

## D12 - MOME Interoperability Database

### Abstract

This document outlines the database design and database specifications for the MOME Interoperability and Tools Database. It includes the Interoperability database table's definitions. Also it provides a survey of existing tool database systems. This Deliverable provides in addition a description of the security and scalability requirements for the database and some preliminary tests and their results.

### Keywords

MOME, Deliverable D12, Interoperability Database, Database Requirements, Specification, IST Projects, Measurement Tools

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## List of Acronyms

CAIDA	The Cooperative Association for Internet Data Analysis
CLI	Command Line Interface
ETSI	European Telecommunications Standards Institute
IETF	Internet Engineering Task Force
IPFIX	Internet Protocol Flow Information Export
IPPM	Internet Protocol Performance Metric
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IST	Information Society Technologies
ITU	International Telecommunication Union
QoS	Quality of Service

## **Executive Summary**

This document describes the design and specifications for the MOME Interoperability Database. It comprises the detailed database design and the database specification.

This document communicates the database specifications in sufficient details to support ongoing installation and operational activities (e.g. configuration management, tools administration, system installation and maintenance).

For this purpose it is structured into the following chapters:

Chapter 1 is the introduction. It also summarises on what has been done in D11 [1].

Chapter 2 gives requirements and the detailed specification of the database regarding functionality, scalability and security.

Chapter 3 presents a state of the art of existing databases in terms of their availability, design, and usability for MOME purposes.

Chapter 4 details of the chosen database specification.

Chapter 5 provides the implementation of the database.

Chapter 6 shows an overview of the system and it's usage.

Appendix A provides the hardware and software requirements.

Appendix B presents the preliminary tests and their results.

## 1 Introduction

This deliverable (D12) is the direct successor of the MOME deliverable D11[1]. Building on the documentation of taxonomy for measurement and analysis tools classification from D11, the deliverable D12 presents the requirements for an interoperability and tools database, gives an overview of existing tools databases, and presents in detail the design and implementation of the model which was chosen for the MOME interoperability database.

The predecessor D11 reviewed a number of measurement and analysis tools. These build the starting set of tools for representation in the online MOME tools and interoperability database. Additionally this document describes the opportunities for interaction between tools in the area of traffic measurement and analysis. Finally D12 defines the functionalities that the MOME tools database will have, and how these are represented and usable for the MOME database user.

From Deliverable D11 we learned the possible interaction scenarios between tools, i.e. in what combination different tools can interact and what kind of information is exchanged during the process.

The following conclusions were drawn from the evaluation of tools interoperability:

- Interoperability is an underrated issue, often chances lay unused
- Most common denominator is the tcpdump tool for capturing traffic into data input files for other tools or the libpcap live packet capture library
- Some tools produce output directly suitable for visualisation tools such as gnuplot or rrdtool
- Conformance to standards such as IPFIX or PSAMP is not a goal in freely available tools
- A number of tools claim conformance to IPPM metrics (yet this was not verified)

This document highlights the benefits for a user searching for applications in the areas of network monitoring and traffic analysis. The data stored in the MOME database will help him/her to select an appropriate tool or set of tools for the problem at hand, or will help to choose tools which can be used in conjunction to an existing tool already in use.

Separate sections in this document provide a description of the database system implementation. Finally the system user manual and preliminary system tests and their results are presented.

## 2 Requirements for Tools Database

The Tools database contents will be publicly accessible via a web-based front end user interface which will be presented at the next open MOME workshop IPS2005 (March 14-15, 2005, [14]). To become widely known it will be promoted regularly by all MOME partners.

The Tools database should

- be accessible using a standard web browser
- not require any special client-side software or browser plugins
- provide quick search as well as detailed search functions
- store meta-data only: tools information, test information, user comments
- shall allow/deny functions to users with respect to their permissions
- enable search data and on interoperability fields
- provide users an easy way to exchange experiences with those tools listed in the database

### 2.1 Functional Requirements

The MOME Workstation consists of three main functional components:

- the Web Server,
- the Database, and
- the Data Analysis server.

