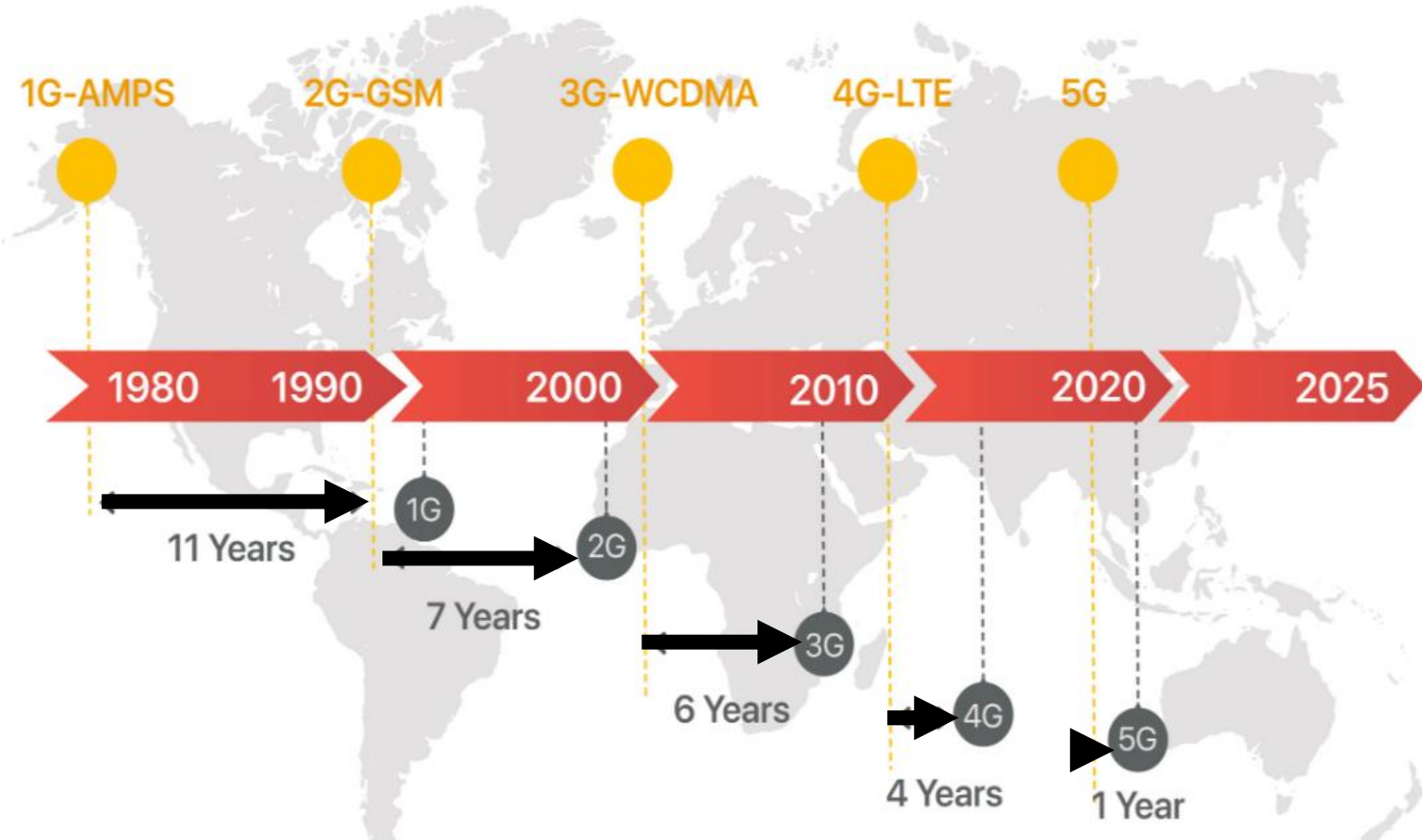
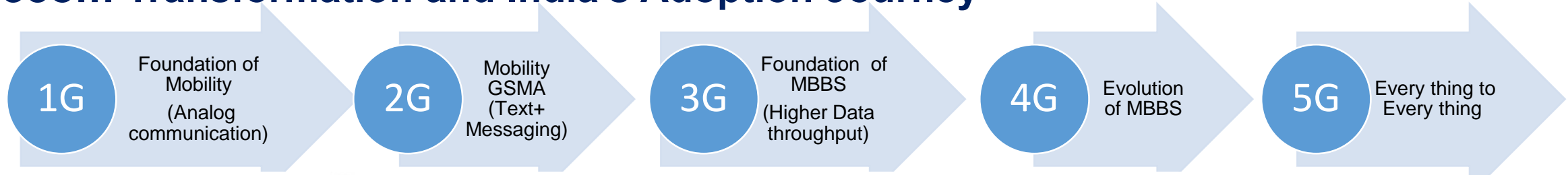


