www.bsc.es

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Centro Nacional de Supercomputación

High Performance Computing for the Public Sector

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Disclaimer:

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My personal opinion, as a veteran of EU projects in large, distributed computing and HPC

- While at CERN (1975-2005), leader of large data and distributed computing infrastructures i.e. European Data Grid, EGEE, AI at Stanford in the 80's, Cloud pioneer at Microsoft 2005-2013

Now at BSC (2013 -) mostly involved in HPC, EuroHPC and the European Processor Initiative

BSC

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Centro Nacional de Supercomputación

- Spanish national supercomputing centre and Severo Ochoa Centre of Excellence in Spain
- Hosting member of PRACE research infrastructure and coordinator of the Spanish Supercomputing Network (Red Española de Supercomputación)
- Internationally recognized research centre employing over 650 members of staff with portfolio of 75 competitively funded projects, mostly from the EU

HPC in the public sector

- Computing has reached in the last few years an incredible level of performances
- The availability of new innovative H/W and S/W to process huge amount of data has changed the way computing is performed moving from algorithmic to ML big data processing
- The result is that computers are now better than humans at many tasks, as for example in playing complicated games such as GO **"Google's AlphaGo AI beats the world's best human Go player"** and this was done not just being faster but inventing strategies and moves which the best experts have hard time to understand
- So we are not yet at the *Singularity Point* but computers are now essential in any aspect of modern life
- The most effective computing AI/ML requires processing of massive amount of data, and therefore the use of large HPC systems
- The impact on the public sector is obvious and important

HPC in the public sector 2

- New medical diagnostics such as the processing of X-rays with ML techniques can make the pro-active screening of entire populations affordable
- Genome based disease prediction can save many lives and generate enormous saving for the public health sectors
- Precise weather predictions and climate modelling can protect and improve agricultural production in a big way
- New sources of energies can be developed while more conventional ones can be made more efficient

This list can continue for a long time, but the conclusion is that Computing and especially HPC computing is by now indispensable not only for the Big Science but for everybody

Unfortunately the Public Sector traditionally lacks the competences and resources for fully profiting from HPC, therefore synergy with HPC centres of competence is essential

CALIOPE real-time air quality forecasts

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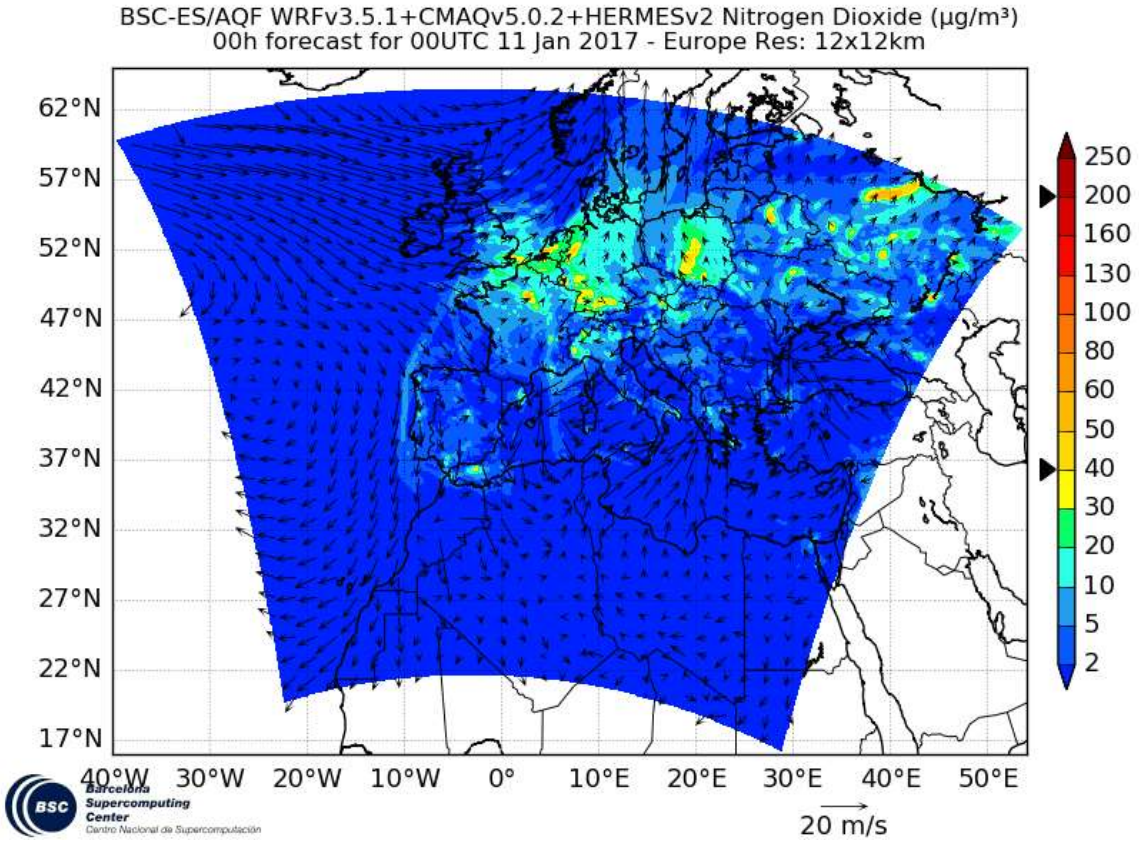
Provides air quality related information for the coming days and for the application of short term action plans for air quality managers.



