# Electronic & Electrical Engineering

## Information for Stage 1 Students

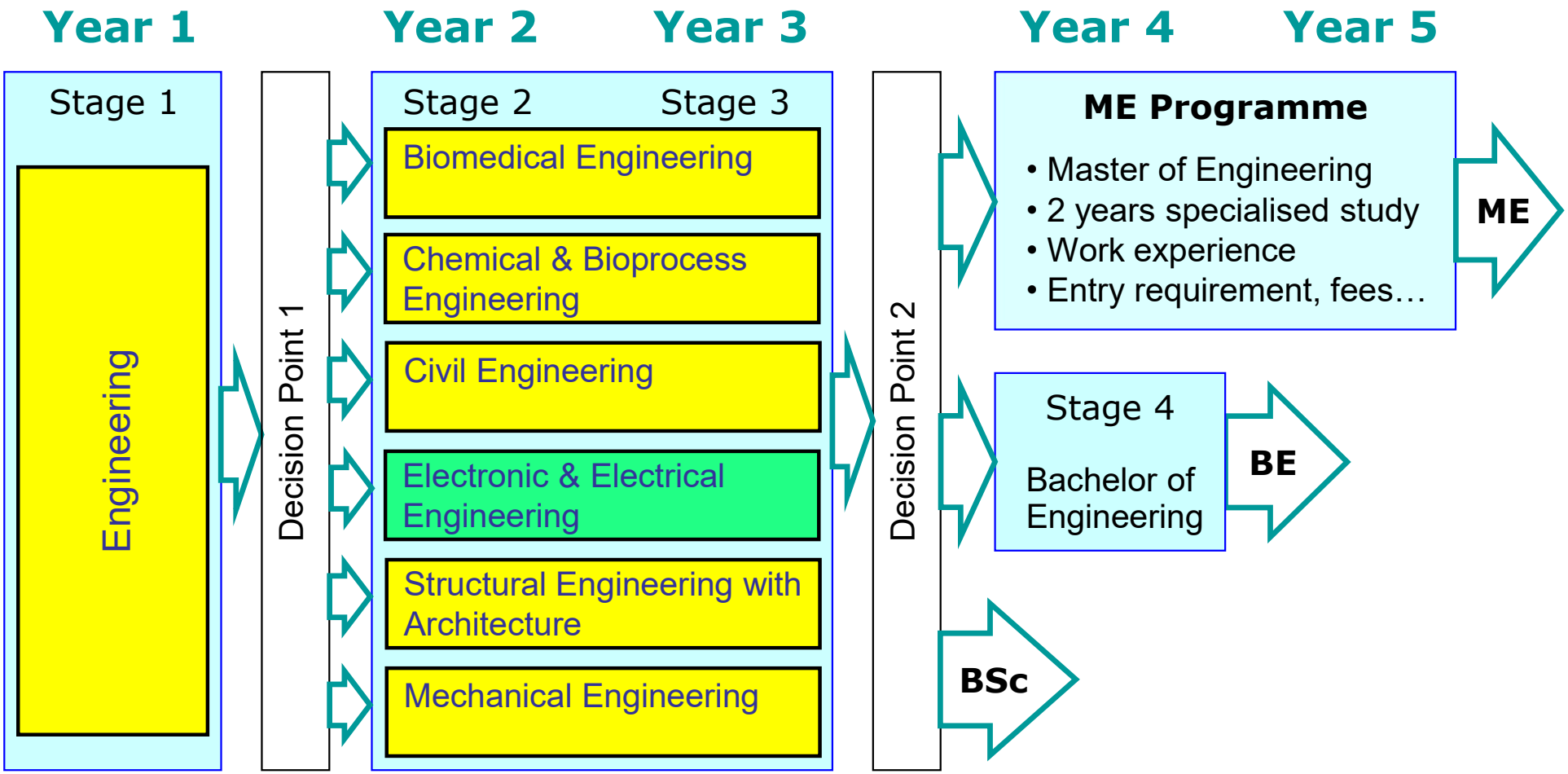
## February 2025

Dr Nam Tran (nam.tran@ucd.ie)

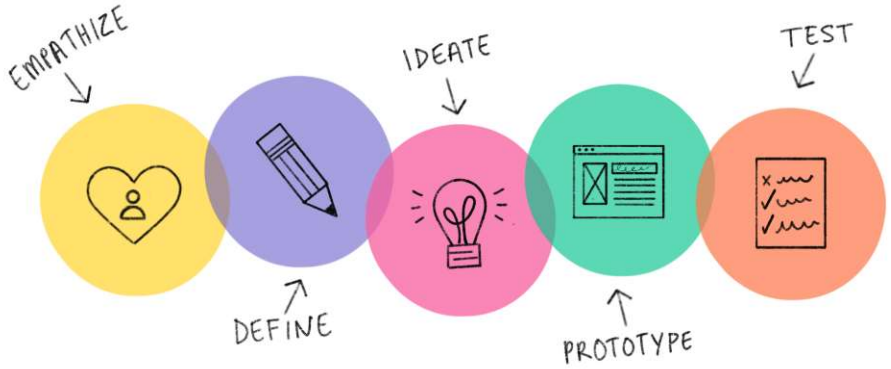

**UCD School of Electrical and Electronic Engineering**

**Scoil na hInnealtóireachta Leictrí agus Leictreonaí UCD**

# UCD Engineering Pathways – DN150



# What Do Engineers Do?




- Design and Innovate
  - create things that did not exist before
  - maybe a completely new concept
  - maybe just better, cleaner, safer, cheaper…
- Solve problems
  - making the world better (or some small part of it)
  - you might work on a few big problems in your career
  - or many smaller problems

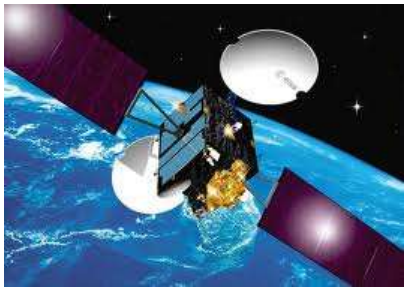
# Electrical Engineers

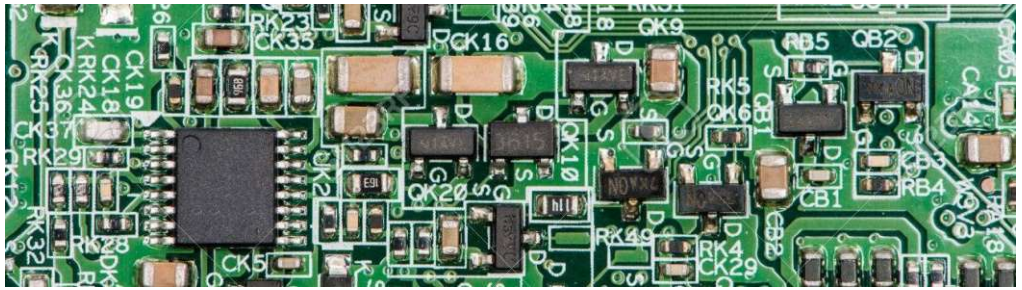
- Focus on electricity as a form of energy
  - for heat, light, transport, machines, etc.
  - usually large scale, high power
- Generating electricity – many new challenges
  - renewable energy is changing the norms…
- Transporting electricity to where it is needed
  - the "grid" is critical infrastructure in the 21st century
  - not just big wires now – "smart grid" needs control, communications, optimisation, etc.

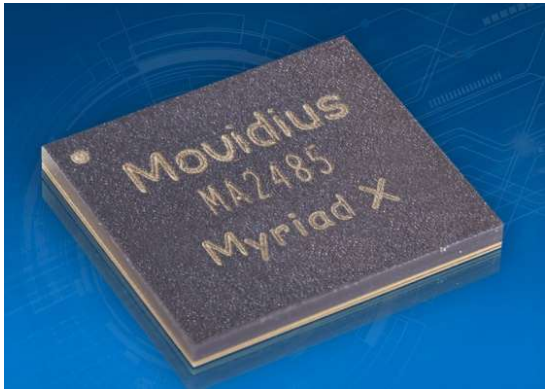
# Electrical Engineers

- Storing electricity – on a large scale
  - would bring huge benefits with renewable generation
- Electrifying transport – some good progress
  - but many problems remain to be solved
  - need chemical and mechanical engineers on the team
- Electrical machines, electrical installations
  - in every building, domestic, commercial, industrial
  - all designed by electrical engineers

