

---

# **Performance Modeling and Analysis for Software Integration**

**Kang G. Shin**

**Real-Time Computing Laboratoty**

**Department of EECS**

**The University of Michigan**

**Ann Arbor, MI 48019-2122**



# What makes SW building so hard?

---

- **Getting too big**
- **Requiring too many things**
- **Omnipresent, especially mission- and safety-critical embedded applications**
- **Very long-lived, e.g., aircraft, so evolves over a long period**
- **Difficult to model system, analyze, test/verify model-generated or hand-coded SW against real system requirements**



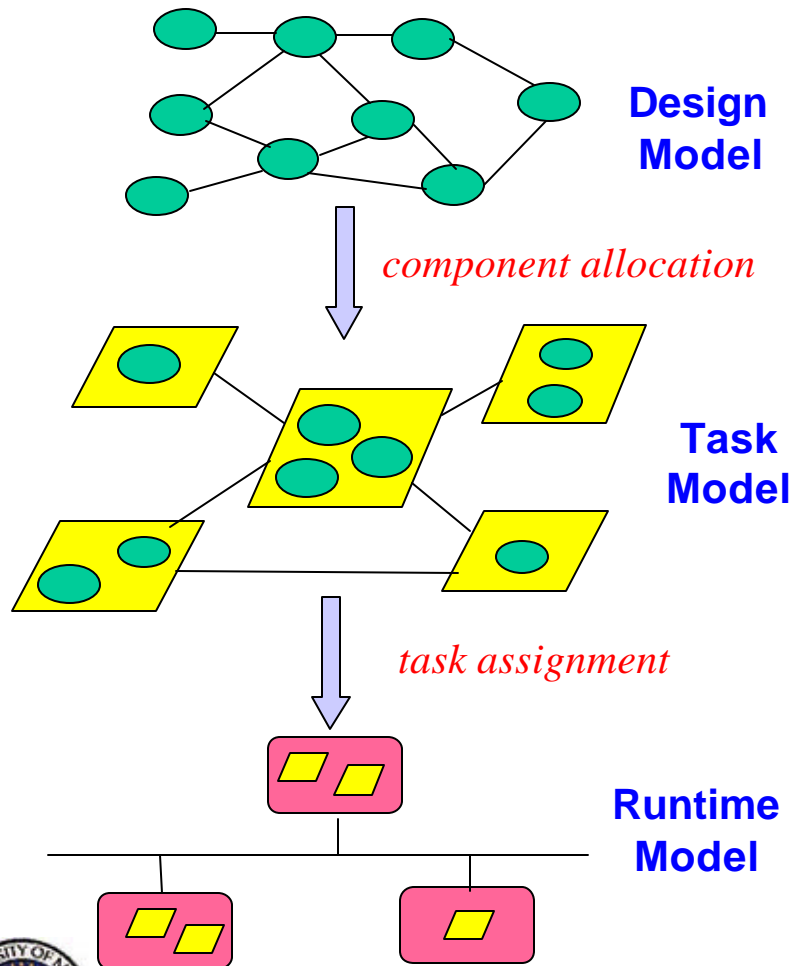
# Promising Technologies

---

- Software *synthesis*
  - Component/model integration
  - Model-based code generation
- Heterogeneous *modeling*
  - Different models used for different development phases
- System *analysis*
  - Focuses on design-time analysis
  - Tries to analyze both functionality and *performance*
  - Verifies correctness by analysis instead of simulation



