NGI Consultation Platform Report
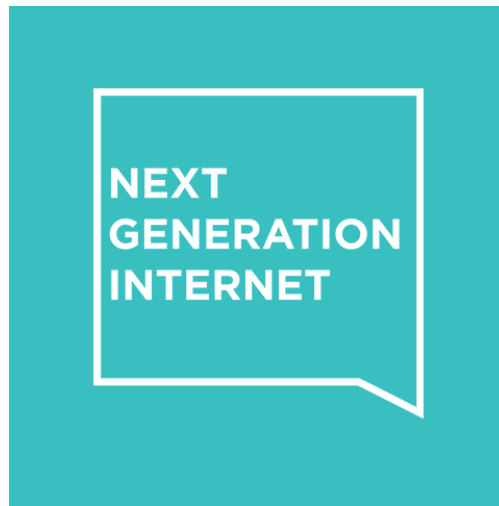
This report provides four different views into the current status of the NGI online consultation platform.

Roadmap View
Topic View
Technology View
Socio-Economic View

Roadmap View

- **2018 - 2021 (WP 2018 Topics)**
- **2019 - 2022 (WP-2019 Topics)**
- **2020 and beyond (post H2020)**

2018 - 2021 (WP 2018 Topics)

This section represents discussions that are related to topics that could be addressed in topics that are targeted in WP-2018 calls for proposals.

Privacy and Trust Enhancing Technologies

This discussion area helps to identify the challenges arising within the privacy and trust enhancing scenario, as well as potential solutions to address these challenges, and to identify gaps that need to be filled by research and innovation projects within this topic area.

Read more about this discussion channel here.

H2020 WP 2018-2020 includes three calls for proposals related to this discussion channel:

- ICT-24-2018-2019: Next Generation Internet - An Open Internet Initiative
- SU-ICT-03-2020: Advanced cyber security and digital privacy technologies
- EUJ-01-2018: Advanced technologies (Security/Cloud/IoT/Big Data) for a hyper-connected society in the context of Smart City

a)   Lack of Control over Data

There is a fear that citizens' privacy is being eroded by the exploitation of citizens' personal data by profiling, and citizens have no control over this. Read more.

b)   Implications of giving away Personal Data

At the workshop on Personal Data Spaces and Privacy, there was a discussion about how people need to better understand the effects of giving away personal data. There is a belief among citizens that when we're getting free services, we don't have to think about our data. There is a need to give more attention to the debate about privacy, at the political level, or market forces will prevail. Another aspect which was debated at the workshop was the issue of transparency and to what extent users were aware of the level of privacy they get when they access service. Read more.

c)   Ensure continuing confidence in the system

When considering highly interconnected networks, it is clear that trust, security and privacy are the prominent concerns. The Fire Study DIN 2017 looked at technology drivers and found IoT and 5G to be the key components. Highlighted was the need to understand the Trust, Security & Privacy concerns within NGI regarding the interaction of humans and autonomous, manual and remotely operated machines. There is a need to look deeper at the security threats even for liberal governments as cyber security will become impossible to secure because of the ease of connectivity as the internet of Things becomes ever more prevalent. More urgency is needed on this. Read more.

d)   How Technologies impact Privacy

The power balances between providers and users created by IoT and Big Data needs to be framed by European values, as discussed at the workshop on Personal Data Spaces and Privacy. Read more.

e)   Impact of AI on Internet security and network intelligence

As networks and traffic streams become increasingly complex, AI can help network managers to understand traffic patterns and create heuristics that identify security threats. At a basic enterprise level, AI can perform tasks normally carried out by an IT helpdesk, such as troubleshooting employee computer problems. In this way the IT professionals will get more time to implement security best practices and better secure their systems and networks. Read more.

f)   Inadequacy of Responses and the Impact on Trust

Cybersecurity will be the most pressing challenge of the next decade. Inadequate management of cyber threats will put users increasingly at risk, undermine trust in the Internet and jeopardise its ability to act as a driver for economic and social innovation. Disproportionate government responses will threaten freedoms, and contribute to a climate of fear and uncertainty. The ISOC report on "Paths to Our Digital Future" released in 2017 brought attention to the fact that we need new models to increase cybersecurity readiness and reduce vulnerabilities but also to ensure end-user security. The complexity and scope of cyberattacks necessitates multi-stake holder and expertise-driven responses for the digital economy to thrive and for trust in the Internet to be rebuilt. Read more.

g)   Safeguarding Confidentiality

Privacy and confidentiality are essential human values which should be ensured in the single largest ubiquitous fabric of modern communication that is Internet. On a contrary, shocking revelations from whistle-blowers like Edward Snowden have made it very clear that this shared trust in the internet has been naive and undeserved, and that weak parts of the design of the internet have being systematically abused at a scale beyond comprehension. NGI initiative seeks to craft an internet that is resilient, trustworthy and sustainable, and varied aspects that would inject confidentiality into the core Internet have been suggested. Read more.

h)   Cooperative Security Needed in the Future Internet

Too often companies and other entities are reluctant (for good reasons) to share security related information. Prevailing principle is: what is inside my walls is my business, the rest of the Internet including my customers, does not concern me. Plus everyone handles security patching themselves, or leaves it until later. No surprise that most security breaches take place using known vulnerabilities for which patches exist. The hackers can keep on using the same resources against many potential victims. The solution is cooperative firewall (customer edge switching). Read more.

i)   End-user friendly transparency mechanisms

User-friendly mechanisms to overview transparency of Internet services should be pro-visioned for end-users, such as - transparency on the security situation of a connection, background processes, data collected and observed or data retention. These mecha-nisms may also provide tweaking options empowering the user to define custom and desired security levels. This will lead to higher trustworthiness of the Internet with the effect of enabling innovation and creativity. Read more.

j)   Securing end-user rights, protection and reputation

Trust is the key driver for human interaction. Identity and reputation are characteristics which should be an intrinsic part of the internet infrastructure, yet any such unbiased shared infrastructure is lacking. In order to secure end-user rights, the NGI needs to create decentralised internet-wide identity mechanisms, distributed reputation options and ensuring viable means of extending end-of-life of software and software-enabled devices. Read more.

k)   User empowerment through freedom of choice

Typically Internet users do not possess much understanding of security issues and ways to protect oneself as user. There is a need to develop standard interaction patterns to allow declarative interaction. By standardising popular interaction patters, users only have to passively declare the desired interaction, and do not have to bother the user with permission to run unverifiable scripts on a web page. The users will have the right to be off-line when using connected devices, as well as using safe content profiles or generic profiles for revealing personal information. Read more.

l)   GDPR and NGI

GDPR is seen as a big chance to improve the protection of the users privacy, but on the other hand it is a big burden for companies with all the new regulations, and especially with the fear to get huge fines. There's little support for SMEs and high personal risks for SME owners due to the potential high fines. Read more about this discussion.

m)   Privacy is everywhere

Disinformation, malinformation and misinformation are eroding trust in internet users and putting European human values at risk. Many studies are taking place across Europe and the Council of Europe in setting down recommendations and actions to

help citizens make more informed decisions about how they how use the internet. EuroDIG 2018 is offering an important forum for debate in this regard, which is open and evidence-based to ensure diversity of information, freedom of speech and privacy as a fundamental human right. Read more about this discussion here.

n) Workshop on Privacy and Trust at the NGI Forum 2018
Realising the values of privacy, trust and related others is difficult, because some of them are in conflict with each other and because we need to decide where to focus our energy. Engineroom project ran a workshop to get participants in the NGI Forum 2018 to think about these issues and gather their insights, which will help inform our own thinking about the future internet, and the values it should champion. Detailed insights from the workshop are available here. Read More.

o) Privacy Issue in Real-Time Data Marketplaces
In an EU project, a real-time data marketplace where thousands of car sensors automatically publish real-time data is developed, which is streamed through channels and subscriptions to the interested service providers. During the post project exploitation phase there were issues related to consent management. The current mechanisms do not seem practical. The project called for wider community inputs and suggestions to solving this issue. Read More.

p) User control and privacy in the global app market
Today's app markets are not informing us of what they track or when. Users have no way to check this behaviour. Our movements can be followed through tracking tools but do the app developers really need to track our location? To turn things around, we need improvements on several levels like trustworthy hardware, robust mobile operating systems, etc. We need to create a world where every citizen can understand privacy settings and their implications. Read More.

