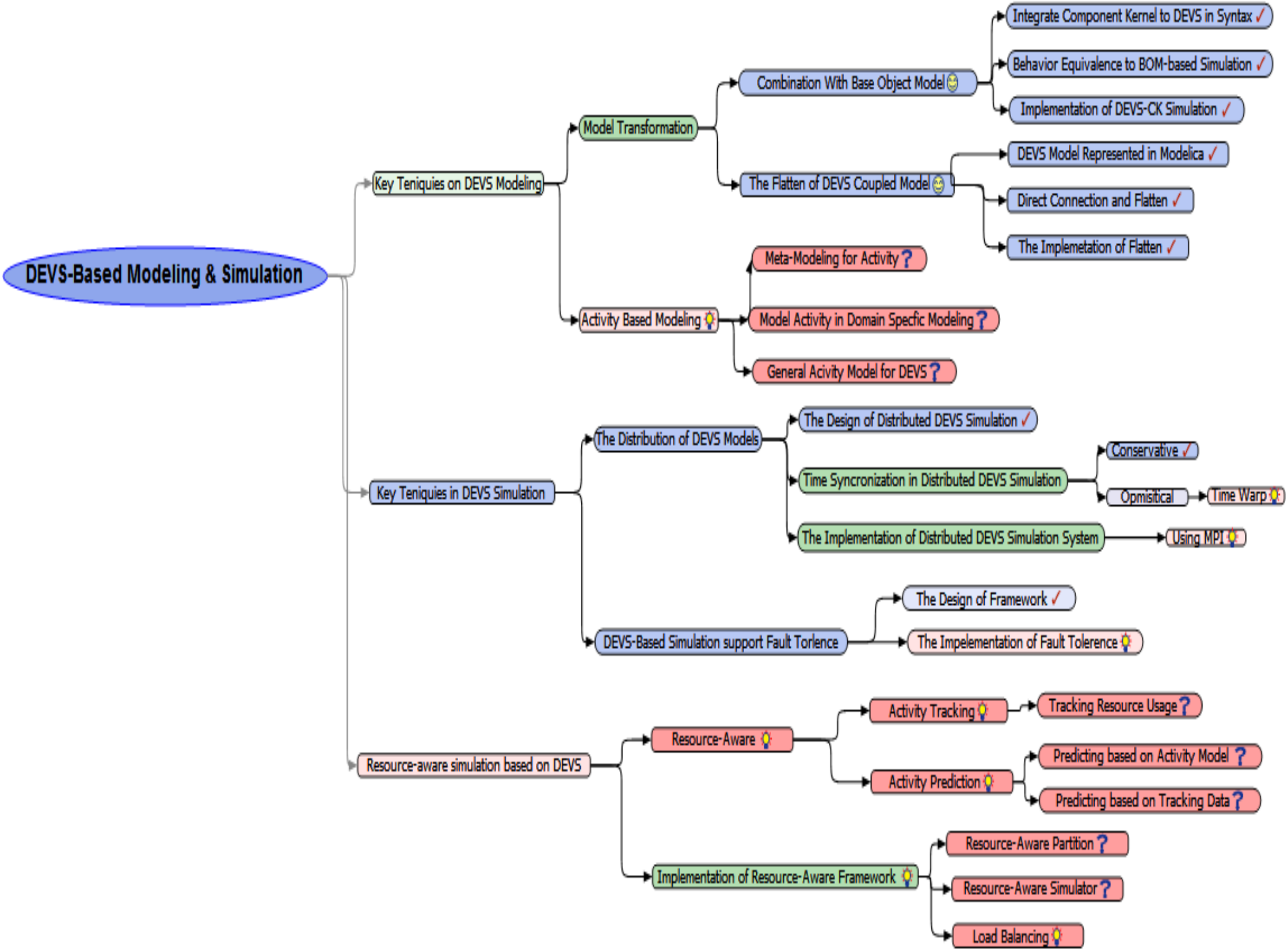

DEVS-Based Modeling & Simulation
Key Teniquies on DEVS Modeling
Model Transformation
Combination With Base Object Model
Integrate Component Kernel to DEVS in Syntax ✓
Behavior Equivalence to BOM-based Simulation ✓
Implementation of DEVS-CK Simulation ✓
The Flatten of DEVS Coupled Model
DEVS Model Represented in Modelica ✓
Direct Connection and Flatten ✓
The Implemetation of Flatten ✓
Activity Based Modeling
Meta-Modeling for Activity ?
Model Activity in Domain Specfic Modeling ?
General Acivity Model for DEVS ?
Key Teniquies in DEVS Simulation
The Distribution of DEVS Models
The Design of Distributed DEVS Simulation ✓
Time Syncronization in Distributed DEVS Simulation
Conservative ✓
Opmisitical
Time Warp
The Implementation of Distributed DEVS Simulation System
Using MPI
DEVS-Based Simulation support Fault Torlence
The Design of Framework ✓
The Impelementation of Fault Tolerence
Resource-aware simulation based on DEVS
Resource-Aware
Activity Tracking
Tracking Resource Usage ?
Activity Prediction
Predicting based on Activity Model ?
Predicting based on Tracking Data ?
Implementation of Resource-Aware Framework
Resource-Aware Partition ?
Resource-Aware Simulator ?
Load Balancing

Resource-aware Simulation

Bin Chen, Hans Vangheluwe
Modeling Simulation and Desgin Lab
Montreal
August 27th,2009

