

# AnyLogic

## Multi-Paradigm Simulation for Business, Engineering and Research

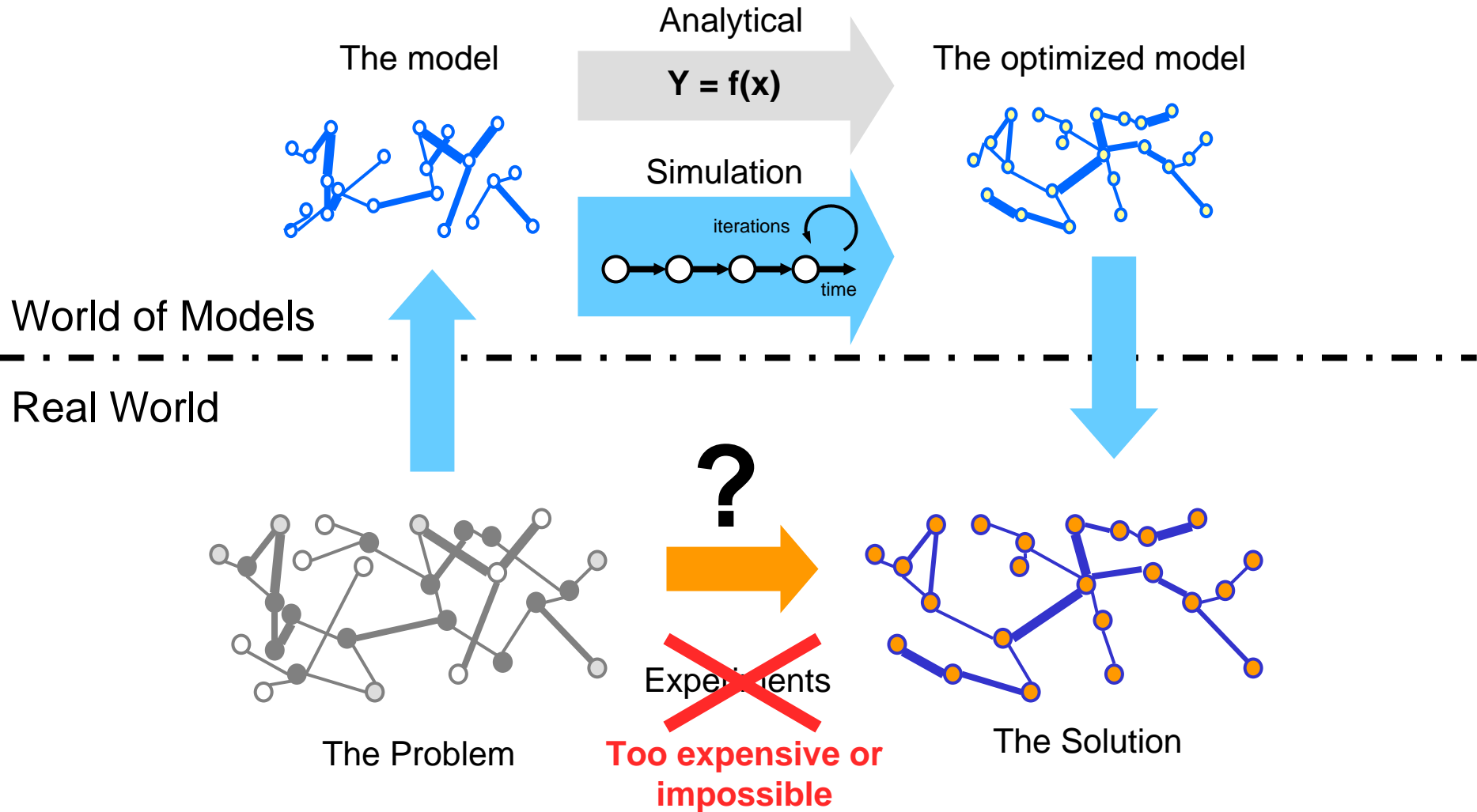
Andrei Borshchev & Alexei Filippov, XJ Technologies

