KEY DIGITAL TECHNOLOGIES JU

ECSEL AND KDT INDUSTRIAL AI AREA

Dr. Georgi Kuzmanov

International Workshop on Edge Artificial Intelligence for Industrial Applications (EAI4IA), 25-26 July, 2022

KDT JU
KEY DIGITAL TECHNOLOGIES JOINT UNDERTAKING

EUROPEAN PARTNERSHIP

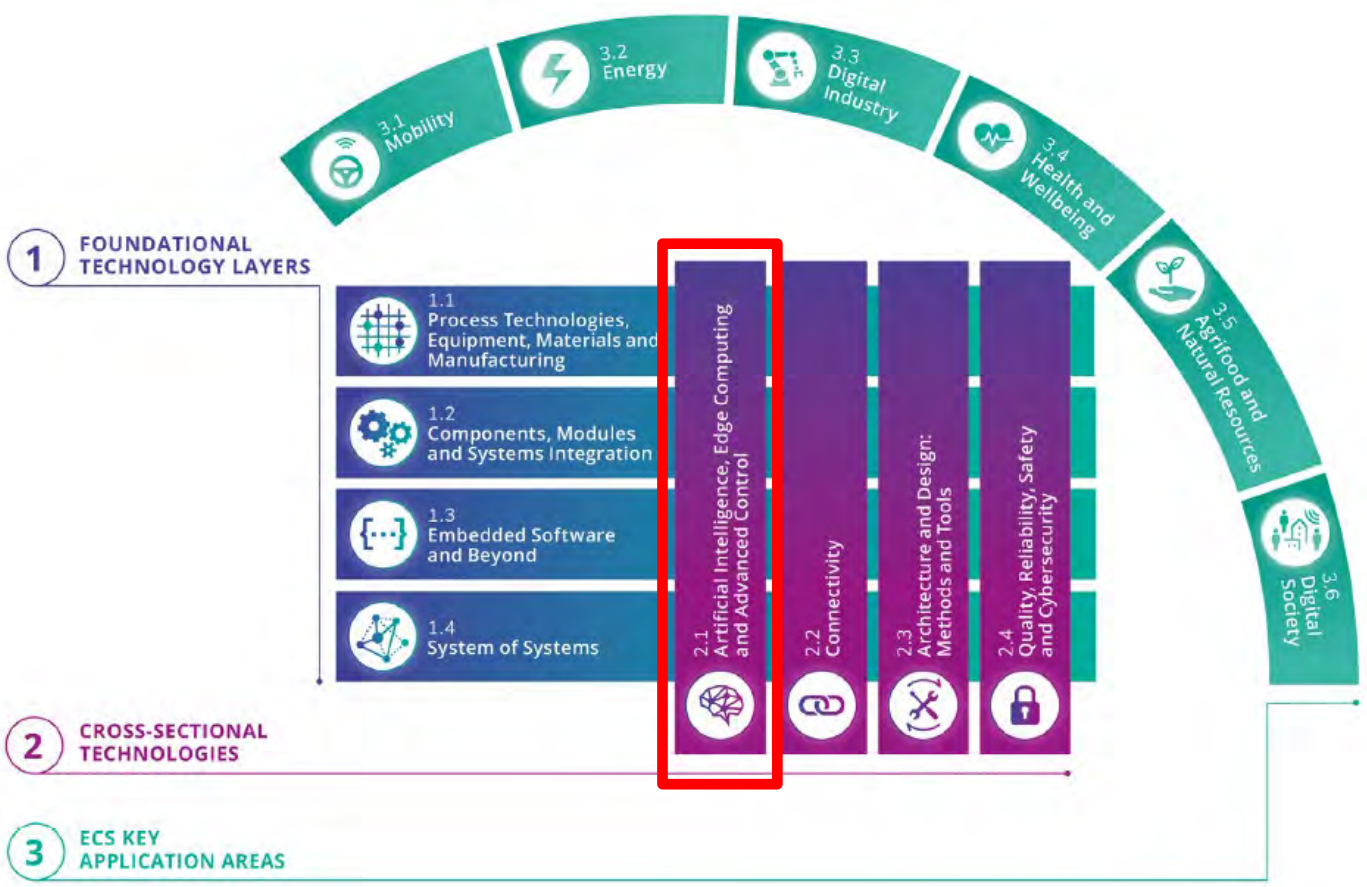
OUTLINE

- ECS SRIA and roadmaps
- ECSEL and AI, IoT, Edge for Industry
- KDT's Top-down programme steering: design oriented FOCUS TOPICS
- KDT Calls 2021 and 2022
- Other Focus Topics in Call 2022
- Conclusions

