

# Aufbauhilfen RoboCup 2006

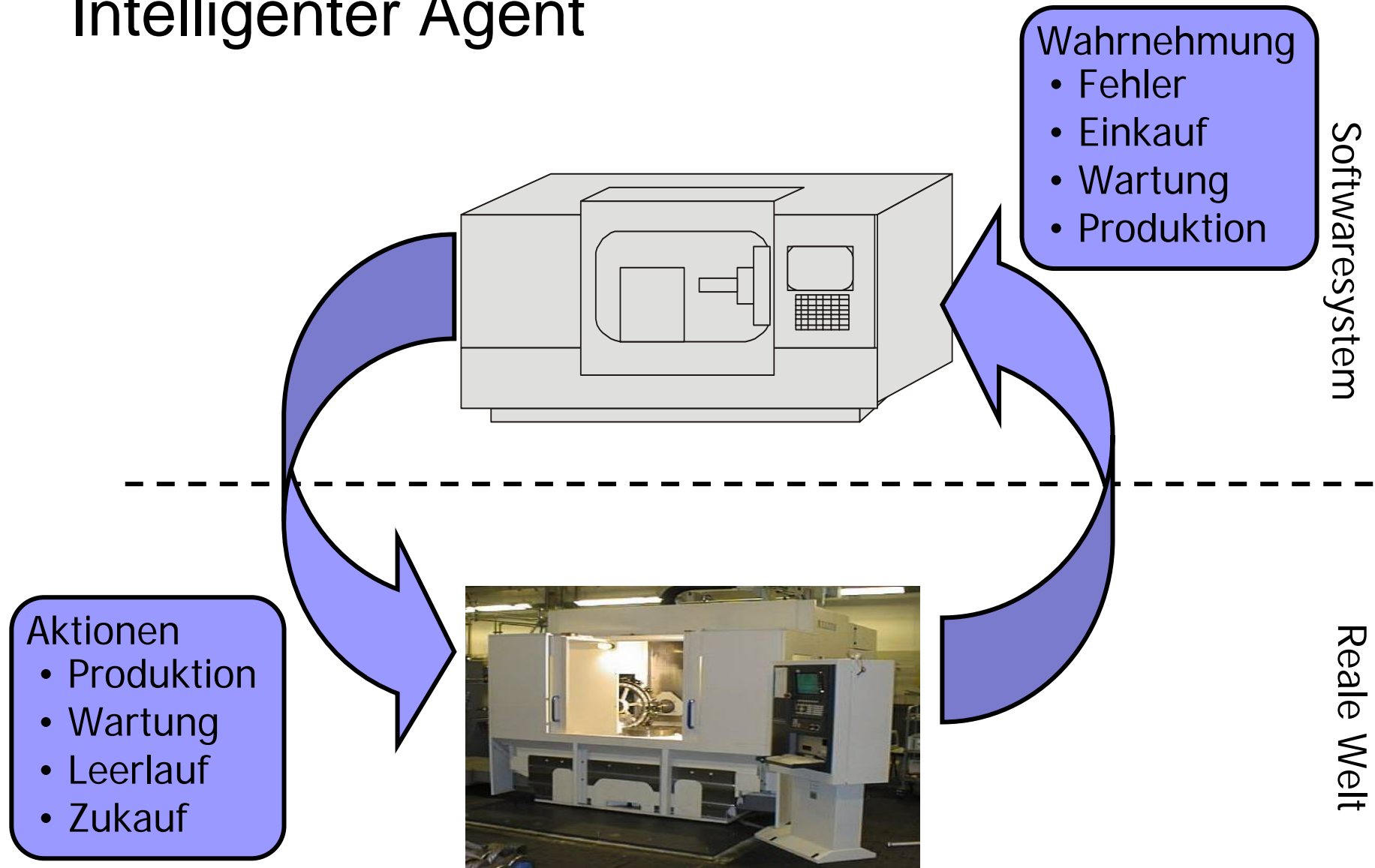
- Zeitplan
  - Spartenkanäle öffnen/verschließen
    - Mi., 31.5., 12-18 Uhr, 6 Pers.
    - Do., 1.6., 9-18 Uhr, 6 Pers.
    - Fr., 2.6., 9-18 Uhr, 6 Pers.
  - Verkabelung Teamareas
    - Mi., 7.6., 12-18 Uhr, 10 Pers.
    - Do., 8.6., 9-18 Uhr, 10 Pers.
    - Fr., 9.6., 9-18 Uhr, 10 Pers.
  - Abbau Verkabelung Teamareas
    - So., 18.6., 20-1 Uhr, 20 Pers.
  - Spartenkanäle öffnen/verschließen
    - Di., 20.6., 9-16 Uhr, 12 Pers.
- 2 Freikarten pro HelferIn
- Mail an: roefer@tzi.de



