Model Behavior
The way a company really works is probably not the way managers think it does.
Network-analysis

by Eric Bonabeau and Valdis Krebs
October 2002, Issue 22

Just as everything else in modern business is being re-evaluated and overhauled, so is the traditional organizational chart. Long a human-resources staple in most companies, these detailed flow charts showing who works where and who reports to whom are essentially a tool for control and planning. That may have been sufficient in a time when companies faced only gradual change, but no more. In fluid business environments, there's often a big difference between how managers think work is getting done and how it actually gets done.

A fast-paced economy requires flexible, adaptive structures that self-organize internally in response to external changes. Managers don't need pictures of hierarchy; they need visualizations of the wide-ranging connections that make up companies' learning systems. Rather than charts showing who reports to whom, they need charts to show who knows what and whom, and who works most often with whom. That's the purpose of organizational-network analysis, the application of social-network theory to organizations. ONA paints a much more accurate picture of how a company actually works, shares knowledge, and completes processes.

By collecting and analyzing quantitative information, ONA can reveal how much informal networks differ from the official reporting charts. A person thought to be a key player may actually be surprisingly isolated, while anonymous workers may be shown to hold powerful influence. The technique maps knowledge networks that uncover interactions within and across the boundaries of the organization.

The roots of social-network analysis go back some five decades, but only in the past five years or so have automated data-collection tools and techniques emerged to make ONA a viable and increasingly common approach to redefining and improving corporate culture. ONA is now in transition from exotic scientific theory to solid management practice, with some 200 companies and public-sector entities using the method. IBM, Merrill Lynch, the Ohio Department of Education, Rubbermaid, and Steelcase are among those that have used ONA to better understand their organizations and to make them more adaptive.

ONA helps executives put numbers on concepts that are usually excused as too soft to measure. It uses the rigor of systems analysis—the mathematical modeling of abstract ideas—to reveal the behavior inside and between companies. Managers and consultants use these revealing diagrams in the same way that doctors use X-rays and CAT scans—to see what's usually invisible. At its

best, ONA uncovers the hidden dynamics that support learning and adaptation—letting managers measure and benchmark those dynamics.

CIOs should certainly apply ONA to their own IT departments, but these executives also are in a position to lead the deployment of ONA throughout the company. The analysis can be an important part of creating an IT infrastructure that's more responsive to individual managers' information needs than one built on the rigid structures of the organizational chart (see "The Essence Of Business Agility," September, p. 26).

Search-Engine Similarities
ONA is a software-supported methodology dependent on data collection that's ideally automated through the use of electronic questionnaires and activity-monitoring tools. These tools can pinpoint subject-matter experts in a department or company with network metrics similar to the PageRank algorithm used by the Google search engine in ranking Web pages by relevance.

PageRank is an Internet-age take on a social-network analysis measure dating back to the 1950s called Prestige, which ranked influencers and leaders in the medical community. A doctor's Prestige measure, based on nominations by peers, increased if the nominators had high Prestige rankings themselves. Similarly, Google measures and ranks the links *between* Web pages, using the number and quality of links into a Web page to judge and rank its relevance. And it gives more weight to incoming links from sites that themselves have a lot of incoming links.

This idea is applicable to corporate environments as well. You can design a corporate search engine to take advantage of the knowledge of who knows whom, combined with knowledge of who knows what. Assign a search to a category corresponding to one of the social networks, such as the innovation network, the IT network, or even the "grapevine" network. The nodes with the highest combination of Prestige (derived from who knows who) and Relevance (derived from who knows what) will be ranked first.

Along these lines, AT&T Labs in 1998 developed ReferralWeb, an online tool combining ONA and collaborative filtering. Workers in AT&T Labs' research centers, for example, use the technique either to find the best expert in a field or to find someone they know who can introduce them to the person they want.

To collect ONA data, simply E-mail employees a "question of the week." Ask them to select two or three people with whom they interact on a number of dimensions, then ask questions like:

- Mission and vision: With whom do you discuss the company vision and business strategy? With whom do you discuss what's important and valued in the company?
- Work interactions: With whom do you work to get your job done?
- Grapevine: With whom do you discuss what's going on at work?
- Decision making: From whom do you seek feedback, input, and suggestions before making a decision?
- Innovation: With whom do you discuss ideas, innovations, and better ways of getting things done?

