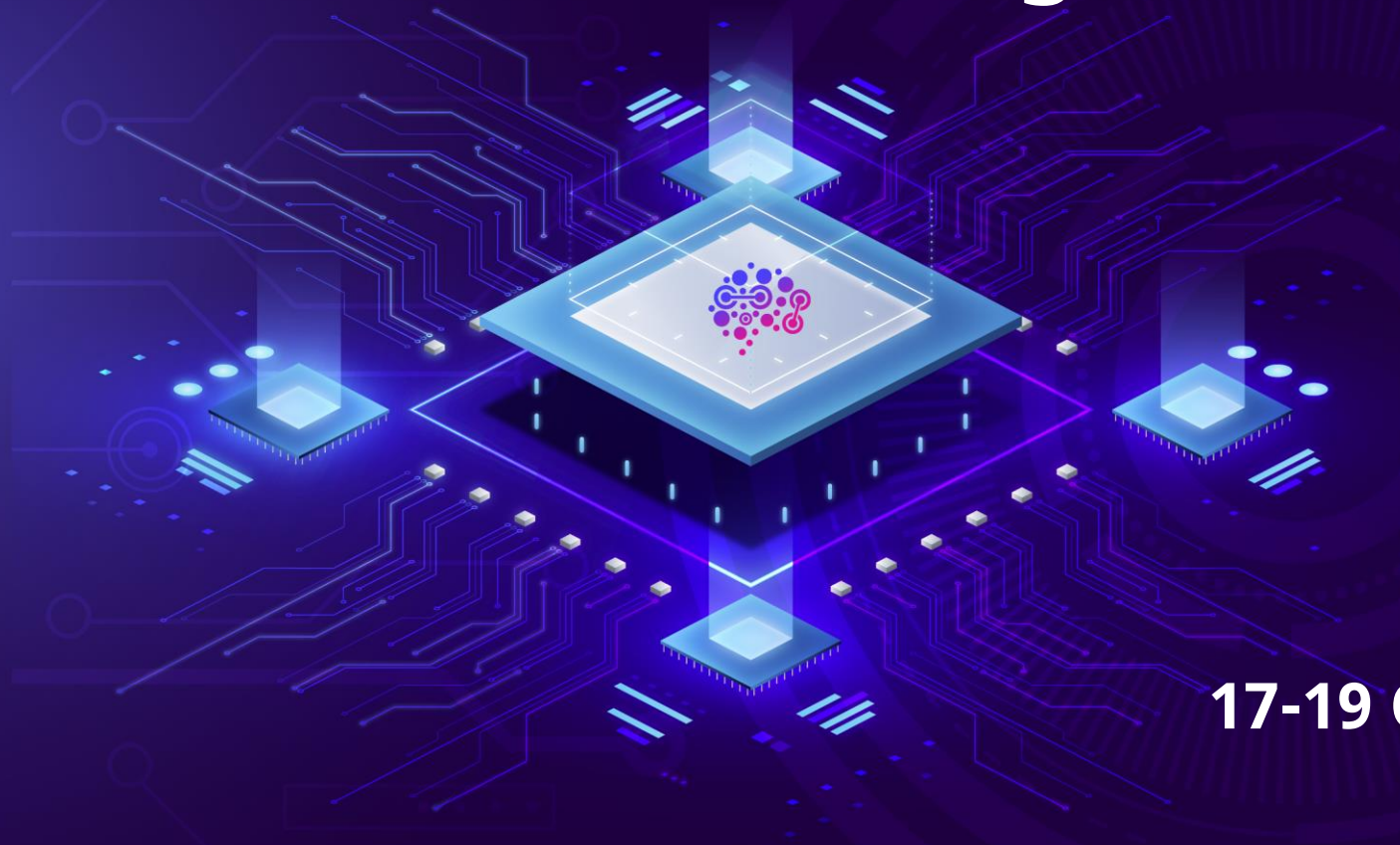
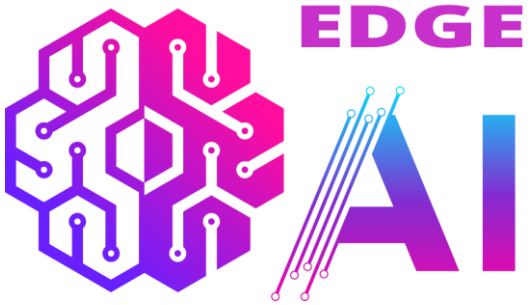
European Conference on EDGE AI Technologies and Applications - EEAI



Advancing emerging edge AI technologies and driving next generation intelligent applications.

