NETWORK SLICING IN 5G

Hans J. Einsiedler

ERLEBEN, WAS VERBINDET.

WHY WE NEED 5G!

SATISFACTION OF FUTURE USE CASES

Broadband access everywhere

50+ MBPS EVERYWHERE

Broadband access in dense areas

PERVASIVE VIDEO

Higher user mobility

HIGH SPEED TRAIN

Massive Internet of Things

SENSOR NETWORKS

Extreme real-time communications

TACTILE INTERNET

Lifeline communications

NATURAL DISASTER

Ultra-reliable communications

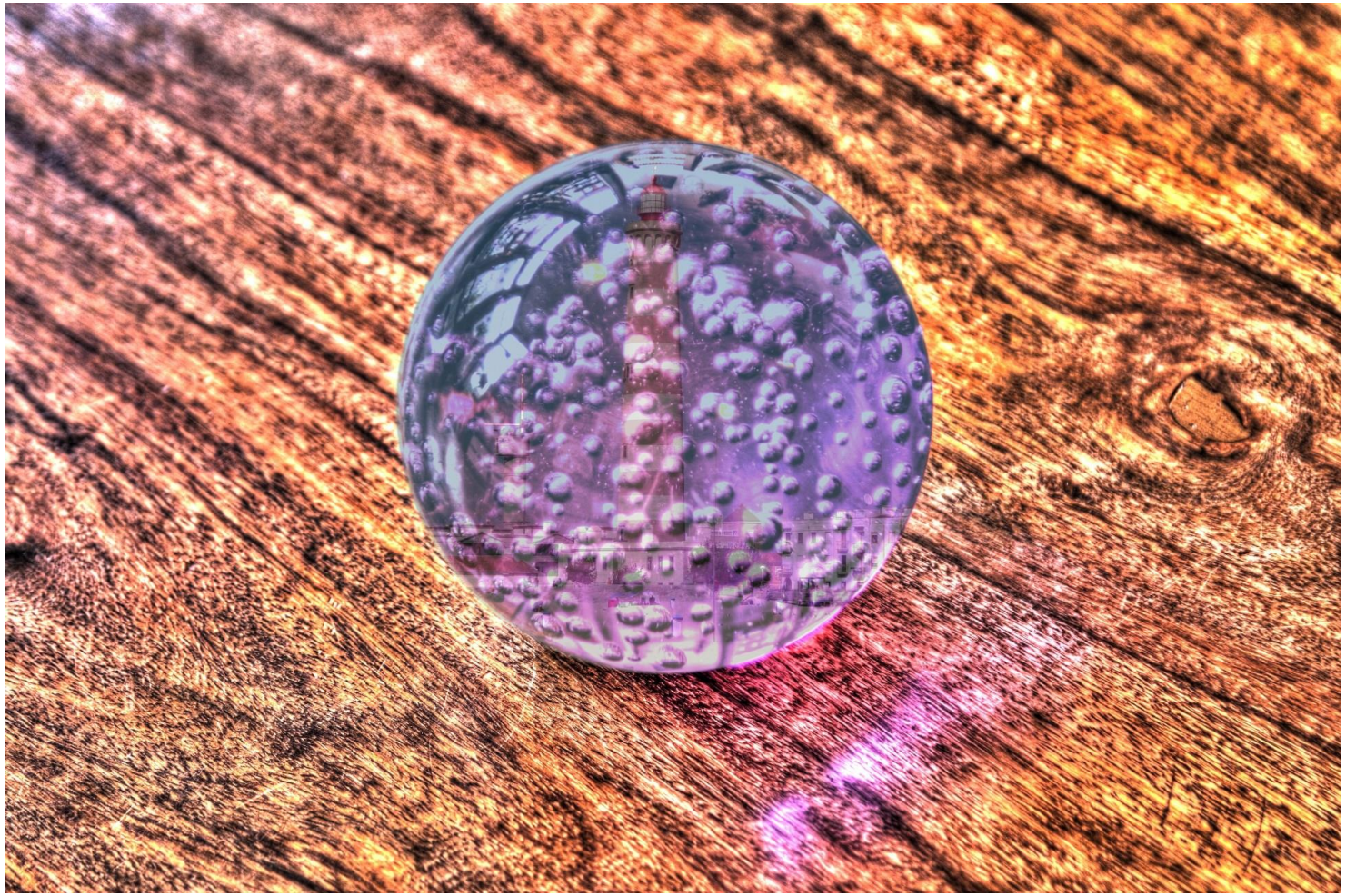
E-HEALTH SERVICES

Broadcast-like services

BROADCAST SERVICES

THE MOST IMPORTANT USE CASE - THE UNKNOWN ONE!