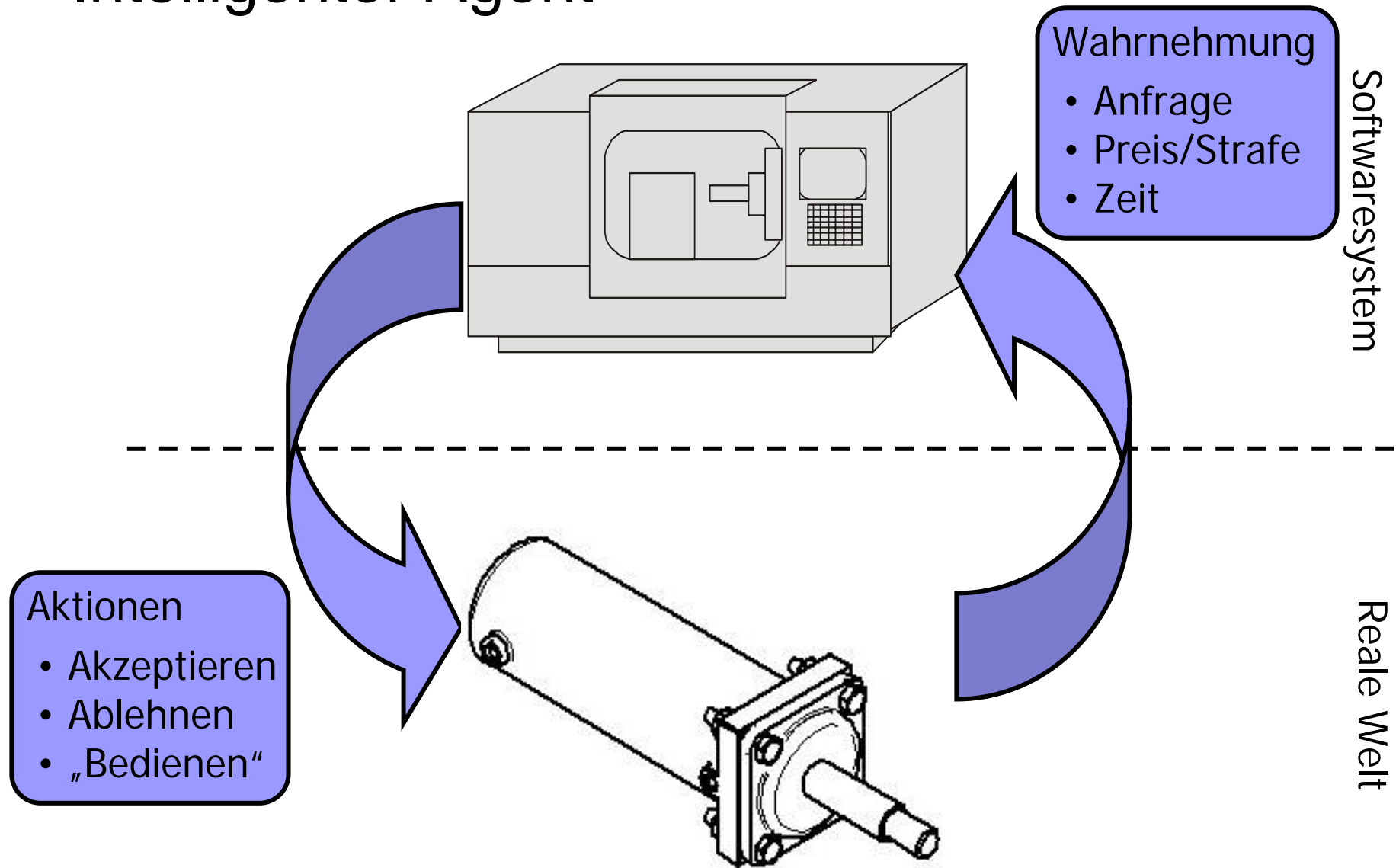


Formalisierung

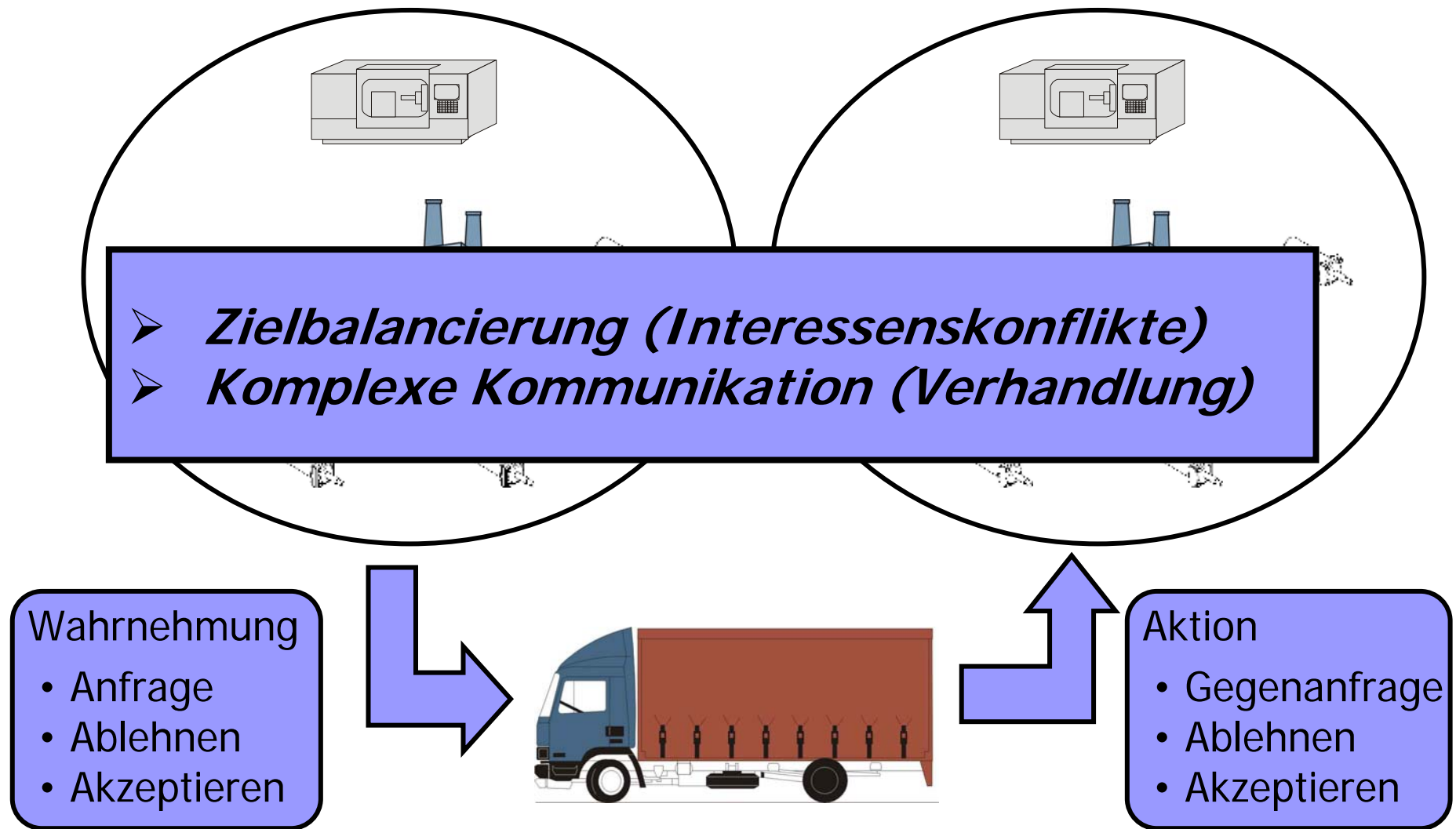
# Intelligenter Agent



# Intelligenter Agent



# Multiagentensysteme

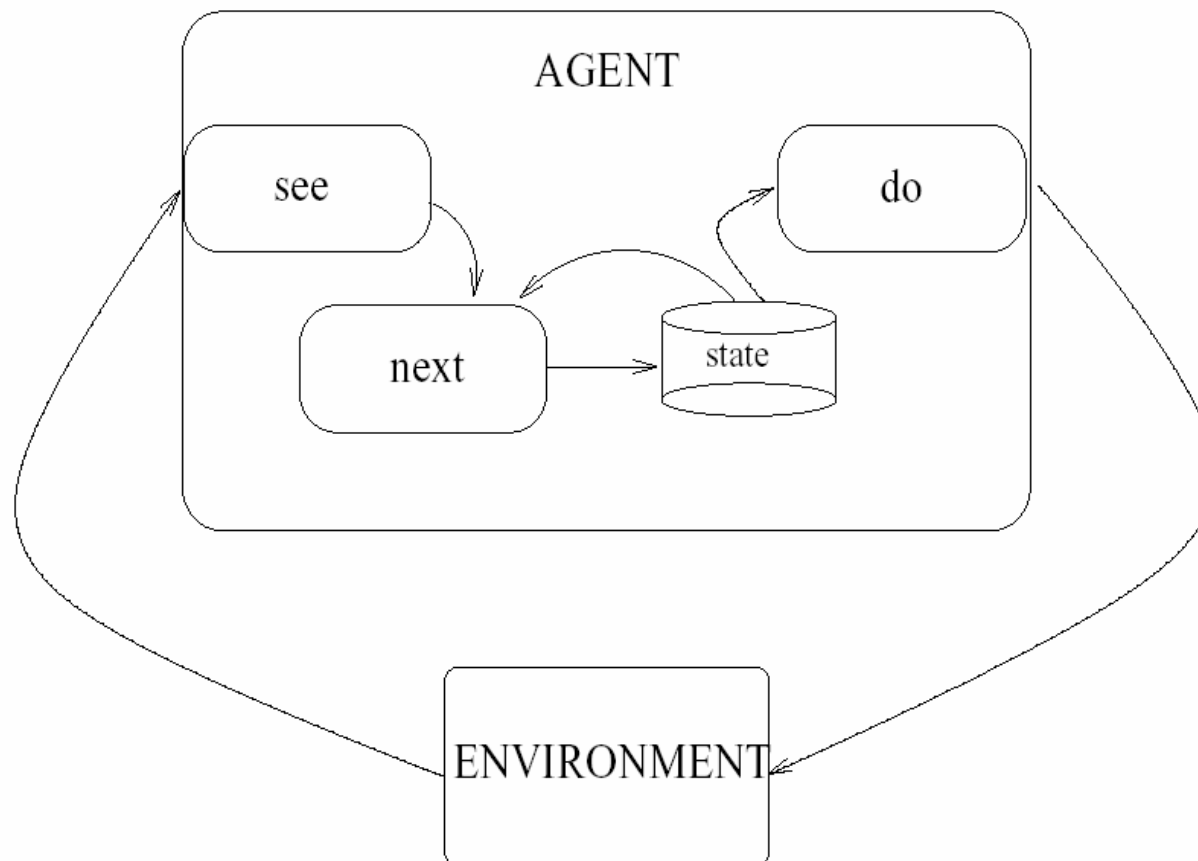




# Logik der Diskursagenten

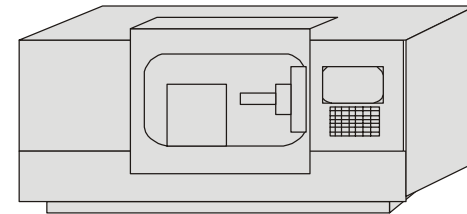
- Agent
- Agentenumgebung
- Multiagentensystem
- Globale, lokale Zustände
- Zustandstransformation

