Joint Commission for Oceanography and Marine Meteorology (JCOMM)
IOC Committee on International Oceanographic Data and Information Exchange (IODE)
JCOMM/IODE Expert Team on Data Management Practices (ETDMP)

OVERVIEW
OF “END-TO-END” DATA MANAGEMENT TECHNOLOGY
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1 INTRODUCTION

1.1 Scope

The end-to-end data management (E2 EDM) technology has been developed by IODE/JCOMM ETDMP (Expert Team on Data Management Practices) and Russian NODC under the E2 EDM Pilot Project (2004-2006). This technology is considered as an “umbrella” that comprises local data systems managed by IODE and other data centers and provides “transparent” and remote access to the metadata, data and products (resources) generated by these local data systems.

This document contains a general description of the E2 EDM technology (version 1.0) and describes the ways that the E2 EDM technology can be of use to build a distributed marine data system.

The document, intended for administrators, data managers and other specialists, to provides a non-technical overview of the E2 EDM technology.

1.2 Document overview

The document includes the following sections:

Section 1 – Introduction;

Section 2 – E2 EDM background - the goal and overall solutions which were used to develop technology;

Section 3 – A short description of the E2 EDM components from a functional viewpoint;

Section 4 – The implementation mechanisms of the E2 EDM technology to build a distributed data system;

Section 5 – E2 EDM documentation

1.3 Terms and definitions

Data set (local) - the set of data (or metadata) created by a Data Centre. It is characterized by a specific data model, data coding system, data storage system and format, and conditions of access to data.

Distributed Data System (DDS) – the set of data sources in Data Centres operating under the E2 EDM technology Integration Server.

Data Source – the Data Provider (E2E software component of DDS) connected with the local data system (information component of DDS).

Data Provider (DP) – the E2 EDM technology software providing access to the local data sets (local data system).

Integration Server (IS) - software performing the management of the DDS data sources and access to distributed data sources on requests from external software applications (portals services and other) addressed to the DDS.

Resource – data presented by the DDS data source from a local data system. A Resource has a unique E2 EDM identifier and may consist of structural data units (resource instances). Data set that connected with DP can be represented by one or more resources. And each resource can be represented by a number of instances. For example, Ocean cruise data set can be...
represent as 4 resources for time periods: from beginning – 1950; 1951-1970, 1971-1999, 2000- to current time. And each resource can be represented by cruises as instances.

**Data exchange protocol** – conventions, rules and structures regulating data exchange between the Data Provider and the Integration Server. The data exchange protocol consists of request-message, response-message and transport data file.

**Transport data file** – the data set provided by a Data Provider in response to the request from the Integration Server addressed to the local data system.

1.4. Reference

This document has been prepared by Nikolay Mikhailov (ETDMP chair, RIHMI-WDC/Russian NODC).

Information on the E2EDM technology is provided on a dedicated web site: [http://data.meteo.ru/e2edm/index.php?section=1](http://data.meteo.ru/e2edm/index.php?section=1). This site provides background information and technical documentation on the End-to-End Data Management Prototype including instructions for software installation.

The IODE Ocean Data Portal prototype based on E2E technology is available at [http://e2edm.vliz.be/e2edmclient/](http://e2edm.vliz.be/e2edmclient/).

1.5. History

2003

- The draft E2EDM development technology concept was presented by Nikolay Mikhailov (Russian NODC/RIHMI-WDC, Russian Federation) at the First Session of the IODE/JCOMM Expert Team on Data Management Practices (Oostende, Belgium).

2004

- The E2EDM concept and working plan for the E2EDM prototype were adopted at the Ad hoc Session of the IODE/JCOMM ETDMP (Oostende, Belgium).
- The draft of technical specifications of the E2EDM technology prototype was developed, including the data model, metadata/data record formats, and Data Exchange Protocol formats.

2005

- The working version of the E2EDM software components to provide the functions of Data Provider and Integration Server services were developed and an E2EDM Prototype demonstration was made.
- Data Providers were installed at RIHMI-WDC (Russia) and VLIZ (Belgium) and these tools provided remote access to and integration of historical ocean cruise data and GTS BATHY/TESAC data for North-Atlantic. The E2EDM Integration Server was installed at VLIZ with a mirror at RIHMI-WDC.
- The E2EDM prototype was successfully demonstrated at IODE-XVII session and IOC/WMO JCOMM - II session.