# Software Integration Process



- **Technical Barriers**

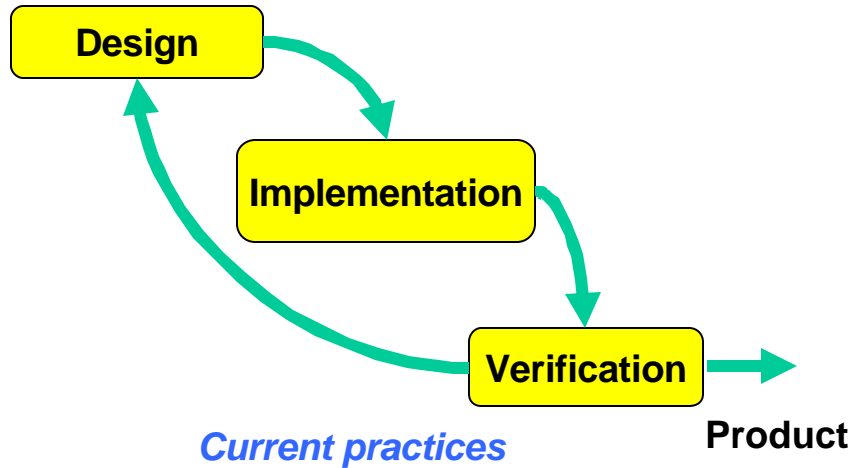
- Only functional specification is available at design time
- Performance depends on
  - system structure
  - implementation
  - platform
- Heterogeneous models/tools
- *Little performance information available before prototyping*

- **Performance model**

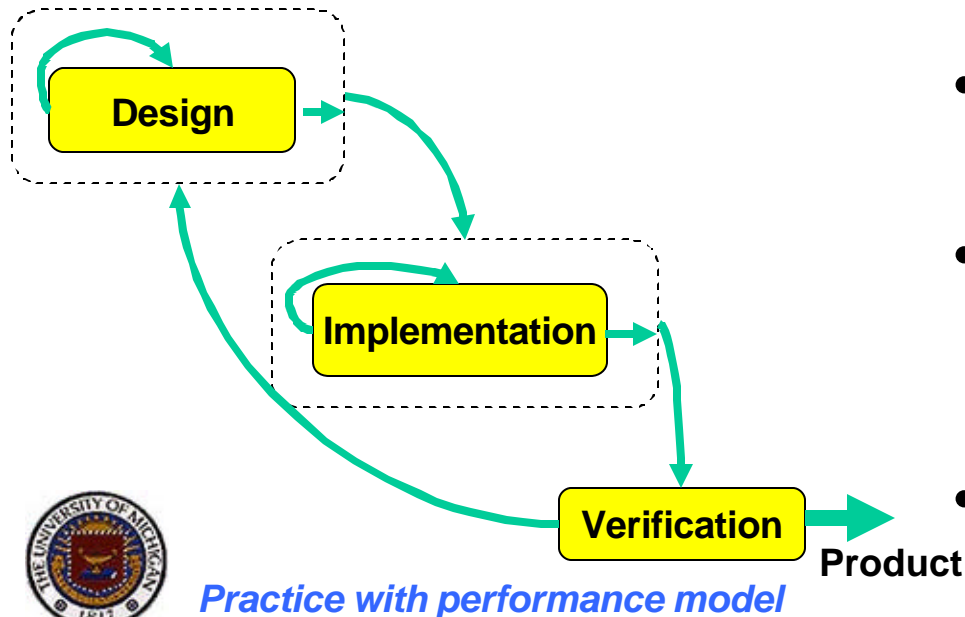
- Usable with different functional models
- Used for analyses at all development phases



