EMBEDDED HPC: THE CHALLENGE OF THE H2020 EUROPEAN PROCESSOR INITIATIVE
SUMMER SCHOOL "ENABLING TECHNOLOGIES FOR INDUSTRIAL IOT", 15 TO 20 JULY 2019, PISA

S. SAPONARA

(EPI TEASER V3.4, MAY 2019)

FRAMEWORK PARTNERSHIP AGREEMENT IN EUROPEAN LOW-POWER MICROPROCESSOR TECHNOLOGIES

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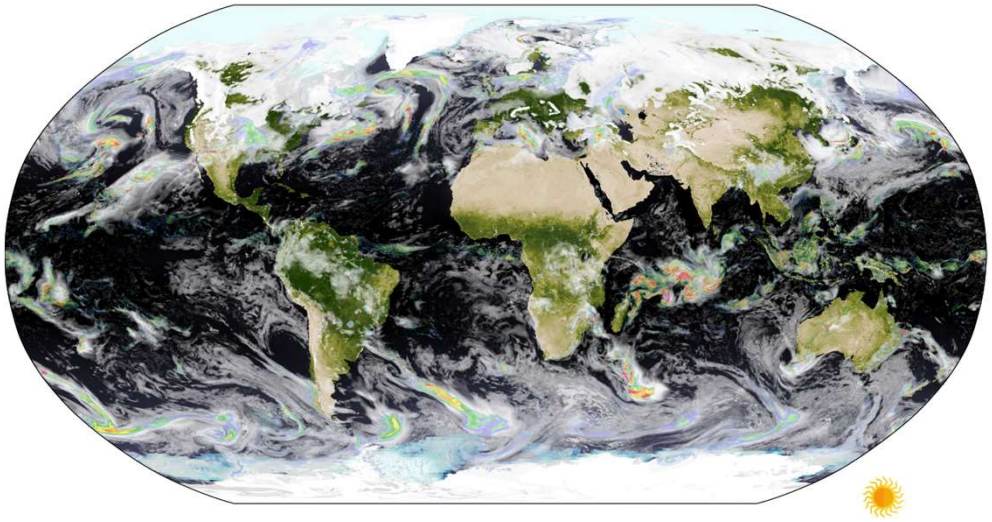
DRIVERS OF THE EPI PROPOSAL (1)

