

# DOCUMENTATION OF SPARQL QUERIES IN MLT-OWL

Technical Report, v1.0, June 2016.

Freddy Brasileiro<sup>a</sup>, João Paulo A. Almeida<sup>a</sup>, Victorio A. Carvalho<sup>a,b</sup> and Giancarlo Guizzardi<sup>a</sup>

<sup>a</sup>Ontology & Conceptual Modeling Research Group (NEMO), Federal University of Espírito Santo (UFES), Vitória, ES, Brazil.

<sup>b</sup>Research Group in Applied Informatics, Informatics Department, Federal Institute of Espírito Santo (IFES), Colatina, ES, Brazil.

freddybrasileiro@gmail.com,  
gguizzardi@inf.ufes.br

jpalmeyda@ieee.org,

victorio@ifes.edu.br,

## CONTENTS

1. Derivation Rules .....	2
2. Integrity Constraints.....	5

## LIST OF TABLES

Table 1. Derivation Rules Corresponding to Axiom A3 of MLT .....	2
Table 2. Derivation Rules Corresponding to Axiom A4 of MLT .....	2
Table 3. Derivation Rules Corresponding to Axiom A5 of MLT .....	2
Table 4. Derivation Rules Corresponding to Axiom D1 of MLT .....	2
Table 5. Derivation Rules Corresponding to Axiom D4 of MLT .....	3
Table 6. Derivation Rules Corresponding to Axiom D5 of MLT .....	3
Table 7. Derivation Rules Corresponding to Axiom D6 of MLT .....	3
Table 8. Derivation Rules Corresponding to Axiom D7 of MLT .....	3
Table 9. Derivation Rules Corresponding to Axiom D8 of MLT .....	4
Table 10. Derivation Rules Corresponding to Axiom T7 of MLT .....	4
Table 11. Derivation Rules Corresponding to Axiom T8 of MLT .....	4
Table 12. Derivation Rules Corresponding to Axiom T9 of MLT .....	4
Table 13. Derivation Rules Corresponding to Axiom T15 of MLT .....	5
Table 14. Derivation Rules Corresponding to Axiom T16 of MLT .....	5
Table 15. Derivation Rules Corresponding to Axiom T17 of MLT .....	5
Table 16. Integrity Constraints Corresponding to Axiom A1 of MLT .....	5
Table 17. Integrity Constraints Corresponding to Axiom T5 of MLT .....	5
Table 18. Integrity Constraints Corresponding to Axiom T6 of MLT .....	6
Table 19. Integrity Constraints Corresponding to Axiom T13 of MLT .....	6
Table 20. Integrity Constraints Corresponding to Axiom T14 of MLT .....	6
Table 21. Integrity Constraints Corresponding to Axiom T18 of MLT .....	6

## 1. DERIVATION RULES

Table 1. Derivation Rules Corresponding to Axiom A3 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?x WHERE {   ?t rdf:type mlt:1stOrderClass .   ?x rdf:type ?t . }</pre>	For each returned ?x, it is added the information that ?x is an instance of <i>mlt:TokenIndividual</i>
<pre>SELECT DISTINCT ?t WHERE {   ?x rdf:type ?t .   ?x rdf:type mlt:TokenIndividual .   filter(?t != mlt:TokenIndividual) . }</pre>	For each returned ?t, it is added the information that ?t is an instance of <i>mlt:1stOrderClass</i>

Table 2. Derivation Rules Corresponding to Axiom A4 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?t1 WHERE {   ?t rdf:type mlt:2ndOrderClass .   ?t1 rdf:type ?t . }</pre>	For each returned ?t1, it is added the information that ?t1 is an instance of <i>mlt:1stOrderClass</i>
<pre>SELECT DISTINCT ?t WHERE {   ?t1 rdf:type ?t .   ?t1 rdf:type mlt:1stOrderClass .   filter(?t != mlt:TokenIndividual) . }</pre>	For each returned ?t, it is added the information that ?t is an instance of <i>mlt:2ndOrderClass</i>

