CARRIER LANDSCAPE FOR SDN
NEXT LEVEL OF TELCO INDUSTRILIZATION?

Andreas Gladisch, Fritz-Joachim Westphal

Deutsche Telekom Innovation Labs

ERLEBEN, WAS VERBINDET.

COMPLEXITY BY DOZENS OF SPECIALIZED BOXES AND THOUSANDS OF PROTOCOLS .


Message Router


CDN

Session Border Controller


WAN Acceleration


Video processing


DPI


Firewall


Carrier Grade NAT


Tester/QoE monitor


Load Balancer


SGN/GGSN


PE Router


BRAS


Radio Network Controller

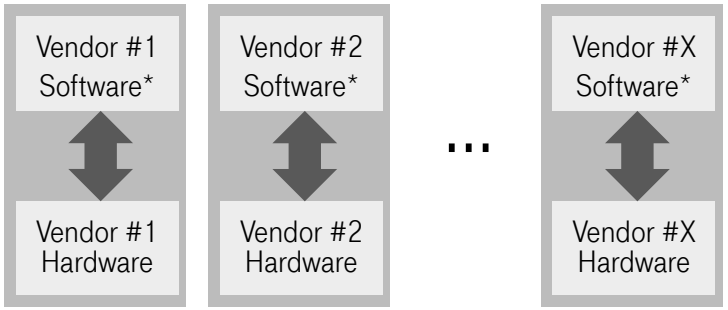

SGW, PGW

How can we get rid of the specific boxes, especially gateways & middle-boxes? SDN promised a drastic simplification.

BESIDE COMPLEXITY, ALSO VENDOR LOCK-IN MAKES LIVE OF OPERATORS DIFFICULT.

