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Basilisk – Continuous Benchmarking for Triplestores

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Abstract. Abstract

Contents

1 Introduction **1**

2 Related Work **3**

3 Background **5**
3.1 Knowledge Graph 5
3.2 Triplestore 5
3.3 SPARQL 6
3.4 Benchmark 6
3.5 IGUANA 6

4 Approach **7**

5 Implementation **9**

6 Evaluation **11**

7 Summary and Discussion **13**

Bibliography **14**

1 Introduction

In the field of Semantic Web, knowledge graphs are an important structure to represent data and its relationships. To easily store and query the data in these knowledge graphs, some data structure or database is needed. The special kind of database developed to store knowledge graphs are called Triplestores.

Since knowledge graphs can contain huge amounts of data which can also be subject to many changes, Triplestores need to be able to handle many different workloads. Some scenarios need to handle huge amount of data being added, while others need to handle a lot of changes on the current data. To better test and compare Triplestores in these diverse scenarios, benchmarks are performed to allow an appropriate comparison between different Triplestores[5].

In general, Benchmarks are used to measure and compare the performance of computer programs and systems with a defined set of operations. Often they are designed to mimic and reproduce a particular type of workload to the system. In the context of Triplestores, a benchmark usually consists of creating a given knowledge graph on which multiple queries and operations are performed.

Often Triplestores are developed in long iterations and are bench-marked only in a late stage of such an development iteration. Today benchmarks and the evaluation of their results are usually done manually and bind developers time. Thus, performance regressions are found very late or never.

Several benchmarks for Triplestores have been proposed [5]. IGUANA is a benchmark-independent execution framework [2] that can measure the performance of Triplestores under several parallel query request. Currently the benchmark execution framework needs to be installed and benchmarks need to be started manually. Basilisk is a continuous benchmarking service for Triplestores which internally uses IGUANA to perform the benchmarks. The idea is that the Basilisk service will check automatically for new versions of Triplestores and start benchmarks with the IGUANA framework. Further it should be possible to start custom benchmarks on demand. If a new version is found in a provided GitHub- or DockerHub-repository, Basilisk will automatically setup a benchmark environment and starts a benchmarking suite.

This means that developers do not have to worry about performing benchmarks at different stages of development.

In this thesis we continue the development of the Basilisk platform and deploy an instance to a publicly available virtual machine.

2

Related Work

3 Background

This chapter explains the fundamental topics required to understand this thesis.

3.1 Knowledge Graph

Knowledge Graphs are graphs intended to represent knowledge of the real world or smaller scenarios. The knowledge stored in Knowledge Graphs is modeled in a graph-based structure. Nodes represent entities which are connected by various types of relations, represented by labeled edges in the graph. This has the benefit to represent complex relations between different nodes and edges[4].

The simplest knowledge graph consists of three elements. The subject entity, the object entity and the labeled edge between them describing their relation. This atomic data entity is called triple.

In figure 3.1 a simple example of a knowledge graph is shown.

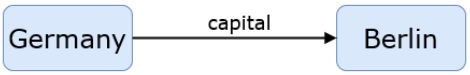

Figure 3.1: Simple Knowledge Graph

Since a graph structure is hard to store in a classic relational database a different type of storage is needed. The special kind of database developed to store knowledge graphs are called Triplestores.

3.2 Triplestore

Triplestores are a special kind of database developed to easily store and access knowledge graphs through queries. Example of Triplestores are Tentris[1], GraphDB[1], Virtuoso[2], or Jena TDB[3].

This thesis focuses on Triplestores that accept SPARQL queries, since the used benchmark framework IGUANA is using the SPARQL endpoint to perform benchmarks[2].

[1] https://graphdb.ontotext.com/
[2] https://virtuoso.openlinksw.com/
[3] https://jena.apache.org/documentation/tdb/

3.3 SPARQL

SPARQL (SPARQL Protocol and RDF Query Language)[3] is a query language for manipulating and retrieving data stored in Triplestores. Queries can contain optional graph patterns, conjunctions, disjunctions, as well as aggregation functions

3.4 Benchmark

3.5 IGUANA

4

Approach

5

Implementation

6 Evaluation

- Experiment setup, requirements - Performing of benchmarks - Result evaluation

7

Summary and Discussion

- Summary of the work - Highlighting the key findings of the evaluation stage

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