



NEM Position on Next Generation Internet

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NEM Position on Next Generation Internet

Executive Summary

Next Generation Internet (NGI) is a human centric* initiative and NEM is European Technology Platform addressing human needs in terms of content and interaction. This paper is based on the NEM members vision on NGI, and in particularly regarding the evolution of European digital space in terms of content, media, creative industry and interaction, including immersive technology and accessibility.

One of the most important concerns in European landscape is security&privacy linked with service personalisation. Hyper-personalisation is part of the NEM Agenda and related research topic proposals have been clearly identified in dedicated NEM Position Paper. In this context trust is one of the key ingredients to develop the Next Generation Internet fitting user needs and wishes.

IoT will also be one of the biggest sources of content in the future, they should contribute to hyper-personalisation but also augmented reality content.

To achieve such a goal, there is a need to manage and analyse all these big amount of data using new algorithms provided by artificial intelligence, cloud computing and big data technologies.

Worth to say that there is also a need for governance and law in order to avoid problem with such a “Big Brother” running with no rules. Such governance is a huge task, not to be handled by NEM, but NEM would like to alert the European Commission about such a risk. Data protection is one of the key topics to be regulated at European Union level.

Media&content should have a great contribution in order to bring the entertainment dimension to the NGI. Today most of the social media usages are around pictures&vidéo sharing and NGI should encompass this domain in order to reach the objective of a human centric Internet.

The NEM members have identified the following technology areas and research domains as the most relevant for NGI

1. Personal Data Spaces
2. Internet Of Things
3. Blockchain
4. Artificial Intelligence
5. Distributed architectures and decentralised data governance
6. The future of Social media
7. New forms of interactions and immersive environments
8. Other important technologies
 - Discovery and identification tools
 - Software defined technologies
 - Networking solutions beyond IP

*Human centric:

At the service of the people and the society
Address present issue
Make “internet for the people”

Table of Content

Executive Summary	2
1. Context	4
2. NGI short presentation.....	5
2.1. NGI description	5
2.1.1. NGI Values	5
2.1.2. Other visions	5
2.2. NGI Technology Areas	6
2.2.1. Personal Data Space.....	6
2.2.2. Artificial Intelligence	6
2.2.3. Distributed architectures and decentralised data governance	7
2.2.4. Other technology areas proposed in the consultation.....	8
2.3. Types of research, who should do it and initiatives to follow.....	9
3. NEM short presentation.....	10
3.1. NEM description	10
3.2. NEM research domains.....	11
3.2.1. Content distribution.....	12
3.2.2. Hyper-personalization.....	12
3.2.3. Immersivity	13
3.2.4. Media analytics	13
3.2.5. Professional media workflow	13
3.2.6. Secure and trustable content - Block chain	13
3.3. The future of Social Media	14
3.4. Internet of Things	14
4. Mapping NGI and NEM research domain	16
5. Additional relevant NEM research domain to NGI	20
6. Conclusions & recommendations	22

NEM Position on Next Generation Internet

1. Context

The Internet of the future should provide better services, more intelligence, more security, more protection, especially to vulnerable audiences, more capacities to discern veracity of information, greater involvement and participation. It needs to reflect the European social and ethical values: free, open and more interoperable.

Several workshops and consultations took place in 2016 and early 2017, the synthesis is available at <https://ec.europa.eu/futurium/en/content/final-report-next-generation-internet-consultation-0>

In order to speed up the definition of the NGI, the EC will be funding three CSA projects under the ICT-41 call (opened in April 2017). The three CSA projects correspond to three different strands::

- Strategic Research Agenda (Think-NGI supported by NEM)
- Ecosystem animation
- Program structure (Think Virtual supported by NEM)

Current ICT-LEIT-Workprogram 2018-2020 has already defined the shape and content of the NGI, including:

