

EUROPEAN PROCESSOR INITIATIVE: EMBEDDED HPC FOR AUTOMATED AND CONNECTED VEHICLES

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5G & THE FUTURE OF MOBILITY, PISA, 11/04/2019



FRAMEWORK PARTNERSHIP AGREEMENT IN EUROPEAN LOW-POWER MICROPROCESSOR TECHNOLOGIES

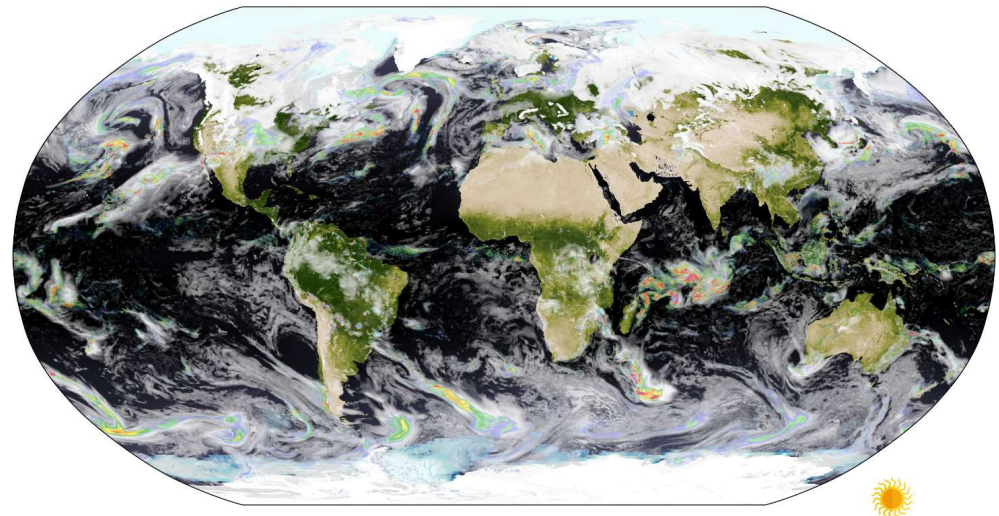


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DRIVERS OF THE EPI PROPOSAL (1)

Societal challenges

- Aging population
- Climate change
- Cybersecurity
- Increasing energy needs
- Intensifying global competition
- Sovereignty (data, economical, embargo)



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

DRIVERS OF THE EPI PROPOSAL (1)

- HPC can save billions by helping us to adapt to climate change
- HPC can improve human health by enabling personalized medicine
- HPC can improve fuel efficiency of aircraft & help design better wind turbines
- HPC can help us to understand how the human brain works

