FOUNDATION
OPENHW™
PROVEN PROCESSOR IP

European Competitiveness in Microelectronic and AI

Frédéric Desbiens
Senior Manager, Embedded and IoT | Eclipse Foundation

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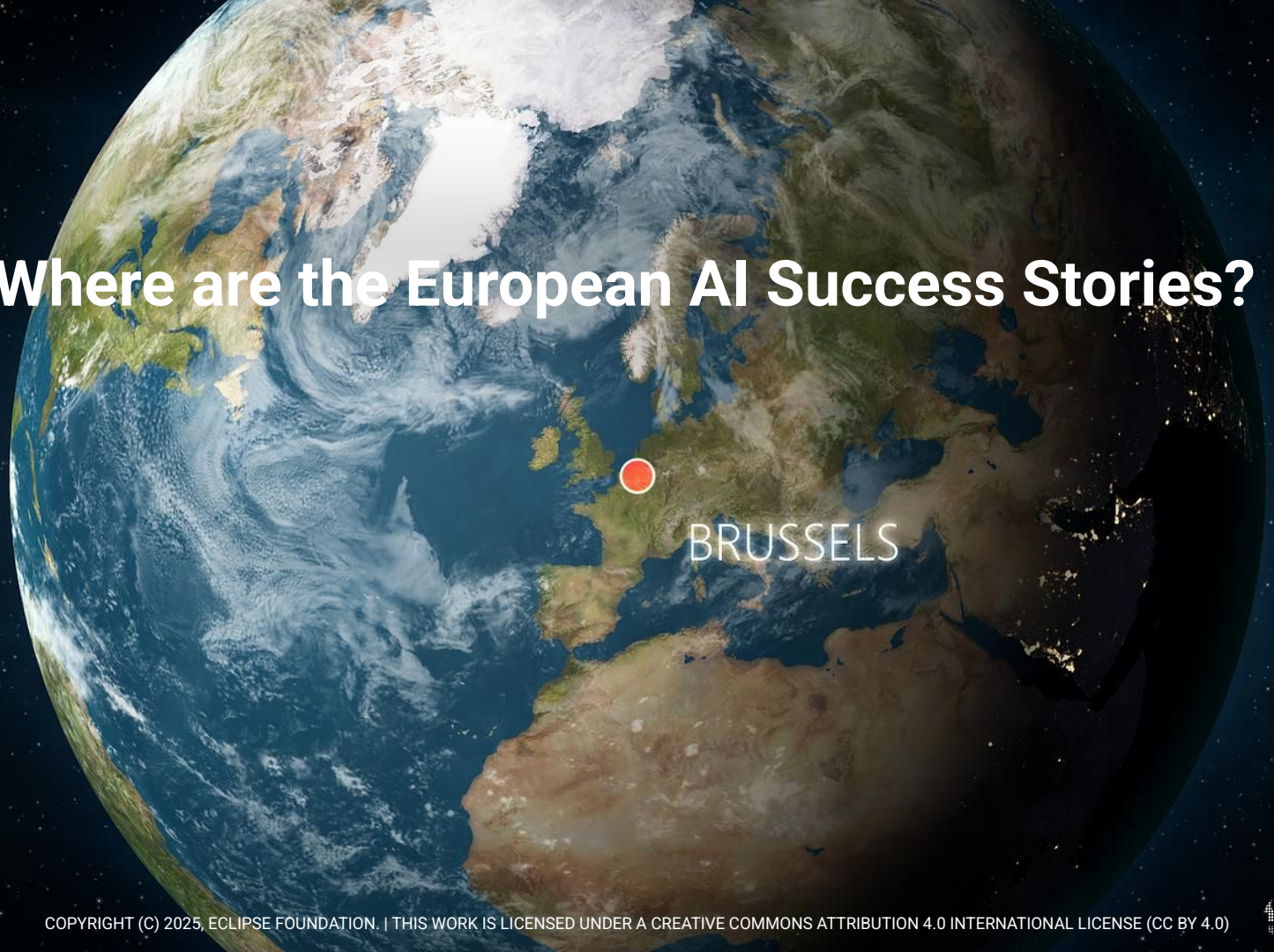
Where are the European AI Success Stories?