2006
The E2EDM technology technical specifications and software were improved, including data granularity and metadata/data record formats.

The E2EDM technology began testing under the Unified System of Information for World Ocean Conditions of Russian Federation.

Additional Data Providers were installed at IFREMER (France) and MetOffice (UK) to provide remote access to marine meteorological and Argo data.

The E2EDM technology was used as the basis of DCPC – Obninsk (Russian Federation) development under the WMO Information System prototype. The E2EDM-DCPC (Obninsk) was successfully demonstrated as a component of the WIS prototype at WMO Technical Conference (Republic of Korea, October 2006).

2007

The E2EDM technology components were improved:

- updating the rules and procedures of the metadata management and modifying the Data Provider software based on these rules;
- improving the IS/DP functionality (data source federation management, descriptive metadata synchronization and harvesting, etc.) and development of new user-friendly interfaces (web-forms) to install and use the Integration Server and Data Provider software.

The IODE Ocean Data Portal prototype based on E2EDM technology was developed and launched. The operations of the MetOffice and IFREMER data sources of distributed data system prototype were finished.

An E2E training course was held at the IODE Project Office for future construction of a regional, distributed data source system for the IODE ODINs attended by 17 data specialists from ten countries (mostly from Black Sea countries). During two days of practical work 15 DP installations were completed including the registration of 45 resources (data set segments, object files, software applications).

2. E2EDM BACKGROUND

The E2EDM system is composed of the coordinated and inter-connected combination of the following basic components:

- ocean and marine meteorological data management systems (local systems) which are operated and being developed under various ocean study programs and services;
- integration technology as an “umbrella” that comprises local data systems and provides communication and transparent interaction between metadata, data and products from these local data systems and provides end-user access to any data and information generated by the systems.

2.1. Goal

The goal of this E2EDM technology is to integrate non-homogenous local data systems into a unified distributed marine data system, that will provide transparent exchange between these local systems and access by an end-user to numerous data flows/sets/bases in a “one stop shopping” manner.
The E2EDM technology provides real-time access to, and fusion of distributed marine data:

- at operational and delayed-mode time scale;
- across oceanographic and marine meteorological disciplines;
- for various data categories – observation, climate, forecast, analysis;
- from multiple local data formats and data storage types;
- from multiple data providers in different geographic regions.

2.2. Overall solutions

The basis of the E2EDM technology is a model of distributed information resources on the concept of technology objects - any entities producing or using data (metadata) under the framework of the E2EDM system. These objects include the local data system, data source, information resource, transport data file, E2EDM services and end-users.

The architecture of the E2EDM technology is based on the “client-server with mediator and wrappers” concept and sometimes named as “virtual data holdings or virtual organizations” (fig.1.):

Fig.1. The overall model of E2EDM system

- wrapper (the Data Provider of E2EDM) provides access to data or metadata of the local data system that exist in DBMS, structured or formatted data files, and object data files (such as images, video files, documents, etc.). As soon as the wrapper is
installed in the local data system, the latter becomes a data source for the distributed data system;

- mediator (the Integration Server of E2EDM) integrates data from various local data systems interacting with wrappers (Data Providers) and with other mediators (Integration Servers of E2EDM, and other portals accumulating descriptive metadata). This makes it possible to construct a complex network as a federation of data sources to meet the needs of various projects and applications.

After an analysis of currently existing systems and technologies it was decided to use the following existing systems and tools: DiGIR Provider software and Protocol, NetCDF/OPeNDAP Protocol and Java-utilities. The data model and metadata/data structures were developed on the basis of ISO 19115 and taking into account the WMO Core metadata profile, ESIMO (Russian system) and NERC DataGrid data models and metadata formats.

3. E2EDM TECHNOLOGY COMPONENTS

The E2EDM Technology is based on the following components (fig.2):

- Technical specifications for data exchange between non-homogeneous distributed local data systems;
- Software components for management, access to and use of distributed data sources.

