

Evolution of Intel Processors

From 4004 to Core Ultra

By : Rafif Ahmad Yudhistira (3124500045)

Based on <https://www.youtube.com/watch?v=PT787d9odKk>

Introduction

The Evolutionary Journey of Intel Processors



Importance of
processor evolution in
computing history

1



Intel's role as industry
pioneer since 1968

2



Key metrics for
improvement:
- Transistor count
- Clock speed
- Power efficiency
- Architectural
innovations

3

Timeline

1971-1989



Milestone Processors:

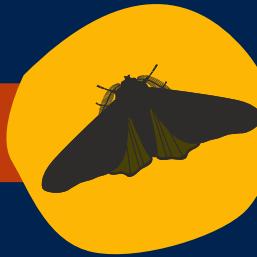
1.4004 (1971)

- First microprocessor
- 2,300 transistors
- 740kHz clock speed

2.8086 (1978)

- First x86 architecture
- 29,000 transistors
- 5-10MHz

1990s



Key Developments:

- Pentium (1993)
 - Superscalar architecture
 - 3.1 million transistors
 - 60-200MHz
- Pentium Pro (1995)
 - Out-of-order execution
 - RISC core with x86 decoder

2000-2005



Notable Processors:

- Pentium 4 (2000)
 - NetBurst architecture
 - Hyper-Threading introduced
 - 3.8GHz peak clock speed

Challenge: Power consumption and heat issues

Timeline

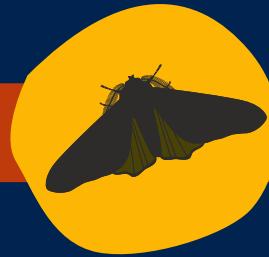
2006-2010



Paradigm Shift:

- Core 2 Duo (2006)
 - Return to P6 microarchitecture
 - First dual-core mainstream CPU
 - 65nm to 45nm process
- Nehalem (2008)
 - Integrated memory controller
 - Turbo Boost technology

2011-2016



Intel's Development Strategy:

- Tick: Process shrinkage (22nm Ivy Bridge)
- Tock: Architectural improvements (Haswell)

Key Innovations:

- 3D Tri-Gate transistors
- AVX instructions
- Power-optimized designs

2017-Present



Recent Advancements:

- Hybrid Architecture (Alder Lake)
 - Performance + Efficiency cores
 - Intel 7 process (10nm Enhanced)
- AI Integration
 - DL Boost instructions
 - NPU in Core Ultra



Future Directions

Upcoming Technologies :

- Intel 20A (2nm class)
- PowerVia backside power delivery
- Quantum computing research

Challenges :

- Moore's Law slowdown
- Competition from ARM/RISC-V

Conclusion

1. From Humble Beginnings

- 1971's 4004 (2,300 transistors) to today's Core Ultra (billions of transistors)
- Clock speeds increased from kHz to GHz, now optimizing for efficiency

2. Architectural Revolution

- Evolved from single-core to hybrid (P-core/E-core) designs
- Pioneered technologies: Hyper-Threading, Turbo Boost, AI acceleration

3. Industry Impact

- Enabled personal computing → cloud computing → AI era
- Continues to push boundaries with Quantum and neuromorphic research

4. Future Challenges

- Sustaining Moore's Law with 3D stacking and new materials
- Competition in ARM/RISC-V ecosystems



The background features abstract organic shapes in light blue, orange, and red against a dark navy blue backdrop. A prominent yellow starburst shape is located in the upper left quadrant.

Thank you!