University Semantic Grid Social Network (USGSN)

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Abstract

Social networks are links between nodes that can be people, datasets, tools and other resources. Through these networks, different communities connected to other and share information. The semantic web provides the aggregating information across heterogeneous sources. The semantic web will allow different communities to share unambiguous information by using ontologies. Information that is missing or hard to access for our machines can be made accessible using ontologies. In the University Semantic Grid Social Network (USGSN) project, using the core concept of semantic grid and (online) social network as middleware, will improve online content management, resource sharing and searching, especially for analysis and processing experimental information and other educational resources. To analyze interaction among different users of USGSN, Community Algorithm can be applied.

Introduction

Social networking sites are the most popular places to gather people with common interests on the web, over the last few years. The major problems[1] faced by these sites were portability of information among social networks and providing information on users' own terms. These problems were solved by semantic web technology that converts these data into machine-readable format such as RDF. The social networks can play a vital role in higher education, but the social networking sites are not facilitating this. Mostly users share their non-educational social activities and experiences, on these sites.

The University Semantic Grid Social Network (USGSN) is the semantic grid based social network of universities, higher educational institutes and research institutes in Pakistan. USGSN will be the educational social network, which can share the resources related to academia and research. In Pakistan, there are many public, private sector universities, institutes of higher education and research institutions exist. Some universities lack expensive research equipments and resources like qualified and specialized researchers, due to insufficient budget and limited education investment. The unutilized or under-utilized resources need to be shared by all the listed entities, with each other through the grid. The USGSN will provide platform to connect universities, higher educational institutes and research institutes to share their resources, instruments, experimental equipment, data and educational contents like lecture notes, courses, schedule, etc.

Dispersed existent educational resources can be effectively managed in grid environment; it will also serve to improve resource utilization. Grid computing is effective in obtaining, analyzing and comparing distributed data. Foster[2] defines the grid concept as "the controlled and coordinated resource sharing and problem solving in dynamic, multi-institutional virtual organization". The Virtual Organization (VO)[3] is dynamics grouping of entity that defined the rules for sharing. In USGSN, the entity may be an individual, group or organization (universities and institutes). The resources that are dispersed on different location will be handled by using grid, where as information redundancy and waste of resources will be manage by using semantic web approach. The integration of grid computing and semantic web can play a vital role. The semantic grid is the best solution to implement and manage the USGSN project.

In this paper, a virtual network of higher education institutions – the USGSN is proposed. It can share unutilized or under-utilized resources across the country, for managing the quality of higher education.

Material and Methods

The purpose of social network[4-6] is to relate people on the basis of common interest, from email communication to existing social networks. The structures of these networks change over the period of time, due to massive data. The semantic social network[7-9] combines the concepts of social network and semantic web technologies[10-11]. The data is in machine-readable format such as RDF, which increases the reliability, effectiveness and collaboration. The W3C describes the semantic web as "extension of the current web in which information is given in well defined meaning, better enabling computers and people to work in cooperation."

Grid[11-12] computing provides a platform to efficient use of geographically distributed resources and problem solving among virtual organizations. Grid forms a "super virtual computer" that is composed of many networked loosely coupled computers acting together to perform very large and complex queries.

The complex and heterogeneous biomedical dataset[13] can easily handle by the semantic grid. The ontological classification[14] of the data plays a vital role in semantic grid. The many existing ontologies like Gene Ontology (GO)[15], Biological Viruses Community Ontology (BVCO)[16], Human Biological Viruses Ontology (HBVO)[17] and ontology building tools like Protégé, OBO-Edit[18] and WODE[19] have significant role in semantic web. Semantic Grid[20-21] refers to an approach to compute resources and services by using semantic data model. It's simply the extension of grid in which information and services are given well defined meaning for better enabling machine and people. Term of 'Semantic Grid' was first introduced in 2001 in the context of e-Science[22]. Many projects adopt this notation like myGrid[23] focus on e-Biology, Comb-e-Chem[24] focus on combinations of molecular units, Geodise[25] aims to aid engineers in design optimization and CoAKTing[26] focus on human collaboration, support resource sharing, distributed meetings and trainings. The Virtual Orthopaedic University[27] provides infrastructure for educational, research and administrative activities within digital domain. Similarly, China Education and Research Network (CERNET)[28] aims to build research platform with around 100 universities across the country for research education.