Presented at  
IIE SimSol  
Orlando FL  
March 15-16  
2004

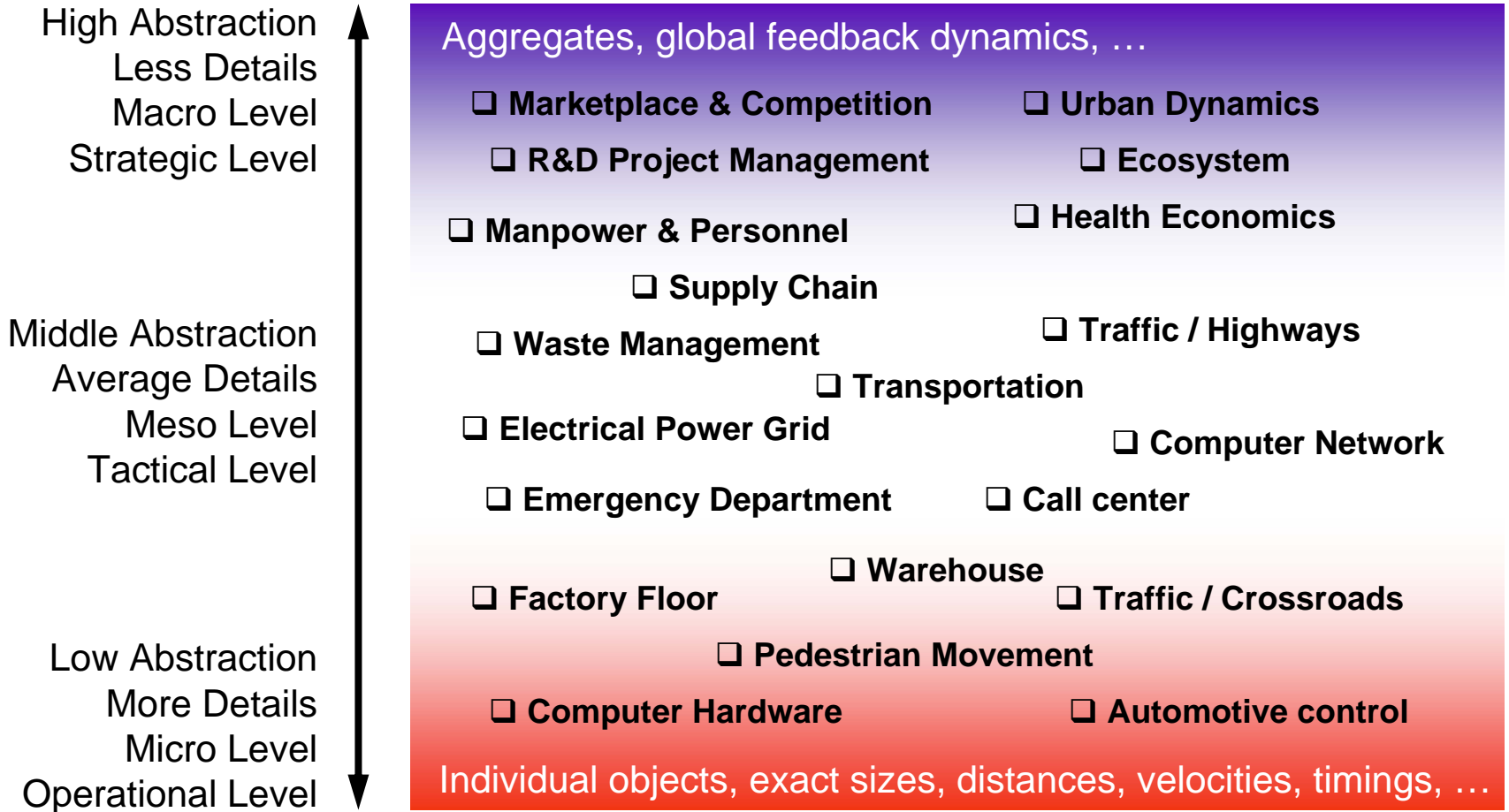


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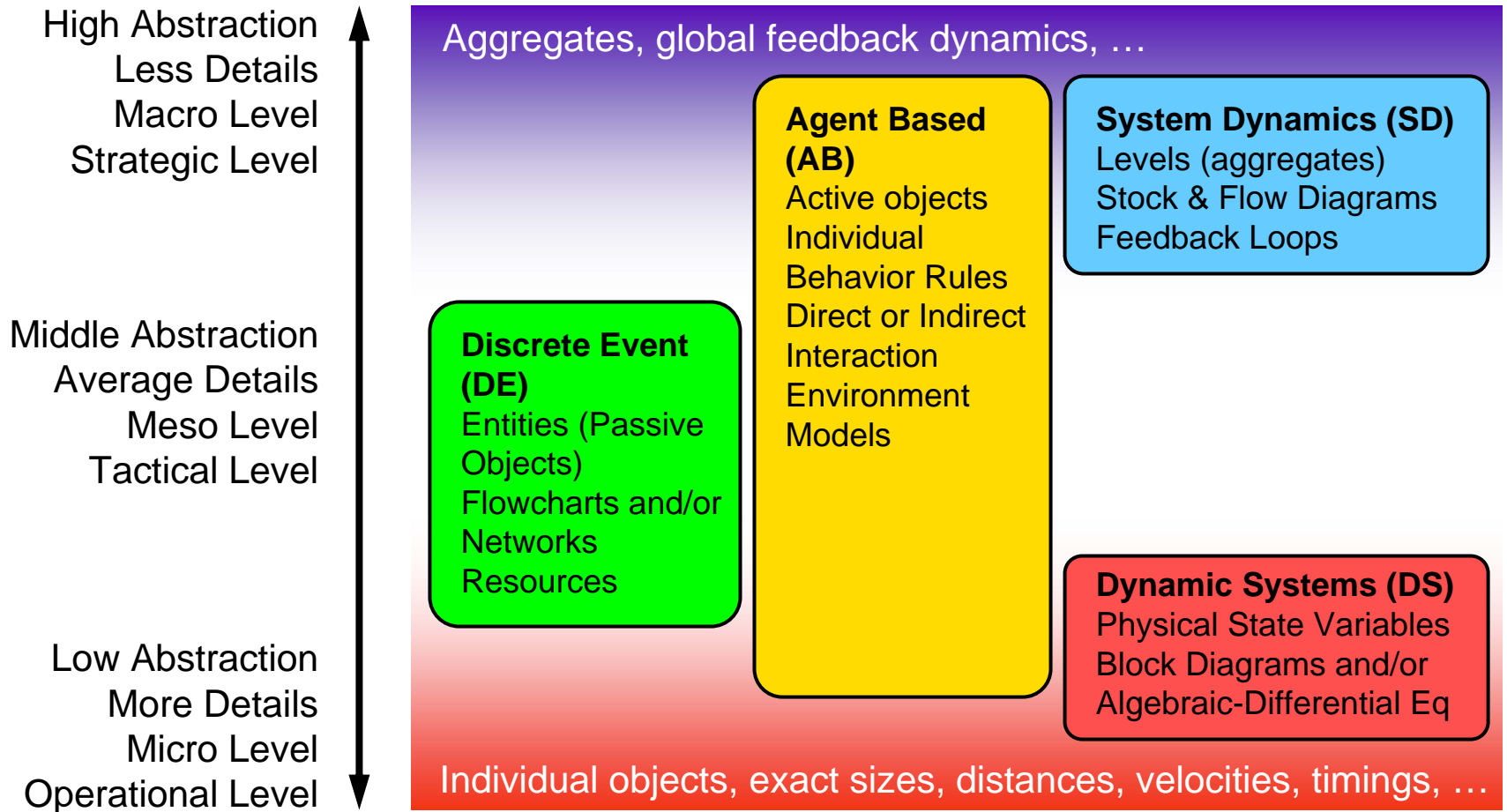
# Modeling



