

Huxelerate: Bringing Software Performance Optimization Research into the Market

IEEE EUROCON 2023
July 7th 2023

Sara Notargiacomo – Co-founder and Chief Business Officer
sara.notargiacomo@huxelerate.it

**GLOBAL ENERGY
CONSUMPTION**
Doubles every 3 years

>

**GLOBAL ENERGY
PRODUCTION**
Grows by 2% a year

Huge energy consumption might recall...



Data-center on Wheels

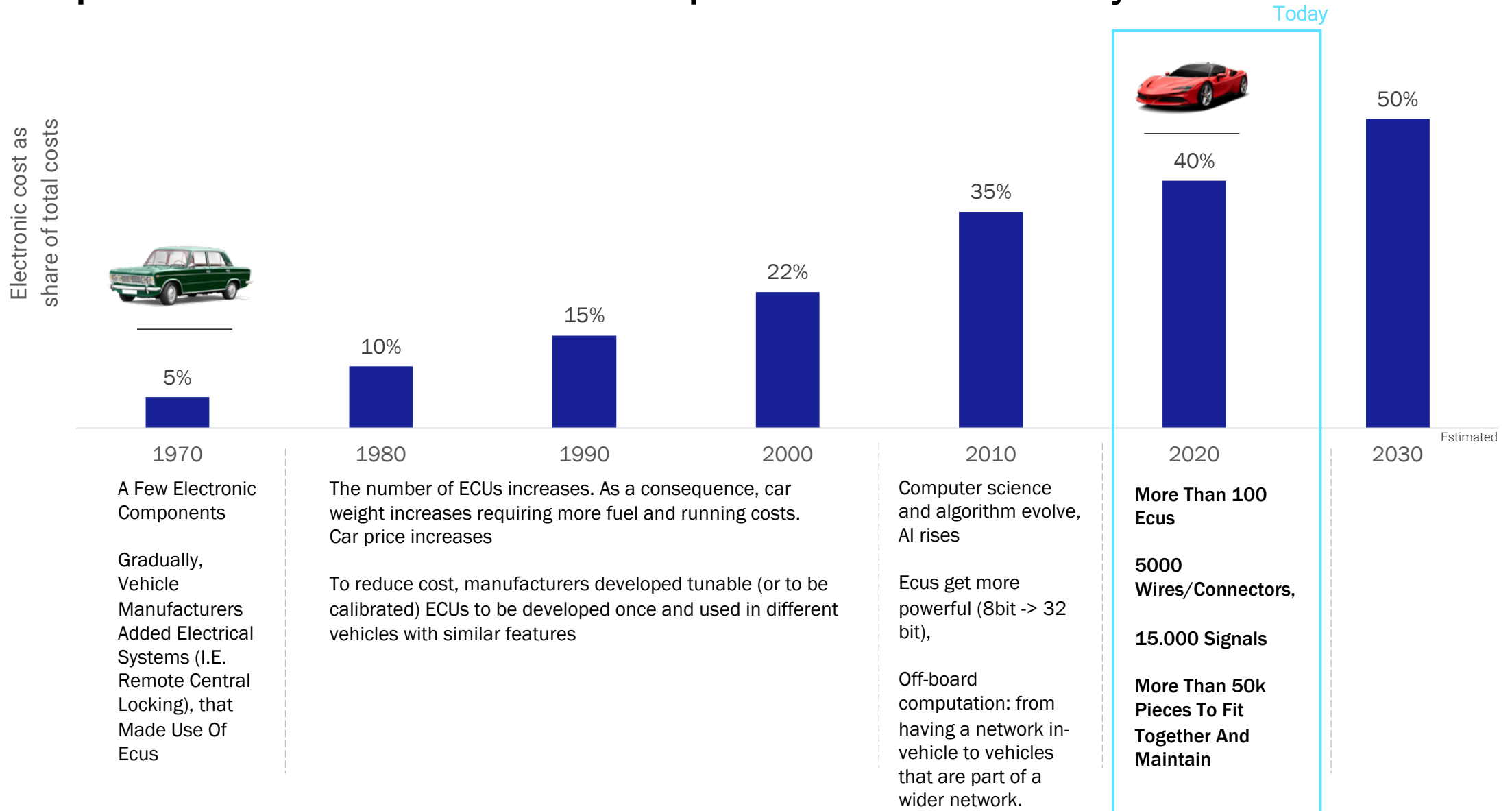


COMPUTING EFFICIENCY MUST DOUBLE EVERY 1.1 YEARS

- **Computing power 10x each next level of autonomy.** L3-L4-L5 autonomy 10s, 100s, 1000s TOPS (tera operations per second)
- By 2050 95% of the global fleet autonomous

