

## D22 - MOME Data Analysis Workstation

### Abstract

Deliverable 22 documents the implementation and deployment of the MOME Data Analysis Workstation in TERENA's data center. Starting from the high level design of the MOME Database, documented in D21, this document covers the low level design of the MOME Database Graphical User Interface(GUI).

The MOME database model finally deployed in the MOME Data Analysis Workstation is an enhancement of the initial design of Deliverable D21, due mainly to the synchronisation of the work of Workpackage 1 and Workpackage 2.

### Keywords

MOME, Deliverable D22, MOME Data Analysis Workstation, Tools and Interoperability Database, Design, Database Requirements, Implementation, Meta-database, State of the Art, IST

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## List of Acronyms

WP	Workpackage
GUI	Graphical User Interface
CLI	Command Line Interface
GPL	General Public License
PHP	PHP: Hypertext Preprocessor
ACID	Atomicity, Consistency, Isolation, Durability
HTTP	Hypertext Transfer Protocol
QoS	Quality of Service
URI	Universal Resource Identifier
CLI	Command Line Interface
CGI	Common Gateway Interface
FAQ	Frequently Asked Questions

## Executive Summary

Deliverable 22 documents the implementation and deployment of the MOME database server and GUI at TERENA's facilities. Starting from the high level design of the MOME Database, documented in Deliverable 21 [2], this document covers the low level design of the MOME Database Graphical User Interface (GUI).

The database finally deployed is an enhancement of the initial design of Deliverable D21, due mainly to the synchronisation of the work of Workpackage 1 and Workpackage 2.

This document is structured as follows:

- Chapter 1 provides an update on the state of the MOME Database compared to its state as documented in D21. It also shows the state of the installation progress of the MOME Data Analysis Workstation.
- Chapter 2 updates the functional requirements of the MOME Database, which were initially defined in D21
- Chapter 3 provides an overview of the MOME Data Analysis Workstation deployed in TERENA's data-centre
- Chapter 4 updates the MOME Database specification, taking into account the cross-WP integration, which has taken place after the issue date of D21
- Chapter 5 documents the implementation of the system
- Chapter 6 is the User's Guide of the MOME Database

Low level technical documentation is included in the appendices:

- Appendix A is the Hardware and Software Requirements
- Appendix B is the System Test Documentation

## 1 Introduction

The MOME database has had during the period between D21 and D22 a very drastic evolution from a concept of a measurements-only database and a tools-only database with parallel user management to an integrated measurements and tools database with a user table which provides the logical link between both.

### 1.1 State of the MOME database at the delivery of Deliverable D21

The MOME database of Deliverable D21 [2] was defined according to the initial concept of two independent databases, one for tools and one for measurements, which had independent user management. The work of D21 was considered complete with the deployment of a prototype database in a development server at Salzburg Research premises. This prototype of the MOME database was used for the development of the Web interface to be deployed in the MOME workstation.

### 1.2 Evolution of the MOME measurement database until the present deliverable.

In parallel, work on the tools database to be delivered by Workpackage 1 as Deliverable 12 [3] unveiled many common functions between the tools and the measurement database. In order to maximise reuse of common functions within the MOME project, the MOME measurement database has evolved towards an integrated tools and measurement database. The measurement tables maintain the paradigm defined in D21 of a central table holding common measurement data and integrating different, measurement type specific tables. The rationale behind the new integrated MOME database design is the following:

1. Users submit trace meta-data and information on tools and request tests
2. Tests require tools
3. Tools use and produce data

It is clear, that the tight relationship between the three actors calls for the new, integrated MOME database structure, which is discussed in chapter 4.

## 2 Requirements for MOME Database

In this section we discuss the requirements considered in the design and implementation of the MOME Workstation. The list of requirements is split into three parts: functional requirements which define the capabilities of the MOME Workstation, scalability requirements related with expected performance of the system, and security requirements for user management and data storage.

### 2.1 Functional requirements

The MOME Workstation consists of three main functional components: the Web Server, the Database, and the Data Analysis Server.

#### 2.1.1 The Web Server

The Web Server implements the Graphical User Interface (GUI) providing access to all functionalities of the MOME Workstation. The GUI functions are implemented in PHP language and are accessible by a public web page, compatible with commonly used web browsers.

The required functionalities of the MOME Workstation (see Table 2-1) have been specified on the basis of database usage cases described in [2]. Functions specific for the measurement tools database [3] have also been included for completeness of description. The functions are marked with the symbol of importance (three stars denote the most important ones), which also has determined the order of implementation work.

	Name	Remarks	Importance
1	Create user identity	User browsing the MOME web page can enter the user management screen and register to the MOME system.	***
2	Login / logout	The registered user can login to the system and logout after finishing the session. Login is based on the user name and password.	***
3	Different user roles	The users of MOME Workstation have different roles and privileges in the system: administrators, registered users, non-registered users.	***
4	Add tool entry	The registered user can upload the description of new measurement tools.	***
5	Modify or delete tool entry	The submitter of measurement tool description (as well as the administrator) can modify or delete the previously submitted entries.	***
6	Add meta-data entry	The registered user can upload the meta-data with description of new raw measurement data set.	***
7	Modify or delete meta-data entry	The submitter of meta-data (as well as the administrator) can modify or delete the previously submitted entries.	***
8	Mail to Administrator	The user can send e-mail to the administrator by submitting the message text in a special field on the web page.	**
9	Basic database search	Basic search function allows for searching the MOME Database for occurrences of particular word or phrase. The results are provided in the form of table with links to the found entries.	***
10	Detailed database search	Detailed search function allows for searching the MOME Database for entries matching the search criteria, entered in multiple input fields: drop down lists and check boxes. The results are provided in the form of table with links to entries matching the search criteria. This function is separated for tools and data	***