ECS SRIA – THE "TRADITIONAL" BOTTOM-UP APPROACH

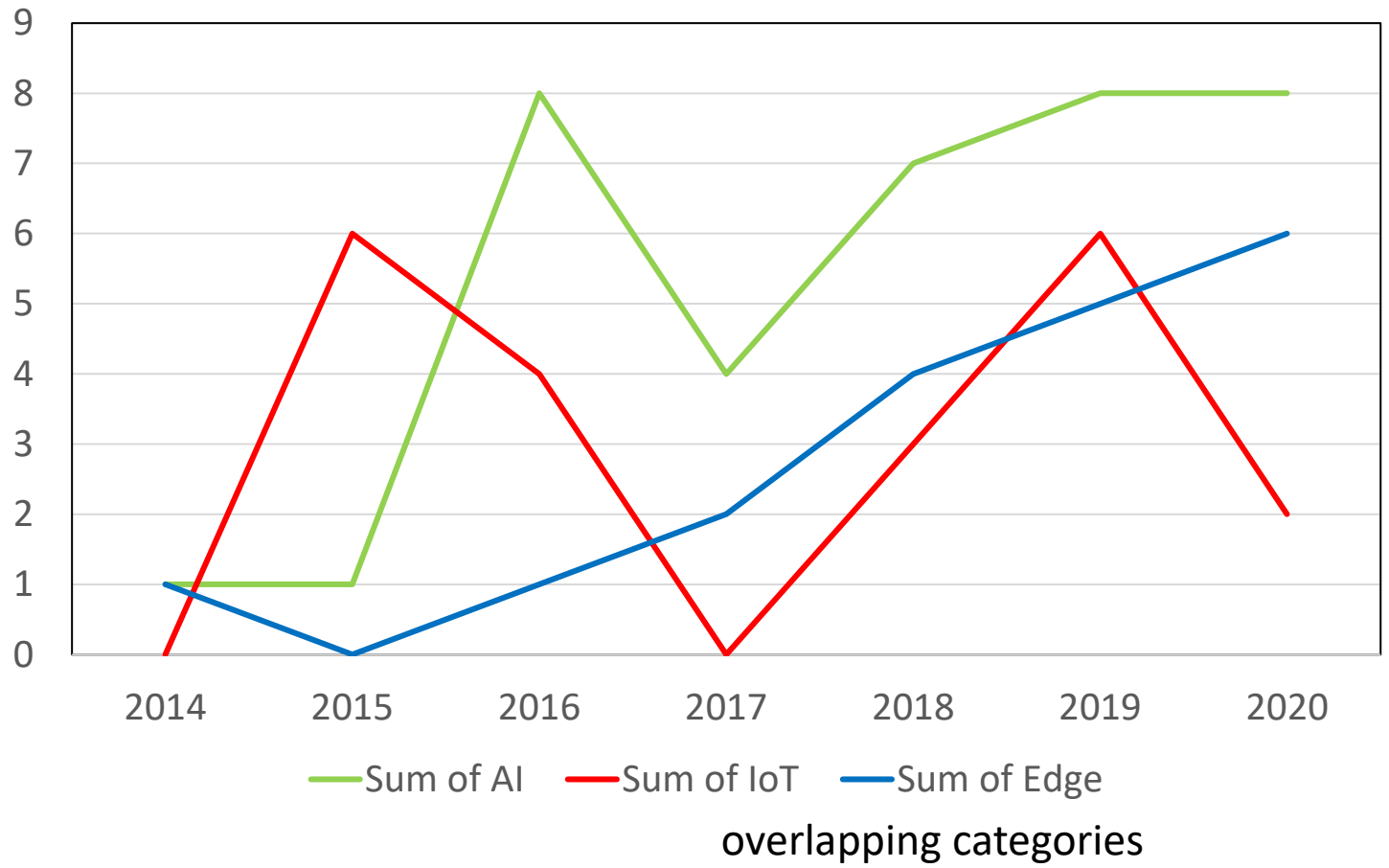
- Boost **industrial competitiveness** through **interdisciplinary** technology innovations.
- Ensure/reinforce **EU strategic autonomy** through secure, safe and reliable ECS supporting key European application domains.
- Establish and strengthen sustainable and resilient ECS value chains supporting the **Green Deal**.
- Unleash the full potential of intelligent and autonomous ECS-based systems for the **European digital era**.

