Mobile Telco Transformation and its Impact on Business and Technology

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Mobile Business II:
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Telco Native

TelekomCLOUD Marketplace - B2B Cloud Portal
Product Manager
Data Analyst

IT Outsourcing and Managed IT Services
Solution Design Complex Deals
Outsourcing Program Execution

Technology Strategies Core Network and Services
Technology Introduction Strategies
3G Greenfield Network Rollouts

Product- and Portfolio Management for Value Added Services
Partnering Programs for Parlay/OSA
IMS Evangelist
Customer Solution Design for Service Layer Solutions

Sales

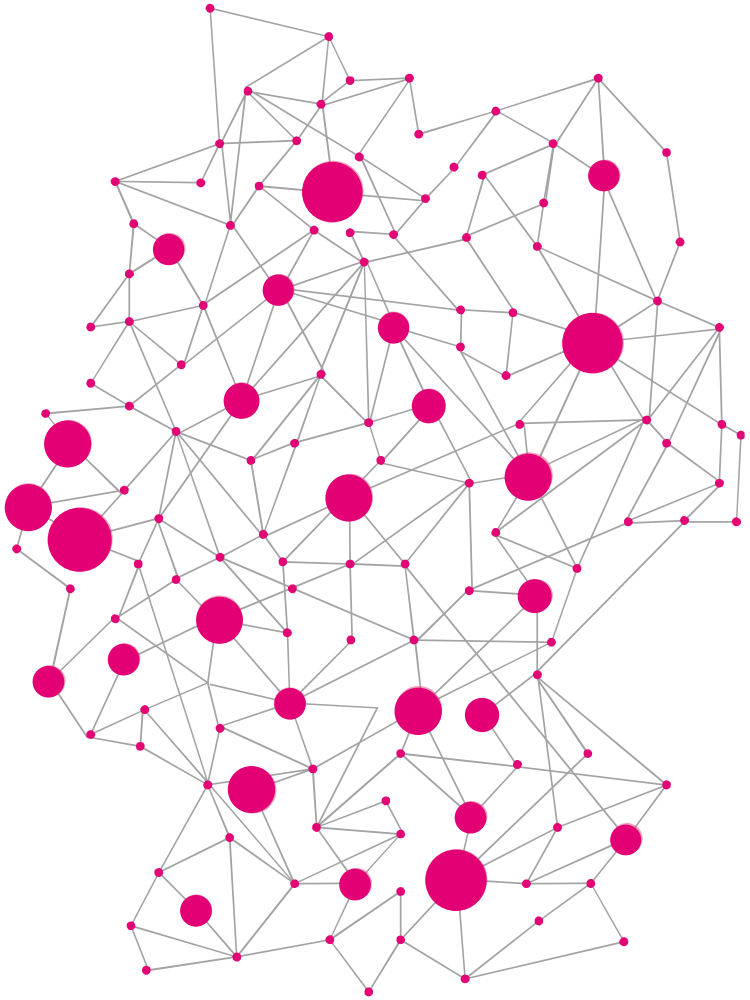
Content

01
Introduction

“If you can't change and innovate fast enough, you get disrupted.”

— Katherine Kostereva, CEO Creatio

German Telecommunications Market

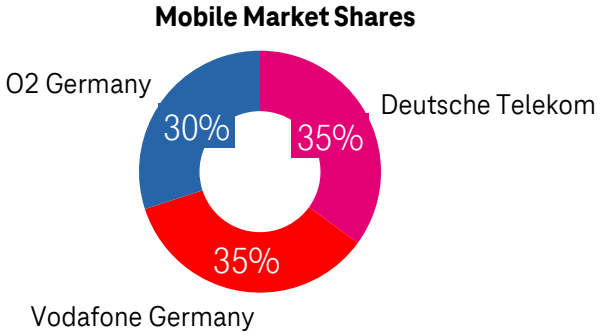


Fixed Network

- 99,4% with fixed broadband
- 3,1% revenue growth
- 26,3 € ARPU

Mobile Network

- 173% mobile penetration
- 9,9 € ARPU
- 6,9% revenue growth



€ 16.8 B
Mobile revenue in 2021

38,4 M
broadband customers

150.8 M
mobile customers

>90%
5G coverage

ARPU – Average Revenue per User

Source: Germany: Service Provider Market Report – 2022, OMDIA

For the Context: A Brief Look Back into History

Letterpress Printing

1450

Scheduled Horse Bus in Paris (Omnibus)

1662

MECHANICAL

1492

Discovery of America

Telephone

1861

Auto-mobile

Engine Powered Flight

1901

Transistor

1948

GSM Networks

TCP Protocol

1974

Tablet Computer

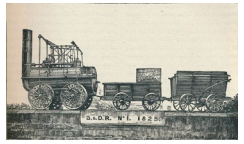
2010

ELECTRONICAL

INTERNET DIGITAL

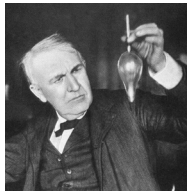
1825

Public Railway



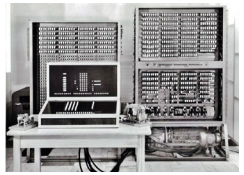
1879

Electric Bulp (Edison)



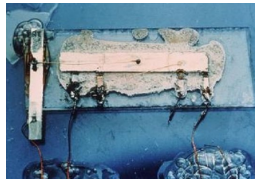
1941

First Computer (Zuse)



1958

Integrated Circuit



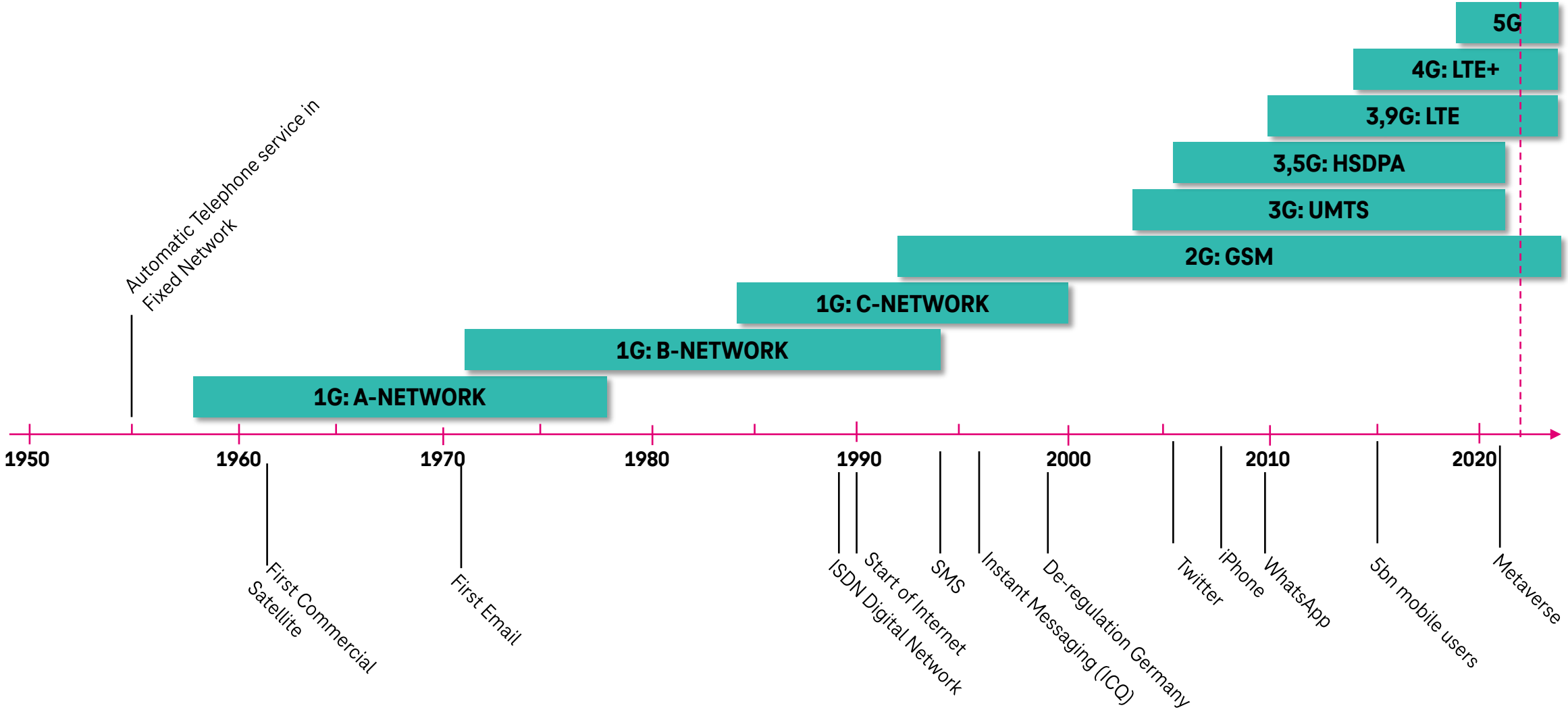
1991

Start of Internet

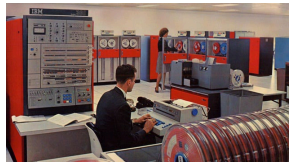
2022

Today

From Voice to Metaverse



Third Era of IT



1st - Mainframes

- Era of mainframe computer
- Centralized data processing and storage with separated terminals for access and shared usage
- Computing became a tool of business
- Enabled automation of operations and early management information

