Specifying E-Alliance contract dynamics through the $\mathcal{M}$OISE$^+$ reorganisation process

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Context

- E-Alliance project
  - Support for collaboration across enterprises forming virtual alliances
  - Preserving enterprises **autonomy**
  - Dynamic environment (the alliance is **open** to new enterprises)
- E-Alliance is a **Multi-Agent System**

Example

- Printshops: autonomy regarding its budget, planning, scheduling, ...
- May create alliances to accomplish customers requests

Problem

- How to represent (and ensure) responsibilities inside the Alliance?
  - Negotiation
  - **Contracts**
- How to coordinate the partners jobs?

Example

- How to represent that a Printshops has contracted another to print 5000 cover pages of a book?
- When a printshop could start printing the cover pages?
- What happens in case the printshop does not print the cover pages?

Objective

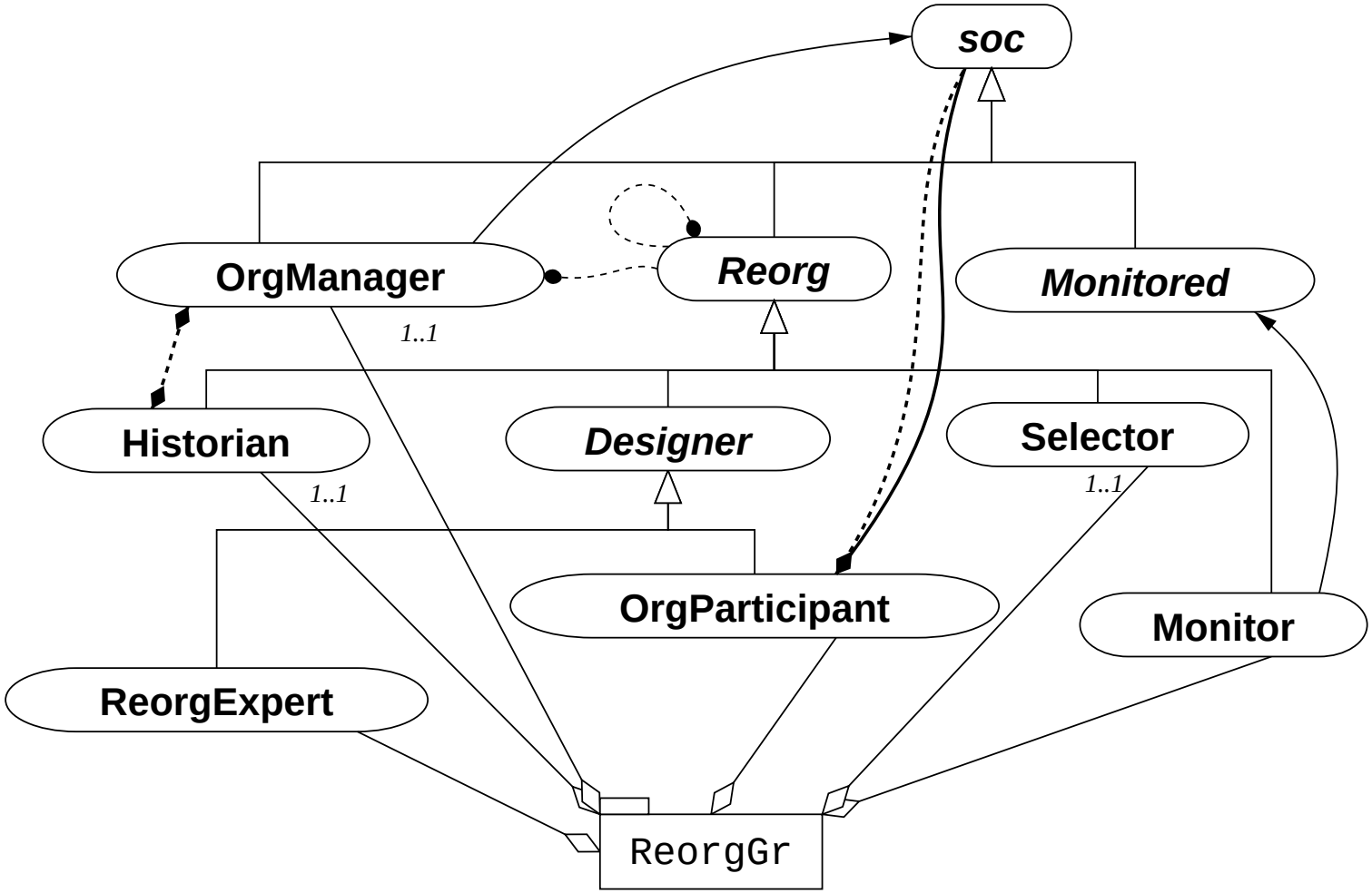
- Model Alliances contracts as an **organisational specification**.
  - Organisation is a set of constraints that a group of agents adopts in order to both control the agents' autonomy and achieve global purposes
- Model the contracts dynamics as an **reorganisation process**
- Use $\mathcal{M}$OISE$^+$ to specify
  - the organisation and
  - the reorganisation process.

