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Introduction

We study bond and site percolation in four real social networks [1]: two Internet society of friends consisting of over 10^6 and 10^7 people, over 10^6 users of music community website and over 5×10^6 users of gamers community server.

We study the properties of the diluted network, i.e. when a fraction p_n of nodes or p_b of bonds retained in the network. If p is large enough the network remains connected and exist a giant component. Below a certain threshold p_c the giant components disappears. Above the threshold the network is in a percolating phase [2]. Percolation in real-world networks is widely recognized as a key problem of interest. Some examples of possible applications are the robustness of communication networks (e.g. the Internet) for random failure, the efficiency of preventive vaccination against the spread of disease or information propagation in networks (e.g. rumor spreading).

Networks under investigations

The aim of this work is to investigate bond and site percolation in four different on-line social networks. Two of them are large social networks of an Internet community, which consists 10^6 (Grono; www.grono.net) 10^7 (Skyrock) individuals. There is one important divergence between Grono and other systems. In the case of Grono membership is strictly invitation only; existing members can invite an unlimited number of friends to the network via email, who, if they choose to do so, join the network by an initial link connecting to the person who invited them. The Skyrock project was started on the website www.skyrock.com. During its existence, it has grown into a well-known social phenomenon among (mainly French-speaking) Internet users. In both systems all users can add, by mutual consent, and remove other people from their databases of friends. In this way undirected friendship network is formed.

The third system under investigation is LastFM - the music community server, and more exactly the part of it known as Audioscrobbler project which was started in year 2002. There is about 10^6 users of this system. Data gathered by the web-service is used to find users with similar music taste. On that basis people with similar music taste and songs they often listen to is present and recommended to users who can see this information on their profile web site via web browser. This way people with similar music taste can meet each other and have the possibility to make friends (mutual consent is required).

The fourth system under investigation is XFire. It is gamers community program similar to every Internet Chat systems, marked out its integration with almost all popular computer games. People who like to play computer games are using this application to keep in contact with other players even when they don't play any game in that moment or play two different games. For this purpose they add other people into their friend list (mutual consent is required) and have possibility to see which game their friend plays, how much overall time they played and can always chat with this person when online. X-fire allows to see friends of your friends so people have greater chance to make new acquaintanceship.