	Name	Remarks	Importance
11	List entries alphabetically	The user can view the full list of tools (or meta-data) entries, listed alphabetically. The results are provided in the form of table with links to the detailed view of the entry.	***
12	FAQ page	The user can read Frequently Asked Questions about the usage of MOME Workstation.	***
13	User downloads raw data	The user can download the file with raw measurement data by clicking on a URI link, visible on a page with a detailed view of the meta-data entry. The download event is logged in the MOME system.	***
14	Request analysis of raw data	The registered user can request the analysis of measurement data described by particular entry in the meta-database. Selected analysis tools, performing typical analysis tasks for different data types (packet traces, flow traces, etc.) are integrated in the system and executed on the Data Analysis Server.	***
15	List latest changes to the database	The users can see the list of latest updates to the database, e.g. recently added new entries.	**
16	Send forgotten password	If the user forgets the password, he can request for re-sending it by e-mail.	*
17	User comments	The registered user can submit comments to the tool or meta-data entries. The comments are visible for all users browsing the MOME Database.	*
18	Database statistics and health check	The administrator can check the statistics of database usage, e.g.: the number of registered users, number of valid entries, etc. As of this deliverable, unregistered users also get statistics. This may change in future versions.	**
19	Announcement list	The user can subscribe to the announcement list and receive updates on new tools and meta-data entries.	*
20	Dead links search	The system periodically checks the validity of external links referenced from the entries in the MOME database.	*
21	Administrator receives info about changes to the database	The administrator receives notification of all changes to the MOME Database.	*
22	MD5 sum computation	After downloading the raw measurement data file, the system can check its correctness by comparing the computed MD5 sum with the original one.	*
23	Wish-list	The user can submit general comments and desired additional functionalities of the MOME Workstation.	*
24	Page preparation and caching	This function can be implemented if it will be necessary to reduce the system load on the MOME Web Server.	
25	Language selection	The MOME Workstation will use English language. In the future, multiple languages can be supported.	

**Table 2-1 Required functionalities of the MOME Web Server**

### 2.1.2 The Database

The database management system chosen for implementation of the MOME Database should meet the following functional requirements:

- Comply with the ACID paradigm (Atomicity, Consistency, Isolation, Durability).
- Provide efficient methods of storage and access to the transactional (often changing) data.
- Provide efficient methods of storage for large amounts of static data.
- Provide indices for items that are often searched (quick search).
- Allow for secure remote data access (to implement the MOME Web Page and Database on separate machines).
- Allow for creating backups during runtime (to avoid disturbing operation of the web page during system back-ups).

### 2.1.3 The Data Analysis Server

The registered user can request statistical analysis of the measurement data referenced from the meta-data entry in the MOME Database. The file with the raw data is downloaded to the MOME Data Analysis Server and temporary stored on a local disk. The Data Analysis Server executes the data analysis tools, capable of performing typical analysis tasks for each of the supported data types (packet traces, flow traces, HTTP traces, QoS measurement data, routing data). Results of analysis are stored in appropriate fields in the MOME Database [2].

The machine, which will be used as the MOME Data Analysis Server, should meet the following general requirements:

- Allow for executing the analysis tools as “background” processes.
- Allow for accessing the Database server.
- Allow for temporary storage of downloaded raw measurement data files.

The functionalities that should be implemented on the MOME Data Analysis Server are summarized in the following table:

	Name	Remarks	Importance
1	Process manager	Process manager periodically checks for the analysis tasks requested by users. If the new request has been detected, process manager triggers the download process and the analysis process. Finally, it puts the results of the analysis in appropriate fields in the MOME Database.	***
2	Download process	This process downloads the raw measurement data file from a specified URI and stores it in a temporary file on a Data Analysis Server.	***
3	Analysis process	This process starts the data analysis tool. Data analysis tool performs actual statistical analysis of locally stored raw measurement data and returns the result to the process manager.	***

**Table 2-2 Required functionalities of the MOME Data Analysis Server**

## **2.2 Scalability requirements**

The scalability property is related with the expected performance of the MOME Workstation with growing number of stored data and database users. Scalability issue introduces the following requirements on the MOME Workstation components:

- The Web Server should be able to handle large number of simultaneous users.
- The network connection between the Web Server and the Database server is sufficient and not limiting for the performance of the whole system.
- The capacity of the Database server disk allows for storing large number (hundreds) of meta-data entries.
- The Database server performs basic search in less than half a second.
- The Database server performs detailed search in less than a second.
- The capacity of the Data Analysis Server disk allows for storing large number (tens) of raw measurement data files.
- The Data Analysis Server deletes the files from the local disk after finishing the data analysis.

## **2.3 Security requirements**

The security requirements are mainly related with the implementation of user management functions:

- There are three access levels in the MOME system: non-registered user, registered user, and administrator.
- Users have full control over their own account: they can change the configuration parameters and delete the account.
- Registering new user requires active e-mail account for confirmation of the user name and password.
- The non-registered users can search and browse the Database.
- User login is based on user name and password.
- Password is stored in the database in encrypted form.
- The administrator has access to all functions of the system.
- Only the registered users can add new entries about measurement data and tools.
- Only the owner of the tool description (or administrator) can change it or delete.
- Only the owner of the meta-data (or administrator) can change it or delete.
- Only the owner of the meta-data (or administrator) can request analysis of raw measurement data.
- The communication between Web Page and the Database has to be secure.

### 3 System Overview

Figure 3-1 shows the set-up of the MOME system and the communication flows. The process encompasses a user interacting through the GUI with a database through the web server, which also enables user access to third parties like public repositories and publish measurement data from associated projects.

