

Collaborate to Innovate

How Deeptech tackles societal challenges

Luc Van den hove,
President & CEO imec


embracing a better life

The world is facing a

POLYCRISIS



The world is facing huge challenges





Deep-tech innovations
will be essential



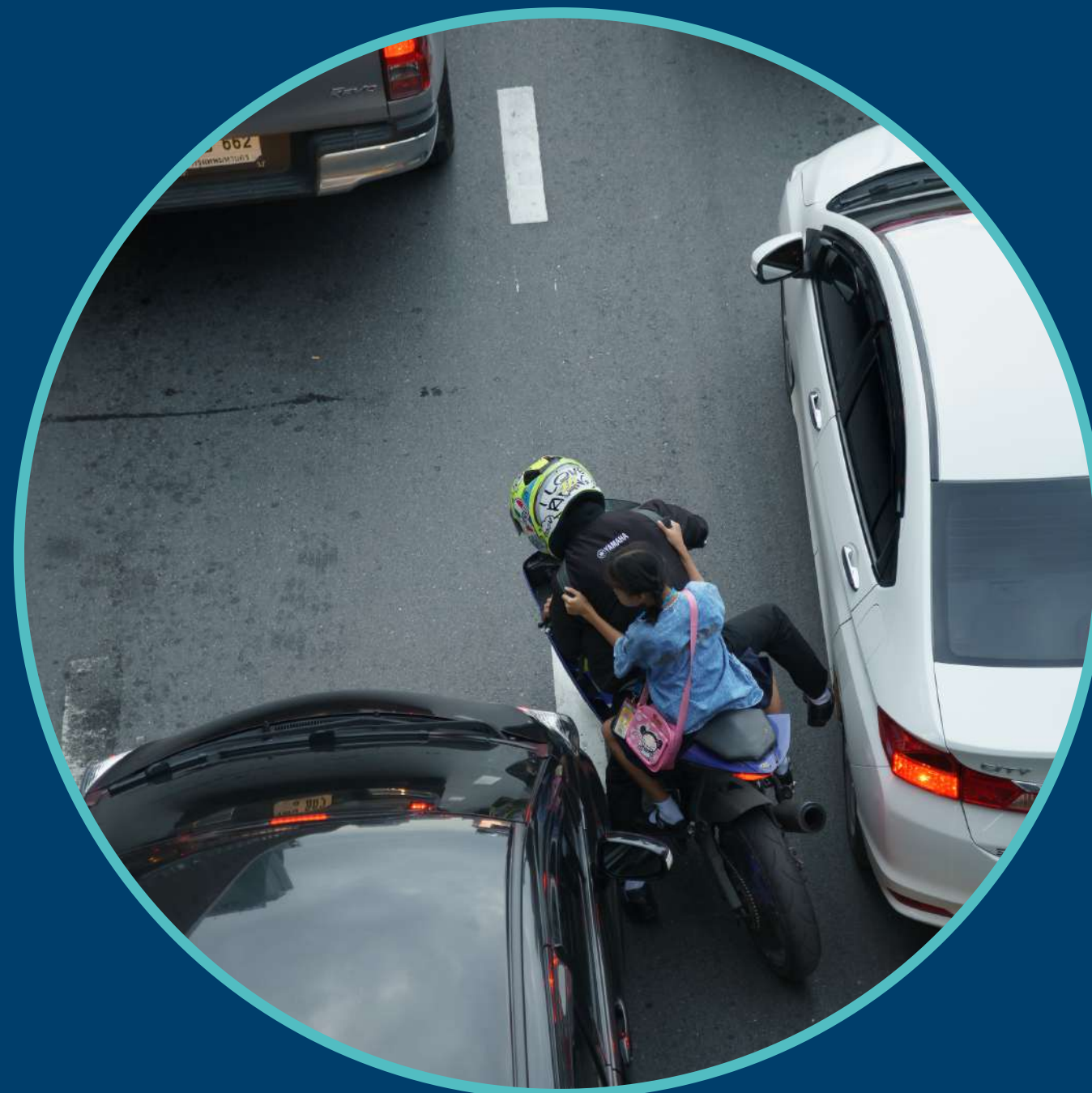
climate crisis

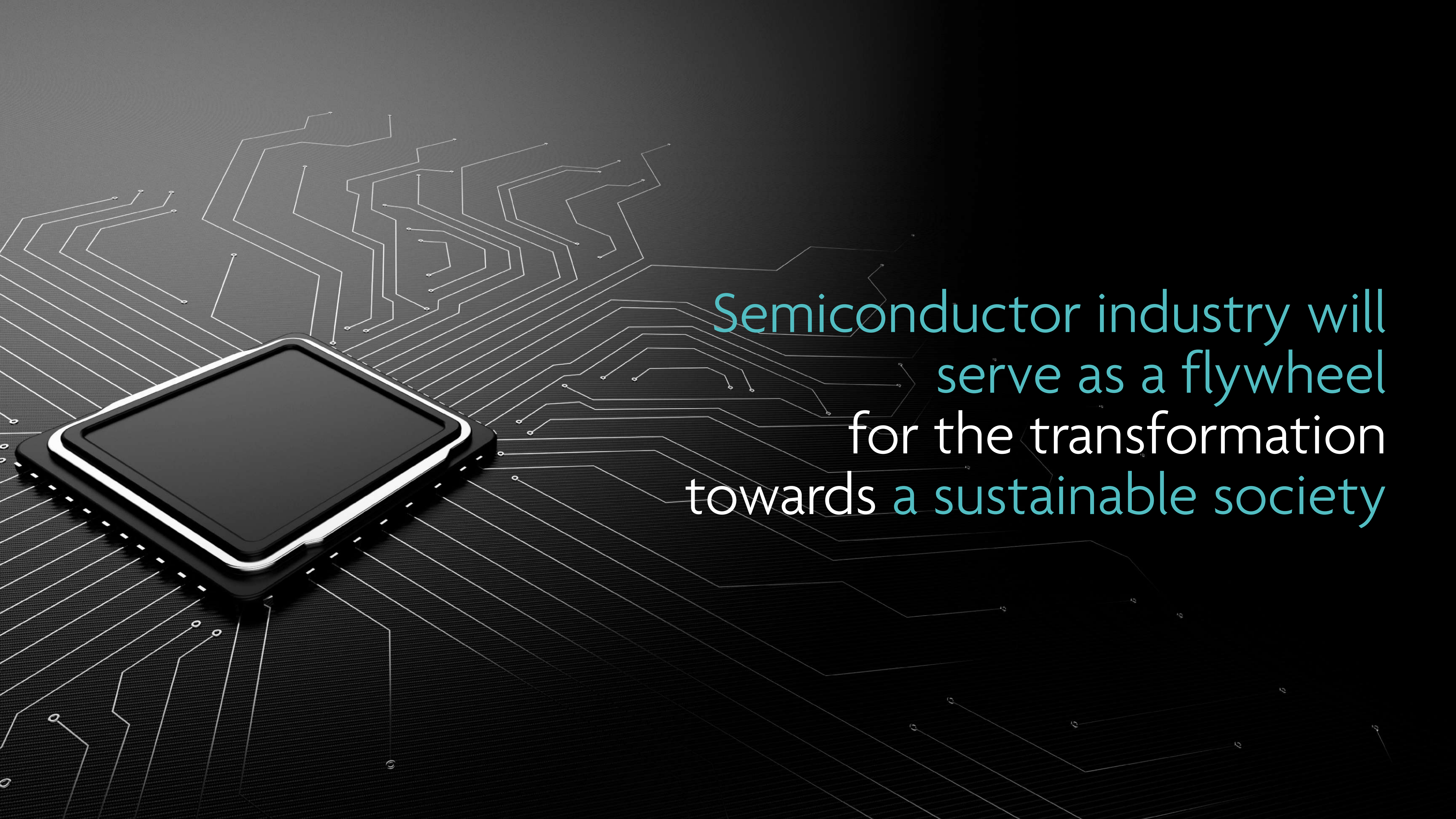
mobility



health

food shortage



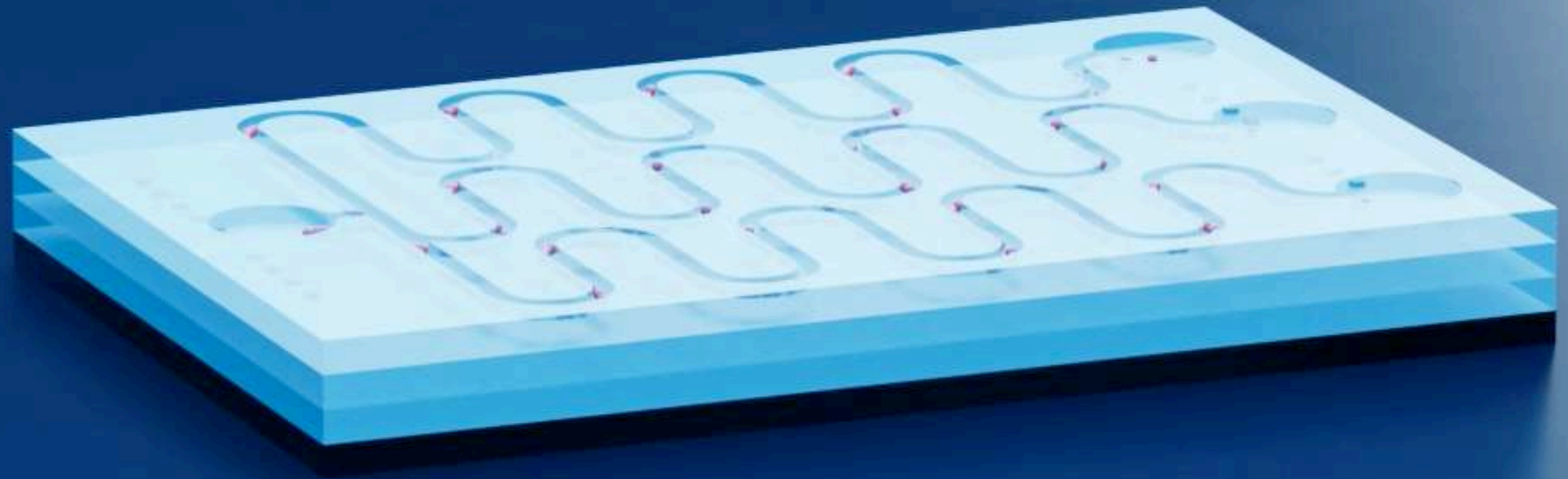


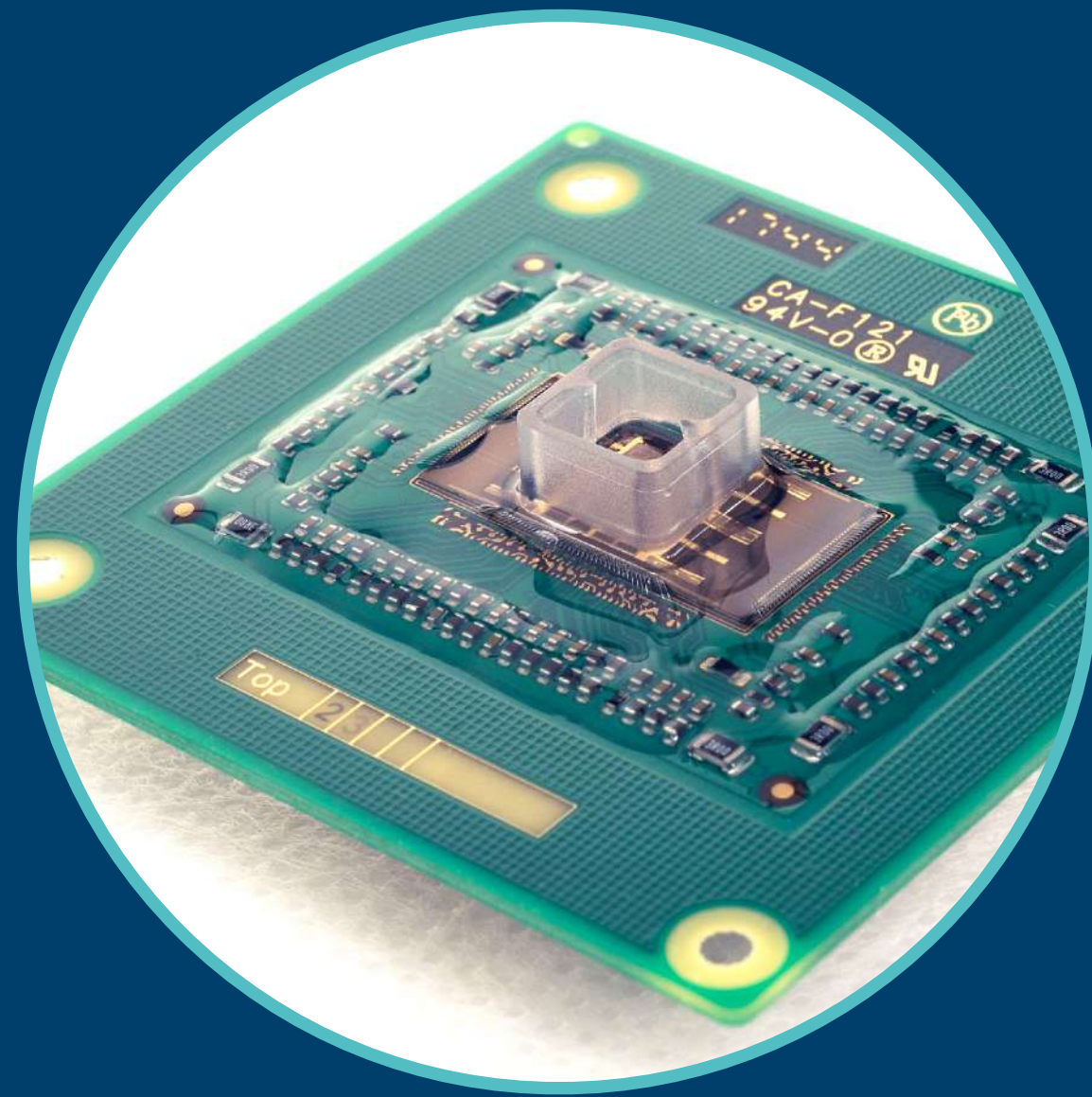
Semiconductor industry will
serve as a flywheel
for the transformation
towards a sustainable society