Reorganisation Process

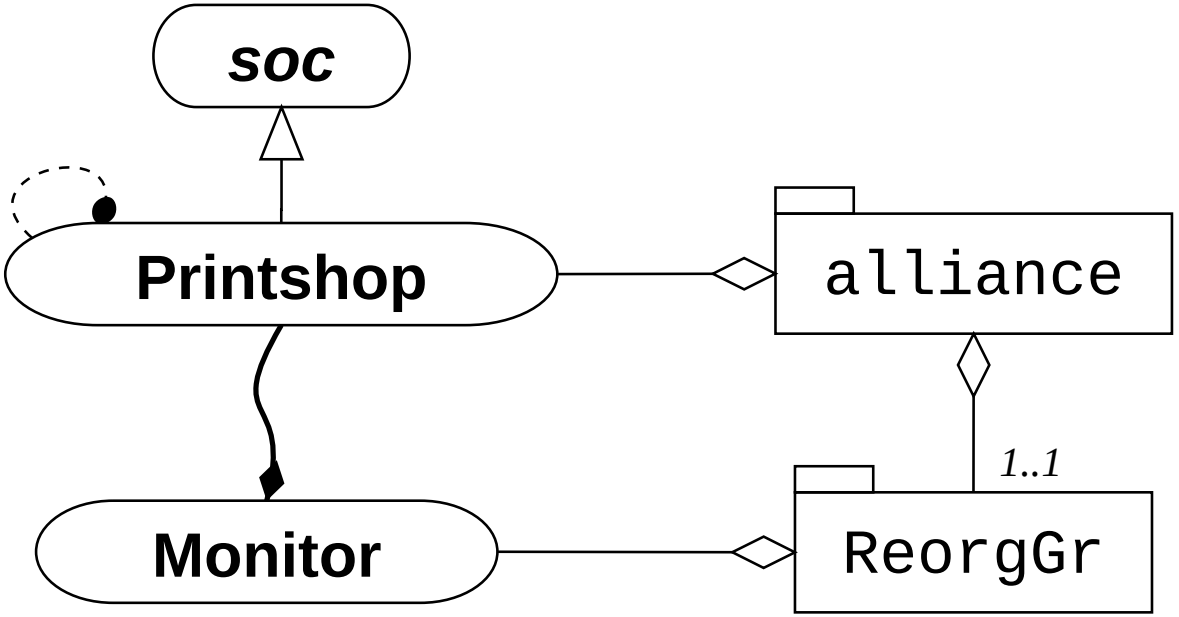
- **Monitoring**: when reorganise
- **Design**: specifying new organisation alternatives
- **Selection**: choose a new organisation
- **Implementation**: change the current running organisation