# Der integrierte Ansatz von VSK



# Agenten

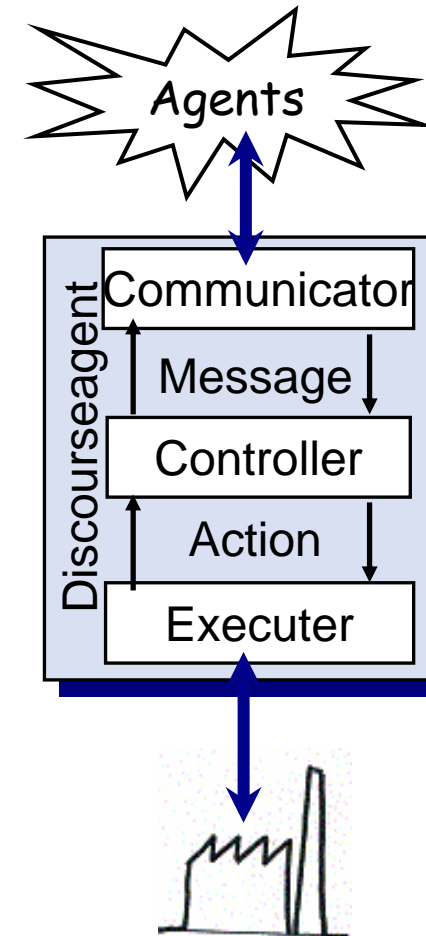
- Mögliche Lokale Zustände
- Aktionen
- Wahrnehmungsfunktion (perception-function)
- Aktions-Selektionsfunktion
- Zustandstransformation
- Initialzustand



$$Ag_i = \langle L_i, Act_i, see_i, do_i, \tau_i, \mathbf{l}_i \rangle$$

# Formalisierung der *Diskursagenten*

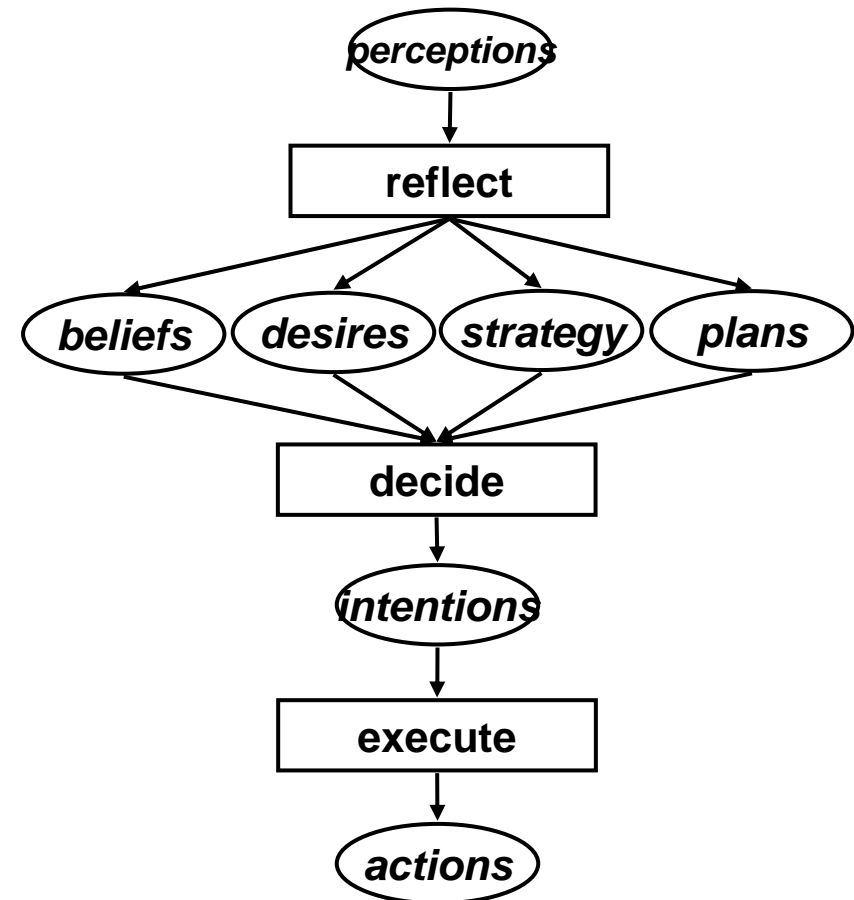
- Communicator
  - Auslösung von Aktionen in der Agentenumgebung
  - Wahrnehmung der Umgebung
- Controller
  - Lokales Wissen ist repräsentiert in mentalen Kategorien
  - Bewertung von Zielen und Optionen
  - Entscheidungsfindung nach Beliefs-Desires-Intention
- Executor
  - Steuerung der Aktionsausführung
  - „Agentifizierung“ externer Programme



$$Ag = \langle L, Act, see, reflect, decide, execute, L_0 \rangle$$

# Formalisierung der *Diskursagenten*

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$$Ag = \langle L, Act, see, reflect, decide, execute, L_0 \rangle$$

