Architecture of IODE ODP V2

Dr. Sergey Belov, et al.
Partnership Centre for the IODE Ocean Data Portal
Introduction

Ocean Data Portal is not creating a new data system. ODP technology provides an access to local data systems with a wide variety of structures, formats, coding systems and data storage types. ODP network links together two categories of components:

- **Data components**, based on existing national, regional, global data systems.
- **ODP data integration and dissemination components**

Service-oriented architecture
Component viewpoint

*ODP V2 being unified distributed system is a set of interacting components.*
Component viewpoint

Component consists of a set of tools:
- telecommunication equipment (routers, connectors, firewalls, etc.);
- computing equipment (servers, workstations);
- software - operating system, environment of operation (application servers, web-servers, etc.), specialized software;
- information resources (data sets and metadata).

Each component fulfills certain services grouped by following layers:
- interface layer (data exchange with data sources and other components);
- business logic layer (data conversion, metadata generation, etc.);
- presentation layer - a visual (tabular, graphical and map) presentation of information in graphical interfaces for ODP end users.
ODP V2 components

- Security
- Monitoring
- Service Bus

Management

- Portal
- Portlets

Presentation

- Data Cache
- Integration Server
- Data Provider

Integration, delivery, exchange

Global node

Regional node

National node
ODP V2 technical architecture

ODP V2 components are developed and operates using ONLY open-source and (L)GPL software!

Operational environment:
- OS – CentOS 5.8 Linux
- Virtualization – VMware ESXi 5
- Database – PostgreSQL 8
- Application server – JBoss 4/5
- Platform – Java 6/7
- Portal software – JBoss Portal 2.7
- AAA – (Single-sign-on) JOSSO
- Metadata service- GeoNetwork 2.7
ODP V2 functional entities

ODP V2 toolkit is a complete set of components used for “plug and play” of the ODP node. Specific composition of the ODP V2 components is building an ODP node.
Integration, data provision and delivery - Data Provider

Major functions:

- Connection and processing of local data sources;
- Creation and provision of discovery metadata;
- Discovery metadata update according to data updates;
- Automatic “data-metadata” bridging;
- Data transformation (for structured data) into NetCDF format (cache mode, on request, on data update event);
- Processing of requests for data and products;
Integration, data provision and delivery - Data Provider

Features:
Provides support for following data storage types:
- SQL-oriented databases;
- CSV-like structured data files (CSV, TSV and derivatives);
- Fixed position structured files (IMMT-3, ARGO, etc.);
- Any unstructured data files (or unrecognizable by ODP services) – multimedia, documents, etc.
- Web links
- WMS, WFS services (under development)
Integration, data provision and delivery - Data Provider

Features:
Support for a various types of data granularity

i.e. makes it possible to create discovery metadata, search and deliver full datasets or subsets (single cruise, number of profiles, single profile, profiles with required parameters, etc.)
Integration, data provision and delivery – Light Data Provider

Features:

Pro
- No installation is required
- Online access with dedicated username and password using facility of existing Data Provider installation
- Same functionality with usual Data Provider except absence of database support
- One usual Data Provider can host multiple centres through the Light functionality

Contra
- Management functions are unavailable
- Storage quota should be agreed with hosting side
- No database support available
Integration, data provision and delivery - Data Provider – user interface examples

Metadata entry online tool – identification and data connection step
Integration, data provision and delivery - Data Provider – user interface examples

Information on platforms, processing level, spatial & temporal resolution, quality info, distribution info
Integration, data provision and delivery - Data Provider – user interface examples

Temporal, vertical and spatial extents of the data (can be calculated from data automatically)
Integration, data provision and delivery - Data Provider – user interface examples

### Data connection interface – structured files

![Data connection interface](image)

**File access service**

<table>
<thead>
<tr>
<th>Metadata</th>
<th>Data source mapping</th>
<th>Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique resource identifier: *</td>
<td>BE_US-NODC_68</td>
<td></td>
</tr>
<tr>
<td>Data format</td>
<td>ASCII-document with value delimiter</td>
<td></td>
</tr>
<tr>
<td>delimiter</td>
<td>comma (,)</td>
<td></td>
</tr>
<tr>
<td>Number of commented lines (header, etc.) in the beginning of the file</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Data processing type</td>
<td>process all files</td>
<td></td>
</tr>
</tbody>
</table>

**Date and time format**

- Use follow characters to specify pattern: y - Year, M - Month in year, d - Day in month, H - Hour in day (0-23), h - Hour in am/pm (0-11), m - Minute in hour, s - Second in minute, S - Millisecond, Z - Time zone
- Use pattern yyyy-MM-dd HH:mm:ss for date and time 2011-01-01 12:00:00
- Example date and time format: yyyy-MM-dd

*Example data:* 2001-07-04T12:08:56
Integration, data provision and delivery - Data Provider – user interface examples

**Add New Data Source**

Add local or remote data source using the form below. To add multiple data sources, specify each path in a separate row!

