Regulating Multiagent Systems: A Basis for Responsible AI

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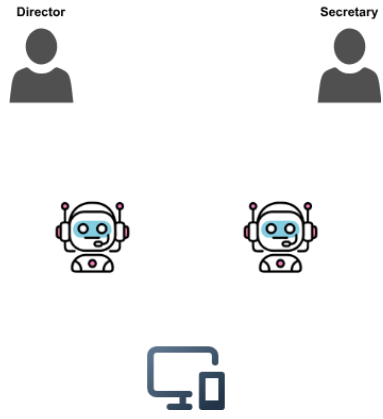
AI Agents and Human Insight – 3rd ENFIELD Webinar
November 21, 2025

Introduction

- Human society is **increasingly becoming dependent** on IT
- Recent advances of AI promotes the **delegation** of goals to artificial agents
- Agents usually **interact** to achieve their delegated goals
- Agents interests are at best **imperfectly aligned**



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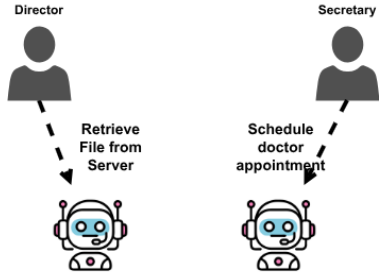

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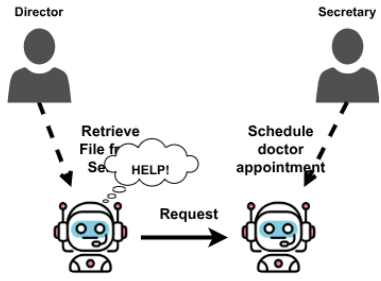

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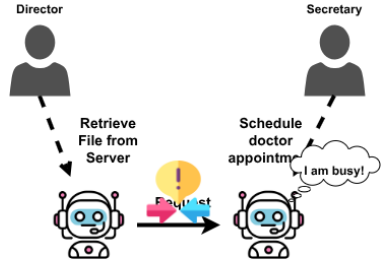

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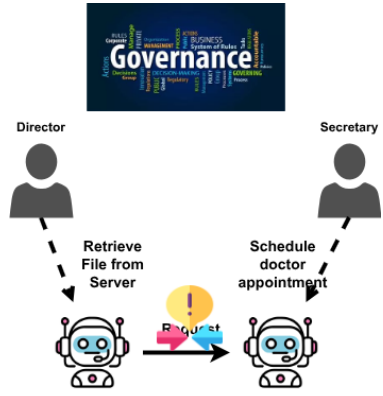
- The success of these systems relies on effective **governance**
  - how interactions are controlled
- Governance should maintain the **equilibrium** between
  - **Autonomy** of the agents
  - **Predictability** of the system



How can we govern these systems interfering the least with the autonomy of the agents?

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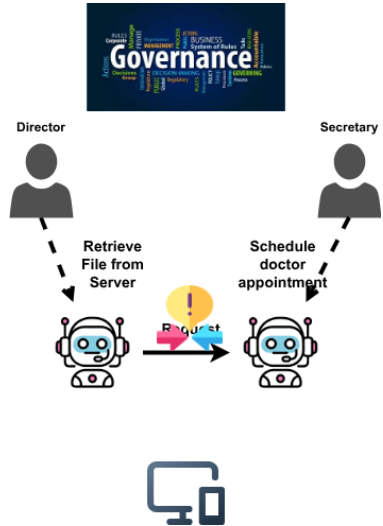

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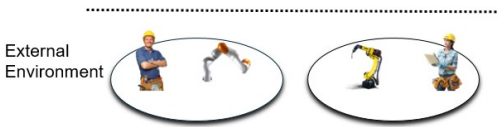
Multiagent Systems: Multiagent Oriented (MAO) Approach

(Boissier et al., 2020)



