EUROPEAN PROCESSOR INITIATIVE:
The Industrial Cornerstone of EuroHPC for Exascale Era

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THE STRATEGIC INTERPLAY

DRIVERS OF THE EPI PROPOSAL

- Climate change
  - more accurate weather forecasting, predicting large-scale natural disasters
  - severe weather cost 149,959 lives and EUR 270 billion in economic damage in Europe between 1970 and 2012.
- Aging population
  - personalised and precision medicine - process information about a person's genes, proteins, and diet to prevent, diagnose and treat diseases.
  - biomolecular research, to investigate the dynamics of biomolecules and proteins in human cells, which is crucial for treating autoimmune diseases and also cancer and diabetes.
- knowledge of geophysical processes
- high-resolution simulation and modelling of the human brain.
- testing of drug candidate molecules

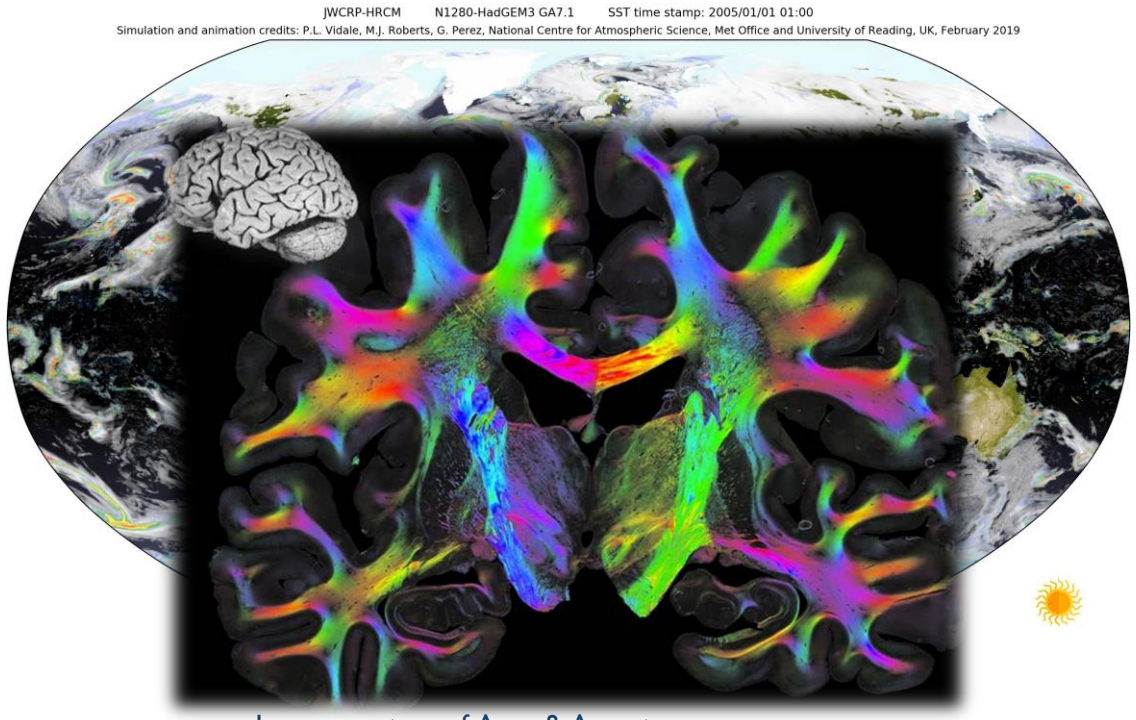


Image courtesy of Axer & Amunts,
INM-1, Forschungszentrum Jülich

Image/video: courtesy of P.L.Vidale, M.J. Roberts, G.Perez, NCAS, Met Office, University of Reading

DRIVERS OF THE EPI PROPOSAL

- Intensifying global competition
  - designing renewable energy parks
  - high performance photovoltaic materials
  - optimising turbines for electricity production.
  - producing higher quality goods and services.
- Cybersecurity needs
  - essential for national security and defence.
  - minimising costs
  - optimising decision processes
  - developing complex encryption technologies, tracking and responding to cyberattacks, deploying efficient forensics, nuclear simulations.
- Sovereignty (data, economical, embargo)