# Abstraction Levels and Approaches



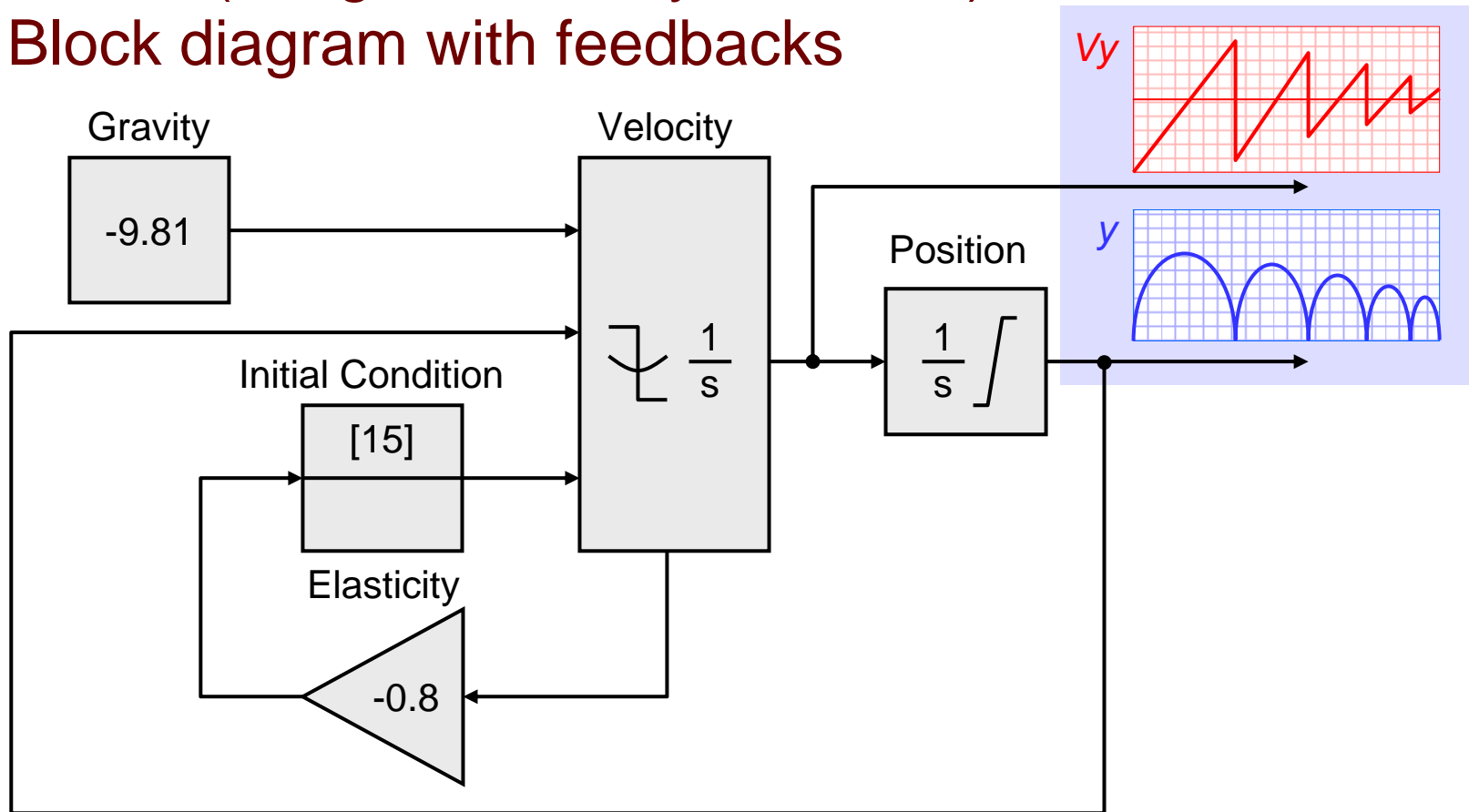
# Abstraction Levels and Approaches





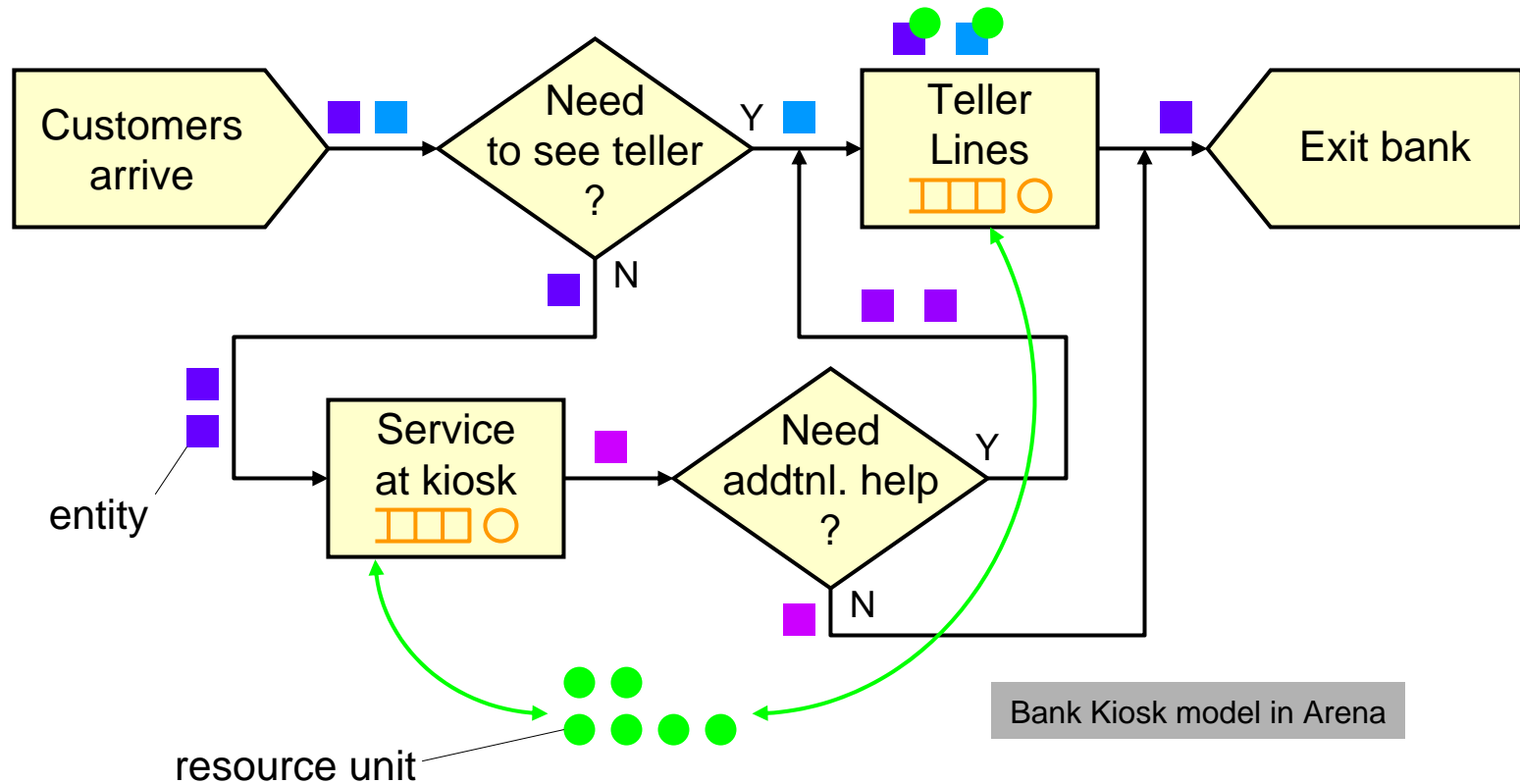
# Dynamic Systems

- Blocks (Integrator, Delay, Gain, ...).  
