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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

MEETING ON THE DEVELOPMENT OF A SEA LEVEL METADATA WEB SERVICE DEMONSTRATOR PROJECT

IOC Project Office for IODE, Ostend, Belgium
28-29 March 2006

SUMMARY REPORT

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ANNEXES

1. OPENING OF THE MEETING

The participants were welcomed by the IODE Programme Coordinator, Mr Peter Pissierssens and by the Head of the IODE Project Office, Mr Vladimir Vladymyrov. The participants were also given a quick tour of the IODE Project Office.

Mr Pissierssens then recalled that the proposal to establish a global tide stations web service pilot project was made during ITSU-XIX in 2005 where the initiative was welcomed. At that point possible collaboration between the project and IODE had been mentioned in view of IODE's involvement in the development of a marineXML. It was further noted that Dr Laura Kong who had called for the current meeting had unfortunately been requested to travel to Bangkok and could therefore not attend.

The Meeting adopted the Agenda as detailed in **Annex I**.

The List of Participants in the meeting is given in **Annex II**.

2. IODE AND MARINE XML

Mr Vladimir Vladymyrov provided an overview of the involvement of IODE in the development of marine XML.

He explained that there are a number of reasons for using a marine XML:

- **Exchange of data**. A major strength and source of potential of XML is that it facilitates the exchange of data between different applications and operating systems. One of XML's strongest points is its ability to do data interchange. Because different organisations (or even different parts of the same organisation) rarely standardise on a single set of tools, it takes a significant amount of work for two groups to communicate. XML makes it easy to send structured data across the web so that nothing gets lost in translation. XML is potentially the answer for oceanographic data exchange, as long as all sides agree on the markup to use.

- **Extensibility**. Extensible means that it is not a fixed format like HTML. While HTML tags must follow pre-set standards, new XML tags can be created by anyone at any time. XML will allow groups of people or organisations to create their own customized markup languages for exchanging information in their domain. Examples of existing industry-specific XML include music, chemistry, electronics, linguistics, engineering and mathematics.

- **Plain Text**. Since XML is not a binary format, files can be created and edited with a standard text making it useful for storing small amounts of data. At the other end of the spectrum, an XML front end to a database makes it possible to efficiently store large amounts of XML data. XML provides scalability for anything from small configuration files to an industry-wide data repository.

- **Data Identification**. The XML standard specifies how to identify data, not how to display it. HTML, on the other hand, describes how things should be displayed without identifying the content. Because the different parts of the information have been identified, they can be used in different ways by different applications.

- **Stylability**. When display is important, the style sheet standard, XSL, can dictate how to portray the data. Since XML is inherently style-free, different style sheets can be used to produce output in postscript, PDF, or any other format.

- **Hierarchical**. XML documents are hierarchical in structure. Hierarchical document structures are, in general, faster to access because you can drill down to the part you need, like stepping through a table of contents.

  A number of initiatives have been undertaken related to marineXML, involving IODE:

- **MarineXML Consortium initiative:** During the year 2000, Mr Ben Searle, former IODE Chairman, established the marineXML consortium that would work on the development of a marineXML standard. A few Partners were identified to start up the Consortium and some funds were contributed. In January 2002 the Secretariat of this Consortium was transferred to the IODE Secretariat, together with the balance of funds.

- **Proposal submitted to EC**: MarineXML: a pre-standardisation development for marine data interoperability using XML: coordinated by the UK company HR Wallingford, a proposal was successfully submitted to the European Commission for funding.

- **Cooperation between IOC and ICES on development of a marine XML**: IOC and ICES created the ICES-IOC Study Group on the Development of Marine Data Exchange Systems using XML (SGXML). It met for its first Session in April 2002.

- **ICES-IOC Study Group on the Development of Marine Data Exchange Systems using XML (SGXML)**
  In 2001 the Intergovernmental Oceanographic Commission (IOC) and the International Council for the Exploration of the Sea (ICES) cooperatively formed a Study Group to examine the application of the eXtensible Markup Language (XML) to marine data exchange systems. The Study Group first met in April 2002 to address issues around the transfer of oceanographic data. The Group has met three times, with the final meeting in May 2004. The Study Group concentrated its efforts on metadata standards, parameter dictionaries and generic data structures for use in an XML-based language. The Group evaluated several international metadata structures and produced mappings between some structures. In terms of the parameter dictionaries, the Group conducted mappings between several international parameter dictionaries, made structural advances to some dictionaries and attempted to account for dictionary issues imposed by units. The generic data structure development produced about 20 data objects that were then used to create an XML data structure for the transport of ocean environmental data. The structure was applied to one and three-dimensional data sets. The Group has also made numerous recommendations to continue the development of international data exchange systems.
  The ICES/IOC Study Group recommended:
  - the need for consolidation of metadata terminology;
  - explicit oceanographic extensions to existing standards;
  - ability to combine metadata holdings from distributed sources;
  - adoption of the British dictionary as the marine community standard and the creation of a structure and procedures to manage the dictionary;
  - further examination of XML-based biological systems;

- **MarineXML EC Project**
  MarineXML is an initiative of the IOC/IODE of UNESCO to improve marine data exchange within the marine community. The European Commission has provided a funding contribution to this initiative as part of its 5th Framework Programme to undertake a ‘pre-standardisation’ task of identifying the approaches the marine community should adopt regarding XML technology to achieve improved data exchange. This project (MarineXML EC) ran from February 2003 to January 2005. Other projects have contributed to MarineXML in this timeframe including the Study Group on XML (SGXML) of ICES/IOC, the UK NERC Data Grid Project and the UKHO S-57 GML project. All these projects worked closely

together to reach consensus on using XML for marine data exchange. We believe that they have been successful in providing a level of pre-standardization to inform a route-map towards an extensible framework of standardisation for data exchange in the marine community based on the adoption of ISO and OGC standards.

The EU MarineXML project recommended:

- the IODE project office serve as the host and focal point for MarineXML;
- all MarineXML work should be compliant to the ISO standards register;
- explicit oceanographic extensions to existing standards;
- continuing development of dictionaries.

- **MOTIVE EU Project**
  Marine Overlays on Topography for Annex II Valuation and Exploitation - MOTIIVE - is a 2-year project funded by the European Union 6th Framework RTD Programme in relation to the joint EC and European Space Agency programme GMES – Global Monitoring for Environment and Security. The project began on 1 September 2005 under coordination provided by HR Wallingford, UK.
  The Technical Secretariat for the project is provided by IOC-IODE via the IODE Project Office in Oostende, Belgium. MOTIIVE builds on the work of the MarineXML project, which ended in February 2005.
  The objective of MOTIIVE is to examine the cost benefit of using non-proprietary data standards while addressing data harmonisation requirements between the INSPIRE data component "elevation" (terrestrial, bathymetric and coastal) and INSPIRE marine thematic data for "sea regions", "oceanic spatial features" and "coastal zone management areas". The project stresses analysis of the cost-benefit implied by strong harmonisation between "core" and "thematic" INSPIRE data, while supporting the infrastructure requirements of the GMES (Global Monitoring for Environment and Security) "Ocean and Marine Applications" theme, now being implemented by GMES Service Element (GSE) Phase 2 projects such as MARCOAST. The aims of MOTIIVE are to produce application instances of a series of OpenGIS specifications and use these to examine the potential need for a formal OGC Working Group (WG) for Marine Data, while actively participating in existing OGC Working Groups within which marine data is an important component of thematic data coverage, e.g. remote sensing, environmental data, etc. Determining such need requires, as per OGC rules, development of a qualified business case for creating such a WG, which must be accepted by the OGC Technical and Management Committees.

He further referred to Recommendation IODE-XVIII.7 (2005) that established the IODE Marine XML Steering group with the following terms of reference:

(i) establish a Pilot Project to set up an ISO 19100 series of standards compliant standards register, with possible collaboration with IHO, to be hosted by the IODE Project Office;
(ii) monitor and assist with XML development activities in other IODE/JCOMM groups, such as ETDMP, GEBICH and SGMEDI.