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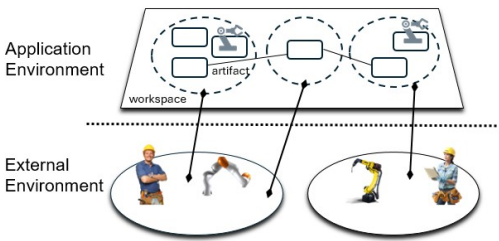

- **Environment**: Shared medium providing the conditions for agents to exist and act
- **Agent**: Autonomous decision-makers capable of responding to events while pursuing goals and taking action to achieve them
- **Organization**: Abstractions to declare and make accessible to agents their collective structure and functioning in a shared environment

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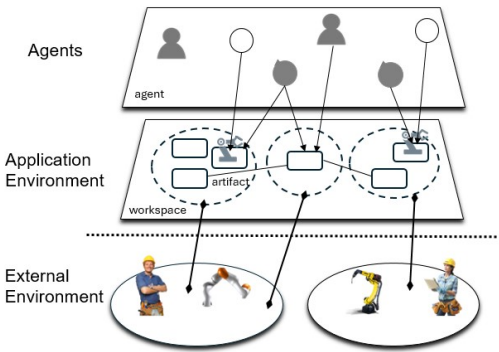

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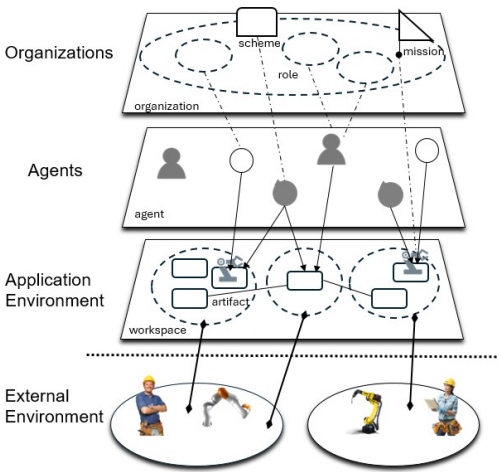

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Regulated Multiagent Systems

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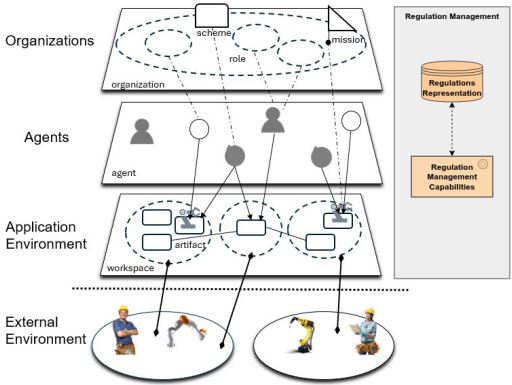
- **Regulation Management**
  - Regulations Representation
  - Regulation Management Capabilities

Regulated Multiagent Systems



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Regulations Representation

- **Constitutive Norms**
  - Institutional interpretations of environmental facts
  - Link *brute facts* to *institutional facts*

$$id : x \text{ count-as } y \text{ [when } t\text{] [while } m\text{]}$$

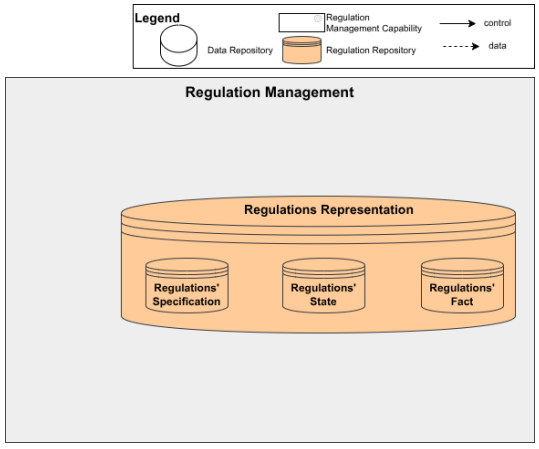
- **Regulative Norms**
  - Prescribe constraints on behavior or state of affairs that are expected
  - Qualify a behavior or state of affairs as obligations, prohibitions and permissions

$$\text{norm } id : \delta \rightarrow \psi \text{ if } \phi : sr_i(args)$$

- **Sanction rules**
  - Consequences of compliance with or violation of regulative norms

$$\text{sanction-rule } sr_i(args) : \rho \rightarrow \text{sanction}(\alpha, \gamma)$$

