

System on Chip

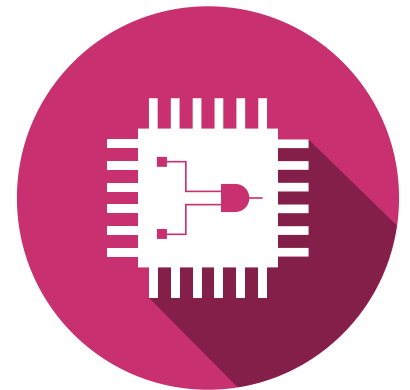
Course Embedded Systems (SEm)

SoC

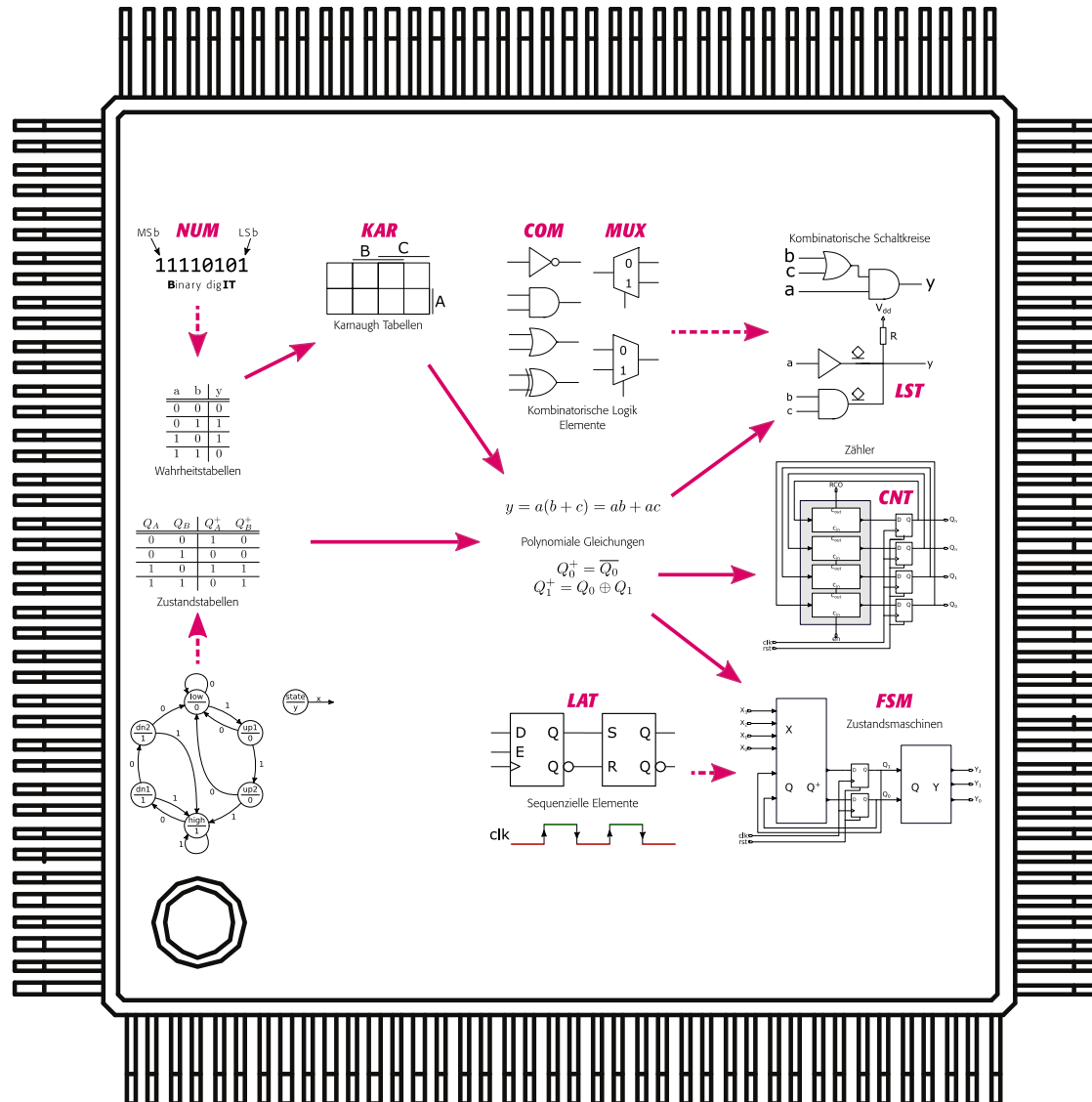


Silvan Zahno / François Corthay

Degree program Systems Engineering
Specialization Infotronics – Embedded Systems



Current content of the topic in the course



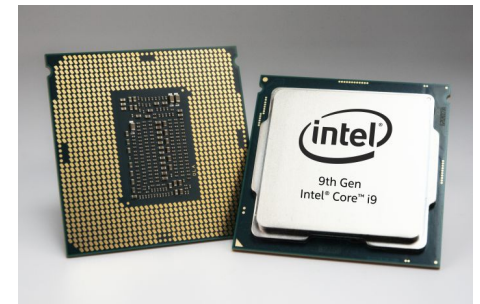
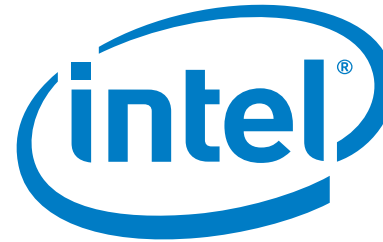
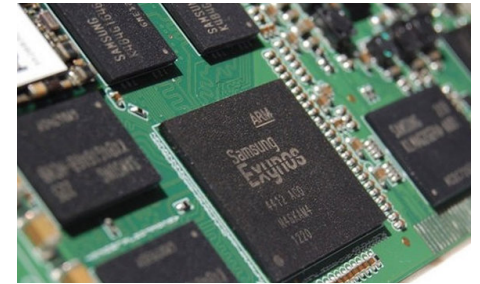
SoC Introduction

- **ARM vs. Intel**
- SoC Elements
- Example Apple M1

ARM vs Intel

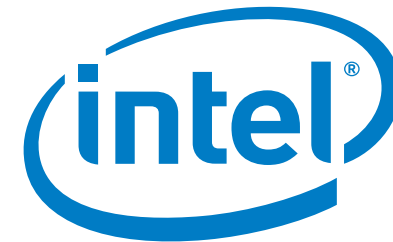
- ARM
 - Mobile Chips
 - Small and Light
 - Low Energy Consumption
- Intel
 - High End Powerful μ Processors
 - Broad Product Range