As the responses come in, the software maps a visualization of who goes to whom for knowledge. The network grows as more employees submit their answers, tracking both tacit and explicit knowledge exchanges.

A recent *Optimize* article by Amir Hartman ("[Why Tech Falls Short Of Expectations](#)," July, p. 20) notes a Standish Group International finding last year that only 9% of technology investments were completed on time, on budget, or within scope, and that 29% failed completely. Hartman cites a range of reasons, from poor decision making to ineffective communication. We suggest that companies are pretty good at the technology of IT, but they're awful at the sociology of IT projects. Project ONA can help you do the sociology much better—both within the project and with customers and stakeholders.

One fluid-handling products manufacturer with locations in Europe and North America sought to find its knowledge stewards—the people with the most expertise in different knowledge domains in the company. Using ONA software tools such as InFlow and KnetMap [Editor's note: Co-author Valdis Krebs is affiliated with both products], the company surveyed employees and some key business partners. KnetMap gathered data about who went to whom for advice and expertise in the company's key knowledge domains, then mapped a knowledge network for each. InFlow, using a network metric similar to Google's, diagnosed each network and ranked each node in the network from high to low importance.

The top-10 list in each knowledge domain contained some expected names but also quite a few surprises. Some experts whom managers expected to see on the list weren't there, while other unexpected employees ranked high in a particular knowledge domain. Why? This analysis didn't merely evaluate expertise; it also evaluated the ability to share knowledge and engage in problem solving and brainstorming. It turns out some experts are not often consulted by others because "they are jerks to deal with," as one employee said bluntly.

And who were the unknown employees ranking high in several knowledge domains? Many were "brokers" in the knowledge network—they weren't the deep experts, but they understood the domain very well and knew where key knowledge was located in the company. Their problem-solving and interpersonal skills were top-notch and they had great reputations within the company. Other experts were discovered along the edge of the company—well away from management's usual horizon of observation. These were knowledgeable employees with a local reputation; they were local resources used by everyone around them.

Hidden Problems Revealed
With ONA tools and techniques, managers can see both positive and negative behaviors, which can be either surprises or expected. The biggest payoff comes from the negative surprises—the problem areas you didn't know you had. This information allows you to peek inside that black box called "You don't know what you don't know."

Steelcase has proved that organizational payoff. The world's largest manufacturer of office furniture used ONA to pinpoint one top executive as a major hub in the leadership network, accounting for a disproportionate number of the network's links. His role indicated the critical need for succession/backup planning, because losing this executive would mean a loss of major knowledge and leadership.

Steelcase also learned that its sales and marketing department had a dense internal network, but very little connectivity to the outside world. All lines coming out of the department converged on a single executive, signaling a lack of path redundancy—a lack of robustness in the communications channels. Even more worrisome, most of the sales and marketing ties were unconfirmed. Person A thought she communicated with person B, but B didn't list A as a contact. Such one-way ties suggested a strong disconnect between the department's employees and its management.

While a company's multiple internal social networks provide deep insights into the reality of how work gets done, there are other equally important social networks that extend beyond the walls of the corporation—to customers, strategic partners, and suppliers. Consultancy Cap Gemini Ernst & Young used social-network analysis to X-ray the practice of sharing knowledge between an automotive manufacturer and its suppliers. Cap Gemini's analysis found that the social networks that supported change notices or innovation were more brittle than the work network, relying on a couple of key individuals who communicated infrequently. By using ONA to uncover inefficient communication that was hamstringing innovation, Cap Gemini found opportunities to save its client $14 million per year.

After mapping the reality of your company with ONA, you face another choice. Should you reorganize so the company resembles how work really gets done, or are you better off leaving the formal organization alone while understanding how it works? It depends on the fluidity of the emergent networks. If they can be expected to change weekly or monthly, then formal reorganization would be futile. But if this new structure is more permanent, then matching the formal to the informal may be reasonable.

In either case, the hierarchy and the workflow should not be so precisely defined and inflexible that they interfere with the natural interactions of the people in their environment. Don't just redraw the organizational chart and hardwire your discovery of the emergent networks, because they'll change and evolve out of their current state as surely as they did out of the formal structures you started with. Recognizing that the information flows and interactive relationships in your company are dynamic and evolving is one of ONA's most important lessons.