It was recommended that

- the membership of the Steering Group shall included Belgium (VLIZ), China (NODC), The Netherlands (NODC), Russian Federation (NODC), United Kingdom (BODC), , the IODE Project Office and other relevant experts, and shall be coordinated by Mr Roy Lowry (UK).
- .the MarineXML web site (MarineXML.net) be hosted by the IODE Project Office as a focal point for MarineXML activities;

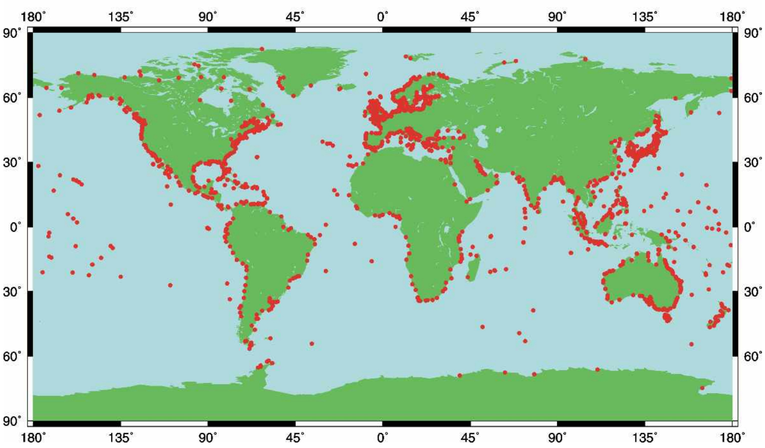
Member States were invited to promote the use of XML, at the national level, as a mechanism for the efficient exchange of oceanographic data;

Mr Vladymyrov concluded that one overall marineXML cannot be developed as many institutions and country have developed their own marineXML versions already. However the main task for marineXML will now be to develop standards on metadata. It will also be a task for IODE to maintain a "registry" of such existing standards.

3. GLOSS

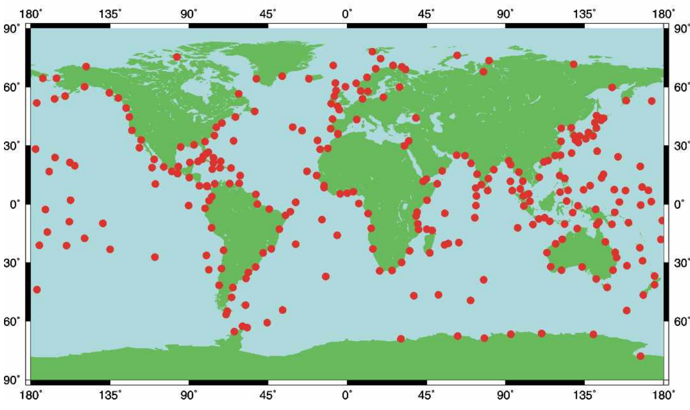
Mr Thorkild Aarup provided an overview of GLOSS. He explained that up to the mid-1980s national agencies made (and still make) sea level measurements and submit MSL values to the Permanent Service for Mean Sea Level (PSMSL). The PSMSL data set contains 54,000 station-years of data from 2000 stations. (~ 1200 station yrs added/year). However data were measured to different standards with different delays in delivery and there was no formal long term commitment to deliver data. There was a major northern hemisphere bias. In addition there was no long term commitment to share higher frequency data (hourly values) and there was no 'fast' stream.

Distribution of PSMSL Stations



The GLOSS programme was established by IOC in mid-1980s with the aim of improving the quantity and quality of sea level data to PSMSL and other sea level centres. GLOSS was a forerunner of Global Ocean Observing System (GOOS) in many ways. Now part of JCOMM structure. The original aim of GLOSS was to develop a GLOSS Core Network of about 300 sea level stations for a range of ocean/climate science and practical applications. Gauges should ideally be spaced 500-1000 km apart, should be geographically balanced and in open ocean locations.

GLOSS Core Network defined by GLOSS02

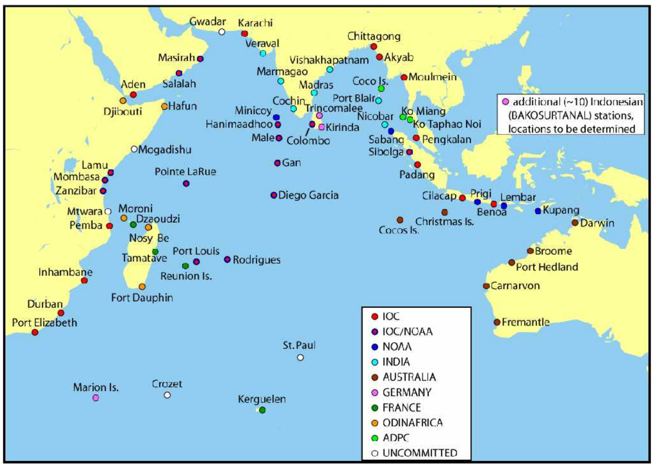


GLOSS sea level stations are used for various purposes:

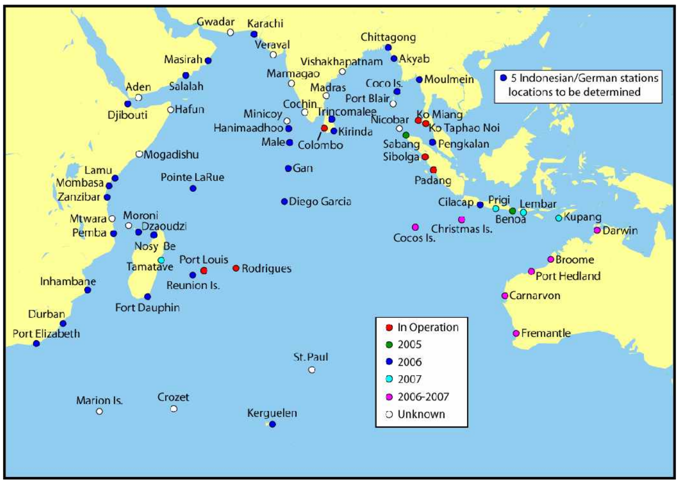
- Satellite altimeters need to be calibrated using in situ sea level gauges
- Continuity and low cost. We need the GLOSS network for global ocean dynamics studies and monitoring variability (ENSO, EL NINO)
- Long mean sea level (MSL) records needed for climate change studies (e.g. for IPCC)
- Many coastal applications, tides, engineering. People live at the coast, not in the deep ocean.
- Long records of higher frequency climate change (e.g. changes in storm surge statistics)
- Higher frequency sampling important for storm and tsunami monitoring and warning.

GLOSS offers various services:

- Global data standards & archiving facilities with QC of data
- Training courses on analysis & uses of sea level observations
- Technical expert visits
- Technical manuals and training material
- Special workshops on technical issues (i.e. How to operate a gauge in harsh ocean environments; New technical developments in sea and land level observations)
- Provision of gauges
- Assistance with development of proposals for upgraded tide gauge hardware



Organizations/countries that contributed sea level gauges in the Indian Ocean



Operational status of sea level in the Indian Ocean

There are now 4 GLOSS data streams

1. Delayed mode, quality controlled Mean Sea Level (MSL) data to the PSMSL
2. Delayed mode, quality controlled higher-frequency data (e.g. hourly heights) to a GLOSS Data Centre (PSMSL or UHSLC)
3. Fast data to GLOSS Fast Centre at UHSLC & Intl Tsunami WCs
4. GPS data to TIGA Centre at Potsdam initiated by IGS/PSMSL in 2001.

All countries committed to gloss should be contributing to all 4 streams. The GLOSS Status can be measured in terms of how well each country contributes to the above data streams. (See Tables in GLOSS Adequacy Report (IOC/INF-1190)).

<u>GLOSS STATUS:</u>

(i) Streams 1,2,3 are operational at approximately the 2/3, 1/3 and 1/3 levels respectively
(ii) Streams 1,2 have been at these levels for some years and have reached a plateau (in spite of constant polite prodding by PSMSL, UHSLC and IOC)
(iii) Stream 3 is making good progress (for various reasons but mainly due to tsunami monitoring) - likely to plateau

IOC is presently upgrading 17 sea level stations in the Indian Ocean as a contribution to the Indian Ocean Tsunami Warning System. Additional upgrades of GLOSS stations in the Indian Ocean will be carried out by national contributions (i.e. Australia, France and India) and under bilateral agreements (i.e. Indonesia-Germany) and will be carried out. An additional 10-12 stations in Africa are targeted for upgrade under the OdinAfrica project – this work is carried out in collaboration with GLOSS .

