NetworldEurope

Visions for Future Communications Summit

POST-EVENT REPORT

Organized by NetworldEurope with the support of 6G-IA, SNS CO-OP, European Commission and IEEE

Lisbon, November 25th and 26th 2025

Visions for Future Communications Summit - Pre-Event Overview

Visions for Future Communications Summit is a top-quality research workshop, with the support of 6G Smart Networks and Services Industry Association (6G-IA), SNS CO-OP, European Commission and IEEE, oriented to identify key research areas in information and communication technologies in the mid-future of 7 to 10 years. The VFCS is an exercise we perform as the launching effort for updating the NetworldEurope Strategic Research and Innovation Agenda (SRIA) for the EU, an effort we have continuously made in the last years. This upcoming SRIA will have a peculiar significance, as it will be the SRIA associated with the launching of FP10, the new framework program. As such, this will have a particularly large long-term impact, in helping defining Europe long term priorities for the whole framework program.

It will follow from the previous events held in 2017, 2019, 2021 and 2023, considering that by 2030 6G will be reaching the market. Given the expected innovation cycle times, it is now appropriate that we start discussions on **Challenges for 2030 and Beyond**.

We invited interested parties to present their views, both in terms of "technologies to address after 2030" and in terms of "the society we will need to support after 2030". Both aspects, the bottom-up technology (the technology supply side) and the top-down requirements (the societal demand side), will be very useful for our collective building of the upcoming SRIA, and facilitate the building of a community view on where we should orient our strategic development lines.

The Summit covered multiple research lines, with several keynote speakers and a set of sessions. All sessions were organized as panels of distinguished speakers from academia, industry and European officials presenting their viewpoints on a subarea within each track. Panels were oriented to encourage interaction among the panelists and between the panelists and the audience. The discussions were very fruitful, and highlighted several areas which should been placed on the R&D roadmap in Europe and U.S. The past Whitepaper, the Strategic Research and Innovation Agenda (SRIA), has been the basis for the design of the upcoming Smart Networks and Services funding calls.

Location: Lisbon (with one online keynote)

