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Abstract	This document defines the NGI-POINTER Work Programme that will rule the NGI POINTER Open Calls that will be launch in WP2 around the targeted Use Case Domains prioritised by the project.
Keywords	Work Programme, Open Calls, Challenges, Domains, Topics, NGI Architecture



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Dissemination Level		
PU	Public, fully open, e.g. web	✓
CL	Classified, information as referred to in Commission Decision 2001/844/EC	
CO	Confidential to NGI POINTER project and Commission Services	

* R: Document, report (excluding the periodic and final reports)

DEM: Demonstrator, pilot, prototype, plan designs

DEC: Websites, patents filing, press & media actions, videos, etc.

OTHER: Software, technical diagram, etc.



EXECUTIVE SUMMARY

Preamble

The Internet has become a dual-use instrument: it can be used to improve societies and humanity, but also as a tool for repression, surveillance and misinformation. Defects become visible in privacy, data protection, content ownership and centralisation. But the internet is still also a space and a tool to develop and defend the values of democracy, human rights, new business opportunities, and a sustainable future.

"Since its inception, the internet has only continued to broaden in size, scope, complexity and diversity, becoming an indispensable global societal resource. Continuous, practical improvements to the architectures, protocols, applications and operational practices, developed and deployed openly and collaboratively between different stakeholders, have been the main reason for this success. It is vital to the future success of the internet to further strengthen this proven approach to architectural innovation." – Lars Eggert

"We will not survive the next 10 years if we are not collaborating and standing together on cyber security" – Natalia Oropeza

The NGI Program for Open INTERNET Renovation

NGI POINTER - NGI Program for Open INTERNET Renovation is a project funded by the European Commission (GA 871528). Between 2020 and 2022, the NGI POINTER project has the mandate to distribute Financial Support to Third Parties (FSTP), parties in a cascade funding framework aimed at supporting "**internet talents**" in developing and providing new marketable solutions, backed in state-of-the-art technology and research, that provide alternative and/or auxiliary tools and protocols with specific value propositions for society and/or self-sustainable Business Models for **9 specific use case areas or challenges** related with internet architecture renovation such as:

- Privacy-by-design;
- Internet at the Edge;
- Network optimization;
- Virtualization and isolation;
- Limitations in the TCP/IP protocol suite;
- Autonomous Network operations and control;
- Energy Efficiency
- Industrial Internet Security
- Trust for New Internet/Web Users

On top of these 9 use case areas, an additional "Open Disruption of the Internet architecture" [ODI] challenge will be defined.

As 'internet talents' we will consider researchers from outstanding research groups as well as organisation and individuals with outstanding track records and with links to internet



governance bodies and/or open source communities¹ that are owners of the internet renovation problems of today. We will call these internet talents, hereinafter, '**NGI architects**'

Thus, the NGI-POINTER Work Programme is a document prepared to **guide the composition of applications** that will be submitted by the '**NGI architects**' that will be invited to submit proposals through **one Open Call with a deadline in June 2020**.

An important part within the process of shaping this NGI POINTER Work Programme is the participation of the **POINTER Advisory Board [PAB]**² that has among its attributed functions to **advise project partners on the project challenges** (i.e. the ones defined in this document) so they have participated in the definition and revision of the 9 specific use case areas or topics / challenges below.

The Vision

NGI POINTER aims to support ambitious *NGI architects** in changing the underlying fabric of the internet and the web with promising bottom-up projects that are able to build, on top of state-of-the-art research, scalable protocols and tools to assist in the practical transition to new or updated technologies, whilst keeping **European Values**** at the core.

*People with an ambition of changing the internet and web with European values at the core. For example, Researchers, Open Source Contributors, Hackers, Software and Hardware developers, Engineers, Computer Scientists, Activists, etc.

** European Values are respect for human dignity and human rights, freedom, democracy, equality, and the rule of law.

The Mission

The mission-oriented approach of the NGI-POINTER project steer the directionality of the project **towards the societal and technological mission of providing a new generation of protocols and open software and hardware tools** for better efficiency, scalability, security and resilience in the internet architecture evolution, which is fully aligned with the values of the Next Generation Initiative of creating a more trustworthy, resilient, sustainable and inclusive internet.

Thus, NGI-POINTER can be defined itself as a **human-centric project** that will contribute to this impact by **discovering, selecting and supporting at bottom-up projects** that will be focused on providing tools to **build a more human centric architecture of the internet**.

Vertical use-cases challenges under NGI POINTER

The following sections define the verticals topics that will gear around the **9 specific use case areas + ODI** challenges mentioned above, and to be addressed by the applicants to the NGI-POINTER Open Calls.

