

NoSQL DBMS based on a new Data Model

Ikarus DataBase Engine

Content:

1	Introduction:.....	2
2	Operations:.....	3
2.1	JSON Objects:	4
2.1.1	store.....	4
2.1.2	get.....	4
2.1.3	delete.....	5
2.2	S-Collection Objects:	5
2.2.1	makecoll	5
2.2.2	deletecoll	6
2.2.3	insertcoll	6
2.2.4	removecoll	7
2.2.5	getcoll	7
2.3	Extra operations:	8
2.3.1	reset.....	8
3	Ikarus DataBase Engine:	8
4	Ikarus DataBase Engine Client:.....	8
5	Additional Information:	8

1 Introduction:

A DataBase Management System requires a defined Data Model. This Data Model consists of two major pieces. On the one hand Data Objects/Structures have to be classified, on the other hand a set of Operations have to be defined. This leads us to the following scheme.

Data Model:

Data Model = <Data Objects, Operations>

Data Objects:

*Data Object = <JSON file + unique ID>
<SCollection + unique ID>*

Operations:

operation name(parameter1, parameter2,) => return_value

The NoSQL DBMS will build up on the database engine, implemented as a web service, as its foundation. It is using persistent data objects encoded as JSON files. These data objects are identifiable by their unique ID and can be combined into S-Collections which themselves are also identifiable by their own unique CID.

For the web service the Java API for creating XML web services, JAX-WS will be used (available with Java EE 1.6+).

The Database Engine will support (at least) the following operations:

- Store, Modify and Delete data objects
- Create and Delete S-Collections.
- Insert and Remove members into/from S-collections.
- Search data objects and S-collections;
- Scan a list of data objects and get the JSON.

The engine is reachable under "http://coronet2.iicm.tugraz.at:8080/lkarusDBEngine/"

A test client is reachable under "http://coronet2.iicm.tugraz.at:8080/lkarusDBEngineClient/"

2 Operations:

There are three core web service operations regarding JSON objects: **store**, **get**, and **delete**. **store** creates a JSON object within the engine and automatically assigns a 6 digit ID to it. **get** retrieves a JSON object, referenced by a 6 digit ID, previously stored within the engine. **delete** erases a JSON object, referenced by a 6 digit ID, that is stored within the engine.

Five additional operations expand the engine's functionality by creating/manipulating/deleting sets of JSON objects, so called S-Collections(see X): **makecoll**, **deletecoll**, **insertcoll**, **removecoll** and **getcoll**.

makecoll creates a S-Collection by receiving a JSON object ID and a name for it. The object ID is automatically assigned as the head object of the recently created S-Collection.

deletecoll erases every information about the S-Collection, referenced by a 6 digit CID (with an additional pre-literal "s-") that is stored within the engine.

insertcoll adds a JSON object to an already existing S-Collection. The number of S-Collection members is limited by the maximum number of JSON objects existing at the same time (999.999).

removecoll eliminates a JSON object from a specific S-Collection. Note that the head object of a S-Collection cannot be removed, as S-Collections per definition require at least one member to exist.

getcoll behaves similar to get, but instead of returning the content of a JSON object it returns a String containing every member of an S-Collection (e.g. head_id1,id2,id3).

All operations require at least one String as an input and also return a String as an output. The reason behind this is, to keep the engine lightweight, easy to use and consistent. The operations regarding S-Collections only manipulate references to JSON objects, not the objects themselves. As a result, the manipulation of S-Collections may never change, corrupt or erase any data stored within the engine.

An additional operation, a hard reset of the engine, also belongs to the basic set of operations. **reset** resets the web service/engine to a point, that is according to the first start of the engine. This operation is designed to only be used by administrators and thus should never be presented to the user directly.

2.1 JSON Objects:

2.1.1 store

store(String json_content) => String json_id

The store operation takes a JSON file, parsed as a String, as an input and will return the unique ID of the JSON file to be stored within the DataBase. The ID's will be assigned automatically during a successful invocation of the store operation. ID's will always consist of a 6 digit number - ranging from 000001 - 999999 as the last valid object ID. A call of store with an empty String (= null) will fail.

e.g.:

<code>store("{example content...}")</code>	<code>=> 000001</code>
<code>store("")</code>	<code>=> null</code>

2.1.2 get

get(String json_id) => String json_content

The get operation takes a unique ID as an input. The ID passed to this operation has to follow the requirement of a 6 digit number, corresponding to the return value of store. Meaning that, 000001 would be accepted, but neither 1 nor 001 would comply. The return value, in case of a call with a valid ID that is already stored within the DataBase, will return the JSON object parsed as a String. In case of an invalid call, either consisting of an invalid ID, or in case that nothing is stored within an maybe not yet existing object, referenced by the given ID, will fail.

e.g.:

<code>get("000001")</code>	<code>=> "{example content...}"</code>
<code>get("01")</code>	<code>=> null // invalid ID</code>
<code>get("")</code>	<code>=> null // empty ID</code>
<code>get("012345")</code>	<code>=> null // nothing stored</code>