Discovery and Identification Technologies

According to the call text related to R&I Actions for H2020, there is a need to search and access the technologies for large heterogeneous data sources, services, objects and sensors, devices, multi-media content, etc. and which may include aspects of numbering; providing contextual querying, personalised information retrieval and increased quality of experience.

H2020 WP 2018-2020 includes one call for proposals related to this discussion channel: ICT-24-2018-2019: Next Generation Internet - An Open Internet Initiative.

a) Semantic Data Organization
At the NGIForum 2018, a discussion was held on how we need new ways of storing, understanding and releasing data based on the semantics of the data itself and the context within which the data exists. Related Human Values, Challenges, Solutions, Initiatives, Gaps and R&I were also identified. Read more.

b)   SME Perspectives for Trustworthy Search and Content Discovery

At the NGIForum 2018, viewpoint of SMEs in relation to their participation in NGI was presented as well as the importance of collaboration between researchers and SMEs for advancement in trustworthy search and content discovery. Related Human Values, Challenges, Solutions, Initiatives, Gaps and R&I were also identified. Read more.

c)   Slovenian Open Data Portal

At the NGIForum 2018, Mr. Černivec (XLAB d.o.o.) presented on search and discovery tools from the perspective of the Slovenian interoperability and open data portal that provides a platform for public authorities to publish their solutions and make them discoverable to citizens. Related Human Values, Challenges, Solutions, Initiatives, Gaps and R&I were also identified. Read more.

d)   Tackling Online Disinformation

At the NGIForum 2018, Prof. Jamal Shahin (VUB and GIPO) presented number of challenges related to tackling online disinformation, and also involved the audience on about how to face this challenge. Related Human Values, Challenges, Solutions, Initiatives, Gaps and R&I were also identified. Read more.

e)   Extant research

Before embarking on a long discussion about what's needed in relation to D&I Tech, there was an identified need for recommendations on a good landscape overview, with one state-of-the-art overview being suggested by Antonio Skarmeta as part of IoT Crawler project. Read more.

f)   Market uptake of eIDAS compliant eID infrastructure

Should eIDAS compliance be obligatory for all EU projects? How to speed up uptake of eIDAS compliant identification and authentication by private service providers? In his blog, commissioner Ansip commented that Germany was the first country to pre-notify EC about its eIDAS compliant eID scheme while Italy is second to this. Read more.

g)   Unbiased and privacy-respectful discovery of content and services

Enabling unbiased and privacy-respectful discovery of content, services and metadata on the Web will lead to higher trustworthiness of the Internet for the users, more openness of content and enhancement of creativity and human potential through alternative access to various types of content and services. Read more.

Decentralised Data Governance

This discussion channel will help to identify the challenges, solutions and gaps arising within the context of Decentralised Data Governance which is one of the RIA actions for H2020 Topic identifier: ICT-24-2018-2019, Next Generation Internet - An Open Internet Initiative.

According the call text, this RIA will cover the following scenario:

"Leveraging on distributed open hardware and software ecosystems based on blockchains, distributed ledger technology, open data and peer-to-peer technologies. Attention should be paid to ethical, legal and privacy issues, as well as to the concepts of autonomy, data sovereignty and ownership, values and regulations."

H2020 WP 2018-2020 includes two calls for proposals related to this discussion channel:

- ICT-28-2018: Future Hyper-connected Sociality
- ICT-24-2018-2019: Next Generation Internet - An Open Internet Initiative

a) Blockchain alone won't make the internet decentralised and other challenges

At the Porto NGI Forum 2018, the main challenge for a secure decentralised Internet that echoed was to avoid the concentration of data (and power) in the hands of a few dominant players. Big corporates have limited interest in empowering their users, but are undoubtedly more competitive than decentralised solutions in the user experience. The challenges to be tackled in this respect are building trust in decentralised systems. Another debate was around the promises and challenges of Blockchain. Despite the decentralised nature of blockchain, the business models related to it are still extremely centralised and reinforce the revenue and power of a single player. Read more.

b) Priorities for a decentralised Internet

At the Porto NGI Forum 2018, major priotiries in achieving the vision of decentralised Internet were discussed - Openness and security, Decentralised business models, Pertinence assessment, Sustainability and Capacity building. Read more.

c) The unbalance of data relationships in the digital market

At the NGI Forum 2018 in Porto, Pablo Ojanguren, founder and CTO of Swell RT, spoke on the unbalance of data relationships in the digital market. Users don't really control how their data are delivered to service providers, which gather them through centralized channels (user interface, web or app) and process them. Also, the information returned by the service can be only consumed in one controlled way. It is like buying shoes that you can only wear in the streets allowed by the vendor. Read more.

d) Advancing decentralised data governance

Dominant data platforms have extremely centralised architectures, especially at the level of data governance. The key question is whether technological solutions enabling intrinsically decentralised data governance break the "rules of the game" that have made current data incumbents successful. Read more.

e) Fixing asymmetry in data governance

Arguing that data is of common good, new economic models will be beneficial that incentivize the sharing of information hoarded by applications and companies such as Google. Read more.

f)   Decentralisation of Control

One of the topics raised in the Hub4NGI D2.1 deliverable that needs to be addressed by NGI research topics is that of "Decentralisation of Control". The report provides evidence from multiple sources including the 2017 DIN Forum Report which acknowledges that the GAFA (Google, Apple, Facebook, and Amazon) incumbents are in such a dominant position that it is difficult for European start-ups to compete. The NGI should enable alternative business models and infrastructure to support alternative solutions to the current centralised service offerings. Read more.

g)   Data Sovereignty

Currently there is a lack of control over personal data. New standards around data portability, interoperability as well as decentralized data governance need to be developed. At the expert workshop organized by NGI Engineroom project in London in March 2018, challenges and opportunities related to NGI topics were examined, including internet and data sovereignty. Read more.

h)   Balancing between citizen-centric NGI and business models based on the data economy

At a COST-CONNECT workshop, a group discussion was held pondering over the question on how to adequately balance a "citizen centric" Next Generation Internet in an environment where the business models are largely based on the data economy, which uses citizens' data as a replacement for payment fees or subscription charges. Read more.

i)   Personal Clouds

In this discussion, it was argued that most of the efforts for open, decentralized, privacy-friendly alternatives to centralized social networks are as cool as unable to make any real difference, in useful time. The author started work on percloud (PERmanent/ PERsonal CLOUD" and invited collaborators and feedback on it. Read more.

Responsible AI

AI is already being used to augment human potential in many ways including cancer diagnostics. With AI becoming more ubiquitous, there is a need for means of redress where decisions made by machines are difficult to understand, or unethical or even illegal. "Responsible AI" concerns applications of AI whose actions need to be explainable and governed from both a legal and ethical standpoint because they are either safety critical or impact the lives of citizens in significant ways. There is still an open question that "will AI empower us as human beings or kill us?"

H2020 WP 2018-2020 includes two calls for proposals related to this discussion channel:

- ICT-09-2019-2020: Robotics in Application Areas
- ICT-26-2018-2020: Artificial Intelligence

Read more about this discussion here and here.

Blockchain as an enabler for NGI:

This discussion is related to the view of how blockchain can enable the Next Generation Internet. How can this technology be applied to empower European citizens in being part of the Next Generation Internet? What are the challenges, technically, socially and legally?

While the TCP/IP made communication easy since it allowed devices to talk to each other, the blockchain technology could help advance it further by making data interoperable in such a way that having to hard code APIs for accessing databases would be a thing of the past.

As someone who deals with data extraction, verification and analysis, it is believed that blockchain can help restore trust in the Internet by allowing storing and dealing with data more interoperable, reliable, convenient and efficient. Doing so helps journalists and the public less prone to falling into fake news traps.

H2020 WP 2018-2020 includes one call for proposals related to this discussion channel: ICT-28-2018: Future Hyper-connected Sociality. Read more about this discussion channel here.

Experimentation Support for Start-ups

Experimentation platforms are important to test and validate new products and services for compliance with real-world conditions, which can be really expensive to simulate particularly for start-ups. Therefore experimentation resources such as hardware, cloud and software should be provided to them as a service. Additionally, for SMEs and start-ups requiring experimentation funding, there should be support for flexible funding (responsive mode and fast turnaround) in addition to existing open calls.

