

Who is behind the Onion?

Understanding Tor-Relay Operators

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1. INTRODUCTION

Privacy-enhanced communication has become an increasingly important need with the rise of public awareness about privacy. Tor, the most well known privacy-enhancing network, now has around 2.5 million daily users [1]. The operation of the Tor network depends on global volunteers contributing their resources to sustain the quality of service, especially the Tor-relay nodes. Tor recruits volunteers through a community-based outreach, with volunteers informing and motivating others to join the network. However, although there are millions of Tor users and around 5000 active relays, there are far fewer relay operators. The Tor-relay network struggles to expand the number of voluntary relay operators [2,3,4]. It is even harder to encourage these volunteers to operate guard and exit nodes in the “guard-middle-exit” node structure of the Tor-relay network because volunteers who operate exit nodes accept additional social and legal risks. How to recruit new volunteer operators around the world and how to encourage volunteers to run guard/exit nodes have become two concerning issues for the Tor-relay network.

Although prior studies have proposed various recruiting strategies, such as using monetary incentives [2,3,4], we suggest that recruiting strategies should be based on the knowledge of Tor-relay operators’ motivations and constraints. Our study, in its early stages, explores the motivations of Tor-relay operators, their current constraints, and their expectations for financial support. To the best of our knowledge, we present the first exploratory study of Tor-relay network operators.

2. METHOD

We collected data via an online survey and disseminated the survey link through a Tor-relay mailing list. At this initial stage, we have 50 effective samples: 77.8% are male, 2.2% are female and 16.3% prefer not to say. The median age is 28-32 with 15.2% of participants between 18-22, 23.9% between 23-27, and 17.4% between 28-32. Other 43.5% are over 32.

Our questionnaire consists of six main sections: the management of relays, personal motivation, the evaluation of risks and constraints, knowledge sharing, community-based beliefs and demographics. In this poster, we provide a preliminary analysis of our participants’ responses and focus on their motivations, constraints and expectations for financial support.

3. RESULTS

3.1 General Picture of Tor-relay Operators

Data was collected about Tor-relay operators’ occupations, nationality, current living locations, the year they first became familiar with the Tor network, and the year they began operating relay nodes. Over 47.8 percent of operators were in a technology-related occupation, such as software engineering, hardware engineering, and system engineering. 15.2 percent were students and 8.7 percent were in an academic field.

As shown in Figure 1, most operators were from and located in Europe and North America, suggesting that Tor-relay nodes are centered in these two regions. As shown in figure 2, the years when participants first became aware of Tor are fairly evenly spread from 2002 to 2014, but participants showed a dramatic increase in operating Tor-relay nodes after 2013. This indicates that people might know about the Tor network for years before operating relay nodes. The dramatic increase in 2013 may have been related to current events about data breaches and governmental invasions of privacy.

