



# Transaction processing needs a refrigerator (or maybe several)

**Ryan Johnson**

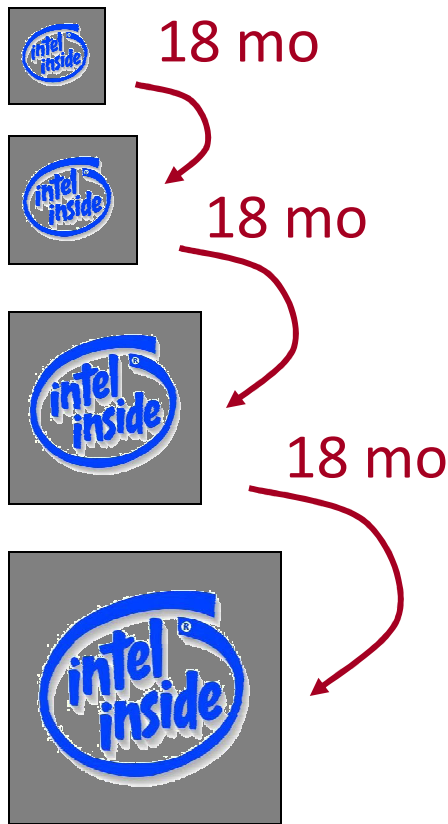
Inspiration: a talk by Babak Falsafi,  
and good work by many folks



# Who's who of computer architecture

## Moore

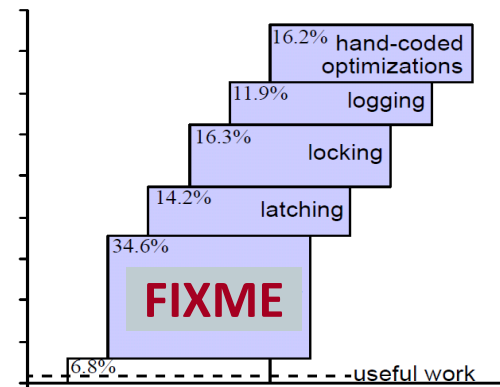
#transistors/chip doubles every 18 months



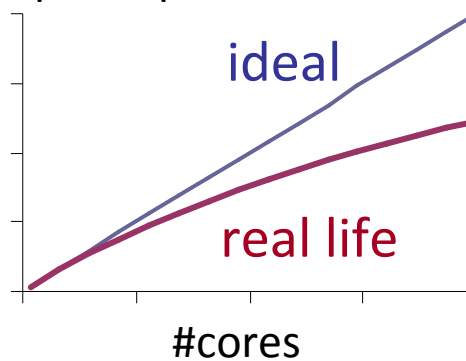
## Amdahl

Law of diminishing returns

Breakdown



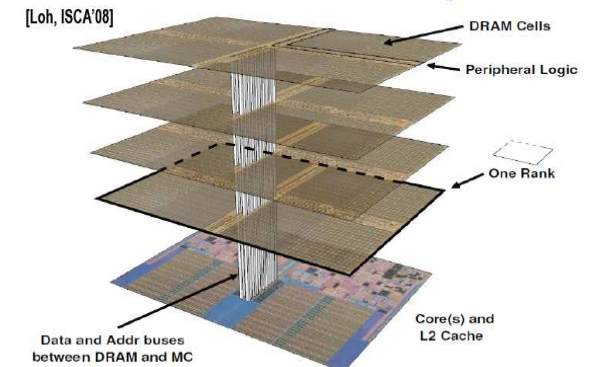
Speedup



## ITRS

Looks into the crystal ball

“I see 3D-stacked memory coming ‘real soon now’”

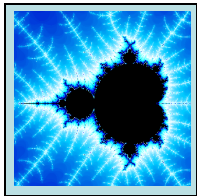
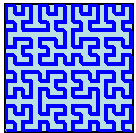
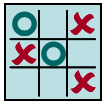


“Moore’s law will hold until at least 2022”

... etc.

# Eras of CPU design – then, now

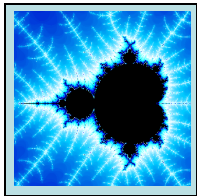
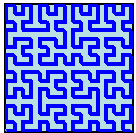
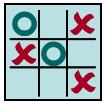
90's – OoO, ILP, CPI



**Why? Because we could!**

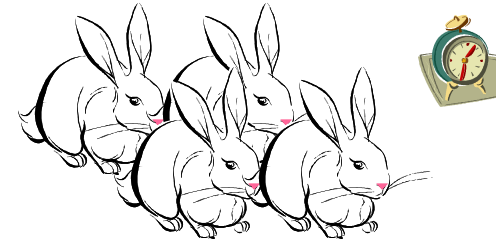
# Eras of CPU design – then, now

90's – OoO, ILP, CPI



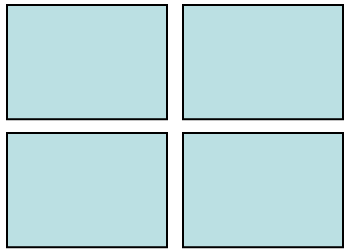
**Why? Because we could!**

00's – multicore



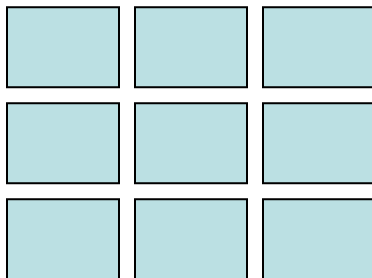
**Why? Amdahl, power**

# Eras of CPU design – soon



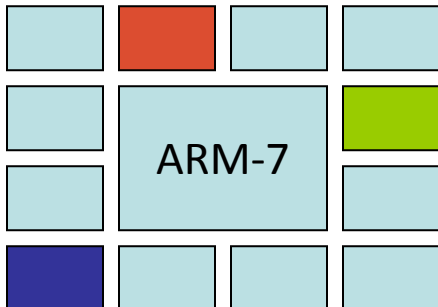
ITRS: “Energy scaling slows after 45nm (2010)”

