THE NEXT GENERATION INTERNET FORUM 2017

EXPLORING THE TRENDS, PRIORITIES AND CHALLENGES OF BUILDING THE NGI ECOSYSTEM

13 SEPTEMBER 2017
BARCELONA, SPAIN

NGI FORUM REPORT

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INTRODUCTION

The NGI Forum took place in Barcelona on September 13th, 2017. With more than 160 registered attendees, 92 contributors from 18 different countries, 15 speakers, and three parallel working sessions, the Forum engaged active participants in the Next Generation Internet community from across Europe and beyond. This was a very positive result, as this event was not co-located with any other and many attendees travelled especially for it, the Forum can clearly be considered a great success.

HUB4NGI, a communication and coordination hub serving the whole NGI community, organized the NGI Forum and had a prominent role in leading the different activities. The aim of the NGI Forum was to gather together those prominent actors that through their work and active engagement in various R&D areas are paving the way to design, build and refine the Internet of tomorrow. It was also an opportunity to share knowledge with leading experts from across a variety of disciplines, including privacy and trust technologies, decentralised data governance, discovery and identification, edge intelligence, etc.

During the day, different issues and possible directions were raised and discussed. This report summarizes and highlights the main outcomes.

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SURPRISED BY LOUIS POUZIN

The NGI Forum was also full of surprises. The biggest and nicest one was the unexpected presence of one of the Internet pioneers: the inventor of the data-frame Louis Pouzin.

Mr Pouzin enriched the day contributing with his enthusiasm and lifelong experience to the working groups and the open discussion. He also gave an interesting speech on the future of the internet talking about the increasing need of having smaller and more controllable networks and reminding the audience of the principles for building scalable and secure systems.

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1 OPENING

The Forum was opened by the organizer Dr. Monique Calisti from Martel Innovate. She introduced the activities for the day and the various keynote speakers.

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2 SPEAKER SESSION

Daniel Marco Parraga, SmartCatalonia Strategy Director, highlighted the evolution of Barcelona and Catalonia in general towards a digital, citizen centric, sustainable and inclusive society. The focus is on developing new solutions related to government challenges like security, health, education, transport and more while engaging and encouraging young people to get involved in the ecosystem via a digital innovation approach like Catalonia Labs (catlabs), where people working in tech can access trainings and connect to other labs.

Sergi Figuerola, Chief Technology and Innovation Officer at i2CAT, talked about infrastructure and system innovation. Sergi highlighted that infrastructure remains the bridge between research output and real world. Research infrastructures should evolve to facilitate collaboration among multi-actor communities and ecosystems, and as a means for the Internet's evolution towards becoming human- and researcher-centric.

Pompeu Casanovas, UAB Law School (Barcelona, Spain) and La Trobe University (Melbourne, Australia) spoke about NGI governance beyond the technical challenges. He stated that the law needs to change to adjust to this new wave of technology by moving towards the three fundamental concepts of:

- **Meta-rule of law:** protections and principles of the rule of law can be represented into the languages of the web of data.
- **Linked democracy:** in absence of a rule of law with international scope, the notion of linked democracy proposes that all elements of society are using linked-data repositories that cannot be treated as separate silos, as they are linked through graph-driven mechanisms.
- **Compliance through design (CtD):** the allocation of behavioural expectations (assignment of rights and obligations) in terms of a shared technological framework.

Georgios Tselentis, Scientific Project Officer at European Commission, spoke about the Next Generation Internet as resilient, reliable and ready for all Europeans. He stated that an Internet that is human centric should be at the service of people and society, which means trust and more citizen autonomy, more societal rather than technology push. Identifying citizens' concerns is required to create a clear line for R&D topics.

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3 KEYNOTE SPEECHES

The main focus of the keynote session was "**Building the Next Generation Internet**" and each of the keynote speakers brought in different views on what will compose the Internet of the future.