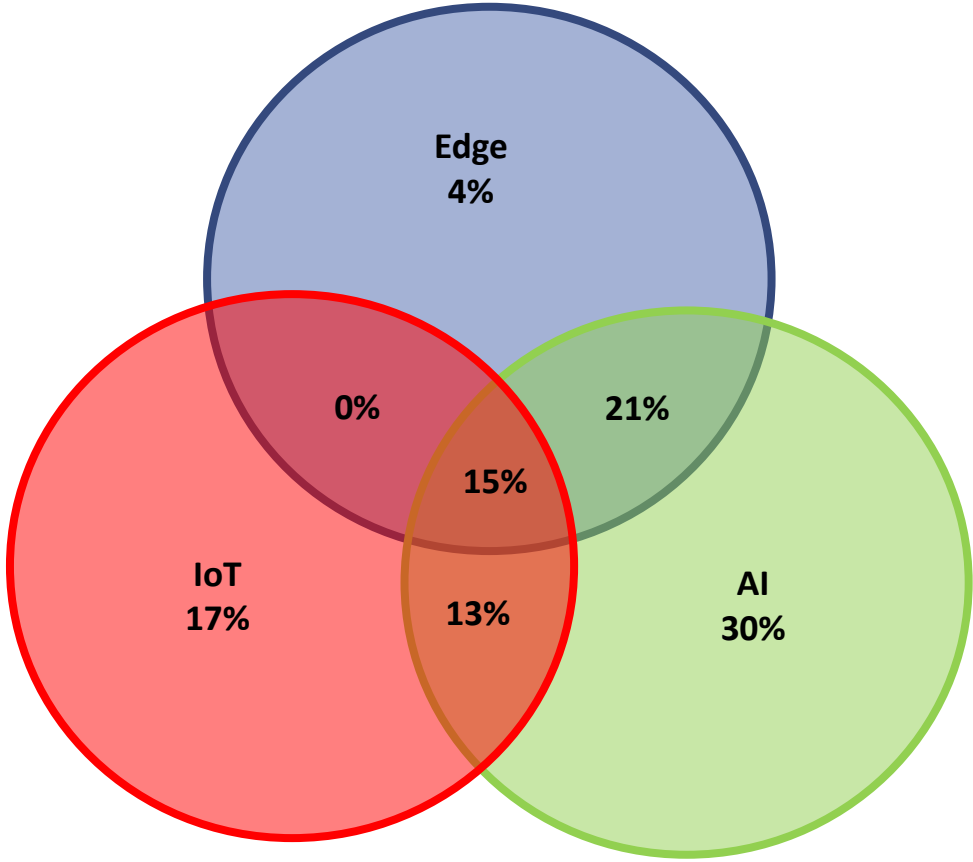
Note Chapter 2.1. **Artificial Intelligence, Edge Computing, and Advanced Control**



The SRIA is Complemented by **roadmaps**, prepared by different Working Groups

Past & Present- ECSEL Projects on AI, IoT, Edge





47 projects out of 92 (51%)

Many of these projects address **Industrial applications** either in individual use cases or as their core domain

AI RELATED ESSENTIAL CAPABILITIES IN ECSEL

AI has a very wide scope– various technologies & numerous application areas

ECSEL projects predominantly address AI techniques and technologies with **practical applicability**, i.e., **making intelligent machines** (ref. SRA), e.g.:

- AI on the Edge (Distributed AI)
- (Deep)Machine Learning
- Smart Sensors - Data Fusion and Processing
- Data Analytics
- Intelligent Software Platforms
- Assisted Decision Making
- Neuromorphic Computing (architectures and chip design)

AI & KEY APPLICATION AREAS & CHALLENGES IN ECSEL

Practically, **all application areas** in the ECS SRIA are **affected by AI**, e.g.:

- **Robotics** – Deep Machine Learning, data analytics, sensor data fusion
- **Mobility** – Assisted & Autonomous driving, data analytics, training data sets, sensor data fusion, Explainable AI – safety, security, reliability, certifiability
- **Healthcare** – decision support, automation, visualization, data analytics
- **IoT Edge Computing** – distributed AI, assisted decision making, sensor data fusion
- **Energy** – production, optimization, grid control
- **Manufacturing** – managing complexity, predictive maintenance, self-configuration

Challenge: trade off **performance** vs **power consumption**
New architectures are needed (embedded GPUs, accelerators, neuromorphic computing) to increase the edge computing performances

Benefits:

- Lower data traffic, lower data storage, lower latency, lower bandwidth constraints
- Lower power consumptions → lower carbon footprint
- Increased data privacy, security and resilience (personal data kept at the edge)

AI IN ECSEL – MOST RELEVANT WP TOPICS & PROJECTS

Edge computing	Neuromorphic platforms	AI and data for (semiconductor) manufacturing	Optical and radar sensors for fail-safe automated driving	Semiconductor components for safe automated vehicles
FITOPTIVIS	TEMPO	iDev40	DENSE	3Ccar
BRAINE	ANDANTE	SemI40	RobustSENSE	AutoDrive
FRACTAL		AI4DI	COSMOS	NewControl
DAIS		MADEin4	PRYSTINE	ArchitectECA2030
StorAIge		MANTIS	NextPerception	TRANSACT
		AI-TWILIGHT		AI4CSM
Distributed AI	Control	Data analytics	Sensors Data Fusion	SC design
Data analytics	Neural Networks	Robotics	Automated vehicles	Safety & Reliability
Networks	AI Platforms	Machine Learning	Dependable Control	Automated vehicles
AI Platforms	Algorithms	Predictive maintenance	Safety & Security & Reliability	Dependable Control
Components	Memories	Data management	Detection	Sensors Data Fusion
	SC design		Data analytics	
			Distributed AI	
			Networks	
			AI Platforms	

ECSEL Budgets for AI & Edge Computing

	Edge computing	Neuromorphic platforms	AI and data for (semiconductor) manufacturing	Optical and radar sensors for fail-safe automated driving	Semiconductor components for safe automated vehicles	Total
EU Cost	187M€	75M€	313M€	103M€	243M€	921M€
EU Funding	51M€	22M€	76M€	31M€	69M€	249M€
Nat. Funding	52M€	22M€	76M€	30M€	61M€	241M€
SME Funding	20M€	2.5M€	20M€	13M€	20M€	76M€

- The ECSEL programme (2014-2021) invested in AI & Edge:
- **490M€ Public funding** (EU + National) - 22% of the entire ECSEL programme
- Of which **76M€ public funding for SMEs** - 25% of the SME funding for the entire programme
- For a total (EU) **cost of 921M€** - 20% of the entire programme cost