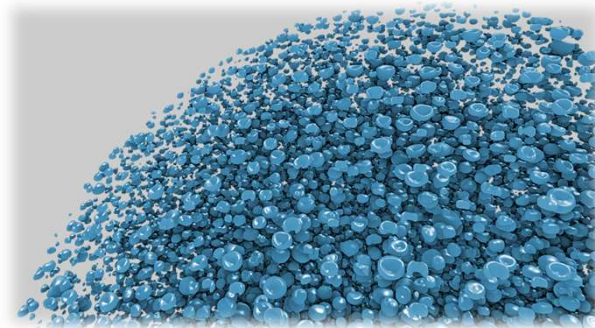


Image courtesy of Petros Koumoutsakos,
ETH Zurich

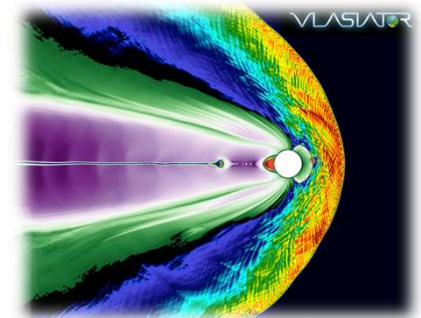


Image courtesy of Minna Palmroth,
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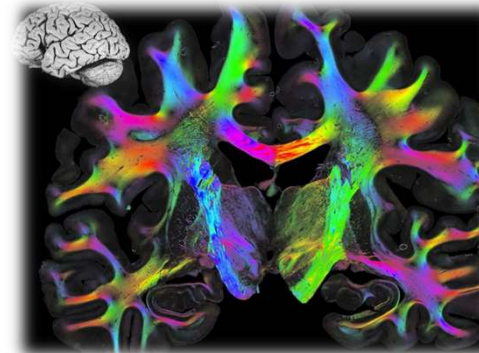
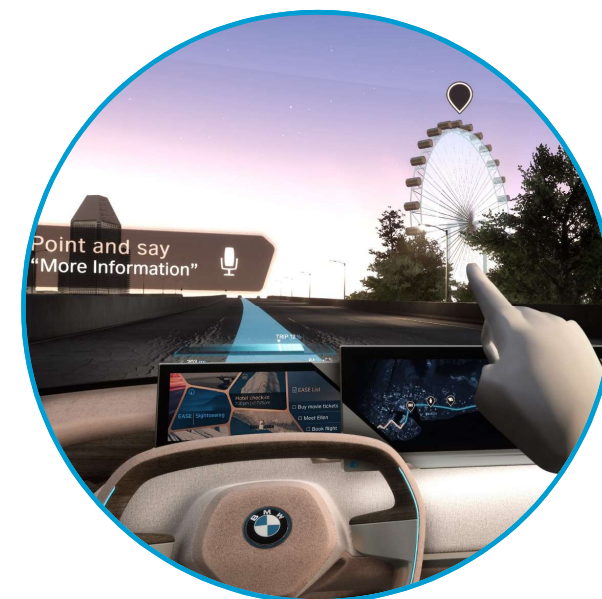


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INM-I, Forschungszentrum Jülich

DRIVERS OF THE EPI PROPOSAL (2)

- Connected mobility & *AD Autonomous Driving 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)

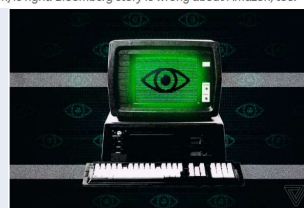


WHY EUROPE NEEDS ITS OWN PROCESSORS

- 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)

Amazon exec and Super Micro CEO call for retraction of spy chip story

'[Tim Cook] is right. Bloomberg story is wrong about Amazon, too.'



NSA May Have Backdoors Built Into Intel And AMD Processors



The US Cloud Act v The EU's GDPR - Data Privacy & Security

A group of researchers showed how a Tesla Model S can be hacked and stolen in seconds using only \$600 worth of equipment

A jet sale to Egypt is being blocked by a US regulation, and France is over it



Car hacking remains a very real threat as autos become ever more loaded with tech

Image sources:

<https://www.theverge.com/2018/10/22/18011138/china-spy-chip-amazon-apple-super-micro-ceo-retraction>
<https://www.businessinsider.in/a-group-of-researchers-showed-how-a-tesla-model-s-can-be-hacked-and-stolen-in-seconds-using-only-600-worth-of-equipment/articleshow/65761310.cms>
<https://eu.freep.com/story/money/2018/01/13/car-hacking-threat/1028270001/>
<https://www.eteknix.com/nsa-may-backdoors-built-intel-amd-processors/>
<https://www.pearse-trust.ie/blog/the-us-cloud-act-v-the-eus-gdpr-data-privacy-security>
<https://www.defensenews.com/global/europe/2018/08/01/a-jet-sale-to-egypt-is-being-blocked-by-a-us-regulation-and-france-is-over-it/>

HOW EUROHPC WILL HELP TO MAKE US STRONGER

- Developing a new European supercomputing ecosystem: HPC systems, network, software, applications, access through the cloud
- Making HPC resources available to public and private users, including SMEs.
- Stimulating a technology supply industry