ICT-24-2018-2019: Next Generation Internet - An Open Internet Initiative / Unit E3
ICT-25-2018-2020: Interactive Technologies - *NEM topic* [DG CONNECT Unit G2]
ICT-26-2018-2020: Artificial Intelligence - *NEM related topic* [DG CONNECT Unit A1]
ICT-27-2018-2020: Internet of Things - *NEM related topic* [DG CONNECT Unit E4]
ICT-28-2018: Future Hyper-connected Sociality - *NEM topic* [DG CONNECT Unit I4]
ICT-29-2018: A multilingual Next Generation Internet - *NEM topic* [DG CONNECT Unit G3]
ICT-30-2019-2020: An empowering, inclusive Next Generation Internet
ICT-31-2018-2019: EU-US collaboration on NGI

2. NGI short presentation

2.1. NGI description

The open consultation for the Next Generation Internet Initiative (NGI Initiative) was held between 10th November 2016 and 9th January 2017, and 449 participants took part providing significant input. Participants were asked to rate and comment upon the importance of value statements and technology areas and encouraged to provide their views on how to support the NGI.

See [full document](#).

2.1.1. NGI Values

Ensuring citizens' sovereignty over their own data and the protection of their privacy is deemed the most important value proposed in the survey by the participants.

Secondly, participants also felt strongly that the Internet should ensure diversity, pluralism and a right to choose.

Thirdly, the concentration of data in a few proprietary platforms is understood as a significant issue today. Internet should ensure citizens' sovereignty over their own data and protect privacy.

Those rating the importance of this value highest also selected Personal Data Spaces as a very important technology area

Therefore an NGI with a focus on Personal Data Spaces (Technology Area 3) may help in addressing the issues of sovereignty over personal data.

Similarly important across all participant categories this value would make an attractive vision to pursue to attract participation.

Internet should ensure diversity, pluralism and a right to choose. Those that considered this value strongest also consider Personal Data Spaces as the most important technology area, while Distributed Architectures and decentralised data governance (Technology Area 4) is next biggest.

Internet should avoid the concentration of data in a few proprietary platforms. There is a close relation between this value and the technology area of Personal Data Spaces (Technology Area 3).

There is strong awareness of the impact of the few proprietary platforms upon the protection of personal data in particular.

Software defined technologies (Technology Area 5) is the second most important technology area for those that hold this value. This value is popular among those already engaged in research funded by the European Commission. This can be useful if progression upon existing initiatives is desired.

2.1.2. Other visions

Other visions proposed drew considerably less interest; however some had an appeal to certain niches within the consultation. Younger participants were attracted to

NEM Position on Next Generation Internet

values of diversity and pluralism and the notion of a level playing field, where older participants preferred values relating to sustainability, resilience and security and a resistance to concentrating data in proprietary platforms.

Respondents from Greece, Belgium and Bulgaria felt strongly about a resilient and secure internet.

Those from Sweden, Greece and Ireland responded more strongly to sustainability than other more dominant countries in the consultation (e.g. UK, Italy, Spain).

Beyond the vision statements proposed in the consultation, participants proposed that a trusted, inclusive internet should be seen as a basic human right and the NGI should be mindful of the protection and safety of its users and their data.

However, they also recognise the tensions between this and the desire for more unencumbered innovation.

2.2. NGI Technology Areas

The top two NGI values above were consistently and strongly held by those supporting the most important of the technology areas. Technology Area 3 (Personal Data Spaces) and Technology Area 7 (Artificial Intelligence) were the most important areas as recognised by researchers and the bulk of the other groups that took part in the consultation.

2.2.1. Personal Data Space

There is a trade-off between the benefits of innovation possible with the Internet of Things and Big Data and the need to prevent abuse of personal data.

The NGI needs to keep personal data secure and this means educating and enabling citizens regards of abusive data collecting and processing practices either from legitimate data-centric businesses or illegal, criminal actors.

Systems that allow assurance, transparency and freedom for citizens to control the data that's held on them should not limit access to innovative services. Infrastructures are needed to both enable benefits and minimise exploitation of using personal data

This will include enabling privacy aware access control and enforcing accountability for responsible use of personal data.

The values of this group are related to data sovereignty, and diversity, pluralism and the right to choose.

2.2.2. Artificial Intelligence

Despite only a few respondents actually working in this area, many more believed they had a good understanding of the area.

NEM Position on Next Generation Internet

Their visions are strongly in line with retaining data sovereignty, diversity and pluralism and not allowing the data to become concentrated in proprietary platforms.