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

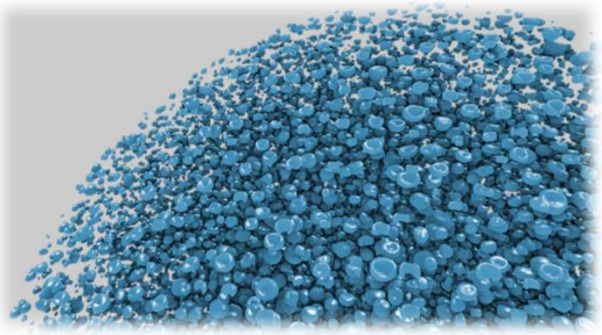


Image courtesy of Petros Koumoutsakos, ETH Zurich

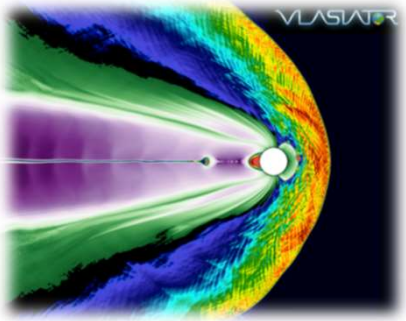


Image courtesy of Minna Palmroth, University of Helsinki

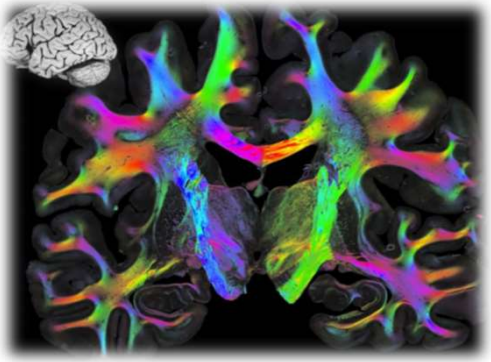
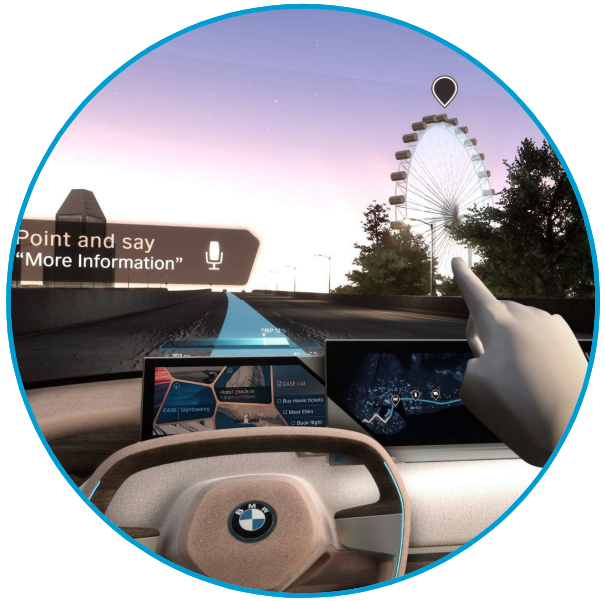


Image courtesy of Axer & Amunts, INM-1, Forschungszentrum Jülich

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)

Image sources:

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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