EUROPEAN PROCESSOR INITIATIVE

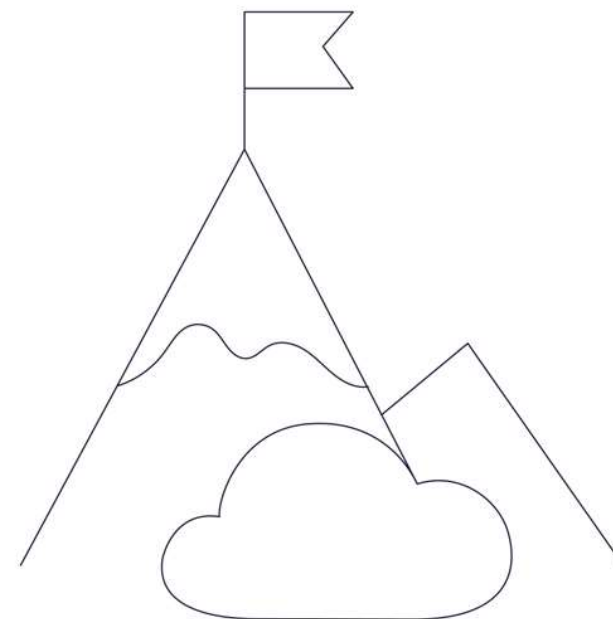
- High Performance General Purpose Processor for HPC
- High-performance RISC-V based accelerator
- Computing platform for autonomous cars
- Will also target the AI, Big Data and other markets in order to be economically sustainable