The meeting then considered the need to describe sea level stations in a standard way and identified the following levels of detail:

Station level
- where is it
- who owns it
- contact info

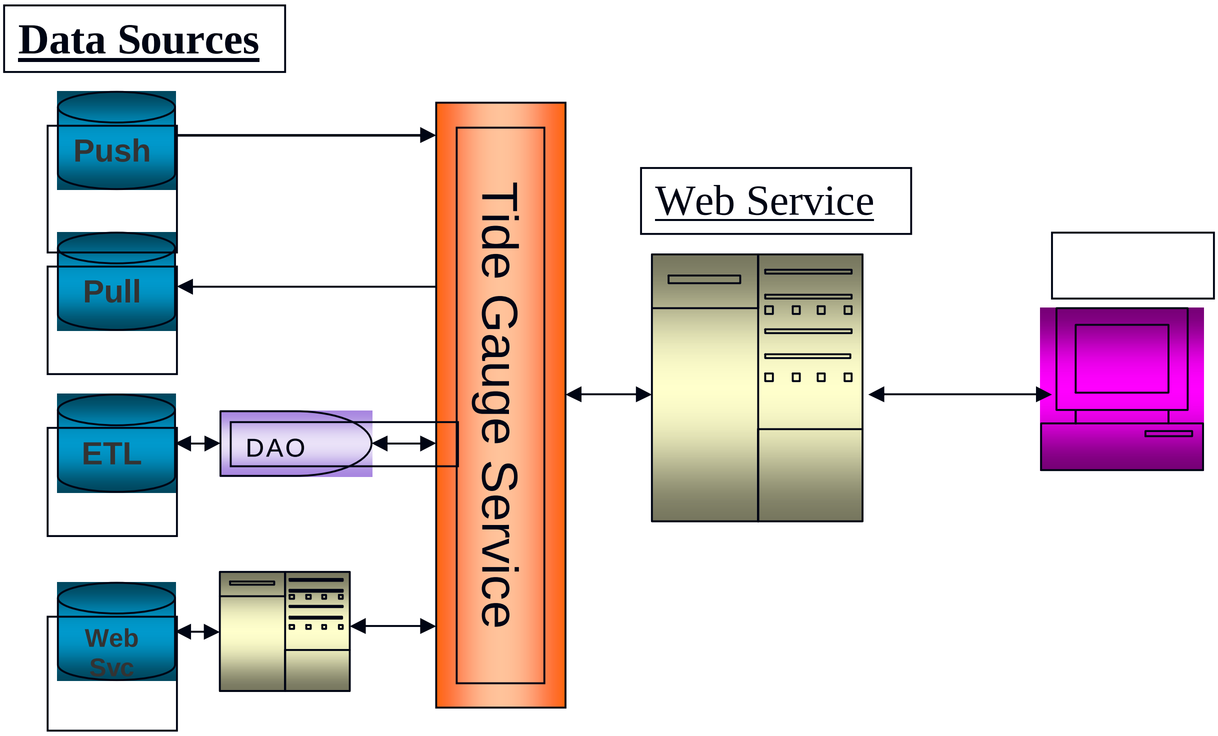
System level
- data collection platform
- sampling interval
- transmission interval

Data product level ⟶ warning bulletin
- real-time data stream
- delayed-mode data stream
- archived: QC info

4. XML SCHEMA DESIGN FOR WATER LEVEL STATIONS

In his presentation Mr Uday Kari explained that the motivation for the GSTWS proposal is based on the following need:
- to upgrade data sources to data services;
- loose coupled data environments
- dynamic (real-time) interactions
- heterogenous platforms
- no “centralized” control/data node

System Architecture:



Web Service: The term Web Services describes a standardized way of integrating Web-based applications using open standards and descriptions over an Internet protocol backbone. Web services allow organizations to communicate data without intimate knowledge of each other's IT systems behind the firewall. Unlike traditional client/server models, such as a Web server/Web page system, Web services do not provide the user with a GUI. Web services instead share business logic, data and processes through a programmatic interface across a network. The applications interface, not the users. Developers can then add the Web service to a GUI (such as a Web page or an executable program) to offer specific functionality to users. Web services allow different applications from different sources to communicate with each other without time- consuming custom coding, and because all communication is in XML, Web services are not tied to any one operating system or programming language.

Thus, the basic concept involves establishing XML schemas, pushing this data out to and/or pulling this data in from multiple provider databases, transforming it, and pushing it out in multiple report formats through a central client server.

Initial efforts will focus on the integration of the NOAA CO-OPs NWLON, UHSLC, and PTWC- WC/ATWC databases as a means to demonstrate the viability of this approach. To further narrow the scope, this effort will focus on the integration and dissemination of information that could be used by tsunami warning center managers to support the establishment and expansion of regional tsunami detection and warning networks. Specifically, the collection and sharing of information needed to determine if a given station is able to support tsunami detection and warning is the target of this initial effort. Unlike traditional client/server models, such as a Web server/Web page system, Web services do not provide the user with a GUI. Web services instead share business logic, data and processes through a programmatic interface across a network. The applications interface, not the users. Developers can then add the Web service to a GUI (such as a Web page or an executable program) to offer specific functionality to users. Web services allow different applications from different sources to communicate with each other without time- consuming custom coding, and because all communication is in XML, Web services are not tied to any one operating system or programming language.

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This 'web service' approach is consistent with the Integrated Ocean Observing System (IOOS) Data Management and Communications (DMAC) efforts underway to support interoperable data access, recovery, and archiving. It will serve as an example of a data system that could be adopted into the data transport component of IOOS. Correspondingly, it is also consistent with the IOC Committee on International Oceanographic Data and Information Exchange (IODE) XML Steering Group's efforts to promote the use of XML as a mechanism for the efficient exchange of oceanographic data. It supports the development of a data communications and management subsystem (DMS) for the seamless discovery and delivery of data within GOOS and for interoperability with other relevant observing systems and research programmes, identified as a high priority by the IODE and the IOC/WMO JCOMM. Further, the focus of this effort is closely aligned with IODE efforts to create an Ocean Data and Information Network (ODIN) with a special emphasis on tsunami forecasting.

5. DISCUSSIONS ON THE WAY FORWARD

The participants then discussed the way forward. Extensive attention was given to a more clear definition of the rationale and objectives of the proposed project. This resulted in the drafting of a **concept paper**, included in **Annex III**.

It was agreed that the concept paper will be distributed to ITIC and UHSLC for further comments. The document will subsequently be submitted to the ODINAFRICA-III Project Management Committee (Ostend, Belgium, 24-26 April 2006), the ICG/PTWS-XXI Session (Melbourne, Australia, 3-5 May 2006) and the next ICG/IOTWS (Bali, Indonesia, 31 July to 4 August 2006). ODINAFRICA partner institutions will be invited to participate in the demonstrator project by "exposing" their sea level station metadata.

It was agreed that, depending upon the decisions of the response of the above mentioned project and ICG meetings, the IODE Project Office may assist by providing a web service host.

6. CLOSING OF THE MEETING

The Meeting was concluded on Thursday 29 March at 10h30.

ANNEX I

AGENDA

1. Opening of the Meeting
2. IODE and marineXML
3. GLOSS
4. XML schema design for global water level stations
5. Discussions on the way forward
6. Closing of the Meeting

ANNEX II

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ANNEX III

CONCEPT PAPER OF A SEA LEVEL METADATA WEB SERVICE DEMONSTRATOR PROJECT

Objective

Develop a distributed metadata system describing sea level stations, starting with pilot activities in a regional framework, focusing on tsunami detection and warning systems being developed by the IOC and partners. The system will also contribute to other marine hazard warning systems (such as storm surges), as well as sea level change monitoring and research.

Rationale

Currently there exist the IOC GLOSS Core network of approximately 300 sea level stations as well as other national sea level stations of which the number and specifications (such as location, collection and transmission capabilities) are insufficiently known or not readily accessible. In order to provide the best possible tsunami and other marine hazard warning services it is essential to develop and maintain a dense and fault tolerant observation network. Through this project the use of existing resources (sea level stations) will be optimized by making available up-to-date information (metadata) on all existing sea level stations.

Case-in-point: *After the Indian Ocean Tsunami of 26 December 2004 it was unclear if there were any sea level stations operating in real-time and, if so, where they were located and whom to contact to obtain the water level records.*

The proposed system will enable easy and rapid access to this information. Such a system could also be used to track progress of developing and emerging tsunami warning systems with regard to their sea level station observation component.

Also, the proposed Demonstration Project is consistent with JCOMM, GLOSS, GEO, IOOS/DMAC efforts underway to support interoperable data access recovery and archiving.

Methodology

The system will use a distributed architecture with (i) sea level station operators providing sea level station parameters (metadata) including location, operators, point of contact, sampling interval, transmission interval, data distribution mode, operational status, last update, (ii) a web service that facilitates integration of station parameters from diverse sea level station operators, (iii) a GIS enabled client application that supports geospatial queries (i.e., generates maps or reports), and (iv) XML as the enabling technology with the implementation conforming to open source standards (e.g., GPL).

