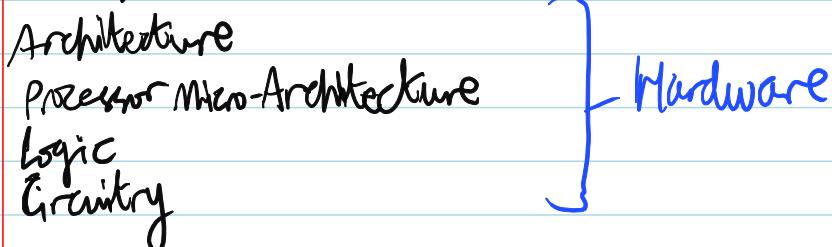


System Architecture - Intro lecture

- Problem
Algorithm
Program
Compile + Runtime + Op. Sys.
PISA
- what happens, NOT how
- Software



- Motivation for increased performance
 - Micro-processors MUCH faster than ages ago
 - Lack of speed prevents them from doing really complicated stuff

- Architecture & the future
 - Speed improvements have gone down due to
 - Power Dissipation
 - Silicon doesn't conduct heat fast enough
 - Physical production limits
 - Device Variability
 - Smaller devices → more risk of errors
 - Moore's Law: "number of transistors in an IC doubles every two years"
 - Do not scale clock speed

- Koonney's Law: amount of computation per Joule doubles
- Smaller, faster circuits → performance improvements

BOTTLENECK:

- "See PU's quickly everywhere I go
Gettin' bottes and neck so good my memory
goin slow"
- Caches crucial for fast processor memory
 - Quick, local, temporary space for mem. locations
 - Web pages on local disc, VM, web content delivery networks
- Locality: Spatial; use address $X \rightarrow$ use address $(X + \frac{\text{small offset}}{\text{offset}})$
Temporal; use now \rightarrow use shortly after
- Circuit capacitance makes stuff slow (need charging)
 - Since bigger memories have ~~less~~ capacitance, faster
 - Dynamic: slow, cheap
Static: fast, expensive
- Reasons for cache: Slow ~~unnecessary~~ memory access without