Semantic Grid Social Network for Resource Sharing: Originally, semantic grid concept was build for scientific community but it can be applicable to any domain, like, education, industry, healthcare, media and government. This evolution of semantic grid can be seen in figure-1.
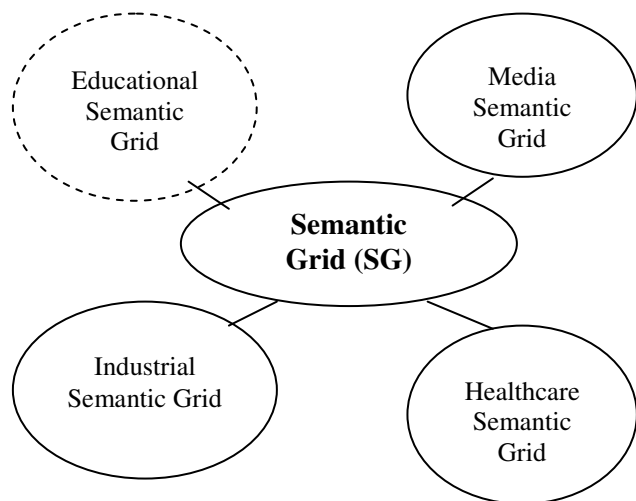
The semantic grid social network for educational resource sharing is a social network of human and educational resources. It will contain the controlled vocabularies of human profiles and resources[29], link these data in grid environment. The user profiles as defined in profile ontology[30] which may contain attributes, like, research profile, publications, teaching experience, etc. Where as, resource profile may contain details, like, experimental equipments, instruments, outcomes, assessment, schedule and lectures, with common tags among resources.

Results and Discussion

University Semantic Grid Social Network: The University Semantic Grid Social Network (USGSN) provides an infrastructure for students, educationalist and researchers, to utilize unused or under-utilized resources across the country. Building on the concepts and technology from semantic grid the major components of the USGSN can be seen in figure-2.

The main goal of the USGSN is to share unutilized or under-utilized resources of these entities by creating rich interlink across the country to facilitate the students, teachers and researchers. The dependencies of these links are based on the human and resources profiles, discussed earlier. The USGSN is based on community[30] of heterogeneous users, like students, teachers, and researchers and the resource ontology (profile). Figure-3 shows the USGSN architecture. Adding semantic to grid and web services will result in developing new ontologies. The Resource Profile and User Profile may use along with Semantic Web Services Ontology (SWSO) and Semantic Grid Services Ontology (SGSO), will make USGSN more efficient. Figure-4 shows the interaction of these four ontologies. The SWSO and SGSO contain the services to facilitate students, teachers and researchers.
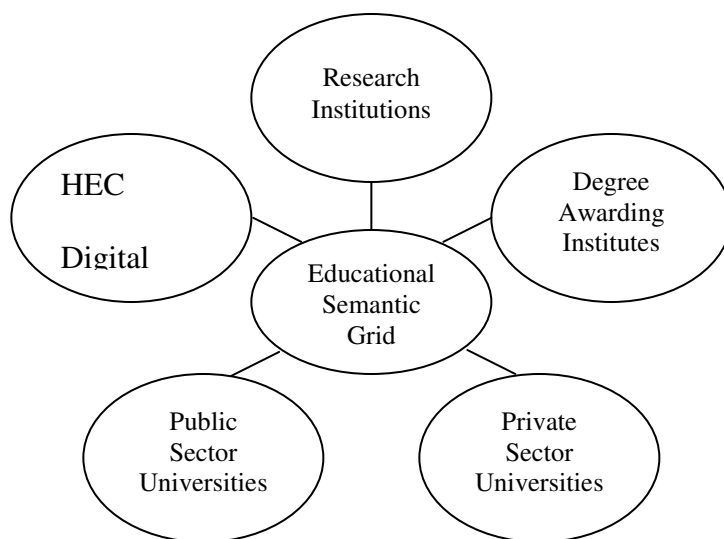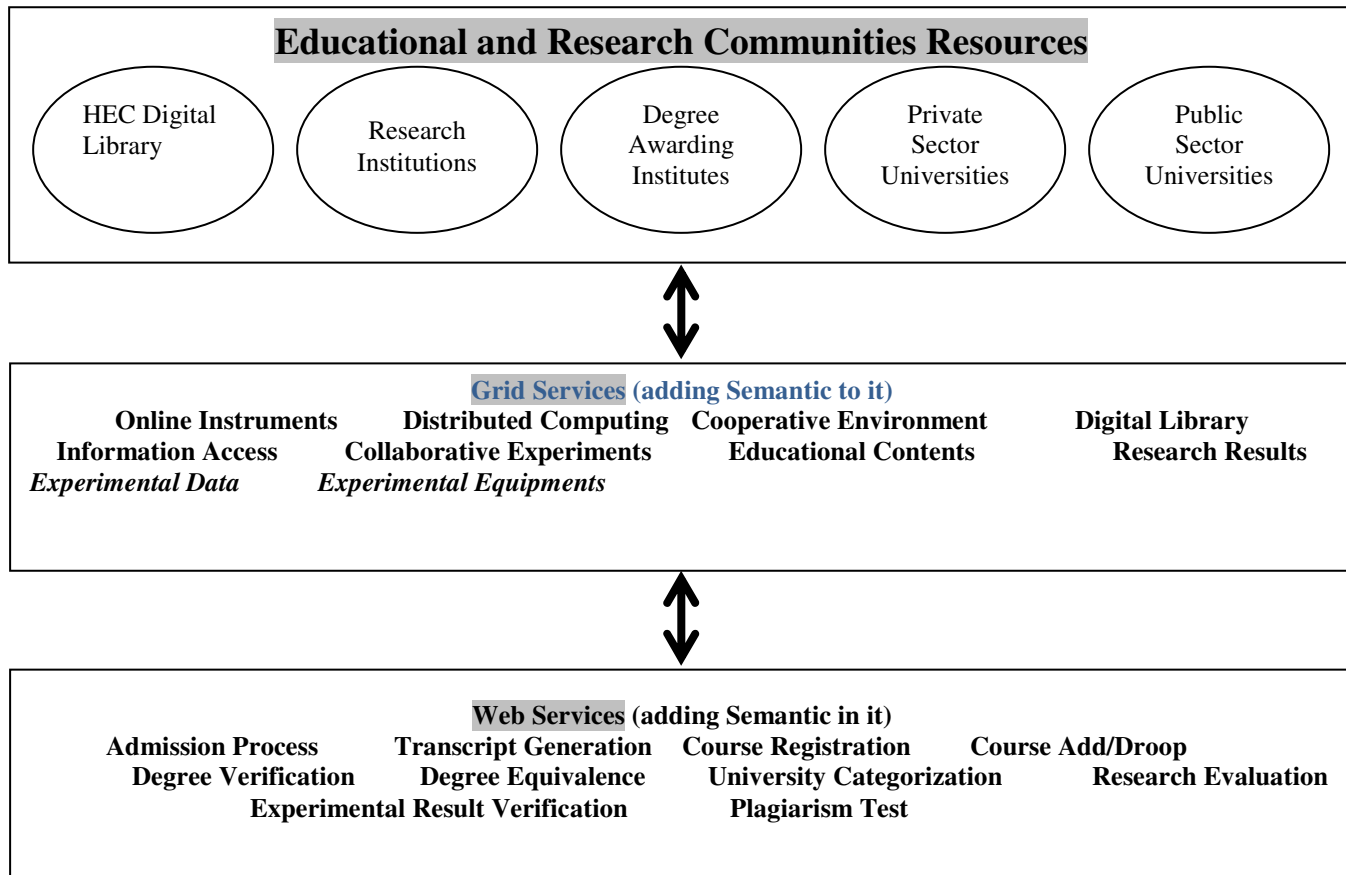