Technical challenges top the list, requiring interdisciplinary approaches and a top-down vision and application of strong use cases (e.g. autonomous vehicles) to shape the needed activities.

The impact of greater autonomy and increasing "responsibilities" placed on systems requires work on communication, ethics and the inclusion of human factors within these decision "making" mechanisms.

A proper and actionable ethical framework for Artificial Intelligence regarding algorithms becomes essential and deserves long-term project commitments to put some already well documented theory into practice.

Data & algorithms are the two sides of a same coin:

- rising benefits from big data and AI technologies have wide impact on our economy and social organization
- Transparency and ethics of such algorithmic Systems (data&algorithms) become increasingly important properties for trust and appropriation of digital services
- Data analytics is changing from description of past to predictive and prescriptive proposals

Algorithms will become in everyday life to provide recommendation, to personalize services and content but they have to be transparent in order to avoid manipulation from content providers (today big players are able to provide specific content to users fitting more with their business than with the real user needs).

The challenges for transparent and accountable data management and analytics 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.

2.2.3. Distributed architectures and decentralised data governance

Participants expressed the potential for a financial revolution from these technologies. A number of specific requirements including the continuance of work on blockchain in particular and the need to deal with the power demands for this technology area proposed.

The main challenges identified were in communicating the business benefits of these digital ledger technologies to existing businesses in a compelling way and collaborating on new decentralised algorithms.

NEM Position on Next Generation Internet

Control for citizens over their own data becomes increasingly important yet challenging in a distributed architecture. Investment is needed in to a diverse future-proof infrastructure that will enable ever greater autonomy.

For all this technology investment is needed to support effective governance that balances rights and supports legislation.

A multi-disciplinary approach is essential.

Separation of content and data from the internet based software is essential and need standardisation of data structures in order to allow anyone to develop applications and services based on personal data.

2.2.4. Other technology areas proposed in the consultation

Discovery and identification tools need to provide assurance that the use and security of personal data is standardised and respected far beyond the initial commercial interest. Non-proprietary, extensible, future-proof, trustworthy standards for the Internet of Things are needed to support end to end connectivity between the Internet and the edge networks connecting all these devices. Semantic repositories are needed.

New forms of interactions and immersive environments face the issues of data privacy, diversity and the concentration of data into proprietary platforms.

Intuitive interfaces necessitate work on understanding the psychological & biological effects and the threats and opportunities for industry and citizens of the constant Virtual Reality world. Supporting industry 4.0, embracing immersive distant collaboration and creating market driven products and service are required.

An NGI is needed that deals with the packets reliably and with minimal latency.

Work is needed in developing the tools for work-flow and process improvements including the advancement of battery technology.

The NGI can be made robust if the agility possible with the **Software defined technologies** is embraced and the right methodologies are employed for small and medium-sized enterprises to take a role in this. Co-developments may fulfill requirements for virtualization and self-adapting algorithms. The protection of such created knowledge will be important. Work on new software specifications is essential as more functionality becomes embedded in soft rather than hardware. Standards need to be future-proofed to accommodate unknown future functionalities that will be required.

Networking solutions beyond IP impact the values of sovereignty of data and pluralism and diversity most strongly. An emphasis on security aspects alongside the palpable need for an improvement over the current IP is justified. The Next Generation Internet may benefit from a non-packet-based approach, but backward compatibility issues must be addressed and an optimal migration path proposed.

NEM Position on Next Generation Internet

Higher throughput, low latency and secure communications will place significant challenges upon the NGI infrastructure and architecture. A new high-speed TCP protocol and tools are important areas in need of development. New networking approaches may demand that security is built within the protocol. Maximizing security and resilience while assuring good interoperability are key technical challenges.

Other important technology areas

Additional technology areas proposed highlight a focus on security in general and then more specific themed technologies around applying autonomous systems to Smart cities and Smart citizens. The desire is for trusted systems to be developed and language technologies are strongly seen as an important investment to achieve this. Beyond this, simulation and large experimentation, as well as more hardware orientated projects such as robotics, are proposed as alternative technology areas.