NFV SDN Conference

11-July-2019

Technology Evolution

Telecom Transformation and India's Adoption Journey



- ✓ During earlier days India was typically a market follower
- ✓ In recent years, India has been setting examples to be a Market leader








● Global Launch

● India Launch

India is no more a laggard in Global technology

Technology Evolution

Growth story in India – Geared up for future

	Country	% of Global New Additions
	India	24
	China	8
	Pakistan	4
	Nigeria	4
	Indonesia	3
	USA	3
	Brazil	3

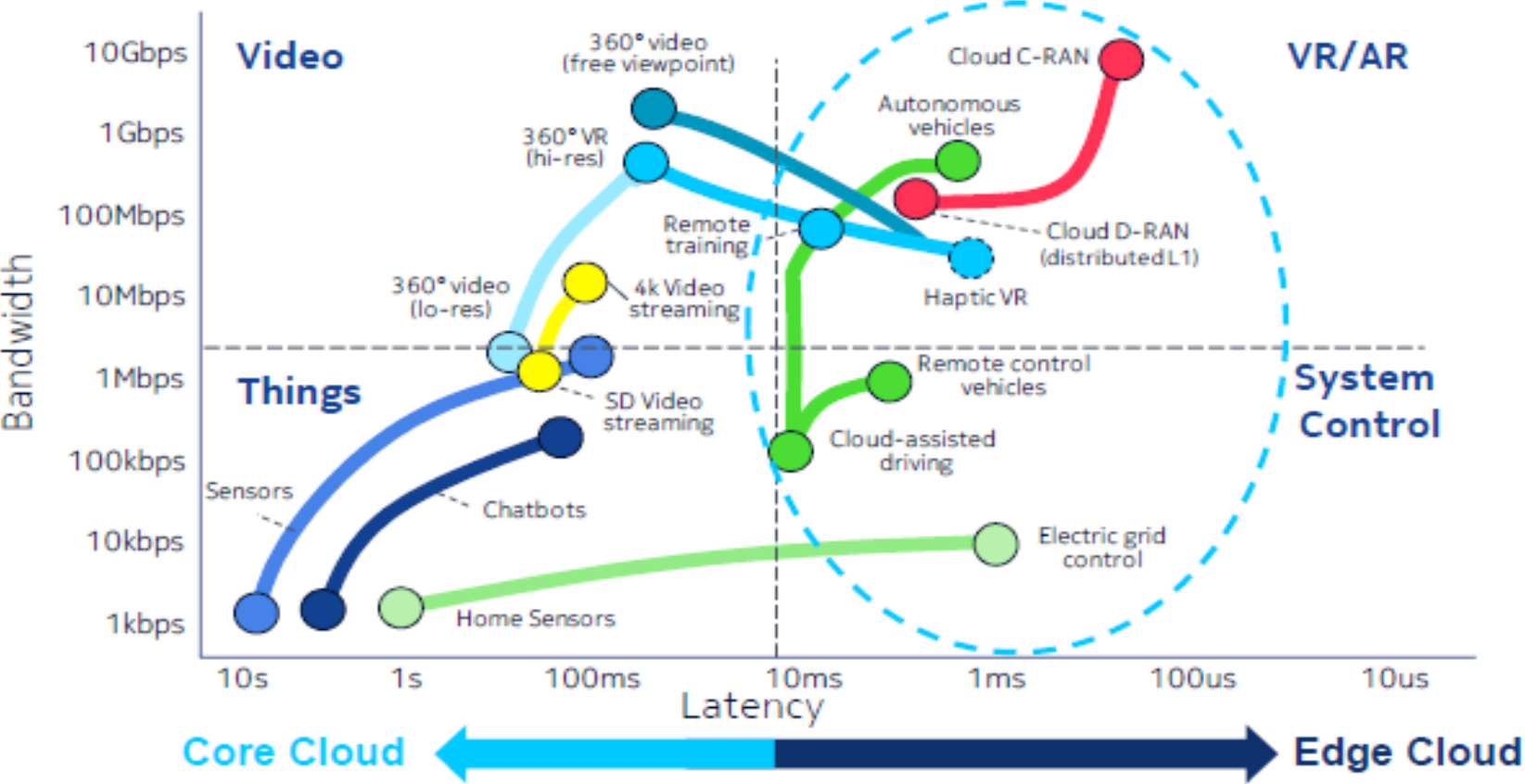
- ✓ India is seeing rapid migration to mobile broadband, particularly 4G-capable devices
- ✓ Entry of Jio in 2016 with 4G LTE-only network and focus on stimulating data traffic growth has been a major catalyst
- ✓ Operators are now focused on growing their 4G subscriber bases and building out coverage and capacity

