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In this issue:

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Industry Association

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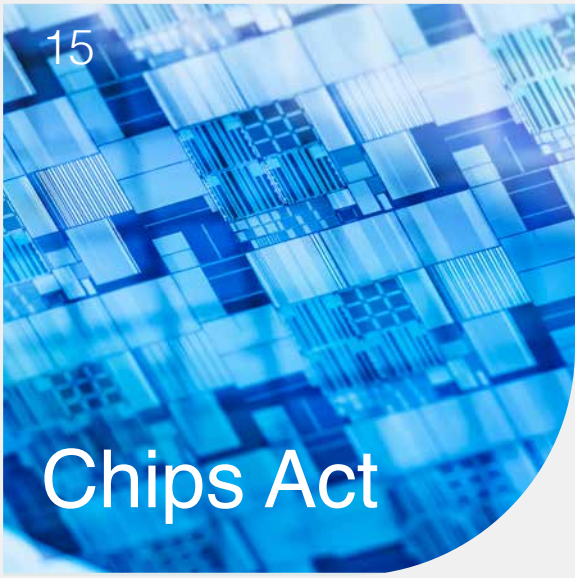

Dear reader,

With the launch of the Chips Act and the Chips JU, along with the Chips JU launch event in Brussels closing off this eventful year, Inside Industry Association presents some of the crucial contributions being made by its members and the wider community to enabling Europe to become an industrial powerhouse in the markets of the future. The article on the Chips for Europe Initiative outlines how the Chips JU (formerly KDT JU) will emerge as a central force within the framework of the European Chips Act.

This European force will be fundamental to feed the evolution of Frontier Technologies such as Web 3.0 that are still evolving and require time to consolidate, with the possibility to revolutionise the digital transformation of our industry, economy, and society. The article about Web 3.0 presents the pros and cons of the next generation internet, highlighting the necessity of investments in research, innovation, standardisation, and more collaboration between stakeholders, industry experts and policymakers: with the Chips for Europe, our community has the right R&I instruments to shape the evolution of foundational technologies enabling the existence of Web 3.0.

In this context – the European force – Dr Jerker Delsing brings us up to date on the Eclipse Arrowhead developments where he champions affordable solutions to cooperative automation, with the focus on edge integration for heterogeneous cyber-physical systems or systems of systems such as IoT. He promotes European industry as automation leader, with a solid ecosystem of global companies, explaining how Europe excels in the current edge arena but needs to consolidate the leadership and extend it to the new technology.

This edition of the magazine also introduces Latvia's Institute of Electronics and Computer Science, whose aim is to create new knowledge, develop innovative technologies and demonstrate their practical impact on real-life applications. Transforming research outcomes into viable commercial products or services requires a delicate balance between scientific innovation and entrepreneurial acumen. Dr Kaspars Ozols and Dr Rihards Novickis share Europe's high ambitions and are fully aware of the increasingly complex geopolitics and intertwined supply chains that confront initiatives like the Chips Act, and underline how privileged they feel to enjoy the benefit of international collaboration, like with INSIDE.

We also present the Swiss Center for Electronics and Microtechnology, which has expanded beyond its heritage in precision manufacturing to encompass everything from artificial intelligence and digitalisation to renewable energy and the life sciences. In this article, Dr Erika Györvary, Lead of European Affairs, discusses CSEM's successes so far, highlighting the crucial role of collaboration that goes beyond countries' borders and the importance of being active in associations like INSIDE, especially given the global nature of the challenges we have to face.

Furthermore, we take a look at the Open Continuum CSA, which is geared towards fostering an open ecosystem for the Cloud, Edge and IoT (CEI) Continuum: INSIDE is part of this initiative sharing the global knowledge of an extensive network of more than 260 members that represent almost the entire value chain in the computing continuum. INSIDE is contributing on topics such as industrial strategies, technology roadmaps, standards and policy recommendations, matured in its participation with ECSEL, KDT and Chips JU, and through the ECS-SRIA.

As a follow-up on AI, we introduce the success story of the SME ZYLK that contributed all its knowledge of AI technologies for edge computing and presents MLBuffet, the main result of its research from the FRACTAL project. MLBuffet allows companies to get insights from data in real time and without the need for an Internet connection, improving competitiveness, optimising resources and increasing their business value in the market.

The second ***Ad Maiora*** article focuses on Dr Annalisa De Pastina, Senior Scientist at SAL Silicon Austria Labs. Annalisa really represents the spirit of INSIDE when she highlights the importance of solid multidisciplinary and multicultural research to achieve the best results in innovation, and when she says "if there is no application, there is no need for it". She recognise the fierce competition characterising the semiconductor market, thus the importance of the Chips Act for initiatives like European Semiconductor Manufacturing Company that will provide advanced semiconductor manufacturing services to strengthen the European semiconductor ecosystem.

Finally, we turn our attention to the Delft University of Technology spin-off, Bi/ond, an innovative biotech startup focusing on developing inclusive and precise cures for all by engineering silicon chips that mimic the human body. Bi/ond represents a success story of a start-up created by enthusiastic and talented researchers supported by an ECSEL project called InForMed. Over time, Bi/ond has become a pioneer in the biotech industry, actively contributing to advancements in drug testing and reducing the reliance on animal testing in pharmaceutical R&D.

This magazine contains a very diverse and fascinating series of articles, and I hope you will draw inspiration from them and perhaps prompt you to pitch your own story and/or views to us: INSIDE is a dynamic community that is growing quickly, where active participation is encouraged and valued.

Paolo Azzoni
Secretary General

Technology Frontiers

Web 3.0 Game-changing possibilities for digital transformation

Paolo Azzoni

The Internet and World Wide Web (WWW) as we know them today are the results of more than 20 years of technology evolution from the Web 1.0, characterised mainly by static and non-interactive contents, throughout the Web 2.0, centralised by few tech giants and known as the read-write Web or the social Web, and the recent Web 3.0, which is supposed to bring the control of security and privacy back to the users.

The third iteration of the web marks a significant paradigm shift based on decentralisation, solid security technologies, artificial intelligence, edge computing and virtual reality, with a new concept of secure application (dApps) running on decentralised and community-driven networks. The addition of semantics and machine learning enables computers to understand the meaning behind information on the web, learning from it and providing a new generation of services and a completely redefined user experience.

The evolution of the technologies associated with Web 3.0 has been turbulent: consider the fluctuating popularity of cryptocurrencies and of related technologies such as the blockchain, or the reduced enthusiasm for the metaverse, or the focus on decentralisation of the future internet which has significantly diminished. Nevertheless, Web 3.0 is introducing significant structural and technological changes which are destinated to remain, being already behind today's web, but according to several studies only a limited number of organisations (20-30%) have concrete plans and defined strategies to exploit Web 3.0, signalling a clear lack of confidence in the new technologies.

In what ways can Web 3.0 technologies consolidate, improve and accelerate digital transformation? How will it change our lives? Let's dig into it...

Web 3.0 explained

The debate about a Web 3.0 definition, about its enabling technologies and its connections with the digital transformation is still open: in 2006, Tim Berners-Lee, who invented the web in 1989, stated that "People keep asking what Web 3.0 is. Maybe when you've got an overlay of scalable vector graphics — everything rippling and folding and looking misty — on Web 2.0 and access to a Semantic Web integrated across a huge data space, you'll have access to an unbelievable data resource…". More or less, this is exactly an early vision of what Web 3.0 has and will become.

The third-generation internet is based on a decentralised architecture, driven by machine learning and artificial intelligence, and leveraging blockchain as the core security technology, to allow users retaining control over their data, contents and assets, and selling or trading them without losing their ownership, without being tracked, risking security and privacy, and without relying on intermediaries. Indeed, Web 3.0 also introduces a change in the business model.

> In a secure decentralised market, data can be trusted by all the organisations that are participating in that market, without any of them owning that data.

A key technology for the innovation introduced by Web 3.0 is blockchain, a decentralised ledger that records all peer-to-peer transactions and allows transactions to be managed without the necessity of a

Web 1.0

1989-2004

- Data gathered and stored in single database
- Static content hosted on web servers
- Read only simple web pages
- Very limited interaction
- HTML

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Web 2.0

2004-2020

- Known as “interactive read-write and social web”: the web we know
- Individual users add data to centralized database
- Dynamic & collective & interactive content
- AJAX, Javascript

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Web 3.0

2016-beyond

- Decentralized
- Individual users can add data & monetize them
- Ensure security, privacy, anonymity, robustness
- Dynamic and executable
- Semantics and AI
- RDF, XHTML, RDFS, OWL

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central clearing authority. The blockchain introduces the concept of digitisation of assets via tokenisation: in a blockchain network, tokenisation converts assets and rights into a digital representation, also called a token. And tokens can become a form of digital currency, such as non-fungible tokens (NFTs) that can easily be exchanged across networks, introducing a new user-centric business model that democratises finance and commerce. NFTs assign an economic value to unique digital assets, which are owned, sold and monetised by users for their own gain.

The shift from the centralised web (Web 2.0) to a decentralised peer-to-peer architecture is enabled by edge computing which - allowing data collection, storage, processing and communication almost everywhere, every time and on any device - makes the new internet ubiquitous, inclusive and easily accessible, and allows the existence of decentralised applications (dApps). Unlike centralised applications such as cloud-based services like Google Docs, which have full access to all of the information in users’ documents, including the ability to read and manage it, dApps benefit from cloud services without having to adhere to a centralised entity. dApps run online on a blockchain or peer-to-peer (P2P) network of computers, and these computations are compensated by the value of blockchain NTFs (e.g. Ethereum “gas” fees). From the user perspective, the only way to use dApps on Web 3.0 is with a crypto wallet, a special dApp that allows a user’s private cryptocurrency keys to be stored and digital money to be sent, received and spent: crypto wallets are available as an extension of a browser like Chrome (a solution prone to many security issues) or as a built-in security functionality of security- and privacy-oriented browsers like Brave. dApps cover a wide range of application domains, including banking, gaming, education, social media, etc.

The new business model introduced by Web 3.0 also relies on the concept of smart contract, which consists of a self-executing contract where the conditions of the agreement between the buyer and seller are defined directly by lines of code and disseminated throughout a decentralised blockchain network. Transactions become trackable and irreversible, and programming regulates their execution. Smart contracts “close the circle” on decentralisation because they eliminate the need for a central authority, a legal system or an external enforcement mechanism to manage and execute trustworthy agreements and transactions between remote and anonymous users. This allows the provision of fairer and trustworthy financial and legal services at a considerably lower cost than traditional solutions.

The Semantic Web and artificial intelligence represent key enabling technologies for the Web 3.0. The Semantic Web (like the web it was created by Tim Berners-Lee) introduces on the web information and meta-informati on that represent a navigable space of interconnected (linked) objects,

> Web 3.0 has the potential to disrupt the current internet infrastructure by decentralising the internet and removing intermediaries.

with URI-to-resource mappings, that are machine-processable, allowing computers to autonomously modify data in a better way and on users’ behalf. While linked data could essentially disrupt the way information domains become interconnected, blockchain goes further to disrupt the way data is stored and managed, adding increasing data availability, data immutability and crowdsourced data. Semantic Web enhances online technologies intended to analyse, create, share and link online material relying on the capacity to “understand” the meaning of words rather than using keywords or numbers such as in Web 2.0. But Semantic Web focuses only on data and universal data models, allowing the machine to read data: AI on the other hand goes beyond inference and is capable of applying reasoning. In Web 3.0, AI, machine learning and natural language processing build on Semantic Web, allowing computers in Web 3.0 to discern and process information in a human-like manner, producing more relevant and useful information in a faster way and better meeting user needs. Coherently with the decentralised architecture of Web 3.0, these technologies are available today almost everywhere and on

every device, thanks to powerful, efficient and miniaturised hardware and a new generation of embedded software (Apple Siri is a good example of dApp enabled by Web 3.0 and its core technologies).

Web 3.0 pro and cons

The advantages introduced by the new generation of the web lay in both technical and non-technical aspects:

- The decentralised architecture and blockchain technology significantly increase the level of security, privacy and anonymity, ensuring more control over personal data and complete users' ownership of their information, which is shared only with users' permission and on a case-by-case basis. Consequently, access to users' data won't be possible and the big tech giants will be no longer able to use and resell it to advertisers without user permission and compensation.
- The absence of intermediaries prevents the presence of third parties charging fees for services, simply because, with decentralisation, providers and end-users get a direct connection.
- Web 3.0 means transparency because, no matter what blockchain users select, the primary functionality is data tracking and the code behind platforms can be inspected.
- Web 3.0 blockchain decentralises storage and enhances security, specifically the encryption technology, allowing the sharing and analysis of data, and collaboration without the risk of exposure, data leakages and attacks, offering new opportunity for all industries to improve security and productivity.
- Semantic Web and AI based services can significantly automate various tasks and generate more valuable information, leading to increased efficiency and productivity, with an improved user experience. Directly and indirectly, these services can also lead to a personalised user experience, promoting and simplifying the collaboration between industries, and creating new business opportunities.
- Thanks to decentralisation, in Web 3.0 data are always available in any circumstance because data are distributed over various nodes of the network to provide redundancy: decentralised networks do not have a single point of failure. The result is the possibility to provide seamless services, characterised by no service interruption and more robustness against security and operational threats, like account suspension and denial of distribution services.
- By providing a global data layer, blockchain improves interoperability between various devices and platforms without a costly and resource consuming integration process. Improved interoperability accelerates the creation of new ecosystems.
- Web 3.0 allows users to use a single profile on all platforms, services and dApps.

