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A new method of Adaptive Traffic control based on Virtual Routing topologies for better QoS

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ABSTRACT:

The Internet is a global system of interconnected computer networks that use the Internet protocol suite (TCP/IP) to link several billion devices worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies. A network management system (NMS) is a set of hardware and/or software tools that allow an IT professional to supervise the individual components of a network within a larger network management framework. Traffic engineering is an important mechanism for Internet network providers seeking to optimize network performance and traffic delivery. Routing optimization plays a key role in traffic engineering, finding efficient routes so as to achieve the desired network performance. In this paper, we implement a new system, AMPLE – an efficient traffic engineering and management system that performs adaptive traffic control by using multiple virtualized routing topologies. The proposed system contains three complementary components: offline link weight optimization that takes as input the physical network topology and tries to produce maximum routing path diversity across multiple virtual routing topologies for long term operation through the optimized setting of link weights with admission traffic control algorithm.

***Keywords:** Traffic Engineering, Internet, NMS, TCP/IP, BGP.*

Introduction:

The Internet is a globally distributed network comprising many voluntarily interconnected autonomous networks. It operates without a central governing body. Internet service providers establish the world-wide connectivity between individual networks at various levels of scope. End-users who only access the Internet when needed to perform a function or obtain information, represent the bottom of the routing hierarchy. At the top of the routing hierarchy are the tier 1 networks, large telecommunication companies that exchange traffic directly with each other via peering agreements. Tier 2 and lower level networks buy Internet transit from other providers to reach at least some parties on the global Internet, though they may also engage in peering. An ISP may use a single upstream provider for connectivity, or implement multihoming to achieve redundancy and load balancing. Internet exchange points are major traffic exchanges with physical connections to multiple ISPs.

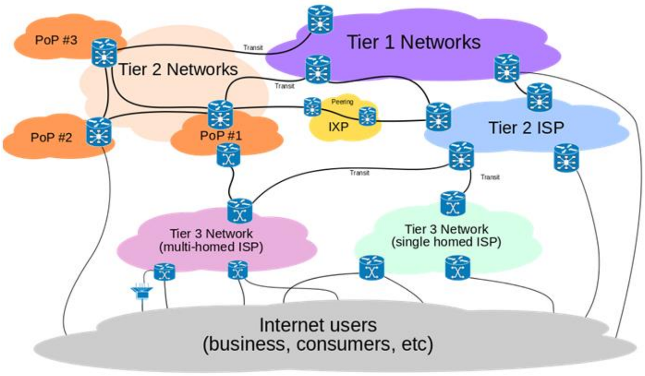


Fig: Packet routing across the Internet involves several tiers of Internet service providers.

Network monitoring is responsible for collecting up-todate traffic conditions in real-time plays an important role for supporting the ATC operations.

Network management system components assist with:

- Network device discovery - identifying what devices are present on a network.
- Network device monitoring - monitoring at the device level to determine the health of network components and the extent to which their performance matches capacity plans and intra-enterprise service-level agreements (SLAs).
- Network performance analysis - tracking performance indicators such as bandwidth utilization, packet loss, latency, availability and uptime of routers, switches and other Simple Network Management Protocol (SNMP) -enabled devices.
- Intelligent notifications - configurable alerts that will respond to specific network scenarios by paging, emailing, calling or texting a network administrator.

Internet Traffic Engineering is defined as that aspect of internet network engineering dealing with the issue of performance evaluation and performance optimization of operational IP networks. Traffic engineering encompasses the application of technology and scientific principles to the measurement, characterization, modeling, and control of Internet traffic.

Traffic Engineering (TE) is an essential aspect of contemporary network management. Offline TE approaches aim to optimize network resources in a static manner but require accurate estimation of traffic matrices in order to produce optimized network configurations for long-term operation (a resource provisioning period each time, typically in the order of weeks or even longer). However these approaches often exhibit operational inefficiencies due to frequent and significant traffic dynamics in operational networks.

Existing System:

In Existing System, IGP-based TE mechanisms are only confined to offline operation and hence cannot cope efficiently with significant traffic dynamics. There are well known reasons for this limitation: IGP-based TE only allows for static traffic delivery through native IGP paths, without flexible traffic splitting for dynamic load balancing. In addition, changing IGP link weights in reaction to emerging network congestion may cause routing re-convergence problems that potentially disrupt ongoing traffic sessions. In effect, it has been recently argued that dynamic/online route re-computation is to be considered harmful even in the case of network failures, let alone for dealing with traffic dynamics.

Disadvantages of Existing System:

• Does not achieve good performance in minimizing the MLU

• Even if multiple traffic matrices with different pattern characteristics are considered in link weight optimization, unexpected traffic spikes may still introduce poor TE performance.

