Objekt-Petrinetze

- Modellierung durch Abstraktion -

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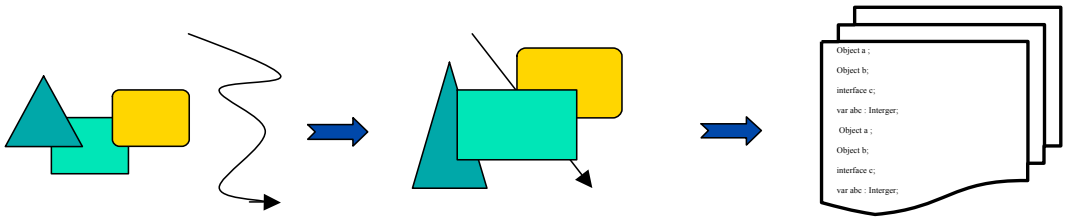
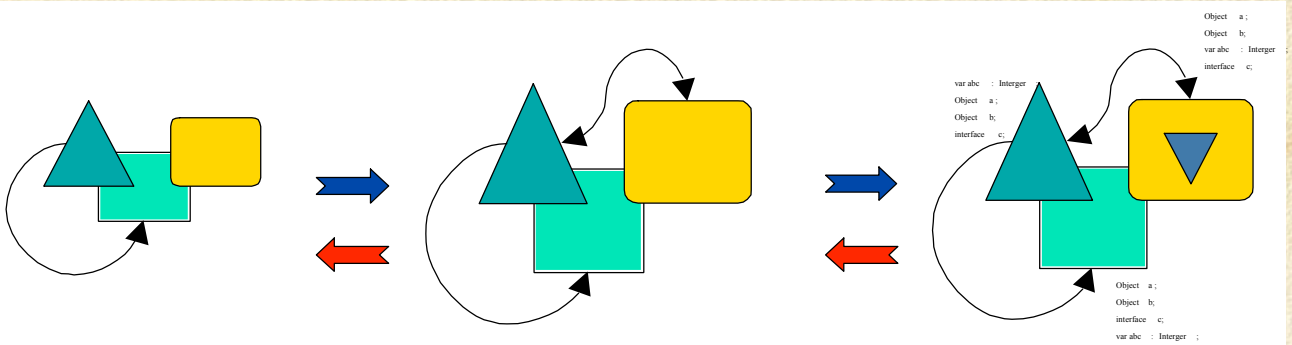
Visionen der Softwaretechnik

Gestern und heute:



Analyse Entwurf Implementation

Morgen:



round-trip engineering

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Inhalt

- Netze in Netzen
- Referenz-Semantik von Objektnetzen
- Das Renew-Werkzeug
- Das Garbage Can Beispiel
- Agenten und Komponenten

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Netze in Netzen

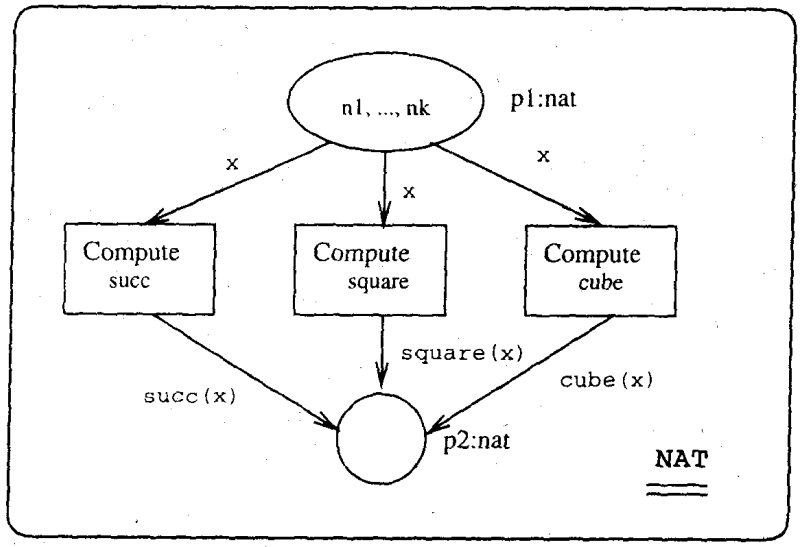

Fig.1: Algebraic High-Level Net `Computation`

Katrin Hoffmann
in: Petri Net Technology
for Communication-Based Systems

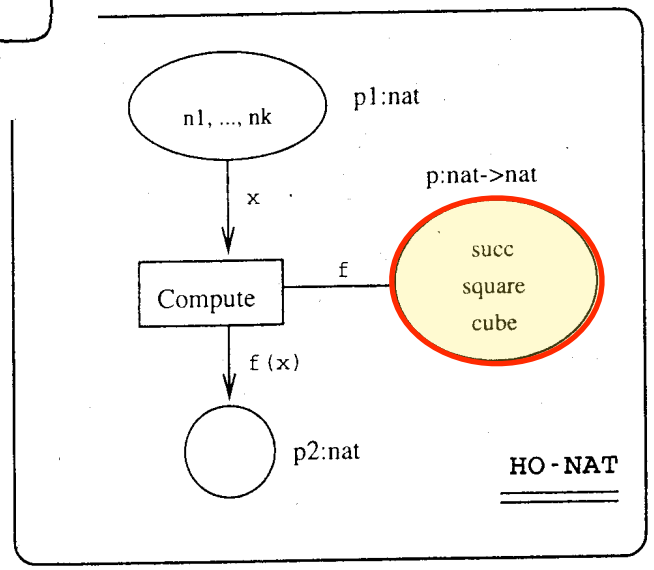

Fig.2: Algebraic Higher-Order Net `Computation'`

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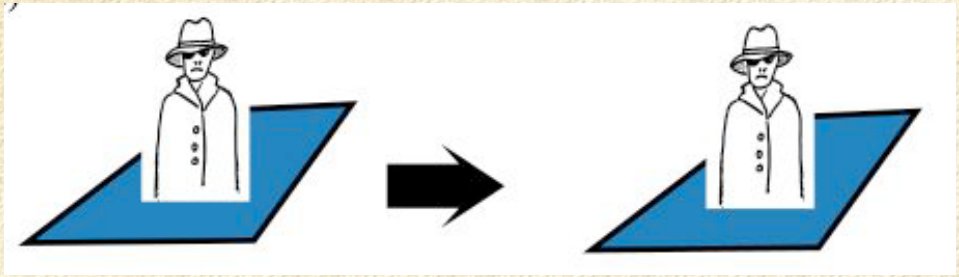
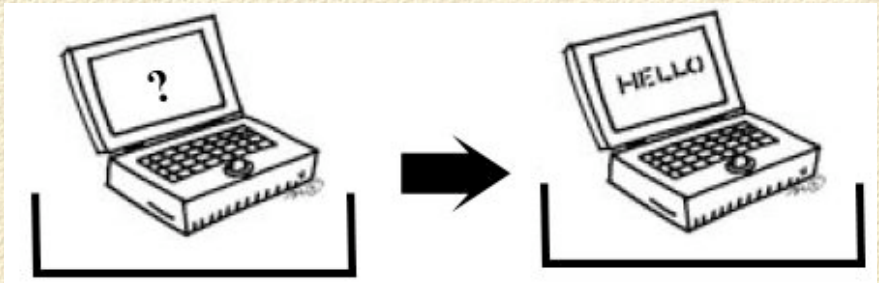


location A location B

software agents



security environment A

security environment B

mobility

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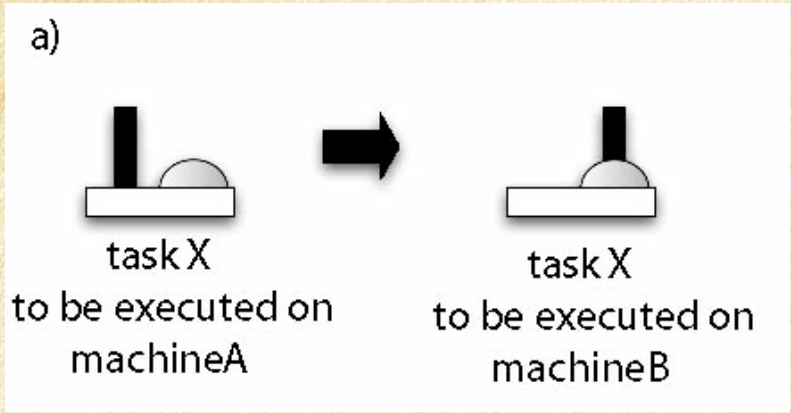
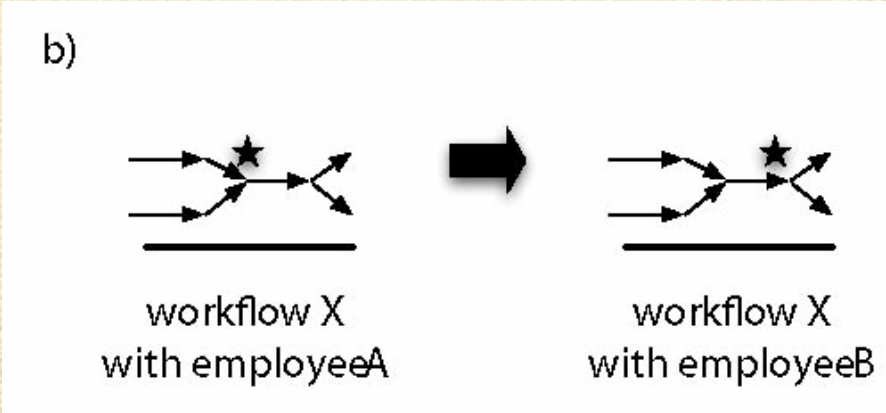


flexible manufacturing



workflow

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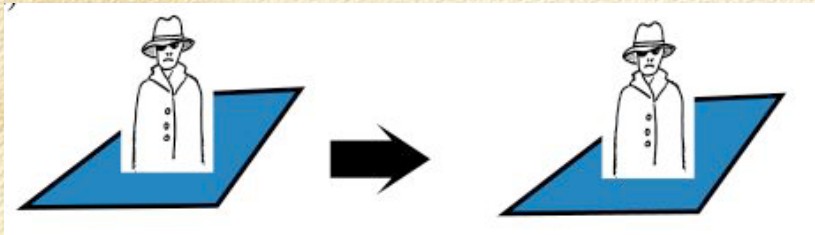
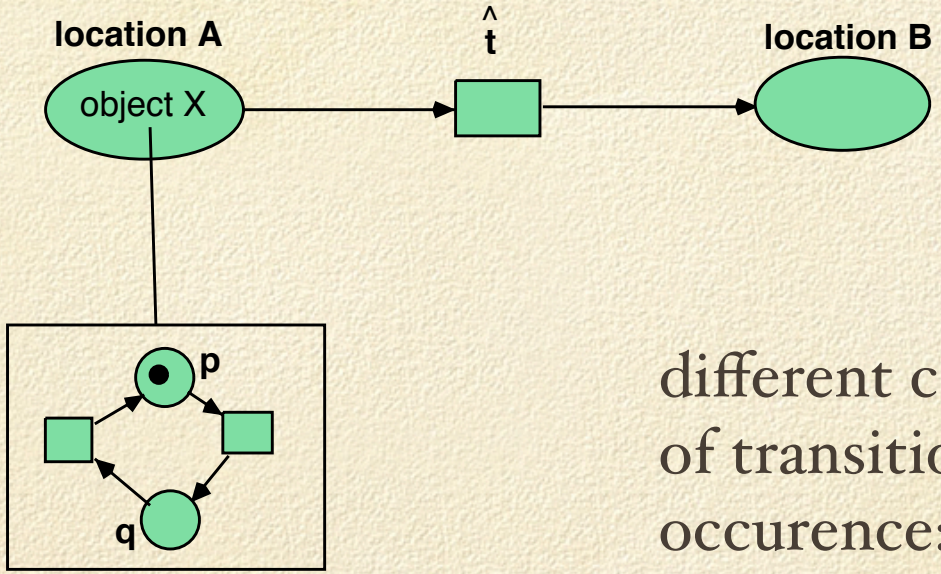
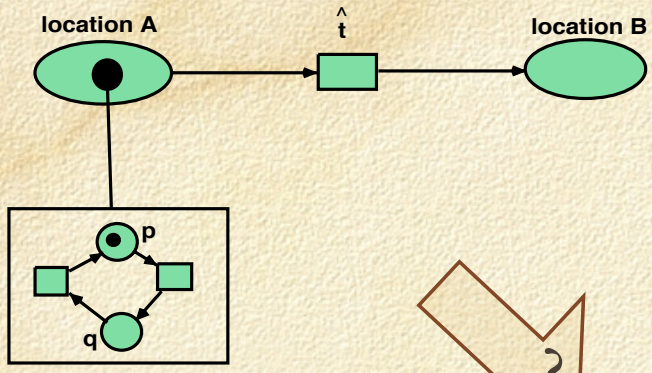


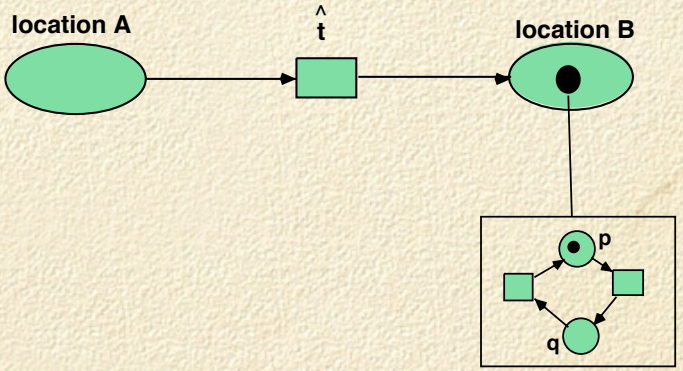
location A location B



different cases of transition occurence:



transport



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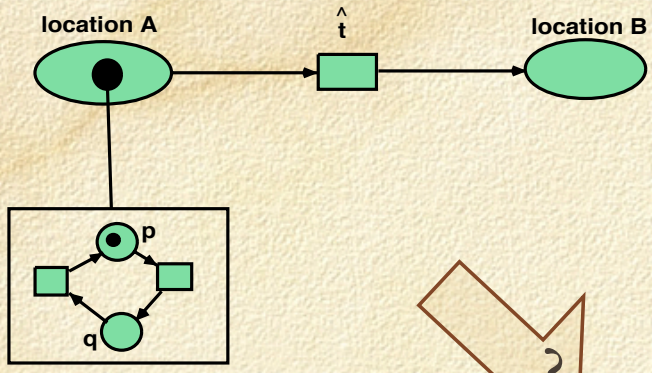
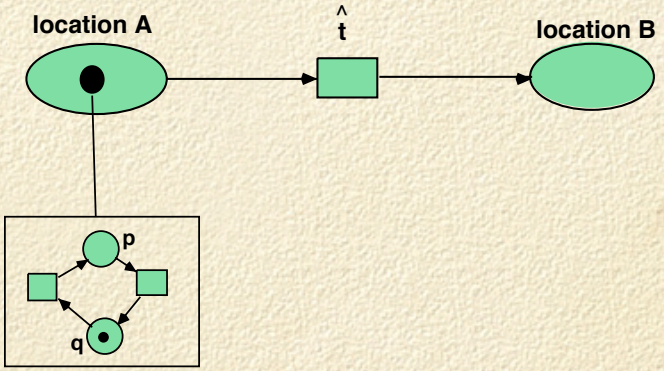


autonomous action



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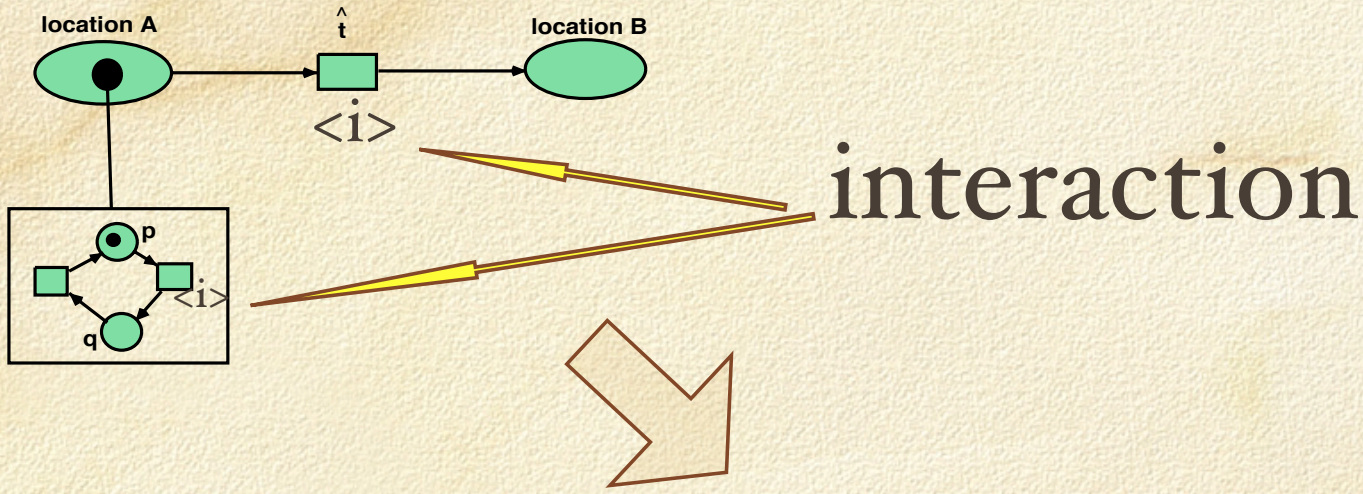