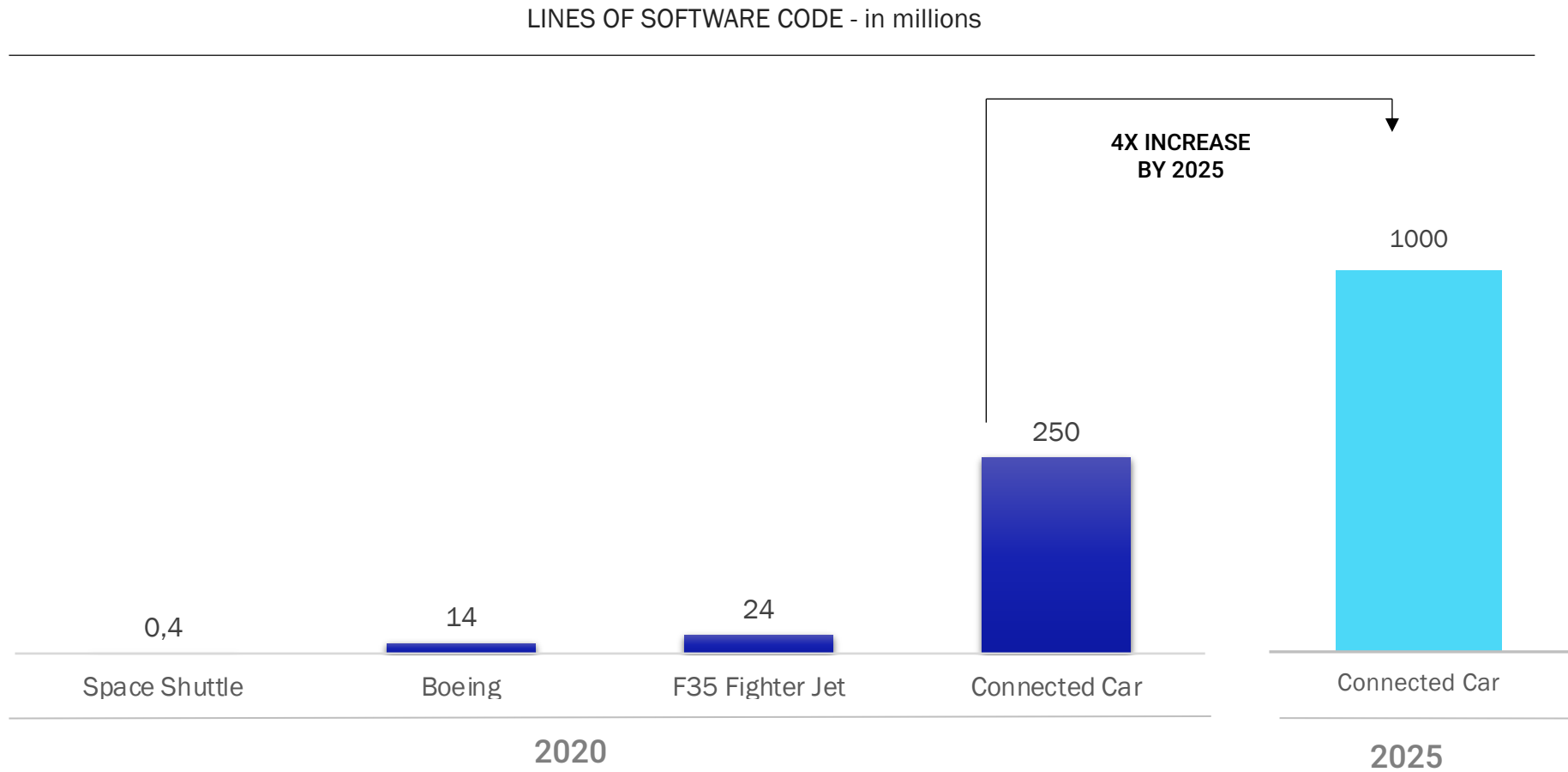
Source: MIT "Data Centers on Wheels: Emissions from Computing Onboard Autonomous Vehicles"