# Electronic Engineers



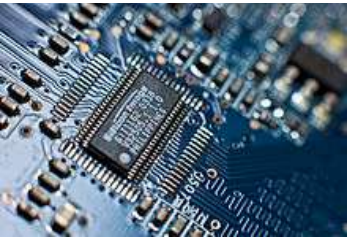




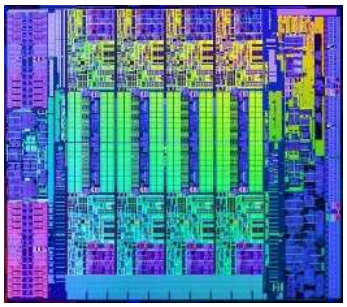

Intel Movidius

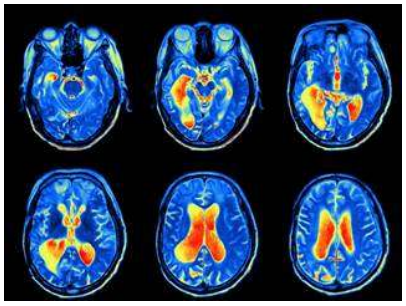
- Focus on electricity for information
  - computers – storing and processing information…
  - telecommunications – moving information…
  - entertainment – delivering content, gaming…
  - usually low power – do more with less energy?
- Electricity for control
  - electronic controls in aircraft, cars, washing machines…
  - often hidden, now becoming connected…

# Smart Systems



- Many different systems
  - getting "smarter"
  - connecting to the Internet
    - "Internet of Things"
  - healthcare devices, wearables
  - home appliances
    - TV, washing machine…
    - home security, automation…




# Why Choose Electronic/Electrical?

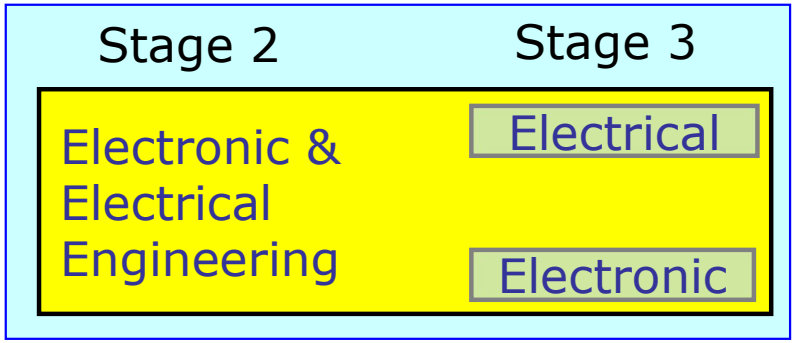

- Interesting and exciting field
  - technology is changing all the time
  - making possible new products, new systems…
  - you have an opportunity to be part of that!
- Broad field – you can specialise further later
  - within the degree programme (more on this later…)
  - or after graduation – where you work, what you do…
- Choose to suit your aptitude & interests
  - relies heavily on maths – design, analysis, etc…
  - computer – use as a tool, to solve complex problems…
    - also write software, design hardware…

# Electronic & Electrical Stage 2

- Computer Engineering
- Digital Electronics
- Electrical & Electronic Circuits
- Multivariable Calculus
- Solid State Devices
- Communication Systems
- Electrical Energy Systems
- Electromagnetic Fields
- Electronic Circuits
- Statistics & Probability

- Fundamentals of Electronic & Electrical Engineering
  - both areas build on the same principles
  - so common curriculum in Stage 2
- Apply your knowledge to real-world problems
  - lots of lab work, mostly in groups of two…

# E & E Stage 3




Core modules:

- Circuit Theory
- Computer Science
- Signals and Systems
- Multivariable Calculus
- Analogue Electronics
- Electromagnetic Waves
- Modelling and Simulation
- Signal Processing

Options: choose two of:

- Electrical Machines
- Power Systems Engineering
- Communication Theory
- Digital System Design

- Specialise further: Electrical or Electronic
  - by choosing two option modules
- More complex topics, but more interesting…
  - still plenty of laboratory & computer work

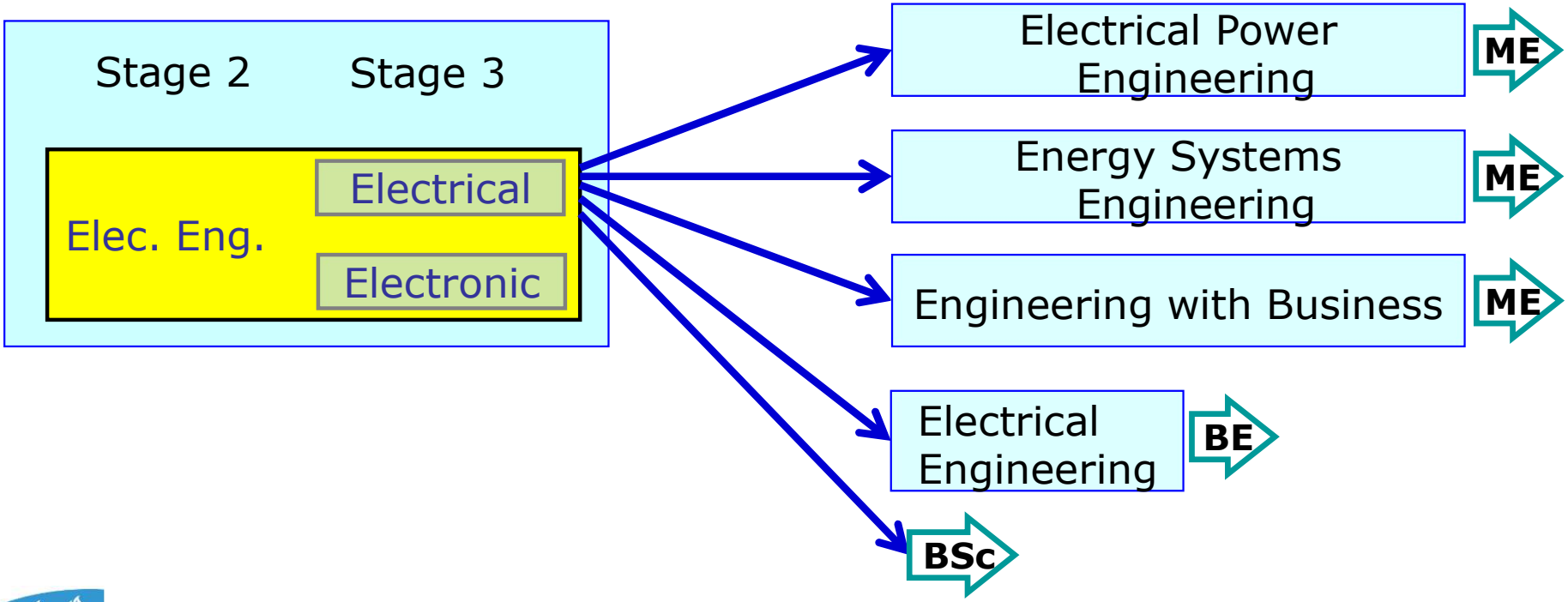
# Study Abroad

- Usually in Stage 3
  - arranged through UCD Global…
  - need GPA ≥ 3.00  (for all Engineering students)
  - normally, all core module grades at least C-
- Popular destinations:
  - Australia
  - Canada
  - Singapore
  - USA
    - at least 10 different universities
- Europe: Erasmus
  - France
  - Germany
  - Switzerland
  - Malta
  - …

# Decision at end of Stage 3

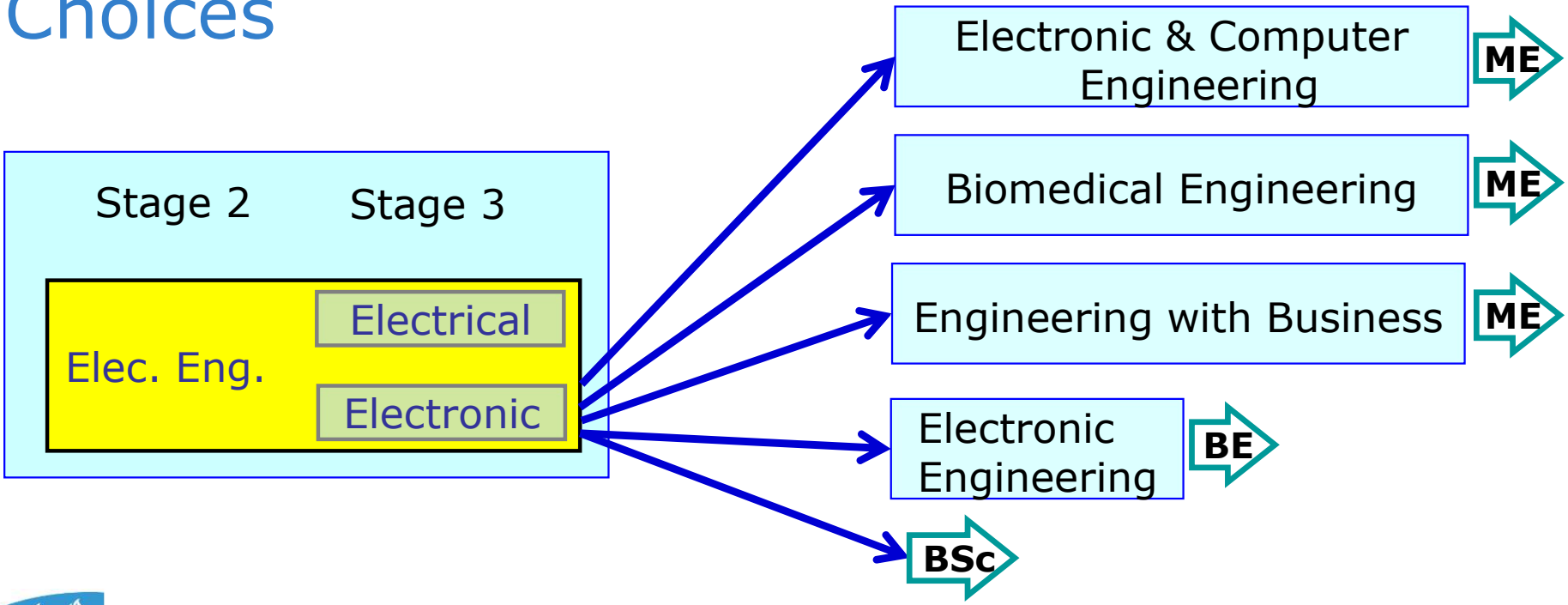
- Continue towards BE (bachelor of engineering)
  - four years study in total
  - traditional qualification for a professional engineer
- Enter ME (master of engineering) programme
  - two years specialised study (five years total)
  - various options available…
  - entry requirement, fees…
- Option to graduate with BSc (Engineering Science)
  - 3 years, 180 credits, not a professional qualification
  - for work or further study in another area
  - or for an ME programme elsewhere in Europe