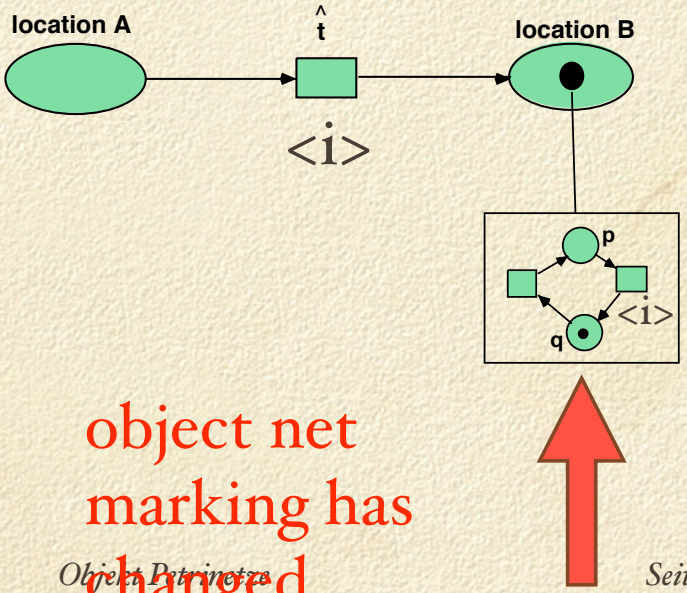

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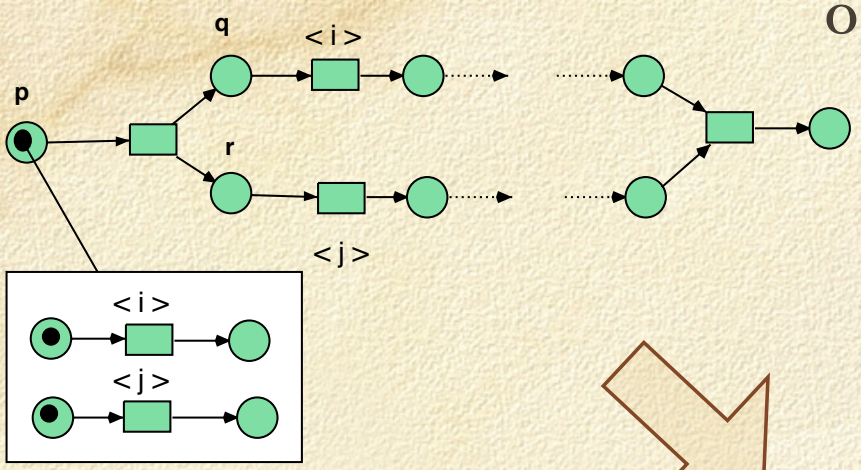
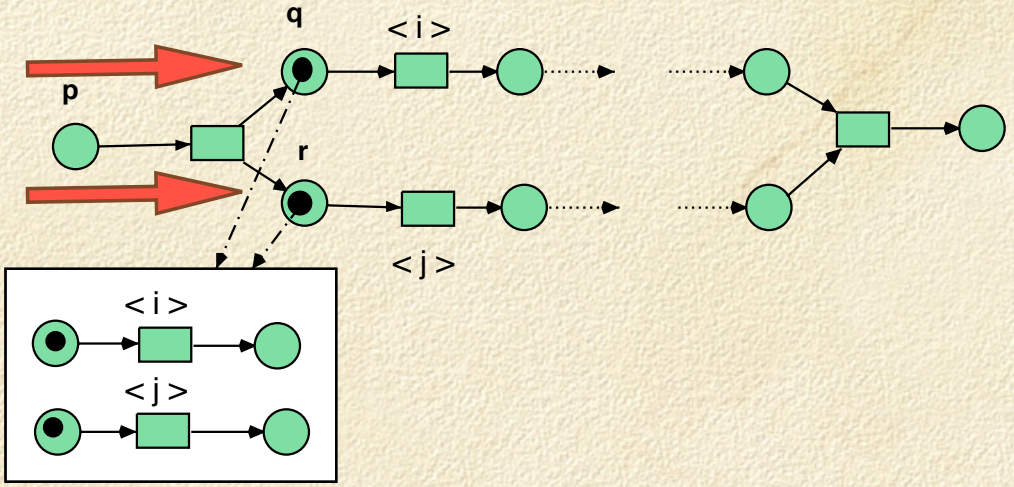
creating distributed objects





reference semantics

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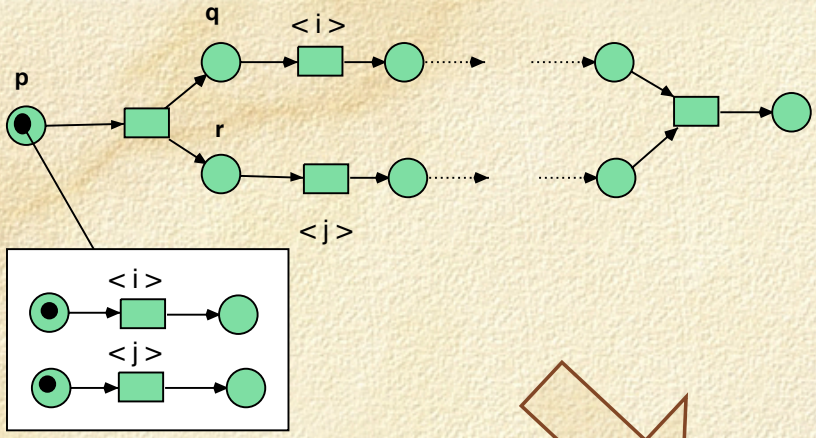
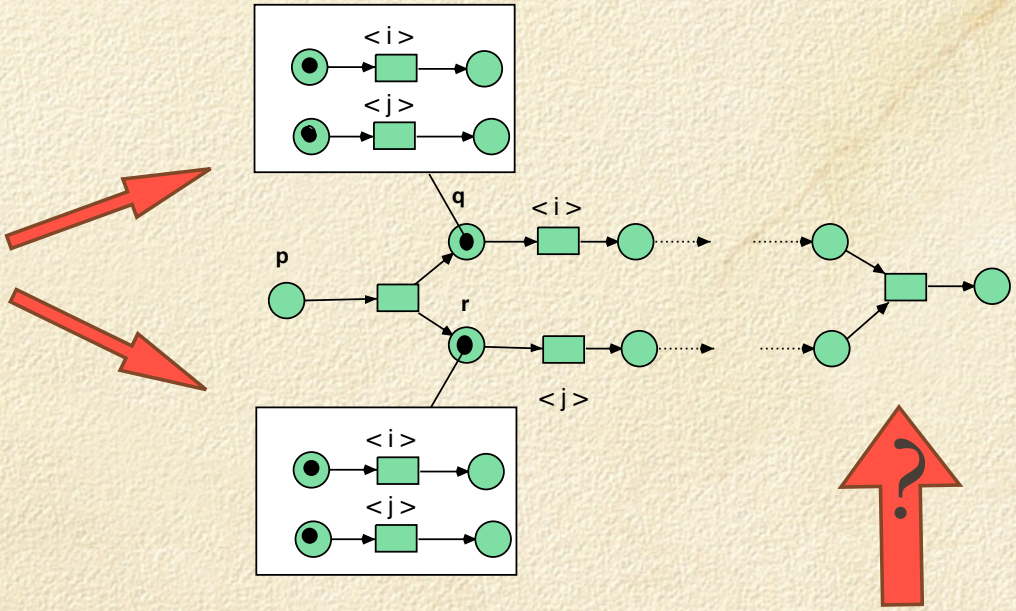
creating distributed objects





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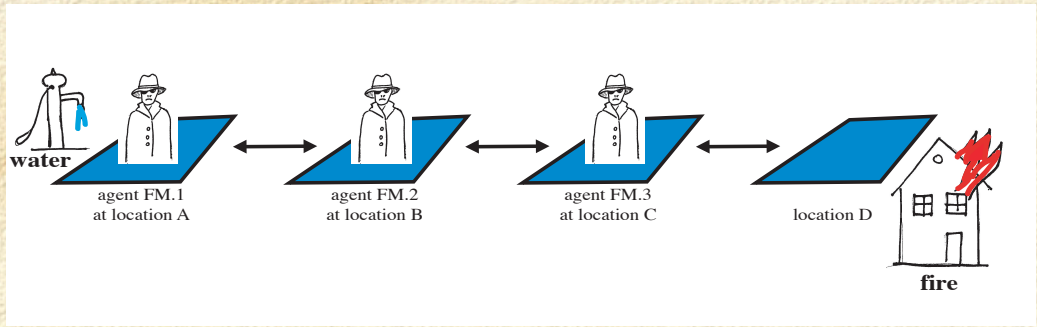
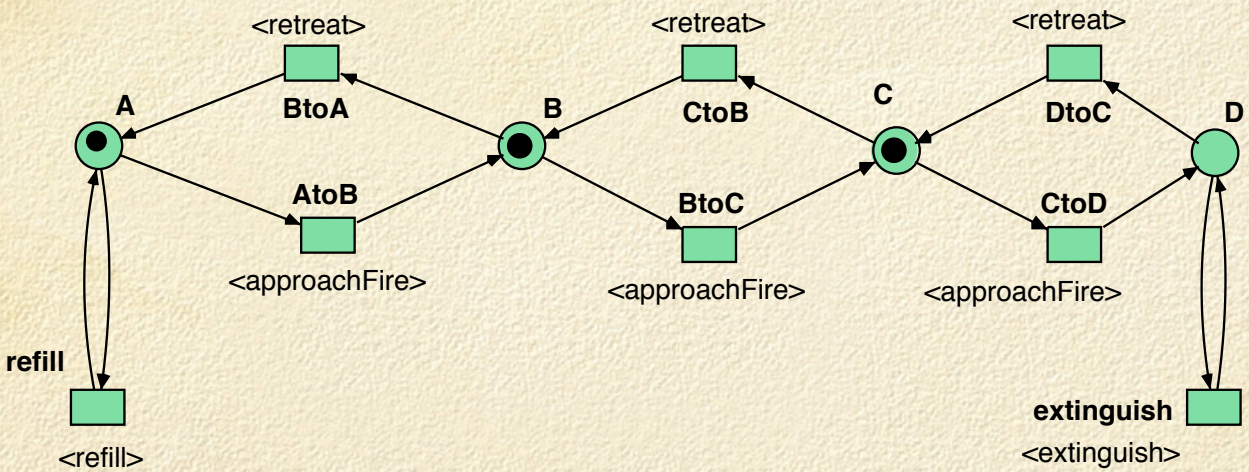
Referenz-Semantik





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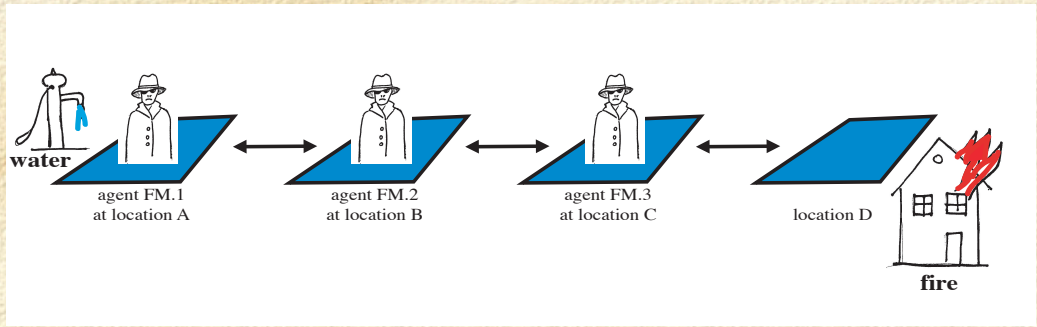

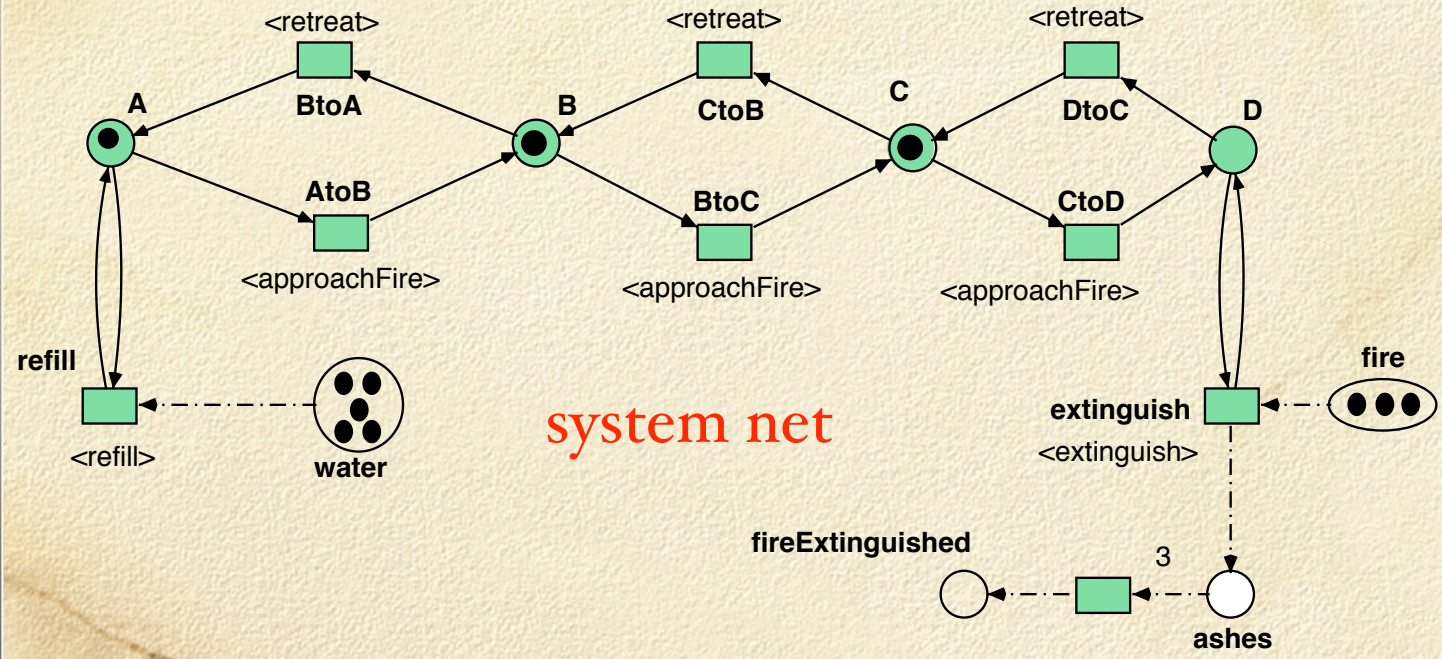

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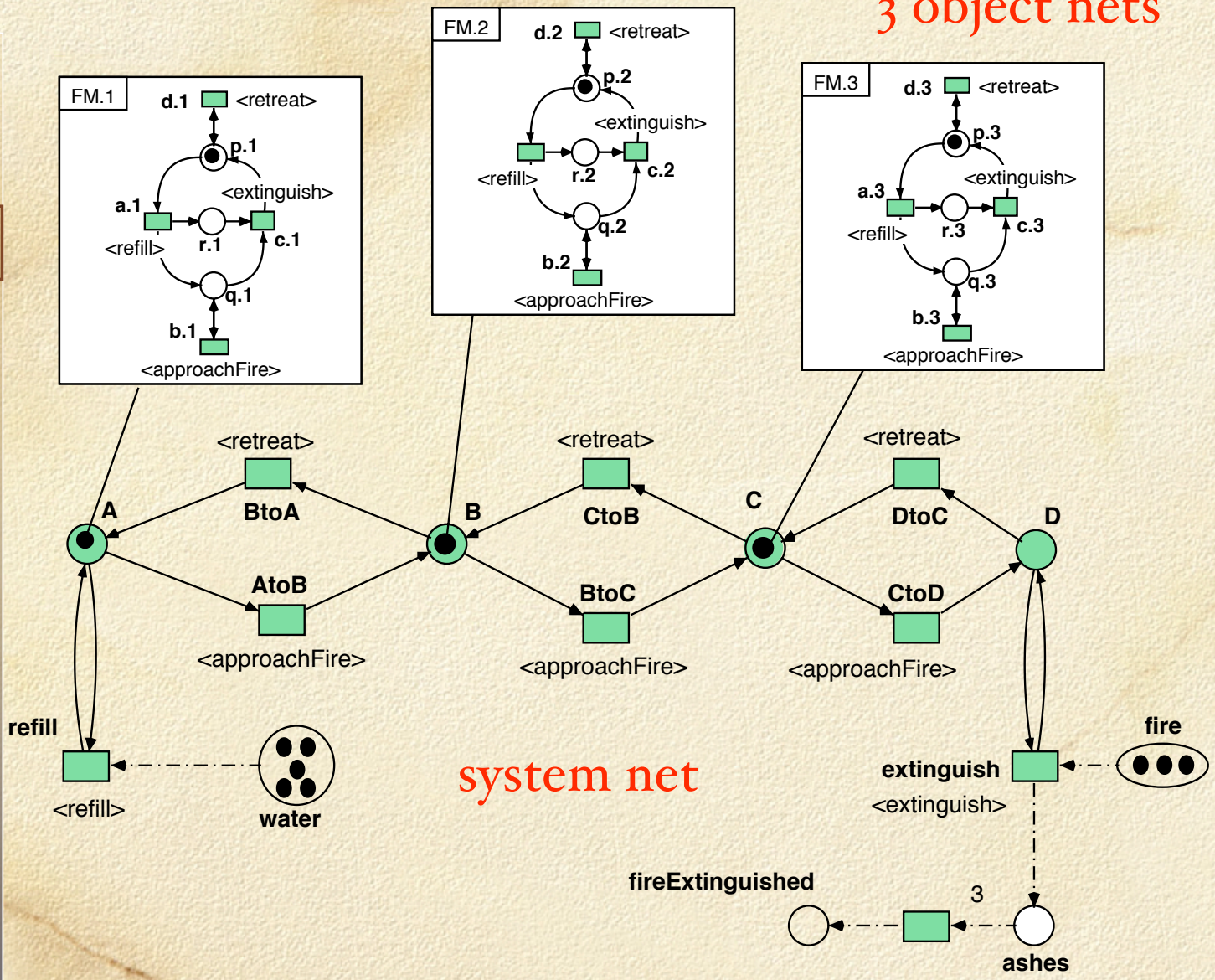
3 object nets



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Formal definition of an object system:

Definition 2.1 *(elementary object system)*
An elementary object system *is a tuple* $OS = (SN, \mathcal{ON}_{m^0}, \rho, \sigma, \mathbf{R}_0)$ *where* SN *is the* system net, $\mathcal{ON}_{m^0}$ *is a finite set* $\{(ON_1, m_1^0) \ldots, (ON_k, m_k^0)\}$ *of* marked object nets, ρ *and* σ *are the* interaction relations *and* $\mathbf{R}_0$ *is the* initial marking, *which are defined as follows. (The sets of places and transitions of all involved nets are assumed to be disjoint.)*

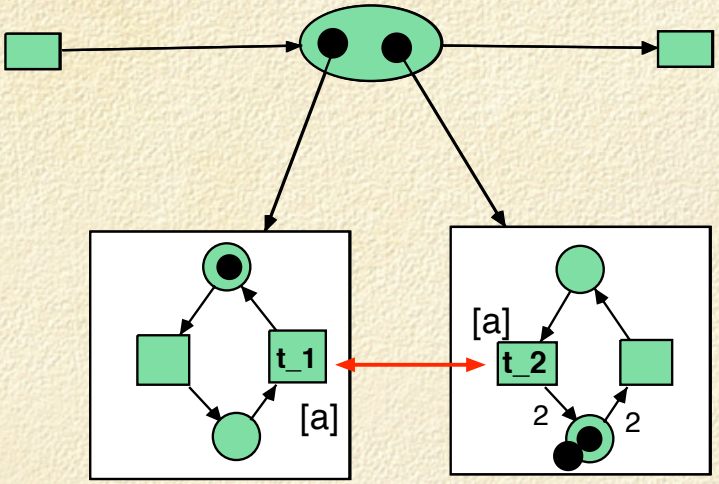
a) A system net *is a Petri net* $SN = (\widehat{P}, \widehat{T}, \widehat{W})$ *where*

1. *the set* $\widehat{P} = P_{ob} \cup P_{bt}$ *of places is divided into disjoint sets of* object places P_{ob} *and* black-token places P_{bt}, $\widehat{T}$ *is the set of* transitions,
2. *the set of arrows is given as a mapping* $\widehat{W} : (\widehat{P} \times \widehat{T}) \cup (\widehat{T} \times \widehat{P}) \to \mathbb{N}$. *For* $\widehat{W}(x, y) > 0$ *the arrow* (x, y) *is called an* object arrow *if* $\{x, y\} \cap P_{ob} \neq \emptyset$ *and a* black-token arrow *if* $\{x, y\} \cap P_{bt} \neq \emptyset$.