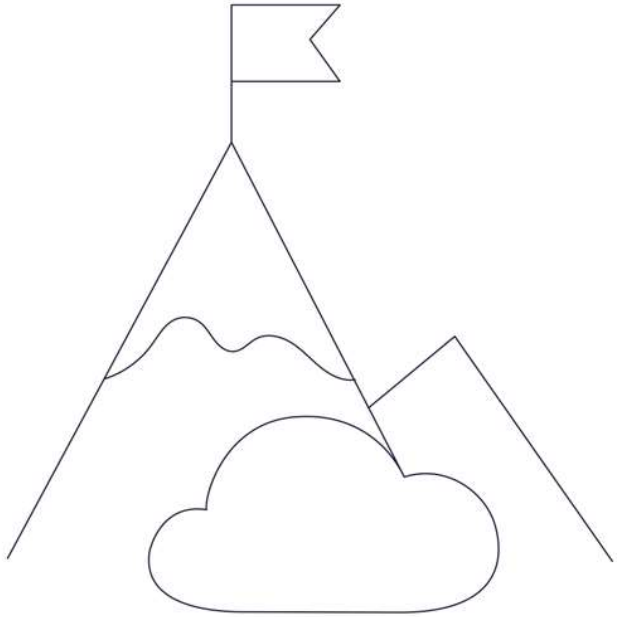
EUROPEAN PROCESSOR INITIATIVE

- 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

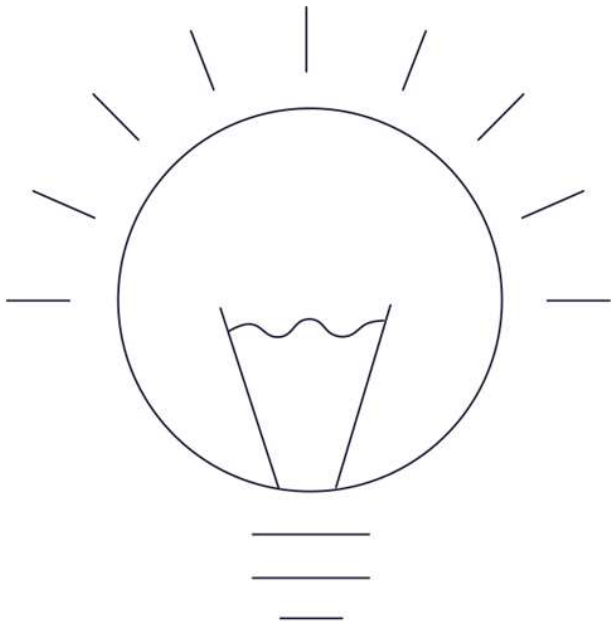
MISSION

- 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



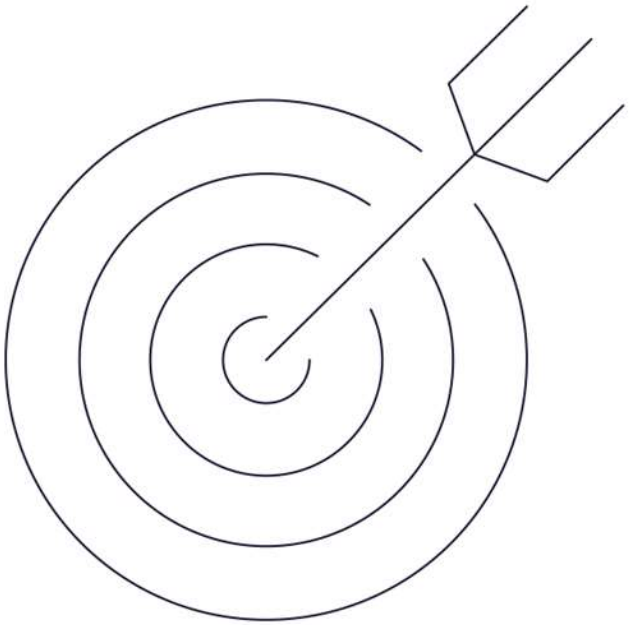
VISION

- 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)