Block diagram with feedbacks



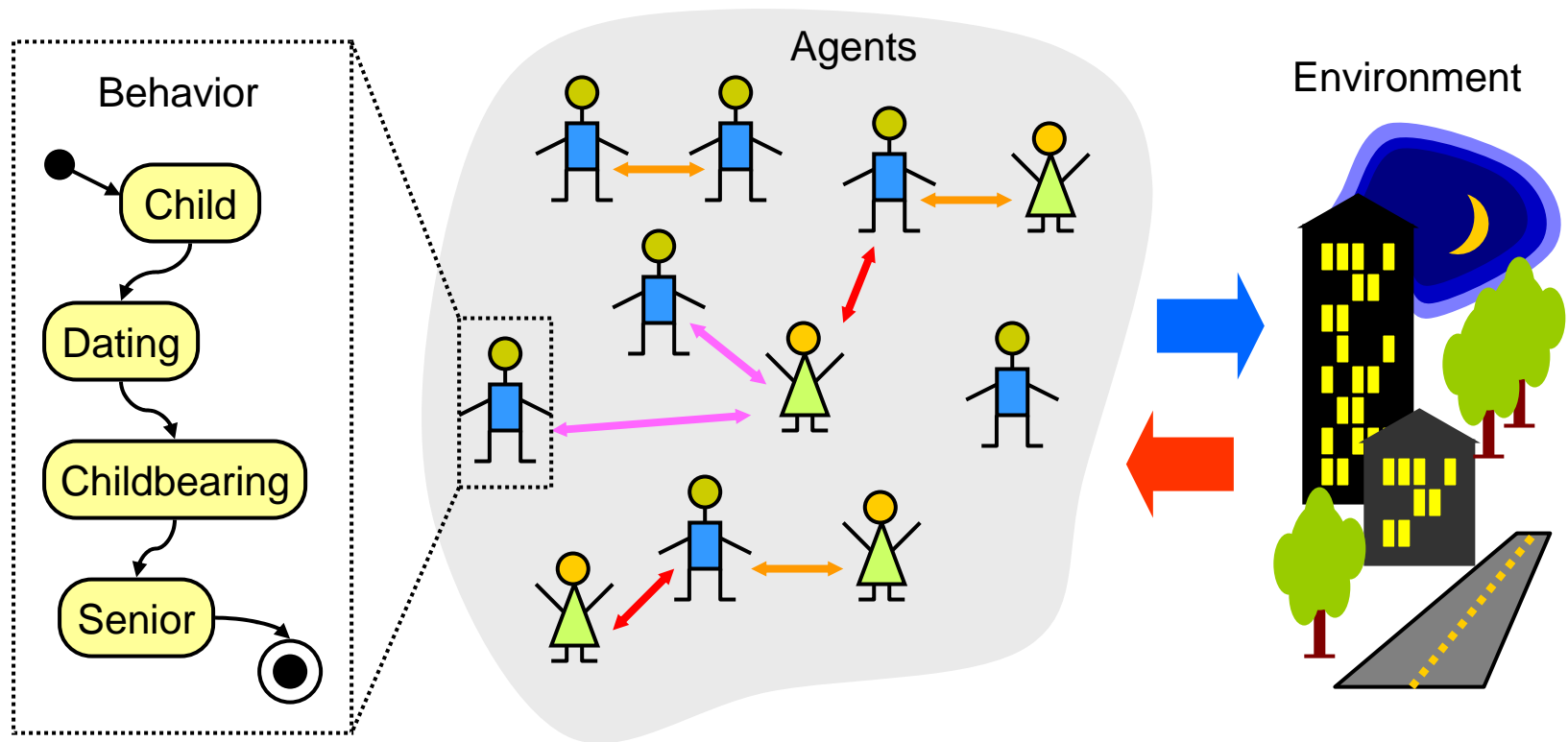
# “Discrete Event”

- Entities and Resources (passive objects).  
Flowchart blocks (Delay, Q, etc.) drive the model

