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A cybernetics Social Cloud

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ABSTRACT

This paper proposes a Social Cloud, which presents the system design, development and analysis. The technology is based on the BOINC open source software, our hybrid Cloud, Facebook Graph API and our development in a new Facebook API, SocialMedia. The creation of SocialMedia API with its four functions can ensure a smooth delivery of Big Data processing in the Social Cloud, with four selected examples provided. The proposed solution is focused on processing the contacts who click like or comment on the author's posts. Outputs result in visualization with their core syntax being demonstrated. Four functions in the SocialMedia API have evaluation test and each client-server API processing can be completed efficiently and effectively within 1.36 s. We demonstrate large scale simulations involved with 50,000 simulations and all the execution time can be completed within 70,000 s. Cybernetics functions are created to ensure that 100% job completion rate for Big Data processing. Results support our case for Big Data processing on Social Cloud with no costs involved. All the steps involved have closely followed system design, implementation, experiments and validation for Cybernetics to ensure a high quality of outputs and services at all times. This offers a unique contribution for Cybernetics to meet Big Data research challenges.

1. Introduction

Social networks have been pervasive in our everyday part of many peoples' lives. There are social network sites such as Facebook, Twitter and LinkedIn who have huge user communities, and users are actively engaged with their social activities online. The social behaviors have been changed as a result of social networks due to the following reasons (Gross and Acquisti, 2005; Farkas, 2007; Glanz et al., 2008). First, more online communications are available and interactive on social network sites. Features include live update, chats and videos allow contacts in the social network to communicate with each other directly or indirectly. Second, a significantly high volume of information can be shared, exchanged and read on daily basis. All the contacts in the network can know about the up-to-date news in a speedy fashion, which supports the Web 2.0 to allow individuals to broadcast about themselves and news centered around them. Third, an increasing number of people have used social network site in search of the information they pursuit, and find out what have happened in the news headline broadcasted by their contacts. For example, the news that the wedding of Prince and Princess of Cambridge and the birth of their son have created millions of twitter tweets and Facebook messages (British Council, 2013). In another example, when the wedding pictures from one of the author's friends were available on the social network sites, the bride received more than 200 congratulations from friends around the world within the first twenty four hours. In comparisons to pre-social network era of early 2000 s, this could take months for the brides to receive the same volume of congratulations and best wishes due to the barriers of communications caused by long distance and mobility of people.

Social networks allow people to broadcast their headlines, share any information and interact with friends easily who can be geographically away (Chard et al., 2010). There are no or nearly low costs involved. The speed of interactions is almost instantaneous, and allows users to see pictures or watch videos of places that they have never been, or experienced the detailed scenes in important events such as wedding. Contacts in the network need not take part in those events, but they can find out details by being part of the network contacts and visiting photograph albums and video clicks. In contrast, there are downsides of this information sharing model. First, not every contact in the network is interested in anything posted to his or her account. When a particular event happened to the individual contacts that had an unpleasant experience, messages of sadness and disappointment can be frequently updated on the website. In another example, individual contacts may share multiple links to other news, which appear to be uninterested in the majority of their contacts. Second, some controversial topics such as inequalities in sex and religions, as well as

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social topics such as same-sex marriage and benefit reform can spark debates on the social networks. While negative comments are unavoidable due to conflicts of opinions, friendship can be damaged to a certain extent of debates becomes viral.

While social networks are influential to our everyday's lives, they generate billion of data including chats, posts, photographs, videos, clicks (such as likes), messages and forums. There are three groups demonstrating their innovative approaches for the social network data organization and management. Chard et al. (2010, 2012) demonstrate their Social Cloud by using Facebook APIs and their proposed architecture to effectively manage thousands of social network data. Facebook introduces their APIs for developers to organize thousands and millions of user data efficiently (Facebook, 2013). Suh et al. (2010) demonstrate how to manage millions of twitter tweets in the use of Twitter Network. Consequently the amount of data they received fall into the category of Big Data Science, whereby examples demonstrated by Chard et al. (2010, 2012), Suh et al. (2010) can help scientists to manage Big Data for social networks (BDSN) and support the concept that social networks are part of the Big Data science. BDSN is an important topic as follows. First, BDSN can provide better recommendation to manage so much data generated on daily basis. It allows the researchers, developers and system managers classify the type of data and to design the right types of algorithms for different purposes. For example, if the focus of a research study is to investigate the relationship between different contacts, the system can query all the number of exchanged messages and replies in the selected contacts, rank them in the order. In another example, if the focus of another research study is to investigate the daily activities on social networks, archive all these information and present them in analytics form, the emphasis is on information gathering, retrieval and visualization. This requires multi-disciplinary approach to understand the complexity, implication and interpretations of Big Data science.