Regulations Representation



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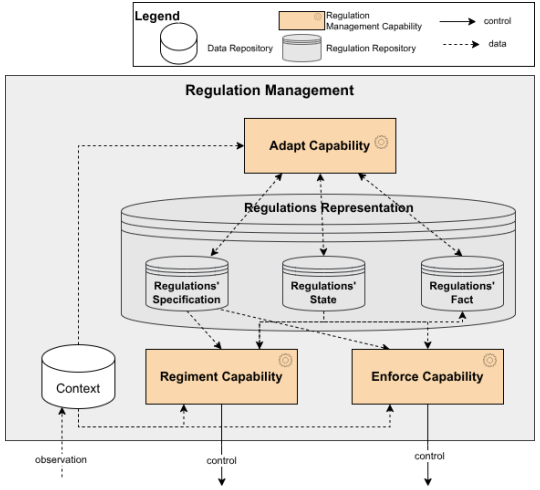
Regulation Management Capabilities



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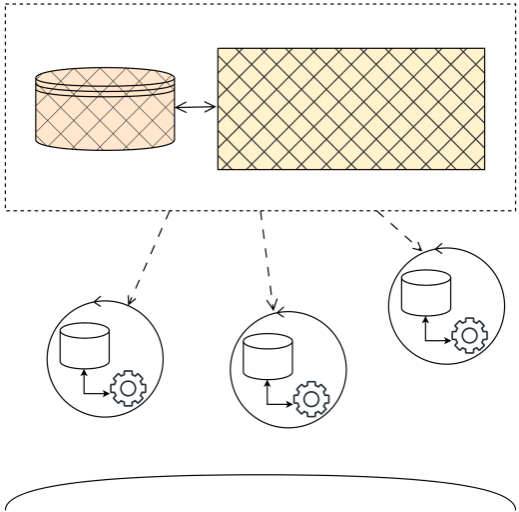
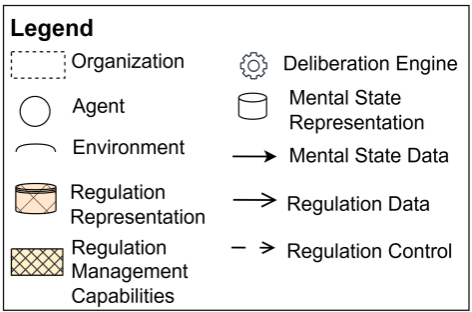
Organization-Centric Regulation Management Perspective





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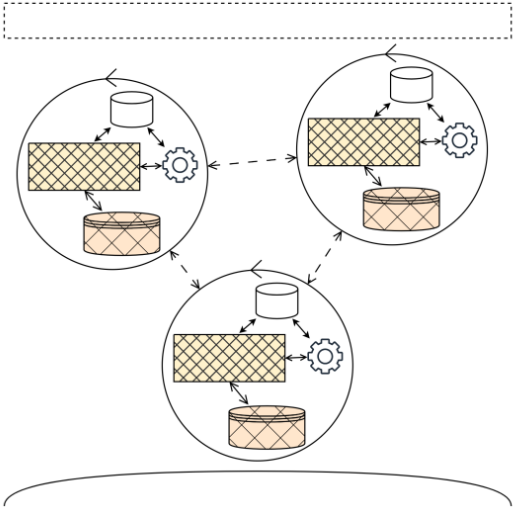
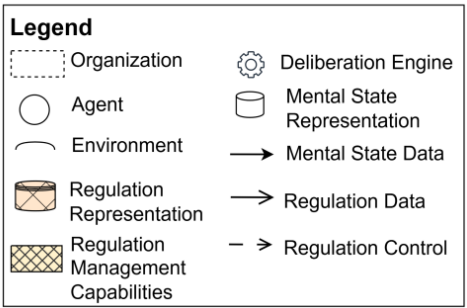
Agent-Centric Regulation Management Perspective