Agenda

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

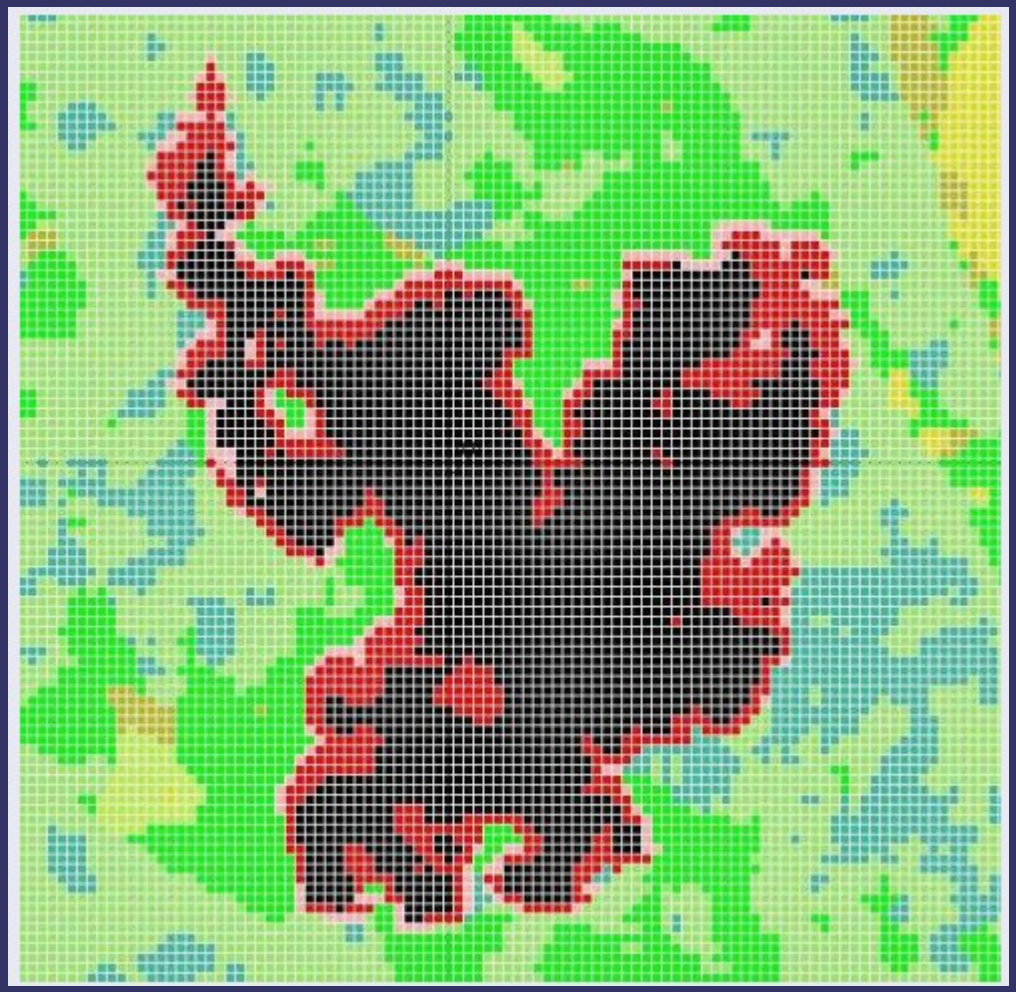
Introduction

- Dynamic Load Balancing Algorithms
  - Q Learning
  - Simulated Annealing
- Model-based Performance Prediction