Specification of the Reorganisation Group

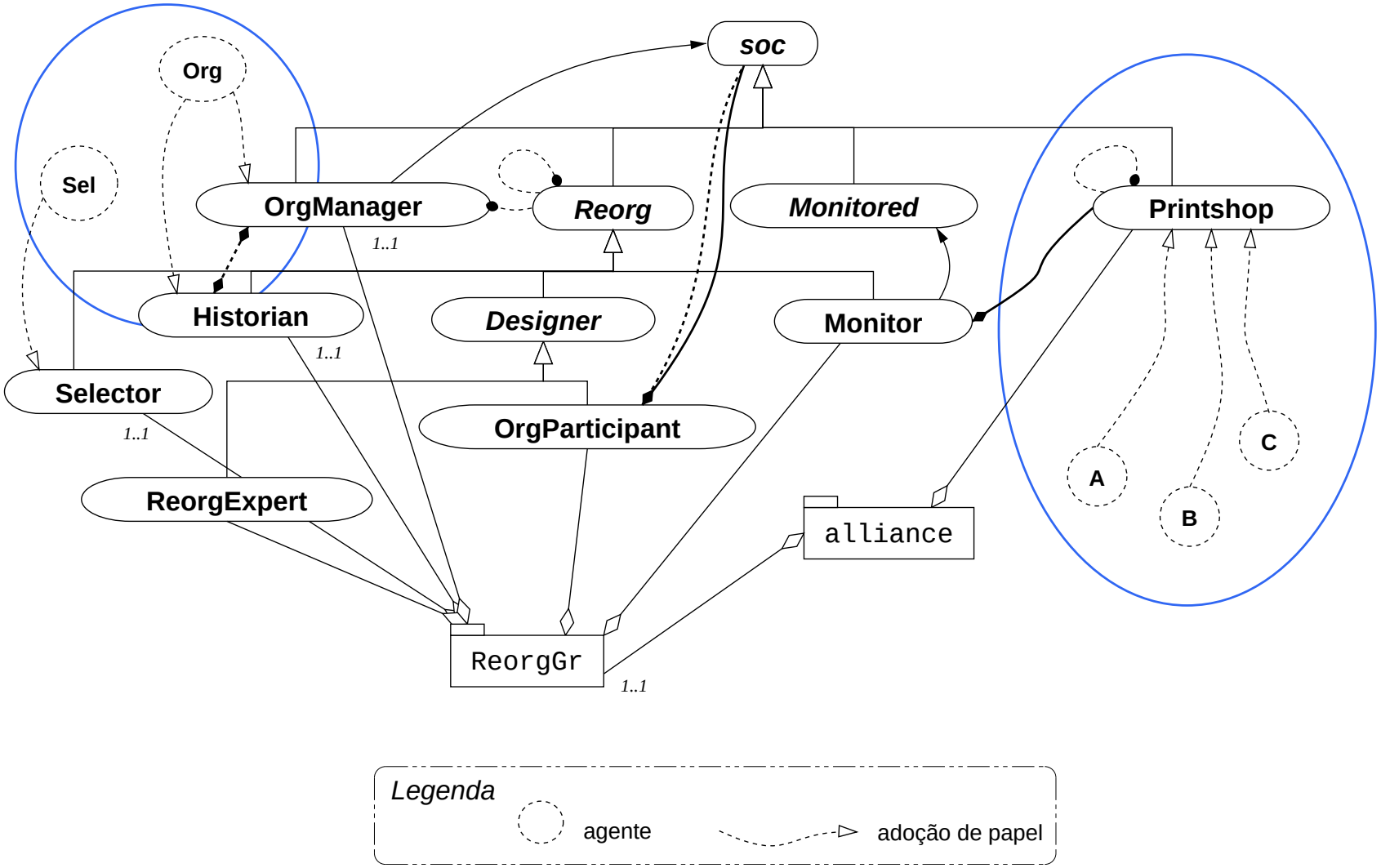
organisation of reorganisation



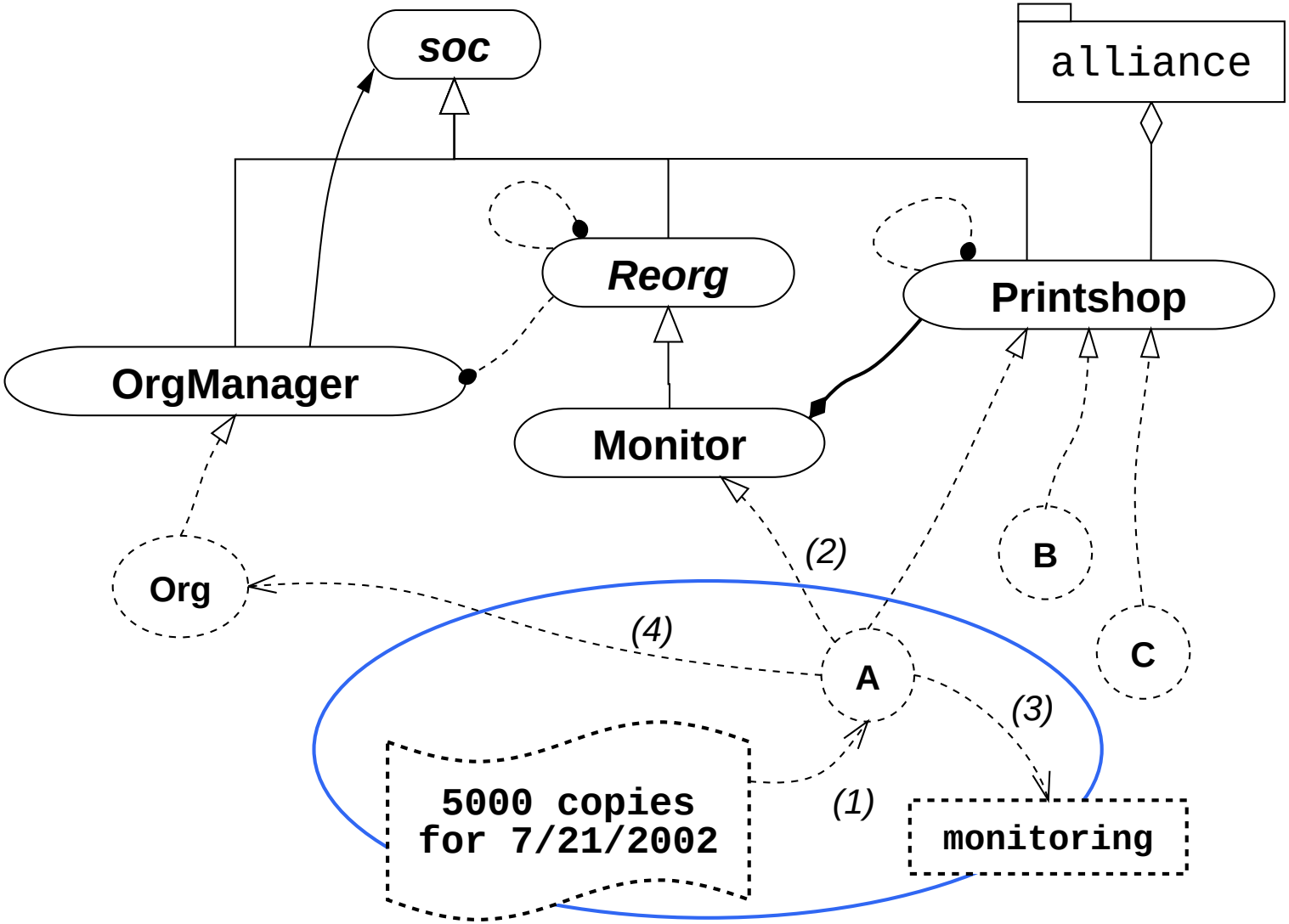
E-Alliance initial **organisation**