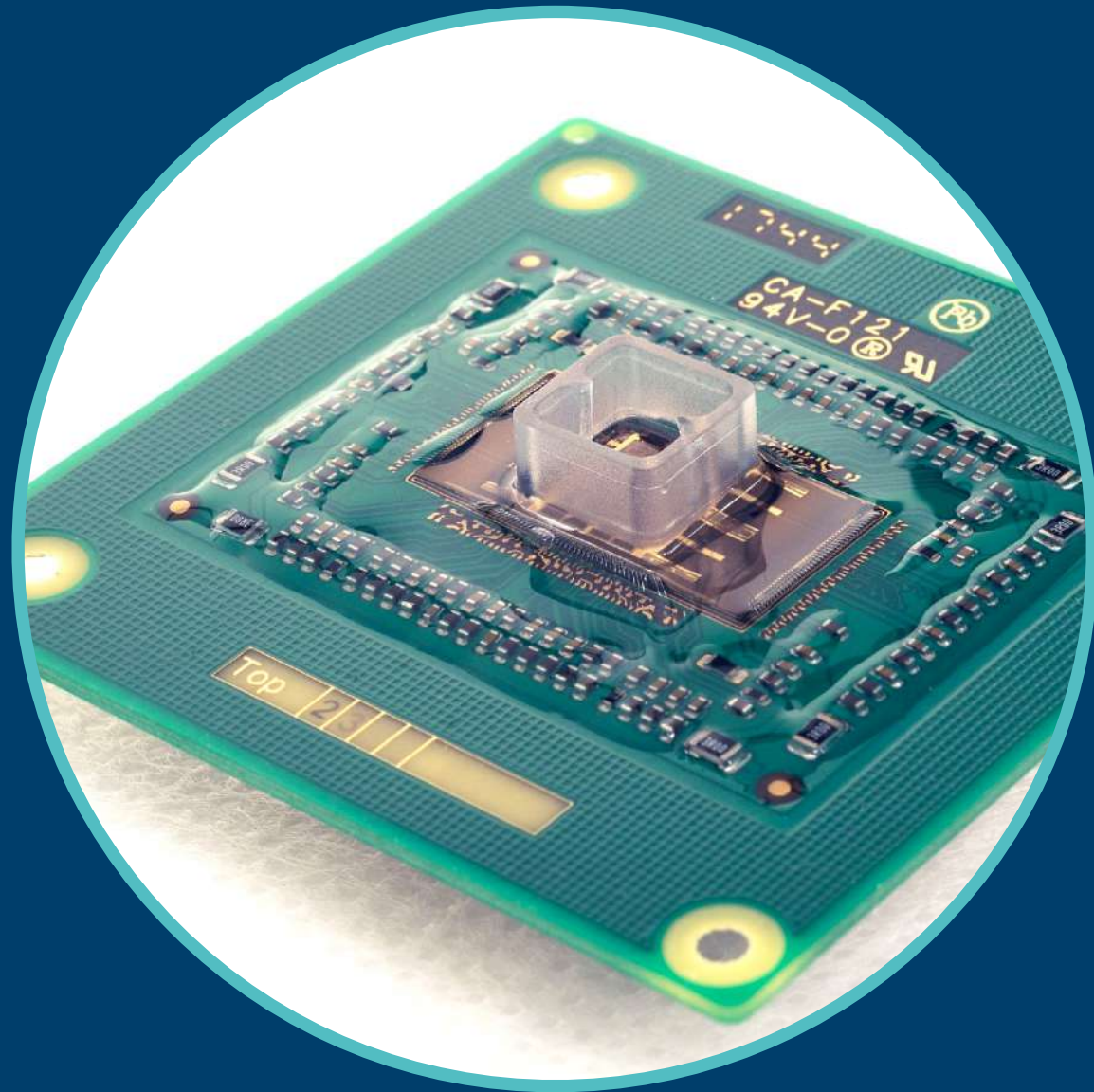


Si-based medical device platform





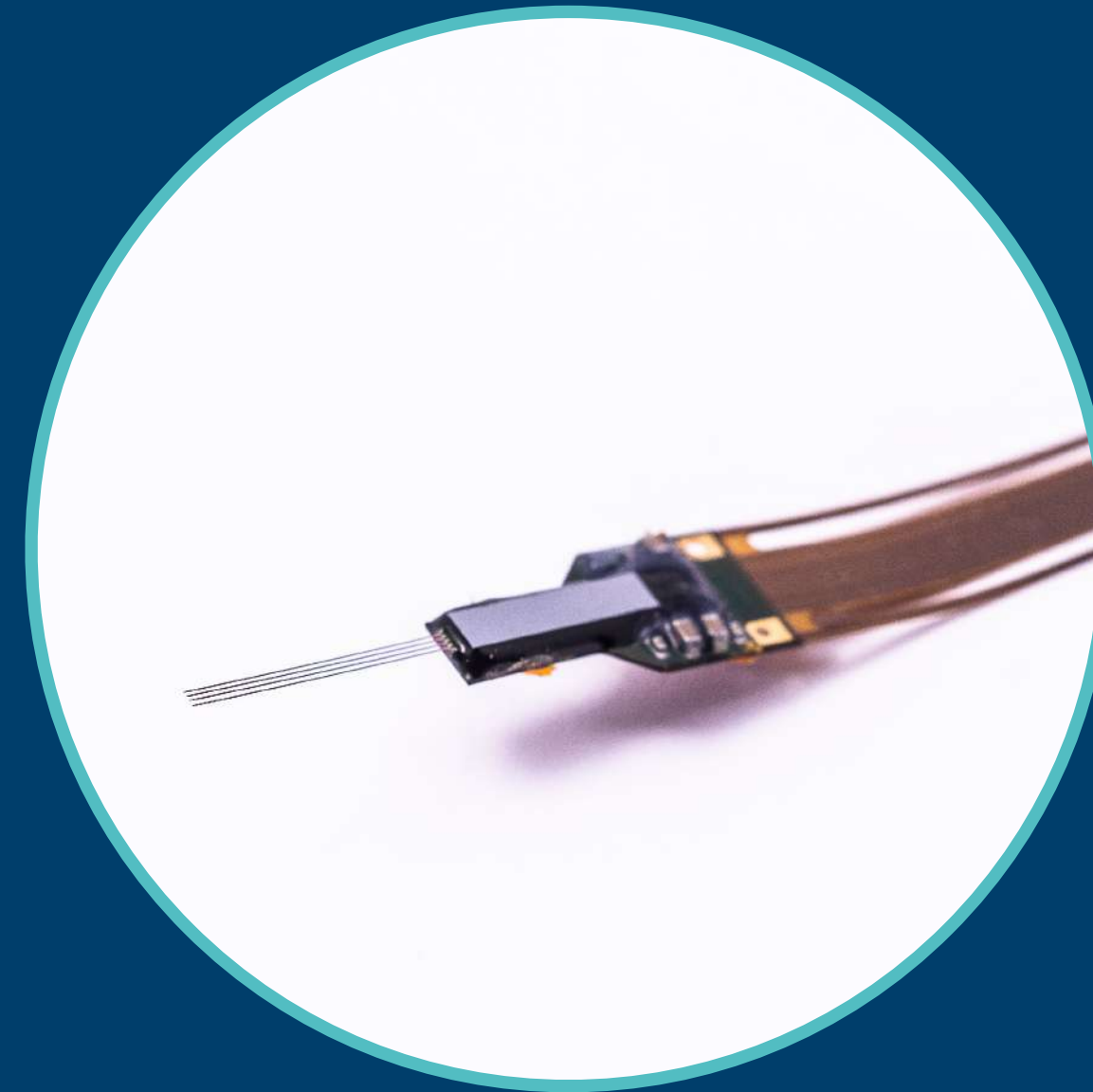
DNA
sequencing



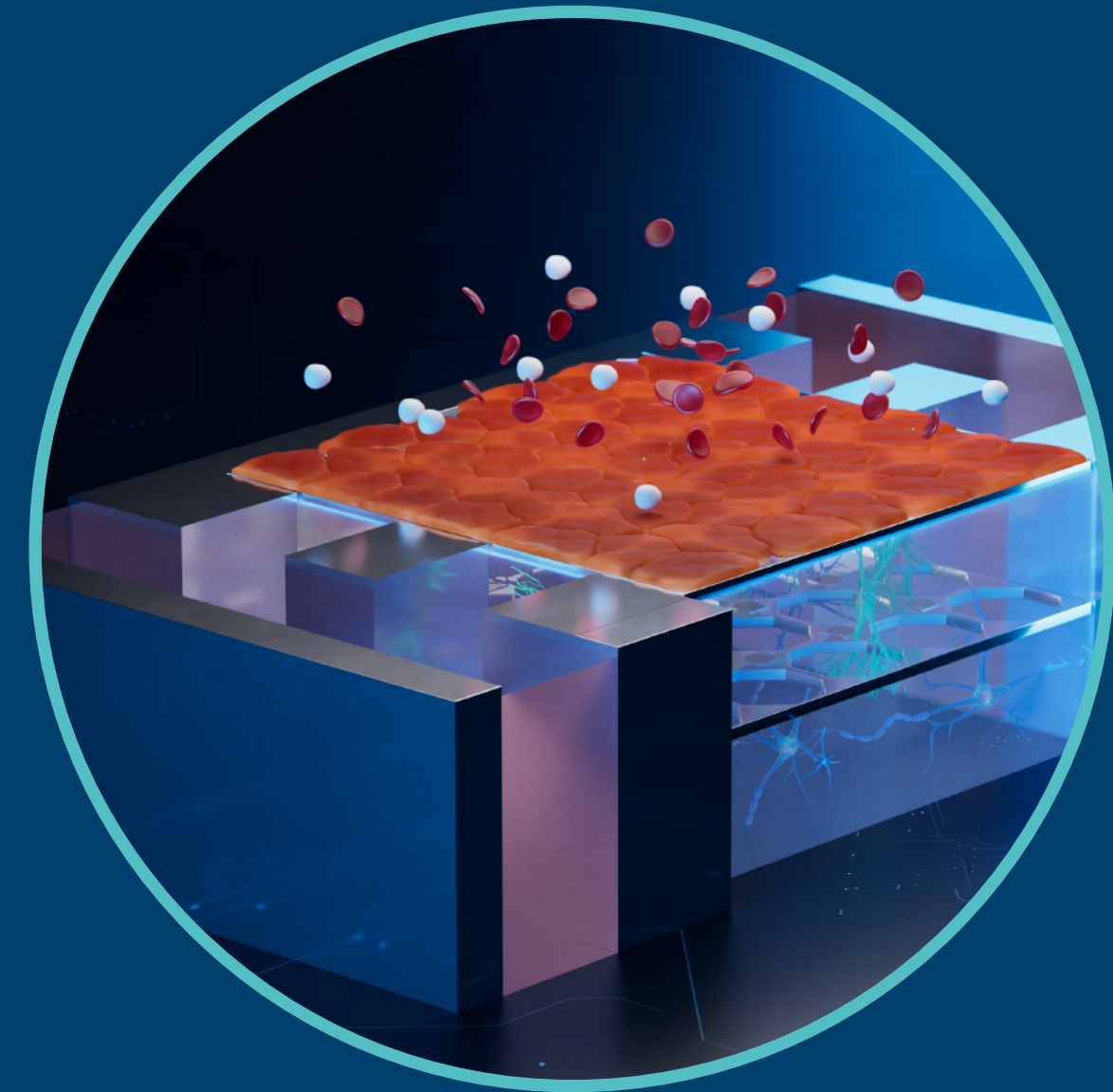
DNA
sequencing



process analytic
technology

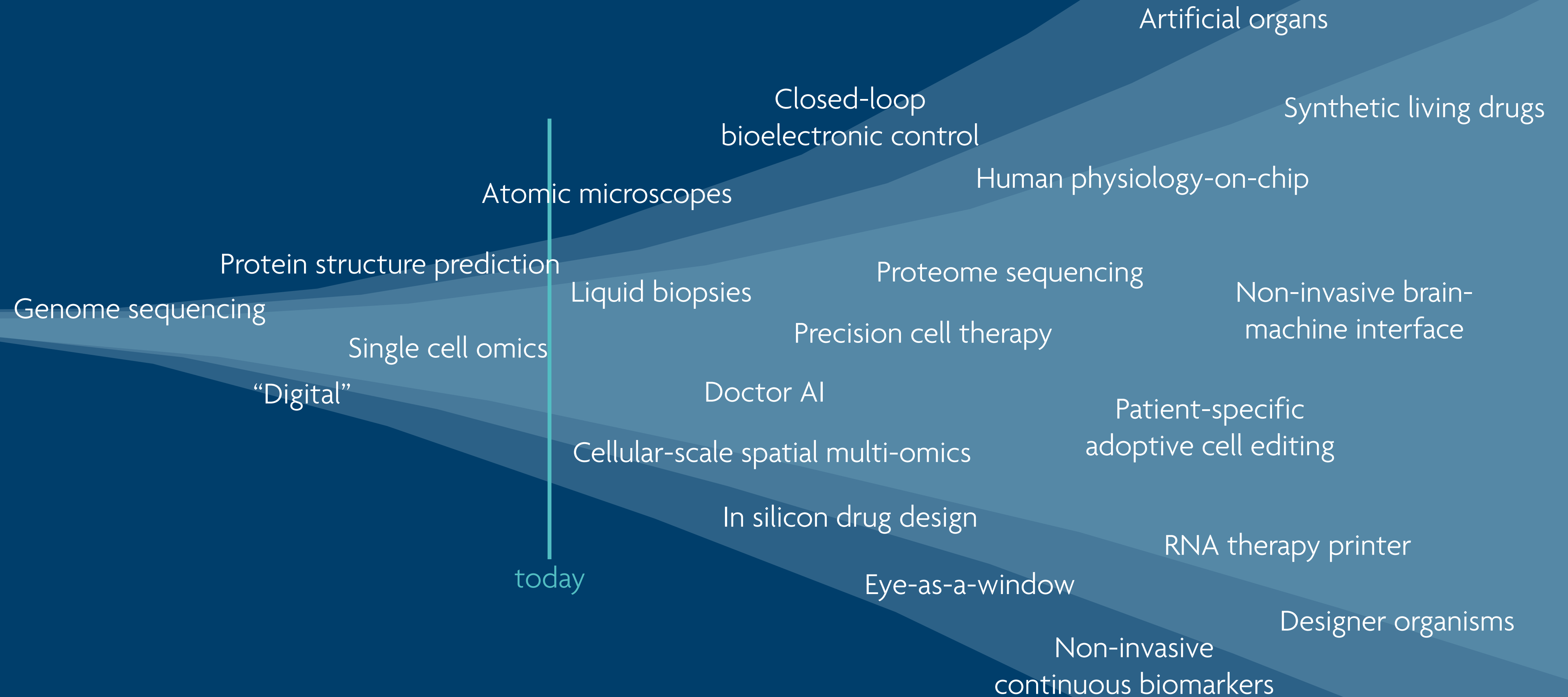


neuroprobe

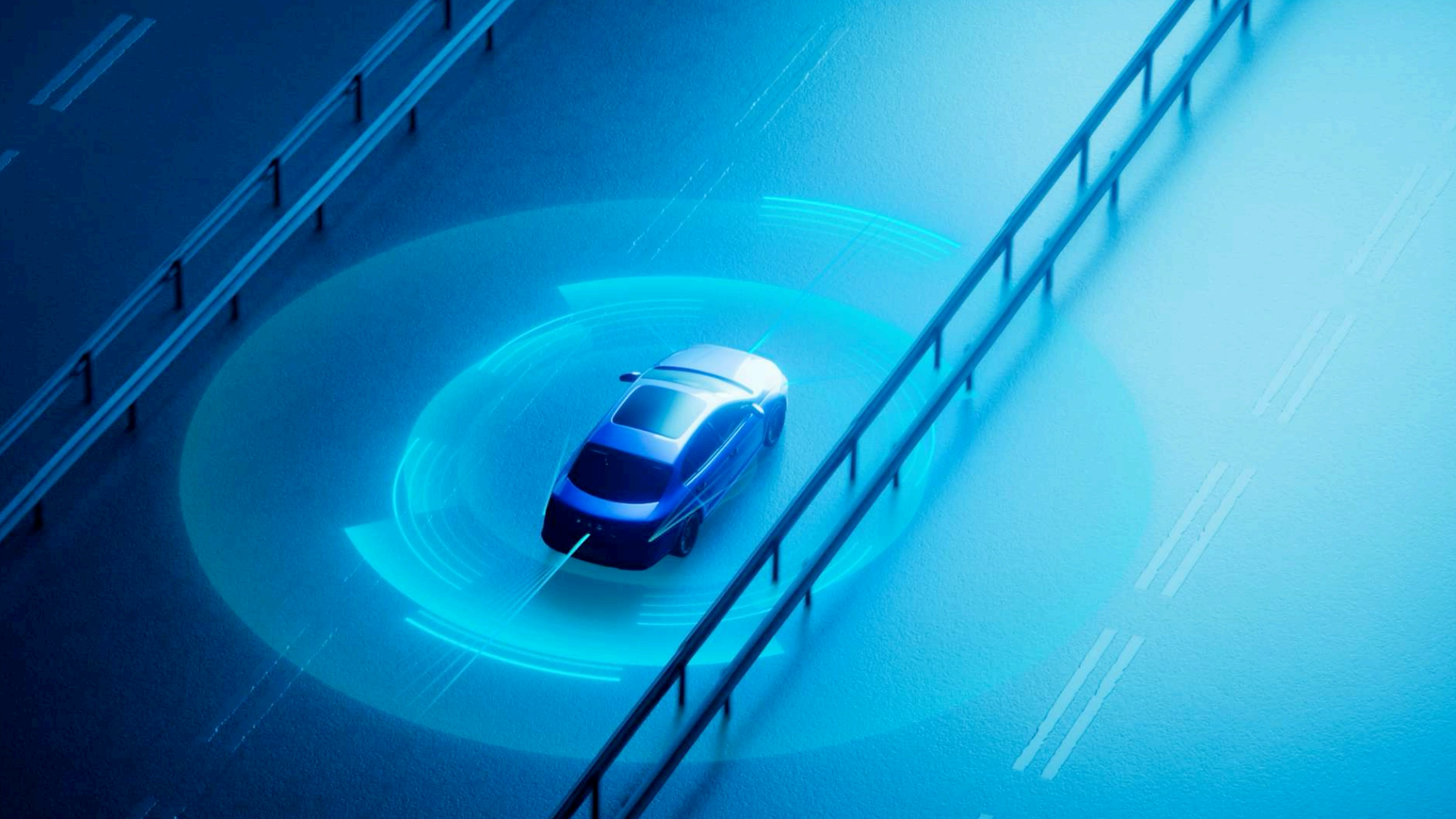


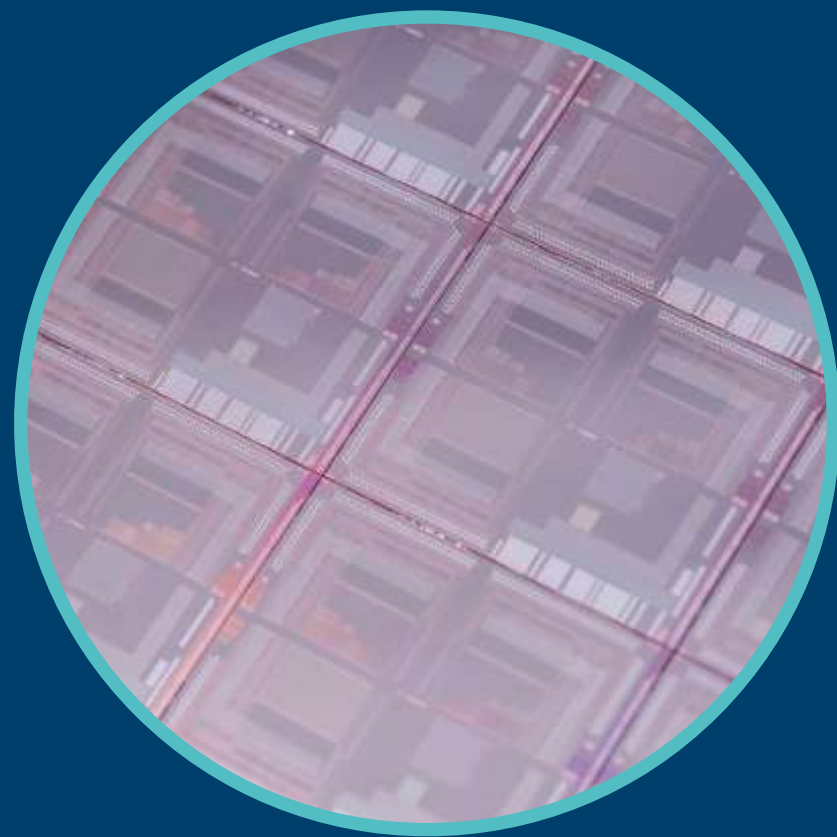
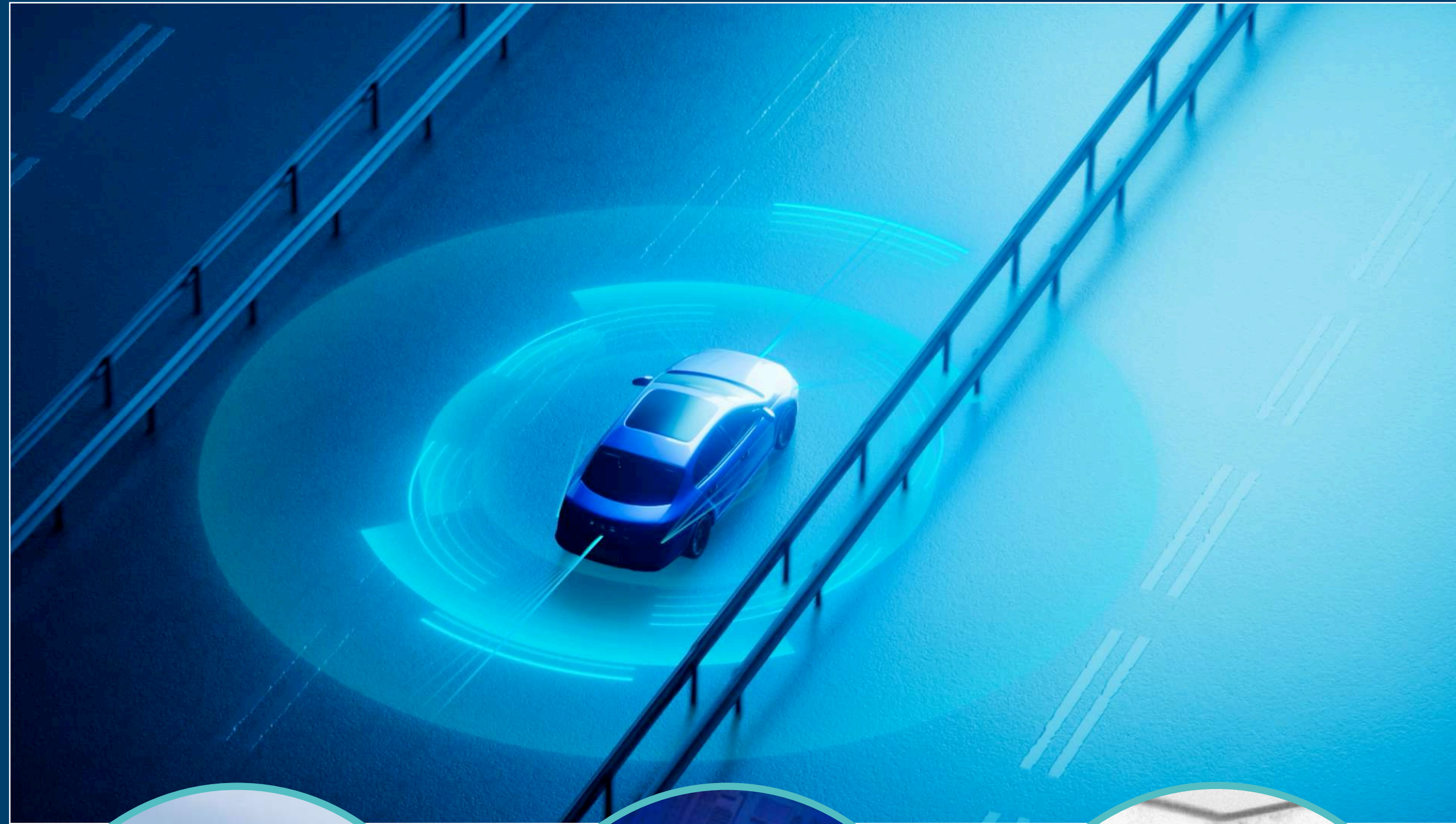
organ on
chip