The explosion of vehicle electronic components in the last 50 years



Source: Statista

Explosion of vehicle software complexity

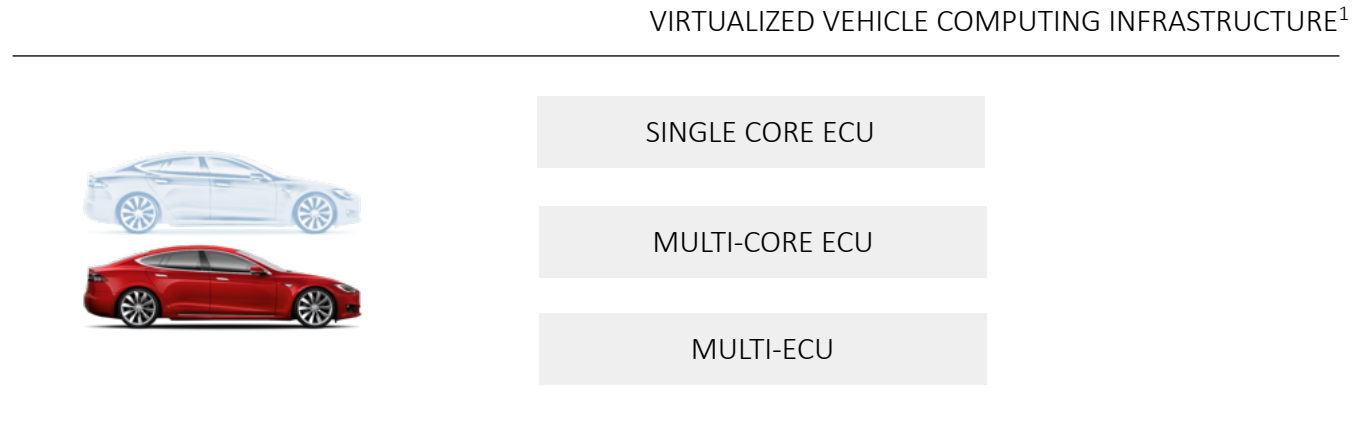


Source: McKinsey & Company, *When code is the king: Mastering automotive software excellence*. Roland Berger, *Computer on wheels / Disruption in automotive electronics and semiconductor*

1. **CORRECTLY SIZE** AND OPTIMIZE THE VEHICLE COMPUTING INFRASTRUCTURE
2. ENABLE **SOFTWARE AND RESOURCE USAGE OPTIMIZATION**

HUXELERATE OFFERS A
SaaS DEVELOPMENT TOOLBOX
TO SUPPORT DEVELOPERS IN
OPTIMIZING VEHICLES SOFTWARE AND
COMPUTING INFRASTRUCTURE

Huxelerate automates performance estimations and optimization directives virtualizing the entire vehicle



PERFORMANCE ANALYSIS

- **Estimate the current and achievable performance** of software on different computing hardware
- **Correct sizing of vehicles computing infrastructure:** select the processors and computing hardware that maximize performance and computing efficiency, given a target cost
- **Estimate CO2 Savings**

DIRECTIVES FOR OPTIMIZATION

- **Software performance and resource optimization:** performance estimated and optimization directives to support developers in achieving the highest level of performance and optimizing usage of available resources

HUxelerate[↗]

