



# Getting Beyond the Silos

Niall Carter and Bruce Gittings from the University of Edinburgh describe a middleware solution to the problem of delivering integrated geographic information to an end user drawn from diverse information providers. The solution makes use of web services technology utilising the Keyhole Markup Language.

With the ever-increasing volumes of digital information and the ability to distribute through the rise of web services there is a growing need for a reassessment in the paradigm of system integration. While numerous information rich web sites are being developed by government, these exist individually in a vacuum, with bridges between them being rare. Great advantages can be realised if a single service can be offered to connect these 'Information Silos' and breakdown the mentality of proprietary digital information.

A new direction has been adopted and implemented by the University of Edinburgh in collaboration with key Scottish information providers to allow a bottom-up approach to accessing information. The 'Connecting Your Geographies' (CYGnus) system allows decentralised information to be delivered, from a single source, directly to users. No changes to underlying infrastructure are required for the information providers and they retain absolute control at all times as to the level, amount and quality of information returned. Delivery adheres to a recognised international standards and so cooperation has already seen seven Scottish information providers conform to the same method of delivering previously proprietary information to the public. By querying a selected location, thus treating Geography as the 'glue' through which information can be related, the user is able to have pro-

vided to them a standardised container for the information provided which can be either instantly visualised or readily consumed within a local client.

## Origins of the project

The CYGnus system was implemented by Niall Carter and Bruce Gittings at the University of Edinburgh within the context of the MSc programme in GIS. Collaborating partners include the Royal Commission for Ancient Monument of Scotland, Historic Scotland, South Ayrshire Council, the Gazetteer for Scotland and the Scottish Government. The aim of the project was to provide a middleware solution, which would lie between the end-user application and the information provider. This approach has considerable appeal, because it avoids the need for the end-user to install specialist software or for the information provider to expend effort in a customised solution for a particular requirement. The middleware is able to interpret a geographical location and use it to return records from each information provider based upon that location. Whilst previous systems have been described as data discovery systems with only information pertaining to stored datasets being returned, CYGnus can be accurately described as a data delivery system with the distinction being that the user is be



The solution is lightweight and standards compliant. It is has already been consumed in a variety of ways and provides proof of concept that a new paradigm of system integration can be developed which is not reliant on a heavy, costly top down approach.

**The main accomplishments of CYGnus are:**

- enforcing a standardised approach across several Scottish information providers by utilising Keyhole Mark-up Language to transport geographical information across the Internet
- providing a single service which provide access to multiple information silos
- implementation of a lightweight solution which is able to be consumed by a variety of client interfaces and so offer flexibility in its use and branding
- Illustrating the ability of a grass roots approach to system integration can work and does not need to rely on a large public sector spending, coordinated infrastructure change and heavy-handed top-down managerial approaches.

Although starting as a point-only service CYGnus has already grown in terms of its functionality, a tribute to the ease of development which KML affords, to now allow a polygon service (providing polygons depicting the 1951 parish for the location entered) as well as an OGC WMS image overlay drawn from the National Library of Scotland. CYGnus does not host data, instead offering an access point to a realm of data connected by geography.

Being middleware, this can be exploited by a range of different user interfaces. From a 'branded' web site with embedded mapping to a range of clients from geo-browsers such as GoogleEarth and Whirlwind to GIS clients which can read either KML or the XML feed, to other web services which can consume these formats. Other formats can be added with relative ease.

able to download in a standardised format the information held within the proprietary information provider's own databases. This was to be a lightweight solution so that different interfaces can be developed and different programs can consume CYGnus.

**Aims:**

- Provided data delivery services to users allowing access to detailed textual information held by information providers.
- Provide the data in a standardised format to allow easy post download development and to encourage adoption of an industry wide standard.
- Develop functionality within a lightweight

and scalable framework to encourage uptake

- Provide access to information through a geographical location and to be independent of different geographies (such as projections). In the same vein be able to understand and deliver information in a range of geographical representations such as points, lines and polygons.

**Successes**

CYGnus provides a mechanism for a broad range of users (from professionals to the general public) to gain access to integrated information that has been previously held and offered solely through information silos.