ARM



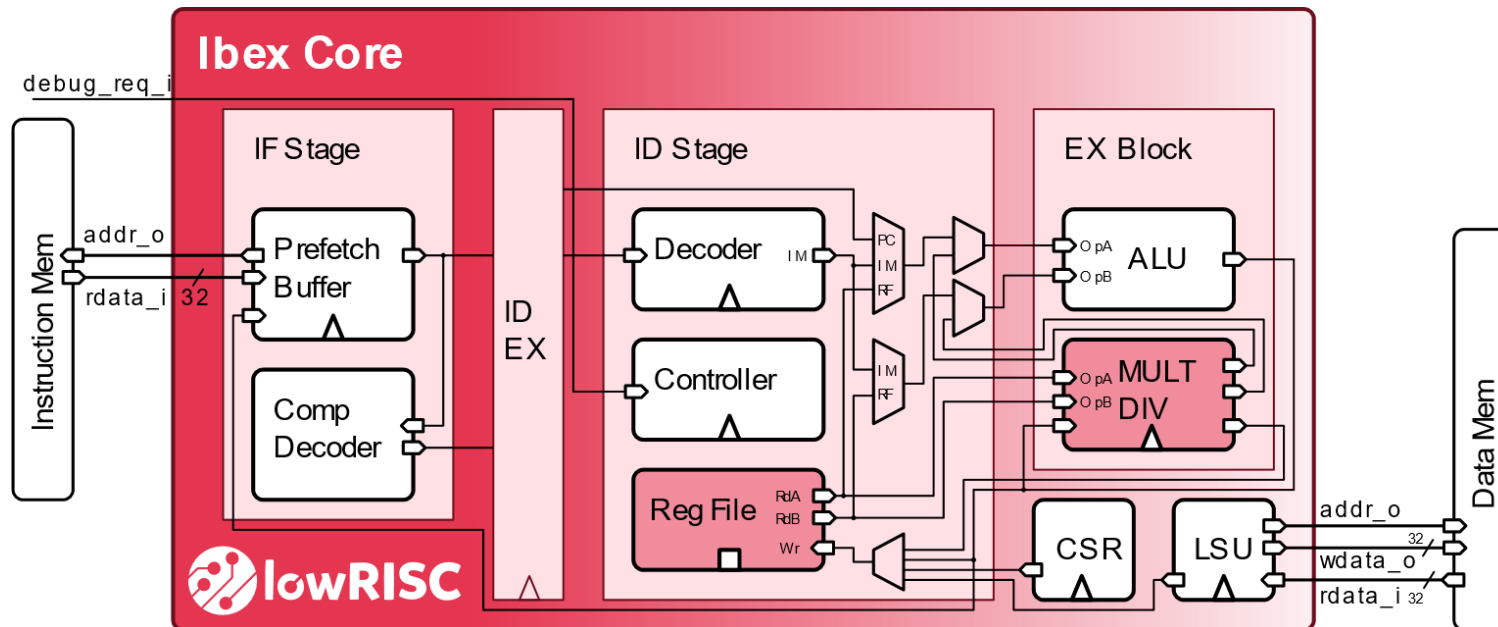
ARM vs Intel

ARM



Typ	ARM	Intel
Architecture	RISC Reduced instruction set computer	CISC Complex instruction set computer
Speed	Moderate	Important
Power Consumption	Important	Moderate
Compiler	Important	Moderate

