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Enhanced Cloud Web Services Using Community Structure Based Complex Networks

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Abstract

A Web service is a well defined concept of a set of computational or physical activities involving a number of resources, designed to fulfill the needs of customers or for business requirement. Community structure is the most common topological structure in complex networks. A significant characteristic of complex networks is that they are generally composed of highly inner connected sub networks called community. It is very helpful and important to understand the features of these communities. This paper has focused on the community structure of structural service networks formed by public web services available on the Internet. The overall objective is to enhance the cloud web services using complex networks.

Keywords- *Complex network, Community structure, Web services, Modularity*

1. Introduction

Complex network is a huge set of nodes which are interconnected with each other, in which a node is a basic element which basically contain information content. For examples the Internet, Internet is a complex network of computers and routers connected by various physical or wireless links like the WWW, which is an large virtual network of web sites connected by hyperlinks; and various communication networks, food webs, biological neural networks, social, metabolic networks and et**c.** Several complex systems can be represented as networks. The efficient information hidden behind the network data can be used to mine the relationships among objects composing many real-world systems. From the viewpoint of graph theory, networks can be modeled as graphs, where edges represent the interactions among these objects and nodes represent the objects.

2. Community Structure

Community structure, which is a property of complex network, can be described as the gathering of vertices into groups such that there is a higher density of edges within groups than between them [4]. From the definition, the nodes in a community should have more intra-community connections rather than inter-community connections. Communities are defined as collections of nodes, connection between the nodes are thick, but between which connections are rare. There are numerous of networks or real world networks which show community structure, and community structures are play an important role in many real world networks.

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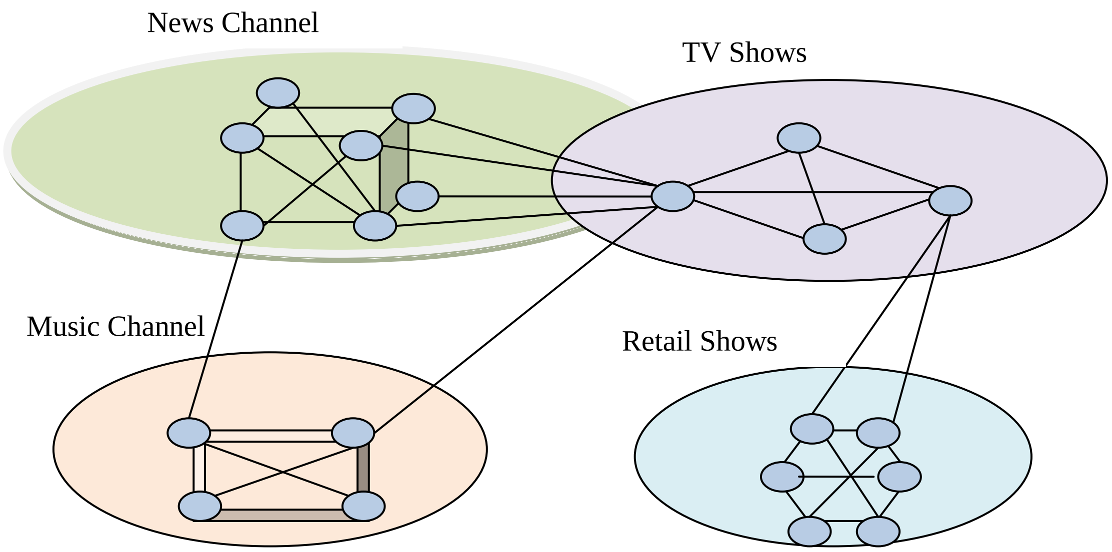

Figure 1. Different Communities in TV Cable Network

3. Web Services

A web service is a well defined concept of a set of computational or physical activities involving a number of resources, designed to fulfill the needs of customers or for business requirement. A web service is interacting through Internet based protocols and describes, advertise and discover by using standard based languages. With the technology of web services, companies or enterprises are able to represent their internal business processes as services and make them reachable via the Internet. Nowadays, companies such as Facebook, Google, Twitter, and Amazon have offered web services to provide simple access to some of their resources and enabling third parties to join and reuse their services