The explosion in bioconvergence has just started



The medical & pharma industry
will become a massive data industry

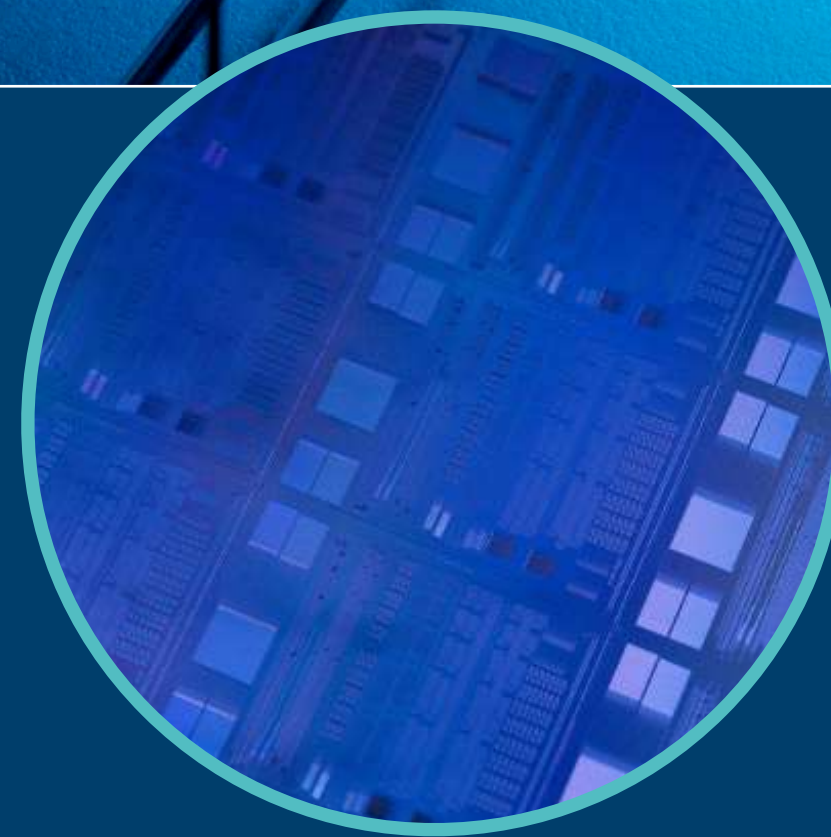




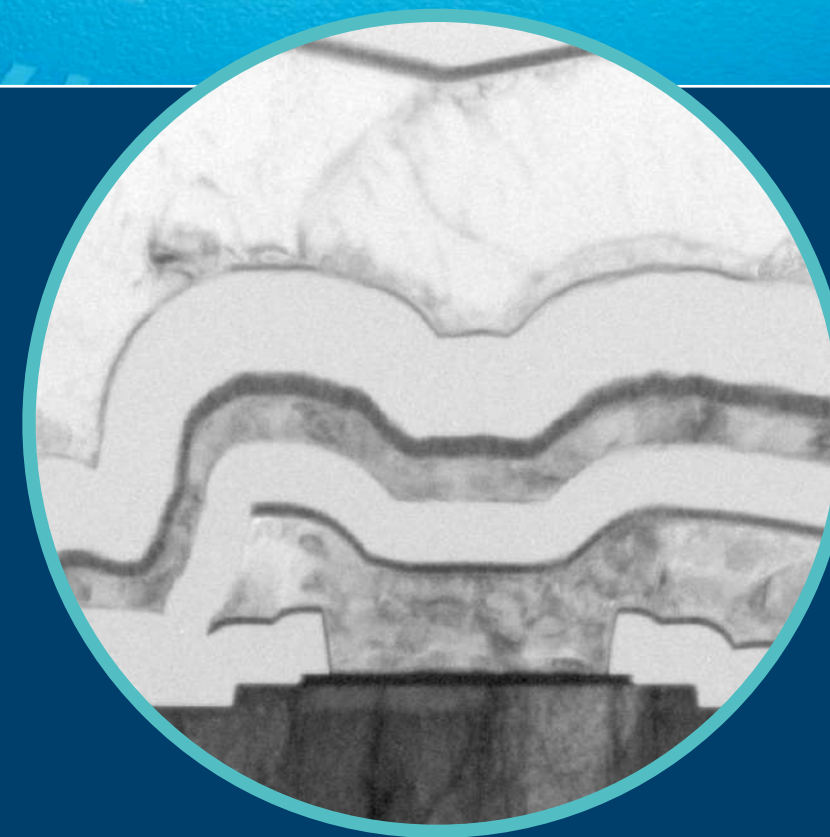
CMOS-based NIR and SWIR imagers



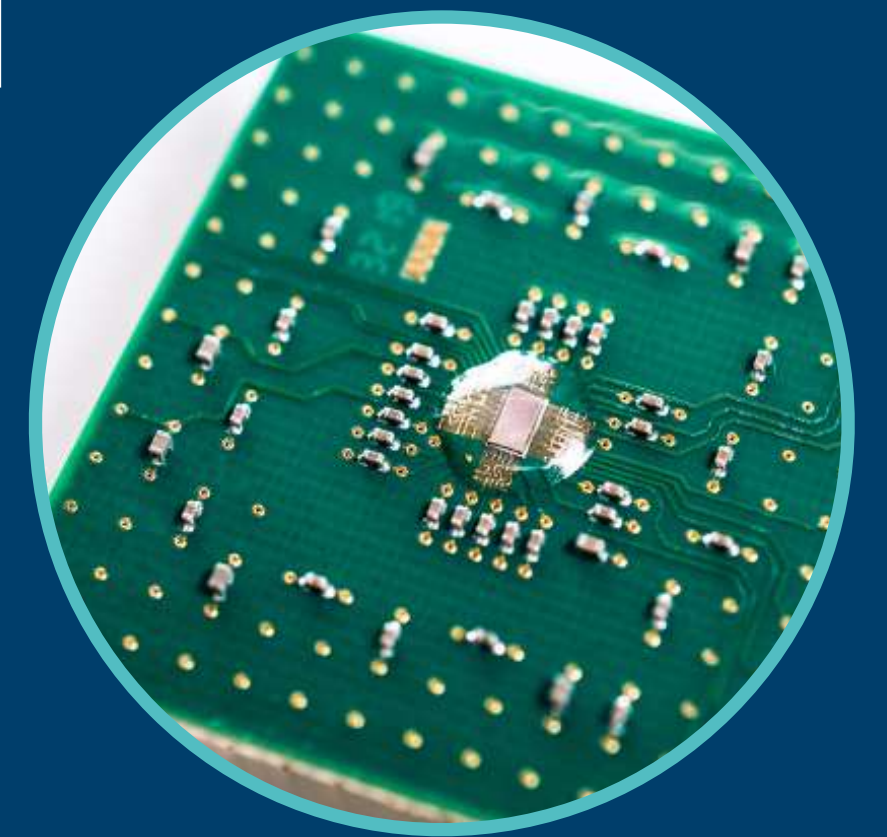
140 GHz radar in deeply-scaled CMOS



integrated photonics for on-chip lidar



GaN for power



edge-AI chip

level 1-2



level 2(+++)



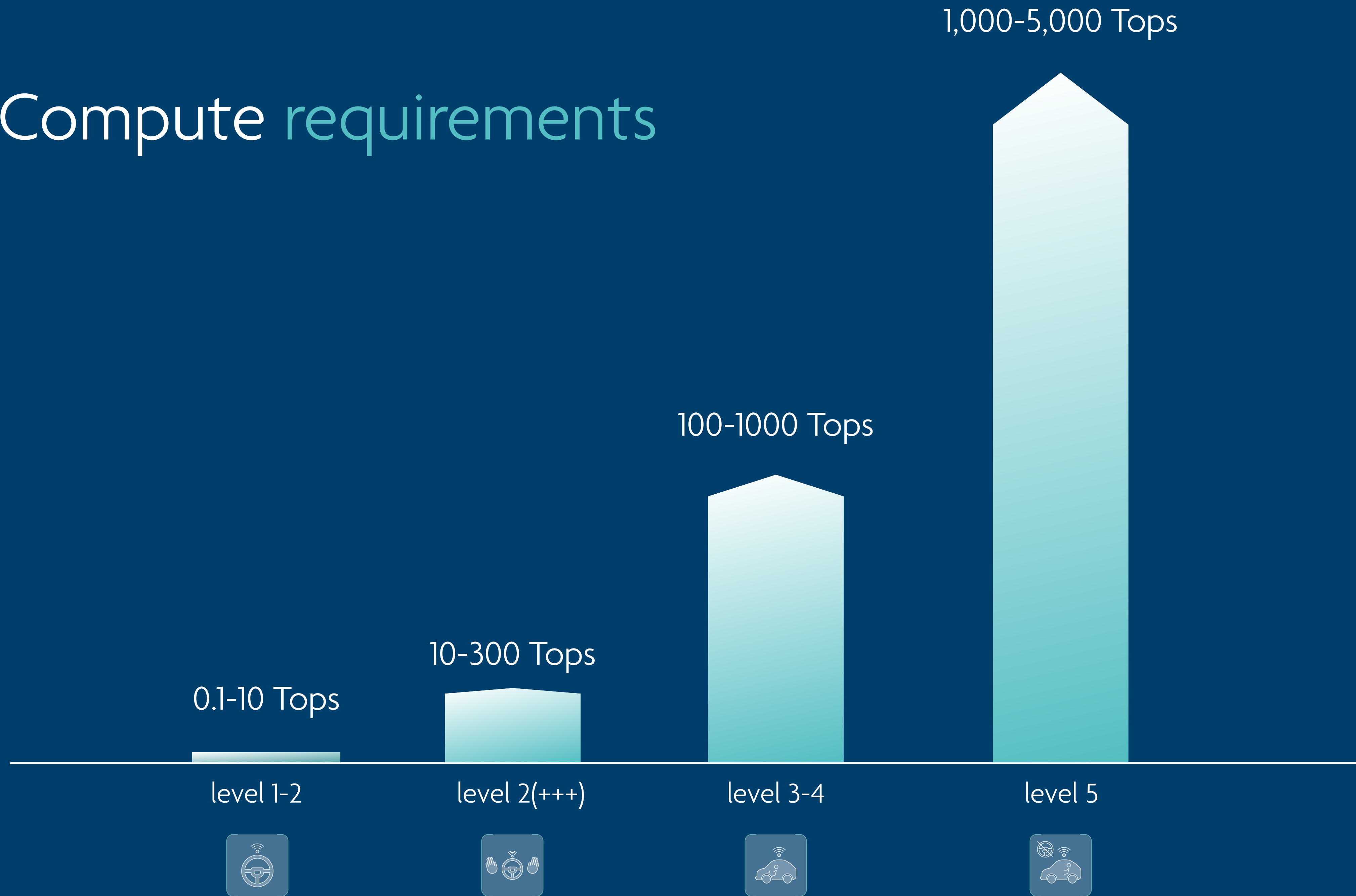
level 3-4



level 5

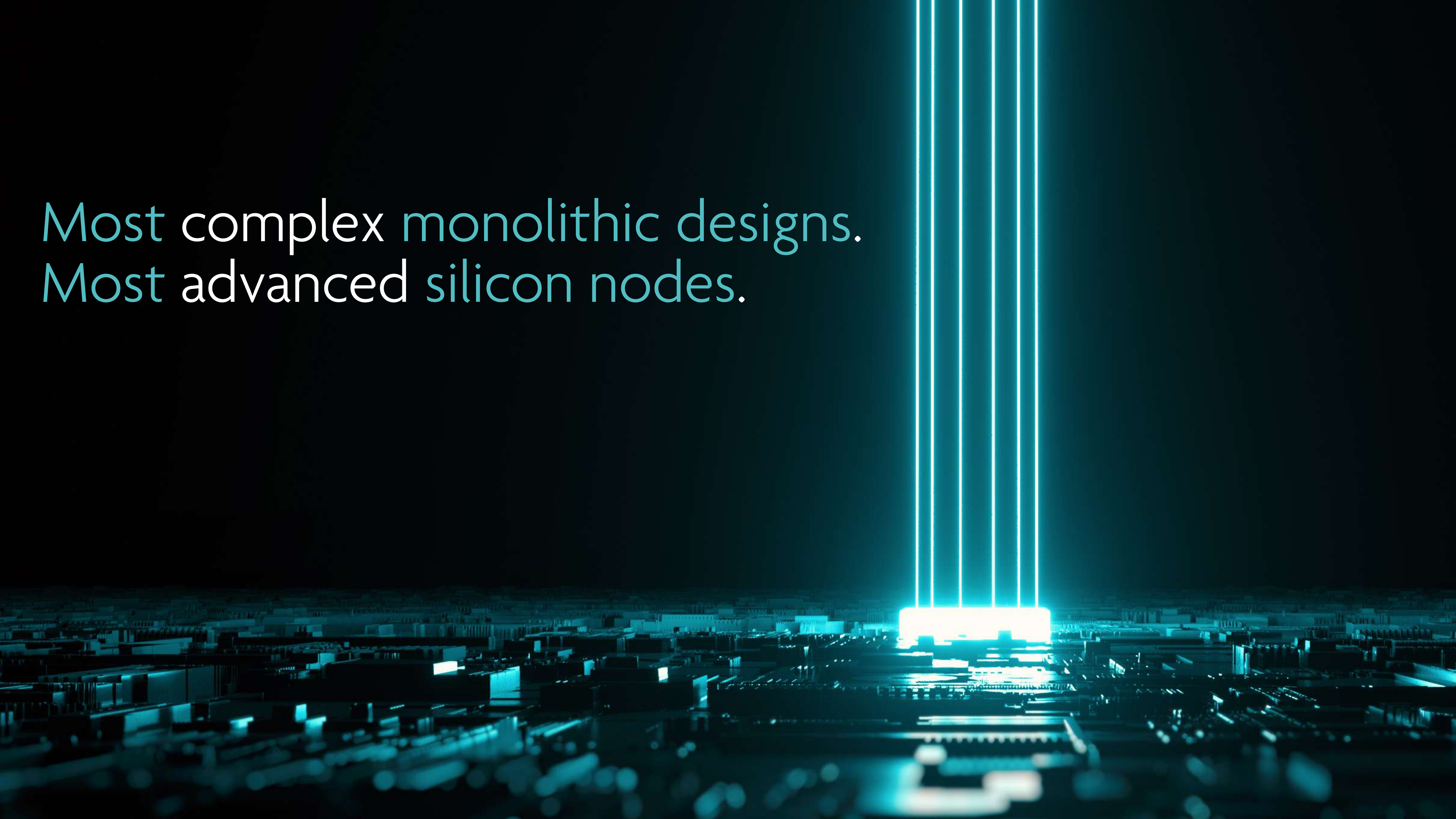


Compute requirements

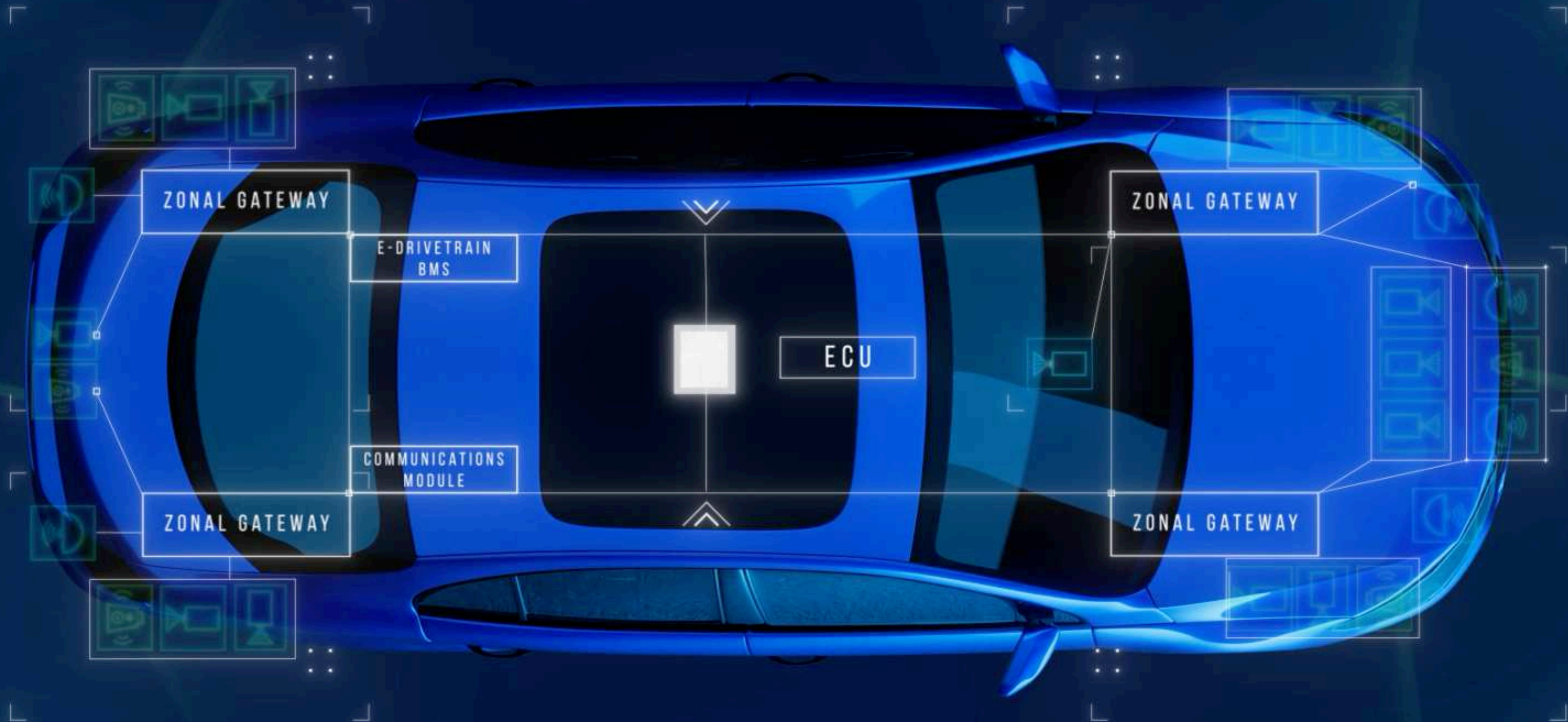


Electronic control units evolve to
supercomputer performance

Most complex monolithic designs.
Most advanced silicon nodes.