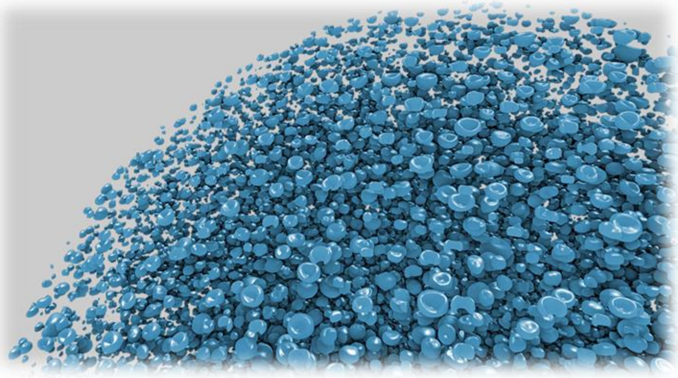


Image courtesy of Petros Koumoutsakos, ETH Zurich

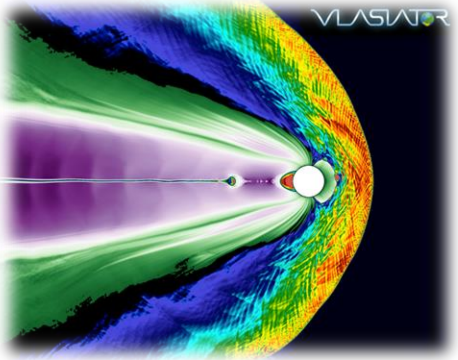


Image courtesy of Minna Palmroth, University of Helsinki

EUROHPC DECLARATION

- March 2017, Rome: EC launched the ***EuroHPC declaration***

- Agreement of signatory countries to commit to work together with each other and with the EC to acquire, build and deploy an integrated world-class High Performance Computing infrastructure in Europe

- January 2018: EC proposal to invest jointly with Member States €1 billion in world-class European supercomputers through a new legal and funding structure – the EuroHPC Joint Undertaking.

EUROHPC JU

- Legal instrument that allows the EU, Member States and associated countries and private partners to:
  - efficiently combine joint procurement and ownership of supercomputers
  - make joint investments in the development of leading technology, software and applications in Europe
- FOCUS:
  - **INFRASTRUCTURE**
  - **R&I**

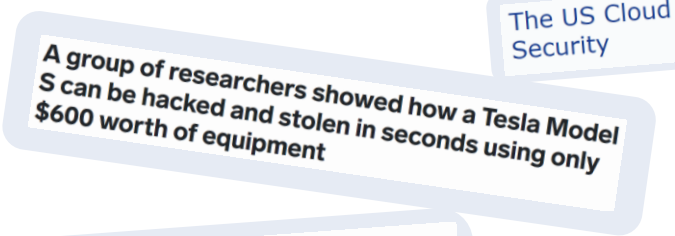
EUROHPC JU PARTICIPATING STATES

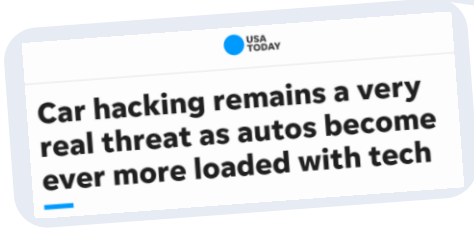
EUROHPC JU FOCUS

- Acquisition of world-class supercomputers, including
  - at least two petascale systems
  - two pre-exascale systems
  - Providing access to this new European supercomputing infrastructure to users from academia, industry and small and medium-sized enterprises, and the public sector, no matter where they are located in the EU.
- The Joint Undertaking will support the ***European Processor Initiative*** to develop, using European technologies, the low-power microprocessors needed to power supercomputers. This will make Europe less reliant on foreign technology in a field that is essential for many areas of the digital economy in high-performance computing and beyond

WHY EUROPE NEEDS ITS OWN PROCESSORS

- Processors now control almost every aspect of our lives
- **Security** (back doors etc.)
- Possible **future restrictions on exports to EU** due to increasing protectionism
- **A competitive EU supply chain** for HPC technologies will create jobs and growth in Europe
- Sovereignty (data, economical, embargo)





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WE GO BEYOND THAT…

DRIVERS OF THE EPI PROPOSAL (2)

- Connected mobility & ***A**utonomous **D**riving computing needs beyond 2023*
- Develop customized processors able to meet the performance needed for autonomous vehicles that would offer:
  - implementation of vehicle perception tasks in real-time in a fail-operational manner
  - increased computing performance, fail-operational, functional safety, cyber-security and real-time behaviour (RT)
  - compute resources with the same characteristics as their “big brothers” in exascale class supercomputers
- Sovereignty (data, economical, embargo)
- EU car manufacturing supremacy