# Electrical Engineering Choices




- Other options are possible…
  - these are the obvious paths in UCD at present
    - ME Energy Systems is also available from the Mechanical route

# Electronic Engineering Choices




- Other options are possible…
  - these are the obvious paths in UCD at present
    - ME Biomedical is also available from the Biomedical route

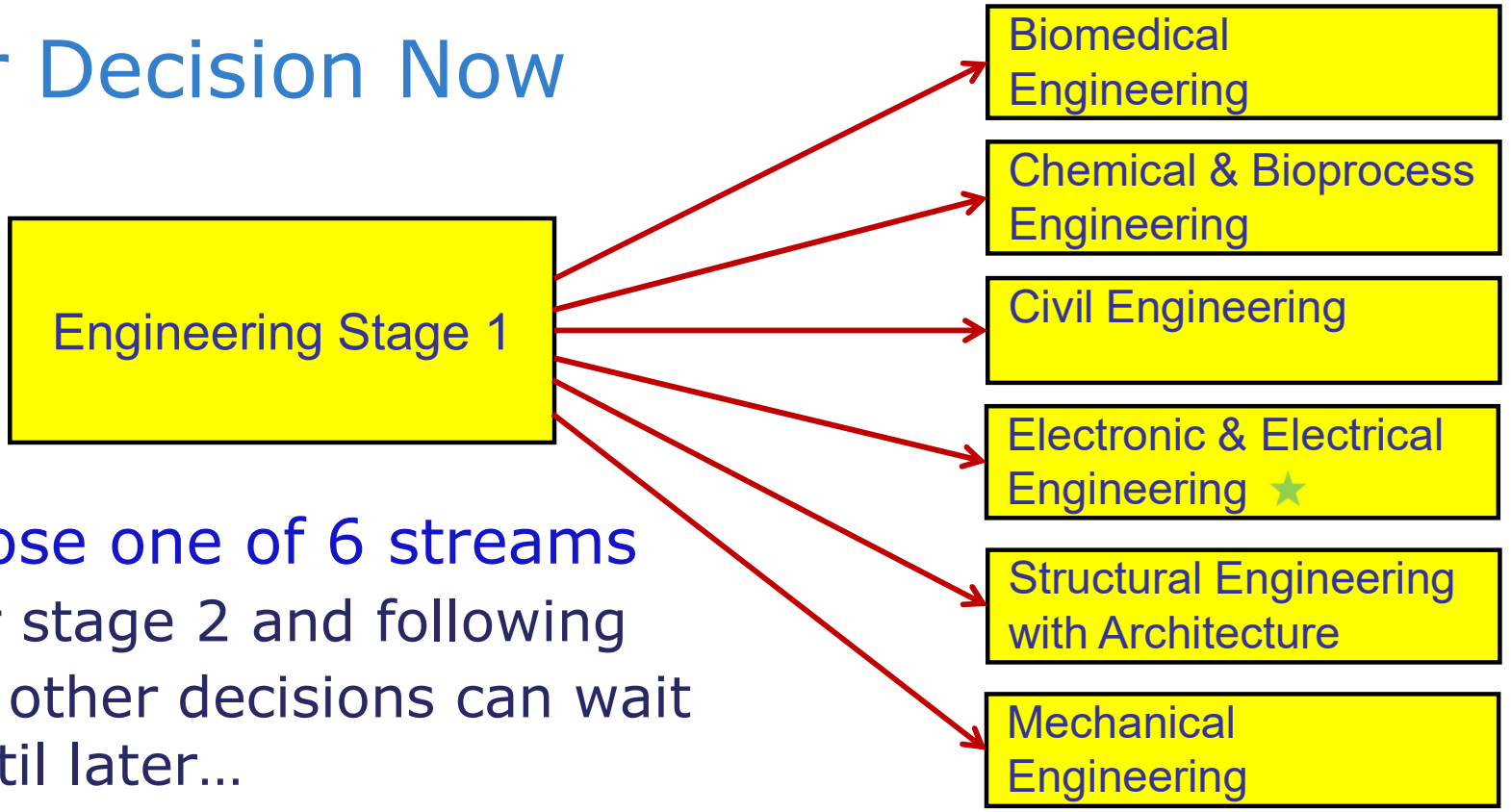
# ME Programmes

- Two years of study in your chosen field
  - making five years in total
  - includes a major project at Master level (20-25 credit)
  - includes a work placement (usually 7 months, 30 credit)
    - UCD will arrange this work placement
- Entry requirement
  - based on stages 2 and 3, weighting factors 3 and 7
  - minimum GPA 2.8 (equivalent to a C grade)
- Tuition fees
  - currently €9530 per year for EU students
  - usually only have to pay for last year…

# Scholarships for ME Programmes

- Réalta scholarships from UCD - €9500
  - aimed at students for whom ME fees are an issue
- Industry wants more graduates in these areas
  - so offering incentives to encourage more students
  - scholarships vary from €2000 to €3000
    - for a small number of students each year
  - terms and conditions apply!

# Your Decision Now




- Choose one of 6 streams
  - for stage 2 and following
  - all other decisions can wait until later…
- Decision needed by April

# ME Electronic and Computer Engineering

**LEAH GREENE**

Leah Greene
Fifth Year (Stage 2 of ME Electronic and Computer Engineering)
leah.greene@ucdconnect.ie

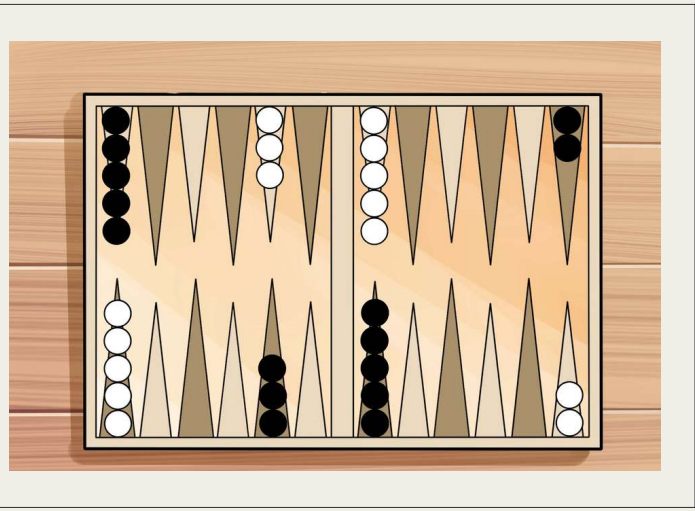
## WHY ELEC?