Source : GSMA Intelligence

- **Ranked #1** in Global Data Consumption. Total **Data carried > 4 major MNOs** in USA
- **Video Centric behavior:**
 - YouTube, Hotstar, JioTV, Netflix, Amazon Prime
 - Social media like WhatsApp, FB, Instagram, etc.
- Ind-Pak CWC2019 match – **11 Million** Hotstar viewers.
- **800+ TV channels.** Each **major channel** has its own **Mobile App** (Zee, Sony, Eros Now, Alt Balaji, etc.)
- All major channels will eventually upgrade to **4K/8K**

24% of the new global subscribers will come from India by 2025

Redefining Network Requirements for Future

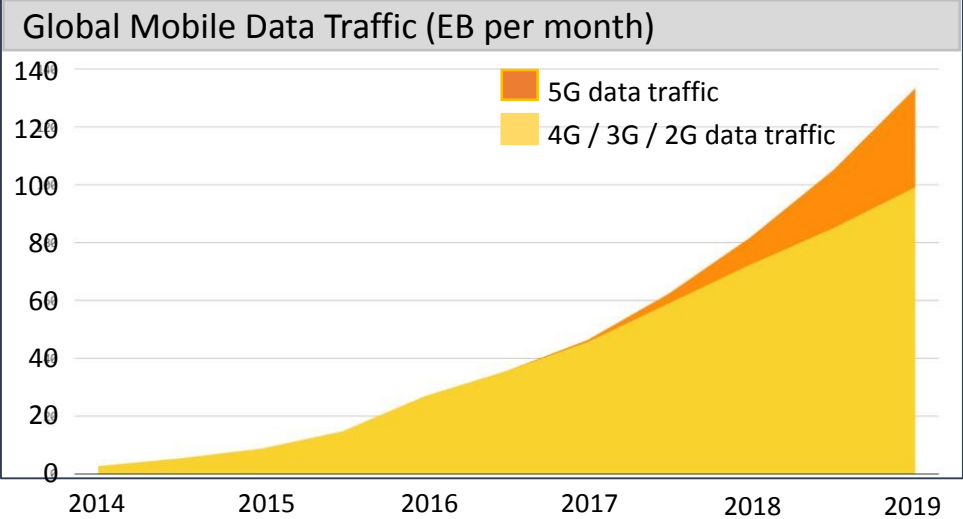
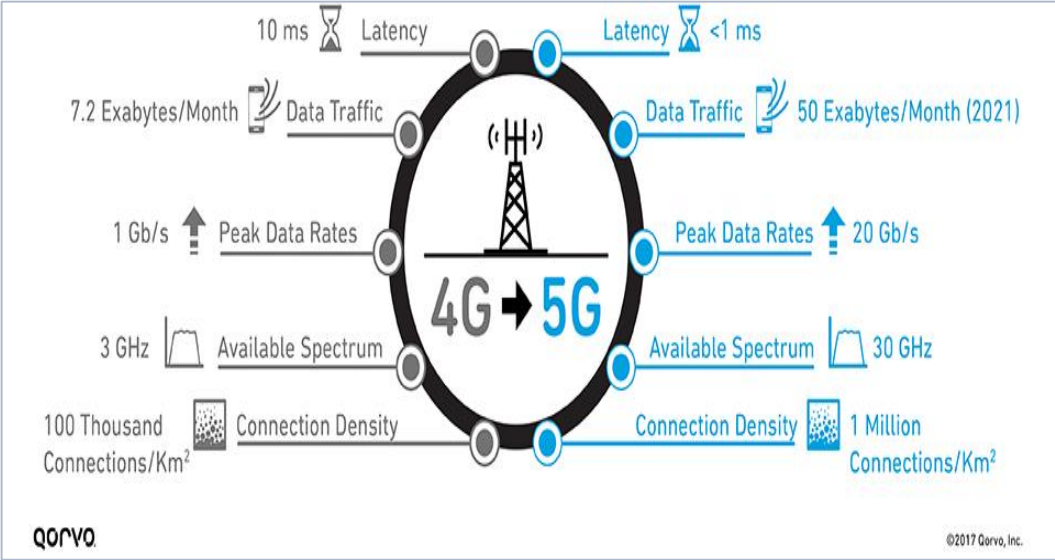


