

## Reasoning about Norm-Compliance with MDP Agents

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# Outline

- 1 Introduction
- 2 Norm-Compliant MDP Agents
- 3 Non Norm-Compliant MDP Agents
- 4 Conclusion and Future Work

## Regulated Multiagent Systems

### In Regulated MAS...

... no guarantees regarding the *agents' behaviour*.

*It may deviate from the regulative prescriptions*

### Regulative Mechanisms...

⇒ For achieving a global behaviour

⇒ i.e. Norms (*obligations* and *prohibitions*)

## Rational Agents' Perspective

On the other hand, the **MDP Agents** try to maximize their rewards in the RMAS.

### Two agent types:

1. *Full norm-compliant agents*
2. *Agents that reason about norm violations*

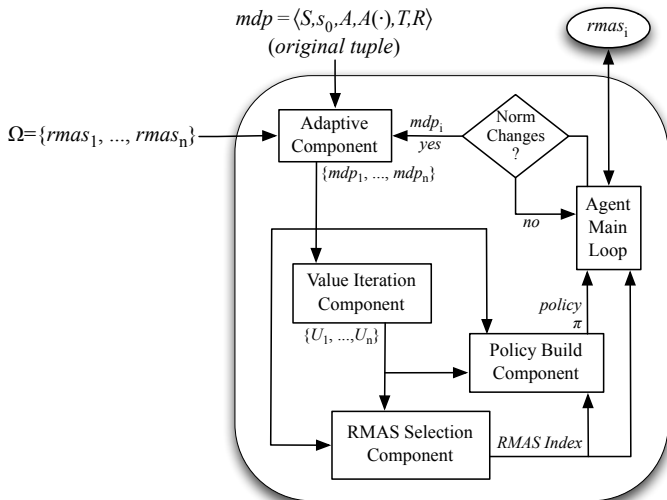
We are interested in this **micro** perspective!

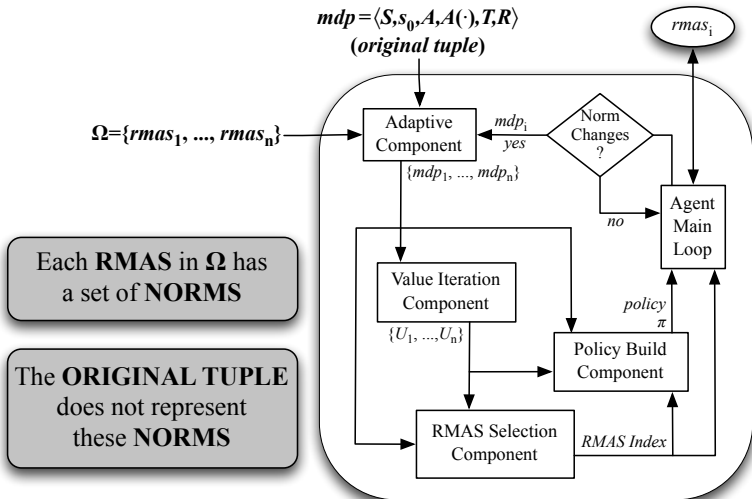
## Norm-Compliant MDP Agents

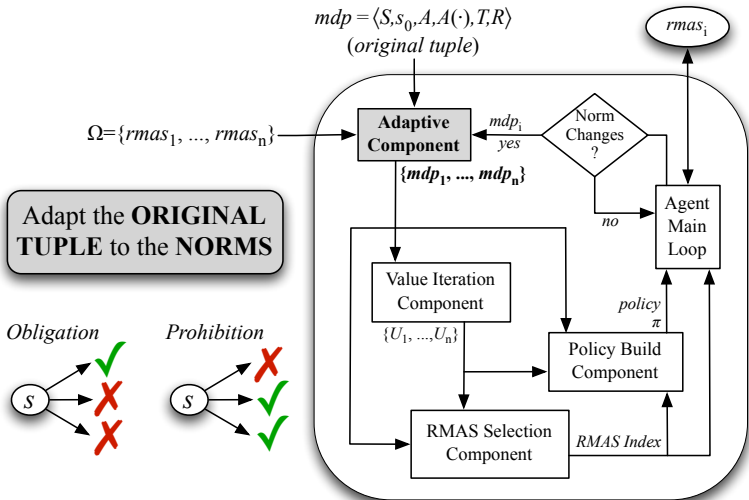
Always follow the norms prescribed by the RMAS.