High platform complexity

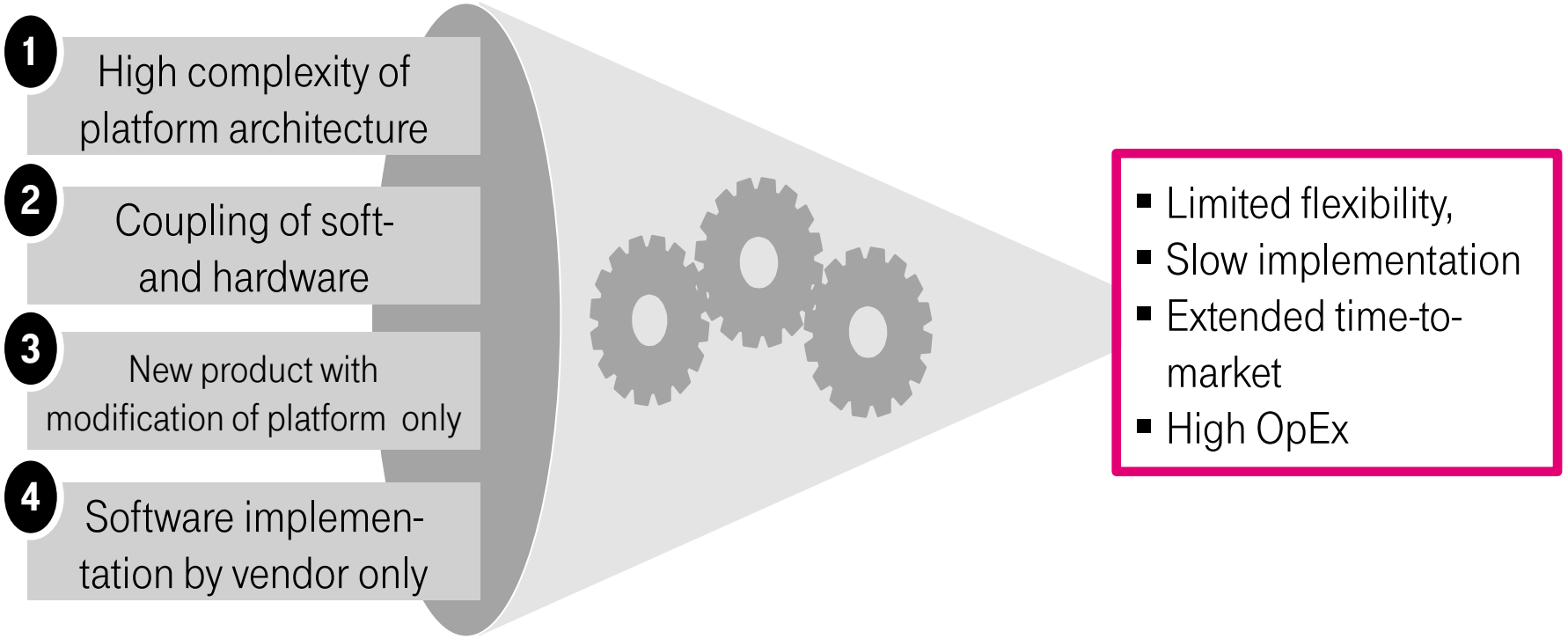
Vendor lock-in style of eco-systems



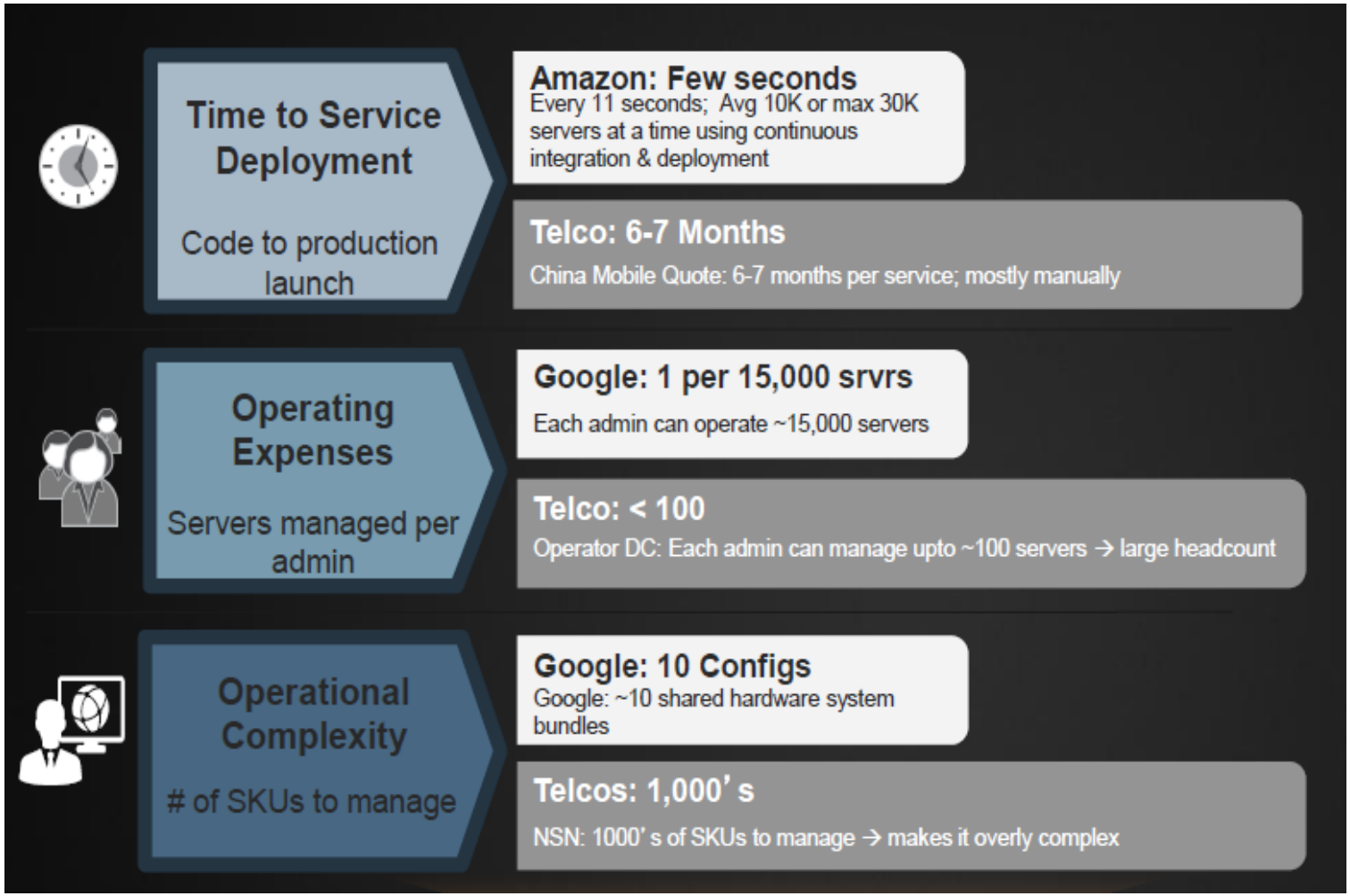
- New products with modifications of platform only
- Software implementation by vendor only

➢ **Limited flexibility, slow implementation, Extended time-to-market**

DIFFICULT TO EFFICIENTLY REALIZE NETWORK SERVICE INNOVATIONS.



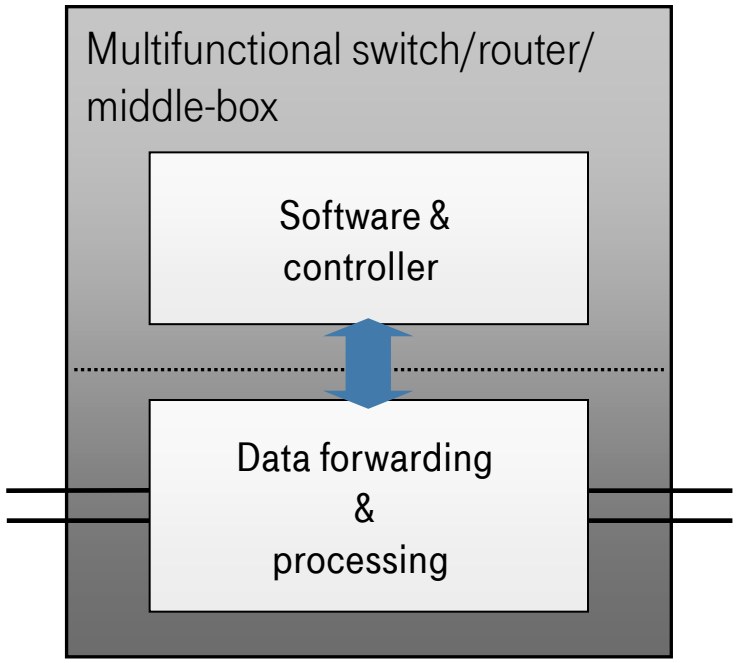
TRENDS IN IT: ORDER OF MAGNITUDE CHANGES ARE UN-STOPPABLE (JUNIPER'S VIEW).



