Holon – Like Approach for Robotic Soccer

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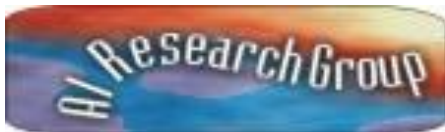
Artificial Intelligence Research Group Sibiu, Dept. of Robotic Soccer

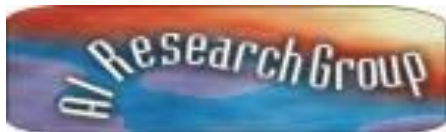**2A Reconstructiei St, 2400 Sibiu, ROMANIA**
Phone:+40-69-224168
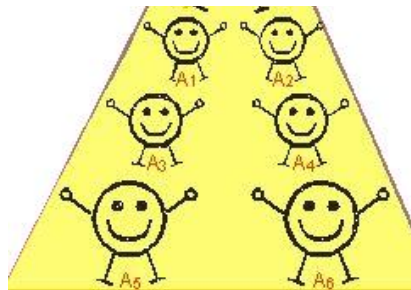email:{ciprianc, mariuss, bbarbat}@airg.verena.ro
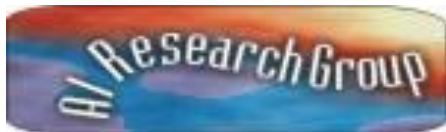web: http://airg.verena.ro

Outline

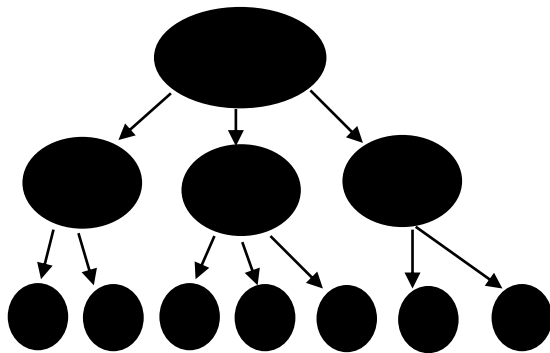# Introduction

Multi - Agent Systems

Holonic Manufacturing Systems

Holonic Approach

- Is very successful in the industrial process planning, increasing the flexibility of decisional systems. They function (a) as autonomous wholes in supra-ordination to their parts (b) as dependent parts in subordination to controls on higher levels (c) in co-ordination with their local environment
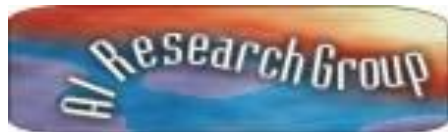
-

Organism

Organic system

Organ

Tissue
Cell
Micro-
organ

Holarchy proposed by
A. Koestler (1967)

Battalion

Company

Platoon

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Slide 4
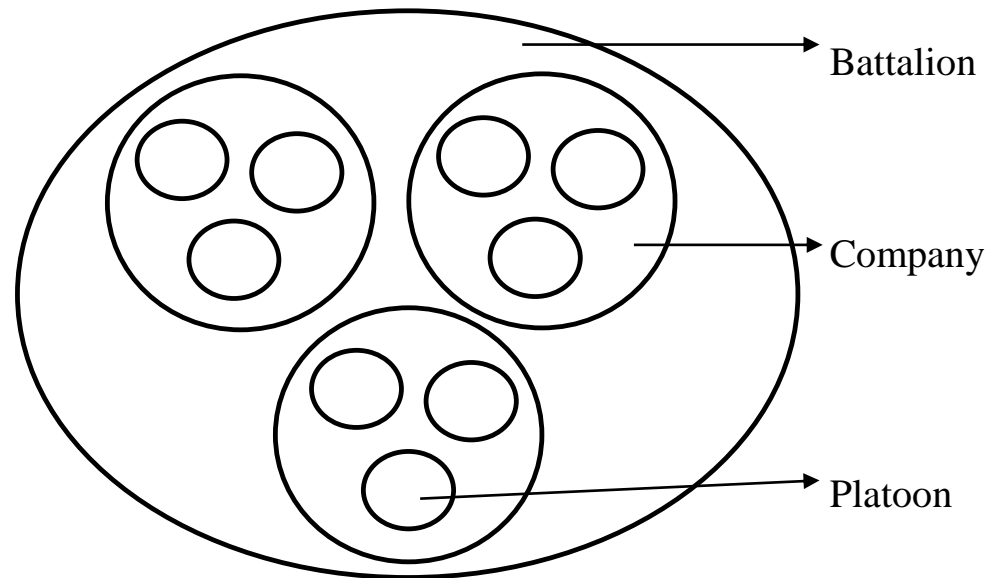
PROSA Architecture