Preliminary results

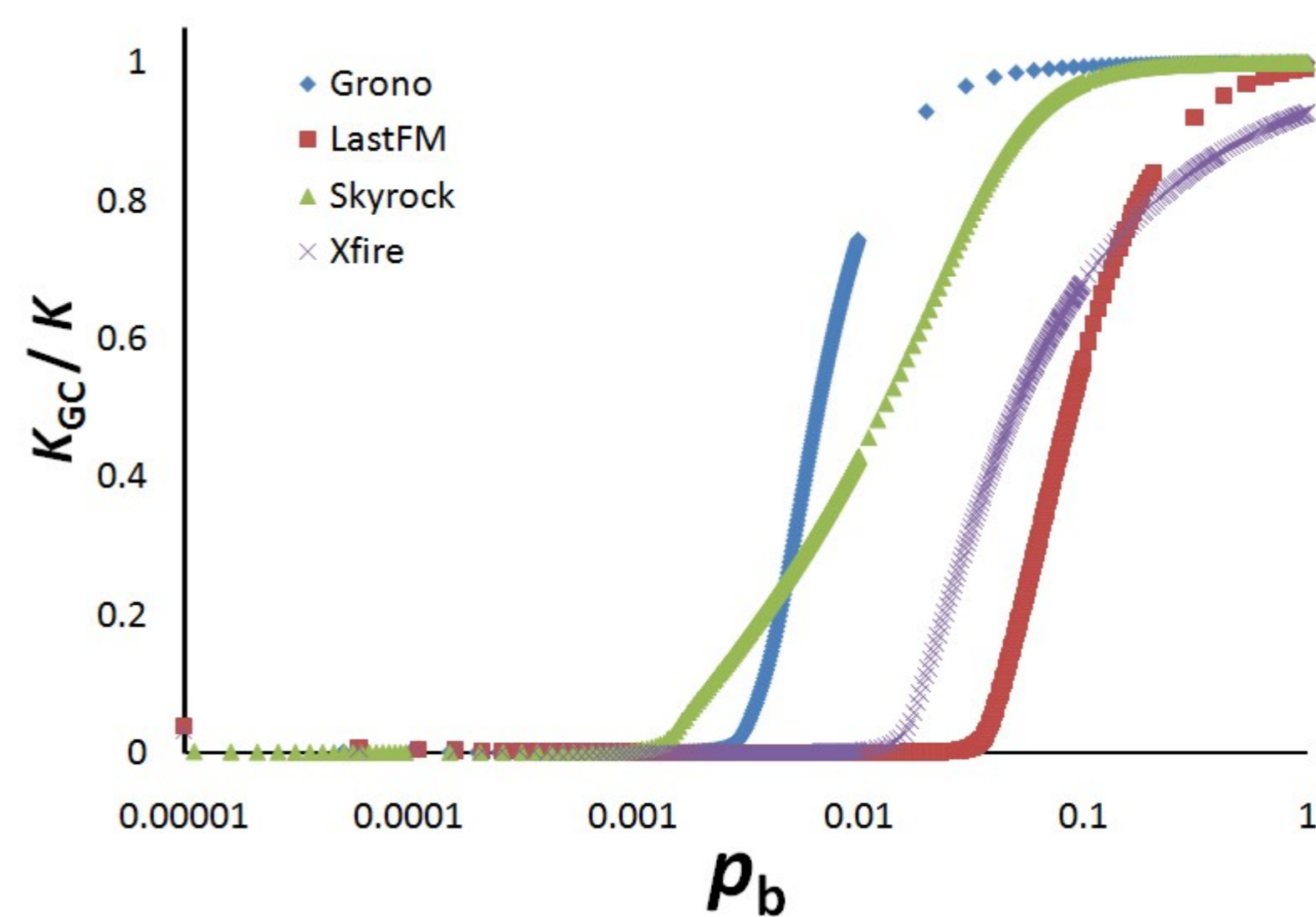


Fig.1. Relationship between relative number of bonds in Giant Component and probability p_b .

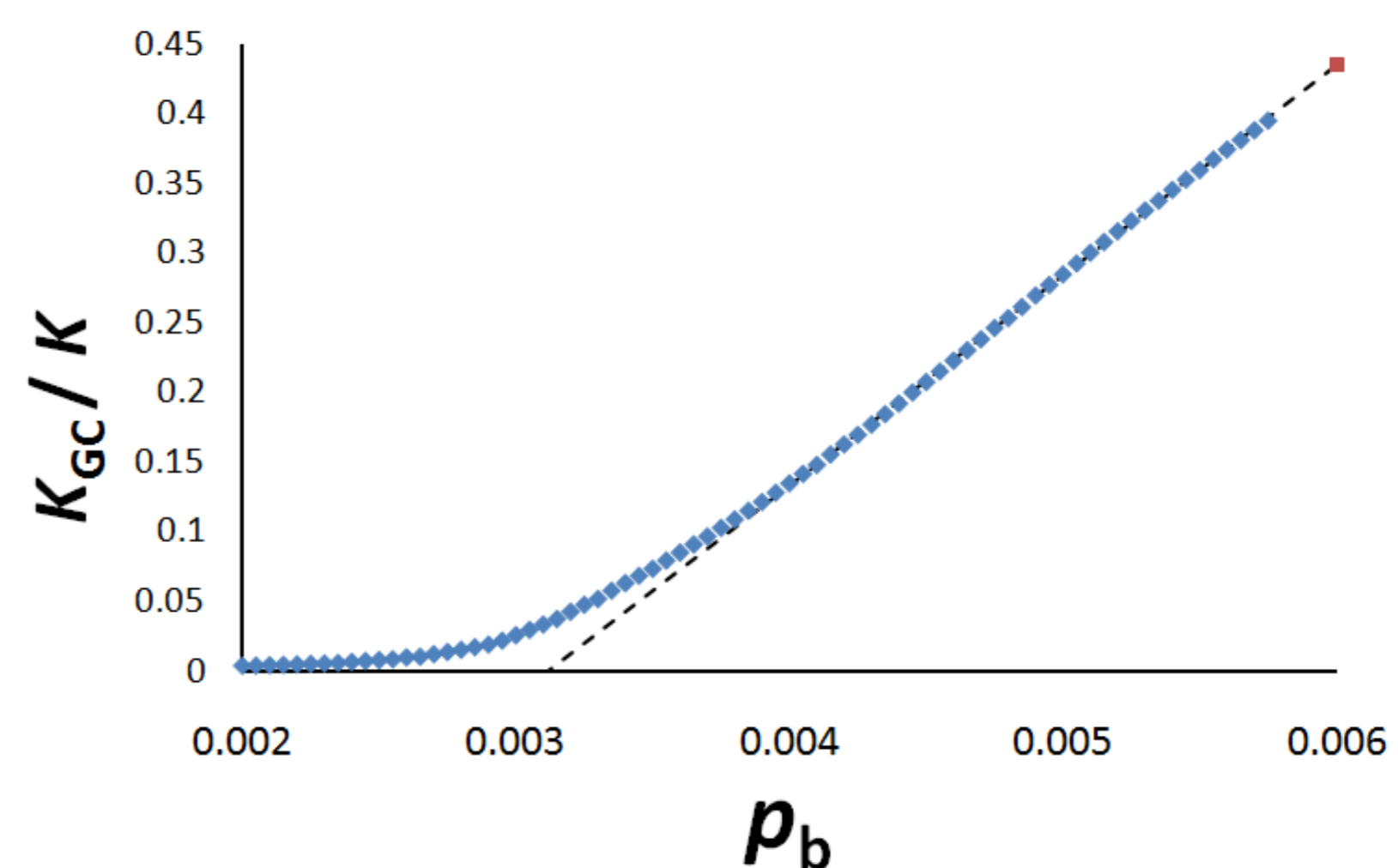


Fig.2. The relative number of bonds in Giant Component increases linearly with probability p_b for $p_b \approx p_c$.