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**E2EDM Technical specification**

- E2E Namespace
- E2E Global XML Schema
- E2E Conceptual XML Schema
- E2E Metadata records
  - E2EEElementsMD
  - E2ECodesMD
  - E2EInterfaceMD
  - E2EUserMD
  - E2EUserMD
  - E2EUserMD
- E2E Data records
  - E2EPointDD
  - E2EProfileDD
  - E2EGridMD

**E2EDM Software components**

- Integration Server
- Data Provider
- E2E Exchange Protocol
  - Request-message
  - Response-message
  - Transport data file
Fig. 2. E2E Technology components

3.1. Technical specifications

The E2EDM Technical specifications are based on a single data model and include specifications of:

- namespace;
- metadata and data records;
- data exchange protocol.

3.1.1 The E2E namespace

The namespace determines a semantic content and structure of elements, supported by the E2EDM technology tools. The namespace is described by global and conceptual XML Schemas with unified rules of identification and naming for each element and structure.

The global XML Schema includes the elements (more than 100) and element classes (27 classes) which are used to describe the properties (contents, space-time characteristics, interfaces, etc.) of the local data sets, users (external applications) and other E2EDM objects. The E2EDM elements and classes are equivalent and compatible with ISO 19115. In comparing with ISO 19115 there are additional classes which are accepted for the reflecting the marine data specificity and realization of the fully metadata-driving approach for distributed data management.

The element classes represent “construction blocks” of 11 records of metadata and data that are used to provide implementation functions of the E2EDM technology. If necessary, the Global XML Schema classes can be used to construct new records that add to the functionality of the technology.

The conceptual XML Schema comprises descriptions (names, types, etc.) of data elements (marine environment parameters and derivatives such as means, extremes, etc.) and the related metadata (platforms, space-time characteristics, etc.) that are managed by local data systems connected to the E2EDM system.

The conceptual XML Schema is independent of the Global XML Schema as the Global XML Schema is only the environment to manage the conceptual elements. The several conceptual sub-schemes (based on a single Conceptual XML Schema) can be defined such that each of these will contain a description of data/metadata elements of the thematic (specialized) data source federation as a virtual fragment of a distributed marine data system. If a newly added local data system contains elements which are absent from the conceptual scheme, the conceptual XML Schema can be extended without changing other components of the E2EDM technology. The Global XML Schema and Conceptual XML Schema are linked through the E2EEElementsMD record (see below).

It is possible to use a few independent Conceptual XML Schemas and in this case a few distributed data systems will operate based on E2EDM technology interacting via their Integration Servers.

The E2EDM technology provides the unification of specifics of storage structures and data coding systems of the local data systems through the mechanism and tools of translating local formats and codes to the common transport data file and system codes. The common system codes and other encoding tools (configuration files of local data sources) are based on the Conceptual XML Schemas. It is by this means that it is possible to link independent distributed data systems which use different coding systems.
3.1.2 The E2E metadata and data records

The metadata records are:

- E2ESearchMD – description of a local data (or metadata) source as an information resource generated by Data Provider with the degree of data granularity determined by specified rules. Functions – data discovery and distributed data source monitoring;

- E2ECodesMD – description of the common (system) code lists and dictionaries used for mapping local codes into system codes. Functions – unification of data from various local data sources with different code systems;

- E2EElementsMD – description of thematic elements (data and related metadata elements) managed by the E2EDM technology. Functions – defining the parameter dictionary for system implementation and providing the flexibility of E2E technology for various implementation cases via the data source federation concept;

- E2ETermMD – description of the data semantic structure to link the topics with data elements managed by DDS. Functions – supporting the end-user screen forms if the user does not want to use the standard classification (ISO 19115, GCMD etc.) for data search;

- E2ELinkMD – description of a data/metadata source to provide access to the local data/metadata system: DBMS, structured data files, object data files, web-applications. Also specification of Data Provider functions – scheduling the descriptive metadata (E2ESearchMD) updating, path to the local xml-files and others. Functions – providing the connection of the Integration Server with local data systems via Data Providers, supporting the Request/Response exchange and Data Providers monitoring;

- E2EInterfaceMD – description of an information interface of the end-user external software applications (i.e, system Portal services) with the Integration Server. Functions – supporting data exchange between the Integration Server and external applications;

- E2EUserMD – description of end-user external applications (identification, privileges, data delivery point etc.). Functions – data delivery scheduling (which resources, where delivered, etc.) and applications status monitoring to accumulate statistics of distributed system use.