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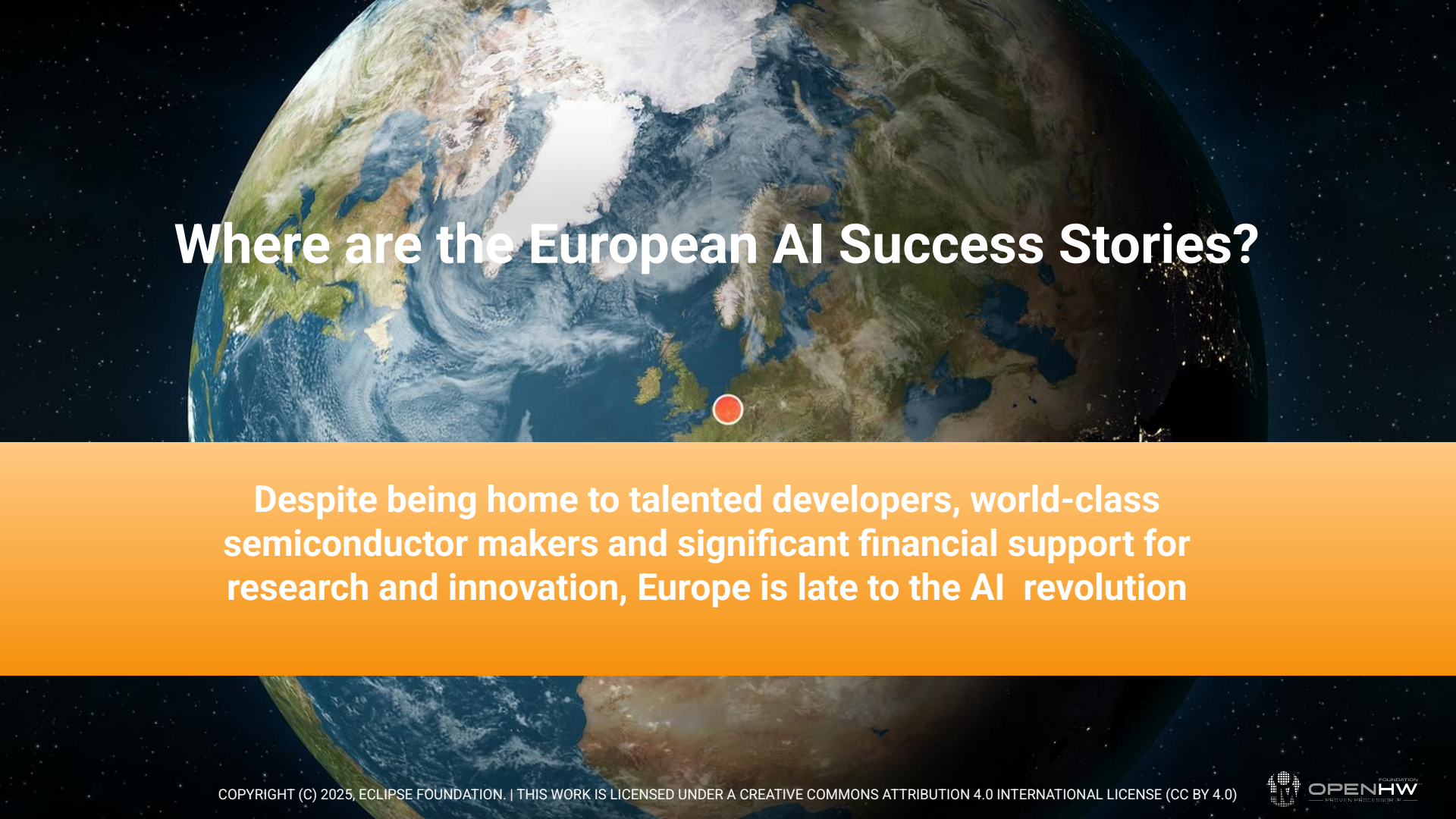

Where are the European AI Success Stories?

Despite being home to talented developers, world-class semiconductor makers and significant financial support for research and innovation, Europe is late to the AI revolution

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Agenda

- Microelectronics Sovereignty
- AI Case Studies
- OpenHW Foundation

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Microelectronics Sovereignty

A Challenge With an Open Source Solution

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Understanding the Current Gap

The microelectronics industry is dominated since the 1960s by US companies and their Asian partners

The growth of Embedded, IoT, and AI use cases drives microelectronics innovation

The EU realised that a strong domestic microelectronics ecosystem is key to its sovereignty and growth

General-purpose compute innovations slowed down significantly. Traditional CPUs are a commodity

There is tremendous value in custom chip designs.and specialised microelectronics

RISC-V provides an open, industrial-grade instruction set providing high-quality building blocks

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What’s The Plan?