1941 - 1980

2nd - Personal Computers

- Era of the personal computer
- Small multi-purpose computers
- Accessible to businesses of any size
- Operated directly end user, rather than by an expert or technician
- Uses commercial OS and software
- Enabled large scale industrialization of enterprise IT and mass market computer usage

1980 - 2010

3rd - Cloud and IoT

- Era of cloud computing and Internet of Things (IoT)
- Changes business based on data processing technologies, information and ubiquitous connectivity
- Data stored anywhere in the world and accessed from any device
- Smartphones, IoT devices, wearables, headsets and appliances, industrial machinery

2010 - today

02
Changes in the Telco Industry

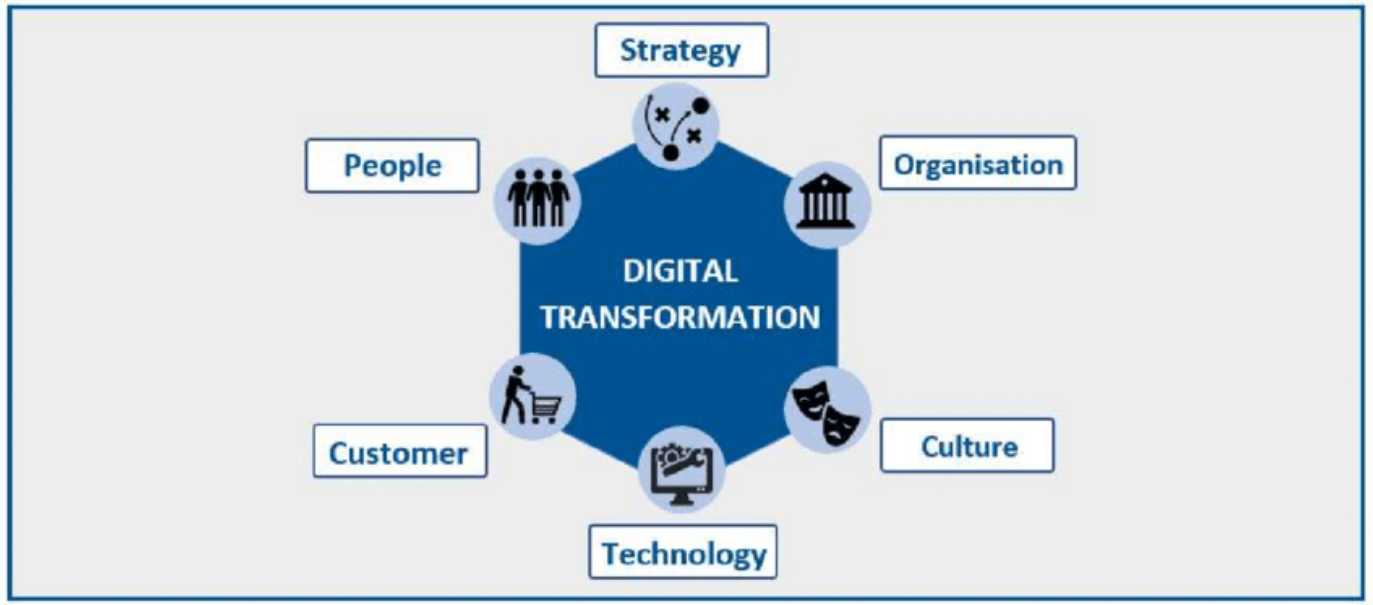
“It’s no longer the big beating the small, but the fast beating the slow.”

— Eric Pearson, CIO, IHG

What is transformation?

- **Business Transformation** means making fundamental changes in how business is conducted in order to adapt to changing market environments
- Applies to the organization as a whole or to parts of it
- Caused by internal or external changes
- Target is to stay relevant
- Approaches
  - Increase revenue or market share
  - Improve customer satisfaction
  - Cost efficiency
- Difference compared to improvement efforts
  - Commitment to fundamental change – opposed to incremental changes to processes or products

- **Digital Transformation** is the integration of digital technology into all areas of business - fundamentally changing how an organization operates and delivers value to customers
- Requires organizations to continually challenge the status quo, experiment often, and get comfortable with failure (fast)



Changes in Network Infrastructure Supplier Market

- Past 15 years has seen a significant consolidation of telecommunications infrastructure suppliers
- Driven by faster development cycles and All-IP technologies

Wave 1	Consolidation of established telco suppliers	Merger or collapse of few telco incumbent suppliers	NORTEL, ALCATEL, Lucent Technologies, MOTOROLA, SEL ALCATEL, Alcatel·Lucent, SIEMENS, NOKIA, ERICSSON	• Low market share • Faster development cycles • Increasing network complexity • Ericsson and Nokia survived
Wave 2	Raise of new players	New competitors as telco suppliers from IT industry or based on long term strategic approach	broadsoft, ORACLE, HUAWEI, JUNIPER NETWORKS, MAVENIR, ZTE, REDKNEE	• Introduction to All-IP • Expansion of existing product range • Strategic development of telco supplier industry of China (Huawei, ZTE)

03
Transformation of Technology

“Clearly, the thing that’s transforming is not the technology - the technology is transforming you.”

— Jeanne W. Ross, MIT Sloan’s Center for Information Systems Research

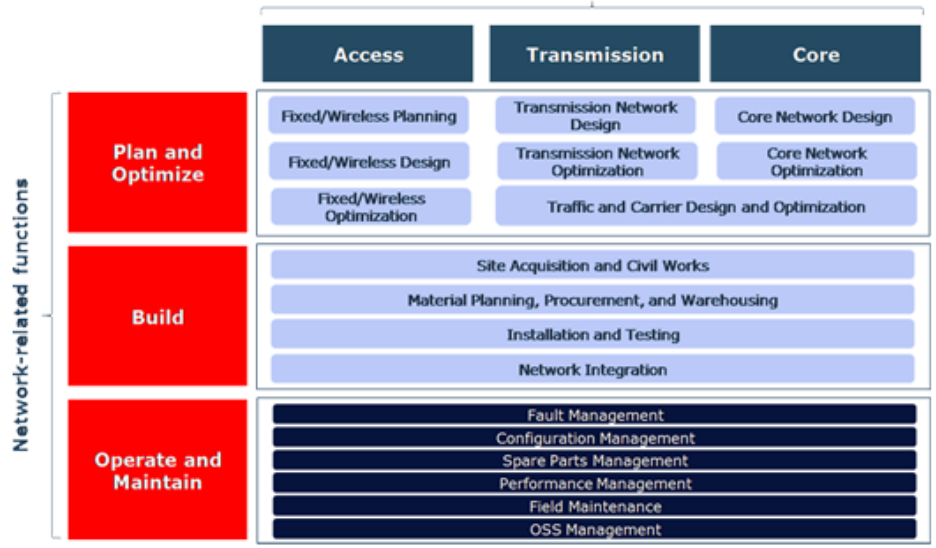
Mobile Networks Generation Overview

Generation	Technology	Main Benefit	Speed	Features & Services
5G	PS	Performance & Integration	10 Gbps	· Low latency, QoS, resilience, trusted devices, network slicing · Private and public networks, IoT/M2M
4G LTE+/LTE-A	PS	Capacity & coverage	1 Gbps	· Mobile broadband
3,9G LTE	PS	Capacity & speed	300 Mbps	· First full All-IP network · Full support of IP Multimedia and VOLTE (VoIP)
3,5G HSPA/HSPA+	CS & PS	Data capacity	7,2 / 42 Mbps	· Mobile Broadband
3G UMTS	CS & PS	Data services Roaming	384 Kbps	· Video Telephony · Voice still CS based
2G GSM, CDMA, TDMA	CS	Mobility	n.a.	· First mobile standards with global roaming · SMS, Voice, Value Added Services

CS – Circuit Switched
VoIP – Voice Over IP
PS – Packet Switched
IoT – Internet of Things
IMS – IP Multimedia Subsystem
M2M – Machine-to-Machine

Network Deployment Strategies

- 2G CS / PS mobile networks were standardized but mainly “closed” systems with few interoperability points
  - Networks supplied often by 1 - 3 vendors with limited integration points
  - Multivendor networks required extensive integration and testing
- Operator took mostly end2end responsibility



