
NEXT GENERATION INTERNET CORE (NGI)

CONSULTATION ON METHODOLOGY

FINAL REPORT

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EXECUTIVE SUMMARY

In-depth discussions took place over the course of Nov/Dec 2016 with about 50 researchers, startups, hi-tech SMEs, and civil society representatives through bi-laterals, web-workshops, and on-site workshops in relation to the Next Generation Internet methodology needed to scale up the speed of Internet development and drive research towards a more human, user-centric Internet.

Interviewees included young talents (PhD candidates, post-docs, young professors, and startup founders), senior core Internet researchers (including [IETF](#) contributors, workgroup chairs, and area directors as well as an Internet Hall of Fame inductee) and representatives from civil society involved in the evolution of the Internet.

There is a largely shared vision that a new NGI core programme should contribute to make Europe the best place in the world for a more human and trusted Internet that reflect key European values of: openness, cooperation, spanning administrative and geographical borders, federation of autonomous entities, decentralisation, transparency, inclusiveness, protection of individuals' privacy.

By centring the evolution of the Internet around these core European values, there is a major opportunity for restoring trust in the network, creating new business opportunities with expanded usages, and making Europe a trusted hub at the global level.

There is broad consensus that the new programme targeting Internet developments should address small-scale focused projects with short lifecycles. Moving from deliverable-based accountability and associated paperwork towards what makes Internet researchers “really tick”, i.e. new ideas, decisive contributions to Internet development, gaining seniority in the community.

The new programme should challenge Europe's unique playground of brilliant Internet research talents including young hackers, disruptors from academia, hi-tech SMEs, and startups.

To reach out to this generation of Internet talents, intermediaries such as adopters of Internet technologies are essential at all stages of the process: in framing research in line with real-life use cases; in providing guidance for ongoing research; and by harvesting the results and deploying them. The role of these intermediaries will be key in balancing diversity and convergence towards European values.

In the development of Internet technology, there is a path from ideas to prototype to early deployment and full scale deployment. Each step requires a different mix of contributors, competition levels, methodology, risks, and standardisation levels.

Civil society organisations and individuals (such as internet activists and hackers) active in the evolution of the Internet should be involved in qualifying trust in NGI technologies, in identifying new possible usages of Internet, and in ensuring outreach and inclusion towards citizens at large.

The new programme should encourage open software, firmware, and hardware design, access to network data, open standardisation activity (with longer timeframes), and access to testing and operational infrastructure, to ensure that new technologies do not result in individual solutions that create fragmentation, but rather contribute to a global inclusive Internet based with equal values and opportunities for all.

1 MAIN CONCLUSIONS FROM STAKEHOLDERS ENGAGEMENT

1.1 RESEARCHERS

In-depth discussions took place over the course of Nov/Dec 2016 with about 20 researchers during bi-laterals, web-workshop, and on-site workshop in relation to the Next Generation Internet and more precisely on the mechanisms needed to 1) scale the speed of Internet development 2) drive research towards a more human Internet.

Interviewees include both young generation (PhD candidates, post-docs, young professors) and senior core Internet researchers (including IETF contributors, workgroup chairs and Area Directors, as well as Internet Hall of Fame inductee).

Vision

1. The vision of a more human Internet matches some of the fundamental guiding principles of the Internet such as the end-to-end principle that put the intelligence at the edge rather than in the intermediate nodes or an open development process that is inclusive of any party to contribute.
2. However, there is a risk of divergence today, with policies incentivizing large aggregation or censorship as well as a lack of trust in the Internet¹ preventing its extended development.
3. By centring the evolution of the Internet on some core European values such as cooperation, openness, cross administrative and spanning geographical borders, federation of autonomous entities, inclusiveness, privacy and protection, there is a major opportunity of restoring trust in the Internet and make Europe the global trusted hub for its development.

Internet research practices

4. In the development of Internet technology, there is a path from ideas to prototype to early deployment and full scale deployment. Each step requires a different mix of contributors, competition levels, methodology, risks, and standardisation levels.
5. There is also a clear distinction made between a) standalone applications development using standard virtual machines (VMs), big data analytics, Artificial Intelligence (AI), Machine Learning technologies (MLT) etc. in a highly dynamic and competitive setting and b) federated network technology development implying longer life-cycle and standardisation requirements.
6. The question of deployment is not an immediate concern of researchers: trying to push them in that direction is seen as counterproductive. However, in this process, the involvement of intermediaries for example adopters of technology from verticals, civil society, startup clusters, hi-tech SMEs, or industry at large is valued at different phases: a) in the definition of topics as a way to stimulate creativity on real life cases; b) during the research itself through closing the loop between adopters and innovators; c) and then after the research in harvesting the results thanks to early involvement and appropriate IPR regime.

NGI core programme characteristics

7. There is a very broad consensus that a new programme targeting Internet development should address small scale focused projects with short lifecycle.

¹ <http://www.internetsociety.org/news/internet-trust-all-time-low-not-enough-being-done-protect-data-says-internet-society-report>

8. Moving from deliverable-based accountability and associated paperwork towards what make Internet researchers really “tick”: new ideas, decisive contributions to Internet development, gaining seniority in the community.
9. The question of risk taking is complex as some view large H2020 projects as very risky, while, according to the EC review process, they always succeed. The debate would gain from moving from risk to accountability on both self-defined Key Performance Indicators (KPIs) and programme level KPIs.
10. Infrastructure is important for testing (VMs, hardware, links) however there is no clear set of common requirements that could drive a shared testing infrastructure and this is treated on an ad-hoc basis e.g. depending on the source of funding.
11. Access to real network data (traffic, events) is essential to test the limits of proposed ideas; however, there is a clear issue in accessing such data today.
12. Open standard activities (notably through IETF) is both valuable for removing fragmentation and for individual's reputation. However, it requires relatively longer time-frames. NGI core should address this concern.
13. Although a foundational aspect of the Internet, hardware platforms are practically not funded. Open hardware development using COTS (Commercial off-the-shelf) components is very much valued².
14. There is also an interest to use NGI funds to contribute to multi-funding source projects as an (eligible) contribution.
15. Finally, there is a rich set of funding sources for Internet researchers on a project basis (industry, national funds, international organisations such as Internet Society, ERC grants...) or non-project basis (universities, research institutes both public and private): NGI core must differentiate through its framing conditions.

