



EUROPEAN PROCESSOR INITIATIVE

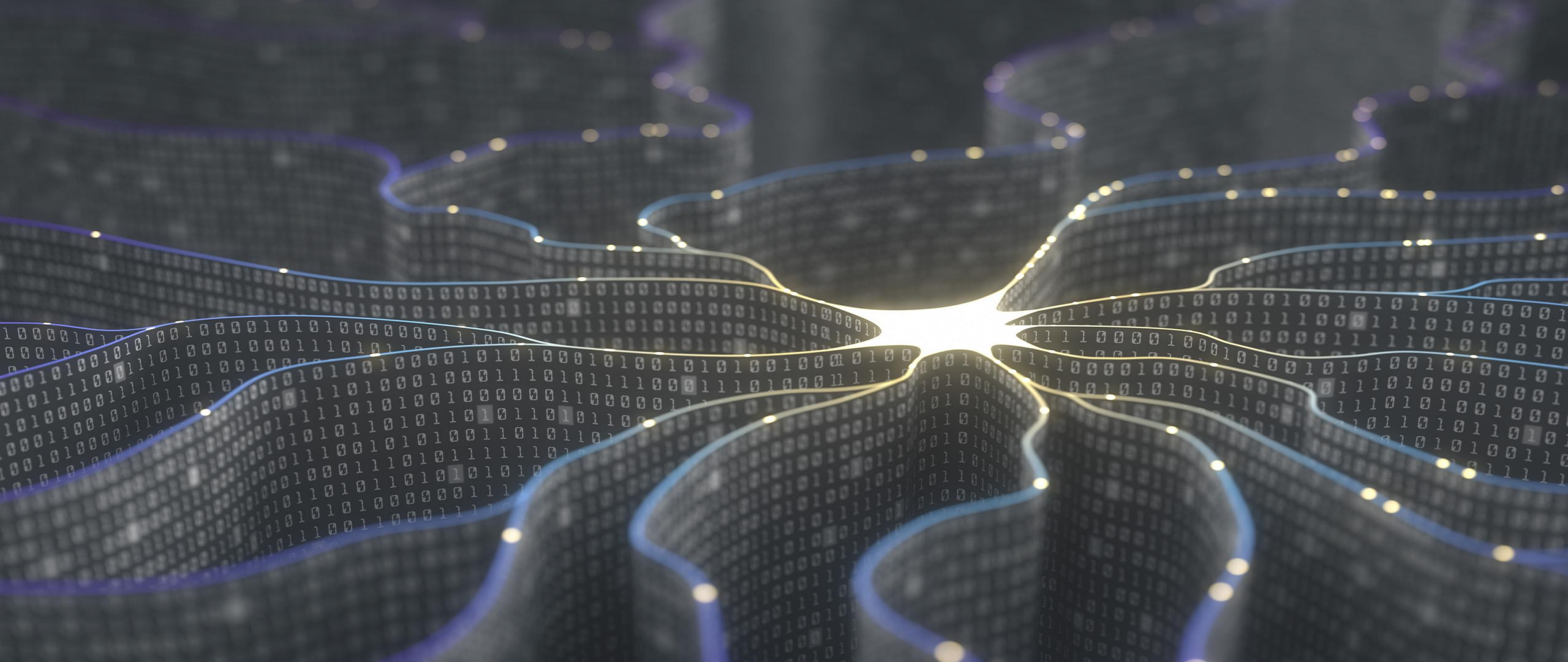
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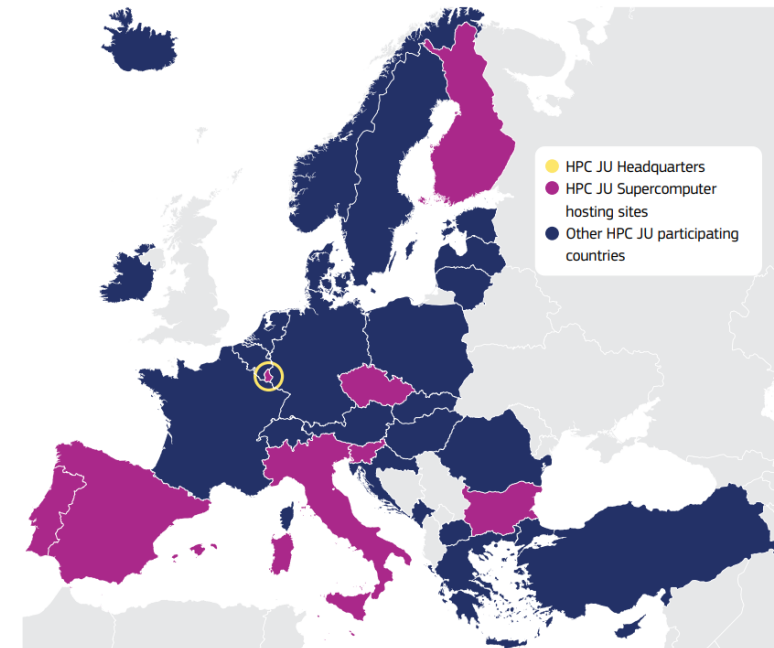
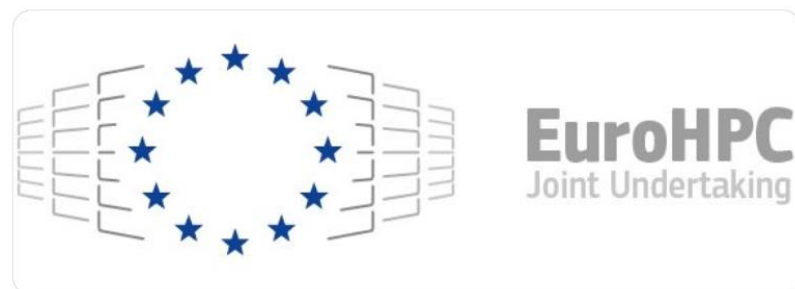




