A model for investigating motivations of hybrid wireless community participants

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Abstract—The emergence of wireless communities offers an attractive alternative to operator-centric models for providing broadband wireless services. While the first attempts of purely self-organized communities have been limited by the difficulty of attracting enough members willing to share their resources with the community, newer hybrid wireless communities (where a firm supports and incentivizes individuals who share their infrastructure in exchange of being able to exploit the network) is developing rapidly. This difference suggests the importance of attracting and motivating members with suitable incentives. While this is widely recognized as a key issue, existing research is limited to pure communities and does not adequately cover hybrid communities. Our research project intends to address this shortcoming by focusing on hybrid communities, building an adapted theoretical model considering specific motivations and collecting empirical evidence using mixed qualitative and quantitative methods like content analysis, interviews and a large-scale survey. As this is a research-in-progress, only the first results of the project are shown, namely an adapted theoretical model and some evidence from a content analysis of hybrid wireless community forums. Participation appears to be motivated by tangible rewards (free network access, revenue sharing), social rewards (socializing with peers and feel part of a community), psychological rewards (pursuing idealistic goals and feeling competent) and intrinsic enjoyment, but hindered by participation efforts (monetary costs and required effort) and other concerns (security, legality and bandwidth use).

Keywords: hybrid wireless communities, motivation, participation

I. INTRODUCTION

In the last decade, broadband wireless Internet access has grown at a rapid pace. Surprisingly, this has not firstly come from 3G networks but from WLAN technologies [1]. While mobile operators had problems deploying their 3G networks, a grassroots movement has quietly deployed open WLAN hotspots, transforming it from a mere indoor cable substitute into wireless broadband community networks [2].

This movement quickly started to organize by means of wireless communities: organizations formed by a group of individuals sharing their wireless access points and providing free wireless Internet access in their areas to others. With the diffusion of flat-rate Internet connections and cheap WLAN equipment, such communities were deemed as an alternative to 3G in densely populated areas where access points could be nearly everywhere [3].

Drawing on the similarity with peer-to-peer networks, some analysts claim that wireless communities may bring a napsterization of wireless communication, possibly realizing a free wireless Internet for everyone everywhere [4]. Alike, others foresee large wireless self-organized ad-hoc networks where devices relay communication to each other to extend the current patchwork of WLAN hotspots to “a wireless grid in which users will self-organize to manage their own local networks and peer with others to create a distributed system capable of providing broadband Internet services” [5].

The greatest issues, however, are not technical but social: those communities need the involvement of many members willing to share their resources to be viable. Since the value of a community depends on network externalities (more members means a larger and more valuable network which, in turn, attracts more users and so forth), building critical mass is a key imperative for growth [6].

It is worth noticing that in addition to ‘pure’ communities that are exclusively built and operated by members in a self-organized way, entrepreneurial firms also created ‘hybrid’ communities, where the firm supports individuals who share their access points within a community network by offering them technical support and incentives (free network access, subsidized equipment, revenue sharing etc.) in exchange of being allowed to exploit the network (by selling equipment, advertising or connectivity to non members).

This difference is important, because while pure wireless communities have emerged first, their development has been limited due to “commercial, technical, social and political barriers” [7]. The key problem is that they could not get a critical mass of members to contribute their resources to the community, probably because they did not offer enough benefits and had legal and security concerns [8]. In contrast, some hybrid communities have grown at a remarkable pace: the launch of promising projects like Wisher and the huge development of FON - capable of attracting partners like BT, Neuf and thousands of members in a few years - are illustrative of the large potential of these hybrid communities.

A reasonable explanation of their different development is that hybrid communities are able to overcome the effort and motivation barrier by letting the underlying firm offer an easy-to-use solution along with an attractive mix of incentives to convince people to join the community and share their resources.

In order to grasp the mechanisms underlying the possible formation, expansion and sustained existence of wireless communities, the key research question is therefore to understand what motivates individuals to voluntarily join and actively participate in a wireless community. Notice that...
besides initial motivations to join a community, which are critical for assessing their initial development, understanding how motivations evolve is useful to assess their sustainability as members must be kept involved over time. The reasons that induce members to continue or stop participation may be different from those that made them join: some may join a community to get short term benefits like connectivity or subsidized equipment and cease to participate thereafter.