Figure-1
Evolution of Semantic Grid

Figure-2
Major Role Players of Educational Semantic Grid

Educational and Research Communities Resources

HEC Digital Library   Research Institutions   Degree Awarding Institutes   Private Sector Universities   Public Sector Universities

Grid Services (adding Semantic to it)

Online Instruments   **Distributed Computing**   **Cooperative Environment**   **Digital Library**
Information Access   **Collaborative Experiments**   **Educational Contents**   **Research Results**
Experimental Data   *Experimental Equipments*

Web Services (adding Semantic in it)

Admission Process   **Transcript Generation**   **Course Registration**   **Course Add/Droop**
Degree Verification   **Degree Equivalence**   **University Categorization**   **Research Evaluation**
Experimental Result Verification   **Plagiarism Test**

Figure-3
University Semantic Grid Social Network (USGSN) Architecture
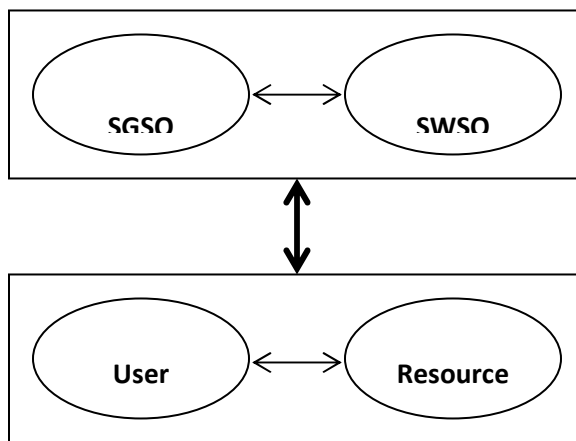
SGSO   ⟷   SWSO

User   ⟷   Resource

Figure-4
Ontologies Used in USGSN

The grid services by using semantic web technology are the core of USGSN. The main challenge facing by our students and researchers are to handle, manipulate and share their and others experimental data due to the lack of resources. The USGSN will have following roles in future: i. To provide HEC to have common interface for monitoring the activities of various universities. ii. Tracking and monitoring of experiments and research. iii. Providing different approaches in similar areas of learning and teaching. iv. To reduce the computational cost. v. To provide the common and standard principles for higher education as HEC needed. vi. To enable access to research data and its outcomes across the country. vii. To measure interaction

level between different stakeholders of USGSN by Community Algorithm[31]. viii. To avoid redundancy in same area of research. ix. To provide the future direction of work.

These are some of the impacts of the USGSN. What is needed, a dedicated group of people for overall project planning, facilitation, coordination and monitoring. We encourage the researchers and academic communities to join this project and build USGSN, which will be helpful for higher education in Pakistan.

Conclusion

The semantic grid for educational social network will be dynamic and intelligent information and computing system for future. The USGSN will provide a virtual infrastructure of distributed architecture for universities and institutions. Most of the administrative, educational and research matters will be manage by this project. The research is at the initial stage and needs continued efforts to implement and improve it.

Acknowledgement

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