THE STRATEGIC INTERPLAY

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
- 13.7.2021.: EU Council established new EuroHPC JU
 - the 27 Member States, 6 other countries, 2 Private Members
 - €7 billion investment



EUROHPC JU AMBITIOUS MISSION

- **Supercomputers**
 - reaching the next frontier of high-performance computing: the acquisition of exascale supercomputers
- **Interconnectivity**
 - interconnection through terabit networks of this supercomputing infrastructure, as well as in allowing access from the cloud to a large number of public and private users from anywhere in Europe
- **Applications for life**
 - further development of novel scientific and industrial applications
- **Skills and engagement with business**
 - increased investment in skills, education and training in the use of HPC, co-investment with industry in the acquisition of dedicated systems and in the development of large-scale industrial applications, creation of HPC Centres of Excellence
- **Technology activities**
 - the development of high-end European technologies, for example in the [European Processor Initiative](#) (EPI)



DRIVERS OF THE EPI PROPOSAL

Societal challenges

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

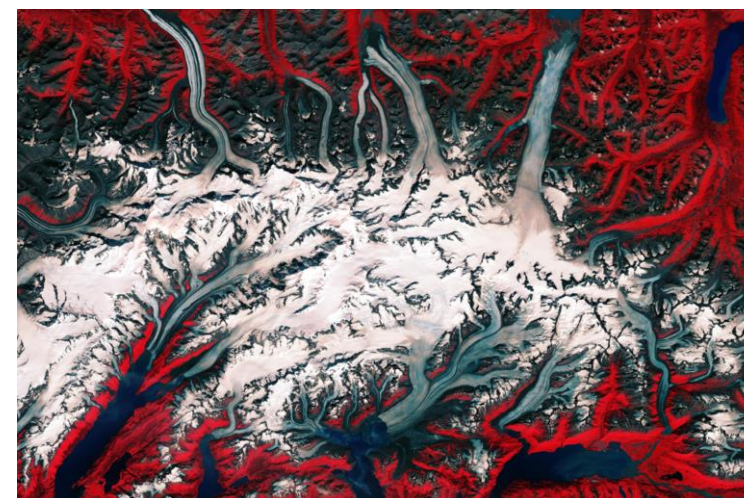


Image: <https://www.combiomed.eu/services/software-hub/>

DRIVERS OF THE EPI PROPOSAL

- 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





European Processor Initiative

28 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

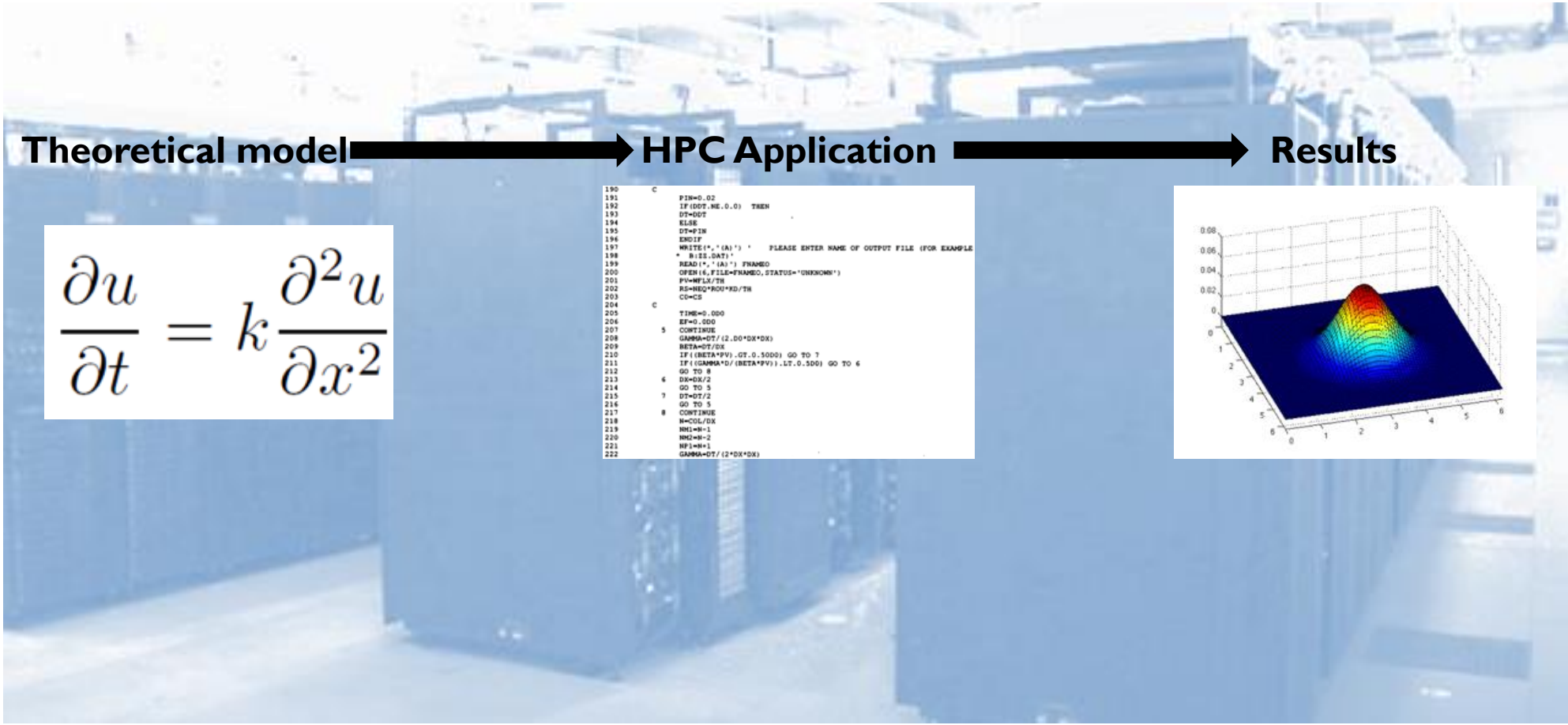
 - TRL 4-9 are for short to mid-term objectives (decade) with products designed in EU