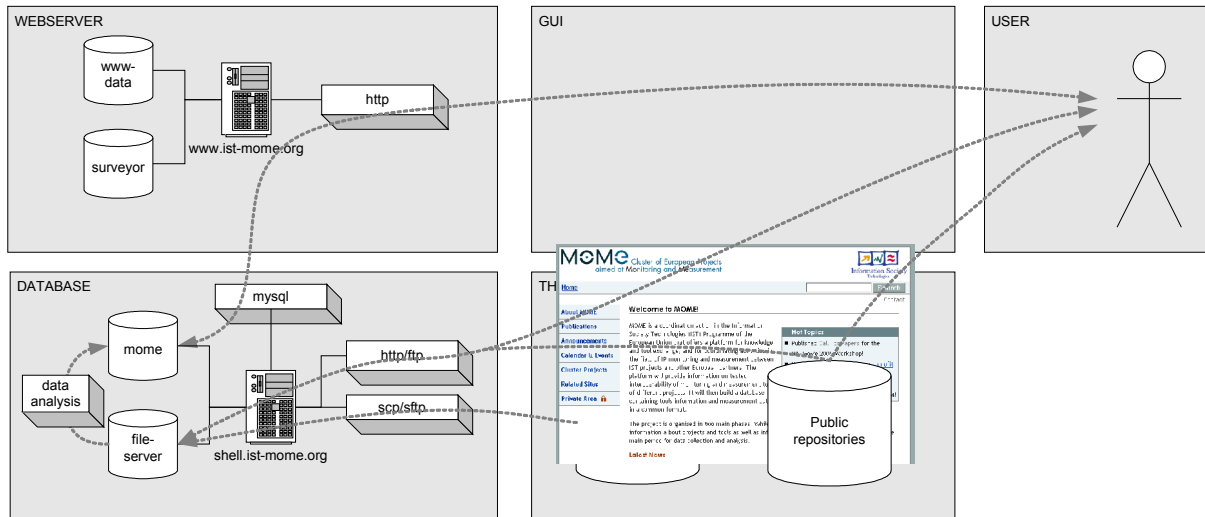


Figure 3-1 MOME System Overview

The user accesses the system through a GUI which is produced as a web page on the MOME web-site [1]. Initially, the functionality is limited to a basic subset for unregistered users. Logging into the system will expose the full functionality to the user. Chapter 6 describes in detail which functions are available for the different categories of users.

The data displayed in the GUI are held in the database, which is located on a separate machine (shell.ist-mome.org). This machine uses MYSQL as the database management system for storing the measurement data and tool meta-databases. Further this machine acts as a file server, where local measurement data files are stored.

Measurement data are kept locally in public repositories and meta-data describing the measurement are entered by registered users to the database using the GUI. In addition trusted, "associated measurement sites" can directly upload these meta-data to the database. Once meta-data is correctly available in the MOME database, the user can perform analyses on the measurement data. After the analyses the results are written back to the MOME database. The main amount of measurement data should be linked to public available external data sources. Only a limited set of measurement data will be stored on the MOME file server. The links are stored in the MOME database and are checked in regular intervals.

## 4 Database Specification

The MOME database is a crucial part of the MOME architecture. Deliverable D21 [2] defined a preliminary version of the MOME measurement database. The MOME tools database has been defined as part of Deliverable D12 [3]. In the meantime the two databases have been integrated to form a single MOME database. The current deliverable specifies the integrated database, which also has some additional tables required for operation.

### 4.1 Contents

The database stores metadata about measurement traces and measurement tools, and several other kinds of internal data required for the operation of the MOME system.

### 4.2 Tables and Structure

The MOME database consists of 19 tables as described in the following table.

<i>Table name</i>	<i>Table description</i>
CommonAttributes	Common attributes for all measurement data entry types
FlowTraceAttributes	Additional attributes for the flow traces
FlowTraceAnalysis	Results of analysis tasks applicable to the flow traces
QoSAttributes	Additional attributes for QoS results
QoSAnalysis	Results of analysis tasks applicable to the QoS results
HttpAttributes	Additional attributes for the HTTP traces
HttpAnalysis	Results of analysis tasks applicable to the HTTP traces
PacketTraceAttributes	Additional attributes for the packet traces
PacketTraceAnalysis	Results of analysis tasks applicable to the packet traces
RoutingAttributes	Additional attributes for the routing data
RoutingAnalysis	Results of analysis tasks applicable to the routing data
WebRepositoryAttributes	Web-based data repository information
UserAttributes	User information of registered MOME users
Tests	Tool testing data
Comments	Comments submitted by a user on a specific tool
Toolmaintainer	Relates tools to users that maintain the tool information
Uses	Relates measurement data to the tools that were used to produce the data
Tools	Information on measurement, analysis, etc. tools
AnalysisRequests	Information on automated analysis of traces

**Table 4-1 The MOME database tables**

A detailed description of the fields of the measurement database tables (CommonAttributes, FlowTraceAttributes, FlowTraceAnalysis, QoSAttributes, QoSAnalysis, PacketTraceAttributes, PacketTraceAnalysis, RoutingAttributes, RoutingAnalysis, WebRepositoryAttributes, UserAttributes) can be found in Deliverable D21, while the detailed explanation of the tool database tables (Tools, Tests, Comments, ToolMaintainer) can be found in Deliverable D11. However, there are two newly added tables in the database: the *Uses* table and the *AnalysisRequests* table. The fields of the new tables are explained in the following two tables.

<i>Ma nd.</i>	<i>Attr. name</i>	<i>Data type</i>	<i>Description</i>
Y	CommonAttributesId	integer	The measurement produced using the tool
Y	ToolID	integer	The tool used
N	Type	set	Analysis/Measurement

**Table 4-2 The Uses table**

<i>Ma nd.</i>	<i>Attr. name</i>	<i>Data type</i>	<i>Description</i>
Y	RequestId	integer	Unique identifier
Y	UserID	text	Starter of the analysis task
Y	TraceId	text	The measurement trace to be analysed
Y	DateStart	datetime	Start time of the task
N	DateEnd	datetime	End time of the task (filled after completion)
Y	Status	enum	'pending remote', 'pending local', 'analysis in progress', 'complete', 'error: file not found', 'error: wrong file format', or 'error'
Y	NotificationType	enum	'mail' or 'none'
Y	AnalysisType	text	Type of analysis performed

**Table 4-3 The AnalysisRequests table**

The integrated and extended physical database model is depicted in the following figure.

