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AN EFFICIENT SUPER PEER SELECTION ALGORITHM FOR PEER-TO-PEER (P2P) LIVE STREAMING NETWORK

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ABSTRACT

Peer-to-Peer (P2P) computing is the fast emergent overlay network distribution system, the main gains of P2P is each peer in the network can act autonomous. Super peer network representation is an advancing design of centralized topology embedded in a decentralized system in the Peer-to-Peer system. Super peer overlay helps to improve the performance of P2P applications such as live streaming. To avoid the risk of super peer node failure in the network communication model, this paper proposes the gossip communication based established protocol and firefly algorithm to select the fail over super peer node from a cluster of peers in order to maintain the reliability, scalability and robustness of the network. We simulated this network model in peersim simulator to accomplish great performance.

Keywords:- *Convergence Time, Distributed Network, Firefly Algorithm, Gossip, Super peer overlay*

1. INTRODUCTION

P2P computing is the self-governing distributed network system, it is enormously scalable for a huge number of users and peers, nodes can be linked or detached anytime in this network The Peer-to-Peer system became very popular in sharing a large amount of data. The P2P is utilized to distribute the resource, sharing the data, disk-space and also bandwidth for transferring those data [8]. The P2P network technologies help to construct large scale network service and applications such as Bittorrent, Skype, pplive. Many P2P network constructions were made to enable the P2P applications to run more efficiently. Super peer P2P model is the new wave advancing architecture of centralized topology model in pure P2P system. In Pure P2P system, each node in the network is interconnected to each other and shares their information with other nodes. But this system also tends to be fault tolerant; the failure of one node does not affect the performance of other nodes in the network. Super peer overlay network forms the decentralized P2P nodes with centralized super peer nodes. The super peer nodes manages all traffic query of the nodes in system, the searching is more faster in super peer model when compared to other network models, since the super peer have all the resource information for their connected set of peers[1]-[8].

Performance of the P2P application is based on the allocated nodes with high bandwidth and high computation processing. Super peer node takes care of all the above things in a super peer overlay network. But the major issue in super peer overlay network is risk of failure of the super peer when super peer node is down, there must be a new high performance to take care of those processes. Therefore to construct a robust super peer overlay network we need the best algorithm to find best peer in the group of peers. This paper utilized the gossip communication method and firefly algorithm in order to select next high performance node from the group of peer nodes.

Normally the P2P content delivery carryout the following basic concept, In order to conquer the connectivity difficulty in P2P system, this paper proposes bandwidth based cluster. The

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video server make cluster based on bandwidth size subsequent to client registration. After the request is received from client / server, the video server instantly finds the highest bandwidth and LFU peer within the cluster and forwards the service. So, the highest bandwidth peer provides service to requested peer. Likewise, the subsequent highest bandwidth peer takes charge to provide service to client as the highest bandwidth goes off-line. Therefore we understand that the service is provided by the highest bandwidth peer. The experimental result proves that there is enhanced data accessibility and effectiveness of data transferring [24], [25].

To download the accessible data segments, the client initially conveys the request to the adjacent peers or else it can download from the video server. By utilizing the time period of each data piece, the proposed approach concentrates on the reputation of the data pieces which are accessible in the tail part. And rather than eliminating the data pieces of the tail part it can be kept for more processing [26].

In this paper the first section focused on introduction about P2P networks and related with super peer selection. The second section carried out related work on P2P and super peer section. Third section mainly gives details about proposed model. The fourth section gives result and discussion and the final section comprehends conclusion and future works.

2. RELATED WORK

There are numerous researches presently going on to construct a better super peer overlay network [13-14]. So numerous design principles were released to assemble the super peer overlay [13, 14] Most of the studies were connected to enhance find and security issues of the super peer network. This network Super-peer selection has to make a trade-off between tumbling communication latency and selecting influential super-peers. Further studies investigated the semantic similarity of peers after constructing a super-peer overlay; Client peers that share the same significance are connected to the same super-peers. However, these studies aimed to get better search efficiency rather than the efficiency of quickly constructing a robust super-peer overlay. In supplement, little super-peers might be overloaded because of accepted content. The connections amid super-peers and client peers in a super-peer overlay were additionally investigated [14, 17, 19, 20, 22]. However, these studies consented that a super-peer overlay by now exists and focused on managing an existing overlay instead of building an initial super-peer overlay, presented a Labeled Tree to build a super-peer overlay. They are expected to accomplish reliable high-speed transmission in a live stream rather than the efficiency of rapidly constructing a super-peer overlay. In their analysis, super-peers are selected merely established on the online-time, which did not take report of other information of nodes, e.g., processing capacity, and bandwidth.