The technologies at the core of Web 3.0 are still evolving and thereby presenting some disadvantages and, like every time a structural change is involved, they are difficult to apply to existing solutions, limiting their widespread adoption:

- Ubiquity is a critical element for the existence of Web 3.0, requiring that the devices on the network meet specific criteria to appreciate the benefits of Web 3.0. As a result, a lot of existing devices won't be able to become part of the Web 3.0 network. This is particularly critical for devices taking part efficiently on Web 1.0 or Web 2.0 but that, due to obsolescence, will not be able to support Web 3.0.
- Web 3.0 introduces a more user-friendly experience but also requires a cultural and mentality change, which could represent a serious obstacle for the technology adoption by new potential users.
- The access to Web 3.0 technology and solutions is currently expensive. One of the most prominent perceived challenges for organisations trying to adopt Web 3.0 is the cost required to upgrade their existing infrastructure, process and workflows. A deep requirement analysis of the business and of its evolution is required to avoid applying Web 3.0 technologies to situations that don't require it.
- From a social perspective, like the negative effects generated by social media, the virtual reality made available by Web 3.0 could generate addiction issues, unrealistic life expectations and unhealthy comparisons with other users, while others may even begin to prefer the virtual to the real world.
- Despite the potential benefits of Web 3.0, decentralisation, blockchain and cryptocurrencies represent excellent and profitable tools for criminals, organisations and even governments to exploit these systems for personal gain, immoral, unethical and illegal purposes.
- Paradoxically, blockchains could end up being a privacy nightmare for users because they record every transaction, allowing wallet owners anonymity but giving space to cybersecurity professionals employed by organisations or governments to track down the owner of a wallet, without any warrant or any type of legal injunction. In addition, considering the immutable nature of blockchains, it might be extremely difficult for users to delete or remove their account or profile permanently.
- There is a general concern that Web 3.0 will only have the appearance of decentralisation, being owned by the venture capital firms or hedge funds that own large amounts of tokens in the blockchains on which Web 3.0 is based.
- Web 3.0 is often associated with cryptocurrency, with all the related negative connotations that they could have, or it is confused with only the blockchain, making the digital transformation process just the deployment of existing services on the blockchain.

Web 3.0 and IoT

The adoption rate of digitisation solutions based on the Internet of Things (IoT) is continuously increasing and, despite supply chain issues and chips shortage, the number of IoT connected devices is expected to grow globally to 50 billion already by 2025. The IoT is commonly known as a network of physical objects connected via the internet, allowing the information in the nodes on the edge to be collected and processed, exchanged and further processed in more powerful nodes up to the cloud. The concept of IoT can encompass many different "things" and it is easy to link it to the Web 3.0. Current IoT solutions are based on a centralised infrastructure, frequently managed by organisations affected by security and privacy issues and adopting business models based on data and user lock-ins to maximise their business impact and create economic value.

Web 3.0 introduces a paradigm shift based on data ownership and decentralisation that could fundamentally transform the IoT architecture and how IoT operates, and opens new opportunities for Web 2.0 IoT-based companies to redefine their value propositions, customer engagement strategies and adopt other business models.

What is Web 3.0 used for?

Web 3.0 is not visible, but you certainly have already used it, without knowing, in various application areas including education, virtual reality, exchange services, finance, SW development and social networking.

BROWSER

Brave

A Web 3.0 browser is a browser natively capable of connecting to Web 3.0, and provided with crypto wallet, privacy and anonymity capabilities. It is more secure than crypto wallets because it doesn't allow to be extended with add-on that can be spoofed, nullifying the security protection of Web 3.0. E.g. Google Chrome needs extension like MetaMask, while Brave has a native wallet: no extensions is required. Moreover, Brave blocks trackers, fingerprinting, and phishing; has a built-in firewall + VPN; and advanced features like query parameter filtering and private windows with Tor.

OPERATING SYSTEM

Essentia

Essentia is a modular decentralized interoperability and data management framework that empowers the user with the full ownership and control over his identities, data, wallets, assets, dApps. Using the Essentia framework it is possible to operate them in the decentralized web in an easy way, anywhere and from any device.

ARTIFICIAL INTELLIGENCE

Siri

Siri is Apple's AI-based virtual assistant: it uses voice recognition to communicate with the users and AI algorithms to support user needs. Siri is widely based on Web 3.0.

OPERATING SYSTEM

EOS

EOS, the Entrepreneurial Operating System, is a complete blockchain platforms that support decentralized applications (dApps): unlike bitcoin platforms it is part of a broader Web 3.0 ecosystem, EOSIO, intended to move the features and functions of computing, and even the internet itself, onto blockchain networks. EOS is the blockchain platform and its native tokens, while EOSIO is a platform providing the foundation for EOS and other blockchain networks

VIRTUAL REALITY

Decentraland

Decentraland is an online virtual world or metaverse, allowing users to socialize, play games, and attend events. It provides its cryptocurrency (MANA) and a wide variety of dApps.

COMMUNICATION

Ethlance

Ethlance is a job market platform intended to connect freelancers and developers with employers. It is fully decentralized, because its database runs on the Ethereum public blockchain and the front-end source files are distributed on IPFS.

STORAGE

IPFS

IPFS (Interplanetary File System) is a file system that allows the storage of files and version tracking (like Git) on a distributed network (like BitTorrent), allowing direct interaction through a secure and global P2P network. Combining these functionalities, IPFS enables a permanent new web and improve the way existing internet protocols like HTTP can be used.

DEVELOP

Web3-react

Web3-react is a Web 3.0 framework used to build decentralized apps on the Ethereum blockchain network. Like React, the framework is simple, easy to use, and extensible being able to work with other wallets. It uses React architecture to help you build the Front-End of a dApp. It has not a traditional data architecture, allows to write plugins to the blockchain programmatically, and it is perfect for building robust, extensible, and systematic dApps.

STORAGE

Storj

Storj is a crypto-powered cloud storage platforms allowing any computer running Storj to rent unused hard drive space to users looking to store files: unlike a cloud manage by a company (e.g. Amazon or Google) it relies on SW and a network of computers to manage its data storage. Key to the network design is the STORJ cryptocurrency, which allows users to pay other users on the network to store their files, or users with excess storage capacity to sell it.

FINANCE

IDEX

IDEX is a decentralized exchange platform for cryptocurrencies supported by Ethereum, Polkadot, and Binance Smart Chain. It includes elements of centralized exchanges that make the network faster while maintaining its integrity as a decentralized environment: the objective is to execute and process thousands of transactions per second.

COMMUNICATION

Status

Status is a multi-purpose communication system, combining a private messenger, a decentralized crypto-wallet (giving user's funds autonomous control), and a Web 3.0 browser (enabling interaction with peers and DApps). All Status transactions require security verification, protecting from phishing attacks.

SOCIAL

Steem

The Steem blockchain is the core of an ecosystem of decentralized social media platforms based on Steem protocol. Some example are Steemit, D.tube, and Dlive. Steem has been adopted also to develop other decentralized applications (dApps), like decentralized finance (DeFi) and blockchain gaming.

SOCIAL

Akasha

Akasha is a Web 3.0 social media platform based on Ethereum blockchain and offering its users a restriction-free environment to share their innovative ideas and thoughts. It offers an interactive interface which allows users to discuss, comment and upload content.

COMMUNICATION

Experty

Experty is a decentralised teleconferencing app for mobile and desktop. Experts get paid by callers based on their predetermined minute rate. People from across the globe, including the unbanked areas, can sell their time, knowledge, and expertise globally. The objective is to use cryptocurrencies (like Bitcoin) for fair value knowledge exchange. distributed on IPFS.

Moreover, security represents a key issue in Web 2.0 IoT solutions, in terms of software and firmware vulnerabilities, inefficient control of IoT systems, possibilities of cloud breaches, malware risks, lack of security, etc., pushing companies to find a paradigm shift towards an embedded concept of security.

Blockchain is the first core technology of Web 3.0 that could resolve several IoT security issues: for example, the current IoT infrastructure frequently relies on intermediaries and centralised entities to validate the data collected from sensors, while the peer-to-peer blockchain approach and consensus mechanisms (like with cryptocurrencies) allow the addressing of data trustworthiness directly at the source, from the sensor. Moreover, this approach can be extended to devices because the public key they already use to access the IoT network could be stored in a blockchain using a cryptographic identity, allowing the reputation of the device to be transparently defined, in terms of its operational history, its transactions and interactions, the data processed and sent, etc. Each node of the IoT network would retain its privacy despite the traceability of all the operations, and the overall security would increase, preventing DDoS attacks, for example.

From a business perspective, current IoT solutions are company-centric and conceived to reach specific business goals, with IoT infrastructures, platforms and collected data fully controlled by the company. Frequently, users pay for IoT services and devices but don't own the devices or the collected data. Web 3.0 reverses the perspective, starting from customer-owned IoT equipment and connecting them through a community-driven decentralised and token-based IoT infrastructure. With this approach, every device binds with its blockchain wallet and only the device owners can decide how to manage the collected and processed information. Each stakeholder in the IoT infrastructure will receive a compensation for certain functionalities the owned device is offering (e.g. storage, computation, connectivity, or specific applications), and this remuneration is possible because the IoT solution is built on well-designed token economies models and uses digital assets to promote and encourage the community involvement. With the same approach, companies could issue and use NFTs to represent their IoT products on a blockchain, increasing customer engagement and driving social impact, instead of focusing only on the creation of smart and attractive devices and services and their extensive marketing campaigns.

A similar shift will certainly require a multi-phase transformation strategy to minimise the risks associated to the new system architecture, the adoption of Web 3.0 technologies and the changes in the business model. But the flexibility and scalability of Web 3.0 allow an initial hybrid integration to be performed between the existing IoT solution and the new technologies, connecting the existing systems to a dApp and feeding it with the IoT data, thus creating a new hybrid system that allows the migration from the original business application to a Web 3.0 one without changing the architecture of the original solution and the associated digitisation process. After this intermediate step, the transformation of the hybrid IoT solution must focus on the progressive decentralisation of the IoT infrastructure and to handing back the control on IoT devices to customers, reaching the full adoption of Web 3.0 paradigm.

Digital transformation, Web 3.0 and its applications

Why is Web 3.0 so important for the digital transformation? The simplest answer is that it represents an opportunity to share value across an open network, avoiding monopolies, ensuring ownership and control over user data. These factors help avoid many obstacles of technology adoption and help open up new business models. Web 3.0 is contributing to and accelerating the ongoing process of digital transformation and is helping to drive the growth of the digital economy. The digital transformation is a complex concept that involves many distinct aspects of business and technology. It generally refers to the integration of digital technologies into all business areas, resulting in fundamental changes to how business is organised and managed, how it operates, how business processes are automated and how it delivers value to customers. The main purpose of the digital transformation is to improve business efficiency, reduce its costs, increase competitiveness, simplify the evolution of products and services offer, deliver value to customers in new ways, build stronger relations with them, etc.

Web 3.0 can be adopted in many sectors thanks to its tamper-proof, secure and transparent ledger capable of easily tracking digital assets and information that are circulating on the related blockchain network, assigning them a value with digital tokens, processing thousands of automated transactions and simplifying their error-free and efficient management. Web 3.0 also introduces new business model and, in conjunction with IoT and AI, can significantly transform the supply chain of several industries and more generally their digital transformation.

> All vertical domains can benefit from Web 3.0, but the ones that can experience an immediate advantage are those dealing with sensitive data and requiring their trustworthy management.

Web 3.0 is indeed influencing the digital transformation of a wide range of industries, vertical domains, and several aspects of society, including:

- Healthcare, where Web 3.0 is used to develop decentralised applications for medical records management and sharing, benefiting from uninterrupted services, high levels of security and privacy of extremely sensitive personal data and improved interoperability. Web 3.0 simplifies the sharing of medical records between care providers, under the strict control of user consent. This increased level of secure interoperability can be exploited, for example, to ensure that inclusion of multi-brand sensors, wearable devices and medical equipment in our daily life and in medical procedures, to respect our privacy, ethical and moral principles and involve only authorised entities. Also, the supply chain for sensitive goods like medicines gains a great advantage from Web 3.0

security, privacy, and resilience, improving traceability and avoiding frauds.

- In logistics and supply chain management, Web 3.0 technologies allow decentralised applications to be developed for tracking and managing the movement of goods along the supply chains, improving their interoperability, efficiency, transparency and security. Modern supply chains are global, complex, delicate (consider the effects of pandemic) and prone to disruption: the blockchain can consolidate supply chains and make them more resilient, simplify the interactions between the involved actors, improve the integration of supply chain logistics, from manufacturing through shipment to delivery, improve its sustainability and make it transparent, etc.
- For Governments, Public Authorities and Services, Web 3.0 is fundamental to develop decentralised and distributed applications for the storage, management, sharing and usage of any kind of information, potentially in any sector (public and private, financial, administrative, statistical, territorial, industrial, etc.), improving the transparency and accountability of public agencies and services. Voting and online governance could gain great advantage from Web 3.0 in terms of identity verification, secure and trustworthy voting management, vote or election rigging, cyber-attacks prevention, etc.
- Banking and finance represent one of the first vertical domains in which Web 3.0 has been adopted, with digital currencies (like Bitcoin) that have become a global store of economic value, and the blockchain becoming a core solution for digital trading and being used by several countries for asset issuance and security.
- In the insurance sector the Web 3.0 AI can learn to evaluate risk and assess claims on a case-by-case basis, introducing a fairer assessment of premiums, while the blockchain allows the introduction of smart contracts, automation of payments collection, and claims pay-outs. Web 3.0 could transform insurances from annual/semestral contracts to “real-time” contracts paid on a daily or even hourly basis, reflecting the real activities in which the customer is engaging and the actual profile (imagine paying car insurance on a daily basis, with a premium that is proportional to the actual risk: lower when the car is parked, higher when you are driving in traffic).