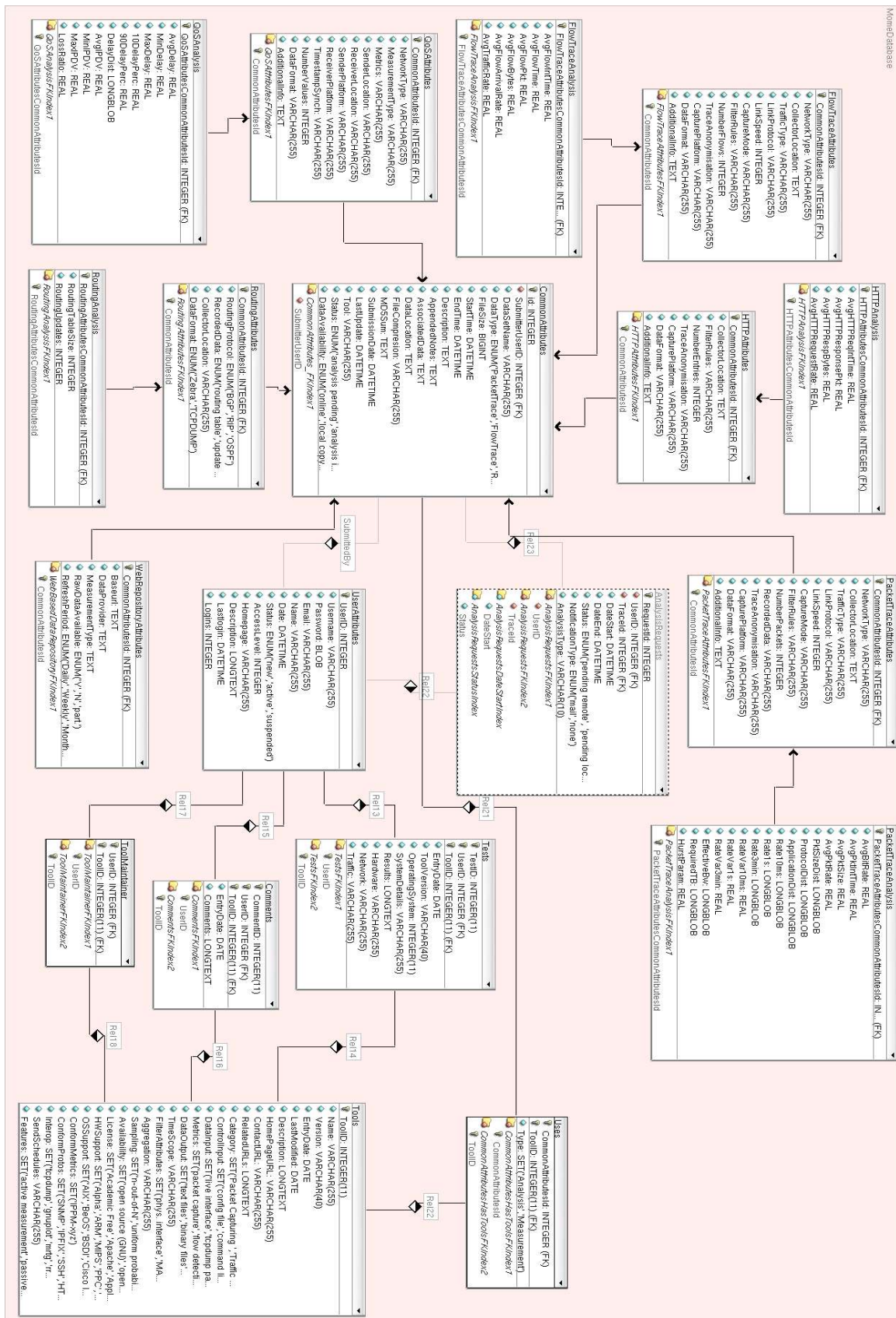


Figure 4-1 Integrated MOME measurement & tool database

## 5 Implementation

The implementation of the MOME database has taken into account the specific environment in which it is being deployed and uses the de-facto standard software tools at TERENA's hosting site. MYSQL is used as DBMS together with the Apache web-server. Database access is implemented using the server-side script language PHP, which provides the integration between the database and web-server. The PEAR framework provides some of the core functionality such as Table layout, Configuration, etc.

### 5.1 Frontend

The GUI to the MOME database is integrated to the MOME web-site and therefore uses the same format templates. From the menu in the MOME web-site, the item "Database" links to the main menu of the MOME system, containing links to both, measurement data and measurement tools databases. The measurement tool database is described in more detail in D12 [3].

The user navigates through the system with a web-browser. Only one single file is accessed by the user (index.php). This acts as a dispatcher function and invokes the corresponding commands depending on the different GET-variables set by link parameters. It provides the following main functions from any page:

- Login: an existing user can log into the system
- Register: new users can register themselves to the system
- FAQ: A list of frequently asked questions can be requested
- Logout: logged in users can logout.

Once within the Measurement Data submenu, the user can choose between three different commands on the measurement data sets:

- Search: A search function over the measurement data, being able to search by different attributes
- Browse: Browsing through the measurement data, displays a list of contents with most recent items above.
- Add: Registered users may add new data-sets to the database.

