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Cloud Computing Worldwide: Changing the Strategies of NGOs Work

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Abstract — Cloud computing has had a tremendous impact on NGOs. Their adoption of the technology has helped to cut operational costs, streamline the flow of communications, modernize accounting systems, and facilitate resource management. Indeed, the cloud has introduced a paradigm shift in the way people manage information of resources. Email, websites, e-commerce, webinars, and social media - all of which are based on cloud computing - are now fundamental elements of NGO operations. With the increasingly ubiquitous nature of Social Networks and Cloud Computing, users are starting to explore new ways to interact with, and exploit these developing paradigms. Social Networks are used to reflect real world relationships that allow users to share information and form connections between one another, essentially creating dynamic Virtual Organizations.

The objectives of this research are: 1- to outline the vision of, and experiences with, creating a Social Storage Cloud, looking specifically at possible NGOs' resources mechanisms that could be used to create a dynamic Cloud infrastructure in a Social network environment to assist other people, 2- to build communities, accommodates and promote a culture of resources sharing and 3- To be applicable for real world and that was achieved nowadays. This research won in two consecutive years the Microsoft Imagine Cup Competition as it will be mentioned in the conclusions section.

Index Terms — NGO, Cloud computing, Charity Social Network, Big Data and Database.

1 Introduction - NGO-growth and networking

Leveraging the pre-established trust formed through people relationships within a Social Network to form a dynamic "Social Cloud", enabling people to share resources within the context of a Social Network was propose here. A believe that combining trust relationships with suitable incentive mechanisms (through financial payments or bartering) could provide much more sustainable resource sharing mechanisms [1].

Cloud computing is transforming how all of us work and how we use technology. Most people are probably already using cloud services or applications like Google Docs, Skype, or Microsoft Office Web Apps. Its how growing numbers of Non-Governmental Organizations (NGOs) aim to save money, reduces their software and hardware needs, and go green. Social networks have become an excellent platform for sharing and communication that reflects real world relationships.

There is a certain report which aims to create a Social Storage Cloud that looks at probable mechanisms to be used in creating a dynamic cloud infrastructure in a Social network environment. It is believed that combining the pre-established trust with suitable incentive mechanisms can be a way to generate sustainable resource sharing mechanisms. Cloud solutions are more than just a supplement to an NGO's technology architecture. For one thing, they have great potential for the convergence of stakeholders - from donors and partners, to supporters and beneficiaries. Cloud technology thus serves as the cornerstone of communities, which organizations can leverage in initiatives for knowledge transfer and capacity building. There are multiple instances of Social network and Cloud computing integration. However, most examples use Cloud platforms to host Social networks or create scalable applications within the Social network [2].

Figure 1. Millennium Development Goals (MDGs)

There are a number of advantages gained by leveraging Social networking platforms, in particular we gain access to huge NGO's communities, can exploit existing NGO's management functionality, and rely on pre-established trust formed through NGO's relationships. The United Nations Millennium Development Goals (MDGs) are eight goals that all 191 UN Member States have agreed to try to achieve by the year 2015. The United Nations Millennium Declaration, signed in September 2000 commits world leaders to combat poverty,

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hunger, disease, illiteracy, environmental degradation, and discrimination against women as shown in Figure 1. The MDGs are derived from this Declaration, and all have specific targets and indicators, so does this research in some parts [3].

This paper outlines the vision of a Social Cloud and describes the acquired experiences with a real prototype called "NassHope". The rest of the paper is organized as follows: section 2 outlines related research and some example applications that may use a Social Storage Cloud. Section 3 presents system definition that uses a social storage cloud. Section 4 imparts the problem definition and challenges faced. Section 5 shows the design of the proposed system. A network analysis is described in section 6, before the evaluation of the presented in section 7. Finally, section 8 outlines system advantages and section 9 provides future work and concluding remarks.

2 Related Work

There are multiple instances of Social network and Cloud computing integration. However, most examples use Cloud platforms to host Social networks or create scalable applications within the Social network. For example, Facebook users can build scalable Cloud based applications hosted by Amazon Web Services [4]. There is no literature related to creating a Cloud infrastructure influencing Social networking as a means of dynamic user management, authentication, and user experience. Automated Service Provisioning ENvironment (ASPEN) [5] takes an enterprise approach to integrating Web 2.0, Social networking and Cloud Computing by exposing applications hosted by Cloud providers to user communities in Facebook as shown in Figure 2. The Social Cloud web application generates page content which is parsed by Facebook to create the page delivered to the user.