Permitted to connect archived files with extensions. Zip. Gz. Tar.gz, files are automatically unpacked to server file system

Data source examples:
- c:\data\forecast.txt
- ftp://ftp.ifremer.fr/ifremer/argo/etc/argo_profile_detailed_index.txt.gz


**Upload file to the server**

If you need to upload the file to the server with the current workstation, use the form below. Click the "Browse" and locate the file the file system and click the "Upload a data file."

Please note that the data file will not be updated automatically. If necessary, update the file on the server to upload the file again.

To update data file automatically specify HTTP or FTP link using form above

Data connection interface – files (local, upload, remote)
Integration, data provision and delivery - Data Provider – user interface examples

Data connection interface – files, fields mapping
Integration, data provision and delivery - Data Provider – user interface examples

Data connection interface – SQL database
Integration, data provision and delivery - Data Provider – user interface examples

Metadata catalogue management – publish/block, test, set data scan -> metadata update schedule, validate, check completeness, add/remove/edit
## Integration, data provision and delivery - Data Provider – user interface examples

### Data catalogue management – view parent/child metadata, edit/remove, view ASCII, NetCDF
Integration, data provision and delivery - Integration Server

Major functions:
- Metadata harvesting (on demand, schedule, event-driven)
- Metadata catalogue services (HTTP, SOAP, CSW)
- Request for data processing - data location calculation, call for data, data retrieval and transformation (netCDF -> ASCII, zip, etc.)
- Data submission for Data Cache
- Data dissemination according to the distribution catalogue (service-based)

Additional functions:
- Data provider network monitoring
- Metadata backup and restore
- Data cache backup and restore
Integration, data provision and delivery - Integration Server – user interface examples

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGODC/IO-EAS</td>
<td>Bulgarian National Oceanographic Data Centre</td>
</tr>
<tr>
<td>GDUA</td>
<td>Tbilisi State University, Georgian DNA</td>
</tr>
<tr>
<td>IMOS</td>
<td>Integrated Marine Observing System</td>
</tr>
<tr>
<td>IOOE</td>
<td>International Oceanographic Data and Information Exchange</td>
</tr>
<tr>
<td>ISDM</td>
<td>Integrated Science Data Management</td>
</tr>
<tr>
<td>LaMIS/INRS</td>
<td>Institute of Biology of the Southern Seas National Academy of Sciences of Ukraine</td>
</tr>
<tr>
<td>METI/MHI</td>
<td>Marine Hydrophysical Institute National Academy of Sciences of Ukraine</td>
</tr>
<tr>
<td>MEO</td>
<td>Met Office</td>
</tr>
<tr>
<td>MSNC/T</td>
<td>Ministry of Science, Technology and Productive Innovation</td>
</tr>
<tr>
<td>MIRC</td>
<td>Marine Information Research Center</td>
</tr>
<tr>
<td>NMDE</td>
<td>National Marine Data and Information Service</td>
</tr>
<tr>
<td>NCEO</td>
<td>National Oceanographic Data Centre, Russia</td>
</tr>
<tr>
<td>NCOME/NIMRD</td>
<td>National Institute for Marine Research and Development</td>
</tr>
<tr>
<td>US-NCCDC</td>
<td>US National Oceanographic Data Center (NCCDC)</td>
</tr>
</tbody>
</table>

Data providers management and monitoring
Integration, data provision and delivery - Integration Server – user interface examples

 Consolidated metadata catalogue
Integration, data provision and delivery - Integration Server – user interface examples

Consolidated metadata catalogue
Integration, data provision and delivery - Integration Server – user interface examples

Consolidated metadata catalogue
Integration, data provision and delivery - Integration Server – user interface examples

<table>
<thead>
<tr>
<th>Manage Providers:</th>
<th>Manage Users:</th>
</tr>
</thead>
<tbody>
<tr>
<td>View configuration</td>
<td></td>
</tr>
<tr>
<td>Add new Data Provider</td>
<td></td>
</tr>
<tr>
<td>DATA CENTRES LIST</td>
<td></td>
</tr>
<tr>
<td>Edit data providers</td>
<td></td>
</tr>
<tr>
<td>Check Data Providers online status</td>
<td></td>
</tr>
<tr>
<td>Synchronize resources and instances</td>
<td></td>
</tr>
<tr>
<td>Report on resources</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manage Tasks:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Task</td>
</tr>
</tbody>
</table>

