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This Issue...

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by Dr Mike Osborne, OceanWise Limited

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Recent developments, however, are leading to more open systems becoming available. It is now possible to select the optimum sensor for a particular application or budget, and to send data to an online data storage and publishing service, without the need for bespoke development or costly IT equipment. Future developments promise to make environmental monitoring a 'plug and play' operation, so that the state of the environment at a reported location could become – with advent of low cost GPS receivers – as ubiquitous as location itself.

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Online Publishing of Environmental Monitoring Data Made Easy

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Advances in communication and sensor technology have lead to the possibility of environmental monitoring data becoming available in real or near real time on the Internet. Numerous examples of this are already operational but the vast majority of these comprise proprietary hardware and software tied to a particular instrument or modem manufacturer. As a whole, these integrated systems tend to be expensive to procure and maintain.

Recent developments, however, are leading to more open systems becoming available. It is now possible to select the optimum sensor for a particular application or budget, and to send data to an online data storage and publishing service, without the need for bespoke development or costly IT equipment. Future developments promise to make environmental monitoring a 'plug and play' operation, so that the state of the environment at a reported location could become – with advent of low cost GPS receivers – as ubiquitous as location itself.

Open Telemetry Systems

An example of an open system is the Data Telemetry Unit from UK based manufacturer, Valeport (Figure 1). The unit is supplied in a robust weather proof housing, which also contains an internal battery pack for total autonomy. The unit is compatible with Valeport products, as one would expect, but can also receive and onwardly transmit data from third party equipment, such as Gill Instruments' Metpak™ multi-sensor weather station.

The basic operating pattern of the device is to stay in a low power sleep mode until woken by the attached instrument, store ASCII data string transmitted by the instrument and establish a GPRS data link and post data to a defined FTP address, then return to sleep mode. The GPRS telemetry unit is designed to provide data files from the instrument to any third party Internet sites and other data display services able to handle the data, for example 'Port-Log.net' (see below).

The unit can also internally buffer data from the connected instrument and upload it to a user-defined schedule. For example, the Unit can hold over 700 records from a TideMaster tide gauge before having to upload the data. The unit always requires a sufficient GPRS carrier signal to successfully transfer the data, hence the buffering capability provides protection from network outages.

Figure 1 Valeport's Data Telemetry Unit (GPRS)

The units are supplied pre-configured with a pay as you go SIM card, which provides GPRS in over 80 countries worldwide (subject to local coverage). The cards allow for a great deal of flexibility and on average in Europe, data costs are ~ £0.01 per transmission. GSM, UHF and VHF versions are also available, providing transparent links between instruments and operating software. Costs vary depending on the transmission method employed.

Why Monitor?

Monitoring the environment has many benefits, from assessing baseline conditions prior to development to assessing impacts and ensuring safe operations. Historically, data is either stored locally in a Data Storage Unit (DSU) or transmitted by wire to a proprietary display unit or computer screen. In the

former, the data only becomes available after the DSU is recovered. There is no possibility of knowing if the senor has failed prior to recovery, so acquisition can be unreliable, potentially leading to large gaps in the record.

With a connected wire, the data is available in real-time but only to a local operator, who in the case of a fault may not have the skills or resources to fix the problem. Long-term storage of data is often a manual process, performed by copying data from the DSU or local display unit to a central storage device. This is cumbersome and in many cases avoided, thus detracting from the value of the data for long-term study.

Being able to store and display data locally and to transmit it to a remote site opens up many more possibilities. Being able to display this data over a corporate intranet or selectively on the Internet opens up many more. These include managers and other operational staff having immediate access to conditions at remote sites, automatic storage of data on a secure server and maintenance staff being able to monitor the performance of each instrument or telemetry system, either to carry out adjustments on-line or to be able to optimise the scheduling of maintenance visits. Either way, large costs savings and protection of valuable data result.

On-line Publishing

Different sensors produce data to different specifications. It is essential, therefore, that any system receiving this data is able to recognise and handle it. Sometimes, data is text based and this operation is fairly straightforward. However, often it is in binary format, and complex, and expertise is required to understand and decode it. Any changes in specification also need to be accommodated.

Whilst the entire system is based on a single manufacturer, having data structured and encoded differently is not usually a problem. However, with flexible open systems, it is necessary to have software that recognises these differences and is able to decode and, if necessary, process each data set for onward storage and use. Ultimately, this is best achieved through open standards, where the standard is also machine-readable, allowing for updates.