- EEEN10010 module
- Mechanics
- Biomed/Elec
- Coding
- Lots of opportunities

## SOME PROJECTS

**Hangman**
*Computer Engineering, 2nd Year*


**Digital Clock**
*Digital Electronics, 2nd Year*



**Calculator and Bike Light**
*Digital System Design, 3rd Year*


**Solitaire and Backgammon**
*Software Engineering, 4th Year*

## FINAL YEAR PROJECT

# SLAM-based Real-time 3D Digital Mapping of Cave-Like Structures with a UAV

## INTERNSHIP

Start up Biomedical Company

Monitoring device for Heart Failure Patients

Worked on the Electronics team

FIRE1

# Thank you!

## ANY QUESTIONS?

Leah Greene
Fifth Year (Stage 2 of ME Electronic and Computer Engineering)
leah.greene@ucdconnect.ie

MIDAS IRELAND

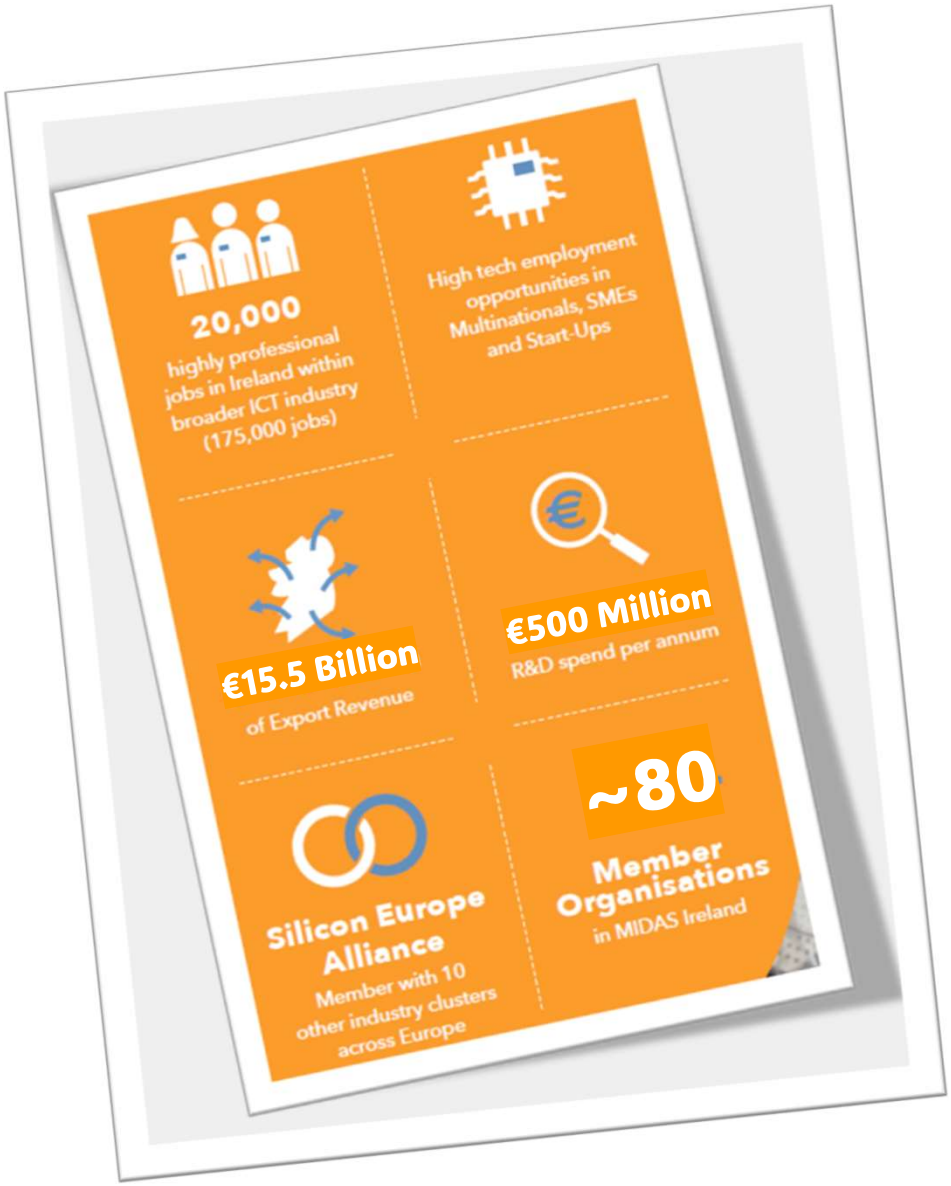
# Industry Presentation to UCD

***February 19th, 2025***

# Introduction

MIDAS IRELAND

- Glenn Gilmartin - Physical Design Engineer, AMD - UCD Graduate
- David O'Carroll - Design Automation Engineer, Intel - UCD Graduate
- Kelly Kaulsay - Physical Design Engineer, Intel - UCD Graduate
- Eoin Lambe, AMD - MIDAS Ireland Education & Outreach
- John Blake - MIDAS Ireland General Manager



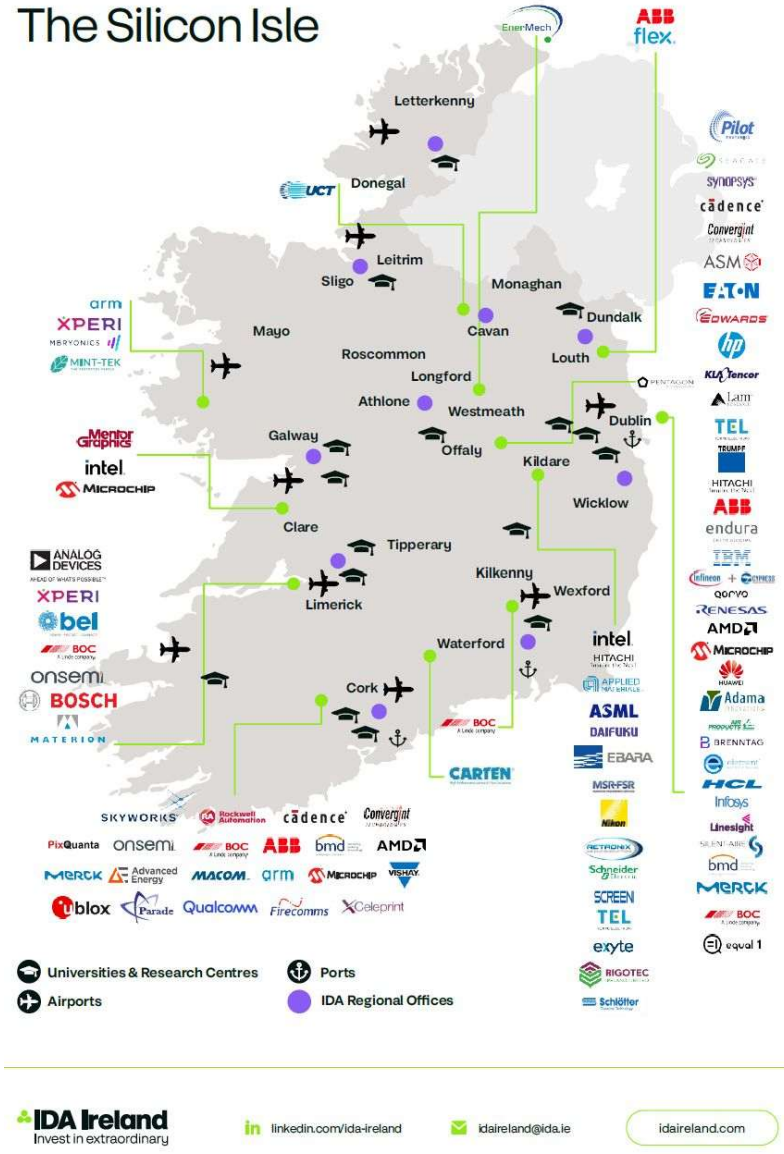

MIDAS IRELAND

**Industry Association for Semiconductor / Microelectronics sector**

**Industry led partnership, established in 1999**

- **Multinational and indigenous companies**
- **Educational organisations**
- **Research institutions**
- **Government agencies**
- **About 80 member organizations today**

**Working collaboratively together to address common challenges**

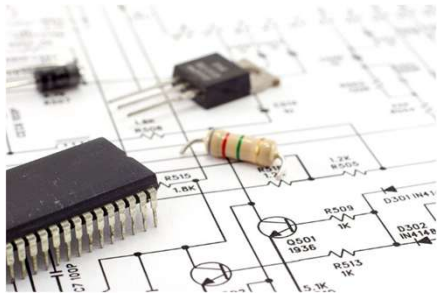


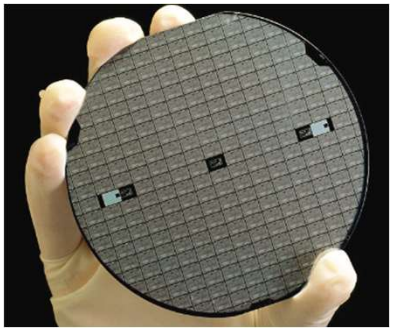

# The Semiconductor Sector in Ireland

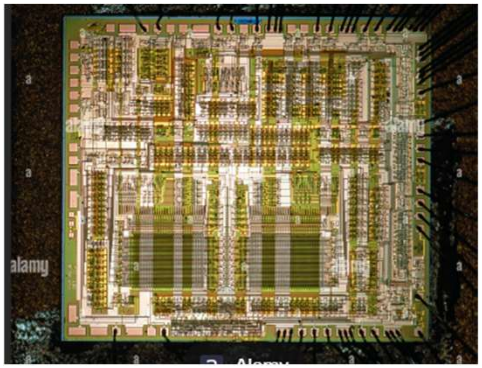
MIDAS IRELAND

- The overall semiconductor sector started in the 1950's
- It started in Ireland with the arrival of Analog Devices in the mid 1970's
- The NMRC (now Tyndall) started in 1980
- Intel arrived in the late 1980's
- Xilinx (now AMD) started in the 1990's
- Many other global companies have come to Ireland and many local companies have started up during the following 30 years