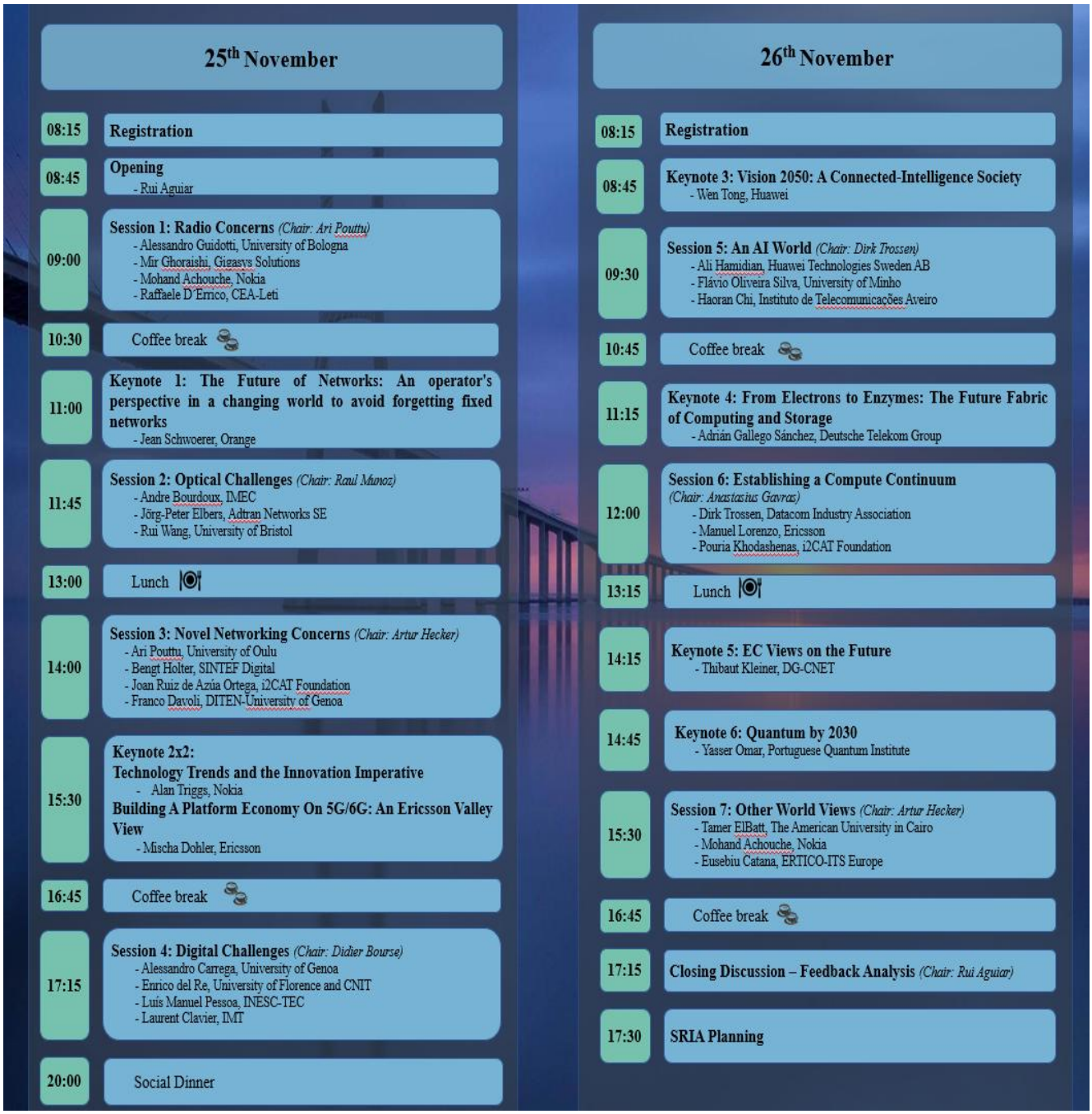
Date: 25-26/11/2025

Duration: 2 full days (16 hours)

Maximum number of simultaneous attendees: 41

Event Post-Report by: José Cabaça, Julio Camejo, Sofia Vaz

Visions for Future Communications Summit - Agenda



Visions for Future Communications Summit – Day 1

Opening Speech and Introduction *by Rui L. Aguiar (NetworldEurope SB Chair/University of Aveiro)*

Prof. Rui Aguiar welcomed the speakers and the participants to the 5th Visions for Future Communications Summit. He then gave an overall perspective of the agenda and concluded his opening speech by noting the very good curricula of the event speakers and thanking them for their availability and participation.

Session 1: Radio Concerns *(Chair: Ari Pouttu)*

The session explored how 6G is converging toward a unified, intelligent and eco-aware network fabric that tightly integrates terrestrial and non-terrestrial networks, advanced hardware and AI-native software.

On the access and spectrum side, NTN was positioned as a core pillar of 6G, evolving from separate TN/NTN systems into multi-orbit, multi-band architectures that deliver direct-to-device coverage below 7 GHz and high-capacity links above 10 GHz to vehicles and fixed terminals, with stringent requirements on GNSS-resilient positioning, dynamic and federated spectrum sharing across satellite operators, and the use of new bands and optical links orchestrated by AI and federated management. Complementing this, it was proposed **an aggressive FR3 and sub-THz roadmap** where 10–20x 5G capacity gains rely on extreme massive MIMO on the existing site grid, highly integrated front-end modules and hybrid analog–digital beamforming, raising major R&D challenges in RF chains, filtering, converters and packaging that must be addressed through coordinated European programs. On the architectural side, an AI-native RAN was framed as a distributed software system in which differentiation and even sovereignty will depend more on software and AI than on hardware, but with serious risks of cost concentration, new forms of lock-in at the hardware–software boundary, immature AI operations tooling and difficulties in explaining, certifying and governing non-deterministic AI in mission critical loops; a European response was proposed around shared open abstractions, reference stacks and intent driven, eco aware RAN designs aligned with values of safety, trust and sustainability.

This view was extended to a beyond 2030 compute–connectivity continuum that combines energy efficient FR3–THz front ends, analog and wave based computing, photonic electronic integration, semantic and goal oriented communications, free space optics, regenerative satellite payloads, physical layer security, zero energy IoT and even quantum RF sensing, all evaluated through detailed energy and life cycle assessments. In the discussion, participants repeatedly questioned the "more of everything" trajectory, emphasizing the need to truly address economic and energy costs, bring security and trust into the design from the start, develop richer KPIs that account for life cycle costing and societal impact, and reinforce interdisciplinary collaboration so that 6G innovation remains not only technically ambitious but also secure, explainable, economically viable and environmentally sustainable.

