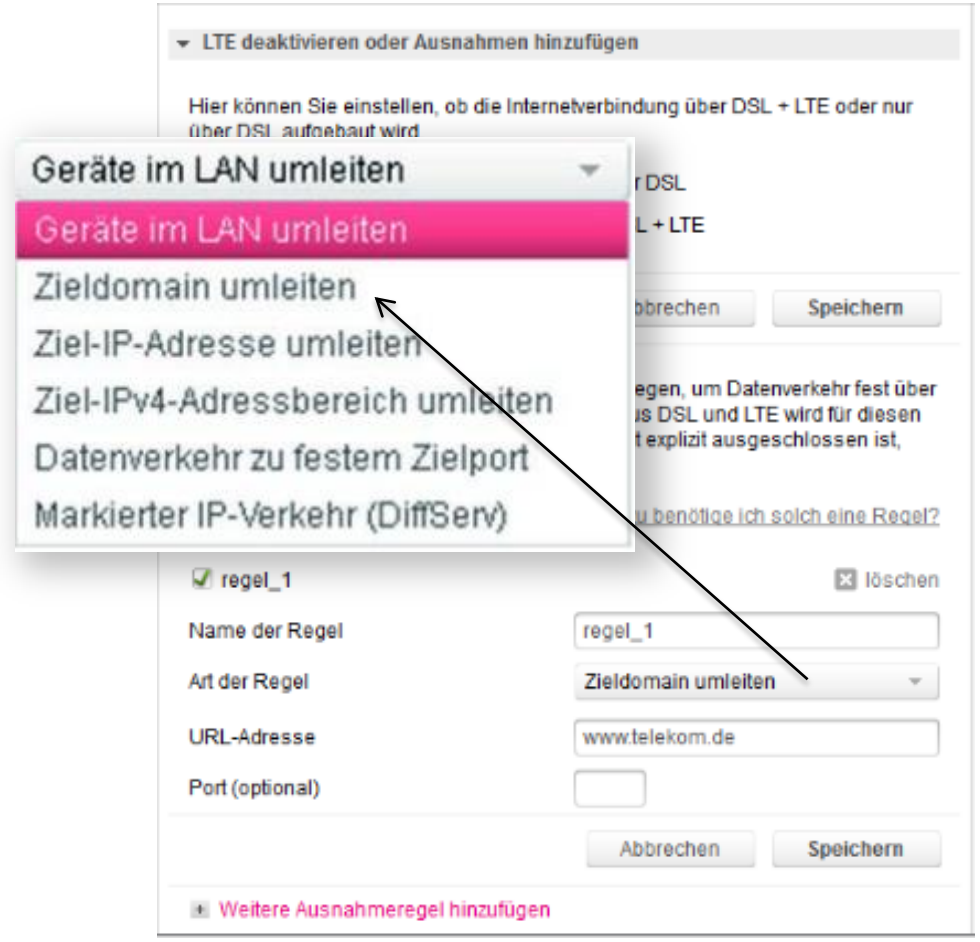


HYBRID ACCESS
SOME IMPLEMENTATION DETAILS

- Due to the requirements and time line, a GRE based approach was chosen (more details see [1]) in close cooperation with a partner (for Home Gateway and HAAP)
  - protocols extensions are public (IETF Draft)
- GRE based IPv6 only tunnel, per packet mechanism (with „cheapest pipe first“ enabled)
- Only best effort traffic is send over the tunnel
- Traffic control, traffic can be dynamically moved to/from tunnel interfaces without interruption of session
  - e.g. if traffic needs to be moved from wireless/mobile interface to fixed line interface
- Customer can define filter rules to bypass the tunnel
  - also used for DT specific services, e.g. IP Multicast/IPTV (no multicast replication @ HAAP) or VoIP
- Not only bundling of interfaces possible, also other use cases possible
  - e.g. redundancy

HYBRID ACCESS
BYPASS TRAFFIC („FILTER“)

- Customer is able to switch on/off the LTE modem (aka: enable/disable hybrid access)
- In addition, bypass traffic can be defined using different rules
  - specific devices inside LAN environment
  - based on domain name
  - based on IPv4/IPv6 addresses
  - destination port
  - DiffServ traffic (non BE)



HYBRID ACCESS
MORE INFORMATION

[1] http://www.geschaeftsbericht.telekom.com

[2] http://www.golem.de/news/festnetz-und-mobilfunk-telekom-hat-58-000-hybrid-kunden-1508-115626.html

[3] draft-zhang-banana-tcp-in-bonding-tunnels-00.txt, Flow Control for Bonding Tunnels

[4] draft-zhang-gre-tunnel-bonding-04.txt, GRE Tunnel Bonding

[5] „Schnelles Doppel“, c‘t Magazin, 7/2016, pages 150 & 151

[6] http://www.telekom.de/privatkunden/zuhause/internet-und-fernsehen/das-ist-hybrid

[7] draft-zhang-banana-problem-statement-03.txt, Banana Problem Statement

THANK YOU