Real-time metadata & data update and delivery monitoring
Integration, data provision and delivery - Integration Server – user interface examples

Management of data dissemination catalogue
Integration, data provision and delivery - Integration Server – user interface examples

System management and reporting tools – settings, access to logs
Integration, data provision and delivery – Data Cache

Major functions:

- Centralized data storage facility for essential data and backup data access;
- Event-driven update model;
- Data access facility (SOAP, HTTP) for ODP Portal services;

**Graphical user interface for accessing Data Cache is provided via Integration Server**
Metadata “broadcasting” model

1. Metadata add/update/delete
2. Event signal (SOAP)
3. Harvesting
4. Broadcast signal (SOAP)
5. Harvesting (SOAP)

Global Node

Regional Node 1

Regional Node N

National Node 1

National Node N

databases
files
products
services
Data dissemination model

1. Data update
2. Event signal
3. Broadcast signal
4. Subscriptions check
5. Data pull (SOAP)
6. Caching & conversion
7. Data user delivery (FTP, SMTP, WS)

Global Node

Regional Node 1

Regional Node N

National Node 1

databases
files
products
services
Metadata service

Major functions:

- Metadata standards (ISO19115/ISO19119/ISO19110 following ISO19139, FGDC and Dublin Core)
- Harvesting and synchronization of metadata from external metadata catalogs (OGC-CSW 2.0.2 ISO Profile, OAI-PMH, Z39.50 protocols)
- Catalog interfaces (OGC-CSW2.0.2 ISO profile client and server, OAI-PMH client and server, GeoRSS server, GEO OpenSearch server, WebDAV harvesting, GeoNetwork to GeoNetwork harvesting support)

More information about Geonetwork at www.geonetwork-opensource.org
User access - Portal

Major functions:
Entry point for ODP consumers and specified users (administrators, operators) and mean of integrated access to information resources and management of the ODP.
ODP Portal includes two sub portals: User and Administrator.

Portal contains a number of services and solutions to search and discover data/services, provide data visualization, news and other relevant information to the user community.
User access – Portal – user interface examples
User access – Portal – user interface examples

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Australian Ocean Data Network</td>
<td>An interoperable, online network of marine and coastal data resources, including data from the US ODP partner agencies, supported by standard-based metadata, which will serve data to support Australia’s science, education, environmental management and policy needs. Australia’s digital ocean compendia.</td>
</tr>
<tr>
<td>2</td>
<td>Integrated Science Data Management</td>
<td>Fisheries and Oceans Canada is the lead federal government department responsible for developing and implementing policies and programs in support of Canada’s economic, ecological and scientific interests in oceans and land waters. This mandate includes responsibility for conservation and sustainable use of Canada’s fisheries resources.</td>
</tr>
<tr>
<td>3</td>
<td>Marine Information Research Center, Japan Hydrographic Association</td>
<td>MIRC was established in the Japan Hydrographic Association under the financial support of the Nippon Foundation. MIRC conducts high-grade quality control to the oceanic data compiled by JOCDC, and produce useful data products for users of various fields. Spatio-temporal distribution of necessary data set and of data products is also the task of MIRC.</td>
</tr>
<tr>
<td>4</td>
<td>Met Office</td>
<td>The Met Office is the UK’s National Weather Service. It employs more than 1,000 services at 60 locations throughout the world. Metoffice are recognized as one of the world’s most accurate forecasters. Using more than 10 million weather observations a day, an advanced atmospheric model and a high performance supercomputer to create 3,000 tailored forecasts and briefings a day.</td>
</tr>
<tr>
<td>5</td>
<td>National Marine and Information Service (NMIS)/State Oceanic Administration (SOA) of China</td>
<td>National Marine Information Centre. The main function is the management of national marine information resources, guidance, coordination of national oceanographic information operations, marine economy, marine management, public services and marine safety. Marine Information business support, technical support and service.</td>
</tr>
<tr>
<td>6</td>
<td>National Oceanographic Data Center (NODC), US</td>
<td>NODC serves to acquire, process, preserve, and disseminate oceanographic data. Its primary mission is to ensure that global oceanographic data sets collected at great cost are maintained in a permanent archive that is easily accessible to the world science community and to other users.</td>
</tr>
<tr>
<td>7</td>
<td>Bulgarian National Oceanographic Data Center (BGODC), Institute of Oceanology, Bulgarian Academy of Sciences (BGODC/OBS)</td>
<td>Bulgarian National Oceanographic Data Centre (BGODC) serves as a local portal for the national and international exchange of oceanographic data. The Heart of the data Centre architecture are GIS and Report Servers—a WEB based middle-tier layer that receives incoming report requests, generates, renders, and delivers tabular, graphical and geographical reports to our clients.</td>
</tr>
<tr>
<td>8</td>
<td>National Marine Data Information Service (NMIDS)</td>
<td>NMIDS carries out basic, applied and technological research, crucial for the...</td>
</tr>
</tbody>
</table>
User access – Portal – user interface examples

