A generic modelling to capture the temporal evolution in graphs

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Abstract. A temporal graph is based on two aspects: it is a graph that models the interconnection of data and that includes time dimension to model the temporal evolution of data. Temporal graphs are commonly used in different domains to capture the different evolution types that occur in a graph over time. However, existing modelling solutions of temporal graph do not allow to manage all temporal evolution types in the real world. In this paper, we propose a generic model that is able to manage the temporal evolution at different levels: at the schema level to capture the temporal evolution in the graph data structure, and at the instance level to capture the temporal evolution of data contained in entities and their relationships as well as the temporal evolution of the graph topology. We complete our proposed modelling solution with a set of translation rules compatible with the property graph model. The feasibility of our proposal is illustrated through an implementation of our model in the Neo4j database system.

1 Introduction

Graphs have been widely used to model complex relationships among interconnected entities in real applications (Holme and Saramäki, 2012). For example, in social networks, graphs model relationships between users. Graph modelling is not only exploiting data contained in entities and their relationships but also the graph topology [1], which is also a meaningful source of information. For instance, the graph topology allows to discover the friend of a friend in a social network.

It is also relevant to exploit the temporal evolution of a graph. For example, modelling the activity of users in a social network requires to consider the evolution of the network through time (Ahmed et al., 2010). Accordingly, the *temporal graph* model has been created not only to exploit data contained in entities and their relationships as well as graph topology but also

1. Topology is the way in which the nodes and edges are arranged within a graph.