Open Source Hardware: A European Perspective

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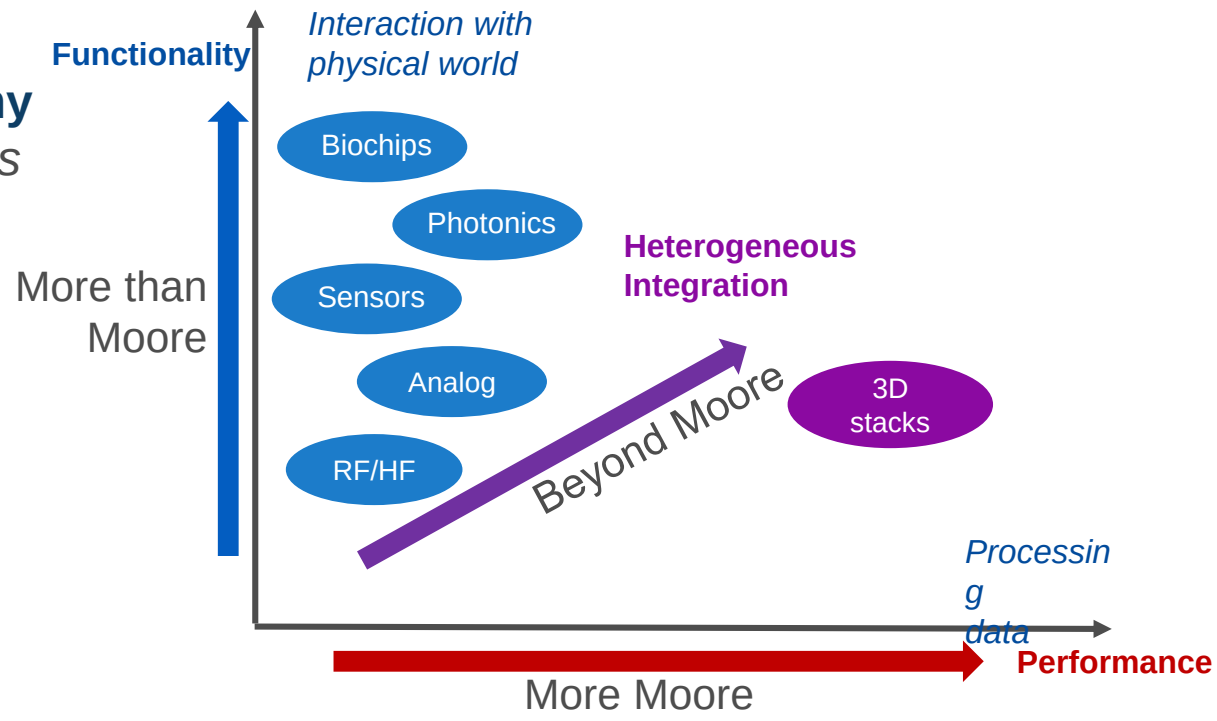
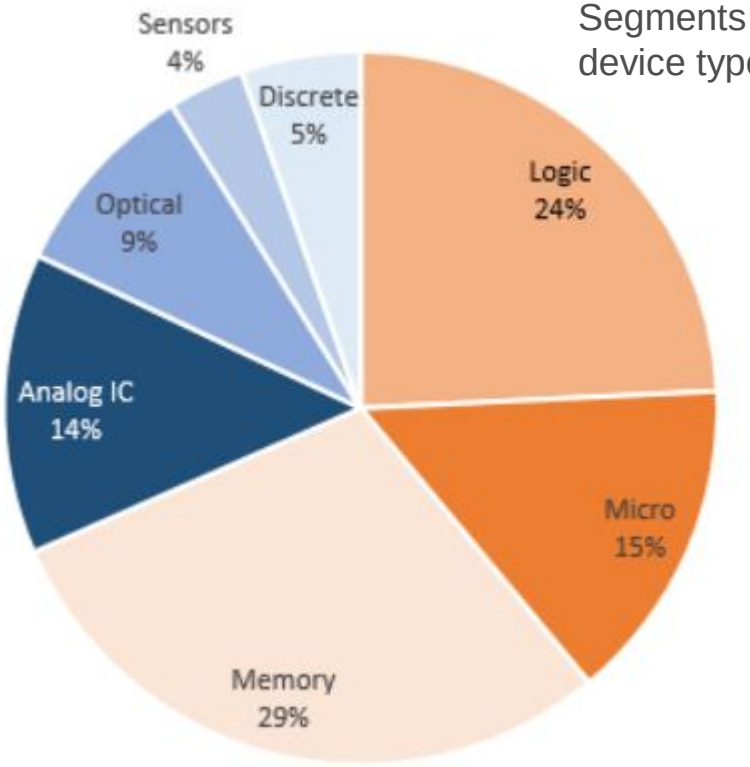
Trends and challenges for semiconductors in Europe

