EUROPEAN PROCESSOR INITIATIVE: Europe's Industrial Technology Cornerstone for the Exascale Era

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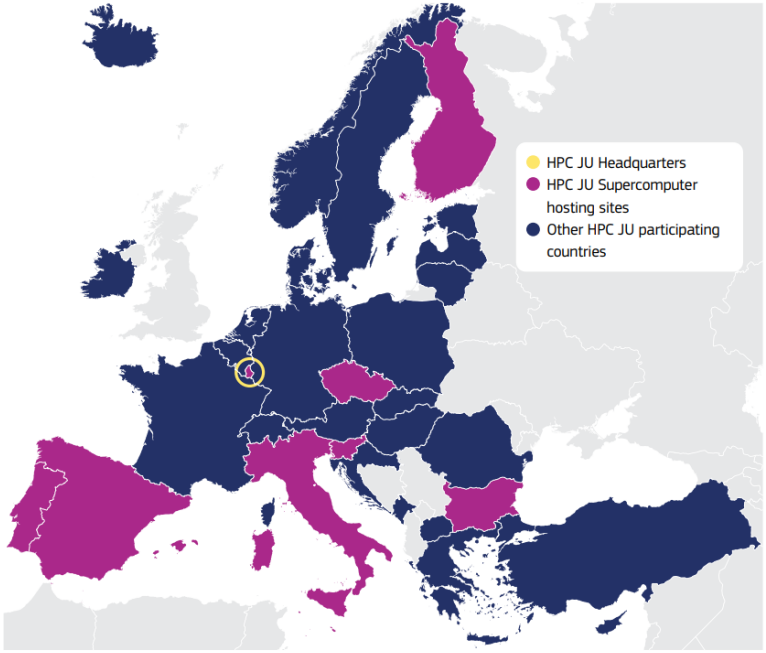
THE STRATEGIC INTERPLAY

EU EXASCALE HPC STRATEGY

- March 2017, Rome: EC launched the ***EuroHPC declaration***
- November 2018, EuroHPC Joint Undertaking, a 1 billion Euro joint initiative between the EU and European countries to develop a World Class Supercomputing Ecosystem in Europe
- Oct 2020: 32 participating countries



THE PRESIDENT OF THE EUROPEAN UNION HAS SET NEW AMBITIONS

SEPTEMBER, 16TH, 2020

Ursula Von Der Lyen
State of the Union
Brussels – September, 16th, 2020

- NextGenerationEU is also a unique opportunity to develop a more coherent European approach to connectivity and digital infrastructure deployment.
- None of this is an end in itself - it is about Europe's digital sovereignty, on a small and large scale.
- In this spirit, I am pleased to announce an **investment of 8 billion euros in the next generation of supercomputers** - cutting-edge technology made in Europe.
- And **we want the European industry to develop our own next-generation microprocessor** that will allow us to use the increasing data volumes energy-efficient and securely.
- This is what **Europe's Digital Decade** is all about!

https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_20_1655

EUROHPC JU AMBITIOUS MISSION

- expand and deploy in the EU a world-class supercomputing and data infrastructure, also in view of having 3 supercomputers in the world's top 5
- make the supercomputing and quantum computing resources accessible to all users across Europe, including SMEs, and provide them with training on necessary skills
- scale up supercomputing technology to irrigate the entire digital strategy, from big data analytics and artificial intelligence, to cloud technologies and cybersecurity

