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Technical Implementation Plan**

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## 1. INTRODUCTION

This document summarises the further technical developments to the MERMAID prototype that will be required before the system can be considered ready to be launched in a live environment, as a fully commercial product. The document has been produced following extensive testing of the prototype system and constructive feedback from the consortium partners. It focuses on the ‘technical’ improvements that should be implemented, and does not deal with the business, marketing or legal factors that will also require consideration. These issues are dealt with in the Exploitation and Business Plan (D12.3). This document is therefore written under the assumption that following the development of a working prototype and therefore completion of the MERMAID research project, the project will subsequently move into a second ‘implementation’ phase. This implementation phase will in effect be a new project, with the objective of developing a full commercial system that can be launched in a live environment. This will be built on the MERMAID prototype, and the subsequent development will fundamentally be based on the Exploitation and Business Plan and this Technical Implementation Plan. A ‘MERMAID’ Legal Entity will be required to finance and manage the development, deployment and subsequent running of a commercial service.

It should be noted that this does not mean that any of the current consortium partners are hereby committed to forming part of such a legal entity. Furthermore, it is noted that under the original MERMAID project contract, the consortium was contracted to produce a working prototype of a Marine Data Broker, together with a Technical Implementation Plan, but was not obliged to subsequently implement such a plan, or to commercially exploit the end product.



## 2. TECHNICAL IMPLEMENTATION

This technical implementation plan summarises the key technical issues that will need to be addressed during implementation. However, it does not list all the specific issues or ‘bugs’ that were raised during the testing phase. These are included as appendices in the Workpackage 8 deliverables (D10.1 and D10.2), and can be referred to during the implementation phase.

This document has therefore been divided into three sections; System Design, Site Design and Administrative Issues (although there is obviously significant overlap between the three). The System Design section deals with improvements, or additions, required to the core functionality of the site, such as the metadata structure. The Site Design section on the other hand looks at the cosmetic improvements such as the layout of the pages. The Administration section covers the other considerations, such as payment methods, from a technical point of view. It should be noted that it may be necessary to make system design changes in order to facilitate a site design, or an administration improvement.

During the 30 months in which the project has been developed, many system requirements have been analysed and most of them have been implemented. In particular, the process undertaken during the project considered both internal and external users. A set of priorities was naturally established, and all of the most critical requirements have been implemented. During testing and evaluation workpackage (WP8), the end-users testing helped to further improve the system and to fix those problems that usually appear when developing such a complex solution.

The ‘bugs’ and issues raised by the testing partners were categorised as either;

- Critical Issues – those that prevented further testing and were critical to the working prototype
- Non-Critical Issues – those that would need resolving, but were not necessarily critical to the continued testing of the site
- Improvements – those issues that were not required, but would improve the system

These included those requirements original defined in the User Requirements Specification (URS – D1), as well new issues or functions that have subsequently been raised, and upon discussion are now thought to be necessary requirements for a full commercial service.

By the end of this workpackage, all of the critical issues had been resolved. Most of the non-critical issues had also been addressed, and also some of the ‘Improvements’ had already been implemented.



## **2.1. System Design**

Following the improvements and bug-fixes that were made, the final prototype was seen to be fully operational in terms of the key functionality as originally specified in the User Requirements Specification (D1). However, the testing phase highlighted certain system design improvements that should be considered during the technical implementation phase in order to make the system more robust, and commercially viable. These have been further subdivided into the following categories.

### **2.1.1. Remote Data Access Engine**

The Remote Data Access Engine (RDAE) allows providers to store files on their own local server, as it communicates with the MERMAID server, and implements all the necessary functions of the Data Access Engine (DAE) that is part of the MERMAID system. This includes data searches, subset extraction, file-packaging and file transfer. This software was developed using JAVA so that it is platform-independent, and can therefore be installed on any operating system. Although the system has been tested on Microsoft Windows, Unix and Linux operating systems, some problems were experienced with establishing the RDAE, especially with configuring the RDAE to communicate through firewalls. In order to make the process of installation and configuration of the RDAE simpler for data providers, who may lack the technical experience currently required, the RDAE should be modified. This will require some small modifications to the JAVA code.