Web 3.0 key concepts

- Decentralized networks store data within peer-to-peer interconnections. Users maintain data and digital assets ownership and access the network securely without being tracked.
- Edge Computing allows Web 3.0 apps and data to be processed at the network edge on devices such as mobile phones, laptops, appliances, sensors and even smart cars.
- Blockchain ensure user data and assets are protected and encrypted, avoiding their control and unauthorised usage by third parties.
- Web 3.0 is ubiquitous because the distributed content and services can be accessed anywhere at any time via any type of devices, not only via computers and smartphones.
- Web 3.0 is powered by semantics, allowing to generate, share and link contents understanding the meaning of word and concepts and through search and analysis.
- AI solutions based on semantic capabilities and natural language processing allow machine to understand information on a human-like level, better satisfying users’ needs.
- Information is more connected and richer with semantic metadata: the user experience is improved exploiting all available information.
- Virtual reality is enabled by Web 3.0 and it can be used in several websites and services, for several applications (e.g. museum guides, computer games, eCommerce, engineering, etc.).

Web 3.0 main layers

INTERACTION	AR/VR, UI, VOICE/IMAGE RECOGNITION, SENSING, AUTOMATION, IoT
PROCESSING	DISTRIBUTED EDGE COMPUTING, ARTIFICIAL INTELLIGENCE, MACHINE LEARNING
INFORMATION	BLOCKCHAIN (DISTRIBUTED LEDGER TECHNOLOGY)

Web 3.0 technology stack

dAPPS BROWSERS

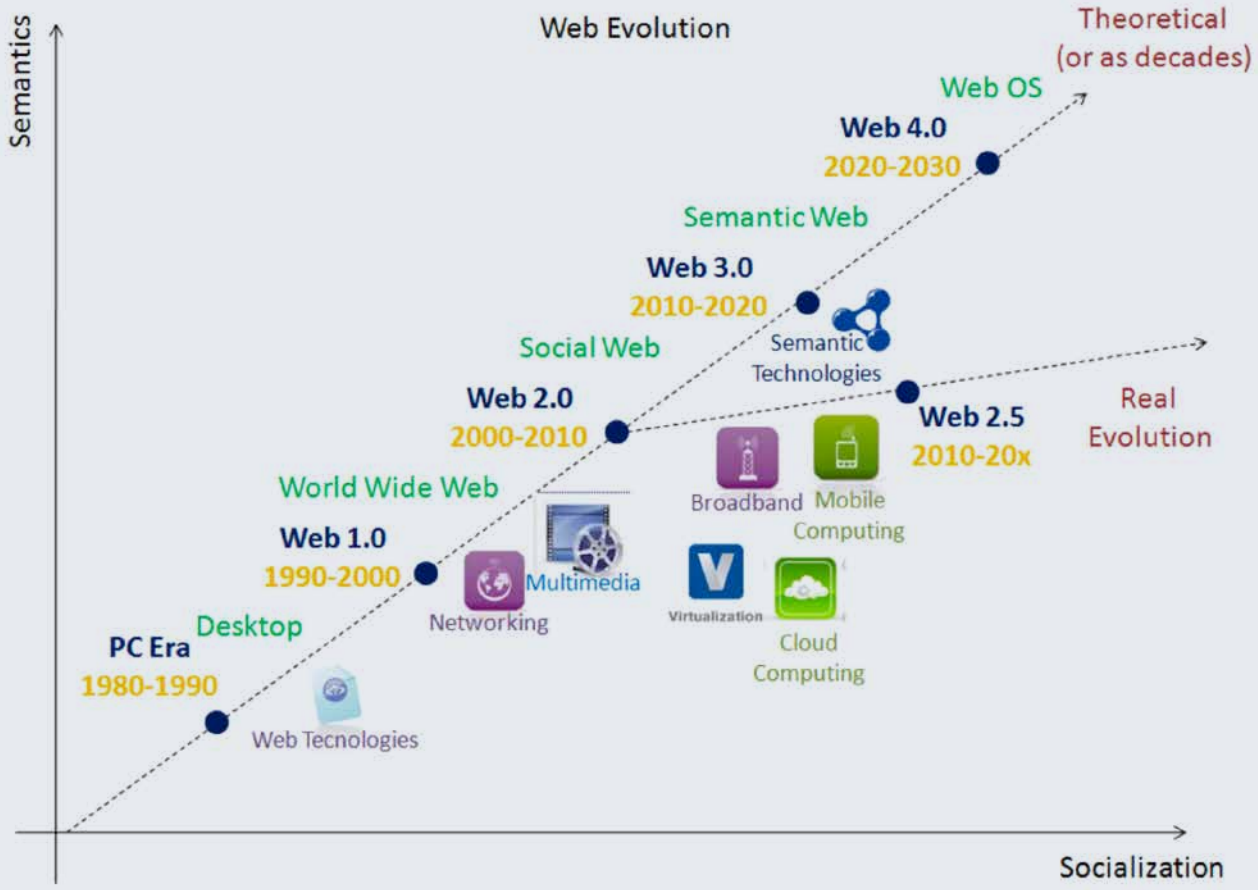
DECENTRALISED APPLICATIONS

MESSAGING, VM, BLOCKCHAIN, IOT, DATA FEED, STORAGE

HARDWARE CLIENTS, M2M

INTERNET NETWORK & PROTOCOLS

- In the real estate sector, the management of land and resources can be simplified and made more efficient with a blockchain-based distributed ledger introducing a structured organisation of planimetries, properties information, satellite imagery and government records. A global property ownership blockchain would improve the control of the territory, the identification of hydro-geological risks, avoid frauds, simplify property trading with digital certificates, etc.
- Web 3.0 opens endless application possibilities in the area of entertainment and social networking. For example, any service requiring identification through a login authentication can benefit from some form of encrypted distributed ledger and from the advantage of using a unique secure digital profile. But we can consider also all the advantages introduced by AI-based recommendations, or the improved user interaction thanks to augmented and virtual reality, more secure interaction thanks to the blockchain, etc.
- In eCommerce and advertising, Web 3.0 introduces a direct relationship between the buyers and sellers and contributes to developing fairer and more secure advertising. Indeed, the current eCommerce models rely very frequently on middlemen to match supply and demand, introducing extra costs for both seller and buyer: Web 3.0 allows the creation of decentralised marketplaces, where vendors can sell directly to customers, AI can support customers in product selection and smart contracts execute the sale and monitor the product delivery through IoT-based solutions. In the advertising sector, user ownership of data and its permission-based sharing reduces the possibility of undesired overwhelming advertising, frauds, un-authorised data sales, fake traffic, identity theft, etc.
- Web 3.0-based tamper-proof, secure and transparent solutions can be adopted in several industry sectors sharing common necessities and similar business models. An example is the energy sector that has been one of the first to adopt Web 3.0 technologies. Despite many initial projects and pilots, which resulted in just



Source: mdpi.com

very expensive solutions and failed the industrialisation step, and despite the need for a new digital infrastructure for the energy sector, Web 3.0 represents a huge opportunity for this application domain which is drastically and quickly evolving, especially considering the need to decentralise network operation decisions. Web 3.0 could simplify the grid management and make it more efficient, introduce the concept of renewable energy certificates, improve energy trading (including the micro-grid level), multiply the number of transactions, and reduce their costs, improve the access to marketplaces, simplify regulatory compliance, etc.

The jury is not out … yet

Web 3.0 technologies are still evolving and require time to consolidate, but they are becoming a concrete reality, with the possibility to revolutionise the digital transformation and have a positive impact on industry and society. Web 3.0 introduces a paradigm shift based on decentralisation and blockchain technology, leading to increased security and control over data, boosted by AI-based services that can automate various tasks and lead to increased efficiency and productivity. Embracing this paradigm shift opens up new business models, increased collaboration between stakeholders, potential new job opportunities and novel user experiences, in almost all the application domains, from decentralised finance to autonomous vehicles. Web 3.0 can support the IoT evolution strengthening security, improving resilience, allowing consumers to retake control over their data and eliminating the divide between the physical and digital worlds by connecting almost everything to the internet. However, Web 3.0.0 still presents several issues and critical potential risks that must be urgently addressed, including potential ethical concerns that could mine the foundational principles on which Web 3.0 is based. Moreover, to fully unleash the potential of Web 3.0, we need more collaboration between stakeholders, industry experts and policymakers, more effort on standardisation, on technology scalability, and on continuous research and innovation in Web 3.0 technologies. Electronic components and systems, IoT and edge AI play a crucial role for Web 3.0 and I believe our community is correctly positioned and has the right R&I instruments with the Chips4EU to really drive research and innovation in the foundational technologies enabling the existence of Web 3.0.

An industrial powerhouse in the markets of the future

Jean-Luc di Paola Galloni

Paolo Azzoni

In September this year, an important step was taken in securing the future for the European semiconductors sector with the establishment of the European Chips Act and the amendment to the Regulation establishing the Chips Joint Undertaking under Horizon Europe. For INSIDE, one significant outcome of these changes is the expansion and renaming of the Key Digital Technologies Joint Undertaking (KDT JU), which will now be known as the Chips Joint Undertaking (Chips JU). Thierry Breton, Commissioner for the Internal Market, called it a decisive step forward for Europe in determining its own destiny, asserting that Europe is becoming "an industrial powerhouse in the markets of the future – capable of supplying ourselves and the world with both mature and advanced semiconductors. Semiconductors that are essential building blocks of the technologies that will shape our future, our industry, and our defence base."

At the heart of the European Chips Act is the 'Chips for Europe Initiative'. This aims to enhance technological capacity and innovation in state-of-the-art chips on a large scale, pooling resources from the European Union, its Member States, third countries associated with Union programmes, and private sector stakeholders. Most of this Initiative will be facilitated through the Chips JU, which will also continue the research and innovation activities in the wider domain of Key Digital Technologiesthat are crucial to capitalise the technology advancements upstream in the electronic components and systems (ECS) value chain, and provide innovative solutions downstream to the vertical applications.

Budget boost

There is no doubt that the EU is putting its money where its mouth is. The new partnership will be powered by an augmented budget, with the EU contribution rising from €1.8 billion up to €4.175 billion. Including other private and public contributions, this brings a total budget of nearly €11 billion. The new Chips JU will be responsible for the execution of an extraordinarily ambitious programme, to overseeing this leading European strategic initiative focused on coordinated and competitive innovation activities in the field of electronic components and systems.

In addition to bolstering manufacturing activities within the European Union and fostering the growth of the European design ecosystem as well as supporting the scaling up and innovation across the entire value chain, the European Chips Act represents a major political milestone, in response to the surging demand for semiconductor technology. Recent semiconductor shortages have underscored Europe's dependency on a limited number of non-EU suppliers. Now national Public Authorities are partnering with the European Commission and Industry to execute this ambitious yet strategically designed programme.

At international level, several initiatives similar to the EU Chips Act are being developed to build a more resilient semiconductor ecosystem (e.g. US Chips Act, the Chips 4 alliance, and the initiatives being developed in Japan, Korea and Taiwan). Compared to them, the EU Chips Act proposes a balanced set of measures including scientific research, pilot lines development and first-of-a-kind facilities, a new platform to support chip design and manufacturing, competence centres to address the lack of skilled human resources, measures intended to monitor and prevent future chips shortages.

Digital strategic autonomy, global leadership

The rebranded Chips JU will emerge as a central force within the framework of the European Chips Act, aligning seamlessly with Europe's journey towards digital strategic autonomy and global leadership in the semiconductor industry. It exemplifies the European Union's determination to invest in its future and lays the foundation for ground-breaking innovations in the field of digital technologies. It is the firm assertion of Ralf Bornefeld, Chair of the Governing Board of the JU, that "from research to production and security of supply, European Industry will develop an improved ability to anticipate and respond to shortages in the electronic components and systems sector."

INSIDE Industry Association's President Jean-Luc di Paola Galloni and Secretary General Paolo Azzoni welcome the initiative, commenting that "the Chips Act offers the concrete possibility to consolidate, strengthen and reorganize the supply chain for semiconductors, increasing its resilience and security and including measures intended to support the corresponding value chains for a wide range of products and services. However, the measures introduced by the Chips Act must include a robust support of the ongoing verticalisation of the entire ecosystem, because the global competition in the ECS domain is played out on complete hardware/software solutions. Additional measures are essential to develop and secure the complete supply and value chain down to application domains that are key for Europe. Hence, the alignment will be monitored between what will be covered by the Chips JU and other digital initiatives on applicative domains".

For more information on the European Chips Act and the amendment to the Regulation establishing the Chips Joint Undertakings under Horizon Europe, please refer to the official source documents: Regulation (EU) 2023/1781[1] and Regulation (EU) 2023/1782[2], respectively.

About Chips Joint Undertaking

Chips Joint Undertaking supports research, development, innovation, and future manufacturing capacities in the European semiconductor ecosystem. Launched by the European Union Council Regulation N_o 2021/1085 and amended in September 2023 as part of the Chips for Europe Initiative, it confronts semiconductor shortages and strengthens Europe's digital autonomy, engaging a significant EU, national/regional and private industry funding of nearly €11 billion. The official launch event will be on November 30th and December 1st 2023, in Brussels.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1781

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1782

Ad Maiora

Working on the technology today for the application solutions of tomorrow

An interview with
Annalisa De Pastina

Annalisa De Pastina

Daniela Cancila

Cristina De Luca

Chris Horgan

This second *Ad Maiora* article focuses on the energetic and pragmatic Annalisa De Pastina, who is currently Senior Scientist at SAL Silicon Austria Labs where she leads a multidisciplinary team of physicists and engineers in the field of microsystems and microelectronics. Annalisa's specific expertise lies in Piezo M/NEMS, microtechnology and microfluidics.

