

5G Convergence in Europe

Technologies, Startups & Business Impact



Key topics

Why convergence matters: for Telefónica and the industry

Convergence is reshaping telecom in Europe. Operators are moving beyond basic connectivity by **combining fixed and mobile services with digital add-ons** like AI tools and security features in modular, customizable bundles. These strategies raise average revenue per user (ARPU) and enhance customer loyalty, as subscribers are drawn to the added value and convenience. For the industry, convergence sets the stage for **new service ecosystems** and **competitive differentiation**.



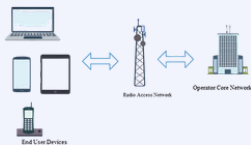
Why NTN & D2D will redefine mobile connectivity – and where the real growth lies

Non-Terrestrial Networks (NTN) extend 5G coverage to areas where traditional mobile networks cannot reach – such as remote regions, oceans, or disaster zones. Instead of ground-based cell towers, they use satellites, high-altitude platforms, and airborne stations to deliver connectivity. Telecom providers adapt existing 5G technology to overcome the unique challenges of space-based communication, such as the greater distances signals must travel.



Edge is the new core: Why MEC matters for resilience, security and growth

Multi-Access Edge Computing (MEC) and edge data centers are driving the **decentralized transformation of communication networks** in Europe. By processing data closer to end users and reducing reliance on centralized clouds, telecom providers enhance **cybersecurity and resilience** against physical disruptions. Highly reliable, ultra-low latency applications unlock new opportunities for real-time streaming and gaming, smart mobility, and Industry 4.0.



5G-Advanced: key changes and what they mean for telecommunications

The 3rd Generation Partnership Project (3GPP) sets the global standards that guide the development and evolution of telecommunications networks, ensuring **worldwide compatibility and interoperability**. For the telecom market, the Release 18, as well as the Release 19, mark the transition toward 6G and a more intelligent, automated network era.



Content

Europe's 5G transformation is in full swing – driven by network convergence, satellite-powered coverage, edge computing, and ambitious new standards. This whitepaper highlights how these trends unlock new opportunities for business growth, digital sovereignty, and innovative services.

At the heart of the transformation are dynamic partnerships: established operators and agile startups working side by side to turn cutting-edge technology into real-world impact. Explore what is next for 5G in Europe and discover how you can help shape the future.



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Why convergence matters: for Telefónica and the industry



Convergence is transforming telecom in Europe. Operators combine fixed and mobile services with digital add-ons like AI tools, cybersecurity, and cloud solutions, thus reshaping the telecommunications market: A significant and growing share of European households subscribe to at least one converged bundle that **unifies fixed broadband, mobile, and digital services**. As of 2024, leading European markets – including Portugal, Greece, the Netherlands, Spain, Germany, and France – continue to report high bundle penetration. In at least eight European markets, fixed-mobile convergent bundles make up more than 40% of all subscriptions, with Portugal remaining at the forefront: over half of households there opt for quad-play packages that include broadband, mobile, TV, and fixed voice.¹

Customers demand simplicity: **one provider, unified billing, and integrated management of all digital and connectivity needs**.

Market growth and outlook

Convergence is unfolding in **two distinct phases**. The first — bundling fixed broadband, mobile, and TV into double-, triple-, and quadruple-play offers — is now mature across much of Europe, with growth plateauing in markets such as France and Spain, where operators have cut FMC discounts after years of price competition.¹

The second phase is only beginning: operators are extending the same "one provider, one bill" logic **beyond connectivity into digital services** — cybersecurity, cloud, and AI-driven tools. This is where the next wave of differentiation and ARPU growth is expected, as core connectivity flattens. Convergence already drives higher spend and lower churn than standalone offers.¹

Europe's OTT market is expected to grow at a CAGR exceeding 15% from 2023 to 2028, as broadcasters and streaming services invest heavily to compete with US players.² Telcos remain well-placed: operators are merging fixed and mobile operations and partnering with OTT platforms, often replacing legacy pay TV with streaming.

