The CLME Information Management System (IMS) and Regional Environmental Programme (REMP)

Report on how IMS/REMP can support the Integrated Coastal Area Management (ICAM) Decision-Making process in the region, and the potential role of the Caribbean Marine Atlas (CMA)
Deliverable 3.7

The "Sustainable Management of the Shared Living Marine Resources of the Caribbean Large Marine Ecosystem (CLME) and Adjacent Regions" is a GEF funded Project. Its main objective is the Sustainable management of the shared Living Marine Resources of the Caribbean LME and adjacent areas through an integrated management approach that will meet the WSSD target for sustainable fisheries.

This document describes the results of a pilot project within the IMS/REMP component of the CLME project. The purpose of the activity was to demonstrate how the IMS/REMP combination can support the policy cycle related to the ICAM process. Specific deliverables highlighted in the report are: (i) The identification of existing and potential future services of the CMA useful to the IMS, and, (ii) The requirements for a direct link between the IMS and the CMA allowing for transparent search actions. The results of this pilot project will be included in the IMS.

Report on the how the Caribbean Marine Atlas (CMA) can support the ICAM Decision Making Process for the Caribbean Large Marine Ecosystem (CLME) Project.

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1 Introduction

The following document contains the report for the Caribbean Large Marine Ecosystem (CLME). It describes the outputs of deliverables that identify the Caribbean Marine Atlas (CMA) and how it can support the ICAM decision making process. The specific deliverables highlighted in the report are:

1. The identification of existing and potential future services of the CMA useful to the IMS.
2. The Requirements for the direct link between the IMS and CMA information resources.

The report is divided into two main sections

Section 1	Current & Future CMA Inputs to Regional ICAM
Section 2	Facilitating Interoperability between the Caribbean Marine Atlas Platform and the CLME Information Management System (IMS)

Each section describes a sub-component of the specified deliverables. In section 2, particular emphasis is placed on the structure of the CMA platform and its Architecture and Usability. Geonetwork OpenSource catalogue applications are also discussed as means to managing spatially referenced resources.

2 Current and Future CMA Inputs to Regional ICAM

2.1 Caribbean Marine Atlas (CMA) Datasets

The Caribbean Marine Atlas (CMA) is a joint initiative of nine (9) countries in the Caribbean region including Barbados, Cuba, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, Trinidad and Tobago, and Turks and Caicos Islands. The project is supported by the participating countries, the Intergovernmental Oceanographic Commission of UNESCO (IOC) through the International Oceanographic Data and Information Exchange (IODE), and the Government of Flanders (Kingdom of Belgium). The CMA is an activity developed within the framework of the Ocean Data and Information Network for the Caribbean and South American Region (ODINCARSA).

The purpose of the CMA is to identify, collect and organize available geo-spatial datasets into an atlas of environmental themes for the Caribbean region as a support service to the sustainable development and integrated management of marine and coastal areas in the region.

CMA datasets currently available that support ICAM decision making are:

1. Raster grids of climatologies (averages of all historical data for each month) for the following parameters: temperature, salinity, dissolved oxygen, nitrate and phosphate. Derived from the World Ocean Atlas database and useful for comparing with future conditions at a regional scale

2. Ramsar Sites Database (RDB) containing information on wetlands designated as internationally important according to the set of criteria and under the terms of the Ramsar Convention on Wetlands. The RDB contains records of sites with multiple-site specific subjects that are populated with thematic information such as habitat, wetland values and land use information.

3. Sea Turtle Nesting Sites (OBIS-WIDECAST) is a spatial database of nesting habitats for six (6) species of Caribbean sea-turtles. It is the most comprehensive for any region in the world, with, 1311 identified nesting sites. Data for each nesting site are standardized and binned abundance estimates based on crawl (nesting & non-nesting attempts), not nest counts so that the dataset could embrace all survey information.

4. Techntonic Plate Features: This dataset is a subset of the United States Geological Survey (USGS) which describes faults and structural features of the Caribbean Region. The map is represented in raster and vector form and delineates geological structural features and fault types in an open file report showing Geology, Oil and Gas Fields and Geologic Provinces of the Caribbean Region which was compiled and referenced to the USGS.

5. Terrestrial Ecoregions: A subset of the Global Ecoregions dataset developed by the World Wildlife Fund (WWF) are the results of regional analyses of biodiversity across the continents and oceans of the world, completed in collaboration with hundreds of regional experts worldwide and by conducting extensive literature reviews. These ecoregions were chosen from outstanding examples of each terrestrial, freshwater, and marine major habitat type. The 26 major habitat types describe different areas of the world that share similar environmental conditions, habitat structure, and patterns of biological complexity, and that contain similar communities and species adaptations.

