



HiPEAC Vision 2023

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2008



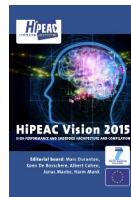
2009



2011



2013



2015



2017



2019



2021



January 2023 version is available at:

<http://hipeac.net/vision>

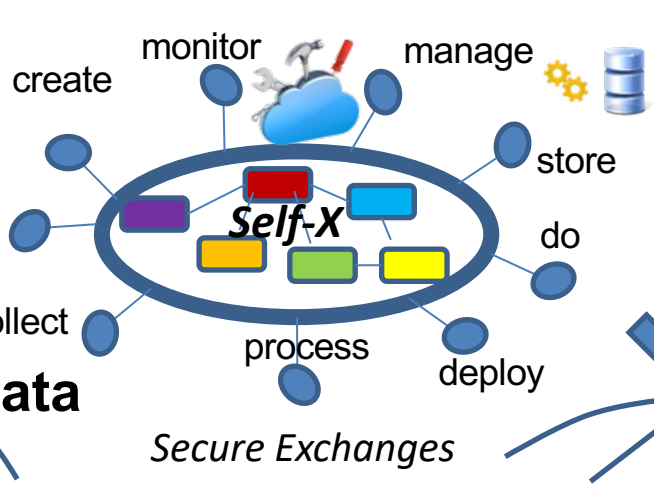


January
2023

Distributed intelligence via sharing and coordination of resources across heterogeneous, connected, locally managed devices

- **Dynamic** construction of applications from **distributed services** (local or remote)
- Taking into account **non-functional requirements** (time, latency, locality, energy, privacy, cost, ...)
- Using **high level abstractions**
- Services (and resources) **where** they are the most efficient
- Built on top of existing technologies (e.g. IP, REST, IEEE P2874, ...)

Trusted computing base



*OS: **Orchestrating System**
Cyber world

Local, distributed, decentralized resources
 (swarm, federated, fog, ..)



Build on a trustable, distributed, smart **meta-level "OS"**

Company/private data

Everything as a Service

physical quantites

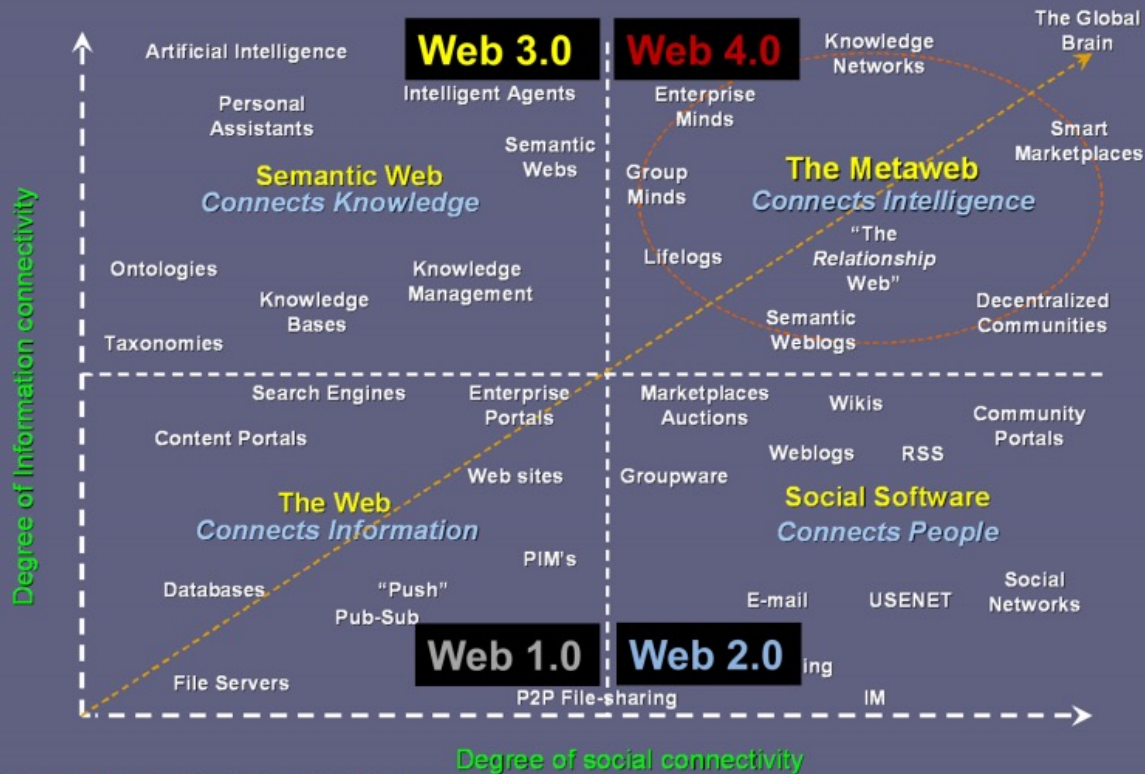


Physical World
 All sectors of the economy



Cross sectors, **avoiding "silos"** (common interoperable technology)

