



# EUROPEAN PROCESSOR INITIATIVE

## EUROPEAN PROCESSOR INITIATIVE THE EURO HPC INDUSTRIAL CORNERSTONE

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# EUROHPC & EPI

INSTITUTIONAL INFORMATION

## EUROPEAN PROCESSOR INITIATIVE

# HOW EUROHPC WILL HELP TO MAKE EU 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 ARM for HPC
- High-performance RISC-V based FP-HP/SP/DP accelerator
- Computing platform for autonomous cars
- Will also target the AI, Big Data and other markets in order to be economically sustainable

# EPI PARTNERS

BMW  
GROUP



Rolls-Royce  
Motor Cars Limited

Atos



Barcelona  
Supercomputing  
Center  
Centro Nacional de Supercomputación



KALRAY



JÜLICH  
Forschungszentrum



semidynamic<sup>S</sup>  
silicon design and verification services



TÉCNICO  
LISBOA



Fraunhofer



ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA



CHALMERS



UNIVERSITÀ DI PISA



E4  
COMPUTER  
ENGINEERING



GENCI



FORTH  
INSTITUTE OF COMPUTER SCIENCE



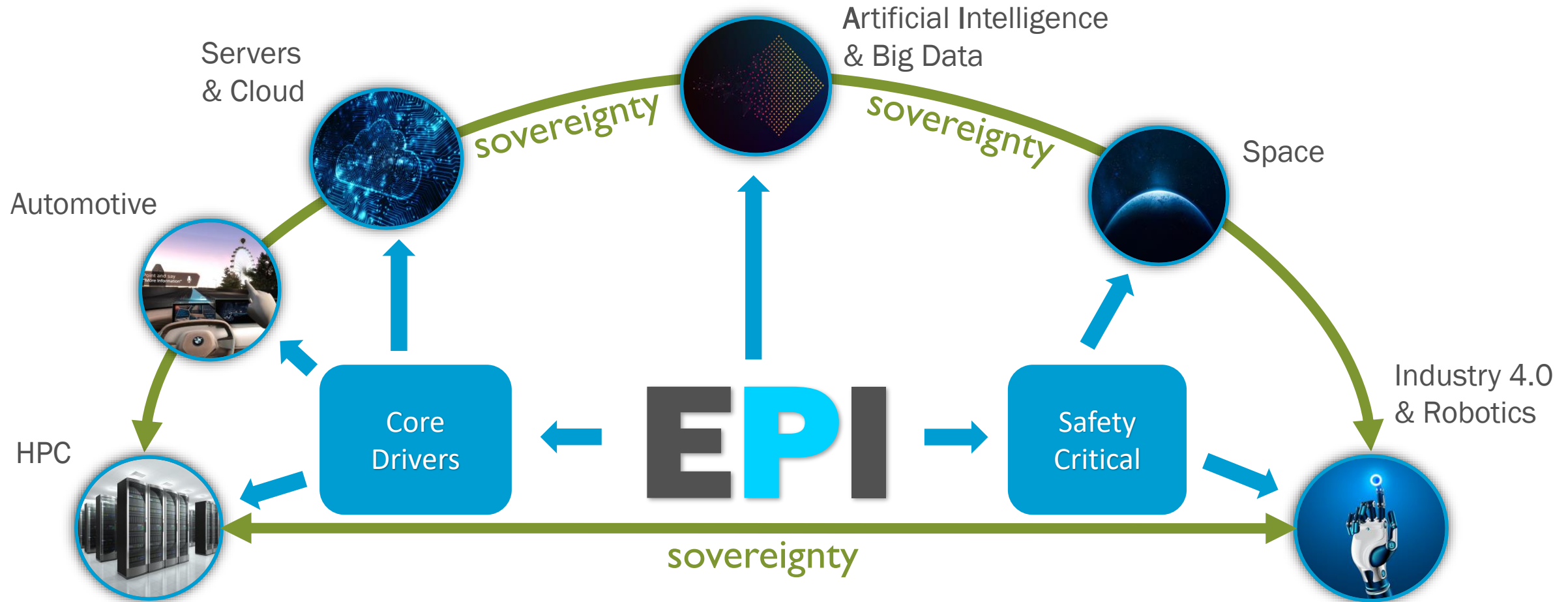
EXTOLL  
latency matters.