(Van Brussel 1999) , adapted

Order Holon — Production Knowledge → **Product Holon**

Process Execution Knowledge

Process Knowledge

Resource Holon
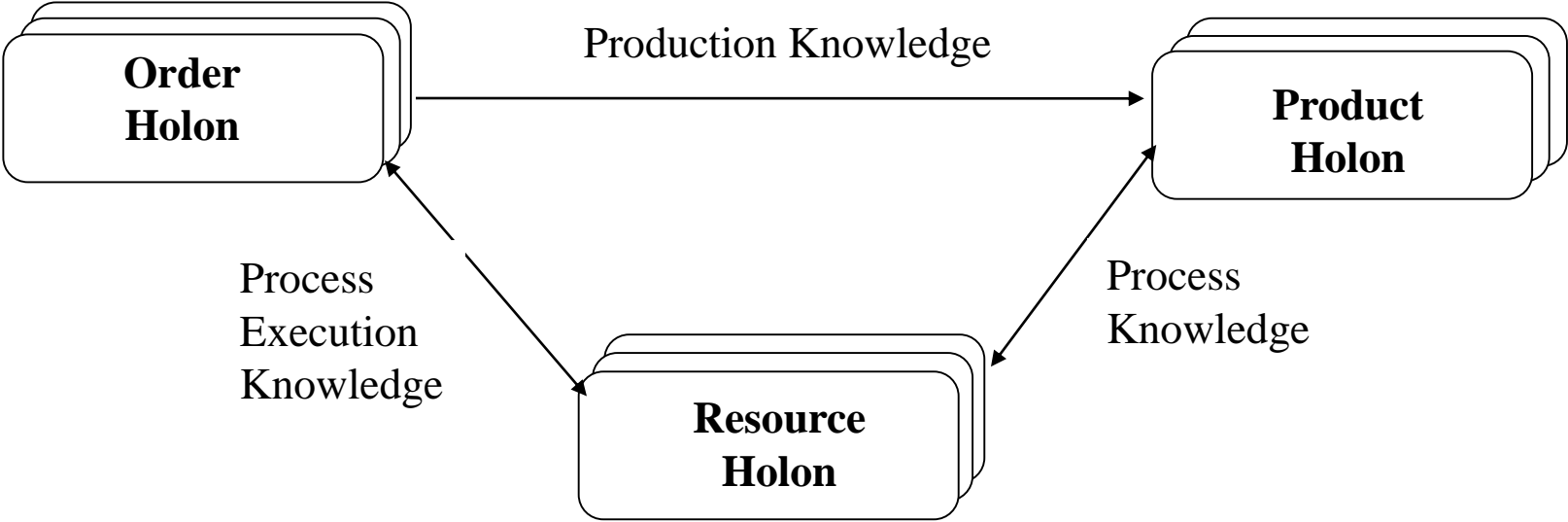
Holonic Manufacturing System
PROSA
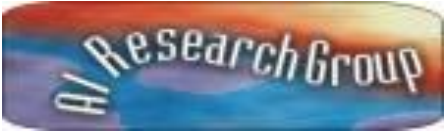
Advantages of using holons in RoboCup

- Can act as a part (modeling a player)

  - Or as a whole (modeling the team)

