

Event-Based Control of Simulated Human/ Robot Interactions using Parameterized Behavior Trees

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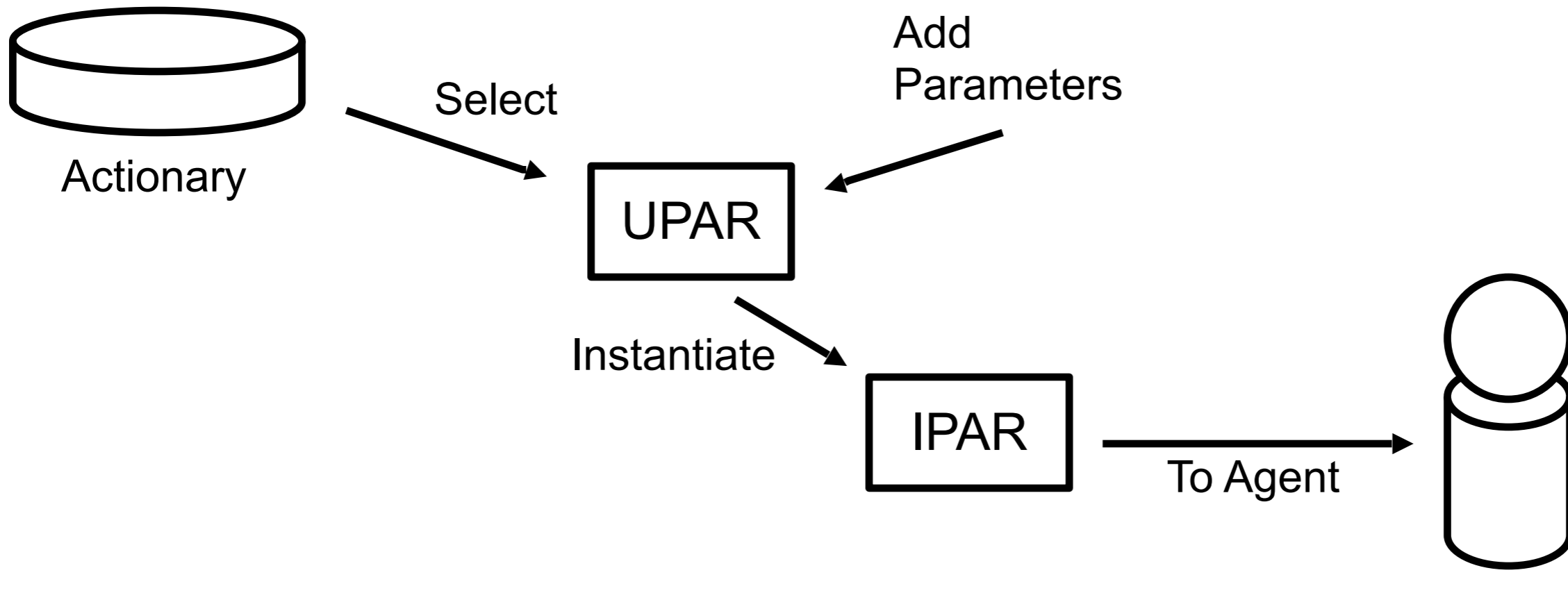
Overview

- **Background**
 - Parameterized Action Representations
 - (Parameterized) Behavior Trees
- **PBTs and Event-Centric Control**
 - Human/Robot Interactions
 - Functional Virtual Populace
- **Future Work**



