



IGUANA v0.3.0  
Manual

November 3, 2015

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# 1 Introduction

In this manual we describe IGUANA - A generic Benchmark Framework for SPARQL and SPARQL UPDATE Endpoints. First we describe why we think IGUANA is necessary in todays world. Then we'll describe the architecture and how you can configure IGUANA. Finally we'll show you how to write your own modules for IGUANA.

## 1.1 Motivation

Triplestores are the backbone of the semantic web, but to determine which of the stores is the perfect one for your datasets and the user given queries you should benchmark the triplestores which fits to your application. While there are several Benchmarks and some serves an execution platform none of them are generic. We provide with IGUANA a solution which handles SPARQL Queries and SPARQL UPDATES for any SPARQL endpoint supported by the jena remote driver. It doesn't care which dataset you have nor queries nor what you want to test. We provide a mighty execution framework which can handle SPARQL Benchmarks you desire.

## 1.2 Goals

IGUANA should be...

- ... easy to use
- ... easy to configure
- ... generic
- ... well documented
- ... nearly completely changeable

IGUANA should can ...

- ... use user defined testcases
- ... log clustering
- ... data generation
- ... work with different testcases
- ... test SPARQL and UPDATE workers
- ... upload testcases
- ... Shell scripting

## 2 Architecture

In this section we'll describe IGUANAs Architecture, it's core, the log clustering function, the data generator and the testcase interface as well as the implemented testcases.

### 2.1 Core

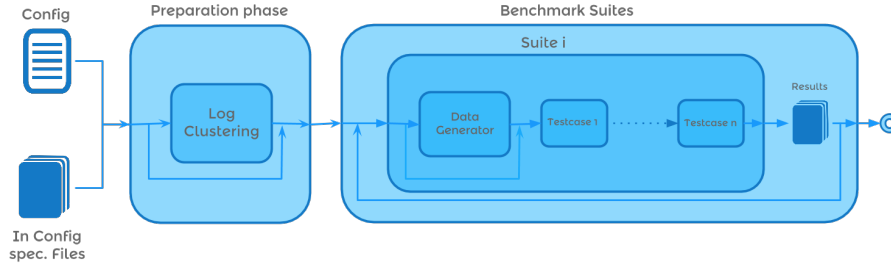


Figure 1: IGUANA Architecture v.0.3.0

As shown in Figure 1 IGUANA starts with a config file and the files/folder specified in this config file. We'll describe later on how the configuration file should look. IGUANA will parse the config file and start its preparation phase where it will cluster a given log file with a user specified log clusterer. This step is optional. If the preparation phase finished the Benchmark suites starts to begin. IGUANA will now start an already implemented in the suite user chosen DataGenerator (this step is optional too) and then all the testcases which were specified in the suite. After the suite finished the results will be saved in a folder called *results\_i* while i is the i'th suite.

The testcases will be executed for all specified and in the current suite referenced connections and all specified datasets.

Be aware that you can change the suites in the config file which will follow the last one while the previous suite is running. Also the testcases can be implemented ones as well as user written ones. If every Benchmark suite is finished IGUANA will be executed and if the user wishes send an email to the user.

### 2.2 LogClusterer

As previous told IGUANA can handle log clustering. While there is only one LogClusterer implemented in IGUANA, called FeasibleClusterer, the user can write an own LogClusterer which only needs to implement the interface *Clusterer.java* in the package *de.uni.leipzig.iguana.clustering.clusterer*. The LogClusterer can have several properties specified in the config. It should cluster a

given log file to a query file with either query templates or queries itself.

### 2.2.1 FEASIBLE

As explaining Feasible would blow the workload we link to the homepage to Feasible [<http://aksw.org/Projects/FEASIBLE.html>] and just tell what parameters you can change in the FeasibleClusterer which will use Feasible.