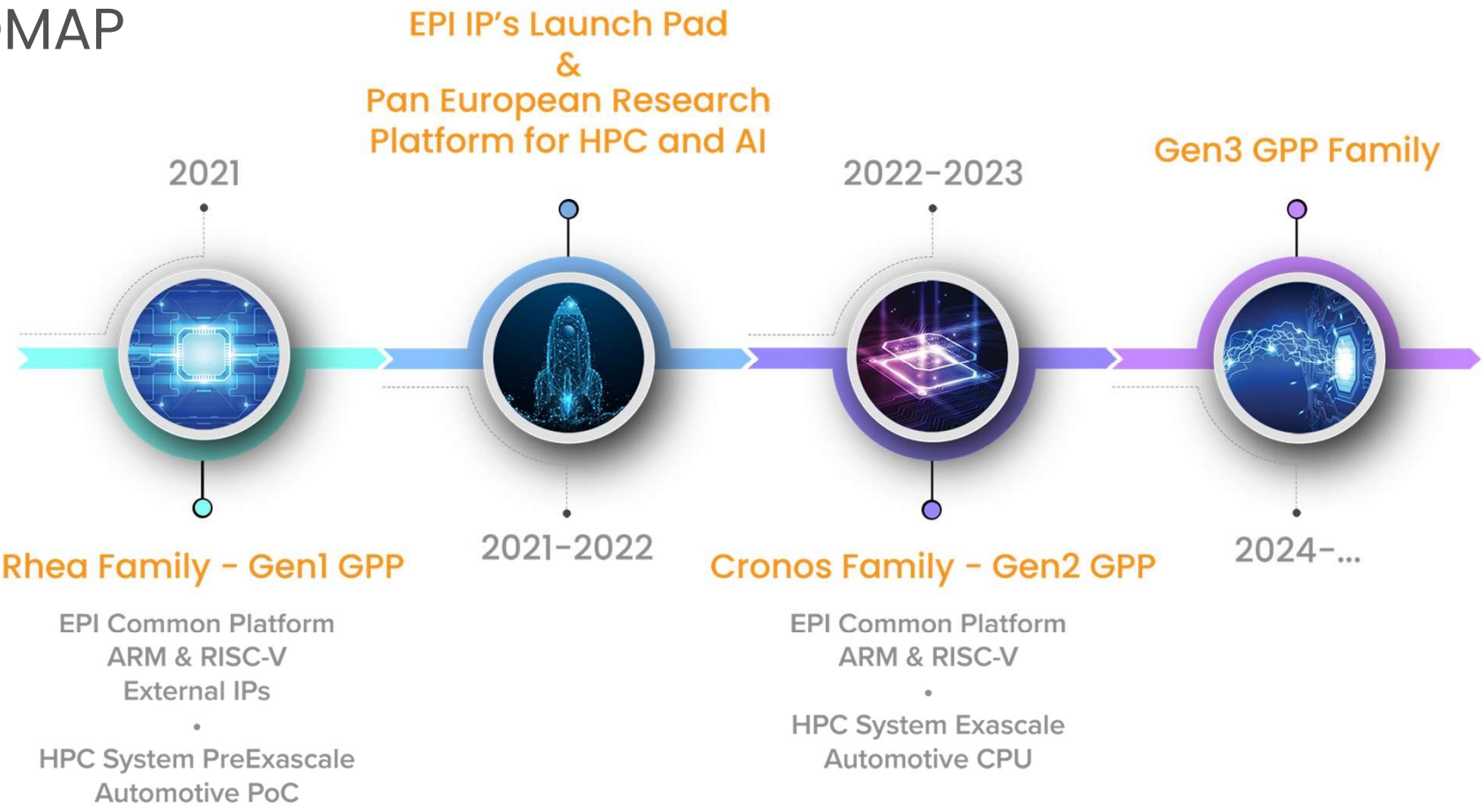


EXPECTED IMPACT

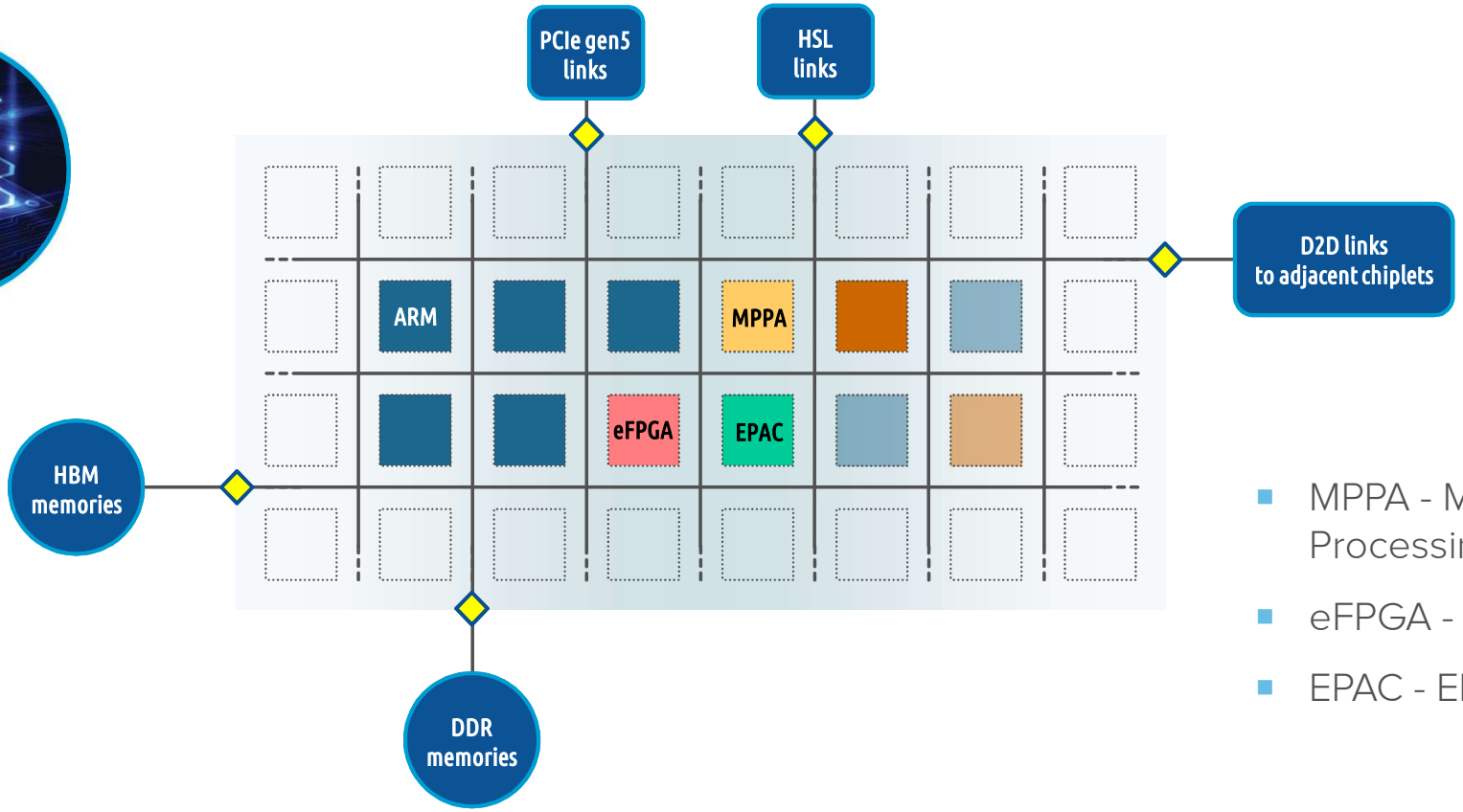
- Strengthening the competitiveness and leadership of European industry and science
- European microprocessor technology with drastically better performance/power ratios
- Tackling important segments of broader and/or emerging HPC and Big-Data markets