The system will require ***minimal*** effort from data providers. In fact, the only requirement is that they have dial-up internet access to post data into the web service. However, a better always-on connection and some basic hosting (server) capability (such as FTP/HTTP) will enhance the cooperation.

The project will build upon an existing prototype developed by UNESCO International Tsunami Information Centre (ITIC) in collaboration with University of Hawaii Sea Level Center (UHSLC), the EWC Pacific Disaster Center (PDC) and the United States National Oceanic and Atmospheric Administration (NOAA) in 2005.

Demonstration Project Activities

- *Regional approach*
  In view of the existence of regional tsunami detection and warning systems in the Pacific and Indian Ocean it is recommended to develop pilot activities in these regions, as desired by the Governing Bodies of these systems. Ongoing efforts to develop tsunami detection and warning could contribute to the pilot projects;
- *Technology*
  Some technology will need to be developed (e.g., the adaptor module transforming raw data sets into the governing XML schema).
- *Sea level station operators*
  They will need to (i) provide a basic level of station metadata and document the format in which it is available; (ii) expose the station metadata to the web service. Resource requirements and options are detailed in Attachment A.
- *Web service*
  A web service will need to be established and software will need to be developed. (A preliminary version of the software toolbox has already been developed within the above-mentioned ITIC prototype). Whether to establish one global directory service or several regional services is yet to be decided. (The IODE and the PDC have been tentatively identified as potential hosts for the proposed web service). Resource requirements to host a web service are defined in attachment B.
- *GIS enabled client application*
  The client application will need some software development. Input will be sought from client communities (e.g. the tsunami warning system managers and disaster managers) regarding detailed specifications of the desired functionality. (e.g., the Hawaii Resource Information System for Coastal Hazards (HI-RISC) map viewer, which is an ArcIMS application, was used as a client to the prototype web service).
- *Capacity building (for sea level station operators)*
  Advisory missions and help-desk support may be provided as needed (within ongoing projects framework).

Implementation mechanism

It is proposed that the ITIC (in collaboration with PDC) will develop the demonstration project. Partners are invited at the levels of (i) Sea level station operators; (ii) Web service host(s).

It is proposed to discuss this concept paper and the development of the demonstration project at upcoming sessions of relevant TWSs and related projects in early 2006 with the objective of starting implementation as from the second semester of 2006 and achieving operability by the end of the year 2006. GLOSS is invited to be a partner in the project.

Attachment A: Sea Level Station Metadata Requirements and Exposure Options

The following is a list of sea level station systems criteria that can be used by tsunami warning center managers to support the establishment and expansion of regional tsunami detection and warning networks. The criteria given below are the minimum needed to support the proposed Demonstration Project.

Examples of accompanying data are shown in **grey.**

Station Parameters

Station Name	**Colombo-B**
Country	**Sri Lanka**
Station Location	
Latitude N 6° 57' 49.08"	**Longitude** E 79° 51' 27.49"
Station Operator (Agency/Institution/Organization)	
	UHSLC (University of Hawai`i Sea Level Center)
Operator Station Identification	*GLOSS02:# 033*
Operational Point of Contact	
Individual	**name**
Phone	### ### ####
Email	**name@place**
Operational Status	*Category 1- fully operational*
Last metadata update	*22-JUL-2005 11:01:00 AM*

System Parameters

Sensor (more than one is possible)	
Sensor Designation	*primary*
Sample Interval (seconds)	60
Platform (more than one is possible)	
Transmission Interval (minutes)	15

Data/Product Parameters

Data/Product Retrieval Mode	*url*

As shown in Figure 1, there at least four basic options (4) to provide sea level metadata to the web service.

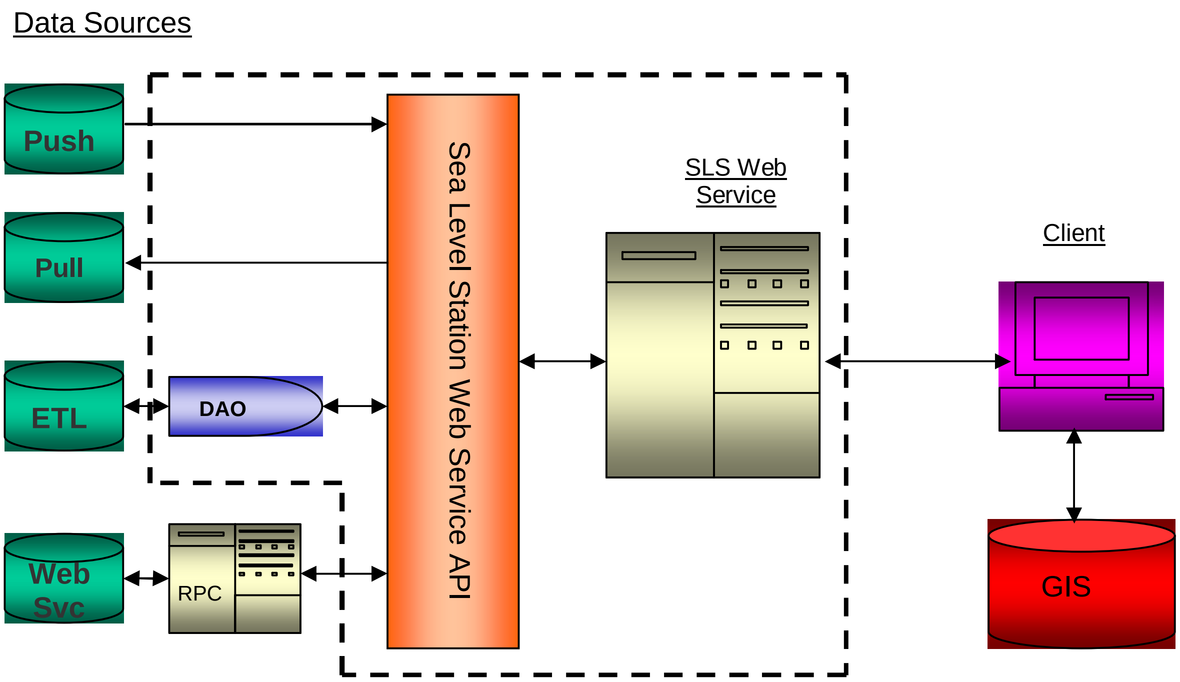

Figure 1: Sea Level Station Web Service Architecture

1. Push Sources: These sources will deposit a text data file into a specified location within the host of the web service. Ideally, this text file would conform to a specified XML format that will be provided. However, a simple text file, containing the minimum metadata requirements along with a format specification would be sufficient as well. This is the "minimum" option, whereby the data provider would just need dial-up internet access.

2. Pull Sources: The service provider would post this data within their own server such as web site or FTP server. Ideally, this text file would conform to a specified XML format that will be provided. However, a simple text file, containing the minimum metadata requirements along with a format specification would be sufficient as well. This option would need some basic server hosting (FTP/HTTP) capability.

3. Database: If the required information is available only in a relational database management system (RDBMS), the provider would need to specify the database connection parameters and the table schema for the station metadata. Alternatively, the data provider can do some simple development, such as writing a database query in SQLX standard, to expose the database contents in the XML format required.

4. Web Service: If a web service already exists, the data provider would need to simply specify the URL (for the Web Service Description Language (WSDL)) that specifies the service interfaces and implementation endpoint according to established XML standards This is the ideal mode of collaboration since all aspects of how the data is generated or maintained are now transparent to the consumers.