Information is delivered using both online or custom applications:

www.bsc.es/caliope

Smart city platform

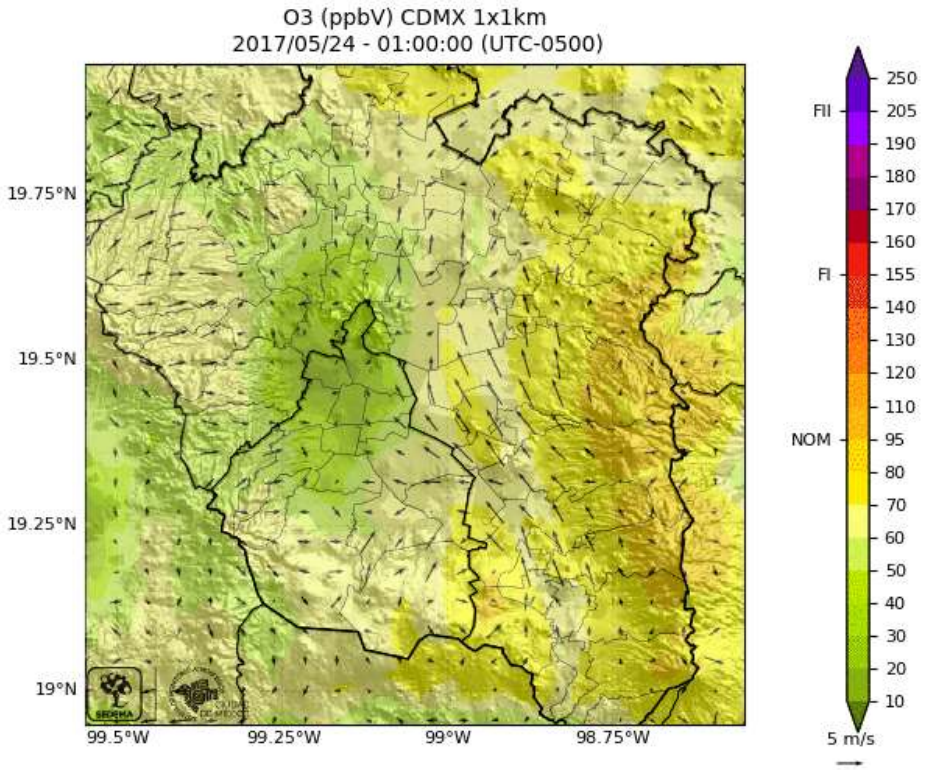
vodafone IBM

Air quality index & population exposed

Pay et al. (2014, GMD)

CALIOPE-Mexico
real-time air quality forecasts

A computational tool for air quality forecast and air quality management in Mexico City



http://www.aire.cdmx.gob.mx/pronostico-aire/

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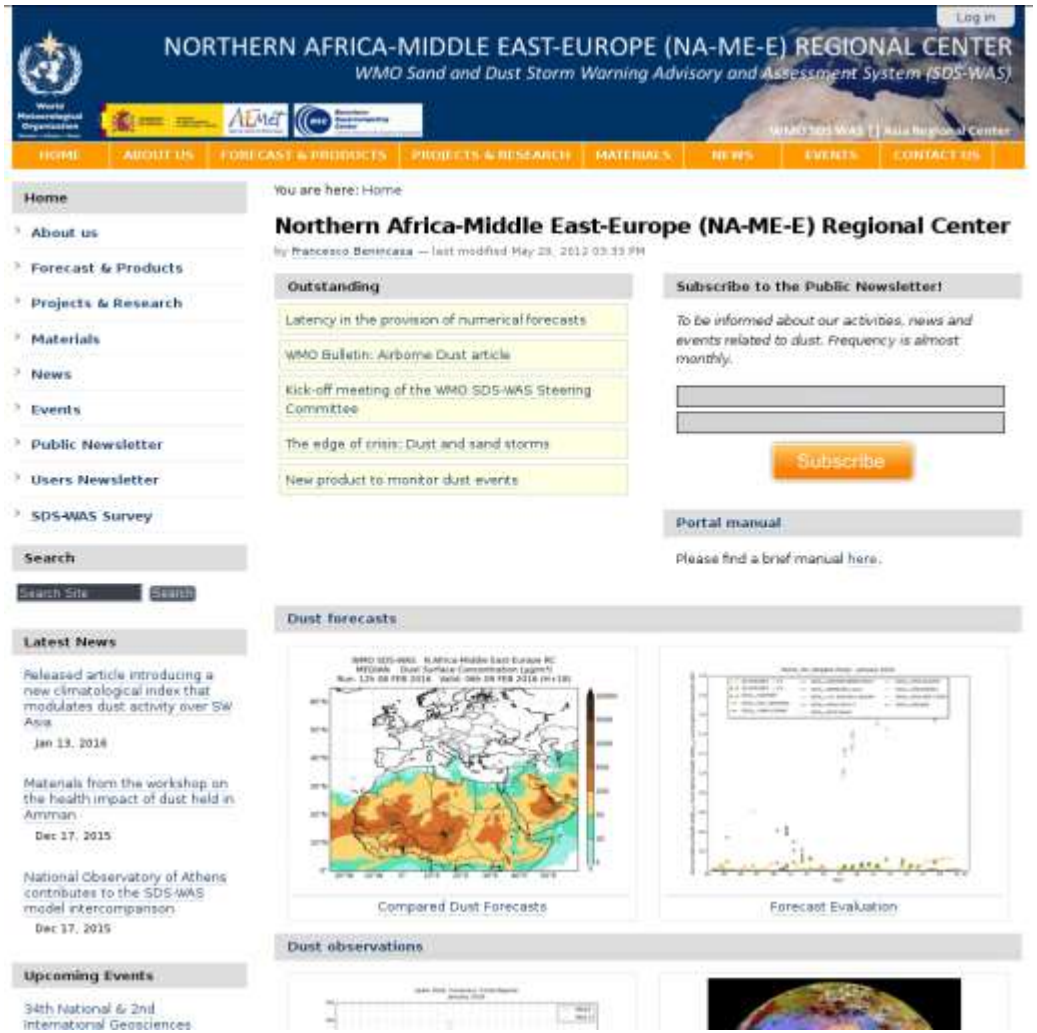
SDS-WAS