# The Semiconductor Industry

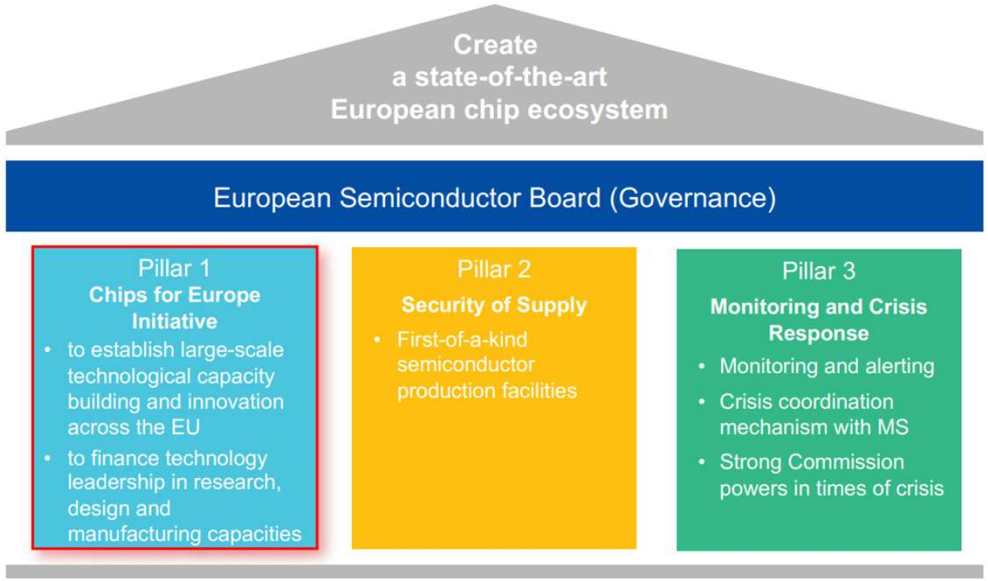






- Electrical circuits are designed and manufactured onto semiconductor wafers
- These wafers are then divided up into chips, packaged up and tested to become Integrated Circuits (ICs)
- These ICs then get designed into a whole range of end applications, from phones to cars, computers to communications systems, from medical devices to industrial applications
- Market will double to $1T by 2030
- Continuous new applications
  - e.g. AI, Quantum Computing, Photonics

# European Chips Act (2023)

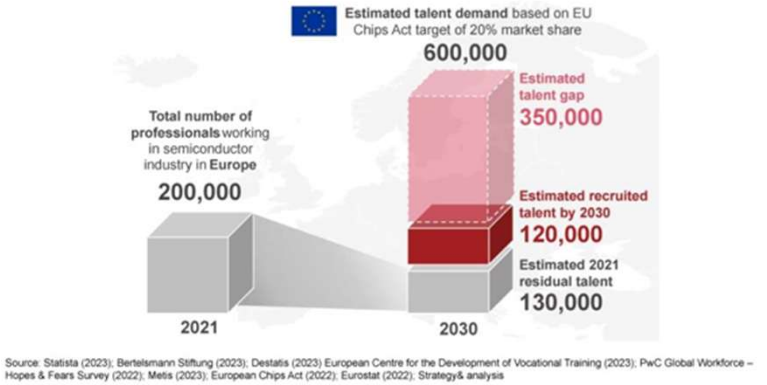



**€43b committed to grow the EU Semiconductor Ecosystem**

**Access to talent is a primary challenge**

MIDAS IRELAND

**Forecast: Estimated talent gap in Europe's semiconductor landscape in 2030**

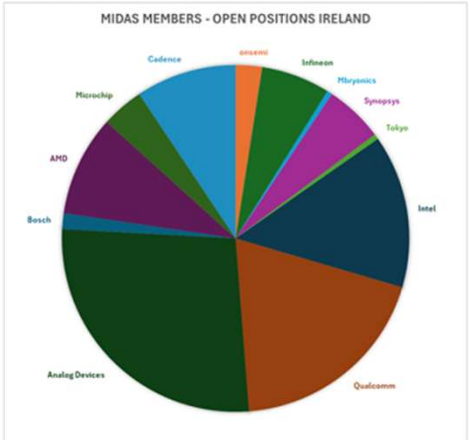


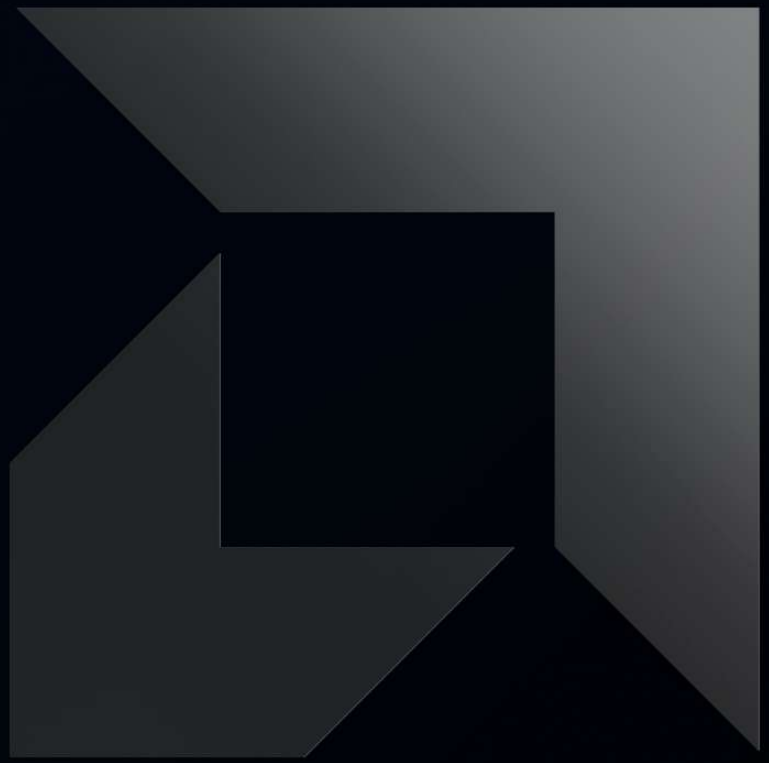

Source: Statista (2023); Bertelsmann Stiftung (2023); Destatis (2023) European Centre for the Development of Vocational Training (2023); PwC Global Workforce – Hopes & Fears Survey (2022); Metis (2023); European Chips Act (2022); Eurostat (2022); Strategy& analysis

**€13.5bn**
Exports

**20,000+**
Employed

**€450m**
spent on RDI





# Electronic Engineering

Physical Design Engineer at AMD

**Glenn Gilmartin**

AMD
together we advance_

# About me!

- From Roscommon!
- Started in UCD Eng. in 2019
- Initially set on Mechanical Eng.
  - Interest in CAD design
  - Formula Student Mechanical Captain
- Enjoyed circuits & programming modules
  - Very logical way of thinking
  - Grew up with electronics
  - Mystery to electronics