Christine Runnegar, *Internet Society*, spoke about how the Internet of the future should be built from the perspective of user trust. She stated that trust requires strong foundations, built on technologies that enable trust, with networks that are trusted and with a government system that is trustworthy. She stated that most users nowadays regard as essential:

- **Knowledge** - what is happening and why
- **Equitability** - being treated fairly
- **Control** - choice, control what is happening
- **Safety**
- **Certainty**

She reinforced that in today's world, the Internet is pervasive and there is a gold rush on personal data. Society is moving from a physical world to a world where the physical and the Internet combine. Personal data protection is required. Why and how the information is collected and used should be clearly shown and explained.

Nozha Boujemaa, *INRIA*, spoke about responsible and ethical data management and analytics. She stated that trust is not just about privacy and personal data, and that we also need to focus on algorithms. She reinforced that data and algorithms are two sides of same coin, and that today data is gathered everywhere and that this leads to algorithms designed to interpret the data. Algorithmic-based decisions are embedded in domains ranging from the processing of personal data to sensitive data in critical industrial systems, and their transparency and ethics become increasingly important for trust. The challenges that to be focused on today in terms of transparency and accountable data management are:

- Explainability & interpretability, reproducibility & robustness, fairness & non-discrimination
- Data provenance and usage monitoring
- Progressive user-centric analytics
- New paradigms for information flow monitoring
- Fact-checking requiring explicit, verifiable argumentation integrating heterogeneous data sources and explainable reasoning

Angelo Corsaro, *ADLINK Technology,* spoke about the Internet of Things' Internet. He began by asserting that the Internet of today is an Internet of people, and while in general people trust the Internet, they don't understand that the Internet is biased. He stated that it's enough to look at Brexit to see what role misinformation had in the outcome of the referendum, and that people seem to be immature in their perception of the Internet.

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He went on to stress that there is the need of more collective experience within the users as a community, and to decentralize and remove the dominance of the USA giants. Referring to the IoT, he stressed that it is important that users remember that the IoT isn't the Internet at all, but rather a collection of devices that talk to each other.

Dirk Trossen, *InterDigital*, spoke about the Internet as a downloadable software package. He began his keynote by stressing that the Internet came from connecting networks, while the web came from connecting services. He stated that in 2016, user access from mobile surpassed fixed usage, and that Internet access has become the experience of installing the right app on a smartphone. So what, he asked, is the Next Generation Internet? Surely there is an app for it, but what is the platform used? And what is the value chain?

He then presented two case studies:

- **Case study 1 - SW based community networks**
  - ubiquitous access - virtualised sw solution
  - H2020 RIFE project
- **Case study - FLAME on a stick**
  - SW complete stack on a USB Stick

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4 ROUNDTABLE DISCUSSION: WHAT IS NEEDED TO BUILD THE NEXT GENERATION OF THE INTERNET?

This discussion took place between the keynote speakers, and was moderated by Sergi Figuerola.

The audience was very engaged and extremely active. Many questions were asked and from the questions it can be concluded that the main concerns lie with lack of neutrality and imbalance of power.

The citizens, as users, don't have access to any of the policies that are used on the Internet, from a higher layer of the stack where they don't know how search engines provide answers, down to the lowest layers where they don't know how the traffic is routed in routers because the policies used are not public. Clearly some parts of the Internet are biased and controlled to achieve determined goals. There is the need to balance the power that few have on the network and introduce some measurements of neutrality.

Right now the users' only power is consumer power, but unfortunately this can be biased and twisted by manipulation and dissemination of fake news to modify public opinion. The NGI Initiative needs to find a way to give back the Internet to the people. Unless the users are the owners of the platform, there will never be a fair system. The large corporates have too much power. It was suggested that the EU needs to fund true cooperativism and it was suggested to involve representatives of the Internet of Consumers in the NGI initiative and in future NGI Forums.