Port-Log.net

One such system is Port-Log.net, designed and operated by **OceanWise**. Port-Log.net is quick and easy to set up and, as discussed above, is totally independent of the types of instrument and transmission method used. It is therefore flexible and accepts data from any telemetry system or sensor. Customers can choose to access it openly or via a secure log-in. It is available as a low cost subscription service, thereby negating the need for expensive IT equipment or development.

Native output from any sensor is sent directly by, for example, the Valeport Telemetry Unit to the Port-Log.net virtual server, where it is decoded and loaded onto a secure database (Figure 2). Port-Log.net standard web pages access and visualise the data, either in near real-time for operational purposes, or as historical summaries for situational awareness and analysis.

Figure 2 Schematic of Port-Log.net

Users are configured to have access to different levels of data, sites or specific sensors, depending on their role in the organisation or project team. Selected data can be made publicly available, if required. Data held in the database can be downloaded in full, or a subset queried and downloaded, for subsequent processing, analysis or presentation using standard desktop applications.

Ocean Database

At the core of Port-Log.net is Ocean Database comprising unique data tables and relationships that are capable of storing many standard types of simple and complex environmental monitoring data. The data tables are created or set up depending on which particular instrument or sampling regime is

incorporated and may be extended at any time to include other standard and non-standard data types, as required. Supplementary tables store associated parameters used in quality control and metadata creation, and divide the data into temporally or spatially referenced blocks for easier identification and management.

Future Development

The **Open Geospatial Consortium** (OGC) is an international standards organisation established in 1994 to encourage the development and implementation of open standards for geospatial content and services. Whilst most OGC standards, such as the Web Mapping Service, relate to the publishing of geographical information or spatial data, the OGC's SensorWeb initiative relates purely to sharing environmental monitoring data. Being able to combine spatial digital mapping data with temporal environmental monitoring data using open standards is becoming a reality and is, the author believes, the ultimate performance indicator for a spatial data infrastructure (SDI).

The aim of SensorWeb is to create and publish specifications for system interfaces and metadata to enable the integration of sensors with generic information infrastructures, including SDI. These specifications will be used to create applications, platforms, and products to connect devices such as flood gauges, air pollution monitors, stress gauges on bridges, mobile heart monitors, webcams, and robots as well as space and airborne earth imaging devices over the web.

Current specifications in development by OGC members include:

1. Observations and measurements standard models and XML schema for encoding observations and measurements from a sensor, archived and real-time
2. Sensor Model Language describing sensors systems and processes associated with sensor observations including sensor discovery, sensors location and observations
3. Transducer Model Language for describing transducers and supporting real-time streaming of data to and from sensor systems
4. Sensor Observations Service for requesting, filtering, and retrieving observations and sensor system information
5. Web Notification Services for delivering messages or alerts from other sensor web services.

The success of the SensorWeb or otherwise will depend on the uptake of these specifications by system manufacturers, such as Valeport, system integrators, such as OceanWise, and publishing services such as Port-Log.net. There is still along way to go but if the technical developments in, for example, mobile communication technology is anything to go by, it will not be too long before publishing, discovering and accessing environmental monitoring data is as easy as standard messaging.

News from the MEDIN Data Archive Centres (DACs)

by David Cotton, MEDIN

One of the key functions of MEDIN is to provide a network of linked Data Archive Centres (DACs) to provide a secure long term storage facility available to all producers of marine environmental data.

The current network includes

- The British Oceanographic Data Centre, for all water column oceanography data, contact **enquiries@bodc.ac.uk**
- The British Geological Survey, for geological and geophysical data, contact **offshoredata@bgs.ac.uk**
- DASSH for marine habitats and species data, contact **dash.enquiries@mba.ac.uk**
- The UK Hydrographic Office for bathymetry data, contact **seabeddatacentre@ukho.gov.uk**

Please note that the Bathymetry DAC at the UKHO is now fully up and running and keen to establish routine data archiving arrangements with all who record bathymetric survey data. So, if you have any bathymetry data to archive, please get in touch with them!

Expanding the DAC Network

The MEDIN DAC network will expand its coverage in 2012 to include **fisheries survey** data and **marine meteorology**. The Met Office has submitted itself for accreditation as the "Met DAC". CEFAS and Marine Scotland will provide two components of the "Fisheries DAC", and CEFAS is already working through the accreditation process. We expect both DACs to be up and running in 2012.

In addition, MEDIN is looking at the arrangements for **Marine Historic Environment** data, **and Socio-Economic** data. The marine heritage community recently met at a MEDIN workshop at the National Oceanography Centre in Southampton, and agreed to work together to establish a coordinated approach to managing marine historic environmental data.

