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Stats on Tap: Intuitive Web-Based Statistical Mapping at the Office of the Deputy Prime Minister

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Abstract

Statistical analysis provides an essential tool in support of policy decision making. Statistical mapping provides a significant extra dimension. This paper examines the requirement for, and implementation of, an easy-to-use, internal, web-based, statistics retrieval and mapping system at the Office of the Deputy Prime Minister (ODPM). It describes the development of the pilot Stats on Tap service for the Housing, Homelessness, Urban and Planning Group (HHPG) and Corporate Strategy and Resources Directorate (CSR).

The analysis, consideration and dissemination of housing, planning and urban area related statistics is a key element of the development and delivery of policy and analysis in the Housing, Homelessness, Urban and Planning Group and Corporate Strategy and Resources Directorate at ODPM. In support of these activities, the Planning and Land Use Statistics Division and Housing Data and Statistics Division required a gateway that enabled internal users to easily and quickly roam and download a variety of housing, planning and town centre related datasets in either spreadsheet or map forms. As such this fits in with the overall Neighbourhood Statistics agenda and is linked to work being taken forward by the Office for National Statistics and the Northern Ireland Statistics & Research Agency. It was required that the same gateway could allow users to produce thematic maps of not only the statistics stored in the Stats on Tap database, but also of their own local, ad-hoc, data, in a way that minimised worries about geo-coding, and increased user understanding of their data.

In designing the system it was recognised that there are a number of groups within ODPM needing to explore statistics and statistical maps, albeit using different datasets. The system was therefore constructed to be configurable, providing an easy-to-use, intuitive set of generic data dissemination & map export capabilities that could be readily tailored to the requirements of diverse groups, and so improve the quantity and quality of facts available to decision makers.

The delivery of 'one-page-does-everything' web-mapping facilities has yielded widespread and accepted benefits in recent years. The paper suggests a further potential of web-based information dissemination may be realised by following a user-centric approach to bring near-desktop level GIS functionality to within a few mouse clicks for first time users and non-GIS specialists; all in a freely usable form.

The paper sets this Stats on Tap case study in the broader context of other current developments in mapping and data dissemination at ODPM and explores how its capabilities will be taken forward.

1. Introduction

1. Statistical analysis provides an essential tool in developing and delivering the business of Government. Statistical analysis combined with statistical mapping provides a powerful extra dimension. This paper explores the requirement for, and implementation of, Stats on Tap, an easy-to-use, pilot, internal, web-based, statistics retrieval and mapping system at the Office of the Deputy Prime Minister. The following text describes the background to the Stats on Tap initiative (section 2), the requirements of Planning and Land Use Statistics Division (PLUS) and Housing Data and Statistics Division (HDS) (section 3), the development approach adopted by Informed Solutions (section 4), and the key elements of the delivery web-mapping and data dissemination system (section 5). Section 6 describes the key benefits of Stats on Tap to the aims of the Office of the Deputy Prime Minister's service delivery, and places the system in the context of the plans for further development of other parallel mapping and statistics initiatives at the ODPM.

2. In the text that follows we highlight the benefits of easy-to-use intranet web-mapping as a vehicle for providing non-GIS users with the ability to explore and exploit the spatial dimension to the statistics, and as such underline the service improvements, and cost reductions, that geographic information and geographic analysis has the capability to bring to those conducting the business of Government.

2. Background of Stats on Tap

3. The Office of the Deputy Prime Minister was created in May 2002 with a portfolio of responsibilities that includes functions previously located in the Cabinet Office and the former Department for Transport, Local Government, and the Regions. ODPM has the aim of thriving, inclusive and sustainable communities in all regions.

4. ODPM's business is to achieve this aim by, for example, working with the full range of government Departments and policies to raise the levels of social inclusion, neighbourhood renewal and regional prosperity, and delivering effective programmes to help raise the quality of life for all in urban areas and other communities. Both of these key objectives include an inherently spatial dimension; the delivery of policy in space, and the delivery of policy across a range of geographic scales.