2.3. Types of research, who should do it and initiatives to follow

An analysis on the type of research, actors and initiatives reveals an appetite for collaboration among interdisciplinary groups engaged in a mixture of long term and applied research projects.

Foresight should direct research and guide the exploitation of evolutionary results into today's technology. Transdisciplinary approaches are needed. Importantly research needs guidance by the social sciences, user needs and awareness of the "known holes" in the current internet.

The "citizens" involvement as "actors" in the research is crucial. This may include representative bodies, policy makers and regulators but these need to encompass women, students and activists.

Relevant initiatives exist within established institutions and are often funded through national and EC programmes. The most popular in the consultation involve Smart initiatives, 5G, Internet of Things and language technologies. Initiatives that address Policy and Societal issues should embrace peer networks, digital learning, e-democracy, e-procurement and e-learning.

Finally, the identified on-going work on Public Sector Information (PSI), Big Data and Networking may provide good starting points for prototypes.

3. NEM short presentation

3.1. NEM description

NEM, the New European Media initiative, is the European Technology Platform of Horizon 2020 dedicated to Content, dealing with Connected, Converging and Interactive Media & Creative Industries. With the launch of Horizon 2020, the NEM Initiative is pursuing its objective to build sustainable European leadership in content, media, and the creative industries. The NEM Initiative promotes an innovative European approach towards a Future Media Internet that will enhance the lives of European citizens; initially and primarily through a richer and more engaging media experience, but with an increasing potential for contributions in other sectors including education, health and societal inclusion and innovation. NEM has more than 800 members and a number of them are national clusters that also represent hundreds of SMEs and startups.

...facing key (r)evolutions:

Content and Creative Industries, while locally, regionally, and/or nationally implemented or even governed, are moving to a worldwide framework, thanks to the digitalization of the whole value chain, from creation through distribution to consumption. These industries are updating the whole process in paralleling a lot of actions all along that value chain and reducing the production time from capture to access. New paradigms are appearing in stocking, processing and accessing the content from the cloud. New ways to consume the content (over the top, on the move, remotely, on devices of all form factors and with increasing degrees of immersivity) are bringing new opportunities and challenges (technological, infrastructural and regulatory). Media convergence means that former “silos” are more and more breaking up, within industries but also between adjacent creative industries. Yet, we are still far away from a unified “creative sector”, let alone from a creative sector with easy access to collaborative research and innovation in ICT. This poses not only challenges for “hard” (technological) innovation, but also for soft innovation (company culture, business development, innovation infrastructure, innovative uses of existing technologies, etc.). Especially in the content access and distribution domains, the market is witnessing the fast entrance of new players with disruptive and focused approaches. This diversity often challenges established businesses and their business models, requiring them to be the involved in the latest technology research and innovation activities of their sector.

... requesting technology and innovation support investments:

To face this fast growing worldwide environment, to maintain - or even better to increase - the footprint of our Content and Creative industries at a worldwide scale, technology and innovation support investments in the Media & Creative industry need to be increased to a level corresponding to their economic weight. Beyond what has been already covered in 2014-2017 LEIT ICT, the technological building bricks defined in the NEM Vision & Strategic Research and Innovation agenda (SRIA) remain relevant. We are particularly convinced about the importance the next Horizon 2020 program focusing on solving those key challenges for Content & Creative industries at

NEM Position on Next Generation Internet

the infrastructure level (formation of an innovation network, virtualization, cloud, ...); at the data level (metadata, privacy, security,...); at the service level (business models, user experience, personalization,...) as well as at the content and format level (immersivity, interactivity, enriching and engaging new formats that deliver added value). Many of these aspects apply to all sectors within the creative industries – including Advertising, Architecture, A/V, Cultural heritage, (Product) Design, Fashion, Film, Games, Publishing, Music – but not necessarily at the same speed. The projects should encourage the integration of the “technical” and “creative” sectors to achieve platforms, which are fit for purpose to extend the success of the European Media and Creative industries.

