MBD
Breakout

2014 National Workshop on Transportation Cyber Physical Systems

Questions

- What is the purpose of the model?
  - Analysis?
  - Simulation?
  - Code Generation?
- What languages are we using?
  - Text based?
  - Graphical?

- What are we modeling?
  - Controls?
  - Physics?
  - Communication?
  - Human behavior?
  - Processor?
  - Architecture?
    - hardware
    - software
    - system
    - model
- What would we like to model and can't?

What are our pain points?

- What are we struggling with?
  - Composition?
    - Composition of differing semantics?
    - Composition of differing levels of abstraction?
    - Composition across domains?
      - continuous/discrete
      - mechanical/electrical
  - Protection
  - Language semantics?
    - Lack of clarity, unclear what they are?
    - If they can't explain them, how do we know the tool is correct?
  - Co-simulation?
  - Analytical capability?
  - Constraints?
    - Takes too long!
    - Can't fit on compute platform?

- liabilities in IP protection?
  - integrator is ultimately responsible
  - models to validate black-box models?
- construction of accurate models
  - where do meta-models come in?
    - capture purpose of the model
    - capture confidence in models
  - how to capture confidence
    - measurements after physical instantiation become available
  - domain specific helps but multiple domains makes things more confusing

- modeling unknown unknowns
  - models are good for known things
  - models can represent best guess at unknown things
- environment modeling to match system models

Data in modeling

- data models are also inherent part of MBD in additional to behavioral models
  - both for storing data for generating the model and for model execution traces
- sources of data for models:
  - test vehicles vs. collected from the field
- privacy in data collection
  - de-identification/fuzzying can affect accuracy

Better tools

- different tools are good at different things
  - how do we combine what different tools are good at?
  - do we have tools that model physics and software equally well?
  - combining models from different tools is an important problem
  - choice of tool is as much a matter of developer expertise as much as expressiveness of semantics

Multi-model environments

- role of ADLs in system modeling
  - helps tie together different models, but it's one more language with its own semantics
- interaction between models
  - different models on the same level, also between levels
  - execution order, data formats, implicit dependencies
  - how do identify faulty models
  - how changes/tuning of a model affects other models
- dealing with security on the model level?
  - identifying interaction points that may be subject to attack

Do we really need models?

- Devil's advocate: do we need models?
  - Internet, one of the most complex systems we have, has been built without models/formal methods
  - often modeling is done post factum: things are invented and tried, then performance modeling is done

Maintenance and evolution

- how do we update models when low-level changes happen?
- More generally, model management and evolution is a practical problem