5. As a result the collection, analysis, consideration and dissemination of spatial statistics is a key element of policy development, delivery and evaluation, at ODPM. The analysis and distribution of geo-spatial statistics is undertaken for Ministers through a number of statistical and research divisions and the delivery of mapping is orchestrated by the GIS Unit and managed within the Planning and Land Use tatistics Division.

6. These activities include the provision of a consultancy service responding to requests for statistical maps of policy related datasets, in particular for the Housing, Homelessness, Urban and Planning Group. The development and delivery of policy initiatives such as the Sustainable Communities plan involved and continues to rely upon a significant range of statistical mapping and geo-spatial data, at a range of spatial scales. In addition, the Planning and Land Use Statistics Division and Housing Data and Statistics Division collect, collate and host the provision

of a range of bespoke datasets that are a key business asset in policy decision making. These include the boundaries and statistics of the Town Centres Project, and a range of housing, and commercial and industrial floorspace statistics, often at the local authority or regional levels.

7. In response to the volume and range of requests for statistical maps of this data, and the desire to further realise the potential benefits of their data holdings PLUS and HDS Divisions sought a vehicle to increase policy colleagues' ability to roam and explore spreadsheet data and statistical maps in an easy-to-use way at their own desks via the ODPM intranet. The aims were to:

   • encourage policy customers to explore the potential of the data and the benefits of spatial representation of that data on maps for themselves;

   • speed the process of delivery of frequently used statistical maps and free the GIS Unit to focus on more specialist GI advisory work;

   • bypass the requirement for uptake of standard desktop GIS packages that would require specialist training and continued skills reinforcement;

   • take the opportunity to geo-code and integrate statistical and spatial datasets, in a consistent structure and format, to facilitate geographical analysis, and comparison to other spatial data.

3. Commissioning the System

8. In response to this requirement Planning and Land Use Statistics Division commissioned a project to deliver a pilot system offering an intranet gateway that enabled internal users to easily and quickly access and download a variety of town centre, housing and planning related datasets in either spreadsheet of map form. In addition, it was required that Stats on Tap could allow users to produce thematic maps of not only statistics stored in the database, but also of their own, local, ad-hoc, data.

9. Whilst the delivered system would be the result of an iterative process of design and review, the project began with the following set of Data and Functional Requirements:

Statistical Data, Metadata and Spatial Data

   • To provide access to Town Centre area statistics, mapped against areas developed by the Town Centres Project.

   • To provide access to a range of housing, urban planning, land use, and context datasets.

   • To provide access to the time series inherent in each of these datasets.

   • To provide access to data at the National, Regional, Local Authority, and Town Centre geographic levels.

   • To provide integrated links to relevant 'metadata'.

Examples of datasets to be included in the internal pilot service include:

Town Centres
Town Centre area statistics (Town Centres)

Housing
Residential property prices (LA & Regional)

Density of residential development (LA)

Percentage of dwellings on previously developed land (LA)

National Land Use Database previously developed land (LA)

Non-Domestic Land & Buildings, and Context

Average rateable value of commercial & industrial floorspace, number of commercial and industrial hereditaments (LA)

Statistical and Mapping Functionality

- To provide simple and fast access enabling roaming to all the datasets, with minimal specialist know-how or training.

- To provide user-friendly methods of searching and browsing the data, including by Category (eg urban capacity datasets), by Keyword (eg 'house prices'), and by Location (eg London boroughs)

- To provide easy-to-use 'thematic mapping' capability for all datasets i.e. to enable the user to produce a map representing statistical values using default or user-defined shading and symbols for each area.

- To enable users to produce exploratory thematic maps of their own 'ad hoc' datasets – not just those in the database.

- To enable users to download the products of their analysis in a simple and intuitive manner for inclusion of spreadsheets & maps in reports and presentations

- To provide a web-based data management interface such that data custodians may securely upload data and associated metadata into the live environment.

- To provide integrated access to relevant metadata at key points.