### **2.1.2. Database Communication**

Although this is not visible to the users of the system, it is felt by the technical partners that the communication between the core databases that store all the information about the data providers, prices and dataset descriptions could be improved. The number of database ID's that are passed between the different engines could be reduced by placing the information into session variables or cookies. This will simplify the communication, and should also improve the speed and efficiency of the system.

### **2.1.3. Dataset Description / Availability Control**

Currently a consumer can proceed through the entire dataset search and purchase procedure, which can take some, only to discover that the dataset they wish to purchase is actually not available. This would occur if the actual file is not at the location as registered with the Catalogue Database. This can only occur for Remote Data Providers, if the provider has incorrectly registered the file, or has subsequently moved it. The MERMAID system should be able to check the availability of the dataset at the beginning of the purchase procedure, and inform the consumer at that point if the file is not available. This is related to the whole issue of validation of the information provided with by the data providers, discussed further in section 2.3.6



#### **2.1.4. Search Engines**

The search engine was initially fairly basic, and there were several problems with the facility, such as the map applet, and errors in the search results. However, following the feedback from the partners during the testing, all of the 'bugs' have now been fixed, and the search engine is much more sophisticated and dynamic. The map applet is fully functional, and the search options have been expanded, to allow the user to select several different criteria using AND / OR options. However, this will require further testing for its robustness, and could well be expanded even further if required.

#### **2.1.5. Metadata Structure**

It was felt that the Metadata Structure was too restrictive for describing many of the datasets that are likely to be registered, in particular data produced by the Met Office (MO). It was also felt that some of the terminology used in the pick-lists was too specialised or scientific, which would make it difficult for 'lay persons' to use the system. The Metadata structure was designed and developed in such a way as to allow future expansion if required. However, in order to implement any changes to the structure, a full specification of the changes required will need to be produced. This should be led by the most likely suppliers of complex datasets, for instance the Met Office, and perhaps should include a further assessment of users requirements beyond the current project consortium. However, the key features that have been identified as requiring modification are:

- Expansion of the Data Theme pick-lists
- Ability to choose more than one data theme for each dataset – many datasets include parameters that cover more than a single data theme
- Renaming of 'scientific terms'
- Removal of the ability for providers to enter their own region names to the pick-lists under USER DEFINED – already implemented
- Making Region pick-lists more clear and complete. Definition of appropriate co-ordinates for each region.
- Data descriptions for 'Datastreams' should be saved by default – the description of a data stream does not change, so the provider should not have to enter this information each time

#### **2.1.6. Subset Extraction Routines**

It was decided very early on in the project that the system would need to be file-format-independent, so that providers could register and upload files in any format, and this is the case. However, it was realised that it would not be possible to write subset extraction routines that were also file-format-independent, and therefore 6 different 'example' file formats were agreed by the consortium, and subset extraction routines for these formats were developed. A template of the extraction software was produced by BMT, which could be given to any data provider, for them to modify to allow extraction of their own formats.



This was tested by giving this template to the MO, for them to modify to allow the extraction from their complex 'GRIB' files. However, the template extraction routine searches for a single area and element (data theme), and therefore requires the file to contain only a single type of data. Unfortunately the GRIB data files frequently contain multiple elements, which made the extraction impossible. Therefore, although the extraction routines work successfully for the core file formats agreed, in order to make this aspect of the system more flexible and attractive to third party data providers, the extraction routine template software should be made more sophisticated. A full specification of the requirements will be needed by the developers, and this should be provided by an organisation that specialises in complex data formats, such as the MO.

### **2.1.7. File Transfer**

Originally only two forms of electronic transfer of files were incorporated into the system. This was either by FTP transfer, which requires the data consumer to establish an FTP server, or by e-mail, which obviously places a size restriction on the files that can be transferred. This was as originally specified in the URS, and then in the system design. However, following feedback from the EU external reviewers, it was felt that a third option, that allows an easier download of the files should be incorporated. A simple HTTP download has in fact already been implemented, but this may require some further development and testing to ensure that it is robust and secure.