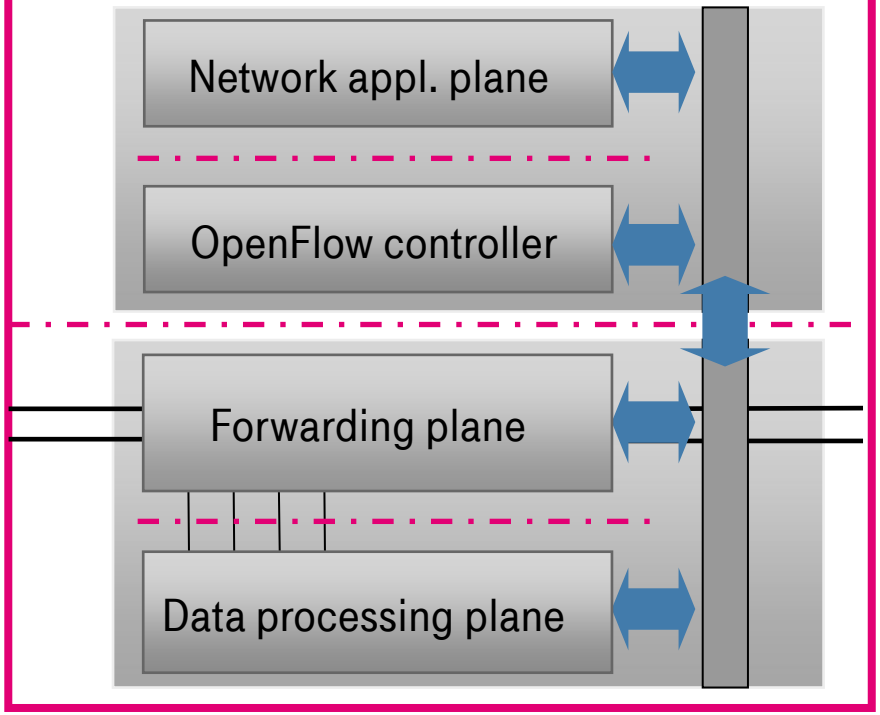
MODULARIZATION & STANDARIZED INTERFACES.

MASSIVE LOWERING OF MARKET AND INNOVATION BARRIER.

Today: Monolithic box



Split Architecture

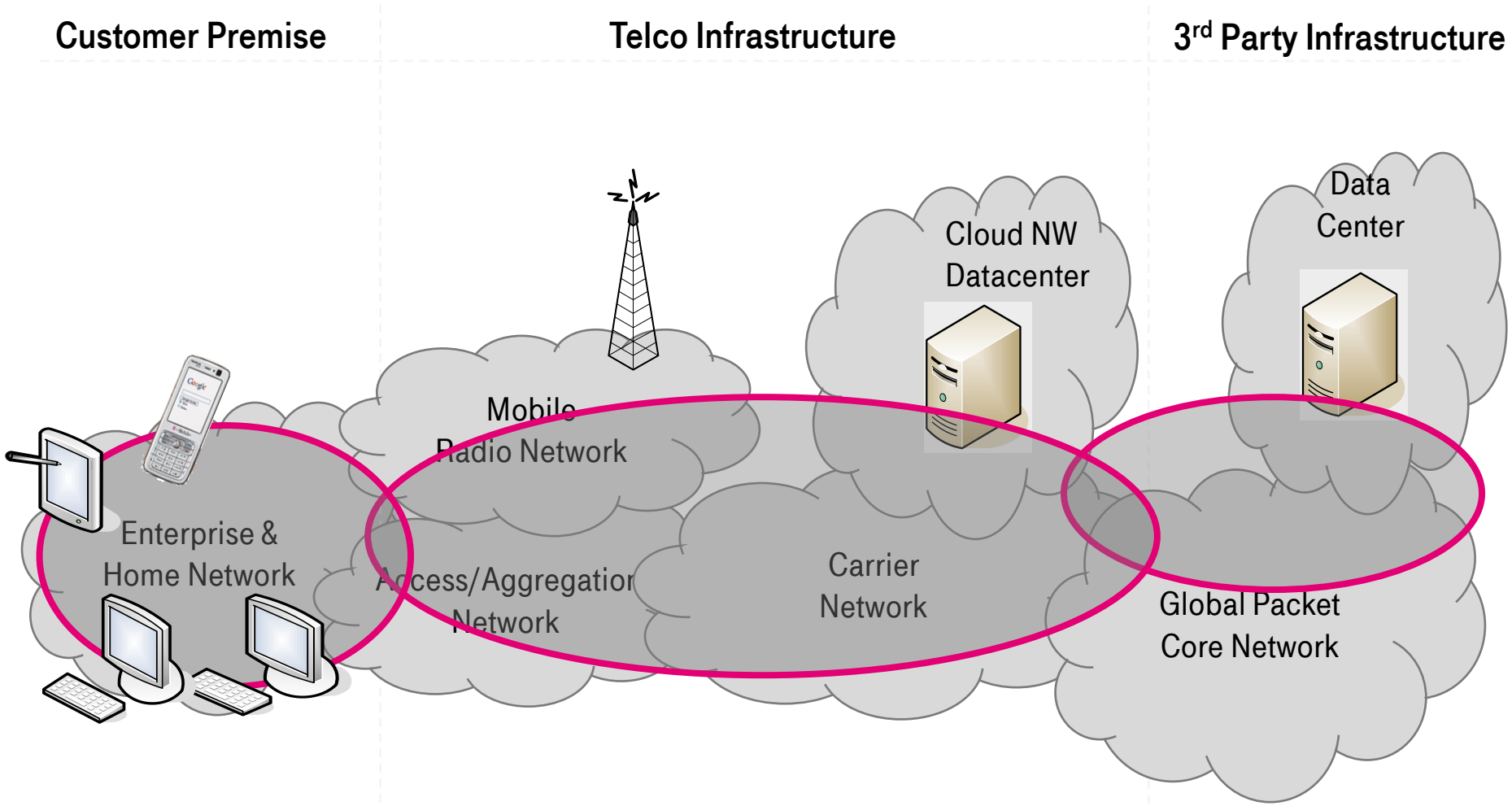


Split of software centric and hardware centric part;
Split of application and control (software); Split of forwarding and processing (hardware).

SDN.
THE TECHNICAL SOURCES OF THE TREND.

How to program forwarding decisions?	Seamless DC virtualization/orchestr.	Can we simplify the middle boxes ?
Academic driven development to control flexibility of forwarding. **Example:** OpenFlow 1.3 **Missing:** ▪ Abstraction of process. actions ▪ Higher level abstraction/ aggregation of functions	**Fast setup of virtual topologies integrated in virtualization /orchestration. framework** **Example:** Open vSwitch OpenStack **Missing:** ▪ L4-L7 integration ▪ Higher level of abstraction	**Virtual Firewall, virtual Load-balancer, virtual ePC on top of x86.** **Example:** ETSI Group on NFV **Missing:** ▪ Activities just started
Campus networks Enterprise Networks	**Inner DC SDN DC interconnect**	**Virtualisation of network functions like ePC**

MANY USE CASE AREAS IN THE TELCO REALM.



