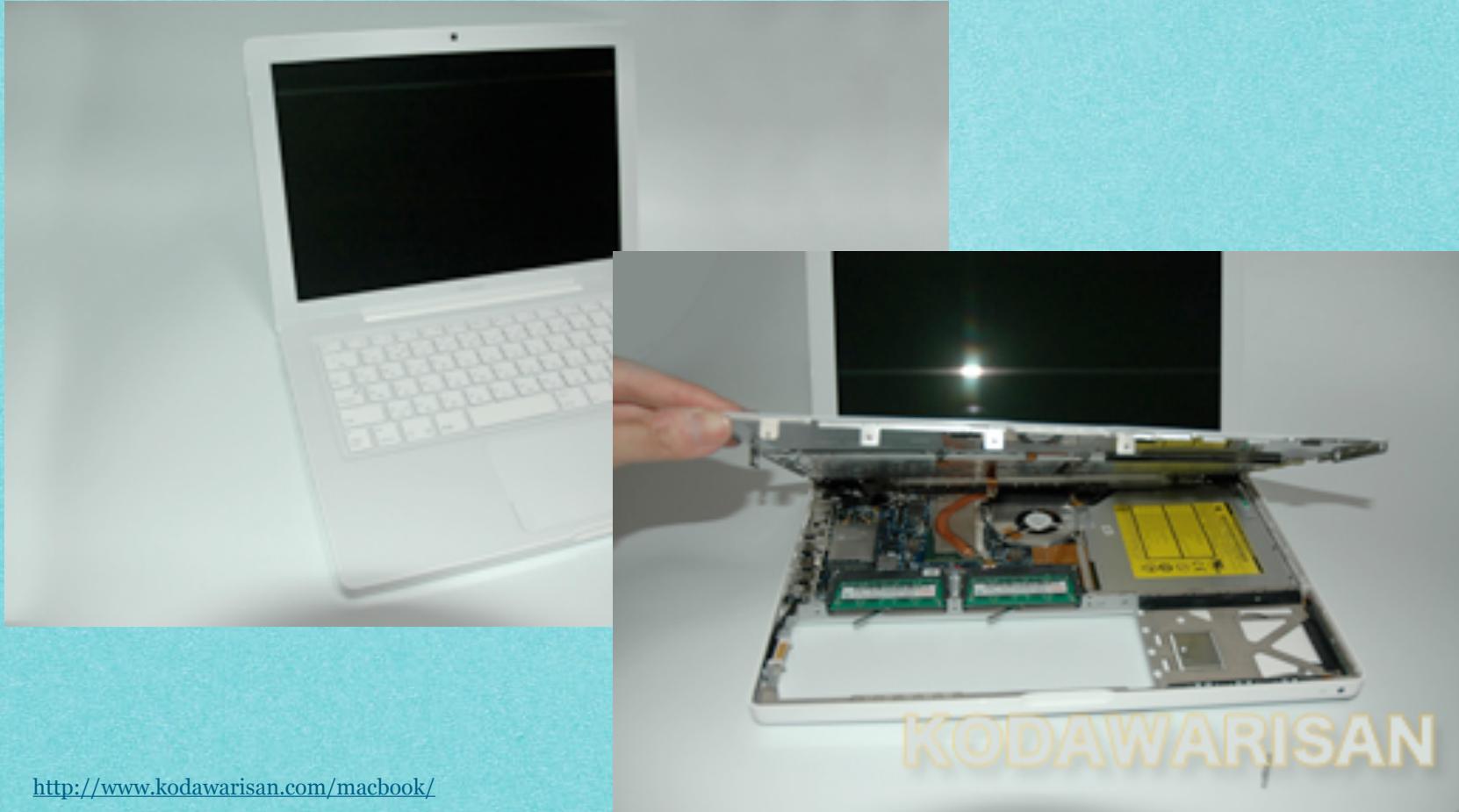


Through the rabbit hole

Adventures in architecturistan

Been there, done that

Processors



<http://www.kodawarisan.com/macbook/>

Processors



