

## QA & Testing



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## 1 Introduction

This document is about the testing and quality assurance phase of the program WHAT WareHouse Analyzing Tool. It contains descriptions of the components of the program tested, the individual tests, the produced results as well as the bugs and problems uncovered in the process. There are also some comments about the programming and code style in general.

The tests are grouped by tasks of the program, which also mostly were in separate packages. The sections of this document follow this structure and complete it with the general sections concerning the whole program.

The functions which have to show the correct web pages or produce correct SQL query where tested by hand. This means that for a configuration and data we tested, if correct looking MySQL queries where produced and correct web pages or charts where shown. But more about this in the specific sections.

We will also describe how we made use of the testing capabilities of the build managers, and the travis continuous integration service.

Additionally, we mention our steps taken to secure the program.

The last section (11) is about the compliance with the requirements set during the functional specification phase.

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## 2 General

This section is about things concerning the whole system.

### 2.1 Coding style

In general value on good coding style was set. This is mostly the aspect of task division to classes and methods. To implement this some classes were totally redesigned and lots of new classes were created. This also helped another important aspect, object oriented programming. So for example a chart host storing all tables, names and filters as Strings and sets, developed to a class containing only one String per axis, Filter objects, which wrap dimension and other objects, and a Measure object, to hold all information, needed for MySQL queries for this chart.

Another aspect was the reuse of code. Reviewing the code, showed that some packages need the same functions, e.g. for reading from JSON object. To bundle this functions and decrease duplicate code some utility classes (3.1) were created.

See the sections of the packages for details.

### 2.2 Structure

We noticed that packages and folders in the application folder app from the play framework the application and the web tier weren't separated. This separation was arranged. The data access tier was considered to be a sub-tier of the application tier.

---

#### Change detail

- Restructure folders and packages to fulfill tier separation

### 2.3 JavaDoc

JavaDoc wasn't written strictly for all packages, classes, methods, attributes and constants. But with the help of CheckStyle (2.4) all of the laziness was uncovered and the JavaDoc written. The quality of JavaDoc is always a matter of opinion, but in the view of the writers it's adequate to its needs.

---

#### Change detail

- Missing JavaDoc written

### 2.4 CheckStyle

When starting CheckStyle first with the standard checks there were about 7290 warnings. Searching where they came from, we found out, that the library of GeoIP from MaxMind,

which was included as a package to make some adjustments, produced 6060 of them. So there seemed to be about 1230.

Adjusting the CheckStyle configuration to checks we thought were useful left only 535 warnings. Those were mostly handled. Only the warning that there should be no hard coded Strings, where ignored, where HTML code was build.

---

#### Change detail

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- CheckStyle warnings fixed

data : 82 config: 57 chart: 85 what: 29 web: 130 controllers: 60 parser: rest

Additionally, there were found 28 javascript warnings, 21 of whom in the charts. This relatively low number can be attributed to the usage of jshint instead of jslint.

## 2.5 Error messages

Stack traces were replaced with meaningful error messages where needed.

---

#### Change detail

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- Replace stack traces with error messages

## 3 Facade, Helper

The Facade and utility classes are placed in the highest package of the application tier.

### 3.1 Utility classes

To bundle some functions needed in more than one package some utility classes were created. They also made error handling and testing easier.

---

#### Change detail

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- New utility classes created

This classes are described below.

#### 3.1.1 FileHelper

Reading configuration files and reading log files share methods. This includes getting the file, checking its existence, rights and file extension. These functions were collected in the class *FileHelper*.

#### 3.1.2 JSONReader

The configuration and parts of the communication between web tier and data tier is accomplished with JSON objects. Also reading and extracting from them is bound with possible exceptions and try-catch blocks. To reduce duplicate code and provide easier access the *JSONReader* class was created.

#### 3.1.3 Printer

The class *Printer* was created to unify error, failure, problem, test and success messages.

### 3.2 Facade

The facade's main functions are initializing everything and then direct incoming requests to the specific mediators.

One problem found was that the creation of tables for the database caused several problems for testing and when they changed. The creation of them was solved dynamically so that one just had to drop the old tables and when the system started, they would be created automatically.

---

#### Change detail

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- Automatic check of the table existence and their creation.

### 3.3 Testing

The facade is tested via its use. If it wouldn't work or show any problems nothing between web tier and application tier would work.

The Printer works fine.

The other classes have a JUnit test class.