4. Approach to System Development

10. ODPM commissioned Informed Solutions to deliver the pilot Stats on Tap intranet site and to prepare a plan for its future development. Working in close partnership together a priority for the design team was to deliver a solution that gave ease-of-use a high degree of precedence, and one that built upon, and linked with other existing ODPM GI systems, such as the Government Office GIS, and corporate on-line National Geospatial Data Framework metadata service.

11. To do this, the design would move away from the traditional 'one-page-does-everything' approach often found in web-based mapping solutions, and take users step by step from home page to data download, and home page to map export. In so doing a data dissemination and web mapping system would be built to try to realise more of the benefits that can accrue from taking account of usability; prioritising ease-of-use for the non-GIS specialist. It was concluded that a one-stop interface for all requests might not be best suited for this requirement. Since users would be interested in spreadsheet data, as much as traditional maps, a step-through approach seemed most appropriate. The consultants' experience had shown that giving due priority to this step-through approach and tabular data delivery would be key for a target user group interested in data, and not just maps.

12. In order to ensure an intuitive and usable design, a Structured Rapid Application Development was adopted, based upon frequent reviews of user requirements and system prototypes. In more detail, key project activities included:

- holding user requirement review workshops with key stakeholders to provide an initial baseline for system design and development.

- compilation and geo-coding of all system datasets by Planning and Land Use Statistics Division and the analysis of those datasets by Informed Solutions, providing ODPM with recommendations concerning structure, consistency, and overall quality.

- development of early prototypes of key functionality for review by users in a number of user review workshops.

- development and maintenance of a prioritised Functional Requirements Matrix encompassing both pilot and target system requirements.

- providing informal, 'at-desk' demonstrations to a wider group of key users, widening awareness and review of system implementation.

- on-site design and development of Stats on Tap pilot functionality and supporting database, built upon and compliant with existing GIS architectures at ODPM.

5. Key Features of Stats on Tap

Intuitive Information Access

13. The Stats on Tap interface provides users with a variety of data access channels. Users may browse available datasets by Category, Keyword or geographical Location. Importantly, access is via an intuitive interface that steps users through to 'Data Display' and download, rather than via map-based access. Once users have browsed to their dataset of interest they may easily and immediately roam it's time-series or metadata, or view, manipulate and download the dataset as a Microsoft Excel™ worksheet. Users are just six mouse clicks from the home page to a spreadsheet of selected data (Figure 1). User access to dataset metadata is via a direct link from Stats on Tap to ODPM's central industry-standard National Geospatial Data Framework metadata service in a seamless fashion.

FIGURE 1: Display and Download of Data with Stats on Tap

Step 1: Choose a **'Category'** search and click to proceed

Step 2: Select a dataset, and year of interest, then choose **'Display Data'** to see the data . . .

'Display Data' in *Stats on Tap* produces a downloadable Excel file like this

Easy-to-Use Statistical Mapping

14. Stats on Tap provides a simple and fast method of building thematic maps using sensible default settings. The aim of this design was to provide infrequent users, first-time users and non-GIS specialists with a simple process of building effective analytical thematic map products within as little as eight clicks of the mouse from the home page. The thematic mapping component walks users through a series of intuitive pages, prompting them to make simple decisions which become the parameters for a default thematic map of that statistic for the whole of England (Figure 2). Users may select either a colour or monochrome map that defaults to five quantile data ranges and a legible predefined area shading ramp. Specific consideration was given to the provision of a range calculation method and area shading styles that would facilitate effective visualisation of a wide range of data (see for example Longley et al, 2001). The thematic map is based on Ordnance Survey's Boundary-Line™ administrative boundaries for the appropriate year. The map is provided within an ESRI ArcIMS web mapping page containing helpful functionality such as print (with a template for headings and legend), and image exports. Zoom, panning, selection, and layer control tools are just a click away. These enable users to focus on areas of interest or add area name labels (Figure 3).