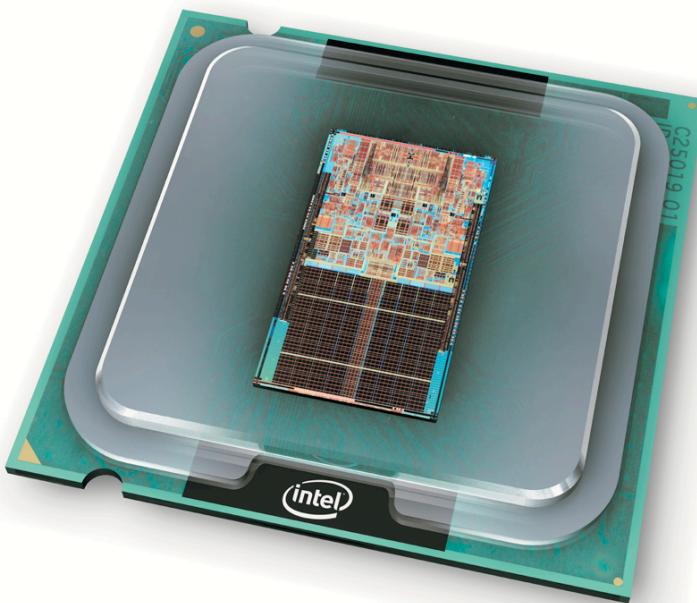
<http://www.kodawarisan.com/macbook/>



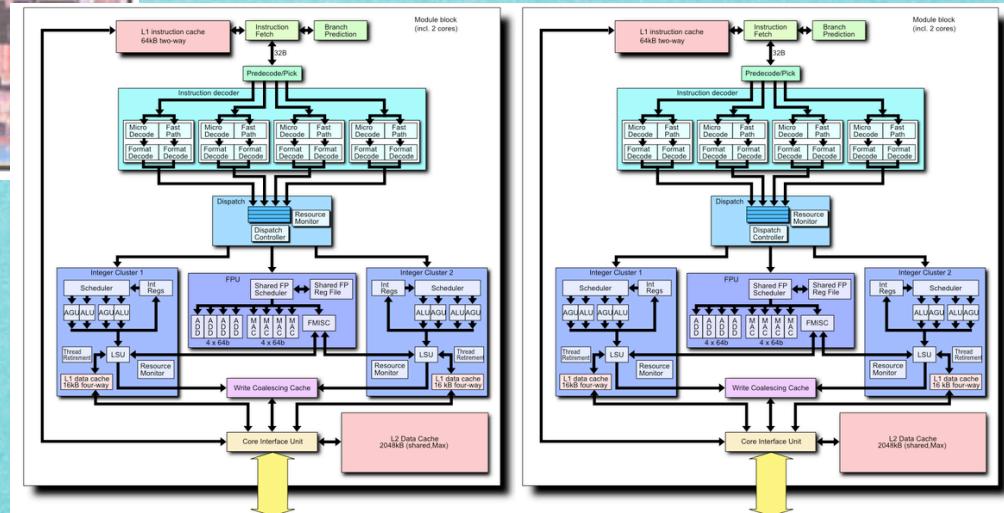
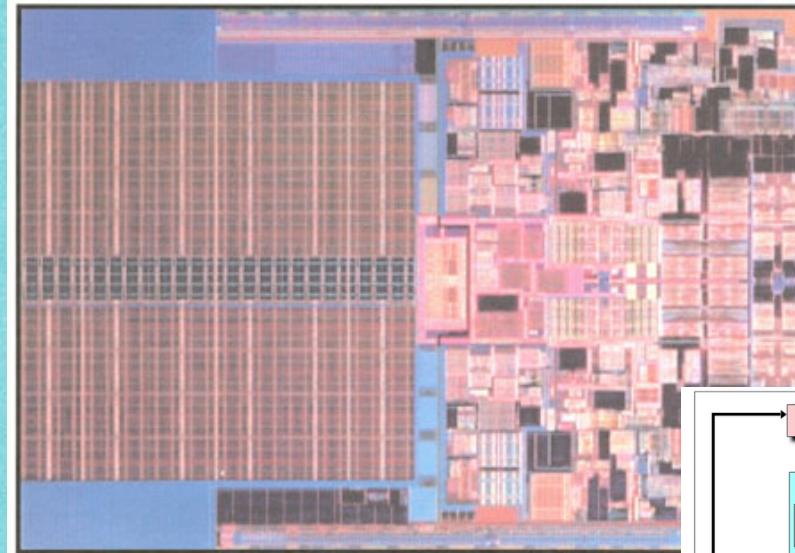
Processors