Low latency drivers

- Virtualized cloud access
- Interactively-intense AR/VR applications
 - virtual remote control
 - real time cloud rendering
 - haptic interaction
- Critical control systems
 - industrial/utility
 - vehicular automation

Similar to speed, latency becomes a point of differentiation

Future Networks

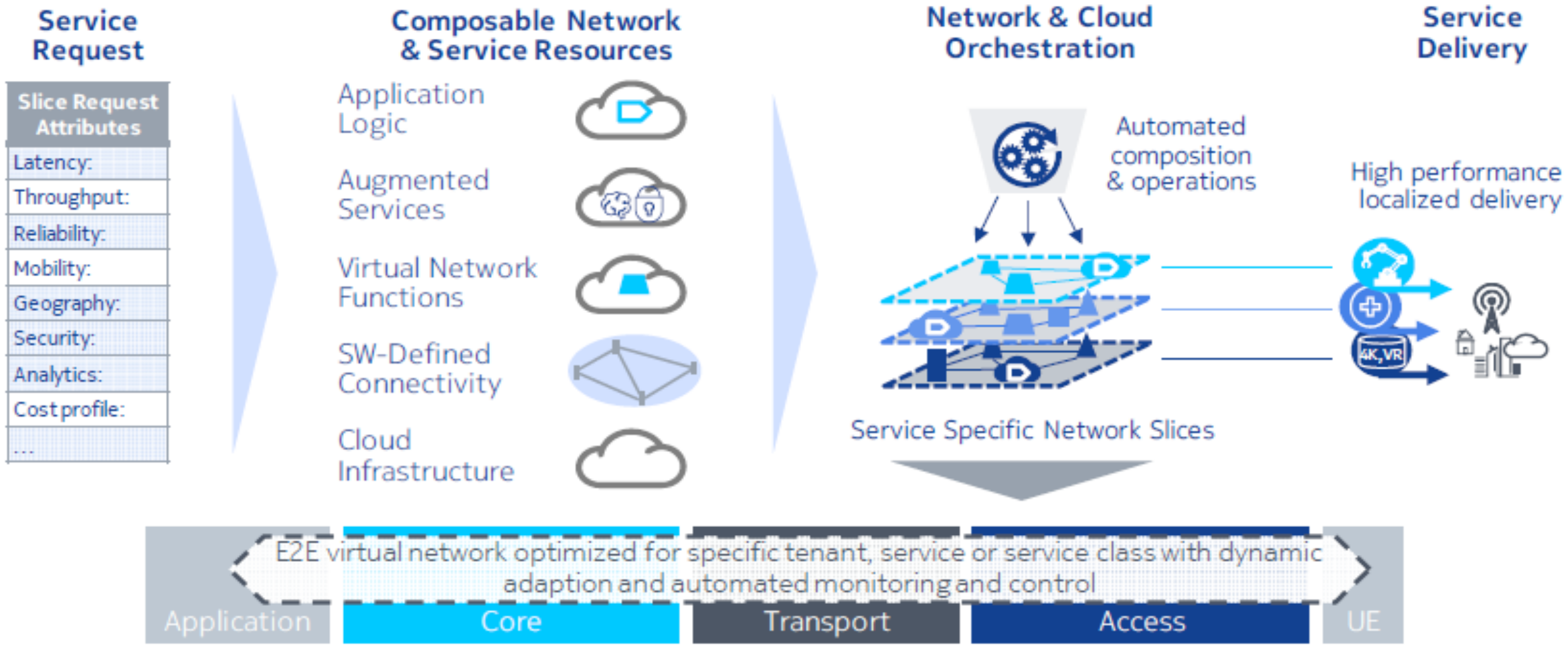


Ericsson Mobility Report Nov-18

OPERATIONAL COMPLEXITY	SERVICES AGILITY	FIXED COST REDUCTION	PACKAGING SCALE	FAULT TOLERANCE
Mobile, Video & Core networks are very complex	Difficult to launch new services and capabilities	Hardware depreciation cycles longer than useful life	Combined control and dataplane challenge agility	Generally very good
Add complexity for automation & standard operating	VNF deployment flexibility allows for accelerated innovation & deployment	More value in software for better utilization & scale	Separate control & Forwarding for better economics	Service Assurance & FCAPS, more challenging in cloud

