Graph-Drawing Contest Report

Christian A. Duncan[1], Gunnar Klau[2], Stephen G. Kobourov[3], and Georg Sander[4]

[1] Louisiana Tech University, Ruston, LA 71270, USA
duncan@latech.edu
[2] Freie Universität Berlin, 14195 Berlin, Germany
gunnar@math.fu-berlin.de
[3] University of Arizona, Tucson, AZ 85721, USA
kobourov@cs.arizona.edu
[4] ILOG, 94253 Gentilly Cedex, France
sander@ilog.fr

Abstract. This report describes the Thirteenth Annual Graph Drawing Contest, held in conjunction with the 2006 Graph Drawing Symposium in Karlsruhe, Germany. The purpose of the contest is to monitor and challenge the current state of the graph-drawing technology.

1 Introduction

This year's graph drawing contest had five distinct categories: the graph drawing challenge, the free-style contest, and three special graph categories. The graph drawing challenge, which took place during the conference, focused on area minimization of straight-line planar drawings. The free-style competition provided participants with the opportunity to present their best graph visualizations, with a focus on both aesthetic beauty as well as relevance to the graph drawing community. The first special category was a mystery theory graph of 101 nodes and 190 edges, with the judging of a graph based on both its visual and informational merit. The second special category focused on visualizing the History of the FIFA World Cup™. This category had the requirement that the submission be an animation showing the evolution of the match results of the world cup over its long history. The third special category was more practically oriented. The task was to provide an informative visualization of the Java compile-time dependency graph with nodes representing Java classes and directed edges representing compile-time dependencies between two classes. Unfortunately, this task proved too challenging this year, and there were no submissions for this category. However, there were 20 submissions among the other categories. The remaining sections go into more details about each category and the winning submissions. Since many of the winning submissions were animations, interested viewers should visit the Contest's website[1] to download and view the winning animations along with their descriptions.

[1] http://gd2006.org/contest

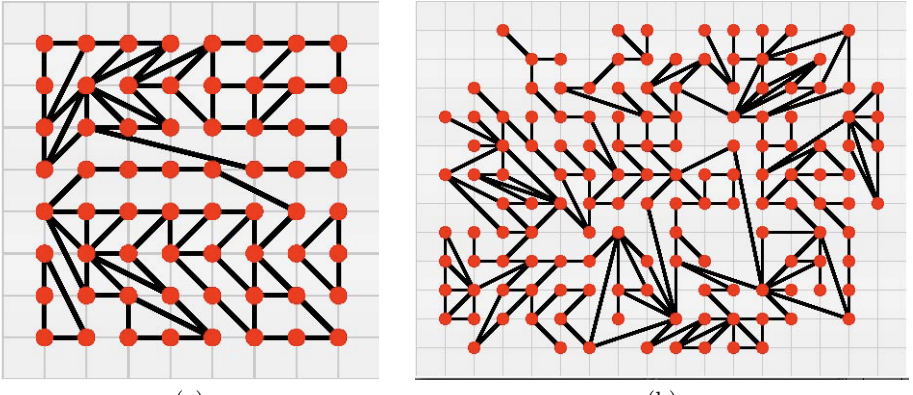
M. Kaufmann and D. Wagner (Eds.): GD 2006, LNCS 4372, pp. 448–452, 2007.

2 Graph Drawing Challenge

This year's challenge dealt with minimizing the area of straight-line drawings of planar graphs. At the start of the one-hour on-site competition, the contestants were given six planar graphs ranging in size from 16 nodes to 400 nodes. The first four graphs were small enough to be manually created, and the last two were automatically generated. Vertices were assigned random grid positions in all of the graphs.

We allowed teams to participate in one of two categories, automated and manual. Manual teams came and solved the problems using ILOG's Simple Graph Editing Tool provided by the committee. The automated teams were allowed and highly encouraged to use additional software tools to help solve the problems. Interestingly, for two of the six graphs people manually obtained better solutions than the automated software.