---

#### Test details

---

- test FileHelper with wrong file and nonexistent files
- test whether needed Files for the system exist via FileHelper
- test all methods of JSONReader with correct keys
- test all methods of JSONReader with incorrect keys



## 4 Configuration file

This section is about the part of the system reading the configuration file and handling its information.

### 4.1 Requirements

We decided that every configuration file and the order of the rows have to follow these requirements:

- starts with time rows
  - rows contain the String 'time'
  - 6 time rows
  - order: year, month, day, hour, minute, second
- has an IP row which follows time
- any other rows, which must be dimension (level > 0) if they are not of type integer or double
- rows of one dimensions follow each other with rising level
- integer or double rows are automatically measures
- at least 1 measure
- statement is at the last position

For configurations following this requirements the system should run successfully now. Some of the things are checked, some would cause a crash of the build anyway.

---

#### Change detail

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- Check the requirements to a configuration file

### 4.2 Creation

The reading of the configuration file was made easier with the *JSONReader* (3.1.2). Because of this the easy creation of the *ConfigWrap* was placed in the *ConfigWrap* itself as a static factory without the need of any helper class.

---

#### Change detail

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- Static factory machine for *ConfigWrap* without special helper class

### 4.2.1 Unneeded attributes

There were unneeded and senseless attributes for all rows in the configuration. They got deleted and replaced by 'N/A' in the reading process.

---

#### Change detail

---

- Set deleted and unneeded row attributes to 'N/A'

### 4.2.2 Space in names

It was not possible to have spaces in names of rows, dimensions or a configurations. This produced incorrect table and column names in the database.

---

#### Change detail

---

- Allow row, dimension and configuration names with space

### 4.3 StringRow

The *StringRow* had unneeded functions. The idea was to store all possible Strings of a row in it. But not really knowing what could be content of the log files, the Strings are read directly from the log files and stored in the warehouse. So the old functions got obsolete.

---

#### Change detail

---

- Remove unneeded functions of *StringRow*

### 4.4 Dimension content trees

The actual existing content of a String dimension is requested from the warehouse and stored. This was made with a construct of *HashMaps* and *TreeSets* of String containing itself or not. It was a bad approach to build a tree.

This was changed with a new class *DimKnot* which forms tree structures. Instances of it also contain information about the level they are on, which makes it much easier to build MySQL queries dynamically from them.

---

#### Change detail

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- *DimKnot* tree structure instead of bad *HashMap* + *TreeSet* approach

### 4.5 Child dimensions

All *DimRows* had a field for trees and time interval. To make this more efficient and object oriented it was changed by adding to child classes of *DimRow*.

---

#### Change detail

---

- Child classes *TimeDimension* and *StringDim* for *DimRow*

### 4.6 Testing

The configuration file and the test configurations were parsed and printed. This seems test enough that it is read correctly.

The trees of the *DimKnots* were tested by checking what values are actually in the database and if they all appear on the web page.

---

#### Test details

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- Two new test configurations
- Parsing with 2 valid test configurations
- Look at web page after parsing if everything fits too
- Parsing with invalid test configurations

## 5 Parser

### 5.1 Task determination

When having too many threads (10+), sometimes a thread stopped working. This caused the counter for finished tasks to be stuck below the number of threads and the program not to get finished. So a watchdogtimer was implemented which replaces a thread by a new one, if said thread doesn't finish a line for a predefined amount of time. (standard = 2 seconds)

---

#### Change detail

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- Added watchdogtimer.

### 5.2 Negative or too high poolsize

The parser works with a pool of threads, which are created when parsing. In the Parser-Mediator there is a variable poolsize, which is the used poolsize for parsing. When using a negative or a really high number (tried Integer.MAX\_VALUE), the program crashes. So we implemented a check for the poolsize, which looks if it is between 1 and 50 and stops parsing if it isn't.

---

#### Change detail

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- Check for invalid poolsize before parsing.

### 5.3 NullPointerExceptions when correct file doesn't exist

sp\_parser.Logfile had a check, if the file which is given to it is actually existent. It used the file-class from java and got a NullPointerException, which was caught and used as an indicator, that there is no file for the correct name.

This worked, but to improve our program, we used a class called *FileHelper* (??). It didn't return a NullPointerException when the file doesn't exist, so this check got overrun and the parser 'thought' that there is a correct file, which was not the case. This caused the program to crash.