DRIVERS OF THE EPI PROPOSAL

Societal challenges

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

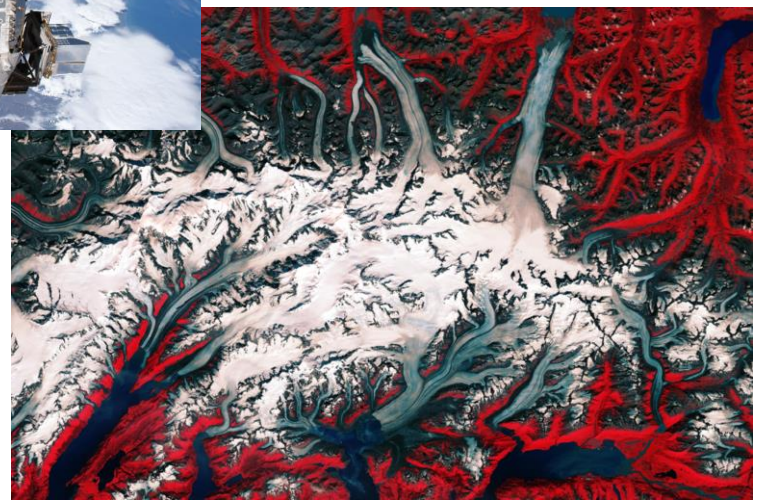


Image: https://www.compbiomed.eu/services/software-hub/

DRIVERS OF THE EPI PROPOSAL

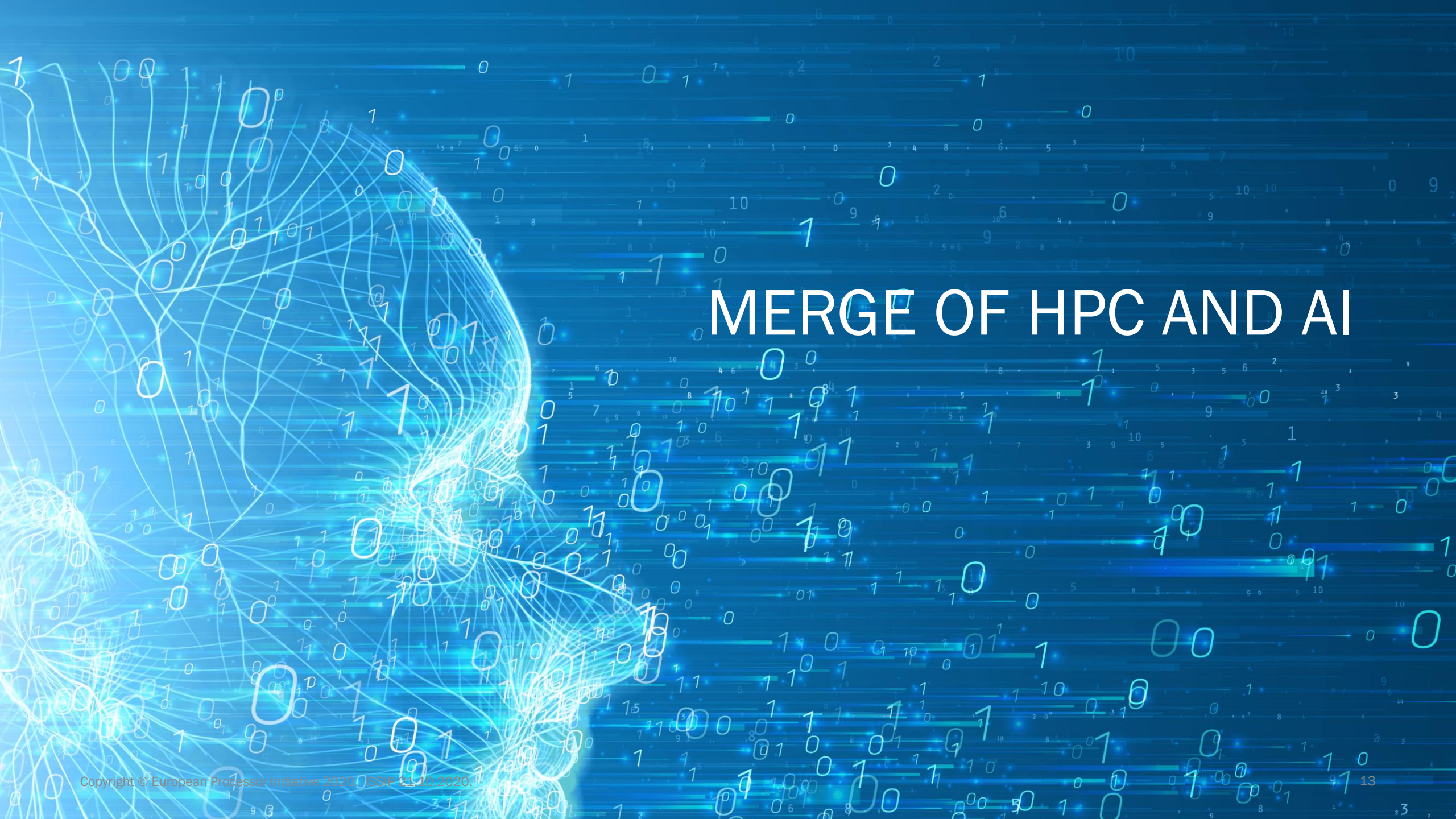
- Connected mobility & ***A**utonomous **D**riving computing needs beyond 2023*
- Develop customized processors able to meet the performance needed for autonomous vehicles that would offer:
  - implementation of vehicle perception tasks in real-time in a fail-operational manner
  - increased computing 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