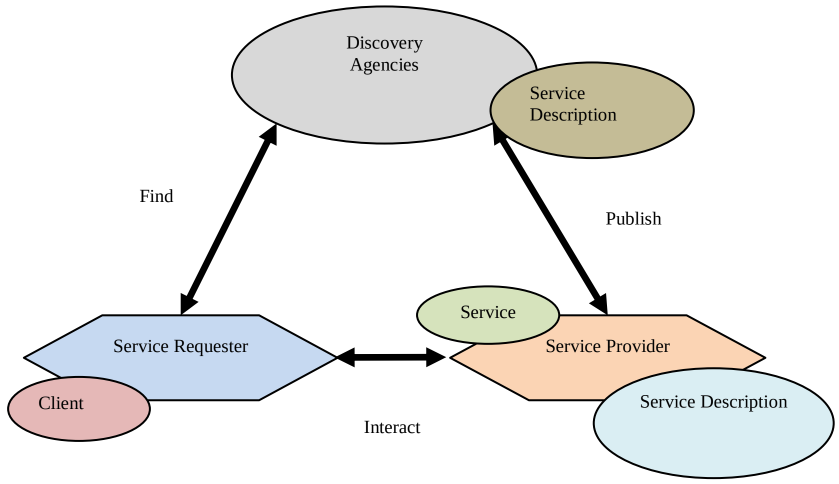

Figure 2. Service Oriented Architecture

4. Literature Review

Ala Trusina (2005), has briefly represent the concepts of complex network for the better understanding. It studied the evolution, function and structure of the complex

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networks. In this paper they direct compare the networks to characterize the networks beyond the simple degree distribution; they developed a tool for quantification of hierarchical features of real networks.

Chantal Cherifi and Jean-Francois Santucci (2013), have conducted an experimental evaluation of the topological properties of two types of composition networks, i.e. dependency and communication networks. They discussed about the description of the most useful properties which summarize the essential of a network structure from the complex networks viewpoint

Chunguang Li and Philip K Maini (2005), have analyzed the scaling properties of the network by using a mean-field approach and proposed an evolving network model with community structure. The analytical and numerical results of this paper indicate that the network can produce community structure.

Erin Cavanaugh (2006), has briefly define the concepts of the web services, the benefits and challenges of web service development. It shows the Graphical view of WSDL creation and editing.

Gonzalo Travieso et al. (2015), discussed that cloud computing has become an important means to speed up computing. One problem affecting the performance of such systems is the choice of nodes as servers responsible for executing the users' tasks. They represent how complex networks can be used to model such a problem. They study the performance of the processing correspondingly to cloud systems.

Gunce Keziban Orman and Vincent Labatut (2011), have discussed the properties of complex network and compare the five community detection algorithms by using a set of artificial networks

Heather Kreger (2001), has given the brief overview of web services. This paper describes the architecture for web service from the point of view of interactions, components, and application development patterns. The architecture presented in this paper includes high-level descriptions of the components and functions required for web services and necessities on the tools and middleware to implement these components and functions.

Ian X.Y. Leung et al. (2009), examined the problem of real-time community detection. They empirically analyzed an efficient, scalable and accurate community detection algorithm. They show that label propagation method with the appropriate modifications is a more reliable and efficient method in detecting communities in large-scale networks than the other popular existing methods.

Matthieu Latapy and Clemence Magnien (2006), have measured the fundamental properties of real-world complex networks. They studied that the collecting as much data as possible, well suited to discover real-world complex network fundamental properties. They compared the results with the usual assumptions of the field and observed that the samples certainly have some stable properties, but that some are in sharp contrast with the classical assumptions.

M. E. J. Newman (2006), has discussed about the community detection methods, the methods of optimal modularity in structural networks, additional methods of modularity maximization and the methods for dividing the network into more than two communalities.

M. E. J. Newman (2003), has reviewed some recent work on the structure and function of networked systems. He discussed about the different types of the networks their properties and network in the real world.

Michelle Girvan and M. E. J. Newman (2001), have discussed the traditional community detecting algorithms and also discussed the new ”edge betweenness” algorithm for detecting the community structure on computer-generated graphs and on real-world networks. They discussed about the different networks and their properties.

Quan Z Sheng et al. (2014), have studied about the state of the art of web services composition. They abstract a generic model for the life cycle of web service composition, which is used to contrast dissimilar research prototypes based a set of assessment criteria. They compared number of web services composition standards and services composition platforms.

Santo Fortunato and Marc Barth elemy (2008), analyzed the modularity and its applicability to community detection in detail. They researched that the definition of community implied by modularity is actually not consistent with its optimization which may favor network partitions with groups of modules combined into larger communities.

5. Proposed Methodology

Proposed algorithm is based on the concept of modularity. Modularity Q is then defined as the fraction of edges that fall within set 1 or 2, minus the expected number of edges within set 1 and 2 for a random graph with the same node degree distribution as the given network. The value of the modularity lies in the range [−1/2, 1] [5]. Given network, the community structure algorithm always produces some division of the vertices into communities; in spite of whether the network has any natural such division. To check whether a particular division is meaningful we define a quality function or "modularity" Q as follows [9].

Let e_{ii} be the fraction of edges in the network that connect vertices in group i to those in group j, and let $a_i = P_j\ e_{ij}$. Then $Q = X_i\ (e_{ii} - a_i^2)$ [9] is the fraction of edges that fall within the communities, minus the expected value of the same quantity if edges fall at random without regard for the community structure. If a particular division gives no more edge or interaction between node within community then we will get Q = 0.