17-19 October 2023, Athens, Greece

European Conference on EDGE AI Technologies and Applications - EEAI



Heterogeneous Processing on the Edge

Yannis Papaefstathiou
Exascale Performance Systems – EXAPSYS

17-19 October 2023 Athens, Greece

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Who is REBECCA ?

	BENEFICIARY	EPS
1	EREVNITIKO PANEPISTIMIAKO INSTITOUTO TILEPIKONONIAKON SYSTIMATON	EL
2	EXASCALE PERFORMANCE SYSTEMS - EXAPSYS IKE	EL
3	IDRYMA TECHNOLOGIAS KAI EREVNAS	EL
4	ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON	EL
5	SYSGO GMBH	DE
6	FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV	DE
7	ITEC BV	NL
8	ALMENDE BV	NL
9	AquaSmart Engineering BV	NL
10	STICHTING IMEC NEDERLAND	NL
11	SOLVER MACHINE LEARNING SL	ES
12	FENT INNOVATIVE SOFTWARE SOLUTIONSSL	ES

	BENEFICIARY	EPS
13	UNIVERSIDAD DE CASTILLA - LA MANCHA	ES
14	BARCELONA SUPERCOMPUTING CENTER-CENTRO NACIONAL DE SUPERCOMPUTACION	ES
15	INTECS SOLUTIONS SPA	IT
16	POLITECNICO DI TORINO	IT
17	LUNDS UNIVERSITET	SE
18	ARCELIK A.S.	TR
19	UAB TERAGLOBUS	LT
20	KLEPSYDRA TECHNOLOGIES GMBH	CH
21	SYNTHARA AG	CH
22	BONSEYES COMMUNITY ASSOCIATION	CH
23	CSEM CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA - RECHERCHE ET DEVELOPPEMENT	CH
24	ZURCHER HOCHSCHULE FUR ANGEWANDTE WISSENSCHAFTEN	CH

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Why REBECCA ?

As we have heard in the keynote and will most probably see in the three days of the meeting there is a clear need for :

- Domain-specific SoCs and platforms integrating manycore CPUs, vector processors, hardware accelerators and FPGAs,
- Hardware Design Tools, Programming environments, aimed at efficiently designing and programming such domain-specific heterogeneous platforms,
- Complete software stacks from application programming to runtime systems to satisfy hard real-time, safety and security requirements, wherever possible, in a formal way.

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How is REBECCA doing it ?

To Address the needs REBECCA is developing a complete HW/SW stack comprising of

- An innovative RISC-V based processing unit, including hardware accelerators for AI and security,
- An advanced System in Package (SiP) consisting of a number of chiplets
- A novel Hardware/Software Design Toolset for the implementation of such heterogeneous systems
- An innovating Programming Environment for the diversified REBECCA systems
- Adapted OSs, runtime systems and middleware for the REBECCA platform (**see next presentation by FORTH**)
- Complete AI frameworks taking full advantage of both the SW and HW of REBECCA
- Applications from UAVs, Consumer Electronics and Utility Infrastructure domains.