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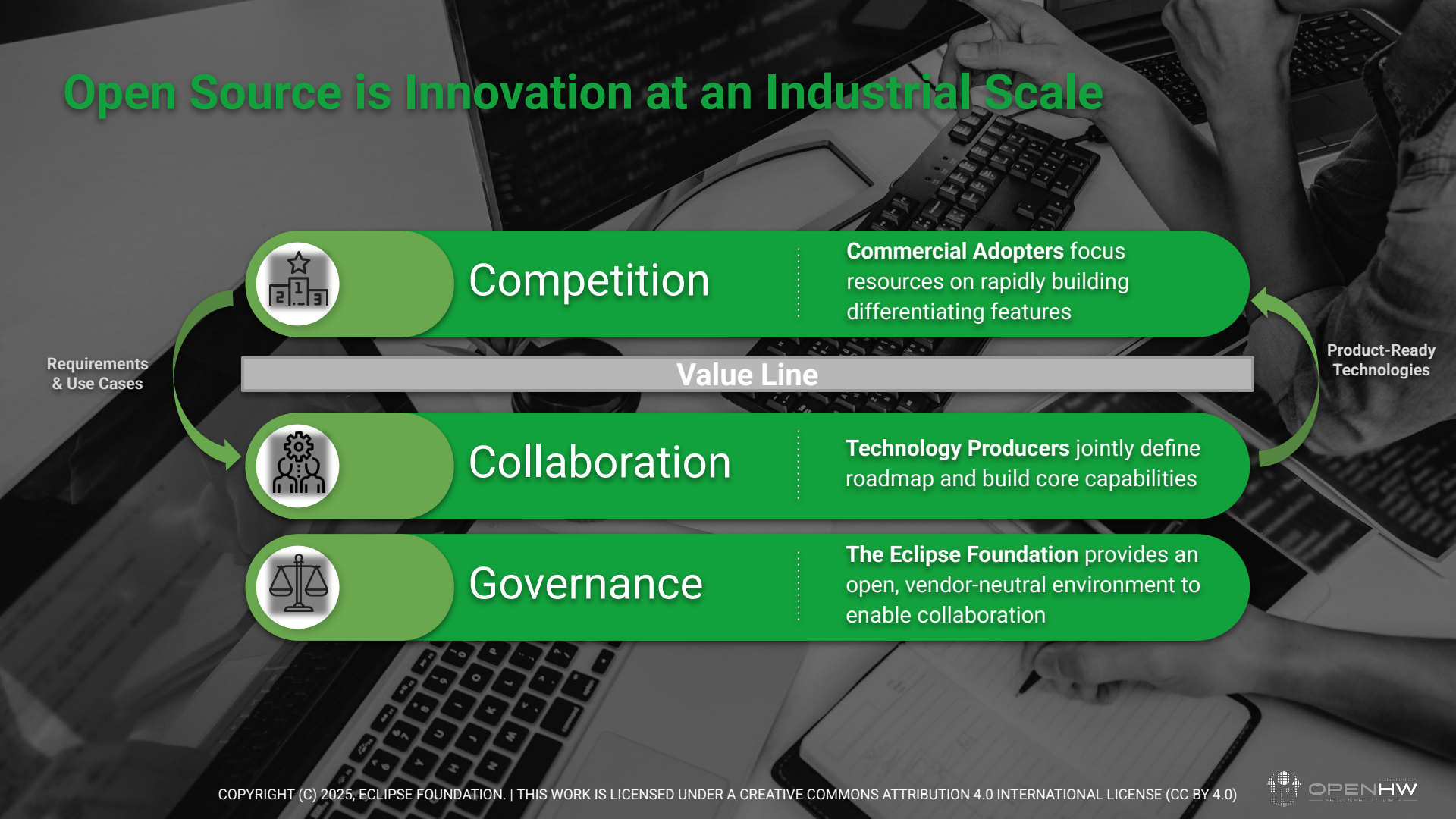
In other words: do not reinvent the wheel