- Semiconductor sector facing **new challenges**
  sanitary crisis, trade frictions, M&A
- Global value-chains vs **open technology autonomy**
  access to key digital, green and secure technologies
- Towards **resilient** and sustainable supply chains
  design environments, advanced manuf., heterogeneous integration
- Semiconductors solutions for **emerging trends**
  AI at the edge, new network generation, HPC
- Accelerate the maturity of '**future' technologies**
  neuromorphic, quantum, spintronics

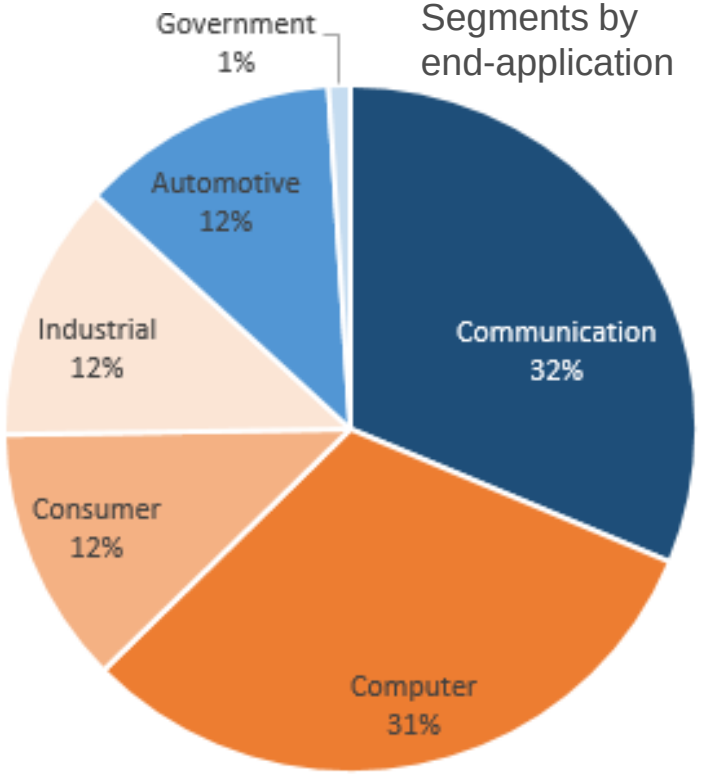


Semiconductor market segments

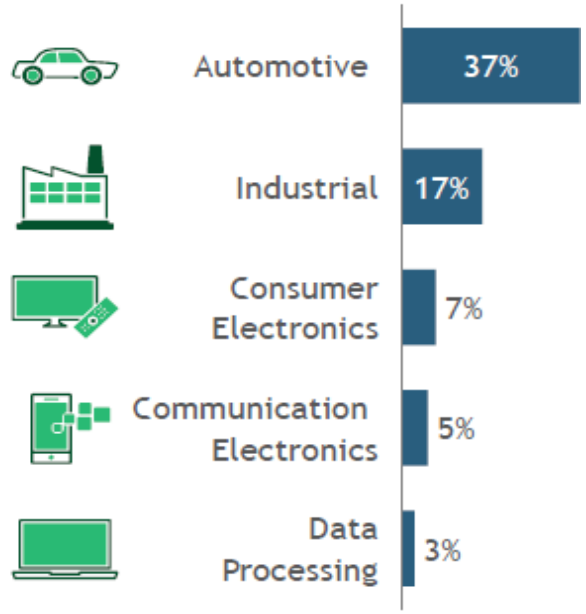
Segments by device type



Segments by end-application



Europe share by end-application



- Digital ICs = Logic+Micro+Memory = ~70%
  - Micro = MPU 71% +MCU 25% +DSP 4%
- Automotive and Industrial highest CAGR, now hit by Covid
- EU strong in embedded ICs, weak in digital ICs (no MPU or memories)

