

An Assessment of Informational Threat in the Functioning Process of Virtual Community

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Abstract

In addition to the support functions of communication, an exchange of opinions, obtaining information, business organization and management, social networks have increasingly become an objects and instruments of external communicatory-psychological management and the arena of informational antagonism at different levels. Social networks have become the perfect tool of influence on national interests in the informational area. In order to prevent informational threats in virtual communities and to prevent implementation in the real world there is a need to assess their performance at the stage of their functioning in social networks.

Key words: virtual communities, social networks, informational security, informational threats

1. Introduction

With the development of social networks and their growing number of users, due to the constant improvement of their tools they become an ideal platform for the formation of virtual communities. Virtual communities in social networks this is a set of discussions which are created by the registered participants of a social network and unite on the basis of the purpose and ideology of living [5].

Along with constructive virtual communities which aim to interact actively with society, for the purpose of life improving as societies as a whole, and separate social groups and individuals on social networks are even more often used for creation of destructive virtual communities. Thus destructive virtual communities, unlike constructive, try to fight against this community with a various, not always legal, methods. The object of aggression of destructive virtual communities is society as a whole or supporters of these or those social groups, as a rule, hostile to this most destructive of virtual community. Besides destructive virtual communities can imperceptibly undermine some state bases by creation so-called “virtual states”, by having all attributes of the state without territory.

The main feature and the main danger of destructive virtual communities is to be recognized by law as a destructive activities under conditions of norms of freedom of speech, press and religion. The only way to make it possible is after implementation into the real world some activities made by the participants which have been carried out under the influence of information. Only then can they be correlated with applicable law and be qualified accordingly.

In order to prevent informational threats and to implement them in the real world there is a need to assess the activity of virtual communities and their content at a stage of their functioning in social networks.

2. Problem Formulation

The analysis of information flows and a large amount of information in the Internet environment, their adaptive aggregation and generalization getting complicated by the lack of standard methods and solutions, incompleteness of the relevant technological approaches. Current research on the analysis of information flows are often highly specialized [3].

Referring to the research [1, 4] the index of informational threat is a quantitative dynamics which is characterized as the number of events per unit time, or number of message concerning their information content. This definition of informational threat for the analysis of online information resources as an assessment of intensity rating publications on the relevant topics.

At the same time, the analysis of information threats in the operation of virtual communities, which are formed through social networks, it is necessary to consider not only their information content and also the number of participants of virtual community and pattern of relationships between elements (discussions) in virtual community.

3. Problem Solution

According to the standard of informational security NIST 800-30 [9] the assessment of risk is defined as a complex assessment of two rates:

Possibility of losses which happen in case of threat implementation; probability of such threat origin.

Considering informational threats of information security of the state in the operation of virtual communities basic approach to the definition of the first indicator it is based on an expert survey of experts in the field of informational security in accordance with the legal documents governing the information security of the state.

The second rate depends on the functioning process of the virtual community – index of informational threats that arises during the functioning process of virtual [7, 8].

The index of informational threats that arises during the functioning process of virtual community - a quantitative evaluation of the implementation of information threats, which carries the content of discussions of virtual community.

While forming a index of informational threat it is necessary to consider the following components:

- the number of participants of virtual community;
- the number of a possible mobilization resource;
- the quality of information content in virtual community;
- the structure of connections between discussions in virtual community.

To determine the index of informational threats that arises during the functioning process of virtual community using the value of the virtual community, which takes into account the number of participants and the relationships between them using the law in order to moderate growth in the value of the network. The value of virtual community is a potential accessibility of participants in community with whom any participant in community can "communicate" in case of need [2].