The data records are:

- E2EPointDD – data with fixed spatial (geographical, depth/height) coordinates, “matrix data” type;

- E2EProfileDD – data with fixed geographical and temporal coordinates, and depth/height coordinates variable, “header and matrix data” type;

- E2EGridDD – data, distributed in the scope by definite geometrical model, “grid data” type;

- E2EObjectDD – representation of object (non-parsing by E2E tools) data (e.g. documents, images, GIS shapes, applications etc.).

3.1.3 The Data Exchange Protocol
The Data Exchange Protocol provides data interaction between the E2EDM Data Provider and Integration Server (or Integration Server and end-user applications) and consists of: request/response messages and transport data file.

The formats and other specifications of request/response messages are based on the DiGIR Protocol. An extension to the DiGIR request/response formats has been developed providing requests/responses for local file-oriented data systems and transferring data using a transport data file.

To cover the different local data storage types there are three types of transport data files:

- structured data file in original data format of local data system if this option was defined (E2EInterfaceMD);
- non-structured data file (Jpeg, HTML, pdf, doc and other) used when the local data system produces the information resource in the form of an object file.

3.2 The software components

Software components consist of the Integration Server, Data Provider and typical external (end-user) application software. Their main functions (according to version 1.0. components) are considered below.

3.2.1. Integration Server

Integration Server provides (fig.3):

(i) Management Service (the term “service” is used to designate the homogeneous functions realized by an API) – supporting the user screen interfaces (web-forms), management of other services, processing of errors, etc.
(ii) Metadata Service – management of system metadata based on interaction with Data Providers – supporting common and controlled dictionaries and tables of codes, harvesting descriptive metadata (E2ESearchMD record) from data sources, synchronization of centralized data sources/resources descriptions with Data Providers metadata, managing the other types of system metadata in interaction with Data Providers and end-user application (portal services), system metadata storage.

Harvesting operations and subsequent metadata synchronization are scheduled by the Integration Server administrator separately for each Data Provider - every month, week, hour and even second if it is needed. The result is descriptive metadata for each data source content and status. The harvesting operation schedule can be changed or canceled by the Integration Server administrator at any time.

The operation schedule depends on the specifics of the local data system– if the data system includes real-time data then the harvesting/synchronization operations should be done often. If during a harvesting session the server of the data source does not respond then the Metadata service will try to connect with the server a number of times – the number of attempts is set by the Integration Server administrator.

(iii) Monitoring Service – accumulation and storage of the statistics about Data Providers status to prepare the information about data sources network that is managed by this IS.

(iv) Navigation Service – processing (data selection criteria against resource descriptions) and decomposition of user requests from external applications identifying individual data sources and their transmission to the Data Access Service for provision to the required data sources.

(v) Data Access Service – check of Data Providers status according to schedule or on request of IS administrator, management of the user requests execution (connection with Data Providers, time of response, processing of errors, etc.) using the Transport Service

Status control operations are similar to the metadata harvesting but the operation provides only a “ready/non-ready” result (there is the E2E list of errors with 3 options to reflect the non-ready status) - therefore the status control operation can be done more often than harvesting operation. The status control operation can be changed or canceled by the Integration Server administrator in any time.

(vi) Transport Service – reception of response messages from Data Provider (E2EResponse), transmission of response with transport data files address to user (external application)

(vii) Security Service - authorization and authentication of external end-user applications for their roles and privileges (E2EUserMD), management of external application interfaces (E2EInterfaceMD) with the Integration Server

3.2.2. Data Provider
Data Provider carries out following functions (fig. 4):

(i) Management Service – adjustment of Data Provider services to adapt to local data, support of the user screen interfaces for Data Provider administrating, etc., decoding of requests from Integration Server and control of Data Provider services, responsible for the access to the data source and formation of response.

(ii) Metadata Service – supporting the existence of common dictionaries and tables of codes (E2E Codes MD, E2E Elements MD) on the local system via interaction with the Integration Server, preparing (updating) the local resource descriptions (local descriptive metadata) according to a schedule or harvesting request from the Integration Server.