2.2 Potential Future Services of the CMA useful to the IMS

There are two services the CMA may offer in the future that the IMS could take advantage of in addition to the current functionality, including the interoperability facilities to be described later in this document.

Firstly, the CMA is aiming to be a repository for spatial datasets generated by regional projects and organizations, such as IOCARIBE ICAM and data products developed by the Caribbean Community Climate Change Centre.

Secondly, the CMA is planning to maintain regional spatial datasets extracted from international databases such as earthquake and hurricane datasets maintained by the NOAA.

3 Facilitating Interoperability between the Caribbean Marine Atlas Platform and the CLME Information Management System

3.1 Structure of the CMA Platform

The CMA is a multi-component, web-based, and open-source platform. These three qualities make the data and information contained within the platform easily accessible by a range of modern data discovery techniques. The three core qualities of the CMA are detailed below:

Multi-Component Platform

The CMA is composed of several server software packages and scripting languages including:

- Geoserver
- GeoNetwork
- Openlayers/Javascript
- HTML
- PHP
- CSS

The various components interact according to web and Open Geospatial Consortium (OGC) standards and, being a multi-component system, allow for no single point of failure in the system. In addition, this paradigm allows for live updates of individual components on the operational platform without severe service disruption.

Web-Based Platform

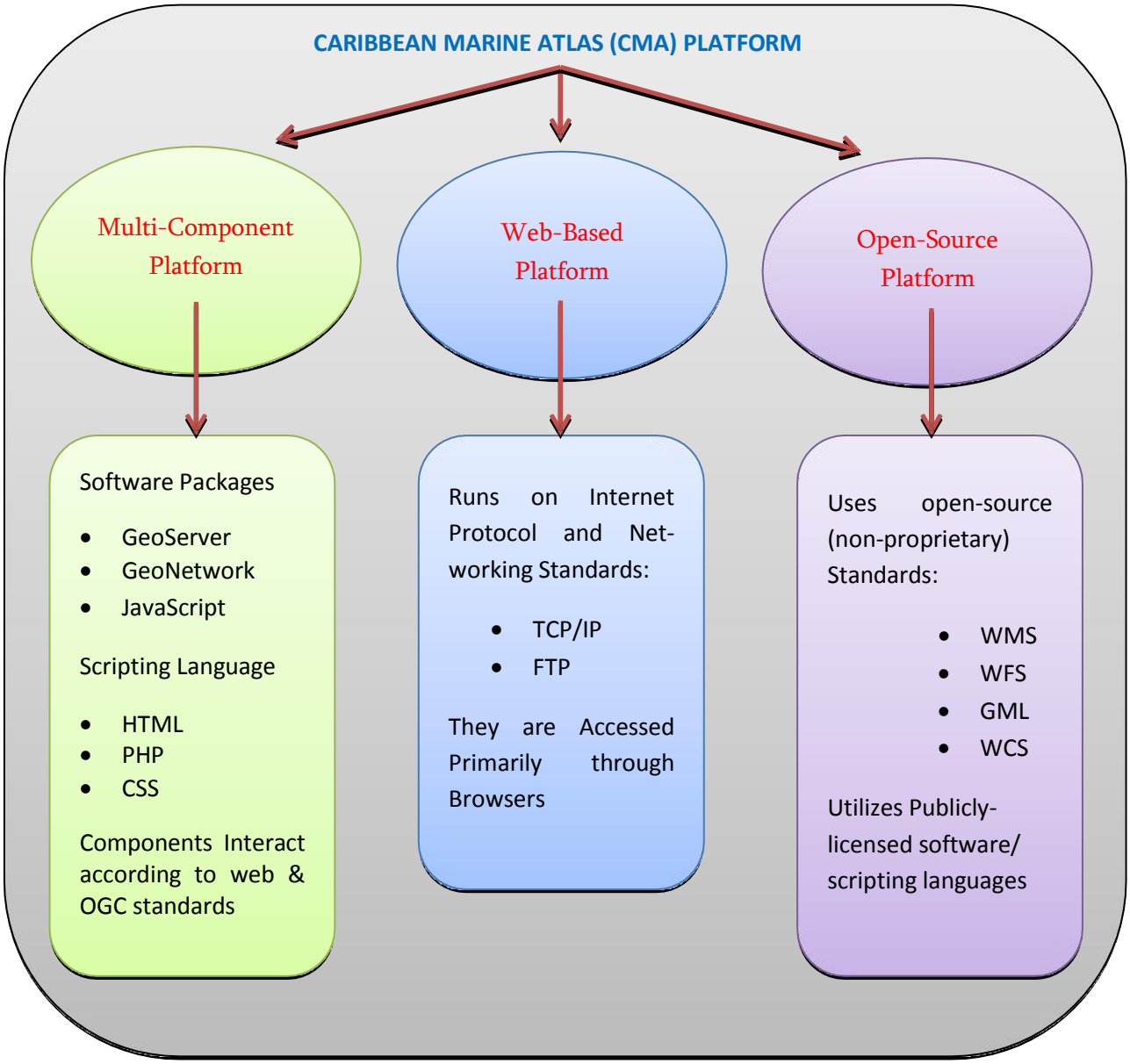
The entire platform runs on internet protocols and networking standards such as TCP/IP and FTP, and as such is accessed primarily through web-browsers. This means that information contained within the CMA is accessible by multiple users simultaneously according to standards-compliant protocols allowing for the easy interaction of end-user in a familiar environment. In addition, aspects of the platform can be easily integrated with existing sites and services such as external data discovery applications and web apps.