Use open source RISC-V building blocks as the foundation for your AI innovations

Open Source is Innovation at an Industrial Scale



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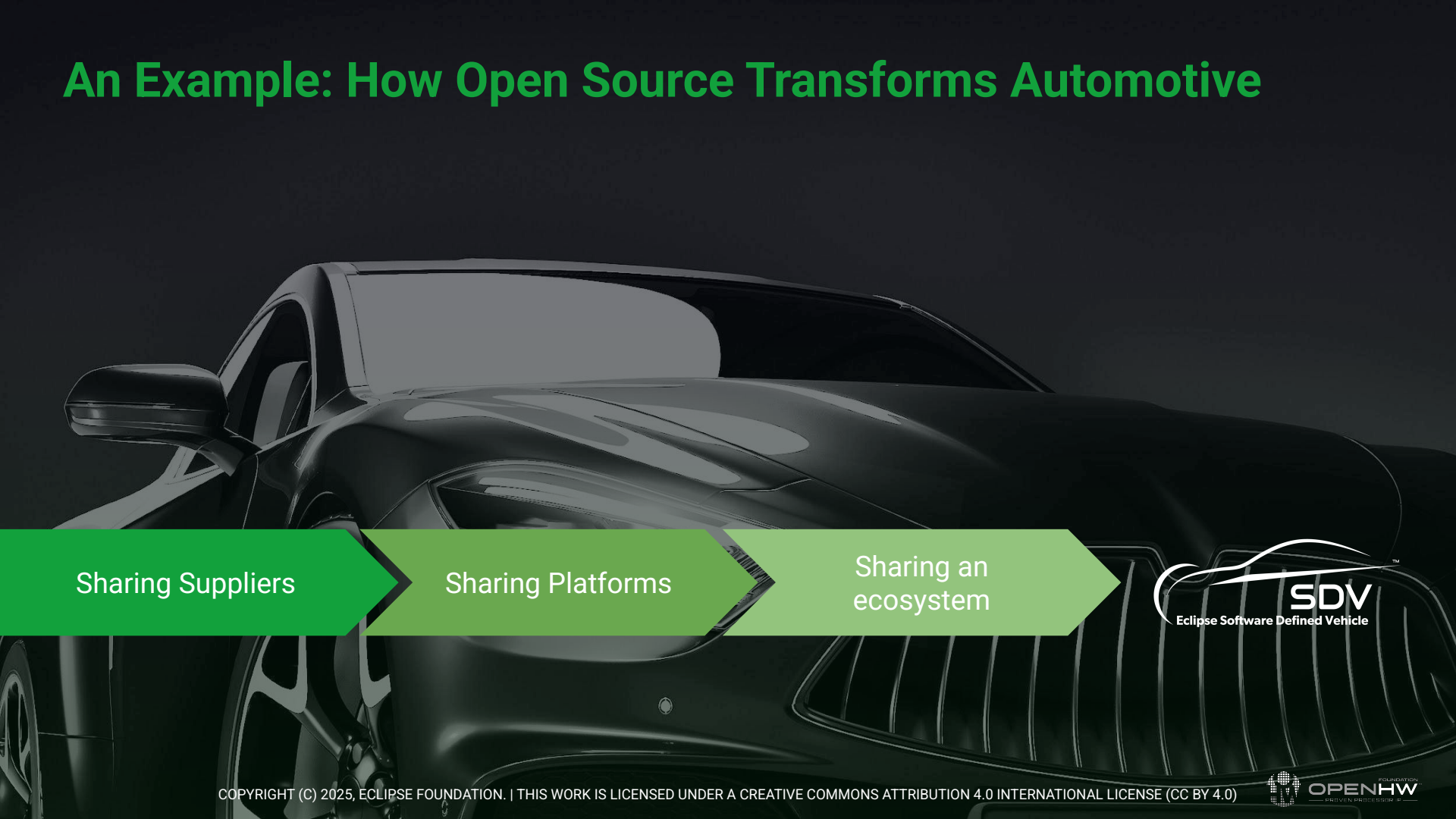
An Example: How Open Source Transforms Automotive



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Suggested Path Forward

- **Open standards** and **open source** is in our view a must ingredient to enable EU companies into a competitive stage and therefore a solid open source system to draw from
- The **European Union** has realized the importance of Microelectronic and putting more resources to make sure we are in a competitive and self sustaining position in this key technology
- Established Players must embrace RISC-V and other innovative approaches

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Open Hardware: the Future of AI, Cloud, and Embedded

The RISC-V CPU market is projected to grow at a **34.9% compound annual growth rate** through 2027.