UCD DUBLIN

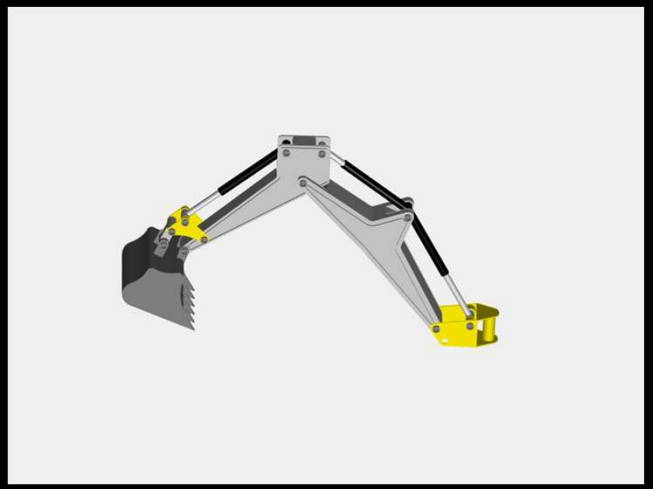
UCD EngArch

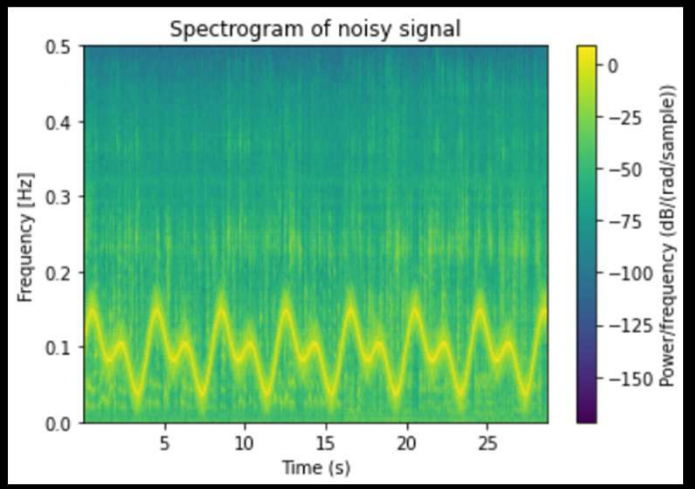


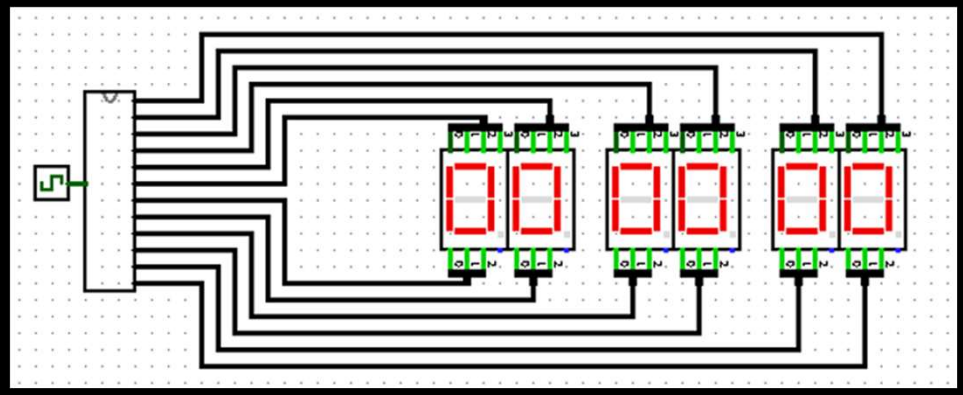

AMD
together we advance_

# What's to come?

- Circuit Design
  - Build & test in labs
- Programming
  - Developing Games
  - Modelling Systems
- Communication Systems
- Signal & Image Processing
- Long nights…





# Electronics In Ireland







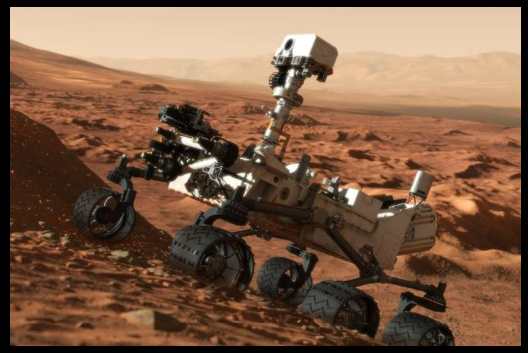





# Overview - AMD


- Multinational semiconductor design company
- State of the art microprocessors – CPUs, GPUs
- ~26,000 employees worldwide
- Different fields of application

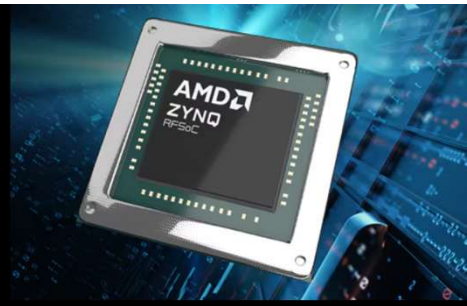
Sony PS5
and Microsoft XBox



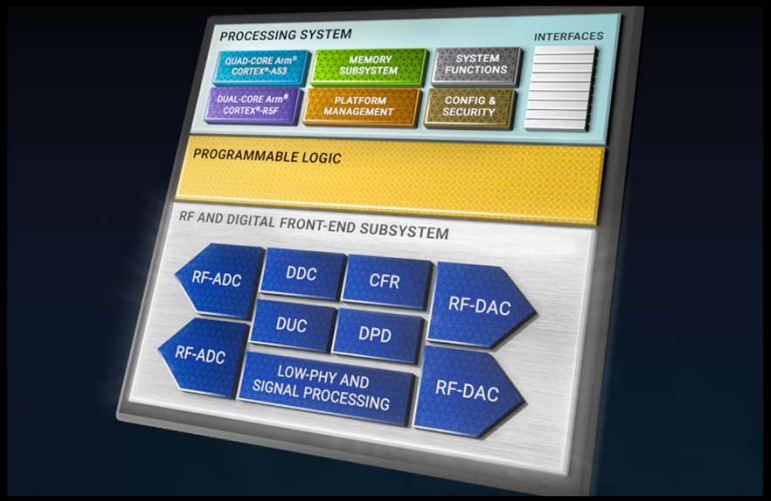
MARS Curiosity Rover

Mercedes Formula 1 car

# My Pathway to AMD

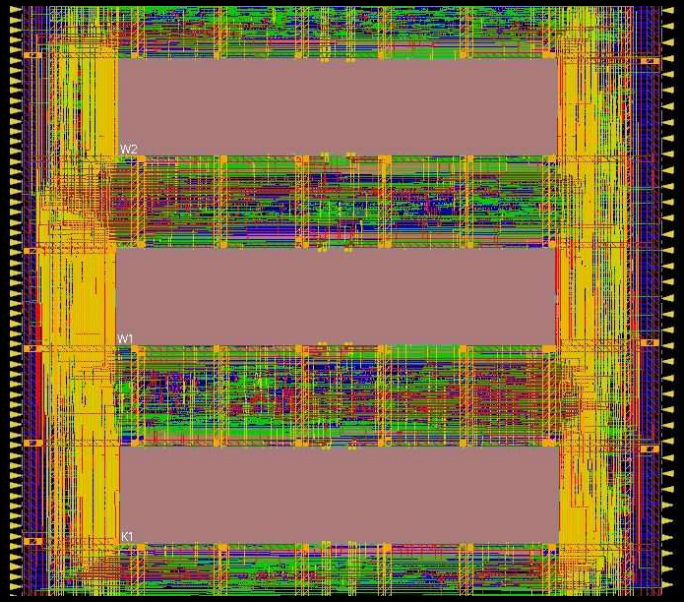


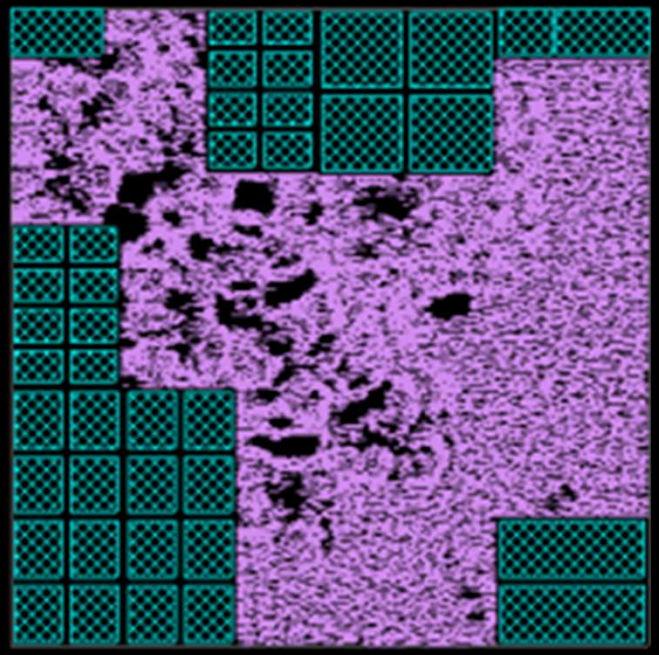

- Summer Internship in 2021 – 3 months
  - Software to model GPU architecture, C++
- Integrated Internship in 2023 – 8 months
  - Digital hardware design – several sub teams
  - Xilinx team
- Graduate Engineer – Sept. 2024
  - Physical design engineer
  - High speed data converters
- RFSoC product
  - Wireless – 4G & 5G
  - Test & Measurement
  - Radar Communication
  - Billions of transistors!