Six teams entered the manual category and the winner was the team of Fabrizio Frati and Markus Geyer from Universitá Roma Tre and Universität Tübingen. Figure 1(a) shows their winning submission for Graph 2. Four teams entered the automated category and the winner was the team from Universität Tübingen led by Andreas Gerasch. Figure 1(b) shows their winning submission for Graph 4.



(a) (b)

Fig. 1. The winning submissions for (a) Graph 2 by Frati and Geyer and (b) Graph 4 by the Tübingen team

3 Free-Style Contest

This year only two teams submitted entries to the free-style category. As there was no clear winner between the two, two honorable mentions were awarded.

Figure 2 shows the submission by the team of Emden Gansner and Yehuda Koren from AT&T Research Labs, which is an example of the improved circular layout algorithm presented at this year's symposium [1]. The graph represents

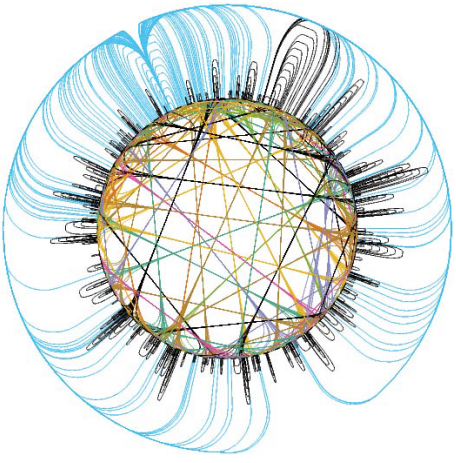


Fig. 2. An example drawing of the improved circular layout algorithm of Gansner and Koren

behind-the-scenes data sharing related to various popular websites. The graph has 2226 nodes and 4710 edges. The node with the highest degree (169) is ad.doubleclick.net, an advertising server. The external edges connected to this node are merged together, making the drawing cleaner. Otherwise, these external edges would dominate the drawing.

Figure 3 shows the submission by the team of Florian Böhl, Robert Görke, and Steffen Mecke from Universität Karlsruhe regarding their Flow Commander program.[2] The program provides an algorithm animation of the *Push-Relabel* network flow algorithm of Goldberg and Tarjan but is designed to support other graph algorithms. The application uses the Java3d library for a system independent means of interactively visualizing the animation in 3D-space.

4 Theory Graph Contest

There were five submissions in the theory-graph category with each contestant giving a different interpretation. The graph used was the graph G_{10} described in [2] formed by the union of two trees $T_1 = (V, E_1)$ and $T_2 = (V, E_2)$ where each tree has a common root v_0 and 10 common children, $v_1, \ldots, v_{10}$. The root r has 90 grand-children labeled v_{ij} such that, for $1 \leq i, j \leq 10$ and $i \neq j$, we have $(v_i, v_{ij}) \in E_1$ and $(v_j, v_{ij}) \in E_2$. Several contestants observed that this graph is also identical to a modification of K_{11} where every edge, except those adjacent to vertex v_0, is duplicated and then subdivided.

The committee awarded two first prizes to two equally interesting visualizations of the graph. Both winning submissions included animated visualizations of the graph. Figure 4 shows a snapshot of the winning submission by Michael