Montresor recommended a gossip-based algorithm, SG-1, for the efficiency of rapidly constructing a super-peer overlay. In SG-1, peers choose whether they ought to seize an act of a super-peer by contrasting their capacities alongside a randomly sampled acquaintance peer that is easy but seizes long period to select demanded super-peers. A super-peer hunts and adds client peers merely amongst its one-hop neighbors. All the peers in the overlay seize the act of a super-peer in the commencing of the overlay assembly

In this paper, we concentrate on constructing better super peer overlay network without the risk of the failure. And also explain the robustness of proposed protocol in Peer-to-Peer network. We take nodes' performance and CPU time as the parameter in order to find the next best super peer.

3. PROPOSED SYSTEM MODEL

3.1 Firefly Algorithm

In present periods, Firefly Algorithm was established by Xin-She Yang in 2007 at Cambridge University [17] which is based on flashing (Social) behavior of fireflies. He utilized firefly algorithm as an optimization algorithm for various applications [19]. A firefly agent with lower flash intensity gets easily attracted in the direction of other fireflies with a higher flash intensity in which the light intensity diminishes as the distance increases. This algorithm has two gains which are innate attractions and automatic regrouping and is consequently disparate from particle swarm optimization. The attraction amid fireflies can be innate or globe reliant on the absorption co-efficient and the light intensity, so that all the innate modes and globe modes will be imposed. As the attraction amid the nearest fireflies is stronger contrasted to the attraction amid the farthest fireflies, they subdivide from

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one another and create a few subgroups. This supremacy makes it appropriate for global optimization problems.

The flashing light helps fireflies in attracting their potential victim, protecting themselves from their enemy, including their successful reproduction, for finding mates and also to share their food. Fireflies are considered as agents that discharge light, relative to the value of luciferin, which is carried in the abdomen of firefly. The idealized firefly algorithm consists of the following three rules (1) The unisexual characteristics of artificial fireflies make them attracted in the direction of other fireflies regardless of their sex; (2) The degree of the attractiveness is relative to the brightness of light intensity and this decreases with respect to distance as the air absorbs light. Hence when two flashing fireflies are taken into account, the firefly with less brighter intensity will travel towards the brighter firefly. If a particular firefly is brighter than any other firefly then it will proceed randomly. (3) The brightness of flashing light is ambitious by the worth of the goal purpose that is to be optimized.

In the design of real-world engineering problems, Azad and Azad [20] and Gandomi et al. [21] proved that multimodal optimization problems can be efficiently designed and solved by firefly algorithm. Banati and Bajaj showed that FA created a reliable and improved performance in terms of time and optimality for feature selection when compared with other algorithms. Horng et al. demonstrated that firefly-based method (firefly-based algorithm) showed high speed and excellent reconstructed images while compressing the digital images.

Chatterjee et al. as well as Basu and Mahanti have presented a firefly algorithm for the optimization of antenna design problem and confirmed that firefly algorithm outperforms artificial bee colony algorithm [19] and particle swarm optimization. Yukon Zhang et al demonstrated the image registration mechanism using FA. In [21], FA is applied to solve job shop scheduling problem, which involves complex combinatorial optimization that are categorized into non-deterministic polynomial (NP) hard problem. Olympia Roeva adapted FA for a model parameter identification of an E-coli fed-batch cultivation process and performed parameter optimization.

By comparing FA with eleven different algorithms, Senthilnath et al. presented a broad performance study for clustering and showed its superior performance. In addition, the neural networks have been trained by firefly algorithm. Firefly algorithm has also been merged with other algorithms to improve the performance.