Proposed algorithms are developed considering main characteristics like performance, reliability, throughput, high availability, and resource utilization. However to achieve these requirements in fig.2 flowcharts, algorithm are shown.

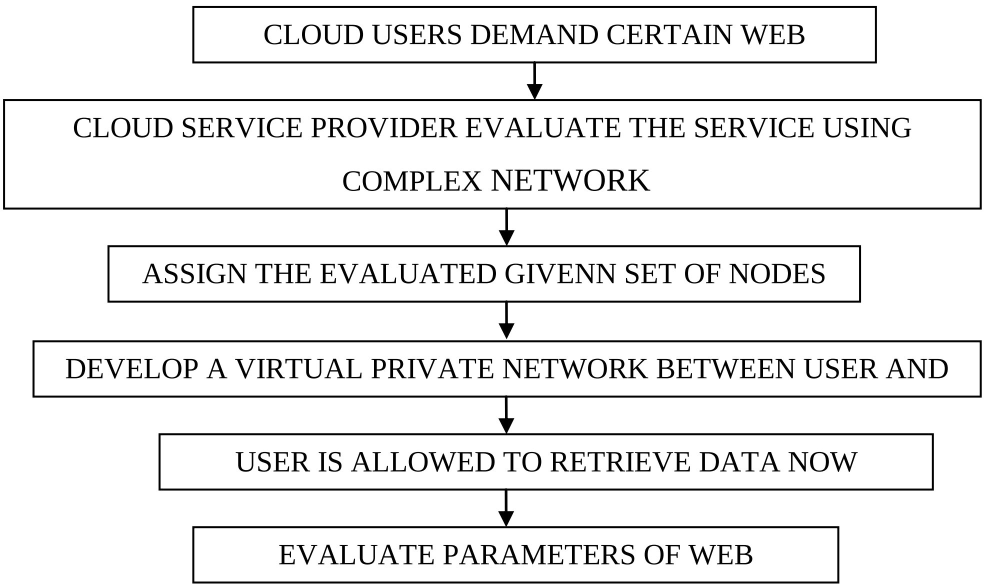

Figure 3. Flowchart of the Proposed Methodology

This flowchart will take the following steps:

Step 1: Firstly client or user of the cloud request or demand for the service.
Step 2: Discovery agencies evaluate or examine the request.
Step 3: Service provider provide the examined set of nodes to the user.

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Step 4: Service provider develop a virtual path between user and owner of the service. This is the platform that hosts access to the service.

Step 5: After step 4 now user is allowed to access the service or resources.

Step 6: At final step of the algorithm we can evaluate the parameters of the web service, such as response time, waiting time and overheads.

5.1 Motivation

It has been found that many networks display community structure, groups of vertices within which links are dense but between which they are sparser and highly sensitive computer algorithms have in recent years been developed for detecting such structure. Existing algorithms are computationally challenging, which restricts their application to small networks. Now we explain a new algorithm which presents excellent results when tested on both Computer-generated and real-world networks and is much faster, typically thousands of times faster than previous algorithms. Proposed algorithm gives better results than the existing algorithms.

6. Experimental Study

6.1 Results for Existing Work

Simulation results by existing algorithm (using MATLAB Tool). If the no. of processors 9, the complex network of cloud will b shown as Figure 4.

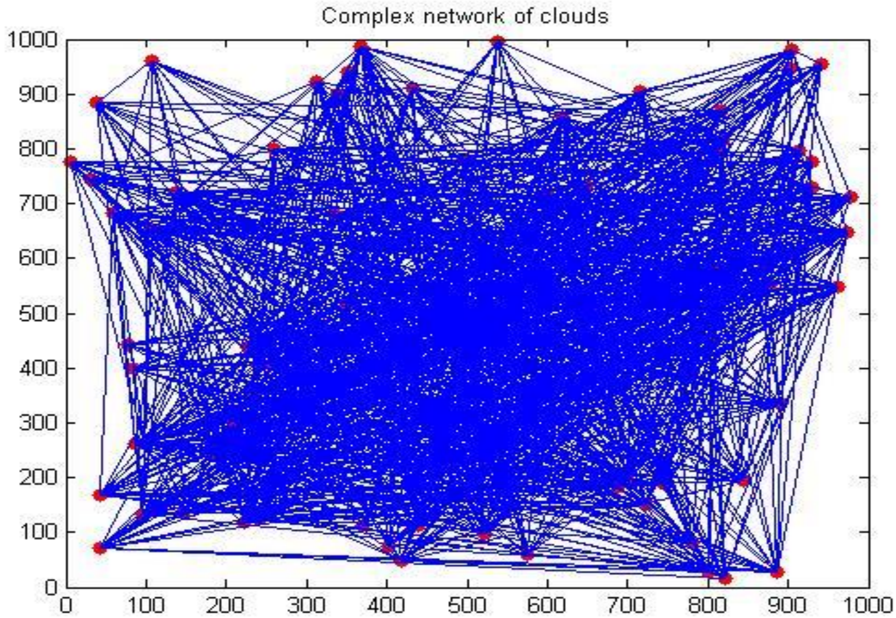

Figure 4. Shows The Complex Network of Cloud If No. of Jobs Is 9

In figure 5, x axis shows degree of the processors and y axis shows the no. of processors.

