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An Efficient Overlay Routing Framework for Competent Resource Allocation

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Abstract:

Routing on the Overlay means the underlying network induces a complete graph of connectivity. Here no real routing is required, but one virtual hop may be many underlying hops away, thus Latency and cost vary significantly over the virtual links. Overlay routing is an efficient way to certain routing properties without long and tedious process of standardization and global deployment of a new routing protocol. Deploying overlay routing requires the placement and maintenance of overlay infrastructure rise to the optimization problem. An algorithmic framework can be efficient resource allocation in overlay routing.

The actual benefit can gain from schemes namely BGP Routing, TCP Improvement and VOIP Applications. A BGP Routing is up-to-date data reflecting the current BGP routing policy in internet, a small number of less than 100 relay servers is sufficient to enable routing over shortest paths from a single source to all autonomous systems(Ass), reducing the average path length of inflated paths. TCP Performance improvement is an optimal placement of overlay nodes and Voice-over-IP (VOIP) applications is a small number of overly nodes can reduce the maximal peer-to-peer delay.

***Keywords:* Overlay Network, Overlay routing, TCP Improvement, BGP Routing, VOIP Applications, Overlay Routing Resource Allocation**

Introduction:

An overlay network is a computer network, which is built on the top of another network. Nodes in the overlay can be thought of as being connected by virtual or logical links, each of which corresponds to a path, perhaps through many physical links, in the underlying network. For example, distributed systems such as peer-to-peer networks and client-server applications are overlay networks because their nodes run on top of the Internet. The Internet was originally built as an overlay upon the telephone network, while today (through the advent of VoIP), the telephone network is increasingly turning into an overlay network built on top of the Internet.

Overlay networks are used in telecommunication because of the availability of digital circuit switching equipment and optical fiber. Telecommunication transport networks and IP networks (that combined make up the broader Internet) are all overlaid with at least an optical fiber layer, a transport layer and an IP or circuit switching layers (in the case of the PSTN).

Enterprise private networks were first overlaid on telecommunication networks such as frame relay and Asynchronous Transfer Mode packet switching infrastructures but migration from these (now legacy) infrastructures to IP based MPLS networks and virtual private networks started.

From a physical standpoint overlay networks are quite complex (see Figure 1) as they combine various logical layers that are operated and built by various entities (businesses, universities, government etc.) but

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they allow separation of concerns that over time permitted the buildup of a broad set of services that could not have been proposed by a single telecommunication operator (ranging from broadband Internet access, voice over IP or IPTV, competitive telecom operators etc.)

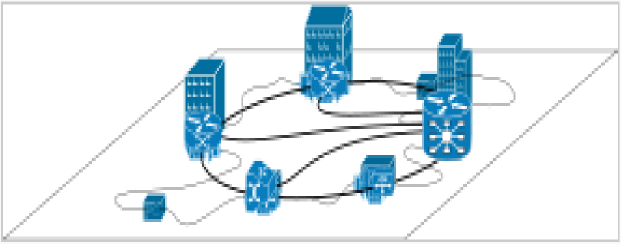

Figure 1: A sample overlay network

Nowadays the Internet is the basis for more overlaid networks that can be constructed in order to permit routing of messages to destinations not specified by an IP address. For example, distributed hash tables can be used to route messages to a node having a specific logical address, whose IP address is not known in advance.

Overlay networks have also been proposed as a way to improve Internet routing, such as through quality of service guarantees to achieve higher-quality streaming media. Previous proposals such as IntServ, DiffServ, and IP multicast have not seen wide acceptance largely because they require modification of all routers in the network. On the other hand, an overlay network can be incrementally deployed on end-hosts running the overlay protocol software, without cooperation from ISPs. The overlay has no control over how packets are routed in the underlying network between two overlay nodes, but it can control, for example, the sequence of overlay nodes a message traverses before reaching its destination.

For example, Akamai Technologies manages an overlay network which provides reliable, efficient content delivery (a kind of multicast). Academic research includes End System Multicast and Overcast for multicast; RON (Resilient Overlay Network) for resilient routing; and OverQoS for quality of service guarantees, among others.

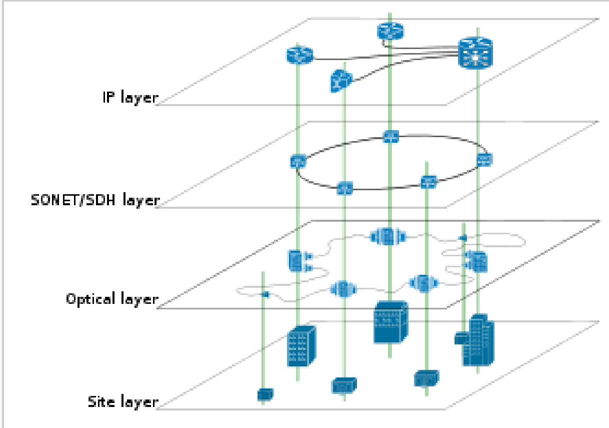

Figure 2: Overlay network broken up into logical layers

EXISTING SYSTEM:

Using overlay routing to improve routing and network performance has been studied before in several works. 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 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.

