Strategic Research and Innovation Agenda 2021

> E C S Strategic Research and Innovation Agenda 2022

ELECTRONIC COMPONENTS AND SYSTEMS

ECS-SRIA 2021 & 2022 OVERVIEW

KDT National Infoday

Lisbon, 21 February 2022, online meeting

Paolo Azzoni Chairman of ECS-SRIA 2022 Secretary general, Inside Industry Association Electronic Components and Systems

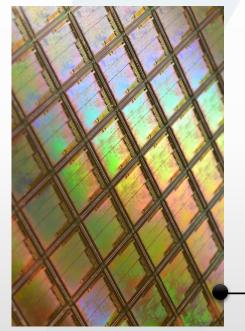
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The SRIA for the ECS value chain

Electronic Components and Systems

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Materials, processes, semiconductors, micro & nano electronic components, ...



Smart sensors, integrated devices, edge AI, embedded SW,

...

Systems and applications, value creation, societal goals, ...



ECS engineering support



ECS-SRIA 2021 vs 2022



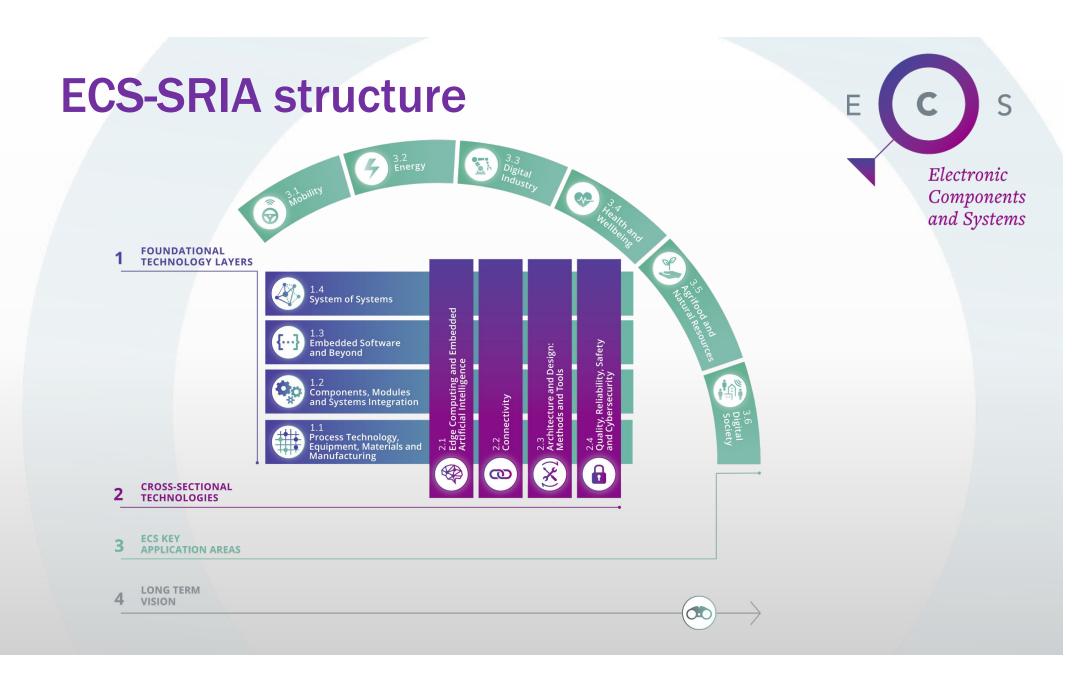
KDT-SRIA '21 KDT Call 1:

overview/news-ecs-sria-final.htm

- Published 16/12/21
- Closes 27/04/22 •

KDT-SRIA 2022 KDT Call 2 (beginning 05/22)