The important steps of firefly algorithm are as follows: The first step is to initialize firefly agents in which each firefly is characterized by its light intensity. During the pair-wise firefly comparison in each loop, the brighter firefly attracts the firefly with lower light intensity. The attraction relies on the distance between the two fireflies. After attraction, the new firefly is assessed for its light intensity and it is updated. The best-so-far solution obtained at the end of each pair-wise loop is updated iteratively. This pair-wise loop comparison process is performed till the termination criterion is verified.

3.2 Gossip Protocol

Gossip protocols have proven to be effective means by which failures can be detected in massive, distributed systems in an asynchronous manner without the limitations associated with reliable multicasting for group communications. In this paper, in our work, we use Newscast (a gossip protocol that maintains a dynamic random topology) for data dissemination amid peers. Newscast has been utilized for P2P applications, such as broadcast [7] and aggregation for its effective information dissemination. Further-more, Newscast is designed for a dynamic environment and enables peers to capture the dynamicity of an overlay, e.g., joining of a new node or departing of a node.

The finished believed of Newscast is as follows: in Newscast, every single solitary node maintains a partial view that is constituted of a fixed-size set of peer descriptors. A peer descriptor is composed of the data of the address of a node, a timestamp knowing afterward the descriptor is crafted, and request specific information. Every single node periodically exchanges and merges its partial view with a randomly selected node to get an up-to-date partial view and a better approximation of the target topology. Extra data can be discovered in Jelasity et al.[14] .

The function Randompeer () selects the random nodes from the peer sets and the update () function performs the information update of

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the selected random peer. Simultaneously functions, receive () and return (), exchange the information between the selected peers. These functions replace the old information about the peers in regular intervals. A Description of the gossip newscast protocol is as follows,

3.2.1 Algorithm for proposed Gossip Protocol:

infinite loop

regular time interval

np=randompeer();

Sendstate(np)

state(np)=receive(np)

Update(state(np),np);

infinite loop

regular time interval

state(np)=receive(np)

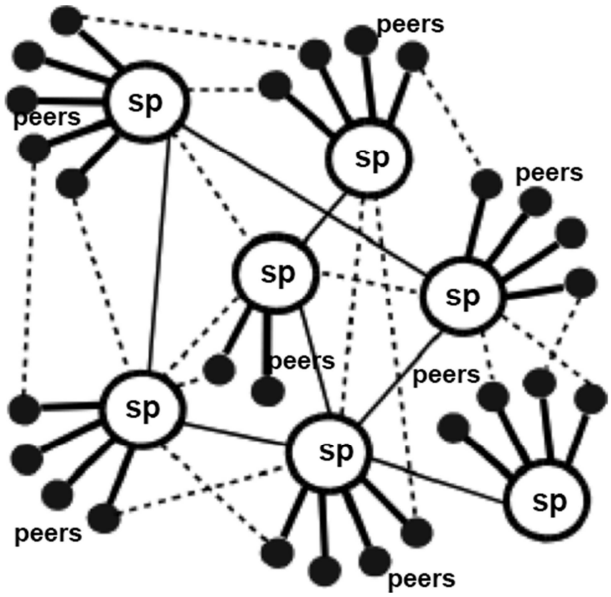
Return(own

Update(state(np),np);

All the super peers continuously try to find the normal peers with large capacity and rank them before adding them into under-loaded list. Firefly algorithm helps to assign the ranks for the each node in the peers set. Firefly ranking step described in the implementation section. Gossip newscast protocol features help to find the crashed super and normal peers in the network. This paper only considers the failure of super peer in the network. Super peers and client peers are able to detect both the failures while faulty client nodes are removed from peers set. When client peers detect the failure of the super peer it will check the rank of the other under-loaded peer, higher rank peers act as the super peer.

