The European Processor Initiative, Dearborn, Michigan, September 2018

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IN THIS UPDATE

The HPC User Forum was established in 1999 to promote the health of the global HPC industry and address issues of common concern to users. In September 2018, the 70th HPC User Forum took place in Dearborn, Michigan. This update summarizes a presentation from that meeting in the session, *Leadership Computing Initiatives,* entitled The European Processor Initiative, given by Jean-Marc Denis, the Chair of the Board, European Processor Initiative.

Denis' talk highlighted the status and goals of the recently formed European Processor Initiative (EPI), an EU multi-member state collaborative effort to develop an indigenous European processor. The chip is initially targeted for inclusion in an EU pre-exascale HPC by 2021 and EU exascale machines by 2022-2023. An additional key element of the program is to build a solid, long-term economic model for a European processor base that goes beyond the HPC market and addresses the processing needs of the larger European industrial sector, such as in automobile, cloud, and server sectors.
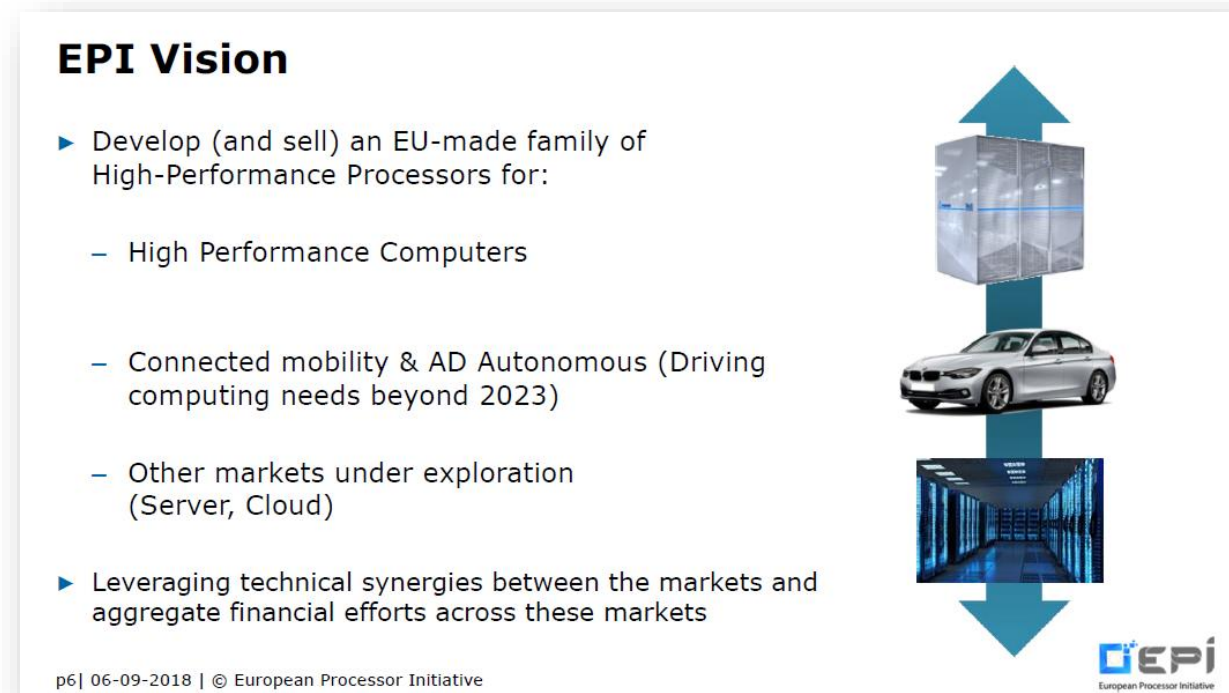

Source: EPI and Hperion Research, 2019

PRESENTATION: THE EUROPEAN PROCESSOR INITIATIVE, JEAN-MARC DENIS, THE CHAIR OF THE BOARD, EUROPEAN PROCESSOR INITIATIVE

John-Marc Denis, Chair of the Board of the European Processor Initiative (EPI), discussed that the first objective of the EPI is to provide the European Union with independent HPC processor technologies sufficient to assemble a globally competitive pre-exascale machine using the first-generation European processor by 2021 and follow-on exascale machines by 2022-2023. An additional key element of the program is to build a solid, long-term economic model for a European processor base that goes beyond the HPC market and addresses the processing needs of the larger European industrial sector, such as in the automobile sector as well cloud-based or server systems.