ETH zürich



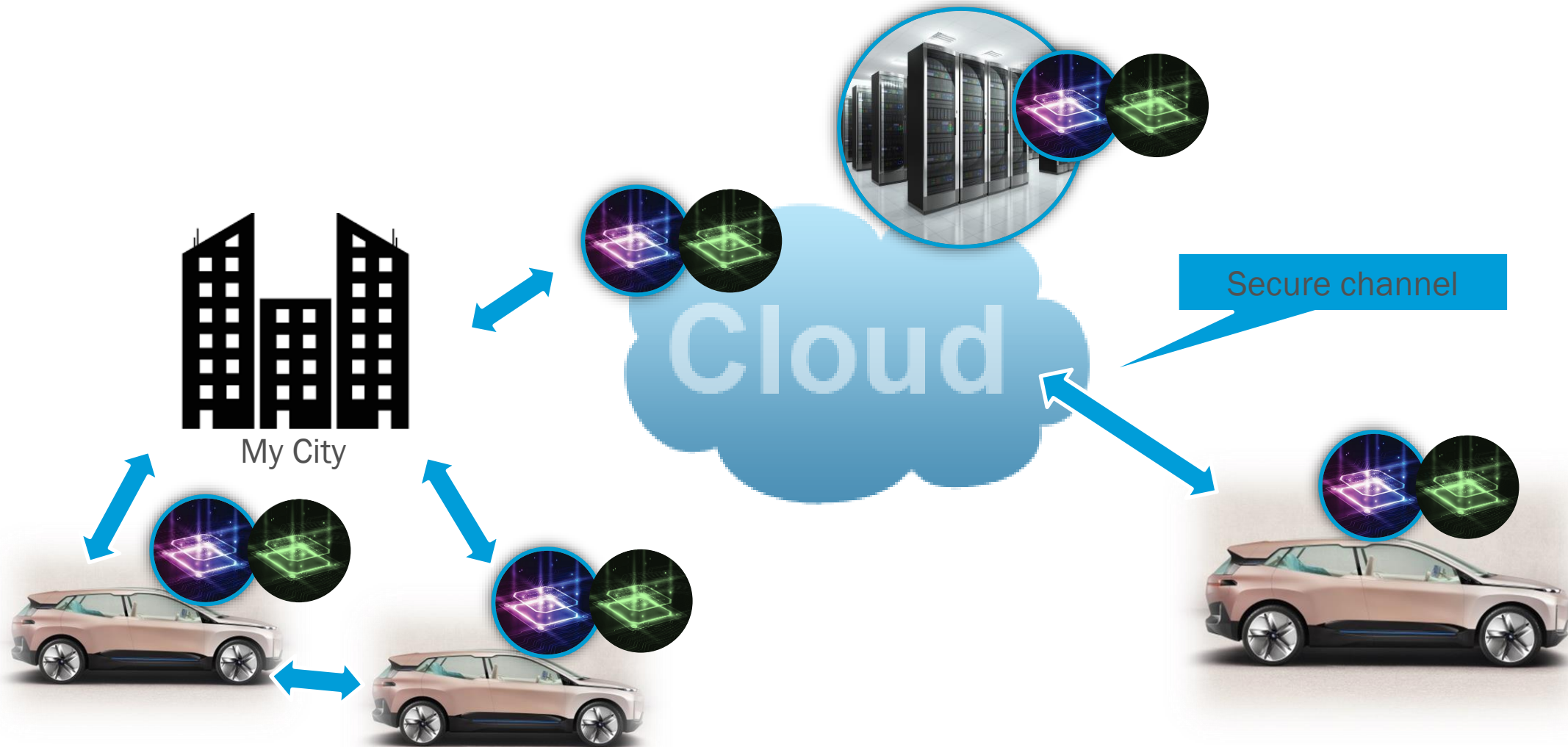
Elektrobit

# EPI IS THE CORNERSTONE OF THE EU DATA SOVEREIGNTY





# END2END - FROM THE AUTOMOTIVE SYSTEM TO THE HPC/AI CLOUD

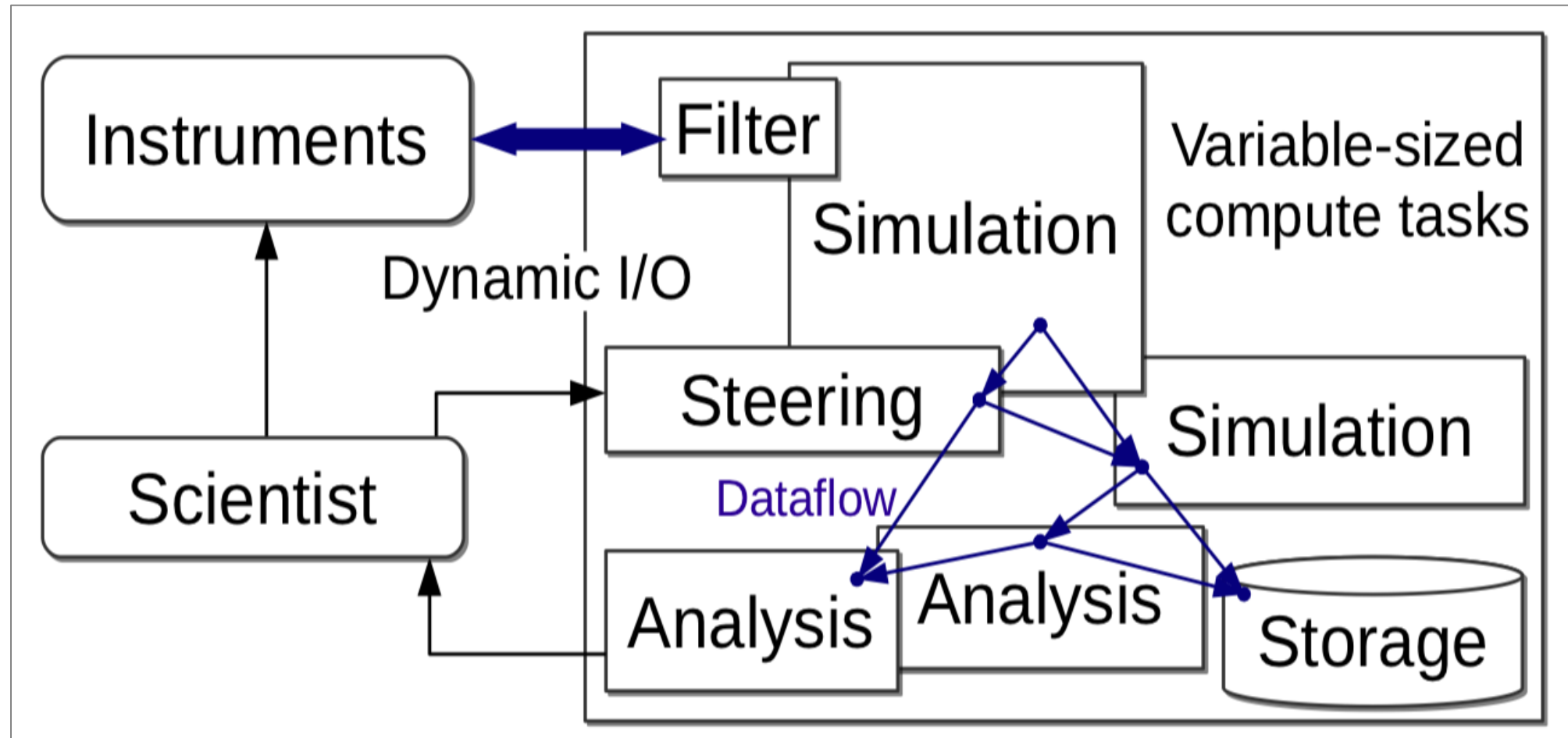


# TRENDS FOR (POST) EXASCALE

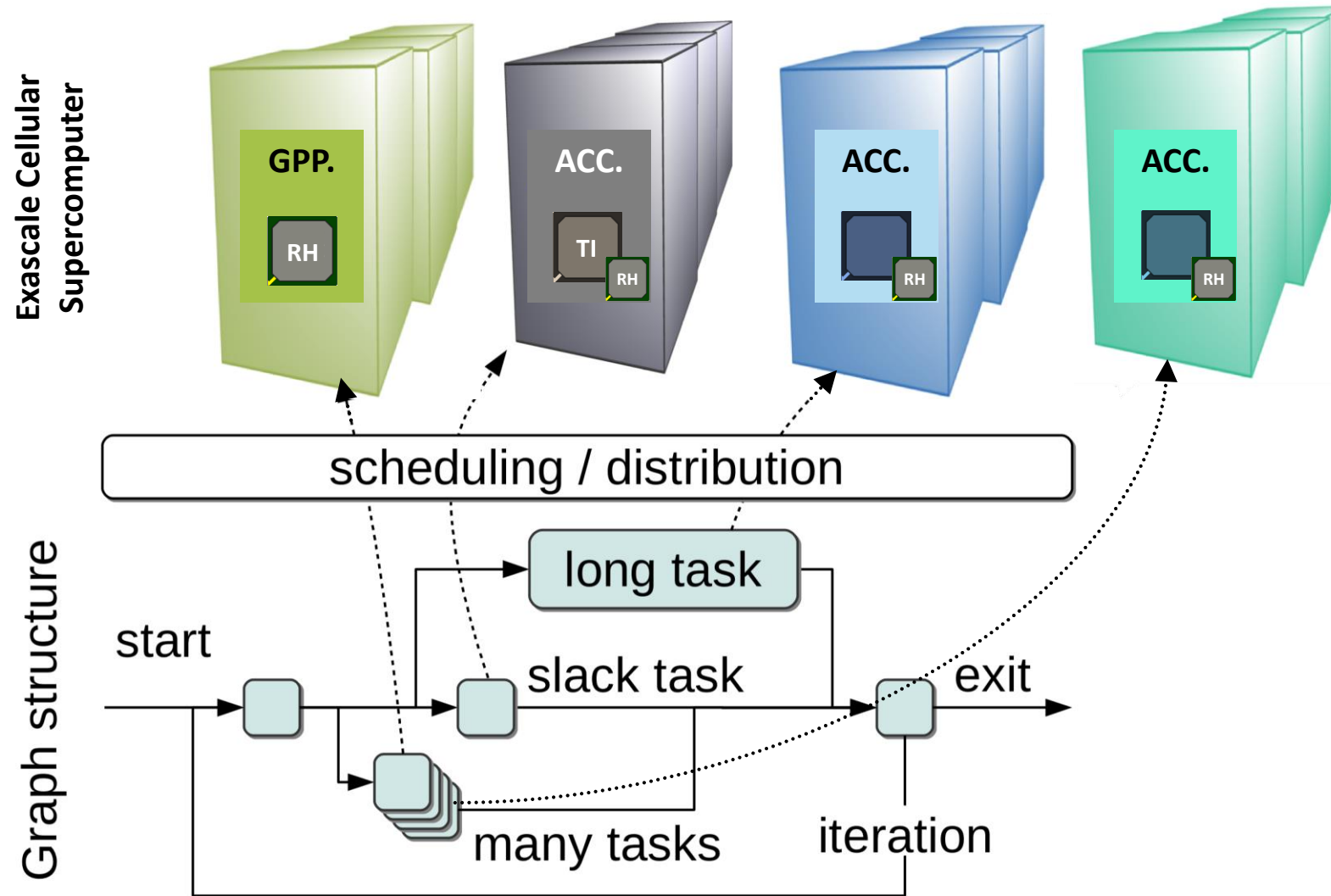
## EUROPEAN PROCESSOR INITIATIVE



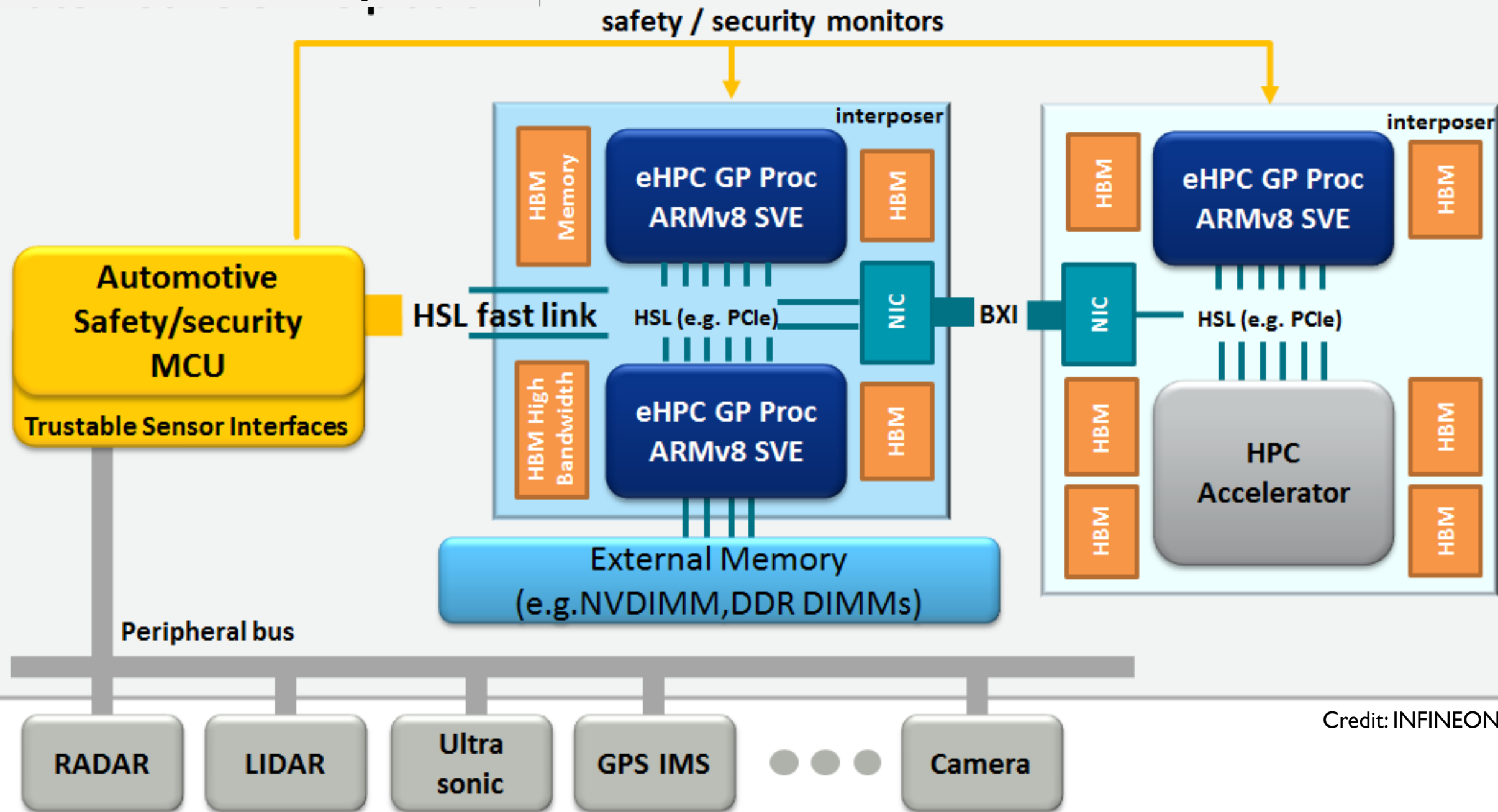