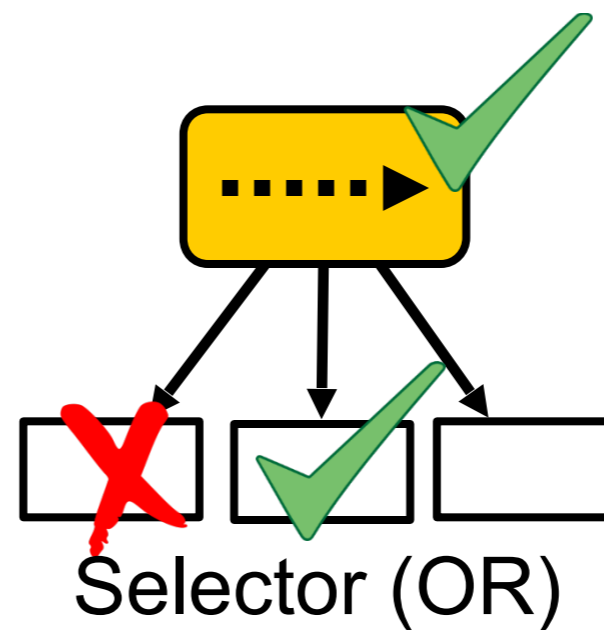
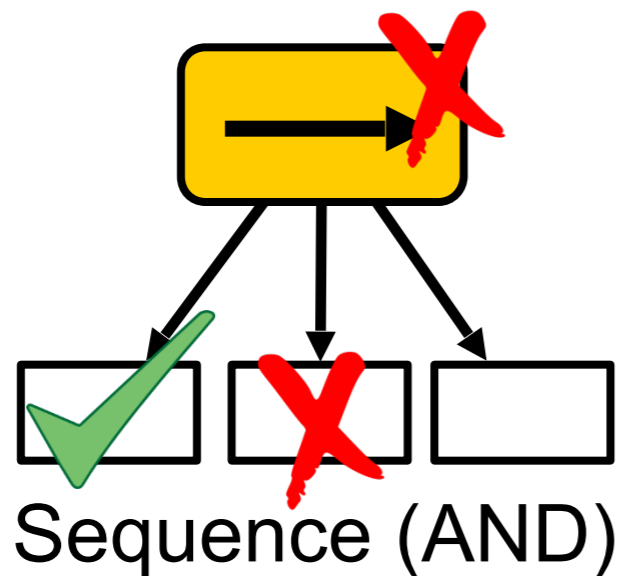
Background: PARs and PBTs

- **Parameterized Action Representation (PAR)**
 - Knowledge frame for dictating and specifying agent actions
 - Selected from an authored database and instantiated
 - Based on a precondition/preparatory-specification system