Drivers and challenges

Phase 1 — connectivity bundling

- Saturation in core fixed and mobile products
- Declining ARPU from legacy standalone services
- Bundle discounts under pressure as competition intensifies

Phase 2 — digital services

- Agile, cloud-native OTT and cybersecurity competitors
- Demand for complex, integrated service combinations
- AI, cloud and security expertise sits outside the traditional core

Strategic advancement

Future success depends on **partnerships and ecosystem collaboration**. Operators must integrate AI-driven services, edge computing, and advanced cybersecurity features to create differentiated bundles and enterprise solutions.

Telefónica already created significant impact by collaborating with startups:

- [Telefónica expands its AI services by offering Perplexity to B2B](#)
- [Telefónica joins forces with Wiz to offer next-gen multi-cloud security](#)

Market impact

- Enhance customer retention and lifetime value
- Grow ARPU by meeting a broader range of needs
- Enable cross-selling of digital, entertainment, and AI-driven services
- Streamline operations through unified product management

Startups enabling new digital services for convergence in Europe

The following **companies** and **startups** play a key role in shaping converged offerings by bringing agility and innovation to areas like AI, security, eSIM, and digital content.



Lingokids delivers an interactive and award-winning learning platform for children aged 2–8, ideal for bundling with family connectivity plans to boost household value.



Prosegur provides global security, cash management, and cybersecurity solutions, helping businesses and households protect assets through advanced technology and trusted security services.



Storytel offers a rich library of audiobooks and podcasts across multiple languages, making it a strong fit for entertainment-rich converged packages targeting commuters and families.



Airalo provides a global eSIM marketplace covering 200+ countries, enabling seamless international connectivity for travelers without the need for physical SIM cards.



Solar360 delivers AI-driven energy management and solar solutions, enabling sustainable smart home services and new revenue streams for telcos entering the energy space.



Surfshark provides a comprehensive VPN and cybersecurity suite, protecting user privacy across unlimited devices and enabling secure access to digital services globally.



NordVPN provides industry-leading VPN and cybersecurity solutions, securing online connections for millions of users worldwide and complementing digital service bundles with trusted privacy tools.



Proton offers an encrypted ecosystem of email, VPN, and cloud storage, empowering users and businesses with privacy-first digital tools built on open-source technology.



Tibber delivers a smart energy platform that connects electricity consumption with real-time pricing and renewable sources, enabling cost-efficient and sustainable home energy management.

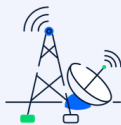


Qustodio offers advanced parental control and digital wellbeing tools, giving families granular oversight of screen time, content access, and app usage across all devices.

Why this matters for Telefónica

- Expand digital service portfolio for convergence
- Test new solutions quickly and without risk through PoCs
- Accelerate service integration and respond to evolving customer needs

Why NTN & D2D will redefine mobile connectivity and where the real growth lies



Non-Terrestrial Networks (NTNs) are becoming critical components in Europe's mission to deliver **widespread 5G coverage**. They are particularly important in sparsely populated or hard-to-reach regions where terrestrial deployment is technically or economically impractical. By leveraging satellites, high-altitude platforms (HAPS), and airborne base stations, NTNs allow us to bridge the digital divide and ensure continuous, robust mobile service across diverse geographies.³

Satellite Market growth and outlook

The **global satellite NTN market** is set for rapid growth. MarketsandMarkets estimates its value at \$0.56 billion in 2025, growing to \$2.79 billion by 2030 (38% CAGR)⁴; Polaris Market Research projects a longer-horizon value of \$5.13 billion by 2034.⁵ By volume, Europe is the fastest-growing region globally.

The **direct-to-device (D2D) satellite segment** is projected to rise from \$2.5 billion in 2025 to over \$43 billion by 2034. Europe, together with North America, leads thanks to robust ground infrastructure and government-backed digital connectivity initiatives.⁶

Technical and regulatory challenges

- Spectrum harmonization and regulation
- Signal propagation delays and latency
- Doppler shifts and moving cells
- Interoperability

Fusing 5G and NTN

Integrating NTNs with 5G standards ensures seamless and resilient connectivity – even in rural areas, across borders and for highly mobile scenarios. For telecom operators, this means extending **service reach** without the need for costly terrestrial infrastructure, strengthening **digital inclusion**, and enabling entirely **new premium offerings**. As 5G and NTN capabilities converge, operators can shape innovative service models, address untapped markets, and support the EU's ambition for universal high-performance connectivity.