- Modern fixed and mobile 3G/4G/5G networks are more complex and based on open All-IP technologies
  - Standardization considers already multi-vendor networks and interoperability
  - Uniform IP technologies and protocols across complete networks
  - Networks components are mostly based on commercial standard products (COTS) resulting in lower costs
  - Trend towards software-defined networks with deployment of functionality and capacity on-request
- Change of network deployment strategy with e2e responsibilities mostly with suppliers or even as managed service

Shift from Local IP to Cloud - Relevance for Telcos

As Technology to digitize network deployment and operation

- Repackage existing networking capabilities and functions as cloud services
- Fast and automated deployment, highly flexible for changing capacity requirements, cost efficient

As Services to generate revenues

- Partnering with Cloud Service Providers (OTTs)
- Bundle telco-native services with cloud services or enrich cloud services with telco capabilities

As Enabler for data driven business

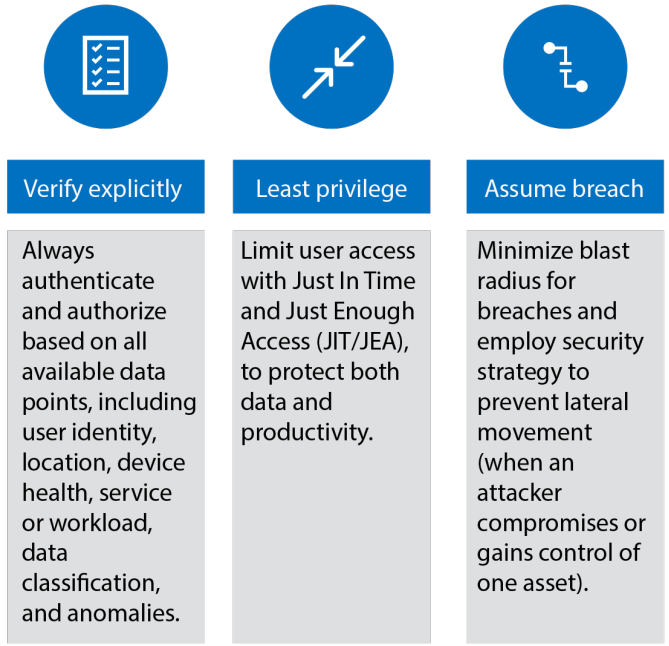
- Advanced data analytics on customers and services to support business growth and company strategy decisions
- But: data privacy and security aspects limits to monetize data analytics for most telcos

OTT – Over-the-Top

The Raising Importance of Network Security

- Circuit switched, fixed and 2G / partly 3G networks had a ‘trusted network domain’ approach
  - Focus of security mechanisms on network access and domain interconnections
- IP based and 4G or 5G networks with enhanced and more complete security mechanisms
- Modern networks with higher focus on security due to
  - Usage of IP technologies and protocols being global standard technology with many ‘experts’
  - Deeper integration of networks in enterprises and society (production, confidential or mission critical data, …)
  - Reduced visibility on network operations due to managed services or usage of cloud infrastructure

- Networks often based on Zero Trust approach
  - All users authenticated, authorized, and continuously validated
  - Assumes that there is no traditional network edge (perimeterless security)



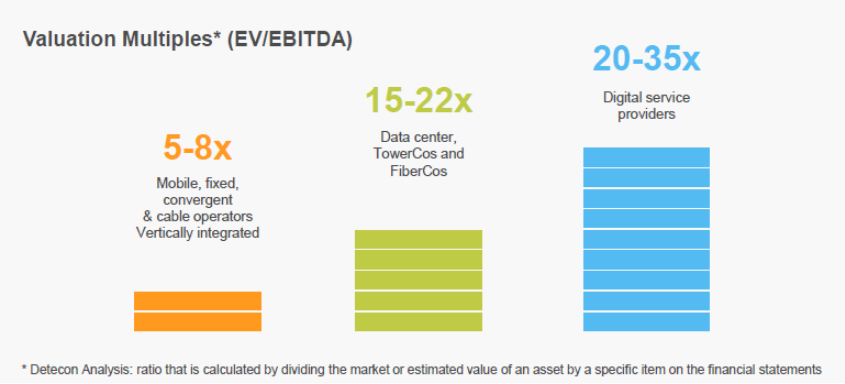
04
Transformation of Organization

"Don't be fooled by some of the digital transformation buzz out there, digital transformation is a business discipline or company philosophy, not a project."

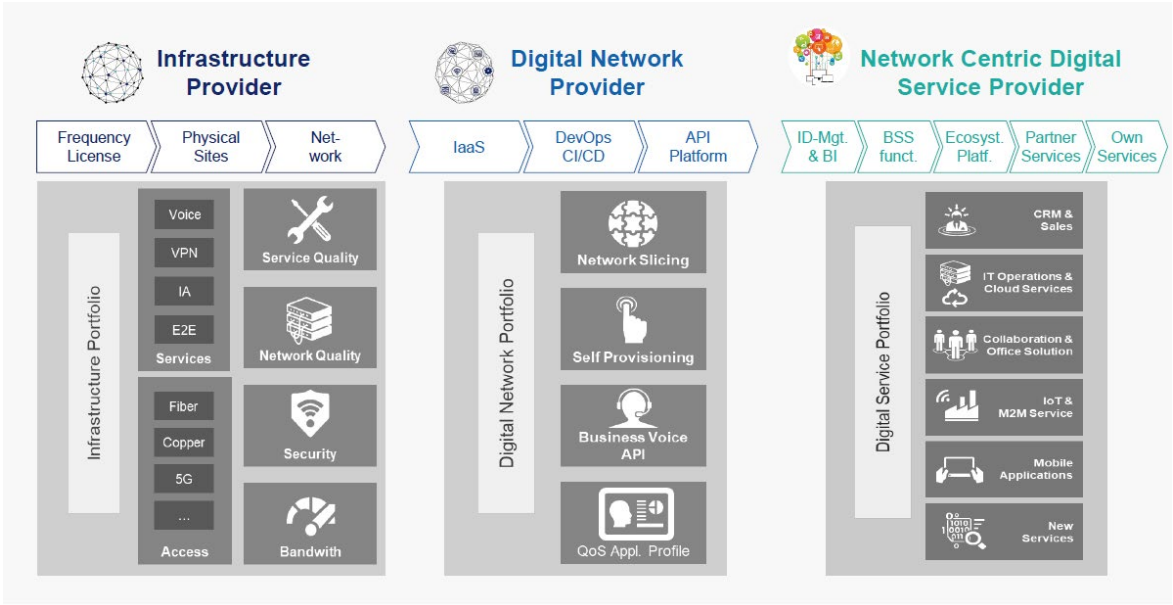
— Katherine Kostereva, CEO Creatio

Changing Markets Requires Telcos to Transform

- Telcos face fundamental and structural challenges
  - Low market growth with connectivity services
  - Large capital investment for 5G, broadband and digitization of networks and processes
  - Fast technology evolution and new competition
  - Change of value chain and market models
  - Telecommunications market de-regulation



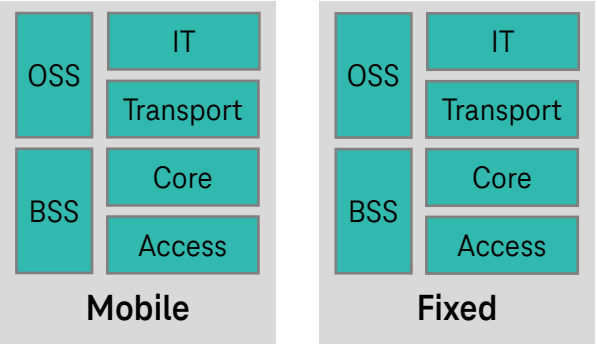
- Telco transformation process
  - Physical assets and network (networks, frequencies, ...)
  - Operating model (skills, processes,...)
  - Business models (market, products, customers)
  - Strategy (mission, objectives, stakeholders)



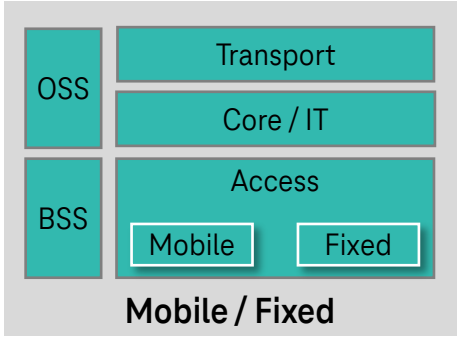
Source: Detecon, Organizing a new Telco, 2021

Change of Network Organizations and Processes

- Traditional telco network organizations follow Plan-Build-Run concepts
- Organized based on technology domains such as mobile access, fixed access, transport, core and IT
  - Results in silo-type organizations
  - Processes and skills optimized for each domain
  - Monolithic (legacy) applications with complex integrations
  - Long planning and deployment cycles, inflexible and expensive evolution