DRIVERS OF THE EPI PROPOSAL (3)

- Servers and Cloud Low Power CPU needs:
  - energy efficiency - lower power consumption
  - new generation of secure and safety-aware virtualization capabilities
- Sovereignty (data, economical, embargo)

European Processor Initiative

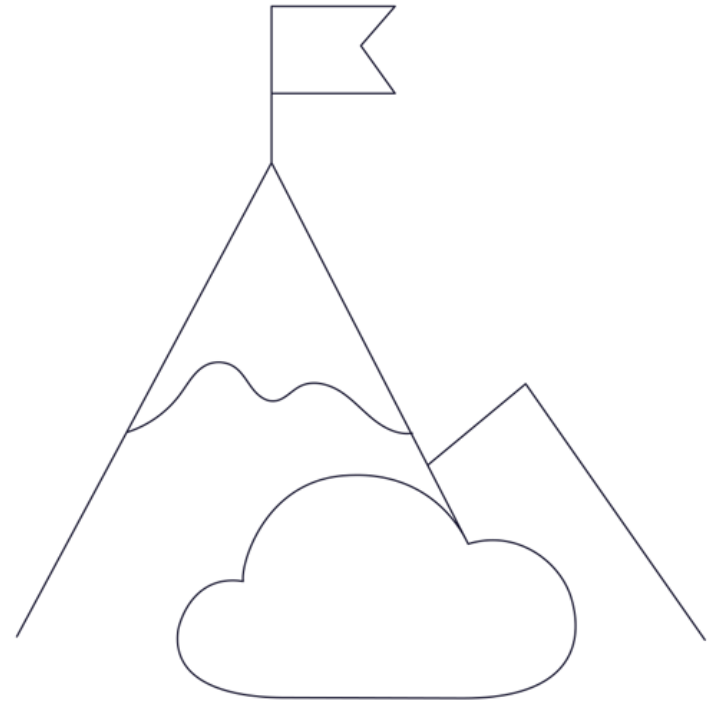
EUROPEAN PROCESSOR INITIATIVE

- High Performance General Purpose Processor for HPC
- High-performance RISC-V based accelerator
- Computing platform for autonomous cars

- Will also target the AI, Big Data and other markets in order to be economically sustainable

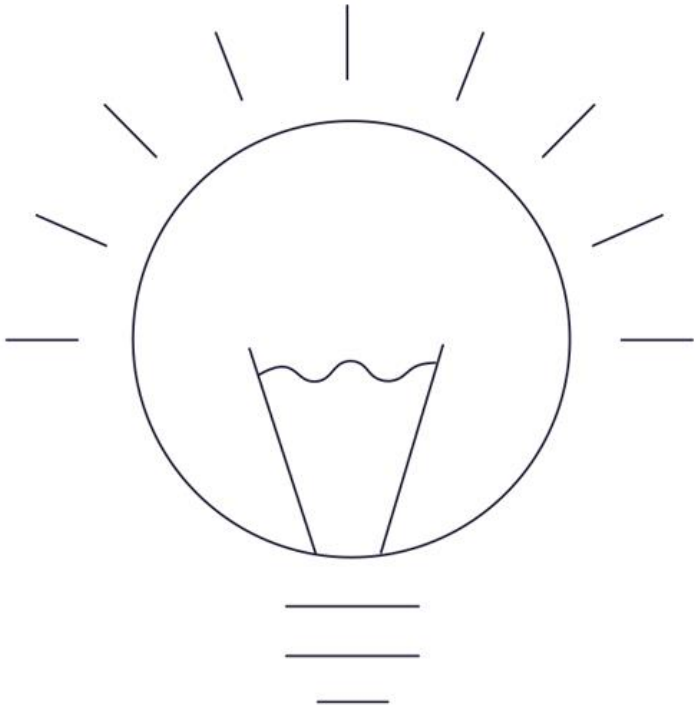
MISSION

- European independence in High Performance Computing Processor Technologies
- EU Exascale machine based on EU processor by 2023
- Based on solid, long-term economic model, Go beyond HPC market
- Address the needs of European industry (car manufacturing market)
- End-to-end data security