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State of the Union

EC President von der Leyen's address

16th September 2020

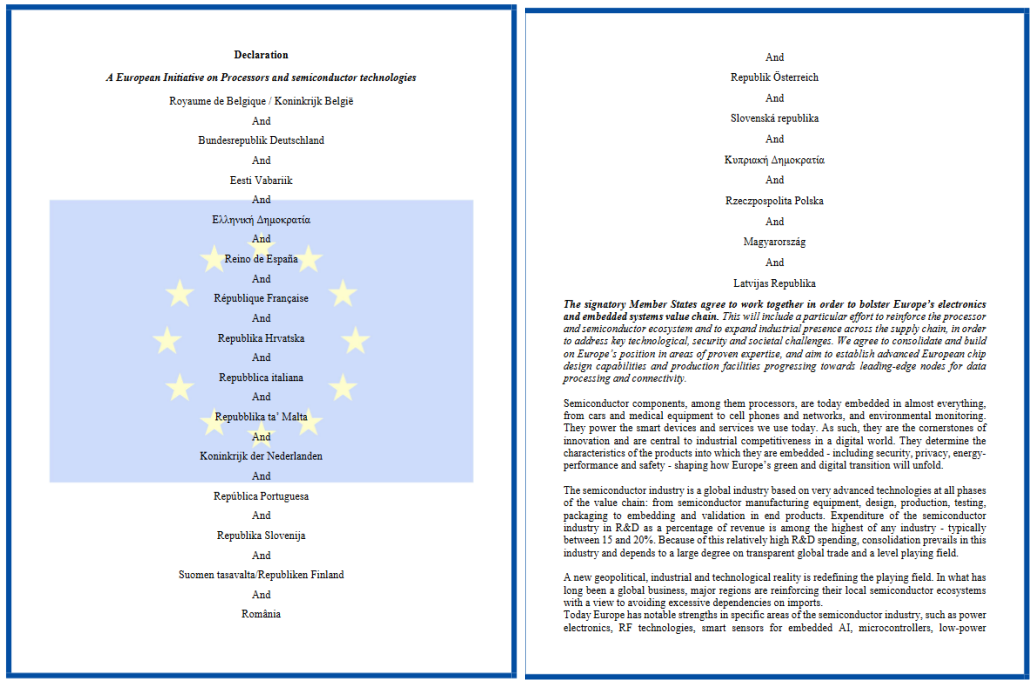
"Building the world we want to live in:
A Union of vitality"

Europe's Digital Decade (2020-30): "We will **invest 20% of NextGenerationEU on digital**"

Three areas to focus on:

1. Technology
   - European industry to develop our own **next-generation microprocessor** that will allow us to use the increasing data volumes energy-efficiently and securely
   - Europe's digital sovereignty -> investment of 8B€ in the next generation of **supercomputers with cutting-edge technology made in Europe**
2. Data Building a European cloud – based on GaiaX
3. Infrastructure NextGenerationEU to focus on secure connectivity, on the expansion of 5G, future 6G and fibre (40% of people in rural areas still do not have access to broadband connections)