Hailing from a humble background, she began her studies in Rome where she graduated with a BSc in Clinical Engineering, followed by an MSc in Biomedical Engineering. She continued her research studies at EPFL (École Polytechnique Fédérale de Lausanne) in Switzerland where she gained a doctorate in Microtechnology, analysing topics like design, FEM modelling and the fabrication of suspended microchannel resonators (SMRs) with integrated piezoelectric (PZE) transduction for biosensing applications. She also worked on the development of an experimental interface for piezoMEMS biosensors including fluidic delivery, electrical connection, vacuum encapsulation and temperature control. She stayed in Switzerland for about five years, dealing with one of the most fascinating challenges in her career: participating to the growth and development of a new Lab from scratch, revolving around MEMS resonators for biosensing and communication applications. It was when she moved to Ireland as a Postdoctoral Researcher in Biophysics at Trinity College Dublin that she realised how she could apply her engineering knowledge to biology, diagnostics practice and analysing data, in this way she started shifting her point of view from concept to practical applications, allowing her to grasp the broader picture of the subject matter.

Dreaming of making the world a better place

As a kid Annalisa would spend hours disassembling objects around the house or observing her father or grandfather building their own solutions on the family farm. Through the combination of these two ingredients, she developed a very practical and pragmatic mindset that she would later apply to her research and development, under the motto that "if there is no application, there is no need for it." It was actually during her high school years that she felt in love with mathematics and physics. That she ultimately chose to take biomedical engineering studies can be attributed to the impact this field can have in making the world a better place and improving people's lives.

Working on making the future happen

Today Annalisa is helping to shape the future of Europe. She is both a scientist and team leader, a dual role that suits and inspires her. She is dealing with the development of microchips that are present everywhere all around us (from phones, laptops, cars, etc.). With her extensive knowledge and experience gained over the past ten years, she has been working in the entire MEMS microchips creation process, although currently the focus is more on the development of acoustic MEMS transducers integrating piezoelectric thin films.

"Technology can change so quickly that we are constantly having to generate updates and predict what society will need in five to ten years' time. As a scientist, therefore, my biggest challenge is to think about the future. For example, the shift in technology towards smart sensors today tells us that this technology will be integrated even more into our lives in the not too distant future. Think for example of glasses. These will be equipped with smart sensors to make our lives easier. And if in the future this technology will be integrated into our daily lives, we as scientists must work on it today to make this happen."

Teamwork

Annalisa coordinates a team of eighteen physicists and engineers from all different fields, since the piezoelectric MEMS they are developing requires knowledge in multiple domains to make it work. Not only is the team multidisciplinary but also multicultural, all with different personalities, expectations and

needs. Her challenge in this case is to bring together everyone´s skills, experience and motivation to achieve, as a team, the best results in terms of innovation. And motivation goes along with excellent and constant communication, something she demonstrated during this interview. The current focus of the team's work lies in automotive applications, consumer electronics (such as microphones to regulate the noise inside aeroplanes), medical imaging sensors, optical MEMS for projectors as well as RF MEMS resonators for 5G and 6G communication applications.

Annalisa underlines the value of feedback from the outside, appreciation from the team and support. "It is priceless to apply all the knowledge I have developed through years of studies in the real day-to-day work. Each time I see the application of any of the microchips we develop, I feel happy because we made it real. But the realisation of a project goes hand in hand with its responsibilities as well, and in my case I feel responsibility towards society. It's essential to remember that our innovative solutions should consistently address a societal need, with the ultimate goal of improving our world. Again, if there is no application, there is no need." In all of this, Annalisa is very clear about the underlying code governing her work and her life. "I believe in fairness, meritocracy, rules and clear properly structured communication."

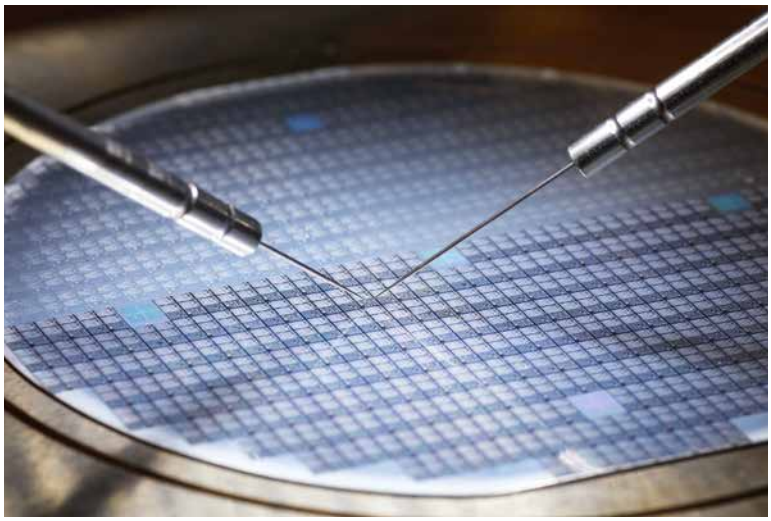
Annalisa in Silicon Austria Labs

European Semiconductor Manufacturing cluster

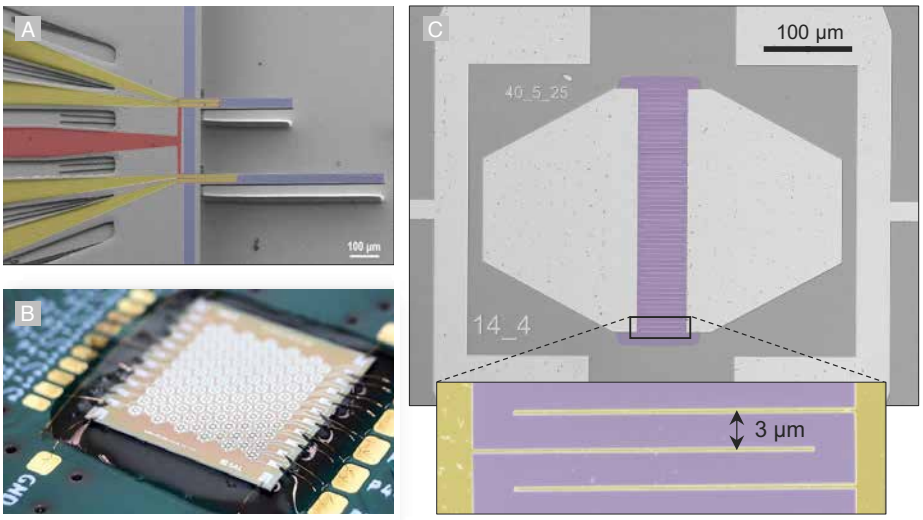
Annalisa is aware of the fierce competition that exists, especially given the urgent demand for microchips, and the external developments of recent years have made Europe realise, albeit late, that it needs to be independent. In terms of production, Asia pulls the strings while for design and innovation the US leads the way. However, in terms of infrastructure and human brain power there is a great opportunity for Europe for future applications. The need to establish a cluster in Europe under the framework of the European *Chips Act*[1] is gaining pace, for instance with the announcement of a plan to create a European Semiconductor Manufacturing Company (ESMC) GmbH, in Dresden, to provide advanced semiconductor manufacturing services[2]. With monthly production expected to reach a capacity of 40,000 300mm (12-inch) wafers, Europe's semiconductor manufacturing ecosystem will be strengthened and about 2,000 direct high-tech professional jobs generated. ESMC aims to begin construction

> "I believe in fairness, meritocracy, rules and clear properly structured communication."

Silicon Austria Labs cleanroom.



Wafer with MEMS devices under electrical testing.



Examples of MEMS devices[3]:
a) suspended microchannels resonators with AlN integrated transduction
b) AlScN piezoelectric micromachined ultrasonic transducers
c) LiNbO3 bulk acoustic resonator for 5G filters

of the plant in the second half of 2024 with production targeted to begin by the end of 2027.

At Silicon Austris Labs, Annalisa is also witnessing and participating to the boosting of new technology opportunities: The Technology Park Villach (tpv), which already houses numerous companies and research institutions, is undergoing an impressive expansion. As part of an infrastructure investment of 17.5 million euros, not only are 3,000 square meters of new office and laboratory space being created, but also the largest research cleanroom in Austria, spanning an area of 1,100 square meters. This state-of-the-art cleanroom is equipped with the latest generation research equipment for microfabrication and prototyping, enabling both the production of chips in small series and research with cutting-edge equipment for micro- and nanoelectronics.

The lack of semiconductors has been problematic, especially in view of recent geopolitical trends. The need to secure supply chains is vital so the construction of new and significant semiconductor foundries and technology centres is needed in order to add innovation and capacity to the range of MEMS devices required to supply the sharply increasing digitalisation and electrification of the automotive and industrial sectors. Creating new semiconductor production hubs represents an important milestone to bolster the European semiconductor ecosystem and the advanced capabilities will provide a basis for developing innovative technologies, products and solutions to address the global challenges of decarbonisation and digitalisation.

For Annalisa and her ambition to make the world a better place, these announcements come as a real silver lining. With the promise of a secure materials supply chain, she will come a step closer to being able to concretise this ambition and realise her definition of Innovation: “Think ahead – new material, new technology, new design, new needs.”

Annalisa De Pastina
Senior Scientist at SAL Silicon Austria Labs

1 https://www.european-chips-act.com/

2 https://www.automotivepowertraintechnologyinternational.com/news/battery-materials/joint-venture-announced-to-bring-advanced-semiconductor-manufacturing-to-europe.html

3 a) De Pastina et. al, Microelectronic Engineering, 2018. https://doi.org/10.1016/j.mee.2018.02.011.
b) Xu T. et al., Silicon Austria Labs
c) Faizan, De Pastina et al., IEEE TRANSDUCERS & EUROSENSORS XXXIII 2019. doi: 10.1109/TRANSDUCERS.2019.8808179.

Collaboration competitivene

CSEM, Switzerland and the European Union

An interview with Erika Györvary

for ss

Erika Györvary

Chris Horgan

In the heart of Switzerland's watchmaking valley, CSEM, the Swiss Technology Innovation Center, has expanded beyond its heritage in precision manufacturing to encompass everything from artificial intelligence and digitalisation to renewable energy and the life sciences. By developing and transferring disruptive technologies with a high societal impact, they and their partners in academia and industry aim to meet the most urgent challenges of our time while strengthening innovation and the economy. Dr Erika Györvary, Lead of European Affairs, discusses CSEM's successes so far, as well as the role of collaboration in achieving these.

An international orientation

Just as CSEM operates globally and draws from 46 countries among its 550 employees, Erika brings a wealth of international experience to the organisation: raised in Finland, she completed her PhD in Physical Chemistry at Åbo Akademi University, Turku, and then moved to Austria for her postdoc at the University of Agricultural Sciences, Vienna. Following work as a senior scientist at Integrated Microsystems Austria, she joined CSEM as a nanotechnology expert and later served as a founding member of CSEM Brasil in Belo Horizonte. She is also a member of several international boards and the MedTech Working Group (WG) of the European Association of Research and Technology Organisations (EARTO).

"We develop technologies, not products, and transfer them to industry partners in order to transfer them to the market," Erika explains. "We were founded in 1984 and operate now six sites across Switzerland. As a public-private, non-profit organisation, the focus is really on increasing the competitiveness of industry. So, we are not an academic partner – although we collaborate with academic partners – and we are much more on the applied side of things. And although we are Swiss-based, we work worldwide with three research priorities: digital technologies, precision manufacturing and sustainable energy."

Building up value chains

As a gateway between research and the economy, CSEM's network consists of leading universities, research institutes and industrial players – the latter of which involves 230 partners per year. 26% of these are in Europe and have direct mandates with CSEM, but also often use public funding from programmes like Eurostars, Eureka, Key Digital Technologies Joint Undertaking (KDT JU) and Horizon Europe to facilitate collaboration. From the 2021-2022 calls, for instance, CSEM acquired 32 new Horizon Europe projects and nine KDT projects. "We have a more than 50% success rate for the KDT projects," Erika notes. "These projects are important to us and our Swiss industrial and academic partners because we can build up the value chain in electronic components and systems and focus on several important European application domains, such as the health, ICT, energy and industry in general."

In addition to bringing longstanding and highly valued expertise in areas such as photonics, photovoltaics, sensors, coatings and microfluidics, CSEM's EU activities include networking with and participating in industry associations – including INSIDE, of which CSEM is a relatively new member. "We are looking forward to being an active member," says Erika. "In EPoSS, we have been active for several years and I lead the working group Green ECS, where we have just finished a white paper. We are also part of an alliance with leading European research and technology organisations in micro-technologies called the Heterogeneous Technology Alliance, which includes VTT in Finland, CEA-Leti in France and Fraunhofer-Gesellschaft Microelectronics in Germany. In this collaborative effort, we jointly develop new technologies within EU projects and offer complete system solutions to our clients."

"CSEM's collaboration with the EU is consistently growing"

Despite such strong successes, CSEM is currently facing a challenge in the form of Switzerland's non-association with European programmes of as 2021. Although Swiss partners can collaborate in most projects in Horizon Europe, they are unable to coordinate European projects and cannot access high TRL calls regarding quantum, cybersecurity and space due to efforts on strategic European sovereignty. This aims to develop resources in key strategic areas so that the European Union can act autonomously or cooperate with partners as needed. In spite of CSEM's mature, cutting-edge technologies in such areas, they are blocked from using them with EU partners. In the longer term, this could result in Switzerland becoming a less attractive destination for research and innovation and lagging behind the rest of Europe in emerging technological fields. But also Europe looses the connection to the cutting edge Swiss technologies – together we would be more strong in the competition against Asia and the USA.

Changing the world

Despite the difficult political situation, there's plenty to be optimistic about. CSEM's collaboration with the EU is consistently growing nonetheless, while partnerships within Switzerland are also very strong. This includes connections with academia and RTOs, such the Swiss Federal Institute of Technology Lausanne (*École Polytechnique Fédérale de Lausanne, EPFL*) and ETH Zürich. Some staff members also hold dual appointments in academia and industry, through which they can supervise PhD students working at CSEM. As an example,

Logitech TrackMan Marble

Erika mentions Professor Christophe Ballif, who has pioneered various processes for the preparation of thin-film silicon at EPFL and leads a CSEM business unit on sustainable energy, including photovoltaics and batteries.