The Data Provider administrator can set the schedule for updating the local descriptive metadata and such operations will be done by DAS or FAS – see below. The harvesting operations schedule of IS should be consistent with Data Provider updating operations.

(iii) Database Access Service (DAS) – connection to the data source of type DBMS, formulation and implementation of SQL-request, reformatting the local data codes to system codes, and data transmission to Data Format Service. The processing of the local data to prepare the descriptive metadata for Metadata service on schedule or request.

(iv) File Access Service (FAS) – the same functions as DAS but for data source of type file. If the local data are stored as an object data file (Jpeg, htm, doc. etc) or the request defines to provide data in the local format then the access path to this file is only provided.

(v) Data Format Service – formation of response messages and preparation of transport data files (binary NetCDF, ASCII, XML versions, or data file in local format depending on the request).
(vi) Security Service - providing the connections with given list of IP addresses – Integration Server IP and other agreed IP.

3.2.3. Typical external application

The typical external application provides:

- entry to the system via a web browser and defines selection criteria using map, region, time period, resource, etc.;
- access to remote data sources via the Integration Server including request status monitoring;
- processing the transport data files and tabular-graphic visualization of data, saving requested data on user side.

4. IMPLEMENTATION OF E2EDM TECHNOLOGY

4.1. Implementation approach

An important task of IODE and JCOMM is to provide an effective and comprehensive marine information service for the study and exploration of ocean, or other marine activity.

A marine information service can be divided into a number of classes: on-line access to metadata about observations, data centers and their resources, etc, on-line access to real-time and delayed-mode data and products (data summaries, analyses, forecasts) that are supported by data centers, management and access to global ocean data sets, specific services such as climate change monitoring, support to hazard warning systems, etc.

Each of the information service requires specific ocean/atmosphere data or products, delivery times (real-time or delayed-mode), access forms (on-line/off-line), representations for users (data copies, interactive maps/plots/tables), etc. Each marine information service is implemented through the activities of IODE (or WMO, JCOMM) data centres.

Using the E2EDM technology it will be possible to establish the IODE/JCOMM distributed marine data system to make more effective marine information services. This will be the technology to build the IODE/JCOMM Ocean Data Portal.

From an implementation point of view the Ocean Data Portal can be considered as a specific and multifunctional external application (in E2EDM technology terms) providing the full range of processes: data discovery, access, delivery, and publishing (visualization, copies of data, etc.) based on E2EDM technology - Integration Server/Data Provider software and E2EDM technical specifications. The Ocean Data Portal services are responsible for interaction with end-users, and E2EDM components provide integration and access to the distributed and diverse data sets, involved in DDS.

The overall model of the IODE/JCOMM Ocean Data Portal is shown in fig.5. This model takes into account regional and project-oriented activities of IODE and JCOMM.
In general, the functional aspects of the IODE/JCOMM Ocean Data Portal model maps to the E2EDM model in the following way.

The IODE NODC/DNA and JCOMM data centers, which are data providers (Data Provider Centre) in DDS, install and operate the E2EDM Data Provider software. It means that the local data or products will be accessible to Ocean Data Portal services via the Integration Server.

The appointed data centre coordinator of the DDS installs the Integration Server software and provides the management of system metadata, control of the references to distributed data sources and ensures the connection with distributed data sources on request by external end-user applications.

The end-user application is a Web-based client accessible via a Web browser or software for data processing/modeling on a local computer connected with the Internet. The E2EDM technology provides the interaction interface (rules and metadata structures, API) to link the external end-user application with the E2EDM distributed data system via the Integration Server. The end-user application in combination with administrative and other services can be organized as the Ocean Data Portal distributed data system. There is the possibility for an end-user to connect with the Integration Server and to get the metadata about data sources/resources for data access.

An end-user can enter the distributed data system via the Web browser to start an application and request data for single or multiple types from distributed data sources by
specifying parameters, space, time and other criteria. The appropriate data are automatically sourced from wherever they reside and returned to the requesting application.

4.2. Implementation requirements

The following are the general requirements for a Data Provider centre. The full requirements are given in the document “Checklist of technical requirements for data providers for E2E technology implementation”.