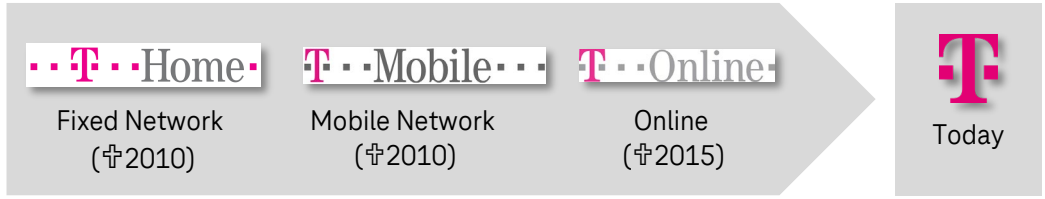


- Shift towards integrated and convergent organizations due to introduction of All-IP technologies and changing customer behavior
- Impact on
  - Common functions and components (Billing, transport, access, O&M,...)
  - Field services & deployment (rollout, software defined networks)
  - Converged products and services
  - Pricing, marketing
- Create networked organizations (horizontal collaboration)



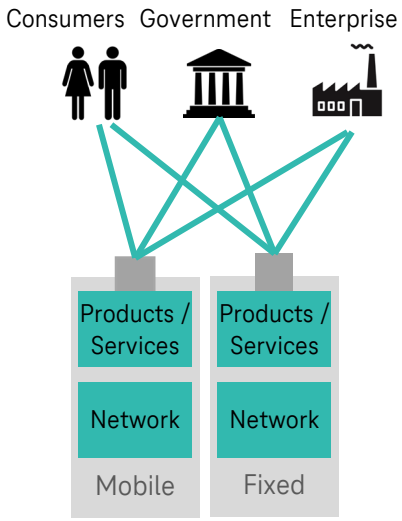
Change towards Go-To-Market Organizations

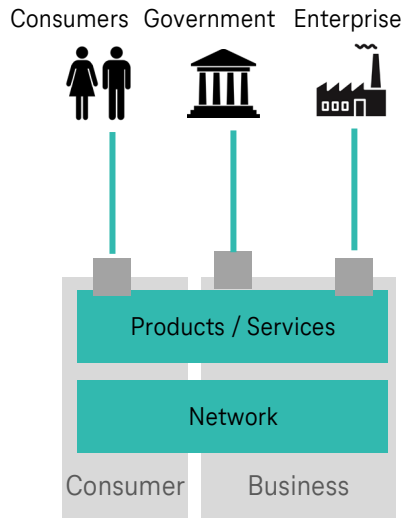
- Customer experience changes the telcos – because the context has changed
- In the past: Focus on technology and features
- Today: Focus on Customer
- Drivers
  - Customer loyalty
  - Personalized customer experience
  - Growth (absolute and in market share)
  - Convergence of services and technologies
  - Cost optimization



Deutsche Telekom brands

- Restructure business organization around customer and their business & needs
- Growing use of digitization,
- Customer raised their expectations on brands
- Omnichannel customer journeys
  - Each touch point differently per consumer type





Change of Purchasing Strategies

Past: 'Dependence'

- Technical scope on purchasing complete sub-network domains (e.g. RAN, core network, transmission, Billing)
  - Often telco specific requirements
  - Limited flexibility for multivendor strategy due to
    - Telco specific requirements
    - Limited interoperability between network domains
- Results in
  - E2E integration responsibility often with telcos
  - Vendor lock-in or vendor dependence
  - Long development technology cycles (1-2 releases/year)
  - Limited cost optimization options (for supplier and vendor)

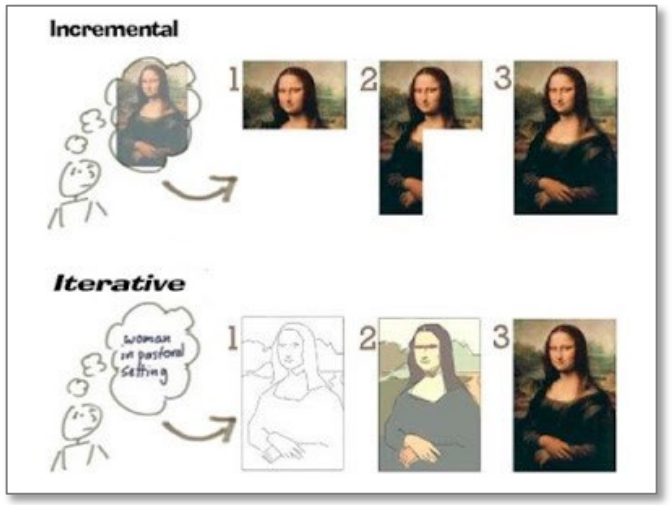
Today (and Outlook): 'Diversity'

- Shift towards purchasing network components instead of networks or sub-networks
- Focus on open interfaces, interoperability and standards
- Introduce new, innovative suppliers into network
- No dominant supplier per network domain
- Easier to replace components and drive innovation
- Highly competitive
- Centralized purchasing & e-auctions

Changed Ways of Working: from Waterfall to Agile

Typical challenges of telco projects (…in the past)

- Complex: large scope, complex technologies
- Long durations (e.g. 6-18 months)
- Cross organization: multi-domain, multi-organization, multi-vendor
- Bespoke: solutions often deviate from standards
- Well established business and processes since decades
- Hierarchical management and control structures



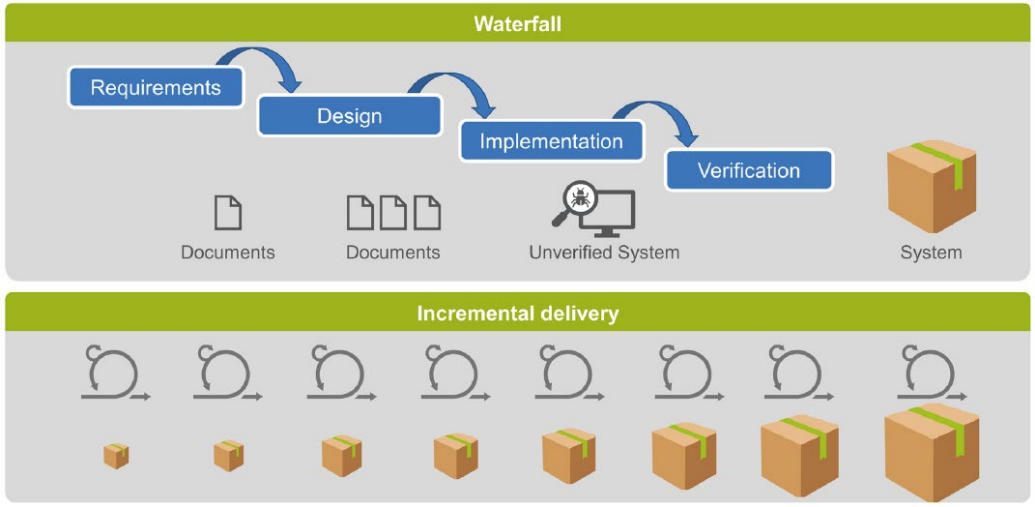
Time

- Majority of telcos started to use agile methods
  - Not standard yet – but with positive trend
  - Need for faster & more efficient development projects
- Benefits using agile methods
  - Early feedback allows to re-align project scope fast
    - Continuous deployments and faster time-to-market
    - But: challenging
      - In multivendor projects (trust versus contract)
      - Needed mindset change (loss of control)

Side Note: Agile Development Concept

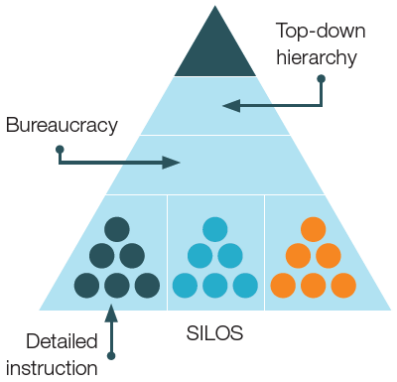
What is agile?

- Development concept centered around iterative development
- Collaboration of self-organizing cross-functional teams
- Characteristics:
  - Iterative with incremental delivery
  - Faster time-to-market
  - Cope with change, increase quality
  - Reflect-and-adjust for relentless improvement
  - Organize around value
  - Flow: Permanent integration and delivery



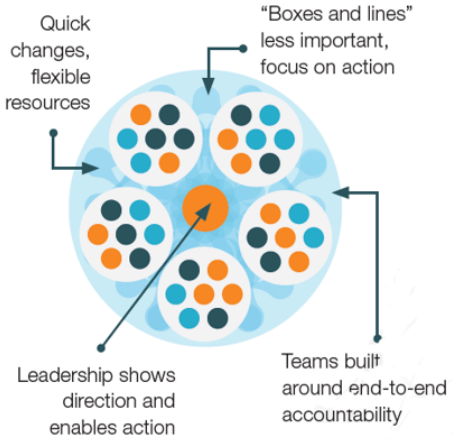
Source: Scaled Agile Inc.

