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Delivering and realising the benefits of Multi-utility GIS systems for United Utilities

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Abstract

This paper reviews United Utilities integrated multi-utility Water, Electricity and Sewage GIS systems and focuses on delivery of the new electricity modules to these systems. Included is review of business benefits available to major utilities from such approaches, including lower data maintenance costs, improved health and safety benefits for all users of utility data, and improved asset and network management benefits.

1.0 A Profile of United Utilities

United Utilities is quoted on the London Stock Exchange. It is a provider of Utility related Services throughout the world to a population in excess of 22 million and consists of:

1. **UU Service Delivery:** Operates the regulated water, electricity and sewage networks owned by UU, which service the north west of England. This area includes the urban areas of Manchester, Preston, and Liverpool and rural, Cheshire, Lancashire and the Lake District National Parks.
2. **UU Contract Solutions:** Operating utility services and operating contracts on behalf of third parties. Contracts and concessions have been secured in Wales, Eastern Europe, Australia, Scotland, and Argentina.
3. **Your Communications:** Telecom supplier focused on key market segments and growing at 30% p.a.
4. **Vertex:** Supplying Customer Outsourcing Services, to Local Authorities, Utilities and Central Government. Growing at 35% p.a.
5. **Green Energy:** A leading supplier of renewable energy, such as CPH, Wind Farms and Landfill gas projects. 30% of its 50 schemes have been commissioned in the last year.

Clive Deadman is a General manager within UU Service Delivery and in this talk will be reviewing how UU has realised multi utility benefits from its GIS and Asset Record IT systems.

2.0 A Profile of UU Service Delivery

UU Service Delivery operates UU's regulated Water, Electricity and Sewage networks and treatment plants in the north west of England. These areas include the heavily industrialised heartland of the UK's industrial heritage, including Manchester and Liverpool, and rural Cumbria and Cheshire, including parts of the Peak District and the Lake District. Service Delivery's Electricity, Water and Sewage networks have an estimated replacement cost of £38b billion. 4,200 staff operate the network. Key statistics are as follows:

- 6.7 million people serviced by Water and/or Electricity and/or Waste water services
- 14,000 km² area of operation.
- 76,000 km of underground electricity assets.

- 900,000 manhole covers
- 17,000 km of overhead electricity assets
- 42,000 km of water assets and
- 650 sewage works and 200 water treatment works
- 30,000 km of sewerage assets.
- 33,000 transformers and sub stations
- 200,000 repairs undertaken p.a.
- 132km of new and renewed sewers p.a.
- Annual Capex budget of £500 million pa, or £1.5m per day.

If the geographical area serviced by UU Service Delivery’s utility networks was a separate state it would be bigger than four of the existing members of the European Union.

UU Service Delivery is completing a programme to reduce operating costs by an aggregate of £480m in the 5-year period ending 2004/5. This is being achieved by a variety of measures, including realising economies of scale through the use of multi-utility management of the regulated network.

3.0 UU Service Deliveries GIS/Asset Records Systems

In 1994 Water and Sewage Network Asset Details were captured in a GIS data model based on the Vision system. This system has been refined, and integrated with work management, address and customer management and numerous other corporate systems. Network modelling and data maintenance, mobile systems are all employed.

In 2000 construction of a data model and data capture programme for electricity assets was commenced. This would allow the 170,000 drawings maintained in 4 drawing offices to be replaced with a GIS LV and HV model of the network and customer locations.

For the purposes of the scope of this paper the project costs were as follows:

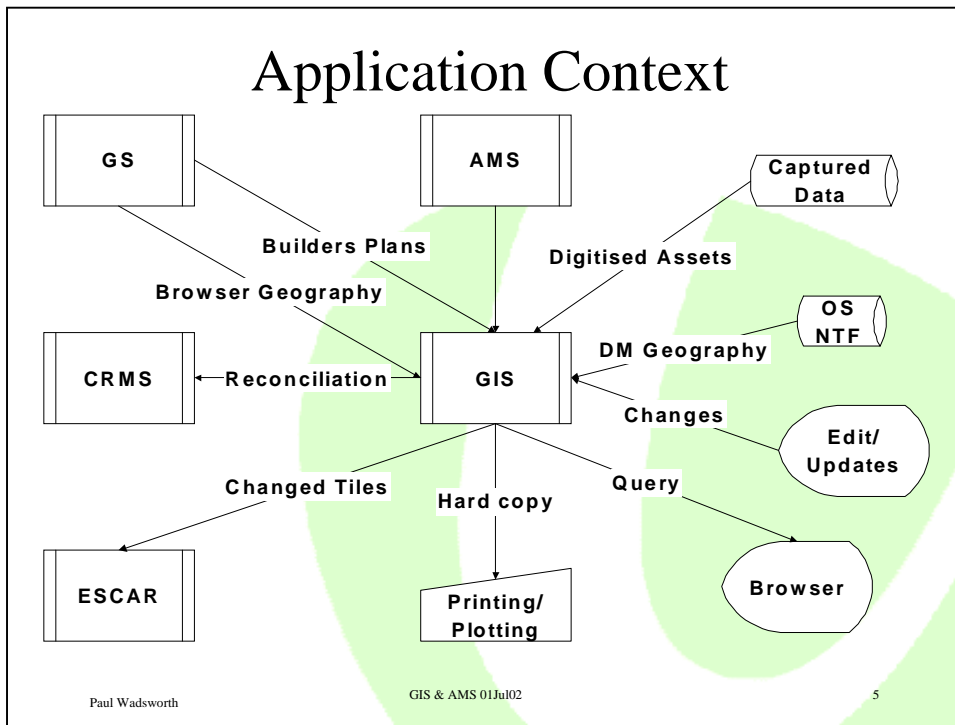
GIS & Hardware & Communications	£5m
Programme Management	£1m
Data Capture	£8m
Business Change	£1m
AMS (Address Management)	<u>£1m</u>
Total	<u>£16m</u>

Each of the elements of the programme are discussed below:

3.1 GIS & Hardware & Communications

A clustered hardware system, which allowed 24 by 7 system availability with extremely high confidence factors, was specified.

The GIS solution was provided by Autodesk, using Oracle technology extended through the use of Autodesk GIS Design Server, to provide the functionality and transaction management capabilities necessary for large, distributed GIS implementations required by major utility companies.



The Autodesk GIS Design Server-based solution delivers:

- a single, standard Oracle database to manage all asset data and provide the necessary interfaces to other corporate systems;
- a single object model, based on the appropriate data model, to define and manage all facets of that asset data – spatial, attribute, connectivity and other relationships;
- a solution deployed on industry standard, open, non-proprietary technology;
- extensive capability for integration with other applications;
- an edit update client that utilises Autodesk Map to edit and update the GIS database;
- View and Query access to the GIS data, provided by Autodesk MapGuide.

In addition data extracts are fed from the corporate GIS systems into a variety of other desktop and mobile standard GIS PC applications, such as MapInfo and Strumap.

In anticipation of closure of the four drawing offices and centralisation of all water, electricity and sewerage data maintenance activities to one central location a refurbished 10,000 square feet facility was prepared in Wigan, with duplicated infrastructure, and excellent WAN and LAN communications.

3.2 Programme Management

Good programme management is critical for the delivery of a complex IT system tailored to business needs. Simple risk management, human and equipment resource management systems were established under the control of a programme office. Key operational expertise was essential, and support was ensured by strong Director and Board level commitment to reasonable requests support. Short weekly project manager meetings and separate monthly cycles of risk management, financial challenge and Board Meetings were undertaken to consolidate progress made by programme staff during the month.

An emphasis on planning and employing the highest quality staff and advisors in all activities is critical.

3.3 Data Capture

The Electricity data model required network and plant details from the 160,000 paper records and extracts from numerous other legacy asset systems. All this data had to be cleansed and assembled, in a variety of scanned and digital formats.

A review of the UU footprint allowed the region to be broken up into 282 batches, of uneven sizes, but comparable numbers of features. This approach allowed an even flow of work through the data capture and quality inspection process.

Contracts were let to single suppliers of Data Capture Services (Agra Baymont, Kuala Lumpur, Malaysia) and Quality Inspection services (Cad Capture, Blackburn, England). The Data Capture process involves 328 staff working on 2.5 shifts over a six-day week for 2 years. Quality Inspection involves 15 staff using a Data Manager System. This Data Manager System was created by United Utilities, Autodesk and Cad Capture. In addition to incorporating pre-prepared tools to sample assets, allow inspections, hold audit trails for all work and measure productivity it also automatically undertakes 100% logic tests in incoming data batches, to ensure basic connectivity rules are satisfied. The Data Manager System also allows batches of raw data to be assembled before they are put into quarantine and sent out to Malaysia. The system also records and holds details of all queries; clarification sketches and clarification answers given during data capture. Cad Capture's quality inspection team therefore have access to all this data during inspection, and can guard against failing inspection tests, where Agra Baymont have deviated from the data Capture specification as a consequence of specific advice from United Utilities.