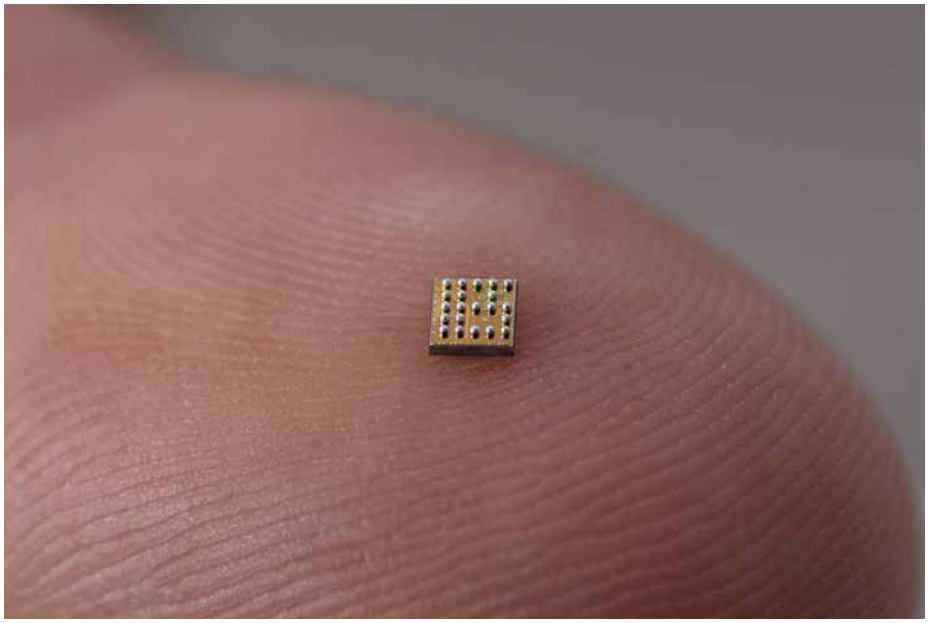
On top of this, CSEM is able to attract partners with their proven track record of ground-breaking innovation. The Logitech TrackMan Marble, for instance, was the first high-volume computer mouse to employ precision optical technology instead of mechanical motion to measure movement and its optoelectric system was designed and developed by CSEM using bio-inspired techniques. Meanwhile, in collaboration with EM Microelectronic and Swatch Group R&D, they beat Silicon Valley to the punch on the smallest Bluetooth chip on the market, with over five million transistors on a surface of just five square millimetres.

"There's also a lot of innovation around the life sciences at the moment, which is especially interesting for me," says Erika. "For example, a Swiss company called CUTISS focuses on personalised skin tissue therapy for extensive skin injuries and we developed a machine for them so that they can do bioengineering of skin grafts in larger quantities and areas. Our organ-on-chip technologies, based on microfluidics, biosensing, and automation, are also gaining traction in the life sciences. Pharmaceutical products that were developed based on mouse models are now starting to use human cells to develop future drugs. The next innovation is based on multi-omics data

in order to have more personalised medicine and then regenerative medicine solutions. This will change the world."

The start-up spectrum

With fingers in so many pies, it's inevitable that CSEM sometimes generates developments which are too early to have an industrial partner on the market. In such cases, the organisation has a long tradition of creating start-ups, allowing them to serve as both the bridge and the catalyst for the efficient transfer of technology and knowhow between science and the Swiss and European economies. Erika: "One of the best examples was our involvement in an ESA project 20 years ago to develop wearables for astronauts to track their vital signs in remote locations. Today, we have



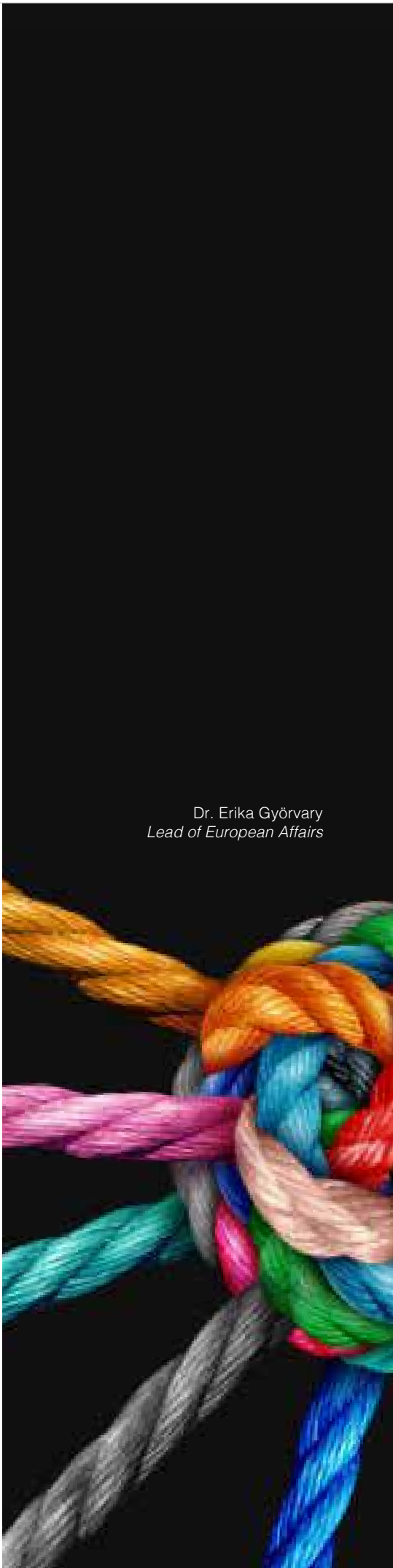
a nice portfolio of medical-grade wearables including both hardware and software to track vital signs. From this field, it was fantastic to see the further development of a continuous optical blood pressure monitoring device for the wrist. This resulted in Aktiia, a start-up dedicated to combating hypertension."

In a completely different field, CSEM's nanotechnology innovations have enabled the creation of the first ever coloured solar modules (now produced by Solaxess), making photovoltaics more aesthetically pleasing and architect-friendly – even opening up the possibility of creating artwork using solar panels. "The micro-lenses developed by CSEM start-up Heptagon, later acquired by AMS, are found in many mobile phones worldwide," adds Erika. "And as INSIDE is also on the software side, I can mention CSEM start-up ViDi, purchased by Cognex. Since 2012, this has been dedicated to the development and commercialisation of ground-breaking learning-based vision software for the automatic inspection challenges of today's industry." This helps eliminate the need for complex programming, making deep learning technology more accessible for non-vision experts.

A voice in Europe

As for the future, CSEM remains committed to close collaboration with its European partners and clients in spite of the political situation between Switzerland and the European Union. A similar (although less severe) challenge was resolved in 2014 and Erika is hopeful that a solution can be found to the ongoing split through the recent reopening of negotiations and the Swiss Federal Council's desire to reacquire full association with Horizon Europe and its related programmes and initiatives. Regardless of the outcome, CSEM will continue to do what it is does best: continually adapting its research focus to meet industry needs while taking a proactive role in the most forward-thinking ecosystems worldwide.

"Because of the situation today, we have seen how important it is to be active in associations like INSIDE and EPoSS. Industry associations are almost our voice to Europe at the moment," concludes Erika. "We think and believe that this research and development should not be limited by borders. These challenges are global. The solutions need to be created in collaboration beyond political borders. That's why European collaboration is important to us."



Dr. Erika Györvary
Lead of European Affairs

Research Project Highlight

MLBuffet

An open-source ML model server developed by ZYLK

Ester Sola

The consortium is led by IKERLAN, who is also a project coordinator. IKERLAN is a RTO with extensive experience in management of large EU projects and acknowledged expertise in integrating complex systems.

IKERLAN has a proven track record of managing large scale research and commercial projects. IKERLAN Innovation work leading big project such as SAFEPOWER, MULTIPARTES, LABONFOIL, BATTERIES2020, among others.

Key contact details:

Project coordinator
Ikerlan Scoop

Project leader
Dr. Aizea Lojo

In August 2020, the FRACTAL project started with the support of the HORIZON 2020 Programme. As one of the participating partners in this project, ZYLK can be regarded as a success story. This SME has contributed all its knowledge of Artificial Intelligence technologies for Edge computing and as the project comes to its conclusion after three years, ZYLK is able to present what has been the main result of its research: MLBuffet

MLBuffet is a Machine Learning model server based on Open Source technology, which enables the use of Artificial Intelligence (AI) in industrial environments. It allows companies to get the most out of data in real time and without the need for an Internet connection, enabling them to be more competitive, optimising their resources and increasing their business value in the market.

From a technical point of view, MLBuffet provides a solution to the need to efficiently manage Machine Learning models on the Edge, initially focusing on the deployment of models on IoT devices with the ONNX library.

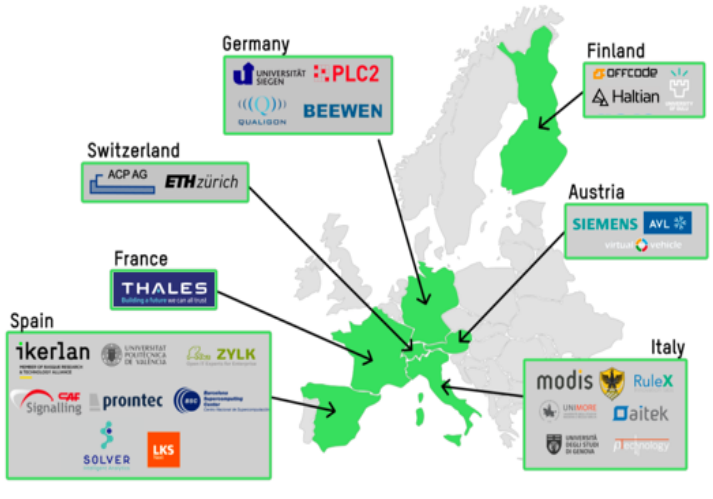
Not only this, but FRACTAL paved the way to go further in the development, adding modules to provide new functionalities such as deploying Machine Learning models in containers on the Edge, making inferences on models developed with the ONNX and Tensorflow libraries, model storage and management, model version control and, finally, a training module that covers the complete lifecycle of the ML pipelines.

MLBuffet allows you to train and deploy models on the Edge and on lightweight devices. This reduces the volume of accumulated data as it is used where it is generated. The independence of Internet connection distinguishes it from other model servers. MLBuffet is designed to make installation and configuration as user-friendly as possible. All the information about installation, usage and features can be found at:
https://github.com/zylklab/mlbuffet

MLBuffet has been used in the FRACTAL project as a model server on FPGA platforms, IoT devices with very low power consumption and high performance, and from the ZYLK Innovation Labs R&D team we continue to develop MLBuffet and extend its functionalities, to make it a reference Edge model deployment and management tool. The ZYLK website (www.zylk.net) provides more information about the project and the company, which is open to new collaborations and projects for the development of AI on the Edge.

Learn more about MLBuffet:
Brochure: https://www.zylk.net/landing/mlbuffet-an-optimal-ml-model-server-for-the-edge
Vídeo Youtube: https://www.youtube.com/watch?v=TWrBk9Mr7Rk
Learn more about FRACTAL and all the partners: https://fractal-project.eu

CONSORTIUM



The project consortium on the world map. Learn more

Project email
fractal_coordinator@ikerlan.es

Project website
www.fractal-project.eu

This project has received funding from the Key Digital Technologies Joint Undertaking (KDT JU) under grant agreement No 877056. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Spain, Italy, Austria, Germany, Finland, Switzerland.

Inside the Open Continuum project

Albert Seubers

Catarina Pereira

Eugenia Kypriotis

Fostering an open ecosystem for the Cloud, Edge and IoT Continuum

The EUCloudEdgeIoT.eu initiative brings together members across a variety of domains with one key aim: the realisation of a pathway for the understanding and development of the Cloud, Edge and IoT Continuum (CEI), which can help Europe regain competitiveness in core internet infrastructures. And in the Open Continuum project, of which INSIDE is a member, we strive to foster European strategic autonomy and interoperability through an open ecosystem for the CEI Continuum.

The foundation and the framework

The vision of EUCloudEdgeIoT.eu is the creation of a thriving, unified CEI ecosystem in Europe. This will not only enable the efficient management of data closer to its source but also reduce communication and storage costs and energy consumption – all while benefiting citizens and businesses with the integration of artificial intelligence and machine learning. The Open Continuum project therefore envisions a future in which cloud, edge and IoT technologies seamlessly converge, supporting key outcomes such as a common open architecture, collaboration between European public and private initiatives, and large-scale pilots as part of the EU Data Strategy. Through such activities, "EUCloudEdgeIoT.eu strives to play a vital role in advancing the CEI Continuum and raising awareness of the significance of open source and standards for the EU's digital autonomy", says Albert Seubers, coordinator of the Open Continuum CSA and Director of Martel Innovate BV.

As a coordination and support project, Open Continuum is the driving force behind EUCloudEdgeIoT.eu and focuses on the supply side of the CEI Continuum landscape. Its core mission, the ecosystem, places a strong emphasis on open source and open standards as key enablers of CEI development. This requires collaboration with research projects within the CEI domain, as well as the broader community that encompasses cloud and IoT. As a result, the project actively engages initiatives, alliances and stakeholders (including developers, suppliers, business users and potential adopters in the CEI ecosystem) and works to provide guidance to European actors on leading open-source projects and standardisation efforts. Open Continuum is thus integral in establishing the foundation and framework for the development of the CEI Continuum.

Supply and demand

Open Continuum is not alone in these endeavours; it works in tandem with fellow coordination and support project UNLOCK CEI to address different facets of the CEI Continuum. On the supply side, Open Continuum emphasises European strategic autonomy, interoperability and an open ecosystem for CEI development. UNLOCK CEI, on the other hand, concentrates primarily on identifying technology-driven innovation and business opportunities within the CEI Continuum.