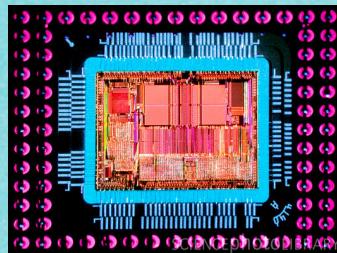
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Processors

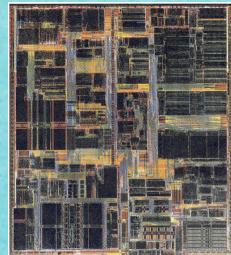


Evolutionary stages



1990: i486DX, **50MHz**
8KB cache on chip
1,1M trans., 1µm
~100mm²

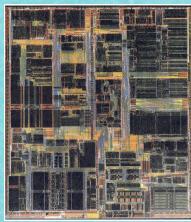
1997: P2, **300MHz**
548KB cache
7,5M trans., 0,25µm
~110mm²



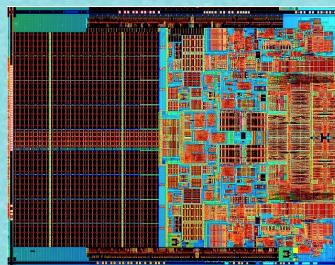
7 years

7,5x more transistors
6x faster clock
more/less same size

Evolutionary stages



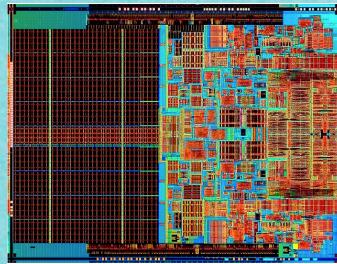
1997: P2, **300MHz**
548KB cache
7,5M transistors, 0,25µm
~110mm²



2004
Core2 Duo, **2,93GHz**
3M cache, **2 cores**
291M transistors, 65nm
107mm²

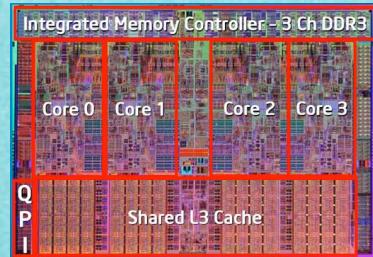
7 years
~40x more transistors
10x faster clock
more/less same size