In addition to the visible commands, some other commands are allowed. The following table lists the allowed commands to index.php in the measurement data submenu:

	Name	Remarks
1	datasearch	Displays an advanced search form. The user can search by several attributes of the database.
2	databrowse	Allows the user to browse through the database. Most recent entries are displayed first.
3	datadetail	Displays the complete data entry. This is usually invoked from the databrowse or search function. Owners will be allowed to edit their datasets.
4	dataadd	Add new datasets to the measurement database. Only for registered users
5	datadownload	Forwards the user to the origin of the measurement data to download.
6	dataanalyse	Users are allowed to perform predefined analysis to the measurement data they have submitted. Administrators are allowed to analyse all datasets.

**Table 5-1 Commands in index.php**

### 5.2 Core Logic

The MOME system bases on some core classes, which provide the database access and the data presentation structures. The following classes have been implemented:

	Name	Remarks
1	MysqlCon	The basic connection class to the mysql server. This generic class implements no MOME specific functions.
2	MomeDatabase	Heavily uses MysqlCon to implement the MOME database specific access functions
3	MomeData	Child class of MomeDatabase, adding more specific functions for the measurement meta-data part of the MOME database.
4	MomeFormat	Does the HTML-output formatting, like table creation and number formatting.
5	MomeDataSet	Handles the access to the data sets in the database. Covers all different Datatypes of measurement data entries.

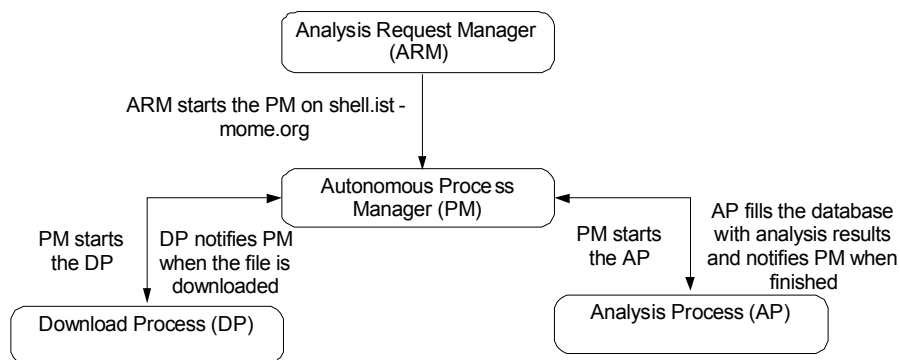
**Table 5-2 Core MOME PHP classes**

### 5.3 Database Backend

The database server hosts both, the measurement meta-data and the measurement tool information. These two parts of the system are interconnected, so that they can be associated to each other. Further, user information is stored to the database. Data entries are associated to users, so that they can maintain their own entries. The details to the database structure have been presented in chapter 4. As DBMS MySQL has been selected, due to its flexibility and wide spread use together with PHP and Apache, which was the existing framework for the MOME web-site. Recent versions of MySQL support InnoDB tables, which were used to keep data integrity. The database has been designed using DBDesigner from fabFORCE.

### 5.4 Analysis Back End

The Analysis Back End consists of four main components (see Figure 5-2): Analysis Request Module (ARM), Autonomous Process Manager (PM), Download Process (DP) and Analysis Process (AP).



**Figure 5-2 Running the data analysis tools**

#### 5.4.1 Analysis Request Module (ARM)

The Analysis Request Module is implemented by the PHP functions running on the web server [www.ist-mome.org](http://www.ist-mome.org). The user can select requested analysis task from the list of available analysis types, displayed on the screen by the PHP function implemented in the ARM. The information on the new request is inserted in the *AnalysisRequests* table in the database.

Additionally, the ARM provides the administration access for managing queued analysis requests. The administrative access allows for viewing the logs of all analysis requests, removing pending requests and viewing the statistics (e.g. total processing time of the request, number of tasks per request), calculated based on the log files.

The interface of the ARM is based on CGI mechanism of the website. It can perform the following functions (the text in brackets is the command for executing particular function of the ARM):

- Initiate the analysis process of raw measurement data set with ID [*trace\_number*] in the meta-database ([www.ist-mome.org/database/?cmd=dataanalyse&id=\[trace\\_number\]](http://www.ist-mome.org/database/?cmd=dataanalyse&id=[trace_number]))
- Provide the administration access for managing the analysis back end ([www.ist-mome.org/database/?cmd=dataanalyse&admin=main](http://www.ist-mome.org/database/?cmd=dataanalyse&admin=main))

#### 5.4.2 Autonomous Processes Manager (PM)

The PM is implemented as a PHP CLI script periodically started by *cron* service running on the server shell.ist-mome.org. It performs the following tasks:

- Checks the *AnalysisRequests* table in the database for new analysis tasks.
- When the new analysis task is detected, starts the Download Process (DP), providing as parameter the request ID and the URI of the file, which should be analysed.
- When the download is finished, the PM changes the trace status to '*analysis pending, local copy*', starts the Analysis Process (AP) providing it as parameters the request ID, analysis type and the name of the local file, where the downloaded measurement data is stored. Then, the status of the trace is changed to '*analysis in progress*'.
- When the analysis is finished, the PM notifies the user by e-mail that the new analysis results are available.

The PM script is accessible by the Command Line Interface. Depending on the option provided while starting the PM, it can perform one of the following functions:

- Check database contents for new analysis requests (*default\_action*).
- Add new analysis request to perform (*add\_request*)
- List locally stored analysis requests (*list\_requests*).
- Remove request if required (*remove\_request*).
- Stop and resume analysis tasks (*stop/start*).
- Notification about completed download (*download\_complete*)
- Notification about unsuccessful download (*download\_error*)
- Notification about completed analysis (*analysis\_complete*)
- Notification about unsuccessful analysis (*analysis\_error*)

#### 5.4.3 Download Process (DP)

The DP is implemented as a PHP CLI script running on the server shell.ist-mome.org. It can be started by the PM via the Command Line Interface. Its task is to download the requested file and save it in the local storage, where it can be accessed by the data analysis tool. The DP finishes its job by executing the PM with one of two options: *download\_complete*, or *download\_error*.