## Lokaler Zustand eines *Diskursagenten*

$$L = \langle B, D, I, Pln, weight \rangle$$

- B: Menge der Überzeugungen (z.B. *failure*)
- D: Menge der Ziele (z.B. *Prod&Sell*)
- I: Menge der Absichten (z.B.  $\langle \text{Prod\&Sell}, \text{sell} \rangle$ ), mit

$$\langle \text{desire}, \text{plan} \rangle \in \mathcal{D} \times Pln$$

- Pln: Menge der Aktionspläne, mit

$$\text{plan} = \langle \varphi_{pre}, \varphi_{post}, \text{Actions}, \text{status}, \text{select} \rangle$$

- weight: Gewichtung, mit

$$\text{weight} = \langle \text{del}, \text{react}, \text{rel}, \gamma, \text{eval} \rangle$$




**DA Ressource#52**

**Status**

Time (0,8)

Current Activity Ready.



**Settings** **EventLog** **MsgLog** **cobac Viewer**

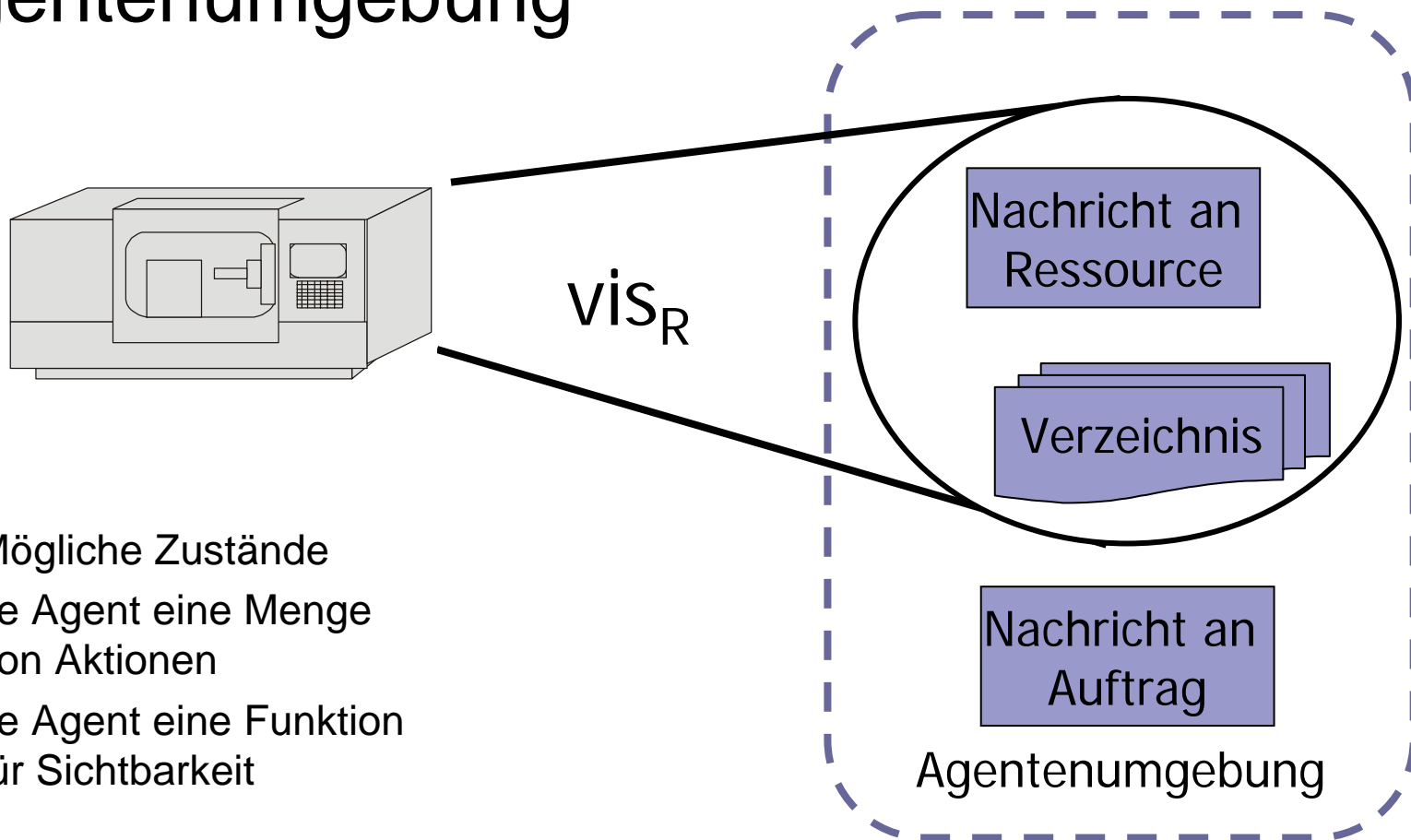
**Overview** **DiscourseAgent** **LocalState** **Options & Conflicts** **Beliefs**