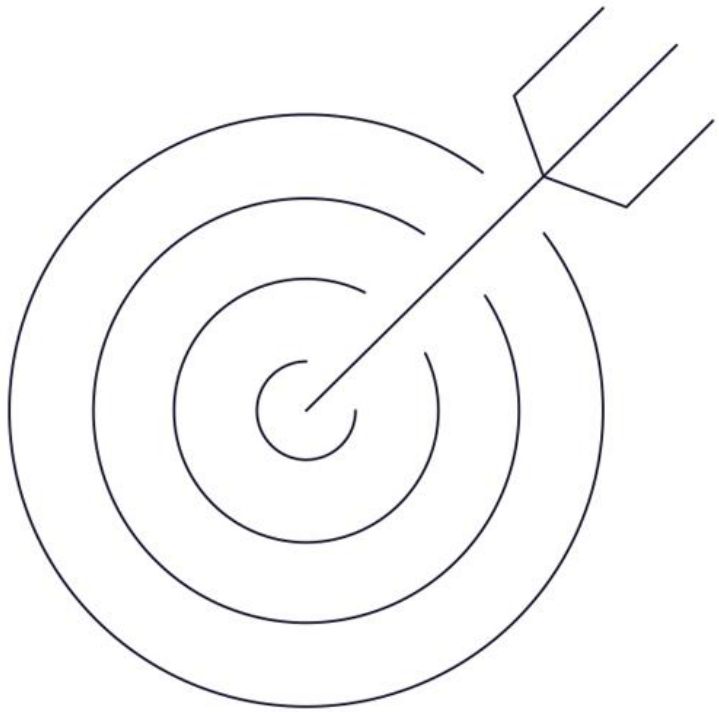
VISION

- High Performance Computing needs for Exascale machines beyond 2022
- Connected mobility & Autonomous Driving computing needs beyond 2023
- Low power CPU needs for Servers and Cloud
- Other markets under exploration (Server and Cloud)