Notice, that multiple DPs can be started at the same time, to download different remote files. The maximum number of consecutive working DPs and maximum total disk space available for local storage of the downloaded raw data files can be fixed in the configuration file:

*manager\_constants.inc.php*.

#### 5.4.4 Analysis Process (AP)

The AP is implemented as a PHP CLI script running on the server shell.ist-mome.org. It can be started by the PM via the Command Line Interface. Only one AP can be running at a time. It performs the following tasks:

- When the AP receives new analysis request from the PM, it starts the external data analysis tool, giving as parameter the name of the local file, which has to be analysed.
- When the analysis is finished, the AP parses the output file with the analysis results, puts the appropriate values to the database and sets trace status to '*analysis done*'.
- The AP finishes its job by starting the PM with one of two options: *analysis\_complete*, or *analysis\_error*.

Remark: initially, only some exemplary analysis tools were integrated in the system. However, the new analysis tools can be easily integrated in the future, depending on the needs.

## 6 System Manual

In this section, we present a short manual of the MOME Workstation. The exemplary usage scenarios are described for three types of users: non-registered users, registered users and administrators. Notice, that we focus only on the measurement meta-database and manual for the tools database is out of scope of this document.

### 6.1 Non-registered users

Below, the usage scenarios for non-registered users are presented.

#### 6.1.1 Public access to the MOME databases

Users access the MOME Databases through the “*Database*” link on the public MOME web page ([www.ist-mome.org](http://www.ist-mome.org)). The main screen (see Figure 6-1) provides links to the two databases: “*Measurement tools*” and “*Measurement data*”.

The “*FAQ*” page provides a short introduction to the functionalities of the MOME Workstation. The “*Contact info*” gives the users contact information to the MOME project, while the “*Mail-to admin*” screen allows for sending a message to the system administrator.



Figure 6-1 Main screen of the MOME Workstation

#### 6.1.2 Registering to the MOME system

An unregistered user, who does not yet have an account in the MOME system, can create it by clicking on the “*Register*” button and providing his users name, valid e-mail address and password. Then, the system sends e-mail to the new user. If the user confirms the registration by clicking on the link included in the message, the account is activated.

#### 6.1.3 Browsing the database

The list of entries in the database is presented in the “*overview*” screen, which shows basic information about the meta-data entry: *dataset name*, *description*, *size* of the file with raw data, *start-time* and *duration* of the measurement, as well as *type* of collected data (Figure 6-2a). By clicking on link to particular entry, users can view the “*details*” screen, where all the fields describing the raw measurement data set are included (Figure 6-2b).

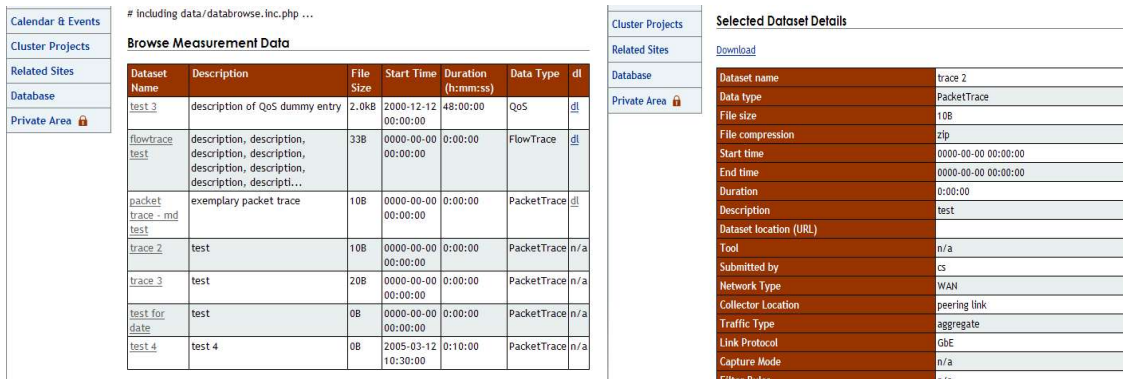


Figure 6-2 Browsing the database: a) overview screen, b) detailed view of selected entry

### 6.1.4 Searching the database

While the user is browsing the MOME Databases, he can access the basic search function from each viewed page. The user can enter a word or a phrase, which occurs in the searched entry.

The detailed search function can be accessed by clicking on the “*Search*” button at the upper part of the screen. The system finds meta-database entries with specified values of the following fields (see Figure 6-3): *data type*, *analysis status*, *data availability*. Another fields: *dataset name*, *description*, *appended notes*, *associated data* and *measurement tool* can be searched for occurrence of particular text phrase. Additionally, the user can search for the entries with: *file size*, *start time*, *end time*, *submission date*, or *last update* smaller than, equal of greater than particular numerical value.

Both search functions provide the results in the form of a table with links to entries matching the search criteria.

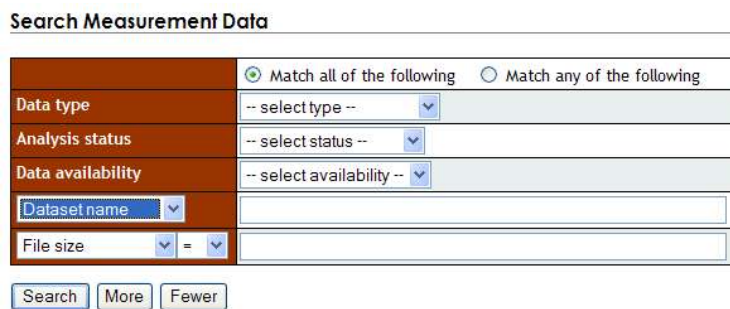


Figure 6-3 Detailed search screen

## 6.2 Registered users

The registered users not only can browse the databases, but also are allowed to add new entries.

### 6.2.1 Login to the system

The registered users login by entering their user name and password. If the user has forgotten the password, he can ask for re-sending it by e-mail.