# What is Physical Design?

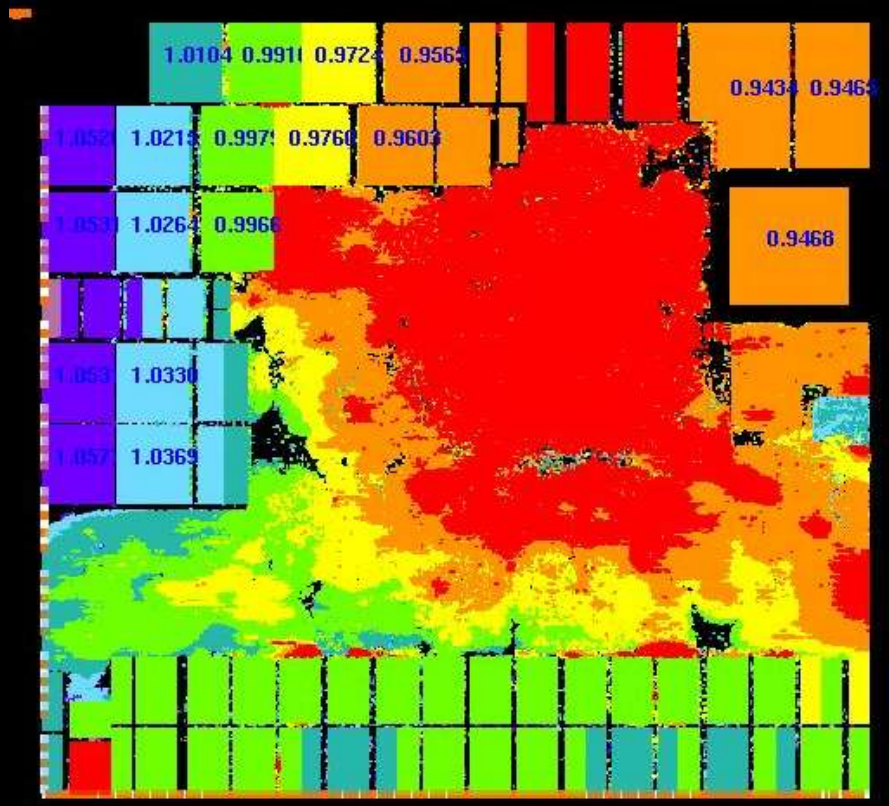
- Consider the Physical constraints on an IC
- Considerations
  - Power
  - Area
  - Congestion
  - Timing
  - Frequency
- Some of what we do:
  - Floorplanning
  - Placement
  - Clock tree design
  - Routing
  - Power analysis



# Case Study: Voltage Drop Analysis

- Chips often need to be small
- Cells are placed close to each other
- Puts a strain on the power supply
- Cells are very sensitive to power supply
  - Characteristics vary widely
- Restrict the placement of cells in region
  - Distribute cells across chip



# Outside of Work

# Any Questions?


AMD

February 2025

# UCD Talk

David O'Carroll & Kelly Kaulsay

Intel NPU Team

intel

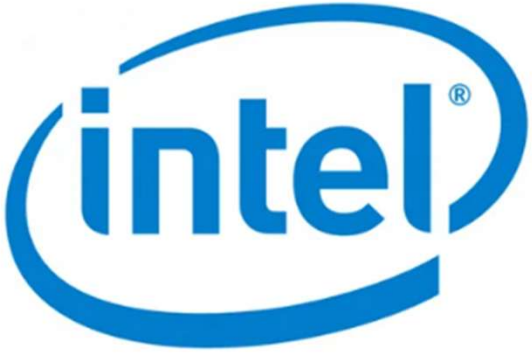

intel

# David BIO


# Education


- Started General Eng UCD in 2018
- Planned to pursue Biomed/Mechanical
- Elec and Computing Modules changed my mind
  - ❿Loved Coding (not very good though)
- Took the leap:
  - Masters in Elec & Computer 2023
  - Thesis on Machine Learning

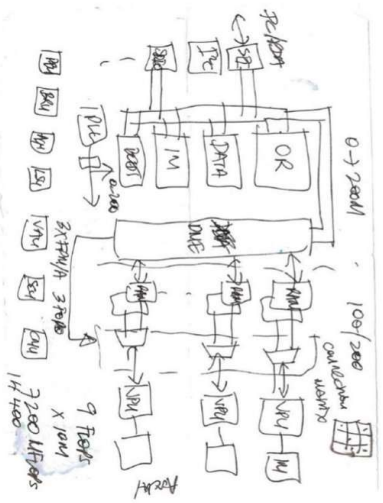
# Career (Short)




- Intel internship 2022
- Returned to UCD for Masters
- Delighted to get a job back in Intel 2023
- Working as a Desing Automation Engineer on the NPU team for 2 years

# History of Movidius

- AI Company started on a menu card in Dublin 2007
- Acquired by intel in 2016
- Now known as NPU team




intel.

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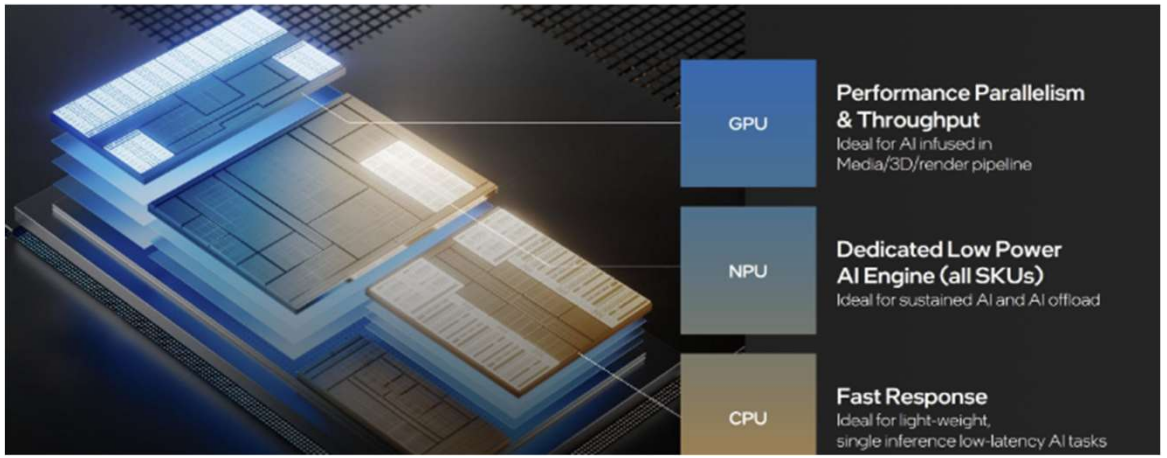
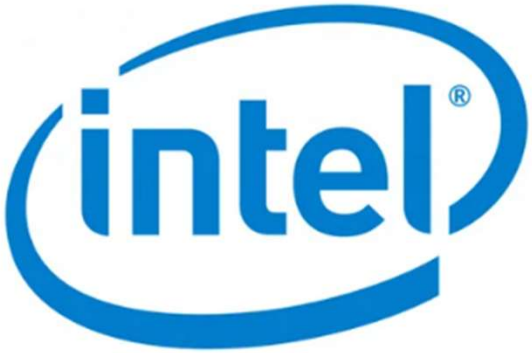


# A Day in the life



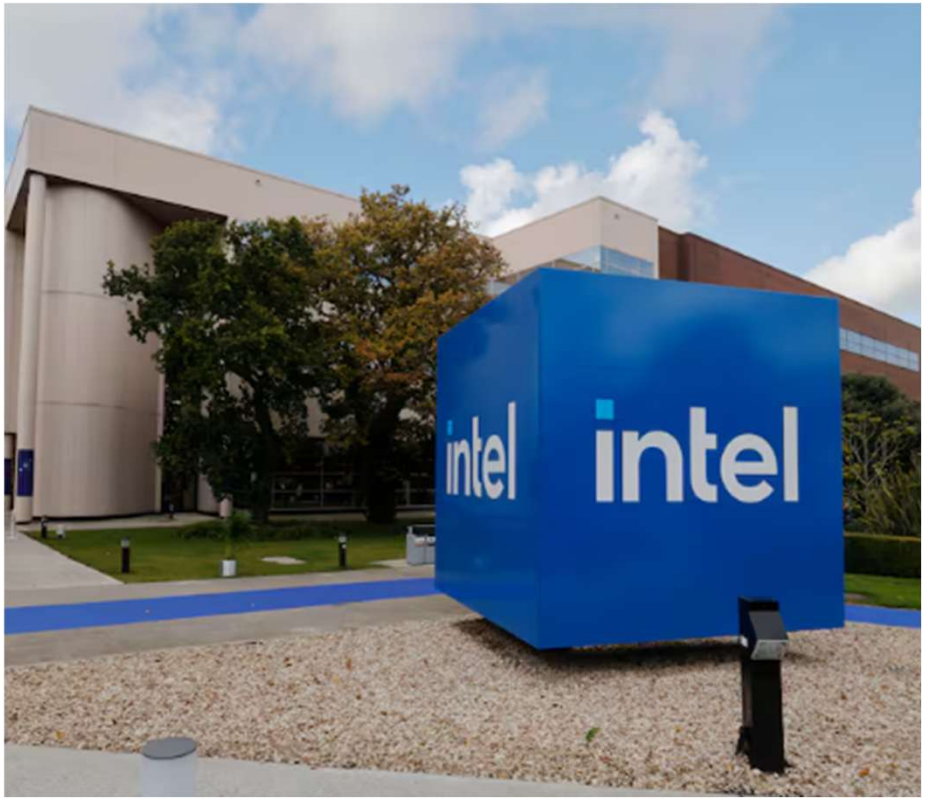

- Log in from home/office.
- Follow - up on priorities , fixes for active issues
- Morning team meeting
- Training
- Project work – Development of Dashboards/Flow enhancement scripts
- Meetings with team members/customers
- Collab with many different teams so large variety
- Every day is completely different!

