Next Generation IoT

Fireside Chat and Strategy Forum Meetings

Haydn Thompson

Drivers for NGIoT

- **The Internet of Things is growing fast and is predicted to be a $1.3 Trillion market by 2026.**

- EC Fireside Chat Report, "*Edge computing is the logical evolution of the dominant cloud computing model, avoiding the transfer of mission-critical data to the cloud, supporting resilience, real time operations, security, privacy and protection while at the same time reducing energy consumption and carbon footprint. In edge computing, the processing moves from a centralised point, closer to (or even into) the IoT device itself, the 'edge' or periphery of the network*."

- Although today's public cloud infrastructure market is controlled by three global companies headquartered in the United States, accounting for 80% of global revenues, the prediction is for a paradigm shift such that **80% of the data processing and analytics will run at the edge of the network where it is most efficient in the next five years to create the "Internet of Intelligent Things".**

- The Strategy Forum workshop brought together over 400 stakeholders and experts to advance the design of a **strategic European vision for Next-Generation IoT and Edge Computing with a market window of 5+ years**.

Fireside Chat Meeting

Next-Generation IoT and Edge Computing unlock the potential for intelligent autonomous applications becoming a key factor in the coming years for creating the Internet of Intelligent Things.

The opportunity for Europe is at the intersection of the Cloud IT world and the operational world, because we are stronger in the operational world.

The Edge and Edge-Cloud federation is game changing and in real-time applications non-functional and functional requirements have to be addressed together. The winner will be the one who understands fully the sectoral requirements.

The EC is adopting a balanced approach with top-down actions stimulating alliances at a corporate level underpinned by bottom-up targeted R&I to build a solid foundation for an IoT and Edge Computing ecosystem.

- The Fireside Chat meeting highlighted Europe's strengths in the operational world and in understanding sectoral requirements.
- IoT and Edge Computing Platforms and Orchestration Mechanisms are needed to provide an integrated environment for the next-generation intelligent decentralised IoT systems.
- Strong support was given for strategic actions that bridge between existing activities to create European critical mass and ecosystems to enable collaboration across constituencies providing linkages between cloud, IoT, ECSEL, KDT, etc., to work on trusted multivendor open orchestration integration platforms and fair marketplaces.
- The initiative on Next-Generation IoT and Edge Computing supports implementing the European Strategy for data across the IoT, edge, cloud continuum. It provides a medium-term future-looking perspective complementing Europe's initiatives on common data spaces and federated cloud infrastructures.

Strategy Forum - System Integration Platforms

We cannot build the Energy Systems of the future on the silos of the past.

Energy Sector

A major step forward would be agreement on a common operating platform.

Automotive

There is a convergence between Operational Technologies and Information Technologies which leads to IoT.

Industrial Automation

Know-how in embedded applications is a European differentiator to win markets.

Semiconductors

There is a need to build a trusted environment where every element is secured and manageable.

Data Driven City

The Connectivity Standards Alliance has become a multi-technology alliance with the Matter Data model considering connecting sensors at the edge.

Home Automation

For cross domain applications it is only necessary to understand what needs to be published and explained to developers in other domains.

Standardisation

Non-functional requirements are a key driver in application domains

Ecosystems and Alliances

To go to the next step users and providers need to build together. It is important that dataspace facilitation is considered first.

GAIA-X
French-German GAIA-X initiative targets cloud and data sovereignty, data interoperability and portability providing terms and conditions for data sharing to promote trust.

Open APIs that can be used by edge application developers are a powerful enabler for new businesses.

ETSI-MEC
industry driven group in ETSI, leading international standardisation on edge computing, in alignment with 3GPP. The Multi-access Edge Computing (MEC) standard considering 5G and WiFi.

Alliances must be open as Europe needs to be part of global ecosystems.

AECC
The AECC Alliance was set up in response to a Japanese automotive player needing to bring people together to solve a specific integration problem.

A pan-European strategy is needed based on collaboration, roadmaps, joint public private funding and standards.

ARTEMIS Industry Association
The ARTEMIS-IA covers a number of industry focal areas including digital industry, health and well-being, energy, digital life, transport and Smart mobility.

Concentrate on impact by building ecosystems around critical and high value projects to accelerate key markets.

Linux Foundation
The Linux Foundation hosts over 400 open-source projects with code contributions from around 250K developers.

Trusted business alliances are needed to monetise end-to-end solutions in the IoT value chain.

Global Semiconductor Alliance (GSA)
The GSA Trusted IoT Ecosystem Security (TIES) is a platform-based business ecosystem supported by over 270 semiconductor, electronics and software suppliers.

