

Complexity

Panel Discussion

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What Does Complexity Mean to You?

“the quality of being intricate and compounded”
-- Princeton Dictionary

- Problem is that the word “complexity” is overused
 - Thermal?
 - Power?
 - Design/Verification?
- I believe that we should always add an adjective
 - thermal complexity
 - power complexity
 - design complexity or verification complexity

For me, design/verification complexity is the effort (hours) required to implement an architectural feature.

Example: Doubling Issue Logic from 2 to 4

- Energy:
 - x2 energy per access
 - x4 peak energy (2x2)
- Performance:
 - IPC (processor/bench setup dependent)
 - 0.85 frequency (CACTI)
- Area:
 - x3.2 area
- Design:
 - roughly the same (if you accept 0.85 frequency degradation)
- Verification:
 - roughly same testbench
 - x2 number of tests to run

Which Areas Would Improve Your Work?

● Design:

- Create a repository of done (old) designs
 - Specification, design time, verification time
- Processor backend is an obscure art
 - Difficult for ASIC flow to go over 1GHz (90nm)
 - More research to avoid/simplify full-custom/semi-custom

● Verification:

- create a “repository” of bugs found on processors
 - Researchers can evaluate different proposals
 - Currently, working with SUN to get it

Long/Short Term Goals?

- Not so much work on simulators, more on real hardware.
 - Simulator advantage:
 - let you do quick tests (1 year enough for a brand new architecture)
 - Simulator disadvantage:
 - may be disconnected from reality (not clear what is the complexity)
 - I try 75% simulator, 25% Verilog/VHDL work
- Metrics/standards to quantify design/verification complexity
- Same perf. architectures but simpler to design/verify
 - I am willing to sacrifice 5% for a substantial complexity reduction
 - Metric?

$$\text{Performance}^2 \times \text{Effort} = \text{const.}$$