1.2 STARTUPS

In-depth discussions took place over the course of Nov/Dec 2016 with about 15 startups during on-site and remote bi-laterals as well as an on-site workshop in relation to the Next Generation Internet and more precisely on the mechanisms needed to 1) scale the speed of Internet development 2) drive research towards a more human Internet.

Vision

1. Balancing diversity and fragmentation avoidance is a key challenge when addressing startups.
2. Despite this difficulty, discussions showed broad consensus on the necessity for the EC to drive a more human Internet, giving the control of personal data exchanges back to the users/citizens and stimulate technologies for that. Increasing trust in the Internet through European values such as data protection is seen not only an ethical duty but also a business opportunity where increased trust means increased usage.

Market segmentation

3. There is a significant market difference between startups developing application over the Internet and those developing Internet technology.
4. Startups developing applications generally address a vertical market (health, media, transport...) in a B2B (business to business) mode and/or targeting the consumer market e.g. by exploiting data from consumers (B2C (business to consumers)). They focus on their core added-value (intelligence out of data combined with interfaces, IoT (Internet of Things), new business models, factories, etc.). For that

² e.g. cryptech.is

they have internal research and development (R&D) resources (e.g. PhD, post-doc) that exploit algorithms (big data analytics, Deep Learning, Machine Learning Technologies, AI...) together with a set of data. For things that are not of their immediate core added value they tend to use existing tools: e.g. Facebook for consumer accounts or Amazon for infrastructure. This market segment is very rich in creativity and diversity and does not require big initial investment.

5. Startups developing technologies for the Internet mostly focus on verticals (e.g. fintech, industry, telecom, energy, etc.). Investment can be important in this segment. Companies are more of (hi-tech) SME type than greenfield startups. They perceive themselves as beneficiaries of R&D funds.

Investment practices and Access to public/EC funding

6. There is very limited capacity to invest and if startups invest it will be on their core added values rather than somebody else's priorities.
7. R&D is important for these IT startups mostly relying on internal researchers/engineers (for example PhDs coming from the nearby University). There is no clear indication that outsourcing research is a priority especially for application startups.
8. System testing is important: having tools to test technologies with minimal costs would help product development as well as proof of concepts.
9. "Large accounts" such as big corporations or administrations can be useful intermediaries to scale startup ecosystems.
10. There are many initiatives at local, national, or European level to stimulate startup ecosystems with funding and brokering functions. This includes SME instruments from the EC, clusters ecosystems, and accelerator programmes at regional/national level as well as private investors. NGI must differentiate itself from those.
11. Access to EC funding is good but perceived as complex, costly, and deceptive for small structures.

NGI core programme characteristics

12. Broad appreciation of the effort of the EC to identify new routes for supporting NGI with more focus on smaller teams, short life-cycles, smaller size projects, less bureaucracy.

Although externalizing R&D to (NGI) new talent is not on the radar screen there is significant common ground to envision a contribution from ecosystems of startups (e.g. clusters) to NGI topics, reaching out towards new talent and appropriating of technologies.

1.3 CIVIL SOCIETY

In-depth discussions took place over the course of Nov/Dec 2016 with about 15 civil society representatives during on-site and remote bi-laterals as well as an on-site workshop in relation to the Next Generation Internet and more precisely on the mechanisms needed to 1) scale the speed of Internet development 2) drive research towards a more human Internet.

Vision

1. There is a need to restore trust in the Internet. As a global trend, users are concerned about their privacy and their lack of control over personal data. Cybersecurity and increasing divides are other important users' concerns.
2. It is a great opportunity for the European ICT industry to fill in the market gap, by designing and implementing digital technologies that encompass the right features to meet the users' needs and requirements; to provide solutions for their concerns over privacy and control of personal data; and to re-establish overall trust towards the Internet.
3. The necessary characteristics to make the next generation Internet more human and users-centric, such as increased privacy and control over personal data, as well as transparency and inclusiveness,

are perfectly reflected into some of the core European values and need to be translated into the technology.

Involvement in NGI core programme

4. Civil society organisations can have an important role throughout the research process: checking that proposals reflect the core values; qualifying trust level in NGI technologies; as well as in the harvesting and outreach activities. Research programmes and policies have a mutual influence; thus, it will be important to include civil society actors as well as social scientists in the process, from early research design stage.

2 DETAILED REPORT ON WORKSHOPS

This report is a summary of several interviews and workshops over the course of several weeks in November and December 2016. The workshops were part of the validation exercise on the Next Generation Internet concepts and had the goal of getting to know the value those researchers, startups, and civil society can see in this new policy as well as feedback on the proposed programme rationale and feasibility.

The meetings took place either in person or over voice and video calls. The general Agenda of each meeting included three points:

- Introduction of the parties involved with a focus on getting to know the participating researchers, startups, and organisations
- Presentation of proposed framing conditions by EC
- Feedback and experience sharing from attendees

The meetings were conducted either as individual interviews with a single organisation or company for about one hour or as workshops with a group of diverse attendees over several hours.

The following sub-chapters reports in detail on the three different streams (researchers, startups, civil society). Each stream starts with a summary of conclusions that could be taken from the meetings and then goes into detail on each session conducted in the respective stream.

2.1 MEETINGS WITH RESEARCHERS

2.1.1 ON-LINE WORKSHOP

A workshop with the following researchers was conducted over video conference: Alaitz Mendiola, SDN (software defined networking) researcher and PhD student at the University of Baste Country (UPV/EHU); Cristel Pelsser, professor at University Strasbourg with a focus on Internet routing and personal data protection; Leif Johansson, R&D and technology leadership at SUNET; Olivier Tilmans, Research Assistant and PhD student at Université Catholique de Louvain working on the topic of SDN; Roland van Rijswijk-Deij, Researcher and Innovator in Internet Security at SURFnet and PhD candidate at the University of Twente; Stephen Farrell, Research Fellow at the Trinity College Dublin in the areas of Security and Delay Tolerant Networking; Annabel Grant, Senior Business Development Officer at GÉANT.

There was a further call with another researcher and a break-out session with researchers as part of a face-to-face workshop in Brussels.