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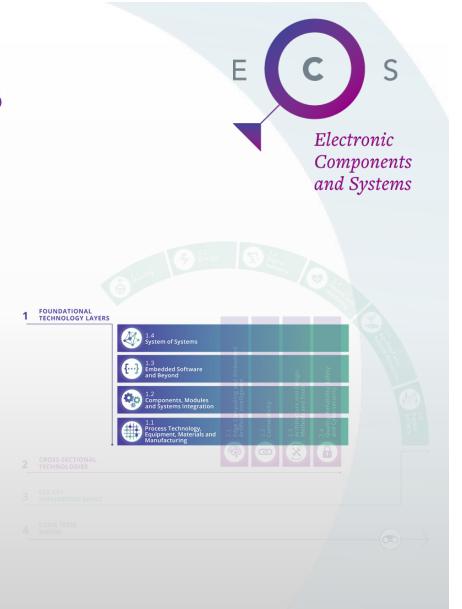
Foundational technologies

The Foundational Technology Layers cover the technology stack of a typical digitalization solution based on ECS.

They have hierarchical dependencies, due to the inherent nature of ECS and the way they compose and integrate in complex entities.

Essential to creating the main components of a digitalization solution.

Represent a very fertile ground where new interdisciplinary technologies, products and solutions can grow.



Cross sectional technologies

Four Cross-Sectional Technology chapters focus on transversal areas, where innovative results emerge from the interdisciplinary contribution of the foundational layers.

E.g.: embedded intelligence on the edge requires

- new integrated circuits
- to develop innovative electronic components
- that can be used to develop smarter and more connected components, modules and entire systems,
- running smart software that will offer new functionalities and capabilities
- that will allow these systems to interact, cooperate and merge in larger Systems of Systems.

The innovation generated by cross-sectional technologies influences foundational layers and amplifies the effect of innovation also in the application domains.

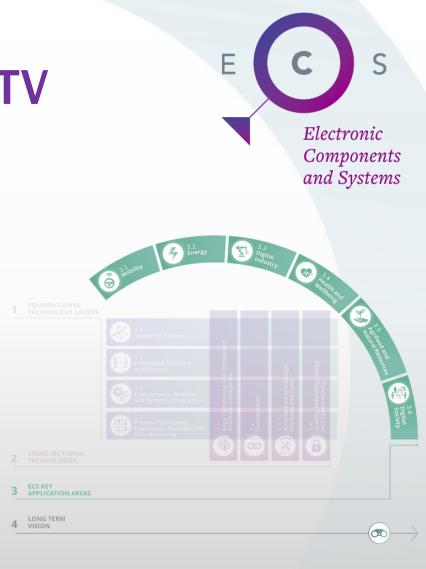


Application chapters and LTV

Six Application chapters describe the challenges of specific ECS application domains, that are key for Europe, and identify the required R&D&I efforts.

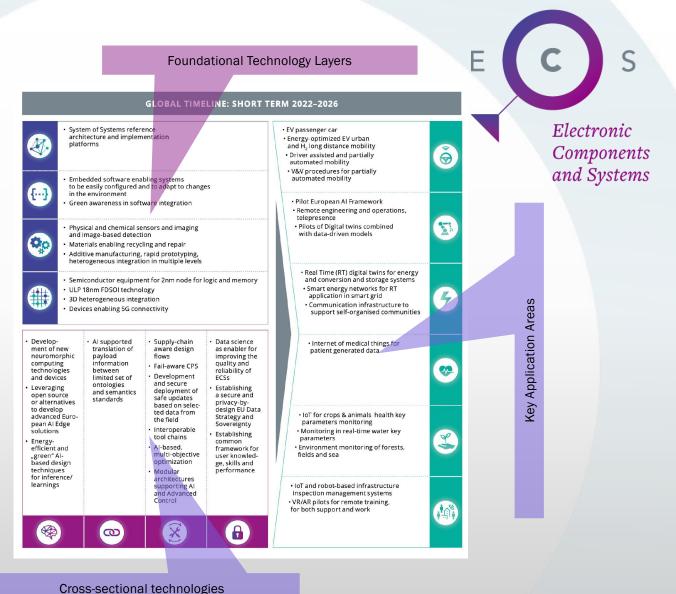
Finally, the Long-Term Vision chapter illustrates our vision of the ECS beyond the time horizon covered by the other chapters:

- it seeks to identify the research subjects that must be addressed at low TRL levels
- and help the research programs in the continuous improvement of European digital technology



Global Timelines Short-term example

- Global timelines provide a compact and structured view of the main milestones foreseen in the next 10 years.
- Three periods:
 - Short term (2022-2026): The industry has a precise idea of what must be achieved during that timeframe.
 - Medium term (2027–2031): Reasonably good knowledge of what can possibly be achieved.
 - Long term (2032 and beyond): Expected achievements are more of a prospective nature.
- Described features expected to be available as ECS at TRL levels 8–9 (prototype or early commercialisation) within that timeframe
- Detailed timelines available in each technology or application section



Objectives of 2022 Update

Updates follow/influence research and market trends and focus both on contents and on the relations between them.

Updates focused on contents:

- Improve the delineation of existing concepts and introduce new concepts
- Minimize unnecessary overlapping and avoid fragmentation

Updates are intended to highlight the ECS-SRIA "systemic" nature:

- Highlight and improve the synergies between the chapters
- Highlight interdisciplinarity
 - Between technology domains
 - Between technology and applications

ECS-SRIA 2022 Outline

https://ecscollaborationtool.eu/publication/download/sria-global-outline-programme.pdf

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| | | | | CROSS-SECTIONAL TECHNOLOGIES | | | |
| 7 | | | 2.1 - EDGE COMPUTING AND EMBEDDED ARTIFICIAL INTELLIGENCE | 2.2 - CONNECTIVITY | 2.3 - ARCHITECTURE AND DESIGN: METHODS AND TOOLS | 2.4 - QUALITY, RELIABILITY, SAFETY AND CYBERSECURITY | |
| | Ż | 11 e | Hardware architectures and their Implementation (Byssems of Chips, Embedded architectures), for edge and Thear the user' devices. Generic technologies for compute, schwarge and communikation (generic embedded architectures) and technologies that are more forused towards edge computing: Enclusion (architecture) and the enclusion using Artificial intelligence at the edge. | The connectivity and interoperability technology is focused on enabling the projected commercial and societaal benefits that are related to the OSI model layers 1, 5 and 6. | Innovations, advancements and extractors, advancements and concesses and methods is defined corresponding cools and fermovins, that are enabling engineers to design and build innovative ECS-based applications with the desired quality properties, efficiently and cost effectively. | Ensure quality, reliability, safety, dependability, privacy and security of ECS as a part of the Design, implementation, and Valication/ Testing process of complex, heterogeneous and intelligent ECS, including human-systems interaction. | 0 |
| | 1.4 - SYSTEM OF SYSTEMS | System of Systems (ScS) enable the argument, control and enables of an entre system composed of enables and system composed of states and system (SrS). This layer covers ScS annihacture, technologies to accuracy and actively compose to the active states and system (SrS) and active according and actively compose and intercepteral ScS plut (Breyce automated only). | Artificial intelligence to outomatically manage the consolition of CECS in 505 and control their reolation Artificial intelligence to improve automate interoperability. Distributes automate interoperability. Distributes level of automation required to importor, to apport decision making and to control the complexity of 565. | Connectivity is a key reader for 5.50 which by defactors, an composed of connected and distributes FCPs. Connectivity at marks and their interfaces are a thre base of the composition process from which SoS anginate. | Engineering mathodislogist, tool chains and continuous adulty are functamental to evaluate the individual of Sas architectures, the implementation of Sas platform and Sas management across theil Vescele. The hoteropeneity of Sas requires and footbhank, imgranda between multiple statehoiders, trands and technologies, supporting efficiency, quality and sustainability. | Enclose-end intra (security, purkey, michalis); etc. sowing y purkey, in a key factor for SG. Trust must be preserved during the composition of GFP's in SG and must be ensured during their evolution. Security, following the complexity of SG. Switch requires automation to efficiency manage trust. | |