ARM

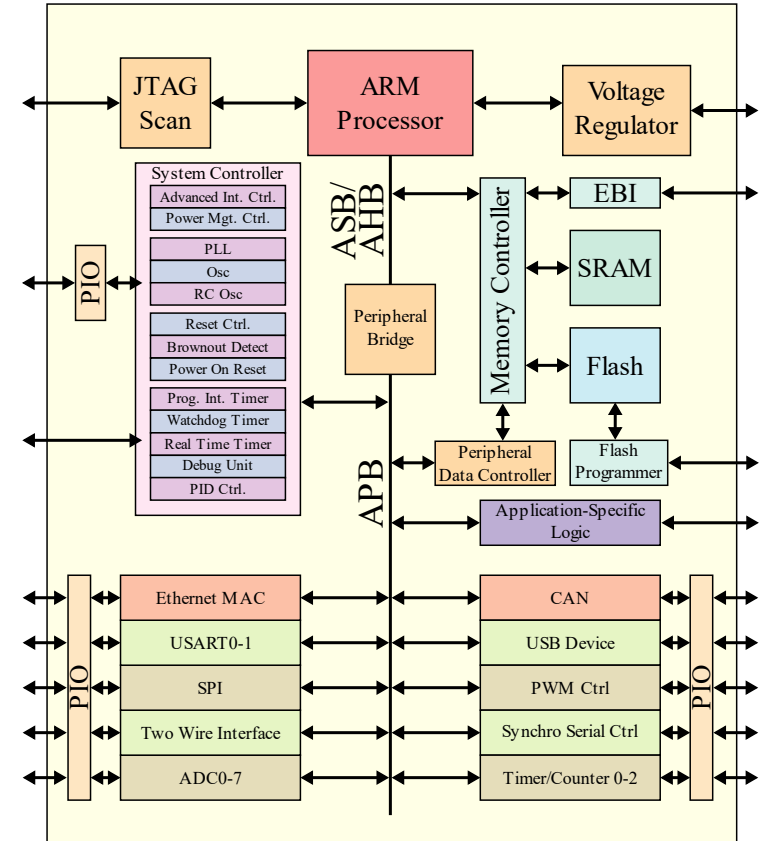


SoC Introduction

- ARM vs. Intel
- **SoC Elements**
- Example Apple M1

SoC Elements

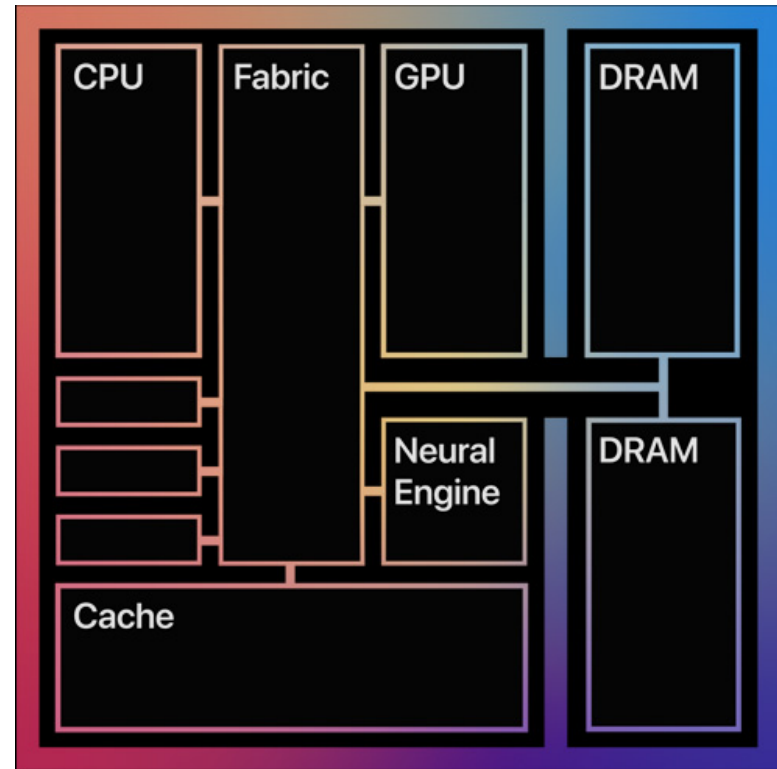
- Basic SoC
 - Bus
 - Processor(s)
 - Periphery
 - Thunderbolt
 - USB 2,3,4
 - PCI, PCI-E
 - CAN, RS232
 - Memory
 - Cache
 - RAM (Random Access Memory)
- Advanced SoC
 - GPU (Graphical Processing Unit)
 - DAC & ADC (Digital \leftrightarrow Analog Converters)
 - Machine learning Core