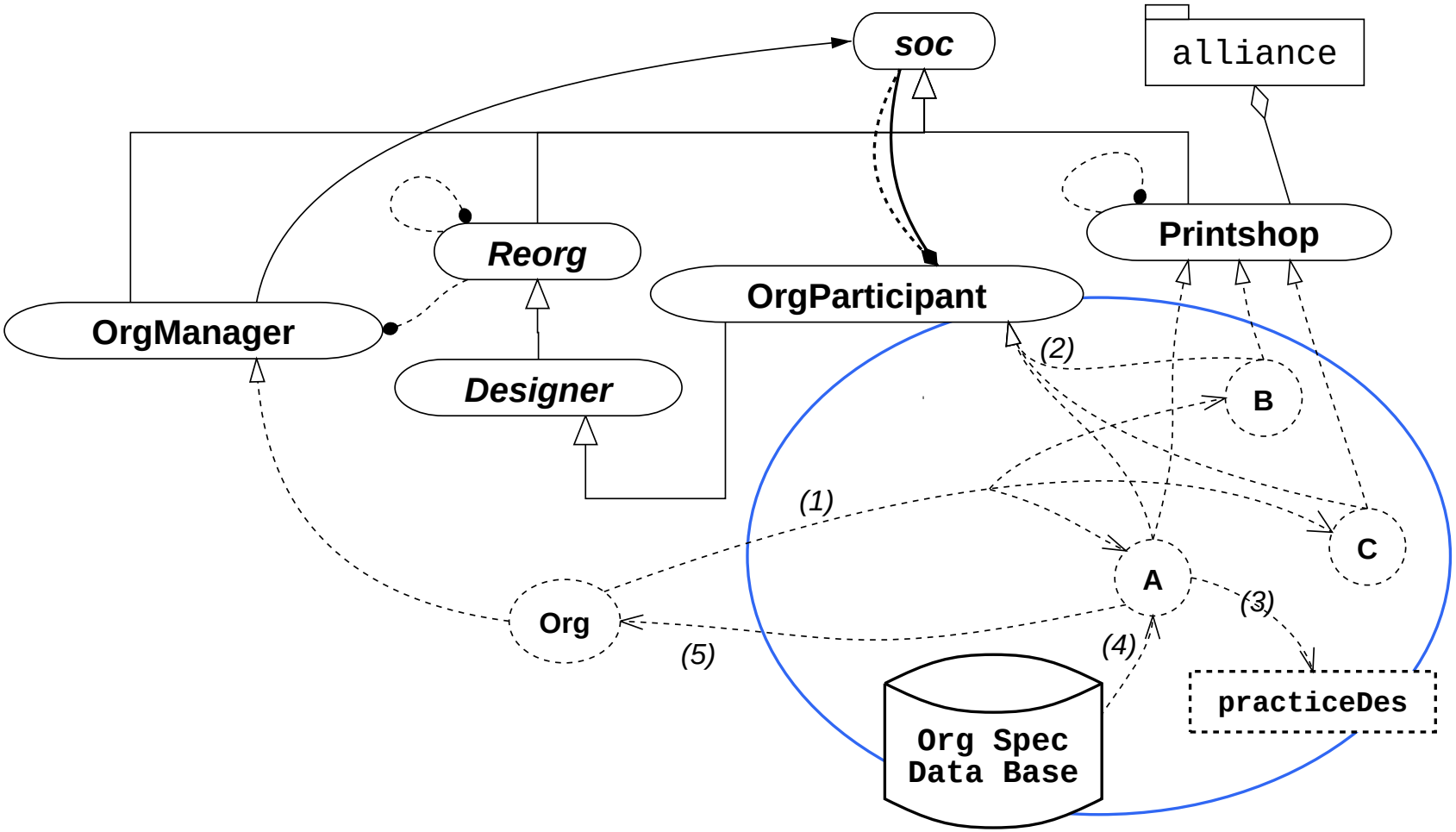
E-Alliance initial **entity**



Reorganisation process: **Monitoring**

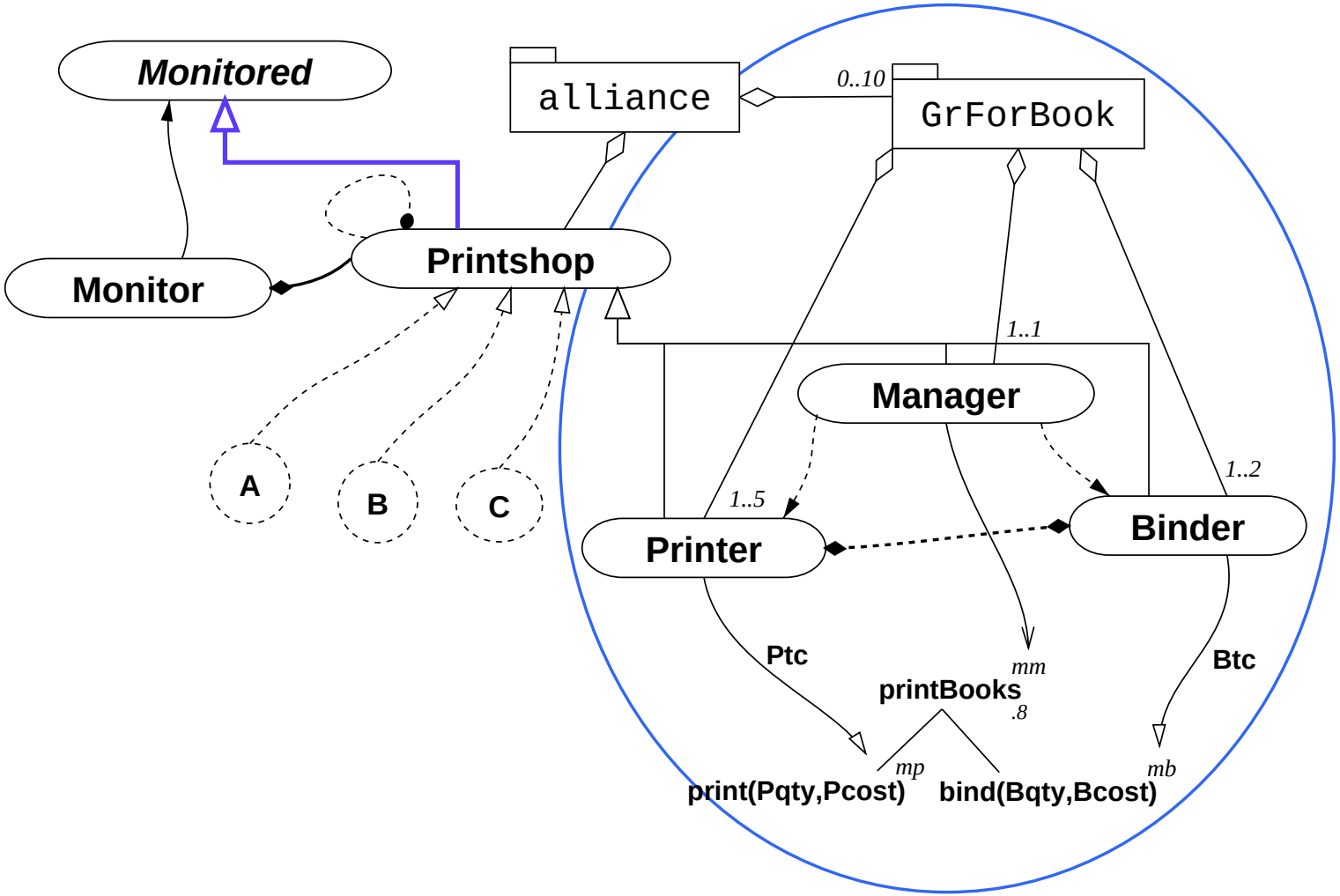


Reorganisation process: **Design**



Reorganisation process: agent A proposal

Contract Type



New organisation entity **examples**

agent	role	mission	goal
		scheme print book	
A	*Manager*	*mm*	
B	*Printer*	*mp*(Ptc="5/20/2005 - 6/18/2005")	*print(5000,700)*
B	*Binder*	*mb*(Btc="6/30/2005 - 7/10/2005")	*bind(2000,100)*
C	*Binder*	*mb*(Btc="6/20/2005 - 7/10/2005")	*bind(3000,150)*