Evolutionary stages



2004: Core2 Duo, **2,93GHz**
3M cache, **2 cores**
291M trans., 65nm
107mm²

2012: Core i7, **3,5GHz**
8M cache, **4 cores**
1,4Billion trans., 22nm
160mm²



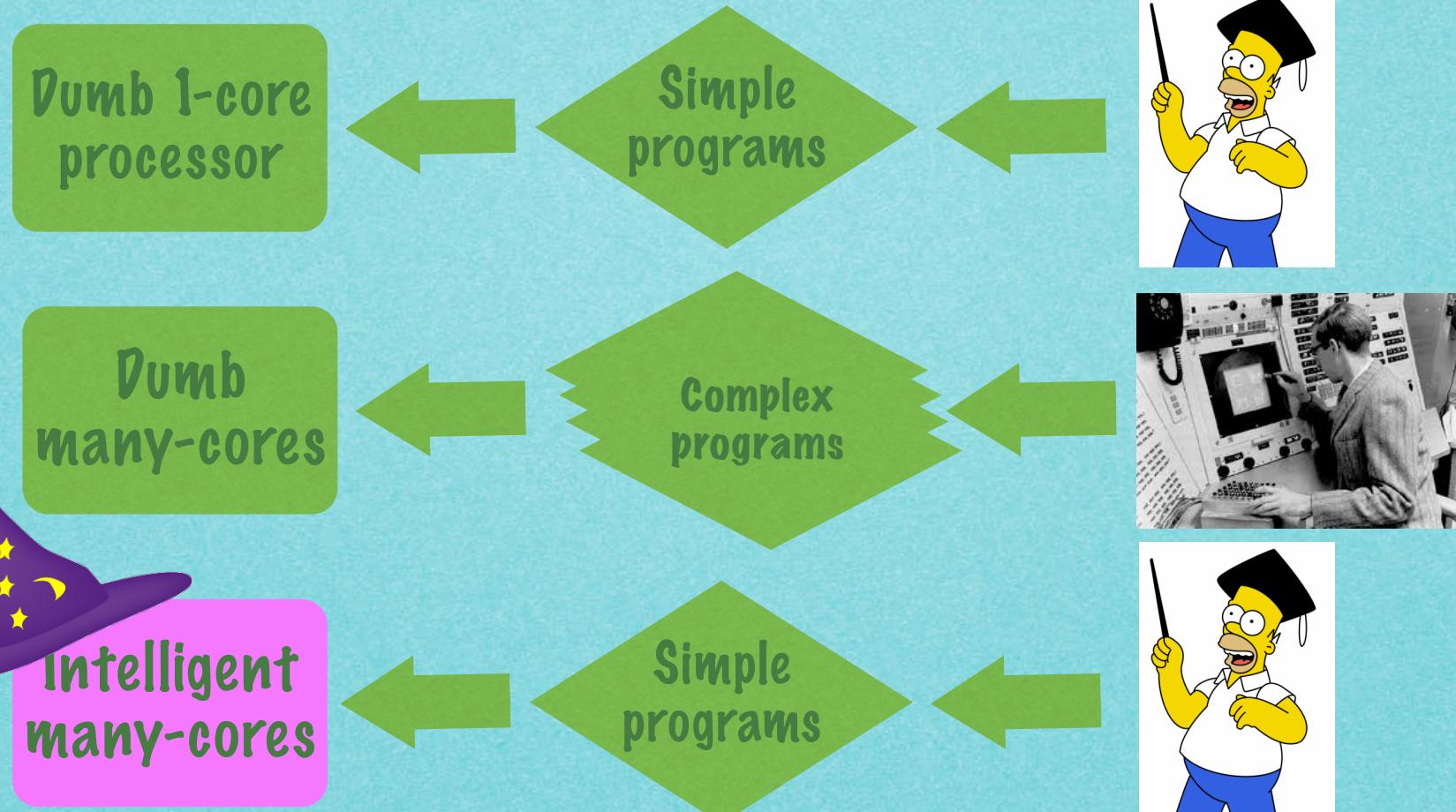
8 years

~5x more transistors
clock not really faster
slightly bigger
more cores, more cache

What's going on?

- ▶ Old way:
more transistors make 1 processor faster
- ▶ But we seem to have reached a limit
- ▶ Idea: **multi-cores**
use the transistors to make more processors
- ▶ But: programmers (**people**)
find **multi-cores complicated**

THE PLAN at the CSA group



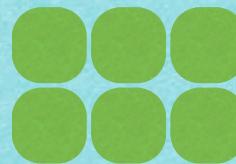
The magic recipe

- ▶ What others do:

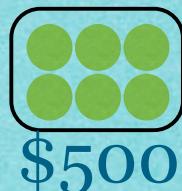
Design
1 complex
core



Copy and put
side by side



Put on die,
sell



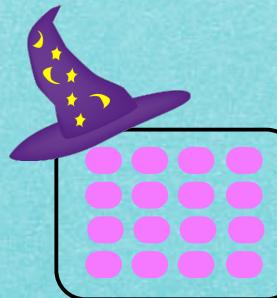
Then hope people catch up...

- ▶ What we do:

Design first
many-core
intelligence



Connect
many
simple
cores



Demonstrate
and
educate



Our “intelligence” is called **hardware microthreading**

Demonstrate + educate = connect people together



Computer
architects

Programmers
of operating
software

Programmers
of application
frameworks

Application
programmers

eg. Linux, iOS,
compilers

eg. Google,
Amazon

Playing on the Architect's team

- ▶ Analyzed my colleague's designs,
proposed a couple **components** of my own
- ▶ Wrote a **whole lot of documentation**
- ▶ My work, especially the docs,
has been used in 2 EU projects + 3 courses

Playing on the OpSw team

- ▶ **Created tools** to help other teams use the new hardware platform
- ▶ Wrote **example programs & tutorials**
- ▶ Helped **communicate** the OpSw team's **requirements back to the architect team**
- ▶ Result: a **stable and sound ecosystem** to start new projects!

Demonstrate + educate = connect people together



Computer
architects

Programmers
of operating
software

eg. Linux, iOS,
compilers

Programmers
of application
frameworks

eg. Google,
Amazon

Application
programmers



Thank you!