H2020 WP 2018-2020 includes one call for proposals related to this discussion channel: ICT-35-2018: Fintech: Support to experimentation frameworks and regulatory compliance. Read more about this discussion channel here.

Algorithmic Accountability

In the Hub4NGI D2.1, a significant issue regarding the responsible AI has been raised which is about whether and how can an AI algorithm be accountable for its actions.

The issue of Algorithmic Accountability was also raised in Net Futures debate "Legal, ethical and social issues in a software defined world" and the participants agreed that there is a responsibility gap for the AI systems.

Transparency is considered to be a key aspect of algorithmic accountability as depicted in the Net Future 2017 debate session. And it is widely agreed that the algorithms need to be able to explain their decisions.

H2020 WP 2018-2020 includes two calls for proposals related to this discussion channel:

- SU-ICT-02-2020: Building blocks for resilience in evolving ICT systems
- ICT-35-2018: Fintech: Support to experimentation frameworks and regulatory compliance

Read more about this discussion channel here.

Ethical Frameworks for Autonomous Machines

- It is important to have an ethical framework in place for artificially intelligent and autonomous machines. It is however still a question to be answered that how ethics can be designed into AI technology and where these ethical and legal questions lie. Multi- disciplinary research and discussion are undertaken to provide answers to legal and ethical questions surrounding AI and its applications. Read more about this discussion channel here.

- The European Group on Ethics in Science and New Technologies (EGE) released a statement calling for the launch of a process that would pave the way towards a common, internationally recognised ethical and legal framework for the design, production, use and governance of artificial intelligence, robotics, and 'autonomous' systems. Read more about this discussion channel here.

H2020 WP 2018-2020 includes two calls for proposals related to this discussion here:

- ICT-09-2019-2020: Robotics in Application Areas
- ICT-26-2018-2020: Artificial Intelligence

The Pressing Need for IoT Security

The Internet Society 2017 report- Paths to our Digital Future quoted "IoT compounds every security problem ever seen and multiplies every problem of the Internet. Your toaster could be sending out spam". This highlights the magnitude of risks posed to critical Internet infrastructure and applications if security frameworks are not included early into the IoT innovation process. The case of Mirai attack of 2016 is often taken up to prove the extent of damage mere plug-and-play remotely-managed IoT devices can have on the broader Internet.

H2020 WP 2018-2020 includes two calls for proposals related to this discussion channel:

- ICT-27-2018-2020: Internet of Things
- EUJ-01-2018: Advanced technologies (Security/Cloud/IoT/Big Data) for a hyper-connected society in the context of Smart City

Read more about this discussion channel here.

IoT, Interoperability and the Future of Internet

Interoperability is fundamental to the success of IoT. As Jari Arkko, former chairman of IETF quoted - "I cannot think of a better example where interoperability is more important than the Internet of Things. Without interoperability, lights won't work with the switches, sensors can't be read by your smartphone, and devices cannot use the networks around them". Without giving significance to interoperability, we face the risk of fragmentation of Future Internet as in a race to progress ahead of their competitors; businesses will deploy and develop proprietary solutions.

H2020 WP 2018-2020 includes two calls for proposals related to this discussion channel:

- ICT-27-2018-2020: Internet of Things
- ICT-29-2018: A multilingual Next Generation Internet

Read more about this discussion channel here.

2019 - 2022 (WP-2019 Topics)

This section represents discussions that are related to topics that could be addressed in topics in the WP-2019 calls for proposals.

Strengthening Internet Trustworthiness with Electronic Identities

This discussion channel will help to identify the challenges, solutions and gaps arising within the context of Strengthening Internet Trustworthiness with Electronic Identities which is one of the RIA actions for H2020 Topic identifier: ICT-24-2018-2019, Next Generation Internet - An Open Internet Initiative.

According the call text, this RIA will cover the following scenario:

"addressing critical challenges related to increasing trust in the internet such as authentication, authorisation, traceability, privacy and confidentiality in personal and non-personal interactions. This topic will engineer federated and/or decentralised technologies for supporting internet-wide e-identities with various levels of identification, reputation and trust, to serve as a basis for new business models for verifying and valuating personal data. Proposers should pay attention to the following dimensions: scalability, ease of use, deployability, sustainability, standardisation and compatibility with the eIDAS framework"

a) Online Identities and Trust

There is a need for secure online identity verification and management system that can replace the trust-less system with trust-enhancing solutions which would be alternatives to codifying trust through reputation systems. At the expert workshop organized by NGI Engineroom project in London in March 2018, challenges and opportunities related to NGI topics were examined, including online identities and trust. Read more.

b)   Initiating trustworthiness

The universal "net neutrality" principal that lies at the heart of the Internet allows everyone to use the Internet to its full potential without holding back. It is essential for democratic ownership of the digital society. It can be achieved only with the use of trustworthy technologies that can be relied upon by all users of the Internet. This can be done by the identification and deprecating existing non-trustworthy elements and creating new trustworthy components. This requires applying severe scrutiny to key 'commodity' protocols and widespread implementations. The core networking components need to be clean without defects or backdoors. The built-in security of core networking components may be the only line of defence for many applications and services on top of the network. Read more.

c)   Genuine Global Identities for Open e-Democracy

A team at Weizmann is engaged on basic research on the foundations of e-democracy. A key threat to any open electronic community in general, and to an open e-democracy in particular, is fake identities, aka sybils. They undermine the integrity of the community, hamper equality and subvert accountability. Genuine global identities are needed in a broad range of contexts, to increase credibility and accountability on the net in general, and to enable democratic processes in particular. To help achieve that, they propose a notion of self-sovereign and decentralized global identity that consists of a public key and a profile, which may be cryptographically-hashed for privacy. Read more.

d)   Tackling Misinformation

In our polarized world, misinformation has shown significant power to shape public opinion and influence the direction of our societies. If we want to share a trustworthy digital landscape, which empowers us to better understand our world and make better decisions because of it, we must create new tools to validate our online information – and fact-checking is a pillar of that effort. A project called CrowdFact in this respect has objectives to (a) reduce the current response time on misinformation from 13 hours to a matter of minutes, and (b) provide a model for stabilizing and protecting the digital information landscape in advance of the worldwide 2020 election cycles. Read more.

Service and Data Portability

This discussion channel will help to identify the challenges, solutions and gaps arising within the context of *Service portability and data decoupling* which is one of the RIA actions for H2020 Topic identifier: ICT-24-2018-2019, Next Generation Internet - An Open Internet Initiative.

According the call text, this RIA will cover the following scenario:
"this topic will address the challenge of personal data portability on the internet as foreseen under the GDPR and the data porting and service provider switching as foreseen in the proposed free flow of non-personal data regulation[3]. The topic should cover the separation of data from the services provided to the end-users, with a view to ensure

seamless combination of internet services and frictionless switching. Attention should be paid to technological developments, standardisation of personal profiles, practical handling of data sets mixing personal and non-personal data, operational and business models, as well as techno-legal constraints and the simplification of end-user contracts and terms of use."

a)   Service portability and data decoupling

Service portability and data decoupling outlines the need for empowering users to separate their content and data from internet software and services. This ability will transform market-dominant 'black box' internet services into universally available alternatives available to all as generic 'white label' building blocks that can be reused and adopted by anyone. This re-establishes the boundaries between content owner and service provider, allowing alternative and complementary services to be mixed and matched. It will also safeguard openness and diversity by actively steering away from market monopolies. In addition, without the pressure to maximise profit, services can be cleaned from psychological manipulation, be made more efficient and better adhere to the ethical preferences of the user. Read more.