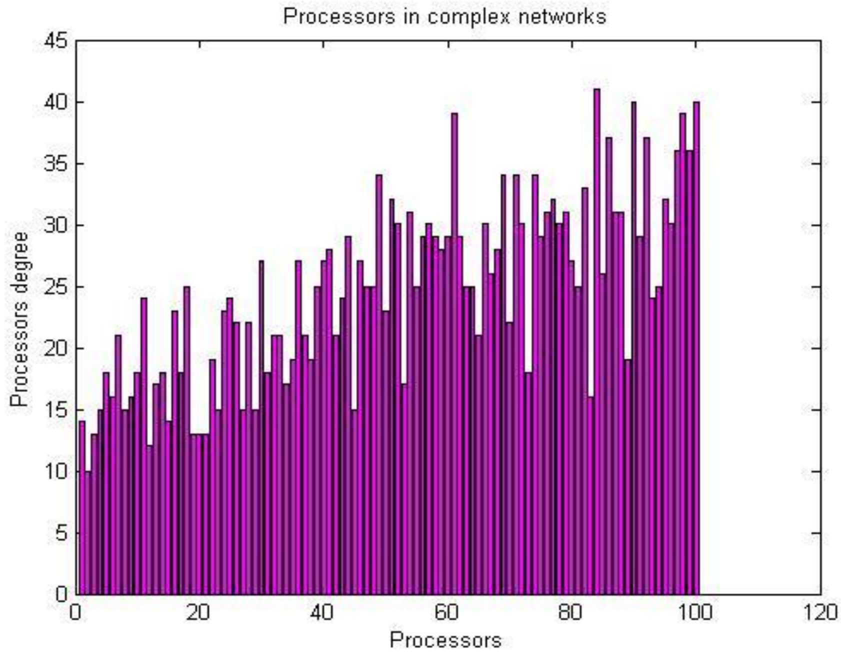

Figure 5. Shows the No. of Processors in Complex Network

In figure 6, x axis shows burst time and y axis shows the degree distribution of jobs.

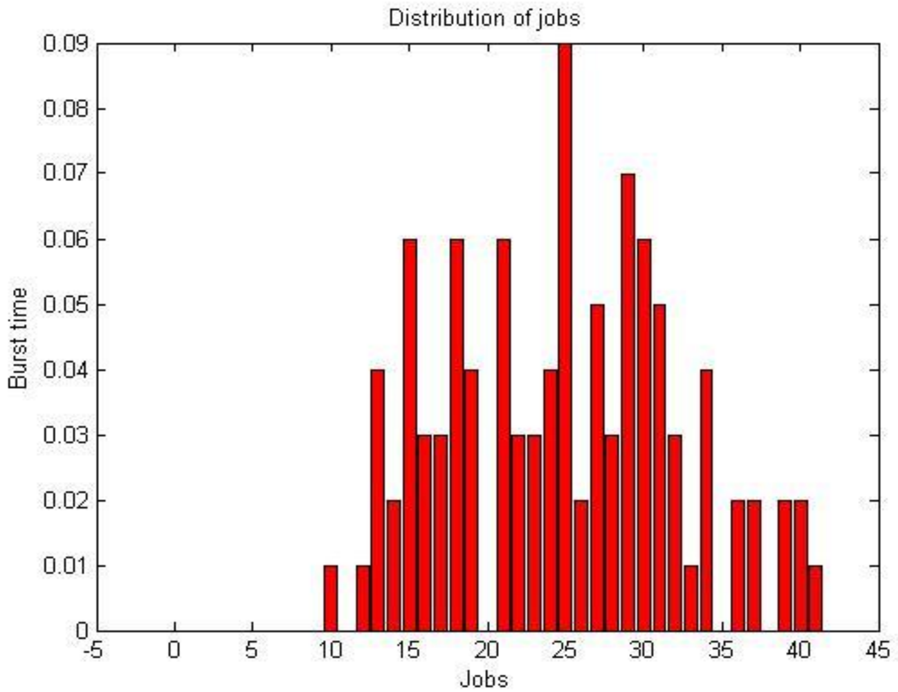

Figure 6. Shows the Distribution of Jobs

In figure 7, axis shows the duration of jobs and y axis shows the no. of processor.