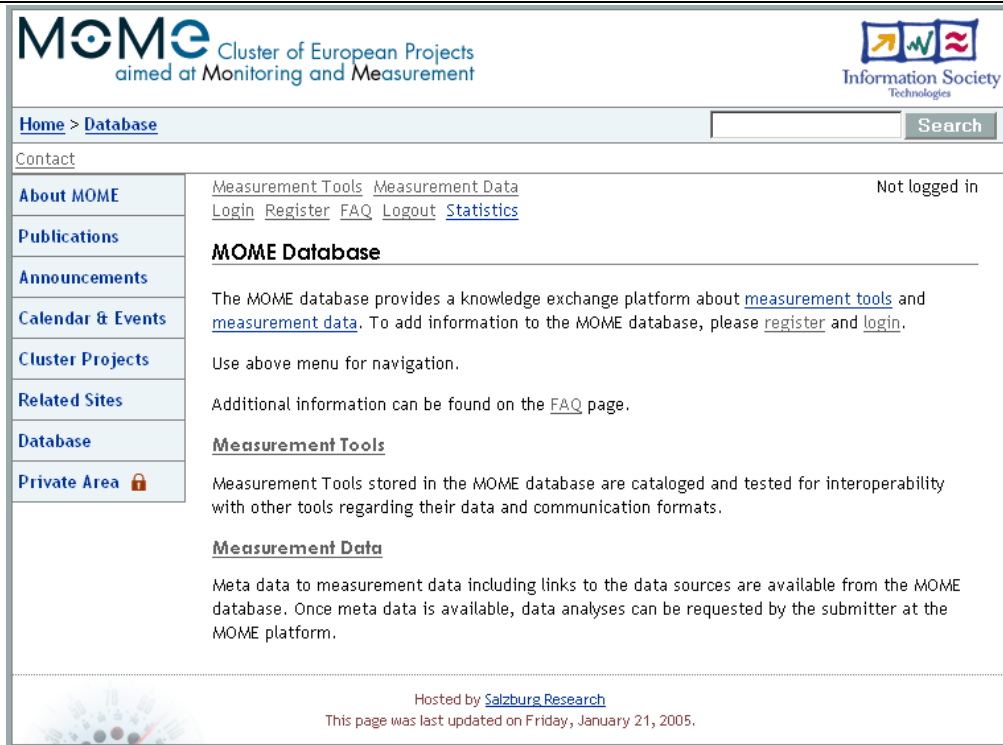
The first two components will be described here while the third is described in details in D22 [2]. Their interconnectivity is also described in D22 in more depth.

#### 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 objective of implementing a web-based user interface is to give the user a clear and complete view of which are the main features of the MOME platform. Thus, the interface has to help the user understand at first sight the basic functionalities of the MOME database. Advanced functionalities are accessible to registered users as it is described in the user manual in chapter 6.

The web server must not make use of technologies that make it possible to have access to it by selected browsers only. Therefore we opted for using of PHP for generation of web pages. The only requirement on the used browser's capabilities is support for cookies to enable tracking of logged in users.



**Figure 1 : MOME database welcome screen**

For a homogeneous presentation of content from the MOME project website, MOME traces database and MOME interoperability database a common look and feel must be used. Our integration work with the traces database and the work of WP2 resulted in a common database solution (common user management) and a unified look and feel under the umbrella of the MOME project platform [4].

### 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, and Durability).
- Provide efficient methods of storage and access of the transactional (often changing) data.
- Provide efficient methods of storage and access for large number of data sets.
- Provide indices for items that are often searched (quick search).
- Allow for secure remote data access (to deploy the MOME Web Server and MOME Database on separate machines, for load sharing).
- Allow for creating backups during runtime (to avoid disturbing operation of the web page during system back-ups).

### **Additional Notes**

- a dead links check will be integrated in order to check and maintain consistency of data in the database (i.e. stored URL pointers to external locations).
- notification functions: the system shall inform the administrator about new/changed users/tool entries; acknowledgement by administrator can be asynchronous (no delay)
- spoof protection shall be deployed: initial user password is sent via mail to newly registered user, this avoids spoofed users to be registered in the user management
- users shall have full control on their own account (change, delete)
- multiple users tagged as responsible for one project must be possible in the db design

## **2.2 Scalability Requirements**

Determining the system's scalability is an important part of development.

The general way to determine a system's ability after theoretical assessment of limitations is to actually test its performance under load. Such tests provide insights into the system's ability to meet scalability requirements and to grow for the future.

The following are the requirements that the MOME database should meet to match acceptable performance:

- The interoperability database needs to be able to store hundreds of tool entries
- The database must be able to handle thousands of stored user comments
- The database is able to perform quick search in less than half a second
- The database system performs detailed search in less than a second
- The database shall be able to present the tools overview in less than two seconds
- The database shall be able to present the tool details (tool and interoperability data, maintainer list, and all related comments) for one tool in less than one second
- The system must be able to handle multiple user sessions in parallel and execute functions quasi-parallel without significant degradation of system performance
- Submitted to performance and load tests it should survive to the simulated stress test

## **2.3 Security Requirements**

The requirements on the user management, the restricted access to functions and the management of passwords provide the basis for the security requirements list:

- there shall be three access levels as specified within D11[1]:  
public, registered user, admin
- public users can search, browse and comment
- registered users can edit their user attributes and all data related to tools they maintain
- registered users can also invite other users to be a maintainer
- administrators can access every function

### 3 Database Platform

For implementing the tool database with a web interface an implementation from scratch (based on a public domain database) was considered as well as modifying already existing databases that serve similar purposes. In particular the following systems were investigated and evaluated:

- Sourceforge [5]  
Sourceforge provides a large repository of open source codes and applications posted freely by projects and users. Its database system features advanced tools: User registration and authentication, Forum system for each project, User management for each project, projects advanced search tools (by category, description and name), information on where to download the code, and more. It is a well designed site which is built on the following packages and servers: Apache, PHP, PostgreSQL, CVS, LDAP, and PROFTP. The Sourceforge's source code is available for download and use. The web interface appears to be well suited.
- Sourcewell [6]  
It is based on the same principles as Sourceforge. The host is the developer group of the open source mediator BerliOS in Berlin. Sourcewell aims at providing a neutral platform for the open source community (developers and users, and also commercial companies). Its system uses PHP, Mysql and Mailman. The source code availability is still unclear
- Tucows [7]  
The source code seems not to be available. There is a developers' center at <http://farm.tucows.com/blog>. Several functionalities meet the requirements defined for the MOME database.
- Palmgear [8]  
Palmgear is web resource for freeware, shareware and commercial software for the Palm OS platform. Functionalities such as user management system, browsing software by selected options and downloadable application code are available. The repository source code seems not to be available.
- Freshmeat [9]  
Freshmeat is a free open source repository based on PHP and MySQL. This project is designed to maintain Unix-based or other cross-platform applications. Its architecture also looks like what could be used for the tools database. Yet source code is currently not freely available.[10]
- zd-net [11]  
Zdnet is a well organised web site which provides many services. From computers, hardware, internet accessories, software, gadgets it provides news, applications to download and more. It looks like a non-open source solution.
- switch [12]  
SWITCH website concerns a description of SWITCH work within TF-NGN task force. It's a webpage with links and not organised as a database. Thus it is not useful for the MOME database.
- SLAC [13]  
SLAC Network Monitoring Tools provides a list of tools used for Network Monitoring and links to where to find out more about them. This site does not look like it is based on a database backend at all. All the tools lists are handcrafted html. It also does neither have an extended search functions nor any notion of a user account.

Sourcewell, sourceforge, and freshmeat are the most suited ones (in this order).

However, an analysis of the source code of these three systems indicated that modifying them in order to turn them into the desired tool database would consume more resources than implementing the tool database from scratch using an open source database system and well-known libraries for presenting the graphical user interface.

Another even more important drawback would be that integration with the MOME traces database would not be possible in a harmonic way. These factors do lead to the decision to only rely on existing libraries (for database access and GUI) to build our common MOME workstation, and not to extend one of those generic tool databases listed.

## 4 Database Specification

The deliverable D11[1] prepared the development of the MOME tools database by defining the basic functionalities that the database will need to implement. The database developed in WP2 is defined in D21 [3] to store collected meta-data about the measurement and analysis tools. Both, tools database and meta-data database present many common functionalities, thus it was decided to integrate the two databases in a single one. Each database keeps its specific functionalities while common are shared. This deliverable will describe the common part and the tools interoperability part of the database.

### 4.1 Database Contents

The MOME interoperability database stores measurement and monitoring tools. The first sets of tools entered in the database are the ones evaluated and reported in D11 [1].

The integrated MOME database stores metadata about measurement data and tools as well as information about registered users of the MOME workstation. Due to this integration process a user account is valid for the traces as well as the interoperability database part.

### 4.2 Functions

The database functions are implemented using the PHP language and comprises the access to the database (connection), the operations on the database (MySQL queries) and providing the HTML pages as output. The latter are the GUI functions which enable the access to the meta-repository via a public web server, compatible with all commonly used web browsers.

The functions designed for the traces database are included to provide the complete picture of the integrated database. The functions are marked with the symbol of importance (three stars denote the most important ones), which also has determined the order of our implementation work.

	Name	Remarks	Importance
1	Create user identity	Any user browsing the MOME web page may enter the user management screen and register to the MOME system. This gives access to additional functions like adding tools and comments.	***
2	Login / logout	The registered user can login to the system and logout after finishing the session. Login is based on 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.	***

	Name	Remarks	Importance
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 a table with links to entries matching the search criteria.	***
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 a 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 should be 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.	**
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.	*

	Name	Remarks	Importance
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 1: MOME System Functions**

### 4.3 Tables and Structure

The main tables regarding the tools database are: Tools, Tests, Uses, Comments, ToolMaintainer and UserAttributes. In the following we will describe the tables required to store all necessary information for the MOME tools and interoperability database.

#### 4.3.1 The Tools table

This table lists all meta-data entries stored about a tool in our database including interoperability information. It is the main table for the tools and interoperability part of the MOME database. For each tool which has been observed and evaluated by MOME partners there will be an entry initially in the database. Registered users may also enter new entries into that table via the web interface of the MOME database using the add tool page.