D2D satellite services

- Standard mobile phones **connecting via satellite** – no special hardware required.
- Expanding coverage for everyday and emergency use.
- Enabling new bundles and enterprise solutions for sectors like logistics and public safety.
- Seamless, borderless connectivity for consumers and businesses alike.

New market potential

NTN can become a resilience layer for critical infrastructure and a growth driver for content delivery and IoT services – key priorities for the telecom industry, seeking to diversify offerings, enhance business continuity, and tap into new vertical markets.

- **Maritime and remote healthcare**: Reliable 5G connectivity supports telemedicine and critical communications beyond terrestrial reach, including ships and remote communities.
- **Critical event communication**: NTNs provide rapid, resilient backup connectivity during natural disasters or infrastructure failures.
- **Media and content delivery**: Projects like 5G-EMERGE are demonstrating the advantages of satellite-enhanced content delivery, including seamless high-bandwidth streaming to homes and vehicles.

³ Connecting the world with 5G NTN

⁴ Markets and Markets, Satellite NTN Market Size Share and Analysis, 2025 to 2030

⁵ Polaris Market Research, Satellite NTN Market Size, Share, Trends, Industry Analysis Report

⁶ Advanced Television, Forecast: D2D market worth over \$43bn by 2034

Startups driving telecommunication through NTN & Direct-to-Device innovation

These [startups](#) play a key role in advancing NTN and D2D by driving innovation in satellite connectivity, IoT integration, and direct-to-device communication.



[Skylo Technologies](#) provides robust machine-to-machine (M2M) communication via satellite in remote and rural areas with limited or no terrestrial coverage, ideal for IoT use cases.



[LYNK](#) enables standard, unmodified mobile phones to connect directly to satellites for messaging and emergency communications – a major step toward true global D2D coverage for every handset.



[AST SpaceMobile](#) aims to build the world's first space-based 5G cellular broadband network, delivering direct high-speed broadband access to standard mobile handsets worldwide without special hardware.



[Sateliot](#) develops a low-Earth orbit satellite constellation designed specifically for narrowband IoT, supporting low-power devices and enabling seamless integration with existing 5G standards.



[OQ Technology](#) provides low-latency, low-power 5G IoT satellite connectivity for industrial, agricultural, and logistics applications – effectively filling critical gaps left by terrestrial networks in hard-to-reach areas.



[Space Lacuna](#) delivers affordable and energy-efficient satellite IoT solutions purpose-built for remote environmental monitoring, asset tracking, and supply chain visibility across vast geographies.

Why this matters for Telefónica

- Fast-track NTN and D2D innovation and deployment
- Extend coverage and services without new network build-out
- Unlock new business models and tailored solutions for remote and IoT markets

Edge is the new core:

Why MEC matters for resilience, security and growth

Whether in smart cities, along transport corridors, or inside industrial sites: Multi-Access Edge Computing (MEC) and edge data centers **position processing power at the network's edge** – enabling local data analysis and decision-making. For the telecom industry, edge is a cornerstone for next-generation services like IoT, immersive media, and AI-driven automation, supporting European data sovereignty and resilience.



Market growth and outlook

- The European edge data center market is projected to grow from \$5.2B in 2024 to \$28.7B by 2034.⁷
- Edge node deployment across the EU is accelerating: node count grew from 498 in 2022 to 1,836 in 2024, against an EU target of 10,000 climate-neutral edge nodes by 2030.⁹ Separately, the EU's Digital Decade programme targets 75% of European businesses using cloud-edge technologies by 2030 — up from 45.2% cloud adoption in 2023.⁸
- By 2025, 75% of enterprise-generated data will be processed outside traditional centralized data centers.⁹

European edge data center market growth



Enterprise data processing shift



Cybersecurity and sovereignty

- Reducing exposure to centralized cloud vulnerabilities and long-distance interception.
- Providing stronger **protection against both physical and cyber threats**.
- Simplifying compliance with EU privacy laws and building trust in digital services.
- Supporting **European data sovereignty** by keeping sensitive data within national or regional borders.

