









In order to build the list of quads that are candidate to be inserted and/or deleted, the algorithm follows a procedure (see lines 32-37) similar to the one implemented by the Algorithm 2. Thanks to the `getInsTriples`, `getDelTriples` and `combine` functions, the algorithm first extracts the triples from each graph and then combines these triples with the corresponding graph IRI.

Eventually, from line 40 to line 50, thanks to the `isPresent` function, the algorithm checks the actual existence (or not existence) of the quads into the quad store. Relevant quads are then inserted into the lists of quads to be returned by the algorithm (i.e., *IQuads*, *DQuads*).

#### IV. CONCLUSION AND FUTURE WORK

This article presents an algorithm that can be implemented to extract the quads that are really inserted and deleted by a generic SPARQL 1.1 Update operation, without effecting the underpinning SPARQL 1.1 Protocol service implementation. The algorithm will be implemented and evaluated as part of the SPARQL Event Processing Architecture. This would lead to understand if the overhead introduced by the processing of a SPARQL update can be repaid by reducing the subscription computational cost in terms of number of subscriptions to be evaluated per update and processing time of a single subscription.

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#### REFERENCES

- [1] C. Bizer, T. Heath, and T. Berners-Lee, "Linked Data - The Story So Far," *International Journal on Semantic Web and Information Systems*, vol. 5, no. 3, pp. 1–22, 2009.
- [2] T. Käfer, A. Abdelrahman, J. Umbrich, P. O'Byrne, and A. Hogan, "Observing linked data dynamics," in *The Semantic Web: Semantics and Big Data* (P. Cimiano, O. Corcho, V. Presutti, L. Hollink, and S. Rudolph, eds.), (Berlin, Heidelberg), pp. 213–227, Springer Berlin Heidelberg, 2013.
- [3] B. Norton and R. Krummenacher, "Consuming Dynamic Linked Data," in *COLD*, 2010.
- [4] J. Umbrich, B. Villazón-Terrazas, and M. Hausenblas, "Dataset Dynamics Compendium: A Comparative Study," in *Proceedings of the First International Workshop on Consuming Linked Data, Shanghai, China, November 8, 2010*, 2010.
- [5] D. F. Barbieri, D. Braga, S. Ceri, and M. Grossniklaus, "An Execution Environment for C-SPARQL Queries," in *Proceedings of the 13th International Conference on Extending Database Technology, EDBT '10*, (New York, NY, USA), pp. 441–452, ACM, 2010.
- [6] J.-P. Calbimonte, O. Corcho, and A. J. G. Gray, "Enabling Ontology-Based Access to Streaming Data Sources," in *The Semantic Web – ISWC 2010* (P. F. Patel-Schneider, Y. Pan, P. Hitzler, P. Mika, L. Zhang, J. Z. Pan, I. Horrocks, and B. Glimm, eds.), (Berlin, Heidelberg), pp. 96–111, Springer Berlin Heidelberg, 2010.
- [7] D. Anicic, P. Fodor, S. Rudolph, and N. Stojanovic, "EP-SPARQL: A Unified Language for Event Processing and Stream Reasoning," in *Proceedings of the 20th International Conference on World Wide Web, WWW '11*, (New York, NY, USA), pp. 635–644, ACM, 2011.
- [8] L. Roffia, P. Azzoni, C. Aguzzi, F. Viola, F. Antoniazzi, and T. Salmon Cinotti, "Dynamic Linked Data: A SPARQL Event Processing Architecture," *Future Internet*, vol. 10, no. 4, p. 36, 2018.
- [9] C. Aguzzi, F. Antoniazzi, F. Viola, and L. Roffia, "SPARQL 1.1 Subscribe Language," 2018. [Online; accessed 21-November-2018].
- [10] A. Seaborne, "SPARQL 1.1 Query Results JSON Format." Web: <https://www.w3.org/TR/sparql11-results-json/>, 2013. [Online; accessed 21-November-2018].
- [11] L. Roffia, F. Morandi, J. Kiljander, A. D'Elia, F. Vergari, F. Viola, L. Bononi, and T. S. Cinotti, "A Semantic Publish-Subscribe Architecture for the Internet of Things," *IEEE Internet of Things Journal*, dec 2016.
- [12] P. Gearon, A. Passant, and A. Polleres, "SPARQL 1.1 Update." Web: <https://www.w3.org/TR/sparql11-update/>, 2013. [Online; accessed 21-November-2018].
- [13] L. Feigenbaum, G. T. Williams, K. G. Clark, and E. Torres, "SPARQL 1.1 Protocol." Web: <https://www.w3.org/TR/sparql11-protocol/>, 2013. [Online; accessed 21-November-2018].
- [14] F. Schmedding, "Incremental SPARQL evaluation for query answering on linked data," in *Proceedings of the Second International Conference on Consuming Linked Data-Volume 782*, pp. 49–60, Citeseer, 2011.