¹ It may be any kind of vehicle: cars, motorcycles, trucks, tractors

Full integration into standard process and consolidated toolchains

Requirement definition



AVAILABLE DATA TO PERFORM SCENARIO ANALYSIS

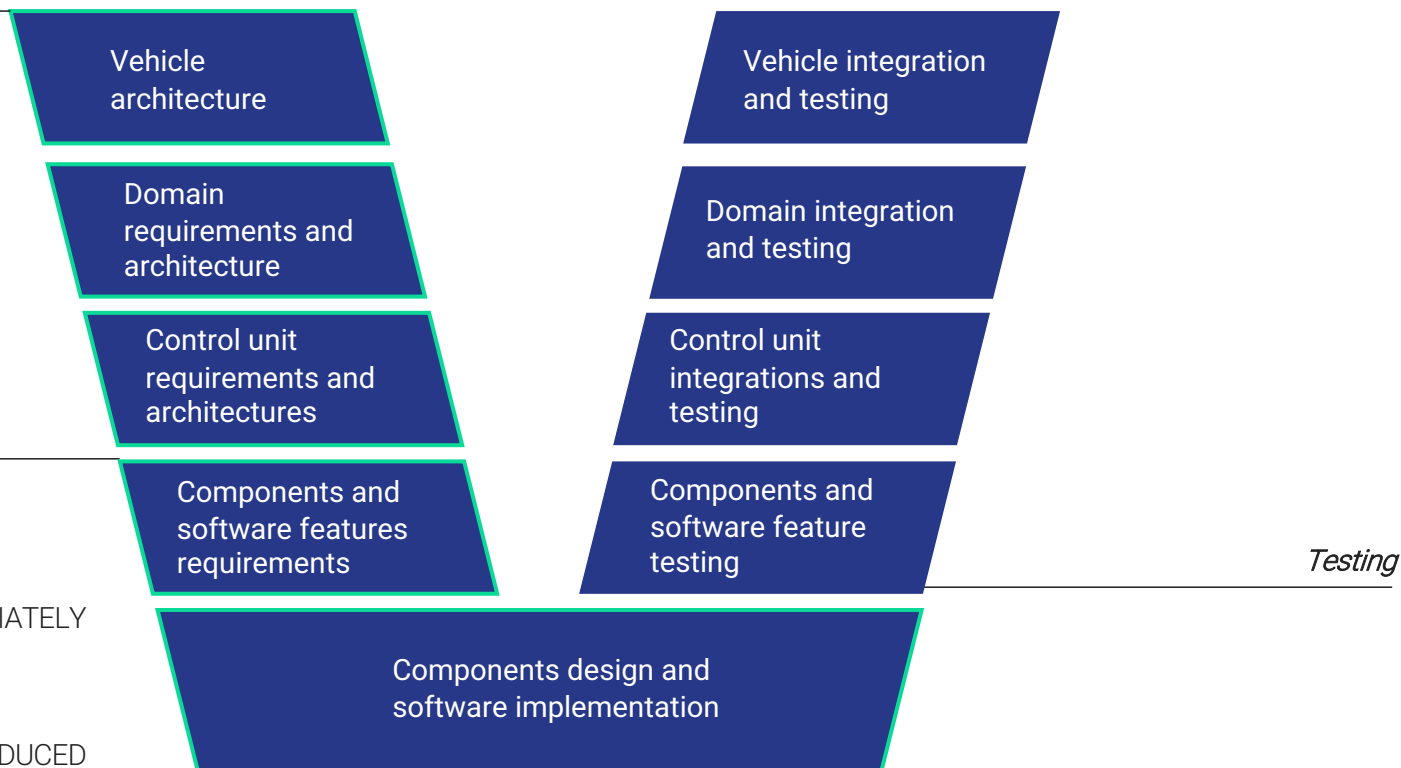
- DESIGN THE MOST EFFICIENT ARCHITECTURE AT VEHICLE, DOMAIN, AND CONTROL UNIT LEVELS (e.g. most efficient processors, communication channels)
- DEFINE THE REQUIREMENTS OF EACH SOFTWARE COMPONENT

Development



THE SOFTWARE CAN BE OPTIMIZED WHILE DEVELOPING

- IDENTIFY EXECUTION TIME AND RESOURCES PROBLEMS IMMEDIATELY
- OBTAIN AND IMPLEMENT OPTIMIZATION DIRECTIVES
- THE NUMBER OF TESTING ON HARDWARE ARE DRASTICALLY REDUCED



Already adopted by car manufactures and Tier 1



**REDUCED COMPUTING
INFRASTRUCTURE
COSTS**

UP TO **40%**



**REDUCED OPTIMIZATION
TIME AND COST**

UP TO **60%**



**IMPROVED SOFTWARE
PERFORMANCE**

UP TO **50%**

WHERE WE STARTED?

Back in 2019-2020: Hugenomic and the focus on genomics research

_____ The Computational Bottlenecks are due to _____
some common limitations

The computational bottlenecks of genomic data analysis are generated by some common limitations:



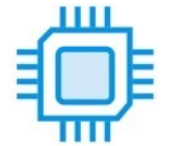
Computational intensive

Sequencing Technologies will require around **2 trillion CPU** hours by 2025



Massive amount of data

Hundreds of gigabytes of data



General purpose architecture are inefficient

The main reason is that they are designed for generic workloads, and they are not optimized for specific scenarios

¹ Source: Decadal Plan Abridged Report

Back in 2019-2020: Hugenomic and the focus on genomics research

The Computational Bottlenecks are due to some common limitations

The computational bottlenecks of genomic data ana

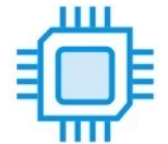
HUGenomic wants to be a key player in the transition from general purpose architectures to domain specific architectures