Whereas Open Continuum builds the foundation and framework for CEI development, UNLOCK CEI represents demand and provides insights and guidance to R&I projects. Together, they facilitate a comprehensive approach to advance the development and adoption of CEI technologies in Europe. Open Continuum plays a pivotal role in enabling the technological ecosystem while UNLOCK CEI promotes innovation and business opportunities within the CEI ecosystem.

Key involvement for INSIDE

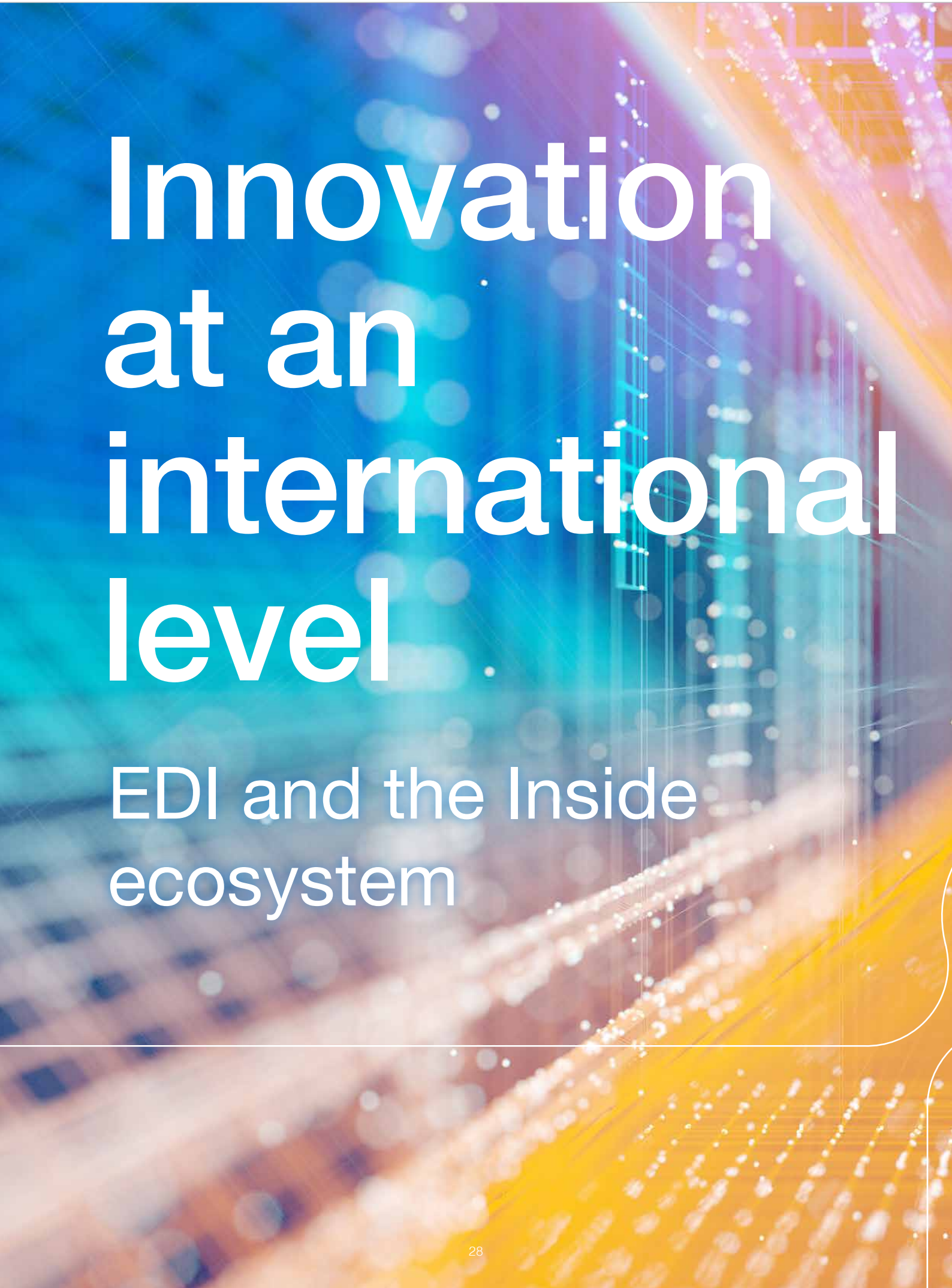
INSIDE plays a pivotal role in the Open Continuum project – and thereby the EUCloudEdgeIoT.eu initiative – as the leader of Task Force 1 for Strategic Liaisons. In this capacity, INSIDE is responsible for managing interactions with key organisations and alliances, including AIOTI, ECS and GAIA-X, to foster synergy and alignment within the CEI ecosystem. Additionally, INSIDE contributes to the engagement with Standardisation Developing Organisations (SDOs) to ensure a coordinated approach to standardisation and interoperability in the CEI Continuum.

INSIDE's contributions also extend to sharing academic and technological outputs, including common publications and conference papers, which helps to disseminate knowledge and advancements in the CEI domain. Additionally, they advocate for standardisation and interoperability approaches, ensuring that technologies within the CEI Continuum work together seamlessly and efficiently. Finally, their role involves liaising with various European initiatives and organisations involved in the Edge-to-Cloud continuum with the aim of identifying common ground and sharing the results of strategic analysis and liaison activities.

Achieving the goals together

Having INSIDE as a member of the Open Continuum project confers a range of substantial advantages. As a prominent industrial alliance with over 260 members, they represent the entire value chain in the computing continuum. Their industry expertise and extensive network are invaluable in shaping industrial strategies, technology roadmaps, standards and policy recommendations within the CEI domain. On top of this, INSIDE's presence amplifies the project's strategic actions, creating a network effect through their members and partnerships and thereby facilitating the project's objectives. Their involvement in managing interactions with various organisations and their focus on standardisation and interoperability approaches contribute to a more harmonised and interoperable CEI ecosystem.

Ultimately, INSIDE is making great efforts to extend and strengthen its position within the Cloud-Edge-IoT ecosystem and to reach out to experts in order to professionalise their activities and services – all of which is to the benefit of members. Their presence strengthens the project's impact and fosters collaboration among diverse stakeholders, while their strategic coordination and alignment with European initiatives and organisations in the Edge-to-Cloud continuum is vital to achieving the goals of the Open Continuum project.



Innovation at an international level

EDI and the Inside ecosystem

Dr. Rihards Novickis

Dr. Kaspars Ozols

Josh Grindrod

Founded in Riga in 1960, the Institute of Electronics and Computer Science (*Elektronikas un Datorzinātņu Institūts*, EDI) stands out as Latvia's top scientific institute in the field of engineering and technology. This position gives them a unique perspective – not to mention the expertise, infrastructure and capacity – needed to make significant scientific contributions at both the national and global levels. Dr Kaspars Ozols and Dr Rihards Novickis discuss EDI's challenges, successes and relationship with INSIDE, including their shared mission to design a better future.

Contributions and aspirations

Thanks to their differing roles within the organisation, Dr Ozols and Dr Novickis can offer complementary insights on EDI. As the deputy director of development, a member of the Scientific Council and a senior researcher, Dr Ozols provides a vision of the institute as a whole. Dr Novickis, meanwhile, is a lead researcher for the Embedded Systems group and will soon lead his own laboratory in this area. This gives him a detailed overview of some of the specific topics on which EDI aims to create new knowledge, develop innovative technologies and demonstrate their practical significance in real-life applications.

"EDI specialises in the research and development of smart embedded cooperative systems, targeting various application fields including smart mobility, production, health, smart cities, energy, space and construction," begins Dr Ozols. "To make meaningful contributions in these fields, EDI has established specific research directions, which include extremely precise event timing, remote sensing and space data processing, robotics and machine perception, signal processing and embedded intelligence, and smart sensors and IoT. With such diverse research directions and extensive applications, our long-term objective is to achieve international recognition as a strong and capable research and technology organisation. And our aspiration is to leverage our expertise in smart embedded cooperative systems to make substantial contributions to key research and innovation areas."

The miscomprehension gap

To some extent, the chips have been stacked against EDI due to Latvia's position within the world of science and technology. In the European Innovation Scoreboard for 2023, the country's performance was just 52.5% of the EU average and this gap is increasing – in no small part due to an allocation of just 0.74% of GDP to scientific funding. In turn, this means that EDI, as a non-profit public research organisation, receives only around 15% of its funding as institutional funding from the Latvian government and must look to other sources. Further hurdles include an underdeveloped innovation ecosystem, limited connections between research institutions and local industry, legal restrictions for scientific institutions, and high levels of bureaucracy.

"One of the major challenges for the Latvian community is dealing with the enormous comprehension gap between legislators and the rest of the country, as indicated by the population's lowest party membership rates in Europe," Dr Novickis explains. "Maybe it's still a Soviet way of thinking or due to a lot of corruption in the nineties. But mostly I think it's because there's no understanding of funding being long term and needing decades of investments. In Latvia, it goes in cycles. Now, everything is a priority, so nothing is a priority. In the coming years, we must break this miscomprehension gap and concentrate on long-term goals."

"For EDI specifically," adds Dr Ozols, "the main challenge is the attraction of top talent. We are not the only one! This affects all of Europe. One solution involves a commitment to maintaining competitive compensation, providing ongoing professional development opportunities and cultivating a high-level

research environment with impactful global projects. However, we place particular emphasis on the imperative to fortify the educational system. This entails proactive initiatives to spark interest in science, technology, engineering and mathematics early on, ensuring a steady influx of skilled and passionate individuals into the scientific community. Still, our universities just dropped out of the top 1000 in the world and the number of people graduating from technical programmes is low. We're a really small country, just under 1.9 million citizens, and there is no ecosystem like in Germany, for example, where Fraunhofer has a lot of contracts with industry."

A unique opportunity

These combined factors give international collaboration a pivotal role in enhancing EDI's research capabilities, expanding its impact and establishing it as a significant contributor in the worldwide landscape of research and innovation. The institute is therefore an active member of various international industrial associations, networks and clusters (such as CLAIRE, HiPEAC and ILRS) and takes great pride in having been a member of INSIDE since 2016.

"The international collaboration facilitated by INSIDE holds great significance for EDI. This partnership unlocks several key benefits and opportunities, especially through projects under the Horizon Europe Key Digital Technologies Joint Undertaking (KDT-JU). These advantages encompass additional funding and innovation, heightened competitiveness, elevated scientific quality, access to cutting-edge infrastructure, networking and knowledge exchange and enhanced international visibility," Dr Ozols notes. "On a national scale, such KDT-JU projects often result in new knowledge and innovations, additional funding for local research and businesses, increased capacity, greater competitiveness for Latvia in the global market and the attraction of further investments to the country. In Latvia, it's not common to see participation of the local industry in European research programmes, so this is a big opportunity for EDI to collaborate and do research together with European industry on interesting and important challenges."

Plenty of projects

The results are clear to see: led by Dr Novickis, EDI is currently coordinating the Horizon Europe *Go IT!* project with partners from Belgium, France, Italy and Spain, aiming to identify all possible obstacles to open-source hardware development and feed the formulated solutions to those with the power to influence the evolution of open source in Europe. Closer to home, the Horizon 2020 ECSEL-JU project *Intelligent Motion Control under Industry 4.E* (IMOCO4.E) enables EDI to collaborate with Latvian cosmetics manufacturer Madara Cosmetics on the automation of manufacturing processes. The goal is to replace manual, repetitive work with an automated solution consisting of robotics and AI-based machine perception, giving the opportunity to introduce innovation to companies that otherwise could not afford it or lack the necessary expertise.

In addition to expanding their portfolio, EDI has established more than 500 new international partnerships through such international projects. For example, EDI is currently implementing eight Horizon Europe KDT-JU projects, collaborating closely with key players from Europe:

- Digitalisation of Power Electronic Applications within Key Technology Value Chains (PowerizeD)
- Artificial Intelligence using Quantum measured Information for real-time distributed systems at the edge (A-IQ Ready)
- Edge AI Technologies for Optimised Performance Embedded Processing (EdgeAI)
- Sustainable and green electronics for circular economy (Sustronics)
- Trusted lifetime in operation for a circular economy (ARCHIMEDES)
- Reliable Powerdown for Industrial Drives (R-PODID)
- Intelligent, Safe and Secure Connected Electrical Mobility Solutions: Towards European Green Deal and Seamless Mobility (EcoMobility)
- Artificial Intelligence in Manufacturing leading to Sustainability and Industry 5.0 (AIMS5.0)

"Our extensive experience in these programs and projects also positions us to look forward with optimism to the future of Chips-JU, which will expand and rebrand the KDT-JU," says Dr Novickis. "One particular area that we would like to emphasise and where EDI possesses expertise is the design of semiconductor IP for various applications. EDI has long-standing competences in the design of digital and analogue solutions, including accelerating biometric and image processing algorithms, improving real-time control, increasing the bandwidth of neural networks, miniaturising radars and designing

"The international collaboration facilitated by INSIDE holds great significance for EDI."

on-chip communications architectures. The competencies are further complemented by expertise in heterogeneous system-on-chip technologies, which mandate a deep understanding of hardware and software computing paradigms and the cooperation between the two."

Inside EDI's projects

Perhaps the most remarkable success story for EDI so far is that within the last decade, they have been able to elevate their scientific quality to European standards and have gained recognition within the scientific community at the European level. One of the most notable examples comes in the field of extremely precise event timing technology, in which EDI created general-purpose event timers and application-specific timing, synchronisation, signal processing and signal conditioning systems. With an extreme precision of less than pico-seconds, their timers are now used in more than half of all world's satellite laser ranging stations and by entities such as the European Space Agency (ESA) and NASA. One space-grade timer is even planned to be used in the ESA's upcoming Hera mission to perform a detailed post-impact survey of the asteroid Dimorphos.