=> Less power/transistor



OLTP: “I laugh at your sophisticated core”

=> Leaner cores work OK



ITRS: “I *said*, energy scaling slows after 45nm!”

=> Can't power up whole chip at same time any more

**Need to put power on ice...**

# Meet “The Fridge”



William Perry  
(Chicago Bears)

Sat on the bench most of the time  
*averaged 4 feet/game*

Not the fastest guy by any stretch  
*weighed 400 lbs / 175kg*

Very specific job: push  
through that last yard!

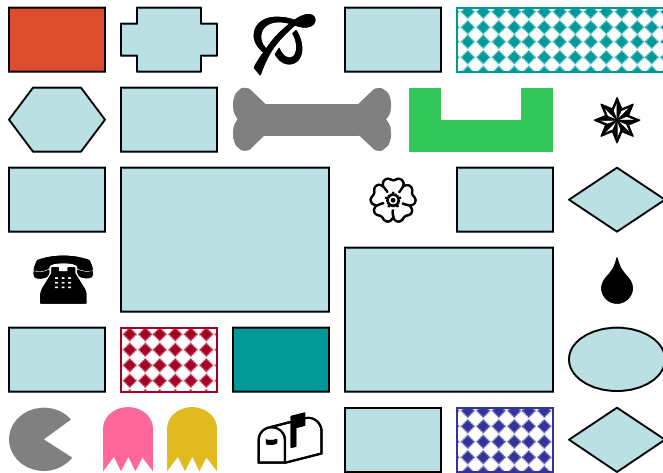
- Ball on 1-yd line
- 4<sup>th</sup> and 1

**Optimized for power, not speed**

\*\* hat tip to Yale Patt for the analogy

# The future of processor design

## “Frankenchip”



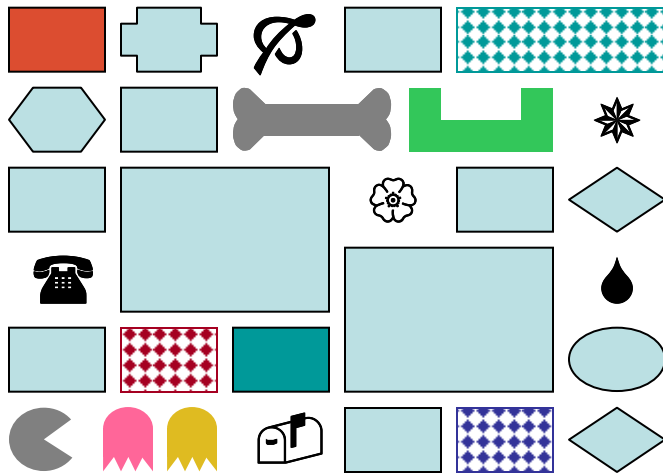
Have transistors to burn:

- Fat cores, lean cores
- Accelerators
- Reconfigurable logic
- ***Who knows what else!***
- ***Only a few powered up at a time... choose well***

**“Accelerators” reduce power, speedup is optional**

# OLTP needs its own “Fridges”

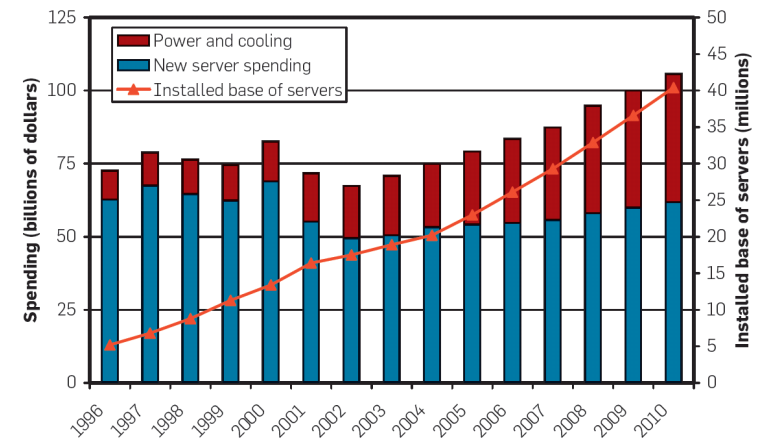
## “Frankenchip”



**Which (and how many) of these belong to us?**

- Even if Amdahl doesn't stop scaling, power will
- Architects need our help tackling OLTP
- Can't just scale out...

Figure 1: IDC estimates for annual cost spent on powering and cooling servers and purchasing new servers.<sup>17</sup>



\*source: [rkm09]

**We have 5-10 years... time to start thinking**