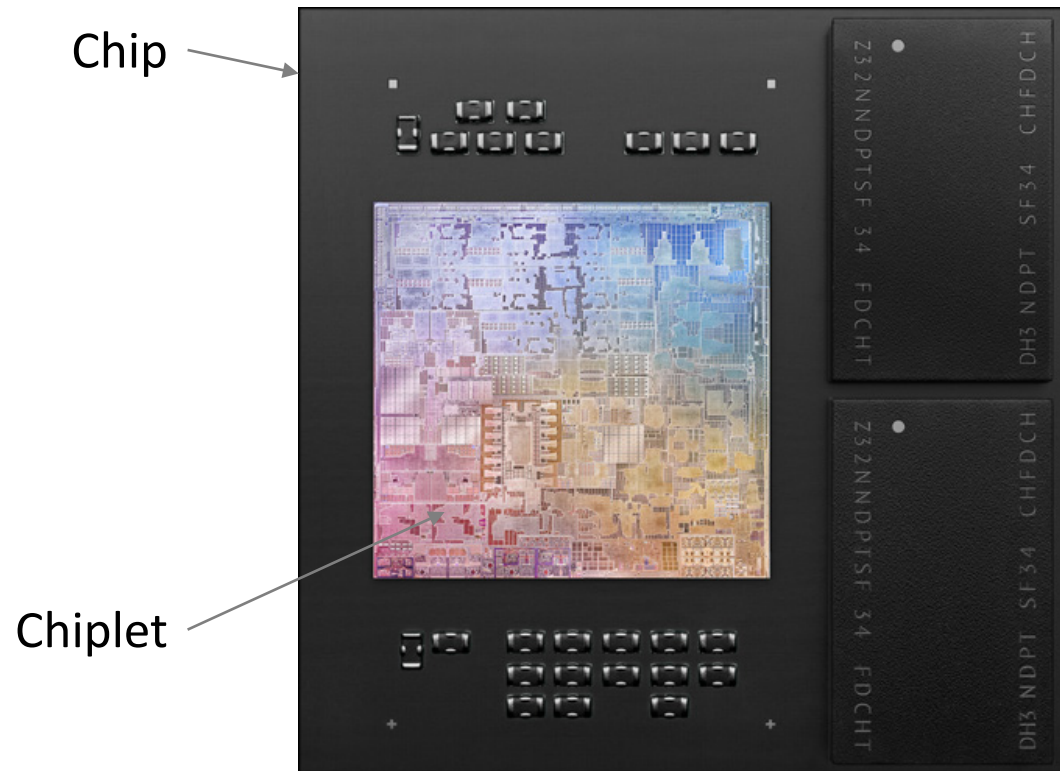
SoC Introduction

- ARM vs. Intel
- SoC Elements
- **Example Apple M1**

Example Apple M1



Example Apple M1



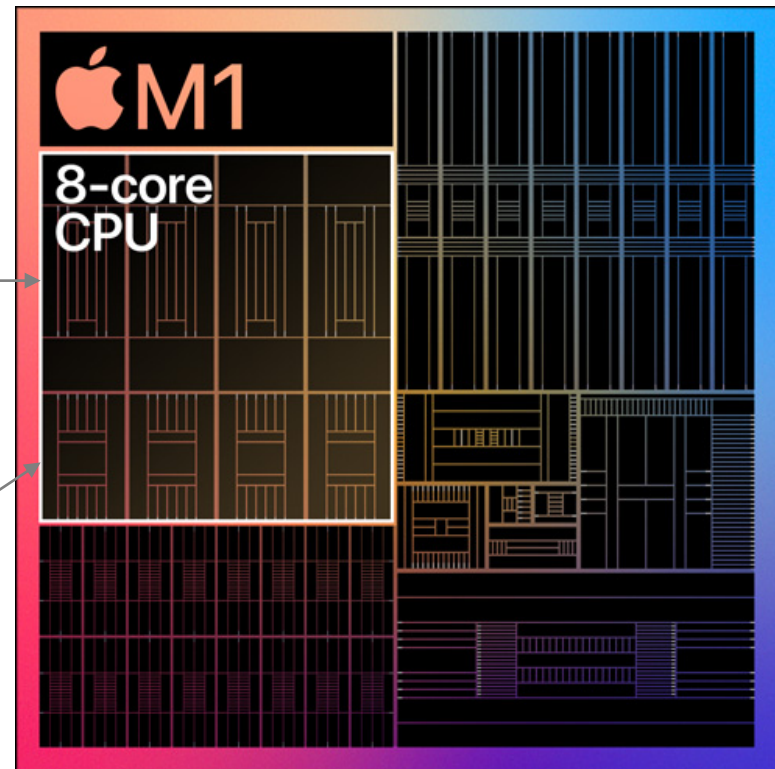
Example Apple M1

High-performance cores