While we can see a diverse set of viewpoints in the detailed feedback there was also some strong common ground in following points:

- The experience with current European research programmes is expectedly sub-optimal. Many smaller national or commercial programmes can show good implementations of more focused, smaller teams, shorter life-cycles, and quick turnaround times.
- A call for less bureaucracy and more focus on goals that are valuable to the researchers (as well as applicable in practice) could solve problems in reaching the right group of academics. If not possible directly, this could be facilitated through intermediaries or co-funding organisations.
- Researchers are generally interested in adoption of their research in practice. Commercial players or non-commercial players such as government and public organisations dealing with societal challenges, bring value to research by posing real-world problems and guiding with applicability of the research.
- Interaction and outreach to industry and the global community could be driven by incentives for researchers to attend industry conferences and work with organisations like [IETF](#), [RIPE](#), etc.

In summary Internet researchers are eager to contribute to NGI topics as long as the framing conditions are related to restoring trust along European values and not only imposing too much bureaucracy, helping the researchers further along their academic career. The main benefits for researchers next to general funding could be co-operation and validation through industry as well as testing facilities.

DETAILS ON THE WEB-CONFERENCE WITH RESEARCHERS

After a short introductory round the attendees went through the proposed framework one by one and gave detailed feedback on each point respectively. The following is the summary of the feedback received on each point.

HOW TO REACH OUT TO INTERNET RESEARCHERS?

From experience with Horizon 2020 there are several challenges. The large and diffuse groups that conform a typical consortium need clear coordination and project management, which needs someone in the group to be available for “running the bureaucracy” fulltime. If nobody is willing to lead it is hard to succeed with a proposal. Furthermore, accountability is top-heavy and focused on deliverables versus academic papers, which would be more interesting for researchers.

From national experience, there are better suited programmes for researchers. These are usually smaller, focused projects. These could be small grants of below 100K € that help researchers get first ideas developed further so that they become eligible for bigger grants and programmes. Others are funded by big commercial entities like Google, Cisco, Microsoft, etc., who offer 100-200K € in funding either as gifts or as work programmes with open calls. These pertain usually to a topic of interest for the company. Most programmes are geared towards single researchers or small teams of 2-3 PhDs and/or post-docs. There’s further middle sized grants up to 750K € for around 4 years of research, with a non-optional participation of at least 10% co-funding in cash from industry or public organisations. Most of these programmes are light-weight in their bureaucracy in terms of checks and reporting and geared towards quick turnaround times.

HOW TO REACH NEW TALENT?

It was noted by several attendees that often times big (EU funded) research projects fund researchers not for doing their PhD, but for working on the deliverables and demonstrators, which are sometimes of low value to the actual academic career. Additionally, researchers often have significant administrative overhead in these projects. Based on this, future programmes should try to have lightweight organisational requirements and encourage deliverables that are useful for academic careers, e.g. as part of the PhD (chapter) or as actual published papers for relevant peer-reviewed conferences and journals. Especially in the field of Internet research, outreach to bodies like IETF, [IRTF](#), RIPE, etc. should be encouraged. Open source and Open research/data should not be valid alternatives for researchers. For young talents funding needs to cover research for 18-36 months, lower funding is not useful. While needing focus the project can’t be too small.

BRIDGING THE GAP BETWEEN RESEARCH AND ADOPTION

One form of ensuring cooperation between research and industry is that companies co-fund projects and make sure they communicate to the researcher what they know is relevant for application in practice. When involved, industry should have the obligation to spend time in the project and actively participate. However, the researchers should keep their academic freedom while being confronted with real-world problems.

Other ways of getting in touch with the industry would be hackathons and industry conferences. Here gatherings like IETF, RACI, RIPE, etc. were mentioned, which hold benefits for researchers to get to know the reality of practice in their area. While academic conferences are valuable researchers need to be confronted with the real world and see where practice is going. They should also strive to get industry feedback on their work and see what the actual real-life concerns are.

RISK TAKING OF EC

It was confirmed that a focus on deliverables can be bad, because of unpredictability of outcomes and documents that are due 4-5 years later. The funder needs to acknowledge that the world changes and research sometimes goes in a different direction, which doesn't mean it's a failure per se. It should be rather about higher level objectives that guide the project.

The question of risk taking is complex as some view large H2020 projects as very risky, while, according to the EC review process, they (almost) always succeed. The debate would gain from moving from risk to accountability on both self-defined Key Performance Indicators (KPIs) and programme level KPIs.

AGILE METHODOLOGY

Agility is good and key to adapt to what the real-world demands on internet. It was noted that the choice of methodology depends on where in the lifecycle the project is. In the development of Internet technology, there is a path from ideas to prototype to early deployment and full scale deployment. Each step requires a different mix of contributors, competition levels, methodology, risks, and standardisation levels. It should be left to proposers to choose and then justify their approach.

(OPEN) DATA SHARING

It is hard for researchers to reproduce or validate the results as either data is not shared or reproduction requires large infrastructures and testing facilities as well as in some cases real-life usage. Researchers often lack the resources to compete with industry. The EC could give incentives to publish data more openly, also for the big operators and providers. However, in many cases it is hardly possible to publish data openly because of privacy and data protection concerns as well as typical ethical reviews for research data. There are few legal ways of sharing data with researchers. Data is often shared between trusted parties; however, for researchers it can be sometimes hard to become part of that trust circle.

While it is valuable to encourage stakeholders to publish open data and conduct open research as well as strive for standards development, for the researcher it is a very time consuming process to be involved in these processes. We cannot force researchers to move their research into the real world as they also have time constraints. However, as it is valuable to have the original researcher(s) involved in the standards development process this could be incentivized by programmes with funding that extends over the project period and ensures the researchers' involvement.

AVOID TECHNICAL FRAGMENTATION

The main topic that was mentioned here was that network researchers often do not know about test facilities like [FIRE](#) or [GENI](#). Especially peer-reviewed researchers are not reached by these testbeds. On the one hand this is a marketing problem as some of the infrastructure can be useful. On the other hand, there was questioning about the efficiency of the investments into such testbeds. It was not clear if actual success stories for the testbeds exist and if they wouldn't have also worked with other infrastructure.

WHAT KIND OF INFRASTRUCTURE DO RESEARCHERS NEED?

There is general need for (virtual) machines and storage as well as routers and switches. The latter are only available at operators currently, which induces the need for either access to those facilities or partners that have that kind of access. The infrastructure is mostly needed for validating results. It was further noted that this infrastructure should be driven by researchers and not by the infrastructure providers.

ENSURE TRUST AND PRIVACY

It was confirmed that Europe cares about these values. However, ensuring trust and privacy is not trivial. More practical guidance and best-practices would be needed. The GDPR is useful but keeps researchers from creating innovation because of the fear around this framework.