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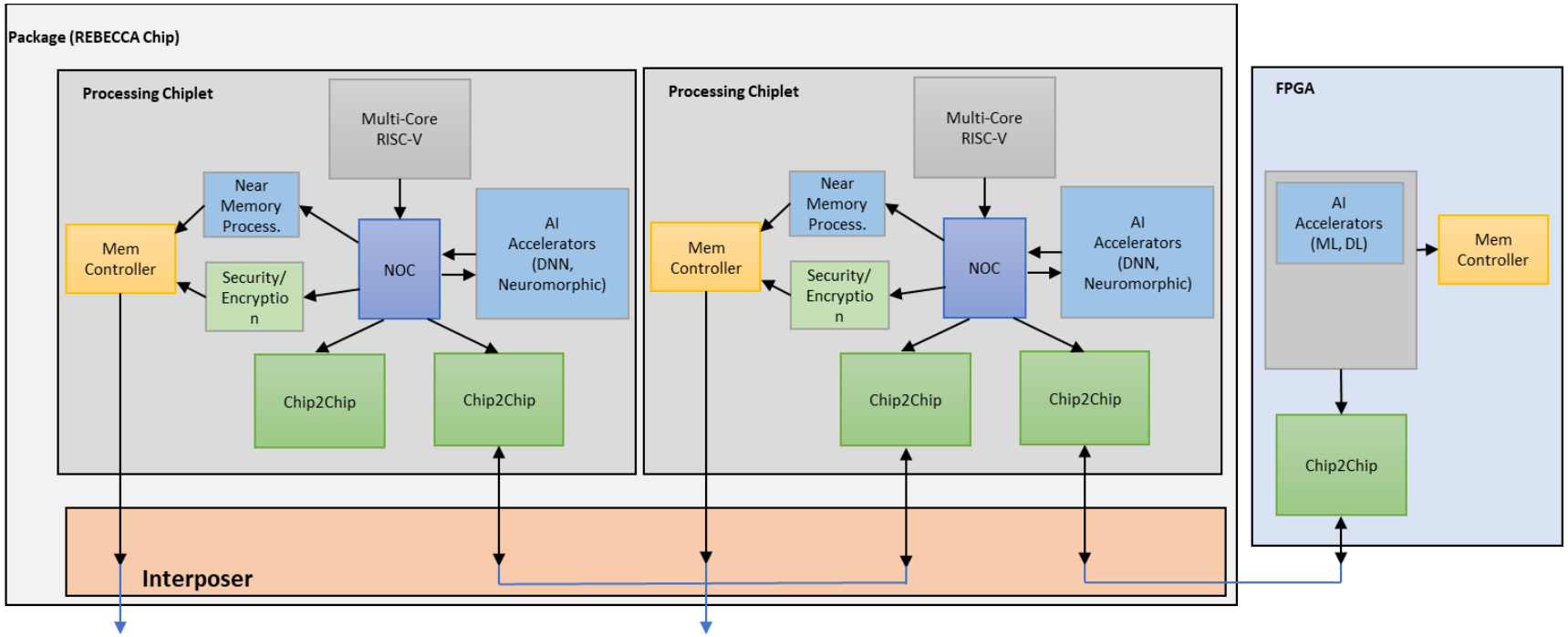
Deeper into REBECCA

- Two identical interconnected processing chiplets
- External FPGA
- Inter-chiplet communication
- Inter-device communication