EPI PARTNERS



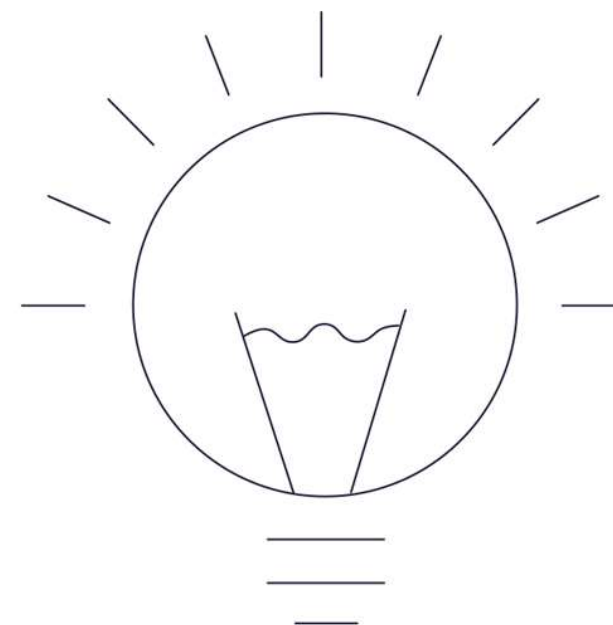
MISSION

- 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



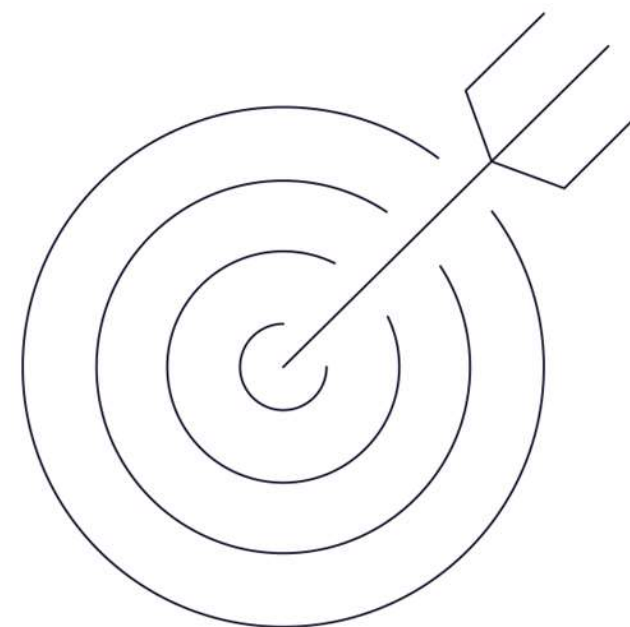
VISION

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

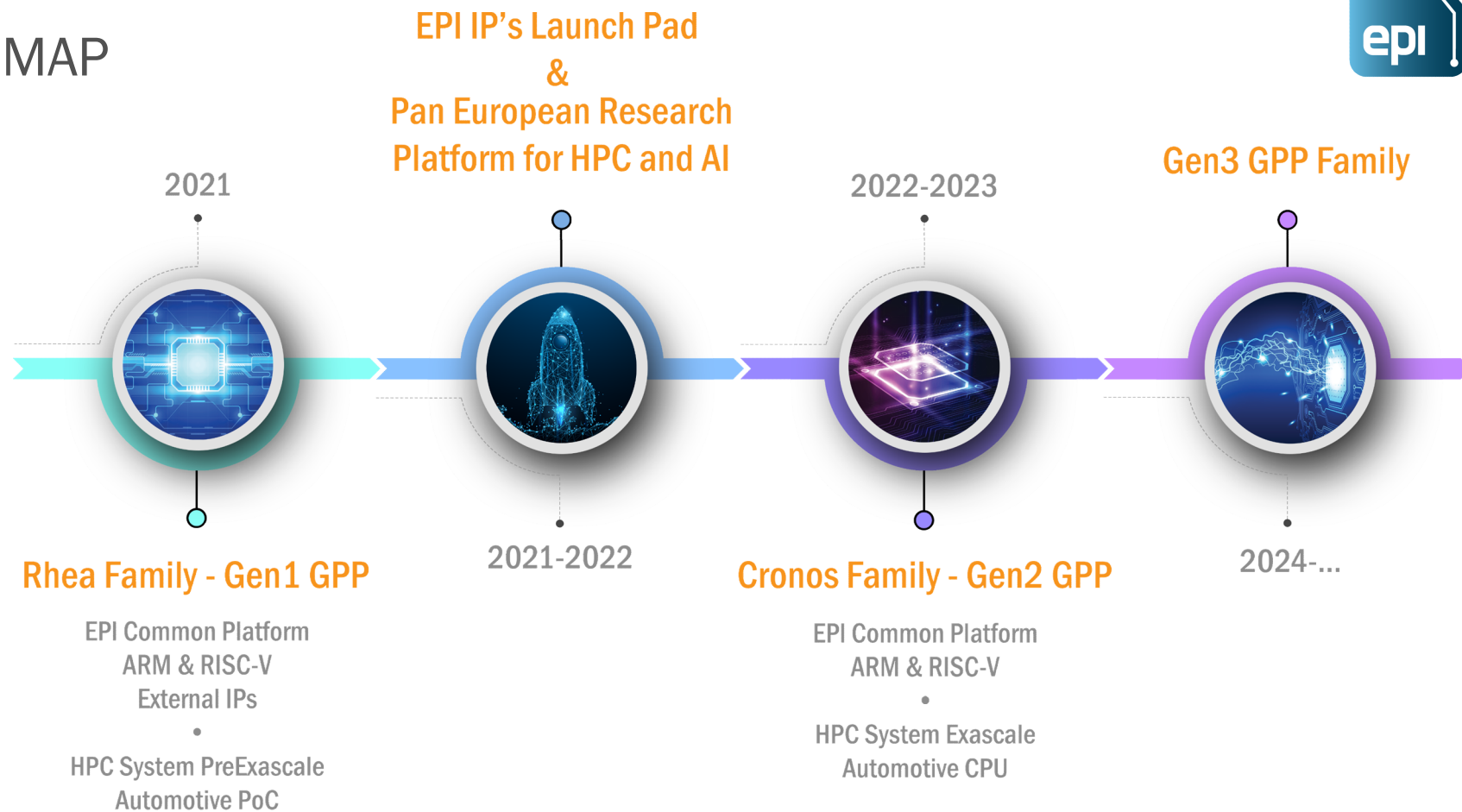


EXPECTED IMPACT