3.3 Proposed Super Peer systems Architecture

The Figure 1 shows the proposed Super Peer system architecture. We assume that peers are connected each other and form the overlay network using the existing routed network, such as the internet, where the peers can communicate each other efficiently. To actually communicate, a node has to know the address of another node. This is achieved by maintaining the registry at each node that contains a set of node descriptor. Views can be elucidated as sets of edges amid nodes, naturally defining a directed graph above the nodes that ascertain the topology of an overlay network. The network is exceedingly dynamic; new nodes could link at each period, and continuing nodes could depart, whichever voluntarily or by crashing. Our way does not need each mechanism specific to leaves: spontaneous crashes and voluntary leaves are indulged uniformly. Thus, in the pursuing, we check our discussion to node crashes. Byzantine failures, alongside nodes behaving arbitrarily, are excluded from the present discussion



SP – Super Peer
Figure 1: Proposed Super Peer system Architecture

3.4 Proposed System Implementation

We implement this system model using Peersim [22] .Peersim is the scalable simulator that supports Dynamic scenarios such as node failure. Since it's more flexible we develop our algorithm using peersim simulator. Peersim supports countless easy, extendable, and pluggable constituents, alongside a flexible configuration mechanism. We modify the SG-1 [23] package, which is helping to construct the fast super peer overlay network. SG-1 was

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previously used in [23]. We added some additional modification from original SG-1 to develop this protocol.

3.4.1 Proposed system Algorithm

```
if status(p(i))== failed then
      failureHandler(p(i))
assign the super peer from underloaded list
      based on the their rank
else
Calculate_Peer_Rank()
endif

Calculate_Peer_Rank() (firefly algorithm)

While (t < No of Peers)

            fori = 1 : n
            for j = 1 : n
      if (capacity(pj) >capacity(pi)),
      move peers i towards j;
      end if
      node with higher Bandwidth
                  and performance
      updateunderloaded node list;
      end for j
      end for i
       Rank nodes and find the current best;
      end while
      end
```

4. RESULT AND DISCUSSION

We evaluate our approach through numerous experiments based on the simulation. We validate out protocol with the condition of node failures and how the protocol acts. All experiments are performed using a custom-developed, peersim round-driven simulator. The In all figures, 20 independent experiments have been performed. Unless stated otherwise, most of the parameters are fixed in all experiments: the size of the network is 105 nodes; the maximum capacity is 500; and the sizes of partial views used in NEWSCAST are 20. All these values can be reasonably adopted or measured in realistic settings; yet, the behaviors of the algorithm observed under variations of these parameters are analyzed in the following sections.

4.1 Convergence Time

This section, we evaluate how speed the proposed protocol can converge. Converge means, in which point the peers can't add no more. Two types of distribution for nodes capacity are evaluated: uniform and power-law distribution. Figure 2 explains the how many nodes where joined in the network when simulation goes on. Converge point of the distribution were shown in figure. No more client peers can't add after the convergence. In power-law distribution the convergence point reached quickly that means takes less time to construct the super peer network when compare to the uniform distribution.

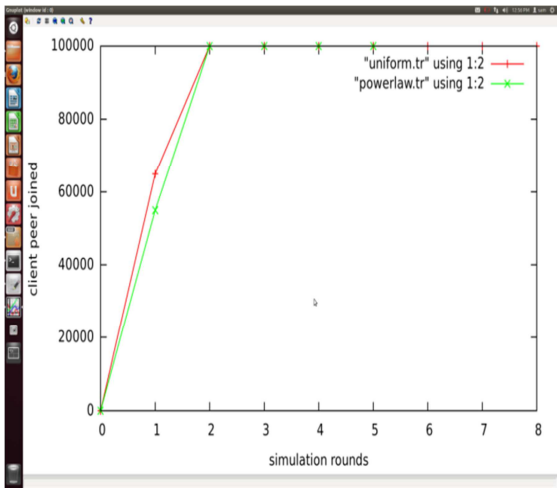

Figure 2 (a): Convergence of the two distributions during simulation

Uniform distribution takes more rounds to reach the convergence point. The number of selected super-peers in the target super-peer overlay as maximum capacity of super-peers increases. Figure 2a.Illustrates the number of needed simulation rounds for convergence as maximum capacity of super-peers increases. Figure 2a shows when the capacity of super peer increase we need more rounds to reach the converge point. SG-1 needs more rounds to convergence when compared to proposal protocol.

In the proposed, a set of super-peer candidates is crafted for selecting peers alongside extremely elevated capacity as super- peers, and a conditional two-hop find method is retained for super-peers to swiftly find client peers. Even after the number of the needed super-peers cuts, most of the super-peers can yet be selected across super-peer candidates across the early insufficient simulation rounds.

