Constellation:
Using Visualization to Find the Path to Experts

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ABSTRACT
By extending a social network visualization to include a keyword search for experts, Constellation enables users to discover and explore the social connections between experts and then map the shortest path between themselves and these clusters. In this way, a social network visualization tool provides a mechanism for identifying, locating, and connecting to distant experts.

1. INTRODUCTION
Social network visualizations are often used as a way of understanding the overall structure of a social group, revealing patterns and composition of the network [1, 3]. In contrast to these approaches, Constellation is a social network visualization tool that supports a user in accomplishing a specific task, in this case, expert finding. Rather than presenting a visualization of the entire network, Constellation allows the user to control which portion and how much of a network is visible at any one time, allowing a user to explore and discover social ties between particular individuals, focusing in on areas of interest. This focus on regions and views enables a user to answer people-centric questions.

One of the challenges of a large, diverse organization is knowing who to go to for information. People most frequently rely on their immediate social network for finding information, but when their colleagues can not provide a solution, they look to outside experts. To address the problem of finding experts, previous systems have utilized social network knowledge to determine the best expert to recommend to the user [4, 5]. This combining of expert finding and social network knowledge is natural, because when people cannot find an expert in their inner circle, they frequently use their social network to locate potential experts.

Constellation (see Figure 1) goes beyond these works by using visualization to assist the user in determining which expert is the most relevant to contact. Users can perform targeted searches for experts and then visualize the results to gain a richer understanding of the search results. Prior social visualization work [1, 3] provides methods for understanding the structure of an entire network and for viewing a single person's network, allowing users to discover patterns. Constellation, although able to support this type of broad interpretation, is unique in its ability to support a user in the task-oriented goal of expert-finding.

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2. MOTIVATING SCENARIO
Imagine you are presenting a project to a new audience. After your presentation, members of the audience enthusiastically suggest that you contact several circuit designers in the organization who may be able to help you. You have not heard these names before and are unfamiliar with how they fit into your organization's hierarchy. To contact them and to begin a collaboration, you would like to know how these circuit designers fit into not just the management chain, but also the social context of the company. *Who do they work with? Where do they work? How long have they worked at the company? Which of them is the best circuit designer for me to contact?* In an ideal situation, the audience would answer these questions, but more likely you will be left to answer these questions yourself.

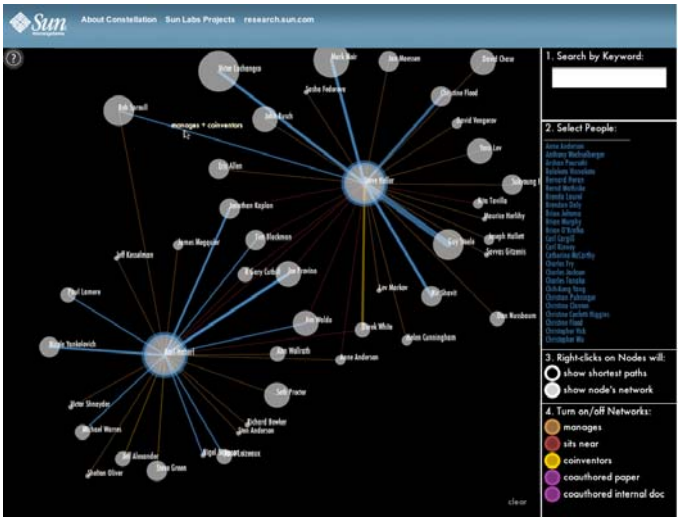

Figure 1: A screenshot of the Constellation application.

3. CONSTELLATION APPLICATION
Constellation, implemented using the Java™ programming language, is an application that can run either as a desktop application or as an applet in a web browser. The software collects and visualizes the social connections between Sun Microsystems' research lab's employees, approximately 250 people. The visual front-end is built using Processing [2]; the social network relations are represented using Jung [6].

Rather than using private data sources such as email exchanges or other personal communication, Constellation uses public sources of social network relationships, similar to Referral Web's use of

public web-based data [4]. To collect strong evidence of relationships between individuals, the application combines data from three databases, to represent five different types of relationships: the company's directory (reporting relationships and neighboring offices), the patent database (co-patenting), and a publications database (co-authorship of internal documents and academic papers). Each of these sources are available company-wide through the corporate intranet. Because of this, we hope to minimize privacy issues that arise from using more sensitive data.