The parameters are:

name	description	default value	optional
draw-voronoi-diagram		true	yes
feature-filter		""	yes
clause-filter		""	yes
ask		false	yes
describe		false	yes
select		false	yes
construct		false	yes
triple-patterns-count		true	yes
result-size		true	yes
join-vertices		true	yes
mean-join-vertices-degree		true	yes
mean-triple-pattern-selectivity		true	yes
bgps		true	yes
union		true	yes
filter		true	yes
optional		true	yes
distinct		true	yes
orderby		true	yes
groupby		true	yes
limit		true	yes
regex		true	yes
offset		true	yes
run-time		true	yes

## 2.3 DataGenerator

As the DataGenerator is currently implemented but not supported (it will be in future work) as it needs too much memory and too much time for even small datasets we decided to not describe how to use it and simply link to the paper how the datagenerator should be if it's finished. [1]

## 2.4 Testcase

The testcase interface is designed so the users can define their own testcases as well as use implemented ones. Testcases are a part of a benchmark, while all defined testcases represent the whole benchmark or at least a big part of a benchmark. Testcases needs to implement several functions. These are a

simple *start* method, a Method to get the results called `getResults()`, a Function to add Results which were derived previously for other connections, called `addCurrentResults(Collection;ResultSet;)`, further on to set the properties specified in the config `setProperty(Properties)`, the current Connection `setConnection(Connection)`, setting the XML-Node where the connections are specified `setConnectionNode(Node, String)`, set the current connection name `setCurrentDBName(String)` and the current dataset `setCurrentPercent(String)` and at last if it's a test which doesn't separate the results in datasets `isOneTest()` (this is needed for example in the `UploadShellTestcase`).

## 2.4.1 StressTestcase

### 2.4.1.1 Properties

### 2.4.1.2 Result Metrics

It will produce several results, with the metrics failed queries, succeeded queries, Queries per second, Total time of queries, Query Mixes per TimeLimit for every worker and also their SPARQL, as well as UPDATE summation, as their means. Queries Per Second will measure for every query how many queries per second the connection can handle. Total time of Queries will sum up for every query how much time all request of this query took. Query Mixes per TimeLimit will measure how many queries the connection can handle in the given timelimit. Failed and succeeded queries measures for every query the number of succeeded and failed queries.

## 2.4.2 FederatedStressTestcase

Same as `StressTestcase` but the update workers can work on different connections, so a Federated Connection can be tested without any problem. The actual endpoint will be the QueryEngine in front of the federated system and the update worker will get the connections behind the federated system. For example if a federated system has `localhost:8080/sparql` as the sparql endpoint for all connections and a virtuoso and a blazegraph connection is behind this federated system the update workers need to know into which of them they should upload. This you can specify

### 2.4.2.1 Properties

Nearly as same as `StressTestcase` but with one more option

name	description	default value
<code>worker[0-9]+</code>	worker0 tells the connection id into which the update worker0 needs to upload to	-

### 2.4.2.2 Result Metrics

See the result metrics at `StressTestcase` with one difference. The summation and mean of the UPDATE workers will be separated. It will get the summation and the mean for every different connection.

### 2.4.3 UploadShellTestcase

This testcase is there to give you the option to upload several datasets to the current connection via shell script. The script can have several arguments called "%%PERCENT%%", "%%DBNAME%%", "%%FILE%%" which will be replaced by the current percentage, the current connection name and the current file/path to upload to.

These arguments needs to stand in the script-name argument. For example:  
script-name="./upload.sh %%DBNAME%% %%FILE%%"

#### 2.4.3.1 Properties

name	description	default value	optional
file	Tells the file which should be uploaded	-	no
script-name	tells the name of the script which should be executed	-	no

#### 2.4.3.2 Result Metrics

This will produce only one resultset for the whole suite. It'll measure the time the shell script took for each percent and each connection.

