# Analysis of Multi-Aspect Comment Evaluation (MACE) Ontology

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1.1 Class & Property Hierarchies

Although they do not provide comprehensive definitions, compact monohierarchical presentations of the class and property IsA hierarchies have been found to significantly aid in the comprehension and navigation of the model, and are therefore provided below.

The class hierarchy presented below has the following format:

- Each line begins with a unique class identifier, consisting of a number preceded by the letter “O”.
- A series of hyphens (“-”) follows the unique class identifier, indicating the hierarchical position of the class in the IsA hierarchy.
– The English name of the class appears to the right of the hyphens.
– The index is ordered by hierarchical level, in a “depth first” manner, from the smaller to the larger subhierarchies.
– Classes that appear in more than one position in the class hierarchy as a result of multiple inheritance are shown in an italic typeface.

The **property hierarchy** presented below has the following format:
– Each line begins with a unique property identifier, consisting of a number preceded by the letter “P”.
– A series of hyphens (“-”) follows the unique property identifier, indicating the hierarchical position of the property in the IsA hierarchy.
– The English name of the property appears to the right of the hyphens.
– The domain class for which the property is declared.
– The range class that the property references.
– The index is ordered by hierarchical level, in a “depth first” manner, from the smaller to the larger subhierarchies, and by property number between equal siblings.
– Properties that appear in more than one position in the property hierarchy as a result of multiple inheritance are shown in an italic typeface.

### 1.2 Classes Hierarchy

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>03</strong></td>
<td>Content</td>
</tr>
<tr>
<td><strong>04</strong></td>
<td>Issue</td>
</tr>
<tr>
<td><strong>05</strong></td>
<td>Topic</td>
</tr>
<tr>
<td><strong>06</strong></td>
<td>Argument</td>
</tr>
<tr>
<td><strong>013</strong></td>
<td>Proposition</td>
</tr>
<tr>
<td><strong>01</strong></td>
<td>Creation_Data</td>
</tr>
<tr>
<td><strong>04</strong></td>
<td>Issue</td>
</tr>
<tr>
<td><strong>05</strong></td>
<td>Topic</td>
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<tr>
<td><strong>06</strong></td>
<td>Argument</td>
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<td><strong>07</strong></td>
<td>Position</td>
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<tr>
<td><strong>08</strong></td>
<td>Comment</td>
</tr>
<tr>
<td><strong>013</strong></td>
<td>Proposition</td>
</tr>
<tr>
<td><strong>02</strong></td>
<td>Strength</td>
</tr>
<tr>
<td><strong>05</strong></td>
<td>Topic</td>
</tr>
<tr>
<td><strong>06</strong></td>
<td>Argument</td>
</tr>
<tr>
<td><strong>07</strong></td>
<td>Position</td>
</tr>
<tr>
<td><strong>08</strong></td>
<td>Comment</td>
</tr>
<tr>
<td><strong>09</strong></td>
<td>Rating</td>
</tr>
<tr>
<td><strong>010</strong></td>
<td>Vote</td>
</tr>
<tr>
<td><strong>011</strong></td>
<td>Star-Based</td>
</tr>
<tr>
<td><strong>012</strong></td>
<td>Category</td>
</tr>
<tr>
<td><strong>014</strong></td>
<td>Moderation_Data</td>
</tr>
</tbody>
</table>
### 1.3 Properties Hierarchy