Another challenge lies in how to express trust and privacy to end-users, who cannot evaluate the levels of said values. We are still far away from teaching these values to end-users. There was a call for incentivizing business models that can support trust as compared to the social and advertising driven models of today.

ENSURE INCLUSIVENESS

It was noted that less included people are often-times also less well organized, which means that they need extra help to get involved in projects. Talking to NGOs and other advocates for the less included could be a way.

GET COMMITMENT OF ACTORS

It was noted that co-funding does not necessarily lead to adoption. Industry should rather help by contributing real problems that they are intrinsically motivated to solve. It should be avoided that co-funders restrict research too much by oversteering in the commercial direction. Industry should rather aim to ground the research in practice.

There was further the notion that funders should be willing to kill projects or even allow for competing projects to co-exist for an initial phase. However, PhDs who depend on this funding to continue their studies should be exempt from such drastic measures.

ENSURE GLOBAL DIMENSION

Here the standardisation efforts talked about above would be of benefit. Furthermore, stakeholders should be motivated to engage in global multi-stakeholder dialogs.

CO-FUNDING

It was further mentioned that it might be beneficial to work together with other funding partners, i.e. organisations that already have connections to the top researchers. Co-funding with or funding through organisations like the Internet Society, IETF, Linux Foundation, or (the future of) [ICANN](#) could bear significant benefits. Another option would be to at least get these organisations' help in selecting the right proposals to fund.

2.1.2 CALL WITH SURFNET

Erik Huizer is Chief Technology Officer at SURFnet and also a part-time professor Internet Applications at University of Utrecht. He is Internet Hall of Fame inductee and serves on the ICANN strategy panel on the Internet Governance Ecosystem.

Huizer mentioned that the main problem of reaching researchers is the long-term view as opposed to the short-term view. Europe is in his view too much focused on short-term goals.

He also stated that at least in the Netherlands there are already quite a few links between researchers and adopters. They focus on both better understanding of the substance as well as close relationship with the researchers by e.g. embedding them on-site. An example would be the SURFnet young talent programme.

The short life-cycle and agility of the proposed new programme is welcomed, but there are questions how this programme differentiates from the ERC grant that offers money, freedom, and agility already.

Europe's way of driving market evolution is a key difference with USA. A recent illustration of this is the agreement among car makers for a common charging point policy and design under the stimulus of the European Commission. The federated nature of Europe construction matches very well the open and federated nature of the Internet (vs. big aggregation logic).

A top priority to enable that is a model where digital identities and associated attributes are verified by governments and other trusted parties for consuming Internet resources and services in a trusted way.

Personal data remains can be exchanged among service providers along the sole control of the users and not third parties (avoiding user-lock-in).

Privacy and respect of personal data is another major European differentiator. It should not be seen as a constraint, but rather an opportunity to increase trust in the Internet and thus more business as well as making Europe a global trust hub for other world regions.

2.1.3 NGI WORKSHOP 30TH NOVEMBER 2016. BREAK-OUT SESSION WITH RESEARCHERS

The break-out session with researchers included a diverse group of researchers from fields connected to the NGI topics.

The researchers mentioned that programmatic constraints should not hamper researcher's passion. Being accountable shouldn't be driven by a static long-term work plan, where deliverables are checked off, but rather by self-defined as well as programme-level KPIs that drive innovation and creativity. Especially PPPs (public-private partnership) contradict the notion of creativity by being pre-structured.

Further the ERC might be good for individuals; however, it does not address groups of individuals as typically needed in Internet research.

For closing the adoption gap there need to be short feedback loops between researchers and adopters. One way to exploit results for lasting impact would be to get researchers to address real-life cases posed by those deploying the technologies (e.g. operators, SMEs, startups, etc.).

While it might be beneficial for a project to include big corporations or many partners from diverse countries just to increase the success rate, the actual benefit in terms of innovation might not always be given. For example, there's often little incentive for big corporates to disrupt their own incumbent business model. Furthermore, big consortia increase the risk of the collective action problem as well as the amount of project management needed just to get the group working.

(Public) infrastructure for testing is needed, notably combining networks & cloud. However, technologies above the network differ significantly from technology in the network layer.

Short term agile projects on smaller scale are required. Here money is needed both for diverse sectors as for different geographies.

The proposal process is currently too complex and has a negative trade-off between paperwork and success rate. Especially the SME instrument requires too much expertise to get in, which considering the limited grants is an even worse trade-off. A 2-step submission process might be beneficial, so that the initial work on a proposal can be kept low until and a more detailed submission can follow a first round of evaluation.

There were suggestions for radicalize the evaluation procedure by giving for example the possibility to defend the research proposal against the evaluators or enlarge the evaluator pool to "Crowd evaluation".

One main problem identified is that participants in EC funding schemes need to submit mainstream ideas as this is the way they can survive, leaving too little space for exposing their "exotic" ideas. So, those innovative ideas the NGI programme seeks might be marginalized.

Most participants were fond of a model of putting small money on the table without prior hard definition of proposals. They also favoured a sort of incubator for ideas open to: subjects, actors, time (overall flexibility). Funding many small projects (in terms of money and duration) at the start, and deciding on the directions later. Maybe a call for the most non-conventional 50 visions around FET (Future and Emerging Technologies) – start broad and narrow down.

We should not define priority only based on future market success – value from NGI comes also from social impact. Thus, diverse communities should participate during the bottom up approach to build the initiative. Also, we make assumptions about the importance of issues (e.g. privacy), which might not be mirrored as high priorities for the citizens – a more thorough analysis is needed. Success is important thus we need better set of impact indicators but analysing failure from projects can be also a very useful input.

2.2 MEETINGS WITH STARTUPS

2.2.1 BI-LATERALS MEETINGS

There were five meetings with different startups and cluster from a diverse selection of backgrounds, products, and stages. The meetings were concluded in person by a team from the EC, one or more founders of the respective startup, a host from [etventure](#)). Additionally, there was a call with a startup-related organisation and a face-to-face breakout session as part of a workshop in Brussels. The diversity of interlocutors presented different angles on the topic at hand, however, there was some solid common ground:

- There was positive appreciation of the effort of the EC to identify and apply a new approach for supporting NGI with a higher focus on smaller teams, short life cycles, smaller sized projects, and removing bureaucracy.
- All startups mentioned that they have very limited capacity to invest (time and money) and if they invest it has to be on their core added value rather than somebody else's priorities.
- R&D is important for these technology startups. However, they mostly rely on internal researchers and engineers, often one or more of these being in the founding team.
- The research topics of Machine Learning, Deep Learning, Big Data analytics, and IoT are general trends that were often mentioned.
- Testing and evaluating technologies fast and with low risk is very important. Having labs and tools to test technologies with minimal costs would help product development.