ROADMAP

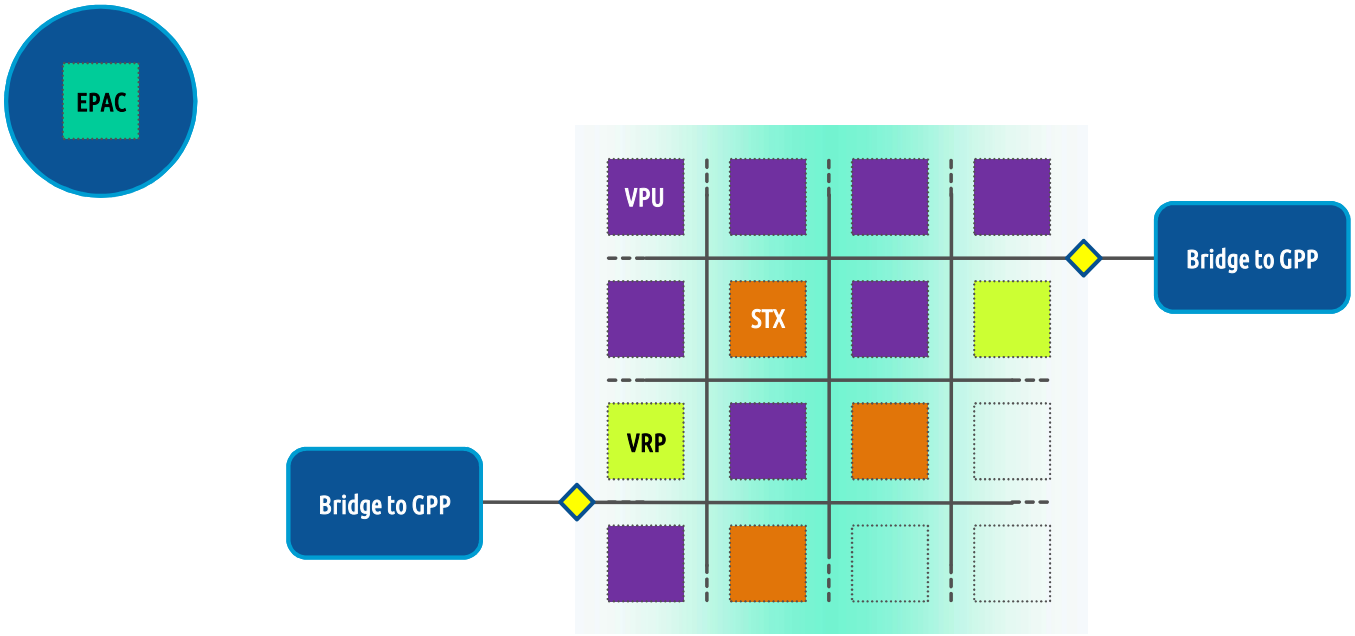


GPP AND COMMON ARCHITECTURE



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

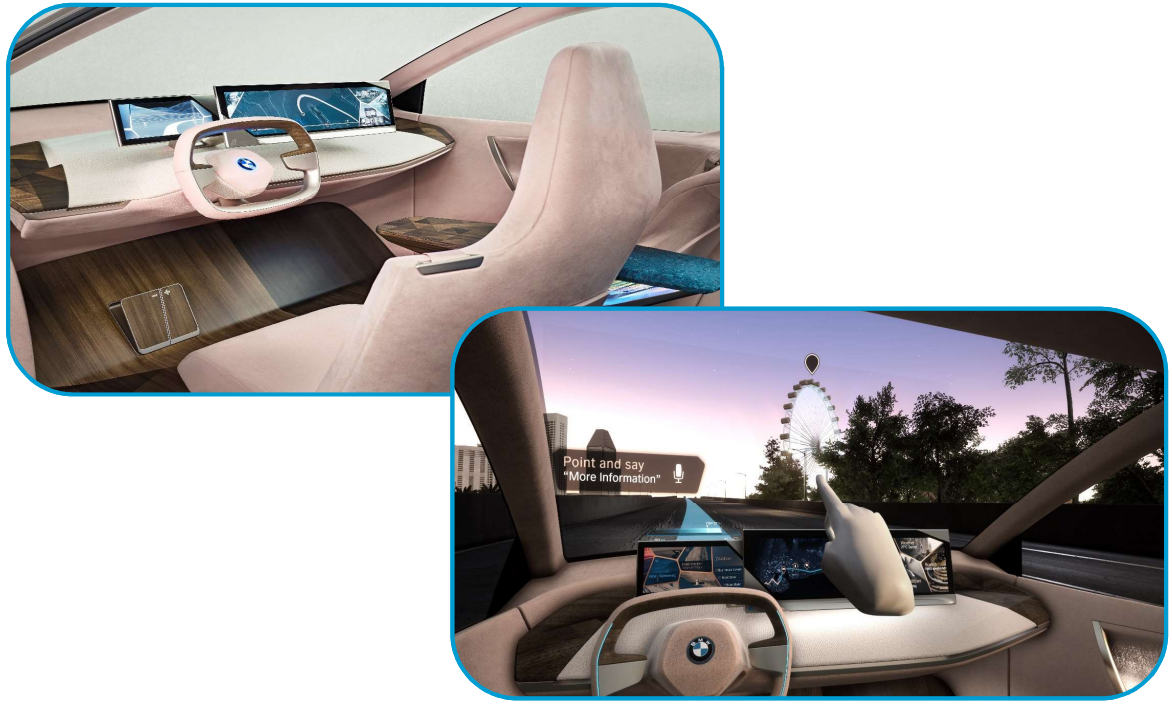