<table>
<thead>
<tr>
<th>Property id</th>
<th>Property Name</th>
<th>Entity - Domain</th>
<th>Entity - Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>has_content_value</td>
<td>O3 Content</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P2</td>
<td>has_content_type</td>
<td>O3 Content</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P3</td>
<td>datetime</td>
<td>O1 Creation_Data</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P4</td>
<td>voting</td>
<td>O2 Strength</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P5</td>
<td>dialogue</td>
<td>O2 Strength</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P6</td>
<td>congruence</td>
<td>O2 Strength</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P7</td>
<td>acceptance</td>
<td>O2 Strength</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P8</td>
<td>quality</td>
<td>O2 Strength</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P9</td>
<td>created_by</td>
<td>O1 Creation_Data</td>
<td>schema:Person</td>
</tr>
<tr>
<td>P10</td>
<td>consists_of</td>
<td>O4 Issue</td>
<td>O5 Topic</td>
</tr>
<tr>
<td>P11</td>
<td>about_topic</td>
<td>O6 Argument</td>
<td>O5 Topic</td>
</tr>
<tr>
<td>P12</td>
<td>attacks</td>
<td>O6 Argument</td>
<td>O6 Argument</td>
</tr>
<tr>
<td>P13</td>
<td>supports</td>
<td>O6 Argument</td>
<td>O6 Argument</td>
</tr>
<tr>
<td>P14</td>
<td>replies</td>
<td>O6 Argument</td>
<td>O6 Argument</td>
</tr>
<tr>
<td>P15</td>
<td>related_to_position</td>
<td>O8 Comment</td>
<td>O7 Position</td>
</tr>
<tr>
<td>P16</td>
<td>rates</td>
<td>O9 Rating</td>
<td>O5 Topic</td>
</tr>
<tr>
<td>P17</td>
<td>contains</td>
<td>O6 Argument</td>
<td>O9 Rating</td>
</tr>
<tr>
<td>P18</td>
<td>is_characteristic_of</td>
<td>O5 Topic</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P19</td>
<td>has_rating</td>
<td>O9 Rating</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P20</td>
<td>status</td>
<td>O6 Argument</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P21</td>
<td>category</td>
<td>O4 Issue</td>
<td>O12 Category</td>
</tr>
<tr>
<td>P22</td>
<td>related_to</td>
<td>O7 Position</td>
<td>O4 Issue</td>
</tr>
<tr>
<td>P23</td>
<td>has_reviews</td>
<td>O4 Issue</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P24</td>
<td>has_education</td>
<td>schema:Person</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P25</td>
<td>marital_status</td>
<td>schema:Person</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P26</td>
<td>belongs_To</td>
<td>O2 Position</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P27</td>
<td>closed_time</td>
<td>O4 Issue</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P28</td>
<td>in_conflict</td>
<td>O13 Proposition</td>
<td>O13 Proposition</td>
</tr>
<tr>
<td>P29</td>
<td>premise_of</td>
<td>O13 Proposition</td>
<td>O6 Argument</td>
</tr>
<tr>
<td>P30</td>
<td>has_conclusion</td>
<td>O6 Argument</td>
<td>O13 Proposition</td>
</tr>
<tr>
<td>P31</td>
<td>moderation_data</td>
<td>O8 Comment</td>
<td>O14 Moderation Data</td>
</tr>
<tr>
<td>P32</td>
<td>moderator</td>
<td>O14 Moderation Data</td>
<td>rdfs:Resource</td>
</tr>
<tr>
<td>P33</td>
<td>moderation_date</td>
<td>O14 Moderation Data</td>
<td>rdfs:Resource</td>
</tr>
</tbody>
</table>

### 1.4 Class Declarations

The classes are comprehensively declared in this section using the following format:

- Class names are presented as headings in bold face, preceded by the class’s unique identifier;
- The line “Subclass of:” declares the superclass of the class from which it inherits properties;
- The line “Superclass of:” is a cross-reference to the subclasses of this class;
- The line “Scope note:” contains the textual definition of the concept the class represents;
- The line “Properties:” declares the list of the class’s properties;
- Each property is represented by its unique identifier, its forward name, and the range class that it links to, separated by colons;
- Inherited properties are not represented;
**O1 Creation_Data**

Subclass of: -
Superclass of:  
  **O4 Issue**
  **O5 Topic**
  **O6 Argument**

Properties:  
  **P3** datetime: rdfs:Resource
  **P9** created_by: schema:Person

Scope note: This class comprises information about the provenance of the object such as the datetime along with the person which created it.

**O2 Strength**

Subclass of: -
Superclass of:  
  **O5 Topic**
  **O6 Argument**

Properties:  
  **P4** voting: rdfs:Resource
  **P5** dialogue: rdfs:Resource
  **P6** congruence: rdfs:Resource
  **P7** acceptance: rdfs:Resource
  **P8** quality: rdfs:Resource

Scope note: This class comprises information required for the score calculation of arguments i.e., comments, positions etc.