Name	Datatype	Description
ToolID	INTEGER	Unique numeric identifier
Name	VARCHAR	Tool name
Version	VARCHAR	Tested tool's version
EntryDate	DATE	When entry was made
LastModified	DATE	When last edit occurred
Description	LONGTEXT	Free text describing tool
Homepage URL	VARCHAR	Link to tool homepage
Contact URL	VARCHAR	Link to author if available
Related URLs	LONGTEXT	More links
Category	SET	Any out of : 'Packet Capturing', 'Traffic Flow Measurement', 'Packet Monitoring', 'Connection Monitoring', 'Application-level Monitoring', 'Service Monitoring', 'Accounting', 'Intrusion Detection', 'Sniffing', 'Performance Measurement', 'Connectivity Checking', 'Route Detection', 'Topology Detection', 'Traffic Visualization', 'Traffic Generation'
control input	SET	Any out of: 'config file', 'command line', 'GUI', 'scripting language', 'telnet', 'ssh', 'web GUI', 'database', 'API binding', 'SNMP'
Data input	SET	Any combination from: 'live interface', 'tcpdump packet file', 'other packet file', 'raw data files', 'csv text data files', 'text via stdin'

Name	Datatype	Description
Metrics	SET	List of what traffic characteristics the tool computes
Data output	SET	Any combination of: 'text files','binary files','to stdout','graphs/images','report documents','via SNMP','via Web interface (http)','via IPFIX'
TimeScope	VARCHAR	Real-time, seconds, minutes, ...
FilterAttributes	SET	Any combination of: 'phys. interface','MAC address','ethertype','IP addresses','IP header attributes','TCP/UDP ports','TCP flags','application level'
Aggregation	VARCHAR	If available, how data are aggregated
Sampling	SET	If supported, sampling schemes
Availability	SET	Freeware, open source, commercial, ...
License	SET	What license(s) the tool is available with
HWSupport	SET	What hardware the tool runs on
OSSupport	SET	What operating systems are supported
ConformMetrics	SET	What standardised metrics are supported
ConformProtos	SET	What standardised protocols are supported
Interop	SET	What other tools this one can be used with
SendSchedules	VARCHAR	What is schedule of data export is available
Features	SET	Additional tool information

**Table 2: Tools Table in Database**

#### 4.3.2 The Tests table

The tests table stores documentation of test results with tools that are available in the tools part of the MOME database. Here registered users can enter what tests they have made and what results have been reached.

Attribute Name	Datatype	Description
TestID	INTEGER	Unique identifier for test entry
UserID	INTEGER	Link to user who is entry submitter
EntryDate	DATE	When entry was created
ToolVersion	VARCHAR	Which tool version has been tested
OperatingSystem	INTEGER	On what operating system
systemDetails	VARCHAR	Details about system under test
Results	VARCHAR	detailed test results
Hardware	VARCHAR	What hardware was in use, e.g. network card
Network	VARCHAR	(Fast) Ethernet, ATM, SDH, etc.
Traffic	VARCHAR	Textual traffic description

**Table 3: Tests Table in Database**

#### 4.3.3 The Comments table

The comments table is available to allow users to add short text to each tool entry (even when they have not made it themselves). Contents from this table will also be shown as part of the detailed tools information view. Only registered users may comments to a tool entry. A tool comment can be seen as a brief version of a documented test. It should motivate users to participate in sharing their experiences with listed tools.

Attribute Name	Type	Description
----------------	------	-------------

Attribute Name	Type	Description
CommentID	INTEGER	Unique identifier for an entry
UserID	INTEGER	Link to user who created this entry
ToolID	INTEGER	Link to tool entry
EntryDate	DATE	When entry was created
Comments	VARCHAR	The comment text itself

**Table 4: Tests Table in Database**

#### 4.3.4 The Uses table

This table builds a link from the traces information stored in the MOME database (see D22, link) to tools documented in the MOME interoperability database. It is used to document what tool has been used to capture, process, and analyse a specific trace.

Attribute Name	Datatype	Description
CommonAttributesID	INTEGER	Unique identifier
ToolID	INTEGER	Link to tool entry
Type	SET	'Analysis' or 'Measurement'

**Table 5: Uses Table in Database**

#### 4.3.5 The UserAttributes table

This table stores all information about registered users of the complete MOME database system. Entries are created upon user registration. Each record can only be modified by the respective user. Users may add links to their homepage as well as to other work here. It will be shown on the user details page.

Man dator y	Name	Data type	Description
Y	UserID	INTEGER	Unique identified for an entry
Y	Username	VARCHAR	Name of the user
Y	Password	BLOB	Password of the user, encrypted
Y	Email	VARCHAR	E-mail of the user
	Name	VARCHAR	Real name of a user
	Date	DATETIME	Date and time of user entry creation
	Status	ENUM	Pending   registerted   suspended
	AccessLevel	INTEGER	Role of the user (Admin/Submitter/Read_only
	Homepage	VARCHAR	URL to user's homepage
	Description	LONGTEXT	Some more information about the user
	lastLogin	DATETIME	Date and time of last login
	Logins	INTEGER	Number of successful logins

**Table 6: UserAttributes Table in Database**

### 4.3.6 The MOME database

This figure outlines the database model including MOME data and tools tables.