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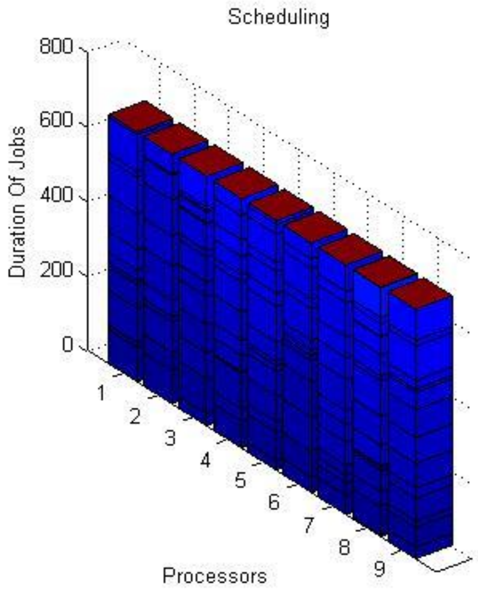

Figure 7. Shows the Scheduling Of Processors

6.2 Results for Proposed Work

Simulation results by proposed algorithm (using MATLAB Tool). If the no. of processors 9, the complex network of cloud will b shown as fig.8

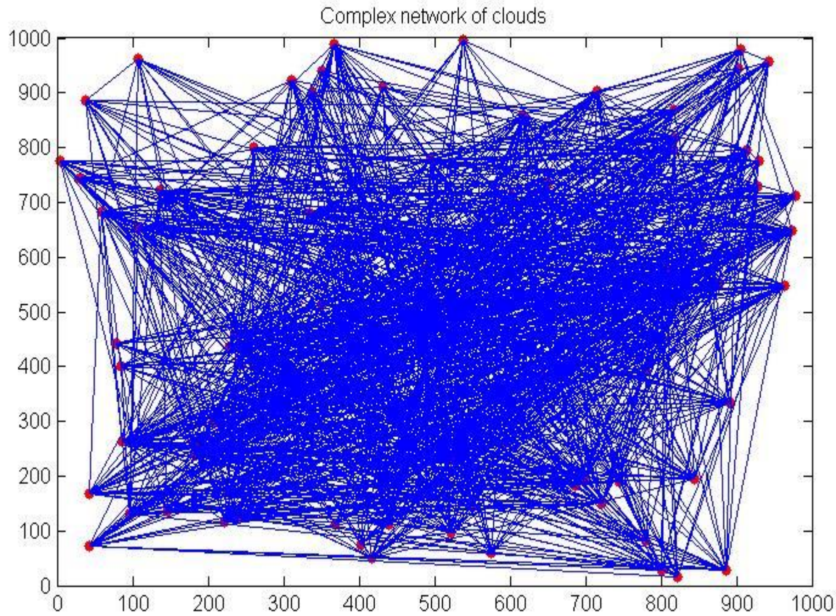

Figure 8. Shows The Complex Network Of Cloud If No. Of Jobs Is 9

In figure 9, axis shows degree of the processors and y axis shows the no. of processors.

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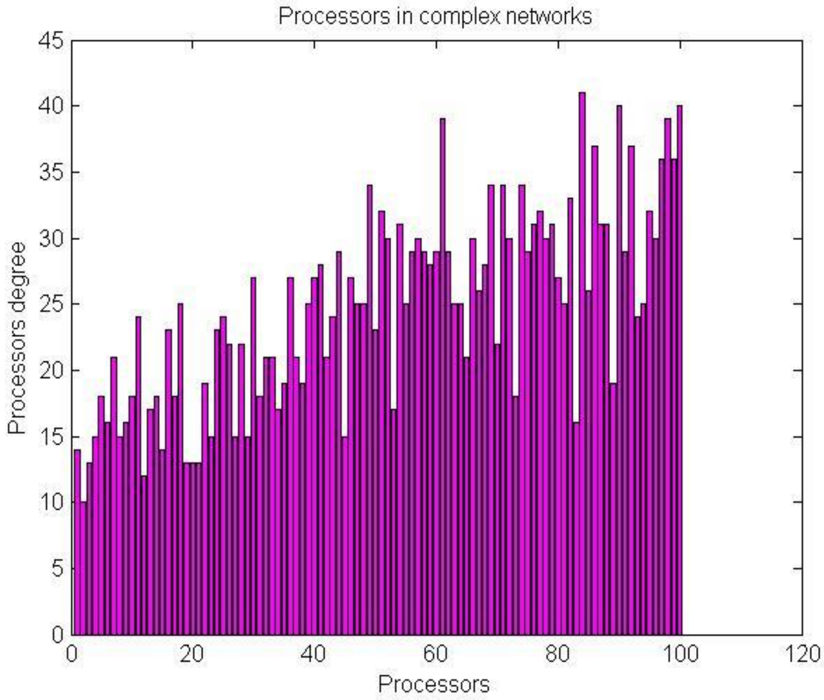

Figure 9. Shows The No. Of Processors in Complex Network

In figure 10, axis shows burst time and y axis shows the degree distribution of jobs.