Chiplet-based compute architecture

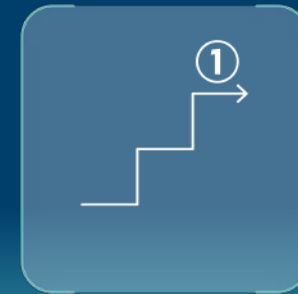


Electronic control unit

Car manufacturers are facing
the biggest transformation ever



car manufacturer



tier 1



tier 2

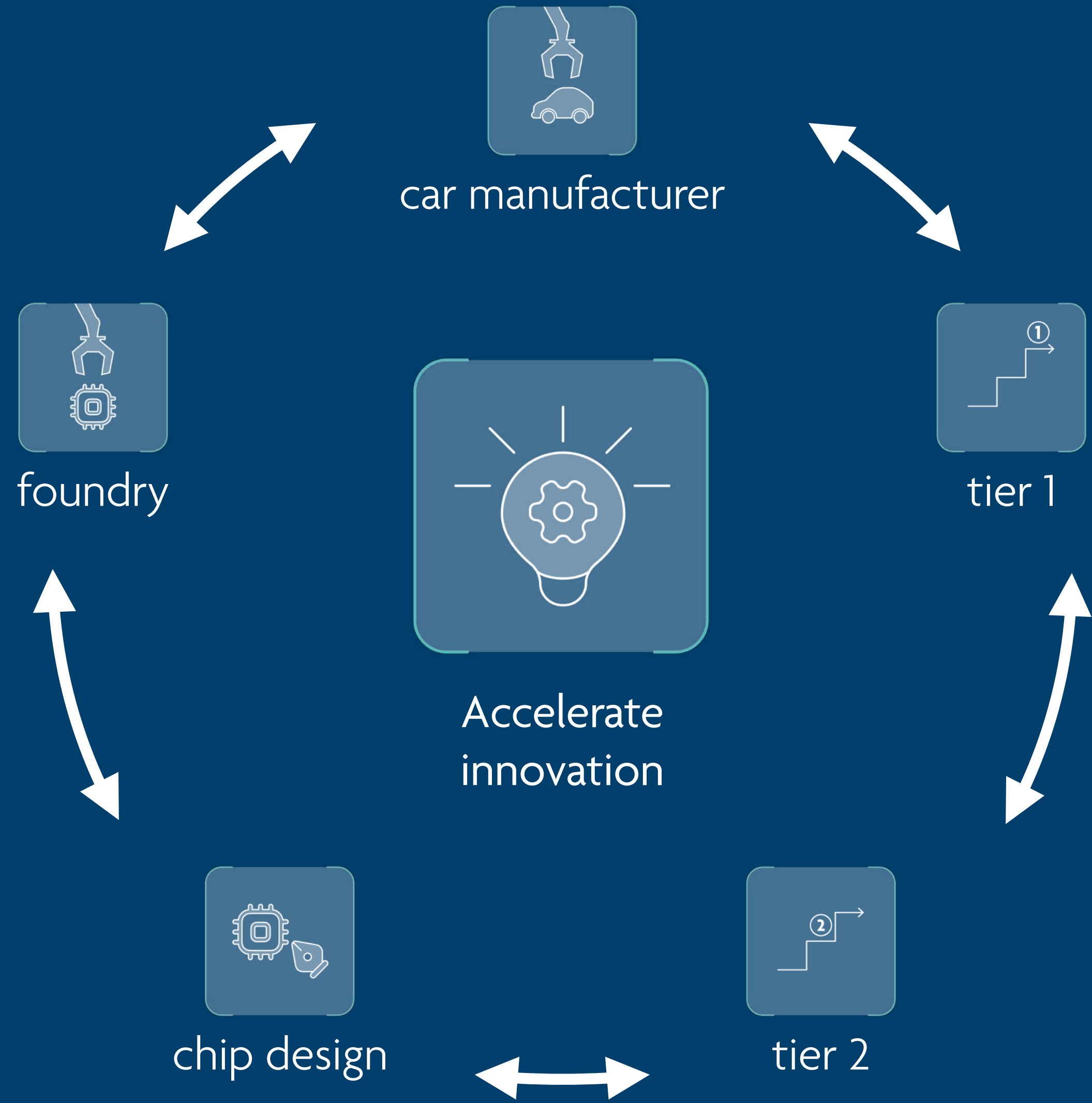


chip design



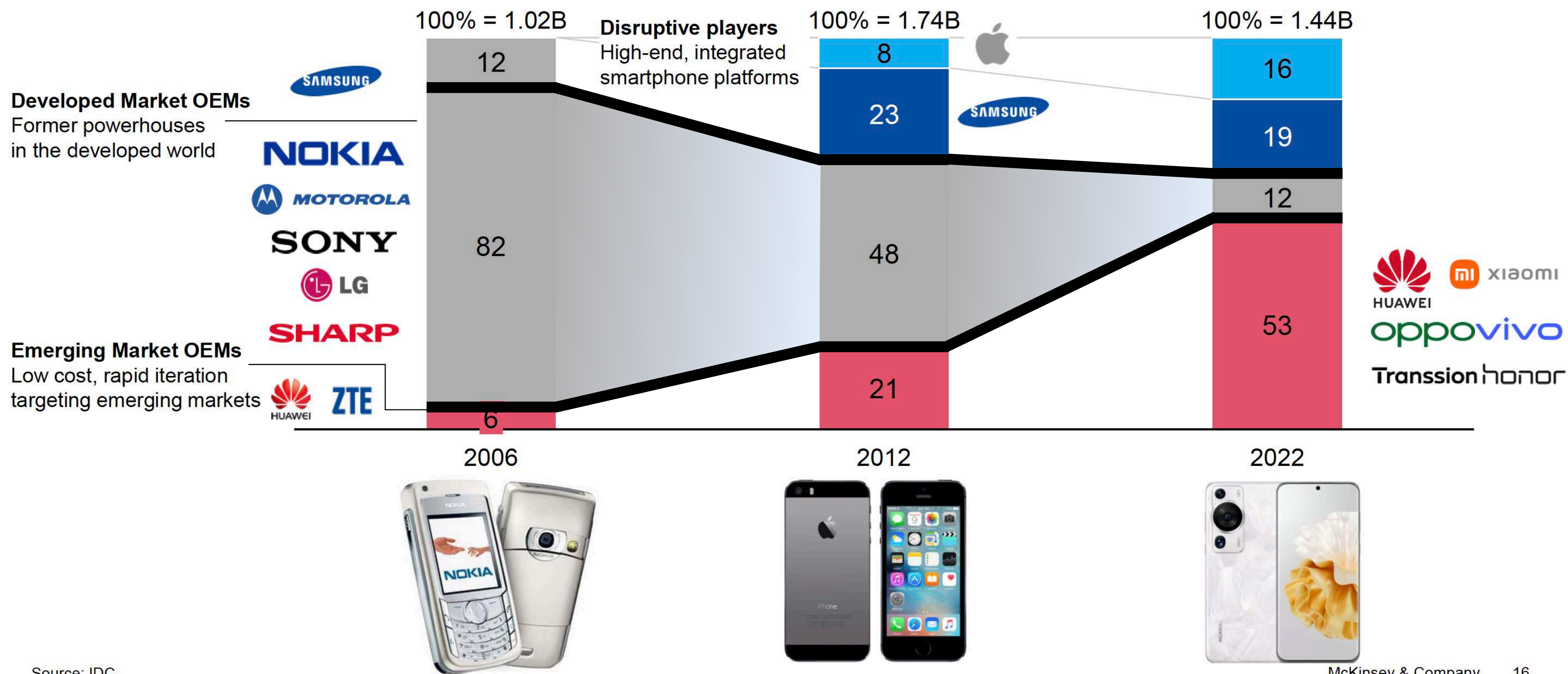
foundry





What innovation / disruption did to phones...

Mobile Handset market share by volume, %



Source: IDC

McKinsey & Company 16

...could happen to cars? (And other industries?)

Automotive Market Share by Units, %

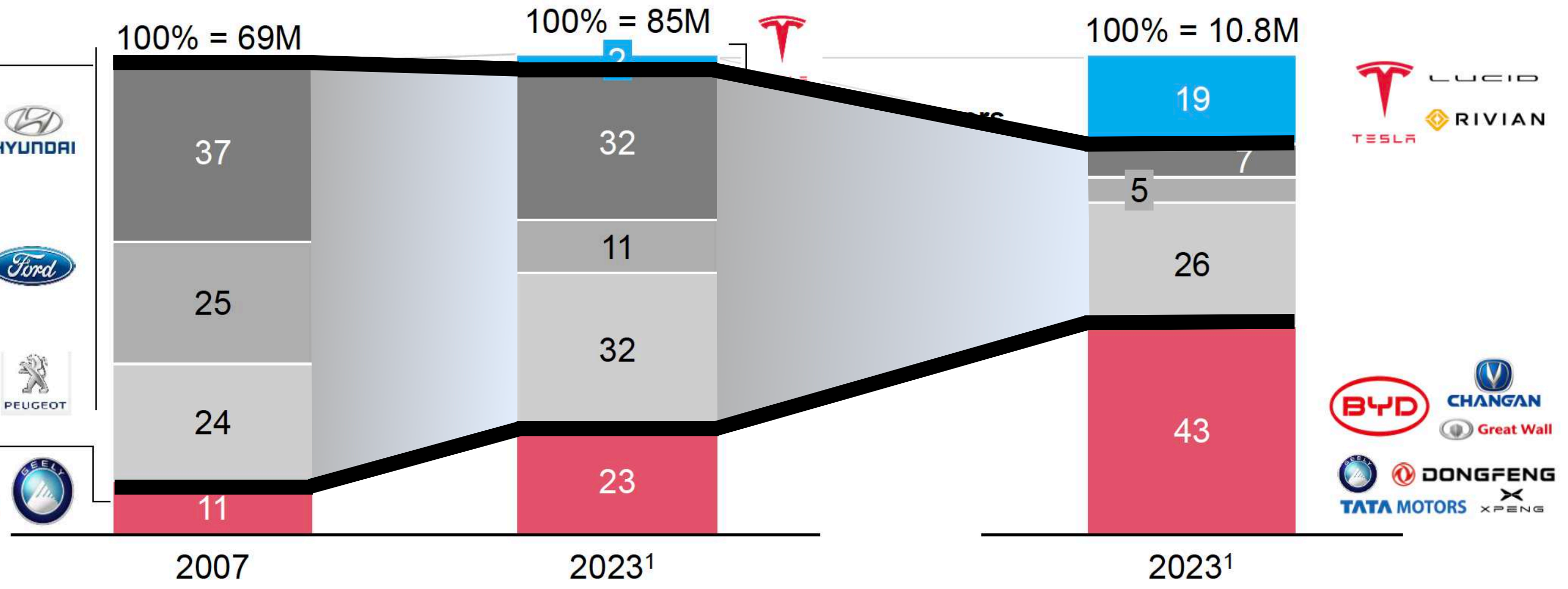
BEV² Market Share by Units, %

■ Japan/Korea ■ NA ■ Europe ■ Emerging Market OEMs

Developed Market OEMs
(Japan/Korea, NA, Europe)
Former powerhouses
in the developed world



Emerging Market OEMs
Low cost, rapid iteration
targeting emerging markets

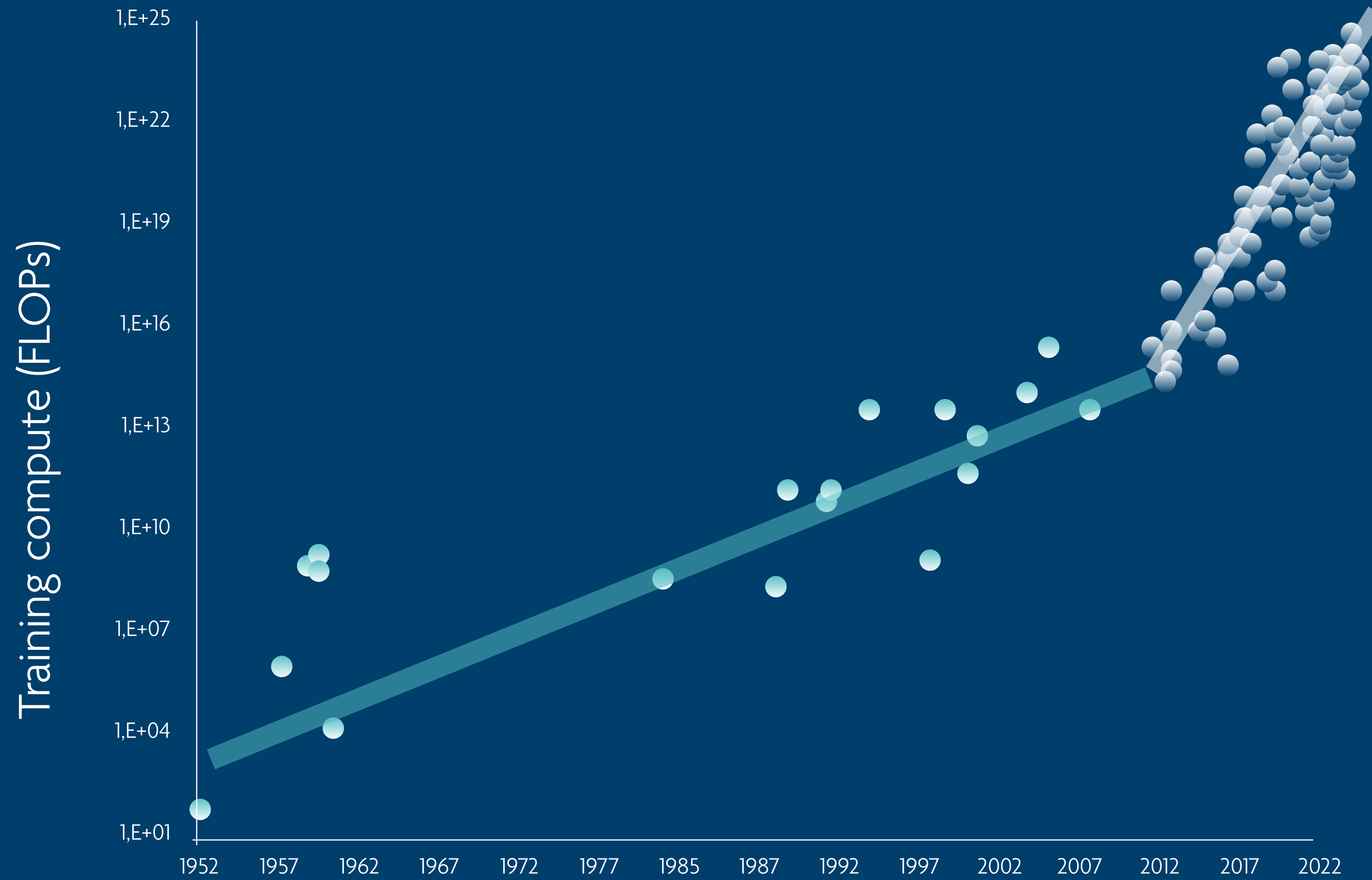


1. Forecasted values for calendar year 2023 | 2. Battery Electric Vehicles
Source: IHS, McKinsey Center for Future Mobility