| TECHNOLOGY LAYERS | 1.3 - EMBEDDED SOFTWARE AND BEYOND | Failbate engineering of encoded and sphere prysical systems (CP) is beached and encoded systems (CP) is beached and encoded systems (CP) is beached and encoded systems (CP) (CP) (controllars engineering and engineering (CP) (controllars engineering and engineering (CP) (controllars engineering and engineering (CP) (controllars engineering and engineering (CP) (controllars engineering systems (CP) (controllars engineering engineering (CP) (controllars engineering)) engineering (CP) (controllars engineering) engineering (CP) (controllars engine | Embedded software represents one of the two waters of embedded yets and artificial relegation in device allow to process data on the edge, allow to process data on the edge, allow to process data on the edge, the edge of the edge, proprior the cooperation tensers the PCP and sustainability. This layer proceedings of the edge of the edge and tederated intelligence on the edge. | ECFS are, for the vest majority, corrected and this layer provides means that correcting the second of the means that correcting inter-system commonications and the capability to means can be capability. The composition of the second patients, the composition of ECFS in 565, and also for the inclusion of legacy system. | Software engineering is exceeding the Innum scale, meaning Com methods supporting tools carrent and future (CPS, due to their compress), require continuous and automated angineering eatends also and system level. Continuous and automated angineering eatends also the software methods and the context and the software and when considering methods and and new computing pandigms (e.g., newromorphic). | Trust represents one the strongent barrier for the acceptance of CECS on the strongence of CECS on the strongence of CECS on the strongence of the strongence AL Trust should be ensured by degreg, and by example, it before at this weak many technology apparts converge in angle system to accept the strongence of the strongence barbard on offeren bases of schorter. Acceptance offeren bases of schorter, and the audit of orthodold schorter, plays a key noe in LOPS. | |
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| • | 1.1 - PROCESS TECHNOLOGY, EQUIPMENT, MATERIALS AND MANUFACTURIN | Someonductor process technology, excurrent, materials and more provided the source of the crigit case, Si more Morel, more statistical and the source of the Material and Chips, Bay provides technique and Chips, Bay provides technique Prukage, Packaget Soci and success in Society Packaget Soci and success in Baard, Paral agent apartaments in Baard, Paral agent apartaments | A adoption covers both the electronic components and their manufacturing the sensor of height can also be and/or to the data sources (io). and or to the data sources (io) to form factor that perfectly usual their applications. Loss in the speny more master complexity, increase reliability, thorters time to subserve (indices) or authorized to the spent of master complexity, seasimability, resource same, you wan production of semiconexitors. | Provide process technologies and decrements required for technologies and technologies and GSGG communications advanced INF and photoness communication rechnologies to indefine between semiconductors components, uubrystems and systems. | Electronic design and automation methods and tools required to an and method and tools required to an and method testics. The design and manufacturing process of future renor- saide semiconductions and electronic components: including assembly and purchaging of electronics and the testication and electronic heterogeneous insignation and to support fieldils, astandes, agile and completible high-volume high-quality semiconductor multicluming are abor considered. | End to end security starts from an account of the security starts from considered including and considered considered including application specific logic, heterogeneous Soc. security by delays, it could be an enabled by in the semiconductor production and enable to the set production of the security by society, and production of the set of the production of the set of the monitor of the process with A early detext, idd/orthold by souss, quild leading, adopt design for reability propriorities health management of ES et al. | |
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KEY APPLICATION AREAS

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3.1 - MOBILITY

nery). The mobility market is increasing integra ere ECS are essential building blocks, b d vehicles: the focus is on affordable, a partial or fully automated vehicles: the focus is on affordable, automater and connected mobility for passengers and freight on road, rail, air and water, on tools and methods for validation and certification of safety. security and comfort of embedded intelligence in mobility, and on real-time data handling for multimodal mobility and related services.