From Organizations as 'machines'



An agile organization is rather a living organism

To Organizations as 'organisms'



Source: McKinsey, The trademarks of Agile Organisations, 2017

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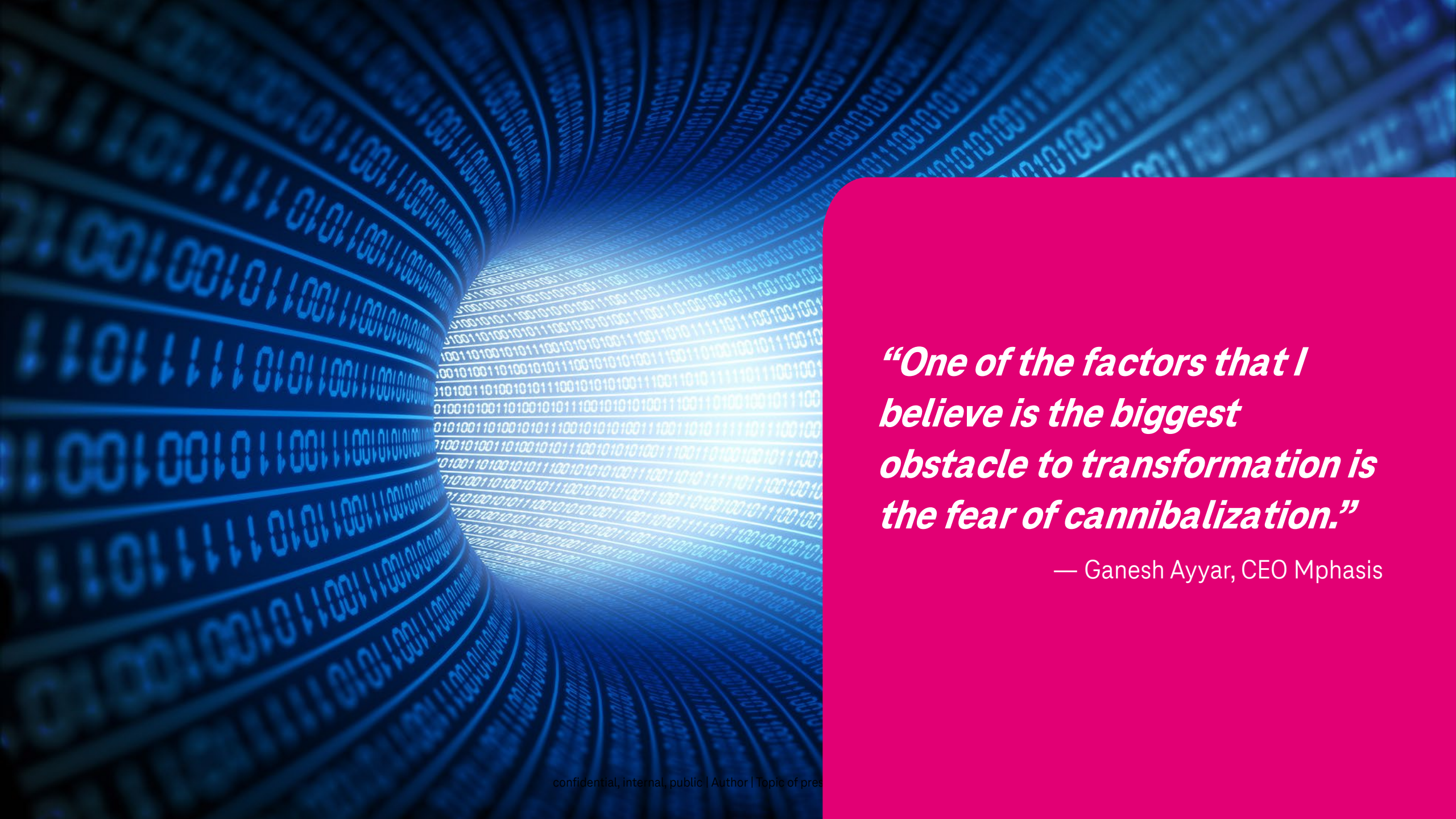
Transformation of Products and Services

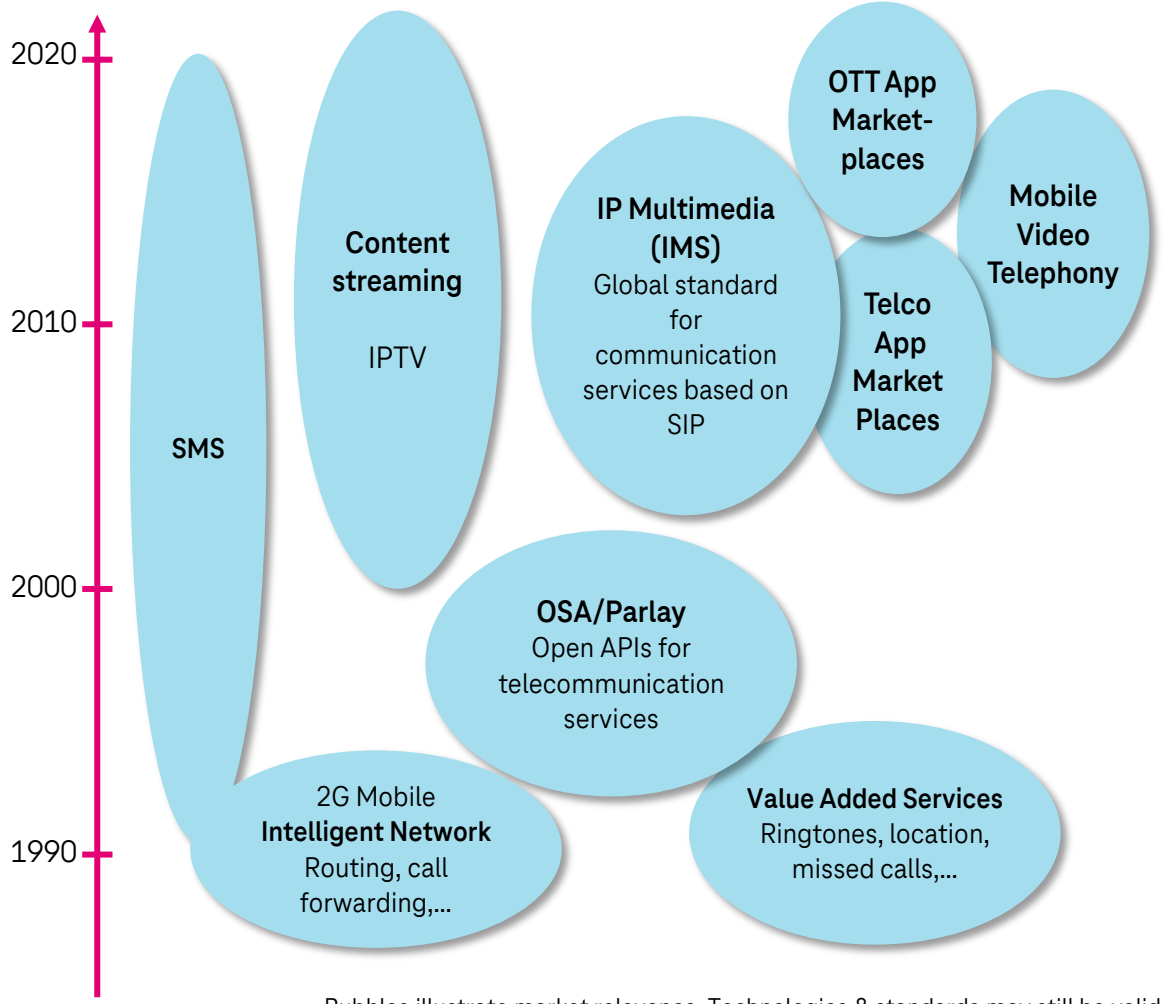


“One of the factors that I believe is the biggest obstacle to transformation is the fear of cannibalization.”