Open-Source Platform

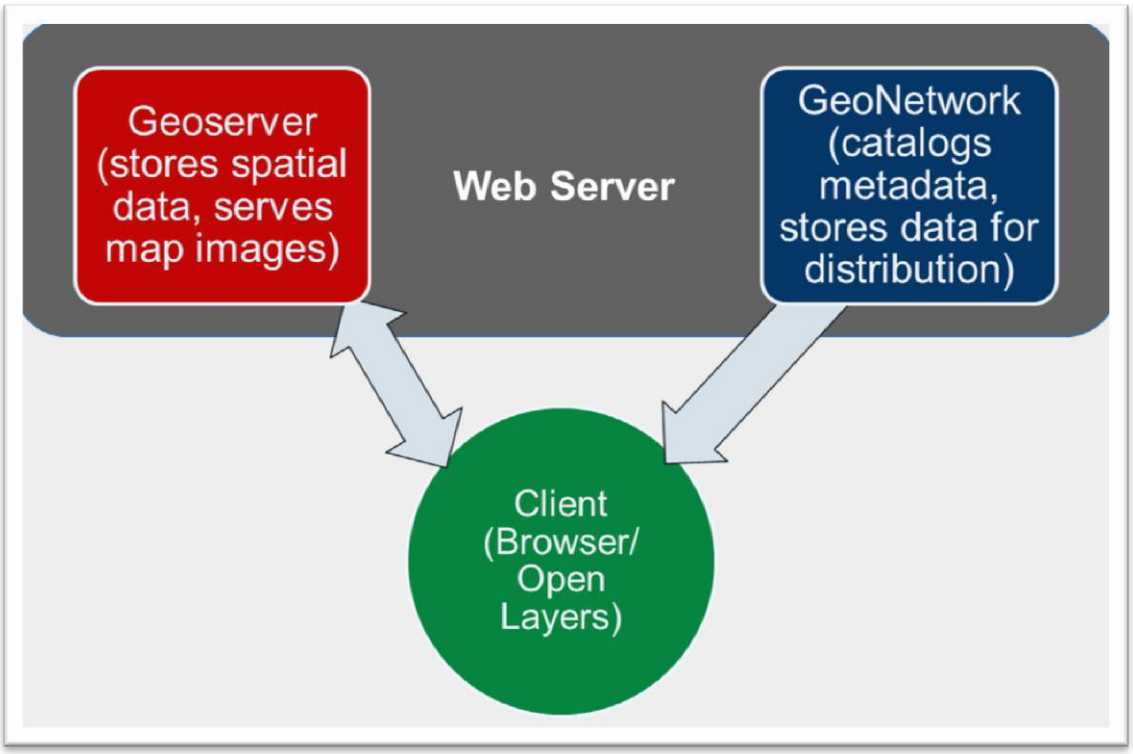
All of the components of the CMA platform use open-source (non-proprietary) standards, including:

- WMS
- WFS
- GML
- WCS

The platform utilizes publicly-licensed software and scripting languages, meaning that they are free to install, use and upgrade, are highly customizable and come with a large user/knowledge/support-base for long-term sustainable management.



3.2 Architecture of the CMA



3.3 Architecture and Usability of the IMS

Software architecture in recent times has been designed to meet the needs of an Internet-scale distributed hypermedia application. Both the design and development process should be focussed around the prospective user by ensuring their goals, mental models and requirements are met as well as to build products that are efficient and easy to use.