AI: the modern-day big bang

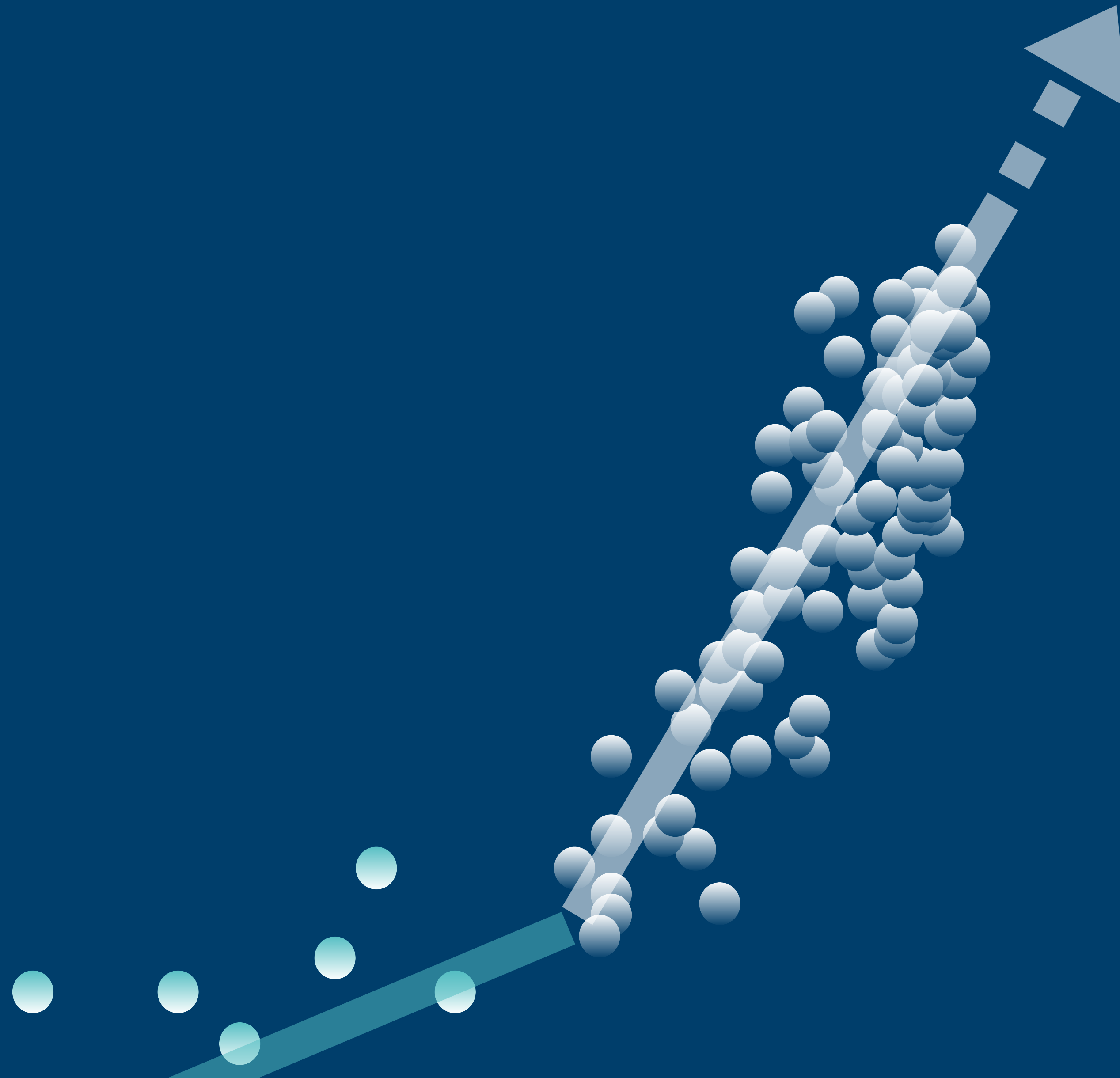


Compute needs are exploding



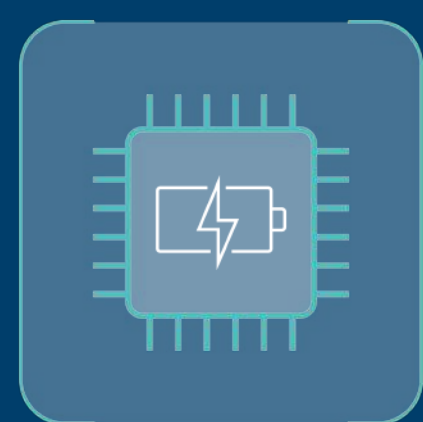
Data source: Sevilla et al. <https://doi.org/10.48550/arXiv.2202.05924>

Compute needs are exploding

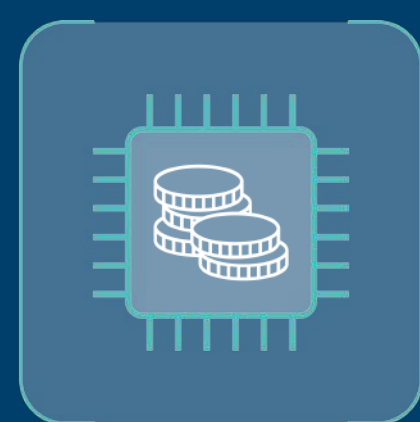


The need for a more aggressive semiconductor & compute systems roadmap

1,000x
improvement / 5 years



performance

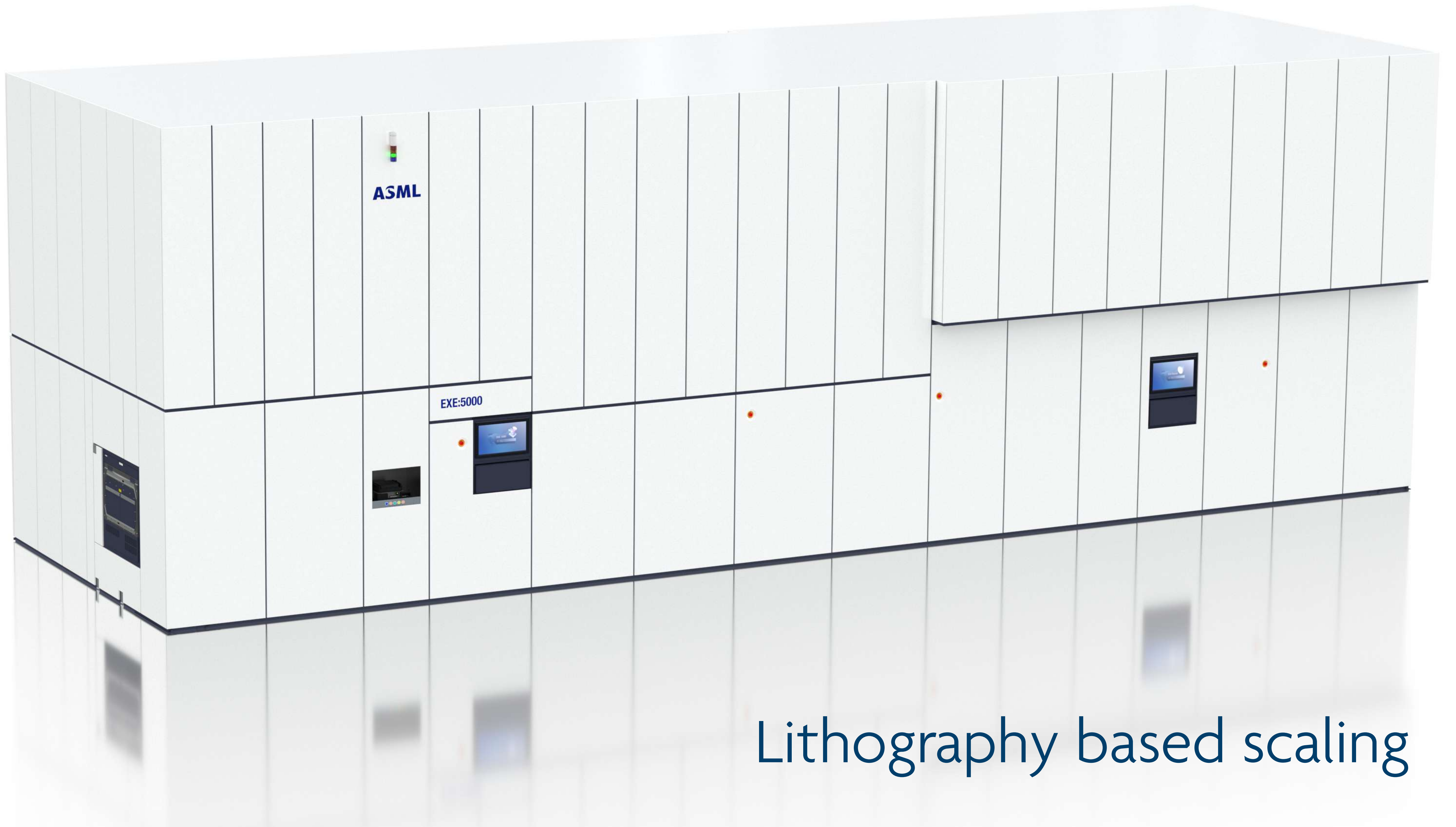


power efficiency



complexity





Lithography based scaling

Potential roadmap extension

2018

2020

2023

2025

2027

2029

2031

2033

2035

2037

2039

N7

N5

N3

N2

A14

A10

A7

A5

A3

A2

sub-A2

0.33NA EUV

0.55NA EUV

Continued dimensional scaling

Metal Pitch [nm]

40

28

22

22

20

18

18-16

16-14

16-12

16-12

14-10

Metal Tracks

6

6

6

5-6

5

5

4-5

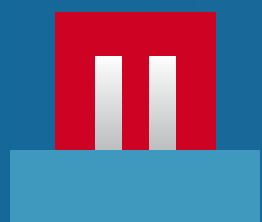
4-5

4-3

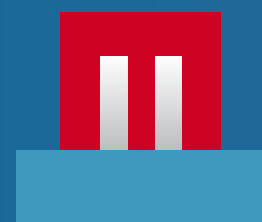
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3

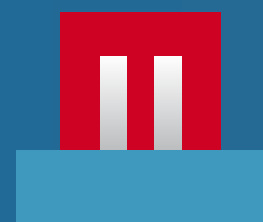
Device and material innovations



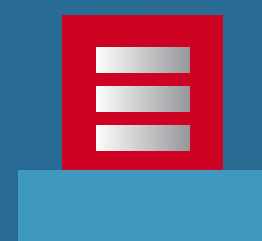
FinFET



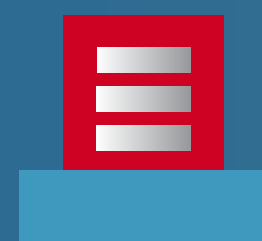
FinFET



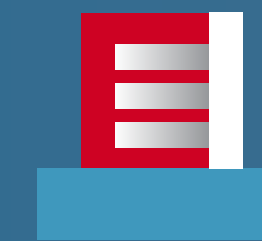
FinFET



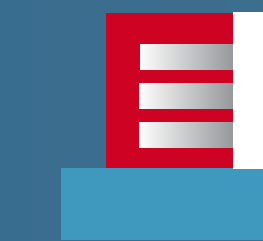
GAA
Nanosheet



GAA
Nanosheet



GAA
Nano/Forksheets



GAA/CFET
Forksheets



CFET



CFET

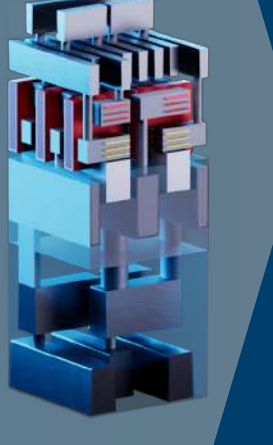
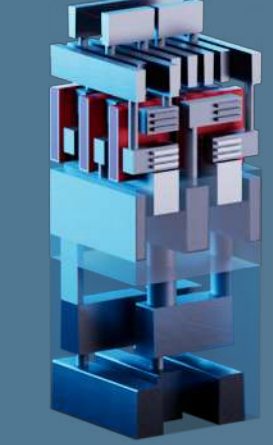
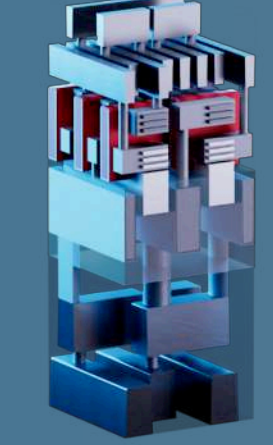
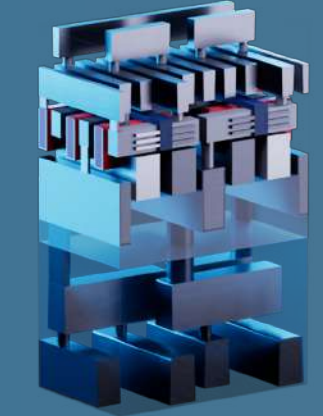
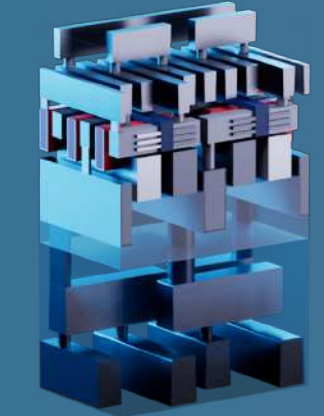
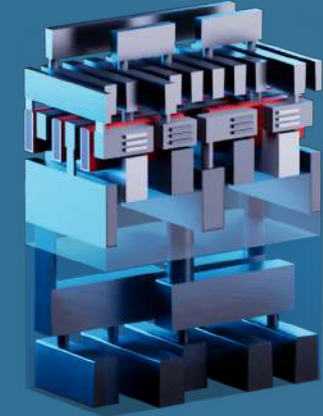
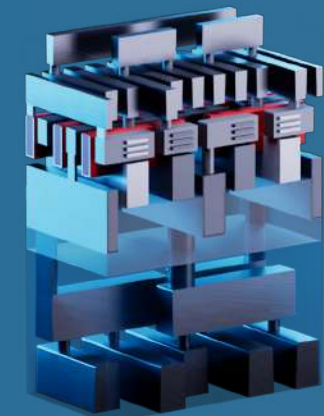
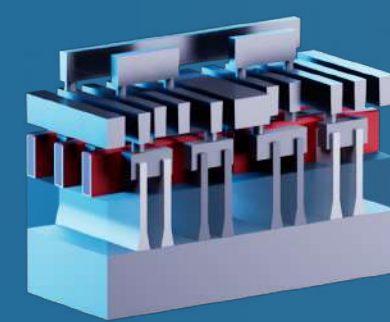
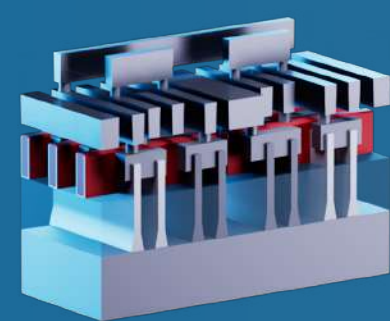
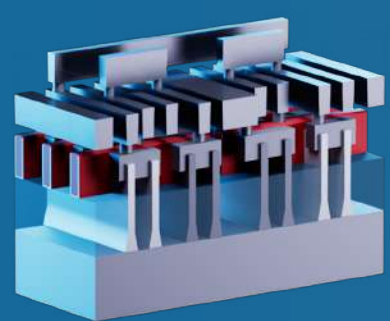