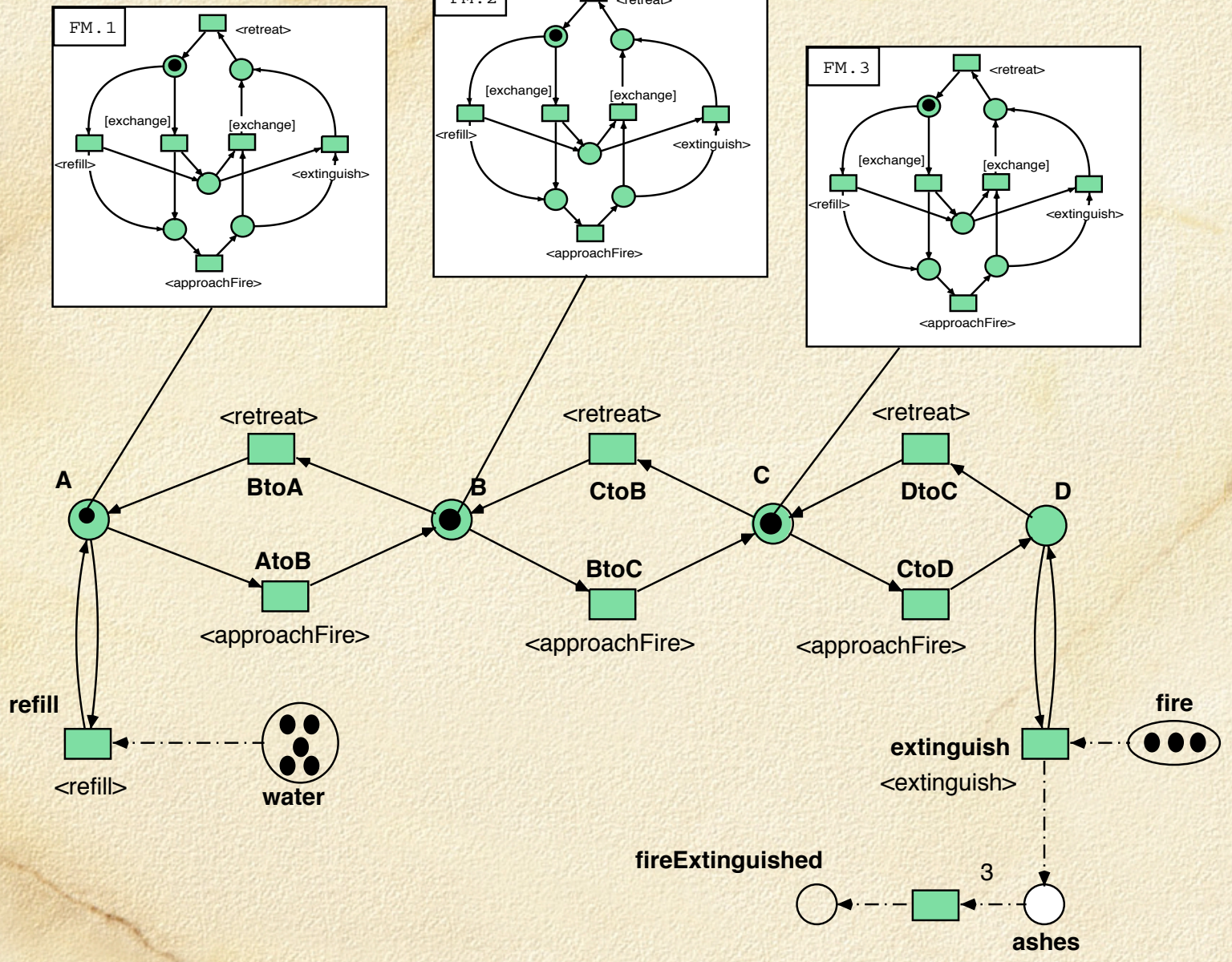
b) An marked object nets *is a marked P/T-net* $ON_i = (P_i, T_i, W_i)$ *(cf. the Appendix)*[1]

[1] It is not very important, which class of Petri nets is chosen for object nets. To keep definitions simple, we define them as P/T-nets. (see Appendix)

object interaction



object nets interact without changing environment



fire extinction chain/formal model

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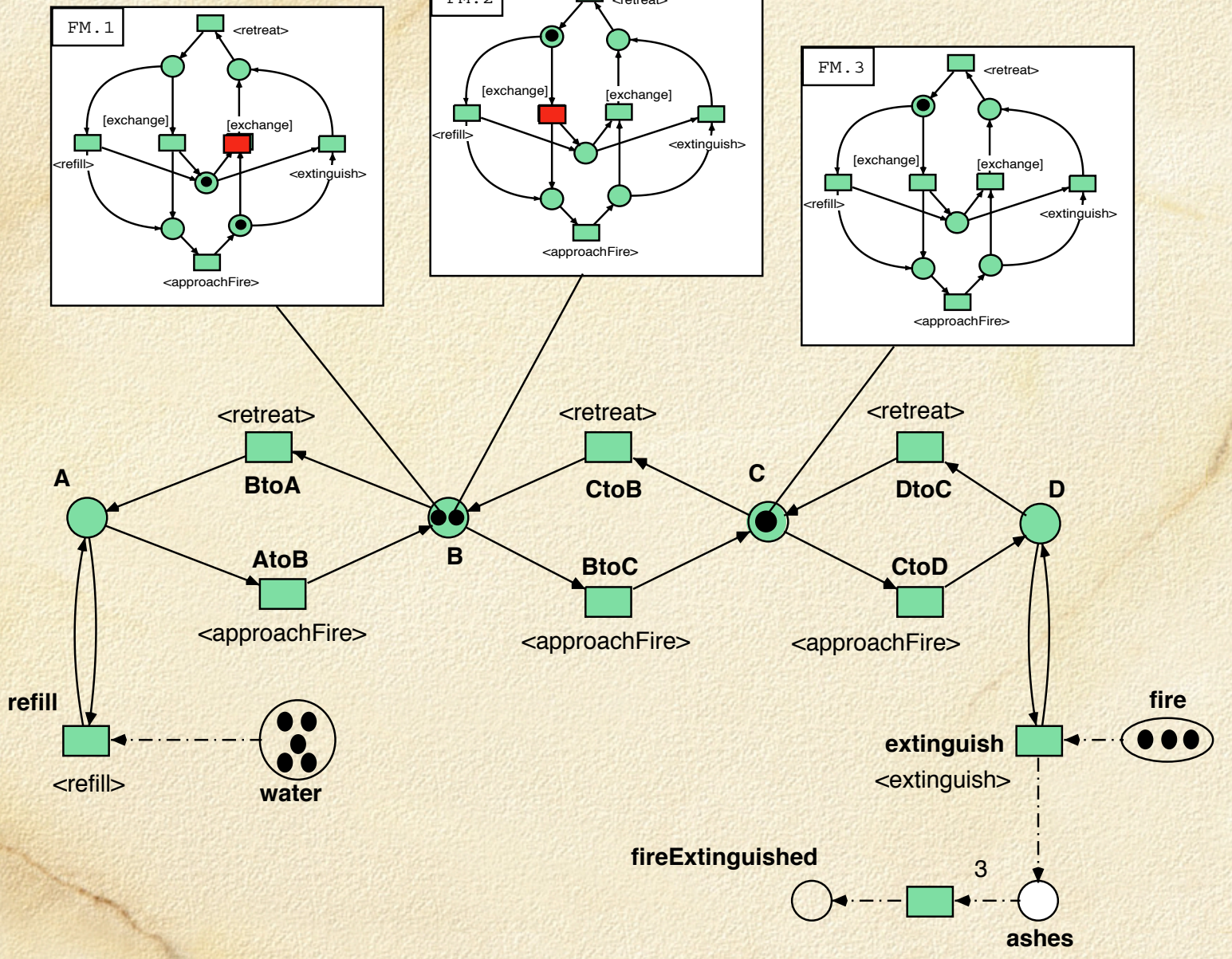

fire extinction chain/formal model

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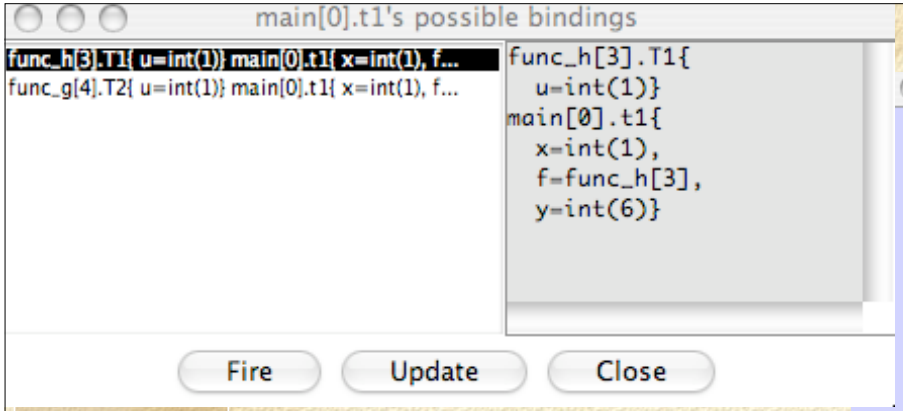
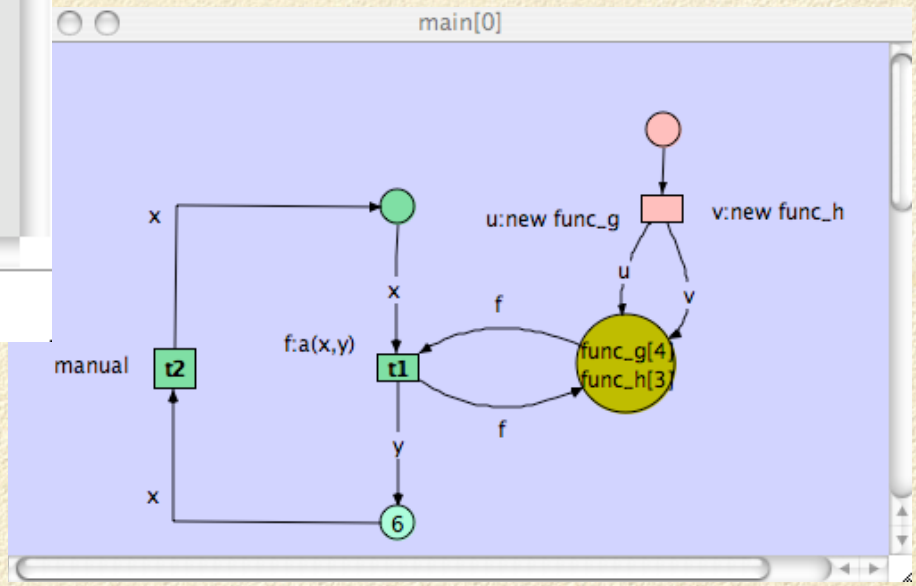
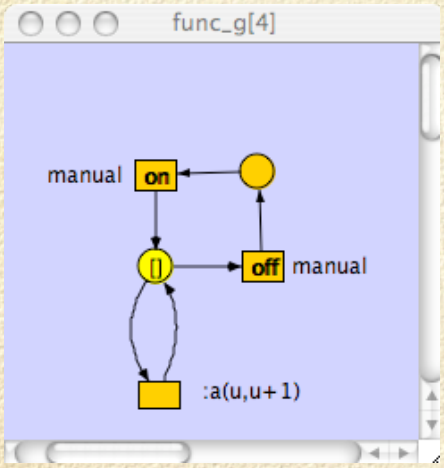
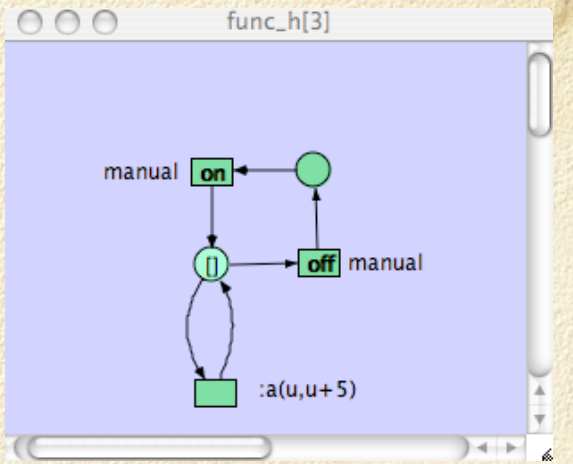
Das Renew Werkzeug









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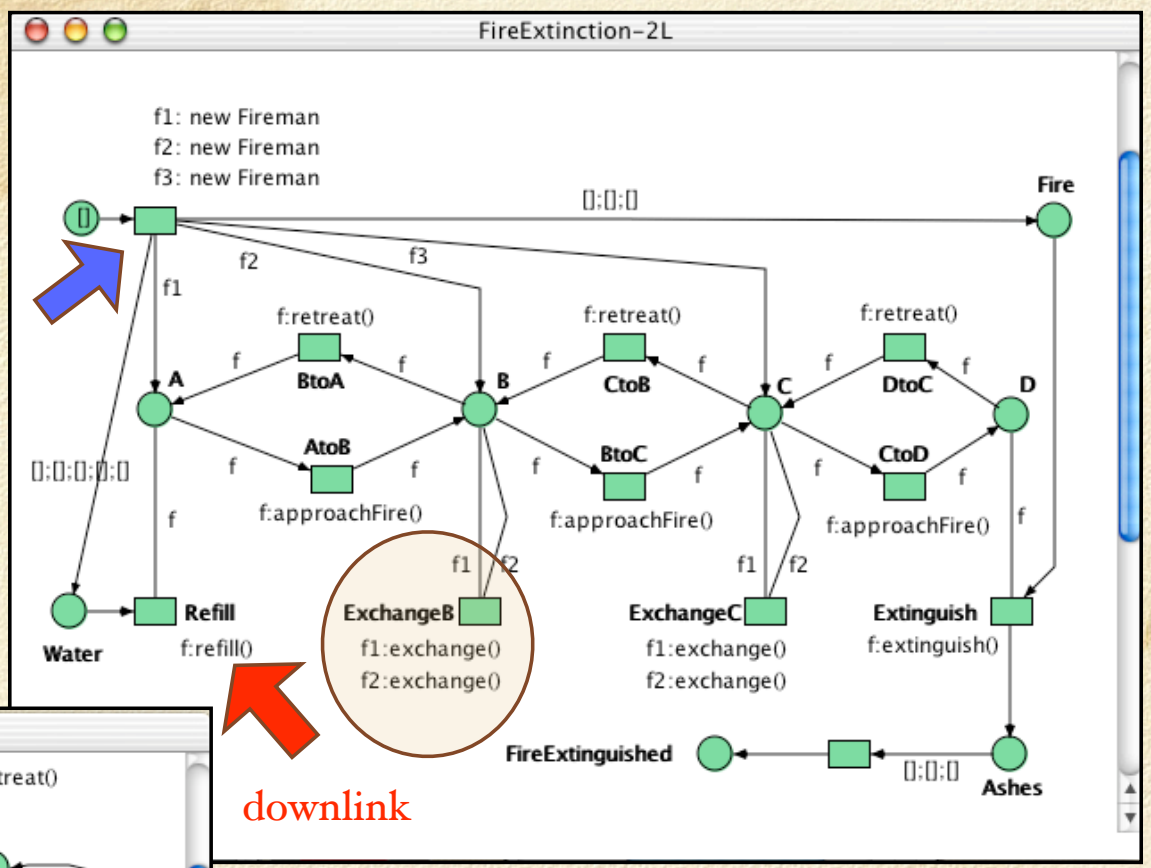