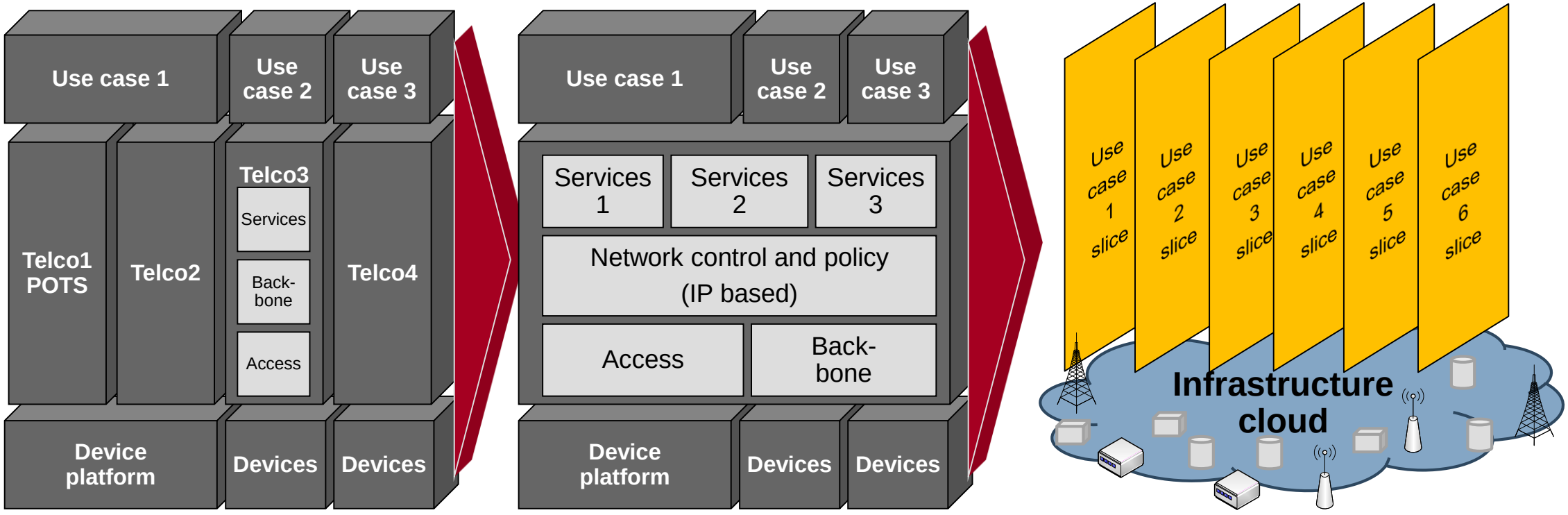
WE CANNOT SEE INTO A CRYSTAL BALL!