Processors & Semiconductors declaration



Declaration

A European Initiative on Processors and semiconductor technologies

Royaume de Belgique / Koninkrijk België
And
Bundesrepublik Deutschland
And
Eesti Vabariik
And
Ελληνική Δημοκρατία
And
Reino de España
And
République Française
And
Republika Hrvatska
And
Repubblica italiana
And
Repubblika ta' Malta
And
Koninkrijk der Nederlanden
And
República Portuguesa
And
Republika Slovenija
And
Suomen tasavalta/Republiken Finland
And
România
And
Republik Österreich
And
Slovenská republika
And
Κυπριακή Δημοκρατία
And
Rzeczpospolita Polska
And
Magyarország
And
Latvijas Republika

The signatory Member States agree to work together in order to bolster Europe's electronics and embedded systems value chain. *This will include a particular effort to reinforce the processor and semiconductor ecosystem and to expand industrial presence across the supply chain, in order to address key technological, security and societal challenges. We agree to consolidate and build on Europe's position in areas of proven expertise, and aim to establish advanced European chip design capabilities and production facilities progressing towards leading-edge nodes for data processing and connectivity.*

Semiconductor components, among them processors, are today embedded in almost everything, from cars and medical equipment to cell phones and networks, and environmental monitoring. They power the smart devices and services we use today. As such, they are the cornerstones of innovation and are central to industrial competitiveness in a digital world. They determine the characteristics of the products into which they are embedded - including security, privacy, energy-performance and safety - shaping how Europe's green and digital transition will unfold.

The semiconductor industry is a global industry based on very advanced technologies at all phases of the value chain: from semiconductor manufacturing equipment, design, production, testing, packaging to embedding and validation in end products. Expenditure of the semiconductor industry in R&D as a percentage of revenue is among the highest of any industry - typically between 15 and 20%. Because of this relatively high R&D spending, consolidation prevails in this industry and depends to a large degree on transparent global trade and a level playing field.

A new geopolitical, industrial and technological reality is redefining the playing field. In what has long been a global business, major regions are reinforcing their local semiconductor ecosystems with a view to avoiding excessive dependencies on imports.
Today Europe has notable strengths in specific areas of the semiconductor industry, such as power electronics, RF technologies, smart sensors for embedded AI, microcontrollers, low-power

