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OPTIMIZATION PROCESS FOR COST-EFFECTIVE RESOURCE IN THE OVERLAY ROUTING NETWORK

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ABSTRACT

Overlay directing is an extremely appealing plan that permits enhancing certain properties of the steering, (for example, deferral or TCP throughput) without the need to change the models of the current hidden steering. These offers ascend to the accompanying improvement issue: Find an insignificant arrangement of overlay hubs such that the obliged steering properties are fulfilled. In this paper, we thoroughly ponder this improvement issue. This gives rise to the following optimization problem: Find a minimal set of overlay nodes such that the required routing properties are satisfied. In this paper, we rigorously study this optimization problem. The first is BGP directing, and we show, utilizing something like date information mirroring the current BGP steering strategy in the Internet, that a relative little number of under 100 transfer servers is sufficient to empower steering over most limited ways from a solitary source to all self-governing frameworks (ASs), diminishing the normal way length of swelled ways by 40%. We additionally show that the plan is extremely valuable for TCP execution change (brings about a practically ideal position of overlay hubs) and for Voice-over-IP (VoIP) applications where a little number of overlay hubs can essentially decrease the maximal distributed postponement.

Key Words: Overlay network, TCP throughput, resource allocation.

1. INTRODUCTION

OVERLAY routing has been proposed in recent years as an effective way to achieve certain routing properties, without going inside the long and tedious process of standardization and global deployment of a new routing protocol. For example, overlay routing are used to improve TCP performance over the Internet, where the main idea involves of breaking the end-to-end feedback loop into smaller loops which requires the nodes capable of performing TCP Piping would be present along the route at relatively smallest distances and some of the examples for the use of overlay routing are papers like RON and Detour, at where overlay routing is used to improve reliability [1]. Yet another example is the concept of the “Global-ISP” paradigm, by which an overlay node is used to decrease the latency in BGP routing. In order to deliver the overlay routing across over the actual physical infrastructure, someone needs to deliver and manage overlay nodes that will have the new extra functionality and with a non-negligible cost both in terms of capital and operating costs. Thus, it is important to study the benefit one gets from improving the routing metric against this cost. In this paper, we concentrate on this point and study the minimum number of infrastructure nodes that need to be added in order to maintain a specific property in the overlay routing [3]. In the shortest-path routing across over the Internet BGP-based routing example, this question is mapped with the minimum number of relay nodes that are needed in order to make the routing between a group of autonomous systems (ASs) use the underlying shortest path within them, In TCP performance , this may finds the minimal number of relay nodes needed in order to make sure that for each TCP connection, there is a path within the connection endpoints for which every predefined round-trip time [5].

(RTT), there is an overlay node capable of TCP piping. Regardless of the specific conclusion in mind, we define general optimization problem called the overlay routing resource allocation (ORRA) problem and study its complexity
Which turns out that the problems is NP-hard, and we present a non-trivial approximation algorithm for it. Note that if we only interested in improving routing properties between a single source node and a single destination, then the problem becomes easy, and determining the optimal number of nodes becomes trivial since the potential candidate for overlay placement is less, and assignment would be good. But when we consider one-to-many or many to many scenarios, then the single overlay nodes may affect the path property of many paths , and that leads to the deciding of best location becomes much less trivial[10].

We test our general algorithm in three specific such cases, where we have a large set of source–destination pairs, and the goal involves of finding the minimal set of locations, such that using overlay nodes in these locations allows to create routes (routes are either underlay routes or routes that use these new relay nodes) such that a certain routing property is satisfied [9]. The first scenario we consider is AS-level BGP routing, at where the goal is to find the minimal number of relay node locations that can allow shortest-path routing

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between the source–destination pairs. Recall the routing in BGP, which is policy-based and depends on the business relationship between the peering ASs, and as a result, a considerable fraction of the paths in the Internet do not go along a shortest path (see [5]) The phenomenon is called as path inflation, which is the motivation for the scenarios. We consider the one-to-many setting where we want to improve routing between a single source and many destinations. This case at where the algorithm power is most significant. since, in many-to-many setting, there is very little amount of overlap between the shortest paths, and thus will not improve completely over the basic greedy approach.1 We demonstrate, using real up-to-date Internet data, that algorithm could suggest the relatively small set of relay nodes which can significantly reduce latency in current BGP routing. The second scenario we consider is the TPC improvement example discussed above. In this, we test the algorithm on a synthetic random graph, and we showed the general framework could be applied also to this case, results in very close-to-optimal results [8].