Specific expected outcomes in the verticals are interoperability and backward compatibility across use cases together with a general strong emphasis on building solutions to concrete problems and according to decentralization principles. Secondly, the requirement for large

¹ i.e. (non-exhaustive list): IETF/W3C; Computer science (network research), IFIP, AoIR, ACM, GEANT, RIPE (+ other RIRs), CENTR, DNS operators, Kernel teams, ISOC, EDRI, FSF, FSFE, APRIL, EuroISPA, DPHA, Eurocloud, EURO-IX

² PAB is an NGI POINTER assessment and support body that will be formed by a representation of the main organizations, platforms and standardization bodies representing industry players. It is expected to gather 12 Chairs with representatives of Internet Governance Bodies such as RIPE NCC, CENTR, Euro-IX, GÉANT, ISOC, EDRI, Free Software Foundation, W3C, IETF; and also digital platforms such as FIWARE Foundation, ETSI and GSMA



scale impact in real-life scenarios. Third, radical innovation should be balanced with a realistic business validation and sustainability of MVPs beyond the span of the project.

The focus will be on advanced and applied research that is linked to relevant use cases and that can be brought quickly to the market; apps and services that innovate without a research component are not covered by this model.

In particular, proposals shall contain a specification for the outcome of the project and criteria for success. They will include an explanation of how the results of the supported project are to be commercialised and of what kind of impact is expected. The expected impacts should be clearly described in qualitative and quantitative terms. Market uptake and distribution of innovations shall tackle the specific challenges in a sustainable way. Finally, applicants shall commit to generate Open Knowledge as result of their projects in the shape of “free software”, “free hardware” and “Open Access” accordingly with the nature of the result, being software, hardware or other intangible piece of knowledge (i.e. research paper).



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ABBREVIATIONS

FSTP	Financial Support to Third Parties
IP	Internet Protocol
ODI	Open Disruptive Innovation (Challenge)
PAB	POINTER Advisory Board
TCP	Transmission Control Protocol
....	



1 THE NGI-POINTER USE-CASE AREAS

NGI Pointer invites applicants to submit blue-sky internet and web architecture renovation projects. Successful projects will achieve one or more of the following:

- Development of clear demonstratable solutions (SW/HW/OS)
- Contribute to Open Source under open source licensing
- Link to relevant standards bodies and communities such as IETF, W3C, 3GPP, GMSI, etc.

Proposals should address the following broad challenges:

Privacy-by-Design	Internet at the Edge	Network Optimisation	Virtualisation and Isolation	Limitations of the IP/TCP Protocol Suite
Autonomous Networks and Operations	Energy Efficiency	Industrial Internet Security	Trust for New Internet/Web Users	Open Disruption of Internet Architecture

1.1 NGI-POINTER-01-2020-2022: PRIVACY-BY-DESIGN

Privacy is a basic human right. But privacy on the internet is in continuous conflict with economic interests such as the advertising industry, and law-enforcement interests and the demand for public safety. Many connected instances are collecting massive data on users and their behaviour, while offering the individual user little control over what is collected, shared, processed and utilised.

NGI Pointer seeks new technologies and approaches that allow for the development of applications, services and products, respecting the users and individual rights on digital privacy and self-determined control of data. Helpful solutions can be for example tools supporting smart home users on rising awareness of data flows, monitoring device data, alert abuse, masking sensitive data, or blocking data leaks. In scope are solutions to support applications and product development by privacy-by-design principles such as design patterns, benchmarking tools, detection of privacy violation, monitoring and control of privacy settings such as safe browsing.

1.2 NGI-POINTER-02-2020-2022: INTERNET AT THE EDGE

Cybersecurity as an afterthought, lack of maintainability and the sheer scale of the Internet connected devices at the edge can lead to less sustainable deployments and products. Since products may not be repairable due to compacted and physically protected components or links to trusted yet proprietary platform architectures. To



increase sustainability the monolith architectures must be substituted by modules based and decentralized designs. This can be achieved by secured hardware modules (e.g. Fairphone) linked to new decentralized architectures such as distributed ledgers.

NGI Pointer seeks to increase the security, scalability and maintainability of the Internet during the complete life cycles of connected (smart) products from development, operation up to sustainable maintenance. Examples are tools for strong encryption in the Internet supply chain from hardware, protocols and applications/services towards data services. Focus should be on new approaches to empower the users of Internet enabled products on controlling the dataflow, and on decentralization of infrastructure e.g. by strengthen peer-to-peer principles and enhancing product sustainability.

1.3 NGI-POINTER-03-2020-2022: NETWORK OPTIMIZATION

Upcoming technologies such as edge-computing, tactile internet and autonomous robotics are creating new challenges in communication networks. Networks will need to deal with ultra-low latency, high bandwidth, billions of connected devices and seamless transitions of devices between networks. One challenge is to create unique IDs for assets and users, keep them consistent between different network transitions while providing security and trust of such IDs.

NGI Pointer seeks new concepts, tools and technologies on networks to increase security, trust, privacy, resilience and energy efficiency. This includes new approaches to strengthen current networks technologies or new approaches for future proof networks such as 5G or low power Internet of Things RF connections.