MERGE OF HPC AND AI

HPC BEFORE ARTIFICIAL INTELLIGENCE



HPC WITH ARTIFICIAL INTELLIGENCE

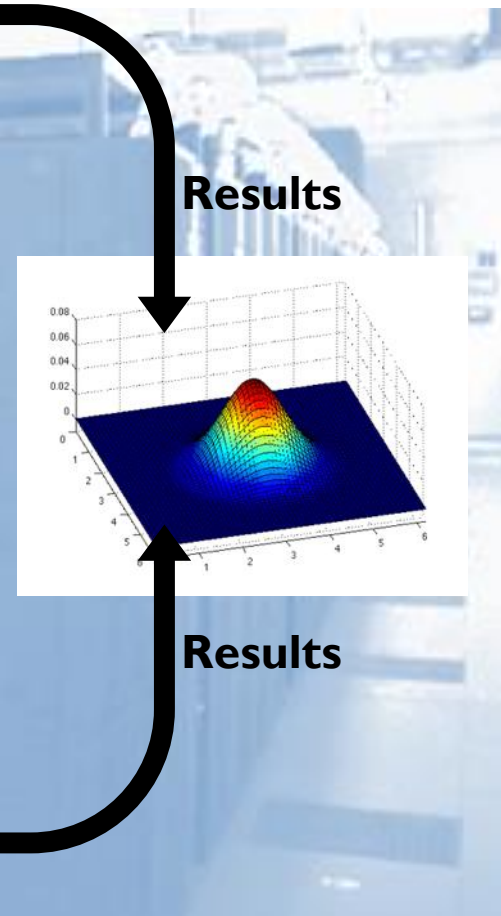
Theoretical model → HPC Application

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

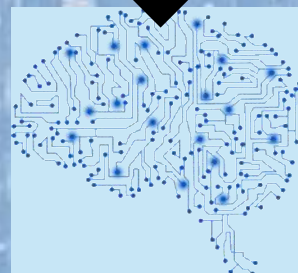
```

190 C      FEM=0.02
191 IF (OPT.NE.0.0) THEN
192   DT=DT*FEM
193 ELSE
194   DT=FEM
195 ENDIF
196 WRITE(*,*) 'PLEASE ENTER NAME OF OUTPUT FILE (FOR EXAMPLE
197   * R121.DAT)'
198 READ(*,*) FRAMED
199 OPEN(1, FILE=FRAMED, STATUS='UNKNOWN')
200 PUNCHES(1)=FRAMED
201 RS=RECORDS/FRAMED
202 CCCC
203 C
204 C      TIME=0.000
205 EF=0.500
206 CONTINUE
207 GAMMA=DT/(2.00*DX*DX)
208 BETA=DT/DTX
209 IF (BETA*PV).GT.0.5000) GO TO 7
210 IF (GAMMA*D/(BETA*PV)).LT.0.500) GO TO 6
211 GO TO 8
212 6      DX=DX/2
213 GO TO 5
214 7      DT=DT/2
215 GO TO 5
216 8      CONTINUE
217 M=COLS/DX
218 NN1=M-1
219 NN2=M-2
220 NN3=M-1
221 NP1=M-1
222 GAMMA=DT/(2*DX*DX)


```



Big Data



AI



Cambrian explosion
Achieving performance through specialization

TOP10 (GREEN) OVER THE LAST 10 YEARS

	2009 – Nov.	2014 – Nov.	2020 – Nov.	2021 – Nov.
CPU <u>only</u>	9	5	2	0
CPU + ACC.	1	5	8	10