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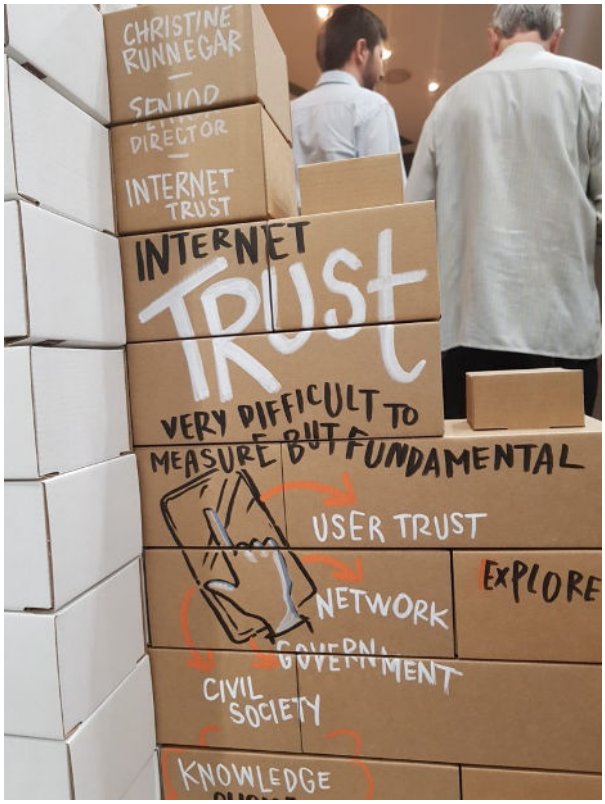

PARALLEL ROUND-TABLE WORKING SESSIONS

Three parallel round-table working sessions were hosted to allow attendees to provide valuable answers and comments for the specific NGI discussion topics. The three parallel sessions were:

- **Identifying R&D Priorities for NGI** - moderated by Michael Boniface, Technical Director of the IT Innovation Centre, University of Southampton (HUB4NGI)
- **Recognising New Business Models & Opportunities** - moderated by Richard Stevens, Director of the Government Consulting Unit in IDC (HUB4NGI)
- **NGI Skills and Education: Opportunities & Challenges** - moderated by John Domingue, Director of the Knowledge Media Institute at The Open University, President of STI International (HUB4NGI)

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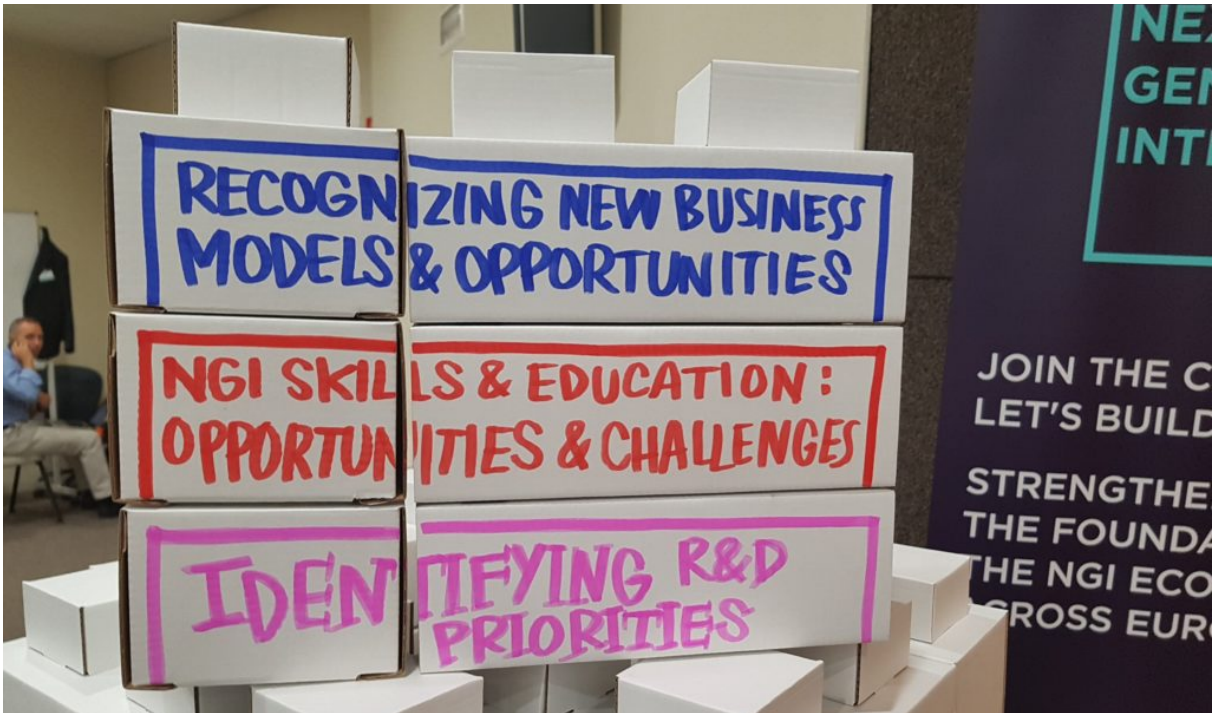