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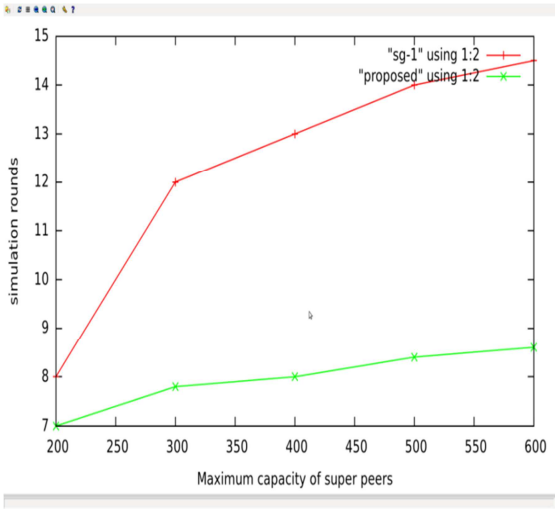

Figure 2(b): Maximum capacity of super peers during simulation

As quickly as super-peers are selected, client peers can swiftly join a super-peer and super-peers can quickly find and add client peers alongside a conditional two- hop find method (which makes the converge even faster). Though, for SG-1, after the number of the needed super-peers cuts, more super-peers demand to change their act to be client peers, as the early act of all the peers is a super-peer. Moreover, super-peers merely difference their capacities alongside one of their acquaintances to ascertain their role and find client peers amid its one-hop neighbors.

4.2 Robustness

This section, we analysis the robustness of the proposed protocol in the condition of super-peer failure and result compared with SG-1protocol.scenarios: (a) 10% of super-peers are removed at the sixth simulation round, (b) 20% of super-peers are removed at the sixth simulation round, and (c) 30% of super-peers are removed at the sixth simulation round. The robustness of proposed protocol is comparable to SG-1 in the face of super-peer failure when taking into account both the convergence time and the impact of super-peers' failure on client peers. In the case of the failure of 30% super-peers as shown in Figure 3 (c), the number of client peers without a super-peer (because of super-peer failure) in proposed protocol (around 3/5 of client peers) is larger than that of SG-1 (around 1/5 of client peers). That is, there is a sharp reduce in the number of client peers that have joined a super-peer in our Counseled protocol contrasted to a tiny reduce in SG-1.However, the demanded simulation rounds for refurbishing stable state in our protocol (restored at round 10) are less than those in SG-1 (restored at round 12). In outline, our SPS seizes less simulation rounds to reinstate in the face of larger number client peers lacking a super-peer (because of super-peer failure) contrasted to SG-1.

When little super-peers are failed at the sixth simulation round, they are removed from the overlay. On one hand, the client peers, whose super-peers have crashed, remove the failed super-peers from their sets of super-peer candidates and rebuild their sets of super- peer candidates by executing the proposed algorithm. Then, these client peers select and join new super-peers. On the other hand, most of the needed super-peers can be selected across the early few simulation rounds. Thus, even additional super-peers fail; there is merely a slight variation in the number of the needed simulation rounds for the overlay to converge again. Based on the simulation results above, we can finish that our protocol is robust to failure of super-peers and our protocol is capable in rearranging a super-peer overlay