# WORKFLOWS & DATAFLOWS



# CONSEQUENCES ON SUPERCOMPUTER ARCHITECTURE



# Automotive eHPC platform



# THE HIGH COST OF DATA MOVEMENT

Operation	Operation Energy Cost (nJ)	Equivalent ADD	Data Movement (64b)	Data movement Energy (nJ)
ADD	0.64	-	-	-
L1->REG	1.11	1.8x	L1->REG	1.11
L2->REG	2.21	3.5x	L2->L1	1.10
L3->REG	9.80	15.4x	L3->L2	7.59
MEM->REG	63.64	99.7x	MEM->L3	53.84
Stall	1.43	-	-	-
Prefetching	65.08	-	MEM->cache	65.08

<http://hpc.pnl.gov/modsim/2014/Presentations/Kestor.pdf>

Analyzing the Energy Cost of Data Movement in Scientific Applications (2014)  
GOKCEN KESTOR, ROBERTO GIOIOSA, DARREN KERBYSON, ADOLFY HOISIE  
Pacific Northwest National Laboratory Richland, WA

**Energy cost for going off-chip is > 150 nJ**

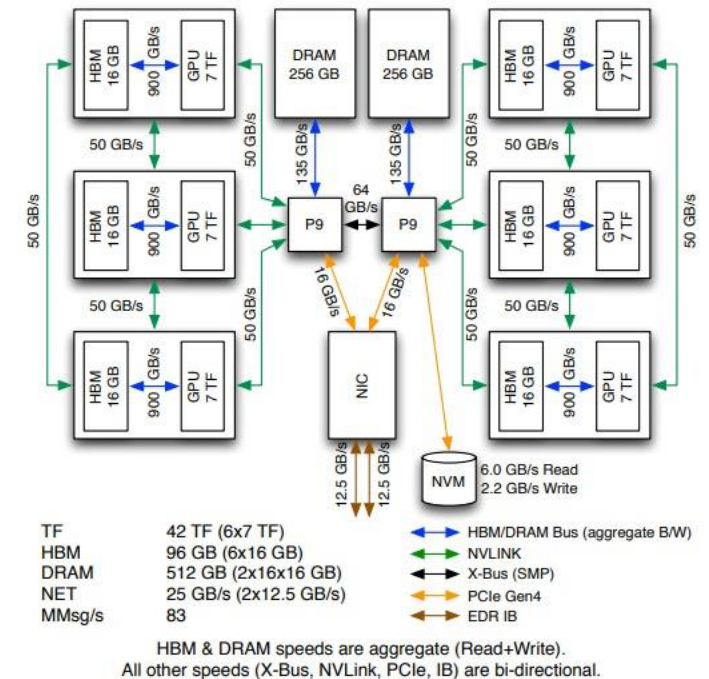
**Energy wall when going off-chip**

## Additional remarks

- Relative cost grows with each generation
- wire delay (ps/mm) not improving

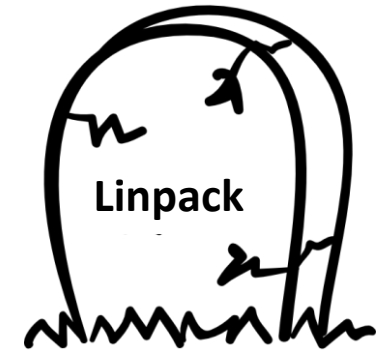
## Conclusion

- Dont go off-ship!!!
- ➔ SUMMIT node (P9/V100) is a great example of what should be implemented.