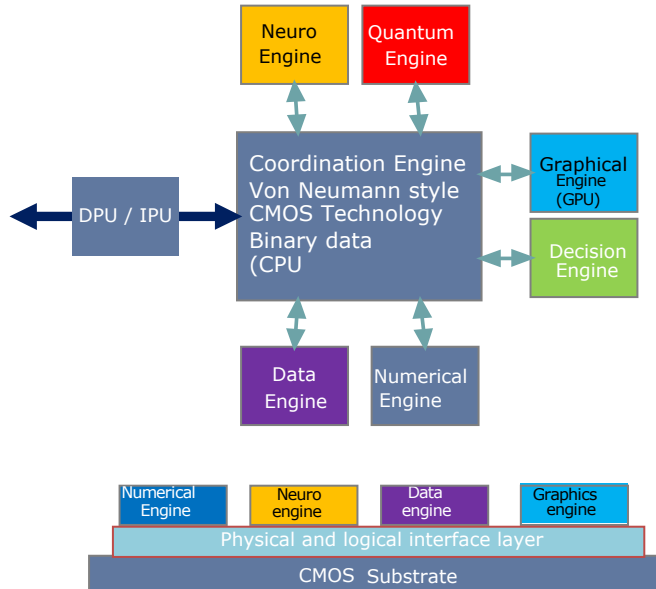
Running on edge hardware



Merging Elements At The Package Level

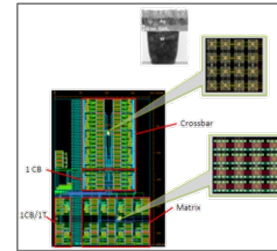
At the hardware level, the Von Neumann/ CMOS partnership can act as a computing substrate, or **orchestrator** of various accelerators/technologies

- Acting as coordination / communication node
- Improving Hardware / Software integration
- Hides SW complexity of various accelerators

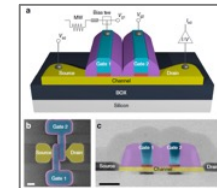


Goal: interoperability of different computing paradigms and information representations (bits, "spikes", photons, Qbits,)

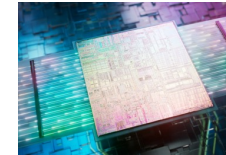
Emerging Silicon Acceleration technologies



Neuromorphic:
NVM Synapses
on Silicon



Quantum:
Qubits on Silicon

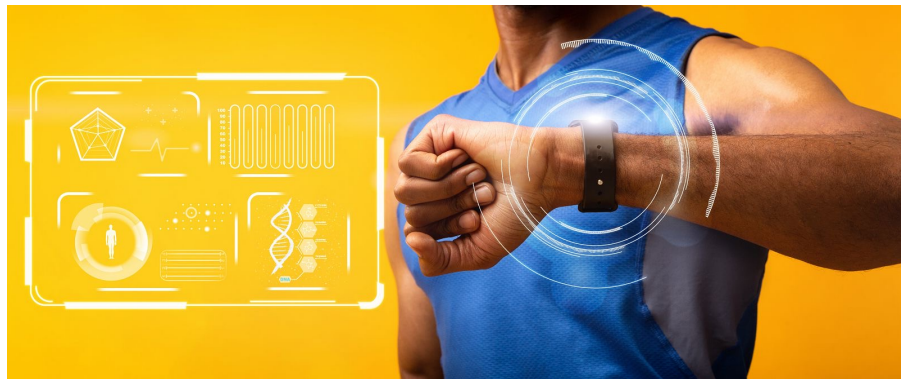


(Silicon)
photonics

Applications that used to run on the cloud will run on the edge devices

Due to the global performance improvement of edge devices, of algorithms, applications that used to run on the **cloud** will run on **edge** devices.

