Established Link Optimization using Particle Swarm Optimization Algorithm

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Abstract - In modern days, various techniques have been proposed to improve overlay network performances. The quality of services is obtained in the overlay network through selection of best links. In previous researches are suggested several methods but has failed to provide optimal links between source and destination nodes. In the existing system, several factors that can affect the performance of overlay network routing, multi-goal optimization model for overlay link selection problem can be put forward. This scenario model assumes the factor of the physical link reuse, and it strives to preserve a greater performance of the overlay routing. But it affects the overlay network performances and hence we go for proposed scenario. In the proposed system, we introduce particle swarm optimization (PSO) which is used to improve the link optimization in overlay network. It preserves the higher performance of overlay routing in less expensive. The resources are allocated sufficiently in the network and it is reusable for number of times hence the utilization is increased. The minimum path is computed between nodes and optimal links are updated in the specified network. The links are optimally improved and hence the overhead communication issue is reduced significantly. From the experimental result, we can conclude that the proposed method is better than the existing system.

Keywords - Link selection, particle swarm optimization algorithm, overlay network, bandwidth, overlay degree.

INTRODUCTION

Overlay networks are distributed systems in general, which operate without centralized organization or control. Peers construct self organizing overlay systems which are overlayed in the internet protocol networks. It is in the form of peer to peer network, end to end host multiport and network security. In recent years, network overlay formation is discovered in several applications. For instance, overlay networks containing the content release caching systems and peer organizer distribution systems related along with tone over IP service providers and several testbed systems. The main purpose of overlay network resources is producing new services which are not possible in the present networking communications through organizing application specific overlays [1].

Overlay network builds a user plane graph in existing systems such as internet by using accessible network links and nodes. It is a virtual link in the user level graph and includes several edges in the specified network. An overlay plays a role of user plane routers and promoting packets to the next overlay connection toward the destination. Overlay gives few challenges for policy in numerous measurements. It has problems along with expensive scenario and regularity policy such as how can overlay communicate along with interconnected links [2].

Several overlays produce different improved functionalities for online web and network services. Thus, there are various types of overlays as there are quality service requirements. Significant benefits which caching overlay provides are greater availability, presentation and source offload. The shortest routing path overlay presents wide area connection with larger reliability, less latency and maximum throughput than public internet.

In [3], Antonio capone et.al presented efficient models and approaches for service design on overlay networks. This research is suggested two optimization models for designing service overlay networks. In this scenario, the cost is reduced and maximizes the profit along with full coverage to all network users. Optimization algorithm is focused on the provision of optimal solution. However it provides the economic risk and challenges in designing effective models. In [4], SeungChul Han et.al discussed the problem of node collection for parallel access in overlay network. The selection approach permits scaling to huge network since it is more effective and it is not required system measurement or set of methodologies as well as routing data. This research is focused on the reduction of congestion in the bottleneck node. Also this method is used to increase the throughput and it considers the less number of system resources.

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In [5], Chiping Tang et al. suggested an efficient approach for increasing the multiple path reliability on topology aware overlay network. The sampling algorithm is introduced to improve the communication reliability by reducing the failure probability. A novel overlay multiple path reliability model is used to compute joint link failure probability and developing efficient routing protocol to choose high quality paths. In [6], Amjad Ali et al. discussed optimization methods to provide quality of services. A novel integer programming method is involved to build the most suitable connection with small number of paths. The current research is used to satisfy the particular end user quality services. The link optimization determines better links but however it has time complexity and communication complexity in given networks.

In [7], Mein Shen et al. presented particle swarm optimization (PSO) and its advantages for specified network. In the specified communication network, PSO is focused on the selection of source node, destination node and set of intermediate node to improve the process more effectively. Mainly, it is reducing the waiting time among source and destination nodes. Also this research is improving the process speed prominently as well as reduced the expensive scenario. In [8], Jing Yang et al. presented soft computing method for achieving quality of services. The objective this research is identifying the optimal links and reducing the searching difficulties. The required service qualities are increased by means of fast computation and reduction of error rate. The present scenario is discovering the objective function and provides faster convergence.