Preliminary version of the XML schema

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
+==========================================================================+
|     Copyright (c) 2006 Pacific Disaster Center, Maui, Hawaii, USA       |
|                    All rights reserved.                                 |
+==========================================================================+
|  FILENAME:  sls.xsd                                                     |
+==========================================================================+
| DESCRIPTION:                                                            |
|   XML Schema for Sea Level Stations                                     |
+==========================================================================+
| HISTORY                                                                 |
|  [01-APR-2006] Uday Kari, initial checkin                               |
+==========================================================================+
-->
<!--  $Id: $ -->
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
        xmlns:sls="http://apps.pdc.org/sls/server/api"
        targetNamespace="http://apps.pdc.org/sls/server/api">

 <xsd:annotation>
  <xsd:documentation>
   XML Schema for Global Sea Level Stations
  </xsd:documentation>
 </xsd:annotation>


 <!--
 //////////////////////////////////////////////////////////
 //  List of Sea Level Stations (Tide Gauges)
 //  this is the most common return data type for the
 //  remote procedures in the WSDL for which this XSD
 //  file is an include.
 -->

 <xsd:element name="list" type="sls:StationListType"/>


 <xsd:complexType name="StationListType">
  <xsd:sequence>
   <!--
   //////////////////////////////////////////////////////////
   //  This is the highest level element in the XSD schema
   //  for Sea Level Station (hence "sls")
   //  All other elements, attributes are subordinate to this
   //  top-level element, which forms a list of gauges
   -->
   <xsd:element name="sls" type="sls:StationType"
            minOccurs="0"  maxOccurs="unbounded" />
  </xsd:sequence>
 </xsd:complexType>



 <!--
 //////////////////////////////////////////////////////////
 //  Define Sea Level Station Type as containing elements
 //  of type stationType, systemType and dataType which are
```

```
//  the immediate children of the highest level sls element
-->
<xsd:complexType name="StationType">
 <xsd:all>
  <xsd:element name="station" type="sls:stationType"/>
  <xsd:element name="system" type="sls:systemType"/>
  <xsd:element name="data" type="sls:dataType"/>
 </xsd:all>
</xsd:complexType>


<!--
////////////////////////////////////////////////////////////
//  The station type
//
-->
<xsd:complexType name="stationType">

 <!-- Element station must have the following elements -->
 <xsd:all>
  <!-- Geographic Location -->
  <xsd:element name="location" type="sls:coordinateType" />
  <!-- Nation Code -->
  <xsd:element name="nation" type="sls:nationType" />
  <!-- Operational Point of Contact (POC) -->
  <xsd:element name="poc" type="sls:pocType" />
 </xsd:all>

 <!-- Station Operator ID -->
 <xsd:attribute name="operatorID" type="xsd:string" />

 <!-- Station Name -->
 <xsd:attribute name="stationName" type="xsd:string" />

 <!-- Operational status -->
 <xsd:attribute name="status" type="sls:statusEnum" use="required" />

 <!-- Operator/Agency/Institution -->
 <xsd:attribute name="operator" type="sls:operatorEnum" use="required" />

 <!-- Start Date -->
 <xsd:attribute name="lastupdate" type="xsd:date" />

</xsd:complexType>


<!--
////////////////////////////////////////////////////////////
//  The system type
//
-->
<xsd:complexType name="systemType">

 <xsd:all>

 <!-- Sensor Elements (can be more than one)-->
 <xsd:element name="sensors" type="sls:sensorsType" />

 <!-- System Elements (can be more than one) -->
 <xsd:element name="platforms" type="sls:platformsType"  />
```

```
 </xsd:all>

</xsd:complexType>


<!--
//////////////////////////////////////////////////////////
//  The data and products type
//
-->
<xsd:complexType name="dataType">

 <!-- Retrieval Mode -->
 <xsd:attribute name="retrievalmode" type="xsd:string" />

</xsd:complexType>


<!--
////////////////////////////////////////////////////////////
//  Sensors Element: can have more than one sensor elements
//
-->
<xsd:complexType name="sensorsType">
 <xsd:sequence>
  <xsd:element name="sensor" minOccurs="1" maxOccurs="unbounded">
   <xsd:complexType>

    <!-- Sensor Designation: Primary, Secondary, Tertiary -->
    <xsd:attribute name="designation" type="sls:positionType" use="required" />

    <!-- Sample Interval -->
    <xsd:attribute name="interval" type="xsd:positiveInteger" use="required" />

   </xsd:complexType>
  </xsd:element>
 </xsd:sequence>
</xsd:complexType>


<!--
///////////////////////////////////////////////////////////////
//  Data Collection Platform (DCP) or, simply, platform element
//
-->
<xsd:complexType name="platformsType">
 <xsd:sequence>
  <xsd:element name="platform" minOccurs="1" maxOccurs="unbounded"
             type="xsd:positiveInteger" />
 </xsd:sequence>
</xsd:complexType>


<!--

 /////////////////////////////////////////////////////////////////////////////////
 //  Elementary Data Types used in schema above
 //  (defined separately for future extensibility and readability of above)
 //  (some of these datatypes are used in the WSDL which includes this XSD)
```

```
-->


<!-- Coordinates (Lat/Lon) -->
<xsd:complexType name="coordinateType">
 <!-- Latitude -->
 <xsd:attribute name="latitude" type="xsd:decimal" use="required" />
 <!-- Longitude -->
 <xsd:attribute name="longitude" type="xsd:decimal" use="required" />
</xsd:complexType>

<!-- Status status data type -->
<xsd:simpleType name="statusEnum">
 <xsd:restriction base="xsd:string">
  <xsd:enumeration value="active" />
  <xsd:enumeration value="servicing" />
  <xsd:enumeration value="pending" />
  <xsd:enumeration value="inactive" />
 </xsd:restriction>
</xsd:simpleType>

<!-- Station Operator Data Type (to be extended)-->
<xsd:simpleType name="operatorEnum">
 <xsd:restriction base="xsd:string">
  <xsd:enumeration value="JMA"/>
  <xsd:enumeration value="NOS"/>
  <xsd:enumeration value="NTF"/>
  <xsd:enumeration value="PTWC"/>
  <xsd:enumeration value="UHSLC"/>
 </xsd:restriction>
</xsd:simpleType>

<!-- Point of Contact data type -->
<xsd:complexType name="pocType">
 <!-- Person -->
 <xsd:attribute name="person" type="xsd:string" use="required" />
 <!-- Telephone -->
 <xsd:attribute name="phone" type="xsd:string" use="required" />
 <!-- Email -->
 <xsd:attribute name="email" type="xsd:string" use="required" />
</xsd:complexType>

<!-- Sensor Designation Type -->
<xsd:simpleType name="positionType">
 <xsd:restriction base="xsd:string">
  <xsd:enumeration value="Primary"/>
  <xsd:enumeration value="Secondary"/>
  <xsd:enumeration value="Tertiary"/>
  <xsd:enumeration value="Fourth"/>
  <xsd:enumeration value="Fifth"/>
 </xsd:restriction>
</xsd:simpleType>


<xsd:complexType name="nationType">
 <xsd:choice>
  <!-- ISO Alpha 3 Codes -->
  <xsd:element name="isoalpha3code" type="sls:isoalpha3codes" />
  <!-- United Nations Code -->
  <xsd:element name="unitednationscode" type="sls:uncountrycodes" />
```

```
  <!-- Other types of country codes can be added here -->
 </xsd:choice>
</xsd:complexType>