## 3 Configuration

In this section we'll describe what you can configure in IGUANA and after this an examples The root element looks like follow:

```
<?xml version="1.0" encoding="UTF-8"?>
<iguana xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
...
</iguana>
```

### 3.1 databases

The databases element consists out of several database elements. It must exist 1 and only 1 time in the config

The database elements consist of two attributes, the id and the type. The type should always be *impl* It consists out of a required endpoint element and optional update endpoint, user and password. The parent is the root tag.

```
...
<!-- minimal occurs: 1 -->
<!-- maximal occurs: 1 -->
<databases main="">
  <!-- minimal occurs: 1 -->
  <!-- maximal occurs: n -->
  <database id="sparqlendpoint1" type="impl">
    <!-- required -->
    <endpoint uri="localhost:8080/sparql" />
    <!-- optional -->
    <update-endpoint uri="localhost:8080/update" />
    <!-- optional -->
    <user value="dba" />
    <!-- optional -->
    <pwd value="dba" />
  </database>
  ...
</databases>
...
```

### 3.2 logclustering

The LogClustering element needs 3 attributes, the class name, the path or the name of the log file and the name of the output queries file. Also it consists out of several properties with the attributes name and value. the parent is the root tag



```

...
<!-- mininmal occurs: 1 -->
<!-- maximal occurs: 1 -->
<log-clustering class="org.example.clusterer.Clusterer"
  path="cluster-path" output-file="queries.txt">
  <property name="ask" value="false"/>
  <property name="union" value="false"/>
  <property name="clause-filter"
    value="(OPTIONAL AND DISTINCT) OR (UNION)"/>
  <property name="feature-filter"
    value="ResultSize >= 5 AND ResultSize
      <= 100 AND BGPs >= 2 AND
      TriplePatterns <=10"/>
</log-clustering>
...

```

### 3.3 suite

The *suites* elements are the elements who contains all the information for your specific benchmark. You have several elements in the suite element. The number-of-triples element tells IGUANA if files which will be uploaded and removed should be splitted into files with the specified number of triples in it. These will be uploaded seperated. Be aware that IGUANA will only measure the time of each file to upload/remove and not the splitting etc. also. The graph-uri element tells IGUANA in which graph datasets should be loaded in. the parent is the root tag

```

...
<!-- mininmal occurs: 1 -->
<!-- maximal occurs: n -->
<suite>
  <!-- mininmal occurs: 0 -->
  <!-- maximal occurs: 1 -->
  <number-of-triples value="9"/>
  <!-- mininmal occurs: 1 -->
  <!-- maximal occurs: 1 -->
  <graph-uri name="http://dbpedia.org" />
  <!-- mininmal occurs: 1 -->
  <!-- maximal occurs: 1 -->
  <warmup time="5" file-name="warmup.txt" />
  <!-- mininmal occurs: 1 -->
  <!-- maximal occurs: 1 -->
  <random-function ...>
    ...
  </random-function>

```

```

        <!-- mininmal occurs: 1 -->
        <!-- maximal occurs: 1 -->
        <test-db ...>
            ...
        </test-db>
        <!-- mininmal occurs: 1 -->
        <!-- maximal occurs: 1 -->
        <testcases>
            ...
        </testcases>
    </suite>
...

```

### 3.3.1 randomfunction

the parent is the suite tag

```

...
    <!-- mininmal occurs: 1 -->
    <!-- maximal occurs: 1 -->
    <random-function type="RandomTriple" generate="false">
        <!-- mininmal occurs: 1 -->
        <!-- maximal occurs: n -->
        <percent value="1.0" file-name="dbpedia2/" />
        ...
    </random-function>
...

```

### 3.3.2 test-db

the parent is the suite tag

```

...
    <!-- mininmal occurs: 1 -->
    <!-- maximal occurs: 1 -->
    <test-db type="choose" reference="ref">
        <!-- mininmal occurs: 1 -->
        <!-- maximal occurs: n -->
        <db id="owlim" />
        ...
    </test-db>
...