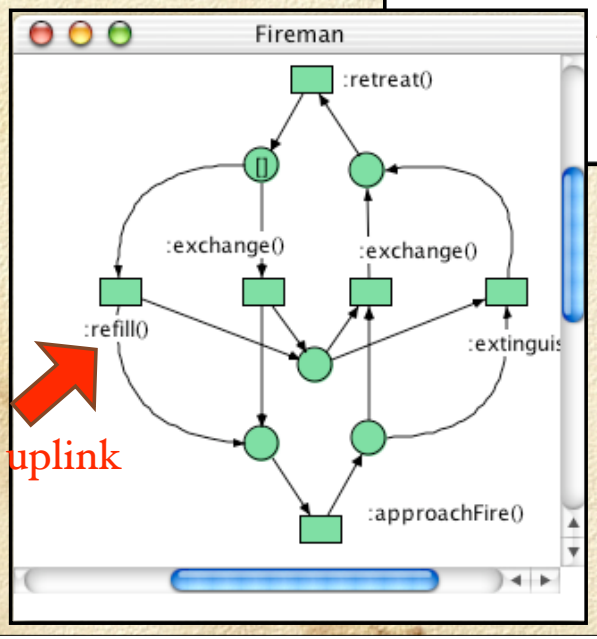

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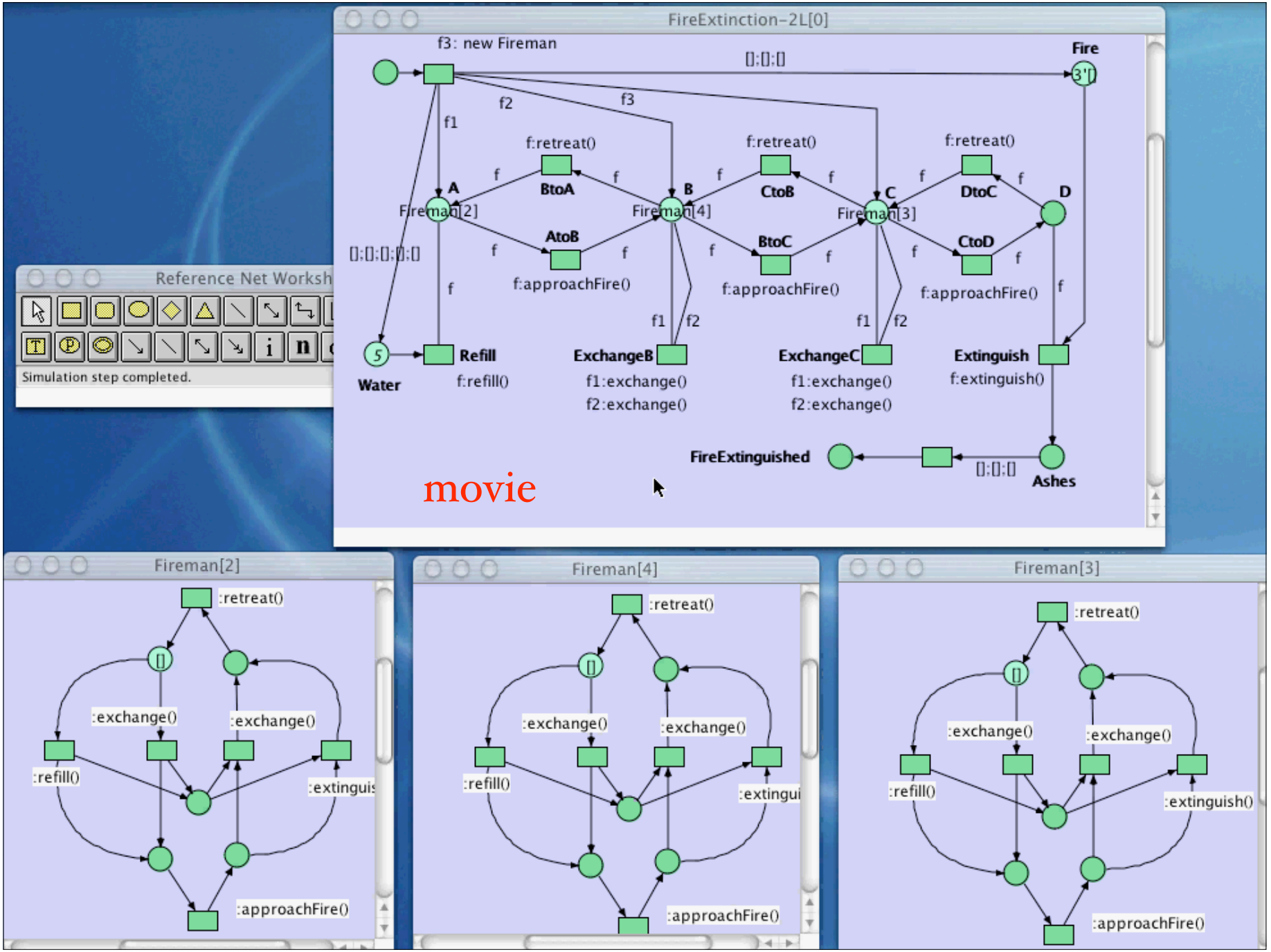
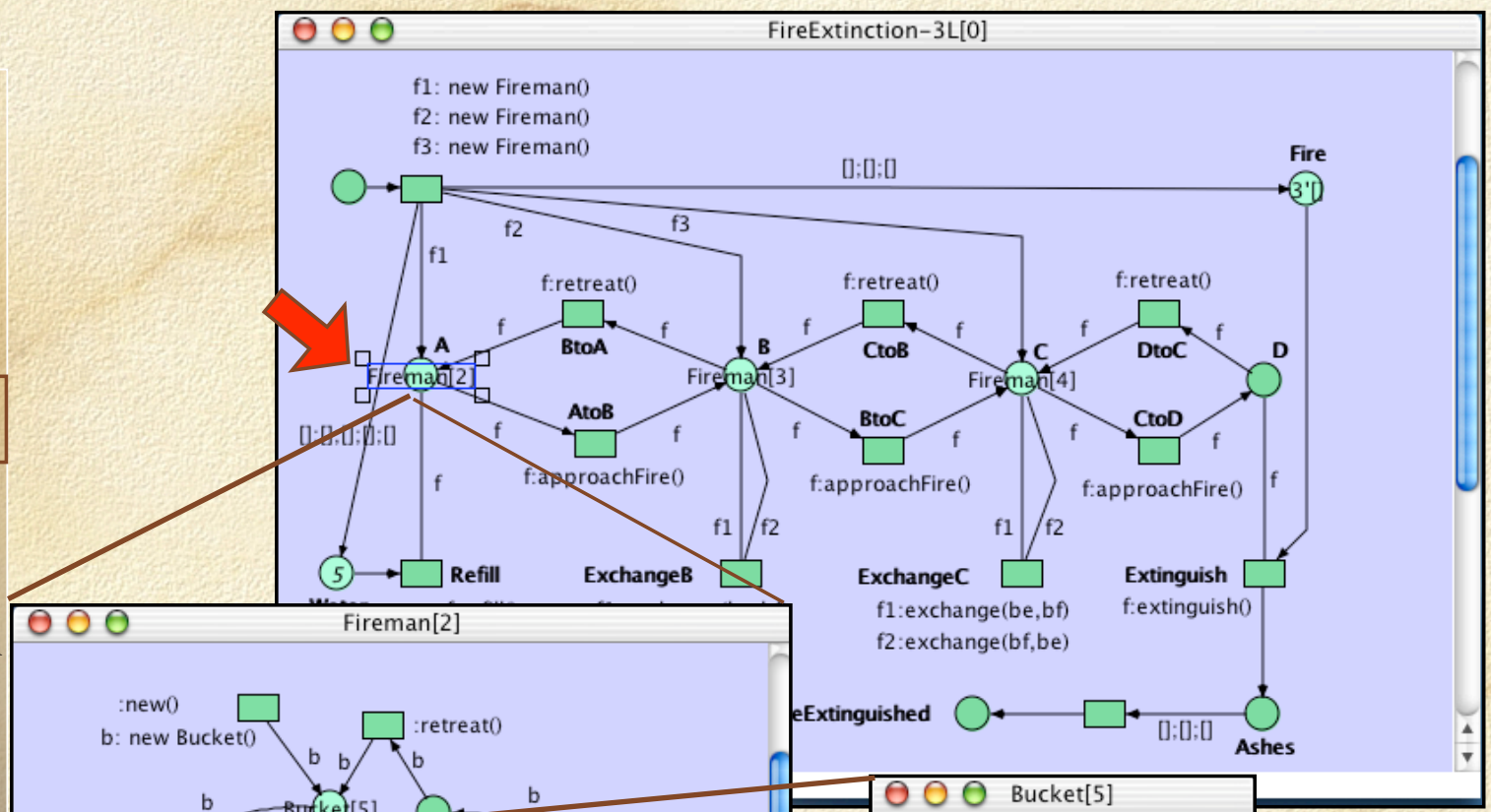
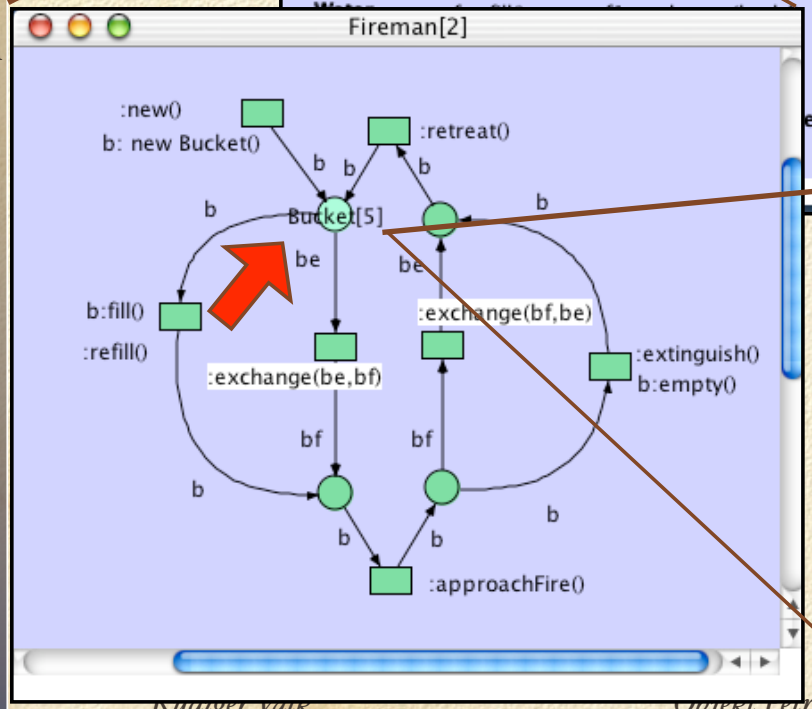
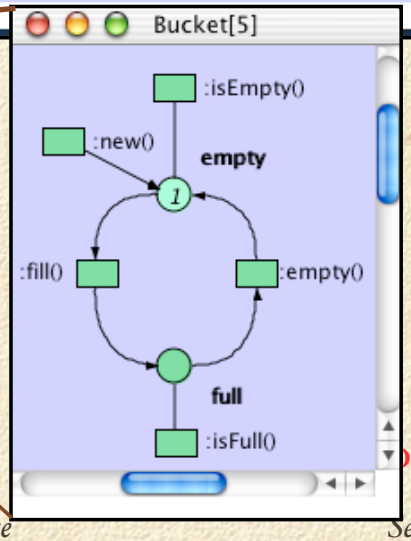

FireExtinction-2L[0]
f3: new Fireman
[];[];[]
Fire
3'[]
f1
f2
f3
f:retreat()
f:retreat()
f:retreat()
A
BtoA
B
CtoB
C
DtoC
D
Fireman[2]
Fireman[4]
Fireman[3]
AtoB
BtoC
CtoD
[];[];[];[];[]
f:approachFire()
f:approachFire()
f:approachFire()
5
Refill
ExchangeB
ExchangeC
Extinguish
Water
f:refill()
f1:exchange()
f2:exchange()
f1:exchange()
f2:exchange()
f:extinguish()
FireExtinguished
[];[];[]
Ashes
movie
Reference Net Worksh
Simulation step completed.
Fireman[2]
:retreat()
[]
:exchange()
:exchange()
:refill()
:extinguis
:approachFire()
Fireman[4]
:retreat()
[]
:exchange()
:exchange()
:refill()
:extingui
:approachFire()
Fireman[3]
:retreat()
[]
:exchange()
:exchange()
:refill()
:extinguish()
:approachFire()







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...on chain/renew

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Garbage Can

"Sozionik" =

Informatik/Multi-Agentensysteme

+

Soziologie

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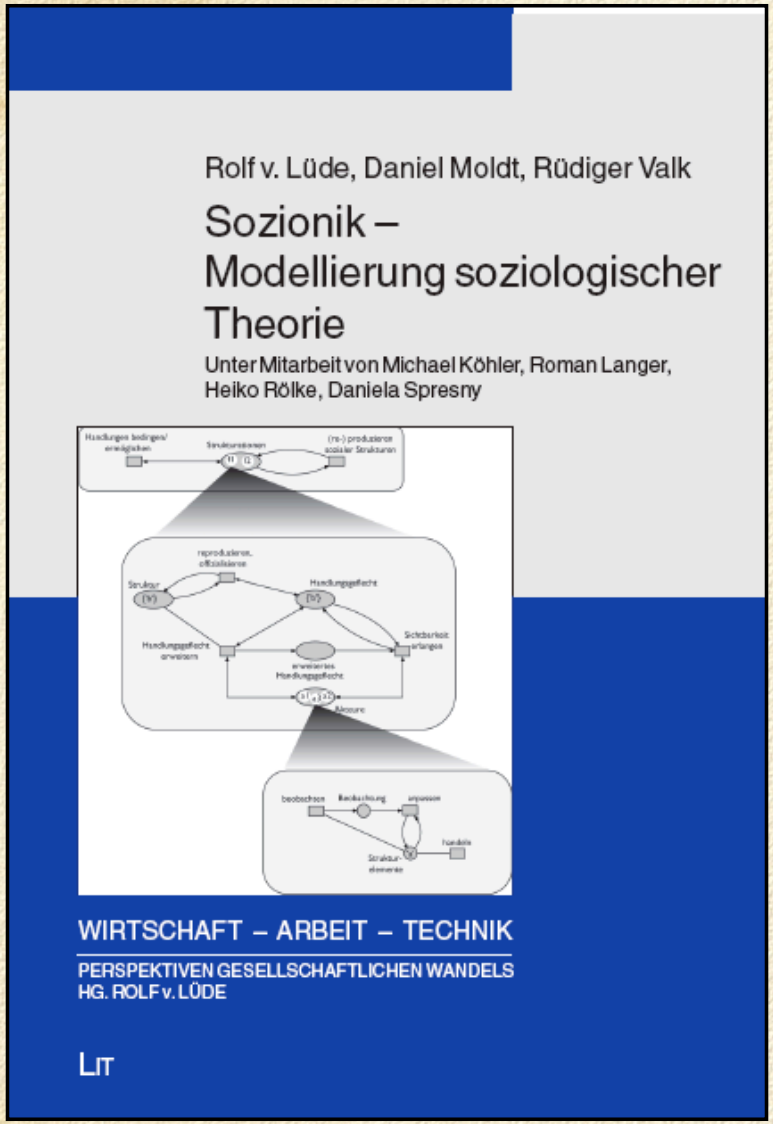

did appear this month

M.D. Cohen J.G. March and J.P. Olsen.
A garbage can model of organizational choice.
Administrative Science Quarterly 17:1--25, 1972.

Consider organized anarchies. These are organizations - or decision situations - characterized by three general properties.

The first is **problematic preferences**. In the organization it is difficult to impute a set of preferences to the decision situation that satisfies the standard consistency requirements for a theory of choice.

The organization operates on the basis of a variety of inconsistent and ill defined preferences. It can be described better by a loose collection of ideas than as a coherent structure; it discovers preferences through action more than it acts on the basis of preferences,

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The second property is **unclear technology**. Although the organization manages to survive and even produce, its own processes are not understood by its members. It operates on the basis of simple trial-and-error procedures, the residue of learning from accidents of past experience, and pragmatic inventions of necessity.

The third property is **fluid participation**. Participants vary in the amount of time and effort they devote to different domains; involvement varies from one time to another. As a result, the boundaries of the organization are uncertain and changing; the audiences and decision makers for any particular kind of choice change capriciously.

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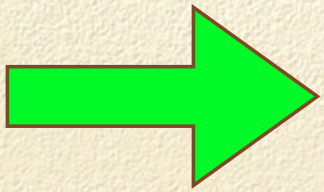
Problems. Problems are the concern of people inside and outside the organization ....

Solutions. A solution is somebody's product. .... Despite the dictum that you cannot find the answer until you have formulated the question well, you often do not know what the question is in organizational problem solving until you know the answer.

Participants. Participants come and go. ..... Substantial variation in participation stems from other demands on the participants' time (rather than from features of the decision under study) .

Choice opportunities. These are occasions when an organization is expected to produce behavior that can be called a decision. Opportunities arise regularly and any organization has ways of declaring an occasion for choice. Contracts must be signed; people hired, promoted, or fired; money spent; and responsibilities allocated.

A stream of choices
A stream of problems
A rate of flow of solutions
A stream of energy from participants



garbage can

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M.Masuch and P. LaPotin.
Beyond Garbage Cans:
An AI Model of Organizational Choice.
Administrtive Science Quarterly 36: 38--67, 1989.

To get an approximate impression of the model, reconsider the finale of the James Bond movie, "A View to a Kill." Agent 007 balances on the main cable of the Golden Gate Bridge, a woman in distress clinging to his arm, a blimp approaching for rescue. In terms of the garbage can model,
the blimp is a solution,
007 a choice opportunity, and
the woman a problem.

In the picture's happy ending, the hero is finally picked up, together with the woman, and a solution by resolution takes place; the problem is solved

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As women, as well as blimps, make their choices simultaneously, but independently of each other, a light hero, on the verge of rescue, may suddenly find himself overburdened. Heavy heroes, in turn, may become rescuable all of a sudden as their women desert them. This mechanism, called "**fluid participation**", creates the possibility of nonsensical solutions or nonsolutions.

Women may switch heroes too swiftly and end up with an overburdened hero each time; then, problems are not solved. Or heroes are rescued just as all women have left; then, a "**decision by flight**" is made.

Finally, heroes may be salvaged upon arrival at the scene before any woman in distress has a chance to grab their arm; then "**decisions by oversight**" are said to be made.

Nevertheless, decisions by resolution do occur.