= owned and operated by DT = owned and operated by other (e.g. content provider)

GOOGLE DATA-CENTER – INTERCONNECTION

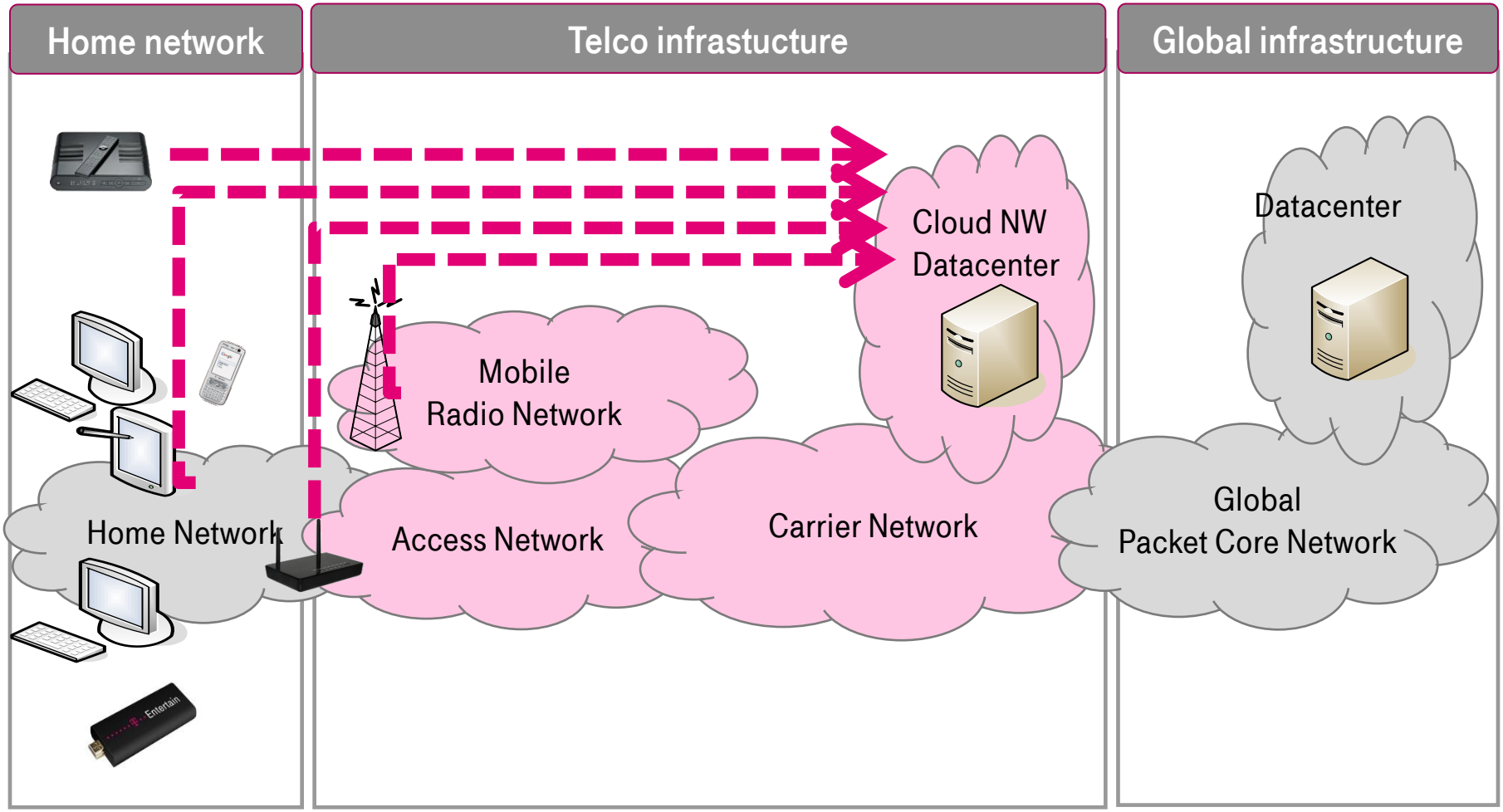
Design Príncipes

- B4 routers built from merchant switch silicon
- Drive links to 100% utilization
- Centralized traffic engineering
- Separate hardware from software

Challenges

- Sacrifice hardware fault tolerance, deep buffering, and support for large routing tables.
- Packet loss becomes inevitable with substantial capacity loss during link/switch failure.
- No existing protocols for functionality. Requires knowledge about site to site demand and importance.
- Previously untested development model. Breaks fate sharing between hardware and software.

MANY USE CASE AREAS IN THE TELCO REALM.
EXAMPLE: CLOUD NETWORK CE NTRIC SERVICES.



THERE ARE TO MANY NETWORKS.

HARMONIZE ARCHITECTURE OF FIXED, MOBILE AND WIRELESS.

Motivation for harmonization

- Customers using several mobile devices in addition to fixed Internet access @home, @work.
  - Count the # of attachment points you use per day!
  - Customers are missing consistent user experience
- Different network interfaces use entirely different network architectures.
- Paths from user to the same content converge only deep in the network, if at all.
- We know the disadvantages in terms of operations, complexity, cost.

LINUX FOUNDATION PROJECTS RELEVANT FOR TELCOS

Carrier Grade LINUX (self telling name: defining requirements)

CGL has two main functions. First, interface with network equipment providers & carriers to gather requirements & produce specifications that Linux distribution vendors can implement. Second, to take unimplemented requirements & foster development projects that will meet these requirements & assist in their upstream integration.