— Ganesh Ayyar, CEO Mphasis

Evolution of Telco Services

- Relevance and size of mobile market
  - 5.3 B mobile users (67% of global population) [1)]
  - 4.2 B mobile internet users [1)]
  - Avg. mobile user spends 3h 43min online per day [4)]
  - 15,1 B IoT connected devices [1)]
  - 26 M jobs supported directly & indirectly [1)]
- 5% of GDP or 4,3 T$ of economy value generated from mobile technologies and services [1)]
- 2% revenue growth per year from connectivity services [2)]
- 80% growth in e-commerce and online advertisement in 2020 [3)]
- 41,8% avg. revenue growth of Facebook 2011 – 2021 [4)]



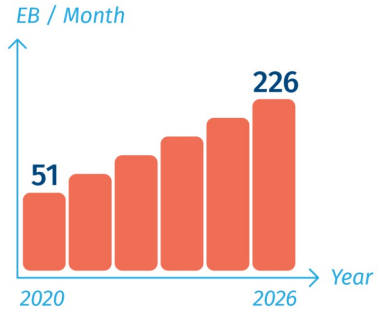
Bubbles illustrate market relevance. Technologies & standards may still be valid

Sources:
1) The Mobile Economy 2022, GSMA
2) Transforming the telecom value chain - a platform business model, Kearney
3) How Telcos Are Transforming to Digital Services Providers, MongoDB 4) Statista

New Service Providers – OTTs

- OTT players offer IP services and applications which are network agnostic can be consumed by telco customers directly
- OTT players are relevant for the telco market since 2005
- Represent a paradox for telcos: “thinking digital” is core to telcos – but it enables the OTT business models
- OTT players are a challenge for telcos
  - Their services consume network capacity without generating revenues
  - Fear of cannibalization of paid telco services
  - Creates pressure on margin growth for telcos
- Dominant OTT players are
  - Amazon, Apple, Google, Microsoft, Baidu, Samsung, Youtube, Netflix, Snapchat, Facebook, Zoom, …

- Operator strategies vary often depending on market maturity
- Frequent reactions to the OTT raise
  - 2005 - ‘Just Parasites’
  - 2010 - Compete against OTTs
  - 2015 - Cooperate with OTTs
  - 2020 - Bundles and Partnering with OTTs
- OTT players started to offer core telco services such as voice or messaging and are becoming a telco themselves – but largely without own access networks



OTT revenues
2019: 83 B$
2025: 167 B$

Source: OTT as a Source of Growth and Revenue for Telcos, Axinom

06
Transformation of Business Models

“Good design can't fix broken business models.”

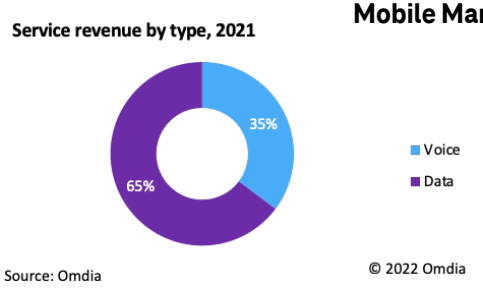
— Jeffrey Veen, VP Products Adobe

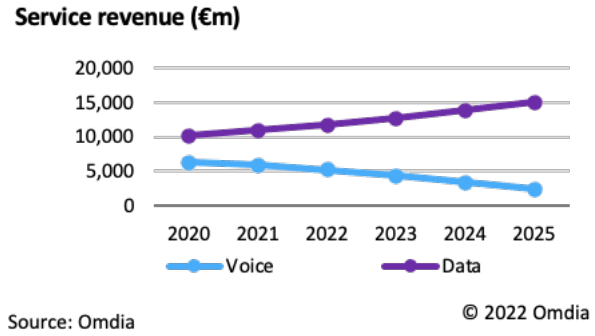
Changing Markets and Consumers

Market

- Megatrend of digitization across all industries and markets
- Digital economy doubled to 6.3 T$ in 2010 - 2020 [1)]
- Mobile voice and connectivity is commodity
- Disruption from new OTT entrants
- Paradigm shift towards software focus and software-defined-networks

Germany
Mobile Market [2)]

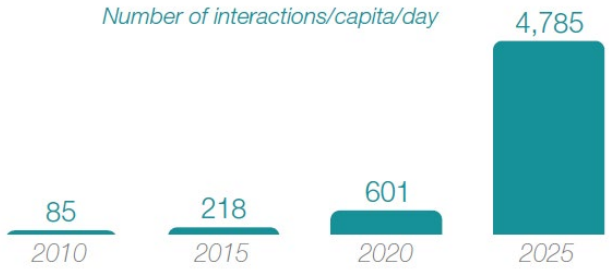




2021 revenue:	€16,869m
Growth vs. 2020:	2.13%

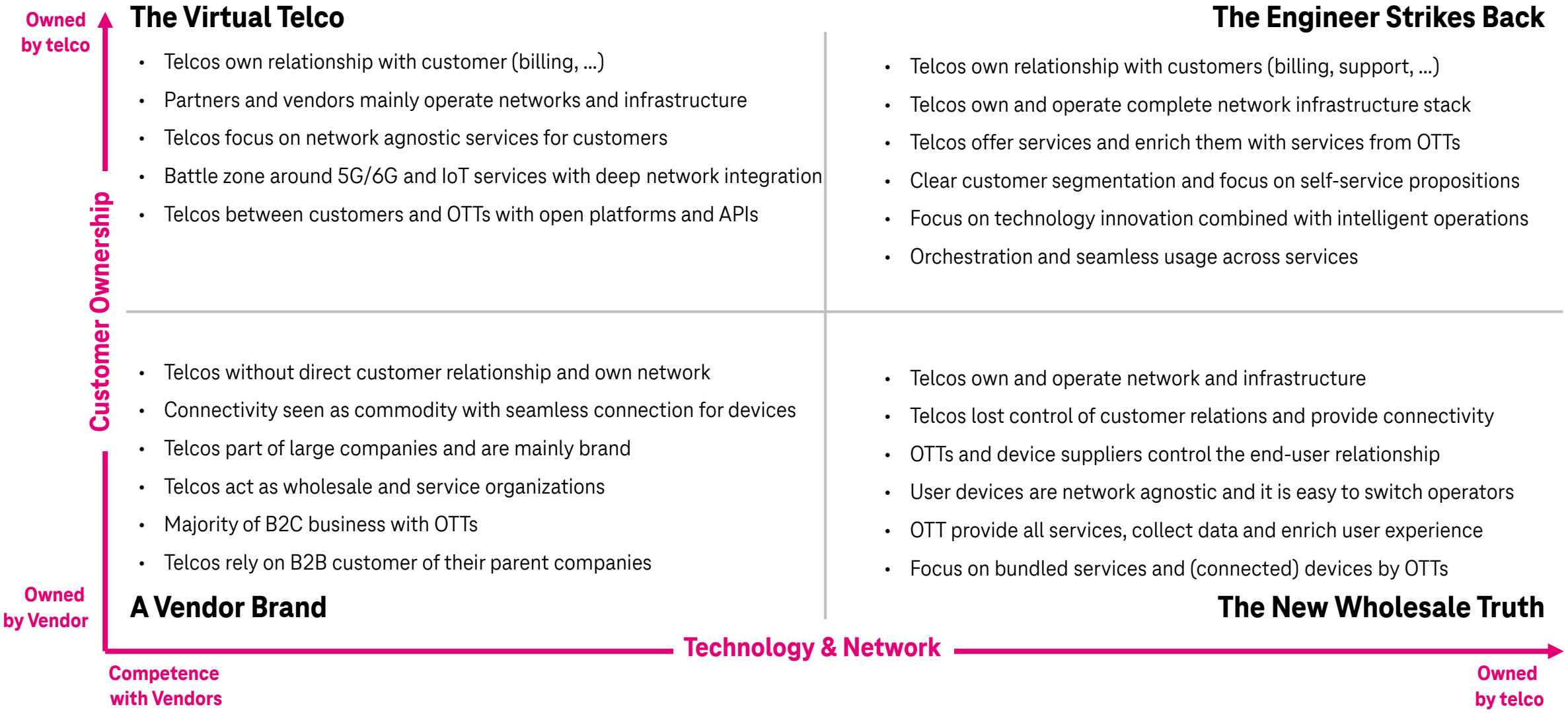
Consumers

- 62% of under 24-year-olds look at their phone within 15 min of waking up (compared to 36min of overall population) [4)]
- But rapidly ageing population in EU: 25% over 65 years by 2050 (today: 20%) [5)]
- Pay-per-Minutes offerings don't come naturally to the digital native generation; communication and connectivity are just basic needs
- Interaction of average connected person anywhere in the world [3)]



1) Transforming the telecom value chain, Kearny 2) Germany: Service Provider Market Report 2022, Omdia
3) Data Age 2025, 2017, IDC 4) The future of the Telco business model, Deloitte, 2017 5) The Connected Consumer 2030, Vodafone 2022

Operator Business Model Scenarios



Source: The future of the telco business model, Deloitte, 2017

New Services and Market Models for Telcos with 5G

5G Benefits

- Higher data speeds (10 Gbps), ultra low latency (<10ms), massive network capacity (1 M IoT devices/km^2)
- Extended coverage (indoor), extreme mobility (500km/h)
- Reliability, power efficiency, increased availability, security, quality of service (QoS), edge computing, network slicing

Outlook

- 5G in 2026 [1)]
  - 60% global population coverage
  - 50% of global mobile traffic
  - 3,5 B subscriptions
  - 27 B connected IoT devices

Enhanced Broadband

Remote control of infrastructure, vehicles, and medical procedures, Immersive experiences (VR, XR, AR)

AI, Machine Learning

Massive IoT

Low cost devices

High volume /density IoT

Edge Computing

Mission Critical Services

Traffic, healthcare,

Hybrid public & private networks

Enterprise verticals

Dual Networks Usage

Public and enterprise networks within same coverage and with dedicated QoS

Enterprise verticals

Industrial automation

1) This is 5G, Ericsson, 2021

VR – Virtual Reality XR – Extended Reality AG – Augmented Reality IoT – Internet of Things QoS – Quality of Service

07
Trends and Outlook

“Let’s go invent tomorrow instead of worrying about what happened yesterday.”

