Future of Electronic Communications Networks in Europe

Executive Summary

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TOWARDS A DIGITIZED EUROPE: POLICY AND MARKET CONTEXT

The EU has set ambitious goals for digital development, including the digital decade targets for 2030 which set targets for expansion of European Communication Networks (ECN) with gigabit networks available to everyone and all populated areas covered by 5G, amongst others.

Indeed, ECN are critical not only to Europe's digital future, but in securing European resilience, as glimpsed during the COVID-19 pandemic. ECN and the connectivity they provide are a pre-condition for digital transformation, with new ECN technologies laying the foundation for broader technological innovation (e.g. Network as a Service enabling smart cities).ECN are also critical infrastructure, underpinning Europe's crisis response and being required to resist increasing cyber-attacks.

According to a study conducted by Deloitte for ETNO (later referred to as the study), telcos have already invested EUR 500bn in fixed and mobile networks in the last ten years. However, European telecommunication operators face significant pressures currently: increasing investment and network upgrade needs, security challenges, and a fragmented and heavily regulated EU market, have resulted in declining profitability. High capex intensity and low returns put pressure on return on capital and eventually in market valuation triggering lower investment. In addition, increasing uncertainty over future monetization opportunities and growing competition from OTTs and non-traditional players such as hyperscalers pose risks of further value migration. These challenges all together reduce telcos ability to address the investment need for new infrastructure, currently estimated by the EU Commission to be at least EUR 174bn.

In response to these challenges, telcos have adapted by decoupling their business models, spinning off passive infrastructure, meaning the market is increasingly disaggregated into companies focused on the provision of infrastructure, network and services.

While there are benefits to this, in terms of increased market capitalization and more efficient business models, this trend creates challenges from an industry and policy perspective. Non-EU players such as hyperscalers and OTT players could have greater opportunities to enter the telco market and provide broadband services by renting towers, fiber and edge data centers. In addition, the ECN coordination and orchestration challenges arising from the value chain fragmentation will open the door to new types of industry players.

KEY TECHNOLOGIES FOR THE FUTURE OF ECN

To support EU policy for ECN development an understanding of the key technologies that will transform the way in which networks are built, deployed and operated is required. The study identified seven key technologies that will characterize the future of ECN and will enable crucial EU policy objectives:

- **5G Standalone (SA):** 5G SA networks boost the deployment of enhanced mobile broadband, ultra-reliable and low latency communications and massive machine type communications, effectively creating faster, more reliable networks that will serve as innovation platforms. In addition, 5G SA networks will be more flexible, cost and energy-efficient and secure through the use of network slicing technologies, virtualization and cloudification technologies.

- **FTTH and FTTx rollout:** Fiber delivers faster and more consistent internet speed and latency. It is also more secure and more energy-efficient and durable than copper-based networks, creating more sustainable networks.

- **Open RAN:** Open RAN will make ECN more agile and flexible by introducing interoperable hardware, software and open interfaces, thereby enabling hardware and software to be sourced from different vendors. It is expected to reduce equipment vendor lock-in and enable the decoupling of the telecom supply chain. However, Open RAN also carries a higher complexity in terms of system integration which will likely require the implementation of new automation and network management functions.

- **Network Function Virtualization (NFV) & Software Defined Networking (SDN):** NFV and SDN will enable ECNs to be more flexible, cost and energy-efficient and secure through the use of virtualization and cloudification technologies. NFV and SDN may also enable progress towards network automation, by leveraging AI/ML, as well as Network-as-a-Service (NaaS) through the use of network APIs to enable greater control and availability of network functions.

- **Edge Computing:** Edge computing enables data processing and analysis to be done closer to the source of the data, hence improving network resilience, efficiency and reducing latency. It can also help reduce dependence on cloud-based services, usually located outside of the EU, enabling greater resilience through localized processing, improved data privacy, and optimized performance.