## **2.2. Site Design**

Although the prototype is functional, there are a number of site design improvements that should be implemented.

### **2.2.1. Web Site Graphics and Layout**

The project objective was to produce a working data broker prototype that would be accessible as a live web site on the Internet. The main objectives of the project were therefore to develop a working prototype, and the styling and layout of the web site was not given a high priority. Although the look of the site has been improved, in that the pages now are at least consistent in their design, none of the consortium partners specialise in web design. The layout was therefore purposefully kept as simple-looking as possible for this phase of the project. However, for commercial exploitation, it will be necessary to redesign the graphics, image and layout of the site, and it is felt that this task should be sub-contracted to a third-party, professional web design organisation.

### **2.2.2. Usability (Ease of Use)**

Although the site is very simple in theory, there are certainly some sections of the site that are not particularly easy to use. Again this aspect of the project was not given a high priority, and the developers did not receive feedback from the partners until the testing phase at the end of the project. The site should therefore be made much more intuitive to use, and a full specification of the changes required should be provided to the developers. However, the functions in particular that could be improved are:

- Editing Provider details
- Editing the pricing and discount structure
- Adding a Remote Provider Server
- Search Interface – the search criteria options should be made clearer
- Purchasing a dataset

### **2.2.3. On-line Help**

It was felt that the addition of comprehensive help facilities would be essential for the site. Even if the site is made more intuitive and user-friendly, on-line help facilities should still be included. Following this feedback, some facilities have already been implemented. Some dynamic 'tooltips' have been added, and a full User Manual is also available on-line. However, the tooltips should be expanded through the site, and the manual will need to be amended to reflect any changes to the site that may occur. It could also be made more 'case-sensitive', with dynamic links from each page on the site to the relevant section of the Manual.



#### **2.2.4. Editing Default Details**

For the Data Providers, there is a great deal of information that is required by the system. Most of this information is requested at registration. However some details, such as pricing and discount policies, and supply and shipping methods originally had to be entered separately for every dataset. Therefore, facilities to enter, and then subsequently edit this information as defaults, which is then automatically applied to each dataset, is required. The pricing and discount default page has now been added, but the facility to configure the default supply and shipping methods is still outstanding, and should be implemented.

#### **2.2.5. Page Updates**

Although the system is functional, the page update process is currently quite slow. This is especially noticeable when entering the metadata, or selecting search criteria. If a different option to the default from a pick-list is selected, then the whole page is refreshed, which can sometimes be quite slow. The user returned to the top of the page, rather than at the last active position on the page. This screen refreshing should be made more efficient, and user-friendly.



## **2.3. Administrative Issues**

Finally, there are a number of administrative issues that will need to be considered.

### **2.3.1. Data Security**

The system will be running in a live environment on the Internet, which is obviously prone to security issues. In order to protect the data and details stored on the site from 'hackers', the security measures on the DAE and RDAE will need to be revised. The most appropriate measures to be employed will need to be researched, but it is felt at this stage that 32-bit encryption keys will probably be required.

### **2.3.2. Financial Security**

Financial security is probably the most important condition of online transactions. Each Mermaid user has to be sure that the financial transaction is safe. For the commercial service it is necessary to utilise an external reliable credit card processing service. The consumer credit-card data should not be stored on Mermaid. A good step forward would be the implementation of the secure Webserver based on Secure Socket Layers (SSL). This would secure the communication between the consumer and the broker.

### **2.3.3. Payment Methods**

During the early part of the project, the possible automatic payment methods were fully researched. At the time, the only practical method that could be incorporated was payment by credit card. For the purpose of the research project, credit card processing was only simulated as the real processing was out of scope, and a precise analysis was conducted on 3<sup>rd</sup> parties able to process credit cards and electronic transactions. Before enabling the service, a specific 3<sup>rd</sup> party should be selected. The choice of course could depend on many criteria, such as cost of the transactions, reliability of the party, performances, new possibilities offered.