Benefits

- Reduced latency
- Mitigated backhaul congestion
- Increased reliability and responsiveness of digital services

Ultra-low latency and advanced use cases

- **Real-time streaming and immersive media:** Powering augmented and virtual reality, live broadcasting, and interactive gaming with minimal lag.
- **Advanced automation and robotics:** Enabling real-time control in manufacturing, logistics, and autonomous vehicles or drones.
- **Smart transport and mobility:** Supporting V2X communications, continuous cross-border service availability, and fast, localized hazard warnings.
- **AI and machine learning:** Facilitating on-the-fly analytics, predictive maintenance, and rapid decision-making in both industry and healthcare.

Startups driving MEC and edge computing innovation

These [startups](#) enable telecom operators to efficiently scale, automate, and secure edge computing infrastructure, which is essential for delivering next-generation digital services.



Edge Centres

[Edge Centres](#) provides flexible, distributed edge data centers across key locations, enabling rapid scaling and robust local processing for a wide variety of enterprise and telco use cases.



[ZEDEDA](#) specializes in secure and scalable edge orchestration, dramatically simplifying the deployment and management of distributed edge infrastructure across multiple sites, vendors, and applications.



[Leading Edge Data Centers](#) provides modular, prefabricated edge data center infrastructure (Tier III colocation), primarily across regional and rural Australia, bringing cloud and network resources closer to underserved communities.



NEARBY
COMPUTING

[Nearby Computing](#) offers advanced orchestration and automation platforms for managing complex multi-site edge and 5G deployments, with strong support for smart cities, connected industry, and real-time applications.



close · coupled · connected

[nLighten](#) focuses on highly reliable, sustainable, and carrier-neutral edge colocation facilities, specifically designed to support latency-sensitive and compliance-critical applications across distributed markets.

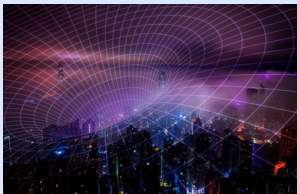


[Radiant](#) develops cloud-native edge platforms, enabling enterprises to deploy and manage AI-driven applications seamlessly across diverse edge environments.

Why this matters for Telefónica

- Speed up edge and **5G rollout** with scalable infrastructure
- Simplify edge management and automation across sites
- Deliver secure, compliant AI and IoT solutions for customers

5G-Advanced: key changes and what they mean for telecommunications



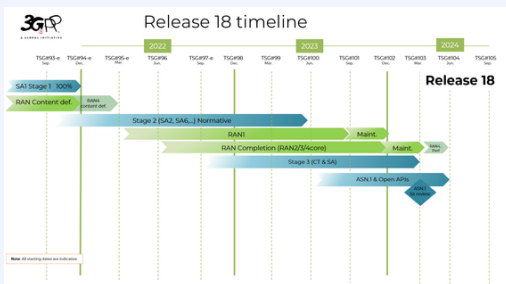
The pace and direction of 5G innovation are set globally by the **3rd Generation Partnership Project (3GPP)**. Each new release shapes the feature set, compatibility, and future readiness of mobile networks in Europe and worldwide.

The 3GPP **Release 18** marks the first phase of **5G-Advanced**, introducing significant enhancements to 5G networks and laying the foundation for next-generation capabilities. **Release 19**, finalized in December 2025, continues the evolution of 5G-Advanced with further enhancements and refinements to existing technologies.

For the telecom industry, these releases set the foundation for **next-generation services** and **competitive differentiation**.