Keynote 1: The Future of Networks: An operator's perspective in a changing world to avoid forgetting fixed networks *by Jean Schwoerer (Orange)*

The session presented an operator view of networks beyond 2030, arguing that **connectivity must be driven by value and sustainability** rather than peak performance, or the telecom sector risks economic unsustainability and loss of societal trust. Future networks should keep or reduce energy use despite traffic growth, quantify and cut end-to-end environmental impact, embed security, resilience, privacy, and digital inclusion as core design goals, and answer four recurring questions: how to ensure sovereignty and resilience, support evolving uses like AI devices and XR, reach carbon neutrality, and increase operational efficiency. Proposed levers include delivering “just enough” instead of over-dimensioning, modular and upgradable hardware and software, smarter energy management, and tighter integration of terrestrial and non-terrestrial networks, edge/cloud, optical, quantum, and semantic techniques, while shifting from rigid “G” generations to continuous evolution guided by usage and sustainability. In the subsequent discussion, participants connected this vision to triple bottom line thinking, noting that economic forces have become dominant and questioning whether research should strengthen the social and environmental legs or seeking to reshape the economic one, and calling for much deeper understanding of societal aspects, user perceptions, and data risks as the ultimate judge of future networks. Verticals were seen as key partners to uncover real needs and co design solutions that reduce their footprint, while examples such as federated networks and shared rural coverage illustrated how technical possibilities often clash with economic realities, reinforcing the need to **rethink business models, regulation, and incentives** so that social impact, digital inclusion, and sustainability are not sidelined by purely financial considerations.

Session 2: Optical Challenges *(Chair: Raul Munoz)*

The Optical session chaired converged on a common vision of future networks where optics, ultra precise timing and AI are tightly intertwined, turning transport from passive bandwidth pipes into an intelligent, energy aware nervous system for

6G and beyond. Speakers showed how 6G fronthaul, midhaul and backhaul, together with AI and LLM traffic that may dominate global flows, require optical networks that are co designed with radio and computing, providing reconfigurable, low latency paths between users, edge, regional and core data centers, and unifying access, wireless and satellite through coherent PON, WDM, optical feeder links and emerging technologies like hollow core fiber and optical wireless. At the same time, optical and photonic advances are being pushed by AI mega data centers in a world of fiber everywhere, where the **bottleneck shifts from bandwidth to power** so low power coherent optics, dense photonic integration and power per bit as a primary design metric become essential. Across wired, wireless and satellite systems, extremely stable timing was highlighted as a future game changer, with chip scale optical atomic clocks promising clock stability on a chip that could drastically reduce phase noise, simplify synchronization and unlock new performance for CoMP, distributed MIMO, inter satellite links, radar and navigation, provided that technology and protocol R and D evolve together.

Security and trust featured prominently, from quantum safe networking with QKD in access, metro, core, satellite and subsea domains to secure and resilient packet optical fabrics for AI clusters and critical infrastructure, and to architectural questions about ledgers, governance and sustainability of security mechanisms. The open discussion repeatedly returned to **where edge computing really makes sense** and why telco edge has not taken off at scale, distinguishing strong European backbones and central cloud from use cases that genuinely need localized compute for data localization, sovereignty, resilience or fairer access to AI, and exploring federated and renewable powered micro data centers as possible directions. Participants also stressed that many challenges are economical and governance rather than purely technical, calling for clearer terminology around cloud, compute and data continuum, better ways to leverage proprietary data for AI without losing trust, and business models and regulation that make energy frugality, sovereignty and social value consistent with deployment incentives.