<!--
/////////////////////////////////////////////////////////
//  International Standards Organization
//  ISO 3166 Alpha Country Codes
//  (Simple Enumeration)
-->
<xsd:simpleType name="isoalpha3codes">
 <xsd:restriction base="xsd:string">
  <xsd:enumeration value="AFG" /><!-- AFGHANISTAN -->
  <xsd:enumeration value="ALA" /><!-- ALAND ISLANDS -->
  <xsd:enumeration value="ALB" /><!-- ALBANIA -->
  <xsd:enumeration value="DZA" /><!-- ALGERIA -->
  <xsd:enumeration value="ASM" /><!-- AMERICAN SAMOA -->
  <xsd:enumeration value="AND" /><!-- ANDORRA -->
  <xsd:enumeration value="AGO" /><!-- ANGOLA -->
  <xsd:enumeration value="AIA" /><!-- ANGUILLA -->
  <xsd:enumeration value="ATA" /><!-- ANTARCTICA -->
  <xsd:enumeration value="ATG" /><!-- ANTIGUA AND BARBUDA -->
  <xsd:enumeration value="ARG" /><!-- ARGENTINA -->
  <xsd:enumeration value="ARM" /><!-- ARMENIA -->
  <xsd:enumeration value="ABW" /><!-- ARUBA -->
  <xsd:enumeration value="AUS" /><!-- AUSTRALIA -->
  <xsd:enumeration value="AUT" /><!-- AUSTRIA -->
  <xsd:enumeration value="AZE" /><!-- AZERBAIJAN -->
  <xsd:enumeration value="BHS" /><!-- BAHAMAS -->
  <xsd:enumeration value="BHR" /><!-- BAHRAIN -->
  <xsd:enumeration value="BGD" /><!-- BANGLADESH -->
  <xsd:enumeration value="BRB" /><!-- BARBADOS -->
  <xsd:enumeration value="BLR" /><!-- BELARUS -->
  <xsd:enumeration value="BEL" /><!-- BELGIUM -->
  <xsd:enumeration value="BLZ" /><!-- BELIZE -->
  <xsd:enumeration value="BEN" /><!-- BENIN -->
  <xsd:enumeration value="BMU" /><!-- BERMUDA -->
  <xsd:enumeration value="BTN" /><!-- BHUTAN -->
  <xsd:enumeration value="BOL" /><!-- BOLIVIA -->
  <xsd:enumeration value="BIH" /><!-- BOSNIA AND HERZEGOVINA -->
  <xsd:enumeration value="BWA" /><!-- BOTSWANA -->
  <xsd:enumeration value="BVT" /><!-- BOUVET ISLAND -->
  <xsd:enumeration value="BRA" /><!-- BRAZIL -->
  <xsd:enumeration value="IOT" /><!-- BRITISH INDIAN OCEAN TERRITORY -->
  <xsd:enumeration value="VGB" /><!-- BRITISH VIRGIN ISLANDS -->
  <xsd:enumeration value="BRN" /><!-- BRUNEI DARUSSALAM -->
  <xsd:enumeration value="BGR" /><!-- BULGARIA -->
  <xsd:enumeration value="BFA" /><!-- BURKINA FASO -->
  <xsd:enumeration value="BDI" /><!-- BURUNDI -->
  <xsd:enumeration value="KHM" /><!-- CAMBODIA -->
  <xsd:enumeration value="CMR" /><!-- CAMEROON -->
  <xsd:enumeration value="CAN" /><!-- CANADA -->
  <xsd:enumeration value="CPV" /><!-- CAPE VERDE -->
  <xsd:enumeration value="CYM" /><!-- CAYMAN ISLANDS -->
  <xsd:enumeration value="CAF" /><!-- CENTRAL AFRICAN REPUBLIC -->
  <xsd:enumeration value="TCD" /><!-- CHAD -->
  <xsd:enumeration value="CHL" /><!-- CHILE -->
  <xsd:enumeration value="CHN" /><!-- CHINA -->
  <xsd:enumeration value="CXR" /><!-- CHRISTMAS ISLAND -->
  <xsd:enumeration value="CCK" /><!-- COCOS (KEELING) ISLANDS -->
```

```
<xsd:enumeration value="COL" /><!-- COLOMBIA -->
<xsd:enumeration value="COM" /><!-- COMOROS -->
<xsd:enumeration value="COG" /><!-- CONGO -->
<xsd:enumeration value="COK" /><!-- COOK ISLANDS -->
<xsd:enumeration value="CRI" /><!-- COSTA RICA -->
<xsd:enumeration value="CIV" /><!-- COTE D'IVOIRE -->
<xsd:enumeration value="HRV" /><!-- CROATIA -->
<xsd:enumeration value="CUB" /><!-- CUBA -->
<xsd:enumeration value="CYP" /><!-- CYPRUS -->
<xsd:enumeration value="CZE" /><!-- CZECH REPUBLIC -->
<xsd:enumeration value="DNK" /><!-- DENMARK -->
<xsd:enumeration value="DJI" /><!-- DJIBOUTI -->
<xsd:enumeration value="DMA" /><!-- DOMINICA -->
<xsd:enumeration value="DOM" /><!-- DOMINICAN REPUBLIC -->
<xsd:enumeration value="TLS" /><!-- EAST TIMOR -->
<xsd:enumeration value="ECU" /><!-- ECUADOR -->
<xsd:enumeration value="EGY" /><!-- EGYPT -->
<xsd:enumeration value="SLV" /><!-- EL SALVADOR -->
<xsd:enumeration value="GNQ" /><!-- EQUATORIAL GUINEA -->
<xsd:enumeration value="ERI" /><!-- ERITREA -->
<xsd:enumeration value="EST" /><!-- ESTONIA -->
<xsd:enumeration value="ETH" /><!-- ETHIOPIA -->
<xsd:enumeration value="FLK" /><!-- FALKLAND ISLANDS (MALVINAS) -->
<xsd:enumeration value="FRO" /><!-- FAROE ISLANDS -->
<xsd:enumeration value="FJI" /><!-- FIJI -->
<xsd:enumeration value="FIN" /><!-- FINLAND -->
<xsd:enumeration value="FRA" /><!-- FRANCE -->
<xsd:enumeration value="FXX" /><!-- FRANCE, METROPOLITAN -->
<xsd:enumeration value="GUF" /><!-- FRENCH GUIANA -->
<xsd:enumeration value="PYF" /><!-- FRENCH POLYNESIA -->
<xsd:enumeration value="ATF" /><!-- FRENCH SOUTHERN TERRITORIES -->
<xsd:enumeration value="GAB" /><!-- GABON -->
<xsd:enumeration value="GMB" /><!-- GAMBIA -->
<xsd:enumeration value="GEO" /><!-- GEORGIA -->
<xsd:enumeration value="DEU" /><!-- GERMANY -->
<xsd:enumeration value="GHA" /><!-- GHANA -->
<xsd:enumeration value="GIB" /><!-- GIBRALTAR -->
<xsd:enumeration value="GRC" /><!-- GREECE -->
<xsd:enumeration value="GRL" /><!-- GREENLAND -->
<xsd:enumeration value="GRD" /><!-- GRENADA -->
<xsd:enumeration value="GLP" /><!-- GUADELOUPE -->
<xsd:enumeration value="GUM" /><!-- GUAM -->
<xsd:enumeration value="GTM" /><!-- GUATEMALA -->
<xsd:enumeration value="GGY" /><!-- GUERNSEY -->
<xsd:enumeration value="GIN" /><!-- GUINEA -->
<xsd:enumeration value="GNB" /><!-- GUINEA-BISSAU -->
<xsd:enumeration value="GUY" /><!-- GUYANA -->
<xsd:enumeration value="HTI" /><!-- HAITI -->
<xsd:enumeration value="HMD" /><!-- HEARD ISLAND & MCDONALD ISLANDS -->
<xsd:enumeration value="HND" /><!-- HONDURAS -->
<xsd:enumeration value="HKG" /><!-- HONG KONG -->
<xsd:enumeration value="HUN" /><!-- HUNGARY -->
<xsd:enumeration value="ISL" /><!-- ICELAND -->
<xsd:enumeration value="IND" /><!-- INDIA -->
<xsd:enumeration value="IDN" /><!-- INDONESIA -->
<xsd:enumeration value="IRN" /><!-- IRAN -->
<xsd:enumeration value="IRQ" /><!-- IRAQ -->
<xsd:enumeration value="IRL" /><!-- IRELAND -->
<xsd:enumeration value="IMN" /><!-- ISLE OF MAN -->
<xsd:enumeration value="ISR" /><!-- ISRAEL -->
```

