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Checking Model Specifications with CrossCheck™

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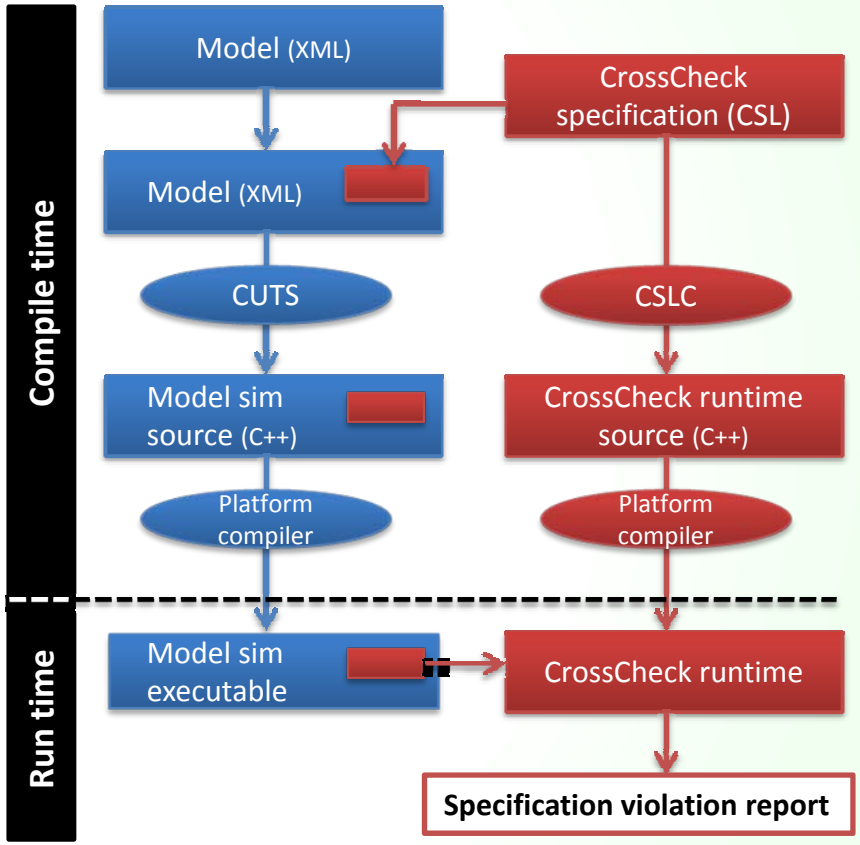
Dynamic Specification Checking for Model-based Development

- ***Why*: Model-based simulation allows early validation of designs**
  - Complex system is modeled as a collection of interacting components
  - Behavior of system can be simulated and examined prior to implementation
  - Reduces iterations in design-implement-test cycle
- ***Problem*: How to evaluate simulation driven by model framework?**
  - Need to be able to check that design specifications hold during the simulation
- ***What*: Applied CrossCheck to CUTS: a model simulation framework**
  - Took example avionics problem from the SPRUCE project and created a model
  - Wrote CrossCheck specifications for message rates in the model
- ***Result*: CrossCheck verified message rates in simulation runs**

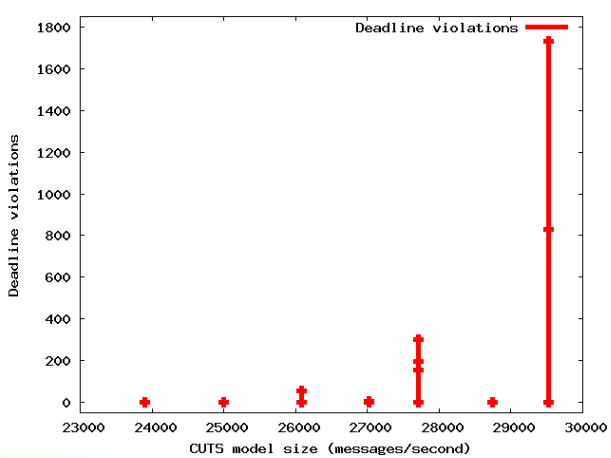
Instrumenting CUTS with CrossCheck

- **CUTS Simulation framework**
  - Model created in XML (GUI-aided)
  - Compiled via CUTS to C++
  - Compiled to simulation executable
- **Instrument with CrossCheck**
  - Specification written in CrossCheck specification language (CSL)
  - Added to model via reusable CrossCheck component
- **Simulation sends events to CrossCheck to check**
  - Works over the network
  - CrossCheck runtime reports on specification violations

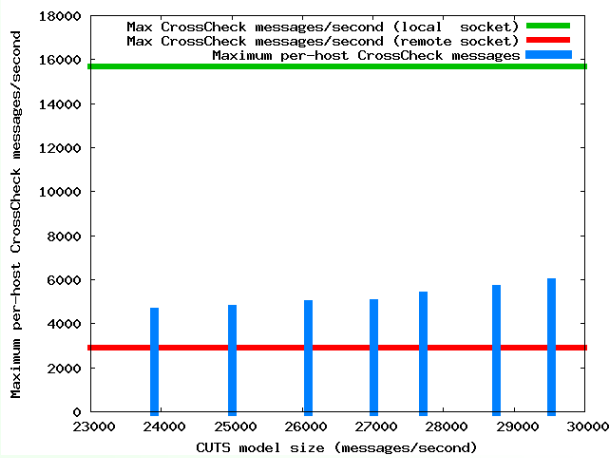


CUTS and CrossCheck in a Combined Environment

Results and Conclusions



Number of deadline violations given SPRUCE CUTS model size in term of messages exchanged per second



Maximum rate of CrossCheck messages sent per-host

- **As model size increases, increased messages-per-s leads to deadline violations (*left, top*)**
  - Violations reported by CrossCheck
- **Using multiple CrossCheck engine instances allows scaling with model size (*left, bottom*)**
- **Reusable connector component helps model builder add CrossCheck event feed**
  - Uses standard CUTS model-building tools (GME, GAME)

→ ***CrossCheck is a useful adjunct to model-based simulation***