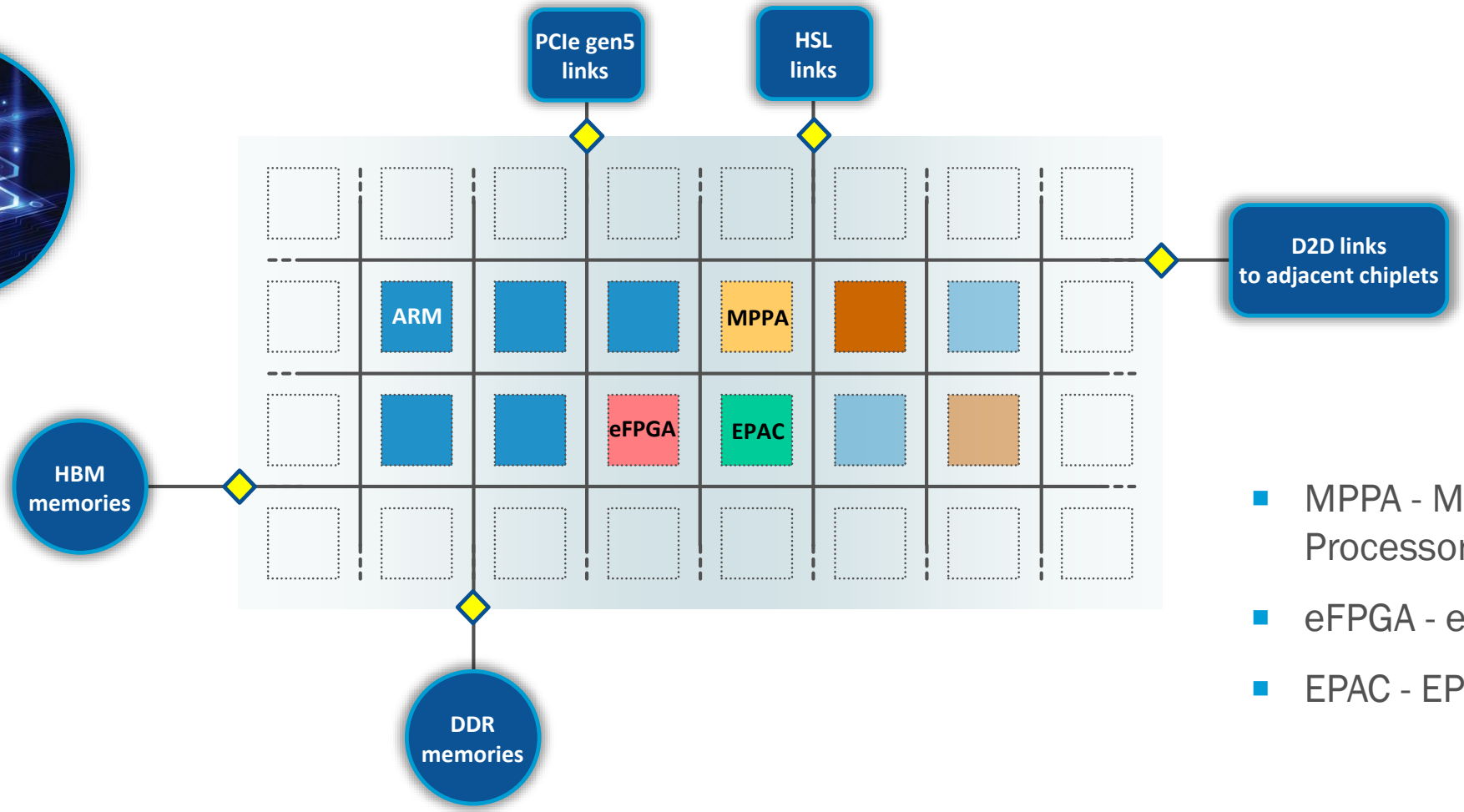
EXPECTED IMPACT

- Strengthening the competitiveness and leadership of European industry and science
- European microprocessor technology with drastically better performance/power ratios
- Tackling important segments of broader and/or emerging HPC and Big-Data markets



