Resource-aware Simulation

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Agenda

- Introduction
- Model Activity
- Activity based Modeling
- Activity Tracking
- Resource-aware Simulation
- Future Work
Introduction

➲ Dynamic Load Balancing Algorithms
  ● Q Learning
  ● Simulated Annealing

➲ Model-based Performance Prediction
  ● Queuing Network, Petri-net
  ● Neural Networks
Model Activity

- Activity: Notion of locality in space and time
- Used in Activity Modeling and Activity Tracking
Activity-Example

Activity and Non Activity Region in Forest Fire
Activity and Non Activity Region in Ballistic Missile
Activity Tracking

- Track states $Q$ of the model
  - State $q(s,t)$ is a function of independent variables space and time
  - A “model”, in the form of some transition function concisely describes how $q$ evolves

Tracking Pattern

- Track the propagation activity, route and compute the exchanged Information
- Compute the Active Set according to the current states and input information
- Re-allocate computational resources
Activity based Modeling

What is Hint?
- The description of Model Activity by Modeler
- Intrinsic Hint
- Extrinsic Hint

Domain Specific Activity Modeling
- Meta-model for Activity
- Activity Model in Domain
Activity based Modeling

- General-Purpose Simulation Formalism (GPSF)
  - DEVS

- Transformation from DSM to GPSF
  - Abstract the intrinsic Activity Model
  - Activity Model from Domain to GPSF
Resource-aware Simulation

The Whole Story
Simulation Framework

➲ Track Resource Usage
  ● Memory Occupation, CPU Utilization
  ● Storage of Tracking data

➲ States Storage
  ● Model States
  ● Simulator States

➲ Activity Prediction
  ● Predicting Resource Need by Activity Model
  ● Predicting Resource Need by Tracking data
Simulation Framework

➲ Dynamic Load Balancing
  ● Computing Load based on Prediction
  ● Adjust Partition to lower load

➲ Static Load Balancing Plan
  ● Without Tracking / Predicting at run-time
Resource-aware Simulation

The framework of Resource-aware Simulation
Future Work

- Implementation of Resource-aware Simulator
- Construct Meta-model for Activity
- Transformation between Domain and GPSF
Thanks

Questions?