

System-level Stimuli Generation for the CELL Processor

Yoav Katz

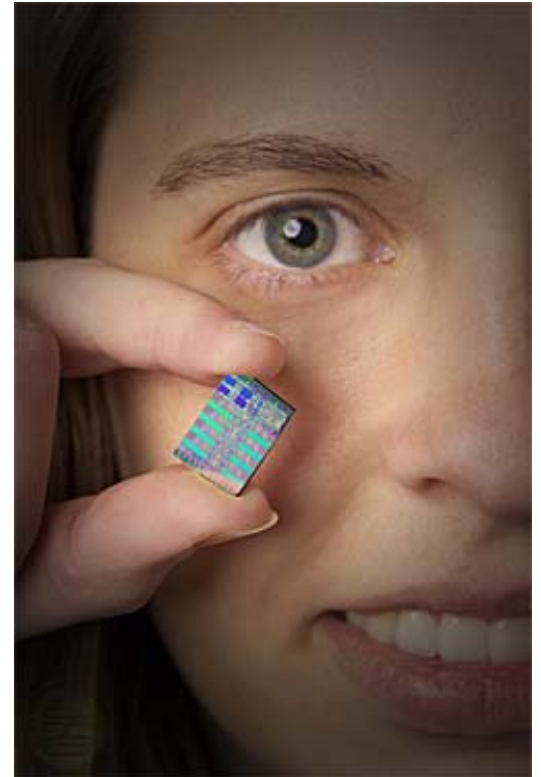
Presentation by Roy Emek

July 2005



Agenda

- ◇ The CELL architecture (again)
- ◇ System-level verification challenges
- ◇ A system-level stimuli generation solution: X-Gen
- ◇ Results





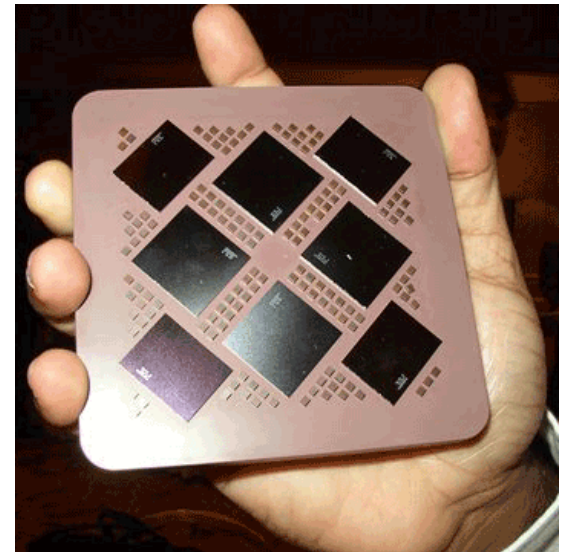
System verification background: where we come from

Mainline system development in IBM

- ◇ Power based eServers: pSeries (UNIX), OpenPower (Linux), iSeries (previously known as AS/400)
 - ◇ Based on Power3, Power4, Power4+, Power5, ...
- ◇ PowerPC 970 based systems (blades, Apple)
- ◇ Mainframes: zSeries (previously S/390)

System verification

- ◇ Processor centric
- ◇ A highly complex memory sub-system: coherency and consistency issues
- ◇ Systems are not tied to a single software application