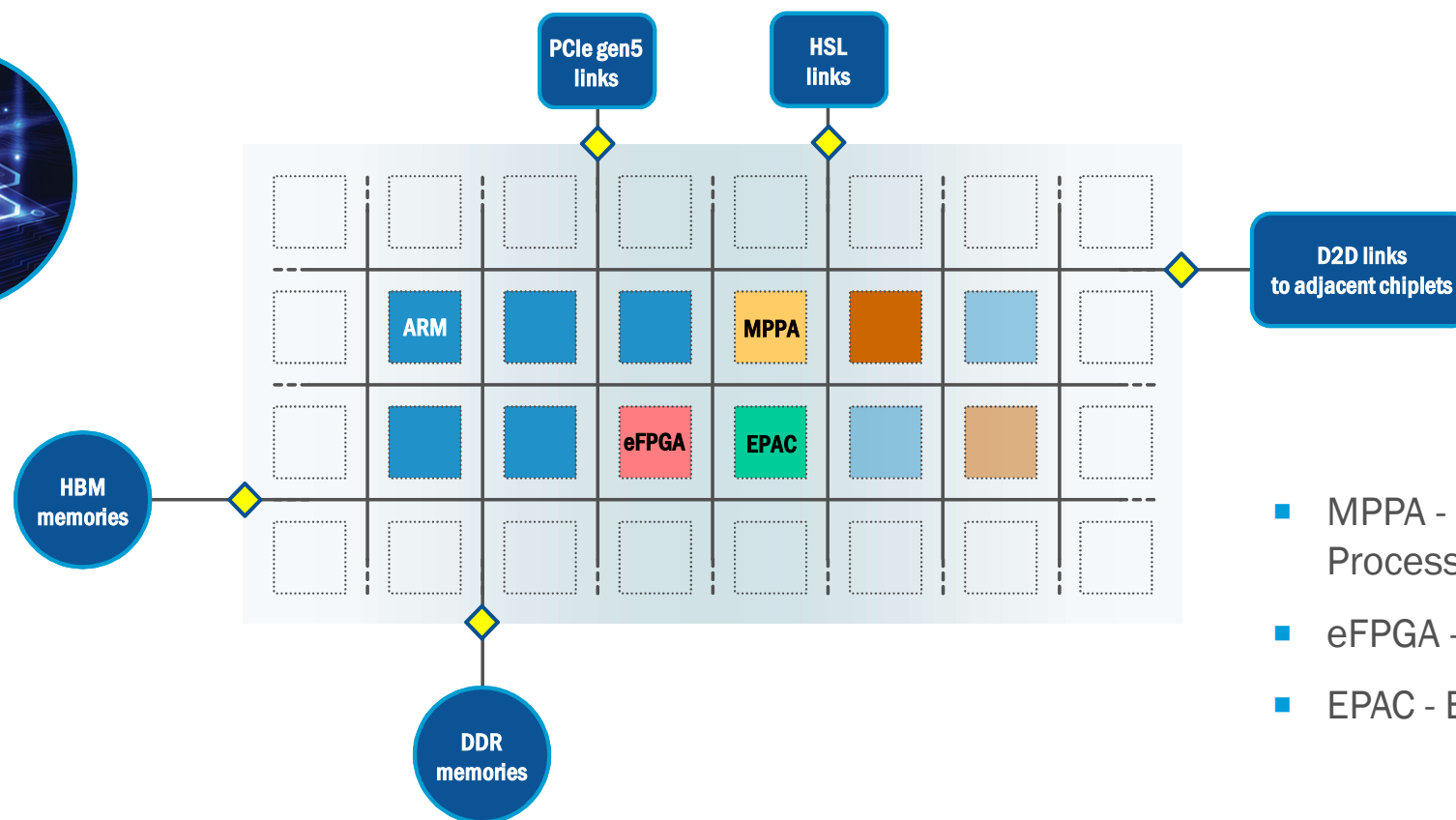
- Strengthening the competitiveness and leadership of European industry and science
- European microprocessor technology with drastically better performance/power ratios
- Tackling important segments of broader and/or emerging HPC and Big-Data markets



