Generic Coordination Model

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Overview



Modeling Coordination (I)

- Coordination types
 - Objective Coordination
 - Organisation of the world
 - Communication between entities
 - Subjective Coordination
 - result from individual point of view of each entity

Subjective Coordination

Intelligent Agents

- gives semantic to coordination
- reasoning about coordination
- P Design and developing coordination artifacts

Reifying coordination - programming the media Reflecting on coordination - inspecting the media

Objective Coordination

Coordination Models & Languages

Using coordination media

- automatisation
- exploiting coordination artifacts embedded in media

Modeling Coordination (II)

- Objective Coordination
 - Spacial dependency: Where is the entity located
 - Social dependency: To who belongs the entity
 - Task dependency: What is the entity doing or where is the entity needed.
- Subjective Coordination
 - Negotiation, Planing and Organisation
 - Changing or Creating rules
 - Implicitly marking good solutions which are followed by others (Stigmergy)

Notation of an Entity

• Definition:

An entity is anything that has a distiguished, separate existence. It can exist physically or virtually.

- Entity classes
 - *Physical entity*: is an object that exists throughout a trajectory in space over a particular duration of time (planet, humans, car)
 - Virtual entity: does not need any place or time to exist.



Objective Coordination

- physical layer
 - managing physical entities and spacial dependencies
- virtual layer
 - managing virtual entities and social dependencies
- tasks structure



Physical Layer

- Representation
 - in general
 - block notation (a)
 - tree notation (b)







Properties

- entities exist only in one place at the time
- Overlapping not possible

Virtual Layer

- Manages the social dependencies
- Different types
 - Communities
 - Organisation
 - Networks
 - Virtual places



Task Structure (I)

- Manages the task dependency
 - how to assign a resource to an activity
 - Definition of a resource

A resource is a physical or virtual entity of limited availability, which can be used to accomplish an activity

3 different processes

Activity





Resource

Task Structure (II)

- Composition
 - depcompsable into subtasks
 - atomic subtask --> activity
 - tasks can run in parallel



Task Structure (III)

- Activities
 - Activity contains a list of actions worked of in time
 - Activity needs resources (entities). Relation is called a role
 - Motivation is decomposable into several goals



Task Structure (IV)

- The role of entities within an activity
 - The resources play a certain role within the activity
 - Actor: Role of an entity who performs an activity
 - **Place**: The activity takes place within this entity
 - Tool: Role of an entity which is passively used to accomplish an activity
 - **Observer**: Role of an entity which observes a situation
 - *Port*: Role of an entity used in an activity to send or receive information
 - Not classified: All entities not taking part within the activity or which are not classified yet

Physical and Social Laws

• Law: Definition:

In general, a rule of being or of conduct, established by an authority able to enforce its will; a controlling regulation; the mode or order according to which an agent or a power acts

- Physical Law
 - Is static and can not be changed by entities
 - No exceptions
- Social Law
 - Can be changed by entites.
 - Exceptions exist.

Social Law

- Definition:
 - Social law defines how entities interaction with each other and how social structures are created
- Can be defined for physical and virtual structures as well as for activities.



Observer (I)

- View
 - Defines the point of view of an observer.
 - Focus: What is the observer focussing on (level, granularity and direction)
 - Location: Where the observer is located
 - Motion: The observer moves explicit to a reference (direction and speed)
 - e.g. Train leaving the train station. Do I move or does the other train moves?
 - The view is relative to a chosen reference (space and time).
 - Observer can observe himself (reflective).

Observer (II)

- The view is mediated by viewers
 - e.g. micro scope, glasses, ears
- The viewer is a physical entity
 - receiving information
 - preprocessing and filtering

Observer (III)

- Perception of the observer
 - Relative structure
 - recognition of atoms
 - recognition of environment



Observer (IV)

- Relative entity classification
 - Agent, Artifact, Object
 - can be done for physical and virtual entities
 - Depends on the knowledge and the experience of an observer



Observer. Entity Classification (I)

- Agent: An entity that is capable of action.
 - Actor: Role of an entity who performs an activity
 - Observer: Role of an entity which observes a situation



Observer. Entity Classification (II)

- Artifact: Entities used or created by agents
 - Tool: Role of an entity which is passively used to accomplish an activity
 - **Port**: Entity used for communication (a and b)
 - View: Virtual entity describing what an observer is looking at



Communication (I)

Definition

Communication is a process of transferring information form one entity to one or more entities.

- Different classifications
 - Communication patterns
 - Communication paradigms
 - Protocols used

Communication Patterns (II)

- Physical message exchange (communication channel based)
 - a) Peer2Peer
 - b) Broadcast
 - c) Multicast
 - d) generic communication



Communication Patterns (I)

- Channels
 - Definition:

A communication channel is a physical media used to transmit information from one entity to one or more entities.

- a) only unidirectional
- b) bidirectional (2 inverse channels)



Communication Patterns (III)

- Instances of communication patterns
 - Conference Call
 - Blackboard meeting
 - Blackboard is a special entity with ports
 - messages can be put on the board
 - messages can be read or taken from the board
 - supports privacy

Blackboard msg msg msg

Communication Paradigm (I)

- Communication vs. Interaction
 - Definition of interaction

Interaction is a kind of action that occurs as two or more entities have an effect upon one another



Communication Paradigm (II)

• Taxonomy of communication patterns:



Communication Paradigm (III)

interactive Communication

A communication is interactive if and only if $m_1^{pipj} \sim m_2^{pjpi}$, $j \neq i (m_1 \text{ has-an-effect on } m_2)$

- where as m_1^{pipj} is a message sent from process p_i (entity) to process p_j and m_2^{pjpi} is a message sent from process p_j to process p_i
- has-an-effect-on extends the definition of happenedbefore from logical clocks
 - includes time and semantic.

•
$$m_1^{pipj} \sim m_2^{pjpi}$$
 implies $m_1^{pipj} \rightarrow m_2^{pjpi}$

Communication Protocols (I)

- Protocols
 - how to perform the communication in order to acheive the preset goal
 - Rules
 - Syntactic rules:
 - Relations among signs in formal structures
 - Semantic rules:
 - relations between signs and things they represent
 - Pragmatic rules:

relations between signs and their effects on those who use them