2. RELATED WORK

Using overlay routing to improve network performance is motivated by many works that studies the inefficiency of varieties of networking architecture and applications. Analyzing a large set of data, explore the question. How good is internet routing from a user's perspective considering round-trip time, packet loss rate, rate, and bandwidth? They showed that in 30%-80% of the cases, there is an alternate routing path with better quality compared to the default routing path. The authors show that TCP performance is strictly affected by the RTT. Thus , breaking a TCP connection into low-latency sub connection improves the overall connections performance. The authors show that in many cases, routing in the internet are inflated and the actual length (in hops) of routing paths between client is longer than minimum HOP distance between tham

Using overlay routing to improve routing and network performance has been studied before in several works. In the authors studied the routing inefficiency in the Internet and used an overlay routing in order to evaluate and study experimental techniques improving the network over the real environment. While the concept of using overlay routing to improve routing scheme was presented in this work, it did not deal with the deployment aspects and the optimization aspect of such infrastructure .A resilient overlay network (RON), which is an architecture for application-layer overlay routing to be used on top of the existing Internet routing infrastructure, has been presented. Similar to our work, the main goal of this architecture is to replace the existing routing scheme, if necessary, using the overlay infrastructure. This work mainly focuses on the overlay infrastructure (monitoring and detecting routing problems, and maintaining the overlay system), and it does not consider the cost associated with the deployment of such system. Here mainly focuses on relay placement problem, in which relay nodes should be placed in an intra-domain network. An overlay path, in this case, is a path that consists of two shortest paths, one from the source to a relay node and the other from the relay node to the destination. The objective function in this work is to find, for each source–destination pair, an overlay path that is maximally disjoint from the default shortest path. This problem is motivated by the request to increase the robustness of the network in case of router failures. They introduce a routing strategy, which replaces the shortest-path routing that routes traffic to a destination via predetermined intermediate nodes in order to avoid network congestion under high traffic variability. The first to actually study the cost associated with the deployment of overlay routing infrastructure.

Considering two main cases, resilient routing, and TCP performance, they formulate the intermediate node placement a san optimization problem, where the objective is to place a given number intermediate nodes in order to optimize the overlay routing and suggested several heuristic algorithms for each application. Following this line of work, the resource allocation problem in this paper as a general framework that is not tied to a specific application, but can be used by any overlay scheme. Moreover, unlike heuristic algorithms, the approximation placement algorithm presented in our work, capturing any overlay scheme, ensures that the deployment cost is bounded within the algorithm approximation ratio.
Node placement problems have been studied before in different contexts in many works, considering web cache and web server placement .overlay node placement is fundamentally different from these placement problems where the objective is to improve the routing using a different routing scheme rather than pushing the content close to the clients

3. PROBLEM IDENTIFICATION

Using overlay routing to improve routing and network performance has been known before in several works. The authors know the routing inefficiency in the Internet and used an overlay routing in order to evaluate and study experimental techniques improving the network over the real environment [20]. While the concept of the use overlay routing to improve routing scheme was presented in this work, it does not deals with the deliver aspects and the optimization aspect of such infrastructure. A resilient overlay network (RON), which is the architecture for application-layer overlay routing to be used on top of the existing Internet routing infrastructure, has been presented and the main goal of this architecture is to replace the existing routing scheme. If needs, use the overlay infrastructure that mainly focuses on the overlay infrastructure and it does not consider the cost associated with the deployment of such system.

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4. NEW APPROACH

In this paper, we concentrate on this point and study the minimum number of infrastructure nodes that need to be Added in order to maintain a specific property in the overlay routing. In the shortest-path routing across over the internet BGP based routing example, the question of what is the minimum number of relay node that are needed in order to make the routing between a group of autonomous systems(Ass) use the underlying shortest path between them. In the TCP performance [35], this may translate to minimal number of relay nodes needed in order to make sure that for each TCP connection end point for which every predefined round-trip time(RTT), and there is the overlay node capable of TCP piping. Regardless of the specific conclusion in mind, we define the general optimization problem called as Overlay Routing Resource Allocation (ORRA) problem and It turns out the NP-hard, also we present a nontrivial approximation algorithm for it [37].