The smaller groups in this exercise allowed all participants time to express their comments/questions/suggestions on the NGI vision and strategy. Each group spent 45 mins discussing the specific session topic in detail, creating new ideas, and answering questions raised by the group's dedicated moderator. The suggested new ideas were discussed individually by the group and were approved as such or modified by consensus.

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5 PARALLEL SESSION RESULTS

SESSION 1: IDENTIFYING R&D PRIORITIES FOR NGI

Moderated by Michael Boniface, Technical Director of the IT Innovation Centre, University of Southampton (HUB4NGI)

This session contained exercises that aimed to get participants' opinions on R&D priorities in three subject areas. For each subject area, participants were divided into groups. Each group wrote down what they thought were the most important R&D priorities, and then everyone in the session voted on each group's contribution. Below are the subject areas, with the background and main question and a results table showing each group's answers. The tables show how many votes each group got, and in some cases there were ties, with more than one group getting the same number of votes - this is reflected in the table by groups sharing the same row.

RESPONSIBLE AUTONOMOUS MACHINES

Background

These are typically autonomous applications of AI whose actions need to be regulated because they are either safety critical or impact the lives of citizens in significant ways. A popular example of an autonomous machine is a self-driving vehicle. Development and use of autonomous machines has thrown up some important considerations that need to be investigated:

- Investigation is needed into whether ethical considerations and or regulation (e.g. compliance with legislation) should be encoded within these autonomous machines, and if so, how.
- Transparency of AI decision making is considered important. There are fears amongst experts that AI decisions may deliberately or inadvertently include bias or discrimination. Investigation is needed into how the algorithms can explain their decisions, and how bias or discrimination can be avoided.

Question

What technological research is important in the future development of responsible autonomous machines?

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Results

Votes	Responsible Autonomous Machines		
6	➔ Coexistence of autonomous and non-autonomous machines and human		
3	➔ Certifiable RRI (Responsible Research and Innovation) ➔ Interdisciplinary: • Validation • Guarantee	➔ Embedding notion of responsibility in AI ➔ Validation / test	➔ Transdisciplinary R&D ➔ Caps for autonomous technology ➔ Understandable AI ➔ Interdisciplinary validation & governance
2	➔ Reliable networking for collaborating AI instances ➔ Timely information exchange for reliable / accurate decisions		

INFRASTRUCTURE DECENTRALISATION

Background

These are typically autonomous applications of AI whose actions need to be regulated because they are either safety critical or impact the lives of citizens in significant ways. A popular example of an autonomous machine is a self-driving vehicle. Development and use of autonomous machines has thrown up some important considerations that need to be investigated:

- ➔ Investigation is needed into whether ethical considerations and or regulation (e.g. compliance with legislation) should be encoded within these autonomous machines, and if so, how.
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Question

What technological research is important in the future development of responsible autonomous machines?