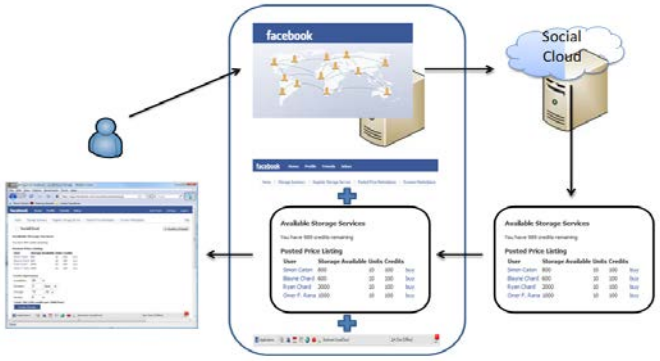

Figure 2. Facebook application hosting environment.

There are similar efforts in the Grid community to influence Social networking concepts, communities, and mechanisms. PolarGrid [6] is one such example which extracts Social data using the OpenSocial [7] interface and relies on OpenID [8] for identification. Different Social networking functions are then incorporated in an application specific portal.

Volunteer computing is a distributed computing model in which users donate computing resources to a specific (academic) project. The first volunteer project was the Great Internet Mersenne Prime Search (www.mersenne.org) in 1996, however the term gained much exposure through the SETI@Home [9] and Folding@home [10] projects in the late 90's. These projects showed the enormous computing power available through collaborative systems. One of the most relevant Volunteer computing efforts is Storage@Home [11] which is used to back up and share huge data sets arising from scientific research. The focus of Volunteer computing has since shifted towards generic middleware providing a distributed infrastructure independent of the type of computation, for example the Berkeley Open Infrastructure for Network Computing (BOINC) [12].

Most Volunteer platforms do not define SLAs, typically users are anonymous and are not accountable for their actions (they are rewarded with different incentives however). In a Social Cloud context this does not suffice as users need to have some level of accountability. A more realistic model for this type of open sharing is a credit based system in which users earn credits by contributing resources and then spend these credits when using other resources. This type of policy is used in systems such as PlanetLab [13].

3 System Definition

As mentioned before this research is a social network for organizations. It can be defined as an implemented strategy for managing the organizations interactions with volunteers, governments, donors, investors and other organizations to organize, automate, and synchronize organizations process and activities [14]. From another perspective the proposed system can be viewed as a huge detailed network that represent the organizations relationships as shown in Figure 3, in terms of network theory it consists of nodes and links.

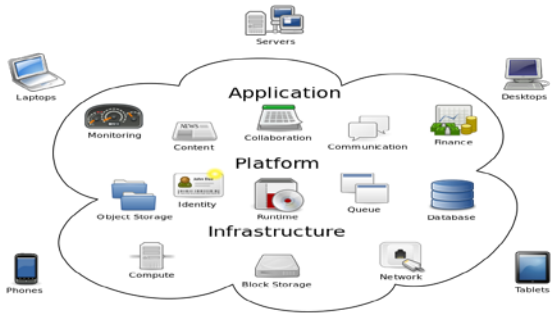

Figure 3. The proposed NASS-Hope Cloud Network

Nodes are the individual actors NGOs (Non-Governmental Organizations), activities, donors, investors, government and the community. Links are the interaction between these actors like activities, services and investments.

Building an online system "Charity Social Network" that can be accessed through Web Browser & Windows Desktop and Mobile Phones to present all the information needed about each NGO and their volunteers, donors and the external entities. Each NGO could have:

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- An account (Containing its information, events, sponsors, etc…).
- Provide a website to the NGO with a domain name.
- Provide e-mail service to the NGO with addresses.

Sponsors will be able to recommend and certify NGOs in order to give volunteers and donors a trust in them through the Trust Area. So, the proposed system aims to provide search ability to volunteers, donors and external entities through which they can:

- Search for NGOs in specific fields (ex: NGOs specialized in education).
- Search for NGOs in a specific place (ex: Searching for all the NGOs in Cairo) and they can see the place of every NGO on the map.
- Search for the locations of a certain NGO (ex: Searching for all the locations in Cairo) and browse it through a map.

The system will provide each volunteer with a "V Passport" which is a dynamic virtual passport inside it:

- A standard application containing all the information about the volunteer including his skills and the activities one want to volunteer in it.
- The location of the Volunteer to recommend NGOs based on his/her location.
- NGOs he/she has previously worked in.