DISADVANTAGES OF EXISTING SYSTEM:

- In order to deploy overlay routing over the actual physical infrastructure, one needs to

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deploy and manage overlay nodes that will have the new extra functionality. This comes with a non negligible cost both in terms of capital and operating costs.

- Our proposed algorithmic framework that can be used in order to deal with efficient resource allocation in overlay routing.

PROPOSED SYSTEM:

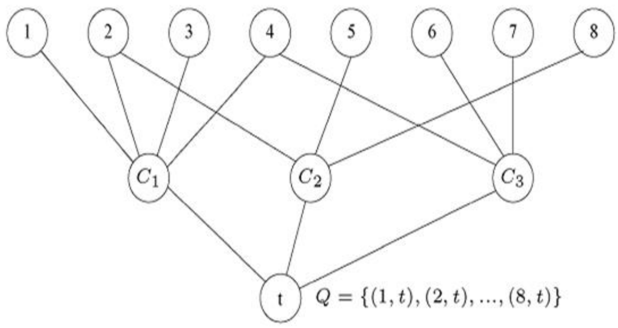
In this paper, we concentrate on this point and study the minimum number of infrastructure nodes that need to be added in order to maintain a specific property in the overlay routing. In the shortest-path routing over the Internet BGP-based routing example, this question is mapped to: What is the minimum number of relay nodes that are needed in order to make the routing between a groups of autonomous systems (ASs) use the underlying shortest path between them? In the TCP performance example, this may translate to: What is the minimal number of relay nodes needed in order to make sure that for each TCP connection, there is a path between the connection endpoints for which every predefined round-trip time(RTT), there is an overlay node capable of TCP Piping?

Regardless of the specific implication in mind, we define a general optimization problem called the Overlay Routing Resource Allocation (ORRA) problem and study its complexity. It turns out that the problem is NP-hard, and we present a nontrivial approximation algorithm for it.

ADVANTAGES OF PROPOSED SYSTEM:

- We are only interested in improving routing properties between a single source node and a single destination, then the problem is not complicated, and finding the optimal number of nodes becomes trivial since the potential candidate for overlay placement is small, and in general any assignment would be good.
- However, when we consider one-to-many or many-to-many scenarios, then a single overlay node may affect the path property of many paths, and thus choosing the best locations becomes much less trivial.

SYSTEM ARCHITECTURE:



Set Cover Diagram for proposed System

MODULES:

1. AS-level BGP routing
2. TPC improvement level
3. Voice-over-IP

MODULES DESCRIPTION:

AS-level BGP routing:

We consider is AS-level BGP routing, where the goal is to find a minimal number of relay node locations that can allow shortest-path routing between the source–destination pairs. Recall that routing in BGP is policy-based and depends on the business relationship between peering ASs, and as a result, a considerable fraction of the paths in the Internet do not go along a shortest path. This phenomenon, called path inflation, is the motivation for this scenario. We consider a one-to-many setting where we want to improve routing between a single source and many destinations. This is the case where the algorithm power is most significant since, in the many-to-many setting, there is very little overlap between shortest paths, and thus not much improvement can be made over a basic greedy approach. We demonstrate, using real up-to-date Internet data, that the algorithm can suggest a relatively small set of relay nodes that can significantly reduce latency in current BGP routing.

TPC level improvement:

We consider is the TPC level improvement in the wireless networks as explained in the above module. In this case, we test our proposed algorithm on a synthetic random graph, and we show that the general framework can be applied also to this case, resulting in very close-to-optimal results.

Voice-over-IP:

Voice-Over-IP type of applications are becoming more and more popular offering IP telephone services for free, but they need a bounded end-to-end delay (or latency) between any pair of users to maintain a reasonable service quality. We show that our scheme can be very useful also in this case, allowing applications to choose a smaller number of hubs, yet improving performance for many users.

Conclusion:

In this paper, we have shown that our scheme is highly useful for the improvement of TCP performance along with usefulness for VoIP applications. Overlays add new functions to the network infrastructure much faster than by trying to integrate them in the router. Routing is the most critical function of a network. For it to scale it must be distributed and resilient to topological changes.Overlay networks are quick and effective ways to add new functionality to the network. A BGP Routing can be used by a 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 customers.

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