5. SIMULATION RESULTS

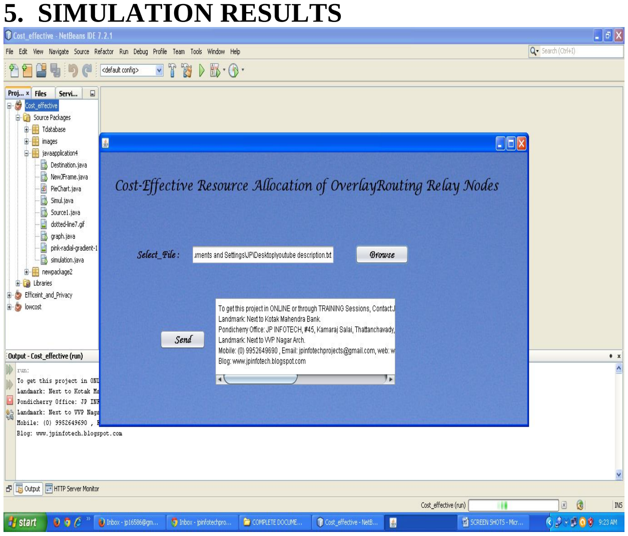

Figure 1: Cost effective resource allocation of overlay routing nodes

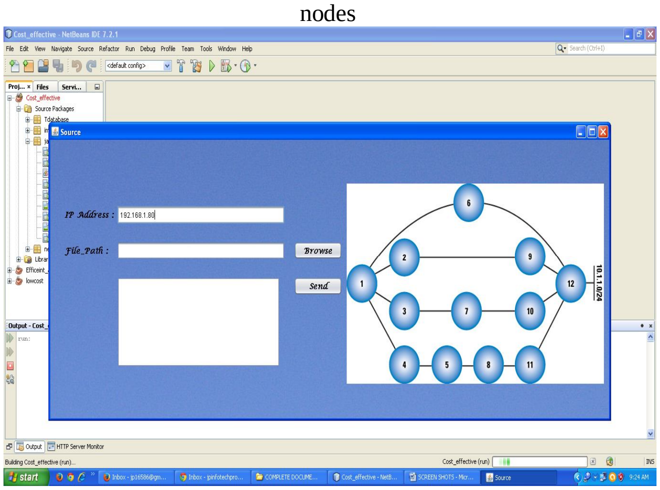

Figure 2: cost effective resource allocation of overlay routing given soure ip address.

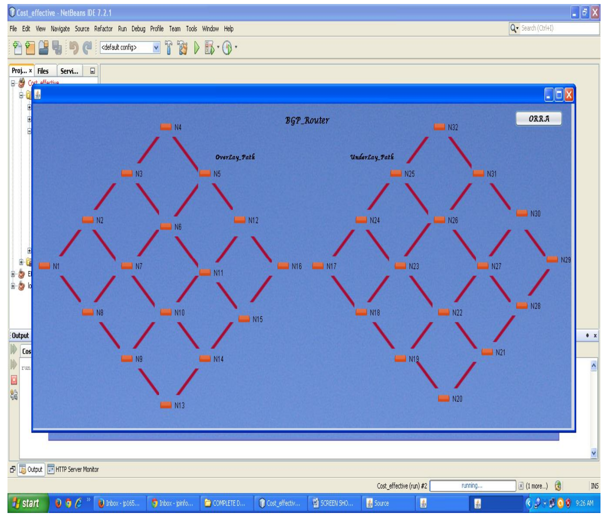

Figure 3: BGP router

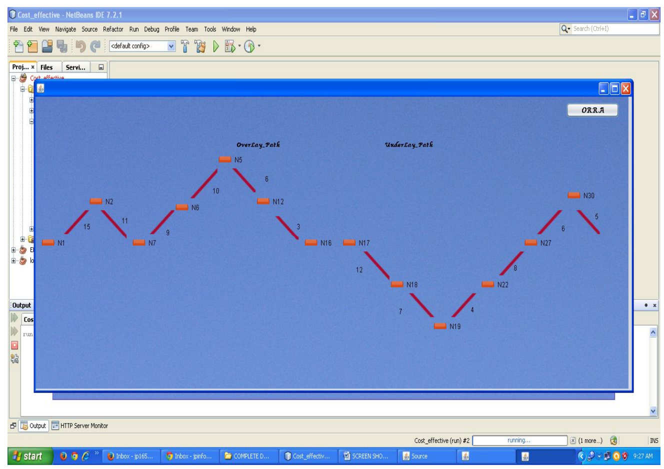

Figure 4: cost effective resource allocation of overlay routing paths.

6. CONCLUSION AND FUTURE WORK

While using overlay routing to improve network performance was studied in the past by marry works both practical and theoretical, very few of them consider the cost associated with the deployment of overlay infrastructure. In this paper ,it address fundamental problem developing an approximation algorithm to the problem. Rather than considering a customized algorithm for a specific application or scenario, it suggests a general framework that fits a large set of a overlay application. Considering three different technique, it evaluate the performance of the algorithm, showing that in practices the algorithm, provides close-to-optimal results. Many issues are left for further research. One interesting direction is an analytic study of the vertex cut used in the algorithm. It would be interesting to find properties of the underlay and overlay routing that assure a bound on the size of the cut. It would be also interesting to study the performance of our framework.

For other routing scenarios and to study issues related to actual implementation of the scheme. In particular, the connection between the cost in term of establishing overlay nodes and the benefits in terms of performance again achieved due to the improved routing is not trivial and it is interesting to investigate it. For example, the one-to-many BGP routing scheme can be used bya large content provider in order to improve the user experience of its customers. The VoIP scheme can be used by VoIP services to improve call quality of their customer. In nboth these cases, the exact translation of the services performance gain into actual revenue is not clear and can benefits from further research.

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