Advanced Thematic Mapping

15. The easy-to-access thematic maps are based upon default colouring schemes, number of classes and range calculation method. If users wish to explore their data further, and as non-GIS users become more confident with thematic mapping analysis, so they may require greater flexibility. Stats on Tap provides users with an advanced thematic mapping menu (Figure 4). This allows users to add new thematic layers to existing maps or to edit the parameters of layers created with the default thematic mapping tool. Importantly, these menus allow users to change parameters such as colour scheme, number of intervals, annotation text and calculation method in a simple and intuitive manner (see for example MacEachren 1995, and Fisher et al 1993). Figure 5 provides an example where a user has changed the colour scheme, and defined their own range thresholds rounded to the nearest £10,000. Figure 6 shows the statistical layer made semi-transparent, with an Ordnance Survey Miniscale[R] backdrop that provides a real-world context to the thematic OS Boundary Line boundaries. Figure 7 shows how policy areas, or other layers of interest can be overlaid over, and viewed in conjunction with, the statistical layer -- in this case the Town Centres in south west London. Figure 8 shows OS 1:10,000 Scale Raster added to provide real world street-level context for the areas of policy interest. All of these maps are printable and exportable for use within ODPM.

Location Search and Sub-Regional Mapping

16. By default Stats on Tap provides data for all of England. Maps derived from this data also show all of England, and range thresholds are based on all these values. Users with interests in data for particular Government Office Regions can use the Location search functionality to deliver data only for the local authorities in that region of choice. Stats on Tap will then provide a map of that region only, and the value ranges will be based on only the data for those local authorities. Figure 9 provides an example for London, and in this case the user has chosen ten as the number of ranges.

Select dataset and the year of interest, then choose to **'Make Map'**

Now select the variable you would like to map (in this case Median residential property price)

This map can be Printed or Exported

Stats on Tap produces a colour statistical map of that data mapped on Ordnance Survey's Boundary-Line^{TM}

FIGURE 3: Pan, Zoom and Area Labelling in Stats on Tap
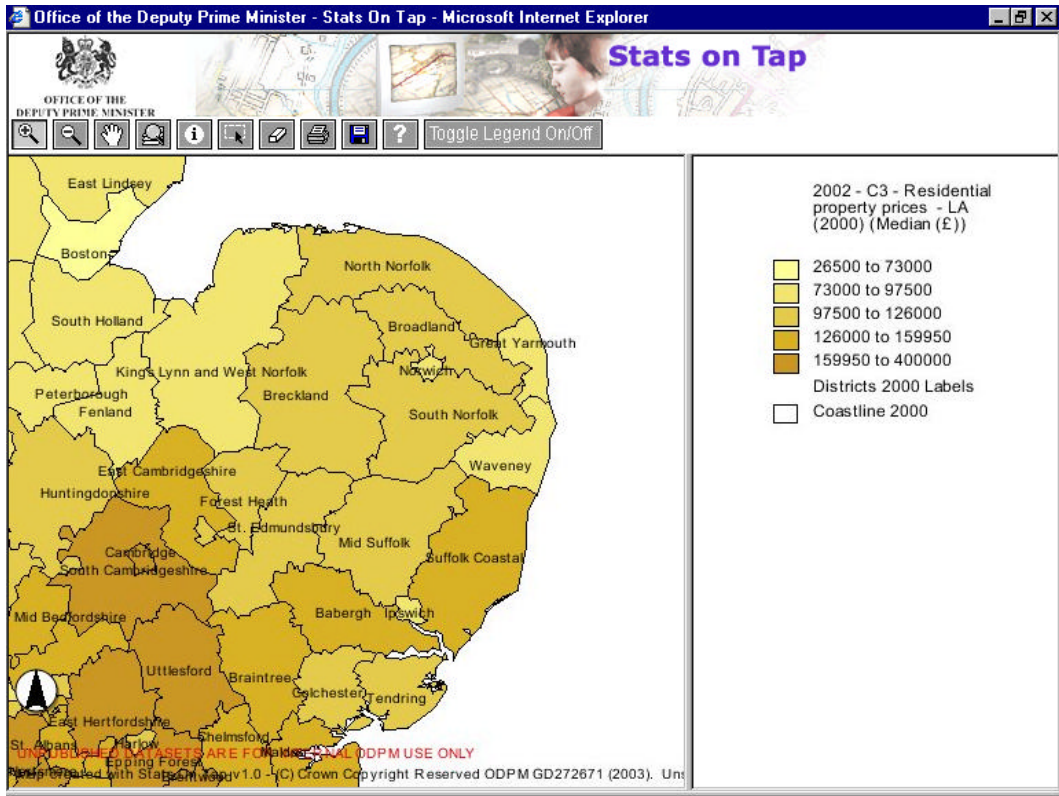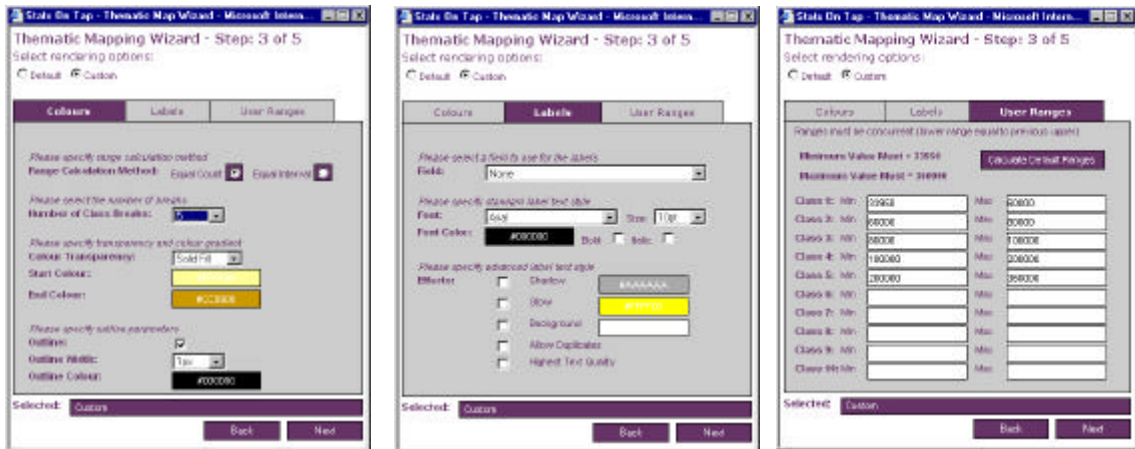