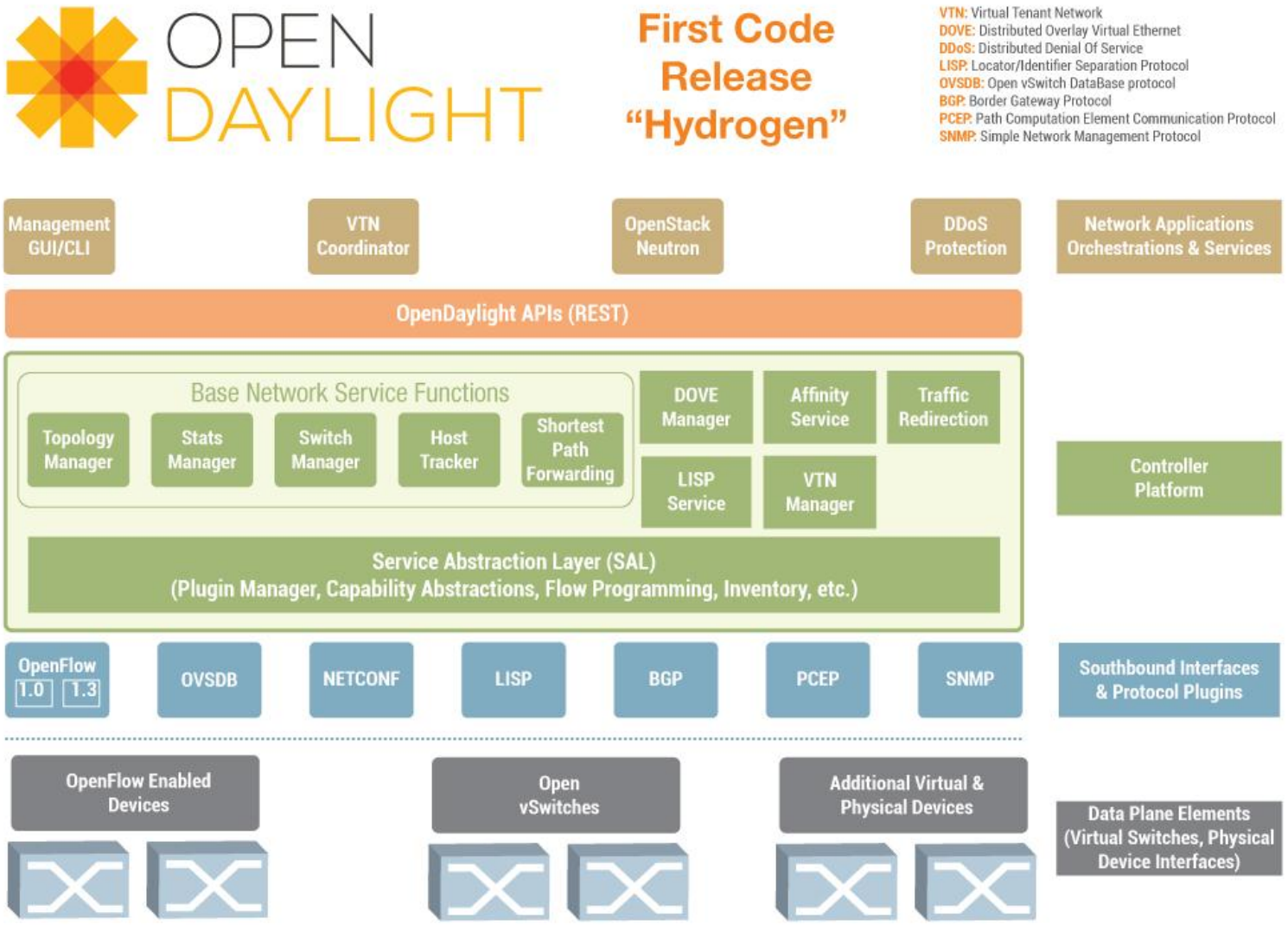
Yocto (Build System and Production)

Yocto provides open source, high-quality infrastructure and tools to help developers create their own custom Linux distributions for any hardware architecture and across multiple market segments. Yocto is intended to provide a helpful starting point for developers.

Open Daylight (SDN Applications)

With Open Daylight, a community has come together…through the combination of open community developers & open source code & project governance that guarantees an open, community decision making process on business & technical issues. Establishing an open source project in this way is designed to help accelerate the development of technology available to users & enable widespread adoption of Software-Defined Networking.

SDN STANDARDIZATION.
CAN WE ACHIEVE A LINUX LIKE OPEN SOURCE MODEL ?