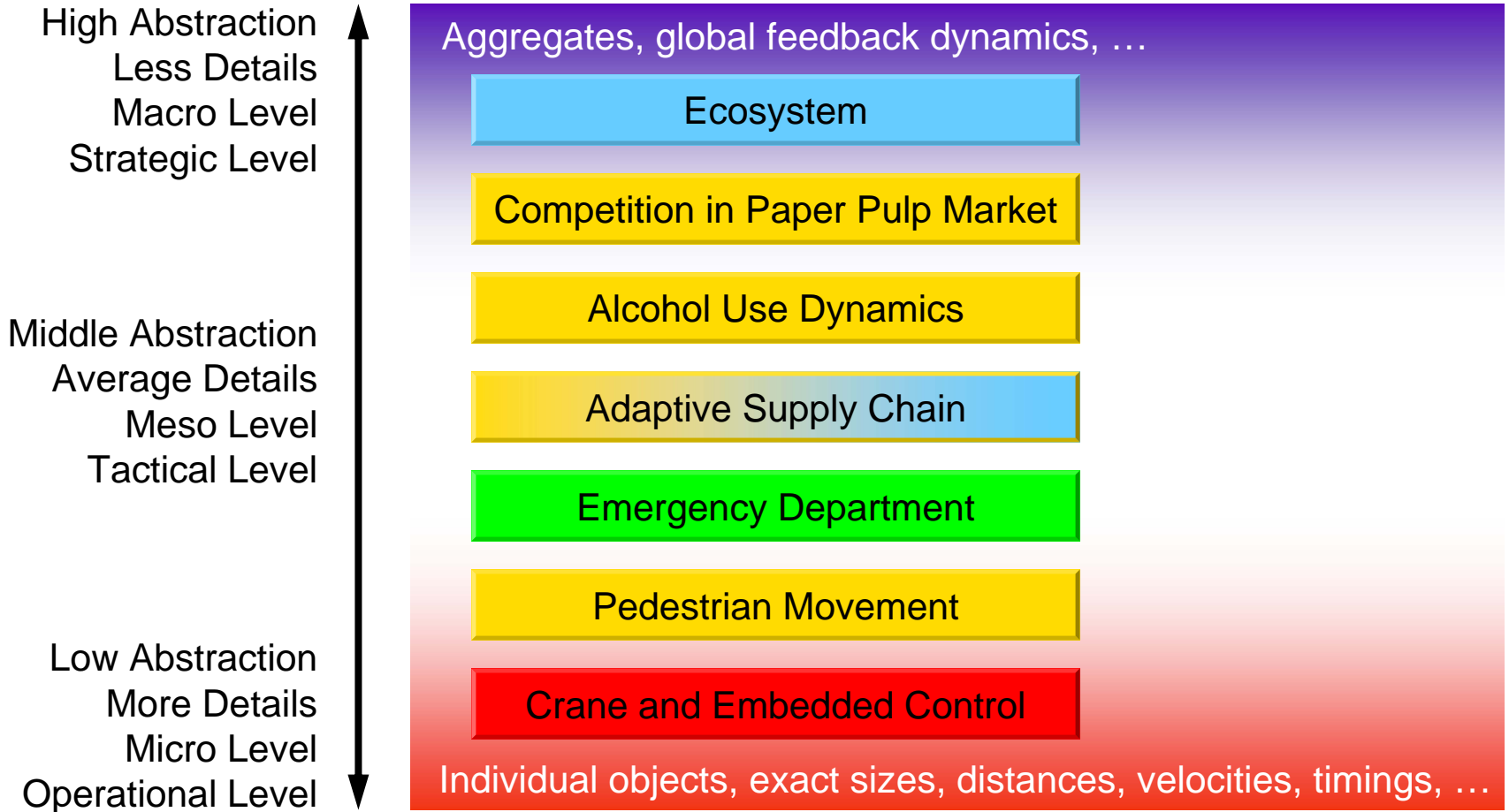


# Agent Based

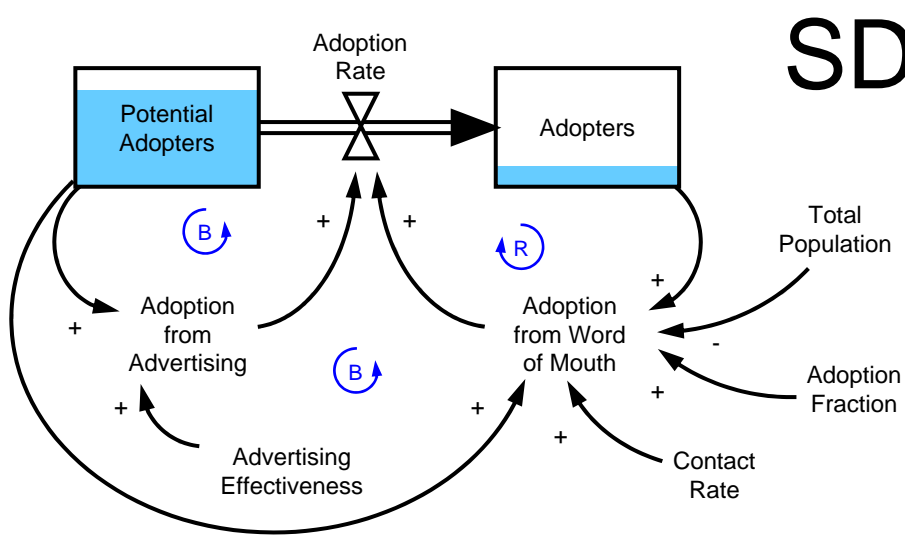
- Agents. Individual behavior rules. **Decentralized.** Communication with each other and environment