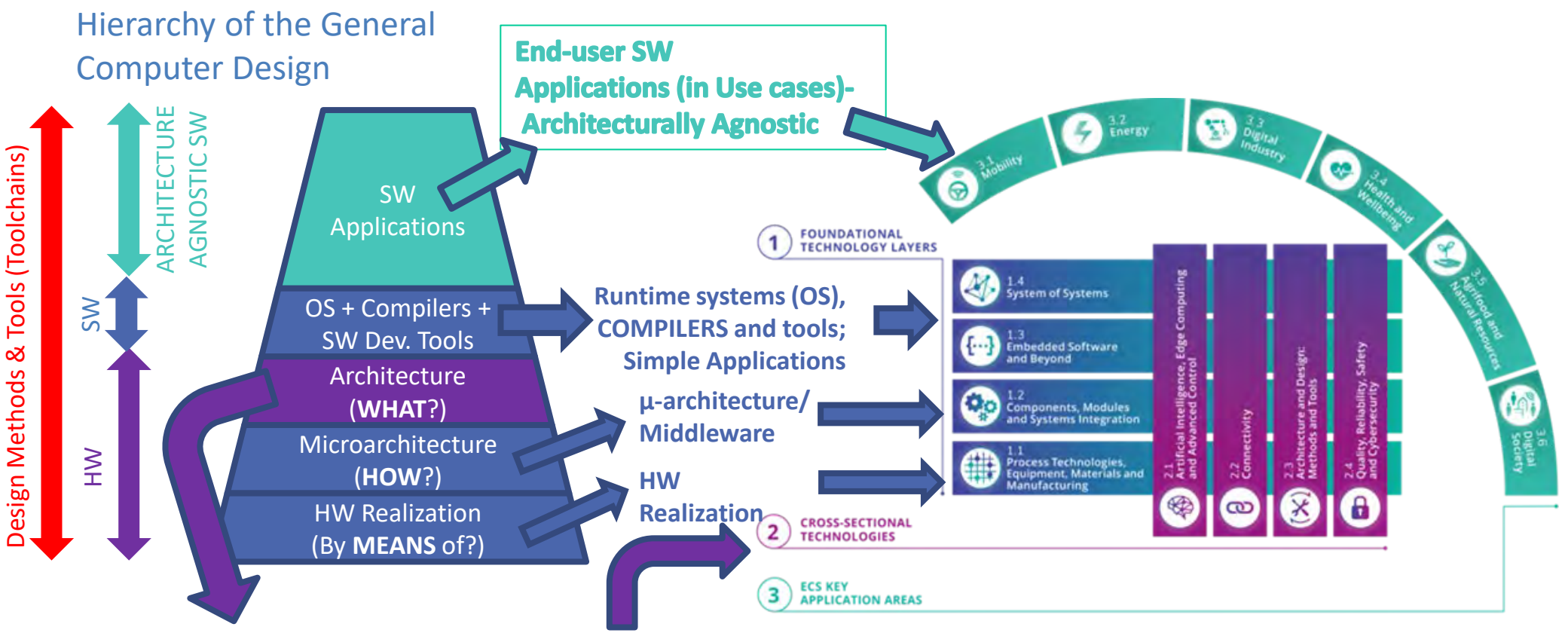
RUNNING PROJECTS WITH MAIN FOCUS ON AI

- **AI4DI** (2018) – focus on AI in Manufacturing
- **TEMPO** (2018) – focus on Neuromorphic Computing
- **ANDANTE** (2019) – focus on Neuromorphic Computing, complements TEMPO
- **FRACTAL** (2019): a cognitive fractal and secure EDGE based on a unique Open-Safe-Reliable-Low Power Hardware Platform Node.
  - This computing platform node will be the building block of scalable decentralized Internet of Things (ranging from Smart Low-Energy Computing Systems to High- Performance Computing Edge Nodes)
- **BRAINE** (2019): big data processing and AI at the network edge
  - One of the objectives is to devise an infrastructure that offers control, computing, acceleration, storage, and 5G networking at the Edge and excels in scalability, agility, security, data privacy, and data sovereignty in Big Data and AI for low latency applications.
- **DAIS** (2020): Distributed Artificial Intelligent Systems
  - Aims at to develop Intelligent and Secure Edge solutions for industrial applications for European industry throughout the whole Supply Chain.
- **AI-TWILIGHT** (2020): **AI** powered Digital twin for lighting infrastructure in the context of front-end Industry 4.
  - The main goal is to merge the virtual and physical worlds in the fields of the European lighting industry.

KDT's Top-Down Programme Steering

- **Focus Topics** to complement the "bottom-up" SRIA
  - Initiated by the KDT's PS and the European Commission
  - Address strategically important areas for Europe
  - Based on roadmaps, prepared by WG of prominent industrial and academic leaders
- **Computer design** oriented **focus topics** in Calls 2021 & 22:
  - Multiannual **RISC V** Focus Topics (2021, 2022, …)
  - Processing solutions for **AI at the edge** addressing the design (2021)

How does Computer Design Fit in the ECS-SRIA?



ARCHITECTURES + EDA Tool chains + middleware, system SW, drivers

MULTIANNUAL RISC V FOCUS TOPICS – LINKED ACTIONS FOLLOWING A ROADMAP

Long term vision: Secure Europe's **sovereignty** relying on a **commonly agreed** and **largely accepted open source RISC V architecture** adaptable to different **strategic applications** and design constraints.

Call 2021-IA – Focus Topic 1: Development of open-sources RISC-V building blocks

Expected outcomes

- **Multiple levels of computer design**: **RISC-V compliant processor architectures, microarchitectures, semiconductor** realisations.
- **System software, design approaches** and **tools**.
- Development of **industrial qualified open-source building blocks**.