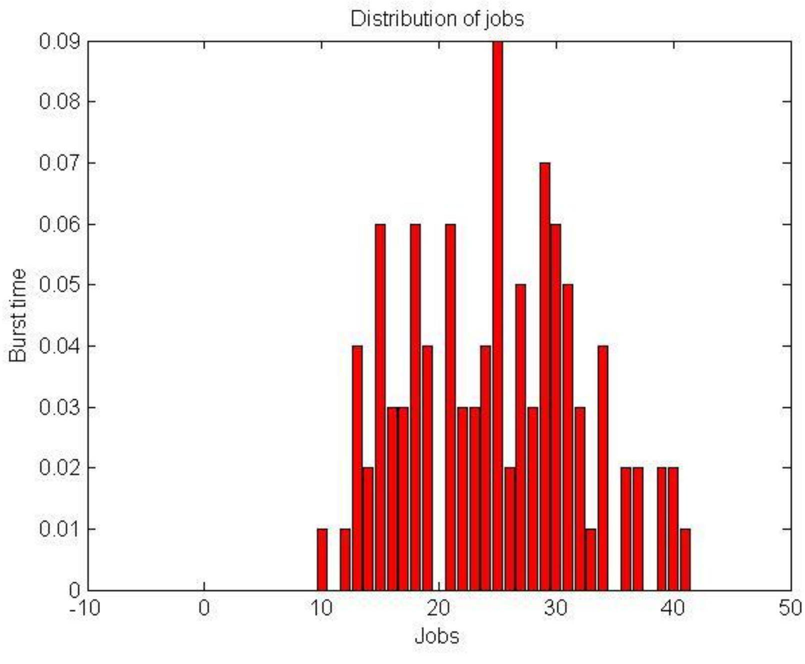

Figure 10. Shows the Distribution of Jobs

In figure 11, x axis shows the duration of jobs and y axis shows the no. of processor.

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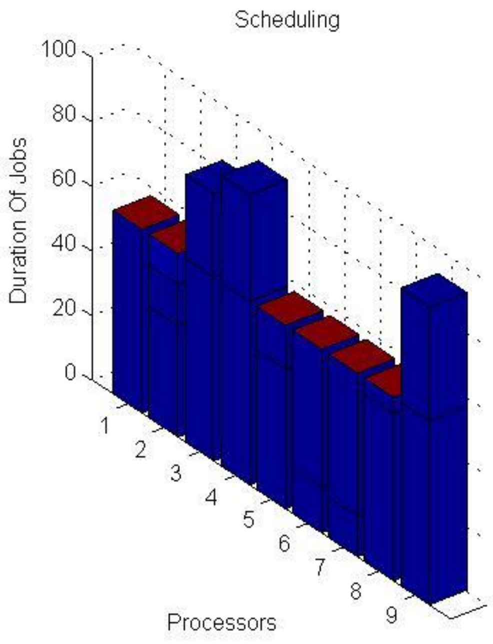

Figure 11. Shows the Scheduling Of Processors

6.3 Performance Evaluation

Response Time: Response time is the total amount of time it takes to respond to a request for service. It is a time from submission of a process to the first time it is scheduled. Table 1 shows that numbers of processors are inversely proportional to response time, when the no. of processors are become increase the response time starts decrease.

Table 1. Comparison of the Response Time between Existing and Proposed Technique

No. Of processors	Existing methods	Proposed method
2	57.5000	0.5202
3	38.3333	0.3613
4	28.7500	0.2906
5	23	0.2493
7	16.4286	0.2108
8	14.3750	0.2083
9	12.7778	0.2008

Figure 12 is representing the performance comparison of response time graphically. For better access to resources, value of response time should be as low as possible.