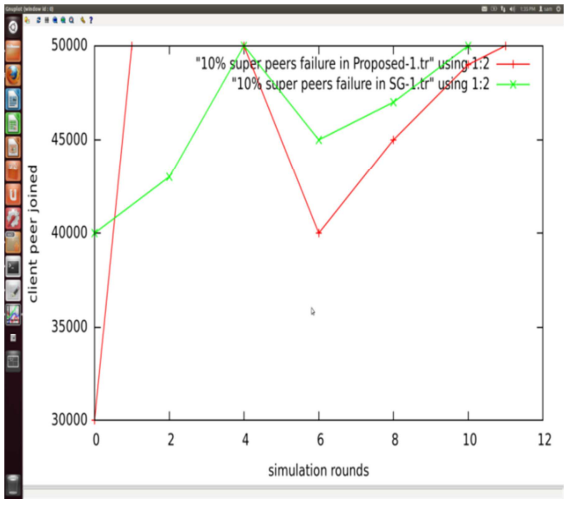

Figure 3(a).10% failure of super peer

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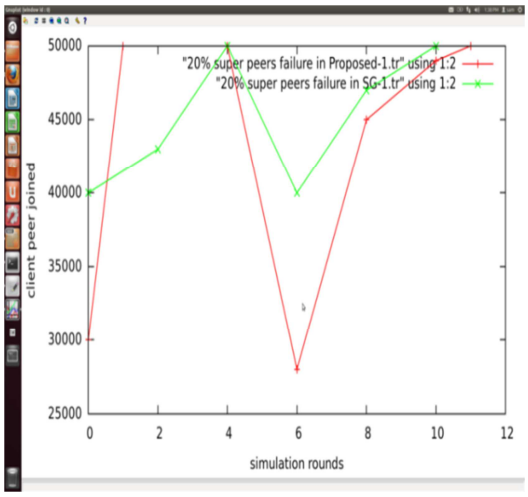

Figure 3 (b). 20% failure of super peer

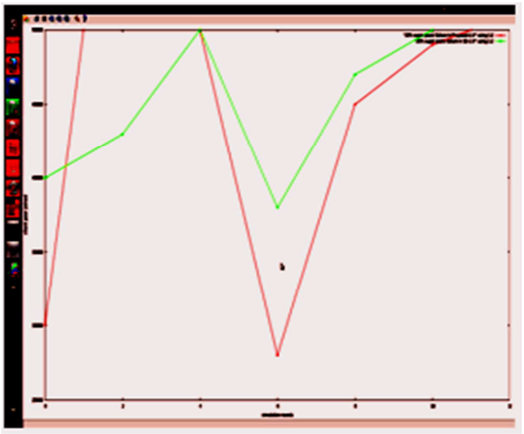

Figure 3(c). 30% failure of super peer

Figure 3. Robustness of the Proposed Protocol to failure of super-peers compared to SG-1.

5. CONCLUSION

In this paper, we have presented Firefly algorithm based gossip protocol in order to solve the problem of node failure in super-peer network. The protocol allows multiple sources to distribute information across a group with low latency, minimal membership maintenance, and without statements on the fundamental network condition. This protocol additionally updates rank of nodes inside the set of peers periodically. We have shown the better performance was achieved with acceptable delay in the proposed model and protocol.

REFERENCES:

[1]. Meirong Liu, ErkkiHarjula and Mika Ylianttila,"An efficient selection algorithm for building a super-peer overlay", *Journal of Internet Services and Applications 2013*, 4:4 doi: 10.1186/1869-0238-4-4, Published: 27 February 2013.

[2]. Pawel Garbacki and Dick H.J. Epema, Maarten van Steen, "Optimizing Peer Relatinships in a Super-Peer Network". *[ftp://ftp.minix3.org/pub/steen/papers/2007a .icdcs.pdf] [accessed on 25.12.13]*

[3]. Robbert van Renesse, Dan Dumitriu, Valient Gough, Chris Thomas, "Efficient Reconciliation and Flow Control for Anti Entropy Protocols",*[http://www.cs.cornell.edu/home/ rvr/papers /flowgossip.pdf] [accessed on 25.12.13]*.

[4]. Hogskolan I Jonkoping, 2008, Tekniska Hogskolan, [http://hj.se/jth.html], [accessed on 25.12.13].

[5]. Vincent Wing-HeiLuk, Albert Kai-Sun Wong, Robin Wentao Ouyang, Chin-Tau Lea, "Gossip-based Delay-Sensitive N-to-N Information Dissemination Protocol", *IEEE "GLOBECOM" 2008*.

[6]. Vincent Wing-HeiLuk, Albert Kai-Sun Wong, Chin-Tau Lea and Robin WentaoOuyang, "RPG: Redundancy Reduced Gossip Protocol for Real-Time N-to-N Dynamic Group Communication", *Journal of Internet Services and Applications*, 2013.

[7]. OtsoKassinen, TimoKoskela, ErkkiHarjula, "Taxonomy for P2P Group Management Solutions", http://www.ietf.org/proceedings/77/slides/P2PRG-7.pdf, [accessed on 25.12.13].