Eric Bonabeau is the chief scientist of Icosystem, a strategy consulting firm that applies the tools of complexity science to the discovery of business opportunities. He is the author of three books. Valdis Krebs is a leading independent consultant on organizational networks.

Sidebar: The 90-Day Plan
Organizational-network analysis will reveal the inner workings of your company, and you can make significant headway in three months. But consider this the first of several 90-day plans; ONA is best implemented on an ongoing basis—do it again a year later, say—as your company dynamics change.

First month: Collect data

Identify the scope of your analysis and choose an ONA measurement system. Using social-network data-collection software, begin asking employees a series of "questions of the week" about information flows within the company. Continue the weekly questions in the second and

third months as well.

Second month: Analyze data

• Analyze the collected data using network-analysis software. Display the various networks your data has identified.
• Extract network metrics such as activity, betweenness, and closeness. Identify characteristics, including emergent groups and communities of practice, emergent leaders and experts, underutilized people, resource or information bottlenecks, and the reality of how work gets done.
• Based on these findings, start to look at where reorganizations may be necessary. Equally important, find where any planned reorganizations may be unnecessary and even potentially harmful.

Third month: Exploit information benefits and reorganize

Complete a reorganization plan using these guidelines:

• Look beyond each individual to see the person's connections and multiple group memberships. Improve the communication flow within and between groups.
• Reward people for directly sharing their know-how and including others in their knowledge-sharing networks.
• Help female and minority employees connect to key knowledge flows and communities in the company. This may help eliminate the glass ceiling.
• Ensure better coordination of behavior between departments or projects by adding crosscuts to minimize the path length of their information-exchange networks. To reduce delays, you want some redundancy in the paths; if one is blocked, alternative communication paths should be available.
• Start designing new information systems to support the actual flow of information in the company. Design systems that facilitate conversations and knowledge sharing. Think communication, not storage and retrieval.

Sidebar: ONA Metrics: Six (Or Fewer) Degrees Of Separation
The basis of organizational-network analysis is not just a visual picture of how your company really works, but quantifiable metrics that support that picture. Consider the Kite Network developed by David Krackhardt, professor of organizations at the H. John Heinz III School of Public Policy and Management at Carnegie-Mellon University. Krackhardt's model measures the centrality, or importance, of a person in the network by the ABCs: activity, betweenness, and closeness.

Social-network researchers measure network activity for a node by using the concept of degrees—the node's number of direct connections. In the example shown, Diane has the most degrees in the network. Conventional wisdom says the more connections, the better, but this isn't always so. What matters most is where those connections lead—and how they connect the otherwise unconnected.

Diane has connections only to others in her immediate cluster—her clique. She connects only

Look Who's Well-Connected
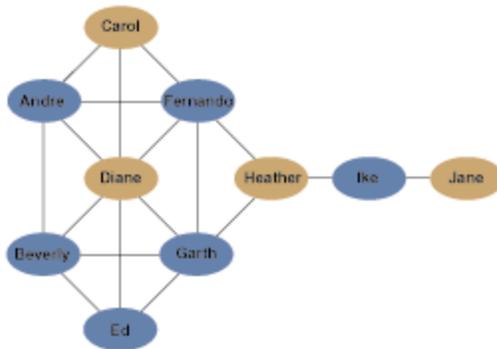
DATA: David Krackhardt

ONA uses quantitative measure-ments to map organizational dynamics

those who are already connected to one another—so in effect, many of her links are redundant.

Heather, on the other hand, has few direct connections, yet one of the best locations in the network. She's a boundary-crosser and broker between two important constituencies. The bad news is she's a single point of failure. Without her, Ike and Jane would be cut off from the information and knowledge in Diane's cluster.

Fernando and Garth have fewer connections than Diane, yet their ties let them access all network nodes more quickly than anyone else. They have the shortest paths to all others. Location, location, location—the golden rule of real estate also works in networks.

The number of hops, or steps, it takes to go from node to node is also critical. In human networks, short paths imply quicker communication with less distortion.

So while Diane might appear at first glance to be the central node, closer ONA measurements reveal that Heather, Fernando, and Garth also occupy very important locations in the company's social network. A manager who knows that can be much more effective in enhancing the productivity, efficiency, or innovation of the entire network.