27 PARTNERS FROM 10 EU COUNTRIES

EPI OBJECTIVES

- **Overall: Develop a complete EU designed high-end microprocessor, addressing Supercomputing and edge-HPC segments**
- Short-term objective
  - supply the EU-designed microprocessor to empower the EU Exascale machines
- Long-term objective
  - Europe needs a sovereign (=not at risk of limitation or embargo by non-EU countries) access to high-performance, low-power microprocessors, from IP to products
- EPI has been set to fulfil this objective
- EPI has to cover all Technical Readiness levels (TRL)
  - TRL 1-3 are for long-term objectives (EU IP)

  and
  - TRL 4-9 are for short to mid-term objectives (decade) with products designed in EU



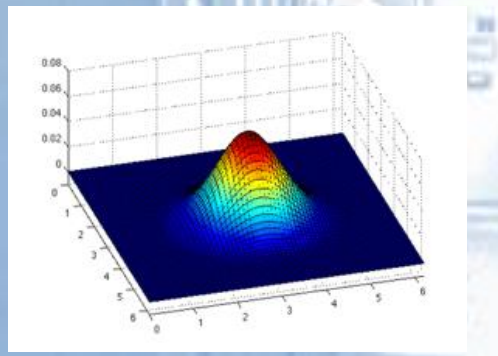
MERGE OF HPC AND AI

HPC BEFORE ARTIFICIAL INTELLIGENCE

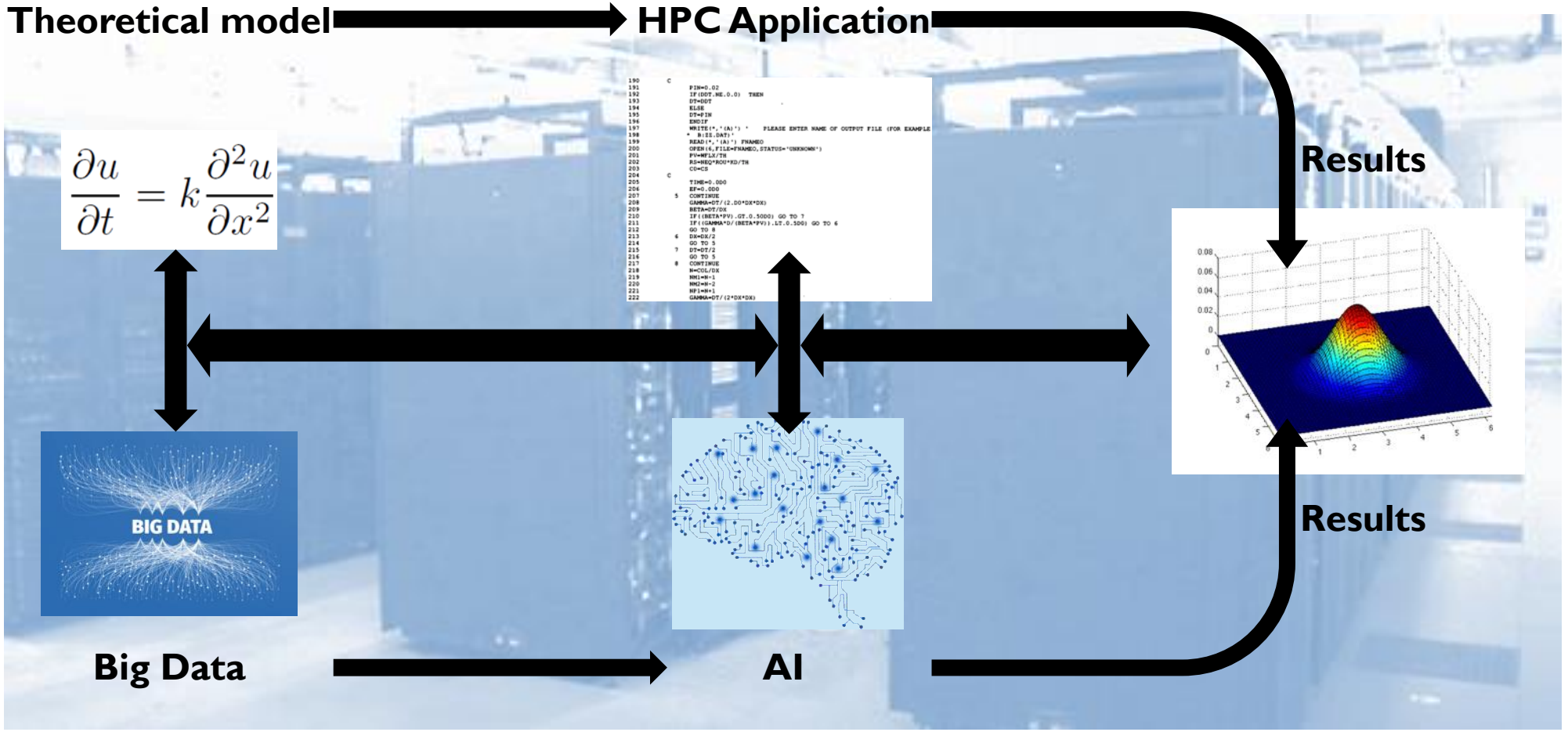
Theoretical model → **HPC Application** → **Results**

$$\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}$$

```
190         C
191               PIN=0.02
192               IF(DDT.NE.0.0)  THEN
193               DT=DDT
194               ELSE
195               DT=PIN
196               ENDIF
197               WRITE(*,'(A)') '    PLEASE ENTER NAME OF OUTPUT FILE (FOR EXAMPLE