Search & Browse Datasets

<table>
<thead>
<tr>
<th>id</th>
<th>title</th>
<th>begin date-time</th>
<th>end date-time</th>
<th>metadata updated</th>
<th>data</th>
</tr>
</thead>
<tbody>
<tr>
<td>RU_RNODC_09</td>
<td>(Example) Forecast of meteorological fields with high scale resolution for World Ocean including Russian seas, 00 hours (NetCDF files)</td>
<td>2012-05-21T00:00:00</td>
<td>2012-05-26T00:00:00</td>
<td>2013-03-08T02:55:28+04:00</td>
<td></td>
</tr>
<tr>
<td>RU_RNODC_11</td>
<td>Global real-time hydrometeorological observation data (air temperature,wind) from meteoestations (FM-12 IX SYNOP - Synopi)</td>
<td>2013-03-07T03:00:00+04:00</td>
<td>2013-03-07T22:00:00+04:00</td>
<td>2013-03-08T02:48:40+04:00</td>
<td></td>
</tr>
<tr>
<td>RU_RNODC_12</td>
<td>Global real-time hydrometeorological observation data (air temperature,water temperature,wind,wave) from coastal stations</td>
<td>2013-03-01T03:00:00+04:00</td>
<td>2013-03-07T18:00:00+04:00</td>
<td>2013-03-08T02:42:07+04:00</td>
<td></td>
</tr>
<tr>
<td>RU_RNODC_04</td>
<td>Real-time hydrometeorological observation data (Air temperature,Water temperature,Wind,Wave ) from coastal Russian and Ukrainan stations for the Black Sea</td>
<td>2013-03-01T06:00:00+04:00</td>
<td>2013-03-07T18:00:00+04:00</td>
<td>2013-03-08T02:39:14+04:00</td>
<td></td>
</tr>
<tr>
<td>RU_RNODC_08</td>
<td>Real-time hydrometeorological observation data (Air temperature,Wind) from meteoestations (FM-12 IX SYNOP - Synopi) for the Black Sea</td>
<td>2013-03-07T03:00:00+04:00</td>
<td>2013-03-07T21:00:00+04:00</td>
<td>2013-03-08T02:14:47+04:00</td>
<td></td>
</tr>
<tr>
<td>RU_RNODC_01</td>
<td>Ship data from VOS programme for the Black Sea- FM-21 V SHIP</td>
<td>2013-02-01T00:00:00+04:00</td>
<td>2013-03-07T20:00:00+04:00</td>
<td>2013-03-08T01:59:40+04:00</td>
<td></td>
</tr>
<tr>
<td>BE_ISDM_02</td>
<td>Atlantic Zone Monitoring Program (AZMP) data</td>
<td>1999-01-01T00:00:00</td>
<td>2010-10-01T00:00:00</td>
<td>2013-03-08T01:11:04+00:00</td>
<td></td>
</tr>
<tr>
<td>BE_ISDM_04</td>
<td>Surface Drifter Data</td>
<td>1990-01-01T00:00:00</td>
<td>2007-12-31T00:00:00</td>
<td>2013-03-08T01:00:10+00:00</td>
<td></td>
</tr>
</tbody>
</table>

ODP network metadata and data - view/download access
User access – Portal – user interface examples

Related projects metadata and data access – simple and advanced search and access interfaces
User access – Portal – user interface examples

<table>
<thead>
<tr>
<th>HOME</th>
<th>COMMUNITY</th>
<th>DATA</th>
<th>SERVICES</th>
<th>DISCLAIMER</th>
</tr>
</thead>
</table>

**GeoNetwork opensource portal to spatial data and information** - GeoNetwork opensource provides Internet access to interactive maps, satellite imagery and related spatial databases. Its purpose is to improve access to and integrated use of spatial data and information. GeoNetwork opensource allows to easily share spatial data among different users.