Reorganisation process: **Monitoring**

- In the second reorganisation, the MAS has a specialised **Monitor** agent
- It triggers a reorganisation process if the success rate of print book scheme goes bellow 60%

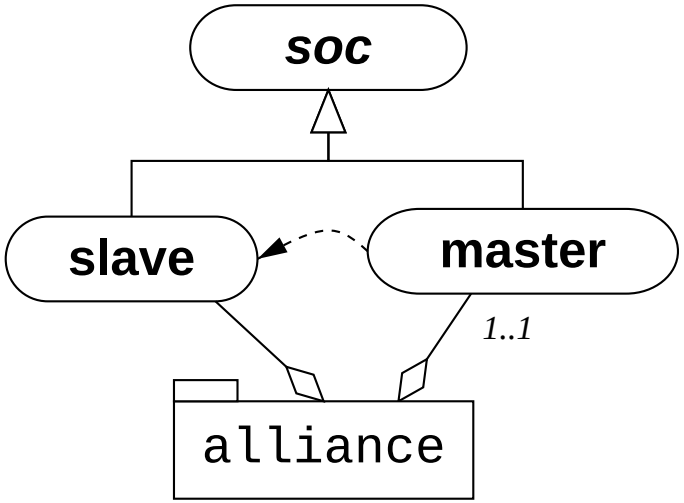
A **ReorgExpert** proposal

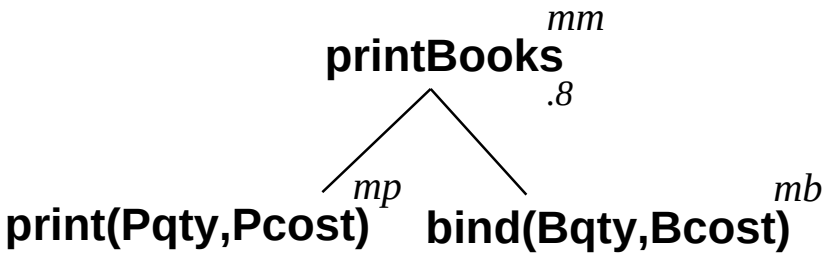
- Increase penalties in 30 %

role	relation type	mission	time	penalty
Manager	*permission*	*mm*	*Any*	—
Printer	*obligation*	*mp*	*Ptc*	$(Pcost/3) * 1.3$
Binder	*obligation*	*mb*	*Btc*	$(Bcost/4) * 1.3$