The system will also provide a channel to the people who are in need for help through a Hot-Line to record their information and needs and the system will automatically add a yellow flag on their location, all the NGOs near his location will be able see this flag. Through the activities carried on through the site, the system will be able to provide analysis and statistics about the performance of NGOs in specific area or interest.

4 Problem Description and Challenges

Many problems faced the proposed social network to achieve its goals which include:

a) Lack of communication between NGOs and the people who want to volunteer in and this problem causes shortage in the number of volunteers.
b) Difficulties in communication between NGOs and those who want to donate, this leads to poor financing.
c) Lack of coordination between the different NGOs, this lead to the establishment of many NGOs having the same goals and serve the same places and borders, at the same time many other locations and other targets require additional efforts to achieve it.
d) Lack of documentation on all the services and activities carried out by NGOs, and therefore it became difficult to know them for those who want to volunteer or donate to them, and also affect the reliability of the NGOs.
e) The locations and the activities of the NGOs is unknown, so it's hard for the volunteer to join it and also hard for the donators to donate to them.
f) Dealing with Big Data V^3 which is the big challenge: Three characteristics define Big Data: *Volume*, *Varity*, and *Velocity* as shown in Figure 4. Together, these characteristics define what at IBM refer to as Big Data. They have created the need for a new class of capabilities to augment the way things are done today to provide before line of site and controls over the existing knowledge domains and the ability to act on them.

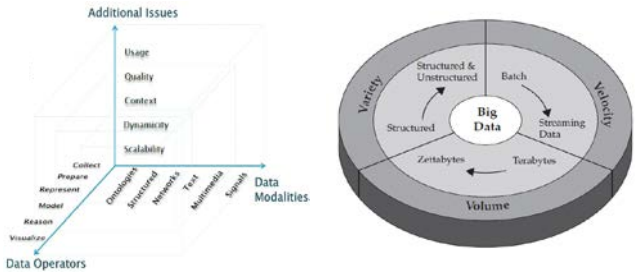

Figure 4. IBM characterizes Big Data by its volume, velocity, and variety-or simply, V^3.

The IBM Big Data platform gives a unique opportunity to extract insight from an immense *Volume*, *Varity*, and *Velocity* of data [15,16].

- The sheer *Volume* of NGOs' data being stored today is exploding. Of course, a lot of the data that's being created today isn't.
- Quite simply, *Variety* represents all types of NGOs' data because it includes not only traditional relational data, but also raw, semistructured, and unstructured data from different NGOs' web pages, web log files, search indexes, social media forums, e-mails, documents, and so on.
- A conventional understanding of *Velocity* typically considers how quickly to manage the data while arriving, processing and storing, and its associated rates of retrieval.

5 Social Cloud Architecture and Implementation

The Social Cloud prototype utilizes Web Services to create a scalable, distributed and decentralized infrastructure [17-20]. All services use Web Service Resource Framework (WSRF). The Data Flow Diagram is shown in Figure 5 presenting the State Diagram and Figure 6 shows the Use Case while Figure 7 shows the Class Diagram. Figure 8 shows the ERD Diagram for the built Database along with its Schema in Figure 9.