II. LITERATURE REVIEW
A practical starting point for describing the state of art of research on wireless communities and the motivation of their members is a literature review from Bina and Giaglis [9]. This study found that 8 out of the examined 40 papers on WLAN (but practically all non-technical papers) recognize the importance of attracting and motivating members to join the community to ensure its growth and sustainability.

This review shows that research on this issue has yet to develop suitable theoretical models and support them with substantial evidence. In particular, the earliest papers [10-13] simply highlight the importance of identifying motivations and devising incentives to attract members, but do not offer concrete examples. Two subsequent papers [2, 14] go further by proposing a list of motivations (create a cooperative spirit, gain prestige in the community, challenge telecom firms and promote free communication) but do not empirically validate them. The two last papers draw on the similarity with other collective structures like cooperatives [15] and commons [1] to show two key problems due to the divergent interests of individuals and the community: fostering collective actions to build the community even though individuals may avoid the cost of contributing and free ride on the effort of others, and avoid the temptation of individuals to consume as much of the collective good for themselves which can lead to an overuse and eventual collapse of the common network.

Based on this review, the authors propose a research agenda on wireless communities where “the main research question refers to the assessment of the role of individuals - visitors and members alike - in the formation, growth and survivability of wireless communities” [9] and that this requires assessing “why do people voluntarily participate and put up effort in community-based WLANS” [16].

Since the publication of this agenda, a few authors have tried to tackle this challenge. A first attempt from the same authors [16] results in an interesting theoretical model for explaining participation in a wireless community based on Self Determination Theory [17] and adapted to the context of wireless communities based on interviews with members of the Athens Wireless community. This model suggests that members participate due to a mix of intrinsic motivations (it is enjoyable or satisfies needs of competence, autonomy and relatedness), obligation-based motivations (to abide norms of reciprocity or other community shared values) and extrinsic motivations (explicit rewards, external pressure, self-esteem, ego involvement, personal connectivity needs, human capital, career prospect, altruism and ideological aspirations). On the other hand, members may be dissuaded from the perceived effort (which includes both monetary and opportunity costs) to join and participate in the community.

The model is tested in two subsequent papers based on surveys submitted to wireless community members. The first [18] presents data from 170 community members in Greece suggesting that different groups of members participate for different mixes of intrinsic and extrinsic reasons, with the former being more prevalent. The second [19] replicates the study with Australian communities, confirming that their members participate more for intrinsic than extrinsic reasons.

More recently, a case study on wireless communities by Cho [20] shows similar motivations, but proposes that short-term motivations based on personal interest (fun, learning, social or professional networking, getting free WiFi access) are complemented by long-term motivations based on public interest like promoting inclusion in the Information Society, media democracy and civic activism.

Wong and Clement [21] study what hinders potential members to participate in a community. People seem to be reluctant to share their network connections because they consider it difficult to participate, lack trust in strangers, fear that this may endanger their security or privacy, and worry that this will impair their available bandwidth. On the other hand, this survey also shows that sharing would be more viable if users could be assured it does not slow their connection, harm their privacy, security or offers tangible benefits like cost sharing or improved reliability.

Abdelaal et al. [22] inspect various types of contributions from members (time, money, expertise, sharing, hardware, software) and show the importance of social capital besides technical and economic benefits, proposing that communities “were built by technology developers to obtain expertise [but] have been redirected to achieve social objectives”.

Finally, Shaffer [23] surveyed 43 members from various WiFi communities (12 from for-profit communities) finding that motivations mostly involve a commitment to expanding broadband access, personal gratification from using technical skills and selfish motivations like getting nomadic network access, but barely to save money or challenge ISPs. On the other hand, members have concerns about signal reliability, speed, security and privacy. Shaffer also suggests ideological differences between members of each type of community.

