Understanding the Open Source Software Community

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Open Source Software (OSS)

- Free ...
  - to view source
  - to modify
  - to share
  - of cost

- Examples
  - Apache
  - Perl
  - GNU
  - Linux
  - Sendmail
  - Python
  - KDE
  - GNOME
  - Mozilla
  - Thousands more
Unanswered Questions

- What is the motivation of the developers?
- Is this a new form of software development?
- Is this the future of work?
- Why do some projects “succeed” while others fail?
- …and many more
Data Set

• SourceForge.net
• Over 100,000 software projects and 1,000,000 registered users as of May 2005.
• Recent agreement between ND and SourceForge.net to get monthly data.
• http://www.nd.edu/~oss
Methodology

• Data Mining
• Network Topological Analysis
• Agent-based Simulation
• Social Network Analysis
• Public Goods Theory
• Future Directions
Data Mining

• Gao, Huang, and Madey; NAACSOS 2004
• Algorithms for prediction, categorization, clustering, and pattern finding.
• Computer scientists love this stuff!
• Just plug the data into the algorithms and out pops the answers, no social theory required!
• Conclusion-- Able to predict very well the failed projects but not the successful projects.
• Limitation-- Algorithms are not sophisticated enough for highly-(inter)dependent, temporal data produced by self-organizing phenomenon.
Social Network

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Developer Network

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Project Network

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Projects

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Developers
Network Topology

- Xu, Gao, Christley and Madey; HICSS 2005
- Degree distribution, Connected components, Clustering coefficient, Diameter
- Small-world network
- Scale-free network (within a range)
- Conclusion-- Interesting global properties but gives little insight about the underlying mechanisms.
Agent-based Simulation

- Gao and Madey, ADS 2005
- Simulate the growth and evolution of the social network.
- Projects and users are agents; rate of new projects and users join the community and/or projects calibrated with data set.
- Users join projects based upon preferential attachment.
- Conclusion-- Had to introduce the notion of project fitness to match the data set.
- Limitation-- Model of reality? …Not exactly. Many models can produce the same global structures. Users don’t have global knowledge about all projects.
Social Network Analysis

- Xu, Christley and Madey; NAACSOS 2005
- Community structure, Betweenness, Assortativity (homophily) between projects within each community.
- Conclusion-- Over 1500 communities; mild assortativity between projects on attributes like OS, programming language.
- Limitations-- What do the communities mean?
- Future-- temporal analysis
Public Goods Theory

- Christley and Madey, Agent 2004 Workshop
- Collective action out of mutual self-interest, jointness of supply, impossibility of exclusion, free rider phenomenon, connectivity, communality
- Characteristics of Individuals, Group, Environment; Action processes
- Conclusion-- Fits well as a descriptive model, All elements are dynamic and change over time, Critical mass is non-monotonic decision function, agent-based model as future work.
- Issues-- Calibration difficult, Time evolution and dynamics versus some “final result”. Complexity out of complexity.
Future Directions

• Positional Analysis
  – Weighted, multi-relational (21) social network.
  – Approximate structural equivalence
  – Clustering and temporal analysis

• Hackman’s model of team effectiveness
Thank You!