  - Queuing Network, Petri-net
  - Neural Networks

Model Activity

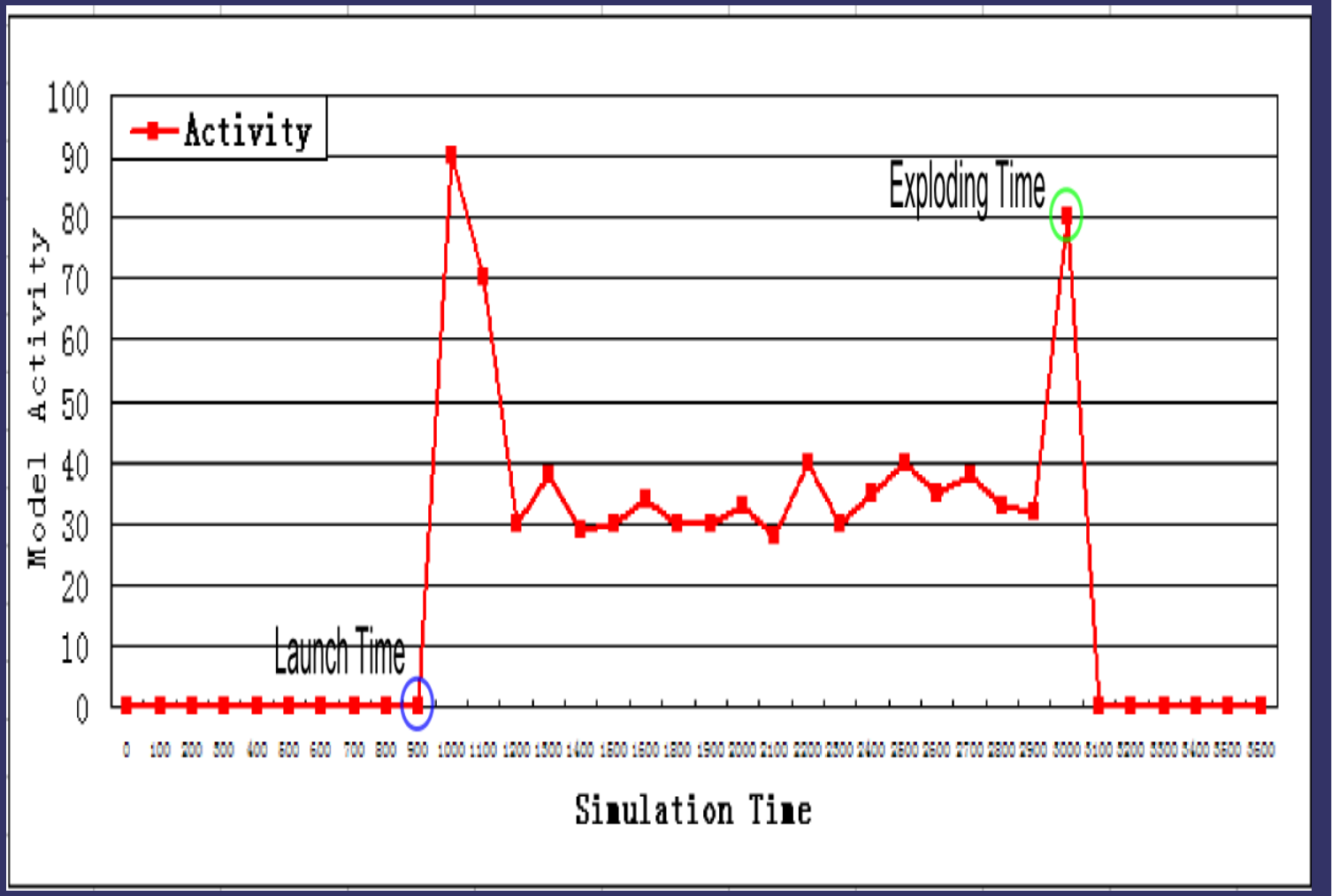
- Activity:Notion of locality in space and time
- Used in Activity Modeling and Activity Tracking