Ultra-wide execution architecture
192KB instruction cache
128KB data cache
Shared 12MB L2 cache

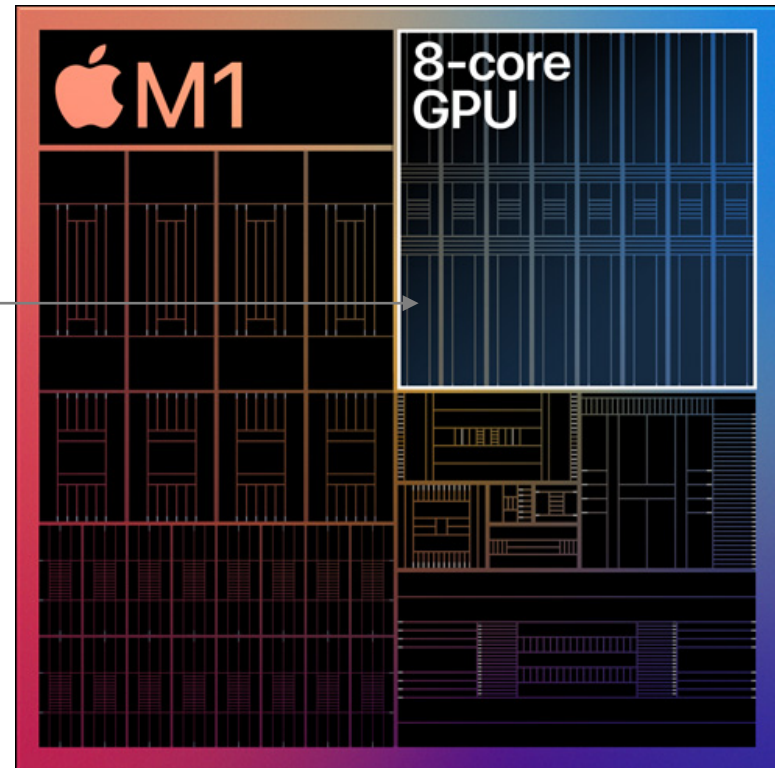
High-efficiency cores

Wide execution architecture
128KB instruction cache
64KB data cache
Shared 4MB L2 cache