Another **ReorgExpert** proposal

- New hierarchical organisation

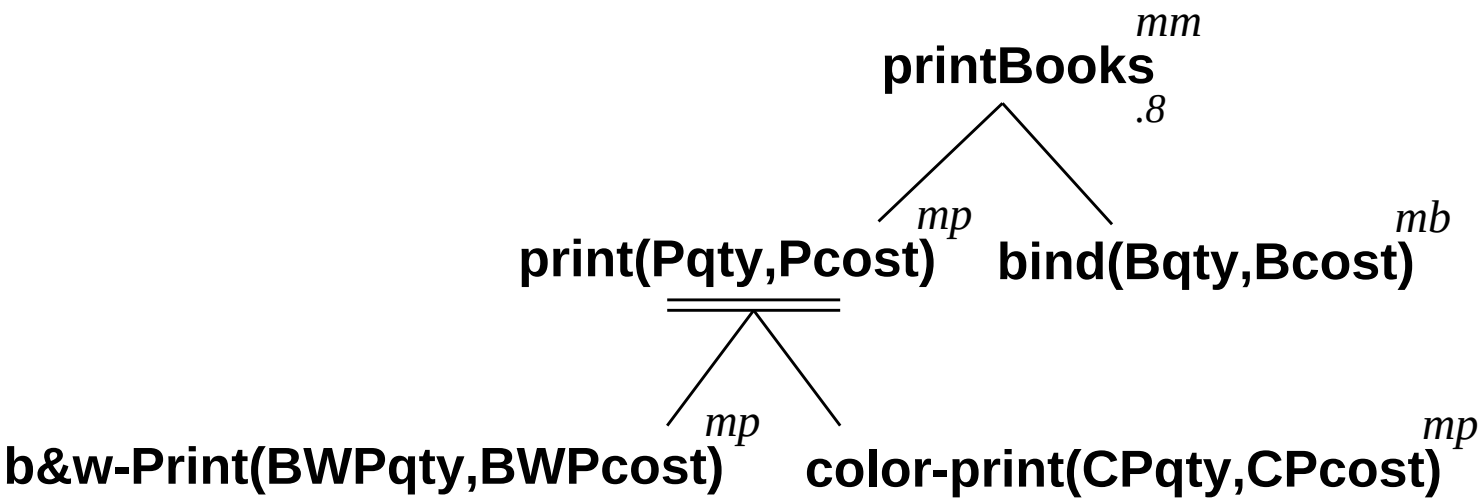




role	relation type	mission	time	penalty
Master	*permission*	*mm*	*Any*	—
Slave	*obligation*	*mp, mb*	*TC*	*Pcost*/2

An **OrgParticipant** proposal

- Increase details in the print book scheme



Proposals classification: **Voting** system

- Experience of the proposer

$$fe(a,p,os_v) = \begin{cases} 0 & \text{if } v = 0 \\ (\theta\ fe(a,p,os_{v-1}))+ & \text{if } v \neq 0 \\ fre(a,p,os_v)+ & \\ fme(a,p,os_v) & \end{cases} \quad (1)$$

- Success of previous proposer's proposals

$$da(a) = \sum_{os_v \in OS_a} \epsilon(startTime(os_v) - endTime(os_v)) \quad (2)$$

- Proposal implementation cost

$$cost(p) = \phi \quad (rolePlayersRemoved(p)+ \\ missionPlayersRemoved(p)) \quad (3)$$

Example of classification

proposal/focus	*position*	*fe* $\theta fe + fre + fme$	*da* $\epsilon(start - end)$	*cost* $\phi(r + m)$
E_1/ DS	0	0.5*0+0+0=0	0	2*(0+0)=0
E_2/ OS	-18	0.5*0+0+0=0	0	2*(6+3)=18
A / SS, GrForBook	12.15	0.5*1+4+0=4.5	7.65	2*(0+0)=0
B / DS, printBook	8	0.5*0+0+10=10	0	2*(0+1)=2
no change	0	0	0	0

Example of election results

proposal	votes	voter's experience (ge)	voter's da	(ge+da+1)
B	E_1	0	0	1.00
	E_2	0	0	1.00
	B	0.5*1+7+10	0	18.50
	C	0.5*1+4+4	0	9.50
	total			*30.00*
A	A	0.5*1+5+6	7.65	20.15
	total			*20.15*

The voter's experience is based on its roles and missions adoption in the system.

Contributions

This paper has presented a general view of the reorganisation problem under the $\mathcal{M}$OISE$^+$ point of view applied to virtual alliances.

- The proposal to use an organisational model to represent the contract, while being a set of constraints, among the enterprises
- to use a reorganisation process to model the dynamics in the alliance.
- voting system for selection

Conclusion

The $\mathcal{M}$OISE$^+$ organisational model has a good support for the specification of an MAS's organisation which intends to reorganise itself

- Gives useful information for the monitoring and design phases
- Allows us to define the reorganisation process with valuable properties:
  - openness for many types of monitoring, design, and selection
  - the definition of special roles like the *OrgManager* and *Monitored*
  - the specification of the reorganisation through the $\mathcal{M}$OISE$^+$ enable any $\mathcal{M}$OISE$^+$ agent to understand and participate in the reorganisation
- `http://www.lti.pcs.usp.br/moise`.