FIGURE 4: Advanced Thematic Mapping Menus

FIGURES 5, 6, 7, 8: Advanced Thematic Mapping with Stats on Tap

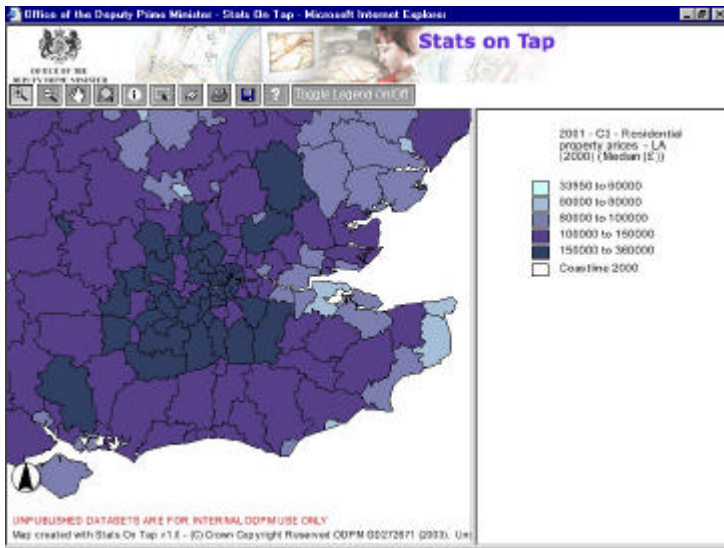Fig 5: Users can zoom in and specify their own class threshold values, here rounded to the nearest £10,000
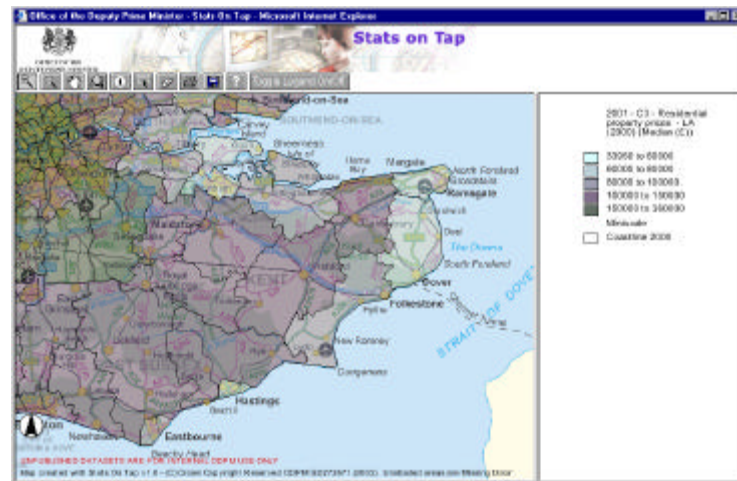