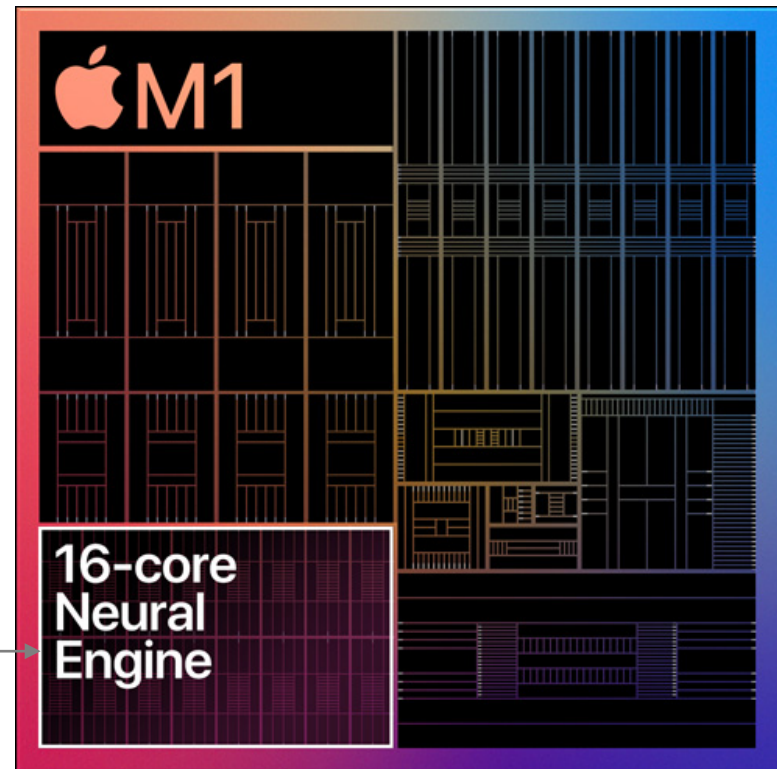
Example Apple M1

8-core GPU
128 execution units
<24,567 concurrent threads
2.6 teraflops
82 gigatexels/second
41 gigapixels/second