Open Internet Architecture Renovation

a)   Recursive InterNetwork Architecture (RINA)

RINA is an Internetwork architecture whose fundamental principle is that networking is only inter-process communication (IPC). RINA reconstructs the overall structure of the Internet, forming a model that comprises a single repeating layer, the DIF (Distributed IPC Facility), which is the minimal set of components required to allow distributed IPC between application processes. RINA supports inherently and without the need of extra mechanisms mobility, multi-homing and Quality of Service, provides a secure and configurable environment, motivates for a more competitive marketplace and allows for a seamless adoption. Read more.

b)   Need for a new Internet Architecture

It is argued by many researchers and technologists that the five decades old Internet architecture is not proved to be able to provide best foundation for the next generation services and applications. The simple 4 layer TCP/IP model has now become a very complex structure. To solve the emerging problems, more and more building blocks were added and a very complex solution is the current result. Today's Internet is it has bad performances, bad security, hard to build and maintain, and configuration and operational costs are through the roof. Read more.

c)   Internet Threat Catalogue critical to NGI

The internet needs to be extremely resilient and should be able to cope with many parts of the modern threat landscape. Different threat categories are identified which could be

prioritized for mitigation in the NGI initiative. Grouped together as 'Force majeure' (Natural disaster, Man-made disasters, Adversary AI), 'Technological' (Cascade of system failure, Spillover from inadequate isolation/segmentation), and 'Human intent' (Cyber warfare and cyber conflicts). Read more.

d)   Improving Maintainability and Deployability
Flexibility and responsiveness is essential for Internet as a system. Without proper procedures for maintenance and without auditability, a system cannot be expected to be secure and reliable. It is also important for NGI initiative to make sure that R&D efforts should be deployable and maintainable in the context of actual Internet environment. A successful approach for NGI would be to create a universal and reliable path to automatable deployment even during (continuous) development. Read more.

e)   Highly Available, Resilient and Robust Internet Infrastructure Components
Alternatives to current legacy core infrastructure have to be developed in order to structurally increase resilience and robustness of Internet at a systemic level. This would provide an opportunity for fixing Internet's known fundamental architectural weaknesses and applying lessons learned in the lowest possible layer, resultantly, the whole dynamics of currently considered undefeatable threats such as distributed denial of service by botnets and mass surveillance can be changed as well providing a lasting answer from the catalogue of threats dangerous to Internet resiliency. Another benefit is in the high availability of Internet services, be it network or application related. Therefore, the NGI goal should be to ensure high availability, resilience, openness and disruption tolerance by providing a resilient, robust and secure routing and transport layer. Read more.

f)   Smarter Asset Distribution for a resilient Internet
Provisioning distributed alternatives to obtaining digital assets from a single source would make the next generation Internet more robust in the event of various threats, outbreaks and downtimes. These measures would prevent complete service failure, and contribute to making Internet less forgetful, allowing content that would otherwise have disappeared to remain available. Given the common and transverse nature of this issue critical to and effecting all actors from service-providers, ISPs to clients, alternatives complementary to each other therefore should be developed and provisioned in parallel. Read more.

g)   Architecture renovation
At the heart of the NGI is architectural evolution that improves upon legacy core protocols of the internet by investigating alternative or auxiliary core infrastructures. This would include projects that are aimed at changing the underlying fabric of the internet and the web itself. Many fundamental issues with resilience and robustness can only be fixed at a systemic level, but the inertia to integrate new solutions into existing Internet is too huge. The matters have been aggravated by the fact that many practical workarounds have been found meanwhile to cater for explosive demand. These workarounds have raised cost, complexity, and even further worsened the known fragility

and inflexibility of Internet. The complexity of designing a successful architecture up-grade is easily illustrated by the fact that over half of the life time of the internet has already been spent on the (arguably not very successful) move away from IPv4. There-fore, research and tools to assist in the practical transition or migration to new evolved technologies should also be investigated. Significant effort will have to go into under-standing and mitigating the many practical aspects of potential transition from the current internet. Read more.

h)   Optimisable,extensible, reusable and reliable open hardware

Creating a future proof Internet infrastructure requires continuous optimisation and inte-gration of best practises at all levels, including at the hardware and system integration level. While the software market has been commodified and democratised through free software (aka open source), the hardware market is still dominated by a small amount of vendors. Commodification of the development of networking hardware, from full-blown optical networking equipment to embedded systems and hardware cryptographic com-ponents, can help to ensure higher availability, lower costs, increase transparency and diversity, and create a more open market where anyone may introduce highly complex new services that require strongly optimised and well-integrated hardware and software. Read more.

i)   Resilient Internet Services

Growing dependency on a few operators might increase the risk of single point of fail-ure. In order to avoid this risk and to make Internet services more resilient, network can be segmented in such a way that issues in one segment have no side effects in other segments/parts of the network, which would allow for uninterrupted use outside of any affected areas. Furthermore, the service quality degradation can be avoided by providing multiple independent alternatives access networks (multihoming), and other means of smarter asset distribution as presented in this discussion. Read more.

j)   Cyber Security and Resilience

There is a need for secure internet infrastructure and protocols which are resilient against cyber-physical attacks with future-proof encryption. At the expert workshop organized by NGI Engineroom project in London in March 2018, challenges and opportunities re-lated to NGI topics were examined, including cyber security and resilience. Read more.

- SU-ICT-03-2020: Advanced cyber security and digital privacy technologies
- EUJ-01-2018: Advanced technologies (Security/Cloud/IoT/Big Data) for a hyper-connected society in the context of Smart City

k)   An inclusive, multilingual internet

An inclusive digital single market means an internet that breaks down language barri-ers, that connects and empowers every citizen and business across Europe. An internet where services are available in multiple languages, accessible to all. A public, open and interoperable European language grid that connects resources and tools, combining and

sharing them across a network of people. Read more.

H2020 WP 2018-2020 includes a call for proposals related to this discussion:

- ICT-29-2018: A multilingual Next Generation Internet

I) Application Areas for NGI Technologies

The following are the key application areas which are expected to be greatly impacted by the emerging NGI technologies:

- **Industry 4.0**
  Industry 4.0 is a big change as agreed by the experts in "The Next Generation Internet Workshop" on "Widen the European Space of Life and Work" held on 8th June 2017. It is considered to be the next phase in the digitization of the manufacturing sector. It relies on Internet services and knowledge is largely shared across the network in order to exploit this available knowledge for faster and better robotic learning.

- **Immersive Environment** With the advancement in AI and learning algorithms, the immersive environments such as Virtual Reality (VR), Augmented Reality (AR) are also expected to be leveraged. However, these new forms of interactions and immersive environments might also face the challenges of data privacy, diversity and the concentration of data into proprietary platforms. Understanding the psychological & biological effects and threats and opportunities for industry and citizens is necessary in the VR world.

- **Collective User Experience**

  Decentralised, heterogeneous and distributed architectures are important in the next generation digital society. For an enhanced user experience, human-centric technologies need to be identified, propagated and managed.

- **Lifelong Learning**
  ICT lifelong learning is important in order to raise people's awareness of the significance of acquiring ICT skills throughout their lives.

- **Inclusiveness**
  Each citizen have the right to benefit from modern ICT services and technologies. And the services should be designed in simple and easy to use way so that everyone including persons with disabilities could get benefit. Ubiquitous access to Internet and other ICT services is the right of each citizen just like access to clean water or energy infrastructure. Inclusiveness and ubiquitous connection are the key themes for civil society.

- **Protection from the dangers of the Internet** Ordinary Internet users are not fully aware how deep they are in the Internet. They sometimes disclose very personal information against social engineering attacks. This poses not only data protection problem but also people themselves protection. It is important for emerging NGI technologies to protect people from dangers of the Internet.
  Read more.

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m) Internet Society Global Internet Report 2019

Internet Society has issued its Global Internet Report. It focusses in particular on the issues around service provider consolidation and flattening of the Internet. In particular consolidation is raising a vital question over the future of innovation over the Internet and of the Internet due to the increasing dependency on a few major industry platforms. Read more.

Don't forget silver surfers

A similar discussion at EuroDig was around potential models for imparting digital literacy to digital migrants or nomads which includes senior citizens and broadly people not brought up with Internet for a more inclusive development and society. Read more about this discussion here.

Compliance with GDPR

GDPR offers a great chance to improve the protection of the user's privacy, but on the other hand it is a big burden for companies with all the new regulations, and especially with the fear to get huge fines. There might be little support for SMEs and high personal risks for SME owners due to the potential high fines. Read more about this discussion channel here.

Limitations to Democracy and Liberty

Another widespread concern, raised in Hub4NGI D2.1, is the abuse of Internet technologies causing threats or limitations to democracy and liberty.

In an online article titled "Will we still have a single global internet in 2025?", the Ditchley Foundation also mentioned that the authoritarian governments wish to use the capabilities of the Internet to exert controls over citizens and keep their data at home in order to ensure access. Read more about this discussion here.