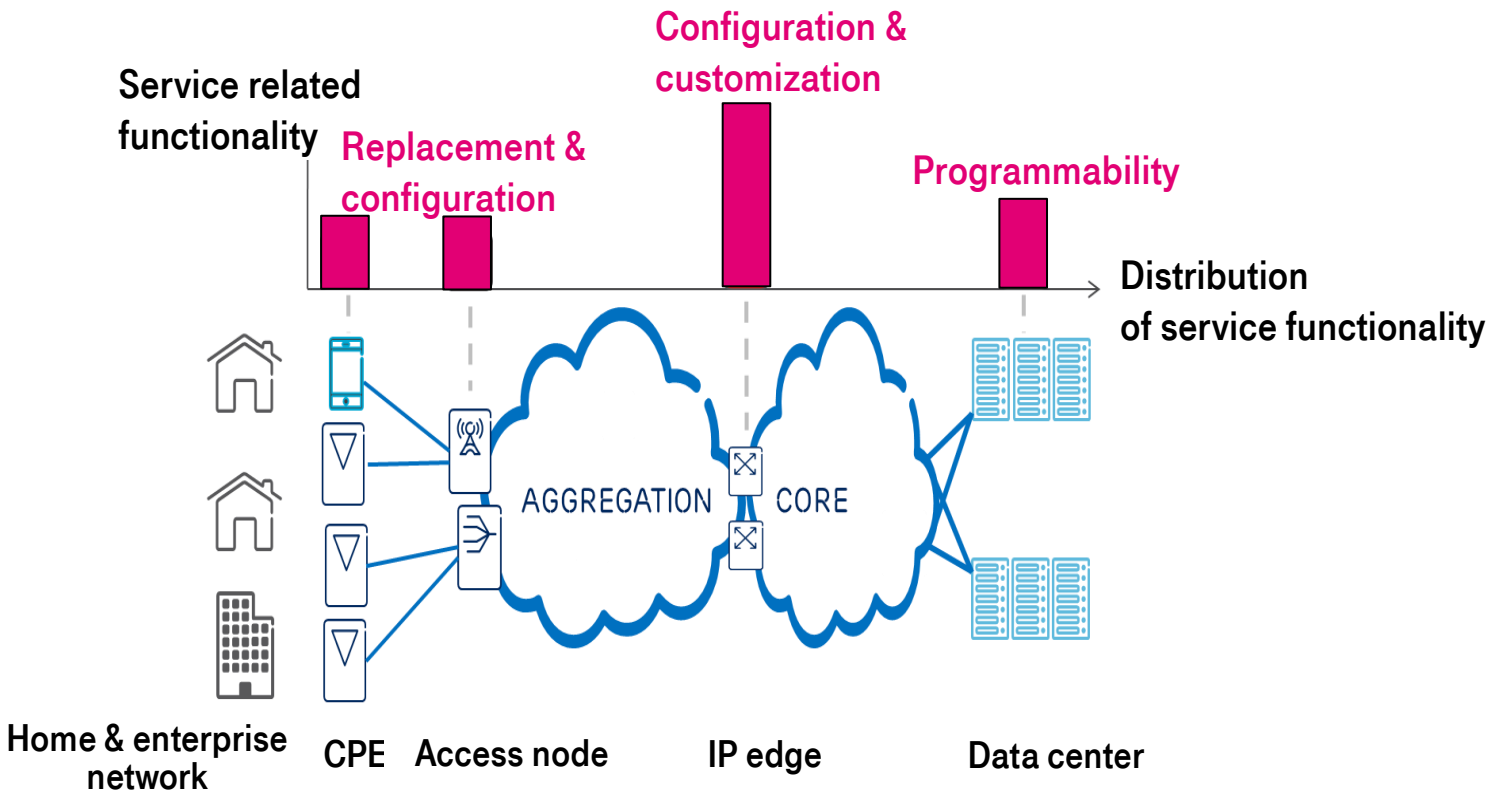


RELEVANCE OF OPEN SOURCE SOFTWARE IS INCREASING.

- MPLS components at : http://www.openflow.org/wk/index.php/OpenFlowMPLS_NOX
- Multitechnology Soft L3/L2 Switch (like OpenVswitch for x86) : https://www.codebasin.net/
- SDN library for building recursive controller and data-path elements: https://www.codebasin.net/redmine/project/rofl-core
- Experimental Network Virtualization „Vertigo“ http://fp7-ofelia.github.io/vertigo/
- Experimental Network Virtualisation Toolkit http://fp7-ofelia.github.io/ocf/

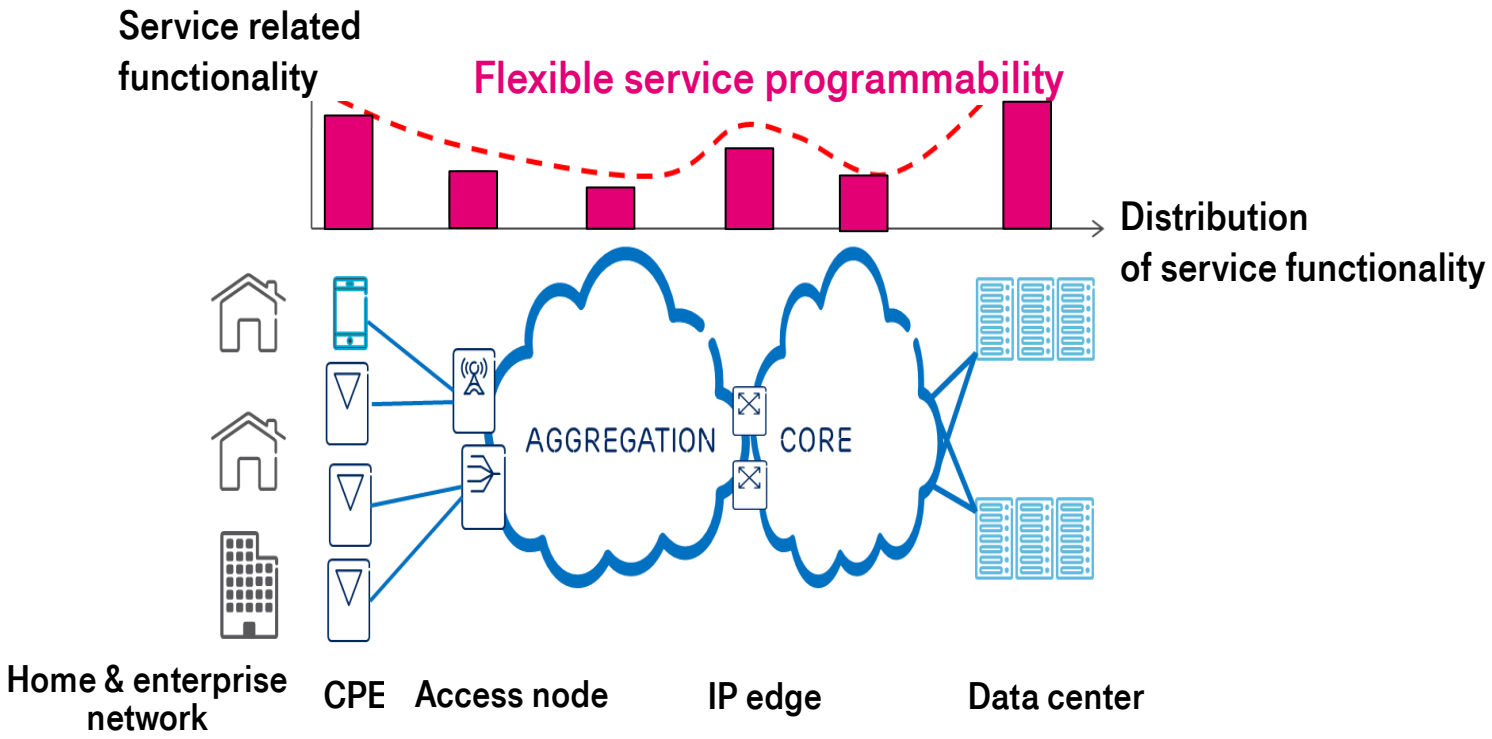
TODAY'S ARCHITECURE.