## Some technical information

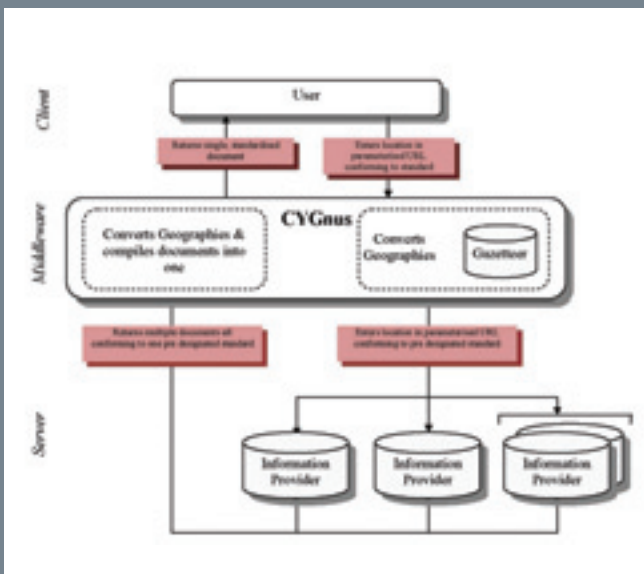
### Geographical entry

CYGnus is a middleware application accessed through a URL API, designed to be compatible with OGC web services. A major advantage, this allows CYGnus to be consumed in a number of different ways which could include a web page interface or from within another application such as ArcGIS Explorer. Geographical location is provided either as a place-name (via a short form gazetteer) or as an X and Y coordinate pair in either latitude/longitude or easting/northing. Support for units such as council areas, counties and parishes can potentially be added easily through use of a web service or an extension to the middleware application.

### Information provision

CYGnus uses the location entered as the basis for compiling further URLs for each information provider. Each information provider hosts a very simple interface to interpret these URLs, search their datasets based on the parameters provided and return a Keyhole Mark-up Language (KML) document back to CYGnus. KML was chosen because it is an industry standard which is relatively lightweight, able to support multiple representations of geography (point, line and polygon) and is able to be readily consumed within recognised and widely distributed geo-Browsers such as Google Earth together with several GIS clients.

The method of retrieving the parameters and searching the dataset is completely controlled by the provider within their own system and so requires very little overhead to implement. The information returned is also completely controlled by the provider, which acts as a further security measure to prevent large volumes (data scraping) or sensitive information from being published.



### Returned Information

KML is extended using a GML snippet to encode coordinates which cannot be provided in latitude-longitude. Harvesting each returned KML document in turn, CYGnus is able to convert geographical coordinates from British National Grid to WGS84 required for KML standards compliance. CYGnus then compiles all returned documents into a single, structured and internationally recognised standards compliant document which is delivered to the user for consumption.



### Question of security

An advantage of CYGnus is that whilst it offers information download, that information is still wholly controlled by the provider, both in terms of brand and with a copyright statement appended. It is the information provider that controls the level of detail, the amount and type of information, together with the number of records which can be transferred. The advantage is that providers are protected from any 'data scraping' which enables external entities to pass the information off as their own. All information presented and used is traceable back to the provider and attributed accordingly.

### Future directions

CYGnus provides a proof of concept which confirms that, with regard to technology, joining disparate information silos is not a difficult feat. It has demonstrated an international standard that can contain both points and polygons as well as offer web services (WMS) directly to clients. Just as CYGnus is able to convert between British National Grid and WGS 1984 projections it could also provide point-in-polygon operations and other lightweight geospatial processing tasks. Other web services such as WFS can be integrated to provide further added value.

CYGnus itself comprises only a little under 500 lines of code; a testament to the fact that a lightweight solution is available. Technology is not a factor in the ability to share data; rather it is the attitudes which govern the use of the data which are key. Without overcoming political barriers and thus encourage further uptake, CYGnus will not demonstrate anything other than a technological proof of concept. Already with seven information providers connected and providing data in a recognised international standard method of transport, the CYGnus model has provided an impetus which is worthy of both encouragement and support from across the public sector in Scotland

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