Technology Evolution vs Legislation

A very important point raised in Hub4NGI is that legislative speed cannot keep up with technical development, resulting in ineffective and out of date legislation. Legislation and the legislative process are recurring themes in the sources.

It is usual that citizens and businesses are ahead of governments in understanding the implications of Internet, and overall conclusion is that the legislative process must reform to adapt to the speed that technology evolves at. Changes are rapid, so legislation must adapt. Read more about this discussion here.

Governance and Ethics in a World of AI

- Technologists themselves say the technology needs to align with human values, and that ethical dimensions must be prioritised at every stage of the design, devel-

opment and deployment of AI systems. The ISOC report on "Paths to Our Digital Future" released in 2017 brought attention to the fact that there could be extensive ethical concerns due to AI and automation. The speed at which AI and related technologies are being developed and deployed will require significant investment and effort in the short term to avoid unintended consequences for society and humanity. "We will need focused research and effective governance structures to make sure AI technologies create opportunities and not harm". Read more.

- The European Group on Ethics in Science and New Technologies (EGE) released a statement calling for the launch of a process that would pave the way towards a common, internationally recognised ethical and legal framework for the design, production, use and governance of artificial intelligence, robotics, and 'autonomous' systems. Read more about this discussion channel here.

Next Generation Internet and Skills

This discussion is more focused to find out the answers to the following questions:

- What skills will workers and citizens need to fully contribute to and participate in the next generation global infrastructure?
- What should we be teaching our children? (and what not?)
- How may new Internet technologies enhance education?
- Can we go beyond MOOCs (Massive Open Online Courses)?
- Will AI supplant tutors?
- Can blockchain be used to disintermediate higher education?

Avoiding Echo-Chambers and Fake News

There is a risk that the Internet becomes an "echo chamber", where profiling of citizens, "fake news" and citizens' own preferences and social groups distort the information citizens can see to biased opinions or sympathetic views that reinforce entrenched views. Read more about this discussion channel here.

Integrated Collaboration Spaces

Collaborations spaces such as incubators and internet forums are essential platforms bringing together stakeholders to innovate on NGI related issues. 2017 DIN Forum report suggested integrating them with other innovation networks like social networks, experimentation platforms and evidence platforms so that people from different disciplines can apply technologies to solve real-world problems. Read more about this discussion channel here.

Innovation Agencies for Commercializing Innovation

There is an identified gap between applied research output that addressed and solved some real-world problems and their transition into a marketable product or service majorly due to the traditional way of funding of these two activities, applied research by

EC or national grants, and product development through private money like venture capital. To address this, it has been recommended that such innovation support be provided by national innovation agencies to create sustainable businesses, expert base, and strengthen economy. Read more about this discussion channel here.

Internet Data Sovereignty

Currently there is a lack of control over personal data. New standards around data portability, interoperability as well as decentralized data governance need to be developed. At the expert workshop organized by NGI Engineroom project in London in March 2018, challenges and opportunities related to NGI topics were examined, including internet and data sovereignty. Read more.

Verification, accountability and automation mechanisms for the NGI

Supporting safety of EU citizens and their data and ensuring the business and social connectivity is the foremost concern in the NGI initiative. The challenge is to provide efficient accountability and security mechanisms for the operational NGI initiative with tamper-proof technical solutions such as security proofs, risk protection, as well as whistle-blowing options and accountability mechanisms. These solutions should ensure high availability of the NGI, counter issues such as sabotage or surveillance, and provide distributed trust mechanisms to remove single points of failure. Given the inherent vulnerability of any single root of trust, there is a preference for distributing trust mechanisms to remove single points of failure, and finding ways to delegate trust in an auditable and controlled way. Read more.

Greening the Internet

Optimal resource consumption and minimization of carbon emission is a great challenge for the Next Generation Internet. Data centres and networking devices consume significant amount of energy. It is imperative to improve energy efficiency, both locally and at Internet level. Currently there is a significant lack of transparency of environmental cost, which should be urgently resolved given the vast scale of resource usage. There is a need to provide transparency mechanisms on the environmental cost of the Internet. Identification and tagging of most resource consuming elements is also very important and urgent. The research is needed to figure out the alternatives to improving energy efficiency. This will ensure sustainability of the Internet and of the economy relying on it. Read more.

Game of Nodes: The Rise of the Regional Internet Blocs

In 2016, Joshua Cooper Ramo hypothesized the shift from one global Internet to a system of regional Internet blocs, each with distinct characteristics and values, in his book The Seventh Sense . In 2019, we can see this unfold with American, Chinese and European versions of Internet. As the strength of a network is based on the number

of nodes, it is argued that the strength of these (presumably competing) regional Internets will depend on the number of countries they have "signed on." So MENA and Oceania countries will have a chance to chose between the U.S., E.U., and Chinese Internet. Consequently, whichever regional Internet creates the most attractive Internet architecture for these nations will have the leading network in the world. Read more.

2020 and beyond (post H2020)

This section represents discussions of topics that need to be addressed beyond H2020 in the NGI flagship era.

NGI Beyond 2020

This is the discussion about the vision for NGI beyond H2020 focusing on the longer term priorities for NGI.

Hyperconnected Sociality

This discussion channel is focused on:

- Mobilising a positive vision as to the role that social media will increasingly play in communication, exchange, business, creation, learning and knowledge acquisition.
- Overcoming the critical issue of trust and governance through democratic reputation mechanisms and user experience.
- Creating a Global Social Sphere.

Inclusive NGI

The aim is to enable every citizen, from all walks of life, to fully take part in the digital single market. The next generation internet will have to empower users, including the most vulnerable or challenged, to have access to the same digital learning opportunities, in forms that are accessible, perceivable and understandable by everybody.

Multilingual NGI

The objectives of this discussion channel include:

- Supporting technology-enabled multilingualism for an inclusive digital single market.
- Ensuring every European has access to content and can engage in written and spoken communication activities without language being a barrier.
- Overcoming linguistic fragmentation to enable all citizens and businesses to engage in online activities and benefit from online content and services.

Wealth Distribution in Digital Economy and New Business Models

Wealth distribution and economies are being increasingly influenced by the digitization and Internet. The proliferation of AI and automation is becoming a major threat to human employment. As the machines will take over certain tasks in the economy, there is a need to find new ways of distributing wealth.

Compared to other business types, SMEs are seen to be at a disadvantage and need help to take advantage of NGI. Investment policies and legislations should aim to increase the abilities of SMEs to profit from NGI technologies. Furthermore, new business models are needed to challenge the current dominance of the large incumbents. New collaboration based business models which integrate people and resources from various disciplines might help significantly. Read more.

Evolving Edge and Safeguarding Open Internet

- Increasingly many new services (IoT, smart grid, health) are being delivered from Internet edge (home or enterprise access networks, their ISPs). However, these emerging services require specialized infrastructure, which may create private islands of connectivity that don't use public Internet posing a risk for interoperability and to the future of global open Internet. Read more.
- Another driver for specialized edge networks is the need to provide ubiquitous connectivity for emerging latency/bandwidth intensive applications such as IoT, HD video, the proliferation of which will make the user edge more complex and lead to the deployment of proprietary and specialised solutions. Read more.

Safeguarding Standardization and Innovation

Open and voluntary standards have long been the core of the Internet's success. However, standardization process will be challenged in the future by the speed of Internet innovation, the complexity of the emerging infrastructure and services, and possible inclination towards proprietary systems. Standards development processes thus have to evolve to mitigate manipulation from big corporations, in making the process less cumbersome and incentivizing as well as engaging more and more innovators into the standardization process. Read more.

Topic View

Privacy

This discussion area helps to identify the challenges arising within the privacy and trust enhancing scenario, as well as potential solutions to address these challenges, and to identify gaps that need to be filled by research and innovation projects within this topic area. Read more.

Trust

As sensors, objects, devices, AI-based algorithms, etc., are incorporated in our digital environment, there is a need to develop robust and easy to use technologies in order to help users increase trust and achieve greater control when sharing their personal data, attributes and information. Read more.

There is a need for secure internet infrastructure and protocols which are resilient against cyber-physical attacks with future-proof encryption. At the expert workshop organized by NGI Engineroom project in London in March 2018, challenges and opportunities related to NGI topics were examined, including cyber security and resilience. Read more.

