Towards a Framework for Customised Information Visualisation

Work-in-Progress Paper

Ryan C. Yates and Janet L. Wesson
Department of Computer Science and Information Systems
Nelson Mandela Metropolitan University (South Campus), PO Box 1600, Port Elizabeth 6000
Tel: +27 (0)41 504 4254, Fax: +27 (0)41 504 2831,
Email: ryan.yates@nmmu.ac.za, janet.wesson@nmmu.ac.za

Abstract— Information visualisation (IV) is used in many fields to facilitate the understanding of large heterogeneous data sets. There are seven typical tasks that IV tools should support, namely overview, zoom, filter, details on demand, relate, history and extract. Many IV tools do not incorporate a history mechanism, meaning that users are unable to save and revisit previously generated views. This paper proposes a new interaction technique and a new visualisation technique together with a framework to support the integration of these techniques into existing IV tools.

Index Terms— information visualisation, framework, history, customisation

I. INTRODUCTION

MANY organisations have large network infrastructures which generate large amounts of network data every day. It becomes more and more difficult to interpret this data as the volume increases. IV tools can, however, be used to exploit the natural perceptive abilities of the user by lowering the cost of finding and accessing information [1].

Shneiderman defines seven key tasks that IV tools should support [2]. These include overview, zoom, filter, details on demand, relate, history and extract. Most IV tools, however, do not support the history task [3]. This means that users are unable to undo or redo changes to the current view. Additionally if a previously generated view needs to be revisited, this view would have to be recreated by re-entering the original parameters used in the dynamic query.

The purpose of this paper is to propose a framework that would facilitate the integration of the history task into existing IV tools. New interaction and visualisation techniques are also introduced to provide a mechanism for creating and storing these customised views.

II. INFORMATION VISUALISATION

IV combines two of the most powerful information processing tools known, the human mind and the modern computer [4]. Its purpose is to provide users with a means of assimilating and understanding a large quantity of data using graphical representations of this data.

A. IV Tools

An IV tool can be broken down into three layers, namely the data layer, the application layer and the presentation layer. The presentation layer will typically consist of some kind of display area, which could be graphical or textual. Some tools make use of multiple displays; these can allow several different views of the same dataset and can also be used to support multiple users with different information needs [5]. The presentation layer would also provide some way for the user to create and generate views; this is usually accomplished by the use of dynamic queries. Sliders or other widgets can be used to change query parameters and in so doing change the displayed view.

The actual data that the user wishes to visualise forms the data layer. This data can take the form of multiple heterogeneous databases, or simply comprise a single table.

The application layer links the two aforementioned layers. Queries from the user are sent to the database and the resulting datasets used to generate views depending on the selected visualisation technique.

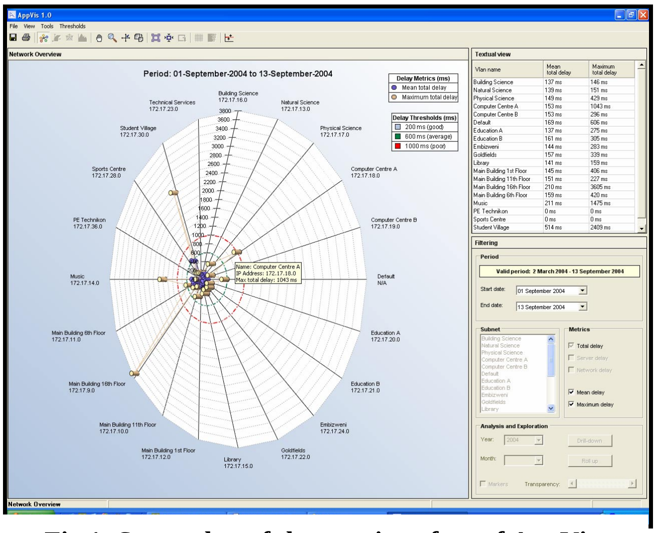

Fig 1: Screenshot of the user interface of AppVis

B. Visualisation Techniques

Visualisation techniques are concerned with the way in which data is represented on the display [1]. A wide variety of visualisation techniques have been devised, the selection of which is dependent on the type of data that is to be visualised [6]. For instance, hierarchical data can best be visualised using hierarchical techniques, e.g. tree views, tree maps or a hyperbolic browser. Figure 1 shows a screenshot of an IV tool called AppVis [7], which is used to visualise network application performance data. This tool supports six of the seven key tasks for IV. The graphical view shows an overview of the delay for several virtual local area networks (VLANS). A zooming facility is provided and the parameters of the current view can be altered using the filtering menu in the lower right quadrant of the screen. Details on demand are shown when the user moves the mouse pointer over a data point on the graphical view and it is also possible to drill down into a particular VLAN to extract further information. The graphical view is coordinated with the textual view; any changes to the data shown in the graphical view will also be reflected in the textual view.