The objective is to provide easier central access to all Marine Historic Environment data to all potential users, and to establish easy to use processes for archiving data within this "virtual" Marine Historic Environment DAC. Underpinning this approach is the continued requirement to provide secure archival for these important historic records

In practical terms this means working towards the establishment of a "virtual" Data Archive Centre for Marine Historic Environment data, accredited as part of the MEDIN Data Archive Centre (DAC) Network. This "virtual" DAC will have a federal structure comprised of existing data management facilities at English Heritage, the Royal Commission on the Ancient and Historic Monuments of Scotland, The Royal Commission on the Ancient and Historic Monuments of Wales, and the Archaeology Data Service.

In becoming part of the MEDIN DAC network, the Marine Historic Environment DAC will be able to establish links with the other DACs that have expertise in different themes (geophysics, geology; marine species and habitats; water column oceanography; bathymetry), thus ensuring proper processes are in place for managing these data.

There remains much work to do to meet the target of establishing the Marine Historic Environment DAC before the end of 2012. The first step, in spring 2012, will be to adopt a common agreed approach to the generation and publication of metadata onto the MEDIN Discovery portal.

Finally, MEDIN is working with the Marine Management Organisation and Marine Scotland to commission a review of data management arrangements for Socio-Economic data. You may have noticed the recent call for proposals on the MEDIN website (now closed – sorry!)

New Data Available through the MEDIN DACs

MEDIN has supported a number of projects in the past year to bring important data sets into the DAC network, and establish data flows from key marine organisations. These projects have included:

MALSF Regional Environment Characterisation Surveys: With funding from the Marine Aggregate Levy Sustainability Fund (MALSF), data from eighteen surveys commissioned by MALSF have now been archived within the MEDIN DAC network. These data are still available at www.marinealsf.org.uk until 31 March 2016, but archival within the MEDIN DAC network ensures these data will continue to be available to the marine community over the long-term

UK Benthos: UK Benthos is a database maintained for UK Oil and Gas, containing biological and chemical survey data collected by the Oil and Gas offshore industry data. Metadata records for each data set can now be searched through the MEDIN portal, and the relevant aspects of grab and core sample data have been archived at DASSH

SEPA Fin Fish Farm Surveys: The Scottish Environmental Protection Agency (SEPA) collects survey data at (marine) Fish Farm sites as part of a routine monitoring programme. Benthic grab and core data from these surveys is now available through DASSH and searchable on the MEDIN portal

Coastal Data Sets held by University Marine Biological Station, Millport (UMBSM): This project is still underway, but when completed priority data sets will have been archived at DASSH, and metadata records for all UMBSM coastal data sets will have been created.

Other projects have supported developments in Marine Historic Environment data, including updating the metadata catalogue on wrecks surveys, and adapting and broadening the existing metadata recording system used by the heritage community so that it can be used to produce MEDIN format metadata that can be searched through the MEDIN portal.

World Ocean Council Launches "Smart Ocean/Smart Industries" Programme On Ocean and Climate Observations
by MEDIN

Major ocean companies are working to expand and better coordinate the collection of oceanic and atmospheric data from ships and other offshore platforms through Smart Ocean/Smart Industries. This programme has been developed by the **World Ocean Council** (WOC), an international, cross-sectoral alliance of nearly 40 private sector bodies from a wide range of ocean industries (oil and gas, shipping, seafood, tourism, ocean technology, maritime law, marine environmental services). Development has taken place in close collaboration with national and international ocean and climate observations programmes, as well as existing voluntary observation programs.

The need to better understand and monitor the ocean and climate has never been greater. Government and scientific institutions have limited facilities and resources to obtain marine and atmospheric data. Shipping, offshore oil and gas and other ocean industries, e.g. ferries, fisheries, offshore wind, aquaculture and others, operate thousands of vessels and platforms. These provide tremendous potential for cost-effective collection of ocean and climate data. Expanded information will help improve the modelling and predictability of weather, ocean conditions and climate change, and will support responsible use of ocean resources – with clear benefits for science, government, society and business.

A WOC Working Group co-chaired by A.P. Moeller-Maersk and Transocean has begun to develop a comprehensive structure and process to scale up data collection from “smart” ships and platforms and expand the spatial and temporal extent of observations. The Intergovernmental Oceanographic Commission (IOC) of UNESCO is hosting a WOC workshop on 12-13 December 2011 in Paris.