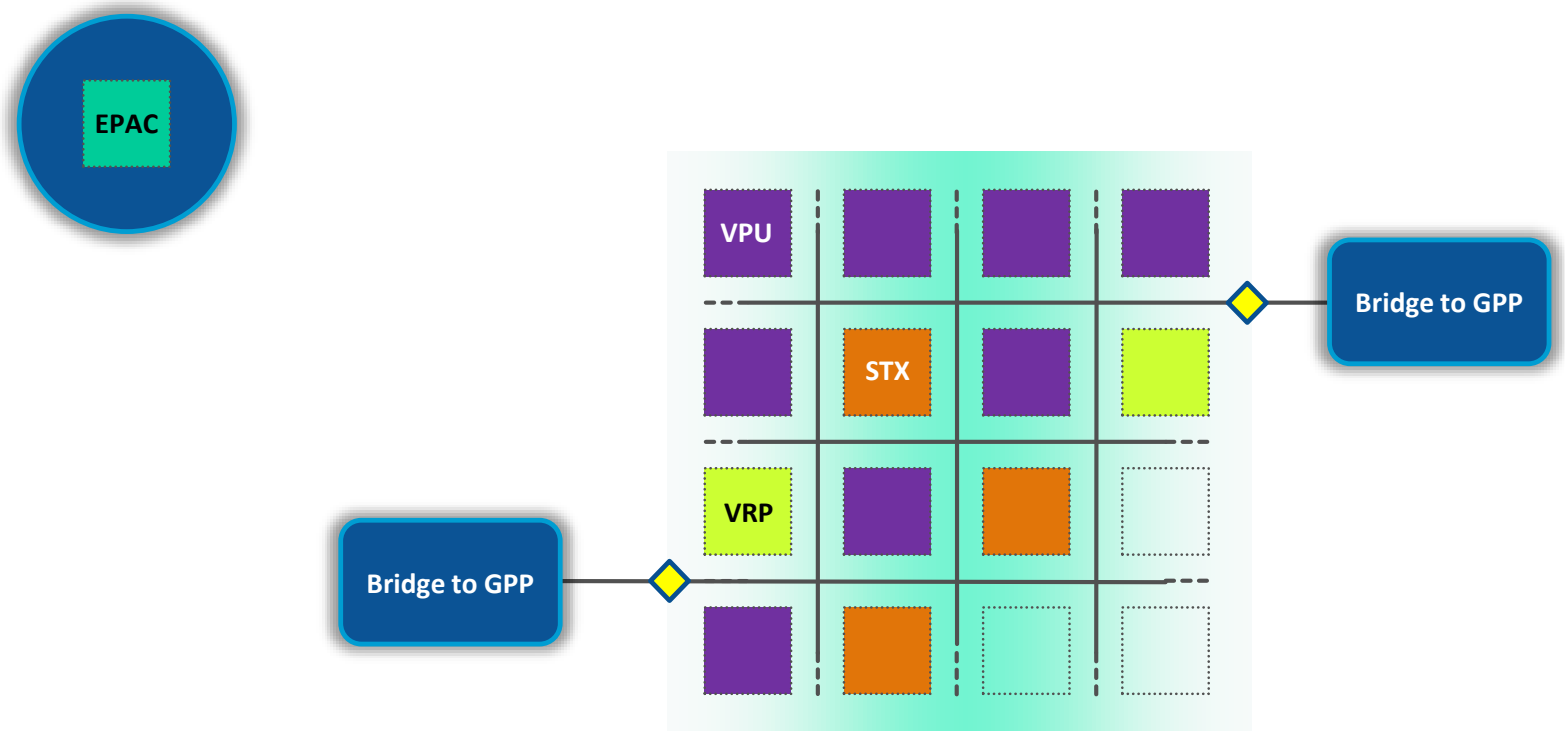
COMMON PLATFORM

GPP AND COMMON PLATFORM ARCHITECTURE



- MPPA - Massively Parallel Processor Array
- eFPGA - embedded FPGA
- EPAC - EPI Accelerator

EPAC – RISC-V ACCELERATOR

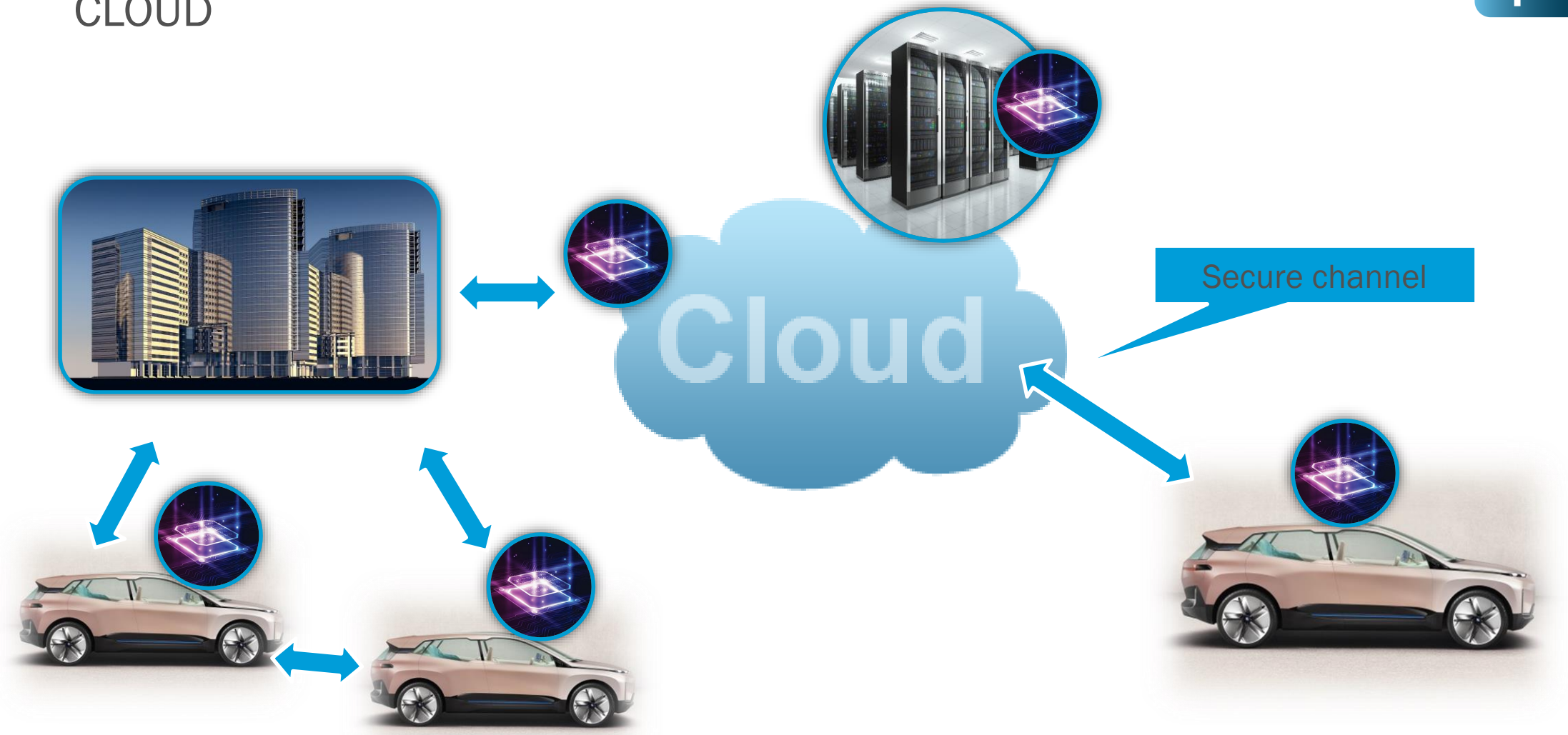


- EPAC - EPI Accelerator
- VPU – Vector Processing Unit
- STX – Stencil/Tensor accelerator
- VRP - VaRiable Precision co-processor