Limited option to optimize placement over time. Programmability in data center only.



VISION, ASSUMING SDN PROGRAMMING OF TRANSPORT & SERVICES: SERVICE CHAINING.

Flexible service programmability will allow optimised and dynamic placement of recources.



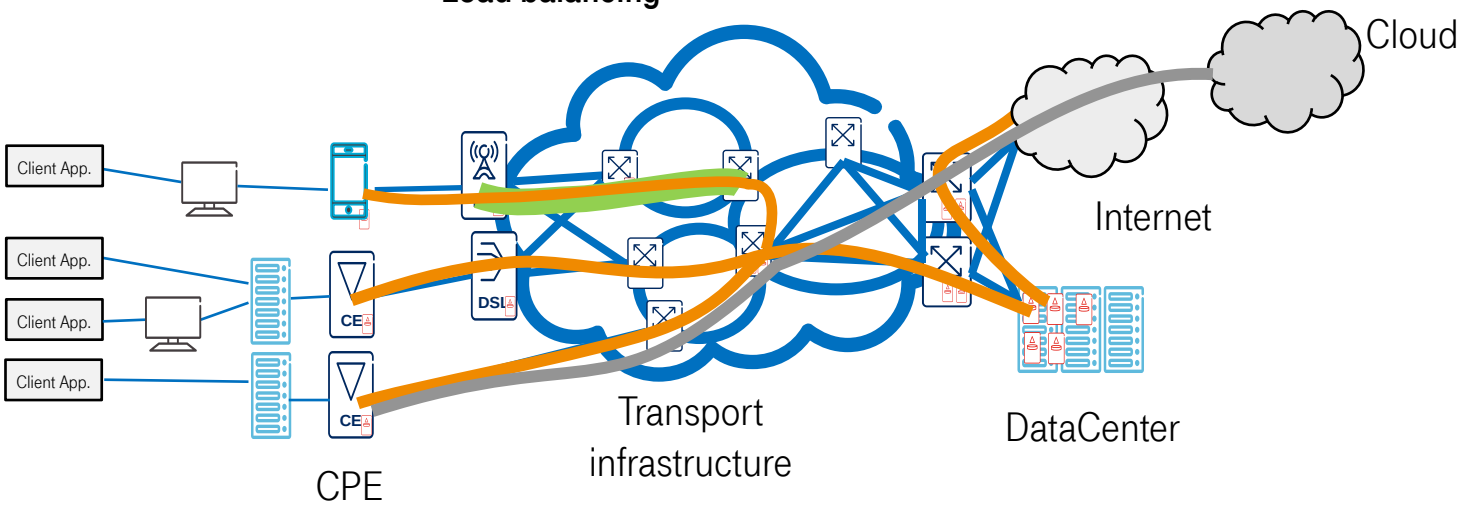
EXAMPLE OF SERVICE CHAINING: ADVANCED VPN

L2 or L3 VPN TIED WITH VALUE ADDED SERVICES

DMZ handling
Mobile access from APN
HTTP header enrichment
Perimeter protection between corp/guest access
Path optimisation
NAT
Firewall

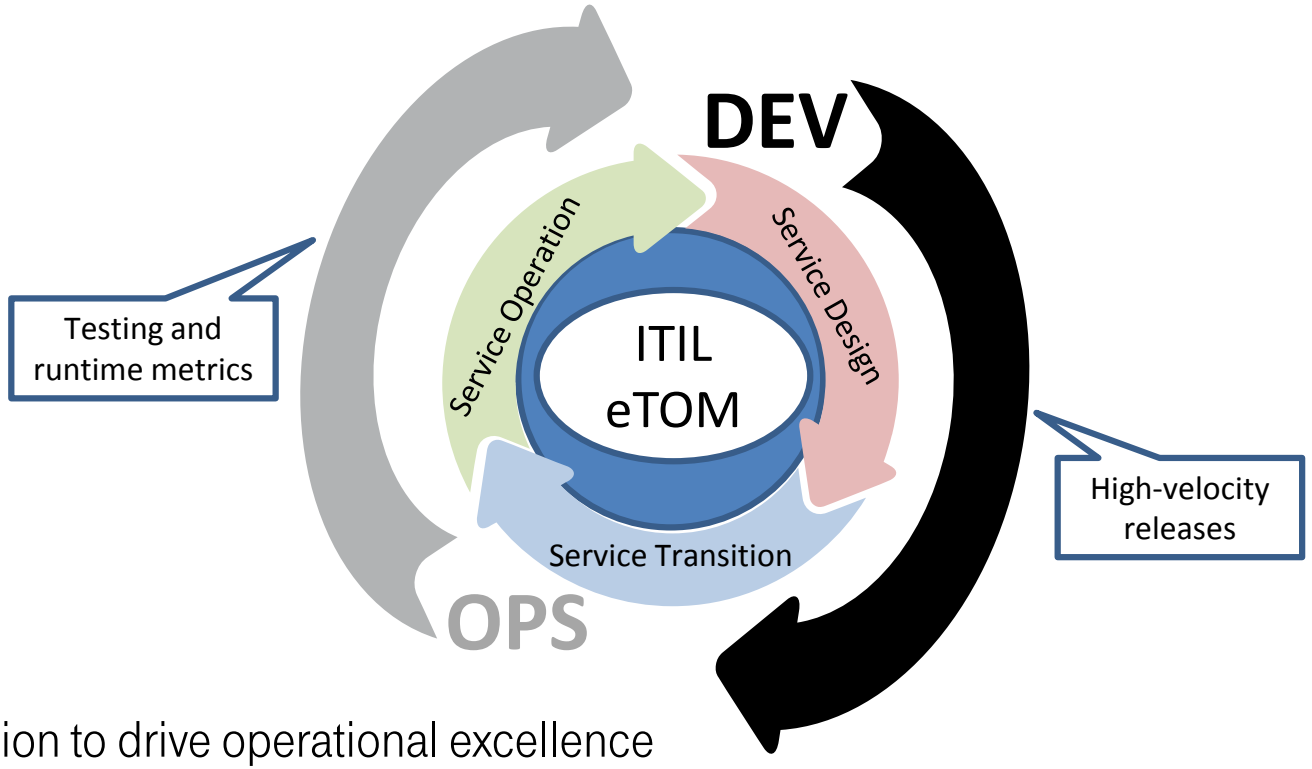
AV scanner
Cache
Spam filter
DPI
IPS, IDS
Content filtering
Internet access gateway
Load balancing

