On debugging

HVC’10 – Yoav Hollander
Agenda

• Why debugging is hard and getting harder
• The challenges of system debugging
• Automatic debugging
• Q & A
Debugging in context

• I’ll talk about HW and embedded SW debugging
  – HW module => SoC => Smartphone + SW

• Many other professions do “debugging”
  – I.e. trying to understand why bad things are happening

• It is hard work
The debug problem is growing

- System bugs are harder
  - See next slide

- In HW, bug finding is now “good enough”
  - So debug becomes the next bottleneck

- In SW, verification requirements are lower
  - So most of verification is debugging anyway
System debug is especially hard

• Lots of HW and SW modules
  – From many groups
  – Some only lightly verified
  – Spanning many disciplines (Digital, analog, many SW layers)
  – Parallelism is hard (many HW modules, CPUs, threads)
  – Nobody has the full picture

• Running environments all have problems
  – Some are slow
  – Some have limited visibility
  – Some are non-repeatable

• Lots of incidental complexity
  – Debug times do not add up
The three kinds of system bugs

• System bring-up bugs
  – Nothing works, every run fails
  – Can recur for every HW/SW version

• Interaction bugs
  – Simple scenarios work, but fail with some specific parameters or specific interaction with other scenarios

• Performance/power bugs
  – Some scenarios take more time / power than expected
  – Often discovered only as a functional bug (e.g. missing frames)
  – Often caused by a functional bug at the lower level
Automatic debugging

• What is it
  – Techniques to make debugging faster
  – Usually assume pre-processing / retries “in the night”

• Techniques
  – Correlations
  – Simplifications
  – Dynamic slicing
  – Formal debug
  – Reverse debugging
  – …
What we do at Cadence

- Can’t tell you ;-)
- A mix of many techniques
- Trying to combine various hints
- Trying to work with the “regular” debugger
- Trying to remove incidental complexity
- Trying to add user “cookbooks”
Summary

• Debugging, especially system debug, is the “next frontier”

• Automatic debugging shows some promise

• Questions?