One Network - Multiple Service Demands

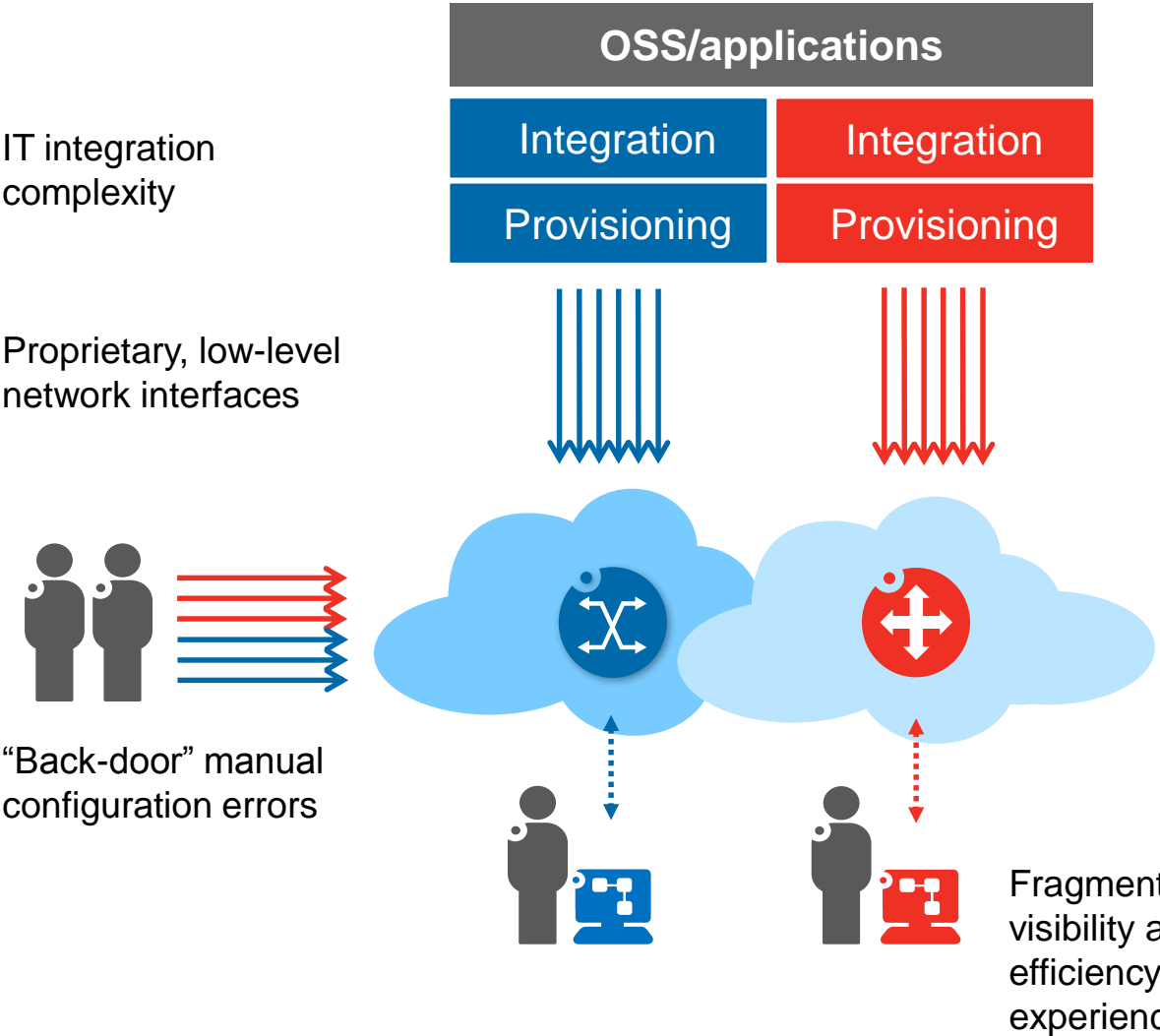
Future Networks Attributes



Network slices are end-to-end 'virtual private services'