Proposed System:

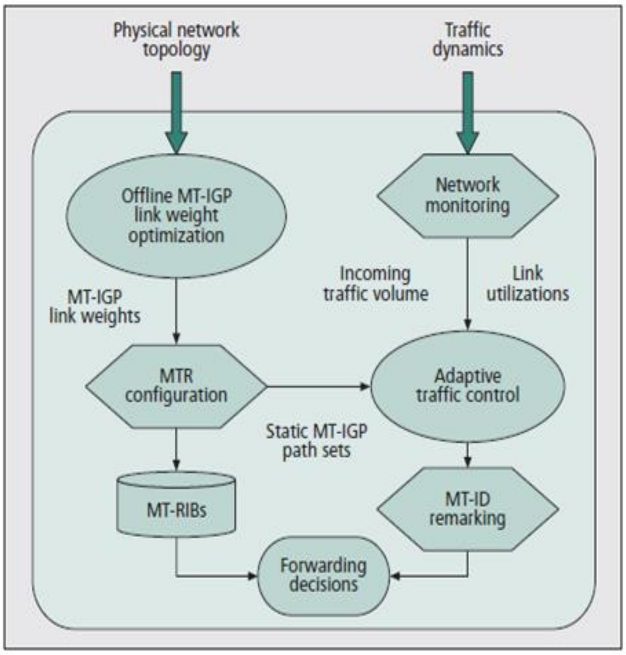
In proposed system consists of two complementary components: offline link weight optimization that takes as input the physical network topology and tries to produce maximum routing path diversity across multiple virtual routing topologies for long term operation through the optimized setting of link weights. Based on these diverse paths, adaptive traffic control performs intelligent traffic splitting across individual routing topologies in reaction to the monitored network dynamics at short timescale.

According to our evaluation with real network topologies and traffic traces, the proposed system is able to cope almost optimally with unpredicted traffic dynamics and, as such, it constitutes a new proposal for achieving better quality of service and overall network performance in IP networks.

Advantages of Proposed System:

AMPLE has a high chance of achieving near-optimal network performance with only a small number of routing topologies, although this is yet to be further verified with traffic traces data from other operational networks when available.

System Architecture:



Modules:

1. Virtual traffic allocation
2. Offline Link Weight Optimization
3. Network Monitoring
4. Adaptive Traffic Control

Modules Description:

Virtual Traffic Allocation

In this Module, the diverse MT-IGP paths according to the link weights computed by OLWO. Monitored network and traffic data such as incoming traffic volume and link utilizations. At each short-time interval, ATC computes a new traffic splitting ratio across individual VRTs for re-assigning traffic in an optimal way to the diverse IGP paths between each S-D pair. This functionality is handled by a centralized TE manager who has complete knowledge of the network topology and periodically gathers the up-to-date monitored traffic conditions of the operating network. These new splitting ratios are then configured by the TE manager to individual source PoP nodes, who use this configuration for remarking the multi-topology identifiers (MTIDs) of their locally originated traffic accordingly.

Offline Link Weight Optimization

In this module, to determine the definition of "path diversity" between PoPs for traffic engineering. Let's consider the following two scenarios of MT-IGP link weight configuration. In the first case, highly diverse paths (e.g. end-to-end disjoint ones) are available for some Pop-level S-D pairs, while for some other pairs individual paths are completely overlapping with each other across all VRTs. In the second case, none of the S-D pairs have disjoint paths, but none of them are completely overlapping either. Obviously, in the first case if any "critical" link that is shared by all paths becomes congested, its load cannot be alleviated through adjusting traffic splitting ratios at the associated sources, as their traffic will inevitably travel through this link no matter which VRT is used. Hence, our strategy targets the second scenario by achieving "balanced" path diversity across all S-D pairs.

Network Monitoring

In this Module, Network monitoring is responsible for collecting up-to-date traffic conditions in real-time and plays an important role for supporting the ATC operations. AMPLE adopts a hop-by-hop based monitoring mechanism that is similar to the proposal. The basic idea is that a dedicated monitoring agent deployed at every PoP node is responsible for monitoring: The volume of the traffic originated by the local customers toward other PoPs (intra- PoP traffic is ignored). The utilization of the directly attached inter-PoP links.

Adaptive Traffic Control

In this Module, Measure the incoming traffic volume and the network load for the current interval as compute new traffic splitting ratios at individual PoP source nodes based on the splitting ratio configuration in the previous interval, according to the newly measured traffic demand and the network load for dynamic load balancing.

Conclusion:

In this article we have implemented AMPLE, an innovative Traffic engineering system based on virtualized IGP routing that enables short timescale traffic control against unexpected traffic dynamics using multitopology IGP-based networks. The framework encompasses two major components, namely, Offline Link Weight Optimization (OLWO) and Adaptive Traffic Control (ATC). The OLWO component takes the physical network topology as the input and aims to produce maximum IGP path diversity across multiple routing topologies through the optimized setting of MT-IGP link weights. Based on these diverse paths, the ATC component performs intelligent traffic splitting adjustments across individual routing topologies in reaction to the monitored network dynamics at short timescale.

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