THE EPI TECHNOLOGY: COMMON PLATFORM

GPP AND COMMON ARCHITECTURE



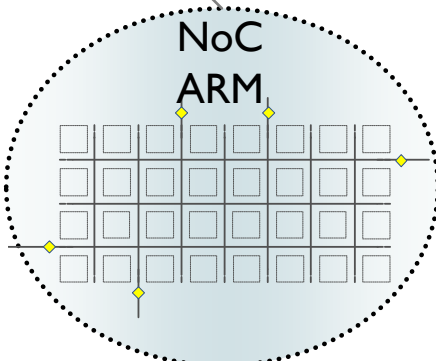
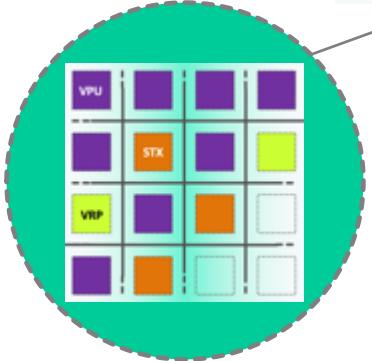
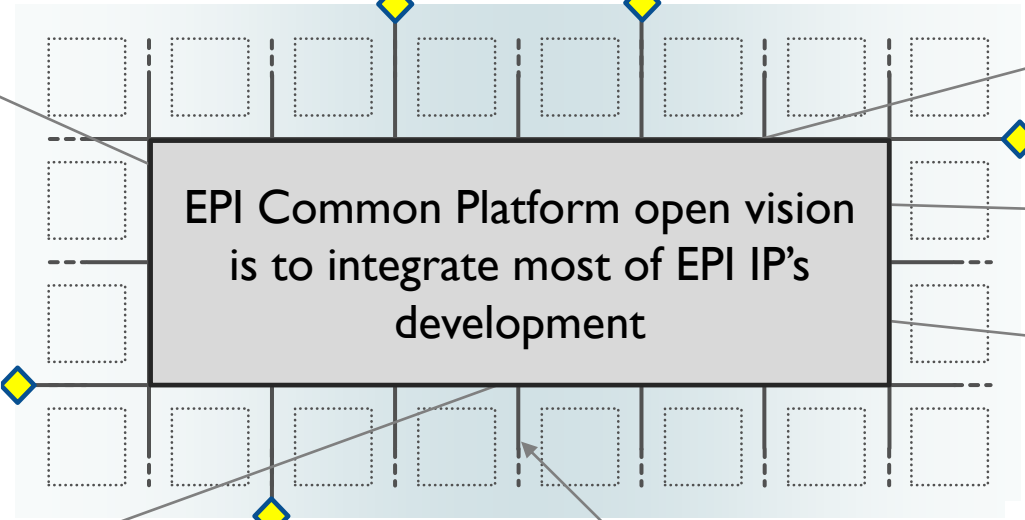
ZEUS
(ARM)

CCIX (RHEA)
CCIX & CXL (CRONOS)

Kalray

Dedicated
cryptographic
IP

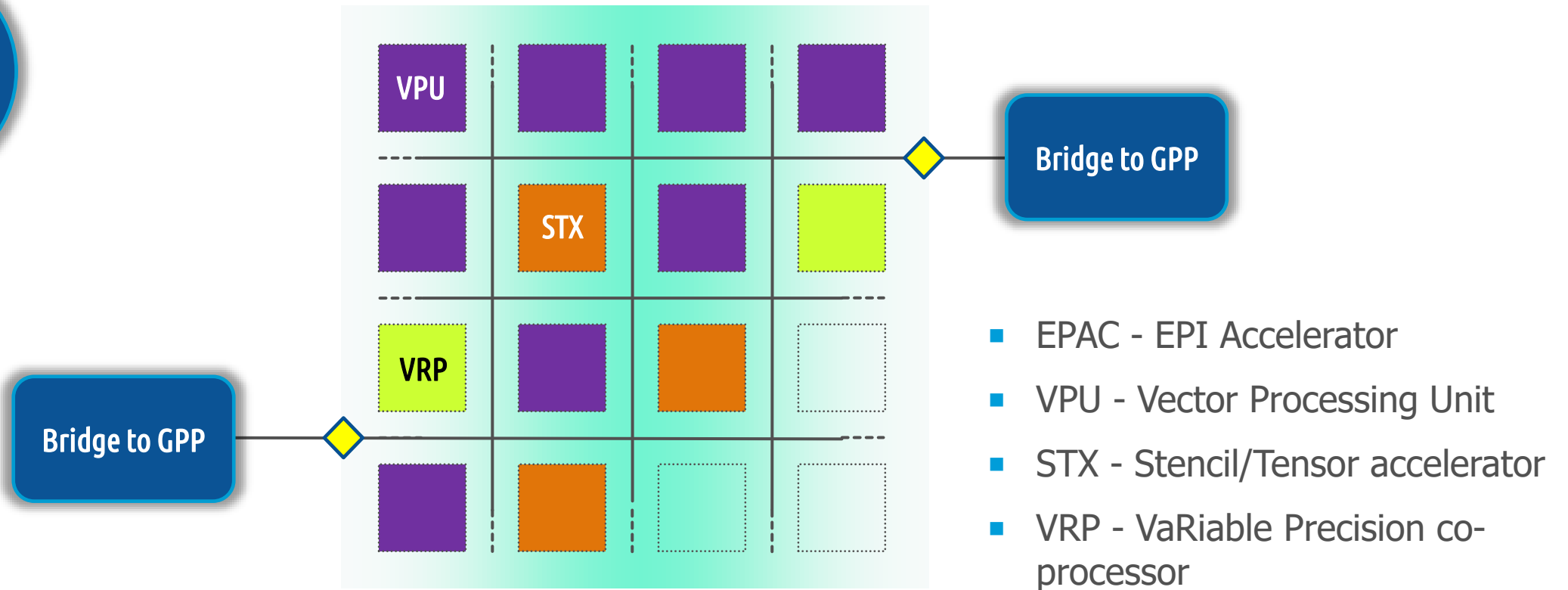
FPGA
Menta
(FR)