4 3.2 - ENERGY

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3.2.-ENERGY The Freign charger focuses on the challenges of a society and inclusity more and more based on electrical energy, addressing energy efficience, related and ensure solutions to charge a charge mercar society by 2005. The chapters cover small rad efficient solutions to manage energy management from a site of antibustion systems, for future transmission grafs. For a class, efficient and results energy sough officience, related and methods and solution systems. For future transmission grafs. For a class, efficient and realistic langer page officience registrations motivity and sociation systems. For future transmission grafs. For a class, efficient and realistic langer and the energy transgement motivity and sociation systems. For future transmission grafs. For a class, efficient and realistic langer and the energy transgement motivity and sociation systems. For future transmission grafs. For a class, efficient classic, graftenerge comparison unit energy relation devices graft for stranding the charge future engineering the system of the system of the charge future motivity and the system of the stranding the engineering engineering engineering the system of the system of the engineering engineering engineering and engineering and engineering engineering engineering engineering and engineering and engineering and engineering engineering and engineering and engineering and engineering engineering and engineering and engineering engineering engineering and engineering and engineering and engineering engineering and engineering and engineering engineering and engi smitt entry related makes is g. for electrical inset, spritt technologes, and determinate inset makes and the spritter of the

3.3 - DIGITAL INDUSTRY

3.3-DetITAL INDUSTRY
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LONG TERM VISION

The Long Tem Velon chapter addresses research solgics to enable and support effective development of European industry in about a decade from today. The chapter huld soper huld soperation that characterize the characterized and the source of the solgical strength means communally in time and a the appropriate pass. Since indicate therhadigal allow application commans, so and the source of the solgical strength means communally in time and a the appropriate pass. Since indicate therhadigal allow application (TRL) to make present of related process. If (TRL) adapt by them end if there solves and the solution domains and profiles. Characterized and the solution communal and the solution the these and process the solution communal communal communation and the solution the function production communal and the solution the function and the solution communal and the solution communal and the solution of the communal and the functions and the solution communal and the solution the solution communal and the solution communal and the solution of the communal and the functions and the functions and the functions and the solution communal and the solution the function solution communal and the solution communal and the solution of the communal and the functions and the solution communal and the solution the solution communal and the solution communal and the solution communal and the solution of the communal and the solution communa established goals and processes lead technologies and applications towards common goals and targets such as the goals of the Green Deal and the European industrial competitiveness. It is apparent that, each of these factors motivates, shapes and initiates innovation efforts at many levels.

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Electronic *Components* and Systems

3.4 - HEALTH AND VELLERING
The balance induces in the factor and the set of th ment of a more integrated care delivery system ons to ensure more healthy life years for an a

3.5 - AGRIFOOD AND NATURAL RESOURCES

the smart reatments of wastewater, rainwater and storms/floods. Fina the chapter covers ES2-based solutions for biodiversity restoration and ecosystem resilience, conservation and preservation, to ensure the narural sustainability of healthy ecosystems and their resources (agriculture, aquaculture, fisheries and forestry). The objectives of the chapter are aligned with the key Horizon Europe missions and with the European Green Deal.