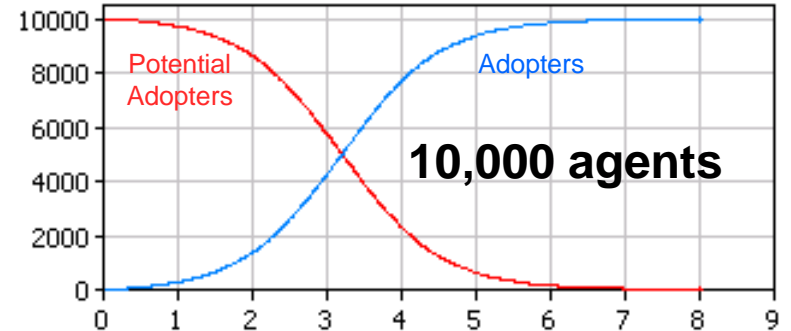
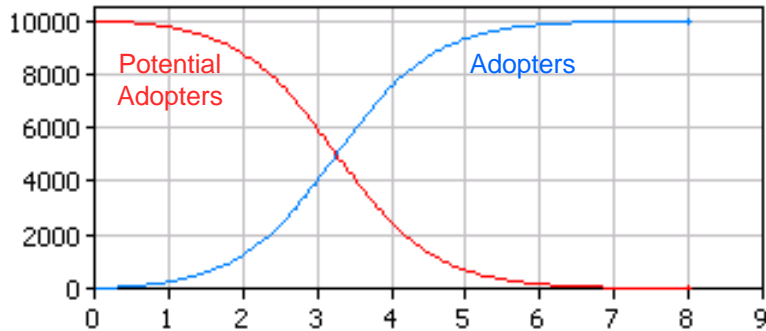
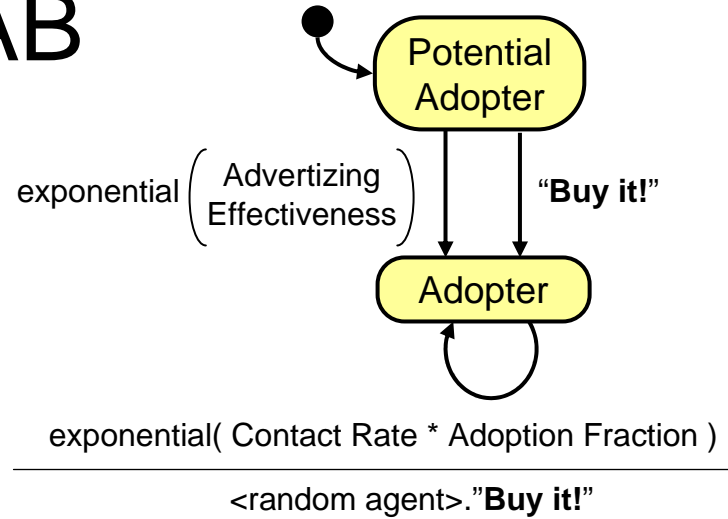
# Examples



# Correspondence Between SD and AB

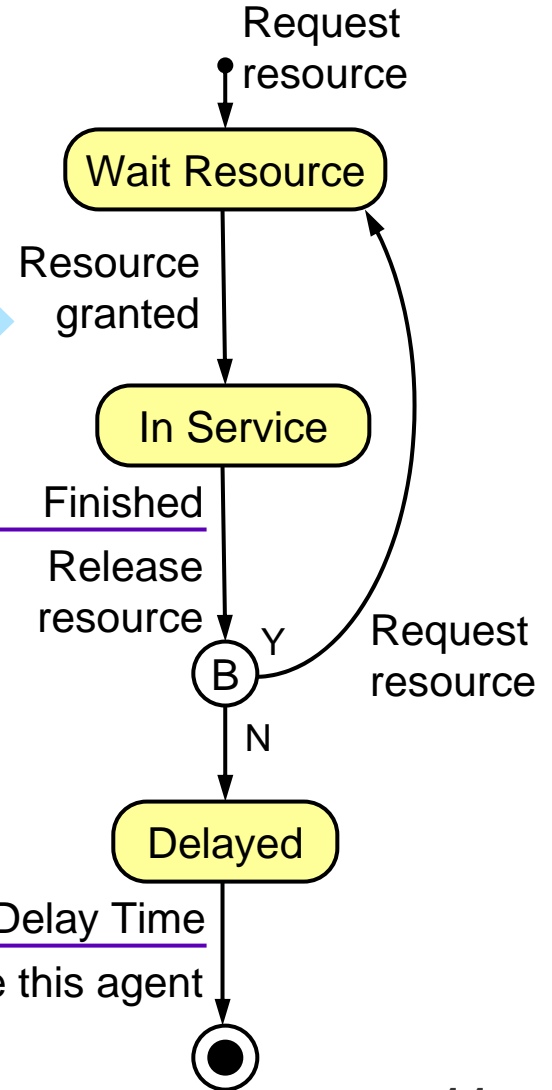
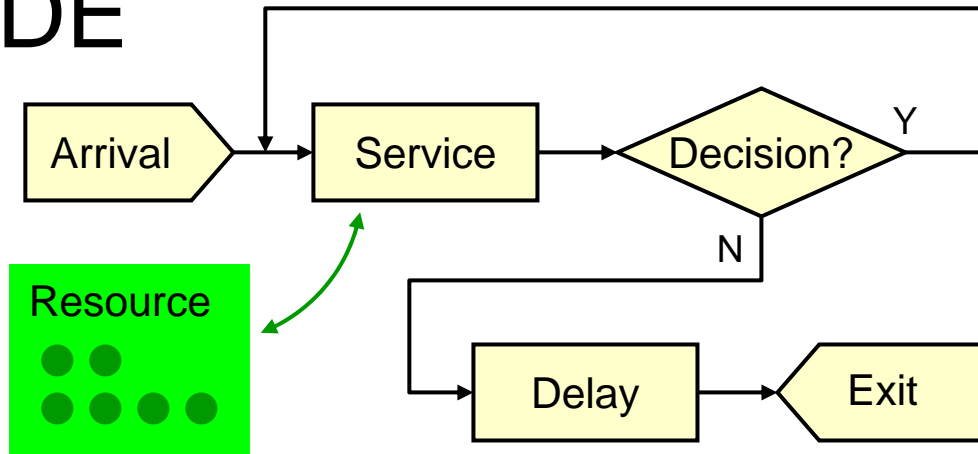