This literature review shows that understanding members motivations is a critical research issue that gets increasing attention. Yet, existing research comes short in terms of the type of wireless communities covered, the lack of theoretical models and their limited empirical validation.

With regard to the type of communities, past studies have focused only on pure communities but did not cover hybrid ones (except [24], which however only analyzes economic motivations using a theoretic game-theory model). This is a key point as the differences between both communities are large enough to expect that motivations are different. Indeed, studies on other virtual communities show that motivations also depend on the governance structure of a community, i.e. whether it is sponsored by a firm [25]. It is also known that rewards have a negative effect on intrinsic motivation [26] and that size influences what incentives foster participation as social factors become less effective in larger groups [27]. While pure communities logically attract people for intrinsic reasons, it is expected that hybrid communities that are
supported by a firm, are larger and offer extrinsic rewards attract members with more utilitarian motivations.

With regard to the lack of alternative theoretical models, existing research has mostly been conceptualized using self-determination theory [16] or suggests similar motivations. While this offers a variegated set of motivations, it is useful to consider a broader set of motivation theories and studies in other virtual communities to explore other motivations and better justify their impact on participation (cf. section IV).

With regard to the empirical validation, existing research has collected some evidence about various motivations, but has not really tested their relationships with participation and more evidence shall be collected from larger samples.

III. METHODOLOGY

The contribution of this research project lies in addressing these shortcomings by extending the field of application to hybrid communities, by developing an adapted model that takes into account their peculiar contexts and a broader set of motivation theories, and by collecting and analyzing more extensive empirical data using mixed qualitative and quantitative methods. Our project consists in four steps.

The first step is to develop an adapted theoretical model to explain why individuals choose to participate in a hybrid wireless community. The model draws on existing research about pure wireless communities, a broader set of motivation theories and studies in other forms of virtual communities.

The second step is to refine and adapt this model through a qualitative analysis based on a content analysis of wireless community forums and explorative interviews with a sample of community members. This allows us to complement the theoretical model with evidence from community members, delve deeper into their motivations and check whether other motivations shall be considered.

The third step is a confirmatory analysis of the model by collecting empirical data from a large-scale survey so as to increase the validity and generalizability of our results. The survey will use whenever possible tested measurement scales to get reliable and comparable results and will be analyzed with quantitative methods like structural equation models.

In a fourth step it is envisioned to conduct a second round of interviews with the same members in order to see whether their motivations and participation change over time.

Since this research project has only recently begun and is still in early progress, we can here only provide an account of the first step and part of the second by showing our model and some preliminary evidence of a qualitative content analysis of member posts in wireless community forums.

IV. A MOTIVATION MODEL FOR HYBRID COMMUNITIES

A good starting point for developing a theoretical model for explaining participation in hybrid communities is the model proposed by Bina and Giaglis for pure communities [16]. This model suggests that participation is driven by a variety of intrinsic, obligation-based and extrinsic motivations but is negatively affected by the perceived effort to participate in the community. Other studies on pure communities support these motivations, adding public interest motivations and some key concerns like bandwidth, security and privacy.

This model has to be revised by considering the peculiarities of hybrid communities and broader theoretical bases. On the one hand, it is expected that hybrid community members are motivated more by extrinsic rather than intrinsic motives due to the presence of a sponsoring firm [25], the crowding-out effect of rewards on intrinsic motivation [26] and their larger size [27]. On the other hand, it is useful to consider a broader set of theories beyond self-determination theory to explore other motivational factors and better justify their impact on participation. Motivation is a popular research theme and there are many relevant theories. The expectancy-valence [28], TPB [29], TAM [30] and UTAUT [31] theories suggest other factors that can be relevant in hybrid communities like perceived usefulness (they offer tangible rewards and access to a larger network), ease of use (they offer a standard easy-to-use solution), social influence (they may have lighter social ties and less enticing social meanings) and facilitating conditions (they offer support). Research on volunteering [32] shows motivations like gaining knowledge, expressing values, abiding to social expectations, enhancing one’s ego or getting some reward: while the first three apply to pure communities, we expect hybrid communities to be largely driven by utilitarian rewards. Finally, innovation diffusion theories [33] may suggest that while pure communities dealt with early adopters driven by intrinsic reasons, hybrid communities cope with more mature segments who are keen on proven solutions and rewards.