http://sds-was.aemet.es

- *Research and development* ***warning advisory & assessment system***
- *Ensemble of models provided by various international partners*
- *Provides:*
  . Model inter-comparison
  . Multi-model products
  . AERONET evaluation
  . Satellite (MODIS, …) evaluation
  . Numerical scores (BIAS, …)
  . Datasets download

The system is managed by a consortium of AEMET and BSC in Barcelona, Spain

Climate predictions for agriculture

Source: https://www.hangtimewines.com/california-grown

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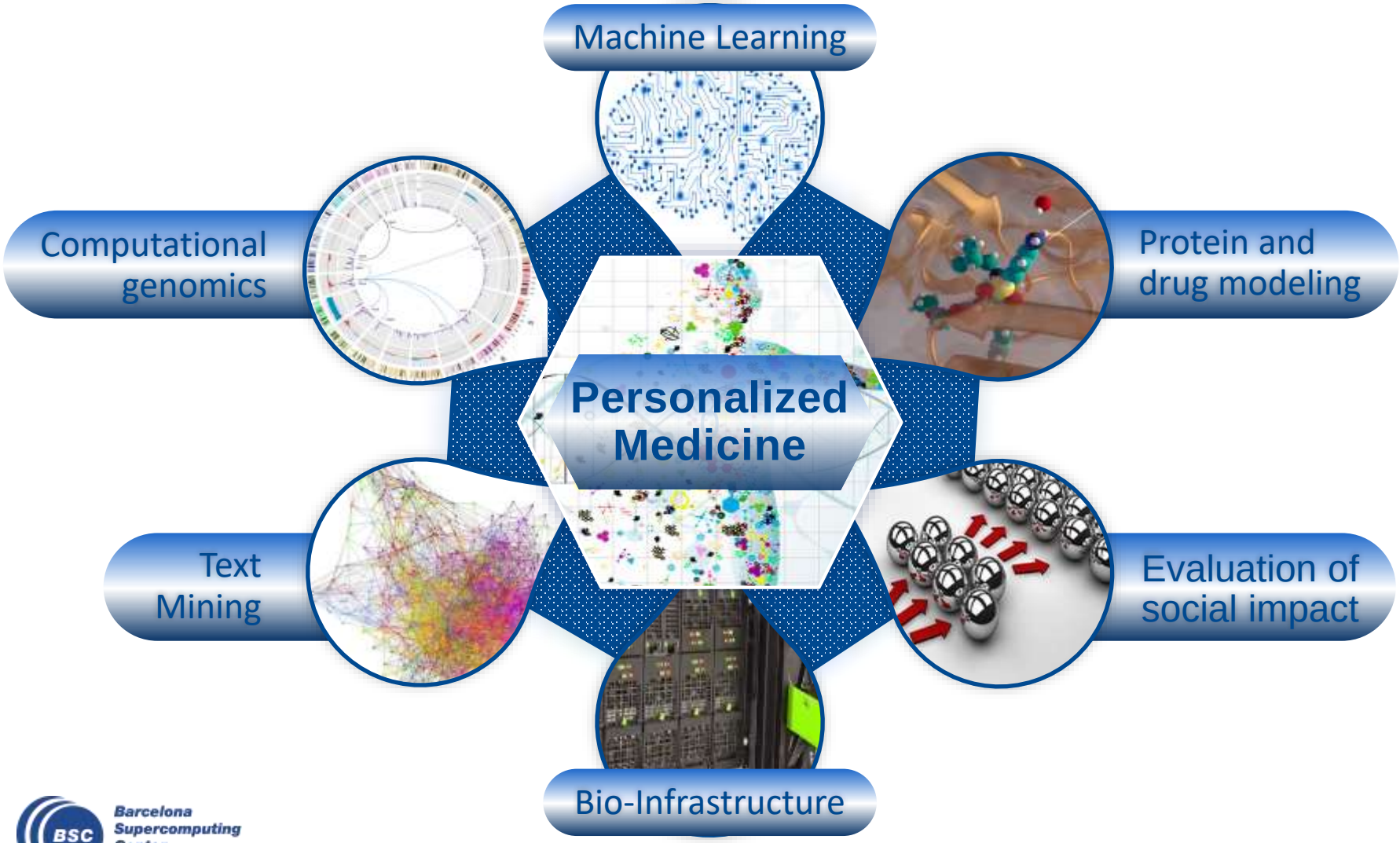
JRC
EUROPEAN COMMISSION