4.2.1. The role of Data Provider Center and technical requirements

Data centers that agree to provide a data sources for the DSS should provide:

- the appropriate middleware for communications: Web server and application server;
- installation of the E2EDM Data Provider software to connect the Ocean Data Portal with the local data system (s);
- registration of data sources and generated resources;
- reliable connections to the local data system.

The requirements to install and operate E2EDM Data Provider are the following:

Hardware: It is recommended that a computer with the following minimum characteristics be used: Pentium IV or compatible, RAM 512 Mb (1 GB is preferable), at least 100 Mb hard disk space. It is also recommended to use a dedicated computer for Data Provider installation.

Middleware: Data Provider works on Windows or UNIX servers with clock speed higher than 1GHz and 512 Mb of RAM. The software that must be installed on the server is as follows:

- Java2 Standard Edition 1.5.0 or higher,
- Apache web server 1.3.27 or higher with PHP 4 module,
- JBoss application server 4.0 or higher

It is necessary to allow sending and receiving of XML messages via HTTP protocol through web-server port. The port number is 8080 by default.

All required middleware components are included in the Data Provider distribution package.

4.2.2. The role of DSS Coordinator Centre and technical requirements

The data center that agrees to provide the coordination role of E2EDM implementation should provide:

- installation of the E2EDM Integration Server software to provide the connection with E2EDM Data Providers of the DDS.
- the appropriate middleware for communications: Web server and application server;
- support the centralized metadata sets (CodesMD, ElementsMD, SearchMD and others) providing the support and operations of these system metadata;

The requirements for installing and operating E2EDM Integration Server software and hardware are the following:
Hardware: Minimum requirements are: Pentium IV or compatible, 1 GB RAM, at least 100 Mb hard disk space.

Middleware:
- Operating System – Windows or UNIX (UNIX is preferred).
- Application Server. JBoss AS (www.jboss.org) application server (release 4 or later);
- Java 2 programming language for implementation of the Integration Server services. JDK (Java Development Kit) 1.5 or later is needed for the Integration Server operation.

4.2.3. Support requirements

To test and operate Data Providers and Integration Server software it is recommended to nominate a person who will be responsible for the E2EDM

4.3. Implementation test case

4.3.1 E2EDM system and IODE Ocean Data Portal prototype

In 2005 the prototype of the E2EDM system was launched under the JCOMM/IODE ETDMP Pilot Project III. The four centres of VLIZ (Belgium), RIHMI-WDC (Russian Federation), Met Office (United Kingdom) and IFREMER (France) installed Data Provider software. VLIZ (Belgium) provided support for the Integration Server (RIHMI-WDC – mirror), The E2EDM system prototype operated with data with the following parameters:

- in-situ data, including marine meteorological data (air temperature, sea surface temperature, pressure, wave height and wave direction, wind speed and wind direction) and oceanographic data (temperature, salinity, oxygen, and nitrates);
- sea temperature and salinity climatic fields;
- synoptic weather charts (imageries).

The geographic area of the E2EDM prototype operation covered the North Atlantic, including Norwegian, North and Greenland seas. The following data types were involved in the E2EDM prototype operation: historical, delay-mode, real-time, climate data (see below).

<table>
<thead>
<tr>
<th>Data Provider</th>
<th>Data contents and storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLIZ (Belgium)</td>
<td>1 resource - part of the World Ocean Atlas (WOA2001) for the North Sea. Parameters: sea temperature, salinity, oxygen, nitrates. Local data system type: DBMS (Oracle).</td>
</tr>
<tr>
<td>IFREMER (France)</td>
<td>1 resource - delayed-mode Argo data for the North Atlantic. Parameters: sea temperature and salinity. Local data system type: DBMS (Oracle).</td>
</tr>
<tr>
<td>Met Office (United Kingdom)</td>
<td>1 resource - historical marine meteorological data from the MCSS project. Parameters: air temperature, sea surface temperature, pressure, wind and wave. Local data system type: data files in IMMT-3 format.</td>
</tr>
<tr>
<td>RIHMI-WDC</td>
<td>6 resources: (i) historical ocean cruise data</td>
</tr>
</tbody>
</table>
(Russian Federation) (temperature, salinity, oxygen and nitrites); (ii) real-time GTS marine meteorological (SHIP) data (air temperature, sea surface temperature, pressure, wave, wind); (iii) real-time GTS ocean (BATHY and TESAC) data (temperature, salinity); (iv) and (v) seasonal climatic fields (average temperature and salinity on standard levels); (vi) real-time weather chart (images). All local data is managed by a DBMS (Oracle) except weather charts that are provided via the GTS for images.