1.4 NGI-POINTER-04-2020-2022: VIRTUALIZATION AND ISOLATION

Container technologies provide a sandbox environment to run applications on heterogenous platforms. But containers are also adding additional abstraction layers and security concerns, which is increasing the complexity of the overall architecture stack. Tools are needed to automate the deployment, monitoring, scaling of containers.

NGI Pointer seeks new approaches for virtualization on the edge and low computing devices to manage increasing complexity in heterogeneous virtualized environments, and new tools and solutions to track dependencies, strengthen interoperability and security on virtualized environments and isolation from physical systems. Supported solutions and tools can fulfil this objective by hardware, software or a combination of both.



1.5 NGI-POINTER-06-2020-2022: LIMITATIONS IN THE TCP/IP PROTOCOL SUITE

New applications for such things as edge computing require new concepts such as decentralized peer-to-peer networks for data distribution and communication. In the case of machine-to-machine communication this can be achieved with new decentralized protocols such as IPFS.

NGI Pointer seeks new solutions, tools and technologies to overcome the limitations of the TCP/IP protocol stack. With the current development of autonomous machines and artificial intelligence the requirements for stable, secure and flexible communication is changing. TCP/IP has limits in security, latency and reliability as needed for new domains such as machine-to-machine economy, autonomous systems or flexible neural networks for artificial intelligence.

1.6 NGI-POINTER-07-2020-2022: AUTONOMOUS NETWORK OPERATIONS AND CONTROL

Growing adoption of mobility, Internet of Things and cloud technology increases the challenges on traditional human-driven network infrastructure. New machine learning approaches and AI-based autonomous network operation can overcome human bottlenecks on troubleshooting, reporting and maintenance of future networks.

NGI Pointer seeks new solutions, tools and technologies for autonomous network control and operations. Such solutions can for instance use natural language processing machine log analysis to identify defective hard- and software components in networks or machine-learning procedures for seamless handling and managing of connection types and traffic.

1.7 NGI-POINTER-08-2020-2022: ENERGY EFFICIENCY

With Agenda 2030 the EU has embarked on a transition towards a low-carbon, climate neutral, resource efficient and circular economy that goes hand in hand with increased security, prosperity, equality and inclusion. The ICT sector needs to contribute to these sustainability goals. As an example of an area that needs improving, the global Bitcoin network currently accounts for about 0.25 percent of the world's entire electricity consumption.

NGI Pointer seeks new technologies, tools and architectures for autonomous energy efficiency in ICT. New approaches are needed to reduce the energy consumption of running application or future applications for optimizing their energy efficiency. This can include solutions for software- and hardware applications on monitoring and reducing the energy consumption during processing or new software- and hardware designs with the scope of energy efficiency.



1.8 NGI-POINTER-08-2020-2022: INDUSTRIAL INTERNET SECURITY

Combining machine-to-machine communication with big data analytics in industry can increase efficiency, productivity, and performance. This creates both new opportunities and challenges: cyber-attacks create a reluctance in industry for a wider adoption without isolation and proprietary solutions. Confidence can be increased with new solutions using hardware and/or software to monitor the integrity of Operational Technology (OT) devices e.g. by machine learning to detect device manipulation by suspicious behaviour as downtimes, malfunctions or data errors.

NGI Pointer seeks solutions, tools and technologies to manage future challenges in industrial security. Industrial internet is facing multiple security challenges by merging Operational Technology and Information Technology in secure ways. Furthermore, security needs to be provided on the industrial supply chain and during long industrial life-cycles.

1.9 NGI-POINTER-09-2020-2022: TRUST FOR NEW INTERNET/WEB USERS

Deception mechanisms such as Deepfake videos can have a significant impact on public opinion when they are used in social media disinformation campaigns. Better detection of misinformation through mechanisms rooted in the internet or web architecture would allow for a better monitoring of the technology.

NGI Pointer seeks new technologies, tools and architectures to increase the trust of new internet uses, whether in recognising fake or misleading information, or identifying phishing attempts or malware.

1.10 NGI-POINTER-10-2020-2022: OPEN DISRUPTION OF THE INTERNET ARCHITECTURE [ODI]

This open-ended challenge offers NGI Architects the chance to submit proposals in areas not included in the nine use-case domains described above. The overarching goal is to renovate, fix and extend the web, internet architecture, protocols and mechanisms, tackling ethical, legal and privacy issues, as well as autonomy, data sovereignty and ownership, values and regulations.

NGI Pointer seeks innovative technology concepts, products and services applying new sets of rules, values and models which ultimately create new markets or disrupt existing markets, with prototyping, validation and demonstration in real world conditions; and help for wider deployment or market uptake. Proposers are encouraged to use a cross-cutting approach with multi-disciplinary teams when relevant. Beyond research, activities should be focused on validation and testing of a potential rollout to a global audience.



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