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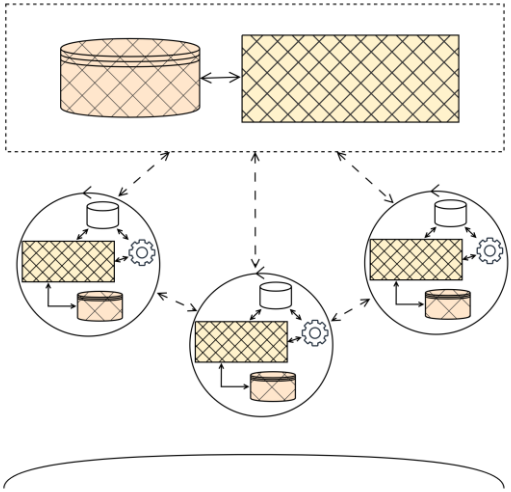
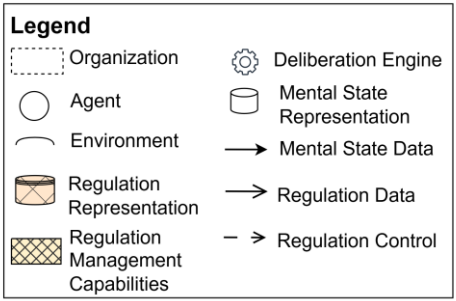
Hybrid-Centric Regulation Management Perspective





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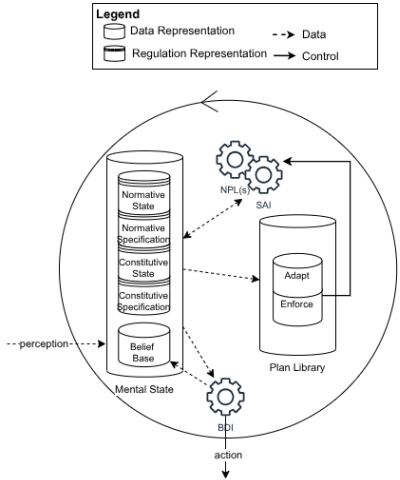
Normative Agent Architecture

- BDI normative agent architecture
- NPL(s) and SAI Engine
- Regulations Repository
- Plans
  - Adapt
  - Enforce



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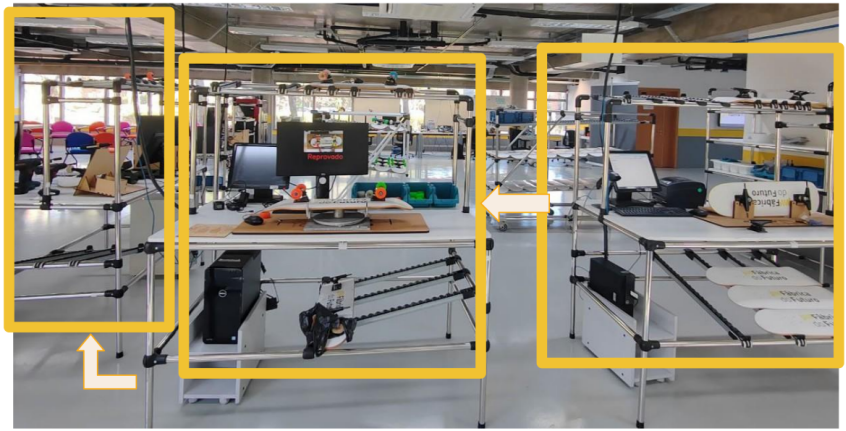
Skateboard Assembly Line