In conclusion, although externalizing (NGI) R&D to new talents is not likely there is significant common ground to envision a contribution of startups and their ecosystems (e.g. clusters) to NGI topics, reaching out towards new talents and appropriating technologies for application in practice.

MEDI LAD

MediLad is a young startup working on a virtual health assistant for women. Their MVP (minimum viable product) is a chatbot, which is currently hosted on AWS and uses Facebook APIs (Application programme interfaces) extensively.

Hajnalka Hejja, the founder of MediLad, confirmed that indeed programme life cycles were too long for Internet projects and saw the new NGI approach positively both in substance and method. Further, they are planning to consider blockchain and distributed ledger technologies (DLTs) and evaluate their use for data keeping and sharing especially in the health sector. There's also a concern to be locked in to Facebook. Although external chat bots are currently in Facebook's interest the future of data access and limitations is unsure and introduces business risk. Asked about how they acquire information about technologies, she mentioned they use online developer communities and keep a connection to academia through a natural language processing (NLP) PhD in the team. It was further mentioned that startups don't have the time to read research papers and apply them to their use cases. They rather need to see working applications of said research in practice or at least in form of prototypes or prototypical code, they need to see it working before investing time in it. Cooperation between startups and (applied) research labs would be a good idea. Hejja further noted that from their point of view the evaluation for grants feels rather random. There's a lot of competition and the low success rate makes it not worth the time that is needed to write a proposal and apply.

MESH:INE

Meshi:ine (represented by Jan Lachenmayer) is a startup aiming to solve problems of network congestion and bad connectivity by applying mesh technology, i.e. connecting mobile devices to each other in a mesh network using their self-developed mobile SDK (software development kit) or B2C app.

The founders have experienced EU projects in a project management role before and thus can relate to the problems of EC funding programmes prior to NGI and welcomed the new approach. However, they mentioned the difficulty of startups to work directly with the very bureaucratic EC organs and that intermediaries might be needed. They further stated that the SME instrument is rather fit for traditional SMEs and not for fast-moving (technology) startups. Expectations from the EC seem to be for a later stage of SME or startup, however, the sums are rather along the lines of early stage angel investments. This creates a discrepancy between companies needing this money and companies that can secure the grants. Funding for early or even super early stage is missing. This is in the eyes of the founders where government money could have the most impact. As innovation ecosystems need a large foundation of early stage startups that try out ideas that might succeed or fail. What is missing are open labs that enable idea shaping and prototyping on a lab level. They could further encourage idea development with European values from the early grassroots. This combined with super early stage acceleration (across all European countries) could build a good foundation for and European innovation ecosystem. The founders mentioned that these accelerators while providing early funding, should not solely have the goal of leading to the next round of investment, which would only lead to competition and serving investors. They should rather lead the startups to innovate according to European values and dream together.

VIRTENIO

Virtenio is an IoT startup offering industry customers a fully-integrated platform of smart wireless devices and cloud software, which enables their customers to gather, monitor, and analyse information.

Thomas Henn, one of the co-founders, of Virtenio, mentioned that they tried twice to get EU money, the first time they didn't succeed, the second time the requirements were too high. He mentioned that usually the grant programmes do not allow to build (and sell) a product. This is in stark contrast to what he sees is needed to bring research innovation to fruitful results. He noted a missing link between research, product, and market. Research often focuses too much on technology itself, but does not think about the applications of technology as a product that solves the needs of a market. For startups, it is important to evaluate technologies through fast trial and error cycles. The longer it takes to evaluate a new technology for its use in applied practice the higher the risk a startup is taking. He would wish the EC to help lower risk barriers and encourage more startups to evaluate technology for application in the market fast. For startups, the most important first steps are getting into the market as fast as possible with a prototype and based on that iterate until they find a technology-market-fit. For Virtenio ML (machine learning), big data, and IoT research in general but also the topic of power harvesting (making wireless sensor even more independent of a power source) would be most interesting.

CAP DIGITAL

Cap Digital is a coordinating and brokering structure offering services to 1000 members (mostly startups) with a focus on B2B (business-to-business) startups.

Cocquet mentioned that in general application for EC programmes is not encouraged until the startup reached a mature development to avoid distraction to the core business. This is also due to the deceptively low (5%) success rate to applications to the SME instrument. For startups, it is important to be agile in demonstrating proof of concepts as described above. As for data protection, there are often national obligations (e.g. in France) to use specific national platforms. There's also some interest in the blue button concept around control over personal data in the USA. Data protection and trust is very important as well as giving back the control to human. Research topics of interest for Cap Digital's startups are by nature: big data analytics, AI

(artificial intelligence), DL (distributed ledger), ML, etc. For the future they envision the need from individuals at large (inclusiveness) to understand the technology easily. The key question is how individuals can increase the trust (in platforms, in using AI, in self-driven vehicles, etc.). Safeguards are needed at, which at European level is a moral duty, but also a business opportunity.

SPLASH

Splash is a technology startup building B2C apps in the VR (virtual reality) and AR (augmented reality) space. Their current product enables users to take 360 degree VR videos and share them with the community and their friends.

Splash made some rather negative experience with applying to the SME instrument. The application took a lot of time to prepare and despite getting high scores in the evaluation their proposal got rejected in the end. Nevertheless, they are planning to reapply soon.

Michael Ronen, one of the founders, confirmed the difficulty for a startup to define deliverables and a fixed business model for even the next 2 years. It would be better to rather have quarterly reporting of KPIs with the goals of the company in focus. This is especially true for startups in the B2C space that need to move fast and adjust to strong competition from the United States, China, and Israel. For him the question should be how Europe can get its startups to compete on the global B2C startup landscape. How can we encourage companies and investors to take bigger risks? He believes that the European as well as national governments can help startup ecosystems to be more competitive.