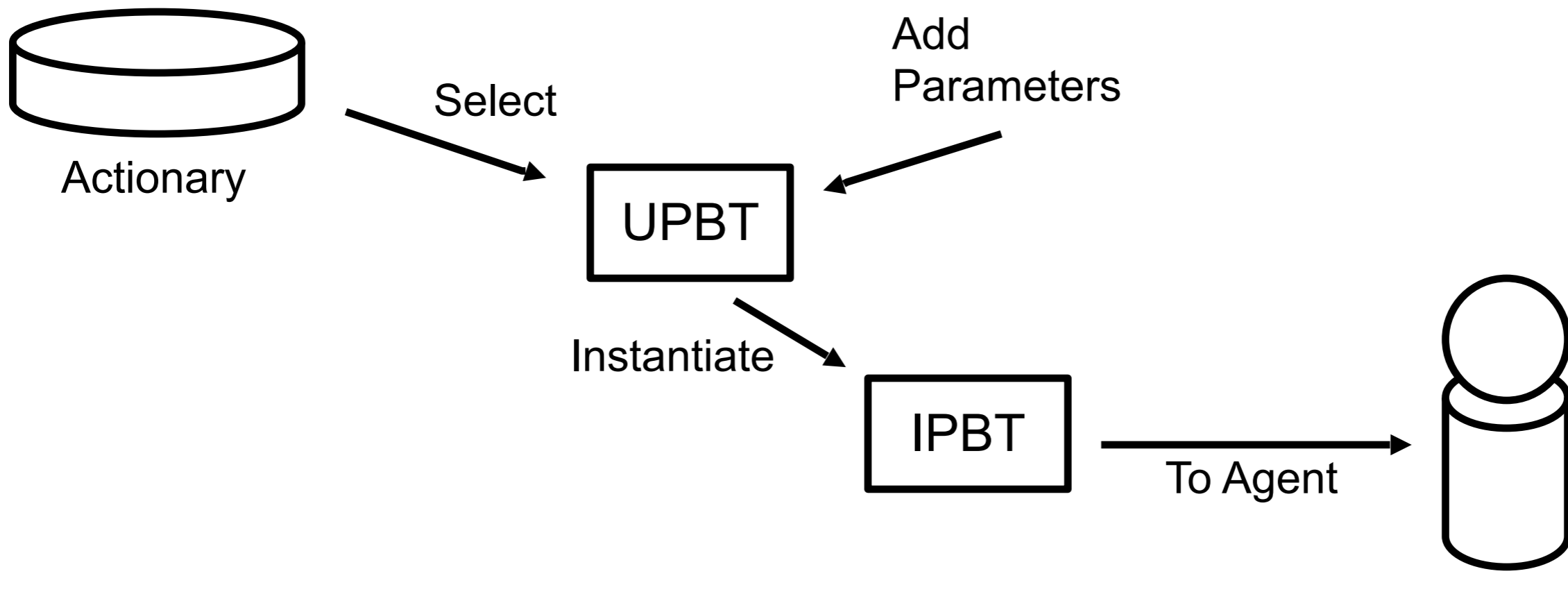
Background: PARs and PBTs

- **What is a Behavior Tree (BT)?**
 - Alternative to Finite State Machines (and PaT-Nets)
 - Hierarchical, Goal-Directed, Flexible
 - Two basic rules for success and failure:



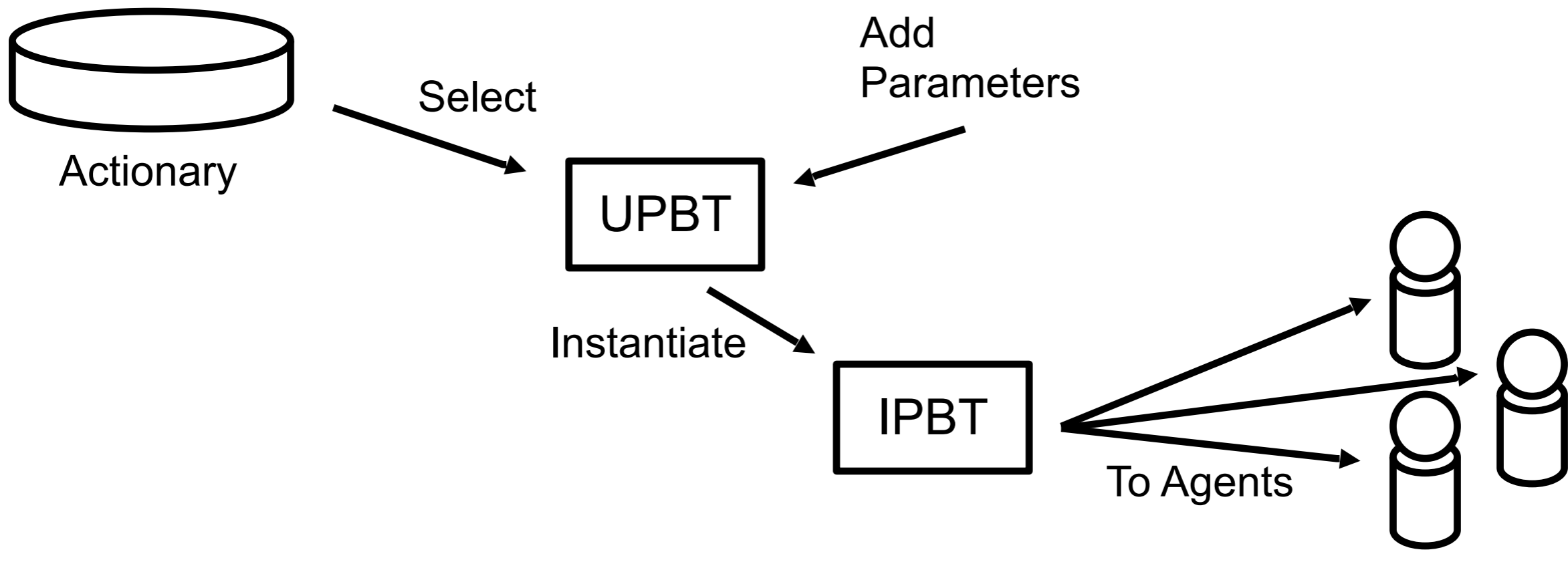
Background: PARs and PBTs

- **Parameterized Behavior Trees (PBTs)**
 - More compact behavior logic than PARs
 - All of the advantage of Behavior Trees
 - Can parameterize actions through hierarchical lookup nodes



Background: PARs and PBTs

- **Parameterized Behavior Trees (PBTs)**
 - More compact behavior logic than PARs
 - All of the advantage of Behavior Trees
 - Can parameterize actions through hierarchical lookup nodes
 - Can simultaneously control multiple agents



PBTs for Event-Centric Control

- **Interactions are managed by Events**
 - Agents do not need to directly respond to one another
 - Easy to author collaborative or competitive behaviors
 - Greater author control over interactions