VISCA
VINEYARDS INTEGRATED SMART CLIMATE APPLICATION

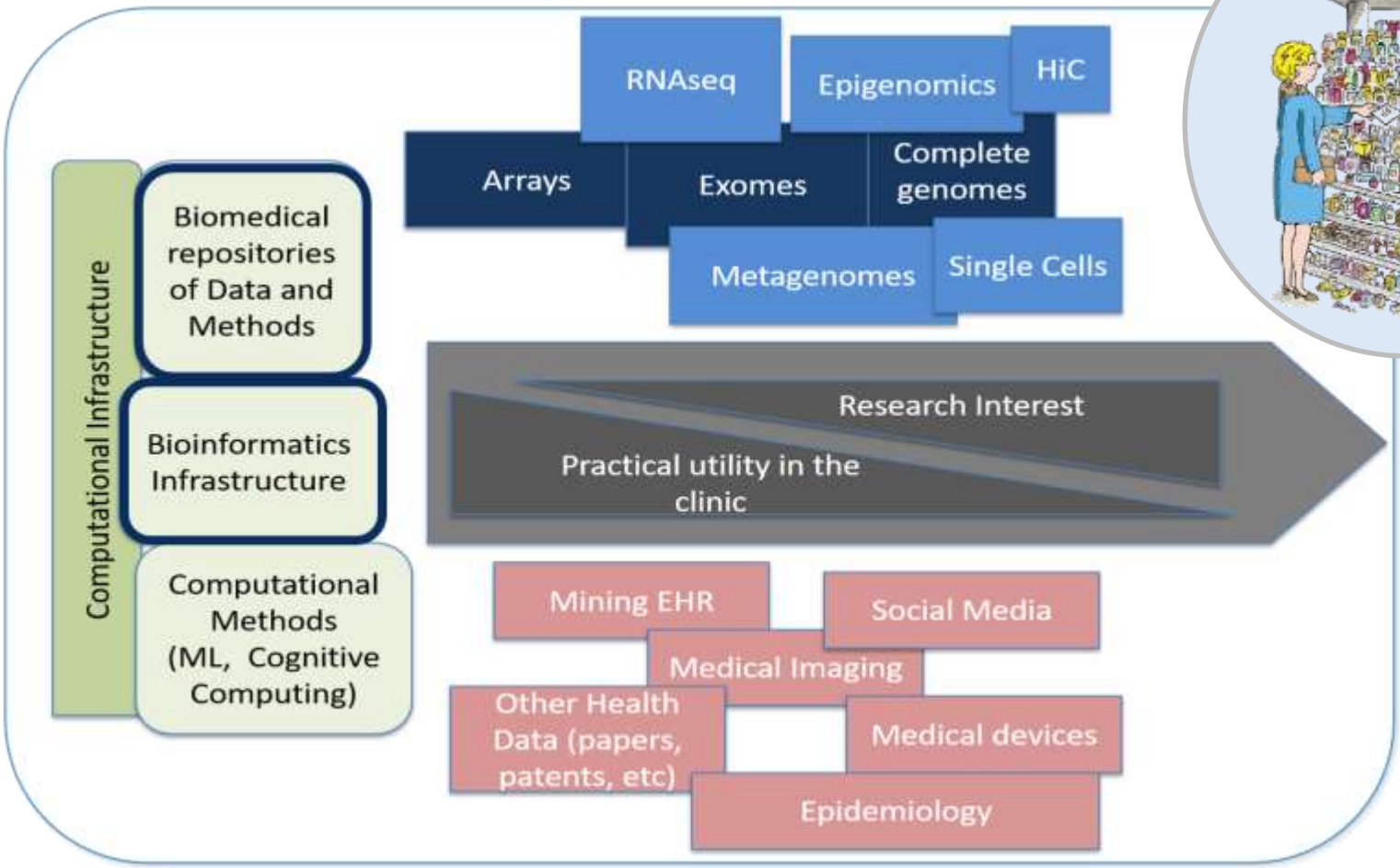
MED-GOLD

Life Sciences