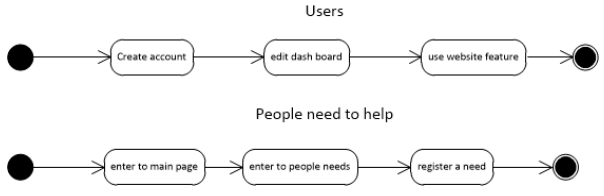

Figure 5. State Diagram

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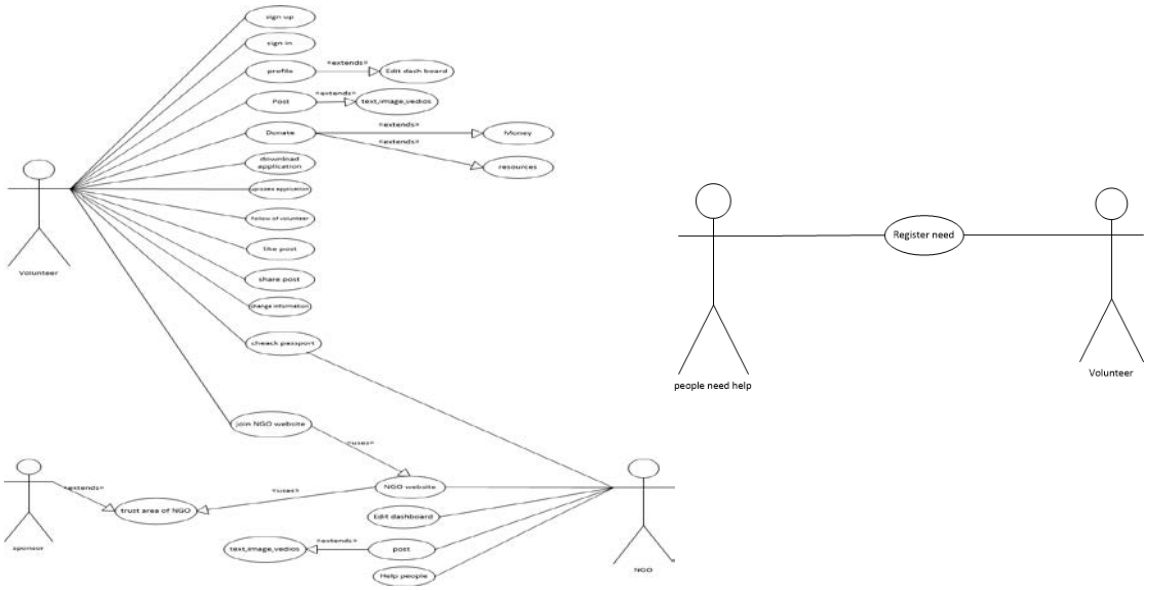

Figure 6. Use Case (people need help)