FIGURE 1

Source: EPI and Hyperion Research, 2019

Denis noted that the short-term goals of the EPI are various and ambitious:

- Protect EU science, innovation, and domestic data sets, as well as develop technology that is not controlled by foreign political decisions concerning export controls of critical technologies.
- Create an EU-based microprocessor maker that will provide Europe with full independence from US and Chinese-origin components.
- Drive domestic employment in a range of high-tech sectors that will use the EPI-developed processors.

EPI planners seek to leverage existing processor technologies using a common platform and common synergies. The initiative is currently making system architecture, codesign and silicon process choices. EPI planners note that when designing a microprocessor, both the design and its related intellectual property are important. The integration of the IPs contributed by the diverse set of developers on the EPI project will complicate this process, but project planners are hopeful that each entity will add significant value to the overall project. Currently the EPI counts 23 partners from the academic, commercial, and government sectors.

FIGURE 3
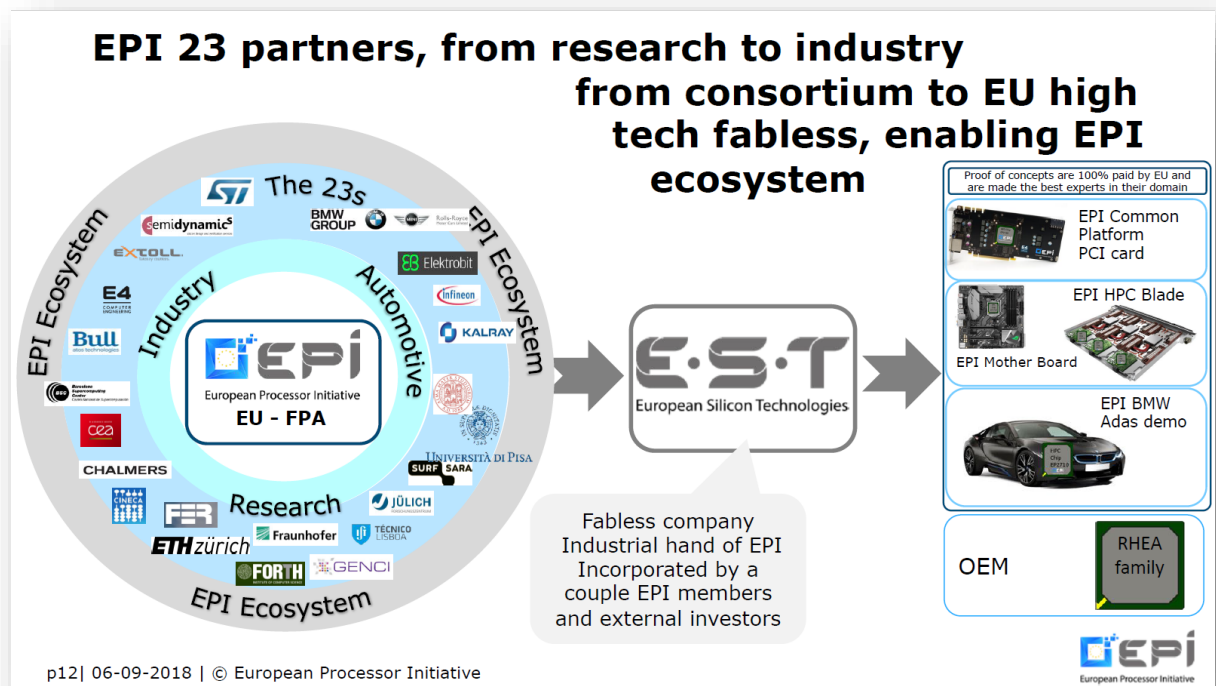
Source: EPI and Hyperion Research, 2019

For the EPI technology roadmap, the chip will likely be a general-purpose processor, with the first generation likely based on ARM. EPI planners are negotiating with ARM the terms and conditions of the contract, so the choice of ARM depends on the results of the current negotiation. However, ARM is

perceived as a first-step effort because this is not true European technology; it is seen instead as Japanese IP (ARM Holdings was acquired by Japan-based SoftBank). In the long-term Europe wants to have full control of the IP.

Planners envision that within five to ten years they will move from ARM-based IP to European-based IP. This process will begin with an effort based on RISC-V, which is an open source processor instruction set architecture (ISA). However, because RISC-V is somewhat immature in terms of IP quality for supporting a general purpose, high-end microprocessor, EPI planners are initially trying to use RISC-V to develop an accelerator with a double-precision, floating-point engine. Then, over time, generation after generation, they will add complexity and capabilities through indigenous RISC-V IP to get a full, RISC-V based, general purpose microprocessor.