Thus the index of informational threats that arises during the functioning process of virtual community in general has the form (1),

$$InfTreat(VirtualCommunity) = \begin{cases} \frac{Value(VirtualCommunity)}{Value(VirtualCommunity)^*}, \\ 1, \text{ if } \frac{Value(VirtualCommunity)}{Value(VirtualCommunity)^*} > 1 \end{cases}, \quad (1)$$

where: $Value(VirtualCommunity)$ - value of the virtual community;

$Value(VirtualCommunity)^*$ - the critical value of virtual community in case of which is implemented information

Using [2] we will determine the value of virtual community taking into account number of its participants (2),

$$Value(VirtualCommunity) = \sum_{i=1}^M ThreadMembers_i \cdot \ln \left(\sum_{i=1}^M ThreadMembers_i \right) - \sum_{i=1}^M ThreadMembers_i, \quad (2)$$

where $ThreadMembers_i$ - the number of participants in i -virtual discussion;

M – the number of discussions in virtual community and critical value of the virtual community (3),

where $Members(InfTreat_i)$ - the critical number of participants of virtual community defined by experts in case of which i -informational threat is implemented without taking into consideration the quality of informational content of the virtual community, the structure of connections between discussions in virtual community.

In the definition (3) we will get the maximum value of virtual community when all discussions are connected among themselves by hyperlinks and do not have negative messages from their users in the information content. The following components (quality of informational content in virtual community and structure of connections between discussions in virtual community) will reduce the value of virtual community.

Considering the quality of informational content through a measure of concordance about the subject direction and messages in discussion, the value of virtual community (3) has an appearance (4),

where $Sim(Thread_i)$ - measure of concordance about the subject direction and i -virtual discussion;

M – the number of discussions in virtual community.

The measure of concordance about the subject direction and messages in discussion - it is a sign which depends on the positive or negative direction of messages in discussion according to its subject direction [6].

We will define a level of compliance as (5),

where $Post_j^+(Thread_i)$ - great number of positive messages in i -virtual discussion; threat without quality of information content in virtual community, structure of connections and discussions in virtual community.

$Post_j^{(flood)}(Thread_i)$ - great number of messages in i -virtual discussion which don't bear any useful information according to virtual community subject;

$N^{(Thread_i)}$ - the number of messages in i -virtual discussion.

$$Value(VirtualCommunity)^* = Members(InfTreat_i) \cdot \ln(Members(InfTreat_i)) - Members(InfTreat_i), \quad (3)$$

$$Value(VirtualCommunity) = \sum_{i=1}^M (Sim(Thread_i) \cdot ThreadMembers_i) \cdot \ln \left(\sum_{i=1}^M (Sim(Thread_i) \cdot ThreadMembers_i) \right) - \sum_{i=1}^M (Sim(Thread_i) \cdot ThreadMembers_i) \quad (4)$$

$$Sim(Thread_i) = \frac{\sum_{j=1}^{N(Thread_i)} card(Post_j^+(Thread_i))}{N(Thread_i) - \sum_{j=1}^{N(Thread_i)} card(Post_j^{(flood)}(Thread_i))}, \quad (5)$$

In (5) definition the measure of concordance about the subject direction of messages in discussion the weight of messages is not considered because in case of big number of messages it will not influence considerably the general result.

To determine the value of a virtual community based on the structure links the discussions in the virtual community it is necessary to consider topology of virtual community which can be formed depending on hyperlinks between discussions.

Depending on hyperlinks between discussions the following elements can be formed:

- discussions that are not related to other discussions in virtual community which means that they do not have internal and external hyperlinks between discussions in virtual community;
- set of discussions which are connected by hyperlinks;
- isolated sets of discussions which aren't connected to other discussions of virtual community.

Thus depending on hyperlinks between discussions we create groups. The group in virtual community is a set of discussions interconnected among themselves by hyperlinks and are not connected to other discussions in a virtual community.

In order to form the groups we need to define the rules of their formation:

1. The group can not be empty, that means that group must contain at least one discussion.
2. In a virtual community can be from 1 to n groups (n - the number of discussions in virtual community) in other words in group can be from 1 to n discussions.
3. All discussions in group are connected among themselves by internal and external links.
4. All group discussions can not have internal and external hyperlinks with discussions from other groups. In case of existence these hyperlinks the groups will be united

$$Value(Group_i) = \sum_{j=1}^{M(Group_i)} (Sim(Thread_j) \cdot ThreadMembers_j) \cdot \ln \left(\sum_{j=1}^{M(Group_i)} (Sim(Thread_j) \cdot ThreadMembers_j) \right) - \sum_{j=1}^{M(Group_i)} (Sim(Thread_j) \cdot ThreadMembers_j) \quad (6)$$

into one group.