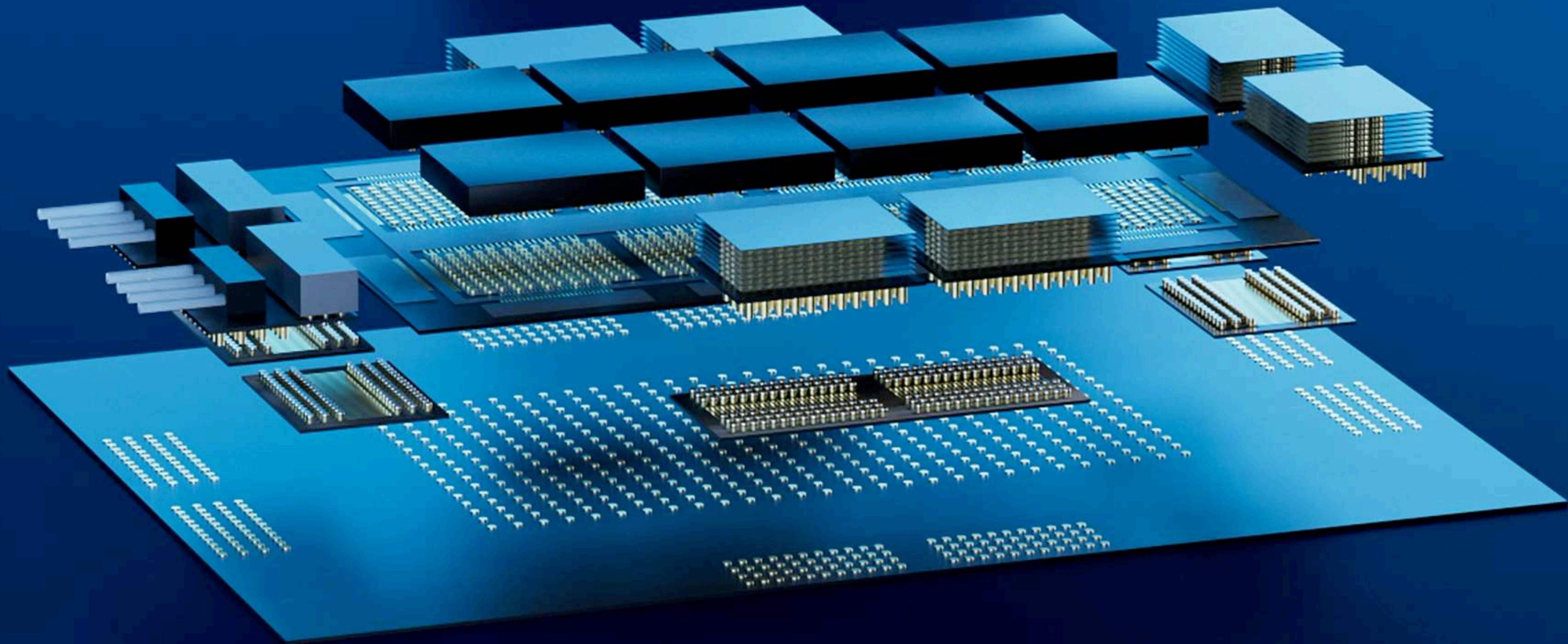
CFET
Atomic



CFET
Atomic

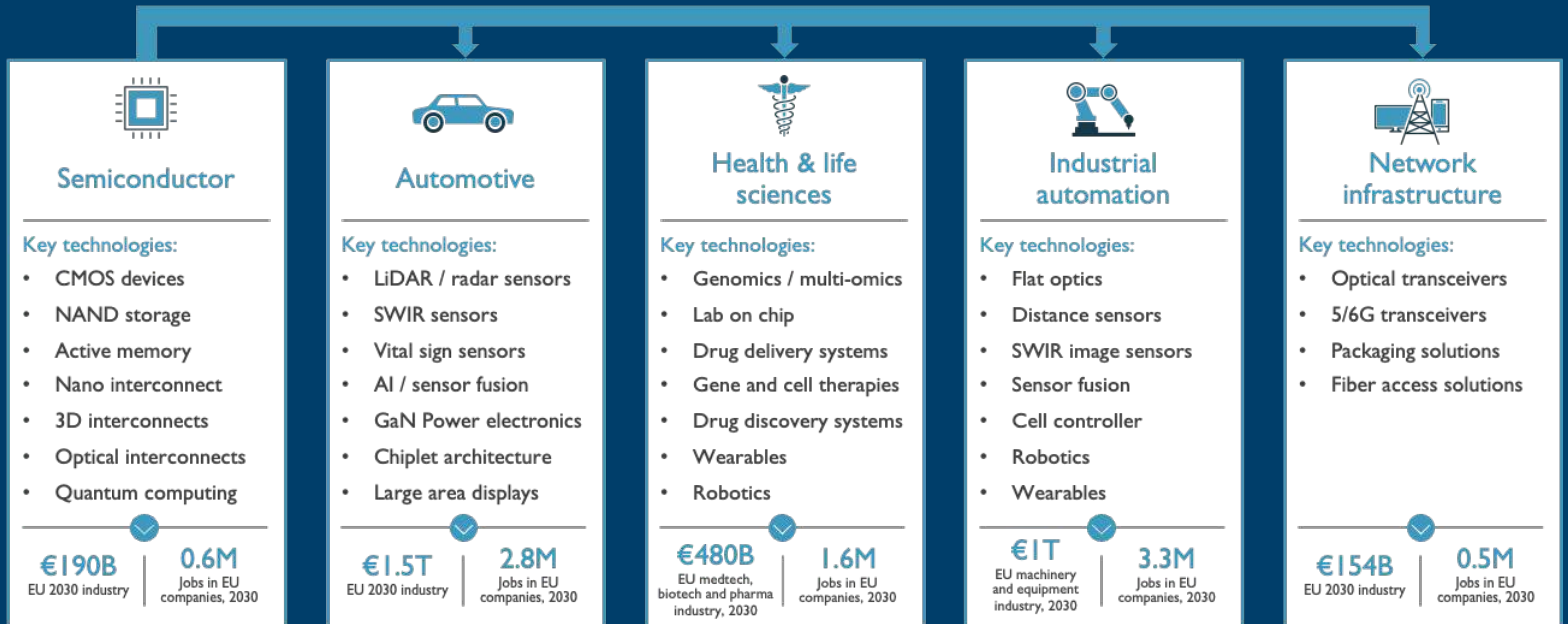
Context-aware interconnect





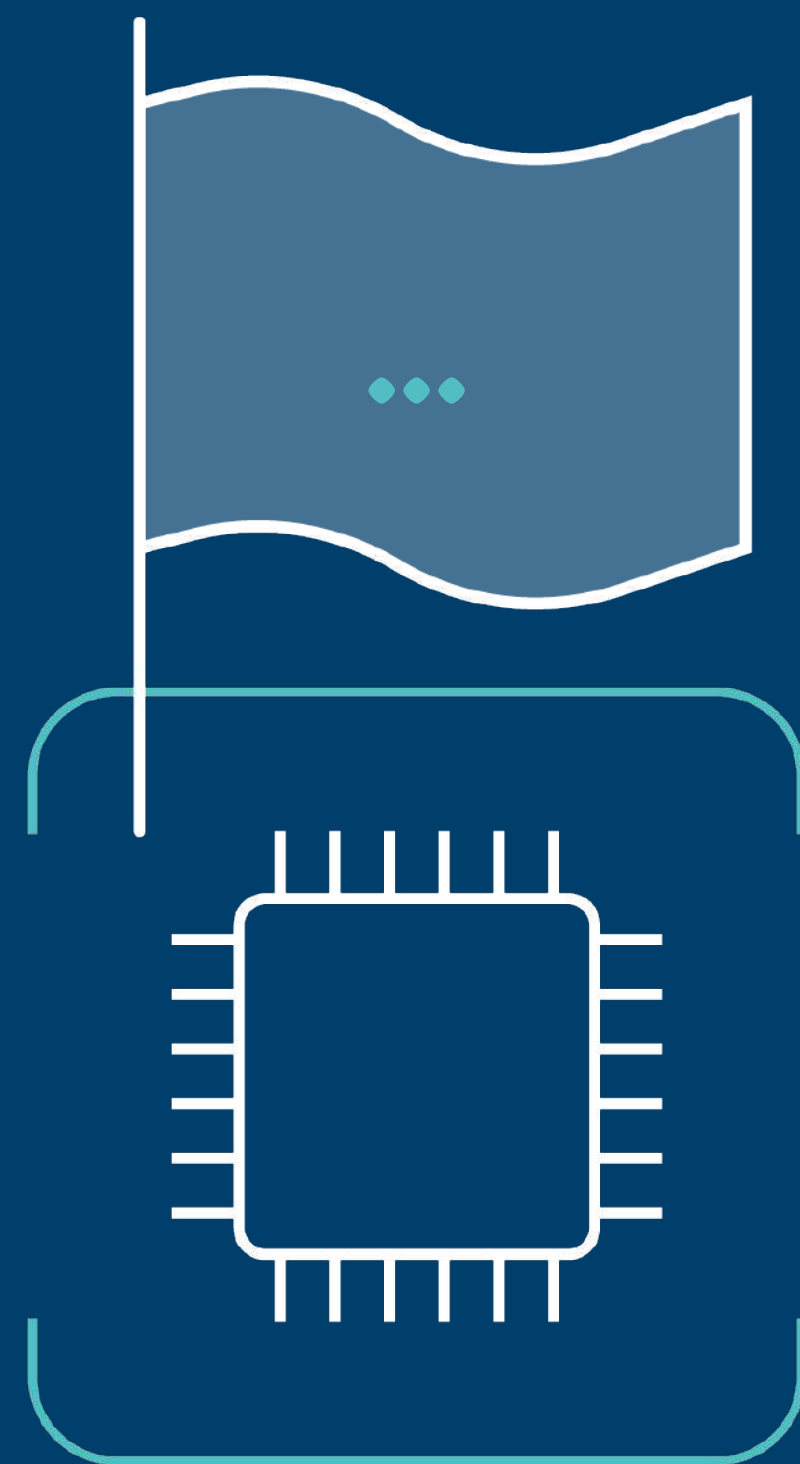
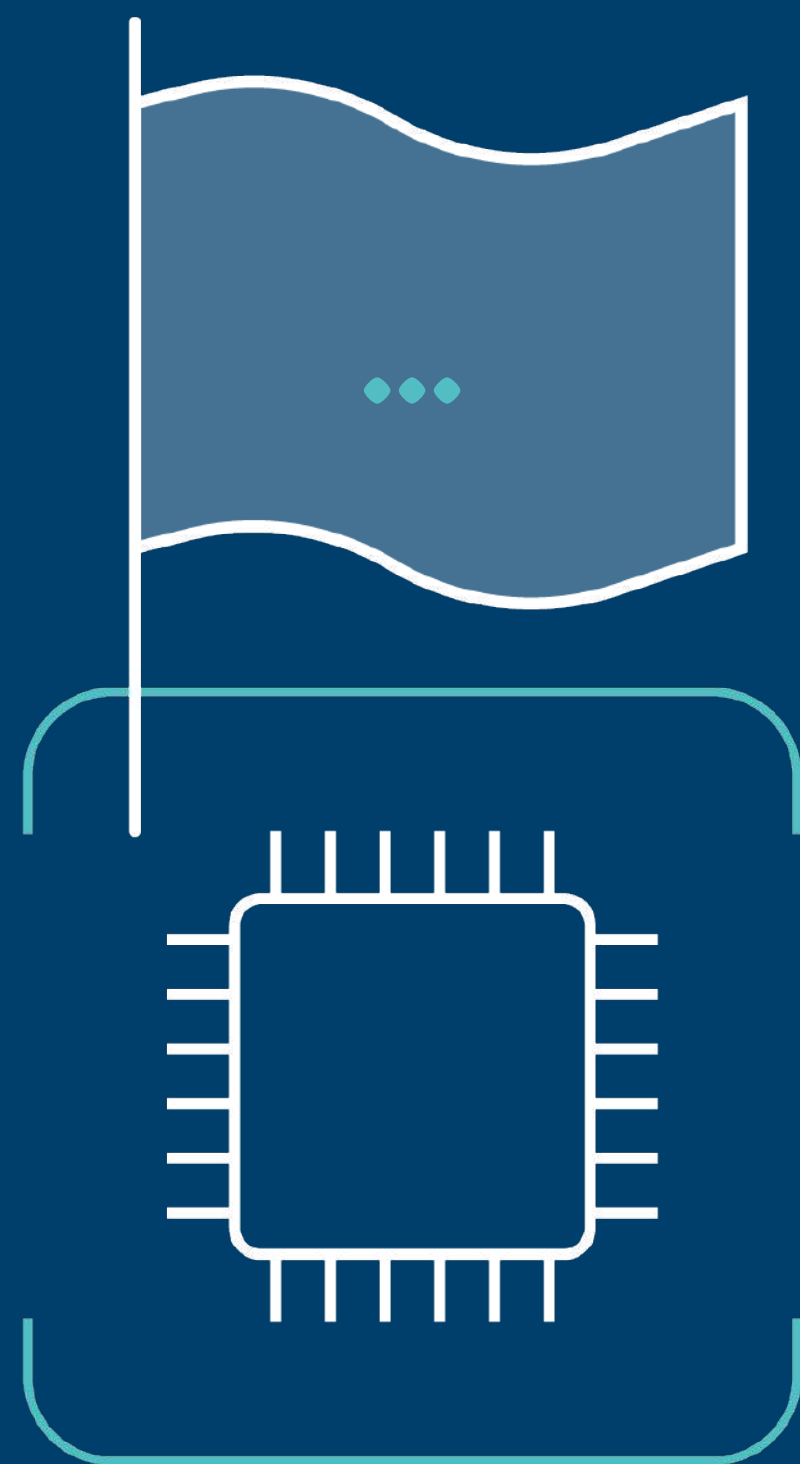
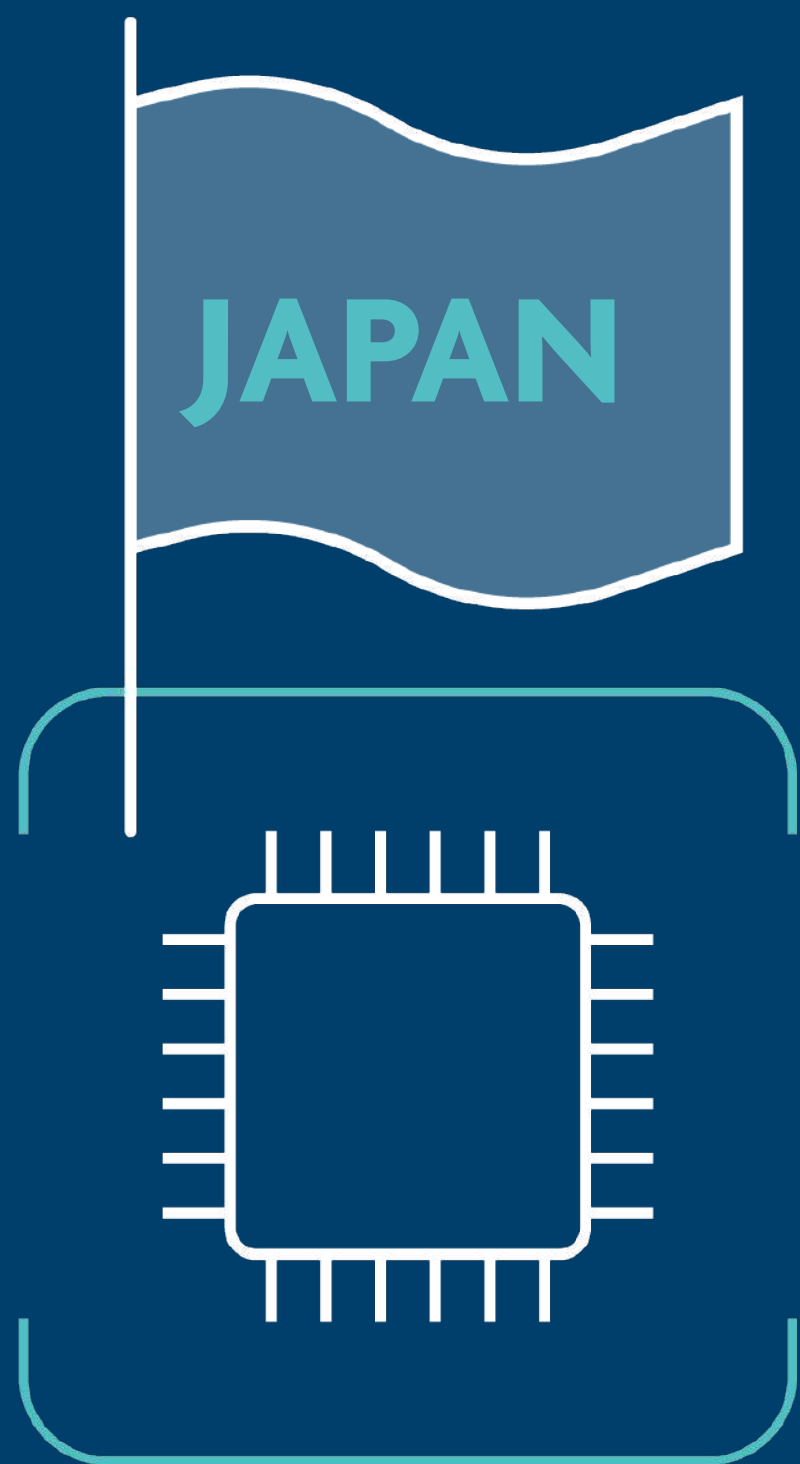
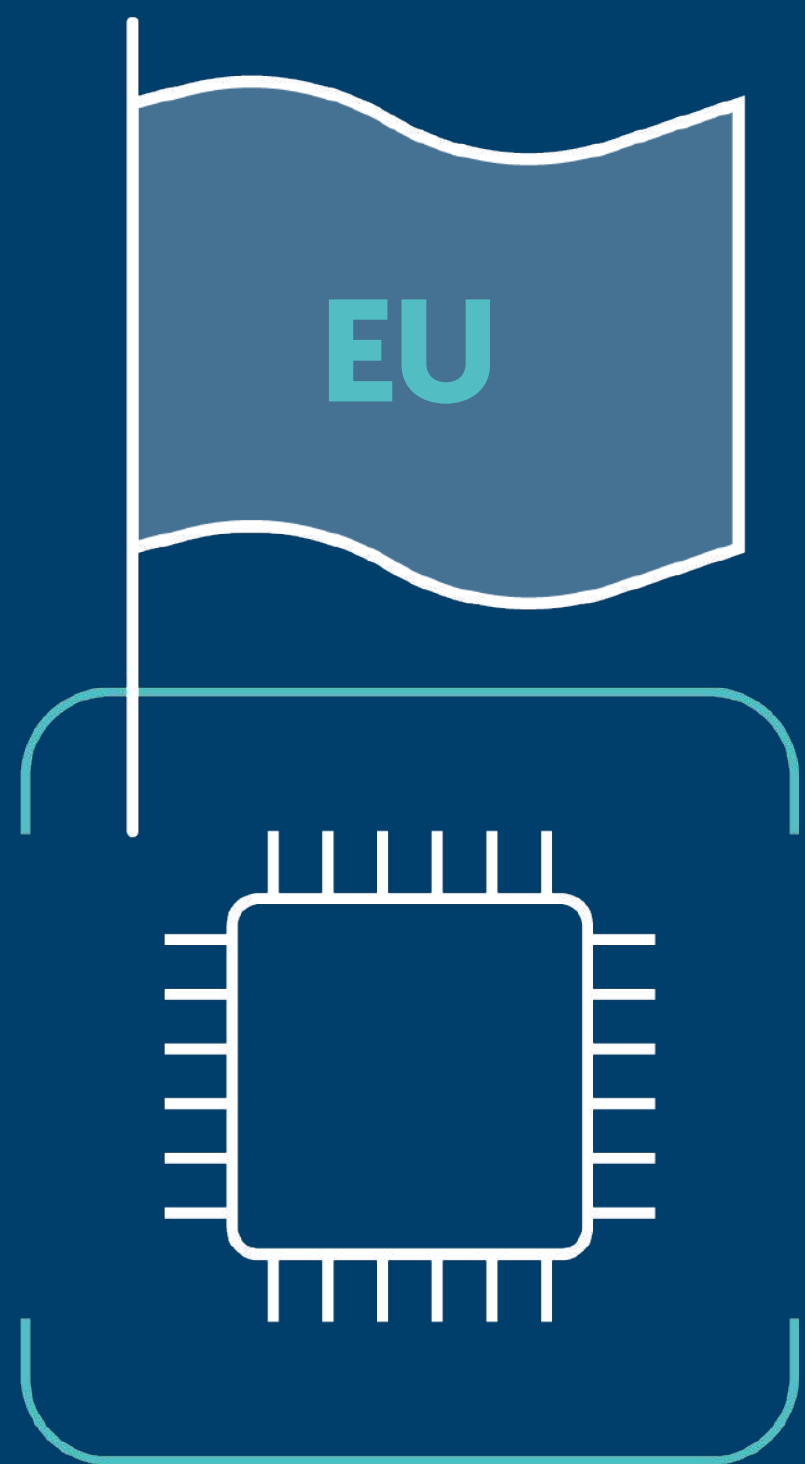
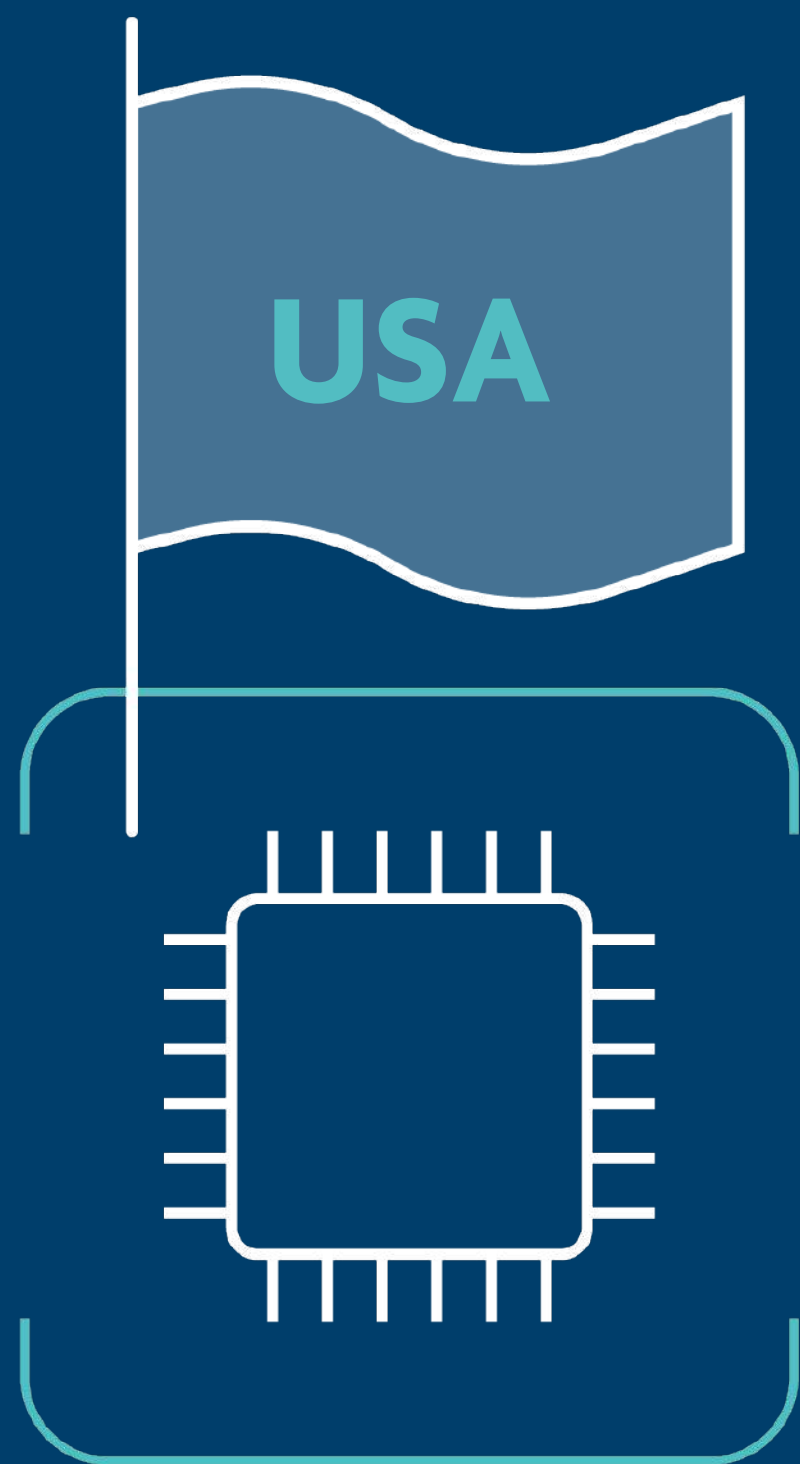
Micro chip technology is everywhere