198              *  B:ZZ.DAT)'
199               READ(*,'(A)') FNAMEO
200               OPEN(6,FILE=FNAMEO,STATUS='UNKNOWN')
201               PV=WFLX/TH
202               RS=NEQ*ROU*KD/TH
203               CO=CS
204         C
205               TIME=0.0D0
206               EF=0.0D0
207             5 CONTINUE
208               GAMMA=DT/(2.D0*DX*DX)
209               BETA=DT/DX
210               IF((BETA*PV).GT.0.5D0) GO TO 7
211               IF((GAMMA*D/(BETA*PV)).LT.0.5D0) GO TO 6
212               GO TO 8
213             6 DX=DX/2
214               GO TO 5
215             7 DT=DT/2
216               GO TO 5
217             8 CONTINUE
218               N=COL/DX
219               NM1=N-1
220               NM2=N-2
221               NP1=N+1
222               GAMMA=DT/(2*DX*DX)
```



HPC WITH ARTIFICIAL INTELLIGENCE




Cambrian explosion
Achieving performance through specialization
Courtesy Steve Scott
Cray CTO

TOP10 (GREEN) OVER THE LAST 10 YEARS

	2009 – Nov.	2014 – Nov.	2020 – Jun.	(Post) Exascale
CPU only	9	5	2	0
CPU + ACC.	1	5	8	10

THE EPI TECHNOLOGY: COMMON PLATFORM

GPP AND COMMON ARCHITECTURE

European Processor Initiative

ZEUS

(ARM)

CCIX (RHEA)
CCIX & CXL (CRONOS)