RISC-V International, 2022

Proprietary hardware architectures often hinder innovation due to high costs and licensing restrictions, slowing down technological progress. **RISC-V addresses these challenges by offering an open source solution that enables faster development, improved interoperability, and lower costs**, especially in industries that require rapid advancements.

Over **16 billion RISC-V cores** are forecasted to be deployed by 2030, driven by sectors like AI, auto, and telecom.

RISC-V International, 2023

As the adoption of RISC-V accelerates in industries such as AI, automotive, and telecommunications, the **demand for robust, industry-grade cores is increasing.** These RISC-V cores ensure the **reliability, scalability, and security essential for mission-critical applications** in these sectors.

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How to Build an AI startup with Open Source RISC-V Designs

Case Studies

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AI for Inference

Meta's in-house AI Accelerator

- Training is infrequent, but inference is forever
- Enterprise Datacenters
- Significant power consumption (100's of watts)
- Large engineering teams

- Yet, a simple design
  - Make a Processing Element (PE)
  - Copy it a few times
  - Add some IO's
  - Powered by RISC-V and serving search results to Europeans today

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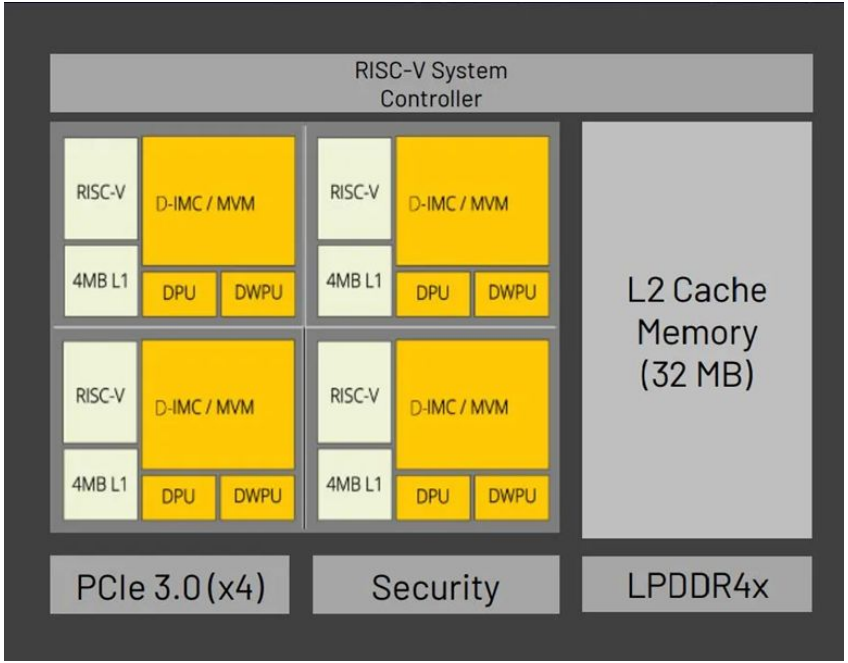
AI at the Edge

Axelera.AI edge AI

- Low-power (Could run on battery)
- Suitable for deeply embedded applications
- Available in M.2 form factor

- Again, a simple design
  - Again: Common building blocks with RISC-V Controller
  - Important: Security on-chip!
- Made in Europe! (Netherlands, Belgium, Italy, France, Switzerland)



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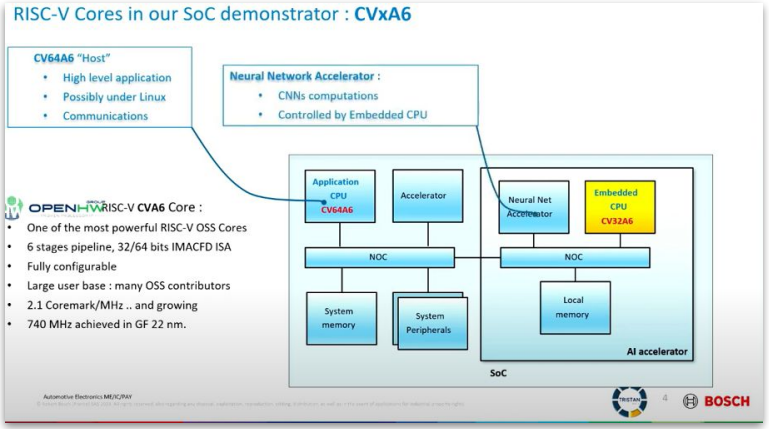
AI in European Automotive