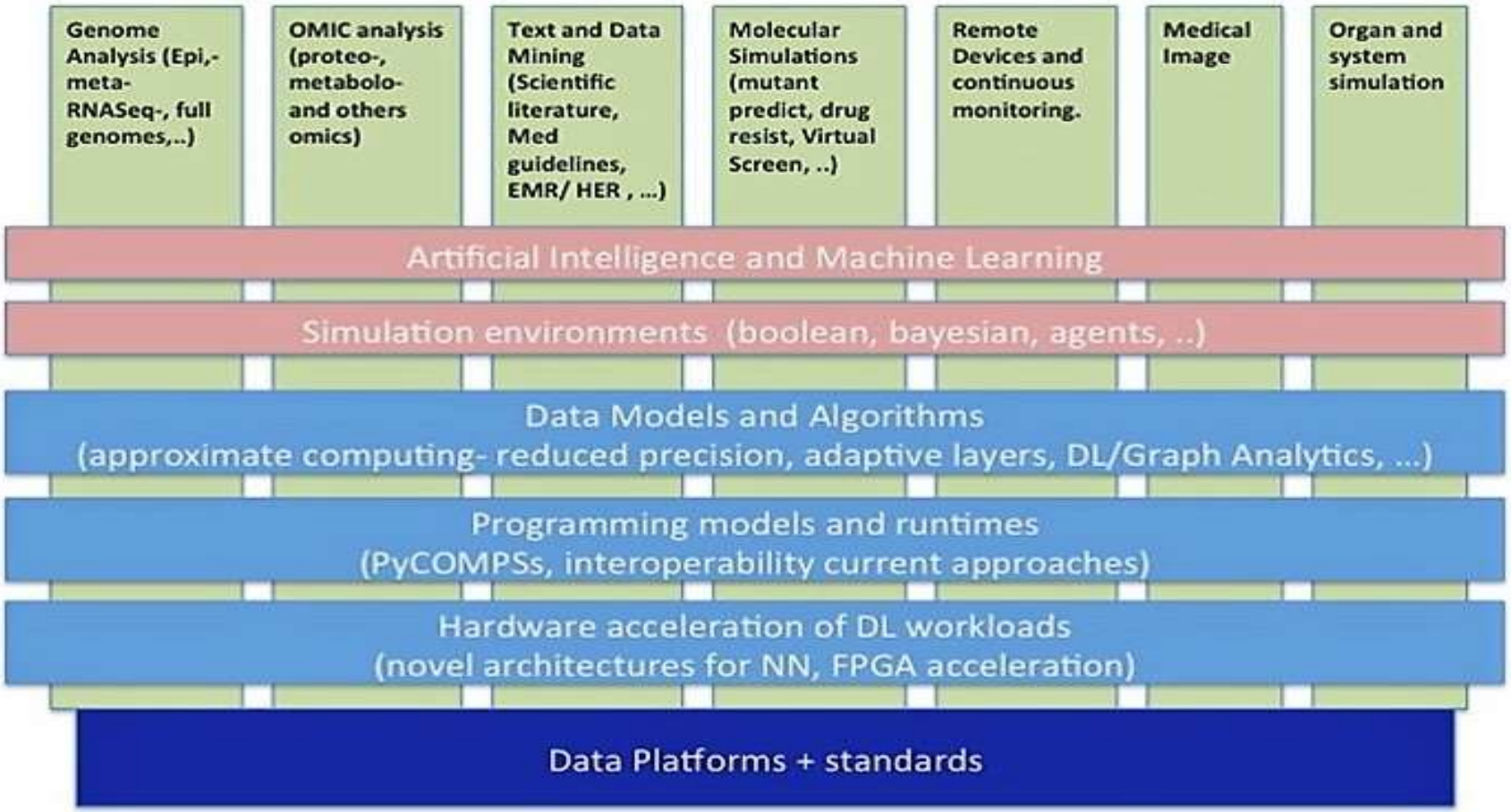
Understanding living organisms by theoretical and computational methods



