Information about the Smart Networks and Services Joint Undertaking R&I Work Programme

SNS

The Voice of European Industry and Research for Next Generation Networks and Services

> Dr. Alexandros Kaloxylos Executive Director 6G-IA





The voice of the European industry for the development, deployment and evolution of 6G Smart Networks and Services

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Smart Networks & Services Proposal

6G networks, new applications and end devices









Proposal supported by more than 1.000 organisations: Industry, SMEs, R&D centers and Universities)

900 M€ public funding + 900 M€ private funding

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The Basis of the SNS WP



ppp.eu/pub/bscw.cgi/d367342/Networld2020%20SRIA%202020%20Final%20 Version%202.2%20.pdf

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Networks

6G Smart

Source: <u>https://5g-ppp.eu/wp-</u> content/uploads/2021/06/WhitePaper-6G-Europe.pdf SNS



SNS – Strategic Objectives

Research & innovation for 6G networks connectivity, devices and service infrastructures

> New applications: "Internet of Sense", XR/VR, digital twins, holographic type communications

Reinforce Europe's technological leadership

Safeguard European values (security and privacy)

Enable a massive digital and green transitions towards low carbon footprint of vertical industries

Cost Effective Affordable Solutions for all Strengthen European data economy 8 everywhere

The voice of the European industry for the development, deployment and evolution of **6G Smart Networks and Services**

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- The Smart Networks and Services Joint Undertaking has started
- First Call for projects in January: € 240 Million

The SNS framework

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SNS Goals: Increased Network Performance, Energy Efficiency, Serve EU policies, address KVIs, strengthen EU's position, stimulate new business ecosystems, ...



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SNS JU: Key links and dates



Missions, Strategic Roadmaps, Budget

Governance and key documents

SNS R&I Work Programme (2021-2022)

More information at Funding and Tender opportunities (ec.europa.eu/)

SNS R&I WP Phase 1 – All Streams Closing Date: 26.04.22 at 17:00 Brussels time





Objectives

- HEU Key Strategic Objective A: "Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains to accelerate and steer the digital and green transitions through human-centred technologies and innovations."
- HEU Key Strategic Objective C: "Making Europe the first digitally led circular, climate-neutral and sustainable economy through the transformation of its mobility, energy, construction and production systems."
- Foster Europe's technological leadership in digital technologies and in future emerging enabling technologies

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- Broader scope than simply improving the network performance
- Bring new service capabilities with wider economic implications (e.g., Internet of senses, digital twins, immersive environments, holographic communications)
- > Target several EU policies (e.g., Green deal, cyber security, etc.)
- Consider a full value chain approach from end-devices to cloud solutions and services
- Consider requirements and advancements in various related technological fields (e.g., AI/ML, HPC, micro-electronics, photonics, IoT, blockchain technologies)

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Related UN sustainable Development Goals

- ✓ SDG 8: Promote sustained, inclusive, and sustainable economic growth: achieve higher levels of economic productivity through diversification, technological upgrading, and innovation.
- ✓ SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation, upgrade infrastructure and retrofit industries to make them sustainable with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes.
- ✓ **SDG 11**: Make cities and human settlements inclusive, safe, resilient, and sustainable
- ✓ SDG13: Climate Action: Support smart low carbon lifestyles, monitoring emissions, and shaping demand in transport and energy, enabling resilient mission critical communications in extreme weather (vertical markets: transport, health, and public safety)

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- Complementary Issues: Privacy, EMF Awareness and transmission power reduction
- Target 6G KPIs (throughput, reliability, delay, jitter, spectral efficiency, etc.), but also
- > Target KVIs:
 - > <u>Democracy</u> (privacy, fairness, digital inclusion, trust),
 - <u>Ecosystem</u> (Sustainability, Business value, economic growth, open collaboration, new value chain),
 - Innovation (Safety Security, Regulation, Responsibility, Energy Consumption)

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Additional Goals of the SNS

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- ✓ Preserve European competitiveness and sovereignty.
- $\checkmark\,$ Bring new actors from, and beyond the verticals.
- ✓ Contributions from industry, Research and Technology Organizations (RTO), academics and Small and Medium-sized Enterprises (SMEs) actors in the connectivity, IoT and cloud/IT domains
- Complemented where applicable, by adequate participation of the micro-electronics industry from the onset of the partnership, in view of their potential impacts at downstream standardisation level.
- ✓ Provide a stable experimental framework towards minimising risks and validating core technologies.
- Provide a unified consensus framework promoting a European approach towards 6G, facilitating international cooperation and placing Europe on par with other regions having started significant 6G initiatives (USA, China, Republic of Korea, Japan).