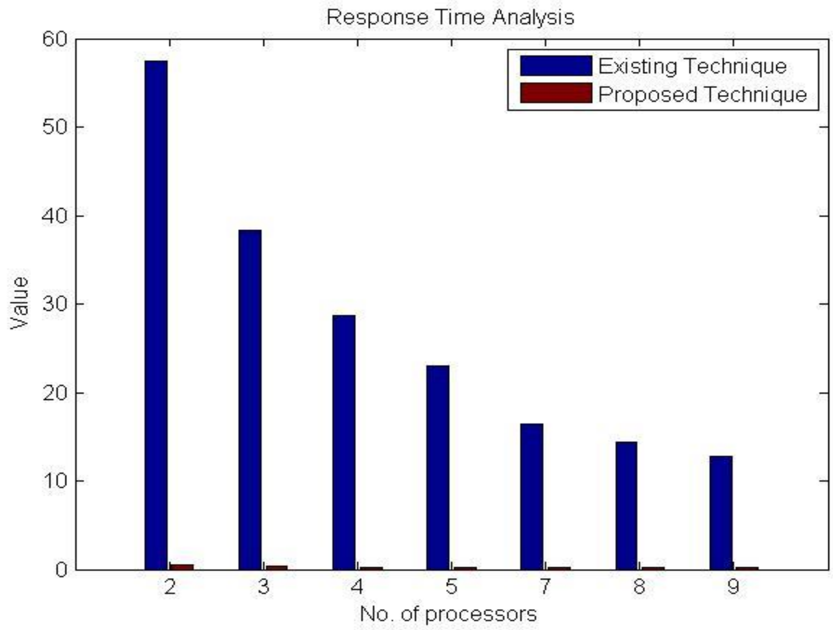

Figure 12. Comparison of Response Time

Overhead: Overhead is any combination of overload or indirect computation time, memory, bandwidth, or other resources that are required to attain a particular goal.

Table 2. Comparison Table of Overhead

No. Of processors	Existing methods	Proposed method
2	0.0938	0.0103
3	0.0286	0.0211
4	0.0279	0.0113
5	0.0275	0.0121
7	0.0347	0.0115
8	0.0296	0.0109
9	0.1854	0.0114

Figure 13 is representing the performance comparison of overheads graphically. For better access to resources, value of overheads should be as small as possible.

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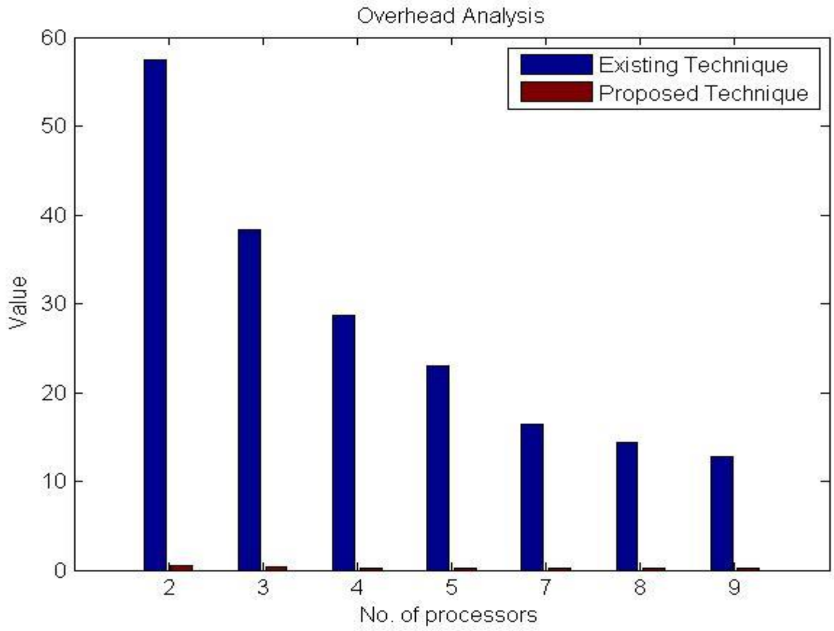

Figure 13. Comparison of Overhead

Waiting Time: Amount of time a process has been waiting in the ready queue. Table 3 shows that numbers of processors are inversely proportional to waiting time, when the no. of processors is become increase the waiting time starts decrease.

Table 3. Comparison Table of Waiting Time

No. Of processors	Existing methods	Proposed method
2	13.2978	0.1121
3	5.2821	0.0562
4	2.9321	0.0311
5	1.8595	0.0220
7	0.9363	0.0135
8	0.7855	0.0109
9	0.6451	0.0097

Figure 14 is representing the performance comparison of waiting time graphically. For better access to resources, value of waiting time should be as small as possible.