December 2020

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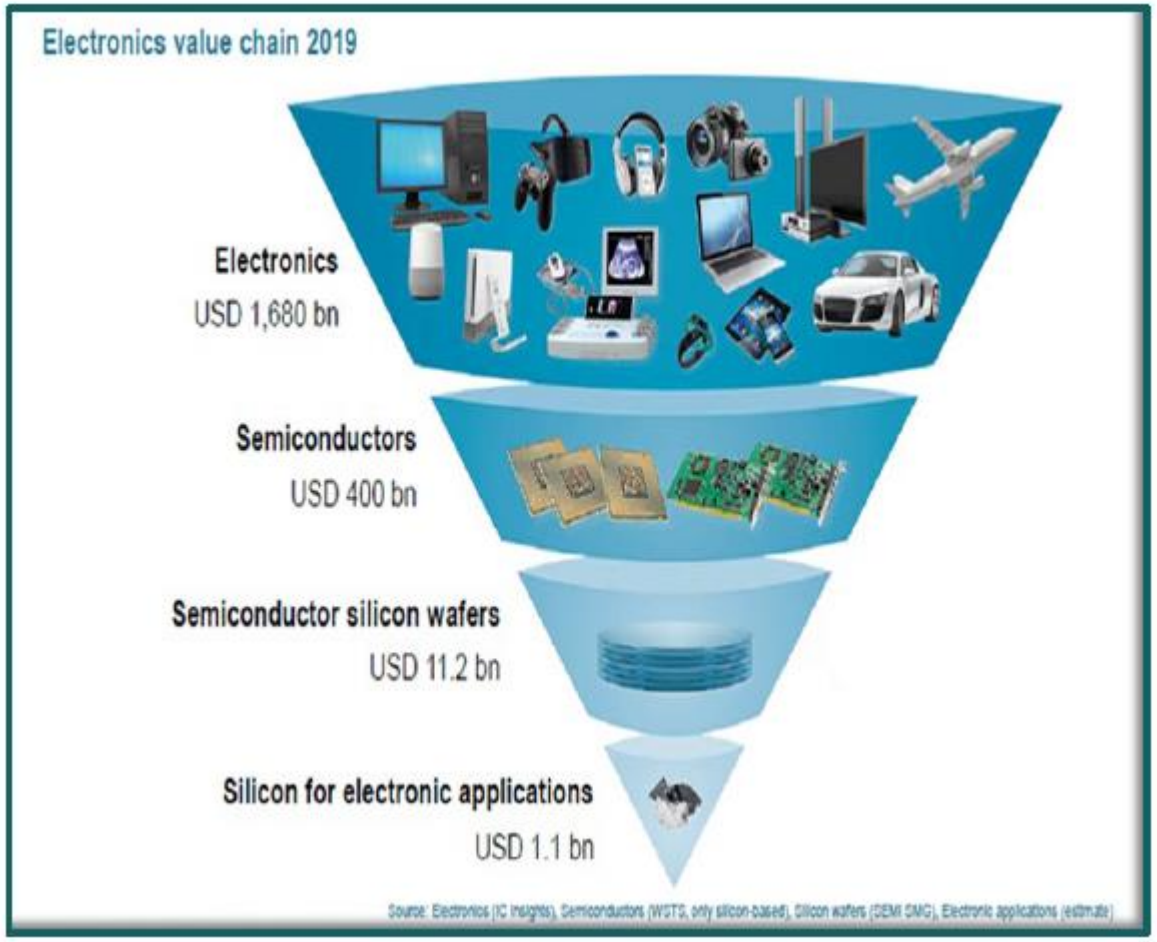
Initiatives related to processor design and manufacturing: Huge momentum!

- **Joint Declaration of Member States** on processors and semiconductors
- **Digital Compass** specific targets for advanced semiconductors
- Important Project of Common European Interest (**IPCEI**) on Microelectronics Technology
- **Recovery and Resilience Fund** and '**Multicountry projects**'



Towards a new *Important Project of Common European Interest* (IPCEI)

- Strengthen capabilities in design and manufacturing and increase autonomy and resilience of EU semiconductor value chains
- Primary focus on **digital** - data processing and communication with power efficiency / sustainability
- Possible areas of development:
  - *Design of processor cores and AI chips for different vertical markets*
  - *Design of chips and systems for communication (5G, 6G and other)*
  - *Development of advanced semiconductor processes (Beyond Moore, More Moore)*
  - *Advanced packaging for 2D/3D heterogeneous integration*
  - *Low power, sustainable electronics*

A European Micro Processor Project

- **The opportunities: Data analytics and distributed AI in the cloud, at the edge and embedded)**
  - Growing needs for higher performance processors (CPUs and GPUs) in all sectors
    - Automotive, energy, health, manufacturing (**all traditional sectors of EU strengths** & value/supply chains)
    - New mobile devices (e.g. wearables)
    - New professional computing systems: **Cloud to edge computing**
    - **HPC**
  - **New requirements where Europe has also a clear strengths**
    - **Low power** consumption
    - Highly **secure** and **safe**
    - Real time
- **The challenge: "Everybody is aware"**
    - Governments and businesses, US, China, SK, JP, etc..
    - **No time to lose,** otherwise we lose everything
    - We can build on clear strengths but have to act collectively