Bosch automotive AI

- ADAS AI
- Radar/Camera image classifier
- Supported by Chips JU within the Tristan project

- Case study on how to enable RISC-V AI systems
- Uses OpenHW Cores



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5G / 6G OpenRAN

5G Infrastructure is a bottleneck

- Picocom (UK, formerly Europe ;))
- RISC-V enables more flexible build
- Has 32 RISC-V Cores in one 5G Chip!
- RISC-V as an accelerator and common building block
- Should look in OpenHW Cores

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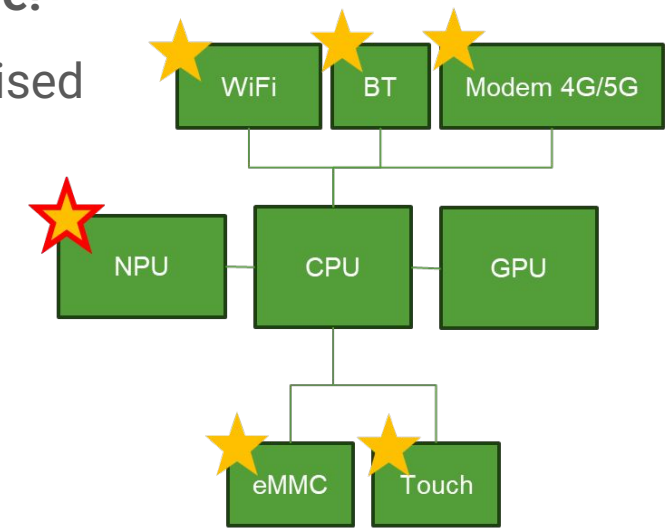
RISC-V in Your Phone

AI powered by RISC-V is already in your phone!

- Several ARM-based SOCs feature specialised cores powered by RISC-V
  - Yes, including “fruity” ones
  - Excludes the Nokia 3390



= RISC-V already today by some manufacturers, sometimes multiple Cores

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OpenHW Foundation

A Provider of Industrial-Grade RISC-V Building Blocks

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Who We Are

Founded in 2019, the OpenHW Foundation is the world's **only non-profit organisation dedicated to providing verified, industrial-grade open source processor cores**.

Through our ecosystem of members and partners, we are the largest open community focused on developing, verifying, and delivering **open source RISC-V cores** that are ready for commercial-grade System-on-Chip (SoC) production, benefiting industries such as embedded, cloud computing, automotive, AI, and IoT.

- Global, non-profit organisation
- Leading developer of industry-ready RISC-V Cores
- Provide infrastructure, coordination and governance
- Supported by a vibrant community of developers
- Driven by its members and partners