2.1.3 delete

delete(String json_id) => String json_id + " deleted"

The delete operation erases all information a specific JSON object stored within the DataBase, referenced by the given ID. Despite that, delete behaves very similar to the get operation and returns either, in case of a successful call the specified ID followed by a "deleted" String literal, or will fail, in case of an invalid call, e.g. the JSON file is not stored within the DataBase.

e.g.:

<code>delete("000001")</code>	<code>=> "000001 deleted"</code>
<code>delete("01")</code>	<code>=> null // invalid ID</code>
<code>delete("")</code>	<code>=> null // empty ID</code>
<code>delete("012345")</code>	<code>=> null // nothing stored</code>

2.2 S-Collection Objects:

2.2.1 makecoll

makecoll(String coll_name, String head_id)
=> String coll_id + "(" + String coll_name + ")"

The makecoll operation takes two parameters as an input: The first parameter is a freely choose able name, used to give a human readable identifier besides the CID(Collection ID). The second parameter is the ID of the JSON object to be marked as HEAD for the new S-Collection. The makecoll operation will return a unique CID, automatically assigned at runtime, for the newly created S-Collection. The collection ID will consist of a String literal "s-" plus a 6 digit number (same requirements as needed for the JSON object ID) followed by the specified name in brackets.

e.g.:

<code>makecoll("mycollection", "000001")</code>	<code>=> "s-000001(mycollection)"</code>
<code>makecoll("", "000001")</code>	<code>=> null // invalid name</code>
<code>makecoll("test", "015")</code>	<code>=> null // invalid id</code>

2.2.2 deletecoll

deletecoll(String coll_id)
=> String coll_id + "(" + String coll_name + ")" + " deleted"

The deletecoll operation takes the unique CID as an input. The return value is the same from the makecoll operation with an additional " deleted" String literal appended. Its additional behaviour is identical to the delete(json_id) operation.

e.g.:

```
deletecoll("s-000001")           => "s-000001(mycollection) deleted"
deletecoll("000001")             => null // invalid coll_id
```

2.2.3 insertcoll

insertcoll(String coll_id, String json_id)
=> String json_id " successfully inserted into " String coll_id + "(" + String coll_name + ")"

The insertcoll operation takes 2 parameters as an input: Firstly the CID of the S-Collection to be inserted into and secondly the ID of the JSON object to insert. It will either succeed, given that the ID's are correctly entered in addition to the S-Collection already existing. It will fail, if any of the above mentioned requirements aren't fulfilled.

e.g.:

```
insertcoll("s-000001", "000002")
=> "000002 successfully inserted into s-000001(mycollection)"
insertcoll("000001" "000002")           => null // invalid coll_id
insertcoll("s-000001", "002")           => null // invalid json_id
```

2.2.4 removecoll

removecoll(String coll_id, String json_id)

=> String json_id "successfully removed from " String coll_id + "(" + String coll_name + ")"

The removecoll operation takes 2 parameters as an input: Firstly the ID of the S-Collection to be inserted into and secondly the ID of the JSON object to remove. It will either succeed, given that the ID's and the name are correctly entered in addition to the S-Collection already existing. It will fail, if any of the above mentioned requirements aren't fulfilled. Additionally, the removecoll operation will fail if the size of the S-Collection equals 1 (meaning that only the head object of the collection remains) - Existing S-Collections always require at least one element (= head), thus the head object can never be removed.

e.g.:

```
removecoll("s-000001", "000002")
=> "000002 successfully removed from s-000001(mycollection)"
removecoll("000001", "000002")           => null // invalid coll_id
removecoll("s-000001", "002")             => null // invalid json_id
```

2.2.5 getcoll

getcoll(String coll_id) => String head_and_members

The getcoll operation takes the ID of the S-Collection to be searched as an input. The return value is a String starting with the head of the S-Collection, followed by the other members of the collections - the elements are separated by commas ','. It will fail, if the S-Collection doesn't exist or the CID is invalid.

e.g.:

```
getcoll("s-000001")           => "000001,000002,000004"
getcoll("000001")             => null // invalid coll_id
getcoll("s-000420")           => null // S-Coll. doesn't exist
```

2.3 Extra operations:

2.3.1 reset

reset(String passphrase) => String success

The reset operation is a feature to clear the DataBase without restarting the server completely. As a passphrase enter "IKnowWhatlamDoing" to clear all JSON objects and S-Collections stored within the DataBase as well as the automatically assigning ID counters.

e.g.:

```
reset("IKnowWhatlamDoing")
=> " Database was successfully cleared!"
reset("")                    => null // empty passphrase
reset("IDontKnowWhatlamDoing") => null // wrong passphrase
```

3 Ikarus DataBase Engine:

TODO

4 Ikarus DataBase Engine Client:

TODO

5 Additional Information:

TODO