Social network analysis: Tracing relationships

Executive Summary: The relationships between people follow distinct principles and patterns. Our connectedness affects the work we do, the choices we make and the things we know. Though still emerging from its academic roots, social network analysis (SNA) is entering the mainstream thanks to better analytical tools, visualization, complementary technologies and data availability. Uses for SNA include: better knowledge management, building defenses against the spread of computer viruses, segmenting markets and perpetrator identification.

The merger of the Serious Business Cartoon Exchange and Important Industry Comix is not going well. Despite change management initiatives being put into place, it has become increasingly obvious that information is not flowing within parts of the merged organization. Using e-mail traffic, IM buddy lists and phone records, you begin an analysis of the relationships between the employees. There are a number of clusters visible, but nothing is obvious. You put together three monthly snapshots of the connectivity within the organization and see several potential barriers to information sharing. First, a number of influential people have become isolated. Second, the strength and numbers of connections have been reduced for many people. Finally, there are many people who are more than three degrees of separation from management. By conducting a series of follow-up interviews you confirm your findings and suggest to management the need to connect some of the key personnel within the group.

How this happens

Most of what we know, what we understand and what we believe in is mediated by our relationships with other people. Our priorities, choices and beliefs exist within a socio-metric context of those around us.

Using socio-metric techniques to observe networks of people goes back to the 1930’s. Since then, academics have been developing a set of techniques called social network analysis (SNA). SNA data is typically collected using surveys and then analyzed using statistical techniques based upon graph theory. The theory is that patterns will become visible, and that they can be used to better understand the relationships between people, assess the health of a group and identify which people are playing key roles within a network. In society, such analysis has been used to understand and help alleviate social problems. For instance, by studying the habits of a “group” of drug users, needle exchange programs have been made more effective. In business, such analysis has been used to manage change, identify key players and experts, improve reuse of intellectual assets and understand the decision making processes.

Milgram’s small world experiment is probably the most well known use of SNA. Milgram conducted experiments based on the premise that every individual in America is separated from every other individual in America by no more than six links, which gave rise to the notion of “Six Degrees of Separation.” Though its conclusions have recently been disputed, people have a sense of connectedness that has validated the experiment in the popular culture. SNA’s statistics-rich, more
rigorous side is still largely academic. However, this may be about to change. There is evidence that SNA is quickly gaining a foothold in the marketplace, and there are four reasons behind this phenomenon:

- The rise of knowledge management
- Availability of sophisticated visualization
- Development of complementary technology, such as deep computing
- A significant increase in data being captured.

**Knowledge management** -- For business, Knowledge Management (KM) is a relatively new concept. To illustrate this point, while there are hundreds of business-oriented KM publications currently listed on Amazon.com, the oldest dates back to only 1994. Now that KM has the attention of business, there is a context for discussing the tools and potential benefits of SNA.

**Visualization** -- Mapping and other techniques have been critical to taking the raw data developed using SNA techniques and making it accessible. Thanks in part to video game technology, the hardware and software for visualization are now faster and more affordable, and allow for easier manipulation and handling of larger amounts of data.

**Complementary technologies** -- Collaborative filtering, expert finder technology, content management and data mining software are tools that can be used synergistically with SNA. In addition, processing power from deep computing advanced algorithms and grid systems makes it possible to take on the computational challenges of analyzing massive amounts of data over huge numbers of relationships.

**Data availability** -- This is the most significant factor. While traditional SNA relies heavily on expensive surveys and interviews for data, a mass of inexpensive data tied to relationships has become available in recent years. Credit card transactions, cell phone calls, global positioning systems (GPS) data, Web site access, e-mail, Internet messaging, ATM transactions, border control, electronic toll payment and supermarket “loyalty” cards are just some of the data points that are being captured. Analysis of this information can help reveal the patterns of relationships.

The door is opening for more extensive applications of SNA, for example, its use in fighting terrorism by tracking terrorist networks that are known to exist and uncovering others that were previously unknown is in the news²,³. Analysis of travel data, bank transactions, telephone calls and Internet use could reveal opportunities for disruptions. SNA can help identify:

- “Isolates” -- Less social people who are more likely to be turned into informers,
- *Connected people who are away from power* -- People who can spread disinformation without it being checked
- *Common sources of funding* -- That can be disrupted or severed. Extrapolating these patterns from similar patterns can also reveal the presence of supporters or unknown terrorist cells that can be monitored.

SNA has also been shown to help clear the path for innovation, to make sure that there is diversity within informal and formal networks, and to help teams gauge how healthy and effective they are. Gerry Falkowski, who has pioneered the use of SNA within IBM, recently did an analysis of a virtual
team and found hidden strengths that could be leveraged, and points where individuals and
devgeographies were not fully involved. He was able to make several targeted recommendations to
improve the operational health of the team. His advice was supported by maps of team interactions
that were visually compelling and difficult to refute4, 5, 6, 7.