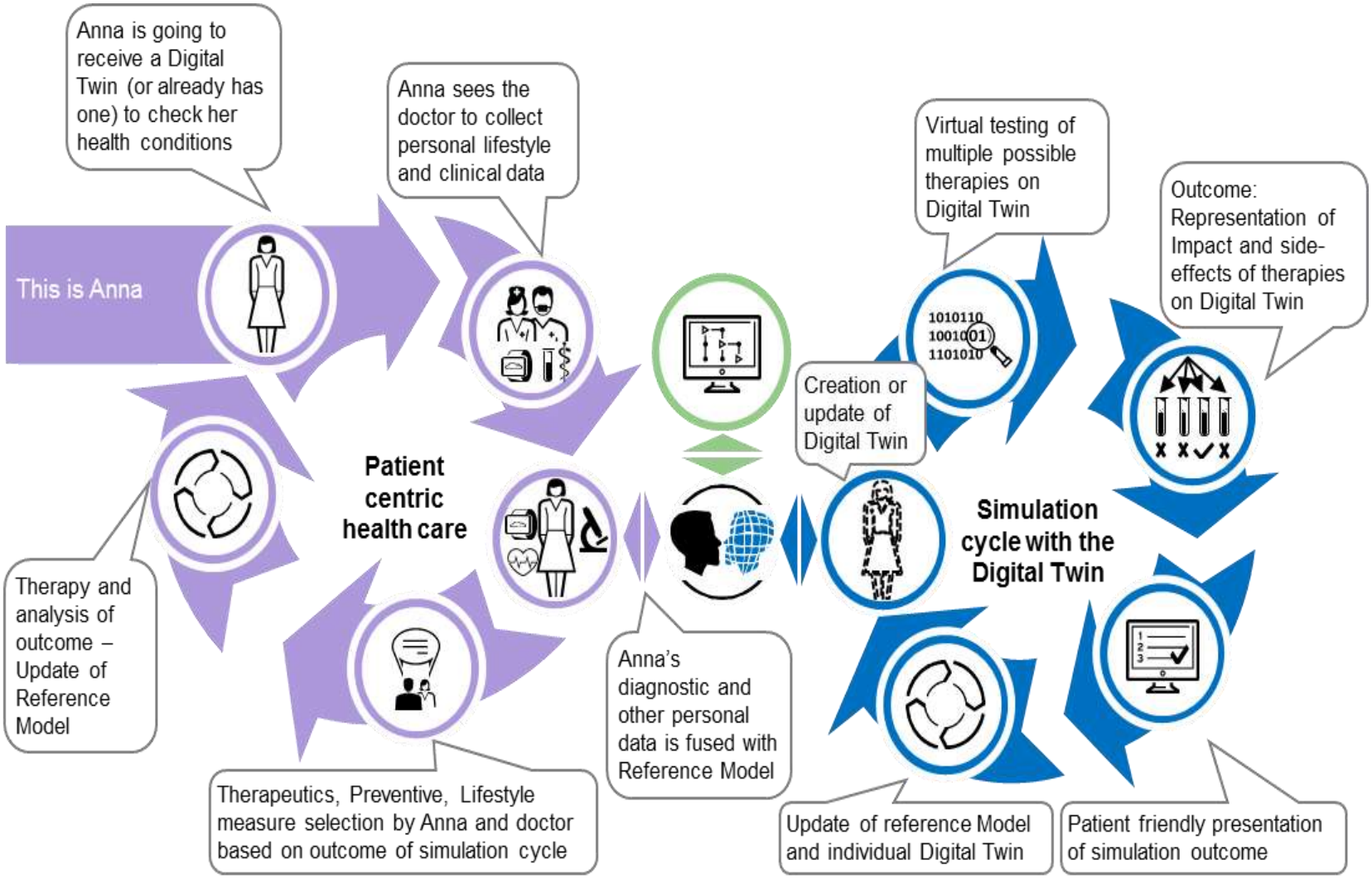
Personalized Medicine: present & future



BSC technical strategy for Personalized Medicine

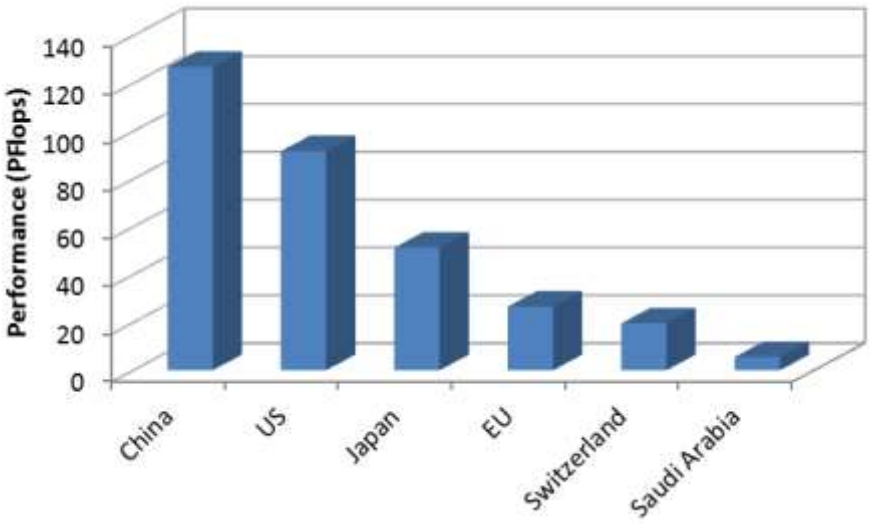


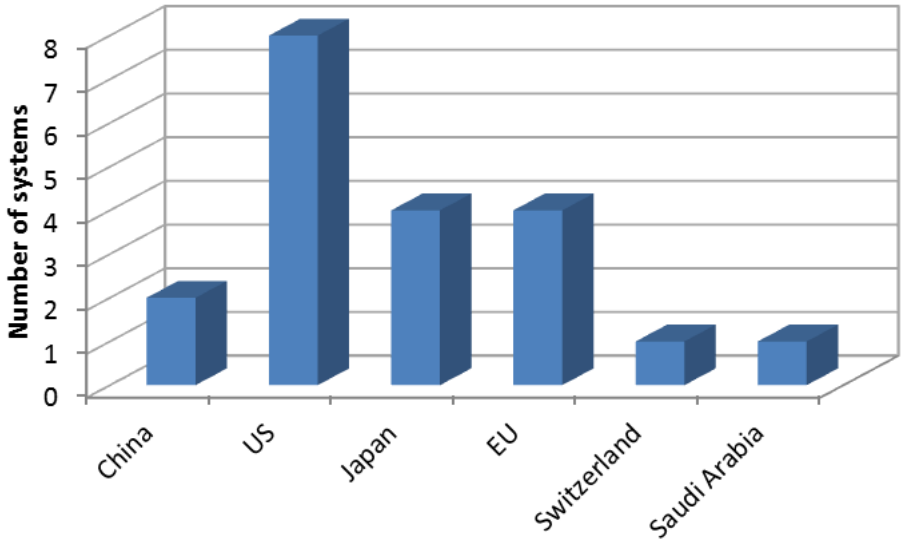
DigiTwins consortium concept



World Top 20 machines (status November 2017)

EU not in HPC world leaders





Europe has only 4 machines in world top 20

- Italy (CINECA) – Nr 14
- UK (Meteorological office) – Nr 15
- Spain (BSC, Barcelona) – Nr 16
- Germany (HLRS, Stuttgart) – Nr 19

BSC and the European Commission

Final plenary panel at ICT - Innovate, Connect, Transform conference, 22 October 2015 Lisbon, Portugal.