The design of the IMS should follow certain key principles of good website usability:

- Availability and Accessibility
    - If users attempt to access the website and are unable to do for whatever reason, the website becomes useless. A few basics of availability and accessibility are:
        - Server Uptime
        - Broken Links
        - Mobile Responsiveness (varying screen sizes & slow connections)
- Clarity
    - Try not distract or confuse your visitors. Visitors come to your site with certain goals in mind. Website configuration should be done in such a way to help users reach their goals as quickly as possible. A clear and usable design can be achieved through:
        - Simplicity

        - Familiarity
        - Consistency
        - Guidance
        - Direct Feedback &
        - Good information architecture
- Learnability
    - Intuitive interfaces should be designed that don't require instructions or long processes of trial and error to figure out. The key to intuitive design is to make use of what people already know.
        - Easy access to site content
- Credibility
    - If users do not trust you, then the content becomes worthless. It is important that users know that you are a real and legitimate organisation. A clear "About Us" page together with contact details and a physical address (if possible) should be included.
    - The content being displayed should also be perceived as trustworthy. Data and information should be honest and precise and mistakes should be avoided.
- Relevancy
    - It is not enough that your website be clear, but your content should also be relevant. It is essential that you know your users and why they are visiting your site.
        - Firstly, with defining who your users will be
        - Secondly, talk to them to find out what their goals are when visiting your site and
        - Thirdly, define user scenarios that demonstrate in which situations people visit the site and for what type of content.
- In addition to the above key principles, the website should also have :
    - A standards-compliant site structure to enhance machine readability (XML, XHTML)
    - The availability of filters for advanced searches and
    - Detailed information object categorization to enhance search results

3.4 Technical Requirements for the Interoperability between the IMS & CMA

The most efficient means of enhancing the interaction between the CMA and the IMS would be to facilitate the interoperability of both platforms. This could be achieved by enabling the discovery and retrieval of metadata records of the datasets contained within the CMA project by the IMS. The CMA uses the GeoNetwork metadata catalogue (discussed below) to store and maintain its metadata records. The IMS would be able to interact with this catalogue using the OGC Catalogue Services for Web (CSW) standard.

3.4.1 Metadata Catalogue (GeoNetwork)

Geonetwork OpenSource is a catalogue application to manage spatially referenced resources. It provides powerful metadata editing and search function as well as an embedded interactive web map viewer. It is currently used in numerous Spatial Data infrastructure initiative across the world.

Geonetwork is a standards-based catalogue that allows the internet users community to easily access and share geographic data and information across the world. It is and open source software that is easy to install and maintain. It is freely downloadable from the web, has a publicly accessible source code and is supported by the GeoNetwork open source user community.

The use of Geonetwork assures the adoption of open standards which help to avoid non-standard formats and compatibility issues which arise when using proprietary software.

The purpose of Geonetwork is:

- To improve access to and integrated use of spatial data and information
- To support decision making
- To promote multidisciplinary approaches to sustainable development and
- To enhance understanding of the benefits of geographic information.

It is a web catalogue that integrates:

- Metadata and data search capabilities to access local and distributed geospatial catalogues
- Download of data
- Interactive access to data through web based services
- On-line metadata editing and management
- Metadata harvesting and synchronization between nodes
- Administration of groups and users through Web interface.

It uses standard technologies and formats such as:

- Standard protocols – OGC specifications for querying to search and retrieve information (Catalogue Service for Web)
- Standard schemes to compile information (ISO, FGDC, DC)
- Standard formats for datasets (geoTiff, Grid, Shapefiles)
- Standards formats for Web Services (WMS, WFS, WCS)

3.4.2 CSW Standards *(www.geoportal.org)*

The CSW interface is based upon the OGC Catalogue Services Specification Version 2.0.1. The interaction between a client and a server is accomplished using a standard request-response model of the HTTP protocol.

The repository resides in an Oracle database and has been implemented using the OASIS/ebXML

Repository Information Model v2.5 (see http://www.ebxml.org). The basic and essential purpose of a catalogue service is to enable a user to locate, access and make use of resources in an open distributed system by providing facilities for retrieving, storing and managing many kinds of resource descriptions.

The metadata repository managed by the catalogue can store a multitude of recourse descriptions that conform to any standard Internet media type, such as:

- XML schemas
- Thumbnail representations of remotely sensed images
- Audio annotations
- Specification documents
- A simple map of a meteorological sensor network and
- Style sheets for generation detailed topographic maps.

Furthermore, arbitrary relationships among catalogued items can be expressed by creating links between any two sources. The CSW catalogue profile is intended to provide a flexible, general-purpose catalogue service that can be adapted to meet the needs of diverse communities of practice within the geospatial domain.

Links to CSW site:
http://www.opengeospatial.org
http://www.geowebportal.org