# TRENDS FOR (POST) EXASCALE – SUMMARY

- Workflows
- Specialization
  - ➔ rise of accelerators
  - ➔ (relative) decline of extra powerful general purpose processors (GPP)
  - ➔ complexity is on the Accelerator. GPPs will be more and more “data proxies”
- data movement reduction. The right technology at the right place



# TECHNOLOGY

CONCEPT OF COMMON PLATFORM



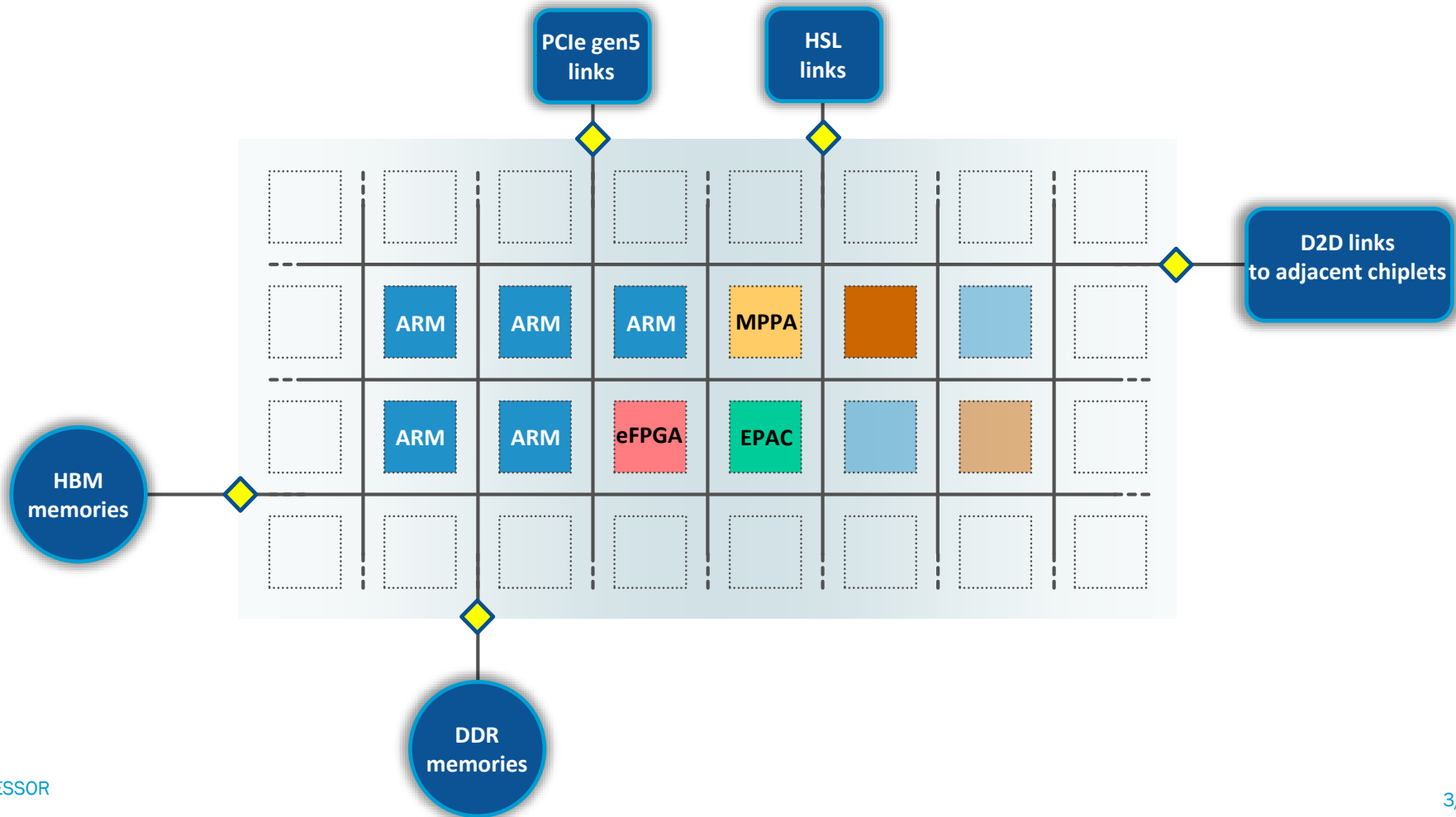
## EUROPEAN PROCESSOR INITIATIVE



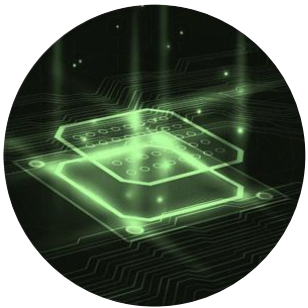
# GPP AND COMMON ARCHITECTURE



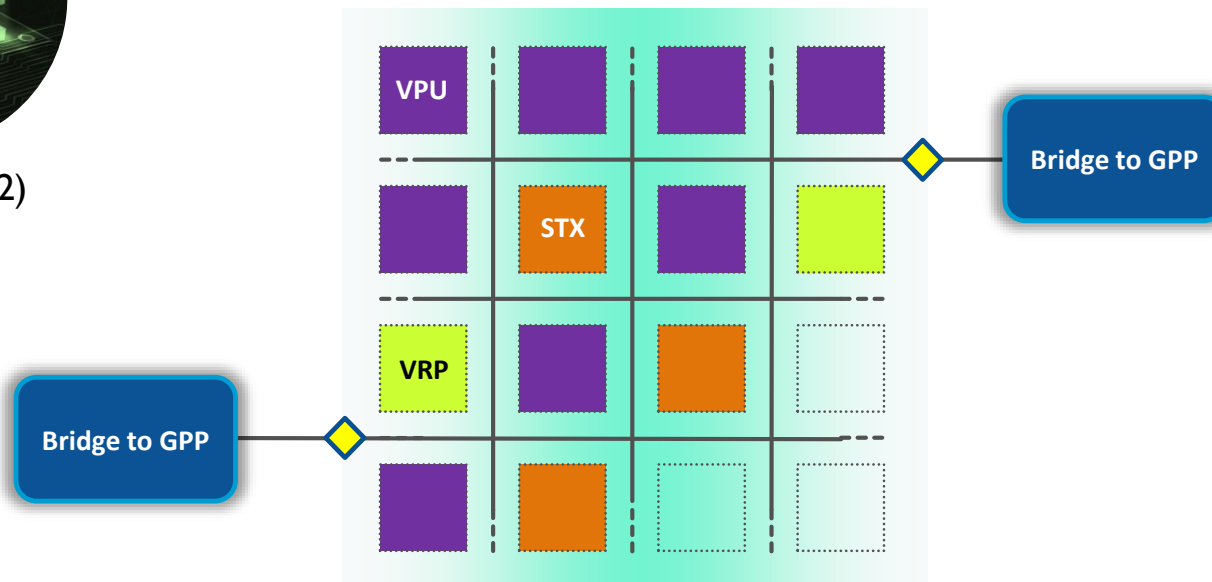
RHEA (Gen I)  
CRONOS (Gen2)