**O3 Content**

Subclass of: -
Superclass of:  
  **O4 Issue**
  **O5 Topic**
  **O6 Argument**

Properties:  
  **P1** has_content_value: rdfs:Resource
  **P2** has_content_type: rdfs:Resource

Scope note: This class comprises information about the content contained by each object. Each content object has a type and a value.

**O4 Issue**

Subclass of:  
  **O1 Creation_Data**
  **O3 Content**

Superclass of: -

Properties:  
  **P10** consists_of: **O5 Topic**
  **P21** category **O13 Category**
  **P23** has_reviews rdfs:Resource
  **P27** closed_time rdfs:Resource

Scope note: This class is the main part of debate and it can be either a question or a statement that need to be answered by participants in the discussion. An issue consists of one or more topics.

**O5 Topic**

Subclass of:  
  **O1 Creation_Data**
  **O2 Strength**
**O3 Content**

- **Superclass of:**
- **Properties:**
  - P18 is_characteristic_of: rdfs:Resource
- **Scope note:**
  A topic is specific tag which is closely related to an issue. Contributors can agree or disagree on specific tag of an issue.

**O6 Argument**

- **Subclass of:**
  - O1 Creation_Data
  - O2 Strength
  - O3 Content
- **Superclass of:**
  - O7 Position
  - O8 Comment
- **Properties:**
  - RP11 about_topic: O5 Topic
  - P12 attacks: O6 Argument
  - P13 supports: O6 Argument
  - P14 replies: O6 Argument
  - P17 contains: O9 Rating
  - P30 has_conclusion: O13 Proposition
- **Scope note:**
  This class represents a set of statements created by users which comprise their opinion about one or more topics. Arguments can also be considered as answers which e.g., attack, supports etc. other arguments and so on.

**O7 Position**

- **Subclass of:**
  - O6 Argument
- **Superclass of:**
  - -
- **Properties:**
  - P20 status: rdfs:Resource
  - P22 related_To: O4 Issue
  - P26 belongs_To: rdfs:Resource
- **Scope note:**
  This class comprise the direct opinions about topics on specific issue. A position can be considered as an argument that can not support or attack another position.

**O8 Comment**

- **Subclass of:**
  - O6 Argument
- **Superclass of:**
  - -
- **Properties:**
  - RP15 related_to_position: O7 Position
  - P20 status: rdfs:Resource
  - P31 moderation_data: O14 Moderation_Data
- **Scope note:**
  This class is considered an extension of class Argument which can be used to represent the dialogues created under positions for certain topics.

**O9 Rating**

- **Subclass of:**
  - -
- **Superclass of:**
  - O10 Vote
  - O11 Star-Based
- **Properties:**
  - P16 rates: O5 Topic
  - P19 has_rating: rdfs:Resource
Scope note: This class comprises information for a general rating system which can be used upon topics, comments etc. The rating system may have various forms such as 5-stars system, positive/negative votes etc.

**O10 Vote**
Subclass of: O9 Rating
Superclass of: -
Properties: -
Scope note: This class represents the special case of a rating system which refers on votes. The votes can be either positive, or negative.

**O11 Star-Based**
Subclass of: O9 Rating
Superclass of: -
Properties: -
Scope note: This class represents the special case of a rating system which refers on stars. The maximum number of stars is application specific and highly customizable.

**O12 Category**
Subclass of: O1 Creation_Data
Superclass of: -
Properties:
P1 has_content_value rdfs:Resource
P2 has_content_type rdfs:Resource
P3 datetime rdfs:Resource
P9 created_by schema:Person
Scope note: This class groups every debate/issues into categories. Every issue according to the subject of discussion is included by the user of the system into specific category.

**O13 Proposition**
Subclass of: O1 Creation_Data
Superclass of: O3 Content
Properties:
P1 has_content_value rdfs:Resource
P2 has_content_type rdfs:Resource
P3 datetime rdfs:Resource
P9 created_by schema:Person
P28 in_conflict: O13 Proposition
P29 premise_of: O6 Argument
Scope note: This class represents the minimum unit, from which an argument is composed. It attaches the structure of <premises, conclusion> to an argument, with the parts of premises, conclusion to be Propositions.

**O14 Moderation_Data**
Subclass of: -
Superclass of: -
Properties: P32 moderator rdfs:Resource

Scope note: This class is used to represent moderation data for each comment. There are use cases where comments have to be moderated by moderators before becoming active (i.e., visible in the front end), participating in the strength function etc. As moderation data, we consider the date of a comment that was created by a certain person (i.e., moderator).