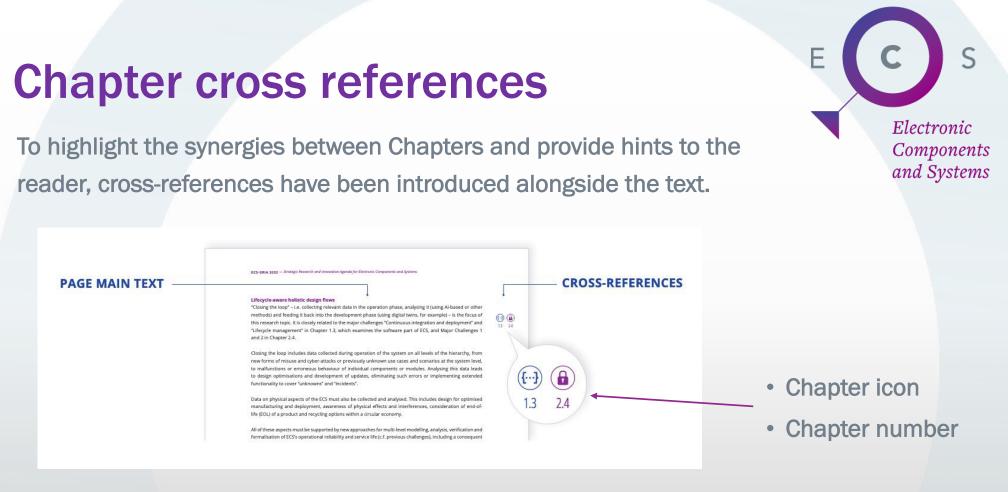
3.6 - DIGITAL SOCIETY

3.4 - HEALTH AND WELLBEING

3.6 - DIGITAL SOCIETY Digital Society Applications of the plant homotophic system invasion of hardings in the Bigst Society Applications of the plant homotophic system in the Bigst Schedule, mobility quantify, servicy and the climate, and consistent homotophic system. The society need Right Solutions that saparticle in the solution of the collection of the solution of the solution of the solution of the solution deep service y simulational and a generated reality, trans-compare interfaced before the two the entropy manufacture of the solution of the solution deep service y simulation and a generated reality, trans-compare interfaced and the memory memory and and a generated reality, trans-compare interfaced with these technologies simulations, which and other, and with a society and the memory memory and the solution of the society facilities related and addings, and will associated in the solution and sacturable environment. self-different, empoverment and resilience, collective inclusion and safety, as well as supportive infrastructure and sustainable environment. The ethical aspects of the digital transformation are also considered, trying to address sociated incorrent in a sustainable way, parametering participation and reducing inequality. A human centred approach is therefore a key spaced of the EUX approach to technology development, it is part of European social and ethical values, sporad) inclusiveness, and experimentation and explore the exploration technology development. It is part of European social and ethical values (social) inclusiveness, and explore the explored and ethical values (social). of sustainable, high-quality jobs through

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Cross-references indicate that the topic described in the main text is linked to the referenced Chapter.

ECS-SRIA 2022 updates

SRIA 2022 updates cover, in different ways, the entire SRIA and include:

- Feedback from the ECS community and the EU Commission on specific topics
- The input provided by the 6 thematic workshops
- Updates already planned last year
- Updates emerging this year

New chapter leaders, e.g. in chapters 1.1 (PTEMM), 3.3 (Digital Industry) and 4 (LTV).

New contributors, in almost all the chapters.

ECS-SRIA 2022 updates (2)

Introduction updates:

- Main Objectives update
 - Extension of the analysis to the new challenges and re-check of updated challenges
 - Main Objectives confirmation
- Global timelines update
- ECS-SRIA Outline

Scope extension to include quantum technologies, integrated photonics, flexible electronics and open-source hardware.

New "Keywords Index", to quickly search key topics and simplify the SRIA "navigation" jumping directly to them.

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| abstraction | 105 |
|-------------------------------------|-----|
| accelerators | 465 |
| access control as a service (ACaaS) | 442 |
| actuating | 44 |

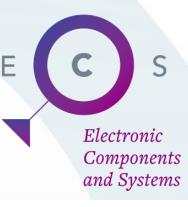
ECS-SRIA 2022 updates (3)

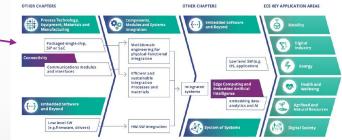
Chapters 1.1 and 1.2 (Process Technology, Equipment, Materials and Manufacturing):