**CurrentState**

([Iteration] = [0])  
([Slot] = [8])  
([Money] = [-82.00])  
([Stock Size] = [7.00])  
([Maintenance Level] = [3.95])  
(Not(Failure))  
([Amount of Custom Orders] = [7.00])  
([Amount of Rush Orders] = [1.00])  
([Amount of New Custom Orders] = [1.00])  
([Amount of New Rush Orders] = [1.00])  
([Amount of External Buy] = [3.00])  
([Amount of Custom Order Sells] = [1.00])  
([Amount of Rush Order Sells] = [1.00])  
(order(Order#77, Custom Order, 7))

0,3)  
(0,4)  
(0,5)  
(0,6)  
(0,7)  
**CurrentState**  
[Sell & Produce - User Rel  
[Maintain - User Rel.: 1.00.  
[Produce & Sell - User Rel  
[Serve RushOrder - User R  
[Sell & Buy - User Rel.: 1.0

# Agentenumgebung

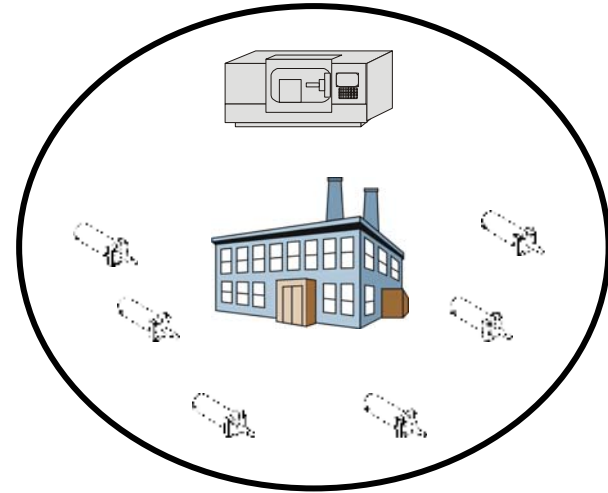


- Mögliche Zustände
- Je Agent eine Menge von Aktionen
- Je Agent eine Funktion für Sichtbarkeit

$$Env = \langle E, Act_1, \dots, Act_n, vis_1, \dots, vis_n, \tau_e, e_0 \rangle$$

# System von Agenten

- Agentenumgebung  
(z.B. Infrastrukturdienste)
- Agenten
- Menge der zulässigen Aussagen



$$MAS = \langle Env, Ag_1, \dots, Ag_n, \Phi \rangle.$$



# Verteilte Künstliche Intelligenz – Kommunikation

VAK 03-710.03  
Universität Bremen

Ingo J. Timm, Jörn Witte



# Gliederung

- Interaktion von Agenten
- Kommunikative Aktionen

# Interaction of Agents

## ■ General assumptions\*

- Presence of agents capable of acting and/or communicating
- Situations which can serve as a meeting point for agents
- Dynamic elements allowing for local and temporary relationships between agents
- Certain amount of 'slack' in relationships between agents, enabling them not only to sustain a relationship but also to detach themselves from it

## ■ Objectives

- Coordination
- Optimization
- Conflict Resolution



### *Forms of Interaction*

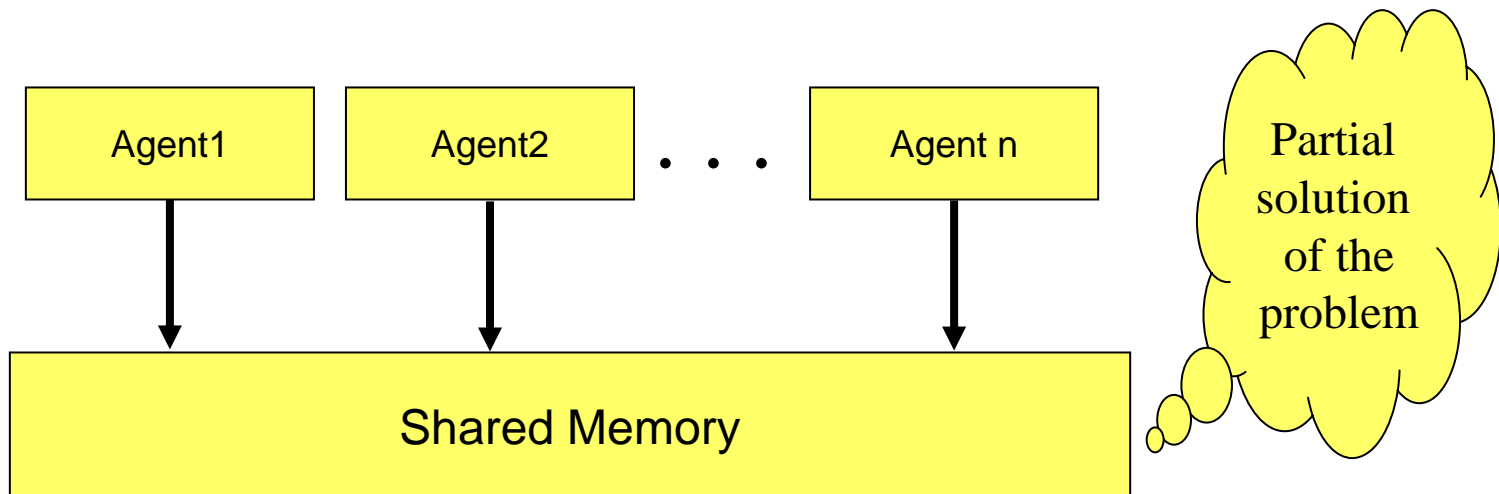
- *Environment Manipulation*
- *Message Exchange*