— Steve Jobs, former CEO Apple

5G Use Cases: Ericsson Smart Factory

See reference case:

Ericsson's USA 5G Smart Factory
https://www.youtube.com/watch?v=p_JPZsRGKI0&t=16s

5G Use Cases: Mining

SIMS
(Sustainable Intelligent Mining Systems)

Project to verify and apply new technologies and solutions for for the mining industry

Collaboration between LKAB, K+S, KGHM, ...

Sweden, Finland, Germany, Poland

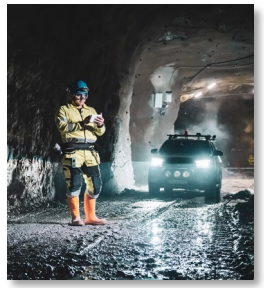
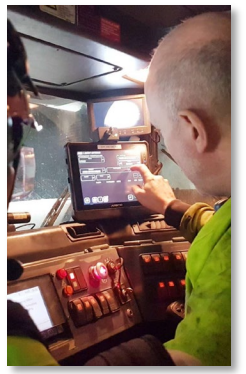
Robotics in Mining

- Autonomous drone and vehicles for inspection activities
- Assisted driving for remote operation
- Robotizing the Charger for explosives
- Augmented Reality for Robotics

Ground Control & Communication

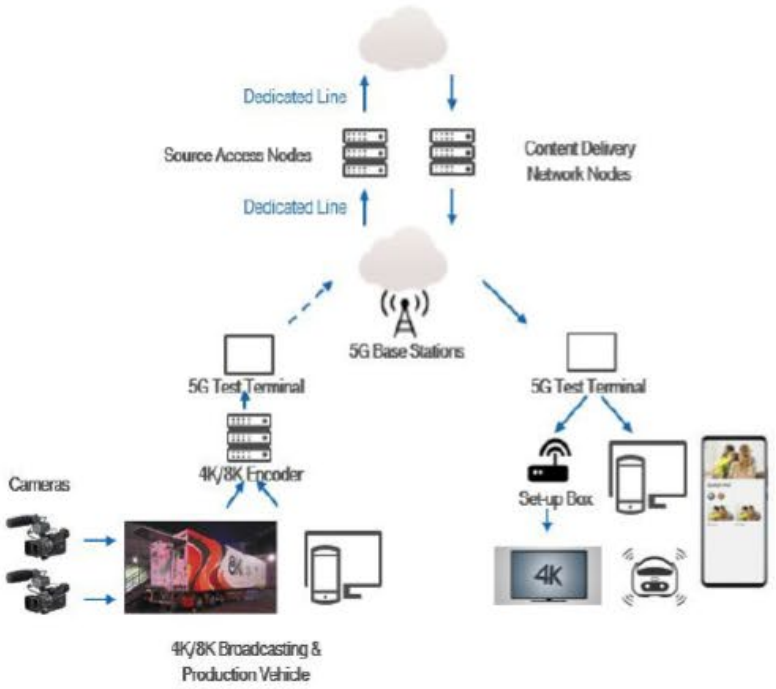
- Close range emergency data communication
- Precision positioning of mobile equipment
- Automated real time process control
- Maintenance reporting from mobile machines.
- Performance Assessment.



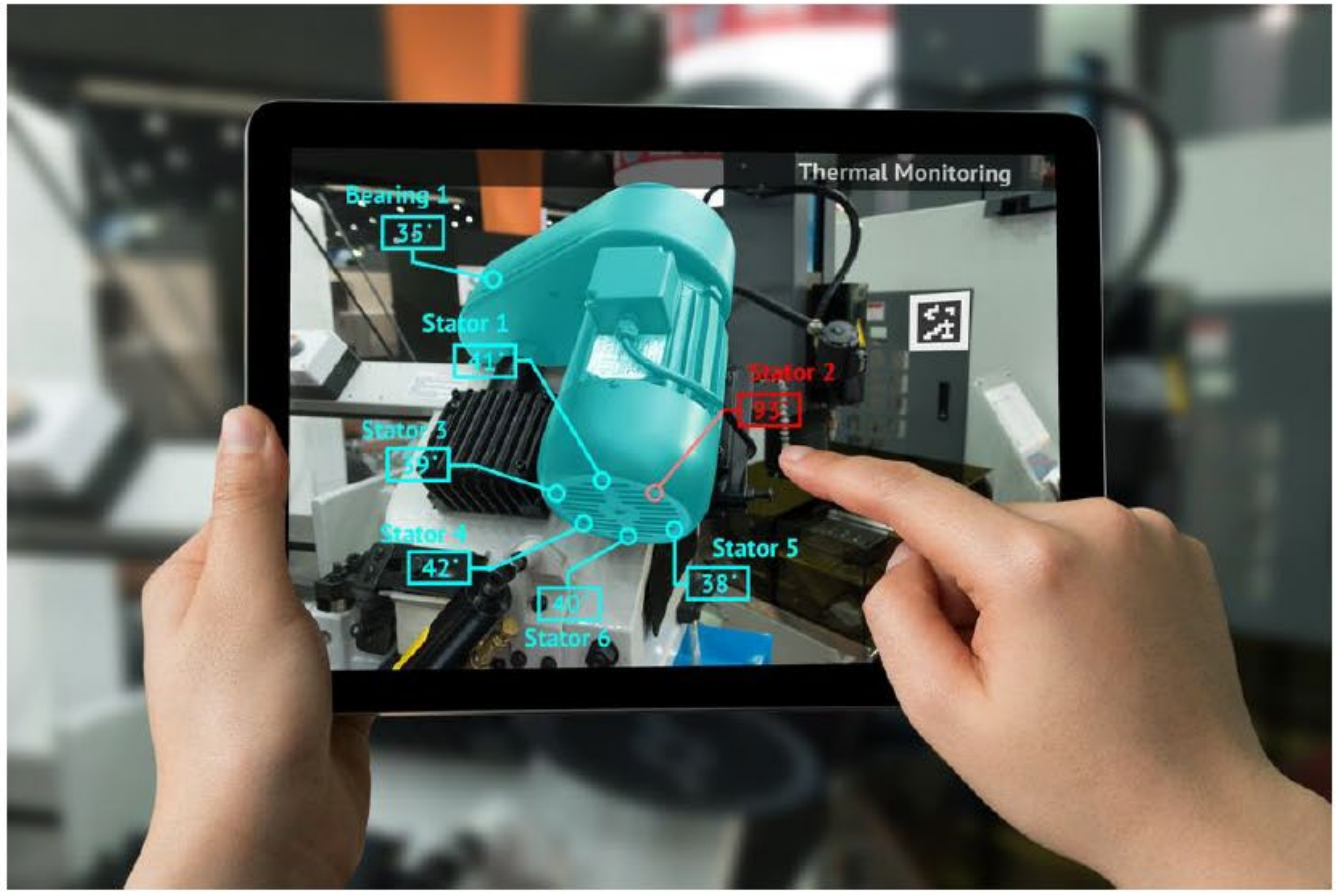
5G Use Cases: Live Entertainment

- 5G network provides desired carrying network capability for 4K, 8K ultra HD video. While extensive using in the scenarios of large event live broadcasting such as concert, live video conference, sport events, VR/AR gaming, and culture exhibition, the high-speed of transformation of 5G also realizes cost-saving in traditional digital copy process in the film industry.
- Combined with 5G enhanced broadband feature and related slicing network capability, plus AI technologies, it brings additional imagination to diverse forms of content, ultra HD video, and immersive entertainment experience.



- Chinese industry players have been exploring and practicing in the filed of 5G-ensured immersive video distribution from end to end. The solutions show how the original stream is able to be uploaded from creation and content to be transmitted to 5G end-use devices.