ROADMAP

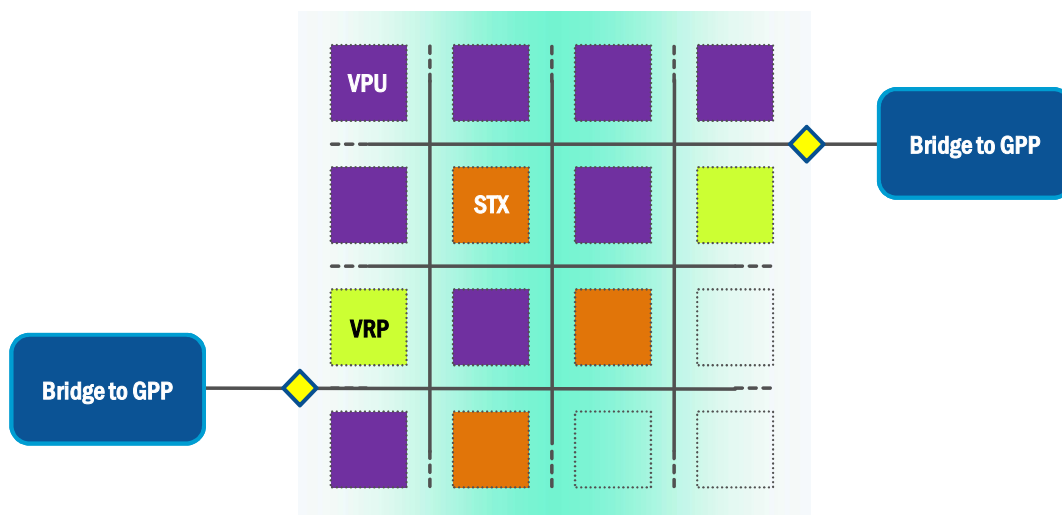
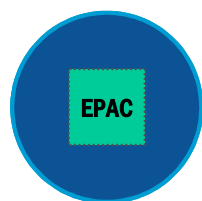


GPP AND COMMON ARCHITECTURE



- MPPA - Multi-Purpose Processing Array
- eFPGA - embedded FPGA
- EPAC - EPI Accelerator