```

### 3.3.3 testcases

the parent is the suite tag

```
...
    <!-- minimal occurs: 1 -->
    <!-- maximal occurs: 1 -->
    <testcases testcase-pre="pre.sh" testcase-post="post.sh">
        ...
        <!-- minimal occurs: 1 -->
        <!-- maximal occurs: n -->
        <testcase class="de.uni_leipzig.iguana.testcases.
            StressTestcase">
            <property name="xyz"
                value="abc"/>
            ...
        </testcase>
        ...
    </testcases>
...
```

### 3.4 Example

```
<?xml version="1.0" encoding="UTF-8"?>
<iguana xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <databases main="dbpedia">
    <database id="owlim" type="impl">
      <endpoint
        uri="localhost:8080/openrdf-workbench/repositories/owlim-
          lite/query" />
      <update-endpoint
        uri="localhost:8080/openrdf-workbench/repositories/owlim-
          lite/update" />
    </database>
    <database id="fuseki" type="impl">
      <endpoint uri="localhost:3030/tdb/sparql" />
      <update-endpoint uri="localhost:3030/tdb/update" />
    </database>
    <database id="blazegraph" type="impl">
      <endpoint uri="localhost:9999/bigdata/sparql" />
    </database>
    <database id="virtuoso" type="impl">
      <endpoint uri="localhost:8890/sparql-auth" />
      <user value="dba" />
      <pwd value="dba" />
    </database>
  </databases>
</iguana>
```

```

</database>
<database id="ref" type="impl">
  <endpoint uri="dbpedia.org/sparql" />
</database>
</databases>

<suite>
  <drop-db value="false" />
  <query-diversity value="2000" />
  <graph-uri name="http://dbpedia.org" />
  <random-function type="RandomTriple" generate="false">
    <percent value="1.0" file-name="dbpedia2/" />
  </random-function>
  <warmup time="20" file-name="warmup.txt" />
  <test-db type="choose" reference="ref">
    <db id="owlim" />
    <db id="blazegraph" />
    <db id="virtuoso" />
    <db id="fuseki" />
  </test-db>
  <testcases testcase-pre="./testcasePre.sh %DBID% %PERCENT% %
    TESTCASEID%"
    testcase-post="./testcasePost.sh %DBID% %PERCENT% %
    TESTCASEID%">
    <testcase class="de.uni_leipzig.iguana.testcases.
      StressTestcase">
      <property name="sparql-user" value="1" />
      <property name="update-user" value="0" />
      <property name="latency-amount0" value="20" />
      <property name="latency-strategy0" value="VARIABLE" />
      <property name="queries-path" value="queries-175.txt" />
      <property name="is-pattern" value="false" />
      <property name="timelimit" value="3600000" />
    </testcase>
    <testcase class="de.uni_leipzig.iguana.testcases.
      StressTestcase">
      <property name="sparql-user" value="2" />
      <property name="update-user" value="0" />
      <property name="latency-amount0" value="20" />
      <property name="latency-strategy0" value="VARIABLE" />
      <property name="queries-path" value="queries-175.txt" />
      <property name="is-pattern" value="false" />
      <property name="timelimit" value="3600000" />
    </testcase>
    <testcase class="de.uni_leipzig.iguana.testcases.
      StressTestcase">

```

```

<property name="sparql-user" value="4" />
<property name="update-user" value="0" />
<property name="latency-amount0" value="20" />
<property name="latency-strategy0" value="VARIABLE" />
<property name="queries-path" value="queries-175.txt" />
<property name="is-pattern" value="false" />
<property name="timelimit" value="3600000" />
</testcase>
<testcase class="de.uni_leipzig.iguana.testcases.
    StressTestcase">
    <property name="sparql-user" value="8" />
    <property name="update-user" value="0" />
    <property name="latency-amount0" value="20" />
    <property name="latency-strategy0" value="VARIABLE" />
    <property name="queries-path" value="queries-175.txt" />
    <property name="is-pattern" value="false" />
    <property name="timelimit" value="3600000" />
</testcase>
<testcase class="de.uni_leipzig.iguana.testcases.
    StressTestcase">
    <property name="sparql-user" value="16" />
    <property name="update-user" value="0" />
    <property name="latency-amount0" value="20" />
    <property name="latency-strategy0" value="VARIABLE" />
    <property name="queries-path" value="queries-175.txt" />
    <property name="is-pattern" value="false" />
    <property name="timelimit" value="3600000" />
</testcase>
<testcase class="de.uni_leipzig.iguana.testcases.
    StressTestcase">
    <property name="sparql-user" value="1" />
    <property name="update-user" value="1" />
    <property name="latency-amount0" value="20" />
    <property name="latency-strategy0" value="VARIABLE" />
    <property name="queries-path" value="queries-175.txt" />
    <property name="is-pattern" value="false" />
    <property name="linking-strategy" value="ID" />
    <property name="update-path" value="ld" />
    <property name="worker-strategy0" value="ADDED" />
    <property name="update-strategy" value="VARIABLE" />
    <property name="timelimit" value="3600000" />
</testcase>
<testcase class="de.uni_leipzig.iguana.testcases.
    StressTestcase">
    <property name="sparql-user" value="2" />
    <property name="update-user" value="1" />