Currently there are two difficult phases for startups. One is that Europe does not have enough knowledgeable Angel and Seed investors. It is still hard to get money from people who have already been successful in the space, especially in B2C except for ecommerce. The other is for those that have managed to secure angel or seed funding to bridge the gap to the series A round. Investors, especially in Europe, want to see much more than is often possible to reach with the typical seed round. Thus, bridging funds are required or the startups will starve to death.

One way would be to train and foster a new generation of angel investors. They should come from an entrepreneurship background themselves. Mentors both for these investors and also for startups need to be sourced globally as the most prolific mentors are often not to be found inside our borders. China for example is doing a great job there.

Furthermore, there are significant legal and financial hurdles to take just to raise and secure even smaller rounds of funding. It is especially hard to get international investors into a round. On top of that there is significant efforts and costs involved with startups that is not based on their business but solely on the basis of high requirements for accounting, notary, tax declarations, etc.

Another problem for startups are offices, which are hard to come by. Ronen sees an opportunity for the state and especially cities to play a bigger role in this and open up public spaces for use by startups. Combined with access to universities and researchers this could be a way to connecting the worlds and give startups more room to breathe.

Splash has their own connections to researchers and academia through the founders and technical employees. However, they see an opportunity for more conventions and maybe competitions that include both researchers and startups to work on bringing research towards adoption in the market.

2.2.2 NGI WORKSHOP 30TH NOVEMBER 2016: BREAK-OUT SESSION WITH STARTUPS

The break-out session with startups included a diverse group of founders from different startups. Based on this diversity in viewpoints the feedback included different angles on the topic at hand, however, there was some common key topics:

- There was a call for more and open playgrounds that enable free experimentation as well as gaining experience and are not tied to success.
- The right to failure is inherent in startups and should be reflected in funding schemes. Failure and experimentation with ideas that are otherwise not fundable by private investors should be encouraged. However, startups should also be encouraged to validate ideas according to actual market and user needs.
- For startups shorter life-cycles and smaller projects combined with less bureaucratic ways of applying and reporting are needed. Participation in larger consortia hardly works and distracts from the startups objectives.
- Clear values and incentives as well as the right legislation can help steering the Internet and startups in the right direction.

2.3 MEETINGS WITH CIVIL SOCIETY

2.3.1 BI-LATERAL MEETINGS

Validation with civil society took place in several bi-lateral meetings with individual NGOs as well as on-site workshop in relation to the next generation Internet. The organisations were picked from a diverse background and included different viewpoints on the topic, however, there was some common ground to be found throughout the sessions:

- There was positive appreciation of the effort of the EC to put emphasis on the topics of privacy, data protection, inclusiveness, and the end-to-end principle in the context of next generation Internet efforts. These (European) values are often at the core of the civil society organisations.
- The organisations saw a need to embed these values in the technology (research) already at the design stage instead of trying to add them in after the fact. This can ensure that technologies have the capability to ensure these values in practice from the beginning.
- In line with that there are calls for a higher-level of involvement of civil society representatives in the research and evaluation process, to ensure that research and later adoption does not lose touch to the above-mentioned values.

ACCESS NOW

Access Now is a global NGO that defends and extends the digital rights of users at risk around the world. Based in Brussels since 2010, the Access Now Europe team focuses on a broad range of issues at the EU-level, including privacy and data protection, surveillance, encryption, national security and net neutrality. Access Now is a member of the EDRI network.

They strongly support emergence of European players in the Internet scene, but mentioned that Internet is global and should remain global - no forced data localization, no Intranets based on regional division. They further support privacy by design and encryption (by a technologically neutral framework).

The issue of digital security is central in IoT. There is no contradiction or clash between privacy and security. Both need to be higher, and they always go together. Connectivity is one of the keys to inclusiveness but not the only one. Regulation over data protection and privacy should be enforced and extended in a harmonized way across Europe.

In the research model proposed, social scientists can have an important role. Research in ICT should not be done exclusively by engineers. Access Now is supporting innovation, and encourages that privacy by design and default are fostering innovation if applied instead of looking at this legal requirements as barriers later in the process. Civil society could contribute in the call for proposals by checking the criteria and providing sanity checks throughout the process.

Access Now supports EDRI's position on demanding higher transparency and more awareness raising regarding the use of personal data. Moreover, a clearer and more precise framework is necessary for personal and non-personal data usage in big data and machine learning.

EDRI

EDRI is an NGO that focuses on human rights in the digital sector with members across continental Europe. They see the Internet as a mean for exercising fundamental rights (but it can also be used to decrease human rights). The organisation's topics of interest include (but are not limited to) net neutrality, data protection, privacy, and surveillance.

They are concerned about the privacy and data protection challenges connected to the area of IoT and other personal data producing innovations. Further, EDRI is critical of the recently presented 5G Manifesto, which in their eyes is not enough concerned with fostering competition and ensuring privacy. The macro-issue from a public policy perspective being that the companies providing the connection services in some cases are asked to get less involved in the content (net neutrality) and in other fields are asked to be more involved (content regulation). The same applies, with a different balance, for online "platforms". The legislation is ambiguous by design. There are Charter protections for fundamental rights such data protection and freedom of expression, however, the Charter in many cases does not apply (if "voluntarily" breached by private actors) or is not enforced (as demonstrated by the recent CJEU (Court of Justice of the European Union) data retention ruling).

When asked about how new technologies could help change the issues, the representatives from EDRI stated that market/network forces are generally good, if the market functions properly, but often times it does not. Services and providers are usually non-neutral as they have to act in their own interest faced with liability and other considerations.

EDRI calls for legislation to be more precise, but also for more transparency and education to raise awareness and consciousness on the topics at hand. However, there also needs to be the right to sufficient information to evaluate and object to use of personal data, and to control the data. Big data and machine learning is using people's data in ways that these people might not understand or expect. It might work towards rewarding or exploiting other people. Anonymization in this case might not be enough, as anonymized vectors can lead to targeting of very specific groups of individuals in the end. This issue is even more important now due to the practice of collecting data without a specific immediate target, only because it might lead to some benefit in the future.

CENTER FOR DATA INNOVATION

The Center for Data Innovation is a global non-profit think tank that studies how public policy can impact uses of data that benefit the global economy and society.