Fig 6: Users can bring in Ordnance Survey MiniScale[R] to provide 'context' and help map interpretability

Fig 7: With *Stats on Tap* users can overlay other boundaries over the statistical map. Here its 'Areas of Town Centre Activity'.

Fig 8: Ordnance Survey 1:10,000 Scale Raster mapping can be overlaid to provide 'context'
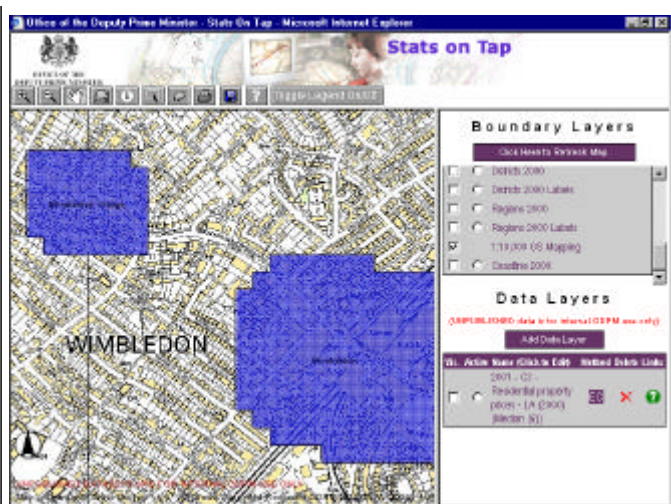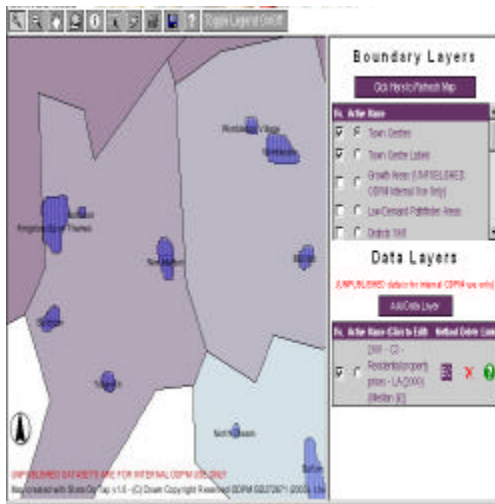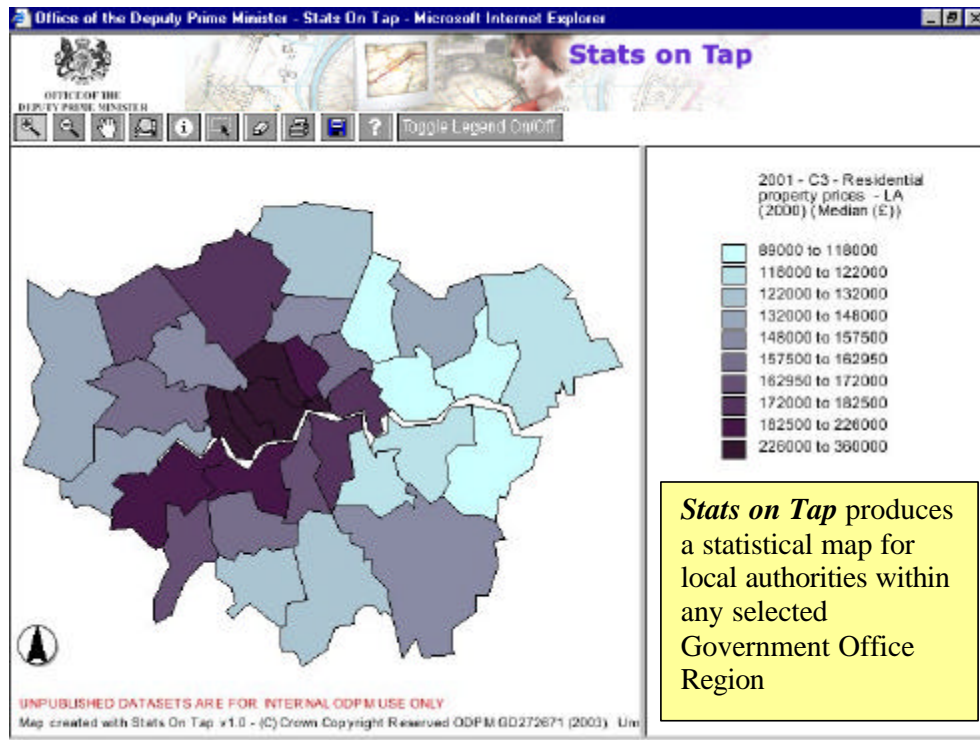
Ad Hoc Thematic Mapping