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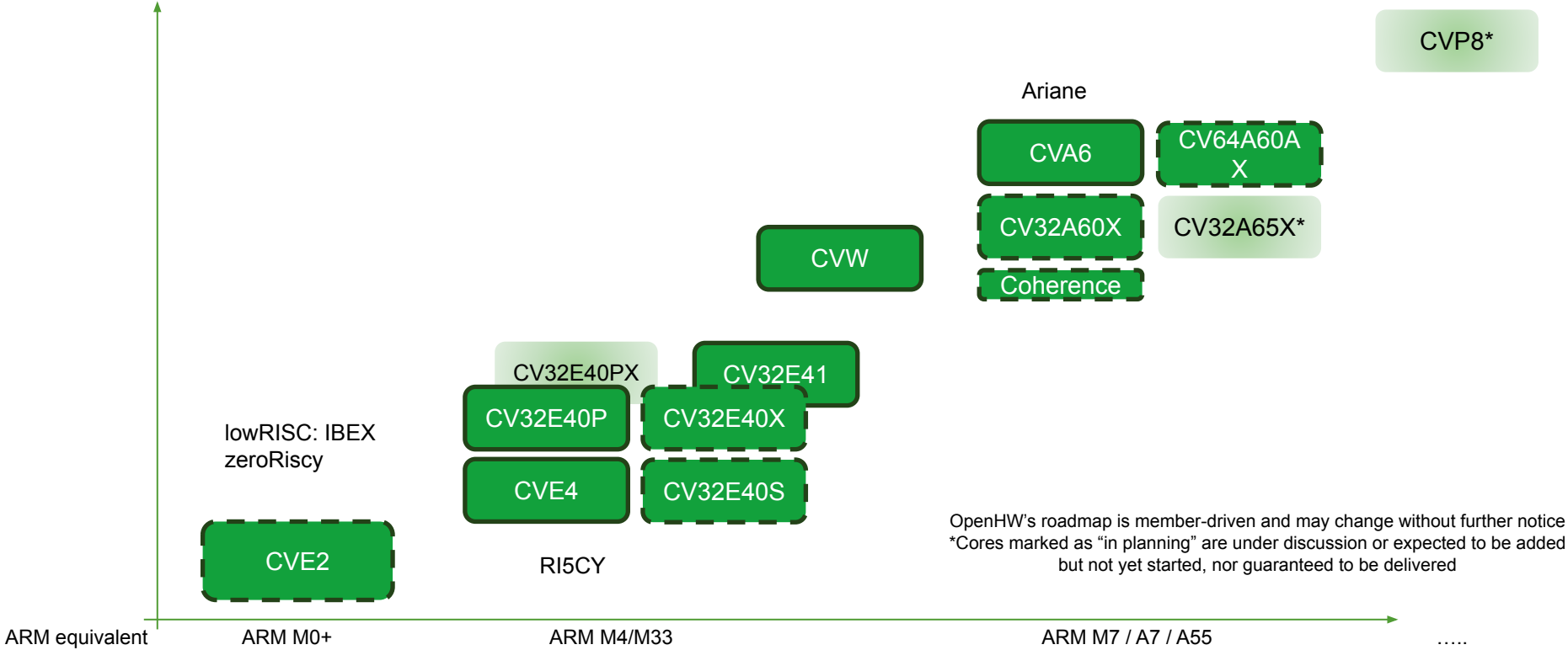
OpenHW RISC-V Roadmap



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TRISTAN Overview

“**T**ogether for **RIS**c-V **T**echnology and **A**pplicatio**N**s”

TRISTAN is a **36 month** KDT-JU (Key-Digital Technology Joint Undertaking) program under the Horizon-Europe calls via a **public-private partnership** focused on research and innovation to reinforce the EU’s strategic autonomy in the electronic components and systems sector

There are **46 participants** in TRISTAN and several are part of OpenHW Group ecosystem

THALES cea NXP SIEMENS

ETH zürich

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

GREENWAVES TECHNOLOGIES

codasip

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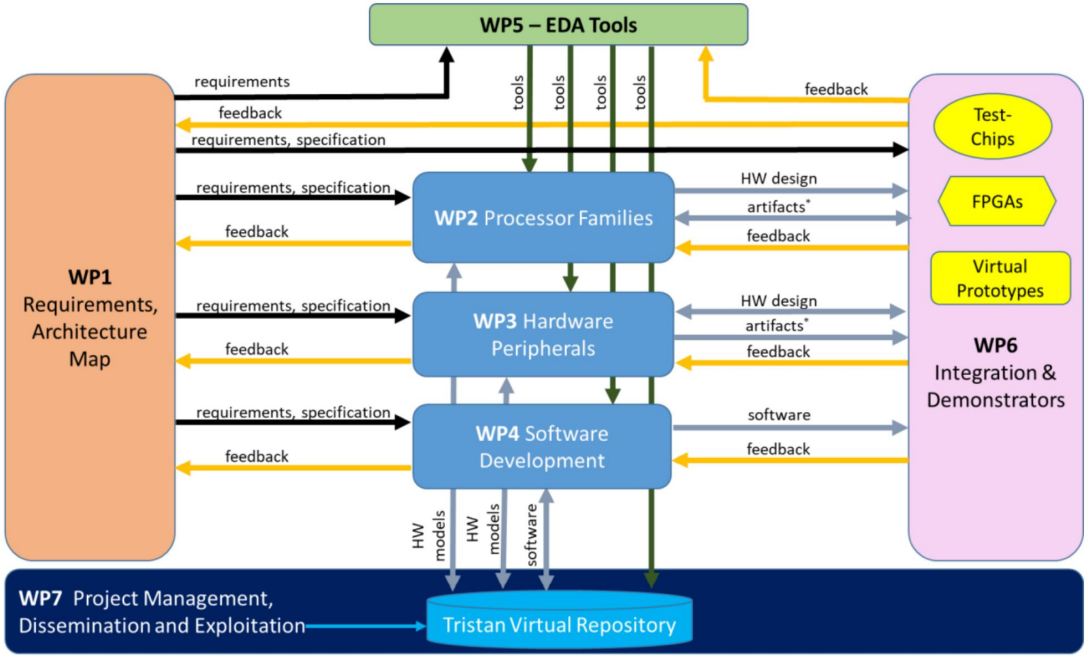
TRISTAN Work Packages

