Case Study of Modelling Multiagent Systems
-- The Example of UN Security Council

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1. Introduction
This is a case study of modelling multiagent system. The model presented here is in the notation of CAMLE, which stands for a Caste-centric Agent Modelling Language and Environment. CAMLE is a work in progress. A model in CAMLE consists of four types of diagrams.

(a) Caste diagram, which provides architectural view of a multiagent systems in terms of the castes (roughly speaking, a caste is an agent class) and the relationships between them including inheritance relations and migration relations (i.e. how an agent of a caste could join another caste and/or quit from a caste);

(b) Collaboration diagrams, which defines the collaborations between agents of various castes in terms of the communications between them and the sequences of activities from a global view of the system;

(c) Behaviour diagrams, which defines the behaviour of the agents of each caste;

(d) Scenario diagrams, which defines the scenarios of the systems and can be used in behaviour diagrams as conditions of actions.

A brief introduction to the CAMLE notations are also given with the model of UN security council. A draft paper about the modelling language and its environment is available. Please contact us if you want a copy of the paper.

2. Caste Diagram
The diagram in Figure 1 shows that the UN Security Council consists of a number of members. These members can be permanent members or elected members. A member can become a chair while stay as a member and a chair can become a member. Details about how such changes of states can happen are presented in behaviour diagrams, but not presented at this view of the model. In addition, UN members can become UN-SC members and retreat from UN-SC.

![Caste Diagram of UN Security Council](image)

3. Collaboration Diagrams
The notation of collaboration diagrams is given below.
Figure 2 shows the collaboration diagrams of the UN security council. The diagram (a) without activity sequences describes the actions that each agent of a caste can take as well as what is observed by each agent of a caste. In certain specific scenarios, the activities of the agents in a system can be put in a linear sequence. In that case, numbers are associated to the activities in a collaboration diagram.

(a) Collaboration Diagram Without Activity Sequencing

(b) Collaboration Diagram with Activity Sequence For the Vote Scenario

(c) Collaboration Diagram with Activity Sequence For the Withdraw Scenario

Figure 2. Collaboration Diagram of UN Security Council
4. Behaviour Diagrams
The following is the notations of behaviour diagrams.

**Behaviour Diagram Notations**

Activity nodes:
- \( \text{Act}(p_1, \ldots, p_n) \)  
  Single action node
- \( \text{Act}(p_1, \ldots, p_n) \)  
  Repetitive action node, where R-Exp defines the number of repetition of the action.
- Predicate  
  State assertion node
- Predicate  
  Continuous state assertion node: where C-Exp defines the period.

Temporal ordering arrows:
- \( \text{T-Exp} \)  
  Temporal order between the events: event A is immediately after event B, where T-Exp is the constraint on the time gap between event A and B.
- \( \text{T-Exp} \)  
  Temporal order between the events: event A is after event B, while there may be other events between them, where T-Exp is the constraints on the time gap between the events.

Logic connective nodes and links:
- \&  
  Logic connectives AND, OR, and NOT, respectively.
- Connections between logic connective nodes.

A behaviour diagram may refer to scenario diagrams, whose notation is given below.

**Scenario-Name**

<table>
<thead>
<tr>
<th>Quantifier A</th>
<th>Quantifier B</th>
<th>...</th>
<th>Quantifier X</th>
</tr>
</thead>
<tbody>
<tr>
<td>A’s activity1</td>
<td>B’s activity1</td>
<td>...</td>
<td>X’s activity1</td>
</tr>
<tr>
<td>A’s activity2</td>
<td>B’s activity2</td>
<td>...</td>
<td>X’s activity2</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td>A’s activityn</td>
<td>B’s activityn</td>
<td>...</td>
<td>X’s activityn</td>
</tr>
</tbody>
</table>

Logic connection network

Format of scenario diagrams

The following is the behaviour diagram for the castes Chair and UN-SC members.
The member_list lists all UN-SC members in alphabetical order except the chair, which is listed at the end of the list.

The scenario Favorable Vote is defined as follows.

The member_list lists all UN-SC members in alphabetical order except the chair, which is listed at the end of the list.

Figure 3. Behaviour Diagrams for Chair

(a) Rules for managing resolutions

(b) Rule of presidency

Figure 4. Scenario Diagram of Favorable Vote
5. Concluding remarks
This paper does not provide sufficient explanation of the language CAMLE and the model of UN-SC.

We will appreciate your comments.