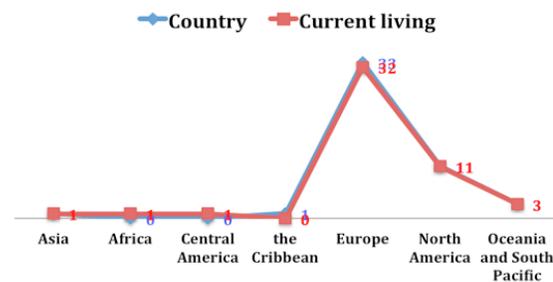


Figure 1. Geographic Regions of Tor-relay Operators

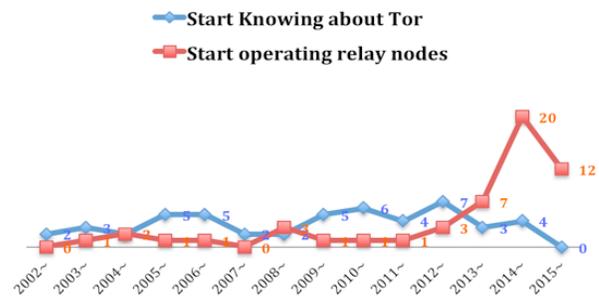


Figure 2. Starting Years for Knowing and Operating relay Nodes

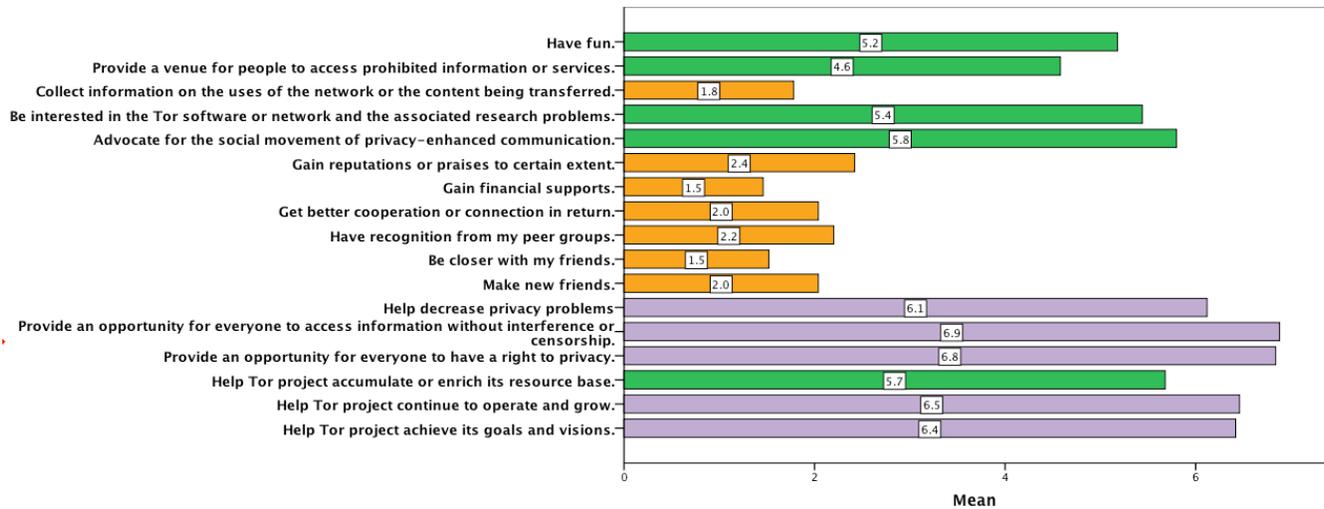


Figure 3. Motivations of Tor-relay Operators

3.2 Motivations of Tor-relay Operators

We explored the motivations of Tor-relay operators and found that the highest motivation was to “provide an opportunity for everyone to access information without interference or censorship.” The right to privacy was the next highest motivation. As displayed in Figure 3, most participants also indicated that they wanted to help the Tor project develop, achieve its visions, and decrease privacy problems (e.g., data breach, surveillance, identity theft). The advocacy of privacy-enhanced communication was also a relatively strong motivation. Conversely, items such as gaining financial support, being close to friends, collecting information on the uses of the network, getting better connection in return and having recognition from peers were not ranked highly as motivations. From the theory of motivation, most of the highly ranked motivations were intrinsic rather than extrinsic motivations [5], which deserves further exploration. Overall, our preliminary results suggest that voluntary operators are highly motivated by privacy-oriented values rather than external benefits.

3.3 Constrains and Financial Expectations

We investigated the constraints that Tor-relay operators face when running more relay or guard/exit nodes. Results indicated that participants do not run more relay or guard/exit nodes because they lack money (42%), they lack time (12%), or they lack both money and time (13%). The remaining 33% of participants do not operate these nodes for other reasons, such as lack of space, concern about legal issues, ISP restrictions, and negotiations with infrastructure providers. Participants also indicated that they do not want to run more nodes because the diversity of the Tor-relay network is important. In general, the lack of money (56%) seems to be the major constraint for many Tor-relay operators.

We further explored their expectations for financial support. 56% indicated that they do not need financial support, 29% expected a support subsidy, 13% expected the support to cover costs, and only 2% expected the support to exceed their costs. That is, around 44% of participants expected partial or full

financial support. Interestingly, the percentage of participants who expected financial support is lower than the percentage of participants who had concerns about monetary resources. Over half of participants (56%) stated that the lack of money was the main constraint, while another 56% of participants expressed that they do not need financial support. These findings reveal a contradiction between financial constraints and financial expectations that deserves further investigation.

4. CONCLUSIONS

Our preliminary results indicate that people may be driven by an important privacy issue (e.g., Snowden case) to actively support privacy-enhancing networks like Tor. Also, Tor-relay network encounters a dilemma: most participants are motivated and value privacy rights, but they are constrained by a lack of monetary resources. More analysis is needed to explore how to recruit more people from around the world. Additional analyses and findings will be presented in future papers.

5. REFERENCES

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