OCIMS

A Federated Marine Data Management And Decision Support System For South Africa

The Architectural Tale Of An Open Standards, Open Source And Open Data Stack

> Graeme McFerren Raymond Molapo Bryan McAlister

An unfortunate elephant metaphor...



Created by TRAVIS BIRD from the Noun Project







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- overall strategic & policy direction, leadership, management and support of integrated coastal management;
- set up and implement ocean conservation strategies & advancement of South Africa's interests in the high seas and Antarctica;
- provide specialist support for Oceans & Coastal monitoring, reporting and evaluation policies

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- Enhance oceans, coastal and maritime governance and sustainable utilisation through
 - monitoring of environmental variables and human socio-economic activity,
 - compliance and enforcement,
 - planning and assessment,
 - information dissemination.



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Requiring an IMS...

- Oceans and Coasts IMS provides facilities for
- a) publishing of,
- b) discovery of,
- c) access to,
- d) interaction with
- e) and management of:
- 1) data and content services,
- 2) decision support tools and applications
- 3) information dissemination channels
- 4) information technology services



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- Turns out, theres much complexity
 - Multiple organisations and stakeholders
 - Only sometimes are there existing systems or components
 - Existing systems not really interoperable or even available
 - Some systems suffer the common problems of being run by scientists ... (fit-for-purpose, data hoarding, overly detailed, non-production quality, etc.)







OCIMS Architectural Description

- To start making sense of this complexity
 - describing and understanding the properties of the system
 - describing principles of the system
 - supporting the planning, construction and ongoing evaluation of the eventual system
 - the communication about the system amongst stakeholders







AIG **Architectural Description**

- Utilised the architectural viewpoints of RM-ODP*, with emphasis on distributed services rather than just distributed objects of computation
 - User requirements for a multi-organisation hosted system, rather than a greenfields cloud system, for e.g.
 - But this was not a deep formal exercise in waterfall system design, rather a guide and reminder to look at OCIMS from a multidue of angles

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*http://www.rm-odp.net/



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NATIONAL CIMS **Architectural Description**



Marcel Douwe Dekker (https://commons.wikimedia.org/wiki/File:RM-ODP_viewpoints.jpg), "RM-ODP viewpoints", https://creativecommons.org/licenses/by-sa/3.0/legalcode





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Architectural Description

Viewpoint		Concerns	
Enterprise		Functional, non-functional requirements, users, stakeholders, policies	
Information	\diamond	Information assets (formats, schemas) and constraints on their use	
Computation	0	Computational elements - service/resource endpoints, databases, data transports, processing engines	
Engineering		Deployment and distribution descriptions	
Technology	*	Specific software, algorithms, hardware that <u>realised just table row</u> ation over information instances using deployment topology	







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Architectural Description

Interaction Layer

Search & discoverAccessVisualiseQueryPublishDecideDisseminate

Production Layer

Models Simulations (Meta)Data Accumulations
Mediation services - e.g. data transforming or data cascade/proxying.
Harmonisation processes - e.g. combining data from different sources into integrated and consistent information products.
Generation services - e.g. event processing and notification services, reports

Acquisition Layer

Acquiring data from: Databases Files Direct Readout Services

Data Streams e.g from sensors or sensor networksData ServicesDownload Services



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OCTMS Architecture departure point

Principles of:

- Interoperability
- Reuse
- Accessibility
- Protocol
- Industry Good Practice
- Openness

Deployed to:

- Impactful Applications
- Large data holdings

- **Providing insight into:**
- Choosing (hopefully) sustainable Tools & Services;
- Linking them together;
- Orchestrating their execution over local, remote and distributed compute resources



Applied To:

- Data

- Software



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- Glue is open standards based systems based on
 - OGC,
 - Unidata,
 - WMO
 - Plus a few de facto e.g. ESRI
- Historically the marine IT community from science to application has been fragmented and this represents a farily bold attempt at interoperability.
- And a chance for FOSS4G tools to shine!







Integrated Vessel Tracking

OCIMS

OCIMS





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Search for ship name/mmsi/

Harmful Algal Bloom & Aquaculture

Harmful Algal Bloom Viewer

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Daily Bloom Risk Historic Bloom Examples Doringbaai 2018-03-31 98 km² Doringbaai 2018-03-31 98 km² Galioenbaai 2018-03-31 7782 km² Jakkalsbaai 2018-03-31 530 km² Jakkalsbaai 2018-03-31 61 km² False Bay 2018-03-31 596 km² Houtbaai 2018-03-31 238 km² Walker Bay 2018-03-31 128 km² Sandown Bay 2018-03-31 87 km² Lambert's Bay 2018-03-31 260 km² Chlorophyll-A from MODIS SST (Fnd) Chlorophyll-A from Sentinel Algal Bloom Detections Odyssea Analysed nEL H OL CI Contact

Harmful Algal Bloom Risk

About



Impactful Applications

Coastal Operations Support

0CIMS



Coastal Hazard

DCIMS



Marine Spatial Planning

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Coastal data viewer

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Data & Integration

CKAN Core – single access point to data from organisations in the OCIMS federation



Map data © OpenStreetMap contributors Tiles by MapBox

Organizations ^

TRANSNET NATIONAL P... (70)

DEA (66)

WESSA (42)

SANBI (11)

More Organizations



/

SEA STATE (71)

WATER QUALITY (43)

MARINE SPATIAL PLAN... (12)

MARINE DOMAIN AWARE... (2)

More Groups

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01 datasets found	Order by: Relevanc
Potential HAB Outlines From Chlorop	hyll-A extrapolated from NFL
• Database of potential HAB areas derived from clustering above-th NFLH algorithm and extrapolated CHLA for	reshold Chla values from CSIR localised thresholde
WMS WFS	
S3a OLCI Chia, CSIR for South Africa	
S3 OLCI WRR based ChI-A from CSIR algorithm on a 0.012 degreer	esolution grid , daily
WMS WCS	
Significant Wave Height	
Earcoast aignificant wave beight for False Pay over a 0.001 degree	e resolution grid, for a limited time period

Datacube accumulating the HDF data daily from CSIR localised thresholded MODIS Aqua NFLH algorithm and extrapolated CHLA for South African region

WMS WCS











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- Several teams, but similar softwares
- Different development cycles
- Frequent releases to client
- Hosted environments
- Some dependency on data tiers e.g. SANs
- Architectural principles













- Not a microservices approach, but ...
- Multiple reusable, reconfigurable, removable containers
- Federation via standard interfaces and metadata in CKAN/ CSW, incl. Harvesting
- Support technologically weaker organisations:
 - Easy to stand up and support IT infrastructure
 - Facade legacy systems with standard services and harvestable endpoints – i.e. smaller instances of the overall architecture







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- This is a system that echoes "good" practices from the 2000's and 2010's
 - Technology white elephant hopefully avoided ;-)
- But what of the inevitabilities of working in the cloud, how does one describe such a system? Is this kind of architecture increasingly invalid?
- No toys!! Users need to have tools and data in their hands – massive stakeholder focus always needed.











Thank you

Thanks for hearing me out

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