- Capacity to modify themselves

- Offering an flexible balance

  - Hierarchical

    - Heterarchical

FixedFlexible
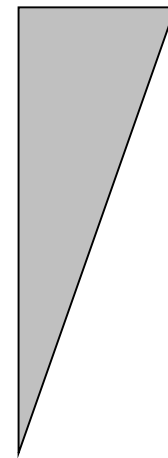Rules Strategies

Hierarchical

Holonic

Heterarchical

AIRG Team Holarchy

Level 0   RoboCup Environment   **Ho** Competition Rules

Level 1   Coach

Hr Resources
Hp Training (Skill)
Ho Team Selection + Monitoring
Hs Game Strategy

Level 2   Player

Hr Resources
Hp Skill
Ho Individual and Team Tactic
Hs Body Parts

Hr	Resource holon
Ho	Order holon
Hp	Product holon
Hs	Staff holon
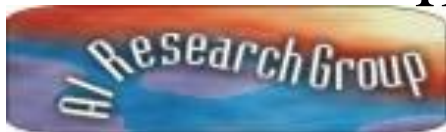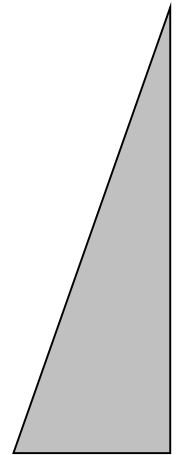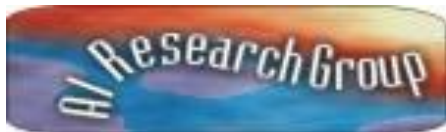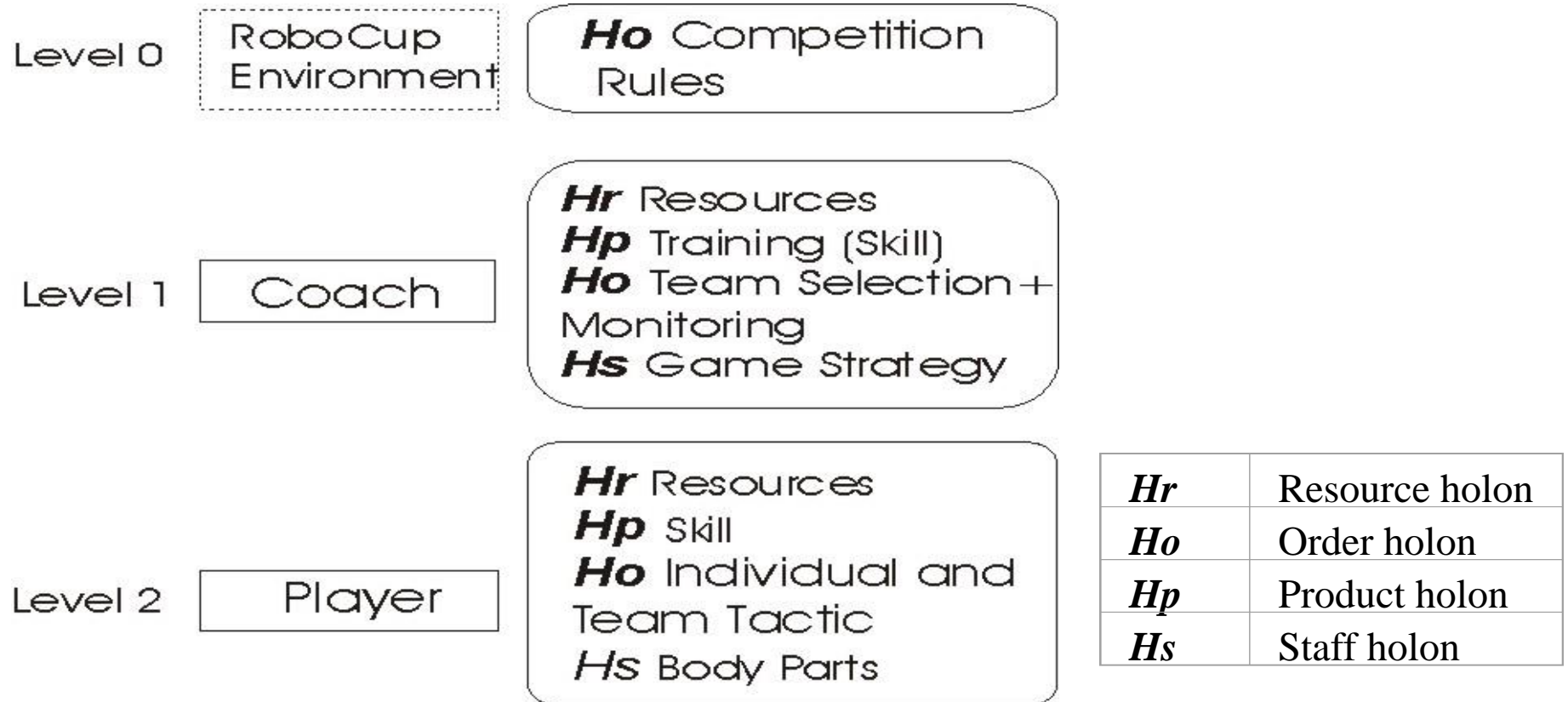
Agent Oriented Holon Architecture

Generic Holon

Level n-1

Reactive Layer

Level n

Deliberative Layer
(Planning)