SDN & NFV – An evolving Revolution

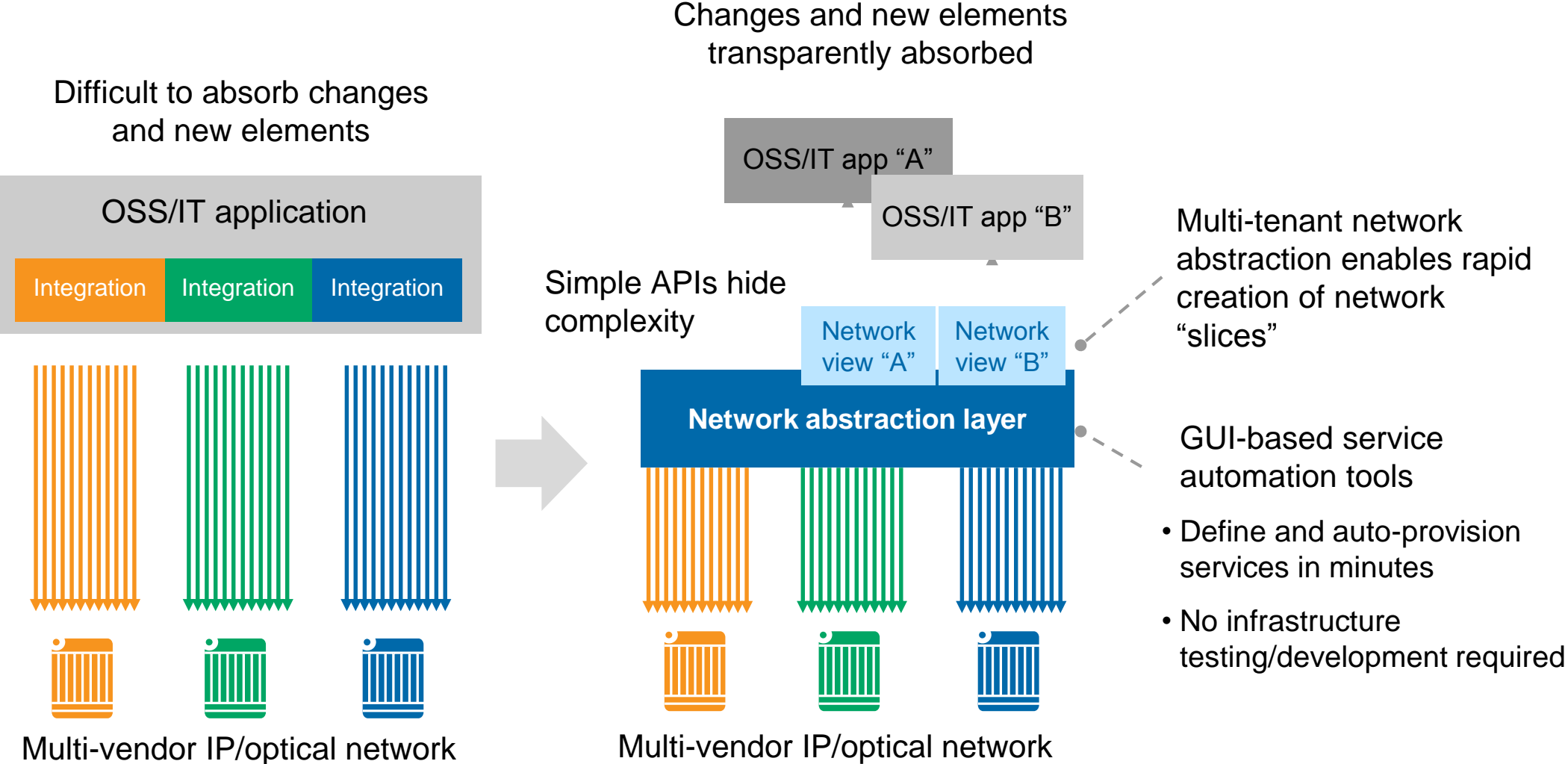
Necessity for a New Technology



- **Enable Innovation:** enabling organizations to create new types of applications, services and business models
- **Offer New Services:** Create new revenue generating services
- **Reduce CapEx:** allowing network functions to run on off-the-shelf hardware
- **Reduce OpEx:** supporting automation and algorithm control through increased programmability of network elements to make it simple to design, deploy, manage and scale networks
- **Deliver Agility and Flexibility:** helping organizations rapidly deploy new applications, services and infrastructure to quickly meet their changing requirements