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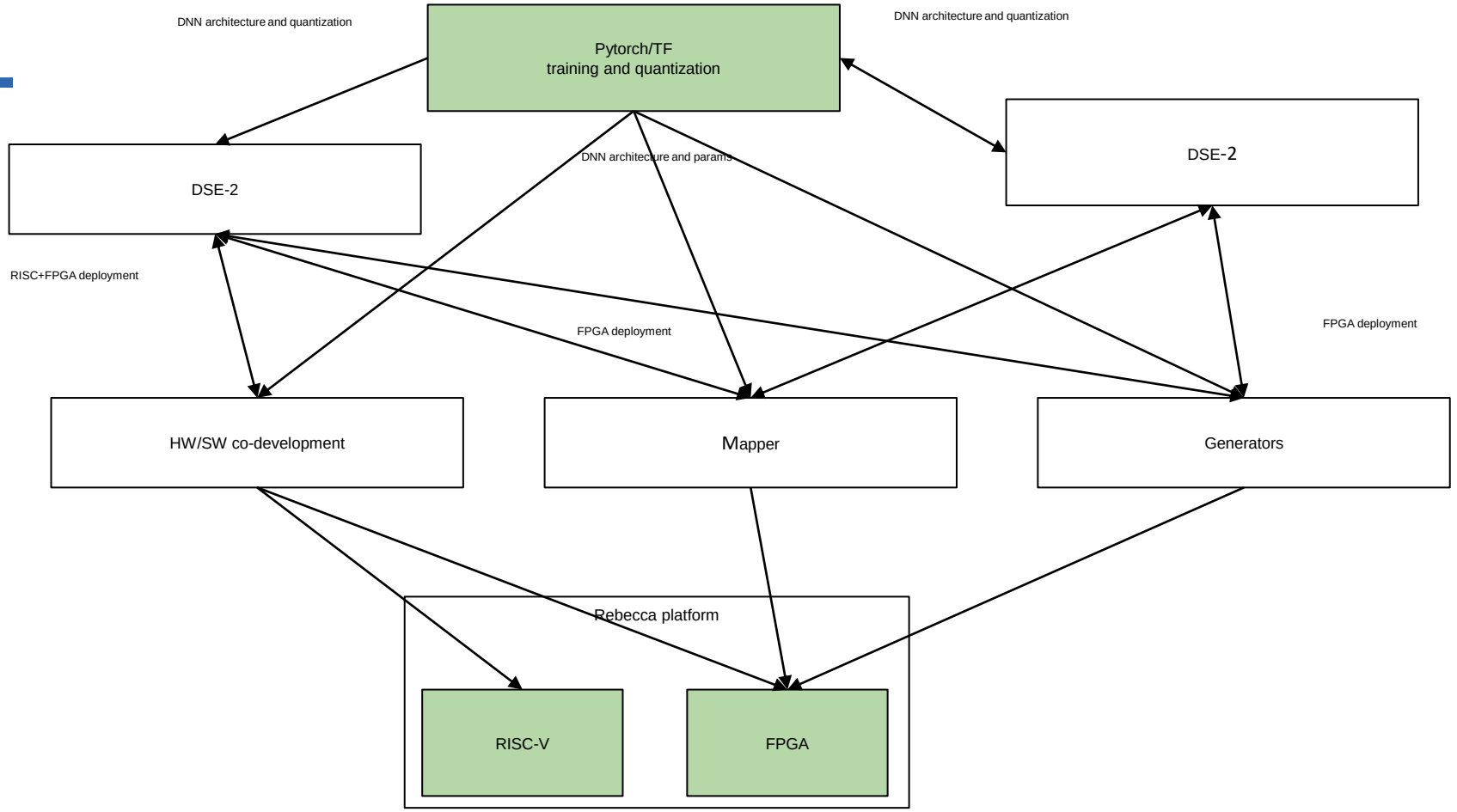
Even Deeper into REBECCA

Hardware Accelerators

Name of Accelerator	Domain	Implementation
Neuromorphic Compute Platform	AI	ASIC
ML Accelerator	AI	FPGA
CNN accelerator	AI	FPGA
AI accelerator	AI	FPGA
Systolic Accelerator	AI	FPGA
Intrusion Detection/Prevention System	Security	ASIC
Near Memory Processing Unit	AI/General-Purpose Processing	ASIC