Eclipse/OpenHW is directly involved in WPs 1, 2, 3 & 7

- Development, verification & maintenance of the CORE-V CVE2, CVE4 & CVA6 and associated I/Fs & peripherals such as: CVFPU, CV-X-IF, GPIO, SPI, UART, PMP, PLIC, CLIC, AMBA-OBI, etc.
- Organizing training workshops such as the TRISTAN Verification workshop at the RV Summit Europe Barcelona June 2023



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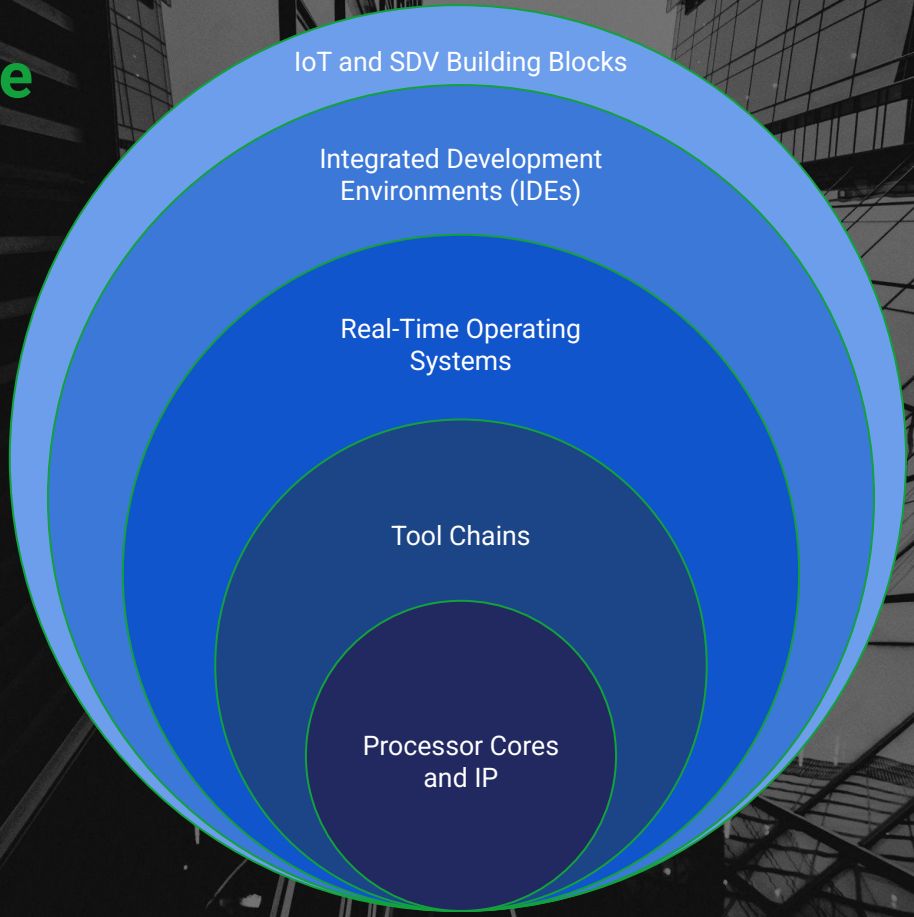
Towards a Comprehensive Open Source Embedded RISC-V stack



eclipse

eclipse iot

THEIA

ECLIPSE THREADX

FOUNDATION OPENHW PROVEN PROCESSOR IP

Call to Action

- We need to catch up fast!
- RISC-V is the recurring theme in AI and Microelectronic in general
- Chips JU and the Tristan project aim to provide standard RISC-V building blocks
  - Crucial contribution of high-quality, free, and flexible processor IP for all European SMEs
- OpenHW Foundation is an ecosystem to host, maintain and verify high-quality, industrial-grade RISC-V cores

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