Session 3: Novel Networking Concerns *(Chair: Artur Hecker)*

This session revolved around making future networks resilient, inclusive of neglected domains, natively TN/NTN unified and intrinsically sustainable, rather than just faster. Resilience was framed as a core design goal for all generations, tightly linked to societal sustainability: mobile networks are now critical infrastructure entangled with power grids and GPS, so it is no longer enough to be robust in normal conditions, networks must adapt, recover and keep working under disasters, cyberattacks and hybrid threats, with clear modes of operation, national strategies and resilience metrics anchored in IMT and 3GPP. In parallel, the vision of a 6G "communication continuum" was challenged to fully include **the maritime and especially subsea domain**, arguing that underwater wireless remains a neglected infrastructure, despite its importance for autonomous operations, climate monitoring and offshore industries, and that Europe could lead by bringing sea and subsea into SRIA topics, working groups, pilots and standards so that the oceans become a first class part of 6G rather than a niche. The evolution of NTN was discussed not in terms of waveforms but as an operational and business integration problem, where satellites, HAPs and drones are managed together with terrestrial RAN as one multi-tenant system, with unified NetOps plus SatOps, predictive multi domain resource management, standard interfaces between mobile and satellite operators, support for virtual operators and in orbit services, and routing that can cope with dynamic multi orbit topologies and intermittent links. Sustainability ran through the session as a full KPI: traffic growth and AI compute mean that efficiency at device level is not enough, so orchestration and control must explicitly trade off performance against energy and environmental impact using **standardized energy reporting**, abstractions like ETSI's Green Abstraction Layer, and multi-level controllers that can reposition functions, slices and even satellite segments across O-RAN and NFV environments.
In the discussion, participants stressed that satellite, Wi-Fi and other access types should be treated as different faces of the same wireless domain while still respecting their specific constraints, that true TN/NTN convergence ultimately means a single device seamlessly using terrestrial and non-terrestrial access, that resilience concerns extend to legacy systems and physical infrastructure, and that many of the hardest issues, from edge deployments to prioritizing critical traffic and sharing proprietary data for AI, are as much about economics, governance and social dialogue as about technology.

Keynote 2x2: Technology Trends and the Innovation Imperative *by Alan Triggs (Nokia)* & Building A Platform Economy On 5G/6G: An Ericsson Valley View *by Mischa Dohler (Ericsson)*

Keynote 2#1 by Alan Triggs painted a picture of an era of **almost unlimited intelligence, compute and energy, driven by AI, quantum and a nuclear revival**, while warning that truly disruptive innovation is not automatic. He highlighted how large enterprises and deep tech investors are pouring money into AI, security and future compute, with nuclear and quantum moving from lab to deployment, yet bibliometric and patent studies suggest disruption is declining and Nobel

level breakthroughs take longer. For Europe, the message was that despite strong deep tech and regulatory capabilities, it lags the US in scale, capital and risk appetite, so it must **deliberately build denser innovation ecosystems**, improve growth funding and keep founders at home, while also managing the human side of innovation: reducing cognitive overload, fostering serendipitous in person collaboration, encouraging polymathic breadth and designing an AI continuum that spans massive data centers, edge clouds and devices, with different model sizes at each layer and networks upgraded to support AI driven (especially uplink) heavy traffic.

Keynote 2#2 by Mischa Dohler took a very concrete Ericsson Silicon Valley view of how this AI continuum will hit mobile networks, arguing that 5G and 6G can become **the core platform for an AI, AR and API based service economy** if they treat **uplink as a strategic resource**. As AI native devices such as smart glasses, laptops, AVs and droids send continuous video and sensor streams, uplink becomes telco's new currency, with UL traffic expected to grow much faster than downlink. He showed how three ecosystems are aligning now: UL optimized 5G SA and 5G Advanced features on the network side, a real market for AI and AR devices on the device side, and a renaissance in XR and volumetric applications, and proposed that operators respond with AI native, level 4 autonomous networks and three monetization bundles: differentiated connectivity with assured uplink, paid boosts during critical "pain moments", and an API driven model where AI agents become invisible network subscribers. His closing call to action was to build an "AAA" strategy – AI, API and AR together – so that operators move beyond bit pipes into a programmable, uplink centric platform economy for AI agents and XR services.

In the joint discussion, participants dug into both the promise and the limits of this AI centric future, questioning how far autonomous AI systems can really go before hitting issues like model collapse and closed loop learning, and what this means for creativity, research and control. They debated where compute should sit in the AI continuum, balancing sovereign, low latency, local compute against hyperscale data centers, and how security, privacy and regulation constrain the use of powerful AI tools in practice so that only a small, carefully vetted subset is acceptable in real enterprises. The conversation also surfaced structural European challenges for making the most of these trends, from fragmented markets, roaming and regulation, to the need for **new models of operator cooperation and network federation**, and highlighted that trust, security and governance will be just as decisive as raw technology in determining whether AI native networks and services can actually be deployed at scale.