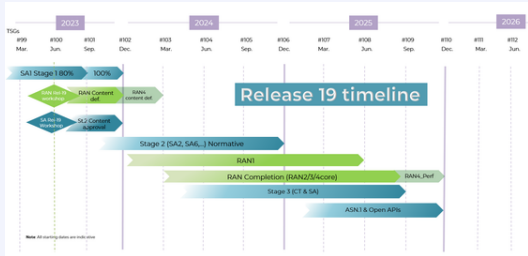
- **NTN and satellite expansion:** Seamless connectivity between terrestrial and non-terrestrial networks for global coverage.
- **Ultra-low latency and uRLLC:** Advanced scheduling for mission-critical services like autonomous vehicles and industrial automation.
- **Energy efficiency:** Network features that reduce power consumption, supporting IoT and sustainability goals.
- **AI/ML and automation:** Intelligent network optimization, predictive maintenance, and automated orchestration.
- **Network slicing and multicast:** Flexible slicing for public safety, enterprise, and media delivery.

3GPP
Release 18:
Advancing 5G



**3GPP
Release 19:
Preparing for
the next wave
of innovation**

- **Industrial IoT and distributed networks:** Further advancements for industrial sensor networks, distributed MIMO (D-MIMO), and advanced automation in smart factories and logistics.
- **AI-powered automation:** Greater focus on automation and energy efficiency. Advanced AI/ML is leveraged for real-time optimization, predictive maintenance, and resource management.
- **Immersive services:** Network adaptations for next-generation XR, VR, and AR applications feature enhanced uplink/downlink capabilities.
- **Integrated sensing and connectivity:** Early steps toward networks that combine communications and sensing technologies. These are essential for autonomous mobility and smart environments.
- **Mobility and network resilience:** Further innovations aim to improve beam management, handovers, and quality of experience across complex radio environments.
- **Setting the stage for 6G:** Early research into integrated AI/ML for mobility management, network intelligence, and future-ready packet handling paves the way towards next-generation 6G networks.



Active engagement with **3GPP standards** keeps Telefónica competitive and innovative. **Release 19** opens doors to new revenue streams in IoT, immersive media, and automation – while laying the foundation for next-generation connectivity.

Startups advancing 5G-Advanced and next-generation network innovation

These [startups](#) enable telecom operators like Telefónica to implement 3GPP Release 18 and 19 capabilities, driving AI-powered automation, ultra-low latency, and next-generation connectivity across industries.



[Acceleran](#) specializes in open RAN and uRLLC scheduling, enabling operators to deploy flexible, mission-critical 5G networks with dynamic scaling and ultra-low latency for industrial use cases.



[DeepSig](#) leverages AI/ML to optimize RAN performance in real time, enabling intelligent automation and predictive maintenance across multi-vendor network environments aligned with 3GPP Release 18 and 19 goals.



[Sequans Communications](#) develops IoT and uRLLC chipsets optimized for 5G connectivity, combining energy efficiency and mission-critical reliability for large-scale industrial IoT and autonomous system deployments.



[Imec](#) drives early-stage 6G and integrated sensing and communication (ISAC) research, developing next-generation radio technologies that bridge current 5G-Advanced capabilities with the future demands of 6G networks.



[Rimedo Labs](#) develops AI-native RAN Intelligent Controller (RIC) applications that optimize open RAN performance in real time, enabling smarter traffic management and energy efficiency across 5G-Advanced networks.

Why this matters for Telefónica

- Accelerate 3GPP Release 18/19 deployment with open RAN and cloud-native core solutions
- Enable industrial IoT and private 5G use cases through lightweight and scalable network infrastructure
- Drive AI-powered network optimization and lay the groundwork for future 6G networks

Shaping Europe's 5G future

– What you can do

The next phase of **5G in Europe** is being driven by converged networks, non-terrestrial technologies, edge computing, and evolving standards. These are not abstract trends—they directly impact how we design, build, and deliver our services.

At **Telefónica**, this means turning strategy into execution—across teams, markets, and partners.

Focus on three priorities:

Break silos: Align fixed, mobile, and digital—build integrated solutions.

Use new tech: Turn edge and satellite into real use cases—start testing.

Work with partners: Bring in startups and vendors early to move faster.



What this means for you:

Look at your **current projects**—where can you simplify, integrate, or accelerate? Where are you still working in isolation? What opportunity are you not using yet?