The IBM Institute for Knowledge-Based Organizations (IKO) has used social network analysis to
study the importance of informal networks in Knowledge creation and transfer. Led by Robert
Cross, an assistant professor at the University of Virginia and an IKO Research Fellow and Andrew
Parker, a consultant in the IKO, the IKO has examined over forty networks in thirty organizations
over the last three years. They have examined issues such as the role of awareness, access,
engagement and safety in knowledge-sharing networks, the use of individual, group and
organizational interventions to impact network development, and the development and importance
of personal networks. Recent articles based on their work have appeared in mainstream business
publications such as the Harvard Business Review, Sloan Management Review, California
Management Review and Organizational Dynamics.8,9,10,11

What this means to you
Social network analysis is emerging as an important approach in the area of Knowledge
Management. Currently, SNA is being used in business management, law enforcement and public
health. Both large organizations, such as IBM Global Services, and smaller companies, such as
Humax12 and Verity13, are using SNA for everything from support for building social capital to use of
expert finding techniques to improve search results. While the techniques used and basic concepts
of SNA are becoming standard in fields such as sociology and anthropology, applying SNA to real
problems is still more of an art than a science. The resulting analyses and diagnoses need to be
validated in other ways, and these analyses do not prescribe standard, off-the-shelf solutions for
organizational dysfunction. While UCINET software from Analytic Technologies -- for the analysis
of social network data -- is the recognized tool for academia, it does not have an equivalent in the
business world.

Social analysis and intervention can raise concerns about privacy and civil rights, particularly when
it is associated with collecting and pooling large amounts of data generated by individuals. While
this may be more than offset by the benefits of increased security when used by law enforcement,
business applications will need to be justified.

SNA has already had proven successes that make it attractive. In addition, since it can be
incorporated into other work, it is likely to be adopted despite the barriers of lack of standardization
and social acceptance. Most of all, the availability and relatively low cost of data that can be used
for analysis are likely to foster the development of innovative applications that will encourage
increased investment in, and acceptance of, SNA.

Social network analysis has advanced to a formal discipline that includes methodologies and
trained practitioners. These practitioners use internal and external tools that can help a
company understand their business communications and strategy development. SNA is also
key to articulating the role of relationships during reorganizations and mergers. In addition,
deep computing capabilities can help a company find patterns -- on a macro-scale -- that take advantage of the massive amounts of data that have become available in recent years.

**Two industries: Retail and Transportation**
The retail industry has already made significant investments in gathering and sharing data about its customers. SNA can be used to help identify clusters for targeted marketing and also to determine who has influence within communities or who might provide connections across communities or groups. Beyond marketing, SNA can provide information that can be used to build loyalty, by developing and supporting communities. In addition, SNA seems likely to build and enhance the identification of patterns used to detect fraud.

The transportation industry has long been aware of the value of social units. Marketing is often targeted toward affiliation groups and families. Social network analysis can provide a look at the roles and relationships within social groups that can be used to expand the marketing base and increase social ties within groups that travel together. This could be particularly powerful when used in combination with experience architecture.

**Some strategies**
SNA is a powerful tool for solving current problems. Business structures, whether formally hierarchical or networked or market-based, have become more ambiguous and fluid as technology has connected people within the organization. Companies can use SNA to better understand their structure and to gain a deeper understanding of how their clients are organized and how they might be supported by the company’s goods or services.

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References


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14. People can belong to a variety of communities. Examples include: practitioners engaged in similar lines of work (like cabinet makers); employees across various functions that support a common product line; or students from different schools who are all interested in chemistry. SNA requires intense evaluation of, and sensitivity to, differences between individuals and communities. Even as the needs of the individual are detected, they must be balanced against the actual or potential needs of the community as a whole.

**Other sites of interest**

Amazon.com
http://www.amazon.com

Analytic Technologies
http://www.analytictech.com/

International Network for Social Network Analysis
http://www.heinz.cmu.edu/project/INSNA/

Collaborative filtering
http://www-1.ibm.com/services/insights/etr_collaborative.html

Communities of practice

Content management
http://www-1.ibm.com/services/insights/hear_td.html

Experience architecture

Global positioning systems
Social network analysis

http://www-1.ibm.com/services/insights/etr_gps.html

Grid systems
http://www-1.ibm.com/services/insights/etr_grid.html

About this publication

Executive Tek Report is a monthly publication intended as a heads-up on emerging technologies and business ideas. All the technological initiatives covered in Executive Tek Report have been extensively analyzed using a proprietary IBM methodology. This involves not only rating the technologies based on their functions and maturity, but also doing quantitative analysis of the social, user and business factors that are just as important to its ultimate adoption. From these data, the timing and importance of emerging technologies are determined. Barriers to adoption and hidden value are often revealed, and what is learned is viewed within the context of five technical themes that are driving change:

Knowledge Management: capturing a company's collective expertise wherever it resides -- databases on paper, in people's heads -- distributing it to where it can produce big payoffs

Pervasive Computing: combining communications technologies and an array of computing devices (including PDAs, laptops, pagers and servers) to allow users continual access to the data, communications and information services

Realtime: "a sense of ultracompressed time and foreshortened horizons, [a result of technology] compressing to zero the time it takes to get and use information, to learn, to make decisions, to initiate action, to deploy resources, to innovate" (Regis McKenna, Real Time, Harvard Business School Publishing, 1997.)

Ease-of-Use: using user-centric design to make the experience with IT intuitive, less painful and possibly fun

Deep Computing: Using unprecedented processing power, advanced software and sophisticated algorithms to solve problems and derive knowledge from vast amounts of data

This analysis is used to form the explanations, projections and discussions in each Executive Tek Report issue so that you not only find out what technologies are emerging, but how and why they'll make a difference to your business. If you would like to explore how IBM can help you take advantage of these new concepts and ideas, please contact us at insights@us.ibm.com. To browse through other resources for business executives, please visit: ibm.com/services/insights
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