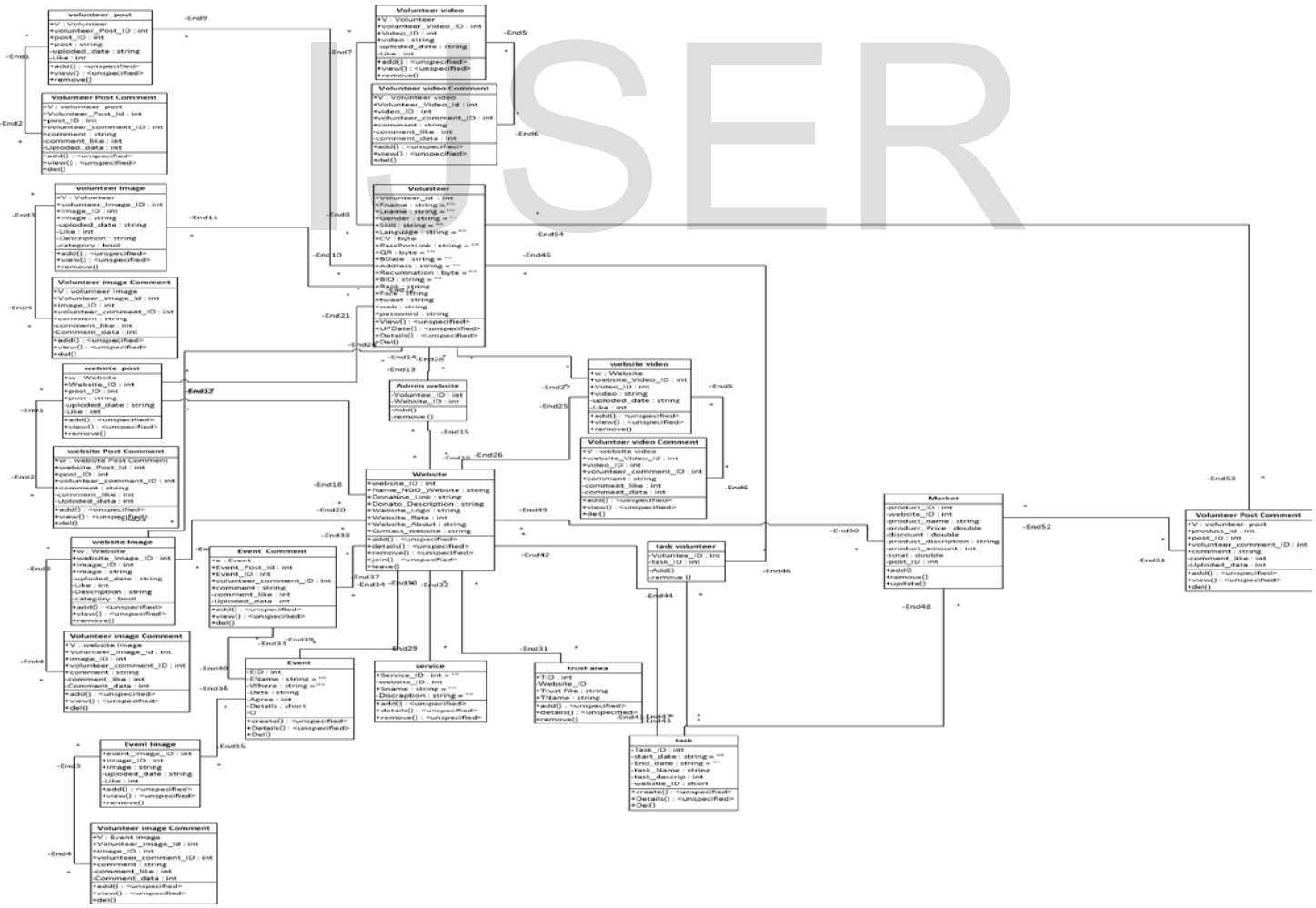

Figure 7. Class Diagram

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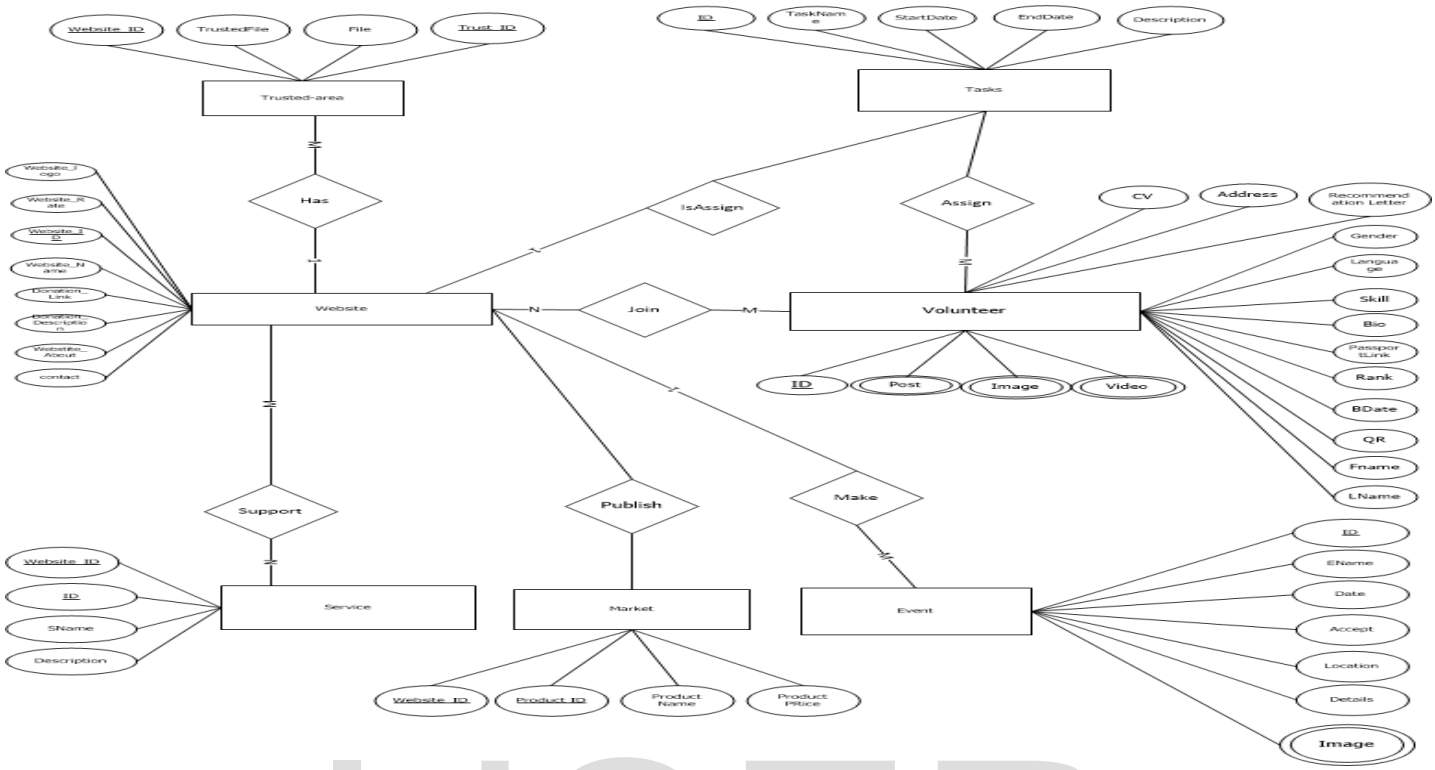

