ABSTRACT

Radial Graph Visualization:

An Algorithmic Framework with Applications

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Graphs are widely and effectively used abstractions for organizing and visualizing information. Many real world domains can be represented as node-link graphs, for example, the backbone of the Internet and B^+-Trees.

This thesis presents a graph data structure for representing graphs and an algorithmic framework for positioning the nodes such that the result is a planar radial layout. An XML-based file format for the storing of graph data is presented. The design of the file format achieves data abstraction amongst its layers separating the data and the application. An object-oriented algorithmic paradigm was taken. As a result, classes with low cohesion that emphasize scalability and efficiency are produced.

Two prototype applications are developed to test the design. Firstly, the framework and data structures are used to create a radial drawing application for a web course storyboard. The radial drawing is a graphical representation of the structure of the web-based course that can be used as the actual site map. The second prototype focuses on the radial drawings of B^+-trees. In both prototypes, the node structure is not the traditional point used by most graph-drawing applications but rather a complex structure with its own internal structure. A

novel specialized design layout for these node structures in which readability of text-based labels is maximized is offered. This adds to the data abstraction of the design, facilitating the reuse of layout information and improving the overall efficiency. The algorithms are linear with O (n) complexity.

Through navigation of the site and interaction with the drawing, the user can alter the focus of the graph as required. This recentering of the graph incorporates animation features for dynamic graph drawing.

In any graph-drawing application, aesthetics need to be considered. Readability and area are focused on here. Readability with respect to the node text labels and area in terms of improving its existential bounds for a given aspect-ratio are considered.

KEYWORDS: Graphs, Graph visualization, Radial Drawing, Data Structures, B^+-Tree, Graph Labeling.