In [9], Peter Pietzuch et al suggested the path optimization in stream based overlay networks. In this research, system aware link optimization approach is presented for stream based overlay networks. It depends on the spring relaxation model which operates in a metric space described via the pairwise link latency in the specified network. Network utilization is improved effectively and delay time is decreased. However it has issue with expensive scenario. In [10], Ajith Abraham et al. presented multi swarm algorithm for neighbor selection in peer to peer overlay networks. The particles are used to encode the upper upper half of peer link matrix using an undirected graph which decreases the search space dimension. The comparison of performance is executed along with suggested algorithms. It provides minimum computational complexity for large data networks.

In [11], Stefano Ferretti et al. presented Self-Healing Protocols for Connectivity Maintenance in Unstructured Overlays. This research is focused on the improvement of reliability factor in the P2P networks. Based on the neighborhood node it extracts the local knowledge and interaction is increased. Efficient cluster is used to discover the several efficient connections for the specified overlay networks. In [12], Marcel Waldvogel suggested Efficient Topology-Aware Overlay Network. Peer-to-peer (P2P) networking is turned into a household word recently, being marketed as a work-around for server scalability issues. This research ensures locality-aware link, thus achieving that a message reaches its destination along with minimal overhead.

II. MATERIALS AND METHODS

A. Form Overlay Network

In this module, we have to create an overlay network structure along with number of vertices and edges. Let an undirected graph $G = (V, E)$. Denote by $V$ the set of overlay nodes, by $E$ the set of edges between any two overlay nodes. For any node $i, j \in V$, edge $e(i, j) \in E$, edge weight function $e(i, j) \in \mathbb{R}^+$ is an indication of the physical link delay, and edge weight function $e_{\delta}(i, j) \in \mathbb{R}^+$ is an indication of the bandwidth of the physical link. $V' \subseteq V$ denotes the set of overlay nodes, and for any overlay node $u, v \in V'$, edge weight $e_{\delta}^o(u, v)$ denotes the overlay link between two nodes. Edge weight function $e_{\delta}^o(u, v) \in \mathbb{R}^+$ is an indication of the physical link delay, and edge weight function $e_{\delta}^o(u, v)$ is an indication of the bandwidth of the overlay link.

B. Reusable Link Selection

In this module, we perform reusable link selection process efficiently. Reusable tags function of IP link.

$$\varphi e_{\delta}^o = \begin{cases} 0 & \text{The overlay links } e_{\delta}^o(u, v) \\ 1 & \text{The overlay links } e_{\delta}^o(u, v) \\ \text{have not used the physical links } e(i, j) \\ \text{have used the physical links } e(i, j) \end{cases}$$

The IP link reuse the most frequent used links based on the number of times selected. The IP links witch used by a number of overlay links are totally or partly the same, the reused IP link may be busy, or even congestion, while the other IP link is in the idle state,
resulting in load imbalance in IP network layer and reduction in the performance of network routing. That is to say, the performance of network will be reduced if the reuse rate of underlying IP link by overlay link is too high.

C. Optimal link selection using k-minimum spanning tree algorithm (KMSA)

In this module, k-minimum spanning tree approach is sued to select the optimal link using physical topology. The given formula is used to select the reuse links using k minimum spanning approach (KMSA)

$$W(i, j) = \sum_{e(i,j) \in \text{KMST}} \Phi \epsilon(i,j)$$

(2)

Physical link reuse rate in overlay network as the number of times all the IP links reused in the KMSA overlay topology, i.e.

Olap(KMSA) = \sum_{e(i,j) \in \text{GON}} W(i,j)

(3)

The bandwidth of overlay links is the minimum bandwidth of all the physical links that constitute the overlay link, i.e.

$$e_p^g(u,v) = \text{Min} \, e_i(i,j) \times \Phi \epsilon(i,j)$$

(4)

The whole overlay network topology is the KMST topology, and the link bandwidth is the sum of all the overlay links bandwidth. It can be expressed as:

Bandwidth (KMSA) = \sum_{e(i,j) \in \text{KMST}} e^p B(u,v)

(5)

When dealing with overlay Link Selection Problem (OLSP), the K-minimum spanning tree approach (KMSA) of the overlay topology structure is adopted.