Accordingly, the following hypotheses are proposed:

![Proposed theoretical model](image)

**H1**: participation is positively correlated with expected extrinsic rewards. It is expected that participation in a hybrid community is largely driven by its instrumental value. This is supported by many theories using similar concepts like self-determination theory’s external regulation, TAM’s perceived usefulness and UTAUT’s performance expectancy. In our case, members can expect extrinsic benefits like free access to a sizeable community network, equipment subsidies and some revenue-sharing income.

**H2**: participation is positively correlated with expected social rewards. As suggested by social exchange theory [34] people can be motivated by social rewards like reputation, respect, approval and friendship from others. Other theories
mention the role of social norms (TPB) and social influence (UTAUT). While this factor seems weaker than the previous and less strong than in pure communities, members are likely partly motivated by social reasons as hybrid communities provide various means by which members can interact with each other and often emphasize their social nature.

H3: participation is positively correlated with expected psychological rewards. People may act to satisfy basic needs like competence, autonomy, enhance self esteem and feeling of worth by performing behaviors for idealistic reasons [17]. While such reasons might be limited due to the sponsoring firm running the business, members may perceive the firm as a more enabler and still participate for idealistic goals.

H4: participation is positively correlated with intrinsic motivation. Intrinsic motivation stems from the enjoyment obtained by performing an interesting task for itself rather than for obtaining some separable outcome [17]. This is one of the most important motivations in pure wireless communities [18, 19]. It is therefore reasonable to think that intrinsic motivation also plays a role in our case, although it may mitigated by the presence of extrinsic rewards (cf. H5).

H5: intrinsic motivation is negatively correlated with expected extrinsic rewards. Many studies show that offering extrinsic rewards reduces intrinsic motivation [26, 35]. Since hybrid communities rely on extrinsic rewards like revenue sharing and advertise them strongly to attract more members, we can expect that this may reduce intrinsic motivation.

H6: participation is negatively correlated with effort expectancy. Assessing participation also requires examining the factors that hinder it. Basic economic theory suggests that an activity is done if its benefits outweigh its costs. In our context, costs are infrastructure expenses and opportunity costs in form of time and effort required to participate. Since hybrid wireless communities make it easy to join by offering low priced, easy to use equipment and support, we expect that effort is not as important as in pure communities.

H7: participation is hindered by security, privacy and legal concerns. People may also be reluctant to share their networks because they lack trust in strangers, fear that it slows their connections, that it endangers their privacy or consent may be illicit [8]. Even though hybrid communities provide a solution that requires members to authenticate, thus limiting privacy and security issues, and control their usable bandwidth, we believe that this concern can be strong.

V. A PRELIMINARY CONTENT ANALYSIS OF FON FORUMS
To validate this model with empirical evidence and better assess members' motivations, we performed a qualitative content analysis of the FON community forums (namely the official boards.fon.com forum and the unofficial German and Swiss forums: fonboard.de and fonero.ch).

Within these forums we analyzed 1100 threads, of which 196 discussed motivational factors. The threads were first coded by two independent coders according to the categories mentioned in our model and verified for intercoder reliability (only the matching items were considered). The results are summarized in the following table and each hypothesis is examined in more detail in the following paragraphs.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>boards.fon.com</th>
<th>fonboard.de</th>
<th>Foneros.ch</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1 tangible rewards</td>
<td>40</td>
<td>18</td>
<td>5</td>
<td>63</td>
</tr>
<tr>
<td>H2 social rewards</td>
<td>21</td>
<td>16</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>H3 psychological rewards</td>
<td>23</td>
<td>20</td>
<td>2</td>
<td>45</td>
</tr>
<tr>
<td>H4 intrinsic motivation</td>
<td>2</td>
<td>7</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>H5 effort</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>H6 cost / effort</td>
<td>36</td>
<td>3</td>
<td>2</td>
<td>41</td>
</tr>
</tbody>
</table>