Session 4: Digital Challenges *(Chair: Didier Bourse)*

The session explored how future networks must be secure, user controlled, intelligent and robust rather than just faster, starting from a proposal to move from reactive to predictive security in disaggregated, cloud native 6G by using network digital twins, federated learning and energy aware algorithms to anticipate threats, test countermeasures in advance and keep security compatible with NetZero constraints. A complementary vision on data protection argued that laws like GDPR are necessary but insufficient, and that **real sovereignty requires data usage control enforced by technology under the direct control of the data owner,** with policies attached to the data and enforced at hardware and OS level, which was framed as a strategic opportunity for Europe in chips and standards.

Another talk defined four priorities beyond 2030, namely edge AI with multimodal perception, sustainability by design, zero touch and reasoning-based networks, and semantic or goal-oriented communications that send only what is actually needed for the task. A national perspective added the idea of a distributed "digital continuum" where computing and intelligence are spread across devices, edge and data centers to prioritize robustness, sovereignty and sustainability instead of pure performance.

In the discussion, participants questioned how far predictive security can really go for zero day attacks, debated the tradeoffs and governance risks of hardware enforced policies versus openness and user control, stressed the need for **graceful degradation and disconnected modes** when virtualized infrastructures fail, and linked semantic or goal oriented communication to concrete examples such as cameras or sensors that only transmit when context demands it, converging on the view that security, data protection, intelligence placement and communication models must be co designed if Europe wants resilient, sustainable and sovereign networks beyond 2030.

Visions for Future Communications Summit – Day 2

Keynote 3: Vision 2050: A Connected-Intelligence Society *by Wen Tong (Huawei)*

Wen Tong outlined a near-term research agenda centered on intent-driven networking and automated workflow generation using agentic AI, natural language network interfaces linking users, AI services and applications, and an A2A protocol acting as the networking fabric and routing layer for an "**AI internet**," together with wireless access network

optimization to support internet-wide token transmission, model transfer, distributed inference and training; mechanisms for data and model discovery and publishing via internet-scale prompting; and multilaterally enforced, distributed trust and verification guardrails. The mid-term discussion then touched on the scaling laws for computing technology and wireless network capacity, identifying the **shift in digital computing scaling where power becomes the main constraint and suggesting that cmWave MIMO should achieve expected spectrum efficiency until approx. 2040**. For a long-term vision, broader ideas of brain-inspired computing, and the positioning of molecular communication as a promising research domain alongside IoT and novel capacity scaling laws for converged wireless were discussed. Participants further debated whether AI could realistically operate as an infrastructure manager and how such a role should be designed to avoid catastrophic or "apocalyptic" failures, as well as what an AI-powered network would mean from an operator's perspective.

Session 5: An AI World *(Chair: Dirk Trossen)*

In this session it was argued that 6G will only be viable if it is fundamentally AI-native, with intelligence as a core design principle and distributed, cooperative AI spanning RAN, core, edge, and cloud to support autonomy, reasoning, and real-time trade-offs, and it introduced the Internet of Agents (IoA) as the logical step beyond this, where intelligent agents representing physical and logical entities self-organize, negotiate resources, and align local actions with global goals such as sustainability, resilience, and business performance, enabling a shift from "connected devices" to "connected intelligence" in post-2030 SRIA. Instead of treating "AI for ICT" and "ICT for AI" as separate stacked toolchains, which risks escalating complexity, cascading failures, and unsustainable energy and carbon costs, the discussion proposed a holistic, **symbiotic framework in which AI is resource-aware**, networks are AI-intent-aware, and optimization accounts not only for traditional network KPIs but also for the "experience" and integrity of AI workloads.
Several speakers raised concerns about trust, safety and values: AI agents can manipulate infrastructure or data (as in the customer-service example that deleted databases), so networking research must address trustworthy operation, control "red buttons", identity, authentication and integrity by design. They also **questioned whether today's IP-based, end-to-end Internet is adequate** for a future "AI world" of digital and embodied agents, or whether new semantics, protocols, agent identities and dynamic "swarm" or domain networks are needed—while still embedding human and societal values (including sustainability and rights) into the architecture and accommodating different legal frameworks across regions.