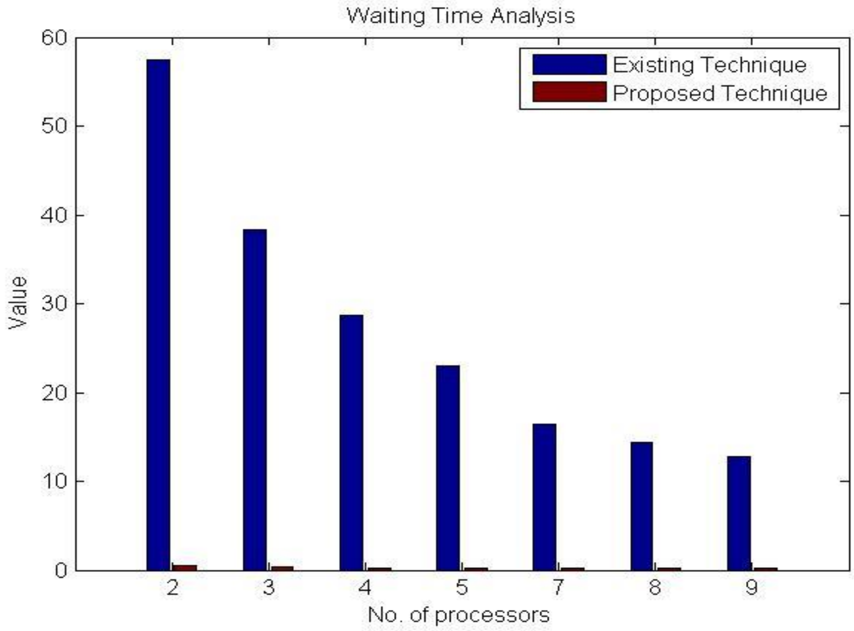

Figure 14. Comparison of Waiting Time

7. Conclusion and Future Scope

Community structure is the most common topological structure in complex networks. A significant characteristic of complex network is that they are generally composed of highly inner connected sub networks called community. It is very helpful and important to recognize the features of these communities. This paper has focused on the community structure of structural service networks formed by public web services available on the Internet The overall objective is to enhance the cloud web services using complex networks. Due to the non-availability of the actual environment, a simulation environment is considered in this dissertation. The proposed technique has been designed and implemented in the MATLAB tool with the help of data analysis toolbox. The comparative analysis has clearly shown that the proposed technique is outperforms over the available technique.

This work has not considered the use of any swarm intelligence to enhance the results more. So in near future we will propose a particle swarm optimization based complex networks to enhance the results further. Also this work is limited to few metrics only, so in near future we will consider some more quality metrics to evaluate the effectiveness of the proposed technique.

References

[1] M. E. J. Newman and M. Girvan, "Finding and evaluating community structure in networks." Preprint cond-mat/0308217, 2003.
[2] Steve Harenberg, Gonzalo Bello, L. Gjeltema, Stephen Ranshous, Jitendra Harlalka, Ramona Seay, Kanchana Padmanabhan and Nagiza Samatova , "Community detection in large-scale networks: a survey and empirical evaluation", doi: 10.1002/wics.1319, 2009.
[3] Chunguang Li and Philip K Maini, "An evolving network model with community structure**",** journal of physics a: mathematical and general, doi:10.1088/0305-4470/38/45/002, 2005.
[4] M. E. J. Newman, "Modularity and community structure in networks", PNAS, vol. 103, no. 23, 8577–8582, 2006.
[5] M. E. J. Newman, "Detecting community structure in networks", University of Michigan, Ann Arbor, MI 48109-1120, 2008.

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[6] Quan Z. Sheng, Xiaoqiang Qiao, Athanasios V. Vasilako, Claudia Szabo, Scott Bourne, Xiaofei Xu, "Web services composition: A decade's overview", ScienceDirect, doi.org/10.1016, 2014.
[7] Santo Fortunato, "Community detection in graphs", Complex Networks and Systems Lagrange Laboratory, ISI Foundation, Viale S. Severo 65, 10133, Torino, I-ITALY.
[8] M. E. J. Newman,"Fast algorithm for detecting community structure in networks", Department of Physics and Center for the Study of Complex Systems, University of Michigan, Ann Arbor, 2003.
[9] Erin Cavanaugh, "Web services: Benefits, challenges, and a unique, visual development solution", Altova WhitePaper, 2 006.
[10] Heather Kreger. "Web Services Conceptual Architecture (WSCA 1.0)", 2001.
[11] Chantal Cherifi and Jean-François Santucci, "A Comparative Study of Web Services Composition Networks", SPE Laboratory Corsica University Corte, France.
[12] Ala Trusina, "Complex network: Structure, Function and Evolution", Department of Physinc Umea university, 2005.
[13] Gunce Orman, Vincent Labatut, "A Comparison of Community Detection Algorithms on Artificial Networks", Springer, 5808, pp.242-256, 2011.
[14] Matthieu Latapy, Clemence Magnien," Measuring Fundamental Properties of Real-World Complex Networks", Paris, 2006.
[15] M. E. J. Newman, "The structure of scientific collaboration networks". Proc. Natl. Acad. Sci. USA 98, 404–409, 2001.
[16] Sune Lehmann Jørgensen, "The Structure of Complex Networks", 2007.
[17] M. E. J. Newman, "The structure and function of complex networks", Department of Physics, University of Michigan, Ann Arbor, MI 48109, U.S.A,2003.

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