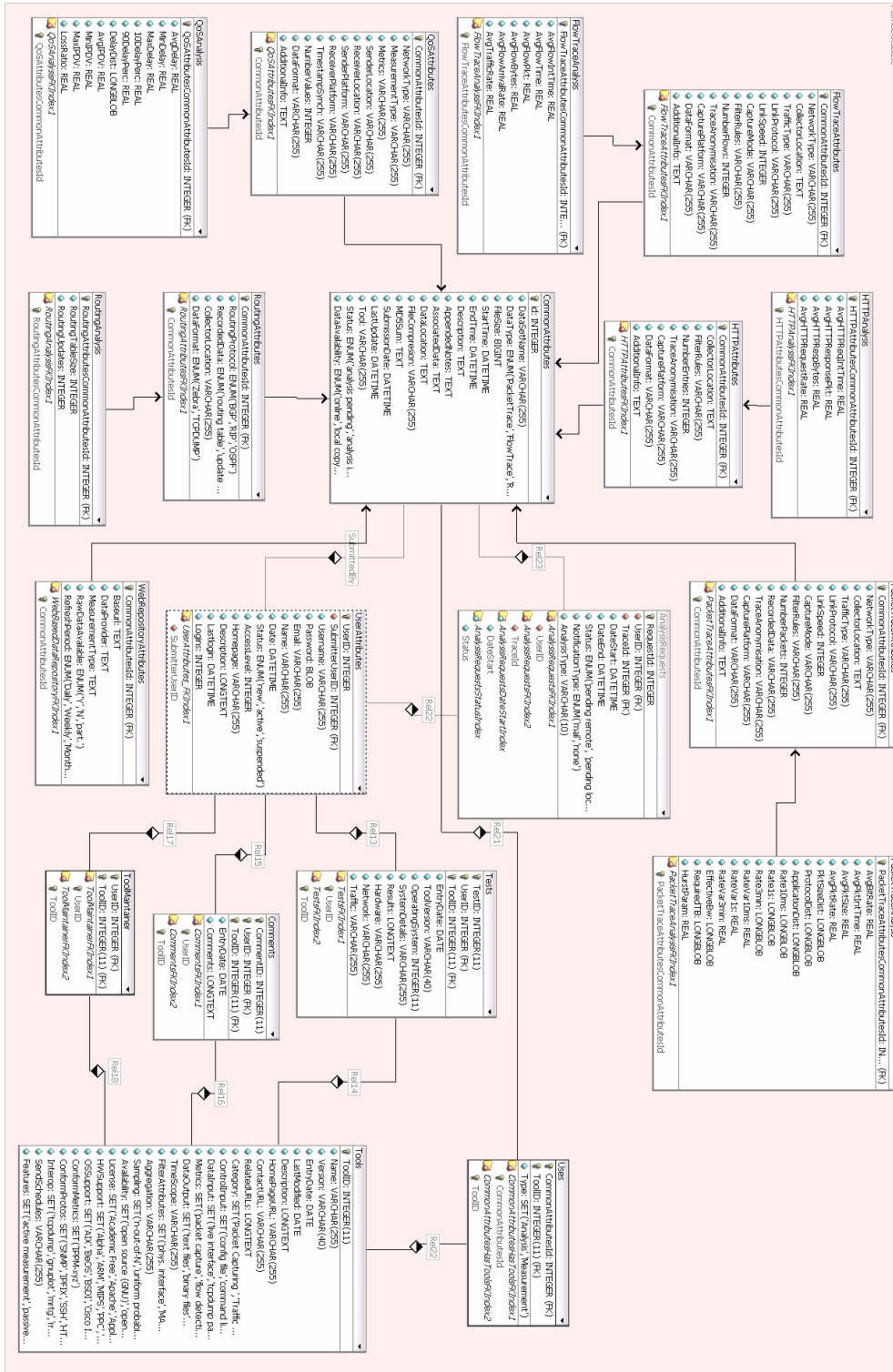


Figure 2: MOME Database (Tables + Relations)

The MOME workstation’s database consists of 19 tables. The tables directly related to the Measurement tools database part are: Tools, Tests, Comments, ToolMaintainer, UserAttributes and Uses. Their fields are described in the sections 4.3.

The fields of the measurement-related tables of our database (CommonAttributes, FlowTraceAttributes, FlowTraceAnalysis, QoSAttributes, QoSAnalysis, PacketTraceAttributes, PacketTraceAnalysis, RoutingAttributes, RoutingAnalysis, WebRepositoryAttributes, HTTPAnalysis, HTTPAttribues, AnalysisRequests) are described in detail in the Deliverables D21 [3] and D22 [2].