EPAC – RISC-V ACCELERATOR



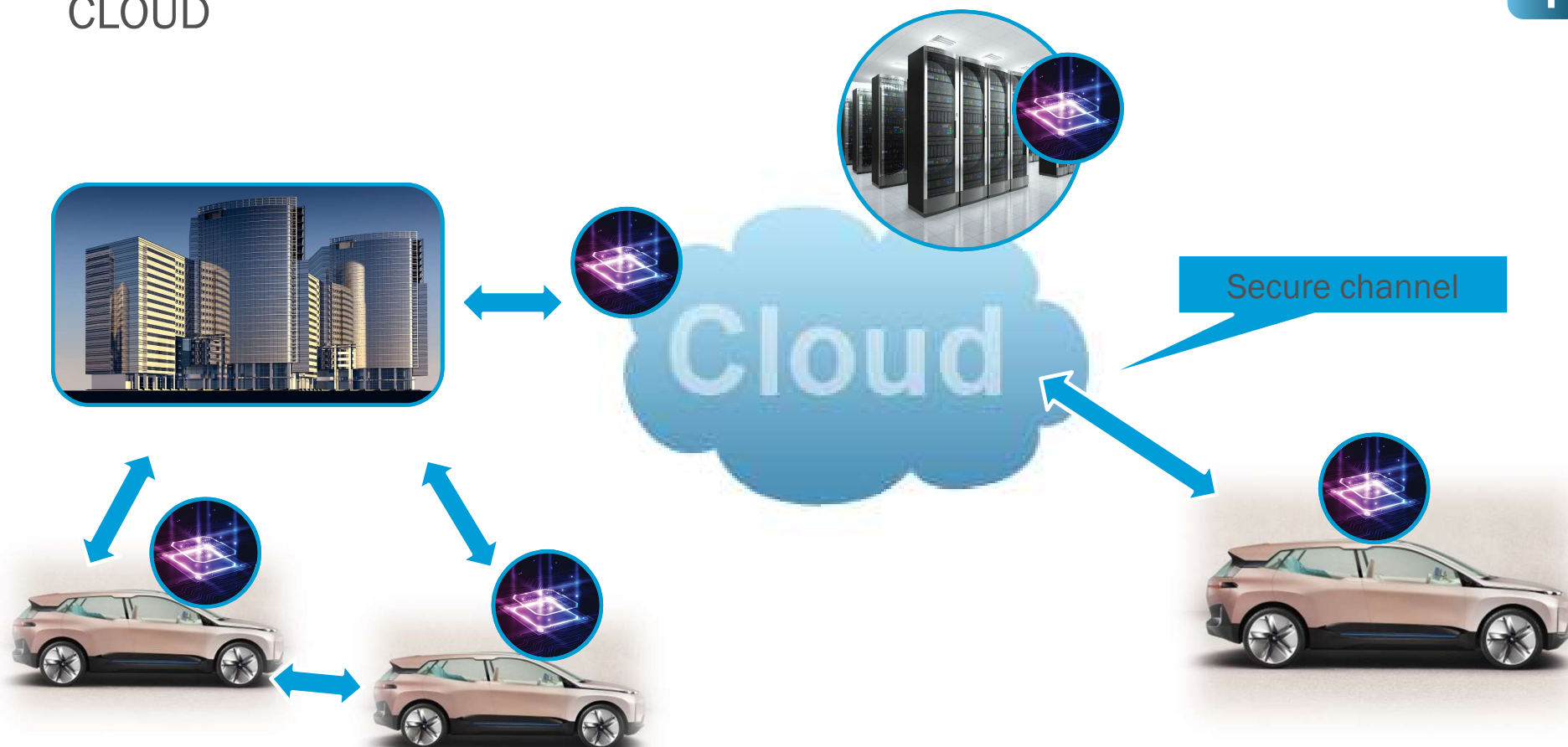
- EPAC - EPI Accelerator
- VPU – Vector Processing Unit
- STX – Stencil/Tensor accelerator
- VRP - VaRIable Precision co-processor