Exploring the beaty of REBECCA



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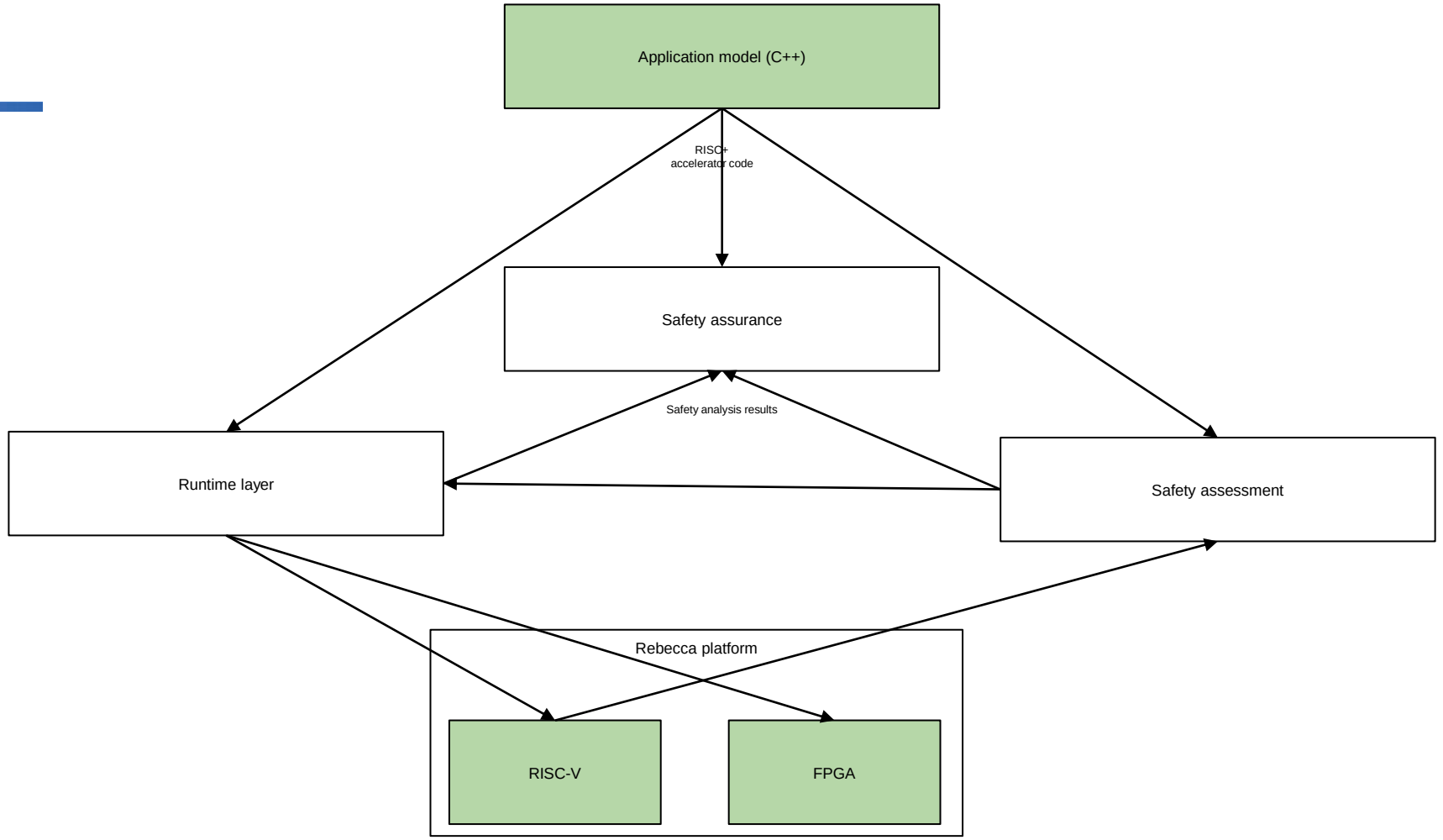
Exploring the safety of REBECCA



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Exploring the security of REBECCA