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Results

Votes	Infrastructure Decentralisation		
6	➔ Personal data centre ➔ Heterogeneity ➔ Provisioning ➔ Open Service Platform		
3	➔ Intelligent traffic forwarding ➔ Coordination of geo-distributed resources ➔ Reassess infrastructure & protocol stack ➔ Essential for IoT applications at large scale ➔ Load balancing ➔ Data transaction guarentees	➔ Military / emergency QoS ➔ Democratisation of infrastructure	
2	➔ Smart Contracts	➔ Aggregating and processing data from distributed sources	➔ Blockchain ➔ Non-transactional protocol research ➔ Energy harvesting ➔ Cybersecurity

PRIVACY ENHANCEMENT

BACKGROUND

Decentralisation of infrastructure refers to the trend towards distributed and edge computing as well as distributed technologies such as blockchains and IoT, where resources (e.g. data storage and processing) are not located en-masse in one location, but spread over a wide area.

QUESTION

What technological research is important in the future development of infrastructure decentralisation?

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RESULTS

Votes	Privacy Enhancement		
6	➔ Homomorphic cryptography		
5	➔ Identity management ➔ Data centric security ➔ Privacy preserving computation		
3	➔ Appropriate categorisation methods for users' choice in privacy	➔ Privacy by design infrastructure e.g. homomorphic encryption ➔ Citizen retribution business models	➔ Searchability and transparency
1	➔ Tracking user data ➔ Multi-layer encryption		

SESSION 2: RECOGNISING NEW BUSINESS MODELS & OPPORTUNITIES

Moderated by Richard Stevens, Director of the Government Consulting Unit in IDC (HUB4NGI)

In this session, it was discussed what's coming in terms of business models and new types of sustainability for the NGI.

The session began with a general introduction by industry expert John Delaney who painted a picture of the Future Internet transforming the types of interactions between actors. John described the Internet of Actions, where instead of being content driven, the Internet would be driven by actions and machine-to-machine communication. The status of the markets, business models and trends will need to take stock of this transformation. Insights were discussed to consolidate a vision of upcoming business models and opportunities for the commercial and societal exploitation of NGI research coming from the community.

QUESTIONS

The session discussed several key topics including:

- **Upcoming market dimensions and market potential.** Which Internet intensive markets are growing and which are shrinking? Which of these markets are expected to be driving the future Internet?
- **Tomorrow's competitive landscape.** What will European companies competitive position look like in these markets? Where can we expect to compete and where could we excel based on today's positioning?

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- **Future customers.** What will customer demographics look like in the coming years? Who will be buying NGI products and services and why?
- **New value propositions.** Will technology or new organisational models affect how and who pays for future Internet services, will business models be the ones we know today?
- **Distribution channels.** What will the physical Internet look like how will people get Internet based products and services?
- **Collaborations and strategic partnerships.** What new type of alliances will emerge and how will players divide revenue streams? Concentration of power (media, capital) is an issue.

FINDINGS

Main findings in this parallel session were as follows:

- **Information is becoming monetary unit, thus:**
  - NGI stakeholders will need to understand how this affects traditional business un before they are taken by surprise or not aware of the value in data
  - Service providers will need to distribute value derived from service provision with data owners
  - Social currency and cooperative models will evolve and need to correctly monetized
  - Internet neutrality will be challenged by those able to dominate the control of information and data
- **New distribution channels will arise:**
  - As Artificial Intelligence proceeds, devices themselves could be active in selling and buying goods (bot with a visa card)
  - the market for devices in the Internet of Things paradigm to be offered “As A Service” will rapidly grow
  - The growing concept of Internet of the people, by the people will drive a social need more equitably distribute costs and income among users
  - Attribution of national licenses of spectrum which is today controlled by governments will need to be opened up to nonprofit organizations, regional and local authorities
- **Information and Analytics as drivers of new business models**
  - Big data analytics will increase the speed of new business models as it helps us understand what we do not know now and where new value can lie

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- Research communities will profit from analytics and the massive amount of data in the Next Generation Internet, for example disease correlation discovery in the healthcare sector
- Industry will improve efficiency through prediction with help of AI + sensor data
- SMEs will need to find economic models that allow them to use data and information and co-exist with big players

Findings from the session can be referenced for future investigation and can be leveraged as insight for academics, industry and policy makers as they plan NGI initiatives or consider how they can exploit their results or plan for future initiatives based on new opportunities.