SD | AB

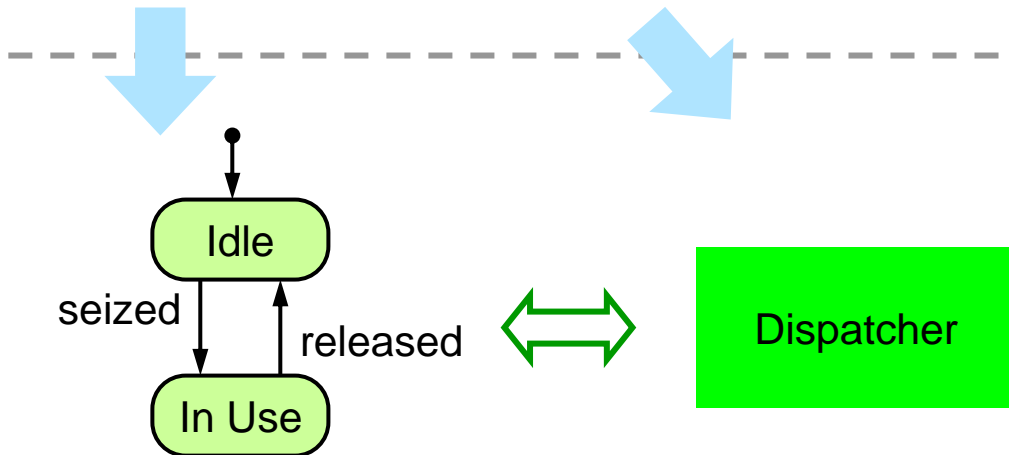


# Correspondence Between DE and AB

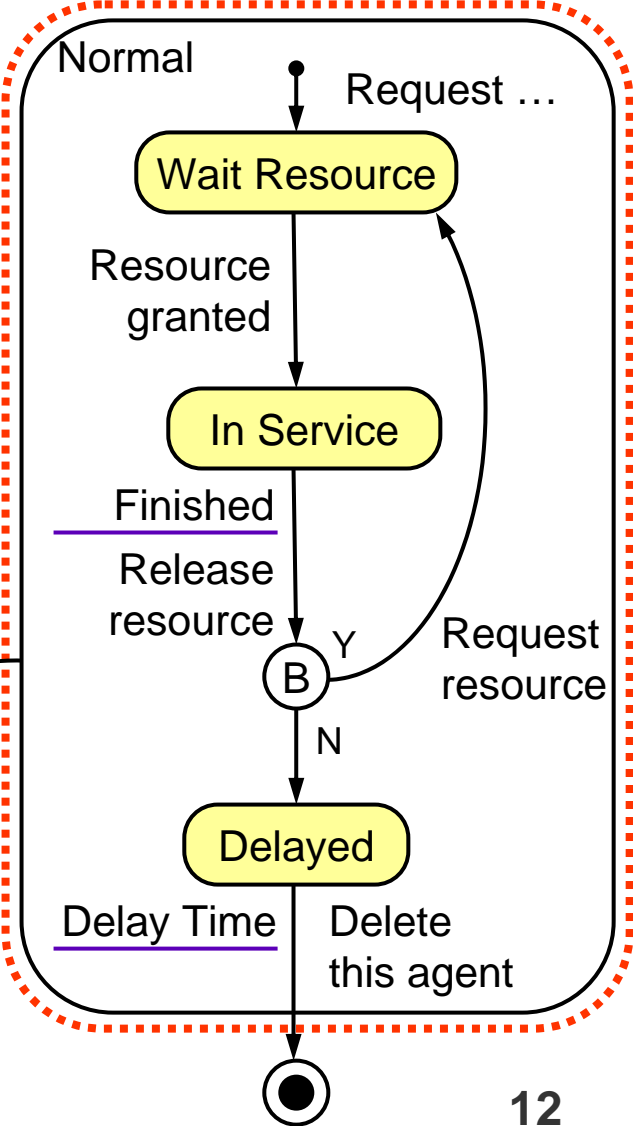
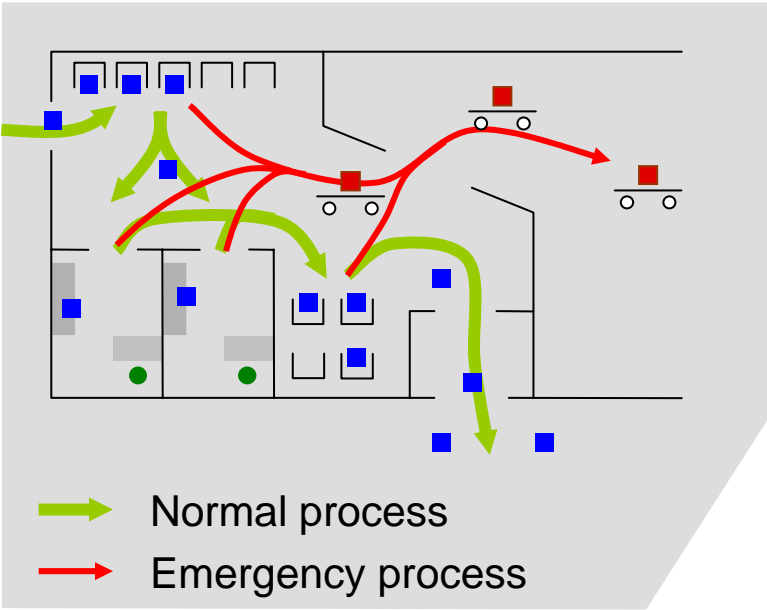
**DE**



**AB**



# Capturing More with AB Model



# Which Approach to Use?

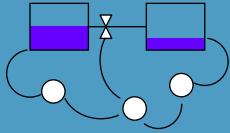
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- If the problem fits well into the DE or SD modeling paradigms and allows the corresponding abstraction –  
*Use traditional approaches*
- If the case your system contains active objects (people, business units, animals, vehicles, or projects, stocks, products, etc.) with timing, event ordering or other kind of individual behavior –  
*You will benefit from applying AB approach*
- Consider mixing different approaches in one model



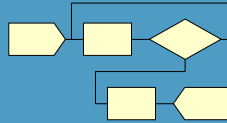
# Tools

## SD



VenSim  
PowerSim  
iThink  
ModelMaker

## DE



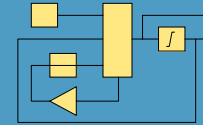
Arena  
Extend  
SimProcess  
AutoMod  
PROMODEL  
Enterprise  
Dynamics  
FlexSim  
eMPlant  
...