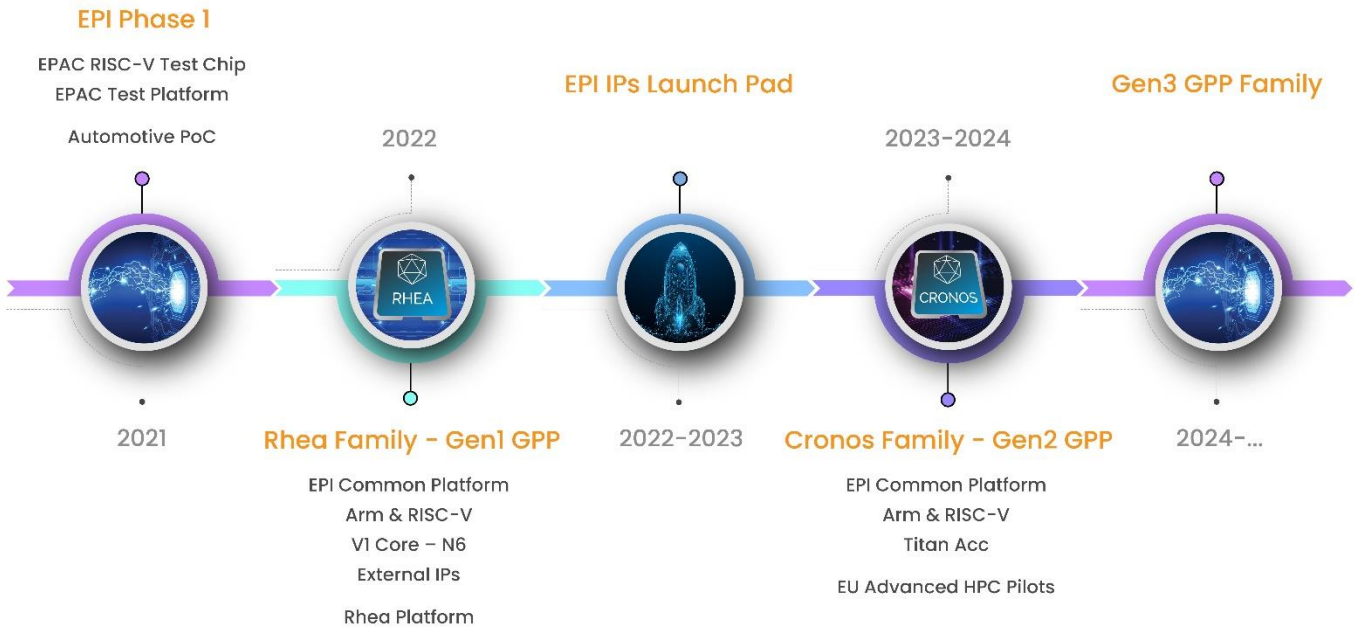
Open Source Hardware

- Clear and increasing interest for open source hardware and RISC-V solutions in Europe.
- Need for an alternative processor ecosystem due to uncertainty about established processor IP providers, geopolitics, creation of healthy competition in processor IP, etc.
- All semiconductor market segments are concerned:
  - Most important penetration is already in the low-end IoT market segment (deeply embedded, non-programmable, close-to-the-sensor, etc.)
  - Edge devices are now attracting interest and entries worldwide
  - High-end processor/accelerator segment making first steps

Open Source Hardware

- Scalability (over various performance/power ranges) and interoperability of processor IP offering is crucial
- To successfully build and market a processor or a SoC you need more than just the RISC-V instruction set architecture especially for higher-end markets (e.g. patent protection, extensions, memory interface, interconnect, peripherals, EDA tools, debugging & bug-fix, testing, foundry libraries, software stack, etc).
- Creation of a complete processor IP ecosystem is a long-term, expensive endeavour.
- Investments range for bringing a specific processor *chip* to the market vary enormously from low-end IoT markets to high-end processors

European Processor Initiative



- Significant role of RISC-V in the European Processor Initiative
- First initiative worldwide to experiment with RISC-V for supercomputers