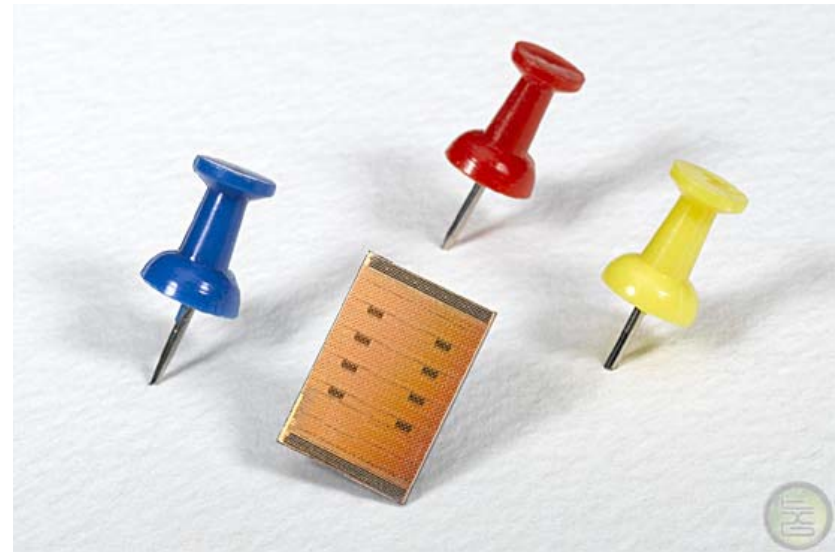


POWER5



Challenge #1: heterogeneous processors

- ◇ A single PPE
 - ◇ Dual thread, 64-bit, PowerPC processor
- ◇ Eight SPEs
 - ◇ Synergetic Processing Element
 - ◇ 128-bit wide vector processor
- ◇ Other high-end systems in IBM are homogeneous
 - ◇ Typically multi-processor PowerPC systems
- ◇ Some MP-oriented verification tools cannot be used





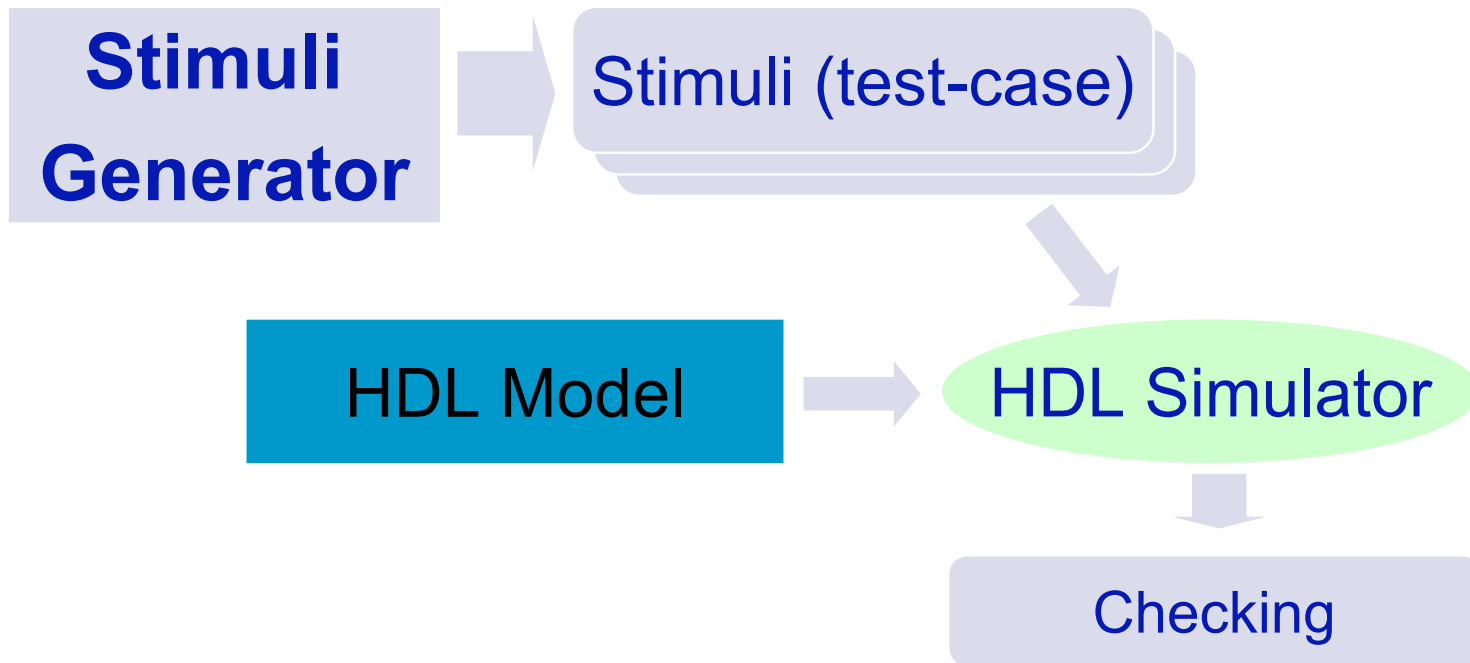
Challenges 3, 4, and 5

- ◆ A completely new architecture
 - ◆ Combines of relative instability and high complexity