# EPAC – RISC-V ACCELERATOR

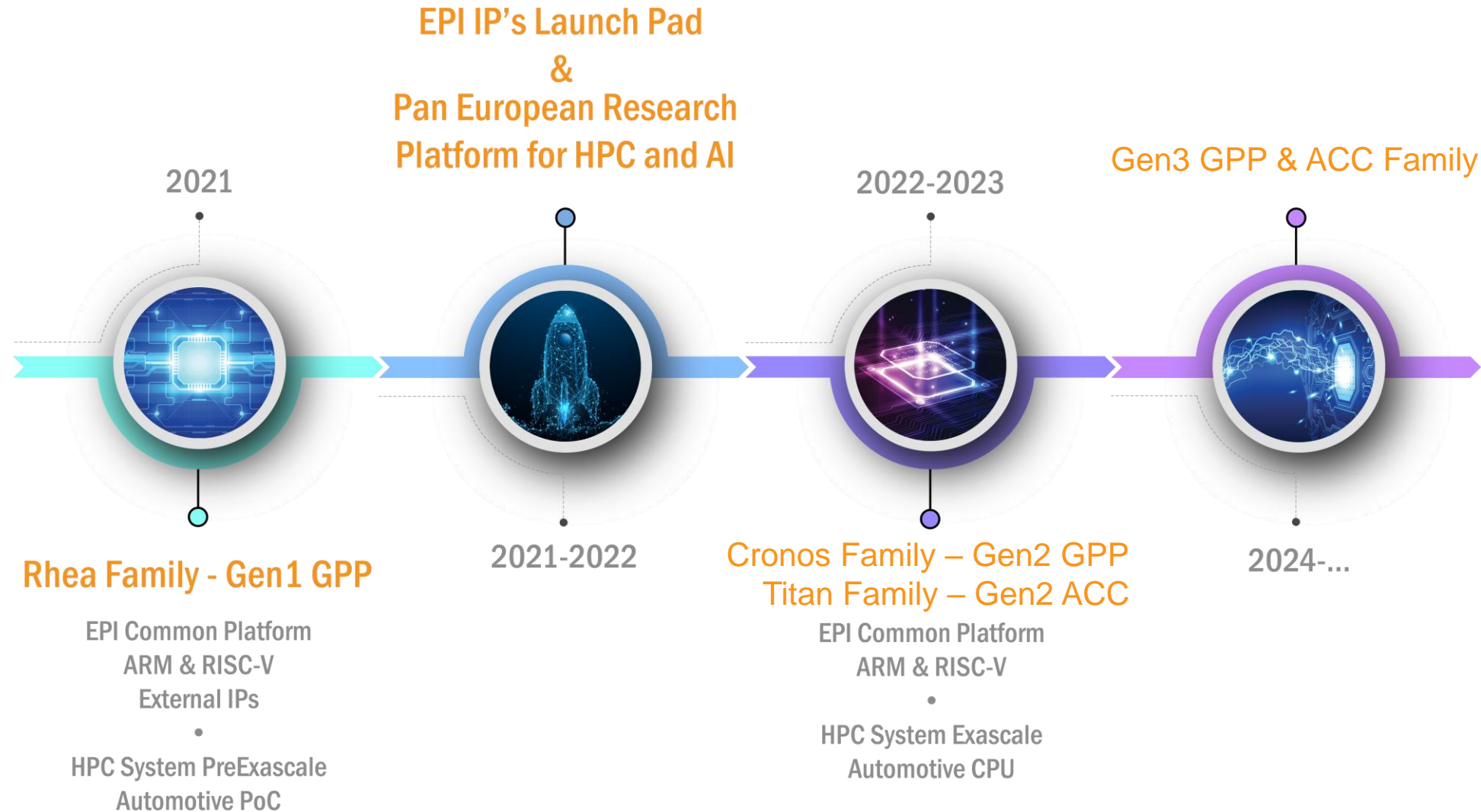


TITAN (Gen2)

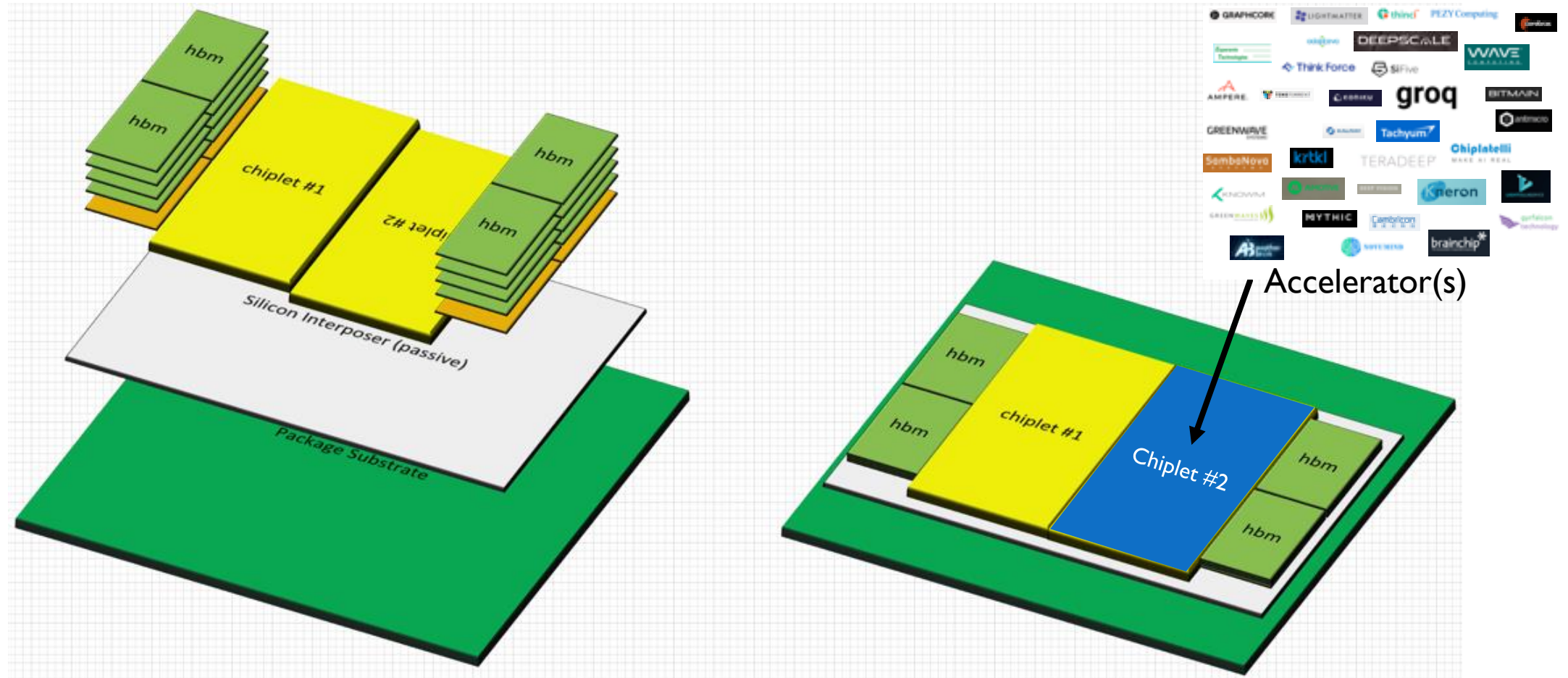


- EPAC - EPI Accelerator
- VPU – Vector Processing Unit
- STX – Stencil/Tensor accelerator
- VRP - VaRiable Precision co-processor

# ROADMAP



# CONCEPT OF COMMON PLATFORM : INTERPOSER



**THANKS FOR YOUR ATTENTION**

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