Keynote 4: From Electrons to Enzymes: The Future Fabric of Computing and Storage *by Adrián Gallego Sánchez (Deutsche Telekom Group)*

Adrián Gallego argued that current computing paradigms place excessive demands on existing technological foundations and that **new computational substrates are needed**, with future systems operating across multiple layers such as digital, analog and quantum for processing, biological and digital media for storage, and quantum, analog and biological systems for data transport; within this vision, analog computing must be rethought to meet performance and efficiency needs, as suggested by developments like the Mythic chip, while quantum computing, despite its challenges, remains a promising direction backed by recent research. In parallel, **biological computing** was presented as an emerging paradigm that uses natural systems as ICT platforms, where exploratory work already shows that computation can occur at molecular and cellular levels using DNA, RNA, proteins and bacteria as optimal substrates for data storage. Besides, it was argued that scaling these mechanisms could lead to fully biological computing architectures that could co-exist with digital environments, with mycelium networks in nature, highlighted as a model for decentralized biological processing that offers distributed computation, inherent sensing, self-healing and adaptive storage capabilities potentially orders of magnitude superior to conventional physical storage systems.

Session 6: Establishing a Compute Continuum *(Chair: Anastasius Gavras)*

The session examined how AI workloads are outgrowing single data centers and argued for interconnecting multiple data centers with networks that natively support collective communication patterns, complemented by "**AI Delivery Networks**" that push generally trained models to the edge and combine them with local data to reduce latency, ease data center bottlenecks, and improve energy efficiency, as well as the development of domain-specific foundational models trained within limited verticals under appropriate governance and data-sharing frameworks. It identified electrification, automation, and digitalization as key forces shaping the future, calling for enhanced 5G and 6G networks with differentiated connectivity and lower energy consumption, and for a data-centric compute continuum that tightly integrates edge and cloud through open APIs, scaling an EU Telco-Edge-Cloud ecosystem while preserving sustainability, ubiquity, security, and privacy. Building on this, the 3C network initiative was presented as a collective, collaborative compute and communication continuum that underpins European AI innovation and sovereignty, enabled by agentic AI for intent-based multi-domain networks managing energy, SLAs, anomalies, network-as-a-service, traffic steering, multi-tenancy across terrestrial and

non-terrestrial domains, and cross-domain intelligence between telcos and hyperscalers, together with harmonized agent communication, telco-cloud federation, dual-use mission-critical applications, and decentralized edge intelligence with privacy-preserving, energy-efficient models.

Trust and resilience were framed around measurable sovereignty metrics, context-aware multi-agent collaboration, self-organization, space-as-a-service with quantum encryption, and cross-domain living labs that bring together engineering, social sciences, government, industry, and citizens, supported by ongoing national initiatives, while inviting reflection on telecom's role in quantum, AI, and energy compared with other sectors, and cautioning against overpromising technologies that have not yet scaled. In the panel discussion, participants questioned the practical value of telco edge given strong fiber backbones and low latency requirements (1-2 milliseconds for most applications) that centralized or regionally distributed clouds already meet, noting that edge has struggled to scale due to weak business cases and slow private 5G uptake, and is currently most justified in isolated or resilience-critical scenarios.

The conversation also highlighted definitional confusion across **"cloud continuum," "data continuum," and "compute continuum",** urging clearer glossaries in documentation to align telecom handover concepts with hardware/software interpretations. Edge motivations extend beyond latency to privacy, sustainability, and multicast-enabled content distribution, though technical challenges are largely solved—remaining issues center on commercialization, federated HPC across fragmented European states, and carbon-negative micro data centers at wind farms using surplus energy. **Data sharing emerges as a key barrier**, with operators hesitant due to privacy fears (e.g., German public backlash to bus passenger tracking), contrasting US initiatives like GENESIS aiming to unlock proprietary data for AI training. Participants stress federated edge models for localized inference/training with fresh IoT data, fair human access, and sustainability drivers like regulation, while distinguishing ledgers from intensive blockchains and advocating precise terminology for MNO uptake.