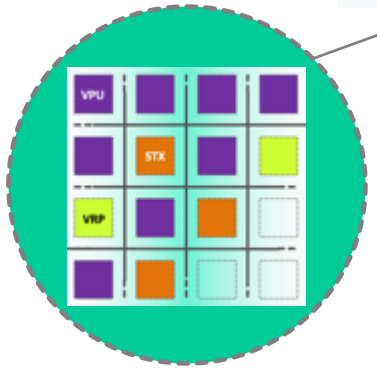
Kalray

Dedicated cryptographic IP

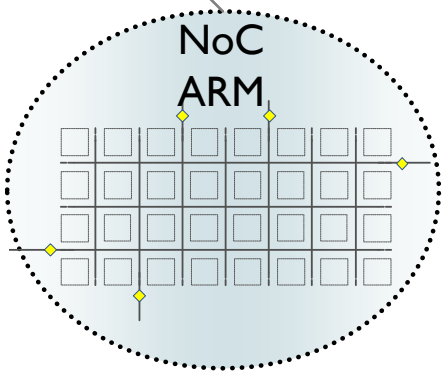
EPI Common Platform open vision is to integrate most of EPI IP's development

FPGA

Menta (FR)



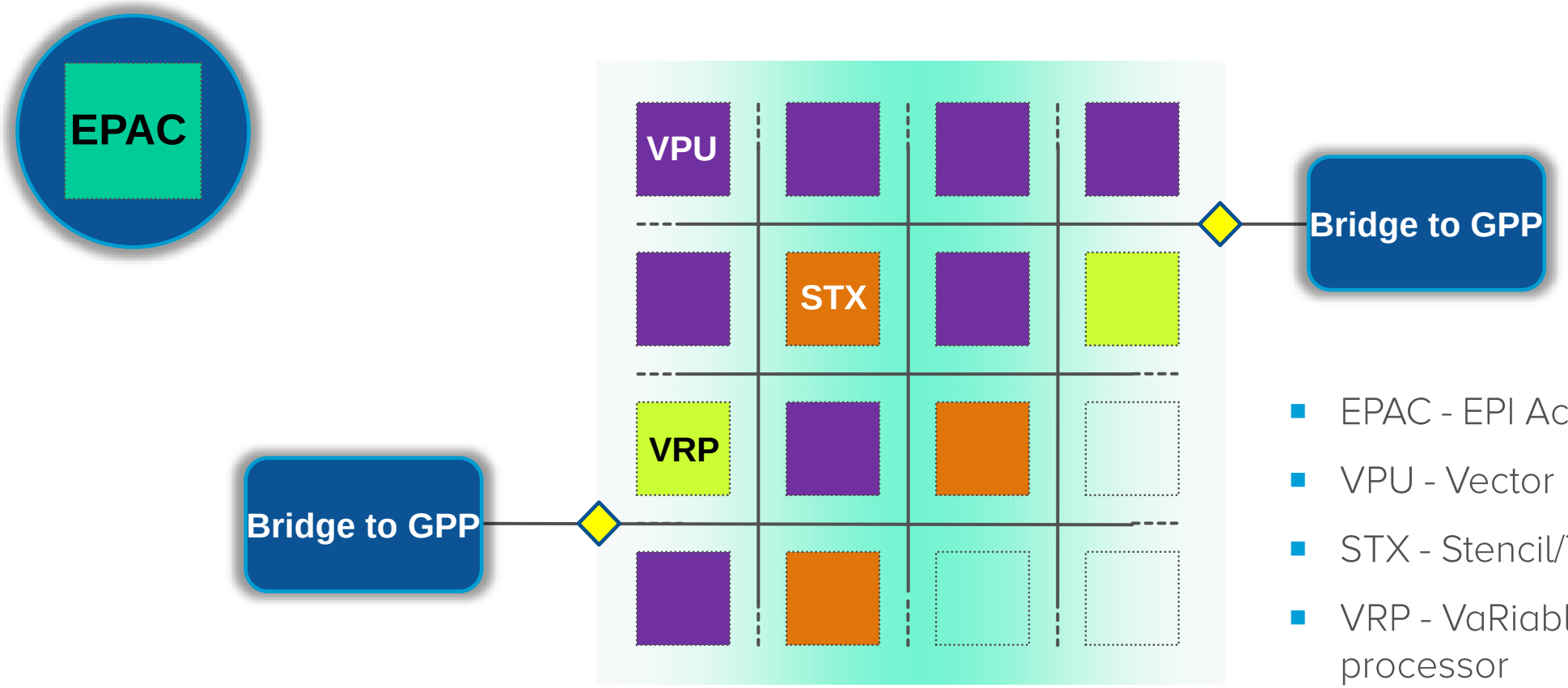
NoC ARM



- Network on Chip (NoC) – ARM
- CPU – ARM – ZEUS
- EPAC – EPI Accelerator (TITAN)
- MPPA – Multi-Purpose Processing Array
- eFPGA – embedded FPGA
- Cryptographic ASIC (EU Sovereignty)
- Any other ASIC