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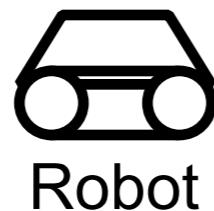


Robot



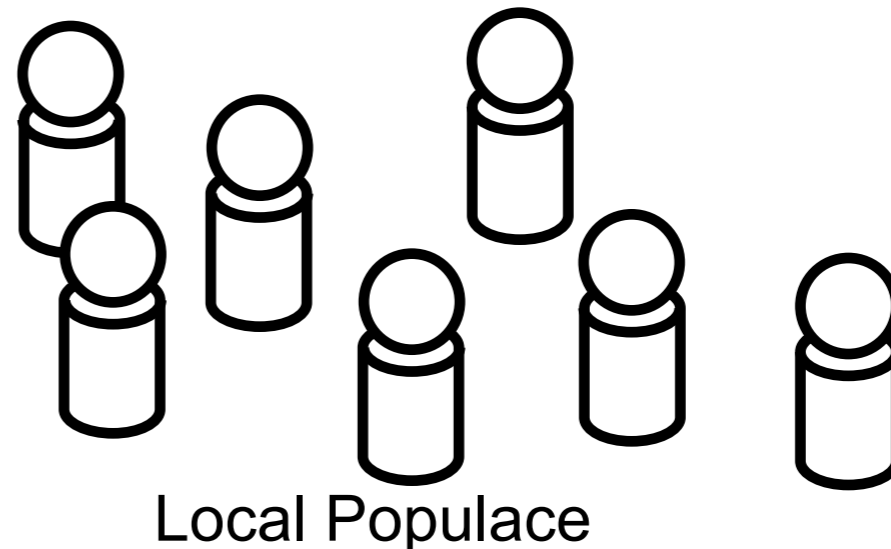
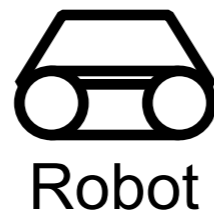
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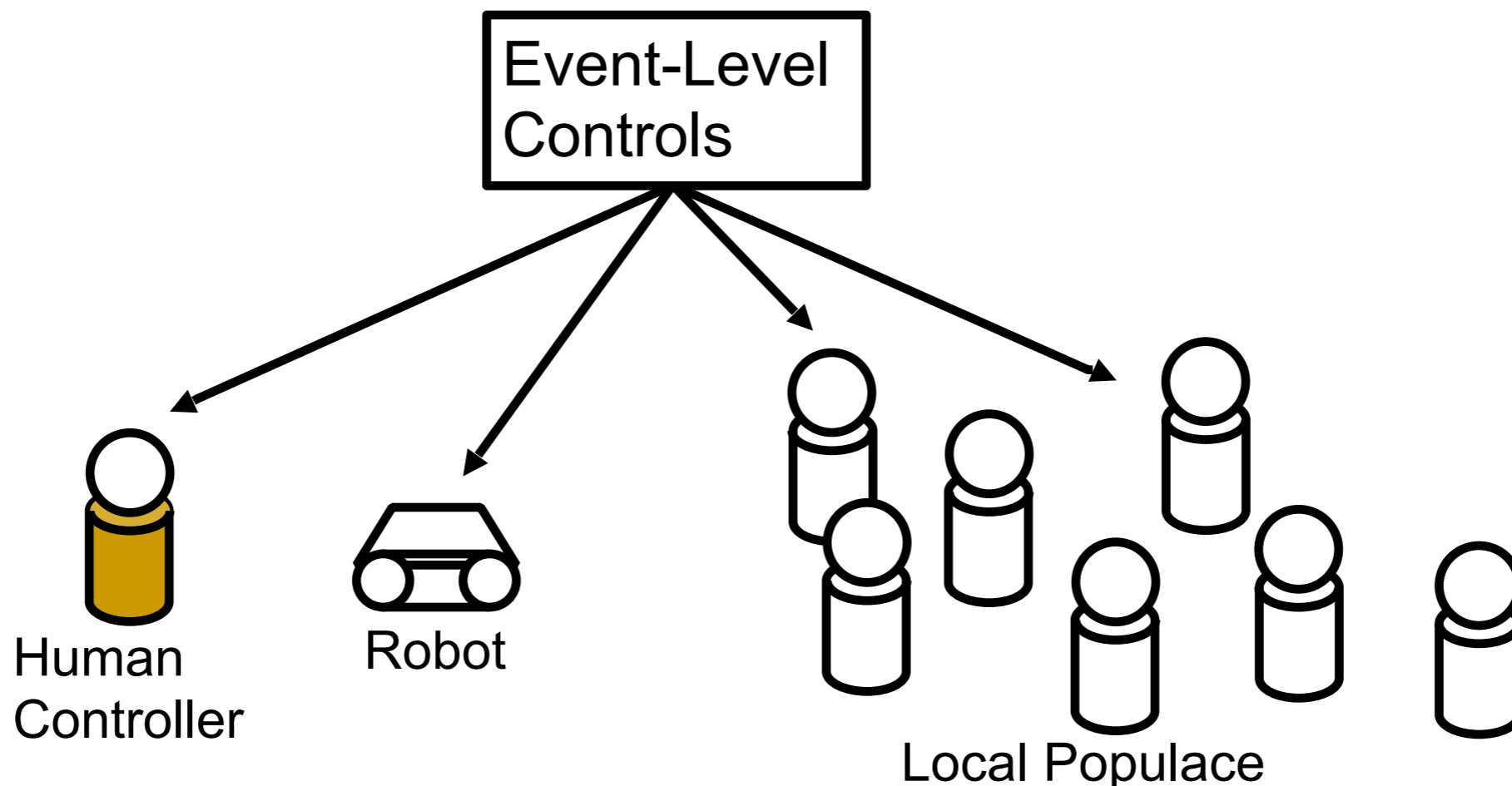
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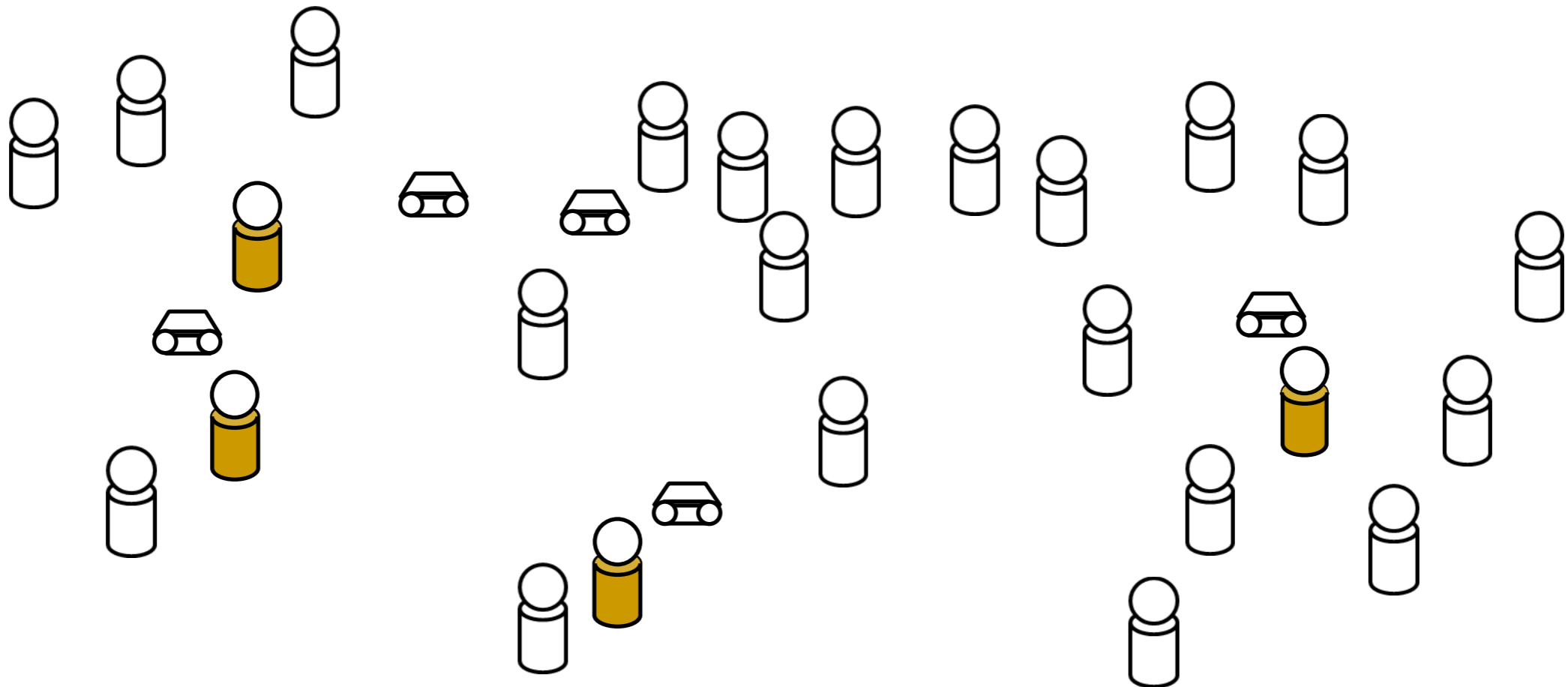