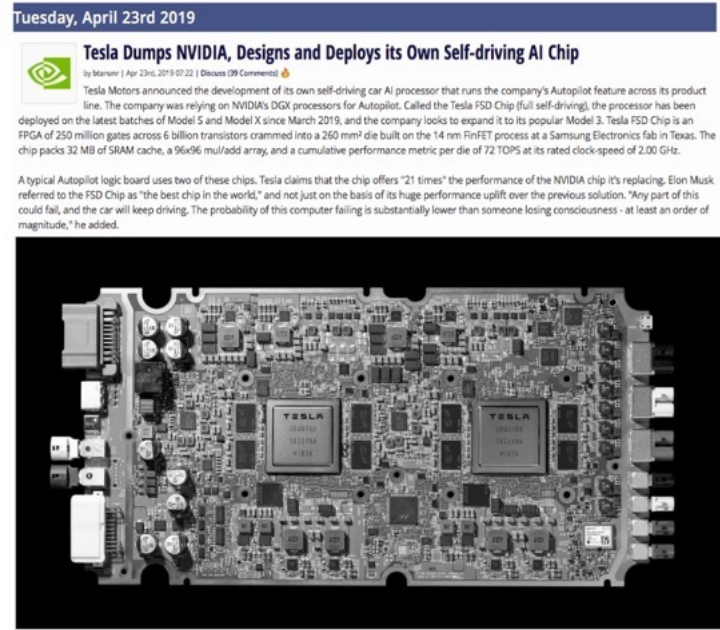
Computational intensive Sequencing by 2020



Massive amount of data Hundreds of terabytes



General purpose architecture are inefficient The market is crowded



On April 23th Elon Musk, CEO of Tesla, announced that Tesla **will no longer use general purpose architectures** on its self-driving cars.

Such announcement is one of the first to establish the start in the architecture shift from general purpose architectures to domain specific architectures.

Domain specific architectures (DSA) allow to achieve higher efficiency by tailoring the architecture to characteristics of the domain. This will require that **hardware design become much more efficient**, and more like modern software design.

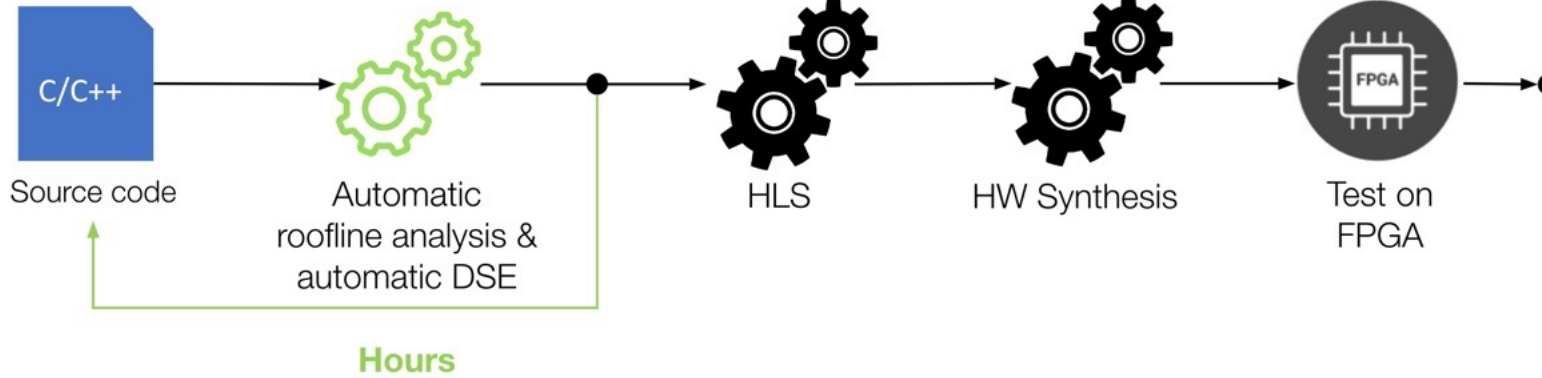
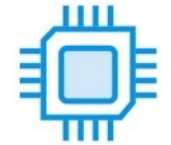
¹ Source: Decadal Plan Abridged Report

Back in 2019-2020: Hugenomic and the focus on genomics research

The Computational Bottlenecks are due to _____
some common limitations

The computat

HUGenomic patented methodology to speedup the acceleration of software on FPGA devices



In order to speedup the process of accelerating algorithms on FPGA, we **reshaped the standard design flow** and added a preliminary step for quickly converging to optimal FPGA designs without the need to iterate throughout the overall process.

asla, announced that **purpose** irs.

irst to establish the eneral purpose hitectures.

) allow to achieve hitecture to

sign become much tern software design.

PATENT PENDING

¹ Source: Decadal Plan, [Advanced Report](#)

HUxelerate[↗]



info@huxelerate.it



[/company/huxelerate/](https://www.linkedin.com/company/huxelerate/)



Via San Martino, 12 Milano