Table 3. Derivation Rules Corresponding to Axiom A5 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?t1 WHERE {   ?t rdf:type mlt:3rdOrderClass .   ?t1 rdf:type ?t . }</pre>	For each returned ?t1, it is added the information that ?t1 is an instance of <i>mlt:2ndOrderClass</i>
<pre>SELECT DISTINCT ?t WHERE {   ?t1 rdf:type ?t .   ?t1 rdf:type mlt:2ndOrderClass .   filter(?t != mlt:TokenIndividual) . }</pre>	For each returned ?t, it is added the information that ?t is an instance of <i>mlt:3rdOrderClass</i>

Table 4. Derivation Rules Corresponding to Axiom D1 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?e ?t2 WHERE {     ?t1 rdfs:subClassOf+ ?t2 .     ?e rdf:type ?t1 }</pre>	For each returned pair of ?e and ?t2, it is added the information that ?e is an instance of ?t2

Table 5. Derivation Rules Corresponding to Axiom D4 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?t2 ?t3 WHERE {     ?t1 mlt:isPowertypeOf ?t2 .     ?t3 rdf:type ?t1 .     ?t1 rdf:type ?t1Type .     filter(?t1Type != mlt:TokenIndividual) . }</pre>	For each returned pair of ?t2 and ?t3, it is added the information that ?t3 is a subclass of ?t2
<pre>SELECT DISTINCT ?t1 ?t3 WHERE {     ?t1 mlt:isPowertypeOf ?t2 .     ?t3 rdfs:subClassOf* ?t2 .     ?t1 rdf:type ?t1Type .     filter(?t1Type != mlt:TokenIndividual) . }</pre>	For each returned pair of ?t1 and ?t3, it is added the information that ?t3 is an instance of ?t1

Table 6. Derivation Rules Corresponding to Axiom D5 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?t2 ?t3 WHERE {     ?t1 mlt:characterizes ?t2 .     ?t3 rdf:type ?t1 .     ?t1 rdf:type ?t1Type .     filter(?t1Type != mlt:TokenIndividual) . }</pre>	For each returned pair of ?t2 and ?t3, it is added the information that ?t3 is a subclass of ?t2

Table 7. Derivation Rules Corresponding to Axiom D6 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?t1 ?t2 WHERE {     ?t1 mlt:completelyCharacterizes ?t2 . }</pre>	For each returned pair of ?t1 and ?t2, it is added the triple [?t1, mlt:caracterizes, ?t2]

Table 8. Derivation Rules Corresponding to Axiom D7 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?t1 ?t2 WHERE {</pre>	For each returned pair of ?t1 and ?t2, it is added the triple

<code>?t1 mlt:disjointlyCharacterizes ?t2 .</code> }	[?t1, mlt:caracterizes, ?t2]
---	------------------------------

Table 9. Derivation Rules Corresponding to Axiom D8 of MLT

SPARQL query	Action
SELECT DISTINCT ?t1 ?t2 WHERE { ?t1 mlt:partitions ?t2 . }	For each returned pair of ?t1 and ?t2, it is added the triples [?t1, completelyCharacterizes, ?t2] [?t1, disjointlyCharacterizes, ?t2]
SELECT DISTINCT ?t1 ?t2 WHERE { ?t1 mlt:completelyCharacterizes ?t2 . ?t1 mlt:disjointlyCharacterizes ?t2 . }	For each returned pair of ?t1 and ?t2, it is added the triple [?t1, mlt:partitions, ?t2]

Table 10. Derivation Rules Corresponding to Axiom T7 of MLT

SPARQL query	Action
SELECT DISTINCT ?t WHERE { ?t rdf:type mlt:1stOrderClass . }	For each returned ?t, it is added the information that ?t is a subclass of <i>mlt:TokenIndividual</i>
SELECT DISTINCT ?t WHERE { ?t rdfs:subClassOf+ mlt:TokenIndividual. }	For each returned ?t, it is added the information that ?t is a subclass of <i>mlt:1stOrderClass</i>

