Lecture 2

Single core Era

$\mathcal{P} = \mathcal{A}\mathcal{C}\mathcal{V}^2 f + \tau \mathcal{A}\mathcal{V}\mathcal{I}_{short} + \mathcal{V}\mathcal{I}_{leak}$

$f_{max}\ \alpha\ 1/\mathcal{V}$

But, we can't just keep reducing the Voltage as:

$\mathcal{I}_{leak}\ \alpha\ 1/\mathcal{V}_{th}$

Dynamic Power consumption

power which is used to charge and discharge the capacitors

Why did Single core era die

Transistor technology should support increasing frequency

Minimum voltage below which you can't reduce
Performance per watt grows exponentially, but there is a limit

- 40% of power consumption is due to leakage power
- Scientists kept reducing threshold voltage until power consumption of leakage power became significant
- Improved cooling techniques and it became too expensive

Since they weren't able to increase frequency and not decrease voltage or cool it, it became the end of single core era

Multicore Era

ILP - Instruction Level Parallelism

Frequency has decreased now-a-days, as with reduced frequency has resulted in same throughput T

Amdahl's law: In computer architecture, Amdahl's law (or Amdahl's argument) is a formula which gives the theoretical speedup in latency of the execution of a task at fixed workload that can be expected of a system whose resources are improved.

due to limited number of pins - not all cores accessible

not all cores can be used at the same times

50% of cores turned off at 8nm -- 50% form *dark-silicon*

- end of multicore era

Dark Silicon era

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- Heterogenous cores
- some cores are faster than others
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