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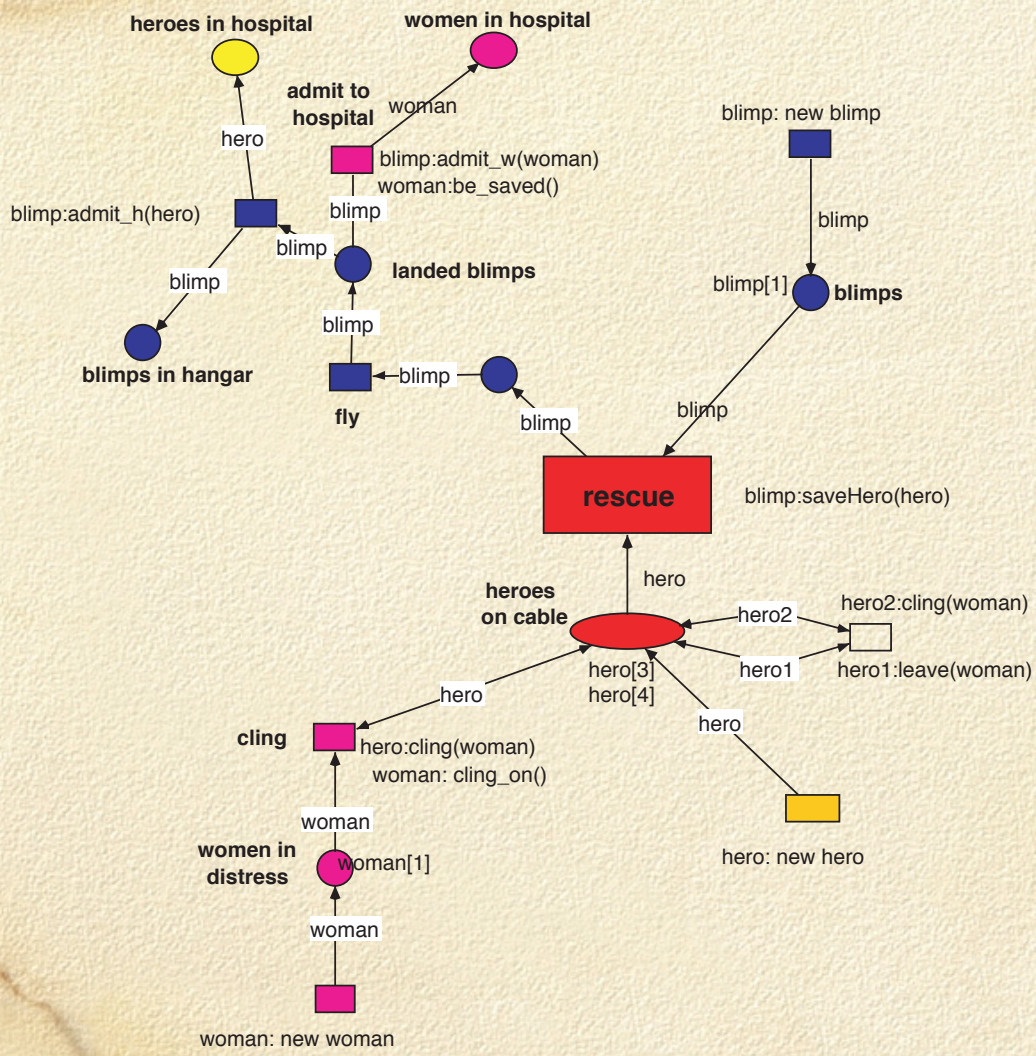
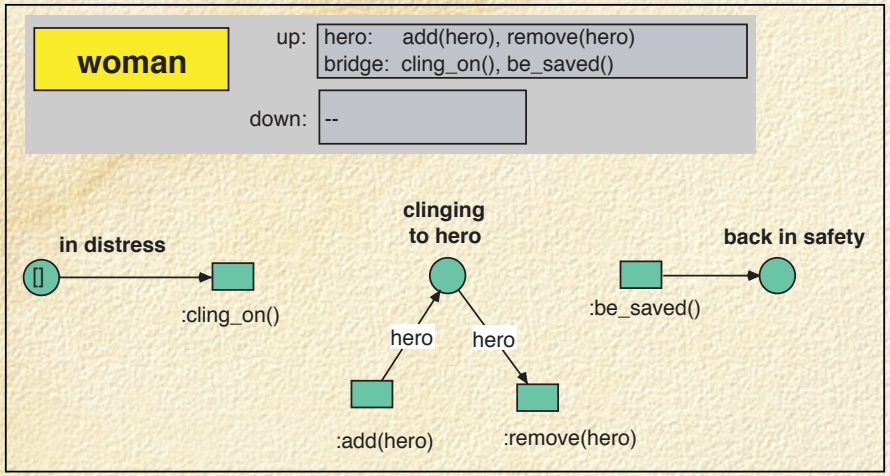
bridge

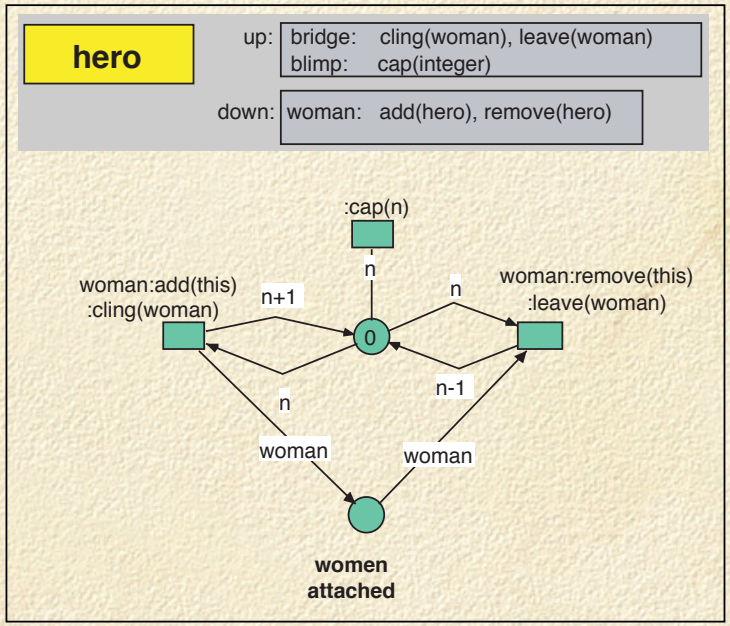
up: --

down:

blimp:	admit_h(hero), admit_w(woman),saveHero(hero)
hero:	leave(woman), cling(woman)
woman:	cling_on(), be_saved()







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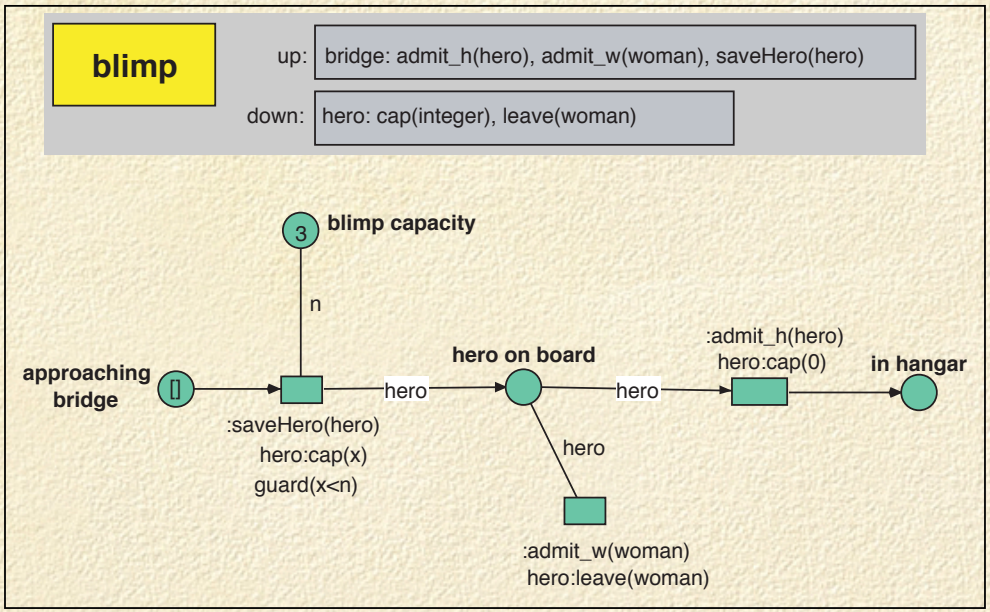

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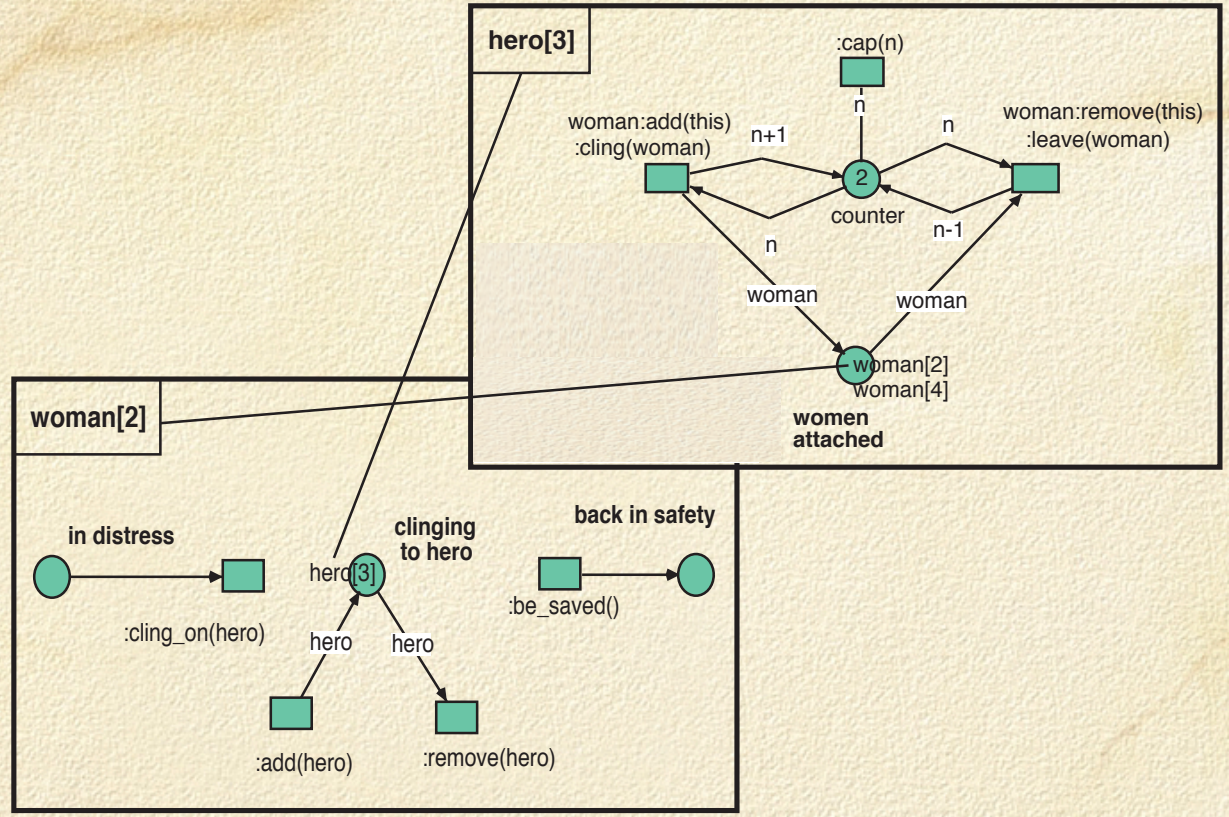

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Renew-Simulation

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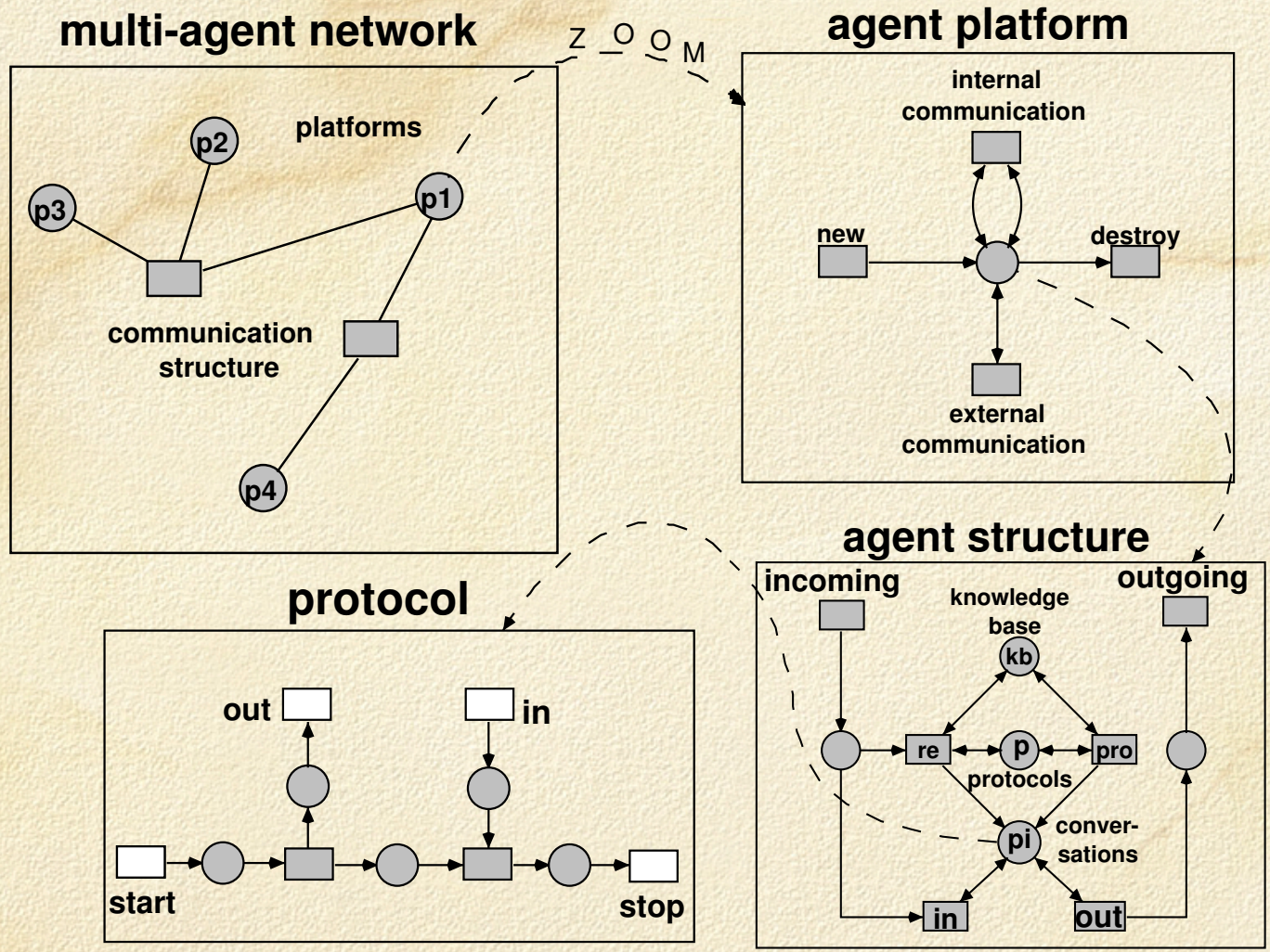
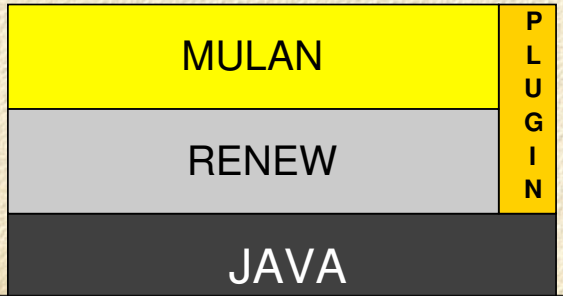
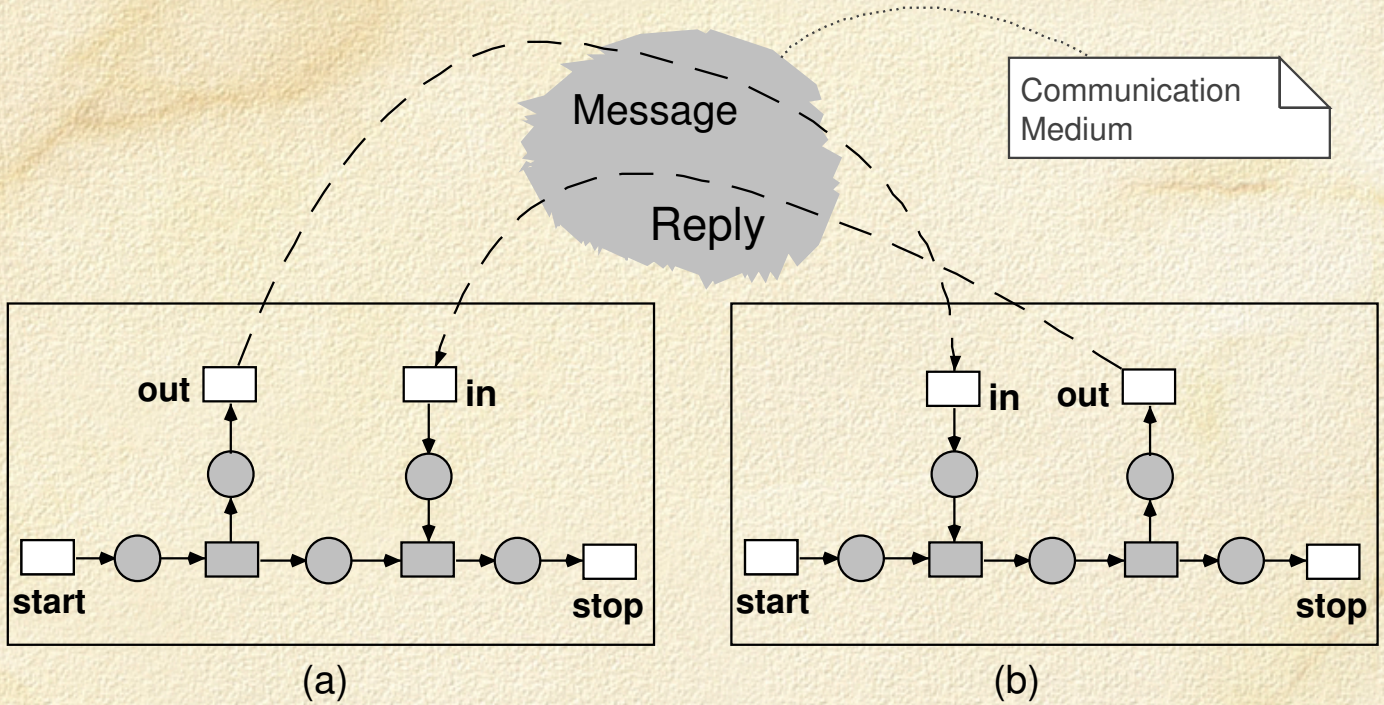
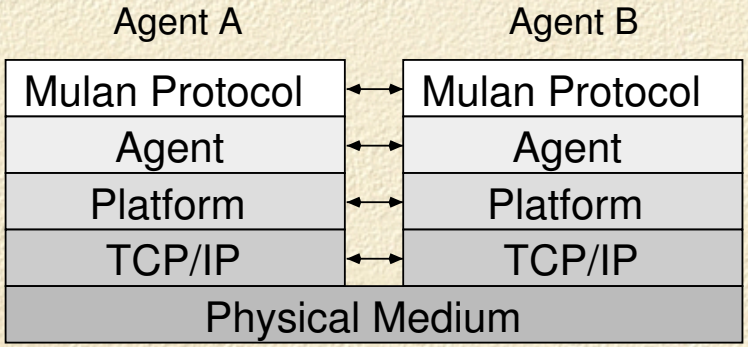
Agenten & Komponenten









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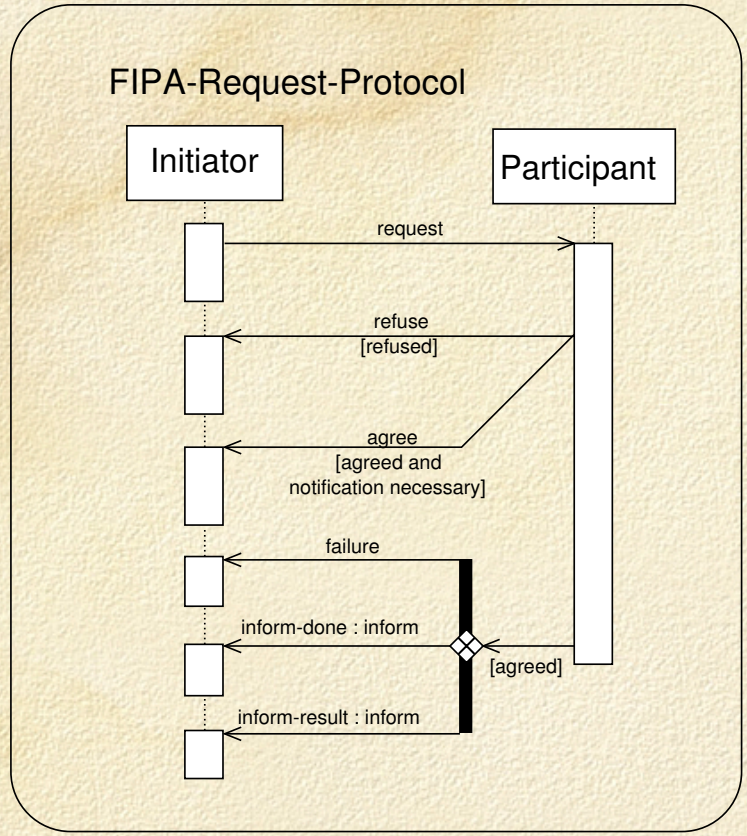