17. One of the more innovative features of Stats on Tap is the ad hoc thematic mapping capability. This component allows users to upload Excel™ spreadsheets of their own statistics from their workstation to the web server, and there to produce a temporary thematic map for the duration of the session. Users simply provide a file with the statistics to be mapped and their relevant ONS geo-codes (ie the code of the local authority or Government Office Region). Uploaded files pass through a quality control gateway which checks features such as format, and importantly, geo-coding. Once an ad hoc map has been produced, users may edit it with the advanced tools described above, and print or export the map image with legend and titles. Intuitive web-based ad hoc thematic mapping brings much of the functionality previously restricted to desktop GIS tools to a wider audience.

Data and Metadata Management

18. Stats on Tap is built upon a series of spatial, statistical, and metadata repositories held in Microsoft SQL Server 2000 and, in the case of spatial data, ESRI's Spatial Database Engine. Stats on Tap provides data custodians with a secure, web-based mechanism of managing their datasets and associated metadata. Data custodians may upload new versions of existing datasets through a quality controlled gateway (checking for parameters such as format, structure, and geo-codes) and, in addition, maintain their relevant National Geospatial Data Framework metadata entries. Once through the quality control gateway, new versions of datasets become immediately accessible to end users. In this way, data custodians may take advantage of the robust, secure, and scalable environment that database management systems afford, whilst retaining the control and maintenance of their information.

19. The Stats on Tap architecture has been designed to provide database administrators with a highly configurable system. Not only is the underlying database technology used to store and manage both spatial and statistical data, a key component of the data architecture are system configuration tables. These tables control important elements of system behaviour and presentation including determining methods of choice of datasets and their variables, user menu options, and default thematic mapping parameters. These tables may be easily maintained by system administrators providing significant flexibility without the need for further specialist

6. Delivering the Benefits and Stats on Tap in the Future

20. Stats on Tap provides Planning and Land Use Statistics Division and Housing Data and Statistics Division at ODPM with a web-mapping system with possible potential in due course to be an enterprise-wide solution to the needs for speedy access to data and easy production of statistical maps. The pilot system will facilitate exploration and roaming of datasets, in a way that will bring new data and mapping capabilities to the desktop of non-GIS specialists. Stats on Tap should enable policy users to view required maps quickly, and so enhance the efficiency of analysis and service delivery. The online data management for Data Custodians and integration with the corporate National Geospatial Data Framework metadata system provide further efficiency and integrity in system maintenance in the longer term.