Figure 8. Entity Relationship Diagram

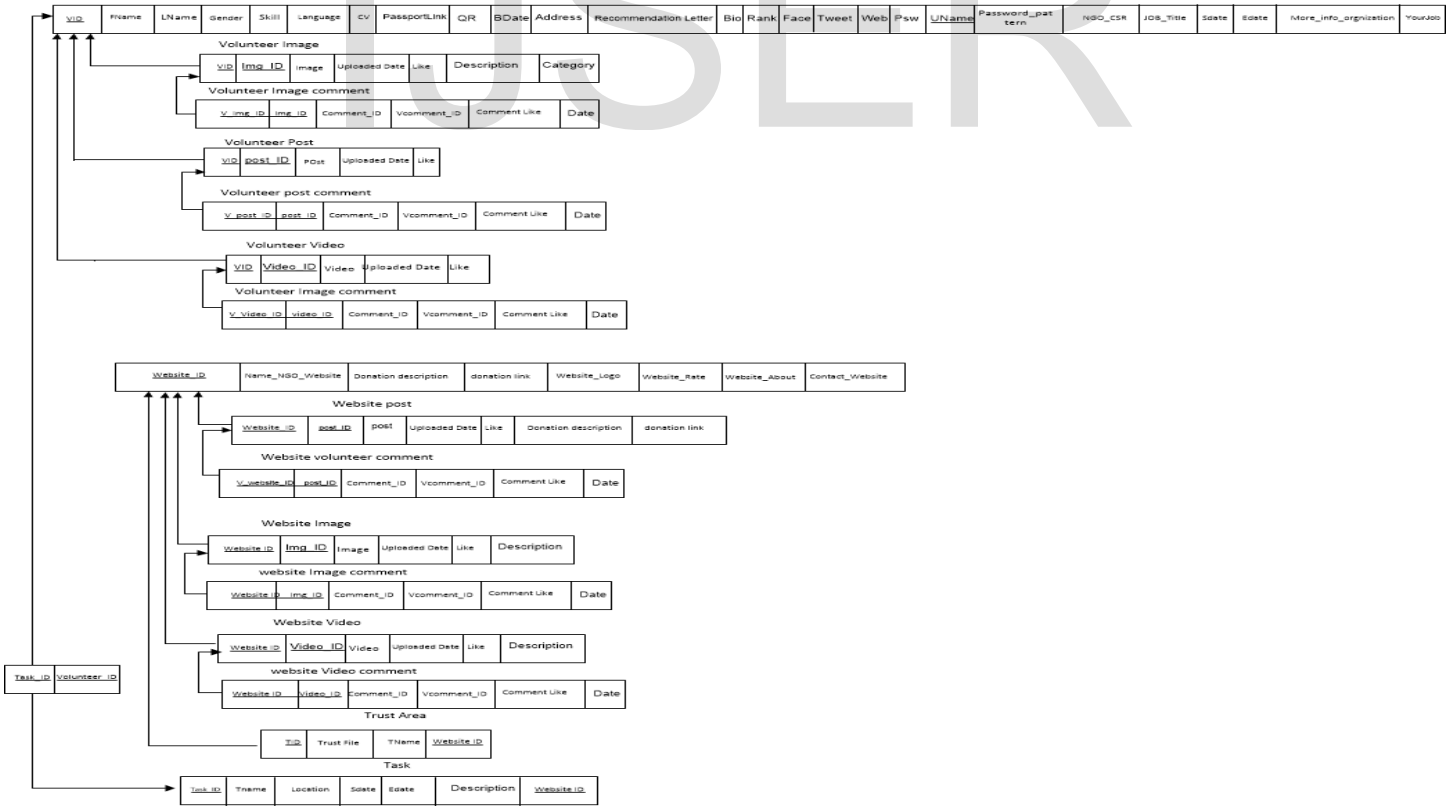

Figure 9. Database Schema

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6 Network Analysis as an Analytical Tool

The previous section presented the Social Cloud Architecture and Implementation and in this section Network analysis is done as an analytic tool to assist in understanding and help in decision-making. As with any tool, one must understand what its basic components are and how to use them. As stated above, a network is a set of relationships between individuals, groups, organizations or institutions [21-23]. In network terminology, these individuals, groups, organizations or institutions represent "nodes" and the relationship linking them, whether informal or formal, represents "ties."

To illustrate this, let's start with an example of five NGOs. Let's say that we asked these five NGOs if they have cooperated with each other in the past 6-months on a project. The table below shows a matrix of the five NGOs. The " √ " in the cells of the table represents that the two NGOs have cooperated with each other in the last 6-months on a project. Table 1 shows that NGO-1 and NGO-2 had cooperated with each other in the past 6-months on a project, as well as NGO-1 and NGO-4, and so forth.