Software Cybernetics (SC) explores the interplay between software engineering theories and practices. Cai (2002) and Cai et al. (2003) demonstrate the control theory and software engineering. They also define the SC concepts and definitions of SC. However, their definition is only on software engineering and control engineering. In the era of Cloud Computing and Big Data, newer definitions, scopes and demonstration should be provided. In this paper, we demonstrate that SC is an emerging area for processing large amounts of information and data in the Cloud and it involves integration of different technologies. For example, there are many people on social networks generating and disseminating a large amount of information. The relationships, discussion threads and extents of trust, collaboration and support between individuals on each person's social network account is different and varied from time to time. This requires intelligent systems such as BDSN that can process a vast amount of data and interpret the complex human relationships and the topics that people like and support. Fast and innovative methods are thus welcome. However, they can be expensive and difficult to use, which motivate us to develop an easy-to-use and cost-effective Social Cloud system.

This paper describes the Social Cloud, a platform based on the adapted BOINC open source project and our development work that use Cloud Computing and Big Data processing. We demonstrate how to use Software Cybernetics to govern the construction and running of the Social Cloud. The structure is as follows. Section 2 presents the BOINC project, its approaches and architecture. Section 3 demonstrates the development of a SocialMedia API, which ensure a smooth delivery of Big Data processing in the Social Cloud, with four examples provided to explain how to analyze and present Big Data analytics for social networks. Interpretations of outputs in visualization and their core syntax will be explained. Section 4 describes Social Cloud experiments involved with four API functions, including the single simulation and large scale simulations on three different types of Clouds. Results support good performance of our proposed solution for Big Data processing. Cybernetics with software testing steps and outputs will be presented at the end of Sections 3 and 4. Section 5 presents four interesting topics of discussion and Section 6 sums up conclusion and future work.

2. The Social Cloud based on BOINC project

This section is aimed at describing the Social Cloud based on BOINC (Berkely Open Infrastructure for Network Computing) project, including approaches, architecture and its relevance to Software Cybernetics. A Social Cloud is defined as a scalable computing platform which can be dynamically shared amongst a group of contacts (friends) in a social network, and resources can be heterogeneously by contacts. A Social Cloud can be benefits from trusts between contacts and the strengthening in friendships as a result of communications and sharing (Farkas, 2007). In contrast to Social Cloud, Virtual Organizations (VOs) have proposed a similar approach, since VOs have policies to define the type, membership and sharing permissions for the groups involved (Foster et al., 2001). However, the Social Cloud is different from VOs in the level of trusts and mechanism for social correction (identifying advantages and disadvantages for contacts to participate) between groups (Chard et al., 2010, 2012). Similarly, users can be members of multiple Social Clouds, and are not restricted to one group like VOs often do.

2.1. The BOINC project: introduction and motivation

According to BOINC (2013), there are at least 2.2 million BOINC participants, which are substantially available for undertaking the Social Cloud experiment. The BOINC project was first started as a generic volunteer computing middleware. It had over 50 supported projects, including a few internationally active ones (Anderson and Fedak, 2006, BOINC project, 2013). The BOINC project had huge processing power of 8 petaflops, which included the supercomputer of Tainhe-I of China (Costa et al., 2011). There are other active projects in collaboration with BOINC. GridRepublic is an account management system which can make multiple project management for volunteers much easier. BOINC has created a Facebook application called Progress Thru Processors (PTP) with Intel, and both organizations will demonstrate their prototypes in due course.

Social Cloud computing offers a novel approach for leveraging social network and distributed computing, and the successful adoption can motivate and facilitate volunteer based sharing. Motivation for using BOINC project for the Social Cloud can be available for two different groups, users and researchers, as follows. First, users need to find appropriate projects, decide which projects suit them the most, set up and maintain required software in the current model. This can be a barrier for some users. The Social Cloud approach can remove this barrier and allows anyone in the contact to join. Second, Social Cloud researchers can connect to the people that can be helpful or supportive to their research. This can reduce the amount of time for them to find partners.

2.2. Related background

This section describes the related work before introducing the approach and architecture adopted by BOINC project (2013). Users must download the BOINC client software, register themselves and install on the system before they can contribute. Users can choose to support more than one project by allocating resource shares for each project. Users can decide the extent of resource sharing and project selection before they start at their free wills. The