The first batch of data was loaded into Production in July 2002. Thereafter 3-5 batches per week have been delivered with target date for completion being Christmas 2003.

3.4 Business Change

Business change has required:

- Methods of recording and updating asset and address records to be reviewed
- The development and delivery of 1500 man-days of training, to ensure maintainers and users of GIS data are familiar with new tool, symbology and processes.
- The closure of 4 drawing offices and the creating on a new multi-utility GIS data maintenance operation for United Utilities.

This process is ongoing, with the two final drawing offices due to close in April 2003 and December 2003.

3.5 AMS

AMS is an Address Management system, which is interfaced into GIS, and other corporate systems. It allows GIS connectivity to allow the impact of interruptions of supply to customers' property and give operational staff information on the impact of network decisions, such as flow switching.

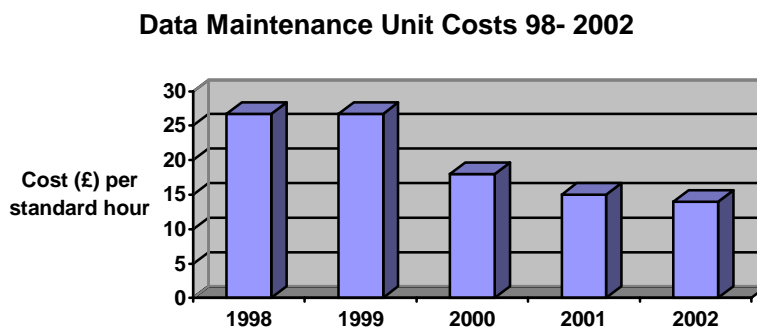
4.0 Business Benefits

4.1 Data Maintenance

Within data Maintenance inconsistencies between different data sets and drawings have been removed, as all geographically related records have been collapsed into a single data set. This has also allowed a substantial reduction in numbers of staff involved. Very considerable volumes of office space have also been released, as 3 acres of drawing cabinets and their associated walkway are not needed.

Consolidation of all data maintenance functions has also allowed symbology and records methods of work to be standardised. The quality of records has also improved, as multi-utility working allows certain updates, such as High Voltage major Amendments, to be entered immediately, while updates of important but less critical tasks, such as deep sewer re-hab work, can be set aside temporarily.

The standardisation of methods of work and a focus on affordable quality, and investment in IT infrastructure also allows step changes in efficiency to be realised. The graph below demonstrated the 45% improvements in unit efficiency realised by United Utilities water Data Maintenance team from 2000-2.



Further benefits have been realised by culling legacy systems, streamlining management of IT systems and Ordnance Survey maps and reducing printing costs. In total approximately £800k per annum of efficiency gains in this area are being realised from the multi-utility operation of United Utilities GIS systems.

4.2 External Data Users

The establishment of a free multi utility web service for contractors, utilities, highway authorities with comprehensive electricity, water and sewage records has greatly reduced the unit cost of supplying data for united utilities. Further savings have been realised by substantial reductions in printing costs, closure of all microfiche and CD distribution processes. Users of data have easier access to more up to date data.

United Utilities external web site employs a MapXtreme product from MapInfo. Fire brigades and many other local authority users haven been offered free access to the system. The system uses 2 servers, with fail over arrangements.

4.3 Asset and network Management

Before the advent of GIS there was no reliable low voltage connectivity model for UU's electrical networks. Associations between cable termination sand MPAN locations are allowing faster and more accurate network management at LV level, which has historically been most difficult.

Another benefit is in the correlation of faults with problem circuits and cable material type, so improving planned replacement and repair cycles for underground cables. Further work to reduce cable damage caused by third parties is bearing major business, health and safety and customer benefits. The external web service prepares reports of who requested what map of what assets when. If subsequently a contractor was to hit a cable, and it transpires that contractor had not requested the correct map, contractors are aware their personal liberty could be threatened.

5.0 Conclusions

In order to maximise business benefits from IT and GIS investments key points are:

1. Preparation of the business case is critical. Support at the most senior level is necessary.
2. During system delivery and data capture programme management is fundamental. The process must be lead by the business with benefits in mind, and a strong and pragmatic approach is important.
3. UU has realised substantial Data Maintenance cost and quality benefits from the introduction of multi-utility centralised maintenance. Business users inside and outside United Utilities enjoy views of large seamless multi-utility asset data.