Scope

- **RISC V architectural aspect** - "**Horizontal**" (General-purpose) **IP building blocks,** implementable with **different design constraints** for **various application domains** and realized in foundries on **best matching semiconductor technologies,** while preserving **identical programming interface**.

Call 2022-IA – Focus Topic 3: Design of Customisable and Domain Specific Open-source RISC-V Processors

Expected outcomes

A. **Customizable high-end RISC-V** based multi-processor core for **high-end computing** or domain-specific applications.

B. Based on A, **domain specific adaptations of RISC-V** customisable processor solutions for **safe**, **secure** and **reliable** computationally intensive applications.

Scope

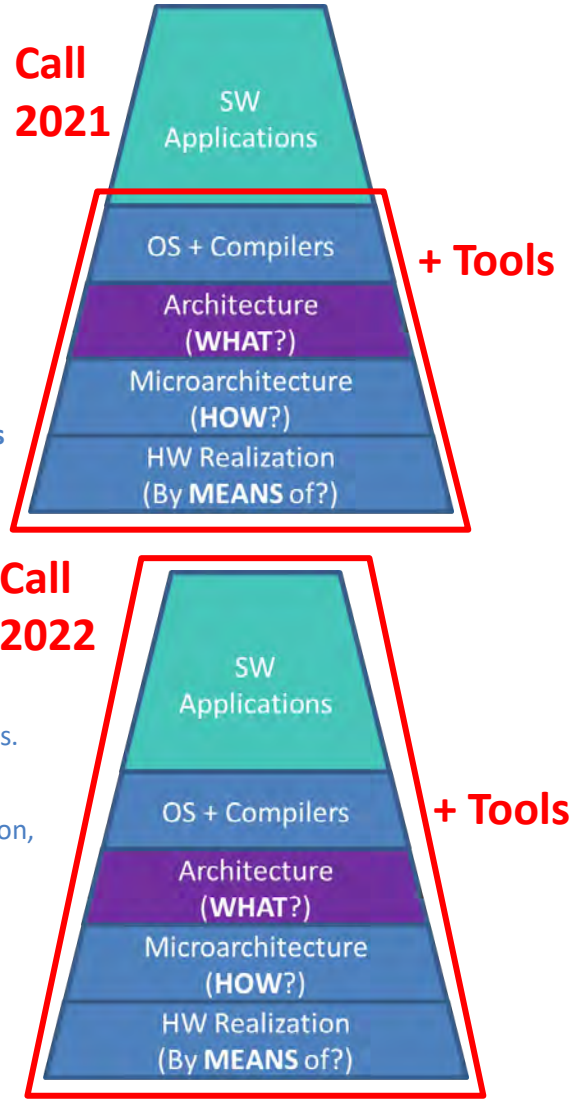
- **RISC V architectural aspect** - "**Vertical**" (Domain specific) **IP building blocks, tools**, **models** and **design flows**, e.g., in the area of architectural exploration, AI/ML augmented verification and safety/security features.