Objective: Assembly custom skateboards based on customer orders

Workstations

- TrunkWS
- WheelWS
- TorqueWS



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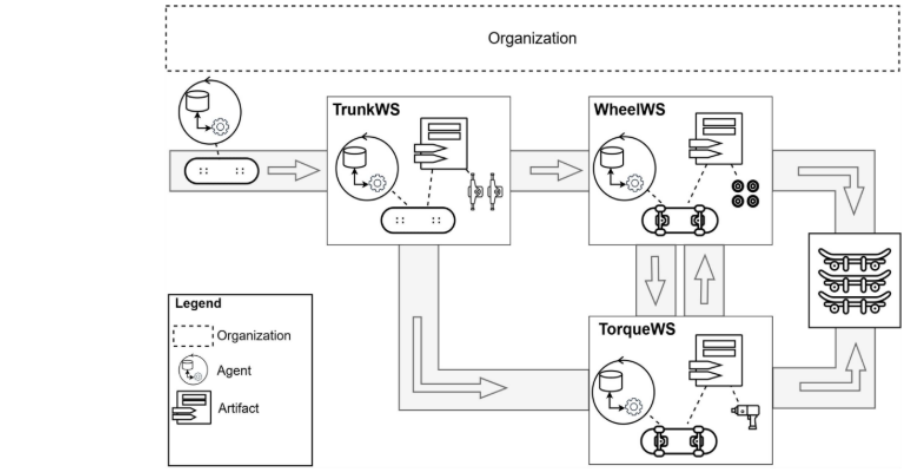
Skateboard Assembly Line



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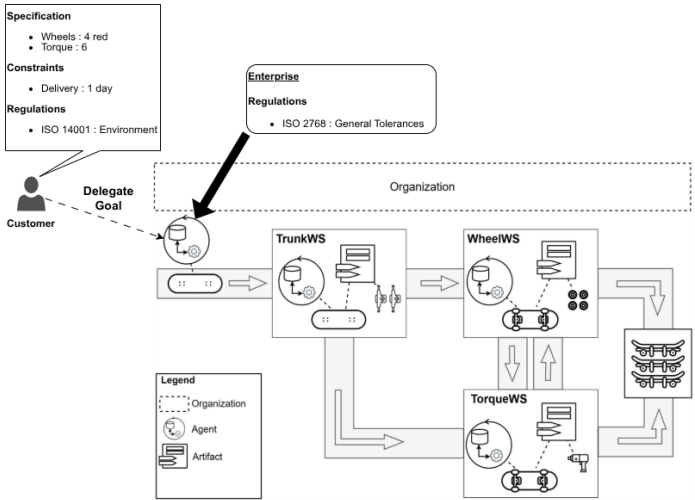

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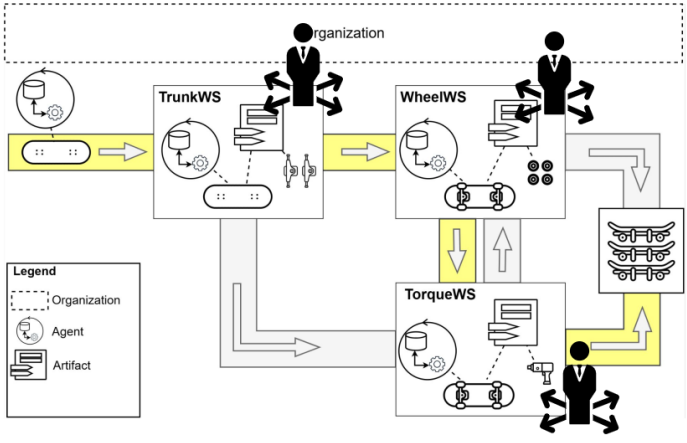

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Support for Responsible AI

- **Collaborative Decision-Making**
  - Facilitate balanced decisions based on explicit expected behavior
  - Establish mechanisms for detecting conflicts or violations enabling quick response
- **Transparency and Explainability**
  - Enhance the comprehension by humans of agents decision-making processes
- **Accountability**
  - Identify clearly the distributed responsibilities, enabling the creation of checks for accountability
- **Adaptability**
  - Enable easy adaptation to new or changing regulatory frameworks

Thank you!

Partially funded by ANR-FAPESP NAIMAN project (ANR-22-CE23-0018-01, FAPESP 2022/03454-1)