... using a range of instruments:

As the actors in the creative and content industry cover a wide range of size, market position and fields of application, we would recommend that a variety of actions be formed, including Research, Innovation and Coordination and Support Actions. In particular, CSAs should be stressed more in the upcoming funding periods, providing instruments for setting up innovation networks within and between respective creative industries & ICT research. All actions should have a range of durations in consideration of the fast changing nature of the sector, and should aim to involve SMEs from the creative sector even further. For achieving the latter, administrative overheads should be kept to a minimum.

NEM is covering the following sectors:

- Book Publishing
- Broadcasting
- Music
- Multimedia
- Advertising
- Gaming
- Fashion
- Cultural heritage
- Design
- Education & training
- User and social engagement and collaboration
- Novel storytelling techniques
- IoT integrated environment
- Digital society - Impact of new media on lifestyle

3.2. NEM research domains

These are the research domains described in the last NEM Strategic & Research and Innovation Agenda (SRIA):

- Content Distribution
- Content processing
- Distribution and display technology
- Designing and maintaining security and privacy

NEM Position on Next Generation Internet

- Autonomy and automation
- Service provision innovation
- Enable bimanual interaction, natural walking interfaces, and whole-body involvement in VR
- Maturation and enhancements of Brain-Computer Interfaces
- Augmented Reality for Inquiry-Based Sciences Education
- Challenges in evaluating human-computer interactions (HCI) and immersive content and technology

Following the update of the NEM SRIA in 2016, it has been decided to extract the most important research domains and objectives that have to be pushed in the next WP2018-2020, completely in line with the priorities elaborated in April 2016.

The NEM members are supporting the following list of priorities:

1. Content distribution
2. Hyper-personalization
3. Immersivity
4. Media analytics
5. Professional media workflow
6. Secure and trustable content - Block chain

These topics target technical/technological trends rather than following market trends. They are shared by several of previously identified sector trends (SRIA Section II). SRIA aims at boosting the potential impact and providing a better overview of the NEM community.

3.2.1. Content distribution

Content distribution integrates all the new trends on the evolution of networks and the provisioning of media services. These include the increased capacity of the actual networks for supporting new media and immersive formats, the potential impact of 5G networks for new business models, the increasingly convergence of “hybrid” services built upon the combination of different networks. The convergence between broadcast, multicast and unicast as well as the potential of SDN networks should be a tremendous opportunity for the media and content industry.

It also includes aspects regarding security and right management to enable new media business models.

3.2.2. Hyper-personalization

Hyper-personalization consider the different aspects of maximizing opportunities to customize content to consistently target the right audience throughout the customer lifecycle. Thus it will create meaningful connections and drive engagement among audience. It can be applied to most of the NEM media sectors. It also encompasses the ATAWAD (any time, anywhere, any device) concept which provide to the end user the best format according to the device used.

NEM Position on Next Generation Internet

3.2.3. Immersivity

Immersivity is very likely to be one of key drivers of media in the upcoming years to reshape the way contents and services are provided and the user interaction is completely renewed. There are a lot of technical topics along the value chain involved, so it can integrate many NEM actors as well. It should encompass the following activities: , Mixed Content Immersive Technology, Content Generation Tools, Science, Technology and Arts in Immersive and Interactive Media.

3.2.4. Media analytics

Media analytics cover the media analytics tools for Big Data and Social Media, positioning media as a core sector for Big Data technologies including the social media. It will also address media search engines which is a potential open field for the European industry.

3.2.5. Professional media workflow

Professional media workflow to address migration, virtualization, co-creation... aligned with production core technologies. Digital cinema, as well as professional content provider workflows have to deeply evaluate new technologies in order to take advantage of them but also to fit the end-user needs who expect more and more personalised content. As a consequence, the producing environment has to be rethought as well as all the tools used by professional content providers.

3.2.6. Secure and trustable content - Block chain

Secure and trustable content - Block chain seems to be promising for DRM and micro payment between users according to recent experiences and publications. This new technology is still very new but seems to have the potential to fix issues that we have not yet solved. A consistent DRM is still expected from end users and for content providers, and as block chain technology is a contract between two entities without any central point, it seems very promising. In the same way, users are increasingly used to creating content with their mobile and are also interested in selling it, micropayment is the solution and the block chain technology could facilitate one to one payment.