The E2EDM technology prototype began operations on April 2005. Current E2EDM parameters:

- Integration Server at VLIZ (RIHM_WDC – mirror);
- Data sources with Data Providers at VLIZ and RIHMI-WDC;
- External end-user application (Integration Server) at VLIZ (RIHMI-WDC mirror).

In 2007 the external application was significantly improved and presently the E2EDM prototype operates as the IODE Ocean Data Portal Prototype.

4.3.2. The contribution to the WMO Information System (WIS) prototype

The E2EDM technology is a one of the WIS prototype components that ensures the operation of the JCOMM Data Collection and Processing Centre (DCPC) of the WMO Information System. This WIS component is installed on the RNODC/RIHMI-WDC (Obninsk) platform.

The following data were provided by the JCOMM/DCPC (E2EDM-Obninsk):

- real-time GTS marine meteorological (SHIP) and ocean (BATHY and TESAC) data (RIHMI-WDC, Russia, DBMS);
- delayed-mode marine meteorological data (MetOffice, UK, local data system type – IMMT data files), operated until the end of 2007;
- weather charts (imagery) (RIHMI-WDC, Russia, object data files - images).

The JCOMM/DCPC-Obninsk provides the following functionality. The E2EDM Integration Server provides the metadata generation for the above-mentioned data sources and supports these metadata in routine operations of the E2EDM system prototype. The WIS E2EDM service translates the E2EDM metadata records into WMO metadata records and into OAI (Open Archives Initiative) metadata records to provide a standalone metadata catalogue.

The GISC-DCPC/Obninsk interaction is implemented using the V-GISC protocol communication operating through the SIMDAT Data Repository for delivery of DCPC/Obninsk metadata to the GISC metadata repository. This permits inter-system interaction and access to E2EDM data sources from V-GISC user interface (fig. 6.).
5. THE E2EDM DOCUMENTATION

The E2EDM documentation (table 1) is available at:

<table>
<thead>
<tr>
<th>NN</th>
<th>Title</th>
<th>Contents</th>
<th>Version and updating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>E2EDM Overview</td>
<td>General information about E2EDM technology and its implementation</td>
<td>Updated May 2008</td>
</tr>
<tr>
<td>2.</td>
<td>The Checklist of technical requirements for data providers for E2E technology implementation</td>
<td>Requirements for IODE data centres to build the E2E Data Providers network</td>
<td>Issued 09 March 2007</td>
</tr>
<tr>
<td>3.</td>
<td>E2EDM technical specification v.1.0</td>
<td>Technical specifications (model, metadata structures, data exchange protocol and etc.) the E2EDM technology</td>
<td>Updated 15 Jan 2007</td>
</tr>
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<td>4.</td>
<td>E2EDM Concept XML Schema</td>
<td>XML document includes ocean and marine meteorological parameters which circulate under the distributed data system (current data source federation).</td>
<td>Updated 16 November 2007</td>
</tr>
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<td>5.</td>
<td>E2EDM Global XML Schema</td>
<td>XML structures of metadata classes (packages) used for E2EDM metadata records construction.</td>
<td>Updated 14 October 2007</td>
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<td>8.</td>
<td>E2EDM Data Provider</td>
<td>Detailed rules, procedures and web-forms for</td>
<td>v.1.1.0</td>
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<tr>
<td>NN</td>
<td>Title</td>
<td>Contents</td>
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<tr>
<td>User Guide - Installation and setup</td>
<td>the Data Provider installation, registration and maintenance. The document is intended for system administrators of the data centres and other institutions responsible for providing data to the system.</td>
<td>Updated September 2007</td>
<td></td>
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<tr>
<td>9.</td>
<td>E2EDM Data Provider User Guide - Registration and maintenance of resources.</td>
<td>Detailed rules, procedures and web-forms for registration and maintenance of the local resources of distributed data sources system. The document is intended for operators of the data centres.</td>
<td>v.1.1.0 Updated September 2007</td>
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