Table 1. Relations between NGOs Network

	NGO-1	NGO-2	NGO-3	NGO-4	NGO-5
NGO-1		✓		✓	
NGO-2	✓		✓	✓	
NGO-3		✓			✓
NGO-4	✓	✓			
NGO-5			✓		
Total	2	3	2	2	1

This table can be converted into a map of the relations between these NGOs to show who has cooperated together over the last 6-months on a project as shown in Figure 10.

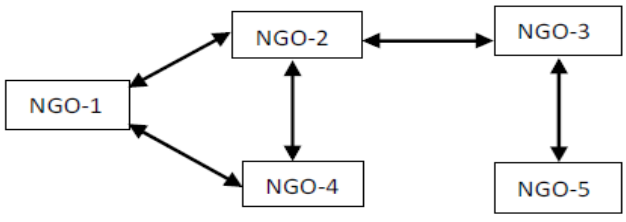

Figure 10. Map of the Relations between these NGOs

Though difficult to see from the table, from this map it is easy to see which NGOs have cooperated with whom. The map shows that NGO-1, NGO-2 and NGO-3 form a sub-group and that NGO-3 is a "bridge" between the sub-group of NGOs and NGO-5. Also, the map shows that NGO-2 is the most central NGO among this network, in that it has a total of 3 links, the most of any NGO in the network [24].

The table also allows us to understand some mathematical characteristics of this network. That is, all the cells in the table represent the total possible number of links between the NGOs. Among these 5 NGOs there is a possibility of 20 total links [that is, 5 NGOs x 4 NGOs (to exclude themselves). If all the NGOs had cooperated with each other in the last 6-months all the cells in the table would be filled with " √ " and there would be 20 links, or this network would completely linked or in network terms, a density of 100%. However, in this example there are only 10 of the possible 20 links; thus, the density of this "project cooperation" network is 50% (10/20*100). Network density can range from 0% (no links between any network members) to 100% (all members are linked to each other). The denser the network, the easier information and resources flow through it.

Furthermore, we can learn other things from mapping the network. For example, NGO-5 is the most "distant" NGO in the project cooperation network [25]. That is, NGO-5 is "2-steps" away from other members in the network map because in order for NGO-5 to reach NGO-1 it must go through NGO-3 (1st step) and then NGO-2 (2nd step). So, NGO-5 is the most peripheral member in the NGO project cooperation network as shown in Figure 11.

Figure 11. Presented Network

NGO-2 is the most central NGO in the network. Why? Because NGO-2 was mentioned by 3 other NGOs (an in-degree of 3) which is more than any other NGO. Also, NGO-2 is a bridge"; that is NGO-2 "bridges" NGO-3 and NGO-5 to NGO-1 and NGO-4.

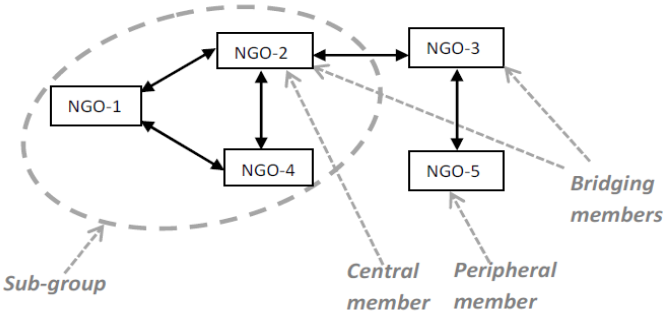

Figure 12. NGOs'Networking

In summary, from this one map of NGO project cooperation as shown ion Figure 12, we can easily understand the roles of individual NGOs: NGO-3 who is a "bridge", NGO-2 who is central, NGO-5 who is peripheral. In addition, we understand characteristics of the network: the NGO network density is 50% and that the longest distance between any two members is 2-steps.

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7 NGOs' Analysis: Step by step

The study involved the following steps: a) study design, b) data collection, and c) creating a database.

A. The Study Design

One of the first steps in conducting a network analysis is to determine who to "include" and who to "exclude", this is called, establishing the boundary. And, unlike other survey research, social network analysts rarely draw samples; rather, network analysts identify a "population of interest" than EVERY one in that population [26].

Determining the Population – For this study, the "population" was: all NGOs working that have a focused and/or confidence mission statement. The boundaries of this network study were: Included - only NGOs.

Compiling a Complete List – The next step, after establishing the population and creating the boundary, was to collect the most complete list of NGOs. This list was updated based on the knowledge of NGO ALERT.