Social Liberty

Restrictions on internet through interventions by authoritarian governments and limited or biased search results from internet search engines cause the limited or biased information generation. Social groups that pursue a particular agenda by reinforcing certain arguments, ignoring other opinions are also the cause of restricted and fabricated information. Read more here. For further discussion, click here.

Net Neutrality

Internet service providers must treat all data on the internet the same, and not discriminate or charge differently by user, content, website, platform, application, type of attached equipment, or method of communication.

Governance and Ethics in a World of AI

- Technologists themselves say the technology needs to align with human values, and that ethical dimensions must be prioritised at every stage of the design, development and deployment of AI systems. The ISOC report on "Paths to Our Digital Future" released in 2017 brought attention to the fact that there could be extensive ethical concerns due to AI and automation. The speed at which AI and related technologies are being developed and deployed will require significant investment and effort in the short term to avoid unintended consequences for society and humanity.

"We will need focused research and effective governance structures to make sure AI technologies create opportunities and not harm". Read more.

- The European Group on Ethics in Science and New Technologies (EGE) released a statement calling for the launch of a process that would pave the way towards a common, internationally recognised ethical and legal framework for the design, production, use and governance of artificial intelligence, robotics, and autonomous systems, compared to current landscape of disparate initiatives. Read more about this discussion channel here. It also highlighted moral questions, need for a wide-ranging ethical framework, and described a set of ethical principles to support the development of a conclusive and inclusive process in making of a diverse ethical framework for a responsible AI.

Decentralised Data and Infrastructure

- Dominant data platforms have extremely centralised architectures, especially at the level of data governance. The key question is whether technological solutions enabling intrinsically decentralised data governance break the "rules of the game" that have made current data incumbents successful. Read further here.
- This discussion proposes decoupling of data storage, control and governance from its applications.

Heterogeneity

According to the call text related to R&I Actions for H2020, there is a need to search and access the technologies for large heterogeneous data sources, services, objects and sensors, devices, multi-media content, etc. and which may include aspects of numbering; providing contextual querying, personalised information retrieval and increased quality of experience. Read more.

Multidisciplinary and End-to-End Design

Multidisciplinary Design is viewed as important by almost all of the sources surveyed as mentioned in Hub4NGI D2.1, and involves bringing together the right mix of experts from different disciplines who collaborate to address the problem at hand. Read more.

Interoperability

Generally speaking, Interoperability is critical to ensure that users are not locked into a particular service or vendor, and applications can function end-to-end up to the last mile of connectivity.

- Interoperability has been identified fundamental to the success of IoT as there will be a proliferation of heterogeneous devices, applications and networks and it will be important for them to work with each other to harness the full value of IoT. Read more.

- Another domain where there are increased interoperability challenges is the user edge as there is a perceived deployment of proprietary and specialized networks in order to power new emerging services. Read more and to provide ubiquitous connectivity for new demanding applications. Read more.

Standardization

Complementary to interoperability is the process of standardization. Open and voluntary standards have long been the core of the Internet's success. However, standardization process will be challenged in the future by the speed of Internet innovation, the complexity of the emerging infrastructure and services, and possible inclination towards proprietary systems. Standards development processes thus have to evolve to mitigate manipulation from big corporations, in making the process less cumbersome and incentivizing as well as engaging more and more innovators into the standardization process. Read more.

Deployability

Deployability means that it should be possible to easily distribute and combine new technologies in order to deploy them. It is important for NGI initiative to make sure that R&D efforts should be deployable and maintainable in the context of actual Internet environment. A successful approach for NGI would be to create a universal and reliable path to automatable deployment even during (continuous) development. Read more.

Maintainability

Without proper procedures for maintenance and without auditability, a system cannot be expected to be secure and reliable. The systems should also be equipped with periodic self-test procedures in order to check the system's integration and immunity against various malicious attacks. Read more.

Confidentiality

Privacy and confidentiality are essential human values which should be ensured in the single largest ubiquitous fabric of modern communication that is Internet. On a contrary, shocking revelations from whistle-blowers like Edward Snowden have made it very clear that this shared trust in the internet has been naive and undeserved, and that weak parts of the design of the internet have being systematically abused at a scale beyond comprehension. NGI initiative seeks to craft an internet that is resilient, trustworthy and sustainable, and varied aspects that would inject confidentiality into the core Internet have been suggested. Read more.

Data Sovereignty

Currently there is a lack of control over personal data. New standards around data portability, interoperability as well as decentralized data governance need to be developed.

At the expert workshop organized by NGI Engineroom project in London in March 2018, challenges and opportunities related to NGI topics were examined, including internet and data sovereignty. Read more.

- Semantic Data Organization: At the NGIForum 2018, a discussion was held on how we need new ways of storing, understanding and releasing data based on the semantics of the data itself and the context within which the data exists. Read more.

Diversity and Inclusion

The digital world needs to be accessible to everyone. We can bridge the digital divide and equip all groups of society, including persons with disabilities and specific needs, by taking advantage of ICT, and by enabling capacity building in digital skills. Read more.

Technology View

Blockchain

- This discussion is related to the view of how blockchain can enable the Next Generation Internet. How can this technology be applied to empower European citizens in being part of the Next Generation Internet? What are the challenges, technically, socially and legally?

  While the TCP/IP made communication easy since it allowed devices to talk to each other, the blockchain technology could help advance it further by making data interoperable in such a way that having to hard code APIs for accessing databases would be a thing of the past.

  As someone who deals with data extraction, verification and analysis, it is believed that blockchain can help restore trust in the Internet by allowing storing and dealing with data more interoperable, reliable, convenient and efficient. Doing so helps journalists and the public less prone to falling into fake news traps. Read more.

- **Blockchain disruptions and emerging business models**: Public and consortium blockchains are widely considered to be disruptive innovations by enabling new market and low-end market footholds. Consortium networks can be the preferred blockchain architecture for businesses because they enable partners to retain control of certain rights while reaping the benefits of a decentralised network. Read more.

- **Standards setting for Blockchain (Permissioned Distributed Ledgers)**: Distributed ledgers like blockchain can be either permissionless (public) or permissioned (private). Permissioned distributed ledgers are better qualified to address the more business-oriented use cases that are of interest to industry and governmental institutions (as opposed to permissionless ledgers like Bitcoin). The creation of a new ETSI Industry Specification Group on blockchain: Permissioned Distributed Ledgers in December 2018 marks an important step towards standards setting. Read more.

Artificial Intelligence

- AI is already being used to augment human potential in many ways including cancer diagnostics. With AI becoming more ubiquitous, there is a need for means of redress where decisions made by machines are difficult to understand, or unethical or even illegal. "Responsible AI" concerns applications of AI whose actions need to be explainable and governed from both a legal and ethical standpoint because they are either safety critical or impact the lives of citizens in significant ways. There is

still an open question that "will AI empower us as human beings or kill us?" Read more about this discussion here and here.

- **No AI without language at its heart**: Natural Language Processing has seen quite a revival with Internet giants putting a lot of smart heads at solving NLP's toughest problems. Incredible progress in processor speed allows to stack neural networks so deep that the successes in computer vision are repeated in NLP. Although Siri and Alexa can follow simple commands and answer basic questions (in a handful languages), they can't hold a conversation. Language will determine whether machines become a part of our everyday life or whether they remain mysterious black boxes. It is thus hard to envision how we will interact with AI without language. Read more.

Internet of Things

IoT is marked as the top technology driver by the number of sources. From the results of a large scale survey of European citizens; IoT, Big Data and machine learning are considered to be the most promising technologies which may have larger impact not only on people's personal lives but also in the labour market. Read more.
At the Digital Innovation Networks (DIN) Forum held on 27 June 2017, from the opinions expressed by experts, almost 80% of participants expressed IoT as the key technology driver for NGI.

Big Data

Big Data is also seen by the European citizens as the most promising next generation technology. Read more.

Edge (Computing)

- Edge Computing is considered as top-priority technology area by 30% experts at the Digital Innovation Networks Forum held on 27 June 2017. Read more.
- Edge space is seeing increased development due to emerging IoT, and the need to provide ubiquitous connectivity for intensive applications like 4K, 8K video streaming which is also pushing towards storage of content at the edge itself (CDNs) (Read more). While this enables operators in providing good quality service to their users, it also poses risk for the development of specialized and proprietary networks risking fragmentation of open Internet. Read more.