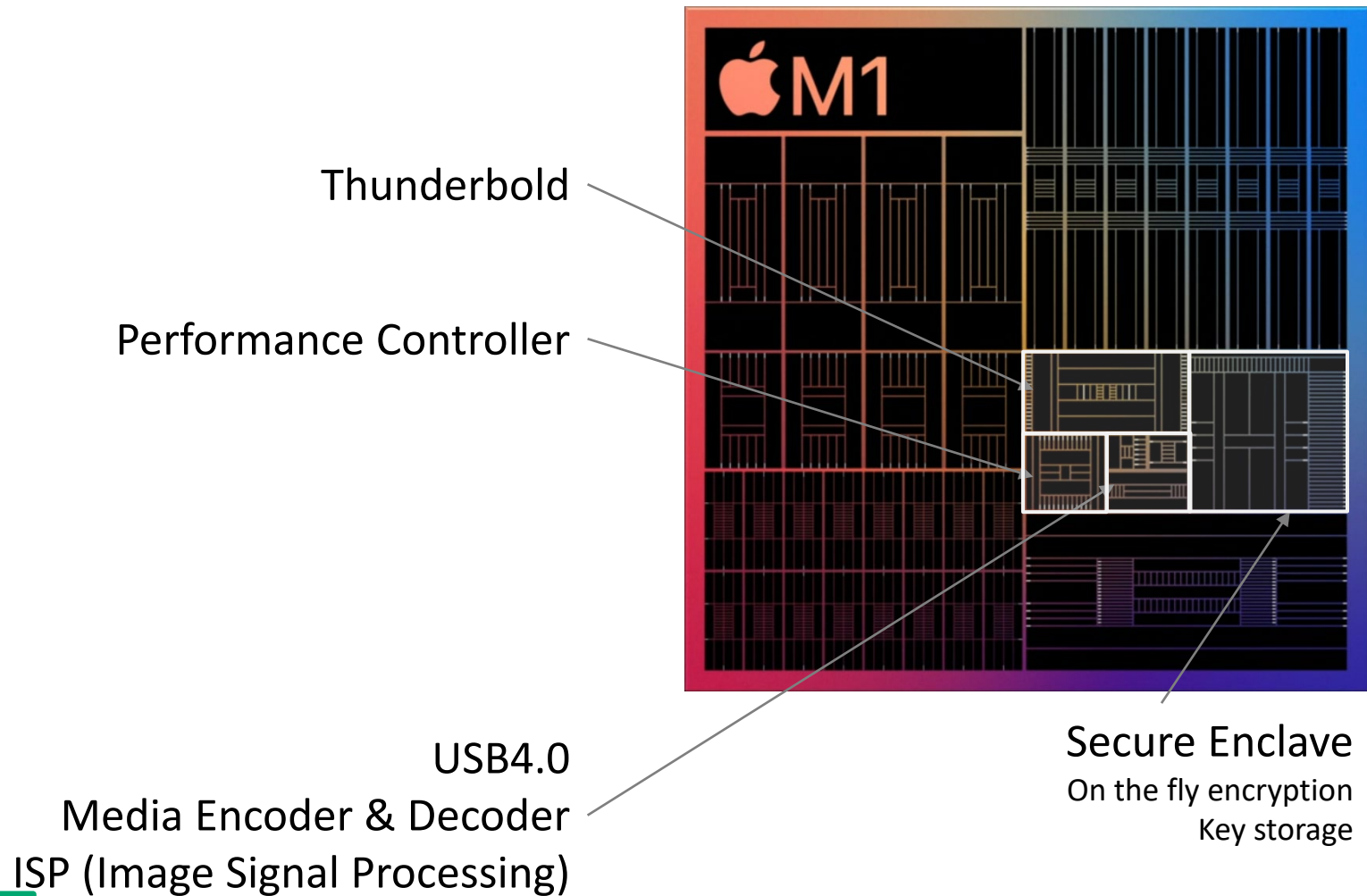


Example Apple M1

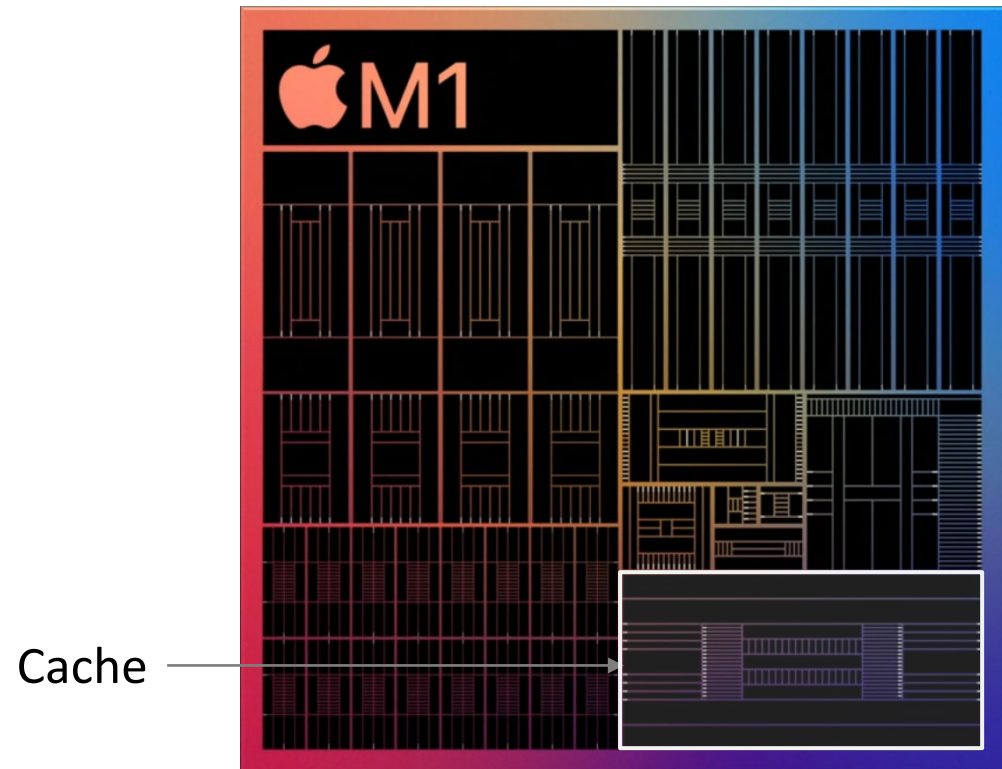
16-core Neural Engine
Machine learning accelerator