Blockchain

Blockchain contains what everyone in data management, from data scientist to chief data officer (CDO), wants: Information that comes with complete provenance. That is data showing who did what, when and with full history from day one. Verified by all parties participating in the network, transparent, with complete reconciliation, and secured by the latest in cryptography.

Blockchains are now capable of storing arbitrary data and establishing permissions to modify that data through self-administering and self-executing scripts which are performed by a distributed virtual machine. These scripts are known as smart

NEM Position on Next Generation Internet

contracts, and they allow platform operators to define complex and fully customisable rules which govern the blockchain's interaction with its users.

Blockchain technologies are a good candidate to avoid fake news certifying the source of information.

3.3. The future of Social Media

NEM has recently published a white paper describing what should be the future of social media. The White Paper elaborates on several aspects of the future social media by providing identified future related service and application scenarios and by deriving corresponding requirements and needed actions on policy and regulation as well as on research and innovation in the area. Even the inputs and requirements provided in the document cannot yet been seen to cover all aspects of the future social media landscape, it is already possible to identify a number of needed actions to enable a future European social media approach around the following main areas:

- Data protection (Protection of individual user rights, Data portability and competition/monopoly issues, Digital Rights Management – prevention of piracy, Management of user information and portability)
- Trust (Regulation in social media, Ensuring trust and diversity, Social media tools)
- New areas in the social media (Social IoT, Blockchain, Media analytics, Source analysis)
- Business and cooperation models (New models related to search of information, Business models for publishing in social media, Collaborative live production workflow)
- Education
- Regulation

3.4. Internet of Things

In the next future, devices will produce a huge amount of information that could be used in the Media&Content industry. The huge diversity of device from sensors, actuators to video cameras will be able to feed data bases and this information should be reused from anyone to create new content and/or to personalize content. For that reason it is crucial that the NGI encompasses Internet of Thing not at the technology level but as creator of new form of content.

In order to achieve this goal, it is important to define standardized data models to facilitate manipulation of this new form of content. We can mention in this context the initiative from ETSI together with the FIWARE foundation which are working on the ETSI CIM standard (NGSiv2), this standard should be very helpful to use a common data set structure for any content providing from IoT devices.

NEM Position on Next Generation Internet

In addition, we can easily link this point to the social media topic as far as in the next future we will have not only social media networks between humans but also social media networks of IoT. In this case, IoT will communicate together using artificial intelligence and give back results of their work to the end users (humans). NGI should need to support IoT Social Media networks.

NEM Position on Next Generation Internet

4. Mapping NGI and NEM research domain

Media and CCI are very closed related and belongs intrinsically to most of the technology areas identified in the NGI initiative. Indeed, the future of media, content and the creative industries rely heavily on the Internet.

Thus, there is a close mapping between NGI research priorities and NEM research priorities as well as with NEM identified enabling technologies to be pushed forward in next EU funding frameworks. Most of the aspects of NGI research priorities are contemplated in NEM SRIA. However, given the different focus of both documents, key aspects of NGI are scattered among technology trends identified in NEM SRIA and most of the times there is not a direct match among them.

In the following Table this mapping is made visible, identifying common aspects of NGI Technology Areas and NEM SRIA research priorities.

NGI Technology Areas	NEM research priorities and key enabling technologies	Comments
Personal data space	Hyper-personalisation Immersivity	Technologies aimed at providing better personalized services have to take into account security aspects for both user data, personnel data captured and data offered by the user. NEM also approaches the need for ensuring user privacy data and controlling data flows through technologies aimed at Hyper-personalisation and immersivity.
Artificial Intelligence	Content distribution Hyper-personalisation	NEM content distribution also addresses the need for AI technologies to automate the access of distributed sources and to provide them to users, content distribution processes, etc.. Among other technologies needed for hyper-personalised media services and offerings, AI is a key.