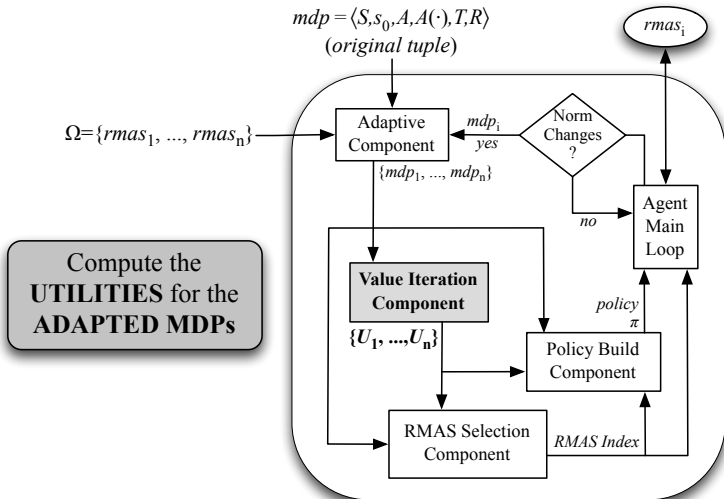
... **an agent model capable of:**

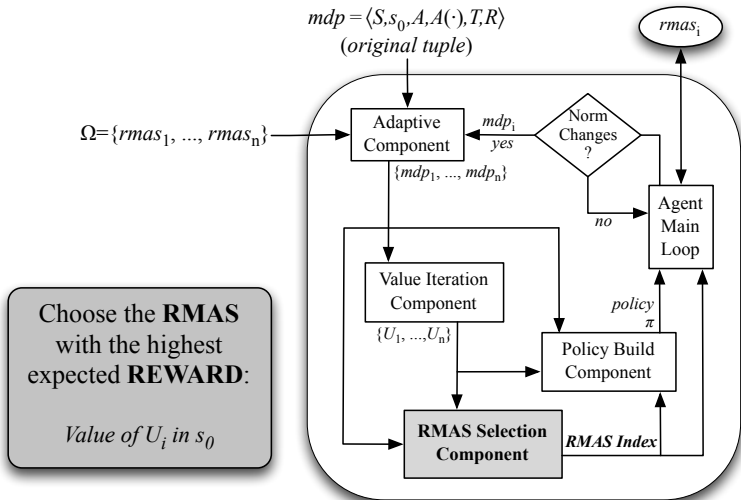
- Adapting her policy to the RMAS' norms  
⇒ *The norms are unknown beforehand*
- Choosing among multiple RMAS  
⇒ *Maximization of expected earnings*