© John Joachim Hermit

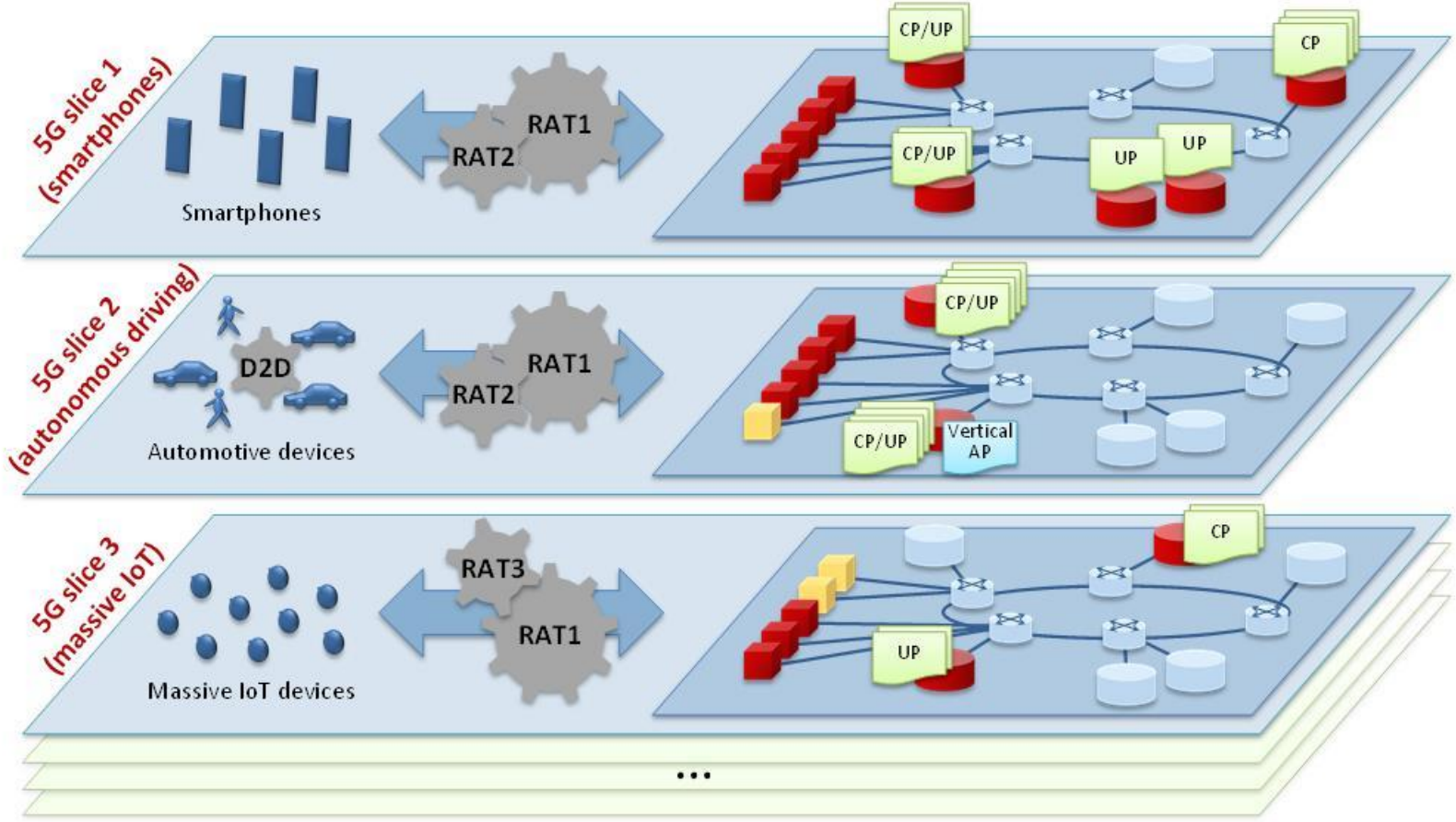
EVOLUTION OF THE NETWORK INFRASTRUCTURE

FROM SILOS OVER MONOLITHS TOWARDS SLICES



USE CASES MAPPED TO NETWORK SLICES