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

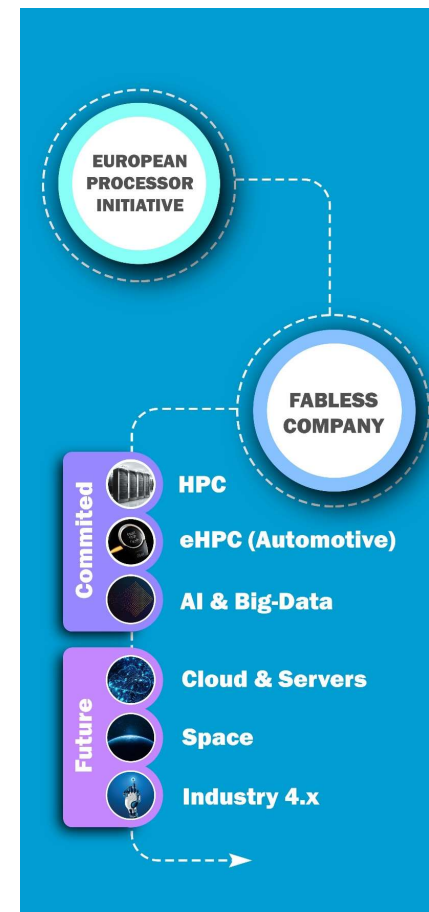


END2END SECURITY - FROM THE AUTOMOTIVE SYSTEM TO THE CLOUD

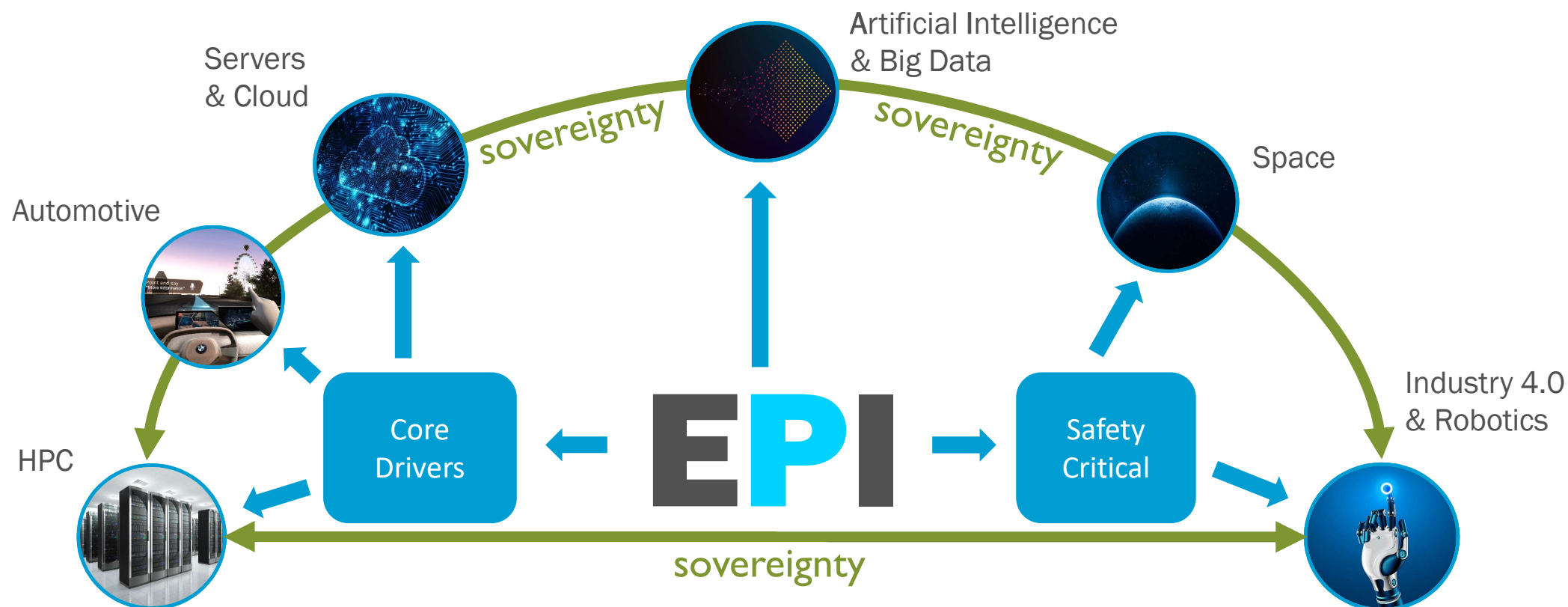


EPI FABLESS COMPANY

- 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, IA, server and eHPC markets
- integrate, market, support & sales the chip
- work on the next generations



SCALABILITY ALLOWS WIDE MARKET POTENTIAL COVERAGE



CONCLUSION

- 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