In addition, alternative payment methods will also need to be considered. The fact that the only e-payment method universally accepted is the credit card will be a big constraint for many organisations whose procedures will not allow them to purchase data in this way. Many other e-payment methods are available but many of them depend on specific agreements with banks. As technology is evolving quickly, a state-of-the-art analysis on e-payment solutions should be performed again and all viable payment possibilities should be seriously considered, in order to offer to end-users a service as flexible as possible

In addition, it should be considered how much the public's opinion towards e-payments and e-commerce has changed in the last months. The Mermaid Business Entity should seriously take into account these changes and try to capture users' confidence.



Finally, the process of payment to the providers will need to be considered. For the prototype system, it was decided that the consumers payment would need to be authorised before the data could be transferred. This can obviously be achieved by standard credit-card on-line transactions, as occurs with any other online shopping service. However, for the providers, it was felt the best approach would be to make regular payments to the providers, for instance on a monthly basis. The MERMAID Business Entity would therefore log all transactions, and determine how much data each provider had sold per accounting period, and make the necessary payment to the providers by traditional methods. There are obviously security issues (as with the Data Security – see section 2.3.1) with protecting the transactions log. It may be that an alternative method is preferable for commercial exploitation.

#### **2.3.4. Informative Error Messages**

In order to facilitate the easy maintenance and future upgrading of the system, more informative error messages should be included in the system. Currently the error messages are not especially helpful when it comes to resolving any bugs in the system, and these should therefore be expanded to give more precise details of the error. This will apply to both end-users of the system, should they use the system incorrectly, and also for the system administrators, for maintaining the system.

#### **2.3.5. Hosting of Service**

Currently the MERMAID system is hosted on a server owned and housed by BMT. Whilst this was more than sufficient for the purposes of the research project, it may not be so for a full commercial service. It should therefore be analysed if it is more convenient to host the system internally, or to rely on a third-party web-hosting provider. The first option seems to be much better in order to let the MERMAID Business Entity to follow the system evolution, but may lead to problems of security, robustness, maintenance, and so on.

#### **2.3.6. Validation / Liability**

There is currently no procedure within the MERMAID system to validate any information provided by the data provider. This includes the dataset description, the Q.A information, the file location and so on. A provider can quite easily give a false description of the dataset, and the consumer will not discover this until the purchase is complete, and they have received the dataset. This was a known issue throughout the project, but the consortium agreed that the system could not validate every piece of information, and that all liability would have to lie with the provider. Although this was the only practical solution for the research project, it may prove to be commercially risky if consumers lose confidence in the system. This issue will therefore require further research, and perhaps a better solution should be found.



### **2.3.7. Legal Terms and Conditions**

It was decided through discussion amongst the consortium partners as well as with external organisations, that the MERMAID system would need to act as a true 'Brokerage' system, with no liability for incorrect information, or ownership of the datasets in any way. However, it was felt by many external users, both consumers and providers, that it would be beneficial to develop a standard set of Terms and Conditions to cover the use of the data. This would allow users to review the standard conditions once, at registration. The purchase of any datasets that conform to the standard set of conditions would subsequently be made quicker and easier, as new conditions would not need to be approved. However, the facility will also be required for data providers to edit these conditions, or submit their own.

The development of such a standard set of terms and conditions was beyond the scope of this research project. The facility for a provider to select to use the Mermaid standard, or to supply their own was therefore not included in the system, and this will need to be addressed.



### **3. CONCLUSIONS**

In order to take the MERMAID Broker System to full commercial exploitation, the key issues summarised in this Technical Implementation Plan will need to be addressed. In conjunction with this document, the specific Issues (or Bugs) Lists as compiled during the testing phase (D10.1 and D10.2) will also need to be consulted, and subsequent detailed specifications for system and site design modifications will need to be produced and provided to the developers. Finally, the Exploitation and Business Plan (D12.3), which details the business and marketing issues, will also need to be implemented.