```

```

<property name="latency-amount0" value="20" />
<property name="latency-strategy0" value="VARIABLE" />
<property name="queries-path" value="queries-175.txt" />
<property name="is-pattern" value="false" />
<property name="linking-strategy" value="ID" />
<property name="update-path" value="ld" />
<property name="worker-strategy0" value="ADDED" />
<property name="update-strategy" value="VARIABLE" />
<property name="timelimit" value="3600000" />
</testcase>
<testcase class="de.uni_leipzig.iguana.testcases.
    StressTestcase">
    <property name="sparql-user" value="4" />
    <property name="update-user" value="1" />
    <property name="latency-amount0" value="20" />
    <property name="latency-strategy0" value="VARIABLE" />
    <property name="queries-path" value="queries-175.txt" />
    <property name="is-pattern" value="false" />
    <property name="linking-strategy" value="ID" />
    <property name="update-path" value="ld" />
    <property name="worker-strategy0" value="ADDED" />
    <property name="update-strategy" value="VARIABLE" />
    <property name="timelimit" value="3600000" />
</testcase>
<testcase class="de.uni_leipzig.iguana.testcases.
    StressTestcase">
    <property name="sparql-user" value="8" />
    <property name="update-user" value="1" />
    <property name="latency-amount0" value="20" />
    <property name="latency-strategy0" value="VARIABLE" />
    <property name="queries-path" value="queries-175.txt" />
    <property name="is-pattern" value="false" />
    <property name="linking-strategy" value="ID" />
    <property name="update-path" value="ld" />
    <property name="worker-strategy0" value="ADDED" />
    <property name="update-strategy" value="VARIABLE" />
    <property name="timelimit" value="3600000" />
</testcase>
<testcase class="de.uni_leipzig.iguana.testcases.
    StressTestcase">
    <property name="sparql-user" value="16" />
    <property name="update-user" value="1" />
    <property name="latency-amount0" value="20" />
    <property name="latency-strategy0" value="VARIABLE" />
    <property name="queries-path" value="queries-175.txt" />
    <property name="is-pattern" value="false" />

```

```
<property name="linking-strategy" value="ID" />
<property name="update-path" value="ld" />
<property name="worker-strategy0" value="ADDED" />
<property name="update-strategy" value="VARIABLE" />
<property name="timelimit" value="3600000" />
</testcase>
</testcases>
</suite>
</iguana>
```

## 4 Write your own ...

In this section we'll describe how you can write additional Modules in IGUANA without changing the code itself.

### 4.1 Testcase

We'll show you how you can write your own Testcase with the example of ...