European Processor Initiative

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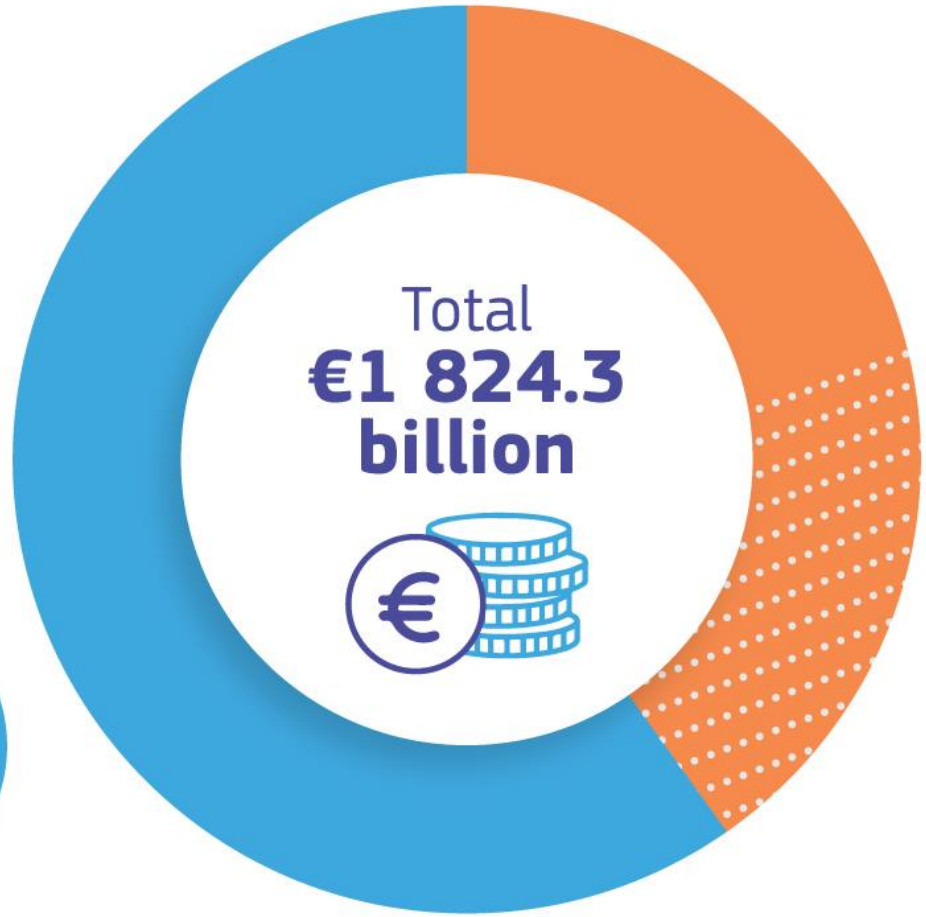
EU expenditure 2021-2027



€750 billion

NextGenerationEU (NGEU)

COVID-19 recovery package

- €390 billion grants
- €360 billion loans

€672.5 billion for the Recovery and Resilience Facility

Multiannual Financial Framework (MFF)

The EU's 7-year budget

€1 074.3 billion

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2021 funding opportunities for Open Source Hardware

Horizon Europe Calls

- Horizon Europe Calls for Proposals will be launched in the coming months
- Specific call related to open source hardware support action
- Specific call for processor design projects in lower TRLs

KDT JU

- Establishment of the Key Digital Technologies Joint Undertaking (KDT JU) - successor to ECSEL JU
- We expect important funding through the KDT JU for open source hardware design and *infrastructure* (i.e. tools etc.) in higher TRLs

Horizon Europe: Key Digital Technologies Joint Undertaking

Objectives

- Reinforce EU's **technology autonomy** in electronic components & systems
  - Support future **needs of vertical industries** and the economy at large
- Establish EU **scientific excellence** and **innovation leadership**
  - in **emerging components and systems** technologies
- Address Europe's **societal and environmental challenges**