D. Optimal link selection using PSO algorithm

In this module, we achieve the optimal link selection through by using particle swarm optimization approach. Peer-to-peer computing is gaining enormous interest and concentration of the computing manufacturing and received popularity amongst computer users and their networked virtual communities. Particle Swarm Optimization (PSO) approach is inspired through social behavior patterns of organisms which live and interrelate within huge groups. In specific, PSO includes swarming behaviors observed in flocks of birds, schools of fish, or swarms of bees, and even human social behavior, from which the Swarm Intelligence (SI) paradigm has emerged. It could be implemented and applied easily to solve various function optimization problems, or the problems that can be transformed to function optimization problems.

As an algorithm, the major strength of PSO is its speed of convergence, which compares favorably along with various global optimization approaches. It is also used to select more optimal links for local and global space more effectively.

At each time step, each particle updates its velocity and moves to a new position according to (6) and (7)

$$v_{i,j}(t) = wv_{i,j}(t−1) + c_1 r_1 (p_{i,j}(t−1)−pij−c2r2pij−t−1−pij−t−1)$$

(6)

E. PSO algorithm

1. Initialize the size of the particle swarm n and other parameters
2. Initialize the positions and velocities for all the particles randomly
3. While (the end criterion is not met) do
4. t=t+1
5. for s=1 to n
6. for i= 1 to N
7. for j=1 to N
8. if j==i, c_{ij} = 0;
9. if j<i, a=j; b=i;
10. if j>I, a=i, b=j;
11. e_{ij} = p[a*N+b-(a+1)*(a+2)/2];
12. if e_{ij} =1, compute c_i \ c_j
13. next j
14. compute f=f+|U_{i=1}^N (c_i \ c_j) \cap e_{ij}|
15. Next i
III. RESULTS AND DISCUSSION

In this section, the performance metrics are evaluated using existing and proposed methodologies. The performance metrics are such as execution time, bandwidth and overlay degree. The existing k-minimum spanning tree algorithm (KMSA) is used to classify the multiple measurement of specified dataset. However the existing system has shown the lower performance in the link selection results. The proposed Particle Swarm Optimization (PSO) has shown the higher performance in the link selection results. The proposed PSO algorithm provides optimal link selection results. From the experimental result, we can conclude that the proposed system is better than the existing system in terms of higher performance.

A. Execution time

The network is better when the system takes minimum execution time for implementing the process.

B. Bandwidth

From the above figure we can observe that the comparison of existing and proposed system in terms of execution metric. In x axis we plot the methods and in y axis we plot the execution values. In existing scenario, the execution value is higher by using KMSA algorithm. The execution value of existing scenario is 87 sec. In proposed system, the execution value is reduced by using the PSO algorithm. The execution value of proposed scenario is 54 sec. Thus it shows that effective analysis is performed by using proposed PSO algorithm. From the result, we conclude that proposed system is superior in performance.

From the above figure we can observe that the comparison of existing and proposed system in terms of bandwidth metric. In x axis we plot the methods and in y axis we plot the bandwidth values. In existing scenario, the bandwidth value is lower by using KMSA algorithm. The bandwidth value of existing scenario is 1200. In proposed system, the bandwidth value is increased by using the PSO algorithm. The bandwidth value of proposed scenario is 1700. Thus it shows that effective analysis is performed by using proposed PSO algorithm. From the result, we conclude that proposed system is superior in performance.
C. Overlay degree

From the above figure we can observe that the comparison of existing and proposed system in terms of overlay degree. In x axis we plot the methods and in y axis we plot the overlay degree values. In existing scenario, the overlay degree value is higher by using KMSA algorithm. The overlay degree value of existing scenario is 95. In proposed system, the overlay degree value is reduced by using the PSO algorithm. The overlay degree value of proposed scenario is 72. Thus it shows that effective analysis is performed by using proposed PSO algorithm. From the result, we conclude that proposed system is superior in performance.

IV. CONCLUSION

In this section, the conclusion decides that the proposed system is increased the link selection performance using PSO algorithm. The various overlay networks is implemented and the methods are focused on the link selection of more effective results. The existing k-minimum spanning tree algorithm (KMSA) is used to handle the efficient overlay networks along with more optimal link selection. The proposed PSO algorithm is used to improve the optimal selection of links among networks and reduce the time complexity issues significantly by using global optimal features. Thus, the experimental result proved that the proposed system is better than the existing system.

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