---

#### Change detail

---

- Use and correct use of *FileHelper*

### 5.4 Whitespace in entries

Some log files contain unneeded whitespace, which produce incorrect data. This was fixed by adding the trim-command in StringRow.split() and StringMapRow.split()

---

#### Change detail

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- Trim the strings before sending them to the database.

### 5.5 Anonymous Proxy

Geolp sometimes returned 'Anonymous Proxy' instead of nothing for cities or countries it didn't find. This gets replaced by 'other' to fit in with the other undefined countries and cities.

---

#### Change detail

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- Check for anonymous proxy

### 5.6 Check for missing or empty parts

The parser now checks whether a part of the line parsed is missing or empty. In this case the line is ignored and the count for incorrect lines gets incremented.

---

#### Change detail

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- Check for missing or empty part in every line
- Flawed lines are not accepted

### 5.7 Only accept when enough lines submitted

Added final static double CORRECT, a double between 0 and 100, which indicates how many percent of the lines need to be submitted correctly for the ParserMediator to return true, signaling parsing was successful.

---

#### Change detail

---

- Only accepts when more than a specific amount of lines are accepted.

### 5.8 Reset

The parser now resets after it finished parsing a logfile, so that another file can be parsed.

---

#### Change detail

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- added a reset-method in the ParserMediator

## 5.9 Testing

Besides the JUnit tests, described below, there were some test by hand. Parsing log files with just a few lines into an empty database. Then compare the content by hand.

---

### Test details

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TODO group them, like the comment in the JUnit class TODO not newest version!!

- Mistakes
  - testIntegerMistake - parse 10 lines with year "2013apples" instead of "2013"
  - testMissingPart - parse 10 lines with one line with a missing statement
  - testEmptyPart - parse 10 lines with one empty statement and one empty year
  - smallParseTestEmptyLine - parse 10 lines with an empty line in between
  - flawedFile - try to parse from a file with a typo in "type" -> Error #11: The configuration file got a different format.
- Poolsize
  - smallParseTestSize10 - parse 10 lines, poolsize 10
  - smallParseTestTooBig - parse 10 lines, poolsize 100 -> Error #2: ParserMediator.poolsizeParsing is bigger than 10.
  - negativePoolsize - parse 10 lines, poolsize -2 -> Error #1: ParserMediator.poolsizeParsing is smaller than 1.
  - mediumParseTestSize50 - parse 1000 lines, poolsize 10
- Just parsing
  - smallParseTestStandardSize - parse 10 lines, standard (5) poolsize
  - mediumParseTestStandardSize - parse 1000 lines, standard (5) poolsize
  - bigParseTestStandardSize - parse 30k lines, standard (5) poolsize
  - doubleParsing - parse 1000 lines twice from separate files
- Ignored
  - veryBigParseTestStandardSize (IGNORED) - parse a whole month, standard (5) poolsize, ignored because it may take hours to finish.

## 6 Chart requests

### 6.1 Object oriented programming

The original design for this package was dropped in the implementation phase. There was neither a visitor pattern nor classes to wrap the information needed efficiently. This decision was withdrawn.

#### 6.1.1 Chart request workflow

The parameter lists in the methods got longer and longer when implementing the missing filter features and the charts with two dimensions.

Something we didn't want to do at first, solved the problem. The problem with the *ResultSet* closing, when closing the statement, made it necessary to write the *JSONObject* of the charts in the data access tier. So the decision was made to send the whole chart instance down to the data access tier.

---

##### Change detail

- Chart itself is parameter of chart requests

Instead of requesting all the information now from the chart and create the MySQL queries, this got changed to a more elegant way. The chart itself returns query parts for the things like SELECT, JOIN or other.

---

##### Change detail

- Creating of query parts in the chart

But it remained a bulge of information stored improperly. This was solved with some classes described below.

#### 6.1.2 Filter class

Instead of requesting all query parts from the config, like table names and keys, a filter stores the dimension on which it is based. First just the lowest level of the filter values was stored, but this was detected to be incorrect. A database may be child of more than one server and a city with the name 'x' may be city in more than one country. For correct filtering, referring to the things selected on the web page, trees were made for this values to build correct filter query parts.

---

##### Change detail

- *Filter* class to wrap information of a filter
- trees of filter values instead of sets without parents

### 6.1.3 Measure class

The approach to store just a string for the measure was neither good style nor was it possible to have other aggregations than `count(*)`. This was solved by the new class *Measure*. It made it also possible to write more information in the JSON sent back to the web page about what the returned chart is.