Constellation supports searching by both employee name and keyword. The keyword search utilizes an index of the abstracts of the papers stored in the publications database. Keywords found in these abstracts are associated with their authors and those names are returned by the search engine within Constellation. While other systems have developed algorithms for determining expertise from data sources [5], we have taken a simpler approach and decided that authorship on either an academic paper or an internal document indicates expertise.

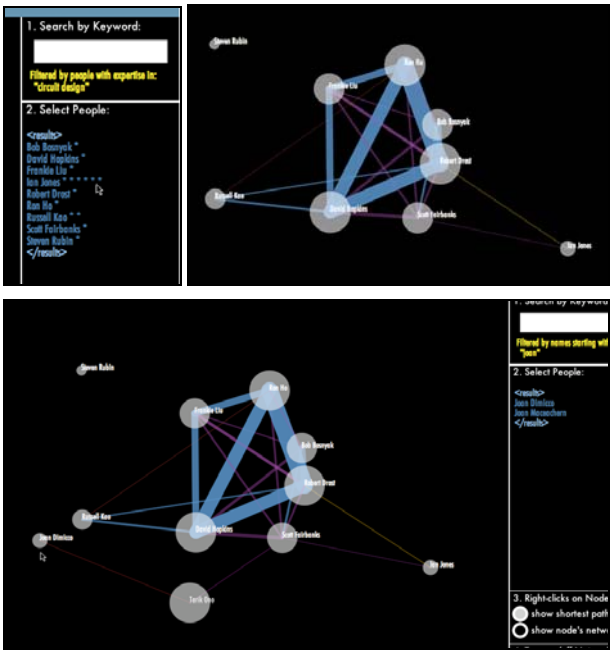

Figure 2: A search for "circuit design" reveals a tight knit cluster with varied connections. By adding oneself to the map, the user can discover the shortest path to this group.

4. USAGE SCENARIO

Let's return to our motivating scenario in which you want to find out more about the circuit designers you should contact. Searching by name, you can use Constellation to view and explore the networks of the circuit designers you've heard about, as Figure 1 shows. An alternative way to use Constellation is to search for the phrase "circuit design," which provides you a list of all of the people who have written papers discussing circuits, shown in the first image of Figure 2. The asterisks beside each person's name indicate the number of documents this person has written on the topic, indicating relative experience on the topic.

By clicking on the listed names, they are placed on the graphing space. This immediately reveals all direct connections between these individuals. As shown in the second image in Figure 2, most of the people are highly inter-connected, forming a tight cluster. With this visualization, you now have an understanding that most of the company's circuit designers have a long history of patenting and writing together and also sit near each other, with the exception of two outliers.

To determine the best way to connect to this tight cluster, you can add yourself to the graph and visualize the shortest path from yourself to these individuals, as shown in the bottom image in Figure 2. By doing this, you discover that a co-worker who sits near your office has co-authored multiple papers with the group.

From using Constellation, you have gained an understanding of who the circuit designers are in the company, the scope and history of their relationships with each other, and the most direct path to getting a personal introduction to the most relevant ones.

5. CONCLUSION & FUTURE WORK

Constellation presents expertise query results within a social network visualization for a user to selectively explore. The application allows the user to control the search context, such as which as individuals are shown, which networks are drawn, and whether the user himself is incorporated into the visualization. With this level of flexibility, we hypothesize that Constellation supports users performing focused person-centric searches.

Constellation, as presented, has been deployed to a subset of the Sun Labs community for preliminary testing. Our initial observation is that on first use, users begin their exploration starting from their own network and expanding up the organizational chain. We plan to run an evaluation that tests our premise that a social visualization tool can assist in the task of expert finding.

In terms of future development, we plan to incorporate additional sources of network data, particularly as we move to deploy the application outside of the research division. Examples of additional networks are connections between blogs, postings to the same news groups, and co-contributors to the same open source projects.

6. REFERENCES

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