1.5 Property Declarations
The properties are comprehensively declared in this section using the following format:

- Property names are presented as headings in bold face, preceded by unique property identifiers;
- The line ”Domain:” declares the class for which the property is defined;
- The line ”Range:” declares the class to which the property points, or that provides the values for the property;
- The line ”Superproperty of:” is a cross-reference to any subproperties the property may have;
- The line ”Scope note:” contains the textual definition of the concept the property represents;

P1 has_content_value
Domain: O3 Content
Range: rdfs:Resource
Scope note: This property identifies the value of the content that an argument can have. In most cases the value is plain text, but it can also be a video, an image, a music track etc.

P2 has_content_type
Domain: O3 Content
Range: rdfs:Resource
Scope note: This property identifies the corresponding type of the content. For the content type we have an extensible set of values such as:
- TEXT
- IMAGE
- VIDEO
- EMPTY

P3 datetime
Domain: O1 Creation_Data
Range: rdfs:Resource
Scope note: This property identifies the creation datetime of an object (e.g., an argument, a topic, etc.).
**P4 voting**
Domain: \[O2\] Strength
Range: rdfs:Resource
Scope note: This property identifies the value of the voting strength of an argument or topic. This value is used for the calculation of the acceptance and quality of the argument.

**P5 dialogue**
Domain: \[O2\] Strength
Range: rdfs:Resource
Scope note: This property identifies the value of the dialogue strength of an argument or topic. This value is used for the calculation of the acceptance and quality of the argument.

**P6 congruence**
Domain: \[O2\] Strength
Range: rdfs:Resource
Scope note: This property identifies the value of the congruence strength of an argument or topic. This value is used for the calculation of the acceptance and quality of the argument.

**P7 acceptance**
Domain: \[O2\] Strength
Range: rdfs:Resource
Scope note: This property identifies the value of the acceptance score of an argument or topic.

**P8 quality**
Domain: \[O2\] Strength
Range: rdfs:Resource
Scope note: This property identifies the value of the quality score of an argument or topic.

**P9 created_by**
Domain: \[O1\] Creation_Data
Range: schema:Person
Scope note: This property identify the user which created a specific argument (i.e., comment/position) for one or more topics.

**P10 consists_of**
Domain: \[O4\] Issue
Range: \[O5\] Topic
Scope note: This property connects an issue of discussion with one or more topics which refer on the said issue.

**RP11 about_topic**
Domain: \[O6\] Argument
Range: \[O5\] Topic
Scope note: This property connects any argument with one or more topics of discussion. This redundant property is useful in cases where we have dialogues of comments about topics as it provides a direct association between the comments and the discussed topics. This leads to a more efficient reasoning over the ontology.

**P12 attacks**
- **Domain:** O6 Argument
- **Range:** O6 Argument
- **Scope note:** This property identifies an attacking relation between two arguments denoting that the subject argument of the property attacks/disagrees with the object.

**P13 supports**
- **Domain:** O6 Argument
- **Range:** O6 Argument
- **Scope note:** This property identifies a supporting relation between two arguments denoting that the subject argument of the property supports/agrees with the object.

**P14 replies**
- **Domain:** O6 Argument
- **Range:** O6 Argument
- **Scope note:** This property identifies a simple relation between two arguments denoting that the subject argument of the property replies on the object without denoting if it agrees or disagrees.

**RP15 related_to_position**
- **Domain:** O8 Comment
- **Range:** O7 Position
- **Scope note:** This property connects one or more comments with a position. This is also a redundant property which is useful in cases where we have dialogues of comments which discuss and argue on a specific position. Having a direct comment-to-topic association leads to a more efficient reasoning over the ontology.

**P16 rates**
- **Domain:** O9 Rating
- **Range:** O5 Topic
- **Scope note:** This property identifies a rating relation between a rating object (e.g., vote, star-based) and a topic which is rated.