REQUIREMENTS WILL DEFINE THE NETWORK SLICES

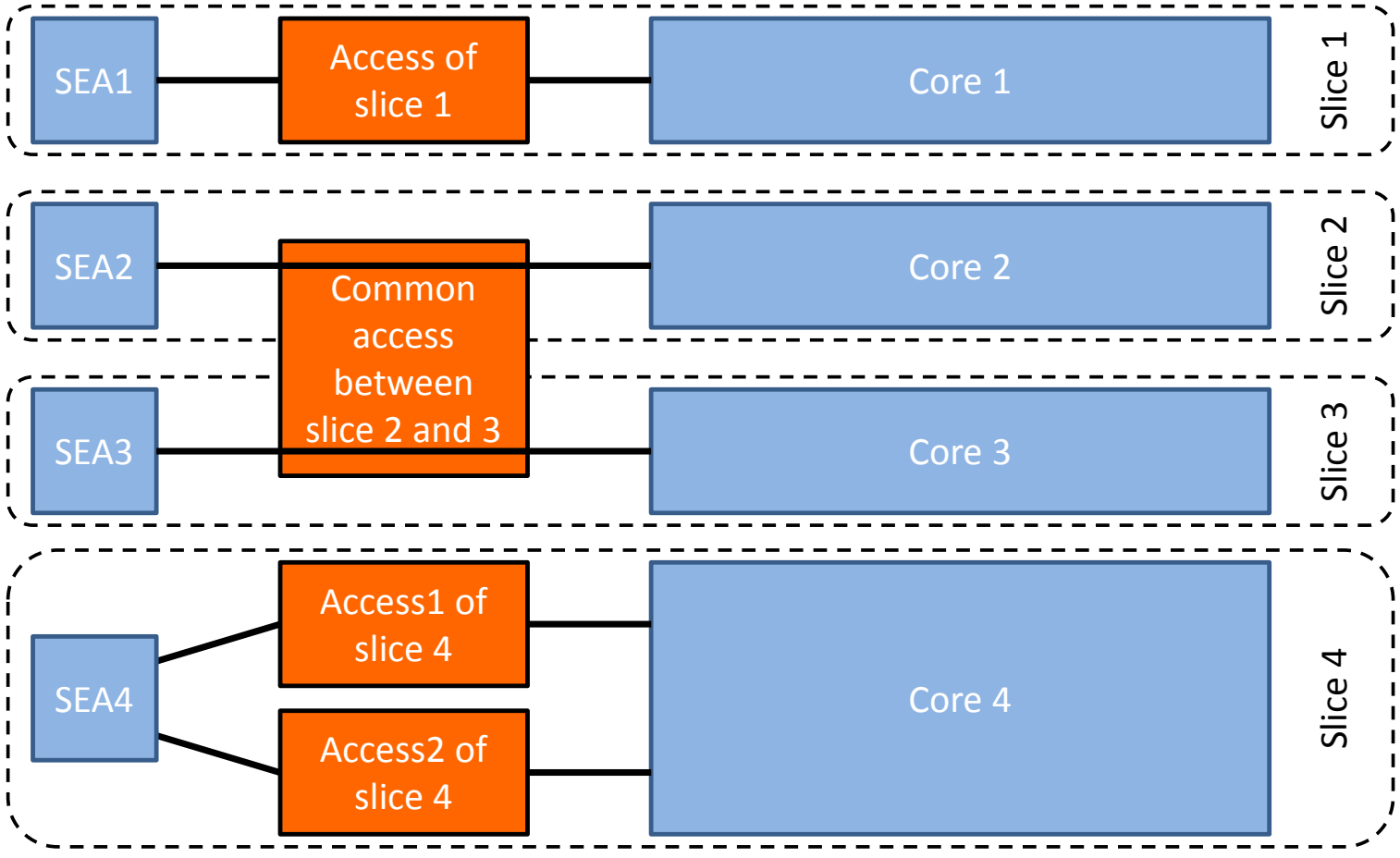


RAT= Radio Access Technology; CP = Control Plane; UP= User Plane; AP= Access Point; IoT= Internet of things; D2D = Device to Device