### 4.2 LogClusterer

We'll show you how you can write your own Log Clusterer with the example of BorderFlow [<http://borderflow.sourceforge.net/>]

```
public class BorderFlowClusterer implements Clusterer{

    private String harden;
    private Double threshold;
    private Boolean testOne;
    private Boolean heuristic;
    private Boolean caching;
    private Integer minNodes;

    @Override
    public String cluster(String logPath, String queriesFile){

        String clusterOutput = "cluster.log";

        String sortedFreqFile = getSortedFrequency(logPath);
        String simFile = getSimilarities(sortedFreqFile);

        borderFlow(harden,
            threshold,
            testOne,
            heuristic,
            caching,
            minNodes,
            sortedFreqFile,
            simFile,
            clusterOutput,
            queriesFile);

        return queriesFile;
    }

    @Override
    public void setProperties(Properties p){
        harden = p.getProperty("harden");
        threshold = Double.valueOf(p.getProperty("threshold"));
        testOne = Boolean.valueOf(p.getProperty("test-one"));
        heuristic = Boolean.valueOf(p.getProperty("heuristic"));
        caching = Boolean.valueOf(p.getProperty("caching"));
    }
}
```



```

    minNodes = Integer.valueOf(p.getProperty("min-nodes"));
}

private void borderFlow(String clusterHarden, double connThreshold,
    boolean testOne, boolean heuristic,
    boolean caching, Integer minNodes,
    String inputQueries, String input,
    String clusterOutput, String output)
    throws IOException{

    //This is the main class of the borderflow jar
    Main.borderFlowDemo(input,
        clusterOutput,
        connThreshold,
        testOne,
        heuristic,
        caching,
        HardenStrategy.valueOf(clusterHarden));
    rankAndChoose(inputQueries, clusterOutput, output, minNodes);
}

private void rankAndChoose(String input, String cluster,
    String output, String minNodes){

    /*
     * DO: rank the given input queries with their cluster bigger
     * than minNodes as you wish and write the choosen final
     * queries in the output file.
     */

}

private String getSortedFrequency(String logPath){

    /*
     * DO: Calculate Frequences of the queries in the logPath
     * Then sort them after their frequency
     */

}

private String getSimilarities(String sortedFreqFile){

    /*
     * DO: Calculate Similarity between the given queries
     * in the sortedFreqFile
     */

}

}

```

## 5 Further information

### 5.1 Links

Beware that these following information can be outdated

website	<a href="https://aksw.github.io/IGUANA/">https://aksw.github.io/IGUANA/</a>
distribution	<a href="https://github.com/AKSW/IGUANA/tree/master">https://github.com/AKSW/IGUANA/tree/master</a>
javadoc	<a href="https://aksw.github.io/IGUANA/javadoc">https://aksw.github.io/IGUANA/javadoc</a>
source code	<a href="https://github.com/AKSW/IGUANA">https://github.com/AKSW/IGUANA</a>
issue tracker	<a href="https://github.com/AKSW/IGUANA/issues">https://github.com/AKSW/IGUANA/issues</a>
contact information	<a href="mailto:mail2cpg@studserv.uni-leipzig.de">mail2cpg@studserv.uni-leipzig.de</a>
Border Flow (Clustering algorithm)	<a href="http://borderflow.sourceforge.net">http://borderflow.sourceforge.net</a>
DBpedia SPARQL Benchmark	<a href="http://aksw.org/Projects/DBPSB.html">http://aksw.org/Projects/DBPSB.html</a>
adjusted wookieConnection	<a href="https://github.com/AKSW/IGUANA/blob/develop/de.uni_leipzig.iguana/src/main/resources/lib/connection-0.0.1-SNAPSHOT.jar">https://github.com/AKSW/IGUANA/blob/develop/de.uni_leipzig.iguana/src/main/resources/lib/connection-0.0.1-SNAPSHOT.jar</a>

### 5.2 License

IGUANA itself is licensed under LGPL [A], but be aware that there are libraries we use which are licensed under different licenses.

## References

- [1] S. Duan, A. Kementsietsidis, K. Srinivas, and O. Udrea. Apples and oranges: A comparison of rdf benchmarks and real rdf datasets. In *Proceedings of the 2011 ACM SIGMOD International Conference on Management of Data*, SIGMOD '11, pages 145–156, New York, NY, USA, 2011. ACM.

## A LGPL

### GNU LESSER GENERAL PUBLIC LICENSE

Version 3, 29 June 2007

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