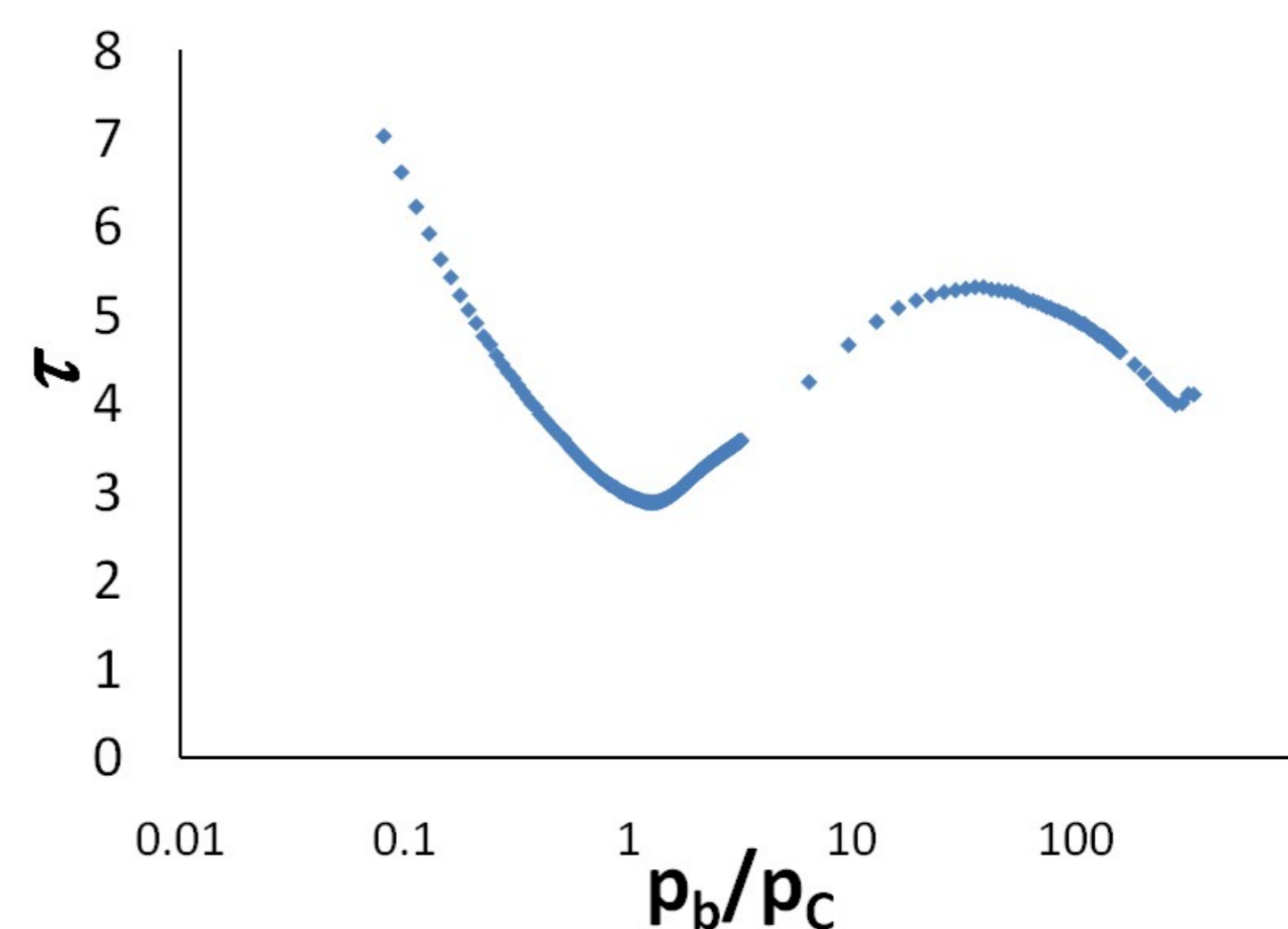


Fig.3. Components size distribution can be fit to power-law $P(S) \sim S^{-\tau}$. This figure shows relationship between exponent τ and probability p_b ; a minimum is visible for $p_b \approx p_c$.

The Bibliography:

- [1] A.Grabowski, N.Kruszewska and R.Kosiński, "Properties of on-line social systems" Eur. Phys. J. B 66, 107-113 (2008)
- [2] R.Cohen, K.Erez, D.Avraham and S.Havlin, "Resilience of the Internet to Random Breakdowns", Physical Review Letters 85, 4626-4628 (2000)