SDN & NFV

Speed up provisioning with SDN/NFV by network abstraction



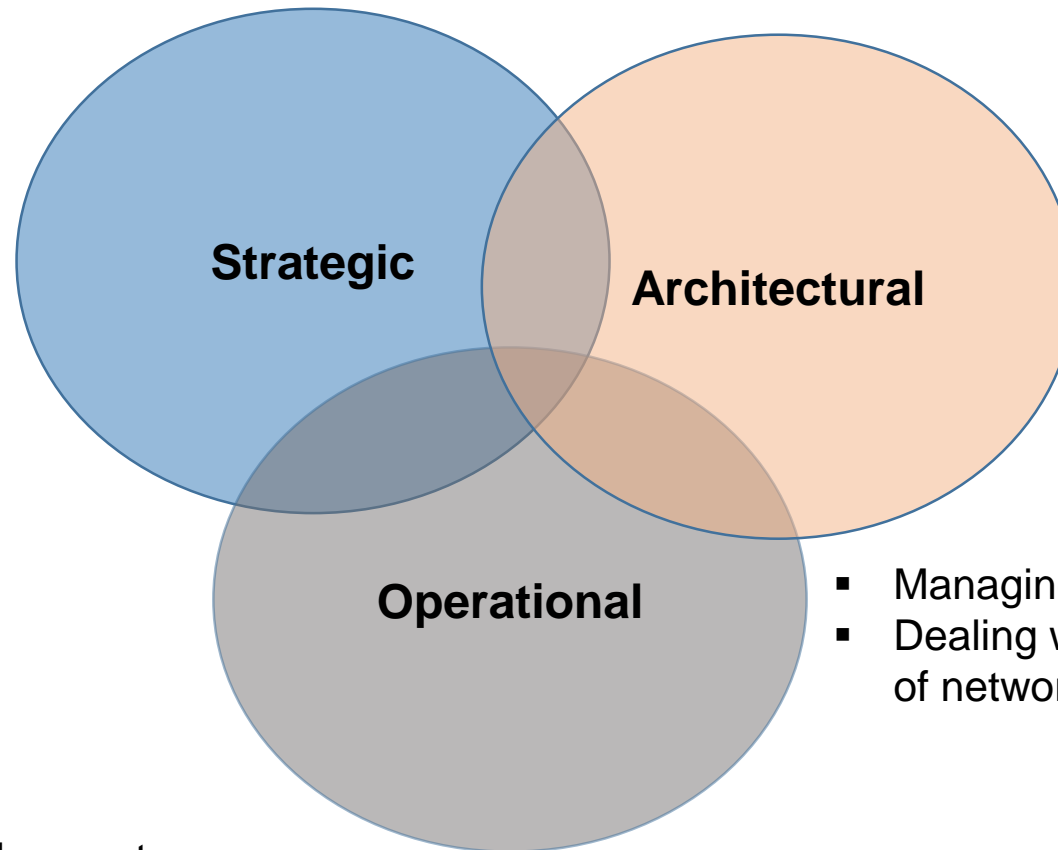
Why SDN & NFV ?

- SDN separates network control functions from network forwarding functions, NFV virtualizes network forwarding functions and other networking functions run on proprietary, dedicated hardware.
- The adoption of open-source based SDN and NFV will provide the ability to manage and provision network services from a centralized location, enabling faster and cost-efficient delivery of bandwidth “on demand” with minimal disruption. The bandwidth flexibility, programmability, and automation will help telecom providers monetize their whole range of cloud services linked to 5G, Smart Home & IoT.
- SDN and NFV are not just about network transformation; it is also about the organizational transformation of the telecom operators. The transition towards virtualized network operations will promote organizational skills and process changes that will reflect the move from physical network engineering to service-driven software and agile operations.
- Leveraging SDN and NFV capabilities, carriers are integrating cognitive technologies such as artificial intelligence (AI) and machine learning (ML) to evolve to a zero-touch network

SDN & NFV

Challenges with Virtualization (To Shift on NFV)

- Change management
- What to virtualize?
- Where to begin?
- How to measure success?



- Managing performance
- Reliability
- Security risks

- Managing complex NFV deployments
- Dealing with the operational complexity of networks.

Area to focus upon for future development:

- Learn to think differently about service innovations.
- Choose an advantageous strategy to deepen transformation.
- Settle on practical tactics, followed by productive actions.
- Dare to make breakthroughs in thought processes.
- Collaborate with others in the industry to avoid fragmentation.

