How Social Networks can leverage and enable Web 2.0 & Semantic Web/Grid

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OUTLINE

- Trend towards virtual team science
- Multilevel motivations for creating, maintaining, dissolving, and reconstituting social and knowledge network links.
- Technologies to harvest and enable social networks in virtual communities
- Examples: CI-Scope, Tobacco research, Emergency Response, World of Warcraft, Communities of Practice
Move to Team Science

Studies of 19.9 million research articles over 5 decades as recorded in the Web of Science database, and an additional 2.1 million patent records from 1975-2005 found three important facts.

1. For virtually all fields, research is increasingly done in teams.

2. Teams typically produce more highly cited research than individuals do (accounting for self-citations), and this team advantage is increasing over time.

3. Teams now produce the exceptionally high impact research, even where that distinction was once the domain of solo authors.

Sources: Wuchty, Jones, and Uzzi, 2007a, 2007b
The trend toward virtual communities was not driven by a growth in teamwork by scientists working with other co-located scientists. Using the Web of Science database to analyze the collaboration arrangements of over 4,000,000 papers over a 30 year period, they found that:

1. Team science is increasingly composed of co-authors located at different universities.

2. These “virtual communities of scholars” produce higher impact work than comparable co-located teams or solo scientists.

3. This change is true for all fields and team sizes, as well as for research done at elite universities

Source: Jones, Wuchty, Uzzi, 2008
Multidimensional Networks in Web 2.0
Multiple Types of Nodes and Multiple Types of Relationships
WHY DO WE CREATE, MAINTAIN, DISSOLVE, AND RECONSTITUTE OUR COMMUNICATION AND KNOWLEDGE NETWORKS?
Social Drivers:

Why do we create and sustain networks?

- Theories of self-interest
- Theories of social and resource exchange
- Theories of mutual interest and collective action
- Theories of contagion
- Theories of balance
- Theories of homophily
- Theories of proximity
- Theories of co-evolution

Sources:
A contextual “meta-theory” of social drivers for creating and sustaining communities

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<tr>
<th>Theory</th>
<th>Exploring</th>
<th>Exploiting</th>
<th>Mobilizing</th>
<th>Bonding</th>
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Projects Investigating Social Drivers for Communities

**Science Applications**
- VOSS: Understanding & Enabling CI in Virtual Communities *(NSF)*
- CP2R: Collaboration for Preparedness, Response & Recovery *(NSF)*
- TSEEN: Tobacco Surveillance Evaluation & Epidemiology Network *(NSF, NIH, CDC)*

**Business Applications**
- PackEdge Community of Practice *(P&G)*
- Kraft Design Teams *(Kraft)*

**Societal Justice Applications**
- Cultural & Networks Assets In Immigrant Communities *(Rockefeller Program on Culture & Creativity)*
- Mapping Digital Media and Learning Networks *(MacArthur Foundation)*

**Entertainment Applications**
- Virtual Worlds Exploratorium *(NSF, Sony Online Entertainment, Linden Labs)*

**Core Research**
- Social Drivers for Creating & Sustaining Communities
### Contextualizing Goals of Communities

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<th>Community</th>
<th>Exploring</th>
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<td>PackEdge Communities of Practice</td>
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<td>Tobacco Surveillance, Evaluation &amp; Epidemiology Community</td>
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Challenges of empirically testing, extending, and exploring theories about networks … until now
Enter Semantic Web/Web 2.0
Its all about “Relational Metadata”

- Technologies that “capture” communities’ relational meta-data (Pingback and trackback in interblog networks, blogrolls, data provenance)

- Technologies to “tag” communities’ relational metadata (from Dublin Core taxonomies to folksonomies (‘wisdom of crowds’) like
  - Tagging pictures (Flickr)
  - Social bookmarking (del.icio.us, LookupThis, BlinkList)
  - Social citations (CiteULike.org)
  - Social libraries (discogs.com, LibraryThing.com)
  - Social shopping (SwagRoll, Kaboodle, thethingsiwant.com)
  - Social networks (FOAF, XFN, MySpace, Facebook)

- Technologies to “manifest” communities’ relational metadata (Tagclouds, Recommender systems, Rating/Reputation systems, ISI’s HistCite, Network Visualization systems)
CI-KNOW: Harvesting the online community's relational meta-data

INPUTS
- Cybercommunity
- Resources
- Cyberinfrastructure
- Use
- External Resources

Generating a Multi-Dimensional network

PROCESSES
- Network Maps
- Network Referrals

OUTPUTS
- Network Diagnostics
- Users’ Profiles
- Documents
- Collaboration Tools
- Datasets
- Analysis Tools
- Bibliographic DBs
- Personal Websites
- Organizational Websites
- Project Websites
- Patent Databases

1. Algorithms to generate Network Referrals
2. Algorithms to create Network Maps
3. Algorithms to compute Network Diagnostics

Linking all data together

Using Tools to Analyze Datasets

Using Chats, Forum

Downloading Presentations

User activity logs related to cyberinfrastructure

Organizational Websites
Project Websites
Patent Databases

SONIC
Advancing the Science of Networks in Communities
CI-KNOW: Harvesting the online community’s relational meta-data

INPUTS
- Cybercommunity Resources
- Cyberinfrastructure Use
- External Resources

Generating a Multi-Dimensional Network
1. Who to contact for what topic
2. What tools to use

OUTPUTS
- Network Maps
- Network Referrals
- Network Diagnostics

1. What nodes are important for what relations
2. The amount of scanning, absorption, diffusion, robustness, vulnerability in a network
Design Examples:
Mapping & Enabling Networks in ...

Tobacco Research: TobIG Demo

Computational Nanotechnology: nanoHUB Demo

Cyberinfrastructure: CI-Scope Demo

Oncofertility: Onco-IKNOW
Summary

- Research on the dynamics of networks is well poised to make a quantum intellectual leap by facilitating collaboration that leverages recent advances in:

  - Theories about the social motivations for creating, maintaining, dissolving and re-creating social network ties
  
  - Development of cyberinfrastructure/Web 2.0 provide the technological capability to capture relational metadata needed to more effectively understand (and enable) communities.
  
  - Exponential random graph modeling techniques to make theoretically grounded network recommendations that go beyond the Lovegety and SNIF
Acknowledgements