SLICES – A SERVICE DRIVEN APPROACH

NEW VIEW ON NETWORKING - ESPECIALLY ON THE END-SYSTEMS

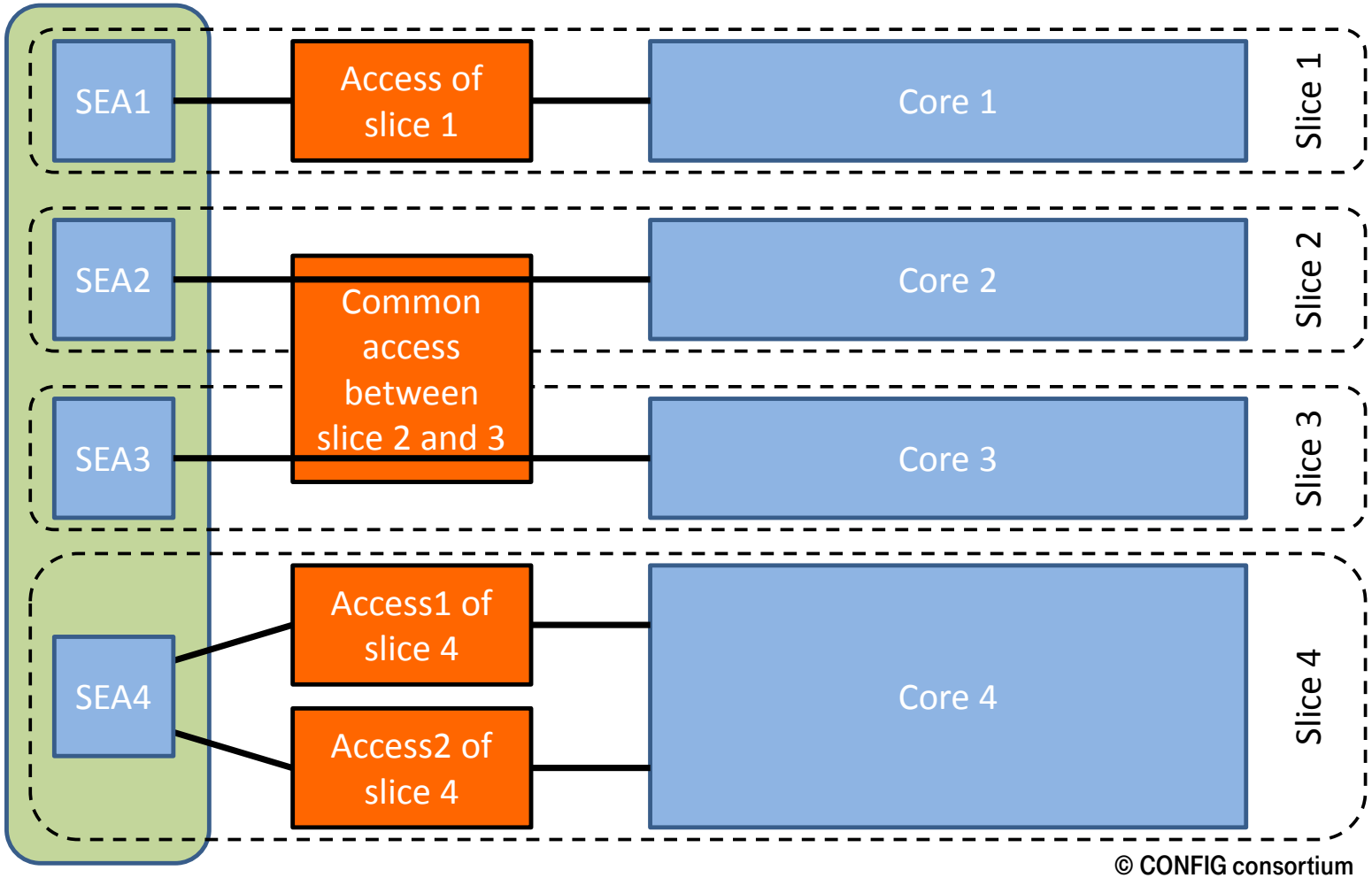
- Different possibilities to implement slices
- End systems (terminals) are part of the slice