21. Plans are to start a roll out of the internal Stats on Tap pilot system in stages; first to key policy users in the Housing, Homelessness, Urban and Planning Group, data custodians and the development advisory group who contributed to steering the project. The system will thus be one example of the ways in which GI and the latest spatial technology is helping ODPM conduct its business -- in this case by enhancing the effectiveness of data communication. Stats on Tap will also improve the service that Planning and Land Use Statistics and Housing Data and Statistics Divisions provide to policy customers, and by reducing calls for the GIS Unit to produce consultancy mapping, should have the potential to drive analytical support costs down.

22. Stats on Tap is just one example of the way that central government is capitalising on the benefits of using GI solutions. This fits in with the overall Neighbourhood Statistics agenda and work being taken forward by the Office for National Statistics (see www.neighbourhood.statistics.gov.uk) and the Northern Ireland Statistics & Research Agency. Stats on Tap is one way Planning and Land Use Statistics Divisions is applying GIS at ODPM. The reader may be familiar with the Maps on Tap service that provides Ordnance Survey topographic maps and gazetteer functionality -- including OS MasterMap[R] -- within ODPM and over the Government Secure Intranet (GSI). Along with sister systems such as Planning Support , that delivers a range of policy related boundary sets, and the Regional Coordination Unit's GO GIS (Government Office GIS), ODPM is building a family of web-based GI solutions to meet core business requirements. Proposed further development of the main Maps on Tap service offers the Office an opportunity for convergence and consolidation of the corporate GI intranet mapping onto a single unified platform, and options for enhanced efficiencies are being reviewed, to shape the form and roles of ongoing services.

7. Conclusions

23. Stats on Tap is one of the current ongoing GIS developments at ODPM. The pilot service has been designed to offer fast, easy-to-use 'statistical mapping' over the corporate intranet. Data is roamable, viewable and downloadable, ready for further local statistical exploration. Maps are viewable, customisable and exportable ready for inclusion in reports and presentations. Stats on

Tap provides some sensible user-friendly default settings for easy statistical mapping, including value ranges and colours, but also offers the ability for users to customise maps whenever they so wish.

24. Statistical functionality offers fast access to regional, local authority, and town centre level data. Searches are possible by data category, key words or location. Data is downloadable as Microsoft Excel™ spreadsheets and maps exportable as images.

25. Mapping functionality enables overlaying of policy related boundaries (eg Growth Areas), and inclusion of Ordnance Survey background roadmaps such as Miniscale™ or 1:10,000 Scale Raster to provide real world context to the statistically shaded maps.

26. An additional on-line module provides metadata from the central ODPM system describing the data. Users are also able to upload their own locally held data and access the full mapping functionality of Stats on Tap to create, print, and download a statistical map of their own data. Stats on Tap provides online help to make geo-coding easier. This should facilitate users' exploration of their own data, and comparison with data and maps available from the Stats on Tap system. Dataset maintenance is also available online enabling authorised Data Custodians to geo-code datasets and upload new or revised versions for immediate inclusion in the live statistical service to policy and analyst users in ODPM.

27. With Stats on Tap the Housing, Homelessness, Urban & Planning Group and Corporate Strategy and Resources Directorate at ODPM now have an easy-to-use web-mapping system with the potential through progressive roll-out to speed and ease the in-house delivery of objective data and statistical maps. The system is capable of providing both existing users and new users of geographic information with both spatial data and a mapping tool to assist in the delivery of ODPM's aim and objectives.

Acknowledgements

Further Reading

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Acronyms

CSR   Corporate Strategy and Resources Directorate at ODPM

HDS   Housing Data and Statistics Division at ODPM

HHPG   Housing, Homelessness, Urban and Planning Group at ODPM

IS   Informed Solutions

LA   Local authority

NeSS   Neighbourhood Statistics

NGDF   National Geospatial Data Framework

ODPM   Office of the Deputy Prime Minister

ONS   Office for National Statistics

OS   Ordnance Survey

PLUS   Planning and Land Use Statistics Division at ODPM

RCU   Regional Co-ordination Unit at ODPM