Two types of project **results expected from both Calls:**

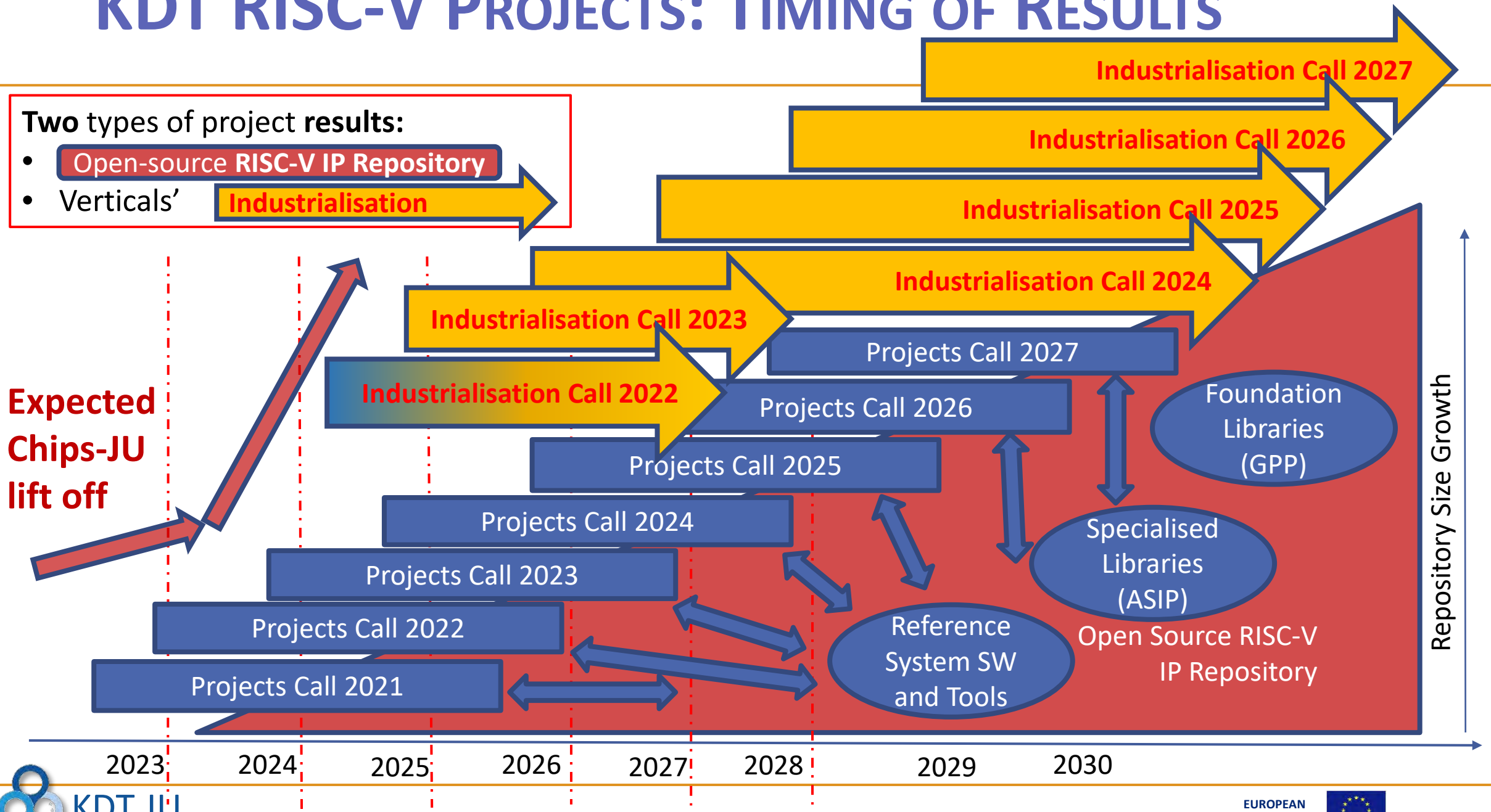
- Horizontal -> **Open-source RISC V IP repository** (shared and reusable)
- Vertical -> **Domain Specific Cores, ready for Industrialisation** (shared or proprietary)

Main differentiator:

2021 - **General-purpose foundational IP building blocks,** i.e., focus on "**horizontal**" activities.
2022 - **Customizable foundational high-end RISC V** designs, i.e., focus on "**verticals**".



KDT RISC-V Projects: Timing of Results



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CALL 2021-RIA - FOCUSTOPIC 1: PROCESSING SOLUTIONS FOR AI AT THE EDGE ADDRESSING THE DESIGN

Expected outcomes

- Development of **Europrocessors/accelerators** for secure embedded intelligence supporting inference and **machine learning** in autonomous intelligent objects and **AIoT at the edge**.
- Development of platforms and tools for **HW/SW co-design** of **edge-AI** based systems.
- Increased **energy efficiency** and **improved processing** capabilities for **edge-AI**.

Scope

Design of innovative and **energy-efficient processing** solutions for AI in edge and deep-edge systems, with a **focus on processors**. **Cohesion activities** with AI, Data and Robotics PPP in view of contributing to the European AI lighthouse.