### 6.2.2 Adding new meta-data entry

The registered user can submit new entry by clicking on the “*Add*” button while browsing the meta-database. After filling-in the general information about the new data set (Figure 6-4a), like e.g.: *name*, *data type*, *start-time* and *end-time* of the measurement, he clicks on the “*Next*” button and then can enter the detailed information on the measurement scenario (Figure 6-4b).

Add Dataset		Add Details to Dataset	
Dataset name	<input type="text"/>	Network Type	<input type="text"/>
Data type	PacketTrace	Collector Location	<input type="text"/>
File size	<input type="text"/>	Traffic Type	<input type="text"/>
File compression	<input type="text"/>	Link Protocol	<input type="text"/>
Start time	YYYY-MM-DD HH:MM:SS	Capture Mode	<input type="text"/>
End time	YYYY-MM-DD HH:MM:SS	Filter Rules	<input type="text"/>
Description	<input type="text"/>	Number of Packets	<input type="text"/>
Dataset location (URL)	<input type="text"/>	Trace Anonymisation	<input type="text"/>
Tool	select tool or enter new tool	Capture Platform	<input type="text"/>
		Data Format	<input type="text"/>
		Additional Info	<input type="text"/>

Next      Add Dataset

Figure 6-4 Adding new meta-data entry: a) general information, b) detailed information

### 6.2.3 Modifying meta-data entry

The registered user can modify previously submitted meta-data entry. Notice, that only the owner of the meta-data entry (and the administrator) has privileges for modifying or deleting the entry.

### 6.2.4 Requesting data analysis

The registered user can request the analysis of previously submitted measurement data. The list of available analysis tasks can be seen after clicking on the “Analysis” button in the “detailed view” page for particular database entry. The exemplary screen on Figure 6-5 presents the analysis page for the “flow trace” data. Two analysis tasks are available for the selected data set. If the user wishes to receive e-mail notification after the analysis process is finished, he should check the “send me an e-mail when done” box. After clicking the “next” button and confirming the selection, new analysis request is added to the list of pending tasks.

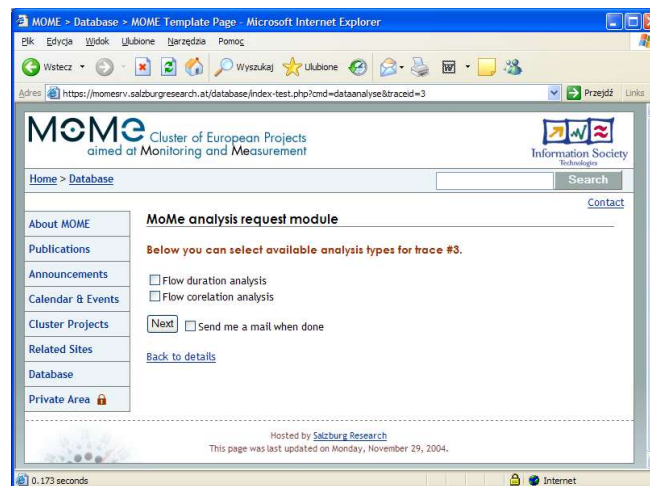


Figure 6-5 Requesting data analysis

### 6.2.5 Submitting user comments

The registered user can add his comments to particular meta-data entry. The comments will be visible for all users browsing the database.

## 6.3 Administrator

The administrators can perform tasks related with database maintenance.

### 6.3.1 Checking the database statistics

The database statistics (Figure 6-6) include: number of registered users and tools maintainers, total number of tool and meta-data entries, as well as total number and size of entries for each category of measurement data (packet traces, flow traces, routing data, HTTP traces, QoS measurements, web repositories).

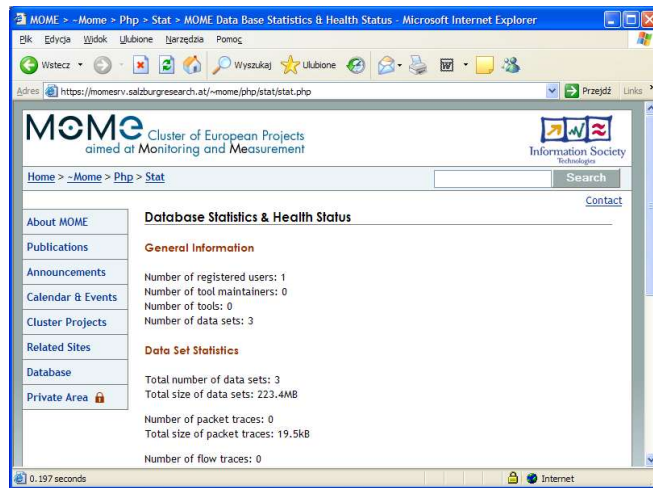


Figure 6-6 Checking the database statistics

### 6.3.2 Checking the statistics of analysis tasks

The administrator can check the status of MOME Data Analysis Server on the following screens:

- *Show active analysis requests*  
 This option shows the status of pending analysis requests. The following information is provided: Request ID, ID of the user who submitted the request, ID of analysed raw data set, start date of the analysis task, status, type of notification after finishing the analysis (e-mail or none), and type of the analysis task.
- *Show all analysis requests*  
 This option shows the log of all active and previously completed analysis tasks (see example on Figure 6-7).
- *Show statistics*  
 This option shows the statistics of completed analysis tasks, e.g. the average completion time.