---

#### Change detail

- *Measure* class to wrap information of a measure

### 6.2 SQL injection

It could have been possible to run SQL injections against the database by using filter values as injection holes. Comparing the values of filters parsed from a chart request JSON with the actual values in the warehouse should have closed this hole.

---

#### Change detail

- Protection against SQL injection

### 6.3 Two axis of same dimension

By playing with the chart we detected that queries for charts with x- and y-axis of the same dimension incorrect queries were created, resulting in not getting a chart.

---

#### Change detail

- Make it possible to create charts with x and y of same dimension

### 6.4 Testing

Correct reading of the JSON-Objects was tested by explicit use of filters, axis and measures, then printing the requests and comparing with the resulting MySQL queries. We couldn't see the usage for any automatic tests there.

Creating the queries from the chart host was tested in the same way.

---

#### Test details

- Print read data and check for correctness corresponding to web page request
- Print queries and check correctness



## 7 Data access

### 7.1 Tables

««««< HEAD Instead of creating tables by hand for every configuration file, functions were added to make it possible creating tables dynamically from a configuration. This automatically needed another feature, storing for which configurations the tables were already created. ===== Instead of creating tables by hand for every config file, functions were added to make it possible to create tables dynamically from a configuration. This depended on another feature, storing the configs for which the tables had already been created. »»»»> 031fc978cfa837912d51702ed274b07180fd9ff1

---

#### Change detail

---

- Add feature to create tables dynamically
- Add feature to store and check if tables for configuration are already created

There showed up problems with the time and location table ««««< HEAD which are always the same. Therefore the creating query ===== which are always the same. Therefore the created query »»»»> 031fc978cfa837912d51702ed274b07180fd9ff1 was changed to CREATE IF NOT EXISTS.

Below are the creation queries for the SkyServer tables. TODO codebeispiel

---

#### Change detail

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- Change table creation query to allow same tables for more configuration

If dimensions of different configurations have the same name - except time and location - will cause incorrect work. The table names are created from the dimension names. It was decided to give the dimensions always a new name. If this is not wanted, it could be changed by concatenating the configuration name with dimension name and the dimension table short to create the table name.

### 7.2 Uploading

#### 7.2.1 Query trunks

With every new request uploading a *DataEntry* the queries for fact and dimension tables were computed completely. To avoid this unnecessary work, the trunks of the queries now get precomputed.

---

#### Change detail

---

- Precompute trunks of upload queries

### 7.2.2 Generating keys with HashBuilder

For every dimension the key of a row is needed in the fact table. Instead of trying to upload the dimension data and get a auto generated key if possible, otherwise requesting the key by hand, the keys are generated with a *HashBuilder* now. The builder gets all items of a row and returns a hashed key, which is used for the upload of the dimension data and the fact table.

---

#### Change detail

- Generating keys with *HashBuilder*

### 7.2.3 No auto committing

Every dimension and the fact table rows were committed one by one. Decreasing the overhead the statement was set to no auto committing. This made it possible to collect all the upload queries in the statement and send them to the database all at once.

---

#### Change detail

- Use no auto committing statements for upload
- Execute all upload queries of on *DataEntry* at once

There was a try to use a second connection pool for the no auto committing connections. They got set to no auto committing once. But this didn't work out, because it seemed, that they didn't store this behavior. So it was changed back to the old strategy changing every used no auto committing connection directly before the use.

## 7.3 Extracting

(SELECT \* FROM tablename WHERE ...) AS nickname was used first to filter the dimensions. This was changed to the more easy to build and, as it seemed, faster version with JOIN tablenames ON .... Making queries got easier because you just have to list the table names, the key filters to the fact table and the conditions of the dimensions.

---

#### Change detail

- Use JOIN instead of SELECT \*

As mentioned before (6.1.1) the new approach with the chart host being a parameter of a chart request and the creating of query parts directly in the chart host made it more easy to build the complex queries. Below is a possible query.

TODO codebeispiel

## 7.4 Closing

There showed up problems, when the system was started often without starting the MySQL server new. The number of connections getting from a MySQL server is limited. With every creation of a *Facade* with a configuration file there are also created all the mediators, including the *DataMediator*. This triggers the creation of a connection pool. So when the system is started to often MySQL will run out of connections and the connection pool won't be created.