[8]. Wolf-TiloBalke and Wolf Siberski, "Unstructured Peer-to-Peer Networks ", Peer-to-Peer Systems and Applications, Springer LNCS 3485, Oct 2007.

[9]. Baptiste Pretre, "Attacks on Peer-to-Peer Networks", http://disco.ethz.ch/theses/ss05 /freenet.pdf, [accessed on 10th Jan 2014].

[10]. "Tips for Authors: Writing and Search Engine Optimization", http:// static. springer.com/sgw/documents/12 98243/application/pdf/H4552_Author_SEO

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

_Tips_Jan2012.pdf, [accessed on 10th Jan 2014].

[11]. Dr. Hongwei Li, Dr. Haojin Zhu, Dr. Bong Jun (David) Choi, "Security and Privacy of P2P Networks in Emerging Smart City", *www.Springer.com*, [accessed on 25th Dec 2014].

[12]. Lin Wang, "Attacks Against Peer-to-peer Networks and Countermeasures", *TKK T-110.5290 Seminar on Network Security* 2006-12-11/12.

[13]. Garbacki P, Epema DHJ, Steen M (2010) "the design and evaluation of a self-organizing superpeer network", *IEEE Trans Comput*59(3):317–331.

[14]. Jelasity M, Montresor A, Babaoglu O (2009), "T-Man: gossip-based fast overlay topology construction", *Computer Networks Elsevier* 53(13):2321–2339.

[15]. Liu M, Zhou J, Koskela T, Ylianttila M (2009),"A robust algorithm for the membership management of super-peer overlay", *Proc of 12th IFIP/IEEE International Conference on Management of Multimedia and Mobile Networks and Services*:132–143.

[16]. Yang X. S, "Firefly algorithms for multimodal optimization in: StochasticAlgorithms: Foundations and Applications, SAGA 2009, *Lecture Notes in Computer Sciences*, Vol. 5792, pp. 169-178, 2009.

[17]. Yang, X. S. "Nature-Inspired Metaheuristic Algorithms", Luniver Press, UK, 2007.

[18]. Yang, X. S. "Firefly algorithm, stochastic test functions and design optimization", Int.J.Bio-Inspired Computation, 2(2), 78-84, 2010.

[19]. Yang, X. S., "Multiobjective firefly algorithm for continuous optimization", Engineering with Computers, Online Fist, DOI: 10.1007/s00366-012-0254-1, 2012.

[20]. Sina K. Azad, Saeid K. Azad, "Optimum Design of Structures Using an Improved Firefly Algorithm*", International Journal of Optimisationin Civil Engineering*, 1(2), 327-340, 2011.

[21]. Aphirak Khadwilard, Sirikarn Chansombat, Thatchai Thepphakorn, Peeraya Thapatsuwan, Waratta pop Chainate and Pupong Pongcharoen. "Investigation of Firefly Algorithm Parameter Setting for Solving Job Shop Scheduling Problems", *Operation Research Network in Thailand*", pp.89-97, 2011

[22]. "Peersim Simulator", [peersim.source forge.net] [accessed on 10th Jan 2014].

[23]. Alberto Montresor. "A Robust Protocol for Building Super peer Overlay Topologies", *In Proceedings of the 4th International Conference on Peer-to-Peer Computing*, Zurich, Switzerland, August 2004. IEEE.

[24]. Narayanan, M.; Arun, C., "An efficient technique for video content managing in Peer - to- Peer computing using multilevel cache and bandwidth based cluster," *Signal Propagation and Computer Technology (ICSPCT), 2014 International Conference on* , vol., no., pp.317,322, 12-13 July 2014.

[25]. M.Narayanan, C.Arun" An Efficient Method for Handling Data Segment with Multi-Level Caching over Video-on-Demand using P2P Computing", *European Journal of Scientific Research*. ISSN 1450-216X Vol. 93 No 2 December, 2012, pp.206-213.

[26]. M. Narayanan and C. Arun "Outliers Based Caching of Data Segment with Synchronization over Video-on Demand using P2P Computing," *Research Journal of Applied Sciences, Engineering and Technology*, 7(21): 4559-4564, June 2014.