The Center is of the view that Europe's strategy for the Next Generation Internet should avoid protectionism and seek competitive advantage by pursuing new forms of technological and data-driven innovation. Rather than waste taxpayers' money on projects that attempt to merely replicate, in "European" form, what has already been achieved elsewhere—whether it be in social media, search engines, or operating systems—the Commission should support efforts to find new ideas and practices that add additional value to the global Internet, including ideas that take advantage of existing technology and software that is produced elsewhere.

For example, the Internet of Things presents a tremendous opportunity for new ideas to improve the way we live and to build products that people the world over will want to buy. European firms large and small could certainly become important players in this field, and the Center welcomes the Commission's recent [orientation paper on smart wearables](#).

However, innovation in the Internet of Things—much like any other kind of innovation—does not happen in a vacuum. It relies on existing products and services, like cloud computing and data analytics, and many of these products and services come to Europe from elsewhere through trade. If European policymakers treat this

trade as a threat, and attempt to freeze it in an attempt to protect European competitors, the potential for European producers to succeed in the global market for the Internet of Things will be severely restricted. An “us versus them” mentality will not bring Europe the outcomes policymakers want.

In particular, policymakers should ensure free data flows, not only between member states, but also to other countries from where key participants in the Next Generation Internet will provide digital services that benefit Europe’s economy and support its ability to develop new and innovative ideas of its own. Policymakers should also revisit the [GDPR](#), which imposes unnecessarily narrow restrictions on uses of data that are not a threat to individual privacy. Without a broader legal basis for legitimate and beneficial reuses of data, European firms will struggle to compete internationally. The GDPR also imposes unworkable restrictions on algorithmic decision-making that will create massive regulatory costs and fail to achieve their intended purpose of ensuring transparency in the use of algorithms and artificial intelligence. Rather than a “right to explanation”, careful monitoring of algorithmic behaviour over time, with reference to existing laws that already grant data subjects a right to certain information where necessary, is a far more effective way of ensuring accountability.

Another important area where the Center for Data Innovation believes European law needs to open up is the current copyright restrictions on Text and Data Mining (TDM). Although the Center welcomes the small step the Commission has taken in proposing that academics be exempt, this does not go far enough. The view of the Center is that, given the growing importance of data mining, the freedom to use automated tools to mine lawfully-accessed text and data should be available to everyone, not just academics. Allowing people to use the latest tools in the free enquiry of information will support scientific and economic innovation in Europe, and contribute to Europe’s competitive position in the Next Generation Internet.

INTERNET SOCIETY

The Internet Society (Isoc) is a mission based non-profit organisation, founded in 1992. Their motto is "Internet is for everybody". With 5 offices across the world their mission is threefold: they are home to the IETF (offering platform and office); they deal with development and capacity building (open-public); they deal with infrastructures and policy; participating in IGF (Internet Governance Forum); providing recommendations to ITU (International Telecommunication Union) and OECD. ISoc is an advocate for users – both policy and technical oriented. ISoc manages the .org top-level domain, and those revenues make the organisation truly independent. At the European-level they are very loud on privacy, advocating for encryption in IPv6 and security. User-centricity is at the core of Isoc. They support the end-to-end principle of openness.

They see the need to empower users to protect themselves. The solution being always at the edge. ISoc has launched its own Next Generation Internet consultation. For the first phase they opened up a questionnaire to selected users. The first results show 8 big concerns of users:

- 1) A.I. will imply a loss of human dimension and discrimination by algorithms
- 2) IoT and control, privacy, vulnerability. Everything you put on the Internet stays on the Internet and becomes part of the Internet.
- 3) Freedom and liberty
- 4) Cyber attacks
- 5) Digital divide
- 6) Evolution of a market-place which will lead to conglomeration and fragmentation. Open standards trend away and become Intranets rather than Internet (silo-service / walled gardens)
- 7) Too much regulation from government and policies
- 8) Media and culture (cultural divide) - organic spread of values will imply the disappearing of cultures

Another issue for ISOC is that they see a push for proprietary standards over open standards. Security needs to be discussed broadly. On a global level, there should be a balance of transparency, user-centricity, and open standards - reversing the paradigm of security into trust. When there is a perceived lack of security and/or privacy (whether real or not) the result will be that users use the Internet less.

STIFTUNG NEUE VERANTWORTUNG

Stiftung Neue Verantwortung (SNV) is a foundation at the cross-section between society and digitalisation. They run measurement lab where they crowdsource data of users. They engage in agile policy making and agile policy support. Technology is too fast to produce papers over many years. They focus on producing results rather quickly and with different stakeholders - a Silicon Valley approach but for policy.

They mentioned that the EU funding structure takes too long, especially H2020 is too long for ICT topics. There's a need for a more user-centric approach. Typical EU project plans are not flexible enough.

The GDPR is European with a focus on Europe. However, there are always strong American ties in European member countries. The GDPR is a big achievement. However, privacy from a consumer protection point of view is low; it would lower privacy standards in Germany. Further, there's room for interpretation in GDPR – a company not based in the EU would be in a grey zone. The formulation is very ambiguous. Consent is another issue when looking at data protection from a consumer protection side. The GDPR should reduce monopolies, so that the consumer has a choice. Furthermore, privacy by design is very vague; data portability is very difficult to implement. European players have a ground now on which develop something taking into account these elements and penalties are so high that the private sector is properly incentivized to refrain from going against the GDPR.

There could be new models from data management. The question is how can you build a personal data store? There are several concepts like PiMs (personal information managers) and safe answer technology, where a code request gets answers from the data store. Another question is, how can you share data without sharing raw data? The user should be able to set the level of data they want to share on a consent basis only. Here, regulation is very important on the data broker side.

Lastly, they mentioned that civil society is not involved enough. Many powerful civil society actors do not really look at ICT. This is the wrong approach, because it is not just a digital issue. There should be digital capacity building for everyone in the long-run.

2.3.2 NGI CONFERENCE 30TH NOVEMBER 2016. BREAK-OUT SESSION WITH CIVIL SOCIETY

The break-out session with civil society included a diverse group of individuals from different organisations. Based on this diversity in viewpoints the feedback included different angles on the topic at hand, however, there was some common key topics:

- The group complained about a lack of clarity in the proposed framework. On the one hand there's a very good high level vision. On the other hand a too narrow and technology-driven part called "technology areas", which focuses too much on technology, while it should rather be issue-driven.
- They see a limited scope in which civil society and new actors can really be involved with these topics.
- The main challenges for civil society include: the digital divide, inclusion, jobs, democracy, privacy (and data protection)
- There was a call for being pragmatic rather than populist (us vs. them mentality). We must avoid building a "European" Internet – it must be worldwide.
- To compete worldwide Europe needs to do something new, which plays to our strengths and does not try to copy successful Internet companies like Google or Facebook.
- SMEs mostly remain SMEs. Startups do not want to remain startups forever (but typically they end up being sold, called "exit" in the US). There's no viable channel for SMEs to have a voice in these discussions – they have a scaling problem.
- Investments should be into open technologies and transparent algorithms to ensure intellectual property rights are not hindering innovation or centralizing power.