The tables CommonAttributes, UserAttributes and Uses are common to the two parts of our database system. This means for example that a user whose information is stored in the UserAttributes table can also use the same account to request a Data analysis (AnalysisRequests table) on the MOME traces 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 the database management system (DBMS) together with the Apache web-server as front end. Database access is implemented using the server-side scripting language PHP, which provides the integration between the database and web-server. The PHP PEAR classes' framework provides some of the core functionality such as Table layout, HTML forms generation, and Configuration management.

### 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 traces database is described in more detail in D22 [2].

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 and invokes the corresponding commands depending on the different variables set by link parameters. It provides the following main functions from any database-related 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 (and answers) can be obtained
- Logout: logged in users can logout.

Once within the Measurement Tools submenu, the user can choose between different commands to be applied on the measurement tool data sets:

- Search: A search function over the tools data, being able to search by different attributes
- Browse: Browsing through the tools data, displays a list of contents with most recent items above.
- Add: Registered users may add new tool entries to the database.
- Append comments to existing tool entries
- Assign tool entry maintainers responsible for an entry

In addition to the directly visible commands, some other commands are allowed. The following table lists all the allowed commands in the tools submenu:

	Name	Remarks
1	toolssearch	Displays an advanced search form. The user can search by several attributes of the database.
2	toolsbrowse	Allows the user to browse through the database. Most recent entries are displayed first.
3	toolsdetail	Displays the complete data entry. This is usually invoked from the toolsbrowse or search function. Owners will be allowed to edit their datasets.
4	toolsadd	Add new datasets to the tools database. Only for registered users.
5	addcomment	Add a user comment to an existing tool entry
6	Addmaintainer	Add a new user as maintainer of a tool entry

**Table 7: Web Interface Functions for Tools database**

### 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.
6	MomeTools	This class represents all special queries related to management of tool entries

**Table 8: Php Classes used by Tools Database Frontend**

### 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 the database management system (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 using automatic checking of foreign keys. The database has been designed using DBDesigner from fabFORCE.

The database tables have been implemented according to the specification presented in chapter 4.

## 6 System Manual

In this section, we present a short manual of the MOME Workstation. The example usage scenarios are described for three types of users: non-registered users, registered users and administrators. Notice, that we focus only on the measurement tools database; manual for the measurement data database is out of the 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 (<http://www.ist-mome.org/>) or directly accessing the related web page (<http://www.ist-mome.org/database/>). The main screen (see Figure 3) provides links to the two databases: “*Measurement tools*” and “*Measurement data*”.

The “*Login*”, “*Logout*” links are needed by registered users in order to perform add/remove/update of the measurements tools entries. In order to browse the database a user neither is required to register nor to log in. The “*Register*” link is required for users to register themselves; the registration procedure is described in Section 6.1.4.

The “*FAQ*” link provides a short introduction to the functionalities of the MOME Workstation. The “*Statistics*” link gives general statistics about the Database and its health status. The “*Contact*” gives the users contact information to the MOME project.

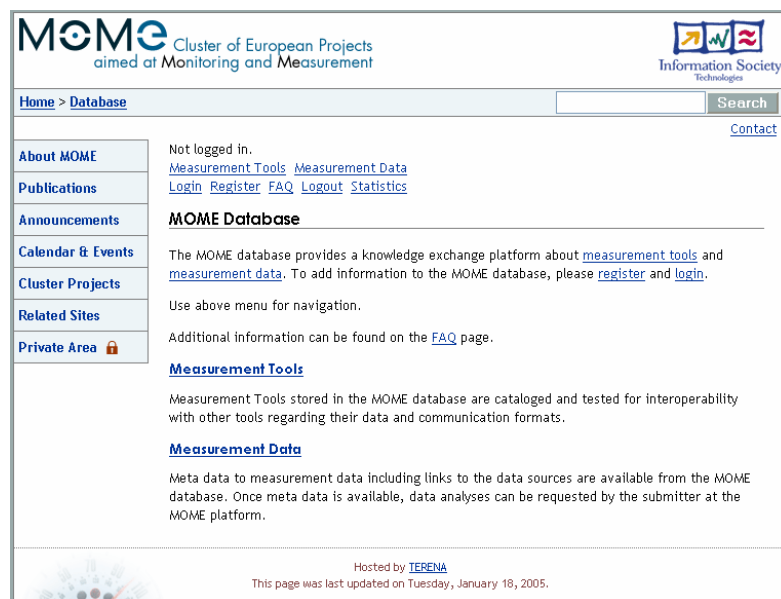


Figure 3: Main screen of the MOME Workstation

#### 6.1.2 Searching in the Measurement tools database

Each user (either registered or not) may search in the tool database. After clicking on the link “*Measurement Tools*” the user is redirected to the main Measurement tools database page (see Figure 4) where he can search the Measurement tools following specific criteria (the “*Search*” link leads to the same page); the search criteria are:

- Name
- Description
- Category
- Metrics
- Control Input
- Data Input
- Data Output
- Availability
- Hardware support
- Operating System Support

**Figure 4: Measurement Tools Database Search page**

A search could be performed either matching all the fields inserted by the user or matching any of them. The search is started once the “Search” button is pressed and results are shown at the bottom of the page.

