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

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is all about this!!
THE STRATEGIC INTERPLAY
DRIVERS OF THE EPI PROPOSAL

- **Aging to change**
- **climate change**

- **personalised and precision medicine** - process information about a person’s genes, proteins, and interactions, allowing diagnosis and treatment of diseases.
- **biomolecular research**, to investigate the dynamics of biomolecules in human cells, which is crucial for treating autoimmune diseases and also cancer and diabetes.
- **high-resolution simulation and modelling of the human brain.**
- **testing of drug candidate molecules**

- **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.
- **knowledge of geophysical processes**

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

- Increasing energy needs
  - design of renewable energy parks
  - high performance photovoltaic materials
  - optimising turbines for electricity production.

- Cybersecurity
  - essential for national security and defence
  - developing complex encryption technologies, tracking and responding to cyberattacks, deploying efficient forensics, nuclear simulations.

- Intensifying global competition
  - reducing development time
  - minimising costs
  - optimising decision processes, production, by replacing higher-quality goods and services.

- Sovereignty (data, economical, embargo)
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

Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and Switzerland.
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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Amazon exec and Super Micro CEO call for retraction of spy chip story

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

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

A group of researchers showed how a Tesla Model 3 can be hacked and stolen in seconds using only $600 worth of equipment


Image sources:

- https://www.businessinsider.in/a-group-of-researchers-showed-how-a-tesla-model-3-can-be-hacked-and-stolen-in-seconds-using-only-600-worth-of-equipment/articleShow/65781310.cms
- https://www.techcrunch.com/2015/06/24/may-backdoors-builtin-intel-and-amd-processors/

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WE GO BEYOND THAT...
DRIVERS OF THE EPI PROPOSAL (2)

- Connected mobility & **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)
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
- 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 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

- Servers & Cloud
- Automotive
- HPC
- Artificial Intelligence & Big Data
- Safety Critical
- Industry 4.0 & Robotics
- Space

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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.