Semiconductor research enables in 2030: 3.3T€ revenue and supports 9M jobs





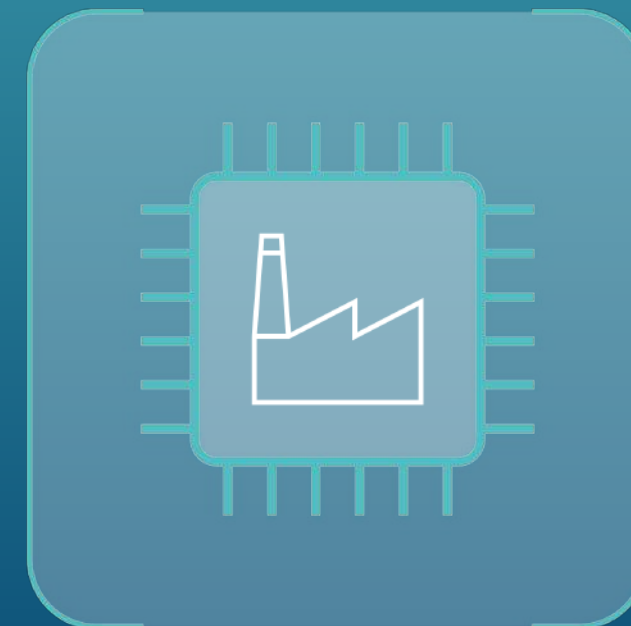
Increased awareness of
the strategic importance of chips



advanced
technologies
and pilot lines



access to
semiconductor
manufacturing



Chips Acts to create critical mass
to accelerate innovation & secure supply

Each region has unique **strengths**



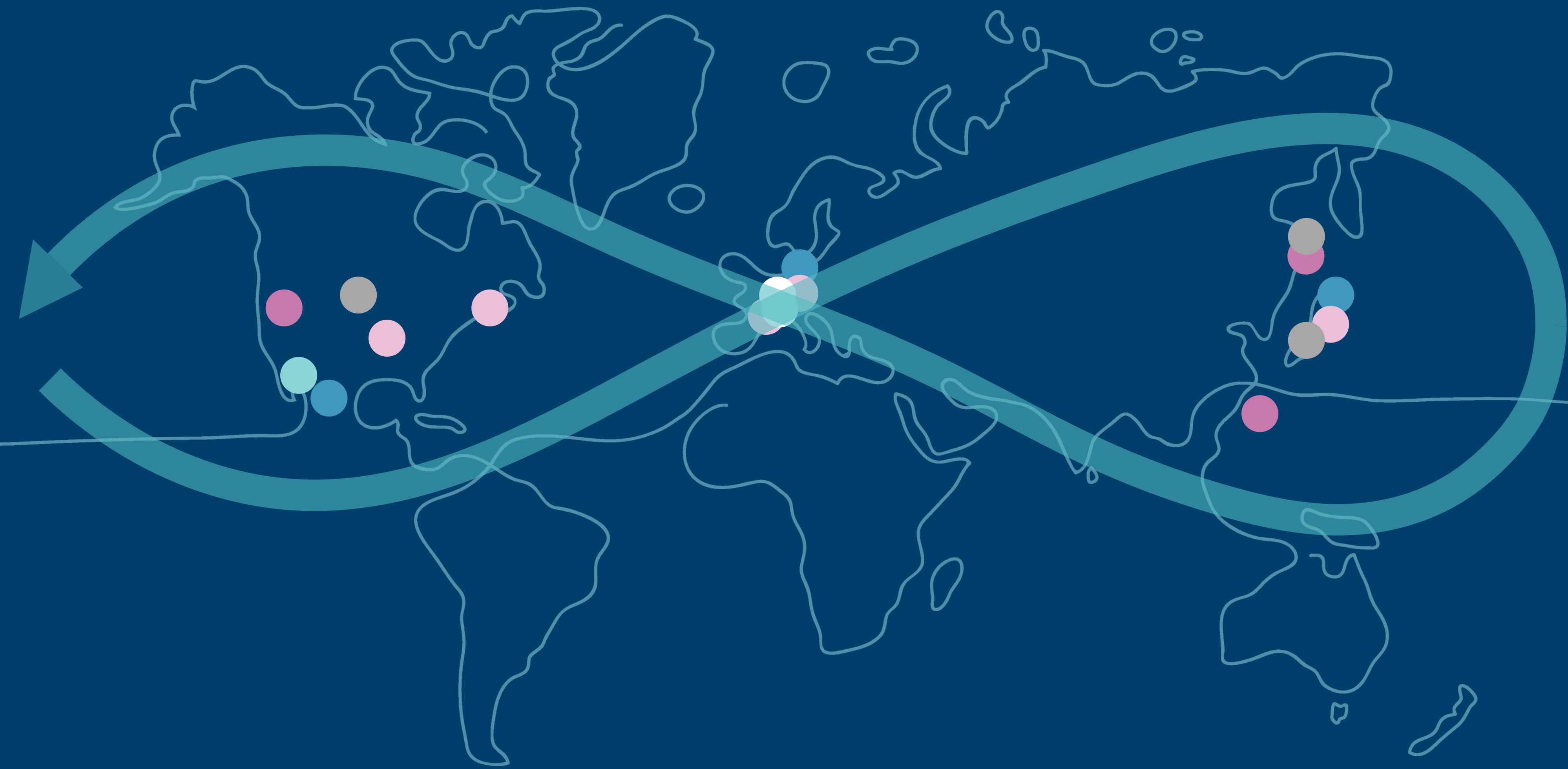
- Advanced logic manufacturing
- Leading-edge equipment & materials
- Advanced memory manufacturing
- Advanced mature node manufacturing
- EDA
- Advanced R&D pilots (RTO)

Self-sufficiency leads to mediocrity

Regions should strengthen their strengths
and complement each other's mutual strengths

Combine the best of the best

It's about smart **de**-connection



Decoupling leads to slowing down innovation



decoupling
world



duplicated
research & manuf.
infrastructure



increase of
cost

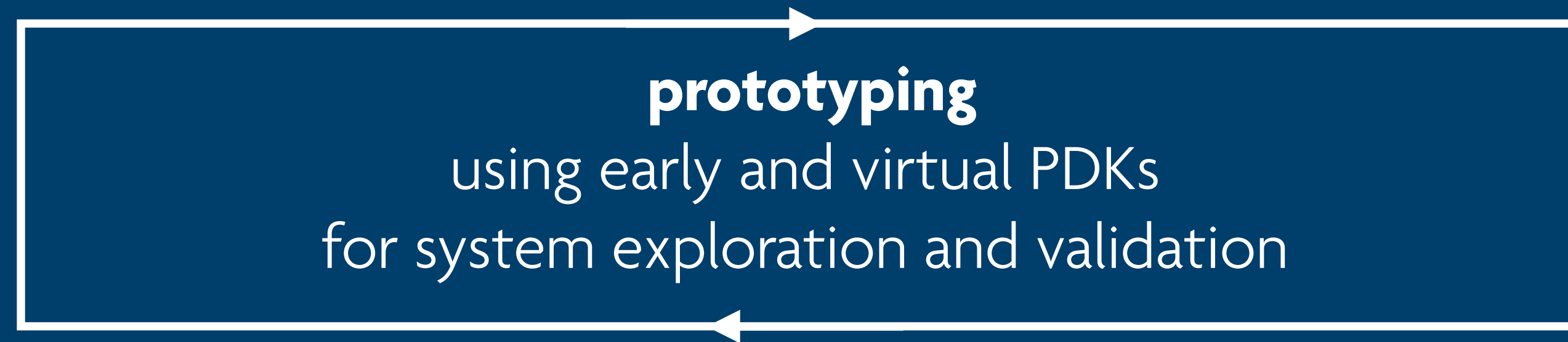


slow down
innovation

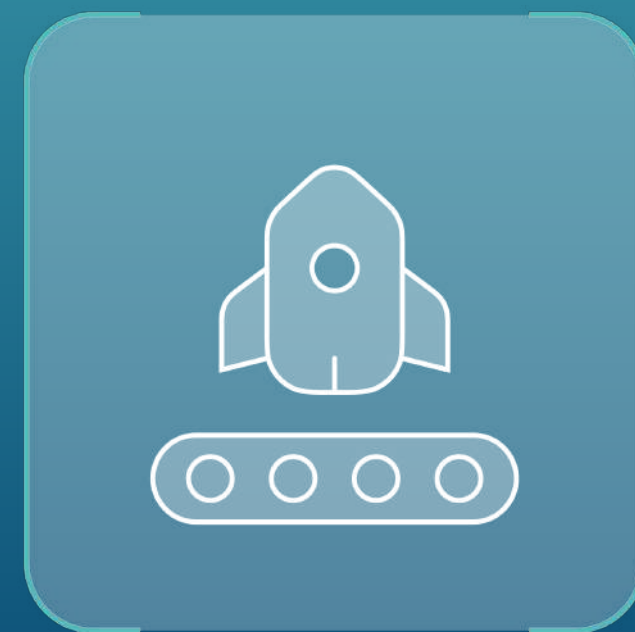
A satellite view of Earth at night, showing city lights and the curvature of the planet. A network of white lines and dots is overlaid on the image, representing a global network or data flow. The text is centered in the middle of the image.

**Need strong collaboration
across (like-minded) countries
across the entire value chain**

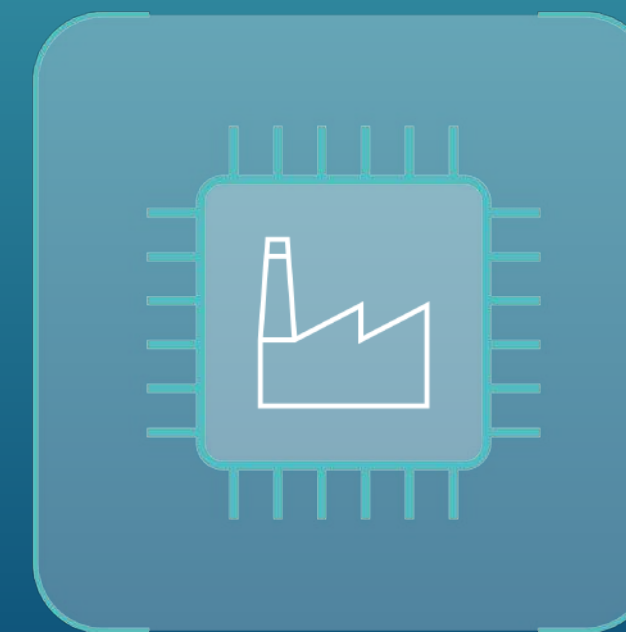
Closing the gap from lab to fab

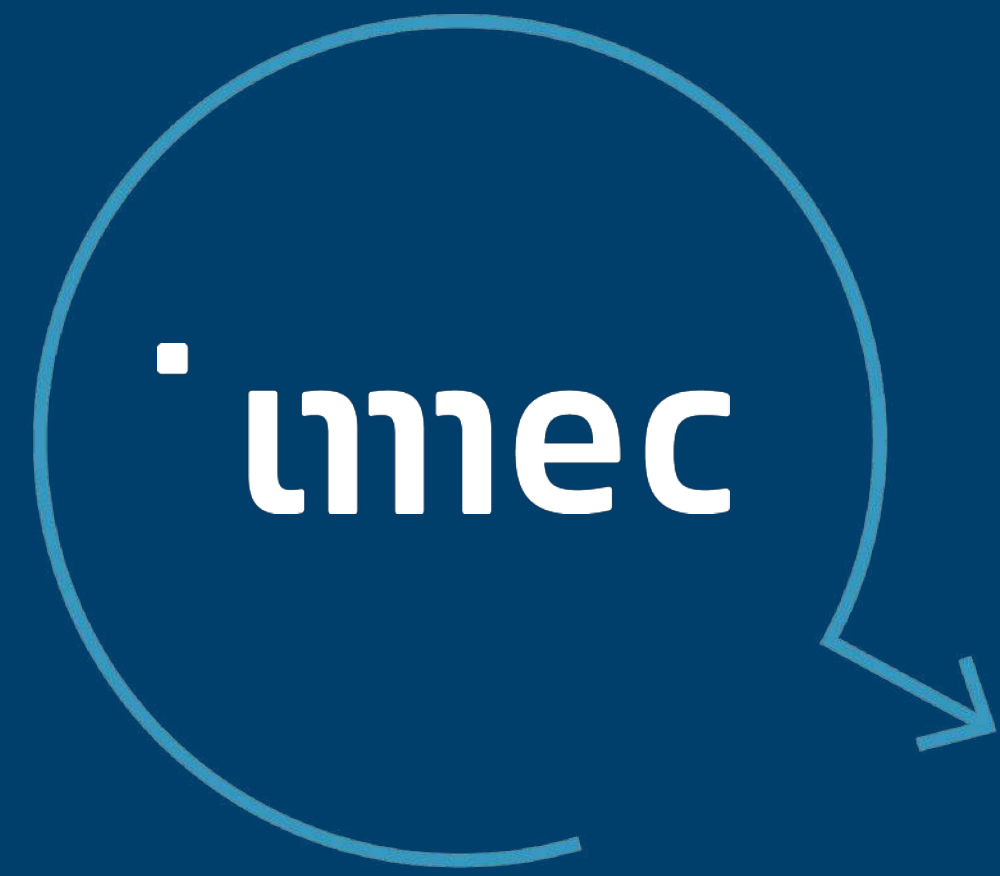


advanced
technologies
and pilot lines



access to
semiconductor
manufacturing

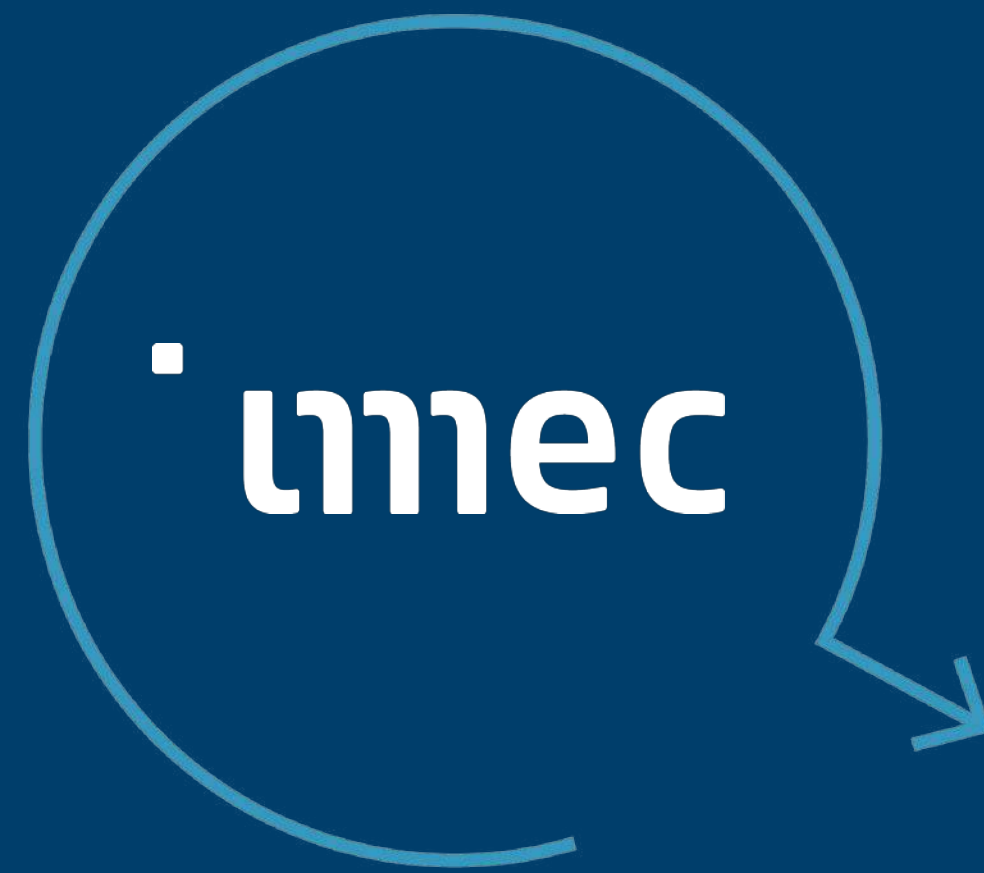




New
system
concept
demonstration



Advanced
Technologies
& 3D wafer stacking



**New
system
concept
demonstration**



Packaging &
System integration

Fully-depleted SOI
(10 nm - 5nm)