# Transition From College

- The transition was a lot easier than I expected
- Colleagues only seem daunting in the interview.
- Degree will give you good base
  - So much learning on the job
- Final year project is great experience

# What makes Intel a great Place to work

- Facilities:
  - 2  onsite gyms
  - 3 canteens, 3 cafes
  - Optician, Dentist, Social rooms & Grafton Barbers
- Flexibility
  - Hybrid work model
  - Remote work options
- Atmosphere
  - Mix of young and experienced Professionals
  - ➓No grad contracts



# Education

- Started Engineering in UCD in 2019
- Planned to do mechanical (because I loved cars)
- Ended up picking Electronic Engineering!!!
  - ⓾ Because all cars were becoming electrical!!
  - ⓾ Became fascinated with machine learning / AI
- Went on to do a masters in Electronic & Computer 2023
- Thesis on Deep Learning Assisted Radars
  - Doing my thesis I realized the importance of NPUs/AI accelerators
    - My thesis took 1 week to run on my normal computer and 8 hours with an AI accelerator!

# My Career

Intel internship 2023 – Physical Design Intern

Did my thesis on Deep Learning Assisted Radars

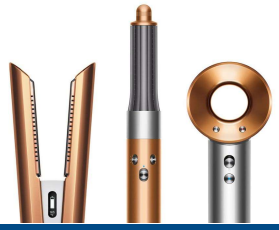
Ended up using AI accelerators (like the ones we make here at Intel) to help speed up and make more intricate deep learning algorithms!

Back as a full-time physical design engineer since 2024

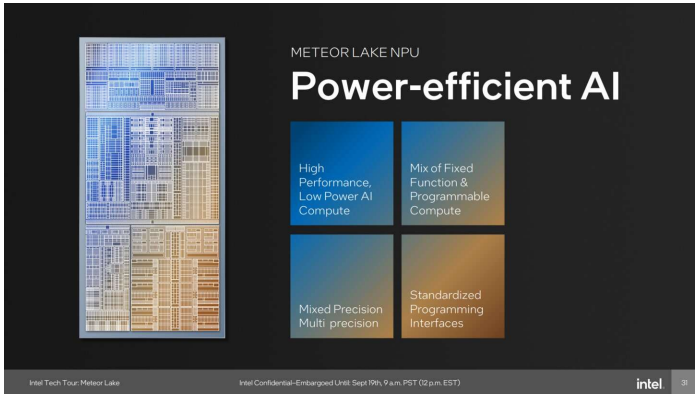
# Why Electronic (and Electrical) is the best

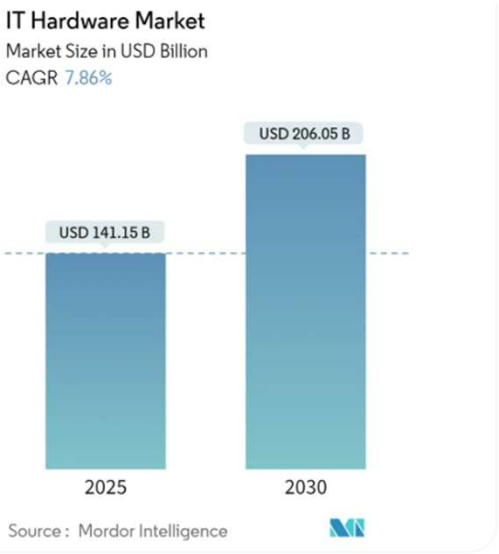
Careers in

- Computer hardware
- Computer software
- Any business/finance firm loves the way engineers are great problem solvers
- Robotics
- Renewable energy
- Biomedical devices/systems
- Aviation and automotive fields
- … basically, anything cool



# Why NPUs?



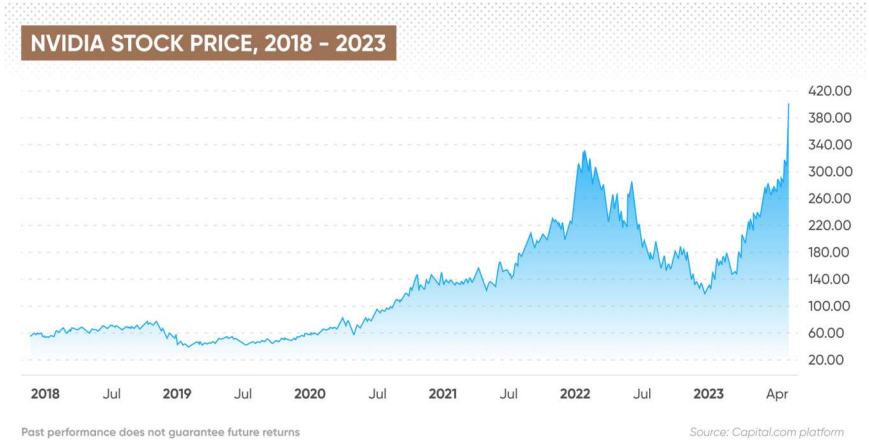




| | |
|---|---|
| Study Period | 2019 - 2030 |
| Market Size (2025) | USD 141.15 Billion |
| Market Size (2030) | USD 206.05 Billion |
| CAGR (2025 - 2030) | 7.86 % |
| Fastest Growing Market | Asia-Pacific |
| Largest Market | North America |
| Market Concentration | Low |

Major Players

DELL Technologies SAMSUNG hp acer intel

*Disclaimer: Major Players sorted in no particular order



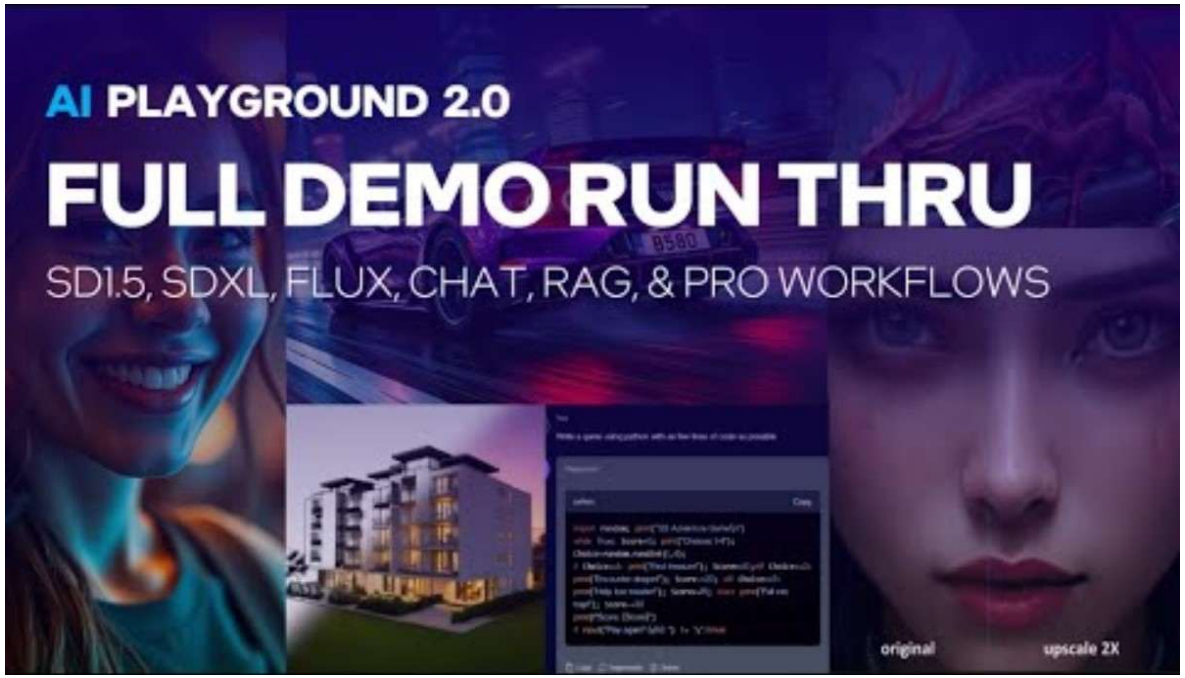

29.4%

The global AI accelerator market size was estimated at USD 19.89 billion in 2023 and is projected to grow at a CAGR of **29.4%** from 2024 to 2030. The market is growing rapidly, driven by a surge in demand for high-performance computing in artificial intelligence (AI) applications.

AI Accelerator Market Size & Trends - Grand View Research

www.grandviewresearch.com/industry-analysis/ai-accelerator-market-report

# Elec Today




- Such an exciting and innovative stream to work in
- Who knows what the future of this industry looks like.
- AI Playground 2.0 Demo Reel