Decline of Transit Networks

Complementary to the evolving network edge, the traditional hierarchy of backbone, access and enterprise networks is flattening. In the past, this hierarchy meant that backbone networks would handover traffic destined for access networks they did not directly connect to other transit ISPs. However, the increasing use of CDNs and the continuous growth of Internet Exchange Points (IXPs), where traffic is often passed

directly to access networks, have reduced the need for transit networks changing the Internet landscape as a result. Read more.

Cloud Computing

Although cloud computing pose some security and privacy threats however it is important because of many reasons. For both education and business, cloud solutions are seen as a great opportunity. In order to overcome the challenges of security, privacy and surveillance, new security built protocols could be designed to support new business and social domains. Read more.

Open Data

Discoverable and easy to process data is important from the perspective of start-ups. There is a need to develop and "open link" in order to overcome the challenges of format interoperability among data representation and data sources. Read more.

- Slovenian Open Data Portal: At the NGIForum 2018, Mr. Černivec (XLAB d.o.o.) presented on search and discovery tools from the perspective of the Slovenian interoperability and open data portal that provides a platform for public authorities to publish their solutions and make them discoverable to citizens. Read more.

Governance and Ethics in a World of AI

- Technologists themselves say the technology needs to align with human values, and that ethical dimensions must be prioritised at every stage of the design, development and deployment of AI systems. The ISOC report on "Paths to Our Digital Future" released in 2017 brought attention to the fact that there could be extensive ethical concerns due to AI and automation. The speed at which AI and related technologies are being developed and deployed will require significant investment and effort in the short term to avoid unintended consequences for society and humanity. "We will need focused research and effective governance structures to make sure AI technologies create opportunities and not harm". Read more.

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Application Areas for NGI Technologies

The following are the key application areas which are expected to be greatly impacted by the emerging NGI technologies:

- **Industry 4.0**
  Industry 4.0 is a big change as agreed by the experts in "The Next Generation Internet Workshop" on "Widen the European Space of Life and Work" held on 8th June 2017. It is considered to be the next phase in the digitization of the manufacturing sector. It relies on Internet services and knowledge is largely shared across the network in order to exploit this available knowledge for faster and better robotic learning.

- **Immersive Environment** With the advancement in AI and learning algorithms, the immersive environments such as Virtual Reality (VR), Augmented Reality (AR) are also expected to be leveraged. However, these new forms of interactions and immersive environments might also face the challenges of data privacy, diversity and the concentration of data into proprietary platforms. Understanding the psychological & biological effects and threats and opportunities for industry and citizens is necessary in theVR world.

- **Collective User Experience** Decentralised, heterogeneous and distributed architectures are important in the next generation digital society. For an enhanced user experience, human-centric technologies need to be identified, propagated and managed.

- **Lifelong Learning**
  ICT lifelong learning is important in order to raise people's awareness of the significance of acquiring ICT skills throughout their lives.

- **Inclusiveness**
  Each citizen have the right to benefit from modern ICT services and technologies. And the services should be designed in simple and easy to use way so that everyone including persons with disabilities could get benefit. Ubiquitous access to Internet and other ICT services is the right of each citizen just like access to clean water or energy infrastructure. Inclusiveness and ubiquitous connection are the key themes for civil society.

- **Protection from the dangers of the Internet** Ordinary Internet users are not fully aware how deep they are in the Internet. They sometimes disclose very personal information against social engineering attacks. This poses not only data protection problem but also people themselves protection. It is important for emerging NGI technologies to protect people from dangers of the Internet.

Read more.

Trusted online identities

There is a need for secure online identity verification and management system that can replace the trustless system with trust-enhancing solutions which would be alternatives to codifying trust through reputation systems. At the expert workshop organized by NGI Engineroom project in London in March 2018, challenges and opportunities related to NGI topics were examined, including online identities and trust. Read more.

Smart Buildings

The dramatic changes, which came with the technology like IoT, AI and Blockchain often focus on "things" and not on people and therefore leaves Citizens out of the City. ETOS's solution integrates smart buildings with a modular and scalable platform to proactively engage with citizens. Their solution is complete- from IoT devices in homes and buildings (Home Energy Management, Smart home, Building energy management) through user interface (with building, city, service providers) and includes also a "digital wallet" in the form of a mobile application, which is seamlessly connected to the platform and enables users the execution of payments and secure storage of the platform utility tokens.

Read more.

Socio-Economic and Legal View

Social Liberty

- Rise in social exclusion for some and problems with balancing rights and liberties against privacy and security aren't just changing the way we lead out lives day-by-day but may also be altering our self-perception. Read more here about the recent discussion on social liberty with NGI perspective.

- Disinformation, malinformation and misinformation are eroding trust in internet users and putting European human values at risk. Many studies are taking place across Europe and the Council of Europe in setting down recommendations and actions to help citizens make more informed decisions about how they how use the internet. EuroDIG 2018 is offering an important forum for debate in this regard, which is open and evidence-based to ensure diversity of information, freedom of speech and privacy as a fundamental human right. Read more about this discussion here.

- A similar discussion at EuroDig was around potential models for imparting digital literacy to digital migrants or nomads which includes senior citizens and broadly people not brought up with Internet for a more inclusive development and society. Read more about this discussion here.

Intervention by Governments (Government Policies)

- IoT will pose a risk to critical infrastructure as there will be a plethora of multi-vendor and heterogeneous connected devices that may not be trusted. Governments will be forced to intervene as a result, but there is a fear that will government response be mindful of privacy, individual autonomy, and not deterring innovation process. Read more.

GDPR (General Data Protection Regulation)

GDPR offers a great chance to improve the protection of the user's privacy, but on the other hand it is a big burden for companies with all the new regulations, and especially with the fear to get huge fines. There might be little support for SMEs and high personal risks for SME owners due to the potential high fines. Read more about this discussion channel here.

Echo Chambers

There is a risk that the Internet becomes an "echo chamber", where profiling of citizens, "fake news" and citizens' own preferences and social groups distort the information citizens can see to biased opinions or sympathetic views that reinforce entrenched views. Read more about this discussion channel here.

Socio-economic Impacts of Artificial Intelligence (AI)

This discussion is particularly important with the proliferation of artificially intelligent machines in our society. Further reading and discussion can be found here that how AI could impact our society.

Socio-economic implications of New Technologies (IoT/Blockchain/etc.)

- IoT is bringing about a convergence of our digital and physical worlds, where Internet will be used to control much of our objects and environment. This disruption can have a big impact on our society and economy - jobs will be effected as many of the mundane tasks can be automated, there will be convergence of ICT and traditional industries, and new cross-industry regulatory frameworks Read more.
- In a hyper connected world, no sector of the economy will be untouched by technology and only those who adapt quickly to technological change will be successful. Governments will need to increase spending on training programs to help workers impacted by technological displacement. The growth of IoT will effectively make all companies technology companies. Read more.

Impact of NGI Technologies on Cost of Innovation

As state-of-the-art expensive Internet architecture is made available to provide better services to the users, the gap between the big players (who can afford the increased cost) and smaller ones (who cannot) will increase. For instance, services are being distributed at very user edges through costly technologies like Content Distribution Networks (CDN), and this may not be feasible for SMEs and start-ups to provision. Read more.

Decentralised Governance

One of the topics raised in the Hub4NGI D2.1 deliverable that needs to be addressed by NGI research topics is that of "Decentralisation of Control". Read more here and here.

Wealth Distribution in Digital Economy and New Business Models

- Wealth distribution and economies are being increasingly influenced by the digitization and Internet. The proliferation of AI and automation is becoming a major threat to human employment. As the machines will take over certain tasks in the economy, there is a need to find new ways of distributing wealth. Compared to other business types, SMEs are seen to be at a disadvantage and need help to take advantage of NGI. Investment policies and legislations should aim to increase the abilities of SMEs to profit from NGI technologies. Furthermore, new business models are needed to challenge the current dominance of the large incumbents. New collaboration based business models which integrate people and resources from various disciplines might help significantly. Read more.