Activity-Example



Activity and Non Acitivity Region in Forest Fire

Activity-Example



Activity and Non Acitivity 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

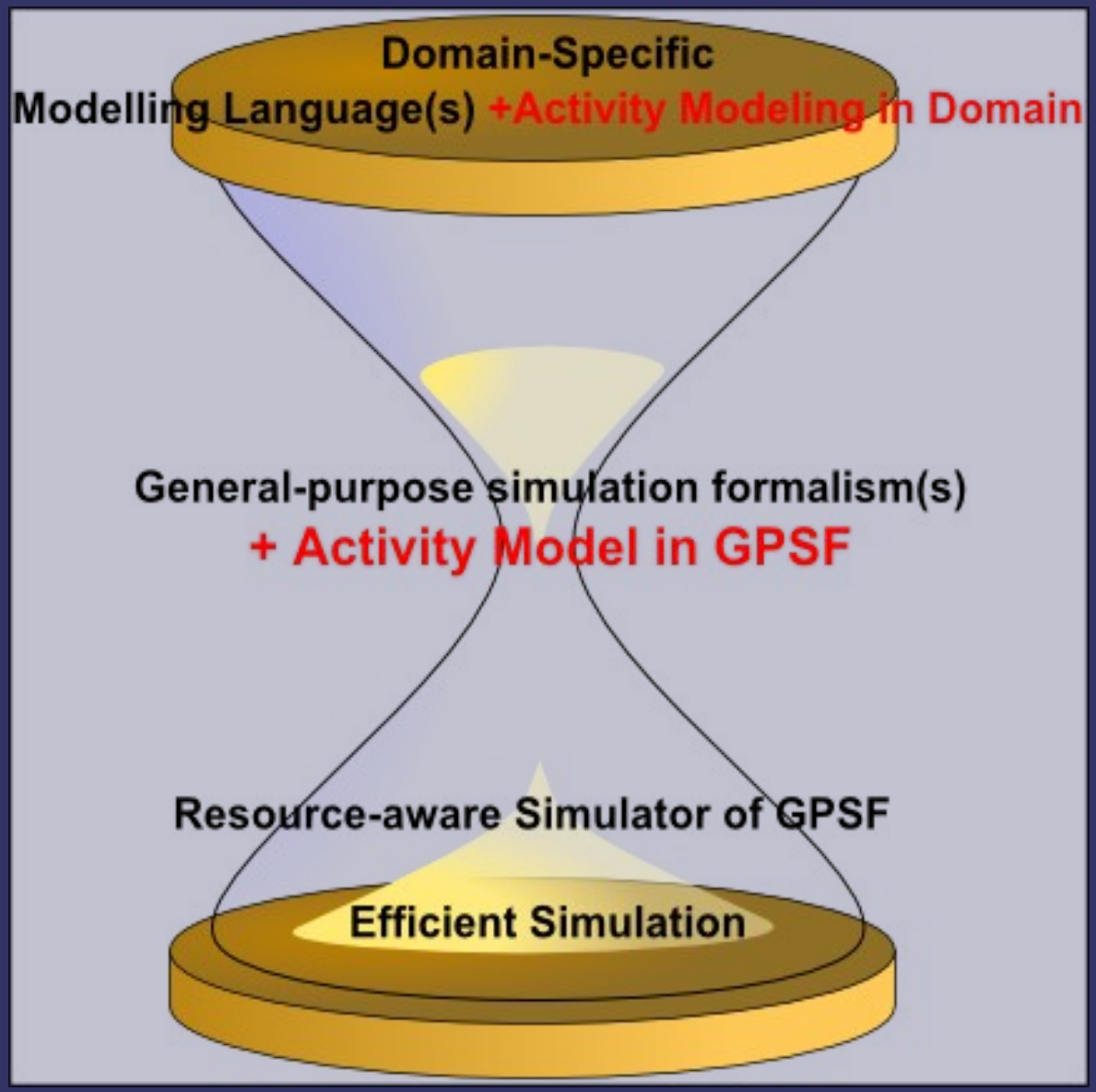
- What is Hint?
  - The description of Model Activity by Modeler
  - Instrinsic Hint
  - Extrinsic Hint