[2] See: `http://i11www.iti.uni-karlsruhe.de/adw/jawsGD/GTVisualizer3D.jnlp`

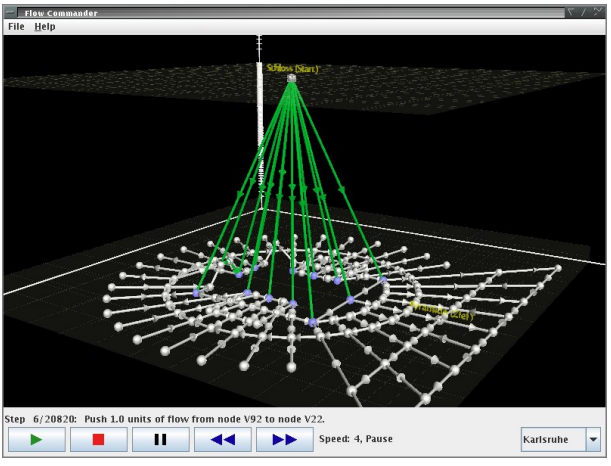


Fig. 3. The Flow Commander application for visualizing Network Flow algorithms

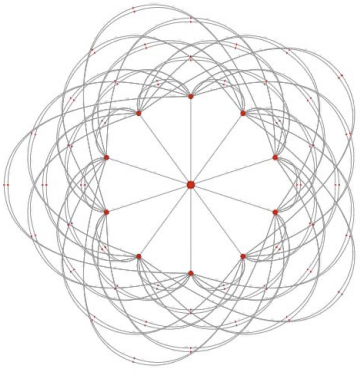
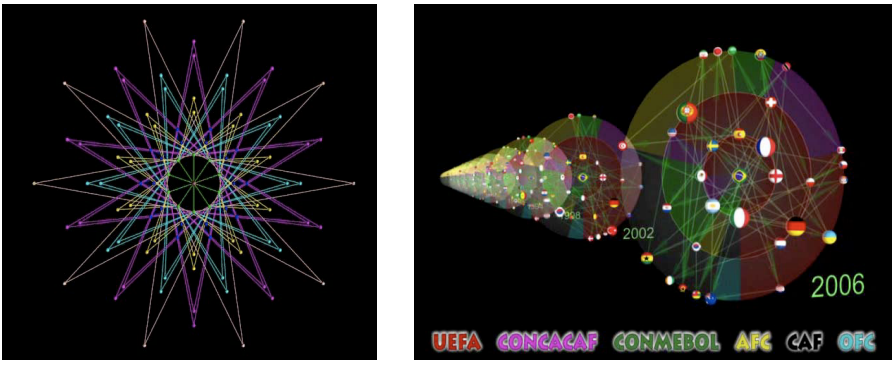


Fig. 4. A snapshot of McGuffin's winning animation of the theory graph

McGuffin of the Ontario Cancer Institute and the University of Toronto. Figure 5(a) shows a snapshot of the winning submission by Adel Admed, Seok-Hee Hong, Quan Nguyen, and Donald Taylor of the University of Sydney and National ICT Australia.

5 History of the World Cup Contest

There were three submissions for the History of the World Cup category. The data given was a collection of every match played in the final rounds of the FIFA World Cup including the country names and final scores. The broad goal was to provide a creative and informative *animated* visualization of the data as an evolving graph. There were many interesting submissions in this category,



(a) (b)

Fig. 5. A snapshot of the Sydney team's winning animations of (a) the theory graph and (b) the World Cup graph

and Figure 5(b) shows a snapshot of the winning animation of Adel Admed, Xiaoyan Fu, Seok-Hee Hong, Quan Nguyen, and Kai Xu from the University of Sydney and National ICT Australia. Their focus was to highlight strong countries and the performance of teams over time. In their approach, the team analyzed the graphs from three perspectives: clustering analysis, centrality analysis, and centrality-based thickness. They also visualized the graphs in three ways: radial view layout, centralily-based 2.5D drawings, and an evolutionary drawing based on team performance.

Acknowledgments

We wish to thank the generous sponsors of the symposium and the contestants.

References

1. Gansner, E.R., Koren, Y.: Improved circular layouts. In: Graph Drawing 2006. Lecture Notes in Computer Science, Springer (to appear)
2. Geyer, M., Kaufmann, M., Vrto, I.: Two trees which are self-intersecting when drawn simultaneously. In Healy, P., Nikolov, N.S., eds.: Graph Drawing. Volume 3843 of Lecture Notes in Computer Science., Springer (2005) 201–210