EPAC – RISC-V ACCELERATOR



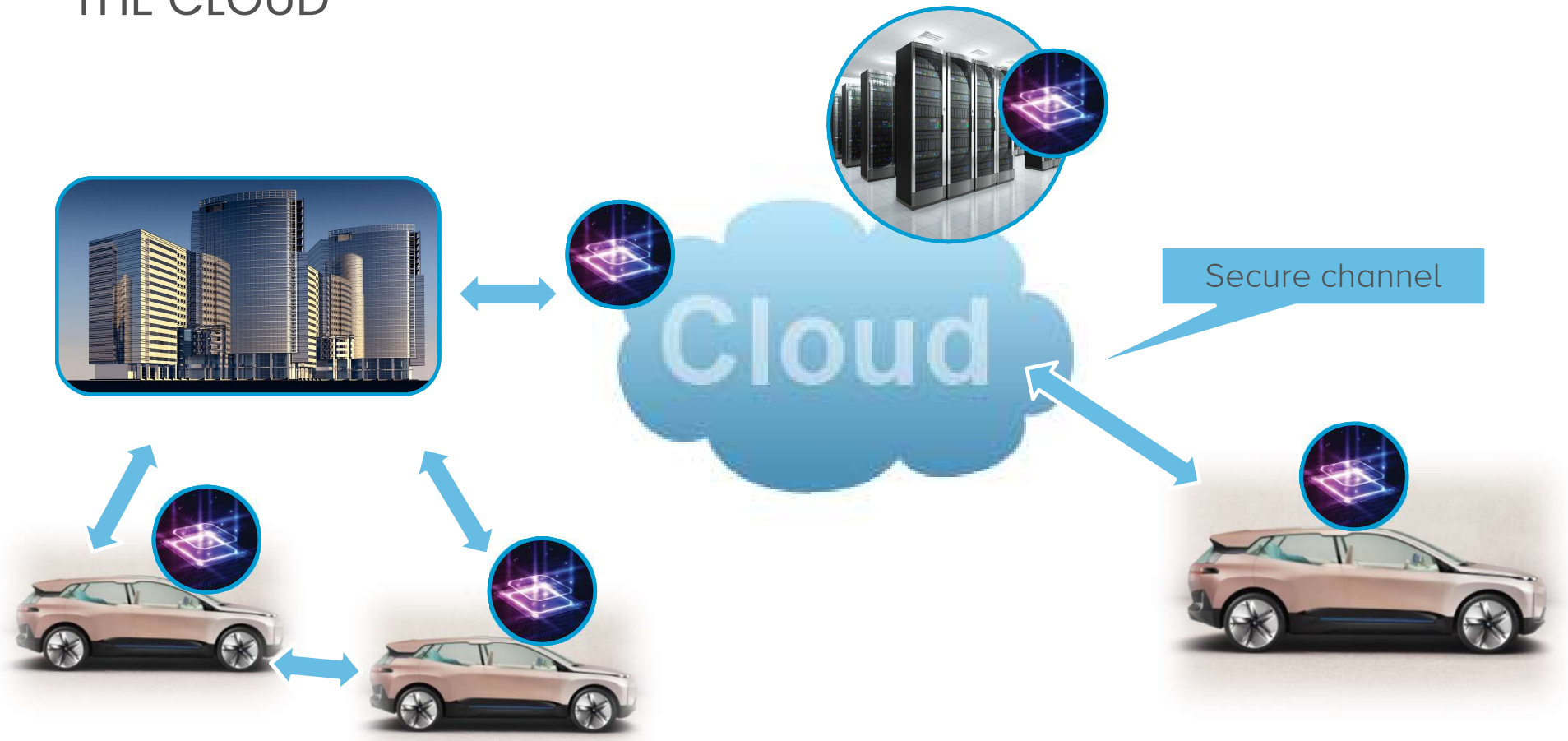
- EPAC - EPI Accelerator
- VPU – Vector Processing Unit
- STX – Stencil/Tensor accelerator
- VRP - VaRiable Precision co-processor