EPI AUTOMOTIVE

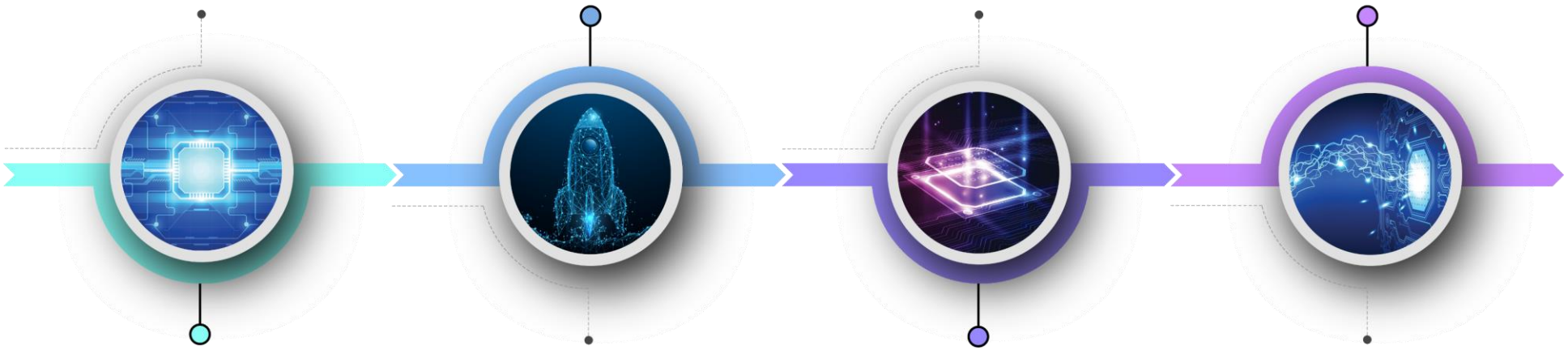
- Autonomous driving systems
- Connected mobility
- EPI: A powerful data fusion platform – the automotive embedded HPC platform
- EPI heterogeneous multicore architecture can provide enough performance and low power consumption in parallel

END2END SECURITY - FROM THE AUTOMOTIVE SYSTEM TO THE CLOUD



EPI ROADMAP

EPI IP's Launch Pad & Pan European Research Platform for HPC and AI



2021

Rhea Family - Gen1 GPP

EPI Common Platform
ARM & RISC-V
External IPs
•
HPC System PreExascale
Automotive PoC

2021-2022

2022-2023

Cronos Family - Gen2 GPP

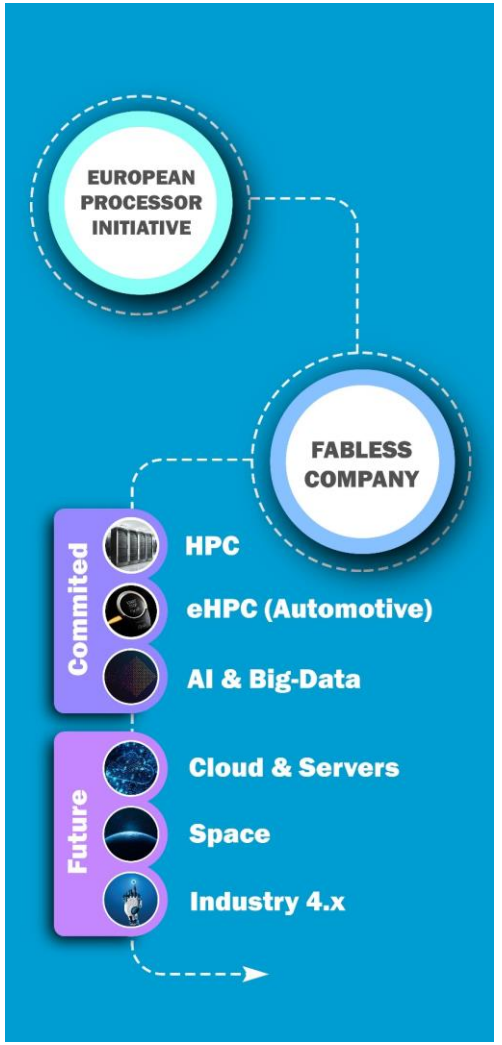
EPI Common Platform
ARM & RISC-V
•
HPC System Exascale
Automotive CPU