# Why Performance Model?



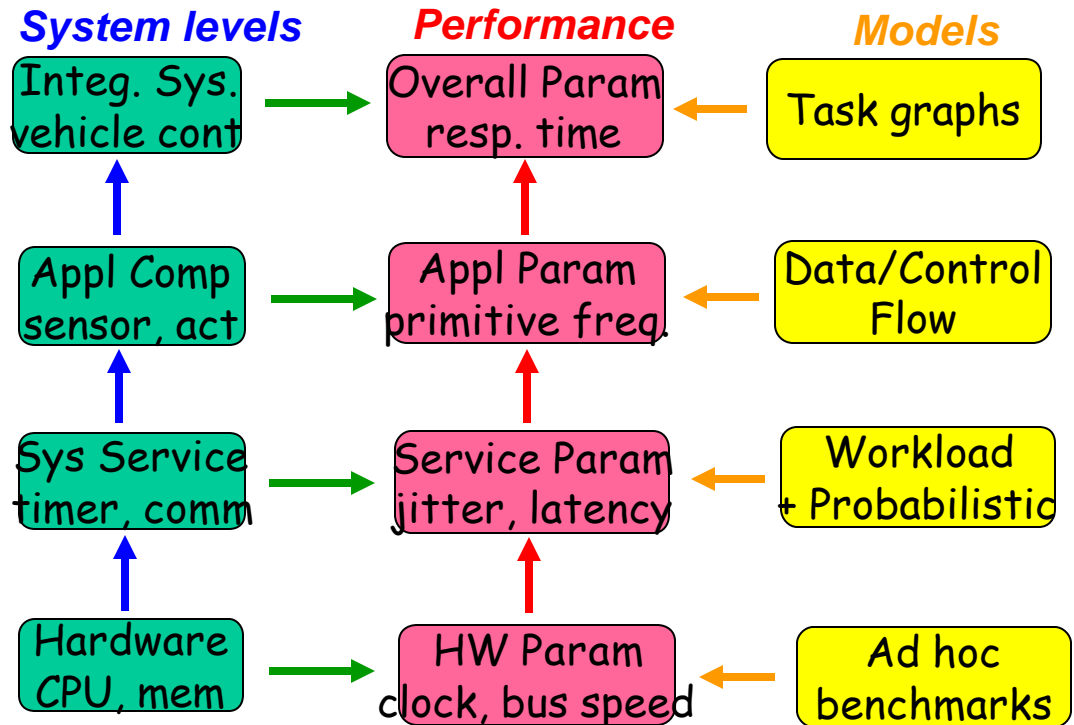
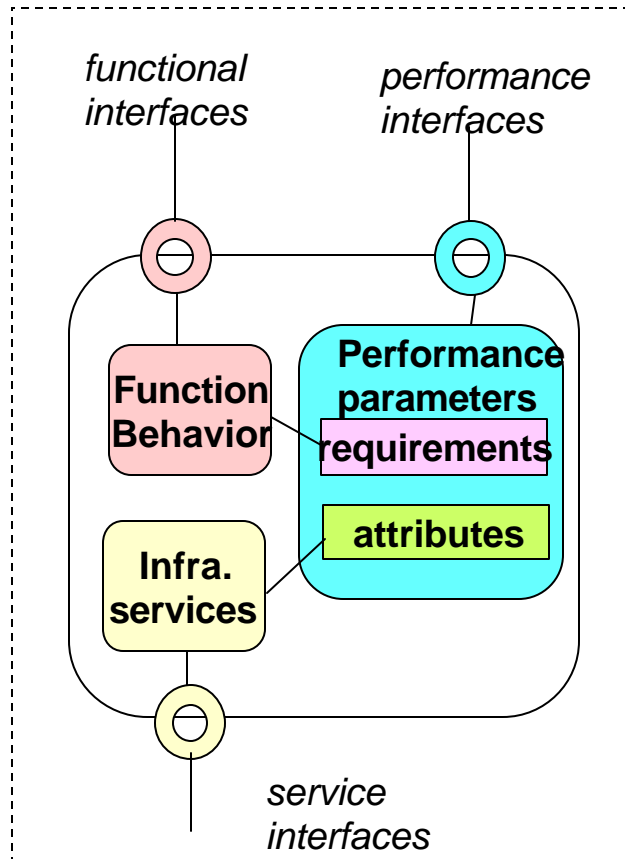
- No performance check at each step
- Errors detected at the end
- Long development cycle



- Performance check at *each step*
- Performance issues first resolved locally (within each step)
- Shorter development cycle



# A Possible Solution



1. Associate performance information with components
2. Construct a hierarchical performance model corresponding to the system model



# Sample Issues

---

- **What is essential performance information?**
  - Application requirements
  - Infrastructure capability
- **How to represent performance information?**
  - Modeling methods
  - Specification languages, e.g., aspect-oriented?
- **How to support SW development with performance information?**
  - **Design-time** : component selection & integration, platform configuration, attribute tradeoff analysis, change propagation
  - **Runtime adjustment**: reconfiguration, attribute adaptation.