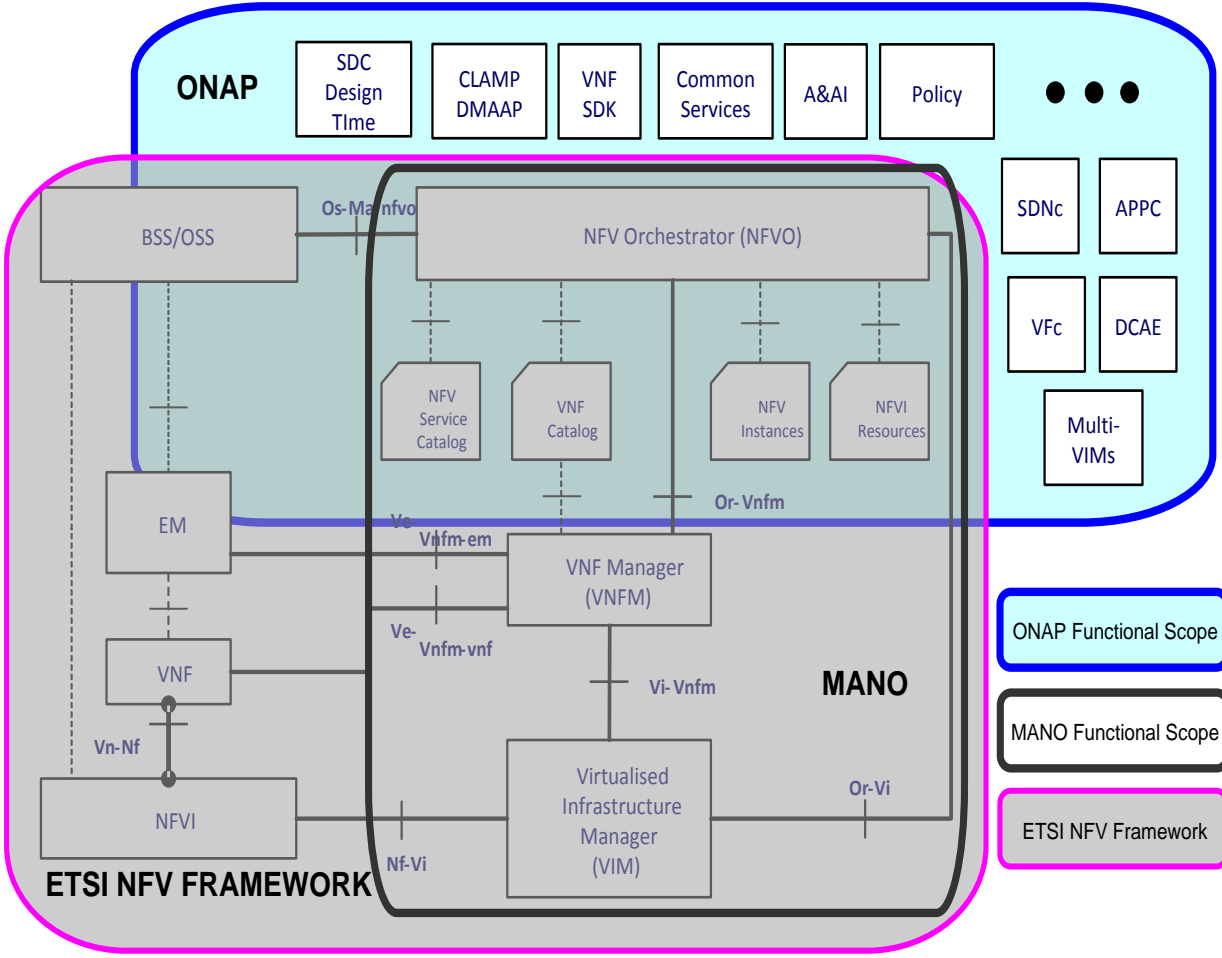
SDN & NFV

ETSI NFV Framework, MANO, and ONAP

- ETSI NFV Framework concept introduced in 2012
- ETSI ISG: A standardization process for defining the NFV framework for all the NFV functions and interfaces and technologies
- 300+ companies in the NFV standard group, and published 100+ NFV specs

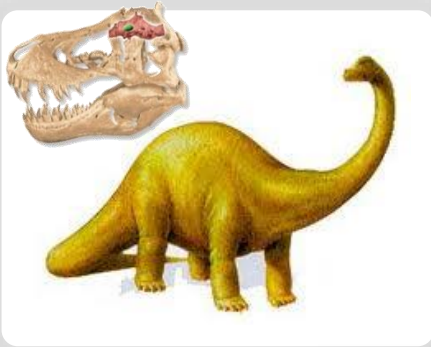
- The MANO in ETSI NFV framework consists of 3 key elements: **NFVo**, **VNFm** and **VIM**.
- MANO to manage LCM and FCAPS for all the Network Services and VNFs/EMs, and NFVi

- ONAP: An open source MANO project (ECOMP+OPEN-O merged and formed ONAP in 2017) by Linux Foundation and many major world telecom carriers and vendors
- Drive to provide a comprehensive platform for real-time, policy-driven orchestration and automation.



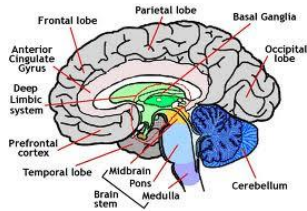
Automation – Key for Success

Traditional



- Very intensive in hardware
- Software not at the core

Web Scale



- Very intensive in software
- Hardware is a necessary base



HARDWARE

SOFTWARE



Adapt to survive: shift focus from hardware to software based Network

SDN & NFV

Setting Organisational Goals

Capitalize fully on SDN/NFV (moving beyond challenges)



- to introduce new services faster
- to build full fledged capability on Network slicing
- to move towards autonomous operations (NOC)
- to provide unmatched digital service experience

Thank You