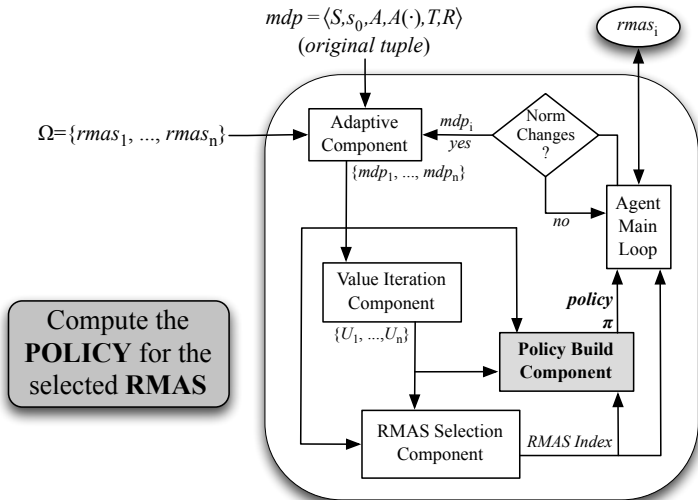


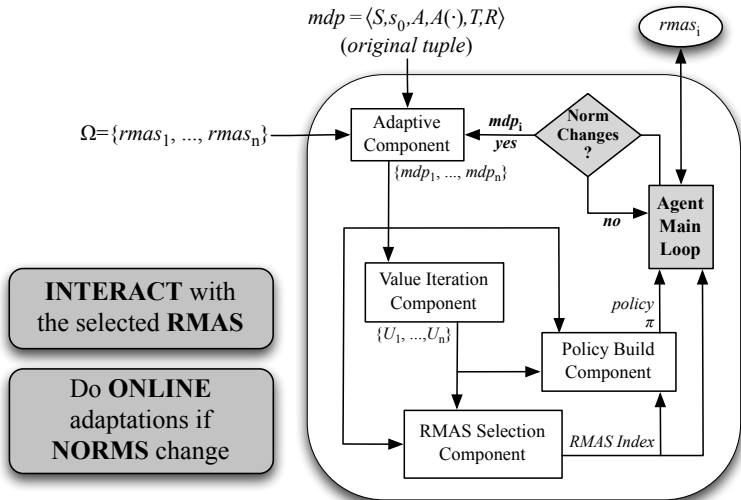












## Non Norm-Compliant MDP Agents

**Change on the adaptation's main goal:**

**FROM** Adaptation to *Norms*  
**TO** Adaptation for *Maximizing Rewards*

Agents that **may not** follow the prescribed norms

- Anticipation/Estimation of *Earnings/Losses* for Violations
- Decisions regarding which Norms are worthy of violating

**Anticipation/Estimation** to support the **Decisions**

## Reactions (Sanctions)

### Reactions' properties:

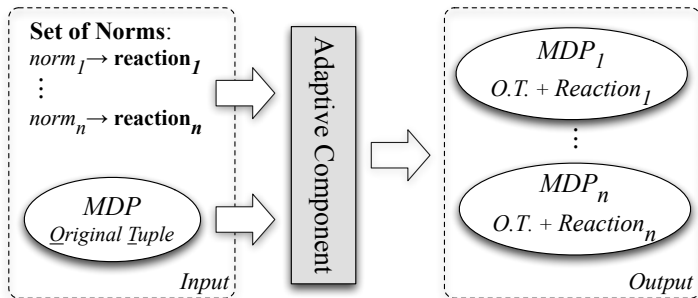
- Immediate and Certain
- Permanent

### In the MDPs, the reactions are represented as:

- Constraints in the *action space*
- Adjustments in the *transitions' probabilities*

## Adaptive Component

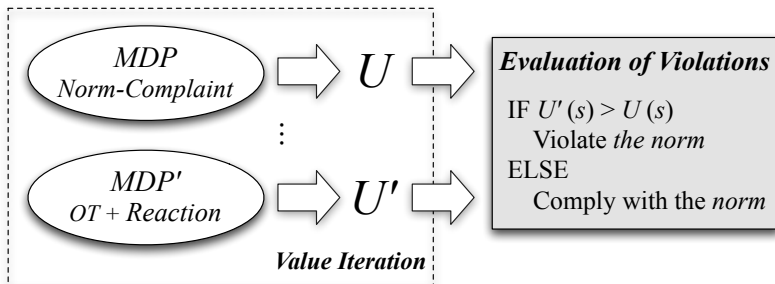
Adaptation of the *Original Tuple* to represent *Reactions*



## Which norms to violate?

Replace **RMAS Selection** by **Evaluation of Violations**

*How bad could be the reactions?*



## Conclusion

### We do..

- Framework to *evaluate* different norm sets
- Well-suited for *adaptation* regarding norms
- *Online* adaptation (re-adaptation)
- Experiments with small state spaces (*3×4 World*)

### We don't..

- *Semantic alignment* between RMAS and Agents
- Norm *consistency checking*

## Research Directions

- 1 Look for approaches (techniques) to improve the performance on the policy search

i.e. *bootstrapping* the utilities with known values

- 2 Take into account other properties for reactions
  - *Non-Immediate*
  - *Uncertain*
  - *Revocable*

Obrigado      Merci  
Danke  
MAHALO      Thank You  
Gracias      Grazie  
Spasibo      ARIGATO