**P17 contains**
- **Domain:** O6 Argument
- **Range:** O9 Rating
- **Scope note:** Taking into account that a comment (or a position) rate on one or more topics of discussion, this property describes this association between an argument and one or more ratings.
P18 is_characteristic_of
Domain: 05 Topic
Range: rdfs:Resource
Scope note: This property identifies the object which is characterized by a specific topic. For example, consider a topic which refers on a facility of a hotel i.e., swimming pool. Using this property, we can denote that this topic is a characteristic of the webpage URL which contains information hotel's swimming pool.

P19 has_rating
Domain: 09 Rating
Range: rdfs:Resource
Scope note: This property identifies the rating value w.r.t. the rating type which is used. For example, in case of voting feature, the rating value is +1 for positive votes and -1 for negative. In case of star based feature, the rating value is the number of stars.

P20 status
Domain: 06 Argument
Range: rdfs:Resource
Scope note: This property identifies the status of a comment or position. For the status of comment, we have implemented an extensible set of values:

- ACTIVE
- OUTDATED
- DELETED
- UNDER_REVIEW
- REJECTED

P21 category
Domain: 013 Category
Range: rdfs:Resource
Scope note: This property identifies the categories that the system (APOPSIS) organizes the different debates. A user can navigate within APOPSIS through the following categories:

- All
- Politics
- Law
- Science
- Technology
- Business
- Social
- Health
- Sports
**P22 related_To**

Domain: 07 Position  
Range: 04 Issue  
Scope note: This property describes the association of any position with an Issue node according to certain topic of discussion. An issue can have one or more positions.

**P23 has_reviews**

Domain: 04 Issue  
Range: rdfs:Resource  
Scope note: This property describes the views that each issue have received according to how many times an author visit or not a debate conversation. There is no restriction of visiting a debate. E.g you do not have to log in first in order to view a conversation.

**P24 has_education**

Domain: schema:Person  
Range: rdfs:Resource  
Scope note: This property is associated with the Person class and describes the education level of each registered author within the web system. The education level consists of three different values:

- Primary School
- High School
- University

**P25 marital_status**

Domain: schema:Person  
Range: rdfs:Resource  
Scope note: This property is associated with the Person class and describes the marital status of each registered author within the web system. The marital status consists of three different values:

- Single
- Married
- Divorced

**P26 belongs_To**

Domain: 07 Position  
Range: rdfs:Resource  
Scope note: This property is associated with the Position class and describes the different stages within a dialogue. The web-system consists of two stages:

- **Stage1**: Each dialogue is open for discussion with users posting comments (position or arguments) and voting on
existing arguments.

- **Stage2**: The strongest positions and answers proceed in the next stage (stage 2) where users are allowed to post their positive or negative opinions and vote upon them. Users are not allowed to post new positions on a particular topic of discussion, through the second stage of discussion.

**P27 closed-time**
- **Domain**: 04 Issue
- **Range**: rdfs:Resource
- **Scope note**: This property is associated with the Issue class and describes the datetime of a closed debate. A moderator has the advantage of closing a debate when he believes that there is no need for keeping a debate active for users.

**P28 in_conflict**
- **Domain**: O13 Proposition
- **Range**: O13 Proposition
- **Scope note**: This property is associated with the Proposition class and describes a conflict between two propositions. In our model, a conflict lies between two mutually confuted contents. For example, two conflicting propositions are the following, "Car X is the best choice" and "Car X is not the best choice".

**P29 premise_of**
- **Domain**: O13 Proposition
- **Range**: O6 Argument
- **Scope note**: This property is associated with the Proposition class and describes that a proposition belongs to the premise set of an argument. An argument may have zero or more propositions in its premise set.

**P30 has_conclusion**
- **Domain**: O6 Argument
- **Range**: O13 Proposition
- **Scope note**: This property is associated with the Argument class and describes the relation between an argument and its justified conclusion. Each argument has exactly one conclusion.
P31 moderation_data
Domain: O8 Comment
Range: O14 Moderation Data
Scope note: This property is used to connect a Comment entity with its moderation data. Each comment can have more than one moderation data, as there are cases where the moderator may change his opinion about a previously moderated comment.

P32 moderator
Domain: O14 Moderation Data
Range: rdfs:Resource
Scope note: This property identifies the comment that was moderated.

P33 moderation_date
Domain: O14 Moderation Data
Range: rdfs:Resource
Scope note: This property gives information about the datetime of moderated stages, when a moderator proceed comments from one stage to another.