However, no facility exists to save a view and users have to re-enter query parameters into the filtering menu to regenerate a view [3]. Thus the history task is not supported.

C. *Interaction Techniques*

Interaction techniques form a vital component of any IV tool. If there are serious usability issues, the user will not be able to interact with the data and the tool will be useless. Interaction techniques such as details on demand and dynamic queries are widely used in IV tools, an example of which is AppVis (Figure 1). The user can specify the query parameters (time period, VLAN and delay metric) and the graphical view is updated accordingly. These query parameters could be stored in the form of *metadata* in order to facilitate the history task.

III. PROPOSED FRAMEWORK.

In order to facilitate the integration of the history task into an existing tool, a new interaction mechanism as well as a new visualisation technique is proposed. This is followed by a discussion of the proposed framework to support these techniques.

A. *Proposed Techniques*

The interaction mechanism for saving a view will be known as "*book marking*" a view. These saved views are then known as *bookmarked* views. A user will then be able to select a bookmarked view and reload it without have to remember the parameters for the dynamic query which was used to generate the view.

B. *Framework for Customised Visualisation*

The framework for customised IV is shown in Figure 2. The framework is divided into the data, application and presentation layers, as discussed in Section II.

Firstly, the Metadata Generator analyses the database, and creates the Metadata Repository for the particular database. When a user wishes to save a view for later retrieval, a query is sent to the Metadata Processor. It in turn stores the metadata for the dataset produced by the query in the Metadata Repository. When the user wishes to retrieve the stored query, the metadata for the dataset is retrieved, and the query is regenerated and sent to the Query Processor. This regenerates the data required and the bookmarked view is sent to the Visualisation Module.

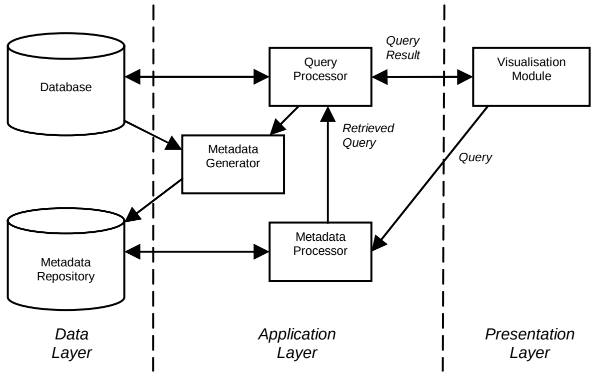

Fig. 2: The proposed framework for customised information visualisation.

IV. CONCLUSION AND FUTURE WORK

A framework to facilitate the integration of two new IV techniques was proposed. Metadata for the datasets generated by dynamic queries will be stored, and used to recreate views that have been specified by the user. This will allow the history task to be integrated into an existing IV tool which does not currently support this facility.

Future work includes the validation of the framework by implementing these techniques into at least two existing IV tools.

ACKNOWLEDGMENT

This research would not have been possible without the financial assistance of the Telkom Centre of Excellence, as well as the Department of Computer Science and Information Systems at the Nelson Mandela Metropolitan University.

REFERENCES

1. Kennedy, J.B., K.J. Mitchell, and P.J. Barclay, *A framework for information visualisation.* SIGMOD Rec., 1996. **25**(4): p. 30-34.
2. Shneiderman, B. *The Eyes have it: A task by data type taxonomy for information visualization*. in *IEEE Symposium on Visual Languages*. 1996: IEEE Press.
3. Kreuseler, M., T. Nocke, and H. Schumann, *A History Mechanism for Visual Data Mining*, in *IEEE Symposium on Information Visualisation*. 2004, IEEE: Austin, Texas, USA.
4. Gershon, N. and S.G. Eick. *Information Visualisation*. in *1997 IEEE Computer Graphics and Applications*. 1997.
5. Schőnage, B. and A. Eliëns. *A Flexible Architecture for User-Adaptable Visualization*. in *Proceedings of the 1997 workshop on New paradigms in information visualization and manipulation*. 1997. Las Vegas, Nevada, United States: ACM Press.
6. Andrews, K., *Information Visualisation Tutorial Notes*. 2002, Graz University of Technology. p. 33.
7. Rademan, J., *The Visualisation of Application Delay Metrics for a Customer Network*. 2004, Nelson Mandela Metropolitan University: Port Elizabeth.

Ryan C. Yates received his BSc Honours degree in 2004 from the University of Port Elizabeth. He is presently doing his MSc in Computer Science at the Nelson Mandela Metropolitan University.