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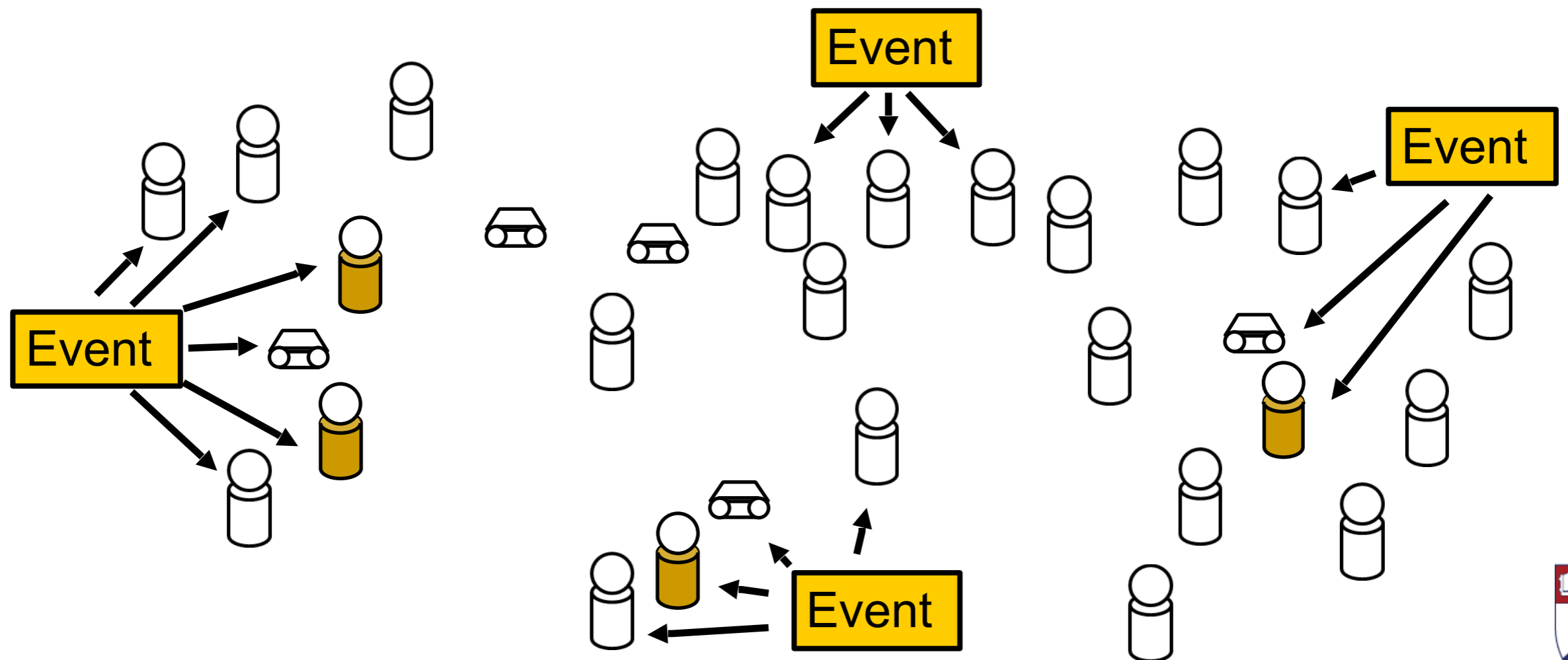
Functional Virtual Populace

- **Coordinate all Agents (Human and Robot) Simultaneously**
 - Centralized control structure
 - Macroscopic control over the population behavior
 - Agents still act reactively when not involved in events



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Conclusions and Future Work

- **Event-Centric Control**
 - Easier to author collaborative behaviors in events than in reactive agents.
- **Future Work**
 - Planning in the event space
 - Abstracted scenario narrative specification