NEM Position on Next Generation Internet

	<p>Immersivity</p> <p>Media Analytics</p>	<p>AI has also a great potential contribution on activities and priorities such as storytelling creation, content generation tools, in the form of algorithms that supports and aids the creative process of immersive content.</p> <p>All aspects of Media Analytics relates directly with AI. Nowadays, most analytical algorithms rely on AI algorithms.</p>
<p>Distributed architectures and decentralised data governance</p>	<p>Secure and trustable content - Block chain</p> <p>Content distribution</p> <p>Professional media workflows</p>	<p>NEM research topic covers needs regarding the use of decentralized and secure communications to improve content protection and rights management.</p> <p>Content distribution also address challenges that require new distributed architectures capable of delivering high volumes of content with controlled latency. Also, content distribution services must adapt to new distributed architectures.</p> <p>Enable novel co-creation, collaborative spaces for content production ensuring protection of created data, trusted networks, etc..</p>
<p>Discovery and identification tools</p>	<p>Media Analytics</p>	<p>The need for more powerful media discovery tools (annotation, etc.) and media search tools are contemplated in the Media</p>

NEM Position on Next Generation Internet

		Analytics priority
New forms of interactions and immersive environments	Immersivity	These two research areas are perfectly aligned.
Software defined technologies	Professional media workflow	Challenges addressed by NEM professional media include the need to move towards more software-based workflows to cope with aspects such as co-creation, virtualization, etc..
Networking solutions beyond IP	Content distribution.	Content distribution challenges need for networks that go beyond IP, such as hybrid, decentralized networks, etc..
	Content distribution	Relation with Beyond IP Security and right management key to new business models AI: New media environments appearing thanks to AI applied to Autonomous driving
	Hyper-personalization	Relation with personal data space
	Media analytics	Relation with Artificial Intelligence
	Professional media workflow	
	Secure and trustable content - Block chain	Relation with Distributed architecture and decentralised data governance

The following Eurecat's contributions are made with the spirit of supporting legitimate media services and business strategies that are respectful of fundamental rights in the digital society. Indeed, the media and creative industries, many of which rely on data-centric business models, ought to create responsible, transparent and rights-respectful mechanisms for ensuring a fair treatment and trade-off for their consumers. On the other hand, individuals need to be aware of their rights, the value of their data and their role as audience and contributing user, so that they can take responsibility in the collective effort of creating a competitive, meaningful, safe and participatory media landscape.

NEM Position on Next Generation Internet

Scientists, researchers and companies must keep up innovating in **with technologies that guarantees *by-design* the protection of consumer's rights** so that resulting advances are compliant of policy and regulatory frameworks.

NGI Technology Areas	NEM research priorities	Comments (how are these related)
<ul style="list-style-type: none"> • Personal data space • New forms of interactions and immersive environments 	Hyper-personalization	<p>Transparent media services in which consumers are empowered to decide</p> <p>Data sovereignty requires users to be able to make informed decisions about the data they generate, including trading with it under fair and transparent conditions. Consumers should be empowered for deciding and managing to which extent they want their contents to be hyper-personalized, and by whom. Personal Data Spaces would enable them to manage their own user profile and enforcing self-set rules. Also, obtaining data valuation information and decide trading options. In turn, content creators would benefit of better data quality as it is validated by user actually generating it.</p>
	Immersivity	<p>Ethical collection and monitoring of personal and sensitive data</p> <p>Advances in immersive media will eventually make possible delivery of multisensorial experiences, which in turn will generate user reactions and traces likely to be measured and processed. This may raise ethical concerns about the handling of personal and sensitive data (e.g. resulting from emotional and behavioural monitoring) for increased interactivity and enhanced UX.</p>
<ul style="list-style-type: none"> • Artificial Intelligence • Discovery and identification tools 	<ul style="list-style-type: none"> • Hyper-personalization • Media analytics 	<p>Ensuring media pluralism and diversity</p> <p>Advances in AI have proven successful for content personalisation and recommendation. Nonetheless, there are concerns about how algorithm-driven media services may be inadvertently</p>