"Another achievement for EDI is in the field of connected and automated driving, where we are collaborating with industry leaders such as Infineon, NXP, Daimler, Audi, Maserati, Volvo, Infineon, TTTech, AVL, Valeo and many, many others," continues Dr Novickis. "Our contributions include the development of fail-aware, fail-safe and fail-operational Vehicle-to-Everything (V2X) communication systems through the Horizon 2020 ECSEL-JU *AutoDrive* project. We've also delved into advanced perception systems, fusing sensor data from cameras, radars and LiDAR in the Horizon 2020 ECSEL-JU *PRYSTINE* project, explored the realms of 5G-enabled cooperative driving via the Horizon 2020 *5G-routes* project and ventured into AI-based, high-resolution 3D 360-degree perception systems in the Horizon 2020 ECSEL-JU *AI4CSM* project. These strides and others represent key milestones in the pursuit of autonomous, self-driving vehicles."

Last but not least, Dr Ozols and Dr Novickis highlight the Horizon 2020 ECSEL-JU project *Advanced packaging for photonics, optics and electronics for low-cost manufacturing in Europe* (APPLAUSE) in which one objective was to develop a European low-cost (<100 euros) infrared sensor. EDI was in charge of accelerating infrared image data preprocessing algorithms and developed a mathematical model of the sensor that was used to develop digital circuits and accelerators for data frame acquisition, non-uniformity correction, defective pixel correction, distortion correction, spatial image transformation and RGB/IR image registration. This project enabled collaboration between EDI and Norwegian SME IDEAS, with the developed accelerators also being licensed on the Design & Reuse silicon IP marketplace.

Driving forward

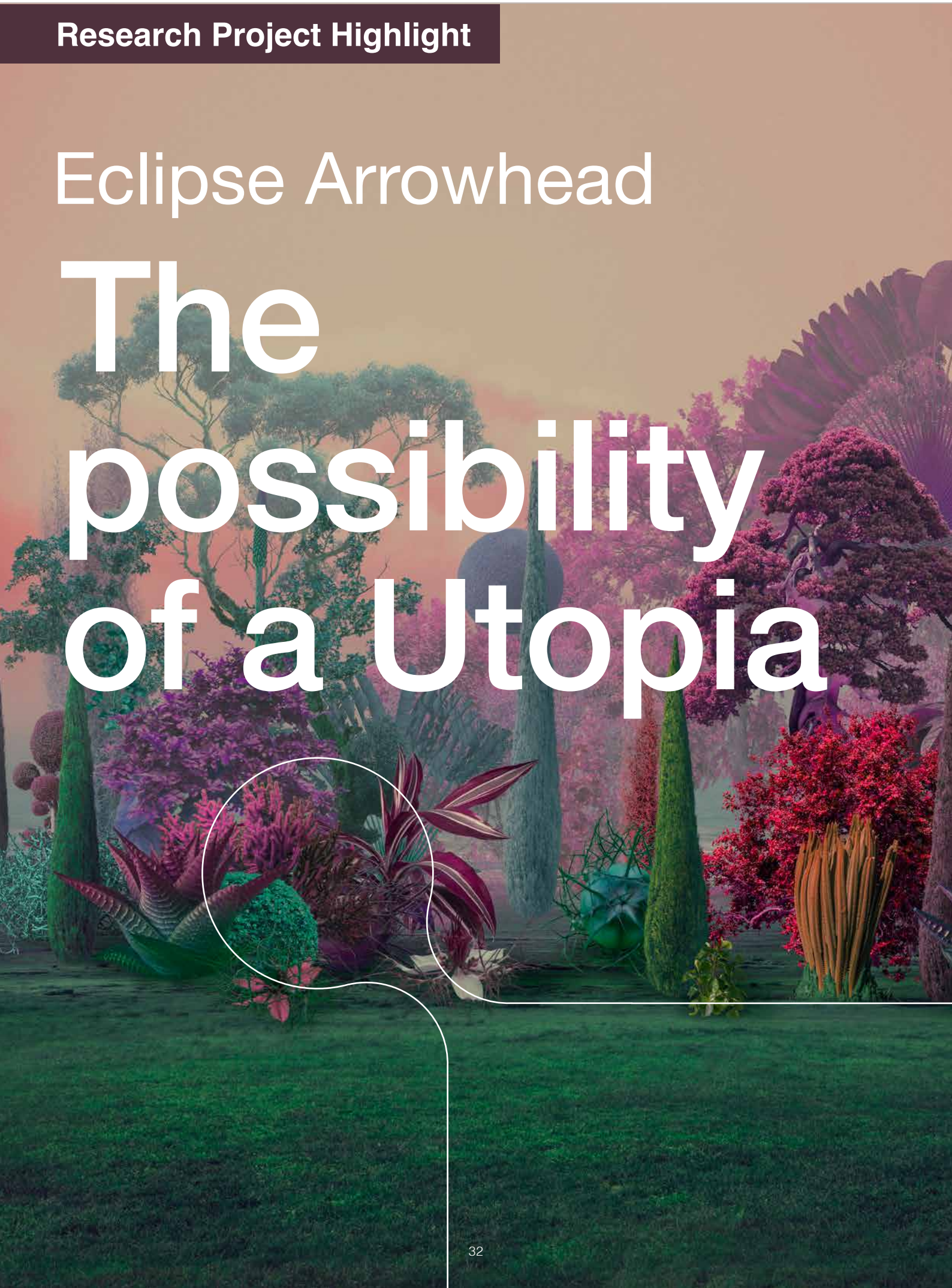
"The intricacies of transforming such research outcomes into viable commercial products or services require a delicate balance between scientific innovation and entrepreneurial acumen. EDI's commitment to translating research outcomes into marketable solutions therefore exemplifies its role as an important driver of innovation and commercialisation," Dr Ozols concludes. "Europe is very ambitious. Nonetheless, even initiatives such as the Chips Act face risks in terms of increasingly complex geopolitics and intertwined supply chains. Europe's success largely boils down to the ability to correctly identify priorities and efficiently bring together member states. Reaching the set goals requires unprecedented cooperation at a multitude of levels: member states, research communities, and, most importantly, between innovators, scientists and legislators."

"What all these challenges have in common is the long term," agrees Dr Novickis. "I've worked here for seven or eight years, so I've seen a lot of change at different levels, including the level of the work we do. International collaboration, like with INSIDE, is a privilege because we have the opportunity to work with scientists from industry and academia from across Europe. Over time, it feels like we've risen to a totally different level and can change the world because there are projects that explicitly give us this chance. Despite the really poor foundation in Latvia, it's been a big success. At EDI, we are on the right track and the fruits of our hard work are already coming in."

Research Project Highlight

Eclipse Arrowhead

The possibility of a Utopia



Jerker Delsing

Chris Horgan

The Eclipse Arrowhead project consists of microsystems and microservices that are needed for anyone to design implement and deploy System of Systems. The foundational concept of the Eclipse Arrowhead is based on the concept of Service Oriented Architectures, and enables all of its users with an SOA architecture infrastructure, which provides support for SOA fundamentals, interoperability, security, SoS support, workflow, management, engineering tools etc., to work open source in a common and unified approach - leading towards high levels of interoperability.

The Arrowhead Framework addresses IoT/SoS based automation and digitalisation. The approach taken is that the information exchange between individual Internet of Things is abstracted to services. This is to enable IoT interoperability in-between almost any IoT elements. The creation of automation is based on the idea of self-contained Local Clouds. Compared to the well-known concept of global clouds, in Arrowhead a local cloud can provide improvements and guarantees regarding real time data handling, data and system security, automation system engineering, and scalability of automation systems. The Arrowhead Framework provides support for building system of systems (SoS) based on service-oriented architecture patterns. Each SoS consists of various Application systems already existing or under development. These Application systems then utilise the SOA architecture infrastructure (Core and Support microsystems) developed as part of the Eclipse Arrowhead project and their Services that provide support in addressing fundamental issues related to, for example, governance, operational management and security.

State of play

"Where we are positioning the Eclipse Arrowhead right now," says Jerker, "is interoperability, composability, security and scalability. But at the edge. We are not trying to do the same thing as Amazon, Facebook and the other companies are doing at the server level but we are trying to use very similar microservice technologies, but at the edge. One of the points we're trying to make is that, yes, you need some kind of support technology or architectural infrastructure. After all, you can't make a telecom network without cables and radio waves. Your cell phone just won't function without the infrastructure. The same is true of service-oriented architecture, whether for building automation, production automation, in a car or between cars. We need an infrastructure comprising fundamental parts to actually enable this type of microservice thinking."

Affordable solutions

This is what Eclipse Arrowhead is providing, with the focus on edge integration for a very heterogeneous set of technologies like Internet of Things, cyber physical systems and so on. Not only that, but to do so affordably. "Cost is a key factor," Jerker explains. "As with many things these days, technically, we are capable of building what people want but then you need the big purse strings at your disposal to pay for it. That's an improbable dream for all but the rich. What we want to do by going the microservice way, and particularly at the edge, is to take account of the return on investment. This is why the microservice approach on the server level has been very successful. It's efficient, it's easy to build, and you can scale up because you're using exactly the same hardware, exactly the same processor, the same compiler. Everything is the same. In our case, of course, we are working with things that are not in one single house. It might be over a whole city. It could also be an enormous, diverse set of things, like Internet of Things. This is the huge challenge. And this is also where Europe is very well positioned in industry, an example being white goods production. For instance, we have Electrolux, we have Whirlpool, leading companies in

their domains. We have the automotive industry and automation companies. But they are working not in data centres but with the distributed things that are in our households, in our buildings. Europe can claim to be the leading lady, as it were. The question now is can we get the edge world to integrate with the server world? And here I think we have one of the interesting technology babies, Eclipse Arrowhead."

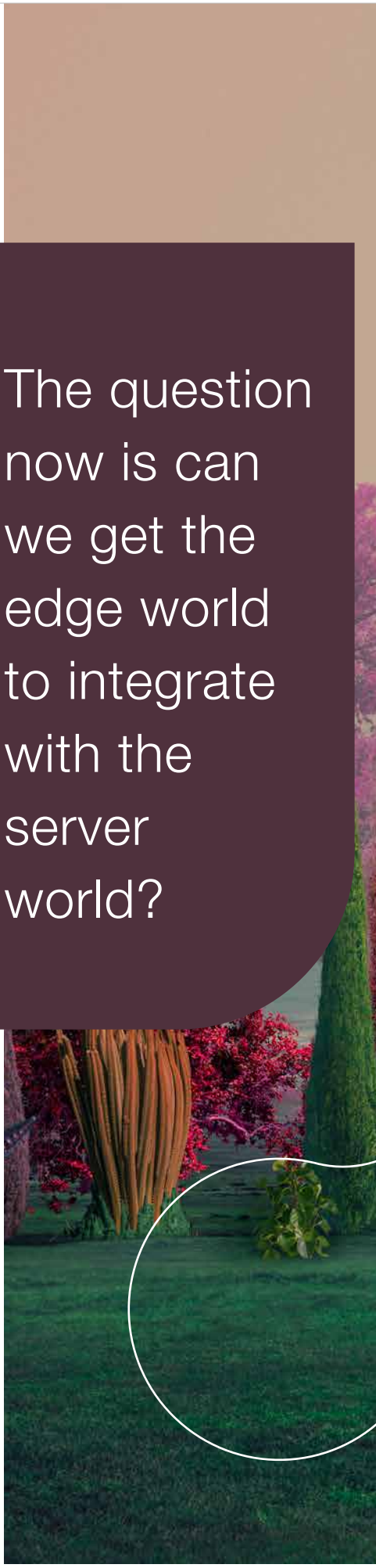
Square peg in a round hole

Arrowhead is clearly one of the leaders in this technology. Only a handful of such initiatives exist. And they are mostly European. Currently, Eclipse Arrowhead can be regarded as the most modern, most developed and most supported, of these initiatives. More technology is being developed thanks to newly launched EU projects like Arrowhead fPVN and AIMS5.0 The primary aim of the Arrowhead fVPN project is to automate the translation of data models such that different machines, or these heterogeneous machines that were designed using a data model for one standard, can talk to another machine that was designed to talk data using a different standard. The quest is to find a translator that can actually identify and support these machines so that they can actually understand each other. Jerker: "We have heterogeneous hardware but we also have heterogeneous software. But we also have heterogeneous data. And solving the data part is one of the remaining large non-interoperable areas where we have huge non-interoperability. So how are you going to get there? We have three roads or three different directions or approaches. One is to look at what we call upper ontology thinking. Can we translate from, let's say, the ISO 103030 standard used by the automotive industry and the airline industry to an upper ontology and can we translate from that ontology to another of the usual standards like the BIM standard common to building industry, or to the ISO15926 standard used in the energy and mining industry? With the automotive industry buying a lot of steel and batteries, these industries need to talk to each other. There are a few small examples of where this is already happening but while this is technically feasible, it's also expensive. If we can reduce the cost by writing more code to autonomously understand what needs to be translated, and then 'employing' a translator for that, then a lot of money can be saved."

This is no groundless claim. In the recently completed Arrowhead Tools project, tools were developed that actually tested the whole microservice paradigm in these heterogeneous environments, involving 25+ use cases in some seven or eight industrial domains. The aim had been to reduce the engineering cost by 20 to 50%. "Very significant and extremely ambitious," Jerker admits, "but the result was even more astonishing. Each individual industrial company applied a very rigorous baseline and also had a very good understanding of how to calculate their costs internally. And the result was a 30 to 95% saving of cost and time. As much as 95% in one case. I mean, industry is clearly benefiting hugely from this."