ANNEX I: PARTICIPANTS' ORGANISATION

Organisation	Group
University of Baste Country	Research
University Strasbourg	Research
SUNET	Research
Université Catholique de Louvain	Research
University of Twente/SURFnet	Research
Trinity College Dublin	Research
GÉANT	Research
SURFnet	Research
European Commission – Joint Research Center	Research
Vienna University of Technology	Research
Universidade Nova de Lisboa – ISEGI	Research
National Research Council - CNR	Research
University of Athens	Research
Linz Center of Mechatronics	Research
Blekinge Institute of Technology	Research
Eotvos Lorand University – ELTE	Research
IOMI Ulm University	Research
Istituto di Informatica e Telematica – CNR	Research
University of Southampton	Research
Berkam Klein Center for Internet	Research
University of Cambridge	Research
SICS Swedish ICT	Research
INRIA Paris	Research
Dialogic Innovatie & Interactie	Research
Cost Association	Research
University of Patras	Research
University of Thessaly	Research
Smart Innovation Østfold AS	Research
Vrije Universiteit Brussel – SMIT	Research
MediLad	Startups
Mesh:ine	Startups
Virtenio	Startups
Cap Digital	Startups
Tuba	Startups
Asociacion Espanola de Startups	Startups
EventHorizon	Startups
Disrupt consulting eG	Startups
T6	SMEs
Bitkom	SMEs
Quadrige Media	SMEs
Clayster	SMEs
AccessNow	Civil Society
EDRi	Civil Society
Center for Data Innovation	Think Tank/Civil Society
Internet Society	Civil Society
Stiftung Neue Verantwortung	Civil Society
Chaos Computer Club	Civil Society
Nesta	Civil Society
IEEE EPPI Working Group on ICT	Civil Society
Telecentre Europe	Civil Society

ANNEX II: DETAILS ABOUT STARTUP PARTICIPANTS

MediLad

MediLad is a young startup founded in August 2016 with the aim of creating a virtual health assistant for women. The first MVP (minimum viable product) is a period tracking chatbot on Facebook. The plan is to add more and more intelligence to it going from NLP (natural language processing) to ML (machine learning) to AI (artificial intelligence). The current target group is female English speakers, although German pilot with a pharma company is in the making. MediLad wants to open its health platform to third parties. Ultimately, their customers could be (call centres of) insurers, hospitals, and pharma companies through licensing and/or white labelling. Like many startups they are currently hosted on AWS and using Facebook APIs extensively. An interesting finding of this startup was that human machine interaction creates even more trust to talk about sensitive personal issues than human to human interaction.

mesh:ine

Mesh:ine is a startup founded in 2015 aiming to solve problems of network congestion and bad connectivity by applying mesh technology, i.e. connecting mobile devices to each other in a mesh through WiFi, Bluetooth, and LTE direct, thus not being reliant on centralized infrastructure. They tried to get national and European grants, however, were not successful in securing such funding. Instead, they got funded in late 2015 by the Telefonica Wayra accelerator programme and are currently in their next fundraising phase. Their product is launched both as a B2C product, letting people connect to each other for free, and a B2B product, selling their technology in form of an SDK to be applied in other apps. Connection can be between devices but also include Internet connection from any of the devices in the mesh. Application areas include smart cities and relieving network congestion, which makes this technology also interesting for network providers. However, use cases in the emerging world as well as avoiding surveillance and preserving privacy are also important to the founders.

Virtenio

Virtenio was founded in July 2010 as a technological spin-off of the Technical University of Berlin. The IoT startup offers a fully-integrated platform of smart wireless devices and cloud software, which enables their customers to gather, monitor, and analyse information. Their customers are mainly from industry and logistics that want to digitize their analogue worlds (related to Industry 4.0 and Digitising European Industry). Virtenio's sensors and actuators have a long life-span and are built to send their measured data over a proprietary wireless protocol (similar to [ZigBee](#)) to a gateway, from which it then gets transferred over [GPRS](#) or [Iridium](#) to the Virtenio cloud. The cloud supports various monitoring and alerting features as well as big data analytics and data export. In the future Virtenio plans to create algorithms and assisting systems that help humans and are easy to use. They are also looking into ML technology for this.

Cap Digital

Cap Digital is the "pôle de compétitivité" for the Ile de France region covering startups active in developing applications exploiting big data. This is complementary to Systematic "Pôle" focusing on hi-tech. Cap Digital is a coordinating and brokering structure offering services to 1000 members (mostly startups) with another 1000 in the radar screen. Patrick Cocquet, the head of Cap Digital, mentioned that their market focus is on B2B (business-to-business) startups that are either addressing a given vertical market (health, media, etc.), possibly with a consumer component e.g. data from consumers (B2C), or rather horizontal hi-tech startups focusing on big data tools (analytics, visualisation...). Cap Digital understands itself – among other things – as a digital transformation tool for "large accounts" such as big corporations or administration on a project basis. They define a case with the large account including the problem to solve and available data and pose this on their platform as a call to potential startups. Out of the applicants they select 1-4 projects as proof of concepts for 3-

4 months. Funding is either provided by the large account or by public money depending on the IPR (intellectual property rights) regime. In the end of the project it is handed over to the business owner.

Splash

Splash is a technology startup founded in February 2015 building B2C apps in the VR and AR space. They started with VR projects in museums and art galleries. Their current product enables users to take 360 degree VR videos and share them with the community and their friends. Their aim is to bring VR and AR to the mass market, focusing on enabling people to communicate and develop social interactions in this new medium. As part of the European Pioneers program they have experienced interactions with the FIWARE community. After winning one of the important competitions at SXSW (South by South West) they gained lots of publicity and are now at more than 200K users. The next iteration of their product will be a working with mixed reality and gaming to further develop social interactions in VR, bringing a more immersive experience of being together into this medium.