NEM Position on Next Generation Internet

<ul style="list-style-type: none"> • Software defined technologie 		<p>fuelling threats to pluralism and diversity (e.g. eco-chamber effect¹, algorithmic bias and discrimination²). There are still questions on how media pluralism and diversity can be measured in the digital society, and how algorithmic-driven threats can be addressed in a way that it preserves both societal and business interests.</p>
<p>Distributed architectures and decentralised data governance</p>	<ul style="list-style-type: none"> • Secure and trustable content - Block chain 	<p>Systems for monitoring and enforcing rights compliance regarding user generated data, and user generated contents.</p> <p>This line of action should help users to track down transactions involving their data. Also, to register and monitor compliance of IP rights over user generated contents shared online through social media and other webservices (e.g. recording of agreed data transactions with third parties and remuneration; ability to track down information and detect fraud or misuse).</p>

5. Additional relevant NEM research domain to NGI

Content processing

The content processing research domain as defined in NEM SRIA poses several relevant research topics which are relevant for the NGI.

Technologies to process and manage crowd content (classifying, annotating and fusing open content (optionally with proprietary data) will be needed to handle new open (user-generated) content and ensuring a more level playing field for any citizen and business willing to distribute contents and promote and engage in the participation of society on content generation.

Object-based representation, coding and rendering technologies (object-based, wavefield lightfield capturing, coding and rendering) for representing and coding single visual objects are needed for enabling new immersive media formats and innovations in contents and easing its distribution and consumption via decentralized networks.

¹ <https://www.wired.com/2016/11/filter-bubble-destroying-democracy/>

² <https://www.nytimes.com/2015/07/10/upshot/when-algorithms-discriminate.html>

NEM Position on Next Generation Internet

Lowest delay capture to photon video delivery. For many applications (augmented reality, interactive applications, tactile internet) lowest delay capture to photon (down to 1 ms) is required.

Evaluation human-computer interactions and immersive content and technology

Methodologies, technologies and tools to assess objectively the quality of the experience of an user when interacting with immersive content are a specific area of research which becomes highly relevant for the NGI where novel and more natural ways of interacting with devices based on immersive environments. This research area aims at identifying where and when are the pros and cons of these novel interfaces, based on the user's mental state during interaction. For instance, estimating the user's mental workload during interaction can give insights about where and when the interface is cognitively difficult to use. Beyond evaluation alone, physiological computing could also improve existing interfaces by increasing the symbiosis between the user and the interface, e.g., for visualization and analysis of large amounts of data.

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6. Conclusions & recommendations

NGI is a human centric initiative and NEM is obviously THE European Technology platform addressing human needs in terms of content and interaction.

One of the most important concerns of European is security&privacy linked with service personalisation. Hyper-personalisation is part of the NEM Agenda and research topic proposals have been clearly identified. In this context trust is one of the key ingredients to develop the Next Generation Internet fitting user needs and wishes.

The current Internet weaknesses with regards to the Next Generation Internet are mainly addressing personal data.

Today, personal data are learned by each application and stored in each service provider data base on which a number of Artificial Intelligence treatment are made in order to shape the user profile.

These personal data are not the same for each provider, the value of them is clearly the service provider business model.

In the Next Generation Internet the idea is to give back to the end user the management and the control of its personal data and to separate content and data from internet based software.

This solution has a number of advantages:

- The end user has the complete control of its own personal data
- Service portability, i.e. the possibility to use any service/application without being linked to a specific service provider (OTT)
- Green, instead of multiple storages of personal data in each service provider data center, there will be only one storage location (eventually at home)
- The competition between service providers is no more on the capacity to collect personal data but on the intelligence of their software based on artificial intelligence
- The end user is able to control the access to its personal data which could avoid or at least decrease the number of fake personal information (mainly in young's social networks)

NEM has obviously all the competencies to fix such issue and could bring inputs to the design of such a personal data which needs to offer standardised APIs to service providers

NEM should have a big role to contribute with the vision of the European Industry to the Next Generation Internet

For such a challenge, NEM is proposing the following approaches

- Appetite for collaboration among interdisciplinary groups engaged in a mixture of long term and applied research projects.
- Transdisciplinary approaches are needed. Importantly research needs guidance by the social sciences, user needs and awareness of the "known holes" in the current internet.

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- The "citizens" involvement as "actors" in the research is crucial. This may include representative bodies, policy makers and regulators but this need to encompass women, students and activists.