### 6.1.3 Browsing in the Measurements Tools database

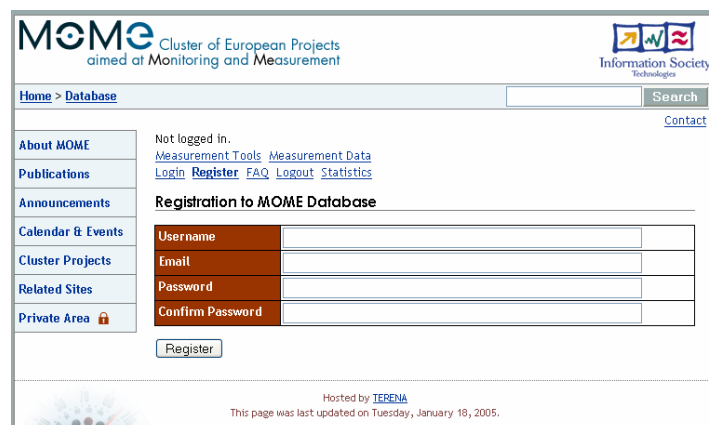
Each user (either registered or not) may browse the tool database. A user can access the “Browse” page by clicking on the “Browse” link. This is the page where a user can browse the entire tools list (possible browsing is: alphabetically, latest, category, etc.). The information a user can retrieve by browsing the tools are: name of the tool, a short description, the category the tool is belonging to, the latest version documented of the tool, the date the entry was last edited (see Figure 5). More detailed information about a tool can be accessed by clicking on the name of the tool. The “Add” page is only accessible by registered users for adding tools entries (further modifications/deletion of the tools entries are only allowed to users with an adequate level of permission).



**Figure 5: Measurement Tools database Browse page**

### 6.1.4 User registration

An unregistered user, who does not yet have an account in the MOME system, can create it by clicking on the “Register” link. The user is redirected to the MOME registration page where, providing a username of his choice, valid e-mail address and password (see Figure 6), can register himself.



**Figure 6: Registering to MOME database**

After clicking on the “Register” button, the system sends an 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 and the user can start adding entries to the database after completing his MOME database information (Name, Homepage and Description, see Figure 7).

The screenshot shows the MOME website's registration page. At the top, the MOME logo is displayed with the text 'Cluster of European Projects aimed at Monitoring and Measurement'. To the right is the 'Information Society Technologies' logo. Below the header, there is a navigation menu with 'Home > Database' and a search box. A sidebar on the left contains links for 'About MOME', 'Publications', 'Announcements', 'Calendar & Events', 'Cluster Projects', 'Related Sites', and 'Private Area'. The main content area is titled 'Complete your MOME Database information' and contains three input fields: 'Name', 'Homepage', and 'Description'. A 'Complete' button is located at the bottom of the form. At the very bottom of the page, it says 'Hosted by TERENA' and 'This page was last updated on Tuesday, January 18, 2005.'

Figure 7: Completing MOME database registration information

## 6.2 Registered users

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

### 6.2.1 MOME system Login/Logout

A registered user, who has an account in the MOME system, can login by clicking on the “Login” link. The user is redirected to the MOME login page where, by providing his username and his valid password, can enter the system.

The screenshot shows the MOME website's login page. At the top, the MOME logo is displayed with the text 'Cluster of European Projects aimed at Monitoring and Measurement'. To the right is the 'Information Society Technologies' logo. Below the header, there is a navigation menu with 'Home > Database' and a search box. A sidebar on the left contains links for 'About MOME', 'Publications', 'Announcements', 'Calendar & Events', 'Cluster Projects', 'Related Sites', and 'Private Area'. The main content area is titled 'Login to MOME Database' and contains two input fields: 'Username' and 'Password'. A 'Login' button is located below the fields. Below the login form, there is a section titled 'Forgotten Password?' with an 'Email' input field and a 'Request' button. At the very bottom of the page, it says 'Hosted by TERENA' and 'This page was last updated on Tuesday, January 18, 2005.'

Figure 8: Logging-in to the MOME database

If the user has forgotten his password he can ask the MOME system to send it by email; the user's password will be mailed to the mail address indicated in the form (if this mail address matches an existing user).