Gen3 GPP Family

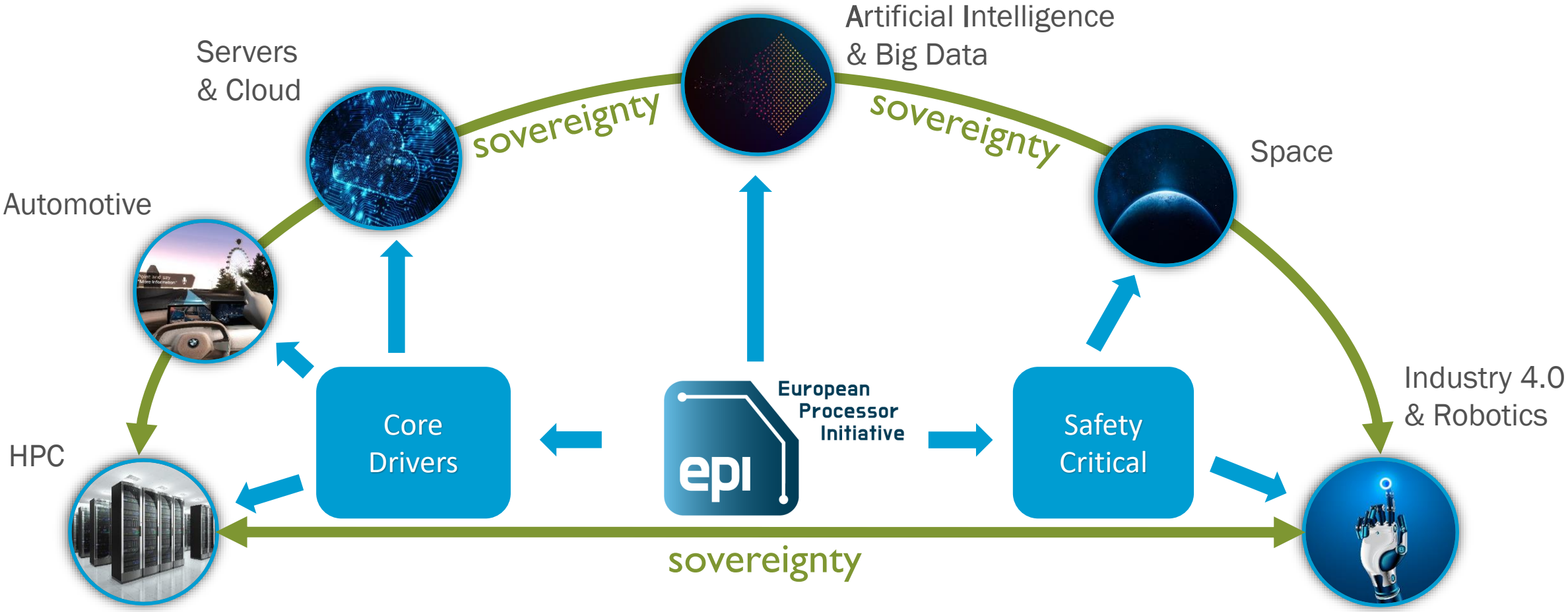
2024-...

EPI FABLESS COMPANY

- EPI's Fabless company
  - licence of IPs from the partners
  - develop own IPs around it
  - licence the missing components from the market
  - generate revenue from both the HPC, AI, server and eHPC markets
  - integrate, market, support & sales the chip
  - work on the next generations



SCALABILITY ALLOWS WIDE MARKET POTENTIAL COVERAGE



TO CONCLUDE

- HPC is crucial to resolve societal challenges and preserve European competitiveness
- Europe is going in the right direction with EuroHPC. This must be sustained in the long-term
- The chip design effort must continue for the EU's security and competitiveness, and should create a processor ecosystem covering IoT, servers, cloud, autonomous connected vehicles and HPC

www.european-processor-initiative.eu