\*[Ferber, 1999]

# Shared Memory

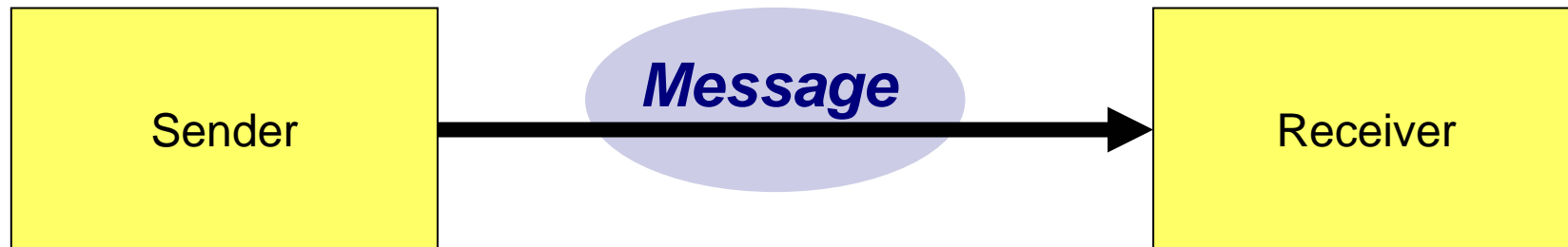
= Blackboard Metaphor [A. Newell, 1962]

*Metaphorically we can think of a set of workers, all looking at the same blackboard: each is able to read everything that is on it, and to judge when he has something worthwhile to add to it. This conception is just that of Selfridges Pandemoneums' a set of demons, each independently looking at the total situation and shrieking in proportion to what they see that fits their nature.*



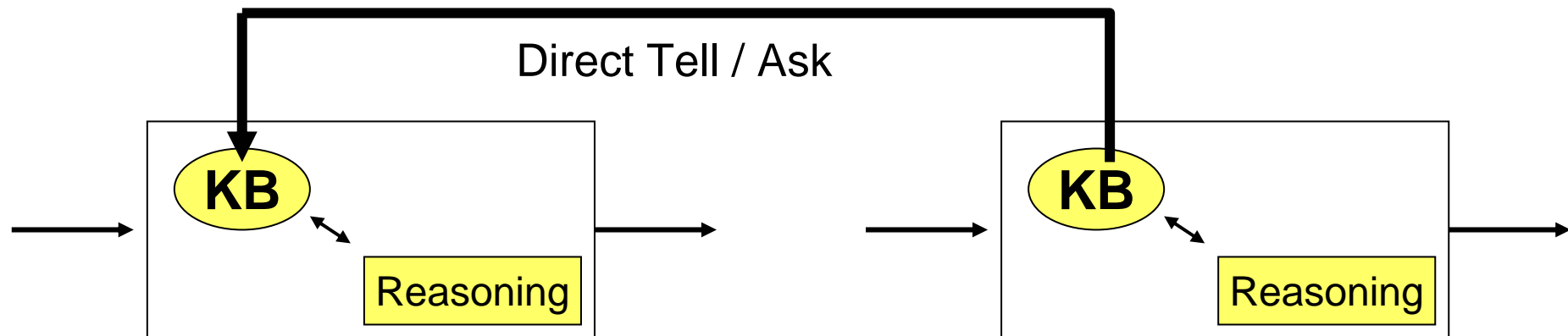
# Message Passing

- Messages are send from the sender to the receiver
- Messages are based on Speech-Act Theory
- Messages are encoded in an agent communication language
- Series of messages produces a dialog – and are often following predefined structured (protocols)



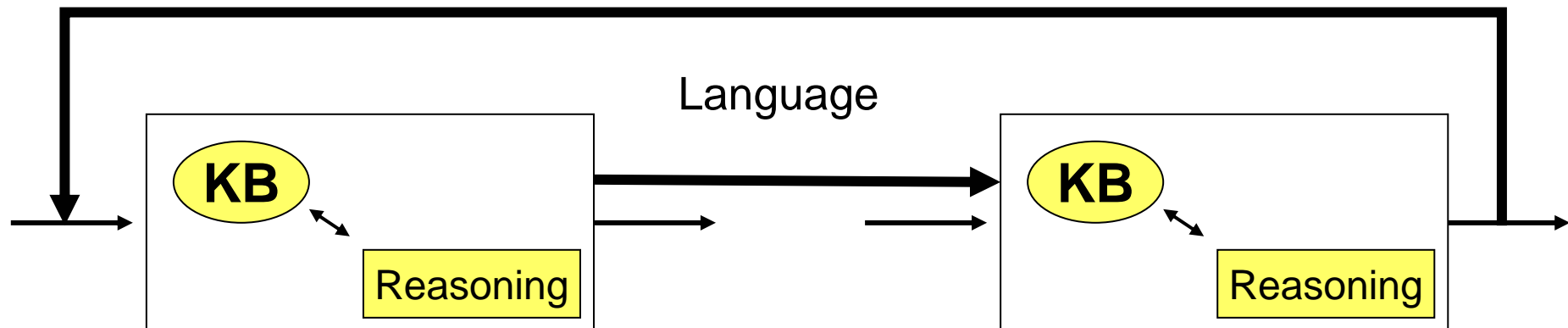
# Direct Manipulation

- Encoded vs. Situated languages:
  - Encoded: state-independent interpretation of message
  - Situated: state-dependent interpretation of message
- Communication is based on a common internal knowledge representation (trusted environment only !)