- **Low Resolution Sea Ice Drift - Multiyear**
  01 Mar 2013 20:25:05 EST

  Low Resolution Sea Ice Drift product covers both Northern Hemisphere (NH) and Southern Hemisphere (SH), ice motion vectors with a time span of 48 hours are estimated by an advanced cross-correlation algorithm, along with a merged multi-year NH summer ice motion product. The algorithm utilizes sea ice drift from the processed charts and similarity of ice drift charts from the same region.

- **Basic measurements of radiative temperature**
  25 Feb 2013 17:34:35 EST

- **Basic measurements of radiative temperature**
  25 Feb 2013 17:34:33 EST

- **Ozone measurements from station Tananarivo (2012-86)**
  26 Feb 2013 17:34:33 EST

- **Radiosonde measurements from station Tanimbar (2012-86)**
  26 Feb 2013 17:34:35 EST

**Services** – feeds, maps and web services

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**Tsunami Information Bulletin**

- PTWO - Indian Ocean Bulletins
- PTWO - Pacific Ocean Bulletins

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**Services** – feeds, maps and web services
Control and management - Service Bus

Major functions:
- Communication layer between components;
- XML-driven model;
- Service registry management;
- Operation control and logging;
- Dynamic web service invocation.

allows composition of simple and complex services using OASIS Business Process Execution Language – BPEL2, typically from multiple service providers. The orchestration engine is the service used to execute the resulting composite services.
Control and management - Service Bus – user interface examples

Components activity journals, service bus “health” and stats

Component status SDI ESIMO on Tues, March 5th, 2013
State service bus SDI ESIMO: Available
Number of web-connected services: 11
Number of queries: 483,499
Number of replies: 431,583
Number of errors: 51916
Average time: 14
Minimum time in ms: 0
The maximum time in ms: 11422

Components activity journals, service bus “health” and stats
Security services

Major functions:

- Single-sign-on (SSO) user authentication and authorization among ODP components and services and other trusted nodes, equipped with same ODP system.

- The user authentication process allows a user to enter one name and password in order to access other components without being prompted to log in again at each of them.

- Security service is responsible for centralization and share of user roles and user records among other ODP components and services and well as among other trusted ODP nodes. User records and roles are communalized with Portal.
## Hardware requirements (core components)

<table>
<thead>
<tr>
<th>VM</th>
<th>OS</th>
<th>RAM (min/norm.)</th>
<th>HDD (Gb)</th>
<th>Middleware</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM_ODP_01_PORTAL</td>
<td>CentOS v.6 x_64</td>
<td>2/8</td>
<td>32</td>
<td>JDK 1.7, JBoss Portal</td>
<td>Security, Portal, Thematic portlets</td>
</tr>
<tr>
<td>VM_ODP_02_DB</td>
<td>CentOS v.6 x_64</td>
<td>2/8</td>
<td>64</td>
<td>PostgreSQL</td>
<td>Database (for Security, Portal, Service Bus, Statistics)</td>
</tr>
<tr>
<td>VM_ODP_03_SOI</td>
<td>CentOS v.6 x_64</td>
<td>4/8</td>
<td>32</td>
<td>JDK 1.6, JBoss</td>
<td>Service Bus</td>
</tr>
<tr>
<td>VM_ODP_04_IS</td>
<td>CentOS v.6 x_64</td>
<td>4/8</td>
<td>32</td>
<td>JDK 1.7, JBoss</td>
<td>Statistics</td>
</tr>
<tr>
<td>VM_ODP_05_DP</td>
<td>CentOS v.6 x_64</td>
<td>4/8</td>
<td>32</td>
<td>JDK 1.7, JBoss</td>
<td>Integration Server</td>
</tr>
<tr>
<td>VM_ODP_06_BID</td>
<td>CentOS v.6 x_64</td>
<td>8/16</td>
<td>60</td>
<td>JDK 1.7, JBoss</td>
<td>Data Provider, Light Data Provider</td>
</tr>
<tr>
<td>VM_ODP_07_GIS</td>
<td>CentOS v.6 x_64</td>
<td>16/32</td>
<td>200</td>
<td>JDK 1.7, JBoss</td>
<td>GIS (Geoserver + Grass GIS)</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td></td>
<td>40/88</td>
<td>452</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
http://odp.oceandataportal.net

Questions?