Traffic shaping
Storage
Customer's cloud scale-out
AAA for each leg
DHCP
Expandability to VPSs



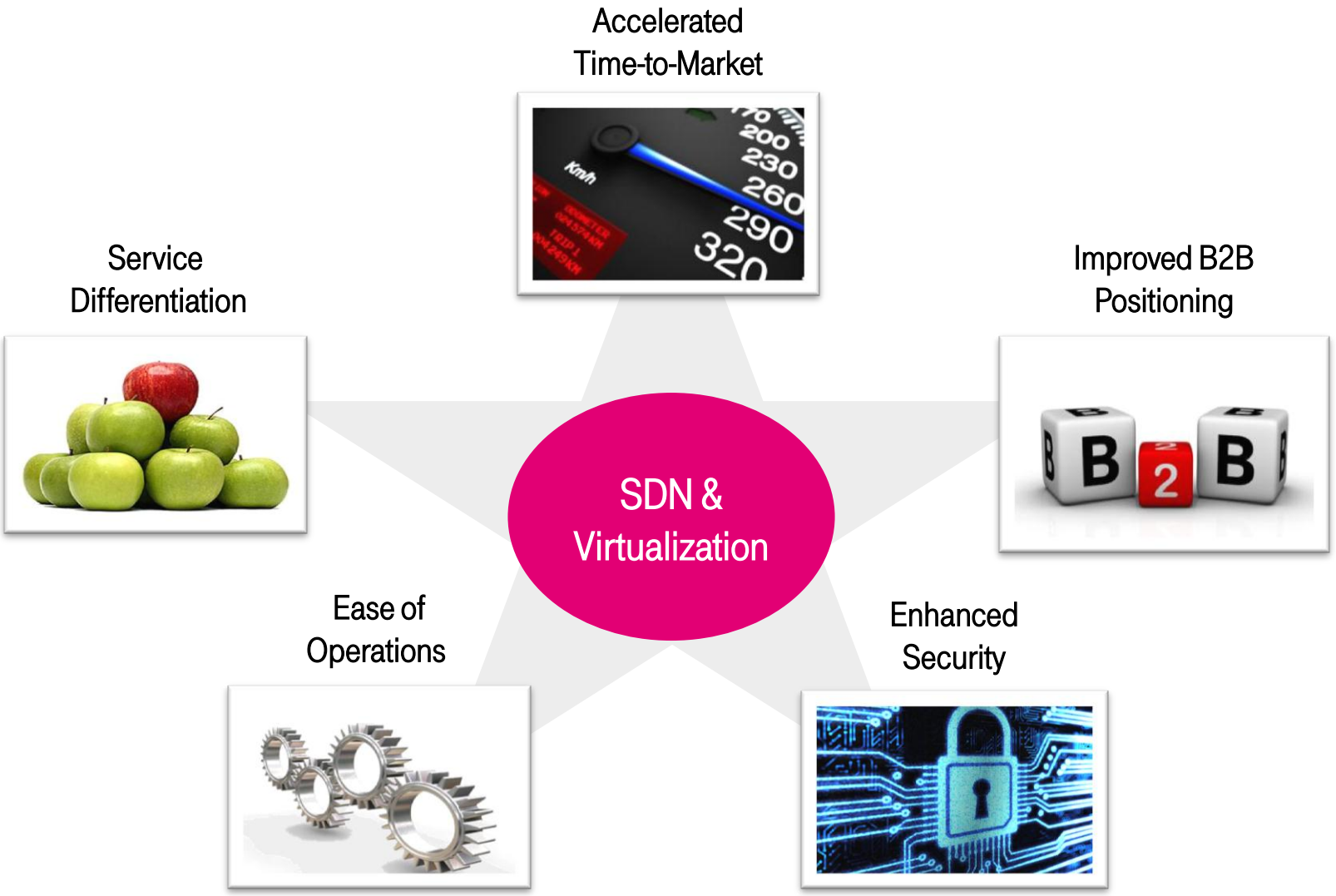
KEY ISSUES FOR OPERATION OF FUTURE NETWORKS: COMBINATION OF DEVELOPER AND OPERATOR

- Support service velocity by being close to developers



- Automation to drive operational excellence
  - Verification, Observability, Activation

THE PROMISE OF SDN & VIRTUALIZATION FOR AN OPERATOR.



SDN – NEXT STEP IN INDUSTRALIZATION

THANK YOU.


Fritz-Joachim Westphal
Network Architecture & Modeling
Telekom Innovation Laboratories
Deutsche Telekom AG
Ernst-Reuter-Platz 7
10587 Berlin, Germany
Phone: +49 30 8353 58865
E-Mail: fritz-joachim.westphal@telekom.de
om Innovation Laboratories