CHAPTER 6

FRAMEWORK FOR SELECTION OF SOCIAL NETWORK SERVICES

6.1 INTRODUCTION

The social network services have tremendously grown during the recent years and have a promising future ahead. Social Networking can be defined as the set of services provided by an organization to the larger community. The social networking sites have the characteristics such as constructing a community within a bounded system, articulating a list of other users with whom to share a connection, viewing and traversing their list of connections made by others in the social networking system (Rachel A. Sauerbier et al, 2010). Today many social networking sites are provided by various organizations which support same or different type of services. These organizations can be classified by their goal of providing the services such as professional, personal, gaming and so on. FaceBook, Twitter, LinkedIn, MySpace etc are a few examples of the popular social networking sites. Social Networking has gained popularity in spite of age, profession and region.

Many organizations are coming forward with wide variety of interesting social networking services. In fact most of the social network services are almost identical and the users select the services based on public perceptions; this trial
and error method sometimes provides lower level of satisfaction to the users. The selection of the service provided by the social networking sites by the user is influenced by individual user perspective and also the group perspective. The selection of the service is also influenced by the gender, attitude, privacy concern, age (Kuan-Yu Lin et al., 2011; Ohbyung Kwon et al., 2010; Sonia Ben Mokhtar et al., 2009). Therefore, discovering and providing the best social network service based on the user’s interest is really a challenge. Discovering a set of feasible social services and selecting the most appropriate social network service based on the user preferences can be modeled as a multi-criteria decision making problem. In this chapter, an efficient, user driven service selection framework for social networking services is proposed adopting PROMETHEE methodology. The experimental results on overhead, social service deduction time, average delay have also been obtained. The results show that the proposed framework is effective.

6.2 FACTORS THAT INFLUENCE SOCIAL NETWORK SERVICE SELECTION

The factors that influence the social network service selection are as follows:

**Service type** (St) (Rachel A. Sauerbier et al., 2010) – the type of service being provided to the user to meet a particular category either professional or personal or nostalgic etc.,
Paid or Unpaid Service (*PuP*) (Hsi-Peng Lu et al, 2010) – the service for which an amount has to be paid is termed as paid service and those which can be used free of cost are termed as unpaid services.

Reliability (*Re*) (Qin Gao et al, 2010) - the extent to which social online activity can be performed reliably and continuously, without any failure or interruption.

Searchability (*Se*) (Qin Gao et al, 2010) - the ability of the system to search for services relevant to social interaction, such as people or events.

Privacy Awareness (*Pa*) (Dong-Hee Shin, 2010) – the extent to which the user’s private information can be controlled by themselves.

Information Richness (*Ir*) – the amount and types of information which can be stored and retrieved from the system.

Platform Independence (*Pi*) – the extent to which the social networking services can be accessed by various handheld devices.

Customizability (*Cu*) – the ease at which the content and format of exchanged information can be controlled.

Activity Support (*As*) – the extent to which groups of special interests can be established and maintained easily.

Prevention from disturbance (*Pd*) – the extent to which the user can distinguish between wanted and unwanted information and can block the latter.
6.3 PROPOSED FRAMEWORK FOR SOCIAL NETWORK SERVICE SELECTION

The social network organizations are clustered in groups based on their objectives. Each group \( G \) consists of a set of social network organizations. In general

\[
G_n = \{O_{n1}, O_{n2}, \ldots, O_{nm}\}
\]

(6.1)

where \( n \) is the number of group and \( m \) is the number of services provided by a single organization. The social network organizations and Users that are available in a particular group are handled by Social Network Service Authority SNSA. The communication between Social Network Service Authority’s takes place through Master Social Network Service Authority MSNSA. The Fig. 6.1 shows the proposed framework for social network service selection. The Social Network Service Authority consists of Service Registration Unit, User Registration Unit, Social Network Service (SNS) Selection Unit and Social Network Service (SNS) Delivery Unit. Each social network organization furnishes the services it wishes to provide and registers it with the service registration unit.

![Fig. 6.1. Proposed Framework for Social Network Service Selection](image.png)
<table>
<thead>
<tr>
<th>O_ID</th>
<th>O_Name</th>
<th>S_ID</th>
<th>S_name</th>
<th>Re</th>
<th>Se</th>
<th>Pa</th>
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<td>0.2</td>
<td>.98</td>
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<td>0.2</td>
<td>.98</td>
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<td>0.3</td>
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<td>Ir</td>
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<td>0</td>
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<td>Game</td>
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<td>0.78</td>
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<tr>
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<td>0.80</td>
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<td>Edu.</td>
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<td>3</td>
<td>Edu.</td>
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<td>0.67</td>
<td>0.5</td>
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</table>
6.3.1 INITIAL REGISTRATION OF THE SOCIAL NETWORK ORGANIZATION

Initially the organization registers itself with the Social Network Service Authority (SNSA). The SNSA plays the role of authorizing the organization to provide social networking site by verifying the documents of the organization and producing a digital signature. Then the organization registers its services with the SNSA by sending a Service_Registration message as shown in Fig. 6.2. The SNSA on receiving the message updates the information both in the social network organizational database and the service database.