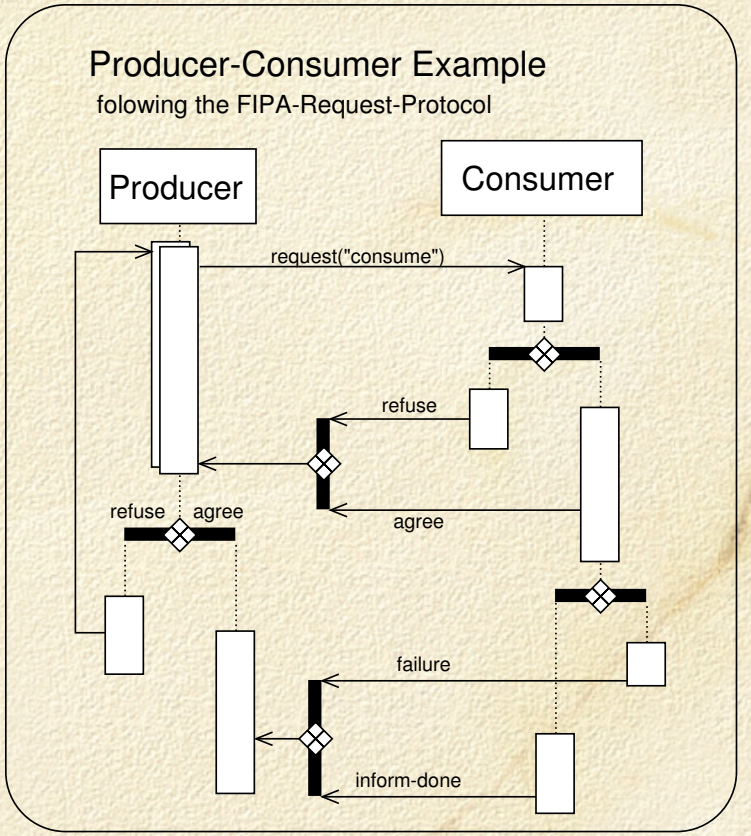

Fig. 11: Interaction protocol diagram of the FIPA Request and a FIPA Request-compliant *producer-consumer* example.

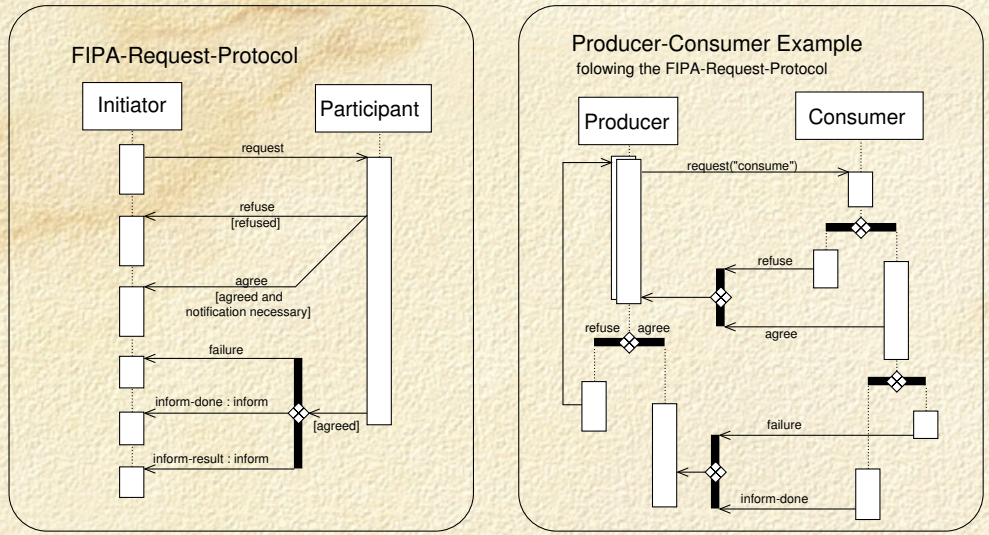

Fig. 11: Interaction protocol diagram of the FIPA Request and a FIPA Request-compliant *producer-consumer* example.

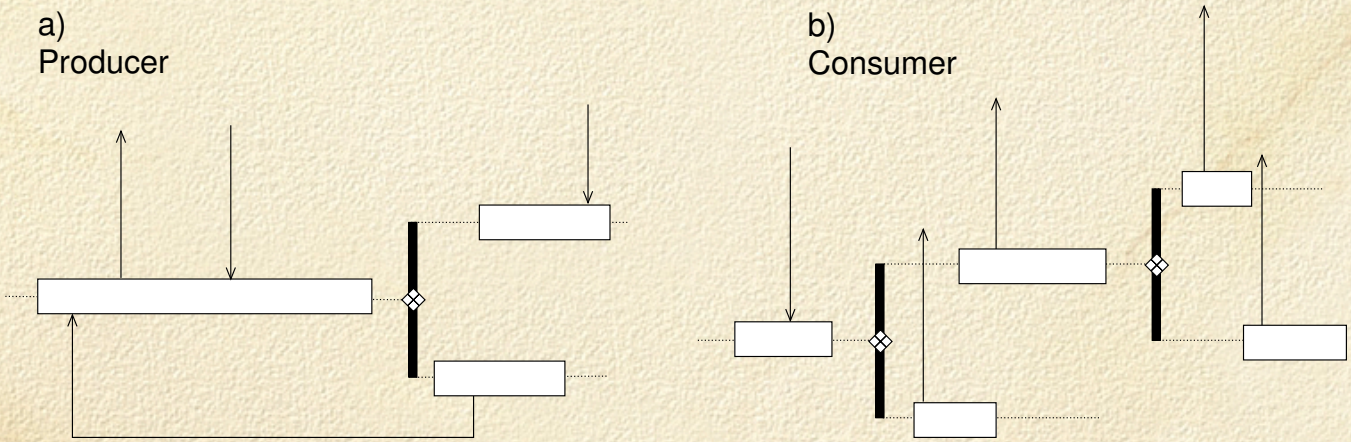

Fig. 12: Two parts of the example diagram; one for each agent.

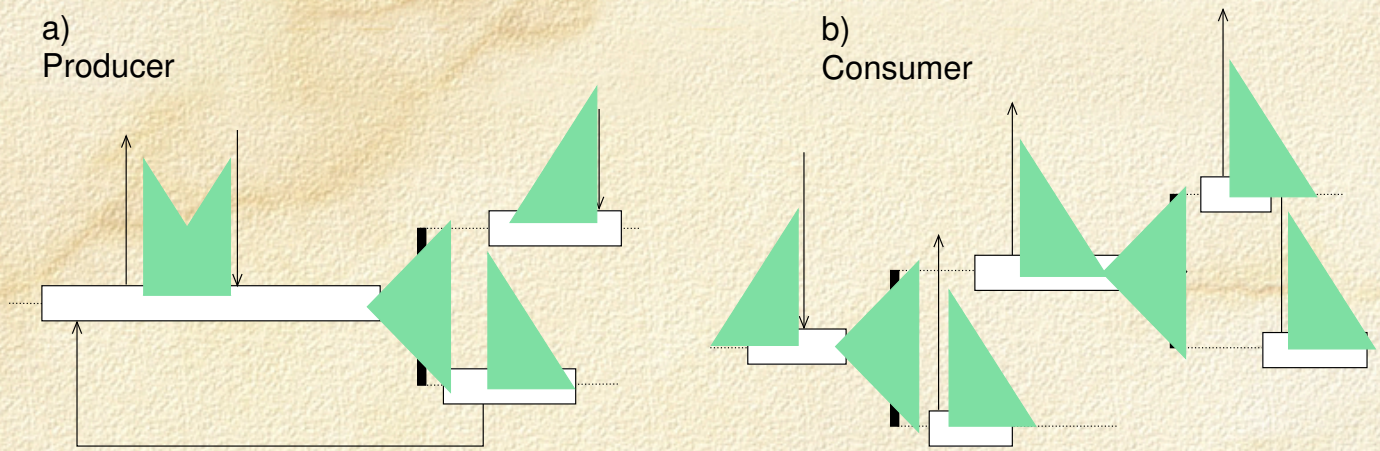

Fig. 13: Both parts augmented by the symbols for the net components.

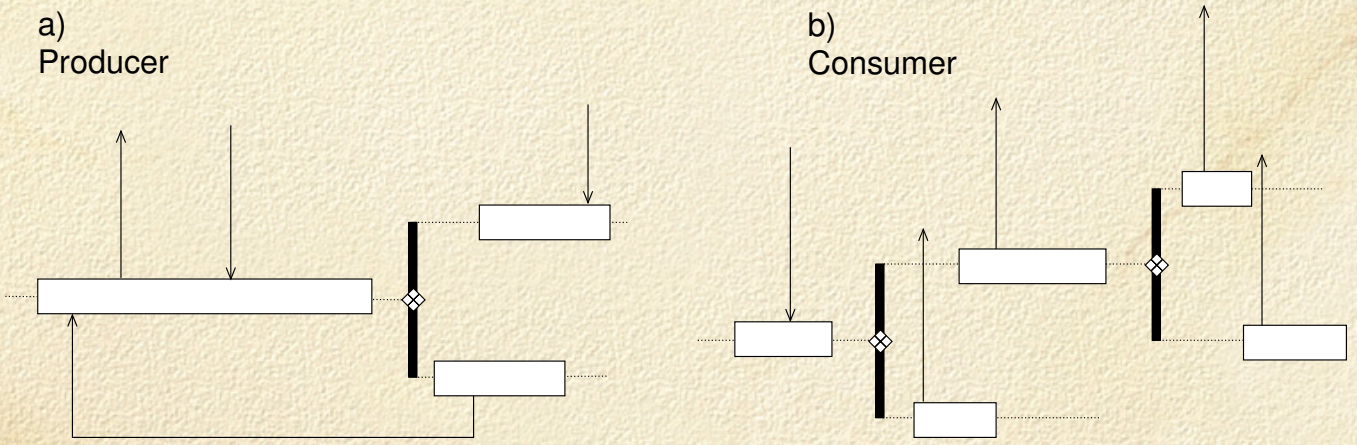

Fig. 12: Two parts of the example diagram; one for each agent.

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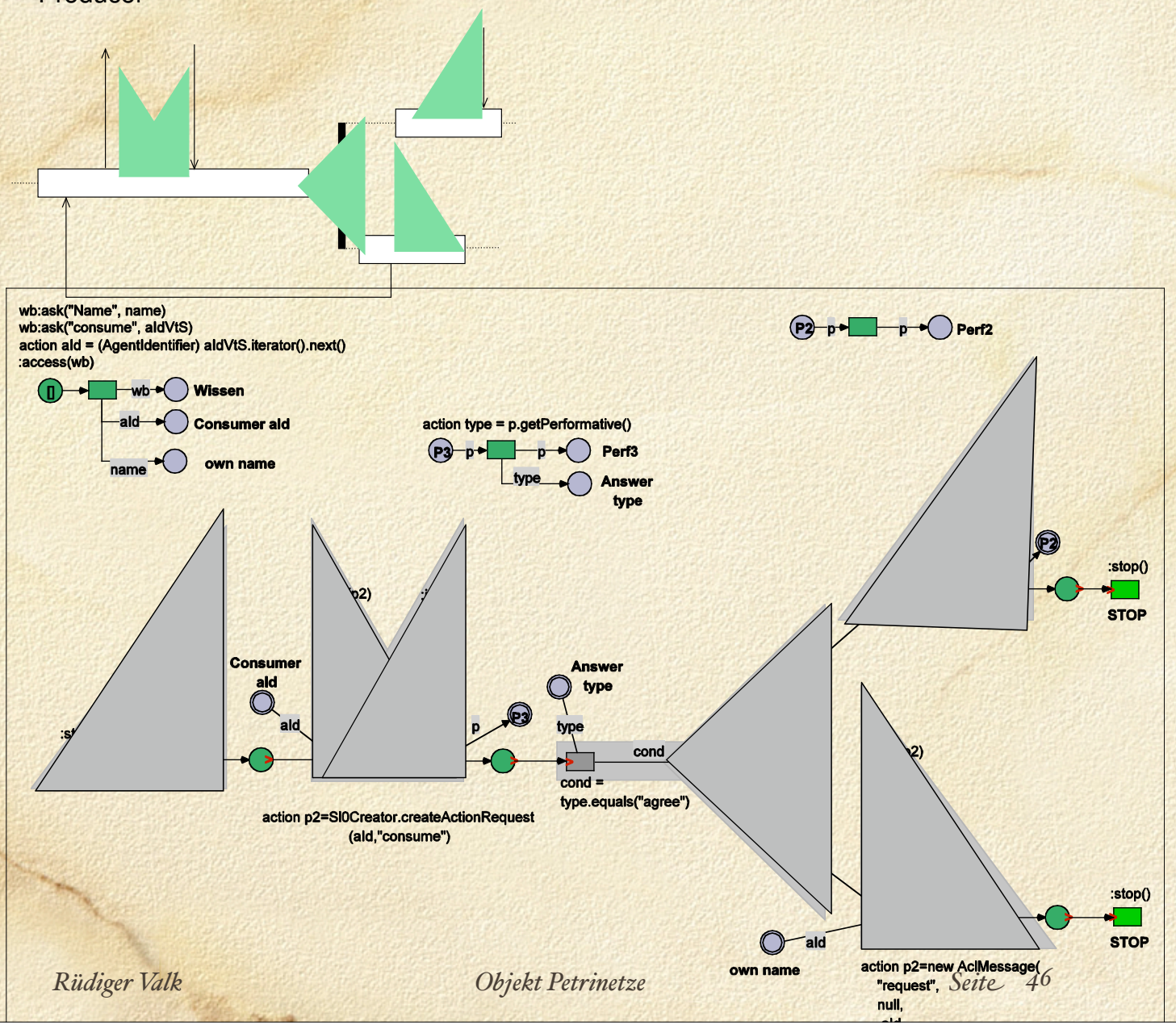
a)
Producer



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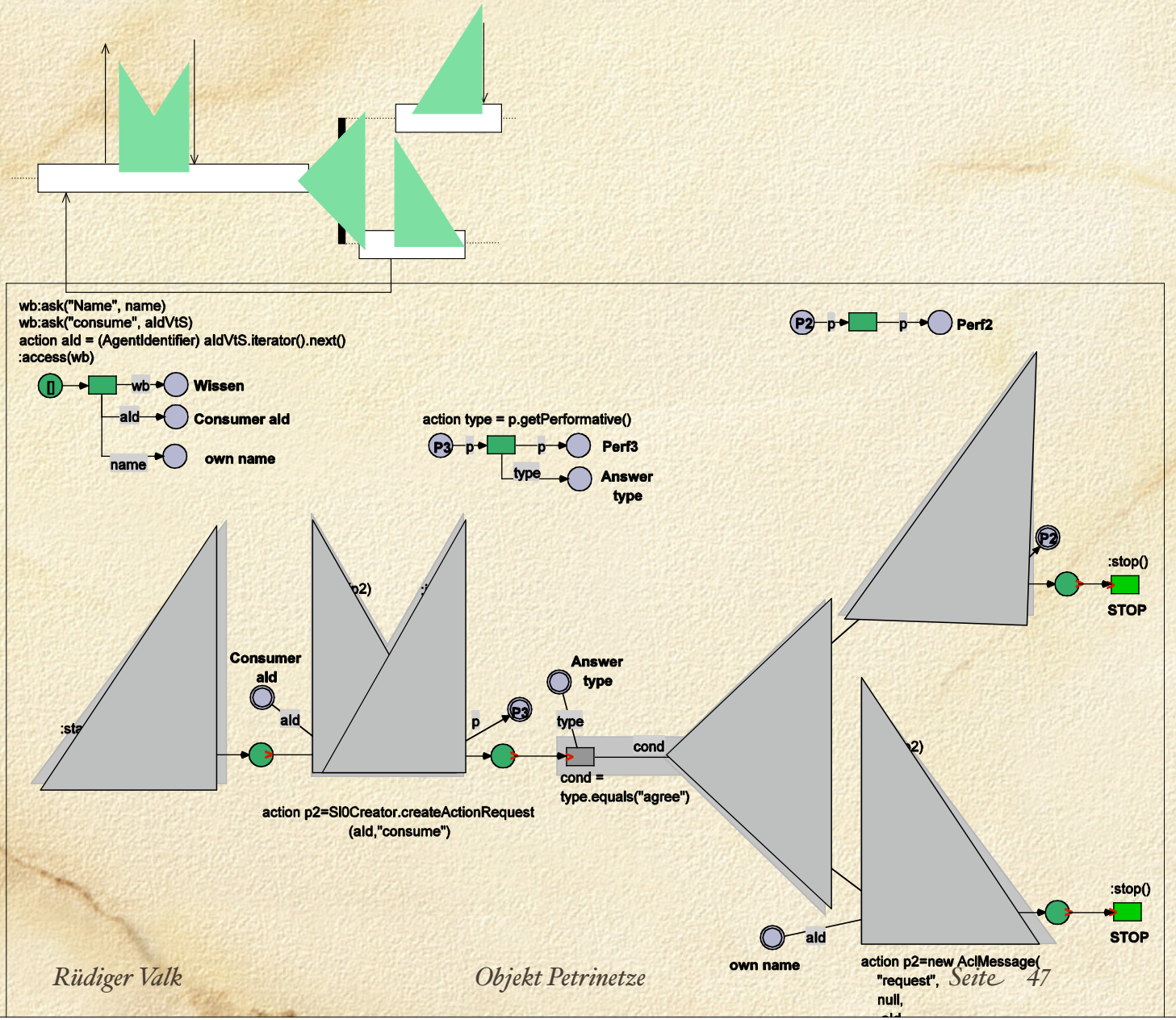
a)
Producer