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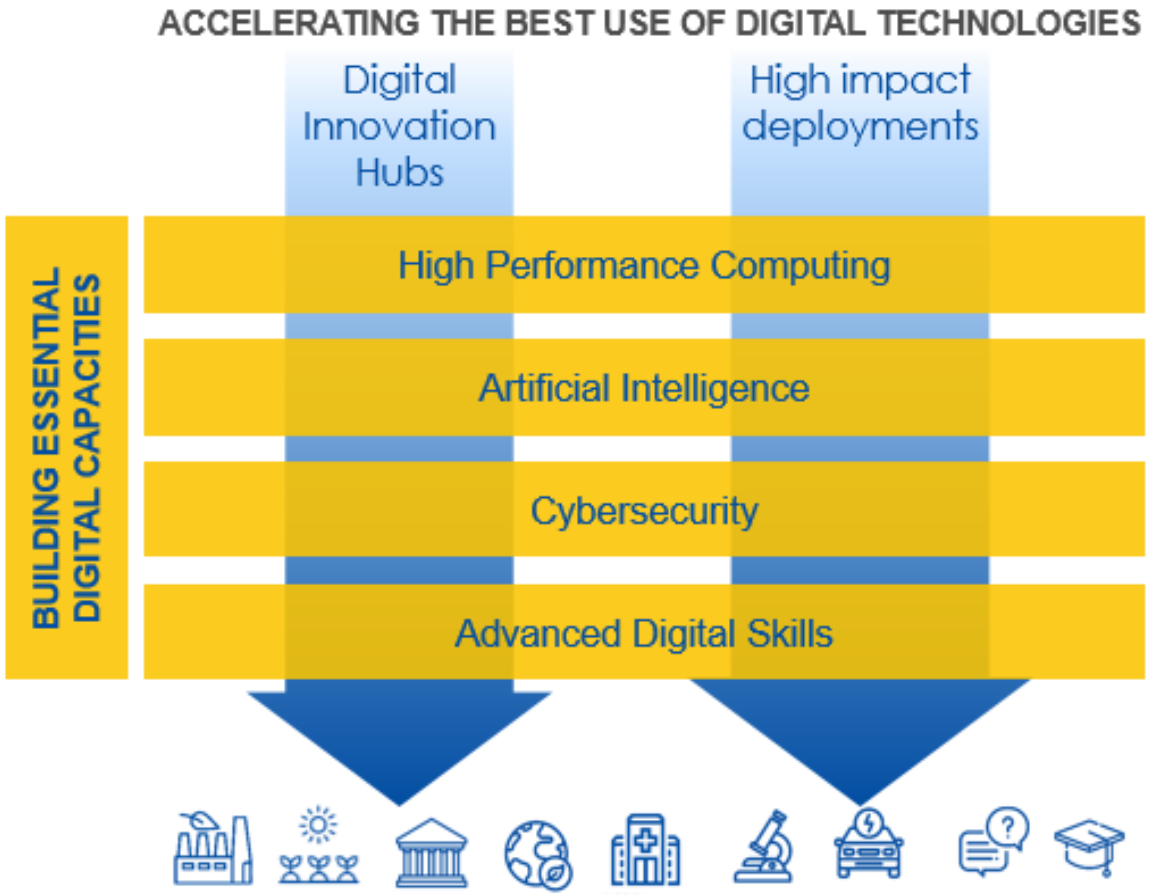
Digital Europe Programme

To **ensure that Europe drives the digital transformation** of the economy and society and brings its benefits to all citizens and businesses.

- Building **essential capacities and advanced skills** in digital technologies, contributing to **Europe's strategic autonomy**;
- **Accelerating deployment** and best use in areas of public interest and the private sector
- **Testing and experimentation facilities in AI hardware**



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Thank you

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