```
<xsd:enumeration value="ITA" /><!-- ITALY -->
<xsd:enumeration value="JAM" /><!-- JAMAICA -->
<xsd:enumeration value="JPN" /><!-- JAPAN -->
<xsd:enumeration value="JEY" /><!-- JERSEY -->
<xsd:enumeration value="JOR" /><!-- JORDAN -->
<xsd:enumeration value="KAZ" /><!-- KAZAKHSTAN -->
<xsd:enumeration value="KEN" /><!-- KENYA -->
<xsd:enumeration value="KIR" /><!-- KIRIBATI -->
<xsd:enumeration value="KWT" /><!-- KUWAIT -->
<xsd:enumeration value="KGZ" /><!-- KYRGYZSTAN -->
<xsd:enumeration value="LAO" /><!-- LAO -->
<xsd:enumeration value="LVA" /><!-- LATVIA -->
<xsd:enumeration value="LBN" /><!-- LEBANON -->
<xsd:enumeration value="LSO" /><!-- LESOTHO -->
<xsd:enumeration value="LBR" /><!-- LIBERIA -->
<xsd:enumeration value="LBY" /><!-- LIBYA -->
<xsd:enumeration value="LIE" /><!-- LIECHTENSTEIN -->
<xsd:enumeration value="LTU" /><!-- LITHUANIA -->
<xsd:enumeration value="LUX" /><!-- LUXEMBOURG -->
<xsd:enumeration value="MAC" /><!-- MACAU -->
<xsd:enumeration value="MKD" /><!-- MACEDONIA -->
<xsd:enumeration value="MDG" /><!-- MADAGASCAR -->
<xsd:enumeration value="MWI" /><!-- MALAWI -->
<xsd:enumeration value="MYS" /><!-- MALAYSIA -->
<xsd:enumeration value="MDV" /><!-- MALDIVES -->
<xsd:enumeration value="MLI" /><!-- MALI -->
<xsd:enumeration value="MLT" /><!-- MALTA -->
<xsd:enumeration value="MHL" /><!-- MARSHALL ISLANDS -->
<xsd:enumeration value="MTQ" /><!-- MARTINIQUE -->
<xsd:enumeration value="MRT" /><!-- MAURITANIA -->
<xsd:enumeration value="MUS" /><!-- MAURITIUS -->
<xsd:enumeration value="MYT" /><!-- MAYOTTE -->
<xsd:enumeration value="MEX" /><!-- MEXICO -->
<xsd:enumeration value="FSM" /><!-- MICRONESIA -->
<xsd:enumeration value="MDA" /><!-- MOLDOVA -->
<xsd:enumeration value="MCO" /><!-- MONACO -->
<xsd:enumeration value="MNG" /><!-- MONGOLIA -->
<xsd:enumeration value="MSR" /><!-- MONTSERRAT -->
<xsd:enumeration value="MAR" /><!-- MOROCCO -->
<xsd:enumeration value="MOZ" /><!-- MOZAMBIQUE -->
<xsd:enumeration value="MMR" /><!-- MYANMAR -->
<xsd:enumeration value="NAM" /><!-- NAMIBIA -->
<xsd:enumeration value="NRU" /><!-- NAURU -->
<xsd:enumeration value="NPL" /><!-- NEPAL -->
<xsd:enumeration value="NLD" /><!-- NETHERLANDS -->
<xsd:enumeration value="ANT" /><!-- NETHERLANDS ANTILLES -->
<xsd:enumeration value="NCL" /><!-- NEW CALEDONIA -->
<xsd:enumeration value="NZL" /><!-- NEW ZEALAND -->
<xsd:enumeration value="NIC" /><!-- NICARAGUA -->
<xsd:enumeration value="NER" /><!-- NIGER -->
<xsd:enumeration value="NGA" /><!-- NIGERIA -->
<xsd:enumeration value="NIU" /><!-- NIUE -->
<xsd:enumeration value="NFK" /><!-- NORFOLK ISLAND -->
<xsd:enumeration value="PRK" /><!-- NORTH KOREA -->
<xsd:enumeration value="MNP" /><!-- NORTHERN MARIANA ISLANDS -->
<xsd:enumeration value="NOR" /><!-- NORWAY -->
<xsd:enumeration value="OMN" /><!-- OMAN -->
<xsd:enumeration value="PAK" /><!-- PAKISTAN -->
<xsd:enumeration value="PLW" /><!-- PALAU -->
<xsd:enumeration value="PSE" /><!-- PALESTINE -->
```

```
<xsd:enumeration value="PAN" /><!-- PANAMA -->
<xsd:enumeration value="PNG" /><!-- PAPUA NEW GUINEA -->
<xsd:enumeration value="PRY" /><!-- PARAGUAY -->
<xsd:enumeration value="PER" /><!-- PERU -->
<xsd:enumeration value="PHL" /><!-- PHILIPPINES -->
<xsd:enumeration value="PCN" /><!-- PITCAIRN -->
<xsd:enumeration value="POL" /><!-- POLAND -->
<xsd:enumeration value="PRT" /><!-- PORTUGAL -->
<xsd:enumeration value="PRI" /><!-- PUERTO RICO -->
<xsd:enumeration value="QAT" /><!-- QATAR -->
<xsd:enumeration value="REU" /><!-- REUNION -->
<xsd:enumeration value="ROU" /><!-- ROMANIA -->
<xsd:enumeration value="RUS" /><!-- RUSSIA -->
<xsd:enumeration value="RWA" /><!-- RWANDA -->
<xsd:enumeration value="SHN" /><!-- SAINT HELENA -->
<xsd:enumeration value="KNA" /><!-- SAINT KITTS AND NEVIS -->
<xsd:enumeration value="LCA" /><!-- SAINT LUCIA -->
<xsd:enumeration value="SPM" /><!-- SAINT PIERRE AND MIQUELON -->
<xsd:enumeration value="VCT" /><!-- SAINT VINCENT AND THE GRENADINES -->
<xsd:enumeration value="WSM" /><!-- SAMOA -->
<xsd:enumeration value="SMR" /><!-- SAN MARINO -->
<xsd:enumeration value="STP" /><!-- SAO TOME AND PRINCIPE -->
<xsd:enumeration value="SAU" /><!-- SAUDI ARABIA -->
<xsd:enumeration value="SEN" /><!-- SENEGAL -->
<xsd:enumeration value="SYC" /><!-- SEYCHELLES -->
<xsd:enumeration value="SLE" /><!-- SIERRA LEONE -->
<xsd:enumeration value="SGP" /><!-- SINGAPORE -->
<xsd:enumeration value="SVK" /><!-- SLOVAKIA -->
<xsd:enumeration value="SVN" /><!-- SLOVENIA -->
<xsd:enumeration value="SLB" /><!-- SOLOMON ISLANDS -->
<xsd:enumeration value="SOM" /><!-- SOMALIA -->
<xsd:enumeration value="ZAF" /><!-- SOUTH AFRICA -->
<xsd:enumeration value="KOR" /><!-- SOUTH KOREA -->
<xsd:enumeration value="ESP" /><!-- SPAIN -->
<xsd:enumeration value="LKA" /><!-- SRI LANKA -->
<xsd:enumeration value="SDN" /><!-- SUDAN -->
<xsd:enumeration value="SUR" /><!-- SURINAME -->
<xsd:enumeration value="SJM" /><!-- SVALBARD AND JAN MAYEN ISLANDS -->
<xsd:enumeration value="SWZ" /><!-- SWAZILAND -->
<xsd:enumeration value="SWE" /><!-- SWEDEN -->
<xsd:enumeration value="CHE" /><!-- SWITZERLAND -->
<xsd:enumeration value="SYR" /><!-- SYRIAN ARAB REPUBLIC -->
<xsd:enumeration value="TWN" /><!-- TAIWAN, PROVINCE OF CHINA -->
<xsd:enumeration value="TJK" /><!-- TAJIKISTAN -->
<xsd:enumeration value="TZA" /><!-- TANZANIA, UNITED REPUBLIC OF -->
<xsd:enumeration value="THA" /><!-- THAILAND -->
<xsd:enumeration value="TGO" /><!-- TOGO -->
<xsd:enumeration value="TKL" /><!-- TOKELAU -->
<xsd:enumeration value="TON" /><!-- TONGA -->
<xsd:enumeration value="TTO" /><!-- TRINIDAD AND TOBAGO -->
<xsd:enumeration value="TUN" /><!-- TUNISIA -->
<xsd:enumeration value="TUR" /><!-- TURKEY -->
<xsd:enumeration value="TKM" /><!-- TURKMENISTAN -->
<xsd:enumeration value="TCA" /><!-- TURKS AND CAICOS ISLANDS -->
<xsd:enumeration value="TUV" /><!-- TUVALU -->
<xsd:enumeration value="UGA" /><!-- UGANDA -->
<xsd:enumeration value="UKR" /><!-- UKRAINE -->
<xsd:enumeration value="ARE" /><!-- UNITED ARAB EMIRATES -->
<xsd:enumeration value="GBR" /><!-- UNITED KINGDOM -->
<xsd:enumeration value="USA" /><!-- UNITED STATES OF AMERICA -->
```

```
  <xsd:enumeration value="UMI" /><!-- UNITED STATES MINOR OUTLYING ISLANDS -->
  <xsd:enumeration value="URY" /><!-- URUGUAY -->
  <xsd:enumeration value="UZB" /><!-- UZBEKISTAN -->
  <xsd:enumeration value="VUT" /><!-- VANUATU -->
  <xsd:enumeration value="VAT" /><!-- VATICAN CITY -->
  <xsd:enumeration value="VEN" /><!-- VENEZUELA -->
  <xsd:enumeration value="VNM" /><!-- VIET NAM -->
  <xsd:enumeration value="VIR" /><!-- VIRGIN ISLANDS (U.S.) -->
  <xsd:enumeration value="WLF" /><!-- WALLIS AND FUTUNA ISLANDS -->
  <xsd:enumeration value="ESH" /><!-- WESTERN SAHARA -->
  <xsd:enumeration value="YEM" /><!-- YEMEN -->
  <xsd:enumeration value="YUG" /><!-- YUGOSLAVIA -->
  <xsd:enumeration value="COD" /><!-- ZAIRE -->
  <xsd:enumeration value="ZMB" /><!-- ZAMBIA -->
  <xsd:enumeration value="ZWE" /><!-- ZIMBABWE -->
 </xsd:restriction>
</xsd:simpleType>