- **Quantum Encryption:** Quantum Encryption can improve network security by providing unbreakable encryption, reducing the potential for cyber-attacks, in particular in the context of sensitive communications

- **LEO Satellite connectivity:** LEO Satelliteconnectivity (e.g., through the EU's IRIS constellation) can help increase broadband coverage in remote areas, as well as potentially increase network stability and resilience by providing alternative routes for data transmission. This will require integration with terrestrial networks and the potential future creation of a network of networks that allows to combine different types of access technologies.

The investment need to deliver on these developments is high; in particular infrastructure technology (FTTH / FTTx and 5G SA) will represent the most significant technology investment area until 2030 for European telecom operators, with estimated investments levels beyond €100 Bn for each.

NFV / SDN and Open RAN may require the most investment among enabling technologies, with investment levels between € 10 to € 100 Bn for each, depending on the degree of uptake. LEO satellites, edge computing and quantum encryption will represent smaller investment requirements, in comparison (i.e., less than € 10 Bn).

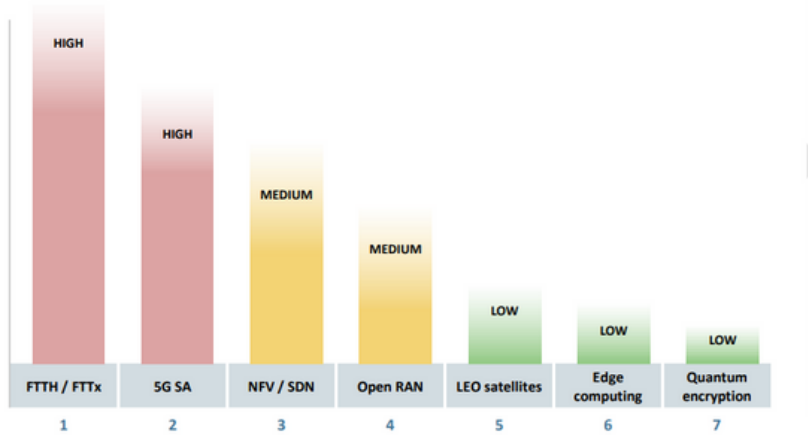
If European telecom operators are able to reap the full benefits of these technologies, the networks of the future will greatly contribute to the EU policy ambitions to enable autonomous, resilient, and sustainable networks that secure digital sovereignty and industry competitiveness. More specifically, fiber, 5G SA, NFV & SDN, LEO Satellite Connectivity and Open RAN must be combined to ensure the network's autonomy and resilience.

Technologies such as Open RAN, NFV & SDN and Edge Computing can have the stronger impact on boosting the EU's industry's competitiveness by enabling the entry of new European players into the ECN ecosystem in segments that are currently dominated by non-European providers.

Finally, virtualization technologies, as well as 5G SA and fiber, reduce energy consumption and promote more sustainable use cases and services in other industries.

High-level assessment of investment requirements for European telecom operators, per technology trends (2023-2030)*

Scales are illustrative only and are not indicative of actual point estimates



* Investment requirement assessment methodology is detailed in appendix. Figures presented are cumulative to 2030 in alignment with time horizons for EU targets and existing estimates of investment requirements and market size.

VALUE CHAIN TRANSFORMATION

ECN technological development cannot be analyzed in isolation and policy makers should recognize the broader industry trends occurring across the value chain. Many players will be impacted by the technological changes that will transform telecommunication networks.

Traditional telcos and network companies will become increasingly virtualized and able to outsource operations. In this context, hyperscalers will be in a prime position to establish themselves as key industry stakeholders by leveraging their leading cloud offerings and strong capabilities in the area. At the same time, hyperscalers will increasingly compete with telcos, not only in the services market but also potentially in the skills market. System integrators have the opportunity to come to play a central role in ECN, as networks become more open and the telecommunication value chain decouples, creating integration and orchestration challenges for telcos. Equipment and software providers will have new opportunities to develop the next generation of ECN equipment; technologies such as Open RAN will increase competition as they pave the way for new specialized players to enter the market. Finally, while service companies and OTT are less directly impacted by network technology developments, they could expand the types of services offered (e.g., application-specific connectivity plans, IoT offerings, B2B services…), their quality and create better customer satisfaction.