Proceeding from (2) we will determine the value of group of virtual community (6), where $M^{(Group_i)}$ - the number of discussions in i -virtual group.

Due to the fact that for two isolated groups of the virtual community, any discussion on one of them is not connected with any other discussions and the value of combining of these two groups is equal to the amount of values of each of them [2].

$$f(m_1 m_2) = f(m_1) + f(m_2),$$

where $f(m_1)$ - the value of the 1st group of virtual community with m_1 agents;

$f(m_2)$ - the value of the 2nd group of virtual community with m_2 agents;

$f(m_1 m_2)$ - the value of combining the 1st and the 2nd groups in a virtual community.

Therefore:

$$Value(VirtualCommunity) = \sum_{i=1}^N Value(Group_i), \quad (7)$$

where N - the number of groups in virtual community.

We add in expression (7) value of group in a virtual community (6) we will get the value of virtual community (8),

where N - the number of groups in virtual community

$M^{(Group_i)}$ - the number of discussions in i -virtual group.

We add (8) in expression (1) we will get a index of informational threats that arises during the functioning process of virtual community taking into account the

$$Value(VirtualCommunity) = \sum_{i=1}^N \left(\sum_{j=1}^{M^{(Group_i)}} (Sim(Thread_j) \cdot ThreadMembers_j) \cdot \ln \left(\sum_{j=1}^{M^{(Group_j)}} (Sim(Thread_j) \cdot ThreadMembers_j) \right) - \sum_{j=1}^{M^{(Group_j)}} (Sim(Thread_j) \cdot ThreadMembers_j) \right) \quad (8)$$

$$Value(VirtualCommunity)^{(Mob)} = \sum_{i=1}^N \left(\sum_{j=1}^{M^{(Group_i)}} (Sim(Thread_j) \cdot ThreadMembers_j) \cdot \ln \left(\sum_{j=1}^{M^{(Group_j)}} (Sim(Thread_j) \cdot ThreadMembers_j) \right) - \sum_{j=1}^{M^{(Group_j)}} (Sim(Thread_j) \cdot ThreadMembers_j) \right) + card(Shadow(VirtualCommunity)) \quad (9)$$

number of participants in a virtual community, quality of informational content in a virtual community and the structure of connections between discussions in a virtual community.

In order to determine the index of informational threat with a possible mobilization resource in a virtual community, the expression (8) has the form (9),

where *Shadow(VirtualCommunity)*- a great number of registered users in social networks that are interested in ideology (subject) of virtual community and are not participants in the discussion.

Thus, we add (9) in expression (1) we receive the quantitative index of informational threats that arises during the functioning process of virtual community.

4. Conclusion

Virtual communities that are created with the help of social networking services in the course of its operation can be either constructive or destructive, depending on their content towards society. There is a problem with an assessment of activities of virtual communities, their informational content, at a stage of their functioning in social networks for the purpose of warning the informational threats and their implementation in real world.

During the analysis of informational threats that arises during the functioning process of virtual community in social networks, except, informational content it is necessary to consider the number of participants in virtual community and the structure of connections between elements (discussions) in virtual community.

The index of informational threat offered in this research for an assessment of the functioning process of virtual community (1) which uses determination of value of a network, takes into account the following components (9):

- the number of participants in virtual community;
- the number of a possible mobilization resource;
- the quality of informational content in virtual community;
- the structure of connections between discussions in virtual community.

Proceeding from the estimates of informational threat (1) it will accept values within [0, 1] that simplifies further decision-making on counteraction of informational and psychological impact of the functioning process of virtual community.

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