The transformational impact of excellent science in research and innovation

"Europe can develop an exascale machine with ARM technology. Maybe we need an consortium for HPC and Big Data".

Seymour Cray Award Ceremony Nov. 2015
Mateo Valero

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The European Commission and HPC

European Commission President Jean-Claude Juncker

"Our ambition is for Europe to become one of the top 3 world leaders in high-performance computing by 2020"

Paris, 27 October 2015

Vice-President Andrus Ansip

"I encourage even more EU countries to engage in this ambitious endeavour"

- Ministers from seven MS (France, Germany, Italy, Luxembourg, Netherlands, Portugal and Spain) sign a declaration to support the next generation of computing and data infrastructures

Digital Day Rome, 23 March 2017

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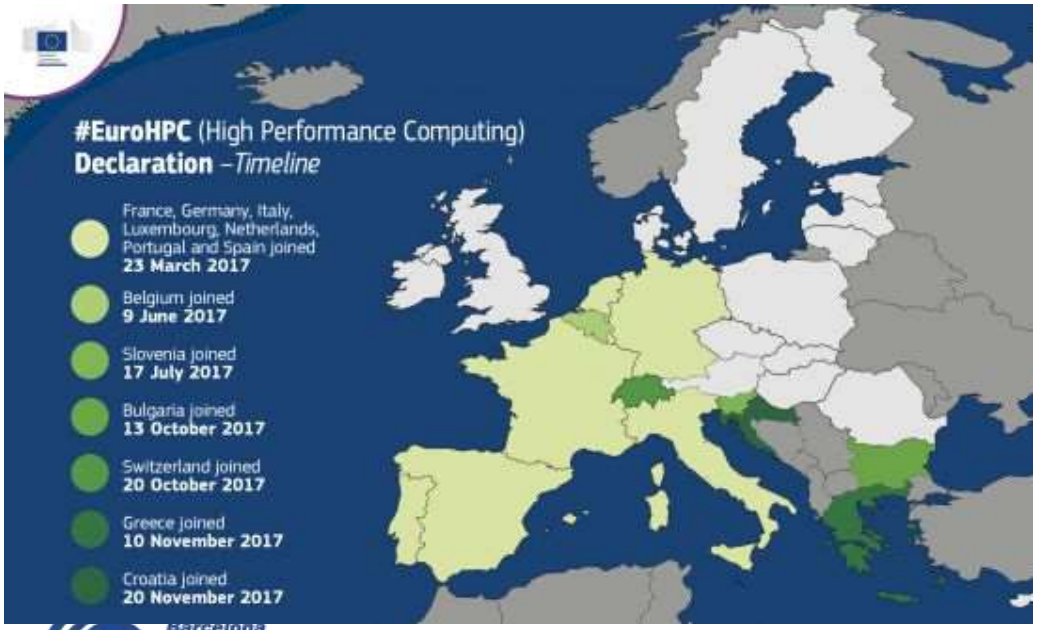
The EuroHPC Declaration

Declaration signed in Rome, March 23rd, 2017 by:

France | Germany | Italy | Luxembourg | Netherlands | Portugal | Spain

Six more countries signed the Declaration:

Belgium | Slovenia | Bulgaria | Switzerland | Greece | Croatia



Agree to work towards the establishment of a **cooperation framework** - EuroHPC - for **acquiring and deploying an integrated exascale supercomputing infrastructure** that will be **available across the EU** for scientific communities as well as public and private partners

EuroHPC latest news:

European Processor Initiative

- Europa portail: (January 2018)

http://europa.eu/rapid/press-release_IP-18-64_en.htm

European Commission - Press release

Commission proposes to invest EUR 1 billion in world-class European supercomputers