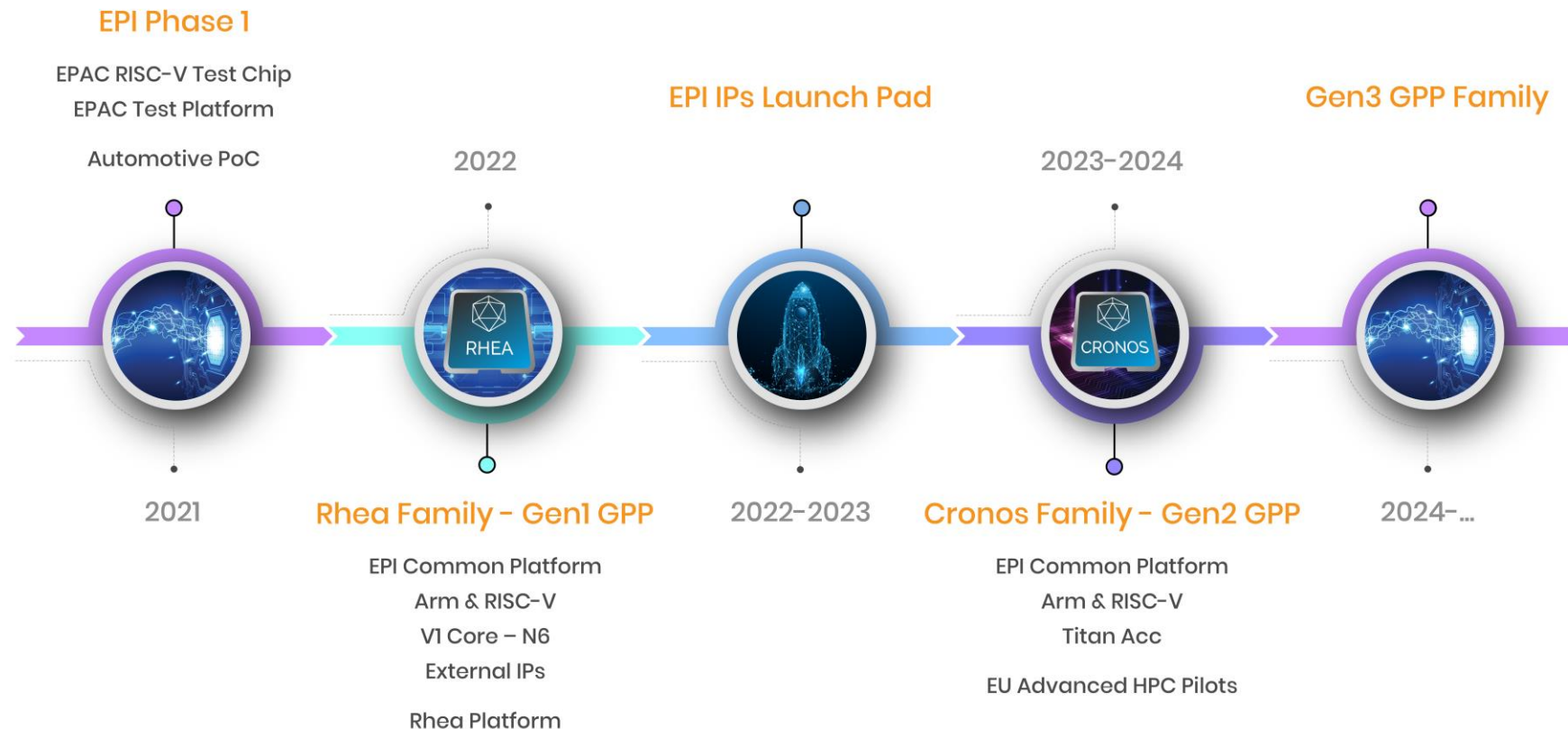


- Network on Chip (NoC) – ARM
- CPU – ARM – ZEUS
- EPAC – EPI Accelerator
- MPPA – Multi-Purpose Processing Array
- eFPGA – embedded FPGA
- Cryptographic ASIC (EU Sovereignty)
- Any other ASIC

THE EPI TECHNOLOGY: ACCELERATORS

EPAC – RISC-V ACCELERATOR FOUNDATIONS

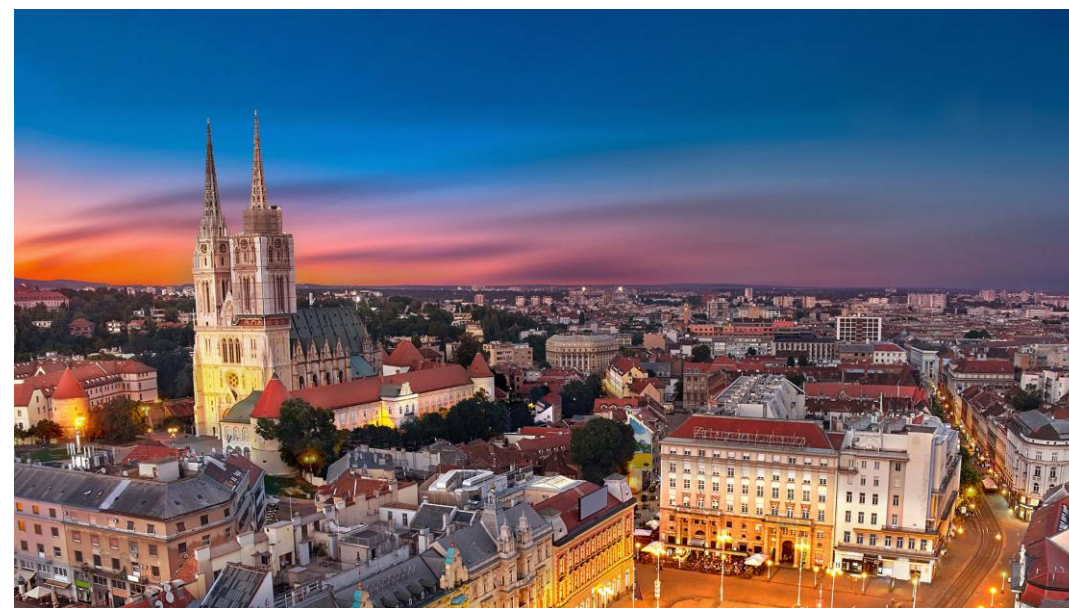




EPI ROADMAP

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 disinvestment
- 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



European Processor Initiative

-  www.european-processor-initiative.eu
-  [@EuProcessor](https://twitter.com/EuProcessor)
-  [European Processor Initiative](https://www.linkedin.com/company/european-processor-initiative)
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