By making these shifts in day-to-day decisions, we don't just follow Europe's 5G evolution—we actively shape it.

Start now.



Startup Map – driving innovation across key domains

Startups are shaping the future of connectivity and digital services. This map highlights innovators in four critical areas: **convergence**, **NTN & D2D satellite IoT**, **edge infrastructure** and **5G-Advanced**. For Telefónica, these categories represent opportunities to expand service portfolios, improve coverage, and accelerate time-to-market for next-generation solutions.

	Convergence	NTN & D2D satellite IoT	Edge infrastructure	5G-Advanced
Startups in the field	    TEF Investment  TEF Joint Venture      TEF Commercial deal	 TEF Commercial deal  TEF Commercial deal  TEF Commercial deal  Space - Connecting - 5G IoT TEF Commercial deal  TEF Commercial deal  GROUP	    Wayra Investment  close - coupled - connected 	 TEF Commercial deal    
	Startups enabling digital services that complement connectivity – e.g., education, content, and AI tools.	Innovators extending coverage and IoT connectivity via satellites and direct-to-device solutions.	Companies providing distributed edge data centers, orchestration, and secure colocation for ultra-low latency services.	Staying ahead of 3GPP standards keeps Telefónica competitive — unlocking new revenue in IoT, media, and automation while building toward 6G.

Your solution created by startups – driving real business impact

Wayra is the bridge between innovative startups and all o2 Telefónica departments. We help you rapidly solve business challenges and unlock new growth – from idea to implementation

What we do:

Startup scouting & matching	Risk-free pilots	Agile execution	Long-term integration
We identify and connect you with startups from our global and trusted ecosystem.	We design and manage proof-of-concept projects, covering all costs.	Our fast-track processes mean solutions are tested and implemented quickly.	If a pilot is successful, we support seamless adoption into your business areas.

Why you should join:

Efficiency Boost	Revenue Boost
• Work directly with startups on your digitalization and operational challenges. • Evaluate real business impact through hands-on testing, with minimal risk or upfront commitment. • Rely on Wayra's expertise ensuring successful scaling within your team after positive pilot.	• Collaborate with market-ready startups and scaleups to enhance your products and services, and open up new market potential. • Build value-adding partnerships to pilot, commercialize, and scale new innovative solutions and reach new customer segments. • Tap into new business models and create added value for end customers.

Ready to start?

Join **30+ Telefónica departments** already working with Wayra to drive tangible innovation.

Start your journey now!

Contact: **Nora Alfen**, nora.alfen@wayra.org

Or click the button to learn more:

Wayra for Telefónica

Sources

Market growth and outlook:

¹ [Fixed-mobile convergence is becoming increasingly crucial for operators' consumer strategy](#)

² [State of Digital Communications 2025](#)

³ [Connecting the world with 5G NTN](#)

⁴ [Markets and Markets. Satellite NTN Market Size, Share and Analysis, 2025 to 2030](#)

⁵ [Polaris Market Research. Satellite NTN Market Size, Share, Trends, Industry Analysis Report](#)

⁶ [Advanced Television. Forecast: D2D market worth over \\$43bn by 2034](#)

⁷ [5GMEC4EU: Connecting Europe through edge-enabled 5G innovation](#)

⁸ [The Edge Observatory for the Digital Decade](#)

⁹ [Edge Observatory for the Digital Decade. Edge Deployment Data Report – 3rd report](#)

¹⁰ [3GPP. Release 18](#)

¹¹ [3GPP. Release 19](#)

Images:

[SPN Global. Focus on fixed+mobile bundles as triple-, quad-play trend down in Western Europe](#)

[Lin, Rommer et. al. 5G from Space: An Overview of 3GPP Non-Terrestrial Networks](#)

[Kaur, Maninder. A Comprehensive Survey on Architecture for Big Data Processing in Mobile Edge Computing Environments](#)

[Illustration Technology 5g Aerial](#)

[3GPP. The 5G standard](#)

[3GPP. Release 18](#)

[3GPP. Release 19](#)

[Illustrations Globe Europe](#)



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