Table 11. Derivation Rules Corresponding to Axiom T8 of MLT

SPARQL query	Action
SELECT DISTINCT ?t WHERE { ?t rdf:type mlt:2ndOrderClass . }	For each returned ?t, it is added the information that ?t is a subclass of <i>mlt:1stOrderClasses</i>
SELECT DISTINCT ?t WHERE { ?t rdfs:subClassOf+ mlt:1stOrderClass . }	For each returned ?t, it is added the information that ?t is a subclass of <i>mlt:2ndOrderClass</i>

Table 12. Derivation Rules Corresponding to Axiom T9 of MLT

SPARQL query	Action
SELECT DISTINCT ?t WHERE { ?t rdf:type mlt:3rdOrderClass . }	For each returned ?t, it is added the information that ?t is a subclass of <i>mlt:2ndOrderClasses</i>
SELECT DISTINCT ?t WHERE {	For each returned ?t, it is added the

<code>?t rdfs:subClassOf+ mlt:2ndOrderClass .</code> }	information that ?t is a subclass of <i>mlt:3rdOrderClass</i>
---	---

Table 13. Derivation Rules Corresponding to Axiom T15 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?t3 ?t4 WHERE {   ?t2 rdfs:subClassOf+ ?t1 .   ?t4 mlt:isPowertypeOf ?t2 .   ?t3 mlt:isPowertypeOf ?t1 . }</pre>	For each returned pair of ?t3 and ?t4, it is added the information that ?t4 is a subclass of ?t3

Table 14. Derivation Rules Corresponding to Axiom T16 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?t1 ?t3 WHERE {   ?t1 mlt:isSubordinateTo ?t2 .   ?t2 mlt:characterizes ?t3 . }</pre>	For each returned pair of ?t1 and ?t3, it is added the triple [?t1, mlt:characterizes, ?t3]

Table 15. Derivation Rules Corresponding to Axiom T17 of MLT

SPARQL query	Action
<pre>SELECT DISTINCT ?t2 ?t3 WHERE {   ?t2 mlt:isPowertypeOf ?t1 .   ?t3 mlt:characterizes ?t1 . }</pre>	For each returned pair of ?t2 and ?t3, it is added the information that ?t3 is a subclass of ?t2

## 2. INTEGRITY CONSTRAINTS

Table 16. Integrity Constraints Corresponding to Axiom A1 of MLT

SPARQL query
<pre>SELECT DISTINCT * WHERE {   ?x rdf:type mlt:TokenIndividual .   ?y rdf:type ?x . }</pre>

Table 17. Integrity Constraints Corresponding to Axiom T5 of MLT

SPARQL query
<pre>SELECT DISTINCT * WHERE {</pre>

<pre> ?x rdf:type ?y . ?y rdf:type ?x . </pre>
--

*Table 18. Integrity Constraints Corresponding to Axiom T6 of MLT*

SPARQL query
<pre> SELECT DISTINCT * WHERE {     ?x rdf:type ?y .     ?y rdf:type ?z .     ?x rdf:type ?z . } </pre>

*Table 19. Integrity Constraints Corresponding to Axiom T13 of MLT*

SPARQL query
<pre> SELECT DISTINCT * WHERE {     ?p mlt:isPowertypeOf ?t .     ?p1 mlt:isPowertypeOf ?t .     FILTER (?p NOT IN (?p1)) . } </pre>

*Table 20. Integrity Constraints Corresponding to Axiom T14 of MLT*

SPARQL query
<pre> SELECT DISTINCT * WHERE {     ?p mlt:isPowertypeOf ?t .     ?p mlt:isPowertypeOf ?t1 .     FILTER (?t NOT IN (?t1)) . } </pre>

*Table 21. Integrity Constraints Corresponding to Axiom T18 of MLT*

SPARQL query
<pre> SELECT DISTINCT * WHERE {     ?t1 mlt:partitions ?t3 .     ?t2 mlt:partitions ?t3 .     ?t1 mlt:properSpecializes ?t2 . } </pre>