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- 6 st Lehreprojekte im WS 01/02 - WS 03/04
- 20 / 50 / 40 Teilnehmer
- Siedler von Catan als Anwendung
- 200 Netze und Klassen
- Einsatz in der Lehre von Java, Renew, Mulan, Capa, Komponenteneditor, Eclipse, CVS, …
- Erfolgreicher Einsatz von AOSE

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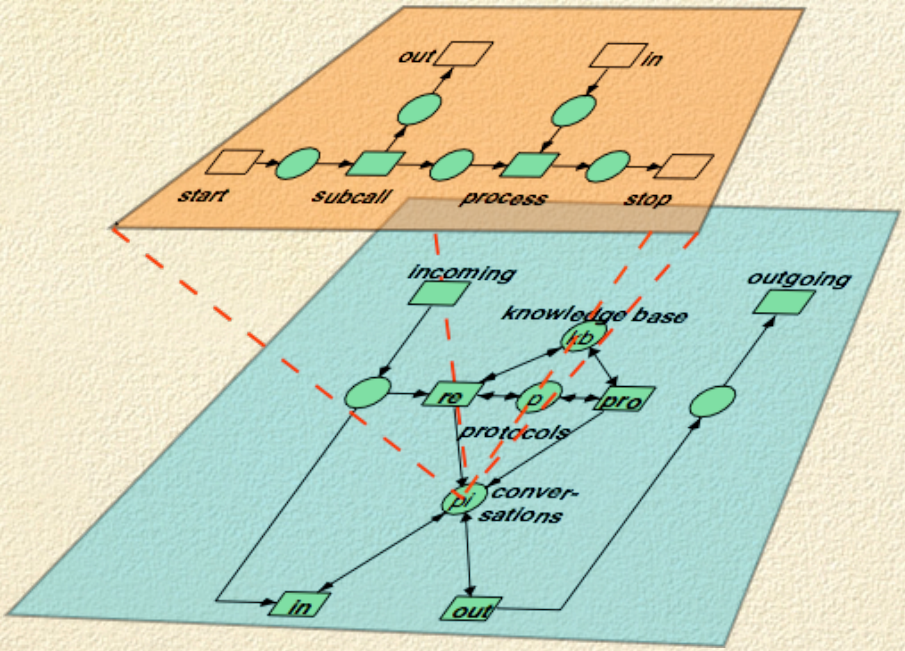

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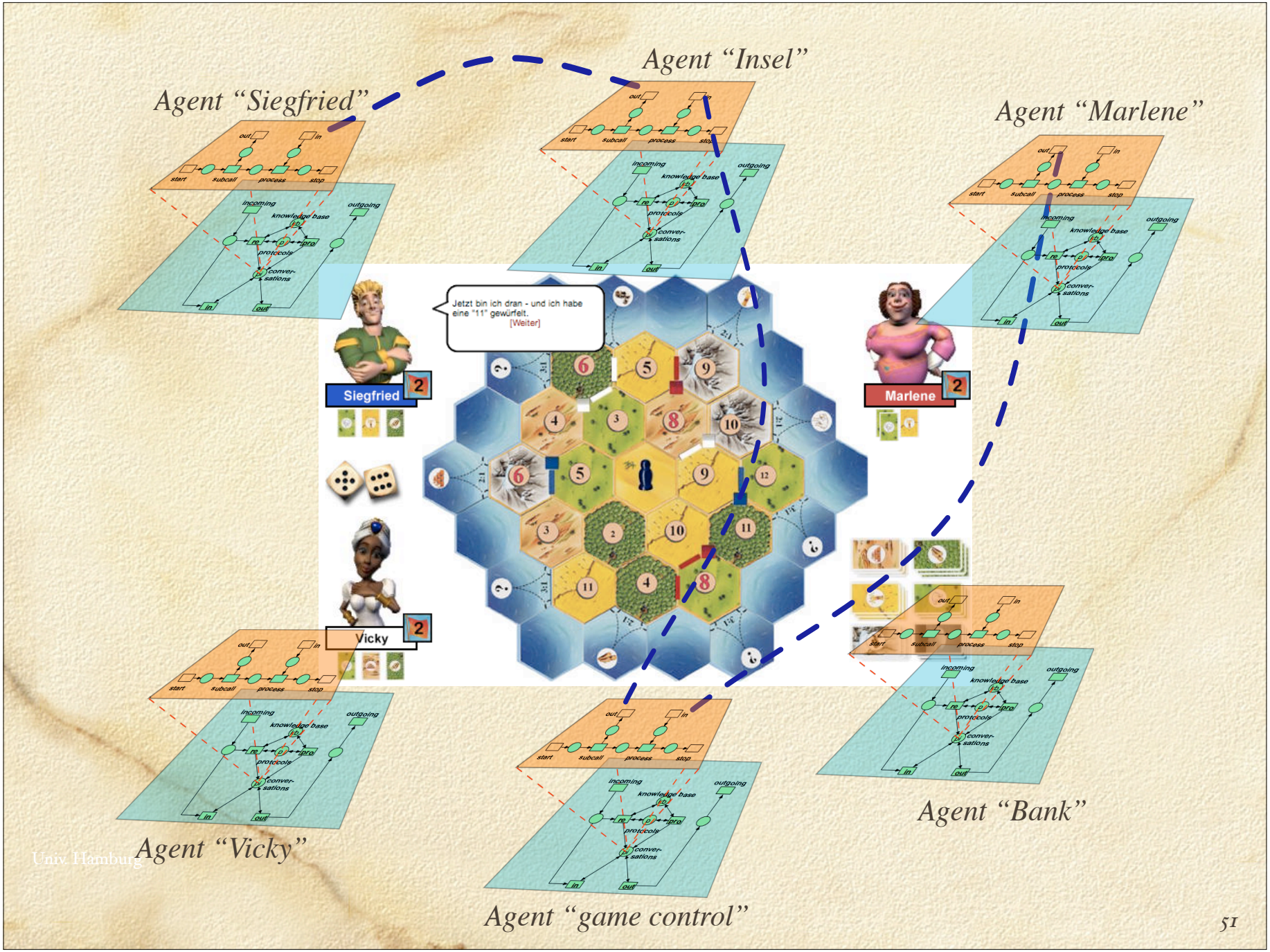

Agent “Siegfried”
Agent “Insel”
Agent “Marlene”
Agent “Vicky”
Agent “game control”
Agent “Bank”
Jetzt bin ich dran - und ich habe eine "11" gewürfelt.
[Weiter]
Siegfried
2
Marlene
2
Vicky
2
out
in
start
subcall
process
stop
incoming
knowledge base
outgoing
protocols
conver-sations

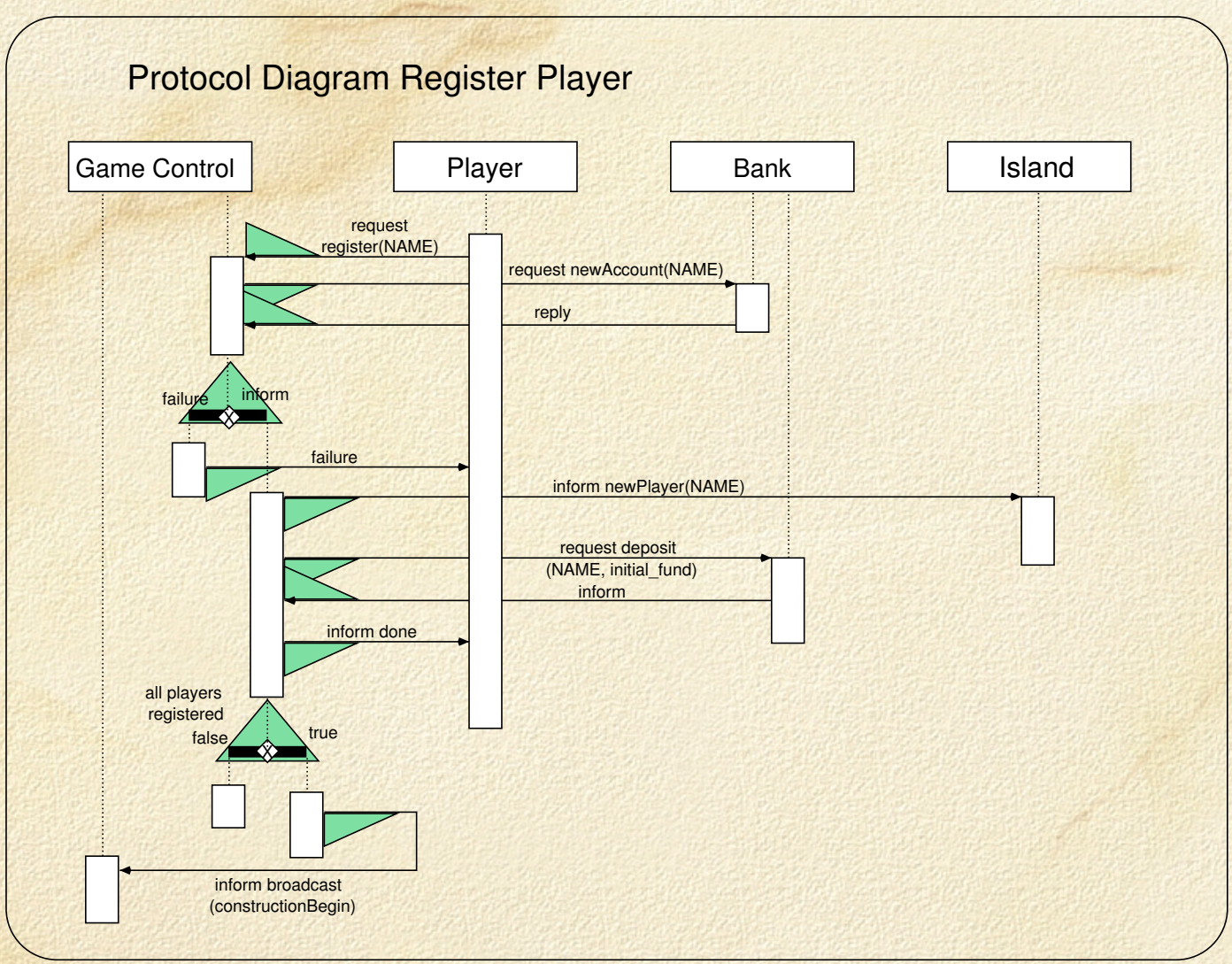


Fig. 17: Mulan conform-structured agent interaction protocol for the registration of a player.

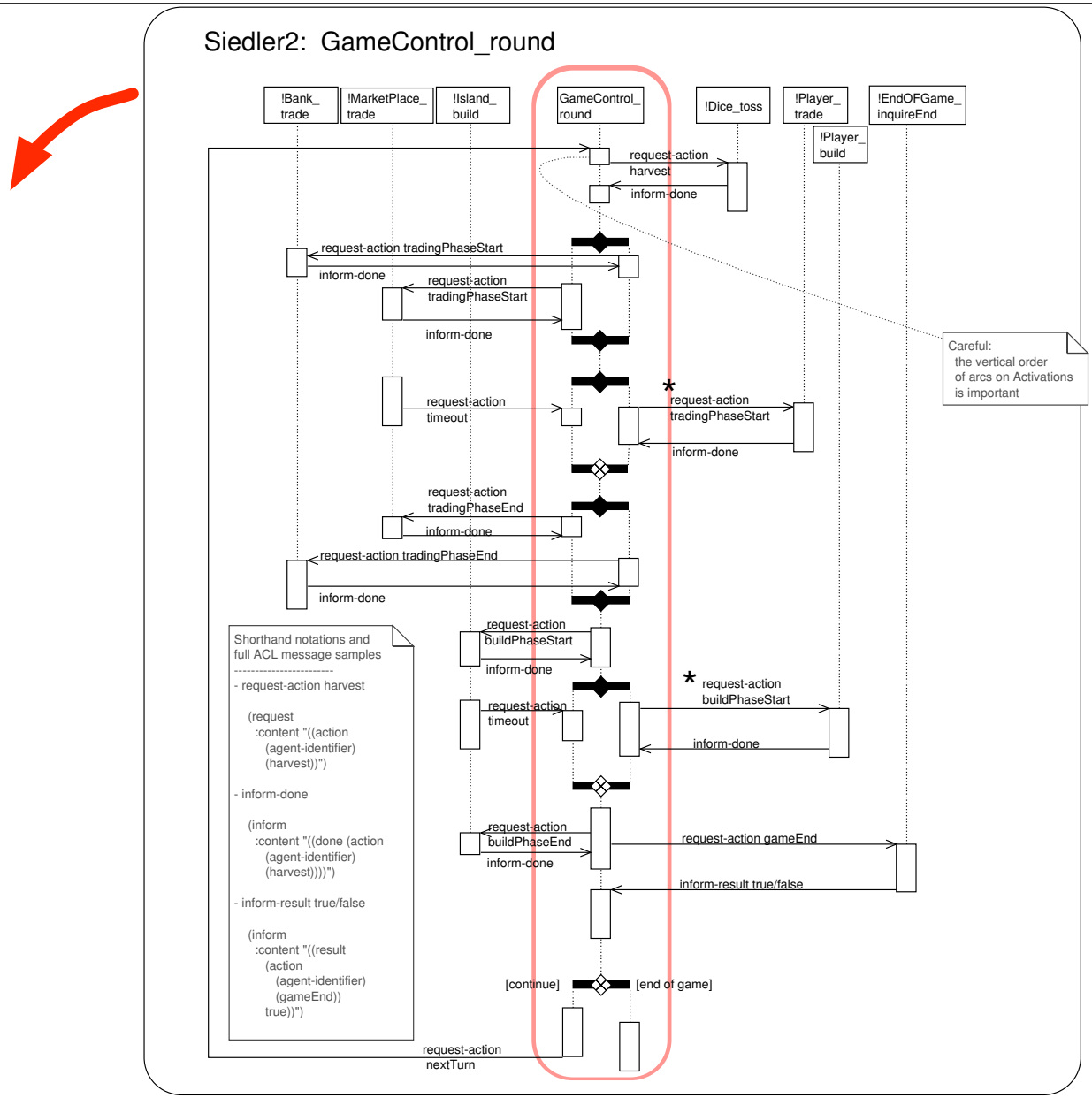
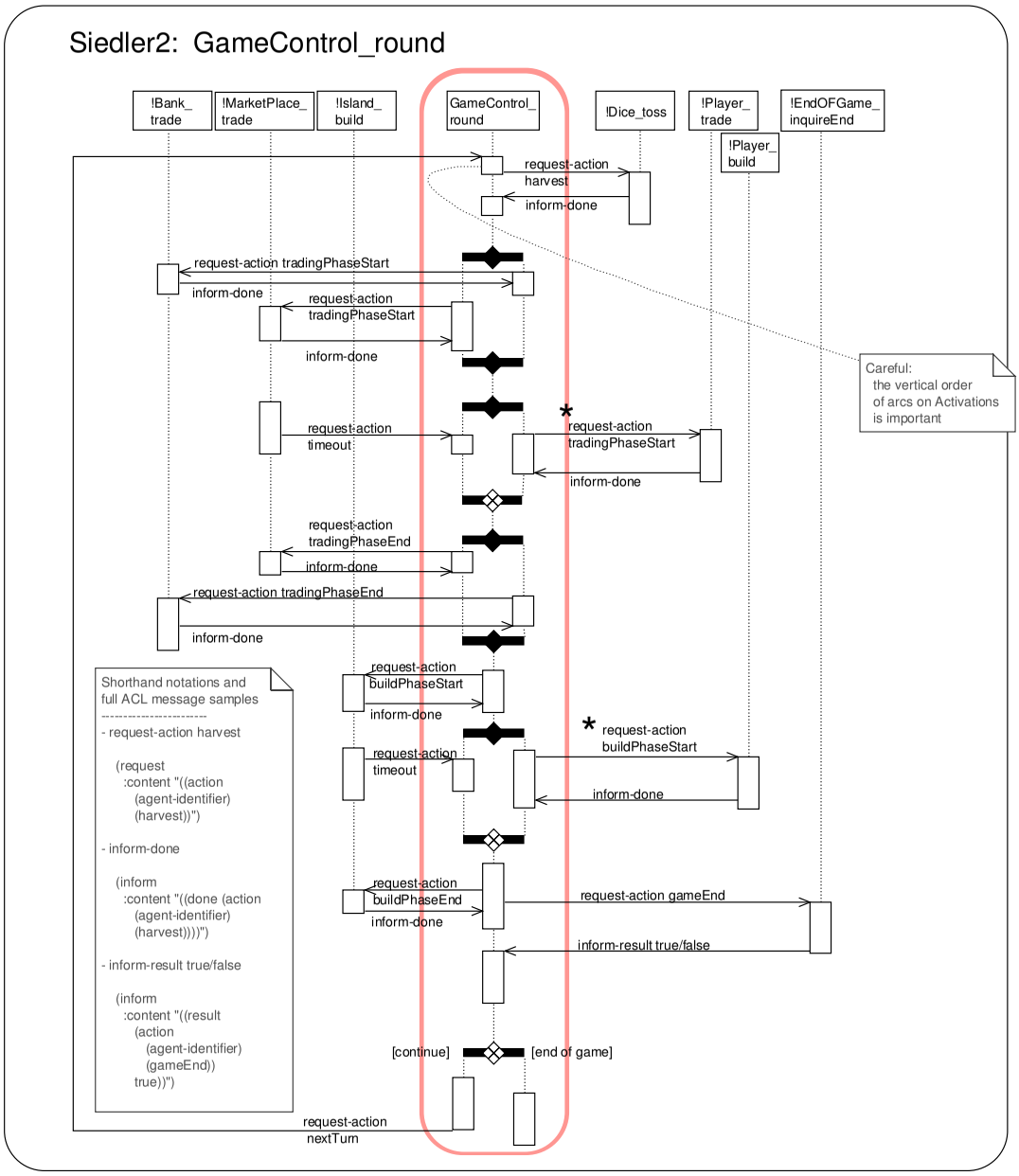


Figure 8.14: Agent interaction protocol diagram for the round of the *settler2* game.