FIGURE 4

Overall architecture concepts
detailed technical specs are under finalization

► 7nm or better
► Common floorplan hosting several core technologies (ARM$^{(*)}$ and Risc-V)
► 2.5D die
► >600mm^2

► ARM 8.4/SVE
► RISC-V DP Flops accelerator
► MB2020 NOC

► **Focus on ease of use, ease of performance**
  – Best in class Byte/Flops ratio
  – Peak DP Flops is not AT ALL part of the equation

(*) subject to contract negotiation

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Source: EPI and Hyperion Research, 2019

EPI planners recognize that this is a challenging undertaking, and that the European processor is not something that will be made overnight. EPI planners note that just having an HPC-oriented processor is not enough because the HPC ecosystem is a niche market. The volume of production for HPC in the European market is seen as being between 100,000-200,000 units a year on the high end. With such a small quantity of processors, EPI planners believe it will be difficult to sustain a robust economic model. So, they plan on developing processors for the HPC sector first, and then to develop other devices that together would create a wide-spread economic model that could sustain future processors developments.

FIGURE 5

Scalability allows wide market potential coverage
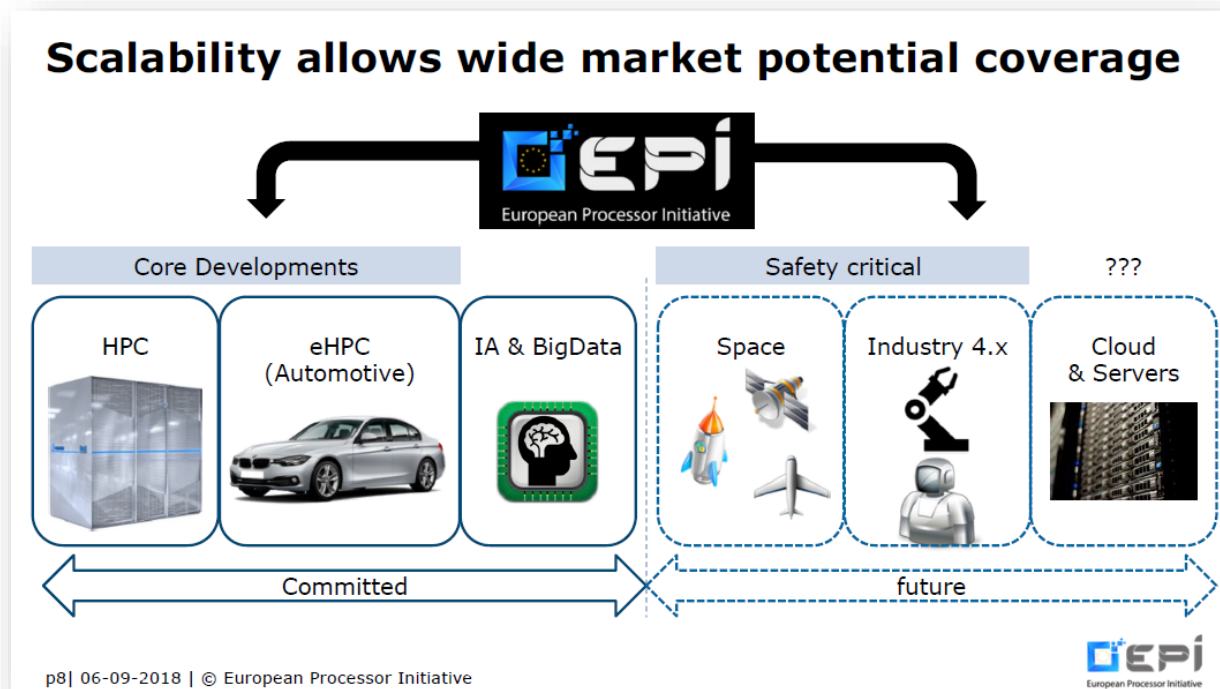
Source: EPI and Hyperion Research, 2019

Based on discussions with the European Commission and key commercial partners, EPI planners have determined that in addition to the HPC sector, there is significant potential for using this processor technology within the automotive sector. This decision is based, in part, on the fact that the car manufacturing industry is the one of the foremost industries in Europe: one third of the cars in the world are produced and designed in Europe and the automotive sector is the largest industry in Europe in terms of employment. Because of this, EU planners determined that providing the car manufacturing industry with a new processor option targeted for autonomous vehicle applications was a logical choice. They note that European car manufacturers want to have a European processor partner to engage, and they do not want to have to fully depend on US or Chinese suppliers for the computer elements in European autonomous cars.

EPI planners are clear that there is significant EU member state interest in this EPI project. They note that in the last century, Airbus was a big success from Europe. Now, they want to repeat that success in the new data world - starting with a world champion processor in the high-end segment.

For more information or to view this and other presentations given at HPC User Forums dating back to 2008, visit www.hpcuserforum.com.

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