## AB



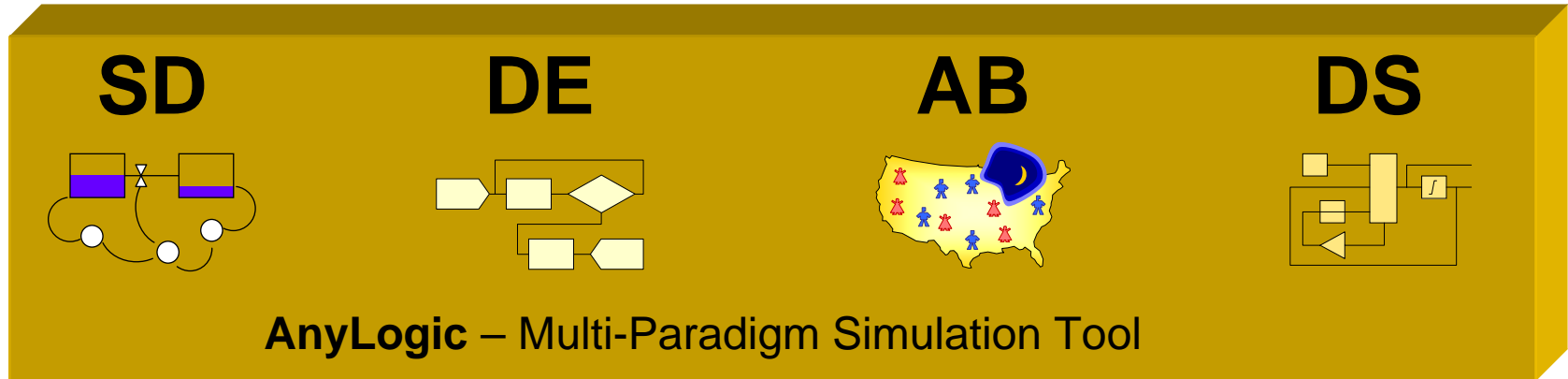
[Academic  
software:]  
Swarm  
RePast

## DS



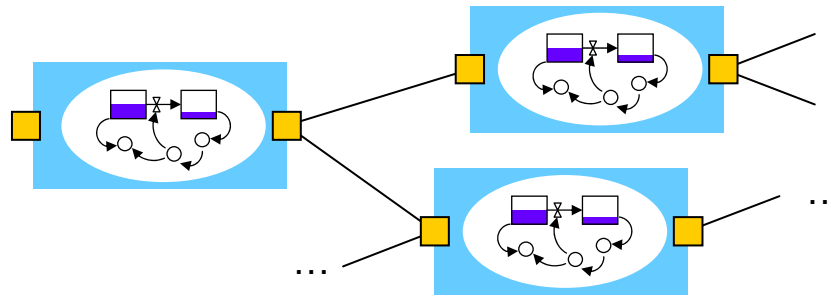
MATLAB  
VisSim  
LabView  
Easy 5  
...

# Tools



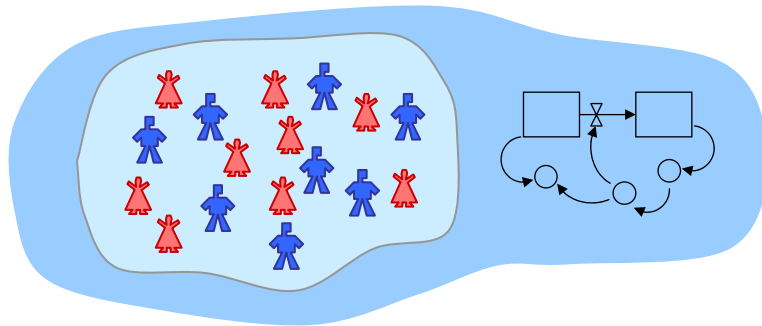
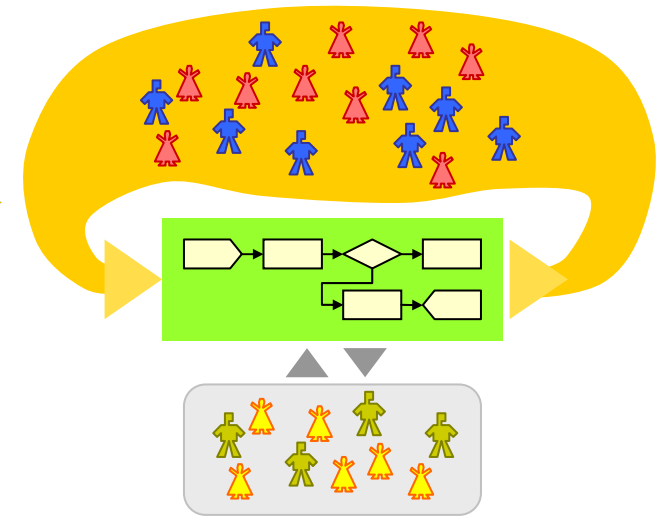
- You can easily vary and adjust the level of abstraction
- You can switch from one approach to another
- You can mix approaches
- All that on one solid object-oriented platform

# Multi-Paradigm Model Architectures



System Dynamics Sub-Models inside discretely communicating Agents

Agents (e.g. customers) interact with other agents (staff) in a Discrete Event flowchart



Agents live in an Environment modeled in System Dynamics way

# Thank You!

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- Questions?