![Fig. 6.2. Service_Registration message](image)

The SNSA sends a service identity number (S_ID) for all the services registered by the particular organization through the Ack message. The Ack message format is shown in Fig. 6.3.

![Fig. 6.3. Ack message](image)

If an organization has $n_s$ services, then the initial registration overhead $O_{oreg}$ is found to be

$$O_{oreg} = 2(n_s + 1)$$ (6.2)
If there are $n_o$ organizations offering $n_i$ services, then $O_{\text{reg}}$ is found to be

$$O_{\text{reg}} = 2\left(\sum_{i=1}^{n_i} n_i + n_o\right)$$  \hfill (6.3)

### 6.3.2 A NEW SERVICE/ MULTIPLE SERVICES ARE OFFERED BY A REGISTERED SOCIAL NETWORK ORGANIZATION

When an already existing social network organization wishes to offer a new service or multiple services, it sends a $Service\_\text{New}$ message which is shown in Fig. 6.4 to the SNSA. The SNSA updates the social network organizational database and the service database.

<table>
<thead>
<tr>
<th>HDR</th>
<th>O_ID</th>
<th>SHDR</th>
<th>S_Name</th>
<th>PuP</th>
<th>St</th>
<th>Ir</th>
<th>Cu</th>
<th>As</th>
<th>Pd</th>
<th>Pi</th>
<th>Stail</th>
<th>…</th>
<th>Tail</th>
</tr>
</thead>
</table>

**Fig. 6.4. Service\_New message**

The SNSA sends a service identity number (S_ID) for the services registered by the particular organization through the $\text{Ack}$ message. If an organization has $n_{s(\text{new})}$ services, then the new service registration overhead $O_{\text{reg}}$ is found to be

$$O_{\text{reg}} = 2(n_{s(\text{new})} + 1)$$  \hfill (6.4)

If there are $n_o$ organizations offering $n_{s(\text{new})}$ services, then $O_{\text{reg}}$ is found to be

$$O_{\text{reg}} = 2\left(\sum_{i=1}^{n_i} n_{s(\text{new})i} + n_o\right)$$  \hfill (6.5)
6.3.3 UPGRADATION OF THE SOCIAL NETWORK ORGANIZATION

If the registered social network organization wishes to upgrade the factors influencing the services provided by the organization, then the organization sends the Org_Upgrade (Fig. 6.5) message to the SNSA with the common parameters. The Org_upgrade message format is as follows.

<table>
<thead>
<tr>
<th>HDR</th>
<th>O_ID</th>
<th>Re</th>
<th>Se</th>
<th>Pa</th>
<th>Tail</th>
</tr>
</thead>
</table>

Fig. 6.5 Org_Upgrade message

Upon receiving the Org_Upgrade message, the SNSA updates the social network organizational database. If an organization has $n_s$ services, the organization upgrade overhead $O_{upg}$ is found to be

$$O_{upg} = n_s + 1$$

(6.6)

If there are $n_o$ organizations offering $n_s$ services, then $O_{upg}$ is found to be

$$O_{upg} = \sum_{i=1}^{n_o} n_{si} + n_o$$

(6.7)

6.3.4 UPGRADATION OF A SERVICE PROVIDED BY A REGISTERED SOCIAL NETWORK ORGANIZATION

If the registered social network organization wishes to upgrade the factors influencing a particular service provided by the organization, then the social network organization sends the Ser_Upgrade message to the SNSA with the
parameters influencing that service. The *Ser_Ugrade* message format is as follows.

<table>
<thead>
<tr>
<th>HDR</th>
<th>O_ID</th>
<th>S_ID</th>
<th>St</th>
<th>PuP</th>
<th>Ir</th>
<th>Pi</th>
<th>Cu</th>
<th>As</th>
<th>Pd</th>
<th>Tail</th>
</tr>
</thead>
</table>

**Fig. 6.6. *Ser_Ugrade* message**

Upon receiving the *Ser_Ugrade* message the SNSA updates the service database.

### 6.4 SOCIAL NETWORK SERVICE SELECTION ALGORITHM

The Social Network Service Authority (SNSA) uses the PROMETHEE methodology concept to select the best social network organization based on the users’ requirement.