<!--
/////////////////////////////////////////////////////////////
//  United Nations Numerical Codes
//  (Simple Enumeration)
-->
<xsd:simpleType name="uncountrycodes">
 <xsd:restriction base="xsd:string">
  <xsd:enumeration value="4" /><!-- AFGHANISTAN -->
  <xsd:enumeration value="248" /><!-- ALAND ISLANDS -->
  <xsd:enumeration value="8" /><!-- ALBANIA -->
  <xsd:enumeration value="12" /><!-- ALGERIA -->
  <xsd:enumeration value="16" /><!-- AMERICAN SAMOA -->
  <xsd:enumeration value="20" /><!-- ANDORRA -->
  <xsd:enumeration value="24" /><!-- ANGOLA -->
  <xsd:enumeration value="660" /><!-- ANGUILLA -->
  <xsd:enumeration value="10" /><!-- ANTARCTICA -->
  <xsd:enumeration value="28" /><!-- ANTIGUA AND BARBUDA -->
  <xsd:enumeration value="32" /><!-- ARGENTINA -->
  <xsd:enumeration value="51" /><!-- ARMENIA -->
  <xsd:enumeration value="533" /><!-- ARUBA -->
  <xsd:enumeration value="36" /><!-- AUSTRALIA -->
  <xsd:enumeration value="40" /><!-- AUSTRIA -->
  <xsd:enumeration value="31" /><!-- AZERBAIJAN -->
  <xsd:enumeration value="44" /><!-- BAHAMAS -->
  <xsd:enumeration value="48" /><!-- BAHRAIN -->
  <xsd:enumeration value="50" /><!-- BANGLADESH -->
  <xsd:enumeration value="52" /><!-- BARBADOS -->
  <xsd:enumeration value="112" /><!-- BELARUS -->
  <xsd:enumeration value="56" /><!-- BELGIUM -->
  <xsd:enumeration value="84" /><!-- BELIZE -->
  <xsd:enumeration value="204" /><!-- BENIN -->
  <xsd:enumeration value="60" /><!-- BERMUDA -->
  <xsd:enumeration value="64" /><!-- BHUTAN -->
  <xsd:enumeration value="68" /><!-- BOLIVIA -->
  <xsd:enumeration value="70" /><!-- BOSNIA AND HERZEGOVINA -->
  <xsd:enumeration value="72" /><!-- BOTSWANA -->
  <xsd:enumeration value="74" /><!-- BOUVET ISLAND -->
  <xsd:enumeration value="76" /><!-- BRAZIL -->
  <xsd:enumeration value="86" /><!-- BRITISH INDIAN OCEAN TERRITORY -->
  <xsd:enumeration value="92" /><!-- BRITISH VIRGIN ISLANDS -->
  <xsd:enumeration value="96" /><!-- BRUNEI DARUSSALAM -->
```

```
<xsd:enumeration value="100" /><!-- BULGARIA -->
<xsd:enumeration value="854" /><!-- BURKINA FASO -->
<xsd:enumeration value="108" /><!-- BURUNDI -->
<xsd:enumeration value="116" /><!-- CAMBODIA -->
<xsd:enumeration value="120" /><!-- CAMEROON -->
<xsd:enumeration value="124" /><!-- CANADA -->
<xsd:enumeration value="132" /><!-- CAPE VERDE -->
<xsd:enumeration value="136" /><!-- CAYMAN ISLANDS -->
<xsd:enumeration value="140" /><!-- CENTRAL AFRICAN REPUBLIC -->
<xsd:enumeration value="148" /><!-- CHAD -->
<xsd:enumeration value="830" /><!-- CHANNEL ISLANDS -->
<xsd:enumeration value="152" /><!-- CHILE -->
<xsd:enumeration value="156" /><!-- CHINA -->
<xsd:enumeration value="162" /><!-- CHRISTMAS ISLAND -->
<xsd:enumeration value="166" /><!-- COCOS (KEELING) ISLANDS -->
<xsd:enumeration value="170" /><!-- COLOMBIA -->
<xsd:enumeration value="174" /><!-- COMOROS -->
<xsd:enumeration value="178" /><!-- CONGO -->
<xsd:enumeration value="184" /><!-- COOK ISLANDS -->
<xsd:enumeration value="188" /><!-- COSTA RICA -->
<xsd:enumeration value="384" /><!-- COTE D'IVOIRE -->
<xsd:enumeration value="191" /><!-- CROATIA -->
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Attachment B: Sea Level Station Metadata Host Requirements

As shown in Figure 1, the essential server high level architecture would require an applications server supporting Java Enterprise Edition (J2EE) servlet technology such as Tomcat, Weblogic, Oracle Applications Server etc. or equivalent. It is assumed that the host data center has some standard networks and security policies such as firewalls etc, shown only in abstraction in Figure 1. The discussion is limited to the components that are logically organized for the purpose of hosting the web service.

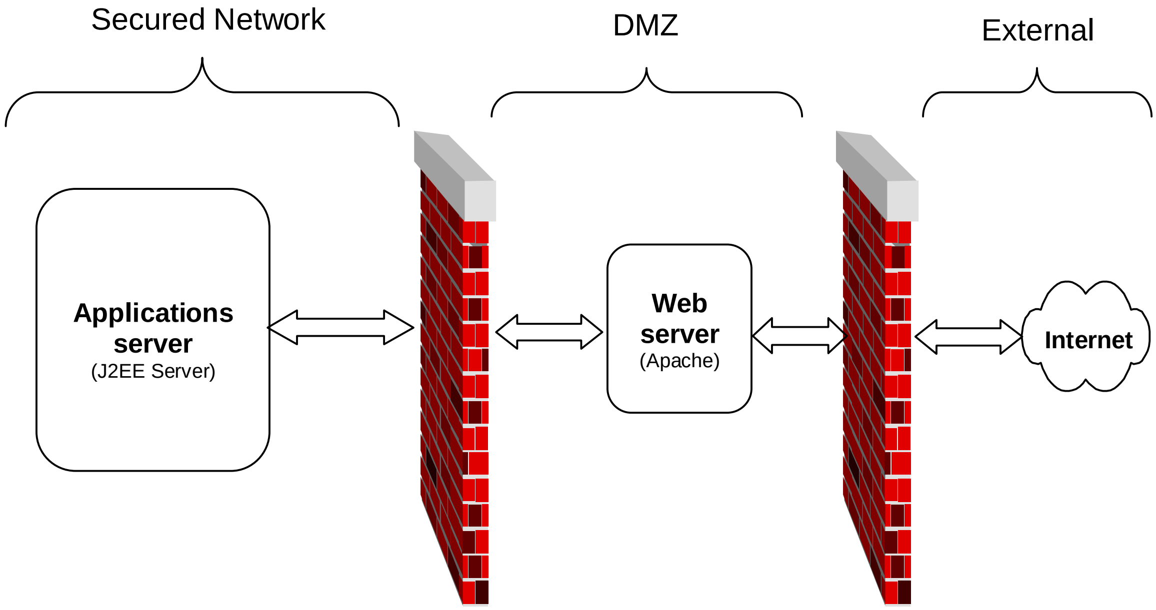

Figure 1: Simplified High Level Server Architecture

Server Side Systems Architecture

The architecture supporting the Sea Level Station web service consists of the following chief components:

- Web Server
- Applications Server

The web server is the chief gateway into the applications and data for web service clients. It will be located in a "Demilitarized Zone" (DMZ) between the internal and external firewalls, accessible over the public internet. The web server connects to the rest of the system through a specific internal port within the firewall as shown in Figure 1. This architecture is generally suited for secure applications and data.

Web Server

As shown in Figure 1, the web server is usually the logical gateway into an enterprise web application environment. It is designed to be a host responding to requests in the standard Hyper Text Transfer Protocol (HTTP), typically delivering fast static web content over the Internet. An example of a server that would meet the requirement would be the Sun Fire Model V240 ***or equivalent***.

Applications Server

The applications server is similar to the web server in the sense that is delivers web content. However, unlike the web server, the applications server is optimized to deliver dynamic content based on platforms, such as Java Enterprise (J2EE), database access etc.

It can run on the same machine as the web server, but is best located on a separate machine separated by a network firewall as shown in Figure 1. The sea level web service host will require a Sun Fire V240 ***or equivalent*** with 73 GB disk and 4 GB RAM available to applications—i.e. above and beyond that used by the operating system and associated non-application memory resident programs.

[end]