Achieve unified global consensus





5G Evolution (40%) \rightarrow evolutionary path

Stream A (17,5% - RIA): Smart communication components, systems and networks for 5G mid-term Evolution systems

Stream D (~20% - IA): Large Scale SNS Trials and Pilots with Verticals



6G (60%) \rightarrow revolutionary path

Stream B (~50% - RIA): Research for revolutionary technology advancement towards 6G

Stream C (~10% - RIA): SNS experimental infrastructures

CSAs ~ 2%

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SNS Proposed Roadmap





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Workshop with EU Partnerships - IAFA World Recommendations Conference

SNS R&I WP: Linking between Streams and Phases



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A high-level view

Smart service development frameworks





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network domains 17

17/02/2022

devices

Stream A



Stream A (RIA): Evolutionary path towards 6G

- Address mid- term requirements from policy objectives, societal needs, business orientations
- Support the European vision for societal challenges (e.g., digital inclusion and accessibility, unlock rural economic values and opportunities) & Green deal objectives
- Enable open connectivity and service platform evolution with reduced energy consumption and lower operational and ecological costs
- Prepare for new advanced user services (e.g., immersive communication, holographic telepresence & AR/VR etc.),

Develop the technologies to support mid-term functional and non-functional properties & integrate multiple enablers from related domains (HPC, Cyber-security, AI/ML, IoT)

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Stream A



Stream A (RIA): Evolutionary path towards 6G

- Focused on a defined technical area per proposal
- Focus on short/mid-term KPIs

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- Target impact in standardization
- Implementation concept: one project for each topic – all topics considered together constitute a system

Stream A projects will define and establish system level interfaces to be able to realize a unified vision of pre- 6G systems, with the support of the Coordination and Support Actions (CSAs)

Al techniques are expected to be widely explored across Stream A projects.

Such open data sets (e.g., date of release, its scope, and the dimension and diversity of data) will be considered as part of the impact evaluation criteria for relevant projects that aim to explore AI techniques

	Sep 2020 Strategic Research and Innovation Agenda 2021-27
	European Technology Platform NetWorld2020
	"Smart Networks in the context of NGI"
A	2020



Stream A: 5G Evolution - RIA

Green radio technology

Ubiquitous radio access

Sustainable capacity networks

Evolved architecture for global green systems

Edge computing evolution



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Trustworthy and Reliable end-to-end connectivity software platforms

Real-time Zero-touch service technologies

Stream B



Stream B (RIA): Revolutionary research towards 6G

- Address long-term challenges to ensure European leadership in 6G networks
- A successful digital and green transitions for the vertical industries

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- Solution that **address UN's SDGs** (coverage, affordability, accessibility) in cases of high public value (e.g., healthcare, agriculture, education, public safety, etc.)
- Efficient **support of upcoming innovative applications** with performance requirements beyond current technological capabilities
- Extend the current set of patchy technologies for security and trust towards a comprehensive end-to-end framework, covering virtualized and software based heterogeneous networking environment
- end-to-end security frameworks must be "dynamic", integrating the different ICT involved, establishing monitoring and evaluation provisions, and identifying those responsible for ownership and successful implementation

Stream B



Stream B (RIA): Revolutionary research towards 6G

- Stream B takes a holistic research approach towards the needed technology (a value chain perspective covering an integrated ecosystem with IoT, devices and software-based solutions in unified networks)
- The target is **a globally connected continuum platform** with the convergence of networks and IT systems to enable new future digital services
- This continuum must provide users with improved performance, higher level of control, increased transparency in interactions with digital services, adequate support of ethical values and conformance with societal requirements and readiness (e.g., GPDR, EMF awareness, etc.)

Stream B



Stream B (RIA): Revolutionary research towards 6G

- Starting point for KPIs and KVIs: NetWorldEurope SRIA, 5G PPP ICT-52-2020 projects, national initiatives in EU or in other regions of the world)
- Projects working on micro-electronics components for future 6G platforms (e.g., IoT devices, virtualized and disaggregated network implementations) are expected to deliver outcomes that can be used as direct specific 6G component requirements towards KDT
- Cloud and edge cloud technologies and software implementation of network/device control functions are expected to provide a clear strategy in relation to EU supply capabilities and the future cloud continuum that may involve interoperation with non-EU systems such as the hyperscalers.
- Projects in topics SNS-2022-STREAM-B-01-01, SNS-2022-STREAM-B-01-02, SNS-2022-STREAM-B-01-03 and SNS-2022-STREAM-B-01-04 are expected to actively cooperate with the SNS-2022-STREAM-B-STREAM-B-01-05 "6G Holistic System" project (e.g., provide KVIs, KPIs, 6G enablers and solutions, etc.)

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Stream B: Research Foundations for 6G -RIA



Implementation concept: guarantee minimal funding for each one of the main areas.