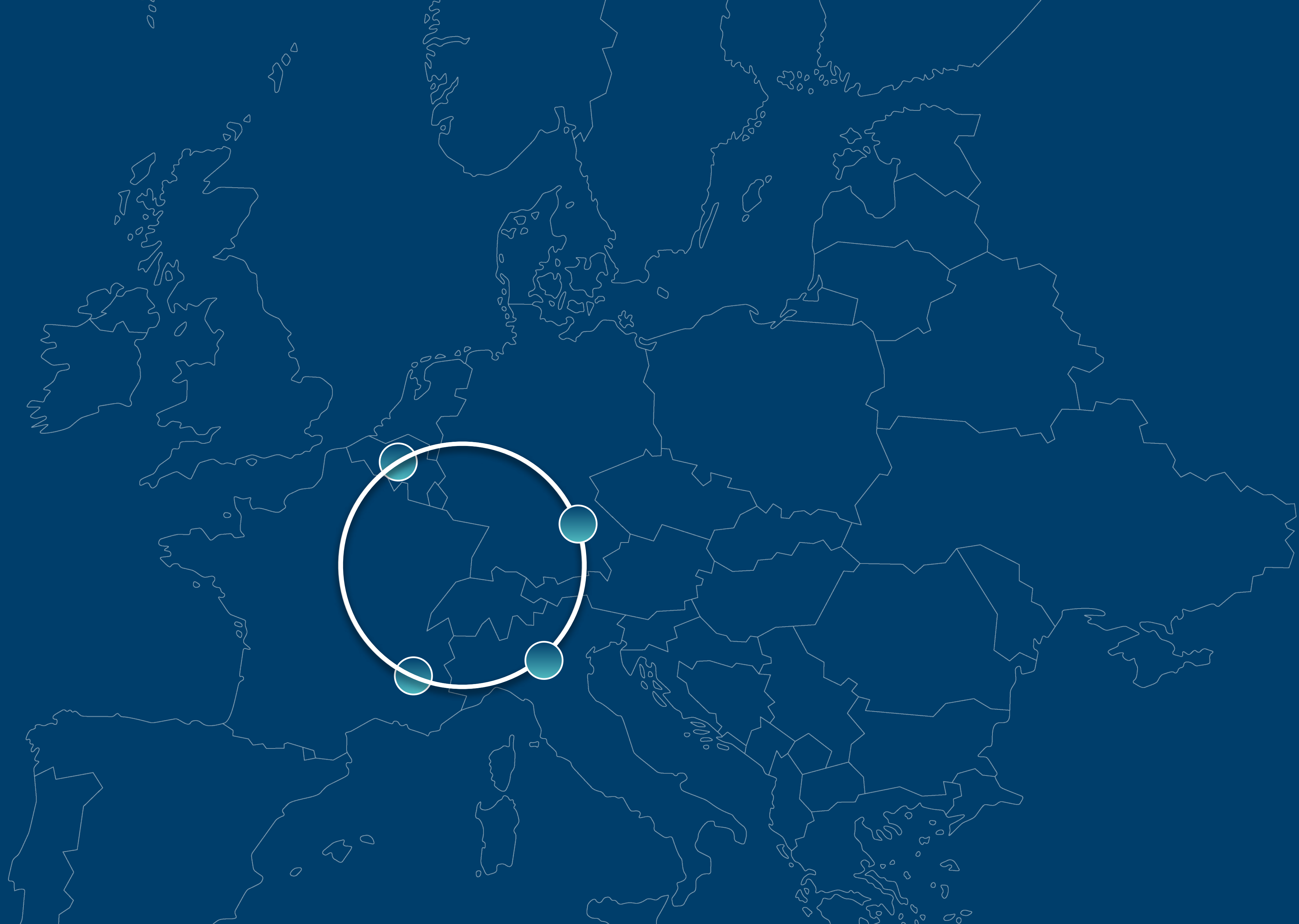


imec

 **Fraunhofer**

leti
ce2tech





● potential competence centers
(for illustrative purpose only -
non-exhaustive list)

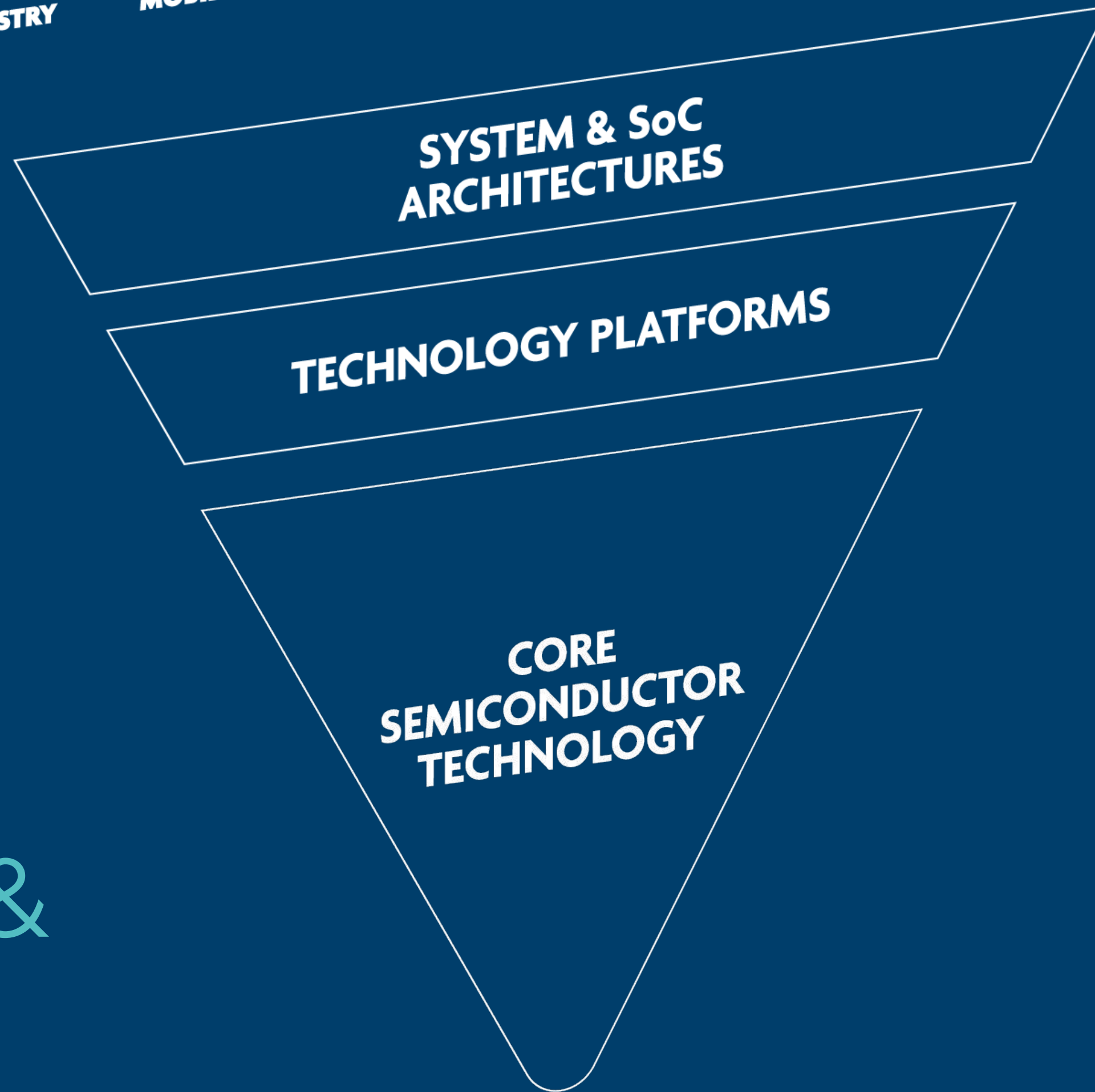
Supporting & partnering with distributed network
of RTO's, competence and design centers



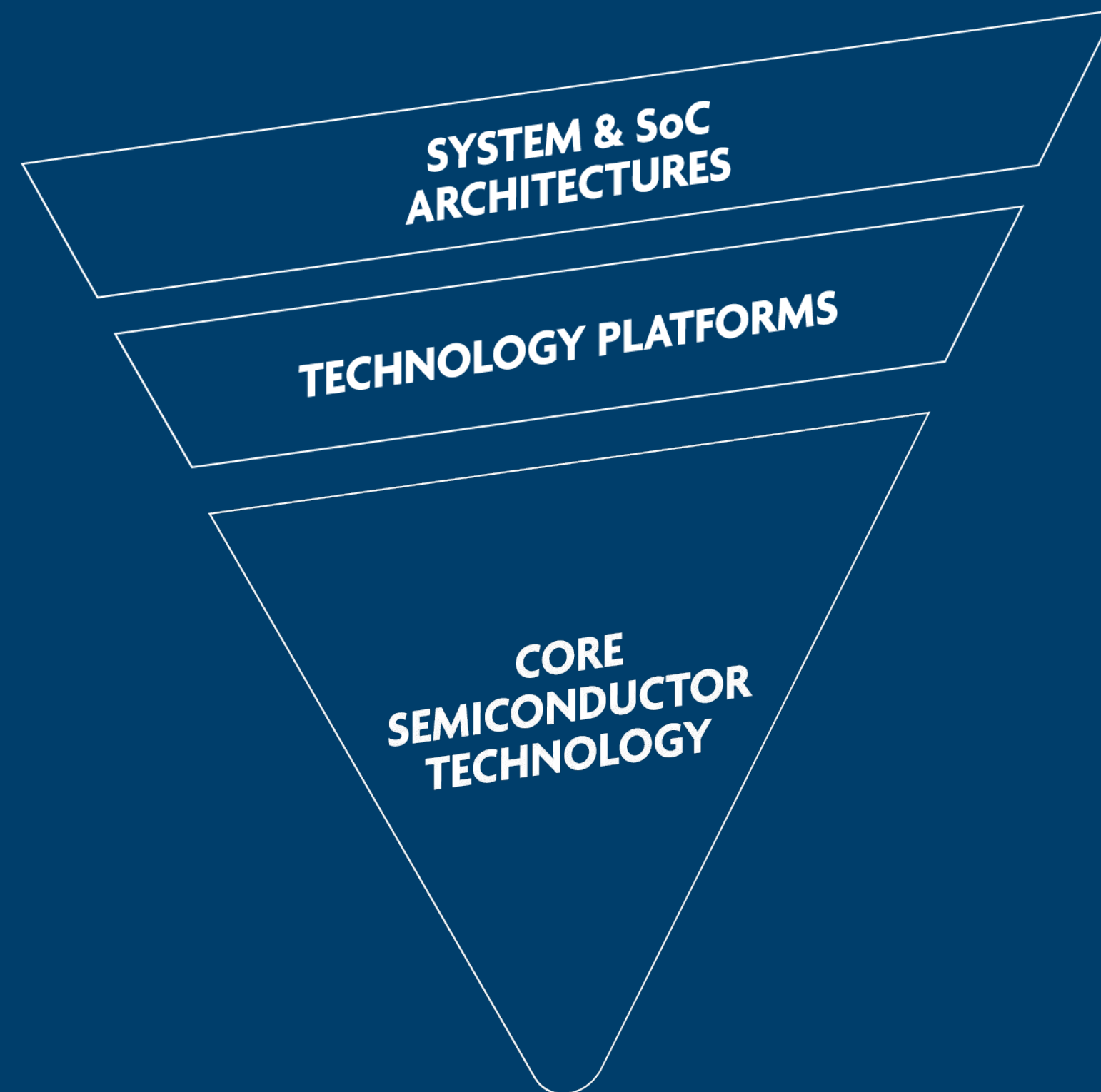
Crowd source innovation



pilot lines



Growing
collaboration
along the stack &
standardization



Growing
collaboration
along the stack &
standardization



Technology prototyping
& incubation of
START-UPS



breakthrough pipeline
through associated
**UNIVERSITY
PARTNERSHIPS**



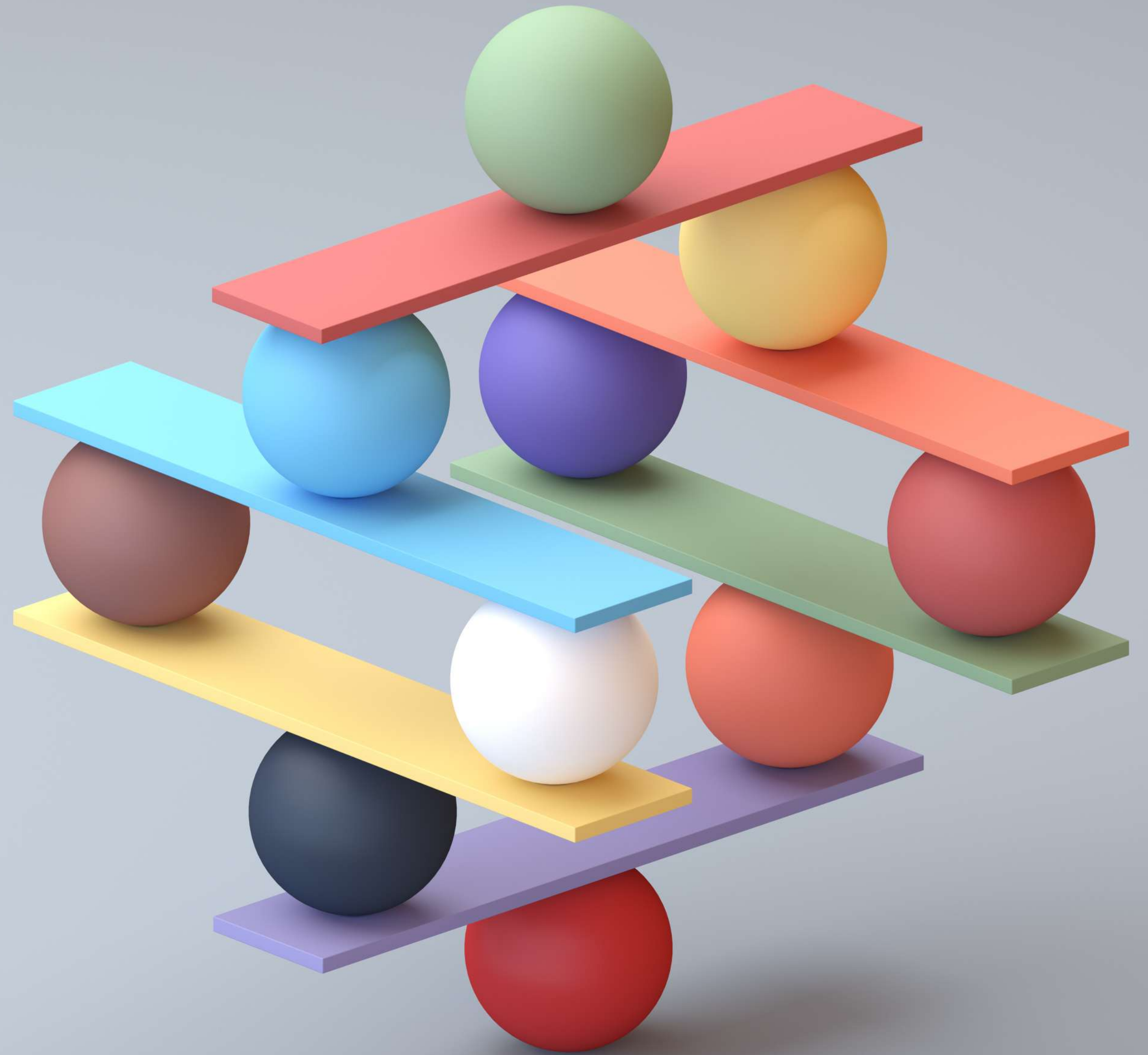
industrial innovation
supporting full
INDUSTRIAL VALUE CHAIN



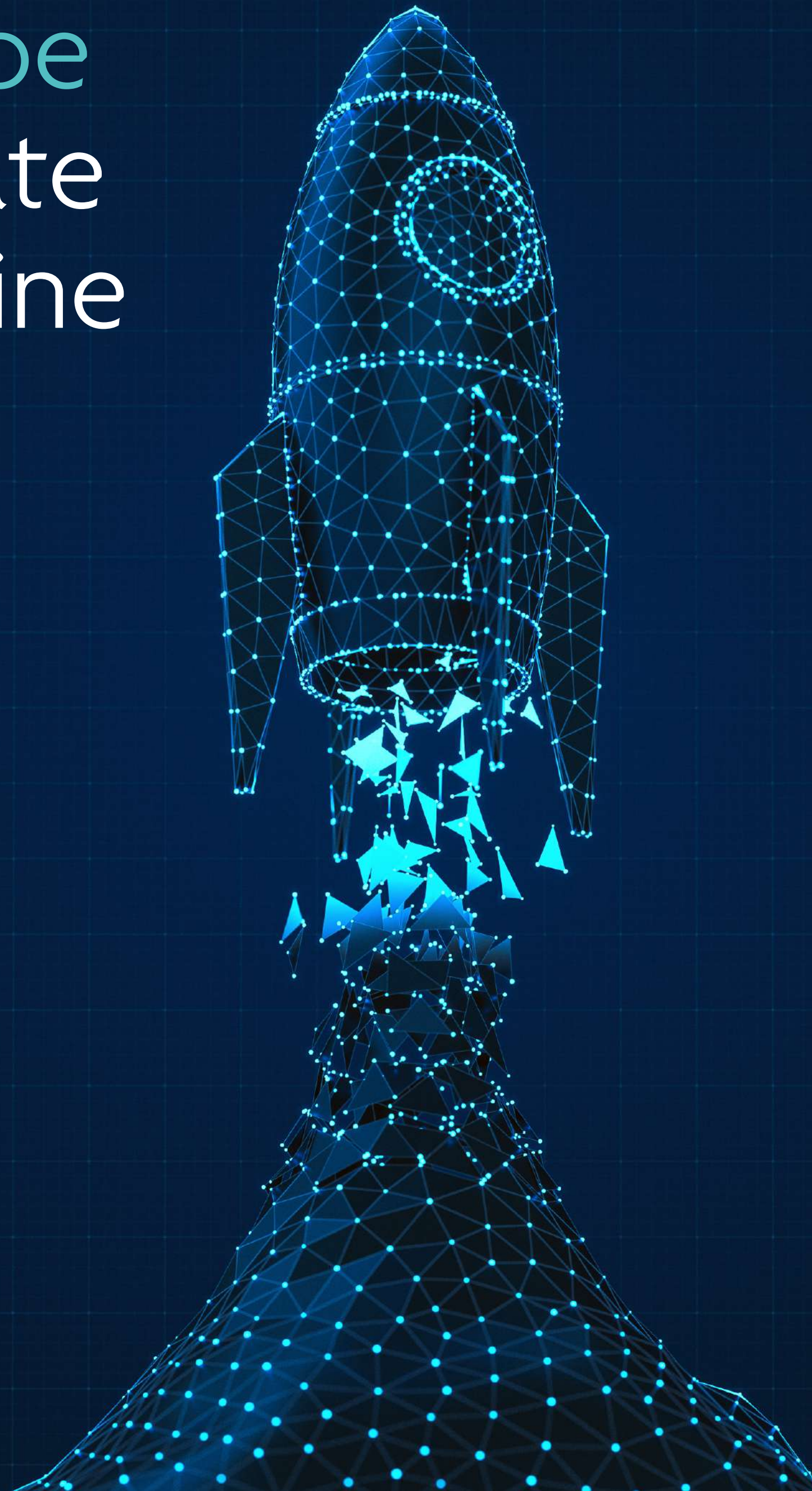
Materials & equipment
innovation through
SUPPLIERS HUB

imec

Pivotal moment



Chips Acts should be
the fuel to accelerate
the innovation engine



A night view of Earth from space, showing city lights and the curvature of the planet. A network of white lines and dots is overlaid on the image, suggesting global connectivity or a value chain. The text is centered in the middle of the image.

**Need strong collaboration
across (like-minded) countries
across the entire value chain**



mtec

embracing a better life