Keynote 5: EC Views on the Future *by Thibaut Kleiner (DG-CNET)*

Thibaut Kleiner discussed how political attention has shifted from connectivity and 5G/6G toward AI and supercomputing, while stressing that **robust, secure connectivity remains fundamental** for data collection, sovereignty, security and the broader digital ecosystem, and that European 6G and advanced connectivity communities must stay at the core of technology development rather than being sidelined, with strong European technology providers framed as strategically important in a context where technology is a key dimension of geopolitical competition. It was argued that networks, cloud and AI are rapidly converging into AI-native 6G and telco edge cloud architectures where intelligence is embedded in core, edge and management planes so that networks become autonomous, self-optimizing systems with strict performance, energy and security targets, and that lessons from 5G show KPI-focused research is insufficient, meaning 6G must integrate sectors, applications and business models to secure operator investment and real-world impact. Upcoming European Commission initiatives were outlined, including efforts to link 6G, AI-native networks, software and energy-efficient cloud, and to promote more agile, commercialization-oriented research cycles that keep connectivity at the center of the EU digital and industrial agenda. The session also highlighted opportunities for dual-use connectivity technologies in areas such as drone sensing, identification and interception, where companies like Nokia and Ericsson and the research community can benefit even if funding is not routed through existing frameworks like SNS JU, and anticipated new EU regulation on standardization and a revised Cybersecurity Act that will emphasize 5G/6G security and resilience, pushing for networks that are natively secure by design. Overall, the discussion **reinforced connectivity as a core European strength essential for AI, resilience, sovereignty and defense**, while calling for research agendas that adapt to faster software-driven cycles, break down disciplinary silos, improve Commission coordination across funding programs, communicate calls more proactively and tighten links between connectivity, hardware and other communities, with the Commission committing to continued engagement with networking researchers and to expanding the SNS scope to reflect converging technologies.

Keynote 6: Quantum Technologies in 2030 *by Yasser Omar (Portuguese Quantum Institute)*

Yasser Omar introduced quantum technologies by recalling Schrödinger's cat to illustrate that physical systems can exist in quantum states, which underpins the entire field. Building on this, he explains that the qubit is the fundamental unit of quantum information, opening a new paradigm for how information is processed, transmitted, and detected, with the potential to disrupt existing information technologies. He notes that qubits enable faster computation, better levels of privacy, and more precise measurements through quantum computing, quantum cryptography, and quantum sensing & quantum metrology. At the same time, the possibility of powerful quantum computers forces a complete rethinking of cryptography, since schemes that rely on computational hardness can be broken much more quickly in a quantum world. **Quantum hardware itself is presented as a major challenge**, as the community still needs to determine which physical implementations are most suitable. The talk highlights ongoing progress in quantum security and mentions the ambition

to build an experimental quantum internet by 2030. Omar stresses that there is a strong global bet on quantum technologies, and while the EU may appear to lag in some areas, the strategic goal is technological sovereignty rather than simply catching up with headline metrics. Overall, the key message is that there is still a lot to develop and build to advance Quantum Technologies, and there are many opportunities for collaboration, including from classical stakeholders, in particular in the domain of networks.

There remains a substantial amount to understand, test, and build before these systems are mature. In the discussion, participants question whether semiconductors are being used appropriately and emphasize the need for regulation amid clear hype around quantum hardware. Both the speaker and the audience agreed that combining quantum hype with AI hype risks creating "mega hype", while also pointing out the practical difficulty of using quantum hardware for large AI models, since classical data must be translated into quantum form. Finally, the speaker and audience examine the trade-off between the number and the quality of qubits, arguing that large qubit counts are meaningless if those qubits are noisy and unreliable, and conclude that **robust quantum progress depends more on the performance and stability of qubits** than on raw headline numbers.

Session 7: Other World Views *(Chair: Artur Hecker)*

The session explored research and innovation priorities for 2030 and beyond across wireless, optical, and mobility domains, arguing that future networks will be quantum-enabled, AGI-native, and immersive. Key wireless directions included addressing the "**spectrum crisis**" through new licensing, coexistence policies, higher spectral efficiency, and novel sharing models, advancing digital quantum transformation with scalable quantum systems, repeaters, and a quantum internet building on EuroQCI, developing AGI-native wireless via goal-oriented generative semantic communications and integrated sensing, and enabling immersive experiences and XR through edge computing and intelligent digital twins. On the optical side, priorities focused on building AI-ready optical infrastructure for massive datacenter and edge traffic (multi-core and hollow-core fibers, space-division multiplexing, highly integrated optical front-ends), ensuring "access for all" through non-terrestrial coherent FSO, next-generation 100 Gbps PON, and scalable hollow-core fiber deployments, creating trustworthy optical networks via quantum infrastructure (high-rate QKD, quantum FEC, repeaters, distributed quantum computing, secure timing), and supporting climate goals with disruptive cooling, low-power photonic components, energy-efficient switching, and photonics for distributed quantum systems. Finally, the discussion turned to **the rise of autonomous vehicles** and Mobility as a Service, envisioned as shared, on-demand mobility that is interoperable, trusted, and fair in value sharing, with significant impacts on energy, telecom, and insurance; this vision requires rethinking urban space (streets, parking, public areas), reskilling the workforce, new models of human–automation collaboration, and robust use of big data, digital twins, and real-time platforms, while still grappling with data governance, privacy, and transparency as critical open challenges.