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

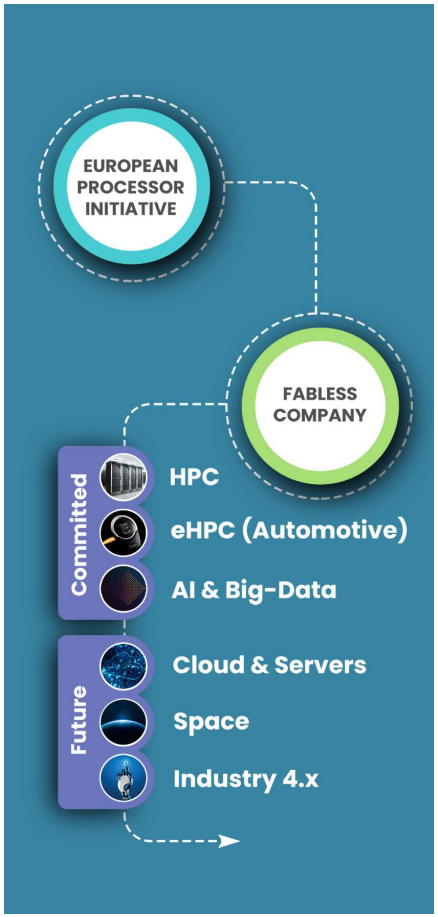


END2END SECURITY – FROM THE AUTOMOTIVE SYSTEM TO THE CLOUD

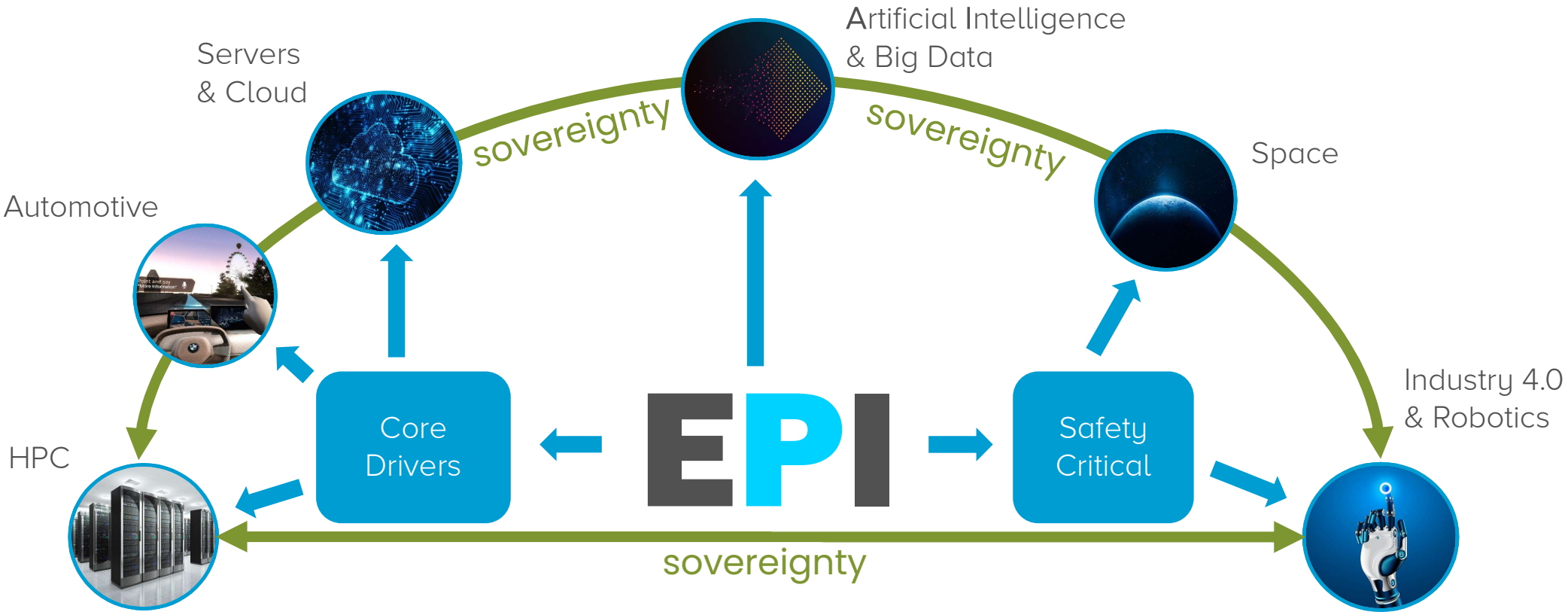


EPI FABLESS COMPANY

- 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

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