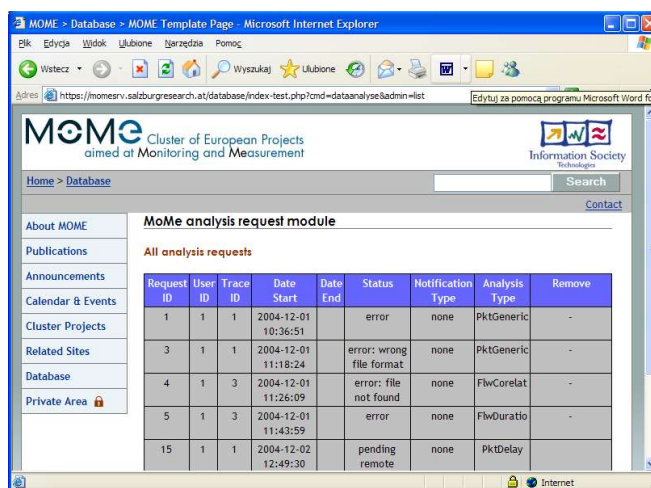


Figure 6-7 Checking the status of analysis requests

### 6.3.3 Adding new analysis tool to the MOME Workstation

The MOME Workstation allows for integrating new analysis tools, which perform additional statistical analysis tasks. However, adding new tool requires some modifications to the software code.

Therefore, it should be done by the person, who knows the internal structure of the MOME system.  
To integrate a new analysis tool one must:

- Insert the new analysis type to the array *\$analysis\_types* in file *dataanalyse.inc.php* (which implements the ARM module). The new analysis type should have a unique name, with maximum length of 10 characters, e.g “*uniquename*”.
- Create a new file with name beginning with word “*analysis*” and with extension “*inc.php*” (e.g. *analysis\_my.inc.php*) in the analysis folder. This file should contain the function (named e.g *my\_function\_name(String \$filename, String DBTraceId)*) that implements the analysis of a given file (or executes external analysis tool) and inserts results to the database.
- Additionally, one should bind the newly created function with the previously chosen unique name (*\$dict["uniquename"] = "my\_function\_name"*).

## References

- [1] MOME web-site,  
<http://www.ist-mome.org>
- [2] MOME Project Deliverable D21: MOME Database,  
<http://www.ist-mome.org/deliverables/mome-wp2-0409-d21-mome-database.pdf>
- [3] MOME Project Deliverable D12: MOME Interoperability Database

## Appendix A Hardware and Software Requirements

The MOME workstation software has been design as a hardware-independent system. The current MOME workstation hardware platform, shown in Figure A-1, is a Dell Poweredge 1750 server blade with :

- 1 Intel Xeon 3.0 GHZ CPU (1 Mb cache)
- 1024 Mb DDR SDRAM
- 146 Gb U320 10K SCSI harddisk

From the Operating System point of view, the platform needs a \*\*IX flavour (i.e. Linux or any other UNIX-flavour) which supports the following software packages:

- Linux version 2.6.8-1-686-smp
- MySQL-4.0.21
- apache-2.0.52
- PHP-5.0.2

To host the MOME Framework, which includes style sheets and templates, the PHP distribution installed needs the following additional packages:

- PEAR packages: Config, HTML/Table
- Smarty

Additionally, some analysis tools are needed:

- libpcap
- wget
- GNU awk



**Figure A-1: The server blade hosting the MOME workstation**

## Appendix B System Tests

### B.1 Setup

Tests were performed under two platforms using different browsers. The operation of the system was examined using the most popular internet browsers. The configurations used are listed in the following table.

<i>Configuration Code</i>	<i>Platform</i>	<i>Browser</i>
<b>WI</b>	<b>Windows XP+SP2</b>	<b>Internet Explorer v6.0</b>
<b>WO</b>	<b>Windows XP+SP2</b>	<b>Opera v7.54</b>
<b>WF</b>	<b>Windows XP+SP2</b>	<b>Mozilla Firefox v1.0</b>
<b>LO</b>	<b>Linux</b>	<b>Opera v7.54</b>
<b>LF</b>	<b>Linux</b>	<b>Mozilla Firefox v1.0</b>

**Table B-1 Platform and Browser Identification Table**

### B.2 Plan

Test scenarios were divided into two main parts. Tests were performed on the appearance of the webpage including the proper working of the links (see Appendix B.2.1), and on the functionality of the webpage (see Appendix B.2.2).

In Appendix B.2.1 the proper working of the menu elements and links on the main screen are examined.

In Appendix B.2.2 the functionalities are examined (e.g. is it possible to log in, to register, to search the database, to browse the database, etc.)

#### B.2.1 Web page tests

The aim of these tests is to check the operation of the menu items and different links on the web site. The tests are made under two platforms using different web browsers (see Appendix B.1).

The investigation is done the following way:

- web page appearance: how the web page is displayed in the browser (does the page appear, if it appears how does it look, do the menu items appear, etc.)
- menu items test: what happens if we click on one of the menu items (does the related web page/window appear correctly, etc.)
- link test: what happens if we click on one of the links (does the related web pages/windows appear correctly, etc.)

The investigation steps listed above are carried out using all the configurations described in Appendix B.1.

#### B.2.2 Functionality tests

The aim of these tests is to examine the functionalities on the web site. As in Appendix B.2.1 these tests were also performed under Windows and Linux operation systems, using different web browsers.

The investigation steps are summarized in the following table:

<i>Scenario code</i>	<i>Functionality</i>	<i>Description</i>
SLI	Login	can a user log in to the web page
SR	Register	can one register as a user
SB	Browse database	can a user browse the database
SS	Search database	can a user search the database
SLO	Logout	can a user log out from the website

**Table B-2 Functionality Identification Table**

**B.2.3 Results**

After committing the MOME database interface in the server, a cross-platform check of the basic functionalities was performed, in order to check their implementation and potential limitations imposed by the some of the current Web browsing platforms.

	<i>WI</i>	<i>WO</i>	<i>WF</i>	<i>LO</i>	<i>LF</i>
<i>SLI</i>					
<i>SR</i>					
<i>SB</i>					
<i>SS</i>					
<i>SLO</i>					

**Table B-3 System test results**

## **Appendix C Software development documentation**

The full source code documentation is kept in the private area of the MOME server.