Reaction

Communication Layer

Environment

Level n+1
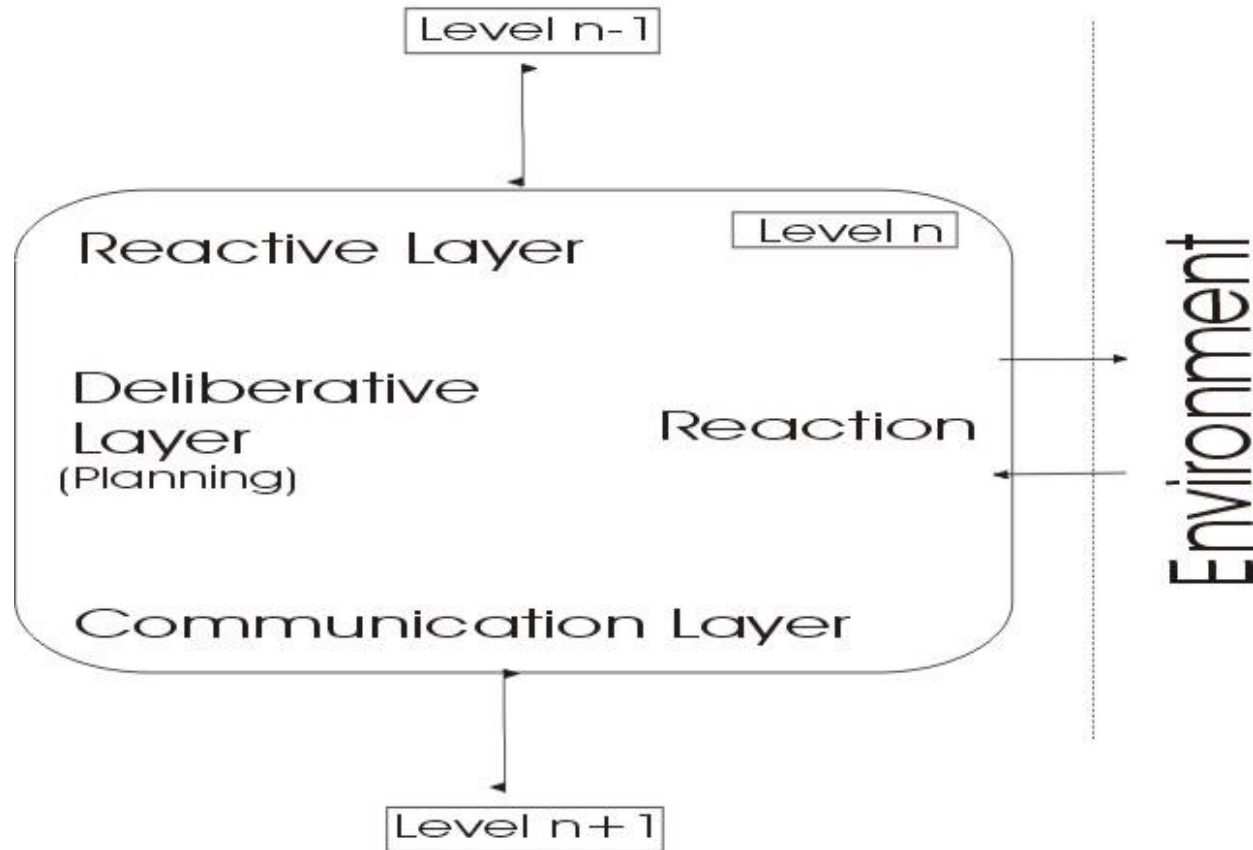
Implementation issues

PROSA	RoboCup	Coach	Player
Product	-	Only off line mode: testing and training the players	Physical skills (ball interception, passing, etc)
Resource	-	Monitoring the players	Stamina, simulation cycle
Order	**Ho**	Off-line: analyzing previous games (In order to find other strategies) On-line: helping the team with advice (e.g. in fixed phases)	Implements the player behavior
Staff	-	Analyze the team behavior and tries to find some solutions.	Coordinate the body parts (Legs, arms, head) **Humanoid robot**

PROSA – equivalent	**ROBOT**
Resource	**R**(esource)
Order	**O**(rder)
Product	**B**(attle) **O**(organizer)
Staff	**T**(actics)

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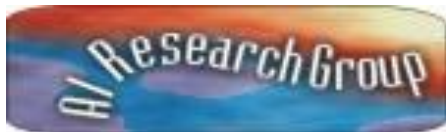
Conclusion and Future Work

- **Preliminary evaluations:**

§ Adapting the holonic approach to MAS is a promising path
§ Robotic soccer offers an adequate test bed for such ideas
§ Despite of obvious difficulties implementing a combined agent-holon architecture improved our team effectiveness.

- **Future work**

§ Improving the generic holon architecture (especially communication/negotiation)
§ Extending and refining the holarchy (focus on introducing a new level: Team Level)
§ Long term target: Real-time modifiable dynamic holarchies