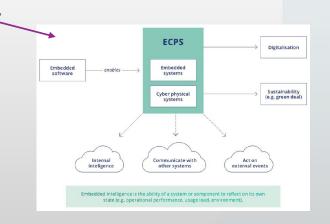
- Improved delineation of concepts and synergies between the Chapters
 - SoC to System-in-Package (SiP) represents the transition between 1.1 and 1.2
 - In chapter 1.2, a new chapter structure has been included
- Extended focus on heterogeneous integration of devices and components for physical and functional integration (PFI) (1.2)
 - Including support for flexible electronics and photonics solutions

Chapter 1.3 (Embedded Software and Beyond):

- Better delineation of the concept of Embedded and Cyber-physical System (ECPS).
- Stronger link with embedded intelligence (2.1)
- Trade off between HW resources and SW abstraction (Green Deal)
- More focus on:
 - Open-source software
 - Digital twin
 - SW features supporting SoS







ECS-SRIA 2022 updates (4)

Chapter 1.4 (System of Systems):

- General restructuring and improvement of concepts delineation
- M.C. 1 and M.C. 5 (2021) merged in a new M.C. 1 "SoS architecture and open integration platforms"
- "Advanced control" topic moved from Chapter 2.1 and created a new challenge M.C. 5 "Major Challenge 5: control in SoS composed of embedded and cyber-physical systems"
- New M.C. 6 "SoS monitoring and management"

Chapter 2.1 (Edge Computing and Embedded Artificial Intelligence):

- Complete restructuring and editing
 - Improved delineation of Edge Computing and Artificial Intelligence
 - And their convergence towards the embedded intelligence on the edge Edge AI
 - Classification of edge computing levels included
 - Positioning of Embedded Artificial Intelligence
 - All 4 M.C. split between Edge Computing and Embedded Intelligence
- Broaden the scope of "advanced control" that has been moved in chapter 1.4 (SoS):
 - Edge AI remains linked to advanced control as an enabler

ECS-SRIA 2022 updates (5)

Chapter 2.2 (Connectivity):

- Analysis of European HW production capability (6G focus)
- 6G focus: alignment with 6G EU Initiatives
- Expansion of connectivity from point-to-point to application-to-application:
 - To support SoS paradigm and network virtualization
 - New M.C. 5: network virtualization enabling run-time engineering, deployment and management of edge and cloud network architectures.

Chapter 2.3 (Architecture and Design: Methods and Tools):

- Better delineation and extended focus on:
 - Support for Fog-Edge-Cloud continuum
 - Integration platforms
 - Full lifecycle support, including maintenance and End-of-Life / second life aspects (Green Deal)
 - Support for AI based components
 - Support for legacy components
 - Support for (SW-)updates

ECS-SRIA 2022 updates (6)

Chapter 2.4 (Quality, Reliability, Safety and Cybersecurity):

- New topics:
 - HW quality and reliability:
 - Digital twin deeper look on the concept
 - Virtualization support
 - Simulation data and process management
 - Design to field to improve test and modelling using field load simulator
 - SW/HW reliability in their interaction
 - Development of novel security and safety approaches with respect to energy and the impact on environment
- M.C. 5 updated from "Human Systems Interaction" to "Human Systems Integration"

Application Chapters

Chapters 3.2, 3.3, 3.5, 3.6: general refresh, following the overall update guidelines

ECS-SRIA 2022 updates (7)

Chapter 3.1 (Mobility):

- New/updated topics:
 - SW defined vehicle
 - Importance of new HW and SW architectures in electronics for mobility
 - Edge2cloud continuum in mobility
 - Influence of pandemic on long-term vision

Chapter 3.4 (Health and wellbeing):

- Refreshed the role of Integrated Silicon Photonics and Flexible Electronics
- Alignment with Health.E lighthouse

Chapter 4 (LTV):

- Complete restructuring and re-editing of the ECS long-term vision
- All the SRIA Chapters have been included

Electronic Components

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ECS-SRIA 2021 & 2022

Thanks for the attention. Any question?

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