- 3GPP and ETSI expression User Equipment (UE) misleading therefore new expression needed – proposal: Service End-point Agent (SEA)



IMPORTANT SLICE ISSUE: SERVICE END-POINT AGENT

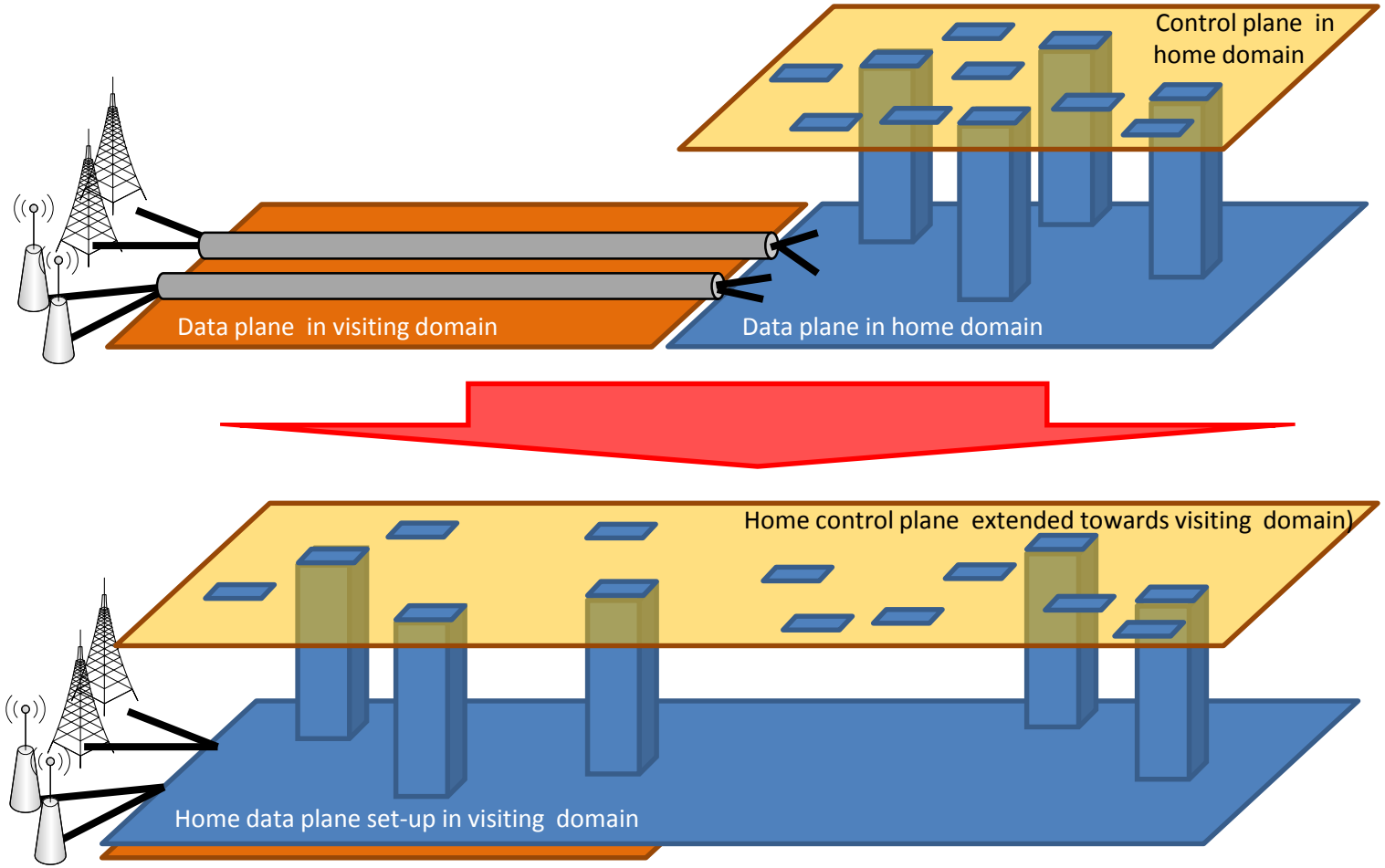
END-SYSTEMS NOT SEPARATED FROM THE NETWORK