SESSION 3: NGI SKILLS AND EDUCATION: OPPORTUNITIES & CHALLENGES

Moderated by John Domingue, Director of the Knowledge Media Institute at The Open University, President of STI International (HUB4NGI)

BACKGROUND

The relationship between NGI and education is bi-directional. On the one hand the current and new global communications infrastructure requires new skills workers. Only the highest levels of training and qualifications will ensure that Europe plays a leading role in the future of the Internet. Without at least basic literacy the majority of our economic sectors will not be competitive in the global market.

Increasing ICT training is also crucial for the European economy. It is estimated that there will be 825,000 unfilled vacancies for ICT professionals by 2020. Despite the fact that 90% of future jobs will require ICT skills 60% of students never use digital equipment in the classroom. As Neeli Kroes (EU Vice-president and Digital Agenda Commissioner) commented recently on the ICT job market situation:

In the other direction, new and emerging NGI technologies can help transform how teaching and learning is delivered. The most recent big technological changes in digital learning include:

- ➔ The rise of **Massive Open Online Courses (MOOCs)** providing world class online learning for free giving students access to rich multimedia materials delivered by academics from the best universities.
- ➔ **Learning Analytics** – the application of data science to understanding and predicting student behaviour.
- ➔ **Augmented Reality** (AR) systems have begun to emerge in teaching contexts.
- ➔ **Distributed ledgers** have to potential to give students control and ownership of all their learning data including accreditation and portfolios of work.

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RESULTS

Within this parallel session a number of priority topics emerged:

➔ **Unknown future**

- Educational systems need to educate understanding that future technologies, contexts and the required skills will always be unknown. Learning as an explicit, lifelong skill will be important to future generations.

➔ **Global education opportunities**

- A key strength of the Internet is its global reach and it is imperative that educational systems are designed to promote and sustain educational opportunities for all

➔ **Other identified topics:**

- Understanding decision making skills
- Have the power to choose
- Crowdsourced research
- Use of VR and AR
- What to remove - what should not be taught any more - e.g. handwriting, facts, foreign language, basic maths (all controversial)
- Critical thinking - understand fake news - what is really true
- What is your digital identity - the Internet never forgets
- Personalised education
- Activism & hacking - teaching children that they can change the world through the Internet
- Aiming for the moon
- Education from ransomware - solve the problem or your computer will be locked!

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6 UPCOMING NGI CALL AND OPPORTUNITIES

OVERVIEW ICT-2018 & WP 2018-2019

Georgios Tselentis, Scientific Project Officer at European Commission, gave an overview of the ICT-2018 & Work Programme 2018-2019 and highlighted some NGI related calls in the work programme. He started his presentation to tell that there are three new NGI Coordination and Support Action (CSA) projects which just started and they cover topics in Engagement, Consultation, and Scouting.

The next work programme - as a preliminary information - will include for example Research & Innovation Action projects (2-3 years) that will use a cascaded funding (Open Calls) mechanism in where the RIA project partners will fund 3rd parties (80% of the budget). The three main topics to be covered will be:

- Privacy and trust enhancing technologies
- Decentralized data governance
- Discovery and identification

The call closing time will be in April 2018, i.e. new projects will start in Autumn 2018.

The other call (2,5 M€) is dedicated to international co-operation with the US (NSF/GENI) with activities e.g. to exchange of workshops between the CSA projects on both sides in Europe and in USA. Additionally there will be a fellowship programme (similar to Marie Curie programme) in the RIA projects. Georgios concluded his presentation saying that the call text will be published in October 2017 and at this stage the call information is presented on a high level only.