Example Apple M1

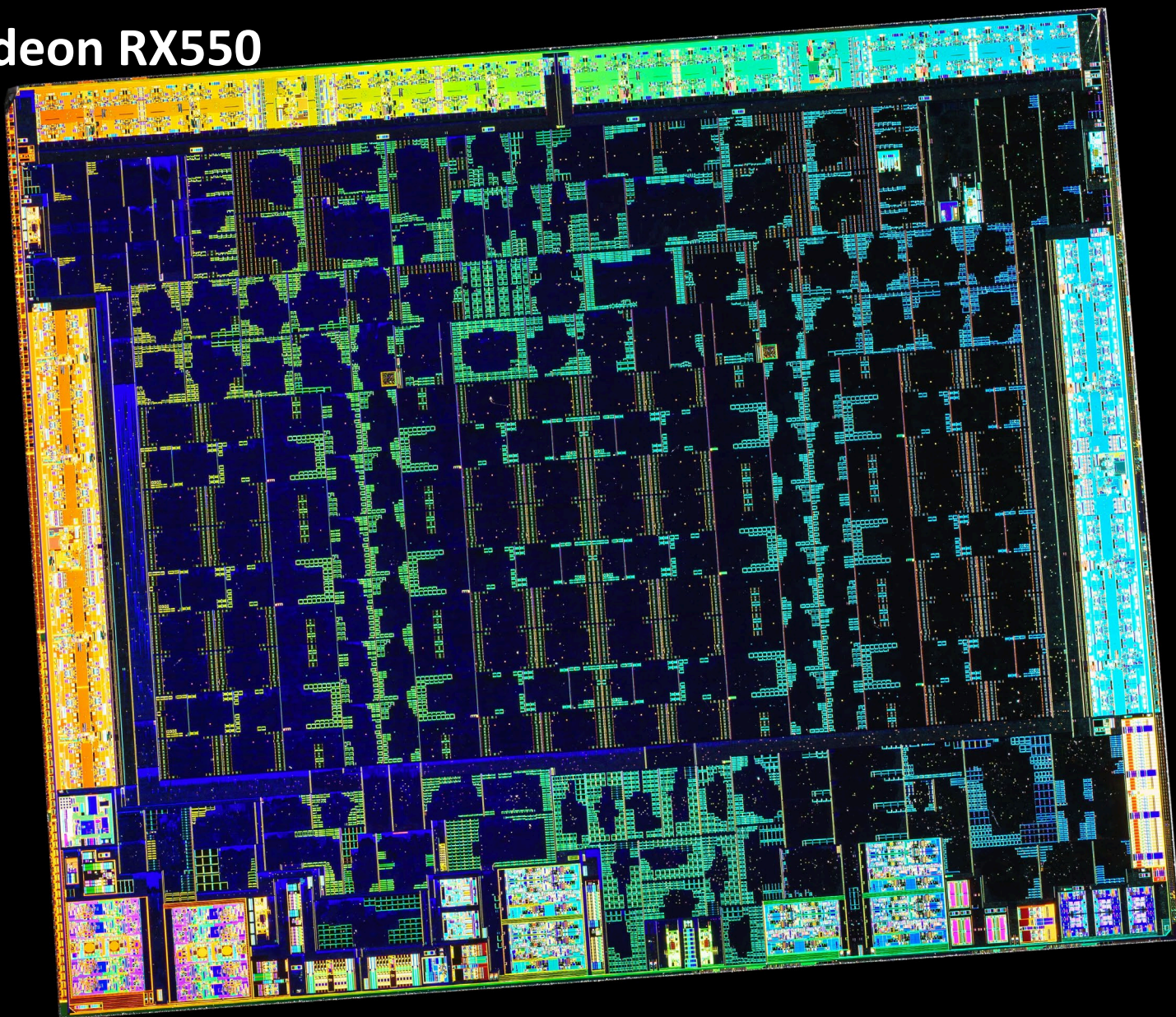


Example Apple M1



AMD Radeon RX550

7nm



References

- [m1] (English) Apple M1
<https://www.apple.com/mac/m1/>
- [soc] (Deutsch) SoC
<https://deacademic.com/dic.nsf/dewiki/377773>
- [pic] (English) Fritzchens Fritz
<https://www.flickr.com/photos/130561288@N04/>
- [ibex] (English) Ibex Risc-V
<https://awesomeopensource.com/project/lowRISC>