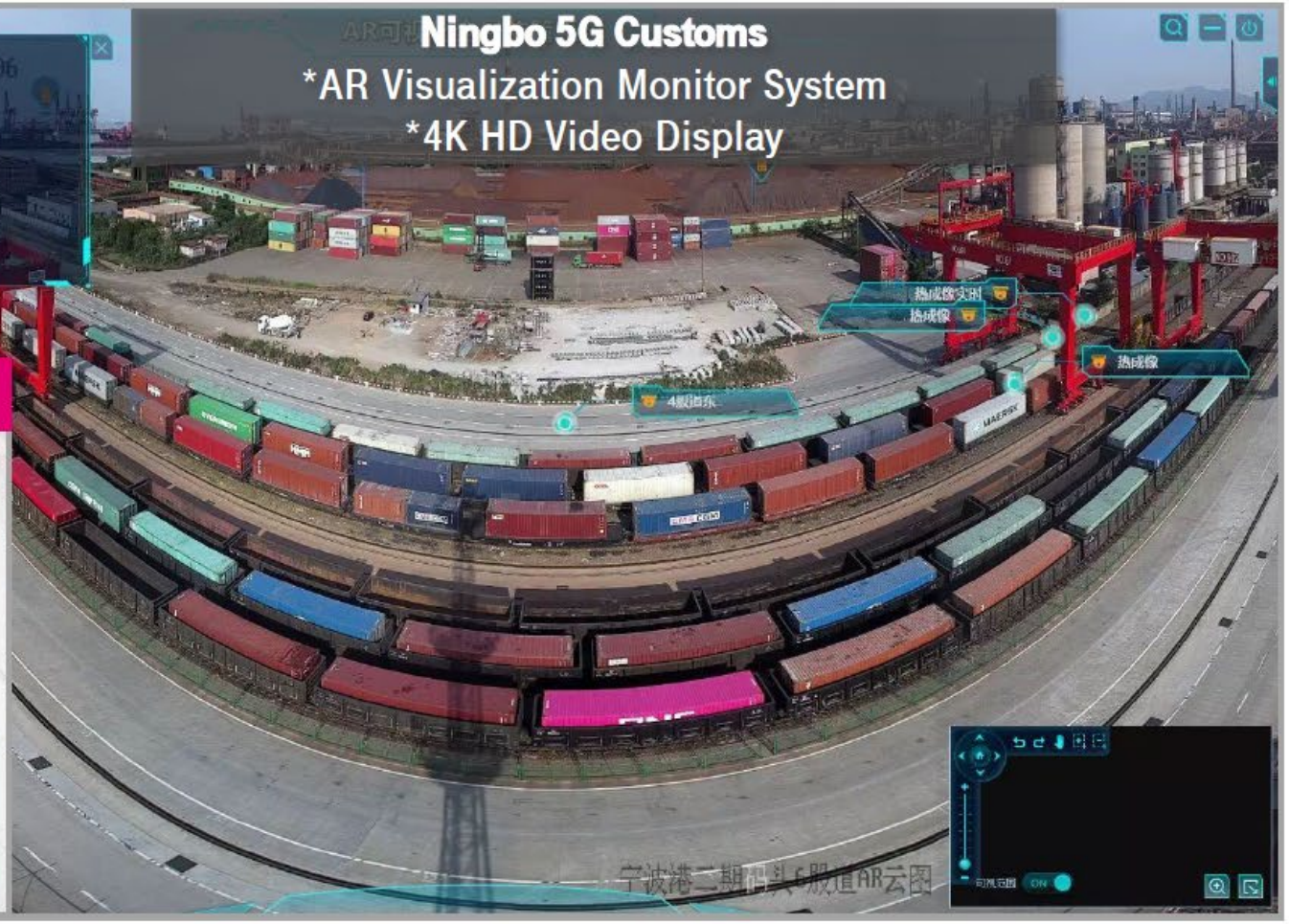
5G Use Cases: Deep Media Interaction



- AR, HD video assistant require higher bandwidth, so by using 5G network connection operators can easy contact to professor to get the deep interaction easily and more efficient. Through 5G network, the connection between operators and operation objects (mechanical equipment) as well as manufacturing execution control system of factory intelligent center, this could enable manufacturing data, images and human travel to depth interaction.
- Key operations need the particular technicians to operate but operation environment is dangerous, so it is difficult for technical person to operate in close. Through 5G network remote operation is highly required so media quality interaction need to be more distinction.

Source: Deutsche Telekom

5G Use Cases: Smart Customs Management



Ningbo 5G Smart Customs

- AR Monitor + AI Recognition
  - On the monitor screen, the officials can select the container. And, the system will automatically identify the track number, origin, destination and goods of the container.
  - In addition, the interface can display the data including dock, ship type, ship name, global sailing trajectory information, etc.
- AR Glasses for inspection, remote coordination for logistics
- Smart Entrance Inspection
  - Intelligent customs verification machines are installed at the inspection spot, with capability to proceed data at ms level.

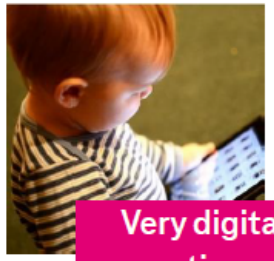
Source: Deutsche Telekom

Trends and Innovations towards Telco 2030: Who will be Our Customers

1.4bn

people over 60yrs in 2030... vs. to 901mn in 2015
(UN, 2015)

Seniors



1.3bn

youth in the **age of 15-24yrs** in 2030... vs. to 1.2bn in 2015
(UN, 2015)

Very digital natives

53%

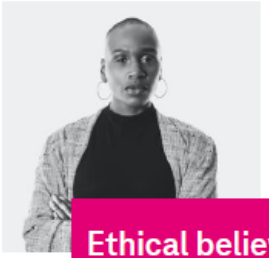
Of **worldwide GDP** (PPP) will come from Asia... vs. 42% today
(IMF, Statista, 2019)

Asian

60.4%

of **global population** will live in **urban *areas***... *vs. to 54% in 2015*
(Statista, 2018)

Urbans



64%

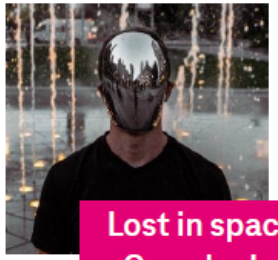
of consumers **buy based on beliefs, values & lifestyle in 2018**... vs. to 51% in 2017 *(Edelman, 2018)*

Ethical believer

Segment of One

in 2030... compared to **10 Sinus milieus today**... vs. to **3-estate system** in the middle ages *(Sinus-Institut, 2020)*

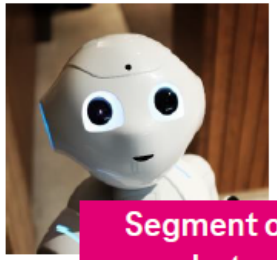
Fragmentation



10%

of US **Republicans** trust **Mass Media** in **2020**... vs. **52% in 1998**... vs. **73% of Democrats in 2020**
(Gallup, 2020)

Lost in space/ Querdenker



20mn

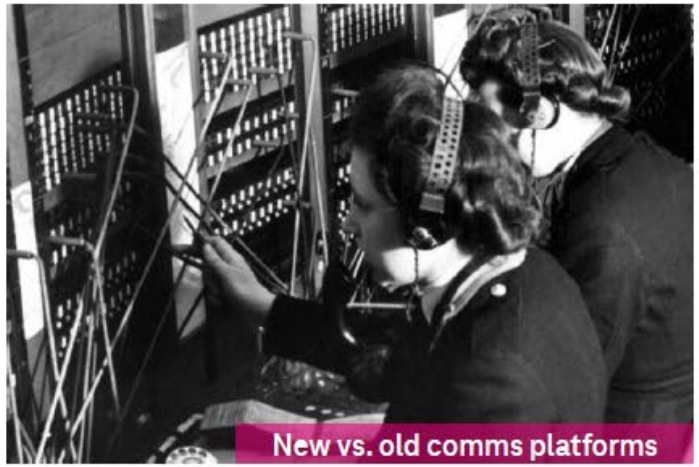
robots across the whole globe 2030... vs. 2mn in 2021
(Oxford Economics, 2021)

Segment of robots

Trends for Telco 2030: ‘Voice’ Goes and ‘Things’ Come

The Age of the Intelligent Thing

- Millions of intelligent **sensors and actors** support business processes
- Small “Things” will generate **unprecedented amounts of data**
- **Sensor data** to **exceed human data consumption** by a factor of 2 by 2030 [1]
- **Processing and analyzing** sensor-generated data requires substantial compute facilities



Communication patterns (and platforms!) change

- **Video calls/conferencing** have replaced the traditional “telephone call”
- **Collaboration tools** are imbedded in enterprise communication
- **Productivity software suites** (such as O365) include UCC/ECC functionality
- **“Voice”** as the original financial contributor to Telco business has **ceased to exist**

Source: Deutsche Telekom

“To improve is to change, so to be perfect is to have changed often.”

— Winston Churchill