# Language-based Communication

- Communication on basis of a formal language
- Problems:
  - Inconsistency of knowledge bases, e.g. if formal semantics is missing
  - Interpretation in the correct context?
  - What have to be communicated?
- Common heuristic:
  - Identical internal and external knowledge representation





# Process of Agent Communication

## ■ Speaker

- ☐ Intention      S wants H to believe  $\varphi$  (S believes  $\varphi$ )
- ☐ Generation      S chooses the words  $W$  (they express  $\varphi$ )
- ☐ Synthesis      S utters the words  $W$  (addressing them to H)

## ■ Hearer

- ☐ Perception      H perceives  $W'$  ( $W'=W$  ideally!)
- ☐ Analysis      H infers tht  $W'$  has possible meanings  $\varphi_1, \varphi_2, \dots, \varphi_n$
- ☐ Disambiguation      H infers that S intended to convey  $\varphi_i$  (ideally  $\varphi_i=\varphi$ )
- ☐ Incorporation      H decides to believe  $\varphi_i$  (or reject if inconsistent?!)



# Speech-Act Theory

- Communication as a sequence of actions
- *Example: „I sentence you to 6 month imprisonment !”*
  
- Speech-acts consist of three parts
  - *Locutionary act*: saying something that makes sense in a language
  - *Illocutionary act*: action intended by the speaker (intention)
  - *Perlocutionary act*: effect or 'take-up' of an illocutionary act
  
- Classification (J.R. Searle, 1976)
  1. Repräsentativa (Representatives)
  2. Direktiva (Directives)
  3. Kommissiva (Commissives)
  4. Expressiva (Expressives)
  5. Deklarationen (Declarations)



# Beispiele

## ■ Repräsentativa (Representatives)

- ☐ behaupten, mitteilen, berichten, informieren
- ☐ „Draußen scheint die Sonne.“

## ■ Direktiva (Directives)

- ☐ bitten, befehlen, anordnen, verbieten
- ☐ „Die Lösungen zu den Übungsaufgaben sind nächste Woche in unserem Fach abzugeben.“

## ■ Kommissiva (Commissives)

- ☐ versprechen, geloben, garantieren, schwören, vereinbaren
- ☐ „Ich werde mich bemühen, die Folien vor der Vorlesung ins Netz zu stellen.“

## ■ Expressiva (Expressives)

- ☐ danken, Beileid aussprechen, gratulieren, klagen
- ☐ „Danke für Eure Aufmerksamkeit.“

## ■ Deklarationen (Declarations)

- ☐ ernennen, entlassen, abdanken, taufen, verurteilen
- ☐ „Ich gebe Dir für Deine Prüfungsleistung die Note XY.“



# Shared Memory vs. Message-passing

## ■ Shared memory approach

- ☐ Independent of expertises
- ☐ Flexible representation
- ☐ Unified representation of the problem
- ☐ Event-based activation
- ☐ Need of management/control
- ☐ Incremental generation of a solution („Anytime“)

## ■ Message-passing

- ☐ Heterogenous representation of the problem
- ☐ Actual distributed problem-solving
- ☐ ...



# Introduction to ACL

## ■ Messages

- Types of ACL-messages as *Speech-acts*
- Semantic is formulated in SL

## ■ Roots of ACL

- Knowledge Sharing Effort (KSE) (ca. 1990), Neches et al. (1991)
- Development of techniques, methods, and software tools for cooperative use of knowledge and its reuse during design, implementation and run-time

### Basic idea of KSE:

Communication is needed  
and communication needs  
a common language



# Agent Communication Languages (ACL)

- ACLs define

- ☐ High-level communication languages
- ☐ Message (action) classes
- ☐ Protocols
- ☐ But no content, syntax or ontology

- And they are independent from

- ☐ Transport mechanism (TCP/IP, SMTP...),
- ☐ Language for content encoding (KIF, SQL, Prolog...)
- ☐ Ontologies defining context of content



# Agent-Agent Communication

Conversation	↔	Agent Level Protocols
Comm Acts	↔	Standard ACL's, Sound semantics
Content	↔	Logical, CSPs, XML, RDF, BizTalk, ebXML
Ontology	↔	XML, RDF, BizTalk, ebXML
Syntax	↔	XML, SOAP (e-speak), CORBA IDL
Protocol	↔	HTTP, IIOP etc.
Transport	↔	TCP/IP etc.



# Communications Stack

Level	Description	Example
<b>Conversation</b>	Sequence of communicative acts related to a particular topic	Communicating about buying and eating an apple
<b>Communicative Act</b>	Communication about a piece of content	Requesting somebody to perform the action of...
<b>Content Expression</b>	Description of states of the world over objects	Expressing the action of eating an apple
<b>Ontology</b>	Description of objects in the domain	Meaning of “apple” and “eat”
<b>Syntax</b>	Representation of Content	HTML, JPG, SQL
<b>Protocol</b>	Data exchange protocol (ISO layer 7)	HTTP, GIIOP, SMTP
<b>Transport</b>	Physical transport and low level transport protocols (ISO layers 1-6)	Optical Fiber, TCP-IP etc.