Eclipse Arrowhead commercial ecosystem

The impact led to the creation of the Eclipse Arrowhead commercial ecosystem, with twenty or so companies, mainly SMEs (e.g. Sinetiq, Thingwave, Jotne, DAC, AITIA, Evopro, Wapice). They are using the code in their commercial products, which are sold in volume to, for example, the mining industry and the automotive industry. "And we know there are several of them who are already making money out of this," Jerker says. "One company is actually building systems for Scania. Very critical systems in their automation of their factories. And they are working with similar projects in the paper and pulp industry and other types of industries. And this is ongoing. And this is all business. This is not a project. This is commercial. We also know that the automotive industry is starting, for example, a dialogue on the software defined vehicle. The same trend is evident among the automation experts in semiconductor, automotive and mining production. There is even a dedicated Eclipse YouTube channel. Interestingly, we had a dialogue with three different companies. The CEO of one startup (15 staff) are moving ahead very rapidly with large companies, in particular in the mining industry. When they attended an IBM event, they received offers from major companies who were prepared to spend big on technology which gives. The startup turned down the offer. The second contact was the chief architect behind the systems for the Scania and the Scania business, and the third was a customer, head of the team looking into automation and digitisation in the mines of Boliden. He was convinced of the importance of this architecture but admitted that it was a long journey for them to actually put into their operations. Nonetheless, it's clear that he is very supportive."



The question now is can we get the edge world to integrate with the server world?

The old with the new, on the edge

There are a number of ongoing EU funded research projects that are part of the Eclipse Arrowhead family aimed at continuing to build the content and the robustness as well as contributing to other, newer parts such as open source for the kind of the technology stack that are being developed. “The potential is growing every day along with the opportunities for companies to use and integrate newer technologies,” Jerker says enthusiastically, “to become more efficient and to get more out of their money, to get cheaper investments or more investments towards greener European production, the green Europe, the sustainable Europe. I think it’s a no-brainer to have this kind of new technology that can actually propel European investment towards greener, more sustainable innovation, but also towards continuous operation over the lifecycle of businesses. In Europe we are leading in this area. It’s not happening in Asia or in the United States. And looking at where European industry is leading, it’s automotive automation, white goods, etc.. And it’s very clear we have a huge number of very strong companies and large companies. They are global. And this is the edge arena. Europe is the leader in the edge arena with the old technology. But we want to be leading with the new technology, too. We are transforming or integrating the old, or operational technology, with the new IT world and bringing these worlds together. So let’s not only maintain our leadership but extend our leadership. On the edge and then being smart about it by actually integrating the edge to the cloud container.”

Jerker Delsing is Chaired Professor, Cyber-Physical Systems, at Luleå University of Technology, Sweden in the Embedded Intelligent Systems LAB division of the Department of Computer Science, Electrical and Space Engineering. He is vice president of Inside Industry Association and serves on the ECS-SRIA working group as well as the ESTEP WG on Smart Production. In addition, Jerker is on the board of the Vinnova SIP Smarter Electronics Systems. His current research focuses on IoT, CPS, SoS and SoCPS with applications primarily to industrial automation and digitalisation, with a particular interest in IoT and SoS architectures, SoS Engineering, low-power electronics and sensors, and embedded EMC. Jerker is the ‘founding father’ of the Arrowhead Framework enabling large-scale System of Systems at the edge.

SME Focus

Beyond one size fits all

Bi/ond and the journey to personalised medicine

Cinzia Silvestri

Founded in 2017, Bi/ond is one of the global leaders in organ-on-chip (OOC) technologies that are composed of 3D microfluidic cell cultures embedded into microchips to mimic the behaviour, mechanics and physiological response of organs or organ systems. This innovative start-up was created by biotech researchers Cinzia Silvestri, Nikolas Gaio and William F. Quiros Solano – with more than 24 years of combined experience in applying electronics to biology – and focuses on developing precise, inclusive cures for all.

Respected roots

Ultimately, the company's roots go back to the founders' work on OOC during their PhD studies at Delft University of Technology (TUD), one of Europe's most prestigious institutions. As a spin-off of this vibrant ecosystem, Bi/ond emerged from the European project InForMed, a €48M initiative led by Philips Electronics Netherlands and with €11M in co-funding from ECSEL JU. This sought to establish an integrated pilot line for medical devices, including micro-fabrication and assembly.

"Within this project, we laid the foundation for our unique technology," says Dr Cinzia Silverstri, CEO and co-founder of Bi/ond. "We subsequently raised €2.3M in public funding – including from ECSEL JU, EIT Health and the Horizon Europe collaborative project MAGIC – to finance the development of our first chips and expand our intellectual property." This has since evolved into multiple chip types, such as inCHIPit™ for oncological applications and MUSbit™ for heart and skeletal muscle applications. Bi/ond's versatile platform, validated in respected European medical centres, allows biologists to insert human cells into an environment that replicates the human body and thereby enhance drug development processes.

The missing link

Over time, Bi/ond has become a pioneer in the biotech industry, actively contributing to advancements in drug testing and reducing the reliance on animal testing in pharmaceutical R&D. Having successfully secured €4.8M in both public and private funding, Bi/ond has also grown into a diverse, multidisciplinary team of 11 member with six nationalities. However, their core mission remains the same: the empowerment of biological innovation by engineering microchips to nourish, stimulate and monitor cells.

Team profile

Dr Cinzia Silvestri (CEO and co-founder)
Bi/ond is led by Cinzia Silvestri, PhD, a leader in nanomaterials and silicon microfabrication for biotechnology who has also been acknowledged for advancing diversity in a male-dominated sector. She holds a PhD in novel on-chip cooling strategies from TU Delft and an MSc degree in Electronics Engineering (cum laude) from the University of Roma Tor Vergata (Italy). Under her guidance, Bi/ond has raised €4.8M in dilutive and non-dilutive funding to date. In 2018, she was named as one of the 50 most inspiring women in Italy's technology sector and, in 2022, among the top young talents in the Netherlands by Het Financieele Dagblad. Thanks to her vision, Bi/ond has been included in the Fund Right Initiative both as a women-led company and for the diversity in the team. She is a TEDx speaker.

Dr Nikolas Gaio (CTO and co-founder)
Dr Gaio holds an MSc degree in Biomedical Electronics (cum laude) and a PhD in organ-on-silicon received from TU Delft. Since his PhD, he has been the demo leader of multiple European projects and has gained experience in R&D and the product commercialisation of medical devices. He has an extensive technological network with multiple companies and universities that are now part of the Bi/ond network. He is the inventor of the patents behind the Bi/ond technology and various trade secrets. He is an animal advocate, as shown by the LUSH award he received in 2018, and a board member of the Dutch animal association Young TPI (Transitie Proefdiervrije Innovatie).

Dr Silvestri: "Bi/ond envisions a world in which every person is understood to be unique and in which medicines reflect their individuality. To enable precise treatment options that value diversity and inclusion, we aim to develop lab technology for more accurate drug testing and for simulations of any tissue type. By building the missing link between biology and engineering, we can pave the way towards personalised medical treatments."

Transformative power

Such a breakthrough cannot be achieved alone; Bi/ond therefore collaborates with top institutions and medical centres across Europe to validate its technology and contribute to advancements in cancer and heart muscle tissue research. In the EU market, their primary focus is on introducing the platform to pharmaceuticals, academic hospitals and research institutes. In doing so, they must overcome challenges related to the adoption of new skills, budget allocation and the need for extensive evangelisation in order to showcase the benefits of modernising biological labs and leveraging the advantages that microelectronics can offer to biologists. Additionally, like many other deep-tech start-ups, capital is crucial to their growth trajectory.

"In spite of these challenges, we have a lot to be proud of," says Dr Silvestri. "This goes beyond the technological achievements: it's about the positive impact on patients' lives. Witnessing the transformative power that microelectronics can have on the well-being of individuals is incredibly rewarding for our team. What was once merely an idea in our heads has now come to life, and the realisation that our innovations can make a meaningful difference in the lives of others is the most gratifying experience."

"As we continue on this innovative path, our commitment remains unwavering: to create solutions that not only meet the needs of today but anticipate and adapt to the evolving healthcare demands of tomorrow. Every breakthrough is a testament to our collective vision and determination to positively impact the world through the fusion of microelectronics and biotechnology."

Save the date!

ECS BROKERAGE EVENT 2024

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Inside Industry Association

Call for Papers

MFI5.0 at IEEE NOMS 2024 in Seoul

Unlocking Industry 5.0: Call for Papers for 5th Workshop on Management for Industry 5.0

Michaela Eder-Jahn

The societal relevance of Industry 5.0 cannot be overstated. As we stand at the precipice of this transformative era, it is imperative to explore and understand the impact on various facets of society. From labour markets adapting to new skill requirements to the ethical considerations surrounding autonomous systems, our upcoming workshop seeks to contribute scientifically grounded knowledge that not only propels industry forward but also addresses the broader implications on society. The future of industrial automation is taking centre stage. In collaboration with the INSIDE Industry Association, we invite you to participate and shape the content of the workshop, focusing on the seamless integration of ISA-95 to RAMI4.0/IIRA.

The workshop aims to bridge the gap between Industry 4.0 and 5.0, emphasising the crucial role of seamless integration and collaboration. Explore themes such as Connectivity, Autonomous Evolution of System of Systems, and the Human in the Loop. Share your research on Migration Management, Operational Management, Security Management, and more.

The workshop held in Seoul will be a global dialogue between industrial stakeholders and academic contributors. You will connect with experts from diverse fields and countries. Keynote speakers will share insights into the challenges and potential of Industry 5.0, exploring the implications on security paradigms and communication in Industry 4.0/5.0 scenarios.

Reflecting on the success of the 4th "Management of Industry 5.0" workshop at NOMS 2023 in Miami, Prof. Dr. Markus Tauber, the scientific director of RSA FG, and a team of partners and researchers from a wide range of countries showcased success stories where new communication technologies, human-centric strategies, and sustainable production practices set the stage for Industry 5.0. Particularly, industries have benefited significantly from these strategies, driving the need for further exploration.

Mark your calendar for May 6-10, 2024, submit your papers, and contribute to shaping the future of industrial automation. Submission guidelines and details about the topics are available on our website (https://mfi50.icb.at).

For inquiries and additional information, reach out to our website or to Prof. Dr. Markus Tauber (markus.tauber@researchstudio.at).

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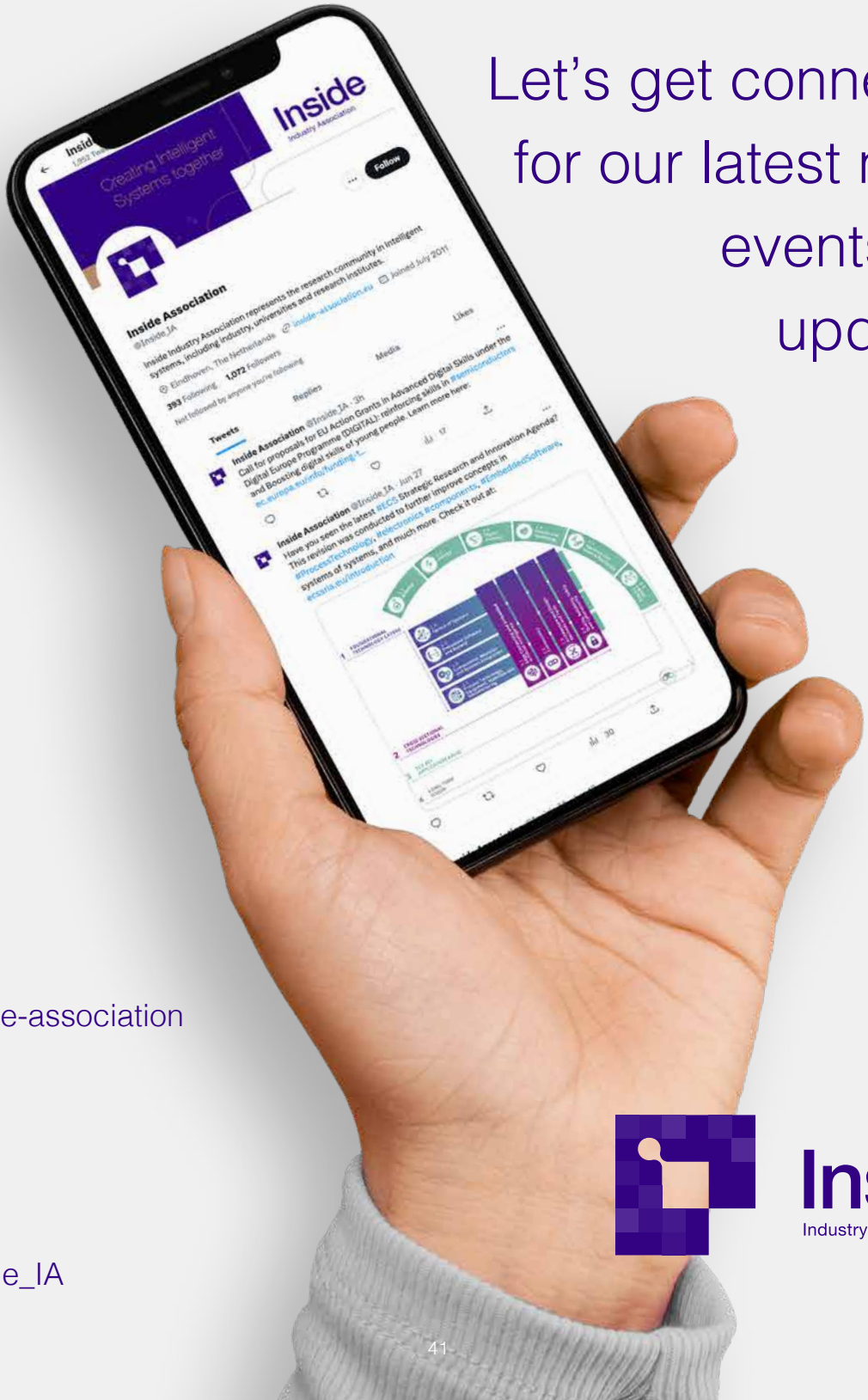

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Contributions
The Inside Industry Association office is interested in receiving news or events in the field of Intelligent Digital Systems.
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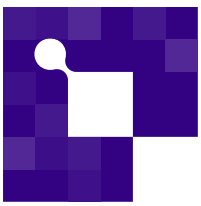

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