- 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

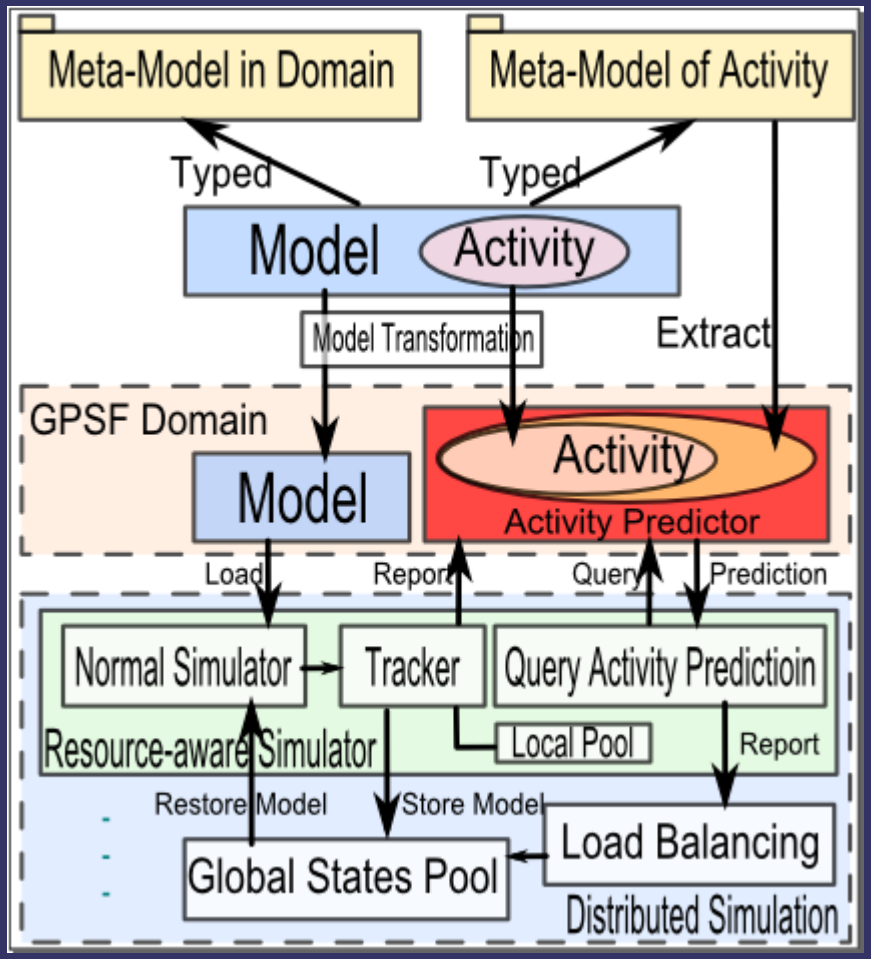
Simulation Framework

- 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?