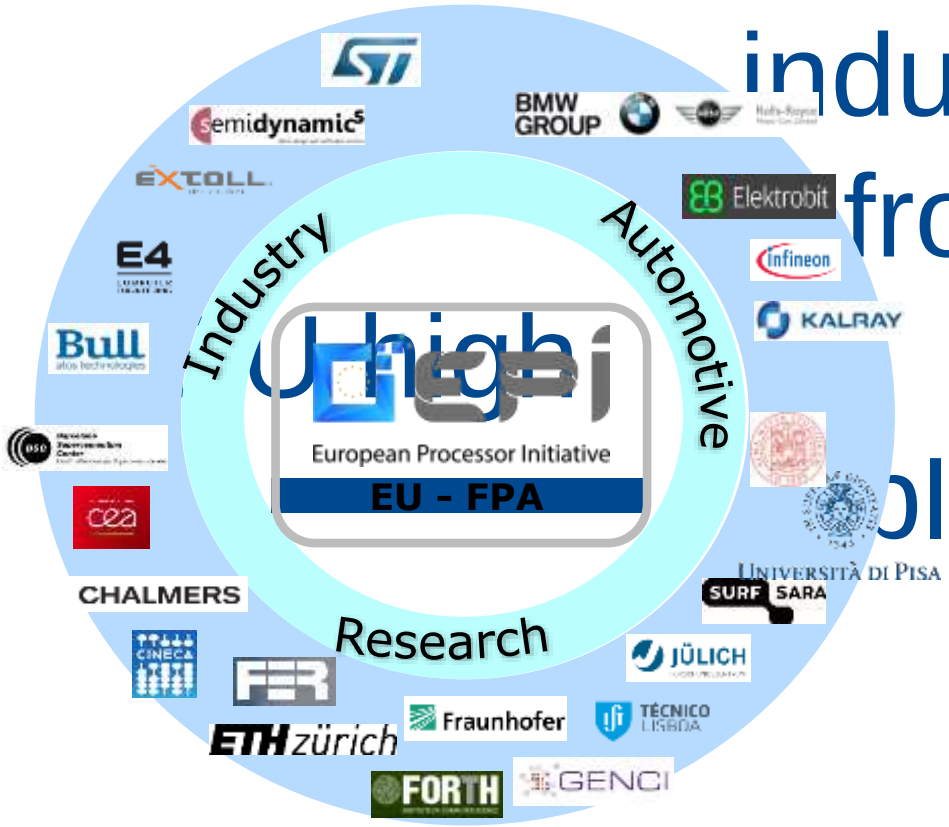
Brussels, 11 January 2018

The European Commission unveiled today its plans to invest jointly with the Member States in building a world-class European supercomputers infrastructure.

Supercomputers are needed to process ever larger amounts of data and bring benefits tothe society in many areas from health care and renewable energy to car safety and cybersecurity.

EPI 23 partners, from research to industry

from consortium to high tech



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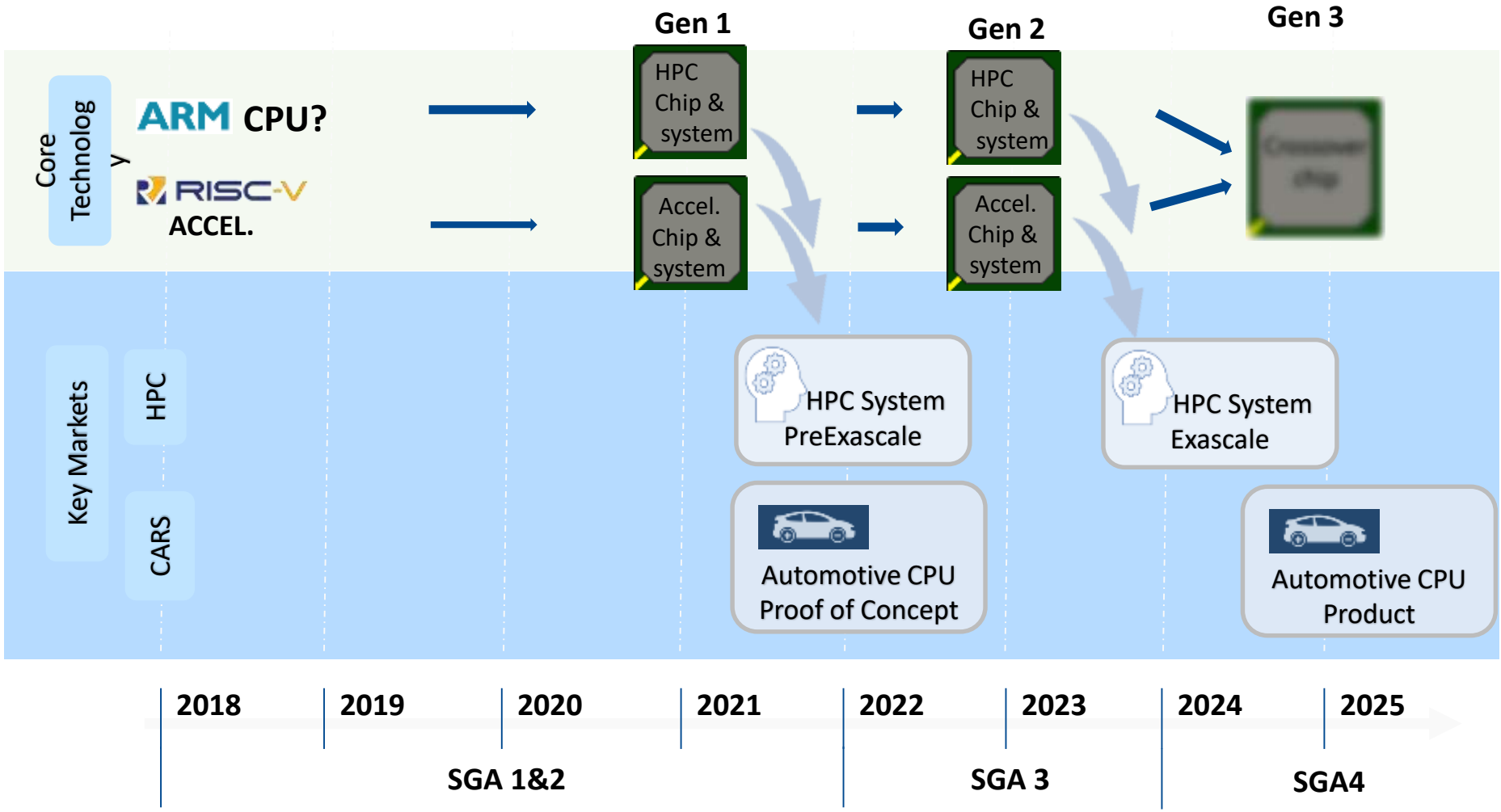
EPI Semiconductor

Fabless company
Industrial hand of EPI
Incorporated by a couple EPI members and external investors

EPI Common Platform

1st EPI production

EPI ROADMAP



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European Processor Initiative