Open-source projects should strive for a clear positioning, in particular in the context of existing architectures and industrial offerings.

Eclipse Foundation
Eclipse provides a sustainable, vendor-neutral collaborative environment.

The importance of software will increase with a growing share in applications.

NESSI European Technology Platform
The NESSI European Technology Platform promotes research in software.

Trust and Trustworthiness

Data collection should be minimised and data should be deleted when no longer required.

Data policies are needed for transparency as well as ways to opt out of providing data.

GDPR is a fact of life in the EU. It is important to concentrate on trusted data sharing.

Data

Trustworthiness can be considered to be a business value and a unique selling point.

Trustworthiness has been identified as a core characteristic of AI.

AI

Trusted IoT and Edge Computing Platforms and Orchestration Mechanisms are needed to accompany digitisation which will transform relations between stakeholders across sectoral value chains but also across different sectors.

Digital trust is key to digital transformation.

Trustworthy Systems

Trustworthiness needs to be addressed as a "first-class citizen" rather than an add on.

Liability

If the cost of certification is too high it can be an entry barrier - the main trust principle is that the system provides no surprises.

When considering responsibility and liability trust is absolutely essential.

Visionary Concepts

There is a convergence of technologies in IoT, edge computing, AI, wireless and cellular 5G/6G, digital twins, etc., which is leading to new terms such as "artificial intelligence of things", "internet of intelligent things" and "swarm intelligence"

The move towards collective intelligence will require intelligent orchestrators for heterogeneous systems leading to swarm computing concepts.	Unbundling of hardware and software can be used to provide an alternative approach to de facto operating systems.	We need to build upon existing technologies to evolve rather than have a revolution in technology.	Strong collaboration is needed to create end-to-end orchestration with easy-to-use APIs utilising portable software.
AIOTI	**Eos Open Platform** (mobile devices & smart phones)	**HiPEAC**	**5G**
European open source should be used to build a European sovereign edge cloud.	Future platforms need to support intermittent connectivity and mobility of applications.	A high degree of automation will be needed for manageability.	A flexible decentralised next generation reference architecture is needed.
Open Nebula (ONEedge.io)	**fortis**	**ThreeFold Tech** (Linux OS for Edge)	**TERMINET** (IoT Reference Model)

Concluding Remarks

Opportunities

- There is a huge potential in Europe for edge computing applications.
- Europe has strengths in systems design for key industrial sectors such as manufacturing, automotive, etc.
- Data should be at the heart of new policies and Operational Technologies that address performance and Information Technologies that provide cloud computing robustness and high availability are coming together to create IoT applications.
- The key differentiator in future will be in providing trusted orchestration platforms that can support the non-functional requirements of the application domains. This is an area where Europe is a leader.
- Nodes optimised for AI inference will be a major share of future edge devices driven by killer Apps in the video processing domain, e.g., Augmented Reality, Virtual Reality and Autonomous Driving, but these may become commodity APPs.

Ecosystems

- There are already many alliances bringing ecosystems together and several associations have produced roadmaps identifying that cognitive CPS and containerisation, etc., will be important in future cloud-edge and edge-edge interactions.
- There is a need to focus on data sharing and interoperability across heterogeneous systems allowing access to edge computing addressed through standardisation, architectures, governance, open APIs and ecosystems.
- It is important that ecosystems are open, global and driven by requirements.

Trustworthiness

- Trustworthiness will be a Unique Selling Point for business and this is a property of the whole system, not just parts of the system. Systems should be loyal to the user not the service provider or owner.
- Key issues are certification and authentication, and security has to be ensured via new cryptographic approaches.

The Way Forward

- Europe needs to concentrate on impact by building ecosystems around critical and high value projects that accelerate key markets.
- Beyond functional demonstration there is a strong need for acceptance testing and demonstration of business value.

Summary of Pitches

Sectors

- Intelligent Traffic Management, Industrial Automation, Healthcare, Agriculture, Smart Cities, Logistic Supply Chains, Energy, Food (Restaurants), Public Protection and Disaster Management.

Platforms

- Platforms for decentralised systems and edge computing, edge-to-edge computing, web of things.

Linkages

- GAIA-X and ECSEL

Orchestration

- Network Management and Orchestration

AI at the Edge

- Many pitches highlighted competence in AI, trustworthiness and federated learning were also highlighted

Testbeds

- Testbeds for edge, 5G were offered

Outreach and Commercialisation

- Dissemination, IP protection, cascade funding, digital transformation for societal impact.