Starting the play server to often will face this problem. But this shouldn't happen in a normal operation mode.

In the JUnit tests the *Facade* is reset with nearly every test. So the problem could be solved by releasing all connections when resetting the *Facade*.

---

### Change detail

- Release connections when resetting *Facade*

## 7.5 MySQL queries + Testing

The queries were produced in all conscience. This means it was tested in the MySQL workbench how the queries have to look and what would work. Knowing this the code producing this queries was implemented.

To test whether correct queries are produced they were printed for several requests and checked by hand if they are of the wanted format.

After uploads of small log files the tables were examined whether they contain all and the correct data. It was also checked whether the filter options on the web page contain all the possible data in the tables. For a small amount it was checked whether the requested data of charts was reasonable. Or for filters for which no data exists, whether the data returned is really empty.

---

### Test details

- Print all queries and compare to wanted queries
- Compare data in tables to parsed log files
- Compare String on web page filters to data in tables
- Compare chart data with requests and tables

## 8 Web

Web seite betreffende Dinge. Meiste wird durch sehen getestet. Aber eben auch Dinge die sicherstellen, dass bei falscher Config nix passiert, dass ohne daten nix passiert

charts einfach so einfuegen

adminzeugs

sprachen

etc

## 9 Charts

The charts saw a fair amount of bug fixes and improvements as well.

### 9.1 Bug fixes

#### 9.1.1 Type of data

The SkyServer contained a significant amount of categorical data. However, their representation on the axes used to cause problems. The charts are now more robust and work with both numerical and categorical data.

---

##### Change detail

---

- Make charts robust against varying data

#### 9.1.2 Error

Errors are now thrown to differentiate between the chart with no data, and the chart with an error, or incorrect data (which the user will hopefully never experience). This was a especially a problem at the Bubblechart, where no axis are printed.

---

##### Change detail

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- Show error pictures to diverge them from empty data

#### 9.1.3 Boring bugs

Boring bugs, such as the text on the data was off by a few pixels were fixed too.

### 9.2 Aesthetics

The charts were made prettier.

---

##### Change detail

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- Tooltips, or text that appears once the mouse hovers over a data point was added to every chart
- Consistent font use
- The text now gets rotated on a number of cases to fit more datapoints. It also makes the charts prettier
- Change the css

### 9.3 Special cases

TODO wie zB nicht viele eintr in barchart TODO kleine bubble charts, nur buchstaben anzeigen falls dir noch was einfällt

---

#### Change detail

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- Show a few amount of bars correct in barchart
- Just show sinle or no letters for small bubbles in bubblechart

### 9.4 Testing

We tested by hand. Something that made testing in this section easier is that it is possible to know how a chart is suppose to look when correct, as well as the charts consisting of different more or less discrete parts - for example, it is easy to tell when just an axis is broken. Also, it is nice to return to a chart to see how nice someone made the css this time.

We also let some project extern person test and use the charts.

---

#### Test details

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- Test by selecting axis, measure and filter combination
- Let project extern people use charts

## 10 Performance

We should test the performance and then check how we could get it better.

### 10.1 Loading

Parsing of 1k lines with old upload schema:

1. 19048ms
2. 22033ms
3. 11020ms

Parsing of 1k lines with new upload schema:

1. 11016ms
2. 10017ms
3. 11017ms

Lukas hat noch mehr Zeiten, werde diese dann Eintragen und was gescheites drauss machen. Das oben war nur um meine zu speichern.

Werd dann noch Test machen, wie lange es dauert, ganze Monate hochzuladen und danach, wie lange eine Chart anfrage braucht. Sobald der Upload wieder geht

### 10.2 Extracting

## Security

While our program does not store user data, we still took precautions to secure it against potential attackers by examining potential attack vectors, and took action to prevent them.

### 10.3 User Input

There is no free form text user input, and it never gets displayed back. In addition, because of the tiered architecture, the data from the tier above gets checked multiple times for validity. This happens both at the web server level, and at the database access level. @joklawitter @ocjojo details?

### 10.4 Authentication

We use the java play authentication mechanisms. The user session has a cookie named PLAY\_SESSION, which is a long hash, different between computers.



## 11 Requirements

TODO: wie gut wir die sachen erfuehlt oder nicht erfuehlt haben, was es mehr gibt oder fehlt und so zeugs