- End-system (physical node) can be part of different slices as long as the end-system hosted different SEAs
- SEA has to be addressed through name or identifier
- ID management become very important in slicing



SLICING OFFERS INTERESTING OPPORTUNITIES (1)
ROAMING IN VISITING DOMAINS

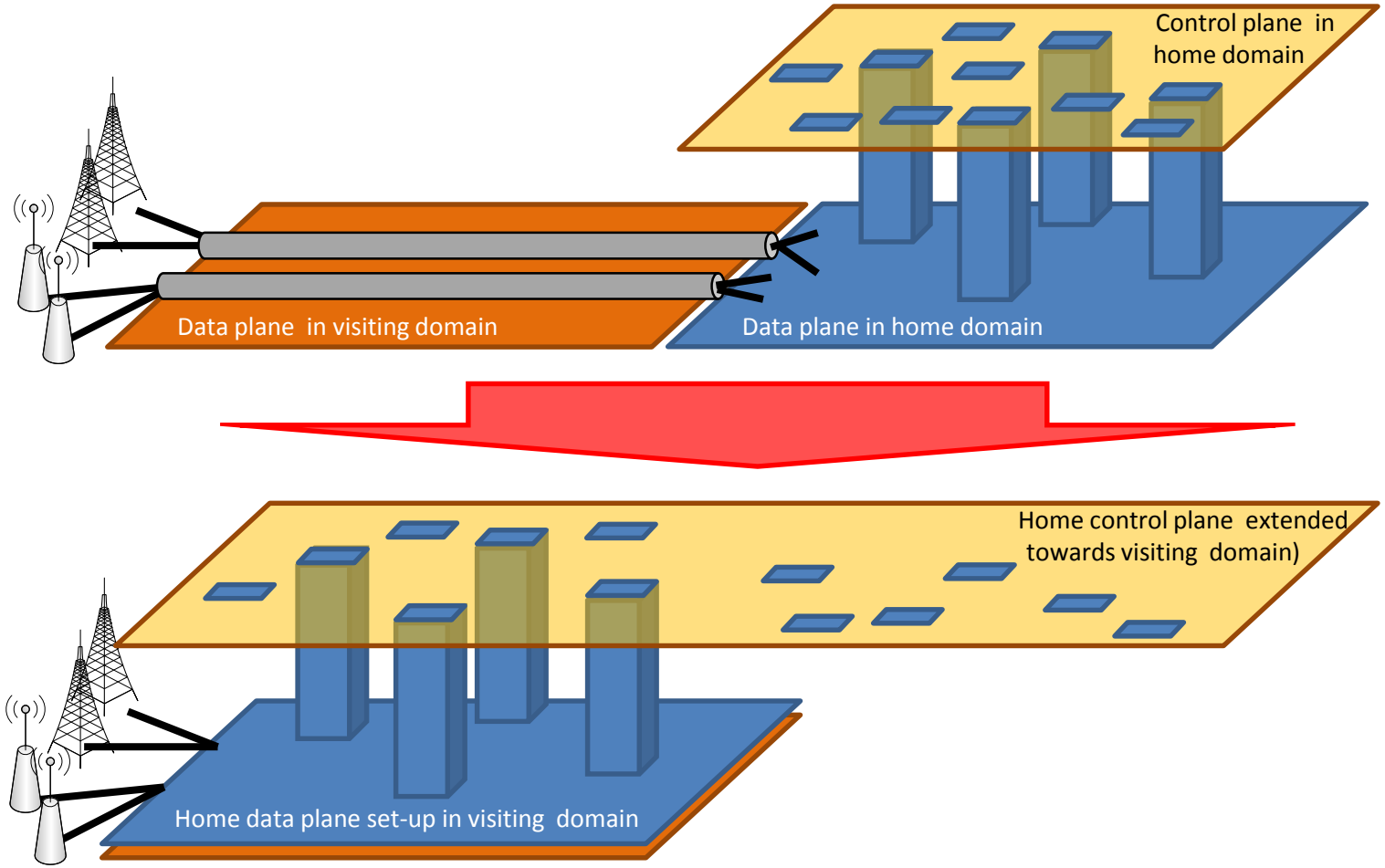
- Local infrastructure can be extended towards other operator domains – visiting domains
- Some control and data plane functions will be moved into the visiting domain
- Legal interception control points (control and data plane) can stay in the home domain