gure 8.14: Agent interaction protocol diagram for the round of the *settler2*

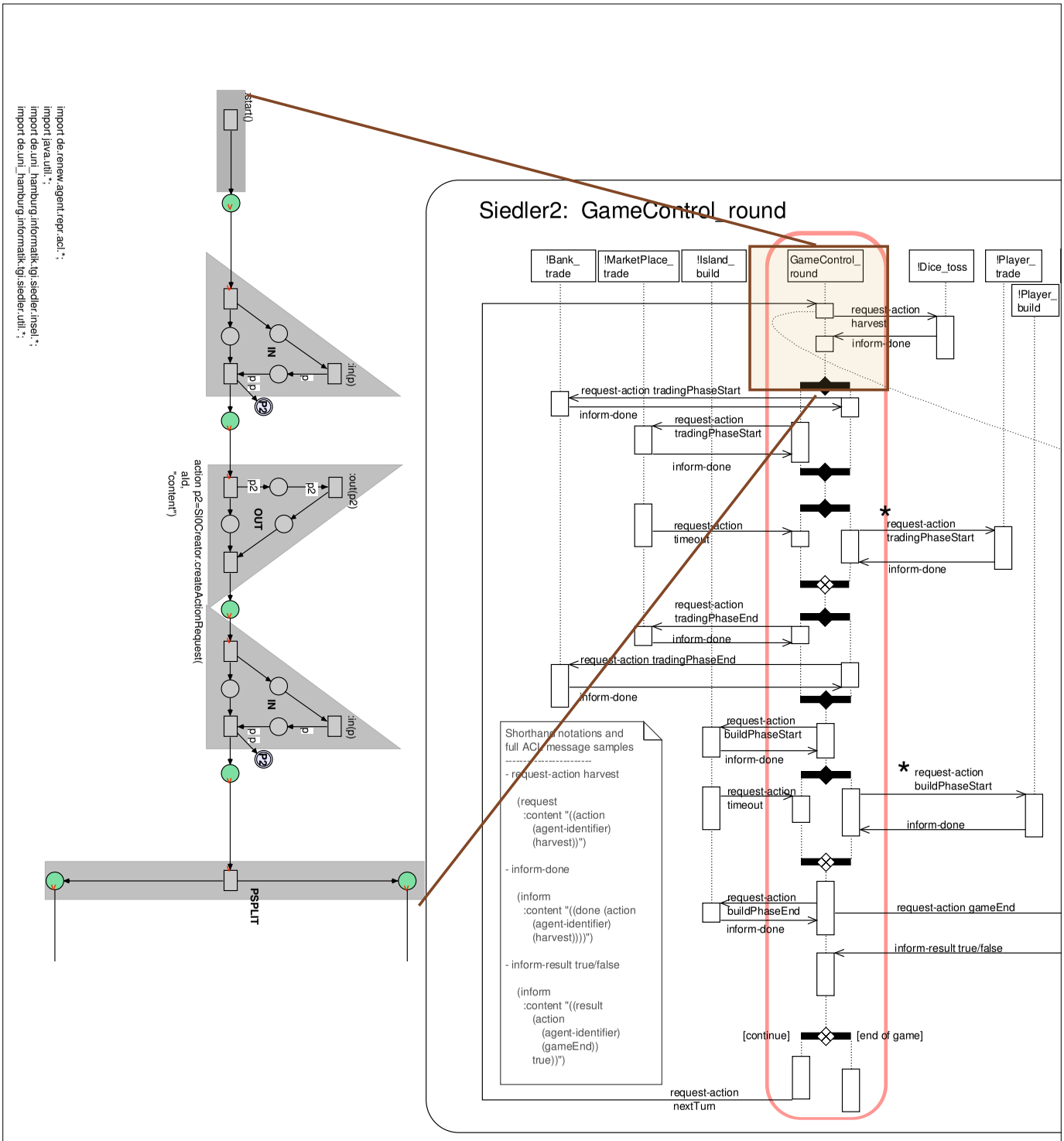


Figure 8.14: Agent interaction protocol diagram for the rou

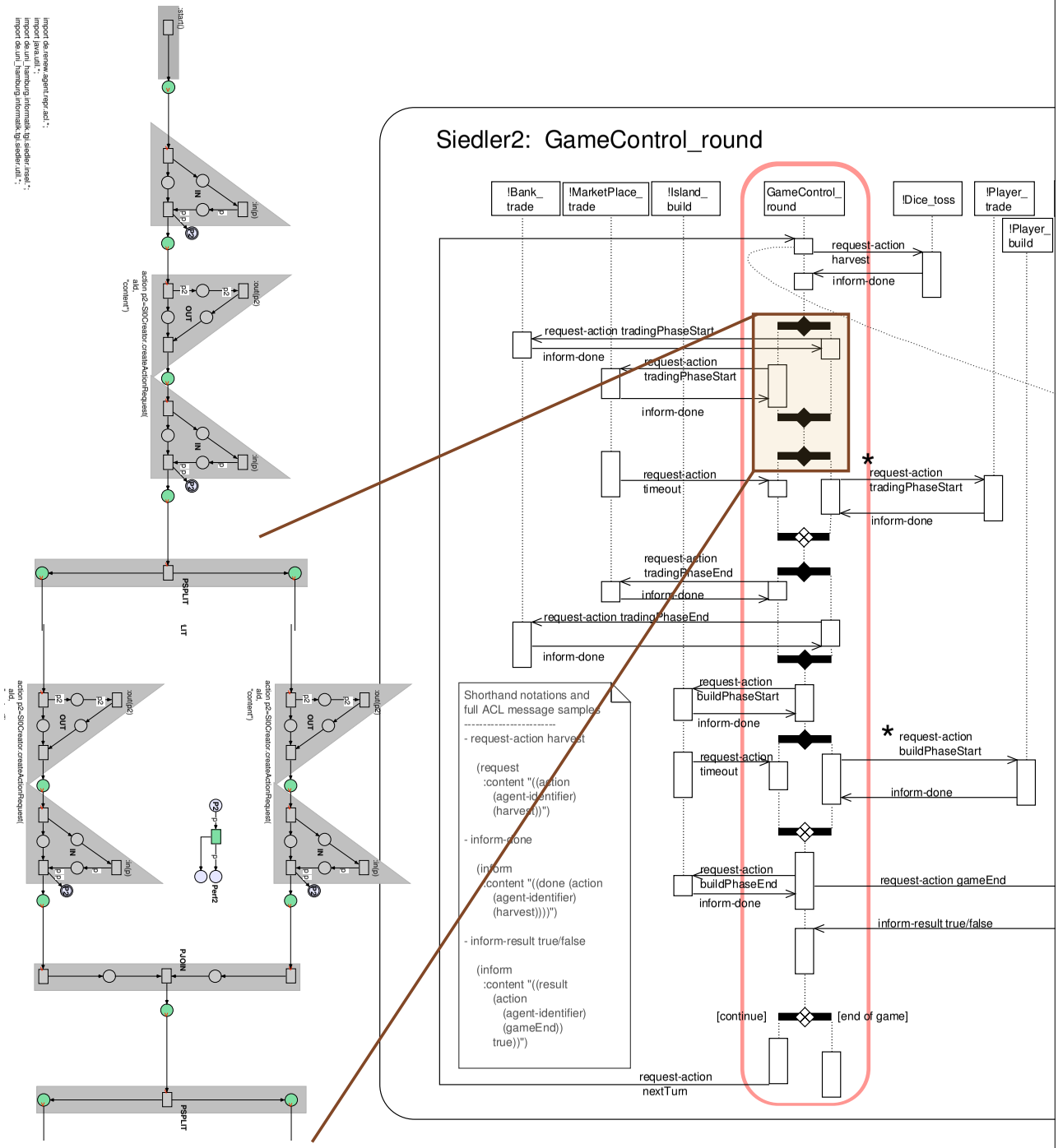
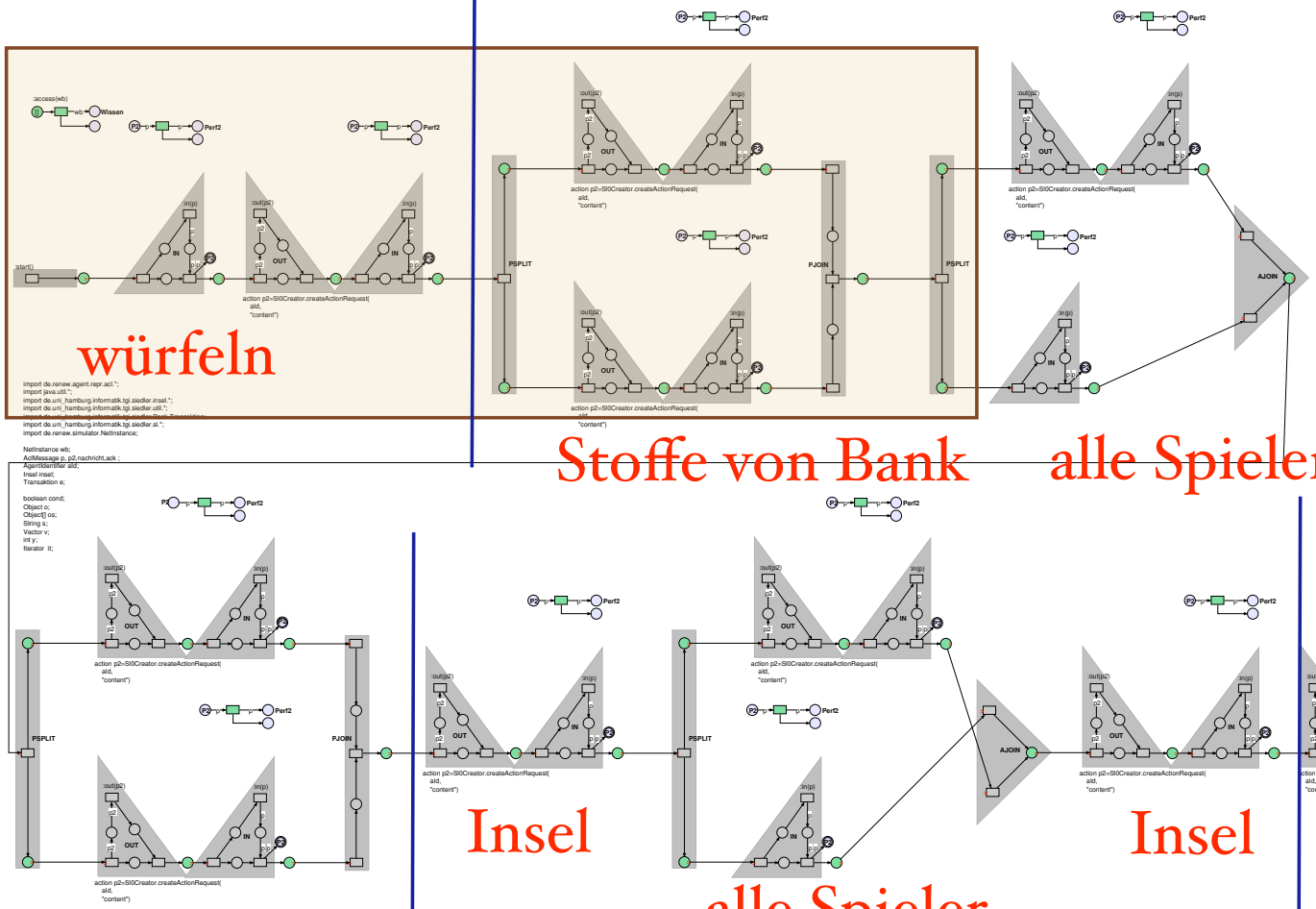


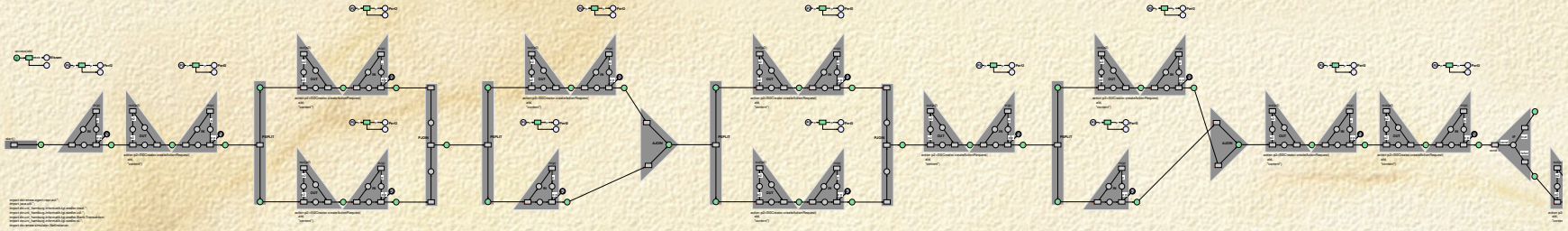
Figure 8.14: Agent interaction protocol diagram for the rou

Würfelphase

H a n d e l s p h a s e

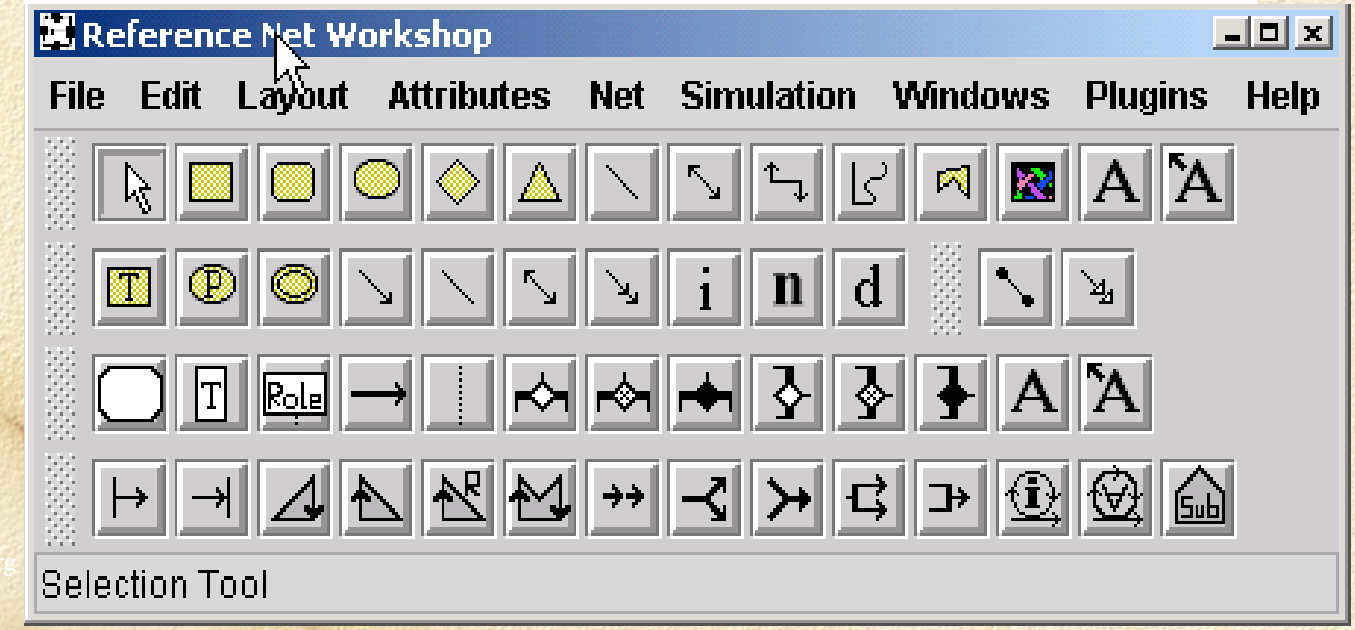


B a u p h a s e

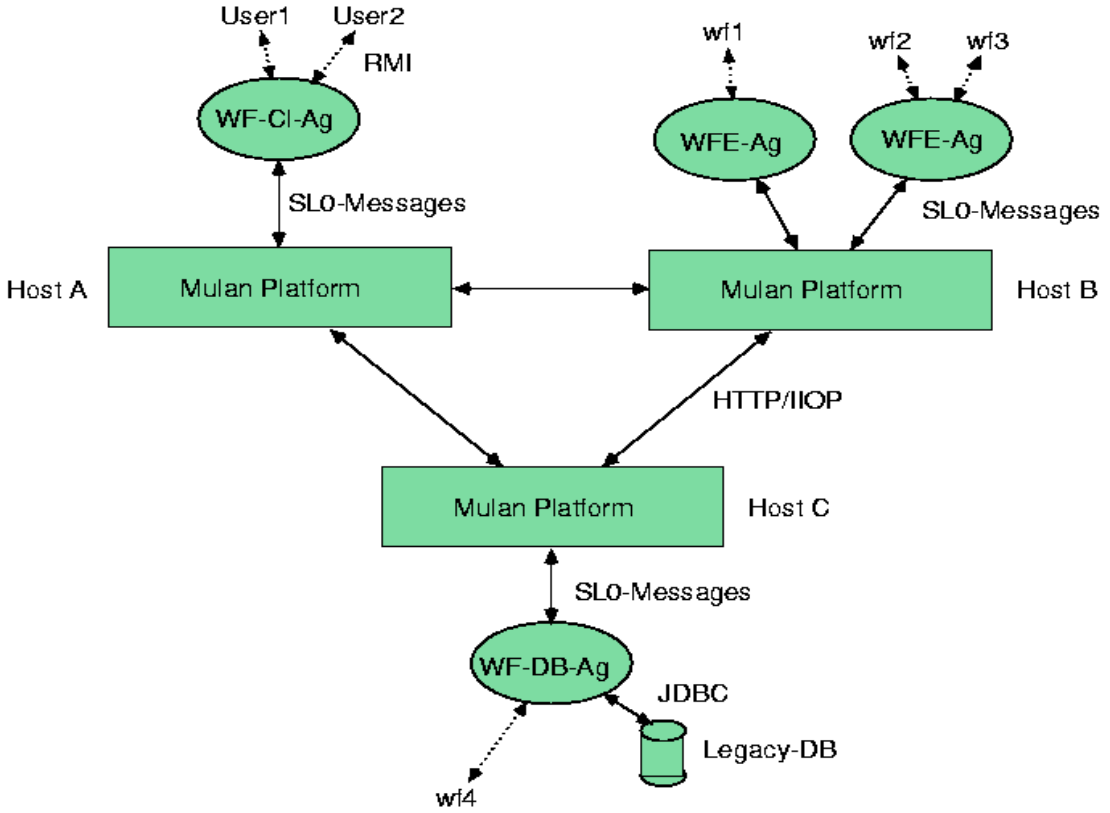


GameControl_round generated code.

Renew: Interaktionsdiagramme + Komponenten Plug-Ins



MULAN-Workflowagenten: Verteilung



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Fazit

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Was wollte ich zeigen?

1. *Objektpetrinetze haben ein großes Modellierungspotenzial*
   - ☛ *reales Objekt ↔ Objektmodellierung*
   - ☛ *Reduktion von Komplexität durch Abstraktion*
2. *Mit Renew existiert ein effizientes Modellierungs, Simulations- und Implementations-Werkzeug für Anwendungen (mit Nebenläufigkeit)*
   - ☛ *Modell ↔ Implementation*
   - ☛ *Plattform für verteilte Programmierung*
3. *Agentenorientierter Entwurf ist möglich und hat zahlreiche Vorteile*
   - ☛ *Verteiltheit*
   - ☛ *Protokoll ↔ Verhalten*
4. *Netzkomponenten*
   - ☛ *Hilfe zur Erstellung komplexer Software*
   - ☛ *bessere Lesbarkeit der Software*

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Vielen Dank für Ihre Aufmerksamkeit