- Synergies with **European partnerships** and **Horizon Europe Clusters** (Cluster 4 and Cluster 6 in particular) are encouraged, e.g. Photonics PPP, the European Processor Initiative.
- **Accelerate developments**, bringing forward topics that were planned for the **future** if possible building on existing projects

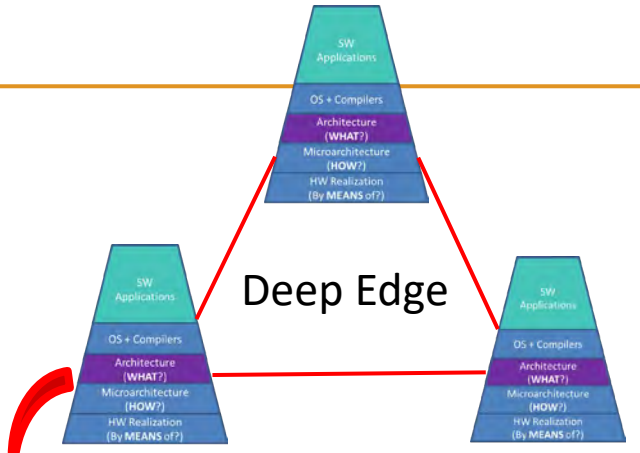
SMEs

- Encourage **SMEs to participate in the developments**, in particular paying attention to the needs of SMEs.
- **Involve SMEs in project execution**, and develop solutions that can be taken up and/or exploited by SMEs.

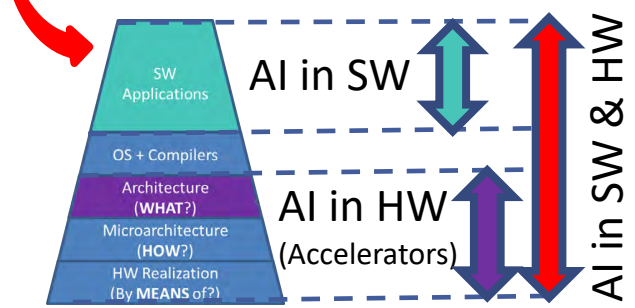
Impact

- **Improve the European position** on edge-AI.
- Reinforce the Union's strategic **autonomy in ECS** to support future needs of **vertical industries** and the **economy**.
- Contribute towards **doubling the value** of the design and production of ECS in Europe **by 2030**.

Today's Edge – Distributed View



AI at the Edge



Future of the Edge – Architectural View

Long term vision: KDT will continue supporting this topic in the future (via general or focus topics) adding to it an **evolutionary architectural perspective.**

KDT Calls 2021: Special Topics Proposals invited to GAP

Call 2021-RIA - FocusTopic 1: Processing solutions for AI at the edge addressing the design:

- CLEVER
- EDGE AI
- REBECCA

Total indicative budget (not finalized yet):

- Cost: 65 M€
- HE funding: 20M€
- NFA funding: Commensurate to HE.

Call 2021-IA – Focus Topic 1: Development of open-sources RISC-V building blocks

- TRISTAN

indicative budget (not finalized yet):

- Cost: 55M€
- HE funding: 15M€
- NFA funding: Commensurate to HE.

CALLS 2022- STRUCTURE AND TOPICS

2 calls, 3 focus topics (2 new)

Action	Topic	Estimated EU Expenditure (M€)
Call 2022-1 T1	Topic 1 General according to SRIA 2022 (IA)	120.0
Call 2022-1 T2	Topic 2: Focus topic on Industrial supply chain for silicon photonics (IA)	20.0
Call 2022-1 T3	Topic 3: Focus topic on Design of Customisable and Domain Specific Open-source RISC-V Processors (IA)	20.0
Call 2022-2 T1	Topic 1: General according to SRIA 2022 (RIA)	74.5
Call 2022-2 T2	Topic 2: Focus topic on Ecodesigned smart electronic systems supporting the Green Deal objectives (RIA)	20.0
	Total	254.5 M€

Proposals on Edge AI are welcome under the **general calls** – remember SRIA, chapter 2.1.

CONCLUSIONS

- **AI at the edge** covered by **substantial** part of the **ECSEL** programme.
- **AI at the edge** for **Industrial** applications has been systematically employed in numerous ECSEL projects.
- **AI at the edge** plays and will play an **important role** in the **KDT** calls.
- The **SRIA** authors have secured a separate **chapter** on AI & Edge.
- A Call 2021 **focus topic** was introduced to steer community's efforts towards **component and system design** for AI at the edge.
- You can help the community **shape the KDT/CHIPS programme's future** through **your active participation** to the calls.

QUESTIONS

Thank You