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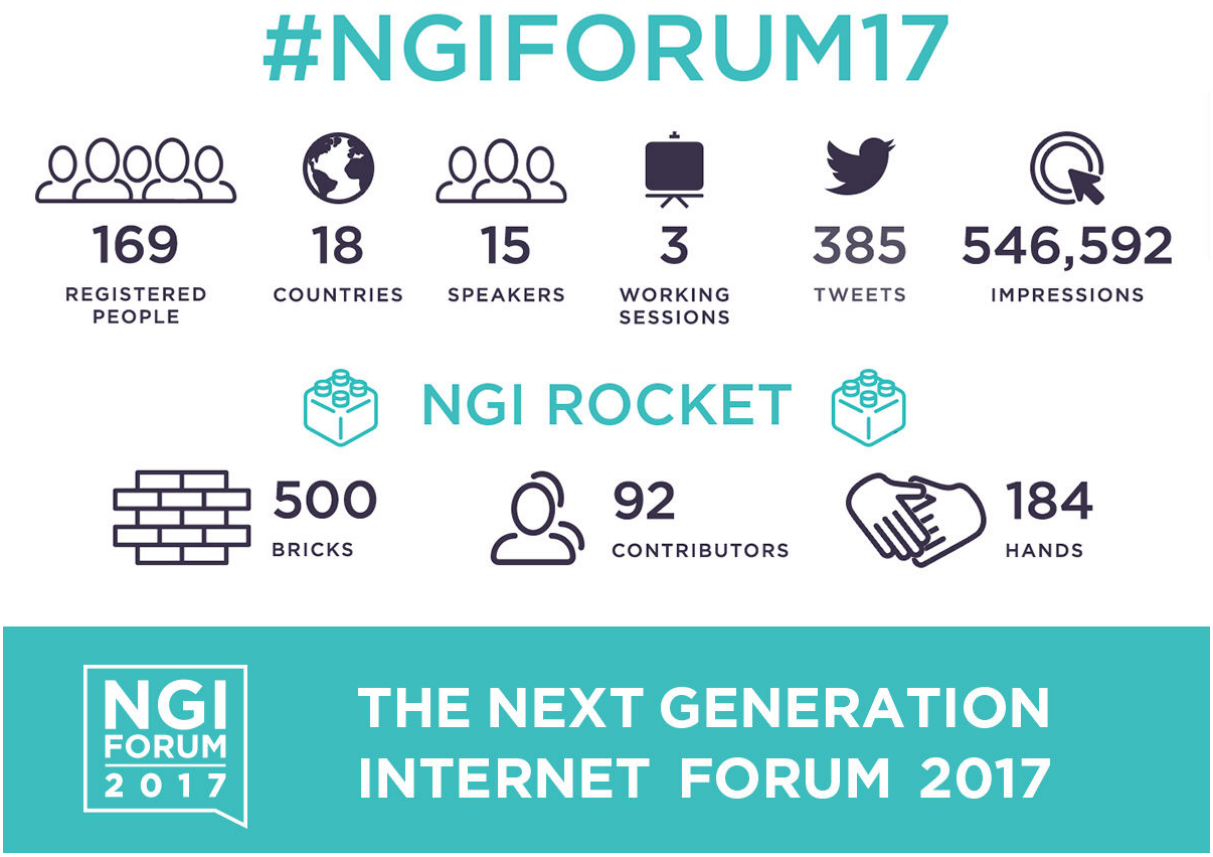
7 CLOSING & NEXT APPOINTMENTS

Dr. Monique Calisti, Director and Partner of Martel Innovate, Coordinator of the HUB4NGI Project, thanked all participants for their active contribution and interest and all organisers of the event. She summarised highlights of the day as illustrated in the picture below:



She pointed out where to find more information and how to contribute to the NGI:

- **The NGI Corner on Futurium** - https://ec.europa.eu/futurium/en/next-generation-Internet
- **The NGI Twitter Channel and hashtags** - **@NGI4EU**, **#NGIeu**, **#NGIForum17**
- **The HUB4NGI web portal** - www.hub4ngi.eu
- **The NGI map of actors** - www.hub4ngi.eu/map/

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Next big events will be as follows:

- **Fed4FIRE+ Engineering Conference 2 | FEC2** – 4-7 October, Volos (Greece) – https://fec2.fed4fire.eu/
- **ICT Proposers' Day 2017** – 9-10 November, Budapest (Hungary)
- **NGI @ Internet Governance Forum** – 18-21 December, Geneva (Switzerland)
- **NGI event to be announced soon by the EC**, most probably February in Luxembourg

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