Closing Discussion *by Rui L. Aguiar (NetworldEurope SB Chair/University of Aveiro)*

The VFCS25 closing discussion highlighted a set of converging technical, architectural, and societal challenges that will shape future communications systems, as discussed in the previous two days.

On the technological side, several areas emerged as particularly strategic. Optical was recognized as more central than initially anticipated, with significant challenges at the device level and promising developments such as hollow-core and other fibre types that could improve capabilities. At the device level, aspects as improved network synchronization appeared as relevant. Underwater communications also appeared as a niche where, for certain applications, traditional undersea constraints may be less dominant and where unique advantages could be realized for specific applications. In parallel, satellite–terrestrial convergence, including in spectrum usage, was seen as a key frontier. The rapid progress of satellite systems—illustrated by the now-real notion of direct connectivity from regular phones—raises concerns that commercial deployments may outpace research, particularly in areas such as GNSS resilience and the use of terrestrial networks as large-scale sensors.

Edge computing and energy efficiency were recurring themes. The group stressed that the main challenge for the edge is not only latency, but also the complexity and jitter arising from the aggregation of highly heterogeneous traffic. Future edge architectures may need to be designed explicitly around controlling time variability, not just propagation delay. On energy, participants called for a clear understanding of who consumes energy and how costs are propagated from infrastructure to users. There was a strong message that systems can no longer be designed "without thinking about power," especially given the dramatic increase in consumption caused by high-throughput wireless use cases. Ideas such as dynamically switching overlapping cells on and off according to traffic demand were cited as examples of more **energy-sensitive network design**. Resilience, dual use, and federation formed another major cluster of discussion. Participants identified the need for frameworks that can guide the design of **infrastructures serving both commercial and broader resilience roles**, particularly

where multiple networks or services are federated. Today, there is no well-defined methodology to link high-level resilience objectives to concrete technical architectures. The concept of graceful degradation was highlighted as an area where current networks fall short, with past attempts at ultra-fast handover architecture having failed due to correlated failure risks. Understanding the fundamental limits of network architectures, and how to avoid cascading failures, remains an open research problem.

A substantial portion of the debate focused on the emerging "**Internet of Agents**" and AI-centric networks. Participants considered scenarios where customers are AI agents rather than humans, raising questions around protocols, identification, skill and capability registration, and the orchestration of dynamic swarms of digital and physical agents. This led to broader reflections on AI delivery networks and the data/compute continuum, including the possibility of treating the network as a unified compute-communication fabric with AI services offered from the edge (an AI-CDN model) rather than from devices themselves. How these concepts interact with telco edge offerings and with large-scale sensing capabilities was identified as a strategic question for future work.

Finally, security and privacy were recognized as foundational concerns that cut across all these topics. While many enabling technologies are already standardized, deployment in real environments often lags behind. The rise of AI agents challenges traditional authentication, authorization and accounting models, especially as agents become adaptive or self-modifying. **New security models will be needed** to manage these entities safely. Overall, **the concluding tone was both realistic and ambitious: technology, particularly AI and satellite systems, is moving faster than expected, while legal, economic and operational frameworks struggle to keep pace**. The discussions clearly delineated a rich agenda for future research on resilient, energy-aware, AI-enabled communication networks.

Prof. Rui Aguiar then elaborates on the next steps forward, namely the new SRIA document and concluded by thanking the team involved in the organization for all their effort and work preparing this event, as well as the speakers, keynotes, panelists and participants that contributed with their views and content and hoping to see everyone again in 2 years' time for the 6th Visions for Future Communications Summit. The SRIA work is now starting inside the Expert Group, and everyone has been invited to contribute to this community endeavor.