“Since 2012 the amount of compute needed to train a neural net to the same performance on ImageNet1 classification has been **decreasing by a factor of 2 every 16 months.**”*



Credit : adobestock - © Prostock-studio

GPT-3: May 2020

Meta OPT: May 2022

1/7 of the CO₂ footprint of GPT-3

Similar performance



The megamodels of today will run on embedded systems in the future! We should be ready for that!

Europe should:

- Be at the forefront of techniques **to move “large” models into edge devices.**
- Support research and tools helping to **identify bias and misbehavior** manifested by AI models.

* <https://openai.com/blog/ai-and-efficiency/>

A holistic approach is needed for efficiency

Global co-design, system thinking and acting is required:
Application ↔ Algorithm ↔ Software ↔ Data coding ↔ Architecture ↔ Technology

Also **between**
Application domains

Application

Algorithm

Programming language

Software stack

Data coding

Architecture

Technology



Shutterstock



Adobe Stock - Goradenkoff



Shawn Hempel - Fotolia



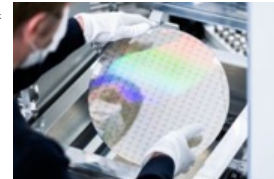
kentoh - Fotolia



foto_don - Fotolia



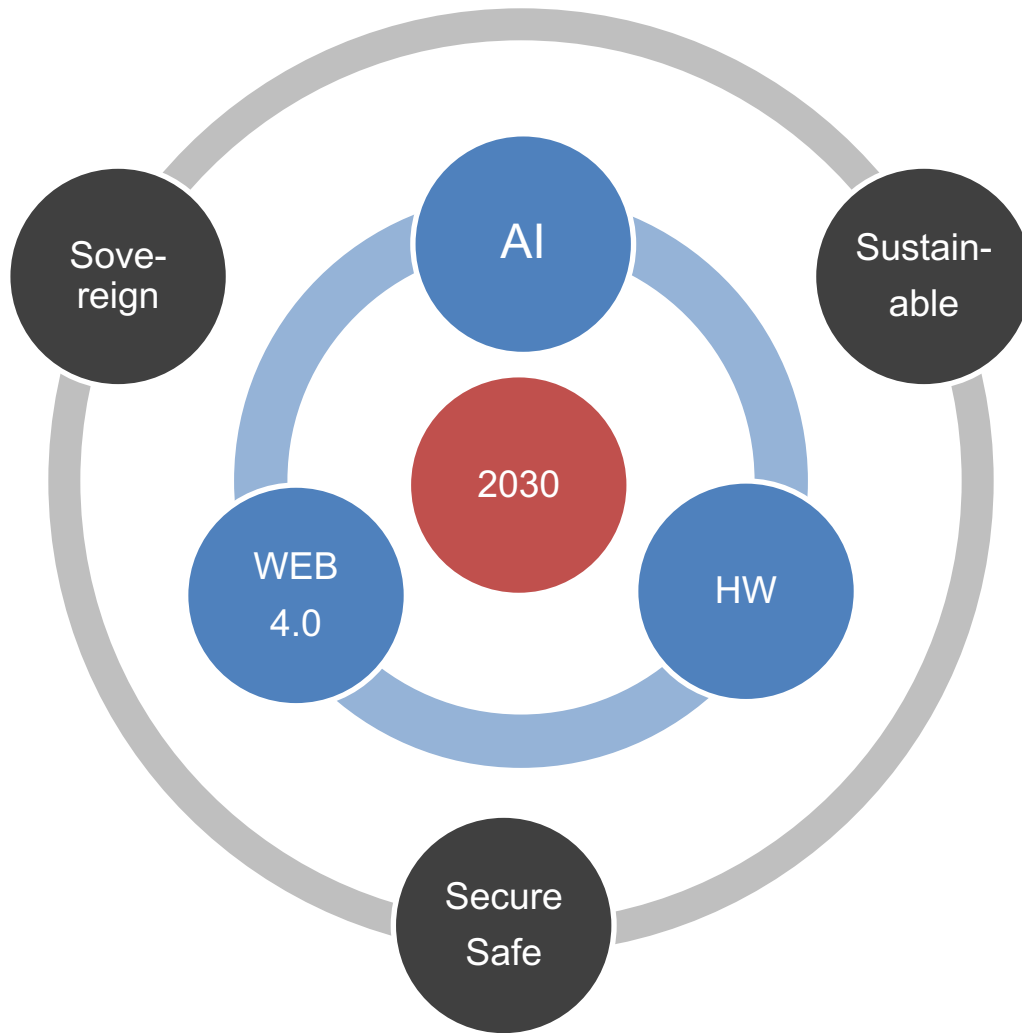
Connect world - AdobeStock



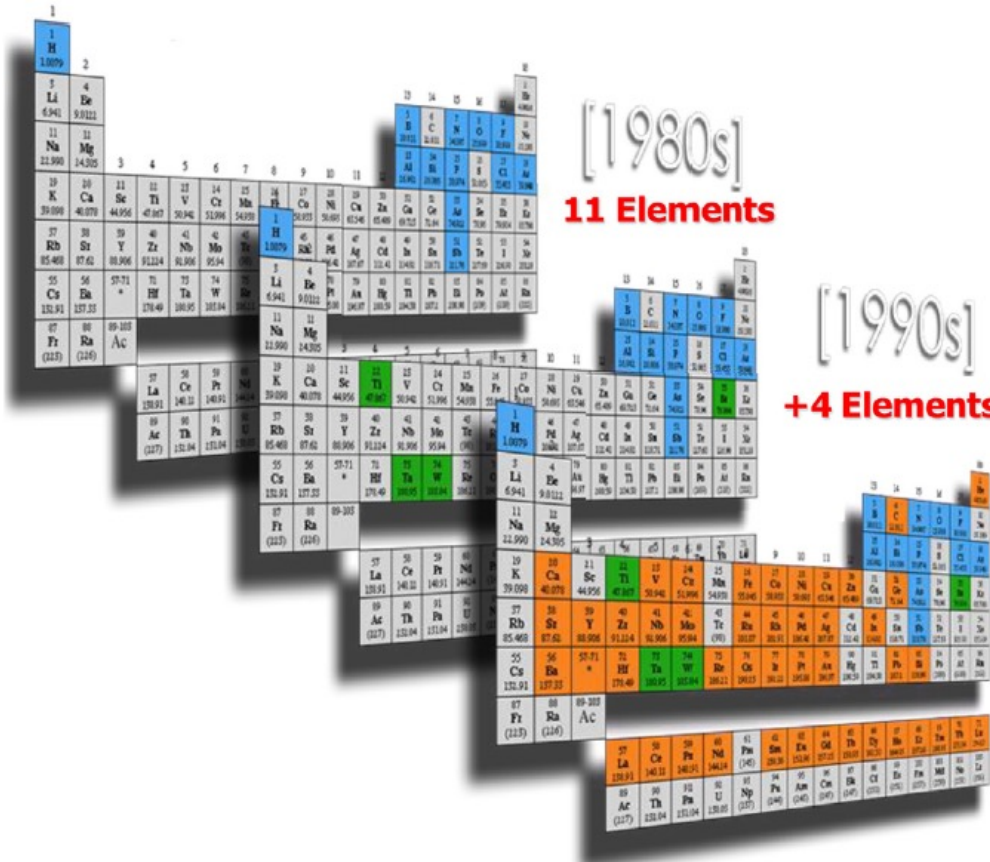
Andréa AUBERT/CEA

Global optimization is key for global efficiency
(a gain in one aspect can be killed by unoptimized other aspects)

chips
digital essentials
talent



Materials usage





Apple's latest model has a smaller carbon footprint, but the environmental cost of upgrading your mobile is not to be ignored.

Millions of new iPhone 14s will be wending their way to excited customers soon, with the new model's release on 16 September.

Its new and improved features include a slightly smaller carbon footprint: the iPhone 14 represents 61kg CO₂e in greenhouse gases compared to 64kg CO₂e for the equivalent iPhone 13.

But trading in your old smartphone for the newest model is the worst thing you could do. According to Apple's own metrics, **79 per cent** of the phone's lifecycle **carbon emissions** are released during production.

Resisting the urge to own the latest iPhone won't reverse emissions for the products hitting the shelves next week, but it will help to limit how many **phones** are made in the future.

Stand-by power

Device	Power
Charger in socket	20 mW
Television off by remote	300 mW
Display sleep mode	370 mW
Notebook off	470 mW
Notebook sleep mode	820 mW
Radio	970 mW
Microwave	1400 mW
Timer	1500 mW
Garage door opener	1800 mW
Cable modem standby	3590 mW
Set top box, off by remote	13240 mW

1 W x 1 billion = 1 GW





2023 version is available at:
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Want to join HiPEAC?
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