- The future of Innovation and Entrepreneurship is dependent on following factors as per The Internet Society 2017 report- Paths to our Digital Future - The ability of innovative start-ups to tackle dominance and takeover from big corporations, availability of interoperable and open standards so that construct of permisionless innovations from new businesses is maintained, and rise of new dominant Internet economies from emerging Asian, African and Latin American markets. Read more.

Limitations to Democracy and Liberty

Another widespread concern, raised in Hub4NGI D2.1, is the abuse of Internet technologies causing threats or limitations to democracy and liberty. In an online article titled "Will we still have a single global internet in 2025?", the Ditchley Foundation also mentioned that the authoritarian governments wish to use the capabilities of the Internet to exert controls over citizens and keep their data at home in order to ensure access. Read more.

Technology Evolution vs Legislation

A very important point raised in Hub4NGI is that legislative speed cannot keep up with technical development, resulting in ineffective and out of date legislation. Legislation and the legislative process are recurring themes in the sources.

It is usual that citizens and businesses are ahead of governments in understanding the implications of Internet, and overall conclusion is that the legislative process must reform to adapt to the speed that technology evolves at. Changes are rapid, so legislation must adapt. Read more.

Algorithmic Accountability

In the Hub4NGI D2.1 deliverable, a significant issue regarding the responsible AI has been raised which is about whether and how can an AI algorithm be accountable for its actions.

The issue of Algorithmic Accountability was also raised in Net Futures debate "Legal, ethical and social issues in a software defined world" and the participants agreed that there is a responsibility gap for the AI systems.

Transparency is considered to be a key aspect of algorithmic accountability as depicted in the Net Future 2017 debate session. And it is widely agreed that the algorithms need to be able to explain their decisions. Read more.

Ethical Frameworks for Autonomous Machines

It is important to have an ethical framework in place for artificially intelligent and autonomous machines. It is however still a question to be answered that how ethics can be designed into AI technology and where these ethical and legal questions lie. Multi-

disciplinary research and discussion are undertaken to provide answers to legal and ethical questions surrounding AI and its applications. Read more.

Lack of Control over Data

There is a fear that citizens' privacy is being eroded by the exploitation of citizens' personal data by profiling, and citizens have no control over this. Read more.

Implications of giving away Personal Data

At the workshop on Personal Data Spaces and Privacy, there was a discussion about how people need to better understand the effects of giving away personal data. There is a belief among citizens that when we're getting free services, we don't have to think about our data. There is a need to give more attention to the debate about privacy, at the political level, or market forces will prevail. Another aspect which was debated at the workshop was the issue of transparency and to what extent users were aware of the level of privacy they get when they access service. Read more.

Role of Innovation Agencies in strengthening economy

National innovation agencies can support innovation by helping applied research results that addressed some real-world problems transition into marketable product and services creating sustainable businesses, expert-base, and thus strengthening national economy. Read more.

How Technologies impact Privacy

The power balances between providers and users created by IoT and Big Data needs to be framed by European values, as discussed at the workshop on Personal Data Spaces and Privacy. Read more.

Ensure continuing confidence in the system

When considering highly interconnected networks, it is clear that trust, security and privacy are the prominent concerns. The Fire Study DIN 2017 looked at technology drivers and found IoT and 5G to be the key components. Highlighted was the need to understand the Trust, Security & Privacy concerns within NGI regarding the interaction of humans and autonomous, manual and remotely operated machines. There is a need to look deeper at the security threats even for liberal governments as cyber security will become impossible to secure because of the ease of connectivity as the internet of Things becomes ever more prevalent. More urgency is needed on this. Read more.

Governance and Ethics in a World of AI

- Technologists themselves say the technology needs to align with human values, and that ethical dimensions must be prioritised at every stage of the design, devel-

opment and deployment of AI systems. The ISOC report on "Paths to Our Digital Future" released in 2017 brought attention to the fact that there could be extensive ethical concerns due to AI and automation. The speed at which AI and related technologies are being developed and deployed will require significant investment and effort in the short term to avoid unintended consequences for society and humanity. "We will need focused research and effective governance structures to make sure AI technologies create opportunities and not harm". Read more.

• The European Group on Ethics in Science and New Technologies (EGE) released a statement calling for the launch of a process that would pave the way towards a common, internationally recognised ethical and legal framework for the design, production, use and governance of artificial intelligence, robotics, and autonomous systems, compared to current landscape of disparate initiatives. Read more about this discussion channel here. It also highlighted moral questions, need for a wide-ranging ethical framework, and described a set of ethical principles to support the development of a conclusive and inclusive process in making of a diverse ethical framework for a responsible AI.

Policy Making in the Digital Age

Like civil society, with the evolution of the digital society and the expansion of the Internet into our economy, governments need to be more active as policymakers. From cyber-security to societal issues to technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI), governments will face a host of new and complex issues that might challenge all aspects of their decision-making. The pressure of security challenges is therefore growing the future of Internet is highly dependent on how the governments respond to this issue. Read more.

Multi-stakeholderism and Multilateralism and the setting of global norms

The rise of nationalism and populism around the globe could cause governments build national policy barriers that fragment the Internet. If current trends are any indication, more and more governments will restrict and control Internet use and access through censorship, network shutdowns and other means. This is a matter of great concern. Read more.

Impact of AI on the Internet economy

Many in industry and government believed that the role of AI is pervasive in the future Internet economy. AI presents enormous opportunities to create new jobs, new industries and new ways of connecting. At the same time many believed that AI would steal thousands of jobs. The nature of work will drastically change as the AI and automation drive significant structural change across industries. This change will empower workers and minimize the inequalities among people and between countries. Many existing jobs may be displaced as AI moves beyond monetising user data to changing how products and services are delivered. Adapting to the pace of change will be a major global challenge for the immediate future. Read more.

Impact of AI on Internet security and network intelligence

As networks and traffic streams become increasingly complex, AI can help network managers to understand traffic patterns and create heuristics that identify security threats. At a basic enterprise level, AI can perform tasks normally carried out by an IT helpdesk, such as troubleshooting employee computer problems. In this way the IT professionals will get more time to implement security best practices and better secure their systems and networks. Read more.

Inadequacy of Responses and the Impact on Trust

Cybersecurity will be the most pressing challenge of the next decade. Inadequate management of cyber threats will put users increasingly at risk, undermine trust in the Internet and jeopardise its ability to act as a driver for economic and social innovation. Disproportionate government responses will threaten freedoms, and contribute to a climate of fear and uncertainty. The ISOC report on "Paths to Our Digital Future" released in 2017 brought attention to the fact that we need new models to increase cybersecurity readiness and reduce vulnerabilities but also to ensure end-user security. The complexity and scope of cyberattacks necessitates multi-stake holder and expertise-driven responses for the digital economy to thrive and for trust in the Internet to be rebuilt. Read more.

Market Consolidation and Walled Gardens

Closed platforms and proprietary ecosystems, referred to as walled gardens, may proliferate without the lack of a competitive environment as market leaders may consolidate their powers. This will result in the loss of choice and constraints on innovation and lead to Internet fragmentation. Walled gardens could also arise as a reaction to political concerns such as economic isolationism and national security, hindering the development of the global economy. Read more.

Impact of GDPR on Blockchain Technologies

There is an interesting blogpost on the paradoxical potential impact of GDPR on Blockchain technologies and some possible workarounds to ensure GDPR compliancy. Certainly solutions will need to be developed in the NGI programme. Read more.

Online Identities and Trust

There is a need for secure online identity verification and management system that can replace the trustless system with trust-enhancing solutions which would be alternatives to codifying trust through reputation systems. At the expert workshop organized by NGI Engineroom project in London in March 2018, challenges and opportunities related to NGI topics were examined, including online identities and trust. Read more.

Open public Data Portal for citizens

At the NGIForum 2018, Mr. Černivec (XLAB d.o.o.) presented on search and discovery tools from the perspective of the Slovenian interoperability and open data portal that provides a platform for public authorities to publish their solutions and make them discoverable to citizens. Related Human Values, Challenges, Solutions, Initiatives, Gaps and R&I were also identified. Read more.

Tackling Online Disinformation

At the NGIForum 2018, Prof. Jamal Shahin (VUB and GIPO) presented number of challenges related to tackling online disinformation, and also involved the audience on about how to face this challenge. Read more.