An Update on Ireland's Integrated Digital Ocean

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Introduction.

A shared understanding of data through coherent acquisition, integration, analysis and delivery is a key component of aligning Information Systems and Information Technology, and is an essential enabler in adding value to data (Nagle & Sammon, 2017). Typically, the presentation and organisation of data is said to give rise to information and the integration of and conversations around information to wisdom (Rowley, 2016). In order to present marine data and integrate marine information from around Ireland's seas Ireland's Integrated Digital Ocean was introduced by Leadbetter, O'Grady & Burke (2016). Organisations contributing data and information to the Digital Ocean platform and portal include:

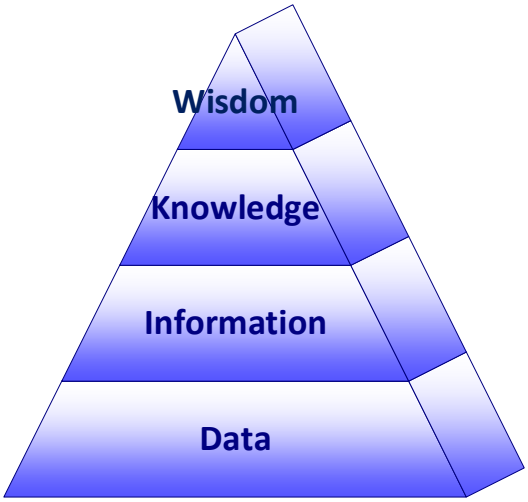

Figure 1: Data-Information-Knowledge-Wisdom pyramid (after Rowley, 2016).

- Commissioners of Irish Lights
- Dublin Bay Biosphere
- Dublin City University
- Electricity Supply Board
- Environmental Protection Agency
- Failté Ireland
- INFOMAR seabed mapping programme
- Irish Underwater Council
- National Parks and Wildlife Service
- SmartBay Ireland
- Sustainable Energy Authority of Ireland
- University College Cork

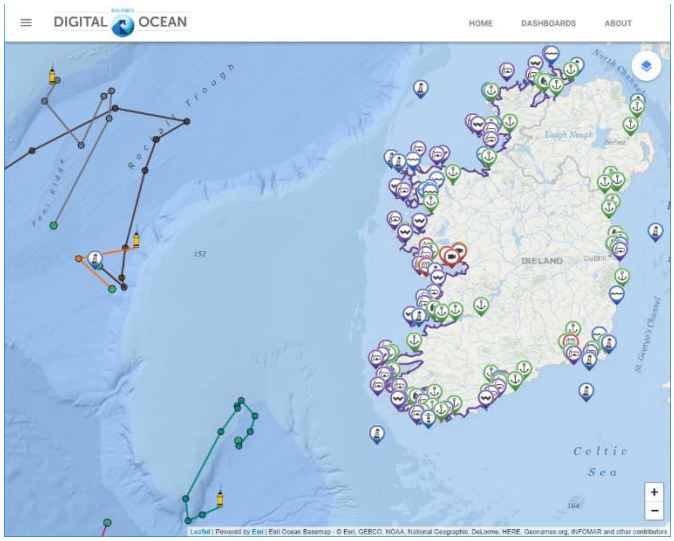

Figure 2: Ireland's Integrated Digital Ocean portal (http://www.digitalocean.ie) showing locations of live data feeds and static information points.

Digtial Ocean Platform Developments.

Since the introduction of the Digital Ocean platform, a number of technical developments have been undertaken in order to increase the breadth of data in the portal. These have included the introduction of tile services, over Web Map Services, for INFOMAR sea bed mapping data to the Digital Ocean as the WMS layers proved to be non-performant for end-users. Modelled data from the Marine Institute's operational forecasts have been incorporated into the platform through extension

of the Leaflet.js mapping toolbox's Time Dimension plugin[1], originally developed by the Balearic Islands Coastal Observing and Forecasting System. This extension has been contributed back to the community, and allows for fade between frames of a time based Web Map Service, in the case of the model data delivered from an instance of NOAA's Erddap data server. Finally, a recent overhaul of the portal's user interface has allowed a switch to a Material Design based look-and-feel (Figure 2) which allows users to more intuitevely navigate the data supplied through the platform.

Figure 3: A 3-D model of a shipwreck, surveyed by the INFOMAR seabed mapping program, made available to a Microsoft HoloLens device from the Digital Ocean platform.

Beyond the web portal, technical developments have been focussed in three areas. First has been the definition of a software architecture which both acknowledges the Internet of Things research conducted in the Marine Institute around the Galway Bay Cable Observatory and offers a production ready, resilient framework. The architecture is also deployable at data nodes to feed into the Digital Ocean platform. Second has been the adaptiation of the GraphQL system[2], developed by Facebook as a query language for Application Programming Interfaces, to allow the querying of data published through the Digital Ocean platform, specifically from Erddap endpoints. Third, the API for the Digital Ocean platform has been used to provide data access to Mixed Reality applications on the Microsoft HoloLens platform (Figure 3).

Conclusions.

The development of the Digital Ocean platform has allowed the creation of value from marine data and information through integration of these assets in a single portal, and delivery of these data to end users; thus reducing the gap between data creators and data users (Figure 4). The Digital Ocean platform has also allowed the use of emerging technological paradigms to create new visualisation techniques in marine informatics. Over the coming years, the sustainability and growth of the network providing data to the platform will be the key challenges.

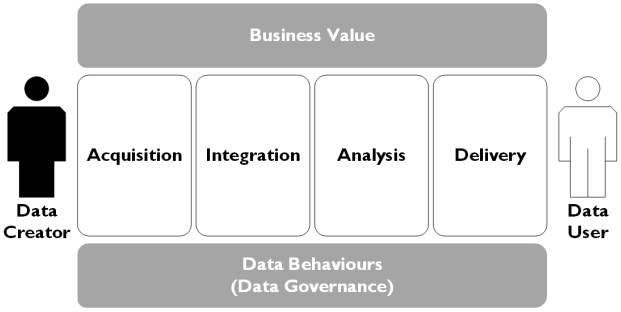

Figure 4: The Data Value Map (after Nagle & Sammon, 2017).

References

Leadbetter, A., O'Grady, E., & Burke, N. (2016). Ireland's Integrated Digital Ocean. *Bollettino di Geofisica teorica ed applicata* 57(supplement), 224-226.

Nagle, T. & Sammon, D. (2017). "The Data Value Map: a framework for developing shared understanding on data initiatives". In *Proceedings of the 25th European Conference on Information Systems (ECIS)*, Guimarães, Portugal, June 5-10.

Rowley, Jennifer (2007). The wisdom hierarchy: representations of the DIKW hierarchy. *Journal of Information and Communication Scienc*e. 33 (2): 163–180. doi:10.1177/0165551506070706

[1] https://github.com/socib/Leaflet.TimeDimension

[2] https://graphql.org/