Social Resilience in Online Communities: The Autopsy of Friendster

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Outline

1. When Online Social Networks Die
2. Measuring Social Resilience
3. The Autopsy of Friendster
Chair of Systems Design at ETH Zurich

Main Research Areas

- **Economic Networks & Social Organizations**
  - e.g. ownership networks, R&D networks, financial networks, ...
  - e.g. online communities, OSS projects, animal societies, ...

Methodological Approach: Data Driven Modeling

- **economic databases**: Bloomberg, patent and ownership databases
- **digital traces**: user interaction, OSN, activity volumes
When Online Social Networks Die

1. When Online Social Networks Die

2. Measuring Social Resilience

3. The Autopsy of Friendster
When Online Social Networks Fail

What are the reasons that drive large amounts of users away from an Online Social Network?
Researching on the death of OSN

When Online Social Networks Fail

What are the reasons that drive large amounts of users away from an Online Social Network?

Internet Archaeology

Analysis of the non-written traces of a disappeared society, aiming at understanding the way it worked and its demise.

The Onion on Friendster:

- “Millions of profiles left utterly untouched”
- “The users prized photos of themselves drinking”
- “Friendster was a primitive society lacking video comments, status updates”
Social resilience and users leaving an OSN

Social Resilience

The ability of the community to withstand external stresses, disturbances, and environmental changes

Stresses for OSN include changes in the user interface, technical problems, threats to privacy, rumors, competing sites...
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- Users have a cost $c$ of using the network (global constant)
  - Time to learn to use, standing ads, fees...
- User benefit $b$ is a function of its social environment
  - Information and attention from social contacts
Social resilience and users leaving an OSN

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- If $c/b < 1$ a user will stay active, or leave otherwise
Finding the users remaining in an OSN

Cascades of users leaving the OSN

- When a user becomes inactive, its friends lose benefit
- The cascade stops at a generalized $K$-core decomposition
- Our assumption: $b$ is proportional to the amount of active friends

Under certain cost $c$, there is a critical $K$ for which the $K$-core of the social network will remain active
Cascades of users leaving a social network
Measuring Social Resilience

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We measured the resilience of five OSN

<table>
<thead>
<tr>
<th>name</th>
<th>date</th>
<th>status</th>
<th>users</th>
<th>links</th>
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<tr>
<td>Facebook</td>
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<td>failed</td>
<td>117M</td>
<td>2580M</td>
<td>Internet Archive</td>
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</table>

**Friendster**

- Founded in 2002
- Reached 20M users in the United States
- Became popular in Southeast Asia, reaching 117M accounts
- Friendster discontinued its OSN service, deleting all profile data
- The Internet Archive crawled as much as possible
- Now Friendster is a flash games site
Empirical K-core decompositions
The social resilience of the five OSN

- The CCDF of the k-core distribution measures the amount of active users under certain cost and benefit conditions
- No network is the best under every condition
- The survival of an OSN does not just depend on its topology
Not power-law degree distributions

A rumor can survive forever in a network with a Power-Law degree distribution

- ML estimation of Power-Law fit
- Evaluation: Kolmogorov-Smirnov test
  - Null hyp: degree distribution follows PL

<table>
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<th>$\hat{\alpha}$</th>
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</tr>
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</table>

- Kolmogorov-Smirnov on ML estimates contradict eyeballing on PDF
The Autopsy of Friendster

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Limited connectivity patterns

- 10M user id bins - connections to future (red) and to past (blue)
- Connectivity to future users is limited in time distance
- Initial community was cohesive but did not bring many new users
Microdynamics of users becoming inactive

- We estimate user as inactive when it does not create new friendship links
- Once a user starts losing friends: when does it become inactive?
- Likelihood of becoming inactive given amount of active friends

Active friends as benefit
- Users with less active friends were more likely to leave
Time series of OSN risk

- Amount of nodes below median of coreness (100K bin)
- Shock at 20M (US collapse), decay after 80M
Simulating Friendster’s collapse

- Estimation of active users through Google search trend
- Simulation of cascades with deteriorating conditions
- $R^2 = 0.972$
Summary

1. We designed a rational model for users leaving an OSN
   - Decision depending on costs and benefits
   - Changes in costs and benefits create cascades that stop at k-cores

2. We measured the social resilience of five OSN
   - K-core decompositions show that no network is the best
   - Costs and benefits analysis is necessary to predict OSN success
   - Statistical analysis rejects power-law degree distributions

3. We analyzed the life and death of Friendster
   - Validated our assumption on user benefits related to active friends
   - Time evolution of coreness shows risky periods
   - Collapse is reproduced by the cascades of our model