Once the user has successfully logged in, he can logout simply clicking on the “Logout” link.

### 6.2.2 Adding new measurement tool entry

The registered user can add new meta-data entry by clicking on the “Add” link. The user is then redirected to the “Add” page (see Figure 9) where he can add a new meta-data entry. The fields to be entered are namely:

- Name
- Description
- Category
- Metrics
- Control Input
- Data Input
- Data Output
- Availability
- Hardware Support
- Operating System Support

The screenshot shows the MOME web application interface. At the top, it says 'MOME Cluster of European Projects aimed at Monitoring and Measurement'. The user is logged in as 'saverio.nicolini' (uid:50). The main content area is titled 'Add Measurement Tool' and contains a form with the following fields:

Name	<input type="text"/>
Description	<input type="text"/>
Category	— any —
Metrics	— any —
Control Input	— any —
Data Input	— any —
Data Output	— any —
Availability	— any —
Hardware Support	— any —
Operating System Support	— any —

At the bottom of the form are 'Add' and 'Extend' buttons. The footer of the page indicates it is hosted by IESENA and was last updated on Tuesday, January 18, 2005.

**Figure 9: Adding a Measurement tool to the database**

It is not mandatory to fill up all the entries. After clicking the “Add” button, the user can decide to enter more detailed information, by clicking on the “Extend” button. This task can be performed several times, to allow multiple entries for the same property (e.g. a tool can be installed on different Operating Systems).

### 6.2.3 Modifying and deleting a measurement tool entry

A list of maintainers is associated to each tool. Only the maintainers of a specific tool will have access to the “Edit” and “Delete” buttons and will be able to delete or modify a tool entry.

## 6.3 Administrator

The administrators can perform tasks related with database maintenance.

## 6.4 Checking the database statistics

The database statistics 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 tools data.

## References

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- [4] MOME project website: <http://www.ist-mome.org>
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## **7 Appendix A: Hardware and Software Requirements**

The requirements are the same as for the MOME traces database workstation. They are listed in detail in the MOME deliverable D22 in Appendix A.

## 8 Appendix B: Preliminary Tests

### 8.1 Setup

System Tests are performed on two operating systems using different web 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>Operating System</i>	<i>Browser</i>
WI	Windows XP+SP2	Internet Explorer v6.0
WO	Windows XP+SP2	Opera v7.54
WF	Windows XP+SP2	Mozilla Firefox v1.0
LO	Linux	Opera v7.54
LF	Linux	Mozilla Firefox v1.0

**Table 9: Platform and Browser Identification Table**

### 8.2 Test 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, and on the functionality of the system and its output to the web page.

#### 8.2.1 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 on the two platforms using different web browsers as listed in above table.

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.)

#### 8.2.2 Functionality tests

The aim of these tests is to examine the functionalities of the MOME system in conjunctions with the web site. These tests were also performed on Windows and Linux operation systems, using different web browsers.

The tests 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
SReg	Register	can one register as a user
SBTo	Browse Tools database	can a user browse the database
SSTo	Search Tools database	can a user search the database by matching all specified fields
SLout	Logout	can a user log out from the website
SLSe	Loose Search	can a user search the database by matching any of the specified fields
SAdd	Add tool	is it possible to add a new tool
SRem	Remove tool	is it possible to remove a tool entry
SEdit	Edit tool	Is it possible to edit a tool entry
SSPass	Send forgotten Password	request password for a registered user and receive it via its email account
SMaint	Add maintainer	add a new maintainer to a tool
SComm	Add comment	add a new comment to a tool
SDShow	Show details for tool	display all the detailed information for a tool in the database incl. comments

**Table 10: System Tests Identification Table**

### 8.2.3 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 some of the current Web browsing platforms.

Table 11 summarizes the results of the tests we performed. We indicated with “++” a positive result, i.e. the function works correctly and conformant to the specifics, with “+” we mean that the function works but it is only partially conformant to the specification (at least at the current stage), with “-” we addressed a negative result while “n/a” means that the function was not available at the time this deliverable was written.

Note that at the delivery date of deliverable D22 some of the tests planned and documented in D22 could not be performed since some function implementations had not been available. At the time of writing D12 the tests from D22 performed well. The test results have been updated there as well.

	WI	WO	WF	LO	LF
SLi	++	++	++	++	++
SReg	++	++	++	++	++
SBTo	++	++	++	++	++
SSTo	++	++	++	++	++

SLout	++	++	++	++	++
SLSe	++	++	++	++	++
SAdd	+	+	+	+	+
SRem	n/a	n/a	n/a	n/a	n/a
SEdit	n/a	n/a	n/a	n/a	n/a
SPass	++	++	++	++	++
SMaint	n/a	n/a	n/a	n/a	n/a
SComm	n/a	n/a	n/a	n/a	n/a
SDShow	++	++	++	++	++

**Table 11: System test results**