**Service Registration Algorithm**

Step 1: Social Network Service Authority broadcasts *Hello_Service_Provider* message

Step 2: Each Social Network Organization submits *Organization_Registration* message to Social Network Service Authority

Step 3: For each Social Network Organization do

{}  
Create Social Network Organization ID (O_ID)

Retrieve and set social network organizational parameters (O_name, Re, Se, Pa) in Social Network Organizational Database

For each service do

{}  
create Social Network service ID (S_ID)
Retrieve and set social network service parameters
  (O_ID, S_ID, S_name, St, PuP, Ir, Pi, Cu, As, Pd)
  in Service Database
}

Send Ack message
}

**Service Selection Algorithm**

Step 4: Each user submits *User_Request* message to Social Network Service Authority

Step 5: Retrieve the Social Network Organization parameters and service parameters of each feasible Social Network Organization from Social Network Organization Database, Service Database and form an Evaluation Table

Step 6: Retrieve user requirements (S_name, PuP, Ir, Pi, Cu, As, Pd, Re, Se, Pa) and normalize to 1.

Step 7: For each feasible Social Network Organization do
{
  
  Compute Preference function \( PR_j(s_x, s_y) \) for each user requirements based on pair-wise comparison.
  
  Compute aggregated preference indices \( \pi(s_x, s_y) \)
  
  Compute Positive outranking flow \( \phi^+(s_x) \) and negative outranking flow \( \phi^-(s_x) \)
  
  Compute net outranking flow \( \phi(s_x) \)

}

Step 8: Rank the Social Network Organization in descending order based on the net out ranking flow.

Step 9: Notify the user, the Social Network Organization with the highest rank.
Step 10: Connect the user with the social Network Organization.

Service Delivery Algorithm

Step 11: For every Service connected and completed do

\{ 
  Compute service cost.
  Deliver the service transactions.
  Obtain the feedback parameter $U_s$ and the payment from the user.
\}

6.5 EXPERIMENTAL RESULTS AND DISCUSSION

The proposed framework was implemented as an ASP.NET web service application using Microsoft Visual Studio 2008 C# in .NET Framework 3.5. Microsoft SQL Server 2005 was used as a backend to store the information about the Social Networking Sites. Intel (R) Core (TM) 2 Duo CPU with 2.92GB RAM was used to host the web application. A Social Network environment with different social networking organizations was generated. The social network organizations were permitted to register initially with the Social Networking Service Authority for providing social network services to the users. Each social network organization was permitted to offer 5, 10, 15, 20 services and the effect of the number of social services on the service registration overhead was studied for various social network organizations.
The Fig. 6.7 shows that the variation of service registration overhead for different number of social network organizations for different number of social network services. It is found that the overhead increases linearly with the number of social network organization. During the operation of network, a few of the social network organizations were permitted to upgrade themselves. The overhead due to this event was studied. The Fig.6.8 shows the variation of Overhead due to social network organization upgrade for various numbers of social network services. It is found that as the number of social network organization upgrade increases; it contributes to additional overhead which increases almost linearly to the increase in the number of organizations.
The social network users who are interested in availing the services from the social network were permitted to register along with their service requirements and preferences. The service selection time for different number of criteria (factors) and different number of Social Network Organizations were obtained.

![Fig. 6.8 Social Network Organization Upgrade Overhead](image)

Experimentation was also carried out to determine the effect of number of users (load) on the service selection time for different number of social network organizations (no) when criteria =5.
Fig. 6.9. Service Selection time for different criteria

Fig. 6.10. Service selection time for different number of users
It is found from Fig. 6.9 that the service selection time of the proposed framework is in a few milliseconds and when the number of Social Network Organizations (no) is increased the service selection time also increases. It is observed from Fig. 6.10 that the user load affects the service selection time i.e., greater the number of users (user load) greater the service selection time.

Three social networking organizations were created in a closed group with 50 users and they were designed to offer different services with different criteria. These social networking organizations were registered with the SNSA. Users were permitted to register with SNSA and provide their preferences in selecting their desired social networking services. The proposed framework was used in selecting the best service for each user based on their preferences. A study was conducted to obtain the user satisfaction from the registered user. The user’s requirements, the social network organization selected by the PROMETHEE method and satisfaction of the users are tabulated in Table 6.3. It is found that 95% expressed that they are excellently satisfied and the satisfaction levels are shown in Fig.6.11.
### Table 6.3 Case Study

<table>
<thead>
<tr>
<th>Users</th>
<th>Service Name</th>
<th>PuP</th>
<th>Re</th>
<th>Se</th>
<th>Pa</th>
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6.6 CONCLUSION

In this chapter, an effective framework for selection of social network services was proposed. The social network service selection was modeled as a multi-criteria decision making problem. Many criteria such as information richness, reliability, searchability, paid/unpaid services, customizability, platform independence and activity support that influence the service selection were considered. The experimental analysis was performed on the proposed framework and was found to be effective.

Fig. 6.11 User Satisfaction