Provide the research foundations for low TRL technology advancement in preparation for the upcoming 6G networks



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Research Foundations for 6G

Implementation concept: at least four projects addressing the topics above (at least one, preferably more.)

Strand 1 - System Architecture

- Technologies for scaling Inter-computing systems
- Control and controllability separation
- Frictionless inter-domain resource management
- Native integration of AI for telecommunications
- New Data Transfer Paradigms with deep Edge integration
- Improve data plane performance
- Deterministic Networking

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Research Foundations for 6G

Implementation concept: at least four projects addressing the topics above (at least one, preferably more.)

- Strand 2 Wireless Communication Technology and Signal Processing
 - Terahertz Communications and Ultra-Massive MIMO
 - Joint communications and sensing
 - New Waveforms, Random and Multiple Access
 - Enhanced Modulation and Coding
 - Wireless Edge Caching
 - Human-friendly Radio systems
 - Spectrum Re-farming and Reutilisation





Research Foundations for 6G

Implementation concept: at least three projects addressing the topics above (at least one, preferably more.)

- Strand 3 Communication Infrastructure Technologies and Devices
 - Flexible Capacity Scaling
 - Ultra-high Energy Efficiency
 - Integration of Optical and Wireless Technologies
 - NTN Infrastructures
 - Integrated NTN service provision
 - New IoT components and devices
 - Troposphere Networking
 - New Physical Layers
 - Nano-things networking





Research Foundations for 6G

Implementation concept: at least four projects addressing the topics above (at least one, preferably more.)

Strand 4 – Secure Service Development and Smart Security

- Human-centric security and privacy technologies
- Holistic smart service development frameworks
- Secure lifecycle service management and smart operation
- Efficient security enablers for dynamic heterogeneous untrusted environments

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Stream B – Holistic System

Research Foundations for 6G

- A complete system perspective of future 6G SNS platform,
- Consolidating 6G KPI's and KVI's as federating SNS targets for European R&I in the field.
- Identify 6G use cases, their requirements, and how they can be supported by the 6G retained architecture/technologies.
- Identify the most promising technologies towards the realisation of the 6G vision.
- Translate societal/ethical use cases requirements into technological requirements
- Identify critical technologies for future standardisation work.
- The project should equally investigate both technical and societal aspects to cover citizen needs in 2030 and beyond.
- Well-defined means of communication with the 6G-IA to ensure the European ICT community vision is appropriately captured

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Stream C



Stream C (RIA): Experimental Infrastructures

- To develop EU wide experimentation platforms that can incorporate candidate 6G technologies for their further validation.
- To make such an experimentation platform capable of hosting advanced pilot "6G" use cases as targeted under Stream D during the subsequent SNS implementation phase
- Reusability and evolvability of the platforms over the lifetime of the SNS programme
- Accessibility and openness (e.g., modular implementation, open-source solutions, welldefined interfaces, complete documentation, etc.).
- **Directionality and optimisation** of previous and related investments
- **Disruption friendly**: experimental facilities, even if originating from earlier experimental initiatives, should be capable of hosting possible upcoming 6G disruption and hence guarantee their future-proofness
- End-to-End: the target experimental facility should be capable of demonstrating E2E service capabilities and include a full value chain including IoT devices, connectivity, and service provision



Stream C (RIA): Experimental Infrastructures

Expected Outcome:

- demonstrate the performance of key 6G candidate technologies, components, and architectures. To that extent, technologies as identified notably under Stream B Strands may be considered as a baseline
- demonstrate technological feasibility of "better than 5G" KPIs, related indicatively to capacity, ubiquity, speed, latency, reliability, density of users, location accuracy, energy efficiency, service creation time, network management CAPEX/OPEX. It will include capability to incorporate emerging 6G specific KPI's and the capability to address key KVI's as developed by ICT52 projects. KPI's from this project may also be taken as reference objectives in that respect.
- demonstrate innovative radio spectrum technologies and the use and sharing applicable to beyond 5G and 6G spectrum. This should include, if appropriate, licensed, unlicensed, or licensed-shared access. It also includes novel spectrum at THz bands.
- validate a representative end-to-end beyond 5G architecture (and later 6G) including end-to-end service provisioning with slicing capabilities and ability to accommodate technological and architectural disruptions of 6G
- demonstrate performance of disaggregated architectures, both at interface level (interoperability) and at cloud implementation level (Open RAN).