A pilot-test of the questionnaire was accomplished in order to get feedback on the clarity of the questions and if the formatting of the questionnaire made responding easy. Once feedback was received from these NGOs, the final questionnaire was developed. In the final questionnaire NGOs were allowed to identify other NGOs that they had exchanged information, resources or participated in advocacy activities with that were not on the NGOs list.

Determining the Critical Issues – As we mentioned earlier, the links between the actors in the network, in this case NGOs, must represent some type of relationship. This is one of the most critical steps; that is, we had to determine which relations between the NGOs were the most important to understand.

B. Data Collection

After the important design aspects of determining the population, compiling a complete list, determining the issues, and establishing the relevant timeframe, the next step is data collection. And, the first step in data collection is questionnaire development [27].

Questionnaire development – in network analysis the questionnaire can be quite simple compared to other types of survey data collection questionnaires. At the top of the questionnaire are introductory remarks and instructions. The remarks should explain the nature of the study. The instructions should explain how to complete the questionnaire.

Data Collection Process – the questionnaire can be completed in several ways, either by an interviewer or be completed by a representative of the NGO by themselves.

C. Creating the Network Data

Now that the data has been collected, it must be entered into a data file.

Preparing the Data – The information in the questionnaire must be converted into a specific data file format that can be loaded into a network. After listing the NGOs (nodes) next we must list the links between them. The links between the NGOs will come from the questionnaires.

Anonymity & Confidentiality – In the data file the NGOs were identified as only NGO-1, NGO-2, NGO-3 and so forth. However, the questionnaire contained the actual names of the NGOs that participated in the study. An important issue to discuss with participants in a study is to get their permission or consent to participate; some participants may not want to be identified in the network maps for various reasons.

Properties of NGO Information, Resource and Advocacy Networks. An important characteristic about a network is the amount of connectivity between all the members, which is referred to as network density. Network density indicates if the network is sparsely or densely knitted together. In mathematical terms, network density is the proportion of actual ties in a network relative to the total number possible [28-30] as shown in Table 2.

Table 2. Social Network Density

	Information	Resources	Advocacy
Total # of ties possible (44 X 43= 1892 possible ties)	1892	1892	1892
Actual # of ties	91	50	28
Network density	5%	3%	2%
Inclusiveness	90%	84%	57%

The formula to calculate network density for directed tie network is, D= AT / (N * N-1), where D is for density, AT=actual ties, N=number of network members. If for example, in a NGO Network of 44 members, if every member was connected to every other member, there would be a total of 1892 connections. To calculate the density of the information, resource and advocacy networks among these NGOs, the actual number of ties were divided by the total possible, 1892.

8 System Advantages

Agility improves with NGOs ability to re-provision technological infrastructure resources.
Cost reductions claimed by cloud providers.
Device and location independence enable NGOs to access systems using a web browser regardless of their location or what device they use (e.g., PC, mobile phone).
Maintenance of cloud computing applications is easier, because they do not need to be installed on each NGOs computer and can be accessed from different places.
Productivity may be increased when multiple NGOs can work on the same data simultaneously.
Security can be improved due to centralization of data.

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9 Conclusions and Future Work

This paper has presented the architecture and implementation of a new trend in Social Cloud; an amalgamation of Cloud Computing, Volunteer computing and Social networking. NGO should aim to be non-profit, non-commercial and non-government. It should subscribe to universal humanitarian values and practices. It should have capacity, and be ready to be held accountable for its actions.

Today the proposed system has a potential to deal with a varity of NGOs which are numerous and, through their networks, they have acquired a sometimes impressive influence on donors, multilateral institutions and development paradigms. So, this research achieved the following objectives:

- Provide a database for the activities of the NGOs, the willing donors, volunteers and investors.
- Reduce the amount of money needed for the NGOs to advertise about their activities.
- Save time and effort needed for coordination between those actors.
- Reduce huge amount of paper work needed.
- Provide a helpful and easy interface for the actors.

The proposed system is generic so it can be investigated on other activities of the NGOs and facilitated all NGOs resources. And as a Future Work the system should include adopting more NGOs and can be enlarged by collaborating with/under the umbrella of the UN who can further enhance the utility of this proposed approach.

This presented system approach won in two consecutive years the Microsoft Imagine Cup Competition - World Citizenships Branch - (got the third place on 13 April 2013 which was held at the American University in Cairo "AUC") [31] and after various great enhancements got the first place on 12 April 2014 which was held at the British University in Egypt "BUE") [32].

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