H1: our results confirm that extrinsic motivations play a primordial role as tangible rewards are the most cited factor. Members mainly mention the importance of gaining free access to the network. More specifically, they expect to be able to connect easily to other hotspots whenever they roam, especially abroad: they care not only about the sheer number of accessible active hotspots but also about their quality of service in terms of availability, reliability and speed. Many express the need for accurate and up-to-date maps to find the hotspots. Some members even developed alternative maps where existing FON-spots can be certified and commented by visiting members. A few members mention the possibility of gaining some revenue. However, while some members living in attractive areas made an effort to deploy a good infrastructure to attract users and are able to make a small profit, most users do not really seem interested in earning money and consider it at best more as a marginal bonus than a motivation to participate in the community.

H2: social rewards are often mentioned but do not seem to be equally prominent. There are several complaints asking for better means to get in contact with other members and create a sense of “community” or “social network”. Some members try to organize conventions, tea times or online gatherings among Foneros at a local level to exchange ideas and get to know each other. In fact, increasing social contact between members seems to be more of an issue in local forums than in the general one. A further aspect is the need for a sense of participation of the firm within the community of Foneros as shown by the many complaints about the lack of communication between FON and its members.

H3: although being a hybrid community, idealistic motivations seem to play a significant role. Members often complain about FON’s service but praise the idea on which it is based and even point out that “it is worth joining FON for altruistic reasons”. Likewise, many members care about the spirit of sharing, reciprocity and complain about commercial agreements with some ISPs. The need of feeling competent is apparent within technical discussions. On the other hand, needs like autonomy and self-esteem are not mentioned often.

H4: Enjoyment and interest are rarely cited but may have a stronger role than on first-sight. There seem to be a strong commitment to computers and technologies, which can be seen by the following quote: “I enjoyed all of the configuring, testing, tinkering and hacking I did with Foneras”. There are even people who have fun studying the availability of FON
access points on their holiday trips in order to understand how usable and widespread FON effectively is.

H5: there is not much evidence that intrinsic motivation is reduced by extrinsic rewards except a few posts about members reacting to the extension of rewards by changing their status so as to charge their hotspot as well. In general, however, rewards are not perceived to be significant yet and since people can continue to provide access for free, the reactions may just indicate a need for reciprocity.

H6: as expected, effort is hardly mentioned in the forums even though there are many technical issues threads. While most just plug the router to get basic functionalities, others do not mind spending extra time to search improvements by discussing new technologies, organizing meetings, creating better maps, finding ways to enhancing infrastructure etc.

H7: legal issues seem to be a major concern in countries like Germany and Italy where legal actions against FON took place and in countries where ISPs have stringent rules. Bandwidth and security issues are also important: although FON claims to manage these aspects with its technical solution, some members worry about bandwidth abuses and do not find it safe enough.

VI. CONCLUSIONS

This paper describes the first results of a research project aiming at enhancing knowledge about member motivations in wireless communities by extending research from pure to hybrid communities, developing a theoretical model adapted for this type of community and collecting empirical evidence using mixed qualitative and quantitative methods. The article proposes a model suggesting that participation is driven by a mix of expected tangible, social and psychological rewards, intrinsic motivations and hindered by participation costs and other concerns. Unlike pure communities, it is proposed that extrinsic motivations are more salient. A content analysis of FON community forums offers some preliminary supporting evidence. Tangible rewards (free network access and, to a lesser extent, revenue sharing) are indeed the mostly cited factors, followed by psychological rewards (pursuing idealistic goals and feeling competent) and social rewards (socializing with peers and feeling part of a community). Intrinsic motivation and effort seem unimportant. On the other hand, concerns about legality, security, social and technical bandwidth issues are quite strong. Due to representativeness and self-report limits inherent to the methodology, these results shall only be considered as some preliminary insight that must be complemented by other methodologies (namely interviews and surveys with a representative sample of members) which will be carried out in the future steps of this project.

VII. REFERENCES