Stream C



Stream C (RIA): Experimental Infrastructures

- As 6G is still largely undefined, proposals may target in the first place KPI's currently contemplated under authoritative industrial/research environments (e.g., 5G PPP ICT-52-2020 projects, and national 6G initiatives or of other regions of the world).
- the proposals should be flexible enough to accommodate new relevant KPI's as they become available from the wider 6G community
- desirable that the platforms support open framework principles (e.g., both legal and technical like open APIs) enabling future vertical projects to access and use them
- evaluation of competing technologies where appropriate
- experimental infrastructure may be based on the integration of components in several solutions developed in the context of previous initiatives like the 5G PPP, IoT or cloud computing projects or in the context of ongoing European 6G initiatives, also at the national level, but this is not a pre-requisite

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Stream C



Stream C (RIA): Experimental Infrastructures

- Each Project <u>may include</u> multiple components in different locations/countries, targeting interconnections between them to create a pan-European experimentation Platform
- stakeholders will facilitate easy replication of results in the same or additional locations/countries if this platform will be selected for large scale trials as part of subsequent phase of Stream D
- The target experimental facilities and their modules should be open and accessible for a long enough period to allow for an easy handover from one phase to the other. Conditions should allow experimental facilities to be easily reused under fair and reasonable conditions for subsequent phases of the SNS programme implementation

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Stream D (IA): Large Scale Trials and Pilots with Verticals

- Demonstrate both technological and business validation with verticals
- The validation of SNS KVI and KPI's and in the context of very advanced digital use cases implemented through Large-Scale Trials and Pilots (LST&P)
- The identification of use case specific KVI and KPI's and how they may be matched by SNS platform KVI and KPI's
- A structured feedback loop from vertical users towards SNS stakeholders, in view of ensuring the best match between beyond 5G/ 6G systems capabilities and users.
- The activity should also target visible and high-level exposure of European capabilities and leadership in beyond 5G/6G technologies through support of large showcasing events.

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Stream D (IA): Large Scale Trials and Pilots with Verticals

- Reusability and evolvability of the platforms over the lifetime of the SNS programme
- Accessibility and openness (e.g., modular implementation, open-source solutions, well-defined interfaces, complete documentation, etc.).
- Directionality and optimisation of previous and related investments (e.g., 5G PPP, End-to-End Facility projects or/and Vertical Pilots projects, IoT & Cloud platforms)
- SMEs, scaleups and startups are expected to play a key role
- **Concerning security**, due to the potential use of 5G and 6G infrastructures for safety-related services and their relevance to public security and public order, it is essential to ensure the highest level of cybersecurity in this sector.

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Stream D



Stream D (IA): Large Scale Trials and Pilots with Verticals

Validation

-Application level:

i) **applications already possible with 5G like AR/VR**. Validation should demonstrate clear benefits of the considered technologies and architectures in terms of <u>scalability, security,</u> <u>and performance improvements</u> in line with medium to long-term socio-economic scenarios.

ii) **applications that are not considered within the 5G current developments**, such as applications to eventually create a **6G network with a sixth sense** that intuitively understands human intentions, making human interactions with the physical world more intelligent, effective, and anticipating our needs (towards Internet of Sense). In that case, the validation should primarily address <u>technological feasibility and affordable deployment</u>.

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Stream D



Stream D (IA): Large Scale Trials and Pilots with Verticals

- Projects will involve and call for SMEs, scaleups and startups.
- In this early phase, the projects may leverage the existing platforms, or components from them, from 5G Infrastructure PPP Phase 3 End-to-End Facility projects or/and Vertical Pilots projects and/or relevant national or international (ESA) initiatives).
- The projects may also leverage as relevant/appropriate existing IoT/Cloud/Edge platforms or components that may be integrated together. A smooth transition is envisioned from 5G Infrastructure PPP activities to capitalize on existing results.

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Some suggestions



SNS is more than connectivity – Link to KVIs (e.g., green deal, SDGs, cybersecurity toolbox)

Have clear targets for verticals or telecom services

Identify opportunities for Europe (e.g., strategy for edge integration in cloud continuum)

Energy is a key topic in several proposals – target for clear gains

Security in 6G - provide clear objectives and advanced solutions

If AI/ML plays an important role in your proposal, provide data sets after the end of the project



Additional information



<u>https://6g-ia.eu/event/sns-ju-public-information-day/</u> Slides and Video from the SNS Public Information Day 27.01.22

<u>https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-</u> 2027/common/guidance/list-3rd-country-participation_horizon-euratom_en.pdf

> List of Participating Countries to Horizon Europe Also check with your NCP

Applying for 6G-IA membership



Although not a prerequisite to participate in most SNS calls, it has clear advantages:

- Being able to participate even at the restricted calls
- As contributors to the IKOP (In kind contributions to operational costs), increase the possibility on being selected in proposal consortia
- Contribute to the shaping of the European vision for 6G networks by participating in all 6G-IA WGs
- Contribute to the follow-up versions of the SNS R&I WPs
- Have an excellent opportunity for networking as all European key players are members of the 6G-IA

https://6g-ia.eu/about/5g-ia-membership-application/

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Thank you for your attention

Email:alexandros.kaloxylos@6g-ia.eu

Website: https://6g-ia.eu

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