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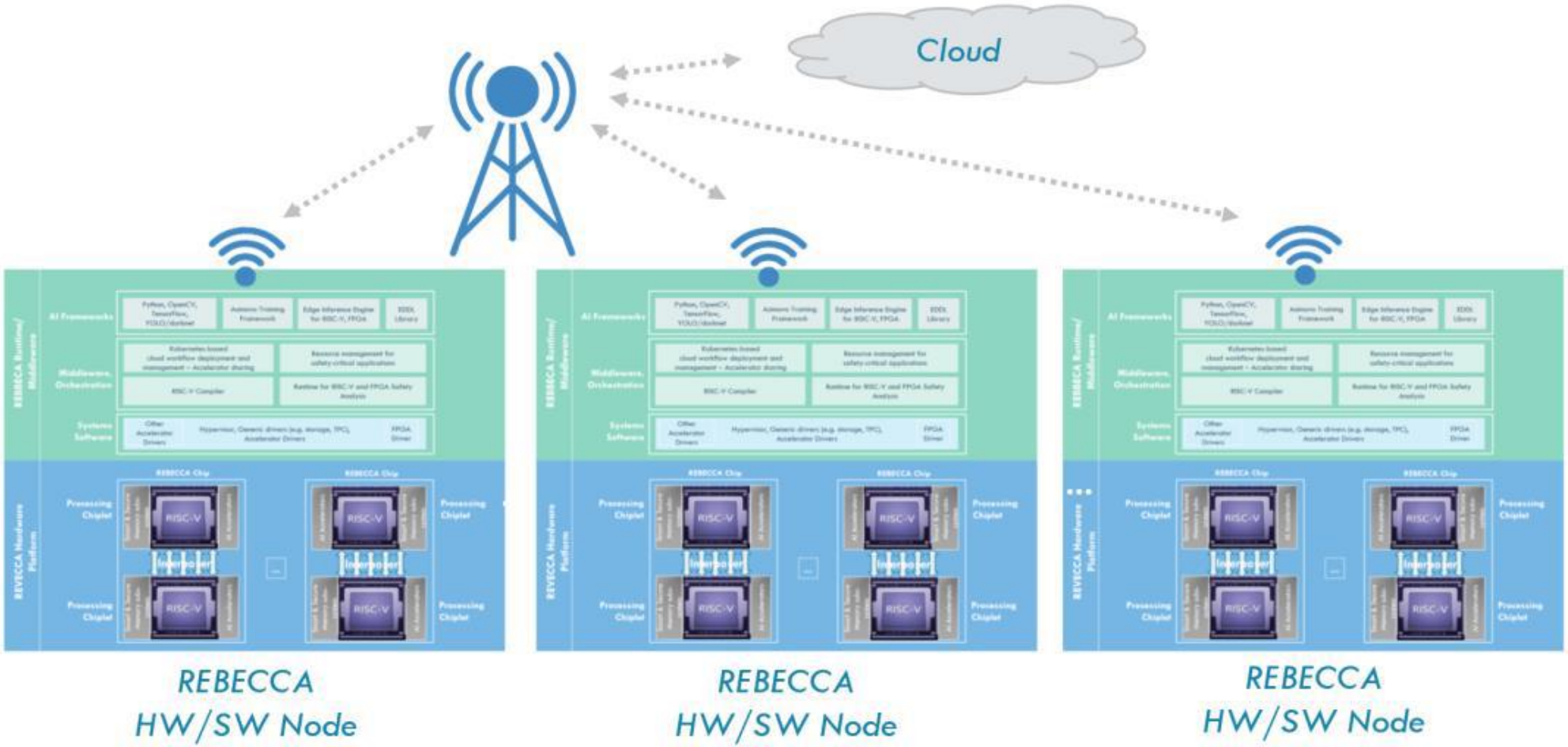
Many REBECCAs together



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REBECCA in (future) action

Real-time defect detection in PV panels on UAVs using computervision and deep learning algorithms.

AI-powered fridges that recognize food with image recognition using edge-AI capabilities and a custom lightweight detector for real-time processing directly on-board.

High-speed damage inspection and vision in the loop on semiconductor equipment using advanced AI and computer vision algorithms to enhance visual inspection and localization capabilities in pick-and-place equipment.

Water infrastructure inspection using high-precision VSLAM and video processing to control drones, climbers, and wall inspectors, with a prototype.

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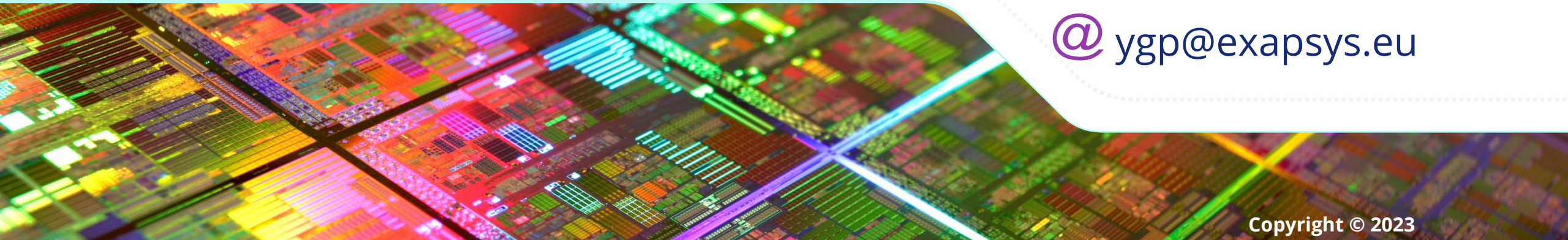
EDGE AI

Thank You

For your attention



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