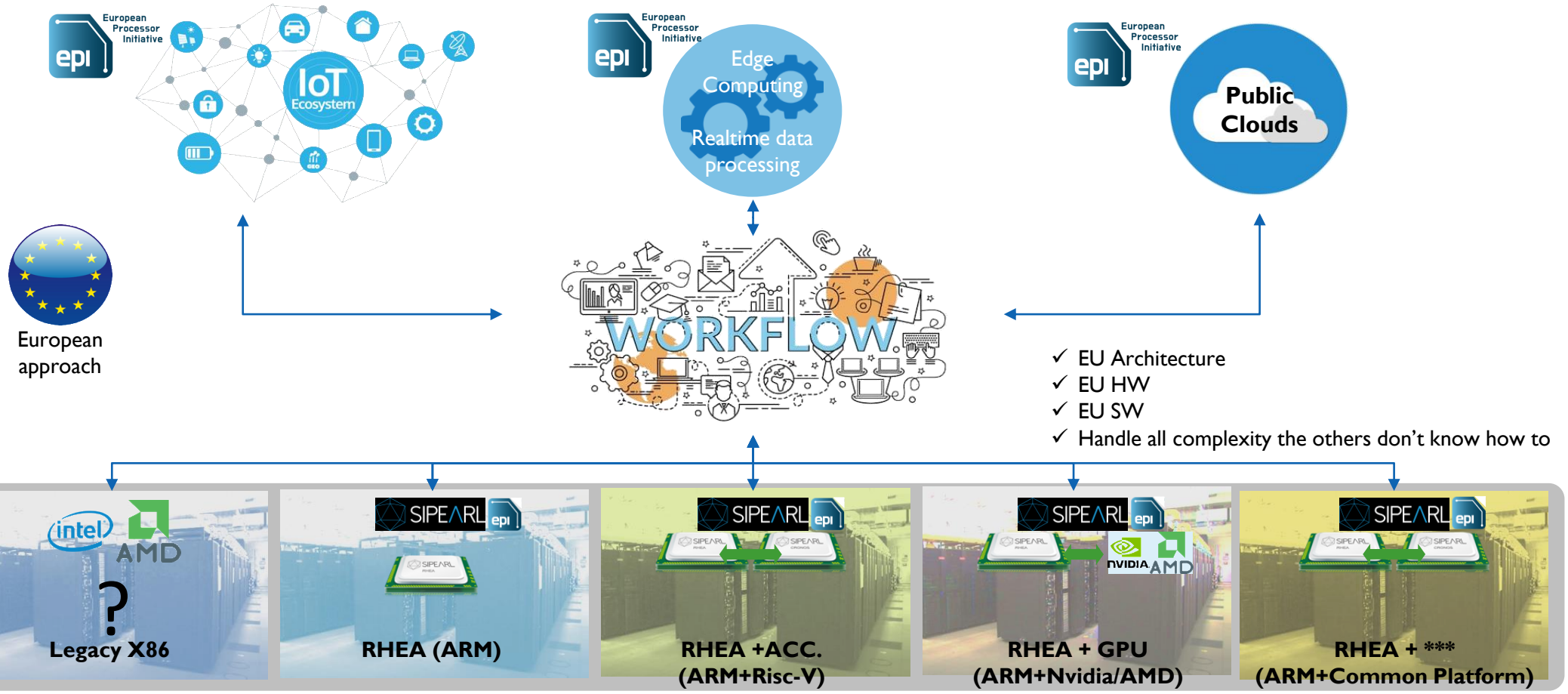
THE EPI TECHNOLOGY: ACCELERATORS

EPAC – RISC-V ACCELERATOR FOUNDATIONS

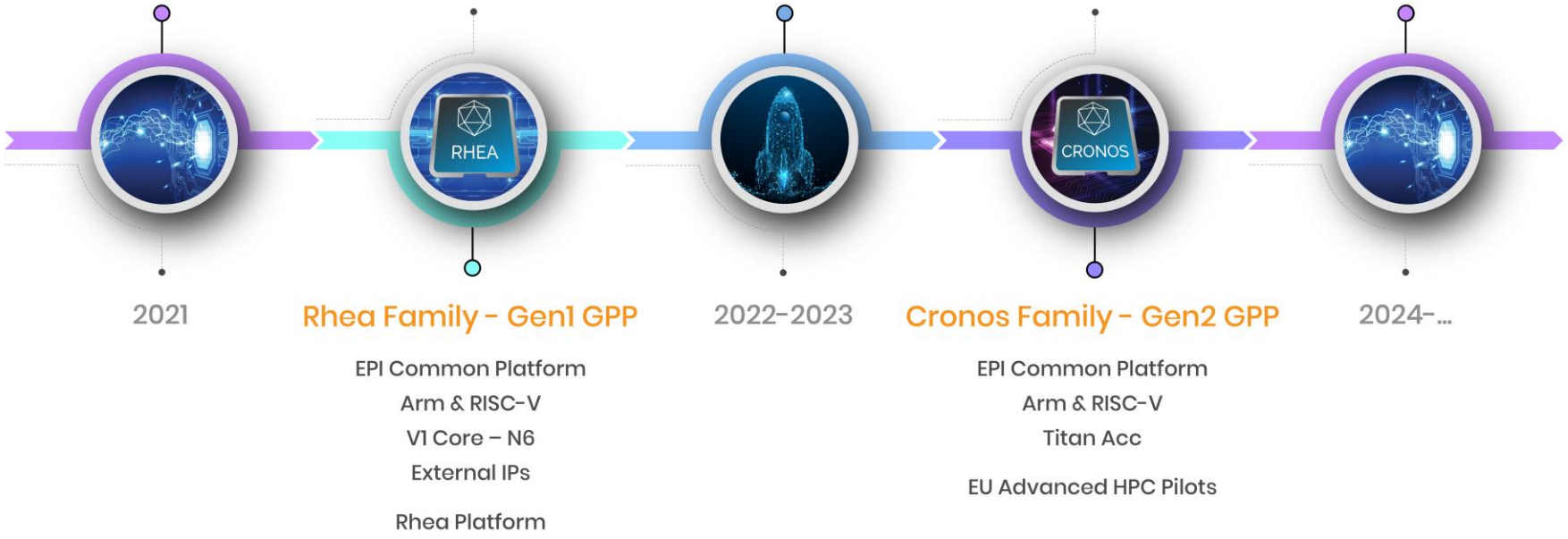


- EPAC - EPI Accelerator
- VPU - Vector Processing Unit
- STX - Stencil/Tensor accelerator
- VRP - VaRiable Precision co-processor

THE EPI EU APPROACH



EPI ROADMAP



TO CONCLUDE

- Use of HPC and AI is cornerstone of successful address of societal and global challenges
- Future science, technologies and applications require processing of vast amount of data and there is a large need for efficient HPC
- HPC provides needed competitiveness for industry and society
- The expertise for developing high-end and complex processing units in Europe, after decades of dis-investment
- The European Processor Initiative aims to provide an EU HPC processor, accelerators and system/application design for exascale HPC systems in Europe and around the globe

THANK YOU FOR YOUR ATTENTION

- www.european-processor-initiative.eu
- @EuProcessor
- European Processor Initiative
- European Processor Initiative

Q&A