SLICING OFFERS INTERESTING OPPORTUNITIES (2)

LOCAL BREAK-OUT

- Operator become a virtual operator in the visiting domain
- Some control functions will stay into the home domain
- All data plane function will be moved to the visiting domain
- Legal interception control plane function will stay in the home domain, data plane function will be in the visiting domain



MODULARIZATION AND CONTEXT AWARENESS IS NEEDED

TWO SUCCESS STORIES

- Modularization:
  - TR23.799 v0.8.0 is included in "Solutions for Key Issue 7: Network function granularity and interactions between them", Section 6.7.4.
- Context awareness:
  - Key points included as text in Section 5.9 "Key Issue 9: 3GPP architecture impacts to support network capability exposure and context information awareness".

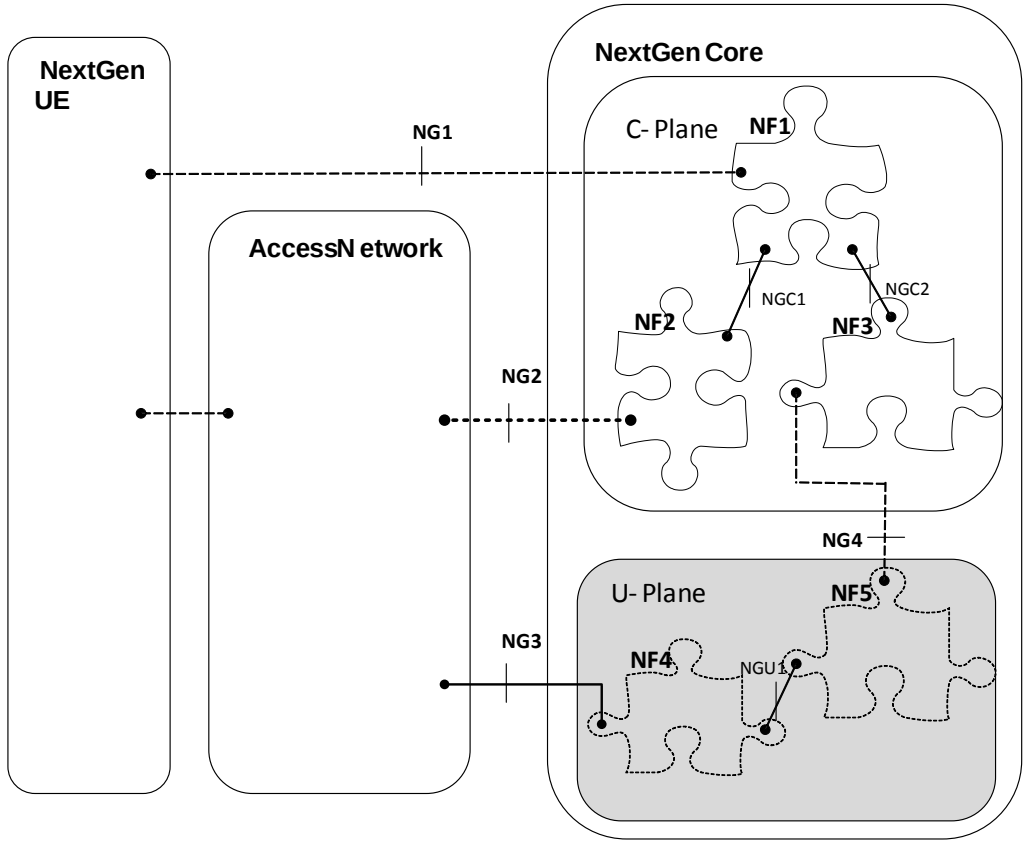
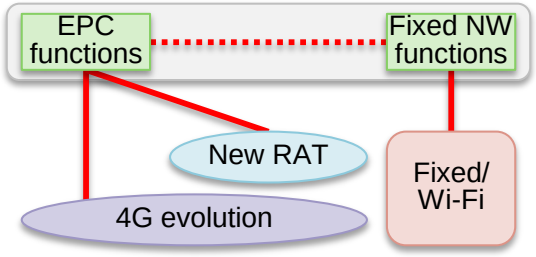
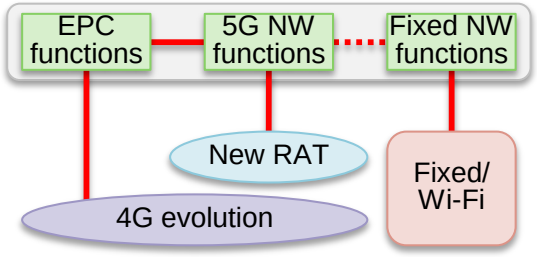
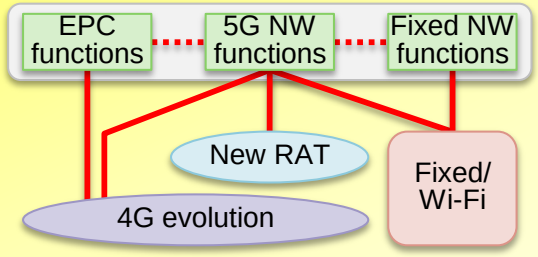


Figure 6.7.4.1-1: Architecture Modularization Reference Model

Source: 3GPP SA2 TR.23.799 v0.8.0

WHERE ARE WE NOW?

THREE OPTIONS – WHICH IS THE RIGHT ONE?

	Option 1	Option 2	Option 3
			
Pros	• No changes to 4G RAN • No need for revolutionary 5G NW functions design	• No changes to 4G RAN • 5G NW functions/ new RAT design can be optimized to fully benefit from new technologies (e.g., virtualization)	• 5G NW functions/ new RAT design can be optimized to fully benefit from new technologies (like virtualization) • Solves mobility issues of option 2 • Provides a sound migration path
Cons	• Tied to the legacy paradigm for all the use cases (which may be expensive)	• New design could only be utilized where there is new RAT coverage • Potential signalling burden due to mobility if the new RAT does not provide seamless coverage	• Impact on 4G RAN to support connections to EPC functions and 5G NW functions

NW Network
EPC Evolved packet core
RAN Radio access network
RAT Radio access technology

Defined interface/ reference point
Potential interface/ reference point

CONCLUSION

5G WILL BE A MODULAR PLUG AND PLAY INFRASTRUCTURE

- **Modular and flexible network architecture: No one-size-fits-all approach**
- **Virtual networks/network slices depending on use case requirements**
- **Context awareness will offer the possibility to optimize the infrastructure and the services**
- **ID management will be important not only to address the customer/end-system, it will also address the interconnection to the slice, the service execution environment**
- **End-systems become part of the network slice through Service End-point Agent (SEA)**

➔ **Future telecommunication infrastructure will be**

- **modular,**
- **software driven,**
- **access agnostic,**
- **virtualized, and**
- **sliced**

PARTICIPANTS AND ACKNOWLEDGEMENT

JOINED WORK OF INDUSTRY AND ACADEMIA

5G CONFIG

Current participants

http://www.5g-control-plane.eu/

Contact: Hans J. Einsiedler {hans.einsiedler@telekom.de}

THANK YOU!

LIFE IS FOR SHARING.