Telcos face both opportunities and threats with the technological development of their networks and its impact on the value chain. On the one hand, telcos can develop more flexible, resilient and higher-quality networks; the integration of AI and data analytics can significantly enhance network management and elevate customer experience; and opportunities for new, strategic partnerships can emerge. On the flip side, as emerging technologies and data analytics become integral to managing ECN, telcos will face the imperative of restructuring their workforce to acquire the specialized labor needed in these fields, which could be in short supply. Additionally, telcos may be faced with the challenge to monetizing increasing data traffic and the technological advancements due to overregulation, uncertainties in demand, high cost and low prices in a high-inflation economic environment, and the relatively limited scale of European markets. These challenges will be further amplified by the blurring of industry boundaries, new entrants and type of players that exert additional competitive pressures on telcos.

POSSIBLE EU POLICY APPROACHES

In light of the future transformation of ECN and their value chains, and of the technology trends that will drive such transformation, it is important that policy approaches support the key EU goals of enabling autonomous, resilient and sustainable networks, and of fostering digital sovereignty and industry competitiveness. To inform this, the study included a benchmarking exercise and identified the following policies building from examples from other countries.

1. Investment to improve the security and resilience in networks

- Policies and strategies to improve ECN security and resilience may deliver important benefits to the EU but also come with a financial cost. Investment in technologies such as quantum encryption and LEO satellite connectivity can support greater security, redundancy and resilience.

2. Standards & requirements to improve security and supply chain resilience

- Streamlining security standards across EU legal frameworks can support network integrity and alignment across Member States to facilitate the development of ECN and component technologies to common standards, and the harmonization of EU critical infrastructure. This will need addressing differences and coordinating stakeholders.
- ECN supply chain are critical elements in increasing overall security and resilience; therefore, particular focus on technologies like 5G SA and Open RAN, critical for security, resilience, and sovereignty, is crucial.

3. Investment in high-speed internet infrastructure

- Building and upgrading high-speed internet infrastructure requires significant financial investments and thus needs support for public and private investment can help address the existing €174bn deficit identified by the EC.

4. Investment to promote digital equity and affordable connectivity

- The lack of adequate digital infrastructure is a barrier to promoting digital equity in rural areas. Investments to support equity and inclusion can help address this investment gap and help achieving wider EU goals related to connectivity.

5. Financial contribution from large content application providers

- Large Content Application Providers (CAPs) may pay for the traffic they deliver over ECN, as is used in South Korea. CAPs are considered by ECN operators and some policymakers to be a key driver of data traffic growth. Other stakeholders identify potential downsides to such policies

6. Funding education program to develop IT expertise

- The EU identifies a lack of IT skills as a key challenge to develop and maintain the ECN and to promote wider implementation and use of digital technologies to support the business case for investment and transformation. Education programs are already being funded by the RRF to address IT skills and expertise and could inform future efforts to expand digital skills in the EU

7. Investment in the cloudification of the public services

- Cloud computing is crucial for achieving the Digital Decade goals, but it requires investment to cover migration and maintenance costs. EU Member States are allocating money to cloud and edge development through the Important Project of Common European Interest. In particular, the EU's edge computing target of 10,000 edge nodes being built by 2030 supports greater use of cloud.

8. Investment to support new technologies

- New technologies development can suffer low investments due to uncertainty in returns but public investment and incentives for private investment can accelerate technologies' development and rollout.

9. Simplification of merger control process and adaptation of assessments to facilitate in-market consolidation that supports policy goals

- Building scale, whether in the form of consolidation, partnerships or joint ventures is crucial to allow ECN operators to operate more efficiently and support the development of ECN, subject to regulatory and competition considerations. Simplification of procedures and protocol for assessing proposed consolidations etc. could help support the industry.

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