 - ◆ Coherency and consistency are still crucial: the PPE, SPEs are all coherent
 - ◆ The CELL is general purpose
 - ◆ Doesn't aim at a single software application
 - ◆ As opposed to more application specific SoCs
- } As in high-end systems



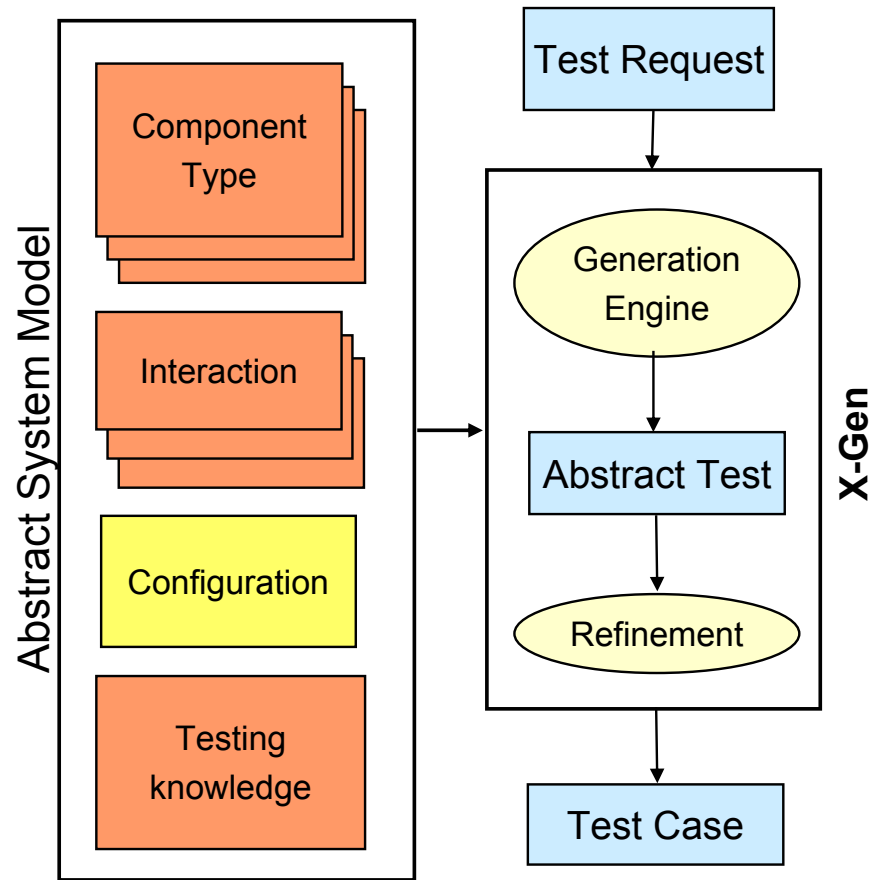
Simulation-based functional verification





System-level stimuli generation solution

- ◇ X-Gen: the same tool is used for high-end servers, the CELL, and other designs
- ◇ Reuse from other systems:
 - ◇ Abstract system model: >40%
 - ◇ Test requests: ~30%
- ◇ Possible due to the model-based test-generation paradigm
- ◇ Dummy configurations were used for verification in addition to 1xPPE – 8xSPE
 - ◇ All with the same set of test requests





CELL System verification results

- ◇ Close to 150 bugs exposed
- ◇ I spoke about stimuli generation:
there's also checking, coverage,
verification execution, ...

